AT HOME IN THE QUARRY

A community engaging and landscape responsive approach to Medium
Density Design within the Three Kings Quarry.

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Figure 1.0 Three Kings Quarry

Abstract

The recently exhausted Three Kings Quarry in central Auckland suburbia is currently being prepared for housing development. As a suburb within New Zealand's fastest growing city, housing pressure and intensification policies mean that higher density design will be a key focus of remediation. Medium Density Design is a relatively young model of higher density housing in New Zealand and has developed a strong negative stigma, engendered by the abundance of unresponsive medium density developments which struggle, both physically and visually, to connect with Auckland's low density suburban culture. Plans to only partially fill the site have been met with opposition by the community as the quarry landscape is seen as an obstacle for connection within the suburb and unfit for human inhabitation. Because of these negative feelings towards both the quarry and medium density design, locals are anxious any

development within the quarry will follow a similar Medium Density housing model that turns its back on its context and community while failing to connect to the Three Kings context.

This research argues that by designing with the slope and existing condition of the quarry, medium density design can produce a scheme that meets the desires of the community and builds a unique and relevant identity for Three Kings. This thesis proposes this can be achieved by acknowledging the significance of the industrial landscape and designing with landform features and environmental systems; through community focussed medium density design; and by taking advantage of opportunities of mass housing design on the slope. These issues are tackled on the urban scale through design of a master plan, as well as cluster and dwelling scale design proposals.

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1.0 Introduction

Thesis Outline

As part of a well-established suburb in Auckland, development of the Three Kings quarry is an area of contention between the community, council, Maori, the developers and the various other stakeholders. This thesis investigates the remediation of the Three Kings Scoria Quarry in Auckland through Urban and Architectural Design. The research explores how design can respond to the opportunities of the industrial landscape for placemaking; develop a more socially integrated medium density design in Auckland; and designing to take advantage of the slope. These design intentions are explored at the scale of the master plan, housing cluster scale and individual dwelling scale within the quarry, in order to test how designed spaces can work together.

Research Focus

Medium Density Design (MDD)

Auckland is the fastest growing city in New Zealand and the most sprawling city in the southern hemisphere (Statistics New Zealand, 2013). Though problems of urban sprawl, housing supply, and population growth in Auckland have been hammered into New Zealanders by the media and government agencies, there is still a resistance to the introduced schemes adopted to combat these concerns. The problem is that many medium density design developments seemed more focussed on reaching density targets and employing standardised construction rather than the role of the development in the wider community. As housing

intensification becomes a necessary measure in Auckland's development the relatively underdeveloped medium density housing model will have a bigger role to play in Aucklanders' lifestyle and quality of life.

Industrial Landscape

As the Three Kings Quarry is being prepared for development the site is being used as a soil landfill. The quarry site which sinks 32m below Mt Eden Road and sits within a suburban context has been widely resented by the community for its detrimental effects on the quality of life of the community. The general negative perception of the quarry and its stark landscape has encouraged a prevailing desire in the community to level the site, erasing these distinctive qualities, in favour of a 'gentle gradient'.

Slope Design

The need for connections to the Three Kings Plaza as well as the remaining volcanic cone through the quarry are stressed in the 'Three Kings Plan'. The scoria cliffs that loosely follow the boundary of the quarry are seen as the biggest obstacle to connection, however the opportunities that the slope and mass housing present to remedy this problem have received little attention.

Scope

The range of topics explored span across multiple disciplines and this thesis acknowledges that they are affected by political, economic, and legal conditions (to name a few). This research, however, focusses primarily on how urban and architectural design principals can influence remediation design in a more socially and environmentally sustainable way.

Figure 1.1 Methodology

Figure 1.2 Thesis structure

Research Method and Structure

The thesis is structured into two sections: the research and design testing. Though the structure of the thesis in a broad sense reflects the sequence of design research, the stages were not exclusive of each other, but part of a constant feedback loop (Figure 1.1). While the sequential stages helped move the research forward, the constant reflection, critique and re-evaluation helped focus research and ensured design relevance (Wang, 2013).

The three design themes act as a platform for design research. Key findings from relevant literature review and case studies as well as an extensive site investigation build a design framework which informs the design testing.

The design phase is split into three different scales under two different sections to aid a holistic design approach. The proposed designs are:

- A) A master plan for the development of the Three Kings Quarry which tests relationships of buildings and networks within the quarry.
- B) A housing cluster proposal identified as part of the master plan. Identified as a relevant problem area for architectural resolution.
- C) Selected Dwelling designs chosen to reflect different conditions of the housing cluster.

For ease of reading, initial site investigation introduces the reader to the Three Kings site while more detailed site investigation later in the thesis gives a greater understanding of the sites current condition.

2.0 Introduction to Three Kings

This chapter introduces the quarry and the Three Kings suburb. Exploring its history, tracking its volcanic formation, both Maori and European settlement, its present condition and projected future condition to help give a complete view of the suburb. This site investigation is expanded in chapter 4.0, giving a more in depth analysis of the existing condition.

Figure 2.0 Location of Three Kings Quarry, Auckland, New Zealand

Three Kings, Auckland

Auckland city is the biggest and most populous city in New Zealand. As the city sprawls over the Auckland Volcanic Field. The shape and form of the city is heavily influenced by the various cones, hills, basins and harbours that are products of intermittent volcanic activity over 250,000 years (Hayward, 2011, p1). Volcanic cones that dot the Auckland landscape are place-markers and place-makers. These volcanoes have become much cherished public parks that have added amenity and character to the city and a sense of place for each suburb; many of which have taken their names from their local volcanic cone (Hayward, 2011, p1). Three Kings was named from three of the biggest of five once prominent scoria cones and can now be recognised by the remaining Big King volcanic cone or Maunga. The reality is that Auckland is not only built over its volcanoes but built of its volcanoes (Hayward 2011, p1).

The history of human settlement within Auckland stretches back 700 years, first Maori and later European settlement. Many years of occupation have led to many surface alterations of the Three Kings landscape and over this relatively short period in the history of the area the landform change rivals that of its volcanic genesis (Hayward, 2011, p54).

Figure 2.01
Auckland volcanic field
drawn by Hochstetter in
1859

Past Condition

Volcanic History

The Three Kings scoria cones were formed 28,500 years ago, by an eruption that was considered the most complex in Auckland's history. An Initial massive wet explosion crater formed 800m across and nearly 200m deep (Hayward, 2011). Close to the crater the ash built up a tuff ring that completely encircled the crater, the highest part of which can still be seen today in North-West of Three Kings. After the wet eruptions, dry fire fountaining of lava began from a number of different vents within the crater, filling the crater with five significant scoria cones piled up to 45 metres high above floor level. The lava breached the low crest of the tuff ring, in the North, and poured into a stream eventually stopping after a 3km journey (Hayward, 2011). This path has become an underground aquifer where water still travels though the cooling cracks before welling up to form the small lake at Western Springs, one of Auckland's most popular reserves.

Figure 2.02
Nature of volcanic
activity and resulting
geology

Figure 2.05 Photo collage of past state

Figure 2.03 Sketch of Existing condition and condition prior to quarrying

Figure 2.04 Sections of Three Kings site showing past and present ground levels

Maori History

The Maori first inhabited the Isthmus of Auckland, or Tamaki Makaurau, over 700 years ago. The oral traditions remember the volcanic cones in different ways but the fertility and workability of the volcanic soils were a fundamental reason for the area being a major centre of population in the pre-European era (Taonui 2014) (Hayward 2011, p57).

The Three Kings was a Maori Pa site and the wider area was used for farming. The predominant archaeological feature of the cones is the tuapapa (terraces), found on the slopes and the highest point. A significant amount of Maori earthworks have been destroyed by quarrying.

In the 2014 Treaty of Waitangi settlement, the volcano was officially named Te Tātua-a-Riukiuta and ownership was vested to the Tamaki Makaurau iwi collective. It is now co-governed by the collective and Auckland Council (LINZ, 2014). Today 7.8% of the Three Kings community is of Maori descent, compared to 10.7% of the entire Auckland population (Statistics New Zealand, 2014).

Figure 2.05 Tuapapa of Te Tātua-a-Riukiuta

Figure 2.06 Maori archilgical features. Adapted (Hayward, 2011)

Figure 2.07
Chris Gaskin's
recreation of
Maori occupation
Matakutereia Volcanic
cone in Auckland.

European Settlement

The area has seen shifts from agricultural use to quarrying to suburban housing (fig. 2.09). Initially the Three Kings area was cleared for agricultural purposes but the scoria's application as a drainage material was quickly realised and became Auckland's largest producer of scoria supplying the majority of central Auckland's drainage material for over a century (Winstone Aggregates, 2014). Quarrying became an issue of contention as the city began to sprawl out into the then rural area of Three Kings (Puketapapa Local Board 2014, p11). The quarry has been held under Winstone Aggregates, a division of Fletcher Building, for the past 90 years and the company will direct future remediation of the quarry.

1940

1959

Figure 2.08 Change in quarry context

Figure 2.09
European
settlement history
of site

Present Condition

Three Kings is now a very ethnically diverse suburb (Statistics NZ 2014). The area is largely one and two storey suburban housing consisting of iconic social housing to the west as well as multiple Medium Density developments to the North of the suburb.

The quarry site itself is approximately 15 hectares and 32 metres below Mount Eden Road level at its deepest. It consists of both basalt and scoria landforms exposed by quarrying. While some quarrying of scoria on site continues, backfilling part of the quarry basin began in April 2012 and will take a number of years to fill to the desired level (Winstone Aggregates 2014).

The plaza in the South is a well used community hub however the confusing layout compromises this function. The immediate area provides sports fields, swimming pool, library, convention centre and supermarket among other services centred on the Three Kings Plaza and Mt. Albert Road. More in depth site analysis of the current condition of Three Kings Quarry in chapter 4.0.

Figure 2.10 Three Kings present context

Figure 2.11
Geology of Three Kings.
Adapted (Pattle Delamore
Partners Ltd, 2008)

Figure 2.12 Football field from reserve

Figure 2.13 Plaza sports fields

Figure 2.14 Plaza carparking

Figure 2.15 Entrance to Library

Figure 2.16 Supermarket parking

Figure 2.17 Fickling Centre and Library

Figure 2.18 Mt. Albert Road and shops

Figure 2.19
current and ex-state
housing to west of
quarry

Figure 2.20
Suburban housing
Three Kings east

Future Condition

The Proposed Auckland Unitary Plan is an Auckland wide initiative that will define where and how people can build. The PAUP supports housing intensification while aiming to retaining and enhance important features. The plan hearings are estimated to end in 2016 and some rules are already in place (Auckland Council 2014). The Three Kings Plan document provides a strategic focus for development of the area over the next 40 years, combining community desires and centralising the focus of the plaza.

Fletcher Building have proposed multiple schemes two of which are pending consent. As the main proposal consists of primarily apartment design as opposed to primarily medium density, an in depth analysis of the scheme is not included in this research.

Figure 2.21 Proposed Unitary Plan for Three Kings. Adapted (Auckland Council , 2012)

Figure 2.22 Desires of community adapted from public workshop (Auckland Council, 2013)

Figure 2.23 Model of Fletcher Building proposal for Three Kings Quarry

Figure 2.24 Fletcher Building proposal from Plaza

3.0 Research and Design Themes

The following three chapters discuss relevant literature and case studies inspired by site analysis of Three Kings as a platform for design testing.

3.1 Industrial Landscape and Design

This Chapter discusses the opportunities of designing with the industrial landscape and how negative perception of the quarry can undermine its importance to reclamation design. Literature review outlines the change from the traditional marginalisation to contemporary celebration of such landscapes through design. Four quarry reclamation design models are proposed that encourage integration of architecture and landscape through design. A critical analysis of The Braga Stadium in Portugal exemplifies how architectural integration can utilise the existing character of the quarry add new value to the area.

Figure 3.10
Three Kings Quarry 1920

Perception of the Quarry

The general perception of quarries among the New Zealand public today is by and large a negative one (Higham et al, 2000). Though some see it as a necessity for urban development and economic growth many see the desolate extraction landscapes as physical evidence of human exploitation, environmental degradation, habitat destruction and corporate greed (Arbogast, 2000) (J. Arwel Edwards, 1996) (Gašparovič et al., 2009, p. 375). These views have been engendered through generations of exposure to the negative social and environmental impacts industrial practice, more notably of international practices associated with the industrial revolution (Binney, 1984, p 209) (Tandy, 1975, p. 13).

In the case of the Three Kings Quarry, the incompatibility of land uses within Three Kings community has also created tension. As the rural quarry site was slowly engulfed by Auckland's urban expansion in the 1930's, the original industrial activity grew more and more at odds with its emerging suburban atmosphere.

Noise, dust, rock blasting vibrations, and dirt tracks from trucks have generated numerous complaints and required constant consultation with community representatives to help mitigate inconveniences to home owners (fig. 3.11) (Three Kings United Group, 2015) (Winstone Aggregates, 2012) (Gibson, 2011). The requirement of industrial sites to block themselves off for public safety portrays a 'keep out' and 'stay away' attitude while the unnatural, visually raw, dangerously steep, and seemingly uninhabitable landscape enforce this feeling of separation and resentment (fig. 3.12) (Hayes 2005, p. 10). These negative and hostile mental images and perceptions does not only help people close their eyes to any opportunity the quarry can offer, but can make them aggressively determined to see it erased (Binney 1984, p. 210). Because of this, Industrial landscapes generally linked to productive activities are often turned into receptacles of waste or landfill (Arwel Edwards, 1996) (Prentice, 1993) (Engler, 2004).

Figure 3.11 Sprinklers help stop dust from travelling into surrounding suburb

Figure 3.12 Fence covering quarry window sends symbolically mixed messages.

Industrial Landscapes

“Landscape is stratified heritage. Landscape is always culture, laden with values, economic practices, stories and myths, emotions, notions and social programmes, as well as with the diverse memories connected with them. The identity of the landscape – and thus identification with that landscape as well – is very closely linked to this (Meggelen et al., 2008, p. 17)”

As humans have proliferated across the earth all landforms have been modified, to a greater or lesser extent, by our works. The quote from ‘Memory and Transformation’ identifies the cultural significance of our landscapes as physical documents of human settlement (UNESCO, 2012) (Weinstock, 2010) (Arbogast, 2000). The quote also outlines the influence the inherent history of the landscape has in defining the communities identity.

Over the past 150 years the fluctuations in the Three Kings cones topography have roughly correlated to the fluctuations in activity of the Auckland construction

sector in Auckland (Winstone Aggregates, 2015). Construction demands that encompass private landscaping to the major infrastructure foundations of the city.

Apart from the sites archaeological significance in helping future generations understand industrial motives and practices of early settlers (just as midden pits help us to understand the diet and volumes consumed by an ancient Maori tribes), the quarry is the industrial counterpoint to a wider culturally significant landscape. The literal inversion of the Tuapapa terraces of the Maunga emphasise the quarries physical significance in

representing the force of human industry over nature. An inherent history that builds a cultural landscape that traces the volcanic, Maori and European history in the area.

The Resource Management Act of 1991 aimed at retaining culturally important sites places much of the responsibility for protection of these sites in the hands of local councils ('Historic Heritage', 2014) As evident in the 'Three Kings Plan' the council places a huge importance on the Maunga for place making but treats the quarry as a void, or obstacle to appreciation of the Big King Maunga and plaza; rather than an

opportunity to substantially enhance its character. This under appreciation of industrial landscapes leaves them vulnerable to obliteration, or backfilling in the case of Three Kings quarry.

The collective perception of the quarry guides how we value our industrial landscapes and therefore what it offers to design. Contemporary discussion of Heritage landscape and its historically negative connotations is indicative of the shift in how we consider reclamation design.

Figure 3.13 Three Kings Quarry
From the Smallfield Ave.
football fields

Visit to the Quarry

As the quarry is closed off to the public many of its features and processes go unnoticed or misunderstood. This section identifies certain significant features of the quarry based on a guided visit to the quarry site.

Because of the constantly changing nature of the quarry contour map represents a slightly outdated version of the quarry floor that does not cater for the accumulation of soil landfill.

Figure 3.14 Map of significant features of Three Kings Quarry

5 Vividly colours of the steep scoria cliffs (present throughout site)

1 The almost vertical scoria cliffs are significantly darker than the recently quarried orange scoria cliffs.

1

2 A deep depression where the scoria deposit has been quarried.

3 This area was used for dumping basalt until a scoria deposit was discovered underneath. The human made basalt layer was quarried away to expose the scoria. The basalt strata traces around the South-West section of the quarry.

3

7 The light industrial buildings were New Zealand's first concrete masonry plant (Winstone Aggregates, 2012). Initially established in the 1950's the remnants of a wall contain the only part left of the quarried scoria cones.

4

4 A basalt landform that has been quarried around protrudes from the landscape. This storage platform has also been lined with discarded basalt rock.

Consiering Industrial Landscapes

“Spaces which have so far been seen as devastations can become unique site of social, cultural and artistic values. At the same time, they represent a particular landscape, architectural space and monumental sculpture (Gašparovic et al, 2009).“

The reality is that quarrying generates a disturbed landscape that many consider waste until it is reclaimed by nature or by human efforts (Arbogast, 2000) (J. Arwel Edwards, 1996). In ‘Designing America’s Waste Landscapes’, Mira Engler discusses the social taboos and perception of wastelands in America and how strategies of remediation have changed from concealing to celebrating (fig 3.15). The article ‘Landscape Models of Reclamation and Conversion of Quarries’ builds on the idea of celebration and integration acknowledging

architecture’s role. The article proposes four models for quarry remediation which have been adapted in figure 3.15 to include sustainable approaches identified by Engler (Gašparoviæ, Mrđa, and Petroviæ 2009, p376). The models act as a palette for adaptive reuse of the quarry landscape, allowing a blending of strategies that respond to the unique natural systems, aesthetic and functional potentials of the quarry. The models also allow analysis and comparison of existing quarry developments to identify how they respond to the quarry landscape. (Gašparovic et al, 2009).

Figure 3.15 Change in approaches to wasteland remediation over time.

Type of Conversion				
Features of Quarry and Conversion	Environmental Recultivation	Landscape Remodelling	Architectural Integration	Land Art
	Biological methods of recultivation applied to site that work with natural systems of landscape	Earthworks that take into account the inherent aesthetic of the exploited field and the newly planned use	Makes use of the spatial potential of the exploited site for introducing built structures, respecting the peculiarities of the existing site.	Large scale art works that are products of aesthetic and cultural values.
	Figure 3.16	Figure 3.17	Figure 3.18	Figure 3.19
	Extracted Material	LOOSE raw materials for construction	COMPACT for architecture and the city BULK raw materials for construction	COMPACT for architecture and the city
	Planned New Use	Ecology renewal Scientific purposes Outdoor amenity Education	Sports and Recreation Culture (Museum, Opera) Tourism	Sports and Recreation Culture (Museum, Opera) Tourism
	New Values Added	Environmental Aesthetic	Functional Environmental Cultural Historical	Functional Cultural Historical
	Intervention Type	Planting Introduction of water	Planting Surface remodelling	Construction
	Established Relationship with context	Integration into context	Visible Highlights Features	Visible Highlights Features Architecture complementing, shaping and/or contrasting
				Artistic (Land Art, sculpture, painting)
				Contrast with landscape

Figure 3.15
Quarry Remediation Strategies focussing on landscape integration.

Case Study - Braga Football Stadium

Site	Braga, Portugal
Completed	2003
Site Size	3.5ha
Capacity	30,154 people
Architect	Eduardo Souto De Moura

3.17 Braga Stadium's position in Portugal

Braga Stadium is located in Dume, as part of a larger Sporting Complex. The Stadium is sited in the Monte Castro Quarry that carves into the hillside at one of the highest points in the city. The stadium consists of two stands, one free standing while the other one digs in the quarry wall (fig. 3.20).

The stadium represents the first architecturally significant project undertaken in the area of abundant disused granite quarries. It is a unique setting for the city and is considered to have played a large part in recovering an economically underdeveloped area serving to support for future growth of the city northwards.

The stark quarry cliffs framed by the two stadiums add to the unique atmosphere and identity of the football stadium while allowing, as was pointed out by President Barack Obama in his Pritzker speech, people who could not afford a ticket to spectate from the quarry cliffs. The concrete materiality and austere industrial form of the Stadium visually integrates into the quarry landscape.

The stadium integrates with the industrial aesthetic and capitalises on landforms more than it utilises landforms for function as clearing the heavy granite rock contributed significantly to the 83.1 million Euro construction cost.

The Braga Municipal Stadium is designed to create a unique experience linked heavily to the aesthetics of the industrial landscape and demonstrates how architectural integration can enhance experience of landscape features and add economic and cultural value to an area which has lost economic viability.

Figure 3.18
Architecture
framing quarry
landform

Figure 3.19
Quarry cliffs as
back drop to
stadium

Figure 3.20 Section through Stadium
showing relationship
with landscape

Conclusion

In a city full of volcanic cone suburbs the scoria industrial landscape of the Three Kings Quarry is a distinguishing part of the identity of Three Kings. The generally negative perception undermines its significance as both a challenge and asset to remediation design. The four models of quarry conversion offer a framework to test the potentials of adaptive reuse of the industrial landscape in adding another layer of cultural value to the area.

3.2 Medium Density Housing

This chapter investigates the current practice of medium density design and how its lack of community engagement has contributed to its negative stigma in Auckland. The chapter tracks the housing history of Auckland and discusses medium density as a relative concept rather than a defined type. Key considerations of MDD and community are identified in relationship to Auckland and the quarry and are discussed through critical review of literature. These issues along with critical analysis of case studies of Stonefields Suburb, Heller Street Development and the Villaggio Matteotti, help inform the design testing later in the thesis.

Medium Density and Auckland

Historically, medium density housing has not played a large role in the Auckland region, a city characterised by stand-alone dwellings with abundant yard space. In its early years Auckland's urban development was restricted by a dependency on the limited range of transport networks. Slowly Railway, electric tramway systems, ferries and later bus systems helped the spread of Auckland's urban environment; but it was the rapid growth in private transport in the period leading up to the Second World War that led to biggest expansion of Auckland's built environment (Watson, New Zealand, & New Zealand, 1996). The convenience of the car provided the luxury of living further from areas of work and encouraged a steady withdrawal from public transport. Legislation and investment in private car infrastructure helped to validate this urban sprawl (Dixon & Dupuis, 2003).

During the 1980's the Auckland Regional Council shifted from promoting growth to focus on higher densities within the existing built up area. This led to the formalisation of Auckland's Metropolitan Urban Limits as a method of containing growth and intensifying commercial centres (Cityscope Consultants, 2011, p. 6). Later, in 1999 the Auckland Regional Council adopted a regional growth strategy for the next 50 years, a document that identified that intensification was necessary to help protect productive rural land, ecologies, contain infrastructure costs, increase efficiency of public services, enhance urban design, boost housing choice and affordability, improve accessibility, and promote a greater sense of community (Cityscope Consultants, 2011, pi) (Auckland Regional Council., 1999). The major platform for this higher density strategy is Medium Density Housing (Dixon & Dupuis, 2003, p. 354).

Figure 3.22 Auckland Harbour Bridge allowing Urban development to spread North (1961)

Defining Medium Density

The term 'density' in the context of housing usually refers to a ratio of a given number of dwellings to an area of land ('AMCORD', 1997). The numerous ways this can be expressed (eg. Floor area to plot size, people per km, and homes per hectare) give us a multitude of ways of thinking about density as a tangible concept (David Turner et al., 2004) ('AMCORD', 1997). Most of these definitions of housing density focus on defined ratios rather than the perception of inhabitants which is how density is experienced and is why these densities calculated on paper, though important legally, cannot be considered an over-arching imperative of Medium Density Design ('AMCORD', 1997).

Medium by definition is a relative term and is culturally informed. What is acceptable to users depends on the conditions of the area and what people are familiar with. For many New Zealanders the relatively low density suburban model has been the reference point for acceptable density (Cityscope Consultants, 2011, p. i). Distinguishing between low density and medium density acknowledges that well conceived design becomes critical above a density threshold of approximately 30 dwellings per hectare to ensure livability (David Turner et al., 2004, p. 2). Though there is no universal or standard application for medium density design it is ill-conceived design approaches that have led to the a distinct image of MDD and a strong negative stigma in Auckland (David Turner et al., 2004).

Issues of MDD

With higher density design come inherent difficulties and opportunities (David Turner et al., 2004). The difficulties of living closer together are often perceived to be synonymous with compromised quality of life, however internationally, where higher density living is more culturally entrenched, the efficiency and sense of community living closer offers is widely considered a positive aspect when done correctly (David Turner et al., 2004) (Katz, 1994). The relationship of dwelling and community; the car and convenience; density and 'style'; the importance of outdoor living space; as well as security and privacy are key issues facing social acceptance of MDH.

Figure 3.23 City, Domain and Sanctuary scale relationships

The Dwelling and the Community

“Architecture[s]... purpose is to mediate between the individual and the natural world by creating the physical reality of the human community, by which the individual is linked to the rest of humanity and nature is in part kept out, in part framed, tamed and itself humanised... It is within that model that human beings live; they need it badly, and if it breaks down they may well become insane (Katz et al., 1994, p. 221).”

Vincent Scully's quote from 'The Architecture of Community' reminds us of the fundamental role of architecture as both a mediating device between humans and nature, and as a physical manifestation of human communal values (Katz, 1994, p. 221). Community can be broadly described as individuals identification with their landscape (natural or built) and each other in one way or another. The notion plays an important role in defining culture and how we live together, interact, and contribute to each other's lives. The Standardisation of processes, widespread infrastructure embrace of the private vehicle, and the widely internally reflective and 'style' obsessed approach of architecture in the 20th century have helped to fragment urban development and in turn society, while these core communal values, so important to human nature and wellbeing, have been slowly eroded (Scully, 1996, p. 10) (Katz et al., 1994) (Elizabeth Mead, 2010).

Despite the overall negative view towards the majority of medium density developments, most residents of these developments are generally happy with their homes (Cityscope Consultants, 2011). This could be due to a number of different reasons, however it does highlight

the disjunction between satisfaction of the individual home owner and the dissatisfaction of the community.

Adopting the spatial scales articulated by Cityscope Consultants, community can be resolved into three main spatial scales: The Sanctuary or the home of the individual, The Domain or the neighbourhood and The Sector or the city scale (fig. 3.22). Establishing these spatial distinctions between the home and the different levels of community acknowledges the importance of the home or sanctuary to the home owner and outlines the dwelling's place within a larger scale community and its relationship with this community (Katz, 1994). Designing to engage all three levels develops a more socially responsive environment and a more socially responsive model will invariably produce a more socially acceptable scheme (David Turner et al., 2004, p. 3).

Because of the sites size, Three Kings Quarry presents an opportunity to build community values in a holistic way through relationships within homes, between homes, to the larger neighbourhood and the wider community. The proximity to the village centre and major public transport route reasserts the responsibility of the designer to connect to the wider context.

Figure 3.24 Exhibition Road, London, shared space

Figure 3.25 The Woonerf, or 'living yard', employed throughout the Netherlands is an example of how a mixed use environment can be achieved through design rather than through signage (J.H. Kraay, 1986).

The Car and Convenience

The introduction of the private car into mainstream culture is widely considered the point where urban and architectural design ceased accounting to human scale and started fashioning itself to the scale of the car (Scully, 1996). The existing suburban landscape in New Zealand and internationally, is a manifestation of this 'car culture' and for this reason fails to appeal to our human scale communal desires. In the past what the car offers in personal freedom has been considered enough to warrant this antisocial urban development (Katz et al., 1994, p. 222). However, In the last 30 years environmental studies as well as new streams of critical thought (Katz et al., 1994), spurred by discontent with our tarmac heavy, carpark scaled urban environments, have revealed the true environmental and social price we pay for convenience.

The reality, however, is that 61.7% of the Three Kings community travel to work by car and that it currently plays a crucial transportation role in Auckland's current infrastructure system and is a key consideration for any successful development (Statistics New Zealand, 2013). Urban design strategies such as increasing permeability can make access to public transport easier and help encourage alternative forms of transport. A way of minimising the cars presence and effect on the suburban streetscape is to introduce traffic calming measures to both slow traffic down and make drivers feel comfortable travelling at a slower speed.

Density and 'Style'

Speculative housing developments have had a long history of modifying and adapting existing architectural styles to meet the perceptions of market preferences, preferring a tried and trusted model before innovation (fig. 3.26) (David Turner et al., n.d., p. 25) (Rouillard, 1987). This speculative approach in Auckland medium density housing has resulted in traditional suburban housing styles and forms being re-employed in compacted versions, both in aesthetics and site layout. However compact living does not work well when translated into 'compact suburbia' and successful approaches in comparable countries identify with local traditions of domestic design while developing housing layouts specifically suited to higher density housing. By

this approach Medium Density Design can establish its own language without reference to imported or suburban 'style' and expression (David Turner et al., 2004, p. 3).

Figure 3.26 Diagram representing influences on medium density design resulting in 'compact suburbia'

Figure 3.27

Figure 3.28

Figure 3.29

Figure 3.30 Analysis of Mt Eden Suburban Homes access and outdoor space use

Outdoor Living Space

Along with its associations with psychological wellbeing, private outdoor space has always had strong roots in Kiwi suburban culture. Summer barbecues, back yard cricket, and do it yourself vegetable gardens are a way of life that many New Zealanders hold dear, however the domestic private space and garden is seldom treated with the same importance as the interior (Coolen & Meesters, 2012, p. 50). In higher density developments outdoor living often means small pockets of private outdoor space that meet a minimum requirement rather than creating functional outdoor living space. When private space is considered closely with public outdoor space outdoor living space use can be optimised. Though there are similarities in the functions of both spaces they offer very different functions in people's lives (Coolen & Meesters, 2012, p. 50).

Private Space

In the article 'the Meaning of Gardens', Mark Francis identifies the personal meaning of the garden to different people (fig 212). These concepts assume different meanings at varying life stages and signify the importance of designing for versatile use (Francis & Hester, 1990). The variety of different uses fall under three broad categories for how we use private space outlined in figure 3.31 (Grampp, 2008). In Auckland, private space can be further distinguished into two main areas.

Frontyard

The frontyard is not as tied to the domestic activities as the backyard is, however individual dwelling entry provides a strongly symbolic image of identity and as a threshold between the public and private realm (Marcus, 1986) (Bernardini & Irvine, 2007). Features like a garden gate in the frontyard help emphasise the public-to-private territorial transition (Marcus, 1986, p. 76). Encouraging

activities in the front yard (like gardening) can help stimulate more social interactions.

Backyard

Because of its increased privacy the backyard takes on a more living and productive garden function. Indoor-outdoor flow is a popular term used in New Zealand expresses the desire for indoor to extend seamless into outdoor living (Marcus, 1986, p. 94) (Coolen & Meesters, 2012, p. 49).

This relationship focuses most of the household activity at the back of the home, totally excluded from the public realm. Though these completely private spaces can be productive (e.g. clothes drying), it removes any possibility of interaction between the public and private realm, a connection which can help live both environments.

Public Space

Public green space helps bring people together and to experience nature and should be conceived as a positive contribution to the livability of the dwelling environment (Bernardini & Irvine, 2007). The relationship between the private and public outdoor space is important and although some of the meanings are shared communal space is not a substitute for private outdoor space (Coolen & Meesters, 2012, p. 65) (Marcus, 1986, p. 102). A strong link between private and public space is necessary for public spaces to be utilised to their full potential (Marcus, 1986).

Private-Public Networks

The opportunity inherent in large developments like Three Kings Quarry is that a holistic approach can be adopted to help integrate public outdoor space and private outdoor space to create strong connections that complement each other's function in a spatially efficient way.

Figure 3.31 Diagram of the relationship of the garden in Auckland suburbia

Security and Privacy

Security and privacy, though not interdependent are strongly linked. Concern over security has long been a key issue in higher density design however there has been little evidence to suggest that MDH in New Zealand is any more susceptible than any other type (David Turner et al., 2004). It is often argued that the greater concentration of building, and proximity of public open space can create anonymity and lessen the possibility of intruders being noticed, however with strategic placement of windows, doors and paths, passive surveillance can help discourage intruders. The physical barrier in Gated developments can block out intruders but because there is a sense that anyone seen 'inside the fence' is probably entitled to be there, the value of passive surveillance is nullified (David Turner et al., n.d., p. 24). Gated developments represent an overreaction to security needs in many cases and create super private and exclusive communities. Though it may build community values within the development, which arguably would be present anyway, the total removal of the possibility of engagement with the wider community invariably has a detrimental effect on the integration into the neighbourhood.

On the other hand lack of delamination of what is private and public can also cause tensions between neighbours and lead to outdoor spaces being under-used (Marcus, 1986, p. 99). Spatial demarcation is usually achieved through head height fencing in suburban developments which create a literal wall between private living and public passages. Planting as well as elevated spaces can ensure privacy without losing connection to the curiosities of public space.

Permeability

Because of the large scale for many medium density developments there is a need to incorporate urban design principals to ensure liveability as well as integration into the wider context. 'Responsive Environments' outlines seven key urban design principals aimed at enhancing the urban environment (Bentley, 1985). Permeability is only one of the seven principals, however it represents a significant challenge for development at Three Kings quarry due to the dramatic topography.

Urban scale

Permeability means making connections between spaces to allow choice for how people experience a place. Physical permeability is dictated by how buildings are divided into blocks and the paths that occupy these divisions. Visual permeability requires a visually legible environment so the user can see where the route will lead and be able to see alternative routes. Permeability encourages intuitive movement through the built environment.

Dwelling scale

The concept of permeability can also be applied to the visual interface between private and public space. Visual permeability between the liveliness of public spaces and private spaces can enrich and add character to both, making the environment as whole a more pleasant place to be.

Case Study - Stonefields Development

Figure 3.32 Stonefield site

Site	Auckland, New Zealand
Completed	2014 (compact dwellings)
Site Size	110ha
Site Density	23-26 Homes per Hectare (incl. Parks and roads etc.)
Developer	Todd Property Group Ltd

Both Three Kings and Stonefields are disused quarry sites being redeveloped for housing. Stonefields sits next to the Mt. Wellington Maunga and the Scheme uses primarily Architectural Integration and Landscape Remediation models aiming to create a sustainable development. The following is a personal critique of Stonefields from multiple site visits, analysing the overall urban scheme, a chosen housing cluster and a dwelling layout.

Figure 3.33 Urban Analysis of Stonefields 1:1000

Urban Analysis

Access

The basalt cliffs prove to be the biggest obstacle to permeability through Stonefields (fig. 3.34). The only vehicle access into the development is from the East. A public pedestrian path leads into the development from the Lunn Avenue shops and looks out over the wetland, however the lack of planting or landscaping here does little to enhance the experience (fig. 3.35).

Housing

When entering from the East you are met with five storey apartments which offer a very hard edge to the primarily medium density development (fig. 3.36). The continuous rows of repeated terraced homes (fig. 3.37), little variation in stand alone dwelling design (fig. 3.39) and the restrictive grey and beige colour scheme creates a monotonous built environment.

Wetland

The Wetland is a response to the drainage needs of the development (fig. 3.38). The wetlands provide significant amenity to inhabitants however the lack of connection to the site means that only residents really take advantage of the wetland amenity.

Lunn Ave. Shops

There is a need for the Lunn Ave. Shops to re-orientate their layout to look over the wetland. However these views from Lunn Ave. and other elevated locations around the perimeter also look out over monotonous skyline of the suburb. The lack of definition in the building volumes means there are no landmarks to break up the roofscape and for users to gain their bearings. This is partially a product of the flat landscape however the repeated housing types do not help.

Figure 3.34 Diagram of terrace

Figure 3.35 Path from Lunn Avenue Shops

Figure 3.36 Apartments

Figure 3.37

Figure 3.39 Limited colour scheme and monotony

Figure 3.38 Wetlands offer significant visual amenity

Figure 3.40 View from Lunn Ave.

Basalt Cliffs

No access is provided to the basalt cliff terraces and the entire development design fails to utilise these dramatic land form features.

Figure 3.41 Basalt terrace

Figure 3.42

Cluster and Home Analysis

The terraced homes are repeated units, sometimes more than twelve units without breaks, which do little to inspire individual expression among homes and makes for very repetitive streetscapes.

Figure 3.43 Vehicle access to cluster

Figure 3.44 Analysis of streetscape

Figure 3.45 Stonefields ground floor plan analysis

Figure 3.46 Enclosed outdoor space

Stonefields development deals with many of the issues facing the development of the Three Kings Quarry. Development of the Three Kings quarry should therefore respond to the weaknesses and strengths of Stonefields to ensure livability of the new development.

Case Study - Heller Street Development (Site Visit)

2011
440m²
Six Degrees

Completed
Site Size
Architect

The Heller Street residence sits on an old clay quarry pit which became a rubbish landfill. The developers worked with the local council to help decontaminate the public park while designing homes that make the most of the communal park. The locally sourced timber clad building sits three storeys above ground level with a private roof terrace. The necessary earthworks needed to decontaminate the site has allowed parking to be concealed underground, allowing a more fluid transition from living spaces to the communal garden.

The long, thin north-facing layout works effectively and efficiently. The small, enclosed yardspace at the rear of the dwellings does little more than offer ventilation to homes and is a product private outdoor area minimum

standards (Brian Zulaikha, 2012).

The frontyard has a extremely public interface, however the setbacks from the pathway make indoor living spaces at ground level sufficiently private.

The design makes the most of natural systems by incorporating passive ventilation, cooling and heating; solar panels and communal garden irrigation fed from the rainwater of the residences (fig. 3.53). While the homes are marketed to higher income earners the development represents a sustainable way of remodelling the quarry landscape and integrating architectural design to utilise public space in an efficient way.

Figure 3.48 Pedestrian entry to homes

Figure 3.49 Very permeable public-private relationship (physical and visual)

Figure 3.50 Kitchen, dining and private outdoor space

Figure 3.51 Ground floor interior

Figure 3.52 Site plan and entry

Figure 3.53 Sectional diagram of development features

Case Study - Villaggio Matteotti

Completed 1969
Site Size 20ha
Architect Giancarlo De Carlo

Figure 3.54 Villaggio Matteotti site

Villaggio Matteotti was built as a social housing scheme for steel factory workers in the industrial city of Terni. The residents were all employees at the steelwork factory and were invited to participate in the design process.

The urban cluster consists of 5 basic dwelling modules that combine to create a huge variety in dwelling types (fig. 3.59). Each dwelling has an outdoor private space with street level entrance connected to both public paths and vehicle access roads.

The heavily planted pedestrian corridors are totally separated from vehicle thoroughfare and connect to public space at either end of the development (fig. 3.55), while the contrasting barren vehicular passages are reminiscent

of industrial service roads. The segregation of routes here focusses on removing the detrimental effects of the car away from the pedestrian areas, however it enhances the barren purely vehicular routes as a result. The various alcoves created by connections of 'sky bridges' and public paths create intriguing spaces however pose a potential security risk due to the lack of passive surveillance.

Public planting and private gardens help break up the concrete heavy environment along the pedestrian thoroughfare, but the large scale of the volumes along with the consistent rough concrete finish presents a very bulky and brutal aesthetic (fig. 3.58). Although the modular design creates a variety of dwellings the consistent concrete aesthetic makes it hard to identify

individual residence.

Though the village is an older example of medium density design, the Villaggio Matteotti exemplifies the fundamental principals of how connection and pedestrian orientated spaces can help foster communal engagement.

Figure 3.55 Site diagram of village

Figure 3.56 Sectional diagram of relationships

Figure 3.57 Pedestrian path

Figure 3.58 Large volumes and bulky aesthetic

Figure 3.59 Housing modules

Figure 3.60 Vehicle access lane

Figure 3.59

Conclusion

In order for the stigma attached to MDH to be overcome, urban and architectural design must acknowledge the role of the home in the wider community; respond to the necessities of suburban outdoor living while rejecting compact suburban models, issues of style and vehicle scaled design. In both case studies there is an attempt to minimise the role of the car in order to focus on interaction between people within the community. Three Kings has a unique opportunity to apply community driven MDD on a large to help shape the way people perceive higher density living.

3.3 The Slope and Mass Housing

The scoria cliff is a prevailing landform of the Three Kings Quarry. This chapter investigates the opportunities and issues concerning mass housing design with sloped landscapes and more specifically how medium density design can help bridge the divide between housing and the slope. Historic slope settlements born out of necessity are discussed in comparison to counter-innovative modern practices of mass housing to illustrate the importance of landscape inspired design. An investigation of sloped design in Wellington as well as literature review informs discussion around innovation and key concerns attributed with mass housing of the slope.

Communities of the Slope

Historically elevated sites and sloping sites were primarily desirable for their defensive qualities (Rouillard 1987, p. 1). The elevation and inaccessibility gained from the steep sites offered unrivalled safety for communities. In addition to security the slope sites offered proximity to crucial resources (fig 3.31), hygiene (as water runs downwards away from homes), visual aspect, sunlight, thermal mass, and fresh air (fig 3.32). In all cases the difficulties of building on such sites were outweighed by the opportunities the slope offered to the communities. These iconic, compact and connected communities built out of necessity have now come to represent seductive vernacular landscapes of structural, architectural and environmental innovation.

Though the necessity of defence is less relevant in Auckland's Suburban environment (as 'fortified' as many MDH developments may seem), the 'housing crisis', demand for living close to the central city and need to protect arable land requires maximum utilisation of land within urban areas. The necessity of land utilisation calls for similarly innovative approaches that utilise the seemingly unbuildable landscape.

(Right and Above)

The Amalfi coast in Italy has been inhabited since the middle ages and is an area of natural and architectural beauty. The settlement is a good example of adapting their use of the land to the diverse nature of the terrain, which ranges from terraced vineyards and orchards on the lower slopes to wide upland pastures. climbing up the steep hillsides and connected by a maze of alleys and stairs (UNESCO, 2014).

Figure 3.62

Figure 3.63

Figure 3.64

(Above)

The Bandiagara Escarpment in Mali, West Africa, has been inhabited since 300 BC. Its current inhabitants are the Dogon people who built with earth-brick and thatch dwellings high up on the cliff face, for protection and to take advantage of cooler air (Enrico Guldoni, 1939, p. 26).

Figure 3.65

Figure 3.66

(Left and Above)

Cappadocia which sits in the Göreme valley in Turkey is a product of early monastic activity in Cappadocia date back to the 400 BC. In order to resist attack they began to form subterranean towns which served as places of refuge (UNESCO, 2014).

The Slope and Innovation

The term slope spans from gentle gradients to almost vertical cliffs and presents an uncomfortable situation for architectural design, expression and theory as it confronts traditional domestic activities, more disposed to flat surfaces. Very little literature has been devoted to slope design and even less is concerned with mass housing on such sites (Rouillard, 1987, p. 19) (Simpson & Purdy, 1984, p. 12).

Figure 3.71 outlines the three principal ways planners and designers can react to any slope (Simpson & Purdy, 1984, p. 12). Though not mutually exclusive and often used together, many large scale developments today rely heavily on the landform adapted approach to fit the preference of standardised mass housing. This standardised practice often result in repeated units conceived in isolation from their landscape and future

inhabitants, while the prominence of the third dimension of the slope highlights and exaggerates the unresponsive architectural features (Simpson & Purdy, 1984, p. 1). Apart from the psychological necessity for housing to have a sense of place or personal identity (Tilley 2006, p. 8), it is not easy for a developer to impose a standardised layout on a sloping site, especially a slope as dramatic as those at the Three Kings Quarry. Encouraging a more landscape inspired and specific design approach therefore helps restore a balance that encourages innovative solutions that respond to the needs of the local landscape and community.

Landscape Inspired

Street layout, access, position and orientation follow the condition of the slope. Traditional building techniques are usually employed here.

Figure 3.67

Landform Adapted

Landforms are manipulated to make construction easier. This is a common approach to design to account for typical suburban home construction.

Figure 3.68

Specific Design

Specific Designs are usually employed on slopes steeper than 8 degrees as it becomes much harder to employ 'flat site' design. This approach involves developing unique forms to fit the complex nature of the slope. This is considered a highly landscape responsive approach to design.

Figure 3.69

Figure 3.70

Figure 3.71 Different planning and design approaches to the slope

Case Study - Wellington City

The topographically challenging landscape of Wellington has had a huge influence on urban development. This study looks at approaches to housing and landscape through analysis of three developments in the suburbs of Kelburn, Te Aro Valley, and Oriental Parade.

The City

The Central City sits on the relatively flat, partially reclaimed land by the Wellington Harbour. As the city moves outwards the suburbs sprawl across the hills that frame the central city. The suburbs mostly consist of typical suburban housing that follow a landscape inspired street layout, and a landform adaptive approach to meet the needs of the suburban housing on individual properties. In many cases this approach does produce some very eccentric layouts as the suburban type is forced to submit to the extreme typography.

Figure 3.72

From top: Kelburn, Te
Aro Valley, Oriental Bay

Figure 3.73 Wellington City contours (black) and built environment (red)

Kelburn Study

This low density subdivision represents the typical manipulation of the slope to the traditional suburban housing type. Where the retaining of the landscape to suit the street front homes severely compromises access to the home behind.

A interesting product of this landform adaptive approach is the incorporation of the carport. For homes that are built down the slope the carport is often placed over the home, acting more like a viewing platform when the car is absent.

Figure 3.74 Difficult access to homes not on streetfront

Figure 3.75 Carports built over homes act as viewing platforms

Figure 3.76 Analysis of subdivided property

Te Aro Study

In this medium density development housing density is pushed to the front of the property by the steep contours of the site. The sprayed shotcrete retaining wall, partially obscured by the homes, allows a relatively flat surface for development. The small change in levels creates a graded roofscape which helps distinguish individual homes and an attempt has been made to diversify homes through varieties of colour and fenestration.

In both Kelburn and Te Aro Valley examples the landform adaptive approach does yield unbuildable and inaccessible spaces, usually behind developments. Though not a conscious effort, these unbuildable spaces produce areas of elevated greenery, providing significant visual amenity to the city, and is a happy consequence of the design approach.

Figure 3.77 Medium density development

Figure 3.78 Elevated greenspace consequence of unbuildable landscape

Figure 3.79 Analysis of medium density development

Oriental Bay Study

Because of the high land value of the area, the Copthorne hotel's utilisation of land has resulted in a high density design allowing the building mass to effectively traverse the slope by sheer mass, connecting the top and bottom of the slope. Though this solution is only possible by the sprayed concrete retaining wall, it does illustrate the opportunities that higher density offers when connecting the top and bottom conditions of the site when dealing with a steep slope.

Sprayed shotcrete retaining walls are frequently used in Wellington to make space for infrastructure and housing, however these structures are not only energy intensive but an eyesore in the landscape. Some efforts have been made to mask the concrete walls effect in the landscape, often helping to highlight its presence (fig 3.81)

Figure 3.80 Copthorne Hotel

Figure 3.81 Green shotcrete retaining

Figure 3.31 Cophthorne hotel analysis

Figure 3.82 Cophthorne Analysis

Mass Housing and the Slope

As the slope represents a unique condition key design considerations must be made for mass housing on sloped sites. These considerations primarily refer to configuration, silhouette, access and privacy.

Configuration

Configuration refers to the physical arrangement of elements of a building and defines the spatial layout. Figure 3.83 presents the different ways the home can relate to the slope. Successful configurations rely on manipulating relationships to respond to the variable nature of the slope and its context (Rouillard, 1987, p. 15). These approaches are not intended for their formal attributes but offer a comprehensive palette for responding to the conditions of the slope and functional needs of homes.

Figure 3.83 'Vocabulary' of home configuration in relation to the slope

Figure 3.84 Relationship of Mass Housing and perception in landscape.

Figure 3.85 Showing how mass housing and proportioning can break up the silhouette

Silhouette

As the slope rises it exposes the housing form, elevating the building for all to see. Because of the size of buildings involved in mass housing the architecture depends on the extent to which the proportions the structure relate to one another, the human scale as well as the landscape that surrounds (Goldberger 2009, p. 66). In this study the silhouette refers to the figure-ground relationship between the building and its context. On a typical flat urban site this usually refers to the neighbouring buildings and the sky, however with a sloping site the building is often framed by its sloping landscape (fig. 3.317). Context specific proportioning, relevant materiality and planting can help soften the silhouette and aid in landscape integration to visually tie into the surrounding landscape.

At the top of the slope the silhouette is formed by the skyline and surrounding buildings. Roof-lines have an important role here in breaking up the silhouette to help distinguish individual homes. Responding to the existing grain, or building pattern, also helps to marry the scheme to the existing building layout (Simpson & Purdy, 1984, p. 176).

Though aesthetic treatment is important to how we experience our built environment this approach is not intended to treat architecture purely as an object when considering silhouette, as it must complement function.

Access

Connecting the top and bottom conditions of the slope maximises productive use of the landscape, even if only possible for the pedestrian. When it is possible building along the contours is the best way to increase accessibility and achieve the most unobstructed views.

Privacy

Though elevation offers privacy from down slope, overlooking can lead to loss of privacy and result in the need to use unsightly walls and fences as a remedy. Designing to reduce overlooking requires considering the sight lines of all public and private spaces as well as providing maximum day lighting. Strategies such as setbacks on public paths can stop site lines invading private territory (David Turner et al., 2004) (Judd & Gamble, 1993, p. 23)

Conclusion

The dramatic slopes of the quarry present a challenge and opportunity when considering medium density design. Designing with slope is not only important to reduce the economic and aesthetic drawbacks of major earthworks, but also in creating integrated built and natural landscapes respond to the local conditions. Though the common landform adaptive practice of developers can produce eccentric results these developments can compromise functionality and innovative discoveries that necessity once inspired. Identifying key considerations of mass housing and slope design allows a more landscape inspired approach that tests specific design solutions for the Three Kings Quarry.

4.0 Site Investigation

This chapter expands on the investigation into the present condition of Three Kings Quarry introduced in Chapter 1. The chapter investigates the site's relationship to the wider Auckland context including amenities, infrastructure and services as well as offer a more specific investigation into the spatial relationship and land uses in the Three Kings area.

Three Kings and Auckland

The quarry sits around 5km south of the CBD of Auckland and 3km North of the Manukau Harbour. The area is very accessible as it sits in a zone between State Highway 1, connecting northern and Eastern Auckland, and State Highway 20, linking to the Airport and Southern Auckland. The train network does not pass through this part of Auckland, so bus travel is the primary form of public transport (fig. 4.01).

The suburb is in close proximity to four other volcanic cones most notably One Tree Hill together with the neighbouring Cornwall park which provides the largest parkland area in Auckland City (fig. 4.02) (Auckland Council, 2015).

Figure 4.01 Wider context analysis

Figure 4.02 Wider context land use and proximity of volcaic cone parks

Three Kings

Land Use

The area of Three Kings Suburb loosely follows the volcanic tuff ring created by the eruption. The area is approximately 112ha and consisting of 46% residential use, 29% Open Space, 13% Quarry use, 6% commercial use, and 5% institutional or community use (Auckland Council, 2014).

Because dogs are allowed off their leashes within the Big King Reserve it is a popular spot for dog walking. The Football fields to the West of the quarry are infrequently used because of their inaccessibility, however the more accessible sports fields as well as tennis courts that sit next to the plaza are used frequently.

The light industrial building block that sits within the quarry property consists of a cafe, pet shop and furniture store accessed from Mt. Eden Road. Light industry to the North conceals the gated medium density housing development tucked in behind. Permeability through this space is limited because of the large building footprints as well as the gated nature of the housing development.

The main entrance to the Big King Reserve sits at the junction of Mt. Eden Road, Duke Street and Rewa Road, adjacent to the neighbourhood centre consisting mainly of retail and dining establishments.

Three Kings Plaza has a very confusing and decentralised layout. Scattered car parking occupies the majority of space which creates a stark car orientated space. The large building footprint segregates the plaza space and the internally reflective layout makes no visual connection

Figure 4.03 Land use and strained connections in Three Kings

to the Maunga. In the 'Three Kings Plan' a more user friendly vision and cohesive vision for the Three Kings Plaza is presented so any development within the quarry should foster these directives. There are almost no safe pedestrian crossings over the busy Mt. Albert Road meaning this block is also cut off from the activity of the plaza.

Figure 4.04 Three Kings Plan intensions for Three Kings Plaza development

Transport and Access

Mt. Eden Road is a district artery with frequent bus schedules that take users primarily to and from the CBD in the North and the airport to the South on the Air Bus route. Mt Albert Road to the South of the site and Duke Street to the North offer additional bus routes providing more access to the East and West of Three Kings.

Collector streets and cul de sacs that border the Western side of the quarry connect to the reserve through numerous pedestrian access ways (Fig. 4.05). There is limited accessibility to the Maunga from the East due to the sheer quarry cliffs and very little public property from this side.

The only existing entrance into the quarry is from the North-East. The South-Western corner of the site is almost level with the quarry floor which makes it a suitable entry point into the quarry development by vehicle and by foot. At the North-Western corner of the Quarry there is also an opportunity to create a walkway connecting the Big King Reserve and the quarry as the drop is fairly short.

Figure 4.05 Pedestrian and vehicular connections within Three Kings

Figure 4.06 Aerial view of key features and land uses in Three Kings

Figure 4.07 Light Industrial and Medium Density Development to North of Quarry

Figure 4.08 Photos of Big King Reserve

Library

Tennis Courts

Figure 4.09 Photos of Plaza

Carparking

Quarry

Contours

The quarry is a basin with terraced scoria cliffs with drops up to 40m. The cliffs roughly follow the quarry boundary in places however gentler gradients to the south of the quarry offer the best option for access into the quarry. This entrance is also compatible with connections to surrounding roads.

Sunlight

Shading from the scoria cliffs presents a difficulty to housing development. Excessive shading caused by the cliffs in areas make them unsuitable for housing integration.

Aspect

The quarry is a basin so views are afforded down into the basin from all around the perimeter. View into and out from the quarry development will play a large role in how the development is perceived by those living in and around the basin.

Figure 4.10 Aerial showing view aspect into and out of quarry.

Figure 4.11 Sunpath diagrams

Figure 4.12 1:500 Contour map

Figure 4.13 1:500 Contour map

Water and the Site

Because of the underground aquifer that joins flows through to Western Springs lake the treatment of the soil and water here has knock on effects to the wider water system. Water has been pumped out of the quarry so that quarrying can occur below the natural water table and this pumping continues today. The natural water table level sits at about 52m above sea level which sits just below the cliff terrace on the eastern cliff of the quarry. If the water table were to return it would submerge most of the quarry floor.

Figure 4.14 Water table returning after dewatering for quarrying

Figure 4.15 Movement of water in the quarry into the porous scoria that surrounds the site

Figure 5.10 Diagram of Design scales

This section of the thesis presents key movements concluding with a proposed scheme for the quarry at a masterplan, housing cluster and individual dwelling scales.

5.0 Master Plan Design

This Chapter presents key design moves and a proposal for the masterplan of Three Kings Quarry. The resolution at the masterplan scale helps to inform architectural focus, presented in the next chapter.

Figure 5.11 1:500 CNC model of Three Kings Quarry

Initial Massing Studies

Initial mass studies tested the possibilities of the dewatered sight. The steep cliffs and terraces help hide high density from outside the quarry and accommodates a high concentration of housing, however excessive shading, difficult access and reliance on pumping to stop flooding makes the quarry, as it is, unsuitable for housing development.

The opposite approach, total fill, was considered but not explored in this study as it erases rather than celebrates the quarry landscape.

Figure 5.12 Initial massing perspective

Figure 5.13 Initial massing section

Strategic Filling

This iteration tests the potential of strategic soil landfilling to aid in quarry design while allowing the natural return of the water table. The connective embankment responds to access needs from Mt. Eden Road while providing land and visual amenity for homes. Vehicular access to dwellings and/or apartments from the top is designed to reduce vehicular clutter in the quarry and encourage a pedestrian centric environment on the lakefront. The vehicular route that connects with the Smallfield Avenue allows permeability from a low traffic area to the West along a relatively gradual gradient.

In this iteration the landscaping fails to reference the significant features of the quarry, creating a new artificial condition rather than utilising the existing industrial landscape. The central passage generates more shading issues for the dwellings making them a very unpleasant place to be most of the day. Though the scheme presents a legible, distinctive environment with significant visual amenity, the infeasibility of the landfill and infrastructure work needed to compact soil for housing foundations make the central passage an impractical option.

Figure 5.14 Perspective of scheme

Figure 5.15 A-A section through scheme

Figure 5.16 Strategic filling masterplan iteration

Perimeter Housing

This perimeter housing iteration embraces the return of the natural water table, creating a central retention lake for stormwater, visual and recreational amenity. The scheme also offers a complete pedestrianised space within the quarry. The perimeter volumes along the slope allow for higher density housing that doesn't conflict with the existing one and two storey skyline of the Three Kings suburb. Allowing the water table to return also allows for sustainable wetland ecologies to be established in the shallower parts of the lake.

The scheme does little to create connections to the Big King but does reduce the need for traffic to enter into the quarry itself. Most of scoria cliffs and topography of the quarry is lost to the rising water, however the fact that this is a natural process validates it as a more sustainable option, while the incorporation of wetlands can help allude to the condition below water level. Though perimeter housing is a seductive solution it does little to respond to Auckland's housing needs and the outdoor land based recreational desires of the community.

Figure 5.17 Perspectives of scheme

Figure 5.18 Perimeter housing masterplan iteration

Memorial Landfill

This iteration explores partial land reclamation of the submerged quarry as reference to the past condition. The two areas of land reclamation signify the area where the two larger quarried volcanic cones once stood. The scheme reintroduces vehicles into the quarry for housing access while allowing pedestrian focussed areas.

The landfill is an artificial attempt at referencing a past condition of the quarry landscape. While the reclaimed land allows for more developable land the landfill fails to utilise the existing condition of the quarry and for this reason loses validity and practicality.

Figure 5.19 Memorial landfill perspective

Figure 5.20 Memorial lanfill masterplan iteration

Proposed Masterplan

This masterplan proposes a framework to structure future development and design of the Three Kings Quarry.

Models of Reclamation

The master plan primarily integrates habitat restoration and architectural integration models of landscape remediation. Landscape remodelling utilised the stockpiles of soil to make it suitable for housing and allow for appreciation of the quarry features.

Access

North and South access points provide vehicular access but much of the perimeter housing is designed to be accessed from outside the basin. Pedestrian routes into the quarry work with topography and building volumes to allow easy access along gradual slopes. One way roads are employed in housing zones to help minimise the amount vehicular space needed and as a traffic calming measure. The lake circuit walkway acts as a pedestrian distributor helping to connect surrounding pedestrian networks and circulation around the site (fig. 5.22).

Figure 5.21 Masterplan land uses

Figure 5.22 Masterplan access

Mixed Use Area

The Mixed Use Area sits at about 13-15m below the level of the current plaza. The cliff that separates the plaza from the Mixed Use zone is connected by a pedestrian route that works across the slope and building form offering an accessible and visually stimulating path. Retail and restaurants at the base of the cliff stimulate activity within the basin and encourage people to take advantage of the visual and recreational amenity provided by the lake, wetlands and walkway.

The Mixed Use Area helps bridge the divide between outside and inside the basin development, supplementing the services of the plaza rather than offering an alternative. The building form within the Mixed Use Area is designed to take advantage of the lakefront, scoria cliff, wetland and volcanic cone aspect and permits restaurants and retail to spill into the public space to help enhance activity within this public area. The protruding basalt rock formations are framed by these design elements and become an attractive feature of the space.

Plaza

The building form frames the plaza space to help centralise future development as a civic node rather than a carpark. Relocation of parking will need to be considered for future plaza development (without congesting quarry development) to ensure a pedestrian friendly environment.

Figure 5.23 Mixed Use Area

Housing

The housing area is designed primarily to foster community interaction. The streetscape is separated into alternating routes: a shared streetscape for cars and pedestrians and public 'green' paths.

Shared Streetscape

These mixed spaces reduce the impact of the vehicle while allowing vehicle permeability. Basalt paving treatment of these shared streetscapes signals to the driver they are entering a slower speed zone. Narrow streets, planters and coarse basalt tile strips make slower speeds more natural to drivers to help slow traffic to walking speed. The planting creates a more pleasant environment and helps soften the presence of parked cars when looking down the street. Planting also offers visual privacy between facing homes, making narrower streets more viable.

The impact of the car scale is reduced by minimising 'car only' space. The flat curb-less streetscape encourages a more diverse use of the space not restricting pedestrians to the footpath when vehicle traffic is low and helping to avoid the street becoming a purely service lane.

Figure 5.24 Site plan of housing clusters

Figure 5.26 Vehicle access, planting and privacy of streetscape

- Public Space
- Medium Density Housing
- Area for Potential Higher Density Design
- Commercial
- Pedestrian Access
- Two Way Vehicular Access
- One Way Vehicular Access
- New Views Created

Figure 5.27 Diagram of housing area and networks through

Green Public Paths

Public paths create a purely pedestrianised environment removed from the impositions of accounting for vehicles. Pedestrian pathways that cut across the development help to break up the continuous volume while offering east-west permeability. Allowing access from the back to homes also increases the potential for a variety of backyard uses.

Living Spaces

Living spaces are designed to allow a fluid connection from street front to living room to backyard to public park and neighbouring homes, to encourage more engagement between public and private. The roof terrace provides a separated outdoor area for more private outdoor activities.

Utilising elevated living space and planting instead of fencing to help demarcate boundaries allows for personalisation of these spaces based on personal preference and create public-private permeability without compromising privacy. Elevation also increases passive surveillance of the public space enhancing security and comfort of use for residents and public space users.

Commercial Offices

The building form and position in the site make it more suitable for commercial use as no direct light enters the space however daylighting and aspect create a pleasant working environment. Design of this building should be considered with the industrial area to the North.

Figure 5.28 Axonometric of shared streetscape

Figure 5.29 Axonometric of green path

Figure 5.30 Plan and section of public and private living space connection

Lake Circuit

The loop track is designed to integrate private and public use of lake front. The purely pedestrian interface between lakefront housing and public spaces helps create a lively atmosphere. Floating wharves protrude into the lake and wetlands extending public space and allowing for recreational access of the lake.

Figure 5.31 Impression of lake front

Lake and Wetlands

The wetlands are incorporated into the shallow regions of the retention lake to help filter storm water. The storm water runoff from homes and sealed roads is filtered through the wetlands before it enters into the aquifer. There is also an option for storm water to be pumped into homes for use in toilet flushing and irrigation of gardens. The wetlands also provide a habitat for native bird life and fauna to flourish.

Elaborate design solutions would need to be incorporated into the master plan to account for needs of sediment filtration of storm water runoff. This scheme presents an allocation of wetland area but because of the focus of this thesis, a specifically designed wetland system has not been explored.

Figure 5.32 Section showing soil fill, wetland and retention lake

Figure 5.33 Lake Circuit

Light Industry

Once the development is completed the existing buildings will need to be redesigned to orientate to the new aspect while retaining the strata tower as a focal point for education of the landscape history.

Figure 5.34 Diagram of housing area and networks through

Reflections on Masterplan

Generally segregation of vehicle and pedestrian passages is discouraged as it can mean a doubling up of space as well as reducing permeability for both parties. The strategy employed in this scheme instead offer integration of pedestrians into vehicular routes. The scheme optimises pedestrian and vehicular permeability, creating environments catering to the human scale rather than the vehicle scale.

So to not compromise water quality, contamination levels from recreational use would need to be investigated.

The masterplan offers a scaffold for development to follow. The building masses are architecturally unresolved, however key relationships of access networks, public spaces, housing and the mixed use area is intended to guide further architectural refinement which will enhance the relationship of networks and integration into the landscape. The master plan helps inform further design testing at a housing scale in the next chapter.

Figure 5.35 Impression of 'Green' path through housing area

6.0 Housing Cluster and Dwelling Design

This chapter presents an architectural design solution for housing within the proposed masterplan, on the site that adjoins Mount Eden Road. The nuances of the site are identified and key design movements are presented to illustrate design responses. A housing cluster and selected dwelling designs are proposed.

Figure 6.1 Mt Eden site plan

Figure 6.2 Mt Eden quarry buffer mound

Figure 6.3 Base of quarry cliff

Scoria Cliff Face

Figure 6.4 Mt Eden A-A site section

Metres below Mt. Eden Road

Figure 6.5 Mt Eden Road home

Why Here?

The site for architectural exploration was chosen for its crucial role in the success of the development as well as its suitability to testing research aims. The long stretch of steep scoria cliff face means there is no access into the quarry here significantly limiting physical and visual permeability through the site. As the boundary is adjacent to an arterial route the edge is a significant physical and visual interface between the public, the quarry and the Maunga. For this reason any development along this edge will play a large role in the identity and perception of the development.

Breakdown of Site

The heavily planted mound that runs alongside Mt. Eden Road was established as a buffer between the quarry and the public since the volcanic cones were quarried below ground level. As an arterial route Mt. Eden Road experiences high traffic volumes but there are no significant traffic problems along this stretch of Mt. Eden Road currently. The form of the quarry slope face is relatively consistent all the way along as it curves around the Southern end of the quarry. The two terraces offer a platform 5 metres width at its narrowest, the lower of which will be submerged when the water table returns.

Figure 6.6 Mt Eden B-B site section

Initial Massing Studies

The initial massing studies tested the building mass along the whole slope and tested how standard units could work cumulatively. Some key considerations were aspect, clustering, connection and landscape integration.

Aspect

Initially formal gestures were aimed at orientating the building to the sun aspect and view of the Big King. Eventually orientating the view to the Big King became an insignificant gesture as views of the lake and landscape became just as relevant. Important views of the Big King could be framed without the need for it to dictate form.

Figure 6.10 Manipulation of clusters to break up mass

Figure 6.11 Analysing the grain of the site

Connection

Public

Mass housing allows large building masses to physically connect the top and bottom of the slope. Public path connections across rather than down the slope allow a more gradual gradient and therefore more accessible route. The path also creates a variety of different dwelling conditions (fig. 6.12).

Private

Different arrangements based on homes spatial needs as well as access were tested to identify optimum configuration of homes (fig. 6.14, 6.15). Making sure connection to Mt. Eden Road and quarry was not compromised for any home.

Figure 6.12 Public path and building volumes

Figure 6.13 Public path connection to wider context

- ↔ Public Path
- ↔ Connection
- ✕ No Connection
- Home 1
- Home 2
- Home 3

Figure 6.14 Testing public path and dwelling access

Figure 6.15 Refining connections into and circulation through dwellings

Landscape Integration

By staggering levels the building mass took on a more horizontal form, mirroring the strata of the quarry (fig. 6.16, 6.18). The use of scoria aggregate concrete was explored to utilise stores of scoria and to integrate the development into the scoria landscape (fig. 6.22).

The planted mound offers a soft edge to Mt. Eden Road but blocks any visual or physical connection to the quarry and Maunga. Different treatments of the mound were tested to utilise the soft edge while allowing physical and visual permeability (fig. 6.17, 6.20).

Figure 6.16 Staggering levels of housing mass

Figure 6.17 Designing with Mt. Eden Road Mound

Figure 6.20 Early tests of interface with mound

Figure 6.18 Perspective drawing of staggered cluster

Figure 6.19 Sectional drawing of staggered cluster

Figure 6.21 Initial testing of configurations of homes on the slope

Concrete-Construct-Northern-AZ

Figure 6.22 Example of lightweight scoria aggregate concrete

Figure 6.23 Testing connections between public and private spaces

Proposed Design

The following section presents the developed cluster and dwelling proposal for the chosen area of the Three Kings Quarry.

Cluster Design

The proposal consists of four housing clusters, public paths and public open spaces which span across the entire slope. All dwellings have access to public paths which connect Mt. Eden Road to the lake circuit.

Figure 6.24 Perspective of cluster across lake

Figure 6.25 Site Map

Access

The public path provides an even surface for pedestrian and cyclist movement through the development. These public thoroughfares connect to public parks between clusters which act as network junctions and spaces for recreation and relaxation (fig. 6.25).

The concrete platform at the base of the development is an extension of the existing quarry terrace and anchors into the submerged terrace to provide for pedestrian and vehicular access to dwellings at the base of the cliff. This construction would take place before the water table was allowed to return.

Figure 6.26 Axonometric showing individual dwellings

Figure 6.27 Western elevation of development

Figure 6.29 Public spaces between clusters

Public Space

The planted mound softens the edge of Mt. Eden Road and does well to conceal the building mass that scales the slope while the cuts into the mound between clusters opens up new views to the Maunga and into the basin. The breaks between clusters expose the cliff face and offer elevated parks for recreational and visual amenity. At the base of the cliff public parks extend to floating wharves to allow a fluid connection between public space and lake amenity. The grouping of public spaces creates view shafts of activity aimed at encouraging awareness, intrigue and use of these communal spaces.

Each park condition is different which allows for variation in park design, adding to the identity to individual clusters. Dwellings and elevated space around public areas are designed to optimise passive surveillance to discourage any inappropriate use of communal spaces.

Figure 6.28 Public space on platform between clusters

Figure 6.30 Public space Mt. Eden road looking to Big King Maunga

Structure

Construction of clusters is set out in phases, starting from North to South along the terrace. This is to allow soil fill to be moved from the North of the site at the same time. Space for a concrete plant at the Southern section of the site has been provided for construction of the clusters. The Structural grid responds to the slope, the aspect of the lake and Maunga as well as the suburban built forms along Mt. Eden.

The primary structure of the development is reinforced concrete. Rock anchors embedded into the scoria and basalt cliff secure the concrete structure to the slope at each level. Reinforced concrete structural walls are used to transmit vertical loads acting as partitions and as an acoustic barrier for neighbouring dwellings. The load bearing concrete walls tie to steel deck in situ concrete slabs poured against the slope. This construction is repeated for each level after which partition walls and concrete facade panels are fitted. Different treatments of coarse and fine Scoria aggregate concrete help create variety in colouring and surface texture of panels while visually uniting the cluster. This also helps to anchor the cluster to the landscape visually.

Figure 6.31 Phased construction of clusters

Figure 6.32 Structural grid of cluster

Figure 6.33 General construction process

Figure 6.34 Sectional Perspective of Dwellings

Figure 6.35 Axonometric of Mt. Eden Road Homes

Dwelling Design

The following homes have been refined to show how homes work with the development and individually, as well as to illustrate the differing conditions of each home.

Each dwelling employs a square plan to fully utilise space and minimised length of corridors while remaining shallow enough to allow light to penetrate spaces. In all cases vertical circulation had to adjust to the changing nature of the slope. Open plan kitchen, living and dining spaces are employed to create a social space and allow individual configuration of spaces. Stair access is used to separate the private realm, retain privacy of living spaces from the public path and create a gradual transition from public to private. Open stairwells are employed to assist in stack ventilation of spaces..

Mt. Eden Road Home

Four Bedrooms

Four Storeys

This home connects with Mount Eden Road and the cluster's public path. The main Entrance and Vehicular access is from Mt. Eden Road. The currently under used street parking is utilised for both residential and visitor parking. The Front garden and private roof terrace offers opportunity for living, expression or cultivation. The lower level windows use fogged glass to retain privacy. The Living space volume protrudes into public space where fenestration is designed to make the most of sunlight and enhance public-private visual permeability while elevation retains privacy.

Figure 6.37 Public Path

Figure 6.36 1:200 Floor Plans

- 1 Kitchen
- 1b Pantry
- 2 Living and Dining
- 2b Outdoor Living and Dining
- 3 Bedroom
- 4 Bathroom
- 5 Carport
- 6 Understair Storage
- 7 Laundry

Figure 6.38 Mt Eden Road Perspective

Figure 6.39 1:100 Transverse Section

Figure 6.40 Level 7 Perspective

Middle Home
Two Storeys
Two Bedrooms

This home is designed for a family of group who do not require a personal vehicle. Setback from planting on pedestrian path discourages overlooking into the private outdoor space. Operable sunshades can also be employed here to increase privacy and act as a screen on sunny days. The outdoor space extends over the lower public path to enhance public-private relationship. The Mezzanine floor is employed to help diffuse light into living and kitchen space while facilitating ventilation of spaces without access to open-air.

Figure 6.41 1:200 Floor Plans

Figure 6.42 1:100 Transverse Section

Quarry Home A

Three Storey

Three Bedroom

This home is accessed via the public path as well as vehicular and pedestrian access from lake circuit. The open garage at ground level helps ventilation and diffused lighting while allowing for versatile use of space based on personal preferences. The open plan living space and balcony extend into the public realm and the space can be completely opened up on fine days.

Figure 6.43 1:200 Floor Plans

Figure 6.44 Level 2 Perspective

Figure 6.45 1:100 Transverse Section

Quarry Home B

Four Storey

Three Bedroom

This home offers pedestrian access from above and pedestrian and vehicle access from below. Entrance through the middle allows the well lit front of the ground floor to be used as bedroom space. Skylights help to light the kitchen and the rooftop terrace provides for private outdoor use.

- 1 Kitchen
- 1b Pantry
- 2 Living and Dining
- 2b Outdoor Living and Dining
- 3 Bedroom
- 4 Bathroom
- 5 Carport
- 6 Storage
- 7 Laundry

Figure 6.46 1:200 Floor Plans

Figure 6.47 Level 2 Perspective

Figure 6.48 1:100 Transverse Section

Home by the Park

Three Storey
Three Bedroom

This building joins into the public space between clusters and the public path. The narrow plan is essential as the public path blocks light into the private areas. The home consists of two quite formal entrances which contrast to the entrances of other dwellings that are access through private outdoor space. The open living level is a social space which looks over the path, development and Maunga.

Figure 6.49 1:200 Floor Plans

Figure 6.50 1:100 Transverse Section

Reflection on Cluster and Dwelling

The proposed housing cluster design helps to physically and visually connect Mt. Eden Road, quarry development and the Maunga. The public walkway is designed to create a safe, lively and pleasant journey into the development while offering easy public transport access to homes that do not require a private vehicle.

The public path that cuts through the dwellings creates a variety of housing conditions allowing a multitude of conditions to be tested and to account for diversity of use, taste and spatial preferences. The slope of the public path creates a transitional space in front of homes where people are encouraged to move through while the flat platforms between clusters encourage people to stop and enjoy the space and the view.

The proposed scheme employs square plans to maximise the dwelling footprint, however this approach was met with problems of ventilation to some rooms and light penetration into the back of homes (most evident in 'Middle Home'). Because many dwellings deal with one aspect further exploration of narrow plans that span across the slope may resolve these issues.

The proposed development structure would rely on slope stability reports and require a substantial investment in construction. These could be minimised by closing the gap between clusters so the parks can span between them without additional tie backs for support.

The entry point for 'Middle Home' and 'Quarry Home A' via outdoor living is a less formal and more inviting entrance for visitors who are immediately immersed in the activity of these spaces (reminiscent of backyard entry in some suburban homes). Entry through outdoor living spaces creates a stronger connection between public and private living and contrasts to the formal entry present in many suburban homes. By offering the options of a

formal and outdoor living entry point and informal entry point the homes account for guests of different status, for example a friend as opposed to a stranger going door to door.

The connection between 'Home by the Park' and the cluster park takes on a more back door role rather than engaging with the park in a constructive way. This illustrates the importance of junctions between clusters and actively engaging interfaces so it's not just a by-product of housing or park design.

Though the scoria aggregate concrete helps to integrate the cluster, incorporating other materials (for example timber) can help break up monotony that a single material palette creates and prevent the cluster from becoming too stark an environment.

7.0 Research Conclusion

This chapter concludes the thesis, reflecting on the process, limitations of the research and how it could progress in the future.

Discussion

Three Kings Quarry represents a site of great devastation and great opportunity. This thesis has dissected anxieties of medium density development within the quarry landscape to illustrate the opportunities that both offer in creating a more socially responsive medium density model.

Research Process

Thorough site investigation identified relevant themes early on and helped focus the research throughout. By working at the urban and architectural scale complex relationships between the home and the development were able to be pursued, helping to effectively test the possibilities of such a large and complex site.

Limitations and Further Research

Because of time constraints and the scale of the site the design proposals do not represent a final solution. However the relationships of public and private spaces as well as the circulation networks act as a framework for further research and design refinement to enhance relationships established in the proposed schemes.

Though this research is site specific, many key findings from individual chapters can be extracted for other relevant studies relating to medium density housing, quarry remediation and slope design.

Though this research does not go into depth about economy of the development, the bones the scheme presents allow an economic perspective to be applied, that understands feasibility based on the cultural and amenity values gained through design.

Because density optimisation was not included in this research, there is scope for further research here to optimise building footprints.

Final Statement

This research presents a scheme that challenges the existing practices of medium density design in New Zealand. Though aspects of the proposal would need be scaled back depending on constraints that were not explored in this research; the final masterplan, cluster and dwelling proposals illustrate the potential of the quarry for housing development when applying a totally landscape and community responsive approach to urban and architectural design.

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