

GREYFIELD RESIDENTIAL PRECINCTS

A New Design Model for the Regeneration of the Middle Suburbs

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INTRODUCTION

This paper draws from research undertaken by the authors for the Australian Housing and Urban Research Institute (AHURI) that scoped the processes and inputs needed for establishing a new redevelopment model in Australia's middle suburbs, with a particular focus on Melbourne (Newton et al 2011). The research comprised a series of investigative panels that were designed to facilitate engagement between leading thinkers and practitioners in the fields of urban policy, design and development. Seventy experts from private industry, government, community and research sectors participated in a four-stage process addressing different aspects of higher-density redevelopment and delivery. The iterative mode of investigation enabled the collective development of ideas by the broad cross-section of stakeholders, and the diversity of opinions and expertise resulted in a comprehensive debate about the need and drivers for sustainable regeneration in the middle suburbs.

It was found that a new redevelopment model for *greyfield residential precincts* is both feasible and desirable, although a number of significant shifts would be required to overcome the barriers within current institutional and industry practices. *Residential greyfields* are defined here as under-utilised property assets located in the middle suburbs of large Australian cities, where housing stock is failing (physically, technologically and environmentally) and energy, water and communications infrastructure is in need of upgrading. *Residential greyfields* are usually occupied and privately owned sites typical of urban development undertaken from the 1950s to the 1970s (Newton 2010). This paper summarises some of the discussions and findings from the AHURI investigative panel process and provides further detail about the proposed greyfield precinct design model.

Research Context

The compounding pressures of climate change and a swelling urban population confront 21st Century cities with an unprecedented challenge. In Australia, one of the world's most urbanised nations, the population is projected to reach more than 35 million by mid-century and over 70 per cent of this growth will occur in capital cities (Infrastructure Australia 2010). The continued expansion of our existing settlement patterns is no longer a viable means of accommodating growth from environmental, social and economic perspectives (Dunham-Jones 2009; Trubka et al 2008; Dodson & Sipe 2008). To meet the demands of our growing cities within sustainable ecological limits, alternative development approaches that can deliver higher densities within the existing metropolitan boundary are needed. This will require new and innovative forms of development, as well as the physical transformation of established urban typologies.

Australia's suburbs, which constitute the majority of our built environment, present the greatest challenge in this context. Regeneration of the middle ring regions of our cities is a particularly vexing issue. In the middle suburbs, the dominant dwelling form is the detached house on relatively large private allotments. This represents a nominal density of around eight to ten dwellings per hectare and is widely accepted as unsustainable. With variable levels of access to public transport, the low density and dispersed suburban fabric is characterised by high car dependency. Ageing housing stock, building systems and infrastructure are environmentally inefficient and the sizable, well-serviced land parcels represent under-utilised assets in terms of both density targets and capital investment. In short, significant areas of the middle suburbs are in need of physical, technological and environmental upgrade as part of our transition to more sustainable cities, however very few appropriate redevelopment strategies have been realised in these areas. Two principal factors contributing to the lack of effectual outcomes are: individual ownership of middle suburban land titles which inhibits the assembly of appropriate development sites; and an absence of design expertise within the projects that are completed.

Each of Australia's major centres is striving to provide 50–70 percent of new housing requirements through strategic infill redevelopment over the next twenty to thirty years (National Housing Supply Council 2010). To meet these targets, current planning frameworks focus on the redevelopment of large land assemblages, including brownfield redevelopment, intensification around activity nodes and more recently, the examination of transport corridors (Adams 2009). These projects are intended to provide substantial increases in housing, employment and public amenity through higher density building types connected to existing transport networks (Victorian Government 2010) While such containment strategies appropriately aim to accommodate population growth within existing urban boundaries, high density redevelopment in targeted

locations does not address the renewal of the existing suburban form. Parallel initiatives for the regeneration of residual suburban areas are also needed. The scale and type of projects intended by strategic planning frameworks has also proven inhibitive; the proposed redevelopment often demonstrates a radical change from the existing built context and is frequently accompanied by considerable economic risk and community resistance. The reality is that the implementation of large-scale redevelopment is very slow and little “on the ground” progress has been made so far, when compared with the small-scale, informal and piecemeal housing development that characterises much of suburban transformation.

A recent review of Victoria’s residential development activity from 2004-2008 (Spatial Economics 2011) indicated that 86 percent of all new housing developments were of 1-2 dwellings, while only 1 percent comprised 20 or more dwellings. Phan et al (2008) revealed that 98 percent of redevelopment completed in the City of Monash in 2002-2006 comprised two to seven dwellings and was broadly distributed across the local government area. Significantly, 80 percent of the new housing was more than eight hundred metres from a nominated activity centre. The study demonstrated that redevelopment was not driven by proximity to transport or activity centres. Rather, it was related to the size of land assets and the age of housing stock. The fragmented pattern of informal infill suggests that small owner/builders redeveloping private land holdings as profitable opportunities arise.

In its current form, piecemeal infill is of inadequate density and quality to contribute to the sustainable regeneration of established suburbs. Generalised requirements for parking, open space, building heights and setbacks restrict the diversity of housing types possible. To maximize profit margins, projects tend to be completed to minimum construction standards with little or no design consideration, which is not a suitable performance level going into the future. On an individual project basis, cost and planning constraints, as well as the duplication of open space and parking requirements, negates the opportunity to provide collective benefits for the broader urban environment. For example, public open space and infrastructure upgrades are not typically delivered through dual occupancy redevelopments. However, the market’s propensity for this scale and type of project offers a potential vehicle for sustainable urban change. If conceived and strategically managed at a precinct scale, coordinated redevelopment across several infill sites could provide significant design, environmental, social and economic benefits.

This paper examines an approach to middle suburban infill that recognises the barriers to allotment consolidation in these contexts and proposes a redevelopment model that operates over a field of non-contiguous land parcels (refer Fig. 1). It discusses how the redevelopment of *greyfield residential precincts* is capable of delivering more affordable and sustainable medium-density housing, as well as broader urban regeneration outcomes. It provides a detailed examination of a speculative design that begins to explore a possible design framework for precinct-scaled infill redevelopment in the middle suburbs.



Figure 1: Indicative greyfield precinct models

GREYFIELD RESIDENTIAL PRECINCT REDEVELOPMENT MODEL

The greyfield residential precinct model involves the assembly of impending infill sites in the middle suburbs for coordinated redevelopment by a single entity. The model proposes to harness the high levels of piecemeal infill currently taking place in these areas and redirect development activity to achieve better design, environmental & social outcomes. Importantly, the greyfield precinct model responds to market and industry drivers that generate the current patterns of fragmented redevelopment and proposes design strategies for clusters of non-contiguous land parcels.

Strategically managing infill redevelopment across several allotments introduces an economy of scale that could increase the viability, affordability and quality of higher density housing outcomes, as well as broader environmental and infrastructural upgrades in middle suburban locations. The precinct approach encompasses a spatial extension to typical development boundaries enabling the reconsideration of conventional building forms, program distributions and open space arrangements, which are usually highly constrained in these contexts. When envisaged in this manner, there's potential to develop new and innovative design solutions that could deliver high quality urban environments benefiting both the residents of the new precinct and the existing local community.

In a greyfield suburban setting high-rise apartment types are unprofitable and undesirable. However, a variety of low to mid-rise building forms of up to four storeys would be feasible; this type of construction could be prefabricated or timber-framed and delivered by the domestic residential sector. In addition to conventional detached, semidetached and townhouse typologies, an infill precinct could also encompass a broader mix of terrace housing, courtyard types and apartments, accommodating a greater diversity of occupations and uses that are less frequently catered for in these contexts.

The dwelling yield and design would vary in response to the size and configuration of allotments constituting the proposed precinct, as well as the existing context within which it resides. For example, a precinct of, say, ten dispersed suburban land parcels could potentially achieve a yield of forty dwellings. This represents a nominal density of 50-60 dwellings per hectare. A precinct could equally comprise 5 lots or 50 lots; a single consolidated development area would enable higher density building solutions up to 120 dwellings per hectare, where a combination of stand-alone and partially assembled sites could nominally deliver densities of 70-90 dwellings per hectare. Three precinct types are considered below, each of which exist in current infill redevelopment patterns, although undertaken on a project-by-project basis by different developers.

Consolidated precinct

This precinct type consists of a single, contiguous assembly of allotments that could support high-density outcomes akin to large-scale redevelopment. Consolidated development sites are desirable because they can produce high yield and construction efficiencies due to the type of buildings possible on larger assemblies of land. For example, on a precinct of 15 adjoining allotments, a mix of flexible apartment types and medium density townhouses could potentially achieve a density of 80-120 dwellings per hectare. The impact of the proposed development on neighbouring properties can be mitigated through considerate siting and design strategies that minimise building masses along boundaries. High densities can still be achieved by concentrating the higher building forms towards the centre of the site while still maintaining good quality amenity for residents, which is more difficult to achieve on smaller sites. Precinct wide sustainable systems, shared infrastructure and services are also more viable, with adequate space for the additional equipment/facilities and suitable development yields to offset the additional costs.

Vehicle egress and parking considerations for consolidated sites differ to that of smaller redevelopments. For instance, the space required for an access driveway shared by 70-80 residents has less of an impact on the overall development than one shared by 3 or 4 dwellings. However, accommodating 80 cars at ground level significantly diminishes options for good quality amenity, open space and pedestrian movement across the site. Alternatively, the cost of underground parking can have an adverse impact on the viability of a proposed development. These types of costs are often passed on to purchasers, affecting the affordability of this development model.

The consolidated precinct model already exists in the market, however it is a rare occurrence and the quality and affordability of development outcomes are variable. There is scope to significantly improve this form of redevelopment through more effective design, construction and delivery mechanisms proposed by the greyfield precinct model (refer *Investigation Areas* below). Consolidated precincts would be the most difficult type to assemble; based on current development patterns there is a low likelihood that 15 adjoining owners would be in a position to redevelop simultaneously. However, in combination with larger suburban greyfield sites, such as underutilised asphalt car parks or failing retail centres, this type of precinct could be more frequently implemented.

Hybrid precinct

This type of precinct consists of a mixture of stand-alone and aggregated lots located within walking distance from each other. For example, a hybrid precinct might be distributed across an area of around 800m x 800m connected by shared infrastructure and landscaped elements (refer Fig. 3). A precinct approach allows for a more effective mix of housing types and open space arrangements than would be provided by typical redevelopments. A variety of low-mid rise building forms would be possible, returning a nominal density of

65-90 dwellings per hectare. Flexible, higher density apartment types (up to four storey) could be developed where lots are partially consolidated, while the singular lots could accommodate a range of terraces, courtyard and semi-detached housing. Shared open space upgrades would be incorporated into the design to break up the building mass and provide good quality amenity to residents and the broader community.

Sharing facilities and services that are typically duplicated on a project-by-project basis would also be possible in a coordinated development. Providing opportunities for shared use encourages community interaction, increases passive security measures and can contribute to lowered costs of living. For instance, a common entertainment room/home theatre or shared kitchen facility could minimise the equipment required by each dwelling and avoids cumulative energy uses for common activities. Benefits are also revealed at a spatial level, whereby less conventional dwelling designs, that achieve higher densities and increase affordability, can be provided without diminishing housing quality or amenity. Similarly, the distribution of programmes within a precinct might be reconsidered. In the appropriate context, one allotment might be given over to car parking, for example. This would prioritise bike and pedestrian movement in other areas of the neighbourhood and enhance the quality of the urban environment. Broader community programmes and services that may be lacking in a particular area could also be incorporated into the project. For example, should a community comprise a number of young families with working parents, a proportion of the dwellings could be adapted for use as a shared studio/office or a community child-care centre. Other constituencies might be served by a community medical clinic or a small general store for use by the precinct residents and the surrounding neighbourhood.

Based on current development patterns, acquiring suitable sites for this precinct model is a reasonable proposition. Certain economies of scale are made possible by coordinating redevelopment in this manner including prefabrication and good quality, replicable designs, the cost of which could be shared across the participating residents. The design and treatment of the connections between allotments within a hybrid precinct could incorporate collective benefits such as public open space upgrades and district wide sustainable infrastructure. For example, rainwater collection and storm water filtration could be provided in a new streetscape linking different portions of the redevelopment. Similar initiatives for district-wide energy, communications technology and waste management could also be implemented. If accessible to the new development as well as existing residents and local business, such infrastructure upgrades might attract shared investment strategies between local authorities, private industry and service providers.

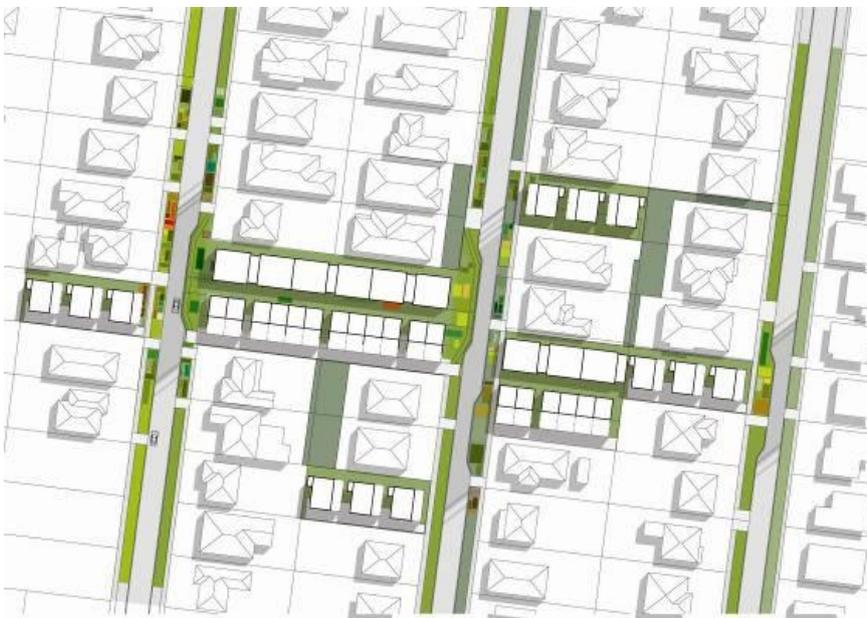


Figure 2: Indicative hybrid precinct

Dispersed precinct

This precinct type comprises a field of stand-alone suburban allotments that are distributed within walking distance from each other. A precinct of 15 lots might be dispersed across a nominal area of 800m x 800m. The lots are likely to vary in size, orientation and proximity to each other but would accommodate high quality, diverse housing typologies ranging from low to medium densities. Detached, semi-detached, courtyard houses and terraces up to 3 storeys could achieve a potential density of 50-70 dwellings per hectare. Like the hybrid model, a dispersed precinct would provide opportunity for broader urban regeneration strategies such as improved landscape and street amenity. The viability of shared infrastructure

upgrades and implementing district wide sustainable systems may be limited by the lowered development yields, but certain economies of scale would still be possible. For instance, prefabricated construction of well-designed housing models would be applicable for this scale and model of redevelopment.

The dispersed precinct would be the easiest configuration of sites to amass. While it may appear to offer diluted benefits when compared with the consolidated or hybrid models, a robust strategy for a dispersed precinct is worthy of further examination given the frequency of piecemeal infill redevelopment in the middle suburbs. A dispersed precinct model has the potential to trigger the re-evaluation of restrictive planning regulations, prompting a new framework that supports good quality and higher density redevelopment outcomes. One example might be the relaxation of floor area to open space ratios for particular lots within a precinct on the understanding that substantial upgrades are being delivered to public streets and nature strips for more effective use as public open space.

AREAS FOR INVESTIGATION

The AHURI investigative panel process revealed that, while the greyfield precinct model is both desirable and feasible, a number of barriers would need to be overcome for successful implementation. Fig. 2 identifies the arenas (shaded) where major innovations need to occur to achieve a new, viable development model for sustainable regeneration in the middle suburbs. Much of the innovation needed is organisational and institutional, supported by some technological advancement. While the diagram suggests that substantial changes are needed across the board, in fact much of the knowledge and expertise exists in various forms. The greatest challenge is bringing the required inputs together to achieve a truly cooperative and integrated development system.

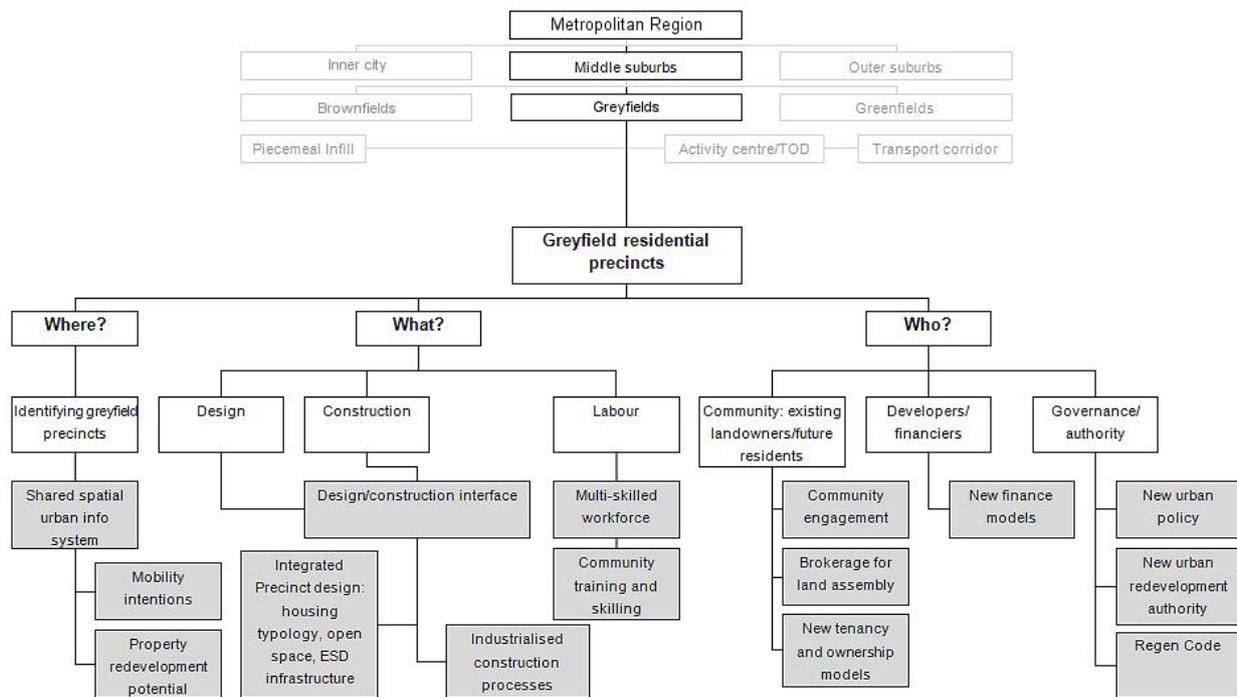


Figure 3: Innovation and ‘future logic’ for greyfield residential precinct redevelopment

Identifying Greyfield Residential Precincts

Analysis of land and capital-improved property values shows that over 250,000 middle suburban properties in Melbourne have a high potential for regeneration in localities where residential building stock is failing and infrastructure is in need of upgrade. However, individual ownership of allotments makes land assemblage extremely problematic and redevelopment tends to occur sporadically as individual assets enter the market. Collating multiple layers of information, such as property redevelopment potential, resident mobility intentions, strategic plans and socio-demographic attributes, within a shared spatial information system would enable a range of stakeholders to envision and explore opportunities for regeneration in a proactive manner. Coordination of this kind would facilitate the assembly of suitable land parcels, even if non-contiguous, for precinct redevelopment and more sustainable urban outcomes.

Planning

Metropolitan planning policies currently lack a clear framework for higher density redevelopment in established suburbs. The length of time and uncertainty associated with current planning processes are significant impediments to innovative and sustainable regeneration outcomes. New planning mechanisms that clearly articulate design and performance benchmarks, streamline the development approval process and alleviate developer confusion are sought by industry and government stakeholders. A new “regen-code” specifically developed for this scale and type of work which fosters the social and environmental imperatives of a 21st century city could be developed. A new urban renewal organisation, impervious to political cycles and transcending municipal boundaries, could administer such redevelopment, eliminating uncertainty at a metropolitan level and maintaining long-term strategic objectives.

Design

A precinct-approach to infill redevelopment in the middle suburbs could provide a diversity of housing types that better respond to market needs and industry processes. Flexible and adaptable designs that accommodate a range of household make-ups and life stages could provide affordable alternatives that are currently not offered by the market. Such designs could include, as one example, downsizing housing options that enable a retiring ‘baby-boomer’ cohort to relocate in their existing area. The consolidated precinct model is most attractive for potential density increases and infrastructure efficiencies. However, the hybrid and dispersed precincts would be the easiest typologies to fund, acquire and administer. Each of the precinct models could provide high quality public open space, improved social amenity, infrastructure upgrades and higher residential yields which are impracticable for single-lot redevelopments.

Development, Construction and Industry Processes

Conventional methods of domestic construction and housing delivery have limited capacity to provide the quantity, diversity and quality of *medium-density* housing needed for effective regeneration of middle suburban areas. Conversely, commercial construction techniques are difficult to deliver on a lot-by-lot basis and at a price point attractive to the current market. Precinct-scale redevelopments encompass an economy of scale that could make innovative manufacturing and industrialised construction viable for medium-density housing projects. This would require substantial changes in the types of housing solutions and in the physical and information technology platforms used to support the delivery process.

Finance and procurement

New forms of greyfield development could be facilitated with different forms of finance or financial incentives. For instance, at an institutional level, development bonds could be used to finance land consolidation and infrastructure improvements, which may help to overcome local opposition to consolidation. Other financial structures could involve superannuation funds, tax increment financing, or land tax and stamp duty rebates. Greyfield residential precincts could also precipitate community finance models such as cooperative building societies in which home-owners and local stakeholders pool capital and assets for shared neighbourhood outcomes.

Proactive community engagement

A proactive approach to greyfield residential regeneration involves a multi-step process that begins with the identification of residential precincts with a high redevelopment potential, followed by a process of community engagement with the property owners of the precinct. Greyfield precinct regeneration offers opportunities for property owners to be engaged as ‘partners’ in the development. A tension exists between providing genuine avenues for resident input early in the development process and the need to demonstrate certainty of the regeneration objectives. The process of engagement would be critical and is likely to require a specialist or dedicated organisation that can “broker” collaborations and maintain trust between parties.

SPECULATIVE HYBRID PRECINCT DESIGN

This section examines the design of a hybrid precinct and begins to explore a possible design framework for coordinated infill redevelopment in the middle suburbs. The speculative investigation is intended to spatially test and illustrate the potential benefits of a greyfield model, involving a range of design alternatives made possible through coordinated redevelopment. A hybrid precinct was selected as the case study because it is a more likely assembly type than a fully consolidated precinct and, for the purposes of the design research, allows for greater speculative analysis than a completely dispersed arrangement of sites. The proposed precinct model aims to deliver the social, environmental and economic imperatives driving the need for

sustainable regeneration in the middle suburbs, including housing affordability, housing diversity, sustainability and social well being. It should be noted that the proposed design is indicative only and has not yet undergone formal economic, environmental or market assessments, which will comprise the next stage of this research.

The Site

The design is configured over 15 stand-alone and partially assembled allotments in the City of Monash that were individually redeveloped during 2002-2006 (Phan et al 2008). Undertaking the speculative investigation on existing redevelopment sites enables the proposed design to respond to 'real world' concerns and contexts as well as offer a comparator to the piecemeal infill that has already been completed. Each site is approximately 550m² in area, with a collective area of 8,155m² (refer Fig. 4). The allotments are dispersed across 3 residential streets within a 400m x 400m area; each site is within walking distance from every other and the closest train station is less than 1km away. To the east of the precinct is a zone of manufacturing warehouses and business centres. Immediately west is a large printing facility and offices, a private at-grade parking lot and a primary school with a sports oval connecting through to the residential precinct. The area also has good access to child care centres and medical clinics. The existing suburban fabric directly to the north and south of the study area is quickly transforming, where older detached houses have been redeveloped and replaced by predominantly dual occupancy residences. A number of these redevelopments are abutting the proposed precinct but have been excluded from this examination on the basis that the changes took place earlier to, or later than, the 2002-2006 period upon which the research focuses. The extent of change does however demonstrate the scale and potential scope for more effective infill precincts in these contexts.

Existing Piecemeal Infill

The piecemeal redevelopment delivered 30 detached and semi-detached units with a net density of around 35 dwellings per hectare (refer Fig. 4). In some instances, the existing dwelling has been retained with a new unit added to the rear of the site. Most of the redevelopments are for 2 x new single storey dwellings, similarly sized and sited, connected by a central garage. Each redevelopment is setback 6-7m from the street, matching the building line of adjoining properties and forming a garden for the front unit. The front garden can represent up to 15% of the total site area, however, its relationship to the dwelling and lack of privacy inhibit its use as an effective outdoor living area. In general, very little other open space is afforded the front unit. The back unit is provided with a small courtyard area on the rear boundary, in many instances lacking trees or vegetation. A concrete driveway that consumes approximately 25% of the site dominates the remainder of the available open space. This area is equivalent to (or sometimes larger than) the new dwellings themselves. Conventional brick veneer construction is used in each redevelopment and very few sustainable systems can be observed. For example, there appears to be no photovoltaic panels installed on the roof for solar hot water or energy production. The dual occupancy model is a very cost effective form of redevelopment however it provides little housing diversity, is built to minimum performance standards and does not contribute any collective benefits to the urban environment.

A Coordinated Precinct Approach

By comparison, coordinated redevelopment of the same 15 allotments could potentially achieve significant design, environmental and economic advantages (refer Fig. 5). Envisioning the collection of sites as a precinct immediately expands the development boundary over the streets connecting the sites and, where lots are contiguous, removes the limitations of building on multiple property boundaries. Given the extent of piecemeal infill occurring around the case study area, it is conceivable that some of the adjacent residences could be subdivided and the "back yard" sold for incorporation into the new precinct.

The following sections demonstrate the design opportunities and potential advantages of hybrid precinct redevelopment in this location.

Site Strategy and Programme Distribution

Optimising passive design techniques is a cost neutral strategy that provides significant design, environmental and social benefits. Each of the allotments in the hybrid precinct is oriented east-west. The building forms and distribution ensures solar access to all dwellings and open spaces. Capturing sunlight is crucial for achieving good quality design outcomes, increasing the use and enjoyment of the spaces provided and contributing to the comfort and well being of prospective occupants. Maximising natural lighting and thermal performance of the buildings reduces the need for artificial lighting and mechanical

heating/cooling minimising energy consumption. Solar penetration to open spaces encourages vegetation growth, providing shade cover in summer and mitigating the effects of urban heat-sinks.

Pedestrian and bicycle movement is prioritised throughout the precinct. In addition to reducing vehicle use, enjoyable and active pedestrian links increase opportunities for social interaction, passive surveillance and incidental exercise. Landscaped circulation paths provide strong visual and physical connections between different areas in the development and scope exists to extend these links to surrounding community amenity and public transport networks. New streetscapes have dedicated bicycle lanes and are designed to calm vehicle movement. Until public transport services are improved, or viable transport alternatives become available, each dwelling is provided with 1 carpark for adequate mobility in the suburbs. A range of convenient drop-off zones and limited parking is provided adjacent to the buildings to ensure accessibility is possible by all ambulatory modes, however most of the parking is consolidated to the periphery of the redevelopment. The parking structures would be screened to mitigate the visual impact on the surrounding context, but designed in a way that enables it to be adaptively reused in the future, when car dependency has decreased.

An important component of the precinct design model is the upgraded public street network for more effective use of public open space and as a conduit for sustainable infrastructure systems. This precinct design expands areas of the road reserves to better accommodate a range activities, such as community gardens and potential recreation facilities. Vegetation, landscaping and street furniture encourages its use a local park. Bus shelters have been provided for public use as well as to serve a precinct shuttle connecting residents to local amenity and facilities in the area. While otherwise well serviced, the existing area lacks a near-by store for daily shopping needs as well as a gathering place for local residents. A unit on the ground floor of the south-east apartment block is initially used as a small general store and café that could also serve the factories, offices and schools surrounding the precinct.

Housing Density and Diversity

Larger development areas offered by the hybrid precinct model enable higher density building forms that are not typically delivered in middle suburban contexts. Coordinating redevelopment minimises unnecessary duplication of common spatial provisions and reduces the restrictions imposed by multiple boundary setbacks. Enhanced streetscapes for more effective use as public open space and appropriate privacy treatments enable portions of the development to encroach on standardised street setbacks facilitating higher density outcomes with improved open space amenity for precinct residents and the broader neighbourhood. A unified design approach across the precinct enables the planning and implementation of a mix of housing types and forms. The diversity of dwellings would increase housing access and affordability for prospective purchasers and the distribution of buildings across the precinct ensures the redevelopment will be integrated into the existing built context.

Three storey apartments are located in three areas of partially assembled lots so no overshadowing of adjoining properties occurs. Each of the apartment blocks comprises 12 dwellings with a mix of 1, 2 and 3 bedroom units with generous private courtyards or balconies. A range of 2-3 storey terraces, courtyard and semi-detached housing is distributed across the smaller allotments, collectively yielding 24 dwellings. The arrangement of buildings and open space provides each dwelling with “livable” private gardens and several zones of shared open space, shared facilities and services (refer below for more detail).

Dwelling Design and Flexibility

Improving the density and design quality of housing in the general market is driven by the need to minimise material and resource use, increase occupant well being, minimise construction costs and increase housing affordability. A significant contribution architects and designers can make in this context is to challenge conventional development trends for large detached houses and generating compact design alternatives that better meet the environmental and social imperatives of higher density redevelopment.

Flexible dwelling designs that can accommodate a range of occupations and life-stages are needed in response to shifting societal trends and new household make-ups emerging from the pressured housing and rental markets. For example, the fastest growing household type is for lone persons (ABS 2010) due to an aging population, which could require live-in care arrangements. Multi-generational families, home offices and shared ownership/leasing by independent persons are also becoming increasingly common. Developing design models that can cater for these housing sub-markets would facilitate the delivery of more appropriate forms of housing in well-serviced areas. This is particularly pertinent in relation to the “baby boomer” cohort, who, as home-owners approaching retirement, look for more equitable opportunities to downsize, relocate in place and still retain some liquidity to fund their retirement.

Generous room sizes combined with efficient internal planning and strong open space relationships can reduce unnecessary floor area while increasing the amenity of spaces provided within the dwelling. Considered design of internal spatial arrangements enables the separation of uses within different zones of a house and can allow the dwelling to adapt to changing household needs over an extended period of time. For example, a dwelling might be designed to adapt and extend as a family grows. This could include the enclosure of appropriately located covered open space or carport for re-use as an additional living area or independent bedroom. Flexible design can also facilitate use of the residence as a source of income by allowing unrelated occupants to co-exist in a single unit. Siting and open space arrangements that enable separate approaches to the dwelling and different access points effectively provide 'dual keying'. This would enable a home office to operate independently of a private residence within the same dwelling; visitors to the business could be received without impinging on the remainder of the house. Another example is the ability to lease a portion of the residence to an unrelated occupant, offering an avenue for alleviating financial pressures if the owner's income is susceptible to fluctuations.

Construction Innovation and Building Performance

Greyfield precinct redevelopment involves an economy of scale that increases the viability of employing advanced construction methods that can significantly improve the quality and performance of infill housing. Integrating design, construction and delivery processes enables off-site manufacturing of building modules for more efficient on-site assemblies and staging of works and trades. Off-site manufacturing in a controlled environment can increase the quality of construction achieved and avoid unforeseeable delays due to inclement weather. This scale and type of precinct might also warrant the establishment of integrated management systems for more efficient staging of works and trades.

In this scenario, a combination of industrialised processes and conventional domestic trades are used. Structural insulated panels (SIPs) are lightweight, contain superior thermal qualities and reduce the time and material required for assembling more extensive framing and cladding systems. This method of building can be undertaken by the domestic labour sector (with some retraining). Site preparation, roofing, sealing and internal finishing are achieved through standard domestic techniques. In addition to the optimization of passive design strategies, efficient fixtures and fittings would be installed to minimise the amount of water and energy required to operate the dwellings and achieve adequate comfort levels. At this scale of redevelopment, the cost impost for installing higher performing household equipment would be minimal.

District-wide Sustainable Initiatives

The benefits of sustainable building systems are compounded when implemented on a collective level. For example, an on-site tri-generation energy system serving a community of residents can be more cost effective, higher performing and a more consistent mode of energy production than individual solar power units installed to each dwelling (Dunster et al 2008). The viability of implementing new technology and infrastructure at this scale of redevelopment is unclear. However it is proposed that, with appropriate life-cycle assessments and measures, the capital costs of comprehensive infrastructure upgrades could be offset by expansion of the systems to surrounding residents and local businesses. For instance, the existing manufacturing and business centres in the case study area might financially contribute, with the assistance of local authorities, to implement shared infrastructures that help to 'green' energy intensive processes as well as provide advantages for the local residential area. More research is required into the feasibility of innovative investment models that could support initiatives of this kind and how they might be delivered through greyfield precinct redevelopment.

The speculative scenario proposed for this hybrid precinct incorporates a number of district-wide infrastructure and services upgrades that are already delivered by larger developments, although often in fringe locations (examples include Aurora by VicUrban, and Glenfield Vision Estate by Mirvac). Storm/ground water filtration is provided through permeable ground surfaces and bio-swales that are incorporated into the new streetscape and shared open space zones. Greywater and rainwater is collected, filtered and redistributed under the existing road reserves for use in washing machines and toilets. District-wide renewable energy generation and hi-speed communications systems are similarly incorporated in the new streetscapes. Less cost intensive initiatives are also pursued. The design and spatial allowance for effective waste management and recycling areas are included in the shared zones of the precinct. Examples include a composting area for the reuse of green waste in productive gardens and an area for sorting and recycling appropriate materials that can be donated to the near-by primary school.



Figure 4: Piecemeal infill redevelopment – City of Monash 2002-2006

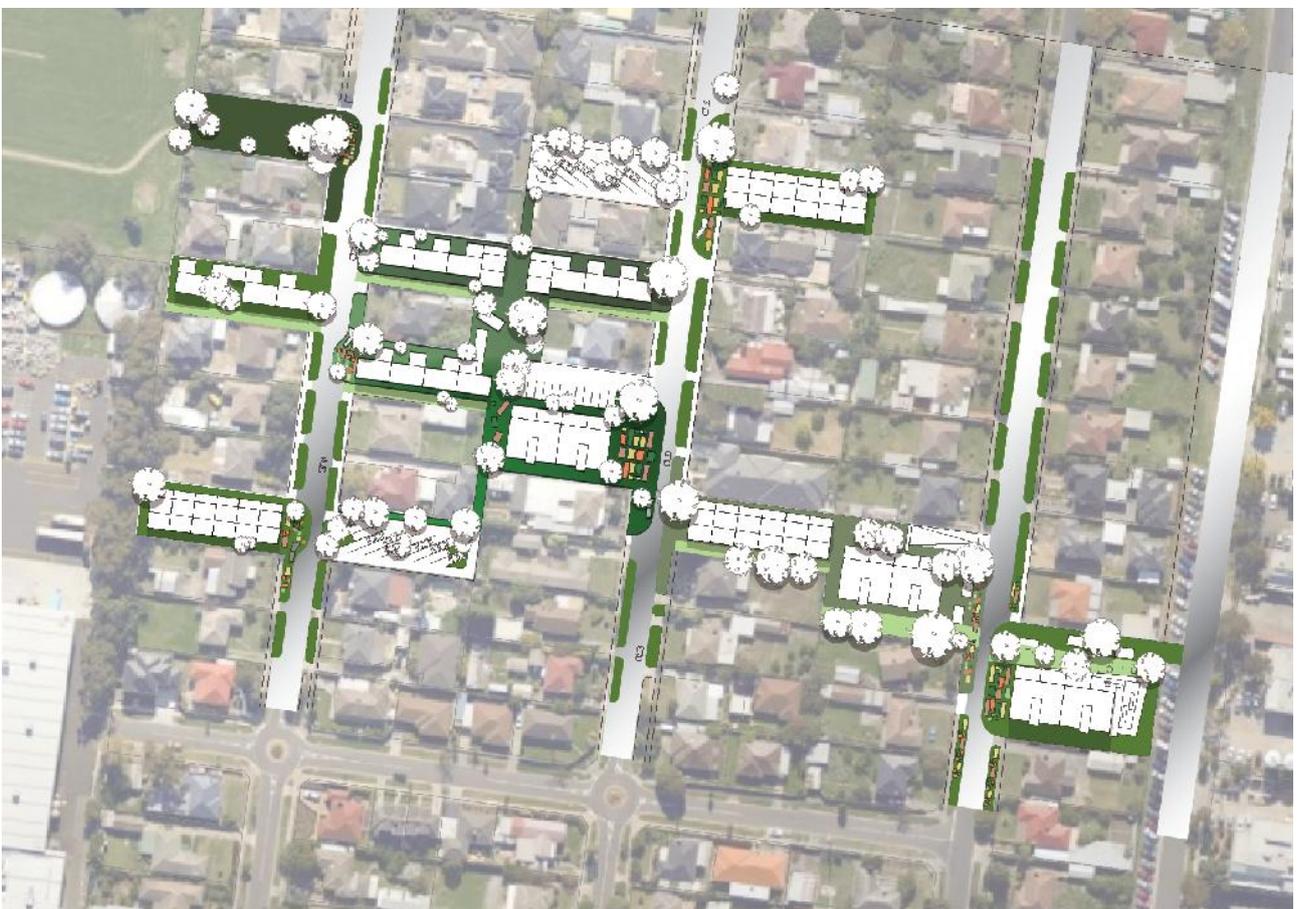


Figure 5: Alternative design for a Hybrid Greyfield Precinct in the same location

Table 1: Design Framework Comparison - piecemeal infill and hybrid greyfield precinct

	Typical Infill	Greyfield Residential Precinct
Dwelling types		
Yield/Density	30 dwellings.	68 dwellings.
Density	28 dwellings per hectare.	63 dwellings per hectare.
Diversity	Single storey detached and semi detached units.	A range building forms, dwelling designs and room numbers, responding to a diverse housing market and supporting several possible tenures and procurement methods.
Flexibility	None provided.	Dwelling and precinct designs that allow a variety of household types and occupations as well as various levels of visitation (within dwelling or shared on-site).
Accessibility	To legislated minimum	All dwellings are accessible or adaptable.
Private open space	Small courtyard to each dwelling; front garden setback.	Min. 2.4m deep balconies; Range of generous private courtyard spaces.
Public open space	Concrete driveway; Otherwise none provided.	Secure shared open space provided within development; public open space enhancements provided to streetscape.
Cars	1-2 per dwelling	1 per dwelling
Building performance		
Passive	To legislated minimum	Optimised solar orientation; 7-star construction energy rating.
Energy	To legislated minimum	5-6 star fittings and appliances; Smart metering
Water	To legislated minimum	Max. WELS rated fixtures
Waste	None provided	Grey water re-use
Construction type	Brick veneer construction	High thermal performance SIPs cladding system
Precinct wide initiatives		
Energy	None provided	Precinct-wide tri-generation system.
Water	None provided	Rainwater collection and reuse; Storm/ground water treatment.
Waste	None provided	Space provided for community wide waste minimisation and recycling
Transport	None provided	Upgraded bicycle lanes to street networks; Ample lockable bike storage; Allowances for car sharing; Bus shelters for public services and private shuttle.
Technology	None provided	Fibre optic communications network; Digital interface for precinct services, e.g. car sharing register and booking shared facilities.
Community capital and shared amenity		
Shared facilities	None provided	Multi-purpose community and entertainment room; Shared work shed, community kitchen and BBQ; Recreation facilities; Suitable areas for informal child minding
Local business/retail	None provided	On-site general store Adaptive dwelling use as small commercial leases and shared/home offices Food cooperative Private shuttle service

CONCLUSION

The proliferation of small-scale infill projects in the middle suburbs and the relative scarcity of larger scale redevelopments question the viability of delivering more sustainable, higher density housing models within current planning and industry frameworks. Formal containment strategies appropriately aim to accommodate population growth within existing urban boundaries, however they are slow to implement and do not address the renewal of the existing urban form. Parallel initiatives for the regeneration of residual suburban areas are also needed.

The renewal of the middle suburbs requires planning, industry and community engagement processes to be realigned through a new development framework that promotes the environmental, social and economic imperatives of sustainable urban growth. Principal amongst a range of factors inhibiting urban regeneration opportunities is the difficulty of assembling land, which is largely due to the private ownership of residential

allotments. Other issues that affect a location's suitability and viability for redevelopment include: the age and character of the surrounding built context; allotment sizes and property values; a compromised planning regime that leads to developer uncertainty and increased land holding costs; building controls that hamper innovative design solutions for higher density dwelling types; and strong community resistance.

The proposed greyfield precinct model begins to examine the opportunities for more appropriate forms of infill redevelopment that could be strategically managed to achieve better outcomes in established suburbs. An action supported by the panel members from the Greyfields AHURI investigative panel was to design, develop and demonstrate the benefits of a precinct approach to infill redevelopment as a basis for further community engagement, economic costing and environmental performance assessments over the life-cycle of precinct. This paper has outlined a range of potentially cost neutral design opportunities, as well as more extensive initiatives that would likely require innovative finance and investment structures. The viability of delivering better quality, higher performing and more affordable housing redevelopment requires more investigation. However, the extent of piecemeal infill occurring in the middle suburbs indicates an economy of scale that could support a number of enhancements with the appropriate institutional, industry and community support.

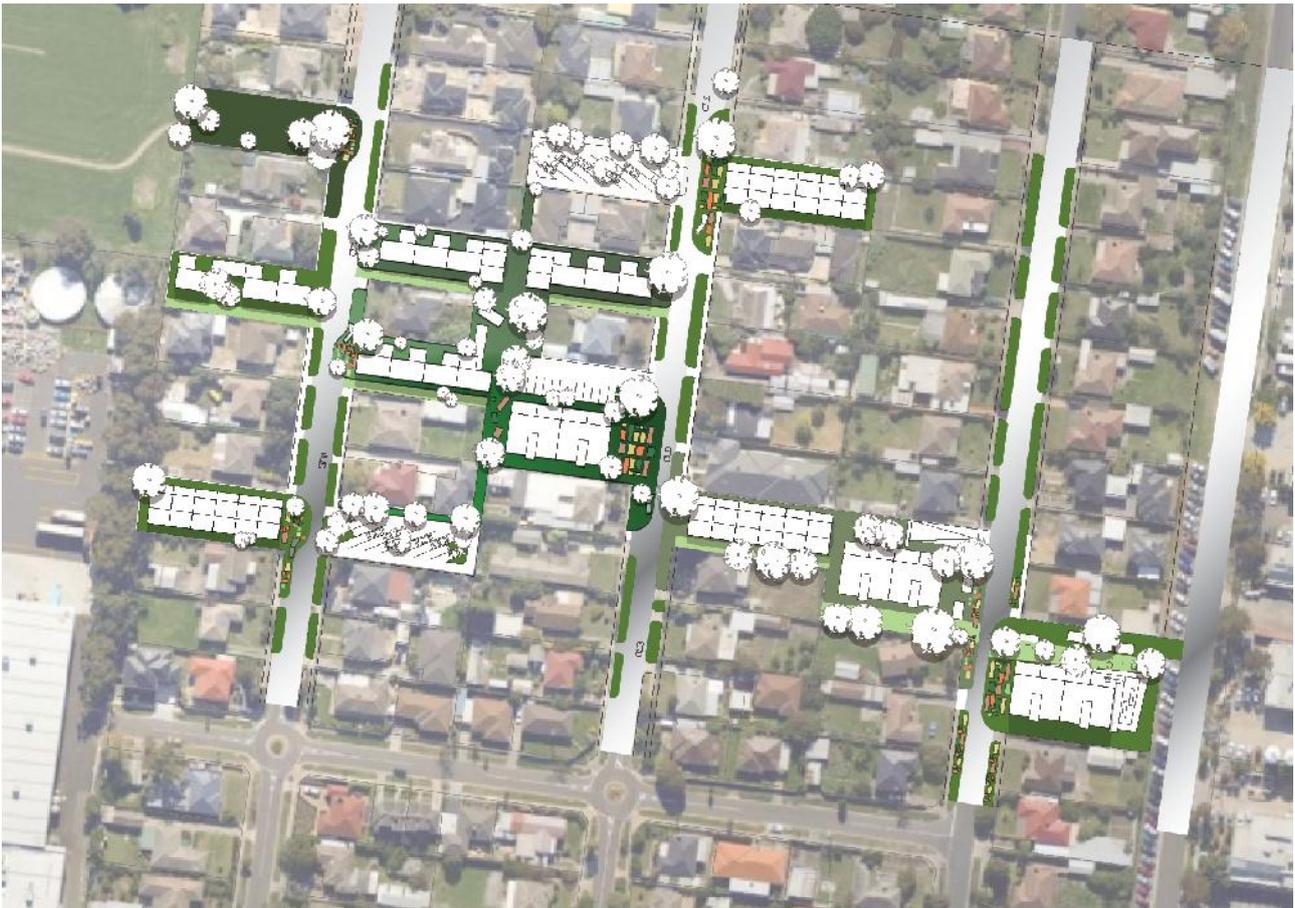
The hybrid precinct articulated in this paper involves design and construction techniques that are feasible within current delivery models. The principal challenge for regeneration of middle suburban precincts is coordinating the various inputs to work in an integrated manner to achieve a shared vision. This would involve genuine collaboration between a number of governments, institutions, private industry and the community which, to date, has proven insoluble.

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