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Preface

Greening the Greyfields integrates two strands of research pioneered by the senior authors of this book: ending automobile dependence and accelerating the supply of more-sustainable, medium-density infill housing in greyfield suburbs at precinct scale. The issues that drive this collaboration are the patterns of disconnected land use and transport development and the dysfunctional model for urban regeneration in the middle suburbs that continue to characterise the rapid growth of twenty-first-century Australian cities (as well as their international counterparts).

Greyfields are the geographic focus of the new planning models outlined in this book: the ageing, occupied residential tracts of suburbs that are physically, technologically, and environmentally obsolescent and that represent economically outdated, failing, or under-capitalised real-estate assets. They are typically located in the low-density, car-dependent middle suburbs of cities developed in the mid- to late twentieth century. They are rich in services, amenities, and employment, compared to the outer and peri-urban suburbs, and are becoming the focus of significant but suboptimal suburban re-urbanisation pressures. Despite these pressures, there is a lack of appropriate planning models for urban regeneration.

Urban regeneration is required to shrink the unsustainable urban and ecological footprints of 'suburban' cities as well as deliver environments that are more resilient, liveable, and equitable for future city populations.

In light of COVID-19, urban regeneration also needs to be aligned to a restructuring of the work–residence relationship of cities, re-localising urban places and increasing their self-sufficiency as '20-minute neighbourhoods'. This presents a grand challenge for the twenty-first century.

Precincts emerge as the most appropriate scale for tackling urban regeneration. They are the building blocks of cities: the scale at which greenfields continue to be developed; and the scale at which brownfields are being redeveloped. At present, however, there is a deficit in precinct-level planning models appropriate for sustainable urban development in the greyfields. *Greyfield precinct regeneration* (GPR) represents that missing class of planning model. In this book, we outline the genesis of the concept and its two sub-models—place-activated and transit-activated GPR—and the broader framework for their targeting and implementation, which involves a new concept and process: district greenlining. This strategic process enables state and municipal agencies to identify the boundaries of larger districts where retrofitting plans and timetables for next-generation physical (energy, water, waste, and transport) and social (health and educational) infrastructures, as well as nature-based services, are developed in an integrated manner, providing the spatial context for better identifying and specifying place-activated and transit-activated GPR projects.

Assembling larger land parcels for precinct-scale renewal is one of the components in establishing a pathway towards realising the United Nations Sustainable Development Goal 11 of 'inclusive, safe, resilient and sustainable' urban development—a critical objective of GPR. GPR requires demonstration of additionality: the multiple benefits that reflect more comprehensive, design-led, integrated land use and transport approaches to planning, compared to business-as-usual fragmented, small-lot infill.

Given the increasingly pervasive and pressing nature of the greyfield regeneration challenge, all levels of government need to become engaged in developing a strategic response. Establishing Greyfield Precinct Regeneration Authorities in major cities, involving partnerships with all major urban stakeholder groups and led by the national government in a *Better Cities 2.0* programme, would represent an important catalyst for driving urban regeneration in the greyfields.

This programme of applied research has been built on multiple competitive funding grants received since 2010: the Australian Housing and Urban Research Institute (AHURI), the Cooperative Research Centre for Spatial Information (CRCSI), the Australian Urban Research Infrastructure Network (AURIN), the Cooperative Research Centre for Low Carbon Living (CRCLCL), the Sustainable Built Environment National Research Centre (SBEnrc), the Australian Renewable Energy Agency, and the Australian Government's Smart Cities and Suburbs Program. Equally important have been significant collaborative partnerships with the Government of Victoria and the City of Maroondah; the Government of Western Australia and the cities of Fremantle, Canning, Perth, and Stirling; and in New South Wales the cities of Blacktown and Liverpool.

We would also like to acknowledge the contributions made by the next generation of urban researchers who have been part of the greyfields research team and who are co-authors of this book: Dr Stephen Glackin and Dr Giles Thomson.

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Abbreviations

AHURI	Australian Housing and Urban Research Institute
AI	Artificial intelligence
BRT	Bus rapid transit
C&D	Construction and demolition
CBD	Central business district
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EV	Electric vehicle
GPR	Greyfield precinct regeneration
ICT	Information and communications technology
KDR	Knock down rebuild
LRT	Light rail transit
NatHERS	Nationwide House Energy Rating Scheme (software)
NIMBY	Not in my backyard
P-A GPR	Place-activated GPR
R&D	Research and development
RPI	Redevelopment potential index
SDGs	Sustainable Development Goals
TAC	Transit-activated corridor
TOD	Transit-oriented development
T-A GPR	Transit-activated GPR

VAMPIRE	Vulnerability Assessment for Mortgage, Petroleum and Inflation Risks and Expenses
WGV	White Gum Valley
WSUD	Water-sensitive urban design
YIMBY	Yes, in my backyard

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The Global Greyfields Transition: Why Urban Redevelopment in Low-Density, Car-Based Middle Suburbs Needs a New Model

1 Introduction

This book introduces greyfield precinct regeneration (GPR), a set of new urban-planning models capable of regenerative medium-density redevelopment in ageing, established, well-located, low-density middle-ring suburbs of large, fast-growing cities that are primarily residential: the greyfields (Box 1.1). Greyfields are areas where the value of built assets now lies primarily in the land rather than in the ageing buildings. The attraction of the middle suburbs is that they are generally well served with local services, facilities, and community groups built over several decades. However, they lack sufficient new housing supply to meet the demand for well-located, diverse, twenty-first-century housing, especially in large, fast-growing cities.

There are two categories of GPR models: place-activated and transit-activated.

1. *Place-activated GPR* targets residential precincts in the middle suburbs with high redevelopment potential due to their attractive locational

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values such as proximity to schools, health services, and parks, but in need of reactivation to meet twenty-first-century needs. They need housing *and* neighbourhood regeneration with new eco-infrastructures for energy, water, waste, transit, and communications, all providing better services with a reduced ecological footprint, but require higher densities and more variety of dwelling types and sizes for the market to work. They are the 'missing middle' of urban renewal: medium density at precinct scale.

2. *Transit-activated GPR* injects new transit along corridors that enable GPR precincts to be created like pearls along a string of tram or major road corridors, together with activated personal mobility systems. This kind of GPR offers similar place-based attractions, but its biggest value lies in its potential to be part of a much more accessible transit service for destinations across the car-dependent greyfields and their centres of urban activity, as well as having local micro-mobility (electric bikes, scooters, skateboards, and shuttles) providing networks and services that link station precincts to their catchments. This model is developed in the book around new forms of mid-tier transit, especially trackless trams, capable of initiating a transition from primarily car-dependent suburbs.

In combination, these two *models* provide transition pathways to more sustainable, liveable, and regenerative twenty-first-century urban development.

Middle suburbs are the focus of the book, as urban regeneration of central and inner areas (particularly in CBDs and brownfields) has been more advanced over the past 25 years in Australian and North American cities after decades of inner-city decline (Box 1.1). However, this growth has not been able to move into middle suburbs in either Australia or North America due largely to zoning and land-assembly issues. Inner-area regeneration has been able to successfully focus on large precincts that consisted of abandoned industrial or warehousing districts or outmoded commercial buildings, often with single property owners, making it easier for developers to create precinct-scale projects. Meanwhile, outer

suburbs have continued to grow as low-density, car-dependent, precinct-scale greenfield developments, based on large blocks of subdivided rural land. Attempts to increase supply of new housing in the middle suburbs using precinct-scale 'growth' zoning of activity centres and major transport corridors have not proven to be sufficient magnets for residential property developers, as these suburbs have a myriad of individual property owners, making precinct-scale developments very difficult. The only model so far demonstrated to attract significant housing redevelopment in these greyfield areas is subdivision of single lots into micro-lots that have a ready market but do not provide the additional benefits and common-good outcomes due to their small scale (outlined in Box 1.1 and in detail in this book). Therefore, the new GPR model in both place-activated and transit-activated forms is based on multiple contiguous lots being assembled into a larger-scale set of opportunities for urban precinct regeneration.

The book will articulate the key *planning and design* features of these models and why they enable many more common-good outcomes (additionality). A major focus is also on how to deliver the GPR. A significant body of work by architects in recent years has demonstrated what the market should be supplying in such areas—but primarily at building, rather than precinct, scale (as reflected in the 'missing middle' housing-design competitions recently held in Queensland, NSW, and Victoria). But apart from 'knock-down-rebuild', there has not been a model able to articulate the *planning processes* necessary for higher-yield regenerative redevelopment in greyfields. Such planning necessitates involvement of multiple stakeholders from government, local communities, and built-environment industries developing a common goal and vision for precinct-scale urban regeneration.

GPR models are of particular relevance to the low-density middle suburbs characteristic of Australian cities, where the underpinning research for this book was based. They are equally applicable to cities in the USA, Canada, New Zealand, and parts of Europe that share common urban geographies and urban development challenges (Loader, 2015).

Box 1.1 The Three Arenas of Urban Development: Greenfields, Brownfields, and Greyfields

There are three arenas for urban planning and development in twenty-first-century cities: greenfields, brownfields, and greyfields (Newton, 2010). *Greenfields* have been the traditional focus for city growth, with low-density urban development occurring on previously zoned rural-agricultural land on the fringe of existing built-up areas. Compact city strategies have attempted to redirect investment, development, and population inwards and upwards to urban infill, rather than outwards, in an attempt to halt urban sprawl. Infill here refers to the process of redeveloping existing ageing built properties, usually at a higher density/yield and sometimes different use. Infill can occur on both brownfield and greyfield sites, but the development models and processes (involving planning, urban design, finance, construction, and community engagement), and the built-environment outcomes resulting from each, are distinctly different (Newton & Glackin, 2014).

Brownfield redevelopment has emerged as a process for re-imagining and transitioning those parts of cities that have 'outlived' their original industrial-era functions. Principal among these are the abandoned or under-used docklands that now occupy prime waterfront sites in all coastal cities, as well as the thousands of industrial-era manufacturing sites in large metropolitan areas. They can be distinguished from greyfield development sites in several key respects: they are typically owned by a single party, usually government or industry; they are of a scale closer to that provided by greenfield sites for development; they are contaminated to some degree, depending on the previous use; and they are usually unoccupied, obviating the need for community engagement at a level required of greyfields. As such, brownfield sites have been attractive to both governments and the property development and finance industries that have been able to create a development model to undertake such projects (Newton & Thomson, 2017).

Greyfields redevelopment has proven to be more challenging. 'Greyfields' is a term used to describe the extensive band of ageing, occupied, residential tracts of inner and middle suburbs that are physically, technologically, and environmentally obsolescent, and which represent economically outdated, failing, or under-capitalised real-estate assets. They typically occur in a 5–25 km radius from the centre of large cities and are rich in services, transport, amenities, and employment compared to the outer and peri-urban (greenfield) suburbs (Newton, 2010). This is the reason they have become a key target for more intensive redevelopment by government planning agencies in their future metro strategies. Current planning strategies are failing to deliver the scale and quality of urban infill in the greyfields, however. Small-scale, piecemeal, fragmented, suboptimal small-lot subdivision is spreading like a virus through greyfield suburbs with high redevelopment potential, removing up to 50% of private green space and blocking prospects for better designed, regenerative, precinct-scale, medium-density 'missing middle' redevelopment (Newton et al., 2020; Newman & Kenworthy, 2015). Developing new models and processes for precinct-scale regeneration in greyfields has been the catalyst for the research behind this book, guided by urban transition theory, concepts, and processes.

GPR (both place-activated and transit-activated) represents niche innovation capable of being incorporated into current metropolitan planning strategies and instruments designed to deliver more *compact, full-service districts* (i.e., with the accessibility and amenities of most inner urban areas) by focusing on *urban infill* rather than greenfield development. Greenfield-based planning strategies are currently proving difficult to implement in a sustainable way because infrastructure and service provision in low-density environments is expensive, and these areas are typically lacking in employment opportunities and thus depend heavily on car-based commutes. GPR offers a better solution for remaking twenty-first-century cities, as it can provide more *integrated land use and transport planning* capable of delivering critical environmental, economic, and social outcomes that respond to a common set of national performance goals for cities: sustainable, liveable, inclusive, resilient, and productive. Transit-activated GPR can integrate land redevelopment with a focus on new transit along main roads and provide links into surrounding areas through 'last mile' local micro-mobility services. Place-activated GPR targets neighbourhoods with high redevelopment potential that integrate high-quality local micro-mobility infrastructures as well as longer services to reach the nearest major transit service. Both GPR models share the need for new planning approaches, with place-activated GPR not likely to attract as much density as in the precincts surrounding transit-activated GPR stations along a whole regenerated corridor.

Such reduced car dependence and increased residential density and land-use mix can often be seen as disruptive to the status quo of many affected residential communities and can thus face resistance in the absence of a clearly demonstrated ability of a GPR project to deliver community additionality. Much of the greyfields redevelopment to date has generated more housing and car traffic in the middle suburbs without any environmental or local amenity benefits: a reason why local residents adopt a NIMBY ('not in my backyard') stance. In this context, our use of the term 'additionality' refers to those attributes of neighbourhood regenerative redevelopment that need to accompany medium-density redevelopment; for example, zero-carbon energy, water-sensitive design and integrated water systems, improved mobility, social infrastructure, and enhanced green space—delivering multiple, measurable benefits to the

local community. Thus, the additionality of GPR is designed to achieve much more than business-as-usual redevelopment. This book emphasises the new planning, design, and engagement processes required to demonstrate how these additionality benefits can become upfront requirements in GPR.

This chapter and those that follow provide a roadmap for reducing risk as well as promoting the benefits of GPR interventions. They address the multiple and well-established challenges facing large, fast-growing cities:

- *Car-dependent sprawl*—the multiple negative externalities of sprawl (increased carbon footprints, increased suburbanisation of social disadvantage, reduced access to jobs and services, increased commute times).
- *Housing diversity*—supplying the right mix of new and affordable housing in the right places.
- *Re-localisation*—the arrival of the COVID-19 pandemic has highlighted the need for cities to re-localise their urban structures, reflecting the increased importance and greater demand for local districts and neighbourhoods—*precincts*—that are more self-sufficient and are capable of supporting increased home-based work, walkability, local greening, and the multiple benefits of 20-minute neighbourhoods.

The next section sets out the 10 core transitions that will be addressed in this book and how they will be explored. Each examines the multiple innovation arenas in which change needs to happen to deliver more-sustainable urban development in the twenty-first century.

2 The 10 Transitions in Greening the Greyfields

City development patterns have evolved over time in response to radically different transport and building technologies, changing locational workplace-residence requirements during different industrial and economic eras, and the city development strategies of influential regimes comprising metropolitan governments and the property industry. A

critical transition challenge that now arises is overcoming the inertia and tensions associated with the inflexible nature of many features of the current built environments to achieve a common set of goals for twenty-first-century cities: sustainable, liveable, inclusive, resilient, and productive. The following sections briefly outline these features and their shortcomings, identify what needs to change, and describe how they will be covered in the book. The first five transitions are related to current built-environment and planning systems and how they vary over time and across cities. The second five concern sustainable urban development transitions and the case for more-compact cities and precinct-scale interventions in greyfields.

2.1 Transition 1: Urban Fabrics

Urban fabric is a shorthand term for the physical built environment patterns that have resulted from different underlying transport infrastructures supporting average journey-to-work travel times of approximately 30 minutes (the 'Marchetti anthropological constant') from agricultural eras to the present. The Theory of Urban Fabrics (Newman et al., 2016) reveals three dominant city types from history: walking cities, transit cities, and automobile cities. Most cities today have a mixture of all three urban fabrics (Fig. 1.1).

Walking cities are dense, mixed-use areas of generally more than 100 persons per hectare. The oldest urban typology, it dominated until the 1850s. Many modern cities are built around a nucleus of an older walking city, but they struggle to retain the walking urban fabric due to the competing automobile-city fabric that now overlies it. Reacting to this competition, many modern cities are now attempting to reclaim the dense, fine-grained street patterns associated with walkability.

Transit cities are extensions of the old walking city made possible by the introduction of trains and, later, trams between 1850 and 1950. Trams and trains supported corridor development with typical densities between 35 and 100 persons per hectare, with higher-density walking fabric around transit stops. The increased speed of transit allowed urban development to extend 20 km or more from the city centre.

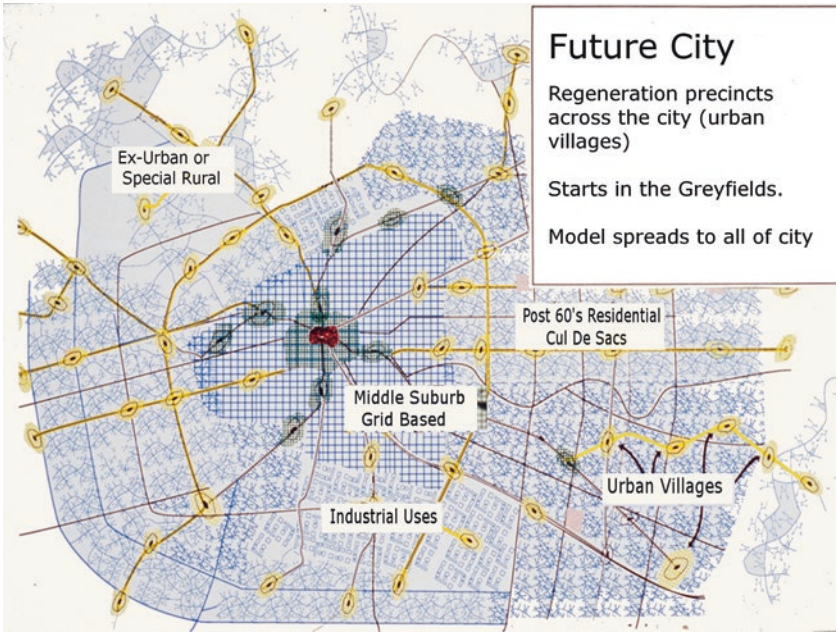

Fig. 1.1 Automobile city, transit city, and walking city—a mix of three city fabrics. (Source: Newman & Kenworthy, 2015)

Automobile cities emerged from the 1950s onwards with the advent of mass automobile production. Once there was individualised motor transport, city growth was no longer constrained to fixed rail corridors. In these new kinds of cities, population densities fell to less than 35 persons per hectare (low-density sprawl) because the flexibility and speed of cars (average 50–80 km/h on uncongested roads) allowed residents to live well beyond a 20 km radius from the city centre. The term 'automobile dependence' was developed in the 1980s to express how cities were increasingly being built around the car, leading to a multitude of issues that are now getting beyond the control of most planning systems (Newman & Kenworthy, 1989).

A fundamental problem with mid- to late-twentieth-century town planning has been the belief that there is only one type of city—the automobile city—and town planning regulations have been formulated to

deliver that. This is notwithstanding the fact that the negative aspects of designing cities predominantly for automobile use have become increasingly apparent and have constituted a failure of urban policy and planning. This book addresses that fundamental issue by suggesting the need for a specific and place-based focus on a new kind of fabric in the middle suburbs.

A forced transition to telecommuting during COVID-19 has raised questions about the prospects of a shift in regime from the daily work commute to one that is more flexible and weekly for many, thereby challenging Marchetti's long-operating anthropocentric travel-time constant (linked to an average 30-minute travel-time budget) that has shaped transport–land use relationships and changes over centuries. The importance of each fabric is more than likely going to continue, with face-to-face urbanity supported by electronic interactions (Florida, 2017). But the need for re-localisation around new centres or precincts is bound to be a new focus for many reasons (Fig. 1.1).

Transition 1 Retrofit automobile-dependent suburbs with walking-city and transit-city transport infrastructures at higher levels of residential redevelopment (a focus of Chap. 4).

2.2 Transition 2: Building Typologies

The urban landscape of large cities reveals three building forms or typologies: high rise, medium density, and detached low density. Each represents different urban qualities and can equally accommodate the requirements for a particular urban form and level of urban density at a precinct scale, depending on spacing and type of building (UrbiumEtOrbi, 2015). For low-density 'suburban' cities, detached housing has represented the dominant mode for accommodating resident populations, and continues to do so for many countries such as Australia, although the percentage share is slowly declining in the capital cities (e.g., in 2016,

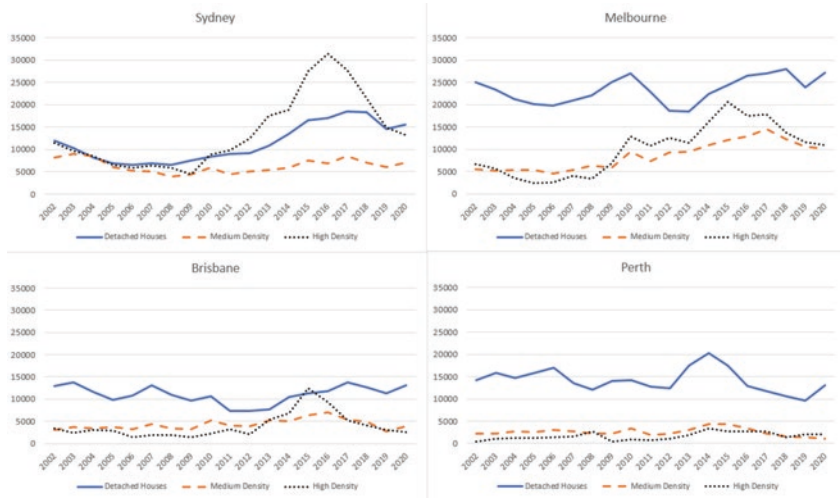

Fig. 1.2 Dwelling approvals 2002–2020 for Australia's major capital cities. (Source: Adapted from Newton et al., 2017)

66% separate houses, 21% medium density, and 13% high-rise apartments; .id, 2018). A suburban-to-urban transition will require the strategic injection of more medium-density and high-rise buildings in established low-density suburban settings where detached housing constituted the original building form from the 1940s on. As discussed in subsequent sections, this will require new models for land assembly and redevelopment in greyfield suburbs.

The pattern of medium-density approvals in Australia's four largest cities (Fig. 1.2) reflects the barriers that this class of development has faced to date in achieving greater take-up: slow recognition by industry of underlying population demand (a focus for Chap. 6); poor urban-design responses, and restrictive government residential zoning policies (a focus in Chap. 7). In the two largest cities with the least-affordable housing, apartment construction has boomed. A comparative analysis of built forms and densities of Australia's three largest cities with Vancouver, Montreal, and London (Spencer et al., 2015) reveals two contrasting patterns of density distribution (Fig. 1.3). The first urban pattern features extensive areas of low (<50 pph) residential suburban densities with a

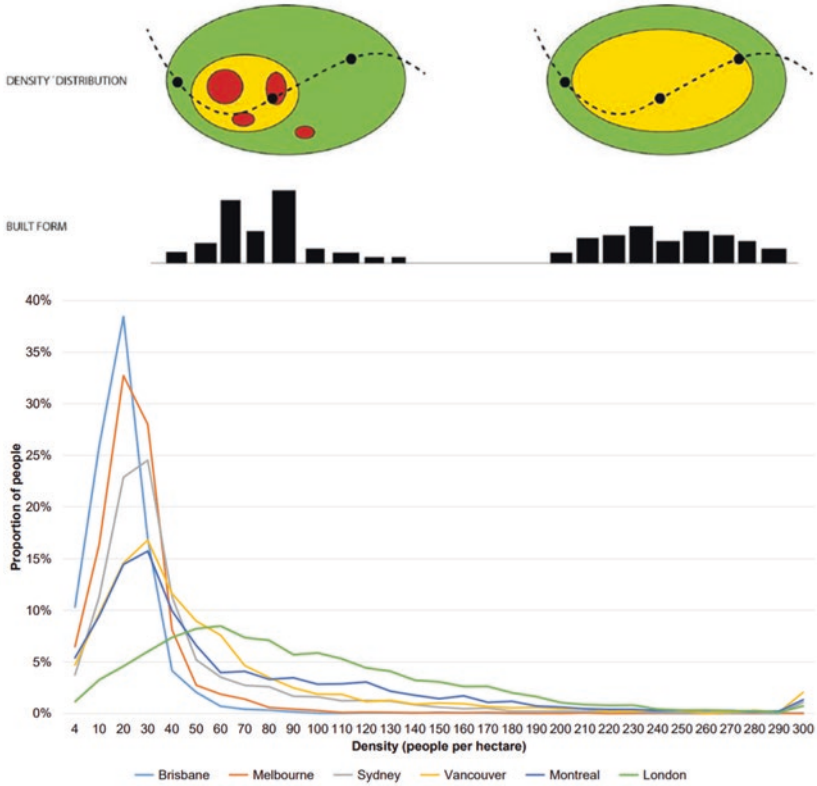

Fig. 1.3 City built-form and density models. (Source: Spencer et al., 2015)

relatively small number of concentrated areas zoned for high-density building (>400 pph)—CBD, major mixed-use activity centres, and transit nodes: effectively the current Australian model. As Woodcock et al. (2010, p. 104) have noted, 'the market has become polarised into fringe suburbs and inner-city towers and there has been a lack of market incentive to innovate at medium density in established suburbs'. The second urban development pattern features a more even distribution of mid-range densities that offers the potential for implementing more cost-effective transit-oriented development versus car-dependent sprawl. Achieving this urban landscape in Australian cities will require redevelopment of established greyfield low-density suburbs capable of

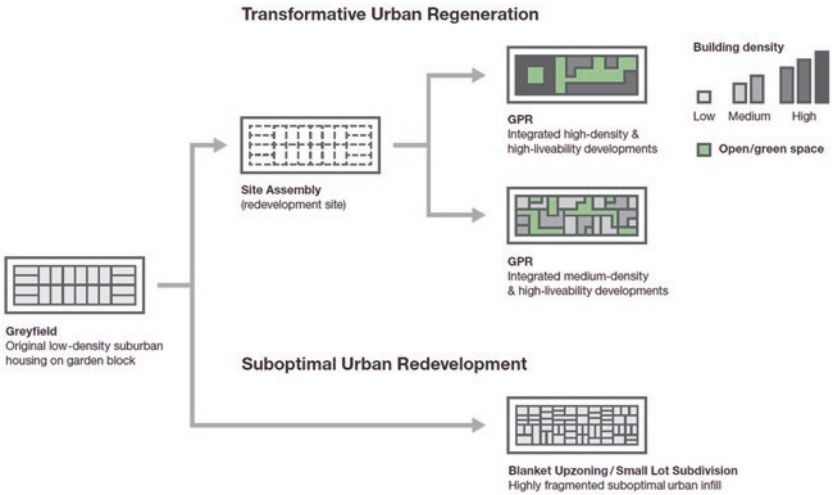

Fig. 1.4 Alternative building typologies and densities for a precinct of common dimensions

transitioning from a model that facilitates suboptimal small-lot subdivision to precinct-scale regeneration involving lot consolidation—a principal focus of this book (Fig. 1.4).

The greatest benefit that urban lot consolidation provides is the enhanced potential for integrated design responses on larger lots compared to the spatial constraints of small lots. Larger assembled parcels of land unlock the potential for transformative urban-design responses. By thinking beyond small individual lots, a step change in reshaping the urban fabric becomes possible; for example, to increase density from individual dwellings on fenced blocks to higher density outcomes with sufficient space to allow for the requisite site arrangement to integrate other aspects that can enhance liveability and sustainability; these can include on-plot open space, building setback for privacy, and retention of existing site features such as trees. These liveability and sustainability benefits will be most successfully achieved through a context-dependent, design-led approach whereby a development proposal is based on meeting pre-established quality criteria, such as urban-precinct design principles.

Current planning practice in most urban areas looks to increase density through blanket up-zoning for small-lot subdivision infill. However,

this type of redevelopment emphasises site yield over site design quality. Not all density is equal. A development that seeks only site yield will increase overall floor area (and population), but does not necessarily improve urban liveability or sustainability; in other words, additionality—additional benefits for residents and the city collectively. In practice, most blanket up-zoning brings about a reduction in the urban amenity and liveability of an area due to increased car traffic, more noise generation, reduced privacy, loss of greenery, and increased hard surfaces. Such decreases in urban quality can drive NIMBY responses. However, through good design, it becomes possible to address each of these potential issues, to deliver increased urban population density as well as additionality. Good-quality design creates a market 'pull' for more of the same—that is, a well-designed GPR product—whereas poor design outcomes in the form of suboptimal infill that results from blunt policy instruments (such as blanket up-zoning) elicits community resistance. The place-activated GPR process developed for *Greening the Greyfields* required that additionality become a core concept as well as a demonstrable outcome from any precinct-regeneration project as a necessary condition for changing a NIMBYresponse from residents and local governments in the middle suburbs to YIMBY ('yes, in my back yard') (Fig. 1.5).

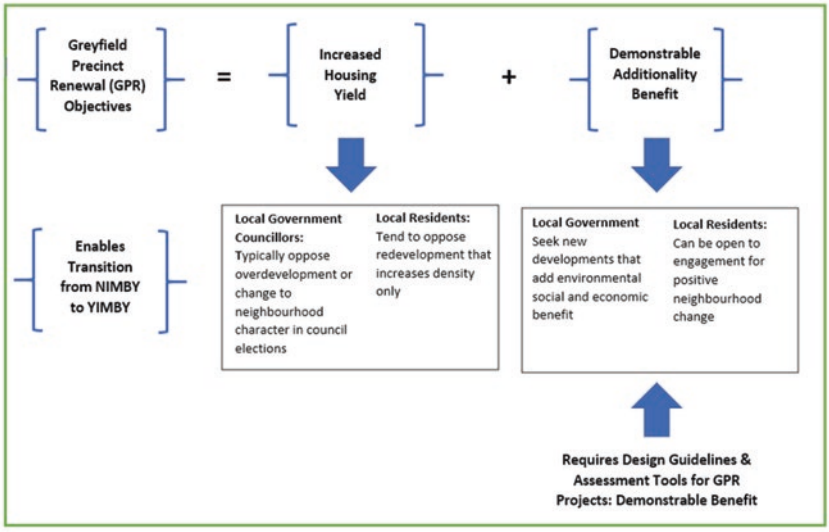

Fig. 1.5 The concept of additionality. (Source: Newton et al., 2020)

Transition 2 Increase provision for strategically planned and designed high- or medium-density housing in established greyfield suburbs, employing innovative place-activated and transit-activated GPR models for high-liveability outcomes that balance development footprint with green space, in contrast to small-lot subdivisions with suboptimal outcomes (a focus of Chaps. 2, 4, 5, and 7).

2.3 Transition 3: The Evolving Spatial Patterns of Urban Industrial Cycles

Most Western countries are now in a post-industrial era of urban development that has witnessed several radical transitions over a relatively short period of time in modern history:

- A transition to the *manufacturing city* where centripetal forces were dominant in locating industries in key centres where raw materials for the production of goods could be readily shipped and processed in factories powered by fossil fuels (primarily coal). Workers followed the jobs, with significant rural-to-urban migration (an urbanisation process that continues in developing countries to the present). Until the 1950s, the urban fabrics of such centres were indicative of walking and transit cities, and were associated with medium levels of residential and population density.
- A transition to the *services city*, linked to an increasingly consumer-driven economy after the Second World War, saw rapid growth in private car ownership that supported the powerful centrifugal forces of rapid suburbanisation. For half a century, the 'American model' of urban development dominated city planning, with suburbanisation centred on uniformly zoned, low-density, single-family, car-dependent, detached-housing estates that defined the automobile-city fabric. A powerful regime emerged to support this model: property developers, the automobile and oil industries, housing and road contractors, and city planners. This era was also associated with a depopulation of

inner-city suburbs as traditional heavy-manufacturing industries began to shift to low-cost regions (often off-shore), creating brownfield sites and 'donut cities', until forces of gentrification and redevelopment linked to a new demographic and a wave of new information industries and workers began to reverse the trend (Brotchie et al., 1987; Newton, 1995) (Fig. 1.6).

- In the twenty-first century, the pendulum has swung from suburbanisation to re-urbanisation, creating pressures on the *established areas* of cities (CBDs and their surrounding inner and middle suburbs) to accommodate new populations, knowledge-economy industries, and housing. They are the favoured locations for the new growth industries: creative, information, and knowledge-based businesses that require face-to-face interactions. They are also favoured locations for their workforces, creating agglomeration economies that are the engines of contemporary economic development world-wide. They also tend to represent the high residential amenity neighbourhoods in walking and transit areas of cities in developed economies, with superior access to higher education and health services, interactive spaces such as coffee shops, public transport, and jobs. High liveability and employment factors combine to make such urban centres highly attractive for both local populations and overseas-educated, migrant populations, and contribute to sustained levels of population growth

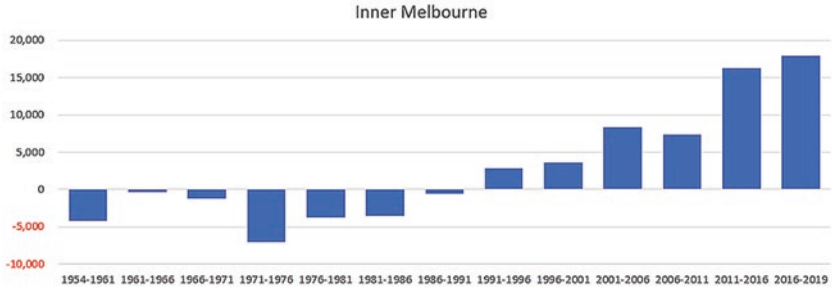

Fig. 1.6 Inner Melbourne—average annual population change revealing eras of depopulation (reflecting early suburbanisation) and repopulation (re-urbanisation). (Source: Victorian Department of Energy Land Water and Planning based on data from the Australian Bureau of Statistics)

and pressure on city governments where a planning and development deficit is now evident. The fact that restrictive zoning schemes 'lock up' most existing greyfield suburbs from higher-density redevelopment means that greenfield development and suburban sprawl, with their associated negative externalities, continue to be a feature of Australian cities.

Transition 3 Design a metropolitan plan for more-compact cities comprising networks of '20 minute neighbourhoods' connected by transit-activated corridors that connect more full-service districts in an information-based telematic era that can now deliver more sustainable urban development (a focus of Chaps. 2, 3, 4, 5, 6, and 7).

2.4 Transition 4: Housing Life Cycles and Residential Redevelopment

Achieving the compact city via suburban re-urbanisation will depend upon both a significant increase in the supply of redevelopable land in brownfields and greyfields and the way they are retrofitted. Brownfield sites are more readily identifiable and redevelopable at precinct scale. More challenging is assessing residential redevelopment potential in greyfields. A first-level analysis in what is a multi-criteria exercise involves calculating a residential redevelopment potential index (RPI) that indicates the proportion of a property's value attributable to the land as distinct from the built asset (RPI = land value/total property value; where an index value of 1.0 indicates that all value is in the land). As Fig. 1.7 shows, using municipal rating data for each property across a city reveals a clear housing life cycle for each district (suburb or local government area), ranging from youthful (in outer suburbs with a concentration of new residential subdivisions), to maturing (the middle suburbs) to regenerating (where a significant level of new infill housing development is occurring as remaining stock continues to decline physically, technologically, and environmentally).

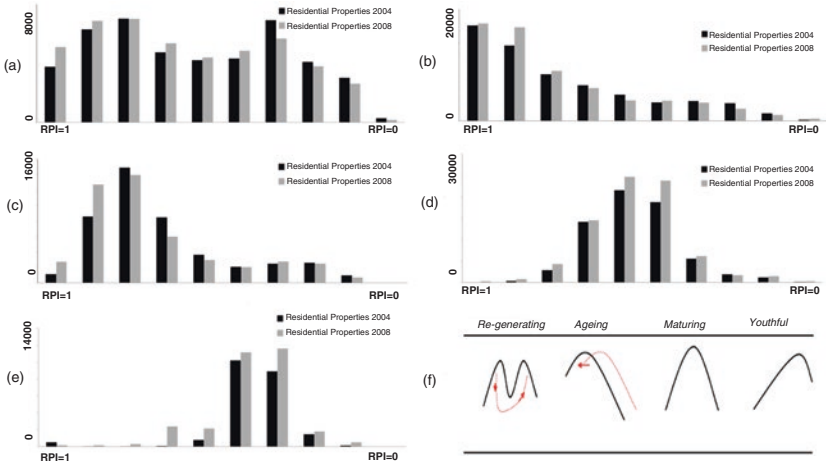

Fig. 1.7 Stages in the housing life cycle across a metropolitan area. Type of municipality: **(a)** regenerating; **(b)** advanced ageing; **(c)** ageing; **(d)** maturing; **(e)** youthful; **(f)** model of stages across a municipality's housing life cycle. (Source: Newton et al., 2011)

A metropolitan-wide assessment of residential redevelopment potential undertaken for Melbourne in 2016 using ENVISION software (Glackin, 2013) revealed that over one-third of the city's 32 municipalities had more than half their housing stock with high redevelopment potential (Fig. 1.8). This represents approximately 660,000 individual residential properties with an RPI index >0.7 across the city (23% >0.8 and 9% >0.9). Research indicates that when properties with an RPI >0.7 come onto the market, they are typically redeveloped within six years, which is significantly more quickly than those with a lower RPI (Newton, 2010).

Fragmented lot-by-lot redevelopment encouraged under current metropolitan residential planning schemes results in knock-down-rebuild and small-lot low-density subdivision—with adverse impacts on the sustainable development of cities. Figure 1.9 illustrates the virus-like spread of piecemeal residential redevelopment in a typical middle-ring Melbourne suburb over a decade. This is progressively inhibiting the potential for higher-yield regenerative urban redevelopment at precinct scale while at the same time destroying urban green space.

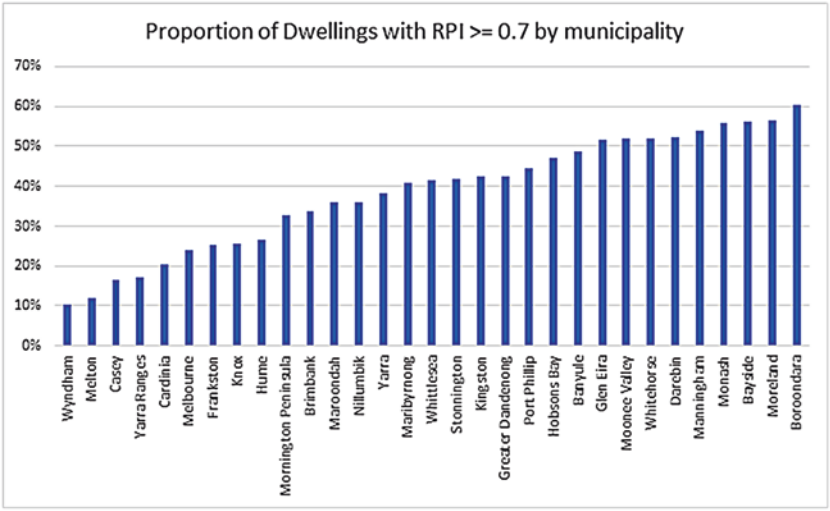

Fig. 1.8 Residential redevelopment potential of properties across Melbourne municipalities, 2016. (Source: Derived by authors from Victorian Valuer General 2016 rates data set)

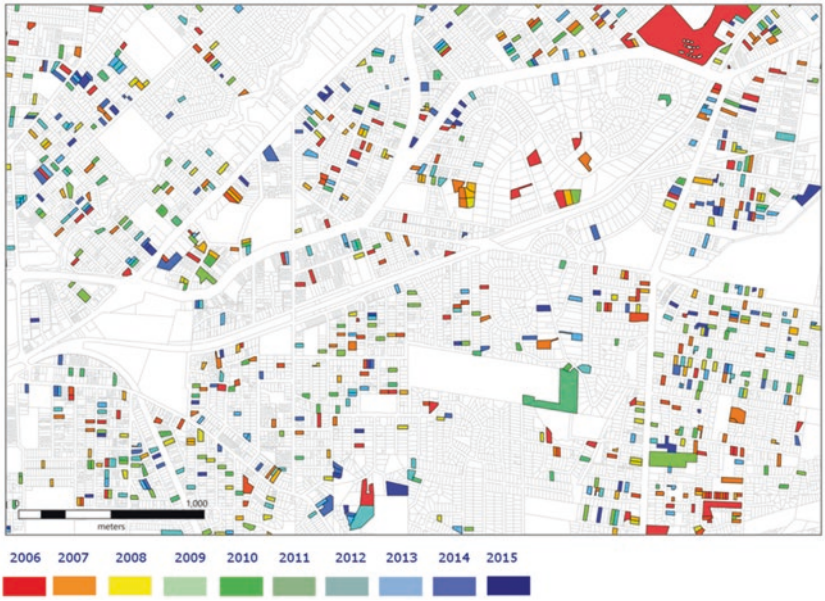

Fig. 1.9 The virus-like process of fragmented infill redevelopment in the City of Maroondah, Melbourne, 2006–2016. (Source: Newton et al., 2020)

Transition 4 Implement a planning and land-assembly scheme that supports planning of greyfields regenerative residential redevelopment that is more agile and forward-looking and enables precinct-scale medium-density projects yielding more housing, more sustainably, by incentivising lot consolidation among neighbouring property owners or by requiring minimum lot sizes for infill redevelopment (voluntary lot consolidation is a focus of Chap. 7).

2.5 Transition 5: Changing Household Structures and Composition

Several significant demographic shifts are underway in the twenty-first century that are beginning to reshape urban housing markets. Principal among these is the maturation of the large 'baby boomer' generation (those born between 1946 and 1964). They are beginning to make an impact as many downsize from their under-occupied (and owner-occupied) housing (Newton et al., 2011; James et al., 2020) and look for appropriate dwellings and locations to occupy in retirement. The most sought-after neighbourhoods are typically those located close to where many currently live: in the established suburbs. Smaller medium-density units best suited to empty nesters are in short supply in these areas, however, and new stock for this type of housing is priced closer to that of older greyfield detached housing, which leaves smaller profit to add to retirement savings, and less incentive to move. This is unless neighbours in this age bracket combine their properties to sell as a consolidated precinct for redevelopment. In this case, evidence suggests that they will reap a higher dividend than if the properties are sold separately.

A real estate 'package' for medium-density dwellings in a well-located middle-ring suburb is also well suited to meeting the needs of several other household types. Single-person households, couples without children, and single parents are projected to increase at about twice the rate of the nuclear family (couples with children); thus, housing production in Australia and other countries with low-density suburban cities needs to dramatically increase housing that fits these needs (McGee, 2016).

Appropriate configurations of twenty-first-century housing need to be incorporated in GPR to enable people to live near the services and functions they are used to.

Transition 5 Support a property-development industry capable of matching demand from an increasing diversity of household types and life-cycle stages with supply of more dwelling types that enable people to live longer in their desired locality (a focus of Chaps. 3, 5, 6, and 7).

2.6 Transition 6: Overcoming Multiple Problems of Sprawl and Regenerating Car-Dependent Suburbs

The pattern and rate of development characterising contemporary fast-growing cities is increasing the urgency of identifying transition pathways capable of reshaping cities to be more productive, sustainable, liveable, inclusive, and resilient (the set of performance goals established by the Council of Australian Governments (COAG, 2011) for Australian cities and made global through the UN's New Urban Agenda). A principal planning intervention that is aligned with all these transition goals is halting urban sprawl by accommodating growth in a more sustainable and equitable manner through re-urbanising the ageing, established, low-density, car-dependent greyfield suburbs.

An extensive literature on this topic links sprawl with:

- *Urban footprints* that are increasing at a faster rate than population in many cities, and are associated with loss of productive agricultural and ecologically valuable land; an extension of settlement into areas of high wildfire risk; and expanding the impacts of urban heat islands.
- *Ecological footprints* that are world-leading due to large carbon footprints and high resource consumption and are typically three times the world average in low-density cities in developed countries (Newton, 2012) (Fig. 1.10). The challenge for these cities is to radically shrink

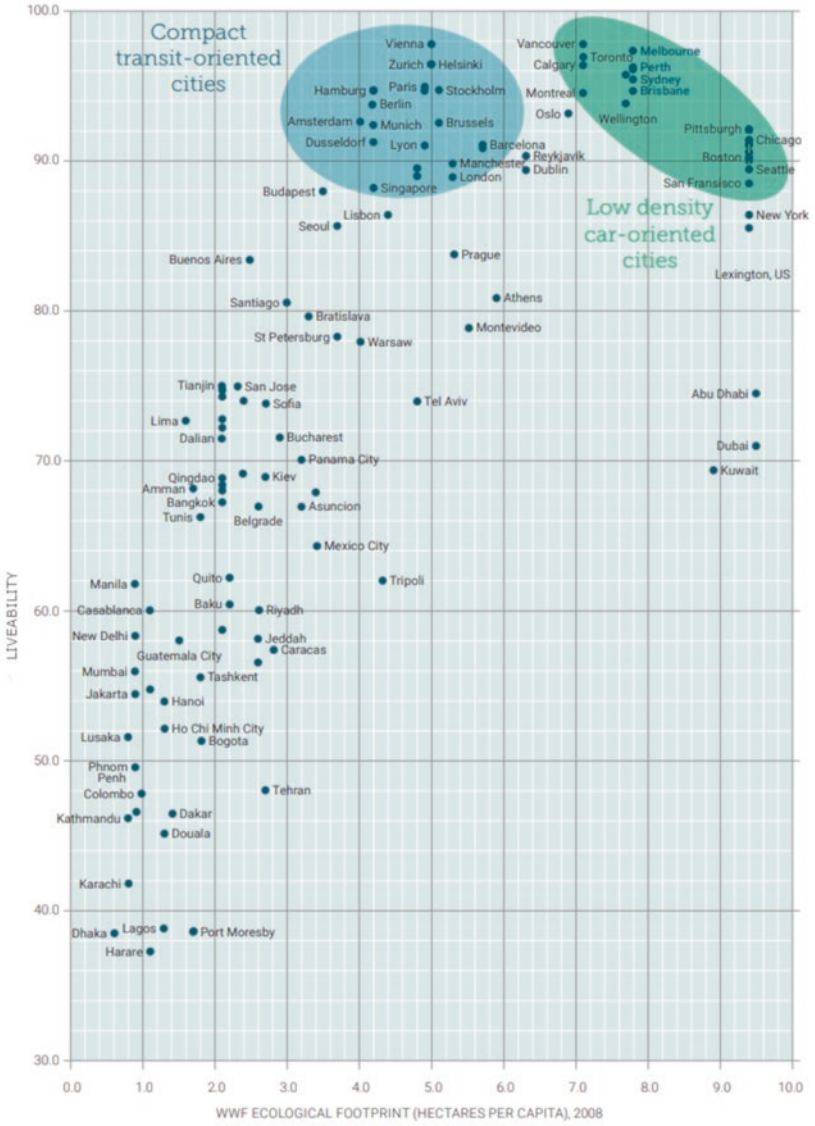

Fig. 1.10 The liveability–sustainability nexus of cities. (Source: Drawn from data published in Newton, 2012)

their footprints while retaining their high levels of liveability—something that many European cities have demonstrated is feasible, as reflected in smaller, less consumptive housing and low-carbon walking and transit fabrics (Newman et al., 2017).

- *Loss of economic and social productivity* among car-dependent suburban populations associated with time spent commuting in daily activity budgets and their associated automobile costs (Newman & Kenworthy, 2015).
- *Loss of health*, especially as a result of obesity-related chronic diseases linked to residence in car-dependent suburbs and neighbourhoods that discourage physical activity, especially walking (The Lancet, 2016).
- *Increasing suburbanisation of social disadvantage*, where households on lower incomes, dealing with social problems and requiring a range of services not available in greenfield areas, are excluded from unaffordable inner and mid-city housing and rental markets (Hulse & Pinnegar, 2015).
- *Reduced physical access* to centralised metropolitan job markets, higher education, and specialist health services (McDougall & Spiller, 2016).
- *Higher cost of providing infrastructure* for new housing in outer suburbs compared to infill in greyfields. The costs of sprawl have been estimated for decades; in Australia, Trubka et al. (2010) have suggested that 30 years of urban development focused on inner and middle suburbs would save $213 billion compared to further developing the urban fringe.

COVID-19 has raised a number of questions associated with envisioning the future city and suburb, especially in relation to telework, commuting, and a changing relationship between home and workplace. The pandemic has reinforced the importance of local accessibility and local amenities (shops, services, recreation, parks): i.e. the 20-minute neighbourhood. During 2020, it became clear that many aspects of contemporary cities and built environments are no longer fit for purpose and are not being positioned for the century ahead. Key urban transitions will need to involve decarbonisation of the built environment, nature-based urbanism linked to integrated, decentralised urban water systems in

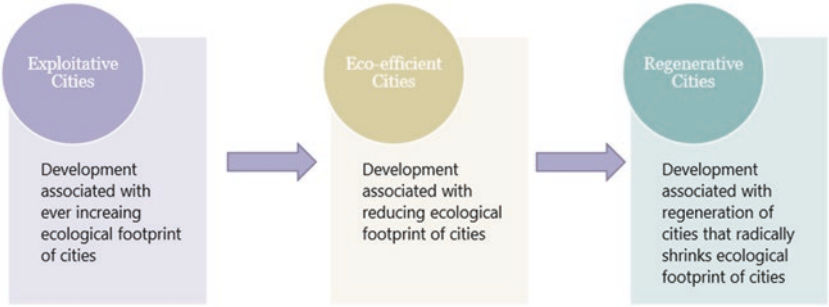

Fig. 1.11 The transition to regenerative cities. (Source: Newman et al., 2017, p. 13)

warming cities with declining rainfall, a circular urban economy, smart distributed urban infrastructures, and new forms of urban governance. All these are drivers of the new precinct-based housing and mobility models that feature in the following chapters, especially in regard to how they contribute to a new era and landscape of *regenerative urbanism* (Fig. 1.11).

This transition pathway seeks to close the door on a model of city development that has been demonstrably exploitative by putting economic objectives ahead of social and environmental concerns. An 'eco-efficiency' framework has emerged over recent decades, which represents an attempt to assess both the positive and negative environmental impacts associated with development projects, with a view to incorporating the results in urban decision-making processes. It recognises that environmental as well as economic calculations need to be involved in built-environment decision-making. The objective is to reduce environmental impact subject to cost, but the primacy of economic performance is typically evident—to some extent due to challenges associated with measuring the positive economic values of urban ecosystem services as well as the negative externalities linked to business-as-usual types of urban development, and incorporating both in the development project's spreadsheet. An inhibiting factor here is that contemporary governments are typically ill-disposed toward regulation requiring the additional measurement inherent in triple bottom-line project assessment; instead, they tend to

favour industry-supported voluntary (often check-box) schemes for performance assessment.

'Regenerative urbanism' has emerged as a new objective for urban development that presents the opportunity and challenge to go beyond minimal reductions in environmental impact to a new vision of how cities can be designed and operate in an 'eco-positive' manner, while maintaining or enhancing liveability (Birkeland, 2008; Thomson & Newman, 2016, 2018, 2020); in other words, removing negative environmental impacts from development and providing ecological gain. This requires regenerative development that is based on 'giving back as well as taking' (Girardet, 2015, p. 11) and needs to operate across all urban sectors and all urban scales: buildings, precincts, and cities. Regenerative urbanism relies heavily on the use of the urban metabolism model framework for representing (and measuring) the flow of resources into and waste outputs from built environments. It highlights the transformational changes that need to occur in urban systems (after Thomson & Newman, 2016, 2018, 2020; Thomson et al., 2016):

- Going beyond reducing consumption of virgin non-renewable resources by transitioning to regenerative resources: creating more renewable energy than needed, using energy generated by rooftop solar while reducing demand by building highly energy-efficient buildings—in combination, a pathway to zero-carbon buildings; significantly reducing the need to import potable water due to the emergence of integrated water systems; and increasing the dematerialisation of industrial and construction products by the use of eco-efficient circular-economy materials, technologies, and processes.
- Going beyond reducing emissions to the air and to solid and liquid waste streams to repairing the ecosystems damaged by industrial and domestic emissions. This would mean both an increased focus on the decarbonisation of energy and deep mitigation of greenhouse gases via sequestering carbon in regional forestry projects and other carbon sinks such as wetlands and soils. It would also mean capturing and treating stormwater and wastewater for non-potable urban water uses and creating zero-waste pathways for industrial, construction, and

domestic waste streams linked to a transition to a circular economy based on industrial-ecology principles.

- Creating smart urban systems and processes to enable cities to have an ecosystem of technologies that enable sharing of resource use and better integration of their infrastructure systems. Such systems will enable more effective and efficient economic, social, and environmental planning and management of cities, as well as better integration of the different levels of government with industry and community stakeholders (smart strategies as well as smart technologies).
- Meshing grey infrastructure with green infrastructure linked to biophilic design on, in, and around buildings to improve the public and private urban environmental quality as well as responding to the environmental stressors from reduced private green space associated with the intensified urban retrofitting and densification of cites. Introduction of water-sensitive urban design and nature-based services into GPR processes improves surface permeability and reduces stormwater runoff as well as reducing urban heat and improving biodiversity. This is especially important in the face of global warming.
- Creating micro-utilities (based on next-generation distributed energy, water, waste, and mobility systems) in designated greenlined urban districts that can increasingly be managed as an integrated enterprise capable of aggregating all the systems and flows (see Fraker, 2013).
- Enhancing liveability and well-being. Due to the extra density and accessibility in GPR, community services and broader city-wide services will be attracted to place-activated and transit-activated precincts to help deliver full-service communities. It can also enable the entire metro region to embrace the more-regenerative processes inherent in GPR by showing how they can move from greyfields into the outer greenfield suburbs. This would enable equity and access to be regained, providing communities in all urban fabrics a more equal share in city liveability.
- Elevating the resilience of cities. Implementing smart, sustainable planning and design technologies and management systems in the retrofitting and regeneration of cities will increase their resilience to storms, floods, heat, fires, and other disruptions through greater adaptive capacity now available as twenty-first-century technologies become

affordable. There would also be an increased ability to cope with shocks linked to volatile global financial markets and health pandemics.

Transition 6 Devise regenerative metropolitan development strategies and new planning and development models such as GPR to enable transformative change at building, precinct, and city levels that is capable of halting further urban sprawl and helping create sustainable, resilient, inclusive, affordable city development (a focus of Chaps. 2, 3, 4, 5, and 7).

2.7 Transition 7: Aligning Metropolitan Planning Strategies with Urban Redevelopment Needs

Urban redevelopment currently occurs in two contrasting urban arenas: brownfields and greyfields. They can be distinguished by the planning, zoning, and development processes involved and the scale and dwelling yield of the on-ground projects. To date, greyfield residential infill redevelopment has been occurring in three urban settings prescribed in metropolitan zoning schemes: activity centres, major transport corridors, and fragmented infill in zoned residential areas. Figure 1.12 illustrates a full range of existing and prospective greyfield redevelopment models.

Activity centres, ranging in scale from the CBD to the more numerous 'principal' and 'major' activity centres characteristic of poly-centred development in large cities (i.e., those involving retail and commercial activity centres) to a myriad of neighbourhood activity centres that constitute the basis for '20-minute neighbourhoods'. They have been a central plank in Australia's metropolitan planning schemes for decades, and in more recent times have featured in attempts to further intensify growth via *transit-oriented development* (TOD) of larger activity centres linked with railway stations. The larger activity centres have been zoned as growth precincts to attract high-density apartment and commercial development.

Major transport corridors, a more recent model for greyfield redevelopment, involves identifying linear transport corridors along main roads as

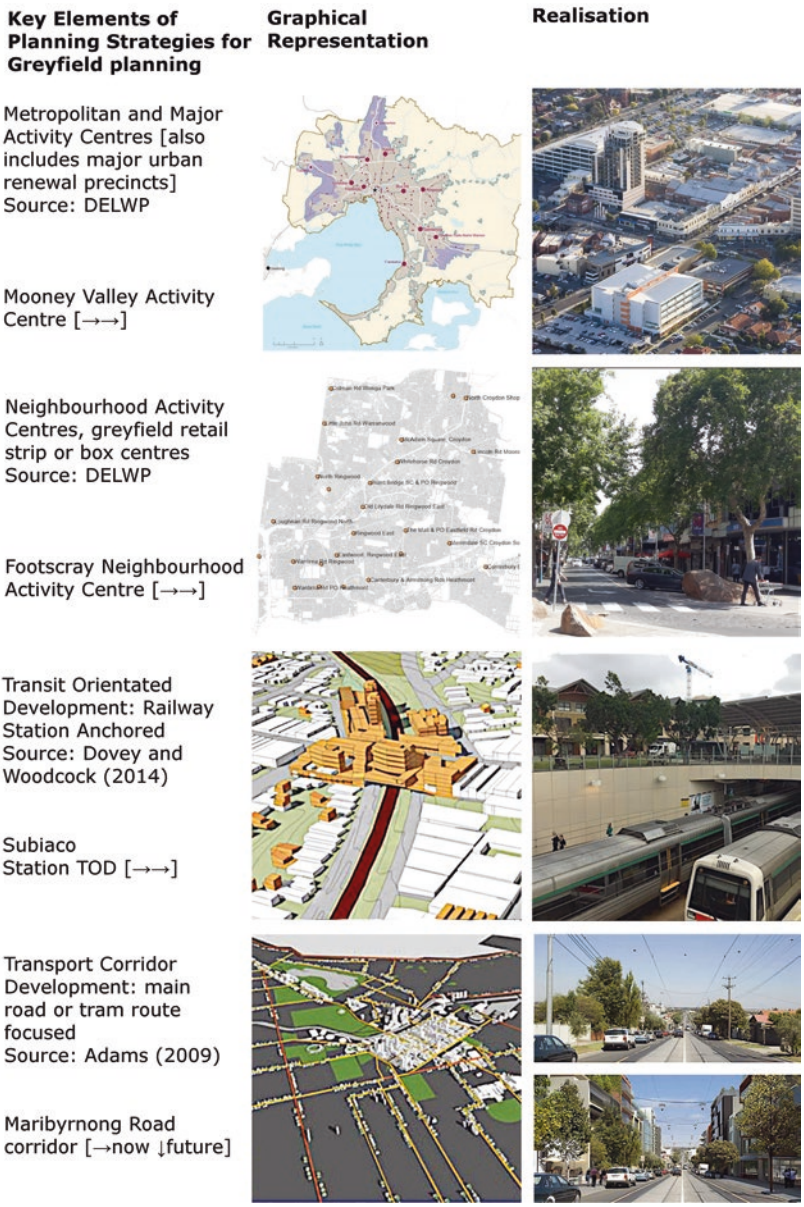

Fig. 1.12 Greyfield planning strategies for accommodating urban growth

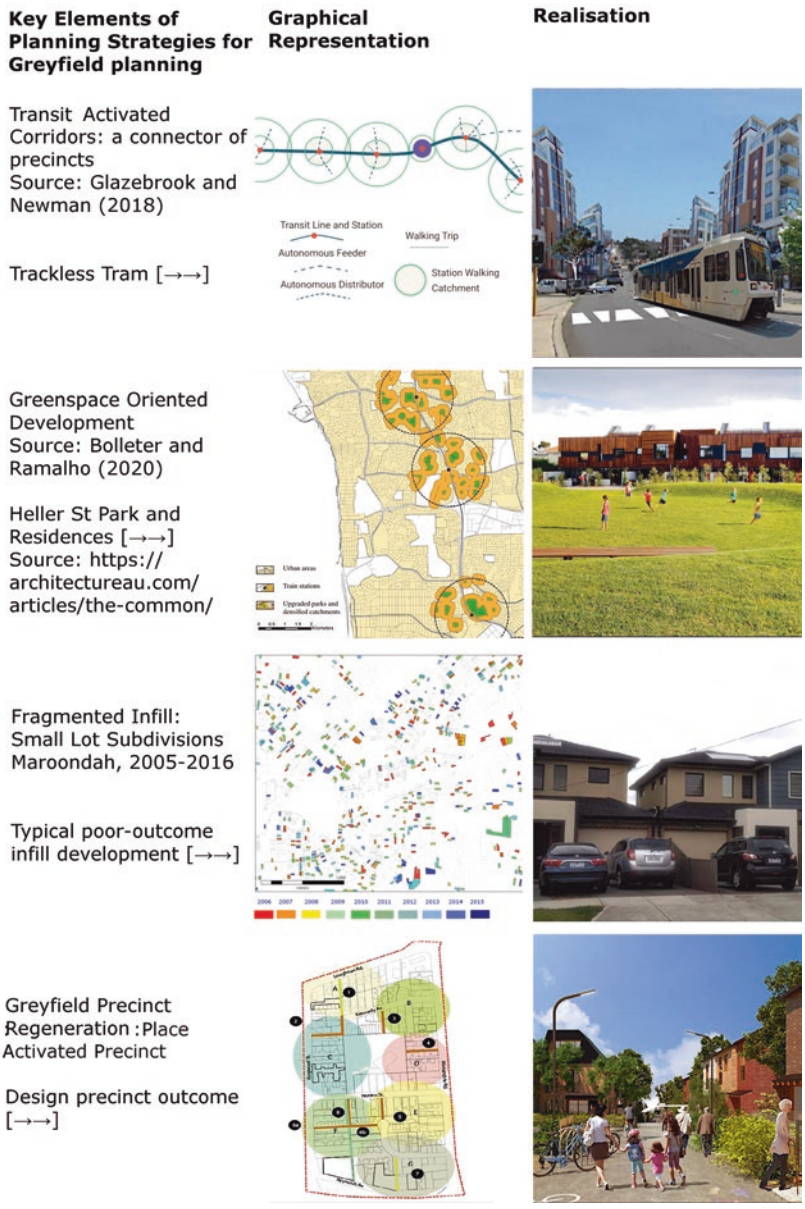

Fig. 1.12 (continued)

an additional focus for medium-rise, high-density development. The requirements for this to work in Melbourne were set out by Adams (2009); they include prescriptive zoning controls over key aspects of corridor development, including upfront 'as of right' development to levels of between four and eight storeys. Much of this model has been built along the inner tram corridors of Melbourne and is now moving into middle suburbs. The need to build for reduced car parking in such transit-activated GPR has now become a much firmer planning principle that should be continued into the GPR planning schemes in future (McClosky, 2009).

The Melbourne corridor model of urban development from Adams (2009) has now been extended into greyfields where no tram systems currently exist (Newman et al., 2019). This transit-activated corridor (TAC) model involves threading new low-carbon mobility infrastructures (light rail, trackless trams, walking and cycling paths) through greyfield precincts in car-dependent suburbs based on new planning partnerships. A recent study by Hendrigan (2020) showed that the next 30 years of urban development in Perth could be accommodated by infill of no more than five storeys around rail stations and along new light-rail lines, mostly in middle suburbs; this topic is developed further in the transit-activated GPR model outlined in Chap. 4.

Green space-oriented development has been advanced as a new model for more-sustainable greyfield redevelopment that is focused on the potential for selectively and creatively redesigning and re-zoning residential areas abutting parks. This would involve re-zoning, buying out, and assembling neighbouring properties and rebuilding at higher densities on the flanks of public parks, especially those accessible to shops and rail stations via walking or cycling (Bolleter & Ramalho, 2020; Weller, 2019). This is a variant of place-activated GPR, but depends on accessing parkland space, which is not as commonly available as the opportunities across most greyfield suburbs.

In Australia, each state government's planning provisions have residential zones that provide for a range of forms and intensities of development outcomes. Though the names and legislative underpinnings vary, they can largely be referred to as 'no-go' (highly restricted redevelopment), 'slow-go' (limited redevelopment), and 'go-go' (large-scale, high-density

Table 1.1 Principal residential zones in Australia's largest capital cities

	Residential zone type		
City	'No-go'	'Slow-go'	'Go-go'
Melbourne	Neighbourhood residential zone (and low-density residential zone)	General residential zone	Residential growth zone and mixed-use zone
Sydney	R2 low density residential	R1 general residential	R3 medium density residential R4 high density residential B4 mixed use
Brisbane	Character residential and low density residential	Low-medium residential density Medium density residential	High density residential
Perth	≤R15	R15–R40	≥R40

redevelopment); these are illustrated for the largest capital cities in Table 1.1. Application of specific zones sets the built-form and regeneration outcomes, and by altering the zone it is possible to alter expected outcomes. Evidence suggests that a particular zoning does not mean that the expected development always follows, as the market for housing depends also on what amenity is also associated with the housing being built not just its density zoning (Limb & Murray, 2021). However, certain zonings such as the Neighbourhood Residential Zone (illustrated in Fig. 1.13) that covers extensive tracts of Melbourne's suburbs effectively 'locks out' the prospect for more regenerative medium density residential infill projects of the type outlined in this book.

A majority of residential areas in Australian cities are zoned as either 'no-go' or 'slow go' in relation to higher-density redevelopment. Consequently, *fragmented infill* represents the majority of housing redevelopment currently occurring in greyfields. It typically involves the construction of between one and four new dwellings on an established 'knock-down-rebuild' site, where the value of the land accounts for 70–80% or more of the value of the property asset prior to its redevelopment. It represents suboptimal redevelopment in many respects in that it generates a relatively low yield in terms of net new housing but is

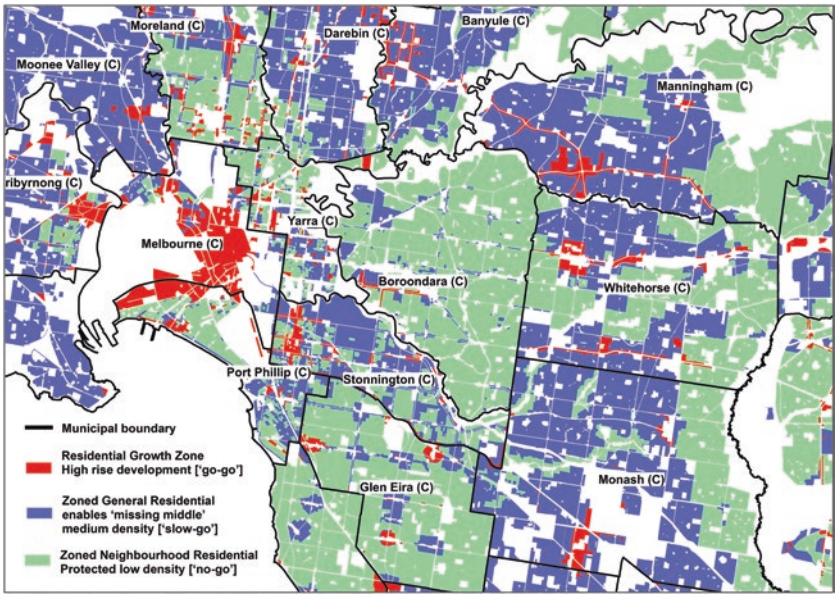

Fig. 1.13 The geography of residential zoning in Melbourne 2021. (Source: Planning layer from data.vic.gov.au)

accommodated within existing planning and building regulations, and as such has become a well-established model for small-scale property developers. However, it represents a slow burn of the local, public urban resource base:

- *Loss of green character and amenity*—there is significant loss of (private) open/green space with the removal of gardens, canopy trees, and lawn that are typically part of older detached housing.
- *More people*—additional population adds to the demands on municipal services without infrastructure improvements that can be incorporated in larger-scale precinct developments.
- *More traffic*—more households currently means more cars and added road congestion, particularly without additional public transport services or car sharing.
- *No extra services*—the scale of redevelopment usually means that the project does not attract a developer contribution that can assist government in redressing the associated negative externalities.

Transition 7 Redevelopment policies and strategies for greyfields do exist but the majority of activity is suboptimal urban redevelopment which is built into the planning system in most redeveloping car-dependent cities and needs to be reviewed and revised at all planning levels and functions in order to transition to more regenerative urban redevelopment (a focus of Chaps. 3, 4, 5, and 7).

2.8 Transition 8: Overcoming Failure of Current Urban Infill Strategies to Achieve Sustainable Redevelopment and Targeted Housing Yields

Managing sprawl in Australia's largest cities will require at least 70% of net new housing to be constructed as infill within the strategic planning framework outlined above. Early reviews of urban consolidation policies reported no observable impact on this target (Goodman et al., 2010, p. 73).

A comprehensive review of housing infill outcomes in Melbourne over the past decade (Newton & Glackin, 2014; Newton et al., 2020) has also established multiple shortcomings in specific elements of metropolitan strategies. In Melbourne, where the most comprehensive infill studies have been undertaken, approximately 50% of new housing is infill (brownfield-to-greyfield ratios vary depending on developer preferences for apartment construction, but are currently about 2:1, given that most high-rise apartment development is in the form of large brownfield projects). The public-transport access level of metropolitan road networks is not a magnet for attracting higher levels of infill (as most main roads just have poor-quality bus services, leaving households attached to car use and causing developers to continue to offer dual car parks, even in some apartments on tram routes). Nor are designated activity centres attracting significant new housing, with the exception of the CBD pre-COVID-19; Limb and Grodach (2020) offers similar evidence for Brisbane. Figures 1.9 and 1.14 illustrate that most residential infill in middle-ring greyfield suburbs is piecemeal, small-lot subdivision.

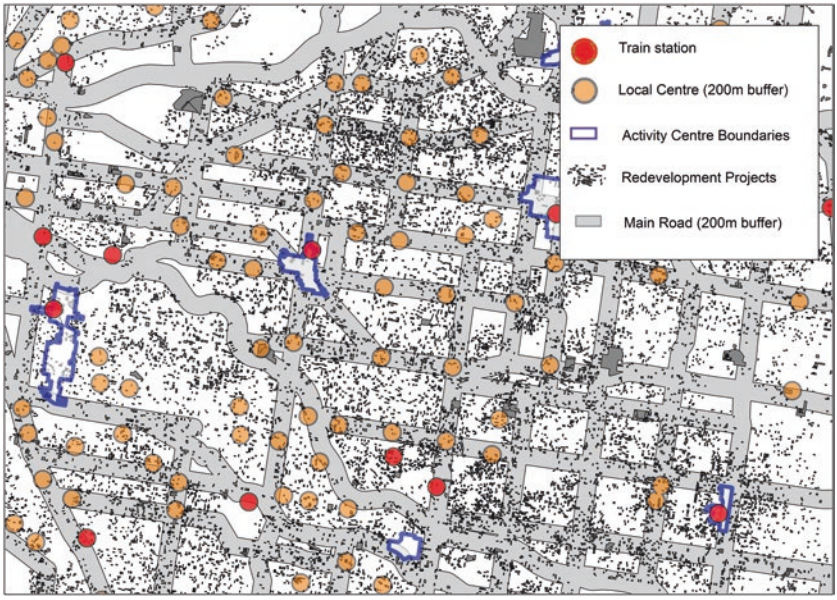

Fig. 1.14 Location of infill housing projects in the context of strategic planning schemes: City of Maroondah 2015; demonstrating that the majority of greyfield infill is not strategically aligned. (Source: Derived from Victorian Government spatial data)

Transition 8 Continue to develop and implement GPR policies and strategies as a response to the fact that most metropolitan planning is failing to deliver the kind of housing and transport outcomes that are set in their strategic plans (a focus of Chaps. 2, 6, and 7).

2.9 Transition 9: A New 'Missing Middle' Model for Housing and Urban Redevelopment: Greyfield Precinct Regeneration

A focus on the location and scale of greyfield infill redevelopment projects is revealing. There continues to be a lack of residential construction projects in greyfields that yield between 5 and 20 new medium-density

Table 1.2 Dwelling yields of residential infill construction projects in Melbourne 2005–2016

Project yield (New dwellings as % of total construction)								
Development arena	1	2–4	5–9	10–19	20–49	50–99	100+	Total
Brownfield	2.0	0.5	0.6	1.6	8.4	8.9	27.0	49
Greyfield	13.0	27.7	5.3	3.9	0.5	0.4	0.1	51
Total %	15.0	28.2	5.9	5.5	8.9	9.3	27.1	100
Total (000)	42.3	79.5	16.7	15.7	25.0	26.3	76.6	282.1

Source: Newton et al., 2020

dwellings—a *missing middle* scale of residential redevelopment (Table 1.1). Larger-scale projects (specifically, high-rise apartment buildings) are concentrated in brownfields. The type of infill housing also varies by the area's socio-economic status: locations with above-average socio-economic status are where 1:1 replacement and high-rise apartments dominate; and those with average-to-below-average socio-economic status are where 1:2–4 and 1:5–9 projects dominate. This points to the challenge of lot consolidation and its role in GPR.

'Missing middle' is a planning and development concept that has only been partially conceptualised and applied in the urban literature. Previously, 'missing middle' was used exclusively as a term related to a set of *medium-density housing types* that sit between detached single-family homes and mid-rise town houses or apartment buildings (Parolek, 2019). Missing-middle policy approaches to urban infill development are happening in countries with low-density cities (such as the USA, Canada, New Zealand, and Australia) where attempts are being made to increase the supply of medium-density housing. However, as shown in Table 1.2, only small-scale, lower-density infill projects are being undertaken, as they more readily conform to existing low-density residential zoning codes and fabrics (discussed in more detail in Chap. 2).

In this work, we are advancing an extended definition of 'missing middle': *medium-density dwelling typologies accommodated in precinct-scale redevelopment projects* (Fig. 1.15) located primarily, but not exclusively, in a city's established, *middle-ring greyfield suburbs* (Fig. 1.16). *If* infill targets for new housing are to be met, then 'missing middle' needs to be seen to include medium-density housing *with* precinct-scale residential regeneration: GPR.

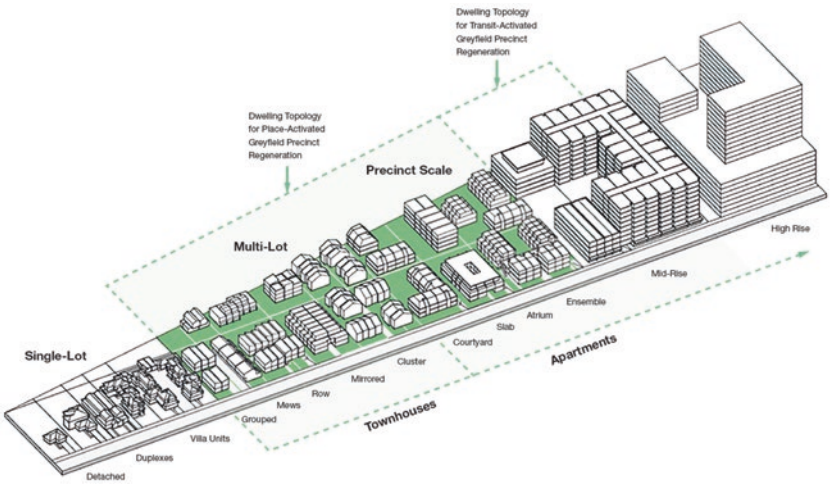

Fig. 1.15 The 'missing middle'—medium-density dwelling types in a greyfields mid-scale precinct redevelopment. (Source: Newton et al., 2020)

Fig. 1.16 The 'missing middle' greyfield suburbs of a city. (Source: Place Design Group, 2019, p. 43)

Mid-rise (four- to eight-storey) apartments are more closely aligned to the scale of redevelopment envisaged for transit-activated corridors; while three- to four-storey medium-density dwelling typologies are a more appropriate scale for place-activated GPR in neighbourhoods away from main roads.

Transition 9 Move from fragmented 'missing middle' housing redevelopments to 'missing middle' medium-density precinct-scale regenerative redevelopment (a focus of Chaps. 2, 7, and 8).

2.10 Transition 10: Establishing 'Precinct' as a Scale for Regenerative Redevelopment

Precincts are the building blocks of cities, representing the scale at which most twentieth-century cities have been traditionally planned and developed. They also represent the scale at which established and ageing sections of cities can best be redesigned, retrofitted, and *regenerated*.

A precinct is a unified area of urban land with a clearly defined geographic boundary. In the context of this book, a precinct is synonymous with a neighbourhood or district. A typical precinct will contain private and public land with shared infrastructure. A defined boundary is critical to the notion of a sustainable precinct because many of the low-carbon precinct concepts involve *distributed infrastructure* that requires clear boundaries from a legal ownership and management perspective (this topic is the focus of Chap. 3). A well-defined boundary, with a clear governance structure, allows for the precinct to be managed and monitored at the local level, permitting it to function as an autonomous or semi-autonomous piece of the city in which local managers drive ongoing and iterative improvements. Fraker (2013, p. 2) suggests that precincts represent opportunities to become integrators and aggregators of key built-environment infrastructures, both physical (energy, water, waste) and natural (such as green spaces), and depending on the size of the precinct, they have the potential to become their own micro-utility, as outlined in Transition 6 and Chap. 3.

Precinct size can vary considerably; for example, the well-known sustainable precincts BedZED in London and Hammarby Sjöstad in Stockholm are 1.7 ha and 250 ha, respectively. The significance of size rests with the fact that distributed technologies tend to have physical thresholds and efficiencies, where the size of the land parcel available will influence the design approach and the technology solution.

Precinct Information Modelling systems now provide a flexible digital platform for precinct design and assessment that permits their boundaries, spatial contexts, and associated design attributes to be defined and redefined in real time to support scenario assessments in urban planning and development projects (a focus of Chaps. 7 and 8).

Precincts also need to be considered in relation to their wider geographic context. While a precinct approach is relevant for a neighbourhood or even a small town, far greater benefits play out at the city scale where multiple precincts interact. This is especially true when they are designed with the discipline of a cellular structure—that is, clustered around the local needs of a community such as for shops, services, and recreational space, or based on linkages between precincts via public-transport corridors, which greatly reduce private vehicle use and therefore carbon emissions, while improving connectivity between neighbourhoods (a focus of Chap. 4). Precincts also represent a scale at which regenerative redevelopment can contribute to mitigating neighbourhood as well as city-scale impacts of climate change, especially flooding and urban heat (a focus of Chap. 5).

Successfully producing long-term metropolitan policies, strategies, and plans capable of directing future urban development and redevelopment in an integrated fashion remains a challenge in terms of both horizontal planning (across provision of housing, transport, energy, water, waste, and social services) and vertical planning (across tiers of government and local communities). Identification of where and how to intervene and at what scale is especially challenging in greyfields. Opportunities for place-activated and transit-activated GPR involving local housing and infrastructure redesign and regeneration are ideally signalled by the new concept of *district greenlining* in metropolitan and municipal plans. District greenlining would be a first step in outlining the intention to regenerate a particular locality or series of localities; a process requiring vertically and horizontally integrated planning. This would enable the

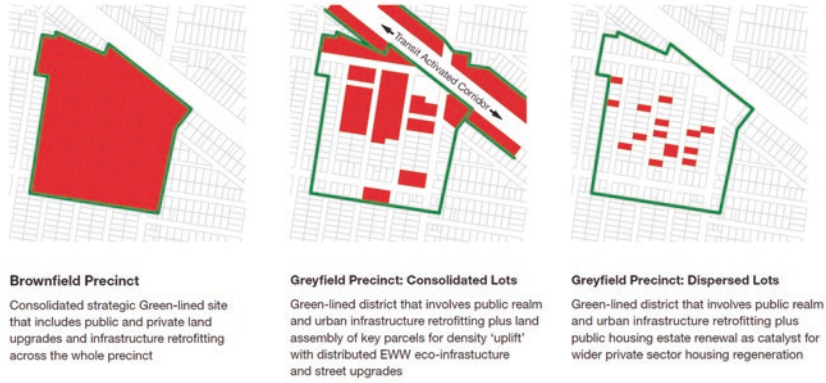

Fig. 1.17 District greenlining and nested precinct redevelopment

start of partnership development and community engagement (as outlined in Chap. 8) and allow planning to be scaled up in its ability to regenerate the middle suburbs. It would enable GPR projects to be attracted to and nest within districts that have been strategically identified in larger-scale and longer-term metropolitan and municipal planning strategies for urban densification and infrastructure retrofitting (Fig. 1.17). Ideally, district greenlining should be undertaken collaboratively between state and municipal planning authorities and major utilities as a necessary first step in identifying future strategies and timetables for major infrastructure retrofitting across the metropolitan area. In the absence of state-municipal level collaboration, future strategic planning by local governments needs to incorporate a district greenlining process to identify localities where change is required within their jurisdiction and where place-activated and transit-activated GPR projects are to be encouraged.

In summary, this book will show how and why precinct-scale redevelopment has the capacity to deliver more regenerative, resilient, and liveable neighbourhoods:

- Housing: greater yield; variety of dwelling sizes, types, and price points
- Mixed-use development: increased population provides opportunity for more commercial and retail services

- Energy: net zero carbon precincts via energy-efficient dwelling shell, distributed renewable energy and storage, community renewable-energy schemes, and electric vehicles
- Water: integrated stormwater/rainwater/greywater systems; water-sensitive dwelling and precinct design
- Waste: recycled construction and demolition waste; recycled domestic glass, paper and plastics; composting food waste
- Mobility and health: more walkable neighbourhoods; fewer cars, which are replaced by active transport, micro-mobility, and car-sharing systems
- Green space: maintain and enhance rather than lose private green space; redesign and activate local streets by redistributing space from automobile to resident use; introduce biophilic design on buildings
- Community space: new pocket parks, rain gardens, local meeting spaces; literally hundreds of possible 'spontaneous interventions' primarily initiated by local residents (see Venice Biennale, 2012)

A growing number of design guides and assessment and rating tools are also available at precinct scale to assist design practitioners and municipal statutory planners lift the bar on urban infill projects, especially in relation to demonstrating the additionality associated with GPR projects (Chaps. 7 and 8).

Transition 10 Providing a regenerative precinct focus in all greyfield redevelopment starting with district greenlining.

3 The Challenge of GPR: Charting the Transition

GPR represents an aspirational mission-oriented project (Mazzucato, 2018) designed to strategically steer research and urban innovation activities in addressing significant metropolitan planning challenges of scale and scope—in this case remaking greyfield suburbs to be more

regenerative and liveable in a suburban-to-urban transition (Newton et al., 2017). We introduce two new urban-development models capable of reactivating places and corridors at precinct scale (place-activated and transit-activated GPR), as well as district greenlining, which provides a broader strategic and spatial framework for specific regenerative projects.

The program of applied research has been guided by a framework that has evolved as a result of extensive co-design and co-production activities between researchers, government, industry, and community engagement (the Preface acknowledges them). The framework has enabled the development of new planning concepts, instruments, and processes that constitute the innovation levers necessary to initiate a GPR transition. Transition-management concepts and methods (Loorbach, 2007; Newton, 2018) guided the process, and the framework shown in Fig. 1.18

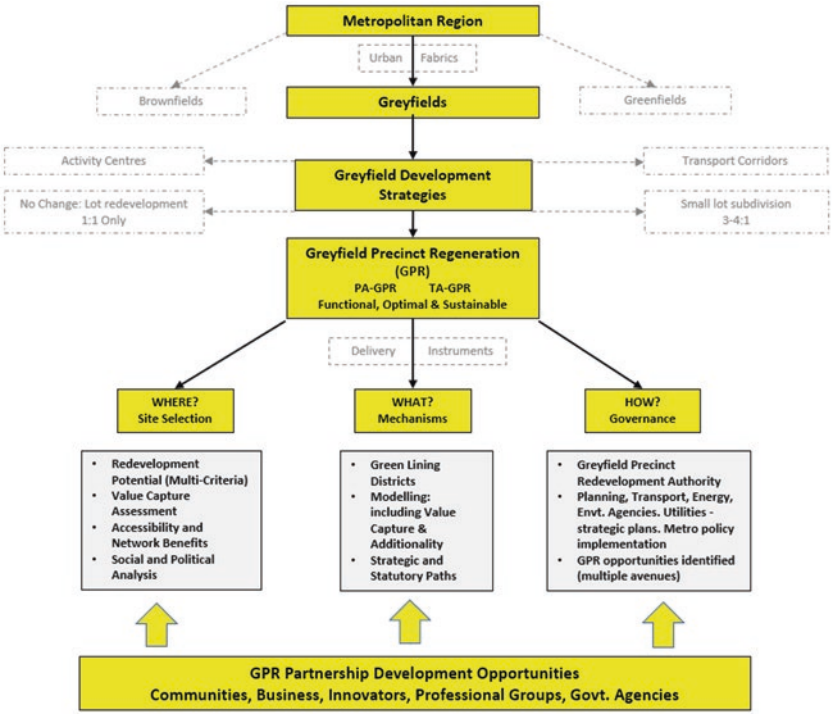

Fig. 1.18 Innovation arenas for establishing greyfield precincts

illustrates key features of greyfields precinct regeneration research and implementation, including next steps.

The framework addresses three key questions:

1. Where should planners focus within a city and suburbs for candidate clusters of properties with high redevelopment potential suitable for place-activated and transit-activated GPR? New methods and tools were developed for housing-market assessment that can be aligned to future (municipal) strategies for urban regeneration and climate adaptation. These include a multi-criteria analysis process that highlights the capacity for enhancing active travel modes, green-space provision, and mixed-use development, as well as analysis that ensures an economically feasible yield of medium-density dwellings; and a demographic overlay identifying concentrations of neighbouring households potentially attracted to lot amalgamation by downsizing from under-occupied, ageing detached housing (a focus for Chaps. 2, 3, 4, 5, 6, and 7).

2. What should be redeveloped in a greyfield precinct? The process here is planning and design-led—a key integrative force in steering urban change by positively reshaping an existing urban morphology: buildings *and* streetscapes. Having identified a district with properties capable of consolidation into a place-activated or transit-activated greyfield precinct, the challenge becomes one of creating the optimal medium-density dwelling and landscape designs (and corridor layouts if transit-activated GPR) that can deliver demonstrably superior outcomes (additionality) compared to business-as-usual practice. As outlined earlier, our use of the term additionality refers to those attributes of neighbourhood regenerative redevelopment that need to accompany increased medium-density housing redevelopment; for example, zero-carbon energy, water-sensitive design and integrated water systems, improved mobility, social infrastructure, and enhanced green space—delivering multiple, measurable benefits to the local community.

Factors influencing the design process for GPR are outlined in all the chapters that follow.

3. How can GPR be delivered in the established low-density middle suburbs? The processes pioneered in *Greening the Greyfields* involve:

- *Achieving acceptance of the GPR model by state government strategic planners and ministers*, thereby providing a signal to local government strategic planners that future municipal-planning schemes need to be able to accommodate this new category of urban redevelopment in the greyfields. This involves effectively making the process less risky by providing clear evidence of the advantages of GPR in the context of future urban development; and identifying preferred districts for intervention (district greenlining) in consultation with local government—places where regenerative change needs to happen.
- *Establishing a fit-for-purpose collaboration to achieve GPR*, a partnership among relevant stakeholders to co-create and co-design a place-based vision and development pathway through to realisation. Key members of such a partnership are municipal and state government planning representatives, design and development professionals, urban technologists, and local community representatives. A GPR development partnership needs to be able to demonstrate the additionality that GPR can make to the locality as well as to property owners and developers (win-win-win). The performance-assessment tools and processes for deriving evidence of GPR benefits have been established and trialled (Newton & Taylor, 2019; Newton et al., 2020). Local governments need to incorporate the specific GPR additionality requirements into their planning scheme when new precinct development overlays or broader re-zonings are established; otherwise such changes will increase the development yield and value of the land asset without creating value for the local community. A shift in focus to value creation and value capture will enable this. The new tools and processes are outlined in Chap. 7.
- *Engaging with resident property owners in agreeing precincts to achieve lot consolidation*, a transition from NIMBY to YIMBY. NIMBYism is a common, understandable community reaction to current urban infill policies that deliver no tangible benefits to local residents. The additionality benefits of GPR have been outlined in earlier sections, and they need to be demonstrated upfront for any GPR project—a basis for municipal planners as well as local residents to turn the 'no' into a 'yes' (Fig. 1.5). New community-engagement processes targeting lot consolidation have been established and demonstrated in collabora-

tion with local government, and tailored to municipal ('town hall') and neighbourhood ('kitchen table') meetings.

- *Developing a case for establishing a Greyfields Precinct Regeneration Authority* with a mandate for developing and overseeing a pipeline of appropriately targeted viable and innovative precinct-scale projects. The *Greening the Greyfields* project identified this from the outset as a key strategy for thought leaders and urban practitioners who are addressing the greyfields redevelopment challenge (Newton et al., 2011), and most recently by the Property Council of Australia (PCA, 2020). It would complement the work of existing authorities established in Australia in delivering better urban development in both the greenfield growth areas and the brownfields redevelopment areas. Additionality would be a mandatory requirement for project approval by any Greyfield Precinct Regeneration Authority or local government. Consortia would be required to demonstrate additionality for the privilege (and profit) of a precinct regeneration project.

4 Conclusion

What is being demonstrated in this book is the emergence of a new urban-planning model, greyfield precinct regeneration, for regenerative urban redevelopment at the precinct scale that can address contemporary challenges facing fast-growing, low-density, car-dependent cities. As Newton (2019, p. 359) has argued: '*If* cities are to achieve the international performance goals and objectives outlined by the United Nation's Sustainable Development Goals and the New Urban Agenda as well as those identified at a national level then it will be necessary for their constituent precincts to demonstrate performance outcomes that align with and add to, rather than subtract from, these objectives'. This applies to GPR whether it is place-activated or transit-activated. This book moves beyond the concept phase to show how new urban design, planning, and engagement processes can be enabled to make such urban innovation happen.

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2

The Greyfield Challenge to Australian Governments

1 Introduction

Australia is an *urban nation*. The Australian Bureau of Statistics indicates that 86% of the population currently lives in urban centres, and project that this is expected to reach 90% by 2040. Australia is also a country of immigrants, with around one-third of the population (7.5 million) born overseas (ABS, 2020a). In 2019, just over 60% of annual growth was due to net overseas migration, with the remaining 40% due to natural increase. Migration rates have increased since the turn of the millennium: between 2000 and 2020, Australia's population grew almost 24% to just over 25 million, with the destination of most migrants being the large cities. As a result, capital-city growth accounted for 79% of Australia's total population increase in the year ending 30 June 2019, and currently just over 17 million people now live in the capitals (ABS, 2020b).

The greatest population increases have been in Sydney (5.3 million population, June 2019) and Melbourne (5 million, June 2019), where growth rates have averaged around 2% per annum. Maintaining this rate would see these cities double to reach 10 million residents soon after 2050. Burgeoning cities have strained infrastructure and lifestyles. There

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https://doi.org/10.1007/978-981-16-6238-6_2

is little evidence that sustained growth rates and business-as-usual urban planning will maintain the quality of life to which Australians are accustomed. Given that projections indicate that these growth rates will be resumed into the future following a recovery from COVID-19 (Centre for Population, 2020), we argue that Australian cities cannot afford—from either economic, social, or environmental perspectives—to continue to grow in the way they have.

National bi-partisan pro-migration policy has triggered the rapid acceleration of growth in Australian cities, but without commensurate national urban planning policies to manage it. Calls have increased for a national vision and plan for Australia's future settlement system that focuses especially on the fast-growing capital cities (Parliament of Australia 2019; PIA, 2018). At the time of writing, the COVID-19 pandemic had interrupted international travel, granting a temporary reprieve to migratory growth in Australia, and consequently dampening that component of urban economic activity driven by population growth. Could this pause present an opportunity to reflect on current practices and develop a better set of blueprints for planning and managing future urban growth and development?

If we were to witness a widespread urban transformation in Australia, what would need to change and what form might this transformation take? This chapter contextualises the question: first, by describing the major challenges facing Australian cities due to unsustainable growth, and second, by describing the impacts and shortcomings of urban planning across the three tiers of Australian government as related to regenerative urban development. The chapter also offers some high-level recommendations on how to address these challenges and how greyfields precinct regeneration (GPR) can fit into this.

2 Challenges Faced by Australian Cities

Australian urban-development challenges can be seen from multiple perspectives. Economic perspectives are most often discussed, as real estate is a national obsession and the construction industry is a significant driver

of economic activity. The dimensionality of urban-sustainability challenges include:

1. Social challenges regarding housing supply, housing mix, affordability and access to jobs and services; and
2. Ecological and resilience challenges relating to resource consumption and pollution, such as energy demand, greenhouse gas emissions, water supply, sewerage, food and waste management, and green space and biodiversity.

These issues overlap with the economic issues mentioned above. The next sections provide some of the reasons why the planning systems in Australia have failed so far to provide solutions to such persistent challenges, centred on the greyfields.

2.1 Housing Needs and Services

Despite decades of rapid urban growth, the Australian built-environment sector has struggled to reinvent itself since planting its mid-twentieth-century roots firmly in *suburban* planning and development principles that set up the greenfield edge-of-city development model as its key objective, effectively shelving issues of residential redevelopment. There was significant de-population of inner-city suburbs from the 1950s to late 1980s, as outer suburbs boomed (creating the 'donut' city). Community backlash from large-scale state government attempts at inner-city high-density urban renewal programs during the early post-war period saw 'slum clearance' schemes in the major capital cities abandoned. Public housing thereafter was primarily built in low-density suburban greenfield estates.

A process of private-sector gentrification in selected inner-city neighbourhoods was underway by the mid-1970s in the larger capital cities, gathering pace in the 1990s up to the present, driven largely by the housing and locational preferences of individual households. This re-urbanisation process was boosted by the federal government's Building Better Cities Program (1991–1996) that established a *brownfield*

redevelopment model created in partnership with all tiers of government and industry that specifically targeted abandoned port areas, disused hospital and commercial sites, and obsolete manufacturing sites, opening up significant precincts for high-density commercial and residential development (see Newton & Thomson, 2016 for an overview). However, the urban redevelopment process has not significantly engaged the greyfields from a long-term planning perspective, as outlined in Chap. 1; this has exacerbated continued sprawl, as most affordable new housing has been delivered as low-density, greenfields, project housing estates.

In parallel with urban population growth, house prices in Australia have risen 150% since 2000 while real wages have grown by less than 30% (Ryan-Collins & Murray, 2020). The average floor area of new housing constructed in Australia's capital cities is the highest in the world at 236 square metres (Commonwealth Bank, 2020). The cost of housing in Australia is also amongst the highest in the world; as a result, home-ownership rates are falling as housing has been commodified through 'investification' (Hulse & Reynolds, 2017). This has exacerbated inequality, with many first-home buyers needing to 'drive until they can afford to buy'. This inequality is captured in the increasing suburbanisation of social disadvantage in Australia's large capital cities (Randolph & Tice, 2015) and worsened by socio-economic stress in car-dependent outer suburbs due to high fuel prices, as measured by the VAMPIRE (Vulnerability Assessment for Mortgage, Petroleum and Inflation Risks and Expenses) index (Dodson & Sipe, 2008).

Residents living in fringe developments travel greater distances to perform daily functions. Traffic congestion and commuting times are emerging as major social and economic problems. A universal travel-time budget averaging about 60 minutes per day for the journey to and from work (the Marchetti constant) appears acceptable to people living anywhere in cities around the world (Newman & Kenworthy, 1999). Exceeding this '30-minute city' travel-time budget for a work trip is usually associated with a build-up of citizen dissatisfaction that triggers public calls for new metropolitan transport and land use plans. In 2019, the average commute in Sydney (77 minutes), Brisbane (67 minutes), and Melbourne (65 minutes) far exceeded the 30-minute trigger. Across the nation's mainland capitals the average commute increased 22% between

2002 and 2017 (Wilkins et al., 2019), revealing urban growth policies as dysfunctional. Automobile-dependent suburbs also tend to be correlated with poorer health, particularly obesity and related chronic diseases, which are less prevalent in walkable locations (Newman & Kenworthy, 1999; Thompson & Stevenson, 2019). Increasing urban density can create the population thresholds necessary to support more-accessible local services and public transport, reducing travel-time budgets.

Metropolitan strategy statements revolve around land-use planning and the issue of land supply. Complaints from traditional greenfield housing industry lobby groups about a lack of land supply only ring true when considered against their particular, but still dominant, model of low-density greenfield development. There *is* land elsewhere in the city—it is just not used efficiently. The failings of vast areas of low-density housing are many, and well documented. Sprawling suburbs are no longer an appropriate model for our large cities. Rather, continuing sprawl is a by-product of a planning system designed in former times under different conditions. Releasing land on the urban fringe is reactive, not strategic. The government-controlled land-use planning system reacts to surges in demand of land for housing, and in the absence of planned alternative supply models the primary 'release valve' for affordable new housing is in greenfields sprawl. As a consequence, the system continues to produce this sprawl, although more recently inner urban brownfield infill redevelopment has begun to supply a greater proportion of new housing, albeit almost exclusively high-rise apartments (Tables 2.1 and 2.2). The system needs a new model that can supply a much larger proportion and variety of housing into areas that provide better services and are closer to most employment. These areas are the established, middle greyfield suburbs.

Table 2.3 describes the characteristic features of the three urban development arenas—brownfield, greenfield, and greyfield—together with their principal development challenges and advantages. Greenfield and brownfield precincts both present models and opportunities for regenerative urban development. Currently, this is not the case for greyfields redevelopment.

Table 2.1 Change in population by ring in selected Australian capital cities (2001–2019)

Zone				
	0–5 km	5–10 km	10–20 km	Outer (>20 km)
Melbourne				
Pop. change ('000)	190	161	315	912
Pop. change (%)	107.0	31.9	25.1	58.3
Avg. annual change (%)	3.9	1.5	1.2	2.4
Sydney				
Pop. change ('000)	153	154	358	544
Pop. change (%)	53.4	26.8	31.7	25.8
Avg. annual change (%)	2.4	1.3	1.5	1.3
Brisbane				
Pop. change ('000)	118	88	180	435
Pop. change (%)	64.5	29.6	34.8	62.6
Avg. annual change (%)	2.8	1.4	1.7	2.7

Source: Victorian Department of Energy Land Water and Planning, based on ABS Regional Population. Note: the boundaries are based on whole SA2s providing approximation of distance rings, and are not perfectly comparable between cities

Table 2.2 Comparison of housing stock across selected Australian capital cities (2016)

Dwelling type (structural)	Greater Sydney (%)	Greater Melbourne (%)	Greater Perth (%)
Separate house	55.3	66.3	74.8
Semi-detached, row, terrace, or townhouse	14.0	17.0	16.7
Flat or apartment	30.0	16.2	8.0
Other dwellings	0.7	0.5	0.5

Source: Tabulated by Authors from ABS Census data 2016, counting dwellings, GCCSA

2.2 Ecological Issues

Climate change mitigation/adaptation has dominated recent planning strategies, but these are just one aspect of broader systemic sustainability challenges. Since 2015, Australia has made commitments to numerous international frameworks to achieve increased sustainable development, including urban sustainability, which has significant implications for planners. Amongst these agreements are the United Nations Sustainable

Table 2.3 The three arenas of urban development

Urban Arena	Characteristics	Challenges	Advantages
Greenfield	Previously undeveloped Urban fringe/ rural interface Focus of peri-urban growth Far from urban employment and services	Development typically displaces agricultural and/or natural landscapes Distance from centres and services, requires new infrastructure Low land value encourages large, low-density plots, creating car dependence	Unencumbered land Cheap land Few neighbours 'Tabula rasa' Can incorporate existing site qualities and landscape features into master plan to retain nature-based services, and can accommodate water-sensitive urban design and precinct energy
Brownfield	Former industrial or commercial land Typically large land parcels Often in single land ownership Well located	Often contaminated; clean-up costs may make development unviable Former zoning likely to mean a dearth of social infrastructure to support residential uses Displaces traditional employment areas	Infill curtails sprawl Typically large parcel size means no land assembly needed Larger sites allow greater flexibility in site planning and urban design Zoning 'upgrade' likely to be supported by nearby residents
Greyfield	Typically ageing, low-density residential land representing under-capitalised real-estate assets Well located, established inner and middle-ring suburbs	Established suburbs with existing population increases potential for community resistance to change Small lot-size requires land assembly for flexible site planning Can displace suburban qualities, green space, and character housing Increased pressure upon certain existing physical and social infrastructures	Good locations Infill curtails sprawl Existing capacity with certain infrastructures Established social infrastructure Increased density can revive/attract local services (shops, transit, etc.) Provides opportunity for greater housing variety Opportunity to design new urban character

Development Goals (SDGs) Agenda 2030 (September 2015), the New Urban Agenda (NUA, October 2016), and the Paris Climate Change Agreement (COP21, December 2015). These international goals cover a wider range of areas that affect, but were not previously considered within, the urban planning system, or, more broadly, within Australia's national regulatory systems, now covering responsible consumption and production, affordable clean energy, decarbonisation, and sustainable communities. Precinct-scale responses to these ecological challenges are the focus of Chaps. 5 and 7, given our premise/proposition that sustainable cities require sustainable neighbourhoods to both directly (via their built environment) and indirectly (via the consumption behaviour of their occupants) drive sustainable urban systems (Newton, 2013, 2019).

2.3 Planning Failure

When Australian city planners look at these global and local goals, they invariably conclude that cities must reduce their urban sprawl, as not only is this kind of urban development ecologically damaging, it is the most seriously underprovided in social facilities and employment. To curtail sprawl, recent metropolitan planning strategies have highlighted the importance of urban consolidation to reduce automobile dependence by encouraging infill—redevelopment within the existing urban boundary—ideally integrated with transit. Metropolitan compact-city strategies set infill targets to increase urban density, but they fall short of describing models to deliver on these targets, with most existing development models misaligned. The section below and chapters that follow will illustrate this in major Australian cities.

Sydney. Sydney's *A Metropolis of Three Cities* (Greater Sydney Commission, 2018) illustrates the intersection of infrastructure, housing, community and placemaking, economic development, and sustainable resilience. Objective 10, 'More Housing Supply', refers to three key priorities: urban renewal adjacent to significant transport nodes; local infill development, preferably near high-amenity areas; and new communities in land-release areas, which will occur mainly in the Western sub-region. The location of the first and third priorities will be determined by the

state government, whereas the second (local infill) is to be determined by councils together with the NSW state planning department. Regarding implementation, councils are provided with infill targets (spanning 5, 10, and 20 years) and will work with the Greater Sydney Commission to identify target areas. This set of policies is supported by placemaking and walkability strategies described in Objective 12, 'Great places that bring people together'. Other than a missing-middle design guide, no other methodology is supplied.

Perth. *The Plan for Perth and Peel at 3.5 Million* (West Australian Planning Commission, 2018) is a strategic plan arguing for the benefits of agglomeration. While stating that there is sufficient land for future development, it also reveals that the city needs to achieve infill rates at 47% to 2050, with varying targets across the four sub-regions to achieve this. It then refers to a range of sub-regional planning frameworks, structure plans, local planning strategies, district/local structure plans, activity centre plans, local planning schemes, and local planning policy, with responsibility for implementation placed upon regional and local councils. To date, the plan's infill targets for housing have not been reached (Prka, 2021). The *MetroNet Project* in Perth is building seven new rail lines out into the fringe suburban areas and is committed to building high-density Metro Hubs around the new stations, where some new designs have begun to appear. However, the middle suburbs continue to be neglected and no serious new model has been suggested to encourage precinct-scale redevelopment.

Brisbane. Brisbane's planning covers the whole South East Queensland region. *Shaping SEQ: South East Regional Plan* (Department of Infrastructure, Local Government and Planning, 2017) opens with housing as its priority policy agenda, which is expressly focused on urban consolidation, particularly where new construction is close to areas served by strong transport networks and ample amenities. Rather than prescribe how this agenda will be achieved, the document specifies the infill targets for each sub-region, with approximately 60% infill for Brisbane and explicit density targets established for key activity centres (Table 2.4).

Furthermore, the Queensland Government makes commitments to sets of deliverables including planning timelines for state government departments, regions, and councils, development requirements for each

Table 2.4 Density targets attributed to activity centres in SE Queensland

	Dwellings per hectare	
Centre type	In or within 400 m of 'centre'	Within 400–800 m of 'centre'
Principal regional activity centre	150–400	100–175
Major regional activity centre	80–200	40–100

Source: *Shaping SEQ: South East Regional Plan* (Department of Infrastructure, Local Government and Planning, 2017, p. 44)

area, and, significantly, an assessment of the planning provisions and development-assessment provisions to ensure effective implementation. Sets of benchmarks are also provided. By way of ensuring compliance, the SEQ planning document states that 'Each local government will be required to ensure their planning scheme reflects Shaping SEQ and is not inconsistent with the SEQ regulatory provisions detailed in Planning Regulation 2017' (Department of Infrastructure, Local Government and Planning, 2017, p. 150). This makes it one of the few strategies that move from strategic overview to state-supported implementation. However, there is no evidence that infill rates are increasing, especially in the middle suburbs of Brisbane, Australia's lowest-density city (Grodach & Limb, 2020).

Adelaide. Adelaide has a much lower demand for new housing than the other major cities in Australia. *The 30-Year Plan for Greater Adelaide* (Department of Planning, Transport and Infrastructure, 2017) again opens with the need for more infill housing, which, while currently operating at 76%, aims to be at 85% by 2045, the majority of which is to be focused on activity corridors (for Adelaide, 'infill' can occur on vacant land within a built-up area that has been leap-frogged by development in peri-urban areas). The 30-Year Plan covers a range of other policies currently being enacted, such as the Integrated Transport and Land Use Plan and a new Planning, Development and Infrastructure Act, illustrating how, together, they will provide a sustainable supply of land and dwellings into the future. While the plan indicates that the state will provide residential design guidelines and new models of housing, it, as do other cities, delegates implementation to local area planning for area

identification, urban renewal policy, and rezoning, all of which are to be implemented by councils. This has generally been the case in all Australian cities since the 1950s, although the state government planning minister can intervene in any development project.

Melbourne. *Plan Melbourne 2017–2050* (Department of Environment, Land, Water and Planning, 2017) sets policies relating to economic development, housing, placemaking/liveability, infrastructure, and sustainability. The areas of focus directly related to housing include:

- Direction 2.1 Manage the supply of new housing in the right locations to meet population growth and create a sustainable city.
- Direction 2.2 Deliver more housing closer to jobs and public transport.
- Direction 2.3 Increase the supply of social and affordable housing.
- Direction 2.4 Facilitate decision-making processes for housing in the right locations.
- Direction 2.5 Provide greater choice and diversity of housing.

All of these illustrate the relevance of increasing housing options in a market dominated by detached three-bedroom dwellings and, notably, the placement of these new housing options. Regarding location, there is a clear emphasis on proximity to transport, but also a focus on greyfield infill. Policy 2.2.4, under Direction 2.2, aims to 'Provide support and guidance for greyfield areas to deliver more housing choice and diversity', which is closely linked to Policy 5.2.1: 'Urban renewal precincts, greyfield redevelopment areas and transit-oriented development areas (such as railway stations) are enablers in the development of an integrated transport system. Well-designed infrastructure for walking and cycling are critical elements. The Victorian Government will work with local governments and other stakeholders to create neighbourhoods that support safe and healthy communities' (p. 100). These policies indicate that there is clear support for the concept of greyfield regeneration, not only as a housing solution, but also as a solution to suburban amenity and liveability. But what about implementation?

These strategies contain policies on liveability, walkability, and placemaking, framed variously through the lenses of healthier places or connected places, or as ways to reduce congestion. However, other than the

Brisbane plan, none provide information on their implementation, deferring to regional collectives of local governments. But despite this focus on application, Brisbane remains the Australian capital city with the lowest residential density (only marginally lower than Perth and Adelaide at approximately 17 persons/ha; Loader, 2011), indicating that pathways to application are still nowhere close to real, demonstrable implementation. Most states also have redevelopment agencies that work mostly on government land and try to demonstrate innovations such as the White Gum Valley (WGV) project in Perth through Development WA. However, the vast majority of development comes from the private sector, following the statutory guidelines provided by state and local governments.

The statutory regulations guiding development in greyfields are all set up for small-lot subdivision; hence, the present small-lot infill model dominates the greyfields property development market. Existing development models and processes for housing projects above small scale (Table 1.2) tend to focus on either new greenfield subdivisions, brownfields, or inner-city high-rise apartments, as they are established and require little government intervention. By comparison, greyfield models are not attracting the desired level of medium-density housing redevelopment (the 'missing middle'), as reflected in Table 2.2, and the proportion of medium-density housing remains a relatively fixed proportion of the housing stock across the major capitals. The construction of high-rise apartments in inner areas is more readily positioned to respond to shifts in demand, such as international students and retirees, but limits to land-supply opportunities are shifting the demand into middle suburbs, where meeting infill rates is currently not possible with medium- or high-density housing due to zoning restrictions.

Greyfield infill development is thus resulting in suboptimal outcomes. It is following the statutory guidelines that allow piecemeal redevelopment approach of 'knock-down-rebuild', involving the demolition of older structures and replacement with either a new detached dwelling or small-lot subdivisions that have many shortcomings (as outlined). Despite infill policies, net housing yields and density gains in the greyfields are small (e.g., 1:1, 1:2–4). Where redevelopment infill ratios are low, further site assembly and higher-order development outcomes are squandered by the virus-like knock-down-rebuild residential supply currently occurring

(Leshinsky et al., 2018). If infill is to be successful in curtailing sprawl, higher densities need to be achieved through redevelopment opportunities linked with lot consolidation and precinct-scale regeneration.

In the absence of greyfield redevelopment at precinct scale, small-lot infill subdivision of single properties typically results in loss of private green space due to more area dedicated to buildings and car space. Loss of green space has multiple negative impacts, as described in Chaps. 5 and 7. Collectively, poor-quality infill development, perceptions of developer greed and overdevelopment, loss of green space, and erosion of suburban qualities—what we have termed a 'virus' (Fig. 1.9)—stigmatise infill development, strengthening community resistance in the form of NIMBYism. It is not hard to feel sympathy for such NIMBY reactions, as there is no opportunity to see different kinds of precinct-scale development, apart from a few demonstration sites such as WGV (Chap. 3) and the City of Maroondah precinct project (Chap. 7). The problems lie in the barriers set up in planning structures and the whole approach to redevelopment, which this book sets out to change.

2.4 Urban Structure

Overcoming sprawl and more successfully engaging with greyfield regeneration in the established urban fabric requires a more strategic approach to planning. This includes finding larger parcels of land in the best locations for higher-density infill, which, in turn, depends on finding the right land parcels in the appropriate urban arena and then creating an appropriate urban structure.

Urban structure relates to the arrangement of blocks, streets, buildings, open space, and other features of an urban area that are set into statutory controls along with other regulations such as density, setbacks, and urban mix. Getting the urban structure right matters, at both the city level and the neighbourhood level, as the urban structure dictates the potential of a redevelopment location and whether larger-scale developers can make sufficient money out of a site, or a collection of sites, to warrant them seeking investment finance. If not, and without the prospect of municipality-initiated rezoning, the original urban structure will

continue to favour the single-lot subdivision redevelopments that we are now seeing.

At the neighbourhood or precinct scale, where single lots can be consolidated because the urban structure allows or even encourages this, whole street blocks can be redeveloped into greyfield regeneration sites capable of accommodating denser, mixed land use that supports distributed infrastructures and more-active forms of mobility. These can be unlocked from the barriers in the planning system that prevent their aggregation into precincts, as will be explained in more detail throughout this book. However, they may still not be sufficiently well structured to allow their full regenerative potential to be reached, as they may not be linked closely enough to major utilities' planned infrastructure retrofits or to the introduction of new urban services, especially quality public transport, as will be outlined further in Chap. 4. A new framework and associated principles and processes for integrated urban and water planning pioneered by the CRC for Water Sensitive Cities (Chesterfield et al., 2021) has identified pathways for how a district greenlining process might proceed.

At the larger city scale, a good urban structure is essential to reduce travel-time budgets and, as outlined in Chap. 4, this may need new mid-tier transit systems to be built along main roads so that land value improves enough for urban developers to want to invest in larger-scale urban redevelopments in the middle suburbs. Thus, the national push towards creating cities of walkable/cyclable neighbourhoods, such as Plan Melbourne's '20-minute neighbourhoods', is only possible by clustering land uses, such as residential uses, close to daily activities linked to shops, services, work, and school, to improve proximity and allow efficient transport modes for longer trips. In bigger cities, the most efficient transport mode is frequent mass transit. Sprawling suburbs and car dependence create the congestion on arterial roads that has seen travel-time budgets increase across all major cities. Wider roads simply do not help, as the bottlenecks still occur somewhere else, such as at popular destinations like employment or shopping centres. Given that mass transit can move 10–50 times the number of people per hour per kilometre of lane space compared to a suburban street or freeway (Newman & Kenworthy, 2015), it becomes clear that to maximise transport and land use efficiency, big cities must be built around transit, not cars.

This must now include middle suburbs that were generally built in the early days of car dependence, and where the resulting urban structures need to be changed if they are to be given opportunity for regeneration and increased density. Thus, integrating land-use and transport planning, specifically with higher-density residential, services, and employment uses within walking distance of mass transit, must be part of middle-suburb redevelopment. Such transit-oriented developments (TODs) are the key to developing a good city-scale urban structure, as they support public transport use and reduce the need to drive; Chap. 4 discusses this in detail.

The term 'precinct' can be considered a synonym for 'neighbourhood' or 'district'. It is a unified area of urban land with a clearly defined geographic boundary, representative of the typical building blocks of cities. Figure 2.1 shows arrangements of precincts, including a string of precincts capable of being built along a high-capacity transit route to form a high-density transit-activated corridor (TAC; described in greater detail in Chap. 4), or a cluster of precincts that form a sustainable municipality and, ultimately, city region. A typical precinct will contain private and public land with shared infrastructure, with larger precincts being typically characterised by:

- medium- to high-density development (to optimise the use of the land);
- mixed-use zoning (residential mixed with retail, services, and employment to reduce daily travel needs);
- provision of good active or public transport (to reduce car dependency);
- access to high-quality urban green space and an emphasis on integrating pedestrian and public spaces to create a 'village' feel in a city context (to enhance quality of life).

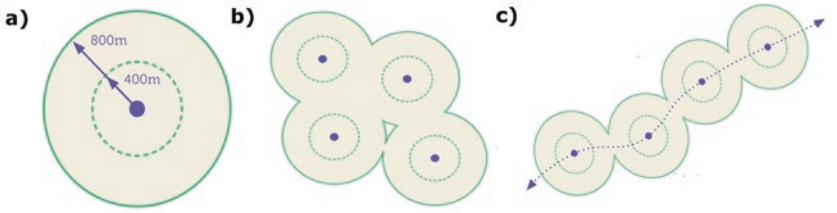

Fig. 2.1 Regenerative precincts as the building blocks of sustainable cities. a) Idealised scale for a precinct: 10 min/800m walk radius. b) Collection of walkable precincts: building blocks of a sustainable city. c) Transit-activated corridor of precincts. (Source: Thomson et al., 2019)

To increase densities within the walkable catchment of transit, medium-high density development is needed. Of particular interest is *medium-density, mid-rise precinct scale development*, which we define as 'the missing middle' from a housing perspective. Policies by planning authorities (particularly in Melbourne and Sydney) need plans to encourage more of this dwelling typology. While definitions vary, the consensus is that the missing middle needs to be represented by upwards of 30–50 dwellings per hectare, rather than the 12 found in traditional car-dependent suburbs. This equates to terraces, multi-dwelling townhouses, and residential apartment buildings, with building stock between three and eight storeys high—the type of density commonly seen in European cities and in Australia's older urban areas.

The higher-density end of this range is likely to be restricted to TACs. Other greyfields precincts that are more place-activated than transit-activated, adjacent to activity centres, schools, health facilities and green spaces, could be redeveloped with multiple advantages at the lower end of this range. Both transit-activated and place-activated GPR require land assembly as a prerequisite. This will be critical to greening the greyfields and is a step that planning systems need to recognise as being the 'missing step in creating the missing middle'.

As suggested above, one of the main reasons greenfield development on the fringes still dominates city growth in Australia despite the numerous advantages of infill (in both brownfield and greyfield) is the greater complexity of delivering infill projects. Different development models involving planning, urban design, finance, construction, and community engagement are required for each. This book will outline how to achieve better redevelopment of greyfield middle suburbs via GPR. A key difference between brownfield and greenfield sites, on the one hand, and greyfields, on the other hand, is that the latter need much more attention given to land assembly to enable scaling up to a precinct.

From an urban standpoint greyfield redevelopment offers the greatest benefits, but also the greatest challenges. Greyfields come with lot sizes averaging roughly 600 square metres, depending on state and municipality, existing physical infrastructure (utilities, roads), and social services (schools, shops, parks, and health care). Delivery of missing middle GPR in the locations with the highest regeneration potential is frequently

challenged by property owners of nearby occupied residential lots. Larger (amalgamated) lots provide greater flexibility for design innovation. But another challenge, less tangible but no less significant, is cultural. In the established inner- and middle-ring suburbs in Australian cities, built when the 'quarter-acre dream' was marketed as an aspiration for all home-buyers, the quarter-acre block (or at least a detached dwelling) remains a tightly held ideal, albeit fading (Chap. 6). Established communities tend to have a strong identity and to resist change, and there are many examples of residents banding together to oppose redevelopment and changes to the existing 'character' (Dovey et al., 2009). As this is entirely understandable, a different model needs to ensure that the character of a place is enhanced whilst enabling other benefits of urban change to occur.

2.5 An Urban-Planning Transformation Agenda

To unlock the potential of the greyfields will require nothing less than a precinct-focused urban planning transformation agenda—but one that goes beyond the few large-scale, economically focused precincts currently on state government agendas for major cities. These include transport-node-oriented precincts around established or new metro rail stations and regeneration/renewal/redevelopment precincts, where there is a change in the underlying use of the existing land. This includes regenerating obsolete industrial land or repurposing an ongoing major use, such as shopping centres reimagined as town centres and mixed-use precincts with residential, commercial development and civic uses integrated into the existing use; and economic and innovation precincts that are co-located with globally significant government or industrial R&D centres. These are seen to require enabling through public- and private-sector strategic planning, policy, partnerships, and engagement (PCA, 2020). These equate to the existing major activity centres of cities illustrated in Fig. 1.12. This figure also draws attention to the significant categories of greyfield precinct that lie outside the 'mega-precincts' currently on the radar screens of government and industry: green-space-oriented development and place-activated and transit-activated GPR.

Greening the Greyfields represents an agenda that seeks opportunities for site amalgamation through incentives or mandating minimum lot sizes for infill redevelopment that can be used to enable lot amalgamation. Lot amalgamation usually requires the involvement of redevelopment authorities as facilitators for land packaging that delivers good-quality and *desirable* medium-density, mid-rise, mixed-use, transit-oriented precincts that local people will *want* rather than try to oppose them through NIMBY groups.

If this happens well in the middle suburbs, new developments in peri-urban suburbia that are car-dependent and far from major urban services will die away as an option for continuing the growth of traditional low-density Australian suburbs. The demand will simply be replaced by a better option. Well-designed, well-located, mixed-use, medium-density precincts can regenerate the urban fabric of middle suburbs by creating twenty-first-century urban villages that are well-designed to create demand for a new desirable way of living. These need to be well-located close to public transport, and offer a housing mix to cater to diverse populations and integrated land uses to place residents closer to jobs, services, recreation, retail, and transport.

However, it is not only the urban structure that would benefit from changes in the planning system. To address ecological sustainability requires a response to rapid changes in technology for energy, water, and waste services as well as mobility that can help with an urban sustainability transformation; but these are not yet being applied to urban infill because we lack the right planning framework to facilitate their introduction. This will be pursued in Chap. 3.

2.6 Conclusion

This chapter has shown that the greatest need in Australian cities is to regenerate the middle suburbs, or 'green the greyfields'. It has also shown that all the current metropolitan strategic planning statements support consolidating such areas, but are failing to deliver them. The key reason that has been shown here is that the middle suburbs require significant land-assembly instruments to make precinct-scale regeneration viable;

hence, the only product that meets the statutory requirements at present is low-density, small-lot subdivision. Larger-scale regenerative development has happened in the inner areas in the brownfields and on the greenfield fringes where consolidated land ownership has made it possible. Thus, greening the greyfields in ageing established suburbs requires planning and delivery processes that include a significant land-assembly focus capable of delivering greyfield precinct regeneration. This does not need significant government funding unless the whole redevelopment process is done by government itself. The Building Better Cities Program in the 1990s set up land-assembly and development processes with state and local governments and multiplied the capital funds through partnerships with the private sector. A similar process of partnerships would be needed to generate the right land assembly, design, community engagement, and sustainability outcomes for place-activated and transit-activated GPR (described more fully in later chapters).

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3

Distributed Green Technologies for Regenerating Greyfields

1 Introduction

The chapter begins by looking at the history of technological change and how big shifts occur after major economic crisis. It will then outline the transition to new technologies and urban systems after the COVID-19-based economic crisis to show why and how distributed green technologies are likely to be mainstreamed in the 2020s and beyond. This will need to be associated with tangible urban system planning changes such as the regeneration of greyfield precincts to form part of a wider urban technological transition. Indeed, it should be possible to use the greyfield-greening process as a substantial catalyst in creating twenty-first-century net zero urban developments linked with the best in smart, innovative, affordable urban technology.

Mainstreaming such technology requires initiating socio-technical transitions that enable distributed infrastructure to flourish (Newton, 2008; Newton et al., 2019). This chapter provides some ideas on how this transition will occur for each type of green distributed infrastructure with application to both types of greyfield regeneration: the place-based systems will be less dense and so can do more with green infrastructure;

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the transit-based systems will be denser with more opportunity for shared distributed technologies. Innovative case studies from Perth will be used to illustrate this rapid change in technology based on demonstrations of distributed renewable energy and storage; integrated water systems; and zero waste to landfill using closed-loop circular economies. Each of the case studies involves smart technology systems for sharing and efficiency.

1.1 Technological Innovation: The Sixth Wave

The 2020 collapse of the global economy due to the COVID-19 pandemic has challenged planners to think about long-term trends and what the future could hold for cities and regions, especially in the context of the climate agenda. The history of economic transitions after crises reveals that they unleash waves of new technologically based innovation (Batty, 2018). Historically, these have been associated with different energy and infrastructure systems and their impact on transport and urban forms. Typically, the new technologies had already begun to emerge before the start of each economic collapse, then proceeded to induce a new economy to emerge as new investors chose to create something better and longer-lasting. This is happening now in cities across the world, and certainly in Australia (Newman, 2020).

Figure 3.1 and Table 3.1 set out the establishment of each of the six waves of innovation and the emergence of the new sixth wave, which involves a critical convergence between the digital transformation ushered in by the fifth wave and the green technologies driving the sixth wave. The new smart sustainable green economy is likely to be driven for the next 30 years and beyond by global sustainability agendas, such as the 2015 Paris Agreement and the work of the United Nations Sustainable Development Group, and have a strong base in a cluster of innovative technologies: renewable energy, electro-mobility, integrated water-sensitive biophilic urbanism (the basis of blue-green cities), circular-economy technologies, and smart cities, which can all be seen as representing distributed green technologies. The resulting urban transformations from these new infrastructure systems are likely to build re-localised centres and denser precincts (Newman, 2020; Mathews, 2018),

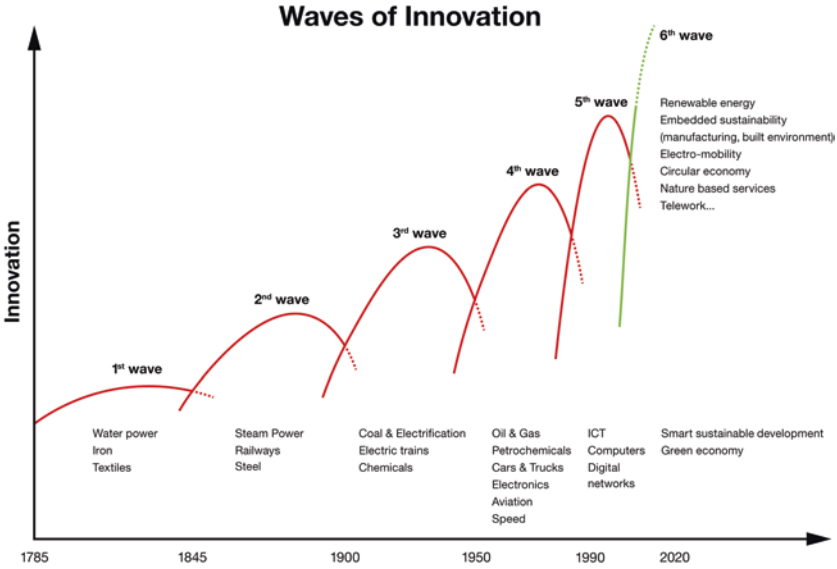

Fig. 3.1 Waves of innovation through industrial history and into the future. (Source: Adapted from Hargroves & Smith, 2005)

core elements in greening the greyfields. This book will set out how best to enable these technologies within the context of greyfield regeneration.

The innovations for this sixth wave are able to attract the cultural and political momentum attached to something much wanted and needed (Rifkin, 2019), but which has not been possible until now (Webb et al., 2018). The opportunity for rapid growth in the new green economy rests on a surplus of savings in the world and a cost of capital expected to be low for many years. Consequently, substantial long-term loans can drive the next green economy, including an agenda of greening the greyfields, particularly when greyfields projects are presented as the net-zero demonstrations that the world of finance is now requiring them to be (Garnaut, 2019, 2021). As shown below, they are also likely to be the cheapest way to do urban redevelopment.

Table 3.1 Technological, societal, and settlement transitions

Economic waves	Technological innovations emerging	Business model	Energy and infrastructure	Transport and city form
1. 1780s to 1840s Industrial Revolution	Water power, iron, mechanisation, textiles, commerce	Small and cottage industries	Water power and horsepower, canals and sailing-ship ports; roads for carriages linking cities	Walking cities rapidly densifying from industry
2. 1840s 'Hard Times' followed by Victorian prosperity	Steam power, railroads, steel, cotton	Cottage industries into large capital firms and factories	Wood and steam into train systems	Walking cities into rail-based linear urban development
3. 1890s Great Depression followed by Belle Epoque	Electricity, chemicals, internal combustion engine	Monopolistic Fordist Firms and factories	Coal and electric tram and rain systems	Tram and train-based corridors
4. 1930s Great Crash followed by Keynesian growth	Petrochemicals, aviation, electronics, space	Multinationals, modernism	Oil and freeways	Automobile-based urban sprawl
5. 1980s Dot-Com recession followed by knowledge economy	Digital networks, biotechnology, information technology	Flexible specialisation and networked globalism	Communications superhighway and ICT systems	Revival of urban centres around knowledge economy
6. 2020s COVID Collapse followed by green economy	Renewable energy, circular economy, smart city	Global localisation	Renewables with batteries, electro-mobility, especially non-car-based, smart cities, hydrogen for industry, circular economy, biophilic urbanism	Re-localised centres, smart, distributed infrastructure, transit-activated corridors fed by micro-mobility, and active transport

2 New Distributed Technologies

2.1 Renewable Energy, Rooftop Solar, and Batteries

The dramatic global growth in renewable energy (solar and wind) in the past decade (Fig. 3.2) has been due to these technologies quickly becoming the cheapest form of power as well as being easy to mass-produce and

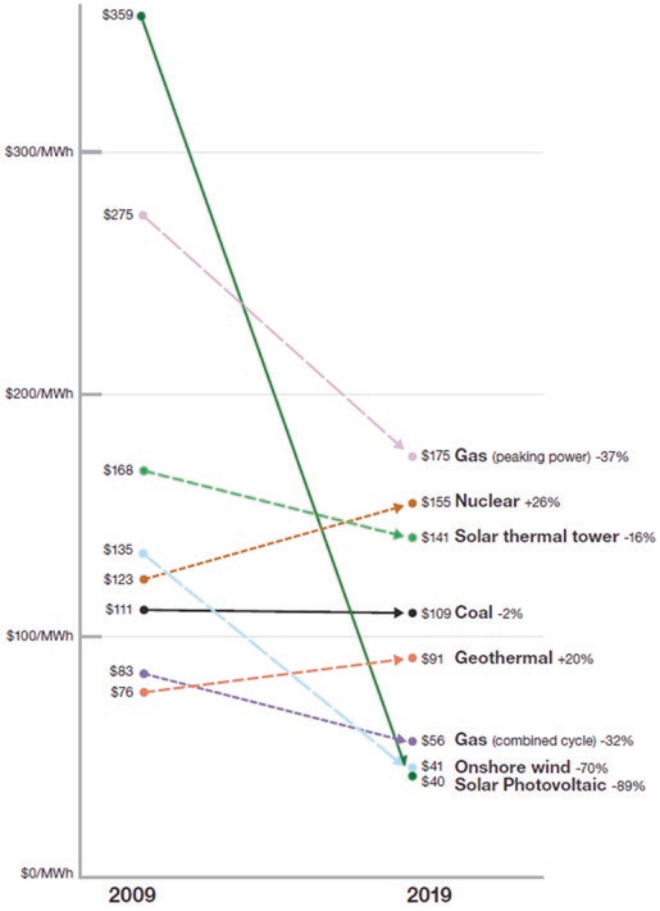

Fig. 3.2 Dramatic changes in world's power sources in the past decade. (Source: Drafted from data provided in OurWorldinData.org)

implement in most cities and economies. This is particularly so with rooftop solar power, as it enables local production and consumption to be integrated, providing the base for localising other infrastructures.

The new patterns of urbanism that are emerging around these systems are already showing why cities will become much more distributed into local areas of infrastructure management—but they will still need to be integrated into a city-wide or region-wide grid system for equity and balance (Green & Newman, 2017; Newton & Newman, 2013). Distributed technologies lend themselves to precinct-scale development because of the benefits that result from clustered utility networks between multiple buildings (such as load balancing, economies of scale, and affordable sharing of the new technologies). The rapid growth in solar power has now moved into shared solar systems for medium- and high-density housing enabled by localised solar utilities with batteries and blockchain-based management; industrial estates with shared solar power appear to be next, although rural and remote settlements were among the first expected to benefit from solar technology (Galloway & Newman, 2014).

The next task appears to be how to achieve grid stabilisation, and this seems to be heading toward localised, community-scale batteries (Sproul, 2019). These are becoming available for many other urban functions including electro-mobility, which, as shown in Chap. 4, can be part of grid stabilisation. Gas turbines (and diesel back-up in small grids) have been seen as necessary for grid stabilisation, but lithium-ion batteries are now cost-effective at over 150 MW, making them cheaper than gas turbines and more effective at providing a rapid peaking function (Denholm et al., 2019). This means that precincts of zero-carbon development will have an important role in future grid management, especially as electric-vehicle batteries can become part of this integrated low-carbon grid system in a cheaper way than the large-scale fossil fuel energy systems of the twentieth-century economy.

Thus, 100% renewable power grids can now be built cost-effectively (AEMO, 2020) and should be part of every new or retrofitted precinct. This is now a market-driven process but is helped by the large and growing sector of ethical investing and the commitment to only funding Net Zero projects by the world's largest finance company Blackrock and the other 574 investment companies representing US$54 trillion in Climate

100+ (https://www.climateaction100.org/) (Fink, 2020). However, there is still work to be done on how to make shared solar power work in precincts (DISER & ARUP, 2020; Green et al., 2020). Greyfield regeneration at precinct scale represents an important target for demonstrating how to integrate a range of distributed green technologies.

2.2 Integrated Water-Sensitive Systems Combined with Biophilic Urbanism

Stormwater capture and wastewater treatment can also be harnessed to minimise demand on centralised potable-water systems to support distributed green infrastructure (nature-based systems that fulfil urban functions and facilitate adaptation to climate change, as discussed in Chap. 5). There is a growing ability to do this at precinct scale that has been mainstreamed in many places (Byrne et al., 2020; Kenway et al., 2019; Newton & Rogers, 2020). Harvesting rainwater at building and precinct scale is now increasingly on the urban-planning agenda in an age of drying climates for many cities.

The use of small-scale wastewater treatment systems has been trialled in places like Hammarby-Sjostad in Sweden (Newman et al., 2017) but this is not likely to be easy for most cities. However, the most obvious need is to build water-sensitive cities that use grey water for local purposes (Byrne et al., 2020). This is part of an integrated water system that includes rainwater harvesting and stormwater capture. These new urban water-management techniques enable biophilic urbanism and blue-green cities as a means of better linking water to local open space and gardens, as well as building natural systems into and onto buildings with green roofs and green walls and converting engineered concrete drains to natural water courses. The best examples have been in dense tropical cities like Singapore that have been able to use high-rise structures as greened habitat (Newman, 2014), but there is no reason why greyfield precincts could not feature such a mix of blue-green technologies and nature-based services (Newton & Rogers, 2020). The biophilic-cities and nature-based systems networks are growing worldwide (Dumitru & Wendling, 2021) and are demonstrating that local biophilic features of cities are playing a

very strong role during the COVID-19 lockdown in providing a healthy link to nature (https://www.biophiliccities.org/covid19-research). The GPR model employs biophilic urbanism concepts for both water-sensitive and biodiversity-sensitive design in 'missing middle' medium-density residential redevelopment (Chap. 7).

2.3 Circular-Economy Technologies

Cities have been attempting for some time to reduce their metabolism (i.e., their resource inputs and waste outputs; see Newman & Kenworthy, 1999). This has been given a new boost as the core agenda for a *circular economy* (GI-REC, 2018; Petit-Boix & Leipold, 2018). The technology for waste disposal traditionally has been centralised, large-scale, and largely linear rather than circular; that is, it has been landfill-based and had little emphasis on recycling unless cities were running out of space. The new systems for the circular economy are, like the other innovations discussed above, much smaller in scale and can be used in more localised and distributed situations. A circular economy can include zero waste in precinct construction (USGBC, 2019); how food waste can be managed locally in compost systems at precinct scale (Graham et al., 2019); and how micro-factories located within municipalities can accept a range of local waste streams such as plastics and transform them into useful products (Sahajwalla, 2019; Perinotto, 2021). Larger new industrial estates operating on industrial-ecology principals and capable of processing multiple waste flows at larger volumes are also essential parts of a new green urban economy, but their locations are likely to be in peri-urban regions.

2.4 Smart City-Based Demand Management

Smart Cities, an agenda that has rapidly grown in the twenty-first century, has many features aligned with regenerative urban development. The cluster of innovations relevant to distributed green infrastructure—solar photovoltaic power, batteries, electro-mobility, circular economy, and integrated water and waste systems—have two key characteristics: they are modular and thus can be employed in urban precinct design as

localised systems; and they work even better if resource consumption and waste generation is reduced. Both can be influenced significantly by smart city-based demand management as long as they are part of strategic urban planning.

Localised systems. New smart-city technologies include an ability to enable any system to learn and self-optimise through artificial intelligence (AI) and machine learning. Many functions of AI have been envisioned to help the zero-carbon agenda (Rolnick et al., 2019), but optimising precinct infrastructure through machine learning is just emerging. GPR operations can be optimised with the application of sensors to manage their energy, water, waste, and mobility more effectively by continuously learning from resident occupants as their data are being processed, and by providing feedback, often in real time. They are akin to neural networks that are constantly improving the urban ecosystem in which they operate.

Welfare for people with disabilities or those in aged care can also be improved with these kinds of infrastructure systems; for example, through service monitoring and management, resource optimisation, and identifying areas for cost-efficiency. Localised smart systems can be managed to provide more-effective solutions for the operation of the built environment, and greyfield precincts are an ideal scale for medium-density, mixed-use development where *shared infrastructure and services* can become the norm.

Reduced consumption. Smart technologies can be used to reduce consumption by supporting change in household behaviour and social practices and subsequent demand and supply management (Creutzig et al., 2018). Smart building demand management systems (Pears & Moore, 2019) enable householders and businesses to understand what they are consuming at any point in time with mobile phone apps and appliance displays in homes and offices, and simple programmable options that build in the optimal efficiencies for use of energy, water, and other services (Byrne et al., 2019). These include apps, such as the Climate Clever Homes calculator, that identify the best utility-services options for a local area (https://www.climateclever.org/homes); they can also be built in from the start as part of a zero-carbon home or precinct. A renewed focus on re-localising living, working and activity spaces associated with COVID-19 has the prospect of advancing the growth of 20-minute neighbourhoods and reducing travel and emissions.

3 Case Studies

3.1 White Gum Valley

In the suburb of White Gum Valley (WGV) in Perth, Australia, a new GPR project has been developed using many of the technologies outlined above to demonstrate how it could meet zero-carbon and other United Nations Sustainable Development Goals (SDGs) (Wiktorowicz et al., 2018) using One Planet Living accreditation. The project has 100 units of housing on an old school site and has been redeveloped in close consultation with the local community at medium-density levels of approximately 45 dwellings per hectare. Development of WGV has been facilitated by having only one owner (the land-development agency DevelopmentWA).

WGV features a range of building types, including two-, three-, and four-storey apartment clusters and attached and detached homes. They all rely on leading energy strategies including:

- Climate-responsive design and landscaping, including strategic use of trees for seasonal shading
- A minimum seven-star Nationwide House Energy Rating Scheme (NatHERS) energy efficiency rating for its houses
- Rooftop solar power of 3.5 kW (minimum) for all houses
- Strata-owned solar panels and batteries on apartments using peer-to-peer energy sharing
- Shared electric vehicle for use by the community
- Energy-efficient hot-water systems, heating, cooling, appliances, and lighting

Other features include:

- Rainwater harvesting for household use
- Stormwater reuse through a community bore to irrigate private and public gardens

- Community green space created from an old stormwater sump, demonstrating water-sensitive and biophilic design
- Apartment living designed to suit students and an artist-run housing cooperative

Applied research undertaken by Curtin University, with the CRC for Low Carbon Living (https://developmentwa.com.au/projects/residential/white-gum-valley/overview) addressed multiple sustainability issues, including energy and water use, technology performance, the interrelation between behaviour change, design, and technology, the facilitation of knowledge sharing (Thomson et al., 2019; Byrne et al., 2019; Breadsell et al., 2019a, b). To test the viability of solar battery storage on strata buildings, the project demonstrated the potential for a blockchain-based sharing system, and potential for a new 'citizen utility' governance model, gaining attention from around the world (Green & Newman, 2017; Green et al., 2020; Eon et al., 2019).

The significance of innovation at WGV is that it demonstrated that a net-zero carbon urban regeneration project can:

- Be commercially viable
- Contribute to the Paris Agreement target that seeks to achieve deep decarbonisation while also delivering the United Nations SDGs
- Build an integrated development using new green distributed technology and support a first international demonstration of how to share solar energy through blockchain
- Ensure community trust and support by meeting other sustainability goals via the One Planet Living international accreditation process.

3.2 East Village

East Village is a planned, 1000-person residential development similar to neighbouring WGV that incorporates a blockchain system built in from the outset for sharing energy, water, and solar-power systems (Byrne et al., 2020). The first stage includes 36 townhouses and two

adjoining apartment sites for 60 dwellings, to be occupied at a higher density than WGV (https://developmentwa.com.au/projects/residential/east-village-at-knutsford/overview). The project's strata systems allow the townhouses and apartments (which are individually owned) to share infrastructure as well as the more conventional access to common property, and are managed by the strata management company. Individual dwellings are metered, with smart meters and blockchain technology providing each home the potential to both produce and consume energy and water that may be shared between properties, and to enable recharging of electric vehicles using a shared fast charger. This smart metering allows for resource optimisation and reduces utility costs. The integration of infrastructure through smart technology enables creation of net-zero, affordable, regenerative development of greyfields. The project also contains a circular-economy demonstration building made entirely of recycled products (https://www.architectureanddesign.com.au/news/curtin-university-living-lab-showcases-sustainable).

4 Conclusion

The regeneration of greyfield precincts represents an opportunity to trial new technologies in combination with precinct-scale urban regenerative planning and design. COVID-19 is a potential accelerator of these innovative, distributed green infrastructure systems, given the widespread debate that has begun about 'what needs to change' in cities. Innovations that were ripe for implementation pre-COVID now have a new opportunity to be mainstreamed. Perhaps the world's cities are poised to create a new model of precinct-driven urban regeneration based on:

- Distributed renewable energy with battery storage as well as smart ICT technologies that create distributed energy markets
- Electro-mobility and associated new transit capacity, walkability, and micro-mobility (Chap. 4)

- Localised integrated water management and biophilic urbanism that bring natural systems into built environments to achieve new urban habitats and blue-green infrastructure
- Circular-economy systems applied to waste streams that are applicable at both local community and precinct scale
- Smart-city technologies that enable these urban innovations to work better, and together to create more intelligent and effective city ecosystems that learn and evolve, demonstrating how to make each place in a city or region achieve multiple sustainable development goals and outcomes

Urban professionals will need to rapidly change the manuals of modernism still so prevalent in their fourth-wave engineering designs and statutory regulations, or else they will miss these early chances to be part of the sixth wave. This book is designed to help cities quickly focus on how to mainstream their new planning and assessment systems to create new sustainability exemplars of zero-carbon, affordable urbanism in innovative greyfield regeneration programmes.

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4

Transport and Urban Fabrics: Moving from TODs to TACs with Greyfield Regeneration

1 Introduction

Greyfields were built as automobile-related urban fabric from the 1940s onwards, and are now highly dysfunctional, as they no longer provide the best housing options but they are unable to cope with the traffic demands of the twenty-first-century city. Although they are desperately in need of regeneration, there is no model that can facilitate their transition in a functional and sustainable way. This chapter will introduce a new model of how main roads and their associated precincts can become the focus for greyfield urban regeneration through an integrated approach using new transit technology, their associated micro-mobility systems, and the distributed infrastructures for net-zero buildings and precincts outlined in Chap. 3.

2 Urban Fabrics and Urban Metabolism

Urban fabric theory (Newman et al., 2016) is based on an analysis of how cities have created different urban fabrics around their transport choices over centuries due to the average travel time budget for the journey to

P. W. Newton et al., *Greening the Greyfields*,
https://doi.org/10.1007/978-981-16-6238-6_4

work, which has been seen to be a consistent driver of how cities are shaped and reshaped (Marchetti, 1994; Newman & Kenworthy, 2015). It shows that all cities have three 'cities' within their structures:

- **The walking city** in the historic centre, densely built with narrow streets usually in a period before mechanised transport; can walk across in one hour.
- **The transit city** in corridors based around trains or trams, usually built in the period from 1850 to 1940; can transit across in one hour.
- **The automobile city** in rings of suburbs built around main road corridors and freeways from 1940 onwards; can drive across in one hour.

Urban fabric theory suggests that all three fabrics are merging and need to be recognised, respected, and regenerated, but in recent decades the demand has been for more walking fabric (Gehl, 2010) and transit fabric (Ewing & Bartholomew, 2013; Newman & Kenworthy, 2015; Sharma & Newman, 2017), especially in the rebuilding of earlier automobile fabric in middle greyfield suburbs that are in need of regeneration. The impossibility of building further automobile capacity into such areas and the inability to enable consistent urban regeneration despite increased demand for more compact, higher-density cities have become major issues in planning and transport policy, and they suggest the need for a simultaneous achievement of improved transit along main roads, micro-mobility along feeder streets, and stations that can be associated with significant precinct-scale urban regeneration, housing densification, and decarbonisation. This is a solution for the sustainable redevelopment of greyfields, though it should also be employed in the design of new estates on the fringe, or even rural settlements.

Effective and efficient corridor-transit infrastructure *and* urban-fabric improvements together enable a zero-carbon corridor to create a market that demands attention. This new market is being driven by the fact that finance for infrastructure investment is demanding net-zero outcomes, governments are wanting urban development to contribute to their net-zero goals, and new mid-tier transit technology is becoming faster than automobile traffic in most cities, creating an opportunity to deliver transit services that are less welfare-oriented and more broadly in demand as part of urban regeneration (Newman & Kenworthy, 2015).

Transit-activated corridors (TACs) are proposed as a new mechanism to help develop more transit fabric in twenty-first-century cities that builds on traditional approaches and adds a high level of twenty-first-century innovation. Different parts of cities have different urban fabrics, and lend themselves to different types of intervention and change, as summarised in Tables 4.1 and 4.2, which show that the three types of fabric also have different urban metabolisms (Thomson & Newman,

Table 4.1 Resource-input variations between urban form types

Input (per person per year)	Automobile city	Transit city	Walking city
Resources			
Fuel in megajoules (MJ)	50,000	35,000	20,000
Power in megajoules (MJ)	9240	9240	9240
Gas in megajoules (MJ)	4900	2940	2940
Total energy in gigajoules (GJ)	64.14	47.18	32.18
Water in kilolitres (kl)	70	42	35
Food in kilograms (kg)	451	451	451
Land in metres squared (m^2)	547	214	133
Urban footprint in hectares (ha)	2.29	1.97	1.78
Basic Raw Materials (BRM) for new building types per person			
BRM (1) sand in tonnes (T)	111	73	57
BRM (2) limestone in tonnes (T)	67	44	34
BRM (3) clay in tonnes (T)	44	29	23
BRM (4) rock in tonnes (T)	66	43	33
Total BRM in tonnes (T)	288	189	147

Source: Thomson and Newman (2018)

Table 4.2 Waste–output variations between urban form types

Output (per person per year)	Automobile city	Transit city	Walking city
Waste			
Greenhouse gas (fuel, power & gas) in tonnes (T)	8.01	5.89	4.03
Waste heat in gigajoules (GJ)	64.14	47.18	32.18
Sewage (incl. storm water) in kilolitres (kl)	80	80	80
Construction & demolition waste in tonnes (T)	0.96	0.57	0.38
Household waste in tonnes (T)	0.63	0.56	0.49

Source: Thomson and Newman (2018)

2018). It is possible to see a greening the greyfields story evolve as communities and governments seek to recreate more walking and transit fabric out of the oldest post-war automobile fabric, which is now failing. Such development can have many advantages, as outlined in this book, prime among them being reduced ecological footprint and enhanced liveability that can achieve net-zero outcomes with more diverse housing at a range of price points.

3 Cities' Current Mobility Trends and Trajectories

The 1950s began the era of car-based urban sprawl that created cities' enormous spatial spread, especially in the new world cities of North America and Australasia. This was associated with growth in high-consumption lifestyles that were locked in by a dependence on cars and oil, along with the adoption of new suburban living patterns and a culture of privatism. Densities plummeted and planning systems locked the new normal into their strategic and statutory systems. There was limited choice as the suburbs were rolled out in 'cookie-cutter' fashion. The differences in resource use and waste impacts is very large between the three urban fabrics (as shown in Tables 4.1 and 4.2) and do not appear to be related to an income effect; for example, in Australian cities, inner suburbs are higher-income areas than outer suburbs, in contrast to most US cities (Newman & Kenworthy, 2015). European trends were much less 'suburban', and urbanism remained as an influence on city planning in those countries during much of the twentieth century. However, there has been a surge in peri-urbanism in the twenty-first century as the established sections of European cities have become very desirable and expensive with peri-urban villages receiving more affordable housing but generally being less transport-friendly (Piorr et al., 2011).

Late twentieth-century suburban 'gated' communities in the suburbs of new world cities ('don't let densities change') meant that many people were forced to move further out into what has been variously called urban scatter, peri-urban, or tree-change areas where low-income residents are

even more at risk socially, economically, and environmentally (Sipe & Dodson, 2008) and very car-dependent. This is a future that is further exacerbated by climate change and the concomitant bushfire threat, now especially evident on the fringes of Australian low-density cities (Newton et al. 2018; Norman et al., 2021).

Re-urbanisation of inner and central cities via compact-city strategies and infill policies has become part of twenty-first-century urbanism approaches, as outlined in Chaps. 1 and 2. The demand for housing in inner suburbs has been constrained by a combination of restrictive residential zoning and resident push-back; as a consequence, this infill and densification movement has spread into middle suburbs, replete with NIMBY issues, as outlined in Chap. 6. However, no models of redevelopment—much less regeneration—were working in suburban car-based middle and outer suburbs, thwarting any attempt to realise higher ('urban') densities capable of supporting more liveable, self-sufficient, mixed-use, transit-oriented, 20-minute neighbourhoods. Notwithstanding the turn in the stated preferences of large segments of big city populations towards denser urbanism (Chap. 6).

Thus twenty-first-century urban planning in North American and Australasian cities is failing to curb sprawl and create what communities and markets are seeking in re-urbanisation, as well as what government strategic plans are saying they need. Why is this locked in? There are many factors in play, but certainly the lack of a good transport solution to enable a greening of the greyfields is likely to be a major one.

4 TODs and TACs

The need for transit-oriented development (TOD) around rail stations has been well accepted (Calthorpe, 1993; Cervero et al., 2002), and persists as an integral feature of city planning that looks for new ways to simultaneously regenerate both transit and urban development around stations. The huge international growth in investments in urban rail has enabled a reduction in car dependence, especially when associated with TOD. However, large parts of inner, middle, and outer suburbs remain without quality transit options. Main roads (often created by removal of

original tram lines following the end of the Second World War) are now usually heavily congested.

The need to regenerate both the mobility and land redevelopment along such roads is the next significant agenda in transport and urban policy. The solution suggested in this chapter is regenerating main roads using transit-activated corridors (TACs), which are a combination of providing new road-based transit technology and creating transit-activated GPR around the resulting station precincts. Just as TOD's role was to help transform rail policy relative to its role in urban densification around stations, the role of TACs is to help transform road policy. The similarity lies in the need to integrate quality transit technology with quality precinct-scale land development on, in, and around transit stops, and to include last-mile integration (Fig. 4.1). TACs are thus a corridor created from currently car-oriented activity centres (often represented by ageing shopping strips; https://tract.com.au/rethinkingthestrip/) by linking them with quality mid-tier transit. The difference is also that TOD projects have primarily been a government initiative, whereas TACs require private-sector engagement in an entrepreneurship role, as they involve considerable urban development, which is usually accomplished by the private sector in accordance with public regulation.

The key to unlocking transit-activated GPR is that communities love the resulting benefits: they get more than just infill housing; instead, they get a transit service along with other urban services within the transit-activated precinct. This is termed 'additionality'—a critical factor enabling transition from NIMBY to YIMBY. This is a fundamental factor

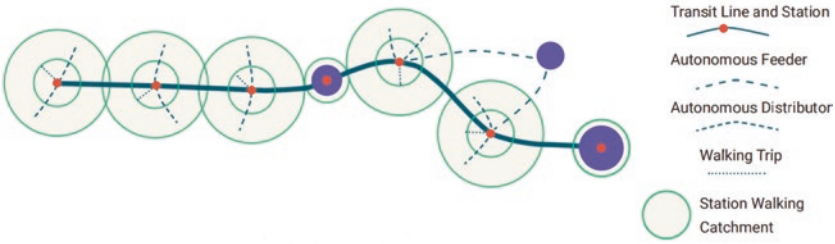

Fig. 4.1 Transit activated corridor. (Source: CRC for Low Carbon Living Guide to Low Carbon Precincts, Thomson et al. (2018)

recognised as missing in recent greyfield infill and is perhaps a key to how greyfield precincts can be regenerated. One of the biggest opportunities in these days of attempting to build net-zero cities is that transit-activated GPR provides an integrated model to generate net-zero corridors, as outlined in Fig. 4.1.

Transit-activated GPR is based on a whole-of-corridor approach where land development and transit are integrated from the outset, and it uses private finance in public-private partnerships to achieve this integration, as well as the technologies outlined in Chap. 3 to introduce distributed infrastructure into precincts. It also needs to draw on a number of the urban planning, design, and engagement processes linked to governments and communities that are the focus of Chap. 7.

5 New Transit and Transit-Activated GPRs

The electrification of heavy train and tram systems is a mature technology based on overhead catenaries, but new lithium-ion batteries have revolutionised the electrification of buses into electric bus rapid transit (BRT) and converting some into trackless trams with smart-city sensors (Newman et al., 2019) that can replace up to the equivalent of six lanes of traffic. These readily fit into cities and enable the development of new higher-density residential and mixed-use precincts around transit stops due to their quiet, pollution-free accessibility. As urban development moves to net-zero buildings and infrastructure, this process can be integrated into a transit-activated GPR. The resultant residential and commercial regeneration can be used to help pay for developing the new transit system (e.g., the associated transit precincts can include recharge hubs for battery-based transit and micro-mobility last-mile linkages). They are therefore enabling distributed infrastructure and supporting the development of a zero-carbon city with less automobile congestion on main roads.

Traditional transit along main road corridors has mostly been buses with some trams left over from previous eras, generally in conflict with traffic. In more recent times, mid-tier transit—both BRT and light rail transit (LRT)—have increasingly shown that there is a role for road-based

transit that occupies a dedicated lane of its own, capable of accommodating the approximate equivalent of six lanes of car traffic (Vuchic, 2005). Increasingly, these systems have improved their service quality (Hidalgo & Muñoz, 2014) through enhanced vehicle guidance, low-floor disability access, and stabilisation of sideways and bumpy movement. However, the arrival of electric battery-powered buses has revolutionised these systems with quieter, emissions-free systems similar to light rail. All of these transit electrification projects involving batteries can make transit-activated GPRs part of facilitating climate-change-based transformation to zero-emissions transit and zero-emissions station precincts where the use of renewable energy and recharging technology are built into the station precincts. If developed with a shared micro-grid and smart technologies managed locally, as outlined in Chap. 3, the new net-zero urban development can move out into the surrounding suburb as each adjoining area joins the local system.

Road-based mid-tier transit was given a significant boost when a new transit technology was developed that we have called a 'trackless tram' (Newman et al., 2019). The trackless tram system has taken six innovations from high-speed rail, put them in a carriage bus—or tram-like vehicle—with stabilisation through bogeys and optical guidance systems; this not only makes them largely autonomous (although not completely driverless), but also able to move at speed down a road with the ride quality of a light-rail car. Being electric battery-powered and with no need for steel tracks, it is significantly cheaper and easier to implement than a light rail system. It is also much better than traditional BRT at being able to attract urban development around it (new European and Chinese electric buses are showing that they are positively associated with significant improvements in urban development (e.g., the new Brisbane Metro; https://www.brisbane.qld.gov.au/traffic-and-transport/public-transport/brisbane-metro/about-brisbane-metro). These innovations in ride quality and speed, as well as the electric traction now in all three on-road systems, have helped make new transit technology for BRT, LRT, and the trackless tram system much more attractive to urban development partnerships. The trackless tram is a low-cost option that brings a much-needed opportunity to create TACs and transit-activated GPRs.

6 Micro-Mobility and Active Transport in Transit-Activated GPRs

Micro-mobility devices, including electric bikes, scooters, skateboards, and auto rickshaws, represent ideal ways to enable 'last mile' trip integration with autonomous shuttles and fixed rail to provide integrated mobility-as-a-service for greyfield precinct residents. New transport options presented by emerging technologies will require new levels of urban design and planning management to enhance station precincts for walkability and to avoid promoting more car-dependent, end-to-end travel (Currie, 2018). This should include electric shuttle buses (not necessarily autonomous but certainly on-demand), which can carry people to station precincts (providing first- and last-mile solutions) without ruining the walkability qualities of the area (Glazebrook & Newman, 2018).

Emerging e-scooter, other on-demand micro-mobility and car-sharing business models may hold the key to reducing car dependence, while reinforcing transit-activated GPR in all its functions. Membership of car-sharing services has been shown to reduce vehicle use and car ownership rates (Muheim & Reinhardt, 1999; Becker et al., 2018), which may achieve a balance with demand-based systems like Uber or Lyft and autonomous vehicles that tend to increase car dependence; though solar-based electric would be still contributing to net zero outcomes (Schaller, 2018; Calthorpe & Walters, 2016).

All forms of electro-mobility need recharging. In cities these can become part of a new recharge hub or battery-storage precinct strategically positioned to support the grid balance needed to ensure universal access and resilience. Such recharge hubs are likely to be driven by power utilities paying for the grid services as well as users' refuelling charges. In Canberra 60% of electric-bus recharge power will be obtained from rooftop solar installations at bus depots. These recharge services can be made available to the multitude of micro-mobility vehicles in local areas, thus supporting local economies and providing last-mile linkages for electric transit as they service corridors of mixed-use development. This integration between electric power and transport delivers net-zero corridors, as outlined below.

The benefits of micro-mobility in enabling local centres to work with fewer cars and to enable transit systems to work without the need for car-dependent corridors has certainly rapidly emerged over the past decades. Transit was seriously damaged during COVID, but so was car traffic, and thus the emergence of the need for and growth of local walkability and active transport has been a global phenomenon, with many cities building this into permanent plans for change (Davies, 2020; Laker, 2020). Electric micro-mobility will be a major part of future greyfield regeneration.

The co-benefits of active transport are very high, and if local economic development is facilitated, active transport becomes part of a low-carbon, green growth agenda to redistribute jobs within cities around these new station/precincts (Laker, 2020; Reid, 2020). Re-localising the city like this becomes a strong positive outcome from the move to active transport, with its support from micro-mobility and new electric transit systems as well as the localised power systems emerging from the solar-battery-based infrastructure to further the transformation of a range of urban precincts and town centres. It is a sign that a new policy orientation has emerged from this cluster of innovations, capable of mainstreaming post-COVID, and exemplified by transit-activated GPR.

7 Delivering Transit-Activated GPR

To convert a main-road corridor into a corridor of transit-activated GPR requires both strategic and statutory planning innovations that are focused on particular corridors and precincts. It also requires significant partnership development, a high-quality transit system, the declaration or zoning of the corridor as *primarily for transit and dense urbanism*, and associated high goals for more-sustainable urban development (e.g., net-zero and water-sensitive precinct development). These are pursued further in later chapters.

A series of plans to integrate movement and place have emerged around the world since Transport for London declared their Street Families policy (Transport for London, 2013), which identifies the streets that give priority to transit and where denser urban development will be given

special encouragement. The Movement and Place framework developed by VicRoads (https://www.vicroads.vic.gov.au/traffic-and-road-use/traffic-management/movement-and-place) has gained traction by asserting that streets are not only about moving people from A to B, but in many contexts also acting as places for people and public life to thrive (Jones et al., 2008). All Australian states are now following this model.

A planning and procurement process could enable the redevelopment of a corridor with a mid-tier transit system that enabled higher-density, mixed-use redevelopment along the corridor and a subsequent increase in land values. Developers could be chosen for each station based on their bids to deliver integrated higher-density development around each station that is walkable and contains all the distributed infrastructure outlined in Chap. 3 and the nature-based solutions from Chap. 5. The central part of this would be a micro-grid that can manage the distributed energy generated from rooftop solar installations and would be critical to managing recharge of all electric vehicles in the area (as well as the transit if necessary); the implementation of the micro-grid would include working with utility managers to provide grid services for back-up and stability (electric vehicles have substantial capacity for stabilising grids based on renewable energy sources). As greyfield regeneration happens in the station precincts, micro-grids can act as micro-utilities that provide net-zero networks to new redevelopments in ageing adjacent suburbs. The distributed net-zero city would thus emerge.

Enabling TACs would necessarily require multi-purpose governance along the corridor. This could come from a consortium of local governments, property developers, and utilities seeing opportunities requiring a shift from traditional dedicated 'specialist' services to a partnership model. The partnership would have responsibility for delivering urban regeneration and next-generation, networked transit, energy, and water services. For example, roads chosen for this category would shift their priority from providing mobility services for 'through traffic' to enabling quality regenerative urban design and development and urban network services delivery (mobility, energy, and water) along the designated corridor. This would deliver value to both developers and resident communities.

8 Conclusion

This chapter suggests that one pathway for greening the greyfields is to build new precincts in a chain along a transit-activated corridor to create a string of transit-activated GPRs. This era of technological advancement is developing systems that work best at a precinct scale, like solar power, batteries, and new small-scale water and waste systems, but they work particularly well if a row of precincts is linked by new local electric transit and micro-mobility systems. Most importantly, the necessary uplift in value that can release the funding or financing of a series of net-zero urban regeneration projects that seek to implement such new technologies will only happen if there is a strong and competitive new-technology transit system feeding residents, workers, and visitors to the precinct. Each precinct will therefore be an opportunity to show how new technology can be used and, most importantly, how the precinct can link into the new-technology transit system.

Fig. 4.2 Future transit-activated precinct. (Source: City of Canning)

Each of the regenerating greyfield precincts will need to have a station with potential to recharge transit, micro-mobility, and private electric vehicles, and a built environment that collects solar energy and incorporates other distributed infrastructure. The whole corridor can be part of an integrated local-metropolitan power system that ultimately spreads across the whole city.

A future city with a network of transit-activated GPRs across most parts of the city and a series of localised centres around stations would begin to look like the precinct illustrated in Fig. 4.2 and the city illustrated in Fig. 1.1, with the various urban fabrics now filled out by a series of new, twenty-first-century boulevards and dense urbanism, providing an enhanced structure for the suburbs that these boulevards traverse.

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5

Climate Resilience and Regeneration: How Precincts Can Adapt to and Mitigate Climate Change

1 Introduction

Cities are designed landscapes. Human settlements are typically sited based on natural endowments such as bioregional context, topography, hydrology, and soils, but as the city grows, the artificial subsumes the natural. In response to the overcrowded and unhealthy working conditions of the industrial era, modernist notions of urban design from the late nineteenth to the late twentieth century encouraged a low-density spread of cities to make space for fresh air and gardens. The rise of the car enabled sprawling garden suburbs to spread out across vast hinterlands, ultimately leading to increasingly dysfunctional cities (as described in earlier chapters). There has been increasing call for more compact and sustainable cities, leading to the need for higher-density regenerative redevelopment in both brownfields and greyfields. This chapter examines whether it is possible to not only densify greyfields, as outlined in the model in this book, but to do it in a way that regenerates the natural qualities of the areas being developed—to improve liveability and to build resilience to climate change.

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Urban regeneration can retrofit sprawl to deliver denser urban environments with potential benefits for residents, but contemporary infill development erodes the suburban qualities of open space and greenery that the early Modernists sought to provide. Poorly designed infill degrades the natural qualities of the typically leafy greyfields suburbs. Fragmented knock-down-rebuild infill is resulting in a significant loss of gardens and canopy trees, and simply creates more hard surfaces without a great deal of density. Residents generally are upset at the loss of multiple benefits associated with the natural qualities of the suburbs. But there are ways to design compact urban areas with nature in mind, and there have been examples of this over the centuries. Yet, most major Australian metropolitan planning schemes support infill as small-lot subdivision with an emphasis on aspects other than urban green space, so it is not unexpected to find that the redevelopment of greyfields has come to represent a loss of natural qualities. It is only recently, as governments around the world have recognised the critical role that urban nature can play in climate-change mitigation and climate adaptation, that there has been a surge of urban-planning interest to include nature more explicitly in future city redevelopment. The question is: how?

This chapter describes risks and opportunities climate change presents to urban areas and how nature-based solutions can support GPR, particularly place-activated GPR, to minimise climate vulnerability while maximising liveability.

2 Metropolitan Climate Projections and Bioregional Considerations

Climate-change projections (e.g., those from the UN's Intergovernmental Panel on Climate Change and Australia's Bureau of Meteorology) indicate an increasing incidence of extreme climatic conditions across the globe (and Australia) related to increased temperatures, episodes of drought and flooding, bushfires of increased intensity, sea-level rise, exacerbated by storm surges and coastal erosion. In Australia, most population growth is expected to occur in the cities of Melbourne, Sydney,

Brisbane, and Perth, all located in the southern half of the continent, which is projected to experience longer, dryer, hotter summers and reduced rainfall. Australia is already witnessing these impacts (Norman et al., 2021).

Perhaps the biggest impact is likely to be increased urban heat, especially the extremes that persist during heat waves that intensify urban heat islands, resulting in more deaths than any other natural hazard (Newton et al., 2018). Projections indicate that temperatures above 40 °C will become more common in the decades ahead (Table 5.1). For example, in Perth the number of days over 40 degrees is projected to increase by 50% compared to their rate of occurrence in the late twentieth century, and to be around five times more frequent in 2090 under the high emissions projections.

Indeed, in January 2020, Penrith, in western Sydney, reached 48.9° and was the hottest place on earth that day. The reality is that all Australian cities are moving in this direction. Climate adaptation is going to need to be embedded in all future urban development, whether it is in central city areas, new areas on the urban fringe, or greyfield areas. Thus, this chapter sets out the key features of adaptation.

3 Climate-Adaptation Strategies

The recent spate of highly damaging extreme events experienced by Australians in recent times—heatwaves, bushfires, droughts, flooding, and coastal erosion—illustrate the threat multipliers of climate change (Newton et al., 2018) and are demonstrating to the nation's population as never before the severity of such shocks to built environments and human well-being. The impacts of climate change have been the focus of increased applied research by major national research centres and networks this century, exploring policy and planning interventions capable of realising transformative mitigation and adaptation pathways. These include: green urbanism (refer to 100 Resilient Cities network; Fastenrath et al., 2019); options to manage sea-level rise (refer to National Climate Change Adaptation Research Facility; Norman, 2016); and urban cooling and local flood mitigation (refer to CRC for Water Sensitive Cities

Table 5.1 Metropolitan urban heat projections

	Metropolitan area							
Urban heat	Adelaide	Brisbane	Canberra	Darwin	Hobart	Melbourne	Perth	Sydney
Projected average warming (from 2015)								
2030 (intermediate emissions RCP4.5)	0.7 °C	0.9 °C	0.8 °C	0.9 °C	0.6 °C	0.6 °C	0.8 °C	0.9 °C
2090 (intermediate emissions RCP4.5)	1.5 °C	1.8 °C	1.8 °C	1.8 °C	1.4 °C	1.5 °C	1.7 °C	1.9 °C
2090 (high emissions RP8.5)	2.9 °C	3.7 °C	3.8 °C	3.7 °C	2.9 °C	3.0 °C	3.5 °C	3.7 °C
Projected Frequency of hot days (>40 °C)								
2015 (baseline)	3.7	0.8	0.3	0.0	1.6	1.6	4	0.3
2030 (intermediate emissions RCP4.5)	5.9	1.2	0.6	0.0	2.0	2.4	6.7	0.5
2090 (intermediate emissions RCP4.5)	9.0	2.1	1.4	0.0	2.6	3.6	9.7	0.9
2090 (high emissions RCP8.5)	16	6.0	4.8	1.3	4.2	6.8	20	2.0

Source: Newton et al. (2018)
Note: >35 °C for Hobart

and CRC for Low Carbon Living; Newton & Rogers, 2020). The first sector to undertake the necessary detailed risk assessment of climate-change impacts on Australia's settlement system was the insurance industry. This represented a major transition over the past 20 years from an exclusive reliance on actuaries and data from historical events to a forward-looking approach that embraced climate science, spatial science, and mathematical modelling. The result has been a detailed small-scale risk-assessment mapping of neighbourhoods across all cities and towns in Australia in relation to properties that are likely to become uninsurable. Such addresses are forecast to rise tenfold in Adelaide between 2019 and 2100 and fivefold in Newcastle and Sydney; and on the Gold Coast by the end of the century one in six properties will be uninsurable (ABC, 2020).

At present, governments tend to maintain a largely reactive disaster-management stance to extreme events. This needs to transition to proactive strategies involving climate-adaption planning and redesign of vulnerable urban landscapes. A high proportion of these will be in grey-fields. Here, increasing pressure will be applied by industries, workplaces, and residents located in at-risk areas for governments to ensure that future urban development responds to a new set of urban-design principles. Planning intervention at a precinct scale—such as GPR—will enable such a sustainablity transition to occur.

3.1 Benefits of Urban Nature

Despite there being numerous benefits to incorporating nature into urban areas, most planning regulations emphasise the built form over urban nature, whereby urban open space becomes increasingly dominated by concrete, asphalt, and other hardscapes. A major challenge is where and how to (re)integrate nature into cities, especially in large and densely developed cities where little space can be found; justifying the preservation of urban nature may be difficult because pressure is high for other land uses (e.g., a greater supply of affordable housing, parking, or additional commercial buildings required for local job creation in the

suburbs). The gradual loss of urban nature in infill areas is insidious, but not inevitable. It is a question of design. Numerous approaches emphasise the design of nature into the city (Frantzeskaki 2020); key concepts are summarised in Box 5.1, which can all be quantified for climate-adaptation risk assessment.

Box 5.1 Urban Nature Terminology

Ecosystem services are the benefits humans obtain from nature. There are many such 'services', such as flood mitigation, urban cooling, nutrient cycling, pollution removal, and food production. Preserving, maintaining, and regenerating nature within cities through an appropriate landscape structure can maximise these low-cost, high-benefit ecosystem services (Breuste et al., 2020). The integration of ecosystem services in the city is often referred to as green and blue infrastructure.

Green and blue infrastructure: within cities includes a range of urban natural assets, representing a counterpoint to the 'grey infrastructure' of roads, buildings, car parks, and other impervious surfaces that cover large areas of industrial cities of the modern era. 'Green' assets include trees, parks, and gardens, while 'blue' assets include elements of water-sensitive urban design (WSUD), such as rain gardens, remediation of local creeks and drainage channels, and stormwater capture and storage in swales and retention ponds (Victoria State Government, 2017). Collectively, networks of green and blue infrastructure can improve environmental conditions and residents' quality of life.

Biophilia and biophilic urbanism: Biophilia was defined by Wilson (1984) as 'the innate tendency to focus on life and lifelike processes'. Biophilic urbanism has become a major social movement within city policy and practice centred on integration of, and access to, nature in and on buildings, not just between them, for both the ecosystem services it offers and the psycho-social benefits it provides (Beatley, 2011). Biophilic urbanism is quantified in Soderlund and Newman (2015).

Nature-based services/solutions is a more recent term introduced by the World Bank (MacKinnon et al., 2008). It has a broad and inclusive range of actions to protect, sustainably manage, and restore multiple ecosystem services as a means to create resilience to climate change in cities, and thus reduce negative impacts on health and well-being (Elmqvist et al., 2019).

This chapter will use 'nature-based solutions' as an umbrella term for designed and managed urban nature that provides human well-being and biodiversity benefits within an established urban arena such as greyfields.

3.2 Planning for Urban Nature-Based Solutions

This book, along with many other planning sources, highlights the benefits that compact city design offers for urban sustainability. However, a compact city agenda creates a dilemma in that higher-density development affects and often replaces green space. The squeezing out of urban nature, particularly the loss of greenery on private property in greyfields suburbs through recent urban intensification, has been extensive, although redeveloped inner areas have at the same time become greener in their public spaces, especially in wealthier suburbs. Thus, it is possible to design a greater level of greening into greyfields using both public and private spaces. If this is not achieved, the city may continue to spiral down in its greening and the demand for prime greenfield land will continue unabated. Increasingly, innovative designers are finding ways to integrate urban greenery into high-density areas, and the possibility for green infrastructure to grow not just between buildings, but upon and over them is now evident. But how? Section 4 of this chapter discusses planning for urban nature that can at the same time be planning for urban density (Thomson & Newman, 2021).

Natural systems are not constrained by administrative boundaries such as property title, neighbourhood, municipality, or even city, and thus they should not be considered at these fragmented levels. Natural systems must be considered at a range of scales—macro (city, catchment), meso (municipality, precinct), and site (individual lot)—that work toward the creation of a connected city-wide green and blue infrastructure network.

Climate adaptation for sea-level rise, flooding events, and bushfires need to be dealt with at national- and local-scale planning (Norman et al., 2021), but may be considered at the level of smaller hydrological subsystems: watershed (catchment), aquifer, or site. Trees can form vast forests, but in the city context a patch of trees may form a small ecology of its own or contribute to an ecological corridor of linked sites across a city. Planning for urban nature requires (eco-)systems thinking. Each of these scales has a relationship to urban planning:

- The *macro scale* should respond to bioregional considerations such as widespread drainage patterns; for example, 'city as catchment' (Kenway & Tjandraatmadja, 2009), coastal areas at risk of sea-level rise or low-lying sites at risk of flooding (Norman, 2009), or large, intact ecosystems that represent relatively cohesive natural landscape divisions worthy of protection. This macro-scale setting will often be larger than the development footprint of the city (such as a riparian corridor or the broader metropolitan catchment) and should form the reference point for decisions at the smaller scales described below.
- The *meso scale* could be considered as the regional open-space structure that preserves high-value landscapes, watercourses with riparian buffers, and other ecologically or aesthetically important landscape features. Planning at this scale is important to support city-scale interaction with urban nature.
- The *micro scale* comprises individual plots, blocks, and streets: the cellular pieces that collectively make up the vast bulk of any city. The cumulative actions taken at this fine grain are most relevant when considering urban infill.

Although the macro and meso scales are predominantly shaped by policy planners, at the micro scale most decisions are made by developers and designers, who can organise a site to design nature either in or out; therefore, this scale is most relevant to GPR. Australian cities are witnessing considerable piecemeal infill development involving a miriad of micro-scale decisions, all of which are currently accommodated within existing building and planning regulations. The result is small-lot subdivision that typically leads to incremental displacement and disruption of natural assets. However, planning mechanisms can be employed to ensure that each of the micro-scale decisions work toward the incremental improvement of urban nature. Local government development assessment instruments and capabilities are critical here: but remain under resourced due to vertical fiscal imbalance in Australia's system of government (Tomlinson & Spiller 2018).

4 Integrating Nature-Based Solutions at the Precinct Scale

4.1 Water

In a drier climate, water scarcity will become an increasing problem for some cities. But the demand for potable water can be greatly reduced through water-efficiency measures as well as water harvesting from rainwater and stormwater collection, and recycling wastewater. All of these water sources can be used to help regenerate aquifers and water bodies in the bioregion. In fact, the whole city can be *designed as a catchment*. Rather than expel water through concrete channels and pipes (grey infrastructure) to the sea, water sensitive urban design (WSUD) seeks ways to funnel and manage stormwater flows to the benefit of the city. WSUD aims to balance urban water flows with natural water flows that existed before urban development. In the hot, dry climate experienced across much of Australia, WSUD may include strategies to hold water (e.g., in wetlands and detention basins) for future uses such as irrigation; or through swales, rain gardens, sumps, and other passive water-retention techniques to slow the rate of runoff, thus reducing urban flood risk while also recharging soil moisture and deeper aquifers. This is the *sponge city* concept.

Many of these techniques are best achieved at the regional scale; however, it is possible to design-in on-site measures that replicate these approaches at the smaller scale, such as 'deep-soil' gardens or green roofs to absorb rainfall at source or small-scale water detention (e.g., rainwater tanks) or greywater treatment. For these reasons it is advantageous to (i) ensure integrated site design that includes WSUD measures, (ii) amalgamate lots to enable greater potential for accommodating WSUD features and to ameliorate the cost over a larger number of dwellings, and (iii) consider developer bonuses for on-site WSUD to incentivise developer-led responses and to reduce public costs on engineering work to address stormwater flows from infill developments.

Site-scale decisions when extrapolated to the city scale have major impacts, either positive or negative, on urban nature. Using the methodology developed by the CRC for Water-Sensitive Cities Urban Infill

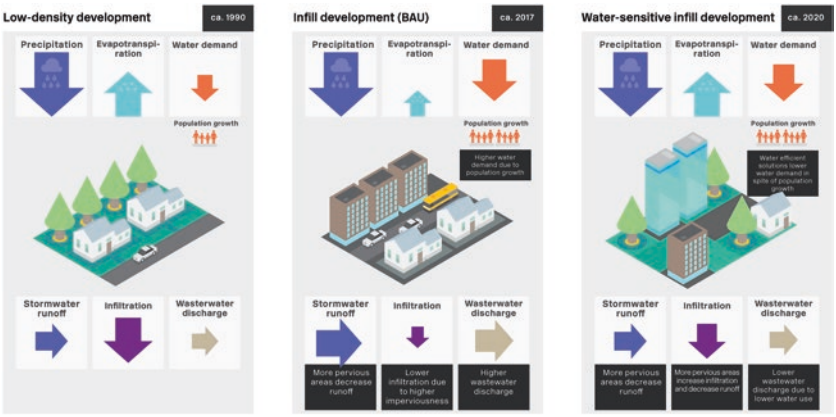

Fig. 5.1 Water-sensitive infill development for small-scale precincts. (Source: Renouf & Sochacka, 2018; London et al., 2020)

Integrated Research Project (Renouf et al., 2020; Renouf & Sochacka, 2018), it is now possible to quantitatively assess the nature-based impact of new urban-development projects on key landscape features such as surface imperviousness, groundwater infiltration, stormwater runoff, changes in green space and canopy tree coverage, evapotranspiration, and urban heating. Figure 5.1 shows various outcomes for business-as-usual infill versus water-sensitive infill, with significant differences in outcome resulting from different site arrangement of buildings, carparking, driveways, and setbacks. More coordinated place-activated GPR approaches can deliver a high site yield *and* larger areas of green space, while small-lot subdivision with larger building footprints, setbacks on all sides, and large driveways and garages may satisfy minimum planning open-space requirements, yet remove almost all urban nature on private plots. Municipalities are increasingly left to address nature-based solution deficits on limited public land with limited public funds. A good, well-designed place-activated GPR will have spaces on-site where green-blue infrastructure can enable multiple benefits. Nature-based assessments of urban infill are currently missing from local government development-assessment processes but are applied for the first time in a case study in Chap. 7 to illustrate the regenerative benefits of precinct-scale redevelopment compared to historical and current business-as-usual small-lot subdivision development.

4.2 Urban Heat

In urban environments, building materials like concrete, bitumen, and metal with high thermal mass absorb heat; pavements and rooftops can also absorb heat to varying degrees (e.g., a dark- versus light-coloured roof). This solar gain combined with the generation of heat within the city itself from sources such as car exhaust and air conditioning tends to result in greater heat than in the surrounding non-urban environments. This can be readily revealed through extensive urban heat mapping now commonly undertaken as part of strategic municipal land-use planning (Ding et al., 2020). This 'urban heat island' effect is exacerbated by global warming, and studies across the world's major cities show that an urban heat island increases city temperatures between 2 °C and 12 °C compared to their rural surroundings (Osmond & Sharifi, 2017).

Urban heat can be reduced through a range of methods such as: (a) high albedo, reflective surfaces (e.g., the Queensland city of Townsville reduced the average air conditioning load by 10% over a decade when they issued a regulation requiring that all roofs be white); and (b) urban greening, which both shades surfaces that otherwise absorb heat (such as concrete and roads) and actively cools through evapo-transpiration. The cooling effect of greenery increases with canopy cover and vegetation type. Osmond and Sharifi (2017) identify a range of urban cooling strategies for precincts (Fig. 5.2):

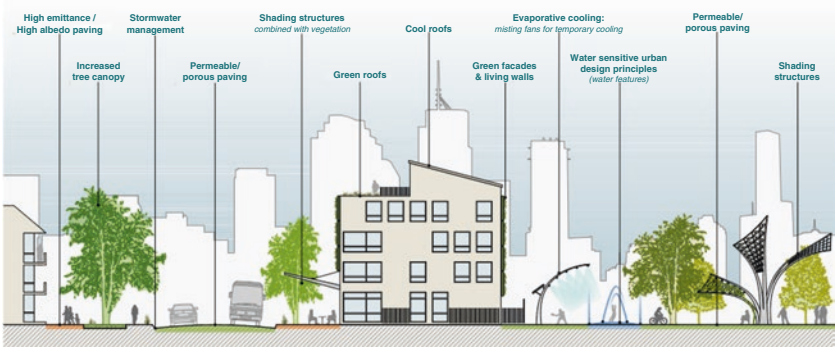

Fig. 5.2 Cooling strategies for urban precincts during summer. (Source: Osmond & Sharifi, 2017)

- Maximise green infrastructure in the public realm through additional well-irrigated street canopy trees and rain gardens and move power cabling underground to improve tree canopy coverage.
- Optimise private and public green space, including green roofs and vertical greenery; use permeable materials in paving.
- Install shading devices for (double-glazed) windows.

Buildings also need to play their part, both individually and as positioned within a precinct, to optimise solar access, shading, and natural ventilation. CSIRO has developed the Nationwide House Energy Rating Scheme software (NatHERS) for assessing the thermal design performance of residential buildings, which is now mandated in the Building Code of Australia and currently set at a minimum of six-star performance (amount of artificial heating and cooling required to keep temperatures inside a dwelling within a comfortable range). Designs capable of attaining seven or more stars are readily available (https://www.nathers.gov.au/owners-and-builders/7-star-house-plans), and when combined with solar photovoltaic power enable transition to zero-emission dwellings (Deng & Newton, 2017). These are design principles employed in the case study precinct design and assessment featured in Chap. 7.

4.3 Urban Vegetation

Vegetation loss as a result of urban infill is a major problem in Australian cities (Hurley et al., 2020). To counteract vegetation loss on private land, many councils are looking to maximise planting in the public realm. Dense and layered tree and shrub planting along streets can help increase shading, air purification, cooling, and noise reduction and slow the rate and speed of stormwater runoff to reduce urban flood risk. Tree-canopy targets are usually the central focus for urban-greening or urban-forest strategies. The City of Melbourne, for example, has a target of 40% canopy cover on public land by 2040 (Croeser et al., 2020). Planting guidelines can specify climate-appropriate vegetation to reduce future maintenance needs and reduce irrigation demand.

In precinct-scale developments, site layout can help find space for gardens by requiring some building setbacks (most likely rear setbacks), and

planning can mandate space for trees on private land through development controls such as deep soil zones (cf. NSW SEPP 65). Larger sites allow greater flexibility for site planning so that building and grey infrastructure can be arranged to maximise on-site green infrastructure. Precinct regeneration on larger sites ideally provides opportunity for a redistribution of street space to green space and reactivation for resident use (Chap. 7). For example, WGV Perth set targets for the infill development to match the tree-canopy coverage measured at the former school and playing grounds prior to the redevelopment in 2014. WGV set a tree-canopy target across the development site of 30% at 15 years post-construction, with a tree-canopy diameter of 6 m (Byrne et al., 2020). In denser urban areas, such as those where transit-activated GPR is appropriate, it is also possible for urban greenery to be integrated on, in, and over built structures; for example, as integrated greenwalls and green roofs that serve as biophilic facades on buildings (Newman, 2014; Thomson & Newman, 2021).

5 Conclusion

Climate projections offer planners increased clarity about potential risks of climate change, and consequently what impacts to plan for. Integrated design that is central to place-activated and transit-activated GPR needs to incorporate nature-based solutions to increase not only livability, but also resilience to climate change. The many nature-based solutions identified in this chapter are an affordable insurance policy against climate shocks that also help create more attractive, more valuable, more biodiverse, and more sustainable communities. The IPSOS (2020) survey closest to the time of the Australian bushfires revealed that environmental concerns had risen to be the top issue among Australia's population wanting action on climate change. Place-activated greening of the greyfields needs to be innovative in improving urban infill through regenerating precincts in relation to better urban design densities *and* better natural urban environment qualities.

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6

Changing Attitudes to Housing and Residential Location in Cities: The Cultural Clash and the Greyfield Solution

1 Introduction

The evolution of Australia's urban residential fabric for much of the twentieth century was characterised by suburbanisation: continuous centrifugal expansion of the city in rings of low-density housing in greenfield estates on the urban fringe. This has led to population densities of the five largest capital cities as amongst the lowest in the world (Loader, 2016). Underpinning this pattern of residential development, especially for the latter half of the twentieth century, was a regime comprising a conventional, risk-averse residential-property industry, firmly tied to a greenfield model, aligned to metropolitan governments' continued support of 'suburban city' planning strategies and an auto industry that promoted car-dependent urban sprawl. Greenfield developments offered households affordable access to house-and-land packages with private front- and backyards in a 'garden city' environment. This constituted the Australian dream, especially for the traditional nuclear family of that era. A review of housing-preference studies undertaken up to the early 1990s confirms this, with all published surveys showing that approximately 90% of all

P. W. Newton et al., *Greening the Greyfields*,
https://doi.org/10.1007/978-981-16-6238-6_6

capital-city residents consistently nominated detached housing as the favoured dwelling type (Wulff, 1993).

Late-twentieth-century forces were challenging the sustainability of continued urban sprawl as a means of accommodating population growth. Significant shifts in demographics, lifestyles, and urban economics were signalling a need to reconsider how cities were being planned, with increasing calls for urban consolidation, more-compact cities, and greater variety in housing provision (Newman & Kenworthy, 1999; Newton, 2000). Gentrification of low-priced inner-city residential property had begun in the late 1970s, initiated by households who preferred an 'urban' living environment, marking the beginning of the end for inner-city depopulation (Newton & Thomson, 2017). Significant re-urbanisation and densification of the inner suburbs was to follow. Similar patterns happened in all automobile-dependent cities across the world, particularly in the twenty-first century as knowledge-economy jobs and more-urban environments became valued for their higher residential amenity and accessibility (Brotchie et al., 1987; Newman & Kenworthy, 2015; Florida, 2010).

As these inner suburbs gentrified, the existing residents opposed the changes in and densification of their neighbourhoods (Huxley, 2001), leading to the formation of 'Save our Suburbs' movements involving local communities banding together to resist what they considered 'over-development' and urban designs that changed 'neighbourhood character'. Transitioning from suburban to urban fabrics via more intensive forms of urban infill represented a challenge to residents of established, more accessible suburbs to share their higher amenity space. During this period, housing in Australia's largest cities was also becoming increasingly unaffordable, and research indicated that an increasing proportion of residents surveyed by the Grattan Institute in Sydney and Melbourne, where property prices were highest, indicated they would prefer living in medium-density housing (Kelly et al., 2011). Results from this study (Table 6.1) show that from a preferences perspective, 40% of Sydney respondents and 38% of those from Melbourne favoured medium-density housing; if high-density housing is included, the preference for density goes up to 60% in Sydney and 52% in Melbourne. For most of the twentieth-century, household surveys showed that preferences for

Table 6.1 Dwelling preferences versus existing dwelling stock—Sydney and Melbourne

Location	Population preference % / Existing (2006) stock %	Dwelling type: Detached	Semi-detached	Up to 3 storeys	4+ storeys	Total
Sydney	Preference	41	25	15	20	100
Sydney	Stock	62	12	16	10	100
Melbourne	Preference	48	26	12	14	100
Melbourne	Stock	72	12	13	3	100

Source: Extracted from Kelly et al. (2011)

higher density living rarely approached 20% (Wulff, 1993). This is a remarkable change in urban culture in Australia and a huge political dilemma in the planning profession, as all the strategic-planning documents began to recognise this significant increase in demand for well-placed density, but the planning systems of control did not allow the demand to be met. The conservative property development and building and construction industries were also slow to respond to these shifts in preferences, a fact reflected in major lags in supply of medium-density dwellings (Kelly 2011; Kelly et al., 2011; Newton et al., 2017; again, see Fig. 1.2).

This chapter seeks to clarify the clash of attitudes and values that has emerged in Australian cities in relation to housing, and to find a solution through regenerative urban redevelopment of the middle suburbs.

2 Greening the Greyfields Survey

This section examines the responses to a September 2016 online survey of 2000 residents living in Sydney and Melbourne to a range of housing issues associated with the *Greening the Greyfields* project (see Newton et al., 2017 for more details of the survey). The focus of the survey was on understanding trends in community attitudes towards medium-density living and neighbourhood change (intensification) in an attempt to understand the clash in cultures outlined above, which is reducing the opportunities for urban regeneration and perpetuating urban sprawl.

2.1 Stated Preferences for Dwelling Type and Preferred 'Living Arrangement'

In response to a question posed to those households who indicated that they were likely to move residence within the next 15 years ('What type of dwelling would you want to live in?'), Table 6.2 shows that close to 60% of residents in both Sydney and Melbourne favoured a detached house and yard. In the space of 30 years (approximately one generation), there has been a significant attitude shift in (unconstrained) housing preferences—towards embracing higher-density forms of living.

While there are overlapping demographics across the housing typologies, those with a stronger preference for medium-density housing tended to be older (>60), in smaller households, living alone or with adult children, favouring a smaller dwelling, and looking to relocate within the same locality they currently live in. Those looking to move into an apartment also revealed a distinctive demographic: either younger (under 30) or older (over 60), more likely to be currently renting, in a small, single-person household or living with other adults, and with a preference for inner-city living and close to a park that can be used regularly. These data

Table 6.2 Preferred type of future dwelling for households indicating a plan to move within next 15 years

			Sydney	Melbourne	Total
What type of dwelling would you want to live in?	Detached, stand-alone house with private back and front yard	Count	214	213	427
		%	59.8	58.8	59.3
	Semi-detached single or two-storey (town house, duplex, villa unit with small amount of private space at ground level at either front or rear)	Count	58	75	133
		%	16.2	20.7	18.5
	An apartment, flat, or unit	Count	71	62	133
		%	19.8	17.1	18.5
	Retirement village/hostel	Count	15	12	27
		%	4.2	3.3	3.8
Total		Count	358	362	720
		%	100	100	100

Table 6.3 Preference for urban living arrangements

			Sydney	Melbourne	Total
If you had to choose between the three living arrangements specified, which would you prefer?	Separate dwelling with a garden in a suburb where there is poor public transport	Count	432	452	884
		%	45.2	46.1	45.7
	Medium-density dwelling with no garden, but close to public transport	Count	435	448	883
		%	45.5	45.7	45.6
	High-rise apartment in CBD or surrounding inner-city neighbourhood	Count	89	80	169
		%	9.3	8.2	8.7
Total		Count	956	980	1936
		%	100	100	100

began to reveal what was motivating this cultural shift towards density. A further set of questions enabled more insight.

Living arrangements were examined to see how much they extended beyond the dwelling to include the neighbourhood and wider (sub)urban context in which people lived. Three distinctive living arrangements were explored (Table 6.3). Responses revealed that combining locational context with housing type significantly boosted preference for medium-density housing when situated in established suburbs well served by public transport and accessible to jobs and services: 46%—equivalent to the level of stated preference for a residential property comprising a separate dwelling with garden and dependent on access to a private car.

The data from this part of the survey indicated that people are more readily attracted towards a more 'urban' housing environment if they are given a sense that the additionality of living there is significant. This additionality is well understood in housing-preference literature and forms the basis for comprehending urban housing markets. A survey in Perth of households who had bought into apartments showed that many had done so because of the sustainability benefits in the housing itself (increasingly being marketed) and in the lifestyles they could now live without

car-dependence (Green & Newman, 2017). COVID-19 has highlighted the increased importance of 'localism' and 'additionality' in relation to neighbourhood amenity and services.

2.2 Exploring NIMBYism: Resident Perspectives on Neighbourhood Densification and Change

The question is whether these shifts in dwelling preference have been reflected in residents' attitudes towards change in the built environments in their neighbourhoods. Seventy-one percent of the total sample of respondents (N = 1983) were 'aware of neighbourhood change in their locality', a percentage that was identical for the property owners (N = 1402) who were no more or no less sensitized to local urban change than renters. For the remainder of the analyses, focus centres on the property owner group since they constitute those residents capable of driving precinct-scale citizen-endorsed or initiated regeneration.

Table 6.4 reveals a high level of consistency in Sydney and Melbourne residents' attitudes to neighbourhood change that is associated with an increase in residential density. Less than 10% of residents in both cities considered it a good thing, but almost 40% responded that they

Table 6.4 Attitude to neighbourhood change

			Sydney	Melbourne	Total
How do you feel about the change that this increase in level of housing development/density is having on the neighbourhood around you?	I think it is a good thing	Count	46	47	93
		%	6.8	6.4	6.6
	I understand that it has to happen	Count	245	281	526
		%	36.4	38.5	37.5
	Neutral	Count	72	83	155
		%	10.7	11.4	11.1
	I would prefer less or no change in density of housing	Count	310	318	628
		%	46.1	43.6	44.8
Total		Count	673	729	1402
		%	100	100	100

understood that it must happen, and just over 10% were neutral. Preference for less or no change sat around 45%. This suggests that there is a capacity to accept change, but at present it is grudging and not strongly endorsed or embraced. NIMBYism remains a barrier to urban redevelopment.

There are interesting demographic differences between those households who thought change is a good thing or understand it has to happen and those who were neutral or preferred no change. The former group tended to be younger, recent movers into the locality, more likely to be renters, in predominantly adult only households, and more likely to have plans to move in the next few years, and to prefer inner-city locations. A review of community resistance in the Australian property-redevelopment context (Newton et al., 2020) indicates it has not moved much beyond a focus on individual project sites, and thus the literature has assumed that community resistance comes primarily from site-specific issues, which is not always the case. Often the externalities associated with a project (i.e., its impacts on local infrastructure, services, traffic, safety, and environment) are what raise the most objections. This suggests that the narrative for change and the benefits that well-designed regenerative development can bring to a suburb and its residents need to be better communicated to the stereotypical property-owning suburban households who prefer less development in their neighbourhoods. Demonstrating the additionality of GPR and communicating this to residents is the focus for Chap. 7.

2.3 Exploring YIMBYism: Perspectives on Resident-led Residential Redevelopment

The next 'planning for change' stage in the survey probed the extent to which property owners contemplating a future move were aware of or open to options of selling as a consortium of neighbours—becoming key actors in resident-enabled regenerative urban redevelopment. While not commonplace, examples of this are being reported together with the value uplift they achieve (Fig. 6.1). The survey revealed that one-quarter of Sydney respondents were open to consolidating property for sale with neighbours; this figure was even higher (39%) for property they owned as an investment (Table 6.5).

Fig. 6.1 Citizen-led lot consolidation in the suburban greyfields. (Source: Compiled by authors)

Table 6.5 Interest in the option of selling property as a consolidated redevelopment precinct in collaboration with neighbours

Is selling property jointly with neighbours something you would consider?	Property currently owned and occupied			Investment property		
	Sydney	Melbourne	Total	Sydney	Melbourne	Total
Yes %	25.4	16.9	21.1	39.1	27.4	33.9
No %	48.1	57.1	52.7	39.8	53.1	45.7
Do not know %	26.5	26.0	26.2	21.1	19.5	20.4
Total %	100	100	100	100	100	100.0
Total *N*	688	712	1400	161	128	289

Several reports on negative community reaction to development include recommendations on overcoming resistance, such as positively framing developments for well-being (Holden, 2019), focusing on the local issues and local benefits (Petrova, 2014), and relying far more on the informal community structures than the formal municipal

communications pathways in gaining community acceptance (Scally & Tighe, 2015). These indicate the necessity to move beyond the current development proposal/complaint system, but are still not developed to the point where they can be readily and effectively implemented as YIMBY methods of practice. Engaging with residents, unpacking their views about the needs of a given locality, and introducing forms of additionality into a precinct can significantly reduce negative reaction to project proposals, and may even lead to support for development (Woodcock et al., 2016). This process is also far more likely to be supported by councillors and political stakeholders, as development purely for yield is typically not openly supported, but developments that satisfy both the community and municipal policy are. Consequently, demonstration of precinct additionality is a near necessity for scaled-up, medium-density construction in greyfields.

There would appear to be a capacity gap here: a deficit of trusted and qualified brokers capable of engaging greyfield residents with the appropriate financial and legal instruments necessary to progress 'kitchen table' discussions through to a positive outcome. This is rarely part of the business model in real-estate agencies, local government, or among property and construction companies.

3 Meshing Housing Life Cycle and Household Life Cycle Analyses: A Step Towards Realising GPR

The data from the above surveys show there is significant potential for urban regeneration at scale in greyfields, and that piecemeal knock-down-rebuild of detached houses is not going to make the difference needed for creating the additionality required to achieve better public transport and better urbanism like that found in inner city walking and transit fabrics. So how can this be enabled?

As outlined in Chap. 1, greyfields are areas within cities with a high percentage of residential properties that have reached or are rapidly approaching the end of their life cycle *and are currently occupied*. The fact that they are occupied by different property owners represents a barrier to

any straightforward lot-assembly process. A significant percentage of greyfield properties are also occupied by older residents (over the age of 55)—a cohort of the Australian population that is expected to double from 5.2 million (2012) to 14.1 million in 2062 (James et al., 2019). It is also a cohort that is confronting the need to consider their future residential and locational options. Over 60% of this age cohort are owner-occupiers (63% for 55–59, rising to 72% for 75–79; Whelan et al., 2019).

These facts provide a range of options for people in the middle suburbs: age in place, move to a retirement village, or downsize/rightsize to owning a smaller medium-density property or high-rise apartment. Several recent studies from the Australian Housing and Urban Research Institute (AHURI), such as those listed above and James et al. (2020), point to the multiple barriers to be overcome, prime among them being the financial cost of moving, but also a significant lack of coordinated and trusted information on seniors' housing options. There is a need to bring the information about housing options to those who are now facing the need to make some choices. The option of participating in GPR is never one of these unless particular residents in a neighbourhood such as featured in the stories in Fig. 6.1 are moved to participate in a lot-amalgamation initiative and create the option for a larger-scale redevelopment.

Urban planning at local and state government level needs to become more proactive in this space at both strategic and statutory levels. At a strategic planning level, bivariate spatial analyses of greyfield residential tracts demonstrating a combination of high redevelopment potential and high percentage of population over 55 years of age will highlight precincts where rezoning for GPR could have the best prospects (Fig. 6.2). At a statutory level, there needs to be realisation of community additionality for precinct-scale redevelopment if GPR is to be realised.

4 Conclusion

This chapter has shown that a major cultural shift is occurring in Australian cities, with over 50% of households now preferring to live in a more urban, amenity-rich location. The reason an increasing number of residents in Australian cities are primed and ready to move into higher-density living environments appears to be because they are increasingly embracing

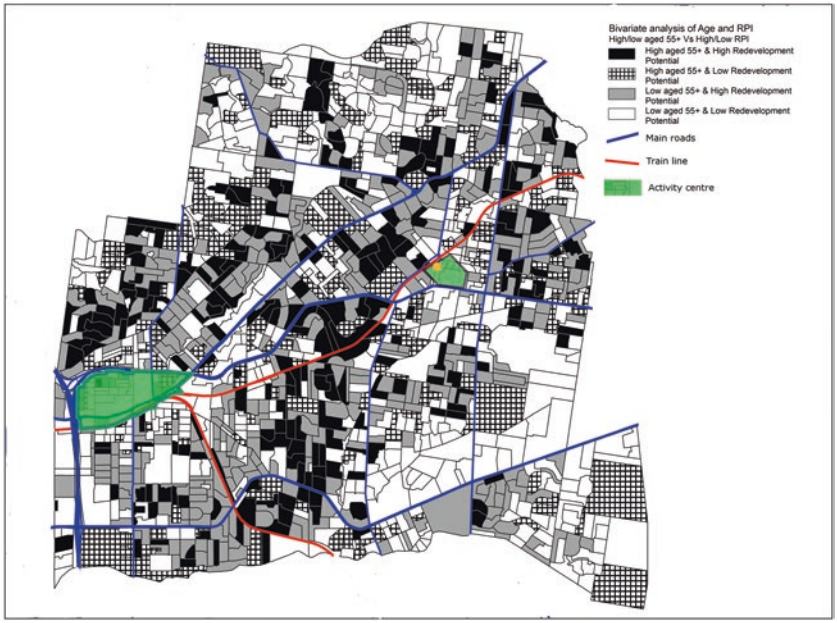

Fig. 6.2 Locating high residential redevelopment potential and high percentage of population aged over 55 in the (largely greyfield) City of Maroondah, Victoria. (Source: Derived by authors from Victorian Government spatial data)

an 'urban' rather than 'suburban' culture and lifestyle. The reality is, however, that the processes that are likely to enable this transition are simply not in place, as the inner suburbs are now beyond the means of most, unless high-density apartment living becomes the option. GPR in the middle suburbs represents a solution to providing the sought-after medium-density housing supply and amenity provision—in the right places. As Kelly et al. (2011, p. 2) have argued: 'We should not be afraid to shape our cities: otherwise we will risk them shaping us. But we should shape them in accordance with what Australians say they would choose'.

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7

Planning, Design, Assessment, and Engagement Processes for Greyfield Precinct Regeneration

1 A Framework for Smart Regenerative Urban Development at Precinct Scale

Previous chapters have shown that delivering more-sustainable regenerative development increases in complexity as urban scale increases and as focus shifts to redeveloping existing urban fabrics, especially greyfields (Fig. 7.1). Here, key objectives relate to *jointly* increasing the supply of medium-density housing, retrofitting urban infrastructures (energy, water, mobility, and waste management) to make them distributed, low-carbon, and regenerative, increasing the mix of residential and commercial land uses to create neighbourhoods that are more productive and liveable, and greening streetscapes by redistributing and reconfiguring land previously allocated to automobile use for nature-based services to accommodate pressures from climate change and densifying suburbs. We have called the integration of these urban performance factors greyfield precinct regeneration. Its goals are set out in Table 7.1 as a list of urban-design objectives.

There is a critical relationship between all the elements in the precinct design and assessment process (Fig. 7.2). The ability to positively

P. W. Newton et al., *Greening the Greyfields*,
https://doi.org/10.1007/978-981-16-6238-6_7

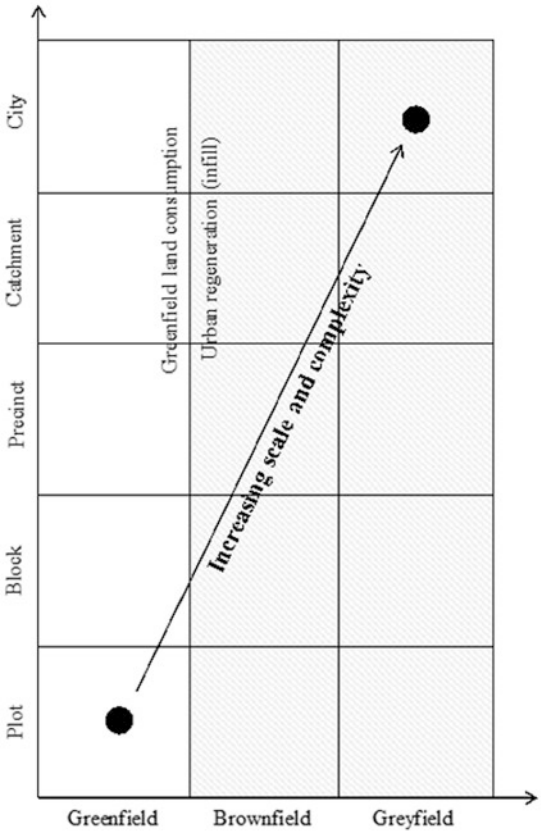


Fig. 7.1 Urban arenas and scale of urban redevelopment. (Source: Adapted from Thomson, 2016)

influence the cost and performance of a precinct design project is always highest at the front end, in the concept-design-feasibility stages, a period during which information to aid decision-making in a timely manner has proven more difficult to assemble. It is for this reason that increasing attention is being paid to new processes, instruments, and platforms that can be introduced for smarter precinct planning and design at concept and design phase (Newton & Taylor, 2019) to address the assessment deficit that currently exists for urban-design practitioners in both private and public sectors (but local government development assessment in

Table 7.1 Dimensions of urban performance requiring a precinct planning and design response

Domains	Objectives of regenerative precinct-scale planning and design.
Housing	Greater dwelling yield; variety and flexibility in designs, floor areas, layouts; underground parking; costing, market feasibility, and affordability assessment.
Energy	Zero carbon energy; distributed renewable energy and storage and electric vehicle (EV) recharging; microgrids; community renewable energy opportunities, including peer-to-peer energy trading; electricity self-sufficiency/export to grid.
Water	Opportunities for integrated water system: stormwater capture, rainwater harvesting and greywater recycling for non-potable uses; water-sensitive urban design.
Waste	Optimised recycling of C&D waste from demolitions; introduction of food waste composting systems for medium density and high-rise apartments.
Mobility	More walkable neighbourhood designs; less area devoted to cars on private property and in public realm; greener streets and rain gardens on verges seamlessly meshed to private green spaces; car sharing; ride sharing; e-mobility.
Communications	High-speed fibre network to the node and ubiquitous broadband services to neighbourhood premises.
Green space	Maintain, rather than lose, canopy trees associated with urban development and redevelopment; activate and revegetate local streets and nearby pocket parks; redistribute sections of road space to green-space.
Safety	Design safety and security in at a neighbourhood scale; over-sight of walkways and public spaces; 'neighbourhood watch'.
Distributed urban services	Distributed energy systems, integrated water systems, waste micro-factories, food-waste composting, and car-sharing systems linked with a precinct scale of urban development; precincts as micro-utilities.
Integrated design	Precincts can be an integrator of all the built-environment objects and flows that feature in urban design at this scale; for example, buildings + land uses + open space + transport systems + utility infrastructures (water, sewerage, electricity, gas, communications); employing integrated urban modelling: BIM building information modelling + PIM precinct information modelling + CIM city information modelling.

(*continued*)

Table 7.1 (continued)

Domains	Objectives of regenerative precinct-scale planning and design.
Place-making	Placed-based approaches to urban planning and design need to draw on new precinct-scale knowledge, frameworks, and instruments to deliver neighbourhoods where people want to live.
Precinct, neighbourhood, district performance rating	Industry-supported voluntary rating systems are emerging in Australia and overseas that are designed to guide and encourage the development of more-sustainable urban communities; for example, *NCOS-Precincts*, *Green Star Communities*, *EnviroDevelopment*, and *One Planet Communities* in Australia; *LEED—Neighbourhood Development, EcoDistricts*, *CASBEE*, and *BREEAM for Communities* all operate internationally. Many elements of these need to become mandatory and linked with scientifically verifiable assessment tools if a transition to sustainable urban development is to be realised.

Source: Adapted from Newton (2019)

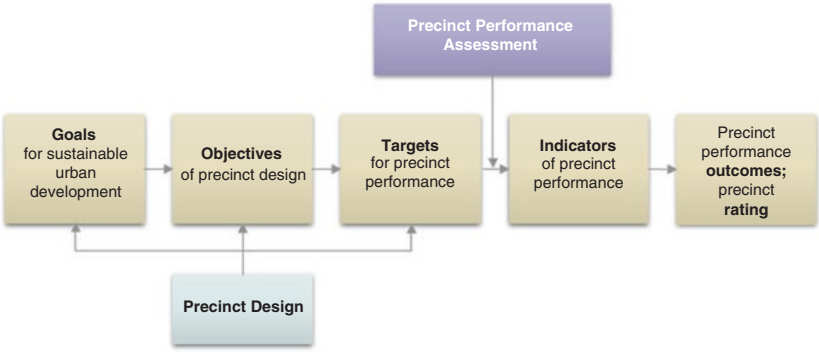


Fig. 7.2 Key processes underpinning greyfields precinct regeneration. (Source: Newton, 2019)

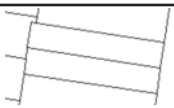
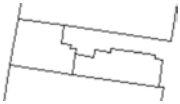
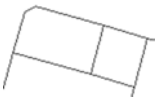
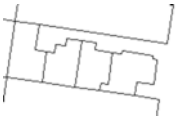
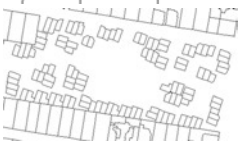
particular). They enable more rapid and iterative assessment of precinct design performance (against objectives) to assess economic feasibility as well as present proof of the additionality that the project delivers to local government and community residents. Both are critical to the GPR model of redevelopment.

Regenerative redevelopment in the greyfields requires land assembly and the greater potential for additionality that a larger site allows. Most redevelopment to date in established suburbs has been small-scale, fragmented, speculative knock-down-rebuild where a single site is purchased and 1:1–4 new dwelling units built on the block in conformance with existing local government building and planning regulations. Residential development in the middle suburbs of Australian cities has typically created lots ranging in size between 400 m^2 and 800 m^2 (average 600 m^2), with the original dwelling occupying approximately a third of this space, the rest being permeable open space and driveways/parking spaces. Housing redevelopment outcomes for small-lot subdivision vary slightly in terms of both dwelling outcomes and site layout (Table 7.2). The small-lot subdivision model has proven to be economically viable and highly replicable, but it does not contribute sufficiently to greyfield net infill housing supply or enable urban redevelopment at a scale and density that can effectively reshape and regenerate low-density suburbia and contribute to broader urban development goals, such as delivering environmentally sustainable outcomes for the future of Australia's fast-growing cities.

An alternative approach to land assembly at a larger (precinct) scale is required in greyfields. Locally organised housing development models driven by a 'group of individuals acting together on the basis of shared interest' (Crabtree, 2018) have emerged in Australia and internationally (Palmer, 2020; Sharam, 2016). They take various forms but are typically led by a 'developer' who aggregates demand for a medium-high-density housing project, enabling a site to be secured and design to be commenced following engagement with local government. Recruitment of participants is unconstrained spatially and is speculative. Getting such projects off the ground has proven difficult, especially those associated with attempts to deliver more socially and environmentally responsive medium-density housing aligned with local government strategic development plans and design guides that require increased levels of sustainability performance (https://nightingalehousing.org/).

GPR is a variant of locally organised housing development models to the extent that it is likely to be a municipality-initiated process requiring

Table 7.2 Typical scales and configurations of greyfield residential redevelopment

Precinct type	Lot type	Net new dwellings	Plan
Small-lot subdivision (SLS): Side by side	Wide lot, difficult with side setbacks	1	
SLS: Battle-axe	House located towards front or back	1	
SLS: Corner site	Any site abutting two roads	1–2	
SLS: Terraced	Long lot	2–3	
SLS: Joint development	Two adjoining lots	4–6	
Greyfield precinct regeneration: Requires amalgamation of several adjoining properties	4+ lots	10+	

Source: Adapted from the Victorian Department of Environment, Land, Water and Planning, Housing Development Data, spatial layer

resident engagement and support at a neighbourhood level, responding to the locality's clearly identifiable, place-specific, strategic development needs. As outlined in Chap. 2, GPR's emergence as a new regenerative model for city redevelopment requires alignment of metropolitan and local government strategic and statutory planning (e.g., district greenling) and a municipality's preparedness to initiate a new level of

engagement with local communities associated with the need for and benefits of local-area change.

Unsolicited bids from developers are an alternative model for transit-activated or place-activated GPR projects that are entrepreneurial, involving land development as a way of paying for the investment. Another possible GPR model would be top-down interventions from state and federal governments. These are all unlikely to be major contributors to greening the greyfields, as most development is a partnership between developers/owners and local governments. Thus, the model outlined in this chapter is a municipality-initiated process requiring partnerships with the owners and the potential developers. This model is developed further in Chap. 8. the current chapter focuses on a development model that is working in its early stages in the City of Maroondah in Melbourne. The process pioneered by the Greening the Greyfields team in the City of Maroondah and in dialogue with the Victorian State Government is set out below as a model for step-wise creation of greyfields precinct regeneration. The project is closer to a place-activated GPR than a transit-activated GPR.

2 Governance Processes for Greyfield Precinct Renewal

2.1 Declaration of Greyfields as Areas Capable of Delivering More Housing Supply, Choice, and Diversity

Based on the body of work undertaken by the *Greening the Greyfields* project, GPR now exists as a new policy and planning directive in Plan Melbourne 2017–2051; this is a signal to local government of the need to create new pathways for urban infill in established suburbs (see Box 7.1):

Box 7.1 Policy 2.2.4—Provide Support and Guidance for Greyfield Areas to Deliver More Housing Choice and Diversity

Greyfield sites are residential areas where building stock is near the end of its useful life and land values make redevelopment attractive. Melbourne has many residential areas that qualify as greyfield sites, particularly in established middle and outer suburbs. These areas often have low-density, detached housing on suburban-sized allotments that have good access to public transport and services. Until now, the redevelopment of these areas has been generally uncoordinated and unplanned. That must change. Greyfield areas provide an ideal opportunity for land consolidation and need to be supported by a coordinated approach to planning that delivers a greater mix and diversity of housing and provides more choice for people already living in the area as well as for new residents. Methods of identifying and planning for greyfield areas need to be developed. A more structured approach to greyfield areas will help local governments and communities achieve more sustainable outcomes.

Source: Plan Melbourne 2017–2050 (p. 51) (https://www.planmelbourne.vic.gov.au/__data/assets/pdf_file/0007/377206/Plan_Melbourne_2017-2050_Strategy_.pdf)

This was an important step, as it gave credibility to the underlying research and encouragement to both the professionals in local government and the consultants who were trying to deliver it.

2.2 A Broad Analysis of an Entire City's Potential for Greyfield Regeneration Needs to Become Part of Future Metropolitan Strategic Planning Processes

In Chap. 1, a metropolitan-wide assessment of residential redevelopment potential undertaken for Melbourne established that over one-third of the city's 32 municipalities had more than half their housing stock with high redevelopment potential. Ideally, the district greenlining process referred to in Chap. 1 becomes a key step in a city's urban regeneration strategy and process, incorporating the longer-term infrastructure retrofit plans of major water, energy, and waste utilities. A governance model for long-term integrated planning involving utilities, transport, and state

and municipal planners that spans the scales from macro to micro level and can become a guide to GPR (both place- and transit-activated) remains to be developed. Even where district greenlining processes are absent at metro level, they are nonetheless possible at municipal level where GPR needs to be activated.

2.3 Locate Candidate Precincts for GPR at Municipal Level: Data Analytics

An analysis of individual residential properties within municipalities using the ENVISION tool provides the starting point for assessing where there is potential for precinct-scale redevelopment. Speculative developers would use the software's basic 'market assessment' RPI outputs to identify properties where value is largely in the land and business-as-usual, small-lot-subdivision redevelopment is prospective.

Municipal planners, however, require a broader analysis that can encompass additional local area redevelopment issues that address area regeneration and community benefit—what we have termed *additionalities*—that can be delivered as part of a GPR project. They cover the list of precinct-regeneration objectives in Table 7.1. ENVISION also enables *multi-criteria analysis* of property redevelopment potential in a municipality that can incorporate many of these objectives, providing an evidence base for change in municipal land use, transport, and housing strategies that are both near-term and long-term in nature. By switching specific property and area attributes on or off, ENVISION highlights locations where there is a cluster of properties with high redevelopment potential *and* neighbourhood features that support higher-density development (such as proximity to public transport, shops, and schools) as well as well as potential for landscape redesign and activation from various perspectives (e.g., flood mitigation, urban greening, or more-walkable streets). Figure 7.3 shows very clearly why the rather dominant blue of the solely market-based RPI becomes a series of stronger colours; indicating why municipal issues are so important to incorporate as well as RPI. Indeed, municipality-initiated or supported GPR is premised on

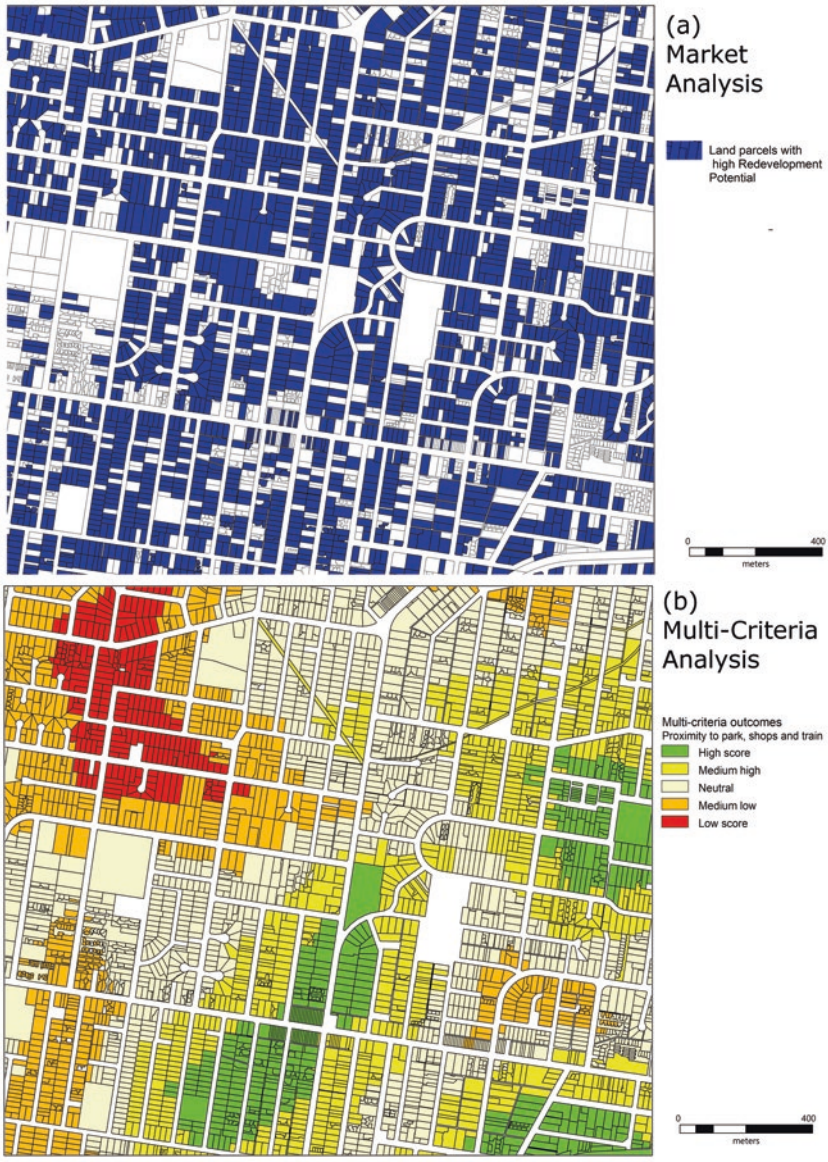


Fig. 7.3 ENVISION analysis of residential redevelopment potential (**a**) and multiple-criteria-assessment of redevelopment context (**b**). (Source: data set derived from more than 20 Victorian Government data sets)

achieving additionality and common-good outcomes for the local community as well as increased housing supply.

Identifying and agreeing on the *best* of the candidate sites requires judgements that are political as well as technical; thus, a final set of steps is needed. Obtaining broad stakeholder involvement is how good politicians and their technical advisers find the best way through a range of options. Below are the steps taken with the selected stakeholder groups to choose specific areas within the municipality.

2.4 Identify GPR Precincts for Rezoning: Municipal-Community-State Government Engagement

Data on residential redevelopment potential alone are unlikely to gain municipal support for a GPR rezoning. Rather, the various arms of municipal government need to be engaged, so that the full range of government, community, practitioner, and political stakeholders can have input to the process. This tiered and multi-faceted method incorporates a plurality of voices in the co-creation of outcomes. Outlined below is the process pioneered in the City of Maroondah:

- *Local government officers*: A whole-of-organisation working group was established across all relevant sections of the municipality, including engineering, parking, planning, community engagement, and open-space and asset management, to consider ENVISION analyses within the context of municipal-development priorities and policies. A set of workshops between these groups identified places within the municipality that had current or emerging challenges and where precinct-scale regeneration was a desirable intervention. An output from these workshops was a map of potential GPR precincts, each with its prospective precinct additionality. In the City of Maroondah, key additionalities sought for the candidate precincts were flood mitigation, enhanced walkability, and green space, in addition to medium-density housing redevelopment. Municipal officers and consultants undertook scoping studies for each issue.

- *Community engagement*: On advice from community-engagement officers, a validation exercise was initiated with community representatives selected from a range of local issues-based groups in response to a call for an expression of interest. This led to a parallel process with a community advisory group of 20 members whose role was to identify priority areas for future redevelopment/revitalisation.
- *Municipal sign-off*: The selection of priority precincts for piloting GPR was a strategic and political decision made by the director of planning, taking into consideration the level of support at community and councillor levels. Figure 7.4 shows the first pilot precinct identified, comprising approximately 200 mostly greyfield houses, and its key additionality objectives.
- *Municipal-state government engagement for statutory planning change*: To deliver greater housing yields and development additionalities, precinct-scale regeneration requires adapting existing planning instruments and legislation so that property owners and developers have clarity about their rights and obligations, and that the additionality incorporated into specific redevelopment proposals can be effectively governed and enforced. Methodologically, this stage of research involved three phases: first, to ascertain what degree of statutory change was viable for an existing residential zone and the proposed future form of redevelopment; second, to iterate prospective planning changes with urban designers, municipal planners, and domain experts (lawyers, engineers, and quantity surveyors); and third, to iterate and agree on the acceptable form of the statutory change with state planning authorities. The initial set of methods to promote lot amalgamation juggled a 'carrot or stick' approach by considering:
  - Restricting single-lot redevelopment through increasing setbacks and minimum lot sizes.
  - Controlling development through consistency with an incorporated plan, effectively enforcing amalgamation to deliver medium density.
  - Simplifying the development process for integrated (amalgamated) projects, thus rewarding developers with faster approval times.

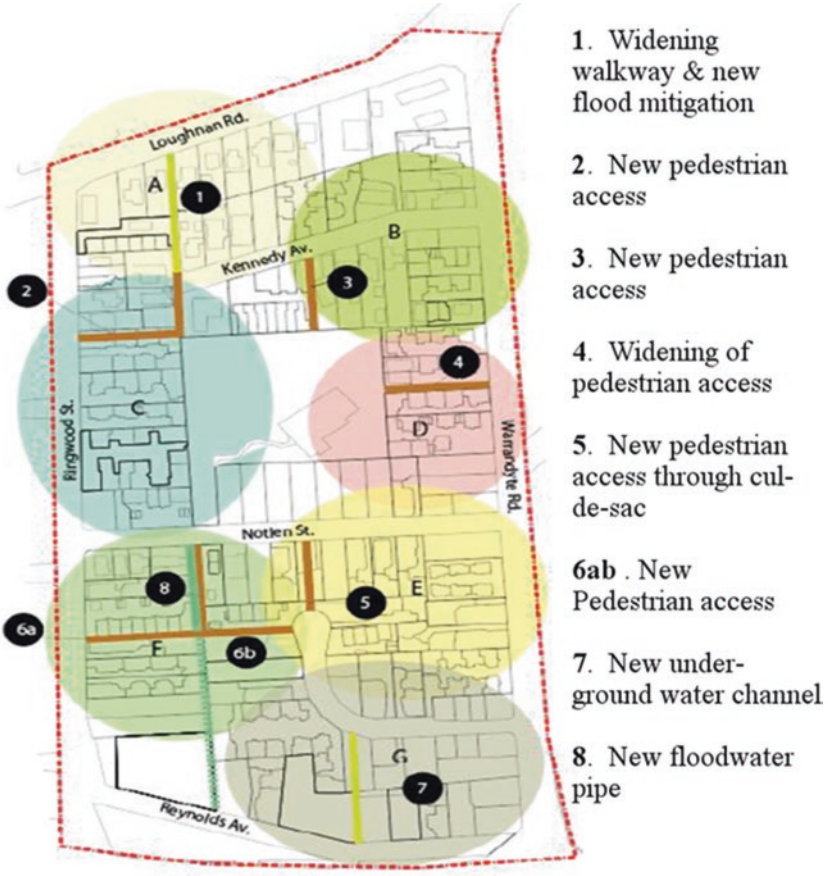


Fig. 7.4 Priority precinct for GPR process implementation with identified redevelopment additionalities. (Source: https://yoursay.maroondah.vic.gov.au/c134maro-ringwood, Retrieved 2 March 2021)

- Applying development contributions to fund precinct additionality.
- Setting out Neighbourhood Character objectives that promote *future character* associated with precinct-scale medium density.

The set of potential planning tools included:

- A software toolkit for precinct design assessment that can be used by urban-design practitioners as well as municipal planning officers in the Development Assessment process to quantify the performance/additionality delivered by a specific GPR project (Newton & Taylor, 2019; CRCWSC, 2021). Chapter 8 explores prospects for an automated Precinct Information Modelling tool and a digital platform for integrated modelling, experimentation, and decision-making capable of accelerating and mainstreaming the precinct design and assessment process.
- A Design and Development Overlay: Where specific forms of development (single-lot subdivision) are not supported, but new forms of development (medium density requiring lot amalgamation) are supported in the schedule to the overlay.
- An Incorporated Plan Overlay or Development Plan Overlay, where a built form that achieves the outcomes of the overlay is exempt from notice (advertising), objection, and third-party review; again rewarding the developer if the outcomes are appropriate. Incorporated Plan Overlays are based on plans provided by developers to suit the context; Development Plan Overlays are based on municipal plans.
- A Neighbourhood Character Overlay: Where the future preferred form is defined in a schedule to the overlay. This effectively works like a Heritage Overlay in reverse, and focuses on the *future* character.
- Public Acquisition Overlay: Where land is compulsorily acquired for public benefit. This overlay is rarely used due to the significant public backlash it generally creates.
- Developer Contribution Plan Overlay: Sets out requirements to pay contributions towards specified infrastructure; it needs to be developed concurrently with a plan incorporated into the planning scheme.

2.5 Establish Normal Planning Processes for GPR Precincts: Municipal-State Government Processes

Workshops with state and local government planners identified three main topics that a new planning scheme needed to address for GPR to proceed: precinct and housing design, precinct additionality, and the cost

of governance and infrastructure. These factors guided the creation of new statutory outcomes through a Development Plan Overlay, combined with a Developer Contribution Plan Overlay necessary to capture a proportion of development/project value to be used on fulfilling 'off-site' precinct additionality work (Fig. 7.5 provides a workflow diagram of this process).

A precinct plan that incorporated dwelling design and precinct additionality elements was rendered as a visual plan for the overlay. The schedule of the overlay (the text defining the rules and obligations) was then drafted to enshrine the preferred types of development. The design guides and other relevant information were placed into the scheme as

Fig. 7.5 Key processes for GPR land-use amendment

incorporated documents and reference documents. The package of all documents was drafted within the (state government-provided) planning-provisions template and presented to the state planning authority to be considered as an amendment to the Municipal Planning Scheme.

Together these documents covered the explicit outcomes developers must deliver to comply with the desired planning outcomes. Should developers comply with the code, and if lot amalgamation were to occur, one additional storey was provided (on lots over 2000 m^2; enabling the development of four-storey buildings to a height of 14 m), and third-party objections were removed. The removal of third parties' rights to object was granted since residents had been engaged and had had the opportunity to object during the advertising process of the new overlay. Objections after its passing were therefore considered invalid. These documents have been submitted to the public exhibition phase of the Victorian government's planning amendment process (represented in Fig. 7.6) and titled Amendments C134-Maroondah, C136-Maroondah. At the time of writing, these Amendments have satisfied all municipal and state planning assessments by the Victorian Planning Panels and have been approved for ministerial signing (Planning Panels Victoria, 2021; again, see Figure 7.5). The Victorian Planning Authority and the City of Maroondah are collaborating to develop a business model for the GPR scheme and an appropriate model of governance, final steps in the precinct regeneration process in order to mainstream and scale up.

This section has set out the planning processes that are needed to accomplish greyfield precinct regeneration. They may appear complicated, but a novel planning solution requires testing to ensure it doesn't fail for lack of forethought or process. However, once the pilot is underway and begins being mainstreamed, the process is expected to become much simpler, as all necessary steps will be known and understood among stakeholder groups (as occurred with brownfield regeneration after the Building Better Cities program). Technical and community stakeholders as well as developers will acquire a sense of trust and confidence in the planning system.

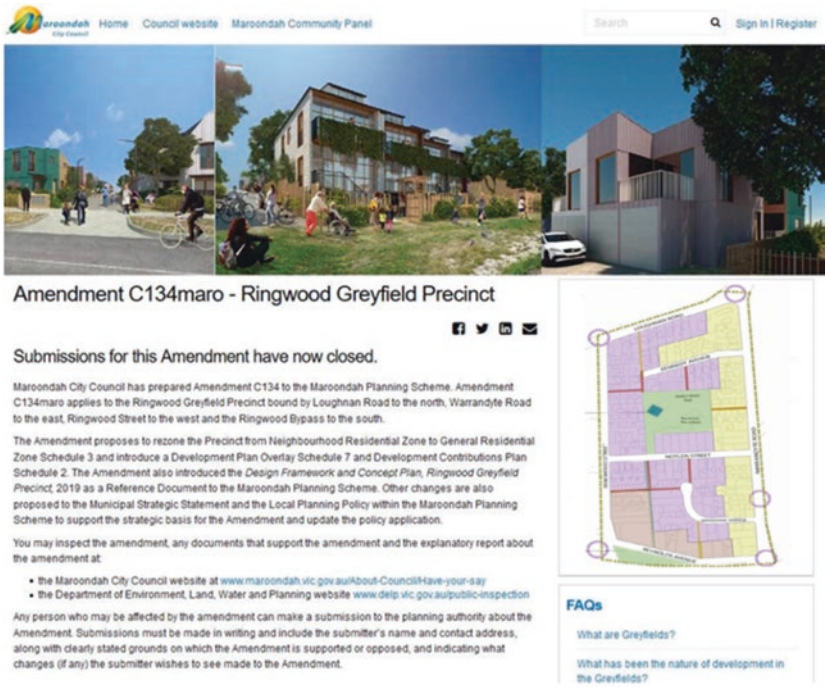


Fig. 7.6 City of Maroondah website for Amendment C134. (Source: https://your-say.maroondah.vic.gov.au/c134maro-ringwood. Retrieved 2 March 2021)

3 Design for Greyfield Precinct Regeneration

In Chap. 1 it was claimed that GPR was not failing for lack of *design* innovation. On the contrary, many architects and urban designers and state government architect offices have illustrated what is possible in precinct-scale redevelopment (https://www.epw.qld.gov.au/about/initiatives/density-diversity-competition; https://www.governmentarchitect.nsw.gov.au/projects/missing-middle-design-competition). However, to date, *planning* had not been able to initiate such precinct-scale design-led initiatives in greyfields. This book, and in particular this chapter, has shown that planning can be unblocked to enable GPR projects. The

chapter now turns to the key design principles for the place-activated GPR design principles and concepts that guided the City of Maroondah project.

The key precinct design principles and objectives outlined in Table 7.1 include attributes of liveability, sustainability, and climate-change resilience, most of which are deficient in state and local governments' current statutory urban-development assessment principles and practices. The following sections outline key steps in this process related to development of dwelling typologies and street typologies appropriate to regenerative precinct redevelopment in low-density greyfield suburbs. Design guides (examples are available at www.greyfields.com.au/documents) will also be required as an incorporated document in any amended local planning scheme and specific development overlays designed to provide the basis for a legislated design-based assessment instrument for any proposed new GPR projects.

3.1 Dwelling Typologies

Medium-density housing is the target for GPR, as it represents the most appropriate 'fit' for a sustainability transition in low-density urban fabrics in the Australian context (outside of activity centres and major transport corridors that have been zoned for higher-density apartment development). The high demand for well-located medium-density housing was illustrated in Chap. 6.

To address the context of the locality, as well as to test the performance of selected housing designs, a set of medium-density dwelling typologies were developed, where the boundaries of statutory planning regimes, building codes, environmental performance, financial feasibility, and community acceptance could be tested. Figure 7.7 illustrates a selection of designs developed for this study, and Table 7.3 lists their attributes. These designs represented a set of dwellings that could be included in candidate GPR projects at sketch level for purposes of visualisation (e.g., 'fit' with neighbourhood), as well as performance assessment against a set of precinct design principles and objectives.

Candidate precincts ranged from single-lot subdivisions to four lot-amalgamation developments, featuring residential densities up to 200

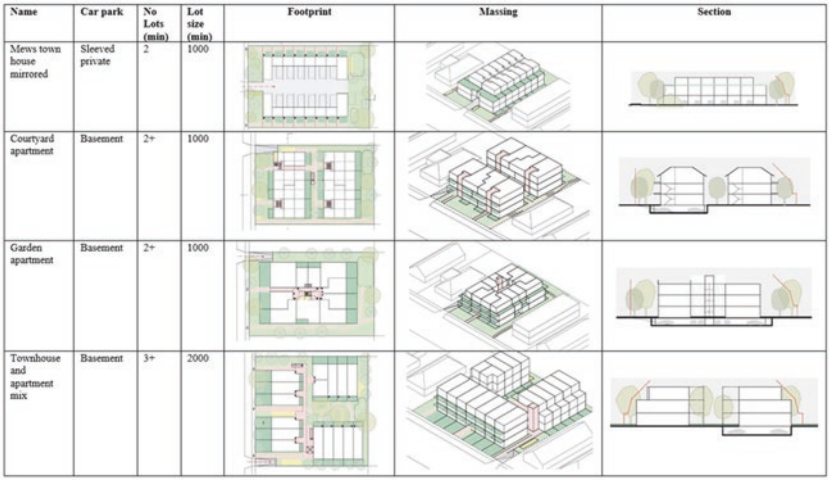


Fig. 7.7 Multi-lot dwelling typologies. (Source: Newton et al., 2020)

dwellings per hectare. They were all scalable to more lots and precinct sizes. Opportunities for underground parking increased as developable lot sizes increased, making underground parking an option. In all cases, the following attributes were included: lot-coverage remained at roughly 50% of hard-surface coverage area; underground parking was planned to ensure space for deep-root canopy trees; public and private space was provided for all typologies; and all walkable surfaces were semi-permeable. Most typologies had a range of unit types, all of which were above industry standard in terms of floor-area requirements. All typologies were assessed against statutory regimes and passed existing regulations for the General Residential Zone. This provided a focus for the GPR overlay zoning where a transition from Neighbourhood Residential Zone to General Residential Zone was proposed as a minimum shift in building and planning controls.

Each state's planning provisions contains residential zones that provide for a range of intensities of development outcomes. Though the names and legislative underpinnings vary, they can largely be referred to as 'no-go' (highly restricted redevelopment), 'slow-go' (limited redevelopment), and 'go-go' (large-scale redevelopment), which are described for all capital cities in Table 1.1. Application of specific zones sets the built-form

Table 7.3 Attributes of dwelling typologies selected for GPR

Typology	Mews	Courtyard	Garden apartment	Townhouse-apartment mix
Site area (m^2)	1350	1350	1350	2070
N. lots	2	2	2	3
N. dwellings	16	24	26	32
N. car parks	12	22	30	37
Density (d/ha)	118.5	177.8	192.6	154.6
Floor area ratio	1	0.8	0.8	0.9
Dwelling footprint (m^2)	700	658	699	1007
Open space (m^2)	650	692	651	1063
* Private	146	176	171	405
* Common	418	427	480	494
* As balcony	168	128	220	316
* Driveway	178	27	27	27
* Semi-permeable	74	124	63	291
Front setback (m)	5.5	7	7.5	6
Side setback (m)	3.8	2.4	4.3	3
Rear setback (m)	7	7	9	2.8
Site coverage	52%	49%	52%	49%
Hard surface	10%	2%	2%	1%
Soft landscaped	42%	45%	48%	43%
Semi permeable	5%	9%	5%	14%
Communal open space	31%	32%	36%	24%
Private open space	11%	13%	13%	20%
Dwelling size (m^2)	60 (1BR) 102 (2BR)	75(2BR)	43(1BR) 66 (2BR)	50 (1BR) 100(2BR) 145 (3BR)
Dwelling mix	12 × 2BR 4 × 1 BR	ALL 2BR	16 × 2BR 14 × 1BR	6 × 3BR 22 × 1 BR 4 × 2BR
Semi-permeable open space / dwelling (m^2)	37	16	12	15
Semi-permeable open space / dwelling (m^2)	37	30	30	35
N. trees	12	12	15	22

and regeneration outcomes, and by altering the zone it is possible to alter expected outcomes. Furthermore, and if there is capacity in the precinct, rezoning could also be written to incorporate precinct-specific additionalities.

3.2 Street Typologies and Activation

Given the significant loss of private green space associated with current patterns of greyfields development, there is increased pressure on streetscapes to perform many of the functions traditionally part of the residential lot: activation for recreation and play, providing space for more biodiversity, canopy trees, flood-water mitigation, and provision for parking. In automobile-dependent suburbs, more land is typically devoted to roads and parking than housing (Litman, 2018), and more road space is dedicated to motorised transport than to pedestrian and cycling modes, even in the Netherlands (Nello-Deakin, 2019). A recent study in Melbourne has also revealed that more than one-third of public green space is road verge (Marshall et al., 2019). Place-activated GPR should afford a significant redistribution of street space (see Murray et al., 2015).

Street typologies were created for the Maroondah pilot precincts to optimise redevelopment options for two of Council's additionality targets: retention of green space (especially canopy trees) and flood mitigation. Design focus was on also on enhancing connectivity and safety on the street to promote streetscape activation simultaneously with precinct regeneration; and to increase the amenity of the streets by altering traffic flow and parking. Figure 7.8 presents a range of scenarios, each of which increases the sustainability metrics of the streetscape (Table 7.4). The scenarios, all of which were verified by municipal engineers and statutory planners for compliance, include:

1. Existing road alignment retained, 4x bio-swales on southern verge to width of parallel parking bays
2. Existing road alignment retained, 1.5 m footpath on southern verge, 4x bio-swales southern side to width of parallel parking bays
3. Road and turning head realignment, 5.5 m roadway, T-junction head, 1.5 m footpath at front of kerb, bioswales along full-length southern verge and indented to parallel parking northern verge
4. As above with footpath at *rear* of kerb

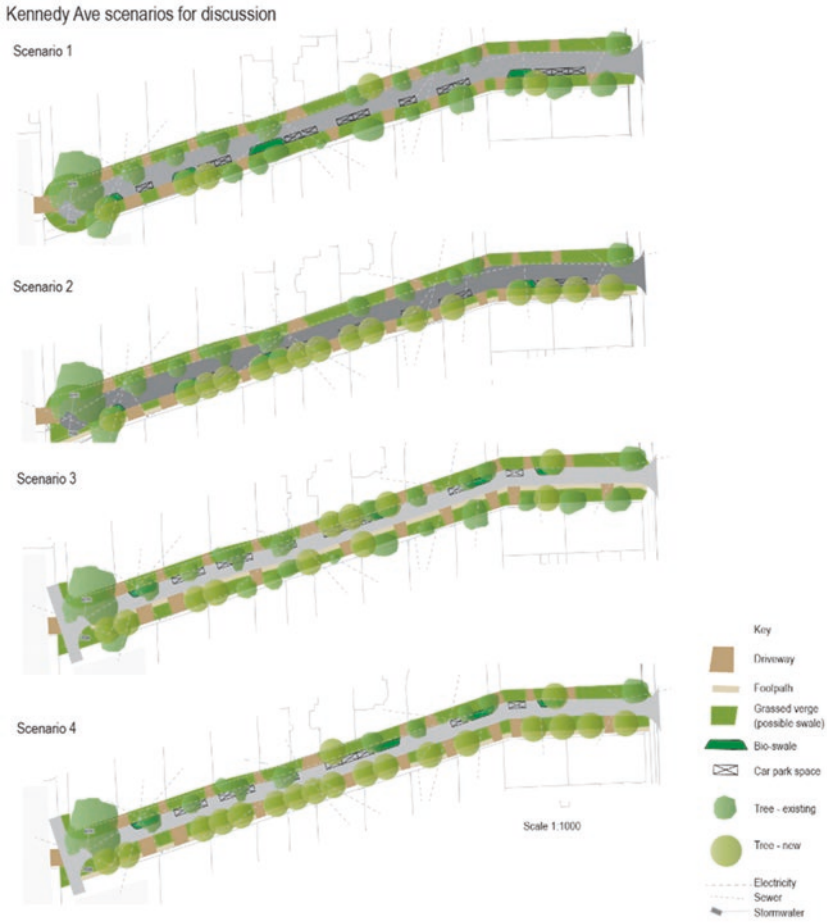


Fig. 7.8 Streetscape redesign options. (Source: Maroondah City Council internal discussion paper)

These interventions show that canopy can be increased from the existing 36.5% coverage to between 45% and 56.2%, and the STORM (Melbourne Water, 2020) rating can be improved from 0% to 107%, indicating that the bioswales and permeable surfaces achieve a 100% STORM rating. They also indicate a 45% reduction in the typical annual load of total nitrogen and thus achieved target water-quality objectives.

Table 7.4 Outcomes of streetscape redesign scenarios

Scenario	Road (m^2)	Path (m^2)	Nature strip (m^2)			Driveway (m^2)	Tree canopy (m^2)	Existing trees remaining	Existing trees removed	New trees	Canopy coverage (%)	Parking bays	STORM rating
			Grass	Swale	Total								
Existing	1381	0	1302	0	1302	273	1100	21	0	0	36.5	0	0
1	1321	0	1302	66	1367	320	1384	21	0	5	46	12	107%
2	1324	249	1054	66	1120	320	1620	10	10	16	53.8	12	93%
3	1174	223	583	670	1310	360	1725	19	3	11	56.2	10	107%
4	1174	239	583	658	1297	360	1710	10	14	18	55.7	10	107%

Source: Maroondah City Council internal discussion paper

4 Precinct Design Assessment Tools

To establish the level of additionality arising from a redevelopment project requires formal quantitative assessment across key performance areas. There is currently a deficit of accessible precinct assessment tools for the urban-design professions (practitioners as well as those in local government; Newton, 2019); although, there is an emerging set of instruments from research groups that can be applied to this process (Newton & Taylor, 2019).

A number of these, including CSIRO's latest NatHERS tool for assessing operating energy efficiency (www.nathers.gov.au) and CRC for Water Sensitive Cities' Urban Infill tool (Renouf et al., 2019) for assessing nature-based performance in areas such as rainwater capture, stormwater runoff, and evapotranspiration, were applied to the GPR pilot precinct in the City of Maroondah. Figure 7.9 shows the precinct identified by the City of Maroondah for GPR development, with the sub-precinct identified for performance assessment highlighted. The assessment examined three scenarios. The first assessed the 'existing' housing built mostly before 1970; all with high redevelopment potential but poor physical and

Fig. 7.9 GPR precinct in the City of Maroondah with representative housing typologies; sub-precinct for assessment highlighted

environmental attributes. The second reflects outcomes if business-as-usual housing redevelopment occurs at a rate of 2.3:1 (reflecting current knock-down-rebuild averages in the surrounding suburb). The third—GPR—illustrates the outcomes of precinct-scale redevelopment that employs the typology 'Townhouse and apartment mix' (illustrated in a plan view of the redevelopment in Fig. 7.9).

Performance assessment was undertaken for the key domains listed in Table 7.5. The benefits of precinct regeneration reported here focus primarily on the immediate built-form innovations possible in the sub-precinct under existing building and planning regulations:

Table 7.5 Precinct performance assessment across three development scenarios

	Scenario		
	1. Existing housing	2. Business-as-usual (knock-down-rebuild) redevelopment	3. Regenerative precinct redevelopment (existing regulations)
Area of [sub] precinct (m^2)	7472	7472	7472
Dwelling outcomes			
Number of units			
1 bedroom	0	0	8
2 bedroom	0	10	20
3 bedroom	11	15	20
Density (dwg/ha)	15	33	64
Estimated population	33	60	108
Total precinct building footprint (m^2)	2291	3179	3138
Roof (% of site)	31	43	42
Conditioned area of all dwellings (m^2)	2291	3179	7512
Open space			
Non-permeable hard surfaces (m^2)[a]	3884	5195	3587
Garden (m^2)[a]	3520	2277	3885
Non-permeable hard surfaces (%)[a]	52	70	48
Garden (%)	48	30	52
Trees			
Canopy m^2 [b]	2011	886	2242

(*continued*)

Table 7.5 (continued)

	Scenario		
	1. Existing housing	2. Business-as-usual (knock-down-rebuild) redevelopment	3. Regenerative precinct redevelopment (existing regulations)
Canopy % of precinct[b]	27	12	30
Parking (onsite)			
Above ground (n)	22	50	0
Below ground (n)	0	0	56
Total (m^2)	440	1000	1120
Above ground (m^2)	440	1000	0
Financials (total dwellings)			
Sales value ($000)[c]	900	2250	3600
Value uplift ($000)[c]	0	1350	2700
Value uplift (%)[c]	0	150 (approx.)	300 (approx.)
Energy			
Star rating[d]	1.85	6	8
Total (MJ/m^2)	469	125	57
Heating (MJ/m^2)	281	75	36
Cooling (MJ/m^2)	188	50	21
Water			
Runoff (ML/yr)	1.78	2.44	1.63
Evapotranspiration (ML/yr)	2.28	1.66	2.43
Infiltration (ML/yr)	0.15	0.9	0.16

Source: Newton et al. (2020)

[a]Taken from geospatial analysis of CAD drawings and aerial photos

[b]Taken from geospatial analysis of CAD drawings, aerial photos, and representative subdivisions locally for business-as-usual modelling

[c]Methodology based on sales values only. Full costings and methods are available in Planning Panels Victoria (2021)

[d]Based on consultant's modelling and averaging all dwellings in multi-unit sub-precinct to eight-star, using NatHERS for Climate Zone 62, Moorabbin, in https://www.nathers.gov.au/sites/default/files/2019-10/NatHERS%20Star%20bands.pdf

- Housing diversity: Precincts have the capacity to deliver a greater variety of housing options, including size, layout, orientation, and price points.
- Compactness: The outcome of good precinct design reveals an almost doubling of the densities that can be achieved compared to business-as-usual. This supports the compact city agenda.
- Building footprint and permeability: The precinct footprint is roughly the same as business-as-usual, but due to optimised design can retain almost half the site area as permeable, as opposed to 30% for business-as-usual. This leads to one-third less stormwater runoff, 80% more rainwater infiltration, and 30% higher evapotranspiration rates, reflecting an enhanced vegetation cover compared to business-as-usual development—a positive contribution to neighbourhood microclimate and climate-change adaptation.
- Energy: The existing housing was estimated to have an operating energy rating of 1.8 stars (Sustainability Victoria 2014), which equates to an average annual energy consumption of approximately 469 MJ/m^2. New dwellings are required to perform to currently mandated (business-as-usual) six-star ratings (approximately 125 MJ/m^2 in Melbourne's climate). GPR precinct dwellings were designed to an eight-star energy rating (54 MJ/m^2 per year, which can probably be met with the electricity produced from solar panels, depending on household energy-use practices). Inclusion of 2 kW solar photovoltaic power per dwelling (generating 2715 kW of electricity per year) provides the pathway to carbon-neutral performance for a household (Newton & Tucker, 2010, 2011).
- Financials: Including the developer contribution plan for precinct additionalities, the additional densities arising from more-effective massing show that precinct value uplift is roughly double that of business-as-usual development (based on sales values), producing a return on investment of at least 20%, based on a yield approximately double that of business-as-usual. An overview of the methodology can be found at https://greyfields.com.au/documents/.

5 Stakeholder Engagement

While the successful outcome of the GPR project rests on the willingness of landowners to embrace the scheme, and thus will require significant engagement, there are also legislative requirements to accommodate prior to land-use change, and political risk-mitigation requirements to ensure that residents are socialised and supportive during the change. Some key steps and principles in the final stages of a place-activated GPR process are discussed in the following sections.

5.1 Legislative Engagement and Political Risk-Mitigation

Contemporary turns in planning have seen community engagement gain prominence as a critical aspect of governance (Aulich, 2009). Aside from reducing community opposition, good engagement practice increases sense of belonging and civic pride (Lawson & Kearns, 2010), as well as improving the quality of urban planning projects (Jarvis et al., 2012; McAfee, 2013). However, it has been shown to be poorly implemented in Australia (Kelly, 2010). This and other criticisms of engagement practices have seen the recently changed Victorian Local Government Act set community engagement as one of its key reforms. This Act ensures that engagement, at a level that experts (e.g., IAP2, 2019) have deemed more than just information provision, be a central aspect of all local government decision-making. Compliance with legislation prior to statutory change, including providing proof of community support to councillors, required the following engagement activities by the *Greening the Greyfields* team formed at the City of Maroondah:

- A municipally approved communications strategy
- *Greening the Greyfields* personnel at all municipal events; ten events over two years, talking to more than 4000 residents, enabling a vote on the concept's value, and broadly socialising greyfield precincts within the local community

- Web presence on municipal website; an information and voting page for residents
- Co-creation of design typologies; precinct additionality discussion and communication with a community advisory group
- Developer outreach to socialise the process to builders and developers locally

As well as adhering to the engagement tenets of the Act, these activities, and the resulting data in the form of community voting, written comments, and engagement metrics, satisfied both municipal management and councillors that the community supported the project.

5.2 Landowner Engagement in Pilot Precincts

Those engagements just described are principally related to satisfying government business logics rather than the true intent of community engagement: empowering citizens to take greater control of the governance associated with their local areas. A more 'grass-roots' style engagement, aimed explicitly at landowners in pilot precincts, took the form of what were termed 'town hall' and 'kitchen table' engagement activities.

Town hall engagement involved hosting publicly advertised open-house events in municipal buildings close to, or within, the pilot precincts; the aims being to ensure that residents knew about the proposed changes to the local planning scheme and to answer any questions residents had about the changes. Each open-house event ran over two days and contained an interactive map of the precinct and the planned additionalities, computer-rendered urban design illustrations of the precinct (pre- and post-development), a voting system for support or opposition to the system, and technical information sheets for dissemination. All landowners within and abutting the precinct were sent written invitations to the open-house sessions two weeks prior. Approximately half attended.

Kitchen table engagement occurs when residents are interested in the process and want to have a discussion with neighbours, municipal officers, and developers about their options. The aim of these meetings in this project was to work towards consolidating lots that represent a

mutually beneficial outcome. The complexities and legalities of land amalgamation, combined with the ethical limits of applied research, meant that, at this point, academic control of the research project ceased, and it became a business process managed by industry professionals. However, to ensure the process had an ongoing engagement methodology (the components of which are illustrated in Fig. 7.10), a set of three playbooks was drafted to be used variously by landowners (to begin the process of land assembly with neighbours), developers (to define the product and its concessions and obligations), and municipalities (to achieve the same outcomes without researcher involvement—effectively the full *Greening the Greyfields* methodology). The playbook for landowners covered issues such as:

Fig. 7.10 Overview of the dimensions of landowner engagement required for lot consolidation and to instantiate GPR as a planning regime. (Source: Newton et al., 2020)

- Municipal strategic planning objectives: Short-, medium-, and long-term objectives for change in particular neighbourhoods.
- Land-assembly proposal: Neighbourhood-specific, with a narrative illustrating the range of potential development outcomes and their benefits, including coordinated single sales, staggered sales, joint sales, land assembly and sale, land assembly with planning approval, or development.
- Legal arrangements: Range of group organisation options, including non-binding memorandum of understanding, partnership, landowners' cooperative/trust, developer joint venture, and incorporation.
- Brokering: Who will be managing each aspect of the process, including the landowner negotiations, planning, consolidation, and sales.
- Design and planning: Key steps if property owners want to consider more than selling land; for example, co-design and co-development.
- Financial feasibility: Increased complexity leads to greater costs, particularly if the landowner group wishes to move into planning and development. Landowners need to understand the costs involved and whether they are able to undertake more than land sale.
- Tax assessment: Before committing themselves to the process, landowners need to understand the tax implications of property sale (and possibly development).

These have been finalised and are available on the *Greening the Greyfields* project website (Greyfields 2020; https://greyfields.com.au).

5.3 Engagement with Developers

Developers were integrated into the engagement work in four areas. The first involved their inclusion in a community advisory group, where precinct location and additionality were debated. Here, developers were simply a voice of the community. The second was during the creation of

the housing typologies and feasibility assessments, where developers provided commentary on dwelling design and reviewed the assumptions related to financial feasibility. The third was at internal (municipal) assessments of draft statutory amendments and, in particular, the developer contribution plans. This aspect was particularly telling, with the key messages being, first, that developers simply wanted to know the rules of the system, after which they would make their own assessments; and second, that the additional cost of the developer contribution (to fund precinct additionality) would easily be offset by either preapproved designs or exempting precinct-scale developments from notification, objection, and third-party review. However, as also indicated by Chandler (2016, p. 1), developers stated that greyfield precinct scale redevelopment was not typical:

> Australia's housing industry has some serious shortcomings that can no longer be avoided…. The capabilities needed to design and build small scaled medium density housing projects of three to 10 dwellings up to three storeys atop below grade parking have yet to be developed. If medium density dwellings of the type described here are to make up a third of the housing landscape, a new marketing platform and delivery model will be required. These will not be offered from the traditional builder display village. New design, procurement and construction skills will be necessary. Only financially viable builders who display a new level of professionalism will be trusted to take on these projects. The industry must shift from its current level of denial of these realities. If governments are seriously minded to harvest the potential of greyfield sites and the urban middle, they will not only need to bring the community along in support of these more modest densification initiatives, they will need to be proactive in making sure the housing industry has the capabilities to deliver them. This is a challenge for the housing industry. It is not a market that general contractors understand or have an aptitude for. This is an opportunity for the first movers in this space to realise the potential of adapting their old project housing delivery model into a modern version of 'build to order' multi-unit. (Chandler, 2016, p. 1)

The GPR development arena needs a range of interventions at the builder/developer level. As outlined by Chandler (2016), the next set of issues to overcome is for the industry to up-skill into this new market.

6 Conclusion

GPR faces multiple barriers to entry that necessitate new process interventions such as those that have been outlined in this chapter:

- Locating prospective regeneration precincts in collaboration with local government and situating them in municipal strategic plans and housing strategies (i.e., 'where')
- Creating innovative medium-density dwelling designs appropriate to higher-density precinct living in the middle greyfield suburbs that can deliver significant additionality beyond small-lot subdivision: regenerative redevelopment and a new urban fabric more aligned to urbanising suburban landscapes (i.e., 'what')
- Making GPR less risky from state and local government, developer and property owner perspectives via a set of development overlays and design guidelines that can deliver appropriate regenerative redevelopment through new partnerships and processes (i.e., 'how')

All Australian planning agencies are committed to public-good goals established for Australian cities: sustainable, liveable, inclusive, resilient, and productive. However, there is a significant lack of attention to trying new ways of delivering such challenging goals. A set of GPR planning concepts, strategies, and practices have been set out in this chapter and a trial has begun in one municipality in Melbourne. A greater commitment to greening the greyfields is required through demonstration projects like the one in the City of Maroondah to increase the experience of how to transform greyfields on a precinct basis. There is currently a lack of the transformative capacity in state and local governments needed for the

delivery of new models of urban transport and housing development such as place-activated and transit-activated GPR. The final chapter further explores GPR transition processes to drive change.

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8

Integrating Transition Processes for Regenerating the Greyfields

1 Introduction

There is currently a deficit in urban planning associated with the future development of greyfields. Strategies designed to encourage the transition to more-compact cities by directing development and population inwards and upwards rather than outwards are not performing as expected. Brownfield development has accelerated, as reflected in the growth of inner-city apartments. However, new housing development in greyfields is underperforming. Higher-density housing development in designated activity centres and on transport arterials is lagging. These established planning approaches are necessary strategies but not sufficient, as they are being undermined by statutory planning regulations governing residential redevelopment in greyfield suburbs. Piecemeal and fragmented small-lot subdivision via knock-down-rebuild has become the principal vehicle for housing redevelopment in the established ageing middle suburbs because they are all that the existing planning schemes permit. This sub-optimal model is readily accommodated by developers, especially small contractors, within the existing residential zoning systems that preside over low-density suburbia, providing 1:1 and between 2:1 and 4:1

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redevelopment. Because of these land-use planning policies, most new housing construction continues to be pushed into the poorly serviced peri-urban greenfields despite strategic plans that incorporate initiatives to curb urban sprawl, and despite heavy demand for well-located, higher-density housing, especially in high-amenity suburbs such as greyfields.

This book advocates for the introduction of GPR as the guide to future urban development in the middle suburbs. Two new, linked models of greyfield regenerative urban redevelopment need to be part of the palette of metropolitan planning strategies and statutory processes: place-activated and transit-activated GPR. The process for change needs to begin by recognising the appropriate locations in greyfields areas for intervention (which cover about 40% of most Australian cities) and undertake district greenlining to establish more specific spatial targets for new GPR projects.

The planning principles set out in this book can be summarised as:

- *Halting car-dependent urban sprawl*, with its associated negative economic, social, and environmental impacts through strategic plans promoting the growth and regeneration of 20-minute neighbourhoods in greyfields
- *Replacing the present redevelopment method* set out in planning schemes *that encourages small-lot subdivision or one-for-one redevelopment, and that is no longer functional*
- *Redeveloping at larger scale with GPR projects in* well-located, well-serviced greyfield suburbs where there is high redevelopment potential
- *Using twenty-first-century technologies and net-zero planning processes* to significantly reduce the high ecological footprints associated with carbon emissions, water use, and waste generation
- *Ameliorating local climate-change impacts at the same time* with nature-based solutions involving redesign, greening, and reactivation of local streetscapes and residential precincts

Figure 8.1 shows this combination of key urban planning principles and charts the direction for future sustainable urban development policy and planning.

Achieving these interventions—reshaping, remaking, redeveloping, renewing, retrofitting, regenerating—is challenging and will require new

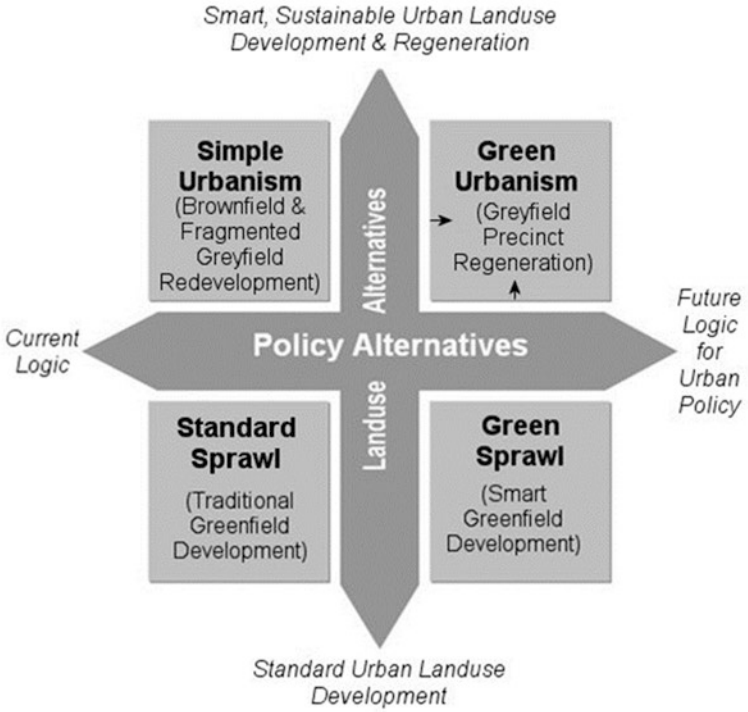

Fig. 8.1 Green urbanism—the planning logic for GPR. (Source: Adapted from Newton et al., 2011 and Newton & Glackin, 2014, including elements of a keynote presentation by P. Schwarz (Global Business Network) on Sustainable and High Growth Cities, World Cities Summit, Singapore, 29 June 2010)

urban land-use planning policies and innovative precinct-scale regenerative urban design processes and regulations, as outlined in the previous chapters. Their transition challenges are highlighted in the following sections.

2 Making the Transition: What Needs to Change

Table 8.1 outlines the 10 Transitions introduced in Chap. 1 with a précis of the innovations required to advance them that are outlined in this book.

Table 8.1 GPR transition challenges and pathways

Transition challenges	Pathways to transition
***Transition 1. Urban fabrics**: retrofitting automobile-dependent suburbs with walking-city and transit-city transport infrastructures at higher levels of residential redevelopment.*	Transit-activated GPR can enable a high-quality transit option along a major road or tram corridor incorporating mixed-use station precincts with walking-city character. Auto-dependent suburbs with high redevelopment potential can use place-activated GPR to recreate neighbourhoods with medium-density housing and more local transport options involving new-technology electric shuttles, scooters, and bikes to link to nearby activity centres, and to trains and trams.
***Transition 2. Urban forms**: increasing provision for medium-density housing in established greyfield suburbs, employing innovative transit-activated and place-activated GPR redevelopment models at precinct scale.*	Standard planning approaches will not work until strategic district greenlining of urban districts becomes the spatial framework for transit-activated and/or place-activated GPR projects; in other words, until the density, mixed-use, and infrastructure requirements and regulations are changed to create precinct-scale regenerative redevelopment opportunities at medium density.
***Transition 3: Urban spatial structures**: developing a metropolitan plan for more-compact twenty-first-century cities, which are capable of delivering sustainable urban development that is productive, resilient, liveable, and inclusive.*	Planning priorities at all three levels of government need to focus on greyfield regeneration for multiple benefits and meeting economic, equity, community, and sustainability goals. A clear metropolitan strategy is needed for each city that identifies the greenlined zones where GPR can be attracted.
***Transition 4: Meshing housing and household life cycles for optimal residential redevelopment**: developing a planning and zoning scheme that supports more agile and forward-looking planning of residential redevelopment in greyfields to enable precinct-scale, medium-density projects yielding more housing, more sustainably.*	New zoning needs to be mandated in designated areas that enable GPR by prescribing minimum lot sizes for infill development (necessitating lot amalgamation) as well as incentivising consolidation among neighbouring property owners. This process can be enabled by district greenlining and partnerships leading to successful transit- or place-activated GPR projects.

(*continued*)

Table 8.1 (continued)

Transition challenges	Pathways to transition
Transition 5: Changing household structures and composition*: fostering a property-development industry capable of matching demand from an increasing diversity of household types and life-cycle stages with supply of more affordable and diverse types of housing.*	Government agencies need to set up more demonstrations with innovative developers who can meet changing demographic demand as well as provide affordable housing in greyfield areas, especially in designated GPR projects. Government can also demonstrate leadership in public housing estate renewal by jointly regenerating housing *and* neighbourhoods. Training programs in planning for greening greyfields will be needed.
Transition 6: Overcoming the problems with sprawl*: smart, sustainable metropolitan development strategies are needed for transformative change to occur at building, precinct, and city levels that can help prevent further car-dependent urban sprawl that continues to erode most elements of sustainability.*	Metropolitan strategic planning needs to establish clear growth boundaries with no incentives for further peri-urban developments, unless connected to public transit; at the same time, metropolitan districts where redevelopment and infrastructure retrofitting is to be focused need to be identified through district greenlining to form a macro-planning context for brownfield and greyfield regenerative precinct development.
Transition 7: Transitioning metropolitan planning strategies linked with urban infill*: this needs to shift from alignment with suboptimal urban redevelopment models and processes built into the current planning system in most redeveloping car-dependent cities and needs reviewing at all planning levels and functions.*	All municipal and state government strategic and statutory planning guidelines that are continuing to be applied in middle suburbs need to be revised so that they no longer give rise to suboptimal, low-quality subdivisions; and guidelines for what can replace them need to be developed and trialled in high-quality GPR demonstrations.

(*continued*)

Table 8.1 (continued)

Transition challenges	Pathways to transition
Transition 8: Overcoming the failure of current urban infill strategies to achieve sustainable redevelopment and targeted housing yields: *most metropolitan planning in the greyfields needs to move on from a constant failure to deliver the kind of housing and transport outcomes that are set in their strategic plans.*	GPR policies and strategies have been developed as a response to this deficit with demonstrations beginning to happen. Building on success will accelerate the transition to GPR and remove the sense of planning failure. The more that community engagement and partnerships are used, the better will be the solutions that are developed for a range of different precincts with different contexts.
Transition 9: Redefining the 'missing middle' in housing and urban redevelopment: *from medium-density housing on small-lot subdivisions to medium-density, precinct-scale regenerative redevelopment.*	All zoning and other statutory regulations that are used to subdivide property in established middle suburbs now need a clear timetable to transition to mandated precinct-scale regenerative developments (transit- and place-activated GPR) guided by a future district greenlining process centred on infrastructure retrofitting, residential densification, and enhanced nature-based services.
Transition 10: Providing a precinct context and focus for all urban planning.	The provision of precinct-scale housing by developers, and precinct-scale technology and infrastructure by all utilities, needs to become the mainstream process in greyfield regeneration, and eventually to move into all other parts of the city.

3 The Need for Partnerships

Fundamental to the processes outlined in Table 8.1 is the need for partnerships. In all GPR projects, whether transit- or place-activated, there will be no precinct-scale land assembly followed by detailed delivery of the necessary land development *unless government, community, and developers are working together*. This was very clear in the Maroondah demonstration project (Chap. 7) and other demonstrations such as WGV

(Chap. 4). Such partnerships need governance frameworks and instruments to enable co-creation of regeneration strategies, plans, and projects.

Figure 8.2 identifies the necessary governance/partnerships space, with key stakeholder groups.

These partnerships all have their specific roles, as identified in Fig. 8.2. GPR projects could start with an initiative from any one of these stakeholders—the three levels of government, innovative businesses,

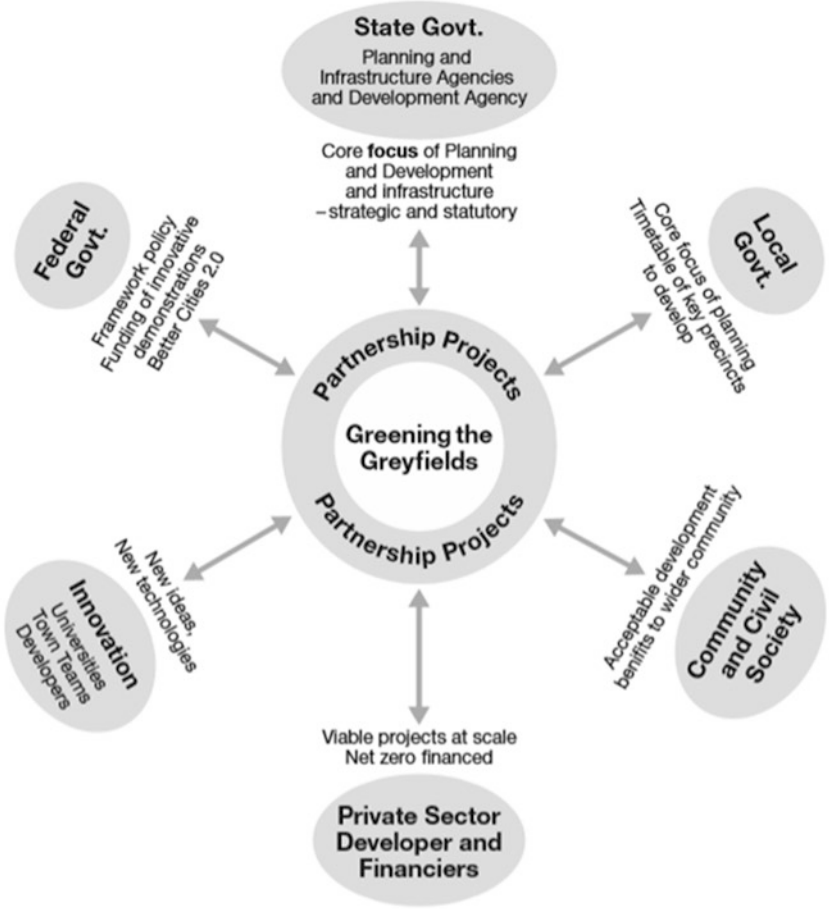

Fig. 8.2 Partnerships needed for GPR

mainstream financiers and developers, and the community. But they will all be needed at some point to accomplish GPR. Engagement and integration are therefore key, and they require partnership governance processes to commence from the moment that a new GPR project is envisaged.

The Building Better Cities Program in the early 1990s in Australia was a federal government program that set up a partnership process and a new model for redeveloping brownfield precincts across all cities. The federal government provided leadership and seed funding and oversaw development of projects involving state and local governments and industry that multiplied the initial seed investment (Neilson, 2008; Sharma & Newman, 2020; Thomson et al., 2017; Newton & Thomson, 2017; Newton, 2018). These pioneering inner-city brownfield regeneration projects had little community involvement, as they were largely on old industrial or abandoned port sites. In today's greyfields it would not be possible to imitate this model without significant community engagement. In greyfields, current top-down planning no longer works effectively; nor does simple bottom-up planning. The required partnership process is not linear; rather, it needs to be seen as a system that can be set in motion from any point but must eventually bring all its facets into a journey that lets them work creatively together.

Some of the key interactions that need partnerships to help deliver GPR are set out below.

3.1 Residents/Community

- Approximately half of all residents located in greyfield suburbs (Chap. 6) revealed a preference for medium-density living in well-located neighbourhoods over a separate house in a car-dependent suburb. However, the other half generally did not want any change to their situation, and without any engagement would be more than likely to establish NIMBY groups.
- The transition from NIMBY to YIMBY requires overcoming the community resistance of homeowners in established low-density suburbs to a more 'urban' future by arguing for a *better* future by demonstrat-

ing the community additionalities to residents in greenlined 'change' areas. Regenerated greyfield precincts need to be places where people *want* to live.

- There is thus a need to make the lot-amalgamation process less risky among neighbours in selected greenlined districts where GPR overlays are being proposed. This will involve innovative forms of engagement in 'town hall' and 'kitchen table' settings with residents as every step of the precinct-regeneration process is co-created.

3.2 Innovators/Urban Designers

- Innovators can be involved in the technology or design side of urban development, and often larger innovative architectural/planning firms are where these new technologies and bolder design concepts are integrated and trialled. Research institutions are also part of this process. However, most greyfield development is currently done by small builders who don't engage architects (less than 5% of all new housing in Australian cities directly involves professional architects). Instead, small builders tend to use the same project-home model for many years. There is a lack of innovation.
- Innovators have a critical role to play in shaping cities in more sustainable and liveable ways. The GPR process should encourage this, perhaps through the procurement process in a formal way; certainly in the early stages they need to inform local governments and communities about what is possible and feasible. In the second quarter of the twenty-first century, there is a dearth of easily accessible and navigable knowledge hubs containing information validated by science and industry for the architecture, engineering, and construction sector.
- Poor design with minimal innovation can begin to be overcome through Medium Density Design Guides and State Government Architect-initiated 'missing middle' design competitions that can raise the sights of developers and the community: https://www.epw.qld.gov.au/about/initiatives/density-diversity-competition.

- Perhaps of more importance is to shift from prescriptive to performance-based building and planning codes for GPR; this enables more innovative design but requires transparent performance assessment, an area currently in deficit (Newton, 2019).

A range of innovative Toolkits exists to assist with precinct performance assessment and visualisation. Many of these have been developed in Australia by the Cooperative Research Centre for Low Carbon Living (Newton & Taylor, 2019) and the Cooperative Research Centre for Water Sensitive Cities (in particular two of their Integrated Research Projects: Water-Sensitive Urban Infill and Economic Evaluation of Nature-Based Services; https://watersensitivecities.org.au/). Next-generation versions of these tools will be integrated within a Precinct Information Modelling framework now emerging (Fig. 8.3; Newton et al., 2018), capable of being employed on national digital collaboration platforms to drive the acceleration and mainstreaming of precinct-scale planning and design (Newton & Frantzeskaki, 2021).

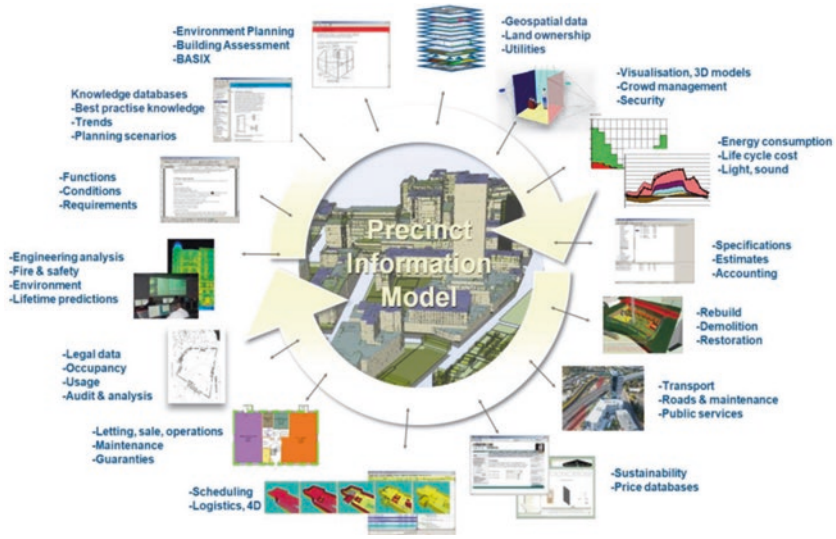

Fig. 8.3 Precinct Information Model—integrating and accelerating the precinct design process. (Source: Plume et al., 2019)

3.3 Urban Developers/Communities and Civil Society

- Developers play a critical role in demonstrating innovation in all aspects of building and construction (including modular construction, selection of more sustainable circular economy materials, and net-zero buildings), as well as implementing precinct design that is attractive to the market and available at different price points. As outlined in Chap. 7, GPR needs a different type of developer to those currently operating in the market (Chandler, 2018). New partnerships will play a role in this process.
- Establishing a new GPR business model for those property developers who do not yet have a GPR mindset is likely to be necessary before GPR will be delivered effectively. This will need to accommodate town-hall and kitchen-table engagement for lot consolidation, co-design and co-development with property owners and local council, and all the other innovations suggested in this book on how to use new technology to deliver more sustainable and affordable twenty-first-century urban environments.
- New groups are being formed, such as Town Teams (https://www.townteammovement.com/), which seek to represent community values in establishing better redevelopment outcomes. Partnerships with such groups and research organisations can provide world best practice to lead partnership discussions that go beyond the industry associations and professional bodies that currently represent developers and builders, and that often settle for business-as-usual outcomes.
- Unsolicited bids for greyfield regeneration in larger precincts, or even whole corridors, along with substantial innovations in local and corridor transport, can be a good solution for some areas where government has not seen the potential for such innovation. Government can still provide incentives for common-good outcomes and use the benefits of partnership to assist with funding in other projects that learn from such innovative partnerships.

3.4 Federal/State/Local Government

- The greyfield redevelopment challenge is common to all major cities in Australia as well as globally. The current deficiencies described in this book do not represent a traditional 'market failure' per se, as there has been a failure on the part of governments at all levels as they shy away from the necessary but challenging urban-planning models and interventions that are the focus of this book. There is a clear planning deficit that requires a response.
- The Australian Constitution established that state and territory governments have principal responsibility for planning and land management whilst delegating most planning delivery to local government. This is the case in most similar jurisdictions across the world. State governments have created specific *authorities* tasked with developing the planning, design, and governance arrangements needed to transform parts of their cities. This has included greenfields (e.g., Growth Area Authorities), brownfields (e.g., Docklands Authority, Barangaroo Authority), and urban land authorities for developing government land. However, no authority or agency has responsibility for greyfield regeneration. This needs to change (Box 8.1).

Box 8.1 Greyfields Precinct Regeneration Authority

In 2020, the Property Council of Australia launched a strategy paper to discuss the principles they considered underpinned successful precincts and how they can be enabled through public- and private-sector strategic planning, policy, partnerships, and engagement (PCA, 2020). The five critical elements included a shared vision and understanding between government and industry about: (1) the need for *a well-resourced precincts authority* to streamline development and foster positive outcomes; (2) the features that enable the delivery of successful precincts; (3) new planning processes that carve out a clearly defined role for precincts as vital infrastructure; (4) the role of the private sector in determining a site's precinct development potential; and (5) the role of government in the timely delivery of vital infrastructure to enable the success of precinct developments. The focus of this paper along with discussions associated with a *Precincts Authority* was large-scale precinct projects such as National Employment and Innovation Clusters. Extensive greyfield precinct redevelopment of a scale that is a

(*continued*)

Box 8.1 (continued)

focus of this book was not in the PCA's scope, being primarily economic-oriented. Planning authorities require a balanced set of objectives: social, community, and environmental as well as economic. Surely it is time that a Greyfields Precinct Regeneration Authority, first advocated a decade ago in the context of greyfield regeneration (Newton et al., 2011), is established that can help create the partnerships necessary to deliver GPR projects.

State governments are also providers of public housing (currently 3–5% of total housing stock), dating back to the mid-twentieth century, when major estate programs were established. This stock has aged and now is primarily in greyfields, and represents a major opportunity for governments to lead by example in initiating precinct-scale housing *and* neighbourhood regeneration. They own all the property, so there is no challenge of consolidating sites. Murray et al. (2013) has documented the deficiencies of private industry's piecemeal redevelopment of individual public-housing properties in response to a federal injection of major GFC funding, and the more recent proposal to sell parcels of public housing property for private-sector redevelopment in a public housing estate renewal program has led to a major government inquiry and remains problematic (Kelly & Porter, 2019). A superior precinct regeneration approach for greyfield public housing estate redevelopment (dwelling plus streetscape redesign) has been established by AHURI (Murray et al., 2015).

- Local governments will always be the first step in the chain of how communities relate to urban development. If GPRs begin to happen through state and federal initiatives or unsolicited bids from developers, local government will need to develop greater capacity for managing development at the precinct scale and guiding the associated local community engagement processes to enable good local outcomes. This highlights the need for a Greyfield Precinct Regeneration Authority capable of assembling the transformative capacity (specialist skills and tools) that can assist with district greenlining as well as key GPR project processes where municipal governments need assistance.

- The Australian federal government has a long history of avoiding responsibility for city planning and development, apart from a short period between 1991 and 1996 when the Deputy Prime Minister established the Building Better Cities programme (Neilson, 2008). There is now a Ministry with responsibility for cities after Prime Minister Malcolm Turnbull 30 years later sought to show leadership in this area—something that has bi-partisan political approval. There is, therefore, an opportunity for the national government to lead a *Better Cities 2.0* Partnership to inject much-needed urban regeneration into the greyfields of Australian cities.

4 Getting Started

A key message in this book is that the goal of achieving green urbanism in greyfields is fundamentally a *problem of planning*, not design, politics, lack of investment, or lack of demand from people looking for better 'living arrangements' (dwelling and location combinations). We are suggesting new ways to do planning that may help. Chapter 7 presented a detailed example of a new GPR planning process in Melbourne. It established a process for engaging the key stakeholders listed in Fig. 8.2 in all the stages required to deliver a GPR project. However, there remains the challenge of achieving a greater level of understanding among stakeholder groups (and especially in the community) to assist with gaining broader political acceptance of planning that enables the greening of the greyfields.

The key concepts of both transit- and place-activated GPR and district greenlining are core to the vision of greyfield regeneration. Mainstreaming what was pioneered in the City of Maroondah is the transformative process that lies ahead.

5 Conclusion

The middle suburban greyfields are in trouble in Australian cities and many other cities around the world. This book has developed the concept of greyfield precinct regeneration with two models for planning and

development, both of which are necessary: transit-activated and place-activated GPR. There are many issues associated with *design* for such precincts that are not new (principles of good precinct design are well established but not yet fully realised in on-the-ground projects), and there are many emerging opportunities resulting from twenty-first-century distributed urban technologies that target the precinct scale, as discussed in this book. There are, however, many *planning* issues that are simply not being addressed, as much of the planning system for greyfields defaults to the delivery of suboptimal small-lot subdivisions that do not halt urban sprawl. They are simply not coping with the demand for new housing and the need for more regenerative redevelopment in greyfields.

A fundamental need is to find a mechanism for stimulating land assembly with the local community within a well-established and accepted strategic planning process so that precinct-scale regenerative redevelopment can be realised instead of single-lot subdivision. District greenlining has been advanced as a necessary strategic planning process that enables the boundaries of larger districts to be identified where retrofitting timetables for next-generation energy, water, waste, transport, and nature-based infrastructures are planned in an integrated manner, providing the spatial context for individual place- and transit-activated GPR projects. This enables the beginning of a process of discussion about the potential for landowners to become positive agents for change and finding better outcomes in such areas, whether that involves selling and leaving or wanting to stay and become a 'partner' in a GPR project. This indicates that *engagement* with local residents to establish win-win partnerships will be the critical step that can unlock the possibilities of greyfield regeneration.

When design, planning, and engagement are integrated into a vision for greening the greyfields, the serious rebuilding of the greyfields can begin. It is a unique twenty-first-century opportunity. Urban regeneration represents the chance to usher in a new restorative economy capable of significant wealth generation and job creation (Cunningham, 2008), as well as a green economy where new technologies and the achievement of goals for sustainable urban development are central to societal progress (Newton & Newman, 2015), setting Australia's cities up for a better future.

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Correction to: The Global Greyfields Transition: Why Urban Redevelopment in Low-Density, Car-Based Middle Suburbs Needs a New Model

Correction to:

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This book was inadvertently published without updating the below correction:

1. Page 17, 1.82 million has been replaced by 660,000.

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