Newburg

Embracing High-density at the Urban Fringe

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Sustainable Urban Development Association (SUDA)

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This document presents the Newburg sustainable city-building concept, the basic principles of which were envisaged some years ago by John Stillich, who was SUDA's Executive Director, and who undertook the research, analysis, formulation, design and documentation contained herein, with additional contributions from the people and organizations mentioned below.

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About SUDA

SUDA is the Sustainable Urban Development Association, a registered Canadian charitable corporation whose mission is to foster a healthy natural environment by providing information about sustainable city-building. Formed in 2005, its activities have included information gathering, processing and dissemination, research, and outreach in the Greater Toronto Area. SUDA is governed by a Board of Directors who work voluntarily to guide the work of the organization. **(Note: As of January 2019, SUDA is an inactive organization. John Stillich, the author of this document, can be reached by telephone at 416 400-0553.)**

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Summary

"Newburg: Embracing High-density at the Urban Fringe" presents an illustrated descriptive example of a practical, pleasant, and family-friendly city-building style suitable for urban areas and small towns that are experiencing population growth. High urban densities and an intensive mixing of uses are essential for environmental protection and the economic sustainability of residents and local business. No suburban municipalities today are close to achieving sustainability.

North American cities and towns will face very serious issues that cannot be addressed using 20th century city-building traditions. The most critical issue is the need to cut greenhouse gas emissions (GHGs) caused by human activity to an almost net zero level. Recent reports by the United Nations Intergovernmental panel on Climate Change (IPCC) and by others warn of dramatic and generally irreversible damage and loss of biological life support systems if GHG emission cuts are not achieved in a very short timeframe. Rapid climate change will affect almost every aspect of daily life (Appendix 1).

The conditions of the 21st century require much more rapid movement towards sustainability in urban development.

20th century land-use practices also eat away the best agricultural lands. Population growth and the risk of lower agricultural productivity from climate destabilization make preserving agricultural lands around cities a requirement for sustainability and well-being.

Newburg is an innovative urban form concept for greenfield development and urban infill that is in many ways environmentally resilient to the dramatic changes that will affect almost every aspect of life. It is economically efficient, fosters social vitality, provides for a high number of jobs within the local

community, and supports energy efficiency. The one square kilometer (.36 sq. mi.) site plan example presented in this document accommodates 9,700 residents and 3,700 jobs in a pleasant and practical matter. If extrapolated to a larger population that includes additional components of a complete city (such as primary industry, universities, hospitals, etc.), the overall density reduces to 10,000 or so residents and jobs per square kilometre, which is still several times less land-consumptive than many of today's typical suburban cities. In some ways, Newburg is modern version of older European towns, where many daily needs are within easy walking distances.

The Newburg example accommodates 10,000 to 13,500 residents and jobs per square kilometer.

The principal characteristics of the Newburg model are:

- An absence of almost all single-storey single-use non-residential buildings, in favour of those that are multi-story and mixed-use;
- Apartment-style residential accommodation as a greater share of all residential units than present in typical suburban communities;
- A significantly reduced number of single detached homes as a percent of all homes, in favour of attached homes (rowhouses) of all sizes, and which have well-sized private backyards;
- Minimal setback requirements for most buildings;
- Shared public parking lots and garages that replace the need for private parking on individual non-residential properties;
- A significantly reduced amount of road space as a percentage of total transportation space, in recognition of higher modal shares for public transit, walking and cycling, and reflective of shorter trip lengths;
- A network of pedestrian lanes that replaces many residential streets;
- More efficient provision and use of public urban parkland;

- The integration of non-residential uses into the community in ways that support active transportation.

The model reflects a rebalancing of the housing mix to reflect overall demographic diversity, affordability issues, and the inadequate housing choices that currently exist in most of today's suburban communities. Apartment buildings in the concept model are generally low-rise and that are suitable for a range of household sizes, as are the model's ground-level homes, almost all of which include well-sized private backyards. Single detached housing is included in small numbers only, due to their relative abundance in adjacent existing communities.

Newburg introduces the pedway, an extensive pedestrian network that replaces streets in front of homes with rear laneways.

The Newburg model's intense mixing of uses enables transportation system requirements to move very significantly away from the use of private automobiles and towards walking, cycling and public transit as principal modes of transportation. It is estimated that a Newburg-style area extended over a multi-kilometer area can reduce the automobile's share of all daily trips by residents to 55% or more.

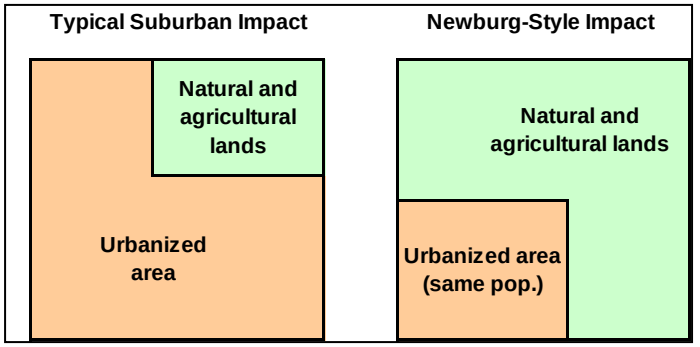
Newburg also introduces the concept of the pedway as a significant design element in residential areas. Where homes have garages facing rear laneways, streets in front of these homes are replaced by 3.5- to 4.5 meter (12- to 14-foot) wide pedways, and small private yards as buffers, creating an interconnected pedestrian environment throughout the Newburg site.

The Newburg model proposes that most non-residential uses, including large and small retail, office and institutional uses, should be blended into the

community rather than separated into large employment zones. Retail and office spaces in the Newburg example are often mixed in multi-storey buildings, many of which are also topped by residential units. This enables many people to access to employment and daily services by walking and by transit, and increases the visibility of small business to the community. Contrary to today's normal suburban development practices, the Newburg model also suggests that small industrial operations can be blended into the community if they meet performance standards for noise, pollution, truck movements, etc. The overall effect is that, in theory, up to 12,000 jobs could be accessed within a one-kilometer radius of a home.

As impacts of rapid climate change increase, an important benefit of the Newburg model is that a great deal more rural and agricultural land is spared compared to traditional development. Additionally, the mix of uses, attached homes, multi-storey construction and renewable power generation can reduce total energy consumption for transportation and indoor climate control by 60% or more, not including additional reductions in fossil fuel consumption from the use of electric-powered motor vehicles (if generated by non-fossil fuels).

The length and strength of the list of advantages of the Newburg style is a compelling argument for change.

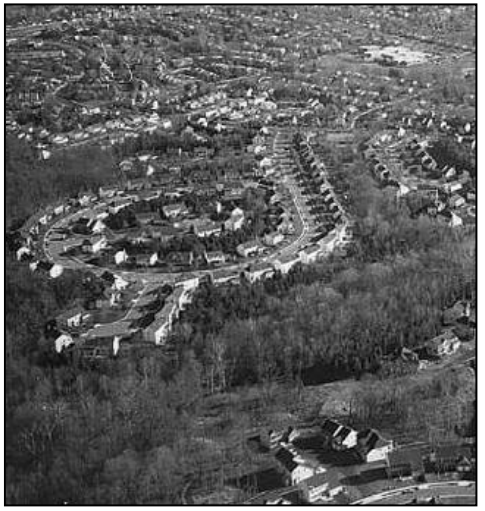


Other features and effects, including alternative development standards, are described in the Newburg document. A list of 51 advantages to households, the economy, the environment and to government is included. Collectively, these multi-faceted benefits substantiate a compelling argument for change.

Introduction

Planners, decision-makers and community residents have often visualized only two options for building new communities at the fringes of existing settlement areas – traditional low-density suburban communities, or the high-density urban model, with high-rise buildings often perceived by suburban and small town residents as being impersonal, susceptible to crime, grime and poverty, and being unfit for families.

The choices are not so stark and limited. There are other forms and shapes that cities can take as they accommodate new growth, and they can be pleasant and family-friendly places in which to live. Moreover, 21st century problems are coming at us with dramatic speed, and the way we expand our cities and towns must change just as fast if these challenges are to be met.



This document provides an example – called Newburg – of a city-building alternative to traditional suburbanization of rural lands. Newburg is a family-friendly high-density but not high-rise-dominated model for the fringes of suburban communities and smaller towns. Its basic features and characteristics, its liveability, economic implications, impacts on transportation, the environment, and on community and personal health are described. The Newburg model is unique,

but is not the only potential option for pleasant high-density urban development. Others exist, such as placing a much heavier reliance on apartment living.

It is hoped that this document will strengthen the ability of urban development stakeholders to partner together to adopt the Newburg style or other higher density styles that are sustainable and marketable. Although the Newburg concept was inspired by rapid unsustainable growth that continues to occur in the regions surrounding Toronto, Ontario[1], it is a viable option for municipalities across Canada and elsewhere.

Reaping the Costs of Suburban Sprawl

Dark clouds are hovering over the suburban dream, and they are bringing a downpour of problems.

Technological advance, an abundance of cheap energy from fossil fuels, zoning regulations that favour low density development, affordability of housing and a seemingly endless supply of land enabled 20th century North Americans to create the sprawling settlement areas that we call suburbs, where the operating credo of builders is a home on a private mini-estate for as many families as possible. The dirty, crime- and grime-ridden city can be left behind, in favour of the quiet, safe small-town community -- or so the dream goes.

Unfortunately, dark clouds are hovering over the suburban dream, and they are bringing a downpour of problems. The quiet, safe and pastoral life in the suburbs has been replaced by traffic-clogged roads and long commutes to work, deteriorating air quality, increasing crime in suburbia, uneasiness about environmental damage, and lifestyles that are less satisfying

and more work and more expensive than expected. The small-town feel with nearby farmers' fields next door has been replaced by endless subdivisions housing thousands of strangers.

The Energy Crisis

North Americans, and especially suburban residents, are among the highest per capita users of energy in the world, and are therefore highly exposed to fluctuating oil and gas prices. Unfortunately, because consumptive lifestyles are a pillar of the traditional North American 'Dream' and its economy, public policy has been focused not on reducing overall energy consumption but on efforts to find more oil and natural gas that damage the environment, and are expensive to extract and process (tar sands, deepwater drilling, shale oil and gas).

Energy efficiency is key to moderating climate change impacts and energy price surges.

While there is new awareness of the urgent need to replace the use of fossil fuels, environmentally-appropriate energy sources (solar, wind, hydroelectric, geothermal) will not be able to replace the energy value of oil and gas production. Energy prices will increase.

The winners (relatively speaking) in the energy crisis will be those people who live in towns and cities that have dramatically reduced their need to travel by automobile and require less energy to heat and cool their homes, and that have implemented major reductions in the consumption of non-renewable energy.

Nature in Danger

Many people who used to live at the edge of urban areas, within eyesight of rural and natural lands are now, without having moved at all, surrounded by a sea of subdivisions and commercial sprawl. Gone are the ponds and the tall grasses, the animal life and the quiet life. Gone are the farmers' fields and the scenic hillsides. Suburban sprawl has become the enemy that takes away what we came to the edge of town to be near. And it's a form of pollution that, bit by bit, eats away at the natural life support systems that support and feed us.

The predominant practice of accommodating growth in the form of low-density suburbs is in direct opposition to the health of the natural environment

Before the 1960s, the desire of many households with children was to escape the dirt and grime and very evident pollution of older cities. Since then, great strides have been made in reducing urban industrial pollution and the emission of toxins from transportation and other sources.

Unfortunately, global economic expansion and rapid population growth in North America and elsewhere have overtaken progress that has been made on environmental protection. We have not yet understood the social and environmental costs of our city-building habits enough to adequately reduce consumption levels of land, energy, water and material resources. Worldwide, we are producing much greater volumes of pollution and greenhouse gas emissions.

In 2018, the United Nations Intergovern-mental Panel on Climate Change (IPCC) issued a dire warning that unless global emissions of greenhouse gases (GHGs) decrease by about 45% by 2030, it will not be possible to contain global warming to 1.5◦ Celsius above pre-industrial levels. North Americans need to reduce GHG emissions by much more. As of late 2019, GHG emissions have continued to increase. Globally, we are on track to exceed the 1.5° target before 2050, and exceed 2.0° soon thereafter. View Appendix 1 for more information.

This will mean widespread destruction of natural ecosystems – for example, loss of virtually all ocean corals that feed the aquatic food chain), more frequent and longer extreme heat events, loss of all summer artic ice, higher sea levels, flooding of coastal areas, and impacts that are irreversible. Suburban communities are among the highest generators of CO_2.

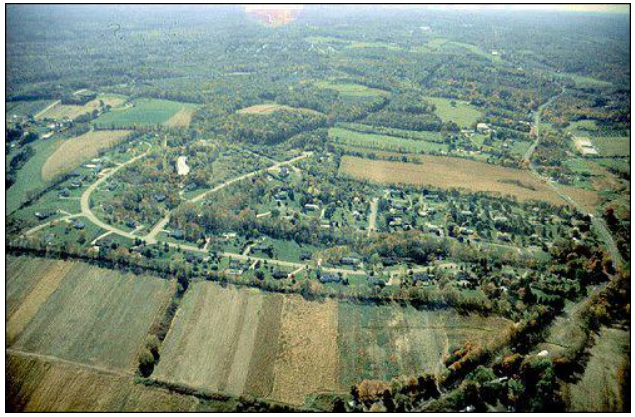
The sheer volume of human activity is also responsible for the extinction of species at a rate not seen since the demise of the dinosaurs. Global warming will accelerate these losses.

The predominant practice of accommodating growth in the form of low-density suburbs is in direct opposition to the health of the natural environment, and of our own health.

Accommodating more growth in low-density suburbs is a threat to human and environmental health.

Food Security

The populations of the United States and Canada are expected to grow by over 70,000,000 in just 30 years[2]. Unless there is a change in direction, the majority of the new growth will be accommodated on currently rural lands at the fringes of existing towns and cities. Between 2000 and 2025, the United States is expected to lose 14,000,000 acres of farmland and environmentally-sensitive lands to suburban expansion, if development practices do not change[3]. In Ontario's fast-growing Greater Toronto and Hamilton Area, almost 40,000 hectares (105,000 acres) of rural lands will be lost over the next 25 years, even with land use controls currently (2018) in place.



The need to preserve local agricultural land is amplified by uncertainties of overall financial affordability, by and rapid climate change. Today's food production and delivery systems are highly energy-intensive. Globalization of food production will be affected by higher costs of production and transport. Productivity will be negatively affected by shifts in weather patterns and ecological imbalances, making preservation of as much nearby agricultural land as possible a prudent strategy.

As population grows and the amount of foodlands people depend on shrink, there is a risk that long term food security will be irretrievably lost.

Economic Impacts

For almost all municipalities, the dependence of residents on travel by automobile is a serious economic drain.

The inefficiencies of traditional city-building in the suburban style are costly to households, local government, and the economy overall. For municipalities, there are more roads and underground pipes to maintain per taxpayer. With homes and businesses more spread out, police and fire services are less efficient than if their service areas were more compact. Public transit services are much less effective and efficient, and require higher subsidies per ride. As a result, service levels are usually poor, or non-existent. This, in turn, means that households are forced to maintain their own transportation services – their cars – at a much greater cost than if transit services were convenient. For example, in the Toronto area, public transit may cost $1,500 per year, while owning and operating a new car may cost $8,000 per year or more, after paying income taxes.

For jurisdictions whose residents import most of their motor vehicle and home heating fuels – the great majority of jurisdictions – poor insulation of buildings and high dependence on daily travel by automobile are serious economic drains on households, commerce and the broader community, and divert money from other needs and activities.

The growing effects of rapid climate change will mean higher costs for mitigation and adaptation, and will strain the ability of government to maintain

current levels of services. There will be demands for tax reductions at a time when more actions by government to respond to climate change impacts are needed.

Not Utopia

Problems associated with suburban living go beyond energy, macro-economics and environment. Time spent driving to and from work and to other distant destinations is time lost from family, recreational activities, developing personal interests and relationships, and other pursuits. Living in a low-density environment also affects personal and community health: a lack of walkable distances has contributed to sedentary lifestyles and poorer physical health. Suburban residents have been shown to have a higher incidence of obesity, cancer, diabetes, traffic injuries and deaths, cardiovascular and lung diseases including asthma in children, and stress-related health problems[6]

People in suburban communities who do not own cars are much less able to access daily or special needs.

Importantly, suburban residents who are unable to own or operate a motor vehicle – because of infirmity, age or economic condition – are distinctly disadvantaged with respect to employment, educational opportunities, social contact, and access to essential services such as medical help, grocery stores and community centres. Driving instead of walking also greatly reduces opportunities for social contact, and creates a disconnect between people and their larger environment. Civic engagement and concern for the general well-being of the larger community are diminished.

The cost of owning and operating automobiles also reduces the ability of households to afford other life priorities, and to enjoy some of the amenities that the community might offer. Motor vehicle crashes also exact an enormous

toll on victims and on those who care about them; hundreds of thousands of people in North America are killed or injured each year by crashes. All of this suggests that new communities should be built in ways that enable people to access their destinations by walking, or if distance is too great, by public transit.

Social scientists also question the assumption that owning a home in the suburbs is essential for happiness or success. It's not the possessions that count, they say, but the intangibles – good health, good interpersonal relationships, people to love and to be loved, financial security, good schools, safe streets, and so on. For many suburban households, the costs of owning and maintaining the home, and dependence on the cars in the driveway, compromise much of this. There is less time to spend with family members and friends when every adult in the home has to hold down a full-time job, and spend hours commuting or tending to lifestyle maintenance.

Things that make people happy:

- *Good health*
- *Loving family*
- *Good interpersonal relationships*
- *Good schools for the kids*
- *Safe streets and neighbourhoods*
- *Financial security*
- *A purpose in life*
- *Job satisfaction*

Sustainable Urban Development

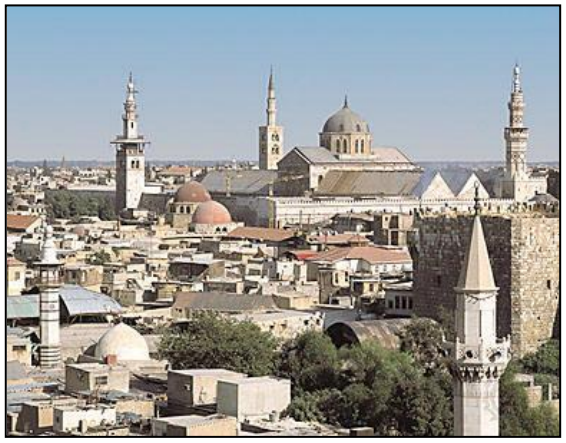
What is it?

The term 'sustainable development' was defined by the United Nations' Brundtland Commission Report on Sustainability as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

Sustainability has also been defined as having a 'triple bottom line', that is, it encompasses environmental, economic and social well-being, all of which are linked. For example, a higher-density mixed-use community is more socially vibrant (it creates more opportunities for social interaction via walking) and attracts business (more customers and potential labour nearby), while being less damaging to the environment (fewer GHG and toxic emissions per capita).

The Sustainable Urban Development Association has defined a sustainable urban area or region as one which:

- Uses energy in a manner that is highly efficient, relies largely on renewable resources, and minimizes the use of non-renewable energy sources;
- Keeps waste production to levels that can be safely absorbed by natural systems, including waste emissions from the production and use of materials, energy, and chemical products, and biological wastes;
- Is compact in form and preserves a maximum amount of agricultural and natural land areas, a goal normally achieved by increasing residential and non-residential urban densities to relatively high levels;
- Is safe, pleasant, affordable and socially positive.



Some cities have existed for thousands of years, producing little waste

By these definitions, no urban area in North America can be considered to be 'sustainable'. Although the number of initiatives that have been undertaken in support of sustainability objectives is increasing, they lag far behind the pace of change that is needed. Importantly, all urban areas depend heavily on supports from rural areas and the biosphere itself, and return few or none of

those benefits. The result is that our natural life support systems are degrading, and resources are depleting. Climate change will accelerate those losses.

High urban population and employment densities and, within that, the intermixing of uses, are key to achieving sustainability. A relatively dense and mixed urban environment, in addition to its social vibrancy and economic benefit, enables significant reductions in the consumption of energy, land, water and material resources, with attendant reductions in waste production. Given today's high population and the problems mentioned earlier, building relatively low-density communities is damaging and no longer appropriate.

Many ideas for the perfect liveable community have been proposed by prominent thinkers in centuries past. For the most part, they have been either based on agrarian alternatives to the very unsanitary, crowded and sometimes violent industrial cities of the early industrial age, or visions of futuristic symmetry and imposing form.

The Newburg concept demonstrates how complete urban communities at the fringe of existing built-up areas can be both high-density and family-friendly.

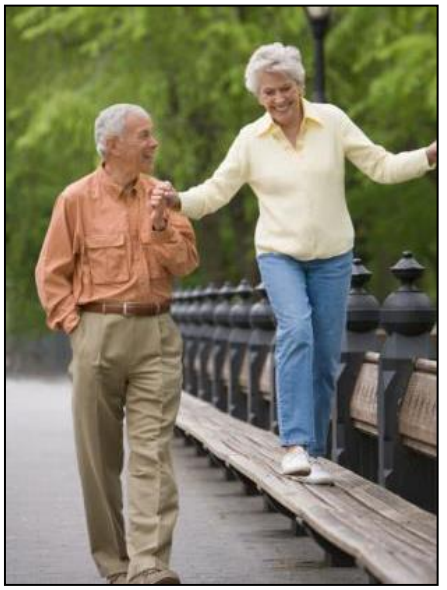
More recently, the concept of 'New Urbanism" has gained prominence. For new communities at urban fringes or in small towns, new urbanism espouses the development of communities that are more compact and walkable than the suburban development model that has held sway since the end of World War II. Its form promotes more social interaction and the importance of public spaces, and for transportation, aims to reduce problems related to dependence on daily travel by automobile. The New Urbanism also arose out of concern for the health of the natural environment.

The key is to achieve the level of density needed for sustainability. Municipalities may say they want to grow in ways that are sustainable, but

continue to cling to traditions of the past, and to densities that consume far more rural land than is necessary.

In the region surrounding the city of Toronto, legislation has required that growth in new development areas be at an overall density of 80 residents and jobs per gross hectare (as at 2018). This is higher than what currently exists in virtually all of the sprawling and car-dependent suburban communities in the region. The Newburg concept described below exceeds that density. It is a high-density example for new urban communities that remains family-friendly, and in doing so, includes a number of features not normally seen in new communities built in New Urbanist fashion.

Demographics



The number of 'empty nest' households will constitute the bulk of household growth between now and 2031.

Sustainable urban development also means paying attention to demographic projections. What the total population will be 20 or 50 years from now, with its segmented components, household formation, and so on, are important determinants of how towns and cities will grow. The population profile of the USA and Canada will be significantly different than that which fostered the suburban boom of the last century. In Ontario, the post World War II baby boom will mean that between now and 2031 the number of people aged 65 years and older will almost double (increasing by 1,730,000), while the number of adults aged between 25 and 64 will grow by 12.6% (increasing by 940,000)[7]. This will decrease average household sizes and the number and type of housing units required in the future.

Generally speaking, pressures to build more single-family homes will be eased by the larger numbers of elderly people vacating existing ones in favour of more

convenient and smaller-sized accommodation, such as condominium apartments. Overall population in some areas in the Toronto region will grow quickly, while in others slowly or not at all. The 2010 to 2031 projections for the USA are not much different, with the 25-64 age groups increasing by only 9.4% and the over 65 group growing by 79%[8].

Tradition and Local Character

The term higher density development does not resonate well with many residents of suburban communities. Low-density urban forms in small town or suburban municipalities are so entrenched in the minds of public officials, the development industry and the general public that even *visualizing* – much less accepting – pleasant higher-density forms of any sort is often very difficult, and often received with skepticism and fear. Some cultural inhibitions to more compact forms of housing have developed. Some people fear that change will bring down their property values, or will bring 'undesirable' strangers to their communities. High density is erroneously equated with high rise 'jungles', overcrowding, ugliness and crime, and as being inappropriate places to raise children.

Families can live happily in well-designed communities at densities of 10,000 or more persons per square kilometer

For most suburban and small-town officials, it is almost unthinkable to not separate workplaces from residences in distinct zones, or to build homes without front lawns or without wide streets in front of every home. Often, rental apartments are not permitted, because they, and their occupants, are considered incompatible with the character of the neighbourhood. The possibility that people who have access to automobiles might choose to travel by public transit or by bicycle is often not considered.

The notion that most families could live happily at densities of 10,000 or more persons per square kilometer has generally not been considered by planners in suburban municipalities. Those densities are left for those considered to be less unfortunate, despite the evidence of many thousands of people who, by choice, are flocking to relatively small high-rise condominium units in urban cores, or are renovating old city homes because they prefer the vibrancy of urban life to the blandness of the suburbs, or are moving into town to avoid long daily commutes to jobs.

Because of the generation-long history of suburbs or small towns, many people have little experience with, or knowledge about, alternative urban environments. Many also feel no personal sense of urgency to change, despite growing problems, or they simply do not see the linkage between the problems and the shape and form of their community. It is unfortunate that many of those who live in these environments and who fight against positive change are unaware that they may be the most adversely affected by their reluctance to change.

Suburban residents who fight against change are unaware that they may be the most adversely affected.

In the Greater Toronto Area, there have been some examples of suburban communities that try to emulate principles of the 'new urbanism'. However, there have not been enough of these to make a measurable difference, and some that have been completed have been so severely compromised by inflexible zoning laws or pressures from land developers and others that they barely resemble the original new urbanism intents.

Judging by the visual evidence of sprawling growth, there is still little understanding by government officials and the public of what a complete community that can be considered sustainable may actually be like.

It is the purpose of this document to provide such an example.

Newburg: A 21st Century Alternative to More Suburbs

Overview

Urban development can occur by building on rural lands or within existing built up areas. Certainly, sustainable development means revitalizing, renewing, intensifying, and infilling existing urban areas, and in the process, sparing rural lands and improving economic efficiency. Most cities and suburbs have significant physical potential to accommodate growth within their built-up area.

However, the fact is that most population growth will be accommodated by consuming more rural lands. The focus of the Newburg concept is to show how this kind of growth can be accommodated at the expense of much less rural land, in a pleasant and sustainable manner that is also highly efficient in many ways.

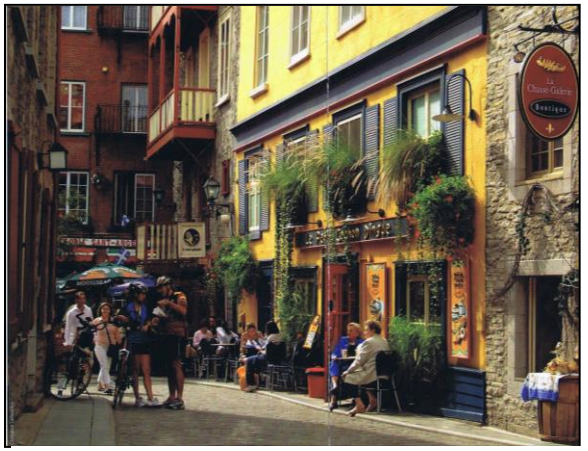
Many planning principles and strategies exist that try to move communities towards sustainability. There are, the Melbourne principles, the principles of New Urbanism, the Awanhee principles, greening strategies and green guides, LEED sustainable building and neighbourhood standards, myriad progressive local strategies and principles, and more around the globe. A common thread in many of these of these is that the bottom-line keys to sustainable urban development include high population and employment densities and a mixing of uses, and energy efficiency. The Newburg concept shows what that might be

like, as a complete community over an area of one square kilometer or more, with a degree of detail that shows visually how the parts of a community relate to each other.

The Newburg concept addresses the question, "How high might urban density be able to go while still respecting the desire of families for ground-level homes with private backyards?" It proposes that high-density can be achieved without forcing residents to live in high-rise apartments, or without lining every major road with apartment buildings.

Newburg also provides an alternative to suburban situations where residents in these communities no longer find detached family homes suitable or affordable, are forced to move away from their neighbourhood, even if they have longstanding social and familial attachments.

The bottom-line keys to sustainable urban development are high population densities, an intensive mixing of uses, and energy efficiency.



A neighbourhood built before the advent of travel by automobile.

Newburg suggests that urbanization of rural lands can be done in ways very different from typical suburban or small-town development. Newburg's shape and form show that high-density greenfield development can, if designed well, be economically efficient, socially positive, and environmentally appropriate communities. It is an example of an intensity of development that must become the norm if energy security, environmental protection and the protection of farmland are to be effective.

Newburg is a concept that is a practical option that can appeal to a wide variety of people, households and age groups. It provides for the functional daily needs and desires of people in a pleasant manner, and recognizes that urban form

must support and include a public environment that is an enjoyable day-to-day living experience.

The Newburg concept is demonstrated here by illustrations and a theoretical site plan that is a microcosm of a complete community (see Appendix), and is supplemented by an analysis that shows the impacts of extending the concept to a larger area.

The Newburg model is generic and not site-specific, and unique in that no such community currently exists.

The Newburg site is not planned with Cartesian symmetry. Rather it has an organic layout, guided by knowledge of urban planning, sustainability principles, future-thinking and a focus on day-to-day functionality for residents and commerce. In many ways, the form is reflective of older (pre-WWII) communities where people walked to meet their daily needs.

The model is generic and not site-specific, and can be applied almost anywhere. Actual application of the Newburg model would, of course, respect local site characteristics and constraints, such as natural heritage features, and respond to surrounding communities. Its form is not rigidly defined by hierarchies of form or use, or prescriptive other than that the key characteristics must be high-density, an intensive mixing of uses, energy efficient, and focused on accessibility by walking and public transit. Although implementation may require some buffering between existing low-density communities and Newburg-style densities, the one square kilometer example is intended to show that high densities can be extended over a large area.

Population and Employment Density

Average population densities in suburban municipalities in the Toronto region and elsewhere in North America, and in small towns, are typically 1,500 to 2,500

residents per km² overall (4,000 to 6,500 per square mile), plus workplaces, and are often even more spread out.

The overall density rate of the Newburg model is much higher. The detailed one square kilometer site example shown in the pages below has an overall density of about 13,400 residents and jobs per km.² (34,700 per square mile). This density is based on a gross land area with no significant physical constraints or features. The site plan includes residential, non-residential and public uses, including employment totaling 3,700 per km² (9,600 per mi.²). The employment figure includes only a partial share of industrial uses - only those that are relatively small and also benign in nature.

Newburg is an example of an intensity of development that must become the norm if energy security, environmental protection and the protection of farmland are to be effective.

The overall 13,400 density level decreases somewhat when extending the Newburg concept to a larger area that includes features that are missing in the example but are elements of complete municipalities, such as hospitals, industrial lands, major parks, treatment plants, major highways and railways, and the like. Adding in these factors reduces density to about 10,600 per km.² (27,500 per mi.². See section 'Newburg in a Larger Context' below). Overall density is also affected by the amount of natural heritage lands that may be included in the urban area, the relative incidence of different forms of residential and commercial forms, and other factors. Although the density seems high at first blush, it is much lower than the overall density of many older European cities, and not dissimilar to older parts of North

American cities excluding their central business districts. It is designed to appeal to households with or without children.

Truly compact mixed-use communities are usually seen only in older parts of urban areas, such as in Toronto, Boston, and San Francisco. There, many people pay a premium price to live in condominiums and renovated homes in downtown or near-downtown environments, indicating that a sizeable market exists for new high-density communities.

Newburg is in a middle-ground between older European towns and more modern (suburban North American) urban forms, designed to appeal to households with or without children.

In addition to its population density, the Newburg concept is characterized by

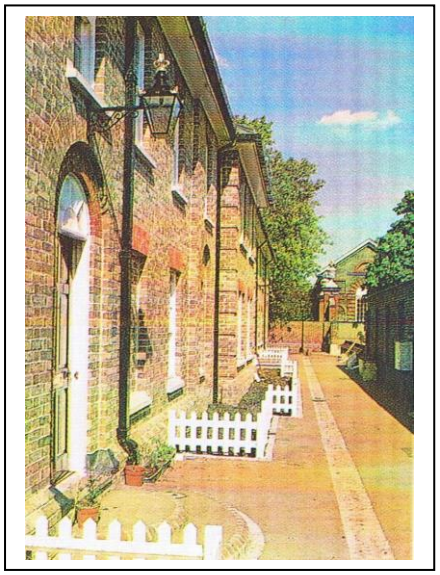
- the pedestrian focus of its transportation plan;
- a focus on attached ground-oriented homes and small apartment buildings;
- an integration of residential and non-residential uses, often within mixed-use multi-storey building;
- efficiency in the use of non-residential land;
- efficiency of transportation space for motor vehicles, and configurations supportive to public transit;
- effective and efficient provision of public spaces; and,
- High overall efficiency in energy, land, water and material resources.

New ideas generate little interest if there are not significant benefits to be derived. As described further on, compact urban development forms generate significant economic, environmental and social benefits to public, private and commercial sectors.

The high-density style exemplified by the Newburg concept is also responsive to future demographic/household profiles, provides a wide range of housing styles, and is very convenient to jobs and other daily destinations. An overall effect of the Newburg environment is that it can elicit a kind of European town ambience that many people enjoy, and that is very livable on a day to day basis for all types of households.

Residences in the Newburg Concept

A common perception is that the best place to raise children, and perhaps the only good place, is in a detached family home in the suburbs. According to municipal officials, that is why people move to the suburbs, and that is why local zoning outside of urban centres is most often overwhelmingly focused on providing single-family homes. Another attraction of the suburbs is that the average price of residential accommodation decreases the farther away from the urban core it is. Unfortunately, many people live in single-family homes in the suburbs because, by local policy, that's all that is available. And because people buy those homes, municipal officials believe that that's what they want.



Newburg-style communities on greenfield lands means fewer 'not-in-my-backyard' protests from existing residents than for changes to existing neighbourhoods.

There is evidence that people currently living in suburbia will accept and can be happy living in higher density environments that are well designed. In a survey done in 2007 by the Sustainable Urban Development Association (SUDA) in the Toronto region, half of survey respondents said that living in a condominium apartment suitably sized for their households is 'acceptable' or 'may be acceptable' ('preferable' was not am option in the survey). Slightly more than half said that a mid-sized or large townhouse that had a private backyard is 'acceptable' or 'may be acceptable'. Ontario's Regional Municipality of Waterloo, as part of its analysis for its growth management plan, in a 2005 survey of residents, found that 70% of respondents would consider living in a re-urbanization area, meaning apartment-style living along a mixed-use main street. These are important findings that suggest that there is credible potential for building significantly fewer single-family homes in new urban development areas, and that building more apartments and attached homes will find a willing market

Newburg's housing plan recognizes that the number and proportion of single-person and 'empty-nest' households will increase in the future, and that there are many families with children that may not wish to take on the burdens of maintaining the private outdoor spaces that come with single-family homes. The SUDA study indicates that many people living in single-family homes even now would like different types of accommodation, if they were available.

Principles of thrift will guide much more home-buying in the future.

Growing income inequality has likely made people more cautious about buying larger properties such as single detached homes, and more receptive of living in attached homes or apartments. As cost issues become an increasing concern, principles of thrift are more likely to become standard operating procedure for more households in the future. These considerations, plus the rush of demographic change created by the baby boomer generation, suggest that fewer new homes in the future will need to be single detached, and more people will reside in condominium and rental apartments. This is already happening in Toronto. In theory, for the fringes of many suburban or small-town communities, there may be no need for more single detached homes at all (see table below).

Aerial view of one square kilometer Newburg sample site. See also Appendix Two.

Michael Dinh

A Newburg-style community adjacent to existing suburban communities would provide an offsetting balance that accommodates the diversity of needs that are not provided for in these pre-existing areas. In the one square kilometer site example here, all housing types are represented, but in very different proportions than normally seen in the suburbs. Few residences are single-family homes; the bulk of homes are apartment units and ground-oriented attached homes (rowhouses). The table below illustrates the residential components of the one km² site example that achieves 13,400 residents and jobs per km².

Newburg rebalances the housing mix at the fringes of urban areas.

Rebalancing the Housing Mix

In an example where the results of SUDA's Housing Alternatives Acceptability Study survey hold true, no new single detached homes may need to be built. For example, in a municipality growing by 100,000 households:

	Singles + Semis	Row-houses	Apartment Units	Other	Total Units
Total Units planned by Yr. 2030					250,000
Possible housing mix	28%	35%	35%	2%	100%
based on survey	70,000	87,500	87,500	5,000	250,000
Current No. of Units	73%	15%	10%	2%	100%
	109,500	22,500	15,000	3,000	150,000
Increase in Housing Units	(39,500)	65,000	72,500	2,000	100,000

Occupancy per housing unit may vary by municipality[9]

The Newburg one square kilometer site includes the following housing mix:

One km.² Sample Site	Household Units	% of all Units	Avg. Hshld. Size	Total Residents	% of Total Residents
Fully-detached homes	81	2.3%	4.00	324	3.3%
Attached ground-level homes	839	23.4%	3.50	2,937	30.1%
Semi-detached homes[1]	395	11.0%	3.50	1,383	14.2%
Stacked rowhouses & plexes	99	2.8%	3.50	347	3.5%
Residential units above retail	230	6.4%	3.00	690	7.1%
Apartments[2]	1,461	38.5%	2.50	3,450	35.3%
Seniors and Supportive care	476	13.3%	1.14	542	5.6%
Totals	3,581	100%	2.73	9,769	100.0%

1 Mostly end units of rows of ground-level attached homes
2. Mostly low-rise condominiums.
Note: Average Houshold Sizes will vary from community to community.

Changing the housing mix affects overall density and land-efficiency: increasing the percentage of single-family homes reduces the overall site example density. If apartment-style housing as a percent of the total housing mix is increased, such as lining both sides of major roads with 4- to 8-storey apartment buildings as exist in many European cities, total density can increase well beyond the 13,400 in the Newburg example.

Ground-Oriented Housing

The Newburg example's housing mix demonstrates a rebalancing of the low-density residential form of typical suburban communities that may be adjacent to it. For example, 37% of housing units in the Newburg one km.^{2} example are ground-oriented homes (housing 48% of the population), only 2.3% of which are single detached. The great majority are attached like rowhouses.

Most ground-level homes have large backyards, and garages facing a rear alleyway.

As the site plan drawing of the concept shows, almost all of these attached homes have a private enclosed back yard of significant size (most are 12 meters (39 ft.) deep, with a variety of widths), plus a car garage at the rear of the lot, facing a rear laneway. This arrangement results in more privacy than in typical residential neighbourhoods, as there are no neighbours visible over the back fence.

Where homes in the Newburg model have garages accessed by a rear laneway, driveways in front of homes have been eliminated, as have large front lawns. Instead, they have been replaced by 2.5 to 4 meter-deep (8 to 13 feet) private outdoor space for porches, flower beds, shrubs, or gardens. Moreover, there is no street at the front of these properties. Instead, homes face each other across a very wide walkway called a Pedway.

This is a significant departure from current practice, and from the New Urbanism style which duplicates road space by having roads both in front of and behind individual properties. The effect of the pedway is to create a public access corridor wider than, but somewhat reminiscent of, the narrower side streets in many old European towns.

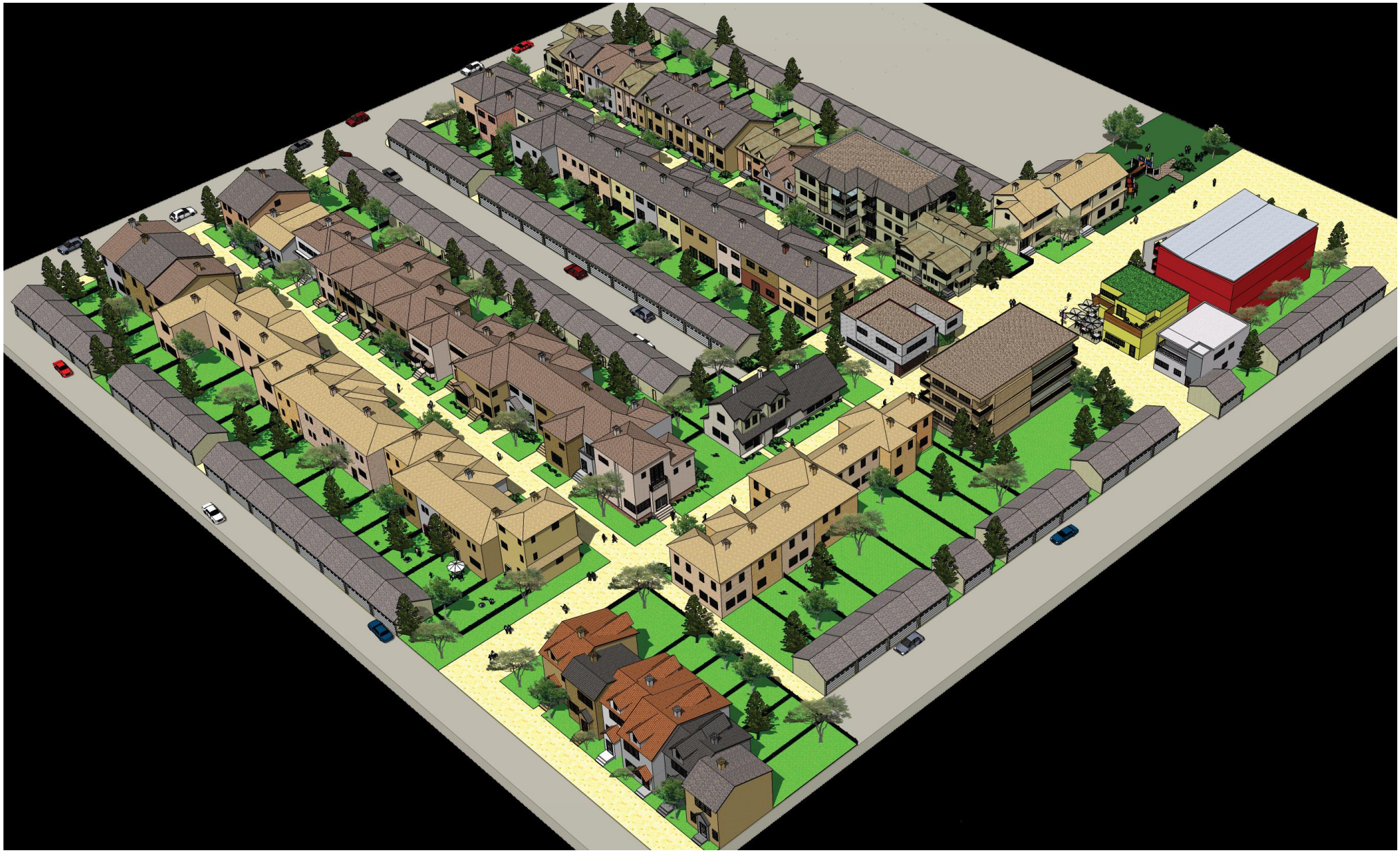
The pedway environment fosters a sense of personal ownership of the neighbourhood and its space.

Very colourful Singapore pedway-style environment

Almost all homes along a pedway are no taller than two or 2½ stories, in order to create a balance between neighbourly openness and a comfortable sense of enclosure. A wide variety of window placements, treatments and dressings, as well as trees, can provide privacy from passersby. The pedway is wide enough – 4 meters -- to enable access by emergency and utility vehicles.

Another outcome of the pedway arrangement is that it is a quieter environment, with no motor traffic passing in front of properties. Pedways are an important element in fostering community, encouraging walking and bicycling as viable transportation modes, and reducing household transportation costs. Attached homes in a pedway environment also reduce land consumption and improve urban density. For a 223 square meter (2,400 square foot) home, gross land area may be 30% less than for a typical lot with a same-sized detached home.

Aerial view of a residential pedway environment, illustrating density, a variety of housing options and uses, and a safe car-free environment



The Newburg design also breaks from the tradition of monotony that has been the bane of townhouse/rowhouse development. Adjacent homes in Newburg are visually compatible yet clearly distinctive, to create a heightened sense of visual separation, individuality and personal place, and a pleasing appearance. The diversity of detached homes along a single street can also be applied to attached homes. In contrast, most rowhouses constructed today tend to have uniform facades and be narrow and tall, limiting their marketability to a narrow range of potential buyers.

Variety in home sizes creates flexibility for families, enabling them to remain in their neighbourhood as their circumstances change.

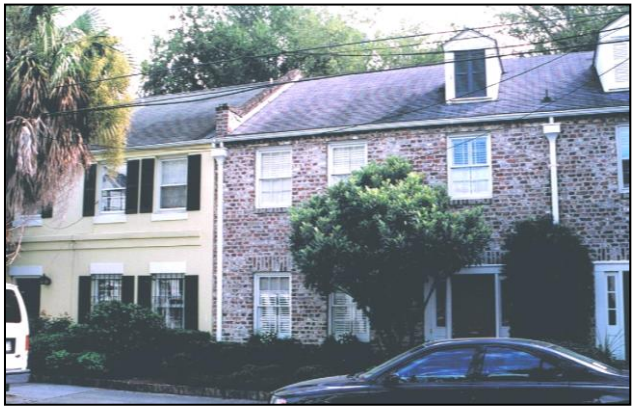
In addition to the individuality of facades, the Newburg concept recognizes the need to accommodate a wide range of household sizes within a neighbourhood, in support of fostering complete communities. As a result, adjacent homes in the model vary in size to from about 70 to over 280 square meters (750 to over 3,000 square feet), to accommodate a range of family circumstances. This arrangement fosters a stronger connection to, and understanding of, the whole community.

Variety in home sizes also creates flexibility for families looking for a larger or smaller house, allowing them to remain in their neighbourhood even as housing needs change. For example, a family of modest means can live in a small home next to a family with a larger home. Grandparents could live in a small home around the corner, or next door, rather than having to move farther away to a seniors' apartment. Newly-independent young adults may be able to live a few doors away from their parents, or along the next pedway (see illustration on page 72).

In every town and city, there are occupants of single detached homes who would move into an apartment if it were suitably sized, designed, and located.

The one square kilometer example also includes 81 studio and bachelor units above rear laneway garages, sized between 37 and 55 square meters of floor space, for people wanting economical accommodation.

The compact and mixed-use nature of the Newburg model minimizes walking distances to destinations and to public transit, and in doing so, increases pedestrian 'eyes on the street' that promote public safety. The intimacy of the pedway environment, with its private frontages and narrower public rights-of-way also fosters a sense of personal ownership of the community and its space, which increases attention to the quality of the neighbourhood environment. The increase in walking as a travel mode fostered by the pedway model reduces overall vehicle-kilometers traveled.



The attached homes in the Newburg example rarely exceed 15 in a row facing each side of a pedway – a length only slightly longer than a football field. This creates a heightened sense of intimacy and local community, avoiding the anonymity of sometimes seemingly endless rows of houses stretching to the horizon.

In some ways, the grand display of an imposing home on a large lot is replaced by more attention to architectural detail, interior use of space, home furnishings and art, and development of private gardens.

Apartment Living

The current predominance of single-family dwellings in suburban and small-town neighbourhoods inadequately reflects changing demographics and the very diverse needs of residents. It is also oppositional to the growing crises of climate change, energy and food security, overall affordability, and environmental health.

Well-designed apartment-style accommodation in a high-density mixed-use environment is highly marketable. The Housing Alternatives Acceptability Study (HAAS) found that fully half of respondents from across the Toronto region – including half of the respondents currently living in suburban municipalities – would accept or could accept living in a condominium apartment. The results likely reflect a number of personal considerations, such as household size, affordability, the ability and desire to maintain private properties, age and other factors.

In every town and city, there are occupants of single detached homes who would move out of them into an apartment if it were suitably sized and designed, and/or if it is located near their place of work or open space and parks, and where daily services are within convenient walking distances. Interestingly, SUDA's Housing Alternatives Acceptability Study found that 68% of respondents in the Toronto area said that having daily destinations within walking distance was either 'must have' or 'very important'. (If they do not live in such communities, one conclusion is that those options have not been adequately provided.) The migration of households from detached homes to apartments and townhouses would have the added effect of increasing the availability of single detached homes for new families who need them.

In the Toronto region, the downtown Toronto core is booming with high-rise condominiums, with 15,000 new residents having been added over the last five years. Unfortunately, some of this movement into the core is due to the short supply of condominium and rental apartments in the region's suburban municipalities, forcing many of those new downtown residents to commute long distances to suburban jobs.

Section view of a residential pedway environment

Attached homes along a pedway

Michael Dinh

Inadvertently, a social divide is being created today: families with children are housed in the suburbs, and households without children are generally rarer in suburban cores. Because downtown apartments are not built for children, once a couple decides to have children, they are almost forced to move away from their friends and neighbours. As mentioned above, the reverse is also true: the lack of smaller, affordable housing in suburbs means that young adults leaving home must move far away from the communities in which they were raised.

Some planners and decision-makers may suggest that apartments are not proper places to raise children, although there is little evidence that they cause bad parenting or unhappiness in children. The example of European cities, where urban densities are generally higher and private yards rare, supports the view of those who suggest that success in life is dependent on factors other than building form.

Increasing apartment-style housing as a percent of the total housing mix creates an urban area that is environmentally sustainable, socially vibrant and economically sound.

Michael Dinh

Designing apartment buildings to accommodate children should be a condition of approval for new apartment-style construction. This would include, for example, a specified portion of units in any apartment building to have three or more bedrooms, and that there should be in-unit and basement storage, secure balconies where designed, designated indoor and fenced outdoor play areas, and on-site child care centres whenever possible.

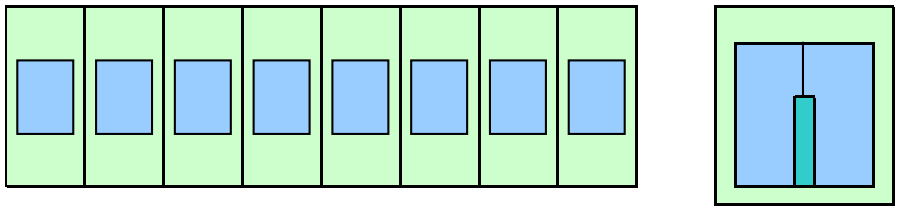
Apartments can be made very suitable for children.

Environmentally, apartment style living – even in smaller buildings – is land-efficient, and should also be very energy-efficient. For example, a three-storey building of six units of 220 square meters each (2,000 square feet) may require a lot size of about 920 square meters; however, six single-family homes of 220 square meters each, plus basement and yard space, may require about 2,200 square meters of land area. Less exposure of each unit of the six-plex to natural elements (cold, heat, rain), and less roof area, means less energy needed for indoor climate control. Less roofing and less basement space can also offset the added cost of sound attenuation between units.

Apartment units blended into a diverse neighbourhood environment.

Taller apartment-style buildings, whether rental or condominium, depending on their particular features, are even more land-efficient, and should be significantly more energy efficient than detached homes. Today's construction techniques and materials can dramatically improve the energy efficiency of apartment-style buildings. Renters or buyers may prefer to pay extra to live in 'net zero' energy buildings.

Comparing Land Consumption: Single Family Homes vs. Eight-plex Building



8 single family homes:

- Each 2-storey Unit = 2,400 sq.ft.
- Lot size = 32,000 sq.ft. combined
- Roof area = 9,600 sq.ft. plus overhangs

Eight-plex:

- Each Unit = 2,400 sq.ft.
- Lot size = 9,900 sq.ft.
- Roof area = 5,600 sq.ft. plus overhangs
- Configuration: 3-storey with 2 units per floor, plus slightly raised basement with 2 additional units

High-rise towers are not necessary in order to achieve high-density

In the Newburg site example, 52% of all units are apartment-style (including 4.6% as seniors' apartments) housing 46% of the resident population. Even with this high proportion, the Newburg example demonstrates that a strong reliance on high-rise residential towers is not necessary in order to achieve land-sparing high-density. Multi-unit residential buildings in the model are generally low-rise or of moderate height so as not to visually or functionally overwhelm neighbouring homes. In the sample site plan, only one is 15 floors tall (at Centrecourt Plaza), and another is 12 floors. Of the remainder, one is 9 stories, another one 8 stories, six are 6 floors tall, six are 5 floors, and the remaining 18 are three and four floors high.

The Newburg community example also includes supportive housing to accommodate frail persons and persons with disabilities (3% of residents in the site plan example).

Within a single square kilometer, a range of housing types and sizes can exist that accommodates virtually all needs. Young adults may live in nearby apartments or small homes, grandparents can live around the corner, households with children can live in a large townhouse within a few minutes

walk of older brothers or sisters, friends whose circumstances change can find new housing without having to move far away, and so on (drawing, page 72).

In addition to stand-alone residential buildings, the Newburg model maximizes convenient access to jobs and daily services by combining uses in many buildings. Ground-floor shops are often topped with a floor or two of office space, and/or low-rise or high-rise apartment living units. This is something that is a common feature in many existing urban cores, and in some cores of smaller communities. This practice eliminates the unnecessary consumption of land for many commercial activities, and is a major factor in improving overall urban density. Single-use non-residential buildings, especially when segregated into commercial or employment zones, are principal contributors to suburban sprawl, environmental damage and transportation problems.

Single-use non-residential buildings segregated into commercial or employment zones contribute to suburban sprawl, environmental damage and transportation problems.

Non-Residential Spaces

The Suburban Mode

Low-density land use practices for non-residential activities in suburban and small-town environments are inefficient and environmentally damaging, and are in part the result of a seemingly limitless availability of inexpensive energy and land in the 20th century. The lack of practical public transportation services in suburban towns and cities means that access to jobs and services by personal automobile is essential, and requires wide roads and a maximum number of parking spaces. Energy consumption is very high, and is contrary to the urgent need for reductions in carbon dioxide emissions.

This should never happen.

Office buildings are at times sited for maximum visibility along major highways rather than being integrated into communities. Retail activities are in single-storey buildings and many office buildings are just one or two floors high. In many towns that have expanded, large retail centers dominated by major chains have bled many small businesses dry, and often exclude them.

Today's suburban and small-town bylaws allow only small-scale population-based commercial activity in residential areas. Other retail, office and institutional activities, and all industrial activities, are typically required to be located in employment-only districts.

The all-in costs of non-residential development are not usually considered. While it may cost a business less to locate at the periphery of an urban/suburban area, those savings to business may be more than offset by the costs incurred by customers and employees to access that business site. It may be more cost effective for the community overall and be more desirable for both employees and customers to add floors to a building on a smaller lot in a more central location.

Including offices and apartments above retail stores is a major factor in improving overall urban densities and social vitality.

Suburban beauty, in the eyes of commerce

Commerce in Newburg

In addition to small business, many larger retail chain stores can blend into the community, on ground floors of larger office buildings, in multi-storey retail/commercial/residential malls. The larger the size and population density of a Newburg-style development, the more favourable the customer catchment area is.

Retail and professional services in the Newburg concept are sited to improve access by walking, cycling and public transportation, generate high visibility within the community, and have access to public parking. Large office buildings are located directly along roads suitable for transit services, to minimize the need for access by automobile. As a matter of policy in support of sustainability (economic as well as environmental) the largest office buildings should be located at major transit intersections[10]. Office buildings shown in the sample site plan are multi-storey but generally low-rise. Other non-residential elements in the site are two schools, a hotel, a cinema, religious institutions, public services, and light industrial buildings.

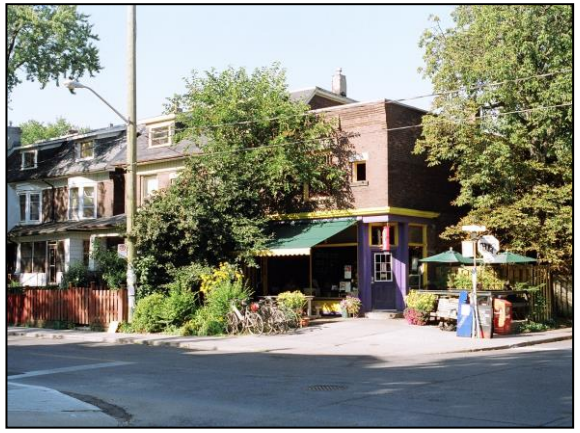
The one km.^{2} site does not include lower-density industrial uses such as warehousing or large manufacturers.

Contrary to standard zoning practices, non-residential activities that do not generate pollutants, excessive noise or significant truck movements, or are not

of excessive height or inappropriate appearance, can be mixed carefully into the general community or located along major roads within walking distance from homes, without adverse effects (performance-based zoning). Alternatively, residential buildings can be mixed into commercial/business areas and shopping mall complexes.

This arrangement improves the visibility of businesses to local customers – especially for smaller businesses typically shunted to out-of-the-way locations – and improves workday access for employees to those businesses, and access to lunch-hour services such as restaurants. Businesses along major roads can also act as noise buffers for residential areas behind them.

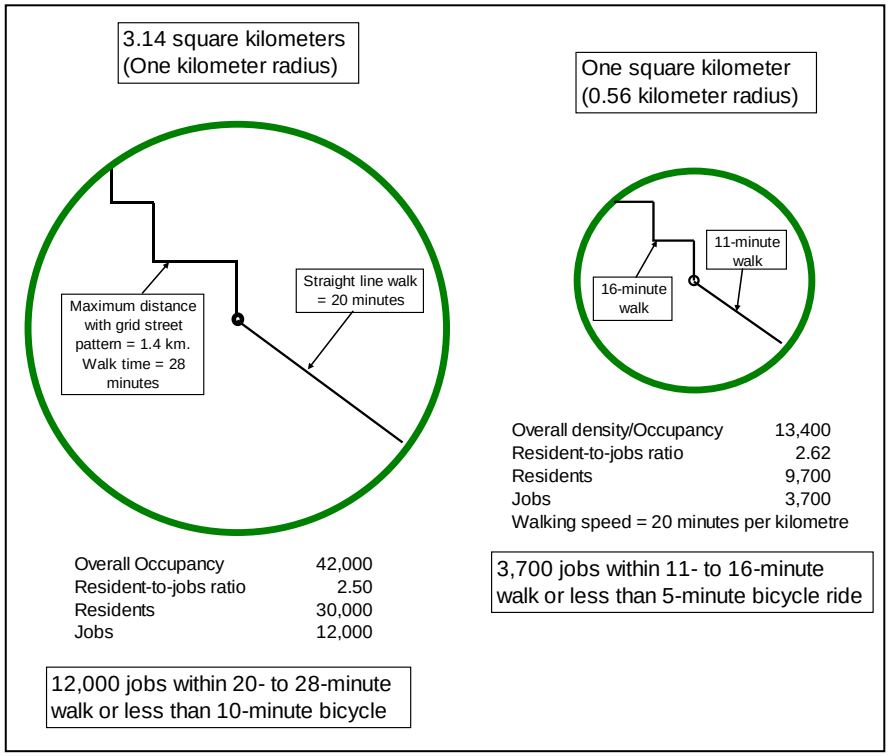
12,000 jobs can be within a one-kilometer walking radius.



The dense mixed-use form illustrated by the Newburg site example demonstrates the extraordinary degree of access to jobs and services within very short distances. At the Newburg density, approximately 12,000 jobs are potentially within a one-kilometer radius (see diagram below). Walking one kilometer (0.6 miles) takes 20 to 28 minutes at most, or 4 to 5 minutes by bicycle. IN this environment, employers have a substantial potential labour pool within a one-kilometer radius. Daily services are also within easy walking distances. For example, the density of Newburg-style environments enables supermarkets to be within a kilometer of virtually every home.

A key goal of the Newburg concept is land and energy efficiency, with very high floor-space-to-lot-size ratios for most non-residential activities (few are single storey), and a mix of uses in buildings, such as offices and/or residential condominiums in shopping areas and above stores.

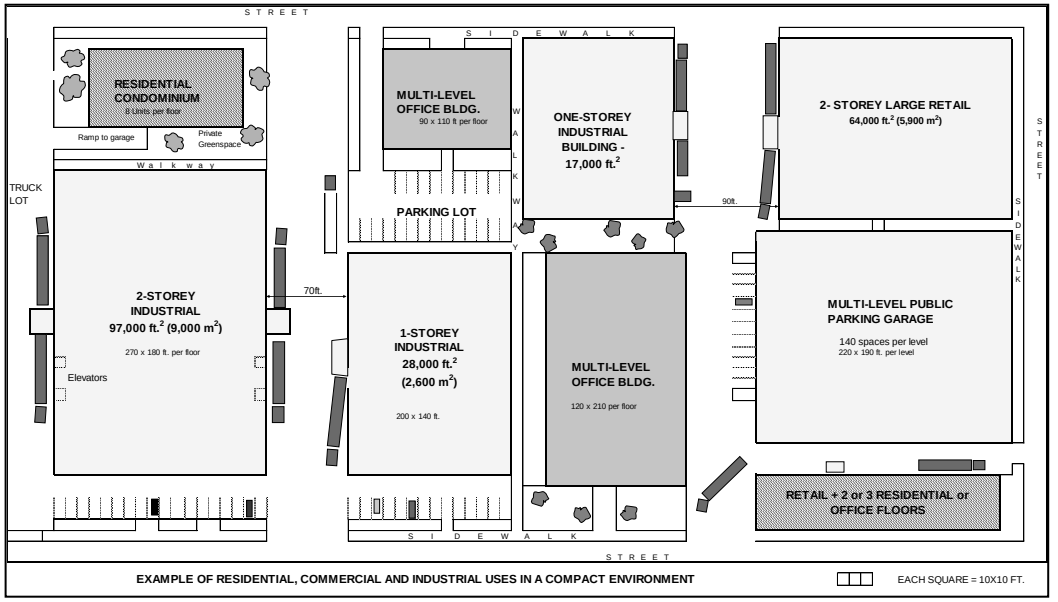
Mixed use multi-storey buildings and shared parking reduce rural land consumption.



Space for private parking on non-residential properties in the Newburg example is reduced. Shared parking is preferred, in the form of multi-level garages or surface parking lots that are publicly-owned.

Land use efficiencies in a mixed-use environment that includes industrial activities can be significant. The illustration below is one example of what may be achievable. In a typical suburban setting, the buildings and properties shown would be spread over an area about three times the size of this compact alternative. The example includes multi-storey public parking that supports industrial, retail, office and residential uses within a very close area. It reflects a situation in which various activities that are not noxious to each other can co-exist (in fact, environmental sustainability requires clean operations). It also supports the fact that a residential market exists for people who would like to

live close to work or to shops (as seen by the condominium apartment in the drawing). The mixing of uses is common in a number of cities where urban cores are being revitalized, but can also work as infill and intensification in small cities and towns, and at their edges.



An extrapolation of the Newburg model to a larger area and population would include additional employment areas for heavy or large manufacturing, warehousing or primary industries that cannot be integrated in to the main community.

Employment densities vary significantly from municipality to municipality, but often 15 employees per acre (35 per net hectare) is used as a benchmark by planners. However, some or all of the land efficiency measures mentioned above can increase these densities significantly, especially if it is cost-effective for business to build more compactly (such as using the proceeds of land sales to public parking authorities to partially fund the cost of building vertically).

With regard to public institutions, the location of schools within the dense and age-diverse population context of Newburg provides for a sustainable flow of school-age children, keeping schools filled over generations. The estimated child population in the one square kilometer example is 500 secondary school-age children, and 1,100 elementary-age students – enough for at least 2 elementary schools.

A full-selection supermarket in the city

Other public services such as medical facilities, government offices, libraries, and so on are an integral part of the community, and are located as such in the Newburg sample site plan. Public buildings and almost all other buildings that are not ground-oriented homes are sited with minimal setbacks from sidewalks.

The Newburg example includes a higher-density concentration of buildings around a plaza in its southeast (lower right) corner (below,+Appendix). A node such as this, and other areas exhibited in the Newburg example, would be a focus of services, employment and other amenities for residents within and beyond the Newburg boundary.

This high-density node in the Newburg example illustrates its transit orientation at a major road intersection, its plaza as a gathering place, and its mix of retail, office, residential and pubic uses. Parking is under the plaza.

Environmental Sustainability in Urban Development

A community cannot be environmentally and economically sustainable unless it reduces its consumption of non-renewable energy resources. Aggressive and immediate reductions the use of energy and the emission of greenhouse gases (GHGs) is vital – the UN's IPCC, the US military and others have said it is a matter of national security and survival. Despite an almost global agreement to achieve reduction targets by 2030 (the United States being the most significant denier of climate change as a problem), GHG emissions have continued to increase through 2019. A rise in the average global temperature beyond 2.0° C. above pre-industrial levels appears to be inevitable, by 2100 or earlier. Widespread degradation of natural life support systems will occur (see Appendix One for some of its implications).

Newburg-style communities can achieve almost 100% energy self-sufficiency for indoor climate control and electric power by using environmentally-appropriate energy systems and by reducing wasteful consumption.

Most of the homes in the Newburg example have a solar orientation, to make use of the heating effects of winter sunshine, and to enable south-facing solar thermal or photovoltaic systems on roofs.

Where parking lots exist, they can (and should) be covered with overhead solar panels to generate power and to shield automobiles from the heat of the sun in summertime.

Renewable energy systems can provide a high proportion of total energy needs of a community.

The one square kilometer Newburg example includes enough roof area for at least 107,000 square meters of photovoltaic cells on residential and non-residential roofs. At about 43° latitude and in a temperate climate (e.g. Toronto), this amount of roof area could produce an average of 18,400 kilowatts of electric power or more (depending on the level of technological efficiency). This is enough to provide approximately 78% of total electricity needs of the one square kilometer site, at current per capita consumption rates. Individual site conditions will result in different solar potential.

Homes that are attached side by side also reduce the number of walls exposed to climate, thereby reducing winter heat loss and summer heat gain. Savings can be significant (they can reach 25%, depending on the shapes of the structures). Awnings and roof overhangs above windows that face the sun provide shade in the summer and allow sun penetration in winter (possibly a 10% energy impact).

Multi-storey buildings, and especially apartment and office buildings with multiple units per floor, significantly reduce exposure to climate per unit. Moreover, apartment and office building roofs, whether they are flat or sloped, can accommodate solar power or thermal systems, and small wind turbines as well. Larger wind turbines can be retrofitted in industrial areas where land is available.

Depending on financial viability, ground-source heat exchange systems (geothermal exchange) can be installed as buildings are constructed. These systems transfer ground heat to buildings in the winter and provide cooler air to them in the summer. Geo-exchange systems can reduce energy consumption for heating, cooling, and hot water by up to 50 to 70% in individual applications. While initially costs are more than a conventional one, those costs will be offset by lower utility bills.

Renewable energy systems produce long term savings and cut importation of fuels.

Water conservation is also an energy cost saver when established as part of Newburg-style communities. Metering water and electric consumption for each unit in apartment buildings creates incentives for conservation. Rainwater capture and its use for both gardens and greywater systems in homes for toilets is another option. This saves not only water but reduces the taxpayer-funded energy cost of pumping water from municipal filtration plants. Less land area per capita also means that more rainfall is absorbed by the ground that would otherwise be pavement runoff into sewers in lower-density urban areas.

Dramatic reductions in the use of fossil fuels for energy means not only avoiding the emission of toxins and many tons of greenhouse gases, but also creates an economic stimulus for the community, in that importation of these fuels is avoided and the dollars are retained within the community for other purposes.

Profitability for Builders

Building communities in compact, sustainable fashion is, from the point of view of the community, a desirable and necessary long-term goal. However, while

governments can set rules and charges that support sustainability goals, a business needs to see an acceptable financial benefit before it will proceed with construction of residential and non-residential properties. Often, the more units that can be built for sale or lease on a given property, the higher the profit potential.

The two principal considerations for builders are the marketability of their products, and profit margins. The diversity of household circumstances suggests that a broader range of residential housing forms than exists in today's suburbs should be well marketable, as suggested earlier in this document. The overall landscape and attractiveness of the larger community, and the quality of the design of individual buildings, both help to determine marketability.

More units per hectare and less space given up for roads can mean more profits for builders.

For example, a narrow rowhouse that requires walking up and down several flights of stairs to get from the front door to an upstairs bedroom, and that has very little backyard space, is not as suitable for many people as a detached home. Wider two-story rowhouses with a larger private backyard are often not available, yet can attractive to more buyers and be suitable for long-term habitation.

For non-residential properties, properties are located and constructed to be cost-effectively marketable to potential occupants. Buyers or renters of professional units, grocery stores and small retailers will seek out spaces that are well-located to serve local and

neighbourhood markets. However, they are often constrained by local bylaws that prevent integration into the community.

Larger retailers may have their own style requirements, and are normally located in retail-only centers separated from residential areas. However, municipalities can decide that such centers are no longer appropriate in light of access costs for customers and employees, plus the desire to preserve rural areas and to create walkable communities. If a municipality zones new communities to be mixed-use at higher densities, larger retailers will decide whether the market that may exist in the overall environment is worth the cost of integrating into the new urban form. Normally, where there's a market, commerce will find a way to serve it.

Where there's a market, commerce will find a way to serve it.

A major supermarket in an office tower

For larger office-type employers or builders, land costs and parking requirements are significant determinants. These employers or builders will also decide whether, for example, a visual profile along a major highway provides as many benefits as would an in-town location that is closer to potential customers and the local labour pool, and is more convenient for employees. The availability of adjacent or nearby public parking may also be a factor that can entice businesses to locate within a community rather than at its edge.

Zoning ordinances can be set to pre-determine the location of various industrial activities. Local taxes, land costs and environmental impacts are factors that determine where businesses locate and, for example, whether it is more cost-effective and operationally effective to build or lease a four-storey structure in a mid-town location or a single-storey space farther away from the community. Performance-based zoning would support sustainable urban development.

Public Spaces

In the older cities of Europe and North America, the public realm – that part of the community beyond private properties, or sometimes simply the 'outdoors' – is considered important because, in part, housing units in those cities are normally not as large as they are in suburban or small-town communities of North America, and private backyards are less common. Hence, more time is spent in public spaces, and much of it on foot.

For many suburbanites, the public realm consists of roads that are wide enough for fast driving, and the distance between one's home and the shopping mall or workplace.

However, most North American suburban residents have private backyards complete with patios, decks and barbeques, and sometimes a swimming pool. Also, the internet and other electronic systems make indoor entertainment more attractive. People no longer need (or even want) to step outside to talk with other people. Where travel occurs, destinations are reached while encapsulated in automobiles, and the speed of travel prevents an appreciation of the details of local surroundings. For too many suburbanites, the public realm consists principally of roads that are wide enough for rapid transportation, and the distance between one's home and the shopping mall or workplace entrance.

The result is that the perceived importance of public amenities and spaces, and even of public services in general, is reduced. Moreover, because of this disconnect, and the cost of owning and maintaining suburban households and its often numerous cars, there is more resistance to bearing the taxes that are needed to create or maintain many public amenities, be it public art or libraries or public transit, or policing and other services.

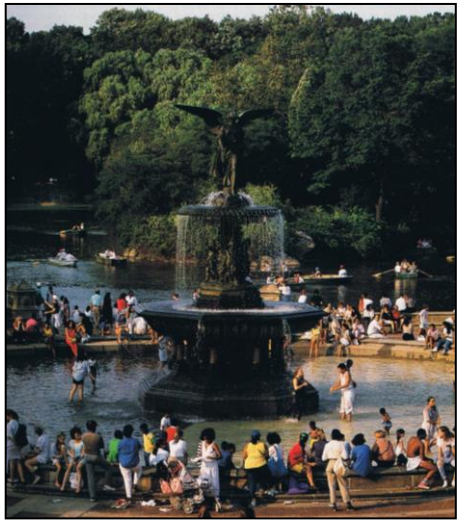
The public realm is where most casual social contacts are made and new relationships formed. Social scientists have long said that increased contact with people of different circumstances, age and cultures reduces the fear of strangers and raises levels of understanding and appreciation of the broader community. Newburg's form enables more opportunities for meeting other people, chiefly through walking. The Newburg environment is also diverse and potentially more visually interesting – qualities that help to bring social and economic vibrancy to public life.

The efficiencies inherent in higher density communities, as well as heightened appreciation of the public condition, enable more public funding for public buildings, art and civic beauty, park maintenance, athletic facilities, better transportation systems, and programs of interest to the community. By its very nature, high-density mixed-use environments can also encourage private development to be more architecturally distinctive and inventive, including commercial development.

Small parks tucked into Newburg neighbourhoods contribute to a greener and more open urban ambience.

In the Newburg site plan example, there is a large public square (Centrecourt Plaza) surrounded by a high-density mix of buildings and amenities such as restaurants, cultural facilities, offices, and medium-rise residential living units. The model also includes small parks tucked into neighbourhoods that contribute to a greener and more open urban ambience. The city of Savannah, Georgia – where dozens of small public squares were designed into the original layout of the city -- is an example of how these can add charm and beauty to the public realm.

These squares, filled with mature trees, flowers, pathways and fountains, provide respite and civic engagement for nearby workers, residents and visitors. In Europe, town squares have been the meeting place for people and commerce for centuries. Unfortunately, in North American suburban cities and towns, the public square has been replaced by parking lots and shopping malls and big box stores where everyone is a stranger.



Beauty in public spaces, seen by many today as unaffordable extravagances.

In addition to the private open space of backyards and the lawns around many multi-unit residential buildings in the Newburg site, numerous parkettes are located along frequently traveled walkways. These parkettes can include flowerbeds, benches and tables, fountains and public sculpture, children's playgrounds, trees, open lawns, and lighting for security. Newburg's parks are connected by urban 'pedways' that connect to larger pedestrian concourses running through the whole of the community, connecting numerous destinations. The parkettes are designed for residents and workers of the immediate neighbourhood rather than as facilities for city-wide use.

In the Newburg example, athletic fields that are used by schools double as public parks. Because of the higher residential density and the number of schools per square kilometer, more people have easy access to them. Providing

adjacent or nearby public open space is most important for apartment residents, who have no private yards, and often no balconies.

Behind one of the Newburg school's sports fields is wooded parkland. Also included in the example site is an outdoor community swimming pool. Tennis courts are located on a transit route in the midst of the residential area.

Overall, the one square kilometer site includes 4.9% of its land area as public greenspaces, including parks and school fields. A larger site might also include natural areas within the urban boundary, plus major city parks and exhibition grounds. The pedways, pedestrian concourses and open plazas provide additional opportunities for outdoor activities.

Providing adjacent or nearby public open space is most important for apartment residents, who have no private yards, and often no balconies.

Michael Dinh

Transportation

A key problem related to urban sprawl in North America is the inefficiency of its transportation systems. Worsening traffic congestion frustrates increasing numbers of suburban residents, and costs regional economies dearly. Ironically, and despite the urgent need to reduce transportation-based greenhouse gas emissions, political leaders continue to decide to expand the road system to accommodate more and more cars, deepening the problem.

Standard public policy has been to build as much road and parking spaces as possible to meet any eventuality of future or peak traffic volume. Policies also reflect assumptions that long trip lengths created by typical land use practices in suburban towns and cities prevent public transit from being financially viable, and prevent walking and bicycling from taking more than a very small share of total daily trips. Public policies that reduce the overall need to travel by personal automobile are inadequate, and not much thought is given to weighing the costs of traffic injuries and deaths in a car-oriented environment compared to transportation systems that are much more pedestrian- and child-oriented.

21st century problems mean building cities where the need to travel by car is dramatically reduced.

It is also often argued that people love their cars and prefer to drive, and therefore cities should be built to accommodate that preference, regardless of the problems created. The truth is that most people feel they need their cars – but not necessarily love them – because they enable access to their daily needs comfortably and conveniently in environments where destinations are spread out and no other transportation option exists. Unfortunately, for many people of modest income – young workers, retired people, single-parent households,

low-paid wage-earners of all sorts – having to own a car is a financial struggle that prevents household financial resources from being available for other needs and opportunities. Owning and operating a new automobile in Canada can cost between $8,500 to more than $15,800 per year in after-tax income.

In suburban areas, people who do not have easy access to a car are in many ways isolated from their community and from social contact. People unable to drive for reasons of physical disability or frailty are particularly hard hit, and find themselves confined to their homes and at the mercy of the minimum public transit available or of those who can provide transportation for them.

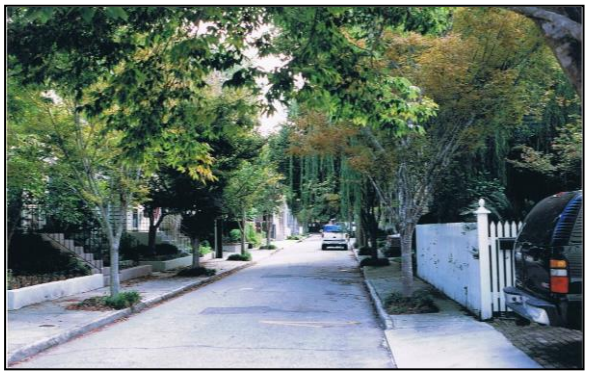
People who do not have easy access to a car in low-density areas are in many ways isolated in their community.

Affordability problems, future energy supply and price risks, and crucial environmental imperatives mean that the overall number of kilometers/miles traveled by motor vehicles must decrease significantly, even as populations grow. This requires building or transforming urban areas in ways that enable almost all people to access their daily destinations conveniently without having to use a car. This means relatively dense mixed-use environments well-served by public transportation. In fact, a community cannot be considered to be sustainable without most daily destinations being conveniently accessible without having to use private automobiles.

Numerous surveys have shown that people want their communities to be 'walkable' – access to destinations by walking is a desired feature. This desire may be a reflection of health-consciousness, frustration with traffic problems,

time wasted chauffering family members, environmental concern, a desire to get rid of the expense of a car, or other reasons.

Newburg



Narrow residential streets reflect reduced use of cars

A nine square kilometer Newburg-style area can result in trips by automobile dropping to about 40% of all trips.

Pedestrian- and transit-focused land use is a key characteristic of the Newburg sustainable city-building model. It's form enables a dramatically reduced reliance on travel by automobile, and convenient access to destinations, an absence of traffic congestion that would hold true over a large area, and with much less space devoted to transportation.

Success in moving away from the use of cars normally depends on urban form and density and with the size of the area so designed; the larger the high-density area, the easier it is to reduce vehicle-kilometers traveled, or the percentage of all trips taken by car. For example, in a typical suburban environment of 64,000 residents, 80% or more of all trips may be by automobile, and many would be relatively long trips. A nine square kilometer Newburg environment, with the same population, can reduce travel by automobile to about 40% of all daily trips by its residents.[11] Moreover, many of those trips would be of shorter length than in a typical suburban environment, because more destinations are closer to trip origins.

Overall transportation space in the Newburg site example, including streets, driveways, pedways, sidewalks, bicycle lanes, parking lots, auto service outlets, and freestanding garages, constitutes approximately 39% of the total land area of the Newburg site plan, which is much less than in most municipalities, where it can reach 50% or more. Importantly, on a per-resident basis, the overall space allocation for transportation is *much* less than currently the norm – in the

example, one-fifth of what may exist in typical suburban municipalities[12]. Even so, traffic congestion is avoided. (The one km² example includes six North-South lanes in each direction, plus two center turn lanes and a transit-only lane. The East-West roads include two lanes in each direction plus bordering arterial road lanes, plus two transit-only lanes and two center turn lanes.). As a result, there is more space for buildings and green space, and less road space to maintain. Reductions in transportation space are also the result of narrower rights-of-way on some roads, reduced land requirements for vehicle parking, and greater presence and use of public transit. Also, the distribution of roads in a grid-type pattern makes better use of all roads.

Per resident, the overall space allocation for transportation in the Newburg model is almost one-fifth of that in typical suburban municipalities. Even so, traffic congestion is avoided.

Places of employment in any area draw labour not only from immediately-surrounding residential areas, but from more distant origins as well. Newburg-style communities located at the fringes of an urbanized region would draw inbound traffic in directions opposite to the pre-existing dominant flow of traffic in the overall urban area, reducing pressure to build additional road lanes. Peak loads on individual roads would vary according to the geographic distribution of businesses and the number and configuration of roads serving the general area.

Public transit services in suburban communities are normally infrequent, inconvenient, or non-existent, and walking distances to and from transit stops are often too long. Due to the much higher densities of the Newburg model, very high penetrations and levels of service of public transit are possible. Indeed, they are necessary for the numerous reasons mentioned earlier. In the Newburg model, transit buses could serve almost all of the roads within the site, as part of a system of longer routes that extend into neighbouring urbanized areas. Transit-only lanes are included on major roads. The great majority of residents and workers are within a three-minute walk to a transit stop, and most are within a three-minute walk to stops on two different transit routes.

Transportation Infrastructure

for

Newburg One Km.^{2}

- Bicycle-only Lanes
- Pedways, Sidewalks & Plazas
- Potential Transit Routes
- Other Roadways
- Parks, School Fields & Boulevards
- Transit Shelters

Higher levels of transit services would evolve on arterial roadways to support large-scale Newburg-style city-building. In addition to the high use of transit by Newburg-area residents, the improved level of transit service also promotes its greater use in adjacent communities, offsetting some of the traffic pressures in those areas.

As a matter of public policy, the largest office buildings should be located at major transit intersections.

A common feature of suburban cities is the enormous amount of space allocated for the parking of cars, either as a municipal zoning requirement or commercial property owners' desire to maximize convenience for the driving public. Efforts by some municipalities to reduce parking ratios for non-residential properties or to increase their floor-space to lot size ratios sometimes act as a deterrent to attracting new businesses for fear there will not be enough parking for customers or employees. With much higher modal shares for public transit and active transportation (walking and bicycling) in Newburg, this is less of a problem, especially if public parking is available nearby.

Rather than each commercial property owner having his/her own lot, the Newburg model includes public or shared parking lots, on-street parking and public multi-level garages to support commercial activity. In this way, space is used more efficiently. An

example of space efficiency is illustrated by a school and a church using the same parking lot, because the lot is used at different peak times by the two users. Many multi-unit residential buildings and some commercial buildings also have private underground parking.

A key feature of the Newburg style is the elimination of streets, driveways and most lawn space from the front of most ground-oriented homes as a way of supporting pedestrianism and compact development. Garages and laneways are at the rear of these properties, and instead of building fronts facing each other across a street, homes are separated by pedways that are reserved for pedestrians, bicyclists, rollerbladers, and perhaps slow-moving motorized electric vehicles. The pedways are wide enough – 4 meters -- for emergency, utility and snow removal vehicles. Overall distance between facing home frontages in the example is typically between 9.2 and 11 meters (30 to 36 ft.).

Pedways, reserved for non-motorized transportation, are wide enough for emergency and utility vehicles.

In the model, laneways for backyard garages are 9 meters wide, to permit easy vehicle passage, maneuverability and room for car washing. A few homes do not have garages adjoining their property; their residents can walk to a garage very close by. These homes also appeal to people who do not own cars for reasons of convenience, age, disability, affordability or lifestyle choice.

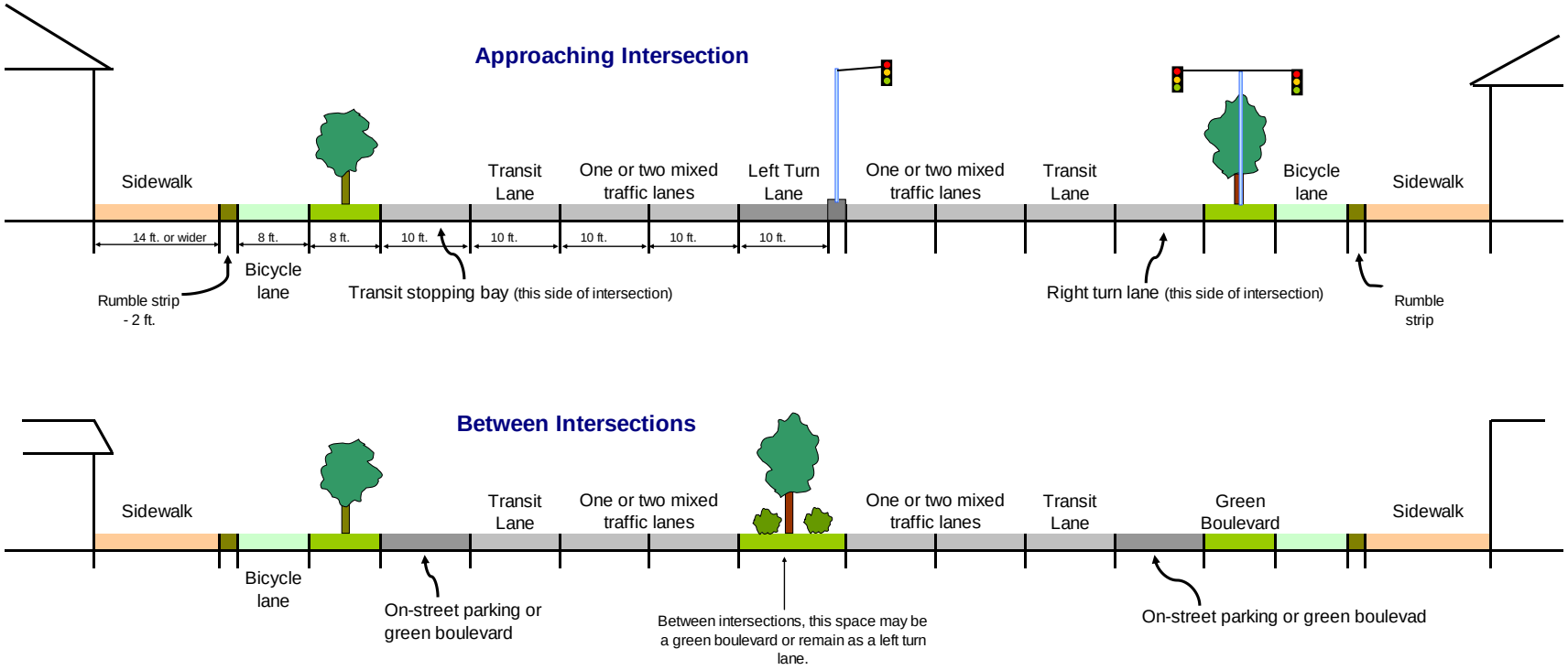
Large-scale Newburg-style communities would make car ownership optional for a high percentage of residents. Garage spaces included in the Newburg site plan example reflect a probability that most households would own a car or two, but use them less. Even so, the total number of garages is very likely well in excess of what would actually be required, especially in the context of Newburg's walkable access to destinations. Over time, unneeded garages can be converted to storage, accessory apartments, small business units, or even laneway cafes. The parking configurations suggest that most garages would be leased from a municipal parking authority or private company, rather than being individually owned. Visitor parking in the Newburg example is available on residential streets and public lots and garages.

A close proximity between homes and schools means that school bus costs can be reduced.

Suburban and small-town communities are dependent on school buses to get children to and from school. It has been estimated that the total cost of school bussing in the USA exceeds the cost of local public transit. In a Newburg-style environment, the close proximity of schools means that walking or bicycling become the principal modes of access for children and for many school staff. The result is a significant reduction in the need for, and expense of, school bus services and the chauffeuring children by car. For parents concerned about the safety of children, 'walking school buses' supervised by parents can be arranged. The density of schools in the Newburg example suggests that all healthy students would be able to walk conveniently to their school.

In support of walkability, sidewalks alongside streets are four or more meters wide along major roadways, and are complementary to residential pedways that connect to them. Bicycling is an important component of the overall transportation system and is supported by dedicated lanes as an integral part of the transportation grid. Lanes are included along all major roads, separated from motor vehicle traffic for safety by green boulevards.

The active transportation focus of the Newburg sustainable city-building model is beneficial to personal health, community awareness, and family finances. Deaths and injury from traffic accidents, and the associated trauma to family and friends, would decline.



Natural Heritage

The public realm also includes the green environment – the natural world and the outdoor landscapes we have built. Natural areas such as forests, grasslands, and wetlands capture greenhouse gases, moderate temperature, build soil, provide stormwater control, support plant and animal species important to ecological balance, and provide products to human economies. Watercourses and lakes provide clean water to natural and urban systems, and are animal habitats. Our natural environment also hosts physical pursuits, and provides humanity with psychological and spiritual supports. Natural capital should not be unnecessarily lost.

Efforts by governments to protect natural areas in or near urban areas have improved but are always under pressure from short-term economic forces. Moreover, the land that is developed between or around those natural areas usually continues to be low density sprawl. Agricultural land, even on the most fertile soils, is almost always considered to be fodder for suburban development. However, as rapid climate change threatens food production, the importance of preserving those lands increases.

The demand that North American urban residents put on the environment – its 'ecological footprint' – is unsustainably large and heavy. What this means is that our demands will not be able to be met much longer, especially when global economic and population pressures are taken into account.

Compared to today's suburban sprawl, Newburg spares far more rural land.

Minimizing Negative Impacts

The form and density of the Newburg model, by fostering sustainable transportation, reducing materials needed for the construction of buildings, reducing space heating and cooling needs, sparing lands, and by including renewable energy systems, helps to reduce the per capita ecological footprint. This is its principal contribution to environmental health. Newburg's restraint in land consumption respects the intrinsic and economic value of natural capital.

The one square kilometer Newburg example does not include

watercourses or other natural heritage features but, as a model of sustainable city-building, such lands would be preserved as they are encroached upon. In addition, public lands such as along roadways and around public buildings that are well-planted with trees help to moderate urban heat island effects and to provide air filtration.

Because Newburg concentrates all urban activities on roughly a third or less of the land that is normally consumed for suburban uses, much more rural and natural land is preserved beyond its boundary, and available for visual, spiritual and/or recreational relief, and for their economic value. The illustration below shows how significant this difference is.

Commercial and industrial buildings in the Newburg model use less open land for parking, heightening an overall sense of urbanity. Relatively more space is covered with trees and other plantings than in today's large expanses of suburban parking lots.

Although it cannot be seen in the Newburg drawings, water resources and groundwater quality are a component of sustainable urban development. In Newburg, the amount of pavement per person is much less than in typical suburban communities. Parking areas can be surfaced with permeable material, adding to groundwater and reducing water runoff into drainage pipes. Rainwater harvesting from rooftops for gardens and for indoor greywater use also reduces the demand for treated and pumped city water, and reduces the need for stormwater management facilities. Moreover, on a per capita basis there is much less salt and motor vehicle waste flowing from roads into groundwater and into sewers – as little as one quarter that of a typical suburb.

On a larger environmental scale, the reduced use of motor vehicles in higher-density mixed-use communities improves local air quality for humans and natural systems, and reduces negative impacts on climate (global warming).

Overall, per-capita greenhouse gas emissions in a Newburg-style development would be dramatically less than under traditional suburban conditions, commensurate with high reductions in vehicle-kilometers. Most suburban municipalities have so far failed to make absolute progress in this important area, and do not consider transportation's negative impacts on the natural environment as an incentive for change.

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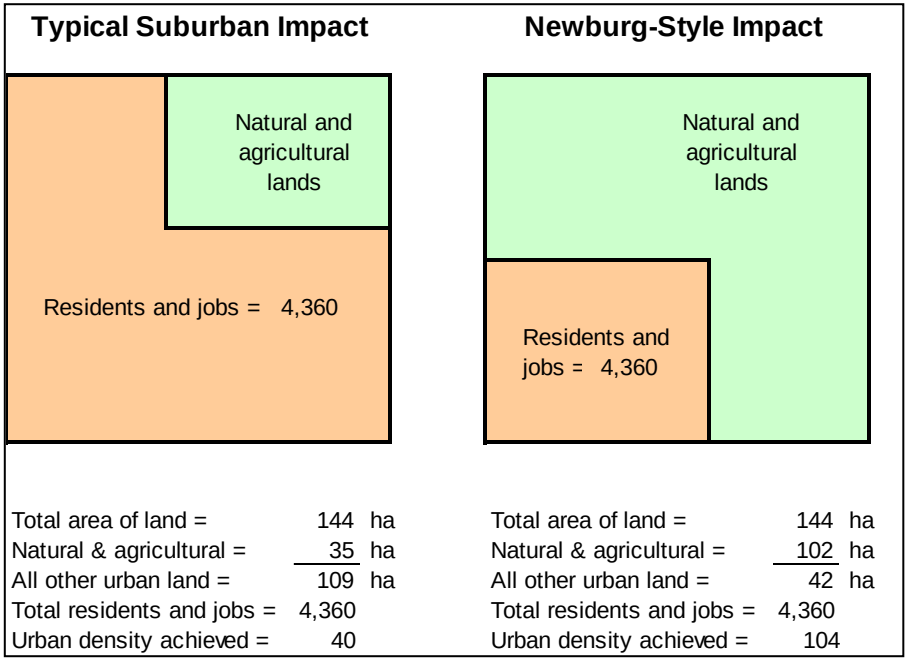


Newburg in a Larger Context

The rapid population growth that North America will be experiencing in coming decades accentuates the need for sustainable urban development. Moreover, the health and social implications of suburban living – unhealthy motor vehicle emissions, affordability problems, sedentary lifestyles, isolation issues, and so on, are signals that change is needed.

Newburg-style communities can provide daily amenities that are often missing from adjacent low-density residential communities.

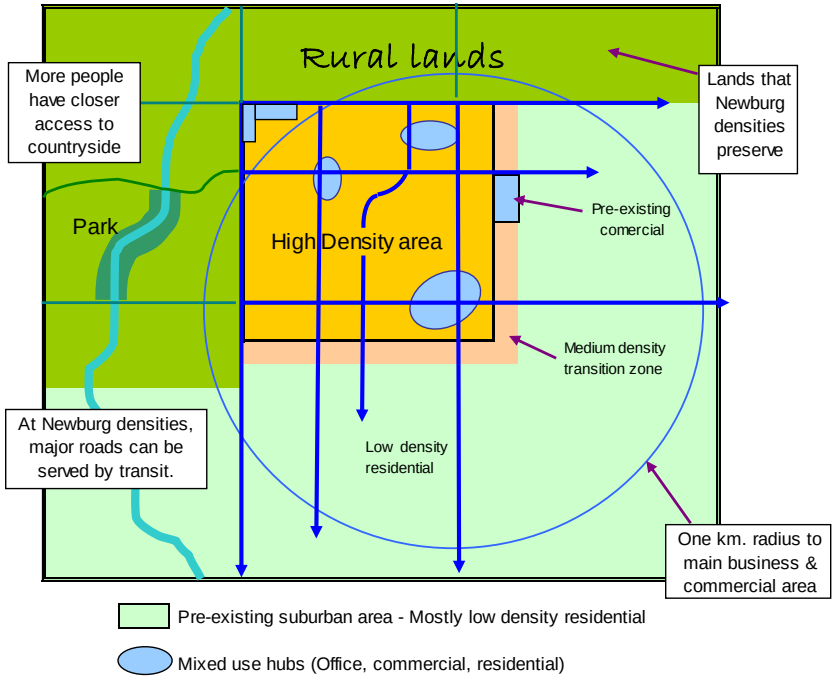
Although it could be a stand-alone new town, Newburg is intended as a concept for compact municipal expansion onto rural lands adjacent to existing built-up areas. Therefore, impacts on or from those pre-existing lands will have to be considered. Existing communities will expect some degrees of buffering or transition densities and uses. For instance, the first row of homes in Newburg behind the fence lines of an existing community may be limited to two storeys and marginally narrower lot sizes. Beyond that, there is little need for compromising high-density except to limit building heights to avoid shadow effects on pre-existing suburban properties. Where the edge of the Newburg area borders a commercial area or a park, buffering with transitional density may be unnecessary (The example of Central Park in New York City calls to mind, where highrise buildings are across the street from the park, and are among the most valuable real estate in the city because of that location). At intersections of major roads, the best new development is high-density, preferably mixed use and served by transit.

Where a Newburg-style development occurs adjacent to an existing suburban area, it can help move the whole community towards sustainability by providing opportunities for more housing choices and supporting more sustainable transportation. Newburg-style communities can also provide many of the daily amenities that are often missing from adjacent low-density residential communities (see illustration below). In doing so, they help to create complete communities on a larger scale. For example, young adults leaving their parents' and friends' homes will have less expensive housing choices nearby, whereas in many suburban areas today, they would have to move much farther away to find accommodation that fits their needs.

Public transit services that connect large high-density communities at the fringes of urban areas with urban cores or major employment areas would also enable transit services in the low-density communities between them to be more frequent. One result is that parking requirements in the pre-existing central business district or other employment and commercial places can be

reduced, allowing for some of those lots to be redeveloped. Another benefit is that the whole community experiences less pollution and traffic congestion.

Newburg area provides a rich variety of services, employment, and housing options not found in neighbouring suburban areas.



Whenever towns and cities must unavoidably be expanded onto rural lands, development must recognize the need and benefit of preserving natural and agricultural lands. The trend of farmlands shrinking as the population dependent on them increases is not sustainable; the appropriate risk management strategy is to spare as much nearby agricultural land as possible.

The larger context requires that the important issue of energy consumption and its impacts on the natural environment be a determinant of the shape and form of new communities, and of transportation policy. Access to inexpensive energy to fuel transportation and other needs is what characterizes today's suburbs,

and this is not sustainable. Although motor vehicle fuel efficiencies are improving, the growth in the number of vehicles and kilometers driven has offset overall fuel efficiency gains, and has prevented reductions in environmental damage. The advent of electric vehicles will drive down fossil fuel consumption for transportation, but only if the electricity is from non-fossil fuel sources.

Compact communities such as Newburg reduce per capita energy consumption significantly, and local renewable energy generation enhances sustainability, reduces climate change impacts (even if in just a small way) and resilience against energy shocks. Energy-efficient city-building is an essential risk management strategy. Because decisions on land use and transportation have permanent effects on people, the longer the delay in implementing sustainable urban development, the more difficult that retrofitting of existing communities will be, and the greater the number of people who will experience hardship.

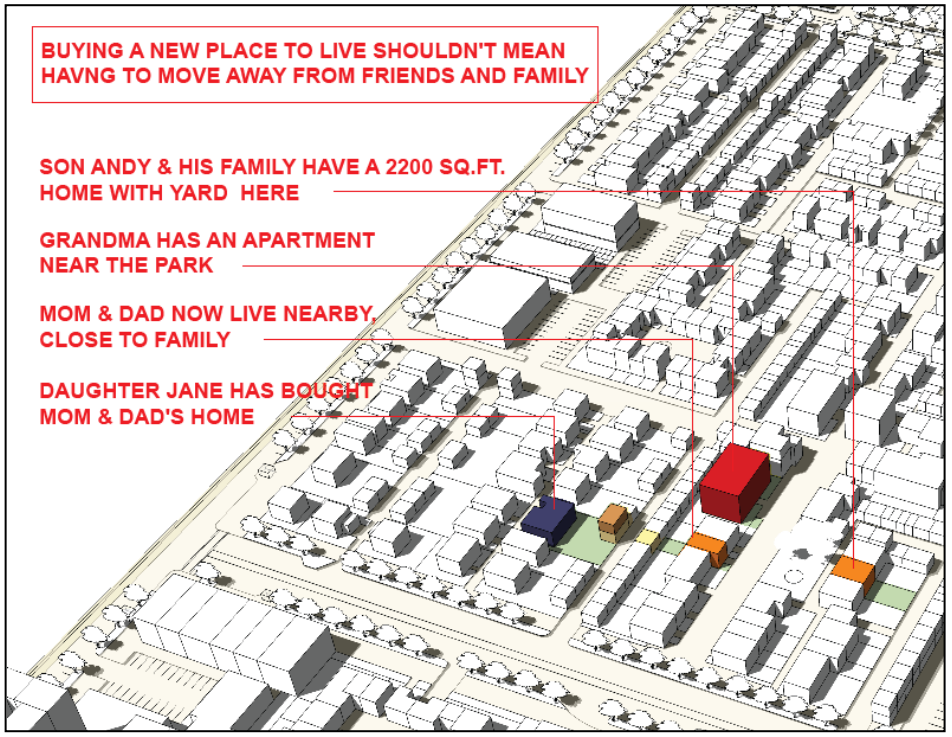
The larger context requires that the issue of energy affordability be an essential determinant of the shape and form of new communities, and of transportation policy.

An initial reaction to Newburg by some people may be that Newburg 'forces' people to live in attached homes and apartments. This argument ignores the diversity of choices in the Newburg area, and misses the fact that many current residents of suburban homes are being 'forced' to live in them because there is not enough of anything else available. The Newburg form increases consumer choice by enabling existing residents to trade in their single-family dwellings for the features and benefits of attached homes or apartments, if they so desire.

An almost universal policy outside of urban cores has been that different land uses should be clearly separated from each other. There are areas zoned as low-density residential, employment, medium density residential, commercial, industrial, natural heritage lands, and so on, each with sub-groupings. The separation of uses is not as beneficial as achieving high-density, mixing uses, and improving walkable access. Urban form should be based on a hierarchy of densities, with the highest normally being located at major intersections, and along roadways served by public transit. The mixing of uses in Newburg is governed by performance standards such as impacts on traffic and accessibility,

parking requirements, sun shadow effects, buffering, and on air pollution and noise pollution standards. For example, a retail store can be located across the street from a residential area if it does not pollute the air, does not deal with toxic chemicals, has adequate parking for customers, and does not operate in the middle of the night.

The separation of uses is not as important as density, the mixing of uses, and access.



Scaling

Although the example of the Newburg style is limited to one square kilometer that accommodates 13,400 residents and jobs, it can be increased in area to accommodate a much larger population. However, expansion would require adding in components of complete urban areas that are not included in the sample site, such as hospitals, major parks, industrial lands, and railways. Overall density would also be affected by changes in the proportion of single-

family dwellings and the overall housing mix, and the amount of land allocated to non-residential uses such as industrial activities and parking.

Note 14 in the Appendix illustrates effects of scaling. The figures assume that the principle of land efficiency is continued for urban uses not represented in the 1 km² example, and that the original Newburg style remains unchanged. Land area was added based on fractions of components missing in the one km.² example, and based on an estimate of the extent to which those services might be required. The employment implications of added components were also factored in and a revised overall density calculated.

Expanding cities and towns onto rural lands should occur only after existing built-up areas have been increased to their full potential.

After adding in the 'missing' urban uses, the adjusted overall density of the one square kilometer Newburg example decreases from 13,400 residents and jobs to 10,600. The overall density of a one square mile area (2.59 square kilometers) drops from 34,800 residents and jobs to about 27,300. While these adjustments are significant, the Newburg character remains intact, and the overall density remains much higher than what is typical of suburban cities and towns across North America. Where adequate land for hospitals, industrial uses or other purposes already exist in neighbouring areas, the density of new Newburg-style communities will be that much less diluted.

A basic measure of a sustainable density and mix of uses is whether almost every resident of the community has the opportunity to reduce or eliminate their need to own and operate personal automobiles. If most daily person trips are not by walking, bicycling, or transit, the overall density and/or mix needed for sustainability will not have been achieved, or the size of the dense community is not large enough to bring most trips to within sustainable transportation distances.

Modifying Existing Communities

A requirement of sustainability in urban areas is that the consumption of natural and agricultural lands be avoided or minimized as much as possible. Consuming

agricultural lands when populations dependent on them are increasing is unsustainable. Before more rural lands are consumed, underutilized areas within existing communities should be intensified – meaning more building floor space and people on the same amount of land -- and vacant properties should be infilled with new construction.

Many opportunities for sustainable development have been missed here

Low-density commercial development may be profitable for property owners, but inflict transportation costs on the public.

In almost every municipality, there is significant potential for intensification and infill. For example, the intersections of many major roads are occupied by single-storey retail uses, fast food restaurants, gas stations, and parking lots – all of which foster or are dependent upon access by automobile. While these uses may be profitable for their owners, they often inflict a cost on each customer, who must bear the expense of accessing the site. On other sites, buildings may be set far back from property lines; other sites may be derelict or obsolete, or are vacant or contaminated.

As properties are redeveloped, good infill and intensification practice means multi-storey buildings and more building coverage of a given property, whether it be for residential or non-residential uses. A restaurant can be topped by several floors of residences and/or offices. A department store can be multi-storey. Tall office buildings can replace gas pumps at major intersections. A parking lot can be replaced by a shared multi-storey public garage. Large lawn spaces in business 'parks' can be filled in with more offices, light industrial uses, and even residential buildings. These transitions require careful design, such as attention to shadow effects, utility requirements, and traffic issues.

As with Newburg communities on urban expansion lands, infill and intensification

that are mixed use and well-planned provide benefits to existing residents and to commerce. Services that were missing become available and become part of the neighbourhood. More destinations are within convenient walking distance; public spaces become livelier and more interesting.

Energy costs for transportation are reduced as fewer kilometers need to be traveled and multi-storey buildings require less energy for heating and cooling. Public transit services become more affordable for governments as more people are within walking distance to transit stops. Intensifying land uses usually adds more property tax revenues without a proportionate increase in costs of municipal services – less road space and water piping per capita needs to be built and maintained.

Intensifying land uses can add to property tax revenues without increasing costs of municipal services.

Oakville, Ontario Midtown Redevelopment

Good residential infill and intensification practices will also address imbalances in the existing housing mix. Housing in many suburban residential neighbourhoods today is highly oriented towards families with children, and for households with similar incomes. The result is that when the children become adults and leave home it is often not possible for them to live in the neighbourhoods in which they grew up if all they can afford is apartment living, because the only apartments are kilometers away. Moreover, when the resulting empty-nesters wish to downsize to a smaller home, they, too, may have to leave their neighbourhood. Similarly, there are not enough apartments that are sized and suitable for families with children. Social sustainability suggests that the separation of households without children from those with children should be reduced, by ensuring that a significant portion of units in apartment buildings are suitable for larger households, and that there are secure play areas on the property or the building is located close to public outdoor greenspaces.

Environmentally, open spaces in existing built-up areas can be improved by using permeable surfaces such as bioswales along roadways, planting trees and shrubs, rainwater harvesting, using greywater, and adding renewable energy systems to new construction. Whenever a decision is made to accommodate growth within an existing community, it is a decision to preserve rural and natural land outside of the existing built-up area. It should be noted that urban open space becomes more important as a given area becomes more populated, especially in intensification areas where most new residents will live in apartments or row houses with limited outdoor space.

Public parkland within the built-up area is more important where residents live in apartments of rowhouses.

Parking is an issue whenever more people and building space are added to an area. If transit services are poor, or destinations of residents are so dispersed that walking is inconvenient, pressures to increase road space increase, and additional parking has to be provided. Whether it is surface parking, public garages in a mixed-use environment, or private underground parking, the need to accommodate cars limits the amount of intensification and infill that can occur. Where vehicle parking is necessary, good planning will replace large areas of surface parking with multi-storey public parking that is shared by a variety of surrounding activities at various times of the day.

Summarizing the Benefits

The list below emphasizes the quantity, scope and magnitude of the benefits of sustainable urban development. The list is long. An overarching message is that Newburg-style communities can be highly marketable as a style that can be pleasant places in which to live and work. The list can be seen as comparative. For example, where the Newburg style provides more of something, traditional practice may provide less of it.

Benefits to the Community:

1. More natural and rural lands preserved for human enjoyment;

...More choices, better health, less expensive, more convenient...

2. Better public health as a result of less pollution from energy use, and from having created walkable communities;
3. Heightened sense of community, and understanding of, community needs through more social contact;
4. Public safety improved as a result of fewer traffic injuries and more 'eyes on the street (and pedways)' moderating public behaviour;
5. More balanced transportation system – less road space required for automobiles, more opportunities for walking and bicycling, better public transit enabled for those who do not drive cars;
6. More pleasant public spaces: public art, flowers, parks, pedway environments, other public attractions;
7. The creation of a kind of compact European town ambience, depending on the mix of uses, the overall diversity and social vibrancy of the community;
8. Increased housing choices for residents of both new and adjacent existing residential neighbourhoods;
9. The variety of housing types within neighbourhoods enables people to stay in their communities as their circumstances change;
10. More daily services nearby or not so far away from existing residential neighbourhoods.

Benefits to Households:

11. Many more jobs and daily services close to home, many within walking distance;
12. Because fewer homes are fully detached, less wall space is exposed to weather, significantly reducing indoor heating and cooling costs;
13. Overall, affordability of housing is improved;
14. Better personal health from less air pollution, more walking, less financial stress;
15. Because of better transit services and closer proximity to trip destinations, the need to chauffeur children and elderly persons is reduced; overall, the need to drive is reduced for everyone;

16. Lower transportation costs - On average, significantly fewer cars need to be owned and operated, and fewer kilometers need to be driven;
17. Almost all children are able to walk to and from school, building children's health and reducing chauffeuring by car;
18. The Pedway arrangement and closer proximity of residential units increases opportunities for social contact, yet maintains privacy;
19. More privacy for people in homes with rear garages and laneways (no neighbour over the back fence);
20. Lower household energy and home maintenance costs mean more money available for other family priorities;
21. Greater flexibility for parents to trade income for family time at home;
22. Less traffic noise;
23. Reduced local tax pressures as public services become more efficient;
24. Likely higher property values for well-designed Newburg-style enviroments.

....protection from energy shocks, profitable for builders, more efficient government services.....

Benefits to Commerce and the Economy:

25. The labour pool for business is closer by, as resident population in Newburg areas is 7,000-9,700 per square kilometer;
26. More agricultural lands are preserved for local food production;
27. Local retailers and service providers benefit from more local spending as household energy and transportation costs are reduced;
28. Reduced impact of future energy shocks on the local economy, from local power production where implemented, and from the inherent energy efficiency of built form;
29. Increased visibility of business to local customers; increased access by sustainable transportation (walking, bicycling and transit);
30. Good profitability for builders from more building units per hectare as a result of less transportation space given up and lower building setback requirements;
31. Possibility of lower business taxes as per capita public servicing costs ease;

32. New opportunities for chain retailers to blend into the community in different and creative ways;
33. Possibility of Newburg areas becoming tourist destinations, depending on the variety, architecture, vibrancy of the community.

Benefits to Government:

34. Reduced overall costs per capita for new public infrastructure;
35. Reduced overall local maintenance and/or operating costs per capita for public services;
36. More efficient use of schools as mixed housing environments provides a steady stream of students over time (fewer school closures);
37. Lower school bussing costs;
38. Public transit more effective, and can more easily and affordably be extended into lower density communities nearby; lower public subsidies possible as ridership increases;
39. Economically superior (for example, lower import losses for energy and automobiles);
40. Reduced exposure to energy shocks for public sector budgets;
41. Preservation of more rural lands for future growth or for rural economy and foodland preservation;
42. Newburg implementation raises leadership profile for local and regional decision-makers as protectors of the future well-being of communities.

...more natural and agricultural lands saved, cleaner air, fewer greenhouses gases..."

Environmental Benefits:

43. Greater resilience as rapid climate changes occur; an overall contribution to mitigation of climate change impacts;
44. Reduced greenhouse gas emissions from indoor climate control, transportation and material resource consumption for buildings and infrastructure;
45. Rural lands spared, as Newburg is several times as land-efficient as a typical suburb;
46. More natural habitats protected; species continuation improved;

47. Increased natural air and water filtration, water/flood regulation, CO_2 capture, human enjoyment;
48. Land consumption and pollution related to transportation (e.g. vehicle emissions and road salt runoff) are substantially reduced;
49. Reduced per capita consumption of material resources for buildings and pavement, and reduced pollution from their production, use and disposal;
50. Reduced water consumption (e.g. lawn watering) and its related impacts on groundwater and pollution related to treatment and pumping;
51. With a smaller per capita urban footprint, more rainfall is absorbed into rural grounds, and runoff is reduced;
52. Reduced noise pollution from transportation and air conditoning use;
53. Fewer toxins released into soil and air from landscape maintenance.

Getting It Done

With a list of benefits this long, why do we cling to the suburban model?

Getting any particular development or development plan approved and implemented involves a host of processes, rules, costs, analyses and other factors that vary from region to region.

Getting Newburg communities actually built requires that its builders see adequate profit potential. Certainly, good community design and the design quality of homes and other buildings are essential to attract buyers. Additionally, builders know that more residential and non-residential units per hectare, and more floor space per hectare, can mean greater profit per given land area.

From the point of view of residents in existing communities, if the impacts of different city-building styles are unknown or uncertain, they are generally opposed, even if those changes are not in their immediate neighbourhood. For municipal decision-makers, the paths to success include positive approaches, highlighting how pleasantly liveable, beautiful and useful to them the new community can be, in an urban way. Communications must also ensure that

people become aware that change is inevitable, and that holding on to 20th century city-building practices in the 21st century will be costly to them personally. The implications of global energy issues, rapid climate destabilization and its dangers, traffic congestion, loss of foodlands, and other problems are too serious to ignore, especially since decisions made now regarding urban form on currently-rural lands will be permanent. Future-thinking by all stakeholders is necessary.

For existing residents who have a particular concern about tax-supported public costs, a selling point for the Newburg style is that it costs existing municipal taxpayers little or nothing compared to traditional suburban development, and can reduce overall per capita pressures on annual property taxes. Increases in density can reduce capital costs for roads by 25% to 60% and reduce water and sewer line costs by 15% to 40%.[13]

Future-thinking is critical. We can no longer afford to just tweak a 20th century suburb and call it a 21st century city.

Implementation of Newburg communities adjacent to existing built-up suburban areas requires changes in official land use plans. New communities should be built in high-density mixed-use fashion if sustainability is to be achieved. If that is not immediately possible to do over a large area, an alternative option is to designate a number of 'special policy areas' of significant size that can develop under different rules than other areas planned for urbanization. if necessary, incentives for builders can be used as levers, such as fast-track approvals, reduced development and impact fees, public parking facilities for non-residential uses, and other incentives. An architectural board may be needed to ensure that criteria for proper scale, density, mix, architectural quality and harmony are met by the development industry.

Upper levels of government can help by encouraging experimentation, by linking grants and subsidies to efficient land use, and by proactively providing more and better funding for transit capital and operating costs. One way of enabling early provision of public transit services in new communities is for municipalities to require that apartment buildings be the first housing form to be built.

Alternative Development Standards for Newburg Sustainable City-Building Communities

Newburg is a conceptual example of sustainable city-building appropriate for 21st century conditions. Development standards should be different than in typical North America suburban municipalities. The following list includes some alternative development standards, expressed in a brief and generally non-technical manner, that support the Newburg style, especially with regard to overall densities and the mix of uses. *The list should not be considered to be complete, nor should the wording be considered as final.* Some items normally considered to be building code rather than zoning are also included.

Residential:

- A *Low-Density* residential area is a defined geographic area occupied by single detached homes or semi-detached homes and where the number of residential and non-residential units in the area totals no more than 20 per gross hectare excluding natural and rural areas designated by the municipality or other level of government for preservation. A non-residential unit is defined as one that is occupied by a single tenant. Low density residential lots shall be limited to no more than 10% of all residential lots in a larger defined urban area of greenfield development unless the proportion of apartment-style residential units relative to all residential units in the adjacent area is in excess of 33%. *(Note: or other percentages deemed locally appropriate yet not significantly different. The count of apartment units in the existing built area can also be defined being within one kilometer or so from the boundary of the proposed new developed area.)*

- A *Medium-Density* residential area is a defined geographic area where the number of residential and non-residential units in the area are included at a *rate* of between 25 and 50 units per gross hectare, excluding public amenities and transportation rights-of-way and natural and rural lands designated by the municipality or other level of government for preservation.

- A *High-density* residential area is a defined geographic area where most residential and non-residential units are stacked one above another, such as apartment buildings, six-plexes and the like, stacked townhouses, residences above retail or office units, multi-storey residential buildings providing special

care (nursing homes, supportive housing, etc.), and non-residential units, and where the overall density per gross hectare is greater than 50 units per gross hectare, where gross hectare excludes public amenities and transportation rights-of-way and designated natural, rural and heritage areas and properties that do not include residences.

- The overall population density of the new development area shall be no less than 100 residents and employment persons (as estimated by the municipality) per gross hectare.

- A pedway is a transportation right-of-way that is normally between 3.5 and 4.5 meters in width, and which separates the frontages of buildings aligned along its length, and which is limited to use by persons travelling on foot or on non-motorized vehicles, and which is accessible by emergency and utility vehicles. Motorized access is normally located at the rear of properties fronting on a pedway, in a laneway configuration.

- Residential building styles along or within every residential street or pedway shall include a visible diversity of architectural facades *(Note: a preference against monotony)*, and internal styles and floor spaces that are suitable for a variety of household circumstances. Ground-oriented homes (row homes, semi-detached homes, single detached homes) along a single pedway or street shall normally be two stories in height, but include variations of no more than one storey.

- Homes and other buildings on properties along a pedway shall be set back from the pedway by no more than five meters.

- Multi-unit residential and mixed-use buildings and low-rise apartment buildings of no more than 4 stories can be located within any residential area.

- A multi-storey apartment building or commercial building shall not be of a height that casts a continuous shadow over adjacent properties *(Note: Or for a number of daylight hours specified by the municipality)*, unless the shaded portion of those adjacent properties are non-residential or the shadowed area is a parking lot or storage facility.

- At least 25% of units in apartment buildings shall include three bedrooms or more, and, where the building contains 50 or more units it shall have secure indoor and outdoor play areas of a functionally effective size for children.

- Rear laneways serving garages of residential properties shall be 9.7 meters wide (32 feet) to enable private parallel parking in front of each garage, 2-way vehicle access and space for snow removal.

- An accessory dwelling above a rear laneway garage can be built if it does not cast a continuous shadow over an adjoining private yard *(Note: Or for a number of daylight hours specified by the municipality)* and its windows do not directly face neighbouring homes, unless the window sill is at least 1.85 meters (6 feet) above floor level.

Non-Residential Uses:

- A geographic area totalling one sq.km. or more shall be planned to accommodate a type and quantity of non-residential floor space adequate to support employment in a ratio of at least one job per three residents of that geographic area, excluding employment areas established for industrial uses (for example, warehouses, metal production or assembly industries, water treatment facilities).

- A full-selection grocery store and a pharmacy shall be located within a 750-meter walking route of any residence.

- A business that is not a retail store or office can be located adjacent to or within a residential area if its hours of operation are limited to between 7AM and 8PM Monday to Friday, and if it does not emit chemical pollutants or illumination in excess of those normally emitted by residential uses of equal indoor floor area, and if the business does not involve significant truck movements or noise or operate in a disturbing fashion between the hours of 7AM and 8PM Monday to Friday or at any hour on Saturdays and Sundays.

- Apartment buildings of more than 60 units must include retail or office uses at street level.

- Buildings housing office and/or retail activities shall have a total floor space to building ground area ratio of at least 3.0 except where a retail business outlet cannot, for structural reasons or due to exceptional size, be accommodated below other floors that house other businesses.

- The ratio of the gross floor area of buildings in which office and/or retail uses are located shall be no less than 2.0 relative to lot area.

- Setbacks of buildings from property lines shall be determined based on the use of the building and whether the space created by the setback serves a reasonable functional purpose for its occupants. *(For example, an apartment building may have yard space behind the building for the benefit of its occupants, whereas an office building may not be allowed to have more than one-meter side lot and 2-meter frontage setbacks).*

- An architectural board administered by a local authority shall establish standards of architectural beauty and quality that must be met for all new construction, including buildings and public spaces (roads, parks), and in ways that conform to land use ordinances.

Transportation:

- Parking spaces shall be provided by the municipality within a two-minute walk of non-residential uses and in quantities sufficient to support the access needs of employees and visitors to any property containing non-residential uses. Where such parking is provided, private parking areas are not required nor encouraged.

- The municipality may, as a condition of approval of the development of land, require the conveyance of an amount of land that it deems necessary to provide for the parking needs of the immediate community or development area *(Note: conveyance of land may be limited and specified by various levels of government).*

- The road configuration of the Newburg-style area shall be one that maximizes connectivity of the people within its area and to adjacent urban areas, and minimizes the amount of road space necessary for an adequate traffic flow. This is normally achieved by a road network that is in a grid pattern, without 'dead end' roadways.

- Sidewalks on every road shall be no less than 2 meters wide (6.5 feet), and at least 4 meters wide (13 feet) along major roadways.

- Properties on which there are non-residential activities shall provide sheltered bicycle parking, unless the local government provides such parking within a 2-minute walk of those activities.

- Pedways shall be designed as a component of the pedestrian transportation system, and be contiguous with other walkways.

- The road network shall be of a configuration that enables public transit services to be accessible by any person, such that every dwelling or place of business is

within 250 meters of an intersection of two pubic transit routes or two potential public transit routes.

- The road network should include transit-only lanes no more than 1,000 meters (3280 feet) apart where roads are generally parallel. The road network shall support a preference for travel by public transit, and road space requirements shall reflect an increased use of walking, bicycling and transit as travel modes.

- Rights-of-way of major roads shall include lanes in both directions that are exclusively for travel by bicycle, and that these bicycle lanes be at least 1.85 meters wide (6 feet) in each direction and separated from traffic and on-street parking by a boulevard or buffer.

- Every transit stop shall have a comfortable shelter for waiting passengers and also include bicycle lock-ups.

Natural Heritage and Open Space:

- Urban development shall not occur on lands determined by the municipality or conservation authority to have significant value as natural capital or natural heritage or to be of scientific interest.

- The geographic extent of the preservation of riparian corridors, other bodies of water, biodiverse natural areas and other natural features shall be determined by the municipality or conservation authority.

- Public open space in the form of parkland and public open fields of no less than 600 square meters (6,500 square feet) in size, or athletic fields on school properties, shall be provided within 200 meters of apartment buildings.

- Overall open space in the form of recreational parkland and public open fields and athletic fields including those on public school properties, shall be no less than 5% of the overall land area of the built-up area, and may be supplemented by natural heritage lands as may be identified by the municipality or conservation authority.

- Small parks of one hectare or less in a Newburg-style area shall be interspersed throughout the community and be contiguously accessible by the pedway network, and shall include a variety of botanical features, benches, tables and chairs of lasting construction, children's playground equipment, splash pads or other recreational features. The perimeter of such parkettes shall be bordered by

masonry or stone walls of at least 1.2 meters (4 feet) in height where they adjoin residential properties.

- The municipality may require, as a condition of approval of development, the conveyance of lands sufficient for the purpose of providing recreational parkland, athletic fields, exhibition grounds, and public open space.

Energy Systems and Energy Conservation:

- The municipality shall establish energy conservation targets for all buildings and energy generation targets for the community as a whole that in their entirety result in an overall reduction in the consumption of non-renewable energy resources in an amount that is at least 70% of the overall average for the remainder of the urban region as a whole.

- The municipality shall require all new building construction to include geothermal exchange systems for all residential and non-residential units, or provide suitable district geo-exchange systems using public open spaces (such as athletic fields) as locations for such systems.

- The construction of all residential and non-residential units and free-standing garages with sloped roofs facing between 15^{o} of due south shall include photovoltaic or solar thermal systems. Photovoltaic or solar thermal systems shall be installed on at least 50% of the roof area of all buildings with flat roofs.

- The municipality may provide district power generation and heating systems, or operate the systems mentioned above, as it may deem appropriate. (For example, “All public and private parking areas of a size that can accommodate 12 parked vehicles or more shall be covered by photovoltaic panel arrays.”)

- Every building shall meet a high level of thermal insulation and electrical efficiency, as specified by the municipality and provincial building codes.

- The municipality shall encourage and enable wind turbines for electricity production to be installed in areas of primarily non-residential activities, where permitted by provincial legislation.

- All actions to reduce or eliminate the use of fossil fuels in the municipality shall be taken in recognition of the urgent need to reduce the global and regional impacts of the rapid destabilization of global climate and ecological systems, and global warming, as advise by the United Nations Intergovernmental Panel on Climate Change.

Water and Waste Management:

- The municipality shall undertake to implement reductions in the use of potable water within each community, and to improve the absorption of water by the ground, by requiring permeability of paved ground surfaces, or other mechanisms that retain rainwater for urban use or to restore groundwater.

  (Other aspects of water management – such as neighbourhood/community treatment of sewage, metering, water recycling for industry, etc. -- are not included in this document. Sustainability policies for water treatment and use can be accessed from other sources. The management of solid wastes from households and other sources, while necessary for sustainable living, are not considered land use issues except for implications for landfill and processing facilities.)

Densities in sustainable communities:

- The overall human occupant density per square kilometer of the Newburg-style community or other community style shall be no less than 10,000 residents and jobs and be of a mixed-use environment, including residential, retail, office, commercial, institutional, and benign industrial activities and the public realm, in order to enable a high standard of environmental and economic sustainability.

The Bottom Line

Current patterns of suburban development are environmentally and economically unsustainable, and are in opposition to the urgent and dramatic reductions in fossil fuel emissions that are essential for avoiding life-threatening damage to life support systems.

Dependence on non-renewable energy must be dramatically reduced by ensuring that all urban development, be it through infill or unavoidable building construction on currently-rural lands, is of high-density and of intimately mixed use wherever possible, such that daily destinations can easily be accessed by walking, bicycling or mass transit. The new development must also be pleasant and safe, affordable, and meet the needs of the demography of the future.

The purpose of this Newburg document is to provide information that raises awareness, understanding and level of acceptability of an urban development form that adequately addresses environmental, economic, energy, transportation and livability aspects or urban life. The Newburg model is a sustainable and viable alternative to current forms of urban development.

Newburg demonstrates that high overall population and employment densities can be achieved while still providing for a substantial portion of ground-level homes with backyards. It is a city-building style that requires no special construction or added expense compared to existing urban development styles. It is a style that is more affordable and more socially advantageous than today's typical suburbs.

Importantly, Newburg is an urban form that is more respectful of the need to leave for today's children and grandchildren an environment that is healthy, and that reduces exposure to environmental and energy-related shocks that will diminish their well-being.

Notes

1. The Greater Toronto Area, on the north shore of Lake Ontario, has 5.9 million residents, 2.6 million of whom live in the City of Toronto itself, and another 3.3 million in surrounding Regional Municipalities of Halton, Peel, York, and Durham. The region is growing by approximately 90,000 residents per year. The region is the economic and financial hub of Canada

2. US population projections were obtained from http://www.census.gov/population/www/projections/summarytables.html. Projections for Canada were obtained from http://www40.statcan.gc.ca/l01/cst01/demo23a-eng.htm.

3. Deleted.

4. Deleted.

5. Deleted.

6. Ontario College of Family Physicians, October 17, 2005.

7. Ontario Ministry of Finance Demographic projections, August 2008.

8. Population Division, US Census Bureau, August 2008

9. Average household population size in the USA is about 2.59; in Ontario, Canada, it is 2.67; however, fringe communities tend to have larger average household sizes. Within these overall averages, household sizes by housing type are variable. If the availability of condominium apartments in a variety of sizes is improved, more families will be drawn to them. This increases their average occupancy, as well as raising the average occupancy of detached homes and ground-level attached homes, because smaller households will migrate to apartments. In the Newburg model, the availability of many large attached homes and the lack of single detached homes mean that occupancy in attached homes will approach those of single detached homes.

10. The Netherlands has instituted an ABC policy that classes urban uses in a way such that uses with the highest concentration of human activity must be located where public transit is best. Conversely, uses such as warehousing industries are located along highways and rail systems, away from areas well served by public transit

11. At Newburg densities, this population (64,000) resides within 9 square kilometers. The combination of density and an intensive mixing of uses enable many more trips to be taken by walking, bicycling, and transit. Although estimates are not precise, this example might reasonably produce a modal share of trips by automobile of 42%, if convenient transit services exist. On average, local car trips would be of shorter length than in a typical suburban environment, because more destinations are closer. Please note that the modal share scenario being described is hypothetical, because no Newburg community actually exists. The total of 128,000 daily trips by the 64,000 residents includes approximately 10,600 trips by automobile during the 6-9 AM Peak period in the Newburg scenario (not adjusted for more than one person per car). Its predominantly-grid pattern of

roadways of two lanes in each direction, or a single lane in each direction plus a center turning or passing lane, would be able to accommodate this peak hour vehicle load without difficulty. This contrasts with most traditional suburban road networks where, very often, traffic is diverted from short or single-access residential streets (crescents and cul-de-sacs) to relatively fewer main roads, often resulting in congestion.

Downstream traffic loads would vary with the size of the Newburg area. However, volumes would be reduced by shorter trip lengths overall. Longer trips in a Newburg situation would be supported by superior transit services and limited-access highways. Because Newburg is intended for urban fringes, no allowance is made here for traffic flowing through the Newburg area from beyond the urban fringe.

A Scenario for Travel Modes for a 9 km.^{2} Newburg-style area of 64,000 residents

Mode of travel	Typical Suburb		Downtown Toronto*		Newburg Model**		Peak Hour Trips	
	Daily Ttrips	Share of Total	Daily Ttrips	Share of Total	Daily Ttrips	Share of Total	Newburg	Share of Total
Walk/Cycle	7,680	6%	38,699	30%	38,400	30%	9,617	30%
Pubic Transit	12,800	10%	37,777	30%	32,000	25%	10,636	34%
Automobile	103,680	81%	47,489	37%	53,760	42%	10,602	33%
Other***	3,840	3%	3,922	3%	3,840	3%	950	3%
Totals	128,000	100%	128,000	100%	128,000	100%	31,683	100%

Average number of daily trips per person = 2.0.

* Based on Ontario 2016 TTS Survey for Wards 19,20,27,28,29,30,31 and 32.

** Hypothetical distribution, assumes that a much greater percent of all trips will be to destinations outside the 9-km^2 area compared to downtown Toronto, where a higher percentag of jobs are located.

*** Includes motorcycle, taxi, school bus and all other modes.

12. Newburg requires far less transportation space than typical suburbs. Transportation space includes public rights of way, private vehicle parking (lots and driveways), servicing and free-standing garages.

Comparisons per Sq.Km.	Typical Suburban	Newburg Style
Total hectares	100	100
% transportation space (est.)	50%	39%
Transportation space	50	39
Typical resident population	2,500	9700
Transportation space / person (square metres)	200	40
Ratio	5.0	1.0

13. (Scientific American, Dec/2000, p. 86).

Note 14

Projection of Newburg to larger area and population:

	One Sq.Km.	One Sq.Mi.	5 sq.km.	3 sq.mi.
Straight-line extrapolations:				
Overall resident population	9,769	25,302	48,846	75,906
Overall employment	3,658	9,474	18,290	28,423
Total overall occupancy	13,427	34,776	67,136	104,329
Land area (hectares or acres)	100	640	500	1,920
Overall Density per km.^{2} or mi.^{2}	**13,427**	**34,776**	**13,427**	**34,776**

Adjustments and additional land for uses not included in one sq.km. site:	**Hectares**	**Acres**	**Hectares**	**Acres**
Water treatment/waste facilities - Note 1	1.0	6.3	4.9	19.0
Hospital(s) - Note 2	0.4	2.5	2.4	9.1
Add'l elementary & secondary schools- Note 3	5.4	34.7	27.2	104.0
University land @ 30 hectares per university	0.3	1.6	1.3	4.9
Cemeteries (assume 0.5% of land)	0.5	3.2	2.5	9.6
Major Parks (at 10 m^2 per resident)	9.8	65.5	48.8	196.6
Major athletic/exhibition grounds	0.5	3.1	2.4	9.4
Renewable energy facilities ?	as desired	as desired	as desired	as desired
Additional industrial - Note 4	11.8	75.2	58.8	225.7
Stormwater management ponds	0.9	9.1	6.9	27.4
Incr. detached housing to 5%	1.4	8.7	6.8	26.2
Municipal works yards, transit yards	2.0	12.8	4.9	18.7
Total Adjustment (hectares or acres)	33.9	222.9	167.0	650.6
Total Extrapolated Area (km.^{2} or mi.^{2})	**1.34**	**1.35**	**6.67**	**4.02**

Adjusted Total Occupancy:				
Residents	9,769	25,302	48,846	75,906
Employment @ original ratio 37.4%	3,658	9,474	18,290	28,423
Plus Industrial emplmt adjustment	552	1,429	2,758	4,286
Hospital staff @ 1,300 per 100,000 pop.	127	329	635	987
Add'l educational employment	68	176	340	528
Adj for more/fewer SFD Units - Residents	49	127	245	381
Total occupancy	**14,223**	**36,837**	**71,113**	**110,510**

Overall Occupancy per km.^{2}	**10,624**	**27,321**	**10,661**	**27,513**

Note 1: One hectare or 2.5 acres per 10,000 residents. Wastewater treatment needs reduced by household/commercial greywater systems, low-flow systems,

Note 2: One hospital and 4 hectares or 10 acres per 100,000 residents. Assumes efficient land use, including multi-level parking.

Note 3: Adjustment based on inadequate allowance for schools in 1 km^2 site, based on population by age cohort.

Note 4: Adjustment re shortfall in industrial employment and land in sample Newburg site. Adjusted to target of 50 jobs per hectare. May also include major retailers such as Wal-Mart and Home Depot.
Additional employment beyond what is calculated here is likely to be office and retail, which can be accommodated on very little additional land.

Appendix One

The devastating Blows to Survival of Rapid Climate Change

Climate change is happening now, thousands of times faster than natural changes in the past. It has consequences that will dramatically damage us in our lifetimes, and become far (far) worse for our children and grandchildren.

250 million years ago, a mass extinction that left only a few species of life on earth alive was caused by rising carbon dioxide levels in earth's atmosphere, and also by huge releases of methane, resulting in a 5° Celsius warming of the planet. Carbon dioxide is being added to earth's atmosphere at a rate that is, by most estimates, ten times faster, and are also now causing methane to be released from permafrost. There is right now fully a third more carbon in the atmosphere than at any time in the last 800,000 years*.

The rapid destabilization and heating of the earth requires actions much greater in scale than are currently planned, and they must be undertaken now — *now*. The UN's Intergovernmental Panel on Climate Change (IPCC), speaking for thousands of scientists around the world, said bluntly in October of 2018 that unless global GHG emissions are cut by 40% to 45% by 2030 (one decade away), we will not be able to limit global heating to 1.5° Celsius above pre-industrial norms, and will face devastating consequences.

Instead of decreasing, global GHG emissions are still rising and show no sign of leveling off, let alone decreasing. The 1.5°C. target will be exceeded between 2030 and 2052*. According to the IPCC, current nationally stated commitments to cut GHGs, if achieved, will result in a 3.2° increase in global temperatures by 2100, and higher beyond that. If we do not meet those targets, the 2100 average temperature increase will be more than 4° – very close to the levels of 250 million years ago. Temperatures in northern latitudes will be higher.

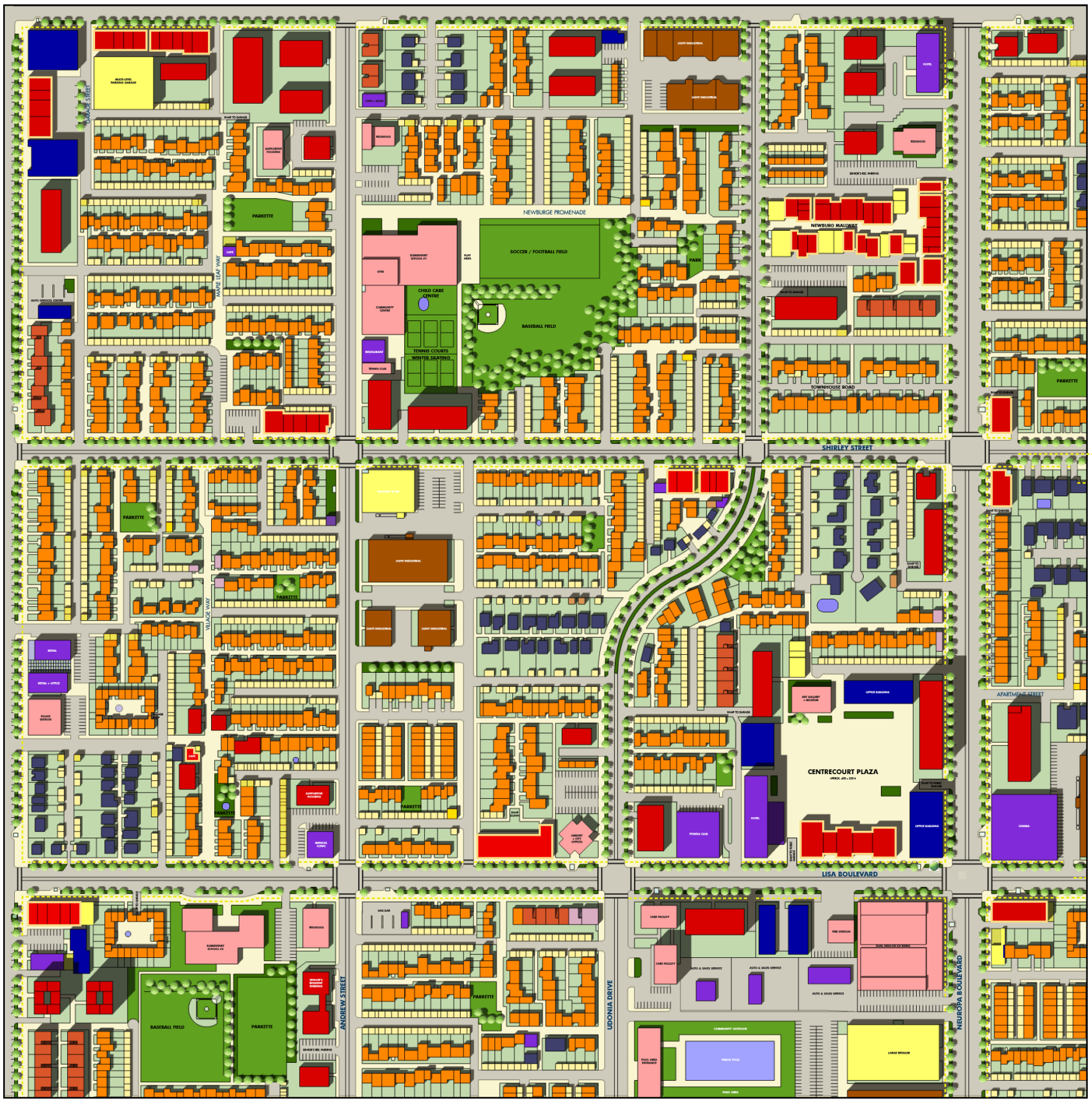
Rapid global warming of 3.2° will have the following devastating and inter-connected impacts. Each of us will be affected as temperatures move rapidly higher to that level by 2100.

- Every natural ecosystem will be at risk of collapse, or will have collapsed.
- There will be a much higher frequency of droughts and precipitation deficits, and lasting for longer periods. This will affect food production; food prices will be much higher than today, where food is available.
- Extreme heat events will become normal, and will last longer. Costs to cool buildings will more than double. The mid-latitudes (including southern Canada, much of the USA, the Mediterranean, central Europe) will experience an average rise of 4°. There will be fewer extreme cold nights.
- Heat-related morbidity and deaths will multiply, and be especially deadly in low latitude countries. Conflicts and economic dislocations will become widespread.
- The loss of livestock and declines in livestock health will affect prices and human diets everywhere.
- The number of wildfires and significant flooding events will multiply and be more widespread. Controlling them will become more difficult, and drain public finances.
- Rising temperatures and dryness in much of the USA will make it unlivable by 2100. Canada will experience a massive flow of climate refugees from the USA that will strain our ability and desire to accommodate them.
- Heating and habitat loss will decimate plant, insect and other animal populations. Rates of extinction will accelerate beyond already extreme rates. Food production will be affected; the variety and quantity of foods available will be at risk.
- Polar ice will continue to melt, at a more rapid rate than is happening now, and will not stop. Sea levels will rise by meters, to the point that coastal cities and marshes will become flooded. Insurance rates will increase, or flooding will not be insured. Every ocean beach will disappear.
- Less arctic ice means more heat from the sun will be absorbed into the oceans, creating a feedback loop that will melt more ice.
- Permafrost is thawing *now*, emitting billions of tons of methane, a greenhouse gas 20 to 25 times more powerful as a GHG than carbon dioxide. It will thaw faster, and may never freeze again. A feedback loop is already occurring that will accelerate global heating.
- Boreal forests will be degraded, and some will be lost.
- Vector-borne diseases will migrate will climate changes.
- The ocean is and will become more acidic, and will experience oxygen loss. Coral reefs, and aquatic life dependent on them, will face total die-off. Populations of fish dependent on them will, in turn, be threatened. Food production from fishing and aquaculture will drop. Land animals will become a greater source of food in many regions; extinction rates will increase.
- Armed conflicts will increase as famine and human-caused disasters spread. North America will not be spared.
- National, regional and local economies will be put in disarray as more financial resources are allocated towards adaptation and mitigation of climate events and trends. Employment dislocation and poverty rates will increase (with artificial intelligence as an additional factor), constraining the ability of governments to keep up with its social costs. Enforcement of laws to limit crimes of desperation will be strained. Politically-driven tax cuts to offset increased household costs of climate change will cripple the ability of governments to keep up with change. Delays in moving to net-zero carbon energy production will make necessary actions more difficult to undertake.
- Political and monetary pressure from fossil fuel industries will make a rapid transition to energy based on non-fossil very difficult, and perhaps dangerous.
- Adequacy of action is and will be constrained by denial of the existence and/or severity of the problem, for the sake of political expediency, or perhaps simply because people's consciences cannot not admit to responsibility for the collapse of climate stability.

* Per sources identified in the book "The Uninhabitable Earth: Life After Warming", by David Wallace-Wells.

Appendix Two

This master plan view represents the one square kilometer example used for the Newburg sustainable greenfield development model. The example is intended to demonstrate that high population and employment densities can be achieved while still remaining family-friendly. Please note that not all components of a complete urban area are included in the example.



NEWBURG

A high-density greenfield development model for sustainability

This one km^2 site plan accommodates:
9,700 residents - 38% in ground-oriented homes; remainder in apartment-style buildings, in store-top units, and in supportive care buildings.

3,700 employment spaces - including office, sevice, retail, light industrial and institutional employment.

Not all urban components are accommodated on this plan (for example, major urban parks, universities, expressways, rail and power corridors, heavy industrial uses)

DESIRABILITY FEATURES:

- Demographically responsive to a full range of household sizes.
- Higher density means less cost per capita for public services (roads, utility lines, libraries, etc...)
- Pedways that minimize exposure to motor vehicle traffic. Family-friendly.
- Urban form that promotes social contact and interaction.
- Quiet front walkways/pedways unobstructed and not disturbed by garages, driveways, roads and motor vehicles.
- Mix of housing enables 'aging in place'; closer proximity & access to family/friends enabled for young adults, seniors.
- Convenient access to parks and open space.
- Few highrise buildings.

ECONOMIC FEATURES:

- Higher density and walkability means better visibility/access to local businesses.
- Commerce is drawn by existence of nearby labour force, amenities for employees, and vibrant community.
- Improved affordability for home buyers.
- Significantly reduced exposure to future energy price shocks.
- Attached homes of architectural quality and mixed style and size, with large private yards. Family-friendly.

SUSTAINABILITY FEATURES:

- Compact mixed use built forms that enable more destinations to be accessed by means other than personal automobile.
- A predominance of attached homes and apartment-style homes that are less energy, land and material intensive.
- A network of wide pedestrian ways called Pedways that encourage walking and cycling as significant travel modes.
- Transit-orientation: Almost all residential and non-residential buildings are within 250 metres of a potential transit-stop; highest densities are generally closest to transit.
- Very compact land use enables more contiguous natural areas to be preserved outside the urbanized area.
- Less transportation space per capita without creating congestion; use of shared parking areas that reduce need for private spaces.
- Less impervious ground surface per capita.

LEGEND

- ROADWAYS AND PARKING LOTS
- PEDWAYS/SIDEWALKS/PEDESTRIAN AREAS
- GARAGES
- UNITS ABOVE GARAGES
- PRIVATE YARDS
- PUBLIC OPEN SPACE, SCHOOL, YARDS
- WATER
- RETAIL
- RESIDENTIAL ABOVE RETAIL
- NON-RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- OFFICE
- ATTACHED HOMES / TOWNHOMES
- APARTMENT BUILDINGS
- DETACHED HOMES
- TRANSIT SHELTERS
- LIVE / WORK UNITS
- BIKE LANE
- TREES

0 10 50 100 200m

(Graphic representation by Mike Dinh)

Appendix Three

Whole Site perspective that shows an aerial view from the Northeast quadrant of the sample site.
(To view, turn page 90° clockwise.)