4.0

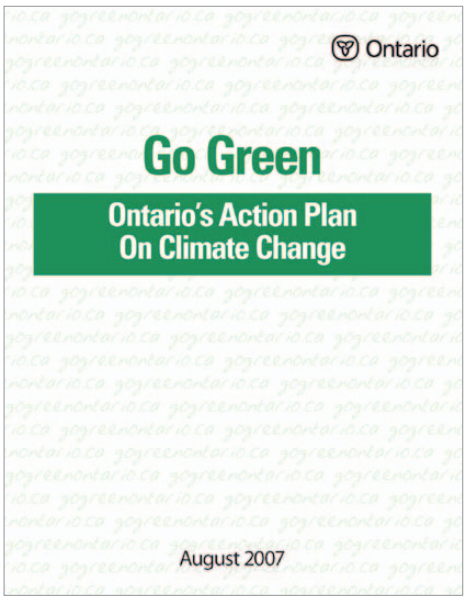
The Opportunity for Tower Neighbourhood Renewal in the Greater Golden Horseshoe

Many of the goals that are typical of Tower Neighbourhood Renewal initiatives in European jurisdictions coincide closely with recent areas of provincial policy development. Increasing transit use, reducing poverty, reducing greenhouse gas emissions, and creating complete communities are central tenets of Tower Neighbourhood Renewal. They are also key areas of provincial interest. Through recent initiatives such as The Big Move - Metrolinx's Regional Transportation Plan, the Poverty Reduction Strategy, the Go Green Action Plan on Climate Change, and the Growth Plan for the Greater Golden Horseshoe, the Province is seeking to achieve a number of the same goals that Tower Neighbourhood Renewal has successfully achieved elsewhere.

In this section, we explore the links between Tower Neighbourhood Renewal and these areas of provincial policy interest, and suggest locations in the Greater Golden Horseshoe (GGH) where there may be particularly high potential for Tower Neighbourhood Renewal to help achieve these provincial priorities.

This analysis places focus on large apartment clusters, which are defined as groupings of five or more Apartment Towers.

4.3 Reducing Greenhouse Gas Emissions



01

Context

The Province's Go Green: Ontario's Action Plan on Climate Change sets targets for GHG emission reductions. The Go Green Plan estimates that if Ontario were to continue with "business-as-usual", emissions in 2020 would be 72 megatonnes (Mt) higher than 1990 levels. Instead, by 2014, the Go Green Plan seeks a reduction of Ontario's GHG emissions to six per cent below 1990 levels (a reduction of 11 Mt of carbon dioxide equivalents (CO2e) relative to 1990 levels). By 2020, Ontario's target is to reduce GHG emissions to 15 per cent below 1990 levels (a reduction of 27 Mt of CO2e relative to 1990 levels). By 2050 Ontario plans to reduce GHG emissions to 80 per cent below 1990 levels.

Energy used by existing buildings for space and water heating accounted for 17 per cent of Ontario's emissions in 2007. The Go Green Plan indicates that energy use by homes will need to account for at least five per cent of the GHG reductions needed to achieve the 2020 target.

Since the adoption of Go Green in 2007, the Government of Ontario has introduced a number of initiatives to achieve these targets. These include the Green Energy Act, Building Code changes, the Energy Efficiency Act, and the introduction of Bill 185, proposed legislation that would allow for the development of a cap-and-trade system. The Ontario Power Authority and the Canadian Urban Institute are working with pilot communities in the GGH to develop and implement energy mapping processes into community energy planning.

The Province has also established ambitious goals for alternative energy sources. As one example, the Province is contributing to the Quality Urban Energy Systems of Tomorrow (QUEST) project which is looking to quantify the potential for integrated community energy systems. Such systems are a common feature of many Tower Renewal initiatives in Europe. Tower Neighbourhood Renewal has the potential to be another component of Ontario's climate change strategy.

Discussion

As described in Section 3.8 of this report, Apartment Towers are among the most wasteful housing types, and collectively are responsible for upwards of two megatonnes of GHGs on an annual basis for building operation alone. However, Apartment Towers are well suited for refurbishment and, in other jurisdictions, they have been upgraded to become model green buildings, with GHG output reduced by more than 50 per cent. Furthermore, Tower Neighbourhoods provide the framework for low-carbon growth.

The high GHG output of Apartment Towers is generally linked to the poor performance of the building envelope, paired with aging mechanical systems. Built before the growing concern for energy conservation, or the widespread application of building science, current energy use for building operation is considerably higher than the requirements for new construction, let alone best practice green building. Refurbishment has the potential to significantly reduce natural gas, electricity and

Refurbish or Replace?

*The primary premise of Tower Neighbourhood Renewal is to view the region's legacy of apartment towers as an asset. This view is reiterated by the successful approaches to renewal found internationally, as well as the local studies cited throughout this report.

Refurbishment is preferable to replacement from cost, environmental and social perspectives. From a cost perspective, refurbishment can be conducted at less than 1/2 to 1/5th the cost of demolition and reconstruction of the same number of units, depending on the scope of renewal work. This is based on per unit cost of refurbishment estimate found in Section 6.1, and a conservative estimate for the cost of demolition and new construction, at approximately $250 per square foot. Furthermore, Apartment Towers are generally revenue generating assets for owners, making demolition even less attractive.

From an environmental perspective, Apartment Towers from this era contain significant embodied energy within their concrete slab construction. Demolition and replacement of the same number of units would be a significantly energy intensive process. From a social perspective, demolition and replacement threatens or completely removes social networks, and significantly disrupts members of the community during the process of reconstruction. Refurbishment can modernize existing housing with relatively minimal disruption and displacement, building upon existing communities, and maintaining the existing housing stock.

Though certain cases may require demolition due to poor state of repair, from the perspective of the research team renewal is the preferred option. However, as these buildings continue to age, the cost and complexity of refurbishment may increase.

water consumption within the region's 1,925 Apartment Towers, as well as improve air quality through a reduction in GHGs.

Recent studies that have examined the local situation, including Tower Renewal Guidelines (John H. Daniels Faculty of Architecture, Landscape and Design, University of Toronto, CMHC, 2009) and Tower Renewal Pilot Community Energy Plans (Arup, City of Toronto, 2010), have determined refurbishment can achieve environmental best practices in building performance in Apartment Towers, and that refurbishment is preferable, from both a cost-benefit and social perspective, to demolition and reconstruction.*

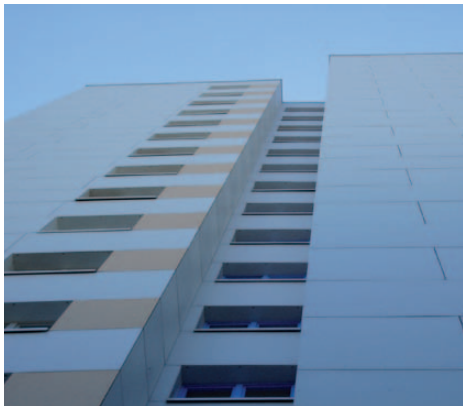
As large buildings housing several hundred households, the green refurbishment of Apartment Towers offers many efficiencies compared to the retrofit of the equivalent number of single family homes. In addition, the dense clusters of Apartment Towers that are common throughout the GGH provide opportunities for using distributed clean energy and district heating and cooling systems, as well as establishing local resource networks for composting, community gardening, or, as in the case of Scandinavia, using sewage for biomass heat generation. This comprehensive approach to retrofit may also result in additional carbon saving from reduced trucking to landfill, reduced municipal pumping of water, and reduced production of energy on a per capita basis.

Internationally, Apartment Tower refurbishment has become common practice as a means of extending the life of this important building stock, while at the same time significantly reducing GHG emissions. Moreover, integration of district systems and green construction practices has made several existing tower neighbourhoods centres of low-carbon growth.** In particular, Germany, The Netherlands, Scandinavia and the United Kingdom have established extensive programs that pair tower refurbishment with site diversification and sustainable new construction to accommodate growth, improve existing neighbourhoods and establish low-carbon communities.

Additional opportunities for GHG reduction can be found in transportation. Currently, 31 per cent of GHGs in Ontario are produced by transportation – 75 per cent of which is a result of gas powered vehicles. Apartment Tower clusters provide the opportunity to reduce auto-dependence through the introduction of rapid transit, as well as the introduction of diversified uses that provide daily conveniences currently only accessible by vehicle.

The environmental refurbishment and green construction associated with Tower Neighbourhood Renewal represents a significant opportunity for growing the green economy, including trade, manufacturing and innovations jobs. With nearly 2,000 Apartment Towers throughout the GGH, in addition to large clusters in Ottawa, London and other Ontario municipalities, Tower Neighbourhood Renewal represents a potentially significant market for the green economy and related industries.

While products and processes related to Tower Neighbourhood Renewal exist internationally, specifically in the European Union, there currently are several capacity gaps in the Ontario marketplace related to home-grown solutions. There is an opportunity to address these gaps by developing processes appropriate to the Canadian context and fostering locally-produced products and expertise that could make Ontario a laboratory for sustainable innovation, and create significant new employment.



02

Images

01) Cover of Go Green, Ontario's Action Plan on Climate Change

02) Refurbished Apartment Building with new Thermal Over-Cladding, Berlin

03) Allotment Gardens, Thorncliffe Park, Toronto

Lower Carbon Growth

**Growth can be a key aspect of the sustainable retrofit and regeneration of Apartment Neighbourhoods. Increased density can aid in the viability of rapid transit, district energy systems, as well as local retail and services, such as grocery stores that also contribute to achieving complete communities.

Though an increased population results in increased GHG production – more people, more carbon – Tower Neighbourhood Renewal provides a potential framework for lower carbon living as compared to traditional suburban alternatives, reducing per capita consumption. From a total carbon emissions standpoint, Tower Neighbourhood Renewal can reduce GHG's from existing buildings, as well as offer more sustainable options for regional growth.

03

Taking A Closer Look - Large Cluster Analysis

While environmental retrofit and refurbishment is likely to result in significant energy efficiency improvements in any of the Apartment Towers, some Apartment Tower Neighbourhoods may contain characteristics particularly well suited for carbon reduction.

In determining these areas, two initial investigations were conducted. The first identified Apartment Towers within 500 metres of large energy producers, which may provide the potential for the establishment of district energy.

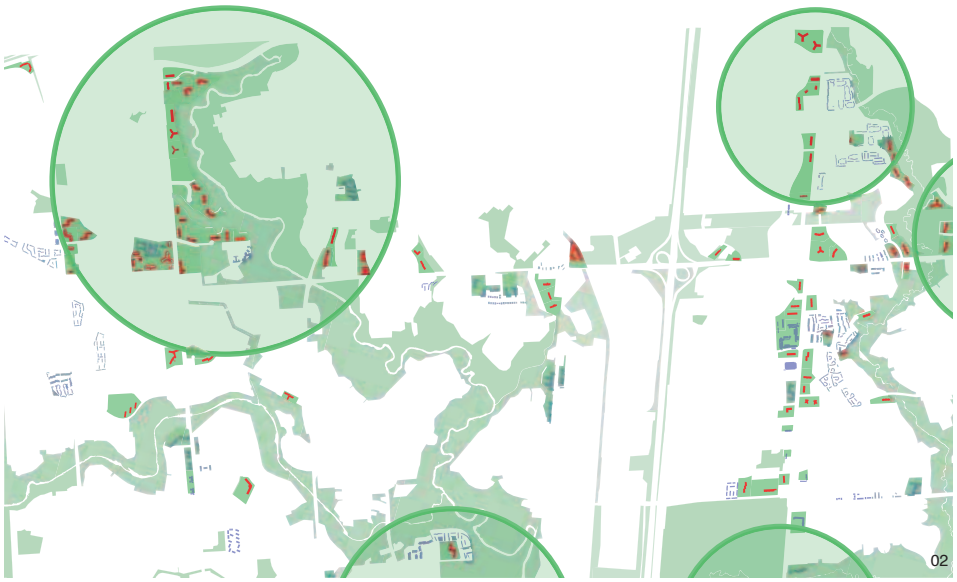
The map on page 79 (opposite) identifies the relationship of Apartment Towers and large energy producers. Forty per cent of Apartment Towers are within 500 metres of large energy users such as hospitals, shopping centres, or industrial areas. Fifteen per cent of these are within 500 metres of two or more large energy users. Large energy users such as these are essential partners for supporting the viability of district energy projects that service nearby residential users. Further study is required to determine true district energy viability.

The second investigation identified specific towers that contained characteristics that would suggest a particularly high potential for GHG reduction. Areas with clusters of Apartment Towers have higher potential because of the economies of scale that can be achieved in retrofitting multiple buildings. Similarly, taller Apartment Towers would be expected to have higher potential for cost-effective improvement.

The time of construction also may be a factor. Recent studies suggest that buildings developed prior to the 1973 energy crisis may be better candidates for refurbishment due to the more robust construction methods that were used after 1973, in response to the crisis.*

The series of maps beginning on page 80 show locations in the GGH where these factors all come together: clusters of five or more Apartment Towers that collectively contain 1,000 or more units, contain at last one larger building (18 storeys or more) and have a majority of towers that were constructed prior to 1973. Together, these represent about half of all towers in the GGH (47 per cent).

Determining the specific opportunities for GHG reduction within individual Apartment Tower Neighbourhoods will require site by site investigation.



02

Variations in Construction

*Throughout the post-war era, no actual building regulations were implemented to mandate minimum energy performance for multiple residential buildings. Rather, variation in building construction and performance were a result of the specific intentions of building developers. Recent studies, including Arup's Community Energy Plans for the Toronto Tower Renewal Office, have indicated that building construction trends towards higher insulation values and better performance towards the close of the housing boom in the mid-1970s, roughly aligning with the 1973 energy crisis. These finding are based on a limited data set, and further study is required to better understand variations in construction method and performance.

01

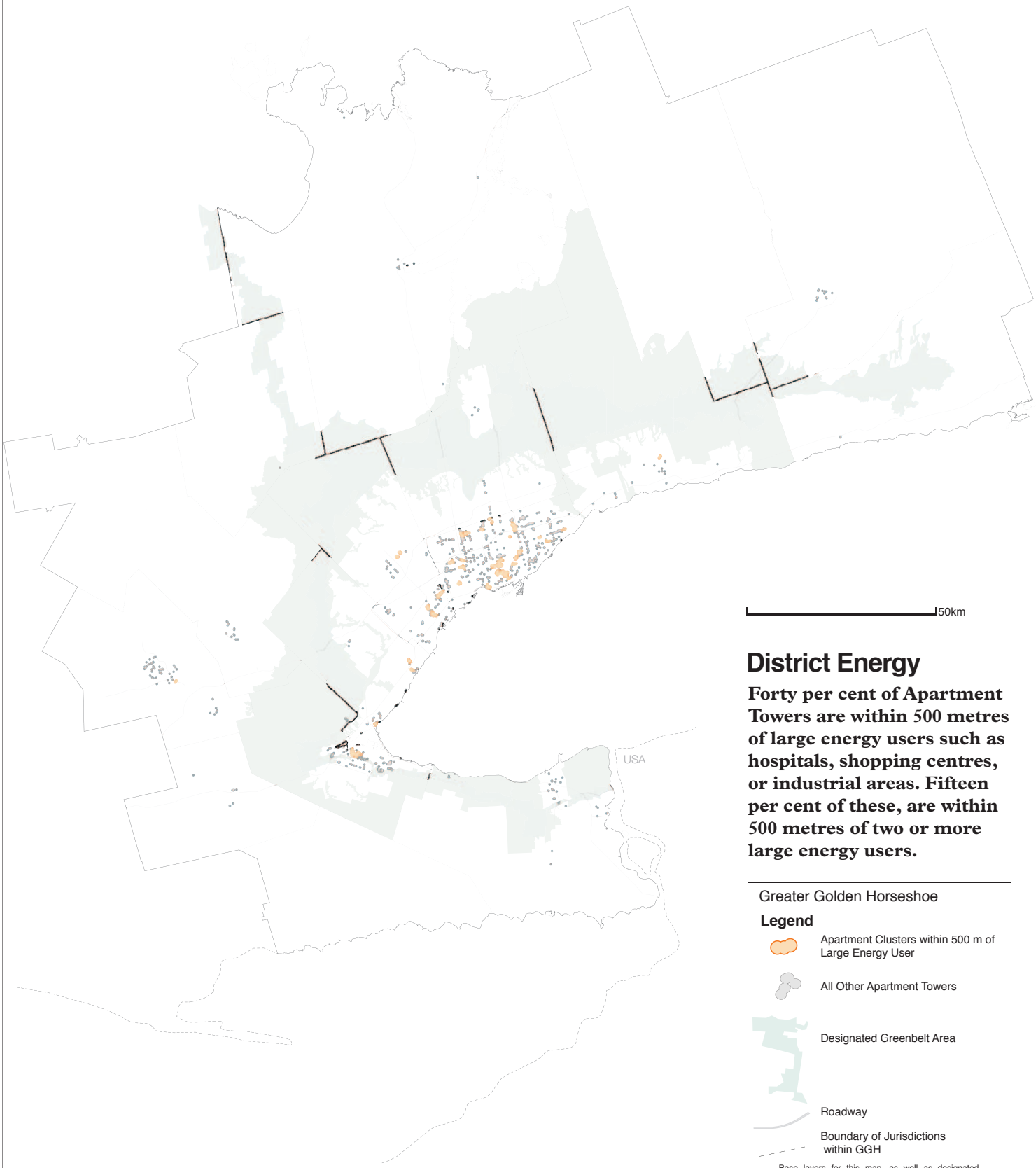
Modern Heritage

The Apartment Towers under study share a consistent architectural style, and are clear expressions of the post-war modernism and mass housing that shaped cities around the world. New technologies at the time in concrete construction allowed for buildings that were structurally expressive, with clearly defined materials. As a result, one of the current liabilities of these buildings are also one of their aesthetic strengths – exposed slab and sheer walls. Although seemingly homogeneous, they contain subtle noteworthy variations, and some, such as the towers of Uno Prii, are local landmarks listed on the inventory of Toronto's heritage properties. As a result, careful consideration will need to be put into their refurbishment.

Images

01) Uno Prii's Jane-Exbury Towers in the former Borough of North York are listed Heritage Buildings

02) Diagram, Intersection of Apartment Cluster and Natural Systems in the GGH, Creating Opportunities for Integrated Sustainable Systems



District Energy

Forty per cent of Apartment Towers are within 500 metres of large energy users such as hospitals, shopping centres, or industrial areas. Fifteen per cent of these, are within 500 metres of two or more large energy users.

Greater Golden Horseshoe

Legend

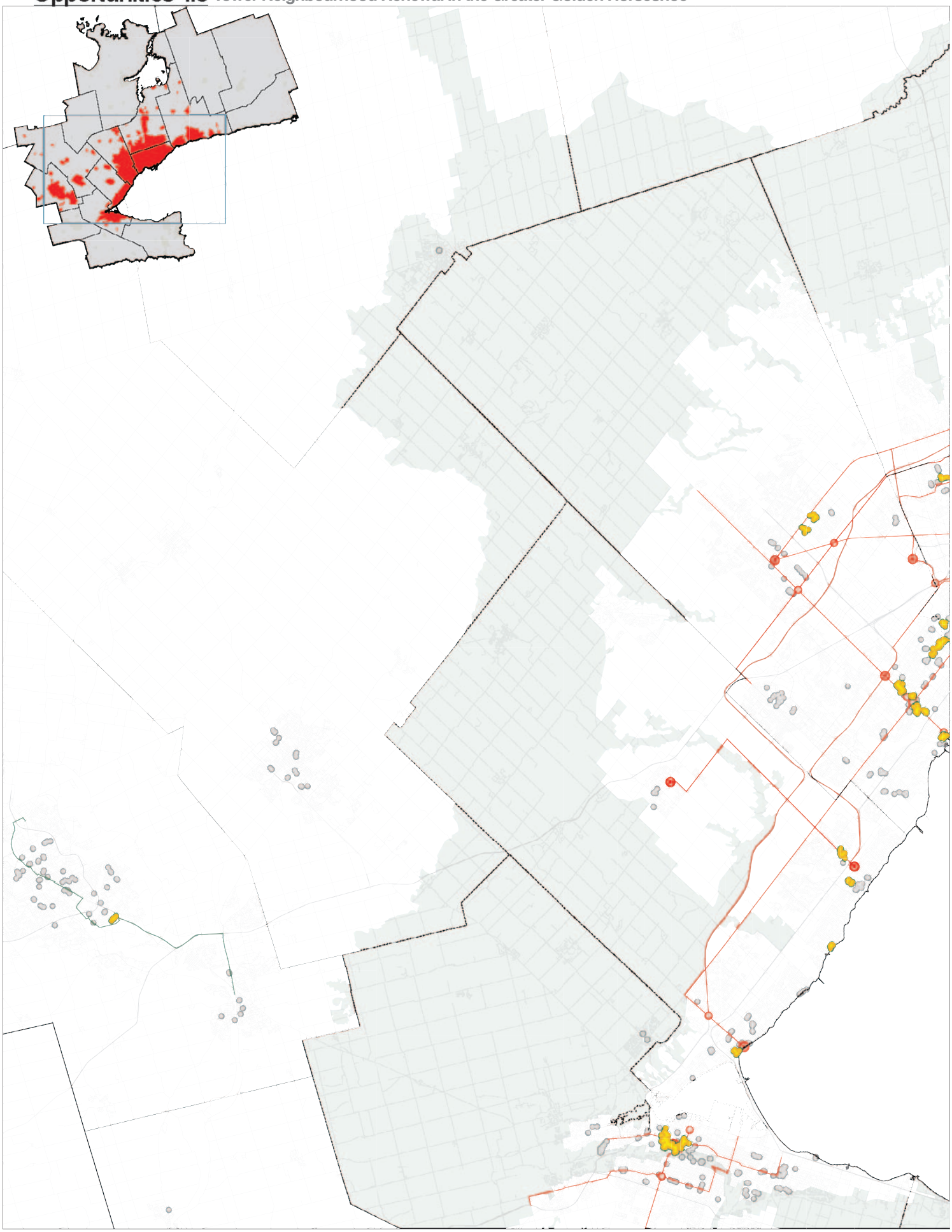
- Apartment Clusters within 500 m of Large Energy User
- All Other Apartment Towers
- Designated Greenbelt Area
- Roadway
- Boundary of Jurisdictions within GGH

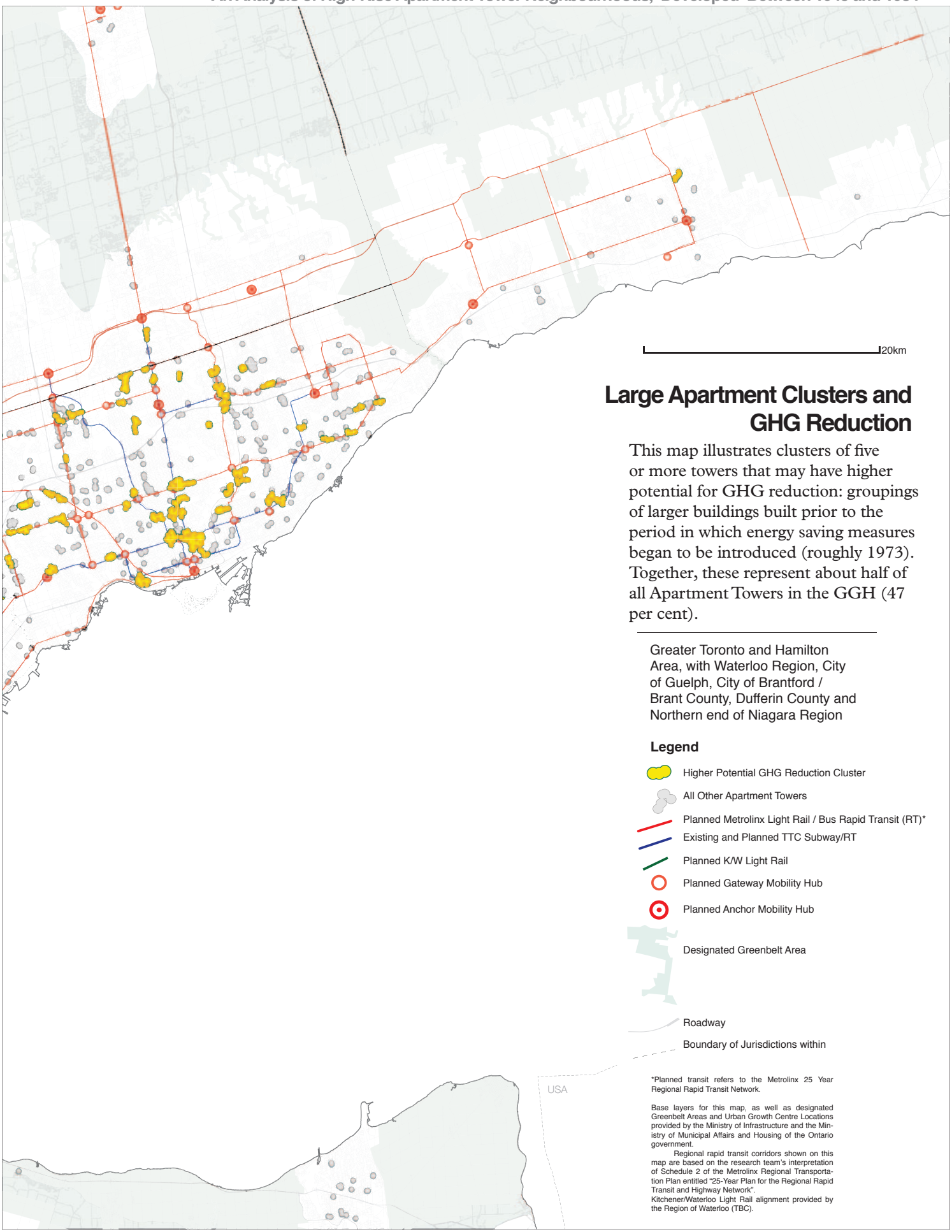
Base layers for this map, as well as designated Greenbelt Areas and Urban Growth Centre Locations provided by the Ministry of Infrastructure and the Ministry of Municipal Affairs and Housing of the Ontario government.

Regional rapid transit corridors shown on this map are based on the research team's interpretation of Schedule 2 of the Metrolinx Regional Transportation Plan entitled "25-Year Plan for the Regional Rapid Transit and Highway Network".

Kitchener/Waterloo Light Rail alignment provided by the Region of Waterloo (TBC).

Opportunities 4.3 Tower Neighbourhood Renewal in the Greater Golden Horseshoe





Large Apartment Clusters and GHG Reduction

This map illustrates clusters of five or more towers that may have higher potential for GHG reduction: groupings of larger buildings built prior to the period in which energy saving measures began to be introduced (roughly 1973). Together, these represent about half of all Apartment Towers in the GGH (47 per cent).

Greater Toronto and Hamilton Area, with Waterloo Region, City of Guelph, City of Brantford / Brant County, Dufferin County and Northern end of Niagara Region

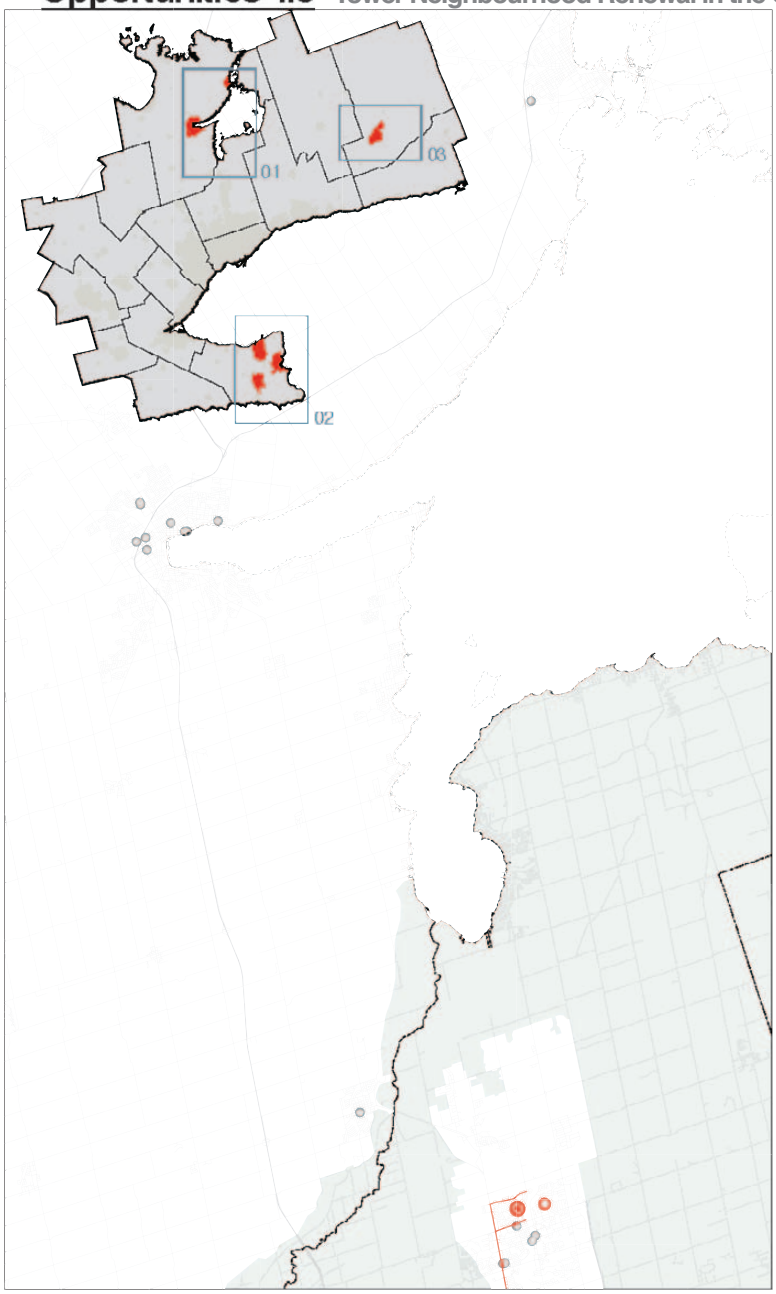
Legend

- Higher Potential GHG Reduction Cluster
- All Other Apartment Towers
- Planned Metrolinx Light Rail / Bus Rapid Transit (RT)*
- Existing and Planned TTC Subway/RT
- Planned K/W Light Rail
- Planned Gateway Mobility Hub
- Planned Anchor Mobility Hub
- Designated Greenbelt Area
- Roadway
- Boundary of Jurisdictions within

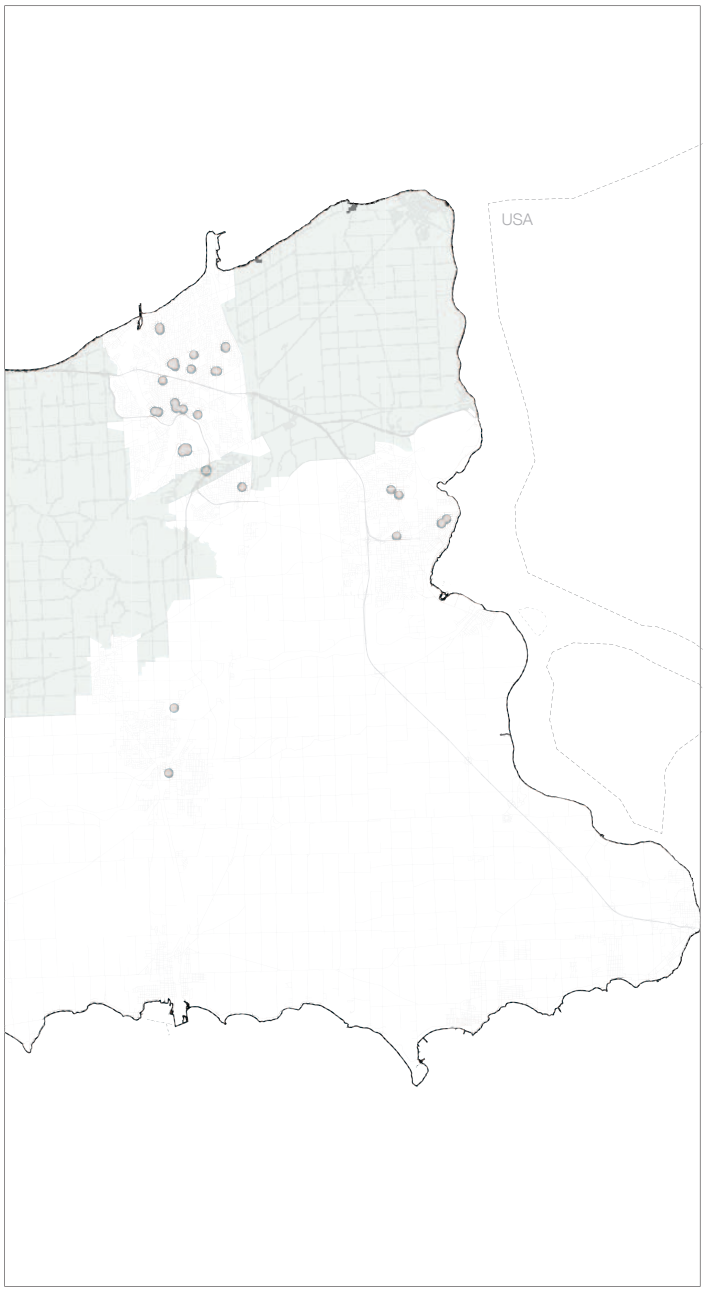
*Planned transit refers to the Metrolinx 25 Year Regional Rapid Transit Network.

Base layers for this map, as well as designated Greenbelt Areas and Urban Growth Centre Locations provided by the Ministry of Infrastructure and the Ministry of Municipal Affairs and Housing of the Ontario government.

Regional rapid transit corridors shown on this map are based on the research team's interpretation of Schedule 2 of the Metrolinx Regional Transportation Plan entitled "25-Year Plan for the Regional Rapid Transit and Highway Network".
Kitchener/Waterloo Light Rail alignment provided by the Region of Waterloo (TBC).



01) Simcoe County



02) Niagara Region

20km

03) City of Peterborough

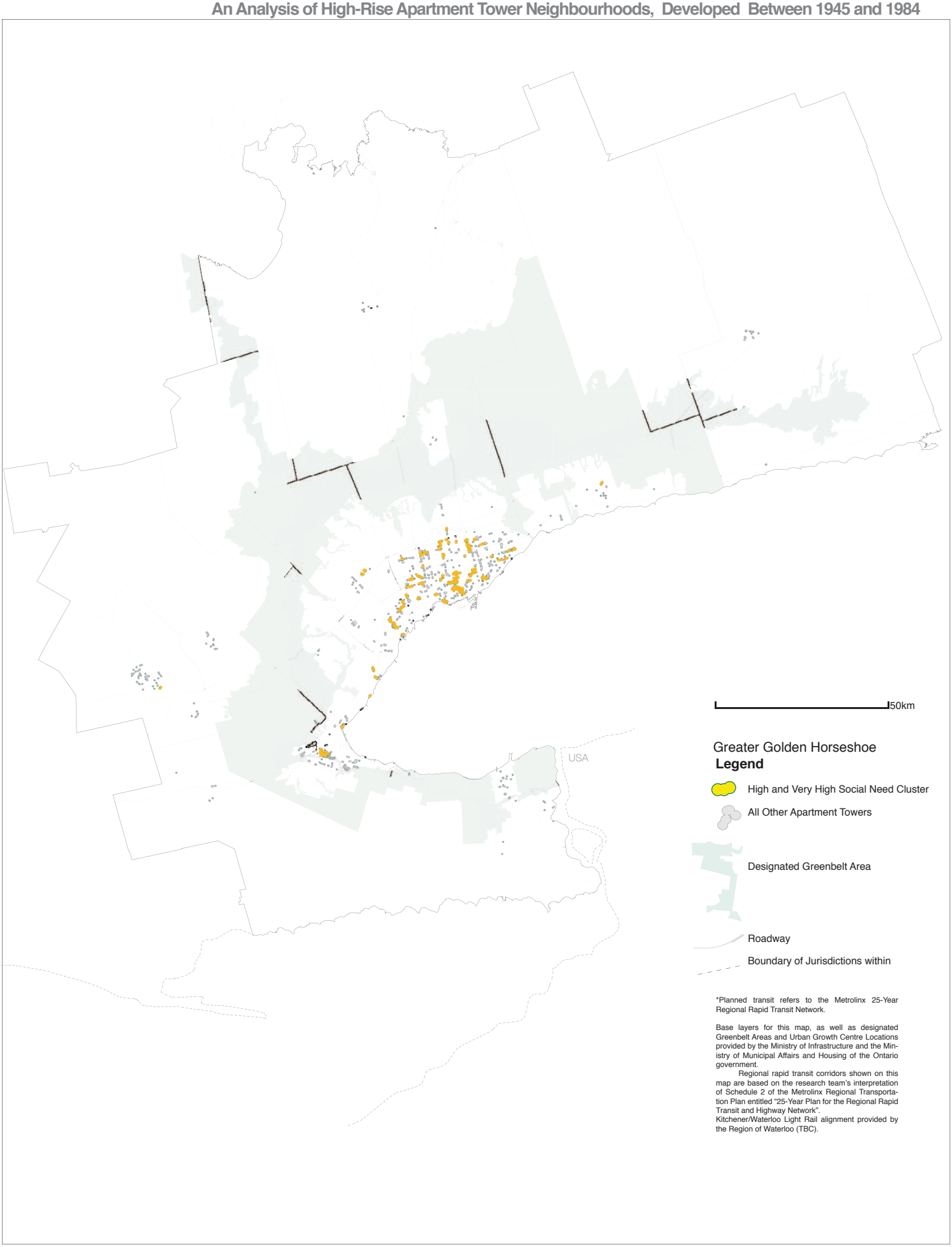
*Planned transit refers to the Metrolinx 25 Year Regional Rapid Transit Network.

Base layers for this map, as well as designated Greenbelt Areas and Urban Growth Centre Locations provided by the Ministry of Infrastructure and the Ministry of Municipal Affairs and Housing of the Ontario government.

Regional rapid transit corridors shown on this map are based on the research team's interpretation of Schedule 2 of the Metrolinx Regional Transportation Plan entitled "25-Year Plan for the Regional Rapid Transit and Highway Network". Kitchener/Waterloo Light Rail alignment provided by the Region of Waterloo (TBC).

Legend

- Higher Potential GHG Reduction Cluster
- All Other Apartment Towers
- Planned Metrolinx Light Rail / Bus RT*
- Existing and Planned TTC Subway/RT
- Planned K/W Light Rail
- Planned Gateway Mobility Hub
- Planned Anchor Mobility Hub
- Designated Greenbelt Area
- Roadway
- Boundary of Jurisdictions within



*Planned transit refers to the Metrolinx 25-Year Regional Rapid Transit Network.

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Kitchener/Waterloo Light Rail alignment provided by the Region of Waterloo (TBC).

European Best Practices in Supporting Greenhouse Gas Reduction

A range of strategies have been implemented in European Apartment Tower Neighbourhoods to significantly cut GHGs through lowered building energy use and the use of renewables. Additionally, European examples of infill development and the associated improvement of open spaces, walking and bicycling networks and transit connections also have an impact on the reduction of transportation-related GHG emissions.

The following are a series of strategies related to achieving carbon reductions within Apartment Tower Neighbouhoods, and the pictures on the following page illustrate several examples.

Introducing Renewable Energy Sources
The application of renewable energy sources is a key strategy for GHG reduction. In Marzahn Berlin, photovoltaic arrays have been added to Apartment Tower facades (image 02), and onto the roofs of buildings in the Bijlmermeer in Amsterdam. Solar water pre-heating systems are part of the renewal of towers in Gardsten in Göteborg, Sweden (06). The Gardsten project was part of a solar house initiative, where significant GHG reduction was achieved through passive heating and solar renewables. Additional energy is supplied to the Gardsten project via a local wind turbine.

District Heating
District systems are commonly applied to produce heat and energy for Apartment Tower clusters in the European Union. The energy sources for district systems range from residual heat from adjacent industrial processes, to power stations, biomass and waste incineration for co-generation. In many tower neighbourhoods, such as Amsterdam's Bijlmermeer, all space and water heating needs are provided through district systems fuelled through renewable processes. A similar system is used in Berlin's Schulze-Boysen-Straße neighbourhood (07).

Re-cladding
New over-cladding systems are applied onto existing towers throughout Europe to improve envelope performance and heating and cooling efficiency (01, 05). An Apartment Tower in Manchester, known as the Three Sister's Project (04), illustrates how re-cladding for insulation purposes is often part of a broader façade renewal that improves the look of the building, while also installing new windows to improve interior environments. A wide range of over-cladding options exist that can dramatically affect building appearance as well.

PassivHaus
Apartment Towers in northern Europe have been retrofitted to the Passivhaus standard, creating carbon neutral buildings, requiring little to no heating systems due to robust envelope and heat recovery systems. Image 10 is a sample wall section of a heavily insulated wall in Alingsas, Sweden.

Enclosed Balconies
Balcony treatments in renewal projects remove thermal bridging through improvements to the building envelope. These vary from open to enclosed. In Berlin's Markisches Viertel, balconies have remained open, with insulation wrapped around slab edges (03). In Gardsten Goteborg, south-facing balconies have been enclosed to enable passive solar gain, while providing new solariums that are inhabitable year round (06). Through operable windows, the solariums have access to the outdoors in warmer months.

Waste Management
Numerous innovative waste management strategies are being introduced in Apartment Tower Neighbourhoods throughout Europe, with the aim of improving diversion rates, as well as using waste as a resource such as bio-fuel (14), compost and heat used in district systems.

Waste collection has been a challenge in many Apartment Tower sites. In the Backa Rod neighbourhood in Göteborg, the Miljo Hus (Environment House) is a new community building where waste sorting and composting facilities are provided in a comfortable social setting (08, 13). Another alternative is the Optibag system used in many Apartment Tower Neighbourhoods in Sweden, in which waste streams are divided into coloured bags for use in traditional building shoots. In Stockholm, an underground vacuum system of tubes known as Envac (09, 10 & 11), sorts and transports waste to collection points on the perimeter of the neighbourhood where it is taken to processing facilities. This system makes waste sorting convenient for residents, and by keeping garbage trucks at the perimeter of neighbourhoods, and eliminating the need for garbage bins, more space is made available for community use within neighbourhoods. This system is currently used in the new city district of Hammarby Sjostad, and is under consideration for use in modern tower districts.

General Refurbishment
In Berlin, an aggressive program of Apartment Tower refurbishment has been underway since German unification in the 1990s. Four main strategies have been used to achieve low-carbon buildings, such as the Schulze-Boysen-Straße tower (see section 6.1 and image 07). These include:

- providing well-insulated and continuous barriers between interior and exterior environments;
- recovering waste heat from ventilation and hot water;
- providing heating, cooling and energy from a district system, preferably one powered by renewables; and
- educating and empowering tenants with the knowledge they need to optimally live in their unit, and the means to track their individual energy use.

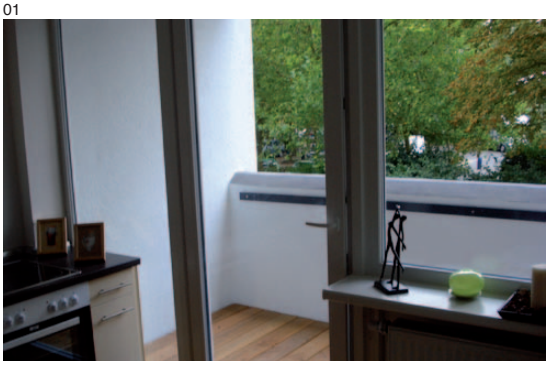
Image
Green Tower Refurbishment, (Manchester, UK)

European Best Practice

Greenhouse Gas reduction strategies

01

02



03

01) Thermal Recladding, Gropiusstad, Berlin, Germany
02) PV Solar energy in Marzahn, Berlin, Germany
03) Balcony upgrade and high efficiency appliances, Markisches Viertel, Berlin, Germany
04) Facade re-cladding, Manchester, UK
05) Balcony re-cladding - Marzahn, Berlin, Germany
06) Solar Thermal heating and enclosed balconies in Gardsten, Göteborg, Sweden

05

04

06

07

08

07) Low-energy towers, Schulze-Boysen-Straße, Berlin, Germany
08) Community waste sorting facility, Backa Rod, Göteborg, Sweden
09) Refurbished Towers in Marzahn, Berlin, Germany
10) Wall insulation sample for PassivHaus conversion of Apartment building, Alingsas, Sweden
11-12) Underground vacuum waste management system in Hammarby Sjostad, Stockholm, Sweden
13) Organic waste composting (inside community waste sorting facility shown in 08)
14) Bio-gas fuel pumping station, Trollhattan, Sweden

09

10

11

12

13

14