Location Allocation Analysis to Determine Potential Sites for a Nursing Home in the City of Kingston

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Introduction

Nursing Homes are of vital importance to both urban and rural populations. They provide locations where elderly citizens can live under supervision and have access to care that may be extremely important to their way-of-life. An analysis was conducted in order to determine suitable locations for the placement of a new nursing home in the City of Kingston.

Currently, there are a total of 2 nursing homes with approximately 122 people on the waiting list for beds in these homes. By providing a new facility we would be able to provide a bed to all those who are currently waiting.

The Data that was used in our analysis can be seen in the table below. It was retrieved from data files that were provided during class labs.

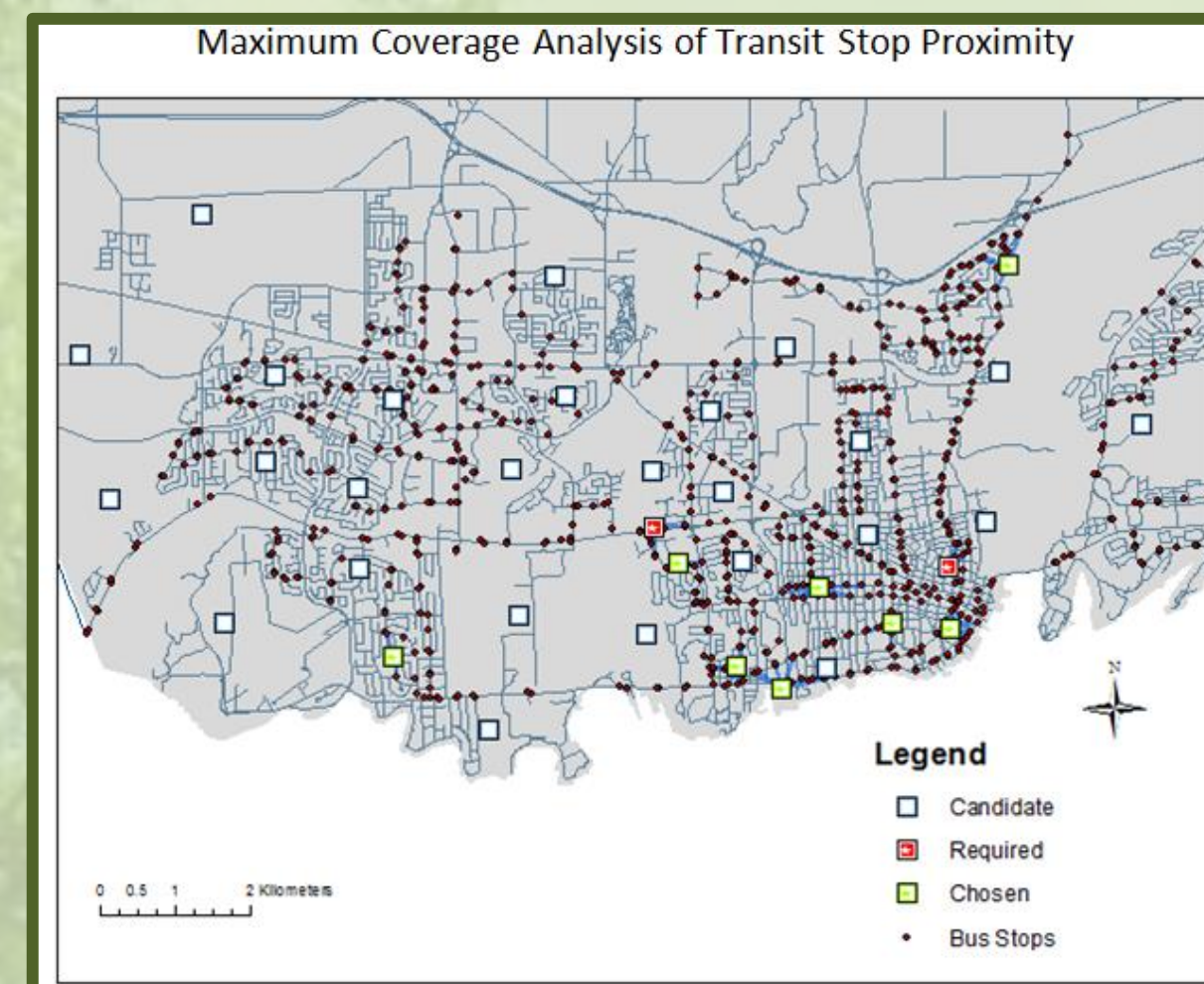| File Name	Feature Type	Importance
FIRE_STATION.shp	Point	Access to emergency services is a key factor in the location of a new facility
HOSPITAL.shp	Point	Access to emergency services is a key factor in the location of a new facility
AMBULANCE_STATION	Point	Access to emergency services is a key factor in the location of a new facility
SHOPPING_CENTRE.shp	Point	The proximity to recreation is a factor to consider
ROAD_ELEMENT.shp	Polyline	The road network will be used in order to run location-allocation problems
Transit_Stop.shp	Point	Being in close proximity to public transit is an important factor to consider in the analysis
LONG_TERM_CARE.shp	Point	This pointfile shows the current location of nursing homes, retirement homes, and long term care facilities in the City of Kingston
Neighbourhood_2006.shp	Polygon	This polygon layer shows the various neighbourhoods in Kingston, and will be used to create potential sites
2011DA.xls	Excel Table	This excel file contains census data which will allow us to examine our target market.
kingstonDA2011.shp	Polygon	Dissemination Areas will be used to examine census data

Methods

A network dataset was made in order to run a number of location allocation problems. The impedance field that was used for the network was a 'Minutes' field, which was calculated using the speed limit for each road.

A shapefile was made with points representing the locations of the already existing facilities. These points used as the required facilities in each location allocation problem.
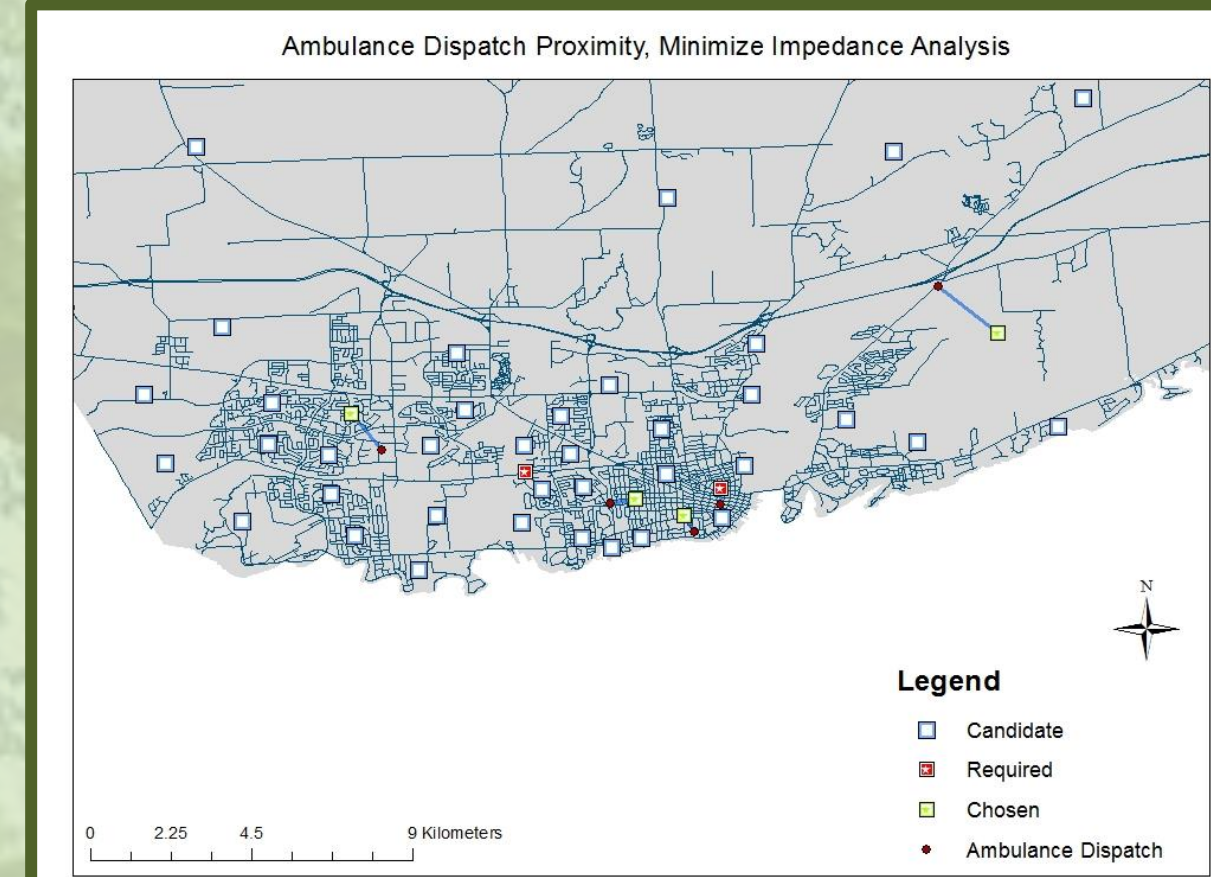
In order to create the candidate sites for our analysis, centroids were created within each of the neighbourhoods displayed in the 'Neighbourhood_2006' polygon shapefile using the *Feature to Point* tool in *ArcToolbox*. This allowed us to have approximately 43 potential sites, with each centroid representing a different neighbourhood. These sites were used as the candidate sites in each of the four analyses.

From here, we moved on to four separate location-allocation analyses, which took into account four different factors that were considered when deciding a new location: proximity to public transit, proximity to fire stations, accessibility to ambulance stations, and closeness to shopping centers.
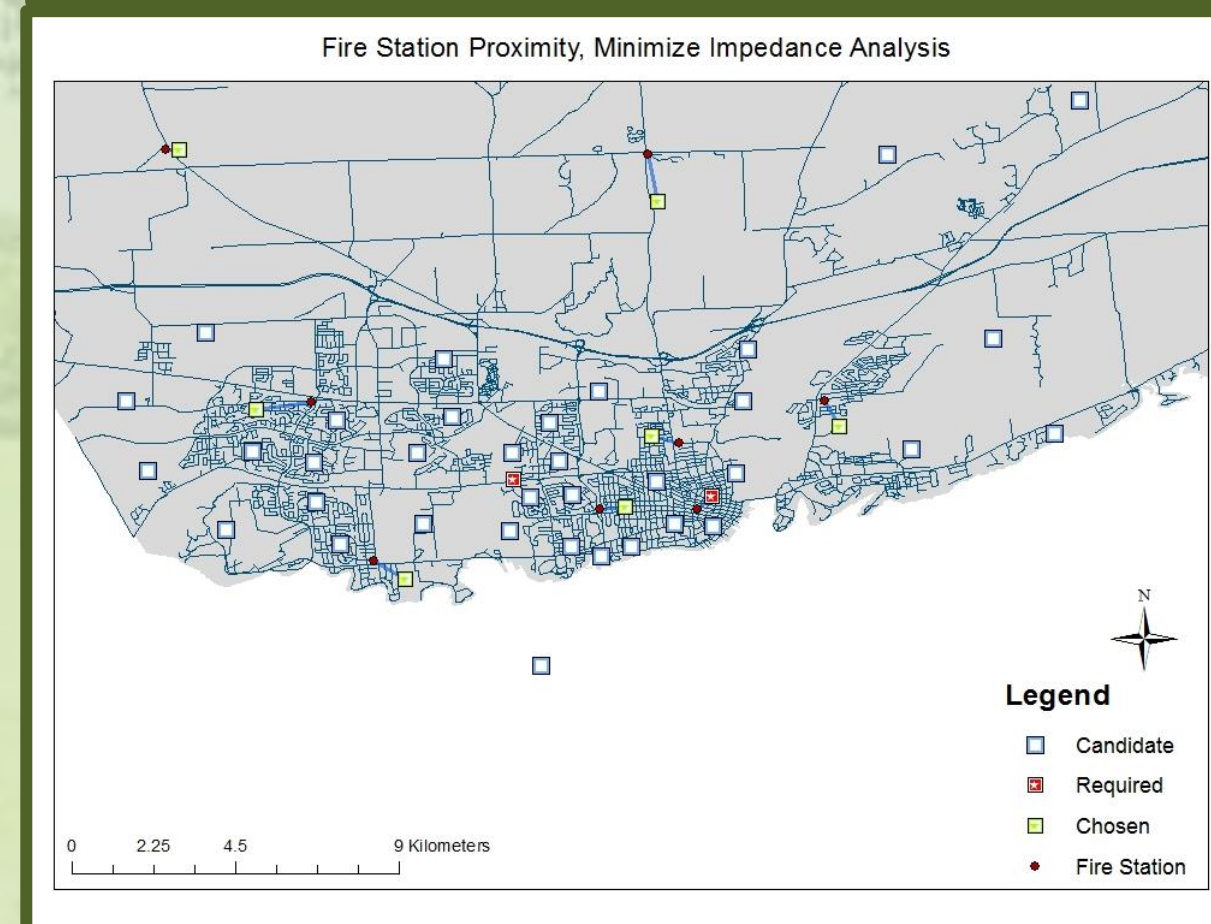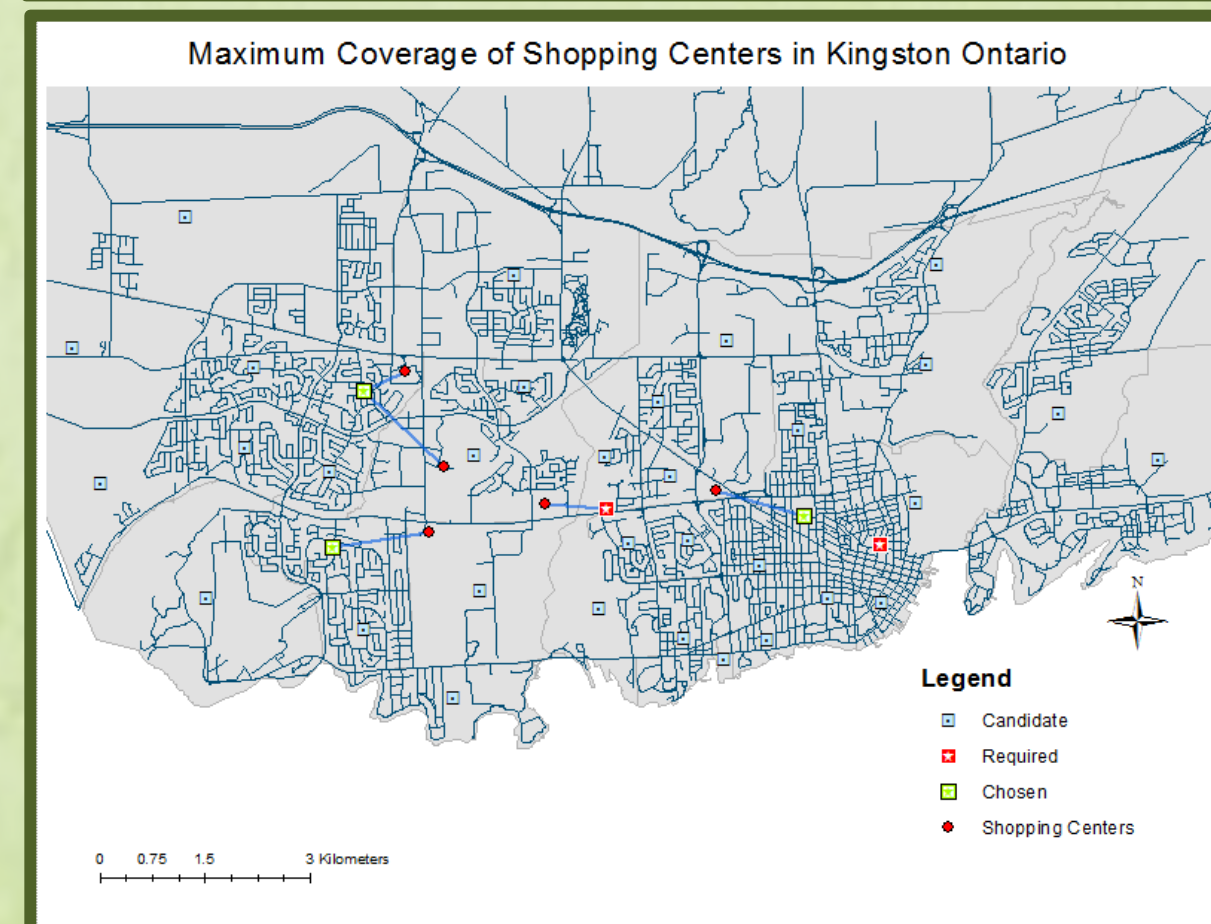

a.

b.

c.

d.

Figure 1: Location-Allocation Analyses of Maximum Coverage and Minimum Impedance for Transit Stop Proximity (a), Ambulance Station Proximity (b), Fire Station Proximity (c), and Shopping Center Proximity (d)

Results/ Discussion

The figure below shows the results of the 4 different location-allocation analyses that were run. Within each analysis, the 5 candidates with the highest demand count captured were chosen as the best sites based on the specific criteria. For the fire stations and shopping centers, some one the most suitable sites were the already existing nursing home locations, so the fire station analysis only provided us with 4 candidates, and the shopping center analysis with 3. Based on this result, it was determined that the Sunnyside neighbourhood is the most suitable site for a new nursing home as it was considered an ideal neighbourhood in 3 of the 4 location allocation analyses (as demonstrated on the figure by the 3 rings in a single neighbourhood.
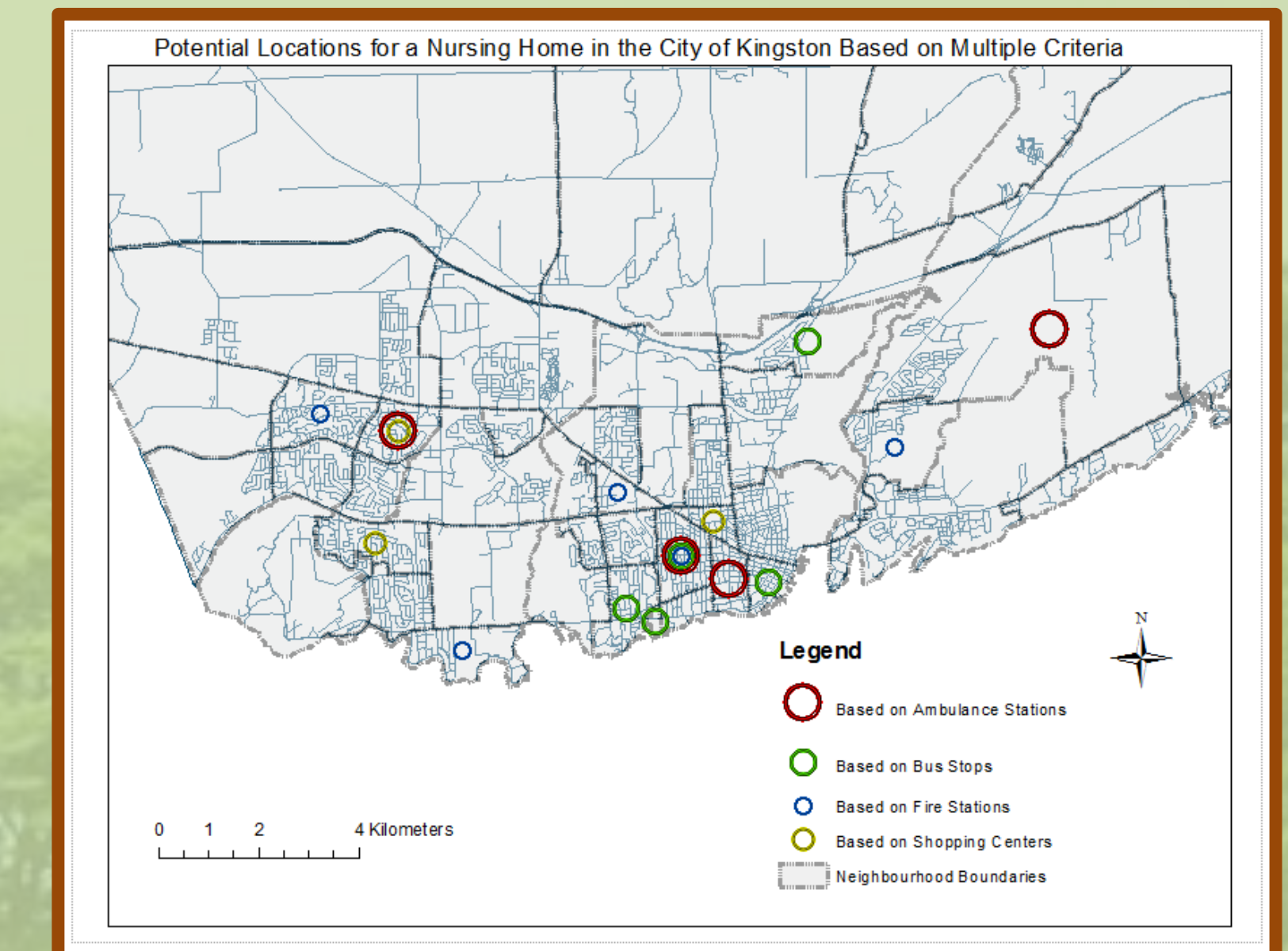

Figure 2: Potential Locations for a Nursing Home in the City of Kingston Based on Multiple Criteria

Conclusion

Based on multiple location-allocation analyses, it was determined that the Sunnyside neighbourhood in the City of Kingston (Figure 3) was the most suitable site for a new nursing home facility. Future analysis could be run to consider other factors that may be important in locating a new facility, including taking into account the cost of land, the possibility of using already existing buildings, as well as population demographic data such as crime rates and income rates.
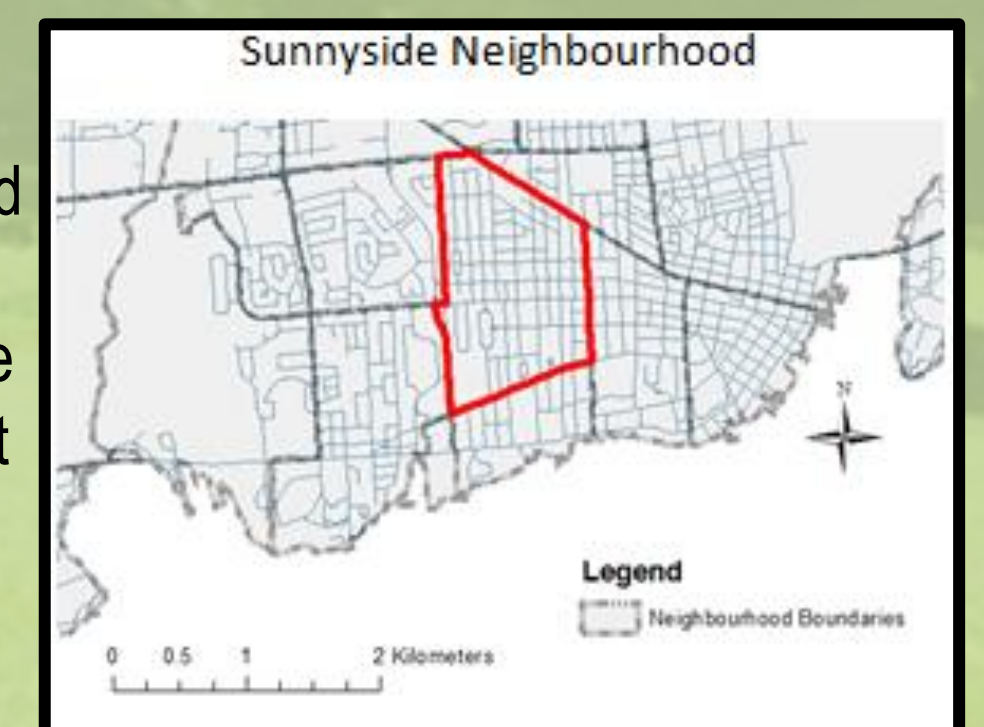

Figure 3: Sunnyside Neighbourhood

References:
1. http://healthcareathome.ca/southeast/en/care/Documents/March%202014%20LTC%20Waitlist.pdf
2. http://www.usroads.com/journals/rej/9704/re970404.htm
3. http://www.cityofkingston.ca/residents/emergency-services/kingston-fire-rescu
4. http://www.health.gov.on.ca/english/public%5Cprogram/ehs/cacc/cacc_mn.html
5. http://www.health.gov.on.ca/en/public/programs/ltc/15_facilities.aspx