Natural Resources Canada | Ressources naturelles Canada

CanmetENERGY
Leadership in ecoInnovation

THE URBAN ARCHETYPES PROJECT

Community Case Study: The City of Whitehorse

The Urban Archetypes Project initiated by Natural Resources Canada's CanmetENERGY in Ottawa investigated 31 neighbourhoods[1] in 8 communities[2] to explore the linkages among urban form, lifestyle patterns of residents and energy consumption.

The project developed energy profiles for representative households within each neighbourhood for personal vehicles, household heat, hot water and electricity for lighting and appliances. It also investigated the influence of urban design, neighbourhood location and lifestyle variables on average household vehicle travel and associated energy consumption. Communities in the project reflected a range of sizes, geographical regions, climates, energy sources and energy efficiency issues.

This fact sheet, one in a series of **eight community case studies**, presents the results for three neighbourhoods in the city of Whitehorse as studied in 2006: Porter Creek; Wolf Creek and Mary Lake; and Granger.

This research project used ***The Urban Archetypes Project Methodology***,[3] which allows for a comparative analysis of energy consumption between neighbourhoods in the same community. A further analysis of all of project's neighbourhoods (31) will be presented in ***The Urban Archetypes Project Analysis***. These documents will be posted to **www.canmetenergy.nrcan.gc.ca** as they become available.

The Urban Archetypes Project is among the first to explore, in an integrated fashion, the energy implications of land use, infrastructure and building decisions through case studies that present quantitative energy information in a neighbourhood context. In so doing, this project begins to address a significant gap in Canadian community energy planning practice. Building on the findings of this project, CanmetENERGY, with project collaborators, will continue to work to make energy information available to assist Canadian communities in making strategic energy = planning decisions.

The **city of Whitehorse** is the political and commercial capital of Yukon and is located at 60°43′00″ north latitude and 135°03′00″ west longitude. Historically, it was an important supply centre during the Klondike Gold Rush. Today, it is a modern and vibrant town with a population of 24 151.[4]

Linear in nature, from north to south, the city extends along the Alaska Highway and Yukon River in a non-contiguous fashion for approximately 30 kilometres (km). The downtown/central business district is located in the geographic centre of town.

The city is situated in the mountain climate region, and its average daily temperatures range from 21°C in July to -22°C in January. Similar to those in many northern communities, residents often rely on a mix of heating fuel sources including oil, propane, electricity and wood. Whitehorse has an abundance of electricity generation capacity – a legacy from Yukon's mining industry development.

[1] The term neighbourhood, as used in this project, denotes an area approximately 300 dwelling units in size and of relatively homogenous urban form; a neighbourhood could vary in size geographically.

[2] The term community, as used in this project, refers to the same scale as the municipality.

[3] Definitions of measures and indicators can be found in *The Urban Archetypes Project Methodology*. *www.canmetenergy.nrcan.gc.ca*

[4] The City of Whitehorse Integrated Community Sustainability Plan. September 2007.

NEIGHBOURHOOD DESCRIPTIONS

PORTER CREEK

Porter Creek is situated on the upper bench of the Yukon River Valley, approximately 6 km from downtown Whitehorse. Built in the late 1970s and early 1980s, dwellings are almost exclusively single detached although some contain legal secondary suites.

The neighbourhood was developed in a grid pattern of streets and avenues complete with sidewalks, streetlights and crosswalks. Houses are set back from the street allowing for manicured front yards and a suburban appearance. Although there are no commercial operations within the study area, a few commercial businesses are found on Centennial Street. A school, church and art theatre are also located nearby. Residents of this area have access to a local park and outdoor rink. There are many recreational trails throughout the neighbourhood.

WOLF CREEK AND MARY LAKE

Wolf Creek and **Mary Lake**[5] are country residential subdivisions of large lots located approximately 15 km south of downtown Whitehorse on the Alaska Highway. Although the first homes were built in the late 1970s, redevelopment continues to take place. The majority of residences are single detached dwellings interspersed with a few mobile homes.

Homes are generally set back from the road, giving the neighbourhood a rural appearance. The road network pattern consists of crescents and cul-de-sacs branching out from a main road. The majority of the streets are minimally surfaced, with street lights but no sidewalks. These subdivisions are surrounded by natural green space in all directions.

There are no city services to Wolf Creek and Mary Lake (no water, sewer or public transportation). No commercial operations exist within this study area; however, a convenience store, gas station and restaurant are located in the nearby McRae industrial area. Residents do have access to a local park and outdoor rink. Many trails are found within and around the neighbourhoods.

GRANGER

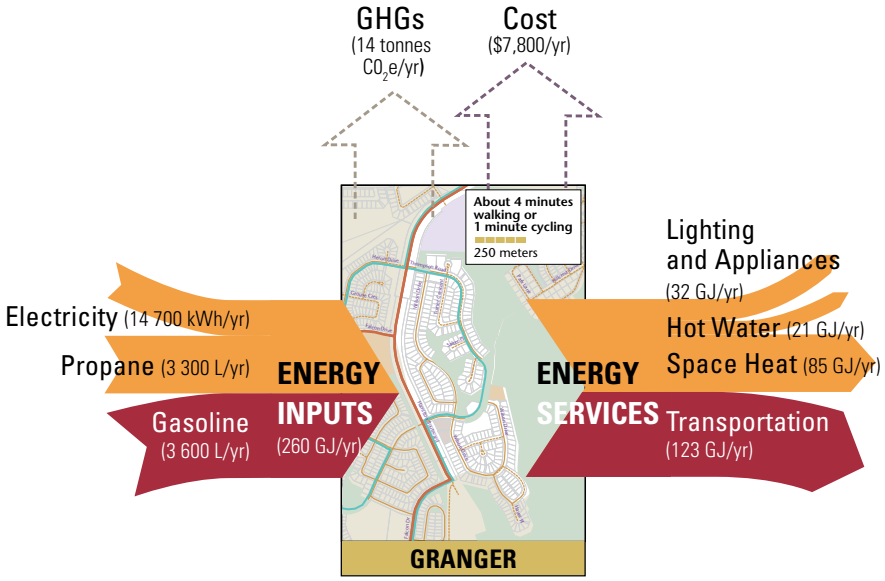
Located on the upper Yukon River bench, **Granger** lies approximately 3 km west of downtown Whitehorse. Developed in the early 1990s, Granger consists mostly of single-detached homes, some of which contain legal suites, as well as a limited number of duplexes and townhouses. Bordered to the south, west and north by residential development, Granger residents enjoy a large expanse of natural open space and recreational trails to the east as well as excellent views of the Yukon River valley and Grey Mountain.

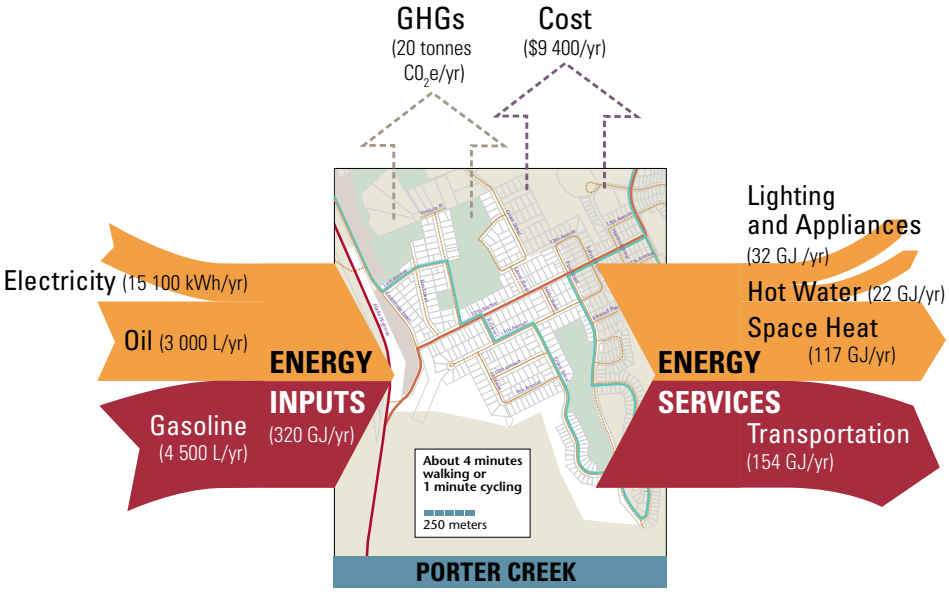
The road network pattern in Granger consists of local roads, crescents and courts branching off from Hamilton Boulevard. Commercial operations include a grocery store, daycare centre, gas station and video store. Granger residents have access to a local park and outdoor rink. Additional recreational opportunities are available at the nearby Canada Games Centre. The neighbourhood has bus service to downtown and bike and pedestrian paths leading to other areas within Whitehorse.

[5] Wolf Creek and Mary Lake are two separate subdivisions but were considered as one neighbourhood for the purposes of the Archetypes Project to ensure a sufficient sample size for the interviews.

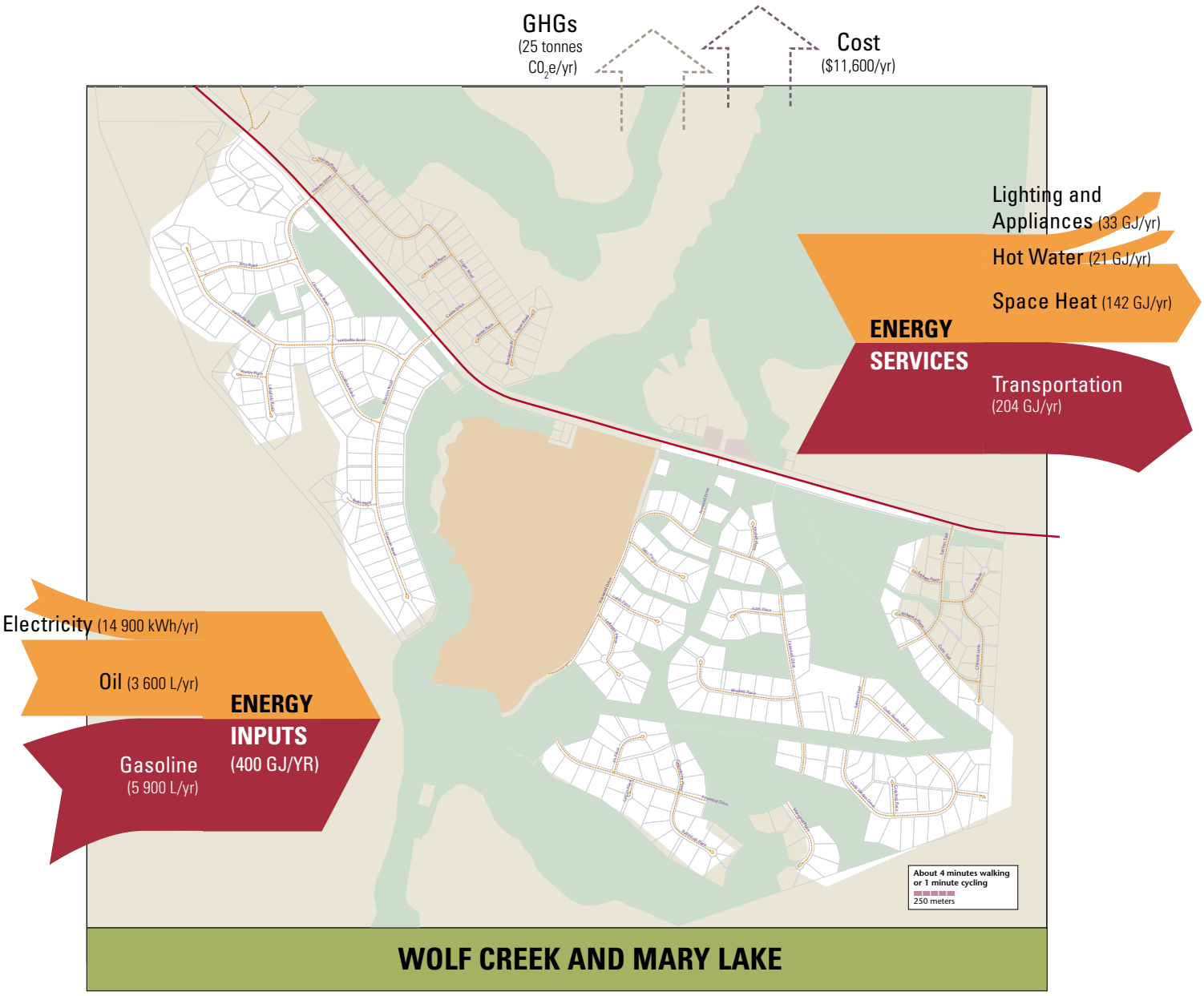
SUMMARY OF ENERGY INPUTS AND SERVICES

The Sankey-style graphics summarize a representative household's annual energy inputs and services.[6] The proportional scale between neighbourhoods is accurate and is reflected in the different sizes of maps and arrows. More detailed source data for housing and transportation follow.





[6] Values in the Sankey diagrams correspond with total household energy consumption modelled for the following representative house types in Whitehorse: Granger B, Porter Creek B and Wolf Creek and Mary Lake C.



Legend for Area Maps

- **Residential**
- **Study area with residential lots**

Land Use

- Retail/Commercial
- Industrial
- Institutional
- Municipal
- Recreational
- Parkland
- Water

Transportation

- Arterial (with sidewalks)
- Collector (with sidewalks)
- Local (with sidewalks)
- Roads without sidewalks
- Alleys
- Pathways
- Bike lanes, bike paths
- Bus routes

[7] Analysis was derived from ecoENERGY Retrofit – Homes (formerly EnerGuide for Houses) records within the study areas. A generalized profile for each representative house type was simulated using HOT2000* software and compared with the regional building archetype. Default values for house temperature and internal gains were used, and occupancy was determined by interview; Parekh, Anil. 2005. "Development of Archetypes of Building Characteristics Libraries for Simplified Energy Use Evaluation of Houses." Ninth International Building Performance Simulation Association Conference, Montréal.

[8] Average costs were calculated using available data for Whitehorse: oil (93.9¢/L, 2006 average), propane (67¢/L, average 2006) and electricity (11.5¢/kWh, 2005 average).

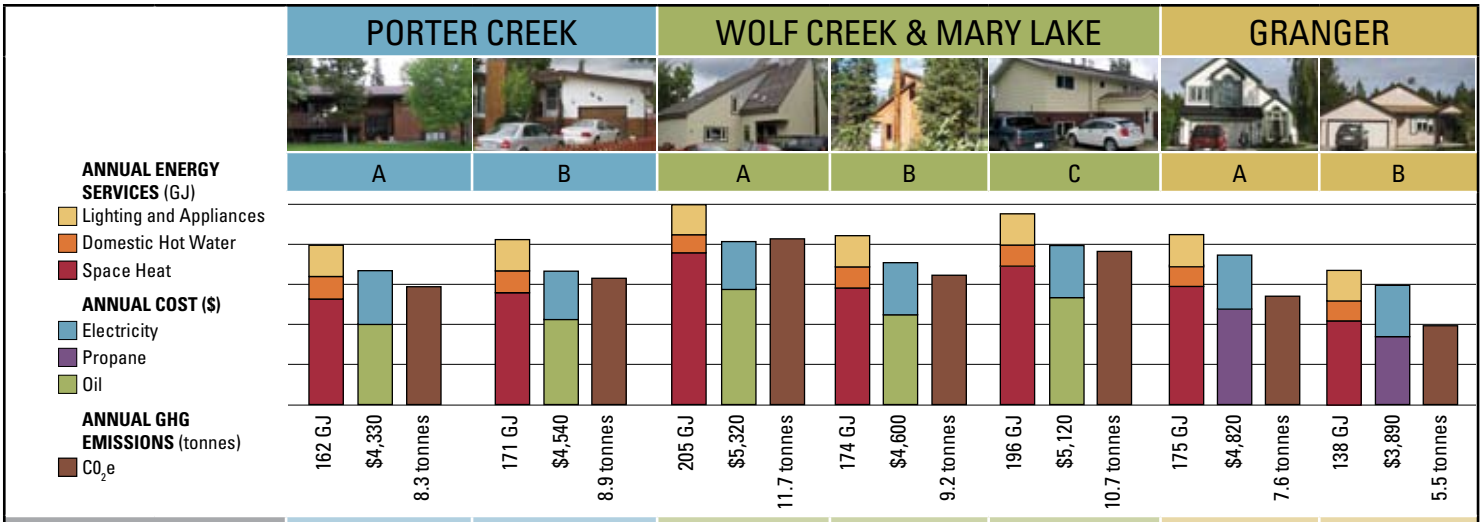
[9] GHG emissions were determined using the marginal fuel factors for the region development by Environment Canada, as used in HOT2000.

*HOT2000 is an official mark of Natural Resources Canada

ENERGY USE IN HOUSES

The amount of energy consumed to provide the energy services of space heating, domestic hot water heating, lighting and appliances can vary substantially from house to house. Factors influencing household energy consumption include levels of insulation and airtightness, efficiency of mechanical systems for space heating and hot water, choice of lighting and appliances, size of house, and occupant lifestyles.

The energy use in common house types[7] found within the Whitehorse study areas ranges from 138 to 205 gigajoules (GJ) per year. For homes heated with oil, this represents 2 750 to 4 000 litres (L) per year. For those heated with propane, it ranges from 3 250 to 4 650 L per year. The electricity use for all houses ranges from 13 600 to 15 100 kilowatt-hours (kwh) per year for water heating, lighting and appliances. Given this consumption, energy costs[8] range from $3 890 to $5 320 per year for the use of a combination of oil or propane and electricity; associated greenhouse gas (GHG) emissions[9] range from 5.5 to 11.7 tonnes (t) of carbon dioxide equivalent (CO_2e) per year.



EnerGuide Rating System		72	71	70	72	70	74	75
Energy Use Intensity		876 MJ/m²	855 MJ/m²	788 MJ/m²	740 MJ/m²	817 MJ/m²	583 MJ/m²	613 MJ/m²
Building Type	Storeys	one storey	one storey	two storeys	two storeys	one storey	two storeys	one storey
	Attachment	single detached	single detached	single detached	single detached	single detached	single detached	single detached
	Built	1978-1983	1961-1977	after 1995	1984-1995	1978-1983	1984-1995	1984-1995
Heated Floor Area		185 m² (2 000 sq.ft.)	200 m² (2 150 sq.ft.)	260 m² (2 800 sq.ft.)	235 m² (2 500 sq.ft.)	240 m² (2 600 sq.ft.)	300 m² (3 200 sq.ft.)	225 m² (2 400 sq.ft.)
Insulation	Ceiling	5.7 RSI (R-32)	4.6 RSI (R-26)	6.0 (RSI R-34)	7.0 RSI (R-40)	4.2 RSI (R-24)	6.0 RSI (R-34)	6.3 RSI (R-36)
	Walls	2.4 RSI (R-14)	2.3 RSI (R-13)	2.9 RSI (R-16)	3.6 RSI (R-20)	2.3 RSI (R-13)	3.6 RSI (R-20)	2.9 RSI (R-16)
	Foundation	2.1 RSI (R-12)	2.3 RSI (R-13)	3.1 RSI (R-18)	2.6 RSI (R-15)	2.4 RSI (R-14)	3.7 RSI (R-21)	3.1 RSI (R-18)
Space Heating	Fuel	oil	oil	oil	oil	oil	propane	propane
	Furnace	furnace with flame = retention head	furnace with flame = retention head	furnace with flame = retention head	mid-efficiency furnace	furnace with flame retention head	condensing furnace	condensing furnace
	Efficiency	83%	83%	83%	85%	83%	91%	91%
Hot Water	Fuel	electric	electric	electric	electric	electric	electric	electric
	Tank	conventional tank	conventional tank	conserver tank	conserver tank	conserver tank	conserver tank	conserver tank
	Efficiency	82%	82%	87%	87%	87%	87%	87%
Lighting		incandescent	incandescent	incandescent	incandescent	incandescent	incandescent	incandescent
Appliances		standard	standard	standard	standard	standard	standard	standard
Occupants		4	4	3	4	4	4	4

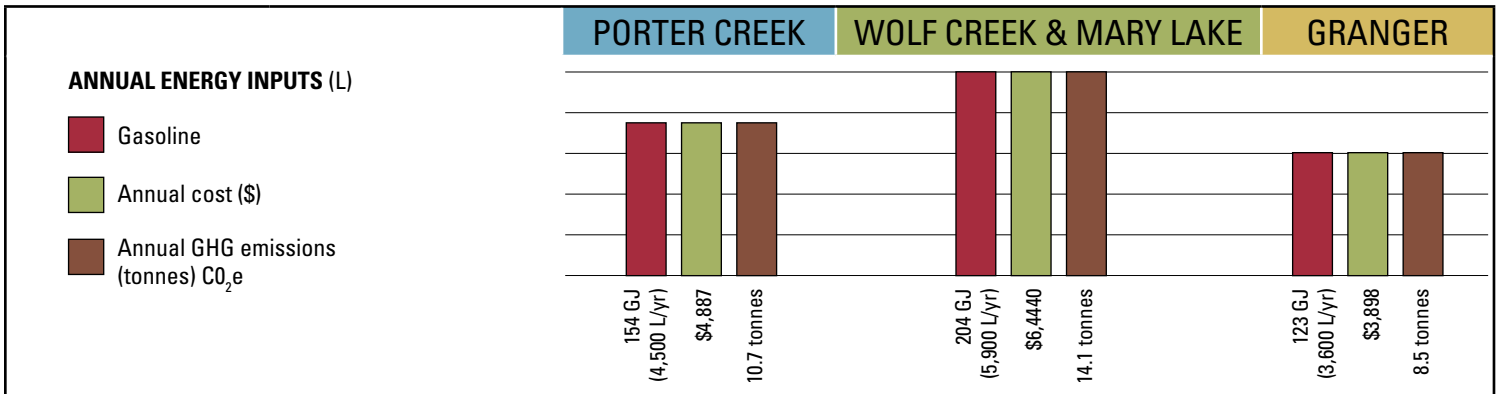
See page 4 for footnotes

ENERGY USE FOR PERSONAL VEHICLE TRANSPORTATION

Personal transportation helps Canadians accomplish a wide variety of activities and is essential for the functioning of our communities. Personal vehicles are the predominant form of personal transportation, accounting for 78 percent of total passenger transportation energy end-use in Canada in 2005. The Urban Archetypes Project calculated energy consumption for personal vehicles[10] and additionally examined public transit and the active modes of walking and cycling.

The factors that influence transportation energy consumption for personal vehicles include distance travelled, vehicle type and fuel efficiency. Furthermore, the influence of neighbourhood design characteristics, location and lifestyle were analyzed for all 31 study neighbourhoods and will be presented in the *Urban Archetypes Project Analysis*.

In the Whitehorse study areas, average annual household Vehicle Kilometres Travelled[11] (VKT) ranged from 30 700 to 42 000 km. In 2006, the average study area household consumed between 3 560 and 5 885 L of gasoline that cost[12] between $3,898 and $6,444 and produced GHG emissions of between 9 and 14 t of CO_2e.



		PORTER CREEK	WOLF CREEK & MARY LAKE	GRANGER
Resident lifestyle	Vehicle kilometers traveled (VKT-AVG)	30,700 km	42,000 km	24,400 km
	Average number of vehicles per household	2.4	2.5	1.9
Neighbourhood design	Gross density (units per hectare)	4.00	0.46 UPH	6.60 UPH
	Percent of housing units Single detached	93%	98%	88%
	Land-use mix index*	0.31	0	0.39
	Total road length	7.9 km	22.8 km	6.0 km
Neighbourhood location	Distance to central business district	6.4 km	15.0 km	3.2 km

*Land-use mix variables include the number of retail/commercial units, retail/commercial buildings, industries, institutions and municipal buildings. The higher the score, the more mixed the land use in the neighbourhood.

PROJECT COLLABORATION

Natural Resources Canada recognizes the contribution of project collaborators in Whitehorse including the City of Whitehorse, the Northern Climate Exchange, Yukon Electrical and North 60° Petro.

FOR MORE INFORMATION

To learn more about the Urban Archetypes Project, or to access project companion documents (methodology, analysis and additional case studies), visit **www.canmetenergy.nrcan.gc.ca** (Buildings & Communities, Communities section) or contact Jessica Webster by telephone at 613-992-9532 or by e-mail at jessica.webster@nrcan.gc.ca.

[10] Personal vehicles include small and large cars and light trucks.

[11] Based on total estimated household Vehicle Kilometres Travelled (VKT) data collected from study area residents in 2007. To account for possible under-reporting, neighbourhood household average VKT was substituted in cases of non-response, producing the Vehicle Kilometres Travelled-Average (VKT-AVG) figure. See *The Urban Archetypes Project Methodology* for more details.

[12] Average costs were calculated using available price data for Whitehorse: gasoline ($1.095/L, 2006 average).

Cat. No. M154-15/2010E-PDF (online) ISBN 978-1-100-14751-2