HYRBRID GROWTH SCENARIO							
TARGET AREA		EXISTING DWELLING UNITS TO 19,000 POPULATION	STAGE 1 DWELLING UNITS TO 25,000 POPULATION	STAGE 2 DWELLING UNITS TO 33,000 POPULATION	STAGE 3 DWELLING UNITS TO 50,000 POPULATION	DWELLING UNITS BUILDOUT TO 50,000 POPULATION	TOTAL DENSITY (U/A)
CORE AREA (5673 UNITS)							
A	Downtown/City Centre	2634	300	400	650	3984	7.9
B	Old Airport Road	309	150	250	400	1109	3.1
C	Old Town	380	50	50	100	580	1.4
CITY SUBURBS (6661 UNITS)							
D	Niven Lake	204	600	500	200	1504	7.4
E	Range Lake North	760	25	25	25	835	2.9
F	Range Lake South	1846	25	25	25	1921	4.3
G	Taylor Road	374	300	300	0	974	4.2
H	Tin Can Hill	207	290	550	0	1047	3.4
I	Kam Lake	120	10	75	175	380	0.5
OUTLYING AREA (4756 UNITS)							
J	Negus Point	6	0	400	1225	1631	7.3
K	Highway 4 North	0	0	0	2150	2150	2.4
L	Grace Lake	0	0	175	800	975	1.4
TOTAL UNITS		6840	1750	2750	5750	17090	2

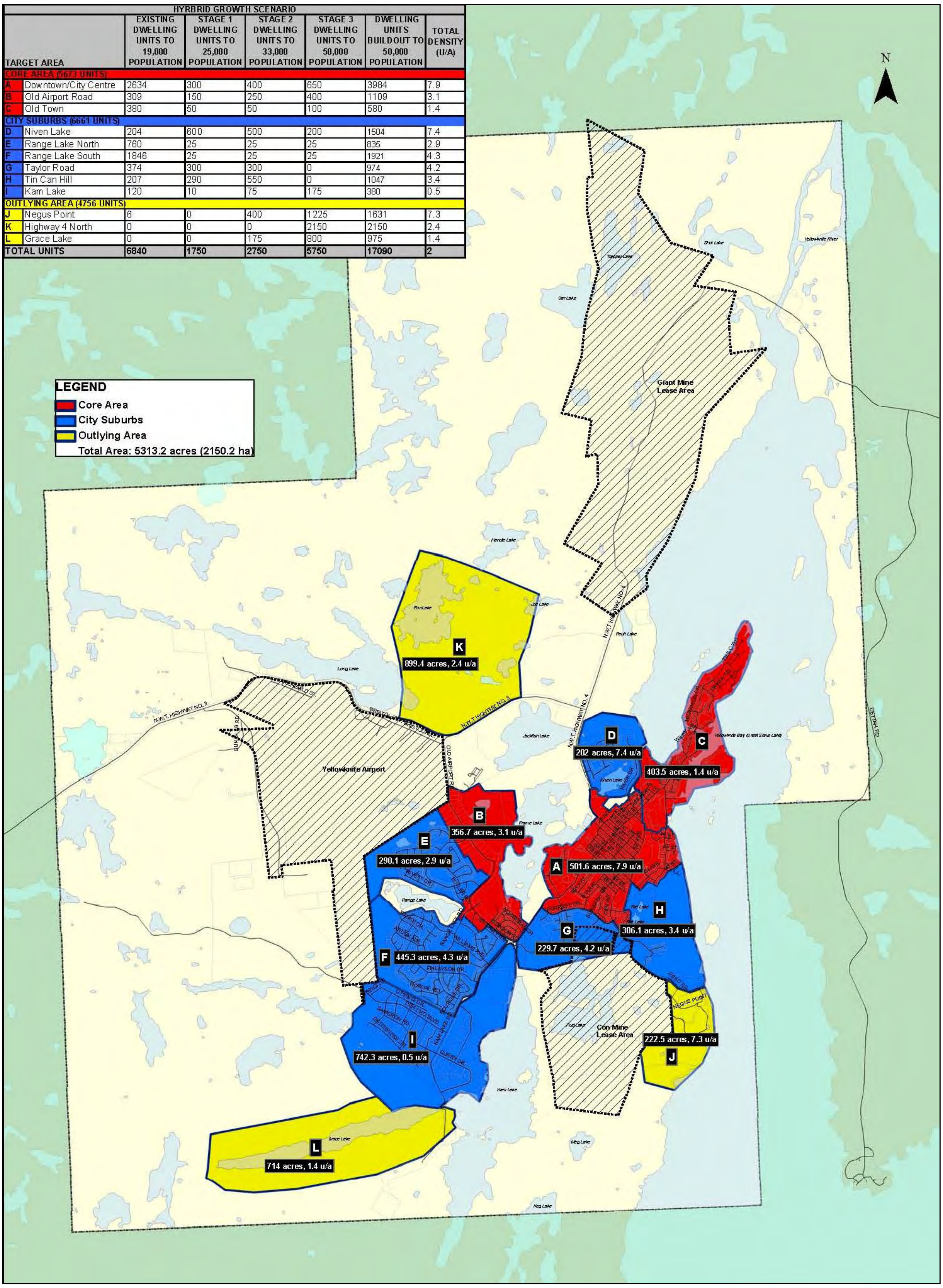


Exhibit 8-3: Households – Hybrid Scenario

EMPLOYMENT GROWTH - HYBRID SCENARIO				
	TARGET AREA	STAGE 1 NEW JOBS 25,000 POPULATION	STAGE 2 NEW JOBS 33,000 POPULATION	STAGE 3 NEW JOBS 50,000 POPULATION
CORE AREA (3750 JOBS)				
A	Downtown/City Centre	600	600	1000
B	Old Town	150	150	150
C	Old Airport Road/Capital Area West	350	300	450
CITY SUBURBS (3675 JOBS)				
D	Kam Lake	200	300	150
E	Range Lake North	25	125	125
F	Range Lake South	25	150	200
G	Niven Lake	25	100	200
H	Con Mine/Tin Can Hill/Negus Point	250	300	700
I	Airport	100	200	500
OUTLYING AREA (9625 JOBS)				
K	Engle Business District	800	800	0
L	Grace Lake/Engle West	200	400	1000
M	Kam Lake East	0	400	2100
N	Highway 4 North	0	500	2300
O	Giant Mine	0	100	300
P	East Shore (Dettah)	25	200	500
Q	Long Lake North/West	0	0	0
	TOTAL NEW JOBS	2750	4625	9675

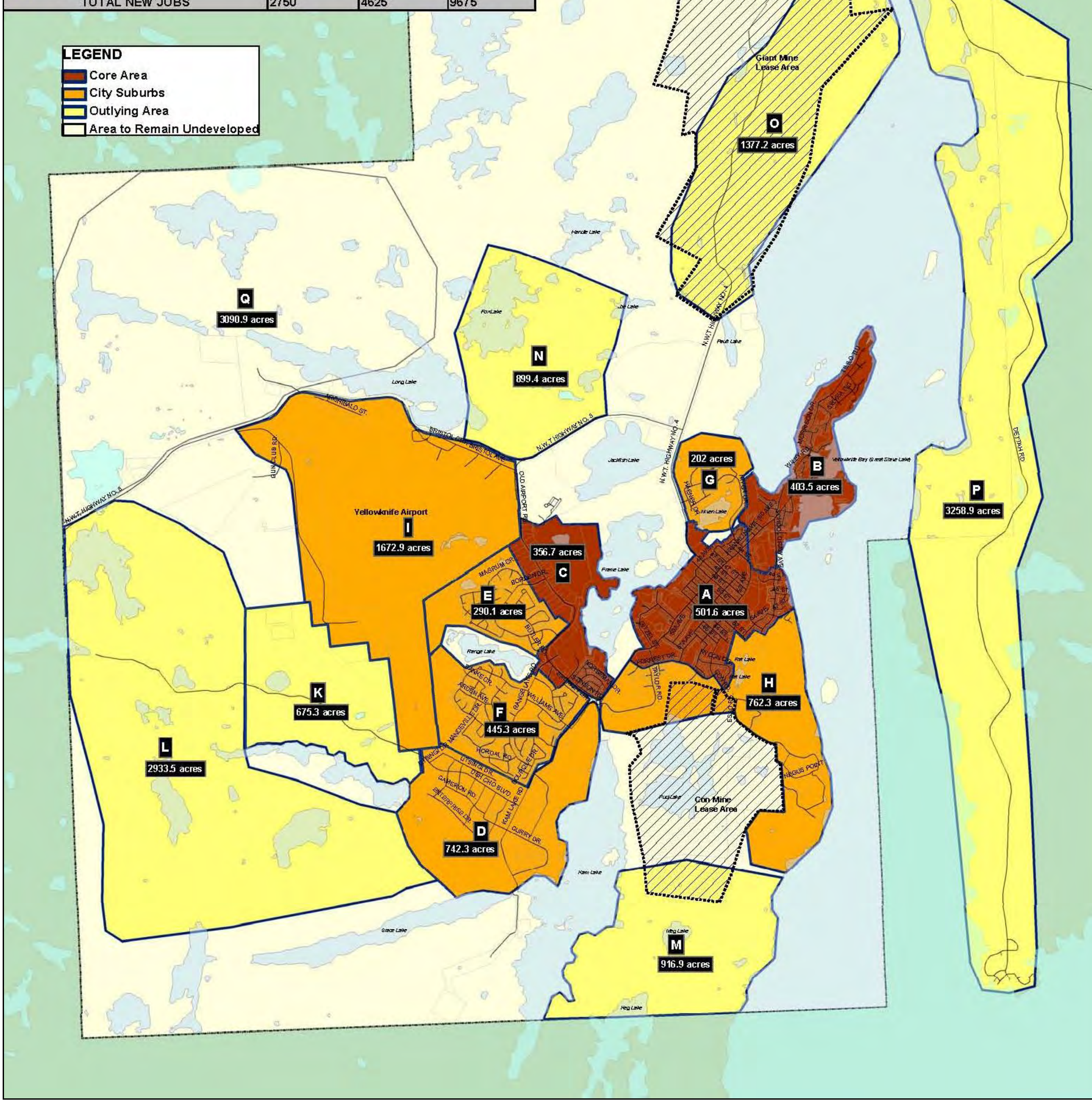


Exhibit 8-4: Jobs– Hybrid Scenario

DISPERSED GROWTH SCENARIO							
TARGET AREA		EXISTING DWELLING UNITS TO 19,000 POPULATION	STAGE 1 DWELLING UNITS TO 25,000 POPULATION	STAGE 2 DWELLING UNITS TO 33,000 POPULATION	STAGE 3 DWELLING UNITS TO 50,000 POPULATION	DWELLING UNITS BUILDOUT TO 50,000 POPULATION	TOTAL DENSITY (U/A)
CORE AREA (4123 UNITS)							
A	Downtown/City Centre	2634	50	100	200	2984	5.9
B	Old Airport Road	309	50	100	150	609	1.7
C	Old Town	380	50	50	50	530	1.3
D	Niven Lake	204	350	500	0	1054	5.2
E	Range Lake North	760	25	25	25	835	2.9
F	Range Lake South	1846	25	25	25	1921	4.3
G	Taylor Road	374	150	150	0	674	2.9
H	Tin Can Hill	207	600	200	0	1007	3.3
I	Kam Lake	120	10	50	50	230	0.3
OUTLYING AREA (7296 UNITS)							
J	Negus Point	6	440	800	50	1296	5.8
K	Highway 4 North	0	0	550	1700	2250	1.3
L	Grace Lake	0	0	0	1000	1000	0.8
M	Kam Lake East	0	0	0	1000	1000	1.1
N	East Shore (Dettah)	50	0	200	300	550	0.2
O	City West End	0	0	0	1200	1200	0.6
TOTAL UNITS		6890	1310	2750	5750	17140	1.3

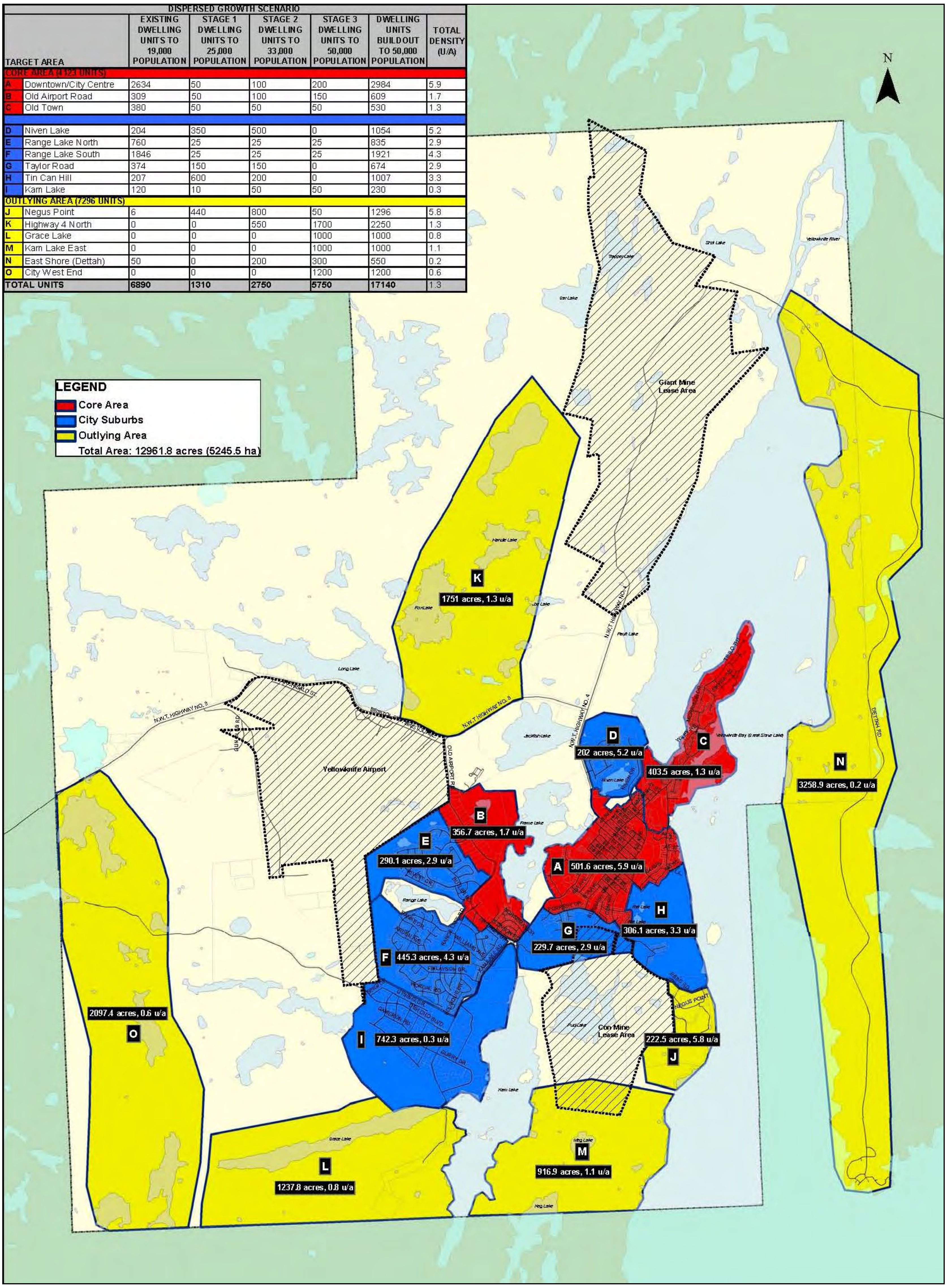


Exhibit 8-5: Households – Dispersed Scenario

EMPLOYMENT GROWTH - DISPERSED SCENARIO				
	TARGET AREA	STAGE 1 NEW JOBS 25,000 POPULATION	STAGE 2 NEW JOBS 33,000 POPULATION	STAGE 3 NEW JOBS 50,000 POPULATION
CORE AREA (1550 JOBS)				
A	Downtown/City Centre	200	250	300
B	Old Town	50	50	50
C	Old Airport Road/Capital Area West	200	200	250
CITY SUBURBS (4300 JOBS)				
D	Kam Lake	100	200	100
E	Range Lake North	50	25	100
F	Range Lake South	25	25	100
G	Niven Lake	25	25	25
H	Con Mine/Tin Can Hill/Negus Point	200	300	500
I	Airport	200	300	800
OUTLYING AREA (11,200 JOBS)				
K	Engle Business District	500	1000	0
L	Grace Lake/Engle West	300	700	1600
M	Kam Lake East	0	400	1000
N	Highway 4 North	700	700	1500
O	Giant Mine	100	50	350
P	East Shore (Dettah)	100	400	1000
Q	Long Lake North/West	0	0	2000
TOTAL NEW JOBS		2750	4625	9675

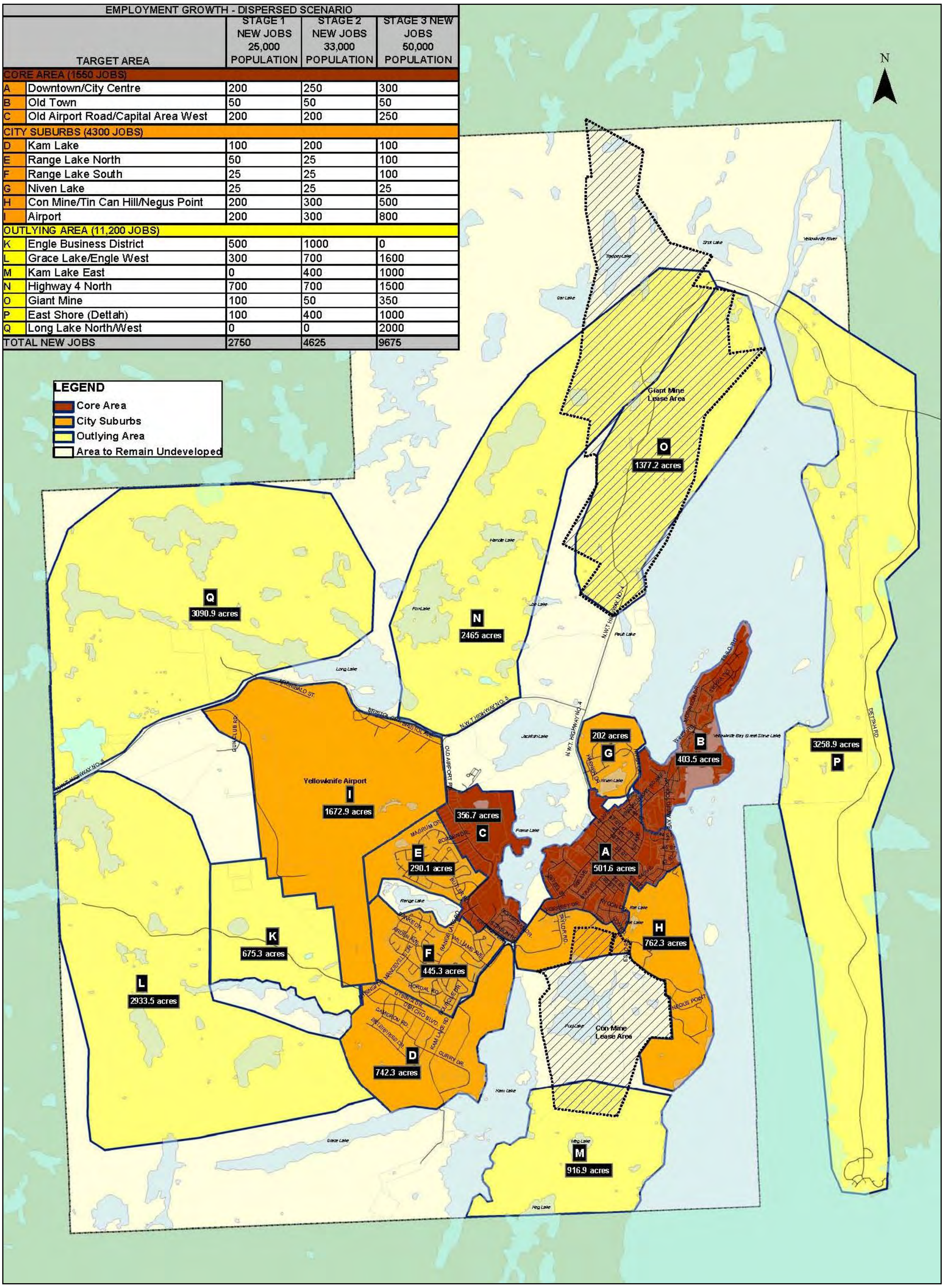


Exhibit 8-6: Jobs – Dispersed Scenario

The total households in each growth scenario for the long-term horizon are summarized in **Table 8-2** and jobs are summarized in **Table 8-3**.

Table 8-2: Long-term Land Use Summary – Households

Smart Growth Plan Zone		Total Number of Households			
		Existing	Compact	Hybrid	Dispersed
A	Downtown / City Centre	2634	4624	3984	2984
B	Old Airport Road	309	1459	1109	609
C	Old Town	380	630	580	530
D	Niven Lake	204	1504	1504	1054
E	Range Lake North	760	835	835	835
F	Range Lake South	1846	1921	1921	1921
G	Taylor Road	374	849	974	674
H	Tin Can Hill	207	1057	1047	1007
I	Kam Lake	120	455	380	230
J	Negus Point	6	1206	1631	1296
K	Highway 4 North	0	1950	2150	2250
L	Grace Lake	0	600	975	1000
M	Kam Lake East	0	0	0	1000
N	East Shore (Dettah)	50	50	50	550
O	City West End	0	0	0	1200
Total Households		*6890*	*17140*	*17140*	*17140*

Table 8-3: Long-term Land Use Summary – Jobs

Smart Growth Plan Zone		Total Number of Jobs			
		Existing[6]	Compact	Hybrid	Dispersed
A	Downtown / City Centre	6739	11739	9639	7689
B	Old Town	301	1001	751	501
C	Old Airport Road/Capital Area West	1061	3761	2761	1861
D	Kam Lake	475	1125	1125	975
E	Range Lake North	553	853	853	728
F	Range Lake South	320	695	720	470
G	Niven Lake	16	391	391	91
H	Con Mine / Tin Can Hill / Negus Point	275	1575	1775	1375
I	Airport	1001	1801	1851	2301
K	Engle Business District	15	1290	1415	1515
L	Grace Lake / Engle West	54	754	1054	2454
M	Kam Lake East	6	6	1056	1406
N	Highway 4 North	6	2006	2606	2606
O	Giant Mine	2	452	602	502
P	East Shore (Dettah)	0	425	775	1500
Q	Long Lake North/West	16	16	516	1916
Total Jobs		10840	27890	27890	27890

All three growth scenarios represent significant growth over the existing, which is to be expected given the long-term household and employment growth forecast. The long-term horizon forecasts a 149% increase in households and a 157% increase in jobs. Although the total growth is the same between each scenario, the exhibits and tables above illustrate that the development patterns are in fact quite different. In the Compact scenario, land use is concentrated in currently developed areas and new areas of development that are close to the core. In the Dispersed scenario, most of the development occurs in “greenfield” sites – currently undeveloped areas further from the core. The areas of development in the Dispersed scenario are also less dense than the Compact scenario. The Hybrid scenario is midway between the Compact and the Dispersed, with some development in currently developed areas and some development in new areas. Suffice to say, that the distance between areas of concentrated development affects the mode choice of people traveling between those areas. For example, long distance trips greater than 10 km are more likely to be made by car than short trips of less than 1 km, whereas the short trips are more likely to be made by cycling, walking, or transit. The impact that the land use has on transportation is examined in greater detail in **Section 9**.

[6] Approximate, based on disaggregation of Statistics Canada 2006 Census Data

The geographic distribution of households and jobs in the three scenarios for long-term horizon are illustrated in **Exhibit 8-7** and **Exhibit 8-8**. These exhibits show that most of Yellowknife's existing jobs are in the core area (±75%) while distribution of households is split 50% in the core and 50% in the suburbs. All three scenarios require development of the outlying areas. In the dispersed long-term horizon, the outlying area has the most households; in the compact, the core area has the most households. A similar pattern is repeated for jobs.

Land use patterns impact mode split, distance travelled, GHG emissions, roadway and infrastructure needs, and the overall character of the community. These concepts are expanded on in **Section 9**.

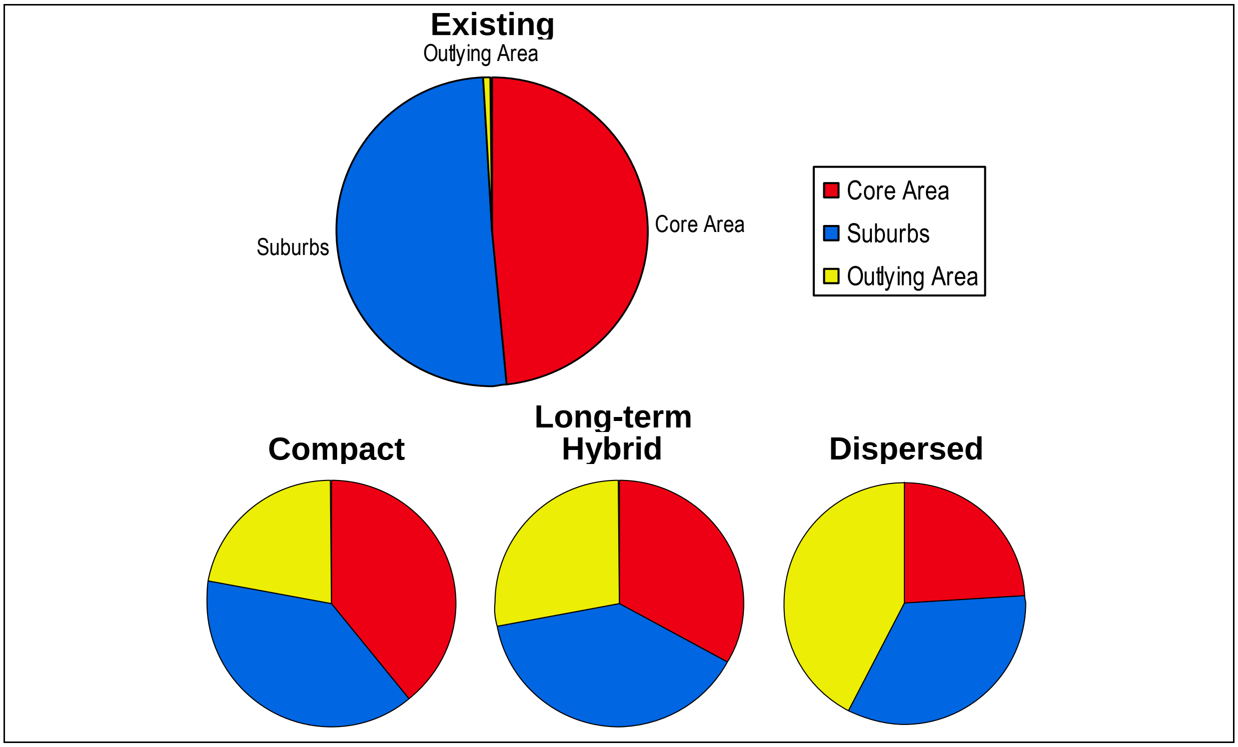


Exhibit 8-7: Distribution of Households by Geographic Area

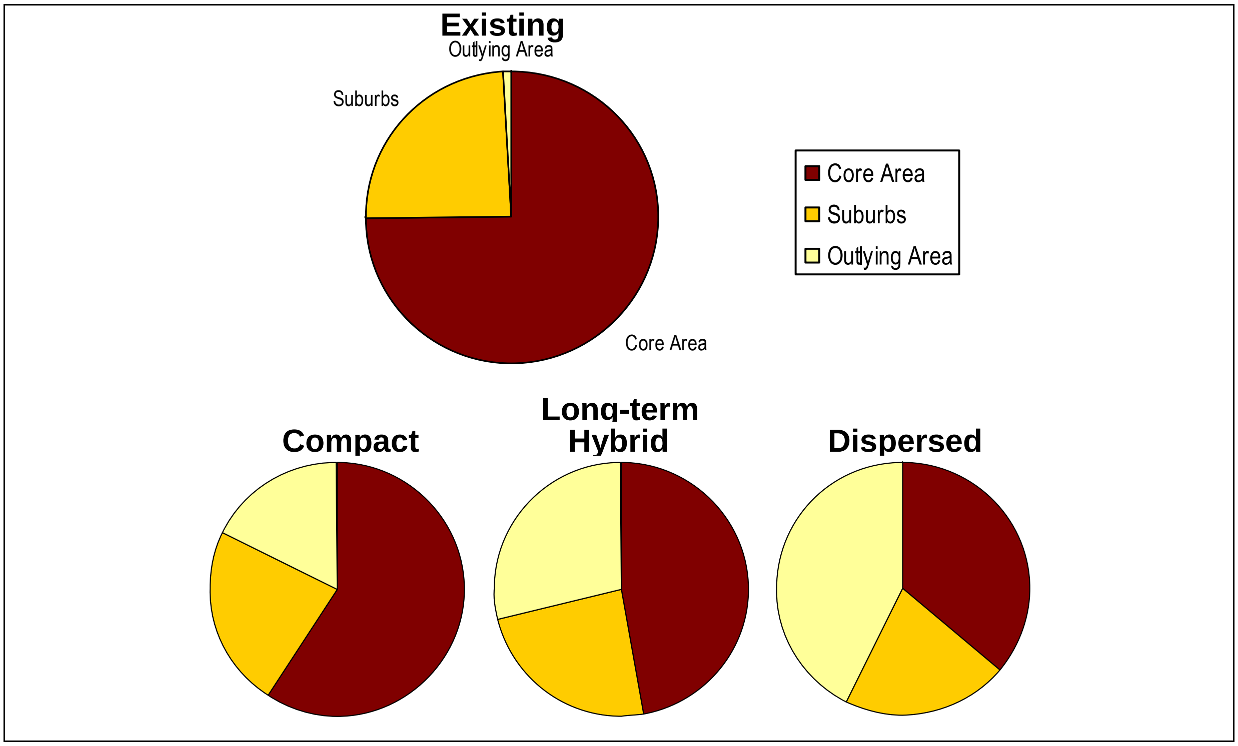


Exhibit 8-8: Distribution of Jobs by Geographic Area

Future Traffic Conditions

9. FUTURE TRAFFIC CONDITIONS

9.1 Travel Demand Model

The purpose of the travel demand model was to estimate the future travel patterns and number of trips based on existing travel patterns given the proposed household and job projections on the existing transportation network. Two future population horizons (intermediate and long-term) were assessed using projected household and employment data for the compact, hybrid, and dispersed growth scenarios, which were provided by City staff.

To estimate future trips in Yellowknife, a PM peak hour travel demand model was created based on a four-step approach:

1. The model was created using the results of the OD surveys and existing road network characteristics as a baseline;
2. The model was calibrated with data from turning movement counts to best reflect existing conditions;
3. The demand modelling work was conducted in a series of Excel workbooks; and,
4. The trip assignment was completed using Quick Response Software (QRSII) via the General Network Editor (GNE).

This section provides a high level overview of the model development, calibration process, and forecasting activities. A more detailed explanation is provided in the *Transportation Model Technical Memo* provided in **Appendix F**.

9.1.1 Baseline Model

9.1.1.1 Transportation Analysis Zones (TAZ)

The model requires that the city be divided into spatial areas, or Transportation Analytical Zones (TAZs). Each TAZ has defined *land use inputs* – households and jobs – based on existing and future projected characteristics. As these characteristics change, the number of trips generated by the TAZ also changes.

The Yellowknife TAZ system was designed to function as ‘building blocks’ based on the land use concepts developed by MetroQuest for the City (Smart Growth Zones as shown in **Exhibit 8-1** through **Exhibit 8-6**). TAZ are typically smaller than the Smart Growth Zones to allow for flexibility in representing future land use patterns. A total of 66 TAZ were used for Yellowknife: 62 internal zones and 4 external zones.[7] The TAZ system is shown in **Exhibit 9-1**.

[7] Internal zones are within the City’s planned growth areas. External zones represent all areas outside of the City.

Future job estimates and existing and future household estimates were provided by City staff. Existing job data was based upon the 2006 Census of Canada. All data was provided in larger zones (Smart Growth or Census) and subsequently disaggregated to the TAZ level.

9.1.1.2 Base (Existing) Trip Table

The OD survey data collected responses from a sample of households in Yellowknife, as described above. This data was expanded by the number of households in large, aggregate TAZ zones. The expanded OD survey data was coded in terms of the 66 TAZs. By coding the data to the 66 TAZs, with one TAZ as the origin and one TAZ as the destination of each trip, a square (66 x 66) matrix of trips was created. Each trip has additional data associated with it, including time of day, selected mode, and trip type.

The complete trip table was split to create base trip tables for the PM peak hour model. A two hour PM peak of 3:45 PM to 5:44 PM was chosen for Yellowknife because it generally generates the most trips for the widest variety of reasons and due to the small sample size of the survey it provided a more complete representation of travel patterns. The two hour PM peak trip table was further divided into two tables; one for work trips and another for non-work trips. Work and non-work trips were separated because they typically have different travel patterns.

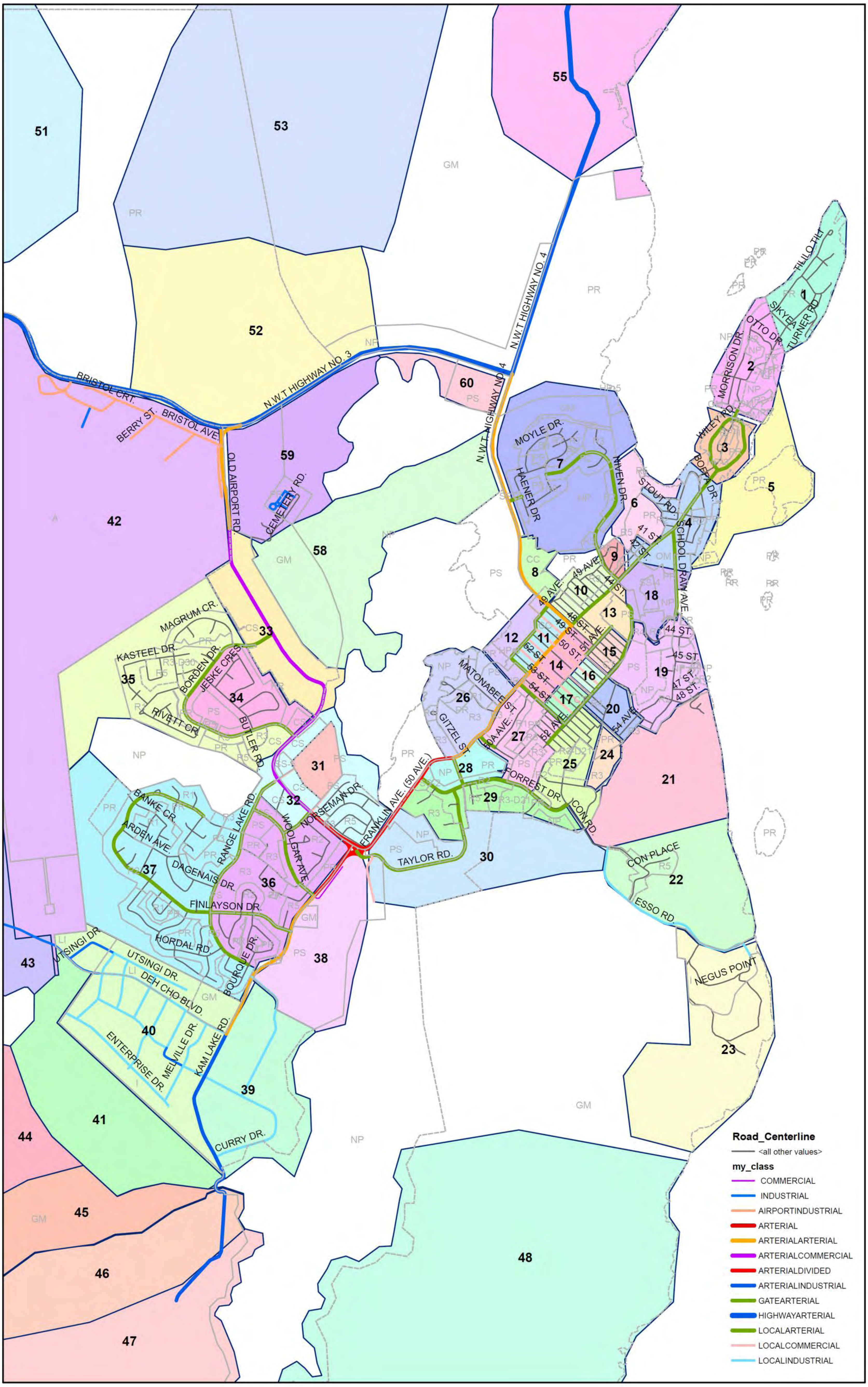


Exhibit 9-1: Traffic Analysis Zones Map

9.1.1.3 Existing Mode Split

The mode split of existing PM peak hour trips was analyzed and used as a basis for mode split in the model. In the OD survey, trips were categorized into the following modes of travel: driver (vehicle), passenger (vehicle), walking, transit, cycling, and other. Together, driver and passenger trips represent trips made by vehicle. As discussed, each trip has a mode, origin, destination, and trip type (work / non-work) associated with it. Using the origin and destination, the trip distance was estimated for each trip. Trips were sorted into six distance categories and mode split for work and non-work trips in each distance category was calculated. A summary of the mode splits for the existing conditions are provided in **Table 9-1**. **Table 9-1** is made up of two smaller tables: the upper table shows work trips and the lower table shows non-work trips.

Table 9-1: Existing Mode Split by Distance Category

Work									
Trip Distance (km)			**V**	**W**	**TR**	**C**	**TA**	**O/DNS**	***Total***
0	to	1	63%	34%	0%	0%	0%	3%	*100%*
1	to	2	71%	28%	1%	0%	0%	0%	*100%*
2	to	5	91%	0%	2%	2%	0%	5%	*100%*
5	to	10	98%	0%	0%	0%	0%	2%	*100%*
10*	to	20	*99%*	0%	0%	0%	0%	1%	*100%*
20	to	1000	*99%*	*0%*	*0%*	*0%*	*0%*	*1%*	*100%*
Total Work Trips			*82%*	*14%*	*1%*	*1%*	*0%*	*2%*	*100%*

* No work trips with lengths greater than 10 km were recorded. Mode split for categories larger than 10 km were based on the mode split in the 5 km – 10 km range.

Non-Work									
Trip Distance (km)			**V**	**W**	**TR**	**C**	**TA**	**O/DNS**	***Total***
0	to	1	72%	22%	0%	0%	0%	6%	*100%*
1	to	2	73%	24%	3%	0%	0%	0%	*100%*
2	to	5	89%	6%	1%	1%	0%	3%	*100%*
5	to	10	84%	0%	5%	0%	11%	0%	*100%*
10	to	20	100%	0%	0%	0%	0%	0%	*100%*
20*	to	1000	100%	0%	0%	0%	0%	0%	*100%*
Total Non-Work Trips			*81%*	*13%*	*1%*	*1%*	*1%*	*3%*	*100%*

* No non-work trips with lengths greater than 20 km were recorded. Mode split for categories larger than 10 km were based on the mode split in the 5 km – 10 km range.

V= Trips by vehicle (driver and passenger), W = Walk, TR = Transit, C = Cycling, TA = Taxi, O – Other, DNS = Did not say

Most PM peak trips recorded were less than 10 km in length, resulting in a very small data set for the 10 km to 20 km and 20 km to 1,000 km ranges. For work trips, the longest trip recorded was in the 5 km to 10 km range. The mode split calculated for the 5 km to 10 km range was used for the larger ranges to account for this data gap. For non-work trips, the longest trip recorded was in the 10 km to 20 km range. The very small data set for this range may have skewed the mode split towards passenger trips over driver trips; however, due to the small number of these trips there was a negligible impact on the model.

The Work and Non-work trips were combined to yield a single, two hour matrix for each mode. These trip tables by mode were then factored to represent a one-hour PM peak, which resulted in a PM peak hour trip table for each individual mode.

9.1.1.4 Trip Assignment

The result of the previous steps is a series of trip tables that sum the number of trips by each mode from each origin to each destination. In other words, each origin-destination pair has a set number of trips by vehicle, by transit, by cycling, by walking, and by other. These trip tables do not show how the trips get from the origin to the destination – i.e. what road they take. Instead, this is undertaken using trip assignment, which puts the trips between each origin and destination pair on an actual road network ‘path’. This is completed using modeling software called GNE.

The city’s road network was represented in the model using the GNE platform. The network is composed of the following:

- Arterial and collector roadways represented by ‘*roadway links*’;
- TAZs – represented by dots called ‘*centroids*’; and,
- The local street network represented by lines called ‘*centroid connectors*‘ that join the ‘*centroids*’ to the ‘*roadway links*’.

The GNE model represents the actual Yellowknife network, in the same way that a globe is a model of the earth. The GNE network is not an exact replica of the Yellowknife transportation network but is instead a smaller and more simplified version. The principal components of the model are represented this way with the correct relative scale or distance.

To represent the real Yellowknife road network, each roadway link in the GNE model has three characteristics: length (km), capacity (vehicles per lane per hour), and posted speed. The model road network is shown in **Exhibit 9-2**. The *roadway links* are shown in green while *centroid connectors* are blue.

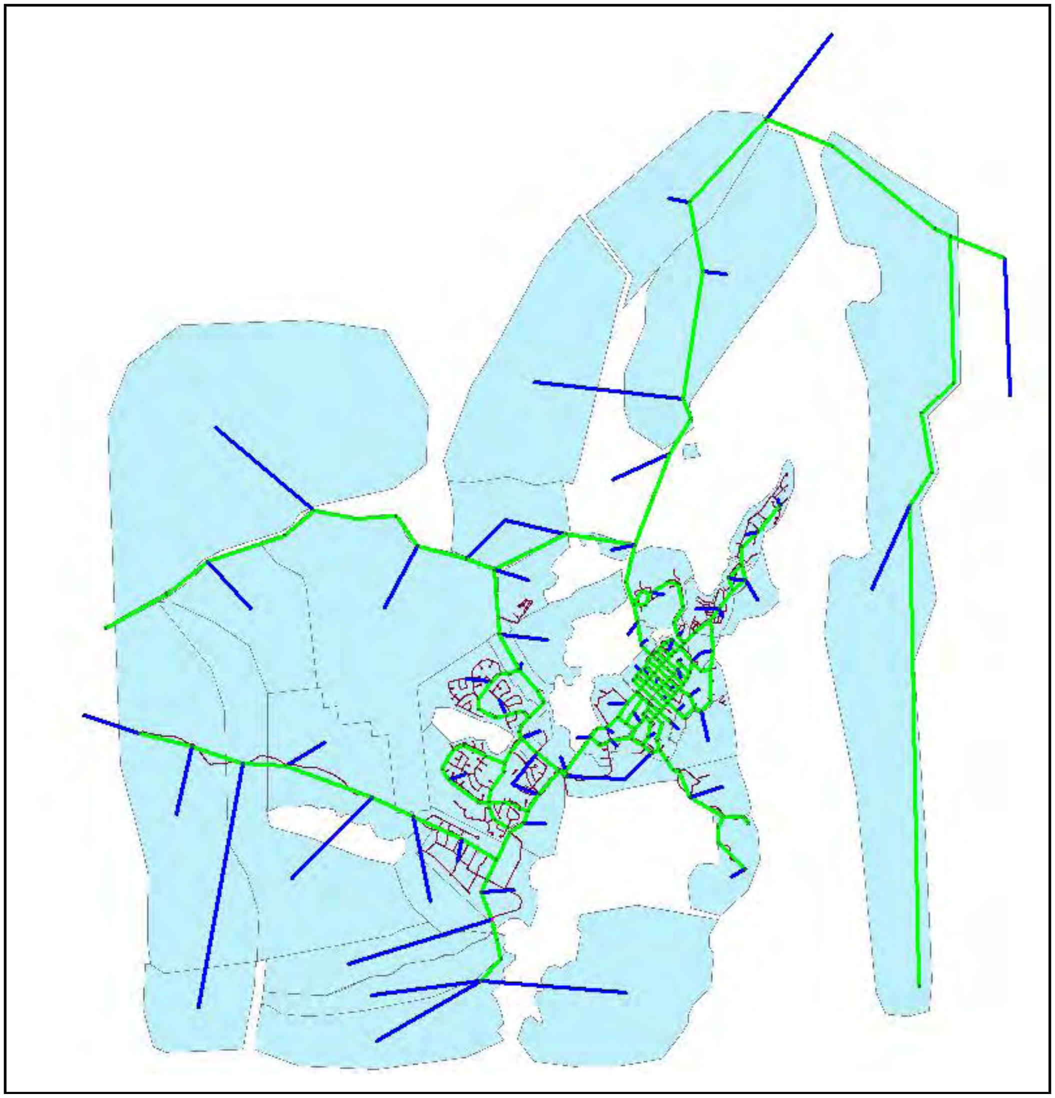


Exhibit 9-2: Model Road Network and Centroids

After the model of the road network was complete, the trips by vehicle were assigned to specific routes. Then all the individual trips on each *roadway link* were added together to show the total number of vehicles expected on that *roadway link*. This process is complicated and is done using the QRSII software package. The result of the assignment is a GNE file with estimated existing PM peak hour volumes on each link.

Although out of the scope of this project, the model allows for the testing of new roads, widened roads, or other improvements but it does not include sidewalks per se (they are assumed to be inherent to the road network). Similarly, cycling paths are not included as they are also assumed to be inherent. However, the model can also be used to place transit trips on the road network; using the model this way can provide an indication of where transit routes are needed in forecast scenarios.

9.1.1.5 Model Calibration

The existing PM peak model is a simplified representation of actual traffic in Yellowknife as captured by the OD survey. The traffic on the model *roadway links* was created using the OD survey as a base. The trip tables are also simplified compared to the actual travel in Yellowknife and were created using a sample, or a portion, of all trips that occur in Yellowknife.

Following standard practice in transportation modelling, at this point the existing world created in the model must be compared to the existing world in the actual city of Yellowknife. Traffic counts at key intersections were collected around the same time as the OD survey. The traffic volume in the model was compared to the actual traffic volume from the traffic counts. The parts of the model (the *roadway links* and the trip tables) are then adjusted to make the results closer to the real traffic counts. This is repeated again and again, until the traffic in the model resembles the traffic counts. The process of adjusting the model is called calibration. Through calibration, when the model is used to forecast – i.e. to predict future traffic patterns – it is using a base that is as close as possible to real conditions. This improves the accuracy of the forecasts.

Two parts of the model were adjusted during the calibration process: the PM peak origins and destinations, and the road network. Because the matrix of origins and destinations was created using a sample of actual travel in Yellowknife, some TAZs may show more trips than they actually have, while others may show less. Adjusting the original origins and destinations results in a new origin-destination matrix (synthetic OD matrix), which is closer to actual travel patterns in the city. The model road network has set speeds and capacities that were adjusted to better reflect actual, on-street conditions. A combination of both methods was used to best reflect existing conditions. The origins and destinations were adjusted in 17 iterations; each of the 17 iterations also included between zero and five changes to the road network attributes. The final results of the calibration were existing PM peak hour trip tables and an adjusted model road network that could be used as the basis for the forecasts.

The calibration resulted in a model where the majority of roadway links (83%) outside of the downtown core show traffic volumes that are close to vehicles of the existing traffic count (within 15% or 100 vehicles). That means, for example, that a road with an existing traffic count of 600 vehicles must have a model traffic volume that is within 15% of 600 vehicles; 15% of 600 is 90 vehicles, so the final model showed between 510 and 690 vehicles for that link. Similarly, 100% of key screenlines are within 15% or 100 vehicles of the existing traffic count.

9.1.2 Forecast Demand

9.1.2.1 Trip Generation and Distribution

The calibrated existing matrix was used as a base to generate future trips. To generate these future trips, two growth factors were applied to the matrix. The growth factors represent the increase in trips due to growth in households and jobs. The two growth factors were developed for each TAZ for each of the six forecasts. Two growth factors are needed because jobs and households in each TAZ grow at different rates. The growth factors are developed by comparing the forecasted number of jobs and households (from Smart Growth projections) to the existing number of jobs and households. These growth factors were applied to the synthetic OD matrix using a growth factoring procedure called 'Fratar'.

Some TAZ have no households or jobs in the existing scenario. Zero values cause errors in the model because applying a growth factor to zero equals zero. To prepare the calibrated base origins and destinations for factoring, TAZs that currently have no households or jobs were given a unit value (1 trip). In general, existing work origins in each zone were factored up using the job factor and existing work destinations in each zone were factored up using the household factor. Non-work origins and destinations were factored up using the household factor. Some zones required different treatment to account for specific conditions. These are described in detail in the *Transportation Model Technical Memo (2009)* provided in **Appendix F**.

After applying the growth factors, the origins and destinations were factored twice more: once so that every scenario in each horizon had the same number of origins and the same number of destinations, and again so that work origins equal work destinations and non-work origins equal non-work destinations. This completed the trip generation process and resulted in a fixed number of work origins, work destinations, non-work origins, and non-work destinations for each zone.

Finally, trips were distributed between the zones. Starting with the calibrated base trip table, each trip pair was factored iteratively until the origins and destinations matched the forecast origins and destinations.

The result of this process was two PM peak two hour trip tables (work and non-work) for each of the six forecasts.

9.1.2.2 Modal Share

Using the existing mode share percentages as a starting point, the future mode share was calculated. Based on previous work, it was assumed that travel patterns within a distance category do not change unless investment in infrastructure makes another mode more appealing. Given this study's focus on moving towards sustainable transportation modes, it was assumed that the city's priority will be to invest in transit, cycling, and pedestrian infrastructure. Therefore, for the future scenarios, five changes to the existing mode split were assumed:

- An increase in walking for short trips;
- A reduction in walking for mid-length trips where transit options are improved (change assigned to transit);
- An increase in cycling for trips up to 10 km;
- An increase in transit use based on mode split research of comparable small communities[8] with developed transit systems. Longer distance work trips are less likely to be made by transit; and,
- An overall reduction of driver trips.

Table 9-2 summarizes the forecasted mode split by distance category for work and non-work trips. The intensity of the mode shift was compared to mode splits from similar communities to assess reasonableness.

Table 9-2: Forecast Mode Split by Distance Category

Work									
Trip Distance (km)			V	W	TR	C	TA	O/DNS	Total
0	to	1	54%	36%	4%	2%	0%	4%	100%
1	to	2	69%	26%	4%	1%	0%	0%	100%
2	to	5	90%	0%	4%	3%	0%	3%	100%
5	to	10	96%	0%	2%	1%	0%	1%	100%
10	to	20	99%	0%	0%	0%	0%	1%	100%
20	to	1000	99%	0%	0%	0%	0%	1%	100%

Non-Work									
Trip Distance (km)			V	W	TR	C	TA	O/DNS	Total
0	to	1	63%	24%	5%	2%	0%	6%	100%
1	to	2	72%	22%	5%	1%	0%	0%	100%
2	to	5	84%	6%	5%	2%	0%	3%	100%
5	to	10	82%	0%	5%	1%	11%	1%	100%
10	to	20	100%	0%	0%	0%	0%	0%	100%
20	to	1000	100%	0%	0%	0%	0%	0%	100%

V = Trips by vehicle (driver and passenger), W = Walk, TR = Transit, C = Cycling, TA = Taxi, O = Other, DNS = Did not say

The mode splits shown in **Table 9-2** were applied to all three growth scenarios to create future PM peak two hour trip tables for work and non-work trips. The number of trips by each mode differs by growth scenario because of the different land use configuration, density, and spacing. The work and non-work trip tables for each mode were combined and a peak hour factor was applied to arrive at final forecast

[8] City of Stratford, ON (2%); City of Timmins, ON (4%); City of Brandon, MB (5%); City of Belleville, ON (4%); City of Fredericton, NB (5%). (%) indicates transit mode share to work according to the 2006 Statistics Canada Survey.

PM peak hour trip tables. **Table 9-3** summarizes the resulting forecasted PM peak hour trips by distance category based on the forecasted mode split.

Table 9-3: Forecast PM Peak Hour Trips by Trip Distance Category (Work and Non-Work Combined)

Long-Term Compact Trips (Work and Non-Work Combined)									
Trip Distance (km)			V	W	TR	C	TA	O/DNS	Total
0	to	1	2,460	1,250	190	85	0	210	4,195
1	to	2	3,040	1,040	195	45	0	0	4,320
2	to	5	8,470	270	435	245	0	290	9,710
5	to	10	7,450	0	250	85	320	80	8,185
10	to	20	1,420	0	0	0	0	9	1,429
20	to	1000	490	0	0	0	0	1	491
Total			23,330	2,560	1,070	460	320	590	28,330

Long-Term Hybrid Trips (Work and Non-Work Combined)									
Trip Distance (km)			V	W	TR	C	TA	O/DNS	Total
0	to	1	1,840	910	140	60	0	160	3,110
1	to	2	2,630	900	170	40	0	0	3,740
2	to	5	6,935	230	360	200	0	240	7,965
5	to	10	8,415	0	270	90	320	90	9,185
10	to	20	3,345	0	0	0	0	18	3,363
20	to	1000	965	0	0	0	0	2	967
Total			24,130	2,040	940	390	320	510	28,330

Long-Term Dispersed Trips (Work and Non-Work Combined)									
Trip Distance (km)			V	W	TR	C	TA	O/DNS	Total
0	to	1	1,610	755	125	55	0	145	2,690
1	to	2	2,185	750	140	30	0	0	3,105
2	to	5	5,000	165	255	145	0	170	5,735
5	to	10	7,205	0	230	80	270	80	7,865
10	to	20	7,100	0	0	0	0	40	7,140
20	to	1000	1,790	0	0	0	0	5	1,795
Total			24,890	1,670	750	310	270	440	28,330

V = Trips by vehicle (driver and passenger), W = Walk, TR = Transit, C = Cycling, TA = Taxi, O = Other, DNS = Did not say

The tables illustrate the impact of land use on trip distance. There are more trips at the shorter distances (under 5 km) in the Compact scenario than in the Hybrid or Dispersed scenarios. This is because trip distance is a function of the land use. In the Compact scenario, there are more households and jobs closer together, so trips are shorter. In the Compact scenario, there are comparatively few trips over 10 km, where as in the Dispersed scenario, where jobs and households are further apart, there is a high proportion of trips over 10 km, especially in the 10 km to 20 km range.

These tables also demonstrate the impact of land use on mode choice. As previously discussed, mode choice is set for each trip distance category in the model. In each scenario, the mode split within one trip distance category is the same; however, because the number of trips in each distance category are different for the different scenarios, overall mode shift changes. In the Dispersed scenario, many trips are longer than 5 km and therefore only about 2000 travellers choose to walk or cycle. Conversely, in the Compact scenario most trips are less than 5 km resulting in over 3000 travellers choosing to walk or cycle. That represents a 50% increase in transportation by walking and cycling between the Dispersed and Compact scenarios.

The forecast mode splits by distance category are an estimation based on assumptions about the type and intensity of investment made in the sustainable transportation system. It also assumes that, for the most part, citizens of Yellowknife maintain their current attitudes and awareness concerning transportation options. As discussed, the changes in the mode split by distance category between the existing and the future are based on mode splits in similar communities that have a greater level of active transportation than currently exists in Yellowknife.

With the Smart Growth Plan, the city of Yellowknife is already making a conscious effort to move towards a sustainable future in transportation. It can further shift travel towards sustainable modes through investment in the sustainable transportation network and transportation demand management (TDM) initiatives as new development and redevelopment occurs. Investments that impact mode choice include improving transit shelters and other transit services and constructing sidewalks, trails, and bicycle routes that provide safe connections between major centres using the shortest possible distances. Operations and policies that impact mode choice include increasing transit frequency, reducing walking distance to transit, and encouraging the development of complete communities. Changes to travel patterns in Yellowknife as a result of these programs should be measured directly. The model can be adjusted over time as mode split changes, or as the impact of these programs is better understood. The model can also be adjusted to develop 'tolerance' estimates to evaluate what the impact of different mode splits has on the transportation network.

9.1.2.3 Trip Assignment

The driver mode trip table was assigned to the network using the QRSII modeling software.

9.2 Forecast Model Results

The travel demand model resulted in forecast total trips in the PM peak hour, as well as more specific forecasts of trips by mode, forecast travel patterns, and forecast traffic volumes. Model results are provided in the following sections.

9.2.1 Forecast Trips by Mode

For the long-term horizon, the total number of trips is fixed for the three growth scenarios because trips are a function of jobs and households, which are the same in every scenario within the horizon. As described in the preceding section on modal share, the total trip tables for the PM peak period were factored into trip tables by mode based on forecasted mode split by trip distance. **Table 9-4** summarizes the total trips made by each mode in the existing and long-term horizons.

Table 9-4: Total PM Peak Hour Trips by Mode (Work and Non-Work Combined)

			Trips By Mode (Work and Non-Work Combined)						
	Horizon	**Land Use**	**V**	**W**	**TR**	**C**	**TA**	**O**	Total
Scenario	Existing	--	7,280	1,000	100	60	50	220	**8,710**
	Long	Compact	23,330	2,560	1,070	460	320	590	**28,330**
		Hybrid	24,130	2,040	940	390	320	510	**28,330**
		Dispersed	24,890	1,670	750	310	270	440	**28,330**

V = Trips by vehicle (drivers and passengers), W = Walk, TR = Transit, C = Cycling, TA = Taxi, O = Other

The total number of trips forecast in the PM peak hour for the long-term horizon is 28,330 trips; an increase of 226% over existing. The trips naturally increased at a higher rate than the households for the long-term horizon. The model accounts for some existing uses, e.g. park, which are recorded in the surveys and are independent of the number of households and jobs in the zone. When high growth in households and jobs occurs in these ‘empty’ zones, the model assumes that background traffic increases with it, which is a reasonable assumption.

Some increase in trips over time is expected, since the number of trips per household typically increases over time. In North America, travel surveys have shown trip rates generally increase slightly over time. In aggregate, households make more trips now than they did in the past. This is not to say that an individual household will make more trips one year than they made the year before, but instead describes the average behaviour of all households over a long period of time. This change is a function of demographics and income. Therefore, in long range modeling, this trend is considered to continue and results in a higher rate of increase for trips than for households.

Table 9-4 shows that walk trips are greatest in the Compact scenarios and smallest in the Dispersed scenario; the same is true for cycling and transit trips. This is expected, as travellers are more likely to walk, take transit, or cycle over shorter distances. The number of travellers using private autos (combined total of drivers and passengers) is highest for the Dispersed scenario and lowest for the Compact scenario.

9.2.2 Forecast Travel Patterns

The land development patterns chosen for the Compact, Hybrid, and Dispersed scenarios had significant impact on the forecast travel patterns. In the Dispersed scenario, travellers were more likely to drive or be passengers in a private auto as illustrated in **Exhibit 9-3**; they also travelled significantly further to reach their destination, as shown in **Exhibit 9-4**. Travellers were more likely to choose an active mode of transportation (cycling or walking) in the Compact scenario, where households and jobs are more concentrated and easier to access by walking or cycling. As expected, travel patterns in the Hybrid scenario lie between those in the Compact and Dispersed scenarios.

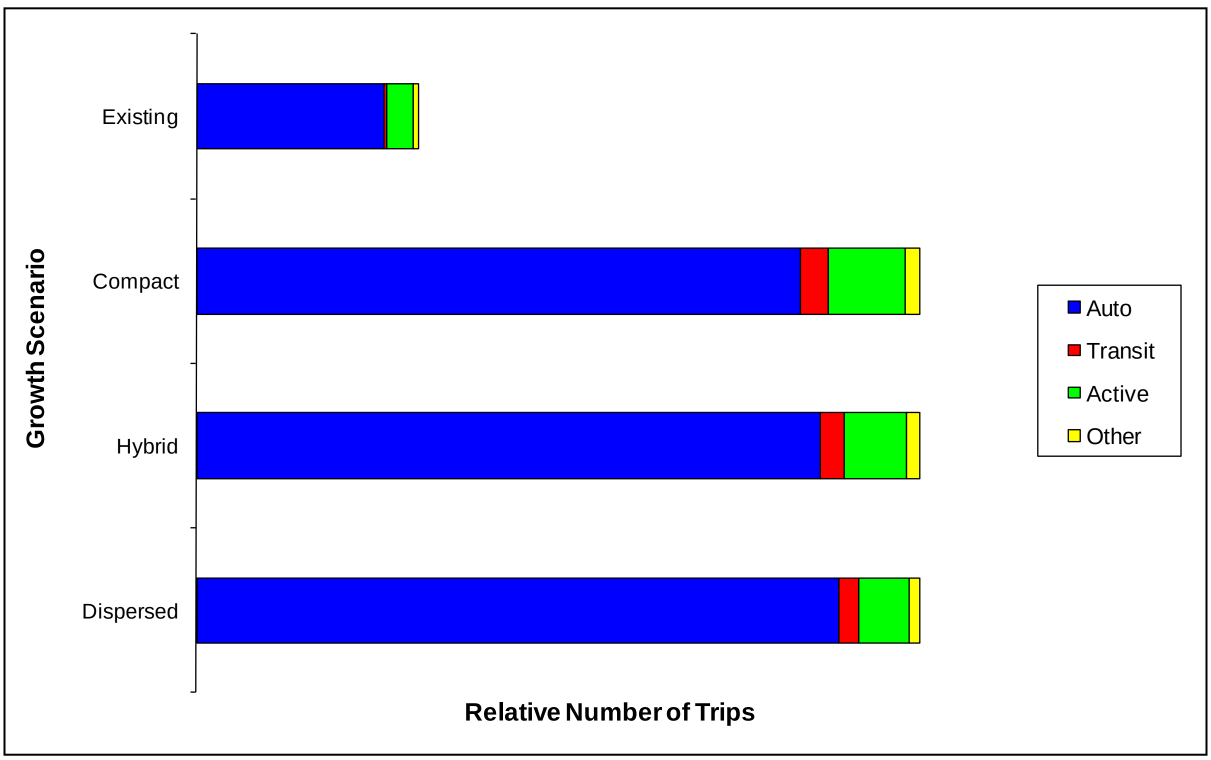


Exhibit 9-3: Relative Trips Made – Long-Term Horizon

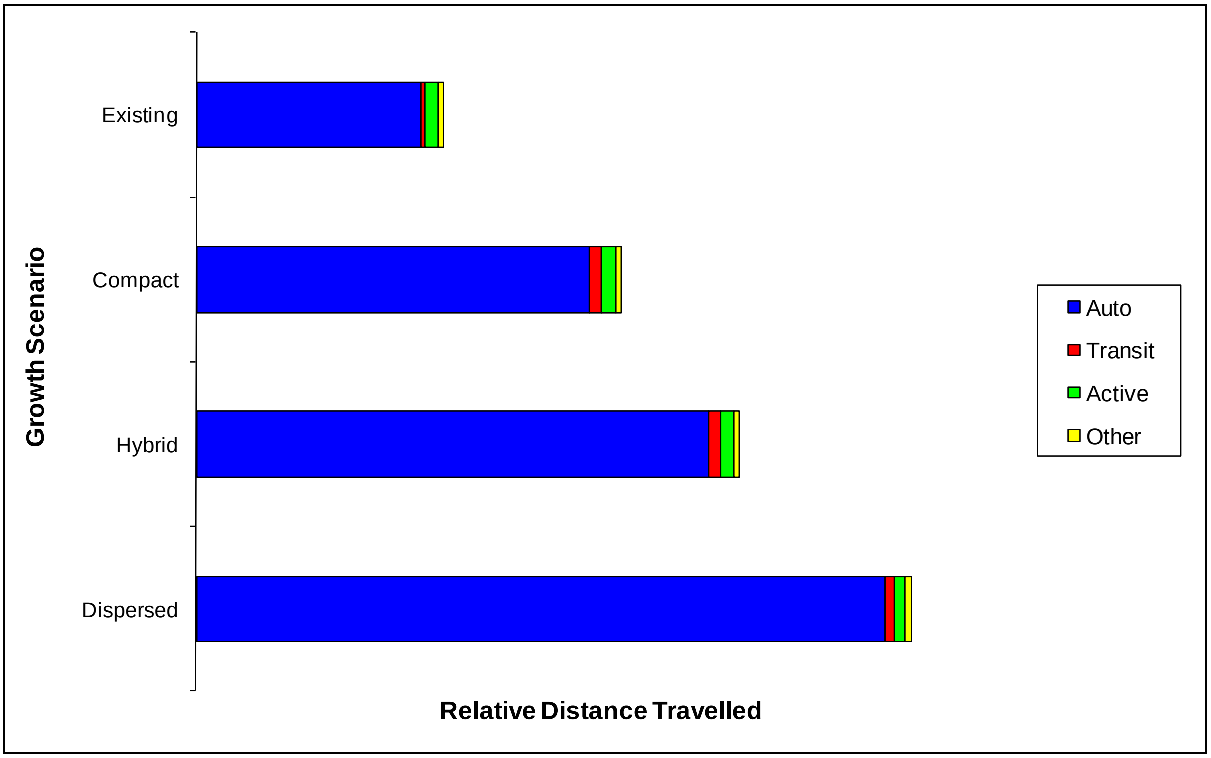


Exhibit 9-4: Relative Distance Travelled – Long-Term Horizon

Changes in the total kilometres travelled by private vehicles (VKT) have a direct impact on greenhouse gas emissions. As vehicles travel further, they consume more fuel and release more GHG emissions. The relative GHG emissions between the different scenarios are shown in **Exhibit 9-5**.

The change in land use patterns in each scenario and horizon also impacts where trips are starting and ending, as well as the number of trips travelling between zones. The following four exhibits illustrate the direction and intensity of travel between different zones in the PM peak period. Trip flows are shown as arrows where the thickness of the line indicates the intensity of the flow. The colour of the line indicates the origin zone. Zone pairs with a relatively small number of trips do not have arrows to improve the readability of the exhibits. If a zone pair does not have an arrow, it means that the pair has a small number of trips relative to the other zone pairs with arrows.

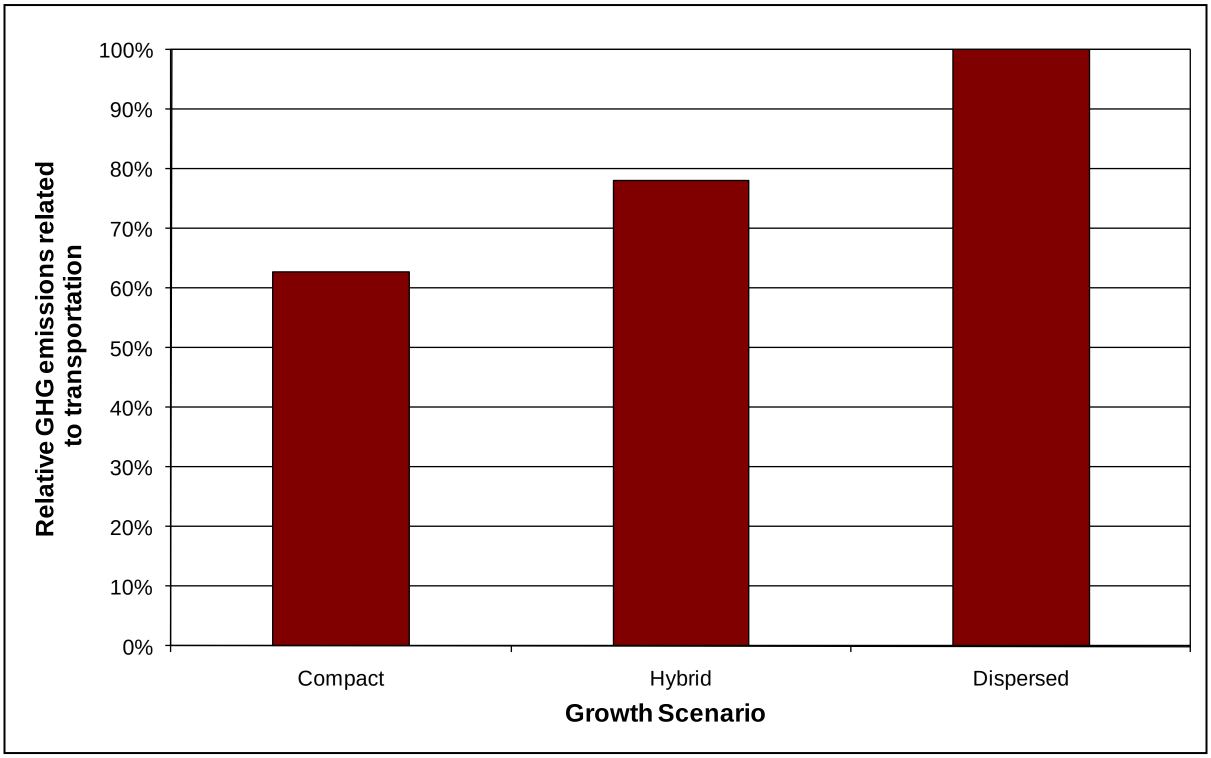


Exhibit 9-5: Relative GHG Emissions – Long-Term Horizon

It is important to note that a thick arrow internal to a zone (i.e. an arrow that starts and finishes in the same zone) does not necessarily indicate congested automobile traffic in that area. Where the number of trips is large, but the distance is small, more trips can be accommodated via active modes (walking and cycling) or by transit. Lower volumes of trips travelling farther distances are more likely to be accommodated by private vehicles and may need to travel through other areas, increasing congestion not only in their origin and destination areas, but also in the areas in between.

Exhibit 9-6 illustrates existing travel patterns. Existing development is reasonably compact, and most trips are within the downtown, or between the Downtown and Kam Lake / Range Lake. This pattern is consistent with expectations, since both Downtown and Kam Lake / Range Lake areas currently have household and job land uses. Some trips travel between Old Airport Road and Kam Lake / Range Lake. With existing land uses, few trips are travelling long distances, as shown previously in the mode split by trip distance data.

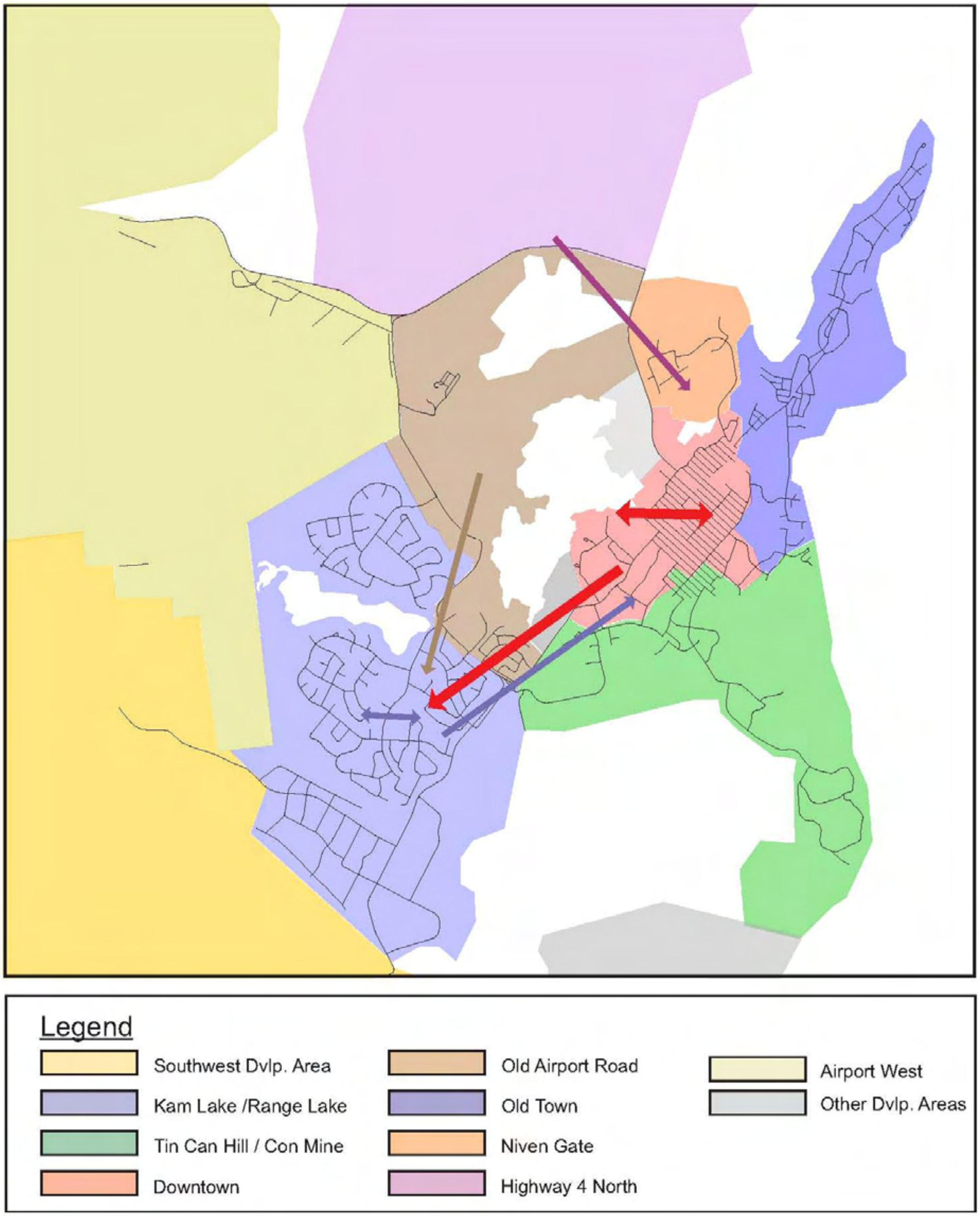


Exhibit 9-6: OD Travel Patterns – Existing

In the long-term horizon, the intensity of trips has more than doubled, with more trips over longer distances in all scenarios. This reflects the significant increase in households and jobs from the existing scenario. In the Compact scenario, shown in **Exhibit 9-7** the highest intensity of trips is still in the Downtown core and between established neighbourhoods and commercial areas, such as Kam Lake / Range Lake and Old Airport Road. In addition to these trips, there is also a higher volume of trips within the Highway 4 North area and significantly more trips between Old Airport Road and other areas. This is consistent with the expectation that Old Airport Road's importance as a mixed use neighbourhood with significant commercial land use.

In the Hybrid scenario, illustrated in **Exhibit 9-8**, trips in Downtown decrease while trips between outlying areas increase. Trips between Highway 4 North and Southwest Development Area and Tin Can Hill / Con Mine will require additional infrastructure.

Exhibit 9-9 shows the impact of the Dispersed scenario. In this scenario, travel within Downtown is greatly reduced compared to the Compact. The largest trip volumes are within the Highway 4 North Zone, and between Highway 4 North and other areas. An increase in trips between Other Development Areas and Southwest Development Area is also seen; this is the only scenario where the Other Development Area / Southwest Development Area origin – destination pair generates a significant number of trips.

The travel patterns for the long-term Dispersed scenario show that dispersed development will require significant investment in infrastructure to accommodate travel between areas that are far apart and not well connected by the existing transportation infrastructure (e.g. Highway 4 North and Southwest Development Area). It is also important to note that increasing intensity between Highway 4 North and Tin Can Hill / Con Mine and Other Development Areas will require improved infrastructure through or around Downtown where there is limited right of way.

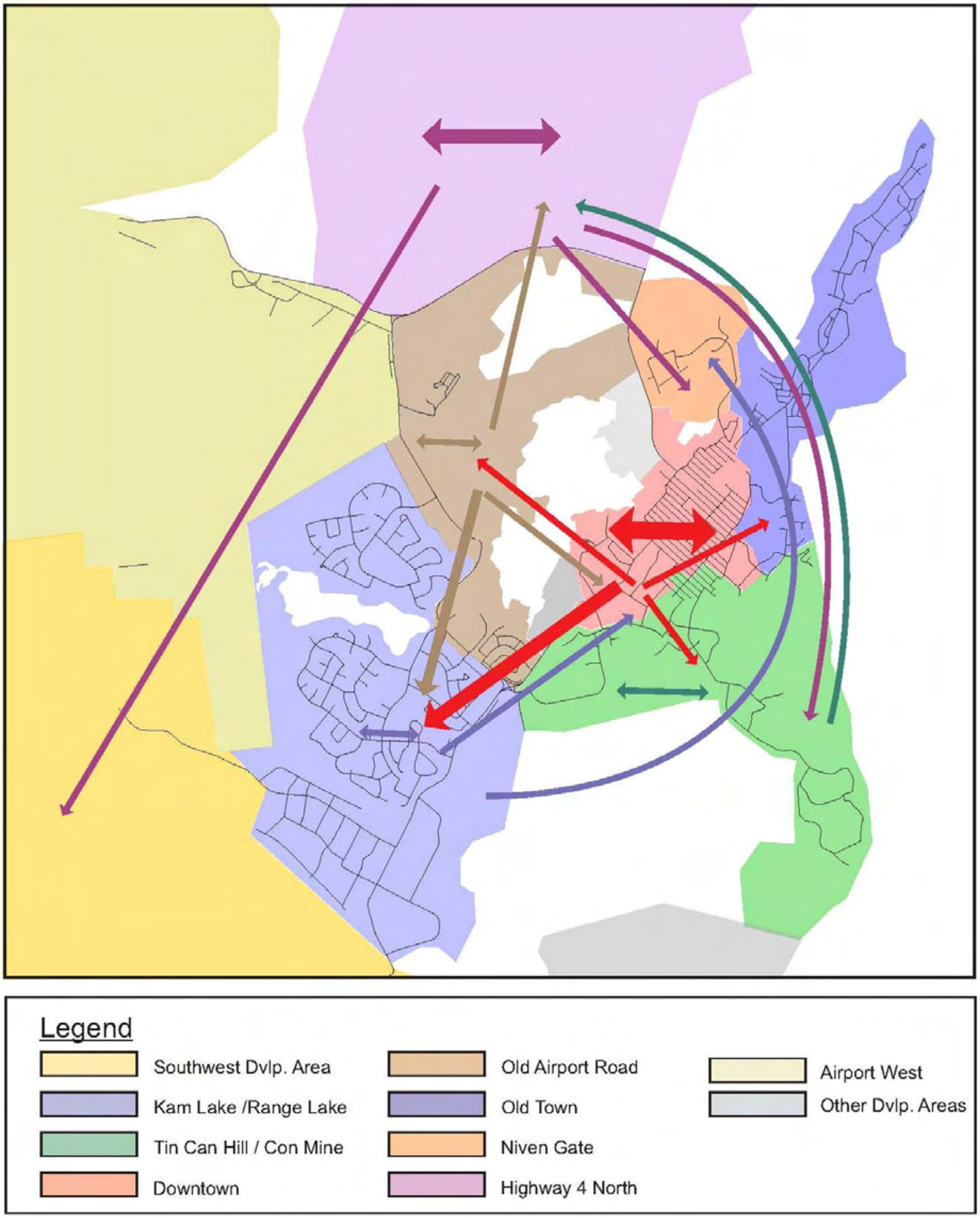


Exhibit 9-7: OD Travel Patterns – Long-Term, Compact Scenario

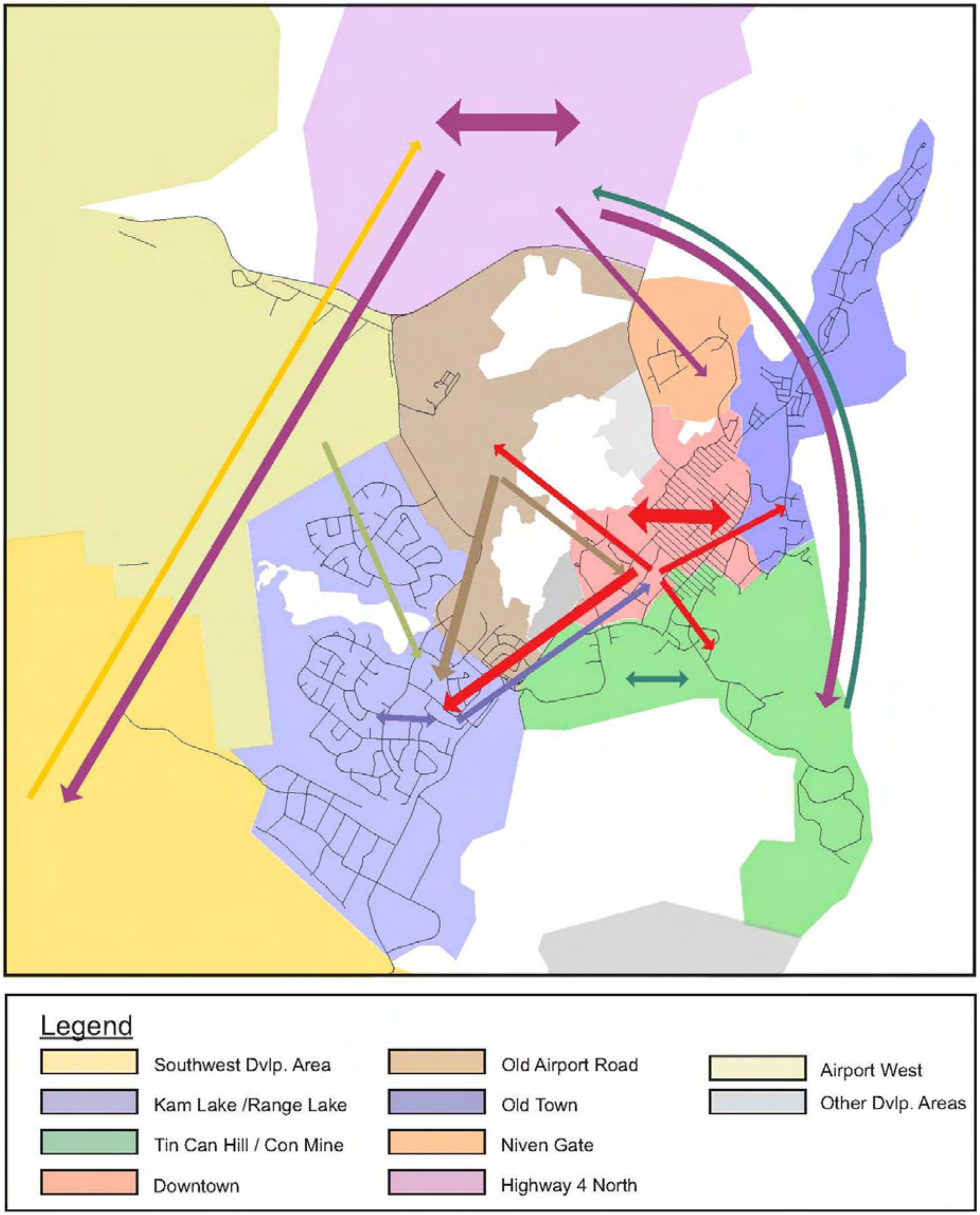


Exhibit 9-8: OD Travel Patterns – Long-Term, Hybrid Scenario

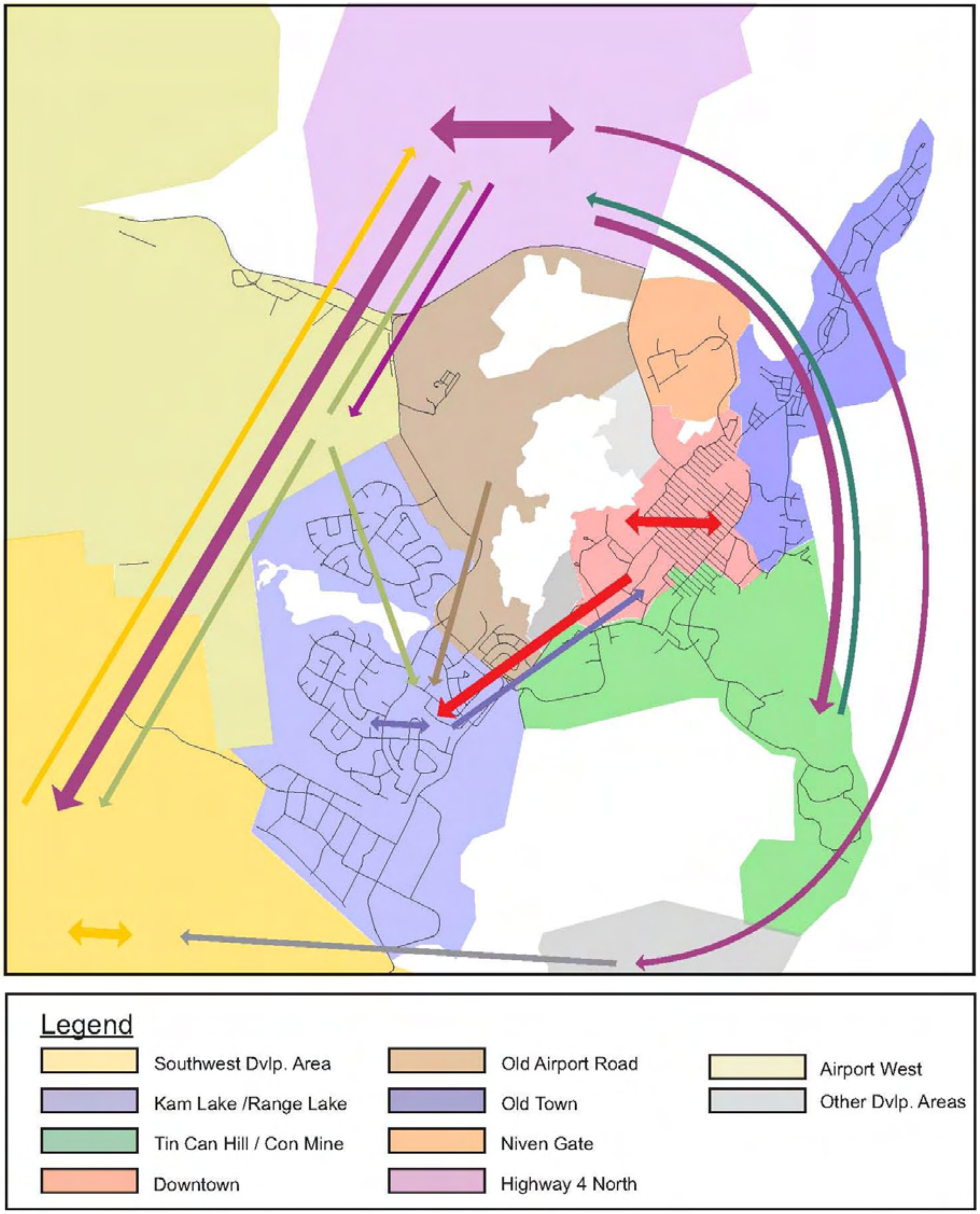


Exhibit 9-9: OD Travel Patterns – Long-Term, Dispersed Scenario

9.2.3 Forecast Traffic Volumes

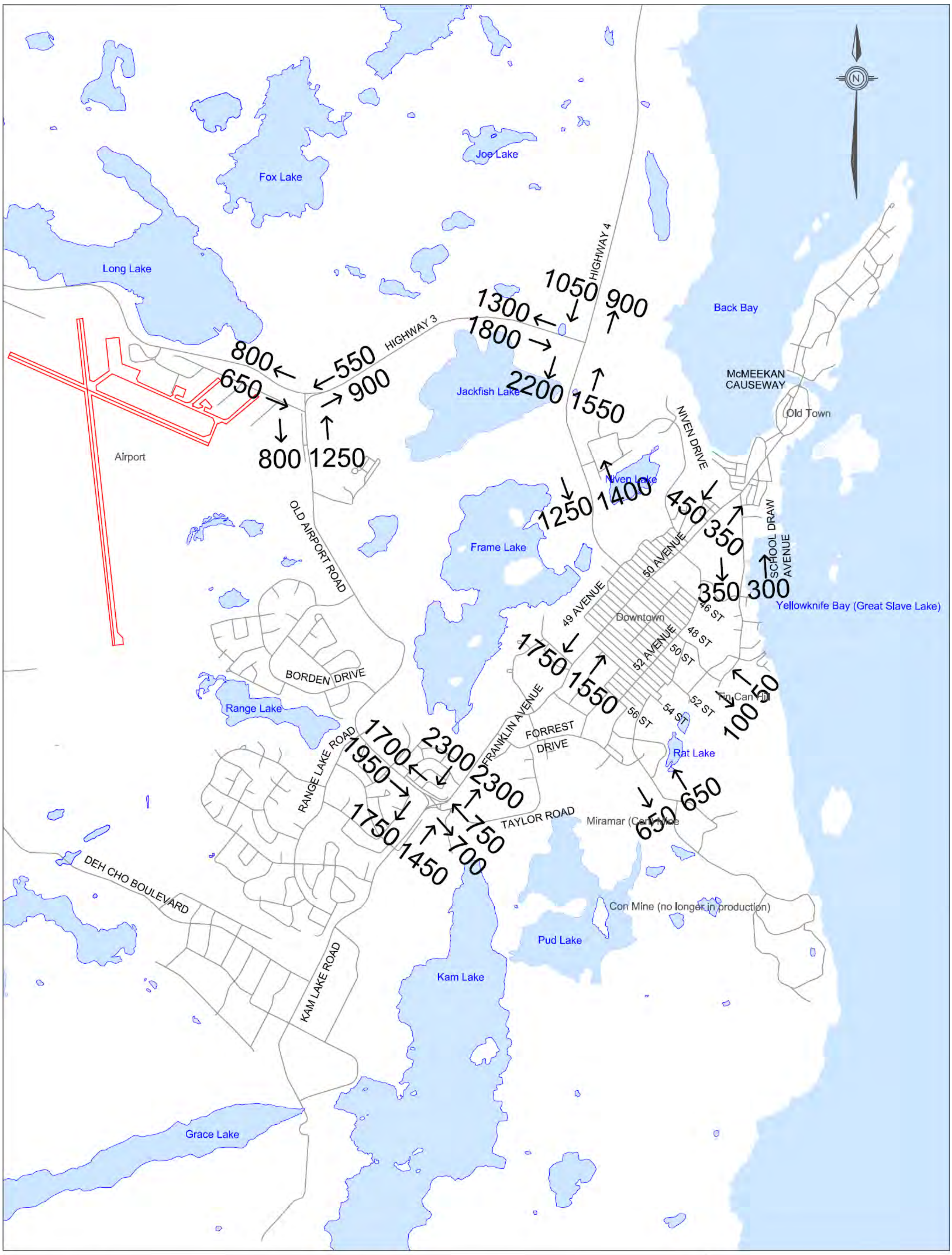
Applying the forecast vehicle trip tables to the QRS model resulted in forecast traffic volumes at key locations on the road network for each horizon and scenario. These volumes are illustrated in the exhibits below. The traffic volumes shown in these figures are closely tied to the travel pattern exhibits in the previous section. To understand potential changes from existing travel patterns, refer to the existing PM peak traffic volumes in **Exhibit 6-1**.

The traffic volumes were forecast on the existing transportation network allowing for the assessment of additional road infrastructure needs. However, this methodology does not allow the testing of new road networks configurations. This analysis can be undertaken by editing the model structure to test future network options, but is outside the scope of work for this study. The city has been provided the model and will be able to run it in the future, if required.

As noted in the previous section, total trips in the PM peak hour are expected to increase 226% over existing in the long-term horizon. These increases are reflected in the forecast traffic volumes.

As expected, roadway and intersection traffic volumes increase again in the long-term horizon. These volumes can be seen in **Exhibit 9-10** for Compact, **Exhibit 9-11** for Hybrid, and **Exhibit 9-12** for Dispersed. Old Airport Road becomes an increasingly important link; existing two-way PM peak hour volume on Old Airport Road at Highway 3 is around 700 vehicles, this volume ranges from 2,050 vehicles (Compact) to 2,800 vehicles (Dispersed) in the long-term horizon. The increase of traffic travelling north and south at the intersection of Highway 4 and Highway 3 is of equal significance, but less balanced between scenarios.

Traffic travelling north / south on Highway 4, north of Highway 3, increases to 1,950 in the Long-term, Compact scenario; this is almost 20 times existing traffic. Traffic at the same point in the Dispersed scenario, is almost 60 times existing traffic. In the Compact scenario, traffic in and out of Downtown on Highway 4 is over three times more than the existing; in the Dispersed scenario that traffic is close to four times the existing. The Dispersed scenario also forecasts more traffic travelling west on Kam Lake Road than the Compact and Hybrid scenarios. This reflects an increase in travel between the Highway 4 North area and the Southwest Development area. Traffic south to the Tin Can Hill / Con Mine area is greatest in the Hybrid scenario.



Legend	
← 450	Approach Volume (PM Peak Hour)

Exhibit 9-10: Long-Term, Compact Traffic Volumes

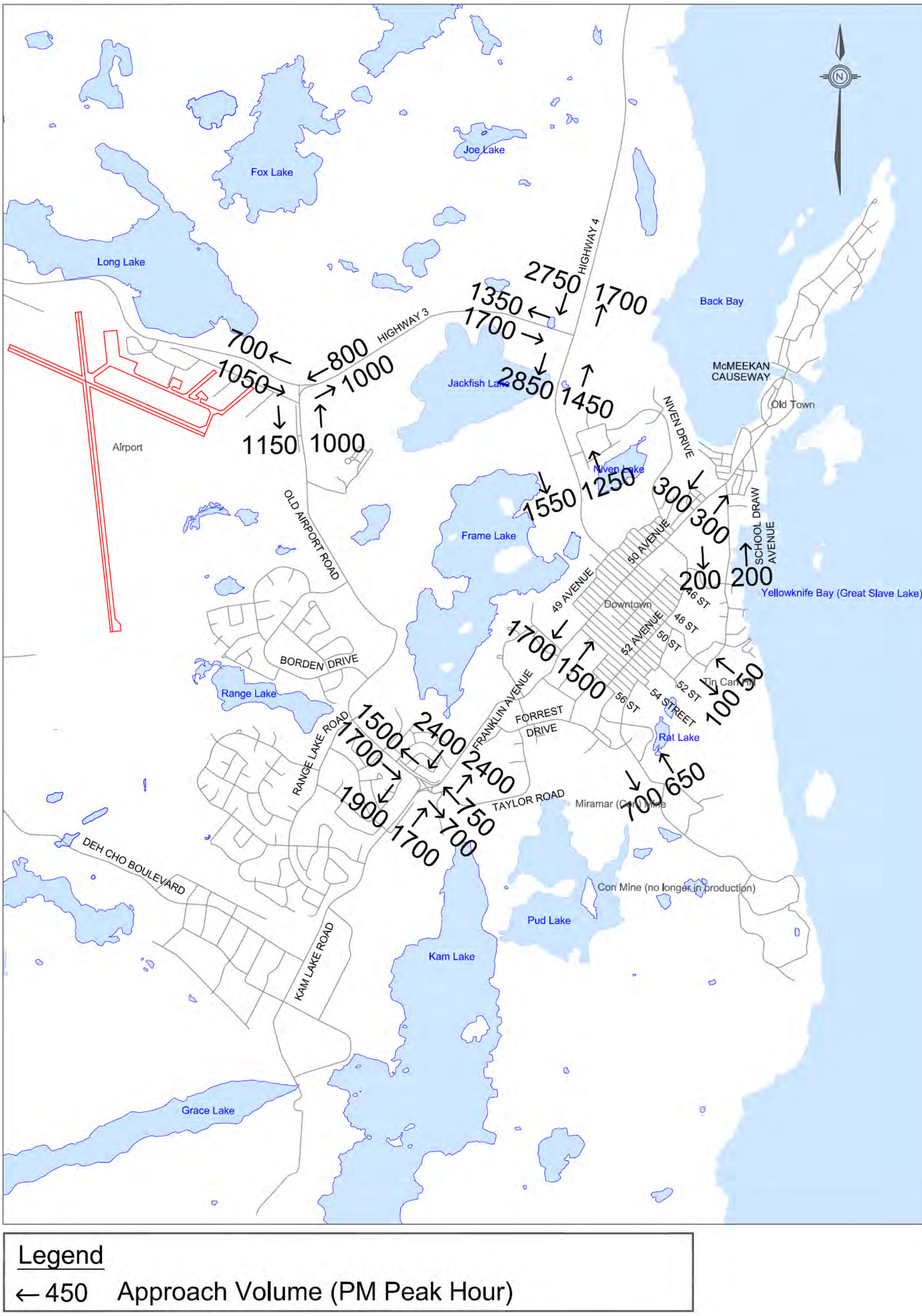


Exhibit 9-11: Long-Term, Hybrid Traffic Volumes

Legend
← 450 Approach Volume (PM Peak Hour)

Exhibit 9-12: Long-Term, Dispersed Traffic Volumes

9.2.4 Summary

The forecast results presented here are approximate and are limited by the strength of the data and assumptions used to construct the model. They are an effective tool to be used in high level planning and to identify gaps and needs in the transportation system. The impacts of the forecast on the Transportation Plan are discussed further in the following Section.

9.3 High Level Scenario Review

This section describes the future transportation networks for each scenario in the long-term horizon. The more detailed analysis is provided as **Appendix G**, and a high level analysis for each of the three growth scenarios is described in this section.

9.3.1 Long-Term, Compact Scenario

The long-term Compact scenario was constructed by analyzing future transit, cycling, walking, and vehicle demand patterns. Transit service was intensified between current nodes and future nodes to provide better service to Tin Can Hill / Con Mine area. The active network was expanded from the existing state to improve connectivity throughout the city and especially to the southern development areas. The following improvements were flagged for the road network at this preliminary stage of the analysis:

- *Franklin Avenue*: Maintain;
- *Old Airport Road*: Widen to 4 lanes;
- *Highway 4*: Widen to 4 lanes;
- *Kam Lake Road*: Widen to 4 lanes; and,
- *New Roads*: 4 roads identified, but only minor linkages required for connectivity.

9.3.2 Long-term, Hybrid Scenario

The long-term Hybrid scenario was analyzed in relation to the Compact. The transit service was expanded to provide more complete coverage than in the compact scenario and service between the proposed northern and southern development areas. The active network was expanded from the existing state to improve connectivity throughout the city and especially to the northern development areas, as well as the southern areas from the compact. The following improvements were flagged for the road network at this preliminary stage of the analysis:

- *Franklin Avenue*: Same as Compact;
- *Old Airport Road*: Same as Compact;
- *Highway 4*: Widen to 5 lanes (1 more than Compact);
- *Kam Lake Road*: Widen to 5 lanes (1 more than Compact); and,
- *New Roads*: 4 roads identified, as in the Compact, but with a more new infrastructure required to service the additional development.

9.3.3 Long-term, Dispersed Scenario

The long-term Dispersed scenario was analyzed in relation to the Hybrid. The transit service area would require a large expansion in order to provide service and coverage between intensified northern and southern development areas. The expansion of the active transportation network, including on and off-street facilities, would be extensive in relation to the Compact as it would required alternative mode connectivity between northern and southern development areas, a considerable distance. The following improvements were flagged for the road network at this preliminary stage of analysis:

- *Franklin Avenue*: Widen to 6 lanes (2 more than Compact / Hybrid);
- *Old Airport Road*: Same as Compact;
- *Highway 4*: Widen to 6 lanes (2 / 1 more than Compact / Hybrid);
- *Kam Lake Road*: Widen to 6 lanes (2 / 1 more than Compact / Hybrid); and,
- *New Roads*: 4 roads identified, as in the Compact / Hybrid, but with an extensive amount of new infrastructure required to service the additional development further from the existing community.

9.3.4 Conclusion

The results of the growth scenario and population horizon analyses were reviewed with City staff, Based on the direction, principles, and vision of the *Smart Growth Development Plan*, the Compact growth scenario was selected as the preferred option over the Hybrid and Dispersed.

The compact growth scenario presented many benefits over the other land uses, such as:

- The promotion of denser development within the city;
- The encouragement of more active mode choices;
- The production of the lowest amount of emissions due to shorter travel distances; and,
- The better utilization of the existing roadway and infrastructure of the city, providing the most cost efficient alternative.

Based on its selection as the preferred alternative, the compact growth scenario was further refined and analyzed, and a long-term transportation strategy was developed.

Future Transportation Analysis

10. FUTURE TRANSPORTATION ANALYSIS

10.1 Traffic Analysis

The model output from the Compact Scenario was reviewed in order to undertake high level analysis of the intersections and determine where future demand may require infrastructure improvements. Turning movements were estimated from the model output and using engineering judgment on future demand. [Once again, it is important to note that the model analyzed the future demand using the existing network as further analysis was outside the scope of this study].

As in the existing analysis, the following eight key intersections were analyzed:
1. Highway 3 and Old Airport Road;
2. Highway 3 and Highway 4;
3. Old Airport Road and Borden Drive (near the Home Building Centre);
4. Old Airport Road and Borden Drive (near Wal-Mart);
5. Old Airport Road and Range Lake Road;
6. 48th Street and 49th Avenue;
7. Deh Cho Boulevard and Kam Lake Road; and,
8. Old Airport Road and Franklin Avenue.

Exhibit 10-1 shows the current intersection laning and the proposed laning for the intermediate and long-term scenarios. The additional lanes are shown in red as well as proposed intersection traffic control upgrades.

The following link upgrades were assumed for the analysis:
- Highway 3 is a 4-lane cross section approaching Old Airport Road and approaching Highway 4.
- Old Airport Road is a 4-lane cross section with median for the fill length from Franklin to Highway 3.
- Highway 4 is a 4-lane cross section from Highway 3 to 49th Avenue.

[Note – For reference – it has been assumed that Old Airport Road runs north – south; Kam Lake Road and Franklin Ave run east- west].

In summary the following upgrades are proposed for the intersections as shown below:

1. **Highway 3 and Old Airport Road**:
   a) No additional lanes required.
   b) In the long-term – upgrade to a new traffic control - either a signal or roundabout).

2. **Highway 3 and Highway 4**:
   a) In the intermediate-term – upgrade to new traffic control – either a signal or a roundabout.
   b) In the long-term – require additional lanes – eastbound right turn (double right turn); northbound left turn (double left turn); and southbound through lane.

3. **Old Airport Road and Borden Drive N (near Home Building Centre):**
   a) In the long-term – require additional lanes – northbound and southbound through lanes.
   b) In the intermediate-term there may be a need for access to the Capital Area, which could be provided by additional roadway links east of Old Airport Road at existing intersections, such as Borden Drive to the north of Co-op corner.

4. **Old Airport Road and Borden Drive W (near Wal-Mart):**
   a) In the long-term – require additional lanes – eastbound left; southbound right turn.

5. **Old Airport Road and Range Lake Road:**
   a) In the intermediate-term – require additional lanes – southbound right turn.
   b) In the long-term – require additional lanes - northbound and southbound left turns (double left turns for both directions).

6. **48th Street and 49th Avenue:**
   a) In the intermediate-term – upgrade to new traffic control – either a signal or a roundabout.
   b) In the intermediate-term – require additional lanes – southbound left turn.
   c) In the long-term – require additional lanes - westbound right turn; northbound through lane; and eastbound left turn.

7. **Deh Cho Boulevard and Kam Lake Road:**
   a) In the intermediate-term – upgrade to new traffic signal.
   b) In the long-term – require additional lanes – southbound right turn; southbound through lane; westbound through northbound through lane; eastbound left turn (double left turn).

8. **Old Airport Road and Franklin Avenue:**
   a) In the intermediate-term – require additional lanes – southbound left turn (double left turn); westbound through lane.
   b) In the long-term – proposed grade separation; at the very least – require additional lanes – northbound through lane.

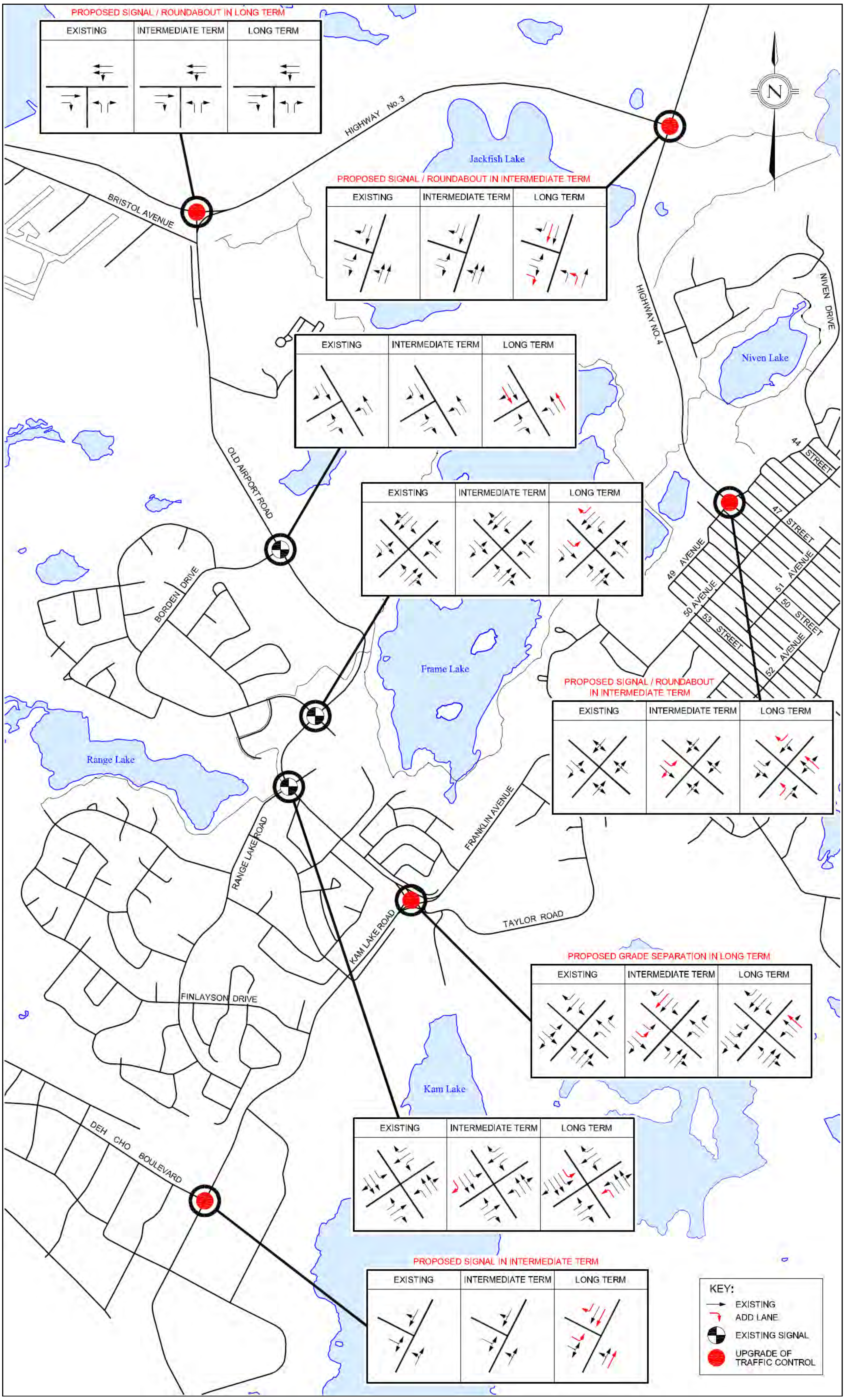


Exhibit 10-1: Future Intersection Improvements

The Levels of Service (LOS) for these intersections were analyzed given the future estimated turning movements and proposed signal timings. Laning was added to as described above to improve operation in order to achieve a LOS of E or better for the intersection movements. Analysis was undertaken of signalization options only. The roundabout analysis should form part of the further review as outlined in the next section.

Table 10-1 shows the analysis summary with the intersection LOS of individual turning movements. This provides a more detailed review of the intersection operations and potential constraints.

Table 10-1: Future Level of Service – Turning Movement Operations

Intersection and Movement	PM Peak Level of Service		
	Exist.	Int.[1]	Long[1]
Highway 3 and Old Airport Road			
Eastbound Through	A	A	B
Eastbound Right	A	A	A
Westbound Left-Through	A	A	B
Northbound Left	B	D	C
Northbound Right	B	D	A
Highway 3 and Highway 4			
Eastbound Left	B	A	C
Eastbound Right	B	C	B
Northbound Left	--	--	D
Northbound Left-Through	A	B	C
Southbound Through	A	B	D
Southbound Right	A	A	B
Old Airport Road and Borden Drive (near the Home Building Centre)			
Eastbound Left-Right	B	B	--
Eastbound Left	--	--	C
Eastbound Right	--	--	A
Northbound Left	A	A	C
Northbound Through	B	A	B
Southbound Through	B	B	C
Southbound Right	A	A	A

Intersection and Movement	PM Peak Level of Service		
	Exist.	Int.[1]	Long[1]
Old Airport Road and Borden Drive (near Wal-Mart)			
Eastbound Left-Through	C	C	--
Eastbound Left	--	--	D
Eastbound Through	--	--	C
Eastbound Right	A	A	D
Westbound Left	C	C	D
Westbound Through-Right	C	C	C
Northbound Left	B	C	F
Northbound Through-Right	A	A	A
Southbound Left	B	B	C
Southbound Through-Right	B	C	--
Southbound Through	--	--	D
Southbound Right	--	--	A
Old Airport Road and Range Lake Road			
Eastbound Left	C	C	F
Eastbound Through	C	B	C
Eastbound Right	A	A	B
Westbound Left	C	C	D
Westbound Through	D	B	C
Westbound Right	C	A	A
Northbound Left	C	C	F
Northbound Through-Right	B	B	C
Southbound Left	B	B	E
Southbound Through-Right	C	--	--
Southbound Through	--	C	D
Southbound Right	--	A	C
48th Street and 49th Avenue			
Eastbound Left-Through-Right	B	C	--
Eastbound Left	--	--	D
Eastbound Through-Right	--	--	C
Westbound Left-Through-Right	A	A	--
Westbound Left-Through	--	--	D
Westbound Right	--	--	C
Northbound Left-Through-Right	B	B	D
Southbound Left-Through	B	--	--
Southbound Left	--	B	C
Southbound Through-Right	--	B	C
Southbound Right	A	--	--

Intersection and Movement	PM Peak Level of Service		
	Exist.	Int.[1]	Long[1]
Deh Cho Boulevard and Kam Lake Road			
Eastbound Left-Through	A	B	A
Westbound Through-Right	A	C	--
Westbound Through	--	--	B
Westbound Right	--	--	A
Southbound Left-Right	B	C	C
Old Airport Road and Franklin Avenue			
Eastbound Left	A	D	F
Eastbound Through-Right	B	C	D
Westbound Left	A	D	F
Westbound Through	A	D	F
Westbound Right	A	C	F
Northbound Left	D	C	D
Northbound Through	C	D	--
Northbound Right	B	B	--
Northbound Through-Right	--	--	E
Southbound Left	E	E	F
Southbound Left-Through	E	C	--
Southbound Through	--	--	D
Southbound Right	A	A	B

[1]With Recommended Improvements
Exist. = Existing Condition
Int. = Intermediate-Term Scenario
Long = Long-Term Scenario
Red Text = Proposed new laning

With the proposed improvements Highway 3 / Old Airport Road, Highway 3 / Highway 4, Old Airport Road / Borden Drive (near Home Building Centre) operate adequately for the long-term.

In the long-term, the northbound left turn at the intersection of Old Airport Road / Borden Road (near Wal-Mart) operates at LOS F. The northbound left turn at the intersection of Old Airport Road and Range Lake Road also operates at LOS F in the long-term despite a double left turn provision. The southbound left turn is also operating at a marginal LOS. These intersections have a high demand based on the proposed land uses in this area and the limited access points. The cross section is already wide with the addition of a dedicated southbound right turn. Access management in this section of Old Airport Road will be critical to manage this demand as well as promote sustainable mode choice. Additional accesses as well as back lane circulation are proposed in the next section which should provide some relief and additional options for the left-turn demand. It is recommended that the City monitor the type of development approved in this area to support sustainable mode choice (i.e., development of Transit Oriented Development nodes). This will reduce the long-term vehicle demand and will likely result in better operating LOS at these locations.

The intersection of 48th Street and 49th Avenue operates well with the new signal as proposed as does Deh Cho Boulevard and Kam Lake Road.

The intersection of Old Airport Road and Franklin Avenue fails significantly in the long-term. This is expected based on the level of development planned in the future combined with the current demand at this location. Some additional laning has been proposed to provide some relief; however, it is highly likely that grade separation will be required for key movements in order to allow for general mobility into Downtown Yellowknife and to develop to the south and west of the city. Other network changes affecting this intersection include the extension of Taylor Road, which will add volume to the 4th leg. In addition, the new Deh Cho Boulevard extension will likely change the current truck movement patterns at the intersection. A detailed traffic and safety study is required to review of current capacity and future demands at this location as well as safety issues and the opportunity for transit priority.

10.2 Parking Analysis

10.2.1 Downtown

A total parking demand of 926 vehicles was captured in the parking survey in the downtown core (on-street and off-street stalls). The existing parking capacity is 1420 parking spaces, which results in a utilization of 65%. This demand of 926 vehicles is directly related to the existing population, which consists of 2364 households and 6641 jobs. This calculates to a 0.35:1 ratio of parking demand to existing household and 0.14:1 parking demand to existing job.

In the long-term, the amount of employment is anticipated to increase by 1500 jobs (22% increase) and 850 households (36% increase), as defined in the Smart Growth land use projections. The intermediate-term has a smaller increase with 1150 jobs 700 households. Assuming that all other factors remain constant, there will be a direct increase in future parking demand attributable to employment and household growth using the 0.35:1 and 0.14:1 ratios above. The majority of the required future parking will be due to employment as the forecasted time period is 2:00 PM. Therefore, 70% of the growth in parking demand was attributed to employment growth and the remaining 30% to household growth. The resulting 2:00 PM future parking demand is summarized in **Table 10-2**.

Table 10-2: Projected Future Parking Demand

Horizon	Parking Demand			Utilization
	Associated with Households	Associated with Employment	Total	
Existing (from survey)	-	-	926	65%
Intermediate-term	352	760	1112	78%
Long-term	367	795	1162	82%

* Assuming 70% of parking is attributable to households and 30% employment

In the intermediate-term, the parking demand increases to approximately 1112 vehicles, growth of approximately 17%. This results a utilization of 78% in the downtown core. In the long-term horizon, the parking demand increases to approximately 1162 vehicles, a growth of approximately 21%. This results in a utilization of 82% in the downtown core.

During the public consultation, there was discussion surrounding the construction of a parkade in the downtown core. While other factors such as safety, walking distance, convenience, etc. may be important considerations and/or driving forces of construction of a parkade, the existing downtown parking supply is adequate for the demand and will remain so for the foreseeable future. Another consideration is that if more parking is built, then there will most likely be a related increase in parking demand. This is contrary to the goals of the Smart Growth principles, which encourage fewer vehicles trips and an increase in transit and other sustainable modes.

10.2.2 Old Town

The existing parking review revealed that there is a current shortage of parking in Old Town, there will be degradation to the ambient nature of the area if normal city-wide parking standards were applied. A review of these standards to create unique policies for Old Town would enable some change without affecting the neighbourhood character.

In consultation with City staff, sites have been identified for future small pocket parking nodes within Old Town. In addition, there is a recommendation to move the boat launch to alleviate the congestion in this vicinity.

10.3 Truck Traffic Analysis

Four intersections that were counted in the original fall counts of 2008 were recounted in the winter of 2009. The truck traffic was captured by approach and is therefore summarized by approach in **Table 10-3**.

Table 10-3: Comparison of Truck Percentage

Intersection	Counts			Percentage		
	Fall	Winter	Diff.	Fall	Winter	Diff.
Highway 3 and Old Airport Road						
Southbound	--	--	--	--	--	--
Northbound	21	28	7	6%	10%	4%
Westbound	28	27	-1	7%	8%	1%
Eastbound	28	11	-17	12%	7%	-5%
Highway 3 and Road accessing the Shooting Club lease area						
Southbound	--	--	--	--	--	--
Northbound	16	6	-10	55%	35%	-20%
Westbound	14	17	3	27%	33%	6%
Eastbound	4	1	-3	11%	4%	-7%
Highway 3 and Highway 4						
Southbound	21	8	-13	23%	24%	1%
Northbound	14	7	-7	4%	3%	-1%
Westbound	--	--	--	--	--	--
Eastbound	31	22	-9	7%	7%	0%
Forrest Drive and Con Road						
Southbound	2	0	-2	4%	0%	-4%
Northbound	0	1	1	0%	3%	3%
Westbound	0	0	0	0%	0%	0%
Eastbound	2	1	-1	5%	3%	-1%

In the fall season, the highest percentage of trucks was experienced in the northbound direction of travel at the intersection of Highway 3 and the road accessing the Shooting Club lease area. However, the largest movement of trucks was in the eastbound direction of travel at the intersection of Highway 3 and Highway 4. The busiest intersection was Highway 3 and Old Airport Road with a total of 77 trucks passing through in the PM peak hour.

In the winter season, the highest percentage of trucks was experienced in the northbound direction of travel at Highway 3 and the road accessing the Shooting Club lease area, which is the same as in the fall. However, the heaviest truck movement was in the northbound direction of travel at Highway 3 and Old Airport Road, which is different than in the fall. The busiest intersection was Highway 3 and Old Airport Road, again the same as in the fall.

During the PM peak hour, there were 52 less trucks in the winter than in the fall, decreasing from 181 to 129. The busiest intersection was Highway 3 and Old Airport Road in both the fall and winter. The difference in truck percentage between the fall and winter were fairly small, except for the -20% decrease in the northbound direction of travel at Highway 3 and the road accessing the Shooting Club lease area.

The analysis indicates that Highway 3 is a route frequented by truck traffic as is Highway 4. Old Airport Road is also a highly used route for trucks as is the road accessing the Shooting Club lease area in the fall. Forrest Drive and Con Road have a low volume of truck traffic.

Preferred Long-Term Transportation Strategy

11. PREFERRED LONG-TERM TRANSPORTATION STRATEGY

This section outlines the long-term transportation strategy for the compact land use growth scenario. The long-term strategy holistically envelopes the intermediate-term and the staging of both future horizons are discussed in detail in the **Section 12: Implementation Strategy**.

11.1 Approach

The preferred strategy was developed with the following basis:

- Using the Smart Growth principles as context;
- Making the best use of existing infrastructure;
- Looking at implementation in a staged manner that could adjust as mode shift occurs;
- Balancing the need for infrastructure upgrades with a view to providing options for active modes;
- Using the compact land use as the preferred growth scenario; and,
- Strengthening and emphasising the relationship between land use planning and transportation.

11.2 Key Aspects of the Strategy

This Strategy will point a direction to the future but provide some intermediate steps that need to be followed in order to realize the vision for Yellowknife. As such, the transportation strategy has to be seen with the interrelationships between modes as well as the close relationship with new developments where change is most likely to occur in the short-term. A mix of good land use planning that emulates the Compact Growth Scenario will also assist the City to provide leadership in planning, demonstrating that the City means business when they speak about sustainability and Smart Growth.

The long-term strategy will not be implemented instantly – it will be an incremental investment that reflects Yellowknife's Smart Growth vision. A framework has been provided for Council and City staff to work within in their pursuit of the long-term transportation vision.

A *refined* version of the preferred long range transportation strategy (Long-term, Compact) is illustrated in **Exhibit 11-1**.

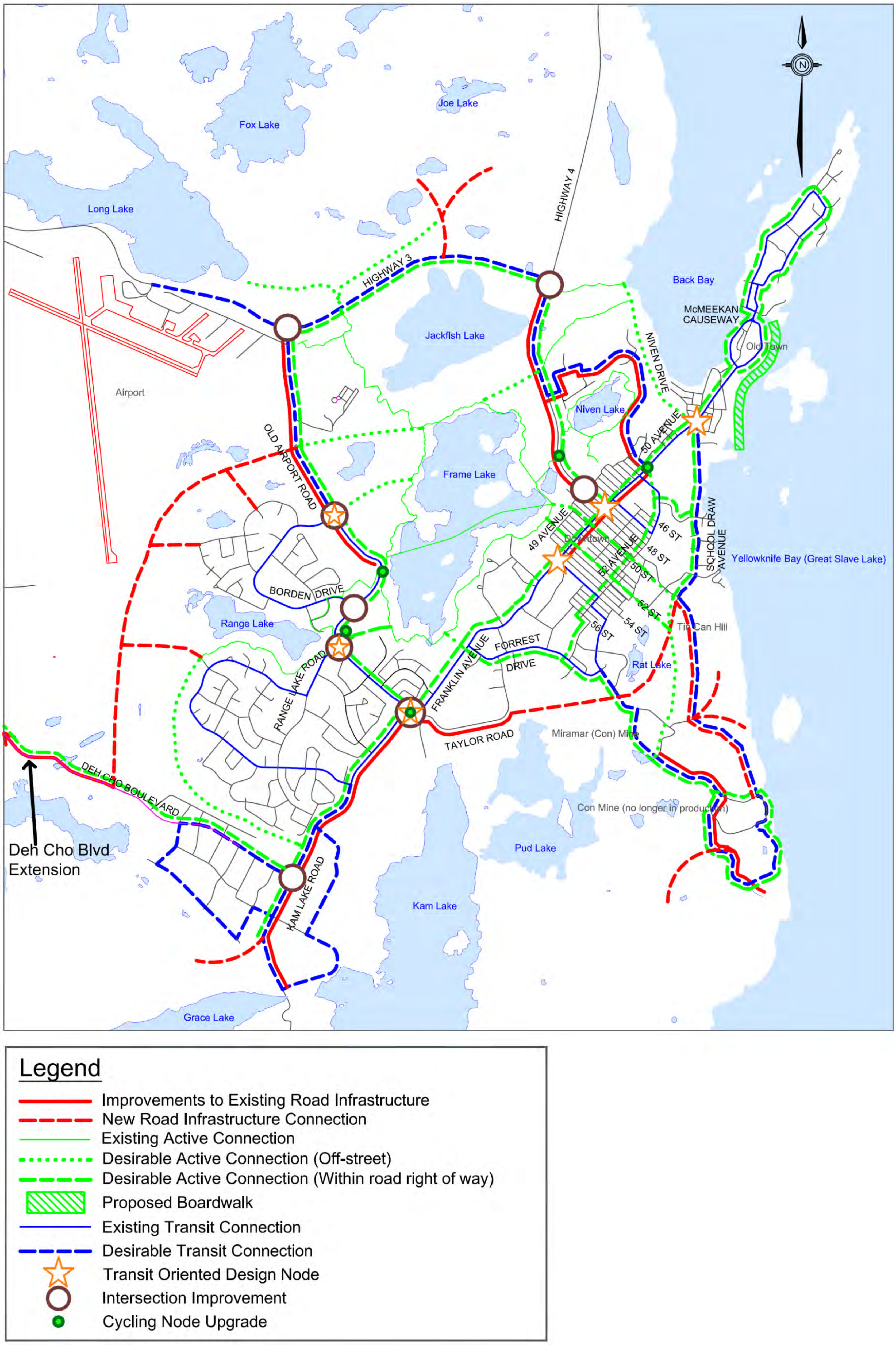


Exhibit 11-1: Refined Long-Term, Compact Scenario – Proposed Improvements

The components of the recommended transportation strategy are listed below and described in more detail throughout the remainder of this section:

- All Modes;
- Transit;
- Cycling and Pedestrian;
- Future Road Network;
- Parking Strategy;
- Truck Strategy;
- Transportation Demand Management;
- Traffic Calming; and,
- Example Smart Growth Strategy.

11.3 All Modes

11.3.1 Context

Important steps in reducing vehicle use can be achieved with the enhanced attraction to active transportation modes of travel.

11.3.2 Strategy

Elements and processes that can be used to work toward this goal are outlined in this section

Develop Planning Documents, Policies, and Bylaws to reflect Smart Growth and Sustainable Transportation
Adopt key policies and bylaw changes that will move the city towards the Vision. Create policies that mandate an update of the transportation plan every five years. These five year plans are specific action lists that allow the community to see progress against goals, chart a course, and create capital budget plans for the medium-term.

Establish and manage base data
It is important to create a platform of the current status of existing routes, and infrastructure that will be the bench mark. The data can be used to identify and prioritize improvements, and produce maps. This bench mark will also be used for measurement of success. Examples include the use of alternative modes to schools, cycle volumes on key corridors, pedestrian volumes at key locations, on-off transit surveys, and travel time data.

Create an asset management system
The asset management database should track existing facilities and status such as - pavement conditions, bicycle facilities (e.g. bicycle parking, routes, lanes, and signage), sidewalks, greenways, transit routes, transit stops, and all related transportation infrastructure. The City is currently investigating this option.

Launch formal social marketing initiatives
Social marketing is the application of marketing with the simultaneous application of additional concepts and techniques aimed to achieve specific behavioural goals. Social marketing campaigns and initiatives can be used to promote sustainable transportation such as walking and cycling but it is often most used to promote transit ridership. Social marketing is important to the success and growth of transit over time. A change in the perception of people toward transit is necessary, away from being unpleasant, uncomfortable, and unreliable. By promoting “try transit” for off-peak and weekend travel, improving frequency and level of service on busy routes, and generally making transit more appealing, a societal shift in the way transit is perceived can be achieved. Other travel planning information can include parking availability displays downtown on main arterials.

11.4 Transit

11.4.1 Context

As the City of Yellowknife moves towards creating a more robust and user friendly transit network, it is important to keep in mind that decisions for all modes can impact the transit system. When looking at new developments and redevelopments, it is important to remember that transit can be facilitated and complemented during subdivision design, but there are numerous factors to take into account. Typical factors include:

Bus Stop Locations
- Bus stop locations should be co-ordinated with the layout of walkways, intersections, and development patterns in order to minimize walking distances to bus stops and to allow for efficient stop spacing.

Walking Distances
- 95% of households should be within a 450m walking distance of a transit stop;
- 66% of households should be within a 300m walking distance of a transit stop;
- Multiple unit dwellings should be no more than 300m walking distance from a transit stop;
- Institutional developments should be within 150m walking distance of a transit stop; and,
- Walkways should be provided in order to minimize walking distances from dwellings to existing or future transit routes.

Acceptable Transit Routes

- Transit routes should be provided on streets with through-access only; crescents and cul-de-sacs are typically not appropriate for transit routes. Typically, a 9m roadway width is the minimum acceptable for transit routes;
- Major arterial and collector roads should not be placed more than 900m apart in order to ensure that adequate transit route coverage can be provided;
- The length of one-way transit loops should be limited to 2km. In general, the length of any one-directional transit loops should be minimized; and,
- A minimum turning radius of 15.2m is typically required for provision of temporary transit vehicle turning locations. Temporary turning locations allow transit routes to be phased alongside the phasing of development construction, with service provided to new communities as they are built.

Transit Route Length

- Transit route lengths within subdivisions should typically be no more than 1.0km per 1000 residents served. This can be achieved by providing road layouts that minimize the distance that must be travelled by transit vehicles in order to serve the population of the subdivision.

11.4.2 Strategy

Transit use is a key element of the transportation system that needs to be utilized to its fullest ability in order to help reduce car travel and promote more active transportation options throughout the community. For example, more bus ridership will reduce vehicle traffic and create more mode share for cycling and walking, in effect creating more users for the active transportation network that are trying to be promoted.

There are two main elements of the transit system that need to be addressed: transit service and transit infrastructure. A transit improvement map is displayed in **Exhibit 11-3** but is not meant to represent a route map. A detailed transit study will need to be carried out when more is known on the exact land use and development pattern that will be constructed. The map is intended to show the areas and corridors that will require service.

Proposed Transit Service Improvements:

- Update Transit Plan;
- Increase frequency to less than 15 minutes in peak periods, which is especially important in the winter months;
- Improve reliability of service by enforcing fixed routes and on-time service;
- Expand service coverage areas as development grows:
  - Kam Lake;
  - Airport;
  - Niven Lake;
  - School Draw; and,
  - Tin Can Hill / Con Mine.
- Provide Demand Responsive Transit:

- Assess dial-a-ride transit;
- Consider small buses which are more socially acceptable, community oriented, and easier to operate given the hilly terrain; and,
- Consider private services (taxi) on fixed routes.

Proposed Transit Infrastructure Improvements:

- Improve transit infrastructure to bus stops: bus stop facilities, linkages to bus stops, etc;
- Outsource provision of bus furniture (e.g., bus shelters) and use income from advertising to fund transit upgrades;
- Enhance route connectivity to improve transferability;
- Provide transit education through schools;
- Support the purchase of cleaner transit fleet vehicles with low GHG emissions as buses are replaced; and,
- Create *Transit Oriented Development (TOD*) nodes with new development or during redevelopment:
    - Old Airport Road / Borden Drive (near the Home Building Centre);
    - Old Airport Road / Franklin Avenue;
    - Franklin Avenue / 54th Street;
    - Franklin Avenue / 49th Street; and,
    - Franklin Avenue / School Draw Avenue.

For example, at the intersection of Franklin Avenue and School Draw Avenue as shown in **Exhibit 11-2**, there is a good opportunity to create a TOD node as development occurs in the surrounding neighbourhood. The node would have a walkable design with pedestrian as the highest priority and the development in the area would contain a mix of uses including office, residential, retail and civic uses. High density development would be encouraged with regular transit service available. The area should also include facilities for bicycles as a daily mode of transportation choice. The redevelopment of this area can be pursued concurrently with the Old Town revitalization plans identified in the Urban Design Initiative.

The benefits of designing a TOD node at this location (and others) includes an increase in mobility, increased transit ridership, a reduction of traffic driving, healthier lifestyle with more walking and cycling, and increased food traffic for the retail and commercial businesses.

Exhibit 11-2: Recommended Future Transit Oriented Development Node at Franklin Avenue and School Draw Avenue

Specific TOD concepts that can be implemented when planning for TOD development in Yellowknife are provided in the box below.

Transit Oriented Development Concepts

The creation of TOD nodes will allow for an improved transit system by providing adequate transit shelters and wait areas for riders, providing appropriate pedestrian crossings and access to stops, and allowing bus stops close to intersections. Enhancement of intersections near the TOD nodes will help the buses utilize the signals to their advantage, with potential for signal optimization or priority as well as improvements for bus riders (pedestrians and cyclists) with push button activation to facilitate movement. Other TOD concepts include:

- Neighbourhood compatibility;
- Mixed-use, high-density residential;
- Ground floor retail adjacent to transit and located along principal pedestrian paths;
- Public space (parks, plazas, etc);
- Pedestrian access;
- Improved streetscapes – wider sidewalks, street lighting and landscaping; and,
- Parking – alternative parking solutions; located behind building coupled with on-street parallel parking.

Exhibit 11-3: Transit Improvements Map

11.5 Cycling and Pedestrian

11.5.1 Context

Numerous types of bicycle facilities are available for both on-street and off-street implementation. The following are the most common types. The information provided below is largely based on observations from the paper ***Vancouver's Bicycle Lanes: Retrofitting Arterial Streets to Accommodate Cyclists***, presented to the Transportation Association of Canada (TAC) in 2009, from the ***North Vancouver Bicycle Master Plan*** (2006), and from the TAC ***Bikeway Traffic Control Guidelines for Canada***. The ***Bicycle Routing for the City of Yellowknife*** study undertaken by another consultant in 2008 was used as a base to build upon for the recommendations that follow in this report. Some of the recommendations from that report are already being implemented by the City and the existing bicycle route improvement plans from the report are attached as **Appendix H**.

11.5.1.1 Shared Bicycle Routes

Shared bike routes are streets where cyclists share the roadway with other vehicles. Marking can range from directional signage along the route to painted markings on the roadway (see "Sharrows").

Table 11-1: Shared Bicycle Route Summary

Implementation	▪ Typically located on local streets with low volumes and speeds less than 50 km/h. ▪ Often parallel to major arterial streets. ▪ These can incorporate traffic calming measures, but they are not required.
Pros	▪ Provide a well-defined route for cyclists to follow. ▪ Provide a visual reminder to motorists of the presence of cyclists.
Cons	▪ Do not help determine the proper placement of road users on the roadway. ▪ Less effective at directly reducing danger for cyclists than other methods.
Cost	▪ Low cost application that can normally be accommodated within operating budgets; signage and pavement markings needed for installation.

11.5.1.2 Shared-Use Lanes (Sharrows)

Shared use lanes are lanes which are shared between cyclists and other motorists. They are marked with "Sharrows", which are painted markings on the roadway surface, meant to guide cyclists to the correct position on the road relative to other vehicles[9]. Sharrows also remind motorists of the expected presence of cyclists on the road, and their right to a portion of roadway space. Sharrows can be implemented on shared bike routes.

Table 11-2: Shared-Use Lanes Summary

Implementation	▪ Often used where there is not enough roadway width to accommodate full bike lanes. ▪ Can either be "single-file" or "side-by-side", indicating the correct placement of cyclists relative to other vehicles in the lane. ▪ Can also be used in conflict zones. ▪ For Side-by-Side applications, roadway speed should be less than 60 km/h. ▪ Required lane widths vary from a minimum of 4.0m if there is no truck or transit vehicle traffic, to a minimum of 4.3m if large vehicles are present.
Pros	▪ Can be used where roadway is too narrow for dedicated lanes. ▪ Inexpensive to implement. ▪ Have been successful at increasing road safety in various jurisdictions[10].
Cons	▪ Provide less psychological / physical protection than dedicated lanes. ▪ Covered with snowfall and easily faded with snow removal equipment.
Cost	▪ Low cost application that can normally be accommodated within operating budgets; signage and pavement markings needed for installation.

[9] "An Overview of Shared Use Lane Pavement Markings for Cyclists", 2009 TAC Conference
[10] "Vancouver's Bicycle Lanes: Retrofitting Arterial Streets to Accommodate Cyclists"

11.5.1.3 Marked Bicycle Lanes

Bicycle lanes are roadway lanes reserved exclusively for bicycle traffic, typically marked with painted lines on the roadway surface (similar to the markings for other traffic lanes). Bicycle lanes are generally at least 1.5m wide. While not usable all year round due to snow cover, they are still valuable infrastructure for cyclist for the cycling season when snow is not covering the painted lines. In key locations, overhead signage can be used to identify laning in combination with other pole uses (e.g., signal poles).


Bicycle lane on arterial road

Table 11-3: Marked Bicycle Lane Summary

Implementation	▪ Used on major streets where there is sufficient roadway space to accommodate marked bicycle lanes in the existing right-of-way, or where the right-of-way can be reconfigured to accommodate the lanes.
Pros	▪ Provides a visual and regulatory barrier between motorists and cyclists, leading to a feeling of greater safety.
Cons	▪ Motorists can easily encroach into lane. ▪ Reduced effectiveness on routes with a high number of right turns / driveways. ▪ Can become covered with snow in winter. ▪ Conflict zones generally remain unprotected.
Cost	▪ Low cost application that can normally be accommodated within operating budgets; signage and pavement markings needed for installation. ▪ More expensive and more maintenance required than other bicycle treatments. ▪ These costs assume space is sufficient for the installation and no re-construction is needed.

11.5.1.4 Separated Bicycle Lanes / Cycle Tracks

Cycle tracks are bicycle lanes which are physically separated from other traffic. Physical separation techniques can include barriers, curbs, bollards, and other similar features. Cycle tracks are often located between the sidewalk and the roadway, or between the sidewalk and parking, if on-street parking is present.

Separated bicycle lane

Table 11-4: Separated Cycle Lane Summary

Implementation	▪ Used where there is sufficient space to accommodate physically-separated bicycle lanes (generally 2.0m wide) in the right-of-way.
Pros	▪ Provides a physical barrier between motorists and cyclists, leading to a higher level of protection for cyclists.
Cons	▪ Reduced effectiveness on routes with a high number of right turns / driveways. ▪ Conflict zones generally remain unprotected. ▪ Can be easily encroached on by pedestrians. ▪ Possible pedestrian safety concerns.
Cost	▪ High cost application with the need to create a raised physical separation between vehicle traffic and cyclist. ▪ This would usually have to be a separate capital budget item and costs vary depending on drainage and boulevard layouts.

11.5.1.5 Bicycle Trails / Multi-Use Pathways

Bicycle trails and multi-use pathways are off-road facilities that can accommodate bicycles, or bicycles in addition to other modes, such as pedestrians, in-line skaters, skateboarders, or people using mobility devises. Trails and multi-use pathways can be primarily for recreational use, provide access to recreational facilities, or may be an alternative to an on-street route. These types of facilities fall under the overall classification of 'greenways,' which are described in **Section 11.5.1.6**.

11.5.1.6 Greenways

Greenways are transportation corridors reserved for non-motorised transportation that typically follow independent routes such as linear parks, electrical / communications transmission corridors, and unused railway tracks. Greenways help to encourage sustainable transportation by providing year-round routes for commuters and recreational users that are fully protected from motorised traffic. Since greenways are often implemented in un-used or under-used corridors, they can be less disruptive to other uses than on-street alternatives. Many cities have implemented or are implementing greenways as a key part of their transportation network. **Exhibit 11-4** shows the City of Vancouver's proposed Greenway Network.

Table 11-5: Greenway Summary

Implementation	▪ Used parallel as an alternative to the roadway network or as a recreational facility. ▪ Can be provided through parks, electrical / communications transmission corridors, unused railway tracks, or other suitable auto-free corridors.
Pros	▪ No conflict with motorized vehicles. ▪ Perceived as safer by recreational or less experienced cyclists. ▪ Can provide for pedestrian and cyclist needs.
Cons	▪ Requires public right-of-way. ▪ Possible pedestrian / cyclist conflict. ▪ May be less direct than on-street routes.
Cost	▪ Variable cost based on the extent of the application. ▪ Generally higher cost than on-street facilities, unless the on-street facilities require re-construction for installation. ▪ This would usually have to be a separate capital budget item and costs vary depending on terrain, right of way, treatment method.

Exhibit 11-4: Example Greenway Map

11.5.1.7 Pedestrian Improvements

Improvements to pedestrian facilities are an important part of encouraging sustainable transportation, since walking is itself a sustainable mode, and other sustainable modes such as transit typically involve some walking as well.

11.5.1.8 Sidewalk Network

A complete sidewalk network is a basic and important step to encourage walking as a mode of transportation. Sidewalks provide a level of psychological and physical protection for pedestrians, and clearly demarcate their place in the right-of-way. They also provide a means of access to businesses, residences, and other facilities, thereby encouraging people to walk to and from those locations.

11.5.1.9 Context Sensitive Design for Pedestrians

ITE *Context Sensitive Solutions* provides roadside design guidelines for walkable communities along different types of urban thoroughfares. Thoroughfares are divided into eight roadway types in six context zones. Each combination calls for a different roadside design.

The Context Zones describe the type of land use conditions surrounding the corridor, as illustrated in **Exhibit 11-5**. The guidelines address Context Zones three through six.

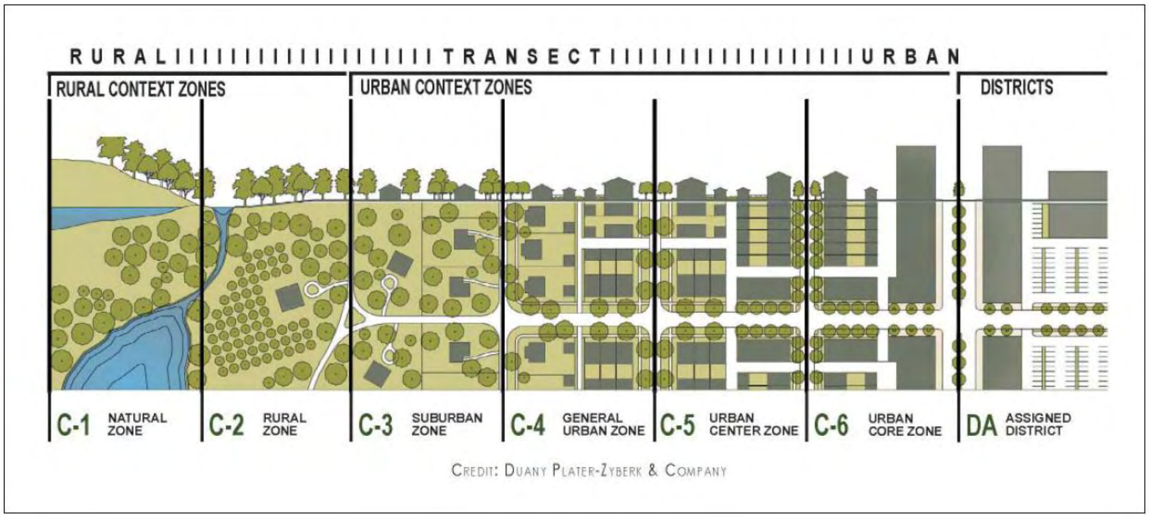


Exhibit 11-5: Context Zones for Pedestrian Design Guidelines[11]

Roadside design guidelines are based on recommended widths and facilities in four roadside zones. These are shown in **Exhibit 11-6**. The following sections provide the ideal and minimum required widths for each of these roadside zones.

[11] Source: *Context Sensitive Solutions*

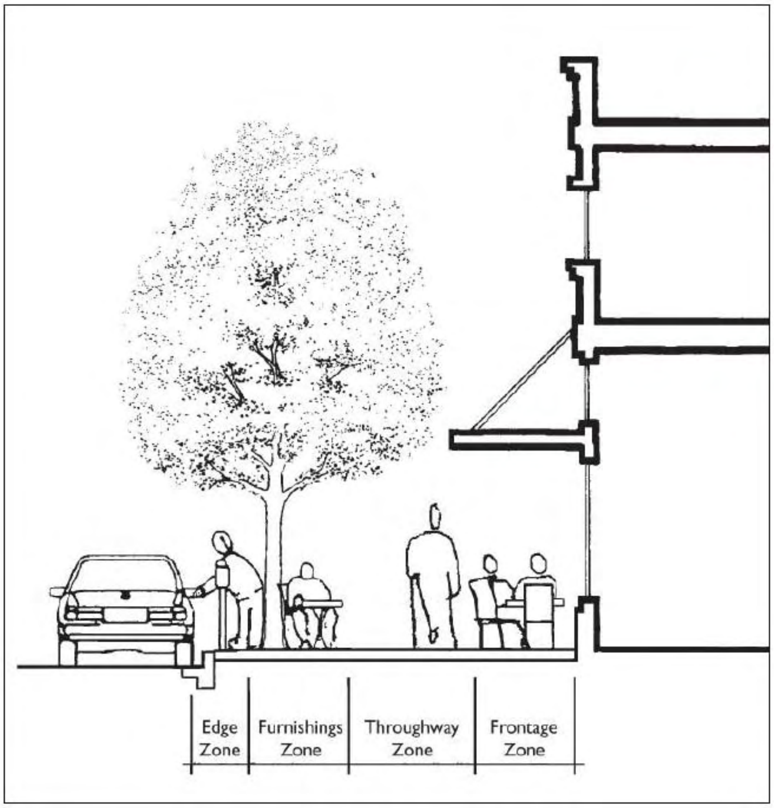


Exhibit 11-6: Roadside Zones[12]

11.5.1.10 Minimum Roadside Design Requirements

The **minimum requirements** for all types of roadways in constrained conditions are presented here. Minimum requirements for commercial development with Ground Floor Retail are shown in **Table 11-6** and minimum requirements for residential land are shown in **Table 11-7**.

Table 11-6: Recommended Roadside Dimensions for Commercial developments with Ground Floor Retail

Roadside Zone		Minimum Width	Total
Edge		1.2 m (combined edge and furnishings)	3.6 m minimum width
Furnishings	**With Parking**		
	Without Parking		
Throughway		1.8 m	
Frontage		0.6 m	

[12] Source: *Context Sensitive Solutions*

Table 11-7: Recommended Roadside Dimensions for Residential

<table>
<tr><th colspan="2">Roadside Zone</th><th>Minimum Width</th><th>Total</th></tr>
<tr><td colspan="2">Edge</td><td rowspan="3">0.9 m (combined edge and furnishings)</td><td rowspan="5">2.7 m minimum width</td></tr>
<tr><td rowspan="2">Furnishings</td><td>With Parking</td></tr>
<tr><td>Without Parking</td></tr>
<tr><td colspan="2">Throughway</td><td>1.5 m</td></tr>
<tr><td colspan="2">Frontage</td><td>0.3 m</td></tr>
</table>

11.5.1.11 Pedestrian Malls

Pedestrian malls are areas closed off to motorised traffic and reserved exclusively for pedestrians (and, occasionally, for cyclists as well). They often take the form of streets or blocks that have been closed off to vehicular traffic. This closure can be on a temporary or permanent basis. For temporary closures, pedestrian malls may be implemented on weekends, evenings, or during a particular part of the year. Pedestrian malls are typically located in dense, central areas with a high number of shops and services to serve as destinations. Pedestrian malls can be combined as a number of streets and / or squares, in which case the area may be known as a pedestrian zone.

Pedestrian malls have been implemented in many jurisdictions in North America and across the world.

Pedestrian Mall, Balingen, Germany

Guidelines for the application of pedestrian malls are described in **Table 11-8**.

Table 11-8: Pedestrian Mall Application Guidelines

Implementation	▪ Typically located in commercial areas with high existing or potential pedestrian volumes. ▪ Often located in areas where traffic can be easily diverted.
Pros	▪ Can be beneficial to local businesses. ▪ Encourages walking and other sustainable modes.
Cons	▪ Causes disruption to traffic flow. ▪ Can disrupt deliveries to local businesses, depending on implementation.
Cost	▪ Varies based on extent of implementation.

11.5.1.12 Measuring Pedestrian Capacity

The Transportation Research Board *Highway Capacity Manual* (2000)[13] provides capacity guidelines based on Level of Service (LOS) for pedestrians. These guidelines are presented in **Table 11-9**.

Table 11-9: Pedestrian Flow Rates

		Expected Flows and Speeds		
Level of Service	**Space (m^2 / ped)**	**Average Speed *S* (m/s)**	**Flow Rate *v* (ped/min/m)**	**Volume / Capacity *v/c***
A	≥ 5.6	≥ 1.30	≤ 16	≤ 0.21
B	≥ 3.7	≥ 1.27	≤ 23	≤ 0.31
C	≥ 2.2	≥ 1.22	≤ 33	≤ 0.44
D	≥ *1.4*	≥ *1.14*	≤ *49*	≤ *0.65*
E	≥ 0.6	≥ 0.75	≤ 75	≤ 1.00
F	< 0.6	< 0.75	---Variable---	

The maximum Level of Service for pedestrian comfort and effective travel is LOS D, reflecting a throughput of 49 pedestrians per minute for a one metre width of sidewalk. This is equivalent to 735 pedestrians in a 15 minute period for each 1 m width of sidewalk. Pedestrian throughput can be increased by increasing the width of the clear pedestrian travel way. Pedestrian flow rate estimates for different widths of clear travel way are shown in **Table 11-10**.

[13] *Highway Capacity Manual*, Transportation Research Board: Washington, 2000.

Table 11-10: Estimated Pedestrian Flow Rates by Width of Clear Pedestrian Travel Way

Width of Clear Pedestrian Travel Way (m)	Flow rate ped/min @ LOS D	Flow rate ped/15 min @ LOS D
1.0	49	735
1.5	74	1,110
1.8	88	1,320
2.7	132	1,980

11.5.2 Strategy

Pedestrian and cycling strategies have been grouped together in this section as many of the same issues pertain to both. For example, many of the recreational trails are multi-use and are shared by both cyclists and pedestrians. While a certain improvement may benefit one mode over the other, the overall benefit created by the improvement is seen to enhance both modes. Where applicable, if an improvement is beneficial for only one mode, they are separated for clarity. **Exhibit 11-7** illustrates the active transportation network for cyclists and pedestrians, but does not dictate a specific installation. Instead, the Exhibit shows the desired movements of cyclists and pedestrian and a network of active connections designed to accommodate their travel.

Proposed Pedestrian and Cycling Improvements:

- Develop minimum pedestrian and cycling standards for each identified roadway classification in the city - should allow flexibility of implementation to different landscape and neighbourhoods;
- Complete an assessment of the pedestrian and cycling network to identify deficiencies, identify, evaluate, select, and prioritize pedestrian and cycling routes;
- Create a formalized map for cyclists and pedestrians;
- Sign and mark existing pedestrian and cycling routes and trails;
- Multi-purpose trails should be expanded to provide city-wide coverage through an off-road trail system;
- Active connections through downtown core:
  - Frame Lake Trail to School Draw Avenue via 50th Street;
  - Franklin Avenue to Forrest Drive via 52nd Avenue;
  - Somba K'e to Tin Can Hill via 52nd Street; and,
  - 49th Avenue to 52nd Avenue via 54th Street.
- Trails recommended to connect with development areas in:
  - Old Airport Road;
  - Kam Lake
  - Deh Cho Boulevard;
  - Downtown;
  - Old Town – Proposed Boardwalk;
  - North of Highway 3; and,
  - Tin Can Hill / Con Mine.

Proposed Pedestrian Improvements

Create more wide and continuous sidewalks with appropriate screening, which is a visual or physical buffer, on major travel corridors such as Old Airport Road and Franklin Avenue. Continued maintenance of existing sidewalks and future installations is important so that they can be fully utilized year round. Improved lighting on certain corridors or streets or at specific locations such as a cross-walk or transit stop can improve utilization.

Proposed Cycling Improvements

Exhibit 11-7 identifies specific cycling node upgrades that should be given high priority due to the lack of trail connectivity, the unsafe nature of the node, the unfriendliness of the location to cyclists, or a combination of the above issues. The creation of alternate on-street bicycle routes away from major traffic corridors would enhance the cycling experience, especially with the appropriate installation of signage and markings to demarcate the route. City staff have indicated that a crossing between Niven Lake and the Capital Area is planned to be undertaken in 2010.

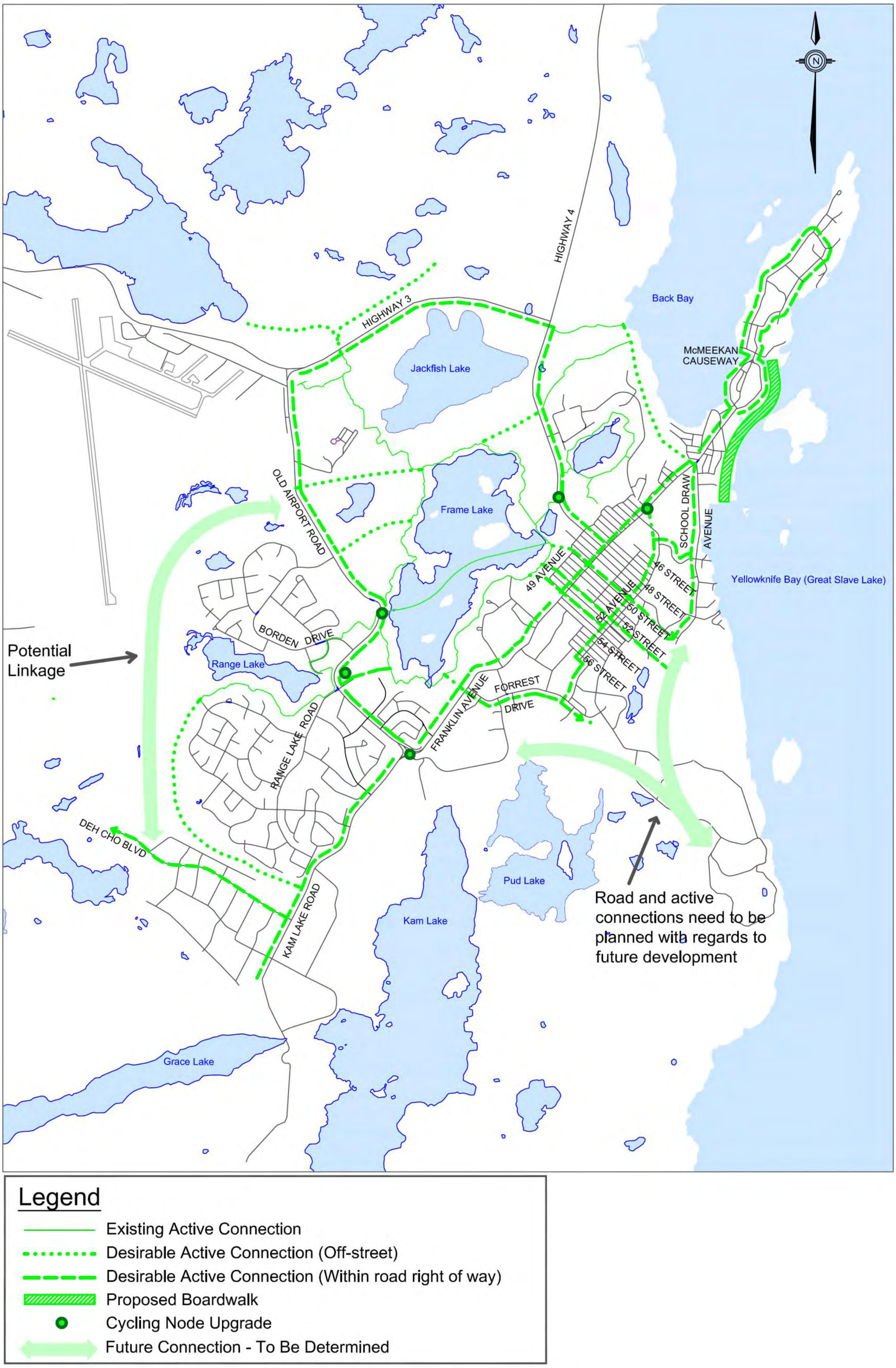


Exhibit 11-7: Pedestrian and Cycling Improvements Map

11.6 Future Road Network

11.6.1 Context

The focus is on increasing person capacity rather than single occupant vehicle (SOV) capacity. Accordingly, the recommendations emphasize improving intersection capacity and making allowance for all modes. The recommendations will support TDM (Transportation Demand Management) measures and discourage single-occupancy vehicle travel. This policy recommendation is critical in meeting the City's objectives as identified in the *Plan*.

In addition, this study recognizes that arterial roads and collector roads are multi-modal corridors that serve cars, transit vehicles, pedestrians, and cyclists.

11.6.2 Strategy

Proposed Improvements to Facilitate Mode Shift away from Auto:

- Promote and provide incentives for carpooling:
    - Dedicated parking stalls (i.e., for example, the closest parking stalls, excluding stalls required for handicapped parking); and,
    - Encourage school, business, and institutions to support ride matching and carpooling.
- City to be a leader by:
    - Promoting teleworking and flexible hours to relieve peak hour travel demand and the City to promote internally where possible through employment contracts; and,
    - Promoting the use of alternative modes such as transit.
- Continue enforcing the no-idling policy, especially at schools;
- Encourage live / work developments and employment close to residential; and,
- Work with car share companies to increase the availability of shared cars near commercial centres and multi-family residential areas.

In conjunction with the efforts made to reduce private auto trips and promote modes of active transportation, there are some priorities identified for the road network itself. These are areas of the road network that have been identified as needing improvement under the proposed long-term compact growth scenario. While these improvements do facilitate auto travel, they also provide a minimum level of service for drivers and it is important to remember an efficient and on-time transit network is reliant on a functioning road environment.

The numbers (#) in this section relate to the location and number illustrated in **Exhibit 11-8**.

Legend

- Improvements to Existing Road Infrastructure
- New Road Infrastructure Connection
- Intersection Improvement
- Future Connection - To Be Determined

(15) – Alignment, location, and routing will be developed once land use concepts are determined.

Exhibit 11-8: Road Network Improvement Map

11.6.2.1 Intersection Upgrades

The intersections that are to be upgraded in the future have been previously discussed in **Section 10** and are listed below for reference**.**

- **Highway 3 and Old Airport Road (1)**
- **Highway 3 and Highway 4 (2)**
- **Old Airport Road and Borden Drive (near the Home Building Centre) (3)**
- **Old Airport Road and Borden Drive (near Wal-Mart) (4)**
- **Old Airport Road and Range Lake Road (5)**
- **48th Street and 49th Avenue (6)**
- **Deh Cho Boulevard and Kam Lake Road (7)**
- **Old Airport Road and Franklin Avenue (8)**

11.6.2.2 Road Widening

There are a number of links that require additional lanes as a result of the growth and there are also proposed new links which will add to the transportation network. This section lists these links and describes Old Airport Road and Highway 4 in more detail. An implementation strategy is outlined in **Section 12**.

- **Franklin Avenue (11)**
  Maintain a 4-lane cross-section along throughout downtown.
- **Taylor Road (12)**
  Construct the Taylor Road extension to provide a linkage to new development in Tin Can Hill and Con Mine. This will also provide an alternative route to Franklin Avenue for vehicles and transit.

Road Infrastructure for further review:

- Consider improvements to Co-op corner with redevelopment and new road accesses along Old Airport Road into Capital Area **(13)**.
- Consider new road connection between Old Airport Road and Deh Cho Boulevard, depending on the land requirements of the airport **(14)**.
- Construct new roads in conjunction with new development (e.g., South of Deh Cho Boulevard, West of Kam Lake, North of Highway 3, in Tin Can Hill / Con Mine area **(15)**. *<u>Alignment, location, and routing will be developed once land use concepts are determined.</u>*

11.6.2.3 Old Airport Road (9)

Old Airport Road is a main access into Downtown and also a key arterial to the new industrial area and future growth nodes. In the future Old Airport Road will need to be widened to a 4-lane cross-section where required for the full length with left-turn lanes at the main intersections.

An example of a typical cross-section is shown in **Exhibit 11-9** with 4-lane cross-section with a median and active transportation network provided in both directions of travel

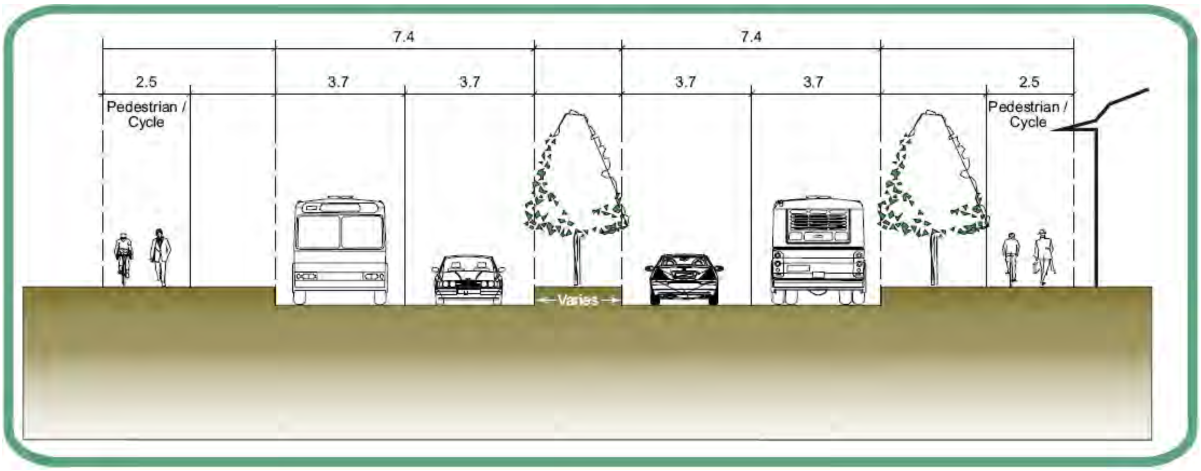


Exhibit 11-9: Old Airport Road – Example of a Typical Cross-Section

The cross-section is illustrated in plan view in **Exhibit 11-10**. This exhibit also illustrates guidelines for future access points and the use of access management strategies to improve efficiency and make the best use of road space for all modes. Access to the Capital Area can be provided by additional roadway links east of Old Airport Road at existing intersections, such as Borden Drive, north of the Co-op corner.

The success of Old Airport Road will be in the ability to effectively manage growth and to successfully allow mobility which promotes alternate modes yet allows for access.

Access management is the first priority along Old Airport Road.

Four main goals of effective access management are:
1. *<u>Limit the number of conflict points</u>*: This is achieved by reducing the number of driveways and limiting the number of left turns out of a site.
2. *<u>Provide adequate spacing between conflict points</u>*: This will allow drivers to sufficient time to react to each intersection or driveway.
3. *<u>Limit the impact on through traffic</u>*: Provide additional capacity such as left turn and right turns lanes at intersections. Limit driveways along the section of roadway and where driveways are provided. Allow for adequate design for vehicles to exit and enter safely.
4. *<u>Provide good internal circulation between main access points</u>*: This can be provided by continuous lanes at the back of the site where vehicles can circulate within multiple blocks of development, or super-blocks. This can be facilitated by cross-access agreements. Provide linkages between parking drive aisles to allow for effective movement off the main road system.

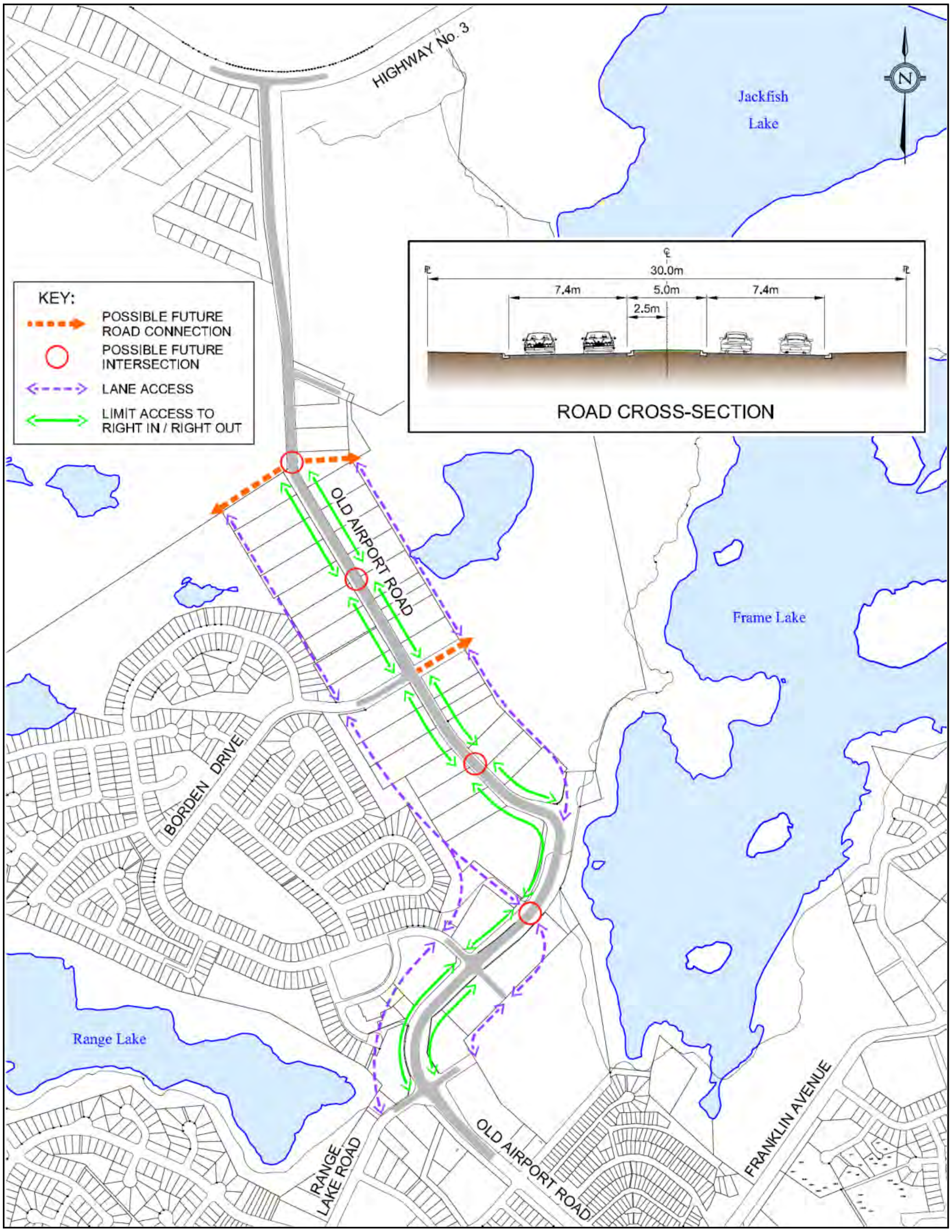
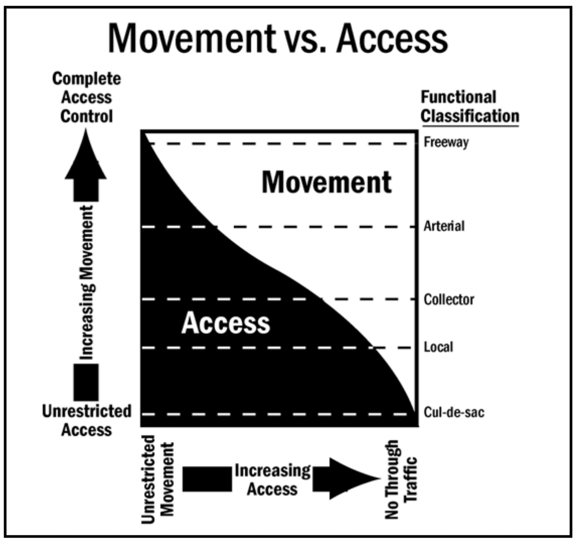


Exhibit 11-10: Future Improvements for Old Airport Road

Design requirements for driveway locations onto arterial and collector roadways in all new development are as follows:

- Entrance and exit driveways crossing arterials and collectors are limited to two per 100m of frontage along any major roadway;
- Driveways should be setback from main road ways intersections – suggested at least 30m from curbline (preferred 50m), measured from the curb; and,
- All new development should promote cross access agreements to limit the number of driveways crossing arterial and collector roadways.

One of the main outcomes of access management is increased safety on the road section. In addition, with good access management, traffic flow will be smoother and average travel times lower. According to the Federal Highway Administration (FHWA), roads that have well managed accesses can show 50% fewer accidents than comparable facilities with no access controls.[14]



Metro Trans Group, NCHRP Report 348: Access Management Policies and Guidelines for Activity Centres, 1992

In **Exhibit 11-10**, the strategies for access management are illustrated with the following aspects:

- Use of the lanes for access across parcels using a back lane, frontage roads or through circulation parking aisles;
- Require the need for cross –access easements between properties so that traffic can access controlled intersections;
- Restrict access to right in-right our on the main arterial between controlled intersections; and,
- Limit the number of driveways accessing the arterial system, therefore improving traffic flow and enhancing safety.

[14] City of Tucson – Transportation Access Management Guidelines, 2003

11.6.2.4 Highway 4 and Kam Lake Road (10)

Both of these roads will be affected by the new development and it is likely that more capacity will be needed as development occurs. It is likely that both roads will need to be widened from 2-lanes to 4-lanes. It would be prudent to undertake functional designs to prepare for future widening to accommodate the capacity. An example of a typical cross-section is provided in **Exhibit 11-11**.

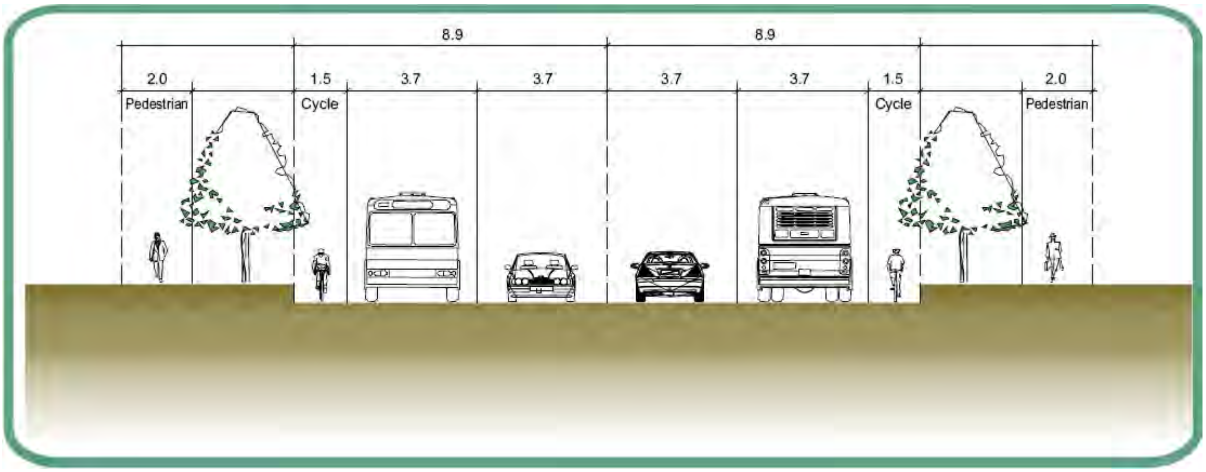


Exhibit 11-11: Highway 4 – Example of a Typical Cross-Section

For Highway 4, a plan view is shown of this cross section in **Exhibit 11-12**.

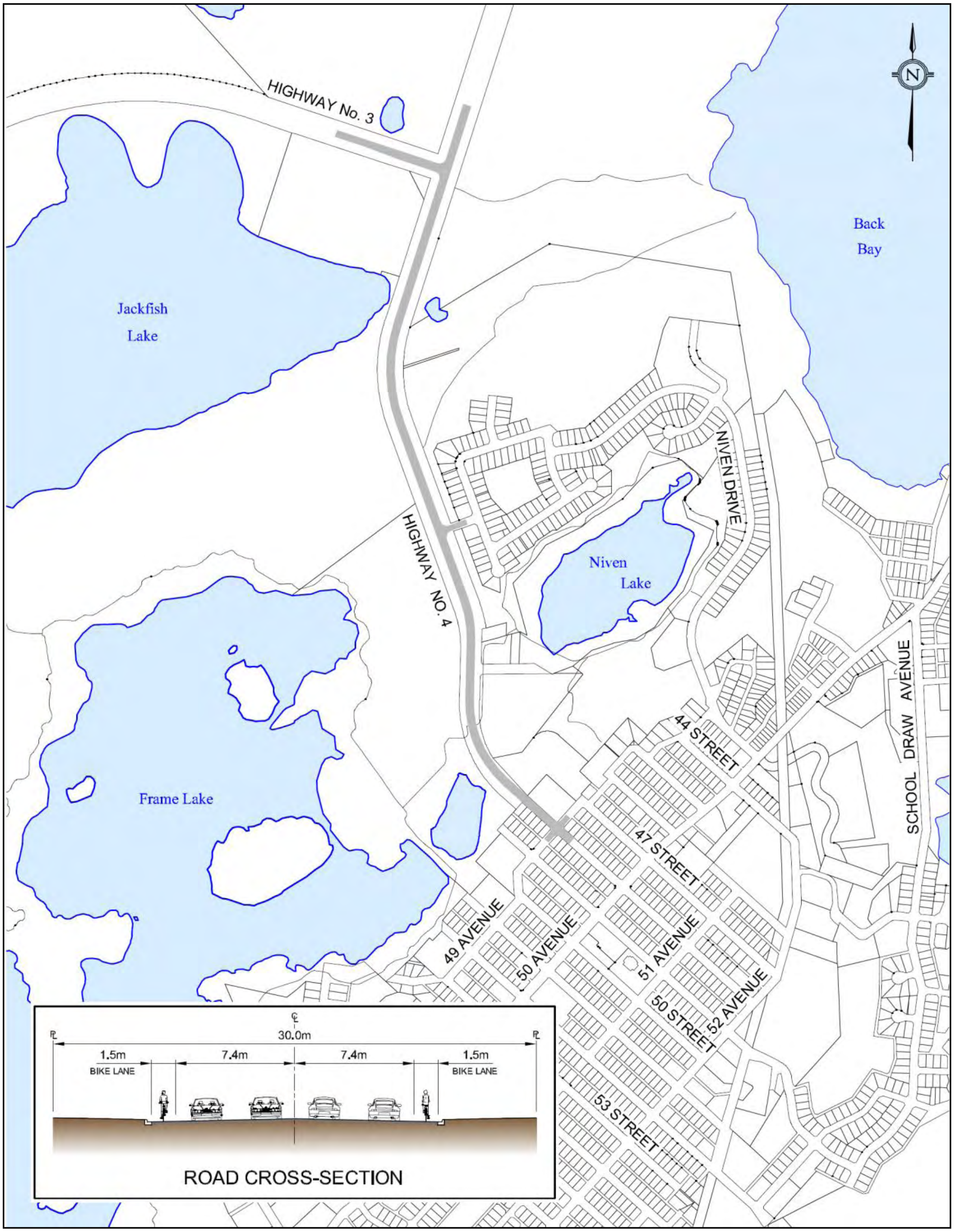


Exhibit 11-12: Future Improvements for Highway 4

11.7 Parking Strategy

11.7.1 Context

11.7.1.1 On-Street Parking

Provision of on-street parking reduces the roadway width available for travel, and creates a psychological narrowing effect. In comparison to other traffic calming measures it can be relatively inexpensive. A summary is provided in **Table 11-11**.

On-Street Parking in Downtown Yellowknife

Table 11-11: On-Street Parking Summary

Implementation	▪ Typically applied on local and collector residential streets with a maximum roadway width of 10m. ▪ On wide roadways with sufficient width to safely accommodate parking (minimum 6.0m roadway width for parking on one side, 7.3m roadway width for parking on both sides).
Pros	▪ Traffic noise may be reduced by a reduction of vehicle speeds and volumes. ▪ Reduction in traffic speeds.
Cons	▪ Reduced visibility of pedestrians crossing the road. ▪ Opened-car doors can be hazardous for motorists and cyclists. ▪ Can cause difficulties for snow clearing, depending on implementation.
Cost	▪ Costs depend on the number of signs required to denote parking zones.

11.7.2 Strategy

The three main areas where parking is most critical include Downtown, Old Airport Road, and Old Town. There is a need to develop parking policies in support of transit and TDM. Such policies will address parking pricing, parking allocation and the requirements for residential and employment developments, particularly along Franklin Avenue and Old Airport Road.

In the downtown core, there is existing parking capacity that will allow for some future redevelopment without immediately supplying additional parking. However, as redevelopment occurs it will be important to consider parking philosophy and allow for parking to be governed by the policies that are created. Policies may include a gradual implementation of parking caps for future residential and employment development in key areas and in the vicinity of improved transit service. Safety at the parkade should be visible during all hours of operation to attract and maintain more users to the underutilized facility.

In the commercial area of Old Airport Road, internal site circulation and parking lot access should be consolidated wherever possible during redevelopment. A corridor study should be undertaken for the complete redevelopment of Old Airport Road, and access and parking requirements should be incorporated into the plan.

In historic Old Town, a unique appeal and functionality creates a delicate balance for residents, business owners, and tourists alike. Opportunities should be taken during redevelopment to enhance parking availability and function, but care should be taken not to implement parking policies in Old Town that are implemented elsewhere in Yellowknife as this could detract from the distinctive nature of Old Town. Smaller parking nodes can be developed within Old Town. Examples provided by the City include: Johnson Property; Pilot Monument; and Latham Island southwest. These are shown in **Exhibit 11-13**. In the case of the Pilot Monument location, parking capacity already exists, but it could be made more formal by expansion, paving, and marketing.

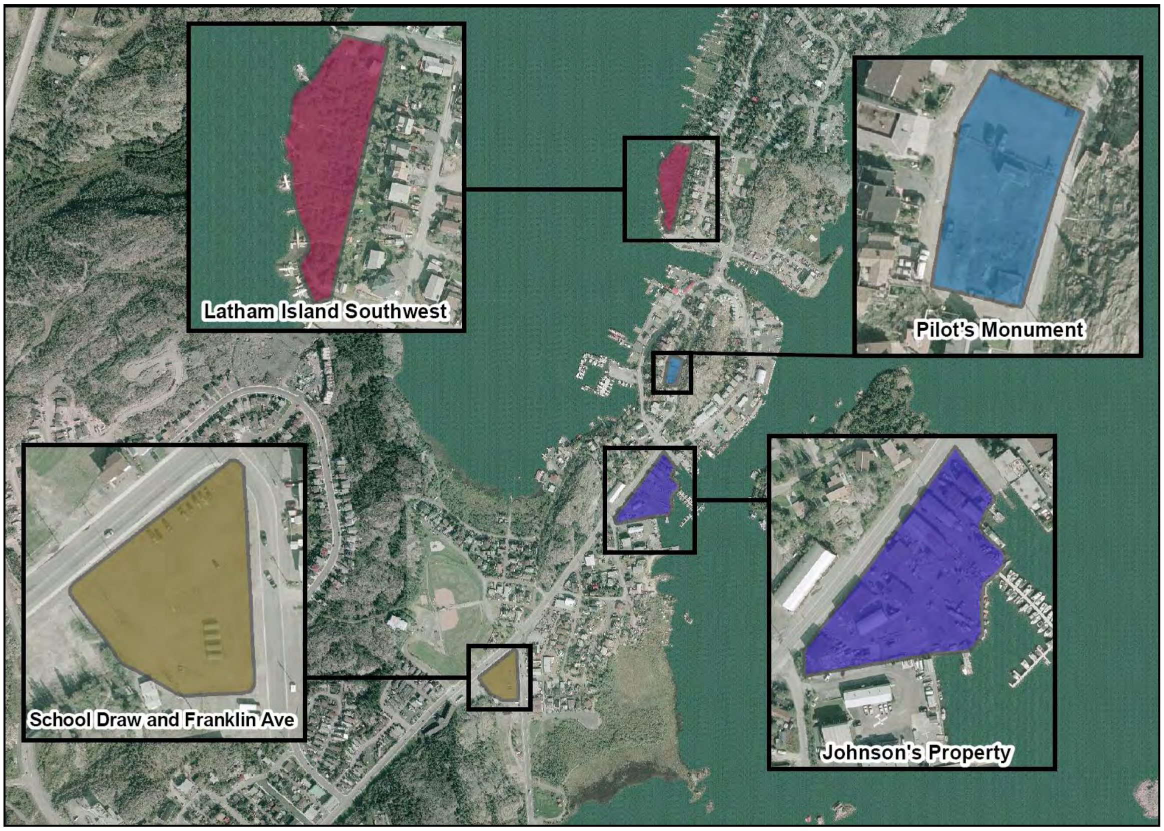


Exhibit 11-13: Potential Parking Nodes in Old Town

Parking lots can be provided in close proximity to Old Town (for example near School Draw Road and Franklin) where transit shuttles can provide linkages to recreational areas, marinas, etc.

Options should be reviewed to relocate the boat launch away from Old Town in order to alleviate the parking congestion especially in the summer months. The City is considering Giant Mine Townsite or Con Mine / Tin Can Hill areas for relocation.

Examples of policies, programs, and management strategies include:

- Prepare a parking strategy for downtown to include policies (e.g., parking caps), safety, time limits, and off-street facility uses;
- With redevelopment, look for pocket parking in the Old Town areas;
- Review zoning bylaw to include unique parking requirements for Old Town;
- Reduced or caps on parking availability in new and redevelopments;
- Priority parking for car-sharing;
- Strategic pay parking;
- Cash in lieu arrangements for parking with new developments which promote alternative modes;
- Balance parking supply with supply of alternate mode choices; and,
- Continue to make use of shared spaces and agreements, additional spaces added with redevelopment as per zoning by-law.

11.8 Truck Strategy

11.8.1 Strategy

In 2009, City Council adopted the Smart Growth Development Incentive Program. One goal of this program was to encourage the relocation of industrial uses from other areas of the city and rezone those land uses to residential and/or commercial. Old Airport Road falls under this Program as a long-term development strategy. Therefore heavy truck traffic on Old Airport Road should be reduced through the establishment of the Deh Cho Boulevard extension to Highway 3 and the encouragement of trucking industry relocation to the Engle Business Park District. The Engle Business District is planned to be the largest industrial subdivision in the city that will provide an area for long-term growth and development. It was designed with larger industrial uses in mind, particularly those relating to transportation. There are 3 phases of the development, but phase one consists of 20 lots zoned general industrial with each lot being a minimum of 1 hectare.

Truck traffic through and to the downtown should be discouraged and/or restricted, unless they are providing delivery services. Forrest Drive and Con Road should be also be discouraged or restricted to trucks as the truck traffic counts showed low usage on these roads. Better truck service levels on Highway 3, Highway 4, and Deh Cho Boulevard can be provided to promote their use as future truck routes. A formalized truck routes map should be created to clearly define the available truck routes and restrictions. A long-term preliminary truck routing strategy is illustrated in **Exhibit 11-14**. The City should facilitate this process through rezoning and discussions with current land owners in the industrial zoned lands.

Policy on truck route and preference for deliveries should be created and/or updated to reflect the goals of the City and the Smart Growth vision. The encouragement of industrial relocation should provided with land use and zoning policy and the City should work with current land owners and tenants to speed up the relocation effort. For example, consideration is being given for providing incentives for industry to relocate to the Engle Business Park District using a 5-year sliding abatement strategy. Other strategies to encourage relocation being considered include industrial relocation and brownfield remediation incentives. Moving the major generators of truck traffic, such as the RTL site and Imperial Oil sites should be the highest priority for the City and will provide the most benefit in reducing truck traffic on Old Airport Road and Downtown.

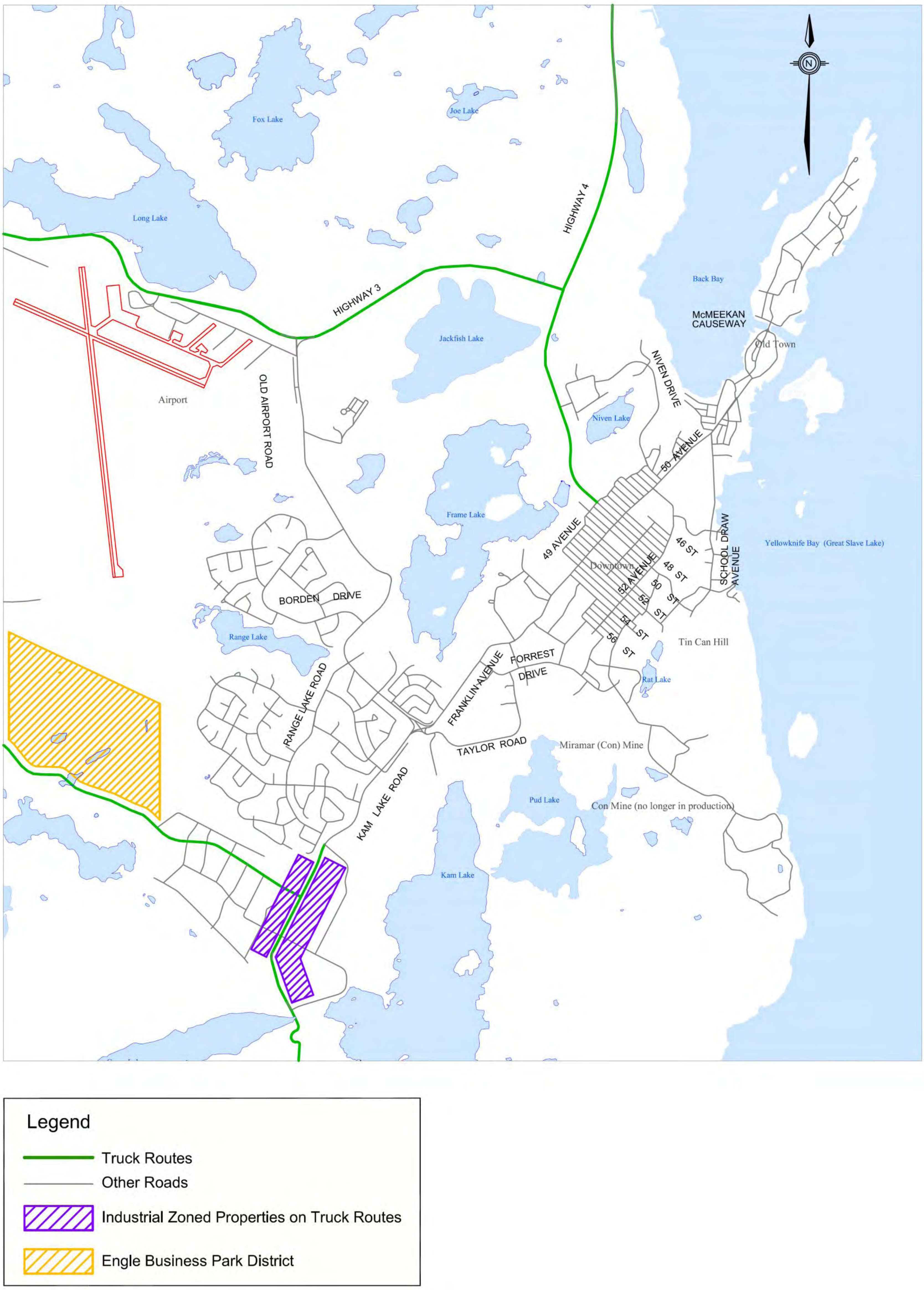


Exhibit 11-14: Long-term Preliminary Truck Routing Strategy

11.9 Transportation Demand Management (TDM)

11.9.1 Strategy

TDM influences the demand for travel by using education, promotion and outreach to change personal attitudes and awareness or by applying travel incentives and disincentives that make one travel option more attractive (or less attractive) than others. TDM policies and programs are typically intended to:

- Shift private automobile use to other modes;
- Spread the travel outside of peak demand period, i.e., before or after main travel hour; and/or,
- Eliminate travel all together.

TDM is generally implemented through policy changes or incentives.

Proposed Policy Changes:

- Encourage policy changes for transit, such as working with school boards to assess parking fees for students;
- Review parking and pay parking policies. Parking pricing should be done dynamically if possible to maximize effect and minimize negative impacts;
- Change bylaw parking requirements for higher density areas to reduce required minimums and implement maximum parking rates for autos; and,
- Continue with practice of having a minimum allotment of bicycle parking in new developments during the application process.

Proposed Incentives:

- Encourage municipal employees to use sustainable modes for commuting by providing incentives such as carpooling spaces, bike storage, and shower facilities:
- Expand the use of preferred parking for car share and carpool;
- Reduce or remove parking subsidies for employees;
- Provide programs to encourage walking and cycling:
  - Provide safe route to school program; involve guardians in planning safe walking and bicycling routes to elementary schools and develop maps; and,
  - Walking school bus program with parent volunteers to walk younger children to school.
- Develop programs to encourage cycling: e.g. bike to work week.
- Consider free transit for children under 13 accompanied by an adult;
- Implement car free days in Old Town;
- Explore tax structure changes:
  - Municipal tax incentives for green neighbourhoods or communities; and,
  - Provide incentives for households to own fewer vehicles.
- Improve travel time of transit and provide equal or better access compared to SOV by reviewing transit priority on main routes.

11.10 Traffic Calming

11.10.1 Context

Traffic calming plays an effective role in helping the City provide for safe and efficient operation of municipal roadways. Traffic calming involves using physical features along the roadway / right-of-way to encourage motorists to drive at a lower speed and to reduce the level of ‘shortcutting’. Although there are numerous traffic calming measures that can be implemented, some of the most common are curb bulges, traffic circles, speed humps / tables / raised crosswalks / cushions and provision of on-street parking. For Yellowknife, measures to be considered are curb bulges and road dieting, which are expanded upon below.

The information provided here is largely based on recommendations from the Transportation Association of Canada (TAC) / Institute of Transportation Engineers (ITE) *Canadian Guide to Neighbourhood Traffic Calming* (December 1998).

A range of high-level cost estimates has been provided for each type of feature; however, it is important to note that exact estimates are dependent on site-specific conditions.

11.10.1.1 Curb Bulge

Curb bulges (also known as curb extensions, chokers, neckdowns, and pinch points) are extensions of the curb / sidewalk that protrude horizontally into the roadway. They can be installed at intersections or mid-block locations, and may be integrated with crosswalks in order to shorten the distance that pedestrians are required to cross, to increase pedestrian visibility and to improve overall pedestrian safety. A summary is provided in **Table 11-12**.

Curb Bulge with Pedestrian Crossing

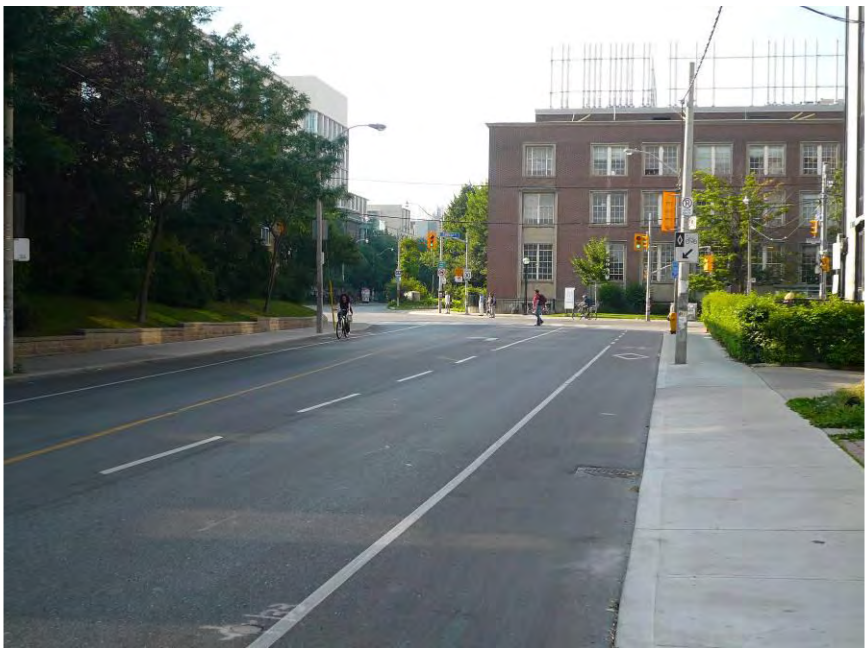
Table 11-12: Curb Bulge Summary

Implementation	▪ Typical lane width is 3.0m with a minimum of 2.5m. ▪ Minimum width for a departure lane is 3.0m. ▪ At mid-block locations, a minimum lane width of 2.75m is required.
Pros	▪ Reduction in vehicle speeds (varies based on exact conditions). ▪ Reduction in crossing distance for pedestrians. ▪ Increased pedestrian visibility. ▪ Can provide aesthetic benefits through landscaping or extension of the pedestrian realm.
Cons	▪ Difficult to integrate with bicycle lanes and wide curb lanes. ▪ May require the removal of on-street parking at the location where the curb has been extended. ▪ Large vehicles may need to cross into adjacent travel lanes to negotiate turns.
Cost	▪ Costs typically vary between $10,000 to $15,000 based on site-specific conditions and implementation.

11.10.1.2 Road / Lane Diets

Road diets involve removing lanes of travel or reducing roadway width in order to improve safety and re-allocate space in the right-of-way to non-motorists. A common application of road dieting is reducing a four-lane, two-way street to two lanes (one in each direction) and a shared centre left-turn lane, leaving one lane's worth of space to other uses (bicycle lanes, expanded sidewalks, etc.). Lane diets are similar to road diets in that they reduce effective roadway width, but this is achieved through narrowing lanes, particularly where lanes are already wider than required. Road and lane dieting can also be combined to achieve maximal re-allocation of space.

Information in this section is largely based on the paper *Applying the Road Diet for Liveable Communities*, presented at the 2005 Institute of Transportation Engineers Annual Meeting.



Lane Diet on St George Street, Toronto, Ontario

A summary of road and lane dieting is described in **Table 11-13**.

Table 11-13: Lane Diet Application Summary

Implementation	▪ Typically applied on two-way streets with four lanes of traffic, or on wide two-lane streets.
Pros	▪ Decrease in collisions due to decrease in number of conflict points. ▪ Reduced vehicle speeds. ▪ Can support sustainable transportation modes by increasing space available to pedestrians and / or cyclists. ▪ Can improve the urban realm. ▪ Little or no traffic diversion to adjacent / parallel routes.
Cons	▪ Can reduce roadway capacity, depending on implementation. ▪ Lane diets can cause difficulty for larger vehicles (i.e. transit, goods movement vehicles). ▪ May increase delay for transit buses, depending on implementation.
Cost	▪ The cost depends on the length of the corridor and if there is a need for reconstruction. Often, restriping and some information signage suffice, in which case the cost can be relatively small.

11.10.2 Strategy

Each neighbourhood is unique and will require a specific study to determine the best application of options and improvements so that speeding is discouraged, short cutting is minimized, and that the road can develop a character which is better suited to the land use.

An efficient and effective way to continue to introduce traffic calming is to develop a traffic calming policy / program and inventory all existing traffic calming measures in the city. The policy will also provide some criteria and possible thresholds where traffic calming is applicable. The City can then request traffic calming features are installed during new or redevelopment projects.

Since traffic calming plays an effective role in helping provide a safe and efficient operation of municipal roadways, the City should continue to install traffic calming; especially measures that are intended to reduce speeds and improve safety.

11.11 Example Smart Growth Strategy – RTL Site

The RTL Site on Old Airport Road was selected as an example site to illustrate how the strategies of this *Study* and the principals of the *Plan* combine to impact an existing area of Yellowknife. The site was reviewed by HDR| iTRANS as well as EIDOS and Dillon. The example emphasizes the development principles and strategic decision to provide sustainable infrastructure to encourage citizens to shift from the single occupancy vehicle to more active, healthier, and sustainable modes of transportation. The purpose is to provide an example of the vision in action and what changes could be made to Old Airport Road given the new sustainable policies and a renewed focus on the implementation of transit and active transportation infrastructure.

The RTL site is a central industrial component of Old Airport Road and defines, in part, the character of the corridor. Old Airport Road is essentially the gateway to the city of Yellowknife and provides access the residential areas west of Old Airport Road and downtown. The land use mix and private driveway access along Old Airport Road significantly impacts the transportation network and the long-term vision of the corridor as a multi-modal environment with mixed use development. This section provides an example of how the RTL site along Old Airport Road might change over time when the Vision and strategies are realized.

Specific transportation elements were included:

- Transit stop near main entrance;
- Pedestrian linkages internal to the development and linking to recreational trails;
- Shared Bike/Pedestrian path adjacent to Old Airport Road;
- Limited driveways;
- Access to lane at the back of the site for circulation and deliveries; and,
- Allowance for future road connections.

The transition of the RTL site and the rest of Old Airport Road will require significant investment and consultation with stakeholders over the next fifteen years and beyond, but this example provides a future configuration that may be attained. Realizing the concepts in **Exhibit 11-15** will depend on further engineering assessment and design, property requirements, and stakeholder feedback.

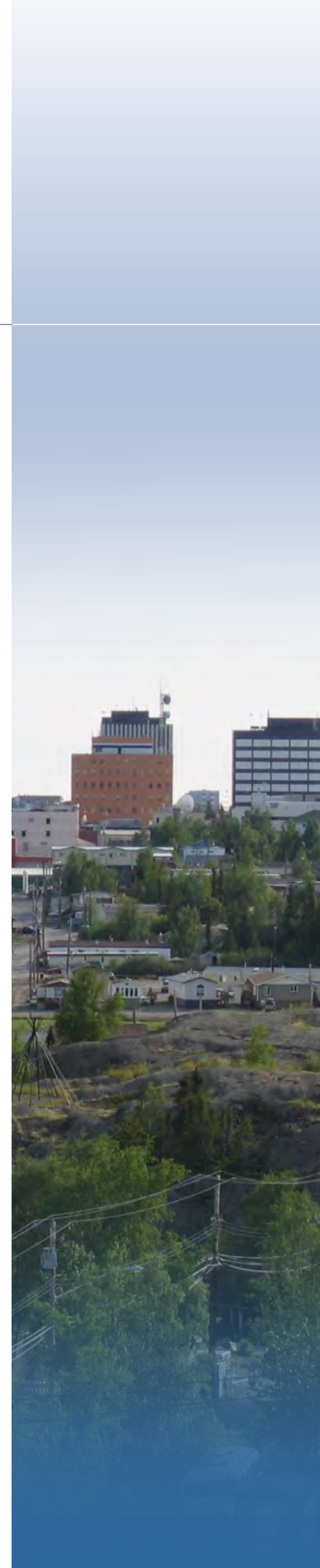
SITE PLANNING / TRANSPORTATION / ENVIRONMENTAL PROTECTION CONSIDERATIONS

Source: EIDOS Consultants Inc.

Exhibit 11-15: Example of the Smart Growth Strategy

Exhibit 11-15 is a conceptual overview of site planning / transportation issues. For a more refined concept and layout, refer to the Old Airport section of the Urban Design Initiative Report.

Implementation Strategy



12. IMPLEMENTATION STRATEGY

The City of Yellowknife can begin implementing these strategies immediately; however, some strategies require more planning and analysis before specific actions, timelines, and costs are identified. The City will need to define the scope of work for these projects before budgets can be finalized. The costs provided are order of magnitude costs to provide some guidance.

The costs provided are order of magnitude costs to provide some guidance. The estimates do not include property costs or environmental impact costs.

12.1 Long-Term

The impact of the long-term out and the associated infrastructure needs is outlined in this section. The intermediate section follows this which outlines the more immediate stage of improvements. This is a complete list of strategies, which includes some projects that will start in the intermediate time horizon and as identified in **Section 10**. These strategies are to be implemented by administration as required by development and as budget and resources permit.

12.1.1 All Modes

Strategy	Action	Additional Cost
Update planning documents, bylaws and polices to enhance and promote sustainable transportation	▪ Internal update by Planning and Development and Public Works and Engineering Departments. ▪ Forward to Council for approval where applicable. ▪ Updates can be done internally with some consultant assistance.	$30,000
Establish and manage base data	▪ Establish a count and inventory programme in house. Outsource traffic count collection. ▪ Retain a consultant to work with staff to update the GIS system to reflect the current systems.	$100,000
Create an asset management system	▪ Retain a consultant to set up a database to track existing systems and their status. ▪ Create an asset management system.	$50,000
Launch formal social marketing initiatives	▪ Request funding support from the Federal Government such as the ecoMOBILITY program or territorial government transit planning funds. ▪ Create new programs (Commuter Challenge, Walk to School, and Bike to Work Week). ▪ Utilize existing corporate resources to promote these programmes under community interactions. Some funds will be required for advertising, sponsorship, etc.	$15,000

Strategy	Action	Additional Cost
Safe route to school program	▪ Choose 3 schools to develop maps where there is the most likelihood of increasing pedestrian modes – e.g. flatter terrain, pedestrian infrastructure. ▪ Maps to be developed based on the GIS system. This can be done in-house or by a consultant. ▪ Maps would need to be confirmed with the School District and then also advertised. ▪ Funds required for consultant and mapping materials.	$15,000
Review priority for buses on main routes	▪ Establish key routes and links for priority - this can be done in-house or by a consultant. ▪ Prioritize areas for future implementation.	$30,000
Establish traffic calming program	▪ Public Works and Engineering Department to prioritize key areas. ▪ Continue to implement measures. ▪ Request traffic calming measures with redevelopment.	$50,000 per year

12.1.2 Transit

Strategy	Action	Additional Cost
Service		
Update transit plan	▪ Work with transit provider to establish a more responsive plan for the changing needs of the city. ▪ Review existing routes and provide staged plan for additions to routes as infill occurs and new areas develop. ▪ Some provision for consulting fees.	$100,000
Improve frequency of service	▪ Review routes and service during peak periods. ▪ Review funding to support additional service hours especially in winter months. ▪ Some provision for consulting fees.	$2,000
Improve reliability of service	▪ Public Works and Engineering to work with the transit provider through the contract to enforce fixed routes and on-time services – consider penalties.	$0
Expand service coverage areas as development grows	▪ Planning and Development to work with Public Works and Engineering to ensure that provision is made for new service as land develops. ▪ City to provide additional funds to subsidize service increases as land use changes.	TBD
Provide demand responsive transit	▪ Planning and Development to review options for alternative transit service. ▪ City to work with transit provider to see if there are more cost effective ways to service lower density neighbourhoods.	TBD
Infrastructure		
Improve transit infrastructure to bus stops	▪ Public Works and Engineering to review locations where there is a need for sidewalk linkages to bus stops; bus stop facilities. ▪ Implement upgrades. ▪ Request cost share with developers, and other agencies.	$100,000 per year

Strategy	Action	Additional Cost
Outsource provision of bus shelters	▪ Review operation by others to establish best outsourcing method. ▪ Develop specifications, tender and select preferred contractor. ▪ Advertising revenue to flow into dedicated fund to implement transit upgrades.	$0
Enhance route connectivity to improve transferability	▪ Review bus route system to improve connections between routes. ▪ Provide pedestrian facilities, such as sidewalks, trails, and pathways, to allow for safe and effective passage.	$50,000 per year
Provide education through schools	▪ City to provide materials to School Boards to educate on existence of transit and possible options for routes to school.	TBD
Support purchase of cleaner transit fleet vehicles	▪ City to work with bus operator for the purchase of transit vehicles that have reduced emissions and use clean air technology.	$0
Create transit oriented development nodes	▪ Planning and Development to review 5 locations identified. ▪ Consultant to be selected to review nodes and provide a functional design of proposed nodes and well as costs. ▪ Improvements to be undertaken with redevelopment or with City budget funds.	$100,000

12.1.3 Cycle / Pedestrian

Strategy	Action	Additional Cost
General		
Develop minimum standards for each roadway classification	▪ City to prepare minimum standards for bicycle and pedestrians for each roadway classification. ▪ To be used for new development, redevelopment, and capital projects. ▪ Forward to Council for approval.	$0
Assess and determine priorities for routes	▪ Assess current cycle and pedestrian routes. ▪ Using the data collected, set criteria to evaluate needs for new pedestrian and cycle linkages. ▪ Establish priorities for new sidewalks and for new cycle routes and cycle lanes. ▪ Identify list for more review and functional design. ▪ Consultant to assist with assessment.	TBD
Create a formalized map	▪ Maps to be developed based on the GIS system. ▪ Maps need to draw from existing information and proposed new routes. ▪ This can be done in-house or by a consultant.	$15,000
Sign and mark routes and trails	▪ City to work with Developers for improved signage between new developments and existing networks. ▪ Public Works and Engineering to identify existing routes which can be signed and marked. ▪ Install signage to link multi-use trails.	TBD
Expand multi-purpose trails.	▪ Undertake a review of current trail network. ▪ Assess where new linkages are needed. ▪ Consultant to assist with review.	$50,000

Strategy	Action	Additional Cost
Route identification and improvement		
Establish active connection priorities	▪ Consultant to be hired to prepare corridor studies of the three routes: • 50th Street from Frame Lake Trail to School Draw Avenue; • 52nd Avenue from 50th Avenue to Forrest Drive; and, • 54th Street from 49th Avenue to 52nd Avenue. ▪ Each study to complete option review - traffic impact review on existing streets, parking strategy, alternative routes. ▪ Conceptual plan to be prepared and cost out. ▪ Submit preferred option for each route to Council for approval and implementation. ▪ Request cost share from Federal funds, Territorial funds.	TBD
Trails to connect to: Old Airport Road, Kam Lake road, North of Highway 3, Tin Can Hill/Con Mine	▪ Review ways in which off-street trails can connect to main corridors. ▪ Planning and Development and Public Works and Engineering departments to work together to ensure co-ordination with development. ▪ Funds to be requested of developers with cost share from Council.	TBD
Provide wider and continuous sidewalks	▪ Review main arterial corridors for provision of better sidewalk facilities.	TBD
Improve cycling nodes	▪ Proposed nodes to be reviewed – this can be done in-house or with a consultant. ▪ Upgrade nodes to provide connectivity to other trails or cycle routes. ▪ Additional cycling links to be identified for implementation. ▪ Request funding. ▪ Implement.	TBD
Maintenance of sidewalks	▪ Using developed GIS network, establish current standard of existing sidewalks. ▪ Need to prioritize existing sidewalks where maintenance most needed. ▪ Summarize funding request in a report to Council to confirm commitment to funds on a long-term basis.	$100,000 per year
Improved lighting	▪ Need to prioritize where lighting required based on existing network and usage. Criteria need to be established to confirm selection. This will need to tie in with transit stops and crosswalks. ▪ Identify 5 key locations for lighting and summarize funding request in a report to Council.	$50,000 per year

12.1.4 Road Network

Strategy	Action	Additional Cost
Policies, bylaws and incentives		
Promote carpool use	▪ Enhance appeal and functionality of carpooling. ▪ Support ride matching. ▪ Planning and Development to request carpool parking spots with development applications. ▪ Provide carpool parking spots in front of institutions, commercial areas, recreation centres, City Hall. ▪ Funds covered under operating or by developers.	$0
Promote teleworking and flexible hours; transit use	▪ City to provide these options for staff where possible.	$0
Enforce the no-idling policy	▪ Public Works and Engineering to ensure main locations have effective regulatory signage for education and enforcement. ▪ Bylaws officers to continue to enforce anti-idling policy. ▪ Funds covered by operating.	$0
Encourage mixed use development	▪ Planning and Development to follow principles of Smart Growth Plan in development to create mixed use nodes that reduce commuter trip length.	TBD
Work with car share companies	▪ City to contact co-operative car companies to encourage provision of vehicles in mixed use developments and in commercial areas.	TBD

Note: The costs for road widening are included in the relevant section of road and are not included in the intersection costs. If the intersection improvements preceded the road widening, the intersection costs would need to be increased to accommodate the necessary local widening.

Strategy	Action	Additional Cost
Infrastructure		
Intersection Upgrades – Seek cost sharing opportunities		
Highway 3 and Old Airport Road	▪ Retain a consultant to undertake a detailed traffic study and functional design. ▪ Review options for type of control – signalization or roundabout. ▪ Review future trail linkages and connections to development to the north. ▪ Undertake detailed design on preferred option. ▪ Implement.	$500,000
Highway 3 and Highway 4	▪ Additional turn lanes required. ▪ Review options for type of control – signalization or roundabout. ▪ Retain a consultant to undertake a detailed traffic study and functional design. ▪ Implement.	$600,000
Old Airport Road and Borden (near the Home Building Centre)	▪ Additional through lanes required but not more than anticipated road widening (see below).	Included in Road Widening Costs

Strategy	Action	Additional Cost
Old Airport Road and Borden (near Wal-Mart)	▪ Additional turn lanes required. ▪ Retain a consultant to undertake a detailed traffic study and functional design. ▪ Review future trail linkages and connections to development to the east. ▪ Undertake detailed design on preferred option. ▪ Implement.	$1,000,000
Old Airport Road and Range Lake Road	▪ Additional turn lanes required. ▪ Retain a consultant to undertake a detailed traffic study and functional design. ▪ Implement.	$1,350,000
48th Street and 49th Avenue	▪ Additional turn lanes required and upgraded traffic control. ▪ Retain a consultant to undertake a detailed traffic study and functional design. ▪ Review options for type of control – signalization or roundabout. ▪ Undertake detailed design on preferred option. ▪ Implement.	$1,250,000
Deh Cho Boulevard and Kam Lake Road	▪ Additional turn lanes required. ▪ Retain a consultant to undertake a detailed traffic study and functional design. ▪ Implement.	$500,000
Old Airport Road and Franklin Avenue	▪ Additional capacity required – new laning plus possible grade separation. ▪ Retain a consultant to undertake a detailed traffic study to review current and future demands with new and proposed network improvements – Deh Cho Boulevards and Taylor Road. ▪ Review options for type of control –grade separation. ▪ Review future trail linkages, transit priority, and safety. ▪ Undertake functional design with staged implementation. ▪ Undertake detailed design on preferred option. ▪ Implement.	$2,000,000 – includes allowance for grade separation
Road Widening – Seek cost sharing opportunities		
Old Airport Road	▪ Undertake a corridor review of Old Airport Road from Range lake Road north to Highway 3. ▪ The Corridor study includes a review of right of way, environmental impacts, land use impacts, context sensitive design, opportunities for landscaping and multi-use trail connection, existing and future traffic demands. The study will also review limiting driveway connections for better access management. ▪ Prepare a functional design for 4 lanes – cross-section to accommodate bicycles, pedestrians, transit, and vehicles. ▪ Phased implementation with redevelopment.	$6,200,000
Highway 4	▪ Undertake functional designs to upgrade this road from 2-lane to 4-lanes. The design will include right of way considerations, environmental impacts, land use impacts, existing and future traffic demands. The cross section needs to accommodate bicycles, pedestrians, transit, and vehicles. ▪ Phased implementation with new and redevelopment.	$7,000,000

Strategy	Action	Additional Cost
Kam Lake Road	▪ Undertake functional designs to upgrade this road from 2-lane to 4-lanes. The design will include right of way considerations, environmental impacts, land use impacts, existing and future traffic demands. The cross section needs to accommodate bicycles, pedestrians, transit, and vehicles. ▪ Phased implementation with new and redevelopment.	$6,600,000
Franklin Avenue	▪ Undertake a corridor review of Franklin Avenue which includes a review of right of way, environmental impacts, land use impacts, existing and future traffic demands. ▪ Prepare a functional design for 4 lanes throughout downtown – cross-section to accommodate bicycles, pedestrians, transit, and vehicles. ▪ Phased implementation with redevelopment.	$200,000 – design only
Taylor Road Extension (New Route)	▪ Undertake a corridor review for the new route connection of Taylor Road. ▪ The Corridor study will need to look at options for alignments and connection into existing network. It will be contingent on how the new Tin Can Hill/Con Mine develops. ▪ The study need to include right of way, environmental impacts, land use impacts, linkages to multi-use trails, existing and future traffic demands. ▪ The cross-section to accommodate bicycles, pedestrians, transit, and vehicles. ▪ Phased implementation with new development.	$500,000 – design only
Other Considerations		
Other Improvements	▪ Improvements to the Co-op corner with redevelopment. ▪ New road connection between Old Airport Road and Deh Cho Boulevard. ▪ Construct new roads with development of green field lands, for example.	TBD

12.1.5 Parking

Strategy	Action	Additional Cost
Policies, bylaws and incentives		
Review parking policies and the options for pay parking	▪ Review zoning bylaw to include unique parking requirement for Old Town. ▪ Review options for pay parking together with possible areas: on-street, off-street private lots as well as City lots should be included. ▪ Present options for review and discussion with Council, neighbourhoods and merchants. ▪ Summarize opportunities together with benefit cost analysis that includes sustainable mode impact. ▪ Consultant study.	$80,000

Strategy	Action	Additional Cost
Locations		
Downtown	▪ Safety of the parkade should be increased in order to maximize the capacity the structure currently provides. Security and enforcement should be visible throughout the full hours of operation. ▪ A downtown planning study should be conducted and a parking plan should be developed through this process. ▪ Consultant study.	$100,000
Old Airport Road	▪ Access to Old Airport Road and internal site circulation and parking should be consolidated and reviewed during redevelopment. ▪ Implementation can be partially funded through development cost charges.	Development Cost Charges (partial)
Old Town	▪ As redevelopment occurs, small areas of pocket parking should be engineered into the process. ▪ Review the location of a parking lot in close proximity to Old Town with transit shuttles – consultant study.	$30,000

12.1.6 Truck

Strategy	Action	Additional Cost
Develop Truck route map to provide alternative truck routes	▪ New truck route map to be developed. ▪ Sign and mark routes. ▪ Restrict truck routes on Old Airport Road, Forrest Drive, and Con Road. ▪ Distribute information to truck companies, distributors, etc. ▪ Work with Municipal Enforcement Division to enforce routes.	$0
Review and enforce truck restrictions	▪ Continue to support truck safety. ▪ City to work with the Municipal Enforcement Division safety office to undertake more truck safety checks.	$0
Review restrictions for goods movement to not impact access or capacity	▪ Public Works and Engineering to continue to encourage goods delivery outside of peak periods with time of day restrictions, loading restrictions, etc. ▪ Work with the commercial owners to encourage efficient use of existing infrastructure.	$0

12.1.7 Transportation Demand Management

Strategy	Action	Additional Cost
Policy		
Encourage policy changes for transit	▪ Work with School Boards and other agencies to reduce auto use for rides to school.	$0
Change bylaw parking requirements for bicycles and autos	▪ Change current requirements for bicycles (require facilities) and autos (introduce parking maximums). ▪ Review with Council Committees and internal City departments. ▪ Submit to Council for approval.	$0
Review pay parking policies	▪ Internal review by Municipal Enforcement Division.	$0

Strategy	Action	Additional Cost
Incentives		
Encourage Municipal employees to use sustainable modes	▪ City to be a leader in the community for employee facilities by: • Providing carpool parking spaces near the entrances; • Shower facilities, safe bicycle storage; and, • Advertise bus stop locations and schedules on internal and external web pages.	$0
Establish programs (Commuter Challenge, Walk to School, Bike to Work Week)	▪ Use corporate resources to promote these programmes under the community interactions. Funds will be required for advertising, sponsorship, etc. ▪ Develop the programs established and refine outreach.	$5,000
Expand the use of preferred parking for car share or carpool	▪ City to work with merchants and other owners to promote car share on private sites. ▪ City to promote identifying carpool parking spots at busy locations.	$0
Provide programs to encourage walking and cycling with Schools	▪ City to develop maps that indicate safe walking and cycling routes to main schools. ▪ City to liaise with the School Boards to implement school programme. ▪ Can be done in-house with some consultant support.	$20,000
Consider free transit for children under 13	▪ Work with transit operator to negotiate this option. ▪ Request subsidy from other agencies such as the Federal Government.	$0
Implement car free days in Old Town	▪ Corporate Services to work with the local Community Association and Merchants to promote car free days and specific times of year – this could tie in with Community festivities such as arts festivals. ▪ Some funds will be needed to arrange traffic management and advertising.	$10,000
Encourage car sharing, carpooling, and ridesharing	▪ Corporate Services to incorporate car sharing, carpooling, and ridesharing in all marketing materials and initiatives.	$0
Explore tax structure changes for incentives	▪ Corporate Services to work on options to create incentives for lowering car ownership, increasing alternative mode use.	$0
Review transit priority on main routes.	▪ Review of transit priorities to be undertaken in parallel with review of overall service plans. ▪ Section of transit priority to be added with new upgrades to infrastructure. ▪ Some consultant support will be required for review and design.	$50,000

12.1.8 Traffic Calming

Strategy	Action	Additional Cost
Develop a traffic calming policy	▪ City to develop a policy whereby decisions can be made on location of traffic calming and the type of facility. ▪ Consultant to review best practices and prepare a policy for Council approval.	$30,000
Inventory all existing traffic calming measures	▪ In-house data collection of current traffic calming measures. ▪ Add to GIS system.	$0
Consider traffic calming with new development or redevelopment	▪ Based on Traffic Calming Policy, the City can request traffic calming measures with redevelopment. ▪ City to review requests based on the Traffic Calming Policy and continue to implement traffic calming measures.	TBD

12.2 Intermediate-Term / Staging

This section outlines strategies that can move ahead in the intermediate stage in planning for the eventual long-term growth. This staging should be closely monitored with the rate and location of development. These strategies are to be implemented by administration as required by development and as budget and resources permit.

12.2.1 All Modes

Strategy	Action	Additional Cost
Update planning documents, bylaws and polices to enhance and promote sustainable transportation	▪ Internal update by Planning and Development and Public Works and Engineering Departments. ▪ Forward to Council for approval where applicable. ▪ Updates can be done internally with some consultant assistance.	$30,000
Establish and manage base data	▪ Establish a count and inventory programme in house. Outsource traffic count collection. ▪ Retain a consultant to work with staff to update the GIS system to reflect the current systems.	$100,000
Create an asset management system	▪ Retain a consultant to set up a database to track existing systems and their status. ▪ Create an asset management system.	$50,000
Launch formal social marketing initiatives	▪ Request funding support from the Federal Government such as the ecoMOBILITY program or territorial government transit planning funds. ▪ Create new programs (Commuter Challenge, Walk to School, and Bike to Work Week). ▪ Utilize existing corporate resources to promote these programmes under community interactions. Some funds will be required for advertising, sponsorship, etc.	$15,000

Strategy	Action	Additional Cost
Safe route to school program	▪ Choose 3 schools to develop maps where there is the most likelihood of increasing pedestrian modes – e.g. flatter terrain, pedestrian infrastructure. ▪ Maps to be developed based on the GIS system. This can be done in-house or by a consultant. ▪ Maps would need to be confirmed with the School District and then also advertised. ▪ Funds required for consultant and mapping materials.	$15,000
Review priority for buses on main routes	▪ Establish key routes and links for priority - this can be done in-house or by a consultant. ▪ Prioritize areas for future implementation.	$30,000
Establish traffic calming program	▪ Public Works and Engineering Department to prioritize key areas. ▪ Continue to implement measures. ▪ Request traffic calming measures with redevelopment.	$50,000 per year

12.2.2 Transit

Strategy	Action	Additional Cost
Service		
Update transit plan	▪ Work with transit provider to establish a more responsive plan for the changing needs of the City. ▪ Review existing routes and provide staged plan for additions to routes as infill occurs and new areas develop. ▪ Some provision for consulting fees.	$100,000
Improve frequency of service	▪ Review routes and service during peak periods. ▪ Review funding to support additional service hours especially in winter months. ▪ Some provision for consulting fees.	$2,000
Improve reliability of service	▪ Public Works and Engineering to work with the transit provider through the contract to enforce fixed routes and on-time services – consider penalties.	$0
Expand service coverage areas as development grows	▪ Planning and Development to work with Public Works and Engineering Department to ensure that provision is made for new service as land develops. ▪ City to provide additional funds to subsidize service increases as land use changes.	TBD
Provide demand responsive transit	▪ Planning and Development to review options for alternative transit service. ▪ City to work with transit provider to see if there are more cost effective ways to service lower density neighbourhoods.	TBD

Strategy	Action	Additional Cost
Infrastructure		
Improve transit infrastructure to bus stops	▪ Public Works and Engineering to review locations where there is a need for sidewalk linkages to bus stops; bus stop facilities. ▪ Implement upgrades. ▪ Request cost share with developers, and other agencies.	$100,000 per year
Outsource provision of bus shelters	▪ Review operation by others to establish best outsourcing method. ▪ Develop specifications, tender and select preferred contractor. ▪ Advertising revenue to flow into dedicated fund to implement transit upgrades.	$0
Enhance route connectivity to improve transferability	▪ Review bus route system to improve connections between routes. ▪ Provide pedestrian facilities to allow for safe and effective passage.	$50,000 per year
Provide education through schools	▪ City to provide materials to School Boards to educate on existence of transit and possible options for routes to school.	TBD
Support purchase of cleaner transit fleet vehicles	▪ City to work with bus operator for the purchase of transit vehicles that have reduced emissions and use clean air technology.	$0
Create transit oriented development nodes	▪ Planning and Development to review 2 locations identified (One on Old Airport Road and one at School Draw). ▪ Consultant to be selected to review nodes and provide a functional design of proposed nodes and well as costs. ▪ Improvements to be undertaken with redevelopment or with City budget funds.	$100,000

12.2.3 Cycle / Pedestrian

Strategy	Action	Additional Cost
General		
Develop minimum standards for each roadway classification	▪ City to prepare minimum standards for bicycle and pedestrians for each roadway classification. ▪ To be used for new development, redevelopment, and capital projects. ▪ Forward to Council for approval.	$0
Assess and determine priorities for routes	▪ Assess current cycle and pedestrian routes. ▪ Using the data collected, set criteria to evaluate needs for new pedestrian and cycle linkages. ▪ Establish priorities for new sidewalks and for new cycle routes and cycle lanes. ▪ Identify list for more review and functional design. ▪ Consultant to assist with assessment.	TBD
Create a formalized map	▪ Maps to be developed based on the GIS system. ▪ Maps need to draw from existing information and proposed new routes. ▪ This can be done in-house or by a consultant.	$15,000
Sign and mark routes and trails	▪ Public Works and Engineering to work with developers for improved signage between new developments and existing networks. ▪ Public Works and Engineering to identify existing routes which have can be signed and marked. ▪ Install signage to link to multi-use trails. ▪ Funding to be sourced from operating budget.	$0

Strategy	Action	Additional Cost
Expand multi-purpose trails.	▪ Undertake a review of current trail network. ▪ Assess where new linkages are needed. ▪ Consultant to assist with review.	$50,000
Route identification and improvement		
Establish active connection priorities	▪ Consultant to be hired to prepare one corridor studies through the downtown. ▪ The study will complete option review – traffic impact review on existing streets, parking strategy, alternative routes. ▪ Conceptual plan to be prepared and cost out. ▪ Submit preferred option to Council for approval and implementation. ▪ Request cost share from Federal funds, Territorial funds.	$100,000 (Study only)
Trails to connect to Old Airport Road	▪ Review ways in which off-street trails can connect to Old Airport Road corridors. ▪ Planning and Development and Public Works and Engineering Departments to work together to ensure co-ordination with development. ▪ Funds to be requested of developers with cost share from Council.	$50,000 (Study only)
Provide wider and continuous sidewalks	▪ Review Old Airport Road and Highway 4 corridors for provision of better sidewalk facilities.	$60,000 (Study only)
Improve cycling nodes	▪ Proposed nodes on Old Airport Road at Range Lake Road and co-op corner to be reviewed – this can be done in-house or with a consultant. ▪ Upgrade of both nodes to provide connectivity to other trails or cycle routes. ▪ Additional cycling links to be identified for implementation. ▪ Request funding. ▪ Implement.	$200,000
Maintenance of sidewalks	▪ Using developed GIS network, establish current standard of existing sidewalks. ▪ Need to prioritize existing sidewalks where maintenance most needed. ▪ Summarize funding request in a report to Council to confirm commitment to funds on a long-term basis.	$100,000 per year
Improved lighting	▪ Need to prioritize where lighting required based on existing network and usage. Criteria need to be established to confirm selection. This will need to tie in with transit stops and crosswalks. ▪ Identify 5 key locations for lighting and summarize funding request in a report to Council.	$50,000 per year

12.2.4 Road Network

Strategy	Action	Additional Cost
Policies, bylaws and incentives		
Promote carpool use	▪ Enhance appeal and functionality of carpooling. ▪ Support ride matching. ▪ Planning and Development to request carpool parking spots with development applications. ▪ Provide carpool parking spots in front of institutions, commercial areas, recreation centres, City Hall. ▪ Funds covered under operating or by developers.	$0
Promote teleworking and flexible hours; transit use	▪ City to provide these options for staff where possible.	$0
Enforce the no-idling policy	▪ Public Works and Engineering to ensure main locations have effective regulatory signage for education and enforcement. ▪ Bylaws officers to continue to enforce anti-idling policy. ▪ Funds covered by operating.	$0
Encourage mixed use development	▪ Planning and Development department to follow Smart Growth Plan to reduce commuter trip length.	TBD
Work with car share companies	▪ City to contact co-operative car companies to encourage provision of vehicles in mixed use developments and in commercial areas.	TBD

Note: The costs for road widening are included in the relevant section of road and are not included in the intersection costs. If the intersection improvements preceded the road widening, the intersection costs would need to be increased to accommodate the necessary local widening.

Strategy	Action	Additional Cost
Infrastructure		
Intersection Upgrades – Seek cost sharing opportunities		
Highway 3 and Old Airport Road	▪ No action required until long-term.	$0
Highway 3 and Highway 4	▪ Signalization or roundabout required.	$200,000
Old Airport Road and Borden (near the Home Building Centre)	▪ No action required until long-term.	$0
Old Airport Road and Borden (near Wal-Mart)	▪ No action required until long-term.	$0
Old Airport Road and Range Lake Road	▪ Additional southbound right-turn lane required. ▪ Retain a consultant to undertake a detailed traffic study and functional design. ▪ Implement.	$150,000

Strategy	Action	Additional Cost
48th Street and 49th Avenue	▪ Signalization or roundabout required. ▪ Additional southbound left-turn required. ▪ Retain a consultant to undertake a detailed traffic study and functional design. ▪ Undertake detailed design on preferred option. ▪ Implement.	$500,000
Deh Cho Boulevard and Kam Lake Road	▪ Signalization required.	$200,000
Old Airport Road and Franklin Avenue	▪ Additional capacity required – new laning. ▪ Retain a consultant to undertake a detailed traffic study to review current and future demands with new and proposed network improvements – Deh Cho Boulevards and Taylor Road. ▪ Review future trail linkages, transit priority, and safety. ▪ Undertake functional design with staged implementation. ▪ Undertake detailed design on preferred option. ▪ Implement.	$1,000,000
Road Widening – Seek cost sharing opportunities		
Old Airport Road	▪ Undertake a corridor review of Old Airport Road from Range lake Road north to Highway 3. ▪ The Corridor study includes a review of right of way, environmental impacts, land use impacts, context sensitive design, opportunities for landscaping and multi-use trail connection, existing and future traffic demands. The study will also review limiting driveway connections for better access management. ▪ Prepare a functional design for 4 lanes – cross-section to accommodate bicycles, pedestrians, transit, and vehicles.	$600,000 (design only)
Highway 4	▪ Undertake functional designs to upgrade this road from 2-lane to 4-lanes. The design will include right of way considerations, environmental impacts, land use impacts, existing and future traffic demands. The cross section needs to accommodate bicycles, pedestrians, transit, and vehicles.	$700,000 (design only)
Kam Lake Road	▪ Undertake functional designs to upgrade this road from 2-lane to 4-lanes. The design will include right of way considerations, environmental impacts, land use impacts, existing and future traffic demands. The cross section needs to accommodate bicycles, pedestrians, transit, and vehicles.	$600,000 (design only)
Franklin Avenue	▪ No action required until long-term.	$0
Taylor Road Extension (New Route)	▪ Corridor review to be triggered by redevelopment plans.	$0

12.2.5 Parking

Strategy	Action	Additional Cost
Policies, bylaws and incentives		
Review parking policies and the options for pay parking	▪ Review zoning bylaw to include unique parking requirement for Old Town. ▪ Review options for pay parking together with possible areas: on-street, off-street private lots as well as City lots should be included. ▪ Present options for review and discussion with Council, neighbourhoods and merchants. ▪ Summarize opportunities together with benefit cost analysis that includes sustainable mode impact. ▪ Consultant study.	$80,000
Locations		
Downtown	▪ Safety of the parkade should be increased in order to maximize the capacity the structure currently provides. Security and enforcement should be visible throughout the full hours of operation. ▪ A downtown planning study should be conducted and a parking plan should be developed through this process. ▪ Consultant study.	$100,000
Old Airport Road	▪ Access to Old Airport Road and internal site circulation and parking should be consolidated and reviewed during redevelopment. ▪ Implementation can be partially funded through development cost charges.	Development Cost Charges (partial)
Old Town	▪ As redevelopment occurs, small areas of pocket parking should be engineered into the process. ▪ Review the location of a parking lot in close proximity to Old Town with transit shuttles – consultant study.	$30,000

12.2.6 Truck

Strategy	Action	Additional Cost
Develop Truck route map to provide alternative truck routes	▪ New truck route map to be developed. ▪ Sign and mark routes. ▪ Restrict truck routes on Old Airport Road, Forrest Drive, and Con Road. ▪ Distribute information to truck companies, distributors, etc. ▪ Work with Municipal Enforcement Division to enforce routes.	$0
Review and enforce truck restrictions	▪ Continue to support truck safety. ▪ Public Works and Engineering to work with the Municipal Enforcement Division safety office to undertake more truck safety checks.	$0
Review restrictions for goods movement to not impact access or capacity	▪ Public Works and Engineering to continue to encourage and enforce goods delivery outside of peak periods with time of day restrictions, loading restrictions, etc. ▪ Work with the commercial owners to encourage efficient use of existing infrastructure.	$0

12.2.7 Transportation Demand Management

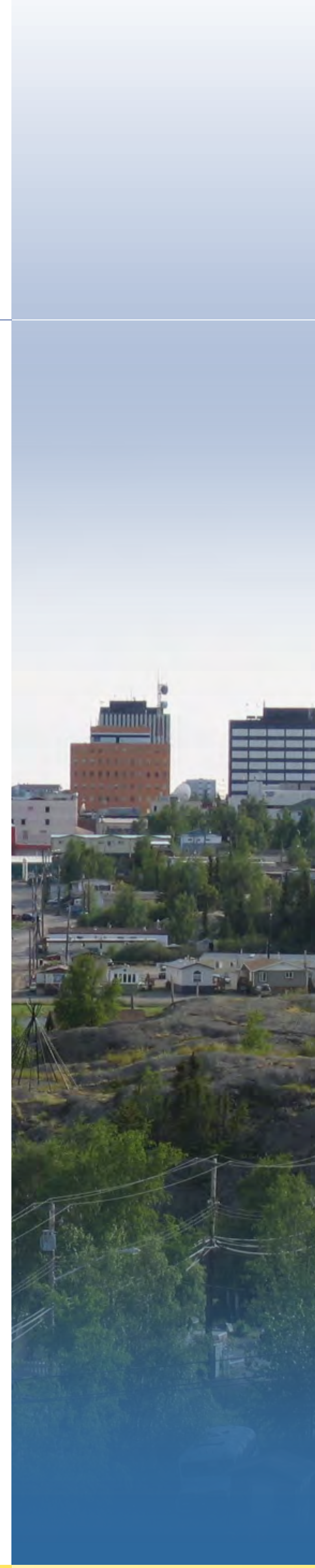
Strategy	Action	Additional Cost
Policy		
Encourage policy changes for transit	▪ Work with School Boards and other agencies to reduce auto use for rides to school.	$0
Change bylaw parking requirements for bicycles and autos	▪ Change current requirements for bicycles (require facilities) and autos (introduce parking maximums). ▪ Review with Council Committees and internal City departments. ▪ Submit to Council for approval.	$0
Review pay parking policies	▪ Internal review by Planning and Development and Public Works and Engineering Departments.	$0
Incentives		
Encourage Municipal employees to use sustainable modes	▪ The City to be a leader in the community for employee facilities by: • Providing carpool parking spaces near the entrances; • Shower facilities, safe bicycle storage; and, • Advertise bus stop locations and schedules on internal and external web pages.	$0
Establish programs (Commuter Challenge, Walk to School, Bike to Work Week)	▪ Use corporate resources to promote these programmes under the community interactions. Funds will be required for advertising, sponsorship, etc. ▪ Develop the programs established and refine outreach.	$5,000
Expand the use of preferred parking for car share or carpool	▪ City to work with merchants and other owners to promote car share on private sites. ▪ City to promote identifying carpool parking spots at busy locations.	$0
Review parking subsidies	▪ City to review and remove any subsidies for parking provided by employees. ▪ City to promote this incentive to other employers.	$0
Provide programs to encourage walking and cycling with Schools	▪ City to develop maps that indicate safe walking and cycling routes to main schools. ▪ City to liaise with the School Boards to implement school programme. ▪ Can be done in-house with some consultant support.	$20,000
Consider free transit for children under 13	▪ Work with transit operator to negotiate this option. ▪ Request subsidy from other agencies such as the Federal Government.	$0
Implement car free days in Old Town	▪ Corporate Services to work with the local Community Association and Merchants to promote car free days and specific times of year – this could tie in with Community festivities such as arts festivals. ▪ Some funds will be needed to arrange traffic management and advertising.	$10,000
Encourage car sharing, carpooling, and ridesharing	▪ Corporate Services to incorporate car sharing, carpooling, and ridesharing in all marketing materials and initiatives.	$0
Explore tax structure changes for incentives	▪ Corporate Services to work on options to create incentives for lowering car ownership, increasing alternative mode use.	$0

Strategy	Action	Additional Cost
Review transit priority on main routes.	▪ Review of transit priorities to be undertaken in parallel with review of overall service plans. ▪ Section of transit priority to be added with new upgrades to infrastructure. ▪ Some consultant support will be required for review and design.	$50,000

12.2.8 Traffic Calming

Strategy	Action	Additional Cost
Develop a traffic calming policy	▪ City to develop a policy whereby decisions can be made on location of traffic calming and the type of facility. ▪ Consultant to review best practices and prepare a policy for Council approval.	$30,000
Inventory all existing traffic calming measures	▪ In-house data collection of current traffic calming measures. ▪ Add to GIS system.	$0
Consider traffic calming with new development or redevelopment	▪ Based on Traffic Calming Policy, the City can request traffic calming measures with redevelopment. ▪ City to review requests based on the Traffic Calming Policy and continue to implement traffic calming measures.	TBD

Glossary



13. GLOSSARY

This section explains and defines key terms that are useful to understand transportation planning activities, infrastructure, and measurement. These definitions are taken from a number of sources, including the Transport Canada ***Canadian Guidelines for the Measurement of Transportation Demand Management Initiatives,*** and the Transportation Association of Canada (TAC) ***Best Practices for the Technical Delivery of Long-Term Planning Studies in Canada***, both by iTRANS Consulting Inc.

Active Transportation
Transportation by a mode that is human-powered, such as walking, cycling, skateboarding, rollerblading, or similar forms of transportation.

Average Vehicle Ridership (AVR)
This is the ratio of the total number of travellers (all modes) to the total number of private vehicles. Again, this number is always equal to at least 1.0. It can be calculated as the total number of person trips (all modes) divided by the number of vehicle trips.

Best Practices:
The term "Best Practices" is used across many disciplines to describe desirable or successful approaches to a process or problem. In the Transportation Association of Canada (TAC) ***Best Practices for the Technical Delivery of Long-Term Planning Studies in Canada***, best practices were defined as either "applied innovation" or "practices proven successful."

Cost-effectiveness
Cost effectiveness is the value received for the investment. This is normally an economic measure of the results of a program, although it can also be expressed as a cost per unit (i.e. cost per tonne of CO_2 reduced).

Counts
Counts record and report data using actual observations (manual or automatic). Counts can record the number of vehicles, vehicle occupants, pedestrians, bicycle riders, or other information across a cordon, at an intersection, or generated by a site.

Criteria Air Contaminants (CACs)
Environment Canada identifies seven air pollutants that are considered to be CACs. The seven contaminants are Total Particulate Matter, Particulate Matter with a diameter less than 10 microns, Particulate Matter with a diameter less than 2.5 microns, Carbon Monoxide, Nitrogen Oxides, Sulphur Oxides, and Volatile Organic

Compounds.[15] More information on CACs can be found through various Environment Canada sources (www.ec.gc.ca).

Efficiency versus Equity

Transportation systems often have two different purposes. The first is the efficient movement of people and goods. The second is providing equitable access to all people. Often, one investment may provide both equity and efficiency, but other times they are mutually exclusive. For example, a new LRT line connecting a dense residential development to a downtown core may provide good efficiency returns based on the number of people moved and travel time for the financial investment. A bus serving a sprawling community with few riders may not be efficient (low returns for investment) but high equity (provides access for residents in that community who don't have access to a car).

Evaluation Measure

An evaluation measure is the means used to quantify or qualify the indicator and provides an assessment of that attribute. For example, the variations in volume to capacity ratio during an evaluation period across the network, or the percentage change in the transit modal share during a typical peak hour. The measure can be expressed quantitatively as a percentage, index, rate, or some other metric or as a threshold, standard, benchmark or logical value; or it could be a qualitative assessment (e.g. high, medium, low). It should be monitored at regular intervals.

Greenhouse Gases (GHG)

Environment Canada defines GHG as "gases in the atmosphere that trap energy from the sun. Naturally occurring GHGs include water vapour, ozone, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Without them, the Earth's average temperature would be about 33°C lower than it is, making the climate too cold to support life (Schneider, 1989). While these naturally occurring gases are what make life possible, a serious concern today is the enhanced effect on the climate system of increased levels of some of these gases in the atmosphere, due mainly to human activities."[16] In order to meet Canada's GHG reduction targets, Canada monitors six gases (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), perfluerocarbons (PFCs), and hydrofluorocarbons (HFCs)).[17] Emissions from fossil fuel combustion for transportation include CO_2 (94.7%), N_2O (5.1%) and CH_4 (0.3%).[18]

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15 Environment Canada, *Air Pollutant Emissions: Glossary*, http://www.ec.gc.ca/pdb/cac/cac_gloss_e.cfm,2007-03-09.

16 Environment Canada, *Greenhouse Gas Sources and Sinks: Frequently Asked Questions*, http://www.ec.gc.ca/pdb/ghg/about/FAQ_e.cfm,2006-11-18.

17 Environment Canada, *Information on Greenhouse Gas Sources and Sinks: Monitoring, Accounting and Reporting on Greenhouse Gases*, http://www.ec.gc.ca/pdb/ghg/ghg_home_e.cfm, 2008-12-11.

18 Environment Canada, *Information on Greenhouse Gas Sources and Sinks: Factsheet 3 – Transportation*: 1990-2000, http://www.ec.gc.ca/pdb/ghg/inventory_report/1990_00_factsheet/fs3_e.cfm, 2009-02-04.

Mobility Management (MM):
Mobility Management is the European term used to describe activities that promote sustainable transportation and reduce or manage demand for auto travel.[19] It is used in essentially the same context as **TDM**.

Mode share, Mode split, and Mode shift
A transportation mode describes a type or means of transportation. The number of modes differs for different types of analysis, organizations, or areas. Often, transportation models or analysis will take into account only one mode (auto) or two modes (auto and transit). For other models or types of analysis, the list of modes can be very extensive, with a number of sub categories. Some of the modes used for analysis include:

- Auto:
  - Drive alone (also known as single occupancy vehicle (SOV));
  - Auto as driver;
  - Auto as passenger;
  - Auto with others from the same household;
  - Auto with others from different households;
  - Taxi; and,
  - Motorcycle.
- Transit:
  - Bus;
  - Light rail;
  - Heavy rail (subway);
  - Commuter Rail; and,
  - Ferry.
- Active transport (modes of transport that are human-powered):
  - Walk;
  - Cycle;
  - Skateboard / rollerblade; and,
  - Wheeling (wheelchair, scooter).

Some trips may include two or more modes. For example, a traveller may walk to a bus stop or drive to a park-and-ride.

Three different terms are used to describe the relationship between the different modes. These are mode share, mode split, and mode shift.

1. **Mode share** describes the percentage of all travellers using that mode. This is usually used when there are multiple modes and considers auto, transit, cycling, and walking;
2. **Mode split** normally describes the ratio of travellers between two or more modes (often auto and transit; although this also can be applied to other modal combinations) rather than among all travel modes; and,

[19] European Platform on Mobility Management, General Information, http://www.epomm.org/index.phtml?Main_ID=820

3. **Mode shift** describes a change in travel patterns of a percentage of travellers from one mode to another over a given period of time. For example, if 100 of 100 employees in an office complex drove to work before the TDM initiative and 15 of 100 of those employees walked to work after the TDM initiative, the initiative has resulted in a mode shift of 15% from auto to walk mode.

Mode share, split, and shift should always be qualified (which mode (share); which mode compared to which mode(s) (split); which original mode(s) to which new mode(s) (shift))

Mode Choice
Mode choice is the third of the four steps in the four-step travel demand forecasting process. Mode choice analysis is the splitting of total trips between two zones by each of the modes available to make the trip.

Objectives, Indicators, and Measures
To evaluate the effectiveness of a program (specifically for a TDM program in the ***Canadian Guidelines for the Measurement of TDM Initiatives***, but also widely applicable to other types of investment), a program must first set objectives, identify indicators, and then choose measures to evaluate success based on those indicators:

- **Objectives** are the overall goals of the program. They should reflect the purpose of the organization and the intention of funding bodies;
- **Indicators** describe the desired output or outcome based on the objectives set for the program. It describes an attribute of the programs performance; and,
- **Measures** are the means used to quantify or qualify the indicator. Measures can be quantifiable values such as percentages or rates, or they can be clearly defined qualitative values such as high, medium, low. Measures must be monitored at regular intervals to show changes over time.

For a TDM program, an example objective may be to lower travel by car with an indicator of reducing VKT by 5% a year. The measure would be the year-to-year change in VKT.

Outputs versus Outcomes
Programs have two types of results: outputs and outcomes.

- **Outputs** are the activities and processes of the program itself. They are the actions taken to achieve the overall goals of the program. Outputs include measures like the number of customers served or the number of brochures distributed. Outputs are necessary to achieving outcomes; and,
- **Outcomes** are the results of the program that will be measured against the overall goals. These may include emissions reduced, mode shift, or VKT reduced.

Performance Indicators
Describes an attribute of a transportation system's performance – an example might be planning level of service of the transportation system. The indicator is not the same as, but rather should correspond to, an objective or goal (e.g., maintain level of service "C"). It must describe clearly and precisely a desired output or outcome (e.g., 'roadways operating at volume to capacity ratio of 0.85' as opposed to 'acceptable level of service'), and must be usable for documenting and monitoring progress towards the goal. The indicator is intended to enable a common, systematic ranking and comparison among competing projects; therefore, it must be usable for all potential projects or locations to be measured.

Person-Trip
A person-trip is a movement between one origin and one destination by a single person for a single purpose, using any mode or combination of modes. One person travelling by car between home and work is one person trip. Two people in one car travelling from home to work equates to two person trips.

This definition describes both ends of a trip. It should be noted that some measures also consider the person-trip, or vehicle-trip (see below) in terms of the trip end to or from that site (i.e., the other end of the trip is not important): this is the case when considering trip generation rates to/from a specific site.

Surveys
Surveys ask individual respondents to provide data about their own actions and experiences directly. An **Origin-Destination Survey**, also known as a revealed preference or travel behaviour survey, quantifies people's travel patterns by asking them to describe their actual travel activity (i.e., what they actually did) over a specified period of time. Information typically is gathered about the trip's origin, destination, purpose, mode(s) used, start time and end time.

Sustainable Transportation
Transportation that reduces resource use, including energy, while still meeting the transportation needs of the current population.

Transportation Analysis Zones (TAZ)
Relatively homogenous areas of land use and activity with clear boundaries used as a basis for travel demand modelling.

Trip
Travel, starting at one location and ending at another. A trip can be made by an individual (see ***Person-Trip***) or by a vehicle (vehicle-trip).

Trip Generation
Trip generation is the first step in the four-step modelling process. This step takes information about land use and estimates the number of trips (either Person-Trips or vehicle-trips) generated by that land use within a given area (see ***TAZ***) in a given time period. Trips generated by a TAZ are either produced (start within the TAZ) or attracted (end within the TAZ).

Trip Distribution
Trip distribution is the second step in the four-step modelling process. Distribution links each trip production to a trip attraction, either in the same TAZ, a different TAZ, or external to the network.

Trip Assignment
Trip assignment is the final step in the four-step modelling process. It determines the optimal routing for each trip between the origin TAZ and destination TAZ. The result of trip assignment is a total volume of trips on a given link of the transportation network (normally transit, vehicle, or goods).

Transportation Demand Measurement (TDM)
TDM influences the demand for travel by using education, promotion and outreach to change personal attitudes and awareness or by applying travel incentives and disincentives that make one travel option more attractive (or less attractive) than others. TDM policies and programs are typically intended to:

- Shift private automobile use to other modes;
- Disperse travel from times of peak demand; and,
- Eliminate travel all together.

Vehicle Kilometres Travelled (VKT)
VKT, or Vehicle Miles Travelled (VMT) is a fundamental measure of vehicle activity, or usage – in this context, the reference is to the activity of personal vehicles. VKT measures the distance travelled by autos in a given time period in a given area. It reflects both the total number of vehicle trips and the distance of those vehicle trips (hence reductions in auto trips and auto trip distance will both reduce VKT).

Changes in VKT are directly linked to changes in GHG and CAC emissions, as well as fuel use and other indicators.