Spruce Grove City Centre Area Redevelopment Plan

INFRASTRUCTURE ASSESSMENT Background Report #1

August 2018

Prepared for the City of Spruce Grove, Alberta

Prepared by Cushing Terrell Architecture Inc.

In collaboration with TeckEra Civil Engineering Consultants and Balon Engineering & Consulting Corp.

City Centre ARP

Infrastructure Assessment Background Report

CUSHING TERRELL
ARCHITECTURE INC.

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1.0 INTRODUCTION

1.1 SCOPE OF ASSESSMENT

The City of Spruce Grove engaged Cushing Terrell Architecture Inc. (CT) to complete an assessment of the infrastructure within the designated City Centre Study Area as part of the City Centre Area Redevelopment Plan.

The purpose of this report is to assess the current City Centre infrastructure, evaluate the system capacities, service life and provide recommended upgrades and where required what the estimated costs could be for associated improvements/upgrades. These upgrades will increase the level of service of the City Centre for current and future development.

The scope of this report is as follows:

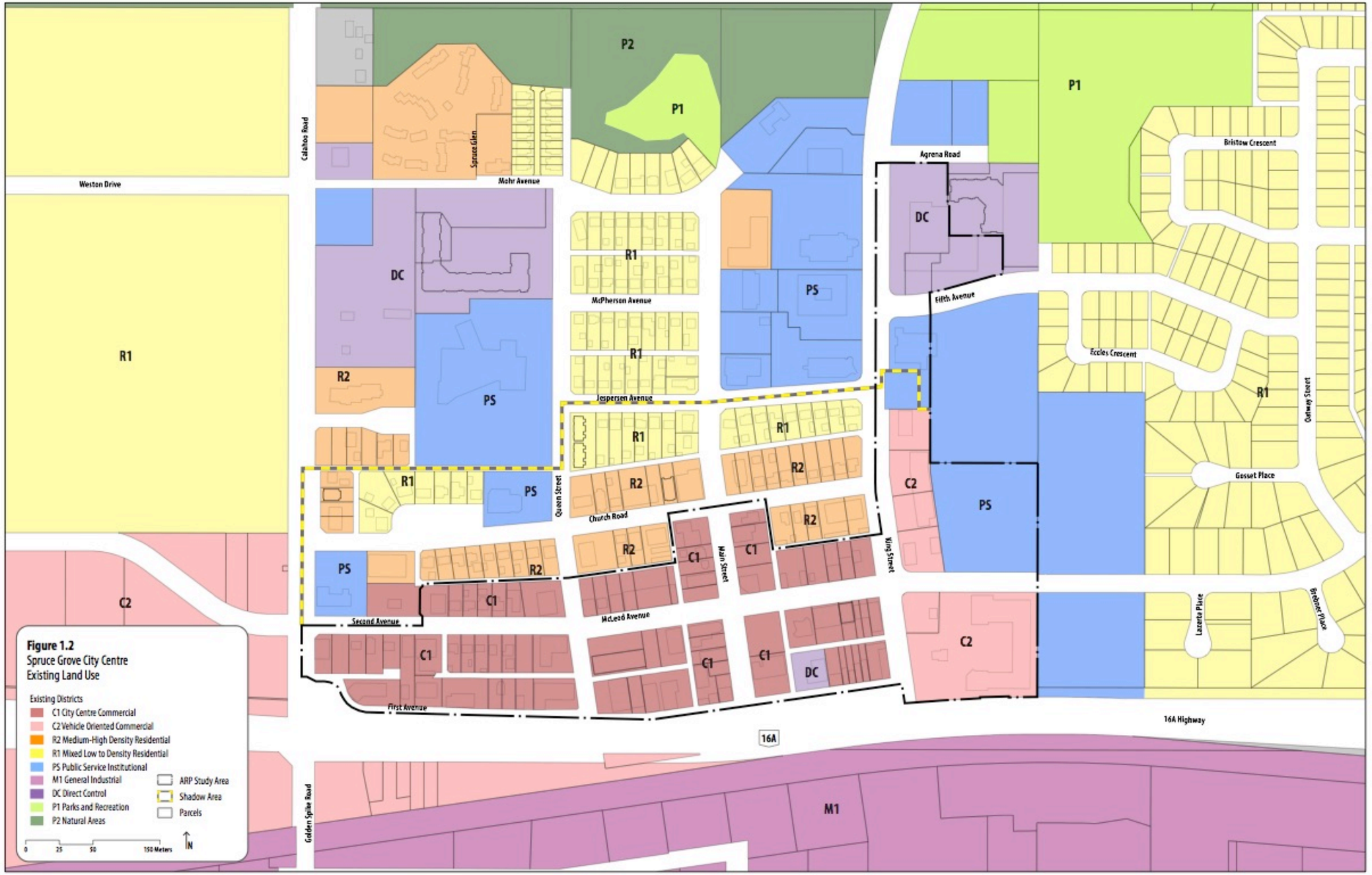
- Review the existing sanitary collection system, water distribution and storm water collection;
- Review existing street lighting;
- Review existing traffic patterns, traffic control, bike access, pedestrian traffic patterns and roadways;
- Evaluate each current systems performances, condition and capacities for current and future City Centre needs; and
- Provide recommendations for replacement schedule with costs, based on the present day conditions of the current infrastructure.

1.2 ASSESSMENT AREA AND LAND USE

The City Centre comprises of the Study Area covered from Calahoo Road to east of King Street and First Avenue to McLeod Avenue with and area from extending north on King Street to Calahoo Road. **Figure 1.1** shows the City Centre Study Area project boundary. In addition to the primary Study Area, consideration has also been given, where applicable to a Shadow Area that surrounds the Study Area, with the understanding that the assessment of the infrastructure in the Study Area does not function in isolation of the lands immediately adjacent.

The current City Centre is primarily zoned C1: City Centre Commercial. As the City overall continues to grow, a focus on higher density development residential and mixed-use retail/commercial will become more desirable in the City Centre Study Area. The City Centre currently does not reflect this type of density. Upon analyzing the current infrastructure, recommendations will emphasize higher density development. **Figure 1.2** illustrates the existing land use.


Weston Drive
Calahoo Road
Spruce Glen
Mohr Avenue
McPherson Avenue
Jespersen Avenue
Queen Street
Church Road
Main Street
King Street
Agrena Road
Fifth Avenue
Bristow Crescent
Eccles Crescent
Oatway Street
Gosset Place
Lazerte Place
Brehmer Place
Second Avenue
McLeod Avenue
First Avenue
16A
16A Highway
Golden Spike Road
Figure 1.1
Spruce Grove City Centre
ARP Study Areas
ARP Study Area
Shadow Study Area
Parcels
0
25
50
150 Meters
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Weston Drive
Calahoo Road
Spruce Glen
Mohr Avenue
McPherson Avenue
Jespersen Avenue
Queen Street
Church Road
Second Avenue
First Avenue
McLeod Avenue
Main Street
King Street
Agrena Road
Fifth Avenue
Eccles Crescent
Bristow Crescent
Gosset Place
Ostrem Street
Lazerte Place
Brabner Place
16A
16A Highway
Golden Spike Road
R1
R2
C1
C2
DC
PS
P1
P2
M1
Figure 1.2
Spruce Grove City Centre
Existing Land Use
Existing Districts
C1 City Centre Commercial
C2 Vehicle Oriented Commercial
R2 Medium-High Density Residential
R1 Mixed Low to Density Residential
PS Public Service Institutional
M1 General Industrial
DC Direct Control
P1 Parks and Recreation
P2 Natural Areas
ARP Study Area
Shadow Area
Parcels
0
25
50
150 Meters
N

1.3 DESIGN LIFE OF INFRASTRUCTURE COMPONENTS

Several agencies (National Research Council, NRC) and institutions (Universities) across Canada have published documentation respecting life expectancy of infrastructure components. Although every case is specific and affected by quality of installation, soil conditions and service conditions, the following highlights typical design life values used:

Pumping Stations:

- Water pumping stations — 25 – 50 years;
- Sewage lift stations — 25 – 50 years;
- Pumping equipment — 10 – 15 years; and
- Control systems — 5 – 10 years.

Gravity and Pressure Piping (sewer/water) — 50 – 75 years.

Culverts — 25 – 50 years.

Reservoirs and Ponds (stormwater) — 50 years.

Roads

- Pavement structures — 20 years (plus patching and sealing)
- Concrete Works (curbs/sidewalks) — 25 years (plus patching and sealing)

1.4 REFERENCES

The following references were utilized in the preparation of this assessment:

- City of Spruce Grove – Municipal Development Standards, 2015;
- City of Spruce Grove – Sanitary Sewer Master Plan
- City of Spruce grove – Downtown Core Water System Technical Review, 2015;
- City of Spruce Grove – Stormwater Master Plan Update, 2015;

2.0 SANITARY SEWER CONVEYANCE SYSTEM

2.1 EXISTING SEWAGE WORKS

The City of Spruce Grove City Centre's sanitary collection system is comprised mainly of 200mm vitrified clay tile (VCT) installed in 1957 & 1972. The existing City Centre area collects wastewater though the 200mm sanitary mains and generally slopes north, where it outlets into a 375mm main on King Street.

Figure 2.1 shows the existing system within the City Centre Study Area.

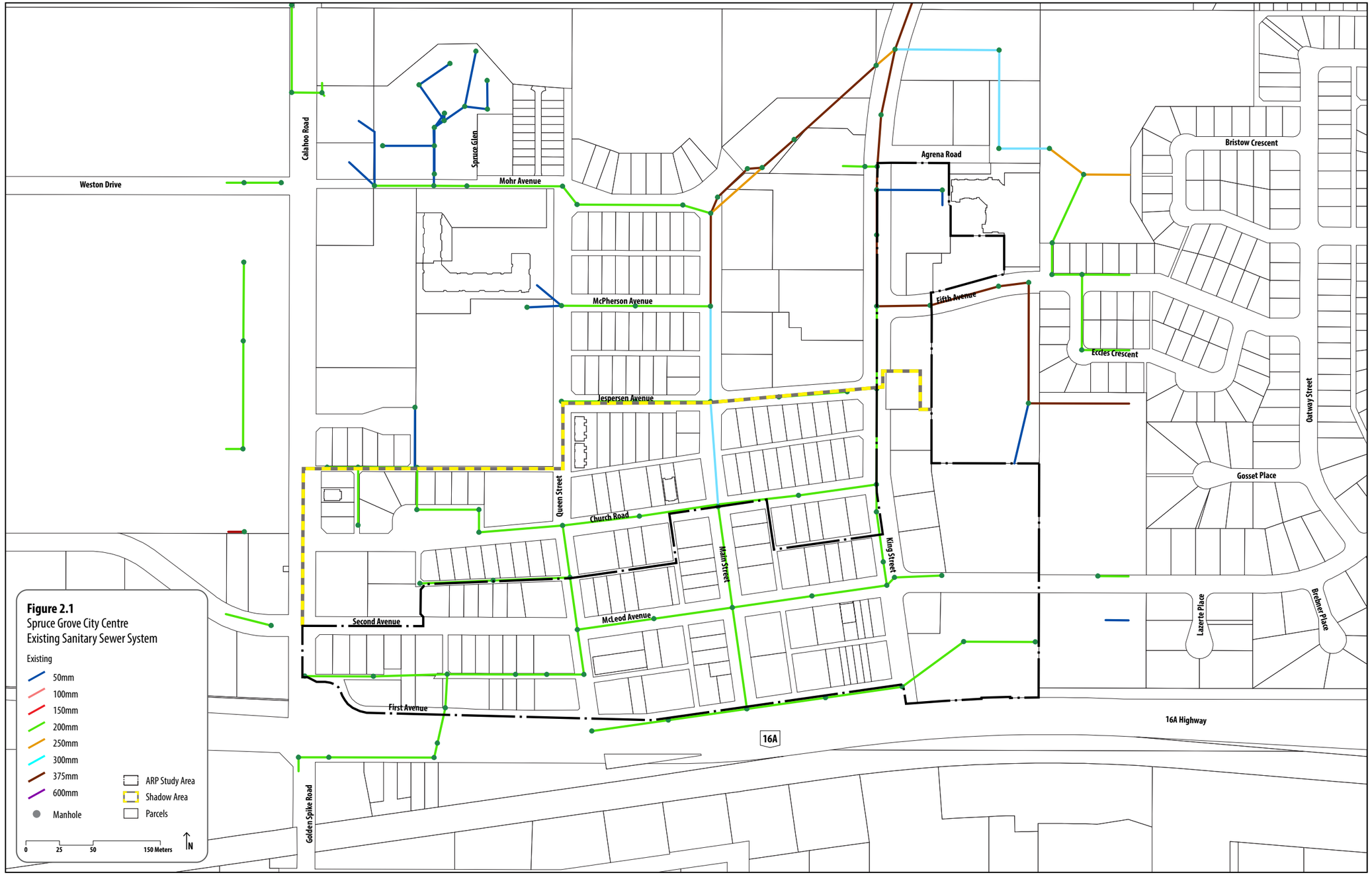
2.2 CITY CENTRE DESIGN CAPACITIES

In 2012, a Sanitary Master Plan was prepared for the community in which the capacities of the entire City system were evaluated.

The design criteria used for this ARP study are taken from the City of Spruce Grove's Development Standards, 2015, along with the Sanitary Master Plan, 2012, and are defined as follows:

- Domestic Average Dry-Weather Flow (ADWF): 280 L/c/d
- Commercial Average Dry-Weather Flow per area: 0.16 ADWF/ha
- Industrial Average Dry-Weather Flow (ADWF): 0.13 ADWF/ha
- Residential area equivalent population: 60 p/ha
- Commercial area equivalent population: 48 p/ha
- Industrial area equivalent population: 39 p/ha
- Harmon Peaking Factor: PF = (1+(14/(4+0.5p)))
- Normal Infiltration:0.28 L/s/ha

A sanitary model was also completed within the 2012 Sanitary Master plan. The model was based on the existing conditions and the above criteria, the results from this model forms the basis of the system assessment.


Calahoo Road
Spruce Glen
Weston Drive
Mohr Avenue
McPherson Avenue
Jespersen Avenue
Queen Street
Church Road
Main Street
King Street
Agrena Road
Fifth Avenue
Bristow Crescent
Eccles Crescent
Oatway Street
Gosset Place
Lazerte Place
Brabner Place
Second Avenue
McLeod Avenue
First Avenue
16A
16A Highway
Golden Spike Road
Figure 2.1
Spruce Grove City Centre
Existing Sanitary Sewer System
Existing
50mm
100mm
150mm
200mm
250mm
300mm
375mm
600mm
Manhole
ARP Study Area
Shadow Area
Parcels
0
25
50
150 Meters
N

2.3 SANITARY SYSTEM ASSESSMENT

Three events were simulated during the development of the Sanitary Master Plan to evaluate the capacity of the existing sewer system. These events are the 1:5 year, 1:25 year and 1:100 (24 hour duration) storms.

The results for each modeled event indicate the sanitary collection system has adequate capacity within the City Centre for each of the 3 events.

2.4 EXISTING SYSTEM SERVICE LIFE

As stated above, the current collection system is primarily vitrified clay tile (VCT) installed in 1957 and 1972. This VCT material has a long service life, but based on the installation timeframe the material is reaching this recommended service life. VCT is subject to cracking due to pressures and soil movement and is no longer widely used.

2.5 RECOMMENDED SYSTEM UPGRADES

In areas where full street rehabilitation is planned or watermain upgrades are taking place the sanitary sewer should be upgraded at this time from the VCT material to polyvinyl chloride (PVC). Any street that is not planned to have upgrades should be further studied to ensure no cracks or breaks are present. This study will be comprised of CCTV inspections. Section 2.6 provides a breakdown per street of the estimated cost per street for sanitary sewer replacement.

2.6 SANITARY SEWER ESTIMATED COST

The estimated cost provided does not take into account any required street replacement which would fall under the streetscape cost estimates as part of the ARP. It is assumed that all sanitary improvements are to correspond with either the streetscape or water system improvements. Unit costs include 15% for Engineering and an additional 20% for contingency.

Table 2.1: Estimated Costs of the Sanitary Sewer Improvements

STREET	ITEM	LENGTH (m)	UNIT COST ($/m)	TOTAL ($)
McLeod Avenue	Remove/Replace 200mm VCT with 200mm PVC	349	$600/m	$209,400.00
First Avenue	Remove/Replace 200mm VCT with 200mm PVC	349	$600/m	$209,400.00
Church Road	Remove/Replace 200mm VCT with 200mm PVC	447	$600/m	$268,200.00
King Street	Remove/Replace 200mm VCT with 200mm PVC	114	$600/m	$ 68,400.00
Main Street	Remove/Replace 200mm VCT with 200mm PVC	228	$600/m	$136,800.00
Queen Street	Remove/Replace 200mm VCT with 200mm PVC	168	$600/m	$100,800.00
Jesperson Avenue	Remove/Replace 200mm VCT with 200mm PVC	319	$600/m	$203,400.00
Andrew Crescent	Remove/Replace 200mm VCT with 200mm PVC	142	$600/m	$ 85,200.00
Alley (1st and 2nd Avenue)	Remove/Replace 200mm VCT with 200mm PVC	310	$600/m	$186,000.00
Alley (North of Andrew Crescent)	Remove/Replace 200mm VCT with 200mm PVC	100	$600/m	$ 60,00.00
Alley (West of Andrew Crescent)	Remove/Replace 200mm VCT with 200mm PVC	65	$600/m	$ 39,000.00
			TOTAL	$1,566,600.00

3.0 WATER DISTRIBUTION SYSTEM

3.1 EXISTING WATER DISTRIBUTION

Spruce Grove's water is sourced from the North Saskatchewan River, where it is treated, and supplied by EPCOR. The water system for the City of Spruce Grove is comprised of two pressure zones. The City Centre is supplied water through Zone 1 and will be the focus of this infrastructure assessment.

The City Centre's water distribution network is includes watermains ranging from 150mm to 300mm diameter and are comprised mainly of polyvinylchloride (PVC) and asbestos cement (AC). It is recommended through this assessment that all AC (asbestos cement) pipes be replaced with PVC (polyvinylchloride) pipes.

Figures 3.1 illustrates the existing City Centre Study Area and Shadow Study Area water distribution network.

Calahoo Road
Spruce Glen
Weston Drive
Mohr Avenue
McPherson Avenue
Jespersen Avenue
Queen Street
Church Road
Main Street
King Street
Agrena Road
Fifth Avenue
Bristow Crescent
Eccles Crescent
Oatway Street
Gosset Place
Lazerte Place
Brabner Place
McLeod Avenue
Second Avenue
First Avenue
16A
16A Highway
Golden Spike Road

Figure 3.1
Spruce Grove City Centre
Existing Water System

Existing
- 50mm
- 100mm
- 150mm
- 200mm
- 250mm
- 300mm
- 375mm
- 600mm
- Hydrant

- ARP Study Area
- Shadow Area
- Parcels

0 25 50 150 Meters

N

3.2 CITY CENTRE DESIGN CAPACITIES

The water distribution system assessment is based on the technical review completed for the City Centre. The criteria for the ARP Assessment is as follows:

- Water consumption rate: 0.20 L/s/ha
- Average Daily Demand (ADD): 5.30 L/s
- Peak Day Demand (PDD): 2.0 x ADD: 10.60 L/s
- Peak Hour Demand (PHD): 3.0 x ADD: 15.91 L/s
- Fire Flow: Commercial, Institutional Area: 300.0 L/s
- Minimum system pressure: 140 kPa (20 psi)
- Minimum pressure at hydrant: 140 kPa (20 psi)
- Minimum water distribution pipe diameters:
    - Commercial, Industrial and Institutional: 250mm
- Pipe velocity: The minimum velocity for watermains 0.6 m/s and 1.5 m/s for water mains and 3.0 m/s under normal operation and fire flow condition is the maximum.
- Roughness coefficient (c-value) for the PVC pipe is 120 for use in this hydraulic model
- Hydrant spacing: Commercial, industrial and Institutional: 120m (60m radius)

Regardless of future redevelopment densities, results from the water model determined the existing systems **does not have the capacity** to provide adequate fire flow, due to the undersized distribution network.

3.3 EXISTING DISTRIBUTION SYSTEM

The current City Centre water distribution system is comprised of pipe sizes ranging from 150mm to 300mm of PVC and AC pipe. The system was originally installed in 1957, which was comprised of AC pipe. AC pipe has a recommended service life of 40 to 60 years. The life expectancy of this material has therefore been reached throughout the City Centre and will need to be replaced.

3.4 EXISTING FIRE FLOW

The design fire flow is based on the City of Spruce Grove's Municipal Development Standards and is as follows:

- Commercial, Institutional Area: 300 L/s; and

The existing Zone 1 fire pump has a capacity of 265 L/s as stated in the Downtown Core Water System Assessment completed by Select Engineering. For this analysis, it was assumed the Zone 1 fire pump provides the recommended fire flow to the City Centre Study Area.

3.5 PROJECTED CITY CENTRE STUDY AREA WATER DEMAND

The water demand for the Business Improvement Area is based on the assumption made within the 2016 Downtown Core Water System Technical Review. The assumption is based on the development of the City Centre Study Area into an area primarily consisting of mixed-use commercial/institutional/multi-family residential uses, or a combination thereof. The demand for these uses is 0.20 L/s/ha. The following table illustrates the demand required at each node.

Table 3.1: Projected Water Demand

Junction Node	Water Consumption L/s/ha	Area, ha	ADD (L/s)	MDD (L/s)	PHD (L/s)
J-4	0.2	2.18	0.436	0.872	1.308
J-5	0.2	1.99	0.398	0.796	1.194
J-6	0.2	1.91	0.382	0.764	1.146
J-7	0.2	3.50	0.700	1.400	2.100
J-34	0.2	3.16	0.632	1.264	1.896
J-35	0.2	3.20	0.640	1.280	1.920
J-40	0.2	1.89	0.378	0.756	1.134
J-41	0.2	2.10	0.420	0.840	1.260
J-47	0.2	2.26	0.452	0.904	1.356
J-253	0.2	1.81	0.362	0.724	1.086
J-345	0.2	2.51	0.502	1.004	1.506
TOTAL			5.302	10.604	15.906

3.6 SYSTEM ASSESSMENT

The existing system does not meet the requirements for demand and fire flow based on the above criteria. Recommended upgrades to the distribution system are outlined for the City Centre Study Area and Shadow Study Area and can be found in Section 3.7.

3.6.1 *Maximum Day Demand plus Fire Flow*

The results from the model analysis show the existing system does not have the capacity to supply the required fire flow to the City Centre Study Area or Shadow Study area. An undersized fire pump and distribution network are the main causes for the lack of capacity in the system. The results of the scenario can be found in **Appendix A**.

3.6.2 *Maximum Day Demand*

The results from the model in the table show the system meets the recommended minimum pressures with the maximum day demand scenario. Results of the model for this scenario can be found in **Appendix A**.

Table 3.2: Maximum Day Projected Water Demand

Condition	Minimum System Pressure (kPa)	Node	Maximum System Pressure (kPa)	Node
MDD	**435.40**	**J-171**	**539.00**	**J-35**

3.6.3 *Peak Hour Demand*

The results from the Peak Hour Demand analysis in the table show the system meets the recommended minimum pressures. Results of the model for this scenario can be found in **Appendix A**.

Table 3.3: Peak Hour Projected Water Demand

Condition	Minimum System Pressure (kPa)	Node	Maximum System Pressure (kPa)	Node
MDD	**349.70**	**J-171**	**453.00**	**J-35**

3.7 WATER STORAGE

The Regional Water Customers Group has recommended that all storage reservoirs of its members be designed to store 2 days of ADD plus Fire Flow Storage. Currently the Zone 1 reservoir has a capacity of 23,000 m^3 and the Zone 2 reservoir has a capacity of 8,619 m^3.

Water storage for the fire suppression (300 L/s for 4.0 hours) and emergency storage (2 x ADD) for Zone 1 and 2 were assessed within the Water Master Plan Update in 2015. This analysis determined the water storage volume of zone 1 to be adequate to the year 2030, while Zone 2 capacity was recommended to be increased by 2018.

Based on the this study the zone 1 reservoir does not require an increased capacity at this time.

3.8 RECOMMENDED SYSTEM UPGRADES

Based on the results of the water distribution system assessment, the following improvements are recommended to meet the future City Centre demands.

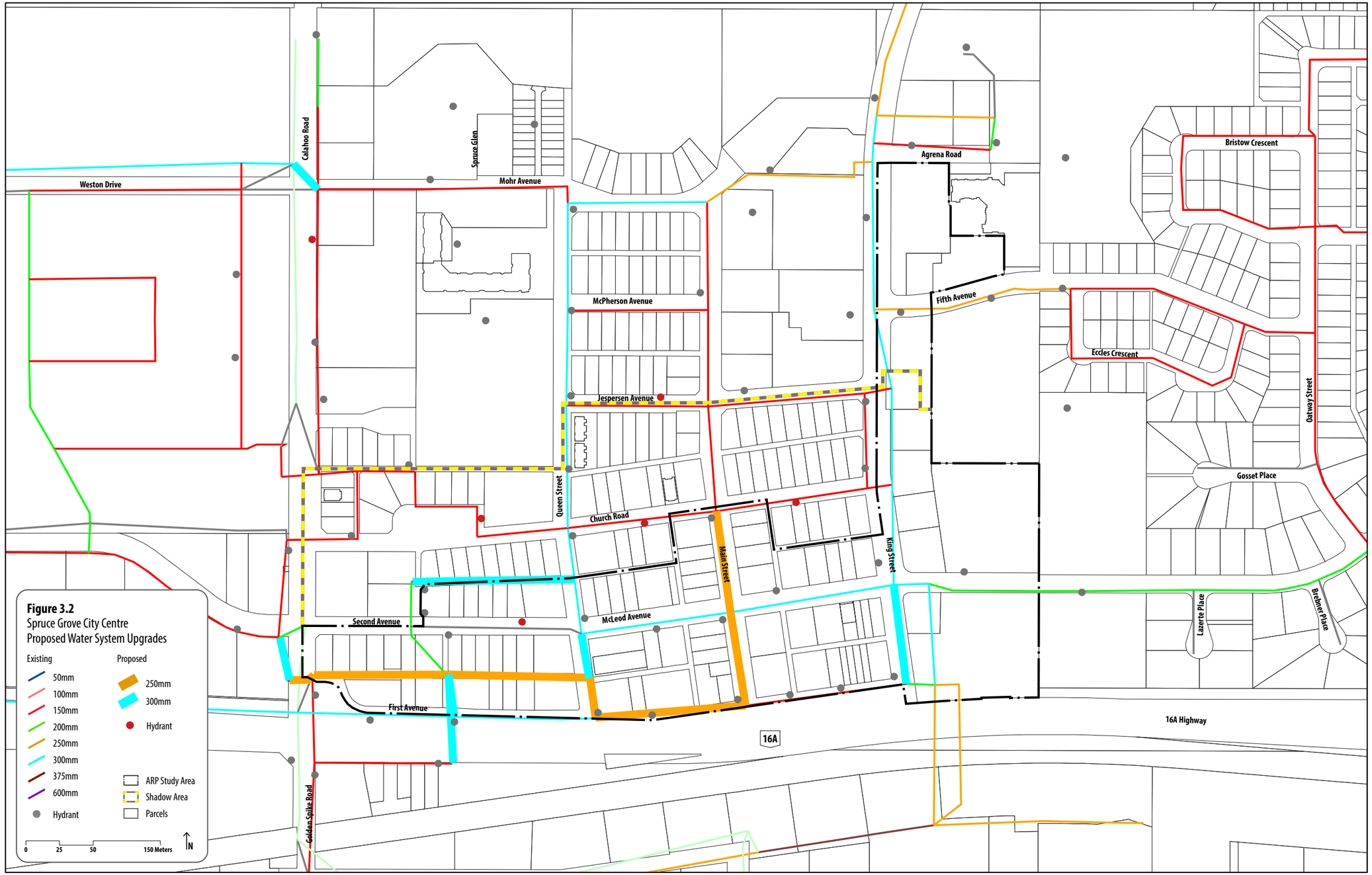
City Centre Study Area recommended upgrades as part of the ARP should include:

1. Fire pump is required to meet the required 300 L/s as per the PPD plus fire flow;
2. Add one 300mm diameter tie in connection to the existing 600mm watermain, north of Mohr Ave. Provide a 300mm diameter tee connection to allow for future extension to the south to service potential developments.
3. Upgrade existing 150mm watermain north of Highway 16A and along the east of Queen St. to 300mm;
4. Upgrade existing 150mm watermain from Queen St. west within the alley between McLeod Ave and First Avenue to 300mm to include south connection midblock south to First Ave;
5. Upgrade existing 150mm watermain along Calahoo Road from First Ave to the north right-of-way of McLeod Avenue;
6. Upgrade 150mm to 300mm mid-block 1st Ave North to the alley between Calahoo Road and King Street;
7. Upgrade 150mm to 300mm alley north of McLeod Avenue from Queen Street;
8. Upgrade all existing 150mm diameter watermain within the City Centre to 250mm diameter pipe; and
9. Install additional two hydrant to provide the required hydrant coverage to meet the fire flow protection within the City Centre Study Area.

In the Shadow Study Area, the recommended upgrades include the following:

1. Install two additional hydrants to provide the required hydrant coverage to meet the fire flow protection within the Shadow Study Area;
2. Replace existing 150mm with 250mm PVC along Church Road from King Street to Calahoo Road; and
3. Replace all Asbestos Cement (AC) pipes with equivalent size PVC. Minimum diameter to be 250mm.

Figures 3.2 & 3.3 illustrate the recommended upgrades to the distribution system for both the City Centre Study Area as well as the Shadow Study Area. **Figure 3.4** specifies the recommended additional hydrants for the ARP area.


Weston Drive
Calahoo Road
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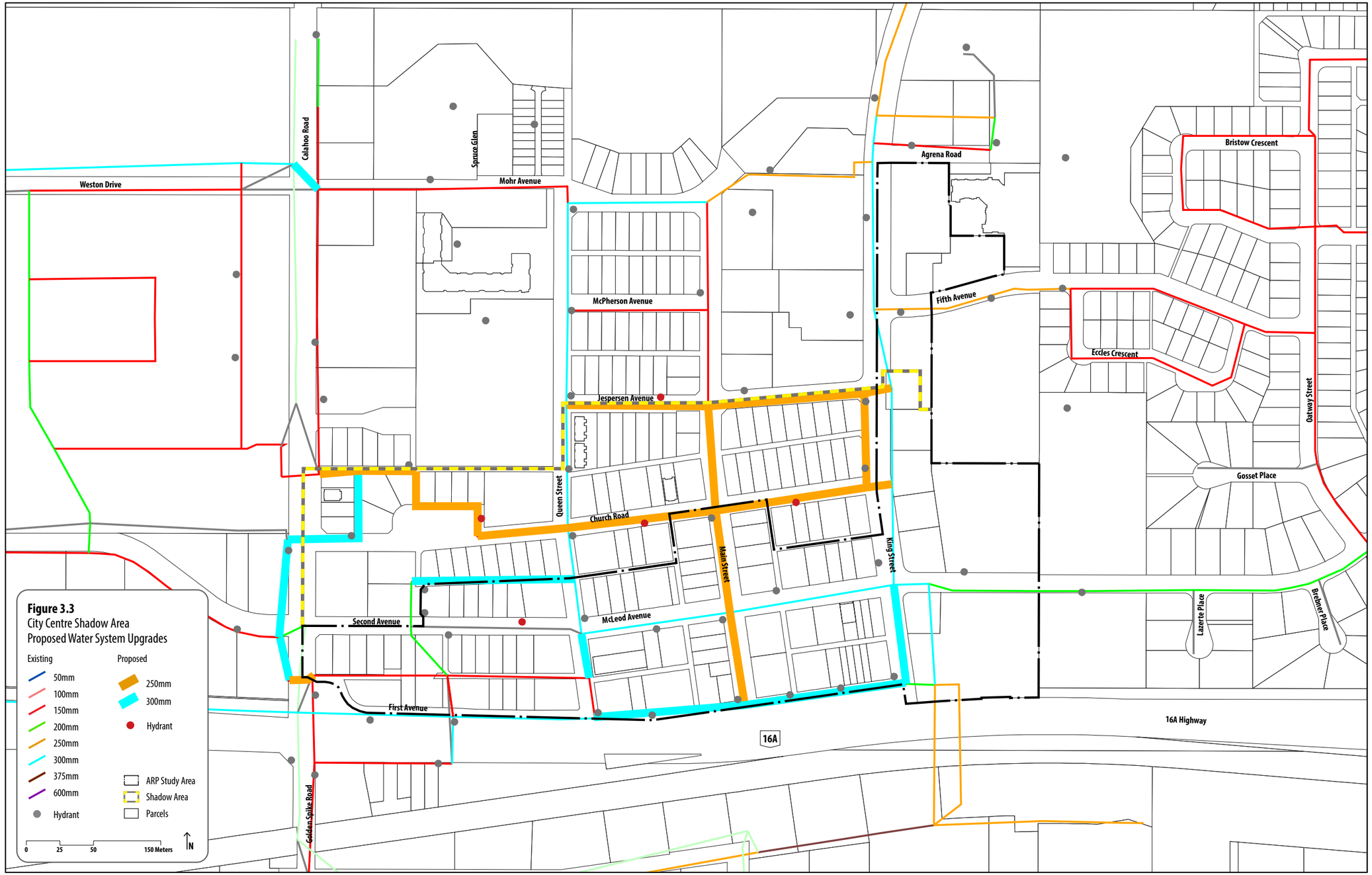
Jespersen Avenue
Queen Street
Church Road
Main Street
King Street
Second Avenue
McLeod Avenue
First Avenue
Golden Spike Road
16A
Agrena Road
Fifth Avenue
Bristow Crescent
Eccles Crescent
Oatway Street
Gosset Place
Lazerte Place
Brabner Place
16A Highway
Figure 3.2
Spruce Grove City Centre
Proposed Water System Upgrades
Existing
50mm
100mm
150mm
200mm
250mm
300mm
375mm
600mm
Hydrant
Proposed
250mm
300mm
Hydrant
ARP Study Area
Shadow Area
Parcels
0
25
50
150 Meters
N


Calahoo Road
Spruce Glen
Weston Drive
Mohr Avenue
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Queen Street
Church Road
Main Street
King Street
Second Avenue
McLeod Avenue
First Avenue
Golden Spike Road
16A
Agrena Road
Fifth Avenue
Bristow Crescent
Eccles Crescent
Oatway Street
Gosset Place
Lazerte Place
Brabner Place
16A Highway
Figure 3.3
City Centre Shadow Area
Proposed Water System Upgrades
Existing
50mm
100mm
150mm
200mm
250mm
300mm
375mm
600mm
Hydrant
Proposed
250mm
300mm
Hydrant
ARP Study Area
Shadow Area
Parcels
0
25
50
150 Meters
N

Figure 3.4
Spruce Grove City Centre
Water System Hydrants

3.9 COST ESTIMATE

The cost estimate below summarizes the recommended upgrades for both the City Centre and Shadow Study Areas. The cost associated with the water supply improvements take street repair into consideration. Unit costs include 15% for Engineering and an additional 20% for contingency.

Table 3.4: Estimated Costs of the Water System Improvements

STREET	ITEM	Units	UNIT COST	TOTAL ($)
Existing Fire Pump	Upgrade existing fire pump to 300 L/s capacity	1	$200,000.00	$200,000.00
Mohr Avenue	300mm tie in connection to existing 600mm watermain along Calahoo Road	1	$250,000.00	$250,000.00
Calahoo Road	Remove/Replace 150mm AC with 300mm PVC	282m	$1,450/m	$408,900.00
McLeod Avenue	Install Additional Hydrant(s)	1	$25,000/ea	$25,000.00
First Avenue	Remove/Replace 150mm AC with 300mm PVC Install Additional Hydrant(s)	349m 1	$1,450/m $25,000/ea	$121,801.00 $ 25,000.00
Church Road	Remove/Replace 150mm AC with 250mm PVC Install Additional Hydrant(s)	442m 2	$1,250/m $25,000/ea	$552,500.00 $ 50,000.00
King Street	Remove/Replace 150mm AC with 300mm PVC	104m	$1,450/m	$150,800.00
Main Street	Remove/Replace 150mm AC with 250mm PVC	350m	$1,250/m	$437,500.00
Queen Street	No improvements required			
Jesperson Avenue	Remove/Replace 150mm AC with 250mm PVC	332m	$1,250/m	$415,000.00
Andrew Crescent	Remove/Replace 150mm AC with 250mm PVC Install Additional Hydrant(s)	142m 1	$1,250/m $25,000/ea	$177,500.00 $25,000.00
Alley (1st and 2nd Avenue)	Remove/Replace 150mm AC with 300mm PVC	179m	$1,450/m	$259,550.00
Alley (North of Andrew Crescent)	Remove/Replace 150mm AC with 250mm PVC	100m	$1,250/m	$125,000.00
Alley (West of Andrew Crescent)	Remove/Replace 150mm AC with 250mm PVC	71m	$1,250/m	$88,750.00
			TOTAL	$3,312,301.00

The total for the recommended water system improvements is estimated to be **$3,312,301.00.** Each listed improvement can be upgraded on a street-by-street basis except for the pump upgrade, tie connection at Mohr Avenue and the upgrades to Calahoo Road. These improvements are necessary to boost the system capacity.

4.0 STORM DRAINAGE SYSTEM

4.1 EXISTING STORM COLLECTION

The City Centre stormwater collection system falls within the King Street Basin, which is in the east central portion of the City. Other neighbourhoods included in the King Street Basin include Linkside, Stoneshire, Fieldstone, Woodhaven, Brookwood, Broxton Park and a Portion of Hillsdowns.

The King Street Basin is approximately 485 ha. The minor system consists 29 km of pipe ranging from 300mm to 1,800mm and 9 stormwater management facilities (SWMF). The largest SWMF is the King Street Regional storm water facility north of Highway 16 and west of Century Road. The major system outlets to a ditch running across the Links Golf Course to Highway 16. The stormwater from the basin is conveyed through the outfall, which consists of 5-1200mm culverts and 1-900mm culvert. Once the stormwater from the basin is routed through King Street SWMF is released to Dog Creek.

Figure 4.1 illustrates the existing storm water collection system and proposed upgrades.

Calahoo Road
Spruce Glen
Mohr Avenue
Weston Drive
McPherson Avenue
Jespersen Avenue
Agrena Road
Fifth Avenue
Bristow Crescent
Eccles Crescent
Oatway Street
Gosset Place
Queen Street
Church Road
Main Street
King Street
Second Avenue
McLeod Avenue
First Avenue
Lazerte Place
Brabner Place
16A Highway
16A
Golden Spike Road

Figure 4.1
Spruce Grove City Centre
Existing & Proposed Storm Water System

Existing
- 200mm
- 250mm
- 300mm
- 350mm
- 375mm
- 450mm
- 525mm
- 600mm
- 750mm
- 900mm
- 1200mm
- Culverts

- Proposed Additional Catch Basins
- ARP Study Area
- Shadow Area
- Parcels

0 25 50 150 Meters
N

4.2 STORM COLLECTION SYSTEM

4.2.1 *MINOR SYSTEM*

In general, a minor system is designed for drainage to accommodate the runoff, which would occur in relative frequent (e.g. 1:5 year) return period rainfall events. More specifically, the minor system is typically applied to the buried drainage network of local and trunk sewers, inlets and street gutters, which have traditionally provided conveyance of storm water runoff from the road surface.

4.2.2 *MAJOR SYSTEM*

The major system, is typically designed to control flooding to accommodate runoff rates and volumes for a 100-year or more return period rainfall event. For instance, when the rate of storm runoff generated by less frequent, more intense, rainfall events may exceed the capacity of the minor system. Subsequent ponding may occur in depression areas or follow whatever overflow escape route is available. This network of planned or unplanned ponding areas and overland flow routes is referred to as the “major system”

4.3 CITY CENTRE DESIGN CAPACITIES

The design criteria used for this assessment were taken from the City of Spruce Grove’s Development Standards, 2015, along with the Stormwater Master Plan Update, 2015, and are defined as follows:

- Commercial Percent Impervious: 90%
- Impervious Area Manning’s n: 0.015
- Pervious Area Manning’s n: 0.250
- Impervious Depression Storage: 5mm
- Pervious Depression Storage: 2 mm
- Minimum Infiltration Rate: 5 mm/hr
- Maximum Infiltration Rate: 75 mm/hr
- Decay Rate:4/hr
- Drying Time: 7 days

The model from the 2015 Stormwater Master Plan completed using PCSWMM and Horton’s Equation was used to model the infiltration.

From the results of the assessment, the 100 year 4-hour storm model indicates there were multiple locations showing a street ponding depth of 0.150m to 0.300m. At this depth, there is a potential of water cresting the curb and flowing back into adjacent lots. This should be taken into consideration when developing adjacent lots to ensure adequate building grades. McLeod Avenue had one location where ponding was greater than 0.400m. Additional catchment will need to be provided at this area to alleviate this ponding depth.

4.4 STORM SYSTEM ASSESSMENT

4.4.1 *RECOMMENDED SYSTEM UPGRADES*

In order to reduce ponding on McLeod Avenue the Infrastructure Assessment recommends two additional catch basins be installed. This work should correspond with the implementation of the ARP. During the detailed design of the City Centre ARP, the street ponding depth should be reviewed and addressed in detail at this time. No improvements are required to system capacity or due to material service life.

4.5 COST ESTIMATE

The cost of the additional catch basin is estimated to be $30,000. This work should be in conjunction with the future recommended streetscape and infrastructure improvements for the City Centre. At this time, the road cross-section is likely to be altered and existing catch basins may be relocated and additional new catch basins installed into the system. Unit costs include 15% for Engineering and an additional 20% for contingency.

Table 4.1: Estimated Costs of the Storm Water Collection Improvements

STREET	ITEM	Units	UNIT COST	TOTAL ($)
McLeod Avenue	Additional catch Basin	2	$15,000.00	$30,000.00
			TOTAL	$30,000.00

5.0 TRANSPORTATION

Note this assessment is based upon information provided by the City of Spruce Grove, as well as from content provided by the Project Consulting Team from kickoff fieldwork. As of January 15th, 2018 no site visit was performed by the Transportation Engineer.

5.1 HIGHWAY 16A

Highway 16A (60km/h) is the major Arterial/Highway corridor that bounds the southern boundary of the City Centre Study rea. This roadway provides one of the two main means to travel east to the City of Edmonton. The other corridor to the north is Highway 16. Access to and from Highway 16A in the study area is achieved by three access points. The first, King Street flanks the study area on the east and has a full access (traffic can move in all direction) signalized intersection at Highway 16A, including a dual southbound left turn. Traffic volumes were provided for this intersection and are in the magnitude of 30,000 vehicles per day.

The second access point heading west along Highway 16A is at Queen Street. This intersection is restricted to right in and out traffic only. No traffic count data or collision information was provided at this location. It is however assumed that the traffic volumes on Highway 16A would be significant.

Given that Highway 16A is a major highway corridor with three through lanes and a right turn lane; there should be some consideration to closing the access at Queen Street. In order to provide a thorough investigation to support full closure, traffic and collision data should be considered. Channelization of the right in and out access would be another consideration at this location. However, land availability for such a measure is limited due to the close proximity of First Avenue.

The third intersection is located at Calahoo Road and is a full access signalized intersection. This is the primary access point to Highway 16A in the study area and would account for the highest volumes.

No parking is permitted on Highway 16A.

5.2 KING STREET

King Street is assumed to be a major collector roadway with a posted speed limit of 50 km/h. No parking is permitted between Highway 16A and McLeod Avenue. King Street does have a transit route north of McLeod Avenue with a far side stop located on King Street just north of the intersection on McLeod Avenue. The intersection of McLeod and King Street is signalized. Northbound King Street traffic has a designated right turn lane, designated through lane and a thru/left lane. Southbound King Street traffic has a thru/left land and a thru/right lane. This intersection could be converted into a roundabout if desired, however geometry, travel volumes and specific land issues could be problematic as it relates to critical access/egress points for the gas/convenience stations located on the northwest, northeast and southeast corners of the intersection of King Street and McLeod Avenue.

The intersection of King Street with First Avenue presents some geometric challenges which presumably results in operational challenges during peak traffic periods. The primary issue is how close the intersection of First Avenue is to Highway 16A. There is not enough length between the intersections to allow a northbound King Street vehicle to turn left onto First Avenue, while southbound vehicles on King Street are queued up to turn left onto Highway 16A.

These same southbound vehicles on King Street would also block the ability of a vehicle on First Avenue to safely turn left onto King Street. In order to create safer operating conditions at this intersection a raised centre median should be constructed along King Street between Highway 16A and north of First Avenue. It would be desirable to observe traffic during peak hours of the day to confirm assumptions at this intersection.

5.3 MAIN STREET

Main Street is a north/south local street with angle parking on both sides between First Avenue and Church Road. The intersection of First Avenue and Main Street is a tee with traffic on Main Street controlled by a stop sign at which First Avenue has the right-of-way. The intersection of Main Street and McLeod Avenue is a 4 way stop. This intersection may be a candidate for a single-lane roundabout, but for the time being it is recommended that it remain as a 4 way stop to enable or prioritize other potential intersection and streetscape improvements.

5.4 QUEEN STREET

Queen Street is a collector Road with a connection to Highway 16A. This intersection is controlled by a stop sign for traffic heading southbound on Queen Street and only right turns are permitted onto Highway 16A. Eastbound Highway 16A traffic turning northbound onto Queen Street have the right-of-way at the intersection of Queen Street and First Avenue. This is due to the presumably large volume of traffic turning off of Highway 16A, as well as the short distance between the intersections of Queen Street with Highway 16A and First Avenue. As discussed previously strong consideration should be given to closing access from Highway 16A at Queen Street, to enable other more prominent streetscape and infrastructure improvements to take place, while managing better and safer vehicular movements.

5.5 CALAHOO ROAD

Calahoo Road is a major arterial roadway for the City of Spruce Grove and a major north south transportation facility. The intersection of Calahoo Road and McLeod Avenue is a large signalized intersection with dedicated turning lanes for all movements. Signal phasing is most likely complex with split phasing. This intersection is not a candidate for a roundabout and should remain signalized.

5.6 FIRST AVENUE

First Avenue runs east/west and directly to the north of Highway 16A separated only by a landscaped, sloping buffer/median. Buildings are located only of the north side of First Avenue. The intersection of First Avenue and King Street as previously described has little separation from that of the intersection of King Street and Highway 16A. This intersection would be improved if a centre median was constructed along King Street to prevent left turns to and from First Avenue. More detailed information such as traffic counts, collision data and a visual observation of its operation would be recommended to confirm this recommendation.

The intersection of First Avenue and Main Street is a tee intersection that is controlled by a stop sign for southbound Main Street traffic.

As previously discussed the intersection of First Avenue at Queen Street is a three way stop with northbound Queen Street having the right-of-way.

First Avenue at Calahoo Road is a right-in right-out intersection. Westbound First Avenue traffic are controlled by a stop sign. This intersection has a centre median along Calahoo Road that prevents left turning traffic to and from First Avenue.

5.6.1 *PARKING*

Parking along First Avenue varies between Calahoo Road and King Street with a combination of parallel and angle parking being provided depending on the width of the road. The goal appears to be to maximizing the number of parking stalls. Between Calahoo Road and Queen Street parallel parking is permitted on both side of First Avenue. Between Queen and Main Streets parallel parking is permitted on the south side, and on the north side a mix of angle and parallel parking is permitted. Between Main Street and King Street parallel parking is permitted on the south side and angle parking is permitted on the north side.

5.7 ONE–WAY OPERATION ON FIRST AVENUE

Consideration was given to the possibility of converting First Avenue to a one direction street. Namely to have the segment between King Street and Queen Street operate only in the westbound direction, and have the segment between Calahoo Road and Queen Street operate only in the eastbound direction. Making First Avenue one-way would facilitate the addition of angle parking on both sides of the street. Access at Highway 16A should be closed in conjunction with any one-way changes. For the purposes of this ARP however, it is recommended that First Avenue remain in its current configuration for 2 way traffic flow, with priority being placed on McLeod Ave streetscape, parking and infrastructure enhancements.

5.8 MCLEOD AVENUE

McLeod Avenue would best be described a major collector roadway. It has an eastbound transit route with a stop at the southwest corner of Queen Street.

The intersection at King Street is signalized. Westbound McLeod Street traffic has a single thru/left/right lane. Eastbound traffic has a designated right, thru and left lane. This intersection could be a candidate for a roundabout, although issues could arise with access/egress as mentioned previously with the three gas/convenience stores that require the attributes afforded by ease of entry/exit.

The intersection at Main Street is a four way stop. Eastbound McLeod Street traffic have a designated right turn lane and a shared thru/left lane. Westbound traffic have a designated right turn lane and a shared thru/left lane. This intersection would be a very strong recommended candidate for a single lane roundabout.

The intersection at Queen Street is also a four way stop. Westbound traffic has a shared left/thru/right lane and eastbound traffic has a designated right turn lane and a shared thru/left lane. This intersection would also be a strong recommended candidate for a roundabout, particularly if the access point from Highway 16A at Queen Street is closed off.

The intersection at Calahoo Road is a major signalized intersection with dedicated lanes for all thru and turning movements in all directions. This intersection, as noted previously is not recommended for a roundabout.

5.8.1 *PARKING*

Parking along McLeod Avenue varies between Calahoo Road and King Street. The segment between Calahoo Road and Queen Street permits parallel parking on both sides, with some restrictions occurring near the intersections. Information has been provided on the state/history of parking between Queen Street and King Street. From previous City Centre input over the years, it is noted and observed that the merchants have indicated a desire for angle parking throughout to increase the net number of stalls, though parallel parking is recommended along McLeod Ave in conjunction with major streetscape enhancements and improvements.

A separate parking study has been completed (as a separate report and study) that assesses full utilization/occupancy of the stalls as well as turnover, to determine if there is in fact a need to have additional angle parking. Additionally, given that McLeod Avenue has an eastbound transit route the installation of angle parking will make the addition of transit stops difficult. A review of the City's future Transit plans, particularly on McLeod Avenue and in the City Centre Study Area is recommended as a critical tool in assessing whether angle parking is viable or required. Such decisions should occur in conjunction with any recommended infrastructure or streetscape improvements "beneath the surface".

5.9 ROUNDABOUTS

The following are some general benefits of roundabouts compared to that of a conventional intersection:

- Lower speeds, therefore shorter braking distances.
- Reduced conflict points; 32 (4 way stop) versus 4 with a roundabout.
- Reduced collisions
- Vehicles are physically separated versus separated by time only.
- Greater capacity and reduced delay.

Given that that McLeod Avenue is assumed to become a likely candidate for more frequent transit service and that some truck traffic would be anticipated for servicing etc, it would be recommended that mountable curbs be used for any roundabout installations. Regardless, it is the recommendation of this ARP that roundabouts not be incorporated along McLeod due to geographic and organizational limitations.

Attached as **Appendix B** is the Canadian Geometric Design Guide's information on roundabouts.

5.10 TEMPORARY INSTALLATIONS

As discussed above opportunities were identified to add a centre median, close an access, install roundabouts and change parking. Depending upon the response to these ideas, the possibility exists to put in any of these measures on a temporary basis for a period of time (typically a year) and evaluate their success. This allows an opportunity to gauge their effectiveness, as well as seek feedback from the public, prior to a larger, more expensive and permanent capital project.

6.0 PARKING STUDY SUMMARY

As part of the overall ARP process, but undertaken as a stand-alone separate study, Balon Engineering & Construction Corp. was engaged to conduct a Parking Study of the Spruce Grove City Centre. The full results of this study are provided as in **Appendix C** to this Infrastructure Assessment, but the following provides a synopsis of the highlights from that separate study, as it relates to the City Centre ARP process.

The Study Area for the Parking Study includes the following streets:

- First Avenue between Calahoo Road and King Street,
- McLeod Avenue between Calahoo Road and King Street,
- Main Street between First Avenue and Church Road, and;
- Queen Street between First Avenue and Church Road.

There are a total of 373 parking spaces in the City Centre Study Area with 135 of the spaces located on McLeod Avenue, 139 spaces on First Avenue, 36 on Queen Street and 63 on Main Street. 198 of the stalls are angle and the remaining 175 are parallel parking.

At present, there are no parking restrictions on Main Street and Queen Street. McLeod Avenue and First Avenue are restricted to a two-hour time limit. For any parking restriction to be effective regular and consistent enforcement is required.

Demand for parking spaces is the highest during noon time and the afternoon. From a parking management point of view, an average occupancy rate of 85% or higher during the peak 3 hours is an indication of parking space congestion and the need to apply parking management techniques. Such an occupancy rate was observed on Main Street between McLeod and First Avenues, and on the west side of Queen Street between McLeod and First Avenues.

The average duration during a typical weekday between 9 am and 6:30 pm was approximately 1.5 hours throughout the study area. This short duration indicates for the most part that drivers are not abusing their parking privileges by parking for long durations.

The review of the parking data has indicated that the average occupancy in the City Centre Study Area is 51.6%, which is not indicative of a parking problem. However, there are two (2) blocks where occupancy exceeds 85%; namely Main and Queen Streets between First and MacLeod Avenues. These blocks are though located in very close proximity to streets with moderate to low occupancy levels, suggesting that an improved City Centre environment could result in a shift in parking.

An additional strategy would be for the City to examine alternatives for off-street parking for employees, which would free up on-street parking for visitors. Potential considerations could include land acquisition in the City Centre or engaging in discussions regarding shared agreements with the nearby Church properties that typically have low parking usage during the weekdays. Shared parking would be a creative solution to parking management with limited cost implications, while ensuring the on-street parking is utilized by those who need it most.

7.0 STREET LIGHTING

The City of Spruce Grove's street lighting underwent a substantial upgrade in 2017 replacing the high-pressure sodium street lights with high-efficiency LED lamps. This upgrade significantly increases energy efficiency and quality of light. It is recommended no further action be taken regarding the street lighting until the detailed design of the ARP and streetscape improvements are identified or implemented. At this time, an assessment based on upgraded pedestrian areas should be completed to ensure the current illumination is adequate for the pedestrian scale realm.

8.0 SUMMARY

The following summarizes the findings of this report:

8.1 SANITARY SEWER COLLECTION

The sanitary sewer collection capacity is sufficient for the area, however the infrastructure is primarily VCT pipe that have reached its intended service life. It is recommended that all VCT pipe be replaced with the equivalent diameter PVC. These upgrades are not required immediately but should be done in conjunction with improvements to the streetscape and/or water distribution system.

8.2 WATER DISTRIBUTION SYSTEM

Upgrades to the water distribution system are required in order to meet the required capacities including a upgraded fire pump, 300mm tie in connection at Mohr Ave and a 300mm upgrade along Calahoo Road from the existing 150mm diameter pipe. The remaining distribution pipes do not meet the minimum pipe size for the zone as per the Spruce Grove Development Standards and are a material that is no longer acceptable. All AC pipe material to be removed and replaced with a minimum 250mm PVC or 300mm PVC as per section 3.8.

8.3 STORMWATER COLLECTION SYSTEM

The stormwater collection system for the City Centre is considered to have adequate capacity. Based on the stormwater Master Plan one area was identified on McLeod Avenue to have a high level of street ponding potential. Two additional catch basins were recommended for this area. With the re-development of the streetscape on McLeod Avenue all major system drainage and ponding should be reviewed at the time of detailed design.

8.4 SUMMARY OF IMPROVEMENT COSTS

The following summary in **Table 8.1** outlines the total costs of the improvements to the City Centre Study Area and is broken down into each street. Each associated cost includes a 15% for Engineering and an additional 20% for contingency.

8.5 PHASING

Phasing of the upgrades should be completed in conjunction with the streetscape construction of the City Centre ARP. Improvements to the water distribution system are most cost effective when upgraded street by street with the exception of the fire pump upgrade, the 300mm diameter tie in connection to the existing 600mm watermain, north of Mohr Ave and the 300mm upgrade along Calahoo Road. These upgrades are required to boost the capacity of the water distribution system. The sanitary sewer upgrades should be completed with either the streetscape upgrades of in conjunction with any water main improvements.

Table 8.1: Improvement Cost Summary

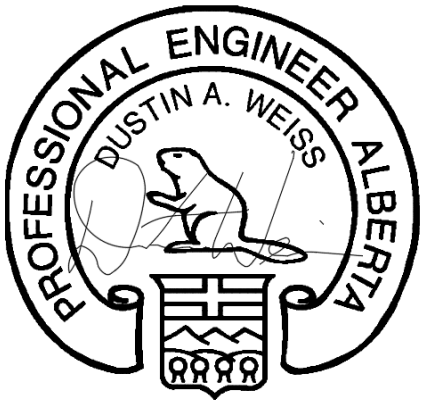
STREET	ITEM	ITEM COST ($)	TOTAL ($)
Fire Pump	Upgrade pump to 300 L/s capacity	$ 200,000.00	$ 200,000.00
Mohr Avenue	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	N/A $ 250,000.00 N/A	$ 250,000.00
Calahoo Road	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	N/A $ 408,900.00 N/A	$ 408,900.00
McLeod Avenue	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$ 209,400.00 $ 25,000.00 $ 30,000.00	$ 264,400.00
First Avenue	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$ 209,400.00 $ 506,050.00 N/A	$ 715,450.00
Church Road	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$ 268,200.00 $ 552,550.00 N/A	$ 820,750.00
King Street	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$ 68,400.00 $ 150,800.00 N/A	$ 219,200.00
Main Street	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$ 136,800.00 $ 437,500.00 N/A	$ 574,300.00
Queen Street	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$ 100,800.00 N/A N/A	$ 100,800.00
Jesperson Avenue	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$ 203,400.00 $ 415,000.00 N/A	$ 618,400.00
Andrew Crescent	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$ 85,200.00 $ 177,525.00 N/A	$ 262,725.00
Alley (1st and 2nd Avenue)	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$ 186,000.00 $ 259,550.00 N/A	$ 445,550.00
Alley (North of Andrew Crescent)	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$ 60,000.00 $ 125,000.00 N/A	$ 185,000.00
Alley (West of Andrew Crescent)	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$ 39,000.00 $ 88,750.00 N/A	$ 127,750.00
Alley (North of McLeod Avenue)	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	N/A $253,750.00 N/A	$ 253,750.00
Total	Sanitary Sewer Improvements Water Supply Improvements Storm Collection Improvements	$1,566,600.00 $3,850,375.00 $ 30,000.00	$5,446,975.00

9.0 REPORT SUBMITTAL

This report has been prepared and submitted by Cushing Terrell Architecture Inc.

9.1 SIGNATURES

Report prepared by:



Dustin Weiss, P. Eng.
Civil Engineer

City Centre ARP

Infrastructure Assessment Background Report

Appendices

Appendix A – Water Model Results
Appendix B – Geometric Design Guidelines for Canadian Roads – Roundabouts
Appendix C – City Centre Parking Study (as prepared by Balon Engineering& Construction Corp.

CUSHING TERRELL ARCHITECTURE INC.

TECKERA civil engineering consultants

BALON ENGINEERING & CONSTRUCTION CORP.

City Centre ARP

Infrastructure Assessment Background Report

Appendix A – Water Model Results

CUSHING TERRELL

Existing Node Results: MDD + FF

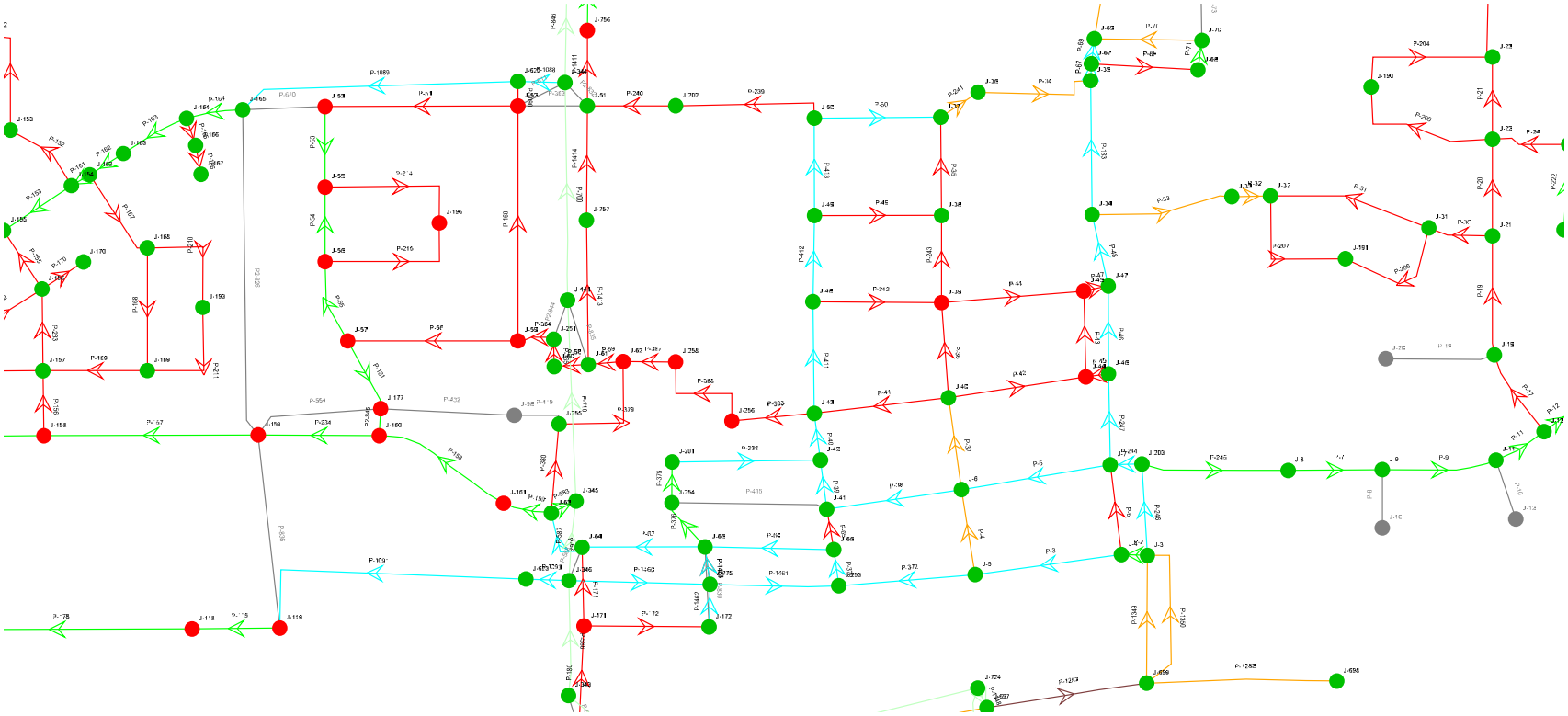
Label	Zone	Fire Flow (Available) (L/s)	Flow (Total Needed) (L/s)	Flow (Total Available) (L/s)	Pressure (Calculated Residual) (kPa)
J-4	Zone-1	288.99	300.00	289.86	140
J-5	Zone-1	289.83	300.00	290.63	148.8
J-6	Zone-1	289.59	300.00	290.35	164.3
J-7	Zone-1	289.44	300.00	290.84	171
J-34	Zone-1	289.03	300.00	290.3	171.6
J-35	Zone-1	289.12	300.00	290.4	177.4
J-40	Zone-1	289.44	300.00	290.2	181.6
J-41	Zone-1	289.63	300.00	290.47	168
J-47	Zone-1	289.22	300.00	290.12	173.4
J-171	Zone-1	190.47	300.00	190.57	140.1
J-253	Zone-1	289.95	300.00	290.67	164.6
J-345	Zone-1	290.45	300.00	291.46	178.7

CUSHING TERRELL

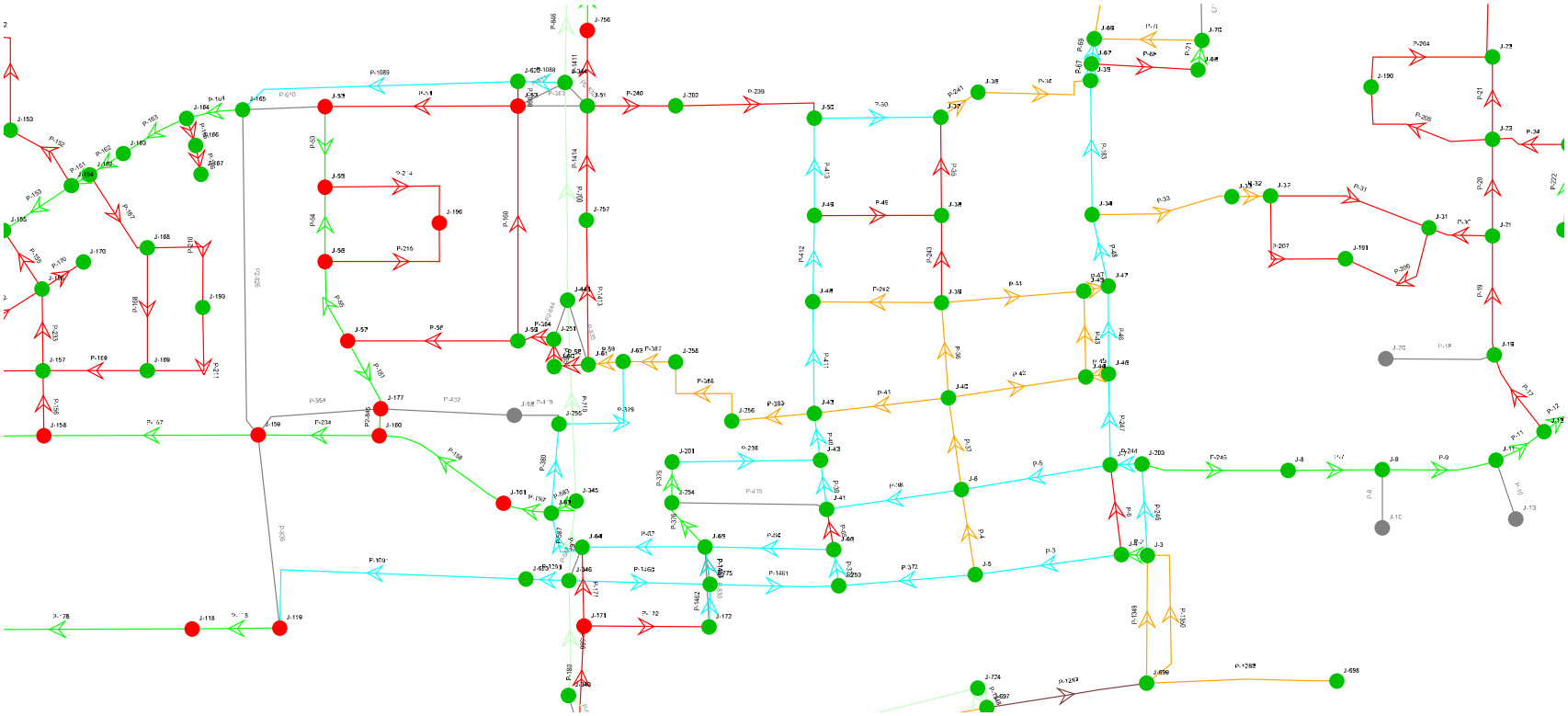
Proposed City Centre Upgrades Node Results: MDD + FF

Label	Zone	Fire Flow (Needed) (L/s)	Flow (Total Available) (L/s)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)
J-4	Zone-1	300	500.44	238.2	336.6
J-5	Zone-1	300	500.4	278.3	339.1
J-6	Zone-1	300	500.38	317.9	341.4
J-7	Zone-1	300	500.7	326.5	345.8
J-34	Zone-1	300	500.63	234.4	271.1
J-35	Zone-1	300	500.64	201.5	202.5
J-40	Zone-1	300	500.38	200.9	331.9
J-41	Zone-1	300	500.42	309.4	335.8
J-47	Zone-1	300	500.45	251.4	285.8
J-171	Zone-1	300	303.01	140	382.7
J-253	Zone-1	300	500.36	318.5	340.8
J-345	Zone-1	300	500.5	390.8	362.6

City Centre Upgrades MDD+FF Node Analysis



City Centre Shadow Study Upgrades MDD+FF
Node Analysis



City Centre ARP

Infrastructure Assessment Background Report

Appendix B – Geometric Design Guidelines for Canadian Roads – Roundabouts

2.3.12 ROUNDABOUTS

2.3.12.1 Introduction

Approximately one-half of the collisions on the North American road system occur at intersections,[20] where drivers are confronted with through, right-turn, and left-turn manoeuvres, and where capacity is restricted. Attempts to provide greater safety for motorists at these points began in the 1930s and 1940s with the construction of traffic circles in several jurisdictions. However, as a result of design differences and inconsistencies in assigning right of way and non-uniform signing, these circles did little to promote safety and moreover, they tended to constrict traffic flow.[20]

The roundabout, a variation of the traffic circle, may provide a solution to these problems in some instances. In Western Europe and Australia, where this type of intersection is commonly found, changes in roundabout design, along with changes in traffic regulations, have noticeably increased road safety and capacity. Now many road engineers in North America have become supporters of roundabouts as a means to reduce collisions and improve traffic flow.

2.3.12.2 Roundabout Characteristics

Roundabouts are distinguished from traffic circles by their operational and design characteristics. The key operational feature is that traffic must yield at entry to traffic already within the roundabout. Deflection of a vehicle's path at entry and exit is an important design feature. Other salient design characteristics are entry angles of between 20 and 60 degrees; crosswalks upstream of the yield line; the absence of parking in the roundabout; and splitter islands, which reduce speed, deter left turns, and provide refuge to pedestrians, at all approaches.

Figure 2.3.12.1 illustrates a number of these significant characteristics. Definitions for each parameter shown are outlined as follows:

D - Inscribed Diameter is the diameter of the largest circle that can be inscribed within the intersection outline.

R - Entry Radius is measured as the minimum radius of curvature of the nearside curb at entry.

E - Entry Width is measured from the point A along a line perpendicular to the nearside curb.

V - Approach Half Width is measured at a point in the approach upstream from any entry flare, from the centreline to the nearside curb, along a perpendicular line to the curb face.

∅ - Entry Angle serves as a geometric proxy for the conflict angle between entering and circulating streams.

l' - The Average Effective Flare Length is found as shown in Figure 2.3.12.1.

The line GF'D is the projection of the nearside curb from the approach towards the yield line, parallel to the median HA and at a distance of V from it.

BA is the line along which E is measured (and is therefore normal to GBJ),m and thus D is at a distance of [E-V] from B.

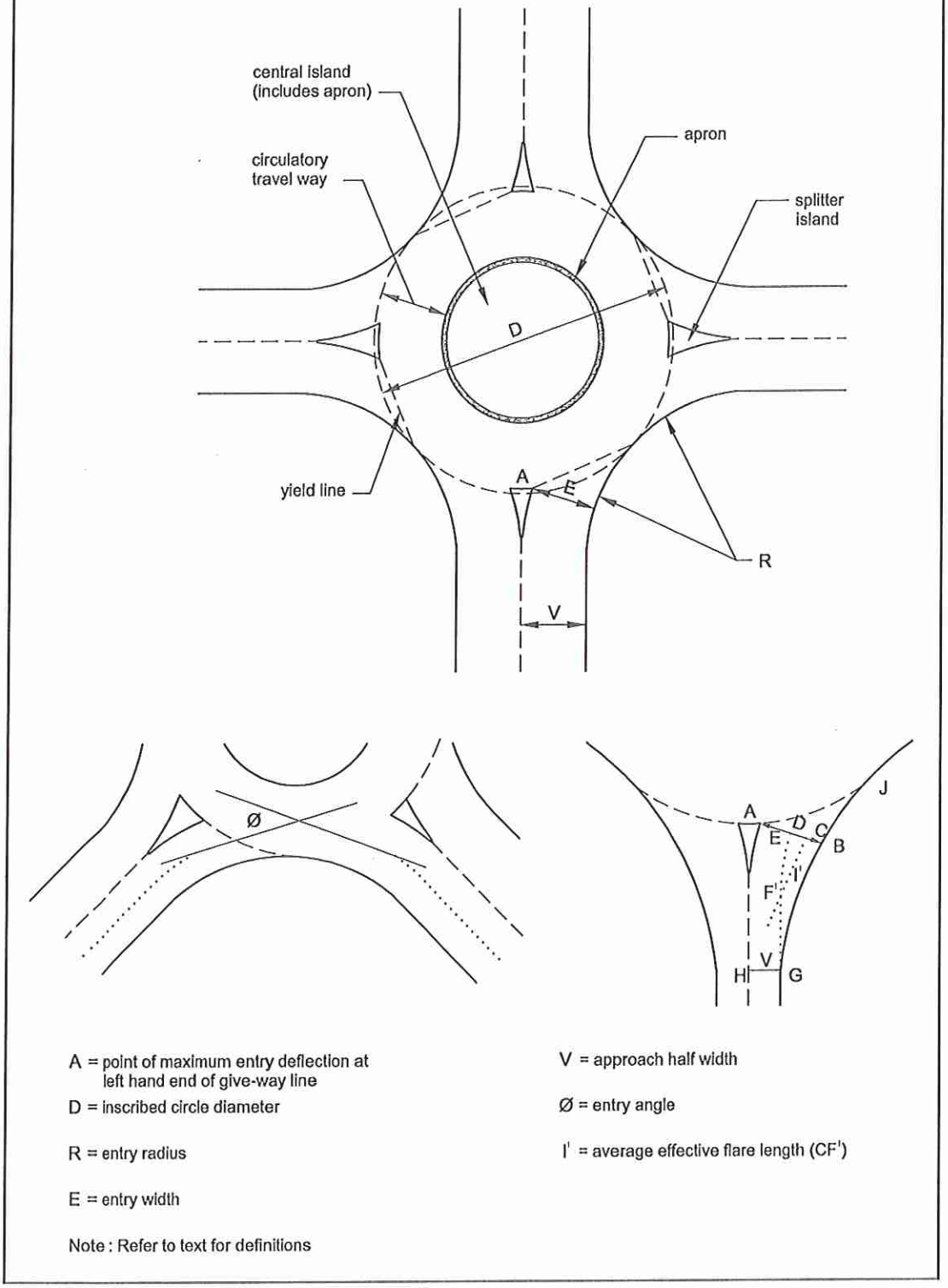
The line CF' is parallel to BG (the nearside curb) and at a distance of [E-V]/2 from it. Usually the line CF' is therefore curved and its length is measured along the curve to obtain l'.[13]

2.3.12.3 Location/Application of Roundabouts

The decision to provide a roundabout rather than some other form of junction should be based on operational, economical and environmental considerations. A roundabout can be used to:

- signify a significant change in road classification (ie. from a divided to an undivided roadway or from a grade separated intersection to an at-grade

Figure 2.3.12.1 Geometric Elements of a Roundabout



intersection), although complete reliance should not be placed on the roundabout alone to act as an indicator to drivers

- emphasize the transition from a rural to an urban or suburban environment
- accommodate very sharp changes in route direction which could not be achieved by curves, even of undesirable radii
- provide a greater measure of safety at sites with high rates of right-angle, head-on, left/through, and U-turn collisions
- replace existing all-way stop control
- accommodate locations with low or medium traffic volumes, instead of signals

Roundabouts should be sited on level ground preferably, or in sags rather than at or near the crests of hills because it is difficult for drivers to appreciate the layout when approaching on an up gradient. However, there is no evidence that roundabouts on hill tops are intrinsically dangerous if correctly signed and where the visibility standards have been provided on the approach to the yield line. Roundabouts should not normally be sited immediately at the bottom of long descents where the down grade is significant for large vehicles and loss of control could occur.

Roundabouts may not be effective when the flow of heavy vehicles is great or long delays on one approach exists.

2.3.12.4 Geometry/Road Capacity

As noted above, roundabouts can improve road safety and increase capacity. Table 2.3.12.1 provides a summary of the relationship between geometric parameters and capacity.

Capacity is very sensitive to increases in the approach width V. This is normally the half width of the approach roadway and can only be increased if sufficient roadway width allows the centreline to be offset.

The entry geometry is defined by the entry width E and the flare length l'. Capacity is extremely sensitive to increase in either, and considerable scope exists for increasing capacity by various combinations.

Increasing the entry radius R above 20 m only improves capacity very slightly. However, as values drop below 15 m capacity reduces at an increasing rate.

The entry angle '∅'is fixed by the alignment of the approach roadways and there is, therefore, little scope for varying '∅' sufficiently to have a significant effect on capacity.

When designing a roundabout the approach width is a known fixed value. The capacity is thereafter almost totally determined by the entry width and the flare length, as typical values of the other geometric parameters have only a minor influence.

Reducing the inscribed circle diameter reduces capacity. If, however, by reducing the inscribed circle radius an increase in the entry geometry can be achieved, then a large net increase in capacity is produced; mini roundabouts (diameter less than 4 m) are the limiting case. As the entry width increases, the entry deflection is reduced and consideration should be given to safety.

Increasing the number of entry lanes or increasing the width of these lanes has the potential for increased traffic conflict. Widening entry lanes is a concern for the safety of cyclists.

Table 2.3.12.1 Geometry/Capacity Relationships

Increase Parameter		Capacity Change
the approach width	V	rises rapidly
the entry width	E	rises rapidly
the flare length	l'	rises slowly
the entry angle	∅	drops slowly
the inscribed circle diameter	D	rises slowly
the entry radius	R	rises slightly

2.3.12.5 Safety Analysis

Research in Europe during the past 5 years has shown that collision rates can be decreased by replacing conventional intersections with roundabouts. The Netherlands achieved a 95% reduction in injuries to vehicle occupants at locations where roundabouts were installed.[20] On inter-urban roads in France, the average number of collisions resulting in injuries was 4 per 100 million vehicles entering roundabouts, compared with 12 per 100 million vehicles entering intersections with stop or yield signs. The safety of roundabouts, installed mostly in France's urban and suburban areas, including residential areas, was generally superior to that of signalized intersections.[20] Researchers noted that large roundabouts with wide entries and heavy bicycle traffic appeared to be less safe than other roundabouts. In Germany the number of collisions was 1.24 per 1 million vehicles entering small roundabouts, compared with 3.35 for signalized intersections, and 6.58 for old traffic circles.[20] In Norway an extensive collision analysis also revealed that roundabouts are safer than signalized intersections. The number of collisions resulting in injuries was 3 per 100 million vehicles entering three-legged roundabouts and 5 per 100 million vehicles entering signalized three-legged (T-) intersections; it was 5 for four-legged roundabouts and 10 for four-legged (cross-) intersections (with and without signals).[20]

In the United States, a recent study confirms the safety benefits of roundabouts. An investigation of six sites in Florida, Maryland and Nevada revealed that the conversion of T- and cross-intersections (stop controlled and signalized) to roundabouts decreased collision rates.[20] According to the study, which was sponsored by the Federal Highway Administration, the reduction was statistically significant.

Given that roundabouts have only recently begun to appear in North America, roadway agencies have had little opportunity to gather empirical data on the safety benefits of the structures. Fortunately, similarities between collision-prediction models developed in the United Kingdom for roundabouts and those developed in the United States for cross-intersections allow agencies to compare in theory the safety of both types of intersections. Both the U.K. and the U.S. models yield estimates of collisions resulting in nonproperty damage.[20] In addition, both models use state-of-the-art regression analysis (Poisson and negative binomial) and samples of sufficiently large size to relate collisions to particular roadway characteristics. On the basis of these similarities, one could draw the conclusion that roundabouts in the United States have the potential to increase safety when compared with conventional intersections, just as they are projected to do in the United Kingdom.

Nevertheless, notwithstanding their good record, great care should be taken in layout design to secure the essential safety aspects. The most common problem affecting safety is excessive speed, both at entry or within the roundabout. The most significant factors contributing to high entry and circulating speeds are:

- inadequate entry deflection
- a very acute entry angle which encourages fast merging manoeuvres with circulating traffic
- poor visibility to the yield line
- poorly designed or positioned warning and advance direction signing
- "Reduce Speed Now" signs, where provided, being incorrectly sited
- more than four entries leading to a large configuration

Additionally, safety aspects to be considered in designing a layout include the following:

1. Angle between legs: The collision potential of an entry depends on both the angle counter clockwise between its approach leg and the next approach leg, and the traffic flows. A high-flow entry should have a large angle to the next entry, and a low-flow entry a smaller angle in order to minimize collisions.

2. Gradient: While it is normal to flatten approach gradients to about 2% or less at entry, research at a limited number of sites has shown that this has only a small beneficial effect on collision potential.

3. Visibility to the left at entry: This has comparatively little influence upon collision risk; there is nothing to be gained by increasing visibility above the recommended level.

Care should be taken with the choice of curb type for roundabout design. A safety problem can arise when certain specialized high profile curbs are used around a central island as they can be a danger to vehicles over running the entry.

Observations have shown that these curbs can result in loss of control or overturning of vehicles unless the approach angle is small and actual vehicle speeds are low. Where high profile curbs are to be used on approaches, the curbs can be hazardous for pedestrians and consideration should be given to the provision of handrails to control pedestrian movements.

High circulatory speeds cause associated entry problems and normally occur at large roundabouts with excessively long and/or wide circulatory travel way. However, these problems can also be caused at smaller roundabouts by inadequate deflection at previous entries. The solution to high circulatory speeds usually has to be fairly drastic, involving the signalization of problem entry legs at peak hours. In extreme cases the roundabout may have to be converted to a "ring junction" in which the roundabout is made two-way and the entries/exits are controlled by individual mini or normal roundabouts, or traffic signals.

If entry problems are caused by poor visibility to the left, good results can be achieved by moving the yield line forward in conjunction with curtailing the adjacent circulatory hatching or extension of the traffic deflection island.

One note of caution should be sounded - the safety record of roundabouts for one group of road users is mixed. Pedestrians using roundabouts have long been considered at least as safe as those using conventional intersections because the prevailing speed is slower, and the islands provide refuge from automobile traffic. However, many countries have documented increases in collisions involving bicyclists after roundabouts were installed. On the other hand, the Netherlands reported a decrease of 1.3 to 0.37 injuries per year to bicyclists at 181 conventional intersections converted to mini-roundabouts.[20]

City Centre ARP

Infrastructure Assessment Background Report

Appendix C – City Centre Parking Study (as prepared by Balon Engineering& Construction Corp.

City of Spruce Grove

City Centre Parking Study

Prepared for:

City of Spruce Grove, Engineering Department

June 2018

Prepared by:

BALON
ENGINEERING &
CONSTRUCTION CORP.

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1.0 STUDY BACKGROUND

1.1 Introduction

The City of Spruce Grove is in the process examining how to redevelop their City Centre area through a City Centre Area Redevelopment Plan (CCARP). As part of this study it was identified that a parking study has not been completed in the City Centre area. A parking study is sought to provide a base line of current conditions. In the event that changes are made to parking through the CCARP, the City will be able to measure if the parking situation improved.

1.2 Study Area

The study area is illustrated in Exhibit 1. The study area includes the following streets:

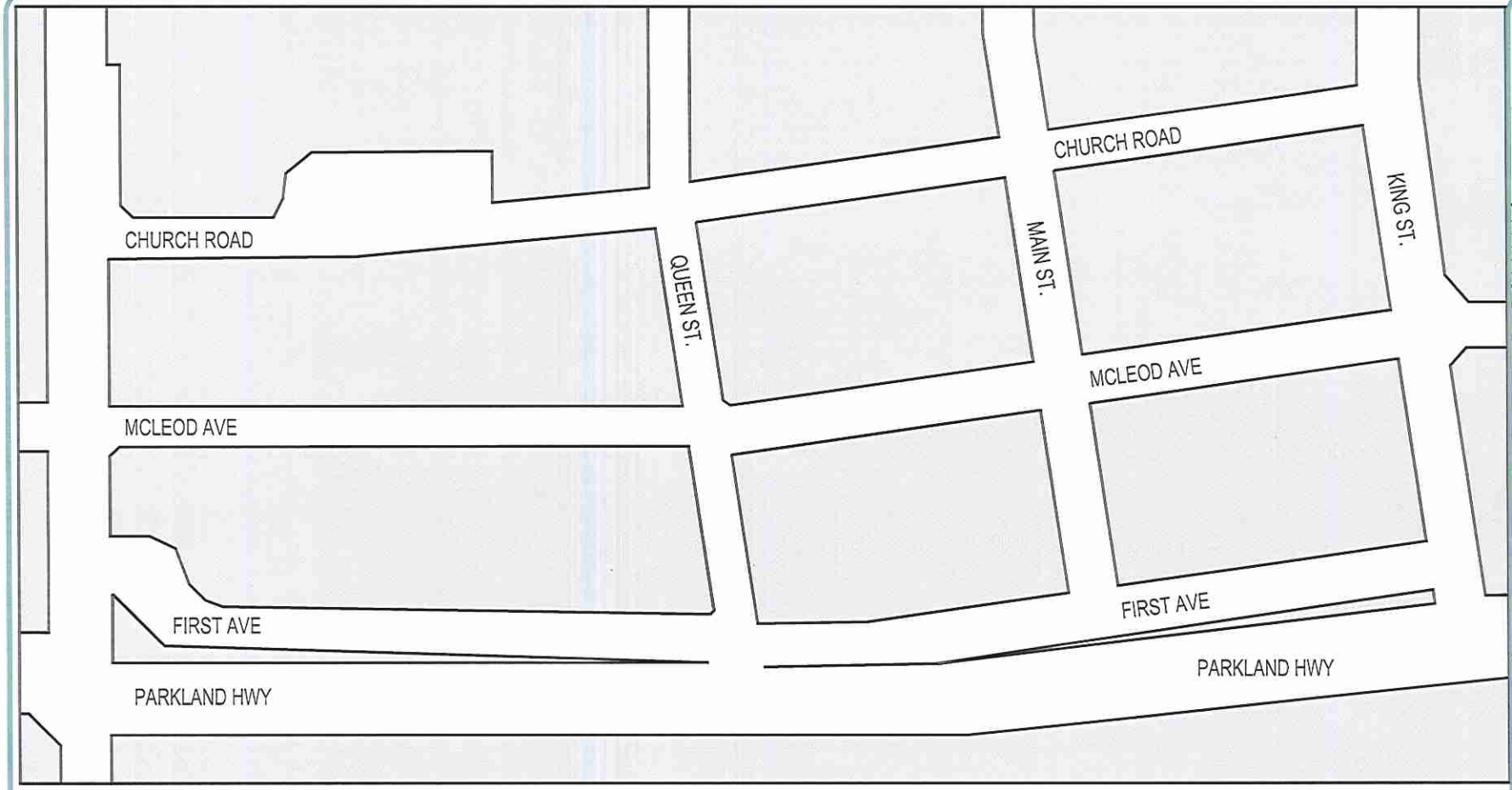
- First Avenue between Calahoo Road and King Street,
- McLeod Avenue between Calahoo Road and King Street,
- Main Street between First Avenue and Church Road, and;
- Queen Street between First Avenue and Church Road.

1.3 Study Methodology

The methodology used to collect the sample data consisted of recording the last three digits of the license plates of the vehicles parked on each block face in the study area in 30 minute intervals between 09:00 hours and 18:30 hours. Data was collected for on street parking only. Off street parking was not considered.

Data was collected on Wednesday April 25th, 2018 representing week day parking conditions. Weekend parking conditions were not considered.

The data was analyzed to determine the various parking characteristics including the accumulation of vehicles, the duration of time that each vehicle was parked and the number of vehicles parked in each space during the study period (turnover). Results of the analysis provided an average for each block face.



SPRUCE GROVE PARKING STUDY AREA

NO.	DATE	NOTES
1.	JULY 6-2018	REVIEW

BALON ENGINEERING CONSTRUCTION CORP

PROJECT
SPRUCE GROVE
PARKING STUDY
Spruce Grove, Alberta

DRAWING
EXHIBIT 1
PARKING STUDY AREA

SCALE AS NOTED
DATE: JULY 2018
PROJECT NO: 11-2018

DRAWING NO.
1

2.0 EXISTING CONDITIONS

2.1 Inventory of On Street Parking

Exhibit 2 illustrates the number of parking spaces per block based on field observations and a typical parking stall length of 6.5 m per stall for a parallel parking layout. There are a total of 373 parking spaces in the study area with 135 of the spaces located on McLeod Avenue, 139 spaces on First Avenue, 36 on Queen Street and 63 on Main Street. 198 of the stalls are angle and the remaining 175 are parallel parking. Exhibit 3 illustrates the angle and parallel parking locations.

2.2 Parking Regulations

Parking restrictions fall into two general categories of prohibited or restricted parking.

At present, there are no parking restrictions on Main Street and Queen Street. McLeod Avenue and First Avenue are restricted to a two-hour time limit. For any parking restriction to be effective regular and consistent enforcement is required.

Parking prohibitions completely ban parking in the area during the time indicated by the sign. Parking prohibitions found in the study area include “No Parking” and “Bus Stop” signs. Parking prohibitions are typically installed for safety reasons or to improve traffic flow.

Loading zones are used to provide on-street space for the loading and unloading of persons and goods. Several general and disabled persons loading zones are located in the study area.

2.3 Average Occupancy

The objective of most drivers is to find a parking space at the curb just in front of their desired destination. As a result, curb side parking spaces are a desired commodity. Based on past studies, it is known that if the parking occupancy exceeds 85%, it becomes increasingly difficult for a driver to find a parking space, causing parker frustration and potentially affecting the economic viability of the business area.

The problem of finding a space in an area with high occupancy is overcome by installing parking restrictions and to a further degree paid parking or parking meters. Restrictions and paid parking encourage turnover and thus, make it easier to find a space.

The demand for parking spaces is the highest during noon time and the afternoon. Exhibit 4 illustrates the on-street occupancy for the peak 3 hours (11:30 to 14:30) of a typical weekday.

From a parking management point of view, an average occupancy rate of 85% or higher during the peak 3 hours is an indication of parking space congestion and the need to apply parking management techniques. Such an occupancy rate was observed on Main Street between McLeod and First Avenues, and on the west side of Queen Street between McLeod and First Avenues. However, it should be pointed out that the block faces immediately around these areas have moderate to lower occupancy levels. If a driver was unable to find a parking space directly in front of their desired location, they would be able to find one 'around the corner' or across the street. The average occupancy throughout the entire study area was 51.6%.

2.4 Parking Duration

Exhibit 5 illustrates the average duration for a typical weekday from 09:00 hours to 18:30 hours.

The average duration was approximately 1.5 hours throughout the study area. This short duration indicates for the most part that drivers are not abusing their parking privileges by parking for long durations.

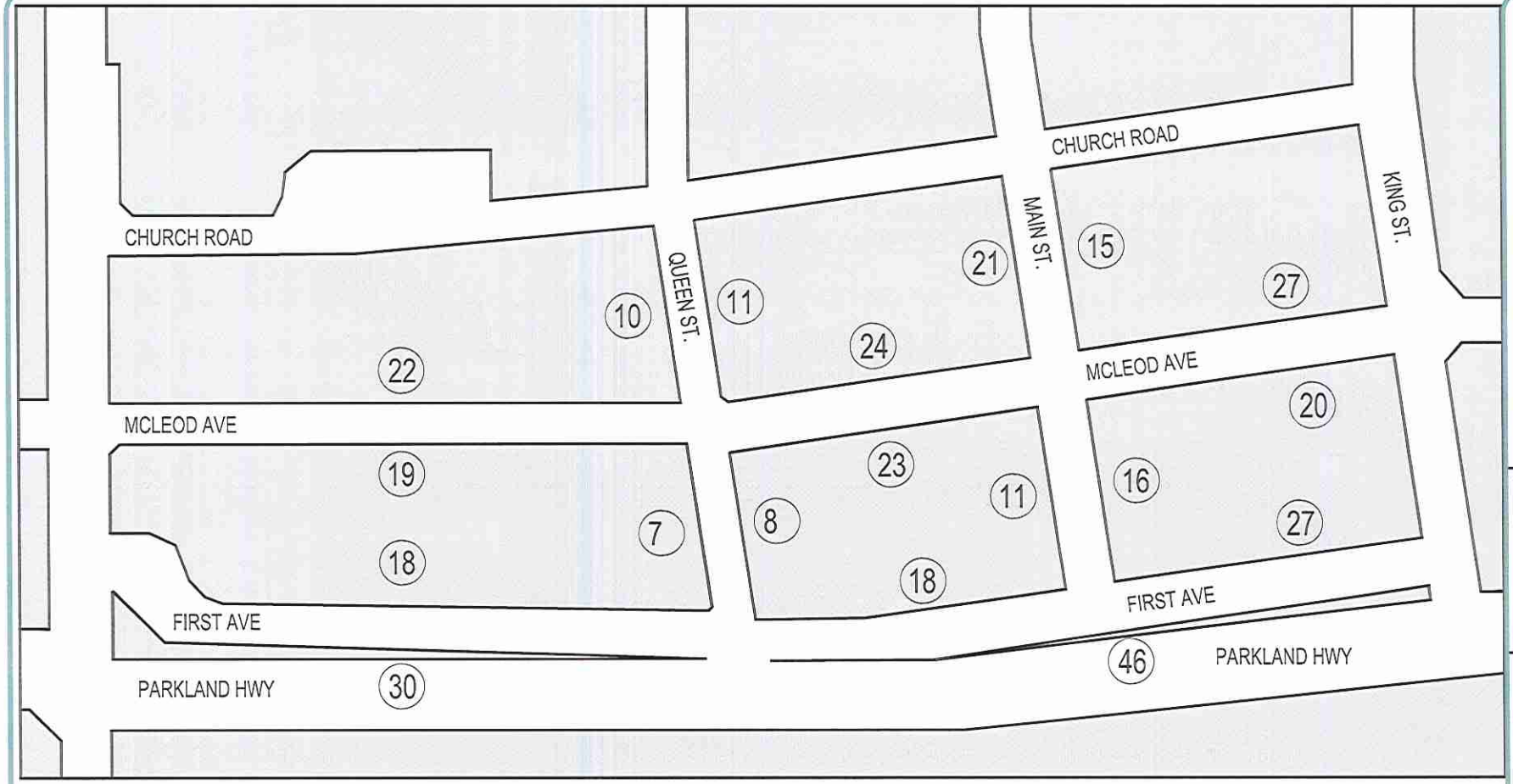
McLeod and First Avenues have a two-hour timed parking restriction. Along these streets average parking durations did not exceed the timed restriction. It should be noted that several vehicles along First and McLeod Avenues parked for much longer durations than the timed restriction. This would be an indication for more consistent enforcement of the timed restriction.

The longest durations occurred on Main and Queen Streets between McLeod and First Avenues. On these blocks numerous vehicles were parked all day. This coupled with high occupancies on these blocks may warrant the need for a timed restriction.

2.5 Turnover Rate

Exhibit 6 illustrates the average turnover for a typical weekday from 09:00 hours to 18:30 hours. As illustrated in the exhibit the average turnover rate was low throughout most of the study area with an average turnover rate of 2.6 vehicles per space.

A low turnover rate is of particular concern in areas with a high occupancy. Such an area is Main and Queen Streets, between McLeod and First Avenues where the occupancy exceeds 85%, yet the turnover rate was less than 4 vehicles per space. This low turnover rate can be explained by the presence of vehicles parking for extended periods of time.



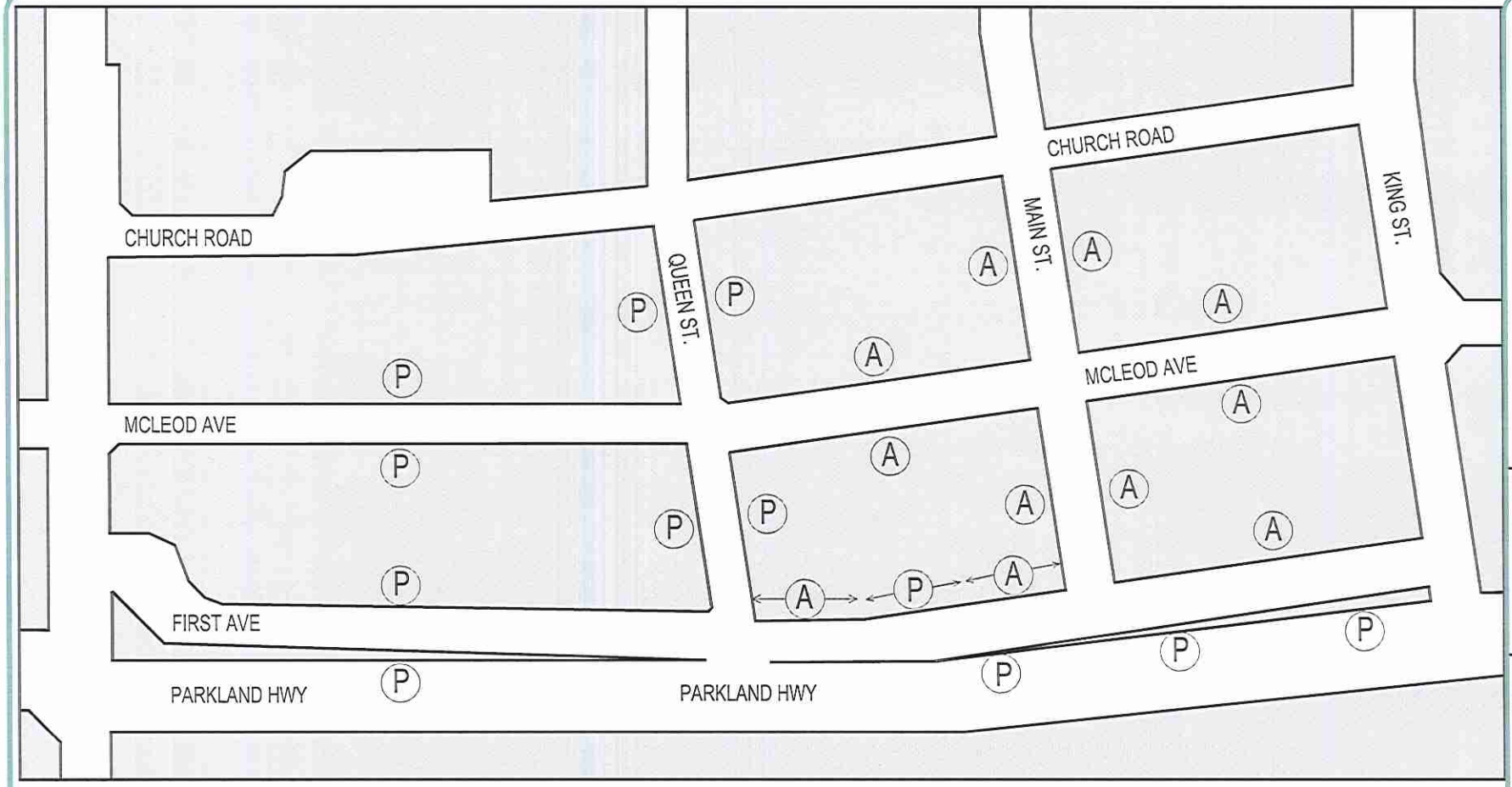
PARKING INVENTORY

BALON

PROJECT
SPRUCE GROVE
PARKING STUDY
Spruce Grove, Alberta

DRAWING
EXHIBIT 2
PARKING INVENTORY

DRAWING NO.
2



LEGEND -

ANGLE AND PARALLEL PARKING LOCATIONS

(A) = ANGLE PARKING

(P) = PARALLEL PARKING

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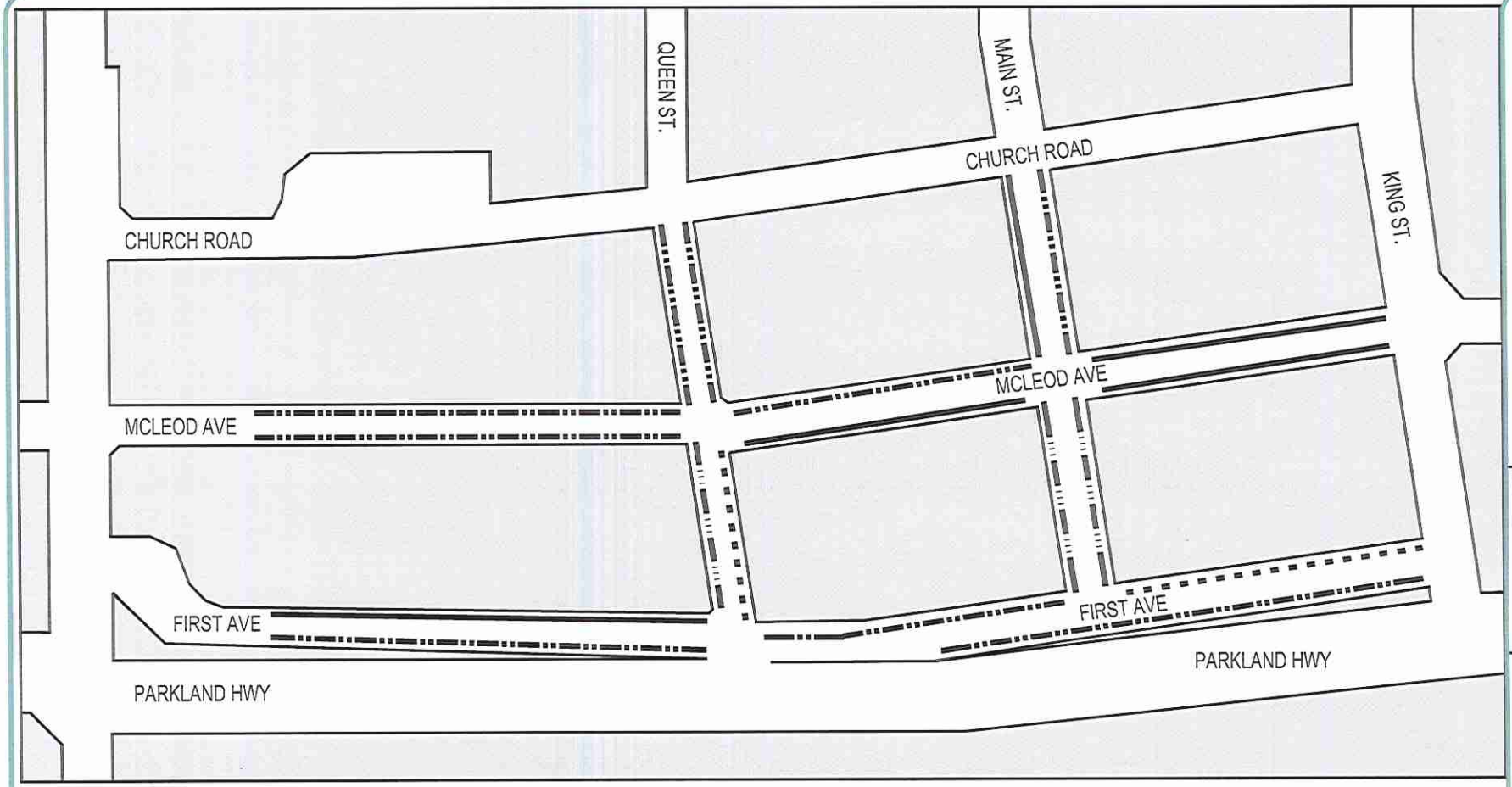
SPRUCE GROVE
PARKING STUDY
Spruce Grove, Alberta

DRAWING
EXHIBIT 3
ANGLE AND PARALLEL
PARKING LOCATION

DRAWING NO.
3



LEGEND -
WEEKDAY OCCUPANCY

- > 85%
- 70% - 85%
- 50% - 69%
- < 50%

N

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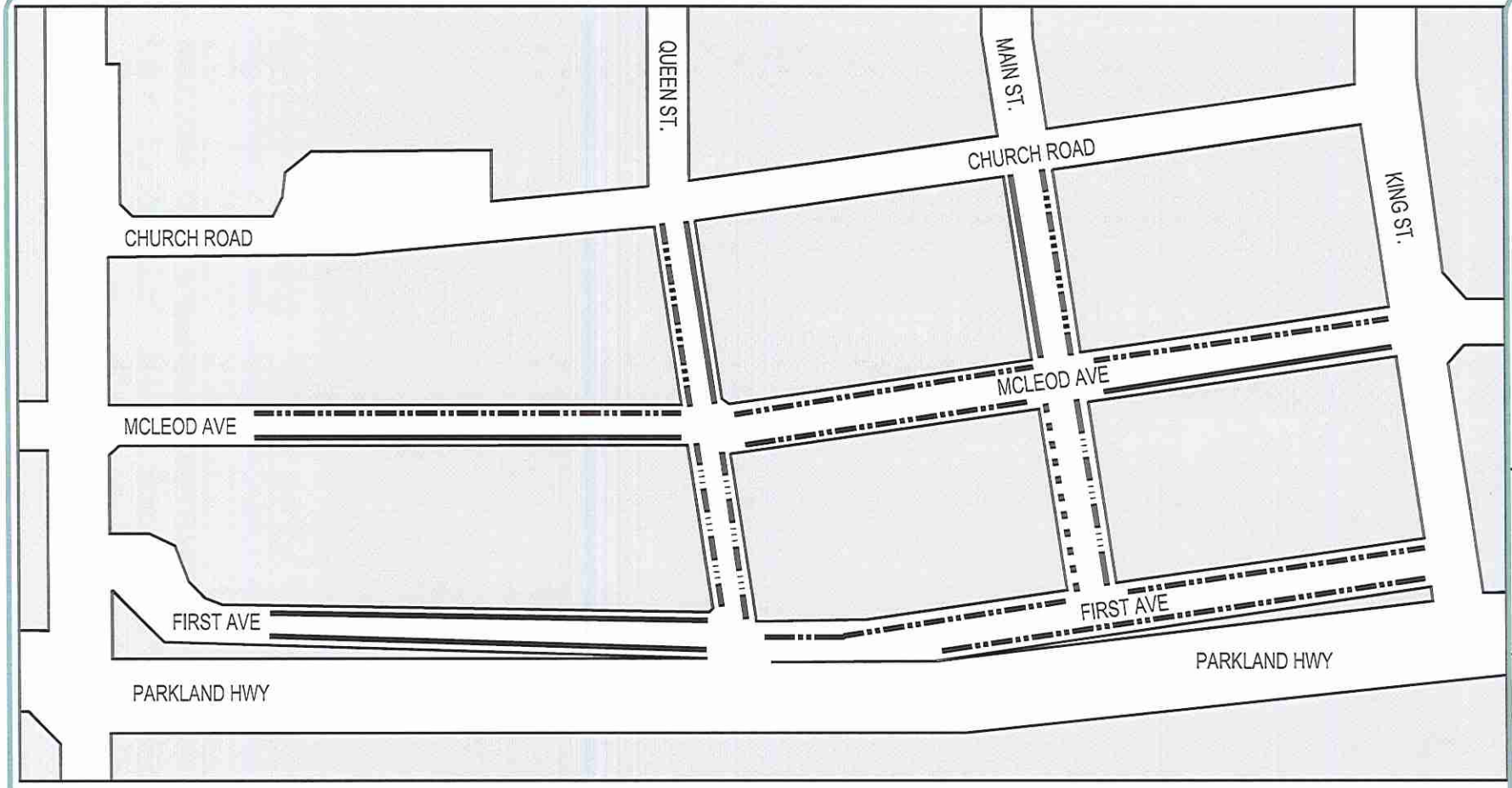
SPRUCE GROVE
PARKING STUDY
Spruce Grove, Alberta

DRAWING
EXHIBIT 4
WEEKDAY OCCUPANCY

DRAWING NO.
4



LEGEND -
WEEKDAY DURATION

- ABOVE 3 HOURS
- 2.0 HOURS - 3.0 HOURS
- 1.0 HOUR - 2.0 HOURS
- < 1.0 HOUR

N

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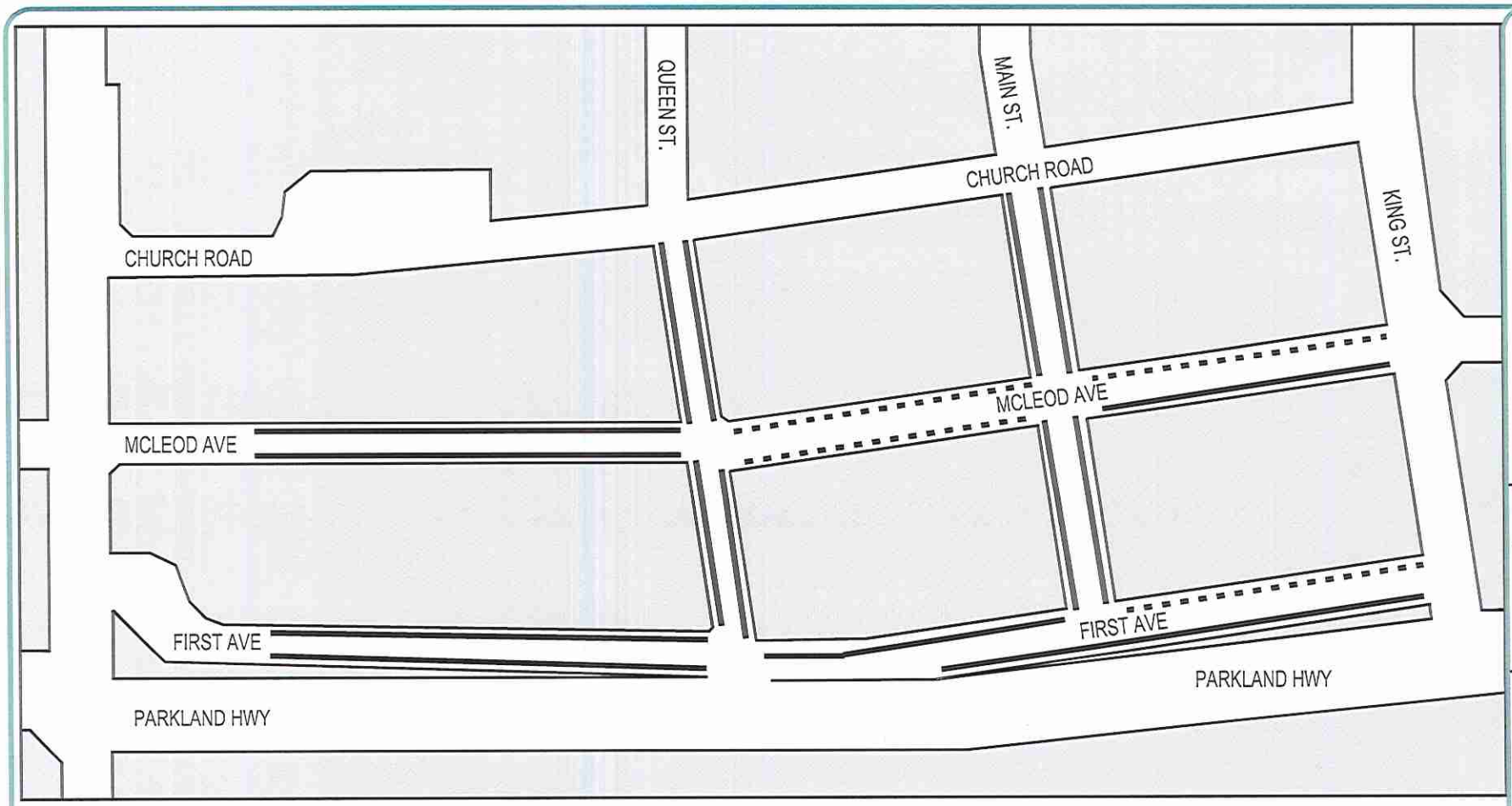
SPRUCE GROVE
PARKING STUDY
Spruce Grove, Alberta

DRAWING
EXHIBIT 5
WEEKDAY DURATION

DRAWING NO.
5



LEGEND -
WEEKDAY TURNOVER

7-10 TURNOVERS

4-6 TURNOVERS

< 4 TURNOVERS

N

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PROJECT
SPRUCE GROVE
PARKING STUDY
Spruce Grove, Alberta

DRAWING
EXHIBIT 6
WEEKDAY TURNOVER

DRAWING NO.
6

3.0 PARKING MANAGEMENT TECHNIQUES

In urban areas where there is a high demand for the use of on-street parking spaces, there are a number of parking management techniques that can be utilized to improve usage of these spaces. There are three primary tools to improve parking space utilization, as follows:

1. Traffic Signs
   - Install traffic control signs that limit the duration of stay of parkers during the period of high demand which usually includes the normal hours of business in the area; i.e. 09:00 to 18:00.
   - Revision of the duration of stay of existing traffic control signing; i.e. in high turnover areas – revise the parking restrictions from the two hours to one hour.
2. Parking Meters
   - Install parking meters or pay by space parking that will establish a maximum duration of stay for parkers, which uses an economic incentive to achieve the desired parking turnover.
3. Enforcement
   - Institute or increase the enforcement levels of existing parking restrictions to reduce the occurrence of long stay parkers.

In considering the appropriate parking management measure for an area, the traffic control devices should be installed in a large enough area to cover the main area where the parking demand occurs. That is, to install parking restrictions in only a one block area may only transfer the parking demand into the adjacent block faces. Therefore, there is a need to install parking control over a large enough area to minimize the transfer of parking problems to the adjacent blocks. This results in parking controls being implemented to block faces that on their own may not warrant such installation.

For the City Centre area there is an existing two-hour timed restriction on McLeod and First Avenues. The restriction on McLeod Avenue does not state a specific time of day that it applies, while the restriction on First Avenue is from 07:00 to 18:00 hours.

4.0 RECOMMENDATIONS

The review of the parking data has indicated that the average occupancy in the study area was 51.6%, which by itself does not indicate a parking problem. However, there are two blocks where the occupancy exceeds 85%; namely Main and Queen Streets between First and McLeod Avenues. These blocks are also in close proximity to streets with moderate and low occupancy levels.

Although the average duration was 1.5 hours, it was noted that some drivers were parking for long durations. The long duration resulted in fewer parking spaces being available and made it increasingly difficult for a driver to find a space in the areas of higher occupancy.

To improve the parking management in the City Centre Area, the following is recommended:

1. The existing two-hour time limit on McLeod Avenue should be changed to a two-hour time limit between 09:00 to 18:00, Monday thru Saturday.
2. The existing two-hour time limit from 07:00 to 18:00 on First Avenue, should be changed to a two-hour limit from 09:00 to 18:00, Monday thru Saturday.
3. A two-hour timed parking restriction between 09:00 to 18:00, Monday thru Saturday, should be installed on Main and Queen Streets, between First and McLeod Avenues.
4. Following a reasonable period of time for parkers to get accustomed to the new parking restrictions, enforcement should commence that is regular and consistent.
5. The City should also pursue partnerships or opportunities to utilize vacant lots or other underutilized spaces such as churches during business hours to provide off-street parking spaces.

APPENDIX

PARKING DATA SUMMARIES

Block Face: South Side
Location: First Avenue
Limits: Calahoo to Queen
Stalls: 30
Meters:
Signed: 2 hour limit 7am to 6pm

Count Date: 25-Apr-18
Day: Wednesday
Time: 09:00 - 18:30
Intervals: 19

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	5	26.32%	3	0900 - 0930	12	40.00%	0.0 - 0.5	26	43.33%	0.11
2	4	21.05%	2	0930 - 1000	15	50.00%	0.5 - 1.0	9	15.00%	0.11
3	3	15.79%	1	1000 - 1030	15	50.00%	1.0 - 1.5	6	10.00%	0.13
4	2	10.53%	2	1030 - 1100	15	50.00%	1.5 - 2.0	3	5.00%	0.09
5	0	0.00%	0	1100 - 1130	17	56.67%	2.0 - 2.5	1	1.67%	0.04
6	2	10.53%	1	1130 - 1200	20	66.67%	2.5 - 3.0	2	3.33%	0.09
7	0	0.00%	0	1200 - 1230	17	56.67%	3.0 - 3.5	4	6.67%	0.22
8	3	15.79%	2	1230 - 1300	11	36.67%	3.5 - 4.0	2	3.33%	0.13
9	0	0.00%	0	1300 - 1330	12	40.00%	4.0 - 4.5	2	3.33%	0.14
10	0	0.00%	0	1330 - 1400	15	50.00%	4.5 - 5.0	0	0.00%	0.00
11	9	47.37%	1	1400 - 1430	13	43.33%	5.0 - 5.5	0	0.00%	0.00
12	1	5.26%	1	1430 - 1500	16	53.33%	5.5 - 6.0	1	1.67%	0.10
13	5	26.32%	1	1500 - 1530	13	43.33%	6.0 - 6.5	0	0.00%	0.00
14	6	31.58%	1	1530 - 1600	11	36.67%	6.5 - 7.0	0	0.00%	0.00
15	19	100.00%	1	1600 - 1630	8	26.67%	7.0 - 7.5	1	1.67%	0.12
16	2	10.53%	1	1630 - 1700	10	33.33%	7.5 - 8.0	2	3.33%	0.26
17	11	57.89%	3	1700 - 1730	5	16.67%	8.0 - 8.5	0	0.00%	0.00
18	2	10.53%	2	1730 - 1800	2	6.67%	8.5 - 9.0	0	0.00%	0.00
19	9	47.37%	2	1800 - 1830	2	6.67%	9.0 - 9.5	1	1.67%	0.15
20	14	73.68%	4				TOTAL	60	1	1.68
21	13	68.42%	4							
22	13	68.42%	5							
23	10	52.63%	4							
24	14	73.68%	3							
25	16	84.21%	1							
26	10	52.63%	5							
27	13	68.42%	2							
28	12	63.16%	5							
29	16	84.21%	1							
30	17	89.47%	2							
		TOTAL	60							

The average Turnover is 2.00 VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is 48.89% STALLS OCCUPIED
The average Duration is 1.68 HOURS PER VEHICLE

Block Face:	South Side	Count Date:	25-Apr-18
Location:	First Avenue	Day:	Wednesday
Limits:	Queen to King	Time:	09:00 - 18:30
Stalls:	46	Intervals:	19
Meters:			
Signed:	2 hour limit 7am to 6pm		

TURNOVER				ACCUMULATION				DURATION		
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	15	78.95%	2	0900 - 0930	5	10.87%	0.0 - 0.5	60	61.86%	0.15
2	10	52.63%	2	0930 - 1000	7	15.22%	0.5 - 1.0	16	16.49%	0.12
3	17	89.47%	1	1000 - 1030	12	26.09%	1.0 - 1.5	8	8.25%	0.10
4	18	94.74%	3	1030 - 1100	14	30.43%	1.5 - 2.0	1	1.03%	0.02
5	4	21.05%	3	1100 - 1130	12	26.09%	2.0 - 2.5	0	0.00%	0.00
6	12	63.16%	3	1130 - 1200	16	34.78%	2.5 - 3.0	0	0.00%	0.00
7	14	73.68%	2	1200 - 1230	16	34.78%	3.0 - 3.5	4	4.12%	0.13
8	12	63.16%	4	1230 - 1300	15	32.61%	3.5 - 4.0	1	1.03%	0.04
9	5	26.32%	4	1300 - 1330	13	28.26%	4.0 - 4.5	2	2.06%	0.09
10	8	42.11%	5	1330 - 1400	16	34.78%	4.5 - 5.0	1	1.03%	0.05
11	6	31.58%	3	1400 - 1430	13	28.26%	5.0 - 5.5	2	2.06%	0.11
12	4	21.05%	2	1430 - 1500	11	23.91%	5.5 - 6.0	0	0.00%	0.00
13	2	10.53%	2	1500 - 1530	15	32.61%	6.0 - 6.5	1	1.03%	0.06
14	5	26.32%	3	1530 - 1600	9	19.57%	6.5 - 7.0	0	0.00%	0.00
15	1	5.26%	1	1600 - 1630	13	28.26%	7.0 - 7.5	0	0.00%	0.00
16	0	0.00%	0	1630 - 1700	14	30.43%	7.5 - 8.0	0	0.00%	0.00
17	11	57.89%	2	1700 - 1730	12	26.09%	8.0 - 8.5	1	1.03%	0.09
18	0	0.00%	0	1730 - 1800	11	23.91%	8.5 - 9.0	0	0.00%	0.00
19	0	0.00%	0	1800 - 1830	11	23.91%	9.0 - 9.5	0	0.00%	0.00
20	2	10.53%	1				TOTAL	97	1	0.97
21	11	57.89%	1							
22	0	0.00%	0							
23	2	10.53%	1							
24	2	10.53%	2							
25	1	5.26%	1							
26	0	0.00%	0							
27	1	5.26%	1							
28	3	15.79%	2							
29	3	15.79%	1							
30	2	10.53%	2							
31	1	5.26%	1							
32	1	5.26%	1							
33	2	10.53%	2							
34	13	68.42%	1							
35	5	26.32%	4							
36	6	31.58%	5							
37	6	31.58%	6							
38	6	31.58%	4							
39	8	42.11%	3							
40	4	21.05%	4							
41	5	26.32%	4							
42	1	5.26%	1							
43	4	21.05%	4							
44	1	5.26%	1							
45	2	10.53%	2							
46	0	0.00%	0							
		TOTAL	97							

The average Turnover is	2.11	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	32.25%	STALLS OCCUPIED
The average Duration is	0.97	HOURS PER VEHICLE

Block Face: NORTH SIDE
Location: First Avenue
Limits: Queen to Calahoo
Stalls: 18
Meters:
Signed: 2 hour limit 7 am to 6 pm

Count Date: 25-Apr-18
Day: Wednesday
Time: 09:00 - 18:30
Intervals: 19

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	18	94.74%	2	0900 - 0930	8	44.44%	0.0 - 0.5	38	53.52%	0.13
2	13	68.42%	7	0930 - 1000	10	55.56%	0.5 - 1.0	11	15.49%	0.12
3	14	73.68%	1	1000 - 1030	10	55.56%	1.0 - 1.5	7	9.86%	0.12
4	18	94.74%	4	1030 - 1100	9	50.00%	1.5 - 2.0	3	4.23%	0.07
5	12	63.16%	4	1100 - 1130	10	55.56%	2.0 - 2.5	1	1.41%	0.03
6	16	84.21%	4	1130 - 1200	12	66.67%	2.5 - 3.0	4	5.63%	0.15
7	11	57.89%	3	1200 - 1230	11	61.11%	3.0 - 3.5	2	2.82%	0.09
8	15	78.95%	4	1230 - 1300	10	55.56%	3.5 - 4.0	0	0.00%	0.00
9	7	36.84%	2	1300 - 1330	12	66.67%	4.0 - 4.5	0	0.00%	0.00
10	5	26.32%	1	1330 - 1400	16	88.89%	4.5 - 5.0	2	2.82%	0.13
11	8	42.11%	4	1400 - 1430	14	77.78%	5.0 - 5.5	0	0.00%	0.00
12	6	31.58%	6	1430 - 1500	10	55.56%	5.5 - 6.0	1	1.41%	0.08
13	10	52.63%	4	1500 - 1530	14	77.78%	6.0 - 6.5	0	0.00%	0.00
14	15	78.95%	4	1530 - 1600	8	44.44%	6.5 - 7.0	1	1.41%	0.10
15	7	36.84%	6	1600 - 1630	9	50.00%	7.0 - 7.5	1	1.41%	0.10
16	9	47.37%	5	1630 - 1700	6	33.33%	7.5 - 8.0	0	0.00%	0.00
17	7	36.84%	6	1700 - 1730	10	55.56%	8.0 - 8.5	0	0.00%	0.00
18	6	31.58%	4	1730 - 1800	8	44.44%	8.5 - 9.0	0	0.00%	0.00
				1800 - 1830	8	44.44%	9.0 - 9.5	0	0.00%	0.00
		TOTAL	71				TOTAL	71	1	1.14

The average Turnover is 3.94 VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is 69.44% STALLS OCCUPIED
The average Duration is 1.14 HOURS PER VEHICLE

Block Face: North Side
Location: First Avenue
Limits: Main to Queen
Stalls: 18
Meters:
Signed: 2 hour limit 7 am to 6 pm

Count Date: 25-Apr-18
Day: Wednesday
Time: 09:00 - 18:30
Intervals: 19

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	6	31.58%	4	0900 - 0930	1	5.56%	0.0 - 0.5	22	62.86%	0.16
2	10	52.63%	3	0930 - 1000	4	22.22%	0.5 - 1.0	4	11.43%	0.09
3	2	10.53%	1	1000 - 1030	4	22.22%	1.0 - 1.5	6	17.14%	0.21
4	5	26.32%	3	1030 - 1100	6	33.33%	1.5 - 2.0	0	0.00%	0.00
5	2	10.53%	2	1100 - 1130	5	27.78%	2.0 - 2.5	1	2.86%	0.06
6	3	15.79%	2	1130 - 1200	7	38.89%	2.5 - 3.0	1	2.86%	0.08
7	1	5.26%	1	1200 - 1230	5	27.78%	3.0 - 3.5	0	0.00%	0.00
8	0	0.00%	0	1230 - 1300	3	16.67%	3.5 - 4.0	0	0.00%	0.00
9	4	21.05%	2	1300 - 1330	2	11.11%	4.0 - 4.5	1	2.86%	0.12
10	1	5.26%	1	1330 - 1400	4	22.22%	4.5 - 5.0	0	0.00%	0.00
11	0	0.00%	0	1400 - 1430	3	16.67%	5.0 - 5.5	0	0.00%	0.00
12	0	0.00%	0	1430 - 1500	5	27.78%	5.5 - 6.0	0	0.00%	0.00
13	0	0.00%	0	1500 - 1530	5	27.78%	6.0 - 6.5	0	0.00%	0.00
14	0	0.00%	0	1530 - 1600	1	5.56%	6.5 - 7.0	0	0.00%	0.00
15	5	26.32%	2	1600 - 1630	2	11.11%	7.0 - 7.5	0	0.00%	0.00
16	8	42.11%	4	1630 - 1700	2	11.11%	7.5 - 8.0	0	0.00%	0.00
17	7	36.84%	4	1700 - 1730	2	11.11%	8.0 - 8.5	0	0.00%	0.00
18	14	73.68%	6	1730 - 1800	2	11.11%	8.5 - 9.0	0	0.00%	0.00
				1800 - 1830	5	27.78%	9.0 - 9.5	0	0.00%	0.00
		TOTAL	35				TOTAL	35	1	0.72

The average Turnover is 1.94 VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is 22.22% STALLS OCCUPIED
The average Duration is 0.72 HOURS PER VEHICLE

Block Face: North Side
Location: First Avenue
Limits: King to Main
Stalls: 27
Meters:
Signed: 2 hour limit 7am to 6 pm

Count Date: 25-Apr-18
Day: Wednesday
Time: 09:00 - 18:30
Intervals: 19

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	5	26.32%	5	0900 - 0930	5	18.52%	0.0 - 0.5	83	64.84%	0.16
2	13	68.42%	3	0930 - 1000	6	22.22%	0.5 - 1.0	22	17.19%	0.13
3	15	78.95%	1	1000 - 1030	8	29.63%	1.0 - 1.5	7	5.47%	0.07
4	16	84.21%	3	1030 - 1100	13	48.15%	1.5 - 2.0	1	0.78%	0.01
5	8	42.11%	8	1100 - 1130	16	59.26%	2.0 - 2.5	5	3.91%	0.09
6	12	63.16%	8	1130 - 1200	21	77.78%	2.5 - 3.0	0	0.00%	0.00
7	8	42.11%	7	1200 - 1230	23	85.19%	3.0 - 3.5	1	0.78%	0.03
8	12	63.16%	11	1230 - 1300	21	77.78%	3.5 - 4.0	1	0.78%	0.03
9	16	84.21%	2	1300 - 1330	19	70.37%	4.0 - 4.5	0	0.00%	0.00
10	17	89.47%	8	1330 - 1400	16	59.26%	4.5 - 5.0	1	0.78%	0.04
11	17	89.47%	11	1400 - 1430	16	59.26%	5.0 - 5.5	0	0.00%	0.00
12	16	84.21%	5	1430 - 1500	20	74.07%	5.5 - 6.0	0	0.00%	0.00
13	9	47.37%	6	1500 - 1530	20	74.07%	6.0 - 6.5	0	0.00%	0.00
14	13	68.42%	6	1530 - 1600	14	51.85%	6.5 - 7.0	2	1.56%	0.11
15	10	52.63%	5	1600 - 1630	14	51.85%	7.0 - 7.5	3	2.34%	0.17
16	9	47.37%	8	1630 - 1700	17	62.96%	7.5 - 8.0	0	0.00%	0.00
17	15	78.95%	2	1700 - 1730	18	66.67%	8.0 - 8.5	2	1.56%	0.13
18	13	68.42%	6	1730 - 1800	18	66.67%	8.5 - 9.0	0	0.00%	0.00
19	3	15.79%	2	1800 - 1830	16	59.26%	9.0 - 9.5	0	0.00%	0.00
20	6	31.58%	5				TOTAL	128	1	0.96
21	10	52.63%	5							
22	9	47.37%	4							
23	1	5.26%	1							
24	17	89.47%	1							
25	2	10.53%	1							
26	12	63.16%	3							
27	17	89.47%	1							
		TOTAL	128							

The average Turnover is 4.74 VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is 71.60% STALLS OCCUPIED
The average Duration is 0.96 HOURS PER VEHICLE

Block Face:	South Side	Count Date:	25-Apr-18
Location:	McLeod Avenue	Day:	Wednesday
Limits:	Calahoo to Queen	Time:	09:00 - 18:30
Stalls:	19	Intervals:	19
Meters:			
Signed:	2 hour limit		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	1	5.26%	1	0900 - 0930	0	0.00%	0.0 - 0.5	12	57.14%	0.14
2	4	21.05%	4	0930 - 1000	0	0.00%	0.5 - 1.0	3	14.29%	0.11
3	10	52.63%	3	1000 - 1030	1	5.26%	1.0 - 1.5	2	9.52%	0.12
4	13	68.42%	1	1030 - 1100	2	10.53%	1.5 - 2.0	1	4.76%	0.08
5	0	0.00%	0	1100 - 1130	5	26.32%	2.0 - 2.5	0	0.00%	0.00
6	1	5.26%	1	1130 - 1200	3	15.79%	2.5 - 3.0	2	9.52%	0.26
7	6	31.58%	2	1200 - 1230	4	21.05%	3.0 - 3.5	0	0.00%	0.00
8	6	31.58%	1	1230 - 1300	3	15.79%	3.5 - 4.0	0	0.00%	0.00
9	1	5.26%	1	1300 - 1330	4	21.05%	4.0 - 4.5	0	0.00%	0.00
10	5	26.32%	3	1330 - 1400	3	15.79%	4.5 - 5.0	0	0.00%	0.00
11	3	15.79%	2	1400 - 1430	3	15.79%	5.0 - 5.5	0	0.00%	0.00
12	3	15.79%	2	1430 - 1500	5	26.32%	5.5 - 6.0	0	0.00%	0.00
13	0	0.00%	0	1500 - 1530	6	31.58%	6.0 - 6.5	0	0.00%	0.00
14	0	0.00%	0	1530 - 1600	5	26.32%	6.5 - 7.0	0	0.00%	0.00
15	0	0.00%	0	1600 - 1630	4	21.05%	7.0 - 7.5	1	4.76%	0.35
16	0	0.00%	0	1630 - 1700	2	10.53%	7.5 - 8.0	0	0.00%	0.00
17	0	0.00%	0	1700 - 1730	1	5.26%	8.0 - 8.5	0	0.00%	0.00
18	0	0.00%	0	1730 - 1800	1	5.26%	8.5 - 9.0	0	0.00%	0.00
19	0	0.00%	0	1800 - 1830	1	5.26%	9.0 - 9.5	0	0.00%	0.00
		TOTAL	21				TOTAL	21	1	1.06

The average Turnover is	1.11	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	17.54%	STALLS OCCUPIED
The average Duration is	1.06	HOURS PER VEHICLE

Block Face: South Side
Location: McLeod Avenue
Limits: Queen to Main
Stalls: 23
Meters:
Signed: 2 hour

Count Date: 25-Apr-18
Day: Wednesday
Time: 09:00 - 18:30
Intervals: 19

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	3	15.79%	3	0900 - 0930	8	34.78%	0.0 - 0.5	90	73.77%	0.18
2	8	42.11%	4	0930 - 1000	6	26.09%	0.5 - 1.0	20	16.39%	0.12
3	4	21.05%	3	1000 - 1030	8	34.78%	1.0 - 1.5	9	7.38%	0.09
4	8	42.11%	3	1030 - 1100	10	43.48%	1.5 - 2.0	3	2.46%	0.04
5	9	47.37%	5	1100 - 1130	9	39.13%	2.0 - 2.5	0	0.00%	0.00
6	7	36.84%	3	1130 - 1200	13	56.52%	2.5 - 3.0	0	0.00%	0.00
7	7	36.84%	5	1200 - 1230	15	65.22%	3.0 - 3.5	0	0.00%	0.00
8	5	26.32%	3	1230 - 1300	11	47.83%	3.5 - 4.0	0	0.00%	0.00
9	8	42.11%	6	1300 - 1330	15	65.22%	4.0 - 4.5	0	0.00%	0.00
10	10	52.63%	6	1330 - 1400	10	43.48%	4.5 - 5.0	0	0.00%	0.00
11	6	31.58%	3	1400 - 1430	16	69.57%	5.0 - 5.5	0	0.00%	0.00
12	8	42.11%	7	1430 - 1500	9	39.13%	5.5 - 6.0	0	0.00%	0.00
13	7	36.84%	4	1500 - 1530	9	39.13%	6.0 - 6.5	0	0.00%	0.00
14	7	36.84%	6	1530 - 1600	6	26.09%	6.5 - 7.0	0	0.00%	0.00
15	13	68.42%	9	1600 - 1630	2	8.70%	7.0 - 7.5	0	0.00%	0.00
16	8	42.11%	8	1630 - 1700	2	8.70%	7.5 - 8.0	0	0.00%	0.00
17	13	68.42%	9	1700 - 1730	5	21.74%	8.0 - 8.5	0	0.00%	0.00
18	7	36.84%	7	1730 - 1800	7	30.43%	8.5 - 9.0	0	0.00%	0.00
19	8	42.11%	7	1800 - 1830	8	34.78%	9.0 - 9.5	0	0.00%	0.00
20	9	47.37%	9				TOTAL	122	1	0.44
21	6	31.58%	5							
22	5	26.32%	4							
23	3	15.79%	3							
		TOTAL	122							

The average Turnover is 5.30 VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is 57.97% STALLS OCCUPIED
The average Duration is 0.44 HOURS PER VEHICLE

Block Face:	South Side	Count Date:	25-Apr-18
Location:	McLeod Avenue	Day:	Wednesday
Limits:	Main to King	Time:	09:00 - 18:30
Stalls:	20	Intervals:	19
Meters:			
Signed:	2 hour		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	12	63.16%	1	0900 - 0930	3	15.00%	0.0 - 0.5	29	41.43%	0.10
2	2	10.53%	2	0930 - 1000	7	35.00%	0.5 - 1.0	15	21.43%	0.16
3	6	31.58%	1	1000 - 1030	8	40.00%	1.0 - 1.5	14	20.00%	0.25
4	5	26.32%	2	1030 - 1100	8	40.00%	1.5 - 2.0	3	4.29%	0.08
5	7	36.84%	2	1100 - 1130	10	50.00%	2.0 - 2.5	3	4.29%	0.10
6	4	21.05%	2	1130 - 1200	11	55.00%	2.5 - 3.0	2	2.86%	0.08
7	1	5.26%	1	1200 - 1230	15	75.00%	3.0 - 3.5	1	1.43%	0.05
8	13	68.42%	3	1230 - 1300	11	55.00%	3.5 - 4.0	1	1.43%	0.05
9	4	21.05%	3	1300 - 1330	13	65.00%	4.0 - 4.5	1	1.43%	0.06
10	11	57.89%	5	1330 - 1400	12	60.00%	4.5 - 5.0	0	0.00%	0.00
11	3	15.79%	3	1400 - 1430	9	45.00%	5.0 - 5.5	0	0.00%	0.00
12	13	68.42%	5	1430 - 1500	11	55.00%	5.5 - 6.0	1	1.43%	0.08
13	10	52.63%	7	1500 - 1530	12	60.00%	6.0 - 6.5	0	0.00%	0.00
14	11	57.89%	4	1530 - 1600	11	55.00%	6.5 - 7.0	0	0.00%	0.00
15	12	63.16%	4	1600 - 1630	4	20.00%	7.0 - 7.5	0	0.00%	0.00
16	12	63.16%	5	1630 - 1700	5	25.00%	7.5 - 8.0	0	0.00%	0.00
17	10	52.63%	6	1700 - 1730	6	30.00%	8.0 - 8.5	0	0.00%	0.00
18	12	63.16%	5	1730 - 1800	7	35.00%	8.5 - 9.0	0	0.00%	0.00
19	11	57.89%	5	1800 - 1830	13	65.00%	9.0 - 9.5	0	0.00%	0.00
20	17	89.47%	4				TOTAL	70	1	1.01
		TOTAL	70							

The average Turnover is	3.50	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	59.17%	STALLS OCCUPIED
The average Duration is	1.01	HOURS PER VEHICLE

Block Face:	North Side	Count Date:	25-Apr-18
Location:	McLeod Avenue	Day:	Wednesday
Limits:	King to Main	Time:	09:00 - 18:30
Stalls:	27	Intervals:	19
Meters:			
Signed:	2 hour limit		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	15	78.95%	8	0900 - 0930	10	37.04%	0.0 - 0.5	60	54.05%	0.14
2	13	68.42%	8	0930 - 1000	9	33.33%	0.5 - 1.0	23	20.72%	0.16
3	14	73.68%	6	1000 - 1030	10	37.04%	1.0 - 1.5	13	11.71%	0.15
4	19	100.00%	3	1030 - 1100	13	48.15%	1.5 - 2.0	8	7.21%	0.13
5	14	73.68%	4	1100 - 1130	10	37.04%	2.0 - 2.5	2	1.80%	0.04
6	11	57.89%	7	1130 - 1200	12	44.44%	2.5 - 3.0	0	0.00%	0.00
7	17	89.47%	6	1200 - 1230	17	62.96%	3.0 - 3.5	2	1.80%	0.06
8	13	68.42%	6	1230 - 1300	17	62.96%	3.5 - 4.0	0	0.00%	0.00
9	11	57.89%	6	1300 - 1330	19	70.37%	4.0 - 4.5	1	0.90%	0.04
10	13	68.42%	4	1330 - 1400	14	51.85%	4.5 - 5.0	0	0.00%	0.00
11	16	84.21%	2	1400 - 1430	14	51.85%	5.0 - 5.5	0	0.00%	0.00
12	12	63.16%	7	1430 - 1500	13	48.15%	5.5 - 6.0	0	0.00%	0.00
13	11	57.89%	6	1500 - 1530	12	44.44%	6.0 - 6.5	1	0.90%	0.06
14	12	63.16%	4	1530 - 1600	9	33.33%	6.5 - 7.0	0	0.00%	0.00
15	8	42.11%	7	1600 - 1630	14	51.85%	7.0 - 7.5	0	0.00%	0.00
16	9	47.37%	6	1630 - 1700	9	33.33%	7.5 - 8.0	0	0.00%	0.00
17	5	26.32%	4	1700 - 1730	11	40.74%	8.0 - 8.5	1	0.90%	0.07
18	8	42.11%	4	1730 - 1800	13	48.15%	8.5 - 9.0	0	0.00%	0.00
19	4	21.05%	4	1800 - 1830	14	51.85%	9.0 - 9.5	0	0.00%	0.00
20	2	10.53%	1				TOTAL	111	1	0.83
21	2	10.53%	1							
22	3	15.79%	2							
23	2	10.53%	1							
24	1	5.26%	1							
25	0	0.00%	0							
26	3	15.79%	2							
27	2	10.53%	1							
		TOTAL	111							

The average Turnover is	4.11	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	57.41%	STALLS OCCUPIED
The average Duration is	0.83	HOURS PER VEHICLE

Block Face:	North Side	Count Date:	25-Apr-18
Location:	McLeod Avenue	Day:	Wednesday
Limits:	Main to Queen	Time:	09:00 - 18:30
Stalls:	24	Intervals:	19
Meters:			
Signed:	2 hour limit		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	9	47.37%	4	0900 - 0930	4	16.67%	0.0 - 0.5	61	58.65%	0.15
2	1	5.26%	1	0930 - 1000	9	37.50%	0.5 - 1.0	23	22.12%	0.17
3	8	42.11%	7	1000 - 1030	7	29.17%	1.0 - 1.5	11	10.58%	0.13
4	6	31.58%	5	1030 - 1100	10	41.67%	1.5 - 2.0	3	2.88%	0.05
5	6	31.58%	5	1100 - 1130	10	41.67%	2.0 - 2.5	3	2.88%	0.06
6	9	47.37%	3	1130 - 1200	9	37.50%	2.5 - 3.0	3	2.88%	0.08
7	9	47.37%	5	1200 - 1230	9	37.50%	3.0 - 3.5	0	0.00%	0.00
8	15	78.95%	7	1230 - 1300	12	50.00%	3.5 - 4.0	0	0.00%	0.00
9	12	63.16%	5	1300 - 1330	10	41.67%	4.0 - 4.5	0	0.00%	0.00
10	8	42.11%	6	1330 - 1400	9	37.50%	4.5 - 5.0	0	0.00%	0.00
11	12	63.16%	6	1400 - 1430	11	45.83%	5.0 - 5.5	0	0.00%	0.00
12	10	52.63%	7	1430 - 1500	9	37.50%	5.5 - 6.0	0	0.00%	0.00
13	10	52.63%	7	1500 - 1530	9	37.50%	6.0 - 6.5	0	0.00%	0.00
14	12	63.16%	4	1530 - 1600	11	45.83%	6.5 - 7.0	0	0.00%	0.00
15	5	26.32%	3	1600 - 1630	12	50.00%	7.0 - 7.5	0	0.00%	0.00
16	10	52.63%	5	1630 - 1700	11	45.83%	7.5 - 8.0	0	0.00%	0.00
17	9	47.37%	6	1700 - 1730	11	45.83%	8.0 - 8.5	0	0.00%	0.00
18	2	10.53%	2	1730 - 1800	11	45.83%	8.5 - 9.0	0	0.00%	0.00
19	3	15.79%	2	1800 - 1830	11	45.83%	9.0 - 9.5	0	0.00%	0.00
20	5	26.32%	1				TOTAL	104	1	0.64
21	9	47.37%	3							
22	6	31.58%	4							
23	6	31.58%	3							
24	3	15.79%	3							
		TOTAL	104							

The average Turnover is	4.33	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	41.67%	STALLS OCCUPIED
The average Duration is	0.64	HOURS PER VEHICLE

Block Face:	North Side	Count Date:	25-Apr-18
Location:	McLeod Avenue	Day:	Wednesday
Limits:	Queen to Calahoo	Time:	09:00 - 18:30
Stalls:	22	Intervals:	19
Meters:			
Signed:	2 hour limit		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	2	10.53%	2	0900 - 0930	4	18.18%	0.0 - 0.5	28	59.57%	0.15
2	2	10.53%	2	0930 - 1000	3	13.64%	0.5 - 1.0	1	2.13%	0.02
3	7	36.84%	6	1000 - 1030	7	31.82%	1.0 - 1.5	10	21.28%	0.27
4	8	42.11%	4	1030 - 1100	6	27.27%	1.5 - 2.0	1	2.13%	0.04
5	3	15.79%	3	1100 - 1130	6	27.27%	2.0 - 2.5	5	10.64%	0.24
6	8	42.11%	3	1130 - 1200	4	18.18%	2.5 - 3.0	1	2.13%	0.06
7	9	47.37%	3	1200 - 1230	3	13.64%	3.0 - 3.5	0	0.00%	0.00
8	6	31.58%	2	1230 - 1300	3	13.64%	3.5 - 4.0	1	2.13%	0.08
9	5	26.32%	1	1300 - 1330	9	40.91%	4.0 - 4.5	0	0.00%	0.00
10	4	21.05%	3	1330 - 1400	9	40.91%	4.5 - 5.0	0	0.00%	0.00
11	3	15.79%	3	1400 - 1430	9	40.91%	5.0 - 5.5	0	0.00%	0.00
12	4	21.05%	2	1430 - 1500	6	27.27%	5.5 - 6.0	0	0.00%	0.00
13	6	31.58%	2	1500 - 1530	5	22.73%	6.0 - 6.5	0	0.00%	0.00
14	0	0.00%	0	1530 - 1600	4	18.18%	6.5 - 7.0	0	0.00%	0.00
15	3	15.79%	2	1600 - 1630	6	27.27%	7.0 - 7.5	0	0.00%	0.00
16	8	42.11%	1	1630 - 1700	7	31.82%	7.5 - 8.0	0	0.00%	0.00
17	4	21.05%	2	1700 - 1730	6	27.27%	8.0 - 8.5	0	0.00%	0.00
18	4	21.05%	2	1730 - 1800	3	13.64%	8.5 - 9.0	0	0.00%	0.00
19	8	42.11%	2	1800 - 1830	5	22.73%	9.0 - 9.5	0	0.00%	0.00
20	6	31.58%	1				TOTAL	47	1	0.85
21	5	26.32%	1							
22	0	0.00%	0							
		TOTAL	47							

The average Turnover is	2.14	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	28.03%	STALLS OCCUPIED
The average Duration is	0.85	HOURS PER VEHICLE

Block Face:	East Side	Count Date:	25-Apr-18
Location:	Queen Street	Day:	Wednesday
Limits:	McLeod to Church	Time:	09:00 - 18:30
Stalls:	11	Intervals:	19
Meters:			
Signed:	No sign		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	4	21.05%	3	0900 - 0930	3	27.27%	0.0 - 0.5	10	52.63%	0.13
2	4	21.05%	4	0930 - 1000	4	36.36%	0.5 - 1.0	4	21.05%	0.16
3	5	26.32%	3	1000 - 1030	5	45.45%	1.0 - 1.5	1	5.26%	0.07
4	5	26.32%	3	1030 - 1100	4	36.36%	1.5 - 2.0	0	0.00%	0.00
5	9	47.37%	1	1100 - 1130	5	45.45%	2.0 - 2.5	0	0.00%	0.00
6	0	0.00%	0	1130 - 1200	3	27.27%	2.5 - 3.0	0	0.00%	0.00
7	10	52.63%	1	1200 - 1230	5	45.45%	3.0 - 3.5	0	0.00%	0.00
8	2	10.53%	1	1230 - 1300	3	27.27%	3.5 - 4.0	0	0.00%	0.00
9	1	5.26%	1	1300 - 1330	7	63.64%	4.0 - 4.5	1	5.26%	0.22
10	19	100.00%	1	1330 - 1400	6	54.55%	4.5 - 5.0	1	5.26%	0.25
11	19	100.00%	1	1400 - 1430	4	36.36%	5.0 - 5.5	0	0.00%	0.00
				1430 - 1500	3	27.27%	5.5 - 6.0	0	0.00%	0.00
				1500 - 1530	4	36.36%	6.0 - 6.5	0	0.00%	0.00
				1530 - 1600	3	27.27%	6.5 - 7.0	0	0.00%	0.00
				1600 - 1630	4	36.36%	7.0 - 7.5	0	0.00%	0.00
				1630 - 1700	5	45.45%	7.5 - 8.0	0	0.00%	0.00
				1700 - 1730	3	27.27%	8.0 - 8.5	0	0.00%	0.00
				1730 - 1800	4	36.36%	8.5 - 9.0	0	0.00%	0.00
				1800 - 1830	3	27.27%	9.0 - 9.5	2	10.53%	0.97
		TOTAL	19				TOTAL	19	1	1.80

The average Turnover is	1.73	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	42.42%	STALLS OCCUPIED
The average Duration is	1.80	HOURS PER VEHICLE

Block Face:	West Side	Count Date:	25-Apr-18
Location:	Queen Street	Day:	Wednesday
Limits:	Church to McLeod	Time:	09:00 - 18:30
Stalls:	10	Intervals:	19
Meters:			
Signed:	No sign		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	0	0.00%	0	0900 - 0930	0	0.00%	0.0 - 0.5	0	0.00%	0.00
2	0	0.00%	0	0930 - 1000	0	0.00%	0.5 - 1.0	0	0.00%	0.00
3	0	0.00%	0	1000 - 1030	0	0.00%	1.0 - 1.5	0	0.00%	0.00
4	0	0.00%	0	1030 - 1100	0	0.00%	1.5 - 2.0	0	0.00%	0.00
5	0	0.00%	0	1100 - 1130	0	0.00%	2.0 - 2.5	0	0.00%	0.00
6	0	0.00%	0	1130 - 1200	0	0.00%	2.5 - 3.0	0	0.00%	0.00
7	0	0.00%	0	1200 - 1230	0	0.00%	3.0 - 3.5	0	0.00%	0.00
8	0	0.00%	0	1230 - 1300	0	0.00%	3.5 - 4.0	0	0.00%	0.00
9	0	0.00%	0	1300 - 1330	0	0.00%	4.0 - 4.5	0	0.00%	0.00
10	0	0.00%	0	1330 - 1400	0	0.00%	4.5 - 5.0	0	0.00%	0.00
				1400 - 1430	0	0.00%	5.0 - 5.5	0	0.00%	0.00
				1430 - 1500	0	0.00%	5.5 - 6.0	0	0.00%	0.00
				1500 - 1530	0	0.00%	6.0 - 6.5	0	0.00%	0.00
				1530 - 1600	0	0.00%	6.5 - 7.0	0	0.00%	0.00
				1600 - 1630	0	0.00%	7.0 - 7.5	0	0.00%	0.00
				1630 - 1700	0	0.00%	7.5 - 8.0	0	0.00%	0.00
				1700 - 1730	0	0.00%	8.0 - 8.5	0	0.00%	0.00
				1730 - 1800	0	0.00%	8.5 - 9.0	0	0.00%	0.00
				1800 - 1830	0	0.00%	9.0 - 9.5	0	0.00%	0.00
		TOTAL	0				TOTAL	0	0	0.00

The average Turnover is	0.00	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	0.00%	STALLS OCCUPIED
The average Duration is	0.00	HOURS PER VEHICLE

Block Face:	East Side	Count Date:	25-Apr-18
Location:	Queen Street	Day:	Wednesday
Limits:	First to McLeod	Time:	09:00 - 18:30
Stalls:	8	Intervals:	19
Meters:			
Signed:	No sign		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	0	0.00%	0	0900 - 0930	7	87.50%	0.0 - 0.5	3	18.75%	0.05
2	15	78.95%	5	0930 - 1000	7	87.50%	0.5 - 1.0	4	25.00%	0.19
3	16	84.21%	1	1000 - 1030	7	87.50%	1.0 - 1.5	1	6.25%	0.08
4	14	73.68%	1	1030 - 1100	7	87.50%	1.5 - 2.0	1	6.25%	0.11
5	19	100.00%	3	1100 - 1130	7	87.50%	2.0 - 2.5	0	0.00%	0.00
6	16	84.21%	1	1130 - 1200	7	87.50%	2.5 - 3.0	1	6.25%	0.17
7	6	31.58%	1	1200 - 1230	6	75.00%	3.0 - 3.5	0	0.00%	0.00
8	17	89.47%	4	1230 - 1300	6	75.00%	3.5 - 4.0	1	6.25%	0.23
				1300 - 1330	6	75.00%	4.0 - 4.5	0	0.00%	0.00
				1330 - 1400	6	75.00%	4.5 - 5.0	1	6.25%	0.30
				1400 - 1430	6	75.00%	5.0 - 5.5	0	0.00%	0.00
				1430 - 1500	6	75.00%	5.5 - 6.0	0	0.00%	0.00
				1500 - 1530	5	62.50%	6.0 - 6.5	0	0.00%	0.00
				1530 - 1600	5	62.50%	6.5 - 7.0	0	0.00%	0.00
				1600 - 1630	5	62.50%	7.0 - 7.5	2	12.50%	0.91
				1630 - 1700	4	50.00%	7.5 - 8.0	2	12.50%	0.97
				1700 - 1730	1	12.50%	8.0 - 8.5	0	0.00%	0.00
				1730 - 1800	2	25.00%	8.5 - 9.0	0	0.00%	0.00
				1800 - 1830	2	25.00%	9.0 - 9.5	0	0.00%	0.00
		TOTAL	16				TOTAL	16	1	3.00

The average Turnover is	2.00	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	77.08%	STALLS OCCUPIED
The average Duration is	3.00	HOURS PER VEHICLE

Block Face:	West Side	Count Date:	25-Apr-18
Location:	Queen Street	Day:	Wednesday
Limits:	First to McLeod	Time:	09:00 - 18:30
Stalls:	7	Intervals:	19
Meters:			
Signed:	No sign		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	17	89.47%	1	0900 - 0930	7	100.00%	0.0 - 0.5	3	17.65%	0.04
2	12	63.16%	2	0930 - 1000	7	100.00%	0.5 - 1.0	3	17.65%	0.13
3	19	100.00%	1	1000 - 1030	7	100.00%	1.0 - 1.5	1	5.88%	0.07
4	15	78.95%	3	1030 - 1100	7	100.00%	1.5 - 2.0	2	11.76%	0.21
5	18	94.74%	5	1100 - 1130	6	85.71%	2.0 - 2.5	0	0.00%	0.00
6	19	100.00%	2	1130 - 1200	6	85.71%	2.5 - 3.0	1	5.88%	0.16
7	18	94.74%	3	1200 - 1230	6	85.71%	3.0 - 3.5	0	0.00%	0.00
				1230 - 1300	7	100.00%	3.5 - 4.0	0	0.00%	0.00
				1300 - 1330	7	100.00%	4.0 - 4.5	1	5.88%	0.25
				1330 - 1400	7	100.00%	4.5 - 5.0	1	5.88%	0.28
				1400 - 1430	6	85.71%	5.0 - 5.5	1	5.88%	0.31
				1430 - 1500	6	85.71%	5.5 - 6.0	0	0.00%	0.00
				1500 - 1530	7	100.00%	6.0 - 6.5	1	5.88%	0.37
				1530 - 1600	7	100.00%	6.5 - 7.0	0	0.00%	0.00
				1600 - 1630	7	100.00%	7.0 - 7.5	1	5.88%	0.43
				1630 - 1700	5	71.43%	7.5 - 8.0	0	0.00%	0.00
				1700 - 1730	5	71.43%	8.0 - 8.5	1	5.88%	0.49
				1730 - 1800	5	71.43%	8.5 - 9.0	0	0.00%	0.00
				1800 - 1830	5	71.43%	9.0 - 9.5	1	5.88%	0.54
		TOTAL	17				TOTAL	17	1	3.28

The average Turnover is	2.43	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	92.86%	STALLS OCCUPIED
The average Duration is	3.28	HOURS PER VEHICLE

Block Face:	West Side	Count Date:	25-Apr-18
Location:	Main Street	Day:	Wednesday
Limits:	McLeod to First	Time:	09:00 - 18:30
Stalls:	11	Intervals:	19
Meters:			
Signed:	No sign		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	17	89.47%	1	0900 - 0930	11	100.00%	0.0 - 0.5	11	40.74%	0.10
2	11	57.89%	4	0930 - 1000	10	90.91%	0.5 - 1.0	2	7.41%	0.06
3	15	78.95%	2	1000 - 1030	11	100.00%	1.0 - 1.5	1	3.70%	0.05
4	12	63.16%	4	1030 - 1100	11	100.00%	1.5 - 2.0	1	3.70%	0.06
5	18	94.74%	2	1100 - 1130	9	81.82%	2.0 - 2.5	0	0.00%	0.00
6	15	78.95%	5	1130 - 1200	10	90.91%	2.5 - 3.0	0	0.00%	0.00
7	16	84.21%	2	1200 - 1230	11	100.00%	3.0 - 3.5	2	7.41%	0.24
8	16	84.21%	2	1230 - 1300	11	100.00%	3.5 - 4.0	2	7.41%	0.28
9	12	63.16%	3	1300 - 1330	11	100.00%	4.0 - 4.5	1	3.70%	0.16
10	16	84.21%	1	1330 - 1400	10	90.91%	4.5 - 5.0	1	3.70%	0.18
11	17	89.47%	1	1400 - 1430	9	81.82%	5.0 - 5.5	0	0.00%	0.00
				1430 - 1500	8	72.73%	5.5 - 6.0	0	0.00%	0.00
				1500 - 1530	9	81.82%	6.0 - 6.5	0	0.00%	0.00
				1530 - 1600	9	81.82%	6.5 - 7.0	1	3.70%	0.25
				1600 - 1630	8	72.73%	7.0 - 7.5	2	7.41%	0.54
				1630 - 1700	7	63.64%	7.5 - 8.0	1	3.70%	0.29
				1700 - 1730	6	54.55%	8.0 - 8.5	2	7.41%	0.61
				1730 - 1800	3	27.27%	8.5 - 9.0	0	0.00%	0.00
				1800 - 1830	1	9.09%	9.0 - 9.5	0	0.00%	0.00
		TOTAL	27				TOTAL	27	1	2.81

The average Turnover is	2.45	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	93.94%	STALLS OCCUPIED
The average Duration is	2.81	HOURS PER VEHICLE

Block Face:	West Side	Count Date:	25-Apr-18
Location:	Main Street	Day:	Wednesday
Limits:	Church to McLeod	Time:	09:00 - 18:30
Stalls:	21	Intervals:	19
Meters:			
Signed:	No sign		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	13	68.42%	2	0900 - 0930	7	33.33%	0.0 - 0.5	26	56.52%	0.14
2	9	47.37%	3	0930 - 1000	11	52.38%	0.5 - 1.0	6	13.04%	0.10
3	9	47.37%	6	1000 - 1030	9	42.86%	1.0 - 1.5	1	2.17%	0.03
4	2	10.53%	2	1030 - 1100	11	52.38%	1.5 - 2.0	0	0.00%	0.00
5	4	21.05%	3	1100 - 1130	11	52.38%	2.0 - 2.5	1	2.17%	0.05
6	7	36.84%	1	1130 - 1200	11	52.38%	2.5 - 3.0	0	0.00%	0.00
7	19	100.00%	1	1200 - 1230	12	57.14%	3.0 - 3.5	3	6.52%	0.21
8	1	5.26%	1	1230 - 1300	13	61.90%	3.5 - 4.0	1	2.17%	0.08
9	2	10.53%	2	1300 - 1330	13	61.90%	4.0 - 4.5	1	2.17%	0.09
10	1	5.26%	1	1330 - 1400	12	57.14%	4.5 - 5.0	0	0.00%	0.00
11	19	100.00%	1	1400 - 1430	11	52.38%	5.0 - 5.5	0	0.00%	0.00
12	11	57.89%	4	1430 - 1500	11	52.38%	5.5 - 6.0	1	2.17%	0.13
13	10	52.63%	2	1500 - 1530	11	52.38%	6.0 - 6.5	2	4.35%	0.27
14	6	31.58%	3	1530 - 1600	16	76.19%	6.5 - 7.0	0	0.00%	0.00
15	2	10.53%	2	1600 - 1630	11	52.38%	7.0 - 7.5	0	0.00%	0.00
16	17	89.47%	4	1630 - 1700	7	33.33%	7.5 - 8.0	0	0.00%	0.00
17	18	94.74%	1	1700 - 1730	8	38.10%	8.0 - 8.5	0	0.00%	0.00
18	14	73.68%	4	1730 - 1800	6	28.57%	8.5 - 9.0	1	2.17%	0.19
19	19	100.00%	1	1800 - 1830	6	28.57%	9.0 - 9.5	3	6.52%	0.60
20	14	73.68%	2				TOTAL	46	1	1.89
21	0	0.00%	0							
		TOTAL	46							

The average Turnover is	2.19	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	57.14%	STALLS OCCUPIED
The average Duration is	1.89	HOURS PER VEHICLE

Block Face:	EAST SIDE	Count Date:	25-Apr-18
Location:	Main Street	Day:	Wednesday
Limits:	First to McLeod	Time:	09:00 - 18:30
Stalls:	16	Intervals:	19
Meters:			
Signed:	No sign		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HOURS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	19	100.00%	2	0900 - 0930	16	100.00%	0.0 - 0.5	1	3.57%	0.01
2	17	89.47%	3	0930 - 1000	15	93.75%	0.5 - 1.0	5	17.86%	0.13
3	18	94.74%	2	1000 - 1030	15	93.75%	1.0 - 1.5	1	3.57%	0.04
4	15	78.95%	2	1030 - 1100	15	93.75%	1.5 - 2.0	0	0.00%	0.00
5	16	84.21%	2	1100 - 1130	15	93.75%	2.0 - 2.5	3	10.71%	0.24
6	19	100.00%	1	1130 - 1200	13	81.25%	2.5 - 3.0	0	0.00%	0.00
7	1	5.26%	1	1200 - 1230	13	81.25%	3.0 - 3.5	5	17.86%	0.58
8	13	68.42%	1	1230 - 1300	15	93.75%	3.5 - 4.0	2	7.14%	0.27
9	15	78.95%	1	1300 - 1330	15	93.75%	4.0 - 4.5	1	3.57%	0.15
10	16	84.21%	1	1330 - 1400	14	87.50%	4.5 - 5.0	0	0.00%	0.00
11	17	89.47%	1	1400 - 1430	14	87.50%	5.0 - 5.5	0	0.00%	0.00
12	16	84.21%	1	1430 - 1500	15	93.75%	5.5 - 6.0	0	0.00%	0.00
13	17	89.47%	3	1500 - 1530	15	93.75%	6.0 - 6.5	1	3.57%	0.22
14	13	68.42%	2	1530 - 1600	14	87.50%	6.5 - 7.0	1	3.57%	0.24
15	16	84.21%	3	1600 - 1630	13	81.25%	7.0 - 7.5	2	7.14%	0.52
16	17	89.47%	2	1630 - 1700	10	62.50%	7.5 - 8.0	4	14.29%	1.11
				1700 - 1730	6	37.50%	8.0 - 8.5	1	3.57%	0.29
				1730 - 1800	7	43.75%	8.5 - 9.0	0	0.00%	0.00
				1800 - 1830	6	37.50%	9.0 - 9.5	1	3.57%	0.33
		TOTAL	28				TOTAL	28	1	4.14

The average Turnover is	1.75	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	87.50%	STALLS OCCUPIED
The average Duration is	4.14	HOURS PER VEHICLE

Block Face:	EAST SIDE	Count Date:	25-Apr-18
Location:	Main Street	Day:	Wednesday
Limits:	McLeod to Church	Time:	09:00 - 18:30
Stalls:	15	Intervals:	19
Meters:			
Signed:	No sign		

TURNOVER				ACCUMULATION			DURATION			
SPACE NO.	INTERVALS USED	% USED	TURNOVER	TIME PERIOD	NO. STALLS OCCUPIED	% OCCUPIED	DURATIONS (HRS)	NO. VEHICLES	% OF VEHICLES	AVG DURATION
1	8	42.11%	3	0900 - 0930	1	6.67%	0.0 - 0.5	21	45.65%	0.11
2	8	42.11%	3	0930 - 1000	3	20.00%	0.5 - 1.0	11	23.91%	0.18
3	3	15.79%	1	1000 - 1030	4	26.67%	1.0 - 1.5	8	17.39%	0.22
4	2	10.53%	1	1030 - 1100	5	33.33%	1.5 - 2.0	4	8.70%	0.15
5	8	42.11%	5	1100 - 1130	8	53.33%	2.0 - 2.5	1	2.17%	0.05
6	5	26.32%	2	1130 - 1200	7	46.67%	2.5 - 3.0	0	0.00%	0.00
7	13	68.42%	1	1200 - 1230	9	60.00%	3.0 - 3.5	0	0.00%	0.00
8	5	26.32%	4	1230 - 1300	6	40.00%	3.5 - 4.0	0	0.00%	0.00
9	10	52.63%	4	1300 - 1330	6	40.00%	4.0 - 4.5	0	0.00%	0.00
10	8	42.11%	5	1330 - 1400	5	33.33%	4.5 - 5.0	0	0.00%	0.00
11	13	68.42%	7	1400 - 1430	5	33.33%	5.0 - 5.5	0	0.00%	0.00
12	5	26.32%	4	1430 - 1500	7	46.67%	5.5 - 6.0	0	0.00%	0.00
13	7	36.84%	3	1500 - 1530	11	73.33%	6.0 - 6.5	1	2.17%	0.14
14	1	5.26%	1	1530 - 1600	6	40.00%	6.5 - 7.0	0	0.00%	0.00
15	5	26.32%	2	1600 - 1630	3	20.00%	7.0 - 7.5	0	0.00%	0.00
				1630 - 1700	2	13.33%	7.5 - 8.0	0	0.00%	0.00
				1700 - 1730	6	40.00%	8.0 - 8.5	0	0.00%	0.00
				1730 - 1800	5	33.33%	8.5 - 9.0	0	0.00%	0.00
				1800 - 1830	2	13.33%	9.0 - 9.5	0	0.00%	0.00
		TOTAL	46				TOTAL	46	1	0.85

The average Turnover is	3.07	VEHICLES PER STALL
The average Accumulation (11:30 - 14:30) is	42.22%	STALLS OCCUPIED
The average Duration is	0.85	HOURS PER VEHICLE