September 12, 2022

Application for substantial amendments to the Development Agreement on property PID#00362442 in Lower Sackville for the purpose of residential development.

Carl Purvis
Planning Applications
Program Manager
Halifax Regional Municipality
Halifax, NS B3J 3A5

Dear Mr. Purvis,

On behalf of our client First Mutual Properties Limited, I am applying to the Halifax Regional Municipality for substantial amendments to the Development Agreement registered against the above identified property located at 70 First Lake Drive in Lower Sackville, NS. The purpose of this planning application is to develop one residential multi-unit building and two mixed-use buildings on the property, containing a total of 800 housing units and additional commercial space. Development Agreements for multiple unit dwellings are enabled by Policy CC-6 of the Municipal Planning Strategy for Sackville, which provides guidance for the evaluation of this development proposal.

The following documents in support of this application are attached to this letter:

+ Basic facts about the property and its context
+ Detailed information about the proposed development
+ Analysis of the proposal's alignment with municipal planning policy
+ An attachment including:
  - Annex A: Site Plan
  - Annex B: Pedestrian and Vehicular Circulation
  - Annex C: Site Renderings and Floor Plans
  - Annex D: Traffic Impact Study
  - Annex E: Servicing Concept
  - Annex F: Servicing Study
  - Annex G: Sanitary Flow Confirmations

We are excited to work with staff, Council and the community on this proposal.

Please do not hesitate to contact me if you require further information.

Sincerely,

Paul Dec, MCIP, LPP

63 King Street
Dartmouth, Nova Scotia
B2Y 2R7

+ 1 902 423 0649
info@uplandstudio.ca
uplandstudio.ca

1 BACKGROUND

1.1 LOCATION AND SITE CHARACTERISTICS

The subject of this planning application is property PID#00362442 registered to First Mutual Properties Limited. The 13.252[1] acre property is situated on First Lake Drive in Lower Sackville and spans the civic numbers 70-80 on that street.

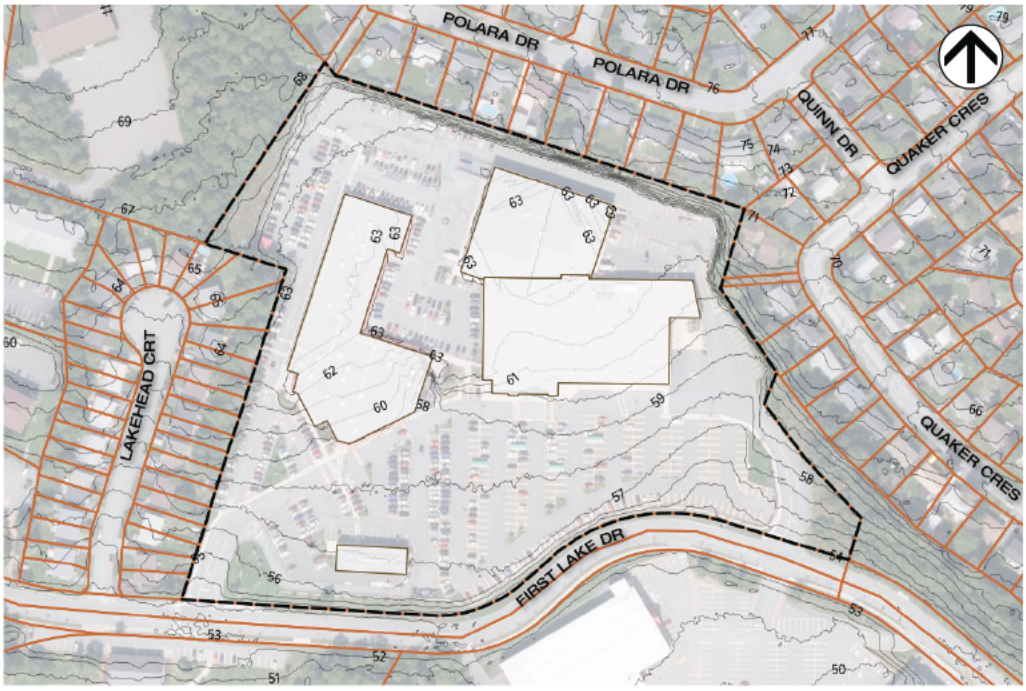


Figure 1: Site map

The property currently contains three separate structures:

+ 7,619 m² building with 'Sobeys' and a mixed commercial space in the rear of the building
+ 7,246 m² building with a 'Staples' call centre and office space
+ 409 m² 'Needs' convenience store and 'Tim Hortons' drive-through in proximity to First Lake Dr

According to LiDAR data, the entire site is situated at elevations between 54 and 69 metres above sea level. The property line abutting First Lake Drive is the lowest part of the lands. Largely separated by a retaining wall from the street level, the main parking lot in front of Sobeys gently slopes uphill with elevations between 56 to 59 metres. The upper level parking lot can be reached through two driveways running along the perimeter of the property and is relatively level at an elevation of about 62 metres.

[1] Based on property records from the Land Registration Office

63 King Street
Dartmouth, Nova Scotia
B2Y 2R7
+ 1 902 423 0649
info@uplandstudio.ca
uplandstudio.ca

1.2 CONTEXT AND SURROUNDINGS

The site is situated between First Lake and Second Lake in Lower Sackville, on a rolling hill which separates these two bodies of water. More specifically, the property is located on the south-facing slope of that hill, overlooking First Lake. The reservoir is the main geographic feature of the site's immediate surroundings and accommodates several important community facilities such as the Sackville Arena, the Kinsmen Community Centre and the Kinsmen Park including a playground, a splash pad and a sandy beach.

The namesake collector road 'First Lake Drive' is the main piece of road infrastructure in the area. The road follows the north shore of First Lake, running from Cobequid Road in the east to Metropolitan Avenue in the west. All other parts of Lower Sackville can be accessed through the road networks continuing from either end of this street.

First Lake Drive also connects to a low-density residential subdivision on the hill crest between First Lake and Second Lake. It can be accessed through Cavalier Drive and Quaker Crescent. Further destinations along First Lake Drive include the Eddie LeBlanc Memorial ball field and the Sackville Lakes Provincial Park, which contains a trail system.

Figure 2: Context map

More than half of the property's perimeter is therefore defined by recreational and institutional land uses along the lake shore and the St. Elizabeth Seton Church to the north west of the site. The remainder of the site's perimeter is defined by neighbouring, low-density residential development. Lakehead Court to the west is a small cul-de-sac with single family dwellings. Polara Drive and Quaker Crescent to the north and northeast feature similar types of development. However, these two streets are separated from the development proposal site by a significant rise in elevation, and retaining walls form a hard edge between the lower-lying development site and the residential area situated uphill.

63 King Street
Dartmouth, Nova Scotia
B2Y 2R7
+ 1 902 423 0649
info@uplandstudio.ca
uplandstudio.ca

2 DEVELOPMENT PROPOSAL

2.1 DEVELOPMENT SUMMARY

First Mutual Properties Limited intends to re-develop the property using three multi-unit dwellings connected by an extensive network of pedestrian promenades and tree-lined plazas. Two of these buildings are proposed as mixed-use developments, additionally accommodating commercial floor area. The introduction of significant residential, commercial, and community amenity space would transform the 13.25 acre site, which currently consists of a big box shopping area surrounded by surface parking, into an attractive and vibrant community.

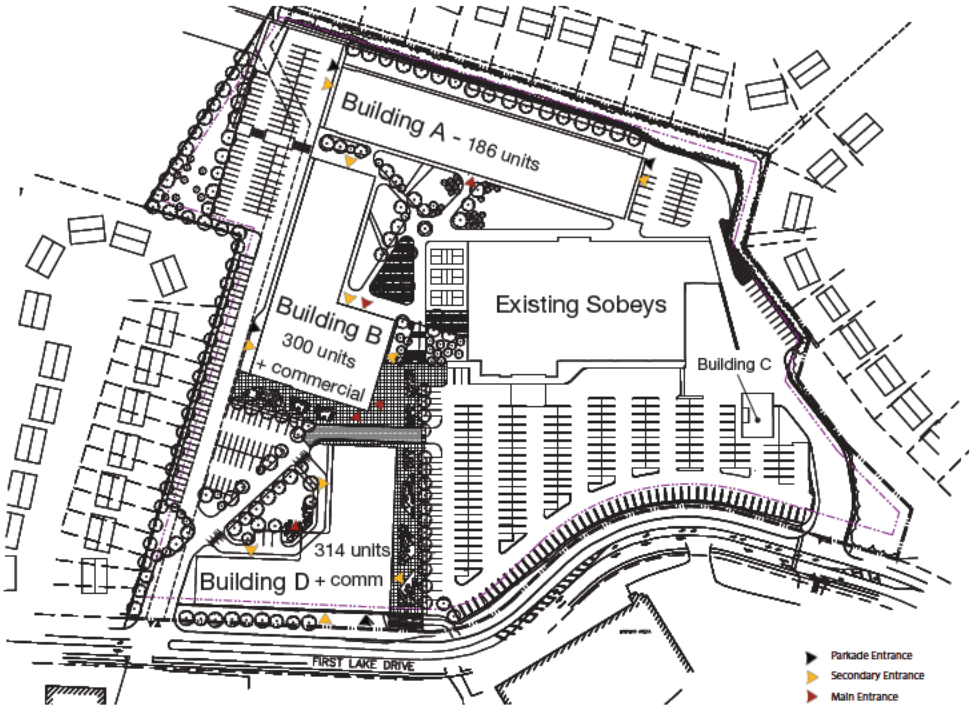


Figure 3: Site Plan (see Appendix A for large drawing)

Buildings A,B, and D proposed in this plan would frame the west and northern edges of the subject site, and replacing the two large-format commercial structures currently occupied by Staples and the Warehouse of Sportwheels Sports. The redevelopment plan also involves relocating the Tim Horton's restaurant to the eastern end of the site (Building C), so that it can open up space for Building D. The Sobey's grocery store would remain on-site unchanged.

The northern-most building, Building A, would replace approximately 75 surface parking spaces with approximately 700m^2 of landscaped open space and a mid-rise building reaching 6 storeys containing approximately 18,478m^2 of floor area.

The central building, Building B, would be constructed largely on the footprint of the existing Staples building. It would be a terraced building reaching 15 storeys containing approximately 34,584m^2 of floor area.

The southern-most building, Building D, would replace approximately 120 surface parking spaces with approximately 800m^2 of landscaped open space and a terraced building reaching 22 storeys containing approximately 35,767m^2 of floor area.

63 King Street
Dartmouth, Nova Scotia
B2Y 2R7
+ 1 902 423 0649
info@uplandstudio.ca
uplandstudio.ca

This results in the following overall building composition:

	Commercial (m2)	Residential Unit Count
Building A	-	186
Building B	1,090	300
Building C	230	-
Building D	1,189	314
	2,509	800

Excluding the parking stalls already dedicated to the Sobeys grocery store, the redeveloped site would offer a combined total of 462 additional parking stalls below and above ground to serve the new developments. Within this total, 400 stalls would be dedicated to the residential components of these buildings while 62 would be specifically provided for commercial purposes.

2.2 BACKGROUND ON THE DEVELOPER

The following is the company profile of First Mutual Properties Limited:

> *First Mutual Properties is a private real estate investment group based out of Dartmouth, Nova Scotia. Established in 1995, they have become one of Eastern Canada's leading developers with an extensive portfolio of commercial / retail, office, and industrial spaces. First Mutual Properties has developed a specialization in custom-built leasing facilities, re-development opportunities, and master communities. They understand that a relationship with the community is essential to execute real estate investment projects correctly, and that successful development comes from genuine community involvement. First Mutual Properties uses the latest in technology, including aerial drone footage as well as financial software for the most accurate financial real estate modelling.*
>
> *First Mutual Properties currently owns and manages an extensive commercial real estate portfolio and as a full-service development company, First Mutual Properties is committed to providing property management services that exceed industry standards. They pride themselves on providing expertise that is customized to the needs of the individual clients they serve.*
>
> *First Mutual Properties has completed custom-built leased facilities for Parks Canada, Lawtons, McKesson Canada and other national and regional companies. Other notable upcoming projects by First Mutual Properties include:*

+ Blue Heron Estates: A rural densification development consisting of a Power Centre & residential development located on Exit 20 in Porters Lake / West Chezzetcook. This project spans 133 acres with direct access to HWY 107.
+ 130 Mann Street, Bedford, NS: 16.93 Acre heavy industrial zoned development site for a custom-built facility with 2 rail sidings for loading and distribution.

63 King Street
Dartmouth, Nova Scotia
B2Y 2R7
+ 1 902 423 0649
info@uplandstudio.ca
uplandstudio.ca

3 PLANNING APPLICATION

3.1 FRAMEWORK

The Municipal Planning Strategy (MPS) and Land Use By-law for Sackville (LUB) subject the property to the policies and regulations of the following designation and zone:

Document	Designation / Zone
Municipal Planning Strategy	Community Commercial
Land Use By-law	C-2

Further to the general requirements of the Land Use By-law, the site is also regulated by a Development Agreement registered against the property. The Development Agreement between the Halifax Regional Municipality and First Mutual Properties was registered against the property on August 08, 2011, with a subsequent amendment registered on August 15, 2016.

The agreement limits various aspects of land use on the property, including site planning, building placements, architectural elevations and minimum parking requirements. With regard to land use categories, the agreements largely defers to the general rules of the Land Use By-law.

The development of new multi-unit dwellings is not included in the 'permitted use' categories of the C-2 zone. However, Policy CC-6 of the Municipal Planning Strategy allows the consideration of such development by Development Agreement, thus enabling this planning application.

3.2 REQUEST

This application is submitted to apply for an amendment to the existing Development Agreement on property PID#00362442, in order to allow for a reconfiguration of the site and for the development of three buildings containing multi-unit dwellings.

3.3 POLICY ANALYSIS

This application for Development Agreement is based on Policy CC-6 of the Municipal Planning Strategy (MPS) for the Sackville Plan Area. The latter Policy also references the generic Policy IM-13 from the Implementation section of the MPS. The following analysis will demonstrate how the Development Proposal (further referred to as 'the Proposal') complies with the applicable Policies of the MPS.

Policy CC-6 - Sackville Municipal Planning Strategy

Notwithstanding Policy CC-2, within the Community Commercial Designation, Council may consider the expansion of existing multiple unit dwellings and the development of new multiple unit dwellings according to the development agreement provisions of the Planning Act. In considering any such development agreement, Council shall have regard to the following:

a) *that the height, bulk, lot coverage and appearance of any building is compatible with adjacent land uses;*

Compliance: The architecture of the three buildings proposed in this redevelopment plan is designed to respond to the urban form of the residential neighbourhoods abutting the subject site. The largest interface between the proposed development and neighbouring low-density

63 King Street
Dartmouth, Nova Scotia
B2Y 2R7
+ 1 902 423 0649
info@uplandstudio.ca
uplandstudio.ca

residential dwellings exists along the northern edge of the property. In this location, the design takes advantage of the a significant elevation change exists between the subject site and Polara Drive. Since the elevation of Polara Drive lies about 5 metres above the elevation Building A's base, the six-storey design chosen for this building is mindful of the visual impacts on the single-family neighbourhood to the north.

The massing of the Buildings B and D has been terraced from their maximum height down to four storeys, shifting the building height to the southeast and stepping down towards the low-density neighbourhoods along Lakehead Court and Polara Drive. This strategy reduces the shadow impacts of these buildings, while allowing more sunlight to penetrate the site.

As the tallest structure on-site, Building D is proposed to be placed directly on First Lake Drive, where it will create an urban backdrop and interactive interface across the street from the Kinsmen park. Due to its location on the southern edge of the property boundary, the majority of shadow impacts from the structure are expected to remain internal to the property.

b) *that site design features, including landscaping, amenity areas, parking areas and driveways, are of an adequate size and design to address potential impacts on adjacent development and to provide for the needs of residents of the development;*

Compliance: The creation of a walkable community core north of First Lake Drive is at the centre of the Proposal. The development will create landscaped public spaces between the proposed buildings and the existing grocery store, thereby triggering improvements for residents of the entire neighbourhood. While currently the walk from Polara Drive to Kinsmen Park or the Community Centre leads over vast expanses of paved parking lots, the Proposal would enable residents to walk through a pedestrian-friendly environment, and to reach First Lake Drive through a descent that will cut through the existing retaining wall which frames the northern boundary of the street.

The proposed development would entail 462 parking spaces specifically dedicated to the new development. 62 spaces are proposed to serve the newly developed commercial floor space (see Annex B for locations). A combined total of 400 parking stalls above and below ground would serve the residential 800 residential units. While this equates to a lower parking to unit ratio than in the Land Use By-law, there are reasons why such an approach may be warranted in this case:

+ The development site is serviced by Halifax Transit Routes No. 82 and 182, with bus stops at the front property line. The recent Rapid Transit Strategy of HRM identifies First Lake Drive as an 'Express' Route, and suggests further investment into transit as well as consistent quick connetions to other parts of Lower Sackville and beyond.

+ The location of the development and its mixed-use concept create a uniquely supportive environment for car-free living in a suburban environment. While a large grocery store, recreational and institutional amenities are in the immediate vicinity of the development proposal, further shops and services are expected to fill the 2,509 m^2 of proposed commercial space, thus offering a complete community which can service many daily needs of residents.

+ The magnitude of the development allows for a better economy of scale in sharing of parking spaces. This circumstance can also by utilized by attracting car-sharing providers and other transportation providers to the property.

+ In the context of an aging population—which Nova Scotia is experiencing—this type of new multi-unit development will naturally attract many seniors which are looking to downsize from single family dwellings. With a large share of seniors to be expected to occupy residential units, the parking to unit ratio may reaonsably be assumed to be lower than in multi-unit dwelling developments of previous decades.

63 King Street
Dartmouth, Nova Scotia
B2Y 2R7
+ 1 902 423 0649
info@uplandstudio.ca
uplandstudio.ca

c) *that municipal central services are available and capable of supporting the development;*

Compliance: A servicing study commissioned by the developer revealed that the local wastewater collection system could handle 832 dwelling units in this location before 80% of the local sewer main capacity would be used up (see Annex F). The development concept underwent changes since the original servicing study was prepared in November of 2021. However, Annex G demonstrates that the proposed buildings of this proposal are equally in line with the municipal wasterwater flow capacities. Conversations with the municipality have indicated that water supply capacity is unproblematic in this part of Lower Sackville.

d) *that appropriate controls are established to address environmental concerns, including stormwater controls;*

Compliance: Stormwater management does already exist on this site, and will be further adapted towards the needs of the redevelopment. See Annex E for the schematic drawing of proposed stormwater management installations.

e) *the impact on traffic circulation and, in particular, sighting distances and entrances and exits to the site;*

Compliance: The Proposal mostly utilizes two existing driveway leading on First Lake Drive.The traffic impact Statement in Annex D further analyzes and assesses the compliance of the Proposal with regard to traffic generation issues.

f) *general maintenance of the development; and*

g) *the provisions of Policy IM-13.*

The last item g) of Policy CC-6 refers to Policy IM-13 and therefore activates the following requirements:

In considering amendments to the land use by-law or development agreements, in addition to all other criteria as set out in various policies of this planning strategy, the Sackville Community Council shall have appropriate regard to the following matters:

a) *that the proposal is in conformity with the intent of this planning strategy and with the requirements of all other municipal by-laws and regulations;*

Compliance: The Municipal Planning Strategy contains a policy allowing residential multi-unit developments in the 'Community Commercial' designation. The Proposal does not appear to contradict any other policies of the Municipal Planning Strategy, either. It can be therefore assumed that the proposal is generally supported by the strategy and in line with the intent of the plan.

b) *that the proposal is not premature or inappropriate by reason of:*

(i) the financial capability of the Municipality to absorb any costs relating to the development;

(ii) the adequacy of sewer and water services;

(iii) the adequacy or proximity of school, recreation and other community facilities;

(iv) the adequacy of road networks leading or adjacent to, or within the development; and

(v) the potential for damage to or for destruction of designated historic buildings and sites.

Compliance: The Proposal is situated in a highly developed part of Lower Sackville, surrounded by long-standing subdivisions and recreational amenities. Locating residential density in such a location should not place any additional burdens on the Halifax Regional Municipality, but in tendency improve the utilization of assets through conversion of surface parking lots into a highly efficient part of the urban fabric.

63 King Street
Dartmouth, Nova Scotia
B2Y 2R7
+ 1 902 423 0649
info@uplandstudio.ca
uplandstudio.ca

c) *that controls are placed on the proposed development so as to reduce conflict with any adjacent or nearby land uses by reason of:*

(i) type of use;

(ii) height, bulk and lot coverage of any proposed building;

(iii) traffic generation, access to and egress from the site, and parking;

(iv) open storage;

(v) signs; and

(vi) any other relevant matter of planning concern.

Compliance: Alignment relating to type of use, height and bulk has already been analyzed in the context of Policy CC-6. With regard to traffic flow through the site, Annex B depicts the detailed approach to pedestrian and vehicular circulation on the property.

d) *that the proposed site is suitable in terms of steepness of grades, soil and geological conditions, locations of watercourses, potable water supplies, marshes or bogs and susceptibility to flooding;*

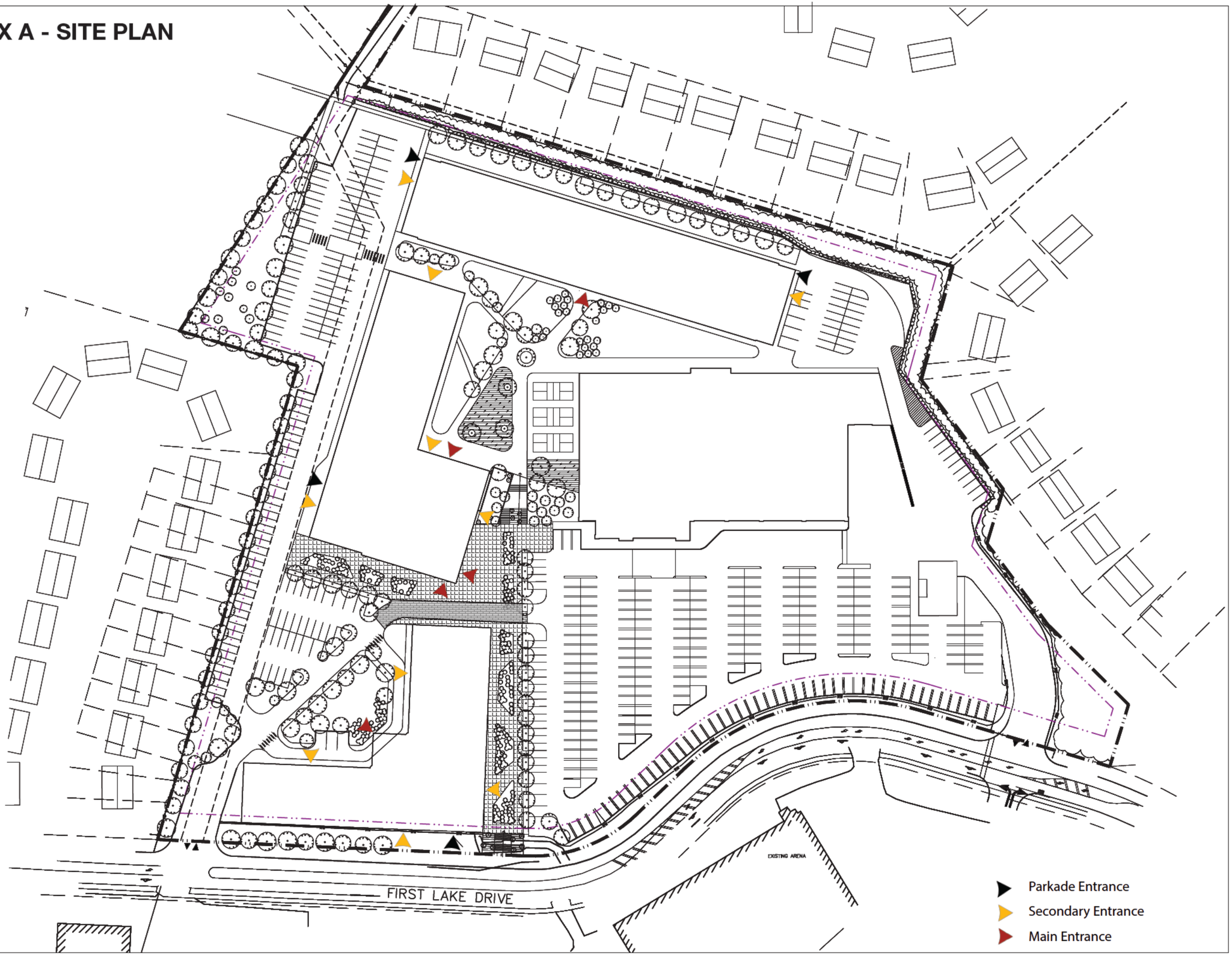
e) any other relevant matter of planning concern; and

f) Within any designation, where a holding zone has been established pursuant to “Infrastructure Charges - Policy IC-6”, Subdivision Approval shall be subject to the provisions of the Subdivision By-law respecting the maximum number of lots created per year, except in accordance with the development agreement provisions of the MGA and the “Infrastructure Charges” Policies of this MPS.

Compliance: Items d) and f) seem to relate to new greenfield developments and are not applicable to the redevelopment of the Proposal site.

63 King Street
Dartmouth, Nova Scotia
B2Y 2R7
+ 1 902 423 0649
info@uplandstudio.ca
uplandstudio.ca

ANNEX A - SITE PLAN



UPLAND

63 King Street, Dartmouth
Nova Scotia B2Y 2R7
+ 1 902 423 0649

uplandstudio.ca

STAMP

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT
70FIRSTLAKEDRIVE

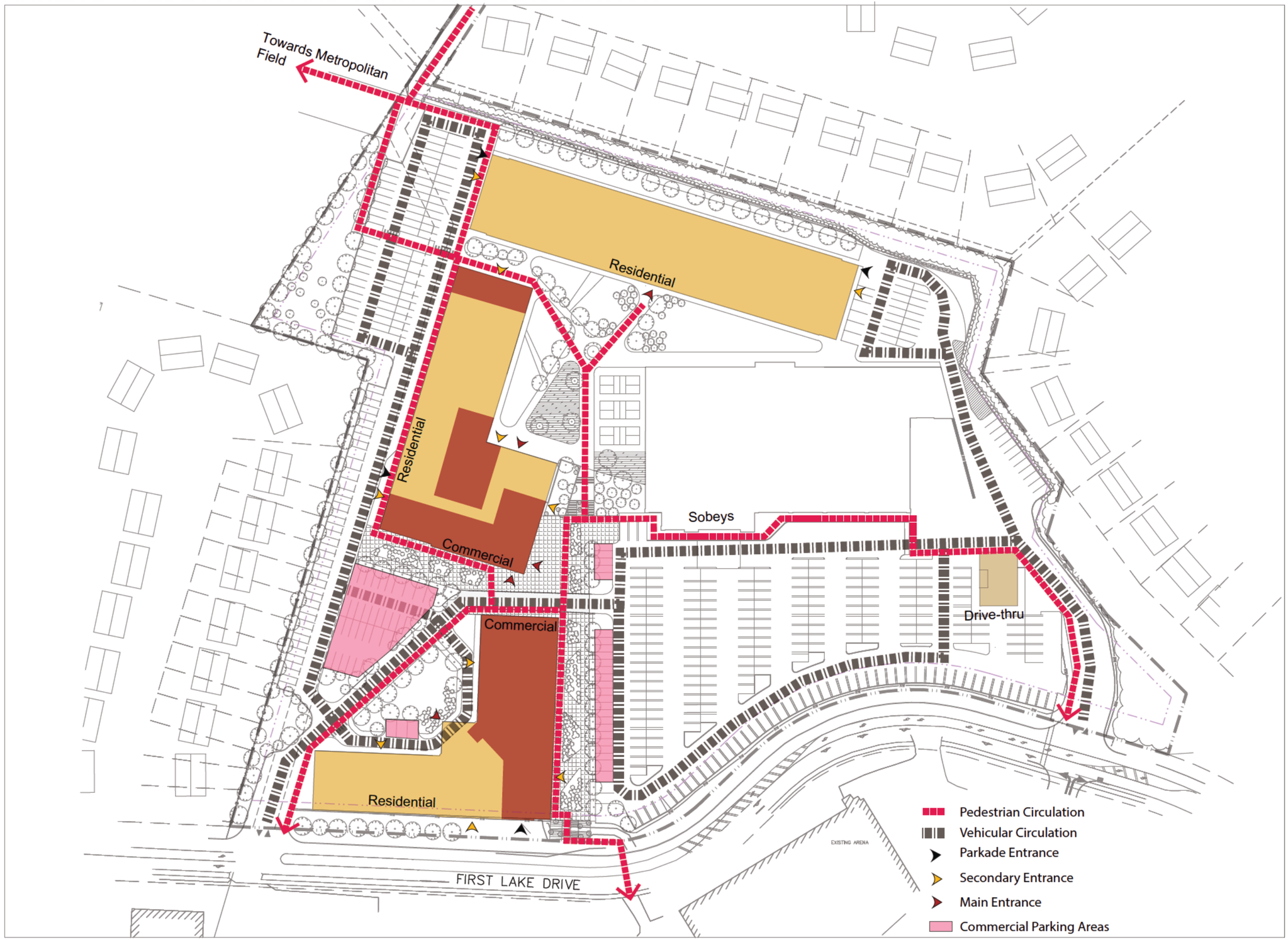
DRAWING TITLE
CONCEPT PLAN

NORTH

SCALE
1:1200

DRAWING #
DRAWING#

ANNEX B - PEDESTRIAN AND VEHICULAR CIRCULATION



UPLAND

63 King Street, Dartmouth
Nova Scotia B2Y 2R7
+ 1 902 423 0649

uplandstudio.ca

STAMP

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT
70FIRSTLAKEDRIVE

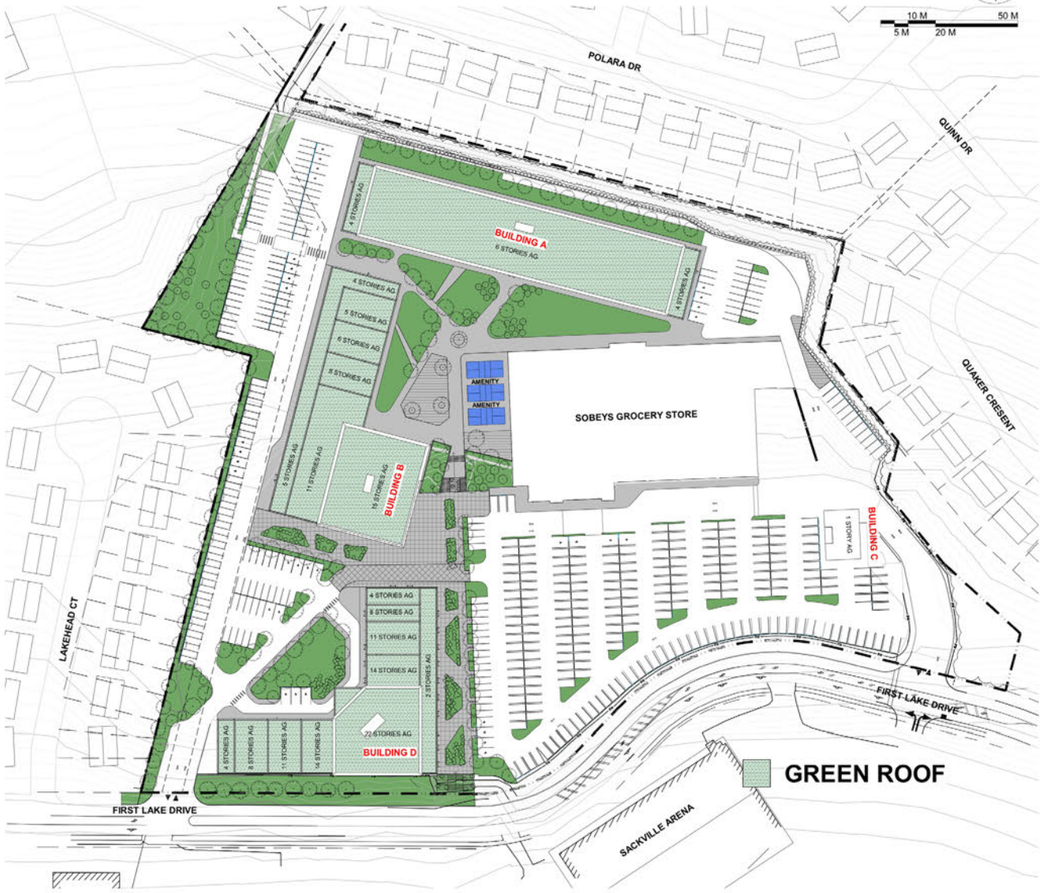
DRAWING TITLE
CONCEPT PLAN

NORTH

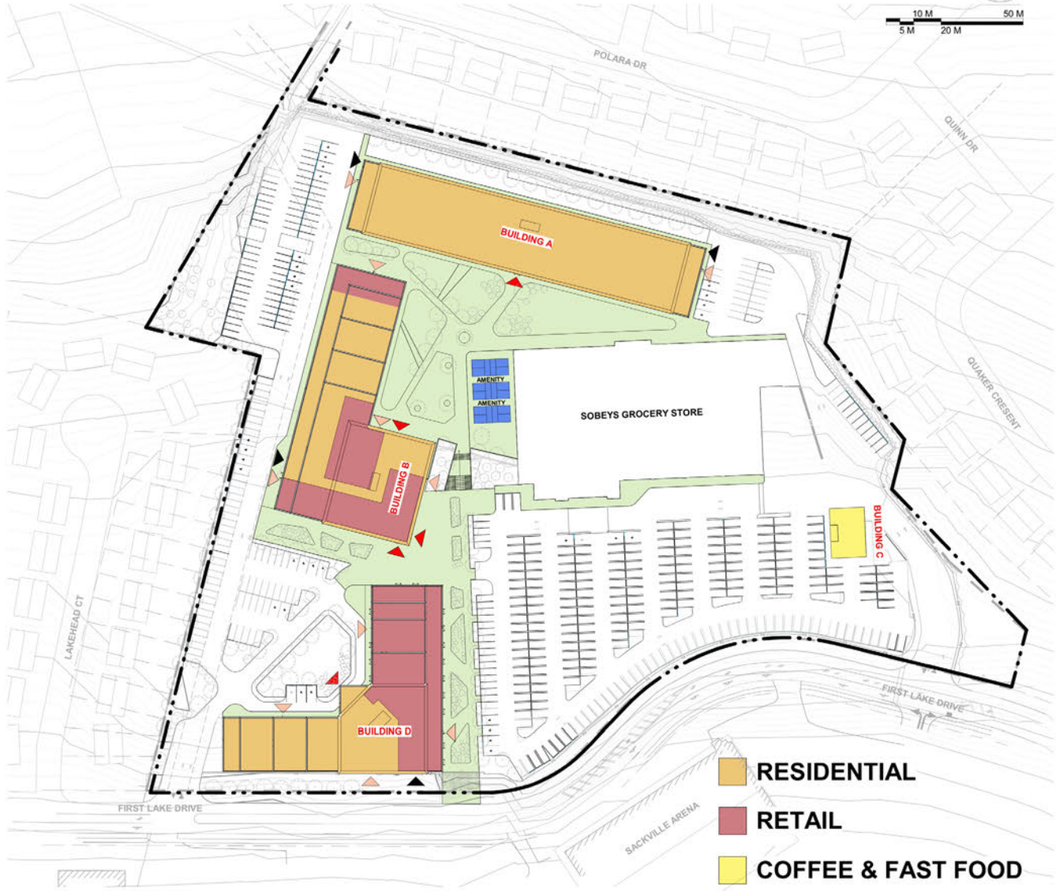
SCALE
1:1200

DRAWING #
DRAWING#

ANNEX C - SITE RENDERINGS AND FLOOR PLANS



① New Site Plan
1 : 1000



③ Site Plan Analysis
1 : 1000

② Existing Site Plan
1 : 1950

BUILDING A

TOTAL FLOOR AREA FOR ALL BUILDING LEVELS ABOVE GROUND: **18,478 m²**

20% SERVICE & CIRCULATION AREA: **3,700 m²**

TOTAL APPROXIMATE RENTABLE FLOOR AREA FOR ALL BUILDING LEVELS ABOVE GOUND: **14,778 m²** 159,069.04 Ft2

BUILDING B

TOTAL FLOOR AREA FOR ALL BUILDING LEVELS ABOVE GROUND: **34,584 m²**

20% SERVICE & CIRCULATION AREA: **6,917 m²**

TOTAL APPROXIMATE RENTABLE FLOOR AREA FOR ALL BUILDING LEVELS ABOVE GOUND: **27,667 m²** 297,805.11 Ft2

BUILDING C - RELOCATION OF EXISTING COFFEE & FAST FOOD BUILDING

TOTAL FLOOR AREA FOR BUILDING LEVEL ABOVE GROUND: **230 m²** 2,475.7 Ft2

TOTAL APPROXIMATE RENTABLE FLOOR AREA FOR BUILDING LEVEL ABOVE GOUND: **230 m²**

BUILDING D

TOTAL FLOOR AREA FOR ALL BUILDING LEVELS ABOVE GROUND: **35,767 m²**

20% SERVICE & CIRCULATION AREA: **7,153 m²**

TOTAL APPROXIMATE RENTABLE FLOOR AREA FOR ALL BUILDING LEVELS ABOVE GOUND: **28,614 m²** 307,998.53 Ft2

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
7.	ISSUED FOR REVIEW	2022.07.26
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKVILLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

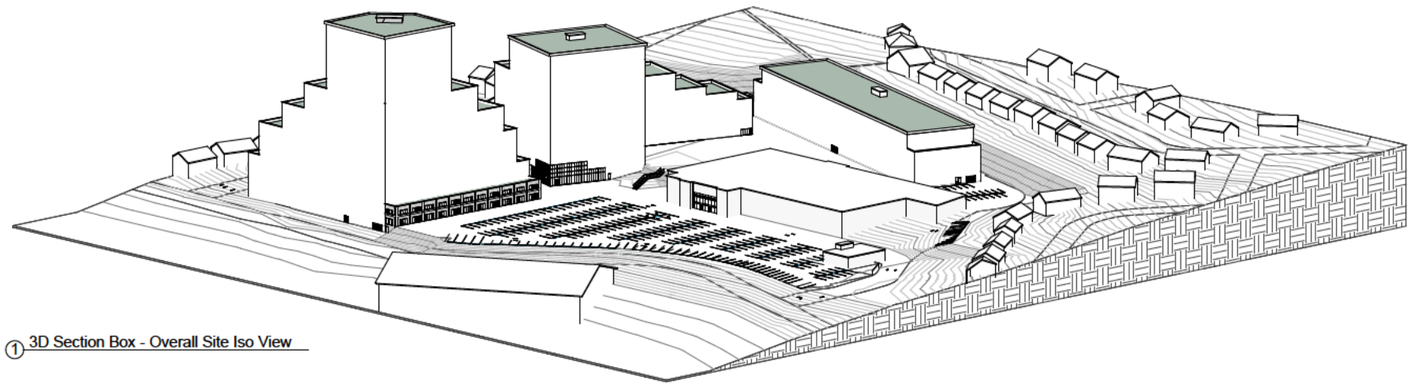
First Lake Development Concept

Site Plan & 3D Perspectives

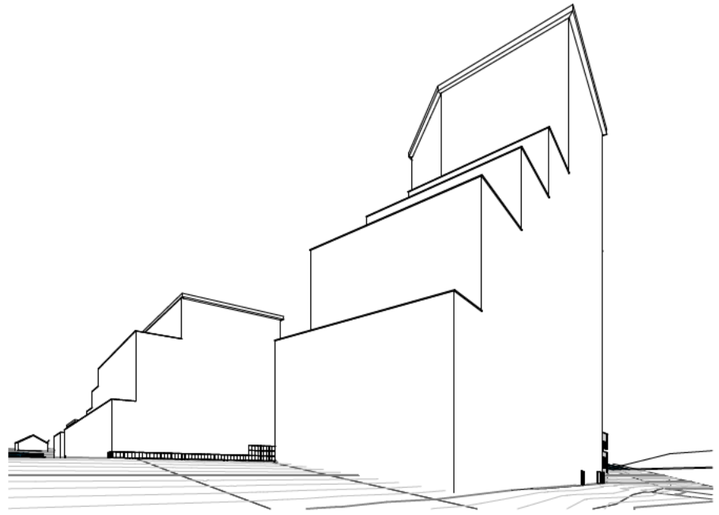
Project Number	17-016
Date	2022.07.26
Drawn By	HA
Checked By	TAS

A-100

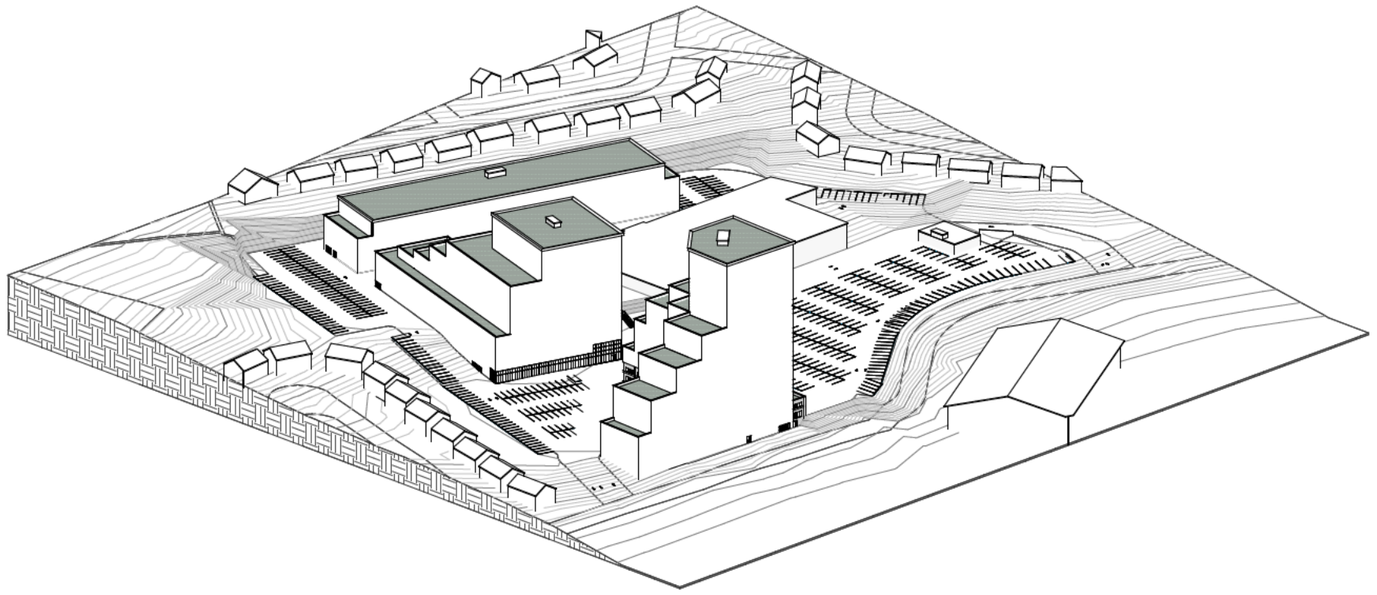
Scale: As indicated



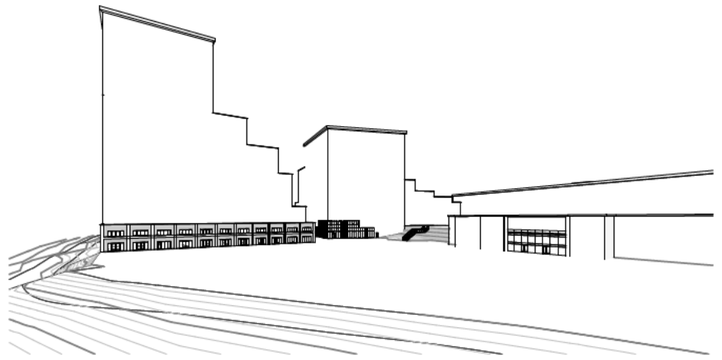
① 3D Section Box - Overall Site Iso View



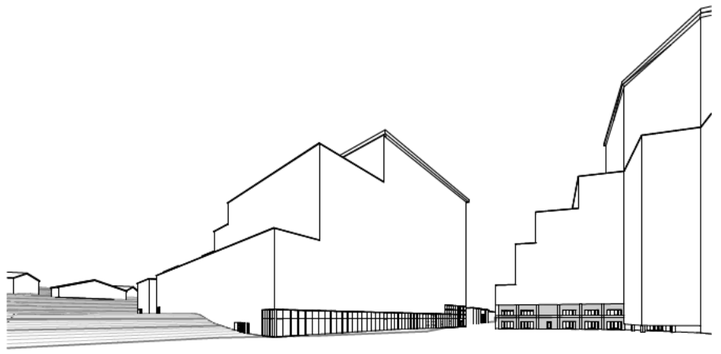
③ 3D View From First Lake Dr. - Buildings D & B



② 3D Section Box - Overall Site Iso



④ 3D View From First Lake Dr. - Buildings D, B, A & Sobeys



⑦ 3D View Between Buildings D & B

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKV LLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

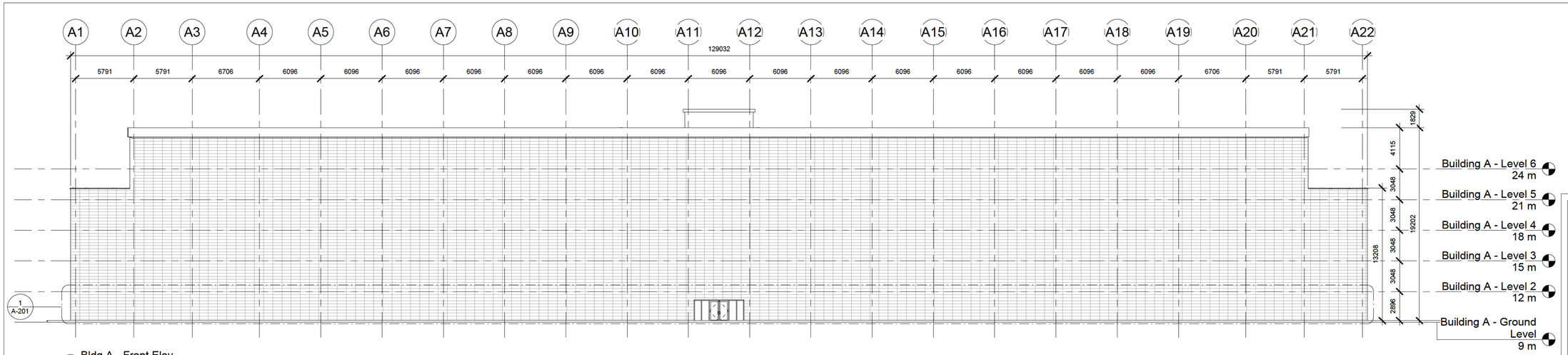
First Lake Development Concept

Poposed New Massing & Bldgs Articulations

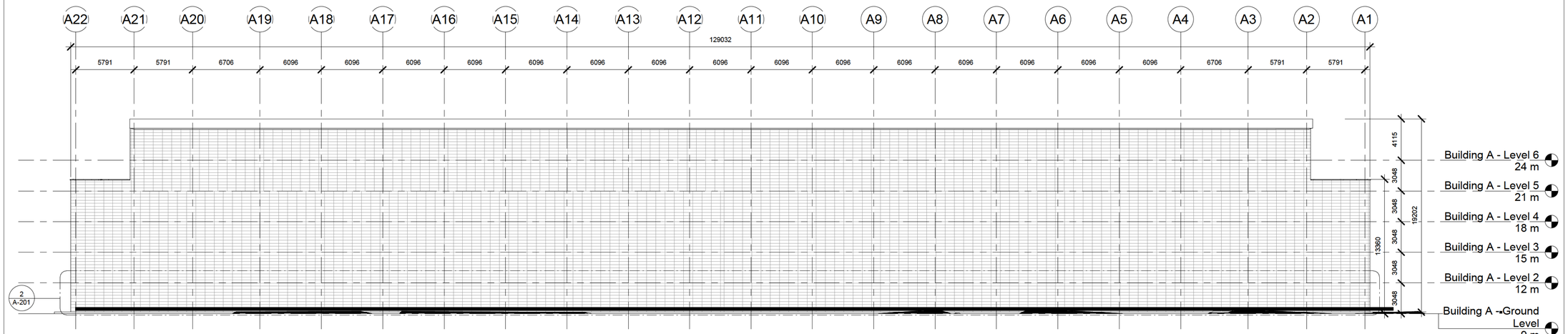
Project Number	17-016
Date	2022.06.23
Drawn By	HA
Checked By	TAS

A-101

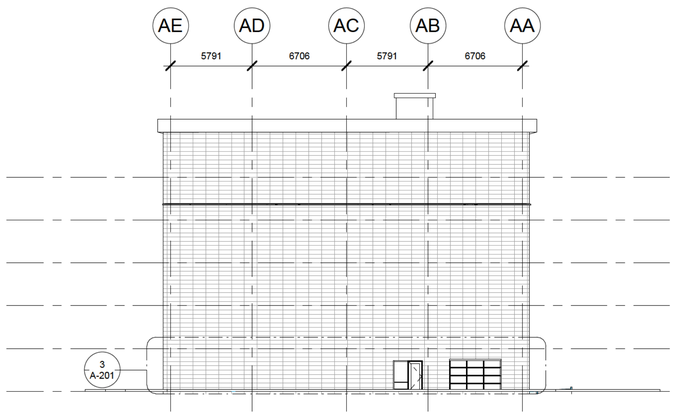
Scale



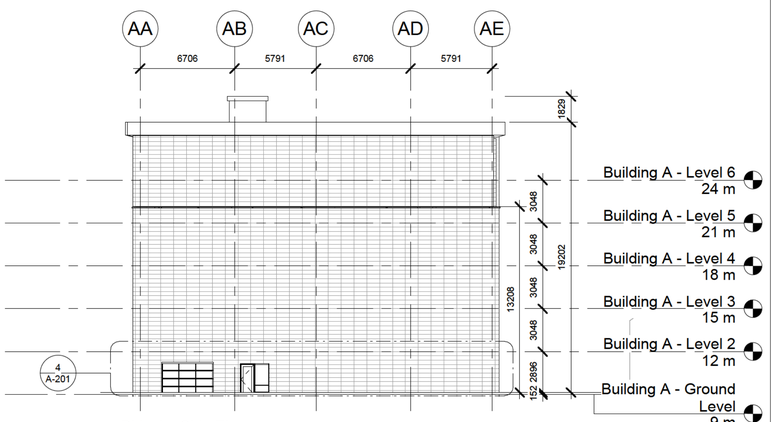
1 Bldg A - Front Elev.
1 : 200



2 Bldg A - Rear Elev.
1 : 200



3 Bldg A - Side Elev. (2)
1 : 200



4 Bldg A - Side Elev.
1 : 200

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
10.	ISSUED FOR REVIEW	2022.08.19
9.	ISSUED FOR REVIEW	2022.08.10
8.	ISSUED FOR REVIEW	2022.08.02
7.	ISSUED FOR REVIEW	2022.07.26
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKVILLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

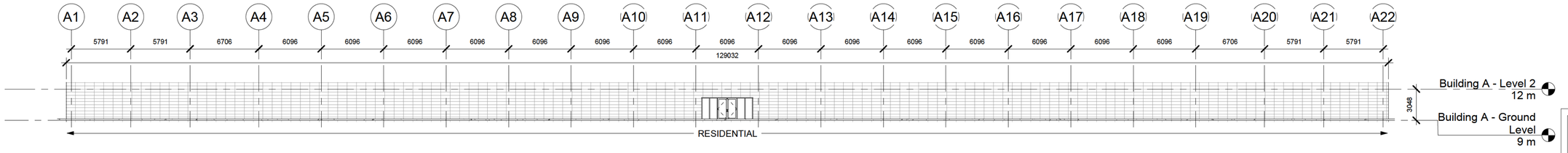
First Lake Development Concept

BLDG A Building Elevations

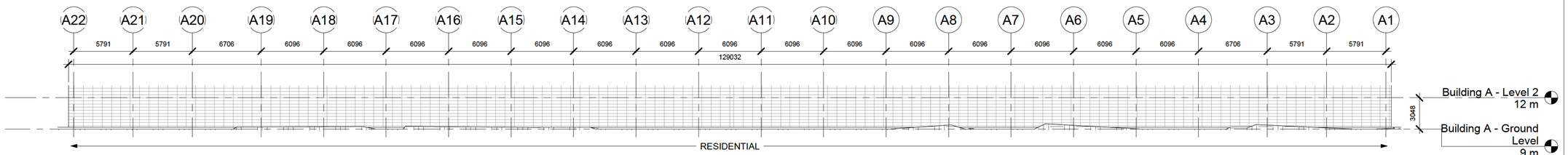
Project Number	17-016
Date	2022.08.19
Drawn By	HA
Checked By	TAS

A-200

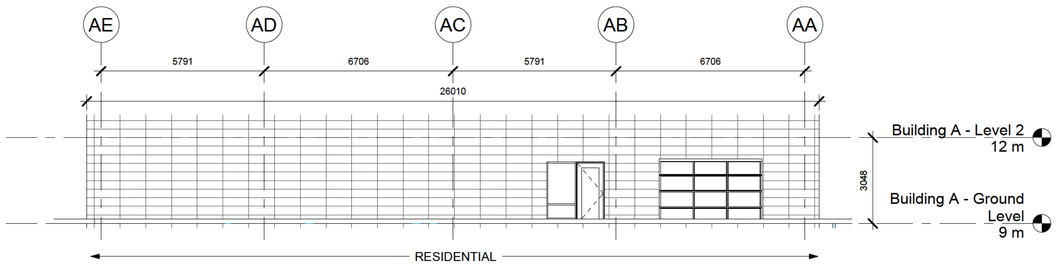
Scale 1 : 200



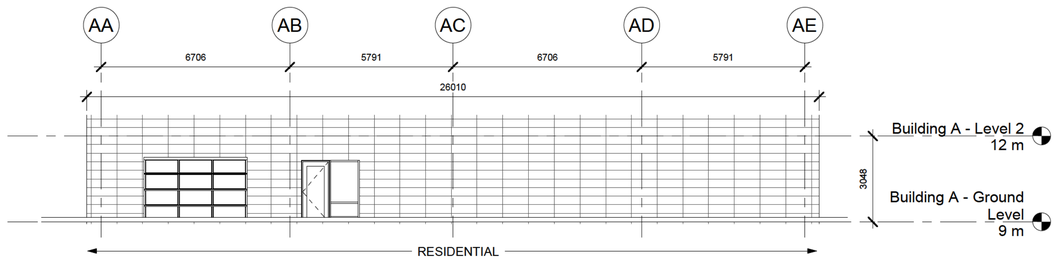
① Bldg A - Front Elev. - Enlarged Ground Level Elev
1 : 200



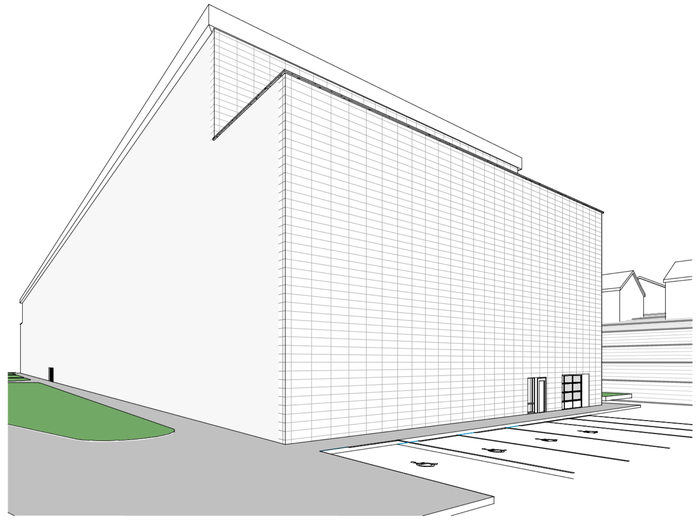
② Bldg A - Rear Elev. - Enlarged Ground Level Elev
1 : 200

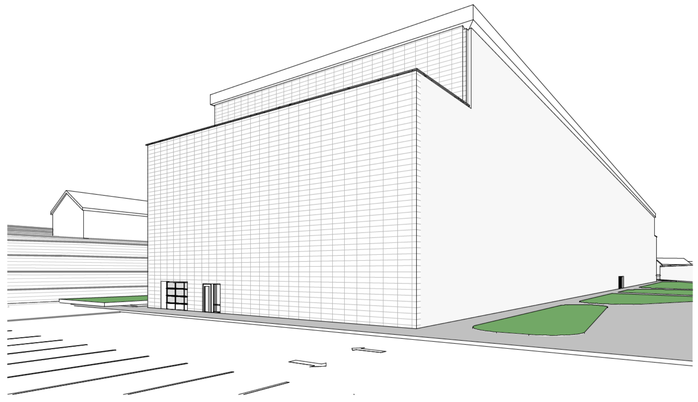


③ Bldg A - Side Elev. (2) - Enlarged Ground Level Elev
1 : 100



④ Bldg A - Side Elev. - Enlarged Ground Level Elev
1 : 100





T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
10.	ISSUED FOR REVIEW	2022.08.19
9.	ISSUED FOR REVIEW	2022.08.10
8.	ISSUED FOR REVIEW	2022.08.02
7.	ISSUED FOR REVIEW	2022.07.26
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKVILLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

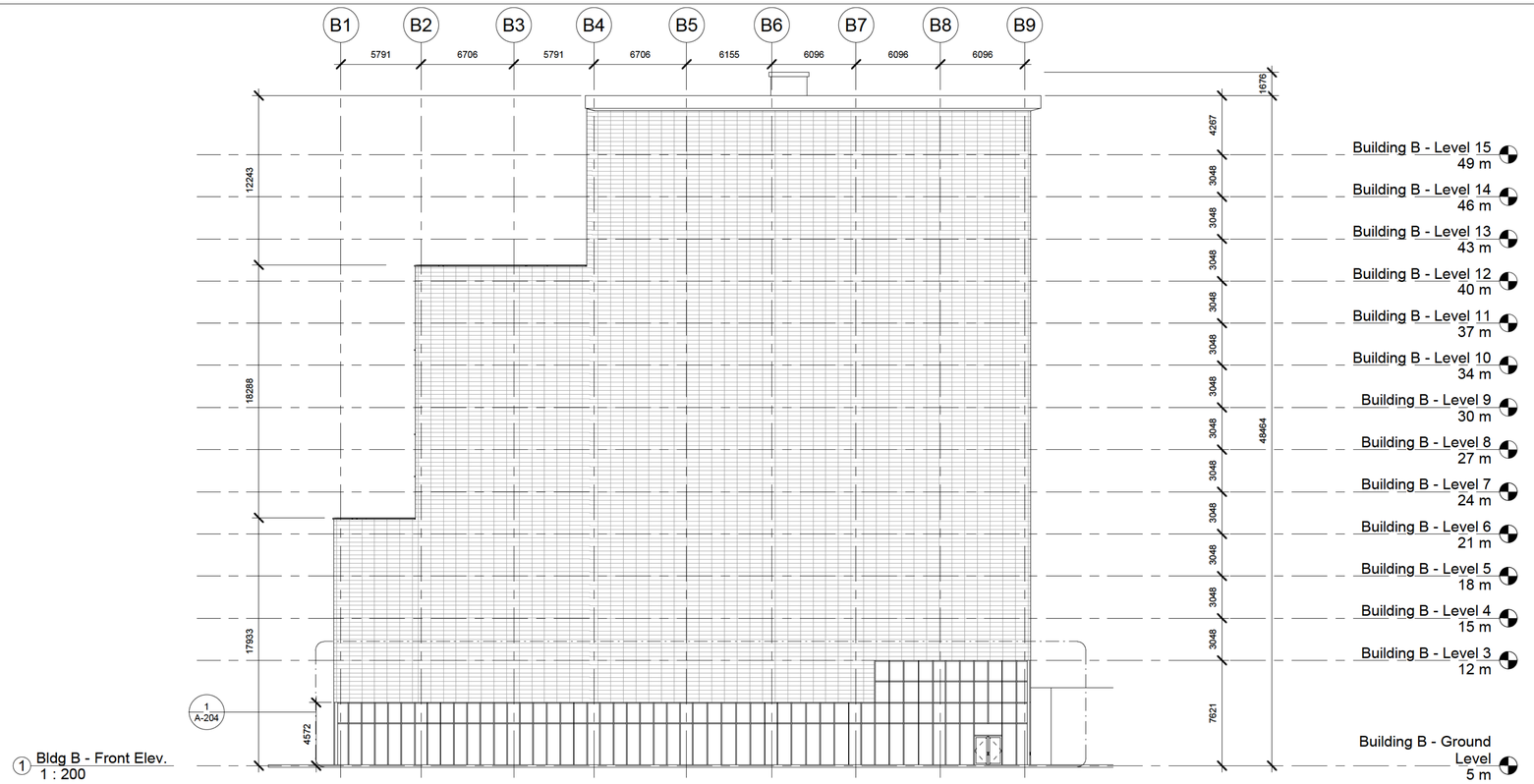
First Lake Development Concept

BLDG A Enlarged Ground Floor Elevations

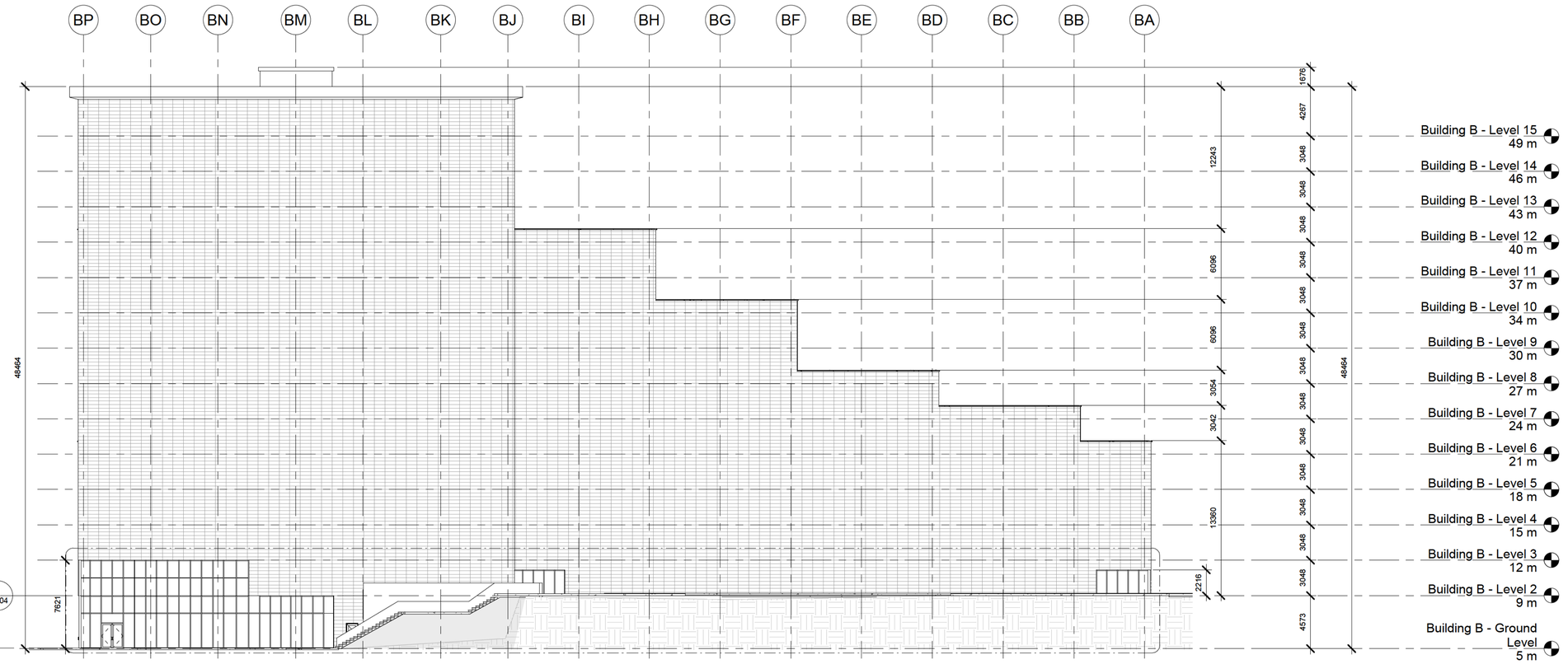
Project Number	17-016
Date	2022.08.19
Drawn By	HA
Checked By	TAS

A-201

Scale: As indicated



① Bldg B - Front Elev.
1 : 200



② Bldg B - Side Elev.
1 : 200

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
10.	ISSUED FOR REVIEW	2022.08.19
9.	ISSUED FOR REVIEW	2022.08.10
8.	ISSUED FOR REVIEW	2022.08.02
7.	ISSUED FOR REVIEW	2022.07.26
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKVILLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

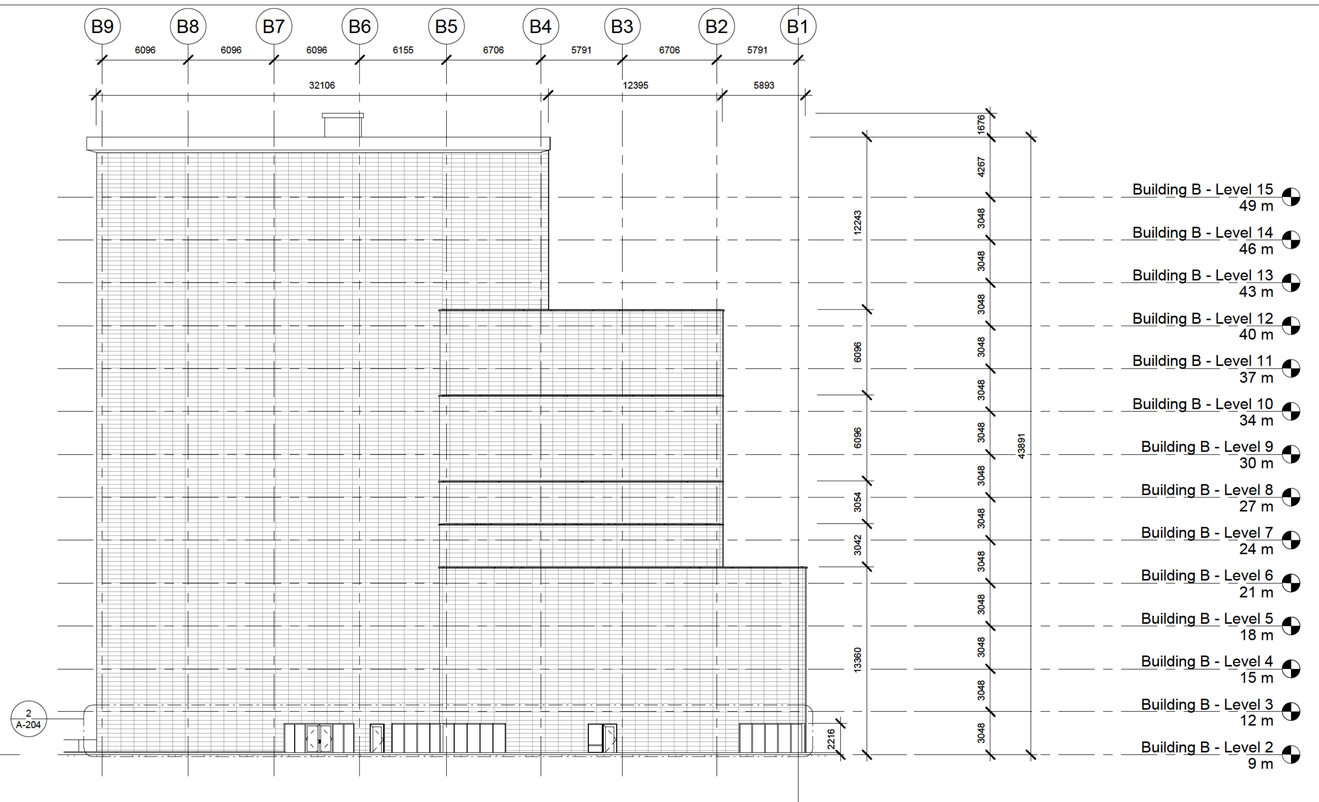
First Lake Development Concept

BLDG B Building Elevations

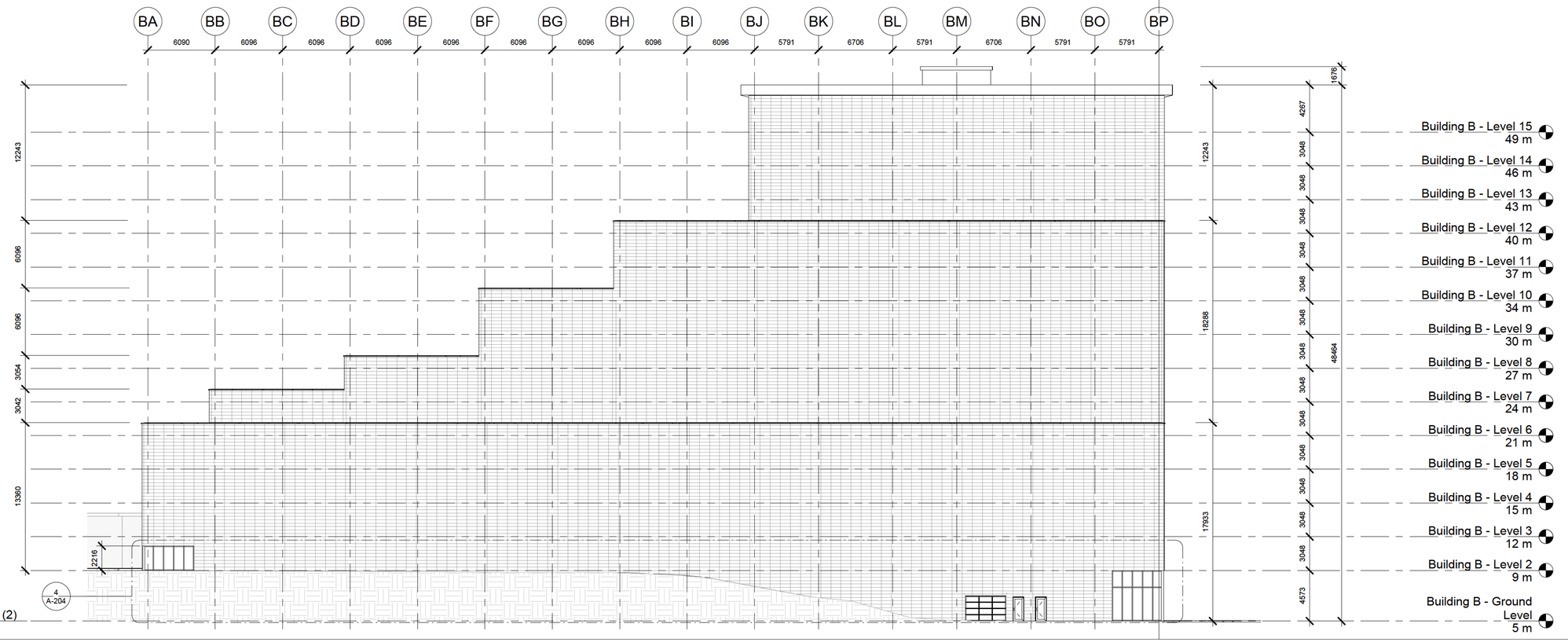
Project Number	17-016
Date	2022.08.19
Drawn By	HA
Checked By	TAS

A-202

Scale 1 : 200



1 Bldg B - Rear Elev.
1 : 200



2 Bldg B - Side Elev. (2)
1 : 200

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
10.	ISSUED FOR REVIEW	2022.08.19
9.	ISSUED FOR REVIEW	2022.08.10
8.	ISSUED FOR REVIEW	2022.08.02
7.	ISSUED FOR REVIEW	2022.07.26
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKVILLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

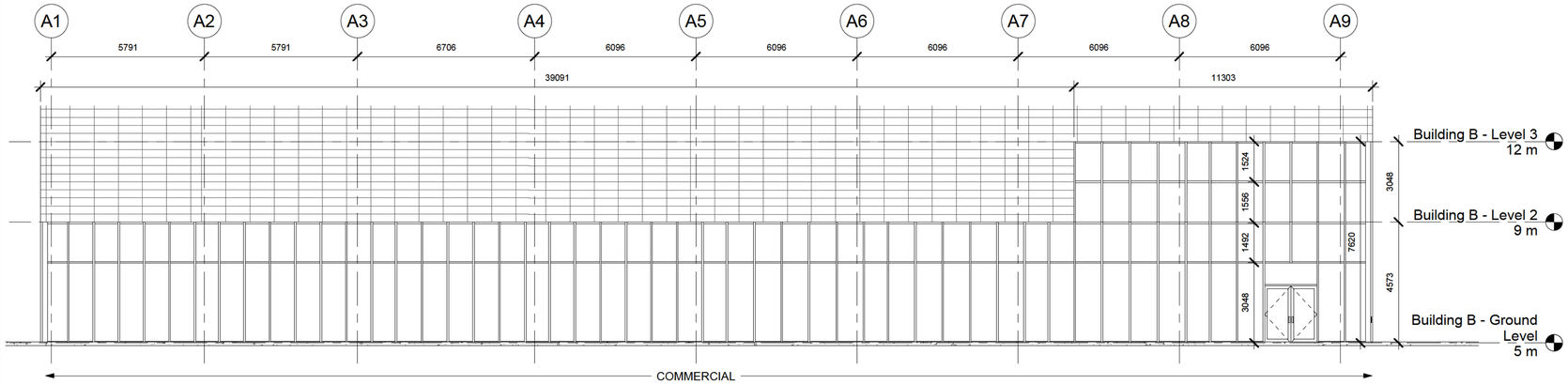
First Lake Development Concept

BLDG B Building Elevations

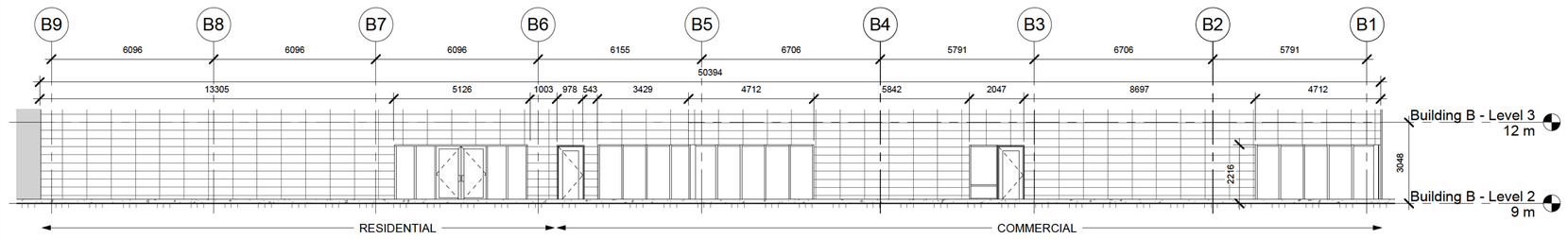
Project Number	17-016
Date	2022.08.19
Drawn By	HA
Checked By	TAS

A-203

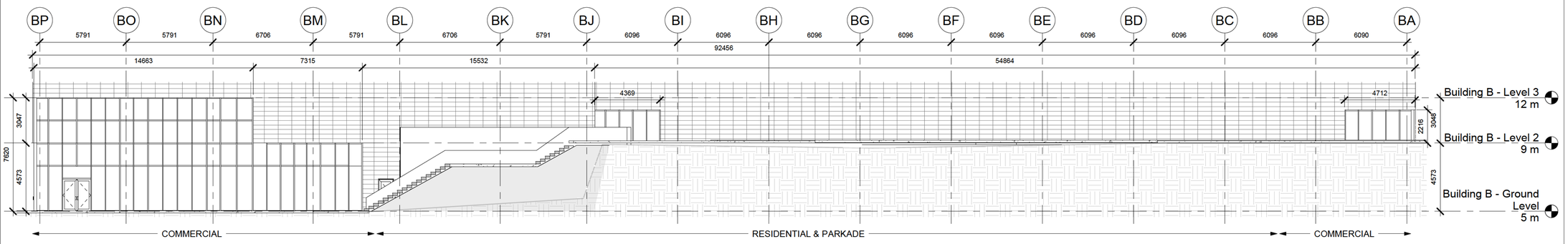
Scale 1 : 200



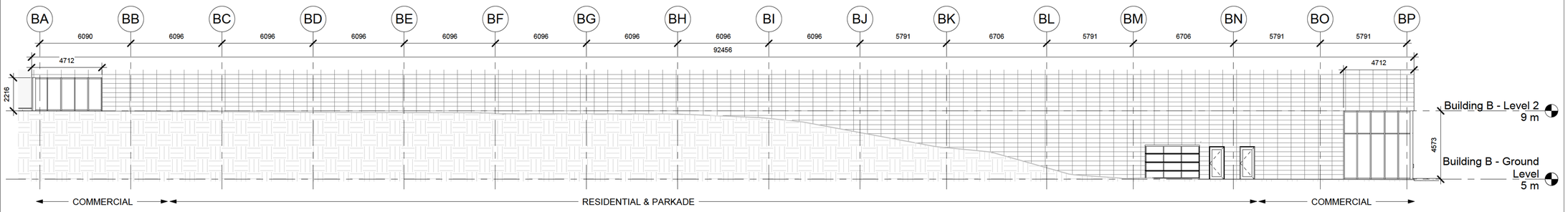
1 Bldg B - Front Elev. - Enlarged Ground Level Elev
1 : 100



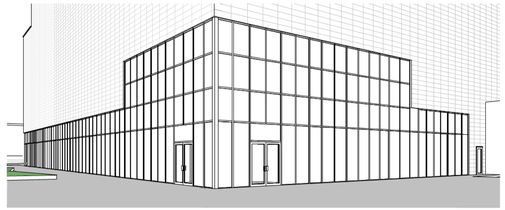
2 Bldg B - Rear Elev. - Enlarged Ground Level Elev
1 : 100

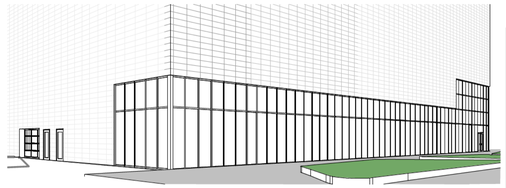


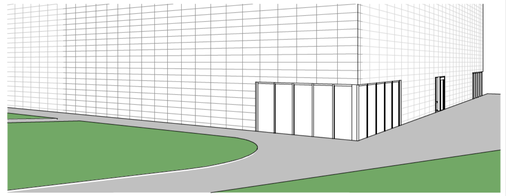
3 Bldg B - Side Elev. - Enlarged Ground Level Elev
1 : 135

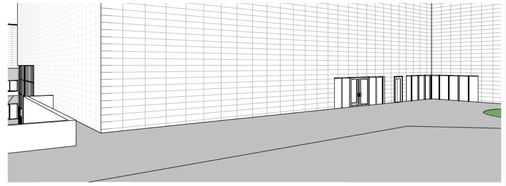


4 Bldg B - Side Elev. (2) - Enlarged Ground Level Elev
1 : 135









T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
10.	ISSUED FOR REVIEW	2022.08.19
9.	ISSUED FOR REVIEW	2022.08.10
8.	ISSUED FOR REVIEW	2022.08.02
7.	ISSUED FOR REVIEW	2022.07.26
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKVILLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

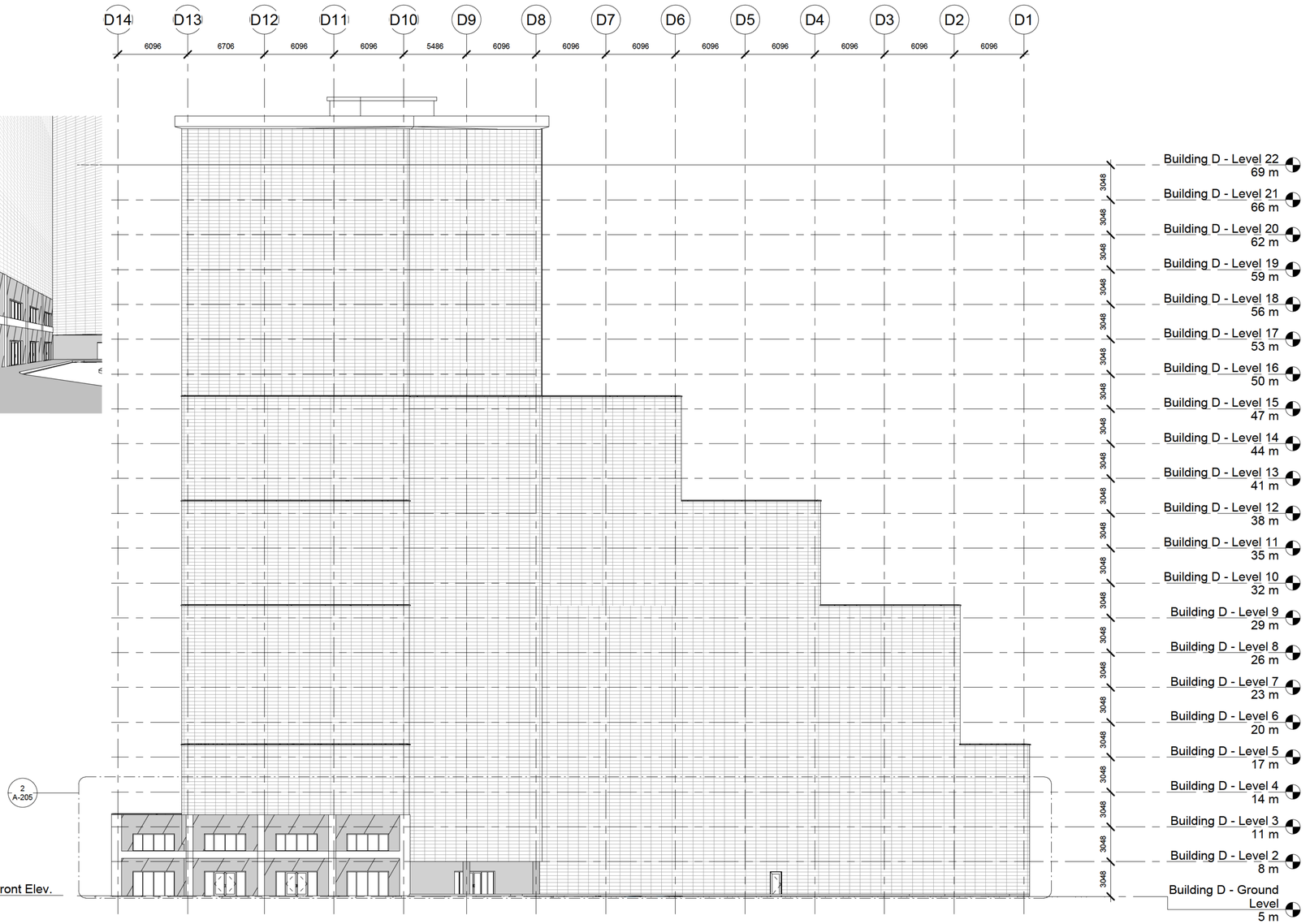
First Lake Development Concept

BLDG B Enlarged Ground Floor Elevations

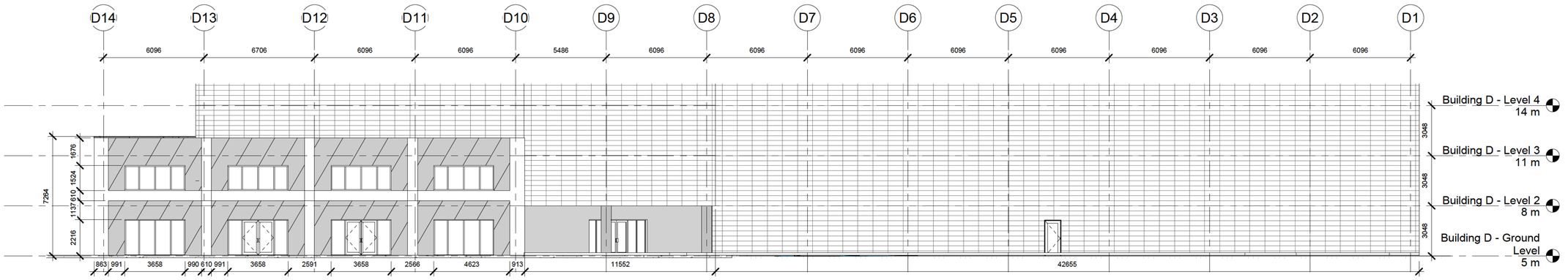
Project Number	17-016
Date	2022.08.19
Drawn By	HA
Checked By	TAS

A-204

Scale: As indicated



1 Bldg D - Front Elev.
1 : 200



2 Bldg D - Front Elev. - Enlarged Ground Level Elev.
1 : 125

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
10.	ISSUED FOR REVIEW	2022.08.19
9.	ISSUED FOR REVIEW	2022.08.10
8.	ISSUED FOR REVIEW	2022.08.02
7.	ISSUED FOR REVIEW	2022.07.26
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKVILLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

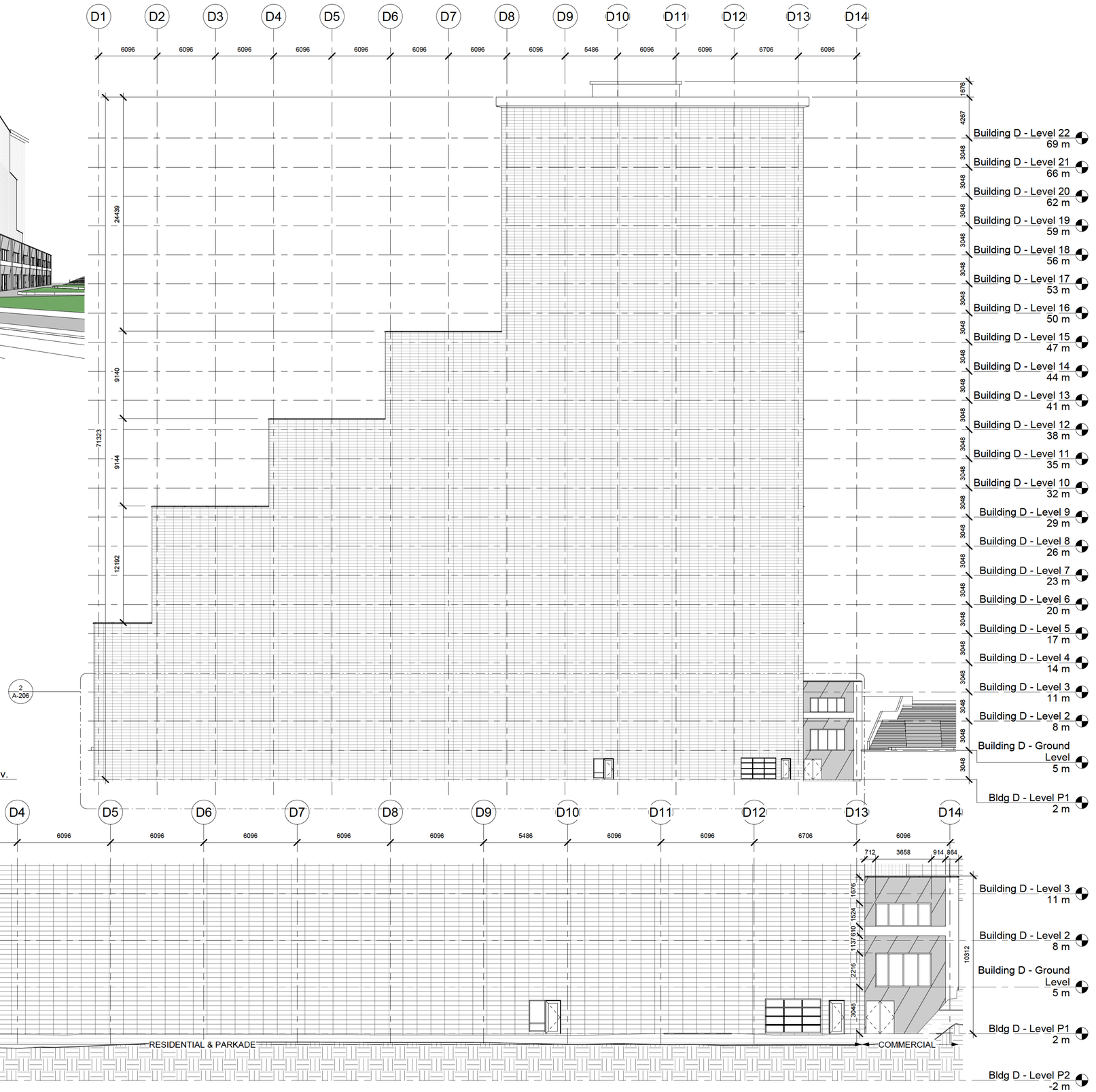
First Lake Development Concept

BLDG D Building & Enlarged Elevs

Project Number	17-016
Date	2022.08.19
Drawn By	HA
Checked By	TAS

A-205

Scale: As indicated



1 Bldg D - Rear Elev.
1 : 200

2 Bldg D - Rear Elev. + Enlarged Ground Level Elev.
1 : 125

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
10.	ISSUED FOR REVIEW	2022.08.19
9.	ISSUED FOR REVIEW	2022.08.10
8.	ISSUED FOR REVIEW	2022.08.02
7.	ISSUED FOR REVIEW	2022.07.26
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKVILLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

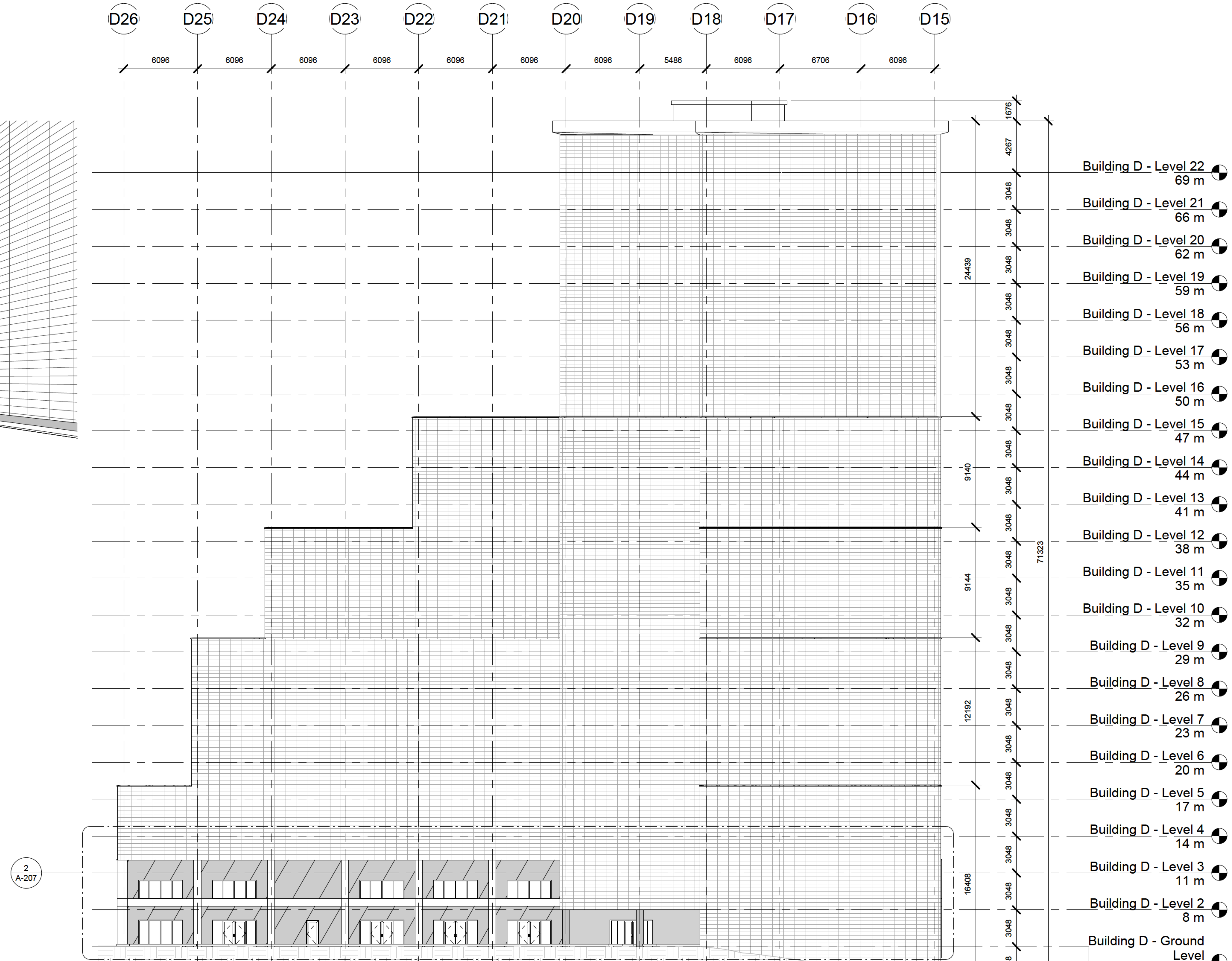
First Lake Development Concept

BLDG D Building & Enlarged Elevs

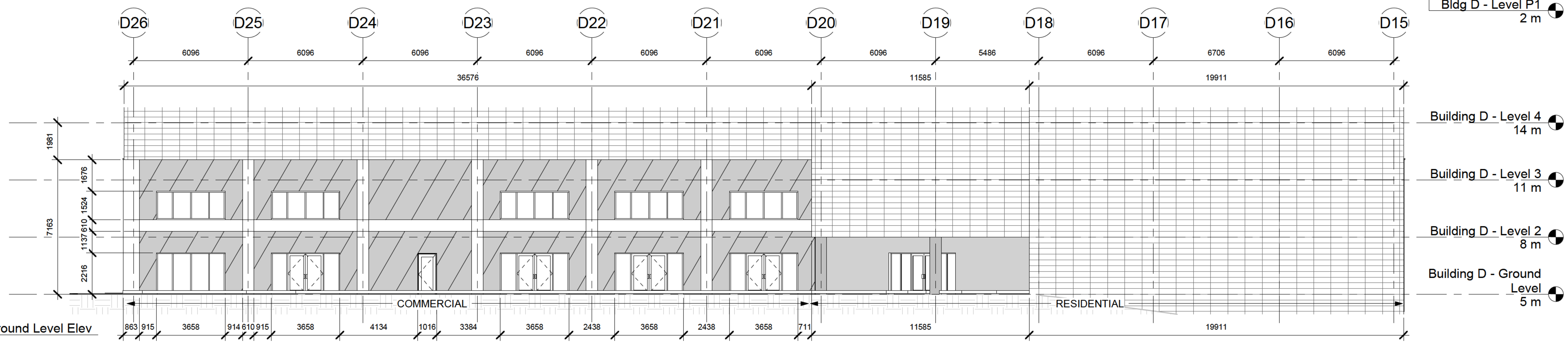
Project Number	17-016
Date	2022.08.19
Drawn By	HA
Checked By	TAS

A-206

Scale	As indicated



1 Bldg D - Side Elev.
1 : 200



2 Bldg D - Side Elev. - Enlarged Ground Level Elev
1 : 125

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
10.	ISSUED FOR REVIEW	2022.08.19
9.	ISSUED FOR REVIEW	2022.08.10
8.	ISSUED FOR REVIEW	2022.08.02
7.	ISSUED FOR REVIEW	2022.07.26
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address: 70 FIRST LAKE DRIVE SACKVILLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

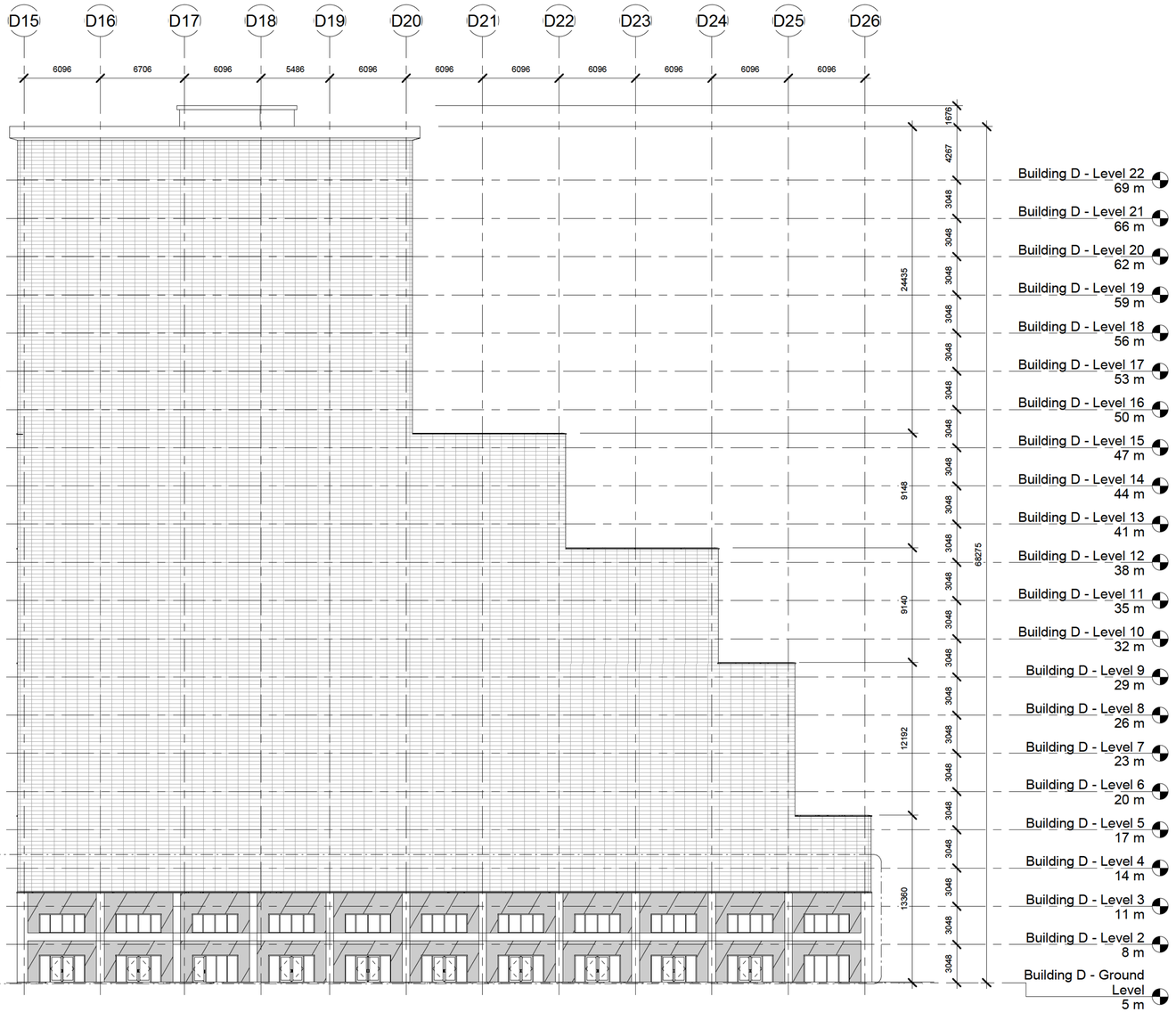
First Lake Development Concept

BLDG D Building & Enlarged Elevs

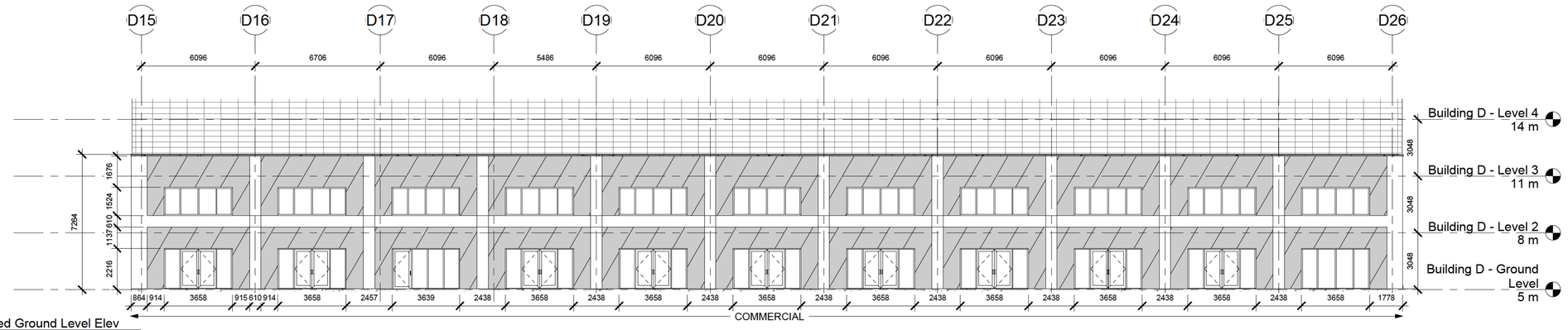
Project Number	17-016
Date	2022.08.19
Drawn By	HA
Checked By	TAS

A-207

Scale: As indicated



1 Bldg D - Side Elev. (2)
1 : 200



2 Bldg D - Side Elev. (2) - Enlarged Ground Level Elev
1 : 125

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
10.	ISSUED FOR REVIEW	2022.08.19
9.	ISSUED FOR REVIEW	2022.08.10
8.	ISSUED FOR REVIEW	2022.08.02
7.	ISSUED FOR REVIEW	2022.07.26
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKVILLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

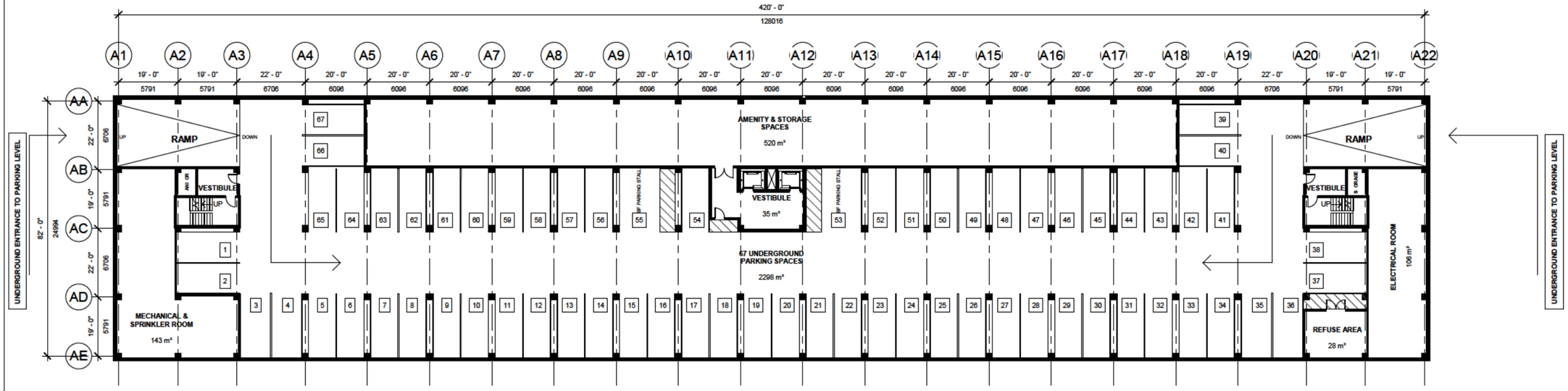
First Lake Development Concept

BLDG D Building & Enlarged Elevs

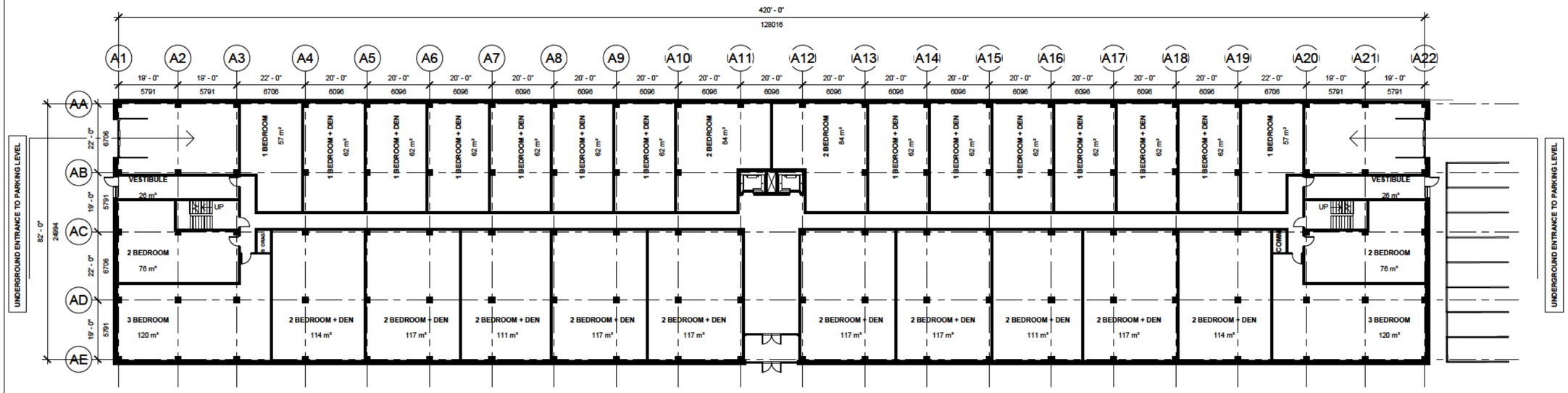
Project Number	17-016
Date	2022.08.19
Drawn By	HA
Checked By	TAS

A-208

Scale	As indicated



1 Building A - Undergorund Parking Level
1 : 200



2 Building A - Ground Level
1 : 200

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKV LLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

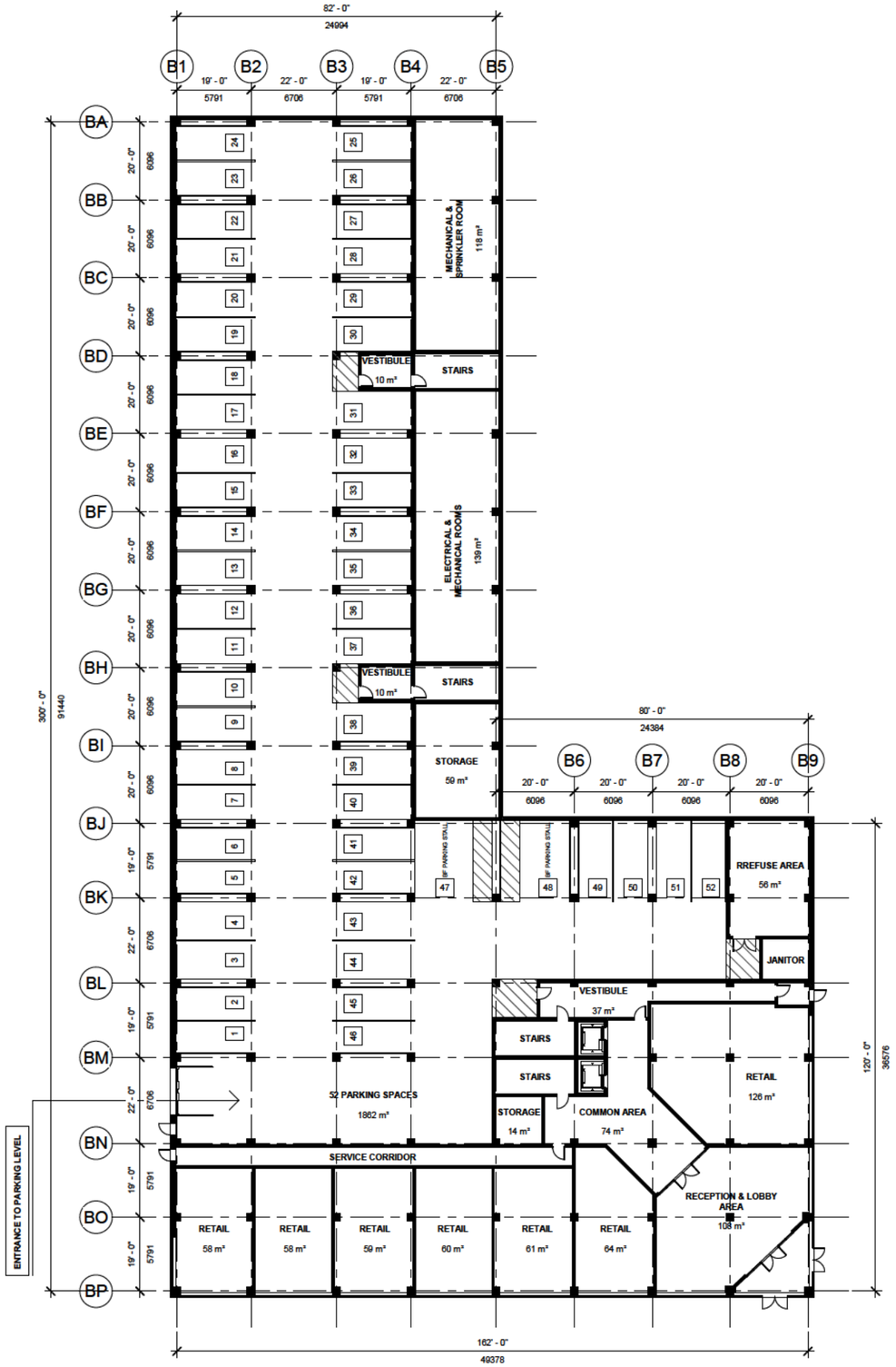
First Lake Development Concept

Building A Floor Plans

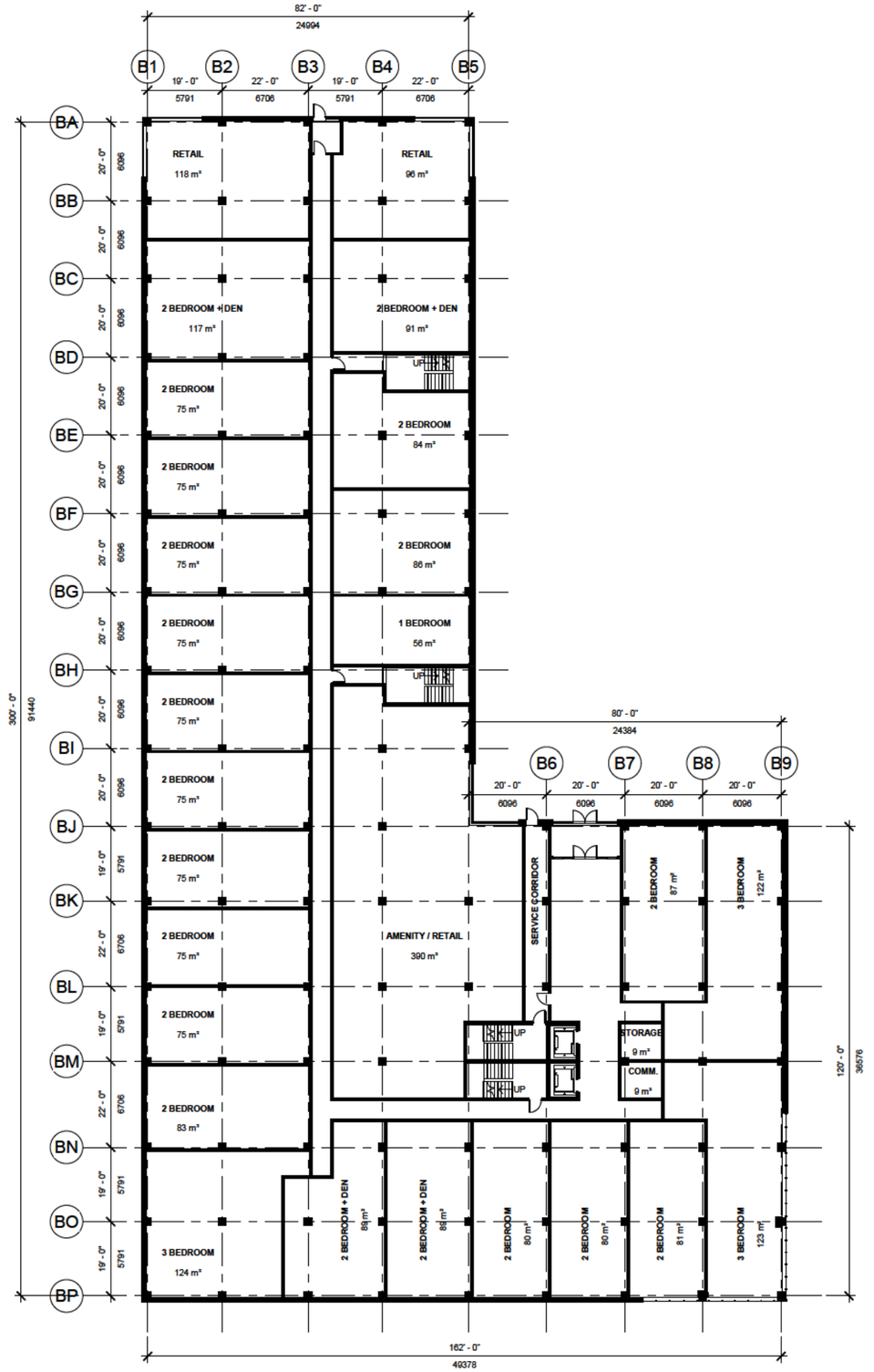
Project Number	17-016
Date	2022.06.23
Drawn By	HA
Checked By	TAS

A-102

Scale 1 : 200



① Building B - Ground Level
1 : 200



② Building B - Level 2
1 : 200

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKV LLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

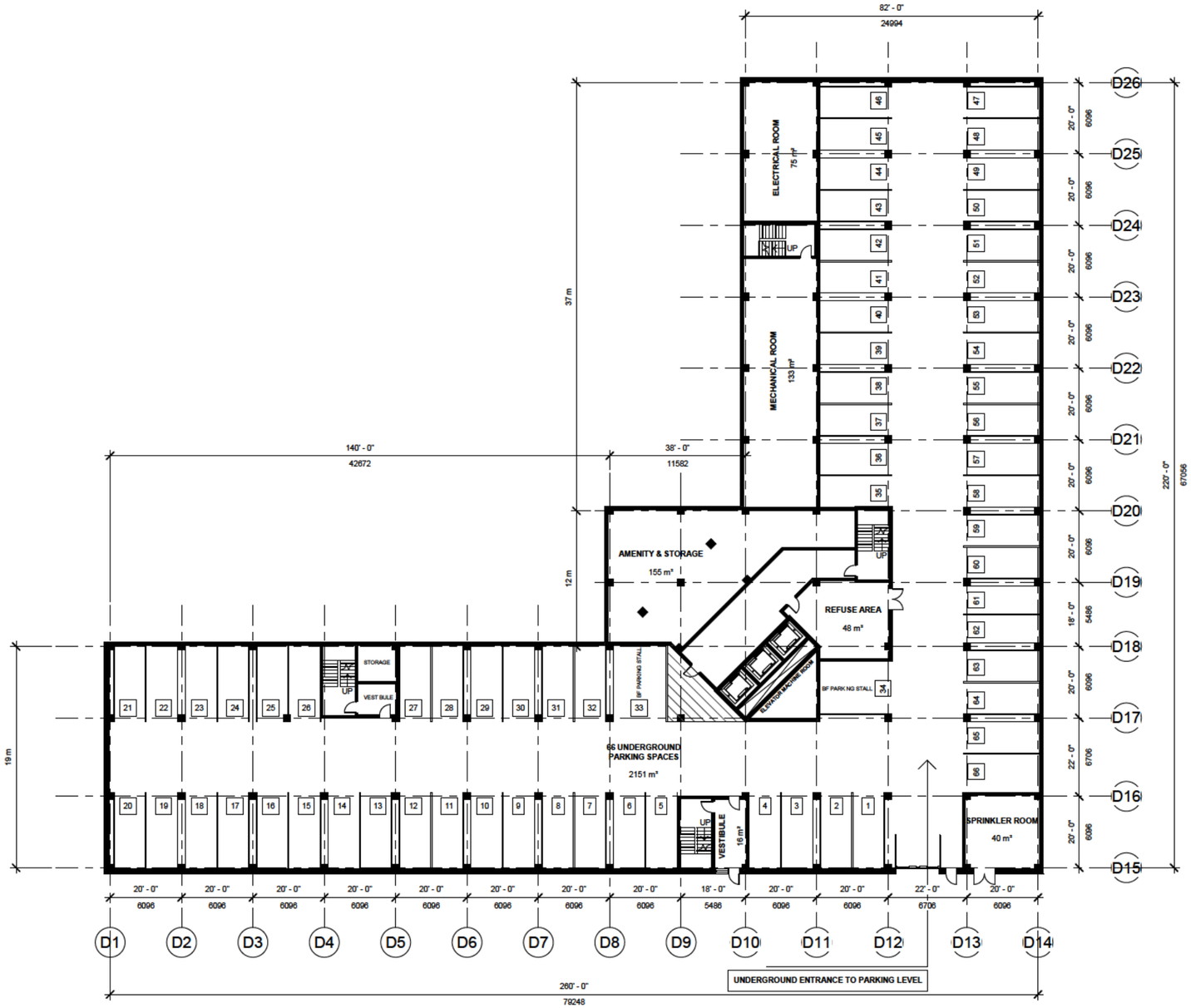
First Lake Development Concept

Building B Floor Plan

Project Number	17-016
Date	2022.06.23
Drawn By	HA
Checked By	TAS

A-103

Scale 1 : 200



① Building D - Underground Parking Level
1 : 200

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKV LLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

First Lake Development Concept

Building D Underground Parking Floor Plan

Project Number	17-016
Date	2022.06.23
Drawn By	HA
Checked By	TAS

A-104

Scale 1 : 200

1 Building D - Ground Level
1 : 200

T.A. SCOTT
ARCHITECTURE + DESIGN
DRAWING INSPIRATION

No.	Description	Date
6.	ISSUED FOR REVIEW	2022.06.23
5.	ISSUED FOR REVIEW	2022.06.16
4.	ISSUED FOR REVIEW	2022.06.15
3.	ISSUED FOR REVIEW	2022.06.14
2.	ISSUED FOR REVIEW	2022.06.01
1.	ISSUED FOR REVIEW	2022.03.23

Issue Schedule

No.	Description	Date

Revision Schedule

Project Address	70 FIRST LAKE DRIVE SACKV LLE , NOVA SCOTIA

FIRST MUTUAL PROPERTIES

First Lake Development Concept

Building D Ground Floor Plan

Project Number	17-016
Date	2022.06.23
Drawn By	HA
Checked By	TAS

A-105

Scale 1 : 200

ANNEX D - TRAFFIC IMPACT STUDY

70 FIRST LAKE DRIVE DEVELOPMENT
TRAFFIC IMPACT STUDY
FINAL REPORT

PREPARED FOR:
FIRST MUTUAL PROPERTIES

Project No. 221-00147-01

JULY 2022

TABLE OF CONTENTS

APPENDICES

1 INTRODUCTION

Background

Plans are being prepared by First Mutual Properties for a mixed development including both commercial and residential units at 70 First Lake Drive in Lower Sackville, Nova Scotia. The proposed development is planned to include 25 townhomes, 125 low-rise apartment units, 680 high-rise apartment units and 10,000 ft^2 of commercial space, as shown in Figure 1. Halifax Regional Municipality (HRM) has requested that a Traffic Impact Study be completed to review the impacts to the adjacent road network.

WSP Canada Inc. has been retained to complete a Traffic Impact Study (TIS) for the proposed 70 First Lake Drive Development.

A Traffic Impact Study Usually Considers Four Questions

A TIS usually consists of determining answers for the following questions:

1. **What is the existing transportation situation** adjacent to the study site? How have volumes changed historically?
2. **What transportation changes are expected** at key Study Area locations? How many vehicle and active mode trips are expected to be generated by the proposed development during weekday peak hours? What routes are the trips expected to use to travel within and through the Study Area?
3. **What transportation impacts will occur** on Study Area roads, sidewalks, and intersections?
4. **What transportation improvements are required** to mitigate project impacts on Study Area travel? Are there transportation modifications that should be made to improve the travel experience for all users?

Study Objectives

1. Develop projected 2030 background weekday AM and PM peak hourly volumes for Study Intersections.
2. Estimate the number of weekday AM and PM peak hour trips that will be generated by the proposed development.
3. Distribute and assign site generated trips to Study Intersections to project 2030 peak hourly volumes that include site generated trips.
4. Evaluate impacts of site generated traffic on the performance of Study Intersections.
5. Complete warrant analyses, as necessary, for Study Intersections and recommend improvements that may be needed at Study Intersections to mitigate the impacts of site development.

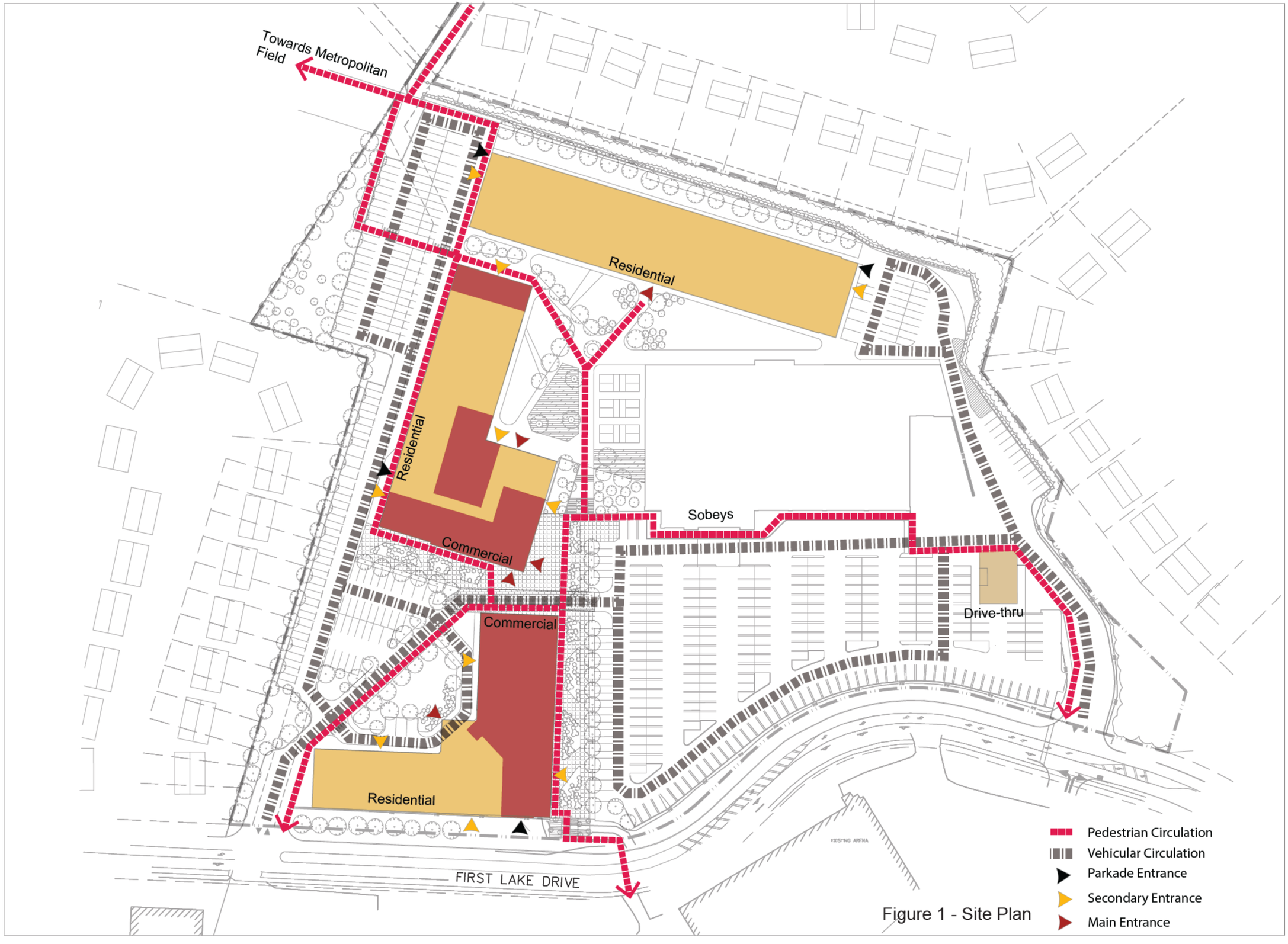


Figure 1 - Site Plan

UPLAND

63 King Street, Dartmouth
Nova Scotia B2Y 2R7
+ 1 902 423 0649

uplandstudio.ca

STAMP

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT
70FIRSTLAKEDRIVE

DRAWING TITLE
CONCEPT PLAN

NORTH

SCALE
1:1200

DRAWING #
DRAWING#

2 STUDY AREA DESCRIPTIONS

Description of Existing Development

70 First Lake Drive is currently occupied with a Sobey's store, Tim Hortons' with a Drive-through, a Call Centre, Glass Repair Shop, Recreation Sport Centre with a batting cage and small commercial stores. There are two access points from First Lake Driveway, one driveway to the west and one driveway to the east. The existing commercial stores to remain with the proposed development include the Sobey's Store and the Tim Horton's is moving to a new location (more to the east), however, remaining on the same site.

Description of Proposed Development

The proposed 70 First Lake Drive Development is planned to include 25 townhomes, 125 low-rise apartment units, 680 high-rise apartment units and 10,000ft^2 of commercial space. The access to the proposed development will be via the existing driveways on First Lake Drive, as shown in Figure 2. It is anticipated that the development will be completed by 2030.

Figure 2 – Study Area with the Study Intersections

Existing Study Road Descriptions

Metropolitan Avenue is a collector roadway with two lanes with one lane in each direction. The posted speed limit within the study area of 50 km/h. There are transit services for Route #82 and #182.

First Lake Drive is a collector road that has two lanes with one lane in each direction supplemented with left-turn lanes at roadways/driveways. The posted speed limit of 50 km/h. There are transit services for Route #82 and 182.

Existing Study Intersection Descriptions

Intersection #1 – Metropolitan Avenue at First Lake Drive is a 3-leg signalized intersection with shared lane approaches and marked pedestrian crossings on all approaches.

Intersection #2 – First Lake Drive at West Driveway is a 3-leg intersection with stop control on the West Driveway approach. First Lake Drive has two lanes with one in each direction and an eastbound left-turn lane. No marked pedestrian crossings at this intersection.

Intersection #3 – First Lake Drive at East Driveway is a 4-leg intersection with stop control on the East Driveway/Sackville Arena Driveway approaches. First Lake Drive has two lanes with one in each direction and an eastbound and westbound left-turn lane. No marked pedestrian crossings at this intersection.

3 BACKGROUND TRAFFIC

Turning Movement Counts

Turning movement volumes were collected by WSP on Wednesday, February 2nd, 2022 at Study Intersection 1 during the morning (7:00-9:00AM) and afternoon (4:00-6:00PM) peak periods and at Study Intersection 3 during the morning (7:00-9:00AM), midday (11:30AM-1:30PM) and afternoon (4:00-6:00PM) peak periods. Intersection counts have been tabulated in 15-minute intervals with peak hours indicated by shaded areas. Turning movement volumes are provided in Tables A-1 to A-2, Appendix A.

Covid-19 Adjustment Factor

It should be noted that a 5% Covid-19 factor was applied.

Traffic Growth Rate

An annual growth rate of 0.5% was applied to the background volumes for this Traffic Impact Study.

Network Re-Distribution for Tim Horton's

With the Tim Horton's being re-located on the site, from the west more to the east, the trips from the west driveway have been re-distributed to the east driveway.

4 TRIP GENERATION, DISTRIBUTION, AND ASSIGNMENT

Prepared Trip Generation Estimates

When using the published trip generation rates in the *Trip Generation Manual (Institute of Transportation Engineers)*, the transportation engineer's objective should be to provide a realistic estimate of the number of trips that will be generated by the proposed development.

Anticipated Land Use for the Proposed Development

The proposed development is expected to include 25 townhomes, 125 low-rise apartment units, 680 high-rise apartment units and 10,000ft^2 of commercial space. The commercial development is unknown at this time and therefore, was assumed to be a Strip Retail Plaza.

Estimation of Trips Generated by the Proposed Development

Trip generated by Strip Retail Plaza (Land Use 822) are estimated for the AM and PM peak hours of traffic by the leasable square footage. Single Family Attached Housing (Land Use 215), Multi-family Housing Low-Rise (Land Use 220) and Multi-family Housing High-Rise (Land Use 222) are estimated for the AM and PM peak hours of traffic by unit count. Trip generation estimates for the proposed development were prepared using published rates from *Trip Generation Manual, 11th Edition* (Institute of Transportation Engineers, Washington, 2021).

Reductions to Trip Generation Estimates

The total trip generation estimate for the proposed development were reduced by 10% to account for cycling and walking (non-auto) trips. Trips generated by the development were reduced by 5% to account for on-site synergies between residential and retail uses on the site.

Trips Generated by the Proposed Development – Full Build-Out

Trip generation estimates for the proposed development are summarized in Table 1. It is estimated that the development will generate:

- 215 two-way primary vehicle trips (78 entering and 137 exiting) during the AM peak hour; and,
- 308 two-way pass-by vehicle trips (173 entering and 135 exiting) during the PM peak hour.

Table 1 – Trip Generation Estimates for the Proposed Development – 830 Units

Land Use[1]	Units[2]	Trip Generation Rates[3]				Trip Generation Estimates[3]			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
Single-Family Attached Housing (Land Use 215)	25.0 Units	0.15	0 33	0.32	0.25	4	8	8	6
Multi-family Housing (Low-Rise) (Land Use 220)	125 0 Units	0.10	0.18	0.32	0.19	12	23	40	24
Multi-family Housing (High-Rise) (Land Use 222)	680 0 Units	0 09	0.18	0.18	0.14	62	121	122	96
Strip Retail Plaza[4] (Land Use 822)	10.0 KGLA	1.42	0 94	3.30	3.30	14	9	33	33
Trip Generation Estimates for Proposed Development - Full Build-Out						92	161	203	159
10% Reduction for Non-Auto Trips[5]						9	16	20	16
5% Reduction for On-Site Synergies[6]						5	8	10	8
Primary Trip Estimate for the Proposed Development - Full Build-Out						78	137	173	135

NOTES:
1. Land Use Codes are from Trip Generation, 11th Edition, (Institute of Transportation Engineers, Washington, 2021).
2. 'Residential Units' for Single-Family Attached Housing and Multi-family and 'Gross Leasable Area x 1000 SF' for Strip Retail Plaza.
3. Rates are 'vehicles per hour per unit'; trips generated are 'vehicles per hour for peak hours'.
4. Commercial uses associated with the development have yet to be identified, therefore, the commercial space was assumed to be Strip Retail Plaza.
5. A 10% reduction for non-auto trips generated by the residential units and strip retail plaza have been used to account for cycling and walking trips.
6. A 5% reduction has be used for trips generated by the residential development and retail plaza to account for on-site synergies within the development.

Trip Distribution and Assignment

Background traffic and the proposed development generated trips were distributed to the Study Intersections based on counted volumes and local knowledge of the area considering major trip origins and destinations in the region. The estimated directional distributions are provided below.

Direction	Distribution	Description
North	5%	(Beaver Bank and surrounding areas)
South	50%	(Sackville, Bedford and surrounding areas)
West	20%	(Middle Sackville and surrounding areas)
East	25%	(Lakeview Airport and surrounding areas)

Volume Figures

Traffic volume figures were prepared for future traffic scenarios for 2030 without and with the proposed development and they are included in Appendix A.

5 INTERSECTION OPERATIONAL ANALYSIS

Intersection Level of Service (LOS) Analysis was completed to estimate how intersections may be expected to operate into the future without and with site generated trips. This section of the report addresses how left-turn lane warrants and traffic signal warrants were conducted and how each intersection was evaluated. The following subsections identify each study intersection and summarize the results of the operational analysis.

Left-Turn Lane Warrant Analysis

Left-turn movements on a two-lane street may cause both operational and safety problems. Operational problems result as a vehicle stopped waiting for an opportunity to turn across 'heavy' opposing traffic causes a queue of stopped vehicles to form. Safety problems result from rear end collisions when a stopped left-turning vehicle is struck by an advancing vehicle, or from head-on or right-angle collisions when a left-turning vehicle is struck by an opposing vehicle.

The *Geometric Design Standards for Ontario Highways Manual* contains nomographs for left-turn lane analysis for two lane streets at unsignalized intersections. The analysis method, which is normally used by WSP Atlantic to evaluate the need for left-turn lanes, uses a series of nomographs that consider speed, advancing volumes, left-turns as a percentage of advancing volumes, and opposing volumes. A point, based on 'opposing' and 'advancing' volumes, plotted to the right of the 'warrant line' of the appropriate '% left-turns' and 'approach speed' nomograph, indicates that a left-turn lane is warranted for the conditions used in the analysis. Similarly, a point that is plotted to the left of the warrant line indicates that a left-turn lane is not warranted.

No left-turn lane warrant analyses were completed for this project, as the site accesses have a left-turn lane on First Lake Drive.

Traffic Signal Warrant Analysis

A signal warrant analysis is completed to determine if the installation of traffic signals at an intersection will provide a positive impact on total intersection operation. That is, the benefits in time saved and improved safety that will accrue to vehicles entering from a side street will exceed the impact that signals will have in time lost and potential additional collisions for vehicles approaching the intersection on the main street.

The *Canadian Traffic Signal Warrant Matrix Analysis (Transportation Association of Canada (TAC), 2005)* considers 100 warrant points as an indication that traffic signals will provide a positive impact. Signal warrant analysis uses vehicular and pedestrian volumes, and intersection, roadway and study area characteristics to calculate a warrant point value.

Traffic signal warrant analyses are included in Appendix B.

Intersection Capacity Analysis Results

Synchro 11.0 software have been used for performance evaluation of the Study Intersections. Summaries of the results are provided in the following sub-sections and detailed results of the analyses are included in Appendix C.

Intersection Level of Service Analysis

The level or quality of performance of an intersection in terms of traffic movement is determined by a level of service (LOS) analysis. LOS for intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and increased travel time.

LOS criteria, as shown in Table 2, are stated in terms of average control delay per vehicle which includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

Table 2 – Level of Service Criteria

Signalized Intersections Control Delay (Seconds per Vehicle)	LOS Description	Roundabouts *and* Two Way Stop Controlled (TWSC) Intersections Control Delay (Seconds per Vehicle)
Less than 10.0	Very low delay; most vehicles do not stop **(Excellent)**	Less than 10.0
Between 10.0 and 20.0	Higher delay; most vehicles stop **(Very Good)**	Between 10.0 and 15 0
Between 20.0 and 35.0	Higher level of congestion; number of vehicles stopping is significant, although many still pass hrough intersection without stopping **(Good)**	Between 15.0 and 25.0
Between 35.0 and 55.0	Conges ion becomes no iceable; vehicles must sometimes wait through more than one red light; many vehicles stop **(Satisfactory)**	Between 25.0 and 35.0
Between 55.0 and 80.0	Vehicles must often wait through more than one red light; considered by many agencies to be the limit of **acceptable** delay	Between 35.0 and 50.0
Greater than 80.0	This level is considered to be unacceptable to most drivers; occurs when arrival flow rates exceed the capacity of the intersection **(Unacceptable)**	Greater han 50.0

5.1 ANALYSIS SCENARIOS

Summary Analysis Scenarios Considered

Scenario 1 – Future 2030 without Site: Represents future 2030 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections.

***Scenario 2 – Future 2030 with Site*:** Represents future 2030 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections with the proposed development.

5.2 INT #1: METROPOLITAN AVENUE AT FIRST LAKE DRIVE

Intersection #1 – Metropolitan Avenue at First Lake Drive:
Operational performance results for this intersection are provided in Table 3 for both the AM and PM peak hours.

The intersection is expected to operate within HRM acceptable limits during the AM and PM peak hours. Minimal changes in the operational performance of this intersection are expected with the addition of the proposed development. All movements are expected to operate at with a v/c ratio of 0.80 or better.

Table 3 - Intersection Capacity Analysis: Metropolitan Avenue at First Lake Drive

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement			Overall Intersection
	First Lake Drive	Metropolitan Avenue		
	WB-LR	NB-TR	SB-LT	Delay
Scenario 1 - Future 2030 without Site AM Peak Hour (Page C-1)				
Delay	14.1	9.6	13.4	12.2
v/c	0.47	0.46	0.48	
Queue	33.7	36.5	43.2	
Scenario 2 - Future 2030 with Site AM Peak Hour (Page C-7)				
Delay	17.5	11.1	15.0	14.4
v/c	0.62	0.54	0.51	
Queue	52.8	43.1	44.4	
Scenario 1 - Future 2030 without Site PM Peak Hour (Page C-4)				
Delay	19.8	14.8	10.9	15.8
v/c	0.61	0.69	0.26	
Queue	60.9	72.4	24.3	
Scenario 2 - Future 2030 with Site PM Peak Hour (Page C-10)				
Delay	28.5	20.9	14.8	22.7
v/c	0.75	0.80	0.35	
Queue	112.3	125.7	35.4	

5.3 INT #2: FIRST LAKE DRIVE AT WEST DRIVEWAY

Intersection #2 – First Lake Drive at West Driveway:
Operational performance results for this intersection are provided in Table 4 for both the AM and PM peak hours. A traffic signal warrant was completed for the 2030 Future with Site scenario, and it was determined that:

- 2030 Future with Site: Traffic signals are not warranted (**17 Warrant Points**, Table B-1, Appendix B)

The intersection is expected to operate within HRM acceptable limits during the AM and PM peak hours. Negligible changes in the operational performance of this intersection are expected with the addition of the proposed development. All movements are expected to operate at with a v/c ratio of 0.20 or better.

Table 4 - Intersection Capacity Analysis: First Lake Drive at West Driveway

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement					Overall Intersection
	First Lake Drive			West Driveway		
	EB-L	EB-T	WB-TR	SB-L	SB-R	Delay
Scenario 1 - Future 2030 without Site AM Peak Hour (Page C-2)						
Delay	7.8	0.0	0.0	13.0	9.5	4.6
v/c	0.11	0.06	0.09	0.01	0.14	
Queue	2.9	0.0	0.0	0.3	3.9	
Scenario 2 - Future 2030 with Site AM Peak Hour (Page C-8)						
Delay	7.9	0.0	0.0	14.2	10.2	3.0
v/c	0.05	0.15	0.15	0.09	0.14	
Queue	1.2	0.0	0.0	2.2	3.9	
Scenario 1 - Future 2030 without Site PM Peak Hour (Page C-5)						
Delay	8.1	0.0	0.0	15.7	10.0	4.9
v/c	0.15	0.08	0.11	0.01	0.20	
Queue	4.2	0.0	0.0	0.4	5.8	
Scenario 2 - Future 2030 with Site PM Peak Hour (Page C-11)						
Delay	8.4	0.0	0.0	21.4	10.9	3.2
v/c	0.12	0.20	0.20	0.14	0.15	
Queue	3.1	0.0	0.0	4.0	4.3	

5.4 INT #3: FIRST LAKE DRIVE AT EAST DRIVEWAY

Intersection #3 – First Lake Drive at East Driveway:
Operational performance results for this intersection are provided in Table 5 for both the AM and PM peak hours. A traffic signal warrant was completed for the 2030 Future with Site scenario, and it was determined that:

- 2030 Future with Site: Traffic signals are not warranted (**19 Warrant Points**, Table B-2, Appendix B)

The intersection is expected to operate within HRM acceptable limits during the AM and PM peak hours. Negligible changes in the operational performance of this intersection are expected with the addition of the proposed development. All movements are expected to operate at with a v/c ratio of 0.27 or better.

Table 5 - Intersection Capacity Analysis: First Lake Drive at East Driveway

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement							Overall Intersection
	First Lake Drive				Sackville Arena	East Driveway		
	EB-L	EB-TR	WB-L	WB-TR	NB-LTR	SB-L	SB-R	Delay
Scenario 1 - Future 2030 without Site AM Peak Hour (Page C-3)								
Delay	7 5	0.0	7.4	0.0	9 9	10.4	9.2	1.9
v/c	0.00	0.06	0.00	0 09	0.00	0.05	0.01	
Queue	0.1	0.0	0.0	0.0	0.1	1.4	0.3	
Scenario 2 - Future 2030 wi h Site AM Peak Hour (Page C-9)								
Delay	7 9	0.0	7.5	0.0	14.0	15 5	9.7	5.1
v/c	0.11	0.08	0.00	0.10	0.01	0.11	0.16	
Queue	3 0	0.0	0.0	0.0	0 2	3.0	4.5	
Scenario 1 - Future 2030 without Site PM Peak Hour (Page C-6)								
Delay	7.7	0.0	7.5	0.0	10.8	11 8	9.7	3.1
v/c	0.02	0.07	0.00	0.12	0.02	0.09	0.06	
Queue	0.4	0.0	0.1	0.0	0 6	2.4	1.5	
Scenario 2 - Future 2030 with Site PM Peak Hour (Page C-12)								
Delay	8 3	0.0	7.5	0.0	20.4	23 9	11.1	6.5
v/c	0.17	0.09	0.00	0.15	0.06	0.24	0.27	
Queue	5.1	0.0	0.1	0.0	1 5	7.3	8.9	

6 SUMMARY, CONCLUSION & RECOMMENDATIONS

6.1 SUMMARY

Background	1.	Plans are being prepared by First Mutual Properties for a mixed development including both commercial and residential units at 70 First Lake Drive in Lower Sackville, Nova Scotia.
Description of Existing Development	2.	70 First Lake Drive is currently occupied with a Sobey's store, Tim Hortons' with a Drive-through, a Call Centre, Glass Repair Shop, Recreation Sport Centre with a batting cage and small commercial stores. There are two access points from First Lake Driveway, one driveway to the west and one driveway to the east. The existing commercial stores to remain with the proposed development include the Sobey's Store and the Tim Horton's is moving to a new location (more to the east), however, remaining on the same site.
Description of the Proposed Development	3.	The proposed development is planned to include 25 townhomes, 125 low-rise apartment units, 680 high-rise apartment units and 10,000ft^2 of commercial space. Halifax Regional Municipality (HRM) has requested that a Traffic Impact Study be completed to review the impacts to the adjacent road network.
	4.	It is anticipated that the development will be completed by 2030.
Proposed Site Access	5.	The access to the proposed development will be via the existing driveways on First Lake Drive.
Study Area Roads	6.	***Metropolitan Avenue*** is a collector roadway with two lanes with one lane in each direction. The posted speed limit within the study area is 50 km/h. There are transit services for Route #82 and #182.
	7.	***First Lake Drive*** is a collector road that has two lanes with one lane in each direction supplemented with left-turn lanes at roadways/driveways. The posted speed limit is 50 km/h. There are transit services for Route #82 and 182.
Turning Movement Counts	8.	Turning movement volumes were collected by WSP on Wednesday, February 2nd, 2022 at Study Intersection 1 during the morning (7:00-9:00AM) and afternoon (4:00-6:00PM) peak periods and at Study Intersection 3 during the morning (7:00-9:00AM), midday (11:30AM-1:30PM) and afternoon (4:00-6:00PM) peak periods.
Background Traffic Volumes & Re-distribution of Tim Horton's Trips	9.	Projected 2030 peak hour future background volumes include: • 5% Covid-19 Adjustment Factor; and, • 0.5% annual growth between 2021-2030.
	10.	With the Tim Horton's being re-located on the site, from the west more to the east, the trips from the west driveway have been re-distributed to the east driveway.

Estimation of Proposed Development Trips	11. Trip generation estimates for the proposed Exhibition Expansion were prepared using rates published in *Trip Generation, 11th Edition* (Institute of Transportation Engineers, Washington, 2021). 12. It is estimated that the development will generate: • 215 two-way primary vehicle trips (78 entering and 137 exiting) during the AM peak hour; and, • 308 two-way pass-by vehicle trips (173 entering and 135 exiting) during the PM peak hour.
Trip Distribution and Assignment	13. Proposed development generated trips were distributed to the Study Intersections based on counted volumes and local knowledge of the area considering major trip origins and destinations in the region. Trips were distributed to the north (5%), south (50%), west (20%), and east (25%).
Analysis Scenarios Considered	14. **Scenario 1 – Future 2030 without Site:** Represents future 2030 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections. 15. **Scenario 2 – Future 2030 with Site:** Represents future 2030 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections with the proposed development.
Warrant Analysis Summary	16. Warrant reviews were completed for traffic signals for Scenario 2 to identify road network upgrades warranted with the proposed development. No left-turn lane warrants were completed, as there are existing left-turn lanes on First Lake Drive. 17. It was determined that traffic signals are not warranted at any Study Intersection.
Summary – Intersection Capacity Analysis	18. Intersection performance analysis was completed using *Synchro 11* at the Study Intersections. 19. All study intersections are expected to operate within HRM acceptable limits during the AM and PM peak hours. Negligible or minimal changes in the operational performance of this intersection are expected with the addition of the proposed development. All movements are expected to operate at with a v/c ratio of 0.80 or better.

6.2 CONCLUSIONS

Conclusion	20. Trips generated by 70 First Lake Drive Development are expected to have a minimal or negligible impact on the operational performance of the Study Intersections and the adjacent street network.

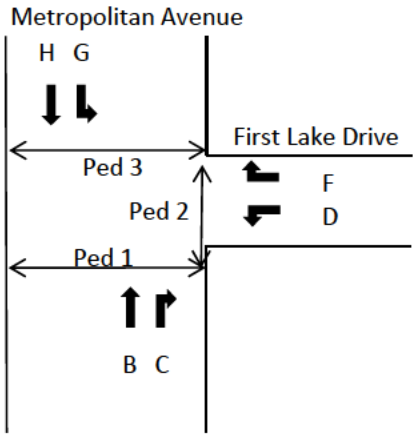
APPENDIX

A TRAFFIC VOLUME DATA

Table A-1

Metropolitan Avenue @ First Lake Drive

Lower Sackville, NS
Wednesday, February 2, 2022



AM Peak Period Volume Data

Time		Metropolitan Avenue Northbound Approach		First Lake Drive Westbound Approach		Metropolitan Avenue Southbound Approach		Total Vehicles
		B	C	D	F	G	H	
07:00	07:15	4	22	23	1	12	32	94
07:15	07:30	14	31	33	6	12	28	124
07:30	07:45	17	48	28	8	13	43	157
07:45	08:00	21	36	51	12	5	45	170
08:00	08:15	17	43	54	10	16	36	176
08:15	08:30	14	27	28	10	6	18	103
08:30	08:45	36	43	42	7	15	57	200
08:45	09:00	55	47	48	19	20	82	271
AM Peak Hour		**122**	**160**	**172**	**46**	**57**	**193**	**750**
07:00	**08:00**	**56**	**137**	**135**	**27**	**42**	**148**	**545**
08:00	**09:00**	**122**	**160**	**172**	**46**	**57**	**193**	**750**
		Ped 1		**Ped 2**		**Ped 3**		**Total Peds**
07:00	**08:00**	**4**		**1**		**0**		**5**
08:00	**09:00**	**8**		**1**		**0**		**9**

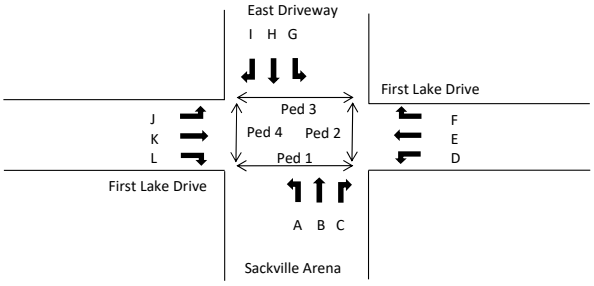
PM Peak Period Volume Data

Time		Metropolitan Avenue Northbound Approach		First Lake Drive Westbound Approach		Metropolitan Avenue Southbound Approach		Total Vehicles
		B	C	D	F	G	H	
16:00	16:15	43	70	44	17	8	26	208
16:15	16:30	50	65	50	17	8	21	211
16:30	16:45	47	63	61	18	4	29	222
16:45	17:00	49	61	58	23	8	35	234
17:00	17:15	40	68	59	29	8	21	225
17:15	17:30	54	63	59	12	6	17	211
17:30	17:45	42	52	57	17	6	15	189
17:45	18:00	33	58	58	13	7	28	197
PM Peak Hour		**190**	**255**	**237**	**82**	**26**	**102**	**892**
16:00	**17:00**	**189**	**259**	**213**	**75**	**28**	**111**	**875**
17:00	**18:00**	**169**	**241**	**233**	**71**	**27**	**81**	**822**
		Ped 1		**Ped 2**		**Ped 3**		**Total Peds**
16:00	**17:00**	**4**		**0**		**0**		**4**
17:00	**18:00**	**4**		**1**		**0**		**5**

Table A-2

First Lake Drive
@
East Driveway

Lower Sackville, NS
Wednesday, February 2, 2022



AM Peak Period Volume Data

Time		East Driveway Northbound Approach			First Lake Drive Westbound Approach			East Driveway Southbound Approach			First Lake Drive Eastbound Approach			Total Vehicles
		A	B	C	D	E	F	G	H	I	J	K	L	
07 00	07:15	0	0	0	1	14	2	3	0	1	2	14	0	37
07:15	07:30	0	0	0	0	23	1	6	1	0	0	16	0	47
07:30	07:45	0	0	0	0	21	3	11	0	2	3	29	0	69
07:45	08:00	0	0	0	0	51	8	6	0	2	1	22	0	90
08 00	08:15	0	0	0	1	38	5	10	0	2	2	22	0	80
08:15	08:30	2	0	0	0	19	3	6	0	2	0	16	0	48
08:30	08:45	0	0	0	0	24	1	8	0	1	1	22	0	57
08:45	09:00	0	0	0	0	32	5	6	0	3	4	20	1	71
AM Peak Hour		**2**	**0**	**0**	**1**	**129**	**19**	**33**	**0**	**8**	**6**	**89**	**0**	**287**
07:00	**08:00**	**0**	**0**	**0**	**1**	**109**	**14**	**26**	**1**	**5**	**6**	**81**	**0**	**243**
08:00	**09:00**	**2**	**0**	**0**	**1**	**113**	**14**	**30**	**0**	**8**	**7**	**80**	**1**	**256**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
07:00	**08:00**	**1**			**0**			**0**			**1**			**2**
08:00	**09:00**	**14**			**0**			**0**			**1**			**15**

Midday Volume Data

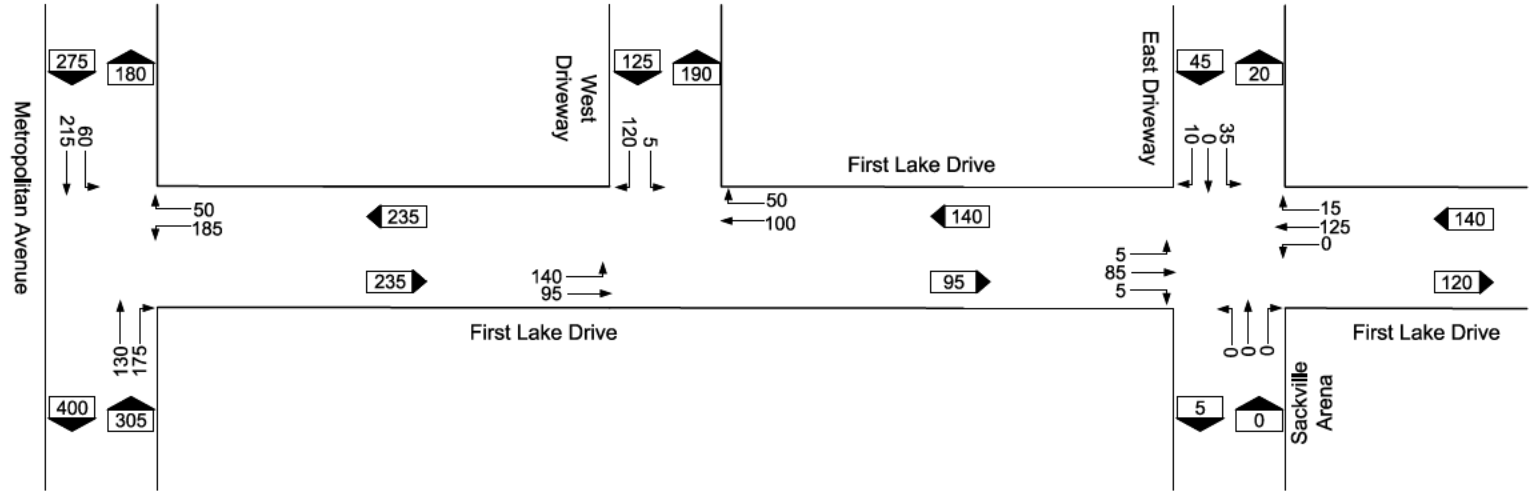
Time		East Driveway Northbound Approach			First Lake Drive Westbound Approach			East Driveway Southbound Approach			First Lake Drive Eastbound Approach			Total Vehicles
		A	B	C	D	E	F	G	H	I	J	K	L	
11:30	11:45	0	0	1	0	10	5	5	0	6	4	17	0	48
11:45	12:00	1	0	0	1	18	8	12	0	3	1	11	1	56
12 00	12:15	1	0	0	0	17	9	12	0	3	2	13	0	57
12:15	12:30	0	0	1	0	25	4	12	0	2	1	12	1	58
12:30	12:45	0	0	0	1	16	6	3	1	4	1	17	0	49
12:45	13:00	0	0	0	0	14	6	12	0	4	3	14	0	53
13 00	13:15	0	0	0	0	14	3	8	0	7	4	10	0	46
13:15	13:30	1	0	0	0	17	7	12	0	8	4	16	0	65
Midday Peak Hour		**2**	**0**	**1**	**2**	**76**	**27**	**39**	**1**	**12**	**5**	**53**	**2**	**220**
11:30	**12:30**	**2**	**0**	**2**	**1**	**70**	**26**	**41**	**0**	**14**	**8**	**53**	**2**	**219**
12:30	**13:30**	**1**	**0**	**0**	**1**	**61**	**22**	**35**	**1**	**23**	**12**	**57**	**0**	**213**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
11:30	**12:30**	**4**			**0**			**0**			**2**			**6**
12:30	**13:30**	**3**			**1**			**0**			**0**			**4**

PM Peak Period Volume Data

Time		East Driveway Northbound Approach			First Lake Drive Westbound Approach			East Driveway Southbound Approach			First Lake Drive Eastbound Approach			Total Vehicles
		A	B	C	D	E	F	G	H	I	J	K	L	
16 00	16:15	0	0	1	1	19	15	13	0	8	3	28	1	89
16:15	16:30	0	1	0	1	25	5	16	3	7	3	28	1	90
16:30	16:45	0	1	0	0	26	11	8	0	9	8	17	2	82
16:45	17:00	0	1	1	0	38	23	10	0	11	5	23	0	112
17 00	17:15	5	1	4	0	26	11	15	2	7	3	32	0	106
17:15	17:30	2	0	0	5	31	15	14	2	8	5	30	0	112
17:30	17:45	0	0	1	0	25	12	13	0	10	4	18	2	85
17:45	18:00	7	0	0	1	16	9	13	0	6	3	22	1	78
PM Peak Hour		**7**	**2**	**6**	**5**	**120**	**61**	**52**	**4**	**36**	**17**	**103**	**2**	**415**
16:00	**17:00**	**0**	**3**	**2**	**2**	**108**	**54**	**47**	**3**	**35**	**19**	**96**	**4**	**373**
17:00	**18:00**	**14**	**1**	**5**	**6**	**98**	**47**	**55**	**4**	**31**	**15**	**102**	**3**	**381**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
16:00	**17:00**	**13**			**0**			**0**			**0**			**13**
17:00	**18:00**	**6**			**0**			**0**			**2**			**8**

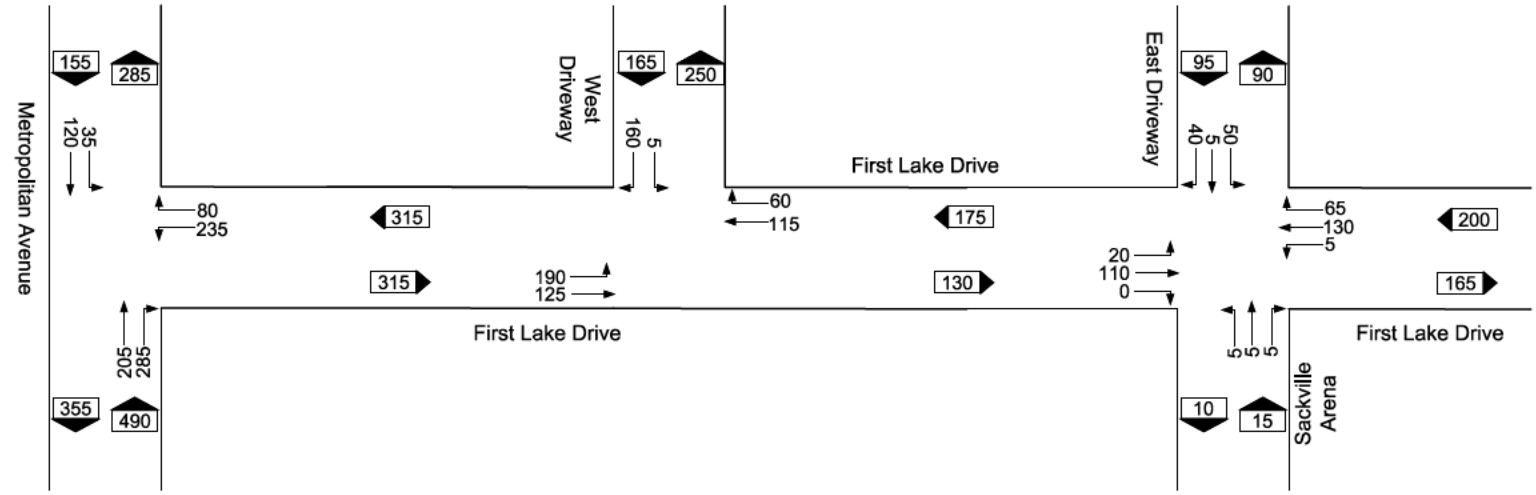
A

AM Peak Hour



B

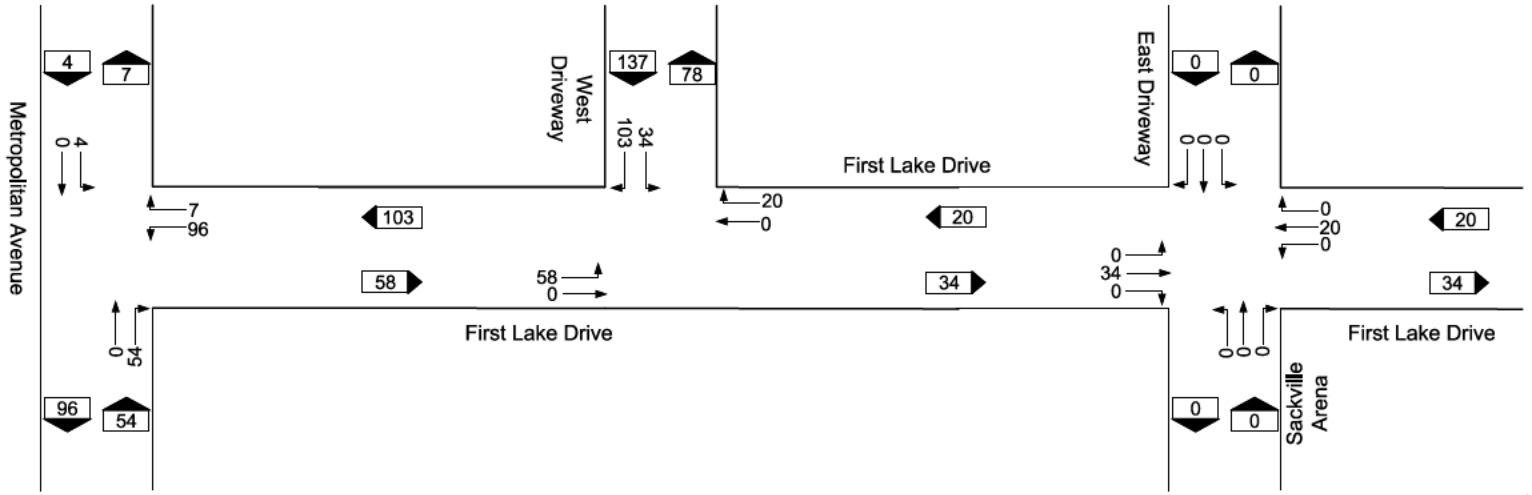
PM Peak Hour



WSP	Traffic Impact Study - First Lake Drive Lower Sackville, Nova Scotia	Figure A-1
	2030 Future Background Without Site Development Weekday AM and PM Peak Hour	March 2022

A

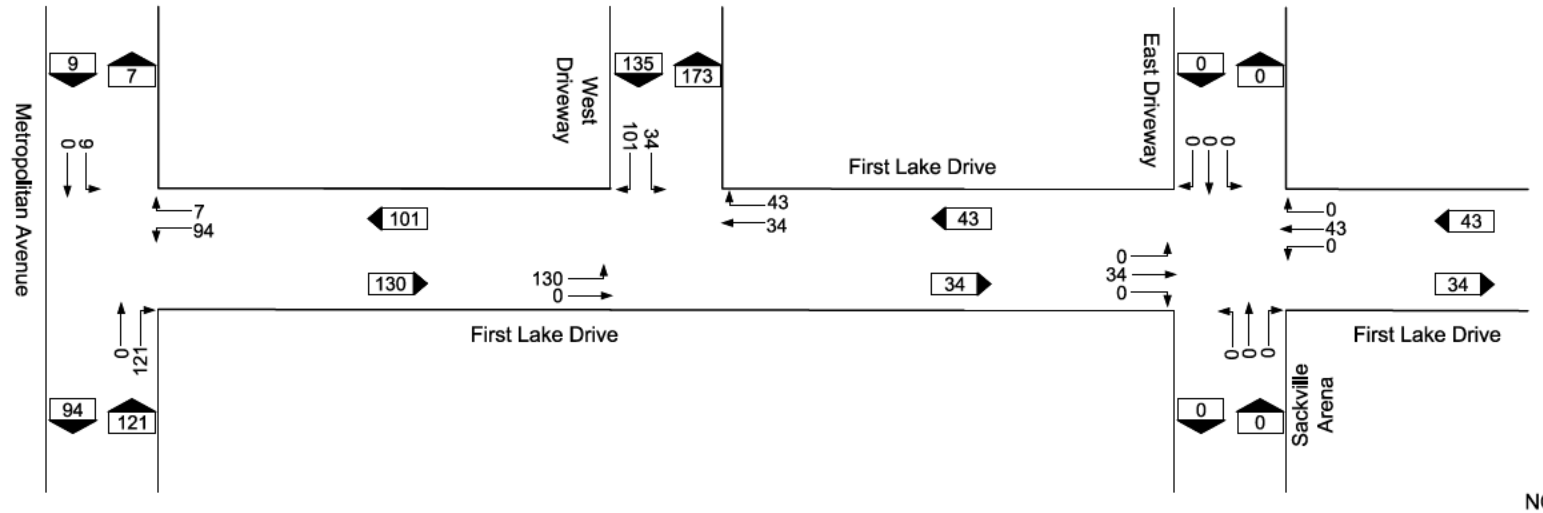
AM Peak Hour



NOT TO SCALE

B

PM Peak Hour

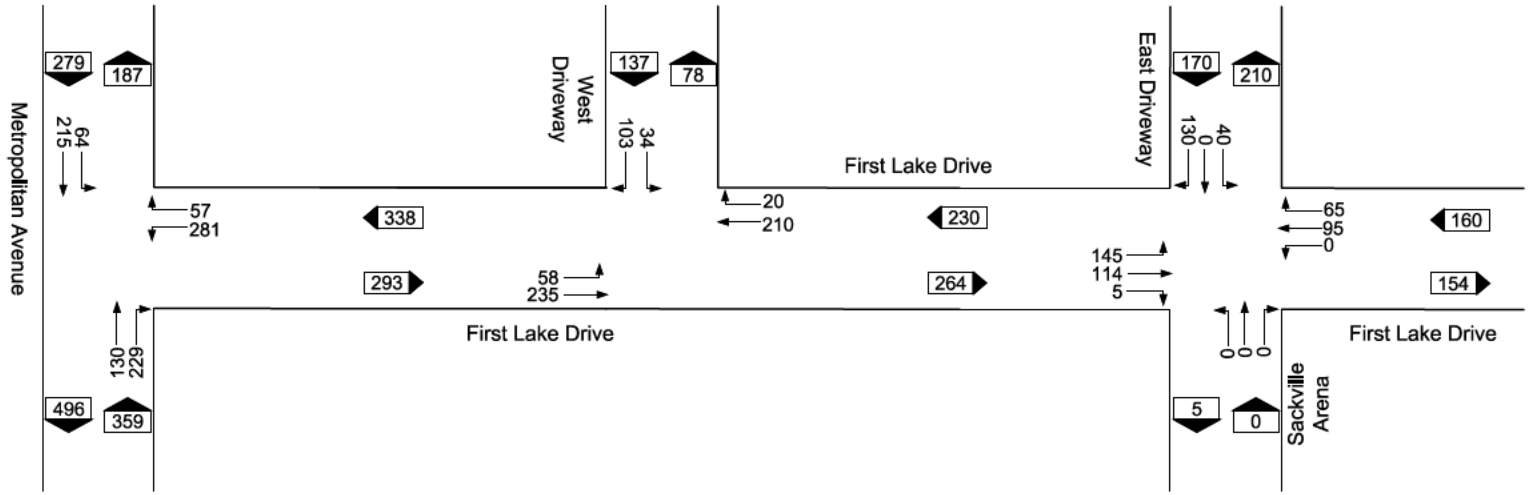


NOT TO SCALE

wsp	Traffic Impact Study - First Lake Drive Lower Sackville, Nova Scotia	Figure A-2
	2030 Site Generated Trips Weekday AM and PM Peak Hour	March 2022

A

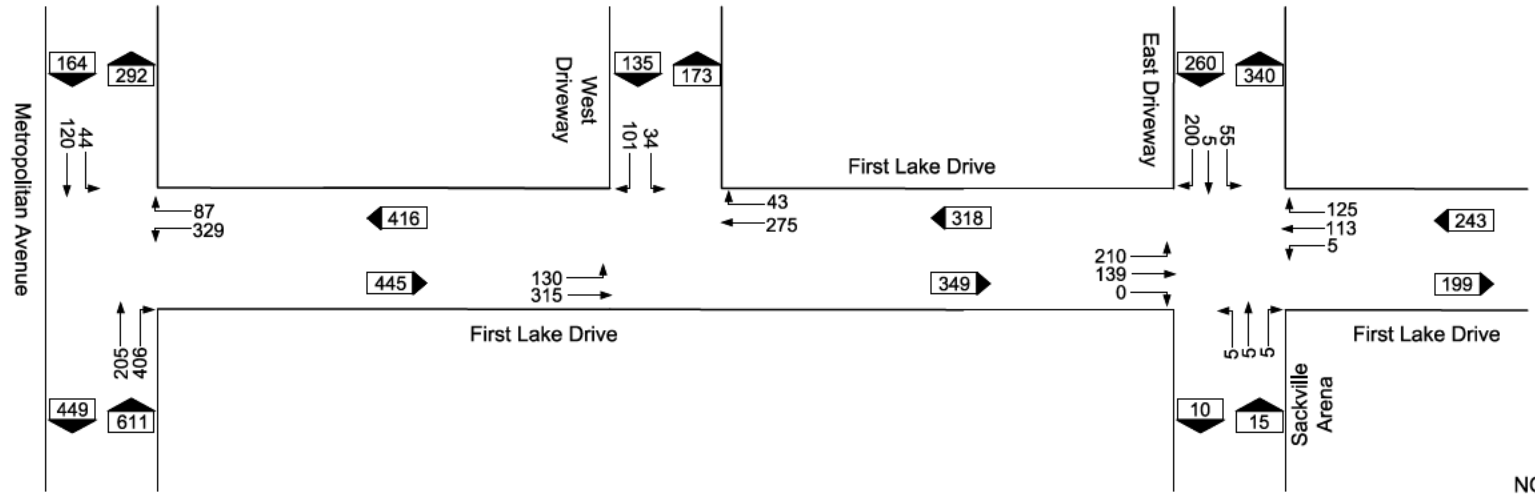
AM Peak Hour



NOT TO SCALE

B

PM Peak Hour



NOT TO SCALE

wsp	Traffic Impact Study - First Lake Drive Lower Sackville, Nova Scotia	Figure A-3
	2030 Future Background with Site Development Weekday AM and PM Peak Hour	March 2022

APPENDIX

B

INTERSECTION PERFORMANCE ANALYSIS

2005 Canadian Traffic Signal Warrant Matrix Analysis

Table: B-1 - First Lake Drive at West Driveway
2030 Future w Site

Main Street (name)	First Lake Drive	Direction (EW or NS)	EW	Date:	March 2022
Side Street (name)	West Driveway	Direction (EW or NS)	NS	City:	Lower Sackville, NS

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
First Lake Drive	WB				1		210	1	
First Lake Drive	EB	1		1			10,000	1	
	NB								
West Driveway	SB	1				1			

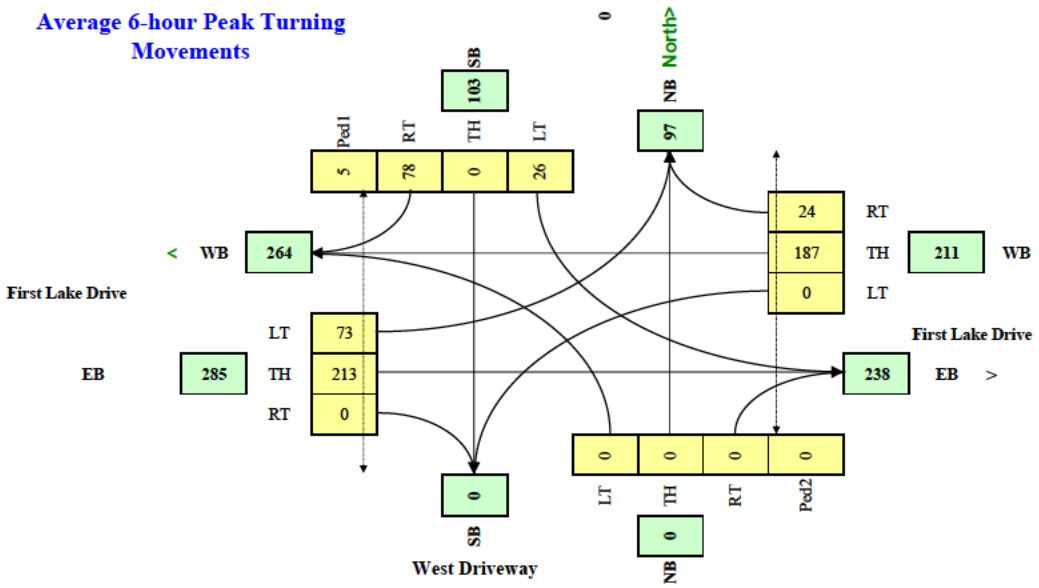
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
First Lake Drive	EW	50	2.0%	y	0.0
West Driveway	NS	50	2.0%	n	

	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7 00 - 8 00	1	0	0	1
8 00 - 9 00	1	0	0	14
11 30 - 12 30	4	0	0	2
12 30 - 13 30	3	1	0	0
15 30 - 16 30	13	0	0	0
16 30 - 17 30	6	0	0	2
Total (6-hour peak)	**28**	**1**	**0**	**19**
Average (6-hour peak)	**5**	**0**	**0**	**3**

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	400,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7 00 - 8 00	0	0	0	35	0	105	0	210	20	60	235	0
8 00 - 9 00	0	0	0	25	0	75	0	160	15	45	175	0
11 30 - 12 30	0	0	0	15	0	50	0	120	15	45	140	0
12 30 - 13 30	0	0	0	15	0	50	0	120	15	45	140	0
15 30 - 16 30	0	0	0	30	0	85	0	235	35	110	270	0
16 30 - 17 30	0	0	0	35	0	100	0	275	45	130	315	0
Total (6-hour peak)	**0**	**0**	**0**	**155**	**0**	**465**	**0**	**1,120**	**145**	**435**	**1,275**	**0**
Average (6-hour peak)	**0**	**0**	**0**	**26**	**0**	**78**	**0**	**187**	**24**	**73**	**213**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\ (X_{v\text{-}p})\ L) / K_2] \times C_i$$

W =	17	14	3
		Veh	*Ped*

NOT Warranted

2005 Canadian Traffic Signal Warrant Matrix Analysis

Table: B-2 - First Lake Drive at East Driveway
2030 Future w Site

Main Street (name)	First Lake Drive	Direction (EW or NS)	EW	Date:	March 2022
Side Street (name)	East Driveway	Direction (EW or NS)	NS	City:	Lower Sackville, NS

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
First Lake Drive	WB	1			1		500	1	
First Lake Drive	EB	1			1		10,000	1	
Sackville Arena	NB			1					
East Driveway	SB	1			1				

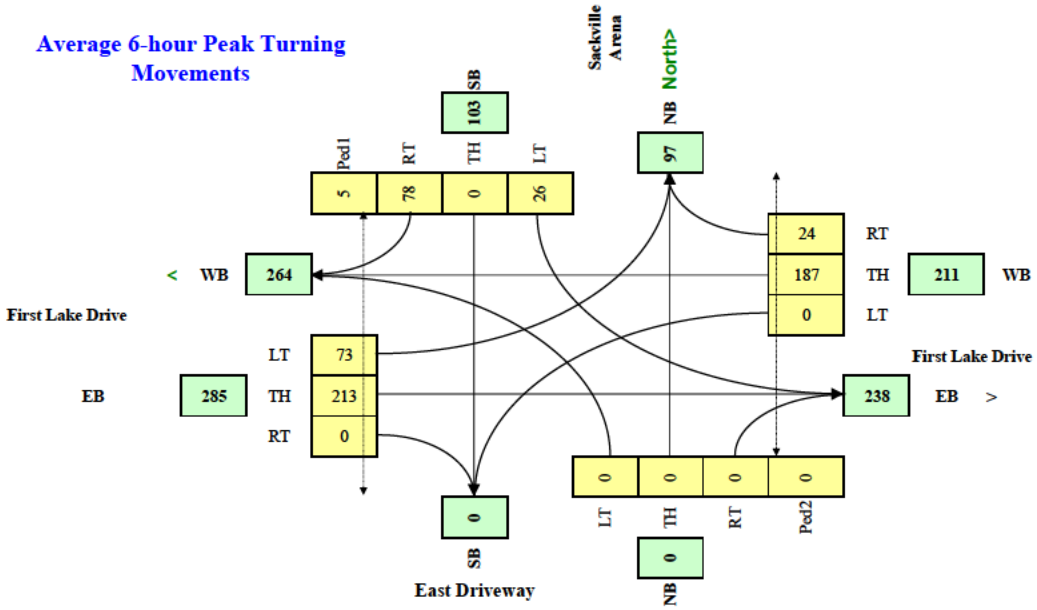
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
First Lake Drive	EW	50	2.0%	y	0.0
East Driveway	NS	50	2.0%	n	

	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7 00 - 8 00	1	0	0	1
8 00 - 9 00	1	0	0	14
11 30 - 12 30	4	0	0	2
12 30 - 13 30	3	1	0	0
15 30 - 16 30	13	0	0	0
16 30 - 17 30	6	0	0	2
Total (6-hour peak)	**28**	**1**	**0**	**19**
Average (6-hour peak)	**5**	**0**	**0**	**3**

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	400,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7 00 - 8 00	0	0	0	35	0	105	0	210	20	60	235	0
8 00 - 9 00	0	0	0	25	0	75	0	160	15	45	175	0
11 30 - 12 30	0	0	0	15	0	50	0	120	15	45	140	0
12 30 - 13 30	0	0	0	15	0	50	0	120	15	45	140	0
15 30 - 16 30	0	0	0	30	0	85	0	235	35	110	270	0
16 30 - 17 30	0	0	0	35	0	100	0	275	45	130	315	0
Total (6-hour peak)	**0**	**0**	**0**	**155**	**0**	**465**	**0**	**1,120**	**145**	**435**	**1,275**	**0**
Average (6-hour peak)	**0**	**0**	**0**	**26**	**0**	**78**	**0**	**187**	**24**	**73**	**213**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\ (X_{v\text{-}p})\ L) / K_2] \times C_i$$

W =	19	16	3
		Veh	*Ped*

NOT Warranted

APPENDIX

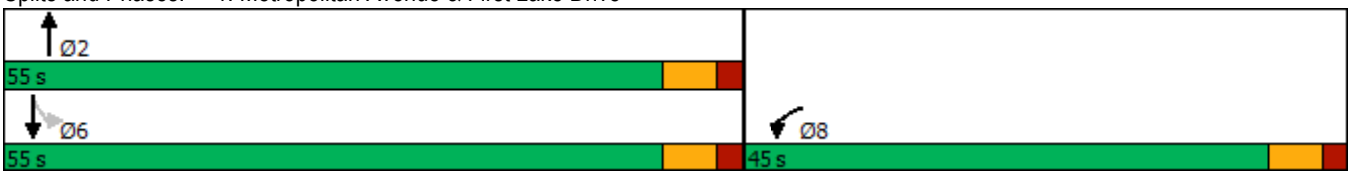
C

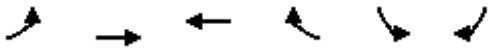
WARRANT ANALYSIS

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	185	50	130	175	60	215
Future Volume (vph)	185	50	130	175	60	215
Satd. Flow (prot)	1729	0	1689	0	0	1842
Flt Permitted	0.962					0.852
Satd. Flow (perm)	1714	0	1689	0	0	1585
Satd. Flow (RTOR)	16		95			
Lane Group Flow (vph)	255	0	331	0	0	299
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Total Split (s)	45.0		55.0		55.0	55.0
Total Lost Time (s)	6.0		6.0			6.0
Act Effct Green (s)	12.9		16.6			16.6
Actuated g/C Ratio	0.31		0.40			0.40
v/c Ratio	0.47		0.46			0.48
Control Delay	14.1		9.6			13.4
Queue Delay	0.0		0.0			0.0
Total Delay	14.1		9.6			13.4
LOS	B		A			B
Approach Delay	14.1		9.6			13.4
Approach LOS	B		A			B
Queue Length 50th (m)	13.0		10.2			13.7
Queue Length 95th (m)	33.7		36.5			43.2
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1611		1639			1536
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.16		0.20			0.19

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 41.9	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.48	
Intersection Signal Delay: 12.2	Intersection LOS: B
Intersection Capacity Utilization 62.0%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 1: Metropolitan Avenue & First Lake Drive

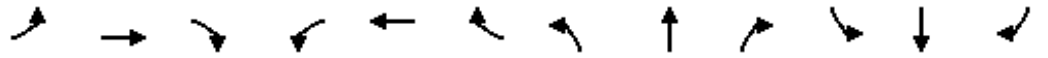




Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	140	95	90	50	5	120
Future Volume (Veh/h)	140	95	90	50	5	120
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	152	103	98	54	5	130
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		219				
pX, platoon unblocked						
vC, conflicting volume	152				532	125
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	152				532	125
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	89				99	86
cM capacity (veh/h)	1429				454	926

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	152	103	152	5	130
Volume Left	152	0	0	5	0
Volume Right	0	0	54	0	130
cSH	1429	1700	1700	454	926
Volume to Capacity	0.11	0.06	0.09	0.01	0.14
Queue Length 95th (m)	2.9	0.0	0.0	0.3	3.9
Control Delay (s)	7.8	0.0	0.0	13.0	9.5
Lane LOS	A			B	A
Approach Delay (s)	4.7		0.0	9.7	
Approach LOS				A	

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	28.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	85	5	1	125	15	1	1	1	35	1	10
Future Volume (Veh/h)	5	85	5	1	125	15	1	1	1	35	1	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	92	5	1	136	16	1	1	1	38	1	11
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	152			97			254	258	94	250	253	144
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	152			97			254	258	94	250	253	144
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	95	100	99
cM capacity (veh/h)	1429			1496			688	643	962	700	648	903

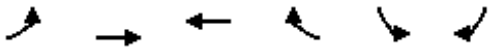
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	5	97	1	152	3	38	12
Volume Left	5	0	1	0	1	38	0
Volume Right	0	5	0	16	1	0	11
cSH	1429	1700	1496	1700	741	700	875
Volume to Capacity	0.00	0.06	0.00	0.09	0.00	0.05	0.01
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.1	1.4	0.3
Control Delay (s)	7.5	0.0	7.4	0.0	9.9	10.4	9.2
Lane LOS	A		A		A	B	A
Approach Delay (s)	0.4		0.0		9.9	10.1	
Approach LOS					A	B	

Intersection Summary				
Average Delay	1.9			
Intersection Capacity Utilization	19.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	235	80	205	285	35	120
Future Volume (vph)	235	80	205	285	35	120
Satd. Flow (prot)	1721	0	1685	0	0	1842
Flt Permitted	0.964					0.830
Satd. Flow (perm)	1707	0	1685	0	0	1545
Satd. Flow (RTOR)	19		104			
Lane Group Flow (vph)	342	0	533	0	0	168
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Total Split (s)	42.0		58.0		58.0	58.0
Total Lost Time (s)	6.0		6.0			6.0
Act Effct Green (s)	15.6		20.9			20.9
Actuated g/C Ratio	0.32		0.42			0.42
v/c Ratio	0.61		0.69			0.26
Control Delay	19.8		14.8			10.9
Queue Delay	0.0		0.0			0.0
Total Delay	19.8		14.8			10.9
LOS	B		B			B
Approach Delay	19.8		14.8			10.9
Approach LOS	B		B			B
Queue Length 50th (m)	21.9		26.6			8.6
Queue Length 95th (m)	60.9		72.4			24.3
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1337		1589			1451
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.26		0.34			0.12

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 49.2	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.69	
Intersection Signal Delay: 15.8	Intersection LOS: B
Intersection Capacity Utilization 64.9%	ICU Level of Service C
Analysis Period (min) 15	

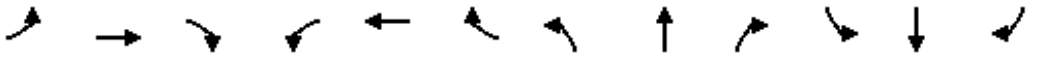
Splits and Phases: 1: Metropolitan Avenue & First Lake Drive



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	190	125	115	60	5	160
Future Volume (Veh/h)	190	125	115	60	5	160
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	207	136	125	65	5	174
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		219				
pX, platoon unblocked						
vC, conflicting volume	190				708	158
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	190				708	158
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	85				99	80
cM capacity (veh/h)	1384				341	888

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	207	136	190	5	174
Volume Left	207	0	0	5	0
Volume Right	0	0	65	0	174
cSH	1384	1700	1700	341	888
Volume to Capacity	0.15	0.08	0.11	0.01	0.20
Queue Length 95th (m)	4.2	0.0	0.0	0.4	5.8
Control Delay (s)	8.1	0.0	0.0	15.7	10.0
Lane LOS	A			C	B
Approach Delay (s)	4.9		0.0	10.2	
Approach LOS				B	

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	33.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	110	1	5	130	65	5	5	5	50	5	40
Future Volume (Veh/h)	20	110	1	5	130	65	5	5	5	50	5	40
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	120	1	5	141	71	5	5	5	54	5	43
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	212			121			361	386	120	358	352	176
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	212			121			361	386	120	358	352	176
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			99	99	99	91	99	95
cM capacity (veh/h)	1358			1467			553	537	931	581	562	867

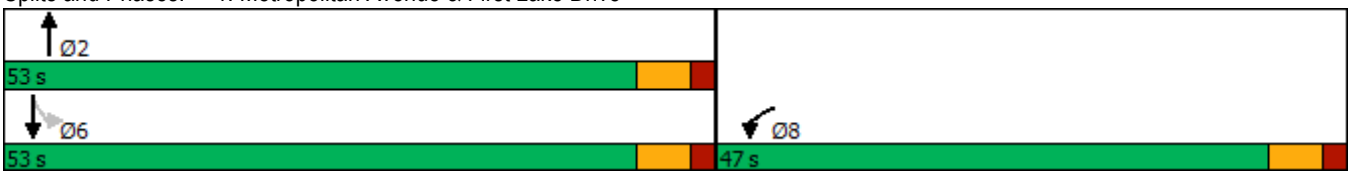
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	22	121	5	212	15	54	48
Volume Left	22	0	5	0	5	54	0
Volume Right	0	1	0	71	5	0	43
cSH	1358	1700	1467	1700	632	581	820
Volume to Capacity	0.02	0.07	0.00	0.12	0.02	0.09	0.06
Queue Length 95th (m)	0.4	0.0	0.1	0.0	0.6	2.4	1.5
Control Delay (s)	7.7	0.0	7.5	0.0	10.8	11.8	9.7
Lane LOS	A		A		B	B	A
Approach Delay (s)	1.2		0.2		10.8	10.8	
Approach LOS					B	B	

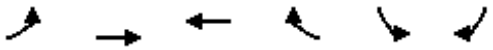
Intersection Summary				
Average Delay	3.1			
Intersection Capacity Utilization	30.2%	ICU Level of Service		A
Analysis Period (min)	15			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	281	57	130	229	64	215
Future Volume (vph)	281	57	130	229	64	215
Satd. Flow (prot)	1738	0	1669	0	0	1842
Flt Permitted	0.960					0.826
Satd. Flow (perm)	1722	0	1669	0	0	1537
Satd. Flow (RTOR)	12		120			
Lane Group Flow (vph)	367	0	390	0	0	304
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Total Split (s)	47.0		53.0		53.0	53.0
Total Lost Time (s)	6.0		6.0			6.0
Act Effct Green (s)	15.0		17.4			17.4
Actuated g/C Ratio	0.33		0.39			0.39
v/c Ratio	0.62		0.54			0.51
Control Delay	17.5		11.1			15.0
Queue Delay	0.0		0.0			0.0
Total Delay	17.5		11.1			15.0
LOS	B		B			B
Approach Delay	17.5		11.1			15.0
Approach LOS	B		B			B
Queue Length 50th (m)	20.8		14.6			17.1
Queue Length 95th (m)	52.8		43.1			44.4
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1582		1601			1470
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.23		0.24			0.21

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 44.8	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.62	
Intersection Signal Delay: 14.4	Intersection LOS: B
Intersection Capacity Utilization 70.2%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Metropolitan Avenue & First Lake Drive

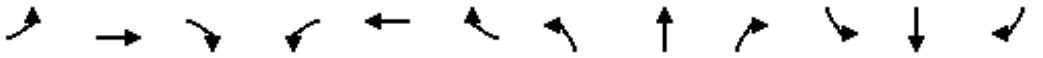




Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	58	235	210	20	34	103
Future Volume (Veh/h)	58	235	210	20	34	103
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	63	255	228	22	37	112
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		219				
pX, platoon unblocked						
vC, conflicting volume	250				620	239
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	250				620	239
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				91	86
cM capacity (veh/h)	1316				430	800

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	63	255	250	37	112
Volume Left	63	0	0	37	0
Volume Right	0	0	22	0	112
cSH	1316	1700	1700	430	800
Volume to Capacity	0.05	0.15	0.15	0.09	0.14
Queue Length 95th (m)	1.2	0.0	0.0	2.2	3.9
Control Delay (s)	7.9	0.0	0.0	14.2	10.2
Lane LOS	A			B	B
Approach Delay (s)	1.6		0.0	11.2	
Approach LOS				B	

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	28.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	114	5	1	95	65	1	1	1	40	1	130
Future Volume (Veh/h)	145	114	5	1	95	65	1	1	1	40	1	130
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	158	124	5	1	103	71	1	1	1	43	1	141
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	174			129			689	618	126	582	586	138
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	174			129			689	618	126	582	586	138
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	89			100			100	100	100	89	100	85
cM capacity (veh/h)	1403			1457			277	359	924	386	375	910

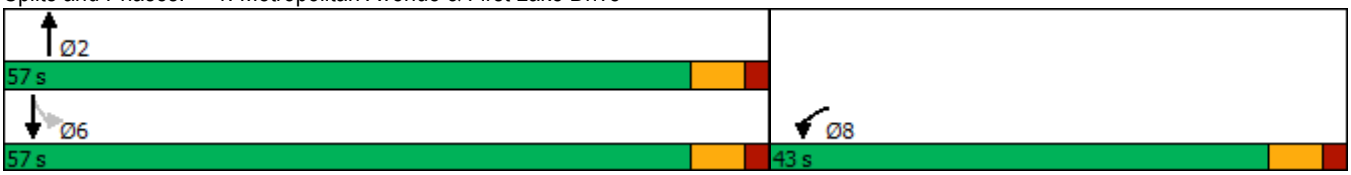
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	158	129	1	174	3	43	142
Volume Left	158	0	1	0	1	43	0
Volume Right	0	5	0	71	1	0	141
cSH	1403	1700	1457	1700	401	386	901
Volume to Capacity	0.11	0.08	0.00	0.10	0.01	0.11	0.16
Queue Length 95th (m)	3.0	0.0	0.0	0.0	0.2	3.0	4.5
Control Delay (s)	7.9	0.0	7.5	0.0	14.0	15.5	9.7
Lane LOS	A		A		B	C	A
Approach Delay (s)	4.3		0.0		14.0	11.1	
Approach LOS					B	B	

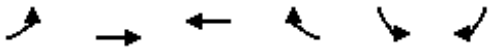
Intersection Summary				
Average Delay	5.1			
Intersection Capacity Utilization	35.1%	ICU Level of Service		A
Analysis Period (min)	15			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	329	87	205	406	44	120
Future Volume (vph)	329	87	205	406	44	120
Satd. Flow (prot)	1731	0	1661	0	0	1839
Flt Permitted	0.962					0.609
Satd. Flow (perm)	1716	0	1661	0	0	1134
Satd. Flow (RTOR)	15		145			
Lane Group Flow (vph)	453	0	664	0	0	178
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Total Split (s)	43.0		57.0		57.0	57.0
Total Lost Time (s)	6.0		6.0			6.0
Act Effct Green (s)	22.6		29.4			29.4
Actuated g/C Ratio	0.35		0.45			0.45
v/c Ratio	0.75		0.80			0.35
Control Delay	28.5		20.9			14.8
Queue Delay	0.0		0.0			0.0
Total Delay	28.5		20.9			14.8
LOS	C		C			B
Approach Delay	28.5		20.9			14.8
Approach LOS	C		C			B
Queue Length 50th (m)	43.9		49.6			12.9
Queue Length 95th (m)	112.3		125.7			35.4
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1096		1358			908
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.41		0.49			0.20

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 65.4	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 22.7	Intersection LOS: C
Intersection Capacity Utilization 78.5%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: Metropolitan Avenue & First Lake Drive





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	130	315	275	43	34	101
Future Volume (Veh/h)	130	315	275	43	34	101
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	141	342	299	47	37	110
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		219				
pX, platoon unblocked						
vC, conflicting volume	346				946	322
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	346				946	322
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	88				86	85
cM capacity (veh/h)	1213				256	718

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	141	342	346	37	110
Volume Left	141	0	0	37	0
Volume Right	0	0	47	0	110
cSH	1213	1700	1700	256	718
Volume to Capacity	0.12	0.20	0.20	0.14	0.15
Queue Length 95th (m)	3.1	0.0	0.0	4.0	4.3
Control Delay (s)	8.4	0.0	0.0	21.4	10.9
Lane LOS	A			C	B
Approach Delay (s)	2.4		0.0	13.6	
Approach LOS				B	

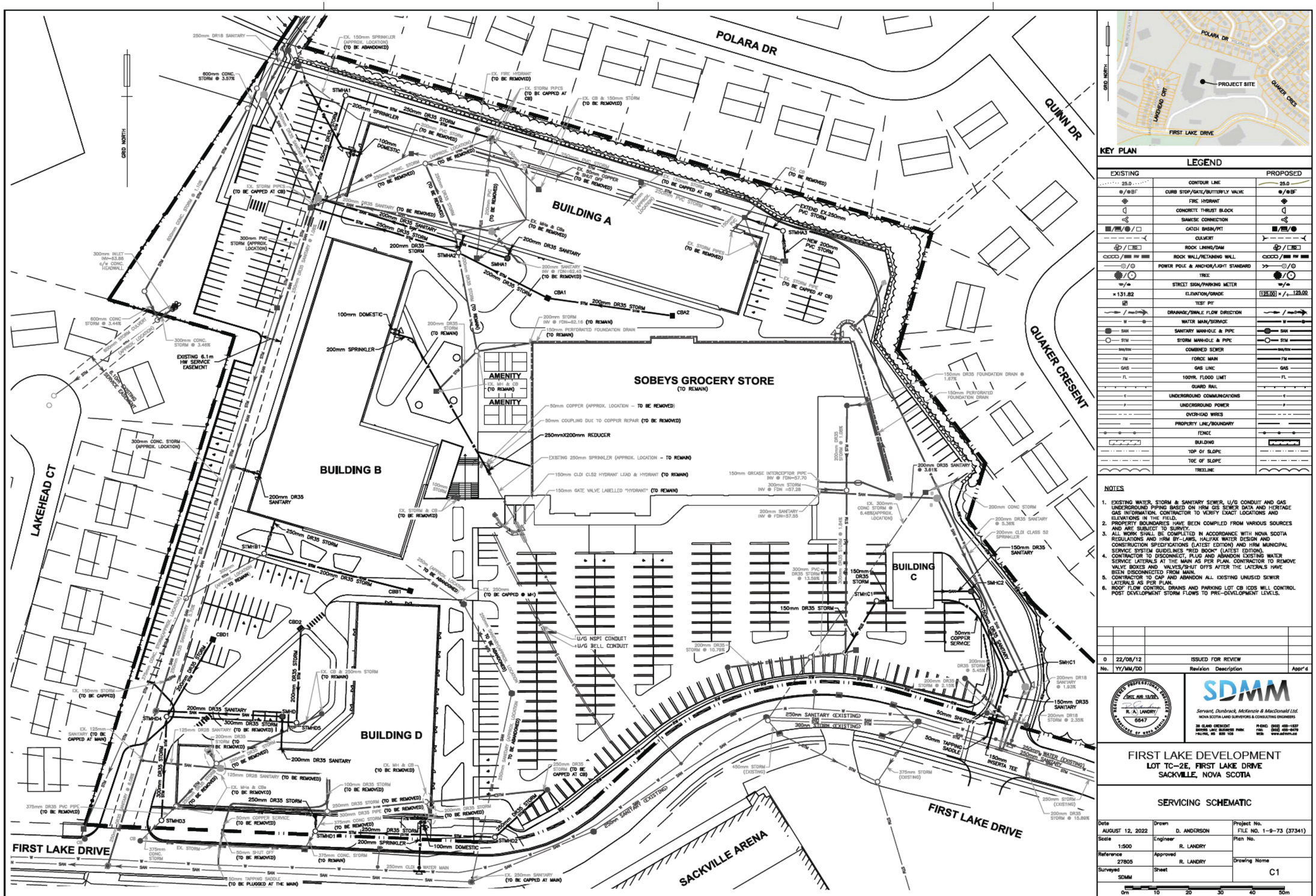
Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	139	1	5	113	125	5	5	5	55	5	200
Future Volume (Veh/h)	210	139	1	5	113	125	5	5	5	55	5	200
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	228	151	1	5	123	136	5	5	5	60	5	217
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	259			152			960	876	152	816	809	191
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	259			152			960	876	152	816	809	191
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	83			100			97	98	99	76	98	74
cM capacity (veh/h)	1306			1429			150	236	895	250	259	851

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	228	152	5	259	15	60	222
Volume Left	228	0	5	0	5	60	0
Volume Right	0	1	0	136	5	0	217
cSH	1306	1700	1429	1700	249	250	809
Volume to Capacity	0.17	0.09	0.00	0.15	0.06	0.24	0.27
Queue Length 95th (m)	5.1	0.0	0.1	0.0	1.5	7.3	8.9
Control Delay (s)	8.3	0.0	7.5	0.0	20.4	23.9	11.1
Lane LOS	A		A		C	C	B
Approach Delay (s)	5.0		0.1		20.4	13.8	
Approach LOS					C	B	

Intersection Summary				
Average Delay	6.5			
Intersection Capacity Utilization	47.9%	ICU Level of Service		A
Analysis Period (min)	15			

ANNEX E - SERVICING SCHEMATIC



LEGEND

EXISTING		PROPOSED
25.0	CONTOUR LINE	25.0
●/●BF	CURB STOP/GATE/BUTTERFLY VALVE	●/●BF
◆	FIRE HYDRANT	◆
◖	CONCRETE THRUST BLOCK	◖
◁	SIAMESE CONNECTION	◁
■/▭/●/□	CATCH BASIN/MT	■/▭/●
⊢ - - - ⊣	CULVERT	⊢ - - - ⊣
⊕/▭	ROCK LINING/DAM	⊕/▭
○○○○/▬▬ RW	ROCK WALL/RETAINING WALL	○○○○/▬▬ RW
○/⊙	POWER POLE & ANCHOR/LIGHT STANDARD	>> ○/⊙
●	TREE	●
⚑/◆	STREET SIGN/PARKING METER	⚑/◆
× 131.82	ELEVATION/GRADE	125.00 × / + 125.00
⊠	TEST PIT	
→ / ⊙	DRAINAGE/SWALE FLOW DIRECTION	→ / ⊙
W	WATER MAIN/SERVICE	W
SAN	SANITARY MANHOLE & PIPE	SAN
STM	STORM MANHOLE & PIPE	STM
SAN/STM	COMBINED SEWER	SAN/STM
FM	FORCE MAIN	FM
GAS	GAS LINE	GAS
FL	100YR. FLOOD LIMIT	FL
	GUARD RAIL	
C	UNDERGROUND COMMUNICATIONS	C
P	UNDERGROUND POWER	P
	OVERHEAD WIRES	
	PROPERTY LINE/BOUNDARY	
	FENCE	
	BUILDING	
	TOP OF SLOPE	
	TOE OF SLOPE	
	TREELINE	

NOTES

1. EXISTING WATER, STORM & SANITARY SEWER, U/G CONDUIT AND GAS UNDERGROUND PIPING BASED ON HRM GIS SEWER DATA AND HERITAGE GAS INFORMATION. CONTRACTOR TO VERIFY EXACT LOCATIONS AND ELEVATIONS IN THE FIELD.
2. PROPERTY BOUNDARIES HAVE BEEN COMPILED FROM VARIOUS SOURCES AND ARE SUBJECT TO SURVEY.
3. ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH NOVA SCOTIA REGULATIONS AND HRM BY-LAWS, HALIFAX WATER DESIGN AND CONSTRUCTION SPECIFICATIONS (LATEST EDITION) AND HRM MUNICIPAL SERVICE SYSTEM GUIDELINES "RED BOOK" (LATEST EDITION).
4. CONTRACTOR TO DISCONNECT, PLUG AND ABANDON EXISTING WATER SERVICE LATERALS AT THE MAIN AS PER PLAN. CONTRACTOR TO REMOVE VALVE BOXES AND VALVES/SHUT OFFS AFTER THE LATERALS HAVE BEEN DISCONNECTED FROM MAIN.
5. CONTRACTOR TO CAP AND ABANDON ALL EXISTING UNUSED SEWER LATERALS AS PER PLAN.
6. ROOF FLOW CONTROL DRAINS AND PARKING LOT CB ICDS WILL CONTROL POST DEVELOPMENT STORM FLOWS TO PRE-DEVELOPMENT LEVELS.

No.	YY/MM/DD	Revision Description	Appr'd
0	22/08/12	ISSUED FOR REVIEW	

REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF NOVA SCOTIA — R. A. LANDRY 6647 — DATE AUG 12/22

SDMM — Servant, Dunbrack, McKenzie & MacDonald Ltd. — NOVA SCOTIA LAND SURVEYORS & CONSULTING ENGINEERS — 39 CLAM CRESCENT, DARTMOUTH, NS B3B 1G6 — PHONE (902) 468-1337 — FAX (902) 468-9479 — WEB: www.sdmm.ca

FIRST LAKE DEVELOPMENT

LOT TC-2E, FIRST LAKE DRIVE
SACKVILLE, NOVA SCOTIA

SERVICING SCHEMATIC

Date: AUGUST 12, 2022	Drawn: D. ANDERSON	Project No.: FILE NO. 1-9-73 (37341)
Scale: 1:500	Engineer: R. LANDRY	Plan No.
Reference: 27805	Approved: R. LANDRY	Drawing Name: C1
Surveyed: SDMM	Sheet	

0m 10 20 30 40 50m

ANNEX F - SERVICING STUDY

Servant, Dunbrack, McKenzie & MacDonald Ltd.
NOVA SCOTIA LAND SURVEYORS & CONSULTING ENGINEERS

36 Oland Crescent
Bayers Lake Business Park
Halifax, Nova Scotia B3S 1C6

Phone (902) 455-1537
Fax (902) 455-8479
Web sdmm.ca

RAYMOND A. LANDRY
MASc , P Eng , LEED Green Associate
CHRISTOPHER J. FORAN
P Eng
GEOFFREY K. MacLEAN
P Eng
RACHAEL W. KYTE
P Eng , LEED Green Associate
ALEXANDER W. PULSIFER
P Eng
MICHAEL S. TANNER
NSLS (Ret)
DANIEL S. GERARD
P Eng , P Surv , NSLS
H. JAMES McINTOSH
P Eng , NSLS, CLS
KEVIN A. ROBB
NSLS
BLAKE H. TRASK
P Eng , NSLS
ADAM J. PATTERSON
P Eng , NSLS

November 5, 2021

Mr. Shawn Chaisson
First Mutual Properties
175 Main Street #203
Dartmouth, NS
B2X 1S1

Re: 70 First Lake Drive, Lower Sackville Nova Scotia – Downstream Wastewater Sewer Analysis

First Mutual Properties is proposing to add three (3) apartment buildings with a total of 450 units to their property at 70 First Lake Drive in Lower Sackville. A sketch of this development (Figure 1) is in the appendix. Based on a density of 2.25 people per unit, this equates in an additional 1013 people. The project incorporates existing commercial spaces in addition to the proposed multi-unit buildings. As per Halifax Water Design and Construction Specifications (2020), Section 4.2.1 and at the request of First Mutual Properties, SDMM has prepared the following capacity analysis for the sewer systems immediately downstream of the proposed development.

Tributary Drainage Areas & Population

The downstream terminus of this analysis was established based on correspondence with Halifax Water Development staff and was determined to be the existing pump station located near the Salvation Army at the corner of First Lake Drive and Metropolitan Avenue. This required seven (7) sections of gravity sewer directly downstream of the redevelopment to be analyzed. Existing and proposed tributary areas for these sewers are depicted in Figure 2 of the appendix.

SDMM determined equivalent populations for the existing sewer sheds based on the following resources:

- Halifax Water Design & Construction Specifications (2020)
- Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment and Disposal (2006)
- Zoning information from the HRM Land-Use By-Law for Sackville
- Correspondence with Halifax Water – Figure 3 (Population Densities & Terminus Point)

A summary of the density calculations is presented in Table 1 of the appendix. Tributary areas and population calculations, including the proposed development are presented in Table 2 of the appendix.

Estimated Wastewater Flow Calculations

Estimated wastewater flows were calculated based on the hydraulic design formula outlined in Section 4.2.2 of the Halifax Water Design & Construction Specifications (2020). Flows calculated include the Halifax Water safety factor of 1.25 with allowances of 0.30m^3 per person per day for residential development and 24m^3 per gross hectare per day for infiltration/inflow.

Existing flows for each section of sewer downstream from the development were calculated. A summary of the theoretical existing flows is presented in Table 3A. The flows for each pipe reach were recalculated to include the proposed development and are presented in Table 3B of the appendix.

Existing Pipe Capacity

Existing pipe capacities were calculated using Manning's Equation for each reach of downstream sewer utilizing pipe characteristics provided by Halifax Water GIS information. A summary of the existing pipe capacities is presented in Table 4 of the appendix.

Existing Pump Station Flows

Existing pump station flow monitoring data from August 2020 to August 2021 was received from Halifax Water. Flows were recorded every five minutes during this time. Based on this data, average flows for each month were calculated and are shown in Table 5 of the appendix. Average flows range from 336.44 m^3/day (August 2020) to 701.65 m^3/day (February 2021).

Conclusion

Comparisons between the estimated flows including the proposed development, calculated in Table 3B of the appendix and existing pipe capacities in Table 4 indicate that the downstream sewer has sufficient capacity to accommodate the anticipated wastewater flows generated by this proposed development. The largest wastewater percentage capacity of the pipe reaches analyzed is 70%.

Existing pump station flows recorded by Halifax Water in Table 5 are much lower than the theoretical calculated flows. This is evident by referring to Table 3A and noting that the last pipe prior to the pump station, 'Pipe G' has an estimated flow of 6476 m^3/day and then comparing this flow to the actual average daily flows in Table 5. The highest flow recorded was 42.33 L/s on September 23, 2020 at 9:30am with that day averaging a daily flow of 1493.16 m^3. Rainfall data provided by Halifax Water as well as data from Environment Canada show that September 22nd and 23rd, 2020 were significant rainfall events (51mm and 38mm respectively), therefore it is expected infiltration was the cause of the higher flows recorded on

this day. Some of this approximately 4 times difference in theoretical to actual flow can be attributed to densities we used to estimate flows on areas of land that may not be currently developed.

We reviewed the feasibility of increasing the residential unit count for the development without exceeding the theoretical pipe capacity. Table 4 indicates our most critical pipe downstream from the development is 'Pipe D' with the largest theoretical wastewater percentage capacity of 70%. We determined an additional 382 units could be added to the proposed 450 units before 80% of the pipe's capacity was exceeded. Flow monitoring will be required to exceed 80% pipe capacity, as per Halifax Water. This is without calibrating our theoretical flow model to the lower actual monitored flows.

In conclusion, the estimated flows from the existing tributary areas with the addition of the proposed development will not exceed the existing downstream wastewater main pipe's capacities.

For additional information or comment please contact the undersigned.

Regards,

Servant, Dunbrack, McKenzie & MacDonald Ltd.

Ray Landry, MASc., P.Eng.
Project Engineer
Z:\SDMM\36000-36999\36600\36615\Design\Sanitary\36615 Wastewater Anaylsis Report.docx

APPENDIX

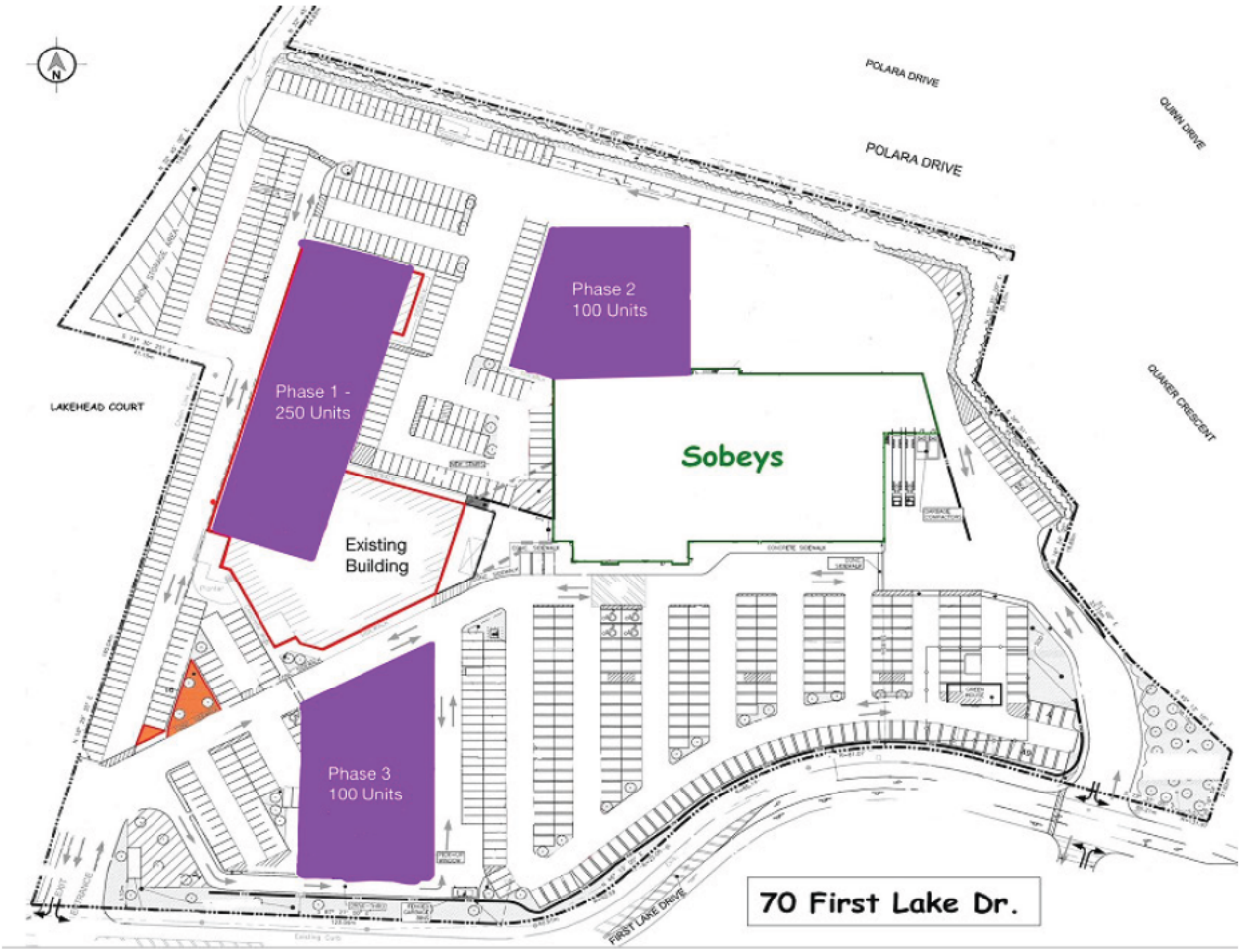


Figure 1: Proposed Development Sketch

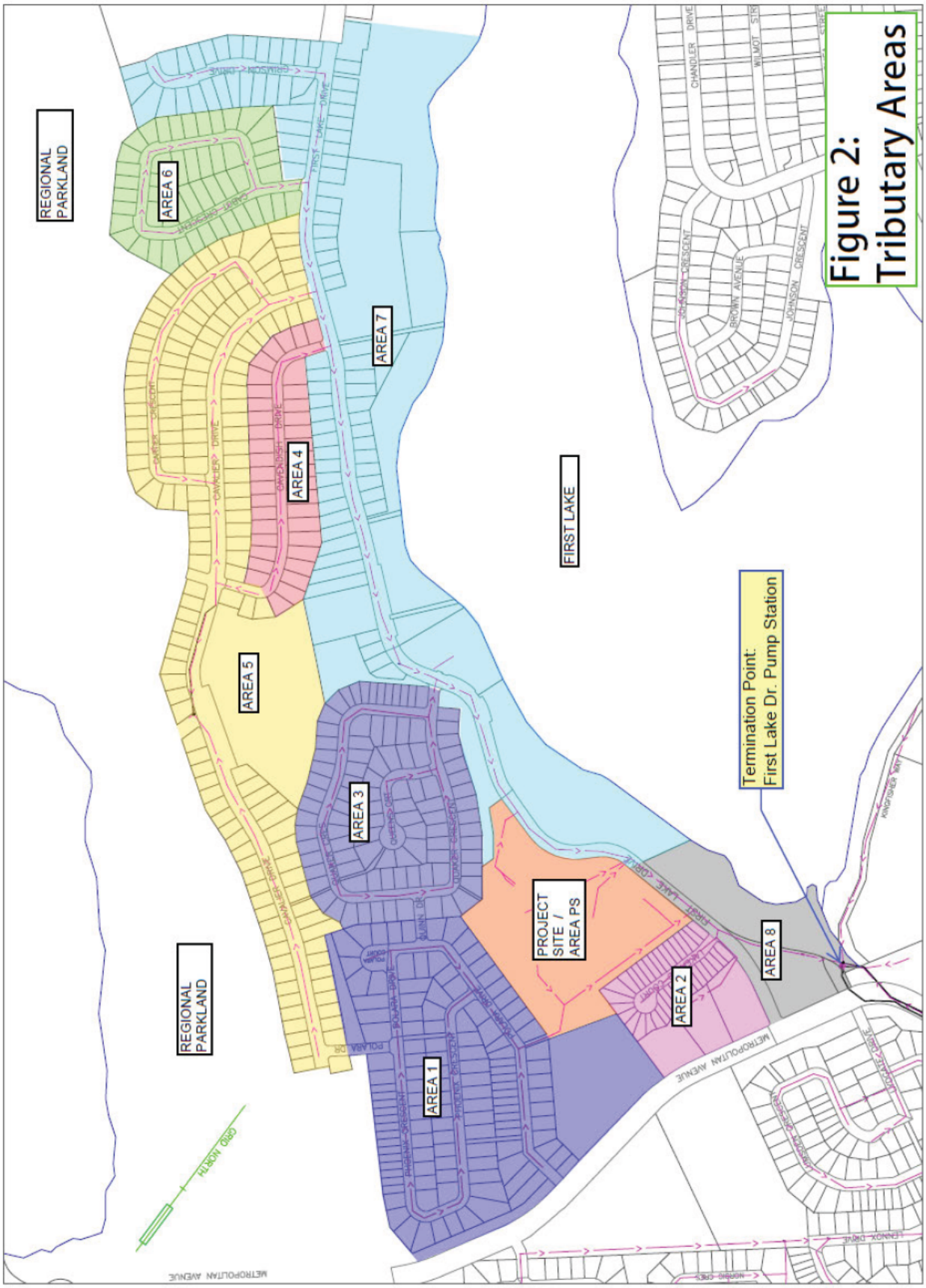


Figure 2:
Tributary Areas
REGIONAL PARKLAND
AREA 6
AREA 7
AREA 4
AREA 5
AREA 3
AREA 1
AREA 2
AREA 8
FIRST LAKE
PROJECT SITE / AREA PS
Termination Point:
First Lake Dr. Pump Station
REGIONAL PARKLAND
METROPOLITAN AVENUE
GRID NORTH

From: Meghan Woszczynski
Sent: Monday, October 25, 2021 10:23 AM
To: 'Justin MacCallum' <jmaccallum@sdmm.ca>
Cc: Ray Landry <rlandry@sdmm.ca>
Subject: RE: First Lake Drive Downstream Sanitary Analysis

Hello Justin,

Just wanted to let you know that I am currently looking into this.

The end point of the analysis will be around the First Lake Drive PS. I am looking into the curtain capacity for the First lake Drive PS in order to determine if a analysis of the pump station is also required. In addition there is flow monitoring data in the area for consideration.

I will get back to you soon,
Thanks again
Meghan

Meghan Woszczynski, M.A.Sc., P.Eng
Development Engineer, Halifax Water
450 Cowie Hill Rd, PO Box 8388 RPO CSC Halifax, NS B3K 5M1
C: 902-209-3915 E: **meghanw@halifaxwater.ca**

Figure 3: Email from Halifax Water Regarding Terminus

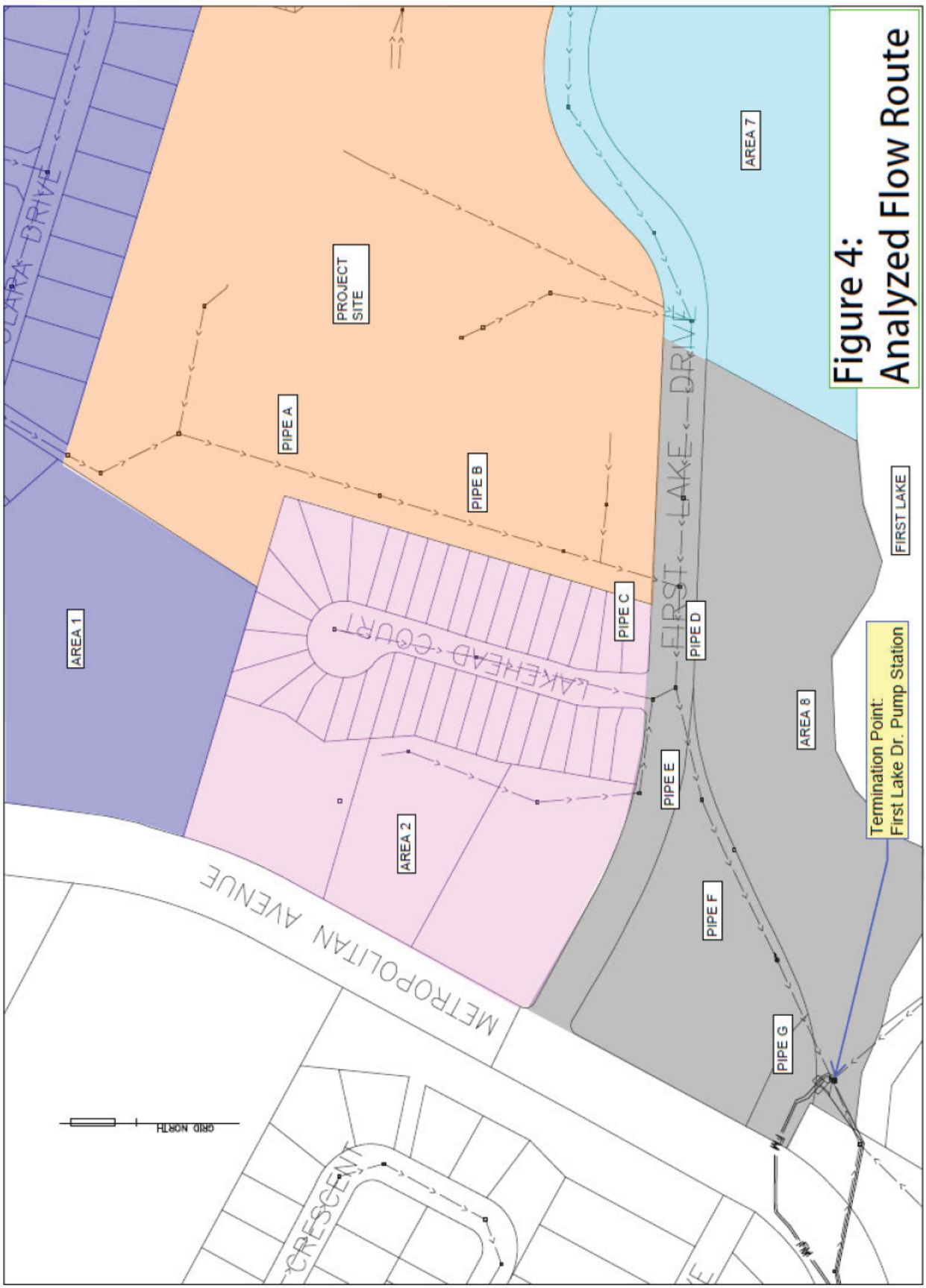


Figure 4:
Analyzed Flow Route
PROJECT SITE
PIPE A
PIPE B
PIPE C
PIPE D
PIPE E
PIPE F
PIPE G
AREA 1
AREA 2
AREA 7
AREA 8
FIRST LAKE
Termination Point:
First Lake Dr. Pump Station
FIRST LAKE DRIVE
LAKEHEAD COURT
METROPOLITAN AVENUE
CRESCENT
CLARA BRIVE
GRID NORTH

Table 1 - By-Law Density Values					
Zoning	Number of Units	People per unit (HW)	Min. Lot Area (ft^2 | Ha)		People per Hectare
R-1 - Single Family Dwelling Zone					
	1	3.35	6,000.00	0.06	60
R-2 - Two Family Dwelling Zone					
	2	3.35	7,000.00	0.07	103
R-4 - Multiple Dwelling Zone					
	*By-Law (75 people per acre)				185
C-2 - Community Commercial Zone					
	*Atlantic Canada Wastewater Guidelines				85
P-1 - Open Space Zone					
	*Atlantic Canada Wastewater Guidelines				0
P-2 - Community Facility Zone					
	*Atlantic Canada Wastewater Guidelines				85
Sackville Land-Use By-Law					

Table 2 - Tributary Areas and Population						
Area	Sub-Area	Number of Units	People Per Unit	People per Hectare	Tributary Area (ha)	Equivalent Population
P (Project Site)						
	Prop. Bld. 1	250	2.25	-	0.26	563
	Prop. Bld. 2	100	2.25	-	0.19	225
	Prop. Bld. 3	100	2.25	-	0.21	225
	Ex. Site (C-2)	-	-	85	4.67	397
				Sub-Totals	**5.33**	**1,410**
1						
	R-1 Zone	97	3.35	-	7.24	325
	R-2 Zone	26	3.35	-	1.02	87
	P-1 Zone	-	-	-	0.28	-
	P-2 Zone	-	-	85	1.99	169
	Street	-	-	-	2.12	-
				Sub-Totals	**12.65**	**581**
2						
	R-2 Zone	36	3.35	-	1.23	121
	R-4 Zone	-	-	185	1.42	263
	Street	-	-	-	0.27	-
				Sub-Totals	**2.92**	**383**
3						
	R-1 Zone	96	3.35	-	5.86	322
	Street	-	-	-	1.60	
				Sub-Totals	**7.46**	**322**
4						
	R-1 Zone	39	3.35	-	2.83	131
	Street	-	-	-	0.60	
				Sub-Totals	**3.43**	**131**
5						
	R-1 Zone	152	3.35	-	10.26	509
	P-2 Zone	-	-	85	3.36	286
	Street	-	-	-	3.51	-
				Sub-Totals	**17.13**	**795**
6						
	R-1 Zone	49	3.35	-	3.52	164
	Street	-	-	-	0.89	-
				Sub-Totals	**4.41**	**164**
7						
	R-1 Zone	86	3.35	-	6.97	288
	R-1 Zone	-	-	60	2.72	163
	P-1 Zone	-	-	-	9.31	-
	P-2 Zone	-	-	85	1.53	130
	Street	-	-	-	3.88	-
				Sub-Totals	**24.41**	**581**
8						
	P-2 Zone	-	-	85	2.78	236
				Sub-Totals	**2.78**	**236**
			Total Area (ha.)	**80.52**	**Total Pop.**	**4,603**

**R1 and R2 zoned properties with existing buildings use a population density of 3 35 people per unit. Properties with multi-unit buildings and undeveloped land use the associated population density shown above of people per hectare.*

Table 3A - Estimated Existing Wastewater Flows in Pipes					
	Pipes				
	A,B,C	D	E	F	G
Area Number(s)	1+0.5PS	All - 2 - (2/3)8	All - (1/2)8	All - (1/3)8	All
Tributary Area (ha)	15.32	75.75	79.13	79.59	80.52
Equivalent Population	780	3049	3241	3512	3590
Average Dry Weather Flow, a (m^3/d)	233.9	914.8	972.3	1053.5	1077.1
Harmon Peaking Factor, M	3.87	3.44	3.41	3.38	3.37
Infiltration/Inflow Allowance, b (m^3/d)	367.6	1817.9	1899.1	1910.2	1932.5
Peak Dry Weather Flow, a x M (m^3/d)	904.5	3143.7	3319.2	3564.3	3635.1
Peak Design Flow, (a x M) + b, (m^3/d)	1272.1	4961.6	5218.3	5474.5	5567.6
Safety Factor	1.25	1.25	1.25	1.25	1.25
Estimated Flow, Q (m^3/d)	**1498**	**5748**	**6048**	**6366**	**6476**

Table 3B - Estimated Proposed Wastewater Flows in Pipes							
	Pipe						
	A	B	C	D	E	F	G
Area Number(s)	1+0.5PS+Bldg(2)	1+0.5PS+Bldgs(1+2)	1+0.5PS+Bldgs(1+2+3)	All - 2 - (2/3)8	All - (1/2)8	All - (1/3)8	All
Tributary Area (ha)	15.25	15.44	15.65	75.75	79.13	77.85	80.52
Equivalent Population	1005	1568	1793	4062	4485	4525	4603
Average Dry Weather Flow, a (m^3/d)	301.4	470.3	537.8	1218.7	1345.5	1357.4	1381.0
Harmon Peaking Factor, M	3.80	3.67	3.62	3.33	3.29	3.28	3.28
Infiltration/Inflow Allowance, b (m^3/d)	365.9	370.4	375.5	1817.9	1899.1	1868.5	1932.5
Peak Dry Weather Flow, a x M (m^3/d)	1144.9	1723.9	1948.1	4055.1	4424.7	4458.8	4527.0
Peak Design Flow, (a x M) + b, (m^3/d)	1510.8	2094.4	2323.5	5873.0	6323.8	6327.3	6459.5
Safety Factor	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Estimated Flow, Q (m^3/d)	**1797**	**2525**	**2811**	**6887**	**7430**	**7442**	**7591**

Table 4 - Existing Pipe Capacity							
	Pipe						
	A	B	C	D	E	F	G
Sewer Type	Sanitary	Sanitary	Sanitary	Sanitary	Sanitary	Sanitary	Sanitary
Pipe Shape	Round	Round	Round	Round	Round	Round	Round
Pipe Diameter (mm)	250	250	250	300	300	300	300
Material	PVC	PVC	PVC	Asbestos Cement	Concrete	Concrete	Concrete
Slope (%)	1.1	5.7	8.1	1.0	1.9	4.6	5.0
Mannings Coefficient, n	0.010	0.010	0.010	0.011	0.013	0.013	0.013
Manning's Capacity, Qc (m^3/d)	**6941**	**15933**	**19033**	**9775**	**11516**	**17919**	**18645**
Wastewater Percentage of Capacity	26%	16%	15%	70%	65%	42%	41%

Table 5 - Existing Flows at Pump Station	
Flow Monitor Data Received from Halifax Water (FG539) At First Lake Drive/Metropolitan Avenue Pump Station	
Month	**Average Flow (m3/day)**
20-Aug	336.44
20-Sep	397.71
20-Oct	395.8
20-Nov	586.76
20-Dec	570.16
20-Jan	536.87
21-Feb	701.65
21-Mar	540.05
21-Apr	528.45
21-May	444.38
21-Jun	442.01
21-Jul	382.22
21-Aug	403.32
Maximum Flow recorded 42.33 L/s (9/23/2020) at 9:30	**1493.16**

Table 6 - Maximum Units for 80% Capacity in Pipe D	
Pipe D capacity with proposed units	70%
80% of Pipe D	7820
Available Flow in Pipe D (m^3/day)	933
Equivalent Population	860
Additional Units to reach 80% capacity in Pipe D	**382**

ANNEX G - SANITARY FLOW CONFIRMATIONS

Servant, Dunbrack, McKenzie & MacDonald Ltd.
NOVA SCOTIA LAND SURVEYORS & CONSULTING ENGINEERS

36 Oland Crescent
Bayers Lake Business Park
Halifax, Nova Scotia B3S 1C6

Phone (902) 455-1537
Fax (902) 455-8479
Web sdmm.ca

RAYMOND A. LANDRY, MASc , P Eng , LEED Green Associate
CHRISTOPHER J. FORAN, P Eng
GEOFFREY K. MacLEAN, P Eng
RACHAEL W. KYTE, P Eng , LEED Green Associate
ALEXANDER W. PULSIFER, P Eng
MICHAEL S. TANNER, NSLS (Ret)
DANIEL S. GERARD, P Eng , NSLS
H. JAMES McINTOSH, P Eng , NSLS, CLS
KEVIN A. ROBB, NSLS
BLAKE H. TRASK, P Eng , NSLS
ADAM J. PATTERSON, P Eng , NSLS

August 3, 2022

Halifax Water
450 Cowie Hill Road
Halifax, NS

From: Ray Landry, MASc., P.Eng. File No. 37341

Re: Lot TC-2E, First Lake Development, First Lake Drive, Sackville, Nova Scotia
Residential Building Sanitary Lateral Size Confirmation

Project Summary:

	Commercial	Residential (Townhouses)	Residential (Multi-Unit)	Lot Area
Building A	0 m^2	0 Units	186 Units	8,037 m^2
From First Mutual Properties				

References:

1. Halifax Water (HW) Design & Supplementary Specifications, 2020 Edition, Section 4.2.2:

Where;

Q = Sanitary sewer flow.
1.25 = Safety factor.
a = Average dry weather flow.
M = Peaking factor using Harmon Formula; $M = 1 + [14 / (4 + P^{0.5})]$
b = Long-term infiltration/inflow allowance.
P = Population in thousands

- Residential Average Dry Weather Flow: 300 L/day per person
- Townhouse Dwelling Population: 3.35 people per unit
- Multi-Unit Dwelling Population: 2.25 people per unit
- Infiltration allowance: 0.28 L/ha_{gross}/s

2. Atlantic Canada Wastewater Guidelines Manual (AWG), 2006 Edition, Section 2.3.

Calculation Summary:

Population Estimate (P)

Reference:

P_1: AWG Section 2.3.4.2 Commercial/Retail: 85 people per hectare

P_2: HW Section 4.2.1 Residential (Townhouse): 3.35 people per unit

P_3: HW Section 4.2.1 Residential (Multi-Unit): 2.25 people per unit

P_1 = 85 people per hectare x 0.000 hectares = 0

P_2 = 3.35 people per unit x 0 units = 0

P_3 = 2.25 people per unit x 186 units = 419

$P = P_1 + P_2 + P_3$ = 419 people or = 0.419

Dry Weather Flow (a)

Reference:

a: HW Section 4.2.2: Residential: 300 L/day per person

a: ACWG Section 2.3.4.3, Table 2.1: Commercial/Retail: 6 L/m2

a residential=	300 L/day	x	419	=	125,700 L/day	or	1.45	L/s
a commercial=	6 L/m²	x	0	=	0 L/day	or	0.00	L/s

Total a= residential + commercial = 125,700 or 1.45 L/s

Infiltration (b)

Reference:

HW Section 4.2.2: Infiltration allowance: 0.28 $L/ha_{gross}/s$

Lot Area= 8,037 m^2 = 0.80 ha

b: 0.28 $L/ha_{gross}/s$ x 0.80 = 0.23 L/s

Peaking Factor (M)

$M = 1 + [14 / (4 + P^{0.5})]$

$M = 1 + [14 / (4 + (\ 0.419\ )^{0.5})]$

M = 4.01

Sanitary Sewer Flow (Q)

$Q = [1.25 \times (a \times M)] + b$

Q = [1.25 x (1.45 x 4.01)] + 0.23 L/s

Q = 7.52 L/s

Sanitary Lateral Size Confirmation:

A 200 mm diameter PVC lateral at 2.00% slope has a capacity of 60.3 L/s. With Q =7.52 L/s, the proposed lateral will have sufficient flow capacity. For additional information or discussion regarding these findings please contact the undersigned.

Servant, Dunbrack, McKenzie & MacDonald Ltd.

[redacted]

Ray Landry, MASc., P.Eng.

Project Engineer

Servant, Dunbrack, McKenzie & MacDonald Ltd.
NOVA SCOTIA LAND SURVEYORS & CONSULTING ENGINEERS

36 Oland Crescent
Bayers Lake Business Park
Halifax, Nova Scotia B3S 1C6

Phone (902) 455-1537
Fax (902) 455-8479
Web sdmm.ca

RAYMOND A. LANDRY, MASc , P Eng , LEED Green Associate
CHRISTOPHER J. FORAN, P Eng
GEOFFREY K. MacLEAN, P Eng
RACHAEL W. KYTE, P Eng , LEED Green Associate
ALEXANDER W. PULSIFER, P Eng
MICHAEL S. TANNER, NSLS (Ret)
DANIEL S. GERARD, P Eng , NSLS
H. JAMES McINTOSH, P Eng , NSLS, CLS
KEVIN A. ROBB, NSLS
BLAKE H. TRASK, P Eng , NSLS
ADAM J. PATTERSON, P Eng , NSLS

August 3, 2022

Halifax Water
450 Cowie Hill Road
Halifax, NS

From: Ray Landry, MASc., P.Eng. File No. 37341

Re: Lot TC-2E, First Lake Development, First Lake Drive, Sackville, Nova Scotia
Residential & Commercial Building Sanitary Lateral Size Confirmation

Project Summary:

	Commercial	Residential (Townhouses)	Residential (Multi-Unit)	Lot Area
Building B	700 m^2	0 Units	300 Units	9,171 m^2
From First Mutual Properties				

References:

1. Halifax Water (HW) Design & Supplementary Specifications, 2020 Edition, Section 4.2.2:

Where;

Q = Sanitary sewer flow.
1.25 = Safety factor.
a = Average dry weather flow.
M = Peaking factor using Harmon Formula; $M = 1 + [14 / (4 + P^{0.5})]$
b = Long-term infiltration/inflow allowance.
P = Population in thousands

- Residential Average Dry Weather Flow: 300 L/day per person
- Townhouse Dwelling Population: 3.35 people per unit
- Multi-Unit Dwelling Population: 2.25 people per unit
- Infiltration allowance: 0.28 $L/ha_{gross}/s$

2. Atlantic Canada Wastewater Guidelines Manual (AWG), 2006 Edition, Section 2.3.

Calculation Summary:

<u>Population Estimate (P)</u>

Reference:

P_1: AWG Section 2.3.4.2 Commercial/Retail: 85 people per hectare

P_2: HW Section 4.2.1 Residential (Townhouse): 3.35 people per unit

P_3: HW Section 4.2.1 Residential (Multi-Unit): 2.25 people per unit

P_1 = 85 people per hectare x 0.070 hectares = 6

P_2 = 3.35 people per unit x 0 units = 0

P_3 = 2.25 people per unit x 300 units = 675

$P = P_1 + P_2 + P_3$ = 681 people or = 0.681

Dry Weather Flow (a)

Reference:

a: HW Section 4.2.2: Residential: 300 L/day per person

a: ACWG Section 2.3.4.3, Table 2.1: Commercial/Retail: 6 L/m2

a residential=	300 L/day	x	675	=	202,500 L/day	or	2.34	L/s
a commercial=	6 L/m^2	x	700	=	4,200 L/day	or	0.05	L/s

Total a= residential + commercial = 206,700 or 2.39 L/s

Infiltration (b)

Reference:

HW Section 4.2.2: Infiltration allowance: 0.28 $L/ha_{gross}/s$

Lot Area= 9,171 m^2 = 0.92 ha

b: 0.28 $L/ha_{gross}/s$ x 0.92 = 0.26 L/s

Peaking Factor (M)

$M = 1 + [14 / (4 + P^{0.5})]$

$M = 1 + [14 / (4 + (\ 0.681\ )^{0.5})]$

M = 3.90

Sanitary Sewer Flow (Q)

$Q = [1.25 \times (a \times M)] + b$

Q = [1.25 x (2.39 x 3.90)] + 0.26 L/s

Q = 11.92 L/s

Sanitary Lateral Size Confirmation:

A 200 mm diameter PVC lateral at 2.00% slope has a capacity of 60.3 L/s. With Q =11.92 L/s, the proposed lateral will have sufficient flow capacity. For additional information or discussion regarding these findings please contact the undersigned.

Servant, Dunbrack, McKenzie & MacDonald Ltd.

[redacted]

Ray Landry, MASc., P.Eng.
Project Engineer

Servant, Dunbrack, McKenzie & MacDonald Ltd.
NOVA SCOTIA LAND SURVEYORS & CONSULTING ENGINEERS

36 Oland Crescent
Bayers Lake Business Park
Halifax, Nova Scotia B3S 1C6

Phone (902) 455-1537
Fax (902) 455-8479
Web sdmm.ca

RAYMOND A. LANDRY, MASc , P Eng , LEED Green Associate
CHRISTOPHER J. FORAN, P Eng
GEOFFREY K. MacLEAN, P Eng
RACHAEL W. KYTE, P Eng , LEED Green Associate
ALEXANDER W. PULSIFER, P Eng
MICHAEL S. TANNER, NSLS (Ret)
DANIEL S. GERARD, P Eng , NSLS
H. JAMES McINTOSH, P Eng , NSLS, CLS
KEVIN A. ROBB, NSLS
BLAKE H. TRASK, P Eng , NSLS
ADAM J. PATTERSON, P Eng , NSLS

August 16, 2022

Halifax Water
450 Cowie Hill Road
Halifax, NS

From: Ray Landry, MASc., P.Eng. File No. 37341

Re: Lot TC-2E, First Lake Development, First Lake Drive, Sackville, Nova Scotia
Commercial Building Sanitary Lateral Size Confirmation

Project Summary:

	Commercial	Residential (Townhouses)	Residential (Multi-Unit)	Lot Area
Building C	230 m^2	0 Units	0 Units	1,848 m^2
From First Mutual Properties				

References:

1. Halifax Water (HW) Design & Supplementary Specifications, 2020 Edition, Section 4.2.2:

Where;

Q = Sanitary sewer flow.
1.25 = Safety factor.
a = Average dry weather flow.
M = Peaking factor using Harmon Formula; $M = 1 + [14 / (4 + P^{0.5})]$
b = Long-term infiltration/inflow allowance.
P = Population in thousands

- Residential Average Dry Weather Flow: 300 L/day per person
- Townhouse Dwelling Population: 3.35 people per unit
- Multi-Unit Dwelling Population: 2.25 people per unit
- Infiltration allowance: 0.28 $L/ha_{gross}/s$

2. Atlantic Canada Wastewater Guidelines Manual (AWG), 2006 Edition, Section 2.3.

Calculation Summary:

<u>Population Estimate (P)</u>

Reference:

P_1: AWG Section 2.3.4.2 Commercial/Retail: 85 people per hectare

P_2: HW Section 4.2.1 Residential (Townhouse): 3.35 people per unit

P_3: HW Section 4.2.1 Residential (Multi-Unit): 2.25 people per unit

P_1 = 85 people per hectare x 0.023 hectares = 2

P_2 = 3.35 people per unit x 0 units = 0

P_3 = 2.25 people per unit x 0 units = 0

$P = P_1 + P_2 + P_3$ = 2 people or = 0.002

Dry Weather Flow (a)

Reference:

a: HW Section 4.2.2: Residential: 300 L/day per person

a: ACWG Section 2.3.4.3, Table 2.1: Commercial/Retail: 6 L/m2

a residential=	300 L/day	x	0	=	0 L/day	or	0.00 L/s
a commercial=	6 L/m^2	x	230	=	1,380 L/day	or	0.02 L/s

Total a= residential + commercial = 1,380 or 0.02 L/s

Infiltration (b)

Reference:

HW Section 4.2.2: Infiltration allowance: 0.28 $L/ha_{gross}/s$

Lot Area= 1,848 m^2 = 0.18 ha

b: 0.28 $L/ha_{gross}/s$ x 0.18 = 0.05 L/s

Peaking Factor (M)

$M = 1 + [14 / (4 + P^{0.5})]$

$M = 1 + [14 / (4 + (\ 0.002\ )^{0.5})]$

M = 4.46

Sanitary Sewer Flow (Q)

$Q = [1.25 \times (a \times M)] + b$

Q = [1.25 x (0.02 x 4.46)] + 0.05 L/s

Q = 0.14 L/s

Sanitary Lateral Size Confirmation:

A 150 mm diameter PVC lateral at 2.00% slope has a capacity of 28.0 L/s. With Q =0.14 L/s, the proposed lateral will have sufficient flow capacity. For additional information or discussion regarding these findings please contact the undersigned.

Servant, Dunbrack, McKenzie & MacDonald Ltd.

[redacted]

Ray Landry, MASc., P.Eng.
Project Engineer

Servant, Dunbrack, McKenzie & MacDonald Ltd.
NOVA SCOTIA LAND SURVEYORS & CONSULTING ENGINEERS

36 Oland Crescent
Bayers Lake Business Park
Halifax, Nova Scotia B3S 1C6

Phone (902) 455-1537
Fax (902) 455-8479
Web sdmm.ca

RAYMOND A. LANDRY
MASc , P Eng , LEED Green Associate
CHRISTOPHER J. FORAN
P Eng
GEOFFREY K. MacLEAN
P Eng
RACHAEL W. KYTE
P Eng , LEED Green Associate
ALEXANDER W. PULSIFER
P Eng
MICHAEL S. TANNER
NSLS (Ret)
DANIEL S. GERARD
P Eng , NSLS
H. JAMES McINTOSH
P Eng , NSLS, CLS
KEVIN A. ROBB
NSLS
BLAKE H. TRASK
P Eng , NSLS
ADAM J. PATTERSON
P Eng , NSLS

August 3, 2022

Halifax Water
450 Cowie Hill Road
Halifax, NS

From: Ray Landry, MASc., P.Eng. File No. 37341

Re: **Lot TC-2E, First Lake Development, First Lake Drive, Sackville, Nova Scotia**
Residential & Commercial Building Sanitary Lateral Size Confirmation

Project Summary:

	Commercial	Residential (Townhouses)	Residential (Multi-Unit)	Lot Area
Building D	1219 m^2	0 Units	314 Units	9,420 m^2
From First Mutual Properties				

References:

1. Halifax Water (HW) Design & Supplementary Specifications, 2020 Edition, Section 4.2.2:

Where;

Q = Sanitary sewer flow.

1.25 = Safety factor.

a = Average dry weather flow.

M = Peaking factor using Harmon Formula; $M = 1 + [14 / (4 + P^{0.5})]$

b = Long-term infiltration/inflow allowance.

P = Population in thousands

- Residential Average Dry Weather Flow: 300 L/day per person
- Townhouse Dwelling Population: 3.35 people per unit
- Multi-Unit Dwelling Population: 2.25 people per unit
- Infiltration allowance: 0.28 $L/ha_{gross}/s$

2. Atlantic Canada Wastewater Guidelines Manual (AWG), 2006 Edition, Section 2.3.

Calculation Summary:

<u>Population Estimate (P)</u>

Reference:

P_1: AWG Section 2.3.4.2 Commercial/Retail: 85 people per hectare

P_2: HW Section 4.2.1 Residential (Townhouse): 3.35 people per unit

P_3: HW Section 4.2.1 Residential (Multi-Unit): 2.25 people per unit

P_1 = 85 people per hectare x 0.122 hectares = 11

P_2 = 3.35 people per unit x 0 units = 0

P_3 = 2.25 people per unit x 314 units = 707

$P = P_1 + P_2 + P_3$ = 718 people or = 0.718

Dry Weather Flow (a)

Reference:

a: HW Section 4.2.2: Residential: 300 L/day per person

a: ACWG Section 2.3.4.3, Table 2.1: Commercial/Retail: 6 L/m2

a residential=	300 L/day	x	707	=	212,100 L/day	or	2.45	L/s
a commercial=	6 L/m^2	x	1219	=	7,314 L/day	or	0.08	L/s

Total a= residential + commercial = 219,414 or 2.54 L/s

Infiltration (b)

Reference:

HW Section 4.2.2: Infiltration allowance: 0.28 $L/ha_{gross}/s$

Lot Area= 9,420 m^2 = 0.94 ha

b: 0.28 $L/ha_{gross}/s$ x 0.94 = 0.26 L/s

Peaking Factor (M)

$M = 1 + [14 / (4 + P^{0.5})]$

$M = 1 + [14 / (4 + (0.718)^{0.5})]$

M = 3.89

Sanitary Sewer Flow (Q)

Q = [1.25 x (a x M)] + b

Q = [1.25 x (2.54 x 3.89)] + 0.26 L/s

Q = 12.61 L/s

Sanitary Lateral Size Confirmation:

A 200 mm diameter PVC lateral at 2.00% slope has a capacity of 60.3 L/s. With Q =12.61 L/s, the proposed lateral will have sufficient flow capacity. For additional information or discussion regarding these findings please contact the undersigned.

Servant, Dunbrack, McKenzie & MacDonald Ltd.

[redacted]

Ray Landry, MASc., P.Eng.

Project Engineer