Environmental Noise Assessment

1 Columbia Street West, Waterloo, Ontario

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SLR Project No.: 241.30640.00000

October 21, 2024

Revision: 1

Revision Record

Revision	Date	Prepared By	Checked By	Authorized By
0	November 18, 2022	Dylan Diebolt	Aaron Haniff	Aaron Haniff
1	October 21, 2024	Dylan Diebolt	Aaron Haniff	Aaron Haniff

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1.0 Introduction

SLR Consulting (Canada) Ltd., was retained by Studio Limina Inc. to conduct an Environmental Noise Assessment for the proposed development at 1 Columbia Street West, in Waterloo, Ontario (herein referred to as "the site"). This report is in support of the Site Plan Application (SPA) for the proposed development. A copy of the Declaration Statements is included in **Appendix A**.

1.1 Focus of Report

In keeping with the Regional Municipality of Waterloo (RMOW) and Ministry of Environment, Conservation and Parks (MECP) requirements, this report examines the potential for:

- Impacts of the environment on the proposed development;
- Impacts of the proposed development on the environment; and
- Impacts of the proposed development on itself.

Mechanical systems associated with the development (e.g., cooling and ventilation equipment) have not been sufficiently designed at this stage and should be assessed at a future date. A general discussion has been included in this report to address impacts of the proposed development on the environment and on itself.

1.2 Nature of the Subject Lands

The proposed development is located on the southwest corner of the intersection of Columbia Street West and King Street North, in Waterloo, Ontario. The site is currently occupied by a high-rise residential building as well as two single-family homes. The two single-family homes will be demolished as part of the redevelopment.

The proposed development will be a seven (7) storey residential building.

Indoor amenity spaces for condominium occupants are planned on floor 1. Floors 2 through 7 will contain residential condominium units.

A copy of the development drawings is included for reference in **Appendix B**.

1.3 Nature of the Surroundings

The proposed development site is bounded by the following:

- Columbia Street West and a convenience store, low/high-rise residential buildings beyond to the north;
- King Street north and commercial land uses beyond to the east;
- A mixture of low-rise and high-rise residential buildings to the south; and
- Low-rise residential buildings and spruce street beyond to the west.

The closest rail line is a spur line of the Guelph Subdivision rail line operated by Waterloo Central Railway. As this line is approximately 1.4 km from the site, assessments of railway noise and vibration impacts is not required.

A context plan is shown in **Figure 1**.

PART 1: IMPACTS OF THE ENVIRONMENT ON THE DEVELOPMENT

In evaluating potential impacts of the environment on the proposed development, the focus of this report is to assess the potential for:

- Transportation noise impacts from surrounding roadways; and
- Stationary noise impacts from the surrounding industries on the development.

There are no airports or railway lines in the immediate vicinity of the proposed development; therefore, an assessment of aircraft and railway noise impacts is not required.

2.0 Transportation Noise Impacts

2.1 Transportation Noise Sources

Transportation sources with the potential to produce road traffic noise at the proposed development include:

- Columbia Street (East and West); and
- King Street North.

Sound exposure levels at the proposed development have been predicted, and this information has been used to identify façade, ventilation, and warning clause requirements.

2.2 Surface Transportation Noise Criteria

2.2.1 Ministry of the Environment Publication NPC-300

Noise-Sensitive Developments

Ministry of the Environment, Conservation and Parks (MECP) Publication NPC-300 provides sound level criteria for noise sensitive developments. The applicable portions of NPC-300 are Part C – Land Use Planning and the associated definitions outlined in Part A – Background. **Tables 1** to **4** summarize the applicable surface transportation (road and rail) criteria limits.

Location-Specific Criteria

Table 1 summarizes criteria in terms of energy equivalent sound exposure (L_{eq}) levels for specific noise-sensitive locations. Both outdoor and indoor locations are identified, with the focus of outdoor areas being amenity spaces. Indoor criteria vary with sensitivity of the space. As a result, Sleeping Quarters have more stringent criteria than Living/Dining Room spaces.

Table 1: MECP Publication NPC-300 Sound Level Criteria for Road and Rail Noise

Type of Space	Time Period	Energy Equivalent Sound Exposure Level L_{eq} [5] (dBA)		Assessment Location
		Road	Rail [1]	
Outdoor Amenity Area	Daytime (0700-2300h)	55	55	Outdoors [2]
Living/Dining Room [3]	Daytime (0700-2300h)	45	40	Indoors [4]
	Night-time (2300-0700h)	45	40	Indoors [4]
Sleeping Quarters	Daytime (0700-2300h)	45	40	Indoors [4]
	Night-time (2300-0700h)	40	35	Indoors [4]

Notes: [1] Whistle noise is excluded for OLA noise assessments and included for Living/Dining Room and Sleeping Quarters assessments, where applicable.

[2] Road and Rail noise impacts are to be combined for assessment of OLA impacts.

[3] Residence area Dens, Hospitals, Nursing Homes, Schools, Daycares are also included. During the night-time period, Schools and Daycares are excluded.

[4] An assessment of indoor noise levels is required only if the criteria in **Table 3** are exceeded.

[5] L_{eq} – the energy equivalent sound exposure level, integrated over the time period shown.

Outdoor Living Areas

Table 2 summarizes the noise mitigation requirements for communal outdoor amenity areas ("Outdoor Living Areas" or "OLAs").

For the assessment of outdoor sound levels, the surface transportation noise impact is determined by combining road and rail traffic sound levels. Whistle noise from trains is not included in the determination of outdoor sound levels.

Table 2: MECP Publication NPC-300 Outdoor Living Area Mitigation Requirements

Time Period	OLA Energy Equivalent Sound Level L_{eq} (dBA)	Mitigation/Warning Clause Requirements
Daytime (0700-2300h)	≤ 55	• None
	56 to 60 inc.	• Noise barrier **OR** Warning Clause A
	> 60	• Noise barrier to reduce noise to 55 dBA **OR** • Noise barrier to reduce noise to 60 dBA and Warning Clause B

Ventilation and Warning Clauses

Table 3 summarizes requirements for ventilation where windows would potentially have to remain closed as a means of noise control. Despite implementation of ventilation measures where required, if sound exposure levels exceed the guideline limits in **Table 1**, warning clauses advising future occupants of the potential excesses are required. Warning clauses also apply to OLAs.

Table 3: MECP Publication NPC-300 Ventilation & Warning Clause Requirements

Assessment Location	Time Period	Energy Equivalent Sound Exposure Level - L_{eq} (dBA)		Ventilation and Warning Clause Requirements [2]
		Road	Rail [1]	
Outdoor Amenity Area	Daytime (0700-2300h)	56 to 60 incl.		Type A Warning Clause
Plane of Window	Daytime (0700-2300h)	≤ 55		None
		56 to 65 incl.		Forced Air Heating with provision to add air conditioning + Type C Warning Clause
		> 65		Central Air Conditioning + Type D Warning Clause
	Night-time (2300-0700h)	51 to 60 incl.		Forced Air Heating with provision to add air conditioning + Type C Warning Clause
		> 60		Central Air Conditioning + Type D Warning Clause

Notes: [1] Whistle noise is excluded.
[2] Road and Rail noise is combined for determining Ventilation and Warning Clause requirements.

Building Component Requirements

Table 4 provides sound level thresholds which, if exceeded, trigger a requirement for the building shell components (i.e., wall, windows) to be designed accordingly to meet the applicable indoor sound criteria.

Table 4: MECP Publication NPC-300 Building Component Requirements

Assessment Location	Time Period	Energy Equivalent Sound Exposure Level - L_{eq} (dBA)		Component Requirements
		Road	Rail [1]	
Plane of Window	Daytime (0700-2300h)	> 65	> 60	Designed/ Selected to Meet Indoor Requirements [2]
	Night-time (2300-0700h)	> 60	> 55	

Notes: [1] Whistle noise is included in the assessment.
[2] Building component requirements are assessed separately for Road and Rail and combined for a resultant sound isolation parameter.

2.3 Traffic Data and Future Projections

2.3.1 Roadway Traffic Data

Future (2032) average annual daily traffic (AADT) volumes and vehicle percentages for Columbia Street West and King Street North were provided by the RMOW's Transportation

department. Commercial vehicle percentages, speed limit, and the day/night split were also provided.

Copies of all traffic data, correspondence and related calculations are provided for reference in **Appendix C**. **Table 5** summarizes the road traffic volumes and associated details used in the analysis.

Table 5: Summary of Road Traffic Data Used in the Transportation Analysis

Roadway Link	Future Volume (AADT)[1]	Day / Night Volume Split		Commercial Traffic Breakdown [2]		Vehicle Speed (km/h)
		Daytime	Night-time	% Medium Trucks	% Heavy Trucks	
Columbia Street	25,300	90	10	1.0	1.1	50
King Street North	18,400	90	10	1.3	1.5	50

Notes: [1] Year 2032 traffic volume projections, vehicle breakdowns, and day/night splits, and vehicle speeds were obtained from the RMOW.

2.4 Predicted Sound Levels

Future road traffic sound levels at the proposed development were predicted using Cadna/A, a commercially available noise propagation modelling software. Roadways were modelled as line sources of sound, with sound emission rates calculated using ORNAMENT algorithms, the road traffic noise model of the MECP.

These predictions were validated and are equivalent to those made using the MECP's ORNAMENT or STAMSON v5.04 road traffic noise models. Validation files are included in **Appendix D**.

Sound levels were predicted along the façades of the proposed development using the "building evaluation" feature of Cadna/A. This feature allows for noise levels to be predicted across the entire façade of a structure.

Topographic contours and surrounding buildings from the City of Waterloo Open Data Portal were included in the analysis. Ground absorption for the surrounding area was considered reflective.

2.4.1 Façade Sound Levels

Predicted worst-case façade sound levels are presented in **Table 6**. The transportation façade sound levels of the development, showing the ranges of predicted daytime and night-time sound levels, are shown in **Figure 2** and **Figure 3** respectively.

Table 6: Summary of Predicted Transportation Façade Sound Levels

Building Façade[1]	Predicted Road Traffic Sound Levels[2]	
	L_{eq} Day (dBA)	L_{eq} Night (dBA)
North	62	56
East	66	59
South	62	55

Building Façade[1]	Predicted Road Traffic Sound Levels[2]	
	L_{eq} Day (dBA)	L_{eq} Night (dBA)
West	54	48
Notes: [1] Façade locations are shown in **Figure 2** (daytime) and **Figure 3** (night-time). [2] The sound levels presented are the highest value predicted for the entire façade.		

Façade sound levels at the east façade are predicted to be above 65 dBA during daytime periods. All other façades are predicted to be below 65 dBA and 60 dBA during the daytime and night-time periods, respectively (i.e., the thresholds described in **Table 4**). Therefore, an assessment of building components is only required for residential units located on the east façade. See **Section 2.4.3** for Façade recommendations.

2.4.2 Outdoor Living Areas

Landscaped areas at grade are considered to be publicly accessible and have not been included as OLAs in this assessment.

Given the above, no assessment of OLA noise impacts is required.

2.4.3 Façade Recommendations

Due to sound levels exceeding **Table 4** requirements, a detailed assessment of glazing is required. Indoor sound levels and required façade Sound Transmission Classes (STCs) were estimated using the procedures outlined in National Research Council Building Practice Note BPN-56. The floor plans and elevation drawings for the site were used to assess representative worst-case residential units on the east façade, and it was assumed the non-glazing portions of the façade were assumed to have a STC 45 rating.

Façade STC requirements are summarized in the following tables:

Table 7: Façade Sound Transmission Class (STC) Requirements

Façade	Wall STC	Living Room Window/ Patio Door STC	Bedroom Window STC
East Façade	45	OBC	OBC
Notes: "OBC" - Glazing elements meeting minimum thermal and structural requirements of the Ontario Building Code.			

Based on the results shown in **Table 8** above, upgraded glazing is not expected to be required for the development.

If detailed floor plans (room dimensions) and façade plans are altered during future development stages, the glazing requirements should be re-assessed and reviewed by an Acoustical Consultant.

2.5 Ventilation and Warning Clause Requirements

The triggers for requiring warning clauses are summarized in **Table 3**. Where required, the warning clauses should be included in agreements registered on Title for the residential units and

included in all agreements of purchase and sale or lease, and all rental agreements. Warning clauses for the proposed development are summarized in **Appendix E**.

Based on the predicted façade noise levels, forced air heating with provisions for future installation of central air conditioning, and an MECP **Type C** warning clause, is recommended for all affected units with façade sound levels from road traffic between 56 and 65 dBA (inclusive) during the daytime, or between 51 and 60 dBA during night-time hours. This includes units on the **north and south façades of the building**.

As predicted transportation sound levels exceed 65 dBA during daytime periods, central air-conditioning and an MECP **Type D** warning clause is required for residential units on the **east façade**,

Façade sound levels for **all units not listed above** of the building are below 56 dBA during the daytime and 51 dBA during the night-time; therefore, there are no ventilation or warning clause requirements.



3.0 Stationary Source Noise Impacts

3.1.1 Guidelines

3.1.1.1 MECP Publication NPC-300 Guidelines for Stationary Noise

The applicable MECP noise guidelines for new sensitive land uses adjacent to existing industrial commercial uses are provided in MECP Publication NPC-300. NPC-300 revokes and replaces the previous noise assessment guideline, Publication LU-131 and Publication NPC-205, which was previously used for assessing noise impacts as part of Certificates of Approval / Environmental Compliance Approvals granted by the MECP for industries.

The new guideline sets out noise limits for two main types of noise sources:

- Non-impulsive, “continuous” noise sources such as ventilation fans, mechanical equipment, and vehicles while moving within the property boundary of an industry. Continuous noise is measured using 1-hour average sound exposures (L_{eq} (1-hr) values), in dBA; and
- Impulsive noise, which is a “banging” type noise characterized by rapid rise time and decay. Impulsive noise is measured using a logarithmic mean (average) level (L_{LM}) of the impulses in a one-hour period, in dBAI.

Furthermore, the guideline requires an assessment at, and provides separate guideline limits for:

- Outdoor points of reception (e.g., back yards, communal outdoor amenity areas); and
- Façade points of reception such as the plane of windows on the outdoor façade which connect onto noise sensitive spaces, such as living rooms, dens, eat-in kitchens, dining rooms and bedrooms.

The applicable noise limits at a point of reception are the higher of:

- The existing ambient sound level due to road traffic, or
- The exclusion limits set out in the guideline.

The following tables set out the exclusion limits from the guideline.

Table 8: NPC-300 Class 1 Exclusion Limits for Non-Impulsive Sounds (Leq (1-hr), dBA)

Time of Day	Class 1 Area	
	Plane of Windows of Noise Sensitive Spaces	Outdoor Points of Reception
7 am to 7 pm	50	50
7 pm to 11 pm	50	50
11 pm to 7 am	45	n/a

Table 9: NPC-300 Class 1 Exclusion Limits for Impulsive Sounds (LLLM, dBAI)

Time of Day	No. of Impulses in a 1-hour Period	Class 1 Area	
		Plane of Windows of Noise Sensitive Spaces	Outdoor Points of Reception
7 am to 11 pm	9 or more	50	50
	7 to 8	55	55
	5 to 6	60	60
	4	65	65
	3	70	70
	2	75	75
	1	80	80
11 pm to 7 am	9 or more	45	n/a
	7 to 8	50	n/a
	5 to 6	55	n/a
	4	60	n/a
	3	65	n/a
	2	70	n/a
	1	75	n/a

Notes:
n/a Not Applicable. Outdoor points of reception are not considered to be noise sensitive during the overnight period.
- Area classifications are: Class 1 - Urban

The applicable guideline limits for infrequent events such as emergency generator set testing are +5 dB higher than the values above.

3.1.2 Ambient Sound Levels from Road Traffic

Since the ambient sound levels were anticipated to exceed the NPC-300 exclusionary limits for most facades and time periods within the proposed development, sound levels from roadway noise were assessed and the corresponding applicable guideline limits were determined.

Table 10 summarizes the current road traffic volumes and details applied in the ambient noise modelling.

Table 10: Summary of Road Traffic Data Used to Determine Minimum 1-hr Ambient Sound Levels

Roadway	2022 Traffic Volumes (AADT)	Minimum Day/Evening/Night Hour Volume % of AADT			Commercial Vehicle Breakdown		Vehicle Speed (km/hr)
		Daytime	Evening	Night-time	% Medium Trucks	% Heavy Trucks	
King Street North	16,700	4.3	3.1	0.4	1.3	1.5	50

As with the Transportation Noise Assessment (refer to Section 2.0), ambient roadway noise was modelled as line sources of sound using the Cadna/A computer model. The minimum hourly L_{eq} for the ambient sound levels were found to exceed the NPC-300 default guideline limits during most periods of the day at assessment locations on the facades of the proposed development. 2022 road traffic volumes were obtained from the RMOW. Minimum hourly percentages for daytime/evening/nighttime periods were based on standard distribution for arterial roads in Ontario.

Surrounding facility noise impacts were assessed against the higher of the modelled ambient noise levels and the exclusionary limits calculated using road traffic data summarized in Table 10.

Predicted minimum ambient road traffic sound levels at the proposed development for daytime, evening and night-time hours are summarized in **Figures 4a, 4b, and 4c** for daytime, evening, and nighttime periods respectively.

3.1.3 Application of the NPC-300 Guidelines

The stationary noise guidelines apply only to residential land uses and to noise-sensitive commercial and institutional uses, as defined in NPC-300 (e.g., schools, daycares, hotels). For the site, the stationary noise guidelines only apply to the residential portions of the development, including:

- Individual residences;
- Communal indoor amenity areas; and
- Communal outdoor amenity areas.

All of the above have been considered as noise-sensitive points of reception in the analysis.

3.1.3.1 Guideline Summary and Interpretation

The following presents a summary of the guidelines and settlements presented above.

- The applicable Ministry of the Environment noise guideline for assessing new residential development applications is Publication NPC-300.
- The Class 1 limits have been considered in this study.

3.1.4 Site Visit and Observations

A site visit was conducted in the area on October 4, 2022. SLR personnel conducted a site visit to the area to identify to identify sources of noise around the subject site.

In general, noise from nearby facilities was not audible at or around the site. The general ambient environment surrounding the development lands is dominated by roadway noise.

3.1.5 Sources of Interest

Based on the information obtained from site visit and aerial photography, the significant sources of noise in the area of the site have been identified. Noise emission rates for the equipment/ activities were determined based on information from SLR's in-house database. Modelled noise sources include:

354 King Street North – Commercial building with rooftop mechanical equipment that is assumed to operate during all times of the day, with reduced operations during nighttime hours.

- HVAC units.

McDonalds Restaurant – Commercial building with rooftop mechanical equipment and drive-thru that is assumed to operate during all times of the day, with reduced operations during nighttime hours.

- HVAC units;
- Exhaust fans; and
- Idling vehicles in drive thru.

Figure 5 shows the location of all modelled noise sources. Noise emission data used in the assessment can be found in **Appendix F**.

Other Institutional/Commercial Lands

Multiple institutional/ commercial land uses exist within 300 m, north and east of the subject site. Given the separation distances and high ambient roadway noise levels created by King Street and Columbia Street, stationary noise from these sources is not anticipated to be of concern. This is consistent with the site observations by SLR acoustics personnel, in which activity from surrounding industries was inaudible at and around the site. Additionally, noise impacts from these facilities are expected to meet NPC-300 guidelines at closer intervening noise sensitive receptors. Therefore, a detailed assessment of these facilities is not considered necessary and was not completed.

3.1.6 Noise Modelling and Results

Worst-case scenario noise levels from the surrounding commercial/ industrial operations were modelled using Cadna/A, a computerized version of the internationally recognized ISO 9613-2 noise propagation algorithms. This is the preferred noise modelling methodology of the MECP. The ISO 9613 equations account for:

- Source to receiver geometry;
- Distance attenuation;
- Atmospheric absorption;
- Reflections off of the ground and ground absorption;
- Reflections off of vertical walls; and
- Screening effects of buildings, terrain, and purpose-built noise barriers (noise walls, berms, etc.).

The following additional parameters were used in the modelling, which are consistent with providing a conservative (worst-case assessment of noise levels):

- Temperature: 10°C;
- Relative Humidity: 70%;
- Ground Absorption G: G = 0.2 default global parameter;
- Reflection: An order of reflection of 1 was used (accounts for noise reflecting from walls);
- Wall Absorption Coefficients: Set to 0.37 (37 % of energy is absorbed, 63% reflected); and
- Terrain: Ground contours have been used in the modelling to account for hills and changes in grade in the area.

Facilities are permitted through the MECP on an individual basis, assessed against the NPC-300 guideline limits. Cumulative sound levels from other stationary sources are not considered in the MECP environmental approvals process. As a conservative assessment, all surrounding stationary sources have been assessed cumulatively.

Predicted façade sound levels for stationary noise are shown in **Figure 6** and **Figure 7** for daytime/evening and nighttime, respectively. Overall predicted sound levels are provided in the following tables:

Table 11: Summary of Predicted Stationary Source Façade Sound Levels

Façade[1]	Stationary Source Sound Levels[2]			Applicable Sound Level Limits[3]		
	L_{eq} Day (dBA)	L_{eq} Evening (dBA)	L_{eq} Night (dBA)	L_{eq} Day (dBA)	L_{eq} Evening (dBA)	L_{eq} Night (dBA)
North	50	50	47	53-60	52-58	45-49
East	50	50	47	61-64	59-62	50-53
South	41	41	38	51-60	50-58	45-49
West	28	28	25	50	50	45

Notes: [1] Façade locations are identified on **Figure 6** and **Figure 7.**
[2] Sound levels presented are the highest predicted for the identified façade.
[3] Sound levels presented are the higher of Class 1 limits or ambient sound level.

Sound levels due to stationary sources are predicted to be at or below applicable guideline limits at all façade locations in the proposed development. Therefore, no additional noise control measures are required.

As there are no applicable noise sensitive OPORs in the development, an assessment of OPORs was not completed.

3.1.7 Mitigation Measures and Warning Clauses

As shown in the previous section, the applicable Class 1 noise guideline limits from worst-case predicted operations in the surrounding industrial and commercial uses are met. Based on the current study, additional physical noise mitigation measures are not required.

A **Type E** noise warning clause is recommended for all units. See **Appendix E** for warning clause details. The warning clauses should be included in documents registered on Title and included in all agreements of purchase and sale or lease and all rental agreements.

PART 2: IMPACTS OF THE DEVELOPMENT ON ITSELF and SURROUNDINGS

4.0 Stationary Sources of Development on Itself and the Surroundings

4.1.1 MECP Publication NPC-300 Guidelines for Stationary Noise

The applicable MECP noise guidelines for new sensitive land uses adjacent to stationary sources are provided in MECP Publication NPC-300, as stated in Sections 3.1.1 and 3.2.2 above.

4.1.2 Surrounding Points of Reception

Nearby worst-case noise-sensitive PORs in all directions were assessed to determine impacts of the proposed development on the surroundings. PORs and associated OPORs were assessed at residential dwellings, north/east/south/west of the proposed development. These off-site locations were assessed against Class 1 Area sound level limits.

Four representative worst-case PORs have been chosen in each cardinal direction:

- POR_01 – Existing residential building at 1 Columbia Street West;
- POR_02 – Residential building at 346 King Street North currently under construction;
- POR_03 – Residential building at 345 King Street North; and
- POR_04 - Residential building at 348 Spruce Street.

The residential building at 346 King Street North is still under construction, a stand-in 4-storey building was modelled to account for noise impacts at the POR.

4.2 Stationary Sources of Noise

Mechanical plans for the proposed development are accurate as of the time of this study. Sound power levels for the equipment/sources were based manufacturers data, and SLR in-house data. The sources of stationary sources noise considered in the assessment included the following:

- Four (4) heat pumps (sources CU-1 to CU-4);
- One (1) make up air unit (source MUA); and
- One (1) exhaust fan (source EF).

Assumed source locations are shown in **Figure 5**.

There are no identified impulsive-type sources associated with the Project site, and impulsive noise from the proposed development is not considered further in this assessment.

4.2.1 Mechanical Equipment

Locations and specifications for heat pumps and the make up air unit are based on received drawings and specifications. Generic information from SLR's in house database was used for

the rooftop exhaust fan. Modelled sound power levels for mechanical equipment are summarized in **Table 12**, with additional operating information provided in **Appendix F**.

It has been confirmed that no PTAC units will be installed at the site.

Table 12: Summary of Modelled Sound Power Levels Associated with Mechanical Equipment

Unit	Sound Power Level (dBA)
Heat Pump (CU-1)	82
Heat Pump (CU-2)	80
Heat Pump (CU-3)	82
Heat Pump (CU-4)	78
Make Up Air Unit (MUA)	92
Garbage Room Exhaust Fan (EF)	79

4.3 Stationary Noise Modelling

Predictable worst-case scenario sound levels from the mechanical equipment were modelled using Cadna/A, a computerized version of the internationally recognized ISO 9613-2 noise propagation algorithms. This is the preferred acoustic model of the MECP. The ISO 9613 equations account for:

- Source to receiver geometry;
- Distance attenuation;
- Atmospheric absorption;
- Reflections off of the ground and ground absorption;
- Reflections off of vertical walls; and
- Screening effects of buildings, terrain, and purpose-built noise barriers (noise walls, berms, etc.).

The following additional parameters were used in the modelling, which are consistent with providing a conservative (worst-case assessment of noise levels):

- Temperature: 10°C;
- Relative Humidity: 70%;
- Ground Absorption G: G = 0.0 as the default global parameter;
- Reflection: An order of reflection of 1 was used (accounts for noise reflecting from walls);
- Wall Absorption Coefficients: 0.37 (37 % of energy is absorbed, 63% reflected); and
- Terrain: Ground contours have been used in the modelling to account for hills and changes in grade in the area.

Stationary source sound levels on the proposed development itself were predicted using the “building evaluation” feature of Cadna/A. OPOR sound levels on the proposed development

itself, off-site plane of window sound levels, and off-site OPOR sound levels were assessed at worst-case locations across the entire façade of surrounding residential buildings.

4.4 Predicted Sound Levels from the Development on Itself

Predicted worst-case unmitigated façade sound levels from mechanical equipment on the development itself are summarized in **Table 13** and shown in **Figure 8** and **Figure 9** for daytime/evening and nighttime respectively.

Table 13: Predicted Worst-Case Sound Levels – Mechanical Equipment on the Development Itself

Building	Façade	Predicted Level (dBA)		Class 1 Area Limit (dBA)		Meets Limit?
		Day/Evening	Night	Day/Evening	Night	Day/Evening
Building A Podium	North	51	51	50	45	**No**
	East	45	44	50	45	Yes
	South	55	54	50	45	**No**
	West	45	43	50	45	Yes

The predicted sound levels of the development mechanical on itself exceed the Class 1 guideline Limits. Therefore, mitigation is required and explored further in **Section 4.6**

4.5 Predicted Sound Levels from the Development on The Surroundings

Predicted sound levels from the proposed development mechanical equipment on the surroundings are summarized in **Table 14** and shown in in **Figure 8** and **Figure 9** for daytime/evening and nighttime respectively.

Sound levels have been predicted across the façades of each POR using the building evaluation feature in Cadna/A to identify the worst-case PORs. No OPORs associated with these PORs were identified.

Table 14: Summary of Predicted Worst Case Sound Levels – Mechanical Equipment on the Surroundings

Point of Reception	Stationary Source Sound Levels L_{eq}(1-hr) (dBA)			Class 1 Area Sound Level Limits, L_{eq}(1-hr) (dBA)			Meets Guideline Limits?
	Day	Evening	Night	Day	Evening	Night	
POR_01 1 Columbia St. W	57	57	56	50	50	45	**No**
POR_02 346 King Street N	42	42	40	50	50	45	Yes
POR_03 345 King Street N	60	60	60	50	50	45	**No**
POR_04 348 Spruce Street	34	34	34	50	50	45	Yes

The predicted sound levels of the development mechanical on itself exceed the Class 1 guideline Limits. Therefore, mitigation is required and explored further in **Section 4.6**.

4.6 Mitigation Measures – Development Mechanical

Based on the above sections, source-based mitigation measures are required for the development's mechanic equipment in order to meet Class 1 guideline limits at the development and surrounding noise sensitive receptors. This can be achieved through selection of quieter equipment, compressor blankets, and or acoustic enclosures. The maximum sound power level for each piece of equipment in order to achieve compliance at all noise sensitive receptors is included in the table below.

Table 15: Summary of Required Sound Power Levels Associated with Mechanical Equipment

Unit	Sound Power Level (dBA)
Heat Pump (CU-1)	73
Heat Pump (CU-2)	72
Heat Pump (CU-3)	73
Heat Pump (CU-4)	73
Make Up Air Unit (MUA)	75
Garbage Room Exhaust Fan (EF)	68

Predicted mitigated sound levels at the site and surrounding area are presented in **Figure 10** and **Figure 11** for daytime/evening and nighttime respectively.

The acoustical design should be reviewed by an acoustical consultant later in the approvals process or as part of the final building design to ensure the guideline limits are met at all noise sensitive receptors.



The predicted mitigated sound levels at the site and surrounding area are shown in the following tables.

Table 16: Predicted Worst-Case Sound Levels – Mechanical Equipment on the Development Itself – Mitigated

Building	Façade	Predicted Level (dBA)		Class 1 Area Limit (dBA)		Meets Limit?
		Day/Evening	Night	Day/Evening	Night	Day/Evening
Building A Podium	North	39	37	50	45	Yes
	East	33	31	50	45	Yes
	South	42	40	50	45	Yes
	West	36	34	50	45	Yes

Table 17: Summary of Predicted Worst Case Sound Levels – Mechanical Equipment on the Surroundings – Mitigated

Point of Reception	Stationary Source Sound Levels L_{eq}(1-hr) (dBA)			Class 1 Area Sound Level Limits, L_{eq}(1-hr) (dBA)			Meets Guideline Limits?
	Day	Evening	Night	Day	Evening	Night	
POR_01 1 Columbia St. W	45	45	43	50	50	45	Yes
POR_02 346 King Street N	32	32	29	50	50	45	Yes
POR_03 345 King Street N	47	47	45	50	50	45	Yes
POR_04 348 Spruce Street	23	23	21	50	50	45	Yes

5.0 Conclusions and Recommendations

The potential for noise impacts on and from the proposed development have been assessed. Impacts of the environment on the development, the development on itself, and the development on the surrounding area have been considered. Based on the results of this assessment, the following conclusions have been reached:

Transportation Noise

- An assessment of transportation noise impacts from surrounding roadways has been completed.
- Based on transportation façade sound levels upgraded glazing is not required within the development, as outlined in outlined in **Section 2.4.3**.
- Ventilation and warning clause requirements are outlined in **Section 2.5**, and summarized as follows:
    - Provision for Air Conditioning and a **Type C** Warning clause are required for residential units on the **north** and **south façades of the building.**

- Requirement for Air Conditioning and a **Type D** Warning clause are required for residential units on the **east façade of the building.**
- The warning clauses should be included in agreements registered on Title for the residential units and included in agreements of purchase and sale/rental agreements. Warning clause requirements are summarized in **Appendix E**.

Stationary Source Noise

- "Stationary" noise from the surrounding commercial and industrial facilities were assessed on the proposed development, as outlined in **Section 3**.
- Stationary noise impacts from the surrounding commercial noise are predicted to meet NPC-300 Class 1 guideline limits on all façades.
- A **Type E** noise warning clause is recommended, as outlined in **Section 3.1.6**, due to the general noise from the surrounding industries and commercial properties. Warning clauses are included in **Appendix E**.
- Stationary sources associated with the development are predicted to exceed Class 1 guideline limits at the site and the surrounding PORs. With the mitigation measures outlined in Section 4.6 compliance is anticipated to be achieved at the site and surrounding PORs.

Overall Assessment

- Impacts of the environment on the proposed development can be adequately controlled without upgrades to the building construction, without the inclusion of mitigation measures for surrounding stationary sources, and the inclusion of ventilation and warning clause requirements, detailed in **Part 1** of this report.
- Impacts of the proposed development on itself can be adequately controlled by following the design guidance outlined in **Part 2** of this report.
- Impacts of the proposed development on the surroundings can be adequately controlled by following the design guidance outlined **Part 2** of this report.

6.0 Closure

Regards,

SLR Consulting (Canada) Ltd.



Dylan Diebolt, B.Sc.
Acoustics Consultant

Aaron K. Haniff, P.Eng.
Principal Acoustics Engineer

Distribution: 1 electronic copy – Studio Limina Inc.
1 electronic copy – SLR Consulting (Canada) Ltd.

7.0 References

International Organization for Standardization, ISO 9613-2: Acoustics – Attenuation of Sound During Propagation Outdoors Part 2: General Method of Calculation, Geneva, Switzerland, 1996.

National Research Council, Building Practice Note 56: Controlling Sound Transmission into Buildings, Canada, 1985.

Ontario Ministry of the Environment, Conservation and Parks, 1989, Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT).

Ontario Ministry of the Environment, Conservation and Parks, Publication NPC-300: Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning, 2013.

Ontario Ministry of the Environment, Conservation and Parks, 1996, STAMSON v5.04: Road, Rail and Rapid Transit Noise Prediction Model.

Figures

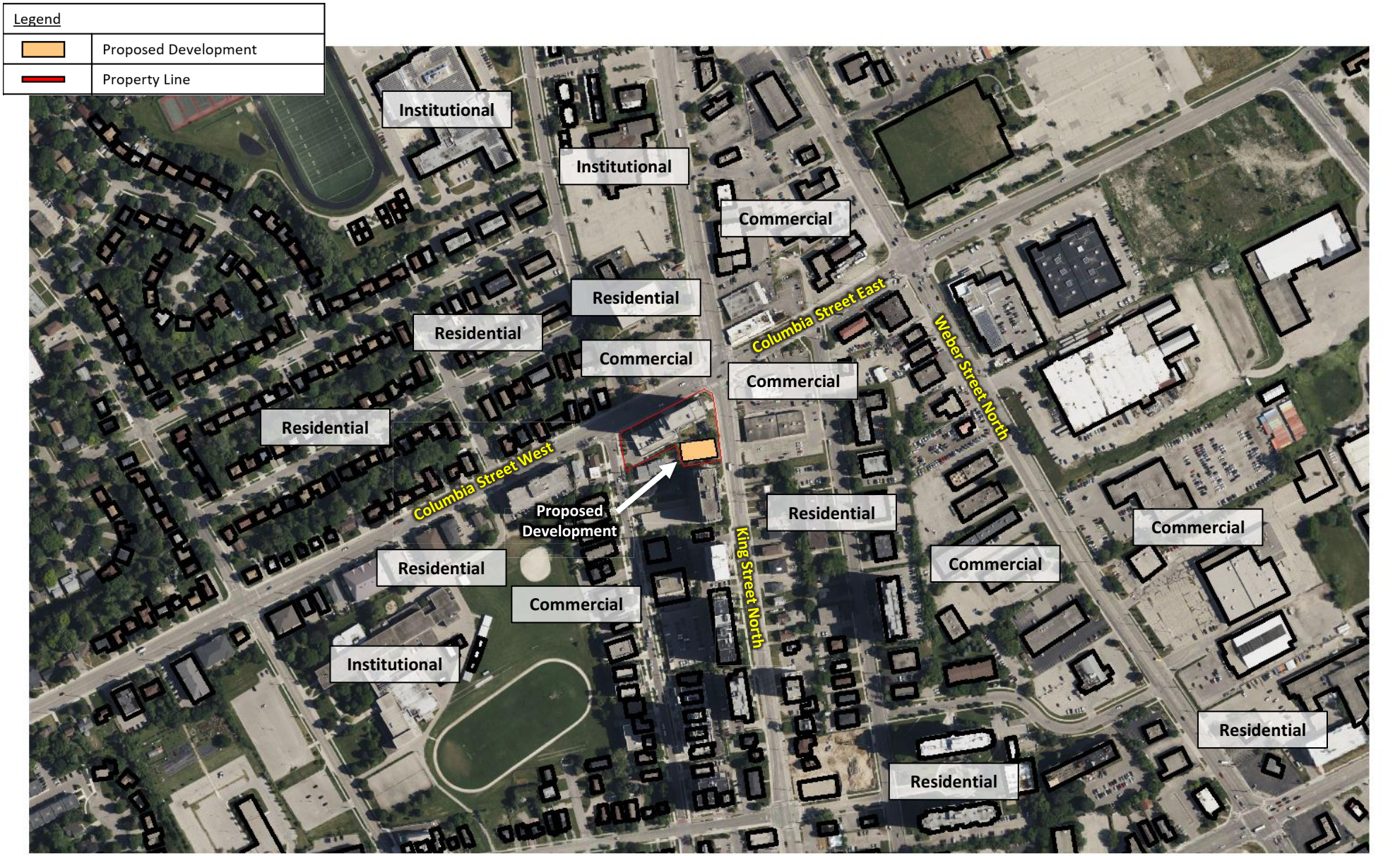
Environmental Noise Assessment

1 Columbia Street West, Waterloo, Ontario

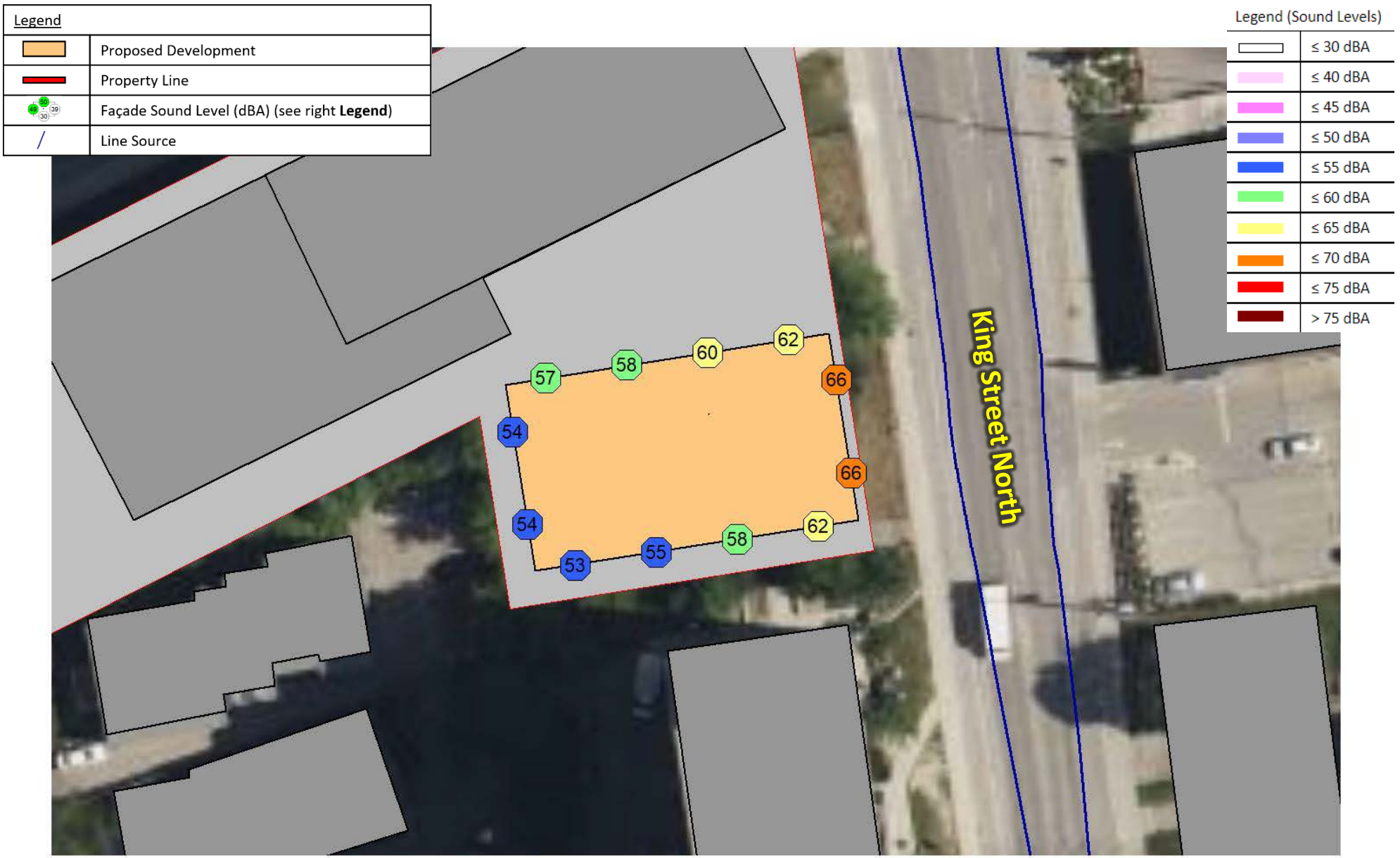
Studio Limina Inc.

SLR Project No.: 241.30640.00000

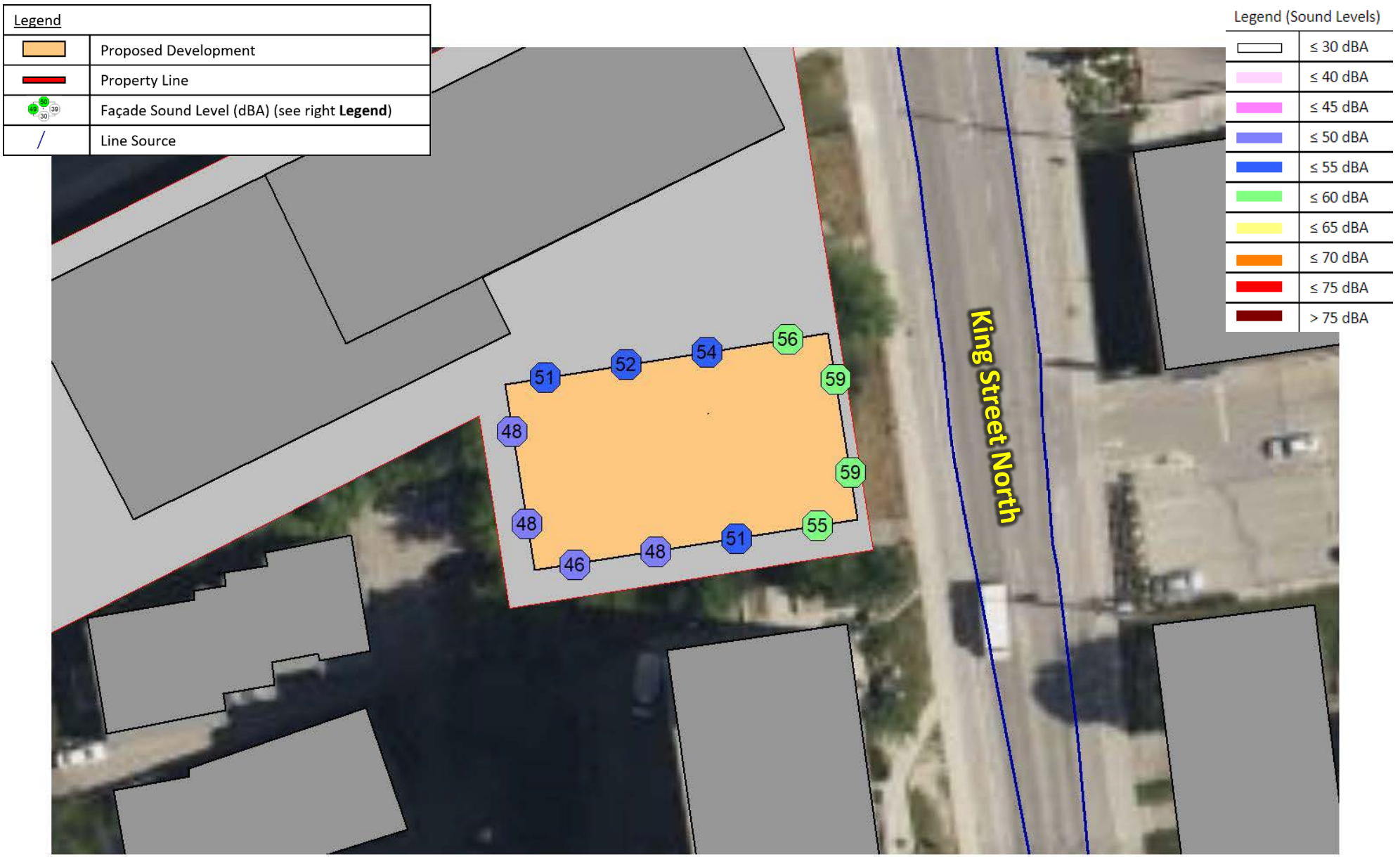
October 21, 2024



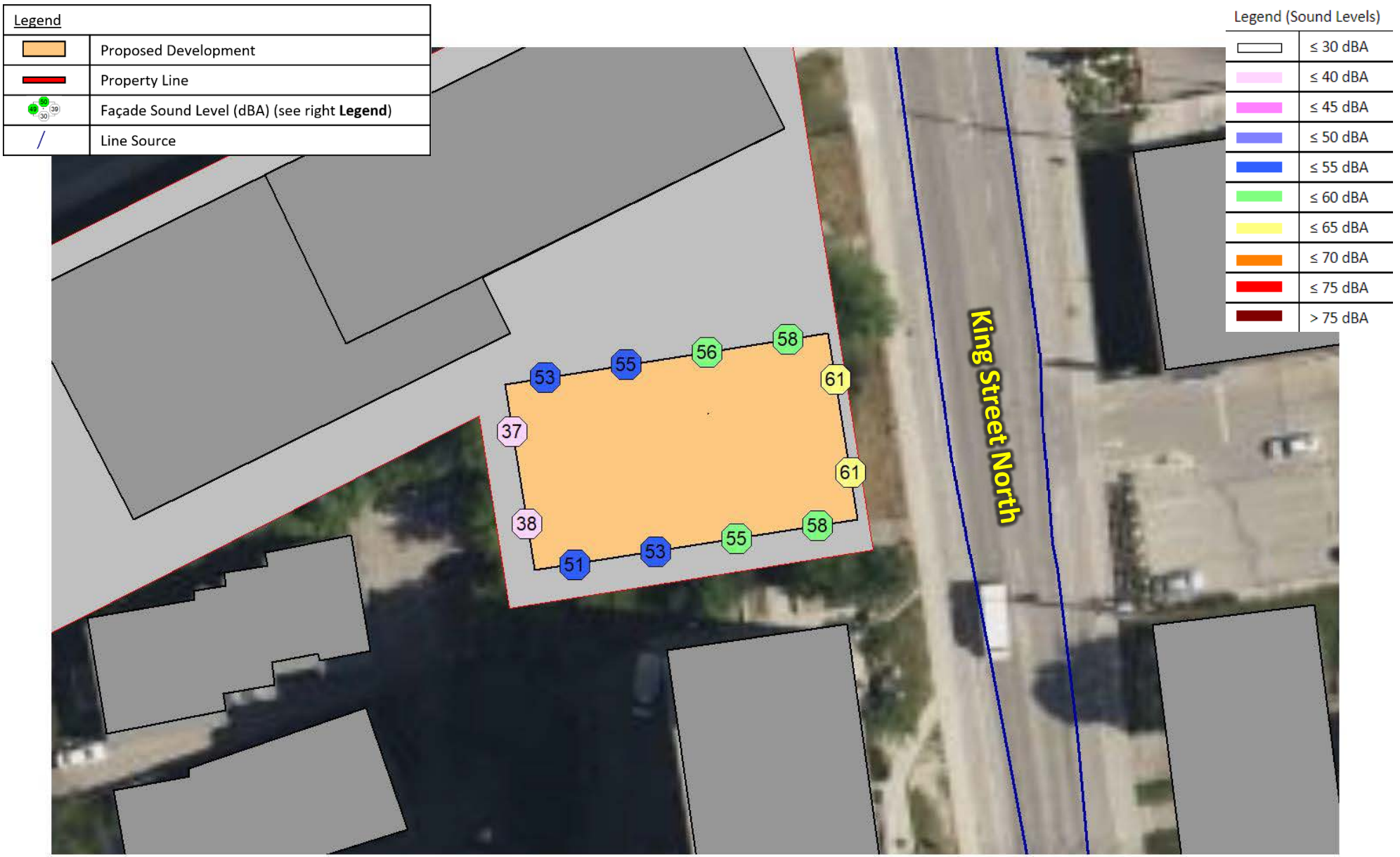
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CONTEXT PLAN		Project No. 241.30640.00000		



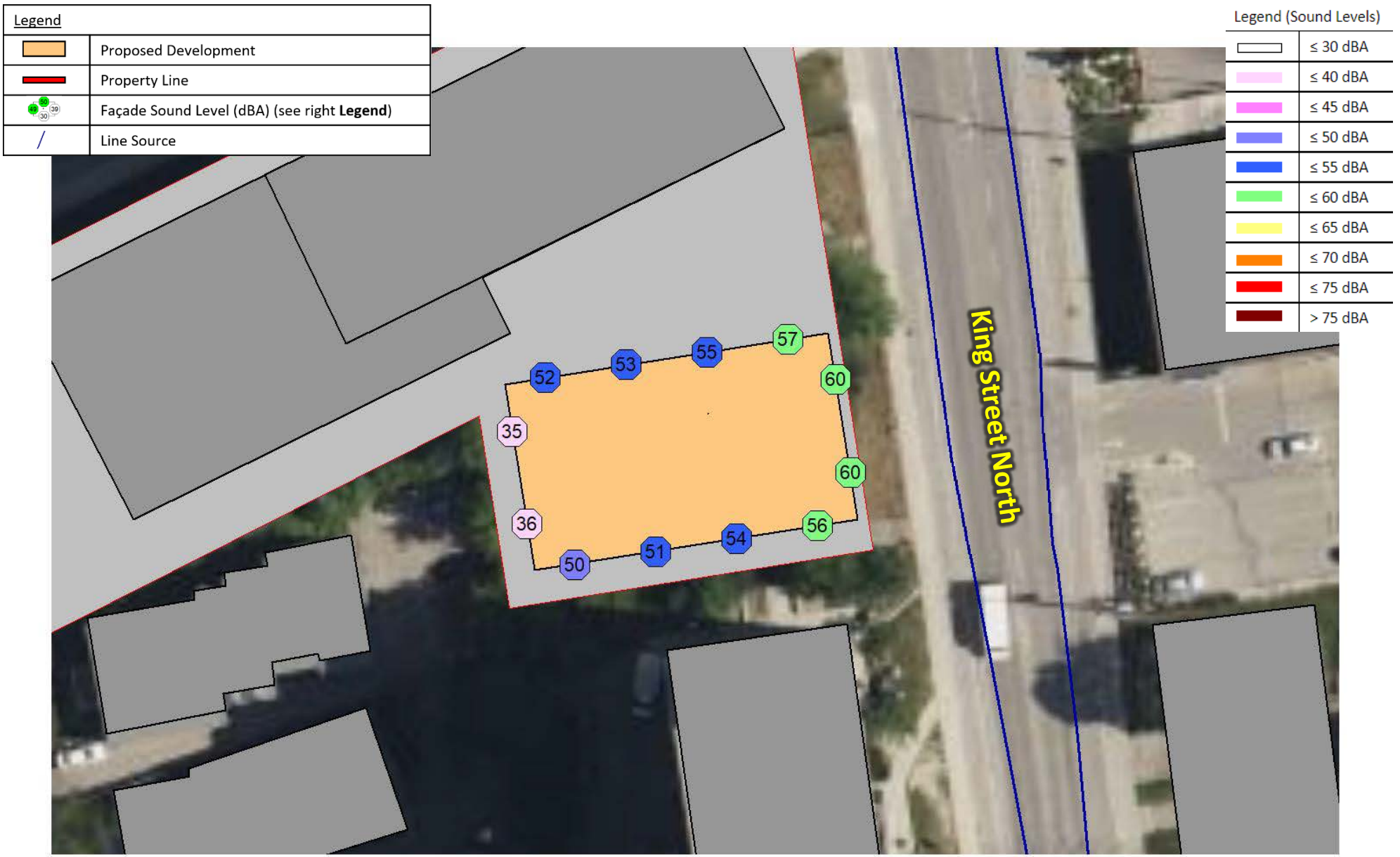
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PREDICTED FAÇADE SOUND LEVELS – ROAD – DAYTIME		Project No. 241.30640.00000		



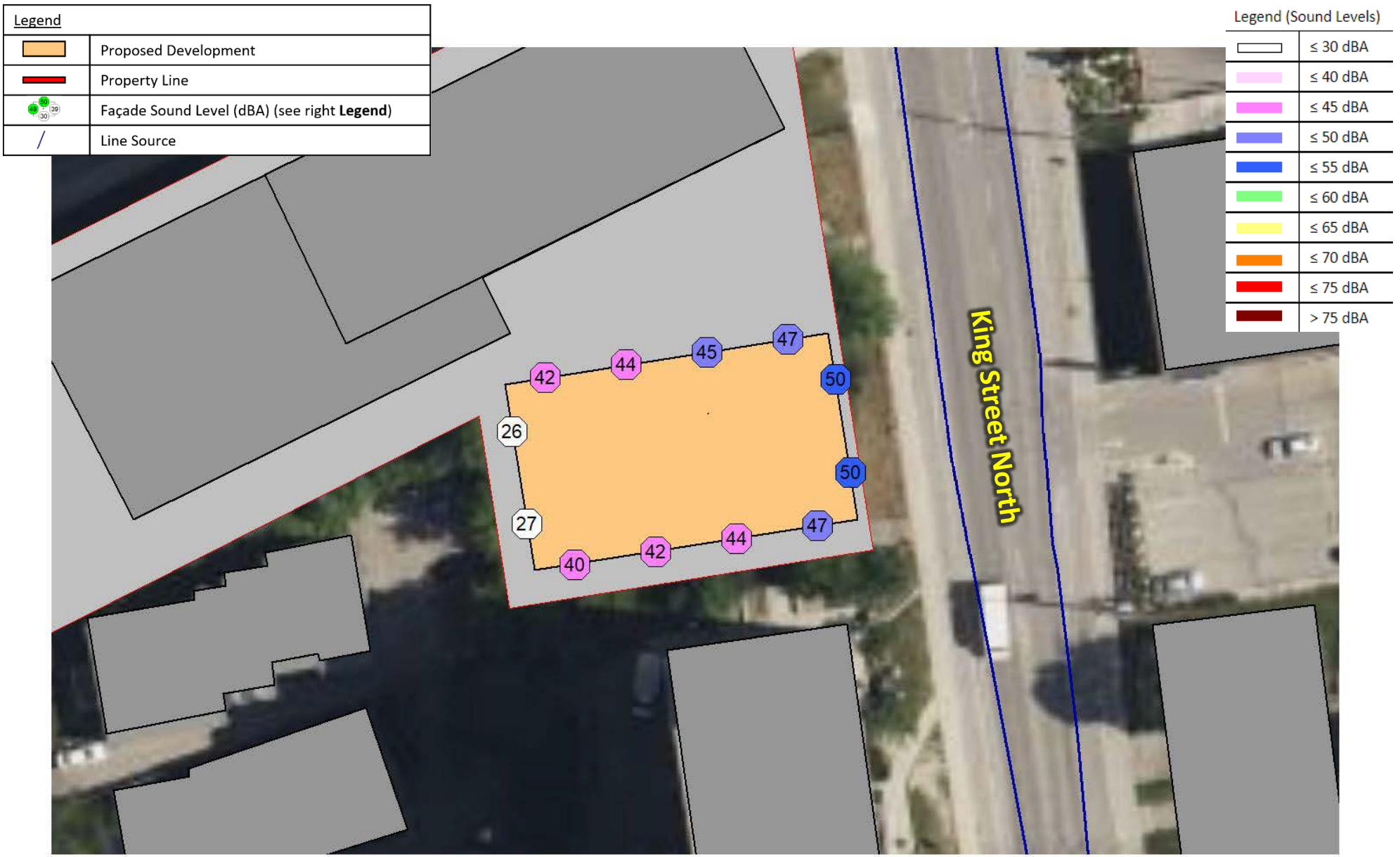
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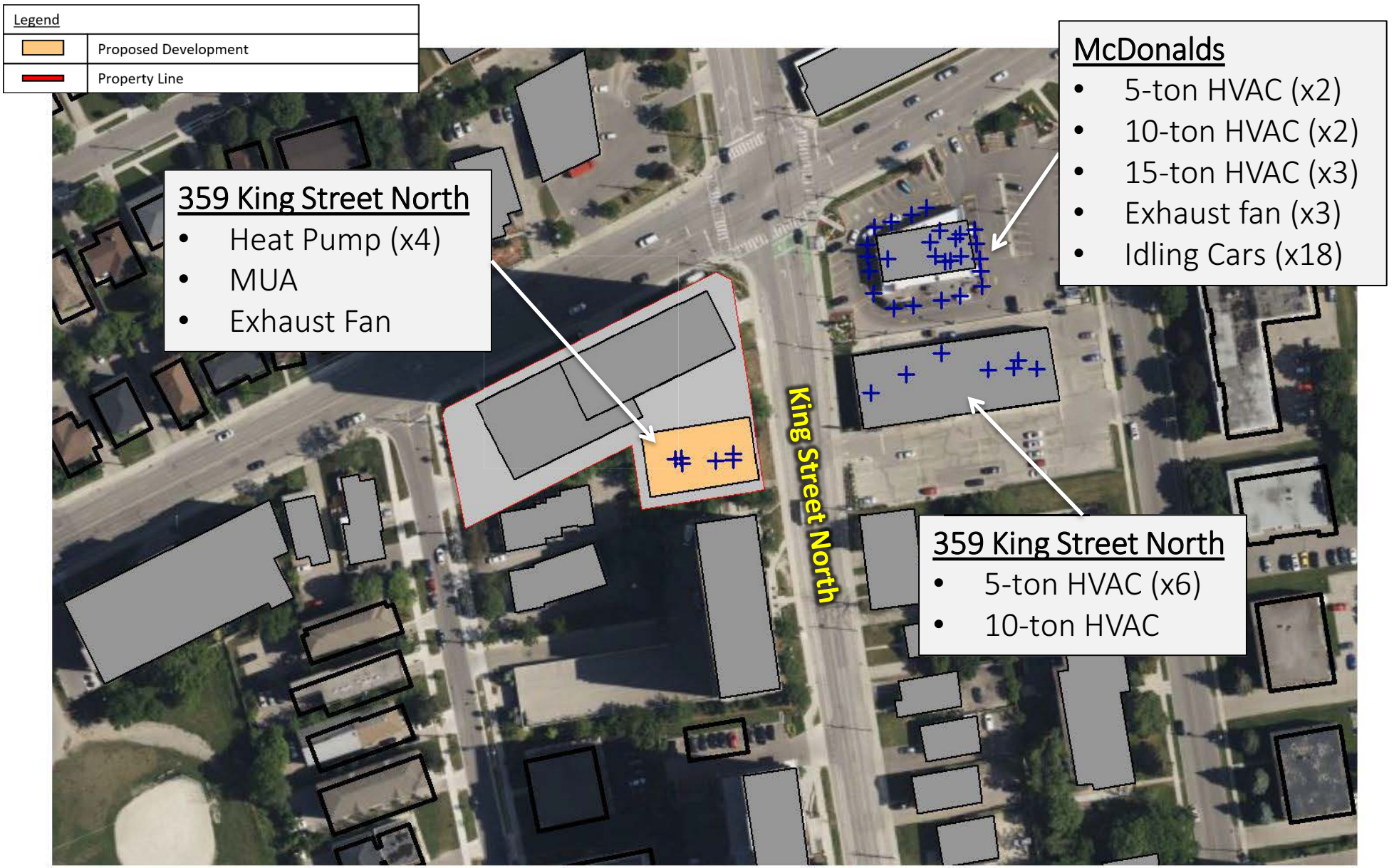
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PREDICTED MINIMUM AMBIENT SOUND LEVELS – DAYTIME		Project No. 241.30640.00000		



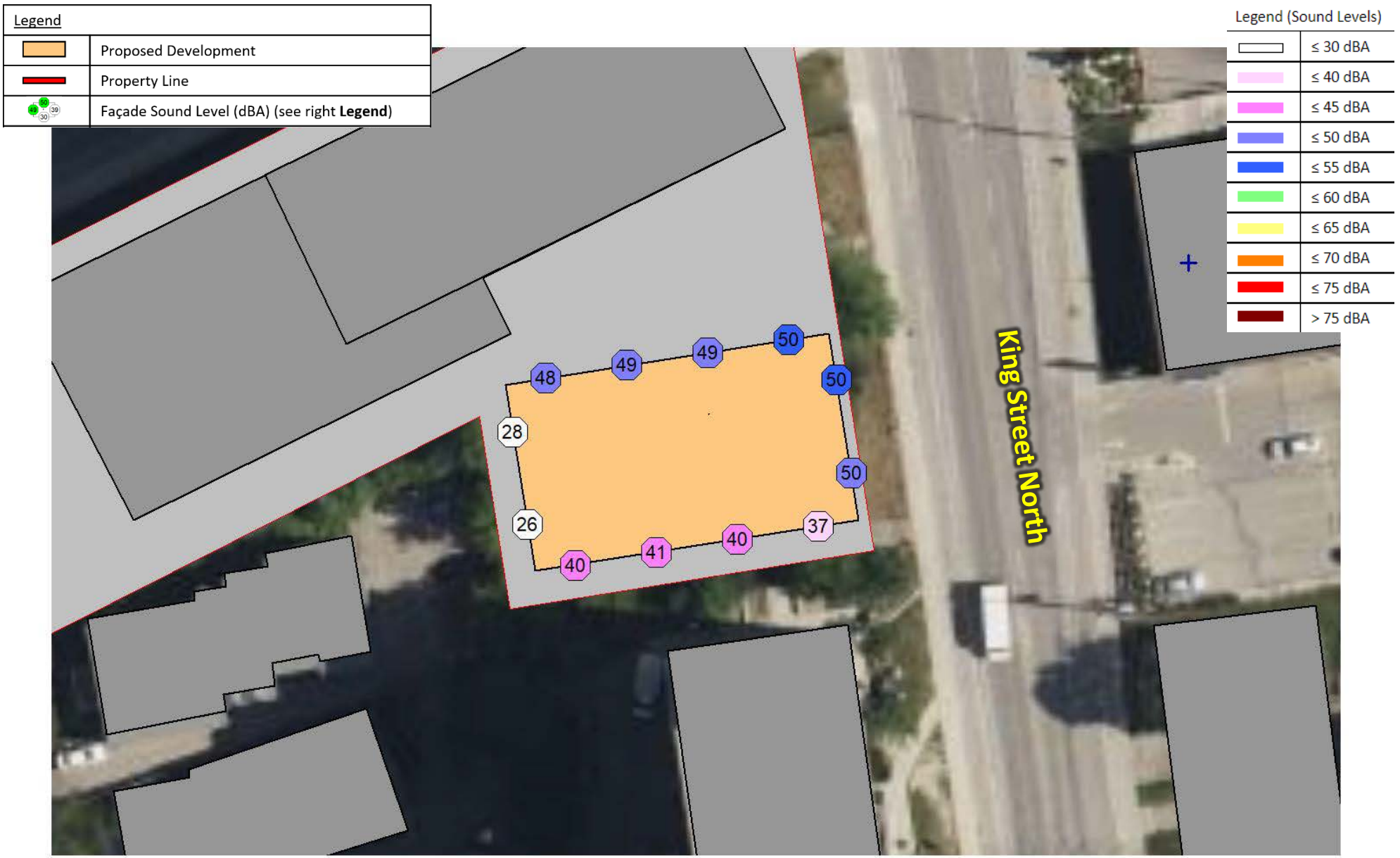
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PREDICTED MINIMUM AMBIENT SOUND LEVELS – EVENING		Project No. 241.30640.00000		



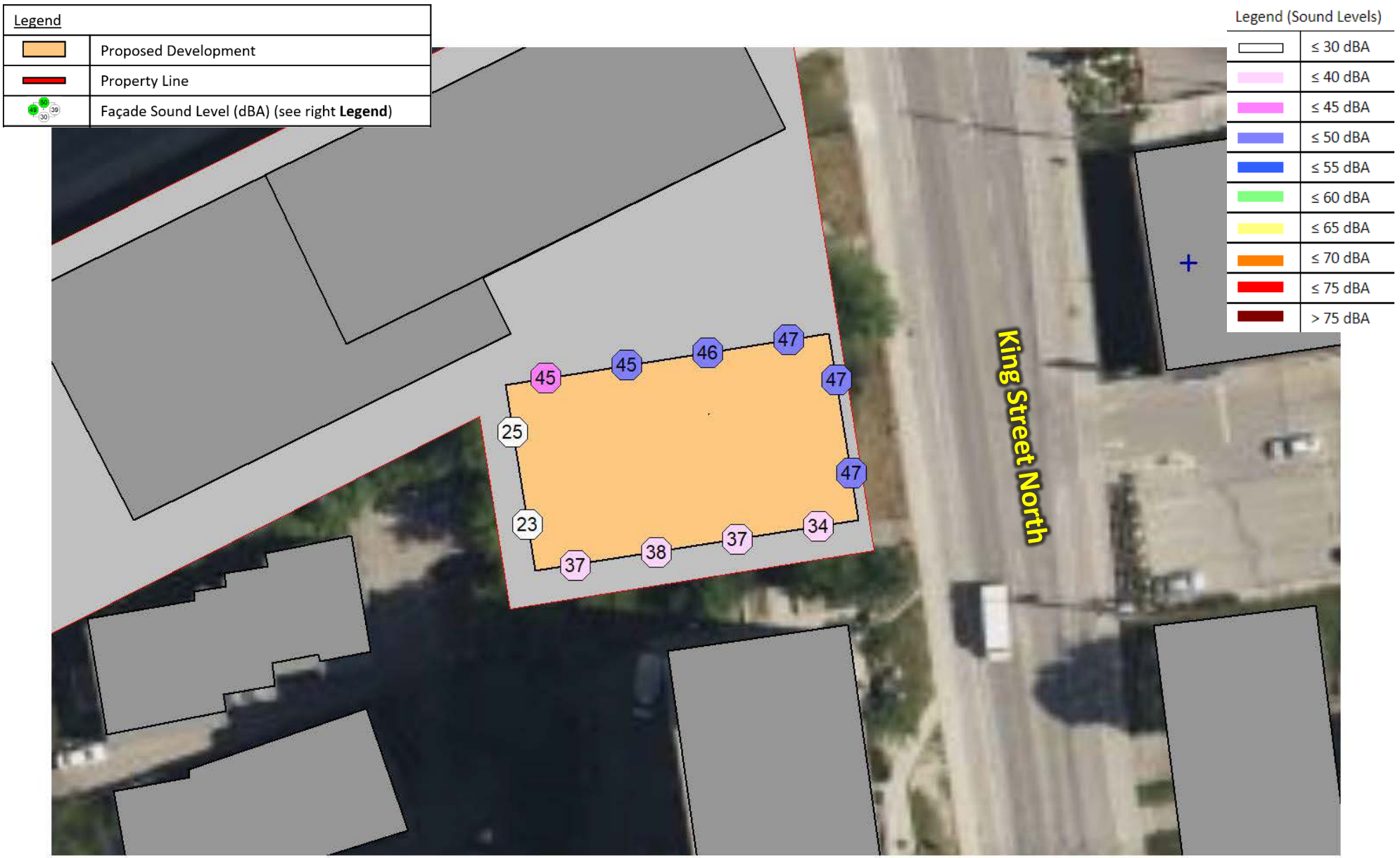
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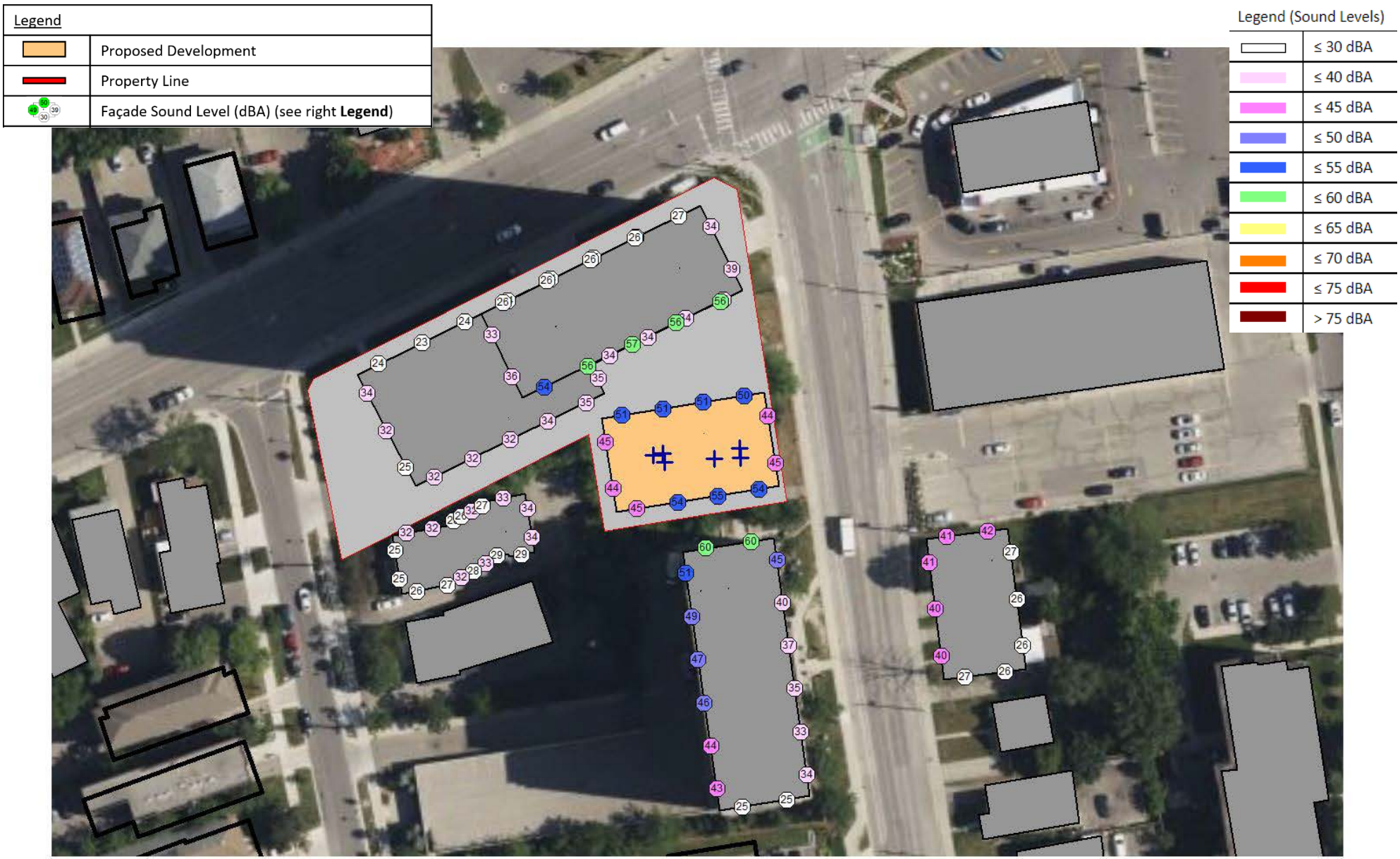
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MODELLED STATIONARY SOURCES		Project No. 241.30640.00000		



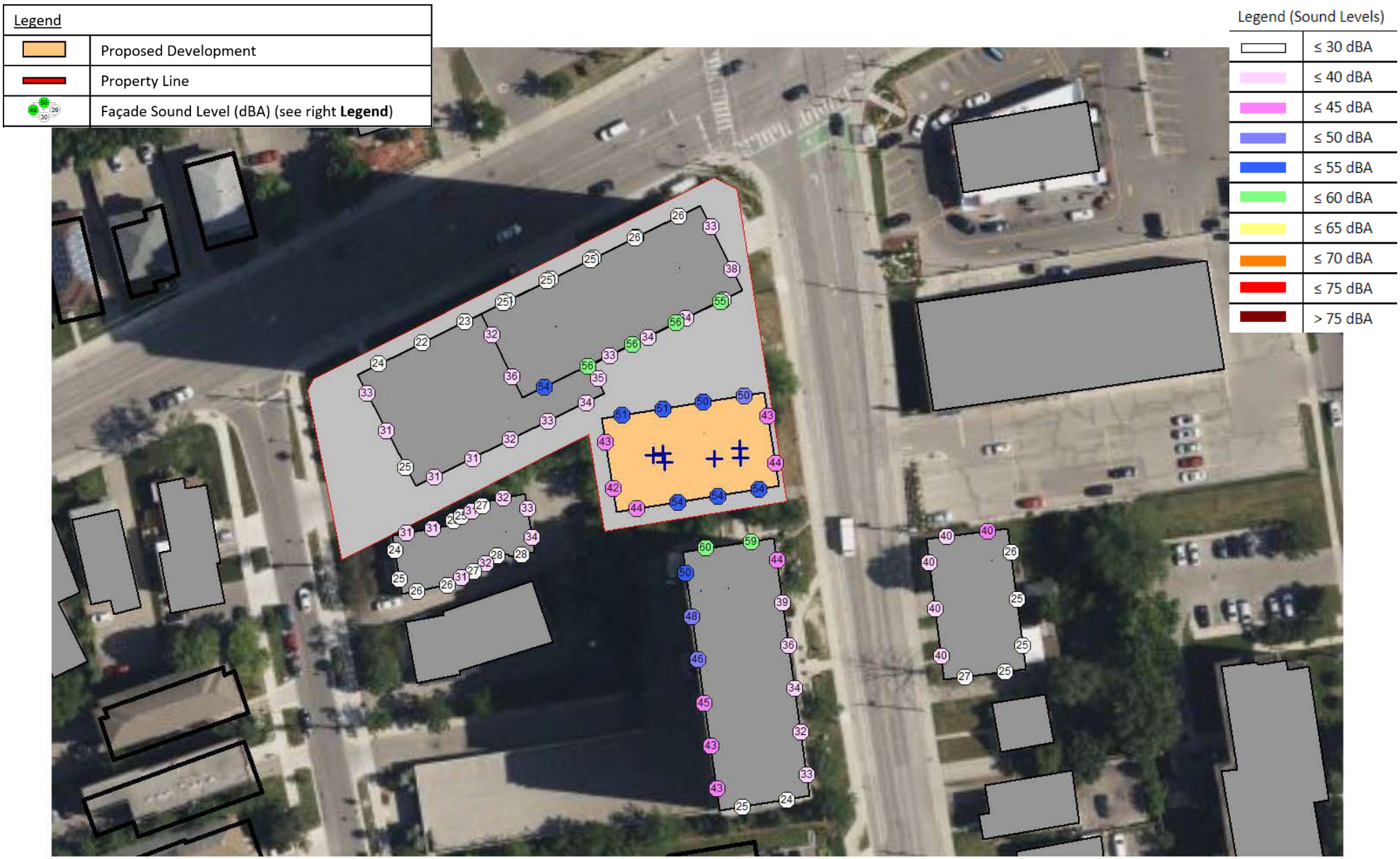
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PREDICTED FAÇADE SOUND LEVELS – STATIONARY SOURCES – DAYTIME/EVENING		Project No. 241.30640.00000		



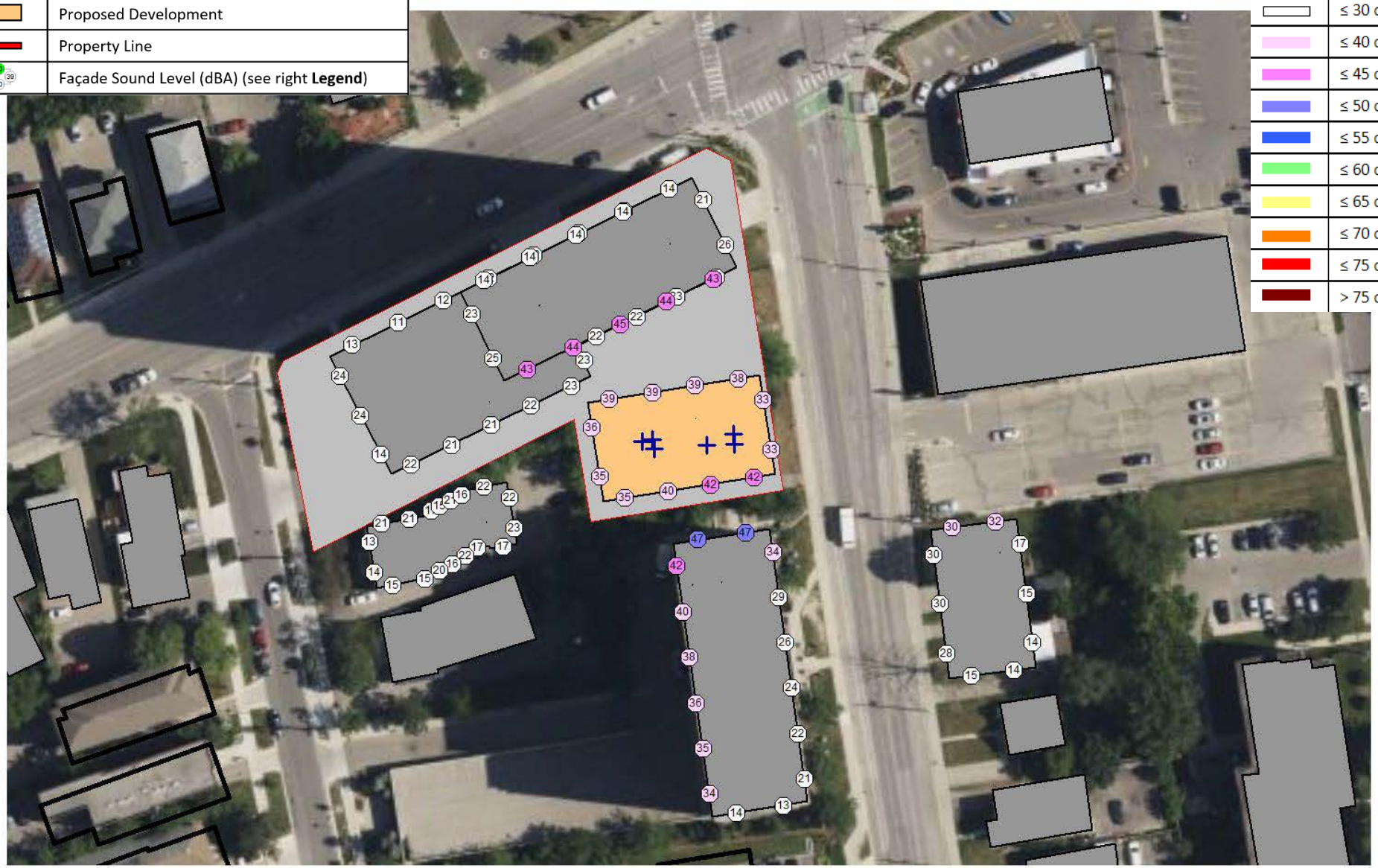
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PREDICTED FAÇADE SOUND LEVELS – STATIONARY SOURCES – NIGHTTIME		Project No. 241.30640.00000		



STUDIO LIMINA INC.	True North	Scale: 1:1000	METRES	SLR
1 COLUMBIA STREET		Date: Oct. 2024 Rev 1.0	Figure No. **8**	
PREDICTED SOUND LEVELS – DEVELOPMENT STATIONARY SOURCES – DAYTIME/EVENING – UNMITIGATED		Project No. 241.30640.00000		



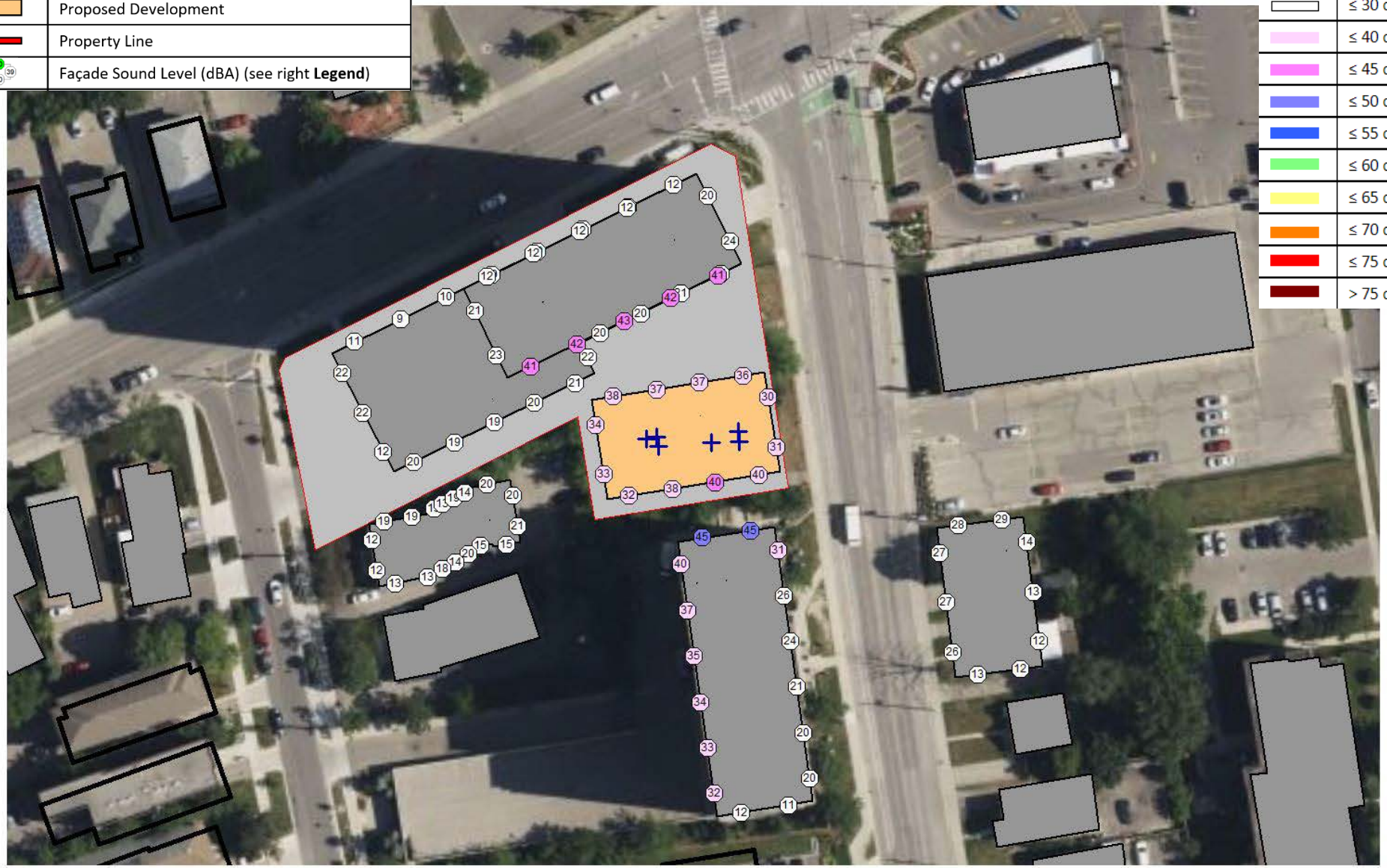
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PREDICTED SOUND LEVELS – DEVELOPMENT STATIONARY SOURCES – NIGHTTIME – UNMITIGATED		Project No. 241.30640.00000		



STUDIO LIMINA INC.	True North	Scale: 1:1000	METRES	SLR
1 COLUMBIA STREET		Date: Oct. 2024 Rev 1.0	Figure No. **10**	
PREDICTED SOUND LEVELS – DEVELOPMENT STATIONARY SOURCES – DAYTIME/EVENING – MITIGATED		Project No. 241.30640.00000		

Legend	
	Proposed Development
	Property Line
	Façade Sound Level (dBA) (see right **Legend**)

Legend (Sound Levels)	
	≤ 30 dBA
	≤ 40 dBA
	≤ 45 dBA
	≤ 50 dBA
	≤ 55 dBA
	≤ 60 dBA
	≤ 65 dBA
	≤ 70 dBA
	≤ 75 dBA
	> 75 dBA



STUDIO LIMINA INC.

1 COLUMBIA STREET

PREDICTED SOUND LEVELS – DEVELOPMENT STATIONARY SOURCES – NIGHTTIME – MITIGATED

True North

Scale: 1:1000 METRES

Date: Oct. 2024 Rev 1.0

Project No. 241.30640.00000

Figure No. **11**

SLR

Appendix A Declaration Statement

Environmental Noise Assessment

1 Columbia Street West, Waterloo, Ontario

Studio Limina Inc.

SLR Project No.: 241.30640.00000

October 21, 2024

CANADA	)	In the Matter of the
	)	Environmental Protection
PROVINCE OF ONTARIO	)	Act and the Planning Act
	)	
	)	
	)	And in the Matter of
	)	1 Columbia Street West
	)	in the City of Waterloo
	)	in the Regional Municipality
	)	of Waterloo

I, Aaron Haniff, P.Eng., of the Town of Guelph in Wellington Region, SOLEMNLY DECLARE THAT:

1. I am a Professional Engineer employed by SLR Consulting Ltd. (Canada), which holds a Certificate of Authorization from the Association of Professional Engineers of Ontario and have personal knowledge of the matters set out below.

2. I was retained or employed as the principal consultant to undertake the assessment of noise impacts and recommendation of noise mitigation measures for the property described as 1 Columbia Street in Waterloo, Ontario.

3. I had the expertise required to perform these services. Any assessment activities or recommendations requiring the application of engineering principles have been undertaken or supervised by an engineer qualified to perform such services.

4. The information used in the study entitled Environmental Noise Assessment - 1 Columbia Street, Waterloo – 241.V30640.00000 dated October 21, 2024, is based on the best information available as of the date of the study.

5. The noise level calculations, the interpretation of noise attenuation requirements, and the recommended measures are in accordance with Ministry of Environment guidelines, Region of Waterloo policies, and any applicable policy or guidelines of the Area Municipality, and any other applicable policy or guideline.

6. The physical noise attenuation measures proposed in this study are feasible to implement and will provide the level of attenuation indicated in the study.

7. I acknowledge that this study may be subject to a peer review conducted at my cost.

8. I acknowledge that public authorities and future owners, occupants and others may rely on this statement.

AND I make this solemn Declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath.

DECLARED remotely by Aaron Haniff)
at the City of Guelph, in the County of)
Wellington, Province of Ontario before me on) _____
this 23 day of October, 2024.)
in accordance with O.Reg 431/20

Administering Oath or Declaration Remotely

Wanda-Lee Harris

A Notary Public

Wanda-Lee Harris, Notary Public,
County of Wellington, limited to the attestation
of instruments and the taking of affidavits,
for SLR Consulting (Canada) Ltd. and
Novus Environmental.
Expires January 14, 2028

WANDA-LEE HARRIS NOTARY PUBLIC ONTARIO

CANADA	)	In the Matter of the
	)	Environmental Protection
PROVINCE OF ONTARIO	)	Act and the Planning Act
	)	
	)	
	)	And in the Matter of
	)	1 Columbia Street West
	)	in the City of Waterloo
	)	in the Regional Municipality
	)	of Waterloo

I, Jack Price of Centurion Property Associates Inc., of the City of Toronto, in the County of _____, SOLEMNLY DECLARE THAT:

1. I am the owner of the property, or the owner's agent, and that I understand and agree with the study entitled Environmental Noise Assessment - 1 Columbia Street West, Waterloo dated October 21, 2024, is based on the best information available as of the date of the study.

2. The application has been designed to avoid the use of berms or walls as noise attenuation features where feasible. Where berms or walls are recommended, the Noise Assessment provides economic, planning and engineering justification.

3. If the application is changed in a way that may affect the noise level calculations, I will have a revised noise study submitted to the Region.

AND I make this solemn Declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath.

Jack Price - VP of Technical Services and Innovation
Centurion Property Associates Inc.

)
)
)
)
)
)



_____

October 21, 2024.

Appendix B Development Drawings

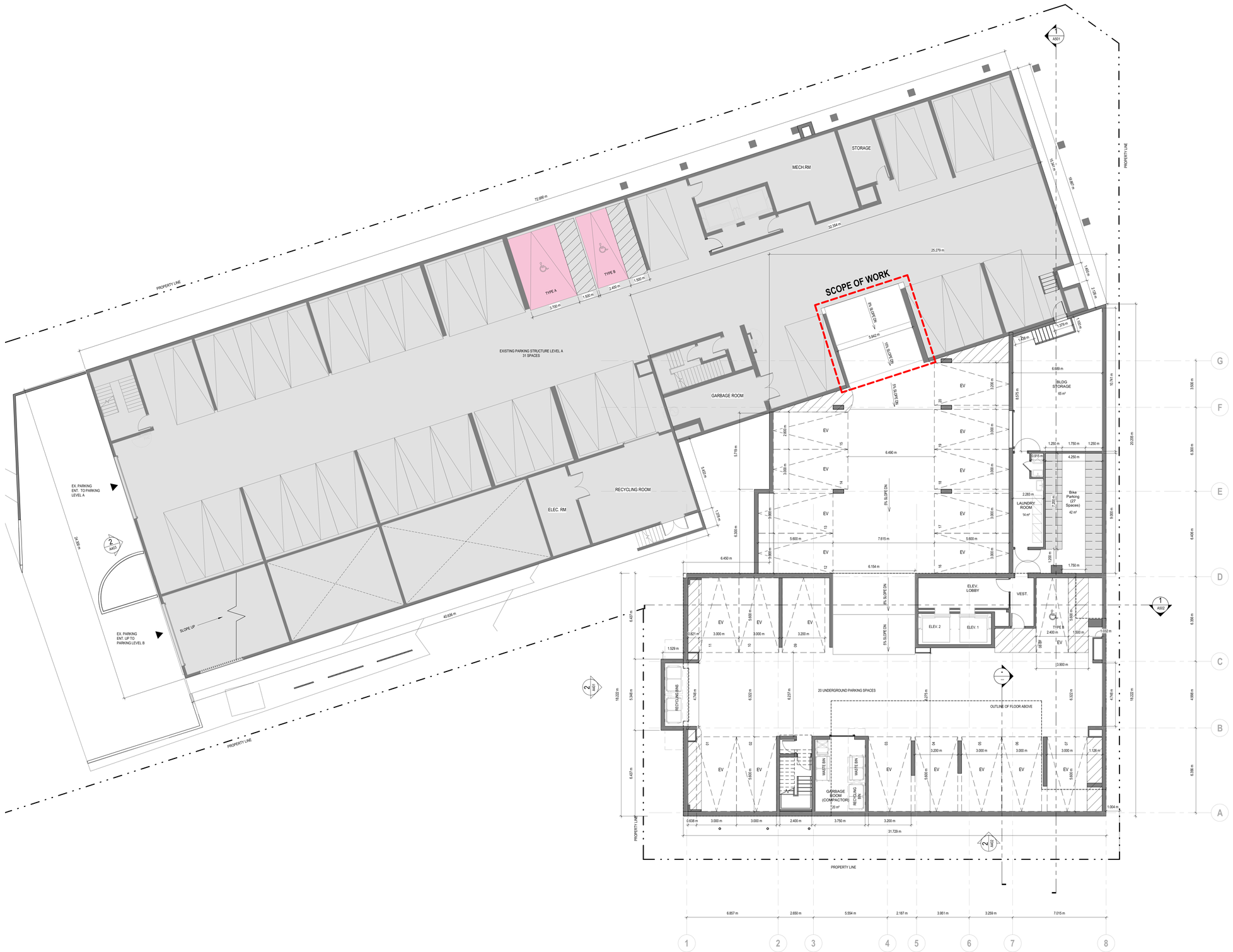
Environmental Noise Assessment

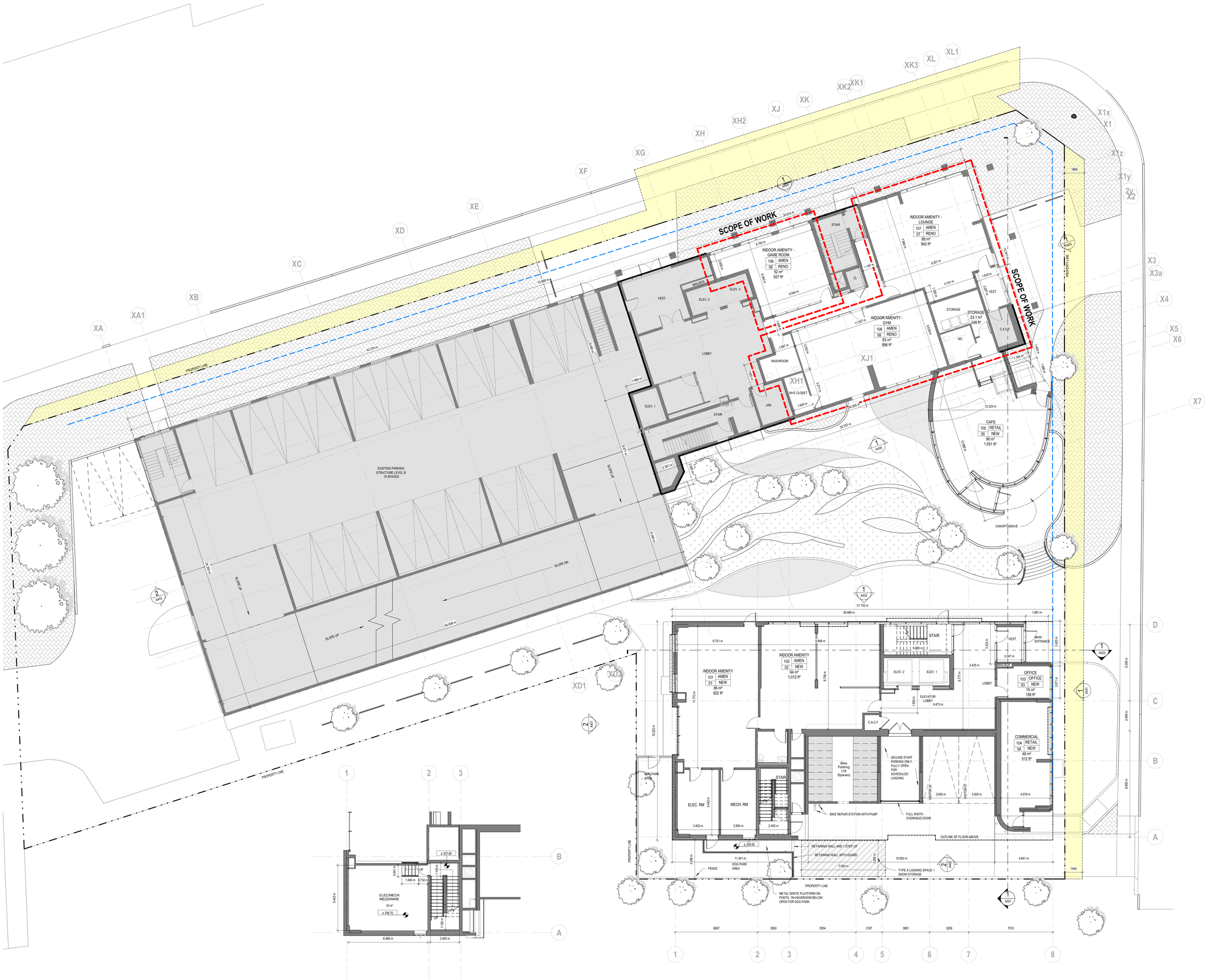
1 Columbia Street West, Waterloo, Ontario

Studio Limina Inc.

SLR Project No.: 241.30640.00000

October 21, 2024


PROPERTY LINE
72.990 m
TYPE A
TYPE B
3.700 m
1.500 m
2.400 m
1.500 m
MECH.RM
STORAGE
31.354 m
25.279 m
SCOPE OF WORK
8% SLOPE DN
6.943 m
10% SLOPE DN
1.329 m
1.400 m
1.738 m
1.200 m
PROPERTY LINE
14.481 m
6.141 m
EXISTING PARKING STRUCTURE LEVEL A
31 SPACES
GARBAGE ROOM
RECYCLING ROOM
ELEC. RM
EX. PARKING
ENT. TO PARKING
LEVEL A
EX. PARKING
ENT. UP TO
PARKING LEVEL B
SLOPE UP
24.987 m
40.626 m
5.437 m
1.195 m
3.179 m
2.600 m
3.000 m
3.000 m
3.000 m
3.000 m
6.300 m
6.490 m
7.615 m
5.600 m
6.154 m
8% SLOPE DN
EV
EV
EV



MEZZANINE 2

REFERENCED FROM 1 / A401 1 : 100

LEVEL 01 1

REFERENCED FROM 1 / A401 1 : 100

bnkc ARCHITECTURE + URBAN DESIGN

410 - 672 Dupont St.,
Toronto, ON, Canada,
M6G 1Z6
T. 416.531.7717
www.bnkc.ca

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This drawing, as an instrument of service, is provided by and is the property of BNKC Architects Inc., and shall be used only for the project named on this drawing and solely for reference purposes only. The contractor is responsible for the coordination and verification of all dimensions contained herein and all measurements and conditions on site as they pertain to these documents. The contractor shall report any discrepancies to the consultant in writing prior to the commencement of any affected work.

DO NOT SCALE THIS DRAWING

This drawing shall not be used for construction purposes unless countersigned

BNKC Architects Inc.

NO.	DATE:	ISSUED FOR:
1	2022.12.20	Site Plan Approval

PLAN LEGEND

- NOT IN SCOPE
- NEW PROPOSED
- SETBACK LINE

DESIGN ARCHITECT
STUDIO LIMINA Inc.
315 - 180 SHAW St., Toronto, ON, Canada, M6J 2W5
T. 416.451.4888

ARCHITECT OF RECORD
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410 - 672 Dupont St., Toronto, ON, Canada, M6G 1Z6
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STRUCTURAL
Blackwell Structural Engineers
31 KING ST. N, 2ND FLOOR,WATERLOO, ONTARIO N2J 2W6
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MECHANICAL + ELECTRICAL
RDZ Engineers Ltd.
30 Pennsylvania Avenue, Unit 17A, Vaughan, ON L4K 4A5
T. 647.674.9656

CLIENT
CENTURION REIT
25 Sheppard Ave W Suite 1800, North York, ON M2N 6S6

ONE COLUMBIA STUDENT RESIDENCE

351/355 King St N, Waterloo, ON N2J 2Z1

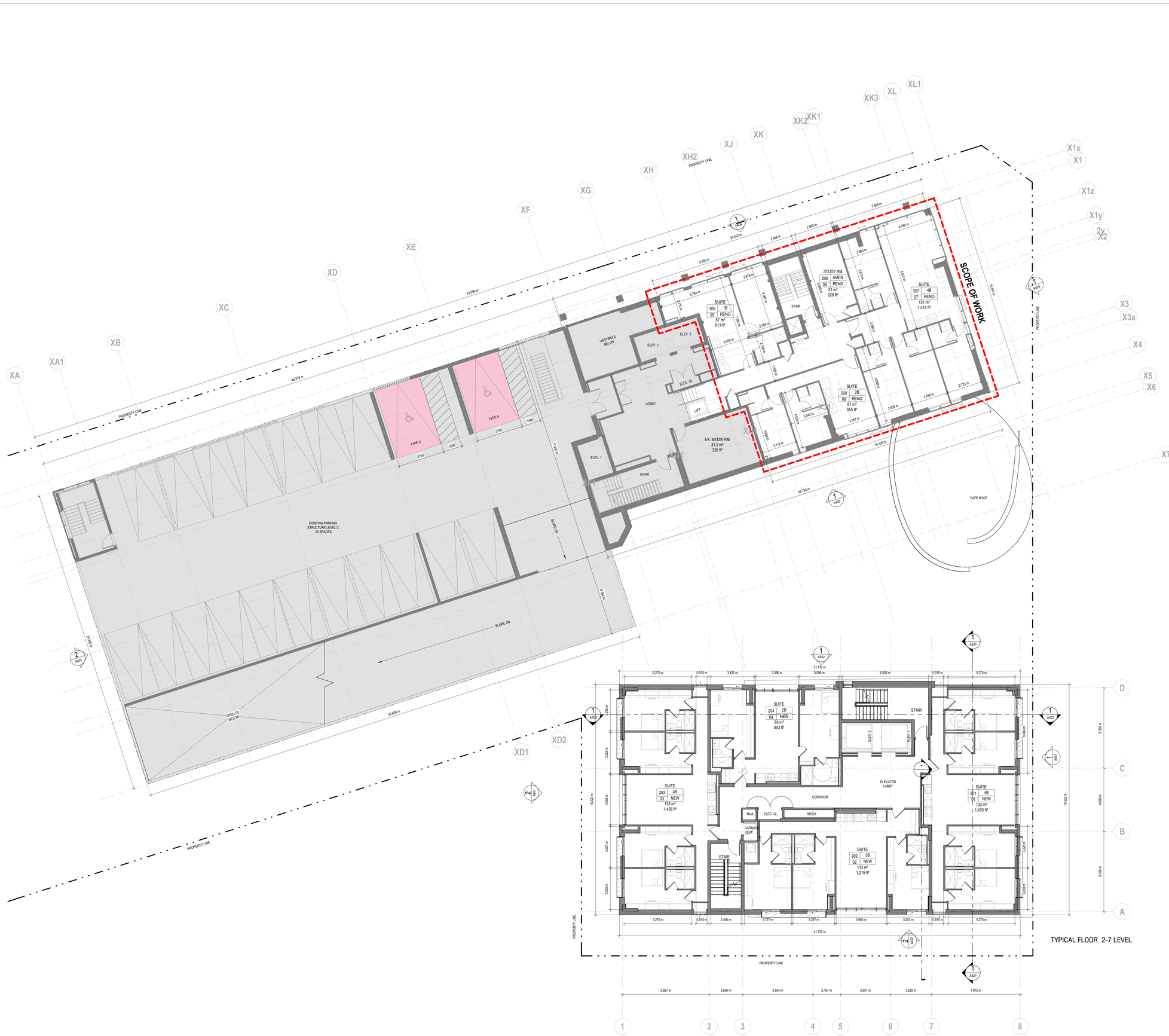
PLAN NORTH

SEAL

LEVEL 01 (GROUND FLOOR)

Author	Checker		
DRAWN BY	CHECKED BY		
22002	As indicated	ARCH E	12/09/22
PROJ NO	SCALE	FORMAT	PLOT DATE

A201



bnkc
ARCHITECTURE + URBAN DESIGN
410 - 672 Dupont St.,
Toronto, ON, Canada,
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SEAL

LEVEL 02

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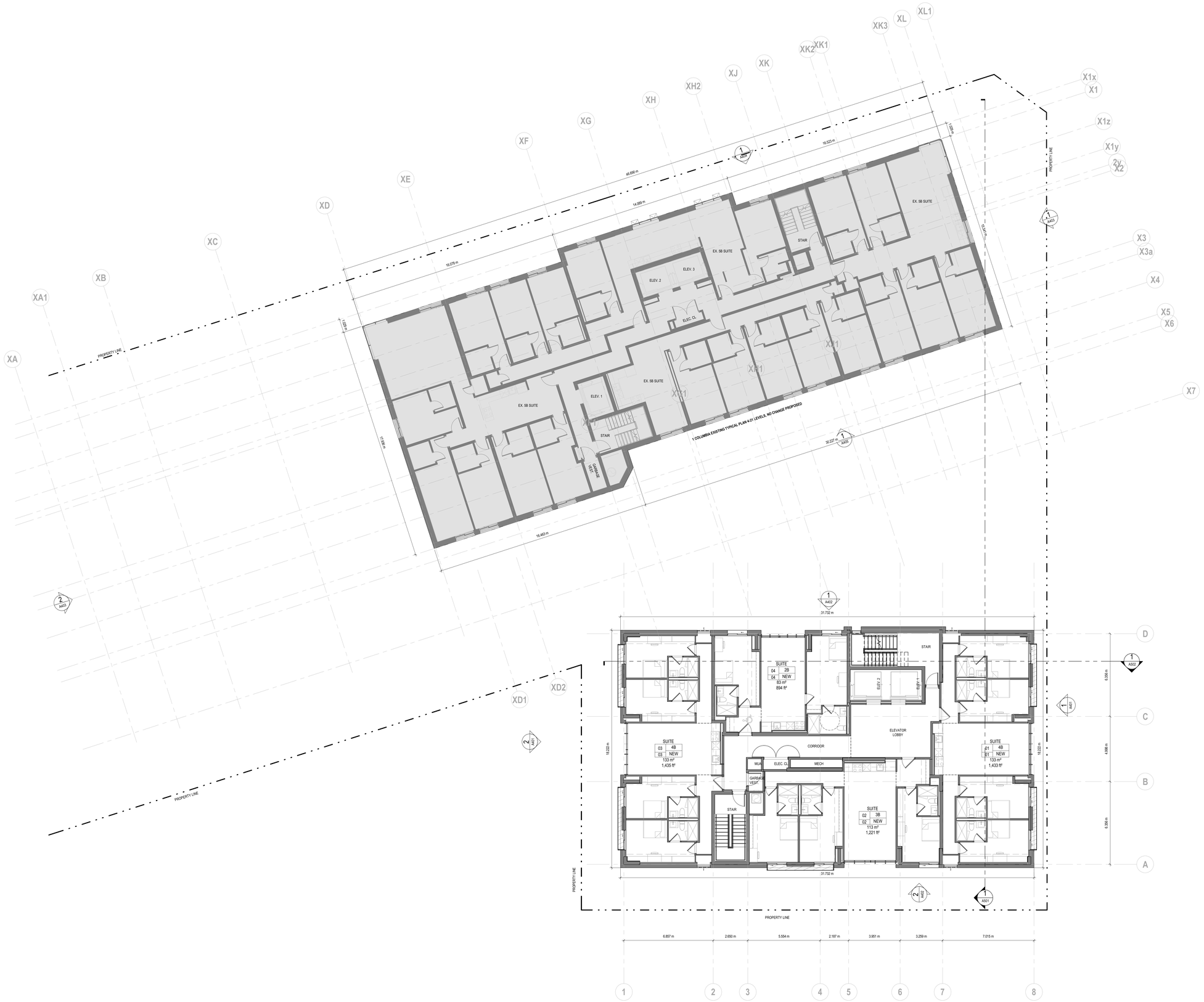
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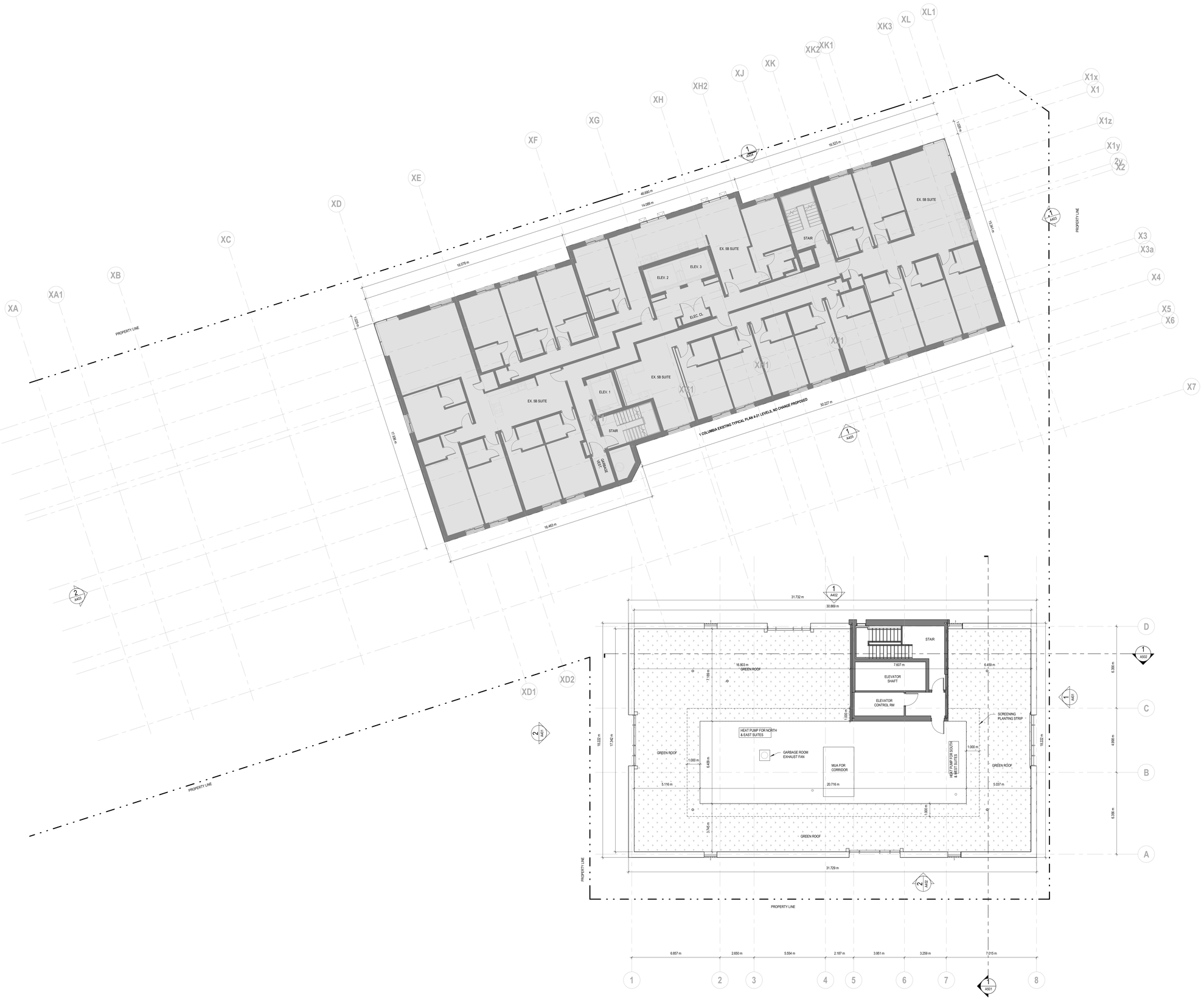
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PLAN NORTH

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1 COLUMBIA
LEVEL 22

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Appendix C Traffic Data and Calculations

Environmental Noise Assessment

1 Columbia Street West, Waterloo, Ontario

Studio Limina Inc.

SLR Project No.: 241.30640.00000

October 21, 2024

Region of Waterloo AADT Forecast for Noise Studies

1. Development/Location

King St N & Columbia St Intersection

2. Current AADT (2022)

South Leg/King St N	West Leg/Columbia St
16,700	22,900

3. Forecast AADT (2032)

South Leg/King St N	West Leg/Columbia St
18,400	25,300

4. Commercial Vehicle Rates

	South Leg/King St N	West Leg/Columbia St
% Medium Trucks	1.3%	1.0%
% Heavy Trucks	1.5%	1.1%

5. Posted Speed Limit

South Leg/King St N	West Leg/Columbia St
50 KM/h	(Check with COW) 50 KM/h

6. Day/Night Splits

Regional Standard 90/10 Day/Night Split

7. Validity Period

December 31st, 2024

8. Notes

This forecast is intended for the purpose of carrying out a noise study only. The above AADTs represent the south and west **Legs** traffic volumes at the intersection of King St N & Columbia St considering King St N is running North - South direction. The City of Waterloo should be contacted to validate the traffic data included in this document for Columbia St as this street falls under the jurisdiction of the City of Waterloo. This forecast remains valid up to the date indicated above. The Region of Waterloo should be contacted for an updated forecast if there are plans to use this forecast beyond the above validity period.

O R N A M E N T - Sound Power Emissions & Source Heights

Ontario Road Noise Analysis Method for Environment and Transportation

Road Segment ID	Roadway Name	Link Description	Speed (kph)	Period (h)	Total Traffic Volumes	Auto %	Med %	Hvy %	Auto	Med	Heavy	Road Gradient (%)	PWL (dBA)	Source Height, s (m)
King_avg	King Street North - NB	Daytime Impacts	50	16	8280	97.2%	1.3%	1.5%	8048	108	124	4	**78.4**	**1.1**
		Nighttime Impacts	50	8	920	97.2%	1.3%	1.5%	894	12	14	4	**71.9**	**1.1**
King_avg	King Street North -SB	Daytime Impacts	50	16	8280	97.2%	1.3%	1.5%	8048	108	124	0	**77.5**	**1.1**
		Nighttime Impacts	50	8	920	97.2%	1.3%	1.5%	894	12	14	0	**71.0**	**1.1**
Columbia_avg	Columbia Street	Daytime Impacts	50	16	22770	97.9%	1.0%	1.1%	22292	228	250	0	**81.3**	**1.0**
		Nighttime Impacts	50	8	2530	97.9%	1.0%	1.1%	2477	25	28	0	**74.8**	**1.0**
King_min	King Street North - NB - Ambient	Daytime Impacts	50	1	359	97.2%	1.3%	1.5%	349	5	5	4	**76.8**	**1.1**
		Nighttime Impacts	50	1	257	97.2%	1.3%	1.5%	250	3	4	4	**75.4**	**1.1**
		Daytime Impacts	50	1	30	97.2%	1.3%	1.5%	29	0	0	4	**66.1**	**1.1**
King_min	King Street North - SB - Ambient	Nighttime Impacts	50	1	359	97.2%	1.3%	1.5%	349	5	5	0	**76.0**	**1.1**
		Daytime Impacts	50	1	257	97.2%	1.3%	1.5%	250	3	4	0	**74.5**	**1.1**
		Nighttime Impacts	50	1	30	97.2%	1.3%	1.5%	29	0	0	0	**65.2**	**1.1**

BPN 56 Calculation Procedure - Required Glazing STC Rating (Fixed Veneer)

ROADWAY

Receptor ID	Source Description	Sound Levels				Room / Façade Inputs					Source Inputs			Veneer - Component	
		Façade Sound Level: (dBA)	Free - field Correction: (dBA)	Required Indoor Sound Level: (dBA)	Required Noise Reduction: (dBA)	Glazing as % of Wall Area	Exposed Wall Height (m)	Exposed Wall Length (m)	Room Depth (m)	Room Absorption:	Incident Sound Angle: (deg)	Angle Correction Factor:	Spectrum type:	Assumed Veneer STC (STC)	Required Glazing STC (STC)
DAYTIME															
East_LR	East Façade Living Room	66	3	45	24	78%	2.7	3.5	6.5	Intermediate	0 - 90	0	D. mixed road traffic, distant aircraft	45	**24**
East_BR	East Façade Bedroom	66	3	45	24	30%	2.7	2.9	2.8	Very Absorptive	0 - 90	0	D. mixed road traffic, distant aircraft	45	**22**
NIGHTTIME															
East_LR	East Façade Living Room	59	3	45	17	78%	2.7	3.5	6.5	Intermediate	0 - 90	0	D. mixed road traffic, distant aircraft	45	**17**
East_BR	East Façade Bedroom	59	3	40	22	30%	2.7	2.9	2.8	Very Absorptive	0 - 90	0	D. mixed road traffic, distant aircraft	45	**20**

Appendix D STAMSON Validation Files

Environmental Noise Assessment

1 Columbia Street West, Waterloo, Ontario

Studio Limina Inc.

SLR Project No.: 241.30640.00000

October 21, 2024

STAMSON 5.0 NORMAL REPORT Date: 19-09-2024 09:09:43
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 1colum2.te Time Period: 16 hours
Description:

Road data, segment # 1: King St - NB

Car traffic volume : 8048 veh/TimePeriod
Medium truck volume : 108 veh/TimePeriod
Heavy truck volume : 124 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 4 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: King St - NB

Angle1 Angle2 : -85.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 26.60 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑
Road data, segment # 2: King St - SB

Car traffic volume : 8048 veh/TimePeriod
Medium truck volume : 108 veh/TimePeriod
Heavy truck volume : 124 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: King St - SB

Angle1 Angle2 : -85.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 16.80 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑
Road data, segment # 3: Columbia St.

Car traffic volume : 22292 veh/TimePeriod

```
Medium truck volume :   228 veh/TimePeriod
Heavy truck volume  :   250 veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 3: Columbia St.
---------------------------------
Angle1   Angle2           :  45.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  54.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

↟
Results segment # 1: King St - NB
---------------------------------

Source height = 1.11 m

ROAD (0.00 + 57.18 + 0.00) = 57.18 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -85      0   0.00  62.92   0.00  -2.49  -3.26   0.00   0.00   0.00  57.18
-------------------------------------------------------------------------------

Segment Leq : 57.18 dBA

↟
Results segment # 2: King St - SB
---------------------------------

Source height = 1.11 m

ROAD (0.00 + 58.71 + 0.00) = 58.71 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -85      0   0.00  62.46   0.00  -0.49  -3.26   0.00   0.00   0.00  58.71
-------------------------------------------------------------------------------

Segment Leq : 58.71 dBA

↟
Results segment # 3: Columbia St.
---------------------------------

Source height = 1.02 m

ROAD (0.00 + 54.63 + 0.00) = 54.63 dBA
```

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
45	90	0.00	66.22	0.00	-5.56	-6.02	0.00	0.00	0.00	54.63

Segment Leq : 54.63 dBA

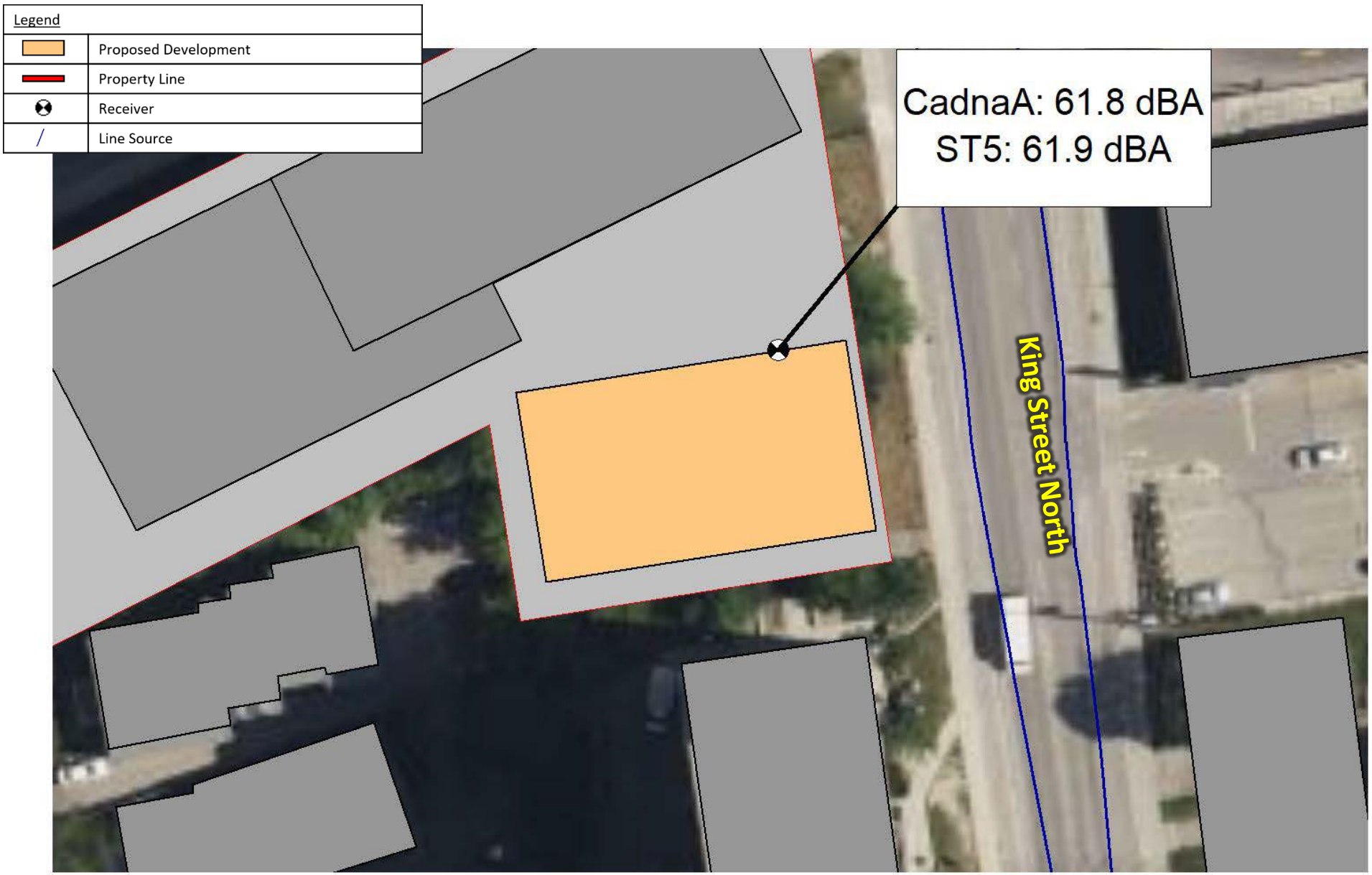
Total Leq All Segments: 61.92 dBA

↟

TOTAL Leq FROM ALL SOURCES: 61.92

↟

↟



STUDIO LIMINA INC.	True North	Scale: 1:500	METRES	SLR
1 COLUMBIA STREET		Date: Oct. 2024 Rev 1.0	Figure No. **D.1**	
STAMSON VS. CADNAA VALIDATION		Project No. 241.30640.00000		

Appendix E Ventilation, Warning Clause and Barrier Summary

Environmental Noise Assessment

1 Columbia Street West, Waterloo, Ontario

Studio Limina Inc.

SLR Project No.: 241.30640.00000

October 21, 2024

Ventilation, Warning Clause and Barrier Summary

The following Warning Clauses are recommended for inclusion in agreements registered on Title for the residential units, and included in all agreements of purchase and sale or lease, and all rental agreements.

A summary of the Warning Clause and Ventilation Requirements is included in **Table E.1** below.

> **MECP Type C Warning Clause:** "This unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."
>
> **MECP Type C Warning Clause** : "This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."
>
> **MECP Type E Warning Clause:** "Purchasers/tenants are advised that due to the proximity of adjacent industries, noise from these facilities may at times be audible."

Table E.1: Summary of Ventilation, Warning Clause, and Barrier Requirements

Residential Units/Locations	Barrier Required?	Air Conditioning Requirement [1]	Warning Clauses
North and South Façades	No	Provision for AC	Type C, Type E
East Façade	No	Requirement for AC	Type D
West Façade	No	No	Type E

Notes: [1] Provision for AC = forced air heating with a provision for installation of central air conditioning.

Appendix F Modelled Stationary Sources

Environmental Noise Assessment

1 Columbia Street West, Waterloo, Ontario

Studio Limina Inc.

SLR Project No.: 241.30640.00000

October 21, 2024

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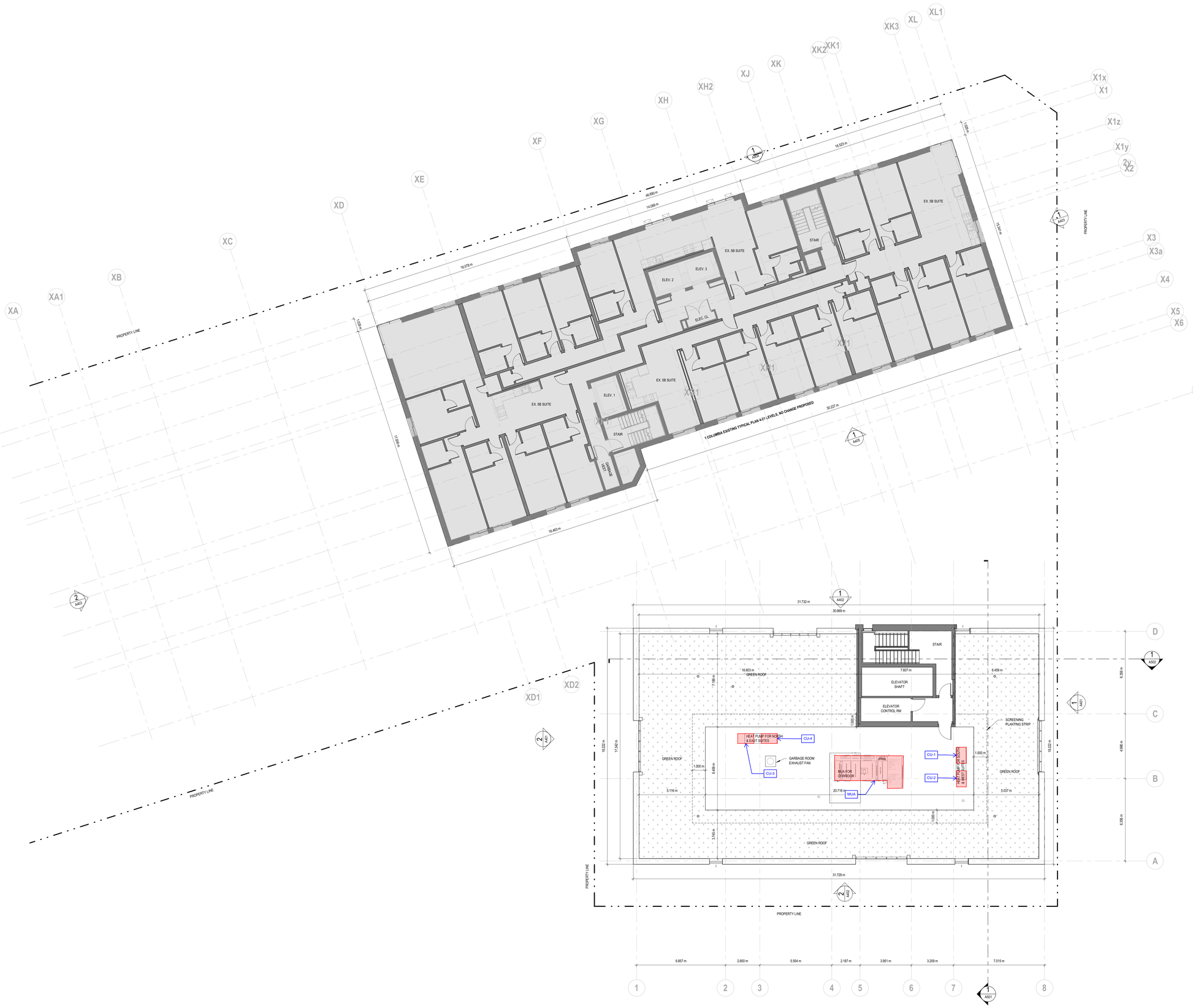
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EngA ENGINEERED AIR

4/5

Unit Sound Data

August 2, 2024

JOB NAME: Queensville Elementary

JOB NUMBER: C4-29-29

INSTALLATION:

UNIT TAG: RTU-3 New RTU-2

UNIT CONSTRUCTION: FWEH103/DJS20/O/MV

CASING METAL:	18 ga	INSULATION DEPTH:	2 in
LINER METAL:	22 Thru-out	INSULATION DENSITY	1.5 lbs /cu.ft.

SOUND SOURCE DATA:

Blower	Make	Type	Size	Qty	Total CFM	TSP ("wc)	Speed (rpm)	BHP (hp)		Sound Power Data 63	125	250	500	1000	2000	4000	8000
S/A	TwinCity	BAE DIDW	122	2	3000	4.2	3297	2.98	Inlet	83	84	87	91	84	82	77	71
									Outlet	91	90	88	89	86	84	78	72
R/A	Lau	FC DIDW	12/12	1	3000	2.6	954	1.2	Inlet	84	82	77	76	77	74	72	70
									Outlet	84	82	77	76	77	74	72	70

OTHER SOURCE SOUND DATA:

Other Sources	Make	Model/Size	Qty	Operating condition	63	125	250	500	1000	2000	4000	8000
Compressor	Emerson	ZP38K5E	3		59.7	49.6	56.2	60.5	63.1	60.2	60.9	59.8
Cond. Fan	LAU	0.75	2	82dBA	78.9	83.5	78.2	78.3	79.3	72.5	65	50.6

UNIT S/A OUTLET:

CENTER FREQUENCY (Hz)	63	125	250	500	1000	2000	4000	8000	A-weighted
SOUND POWER Lw (dB)	86.9	90.8	88.8	88.8	85.8	83.8	76.5	70.8	91.0

UNIT R/A INLET:

CENTER FREQUENCY (Hz)	63	125	250	500	1000	2000	4000	8000	A-weighted
SOUND POWER Lw (dB)	81.4	85.4	86.2	88.9	82.9	80.7	75.0	70.8	89.3

UNIT CASING *:

CENTER FREQUENCY (Hz)	63	125	250	500	1000	2000	4000	8000	A-weighted
SOUND POWER Lw (dB)	84.4	87.0	81.9	82.0	82.5	75.9	70.1	65.0	85.5

* Unit casing sound includes casing breakout and sound sources outside the air streams only. Sound from openings are not included in unit casing sound.

Note:
Unit sound data are calculated for the specified unit construction and operating condition as shown above.

Job Name/Location: **Tag #:**

Date: CU-1

PO No.

For: ☐ File ☐ Resubmit ☐ Approval ☐ Other

Architect: GC:

Engr: Mech:

Rep:
(Company) (Project Manager)



ARUM216CTE5

Multi V™ 5 Single Frame 575V
18.0 Ton Outdoor Unit for Heat Pump and Heat Recovery

LG Life's Good

Performance:

Cooling Mode:

Nominal Capacity (Btu/h)	216,000
Power Input[1] (kW)	15.37

Heating Mode:

Nominal Capacity (Btu/h)	243,000
Power Input[1] (kW)	17.75

Nominal Capacity is outside the scope of AHRI Standard 1230 and based on the following conditions:

Indoor: 80°F DB / 67°F WB Indoor: 70°F DB

Outdoor 95°F DB Outdoor 47°F DB / 43°F WB

Electrical:

Power Supply (V/Hz/Ø)	575/60/3
MOP (A)	53.8
MCA (A)	38.3
Rated Amps (A)	34.4
Compressor A (A)	15.5
Compressor B (A)	13.9
Fan (A)	5.0

Piping:

Refrigerant Charge (lbs)	37.5
Liquid Line (in, OD)	5/8 Braze
Low Pressure Vapor Line (in,	1-1/8 Braze
High Pressure Vapor Line (in, OD) (HR Only)	1-1/8 Braze

Standard Features:

- Advanced Smart Load Control
- Intelligent Heating
- HiPOR (high pressure oil return)
- Smart Oil Control
- Night Quiet Operation
- Fault Detection and Diagnosis
- Active Refrigerant Control
- Variable Path Heat Exchanger
- Subcooling and Vapor Injection Control
- Liquid Cooled Inverter Controller

Optional Accessories:

☐ Air Guide - ZAGDKA52A (1 required)

☐ Low Ambient Baffle Kit - ZLABKA52A (1), Control Kit - PRVC2 (1 per system)

☐ Hail Guard Kit - ZHGDKA52A (1 Required)

Operating Range:

Cooling (˚F DB)**	5-122
Heating (˚F WB)	-22 - 61
Synchronous Operation - Cooling Based	14 - 81
Synchronous Operation - Heating Based	14 - 61

Unit Data:

Refrigerant Type	R410A
Refrigerant Control	EEV
Max Number of Indoor Units[2]	35
Sound Pressure[3] dB(A)	64.0
Net Unit Weight (lbs)	681
Shipping Weight (lbs)	709
Communication Cable[4] (No x AWG)	2 x 18
Heat Exchanger Coating	Black Coated Fin™

Compressor:

Type	HSS DC Scroll
Quantity	2
Oil/Type	PVE/FVC68D

Fan:

Type	Propeller
Quantity	2
Motor/Drive	Brushless Digitally Controlled/Direct
Air Flow Rate (CFM)	11,300

Notes:

1. For AHRI ratings, refer to the AHRI website http://www.ahridirectory.org.
2. The combination ratio must be between 50 – 130%.
3. Sound Pressure levels are tested in an anechoic chamber under ISO Standard 3745.
4. Communication cable between ODU and IDU(s) must be 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the Master ODU chassis only. Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.
5. Nominal data is rated 0 ft above sea level, with 25 ft of refrigerant line per indoor unit and a 0 ft level difference between outdoor and indoor units.
All capacities are net with a combination ratio between 95-105%.
6. Power wiring cable size must comply with the applicable local and national code.
7. The voltage tolerance is +/- 10%.

C SA US Inverter

AHRI CERTIFIED® www.ahridirectory.org
Variable Refrigerant Flow (VRF) Multi-Split AC and HP
AHRI Standard 1230

****Cooling operating range can be extended to -13˚F if the optional low ambient baffle kit and low ambient control kit are installed.This is the range in which the unit can operate as continuous operation.**

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Job Name/Location:

ARUM216CTE5

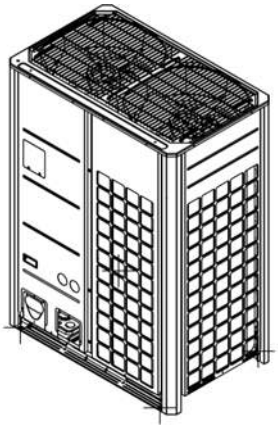
Multi V™ 5 Single Frame 575V

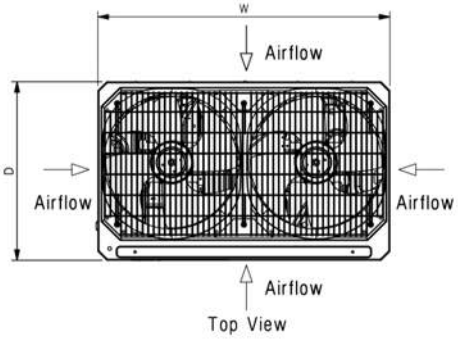
18.0 Ton Outdoor Unit for Heat Pump and Heat Recovery

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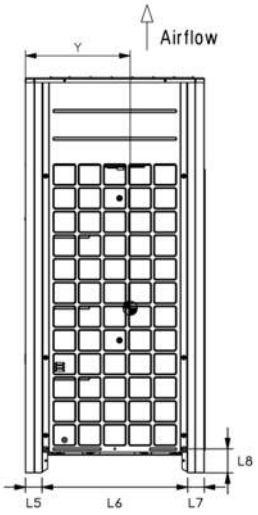
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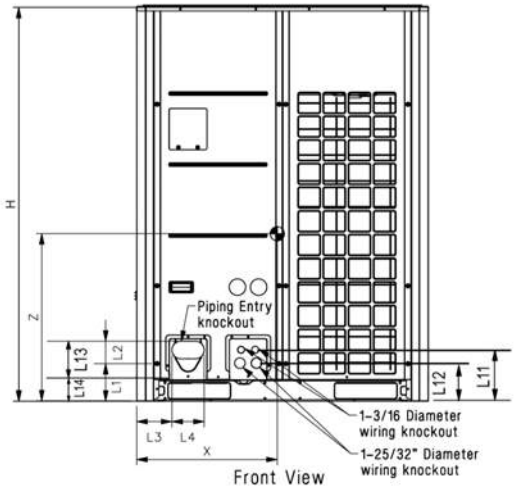




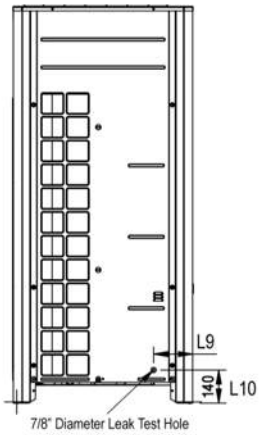
Top View



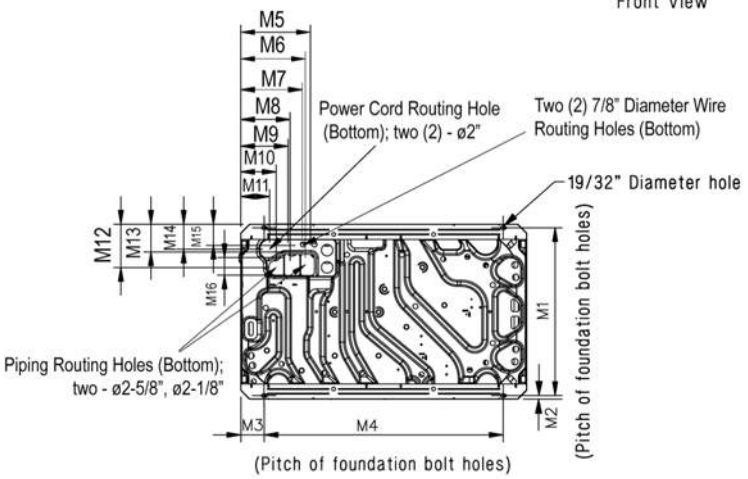
Right Side View



Front View



Left Side View



Bottom Mounting Holes

M1	28-25/32"
M2	5/8"
M3	3-15/16"
M4	40-15/16"
M5	11 – 15/16"
M6	11 – 1/16"
M7	10 – 1/2"
M8	8 – 7/16"
M9	8 – 1/8"
M10	6 – 1/16"
M11	4 – 15/16"
M12	7 – 1/2"
M13	4 – 13/16"
M14	4 – 5/16"
M15	3 – 5/8"
M16	3"

W	48-13/16"
H	66-17/32"
D	29-29/32"
L1	6-5/16"
L2	3-3/4"
L3	5-29/32"
L4	5-13/32"
L5	2-25/32"
L6	24-9/32"
L7	2-25/32"
L8	4-1/32"
L9	6 – 1/2"
L10	5 – 9/16"
L11	8 – 5/8"
L12	6 – 7/16"
L13	9 – 15/16"
L14	3 – 5/8"

Center of Gravity

X	23-7/32"
Y	15-5/8"
Z	25-9/16"

All dimensions have a tolerance of ±0.25 in.

[Unit: inch]

= Center of Gravity

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Job Name/Location: **Tag #:**

Date: CU-2

PO No.

For: ☐ File ☐ Resubmit ☐ Approval ☐ Other

Architect: GC:

Engr: Mech:

Rep:
(Company) (Project Manager)



ARUM192CTE5
Multi V™ 5 Single Frame 575V
16.0 Ton Outdoor Unit for Heat Pump and Heat Recovery

LG Life's Good

Performance:

Cooling Mode:

Nominal Capacity (Btu/h)	192,000
Power Input[1] (kW)	13.61

Heating Mode:

Nominal Capacity (Btu/h)	216,000
Power Input[1] (kW)	15.46

Nominal Capacity is outside the scope of AHRI Standard 1230 and based on the following conditions:
Indoor: 80°F DB / 67°F WB Indoor: 70°F DB
Outdoor 95°F DB Outdoor 47°F DB / 43°F WB

Electrical:

Power Supply (V/Hz/Ø)	575/60/3
MOP (A)	50.5
MCA (A)	35.7
Rated Amps (A)	32.0
Compressor A (A)	14.8
Compressor B (A)	12.2
Fan (A)	5.0

Piping:

Refrigerant Charge (lbs)	30.9
Liquid Line (in, OD)	5/8 Braze
Low Pressure Vapor Line (in,	1-1/8 Braze
High Pressure Vapor Line (in, OD) (HR Only)	1-1/8 Braze

Standard Features:

- Advanced Smart Load Control
- Intelligent Heating
- HiPOR (high pressure oil return)
- Smart Oil Control
- Night Quiet Operation
- Fault Detection and Diagnosis
- Active Refrigerant Control
- Variable Path Heat Exchanger
- Subcooling and Vapor Injection Control
- Liquid Cooled Inverter Controller

Optional Accessories:

☐ Air Guide - ZAGDKA52A (1 required)

☐ Low Ambient Baffle Kit - ZLABKA52A (1), Control Kit - PRVC2 (1 per system)

☐ Hail Guard Kit - ZHGDKA52A (1 Required)

Operating Range:

Cooling (˚F DB)**	5-122
Heating (˚F WB)	-22 - 61
Synchronous Operation - Cooling Based	14 - 81
Synchronous Operation - Heating Based	14 - 61

Unit Data:

Refrigerant Type	R410A
Refrigerant Control	EEV
Max Number of Indoor Units[2]	32
Sound Pressure[3] dB(A)	62.0
Net Unit Weight (lbs)	675
Shipping Weight (lbs)	704
Communication Cable[4] (No x AWG)	2 x 18
Heat Exchanger Coating	Black Coated Fin™

Compressor:

Type	HSS DC Scroll
Quantity	2
Oil/Type	PVE/FVC68D

Fan:

Type	Propeller
Quantity	2
Motor/Drive	Brushless Digitally Controlled/Direct
Air Flow Rate (CFM)	11,300

Notes:

1. For AHRI ratings, refer to the AHRI website http://www.ahridirectory.org.
2. The combination ratio must be between 50 – 130%.
3. Sound Pressure levels are tested in an anechoic chamber under ISO Standard 3745.
4. Communication cable between ODU and IDU(s) must be 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the Master ODU chassis only. Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.
5. Nominal data is rated 0 ft above sea level, with 25 ft of refrigerant line per indoor unit and a 0 ft level difference between outdoor and indoor units.
All capacities are net with a combination ratio between 95-105%.
6. Power wiring cable size must comply with the applicable local and national code.
7. The voltage tolerance is +/- 10%.

C SA US Inverter

AHRI CERTIFIED® www.ahridirectory.org
Variable Refrigerant Flow (VRF) Multi-Split AC and HP AHRI Standard 1230

****Cooling operating range can be extended to -13˚F if the optional low ambient baffle kit and low ambient control kit are installed.This is the range in which the unit can operate as continuous operation.**

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Job Name/Location:

ARUM192CTE5

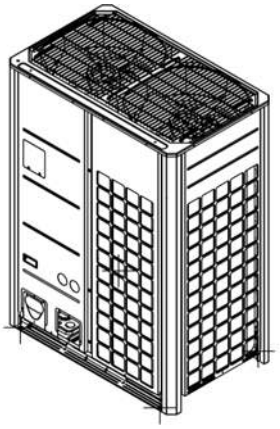
Multi V™ 5 Single Frame 575V

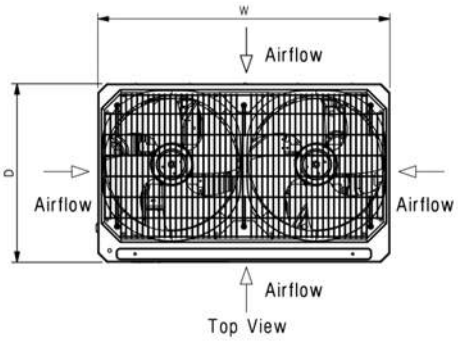
16.0 Ton Outdoor Unit for Heat Pump and Heat Recovery

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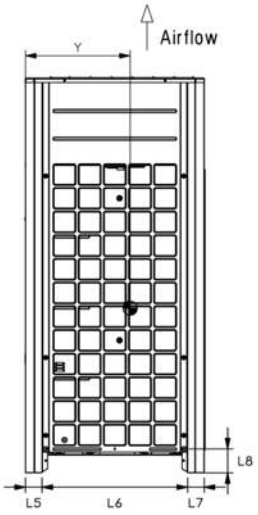
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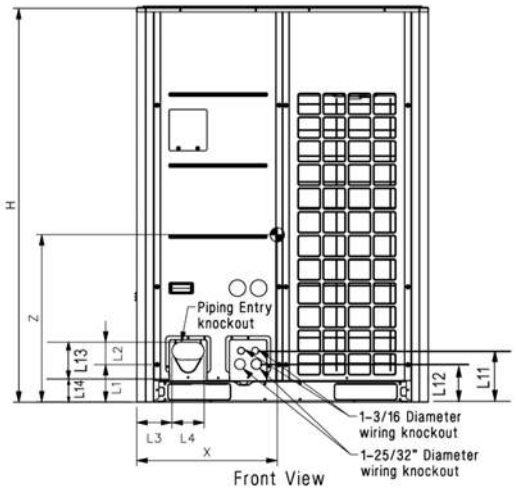




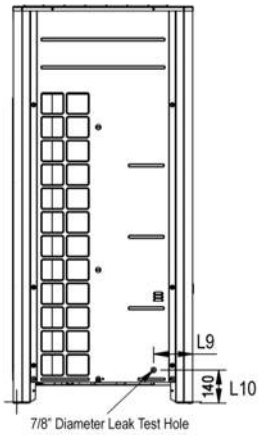
Top View



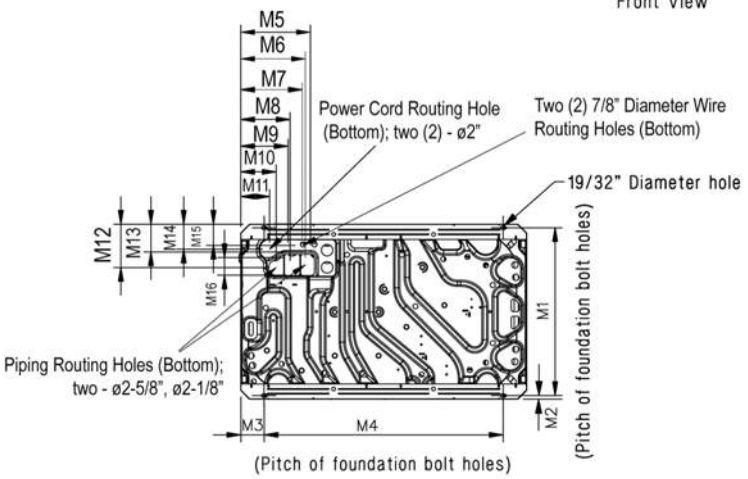
Right Side View



Front View



Left Side View



Bottom Mounting Holes

M1	28-25/32"
M2	5/8"
M3	3-15/16"
M4	40-15/16"
M5	11 – 15/16"
M6	11 – 1/16"
M7	10 – 1/2"
M8	8 – 7/16"
M9	8 – 1/8"
M10	6 – 1/16"
M11	4 – 15/16"
M12	7 – 1/2"
M13	4 – 13/16"
M14	4 – 5/16"
M15	3 – 5/8"
M16	3"

W	48-13/16"
H	66-17/32"
D	29-29/32"
L1	6-5/16"
L2	3-3/4"
L3	5-29/32"
L4	5-13/32"
L5	2-25/32"
L6	24-9/32"
L7	2-25/32"
L8	4-1/32"
L9	6 – 1/2"
L10	5 – 9/16"
L11	8 – 5/8"
L12	6 – 7/16"
L13	9 – 15/16"
L14	3 – 5/8"

Center of Gravity

X	23-7/32"
Y	15-5/8"
Z	25-9/16"

All dimensions have a tolerance of ±0.25 in.

[Unit: inch]

= Center of Gravity

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Job Name/Location: **Tag #:**

Date: CU-3

PO No.

For: ☐ File ☐ Resubmit ☐ Approval ☐ Other

Architect: GC:

Engr: Mech:

Rep:
(Company) (Project Manager)



ARUM216CTE5

Multi V™ 5 Single Frame 575V
18.0 Ton Outdoor Unit for Heat Pump and Heat Recovery

LG Life's Good

Performance:

Cooling Mode:

Nominal Capacity (Btu/h)	216,000
Power Input[1] (kW)	15.37

Heating Mode:

Nominal Capacity (Btu/h)	243,000
Power Input[1] (kW)	17.75

Nominal Capacity is outside the scope of AHRI Standard 1230 and based on the following conditions:

Indoor: 80°F DB / 67°F WB Indoor: 70°F DB

Outdoor 95°F DB Outdoor 47°F DB / 43°F WB

Electrical:

Power Supply (V/Hz/Ø)	575/60/3
MOP (A)	53.8
MCA (A)	38.3
Rated Amps (A)	34.4
Compressor A (A)	15.5
Compressor B (A)	13.9
Fan (A)	5.0

Piping:

Refrigerant Charge (lbs)	37.5
Liquid Line (in, OD)	5/8 Braze
Low Pressure Vapor Line (in,	1-1/8 Braze
High Pressure Vapor Line (in, OD) (HR Only)	1-1/8 Braze

Standard Features:

- Advanced Smart Load Control
- Intelligent Heating
- HiPOR (high pressure oil return)
- Smart Oil Control
- Night Quiet Operation
- Fault Detection and Diagnosis
- Active Refrigerant Control
- Variable Path Heat Exchanger
- Subcooling and Vapor Injection Control
- Liquid Cooled Inverter Controller

Optional Accessories:

☐ Air Guide - ZAGDKA52A (1 required)

☐ Low Ambient Baffle Kit - ZLABKA52A (1), Control Kit - PRVC2 (1 per system)

☐ Hail Guard Kit - ZHGDKA52A (1 Required)

Operating Range:

Cooling (˚F DB)**	5-122
Heating (˚F WB)	-22 - 61
Synchronous Operation - Cooling Based	14 - 81
Synchronous Operation - Heating Based	14 - 61

Unit Data:

Refrigerant Type	R410A
Refrigerant Control	EEV
Max Number of Indoor Units[2]	35
Sound Pressure[3] dB(A)	64.0
Net Unit Weight (lbs)	681
Shipping Weight (lbs)	709
Communication Cable[4] (No x AWG)	2 x 18
Heat Exchanger Coating	Black Coated Fin™

Compressor:

Type	HSS DC Scroll
Quantity	2
Oil/Type	PVE/FVC68D

Fan:

Type	Propeller
Quantity	2
Motor/Drive	Brushless Digitally Controlled/Direct
Air Flow Rate (CFM)	11,300

Notes:

1. For AHRI ratings, refer to the AHRI website http://www.ahridirectory.org.
2. The combination ratio must be between 50 – 130%.
3. Sound Pressure levels are tested in an anechoic chamber under ISO Standard 3745.
4. Communication cable between ODU and IDU(s) must be 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the Master ODU chassis only. Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.
5. Nominal data is rated 0 ft above sea level, with 25 ft of refrigerant line per indoor unit and a 0 ft level difference between outdoor and indoor units.
All capacities are net with a combination ratio between 95-105%.
6. Power wiring cable size must comply with the applicable local and national code.
7. The voltage tolerance is +/- 10%.

C SA US Inverter

AHRI CERTIFIED® www.ahridirectory.org
Variable Refrigerant Flow (VRF) Multi-Split AC and HP
AHRI Standard 1230

****Cooling operating range can be extended to -13˚F if the optional low ambient baffle kit and low ambient control kit are installed.This is the range in which the unit can operate as continuous operation.**

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Job Name/Location:

ARUM216CTE5

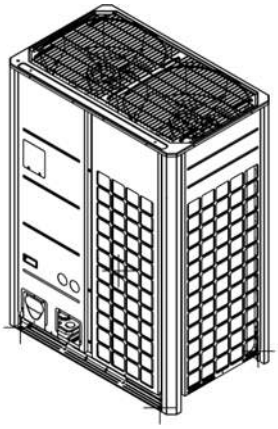
Multi V™ 5 Single Frame 575V

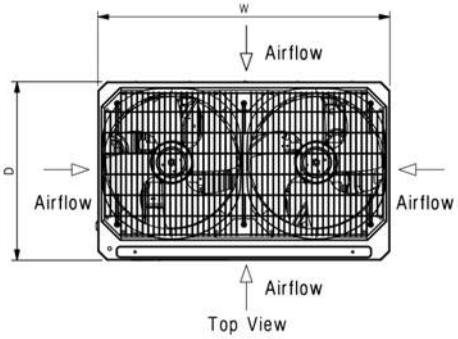
18.0 Ton Outdoor Unit for Heat Pump and Heat Recovery

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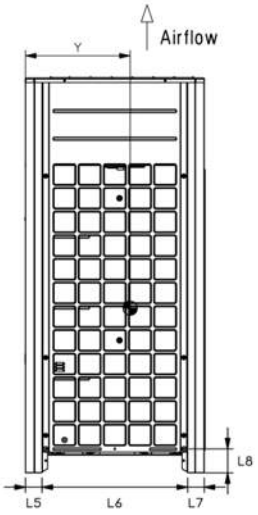
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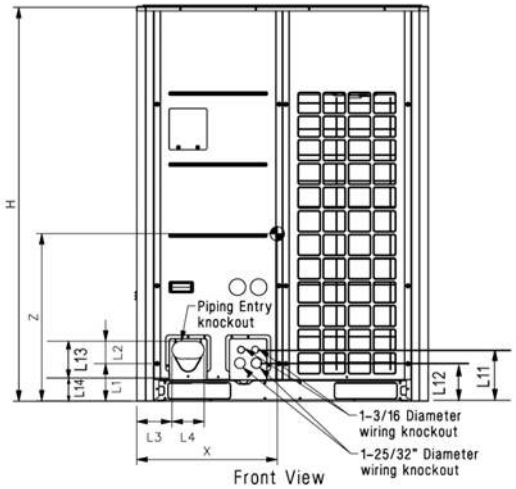




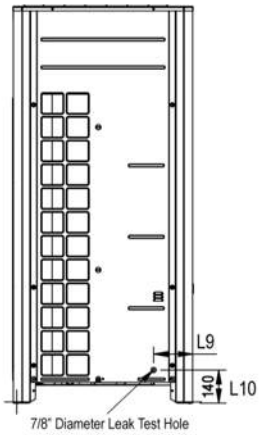
Top View



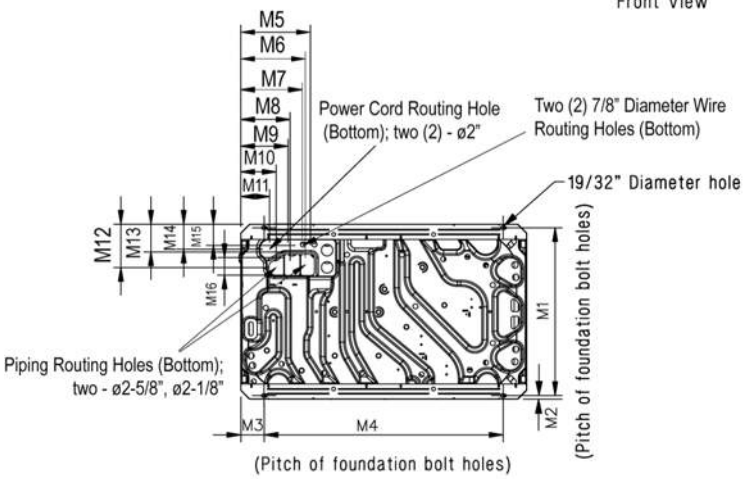
Right Side View



Front View



Left Side View



Bottom Mounting Holes

M1	28-25/32"
M2	5/8"
M3	3-15/16"
M4	40-15/16"
M5	11 – 15/16"
M6	11 – 1/16"
M7	10 – 1/2"
M8	8 – 7/16"
M9	8 – 1/8"
M10	6 – 1/16"
M11	4 – 15/16"
M12	7 – 1/2"
M13	4 – 13/16"
M14	4 – 5/16"
M15	3 – 5/8"
M16	3"

W	48-13/16"
H	66-17/32"
D	29-29/32"
L1	6-5/16"
L2	3-3/4"
L3	5-29/32"
L4	5-13/32"
L5	2-25/32"
L6	24-9/32"
L7	2-25/32"
L8	4-1/32"
L9	6 – 1/2"
L10	5 – 9/16"
L11	8 – 5/8"
L12	6 – 7/16"
L13	9 – 15/16"
L14	3 – 5/8"

Center of Gravity

X	23-7/32"
Y	15-5/8"
Z	25-9/16"

All dimensions have a tolerance of ±0.25 in.

[Unit: inch]

= Center of Gravity

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Job Name/Location: **Tag #:**

Date: For: ☐ File ☐ Resubmit ☐ Approval ☐ Other

PO No.:

Architect: GC:

Engr: Mech:

Rep:
(Company) (Project Manager)



ARUM144CTE5

Multi V™ 5 Single Frame 575V
12.0 Ton Outdoor Unit for Heat Pump and Heat Recovery

LG Life's Good

Performance:

Cooling Mode:

Nominal Capacity (Btu/h)	144,000
Power Input[1] (kW)	9.30

Heating Mode:

Nominal Capacity (Btu/h)	162,000
Power Input[1] (kW)	10.54

Nominal Capacity is outside the scope of AHRI Standard 1230 and based on the following conditions:
Indoor: 80°F DB / 67°F WB Indoor: 70°F DB
Outdoor 95°F DB Outdoor 47°F DB / 43°F WB

Electrical:

Power Supply (V/Hz/Ø)	575/60/3
MOP (A)	36.7
MCA (A)	26.4
Rated Amps (A)	23.8
Compressor A (A)	10.3
Compressor B (A)	8.5
Fan (A)	5.0

Piping:

Refrigerant Charge (lbs)	26.5
Liquid Line (in, OD)	1/2 Braze
Low Pressure Vapor Line (in,	1-1/8 Braze
High Pressure Vapor Line (in, OD) (HR Only)	7/8 Braze

Standard Features:

- Advanced Smart Load Control
- Intelligent Heating
- HiPOR (high pressure oil return)
- Smart Oil Control
- Night Quiet Operation
- Fault Detection and Diagnosis
- Active Refrigerant Control
- Variable Path Heat Exchanger
- Subcooling and Vapor Injection Control
- Liquid Cooled Inverter Controller

Optional Accessories:

☐ Air Guide - ZAGDKA52A (1 required)

☐ Low Ambient Baffle Kit - ZLABKA52A (1), Control Kit - PRVC2 (1 per system)

☐ Hail Guard Kit - ZHGDKA52A (1 Required)

Operating Range:

Cooling (˚F DB)**	5-122
Heating (˚F WB)	-22 - 61
Synchronous Operation - Cooling Based	14 - 81
Synchronous Operation - Heating Based	14 - 61

Unit Data:

Refrigerant Type	R410A
Refrigerant Control	EEV
Max Number of Indoor Units[2]	24
Sound Pressure[3] dB(A)	60.0
Net Unit Weight (lbs)	655
Shipping Weight (lbs)	682
Communication Cable[4] (No x AWG)	2 x 18
Heat Exchanger Coating	Black Coated Fin™

Compressor:

Type	HSS DC Scroll
Quantity	2
Oil/Type	PVE/FVC68D

Fan:

Type	Propeller
Quantity	2
Motor/Drive	Brushless Digitally Controlled/Direct
Air Flow Rate (CFM)	11,300

Notes:

1. For AHRI ratings, refer to the AHRI website http://www.ahridirectory.org.
2. The combination ratio must be between 50 – 130%.
3. Sound Pressure levels are tested in an anechoic chamber under ISO Standard 3745.
4. Communication cable between ODU and IDU(s) must be 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the Master ODU chassis only. Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.
5. Nominal data is rated 0 ft above sea level, with 25 ft of refrigerant line per indoor unit and a 0 ft level difference between outdoor and indoor units.
All capacities are net with a combination ratio between 95-105%.
6. Power wiring cable size must comply with the applicable local and national code.
7. The voltage tolerance is +/- 10%.

C US Inverter

AHRI CERTIFIED® www.ahridirectory.org
Variable Refrigerant Flow (VRF) Multi-Split AC and HP
AHRI Standard 1230

****Cooling operating range can be extended to -13˚F if the optional low ambient baffle kit and low ambient control kit are installed.This is the range in which the unit can operate as continuous operation.**

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Job Name/Location:

ARUM144CTE5

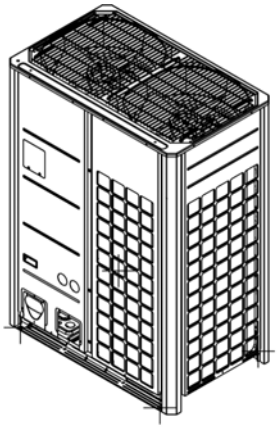
Multi V™ 5 Single Frame 575V

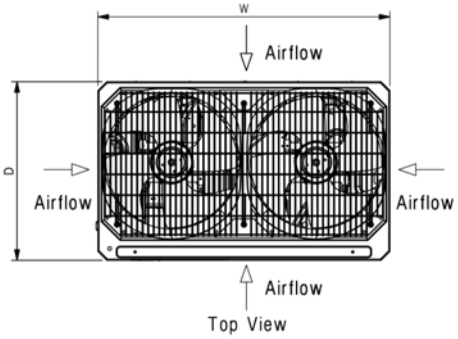
12.0 Ton Outdoor Unit for Heat Pump and Heat Recovery

Tag #:

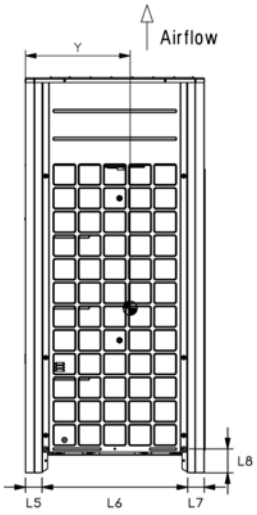
Date:

PO No.:

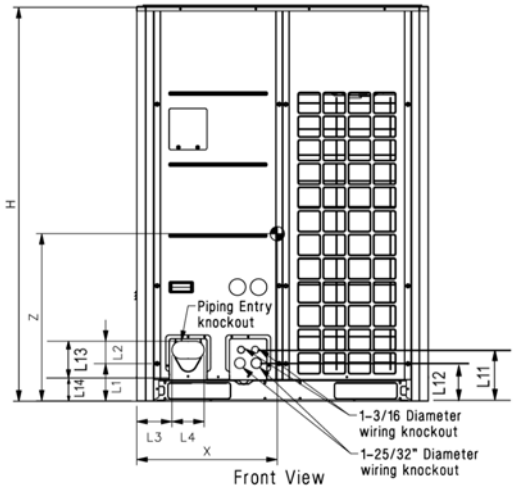




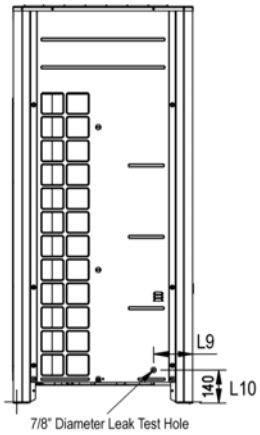
Top View



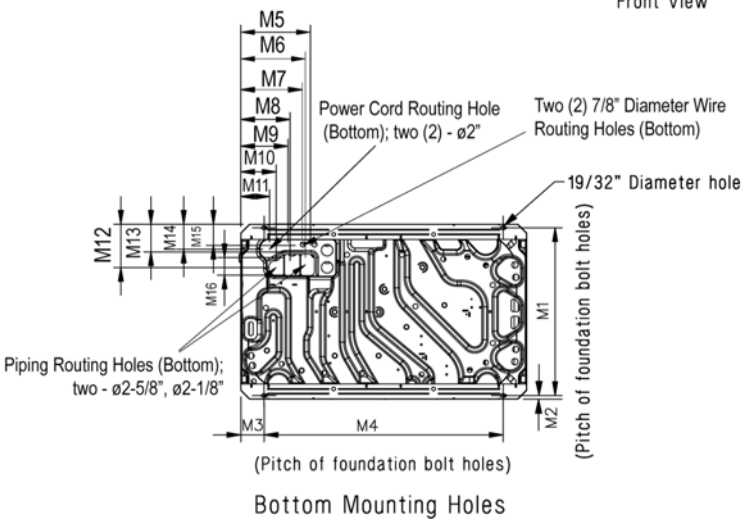
Right Side View



Front View



Left Side View



Bottom Mounting Holes

M1	28–25/32"
M2	5/8"
M3	3–15/16"
M4	40–15/16"
M5	11 – 15/16"
M6	11 – 1/16"
M7	10 – 1/2"
M8	8 – 7/16"
M9	8 – 1/8"
M10	6 – 1/16"
M11	4 – 15/16"
M12	7 – 1/2"
M13	4 – 13/16"
M14	4 – 5/16"
M15	3 – 5/8"
M16	3"

W	48–13/16"
H	66–17/32"
D	29–29/32"
L1	6–5/16"
L2	3–3/4"
L3	5–29/32"
L4	5–13/32"
L5	2–25/32"
L6	24–9/32"
L7	2–25/32"
L8	4–1/32"
L9	6 – 1/2"
L10	5 – 9/16"
L11	8 – 5/8"
L12	6 – 7/16"
L13	9 – 15/16"
L14	3 – 5/8"

Center of Gravity

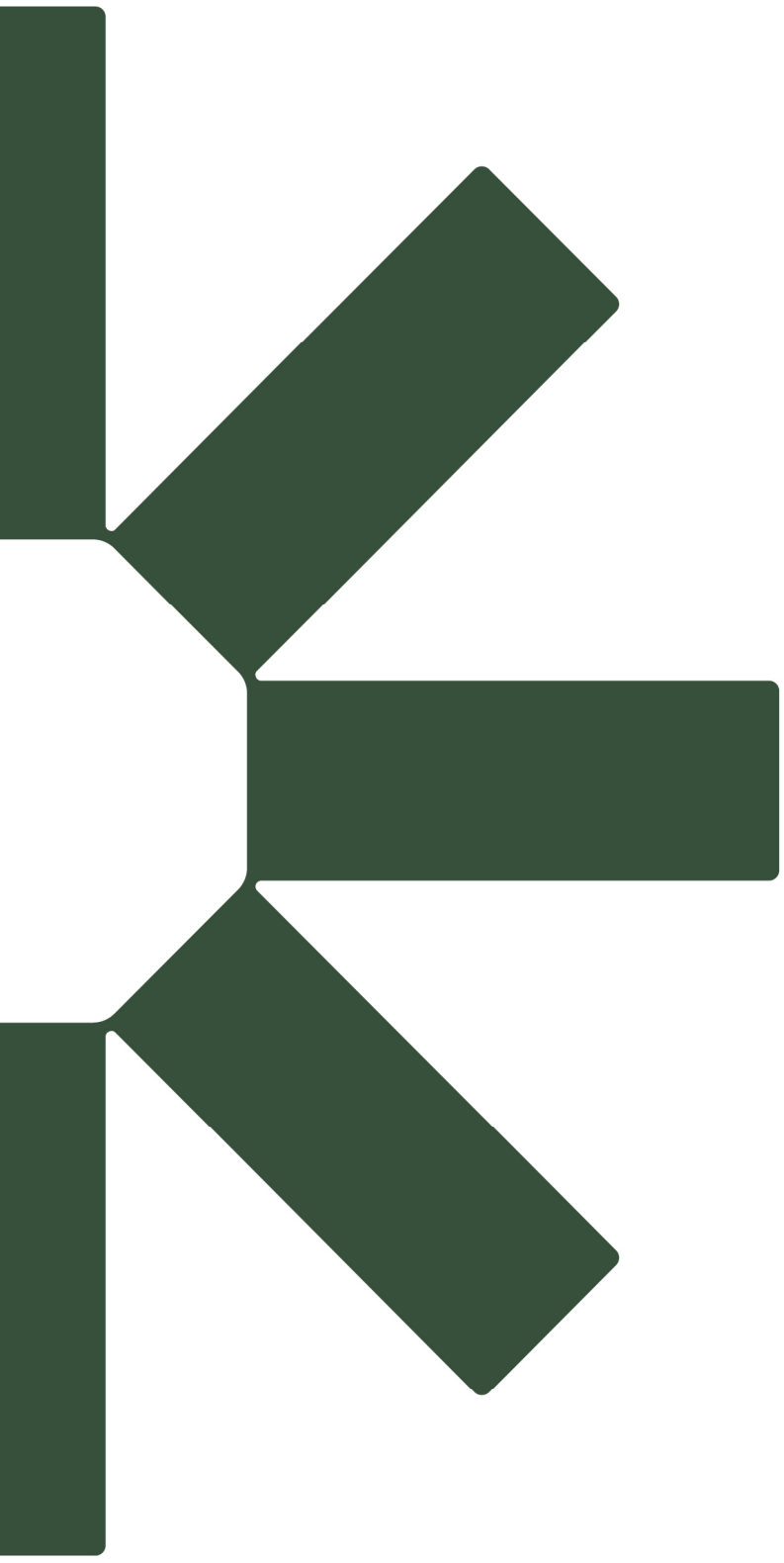
X	23–7/32"
Y	15–5/8"
Z	25–9/16"

All dimensions have a tolerance of ±0.25 in.

[Unit: inch]

= Center of Gravity

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