

# Memo

Date: Monday, November 14, 2022  
Project: Ontario Line TA  
To: Liana Bresler, Andrea Gaus  
From: Mohamed Hosney, David Kantor, Masoud Manzari  
Subject: Geotechnical Desktop Study for the Gerrard Carlaw South Transit Oriented Communities (TOC) – 10 Dickens Street and 388 Carlaw Avenue, Ontario Line

## 1 Introduction

This memorandum provides a summary of the currently available subsurface geotechnical condition for the Gerrard Carlaw South TOC in conjunction with preliminary geotechnical recommendations for the design of the subject development. Furthermore, recommendations are provided for additional geotechnical and hydrogeological investigation which needs to be performed by the prospective TOC developers (DevCo). This memorandum is prepared as part of the TOC submission package to the City of Toronto for the subject development.

The preliminary geotechnical recommendations provided herein are based on our interpretation of the available subsurface data, obtained from the geotechnical investigation conducted at the site by Metrolinx and TTC, by means of a limited number of boreholes, non-continuous sampling, in-situ testing, and laboratory testing on selected soil/rock samples. The recommendations contained in this memorandum rely on the accuracy of the factual subsurface data supplied by others and the authors are not responsible for the accuracy and correctness of the subsurface data provided by others.

The data interpretations and the preliminary recommendations contained in this memorandum pertain to a specific project as described herein and are not applicable to any other project or site location. If the project is modified in concept, location, or elevation, the recommendations provided in this memorandum may not be valid.

The preliminary recommendations presented in this memorandum must not be used for detail design of the subject TOC as the recommendations are subject to confirmation/modification when the detailed final investigation is completed. The scope of the additional geotechnical investigation provided herein is the recommended minimum scope of investigation to further progress the design of the TOC for City's approval purposes. DevCo and its designers shall append this scope of investigation, as required in accordance with their design and complete the investigation before detail design of the subject TOC.

It is a condition of this document that the performance of professional services provided herein is subject to the attached Statement of Limitation and condition.

## 2 Project and Site Description

The proposed OL Gerrard Carlaw South TOC site is located to the south side of the proposed Ontario Line (OL) Gerrard Station and the joint corridor, north of Dickens Street, Logan Avenue to the west and Carlaw

Avenue to the east. Based on the information provided by SvN on August 25, 2022, four new high-rise buildings, denoted herein as Dickens block, Thackeray block, Carlaw block and Badgerow block, are planned to be constructed at the Gerrard Carlaw South TOC site. The preliminary general arrangement drawings of the proposed buildings are included in Appendix A for information only.

Dickens block will be located between Dickens Street, Logan Avenue and Thackeray Street. The new building will consist of 4 to 39 levels above the ground surface and 2 basement levels.

Thackeray block will be located between Thackeray Street, Dickens Street and Carlaw Avenue. The new building will consist of 8 to 12 levels above the ground surface and 2 basement levels.

Carlaw block will be located directly north of the Thackeray block, between Carlaw Avenue and Thackeray Street. The new building will consist of 6 to 23 levels above the ground surface and 2 basement levels.

Badgerow block will be located directly north of the Carlaw block, at the Carlaw Avenue/Badgerow Avenue intersection. The new building will consist of 6 to 8 levels above the ground surface and 1 basement level.

### 3 Sources of Geotechnical Data

A geotechnical investigation has been completed for the OL Project and the results of the subsurface investigation at Gerrard Carlaw South TOC are provided in the reports listed below:

- Geotechnical Data Report (GDR): Lakeshore Segment (Rev.4), Ontario Line, Toronto, Ontario, prepared by GHD, dated August 25, 2021.
- Stage 2 North Tunnel Geotechnical Data Report (GDR), Ontario Line – East of Lower Don River Bridge, Toronto, Ontario, prepared by WSP, dated October 22, 2021.
- Ontario Line – Geotechnical Data Report, Lakeshore Segment, Dundas Street East and Logan Avenue, Toronto, Ontario, prepared by Golder, dated July 30, 2021.
- Draft Geotechnical Data Report (Rev.5), Proposed Ontario Line – North Tunnel, Toronto, Ontario, prepared by Wood, dated September 2, 2022.

Reference is made to the above noted reports for the details of the currently available factual geotechnical and hydrogeological data.

The following laboratory tests were conducted in representative soil samples:

1. Moisture content
2. Bulk density
3. Specific gravity
4. Grain size and hydrometer analyses
5. Atterberg limits

The following laboratory tests were conducted on representative rock samples:

1. Unconfined compressive strength (UCS)
2. Point load
3. Elastic Moduli of intact rock core in uniaxial compression
4. Slake durability

#### 5. Cerchar Abrasivity

The following field tests were conducted or are planned to be conducted during the field investigations:

1. Standard penetration (SPT)
2. Field vane shear test
3. Combined Seismic Refraction and MASW geophysical survey
4. Collection of subsurface gases
5. Single well response hydraulic conductivity assessment
6. Packer hydraulics conductivity assessment
7. Measurement of subsurface gas concentrations in monitoring well headspace

The following laboratory tests were conducted on representative groundwater samples:

1. Environmental groundwater quality analyses (e.g., metals and inorganics, PHCs, VOCs, SVOCs or PAHs, PCBs, dioxins and furans, methane, and Toronto Sewer Use Bylaw parameters).

The following laboratory tests were conducted on representative monitoring well headspace gas samples:

1. Environmental subsurface gas analyses [e.g., light hydrocarbons, VOCs, and matrix gases, which are also referred to as permanent or fixed gases (i.e., carbon dioxide, carbon monoxide, methane, nitrogen, oxygen, hydrogen, and hydrogen sulphide)].

## 4 Subsurface Conditions

Four boreholes (i.e., G85-355-79, OL-08013, OL-8004, and OL-8004B) have been drilled in vicinity of the Gerrard Carlaw South TOC. These boreholes were advanced to depths ranging from about 30.4 m to 55.9 m below the existing ground surface. All boreholes included coring of about 14.9 m to 41.3 m of bedrock.

The advanced and planned borehole locations, the stratigraphy encountered at the borehole locations, and the preliminary interpreted stratigraphy are shown in the Interpreted Stratigraphic Profile in Appendix B. The profile is a simplification of the subsurface conditions encountered at the borehole locations. The information is inferred from generally non-continuous sampling, observations of drilling progress and results of Standard Penetration Tests. The stratigraphic boundaries shown on the profile represent transitions between soil types rather than exact planes of geologic change. Since these boundaries have been interpolated between boreholes, the actual locations of the stratigraphic boundaries may vary from those shown on the profiles.

The stratigraphic profile in the area of the proposed development generally consisted of approximately 14.6 m to 15.5 m thick overburden soils overlying Georgian Bay Formation shale bedrock. The overburden at the general area of the proposed development consists of surficial pavement structure overlying a 3.2 m thick layer of sand and gravel to silty sand fill. The native soil below the fill comprises of approximately 2.9 m to 4.2 m thick layer of loose to dense silty sand to silt followed by approximately 2.6 m to 3.8 m thick layer of very soft to very stiff silty clay till. A 1.3 m to 1.5 m thick layer of dense to very dense silty sand followed by a 3.1 m to 3.8 m thick layer of stiff to hard silty clay to clayey silt were encountered directly above the bedrock.

Intermediate and deep monitoring wells have been installed in the advanced boreholes as shown in Appendix B. The current information on the groundwater level at the site is not adequate to create a

complete groundwater pressure distribution profile. For this stage of the investigation and design, the measured groundwater table within the overburden can was selected to be at Elevation 83 m.

## 5 Recommended Scope for Additional investigation

Additional geotechnical and hydrogeological investigation is required to further progress the design of the subject TOC and for the design of protection system for the heritage structures adjacent to the Gerrard Carlaw South TOC site. The minimum recommended scope of the additional investigation for the design of the Gerrard Carlaw South TOC is presented in Table 1 of Appendix C. The associated locations of the recommended additional boreholes are shown in Appendix B. DevCo and its designers shall append the scope of additional investigation presented herein, as required in accordance with their design and shall complete the investigation before detail design of the subject TOC.

The scope of the environmental testing for groundwater and for the excess soil management shall be designed by DevCo to satisfy all codes, regulations, and guidelines requirements, including, but not limited to, O-Reg 406/19.

## 6 Preliminary Engineering Recommendations

### 6.1 Geotechnical Design Parameters

Preliminary geotechnical engineering parameters for the engineering groups encountered in the boreholes drilled at the area of the Gerrard Carlaw South TOC, that may influence the design of the TOC, are provided in the table included in Appendix D. Average values are typically listed in the tables. Although in certain instances the average values may be appropriate for design purposes, if the designs are sensitive to a minimum and maximum values and/or variation of average values with depth, the range in values must be requested by the designer and considered in their design.

The average values are typically not appropriate for selection of the construction equipment. The contractors/subcontractors should consider the full range of property values when evaluating the selection of equipment and construction methods.

### 6.2 Temporary Shoring Walls

Temporary support to retain excavation walls within the overburden soil will be required for the excavation of the proposed 1 or 2 levels of basements for the four buildings. The design of the temporary support must be in accordance with the 4<sup>th</sup> edition of the Canadian Engineering Foundation Manual (CFEM), and all other applicable codes and standards having jurisdiction over the development. Control of the ground movement should be a design criterion and considered by the shoring designer in order to limit the potential impact on the existing adjacent infrastructures, including the Cosburn Station structures, and utilities. A rigid watertight shoring system (e.g., continuous caissons socketed into bedrock) may be required to support the adjacent sensitive/heritage structures. The north side of the subject TOC will be located adjacent to existing Go Transit tracks. The horizontal and vertical movement of the existing Go tracks due to the construction of the subject TOC shall not exceed the allowable limits as per all applicable guidelines, such as the Metrolinx General Guidelines For Design of Railway Bridges and Structures.

Basic soil properties for the design of the temporary shoring system are provided in Preliminary Geotechnical Design Parameters in Appendix D. Recommended lateral earth pressure to be used in the analytical design of the shoring are provided in Figures D.1 and D.2 of Appendix D. The design groundwater elevation for the preliminary design of the shoring is 84 m.

## 6.3 Permanent Structures

### 6.3.1 Lateral Earth and Groundwater Pressures

The preliminary recommendation for the earth pressure to be used in the design of the underground basements is provided in Figure D.3 of Appendix D. An earth pressure coefficient (K) of 0.5 is recommended for the preliminary stage design. The design groundwater elevation for the preliminary design of the basement walls is 84 m.

### 6.3.2 Foundations

Based on the available subsurface condition, the site seismic classification for the subject development is Site Class C with an average shear wave velocity ( $V_{s30}$ ) of 445 m/s.

It is our understanding that DevCo will be responsible to design the foundations of the TOC which can be either supported by raft foundation or deep caissons.

#### **Raft Foundation:**

The raft foundation for the TOC buildings can be founded on undisturbed native soils as shown in Table 1. If fill material is encountered at the foundation elevation, then the entire fill layer below the foundation shall be excavated and backfilled with compacted engineered fill or lean concrete. The factored geotechnical resistances provided in Table 1 below may be assumed for the preliminary design of the raft foundations.

**Table 1 Preliminary Factored Geotechnical Resistances**

Structure	Base of foundation Elevation (m)	Anticipated Founding Material	ULS Factored Geotechnical Resistance (kPa) <sup>(1)</sup>	SLS Factored Geotechnical Resistance (kPa) <sup>(1)</sup>	Vertical Modulus of Subgrade Reaction $K_v$ (MPa/m)
Dickens Block	~78.9	Very stiff Silty Clay Till	280	130	5
Thackeray Block & Carlaw Block <sup>(2)</sup>	~77.5	Very stiff Silty Clay Till	320	140	5
Badgerow Block	~80.5	Stiff to Very stiff Silty Clay Till or Compact non-plastic soil	280	145	6

(1) If engineered fill is placed below the slab, the geotechnical resistances provided in this table may need to be revised.

(2) The two TOC buildings are supported by one continuous raft.

The geotechnical resistances for the raft foundation are based on a 70 m wide slab for Dickens block, 65 m wide slab for Thackeray block and Carlaw block, and 35 m wide slab for Badgerow block.

The geotechnical resistances are applicable for raft slabs subjected to vertical concentric loading. Where eccentric or inclined loads are applied, the resistance used in the design must be reduced in accordance with the Canadian Highway Bridge Design Code (CHBDC) Clauses 6.7.3 and 6.7.4 [9].

The geotechnical resistances at SLS provided is based on an estimated settlement on the structure not exceeding 25 mm.

A retaining wall is planned to be constructed as part of OL directly north of the subject TOC buildings (i.e., between the existing Go tracks and the subject TOC structures). Therefore, the global stability must be evaluated for all the stages of the construction and for permanent condition.

The effect of the new development loads at the adjacent OL and Metrolinx permanent structure(s) must be evaluated.

**Caissons:**

Caissons must be extended at least 2.5 times caisson diameter into the slightly weathered to fresh bedrock to provide adequate socket support. A minimum centre-to-centre spacing of 2.5 times caisson diameter should be maintained between caissons.

The performance of caissons will depend to a large degree on the quality of construction such as final cleaning at the base and condition of the shaft. The recommended factored axial geotechnical resistances at ULS in compression for caissons of selected diameters and rock socket lengths are presented in Table 2. The geotechnical resistances provided in Table 2 are estimated based on the assumption that no pile load test will be conducted at the site. Given the sensitivity of the caisson performance to the construction means and method, higher geotechnical resistances can be provided if the axial resistance of the caissons will be verified by a properly designed and implemented pile load testing program prior to construction.

The settlement of the caissons at the top of the rock socket, under the SLS load, is anticipated to be less than 10 mm.

The upper approximately 2.5 m of the shale at the site is generally found to be highly to moderately weathered and containing fragmented zones and clay seams. As such, it is recommended that the upper 2.5 m of the bedrock be discounted when calculating the required socket length of the caissons to achieve the target axial resistance.

**Table 2 Preliminary Factored Geotechnical Resistances at ULS for Rock Socket of a Single Caisson**

Caisson Rock Socket Diameter (m)	Socket Length** (m)	Factored Geotechnical Resistance in Compression at ULS (kN)*	Factored Geotechnical Resistance in Tension at ULS (kN)*
0.9	4	4,800	1,070
	6	6,450	1,600
	8	7,890	2,140
1.2	4	6,810	1,400
	6	9,580	2,140
	8	11,490	2,860

\* The structural capacity of the caissons should be evaluated by the structural engineer.

\*\* Socket Length is the embedment depth of the caisson into the slightly weathered to fresh bedrock and should not include the upper highly weathered portion of the caissons.



## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

### 5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

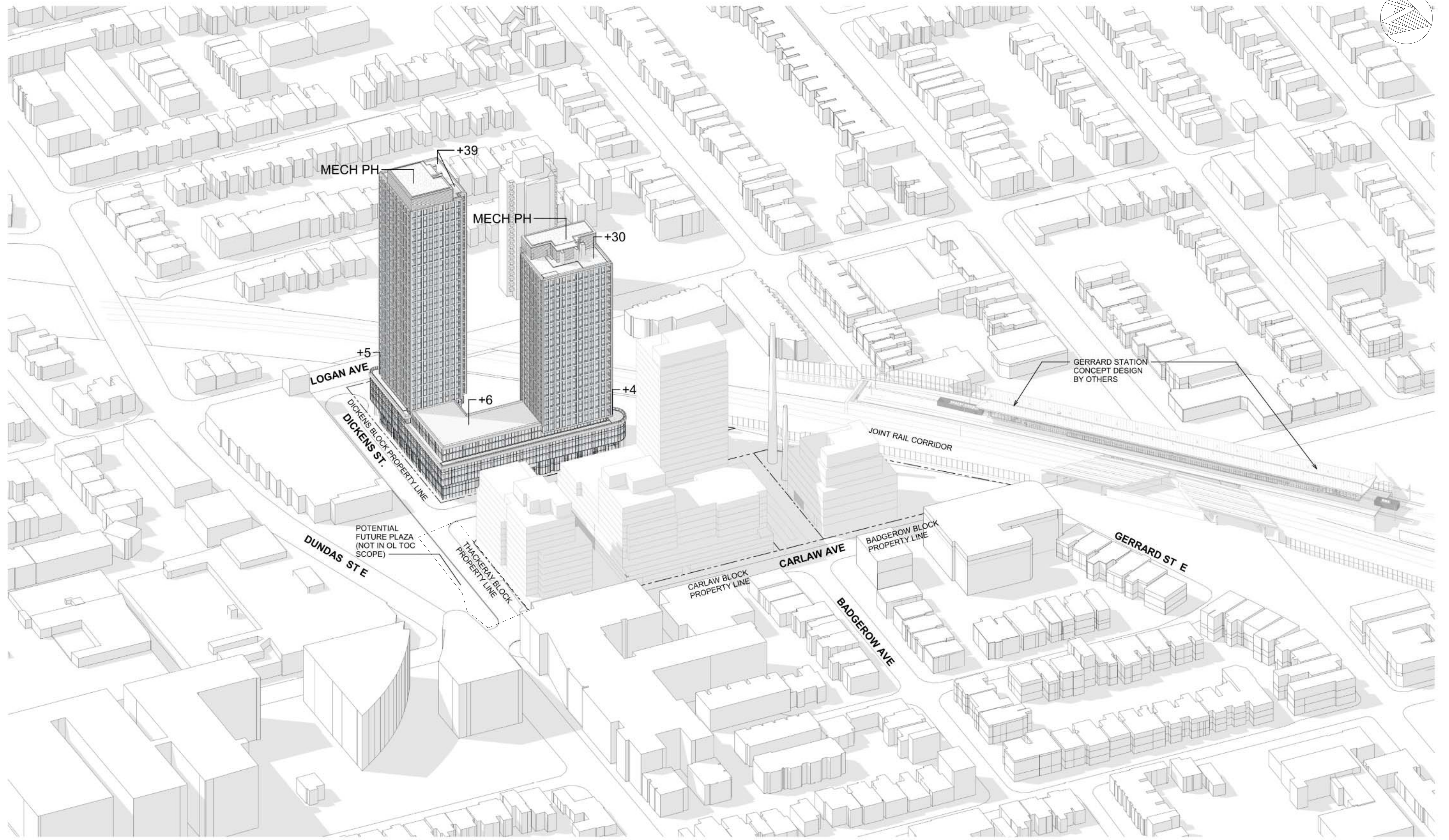
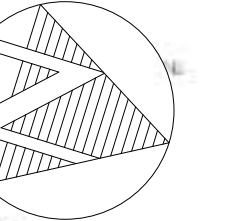
Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

### 7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

## **Appendix A: General Arrangement Drawings**

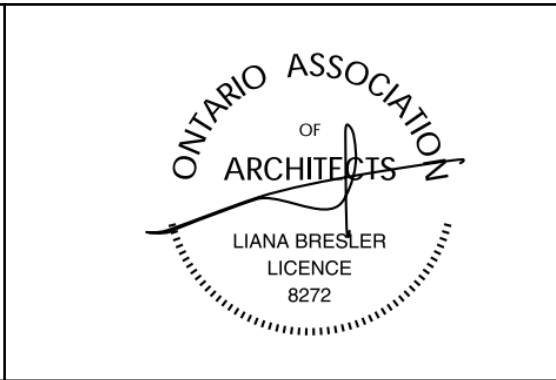




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2	2022-10-31	REISSUED FOR QA/QC
3	2022-11-16	REISSUED FOR QA/QC

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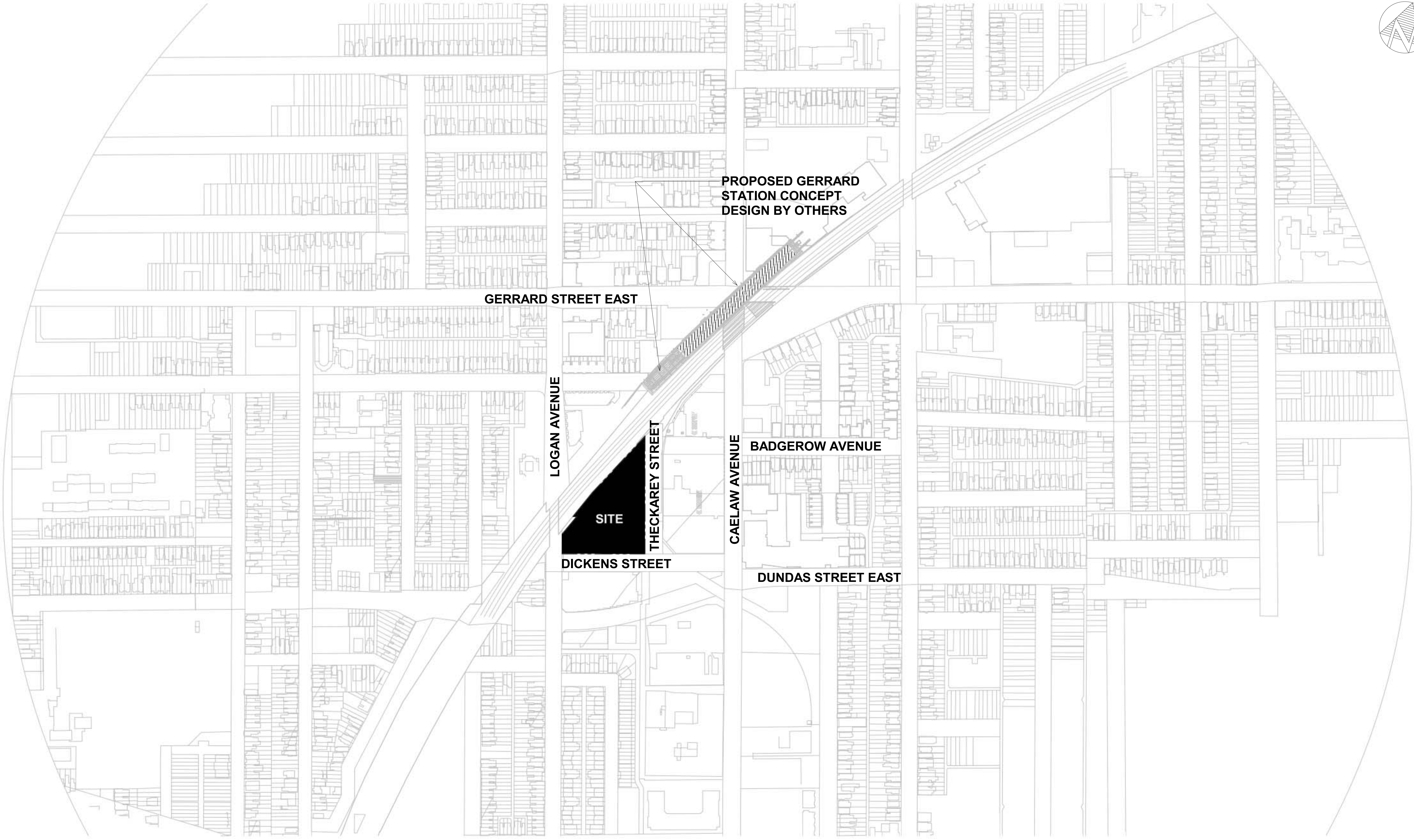
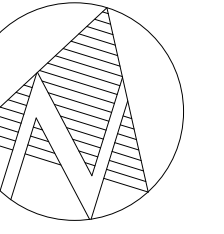


DESIGNED	M.MALEKZADEH
DRAWN	A.A.L. JIRJEES
CHECKED	S.MCINTOSH
APPROVED	L.BRESLER

**ONTARIO LINE**  
**TOC**  
 LAKESHORE EAST | GERRARD SOUTH  
 CONTEXT MASSING

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<b>Infrastructure Ontario</b>	
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NOT FOR ESTIMATING OR BIDDING  
NOT FOR CONSTRUCTION

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ONTARIO LINE TECHNICAL ADVISOR

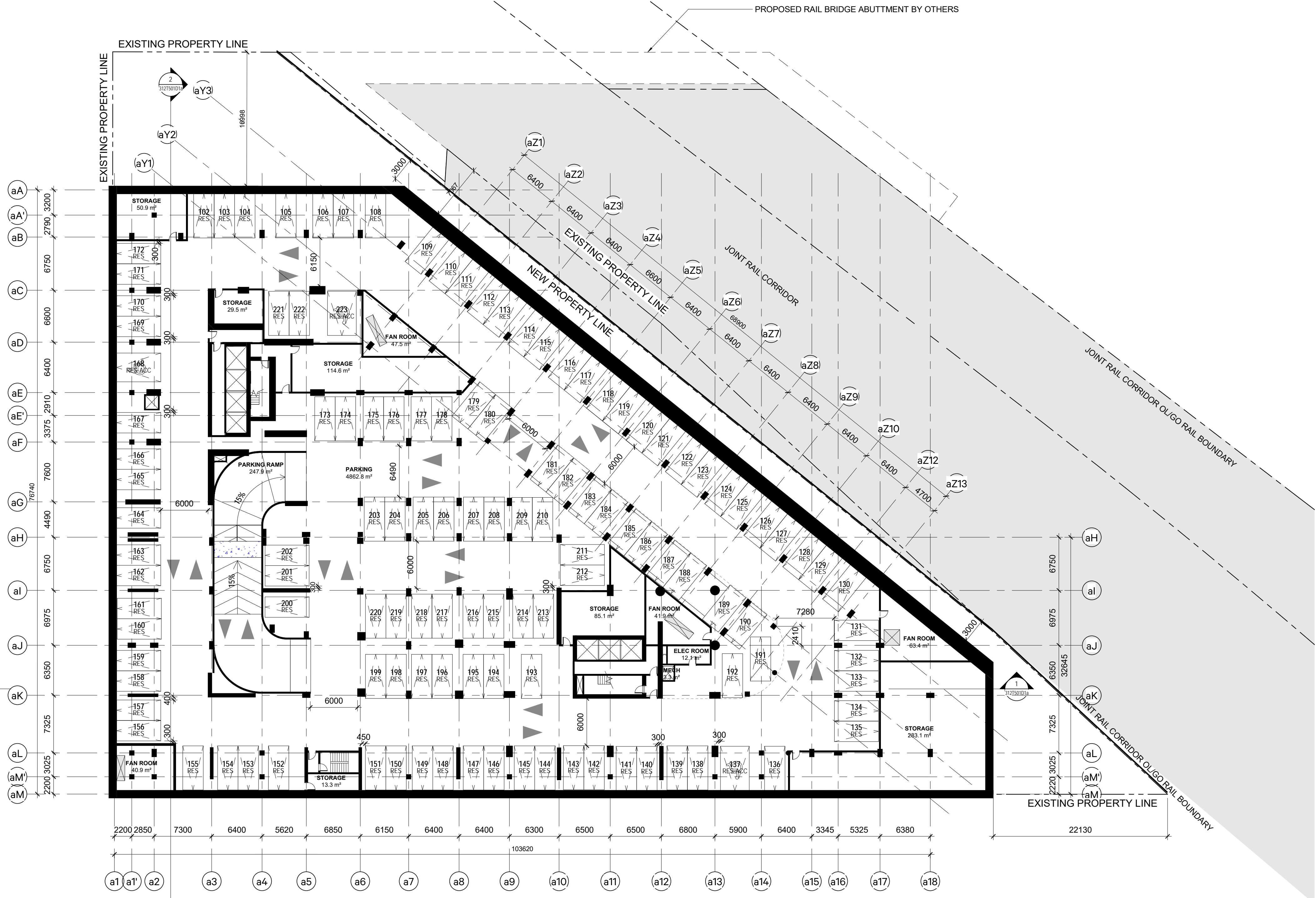
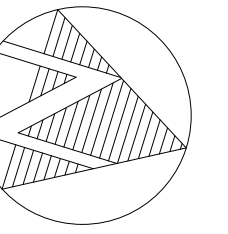
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OF ARCHITECTS  
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LICENCE  
8272

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APPROVED	L.BRESLER

**ONTARIO LINE**  
**TOC**  
LAKESHORE EAST | GERRARD  
CONTEXT PLAN

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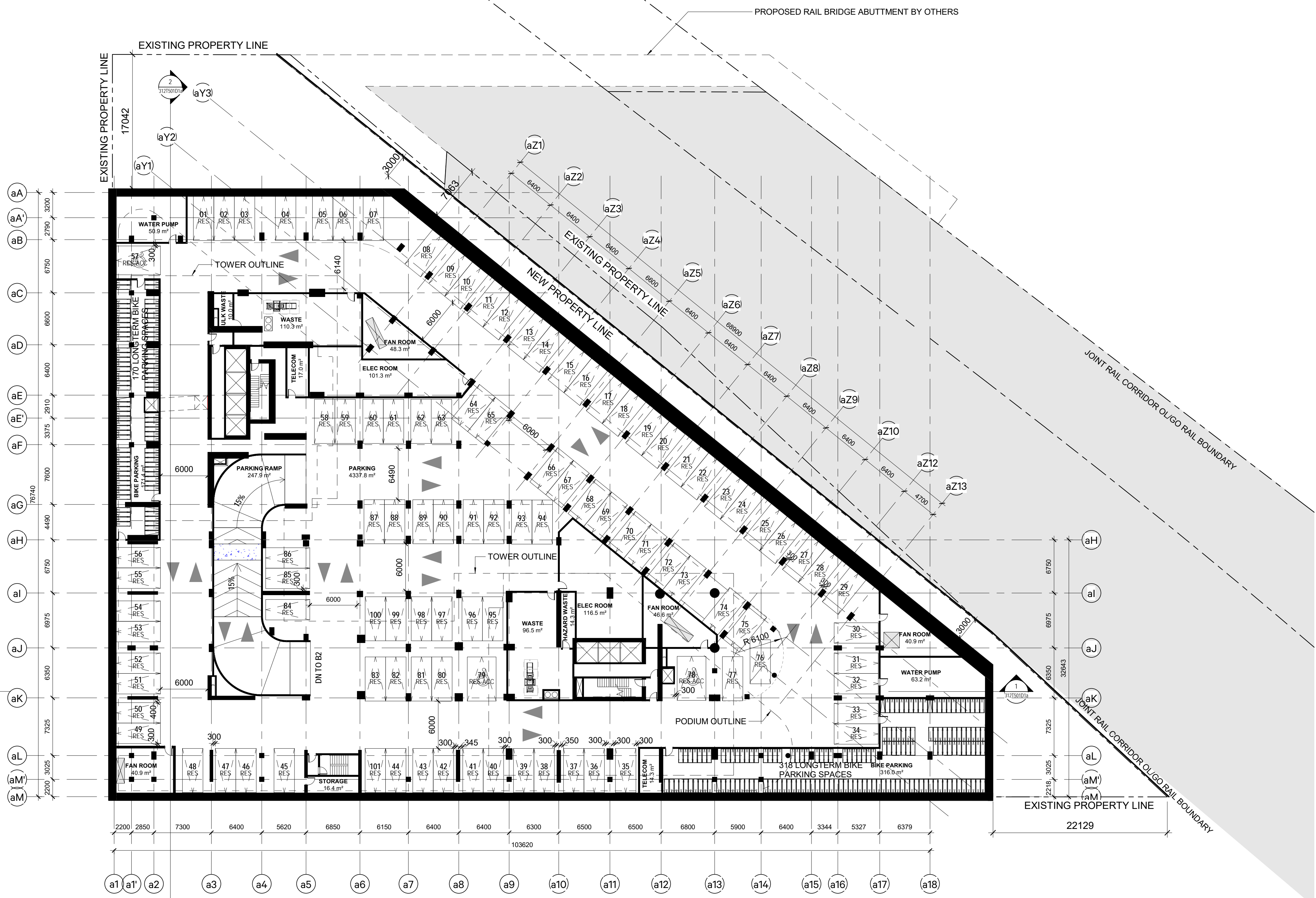
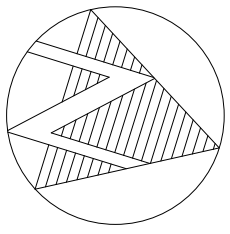
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CHECKED	S.MCINTOSH
APPROVED	L.BRESLER

**ONTARIO LINE**

**TOC  
LAKESHORE EAST | GERRARD  
LEVEL B2**

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**ARCHITECTURE AND  
LANDSCAPE SET - REZONING**



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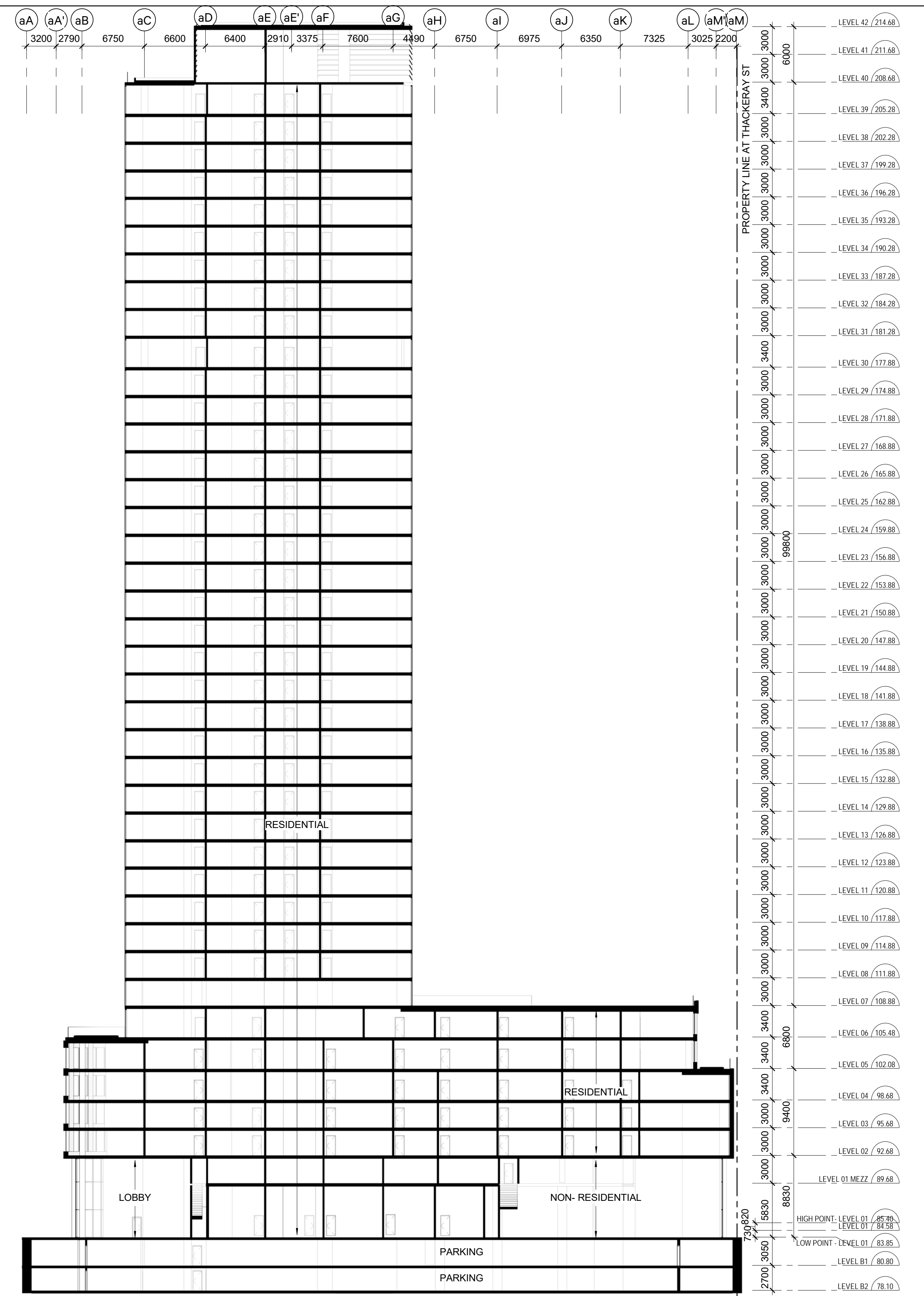
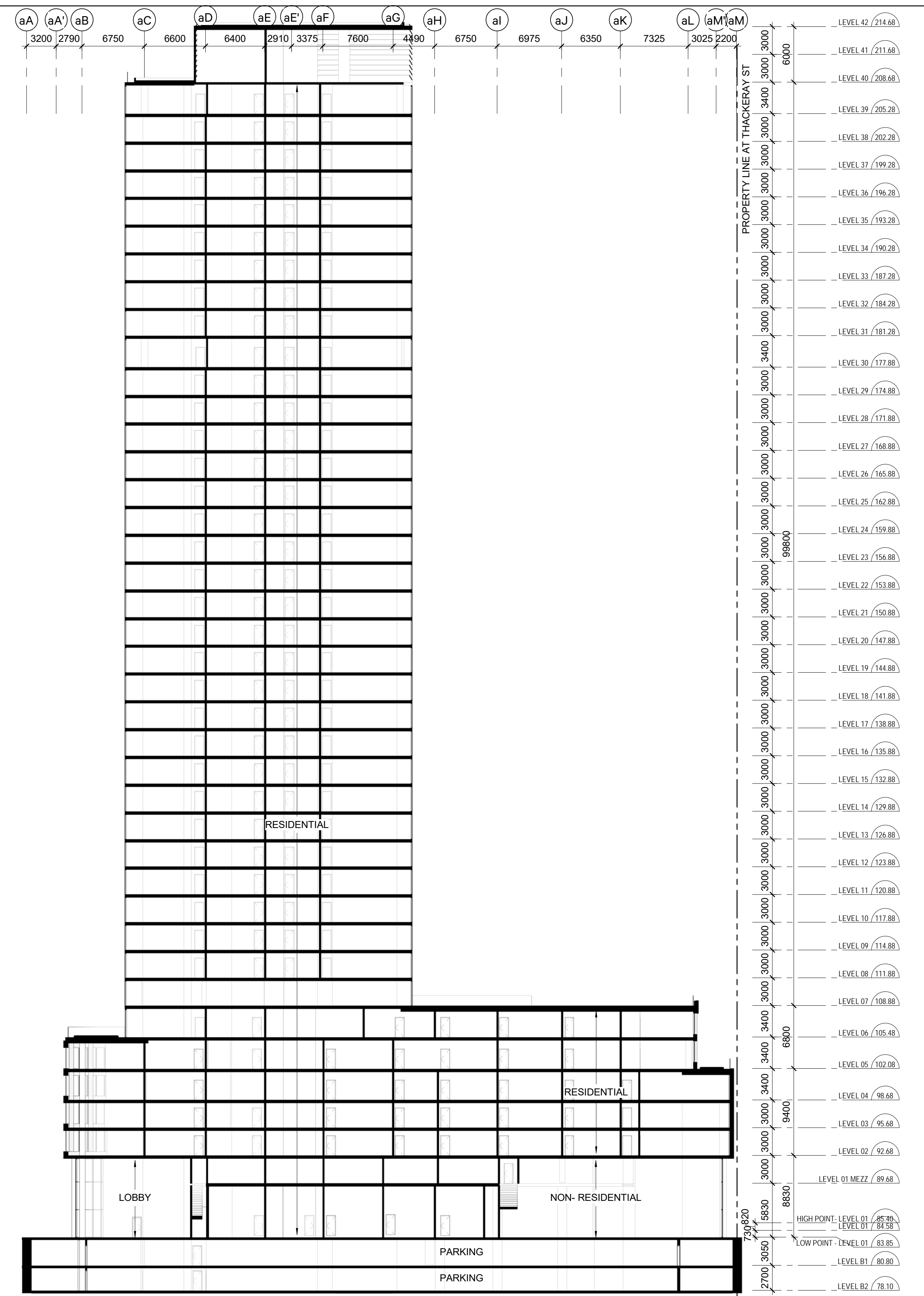
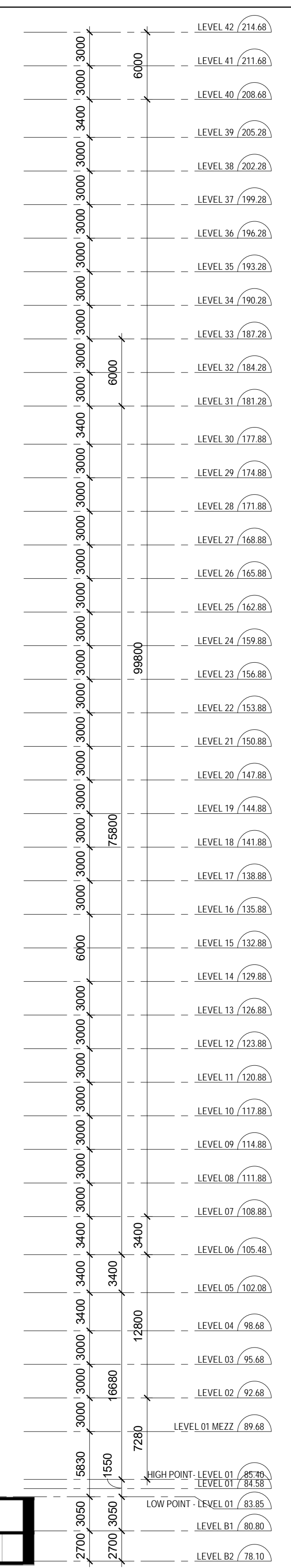
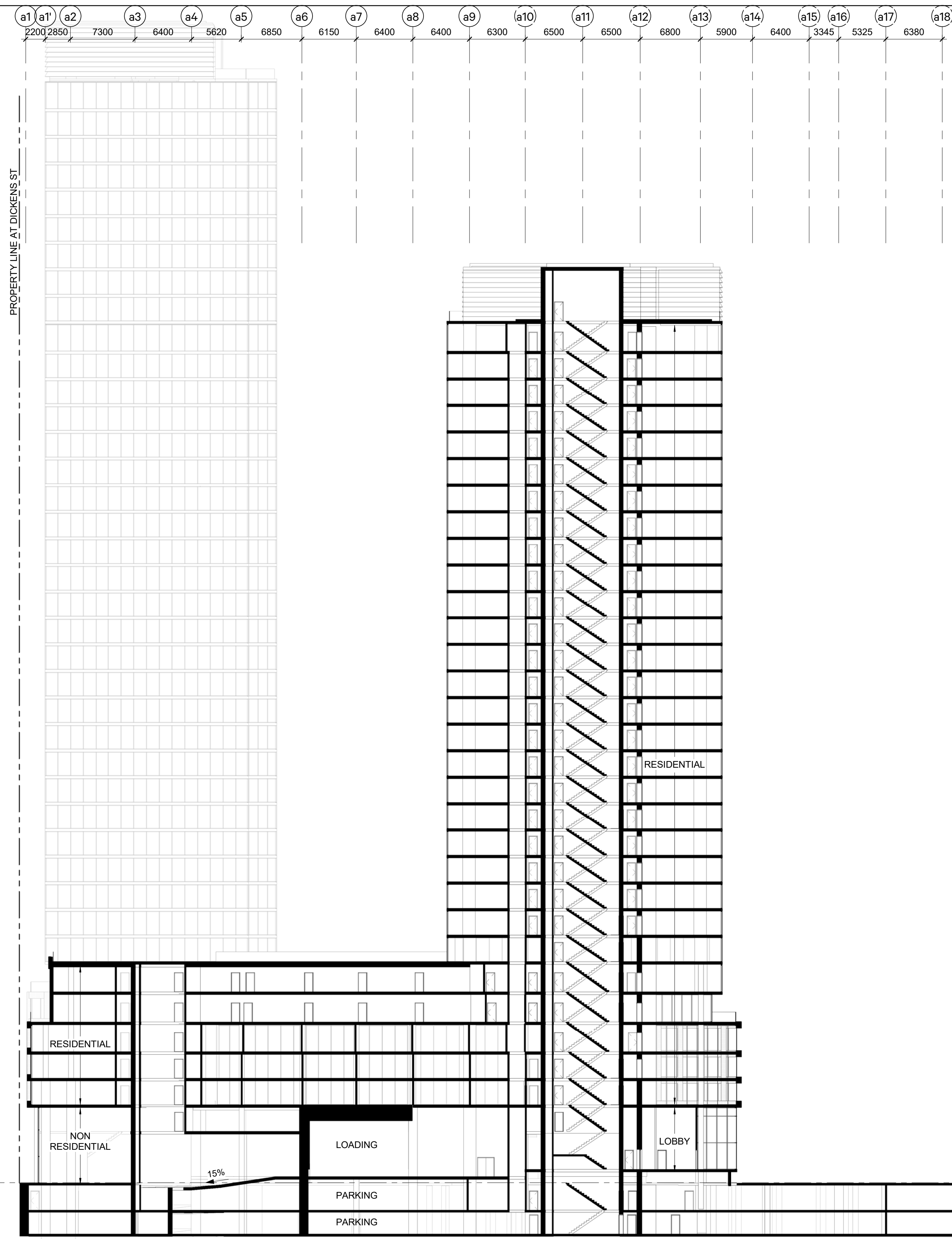
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**TOC  
LAKESHORE EAST | GERRARD  
LEVEL B1**

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**1** LONGITUDINAL SECTION  
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**2** CROSS SECTION  
1 : 300

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**ARCHITECTURE AND  
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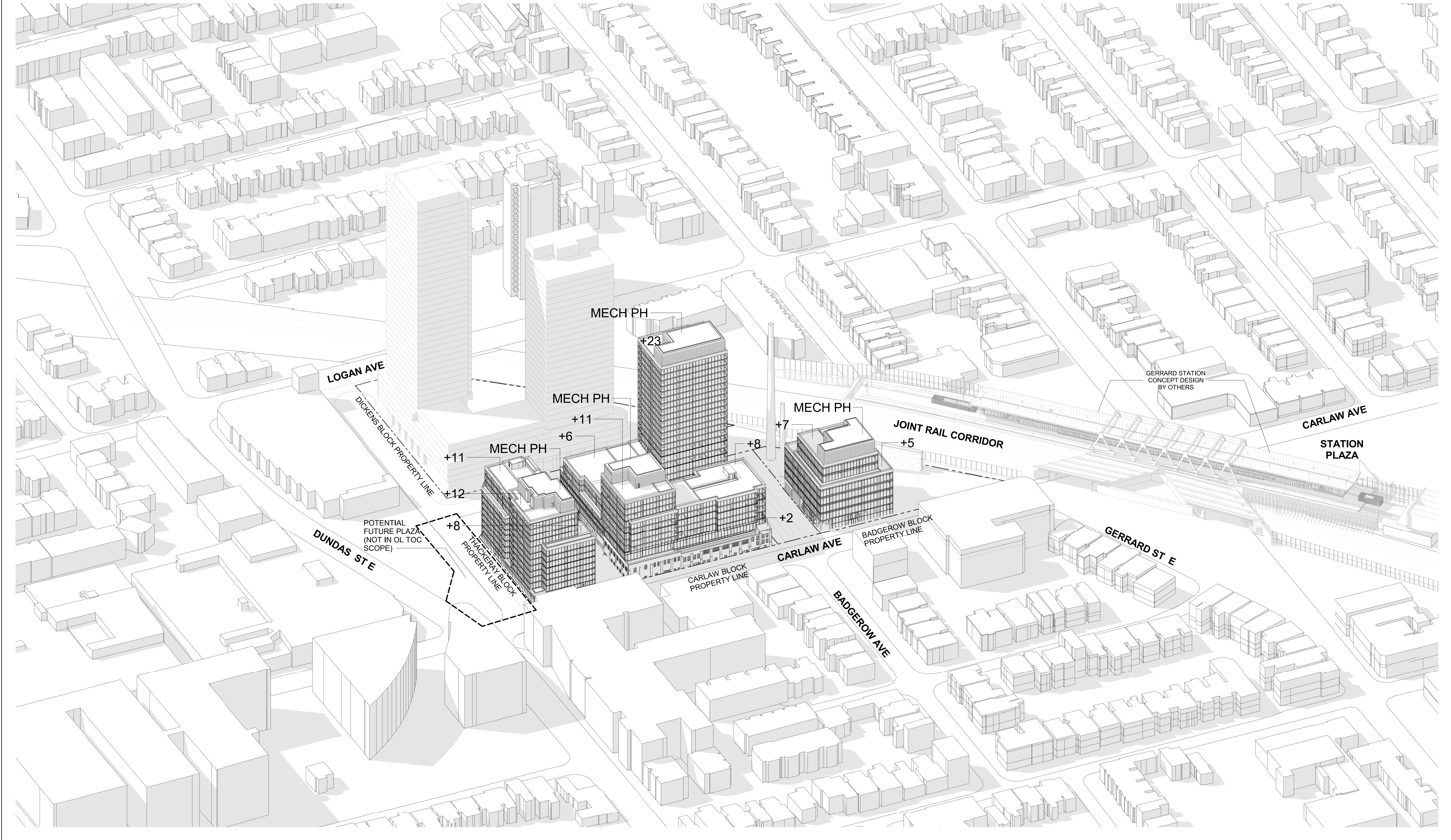
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APPROVED	L.BRESLER

**ONTARIO LINE**  
**TOC**  
**LAKESHORE EAST | GERRARD**  
**SECTIONS**

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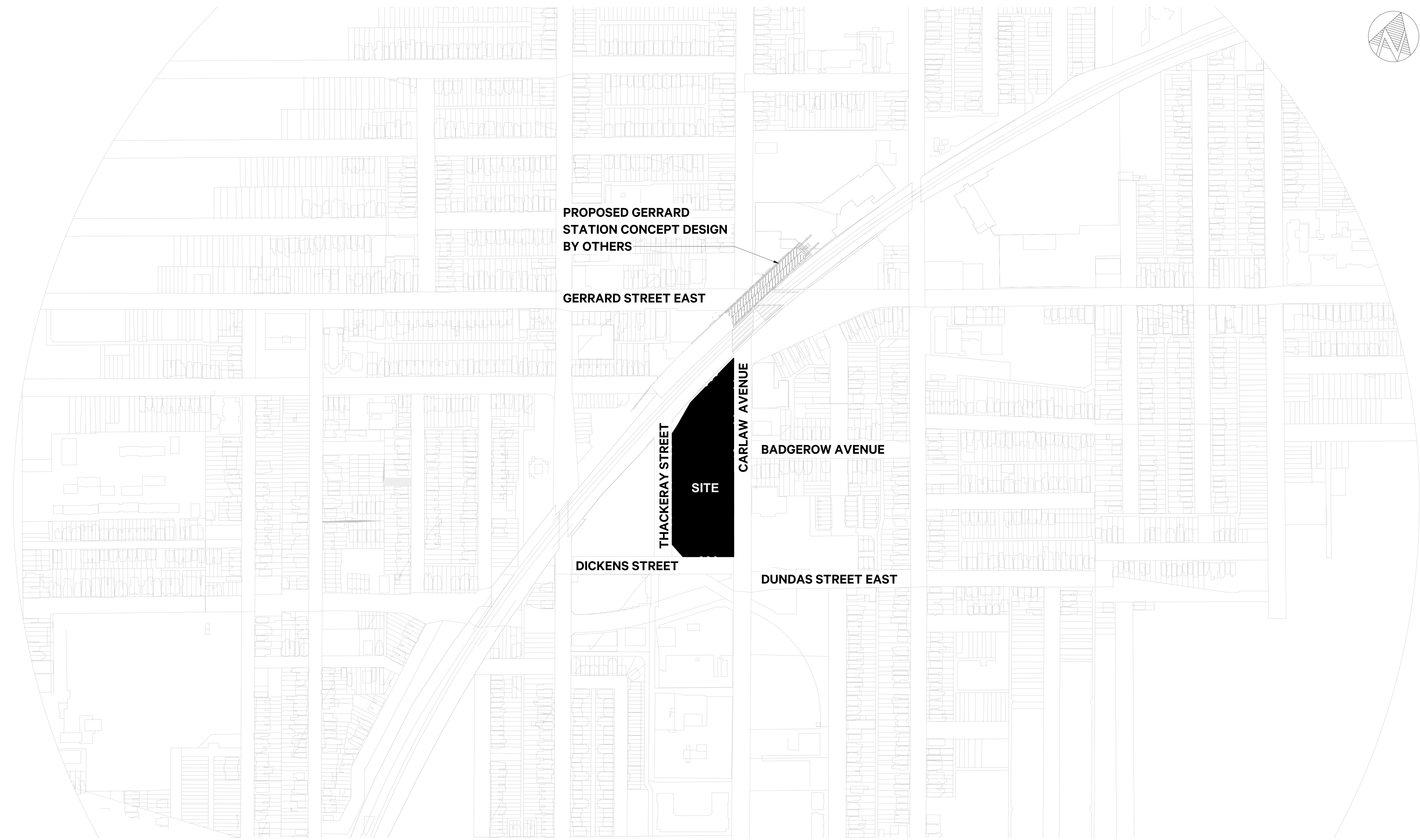
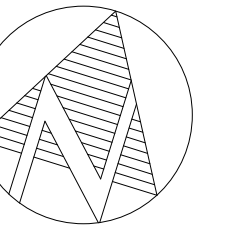


DESIGNED	M.HOSEINI
DRAWN	A.AL-JIRJEES
CHECKED	S.MCINTOSH
APPROVED	L.BRESLER

<b>ONTARIO LINE</b>	
TITLE	
<b>TOC LAKESHORE EAST   GERRARD CONTEXT MASSING</b>	

Plot Date: 2023-02-21 11:43:21 AM	
Infrastructure Ontario	
SCALE	DRAWING NUMBER
	312T001D1b





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2	2022-10-31	REISSUED FOR QA/QC

**ARCHITECTURE AND  
LANDSCAPE SET - REZONING**

**SvN**  
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NOT FOR CONSTRUCTION

**ONETEAM**  
ONTARIO LINE TECHNICAL ADVISOR

ONTARIO ASSOCIATION  
OF ARCHITECTS  
LIANA BRESLER  
LICENCE  
8272

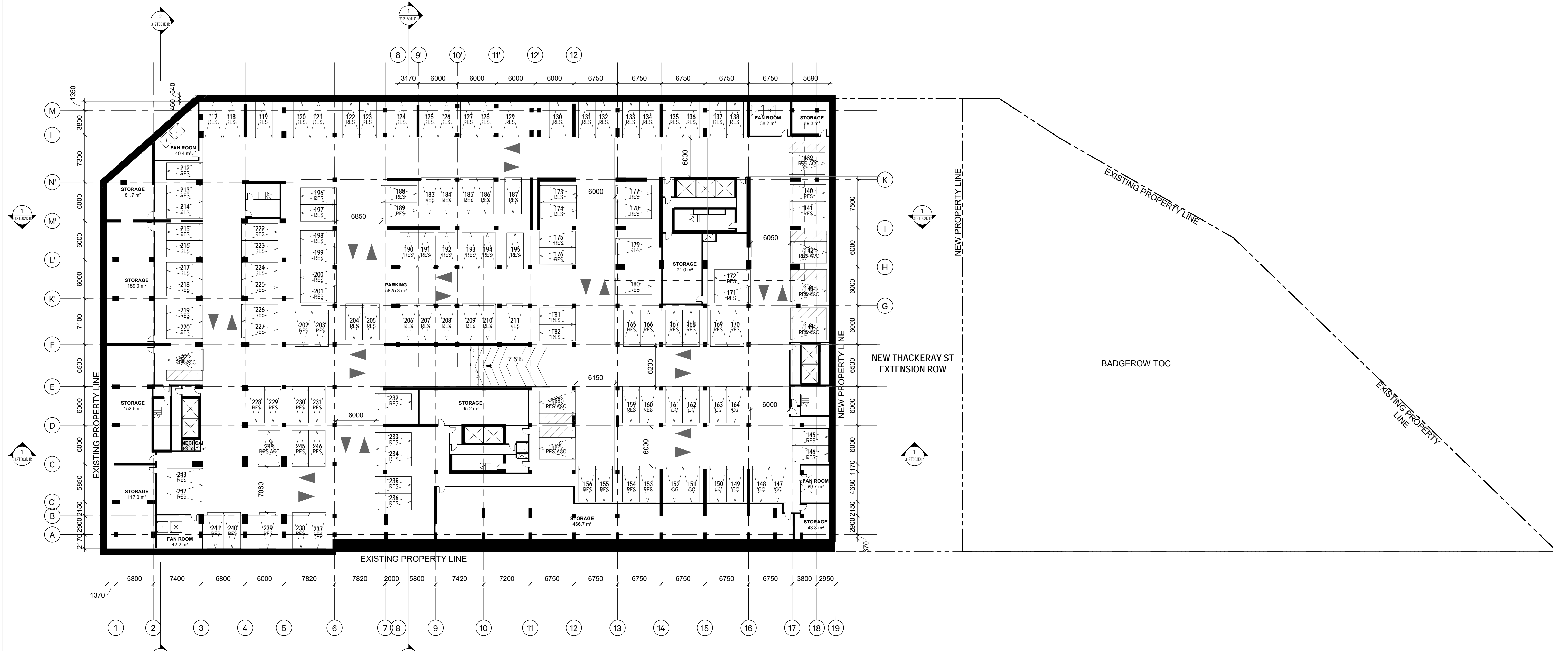
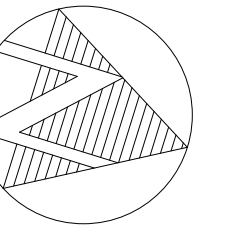
DESIGNED	M.HOSEINI
DRAWN	A.AL-JIRJEES
CHECKED	S.MCINTOSH
APPROVED	L.BRESLER

**ONTARIO LINE**  
TITLE  
**TOC  
LAKESHORE EAST | GERRARD  
CONTEXT PLAN**

Plot Date: 2022-10-31 3:56:09 PM

**METROLINX**  
Infrastructure  
Ontario

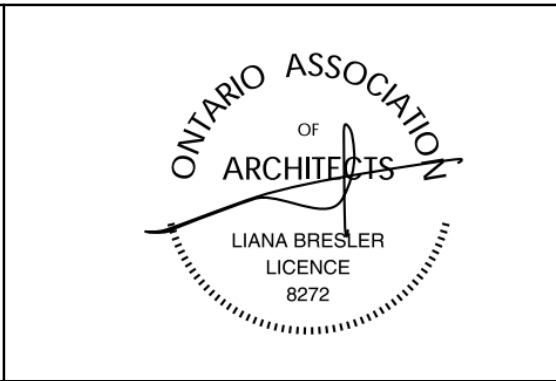
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2	2022-10-31	REISSUED FOR QA/QC

**ARCHITECTURE AND  
LANDSCAPE SET - REZONING**

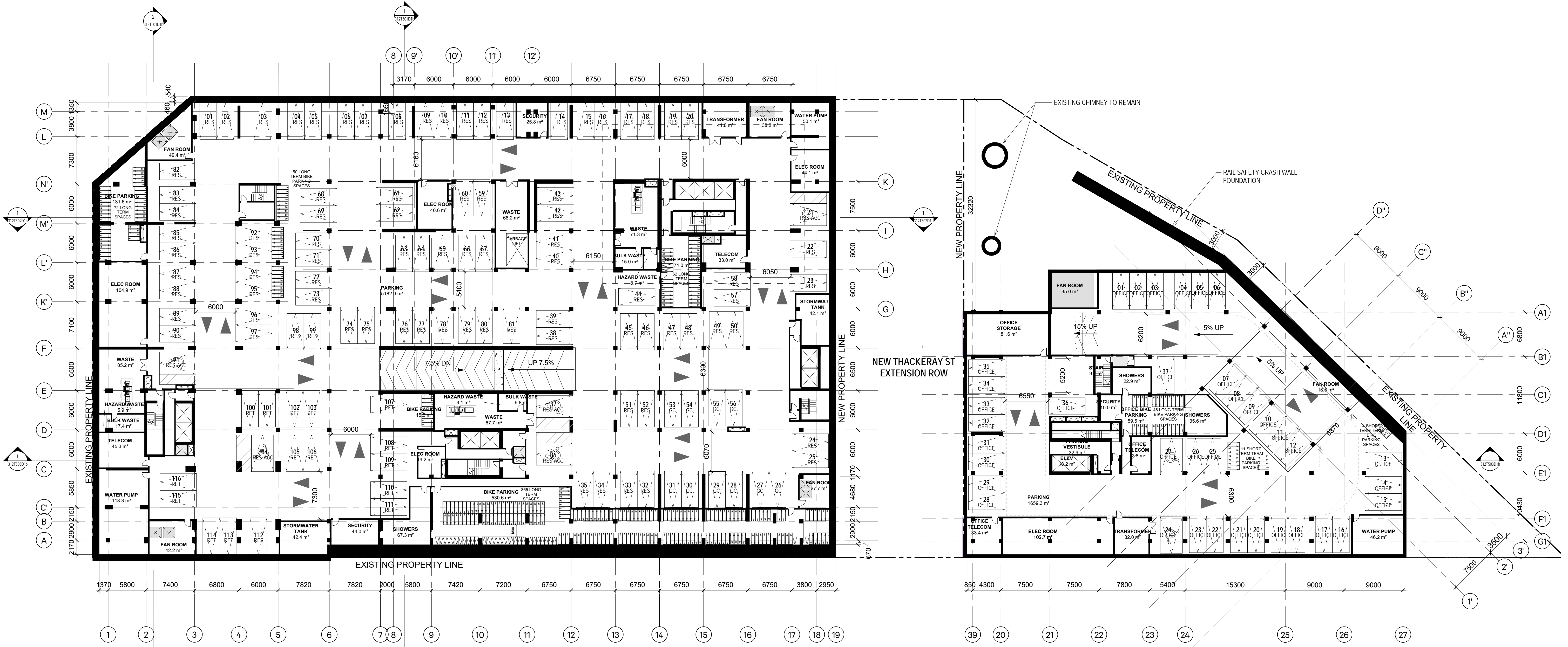
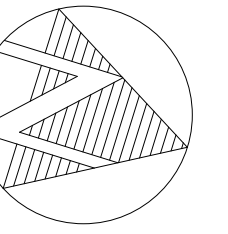


DESIGNED	M.HOSEINI
DRAWN	A.AL-JIRJEES
CHECKED	S.MCINTOSH
APPROVED	L.BRESLER

**ONTARIO LINE**  
TOC  
LAKESHORE EAST | GERRARD  
LEVEL B2

Plot Date: 2022-10-31 3:57:12 PM	
<b>METROLINX</b> Infrastructure Ontario	
SCALE 1 : 300	DRAWING NUMBER 312T101D1b





SHEET No. 312T102D1b - BIM 360/10206938 - O.L.T.A. Planning/10206938-TD012D1b-LKSRE-GERRARD.rvt

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2	2022-10-31 REISSUED FOR QA/QC

**ARCHITECTURE AND  
LANDSCAPE SET - REZONING**

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**ONETEAM**  
ONTARIO LINE TECHNICAL ADVISOR

ONTARIO ASSOCIATION  
OF ARCHITECTS  
LIANA BRESLER  
LICENCE  
8272

DESIGNED	M.HOSEINI
DRAWN	A.AL-JIRJEES
CHECKED	S.MCINTOSH
APPROVED	L.BRESLER

**ONTARIO LINE**  
TITLE  
**TOC  
LAKESHORE EAST | GERRARD  
LEVEL B1**

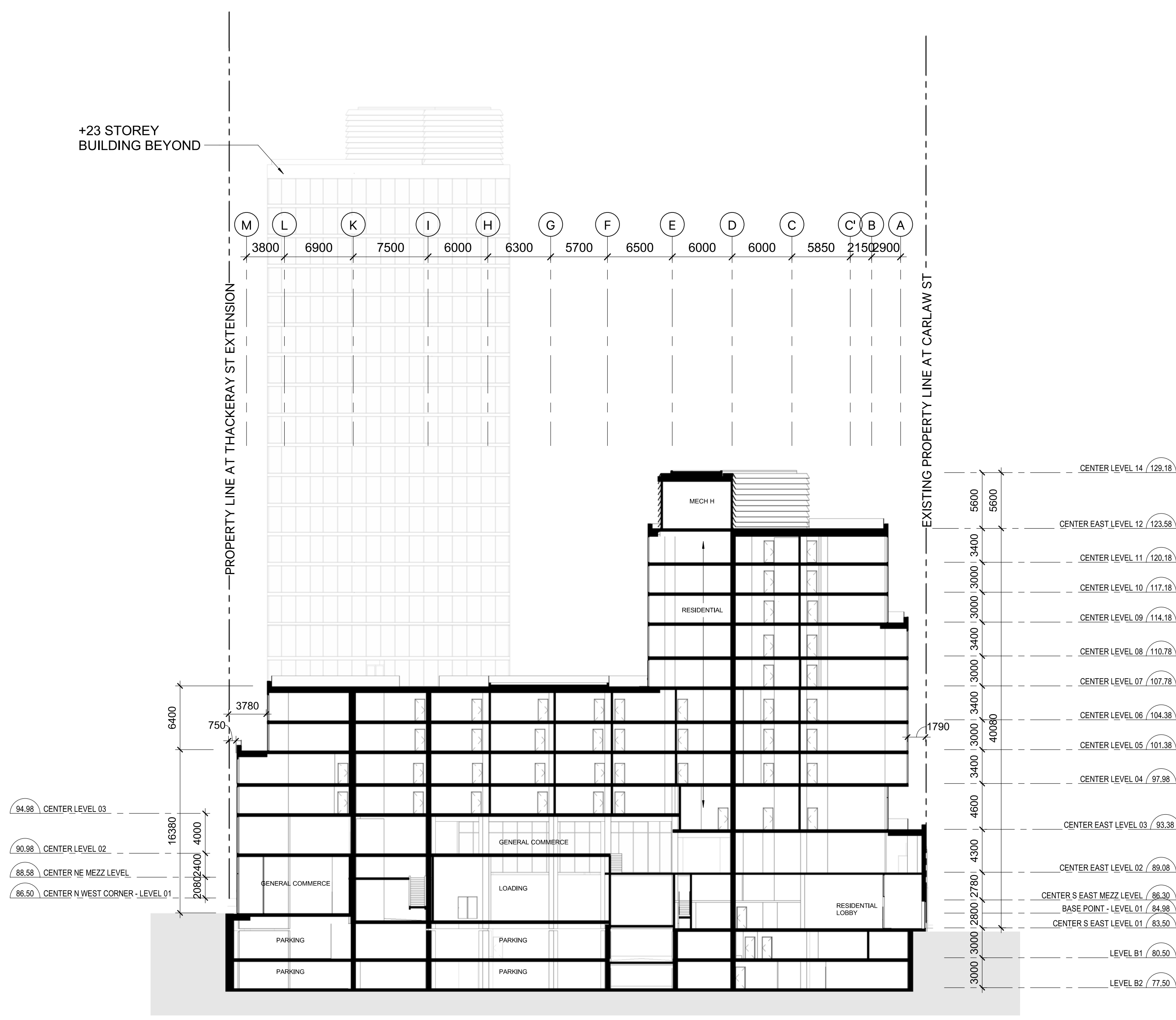
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**METROLINX**  
Infrastructure  
Ontario

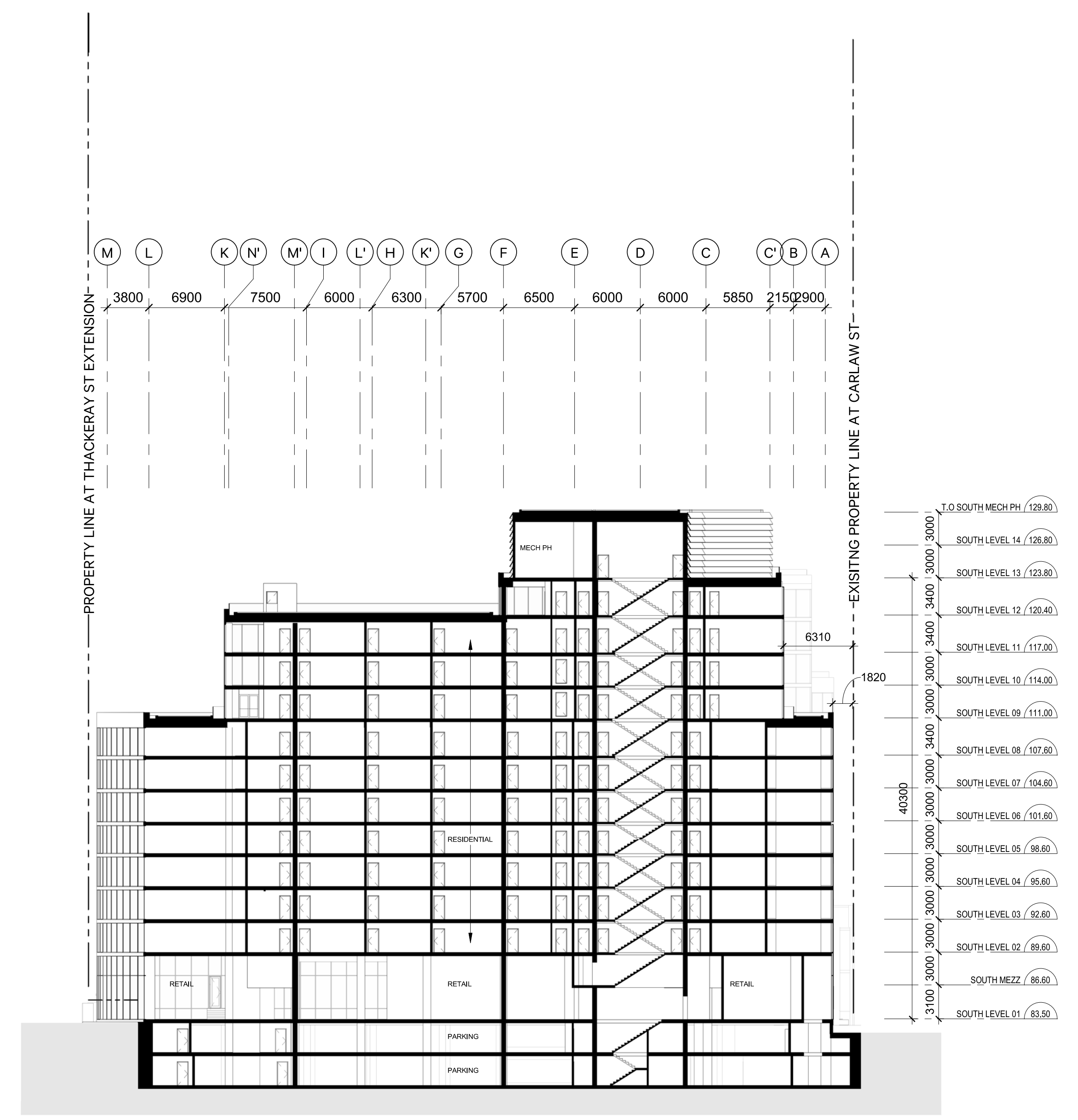
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DRAWING NUMBER  
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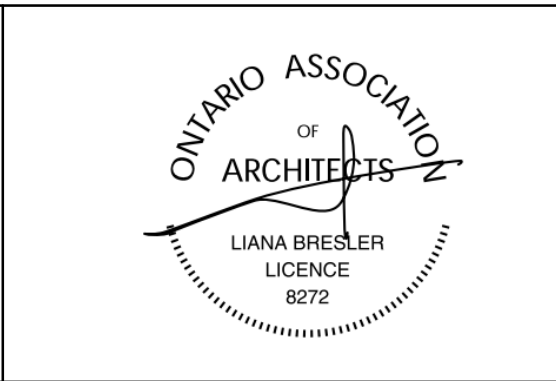
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1 : 300



**2 THACKERAY BLOCK - CROSS SECTION**  
1 : 300

ISSUANCE		
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2	2022-10-31	REISSUED FOR QA/QC
3	2022-11-16	REISSUED FOR QA/QC

**ARCHITECTURE AND  
LANDSCAPE SET - REZONING**



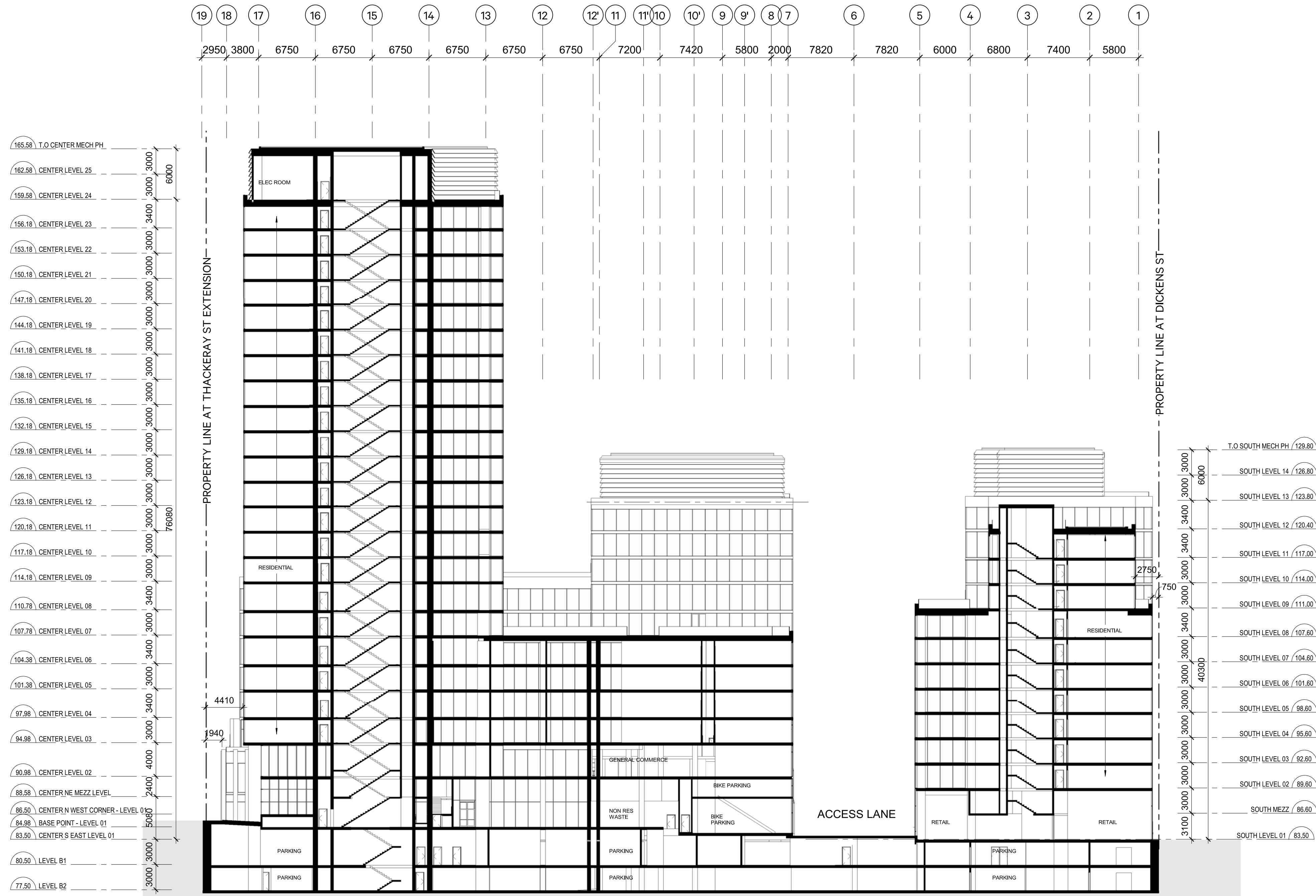
DESIGNED	M.HOSEINI
DRAWN	A.AL-JIRJEES
CHECKED	S.MCINTOSH
APPROVED	L.BRESLER

**ONTARIO LINE**  
**TOC**  
**LAKESHORE EAST | GERRARD**  
**SECTIONS**

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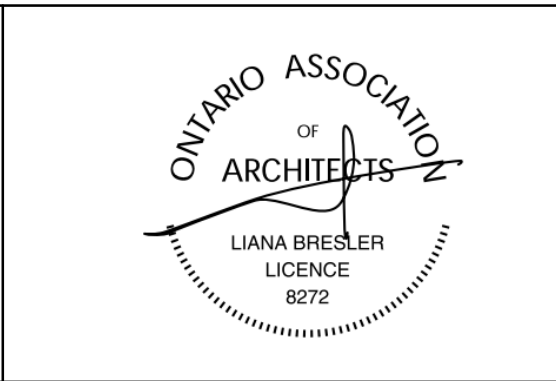
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1 LONG SECTION THACKERAY AND CARLAW  
BLOCKS  
1 : 300

ISSUANCE		
1	2022-10-18	ISSUED FOR QA/QC
2	2022-10-31	REISSUED FOR QA/QC
3	2022-11-16	REISSUED FOR QA/QC

ARCHITECTURE AND  
LANDSCAPE SET - REZONING

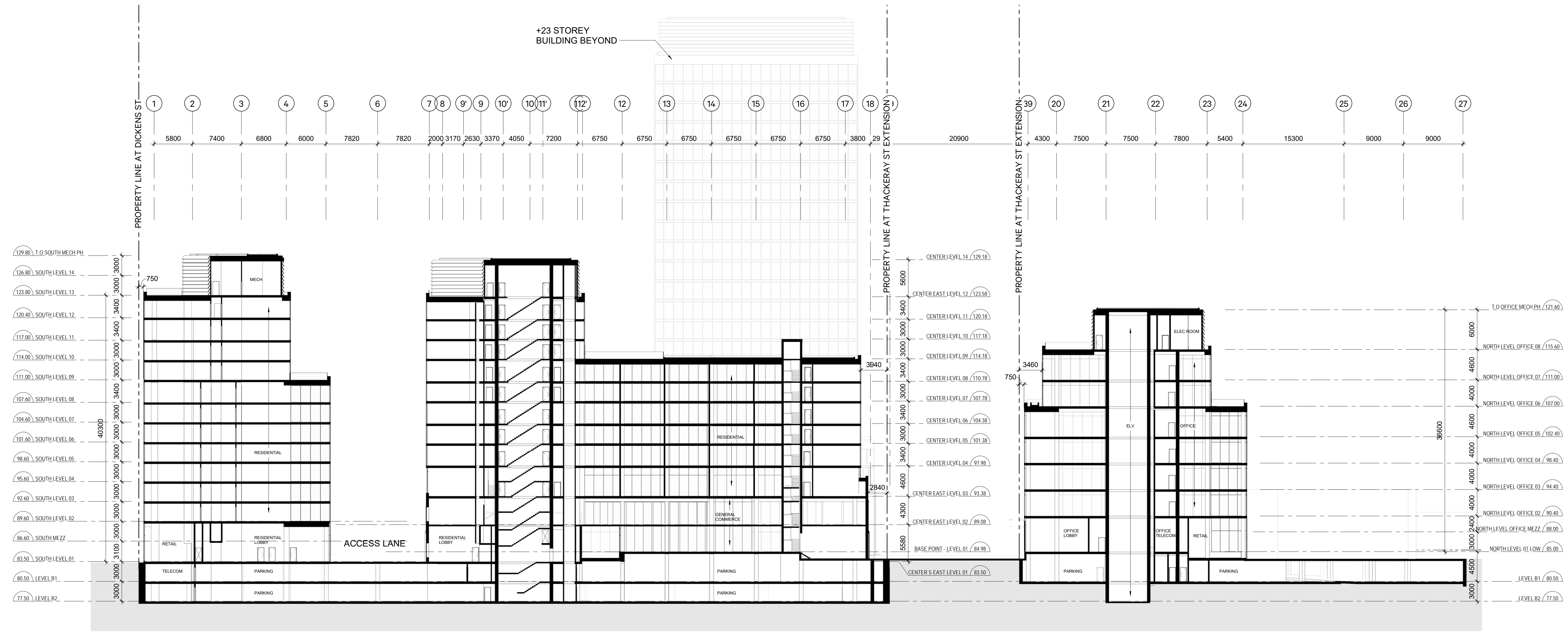


DESIGNED	M.HOSEINI
DRAWN	A.AL-JIRJEES
CHECKED	S.MCINTOSH
APPROVED	L.BRESLER

ONTARIO LINE	
TITLE	TOC LAKESHORE EAST   GERRARD SECTIONS

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SHEET No. 312T503D1b - BIM 360/10206938\_OLTA\_Planning/10206938-TD012D1b-LKSRE-GERRARD.rvt



**1 LONG SITE SECTION**  
1 : 300

ISSUANCE		
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2	2022-10-31	REISSUED FOR QA/QC

**ARCHITECTURE AND  
LANDSCAPE SET - REZONING**



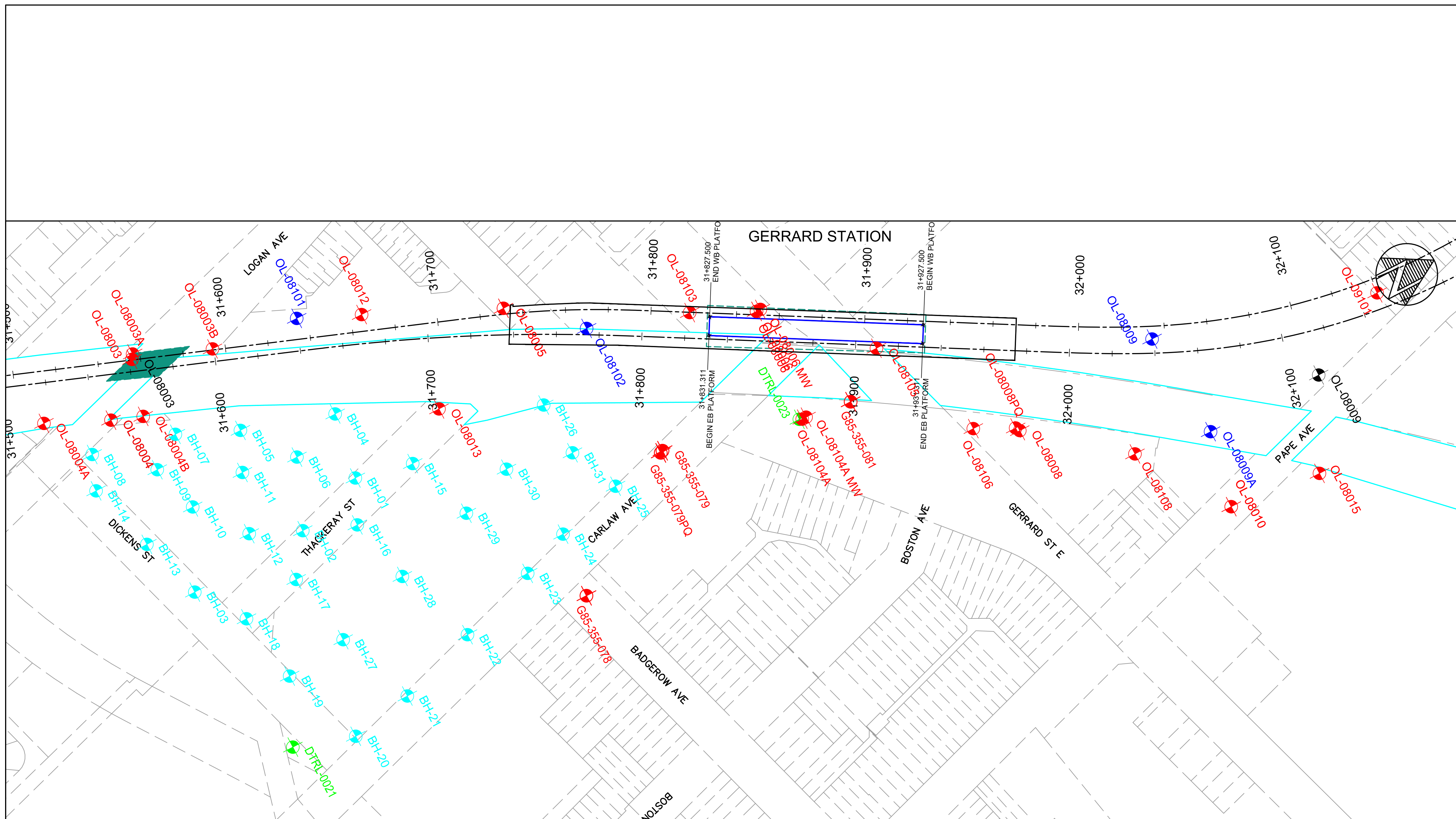
DESIGNED	M.HOSEINI
DRAWN	A.AL-JIRJEES
CHECKED	S.MCINTOSH
APPROVED	L.BRESLER

**ONTARIO LINE**  
**TOC**  
**LAKE SHORE EAST | GERRARD**  
**SECTIONS**

Plot Date: 2022-10-31 4:01:46 PM	
<b>METROLINX</b> Infrastructure Ontario	
SCALE 1 : 300	DRAWING NUMBER 312T503D1b

**Appendix B: Interpreted Stratigraphic Profile and Proposed Boreholes  
for Gerrard Carlaw South TOC**





- BOREHOLE SYMBOLS:**
- EXISTING ONTARIO LINE BOREHOLES
  - BOREHOLE ADVANCED BY OTHERS FOR DIFFERENT PROJECTS
  - PLANNED ONTARIO LINE BOREHOLES
  - PROPOSED BOREHOLES FOR THE TOC

- NOTES:**
1. ALL BOREHOLE LOCATIONS AND SITE FEATURES ARE APPROXIMATE.
  2. SHAFT AND TUNNEL OUTLINES ARE SHOWN FOR GENERAL ILLUSTRATION PURPOSES ONLY AND DO NOT NECESSARILY INDICATE THE EXTENTS OF THE EXCAVATIONS.
  3. ALL ELEVATIONS ARE IN GEODETIC METRES UNLESS OTHERWISE SHOWN.

FILE: 10206938-ge1000-03-bhpp.dwg  
PLOTTED BY: DRAFTING01

REVISIONS	REVISIONS

**AUGUST 2022**  
NOT FOR CONSTRUCTION

SCALE(S)

STATUS

DRAFT



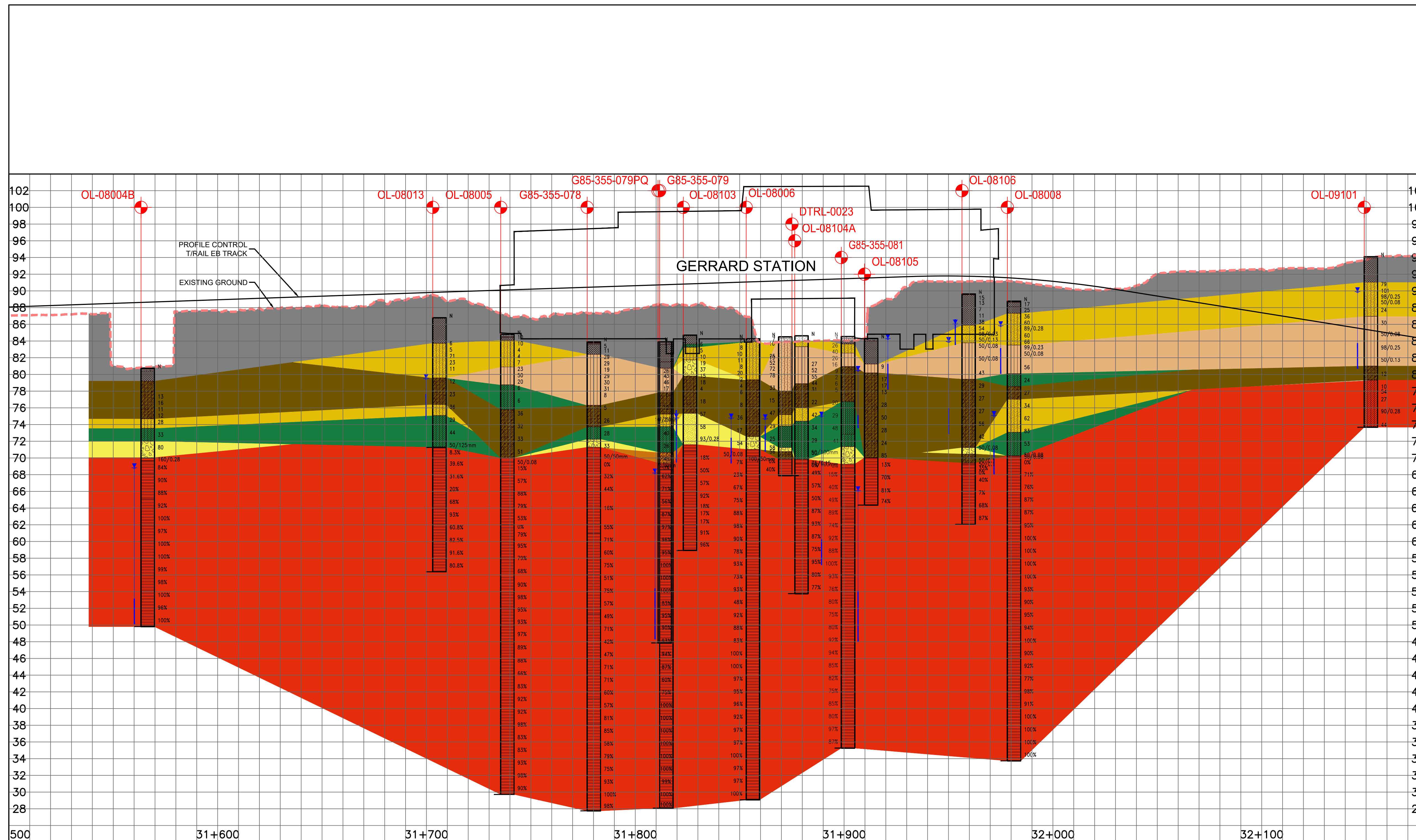
DESIGNED	SH
DRAWN	MFA
CHECKED	JP
APPROVED	_____

**ONTARIO LINE SUBWAY**  
**TOC - NORTH**  
**GERRARD CAELAW SOUTH**  
 STRATIGRAPHIC PROFILE ALONG  
 EASTBOUND TRACK

Plot Date: 3 October 2022

Dwg. No. **FIGURE 1** Sheet No. \_\_\_\_\_





**ENGINEERING GROUP - MAJOR SOIL DEPOSIT:**

F1	FILL
F2	RECENT ALLUVIAL AND FLUVIAL DEPOSITS
1/2	INTERSTADIAL GRAVEL TO SAND
3N	NON-PLASTIC TILL
3C	PLASTIC TILL
4	INTERSTADIAL SILTY SAND TO SANDY SILT
5	GLACIOLACUSTRINE LOW-PLASTICITY CLAYEY SILT TO NON-PLASTIC SILT
6/7	GLACIOLACUSTRINE INTERMEDIATE TO HIGH PLASTICITY SILTY CLAY TO CLAY
B	BEDROCK

**LITHOLOGY GRAPHIC SYMBOLS AND MATERIAL TYPES:**

1	TOPSOIL	8	SANDY SILT TILL
1	PEAT	9	SILTY SAND TILL
1	ORGANIC SOIL	10	CLAY
1	FILL	11	SILTY CLAY
2	SANDY GRAVEL	12	CLAYEY SILT
3	GRAVELLY SAND	13	CLAY TILL
4	SAND	14	SILTY CLAY TILL
5	SILTY SAND	15	CLAYEY SILT TILL
6	SILT	16/17	BEDROCK
7	SANDY SILT		

**BOREHOLE SYMBOLS:**

	EXISTING ONTARIO LINE BOREHOLES
	BOREHOLE ADVANCED BY OTHERS FOR DIFFERENT PROJECTS
	PLANNED ONTARIO LINE BOREHOLES
	PROPOSED BOREHOLES FOR THE TOC

- INTERPRETED PIEZOMETRIC LEVELS:**
- NOTES:**
- SOIL AND GROUNDWATER CONDITIONS BETWEEN BOREHOLES ARE INTERPRETED AND MAY DIFFER FROM CONDITIONS SHOWN. BOREHOLE WIDTH IN PROFILE IS NOT TO SCALE.
  - ALL BOREHOLE LOCATIONS AND SITE FEATURES ARE APPROXIMATE.
  - SHAFT AND TUNNEL OUTLINES ARE SHOWN FOR GENERAL ILLUSTRATION PURPOSES ONLY AND DO NOT NECESSARILY INDICATE THE EXTENTS OF THE EXCAVATIONS.
  - ALL ELEVATIONS ARE IN GEODETIC METRES UNLESS OTHERWISE SHOWN.

**GENERAL LEGEND:**

BOREHOLE SYMBOL AND LABEL		BH
BOREHOLE STRATA SYMBOL		N ← 'N' SPT VALUES 40
WATER LEVEL IN MONITORING WELL/PIEZOMETER		10 80% ← RQD VALUES

FILE: 10206938-ge1000-03-bhpp.dwg  
PLOTTED BY: DRAFTING01

REVISIONS	REVISIONS

**AUGUST 2022**  
NOT FOR CONSTRUCTION

**DRAFT**

SCALE(S) HOR  
0 10 20 30 40m  
0 2.5 5 7.5 10m VER

STATUS

**DRAFT**

**ONETEAM**  
ONTARIO LINE TECHNICAL ADVISOR

DESIGNED	SH
DRAWN	MFA
CHECKED	JP
APPROVED	

**ONTARIO LINE SUBWAY**  
TOC - NORTH  
GERRARD CAELAW SOUTH  
STRATIGRAPHIC PROFILE ALONG  
EASTBOUND TRACK

Plot Date: 3 October 2022

**METROLINX**  
Infrastructure  
Ontario

Dwg. No. **FIGURE 2** Sheet No.

## **Appendix C: Preliminary Geotechnical and Hydrogeological Scope of Investigation**



**TABLE 1**  
**TOC - North - Gerrard Carlaw South**

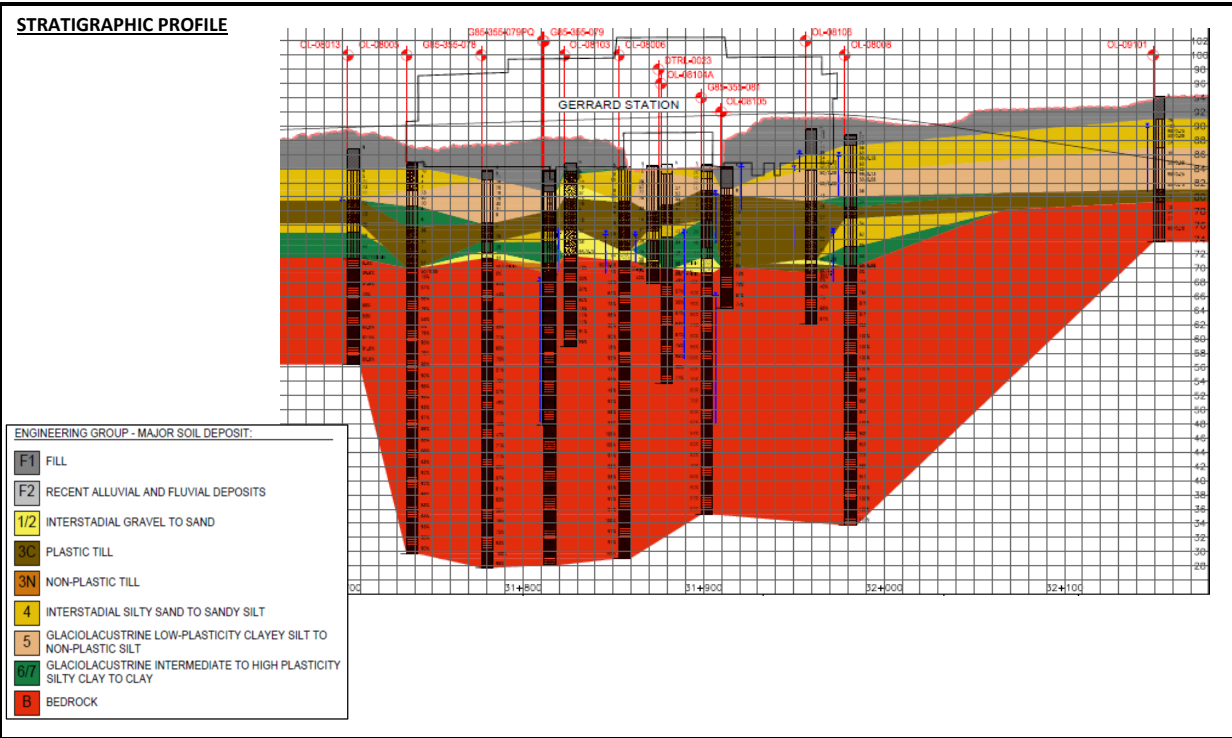
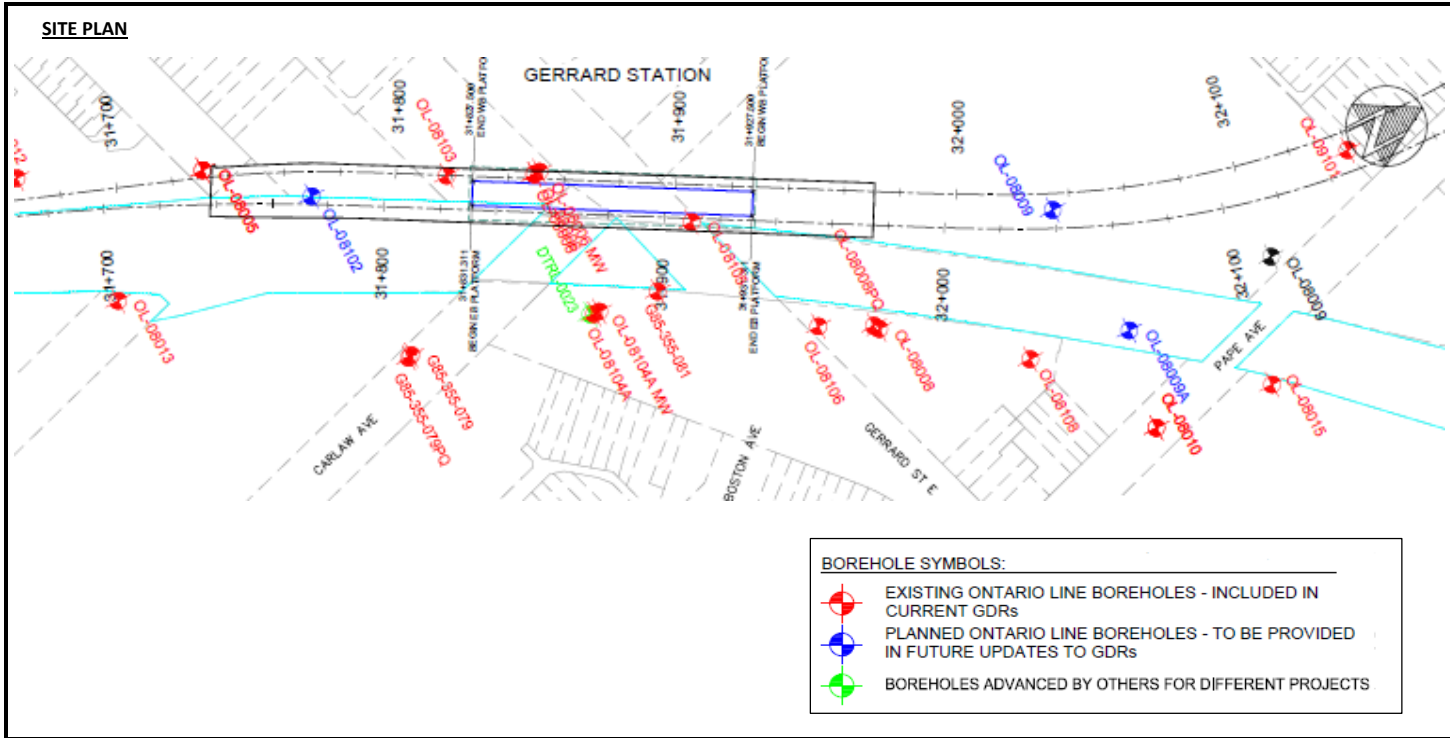
**Preliminary Scope of Work for Geotechnical and Hydrogeological Investigation**

Borehole ID	Depth	Field Investigation	Laboratory Investigation
10 boreholes (BH-1, BH-3, BH-5, BH-8, BH-12, BH-19, BH-22, BH-25, BH-29, and BH-30)	15 [Auger refusal on the top of bedrock]	<p><b>Scope of Work</b></p> <ul style="list-style-type: none"> <li>- SPT within overburden soil at 0.75 m interval up to 6 m depth, increasing to 1.5 m interval up to borehole termination.</li> <li>- Photo of each recovered soil sample showing a sample, measuring tape and sample identification.</li> <li>- If very soft to firm plastic soil is encountered (i.e. N&lt;10), collect Shelby Tube samples, one for every 3 m thickness of the layer, minimum one per layer (Shelby Tube, immediately followed by SPT, followed by VST).</li> <li>- <b>Pressuremeter testing (PMT) and Sonic/PQ Drilling</b> at BH-4, BH-7, and BH-26.</li> <li>- <b>Sonic/PQ Drilling</b> at BH-10, BH-21, and BH-25</li> </ul>	<p><b>Geotechnical Soil Testing</b></p> <ul style="list-style-type: none"> <li>- Moisture content test on all soil samples</li> <li>- Index Properties test (Sieve, hydro, Atterberg) on 30% of the soil samples, minimum one per layer in each borehole.</li> <li>- Unit Weight/Density Test on 5 samples; minimum two tests at each site location.</li> <li>- The following advance testing should be carried out on undisturbed soil samples obtained from the sonic drilling/PQ coring at all subject BHs: <ul style="list-style-type: none"> <li>i- minimum of 2 CD triaxial tests and 2 UU triaxial tests for soil samples from each borehole.</li> <li>ii- minimum of 2 consolidation test for cohesive soil samples from each borehole.</li> </ul> </li> <li>- Rock testing: Unconfined Compressive Strength (UCS) for each run of collected rock cores. Point Load Tests as required.</li> </ul>
6 boreholes (BH-4, BH-9, BH-11, BH-14, BH-16, BH-20)	20 [5 m of bedrock coring]	<p><b>Monitoring Wells:</b></p> <ul style="list-style-type: none"> <li>- Install one monitoring wells with screen tip at 4 m below ground surface at the following boreholes: BH-2, BH-10, BH-16, BH-27, and BH-31.</li> <li>- Install one monitoring wells with screen tip at 6 m below ground surface at the following boreholes: BH-3, BH-14, BH-18, BH-26, and BH-28.</li> <li>- Install one monitoring wells with screen tip at 8 m below ground surface at the following boreholes: BH-4, and BH-23.</li> <li>- Install one monitoring wells with screen tip at 10 m below ground surface at the following boreholes: BH-6 and BH-21.</li> <li>- Install one monitoring wells with screen tip at 15 m below ground surface at the following boreholes: BH-7, and BH-19.</li> <li>- Install one monitoring wells with screen tip at 20 m below ground surface at the following boreholes: BH-9, BH-20, and BH-24.</li> </ul>	
15 boreholes (BH-2, BH-6, BH-7, BH-10, BH-13, BH-15, BH-17, BH-18, BH-21, BH-23, BH-24, BH-26, BH-27, BH-28, BH-31)	25 [10 m of bedrock coring]	<ul style="list-style-type: none"> <li>- Install 50 mm well with 3-m long screen in the aforementioned boreholes. Monitoring wells to be screened within the most permeable zone, with general bias towards the tip elevations mentioned above.</li> <li>- Groundwater level measurements to be completed during drilling and on a bi-weekly basis after installation until the water levels are stabilized, for a minimum of 3 readings.</li> <li>- Single well response test at the above shallow monitoring well locations (i.e., monitoring wells with tip at 4 m, 6 m, and 8 m below ground surface).</li> </ul>	

**Notes:**

- 1- The preliminary locations of the boreholes are shown in Appendix B. The preliminary borehole locations are based on the TOC development footprint obtained from the drawings provided by SvN on August 25th, 2022. The borehole locations shall be finalized by DevCo.
- 2- The field investigation and laboratory testing must be completed in accordance with the best practices for geotechnical investigation and in conformance with all applicable regulations, codes, and standards.
- 3- The scope of investigation presented herein is the recommended minimum scope of investigation to further progress the design of TOC. Dev Co. and their designers must add to the scope of investigation presented herein, as required, for the final design of the TOC.

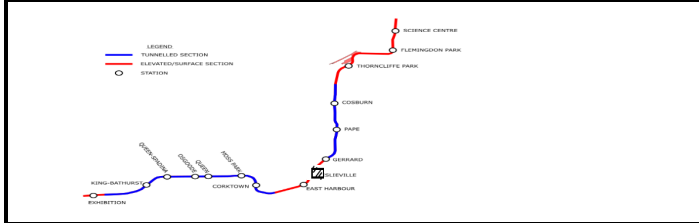
## **Appendix D: Preliminary Geotechnical Engineering Parameters**



**GEOTECHNICAL PROPERTIES**

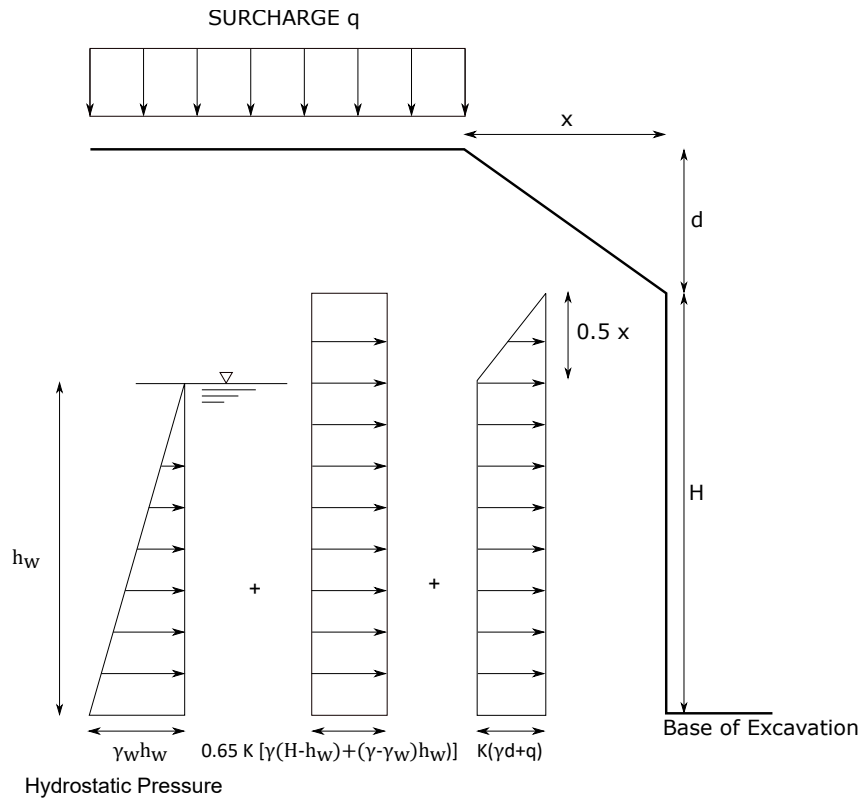
Soil Class	Soil Type Description	Sta. 31+700 to Sta. 31+860 (WB Chainage)				Sta. 31+860 to Sta. 32+000 (WB Chainage)				Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Water Content (%)	Unit Weight, $\gamma$ (kN/m <sup>3</sup> ) <sup>[D]</sup>	Young's Modulus, $E_{50}$ (MPa) <sup>[A]</sup>	Young's Modulus (Unload / Reload), $E_{ur}$ (MPa) <sup>[B]</sup>	Poisson's Ratio <sup>[C]</sup>	Undrained Shear Strength, $S_u$ (kPa)	Effective Friction Angle, $\phi'$ (deg)	Effective Cohesion, $c'$ (kPa)	Earth Pressure Coefficient			
		Elevation (m)		Depth (m)		Elevation (m)		Depth (m)													Active ( $K_A$ )	Passive ( $K_P$ )		
		From	To	From	To	From	To	From	To															
F1	Fill <sup>[F]</sup>	84.5	83.6	0.0	0.9	89.6	81.0	0.0	8.6	-	-	-	14 <sup>[E]</sup>	19.5	12	35	0.2 - 0.25	-	28	-	0.36	2.8		
1/2	4	5	Interstadial Sand to Sandy Silt to Glaciolacustrine Non-Plastic Silt	83.6	79.7	0.9	4.8	81.0	79.4	8.6	10.2	-	-	-	19	20.5	25	100	0.2 - 0.25	-	32	-	0.31	3.2
3C	6/7	Glaciolacustrine Silty Clay to Clay to Plastic Till	79.7	76.0	4.8	8.5	79.4	76.0	10.2	13.6	29	15	14	19	20.5	21	56	0.2 - 0.25	60 - 110	31	10	0.32	3.1	
3C	6/7	Glaciolacustrine Silty Clay to Clay to Plastic Till	76.0	72.0	8.5	12.5	76.0	69.4	13.6	20.2	29	15	14	19	20.5	21	56	0.2 - 0.25	110 - 225	31	10	0.32	3.1	
1/2	3N	Interstadial Gravel to Sand to Non-Plastic Till	72.0	70.0	12.5	14.5	-	-	-	-	-	-	-	11	21	40	160	0.2 - 0.25	-	34	-	0.28	3.5	

<sup>[A]</sup> Secant modulus at 50% of the failure stress. Secant modulus should be increased by 20% to 50% for settlement calculation.  
<sup>[B]</sup> Average Secant Modulus for Unload/Reload condition.  
<sup>[C]</sup> Long-term Effective Poisson's Ratio.  
<sup>[D]</sup> The unit weight values are for the intact condition and do not include bulking factor after excavation.  
<sup>[E]</sup> Some organics and rootlets were observed within the Fill layer. The moisture content presented in this table for fill is not representative of the moisture content of these organics and rootlets.  
<sup>[F]</sup> The top ground elevation of the Fill material noted in this table is based on the existing ground elevation encountered during the investigation. Conditions of fill above elevation 84.5m is unknown..




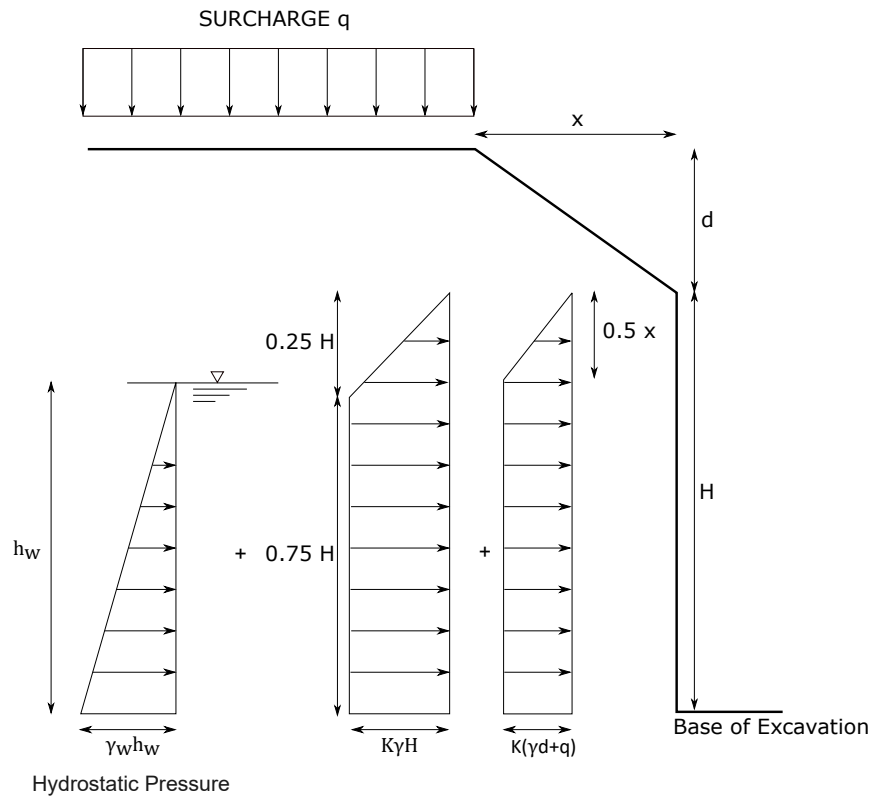
Ontario Line  
 TOC - NORTH  
 Gerrard Carlaw South  
 Preliminary Stratigraphic Profile and  
 Geotechnical Properties

ENGINEER: MM	DRAWN: JP/SH/SJ	APPROVED
DATE: 2022-10-03	SCALE: NTS	




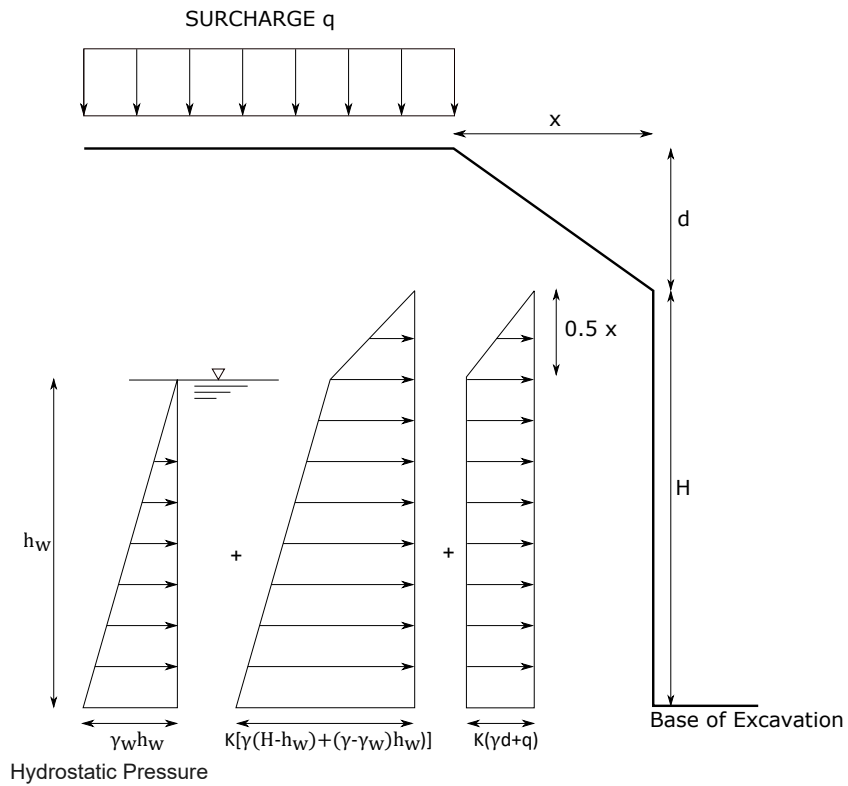
- $\gamma$  = unit weight of soil
- $\gamma_w$  = unit weight of water
- $K$  = earth pressure coefficient
  - =  $K_a$  (where controlling ground deformation is not a concern) -  $K_a$  is the active coefficient of earth pressure
  - = 0.4 to 0.5 (to support semi-sensitive to sensitive structures)

 ONTARIO LINE TECHNICAL ADVISOR		SITE: TOC - North - Gerrard Carlaw South	TITLE: Lateral Earth Pressure Distribution Temporary Braced Excavation in Cohesionless Soils
PROJECT:	Ontario Line	DOCUMENT OWNER: Thurber	
DATE:	2020-11-13		FIGURE: D-1




- $\gamma$  = unit weight of soil
- $\gamma_w$  = unit weight of water
- $s_u$  = undrained shear strength
- $K$  = earth pressure coefficient
  - = 0.2 (where controlling ground deformation is not a concern)
  - = 0.3 to 0.4 (to support semi-sensitive to sensitive infrastructure)

 ONTARIO LINE TECHNICAL ADVISOR		SITE: TOC - North - Gerrard Carlaw South	TITLE: Lateral Earth Pressure Distribution
PROJECT:	Ontario Line	DOCUMENT OWNER: Thurber	Temporary Braced Excavation Stiff to Hard Cohesive Soils
DATE:	2020-11-13		FIGURE: D-2



$\gamma$  = unit weight of soil  
 $\gamma_w$  = unit weight of water  
 $K$  = earth pressure coefficient as indicated in the report

 ONTARIO LINE TECHNICAL ADVISOR	SITE: TOC - North - Gerrard Carlaw South	TITLE: Lateral Earth Pressure Distribution  Permanent Structures
	PROJECT: Ontario Line DATE: 2020-11-13	
		FIGURE: D-3