Memo

Date:	Friday, October 27, 2023
Project:	Ontario Line TA
To:	Andrea Gaus
From:	Mohamed Hosney, Mehdi Mostakhdemi, Masoud Manzari
Subject:	Geotechnical Desktop Study for Transit Oriented Communities (TOC) North - Thorncliffe, Ontario Line

1 Introduction

This memorandum provides a summary of the currently available subsurface ground conditions in the vicinity of the Transit Oriented Communities (TOC) North near Thorncliffe Station. Preliminary geotechnical recommendations in support of the design of the subject development have also presented in this memo. The memo 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 by Metrolinx at the site, by means of a limited number of boreholes, non-continuous sampling, in-situ testing, and laboratory testing on selected soil samples. The preliminary recommendations contained in this memorandum rely on the accuracy of the factual subsurface data supplied by others. The authors of this memo 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 memo may not be valid.

Supplemental geotechnical investigation shall be conducted at the project site. The preliminary recommendations presented in this memo must not be used for detail design of the subject TOC as the recommendations are subject to confirmation/modification when the supplemental investigation is completed. The scope for the first stage of the supplemental geotechnical investigation is provided herein for information.

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 TOC site will be located just north of Overlea Boulevard from about 150 m east to about 300 m west of Thorncliffe Park Drive in Toronto, Ontario. The proposed Thorncliffe Park station is an elevated station integrated with the proposed OL elevated guideway with its foundations at elevation 128.2 m.

Based on the current general arrangement drawings (included in Appendix A for information only), five new buildings, titles herein as '36 Overlea Blvd. TOC', '2-6 Thorncliffe DR TOC', '1 Thorncliffe DR TOC', '14-16 Overlea Blvd. TOC', and '6-8 Overlea Blvd. TOC' will be constructed at the site. The buildings will consist of up to 55 levels above the ground surface and 3 basement levels.

3 Sources of Geotechnical Data

The boreholes used in the preparation of this desktop report are shown on Figure B.1 in Appendix B, and the geotechnical data has been obtained from the following reports:

- Stage 2 North Tunnel Geotechnical Data Report (GDR) – Final, Ontario Line - East of Lower Don River Bridge, Toronto, Ontario, prepared by WSP, dated October 31, 2022.
- Stage 2A and Stage 2B South Civil Geotechnical Investigation Report (GDR) Ontario Line – West of Don River and Proposed Maintenance Storage Facility Toronto, Ontario (Revision 15), prepared by WSP, dated December 5, 2022.
- Geophysical Investigation, Ontario Line – Thorncliffe Segment, Toronto, Ontario, prepared by Geophysics GPR International Inc., dated September 2022.

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

4 Subsurface Conditions

Fourteen boreholes (i.e., OL-12007, OL-12008, OL-12014, OL-12015, OL-13103, OL-13102, OL-13101, OL-13001, OMSF-01, OMSF-012, OMSF-041, OMSF-043 to 046, and OMSF-049) were advanced in vicinity of the TOC North Thorncliffe. The boreholes were advanced to depths ranging from about 8 m to 61 m below the existing ground surface. All boreholes were terminated within the overburden. The bedrock was inferred to be at a depth of about 61 m (elevation 63 m) as shale fragments were noticed within the split spoon sampler in Borehole OL-12015.

The existing borehole locations, the stratigraphy encountered at the borehole locations, the preliminary interpreted stratigraphy and piezometric head measurements 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 subsurface soils and bedrock encountered at the TOC sites have been combined into seven engineering groups according to their deposition history, anticipated engineering characteristics and behaviour. The seven groups are identified by different colours on the profiles. Due to the complex nature of the depositional environments, each engineering group represents a range of soil assemblages. The uniform colours on the profiles do not represent either uniform material characteristics or uniform soil behaviour. Small pockets and seams of one soil group interbedded within the deposits of another soil group could not be shown on the stratigraphic profile.

The stratigraphic profile in the area of the proposed development generally consisted of at least 60 m of 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 1 m to 3 m thick layer of variable fill materials. The fill layer is underlain by 14 m to 24 m thick layer of stiff to hard silty clay to clayey silt (plastic) till. Within the footprint of 36 Overlea Blvd. and 2-6 Thorncliffe DR TOCs, the plastic till layer is underlain by a 10 m to 15 m thick layer of dense to very dense silty sand to sandy silt (non-plastic) till. Within the footprint of the remainder of the TOC buildings, the plastic till layer is underlain by about 20 m to 30 m thick layer of hard glaciolacustrine silty clay to clayey silt. The glaciolacustrine deposit is underlain by layers of silty sand to sandy silt to clayey silt, as shown on the Interpreted Stratigraphic profile in Appendix B.

Shallow, intermediate, and deep monitoring wells have been installed in the boreholes as shown in Appendix B. Based on the shallow monitoring well, the groundwater level measured within the fill and non-plastic till layer is 1.7 m below the ground surface (i.e., at about elevation 126.5 m). Deeper groundwater levels are observed in the monitoring wells; however, the excavation for the basements of the five TOC sites will take place within the shallow groundwater zone.

Descriptions of subsurface conditions presented above is based upon interpolation between borings, extrapolation beyond borings and assessment of laboratory test data. The subsurface conditions might vary between and beyond the borehole locations.

5 Preliminary Engineering Recommendations

This section of the memo provides preliminary geotechnical recommendations for the subject TOC buildings.

Where comments are made on construction, they are provided to highlight those aspects which could affect the design of the project. Therefore, construction related comments should not be regarded as suggestions or recommendations to the contractors/subcontractors given that the comments do not address all aspects of construction, such as scheduling, type of equipment, rate of production, excavation support systems, etc. The contractors/subcontractors undertaking this work must evaluate the factual information presented in the reference reports (as outlined in Section 3) and supplement these where it appears to be needed, and then conduct their assessment and selection of the equipment based on their own interpretation of the factual data coupled with their experience with similar projects in similar geotechnical/geological environments.

The preliminary geotechnical recommendations provided herein are based on the assumption that the design and construction will be in accordance with the applicable codes and standards, and good engineering practices, and project's specifications.

5.1 Geotechnical Design Parameters

Preliminary geotechnical engineering parameters for the engineering groups encountered in the boreholes advanced near the proposed TOCs are provided in the table included in Appendix C. Average values are typically listed in the table. 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 means and methods. The contractors/subcontractors should consider the full range of property values when evaluating the selection of equipment and construction methods, as per comments noted in Section 5.

The groundwater level for preliminary design purposes should be considered to be at elevation 127 m.

5.2 Temporary Shoring Walls

Temporary support to retain excavation walls will be required for the excavation of the proposed three level of basements at the TOC buildings. The design of the temporary support must be in accordance with the latest edition of the Canadian Engineering Foundation Manual (CFEM), and all other applicable codes and standards having jurisdiction over the development (e.g., OL Subway requirements). 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 but not limited to, the OL Thorncliffe Station structures and all adjacent utilities.

Basic soil properties for the design of the temporary shoring system are provided in Appendix C. Recommended lateral earth pressure distribution for preliminary design of the shoring are provided in Figures C.2 and C.3 of Appendix C.

5.2.1 Soil Anchors

For preliminary design of soil anchors for Thorncliffe TOC, the estimated ultimate soil-to-ground transfer load for pressure grouted soil anchors are provided in Table 1 below. The ultimate transfer loads of the anchors within the anticipated soil types depend to a large degree upon the workmanship of the Contractor and their construction/installation means and methods. As such, the Contractor shall be held to a tieback performance specification. Subsequent to the final design and commencement of the construction, any specified design value for the soil anchors must be verified by the Contractor through an adequate number of field anchor pull out tests as per OPSS 942 (Construction Specification for Prestresses Soil and Rock Anchors), PTI DC35.1 14, and all other applicable codes and standards having jurisdiction over the project. All production anchors must be proof tested.

The ultimate unfactored bond strength provided in Table 1 is valid for 150 mm to 200 mm diameter pressure-grouted soil anchors with the grout injected under pressure of about 1.0 to 2.8 MPa. The bond length of the soil anchors typically ranges between 5 m to 12 m. The centre to centre spacing between anchors shall be greater than 4 times the bond zone diameter, 1.2 m, or 20% the bond length, whichever is greater.

Table 1. Preliminary ultimate unfactored bond strength for soil anchors for Thorncliffe TOC

Soil Type in Bond Zone	Estimated Ultimate Load Transfer, τu (kN/m)
Group 3C & 6/7 Soil	100
Group 3N & 1/2 Soil	200

5.3 Permanent Structures

5.3.1 Lateral Earth and Groundwater Pressures

The preliminary lateral earth pressure distribution for design of the underground levels of the structures is provided in Figure C.4 of Appendix C. An earth pressure coefficient (K) of 0.5 is recommended for the preliminary stage design. The design groundwater level is provided in Section 5.1.

5.3.2 Foundations

Based on the available shear wave velocity measurements along the OL subway alignment, immediately to the south of the subject TOC, the site seismic classicisation for the subject development could be Site Class “C” with an average shear wave velocity (V_{s30}) of 455 m/s. This V_{s30} and associated classification represent the results of the currently available subsurface information immediately to the south of the TOC property. Given variable nature of the subsurface soil within the TOC property, the representative average shear wave velocity (V_{s30}) may be somehow different when the site specific geotechnical investigation is conducted for the project.

It is our understanding that the foundation design of the subject TOC buildings will be developed and finalized subsequent to the completion of the planned site-specific geotechnical investigation. The feasibility of supporting the subject TOC buildings on either raft foundation or deep caissons are presented below.

Raft Foundation:

The preliminary estimated factored and unfactored applied pressure under each tower of the subject TOC buildings have been provided by the structural designer (see Appendix D). The base of the subject TOC

buildings, except the 36 Overlea Blvd. TOC, are subject to eccentric loading. Therefore, the pressure distribution at SLS and ULS under each TOC building have been computed in accordance with the Canadian Highway Bridge Design Code (CHBDC, 2019) Clauses 6.10.5 and summarized in Table 2.

Table 2. Preliminary Applied Pressure at ULS and SLS

TOC Structure	Approximate Founding Elevation (m)	Factored Applied Pressure at ULS (kPa)	Applied Pressure at SLS (kPa)
36 Overlea Blvd.	~118.6	415	320
2-6 Thorncliffe DR	~118.9	540	417
1 Thorncliffe DR	~119.8	755	580
14-16 Overlea Blvd.	~118.4	665	530
6-8 Overlea Blvd.	~117.9	1,115	890

The preliminary factored geotechnical resistances at ULS and SLS for raft foundations supporting the five TOC buildings, with considering the load eccentricity, are provided in Table 3.

Table 3. Preliminary Factored Geotechnical Resistances for Raft Foundations

TOC Structure	Approximate Founding Elevation (m)	Anticipated Founding Material	Factored Geotechnical Resistance at ULS (kPa)		Factored Geotechnical Resistance at SLS (kPa), for 25 mm Settlement	Estimated Maximum Settlement Under Applied Pressure at SLS (mm)	
			Undrained Condition (Short term)	Drained Condition (Long term)		Rigid Raft	Flexible Raft
36 Overlea Blvd.	~118.6	[Soil Group 3C] Stiff to Hard Silty Clay to Clayey Silt Plastic Till	1,600	>2,000	180	60	
2-6 Thorncliffe DR	~118.9		1,150	>2,000	145	110	280
1 Thorncliffe DR	~119.8		535	>2,000	140	230	400
14-16 Overlea Blvd.	~118.4		510	>2,000	123	200	400
6-8 Overlea Blvd.	~117.9		585	>2,000	145	345	380

At the location of 36 Overlea Blvd. TOC and 2-6 Thorncliffe Dr TOC, the preliminary factored geotechnical resistances at ULS is higher than the factored applied pressures. However, the anticipated settlements due to the applied SLS pressures are relatively significant (i.e., more than 25 mm). It is noted that the anticipated settlements were derived using preliminary assessment of the soil properties and simplified methods analysis. Hence, subsequent to completion the supplemental investigations, detailed assessment of the

anticipated settlements (e.g., with updated soil parameters and more complex analysis methods such as Finite Element Modelling) is recommended.

For the remaining three TOC buildings (i.e., 1 Thorncliffe DR TOC, 14-16 Overlea Blvd. TOC, and 6-8 Overlea Blvd.), the preliminary geotechnical resistances at ULS in short term are smaller than the factored applied pressures at ULS. However, the factored geotechnical resistances at ULS in long term are typically greater than the factored applied pressure. Given that the construction of the TOCs would take relatively long time, the factored geotechnical resistance at ULS at the end of construction can be somewhere in between the short-term and long-term conditions. If excessive settlement of the mat foundation can be accommodated in the design, a detailed assessment of the geotechnical resistances at ULS can be conducted to verify whether mat foundation provide adequate geotechnical resistance during all stages of the construction. Furthermore, a mat-pile foundation can also reduce the anticipated settlement of the mat foundation. These options require advance analysis and can be conducted, if needed, after completion of the supplemental geotechnical investigation.

Deep Foundations (Caissons):

Where raft foundations are not feasible to support the proposed structures (e.g., excessive settlement), consideration may be given to the use of deep foundations (i.e., caissons).

The base of the caissons for the northern two TOC buildings (i.e., 36 Overlea Blvd. and 2-6 Thorncliffe DR) can be founded on the dense to very dense sand to sandy silt deposits (Soil Group 2 and 3N), about 15 m below the base of excavation of the subject two buildings. The recommended geotechnical resistances are provided in Table 4.

The caissons for the southern three TOC buildings (i.e., 1 Thorncliffe Dr., 14-16 Overlea Blvd., and 6-8 Overlea Blvd.) can either be supported on the very dense non-plastic deposits, extending more than 35 m below the base of the excavation, or on Group 6/7, extending about 15 m below the base of the excavations. The recommended geotechnical resistances for both options are provided in Tables 5 to 7.

It should be noted that the performance of caissons will depend to a large degree upon the construction means and methods. Therefore, higher geotechnical resistances may be considered in the design if the axial resistance of the caissons will be verified by a properly designed and implemented pile load testing program implemented prior to construction. Therefore, two sets of factored geotechnical resistances (for cases with and without conducting pile load testing) are provided in Tables 4 to 7.

A minimum centre-to-centre spacing of 2.5 times caisson diameter is recommended between caissons.

Table 4. Preliminary Factored Geotechnical Resistances at ULS for 36 Overlea Blvd. and 2-6 Thorncliffe DR

Caisson Diameter (m)	Embedment Length / Tip Elevation (m)	Anticipated Founding Material	Factored Geotechnical Resistance in Compression at ULS (kN)		Factored Geotechnical Resistance in Tension at ULS (kN)	
			Without Conducting a Pile Load Test	With Conducting a Pile Load Test	Without Conducting a Pile Load Test	With Conducting a Pile Load Test
1.2	15 / 103.5	[Soil Group 3N or 2] Dense to Very Dense Sand to Sandy Silt	3,700	5,550	775	1,290
1.5	15 / 103.5		5,450	8,200	970	1,600

Table 5 Preliminary Factored Geotechnical Resistances at ULS for 1 Thorncliffe DR

Caisson Diameter (m)	Embedment Length / Tip Elevation (m)	Anticipated Founding Material	Factored Geotechnical Resistance in Compression at ULS (kN)		Factored Geotechnical Resistance in Tension at ULS (kN)	
			Without Conducting a Pile Load Test	With Conducting a Pile Load Test	Without Conducting a Pile Load Test	With Conducting a Pile Load Test
1.2	15 / 104.8	[Soil Group 6/7] Hard Silty Clay to Clayey Silt	1,360	2,050	610	1,000
	37.8 / 82.0	[Soil Group 2 or 4] Very Dense Sand to Sandy Silt	7,400	11,100	2,270	3,800
1.5	15 / 104.8	[Soil Group 6/7] Hard Silty Clay to Clayey Silt	1,870	2,800	765	1,270
	37.8 / 82.0	[Soil Group 2 or 4] Very Dense Sand to Sandy Silt	10,600	16,000	2,800	4,700

Table 6. Preliminary Factored Geotechnical Resistances at ULS for 14-16 Overlea Blvd.

Caisson Diameter (m)	Embedment Length / Tip Elevation (m)	Anticipated Founding Material	Factored Geotechnical Resistance in Compression at ULS (kN)		Factored Geotechnical Resistance in Tension at ULS (kN)	
			Without Conducting a Pile Load Test	With Conducting a Pile Load Test	Without Conducting a Pile Load Test	With Conducting a Pile Load Test
1.2	15 / 103.5	[Soil Group 6/7] Hard Silty Clay to Clayey Silt	1,140	1,700	445	740
	36.4 / 82.0	[Soil Group 2 or 4] Very Dense Sand to Sandy Silt	7,200	10,800	2,100	3,500
1.5	15 / 103.5	[Soil Group 6/7] Hard Silty Clay to Clayey Silt	1,590	2,390	555	925
	36.4 / 82.0	[Soil Group 2 or 4] Very Dense Sand to Sandy Silt	10,400	15,600	2,600	4,300

Table 7. Preliminary Factored Geotechnical Resistances at ULS for 6-8 Overlea Blvd.

Caisson Diameter (m)	Embedment Length / Tip Elevation (m)	Anticipated Founding Material	Factored Geotechnical Resistance in Compression at ULS (kN)		Factored Geotechnical Resistance in Tension at ULS (kN)	
			Without Conducting a Pile Load Test	With Conducting a Pile Load Test	Without Conducting a Pile Load Test	With Conducting a Pile Load Test
1.2	15 / 102.9	[Soil Group 6/7] Hard Silty Clay to Clayey Silt	1,260	1,890	535	890
	35.9 / 82.0	[Soil Group 2 or 4] Very Dense Sand to Sandy Silt	7,300	11,000	2,200	3,600
1.5	15 / 102.9	[Soil Group 6/7] Hard Silty Clay to Clayey Silt	1,740	2,600	670	1,110
	35.9 / 82.0	[Soil Group 2 or 4] Very Dense Sand to Sandy Silt	10,500	15,800	2,700	4,500

6 Supplemental Investigation

Supplemental geotechnical and hydrogeological investigation are required to further progress the design of the subject TOCs. Given variable nature of the subsurface condition, a staged approach in the subsurface investigation is recommended for an efficient/cost effective design process. The minimum recommended scope for the Phase-1 of the additional investigation is presented in Table E-1 of Appendix E. The proposed locations for 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 TOCs.

Based on the findings of Phase-1 investigation, a second phase of investigation may need to be designed and executed to allow the completion of the detailed design of the subject TOCs.

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.

THURBER

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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.

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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.

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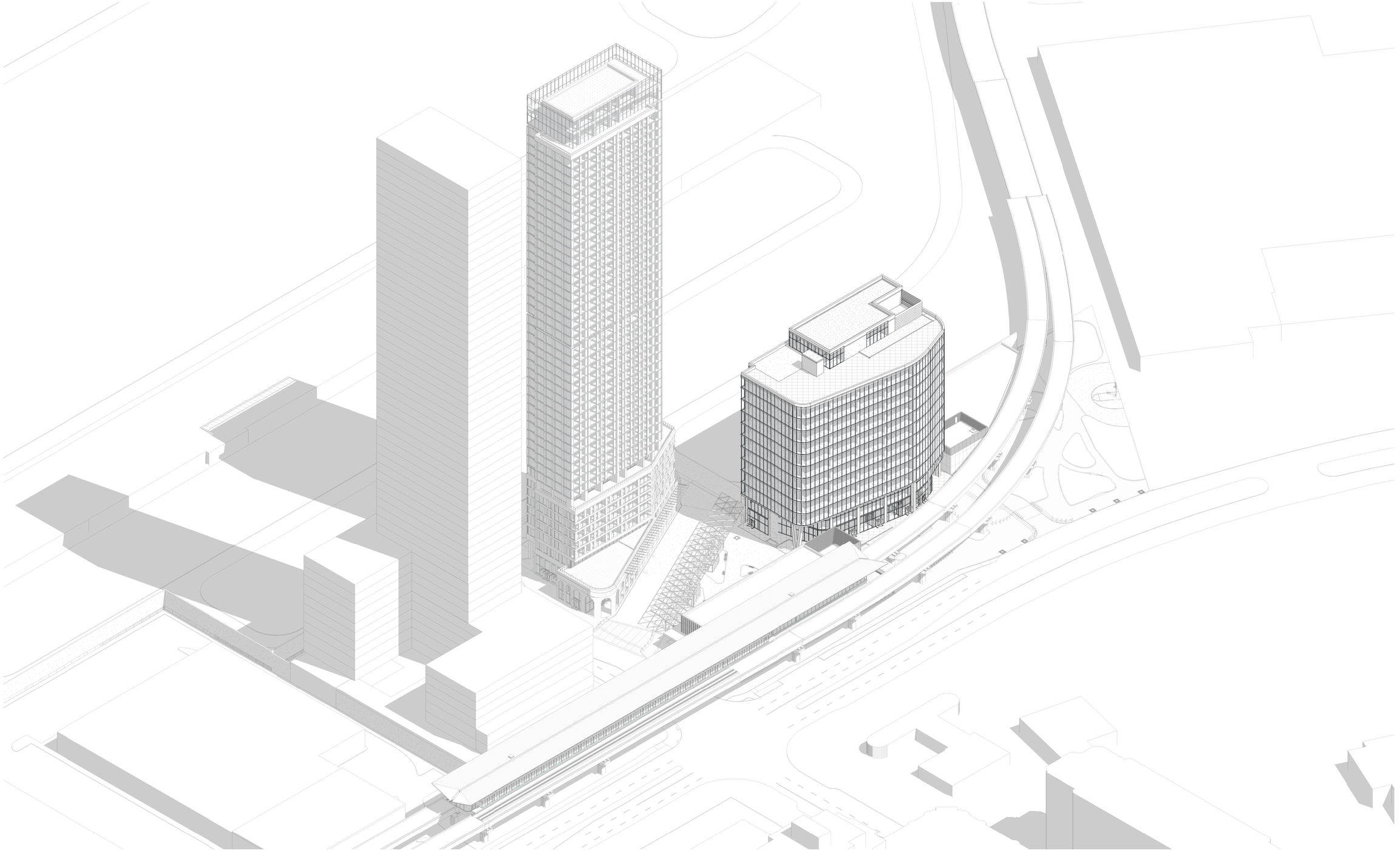
Appendix A: General Arrangement Drawings



REVISIONS		

ARCHITECTURE AND LANDSCAPE SET - REZONING

NOT FOR ESTIMATING OR BIDDING
NOT FOR CONSTRUCTION

SvN

ONETEAM
ONTARIO LINE TECHNICAL ADVISOR

DESIGNED Designer
DRAWN Author
CHECKED Checker
APPROVED Approver

ONTARIO LINE

TITLE

CONTEXT MASSING

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METROLINX
Infrastructure Ontario

SCALE

DRAWING NUMBER
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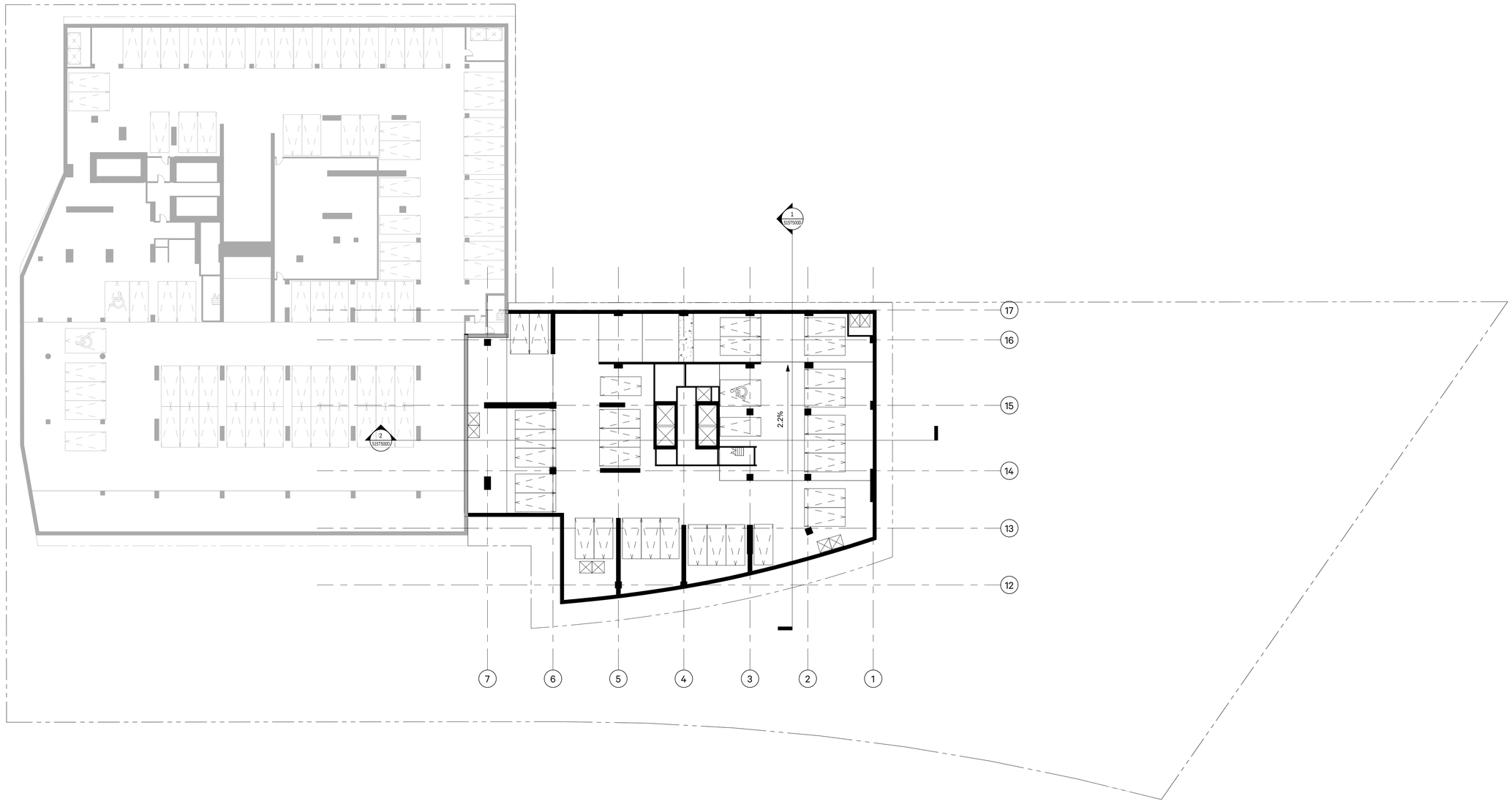

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REVISIONS		

ARCHITECTURE AND LANDSCAPE SET - REZONING

NOT FOR ESTIMATING OR BIDDING
NOT FOR CONSTRUCTION

SvN

ONETEAM
ONTARIO LINE TECHNICAL ADVISOR

DESIGNED Designer
DRAWN Author
CHECKED Checker
APPROVED Approver

ONTARIO LINE

TITLE

LEVEL B3

Plot Date: 2023-06-12 12:55:58 PM

METROLINX
Infrastructure Ontario

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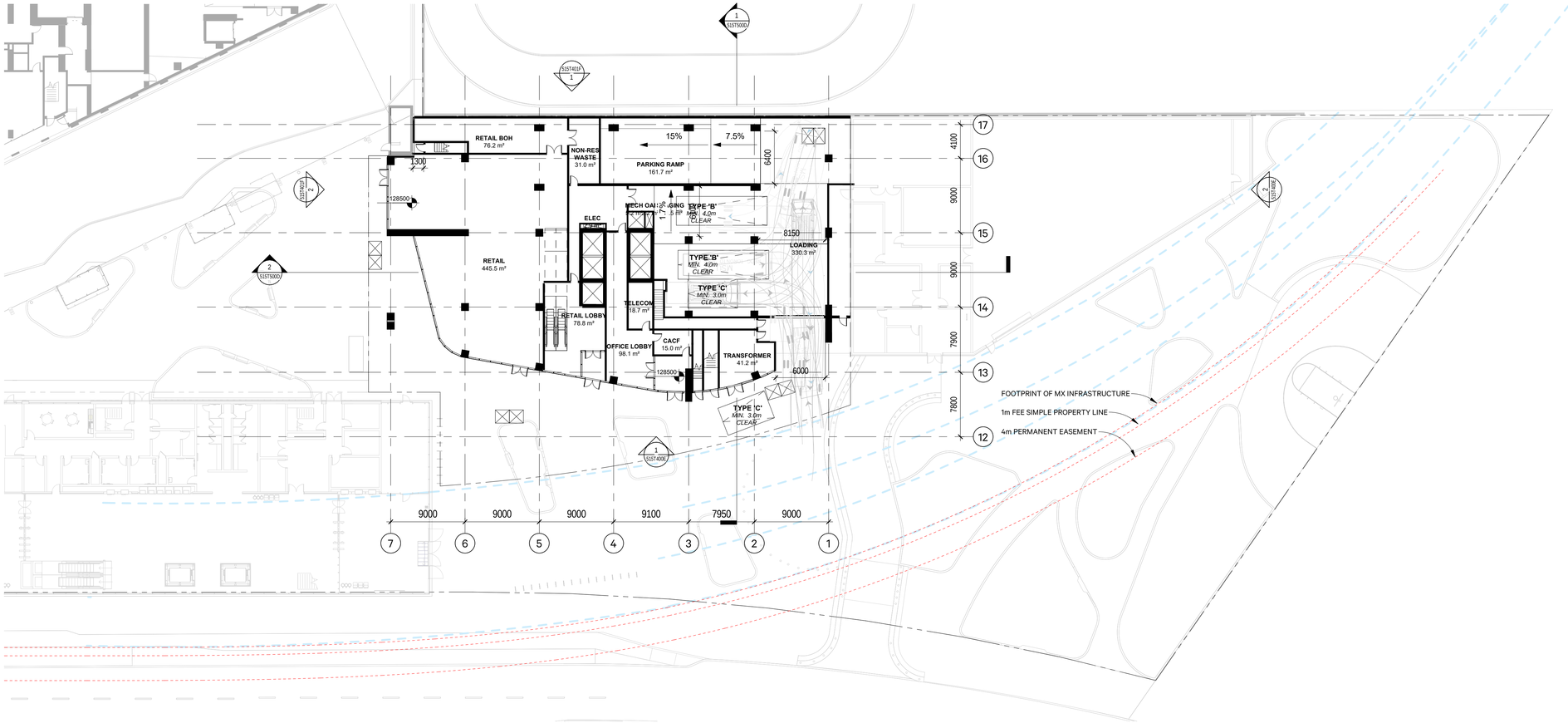

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REVISIONS		

ARCHITECTURE AND LANDSCAPE SET - REZONING

NOT FOR ESTIMATING OR BIDDING
NOT FOR CONSTRUCTION

SvN

ONE TEAM
ONTARIO LINE TECHNICAL ADVISOR

DESIGNED Designer
DRAWN Author
CHECKED Checker
APPROVED Approver

ONTARIO LINE

TITLE
LEVEL 01

Plot Date: 2023-06-12 12:56:02 PM

METROLINX
Infrastructure Ontario

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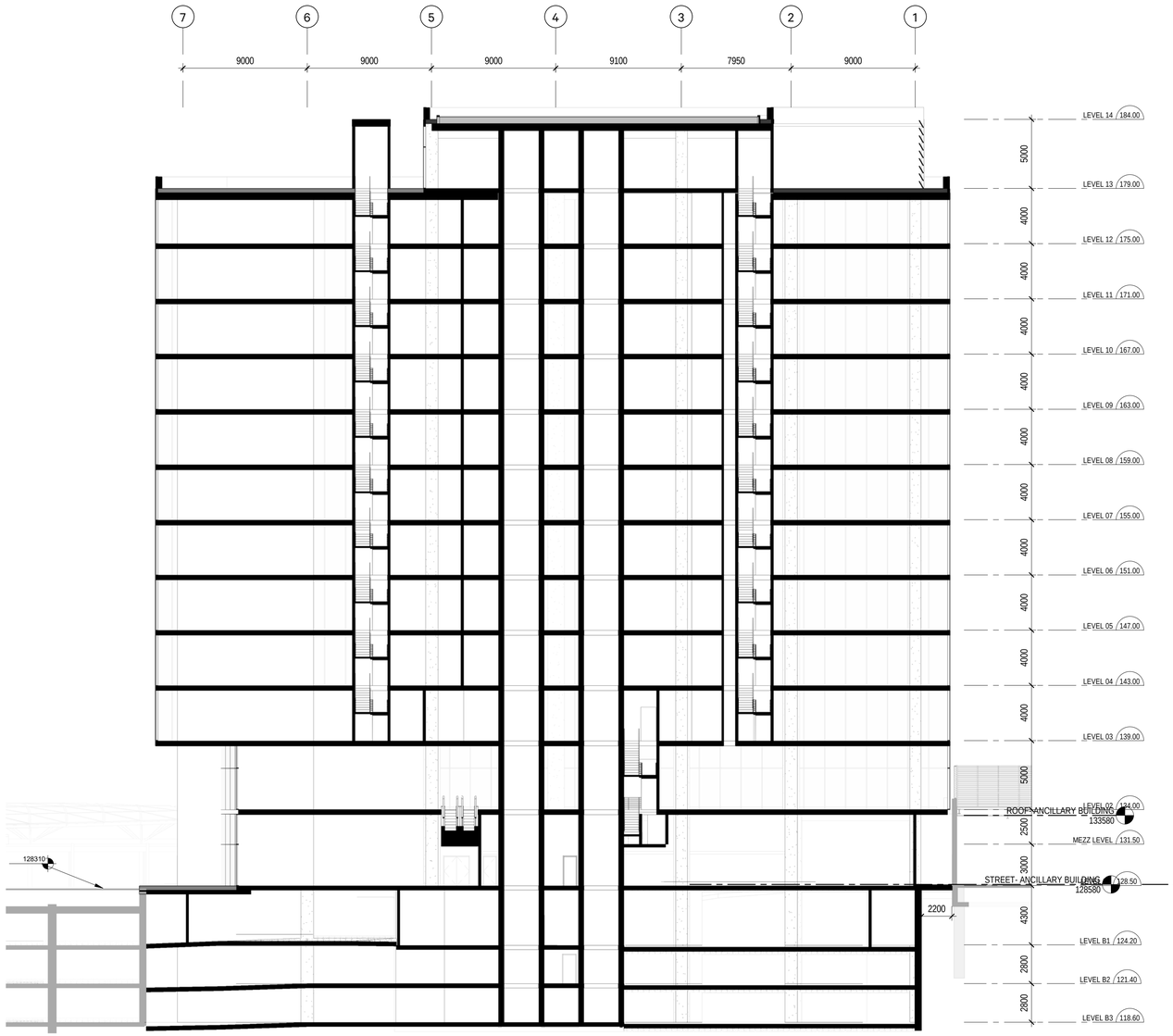
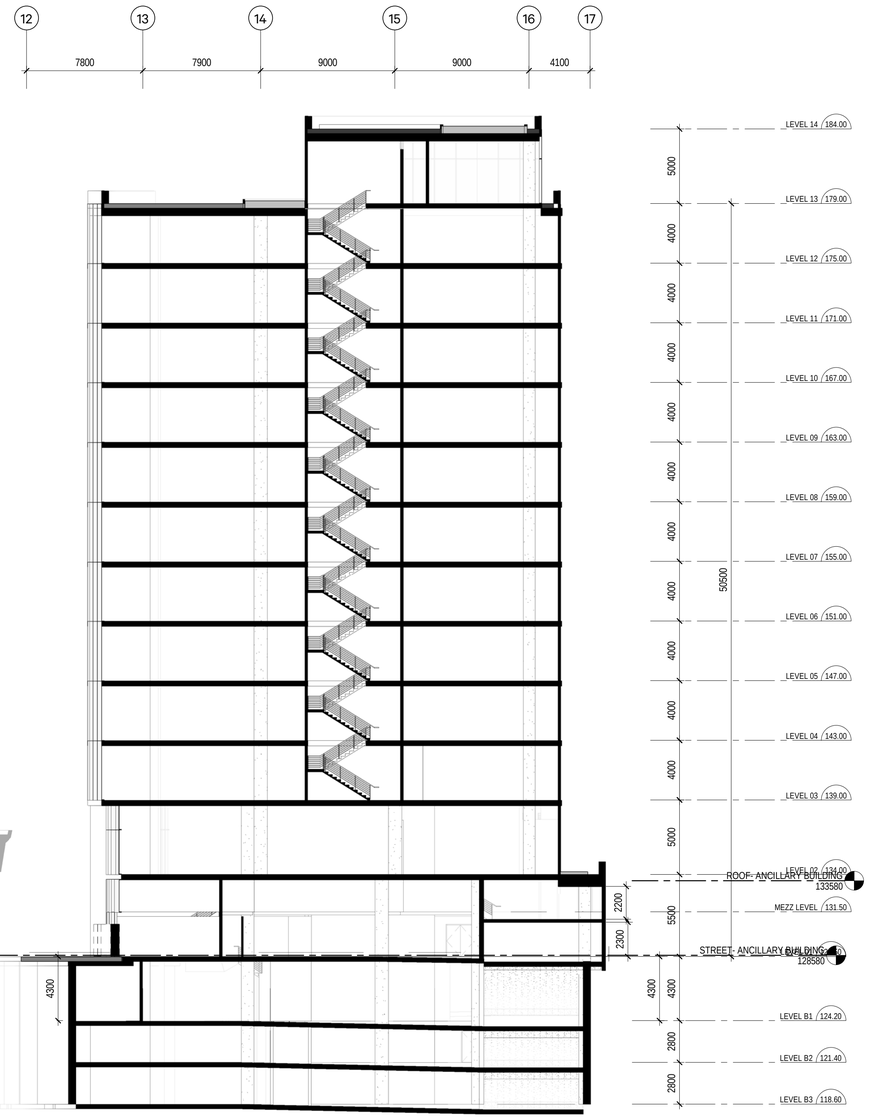


2 LONG SECTION
515T500D 1 : 200



1 CROSS SECTION
515T500D 1 : 200

SHEET No. 515T500DFILE: BIM 360://10206938_OLTA_Planning/10206938-TD015D-THNCF-THORNCLIFFE_PARK.rvt

REVISIONS		

ARCHITECTURE AND LANDSCAPE SET - REZONING

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ONETEAM
ONTARIO LINE TECHNICAL ADVISOR

DESIGNED Designer
DRAWN Author
CHECKED Checker
APPROVED Approver

ONTARIO LINE

TITLE

SECTIONS

Plot Date: 2023-06-12 12:56:42 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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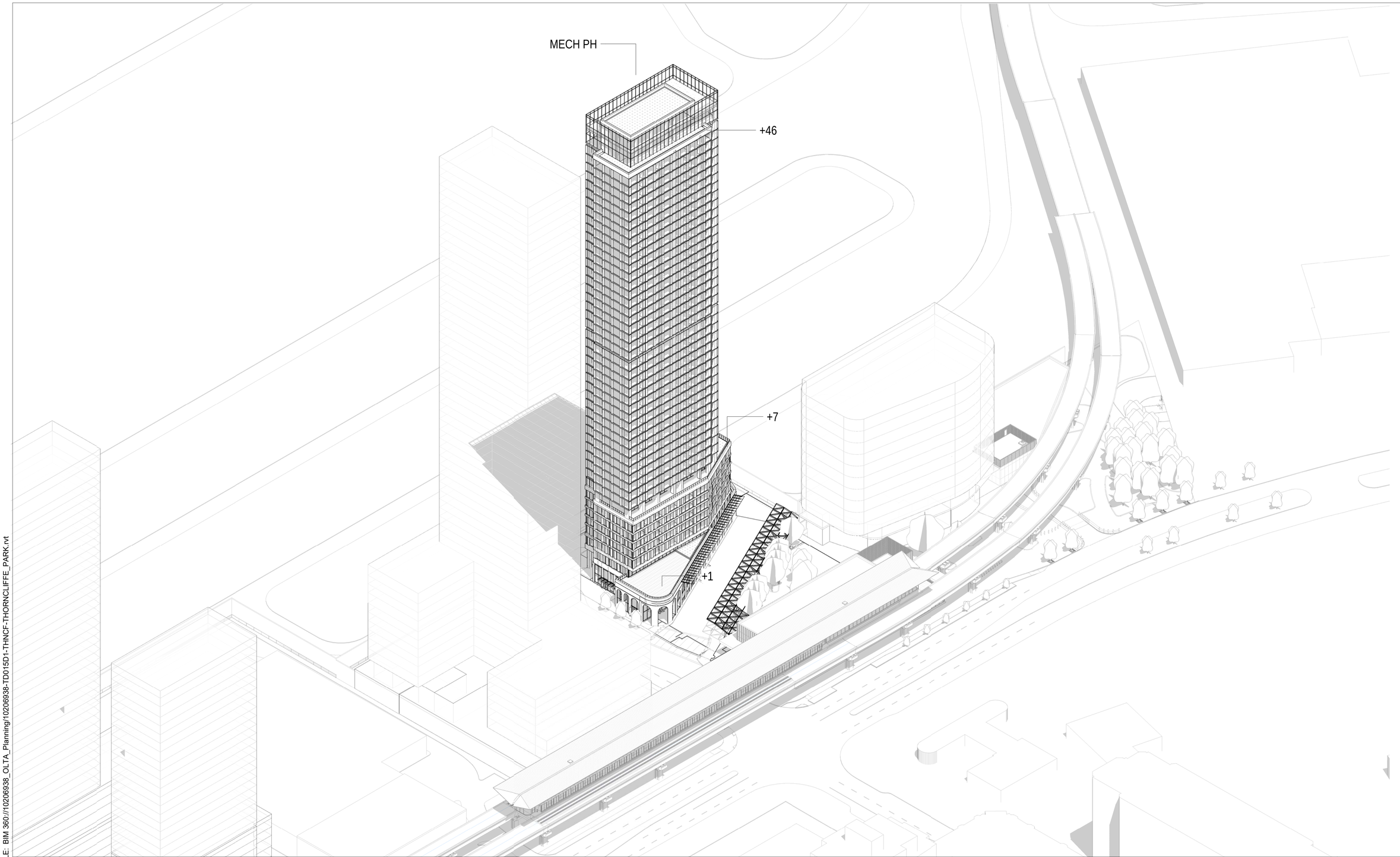

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SHEET No. 515T001D1 FILE: BIM 360://10206938_OLTA_Planning/10206938-TD015D1-THNCF-THORNCLIFFE_PARK.rvt

ISSUANCE

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ONETEAM
ONTARIO LINE TECHNICAL ADVISOR

DESIGNED A.CHRISTOPHER
DRAWN A.ALJIRJEES
CHECKED A.CHRISTOPHER
APPROVED J.RODRIGUEZ-VILLA

ONTARIO LINE

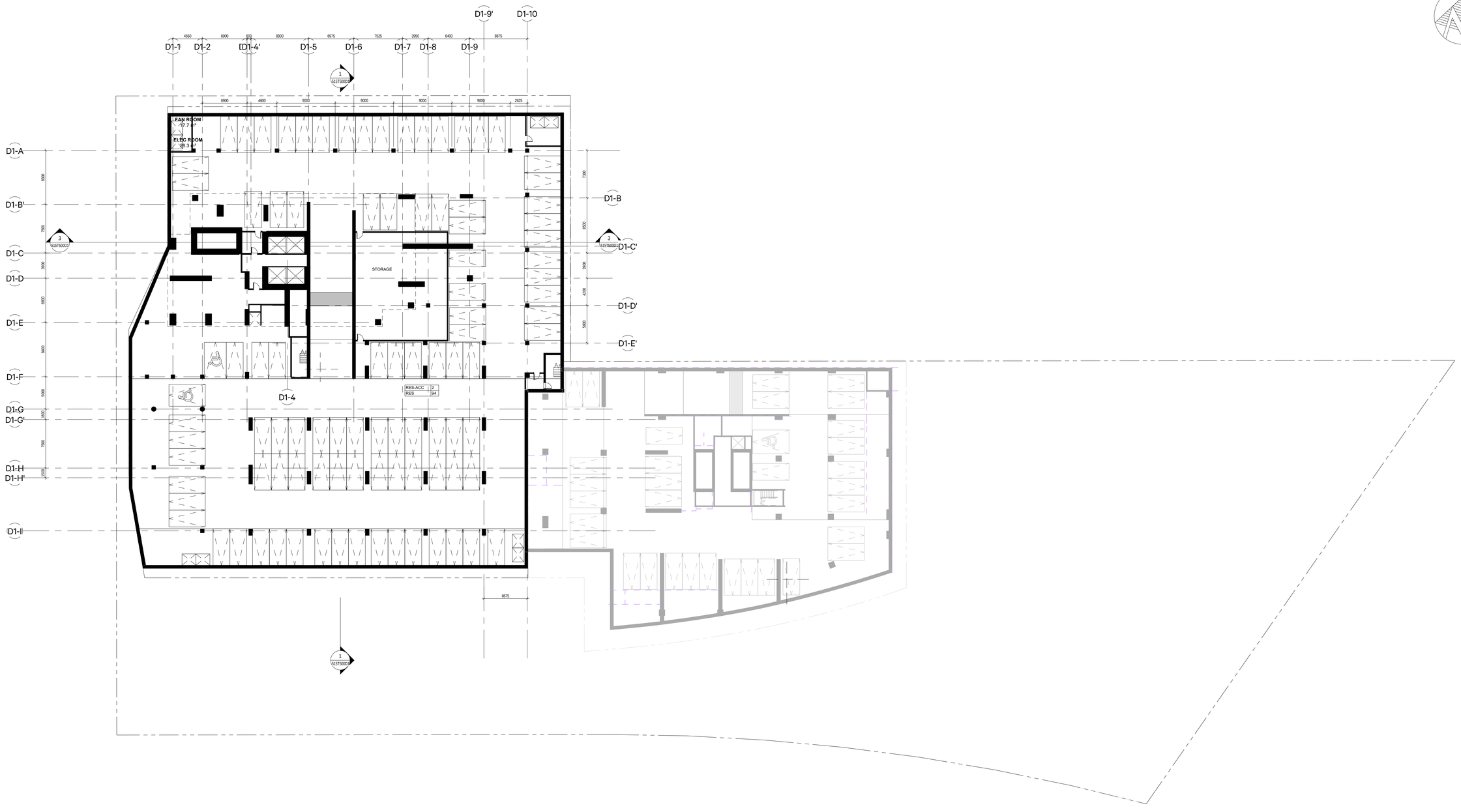
TITLE
ITOC
THORNCLIFFE | THORNCLIFFE PARK
CONTEXT MASSING

Plot Date: 2023-06-09 1:27:54 PM

METROLINX
Infrastructure Ontario

SCALE

DRAWING NUMBER
515T001D1



LEVEL B3

1 : 300

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ISSUANCE		

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ONTARIO LINE TECHNICAL ADVISOR

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LEVEL B3

Plot Date: 2023-06-09 1:28:42 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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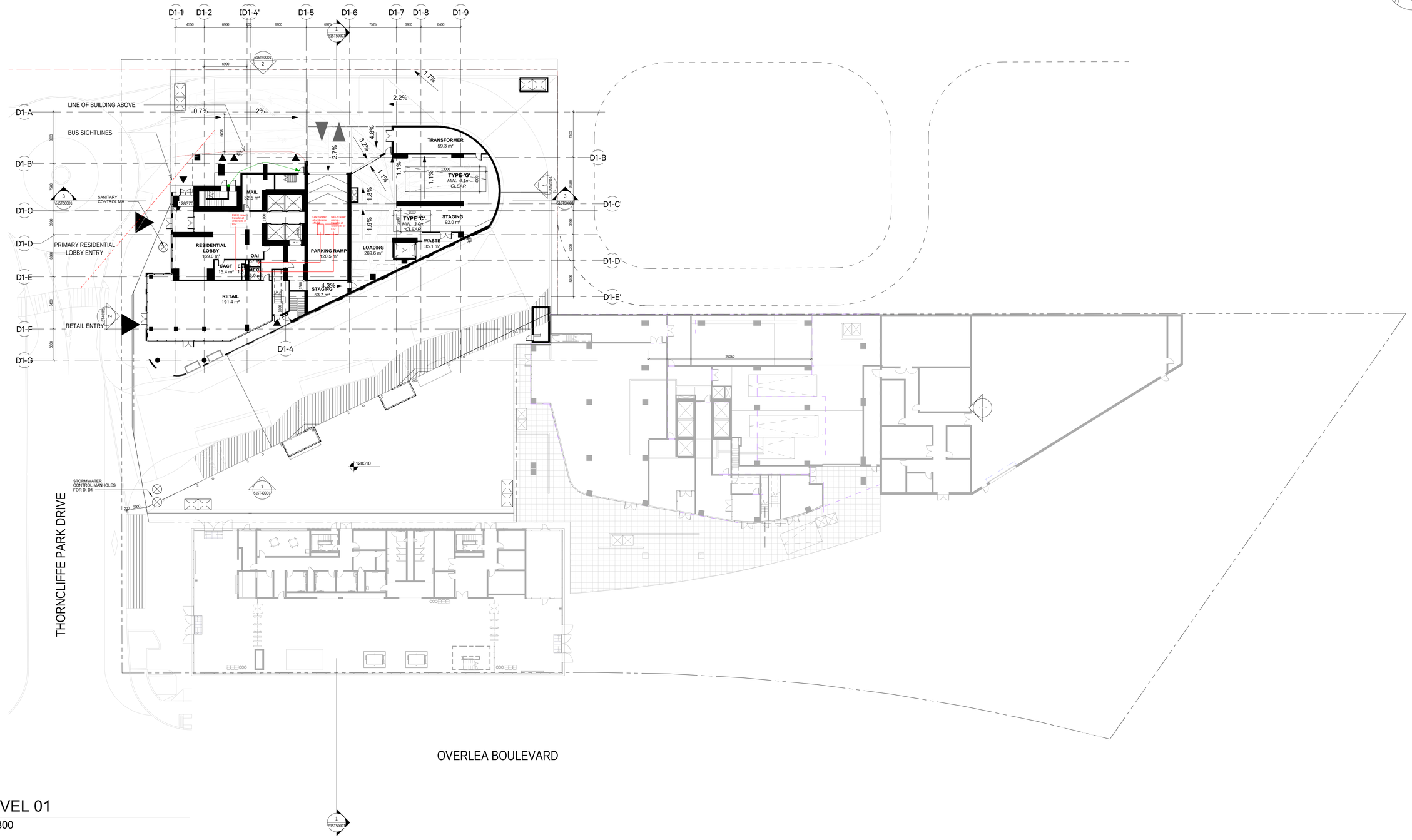

1 LEVEL 01
1 : 300

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SHEET No. 515T200D1FILE: BIM 360://10206938_OLTA_Planning/10206938-TD015D1-THNCF-THORNCLIFFE_PARK.rvt

ISSUANCE		

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APPROVED	J.RODRIGUEZ-VILLA

ONTARIO LINE

TITLE
ITOC
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LEVEL 01

Plot Date: 2023-06-09 1:28:49 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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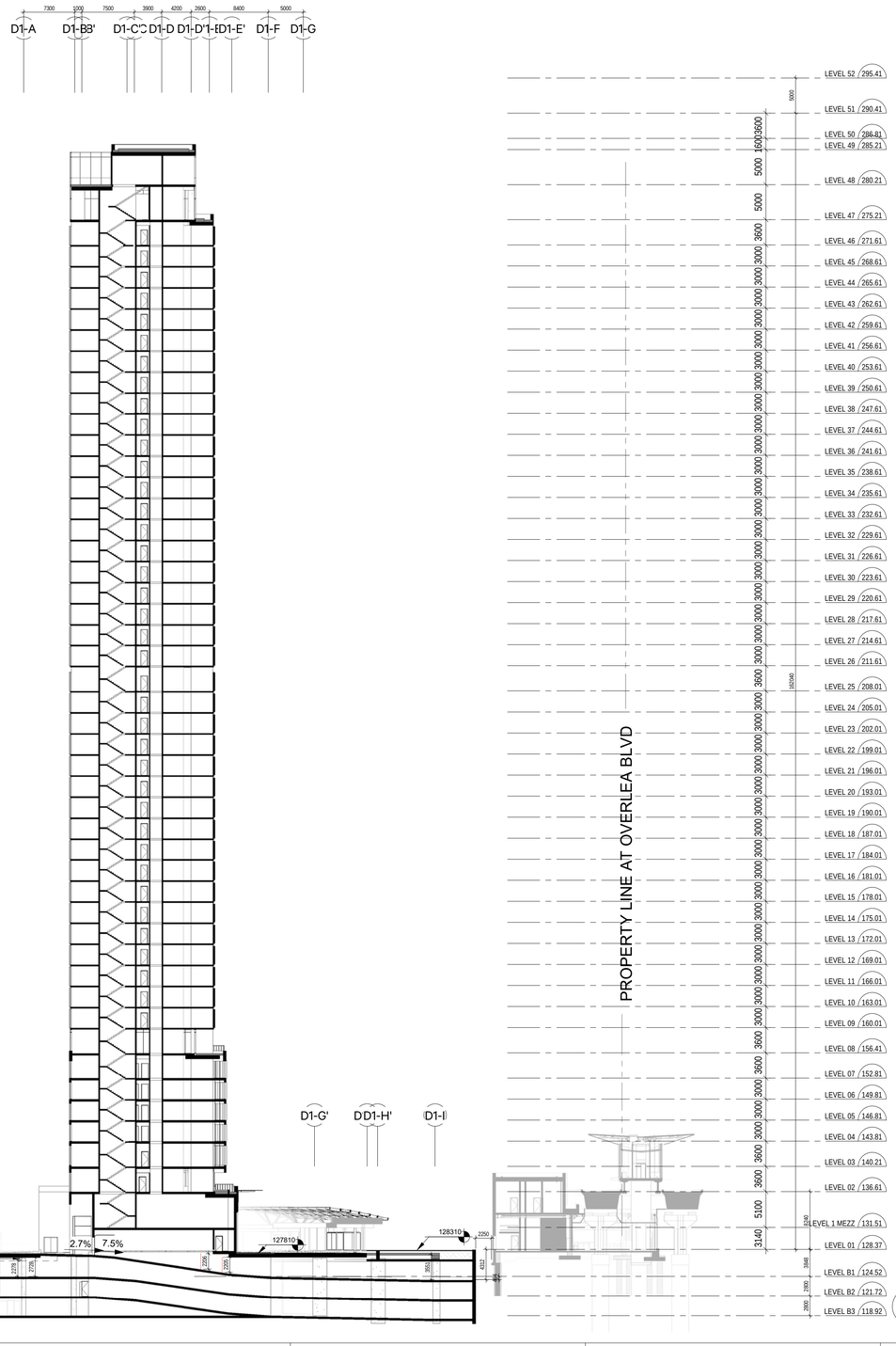
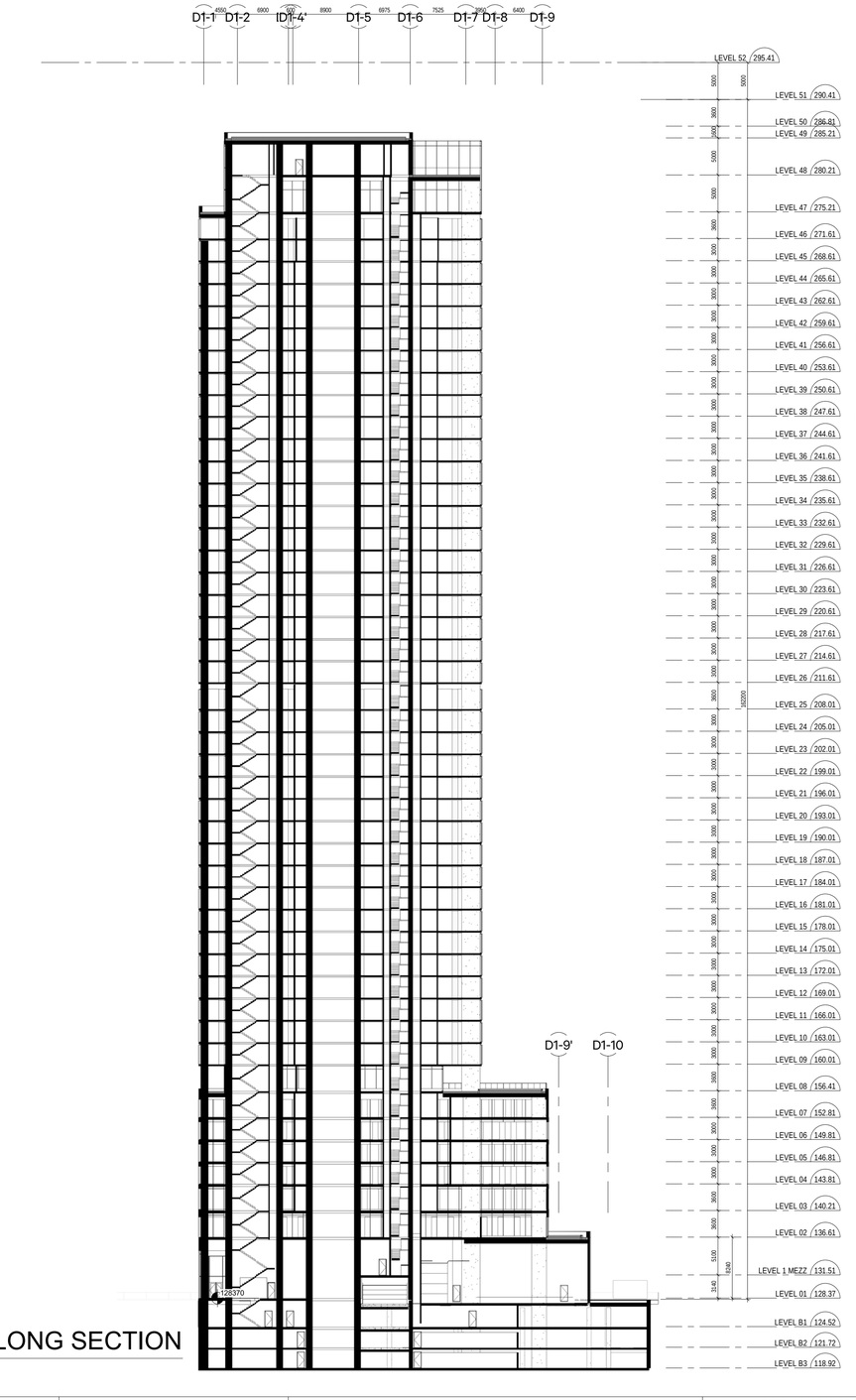


1 SITE D1 CROSS SECTION
1 : 400



3 SITE D1 LONG SECTION
1 : 400

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SHEET No. 515T500D1 FILE: BIM 360://10206938_OLTA_Planning/10206938-TD015D1-THNCF-THORNCLIFFE_PARK.rvt

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ONETEAM
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ONTARIO LINE

TITLE
SECTIONS

Plot Date: 2023-06-09 1:30:07 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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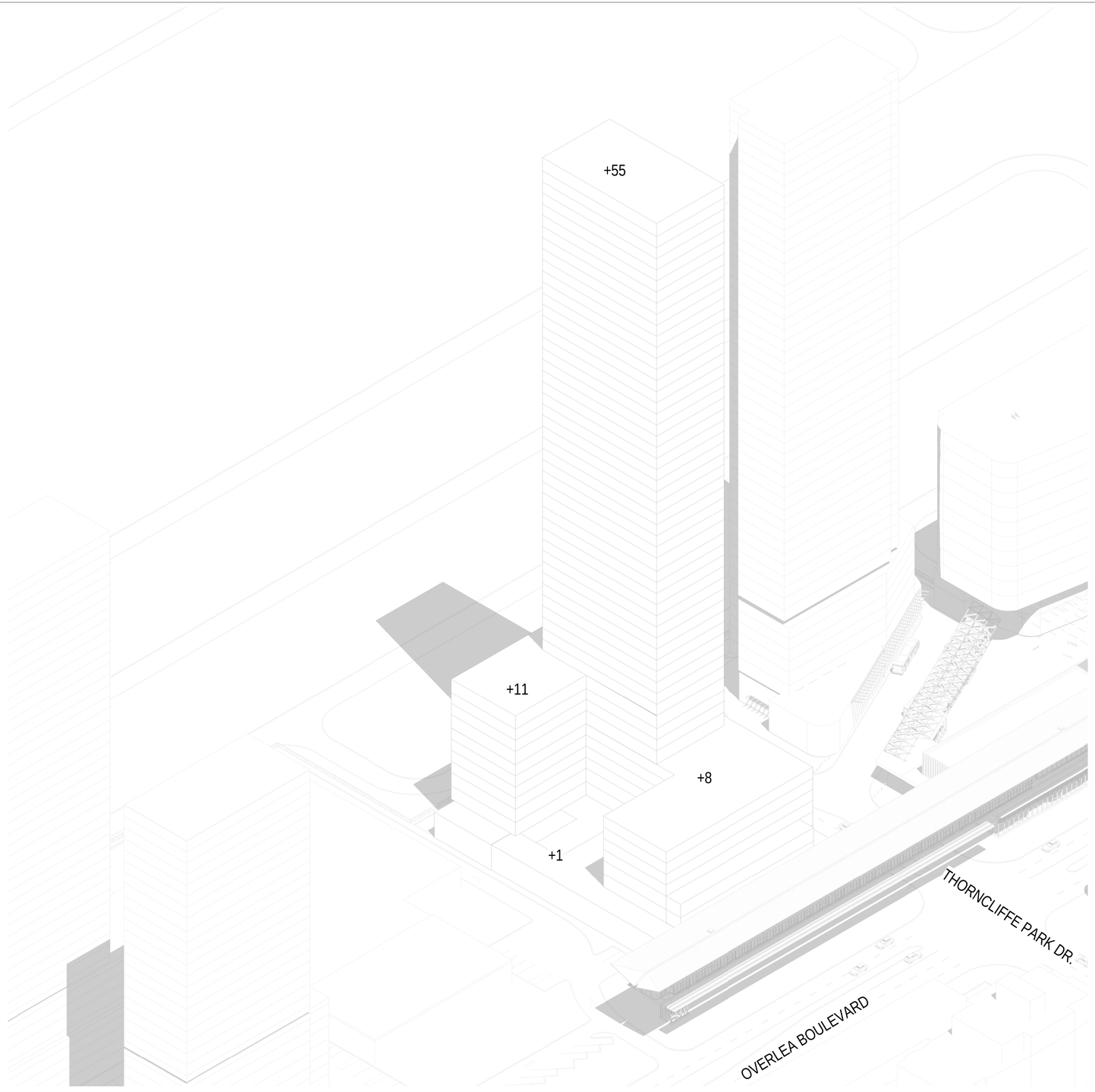

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ONTARIO LINE TECHNICAL ADVISOR

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ONTARIO LINE

TITLE

CONTEXT MASSING

Plot Date: 2023-06-09 2:58:26 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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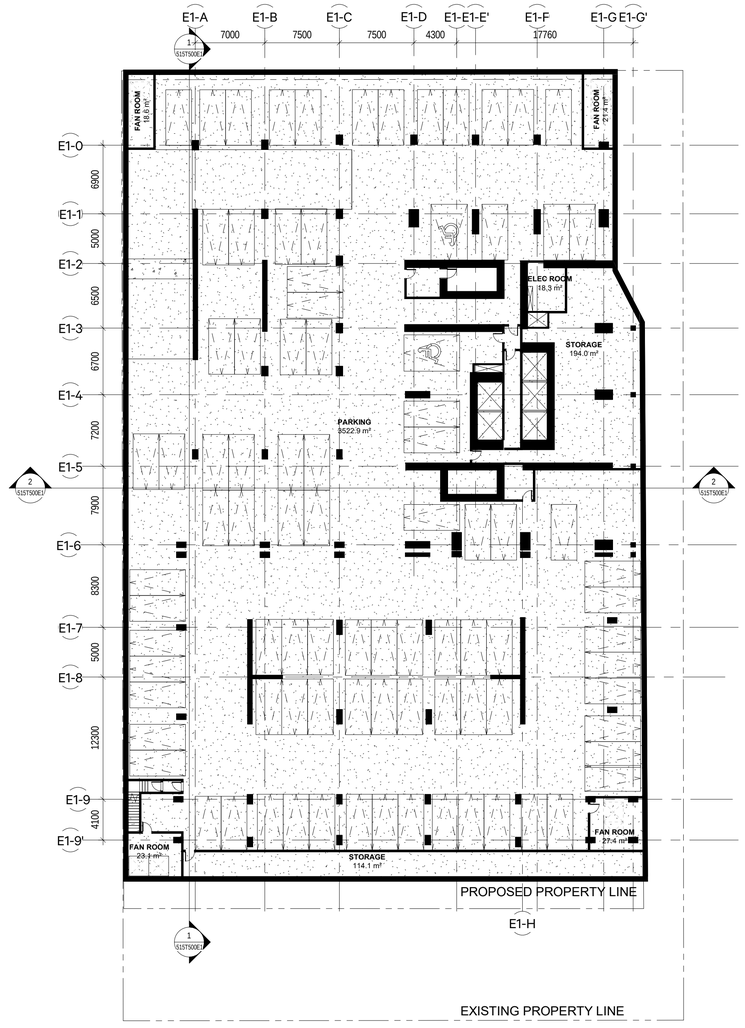

2 LEVEL B3

1 : 300

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SHEET No. 515T100E1 FILE: BIM 360://10206938_OLTA_Planning/10206938-TD015E1-THNCF-THORNCLIFFE_PARK.rvt

ISSUANCE		

SvN

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ONE TEAM

ONTARIO LINE TECHNICAL ADVISOR

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DRAWN	T.UM
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APPROVED	J.RODRIGUEZ-VILLA

ONTARIO LINE

TITLE

LEVEL B3

Plot Date: 2023-06-09 2:58:32 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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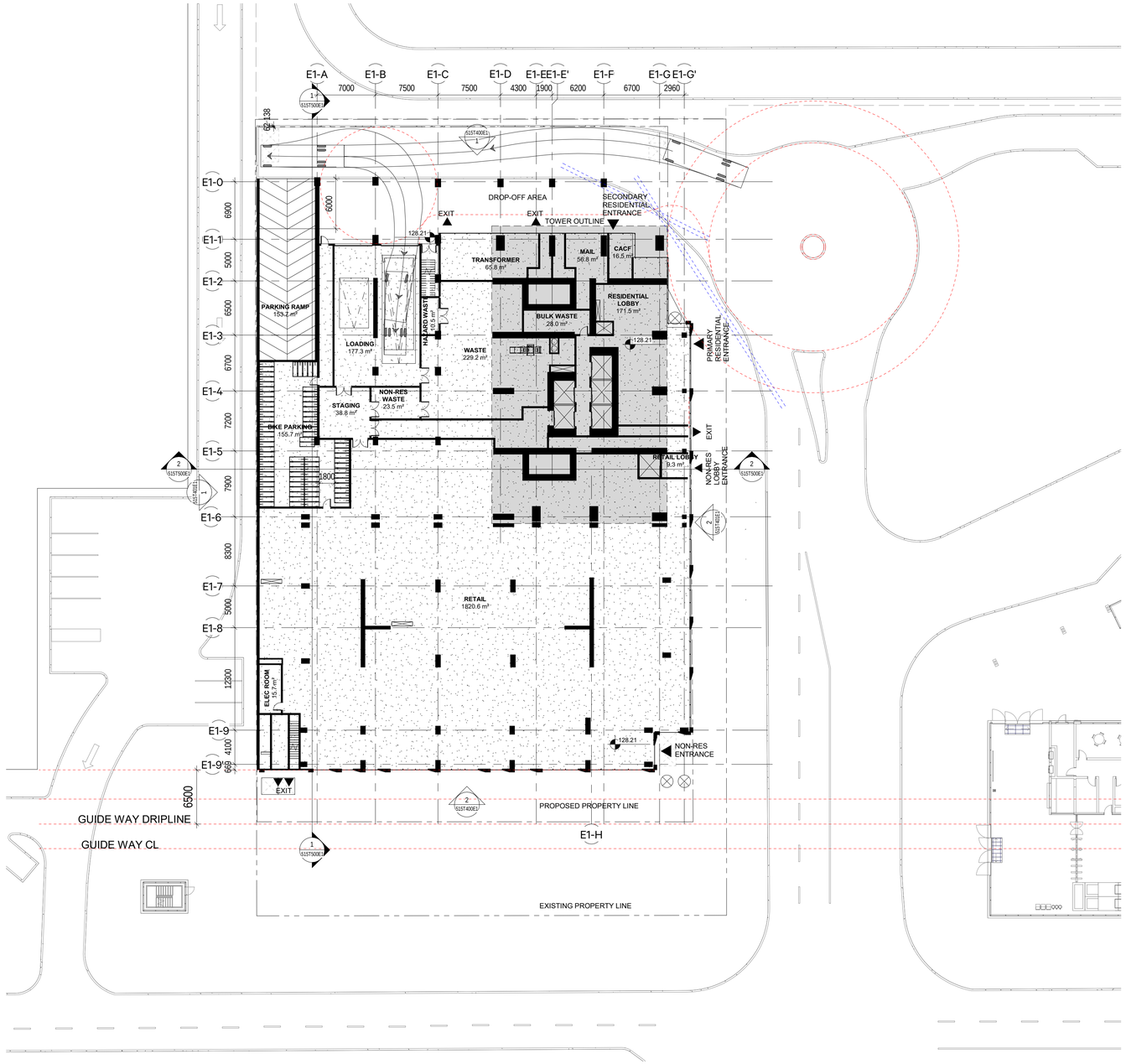

2 LEVEL 01

1 : 300

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ISSUANCE		

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ONETEAM
ONTARIO LINE TECHNICAL ADVISOR

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DRAWN	M.MALEKZADEH
CHECKED	A.CHRISTOPHER
APPROVED	J.RODRIGUEZ-VILLA

ONTARIO LINE

TITLE

LEVEL 01

Plot Date: 2023-06-09 2:58:43 PM

METROLINX Infrastructure Ontario

SCALE	DRAWING NUMBER
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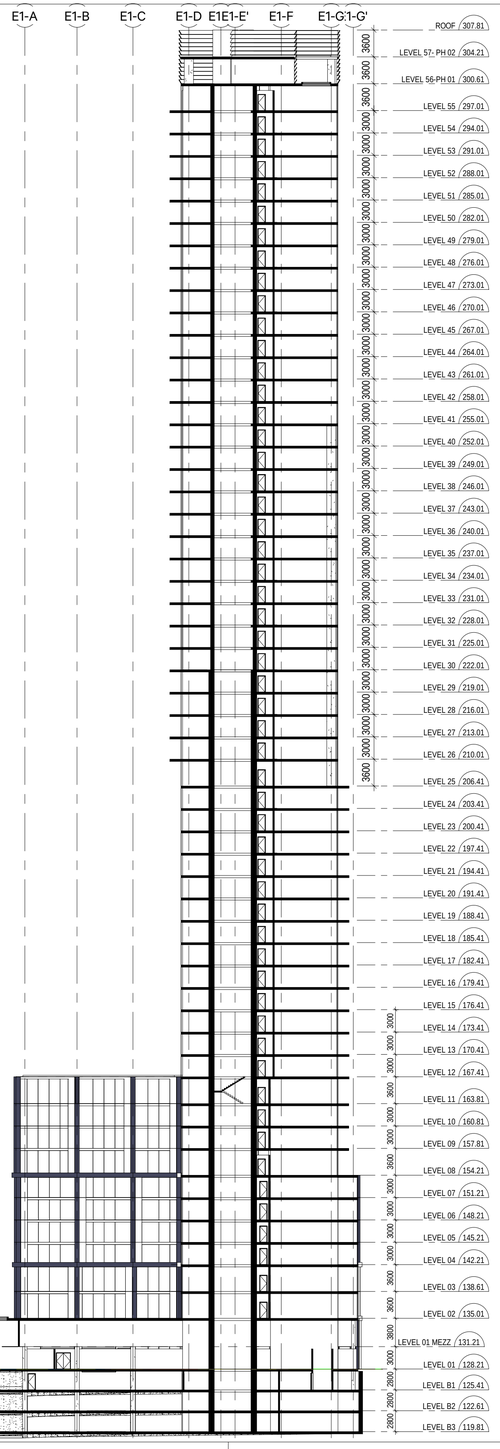
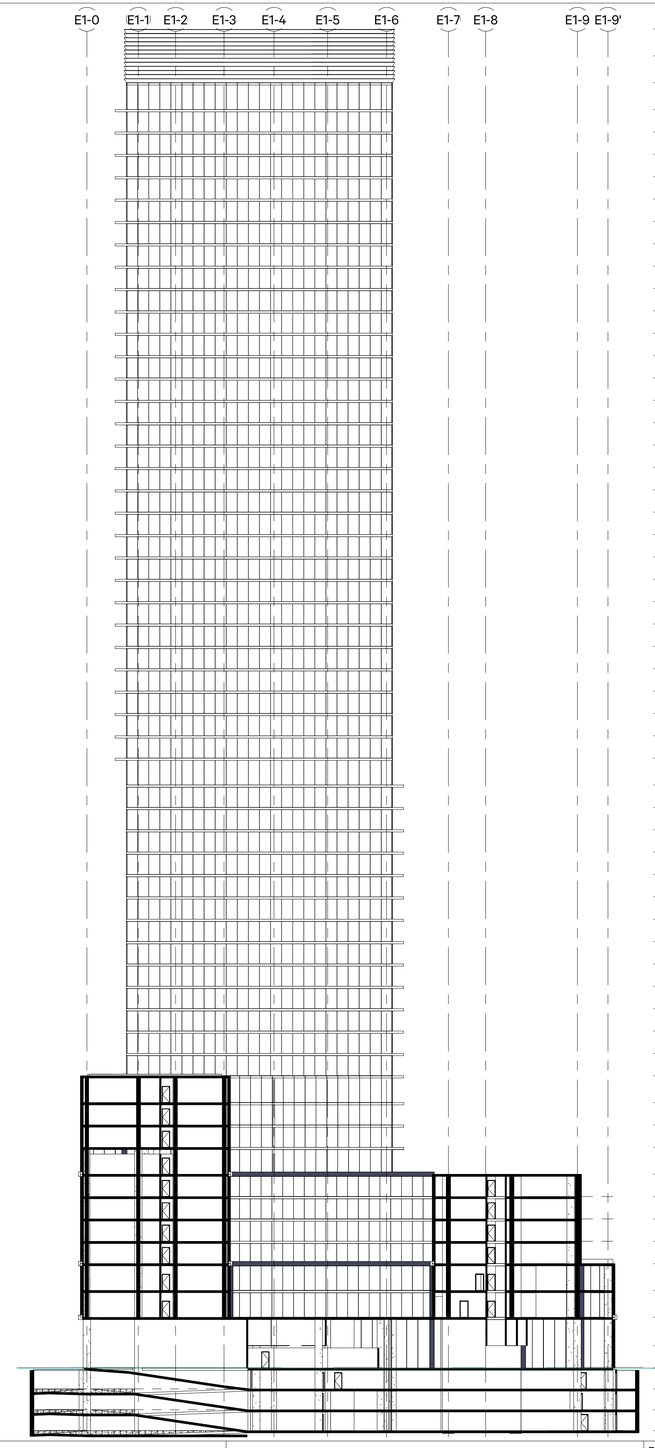


2 CROSS SECTION
1 : 400



1 LONGITUDINAL SECTION
1 : 400

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ONTARIO LINE TECHNICAL ADVISOR

DESIGNED	A.CHRISTOPHER
DRAWN	M.MALEKZADEH
CHECKED	A.CHRISTOPHER
APPROVED	J.RODRIGUEZ-VILLA

ONTARIO LINE

TITLE

SECTIONS

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METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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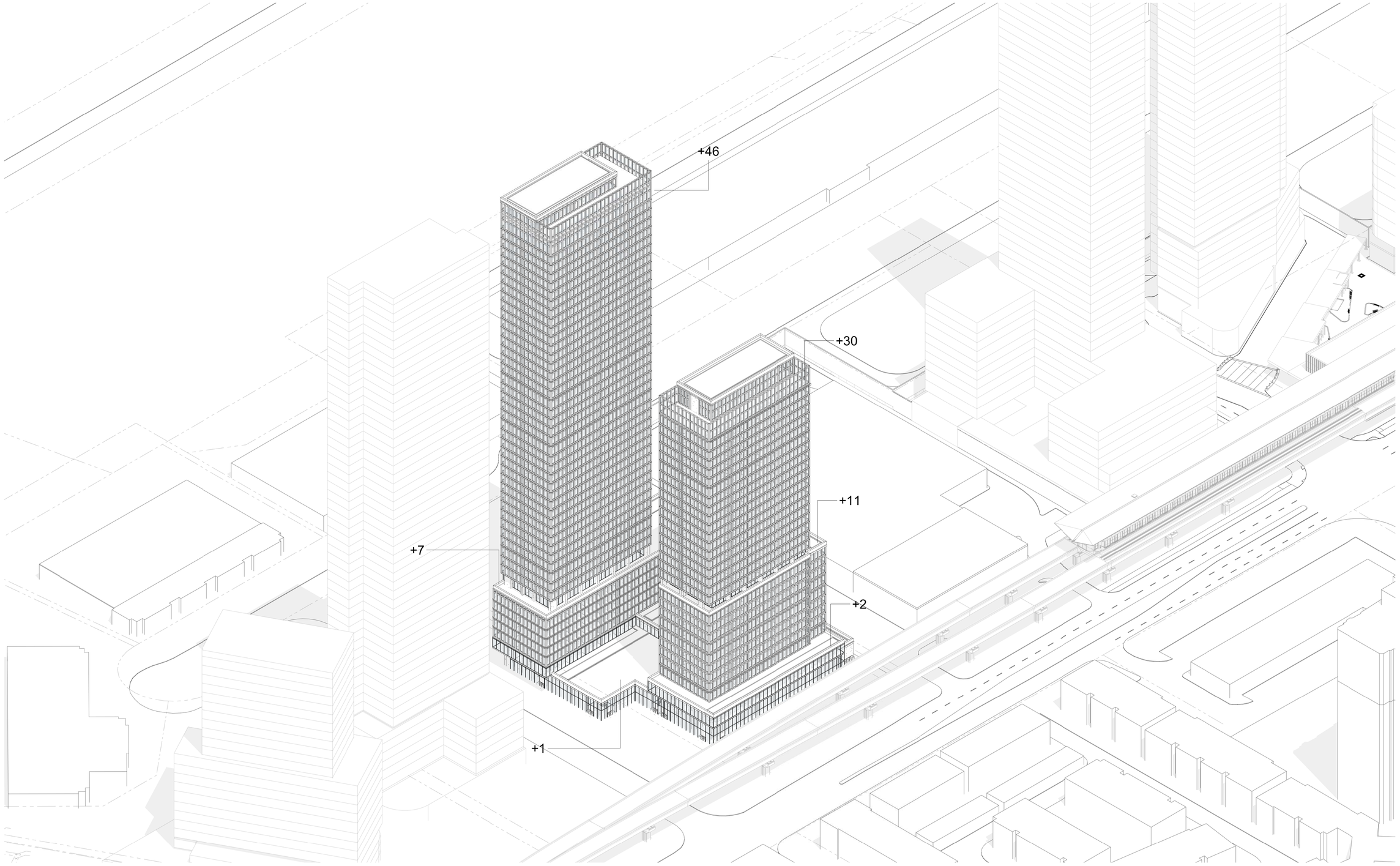

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SHEET No. 515T001E
FILE: BIM 360://10206938_OLTA_Planning/10206938-TD015E3-THNCF-THORNCLIFFE_PARK.rvt

ISSUANCE		

DRAFT RE-ZONING
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LANDSCAPE

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ONTARIO LINE TECHNICAL ADVISOR

DESIGNED Designer
DRAWN Author
CHECKED Checker
APPROVED Approver

ONTARIO LINE

TITLE
TOC
THORNCLIFFE | THORNCLIFFE PARK
CONTEXT MASSING

Plot Date: 2023-06-09 4:49:42 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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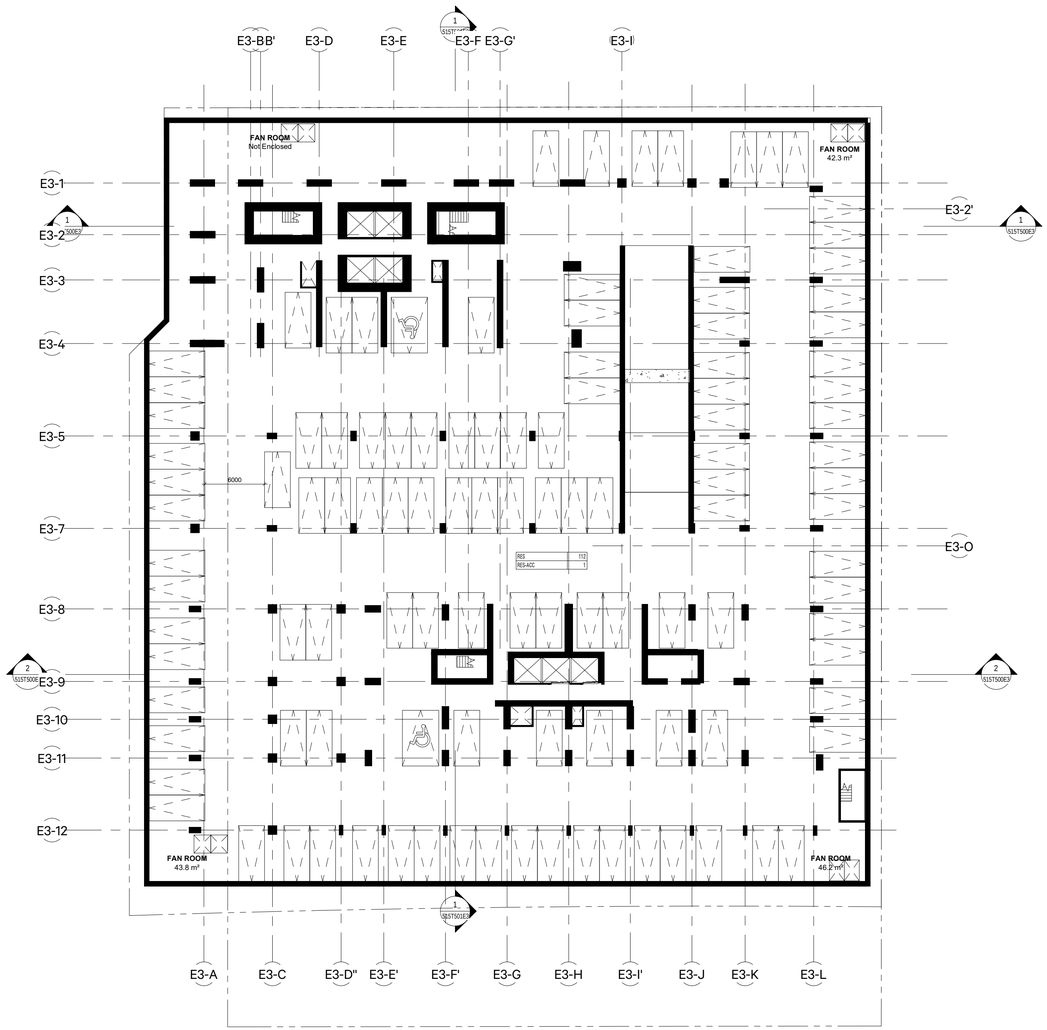

1 LEVEL B3

1 : 300

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SHEET No. 515T100EBILE: BIM 360://10206938_OLTA_Planning/10206938-TD015E3-THNCF-THORNCLIFFE_PARK.rvt

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APPROVED Approver

ONTARIO LINE

TITLE

LEVEL B3

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METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
1 : 300	515T100E3

1 LEVEL 01

1 : 300

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DRAWN Author
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APPROVED Approver

ONTARIO LINE

TITLE

LEVEL 01

Plot Date: 2023-06-09 4:50:12 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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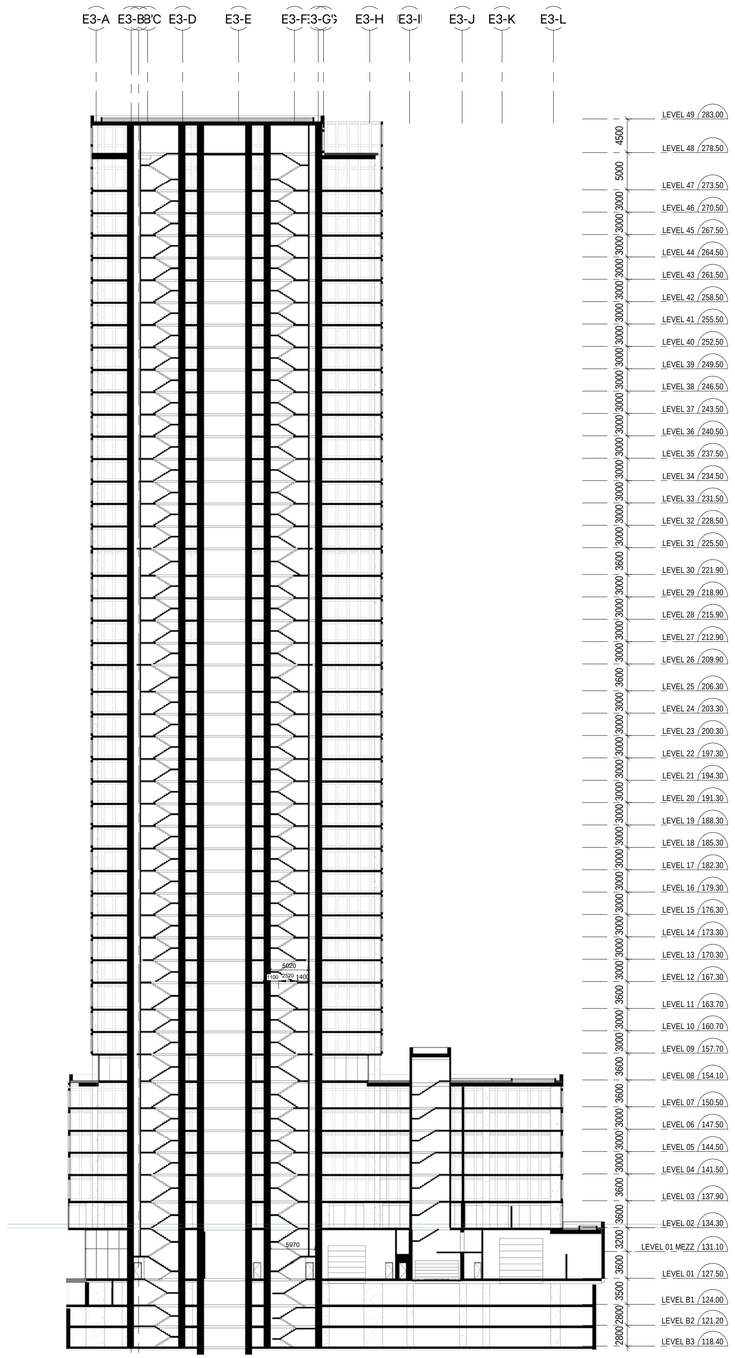
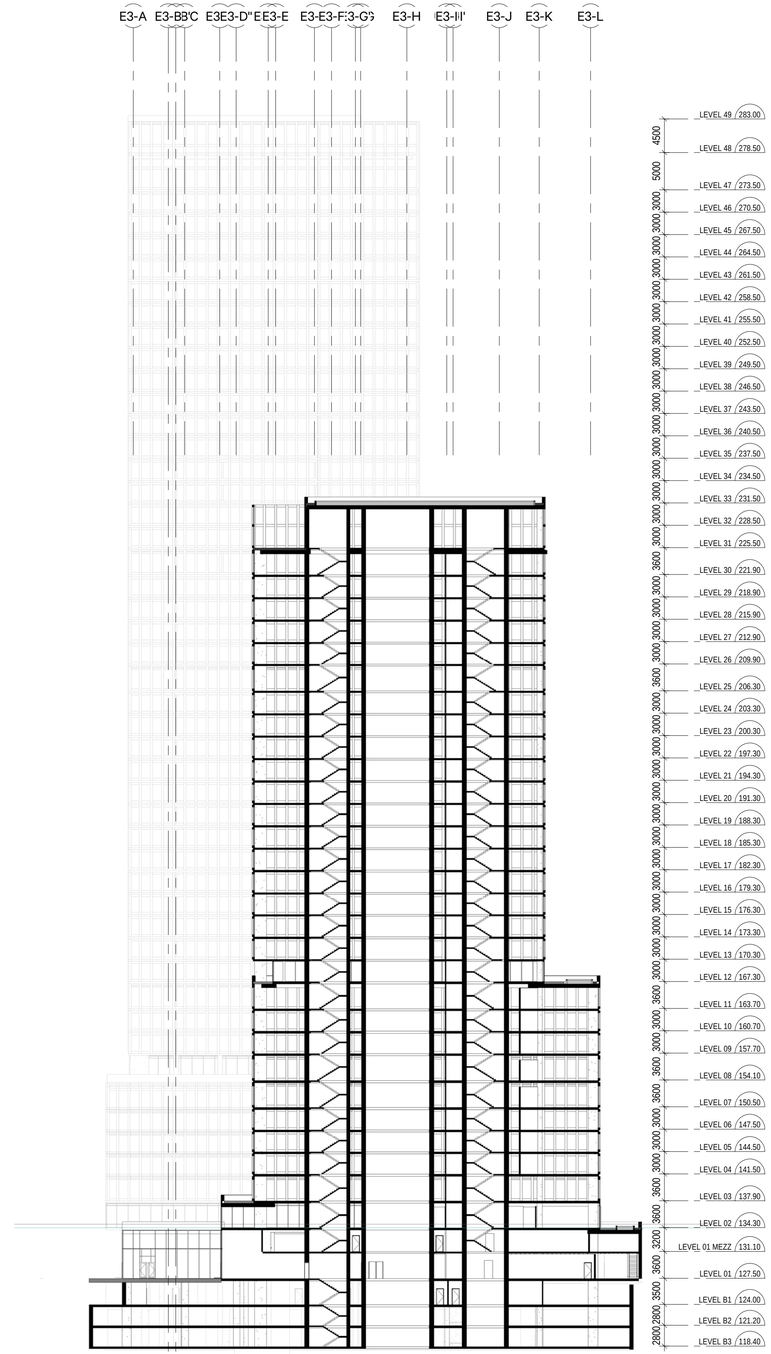


1 LONG SECTION - NORTH

1 : 400



2 LONG SECTION - SOUTH

1 : 400

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LANDSCAPE

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ONTARIO LINE TECHNICAL ADVISOR

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DRAWN Author
CHECKED Checker
APPROVED Approver

ONTARIO LINE

TITLE

SECTIONS

Plot Date: 2023-06-09 4:52:41 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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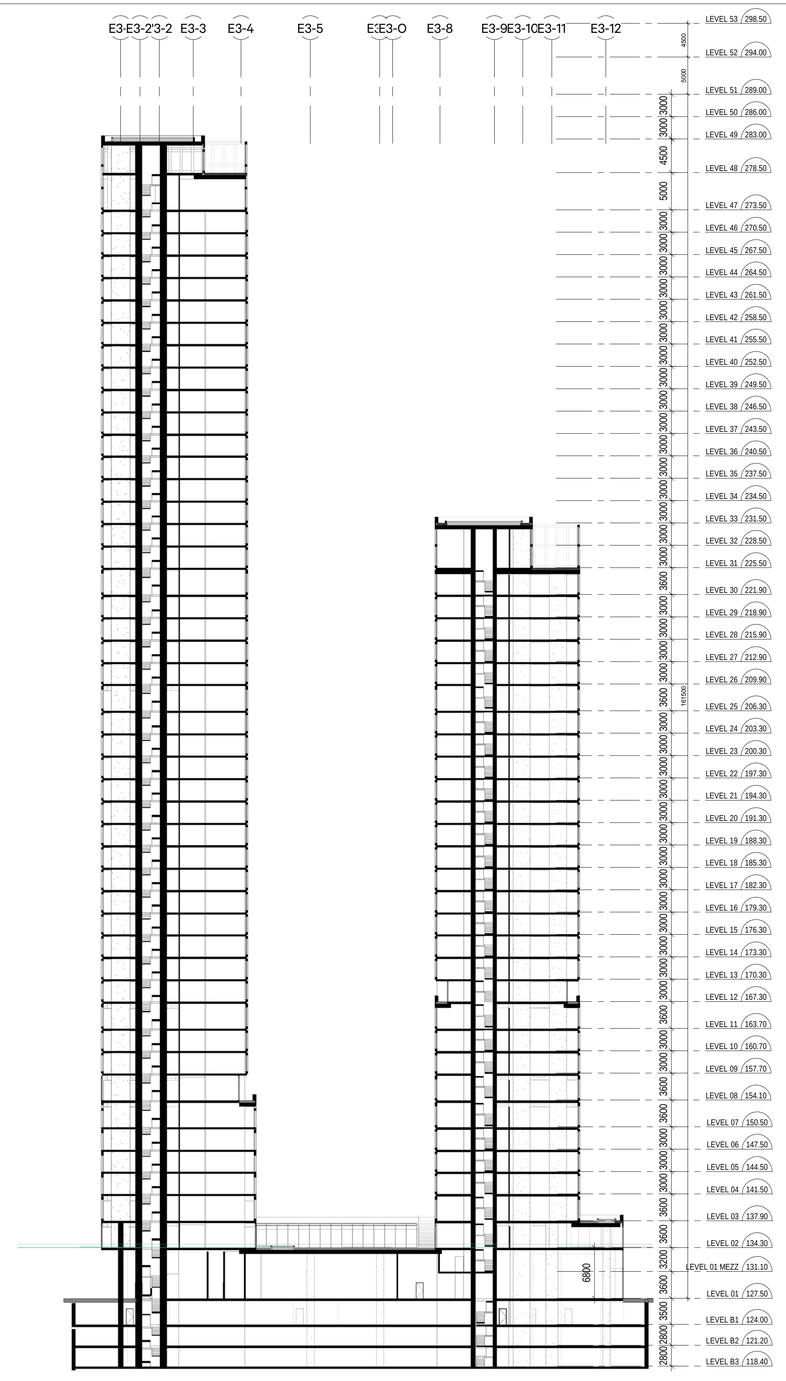

1 CROSS SECTION

1 : 400

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SHEET No. 515T501EBILE: BIM 360://10206938_OLTA_Planning/10206938-TD015E3-THNCF-THORNCLIFFE_PARK.rvt

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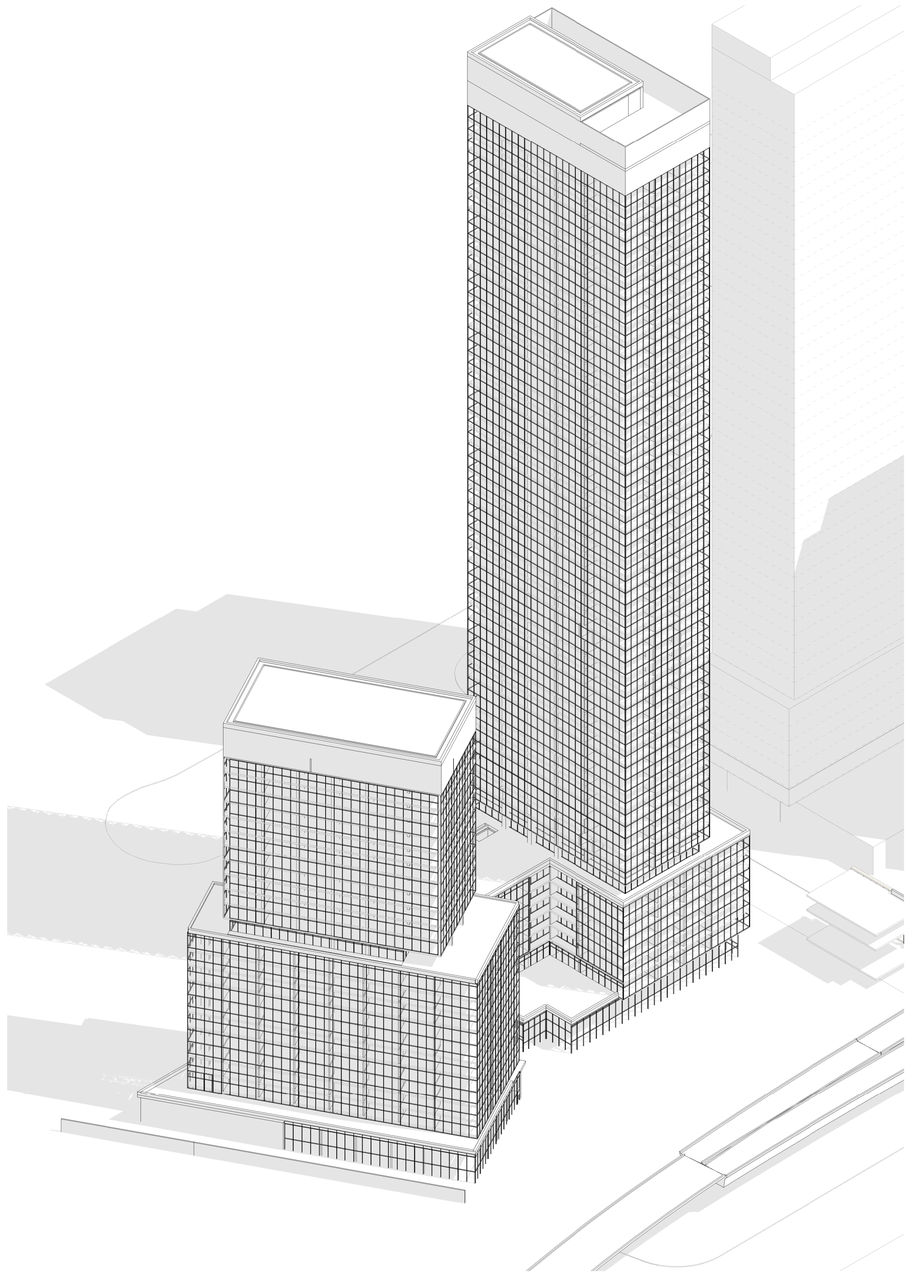

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SHEET No. 515T001E4E5 FILE: BIM 360://10206938_OLTA_Planning/10206938-TD015E4-THNCF-THORNCLIFFE_PARK.rvt

ISSUANCE		

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ARCHITECTURE AND
LANDSCAPE

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ONTARIO LINE TECHNICAL ADVISOR

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DRAWN Author
CHECKED Checker
APPROVED Approver

ONTARIO LINE

TITLE

CONTEXT MASSING

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METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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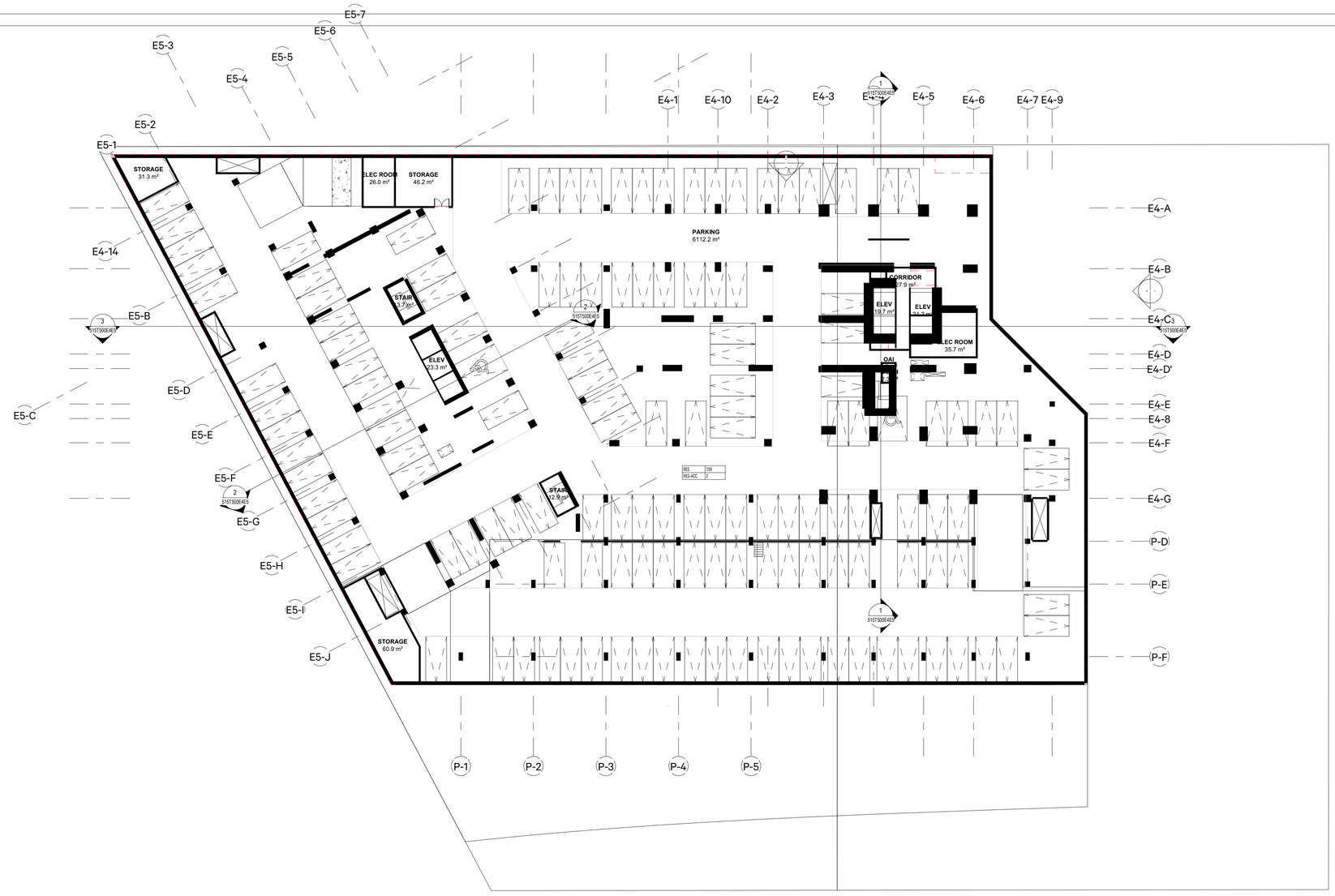

1 LEVEL B3

1 : 300

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SHEET No. 515T101E4E5 FILE: BIM 360://10206938_OLTA_Planning/10206938-TD015E4-THNCF-THORNCLIFFE_PARK.rvt

ISSUANCE		

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LANDSCAPE

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NOT FOR CONSTRUCTION

ONETEAM
ONTARIO LINE TECHNICAL ADVISOR

DESIGNED Designer
DRAWN Author
CHECKED Checker
APPROVED Approver

ONTARIO LINE

TITLE

LEVEL B3

Plot Date: 2023-06-09 4:58:23 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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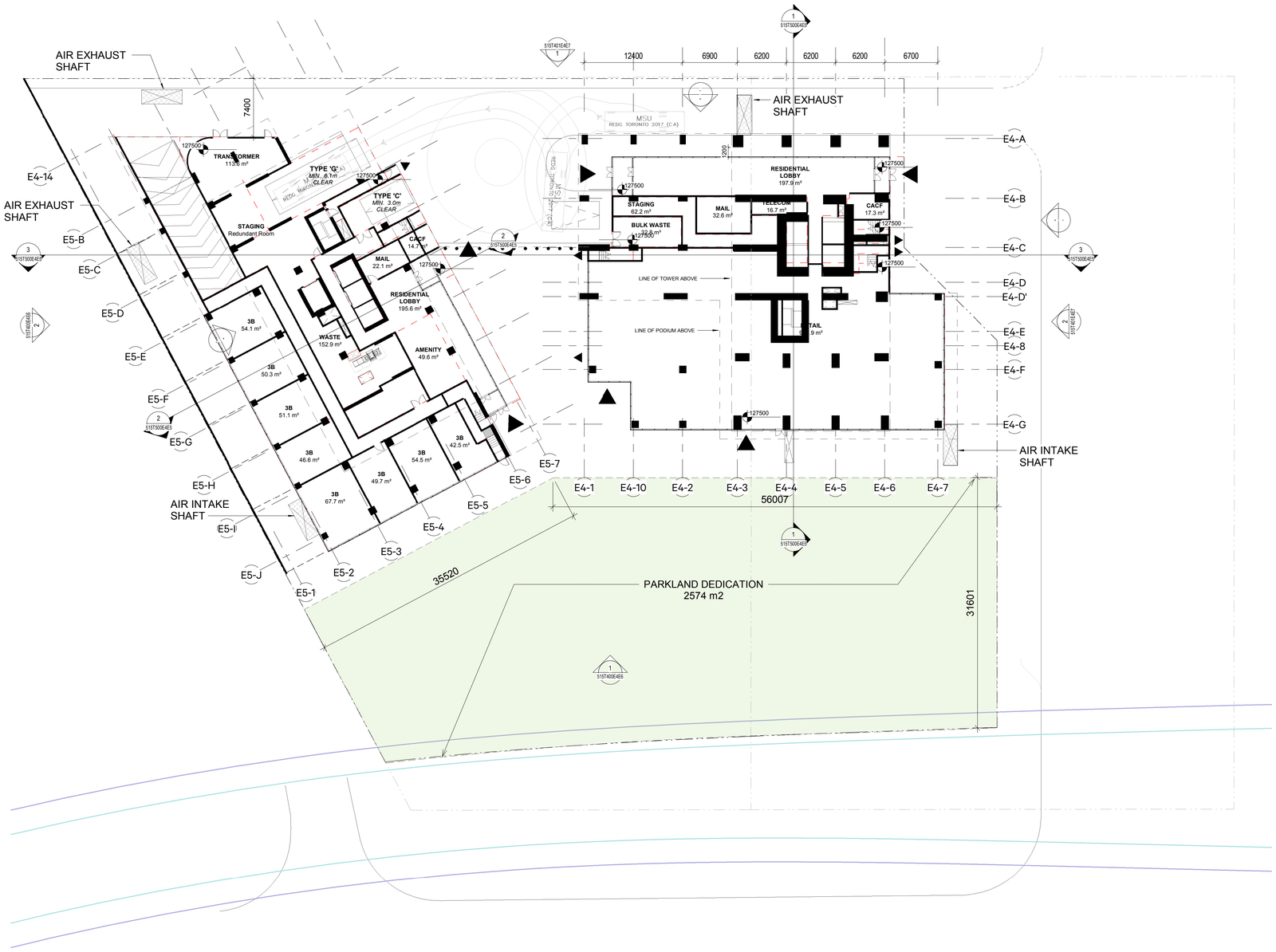

1 LEVEL 01

1 : 300

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SHEET No. 515T200E4E5 FILE: BIM 360://10206938_OLTA_Planning/10206938-TD015E4-THNCF-THORNCLIFFE_PARK.rvt

ISSUANCE		

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LANDSCAPE

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DRAWN Author
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ONTARIO LINE

TITLE

LEVEL 01

Plot Date: 2023-06-09 4:58:52 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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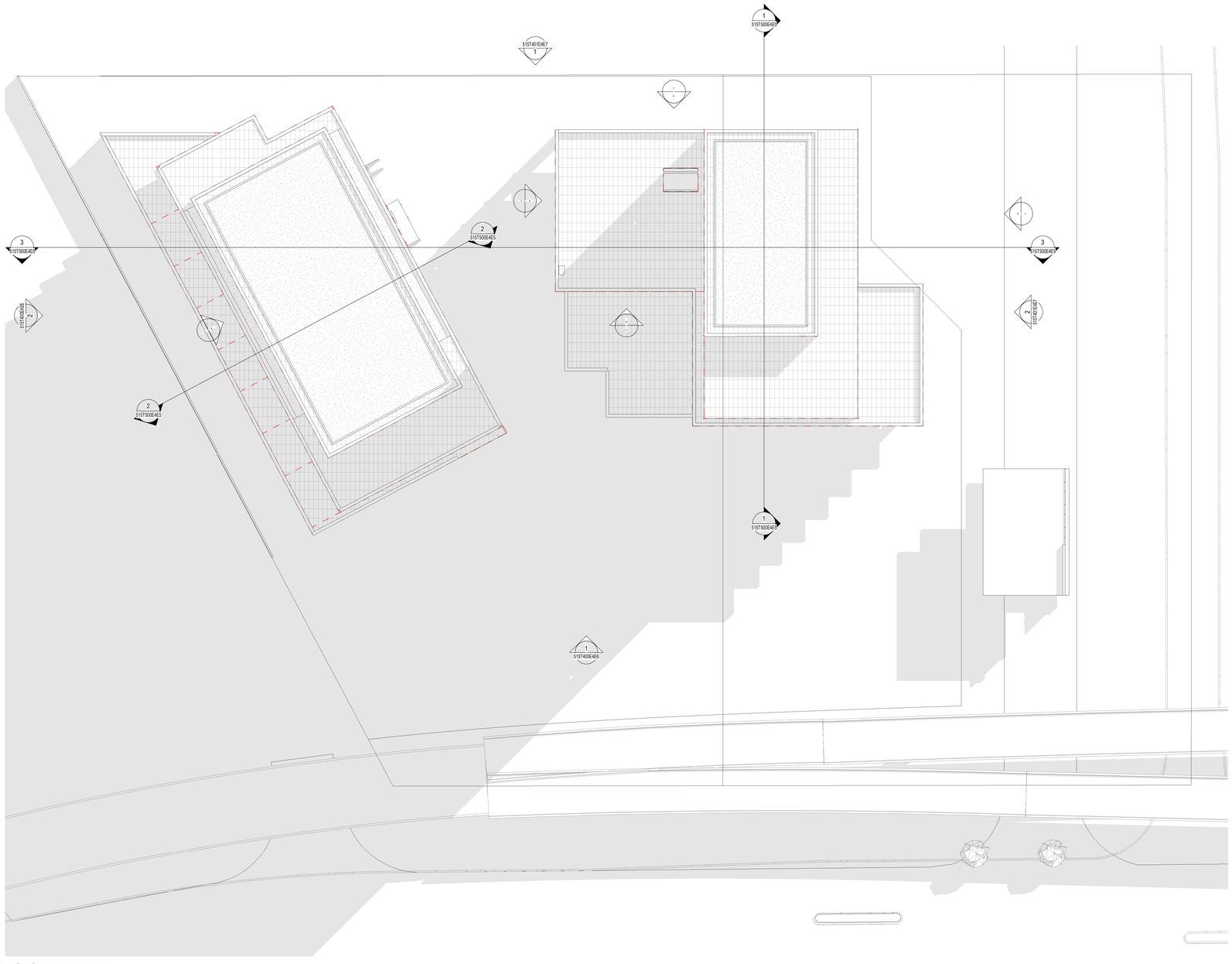

1 ROOF LEVEL
1 : 300

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SHEET No. 515T215E4E5 FILE: BIM 360://10206938_OLTA_Planning/10206938-TD015E4-THNCF-THORNCLIFFE_PARK.rvt

ISSUANCE		
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ONETEAM
ONTARIO LINE TECHNICAL ADVISOR

DESIGNED Designer
DRAWN Author
CHECKED Checker
APPROVED Approver

ONTARIO LINE

TITLE
ROOF

Plot Date: 2023-06-09 5:01:58 PM

METROLINX
Infrastructure Ontario

SCALE	DRAWING NUMBER
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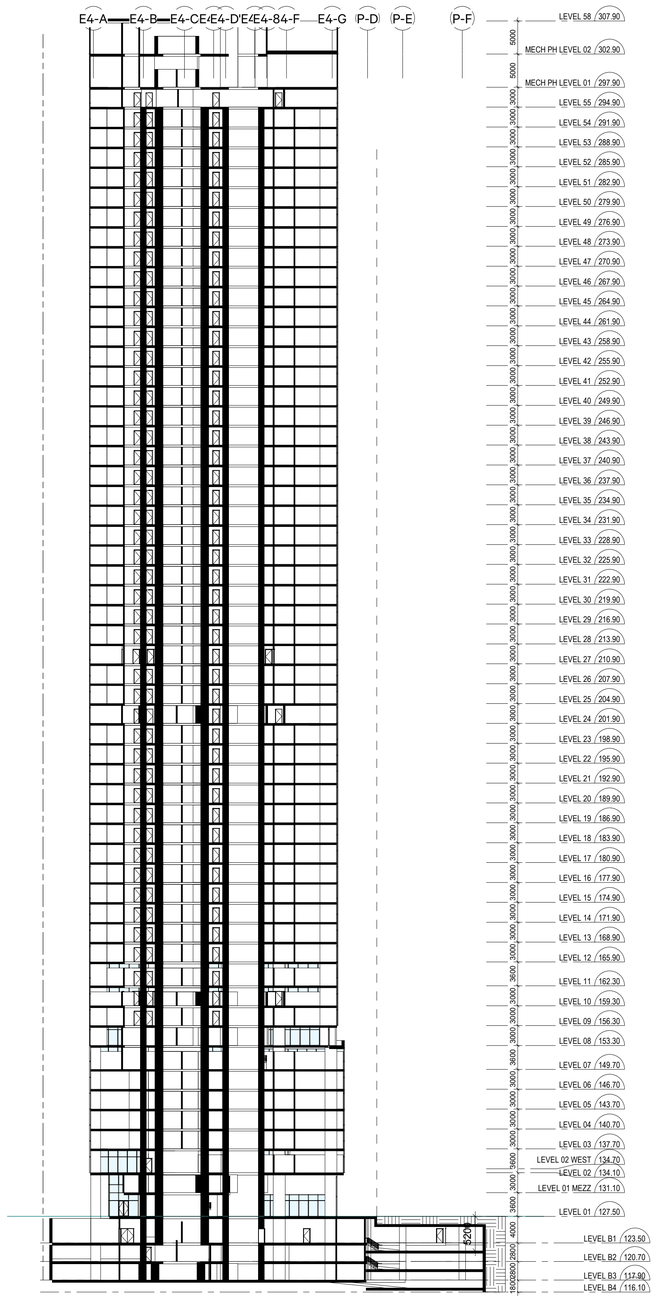
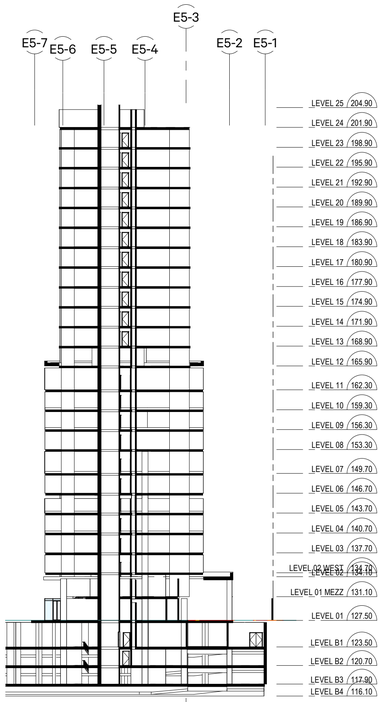
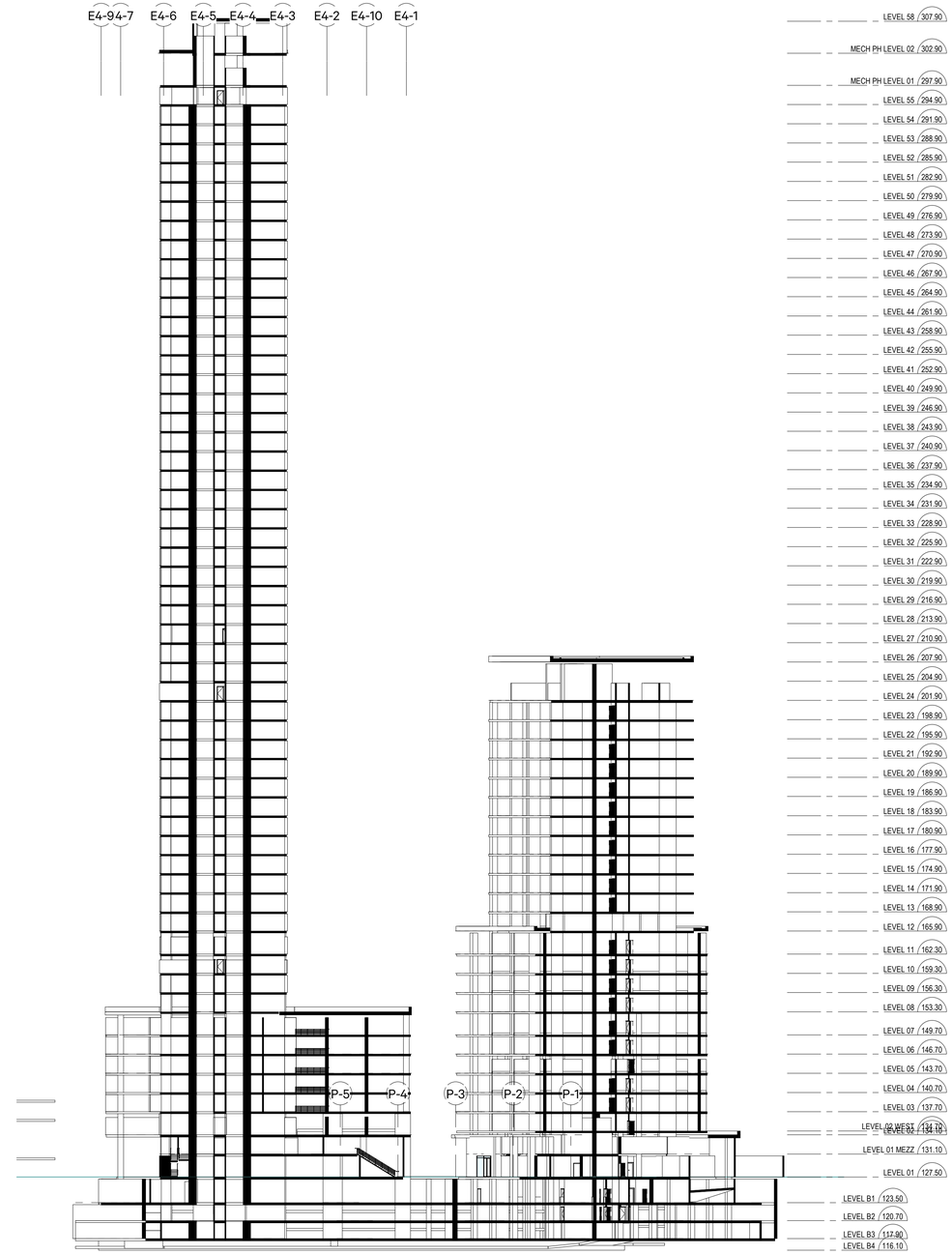


1 SITE E4 LONG SECTION
1 : 450



2 SITE E5 CROSS SECTION
1 : 450



3 SITE E4-5 SECTION
1 : 450

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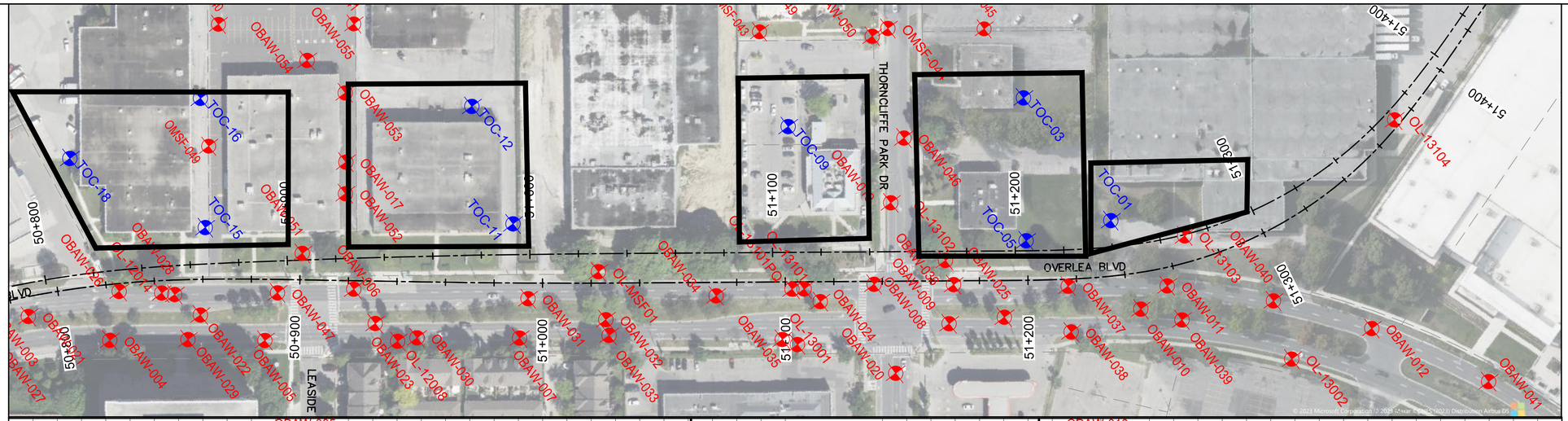
SHEET No. 515T500E4E5 FILE: BIM 360://10206938_OLTA_Planning/10206938-TD015E4-THNCF-THORNCLIFFE_PARK.rvt

ISSUANCE		DRAFT RE-ZONING ARCHITECTURE AND LANDSCAPE	SvN NOT FOR ESTIMATING OR BIDDING NOT FOR CONSTRUCTION	ONETEAM ONTARIO LINE TECHNICAL ADVISOR		DESIGNED Designer DRAWN Author CHECKED Checker APPROVED Approver	ONTARIO LINE TITLE SECTIONS	Plot Date: 2023-06-09 5:03:55 PM METROLINX Infrastructure Ontario SCALE 1 : 450 DRAWING NUMBER 515T500E4E5

Appendix B: Interpreted Stratigraphic Profile



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 (TYPE 16)
- B BEDROCK (TYPE 17)

LITHOLOGY GRAPHIC SYMBOLS AND MATERIAL TYPES:

- 1 TOPSOIL
- 1 PEAT
- 1 ORGANIC SOIL
- 1 FILL
- 2 SANDY GRAVEL
- 3 GRAVELLY SAND
- 4 SAND
- 5 SILTY SAND
- 6 SILT
- 7 SANDY SILT
- 8 SANDY SILT TILL
- 9 SILTY SAND TILL
- 10 CLAY
- 11 SILTY CLAY
- 12 CLAYEY SILT
- 13 CLAY TILL
- 14 SILTY CLAY TILL
- 15 CLAYEY SILT TILL
- 16 COMPLETELY/HIGHLY WEATHERED BEDROCK
- 17 MODERATELY WEATHERED TO FRESH BEDROCK
- INTERFACE BETWEEN TYPE 16 AND 17 BEDROCK

BOREHOLE SYMBOLS:

- EXISTING ONTARIO LINE BOREHOLES
- PROPOSED PHASE-1 INVESTIGATION BOREHOLES

INTERPRETED PIEZOMETRIC LEVELS:

- INTERPRETED SHALLOW OVERBURDEN GROUNDWATER LEVEL

NOTES:

1. SOIL AND GROUNDWATER CONDITIONS BETWEEN BOREHOLES ARE INTERPRETED AND MAY DIFFER FROM CONDITIONS SHOWN. BOREHOLE WIDTH IN PROFILE IS NOT TO SCALE.
2. ALL BOREHOLE LOCATIONS AND SITE FEATURES ARE APPROXIMATE.
3. ELEVATED GUIDEWAY AND STATION OUTLINES ARE SHOWN FOR GENERAL ILLUSTRATION PURPOSES ONLY AND DO NOT NECESSARILY INDICATE THE EXTENTS OF THE WORKS.
4. ALL ELEVATIONS ARE IN GEODETIC METRES UNLESS OTHERWISE SHOWN.
5. THIS FIGURE MUST BE READ IN CONJUNCTION WITH REPORT TITLED "GEOTECHNICAL DESKTOP STUDY FOR TRANSIT ORIENTATED COMMUNITIES (TOC) NORTH - THORNCLIFFE, ONTARIO LINE", DATED OCTOBER 27, 2023.

GENERAL LEGEND:

BOREHOLE SYMBOL AND LABEL → BH

BOREHOLE STRATA SYMBOL → N 40 ← 'N' SPT VALUES

WATER LEVEL IN MONITORING WELL/ PIEZOMETER → 10 / 80% ← RQD VALUES

FILE: 10206938-ge1000-05-bhpp.dwg
PLOTTED BY: DRAFTING01

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

STATUS

DRAFT

ONETEAM
ONTARIO LINE TECHNICAL ADVISOR

ONTARIO LINE SUBWAY

TOC NORTH - THORNCLIFFE

PLAN AND STRATIGRAPHIC PROFILE ALONG OL GUIDEWAY EASTBOUND TRACK

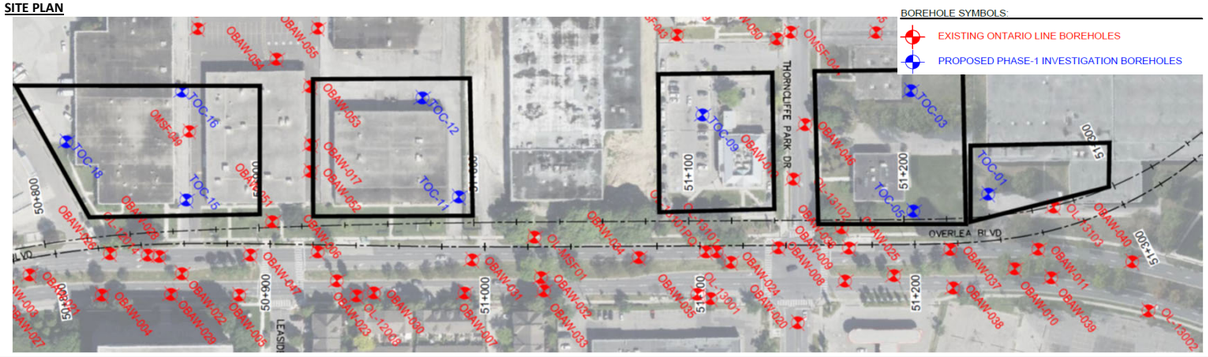
Plot Date: 27 October 2023

METROLINX
Infrastructure Ontario

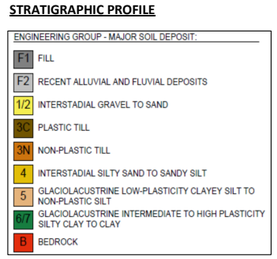
FIGURE B.1

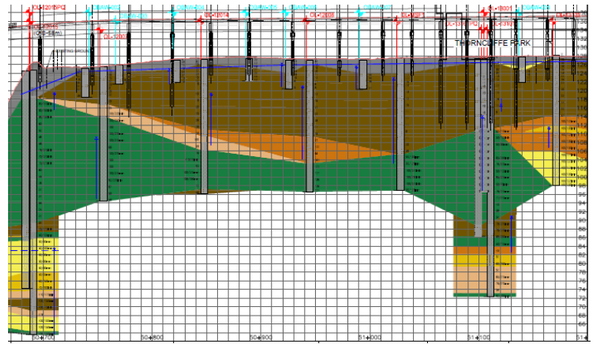
Appendix C: Preliminary Geotechnical Engineering Parameters

SITE PLAN



STRATIGRAPHIC PROFILE





GEOTECHNICAL PROPERTIES

Soil Class	Soil Type Description[H]	Sta. 50+750 to Sta. 50+920				Sta. 50+920 to Sta. 51+150				Sta. 51+050 to Sta. 51+150				Sta. 51+150 to Sta. 51+320				Liquid Limit (LL)[E]	Plastic Limit (PL)[E]	Plasticity Index (PI)[E]	Water Content (%)	Unit Weight, γ (kN/m³)[D]	Young's Modulus, E_{50} (MPa)[A]	Young's Modulus (Unload / Reload), Eur (MPa)[B]	Poisson's Ratio[C]	Undrained Shear Strength, Su[E] (kPa)	Effective Friction Angle, φ(deg)	Effective Cohesion, c' (kPa)	Earth Pressure Coefficient	
		Elevation (m)		Depth (m)		Elevation (m)		Depth (m)		Elevation (m)		Depth (m)		Elevation (m)		Depth (m)														Active (K_A)	Passive (K_P)
		From	To	From	To	From	To	From	To	From	To	From	To	From	To	From	To													
F1	**Fill**	127.2	124.0	0.0	3.2	127.7	124.5	0.0	3.2	127.7	124.5	0.0	3.2	126.9	124.5	0.0	2.4	-	-	-	15	18.0	10	30	0.20 - 0.25	-	28	0	0.36	2.8
3C	**Plastic Till** Stiff to Hard Silty Clay to Clayeye Silt	124.0	110.5	3.2	16.7	124.5	105.0	3.2	22.7	124.5	111.5	3.2	16.2	124.5	108.5	2.4	18.4	21	12	9	13.0	21.0	25	75	0.20 - 0.25	80	32	5	0.31	3.3
3N 2	**Non-Plastic Till / Soil** Dense to Very Dense Sand to Sandy Silt	110.5	106.5	16.7	20.7	-	-	-	-	-	-	-	-	108.5	98.0	18.4	28.9	-	-	-	10.0	21.5	50	150	0.20 - 0.25	-	37	0	0.25	4.0
6/7	**Plastic Soil** Hard Silty Clay to Clayey Silt	106.5	84.0	20.7	43.2	105.0	84.0	22.7	43.7	111.5	84.0	16.2	43.7	98.0	84.0	28.9	42.9	30	17	13	18.0	21.5	40	120	0.20 - 0.25	200	32	5	0.31	3.3
2 4	**Non-Plastic Soil** Very Dense Sand to Sandy Silt	84.0	78.0	43.2	49.2	84.0	78.0	43.7	49.7	84.0	80.0	43.7	47.7	84.0	80.0	42.9	46.9	-	-	-	16.0	21.5	100	300	0.20 - 0.25	-	37	0	0.25	4.0
5 6/7	**Plastic Soil** Hard Clayey Sily to Silty Clay	78.0	72.0	49.2	55.2	78.0	72.0	49.7	55.7	80.0	72.0	47.7	55.7	80.0	72.0	46.9	54.9	30	17	13	15.0	21.5	60	180	0.20 - 0.25	350	32	5	0.31	3.3

[A] Average secant modulus at 50% of the failure stress. Secant modulus should be increased by 20% to 50% for settlement calculation.
[B] Average Secant Modulus for Unload/Reload condition
[C] Long-term Effective Poisson's Ratio
[D] The unit weight values are for the intact condition and do not include bulking factor after excavation.
[E] Atterberg Limit and Undrained Shear Strength values apply only to plastic soil types.
[F] Rankine earth pressure coefficients for smooth vertical wall and horizontal ground surface.
[H] Refer to Stratigraphy profile for varrying depths between station chainages.

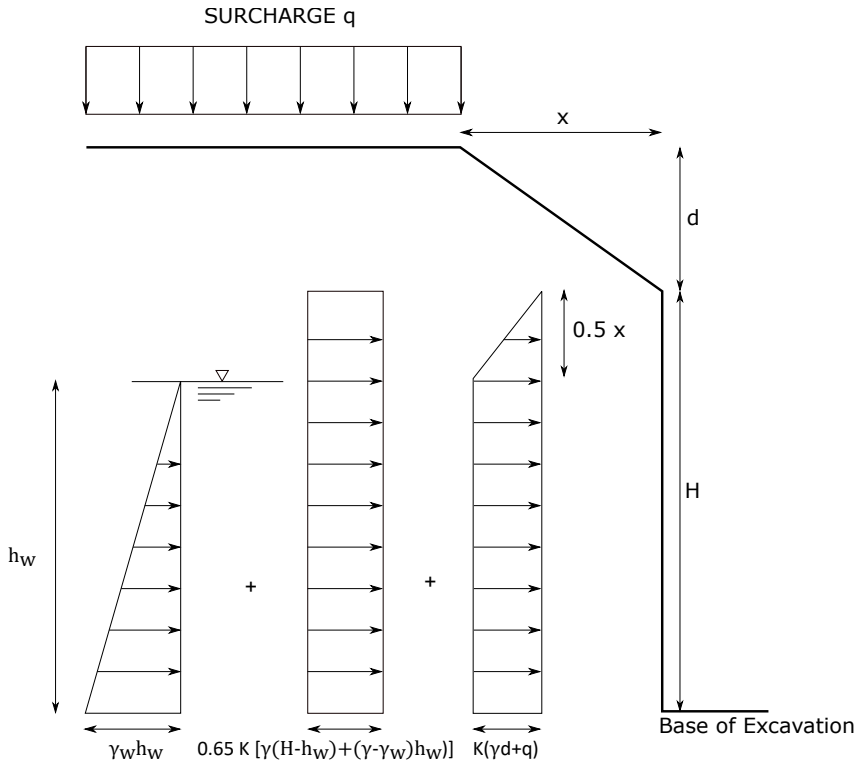
ONTARIO LINE TECHNICAL ADVISOR

Ontario Line

TOC - NORTH - THORNCLIFFE
Preliminary Interpreted Subsurface Stratigraphy and Geotechnical Parameters

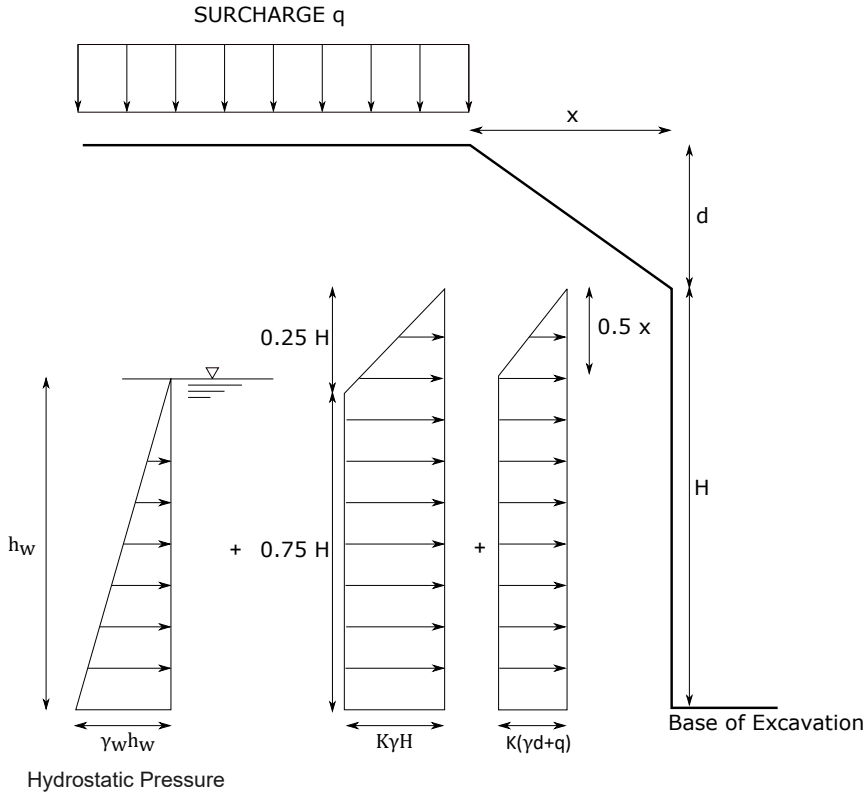
ENGINEER: MM		DRAWN: MH	
DATE: 2023-10-27		SCALE: NTS	FIGURE C-1

DRAFT



γ = unit weight of soil
γ_w = unit weight of water
K = earth pressure coefficient
= Ka (where controlling ground deformation is not a concern) - Ka is the active coefficient of earth pressure
= 0.4 to 0.5 (to support semi-sensitive to sensitive structures)

ONE TEAM ONTARIO LINE TECHNICAL ADVISOR	SITE: TOC - North - Thorncliffe	TITLE: Lateral Earth Pressure Distribution Temporary Braced Excavation in Cohesionless Soils
PROJECT: Ontario Line	DOCUMENT OWNER: Thurber	
DATE: 2020-11-13		FIGURE: C-2



γ = unit weight of soil
γ_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)

ONE TEAM ONTARIO LINE TECHNICAL ADVISOR	SITE:TOC - North - Thorncliffe	TITLE: Lateral Earth Pressure Distribution Temporary Braced Excavation Stiff to Hard Cohesive Soils
PROJECT: Ontario Line	DOCUMENT OWNER: Thurber	
DATE: 2020-11-13		FIGURE: C-3

Appendix D: Preliminary Factored and Unfactored Applied Stress for TOC Buildings

Mohamed Hosney

From: Janelle Stanzeleit <Janelle.Stanzeleit@mottmac.com>
Sent: June 22, 2023 4:00 PM
To: Mohamed Hosney
Cc: Matthew Pearce; Masoud Manzari; agaus
Subject: RE: Thorncliffe Geotech Discussion
Attachments: Thorncliffe TOC - Estimated Loads R2.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Hi Mohamed,

My intention was to use the loads provided as typical loads for similar structures. For completeness I have updated my sketch to provide 2 additional load sets. One for 11 storey podiums and one for the 14 storey office structure at site D. I have summarized the load below for each site.

At site D1
For the tower use the 50 storey loads
Use the "other locations – 5 storey loads" for areas outside the tower footprint

At site D
Use the 14 storey office loads attached

At Site E1
For the tower use the 50 storey loads
For the podiums use the 11 storey loads
Use the other locations loads for the remaining areas

At Site E4/E5
For the east tower use the 50 storey loads
For the west tower use the 30 storey loads
For the podium use the 11 storey loads
Use the other locations loads for the remaining areas

Let me know if you have any other questions.

Thanks,

Janelle

Janelle Stanzeleit
Pronouns: she, her, hers
Senior Project Engineer

D +1 416 840 9334
janelle.stanzeleit@mottmac.com

MMCL
Thorncliffe TOC - Estimated Loads
By: JS
Date: 22-June-2023

Estimated loads on mat foundations below 11 storey podiums

Unfactored Loads:
DL = 200 kPa
LL = 40 kPa

Factored Load = 315 kPa

Estimated column loads below 11 storey podiums

Unfactored Loads:
DL = 7380 to 11530 kN
LL = 1440 to 2250 kN

Factored Load = 11385 to 17790 kN

Site D Loads (Estimated loads on mat foundations below 14 storey office building)

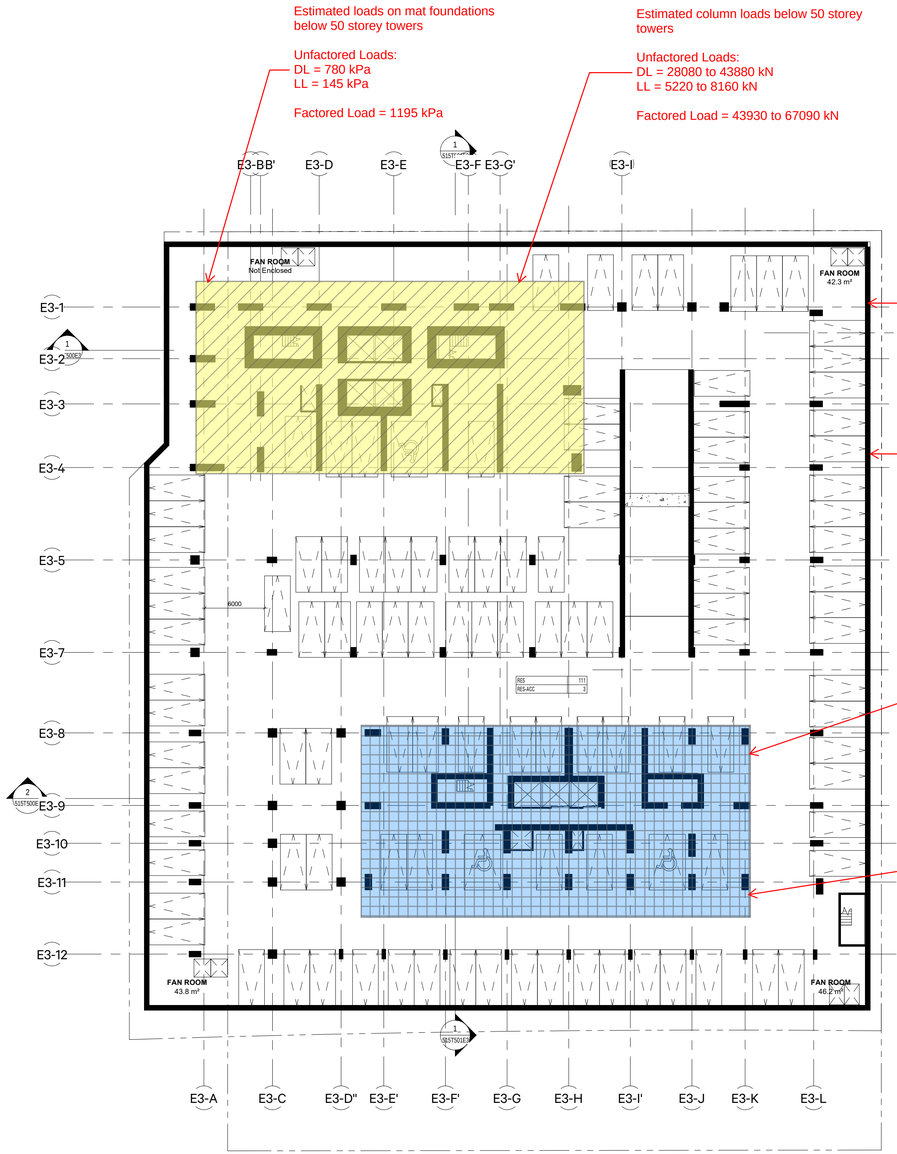
Unfactored Loads:
DL = 265 kPa
LL = 55 kPa

Factored Load = 415 kPa

Site D Loads (Estimated column loads below 14 storey office building)

Unfactored Loads:
DL = 14910 to 21470 kN
LL = 3090 to 4460 kN

Factored Load = 23275 to 33510 kN



1 LEVEL B3
1 : 300

REVIEW ONLY

FOR INTERNAL REVIEW ONLY

SHEET No. 515T100EBILE: BIM 360://10206938_OLTA_Planning/10206938-TD015E3-THNCF-THORNCLIFFE_PARK.rvt

ISSUANCE								
		DRAFT RE-ZONING ARCHITECTURE AND LANDSCAPE	SvN NOT FOR ESTIMATING OR BIDDING NOT FOR CONSTRUCTION	ONETEAM ONTARIO LINE TECHNICAL ADVISOR		DESIGNED Designer DRAWN Author CHECKED Checker APPROVED Approver	ONTARIO LINE TITLE LEVEL B3	Plot Date: 2023-06-13 10:13:46 AM METROLINX Infrastructure Ontario SCALE 1 : 300 DRAWING NUMBER 515T100E3

Appendix E: Geotechnical and Hydrogeological Scope of Investigation _ Phase 1

TABLE E-1
Thorncliffe Station TOCs

Proposed Phase 1 - Geotechnical Scope of Work

1- The preliminary locations of the Phase-1 boreholes are shown in Appendix B. The preliminary proposed borehole locations are based on the Thorncliffe TOC drawings dated May 22, 2022; provided by SvN.

2- The field investigation and laboratory testing must be completed in accordance with the best practices for geotechnical investigation, in conformance with the 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. DevCo and their designer must add to the scope of investigation presented herein, as required, for the final design of TOC.

Borehole ID	Depth	Field Investigation	Laboratory testing
2 boreholes (TOC-TH-05 and TOC-TH-16)	**15**	**Scope of Work** - **SPT** within overburden soil at 0.75 m interval up to 6 m depth, increasing to 1.5 m interval up to borehole termination. -Photo of each recovered soil sample showing a sample, measuring tape and sample identification. - If very soft to firm plastic soil is encountered (i.e. N<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). **Monitoring Wells: 12 in total** **- TOC-TH-01 --> Two monitoring wells screen tips at 5 m and 40 m** **- TOC-TH-03 --> Two monitoring wells screen tips at 6 m and 30 m** **- TOC-TH-09 --> Two monitoring wells screen tips at 5 m and 20 m** **- TOC-TH-11 --> One monitoring well screen tip at 10 m** **- TOC-TH-12 --> Two monitoring wells screen tips at 5 m and 15 m** **- TOC-TH-15 --> Two monitoring wells screen tips at 5 m and 15 m** **- TOC-TH-16 --> One monitoring well screen tip at 10 m** - 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. If no groundwater is encountered within the drilled depth, TA team shall be notified before backfilling. - 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. - Single well response test at the above monitoring well locations. - Groundwater samples collected for environmental testing of the parameters indicated in the adjacent column.	**Geotechnical Soil Testing** - Moisture content test on all soil samples - Index Properties test (Sieve, hydro, Atterberg) on 30% of the soil samples, minimum one per layer in each borehole. - Unit Weight/Density Test on 10 samples; minimum two tests at each site location. - The following advance testing should be carried out on undisturbed samples obtained from the PQ coring at all subject BHs: i- minimum of 3 CD triaxial sets , 3 UU triaxial sets, 3 Direct Shear sets for soil samples at each subject PQ borehole. ii- minimum of 3 consolidation test for cohesive soil samples from each PQ borehole. Rock testing: Unconfined compressive strength (UCS) for each run of the collected cores. Point Load tests as required. **Environmental Soil Testing** Due diligence level of testing as per general OL scope of work (i.e., test COPCs and corrosivity in worst-case sample from each major soil layer, test SPLP and TCLP (incl. bulk PCBs) in worst-case sample from each borehole). Include standard soil QAQC samples (i.e., one field duplicate for every 10 samples, one methanol field blank/trip blank per borehole). **Environmental Groundwater Testing** Submit the groundwater samples collected from each of the installed monitoring wells for analysis of the following parameters: -City of Toronto Sewer Bylaw (including dissolved metals) Collect one field duplicate groundwater sample for every 10 samples. Trip blank/field blank/trip spike samples are not required.
3 boreholes (TOC-TH-09, TOC-TH-11, and TOC-TH-18)	**30**		
2 boreholes (TOC-TH-01 and TOC-TH-15)	**60**		
2 boreholes (TOC-TH-03 and TOC-TH-12)	**70**		