PATERSON GROUP

# Hydrogeological Report

## Proposed Mixed Use Redevelopment

Lansdowne – 945 Bank Street
Ottawa, Ontario

Prepared for Trinity Development Group

**Report PH4423-1 Revision 2 dated October 6, 2023**

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# 1.0 INTRODUCTION

Paterson Group (Paterson) was commissioned by Trinity Development Group to complete a hydrogeological review for the proposed mixed-use redevelopment to be located at 945 Bank Street in the City of Ottawa, Ontario (Refer to Paterson Drawing PH4423 -1- Site Plan in Appendix 1 and Trinity Lansdowne Park Redevelopment Drawings, attached within Appendix 4)

Subsurface information was obtained from the field investigations carried out by Paterson to determine the subsoil and groundwater conditions at the site by means of test holes.

The following report has been prepared specifically and solely for the aforementioned project described herein. It contains a hydrogeological review and assessments pertaining to the proposed development as it is understood by Paterson at the time of writing this report.

## 1.1 Proposed Development

Based on available design plans, it is understood that the proposed redevelopment will consist of a below-grade arena, two multi-storey towers and bleachers/stands connected via a mixed-use commercial building with one level of underground parking occupying the entirety of the proposed work area which will be partially shared with the adjacent development. The western portion of the underground parking lot occupying the majority of the redevelopment area will be at a slightly higher elevation than the eastern portion of the underground parking lot, arena and associated commercial areas. It is understood that the proposed buildings will be municipally serviced. The proposed redevelopment area is only a portion of the existing property and will be referred to as the subject site throughout this report.

In the event that groundwater infiltration is encountered within the excavation at the time of construction, consideration has been given to incorporating a water suppression system that will reduce infiltration volumes and long-term groundwater lowering at the post-construction stage.

# 2.0 SITE CONDITIONS

## 2.1 Surface Conditions

The subject site is currently occupied by a hockey arena, bleachers/stands, mixed use commercial building and a grassed area with an art sculpture. One level of underground parking currently exists under the northern portion of the property which is not undergoing redevelopment. The grassed area contains a large berm located to the east side of the existing football stadium. The topography of the site is generally flat and is at grade with the surrounding roadways. It is bordered to the north by mixed use commercial buildings with one level of underground parking followed by Holmwood Avenue, to the east by an at-grade park followed by the Queen Elizabeth Parkway which runs adjacent to the Rideau Canal, to the south by a football stadium followed by a park and the Queen Elizabeth Parkway, and to the west by a multi-storey residential building with one level of underground parking followed by Bank Street.

According to available mapping, the subject site is located in the Clay Plains physiographic region, but it does not match with the field investigation data.

### Field Investigations

*Amec Foster Wheeler (AFW) Ground Water Monitoring Program (GWMP)*

AFW completed 12 monitoring well installations across the entire property as part of a GWMP in 2015 in support of a Certificate of Property Use (CPU). Five monitoring wells, MW15-6, MW15-7, MW15-9, MW15-10, and MW15-11 are located near or in the subject site and were used in support of this study. The relevant monitoring wells were advanced to a maximum depth of 6.1 m below ground surface (bgs).

The soil profiles are presented on the Borehole Reports by others and the Soil Profile and Test Data sheets in Appendix 2 of this report. The monitoring well locations are presented on Drawing PG5792-1, included in Appendix 2.

*Paterson Group Inc. (Paterson) Geotechnical Report*

As part of the Geotechnical Report in support of the proposed mixed-use redevelopment, Paterson completed six (6) boreholes, including two (2) boreholes equipped with monitoring well installations. The boreholes were completed between October 25, 2021 and November 12, 2021 and were advanced to a maximum depth of 34 m bgs. The test hole locations were distributed in a manner to provide general coverage of the subject site taking into consideration site features as well as evaluating any geotechnical concerns. The borehole locations of the field investigations are presented on Drawing PG5792-1, included in Appendix 2.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 2 of this report.

### Surface Water

The subject site is located within the Rideau Canal subwatershed. Surface water features identified within 500 m of the property include the Rideau Canal located approximately 150 m south and east as well as two inlet ponds to the Rideau Canal located approximately 200 m southwest of the subject site.

### Groundwater

Groundwater monitoring wells were installed in select boreholes by Paterson and AFW to permit the monitoring of groundwater levels at the subject site. Groundwater information is discussed in Section 3 of this report and details are noted on the Soil Profile and Test Data sheets presented in Appendix 2 of this report. A long-term groundwater monitoring program (LTGWMP) was completed at the subject site between September 15, 2021 and November 9, 2022 by Paterson. Additionally, groundwater levels were provided by AFW from June 11, 2021 until Paterson installed data loggers. It should be noted that groundwater levels can fluctuate seasonally and with precipitation events. Therefore, groundwater levels can vary.

## 2.2 Subsurface Profile

The subsurface profile at the subject site is generally comprised of varying amounts of fill material followed by a sandy silt to silty sand with varying amounts of gravel, overlying a till comprised of a silty sand with gravel, cobbles, and boulders extending to the bedrock surface. Bedrock was confirmed by coring completed to depths ranging between 30.68 and 31.57 m bgs in select borehole locations.

Reference should be made to the soil profile records and test hole locations included in Appendix 2 for the details of the soil profiles encountered at each borehole location.

Based on surficial mapping prepared by the Ontario Geological Survey, the subject site is located in an area where surficial geology consists of a fine-textured glaciomarine deposits consisting of silt and clay with minor sand and gravel.

### Fill Material

A fill layer was encountered at all borehole locations underlying the topsoil or asphaltic concrete surfacing. The fill material consisted of silty sand to loamy sand with varying amounts of topsoil, silty clay, gravel, boulders, and asphaltic concrete.

The fill material at the subject site extended to a maximum depth of 9.5 m bgs in the berm location, and 4.7 m bgs throughout the remainder of the site.

### Sandy Silt to Silty Sand

A fine to coarse grained sand with trace silt to silty sand with varying amounts of gravel was encountered at depths as shallow as 2.0 m bgs and as deep as 9.5 m bgs. It was recorded to extend to a maximum depth of 15.5 m bgs in the berm location.

### Glacial Till

Generally, the glacial till deposit was noted underlying the sandy silt to silty sand material in select boreholes. The glacial till deposit consists of a very dense to compact brown silty sand with gravel, cobbles, and boulders and extends to an inferred maximum depth of 31.6 m bgs.

### Bedrock

Based on coring results completed by Paterson, limestone bedrock was encountered near the proposed arena location between 30.7 and 31.6 m bgs and was cored to a maximum depth of 33.5 m bgs. Limestone bedrock was encountered near the northern end of the proposed Towers at depths of 21.3 and 21.4 m bgs and extended to a maximum depth of 24.1 m bgs. The recovery values were recorded to be 100%, while the RQD values generally varied between 98 and 100%. Based on these results, the quality of the bedrock ranges from good to excellent.

Based on available geographic mapping, the subject site is located in an area where the bedrock consists of limestone, dolostone, shale, arkose, and sandstone of the Ottawa Group, Simcoe Group, and Shadow Lake Formation with an overburden thickness between 5 m in the west portion of the site and 15 m in the east portion of the site.

# 3.0 HYDROGEOLOGY

Based on the results of the groundwater monitoring program completed by Paterson at select monitoring well locations, groundwater levels have been noted to range between <59.08 and 60.78 m asl. Results from the groundwater monitoring and correlated precipitation events for each monitoring well location between September 15, 2021 and November 9, 2022 can be found in Paterson Report PH4424 MEMO.01 dated December 2, 2022.

It should be noted that the Rideau Canal is located approximately 150 m south and east of the subject site and is inferred to be hydraulically connected to the groundwater within the subject site. It is understood that the groundwater levels at the subject site are impacted by the rising/lowering of the Canal. Based on the Risk Assessment completed by AMEC in November 2011, the elevations of the Rideau Canal during the navigational and non-navigational season have been noted to be 64.08 m and 62.45 m asl, respectively.

Based on the provided updated Trinity – Lansdowne Park Development Redevelopment drawings dated August 17, 2023, the elevation of the western portion of the underground parking structure associated with Tower 1 and Tower 2 (P1) has been noted to be at 62.5 m asl, while the elevation of the eastern portion of the underground parking structure for Tower 1 and Tower 2 has been proposed to be 61.6 m asl. A building OPS/Storage room is located at the south-eastern end of the underground parking lot and has a proposed elevation of 61.6 m asl. The finished floor elevation of the Arena has been proposed to be 61.6 m asl, while existing parking has an elevation of 60.9 m asl. It is understood that end bearing pile foundations or caisson foundations have been proposed for Tower 1 and Tower 2, and a raft foundation is anticipated for the Arena. It has been assumed that a founding level of approximately 2 m below the finished floor elevations can be expected for each building.

For the purpose of this hydrogeological review, a high and low groundwater level of 60.78 and 58.9 m asl, respectively, has been used for the analysis and is based on the completed long-term groundwater monitoring program performed on site. Given a high groundwater table of 60.78 m asl and the above noted founding levels for the proposed development, it is expected that excavations related to the underground parking structure for all buildings will be partially completed below the high groundwater table.

Based on the drawings provided, an approximate low groundwater level of 58.9 m asl has been noted in February 2021. Given the limited groundwater data collected to date by Paterson during the non-navigational season of the Rideau Canal, a low groundwater level of 58.9 m asl provided by Trinity will be used for the review and analysis. With an assumed foundation thickness of 2 m, and provided the elevations for the western portion of parking at Towers 1 and 2 are 62.5 m asl, and the elevations for the eastern portion of parking for Tower 1 and 2, the OPS/Storage room and the Arena are 61.6 m asl, it is expected that the foundation elevation will be 59.6 m asl at the deepest point. As such, it is expected that excavations related to the underground parking structure for all buildings will be completed above the low groundwater table.

**Should the proposed finished floor elevations and/or subfloor structure extend to greater depths than noted above, additional evaluations will be required.**

On a conceptual scale, hydrogeological/hydrologic conditions at the subject site suggest that water may infiltrate the open excavations as surface water infiltration during precipitation events and through groundwater flow within the overburden material.

The excavation footprint related to the proposed underground parking structure for Tower 1 and 2 is expected to encompass an area of approximately 13,300 $m^2$, split between the higher elevation western portion (62.5 m asl, 8800 $m^2$) serving the apartments and the lower elevation eastern portion (61.6 m asl, 4500 $m^2$) serving as additional event parking. The excavation footprint related to the proposed Arena is expected to encompass an area of approximately 6,400 $m^2$. The Building OPS/Storage is expected to encompass an area of approximately 1,200 $m^2$. Therefore, the potential exists for a moderate to high amount of surface water to intercept the excavation footprints directly during significant precipitation events.

Based on the measured groundwater levels, the proposed excavations are expected to intercept silty sand and glacial till with the saturated depth of excavation. The potential exists for a moderate to high amount of groundwater inflow through the overburden soils. The volume of groundwater encountered will depend on the area specific composition of the overburden and elevation of the water table across the subject site.

Based on the measured groundwater levels at the borehole locations, the local groundwater flow direction is variable, but generally trends in a southeasterly direction. The regional groundwater flow direction is expected to trend north towards the Ottawa River. It should be noted that groundwater levels can fluctuate based on precipitation events and seasonal variations. Therefore, groundwater levels and flow directions may vary at the time of construction.

## Slug Testing

Slug testing was completed at BH 5-21, BH 6-21, BH8-21, and BH9-21 to estimate the approximate hydraulic conductivity of the overburden material within the anticipated saturated depth of excavation. Slug testing (rising head) was completed in accordance with ASTM Standard Test Method D4404 - Field Procedure for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers. The slug testing results have been included in Appendix 2 of the report.

## Hydraulic Conductivity

Following the completion of the slug testing, the test data was analyzed as per the method set out by Hvorslev (1951). Assumptions inherent in the Hvorslev method include a homogeneous and isotropic aquifer of infinite extent with zero-storage assumption, and a screen length significantly greater than the monitoring well diameter. The assumption regarding aquifer storage is considered to be appropriate for groundwater flow through the overburden aquifer. The assumption regarding screen length and well diameter is considered to be met based on the screen lengths of 3 m and well diameter of 0.032 m.

While the idealized assumptions regarding aquifer extent, homogeneity, and isotropy are not strictly met in this case (or in any real-world situation), it has been our experience that the Hvorslev method produces effective point estimates of hydraulic conductivity in conditions similar to those encountered at the subject site.

The Hvorslev analysis is based on the line of best fit through the field data (hydraulic head recovery vs. time), plotted on a semi-logarithmic scale. In cases where the initial hydraulic head displacement is known with relative certainty, such as in this case where a physical slug has been introduced/removed, the line of best fit is considered to pass through the origin.

## Results

Based on the above test methods, the monitoring wells displayed hydraulic conductivity values ranging between 5.86 x $10^{-4}$ and 7.8 x $10^{-5}$ m/sec. The values measured within the monitoring wells are consistent with similar material Paterson has encountered on other sites and typical published values for silty sand and glacial till with a silty sand matrix. The range in hydraulic conductivity values is due to the variability in the composition and compactness of the silty sand and glacial till deposit.

## 3.1 Estimated Water Taking Rates

The potential sources of water taking at the subject site have been identified as the excavation footprints of the underground parking structure/storage associated with the high-rise developments, as well as the excavation footprint of the proposed arena.

The hydraulic conductivity values for the overburden material within the anticipated saturated depth of excavation at the borehole locations were determined based on slug testing. The hydraulic conductivity of the silty sand and glacial till was found to vary from $5.86 \times 10^{-4}$ and $7.8 \times 10^{-5}$ m/sec and is dependent on the variability in composition and compactness of the silty sand and glacial till deposit at a given location. A conservative hydraulic conductivity of **$6.0 \times 10^{-4}$ m/sec** has been chosen for the preliminary calculations.

To determine surface water infiltration into the excavation footprints, an intensity duration frequency (IDF) curve from the Ministry of Transportation - Ontario (MTO) was obtained. The IDF curve is the graphical representation of the probability that a given average rainfall intensity will occur. For the purposes of this project, a 5-year storm event with a one-hour duration was chosen as the design storm. This provides a potential rainfall intensity of $2.63 \times 10^{-2}$ m of precipitation into the excavation footprints. Various duration storm events with their associated rainfall intensities are presented in the IDF Curve in Appendix 3.

The preliminary infiltration rates provided for the following sources were calculated using the Dupuit Forchheimer method:

$$Q = \pi K((h_0^2-h_p^2)/\ln(R/r))$$

$K$ = hydraulic conductivity (m/sec)
$h_0$ = thickness of aquifer (m)
$h_p$ = thickness of aquifer from base of excavation to base of aquifer (m)
$R$ = effective drawdown radius for excavation (m)
$r$ = equivalent radius of excavation (m)

A sample groundwater infiltration calculation is provided in Appendix 3 of this report.

### Building Excavation Footprints

### *Tower 1 and 2 -Underground Parking – Western Portion*

Generally, the subsurface material throughout the site consists of silty sand and glacial till within the anticipated saturated depth of excavation. Based on a high groundwater level of 60.78 m asl and an excavation depth of 60.5 m asl (based on an elevation of 62.5 ma sl), a maximum of 0.3 m of saturated material could be encountered at the excavation location during the navigational season of the Rideau Canal. The subsurface material was assigned a conservative hydraulic conductivity of 6 x $10^{-4}$ m/sec based on slug testing results completed at the subject site. Using the above noted values and an approximate excavation sizing of 8,800 $m^2$, the preliminary steady state volume of groundwater is anticipated to be between **6,150,000 – 6,400,000 L/day** during navigational seasons. These volumes do not account for the initial groundwater inflow into the excavation or unforeseen circumstances.

A factor of safety should be applied to the calculated infiltration rates to account for variability in the overburden soils and any unforeseen circumstances that may arise during construction activities.

With respect to the potential for surface water inflow into the excavation footprint, the subject site is adjacent to developed land on all sides. It is therefore expected that the majority of surface water inflow into the excavation footprint will be caused by precipitation directly onto the footprint rather than runoff from other sources. Given an excavation footprint with a sizing of 8,800 $m^2$ and a precipitation depth of 2.63 x $10^{-2}$ m, a total volume of approximately 230,000 L of surface water can be expected during a 5 year – 1 hour duration precipitation event. It is expected that the contractor will direct surface water away from open excavations whenever possible.

Based on the anticipated volumes, Permit to Take Water (PTTW) Category 3 is recommended for temporary construction dewatering of the proposed development.

### *Tower 1 and 2 -Underground Parking – Eastern Portion*

Generally, the subsurface material throughout the site consists of silty sand and glacial till within the anticipated saturated depth of excavation. Based on a high groundwater level of 60.78 m asl and an excavation depth of 59.6 m asl (based on an elevation of 61.6 m asl), a maximum of 1.2 m of saturated material could be encountered at the excavation location during the navigational season of the Rideau Canal. The subsurface material was assigned a conservative hydraulic conductivity of 6 x $10^{-4}$ m/sec based on slug testing results completed at the subject site. Using the above noted values and an approximate excavation sizing of 4,500 $m^2$, the preliminary steady state volume of groundwater is anticipated to be between **6,850,000 - 7,100,000 L/day** during navigational seasons. These volumes do not account for the initial groundwater inflow into the excavation or unforeseen circumstances.

A factor of safety should be applied to the calculated infiltration rates to account for variability in the overburden soils and any unforeseen circumstances that may arise during construction activities.

With respect to the potential for surface water inflow into the excavation footprint, the subject site is adjacent to developed land on all sides. It is therefore expected that the majority of surface water inflow into the excavation footprint will be caused by precipitation directly onto the footprint rather than runoff from other sources. Given an excavation footprint with a sizing of 4,500 $m^2$ and a precipitation depth of 2.63 x $10^{-2}$ m, a total volume of approximately 120,000 L of surface water can be expected during a 5 year - 1 hour duration precipitation event. It is expected that the contractor will direct surface water away from open excavations whenever possible.

Based on the anticipated volumes, Permit to Take Water (PTTW) Category 3 is recommended for temporary construction dewatering of the proposed development.

### *Arena*

Generally, the subsurface material throughout the site consists of silty sand and glacial till within the anticipated saturated depth of excavation. Based on a high groundwater level of 60.78 m asl and a maximum excavation depth of 59.6 m asl (based on an elevation of 61.6 m asl), a maximum of 1.2 m of saturated material could be encountered at the excavation location during the navigational season of the Rideau Canal. The subsurface material was assigned a conservative hydraulic conductivity of 6 x $10^{-4}$ m/sec based on slug testing results completed at the subject site. Using the above noted values and an approximate excavation sizing of 6,400 $m^2$, the preliminary steady state volume of groundwater is anticipated to be between **7,500,000 – 7,750,000 L/day** during navigational seasons. These volumes do not account for the initial groundwater inflow into the excavation or unforeseen circumstances.

A factor of safety should be applied to the calculated infiltration rates to account for variability in the overburden soils and any unforeseen circumstances that may arise during construction activities.

With respect to the potential for surface water inflow into the excavation footprint, the subject site is adjacent to developed land on all sides. It is therefore expected that the majority of surface water inflow into the excavation footprint will be caused by precipitation directly onto the footprint rather than runoff from other sources. Given an excavation footprint with a sizing of 6,400 $m^2$ and a precipitation depth of 2.63 x $10^{-2}$ m, a total volume of approximately 170,000 L of surface water can be expected during a 5 year – 1 hour duration precipitation event. It is expected that the contractor will direct surface water away from open excavations whenever possible.

Based on the anticipated volumes, Permit to Take Water (PTTW) Category 3 is recommended for temporary construction dewatering of the proposed development.

### *Building OPS/Storage*

Generally, the subsurface material throughout the site consists of silty sand and glacial till within the anticipated saturated depth of excavation. Based on a high groundwater level of 60.78 m asl and an excavation depth of 59.6 m asl (based on an elevation of 61.6 m asl), a maximum of 1.2 m of saturated material could be encountered at the excavation location during the navigational season of the Rideau Canal. The subsurface material was assigned a conservative hydraulic conductivity of 6 x $10^{-4}$ m/sec based on slug testing results completed at the subject site. Using the above noted values and an approximate excavation sizing of 1,200 $m^2$, the preliminary steady state volume of groundwater is anticipated to be between **4,500,000 - 4,750,000 L/day** during the navigational season, respectively. These volumes do not account for the initial groundwater inflow into the excavation or unforeseen circumstances.

A factor of safety should be applied to the calculated infiltration rates to account for variability in the overburden soils and any unforeseen circumstances that may arise during construction activities.

With respect to the potential for surface water inflow into the excavation footprint, the subject site is adjacent to developed land on all sides. It is therefore expected that the majority of surface water inflow into the excavation footprint will be caused by precipitation directly onto the footprint rather than runoff from other sources. Given an excavation footprint with a sizing of 1,200 $m^2$ and a precipitation depth of 2.63 x $10^{-2}$ m, a total volume of approximately 32,500 L of surface water can be expected during a 5 year - 1 hour duration precipitation event. It is expected that the contractor will direct surface water away from open excavations whenever possible.

Based on the anticipated volumes, Permit to Take Water (PTTW) Category 3 is recommended for temporary construction dewatering of the proposed development

## 3.2 Estimated Radius of Influence

A series of steady-state radius of influence calculations were carried out based on Sichardt (1992) using the equation:
$R = r_e + 3000*\Delta h(k^{0.5})$

$R$ = radius of influence (m)
$r_e$ = equivalent radius of excavation (m)
$\Delta h$ = thickness of drawdown within the aquifer (m)
$k$ = hydraulic conductivity (m/sec)

### *Tower 1 and 2 -Underground Parking - Western Portion*

For the purposes of completing the calculations, the following assumptions were made:

$r_e$ = 60 m
k = 6 x $10^{-4}$ m/sec, based upon slug testing results
Δh = 0.3 (navigational season)

Using the above equation and assumptions, a radius of influence of approximately **22 m** could develop as a steady state condition, extending from the edge of the excavation, during the construction of the proposed underground parking structure during non-navigational and navigation seasons of the Rideau Canal, respectively.

### *Tower 1 and 2-Underground Parking – Eastern Portion*

For the purposes of completing the calculations, the following assumptions were made:

$r_e$ = 42.7 m
k = 6 x $10^{-4}$ m/sec, based upon slug testing results
Δh = 1.2 (navigational season)

Using the above equation and assumptions, a radius of influence of approximately **88 m** could develop as a steady state condition, extending from the edge of the excavation, during the construction of the proposed underground parking structure during non-navigational and navigation seasons of the Rideau Canal, respectively.

### *Arena*

For the purposes of completing the calculations, the following assumptions were made:

$r_e$ = 52.2 m
k = 6 x $10^{-4}$ m/sec, based upon slug testing results
Δh = 1.2 (navigational season)

Using the above equation and assumptions, a radius of influence of approximately **88 m** could develop as a steady state condition, extending from the edge of the excavation, during the construction of the proposed Arena and associated parking during non-navigational and navigation seasons of the Rideau Canal, respectively.

### *Building OPS/Storage*

For the purposes of completing the calculations, the following assumptions were made:

$r_e$ = 22.3 m
k = 6 x $10^{-4}$ m/sec, based upon slug testing results
Δh = 1.2 m (navigational season)

Using the above equation and assumptions, a radius of influence of approximately **88 m** could develop as a steady state condition, extending from the edge of the excavation, during the construction of the proposed Music Hall should construction occur during the navigational season of the Rideau Canal.

## 3.3 Water Discharge

The discharge point for the pumped water from the excavation sump is expected to be to the existing City of Ottawa sewer system via a sewer connection. As such, it will be subject to the City of Ottawa Sewer Use Bylaws and a permit will be required to discharge the water to the sewer system.

It is expected that BMP's as recommended by the City of Ottawa - Sewer Use Program (SUP) document (attached within Appendix 5) or similar will be used to reduce sediment loading within the water prior to discharge to the sewer system. If the pumped water does not meet the SUP criteria, it must be retained on site until test results indicate compliance with the SUP criteria or remove the water through other means such as tanker trucks.

Based upon the anticipated water takings being discharged to the City sewer system, it's Paterson's opinion that the water discharged will not cause negative impacts to the natural environment. As the discharged water is not being returned directly to the natural environment, there are no negative effects expected related to the temperature of the discharged water. The location and operation of the appropriate discharge measures are the responsibility of the contractor.

# 4.0 POTENTIAL IMPACTS

## 4.1 Adverse Effects on Adjacent Structures

The subsurface profile at the subject site is generally comprised of fill material overlain by a silty sand and glacial till followed by bedrock. The majority of the expected groundwater infiltration will be encountered within the silty sand and glacial till. The potential dewatering volumes due to groundwater infiltration into excavation footprints are anticipated to be high given the hydraulic properties of the native material. The buildings in the surrounding area consist of a mixture of residential high rise and commercial buildings. The buildings are expected to be founded on either silty sand or glacial till deposits. As such, the compressibility of the materials at the anticipated footing level in the area is expected to be minimal. Furthermore, water takings are expected to be short term in duration, given the nature of the development. Therefore, any effects related to ground surface settlement due to the water taking activities during construction and post-construction are anticipated to be negligible.

It is not expected mitigation methods will be required related to potential adverse effects on structures or infrastructure adjacent to the excavations due to the lack of compressibility of the native material and short-term nature of the construction. However, mitigation methods would consist of halting pumping and providing monitoring of the potential settlement to determine if the negative effects are related to the dewatering program. If the dewatering is causing the consolidation/settlement effects, then a revised dewatering program to reduce the taking of water or providing a water recharge system to reduce the consolidation effects would be necessary.

## 4.2 Adverse Effects on Neighbouring Water Wells

A search of the Ontario Water Well Records database indicates there are a large number of wells within 500 m of the site as depicted in Drawing PH4423-1 included in Appendix 1. However, it is expected that these wells are either no longer in use due to their installation dates and the developed nature of the region or are monitoring well installations. Therefore, dewatering activities at the site are not expected to cause any interference to the water supply of surrounding properties or other negative impacts during construction and post-construction.

## 4.3 Soil, Surface Water and Groundwater

A search of the MECP Brownfields Environmental Site Registry was conducted as part of the assessment of the site, neighbouring properties and the general area. A total of 5 Brownfield sites were located within 500 m of the subject site and have been identified as Registration numbers 2191, 68114, 205852, 213166 and 224722. All Brownfield sites and their respective registration numbers indicated there were no groundwater remediations performed during the cleanup process. With the exception of 213166, groundwater controls were not required under the Records of Site Condition (RSC). No concerns were identified in the review of the MECP Brownfields database.

Registration number 213166 required a groundwater monitoring program (GWMP) prior to the issuing of the Certificate of Property. Available annual reports completed by Woods indicate that all groundwater samples taken from the monitoring well network located at the CPU property in 2019 reported parameter concentrations below the 2011 Table 3 SCS for residential / parkland / institutional property.

The groundwater that is pumped from the site excavation must be managed in an appropriate manner. The contractor will be required to implement a water management program to dispose of the pumped water. It is expected the groundwater will be discharged to the City of Ottawa sewer system in accordance with the City Sewer Use By-Laws. Depending upon the results of the baseline test to be performed for the discharge permit application, the City of Ottawa will determine the appropriate discharge location (storm versus sanitary sewer), on-site treatment or if off-site disposal is required.

It is anticipated that the material on site will be disposed of as per the MECP policy, *Management of Excess Soil - A Guide for Best Management Practices* dated January, 2014.

With respect to nearby surface water bodies, the Rideau Canal is located approximately 150 m south and east of the property. As the Rideau Canal is located outside the theoretical radius of influence, and the anticipated water taking volumes as a result of construction dewatering are considered negligible when compared to expected daily flows from the Rideau Canal, water takings are not expected to influence water levels in the canal. As such, adverse effects to surface water features resulting from dewatering activities at the subject site are expected to be negligible.

## 4.4 Adjacent Permits to Take Water

A search of the MECP Permit to Take Water (PTTW) database provided no active PTTW within 500 m of the subject site. A search of the MECP Environmental Activity and Sector Registry (EASR) database provided no active registered water taking permit within a 500 m radius of the subject site.

# 5.0 STATEMENT OF LIMITATIONS

The recommendations provided in this report are in accordance with our present understanding of the project.

A hydrogeological review of this nature is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. Should any conditions at the site be encountered which differ from those at the test locations, we request notification immediately in order to permit reassessment of our recommendations.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Trinity Development Group, or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

**Paterson Group Inc.**

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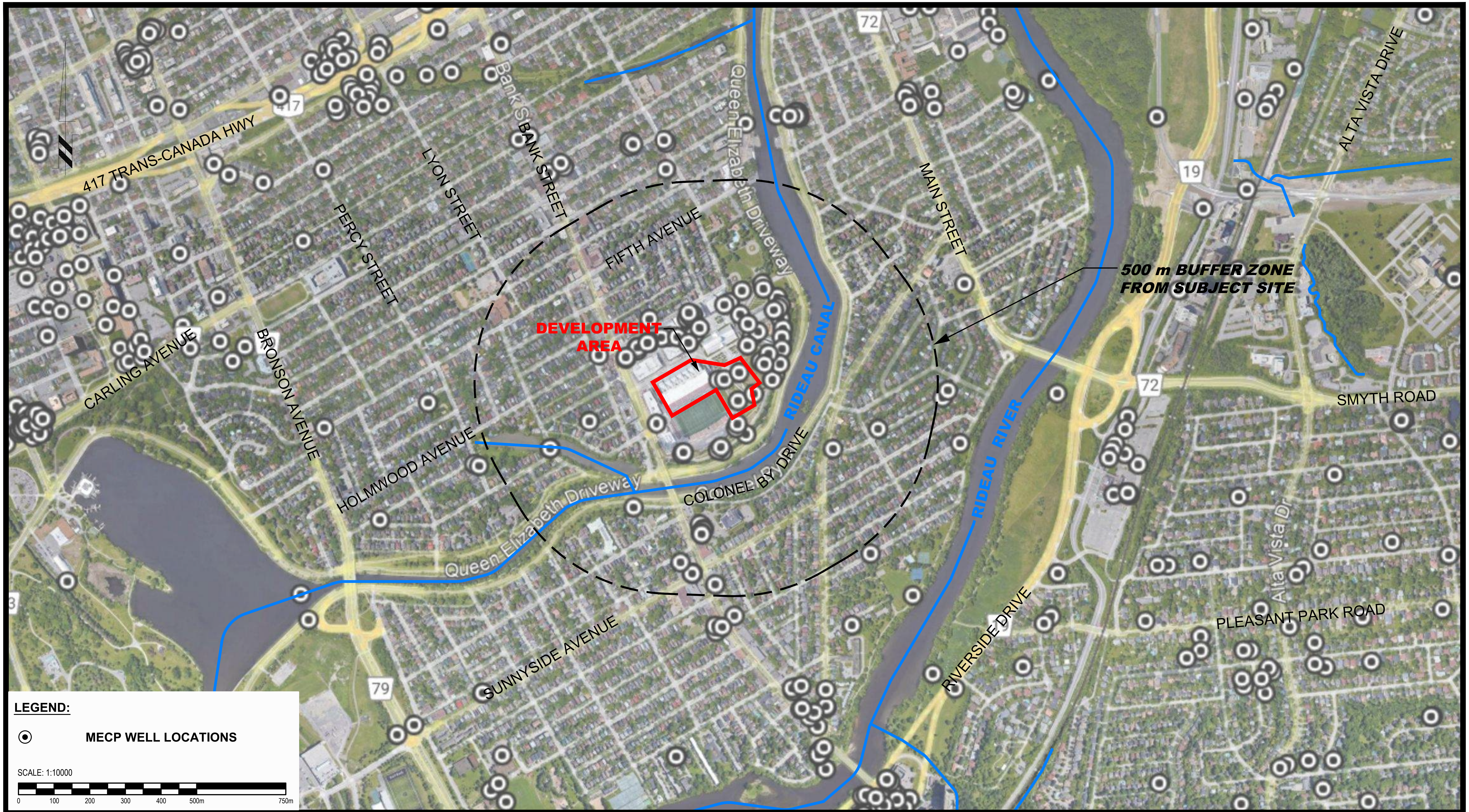
# APPENDIX 1

DRAWING PH4423 - 1 – MECP Water Well Location Plan



**patersongroup**
**consulting engineers**

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| NO. | REVISIONS | DATE | INITIAL |
|---|---|---|---|
| | | | |
| | | | |
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| | | | |
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TRINITY DEVELOPMENT GROUP
HYDROGEOLOGICAL ASSESSMENT
LANDSDOWNE PARK REDEVELOPMENT
PROPOSED MULTI-STOREY BUILDING & RINK STRUCTURE

OTTAWA, ONTARIO

Title:

**MECP WATER WELL LOCATION PLAN**

| | |
|---|---|
| Scale: 1:10000 | Date: 11/2021 |
| Drawn by: JM | Report No.: PH4423-1 |
| Checked by: OB | Dwg. No.: PH4423-1 |
| Approved by: MK | Revision No.: |

p:\autocad drawings\hydrogeology\ph44xx\ph4423 - trinity dev. grp. - landsdowne park redevelopment\ph4423-1 mecp water well location plan.dwg

11x17

# APPENDIX 2

PG5792 – Soil Profile and Test Data

Amec Foster Wheeler – Soil profile and Test Data

PG5792 – 1 – Test Hole Location Plan

Slug Testing Results

Groundwater Monitoring Data

**patersongroup** Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**FILE NO.** PG5792

**REMARKS**

**HOLE NO.** BH 1-21

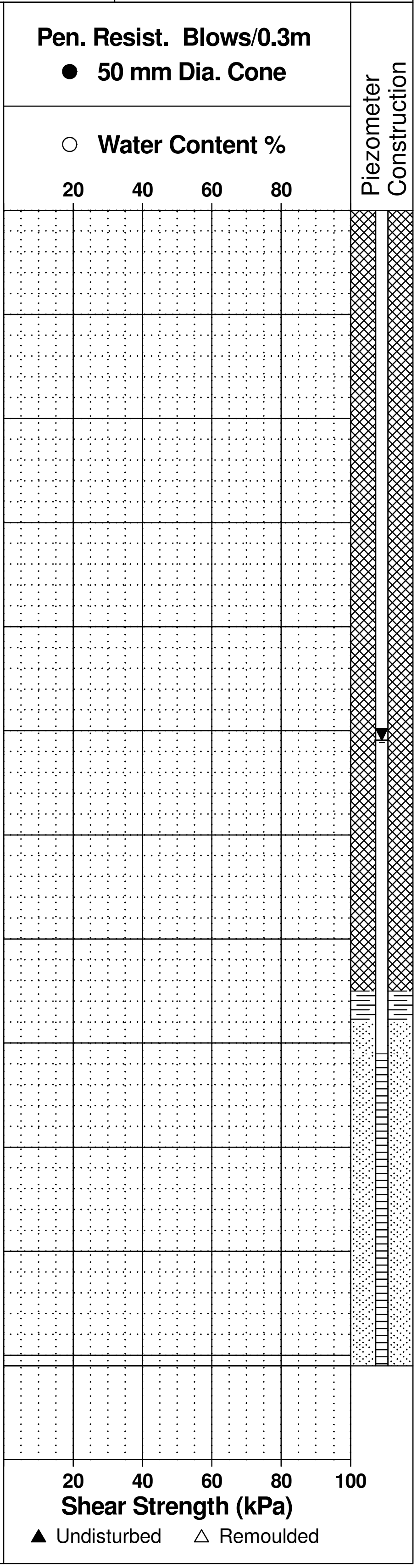
**BORINGS BY** CME-55 Low Clearance Drill

**DATE** October 25, 2021

| SOIL DESCRIPTION | Depth to base (m) |
|---|---|
| GROUND SURFACE | |
| Asphaltic concrete | 0.10 |
| **FILL:** Crushed stone, trace sand | 0.41 |
| **FILL:** Brown silty sand with topsoil | 0.53 |
| **FILL:** Brown silty sand to sandy silt, some clay, trace topsoil | 2.19 |
| Compact, brown **SILTY SAND**<br>- trace clay from 3.0 to 4.3m depth<br>- trace gravel by 4.3m depth | 5.49 |
| **GLACIAL TILL:** Very dense to compact, brown silty sand with gravel, cobbles and boulders | 11.10 |
| End of Borehole<br>(GWL @ 5.09m - Nov. 12, 2021) | |

| SAMPLE TYPE | NUMBER | % RECOVERY | N VALUE or RQD |
|---|---|---|---|
| AU | 1 | | |
| SS | 2 | 50 | 64 |
| SS | 3 | 58 | 28 |
| SS | 4 | 42 | 13 |
| SS | 5 | 25 | 14 |
| SS | 6 | 50 | 15 |
| SS | 7 | 33 | 20 |
| SS | 8 | 50 | 53 |
| SS | 9 | 42 | 32 |
| SS | 10 | 33 | 31 |
| SS | 11 | 25 | 26 |
| SS | 12 | 42 | 21 |
| SS | 13 | 42 | 29 |
| SS | 14 | 33 | 39 |
| SS | 15 | | 65 |

| DEPTH (m) | ELEV. (m) |
|---|---|
| 0 | 64.93 |
| 1 | 63.93 |
| 2 | 62.93 |
| 3 | 61.93 |
| 4 | 60.93 |
| 5 | 59.93 |
| 6 | 58.93 |
| 7 | 57.93 |
| 8 | 56.93 |
| 9 | 55.93 |
| 10 | 54.93 |
| 11 | 53.93 |



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## SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**REMARKS**

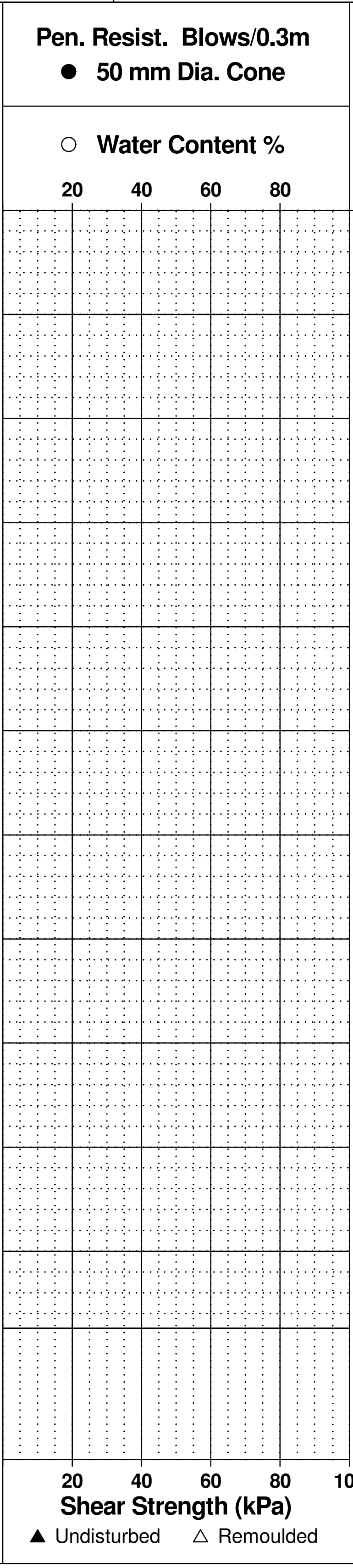
**BORINGS BY** CME-55 Low Clearance Drill

**DATE** October 25, 2021

**FILE NO.** PG5792

**HOLE NO.** BH 2-21

| SOIL DESCRIPTION | | SAMPLE TYPE | SAMPLE NUMBER | % RECOVERY | N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | 0 | 66.04 |
| Asphaltic concrete | 0.10 | | | | | | |
| **FILL:** Brown silty sand with crushed stone and gravel | 0.36 | AU | 1 | | | | |
| **FILL:** Brown silty sand, trace gravel | | SS | 2 | 33 | 32 | 1 | 65.04 |
| | | SS | 3 | 50 | 7 | | |
| | 2.21 | | | | | 2 | 64.04 |
| Compact, brown **SILTY SAND** | | SS | 4 | 50 | 14 | | |
| | | SS | 5 | 33 | 10 | 3 | 63.04 |
| | | SS | 6 | 33 | 11 | 4 | 62.04 |
| - trace gravel by 4.4m depth | | SS | 7 | 42 | 24 | | |
| | | | | | | 5 | 61.04 |
| | 5.74 | SS | 8 | 25 | 59 | | |
| **GLACIAL TILL:** Very dense to dense, brown silty sand with gravel, cobbles and boulders | | SS | 9 | 63 | 50+ | 6 | 60.04 |
| | | SS | 10 | 50 | 77 | 7 | 59.04 |
| | | SS | 11 | 42 | 46 | | |
| | | | | | | 8 | 58.04 |
| | | SS | 12 | 0 | 63 | | |
| | | SS | 13 | 8 | 61 | 9 | 57.04 |
| - some shale fragments from 10.5 to 10.74m depth | | SS | 14 | | 50+ | 10 | 56.04 |
| | 10.74 | | | | | | |
| End of Borehole | | | | | | | |



Piezometer Construction

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# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**FILE NO.** PG5792

**REMARKS**

**HOLE NO.** BH 3-21

**BORINGS BY** CME-55 Low Clearance Drill

**DATE** October 27, 2021

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE | | | | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| GROUND SURFACE | | TYPE | NUMBER | % RECOVERY | N VALUE or RQD | | |
| **TOPSOIL** | | | | | | 0 | 73.10 |
| 0.36 | | AU | 1 | | | | |
| | | | | | | 1 | 72.10 |
| | | SS | 2 | 33 | 16 | | |
| | | SS | 3 | 22 | 50+ | | |
| | | | | | | 2 | 71.10 |
| **FILL:** Brown silty sand, some gravel, occasional cobble and boulders, trace clay and topsoil | | SS | 4 | 17 | 11 | | |
| | | | | | | 3 | 70.10 |
| | | SS | 5 | 44 | 50+ | | |
| - cored through boulder from 3.28 to 3.81m depth | | RC | 1 | 95 | | | |
| | | | | | | 4 | 69.10 |
| | | SS | 6 | 33 | 6 | | |
| | | SS | 7 | 33 | 47 | | |
| | | | | | | 5 | 68.10 |
| - trace ash from 5.3 to 5.9m depth | | SS | 8 | 25 | 50+ | | |
| | | | | | | 6 | 67.10 |
| | | SS | 9 | 25 | 59 | | |
| | | | | | | 7 | 66.10 |
| - trace asphaltic concrete from 7.0 to 7.6m depth | | SS | 10 | 25 | 38 | | |
| | | SS | 11 | 0 | 50+ | | |
| | | | | | | 8 | 65.10 |
| | | SS | 12 | 33 | 34 | | |
| | | | | | | 9 | 64.10 |
| 9.45 | | SS | 13 | 50 | 14 | | |
| | | | | | | 10 | 63.10 |
| Compact, brown **SILTY SAND to SANDY SILT** | | SS | 14 | 58 | 22 | | |
| | | SS | 15 | 50 | 28 | | |
| | | | | | | 11 | 62.10 |
| 11.40 | | | | | | | |
| Compact, brown **SILTY SAND,** some gravel | | SS | 16 | 33 | 17 | | |
| | | | | | | 12 | 61.10 |

**Pen. Resist. Blows/0.3m**
● **50 mm Dia. Cone**

○ **Water Content %**
20 40 60 80

Piezometer Construction

20 40 60 80 100
**Shear Strength (kPa)**
▲ Undisturbed △ Remoulded

# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic
**REMARKS**
**BORINGS BY** CME-55 Low Clearance Drill **DATE** October 27, 2021

**FILE NO.** PG5792
**HOLE NO.** BH 3-21

**SOIL DESCRIPTION**

**GROUND SURFACE**

Compact, brown **SILTY SAND,** some gravel

15.54

**GLACIAL TILL:** Dense to very dense, brown silty sand with gravel, cobbles and boulders

- grey by 20.2m depth

- compact by 21.3m depth

| SAMPLE TYPE | NUMBER | % RECOVERY | N VALUE or RQD |
|---|---|---|---|
| SS | 17 | 33 | 19 |
| SS | 18 | 25 | 18 |
| SS | 19 | 4 | 12 |
| SS | 20 | 4 | 21 |
| SS | 21 | 50 | 36 |
| SS | 22 | 67 | 60 |
| SS | 23 | 33 | 50+ |
| RC | 2 | 70 | |
| SS | 24 | 4 | 50+ |
| RC | 3 | 64 | |
| RC | 4 | 52 | |
| RC | 5 | 30 | |
| RC | 6 | 13 | |

| DEPTH (m) | ELEV. (m) |
|---|---|
| 12 | 61.10 |
| 13 | 60.10 |
| 14 | 59.10 |
| 15 | 58.10 |
| 16 | 57.10 |
| 17 | 56.10 |
| 18 | 55.10 |
| 19 | 54.10 |
| 20 | 53.10 |
| 21 | 52.10 |
| 22 | 51.10 |
| 23 | 50.10 |
| 24 | 49.10 |

**Pen. Resist. Blows/0.3m**
● **50 mm Dia. Cone**

○ **Water Content %**
20 40 60 80

20 40 60 80 100
**Shear Strength (kPa)**
▲ Undisturbed △ Remoulded

Piezometer Construction

# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**REMARKS**

**BORINGS BY** CME-55 Low Clearance Drill

**DATE** October 27, 2021

**FILE NO.** PG5792

**HOLE NO.** BH 3-21

**GROUND SURFACE**

**GLACIAL TILL:** Compact, brown silty sand with gravel, cobbles and boulders

- cobbles and boulders content decreasing with depth

31.57

**BEDROCK:** Good to excellent quality, grey limestone with occasional shale partings

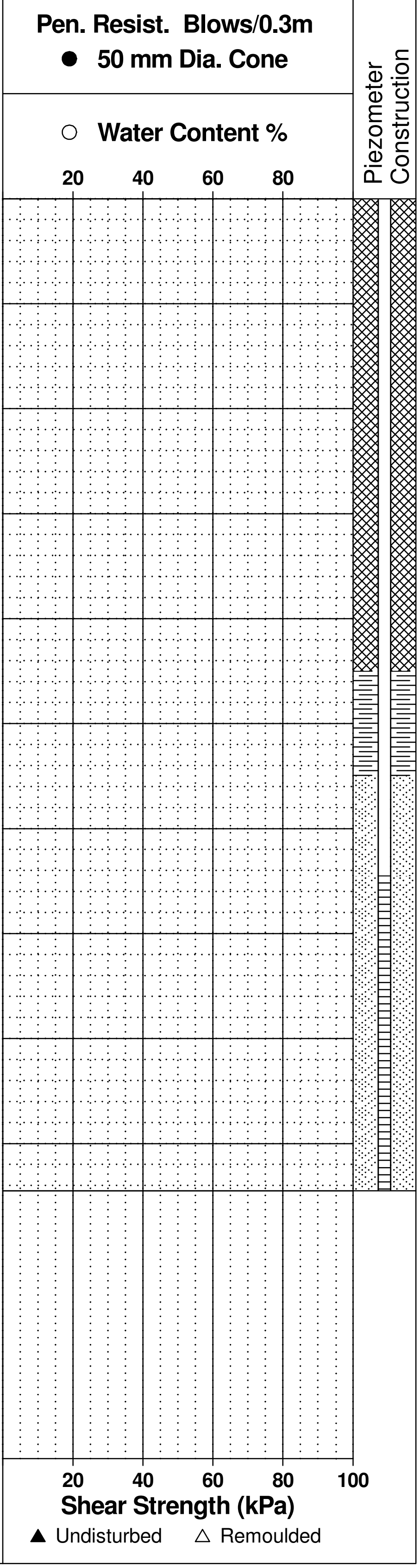
33.45

End of Borehole

(GWL @ 13.46m - Nov. 16, 2021)

| SAMPLE TYPE | NUMBER | % RECOVERY | N VALUE or RQD |
|---|---|---|---|
| RC | 7 | 8 | |
| RC | 8 | 0 | |
| RC | 9 | 0 | |
| RC | 10 | 0 | |
| RC | 11 | 100 | 71 |
| RC | 12 | 100 | 98 |

| DEPTH (m) | ELEV. (m) |
|---|---|
| 24 | 49.10 |
| 25 | 48.10 |
| 26 | 47.10 |
| 27 | 46.10 |
| 28 | 45.10 |
| 29 | 44.10 |
| 30 | 43.10 |
| 31 | 42.10 |
| 32 | 41.10 |
| 33 | 40.10 |



# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**REMARKS**

**BORINGS BY** CME-55 Low Clearance Drill

**DATE** November 5, 2021

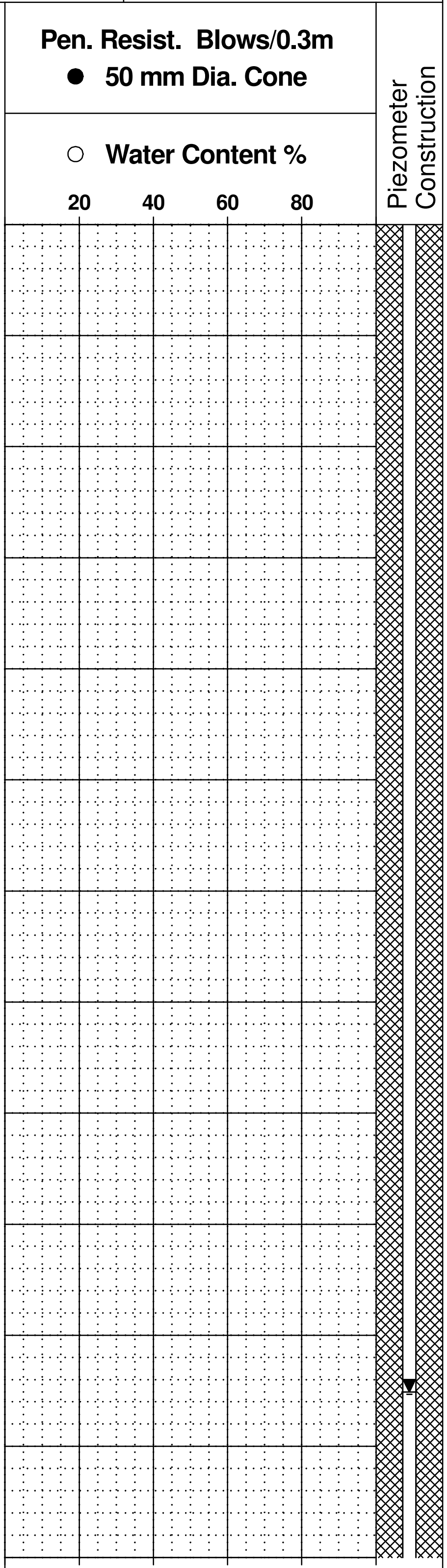
**FILE NO.** PG5792

**HOLE NO.** BH 4-21

| SOIL DESCRIPTION | Strata depth (m) |
|---|---|
| GROUND SURFACE | |
| **TOPSOIL** | 0.30 |
| **FILL:** Brown silty sand iwth gravel and cobbles, occasional boulders, trace clay<br>- some topsoil from 5.3 to 5.9m depth<br>- some asphaltic concrete from 7.6 to 8.2m depth | 8.53 |
| Compact, brown **SILTY SAND to SANDY SILT** | 11.25 |
| **GLACIAL TILL:** Very dense to dense, silty sand with gravel, cobbles and boulders | |

| SAMPLE TYPE | NUMBER | % RECOVERY | N VALUE or RQD |
|---|---|---|---|
| AU | 1 | | |
| SS | 2 | 33 | 5 |
| SS | 3 | 58 | 49 |
| SS | 4 | 50 | 10 |
| SS | 5 | 50 | 8 |
| SS | 6 | 50 | 8 |
| SS | 7 | 42 | 46 |
| SS | 8 | 33 | 28 |
| SS | 9 | 50 | 19 |
| SS | 10 | 18 | 9 |
| SS | 11 | | 50+ |
| SS | 12 | 58 | 13 |
| SS | 13 | | 14 |
| SS | 14 | 42 | 19 |
| SS | 15 | 50 | 18 |
| SS | 16 | 33 | 59 |

| DEPTH (m) | ELEV. (m) |
|---|---|
| 0 | 72.75 |
| 1 | 71.75 |
| 2 | 70.75 |
| 3 | 69.75 |
| 4 | 68.75 |
| 5 | 67.75 |
| 6 | 66.75 |
| 7 | 65.75 |
| 8 | 64.75 |
| 9 | 63.75 |
| 10 | 62.75 |
| 11 | 61.75 |
| 12 | 60.75 |



**Shear Strength (kPa)**

▲ Undisturbed △ Remoulded

**patersongroup** Consulting Engineers
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# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic
**REMARKS**
**BORINGS BY** CME-55 Low Clearance Drill
**DATE** November 5, 2021
**FILE NO.** PG5792
**HOLE NO.** BH 4-21

| SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|
| GROUND SURFACE | | | | | | |
| | | | | | 12 | 60.75 |
| | | | | | 13 | 59.75 |
| | SS | 17 | 60 | 50+ | | |
| | | | | | 14 | 58.75 |
| | RC | 1 | 33 | | | |
| | | | | | 15 | 57.75 |
| | RC | 2 | 41 | | | |
| | | | | | 16 | 56.75 |
| **GLACIAL TILL:** Very dense to dense, silty sand with gravel, cobbles and boulders | SS | 18 | 75 | 50+ | | |
| | | | | | 17 | 55.75 |
| | RC | 3 | 34 | | | |
| | | | | | 18 | 54.75 |
| | RC | 4 | 24 | | | |
| | | | | | 19 | 53.75 |
| | SS | 19 | 0 | 50+ | | |
| | | | | | 20 | 52.75 |
| | RC | 5 | 7 | | | |
| - grey by 20.8m depth | | | | | 21 | 51.75 |
| | SS | 20 | 42 | 15 | | |
| | RC | 6 | 0 | | | |
| | | | | | 22 | 50.75 |
| | SS | 21 | 0 | 50+ | | |
| | | | | | 23 | 49.75 |
| | RC | 7 | 20 | | | |
| | | | | | 24 | 48.75 |

**Pen. Resist. Blows/0.3m**
● **50 mm Dia. Cone**
○ **Water Content %**
20 40 60 80

20 40 60 80 100
**Shear Strength (kPa)**
▲ Undisturbed △ Remoulded

Piezometer Construction

**patersongroup** Consulting Engineers

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# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**REMARKS**

**BORINGS BY** CME-55 Low Clearance Drill

**DATE** November 5, 2021

**FILE NO.** PG5792

**HOLE NO.** BH 4-21

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| GROUND SURFACE | | | | | | | |
| **GLACIAL TILL:** Very dense to dense, silty sand with gravel, cobbles and boulders | | | | | | 24 | 48.75 |
| | | RC | 8 | 5 | | | |
| | | | | | | 25 | 47.75 |
| | | SS | 22 | 0 | 50+ | | |
| | | | | | | 26 | 46.75 |
| | | | | | | 27 | 45.75 |
| | | | | | | 28 | 44.75 |
| | | RC | 9 | 10 | | | |
| | | | | | | 29 | 43.75 |
| | | | | | | 30 | 42.75 |
| 30.68 | | | | | | | |
| **BEDROCK:** Excellent quality, grey limestone with occasional shale partings | | RC | 10 | 100 | 100 | | |
| | | | | | | 31 | 41.75 |
| | | | | | | 32 | 40.75 |
| | | RC | 11 | 100 | 100 | | |
| 32.89 | | | | | | | |
| End of Borehole<br>(GWL @ 10.51m - Nov. 16, 2021) | | | | | | | |

**Pen. Resist. Blows/0.3m**
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100
**Shear Strength (kPa)**
▲ Undisturbed △ Remoulded

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# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**FILE NO.** PG5792

**REMARKS**

**HOLE NO.** BH 5-21

**BORINGS BY** CME 55 Power Auger

**DATE** November 9, 2021

| SOIL DESCRIPTION | Depth (m) |
|---|---|
| GROUND SURFACE | |
| **TOPSOIL** | 0.36 |
| **FILL:** Brown silty sand with gravel, occasional cobbles<br>- trace topsoil and concrete from 2.3 to 2.9m depth<br>- with asphaltic concrete by 6.1m depth | 6.70 |
| Compact to dense, brown **SILTY SAND**<br>- some gravel by 8.5m depth | |

| SAMPLE TYPE | NUMBER | % RECOVERY | N VALUE or RQD |
|---|---|---|---|
| AU | 1 | | |
| SS | 2 | 63 | 50+ |
| SS | 3 | 50 | 19 |
| SS | 4 | 50 | 15 |
| SS | 5 | 0 | 14 |
| SS | 6 | 25 | 13 |
| SS | 7 | 0 | 50+ |
| SS | 8 | 58 | 43 |
| SS | 9 | 67 | 15 |
| SS | 10 | 50 | 14 |
| SS | 11 | 42 | 17 |
| SS | 12 | 50 | 34 |
| SS | 13 | 42 | 47 |
| SS | 14 | 50 | 48 |
| SS | 15 | 88 | 50+ |
| SS | 16 | 50 | 35 |

| DEPTH (m) | ELEV. (m) |
|---|---|
| 0 | 71.14 |
| 1 | 70.14 |
| 2 | 69.14 |
| 3 | 68.14 |
| 4 | 67.14 |
| 5 | 66.14 |
| 6 | 65.14 |
| 7 | 64.14 |
| 8 | 63.14 |
| 9 | 62.14 |
| 10 | 61.14 |
| 11 | 60.14 |
| 12 | 59.14 |

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %
20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**REMARKS**

**BORINGS BY** CME 55 Power Auger

**DATE** November 9, 2021

**FILE NO.** PG5792

**HOLE NO.** BH 5-21

| SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NUMBER | % RECOVERY | N VALUE or RQD |
|---|---|---|---|---|
| **GROUND SURFACE** | | | | |
| Compact to dense, brown **SILTY SAND,** some gravel | SS | 17 | 21 | 9 |
| | SS | 18 | 50 | 23 |
| | SS | 19 | 50 | 28 |
| 14.20 | | | | |
| **GLACIAL TILL:** Very dense to dense, brown silty sand with gravel, cobbles and boulders<br>- grey by 18.2m depth | SS | 20 | 55 | 50+ |
| | RC | 1 | 60 | |
| | SS | 21 | 42 | 71 |
| | RC | 2 | 22 | |
| | SS | 22 | 64 | 38 |
| | RC | 3 | 15 | |
| | SS | 23 | 100 | 50+ |
| | RC | 4 | 15 | |
| | SS | 24 | 0 | 50+ |
| | RC | 5 | 19 | |

| DEPTH (m) | ELEV. (m) |
|---|---|
| 12 | 59.14 |
| 13 | 58.14 |
| 14 | 57.14 |
| 15 | 56.14 |
| 16 | 55.14 |
| 17 | 54.14 |
| 18 | 53.14 |
| 19 | 52.14 |
| 20 | 51.14 |
| 21 | 50.14 |
| 22 | 49.14 |
| 23 | 48.14 |
| 24 | 47.14 |

**Pen. Resist. Blows/0.3m**
● **50 mm Dia. Cone**

○ **Water Content %**
20 40 60 80

Monitoring Well Construction

20 40 60 80 100
**Shear Strength (kPa)**
▲ Undisturbed △ Remoulded

**patersongroup** Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**REMARKS**

**BORINGS BY** CME 55 Power Auger

**DATE** November 9, 2021

**FILE NO.** PG5792

**HOLE NO.** BH 5-21

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | % RECOVERY | N VALUE or RQD |
|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | |
| **GLACIAL TILL:** Very dense to dense, brown silty sand with gravel, cobbles and boulders | | SS | 25 | 80 | 50+ |
| | | RC | 6 | 0 | |
| | | SS | 26 | 0 | 50+ |
| | | RC | 7 | 0 | |
| | | SS | 27 | 86 | 50+ |
| | | RC | 8 | 37 | |
| | | SS | 28 | 0 | 10 |
| 29.95 | | RC | 9 | 100 | 100 |
| **BEDROCK:** Excellent quality, grey limestone with occasional shale partings | | RC | 10 | 100 | 93 |
| 31.55 | | | | | |
| End of Borehole<br>(GWL @ 11.30m - Nov. 16, 2021) | | | | | |

| DEPTH (m) | ELEV. (m) |
|---|---|
| 24 | 47.14 |
| 25 | 46.14 |
| 26 | 45.14 |
| 27 | 44.14 |
| 28 | 43.14 |
| 29 | 42.14 |
| 30 | 41.14 |
| 31 | 40.14 |

**Pen. Resist. Blows/0.3m**
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

20 40 60 80 100
**Shear Strength (kPa)**
▲ Undisturbed △ Remoulded

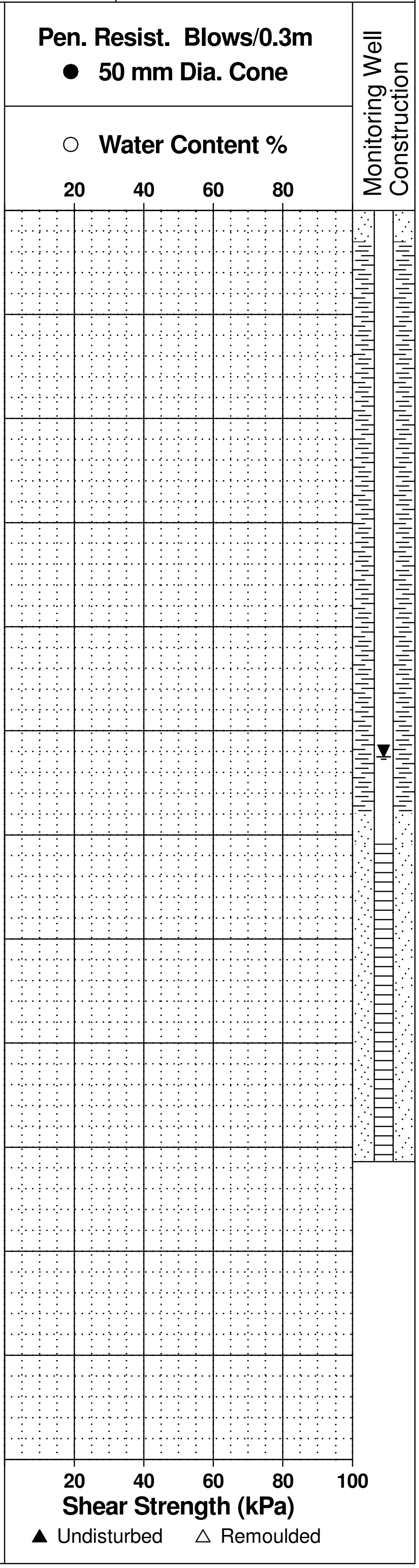
Monitoring Well Construction

# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic
**REMARKS**
**BORINGS BY** CME-55 Low Clearance Drill
**DATE** November 11, 2021
**FILE NO.** PG5792
**HOLE NO.** BH 6-21

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | % RECOVERY | N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| GROUND SURFACE | | | | | | 0 | 65.14 |
| Asphaltic concrete 0.08 | | | | | | | |
| **FILL:** Brown silty sand with crushed stone and gravel 0.91 | | SS | 1 | 67 | 47 | | |
| | | SS | 2 | 42 | 26 | 1 | 64.14 |
| | | SS | 3 | 50 | 17 | | |
| | | | | | | 2 | 63.14 |
| | | SS | 4 | 58 | 13 | | |
| Compact to dense, brown **SILTY SAND,** trace to some gravel | | | | | | 3 | 62.14 |
| | | SS | 5 | 50 | 43 | | |
| | | SS | 6 | 50 | 13 | 4 | 61.14 |
| | | SS | 7 | 50 | 50+ | | |
| 5.41 | | | | | | 5 | 60.14 |
| | | SS | 8 | 50 | 50+ | | |
| | | SS | 9 | 42 | 34 | 6 | 59.14 |
| | | SS | 10 | 42 | 35 | 7 | 58.14 |
| **GLACIAL TILL:** Dense brown silty sand with gravel, cobbles and boulders | | SS | 11 | 50 | 34 | | |
| | | | | | | 8 | 57.14 |
| - silty sand to sandy silt layer from 8.9 to 9.3m depth | | SS | 12 | 43 | 78 | | |
| | | SS | 13 | 50 | 43 | 9 | 56.14 |
| | | SS | 14 | 42 | 38 | 10 | 55.14 |
| | | SS | 15 | 43 | 50+ | | |
| | | RC | 1 | 61 | | 11 | 54.14 |
| - grey by 12.2m depth | | SS | 16 | 40 | 50+ | | |
| | | RC | 2 | 75 | | | |
| | | | | | | 12 | 53.14 |



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# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**FILE NO.** PG5792

**REMARKS**

**HOLE NO.** BH 6-21

**BORINGS BY** CME-55 Low Clearance Drill **DATE** November 11, 2021

| SOIL DESCRIPTION | SAMPLE TYPE | NUMBER | % RECOVERY | N VALUE or RQD |
|---|---|---|---|---|
| GROUND SURFACE | | | | |
| **GLACIAL TILL:** Dense, grey silty sand with gravel, cobbles and boulders<br>- some clay by 16.8m depth | SS | 17 | | 50+ |
| | RC | 3 | 34 | |
| | SS | 18 | 52 | 41 |
| | RC | 4 | 19 | |
| | SS | 19 | 86 | 50+ |
| | RC | 5 | 0 | |
| | SS | 20 | 50 | 28 |
| | RC | 6 | 11 | |
| | SS | 21 | 0 | 50+ |
| | RC | 7 | 14 | |
| | SS | 22 | 0 | 50+ |
| | RC | 8 | 35 | |
| 22.88 | | | | |
| **BEDROCK:** Good to excellent quality, grey limestone with occasional shale partings | RC | 9 | 100 | 85 |

| DEPTH (m) | ELEV. (m) |
|---|---|
| 12 | 53.14 |
| 13 | 52.14 |
| 14 | 51.14 |
| 15 | 50.14 |
| 16 | 49.14 |
| 17 | 48.14 |
| 18 | 47.14 |
| 19 | 46.14 |
| 20 | 45.14 |
| 21 | 44.14 |
| 22 | 43.14 |
| 23 | 42.14 |
| 24 | 41.14 |

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

20 40 60 80 100
**Shear Strength (kPa)**
▲ Undisturbed △ Remoulded

Monitoring Well Construction

# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**FILE NO.** PG5792

**REMARKS**

**HOLE NO.** BH 6-21

**BORINGS BY** CME-55 Low Clearance Drill

**DATE** November 11, 2021

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) | Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone<br>○ Water Content %<br>20 40 60 80 | Monitoring Well Construction |
|---|---|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | 24 | 41.14 | | |
| **BEDROCK:** Good to excellent quality, grey limestone with occasional shale partings | | RC | 10 | 100 | 98 | 25 | 40.14 | | |
| 25.73 | | | | | | | | | |
| End of Borehole<br>(GWL @ 5.25m - Nov. 16, 2021) | | | | | | | | | |
| | | | | | | | | 20 40 60 80 100<br>**Shear Strength (kPa)**<br>▲ Undisturbed △ Remoulded | |

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# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**FILE NO.** PG5792

**REMARKS**

**HOLE NO.** BH 7-21

**BORINGS BY** CME-55 Low Clearance Drill **DATE** November 15, 2021

| SOIL DESCRIPTION | Depth to base (m) |
|---|---|
| GROUND SURFACE | |
| **TOPSOIL** | 0.25 |
| **FILL:** Brown silty sand, some gravel | 1.93 |
| Compact to dense, brown **SILTY SAND,** trace gravel | 4.42 |
| **GLACIAL TILL:** Very dense, brown silty sand with gravel, cobbles and boulders<br>- some shale fragments from 11.0 to 11.5m depth | |

| SAMPLE TYPE | NUMBER | % RECOVERY | N VALUE or RQD |
|---|---|---|---|
| SS | 1 | 50 | 27 |
| SS | 2 | 0 | 48 |
| SS | 3 | 50 | 50+ |
| SS | 4 | 50 | 50+ |
| RC | 1 | 45 | |
| SS | 5 | 53 | 50+ |
| SS | 6 | 0 | 50+ |
| RC | 2 | 56 | |
| RC | 3 | 33 | |
| SS | 7 | 42 | 53 |

| DEPTH (m) | ELEV. (m) |
|---|---|
| 0 | 66.62 |
| 1 | 65.62 |
| 2 | 64.62 |
| 3 | 63.62 |
| 4 | 62.62 |
| 5 | 61.62 |
| 6 | 60.62 |
| 7 | 59.62 |
| 8 | 58.62 |
| 9 | 57.62 |
| 10 | 56.62 |
| 11 | 55.62 |
| 12 | 54.62 |

**Pen. Resist. Blows/0.3m**
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100
**Shear Strength (kPa)**
▲ Undisturbed △ Remoulded

# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**FILE NO.** PG5792

**REMARKS**

**HOLE NO.** BH 7-21

**BORINGS BY** CME-55 Low Clearance Drill **DATE** November 15, 2021

**SOIL DESCRIPTION**

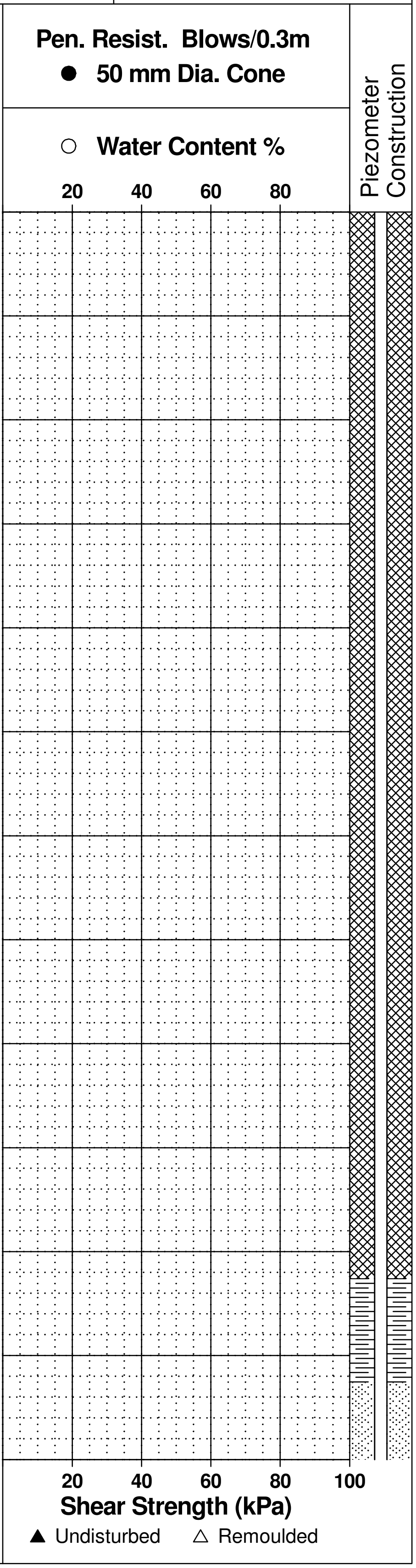
**GROUND SURFACE**

**GLACIAL TILL:** Very dense, brown silty sand with gravel, cobbles and boulders

- grey by 13.7m depth

23.80

| SAMPLE TYPE | NUMBER | % RECOVERY | N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|
| RC | 4 | 48 | | 12 | 54.62 |
| SS | 8 | 33 | 48 | | |
| | | | | 13 | 53.62 |
| RC | 5 | 47 | | | |
| SS | 9 | 33 | 50+ | 14 | 52.62 |
| RC | 6 | 0 | | | |
| | | | | 15 | 51.62 |
| SS | 10 | 0 | 50+ | | |
| | | | | 16 | 50.62 |
| RC | 7 | 30 | | | |
| SS | 11 | 73 | 50+ | 17 | 49.62 |
| | | | | 18 | 48.62 |
| RC | 8 | 12 | | | |
| | | | | 19 | 47.62 |
| SS | 12 | 77 | 50+ | 20 | 46.62 |
| | | | | 21 | 45.62 |
| RC | 9 | 18 | | | |
| | | | | 22 | 44.62 |
| SS | 13 | 0 | 50+ | 23 | 43.62 |
| RC | 10 | 100 | 100 | | |
| | | | | 24 | 42.62 |



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# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**REMARKS**

**BORINGS BY** CME-55 Low Clearance Drill

**DATE** November 15, 2021

**FILE NO.** PG5792

**HOLE NO.** BH 7-21

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| GROUND SURFACE | | | | | | | |
| | | | | | | 24 | 42.62 |
| | | RC | 11 | 100 | 100 | | |
| | | | | | | 25 | 41.62 |
| **BEDROCK:** Excellent quality, grey limestone with occasional shale partings | | | | | | | |
| | | | | | | 26 | 40.62 |
| | | RC | 12 | 100 | 94 | | |
| | | | | | | 27 | 39.62 |
| 27.26 | | | | | | | |
| End of Borehole<br>(BH dry - November 16, 2021) | | | | | | | |

**Pen. Resist. Blows/0.3m**
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
**Shear Strength (kPa)**
▲ Undisturbed △ Remoulded

# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**REMARKS**

**BORINGS BY** CME-55 Low Clearance Drill

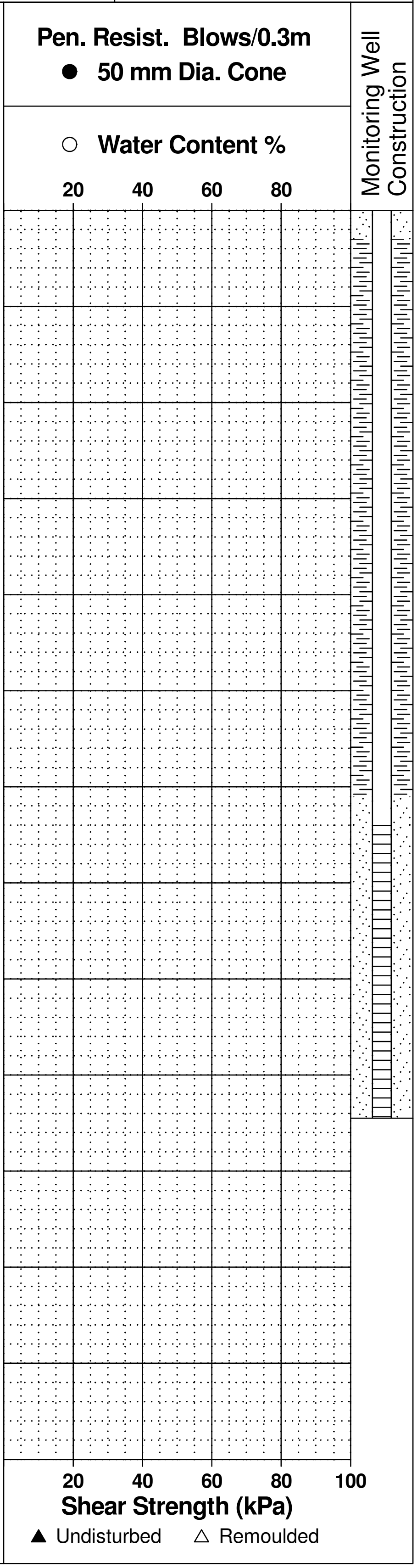
**DATE** November 17, 2021

**FILE NO.** PG5792

**HOLE NO.** BH 8-21

| SOIL DESCRIPTION | Depth to base (m) | SAMPLE TYPE | NUMBER | % RECOVERY | N VALUE or RQD |
|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | |
| Concrete patio stone | 0.15 | | | | |
| **FILL:** Crushed stone | 0.46 | AU | 1 | | |
| **FILL:** Brown silty sand with gravel, occasional cobbles | 2.03 | SS | 2 | 42 | 20 |
| | | SS | 3 | 0 | 15 |
| Compact to dense, brown silty sand, some gravel | 5.13 | SS | 4 | 0 | 8 |
| | | SS | 5 | 17 | 37 |
| | | SS | 6 | 42 | 41 |
| | | SS | 7 | 50 | 57 |
| Dense, brown **SILTY SAND** | | SS | 8 | 42 | 36 |
| | | SS | 9 | 50 | 40 |
| - some gravel, occasional cobbles and boudlers by 7.4m depth | | SS | 10 | 50 | 36 |
| | | SS | 11 | 58 | 47 |
| | 8.89 | SS | 12 | 50 | 41 |
| Dense, brown **SILTY SAND to SANDY SILT,** some gravel | | SS | 13 | 67 | 36 |
| | | SS | 14 | | 45 |
| | 11.18 | SS | 15 | 67 | 69 |
| **GLACIAL TILL:** Very dense, brown silty sand with gravel, cobbles and boulders | | SS | 16 | 67 | 43 |
| | | SS | 17 | 50 | 14 |

| DEPTH (m) | ELEV. (m) |
|---|---|
| 0 | 65.45 |
| 1 | 64.45 |
| 2 | 63.45 |
| 3 | 62.45 |
| 4 | 61.45 |
| 5 | 60.45 |
| 6 | 59.45 |
| 7 | 58.45 |
| 8 | 57.45 |
| 9 | 56.45 |
| 10 | 55.45 |
| 11 | 54.45 |
| 12 | 53.45 |
| 13 | 52.45 |



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# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**REMARKS**

**BORINGS BY** CME-55 Low Clearance Drill

**DATE** November 17, 2021

**FILE NO.** PG5792

**HOLE NO.** BH 8-21

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) | Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone<br>○ Water Content %<br>20 40 60 80 | Monitoring Well Construction |
|---|---|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | | | | |
| | | RC | 1 | 55 | | 13 | 52.45 | | |
| | | | | | | 14 | 51.45 | | |
| | | RC | 2 | 30 | | | | | |
| | | | | | | 15 | 50.45 | | |
| | | SS | 18 | 58 | 28 | | | | |
| | | | | | | 16 | 49.45 | | |
| **GLACIAL TILL:** Very dense, brown silty sand with gravel, cobbles and boulders | | RC | 3 | 0 | | | | | |
| | | SS | 19 | 0 | 50+ | | | | |
| | | | | | | 17 | 48.45 | | |
| | | RC | 4 | 36 | | | | | |
| | | | | | | 18 | 47.45 | | |
| | | SS | 20 | 25 | 50+ | | | | |
| | | RC | 5 | 50 | | | | | |
| | | | | | | 19 | 46.45 | | |
| | | SS | 21 | 0 | | | | | |
| | | | | | | 20 | 45.45 | | |
| | | RC | 6 | 35 | | | | | |
| | | | | | | 21 | 44.45 | | |
| 21.28 | | SS | 22 | | 50+ | | | | |
| | | RC | 7 | 100 | 90 | | | | |
| | | | | | | 22 | 43.45 | | |
| **BEDROCK:** Excellent quality, grey limestone with occasional shale partings | | | | | | | | | |
| | | | | | | 23 | 42.45 | | |
| | | RC | 8 | 100 | 95 | | | | |
| 24.10 | | | | | | 24 | 41.45 | | |
| End of Borehole | | | | | | | | | |

20 40 60 80 100

**Shear Strength (kPa)**

▲ Undisturbed △ Remoulded

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# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**REMARKS**

**BORINGS BY** CME-55 Low Clearance Drill

**DATE** November 18, 2021

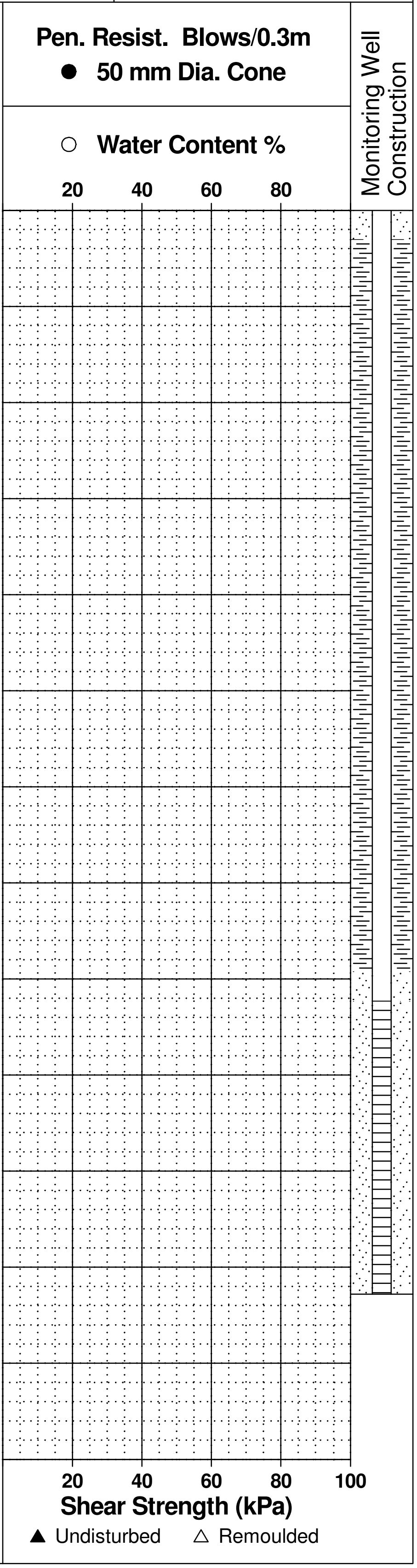
**FILE NO.** PG5792

**HOLE NO.** BH 9-21

| SOIL DESCRIPTION | Depth (m) |
|---|---|
| GROUND SURFACE | |
| Concrete | 0.15 |
| **FILL:** Brown silty sand with crushed stone | 0.46 |
| **FILL:** Brown silty sand with gravel, occasional cobbles | 4.34 |
| Concrete (inferred footing) | 4.75 |
| **GLACIAL TILL:** Very dense, brown silty sand with gravel, cobbles and boulders | |

| SAMPLE TYPE | NUMBER | % RECOVERY | N VALUE or RQD |
|---|---|---|---|
| AU | 1 | | |
| SS | 2 | 17 | 18 |
| SS | 3 | 8 | 17 |
| RC | 1 | 63 | |
| SS | 4 | 42 | 6 |
| SS | 5 | | 50+ |
| RC | 2 | 16 | |
| SS | 6 | 45 | 50+ |
| RC | 3 | 46 | |
| SS | 7 | 0 | 50+ |
| SS | 8 | 50 | 58 |
| RC | 4 | 42 | |
| SS | 9 | 25 | 43 |
| SS | 10 | 0 | 50+ |
| SS | 11 | 60 | 50+ |
| RC | 5 | 13 | |

| DEPTH (m) | ELEV. (m) |
|---|---|
| 0 | 67.07 |
| 1 | 66.07 |
| 2 | 65.07 |
| 3 | 64.07 |
| 4 | 63.07 |
| 5 | 62.07 |
| 6 | 61.07 |
| 7 | 60.07 |
| 8 | 59.07 |
| 9 | 58.07 |
| 10 | 57.07 |
| 11 | 56.07 |
| 12 | 55.07 |
| 13 | 54.07 |



# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Lansdowne Park Redevelopment**
**Prop. Multi-Storey Buildings & Rink Structure, Ontario**

**DATUM** Geodetic

**REMARKS**

**BORINGS BY** CME-55 Low Clearance Drill

**DATE** November 18, 2021

**FILE NO.** PG5792

**HOLE NO.** BH 9-21

| SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|
| GROUND SURFACE | | | | | 13 | 54.07 |
| **GLACIAL TILL:** Very dense, brown silty sand with gravel, cobbles and boulders | SS | 12 | 22 | 50+ | | |
| | RC | 6 | 70 | | 14 | 53.07 |
| | | | | | 15 | 52.07 |
| | RC | 7 | 37 | | 16 | 51.07 |
| | | | | | 17 | 50.07 |
| | RC | 8 | 25 | | | |
| | SS | 13 | 0 | 50+ | 18 | 49.07 |
| | RC | 9 | 48 | | 19 | 48.07 |
| | | | | | 20 | 47.07 |
| | RC | 10 | 11 | | 21 | 46.07 |
| 21.36 | | | | | | |
| **BEDROCK:** Excellent quality, grey limestone with occasional shale partings | RC | 11 | 100 | 90 | 22 | 45.07 |
| | | | | | 23 | 44.07 |
| | RC | 12 | 100 | 100 | | |
| 24.08 | | | | | 24 | 43.07 |
| End of Borehole | | | | | | |

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Monitoring Well Construction

# SYMBOLS AND TERMS

## SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

| | | |
|---|---|---|
| Desiccated | - | having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc. |
| Fissured | - | having cracks, and hence a blocky structure. |
| Varved | - | composed of regular alternating layers of silt and clay. |
| Stratified | - | composed of alternating layers of different soil types, e.g. silt and sand or silt and clay. |
| Well-Graded | - | Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution). |
| Uniformly-Graded | - | Predominantly of one grain size (see Grain Size Distribution). |

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) ‘N’ value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

| Relative Density | ‘N’ Value | Relative Density % |
|---|---|---|
| Very Loose | <4 | <15 |
| Loose | 4-10 | 15-35 |
| Compact | 10-30 | 35-65 |
| Dense | 30-50 | 65-85 |
| Very Dense | >50 | >85 |

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

| Consistency | Undrained Shear Strength (kPa) | ‘N’ Value |
|---|---|---|
| Very Soft | <12 | <2 |
| Soft | 12-25 | 2-4 |
| Firm | 25-50 | 4-8 |
| Stiff | 50-100 | 8-15 |
| Very Stiff | 100-200 | 15-30 |
| Hard | >200 | >30 |

# SYMBOLS AND TERMS (continued)

## SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

## ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

| **RQD %** | **ROCK QUALITY** |
|---|---|
| 90-100 | Excellent, intact, very sound |
| 75-90 | Good, massive, moderately jointed or sound |
| 50-75 | Fair, blocky and seamy, fractured |
| 25-50 | Poor, shattered and very seamy or blocky, severely fractured |
| 0-25 | Very poor, crushed, very severely fractured |

## SAMPLE TYPES

| | | |
|---|---|---|
| SS | - | Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT)) |
| TW | - | Thin wall tube or Shelby tube |
| PS | - | Piston sample |
| AU | - | Auger sample or bulk sample |
| WS | - | Wash sample |
| RC | - | Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits. |

# SYMBOLS AND TERMS (continued)

## GRAIN SIZE DISTRIBUTION

MC% - Natural moisture content or water content of sample, %
LL - Liquid Limit, % (water content above which soil behaves as a liquid)
PL - Plastic limit, % (water content above which soil behaves plastically)
PI - Plasticity index, % (difference between LL and PL)

Dxx - Grain size which xx% of the soil, by weight, is of finer grain sizes
These grain size descriptions are not used below 0.075 mm grain size
D10 - Grain size at which 10% of the soil is finer (effective grain size)
D60 - Grain size at which 60% of the soil is finer

Cc - Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu - Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

## CONSOLIDATION TEST

$p'_o$ - Present effective overburden pressure at sample depth
$p'_c$ - Preconsolidation pressure of (maximum past pressure on) sample
Ccr - Recompression index (in effect at pressures below $p'_c$)
Cc - Compression index (in effect at pressures above $p'_c$)

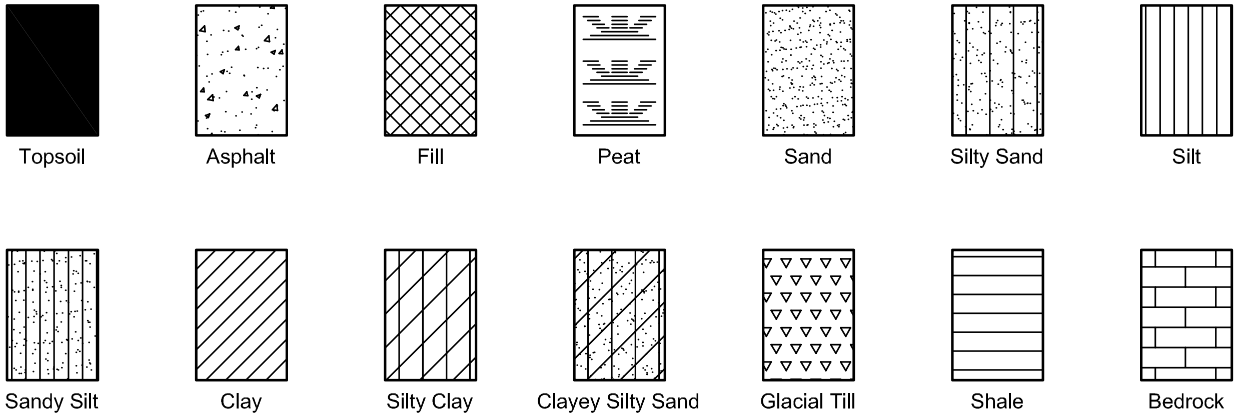
OC Ratio Overconsolidaton ratio = $p'_c / p'_o$
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

## PERMEABILITY TEST

k - Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

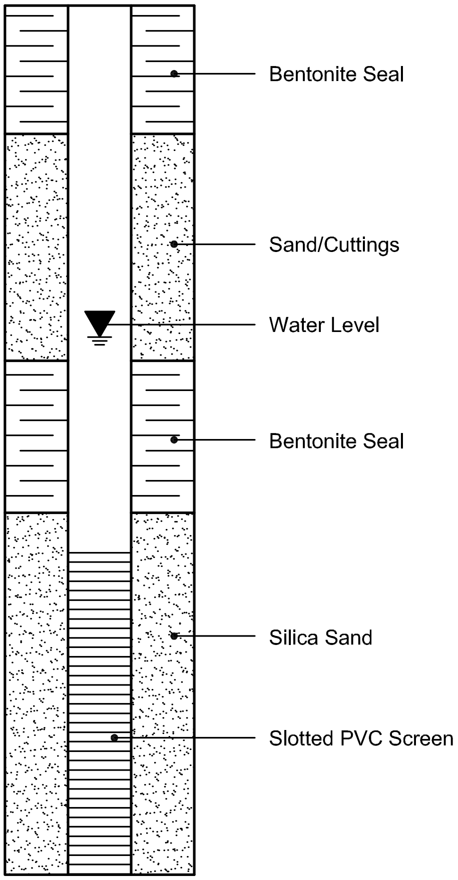
# SYMBOLS AND TERMS (continued)

## STRATA PLOT

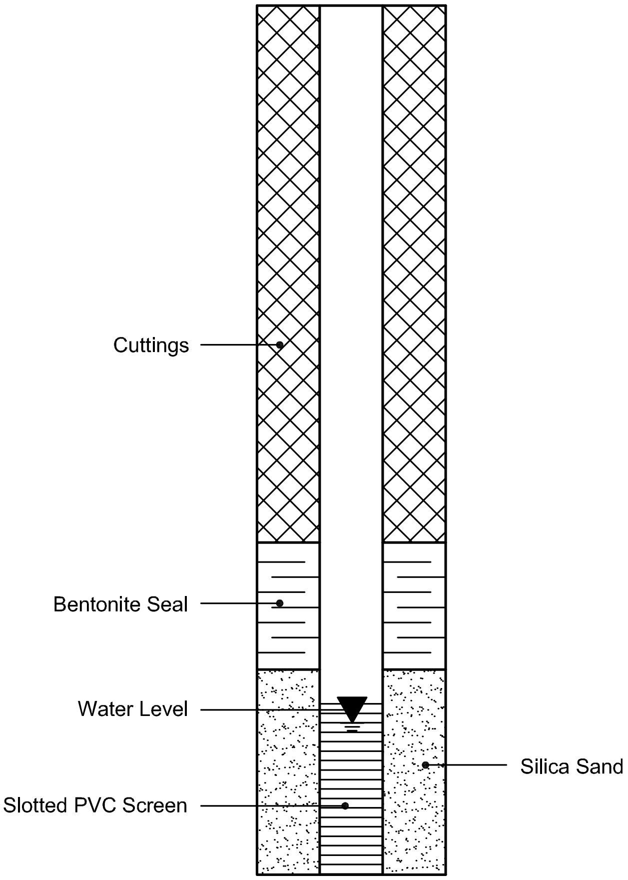


## MONITORING WELL AND PIEZOMETER CONSTRUCTION

### MONITORING WELL CONSTRUCTION



### PIEZOMETER CONSTRUCTION

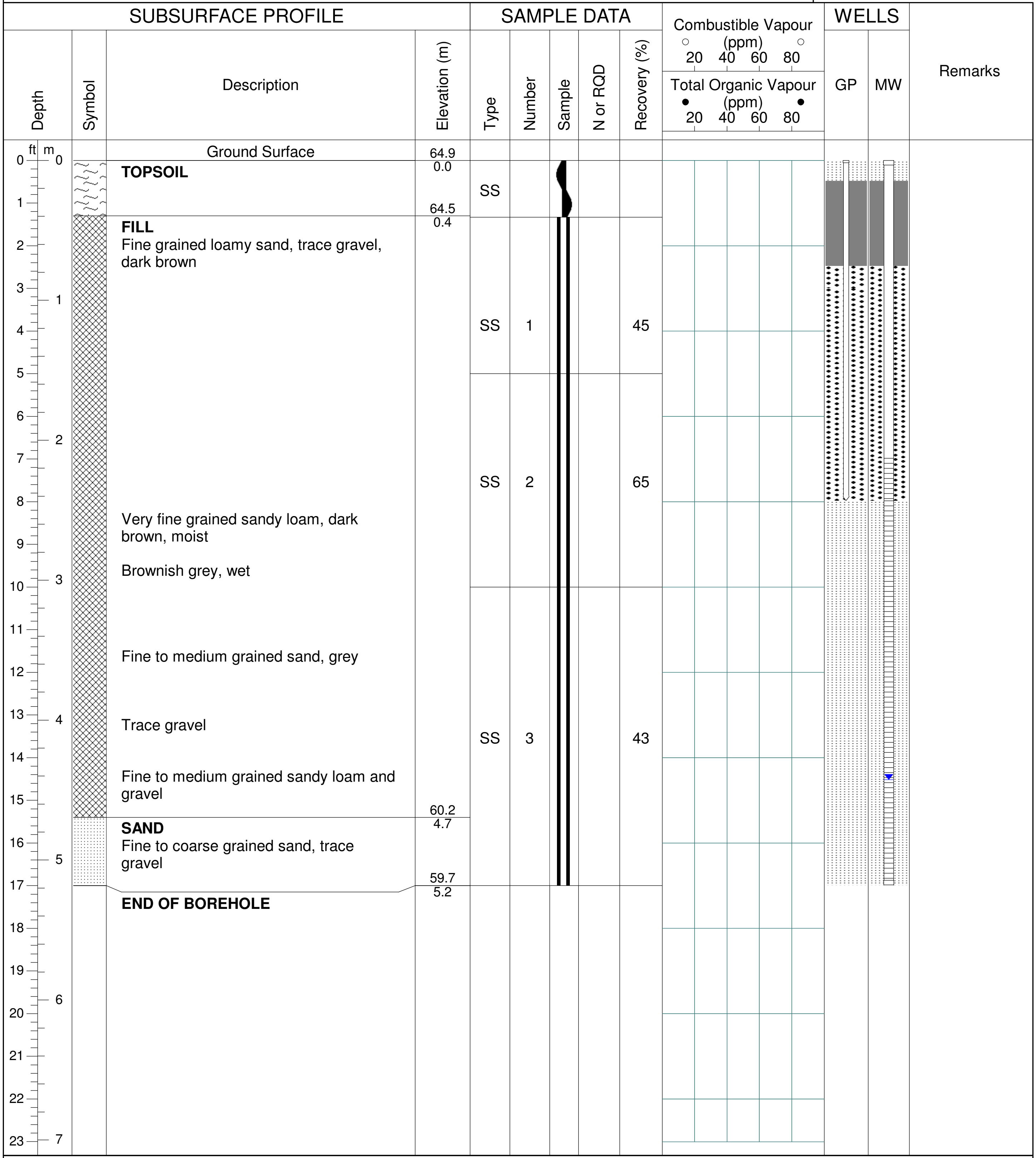


# Stratigraphic and Instrumentation Log: MW15-6 / GP15-10

**Project No:** TZ10100106
**Location:** 945 Bank Street, Ottawa
**Logged By:** JFT
**Drill Date:** October 21, 2015
**Hole Size:** 127 mm

**Project Name:** CPU Ground Water Monitoring Program
**Client:** City of Ottawa
**Entered By:** KYLT
**Drill Method:** Direct Push
**Drilled By:** Strata Drilling Group

Amec Foster Wheeler
300-210 Colonnade Road
Ottawa, Ontario  K2E 7L5



| Description | Elevation (m) |
|---|---|
| Ground Surface | 64.9 |
| **TOPSOIL** | 0.0 |
| | 64.5 |
| **FILL**<br>Fine grained loamy sand, trace gravel, dark brown | 0.4 |
| Very fine grained sandy loam, dark brown, moist | |
| Brownish grey, wet | |
| Fine to medium grained sand, grey | |
| Trace gravel | |
| Fine to medium grained sandy loam and gravel | 60.2 |
| **SAND**<br>Fine to coarse grained sand, trace gravel | 4.7 |
| | 59.7 |
| **END OF BOREHOLE** | 5.2 |

| Type | Number | Sample | N or RQD | Recovery (%) |
|---|---|---|---|---|
| SS | | | | |
| SS | 1 | | | 45 |
| SS | 2 | | | 65 |
| SS | 3 | | | 43 |

Elevation: 64.924 masl
Easting: 368843.807
Northing: 5029183.520

Casing Elevation: 64.615 masl
Well Casing Size: MW 50.8 mm/GP 12.7 mm
Screen Slot Size: MW 0.25 mm/GP 6.4 mm

Filter Pack Size: MW 6.7 mm/GP 9.5 mm
Well Material: Schedule 40 PVC
Vapour Unit: N/A

Datum: Geodetic
Checked by: KDH
Sheet: 1 of 1

# Stratigraphic and Instrumentation Log: MW15-7

amec foster wheeler

Amec Foster Wheeler
300-210 Colonnade Road
Ottawa, Ontario  K2E 7L5

**Project No:** TZ10100106
**Location:** 945 Bank Street, Ottawa
**Logged By:** JFT
**Drill Date:** October 21, 2015
**Hole Size:** 127 mm

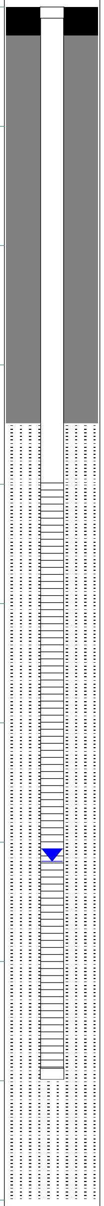
**Project Name:** CPU Ground Water Monitoring Program
**Client:** City of Ottawa
**Entered By:** KYLT
**Drill Method:** Direct Push
**Drilled By:** Strata Drilling Group

| SUBSURFACE PROFILE | | | SAMPLE DATA | | | | |
|---|---|---|---|---|---|---|---|
| Depth (ft / m) | Description | Elevation (m) | Type | Number | Sample | N or RQD | Recovery (%) |
| 0 / 0 | Ground Surface | 64.51 | | | | | |
| 0 / 0 | **TOPSOIL** | 0.00 | | | | | |
| 1.3 / 0.40 | **FILL**<br>Gravel and sand, grey | 64.12<br>0.40 | | | | | |
| | Fine loamy sand, greyish brown | | SS | 1 | | | 68 |
| | Wet | | SS | 2 | | | 70 |
| | Fine to medium grained sand, brown | | | | | | |
| | Fine grained sandy loam | | SS | 3 | | | 65 |
| 12.2 / 3.71 | **SAND**<br>Fine to coarse grained sand, trace gravel, brown, wet | 60.80<br>3.71 | | | | | |
| | Trace silt | | | | | | |
| | Slightly grey | | SS | 4 | | | 55 |
| 20 / 6.10 | **END OF BOREHOLE** | 58.42<br>6.10 | | | | | |

Combustible Vapour (ppm) ○ 250 750 1250

Total Organic Vapour (ppm) ● 20 60 100 140 180

Monitoring Well Details



Remarks

Elevation: 64.513 masl
Easting: 368911.901
Northing: 5029169.410

Casing Elevation: 64.431 masl
Well Casing Size: 50.8 mm
Screen Slot Size: 0.25 mm

Filter Pack Size: 6.7 mm
Well Material: Schedule 40 PVC
Vapour Unit: N/A

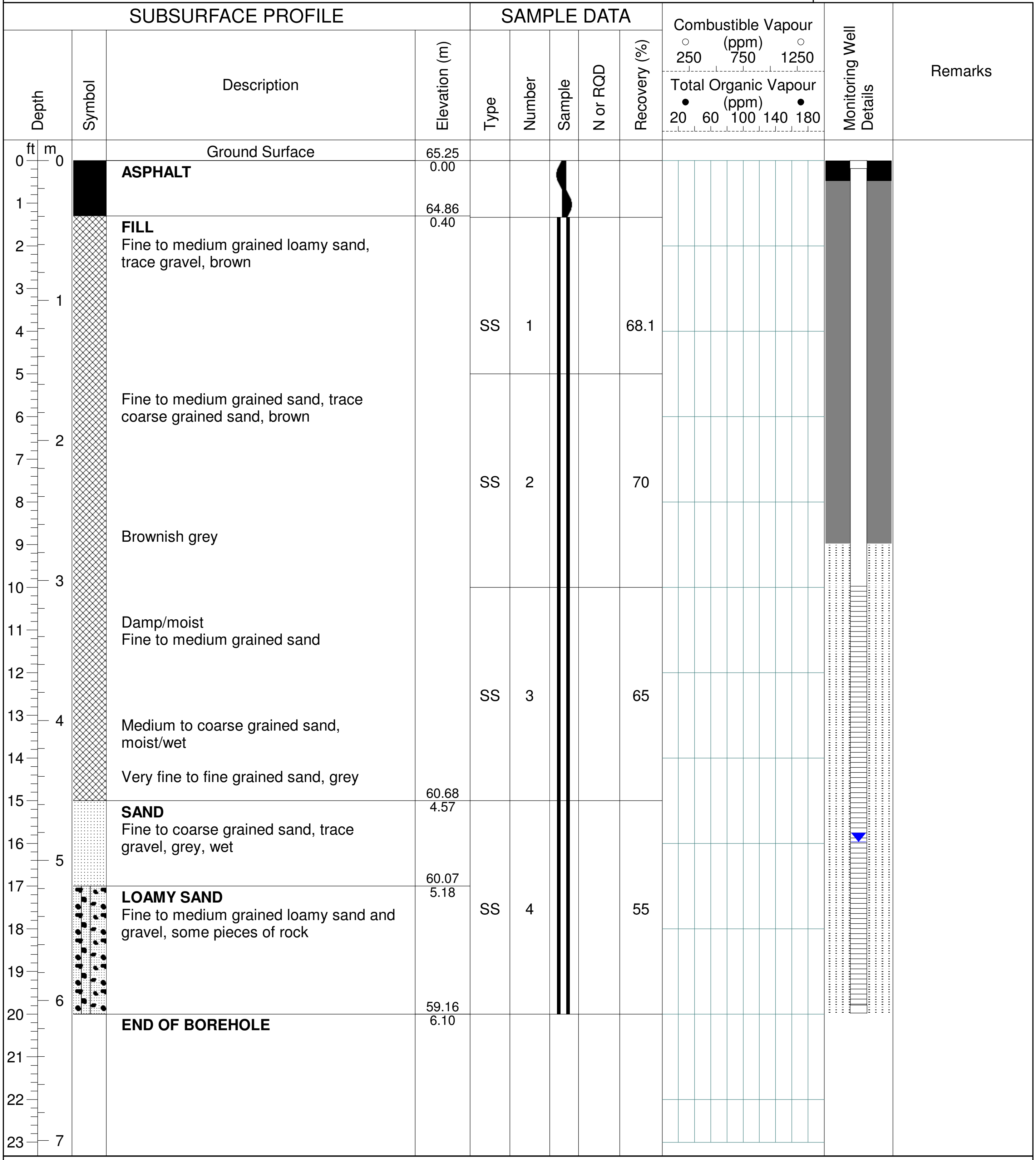
Datum: Geodetic
Checked by: KDH
Sheet: 1 of 1

# Stratigraphic and Instrumentation Log: MW15-9

**Project No:** TZ10100106
**Location:** 945 Bank Street, Ottawa
**Logged By:** JFT
**Drill Date:** October 21, 2015
**Hole Size:** 127 mm

**Project Name:** CPU Ground Water Monitoring Program
**Client:** City of Ottawa
**Entered By:** KYLT
**Drill Method:** Direct Push
**Drilled By:** Strata Drilling Group

Amec Foster Wheeler
300-210 Colonnade Road
Ottawa, Ontario K2E 7L5



| Description | Elevation (m) | Type | Number | Sample | N or RQD | Recovery (%) |
|---|---|---|---|---|---|---|
| Ground Surface | 65.25 | | | | | |
| **ASPHALT** | 0.00 | | | | | |
| | 64.86 | | | | | |
| **FILL**<br>Fine to medium grained loamy sand, trace gravel, brown | 0.40 | SS | 1 | | | 68.1 |
| Fine to medium grained sand, trace coarse grained sand, brown | | SS | 2 | | | 70 |
| Brownish grey | | | | | | |
| Damp/moist<br>Fine to medium grained sand | | SS | 3 | | | 65 |
| Medium to coarse grained sand, moist/wet | | | | | | |
| Very fine to fine grained sand, grey | 60.68 | | | | | |
| **SAND**<br>Fine to coarse grained sand, trace gravel, grey, wet | 4.57 | | | | | |
| | 60.07 | | | | | |
| **LOAMY SAND**<br>Fine to medium grained loamy sand and gravel, some pieces of rock | 5.18 | SS | 4 | | | 55 |
| | 59.16 | | | | | |
| **END OF BOREHOLE** | 6.10 | | | | | |

Elevation: 65.253 masl
Easting: 368798.392
Northing: 5029125.377

Casing Elevation: 65.148 masl
Well Casing Size: 50.8 mm
Screen Slot Size: 0.25 mm

Filter Pack Size: 6.7 mm
Well Material: Schedule 40 PVC
Vapour Unit: N/A

Datum: Geodetic
Checked by: KDH
Sheet: 1 of 1

# Stratigraphic and Instrumentation Log: MW15-10

Amec Foster Wheeler
300-210 Colonnade Road
Ottawa, Ontario  K2E 7L5

**Project No:** TZ10100106
**Location:** 945 Bank Street, Ottawa
**Logged By:** JFT
**Drill Date:** October 22, 2015
**Hole Size:** 127 mm

**Project Name:** CPU Ground Water Monitoring Program
**Client:** City of Ottawa
**Entered By:** KYLT
**Drill Method:** Direct Push
**Drilled By:** Strata Drilling Group

## SUBSURFACE PROFILE

| Description | Elevation (m) / Depth (m) |
|---|---|
| Ground Surface | 64.04 |
| **TOPSOIL** | 0.00 |
| | 63.65<br>0.40 |
| **FILL**<br>Very fine to fine grained loamy sand, brown<br>Very fine to fine grained sand<br>Very fine sandy loam, dark brown<br>Very fine grained loamy sand, brown<br>Very fine grained sandy loam<br>Very fine grained loamy sand<br>Very fine to fine grained loamy sand<br>Very fine grained sandy loam, brown, moist/wet<br>Very fine to fine grained loamy sand<br>Very fine grained sandy loam<br>Very fine to fine grained sand | 59.93<br>4.11 |
| **SAND**<br>Fine to medium grained, trace coarse grained sand, some gravel, some rock<br>Medium to coarse grained sand, some gravel | 57.95<br>6.10 |
| **END OF BOREHOLE** | |

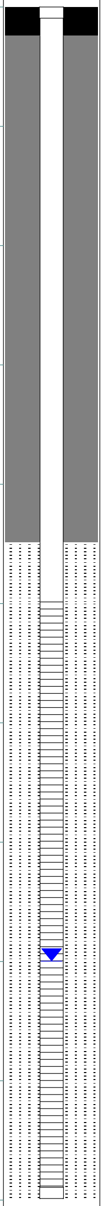
## SAMPLE DATA

| Type | Number | Sample | N or RQD | Recovery (%) |
|---|---|---|---|---|
| SS | 1 | | | 68 |
| SS | 2 | | | 85 |
| SS | 3 | | | 85 |
| SS | 4 | | | 43 |

Combustible Vapour ○ (ppm) ○
250 750 1250

Total Organic Vapour ● (ppm) ●
20 60 100 140 180

Monitoring Well Details



Remarks

Elevation: 64.043 masl
Easting: 368878.435
Northing: 5029083.949

Casing Elevation: 64.979 masl
Well Casing Size: 50.8 mm
Screen Slot Size: 0.25 mm

Filter Pack Size: 6.7 mm
Well Material: Schedule 40 PVC
Vapour Unit: N/A

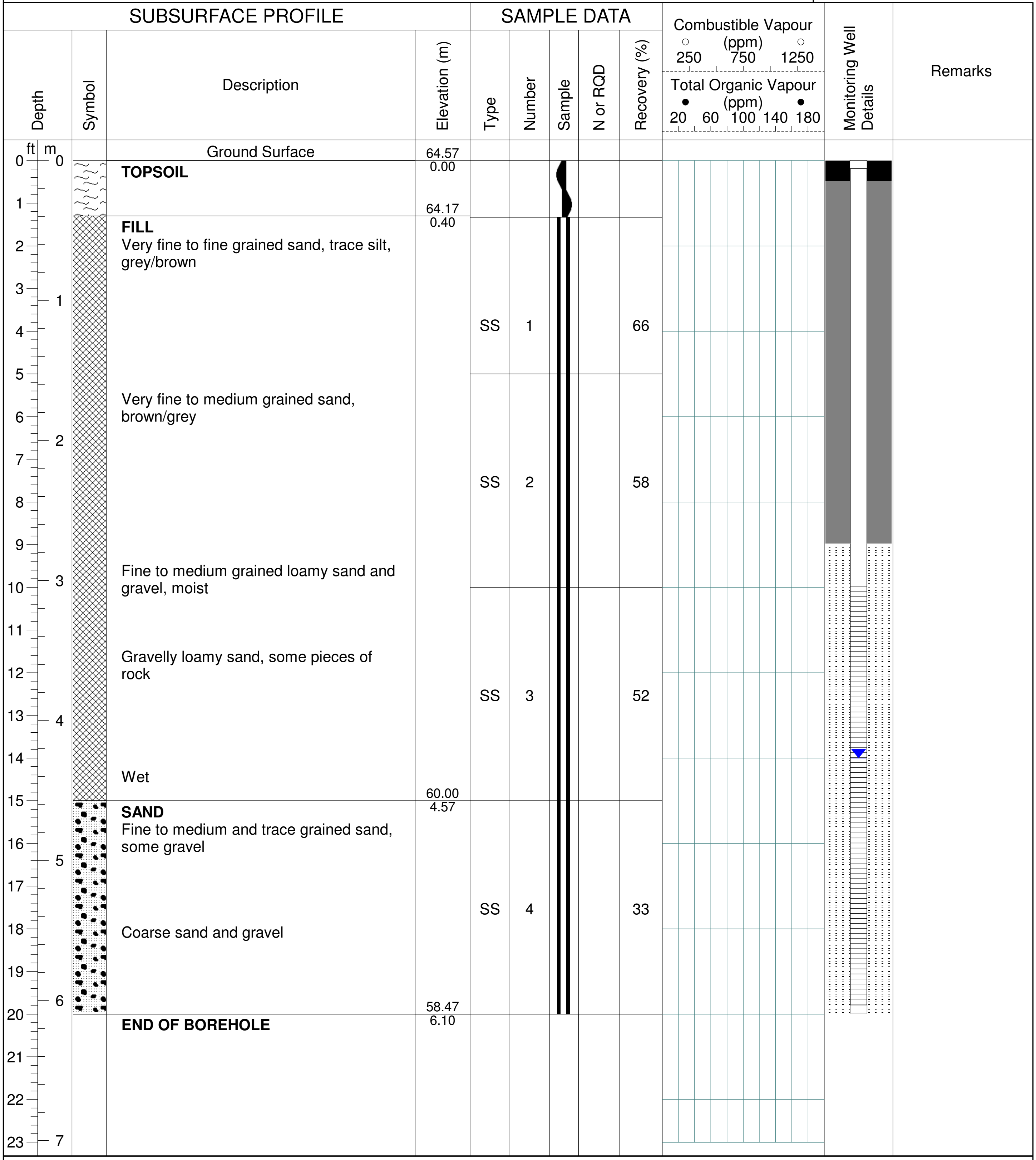
Datum: Geodetic
Checked by: KDH
Sheet: 1 of 1

# Stratigraphic and Instrumentation Log: MW15-11

**Project No:** TZ10100106
**Location:** 945 Bank Street, Ottawa
**Logged By:** JFT
**Drill Date:** October 22, 2015
**Hole Size:** 127 mm

**Project Name:** CPU Ground Water Monitoring Program
**Client:** City of Ottawa
**Entered By:** KYLT
**Drill Method:** Direct Push
**Drilled By:** Strata Drilling Group

Amec Foster Wheeler
300-210 Colonnade Road
Ottawa, Ontario  K2E 7L5



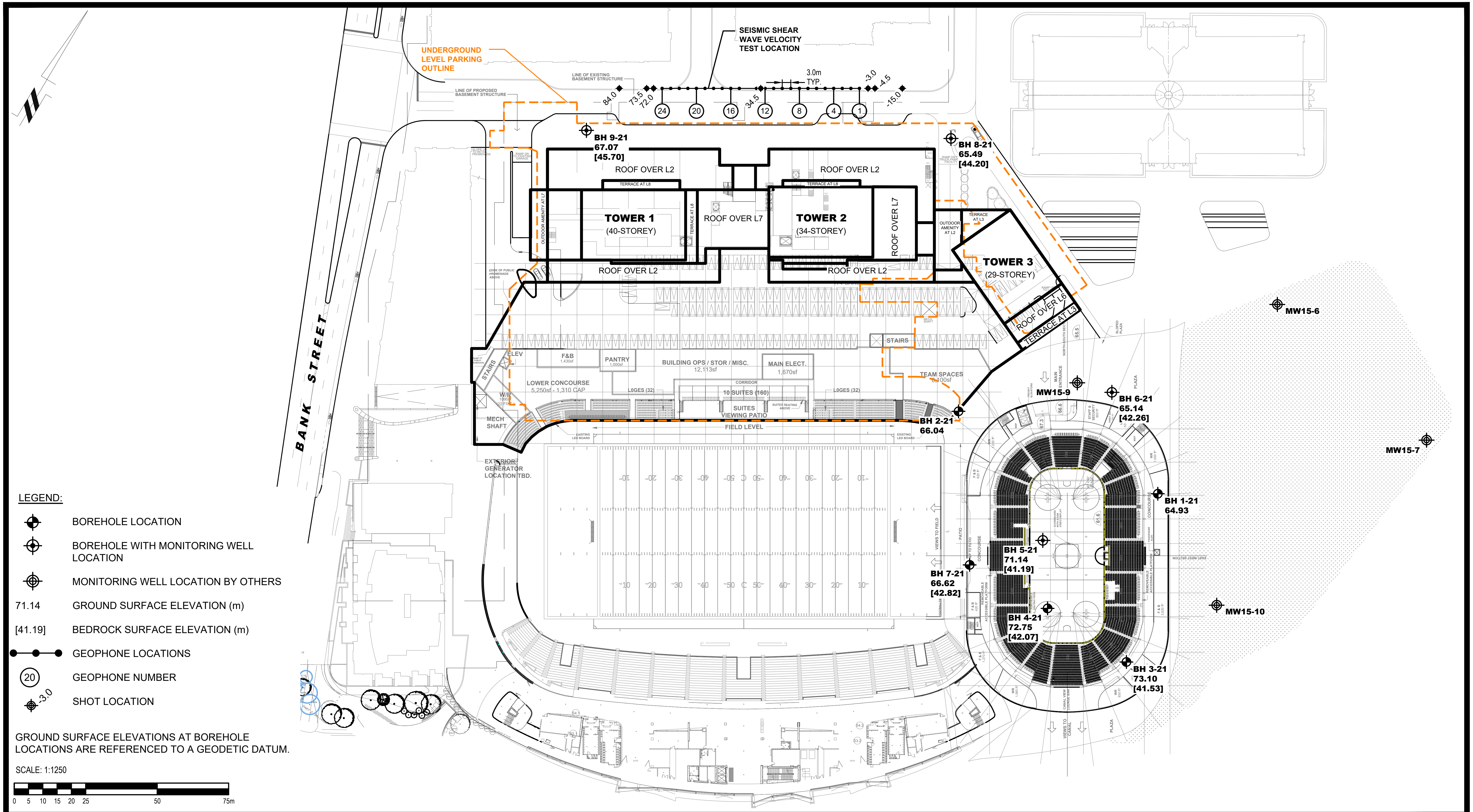
| Description | Elevation (m) | Type | Number | Recovery (%) |
|---|---|---|---|---|
| Ground Surface | 64.57<br>0.00 | | | |
| **TOPSOIL** | 64.17<br>0.40 | | | |
| **FILL**<br>Very fine to fine grained sand, trace silt, grey/brown | | SS | 1 | 66 |
| Very fine to medium grained sand, brown/grey | | SS | 2 | 58 |
| Fine to medium grained loamy sand and gravel, moist | | | | |
| Gravelly loamy sand, some pieces of rock | | SS | 3 | 52 |
| Wet | 60.00<br>4.57 | | | |
| **SAND**<br>Fine to medium and trace grained sand, some gravel | | SS | 4 | 33 |
| Coarse sand and gravel | 58.47<br>6.10 | | | |
| **END OF BOREHOLE** | | | | |

Elevation: 64.571 masl
Easting: 368858.743
Northing: 5028968.821

Casing Elevation: 64.447 masl
Well Casing Size: 50.8 mm
Screen Slot Size: 0.25 mm

Filter Pack Size: 6.7 mm
Well Material: Schedule 40 PVC
Vapour Unit: N/A

Datum: Geodetic
Checked by: KDH
Sheet: 1 of 1



LEGEND:

| | |
|---|---|
| ⌖ | BOREHOLE LOCATION |
| ⌖ | BOREHOLE WITH MONITORING WELL LOCATION |
| ⌖ | MONITORING WELL LOCATION BY OTHERS |
| 71.14 | GROUND SURFACE ELEVATION (m) |
| [41.19] | BEDROCK SURFACE ELEVATION (m) |
| ●—●—● | GEOPHONE LOCATIONS |
| (20) | GEOPHONE NUMBER |
| ⌖ -3.0 | SHOT LOCATION |

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:1250

0 5 10 15 20 25 50 75m

PATERSON GROUP

9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

| NO. | REVISIONS | DATE | INITIAL |
|---|---|---|---|
| 1 | NEW BASE PLAN UPDATED | 20/03/2023 | DP |

CITY OF OTTAWA
GEOTECHNICAL INVESTIGATION
LANSDOWNE PARK REDEVELOPMENT
PROP. MULTI-STOREY BUILDINGS AND RINK STRUCTURE

OTTAWA, ONTARIO

Title:

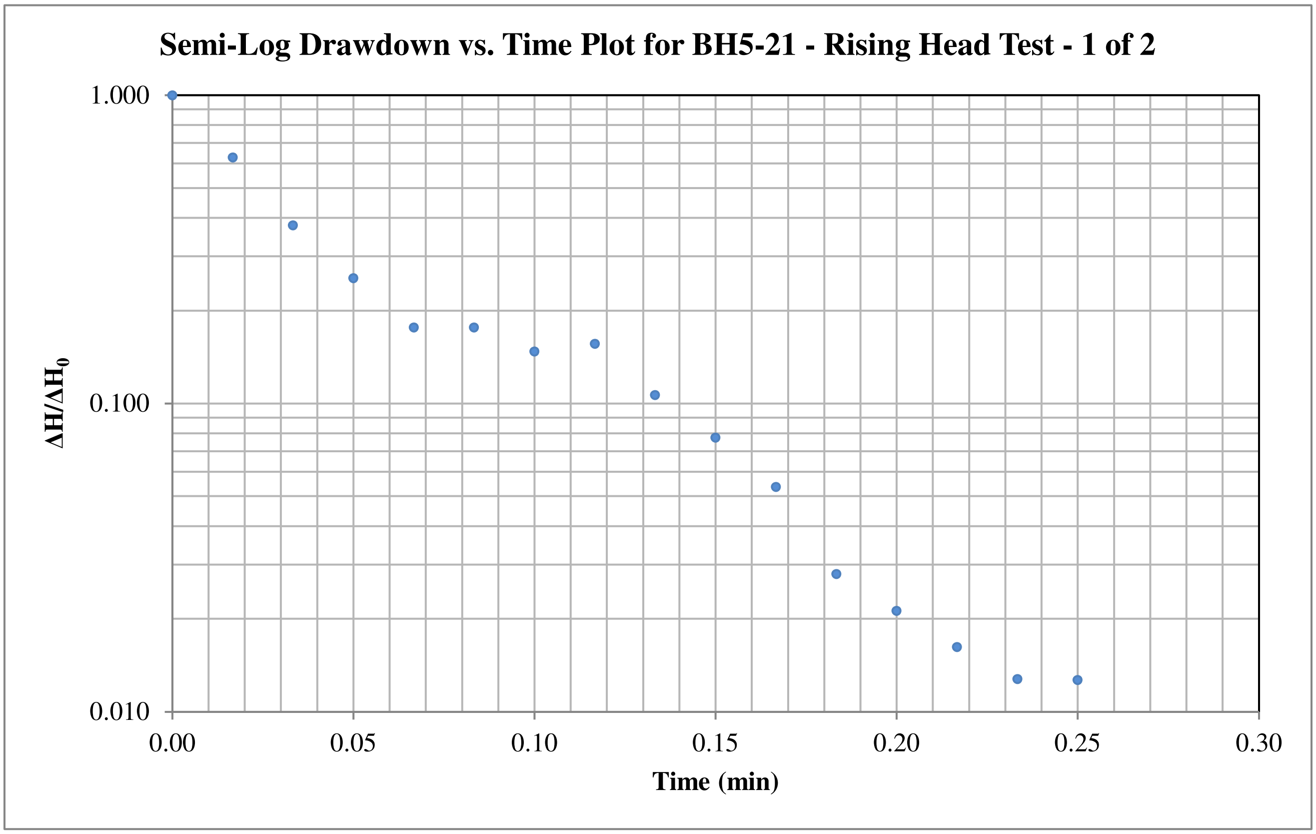
# TEST HOLE LOCATION PLAN

| | |
|---|---|
| Scale: 1:1250 | Date: 12/2021 |
| Drawn by: YA | Report No.: PG5792-1 |
| Checked by: MS | Dwg. No.: PG5792-1 |
| Approved by: DJG | Revision No.: 1 |

p:\autocad drawings\geotechnical\pg57xx\pg5792\pg5792-gps\pg5792-1-test hole location plan (rev.01).dwg

# Hvorslev Hydraulic Conductivity Analysis

Project: Lansdowne - Trinity
Test Location: BH5-21
Test: Rising Head - 1 of 2
Date: November 16, 2021



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F}\frac{1}{t^*}\ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 3.59613

Well Parameters:

| | | |
|---|---|---|
| L | 3 m | Saturated length of screen or open hole |
| D | 0.03175 m | Diameter of well |
| $r_c$ | 0.01588 m | Radius of well |

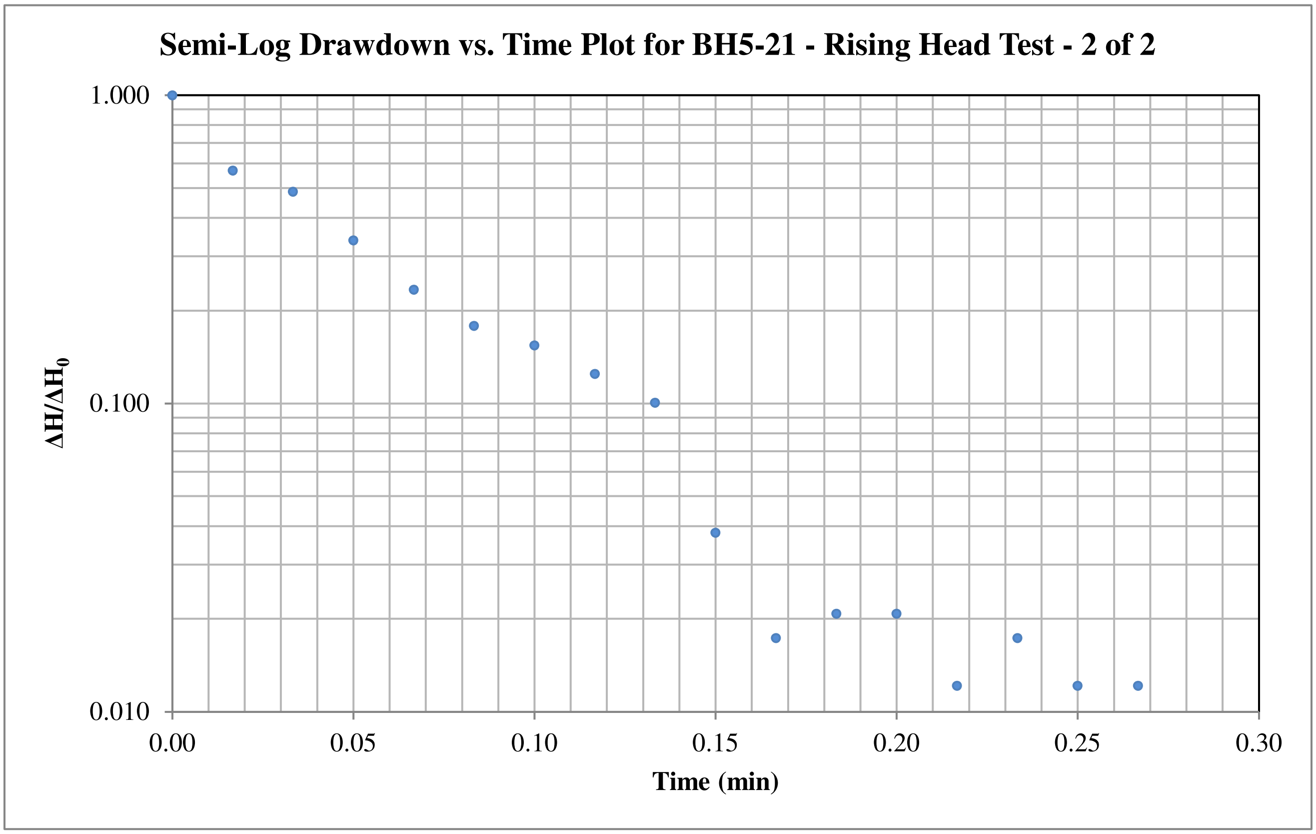
Data Points (from plot):

$t^*$: 0.034 minutes $\Delta H^*/\Delta H_0$: 0.37

**Horizontal Hydraulic Conductivity**
**K = 1.06E-04 m/sec**

# Hvorslev Hydraulic Conductivity Analysis

Project: Lansdowne - Trinity
Test Location: BH5-21
Test: Rising Head - 2 of 2
Date: November 16, 2021



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 3.59613

Well Parameters:

| | | | |
|---|---|---|---|
| L | 3 | m | Saturated length of screen or open hole |
| D | 0.03175 | m | Diameter of well |
| $r_c$ | 0.01588 | m | Radius of well |

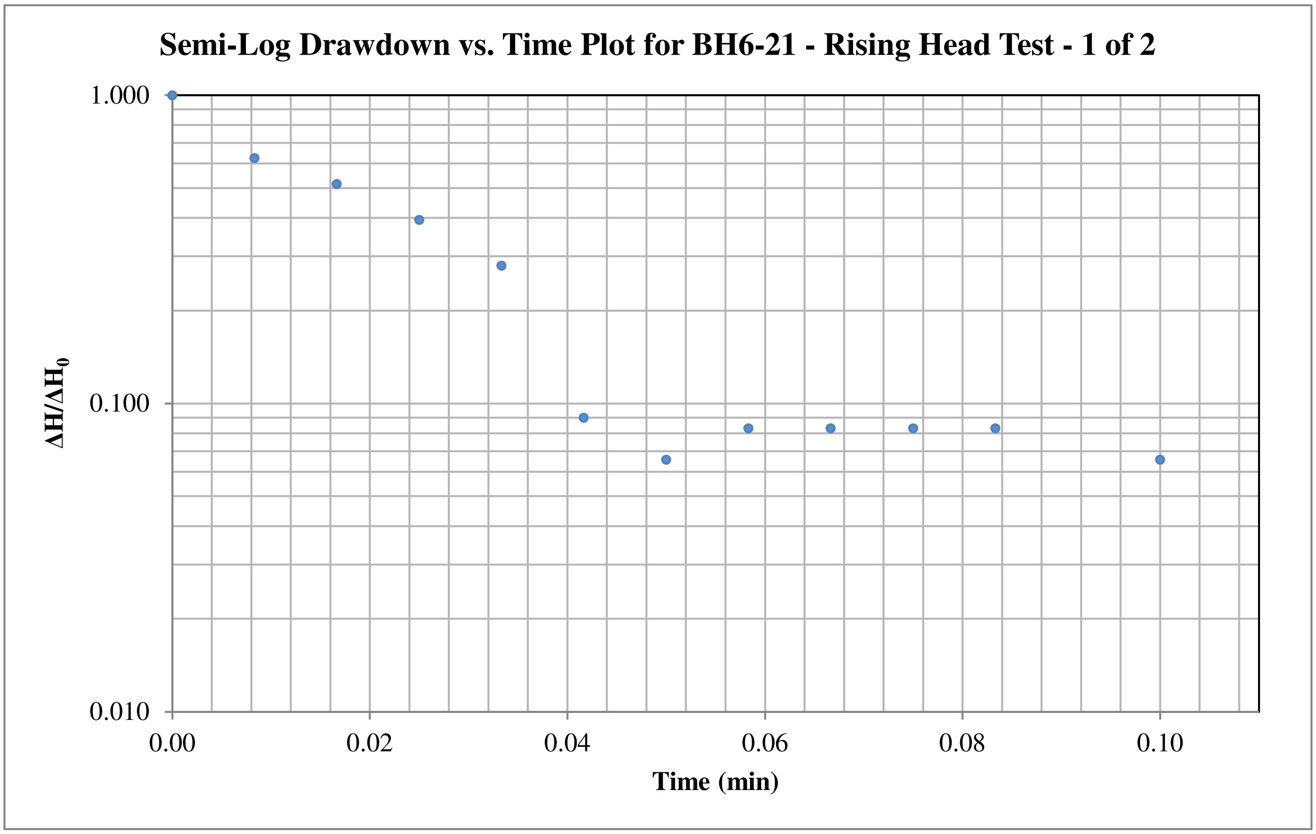
Data Points (from plot):

$t^*$: 0.047 minutes $\Delta H^*/\Delta H_0$: 0.37

**Horizontal Hydraulic Conductivity**
**K = 7.75E-05 m/sec**

# Hvorslev Hydraulic Conductivity Analysis

Project: Lansdowne - Trinity
Test Location: BH6-21
Test: Rising Head - 1 of 2
Date: November 16, 2021



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 3.59613

Well Parameters:

| | | |
|---|---|---|
| L | 3 m | Saturated length of screen or open hole |
| D | 0.03175 m | Diameter of well |
| $r_c$ | 0.01588 m | Radius of well |

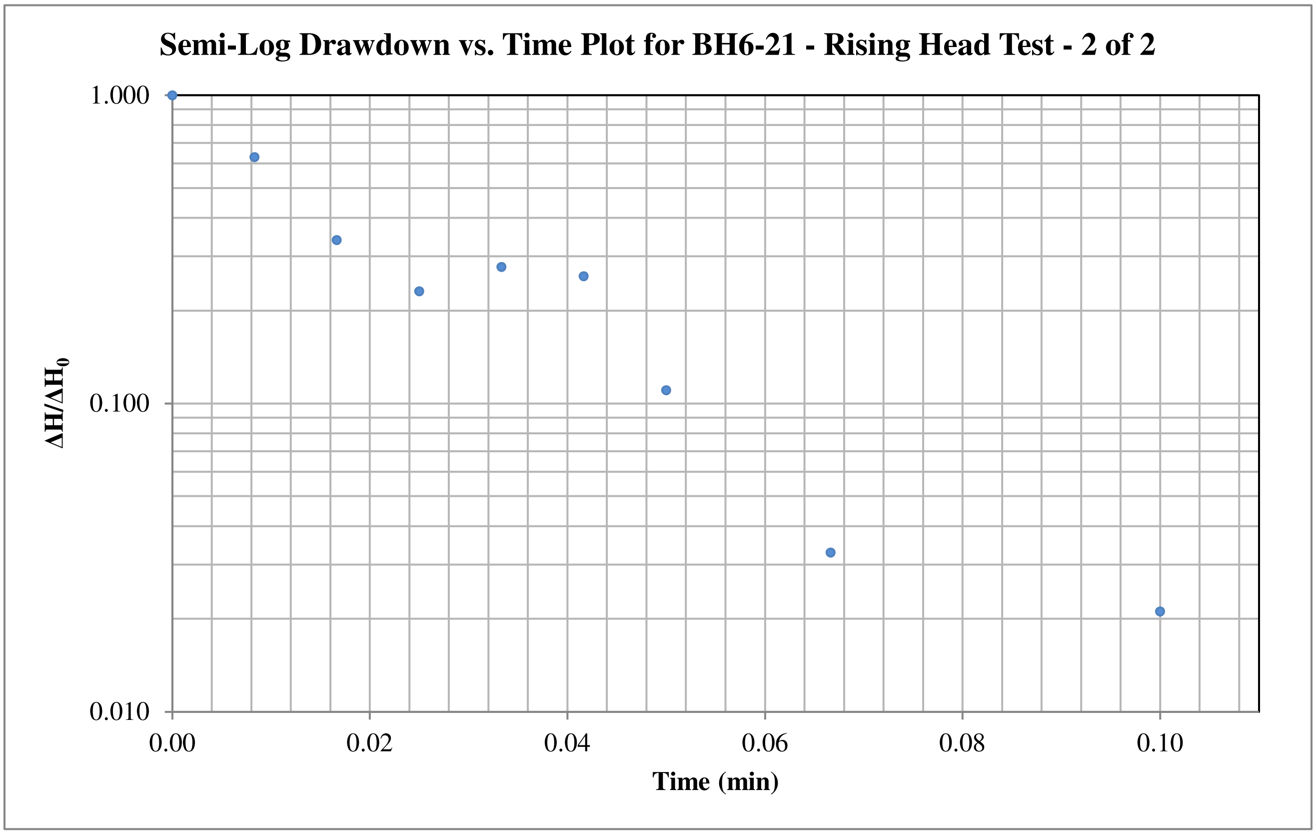
Data Points (from plot):

t*: 0.027 minutes $\Delta H^*/\Delta H_0$: 0.37

**Horizontal Hydraulic Conductivity**
**K = 1.36E-04 m/sec**

# Hvorslev Hydraulic Conductivity Analysis

Project: Lansdowne - Trinity
Test Location: BH6-21
Test: Rising Head - 2 of 2
Date: November 16, 2021



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F}\frac{1}{t^*}\ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 3.59613

Well Parameters:

| | | | |
|---|---|---|---|
| L | 3 | m | Saturated length of screen or open hole |
| D | 0.03175 | m | Diameter of well |
| $r_c$ | 0.01588 | m | Radius of well |

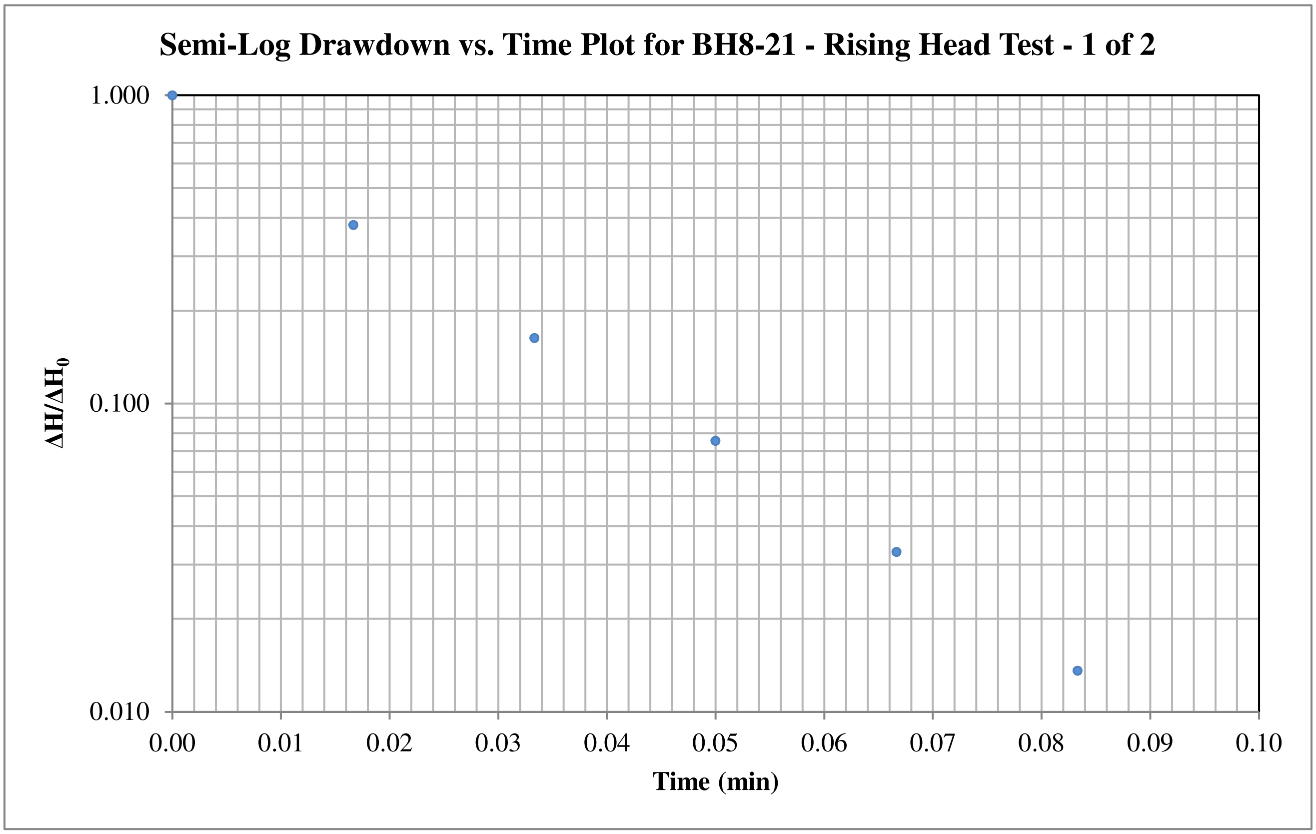
Data Points (from plot):

t*: 0.016 minutes $\Delta H^*/\Delta H_0$: 0.37

**Horizontal Hydraulic Conductivity**
**K = 2.31E-04 m/sec**

# Hvorslev Hydraulic Conductivity Analysis

Project: Lansdowne - Trinity
Test Location: BH8-21
Test: Rising Head - 1 of 2
Date: December 8, 2021



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 3.59613

Well Parameters:

| | | |
|---|---|---|
| L | 3 m | Saturated length of screen or open hole |
| D | 0.03175 m | Diameter of well |
| $r_c$ | 0.01588 m | Radius of well |

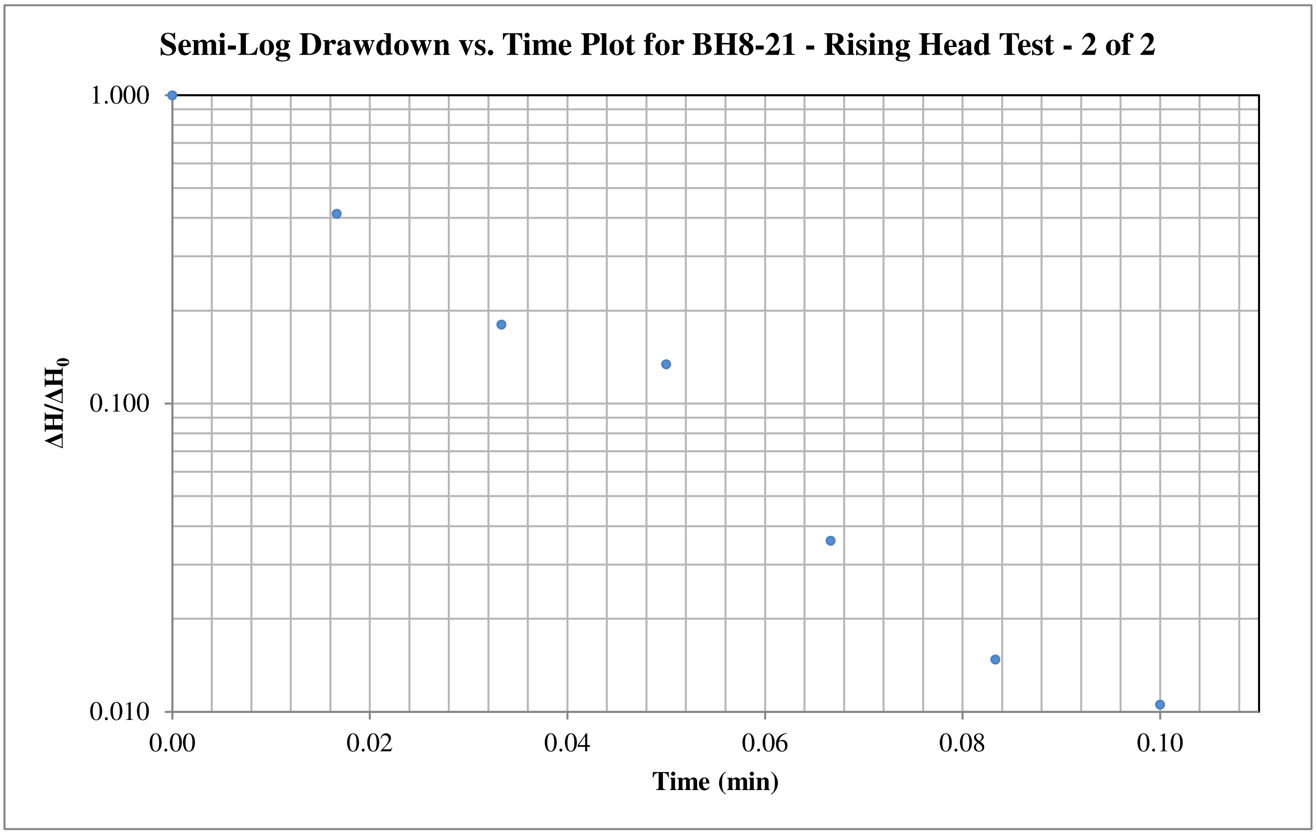
Data Points (from plot):

t*: 0.017 minutes $\Delta H^*/\Delta H_0$: 0.37

**Horizontal Hydraulic Conductivity**
**K = 2.11E-04 m/sec**

# Hvorslev Hydraulic Conductivity Analysis

Project: Lansdowne - Trinity
Test Location: BH8-21
Test: Rising Head - 2 of 2
Date: December 8, 2021



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 3.59613

Well Parameters:

| | | | |
|---|---|---|---|
| L | 3 | m | Saturated length of screen or open hole |
| D | 0.03175 | m | Diameter of well |
| $r_c$ | 0.01588 | m | Radius of well |

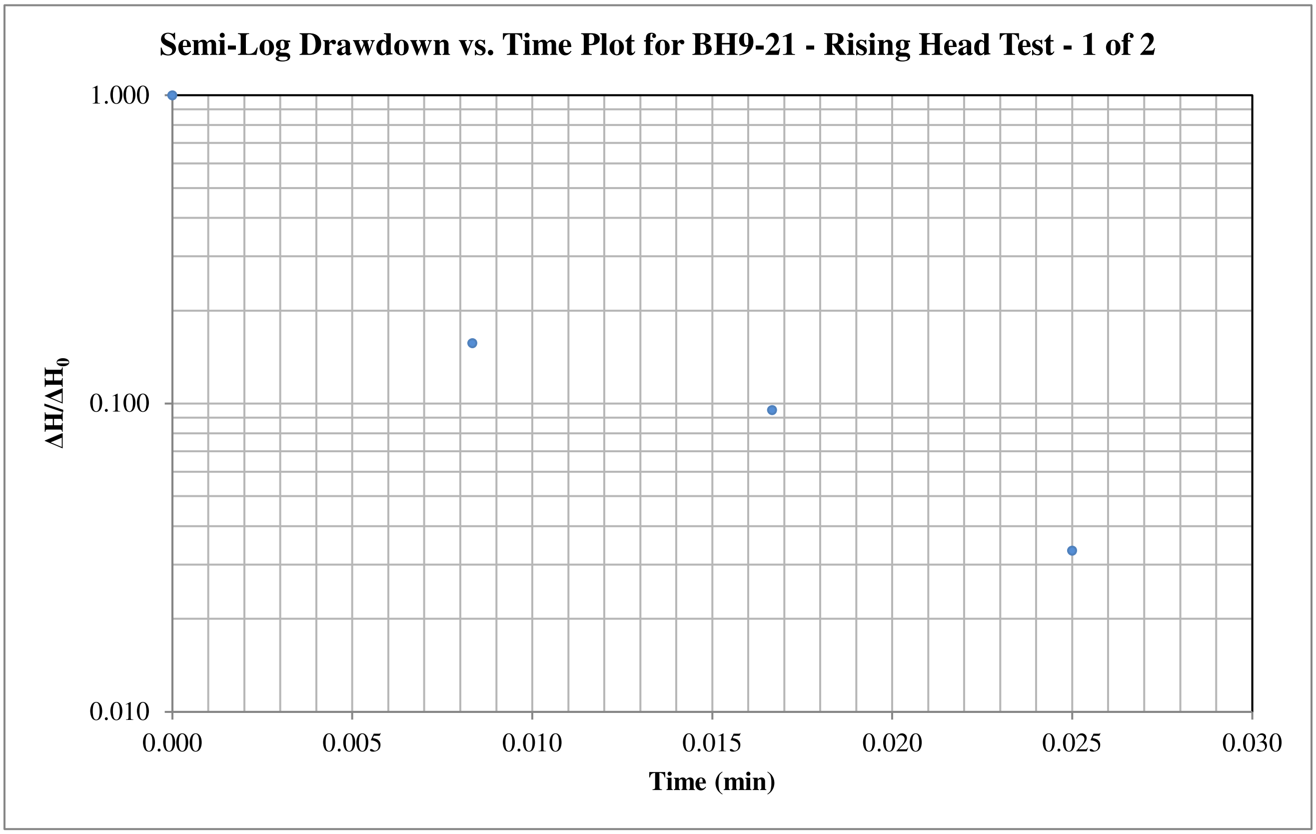
Data Points (from plot):

t*: 0.019 minutes $\Delta H^*/\Delta H_0$: 0.37

**Horizontal Hydraulic Conductivity**
**K = 1.92E-04 m/sec**

# Hvorslev Hydraulic Conductivity Analysis

Project: Lansdowne - Trinity
Test Location: BH9-21
Test: Rising Head - 1 of 2
Date: December 8, 2021



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F}\frac{1}{t^*}\ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 3.59613

Well Parameters:

| | | | |
|---|---|---|---|
| L | 3 | m | Saturated length of screen or open hole |
| D | 0.03175 | m | Diameter of well |
| $r_c$ | 0.01588 | m | Radius of well |

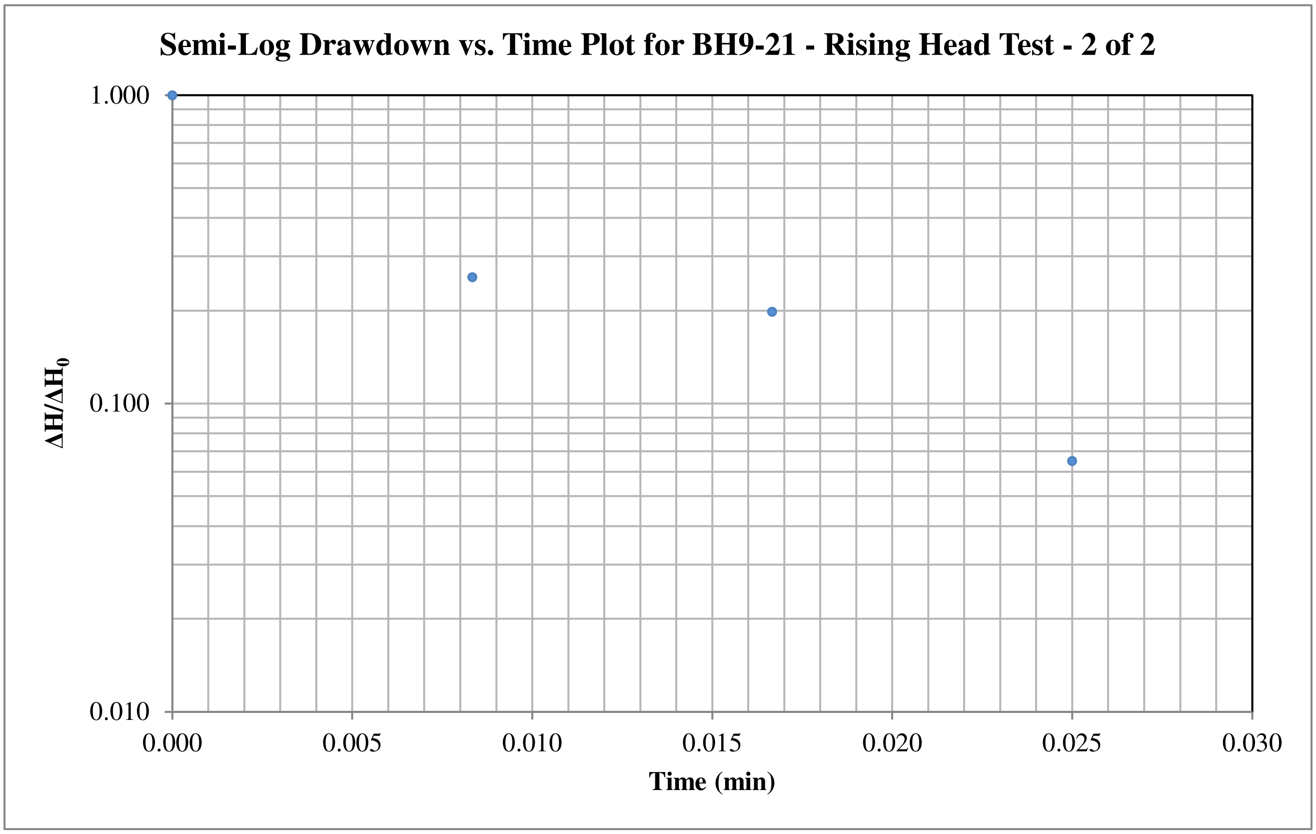
Data Points (from plot):

t*: 0.006 minutes $\Delta H^*/\Delta H_0$: 0.37

**Horizontal Hydraulic Conductivity**
**K = 5.86E-04 m/sec**

# Hvorslev Hydraulic Conductivity Analysis

Project: Lansdowne - Trinity
Test Location: BH9-21
Test: Rising Head - 2 of 2
Date: December 8, 2021



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F}\frac{1}{t^*}\ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 3.59613

Well Parameters:

| | | | |
|---|---|---|---|
| L | 3 | m | Saturated length of screen or open hole |
| D | 0.03175 | m | Diameter of well |
| $r_c$ | 0.01588 | m | Radius of well |

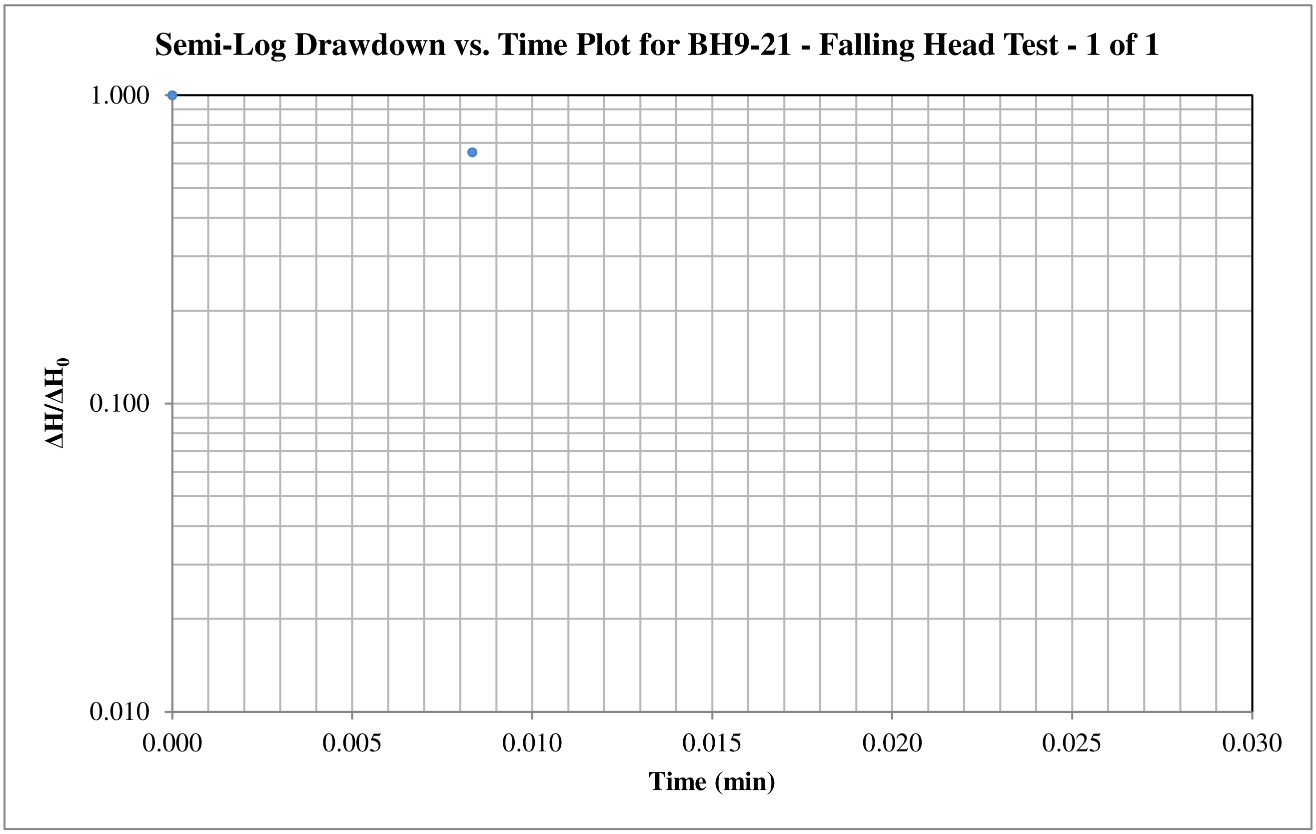
Data Points (from plot):

t*: 0.007 minutes $\Delta H^*/\Delta H_0$: 0.37

**Horizontal Hydraulic Conductivity**
**K = 5.16E-04 m/sec**

# Hvorslev Hydraulic Conductivity Analysis

Project: Lansdowne - Trinity
Test Location: BH9-21
Test: Falling Head Test - 1 of 1
Date: December 8, 2021



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 3.59613

Well Parameters:

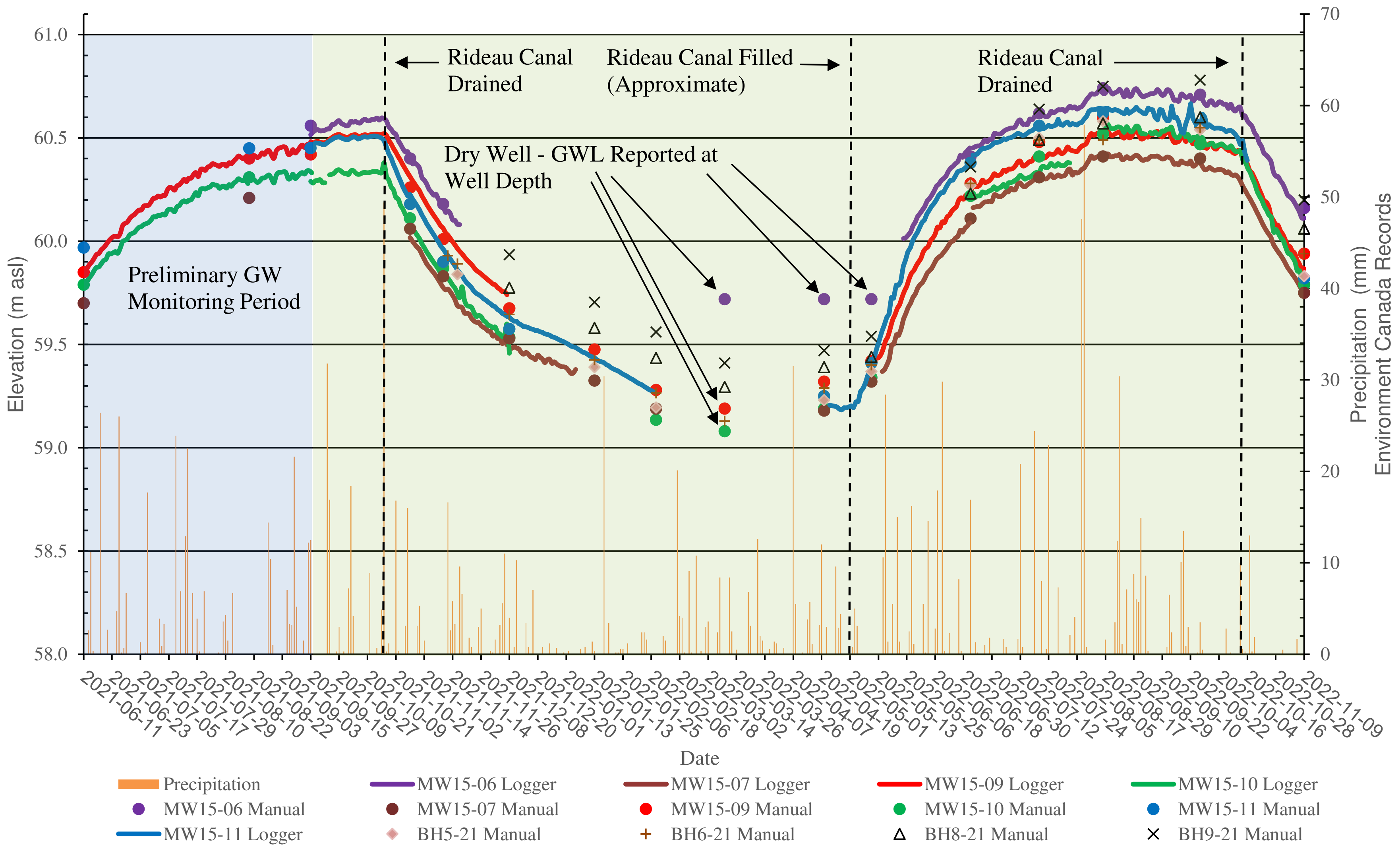
| | | | |
|---|---|---|---|
| L | 3 | m | Saturated length of screen or open hole |
| D | 0.03175 | m | Diameter of well |
| $r_c$ | 0.01588 | m | Radius of well |

Data Points (from plot):

$t^*$: 0.012 minutes $\Delta H^*/\Delta H_0$: 0.37

**Horizontal Hydraulic Conductivity**
**K = 3.05E-04 m/sec**

## Figure 1: Long-Term Groundwater Monitoring Program



# APPENDIX 3

MTO IDF Curves

Sample Calculations – Dupuit Forchheimer

**Ontario** IDF CURVE LOOKUP

## Active coordinate

45° 23' 45" N, 75° 41' 15" W (45.395833,-75.687500)

Retrieved: Thu, 11 Nov 2021 17:54:34 GMT

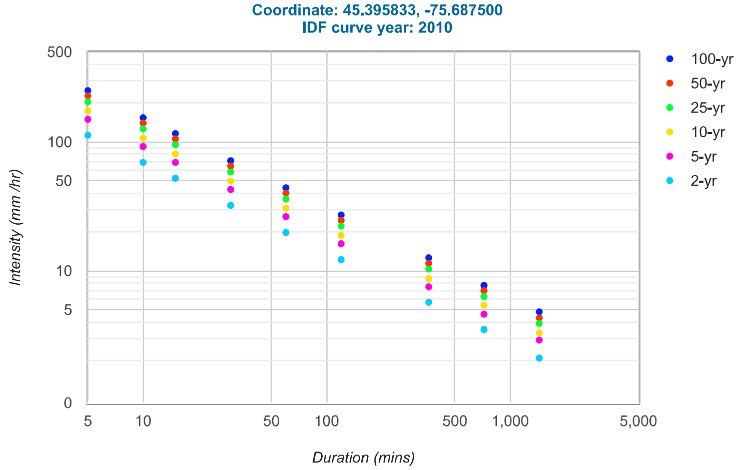
### Location summary

These are the locations in the selection.

**IDF Curve:** 45° 23' 45" N, 75° 41' 15" W (45.395833,-75.687500)

### Results

An IDF curve was found.



### Coefficient summary

**IDF Curve:** 45° 23' 45" N, 75° 41' 15" W (45.395833,-75.687500)

Retrieved: Thu, 11 Nov 2021 17:54:34 GMT

**Data year:** 2010
**IDF curve year:** 2010

| Return period | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
|---|---|---|---|---|---|---|
| A | 19.8 | 26.3 | 30.6 | 36.0 | 40.0 | 44.0 |
| B | -0.699 | -0.699 | -0.699 | -0.699 | -0.699 | -0.699 |

### Statistics

#### Rainfall intensity (mm hr$^{-1}$)

| Duration | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|
| 2-yr | 112.5 | 69.3 | 52.2 | 32.1 | 19.8 | 12.2 | 5.7 | 3.5 | 2.1 |
| 5-yr | 149.4 | 92.0 | 69.3 | 42.7 | 26.3 | 16.2 | 7.5 | 4.6 | 2.9 |
| 10-yr | 173.8 | 107.1 | 80.6 | 49.7 | 30.6 | 18.8 | 8.7 | 5.4 | 3.3 |
| 25-yr | 204.5 | 126.0 | 94.9 | 58.4 | 36.0 | 22.2 | 10.3 | 6.3 | 3.9 |
| 50-yr | 227.2 | 140.0 | 105.4 | 64.9 | 40.0 | 24.6 | 11.4 | 7.0 | 4.3 |
| 100-yr | 249.9 | 154.0 | 116.0 | 71.4 | 44.0 | 27.1 | 12.6 | 7.7 | 4.8 |

#### Rainfall depth (mm)

| Duration | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|
| 2-yr | 9.4 | 11.5 | 13.0 | 16.1 | 19.8 | 24.4 | 34.0 | 41.8 | 51.5 |
| 5-yr | 12.4 | 15.3 | 17.3 | 21.3 | 26.3 | 32.4 | 45.1 | 55.6 | 68.5 |
| 10-yr | 14.5 | 17.8 | 20.2 | 24.8 | 30.6 | 37.7 | 52.5 | 64.6 | 79.6 |
| 25-yr | 17.0 | 21.0 | 23.7 | 29.2 | 36.0 | 44.4 | 61.7 | 76.1 | 93.7 |
| 50-yr | 18.9 | 23.3 | 26.4 | 32.5 | 40.0 | 49.3 | 68.6 | 84.5 | 104.1 |
| 100-yr | 20.8 | 25.7 | 29.0 | 35.7 | 44.0 | 54.2 | 75.5 | 93.0 | 114.5 |

### Terms of Use

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## Estimated Groundwater Inflow

## Lansdowne Redevelopment - Tower 1 and 2 Underground Parking - Eastern Portion - High Groundwater

**Dupuit-Forchheimer Equation** **$Q= \pi K((h_0^2-h_p^2)/\ln(R/r))$**

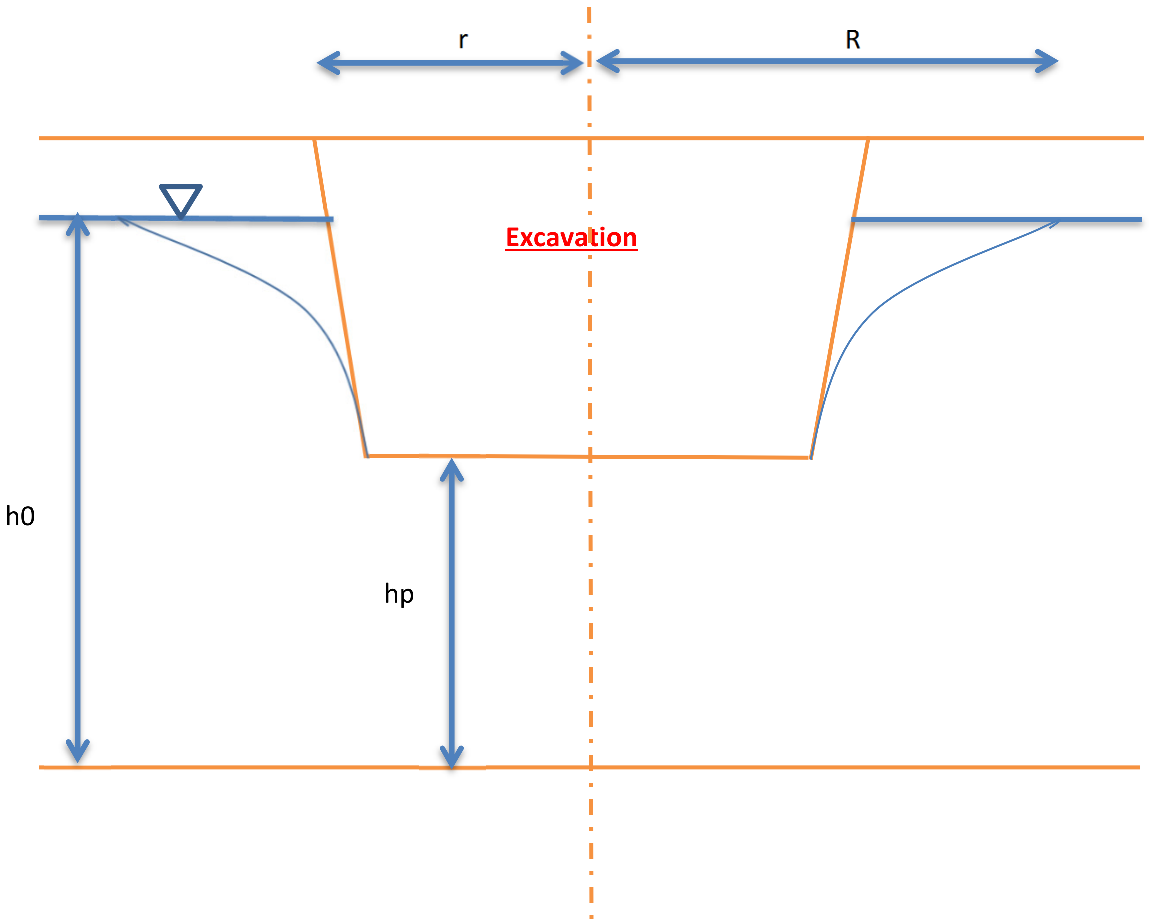
Equivalent Radius of Excavation = A+B=Pi*r

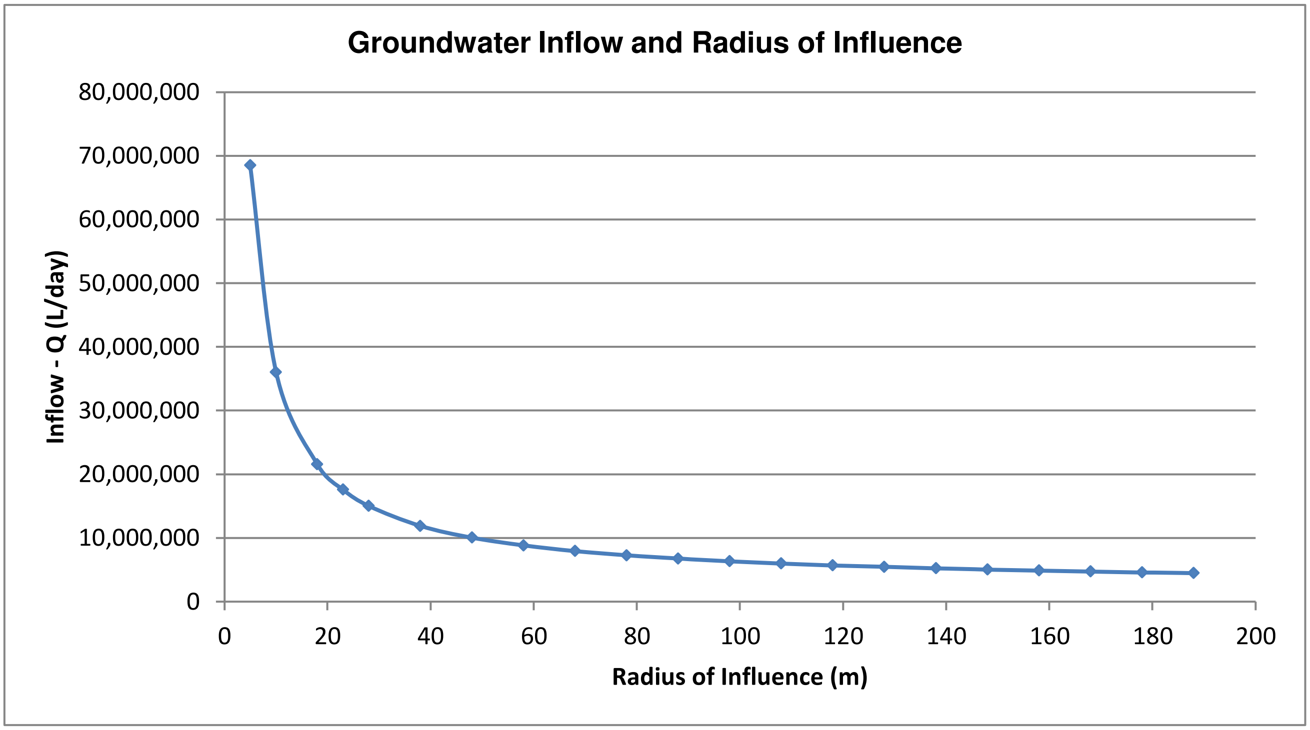
K (m/sec) = 6.00E-04
h0 (m) = 20
hp (m) = 18.8
r (m) = 42.72

Excavation Width (A) = 67.1 m
Excavation Length (B) = 67.1 m
Perimeter Length = 268.4 m
Equivalent Radius (r) = 42.72 m

| R | Distance to edge of excavation |
|---|---|
| 47.72 | 5.00 |
| 52.72 | 10.00 |
| 60.72 | 18.00 |
| 65.72 | 23.00 |
| 70.72 | 28.00 |
| 80.72 | 38.00 |
| 90.72 | 48.00 |
| 100.72 | 58.00 |
| 110.72 | 68.00 |
| 120.72 | 78.00 |
| **130.72** | **88.00** |
| 140.72 | 98.00 |
| 150.72 | 108.00 |
| 160.72 | 118.00 |
| 170.72 | 128.00 |
| 180.72 | 138.00 |
| 190.72 | 148.00 |
| 200.72 | 158.00 |
| 210.72 | 168.00 |
| 220.72 | 178.00 |
| 230.72 | 188.00 |

| Q (m^3/s) | Q (m^3/day) | Q (L/day) |
|---|---|---|
| 0.7929 | 68,504 | 68,504,367 |
| 0.4172 | 36,050 | 36,050,026 |
| 0.2496 | 21,565 | 21,564,904 |
| 0.2037 | 17,603 | 17,603,269 |
| 0.1741 | 15,043 | 15,042,571 |
| 0.1379 | 11,916 | 11,916,032 |
| 0.1165 | 10,068 | 10,068,133 |
| 0.1023 | 8,841 | 8,840,662 |
| 0.0922 | 7,962 | 7,961,934 |
| 0.0845 | 7,299 | 7,299,201 |
| **0.0785** | **6,780** | **6,779,805** |
| 0.0736 | 6,361 | 6,360,579 |
| 0.0696 | 6,014 | 6,014,234 |
| 0.0662 | 5,723 | 5,722,651 |
| 0.0633 | 5,473 | 5,473,315 |
| 0.0608 | 5,257 | 5,257,298 |
| 0.0587 | 5,068 | 5,068,051 |
| 0.0567 | 4,901 | 4,900,660 |
| 0.0550 | 4,751 | 4,751,360 |
| 0.0534 | 4,617 | 4,617,218 |
| 0.0520 | 4,496 | 4,495,914 |


r
R
Excavation
h0
hp


Groundwater Inflow and Radius of Influence
80,000,000
70,000,000
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
Inflow - Q (L/day)
0
20
40
60
80
100
120
140
160
180
200
Radius of Influence (m)

## Estimated Groundwater Inflow

## Lansdowne Redevelopment - Tower 1 and 2 Underground Parking - Western Portion - High Groundwater

**Dupuit-Forchheimer Equation** **$Q = \pi K((h_0^2 - h_p^2)/\ln(R/r))$**

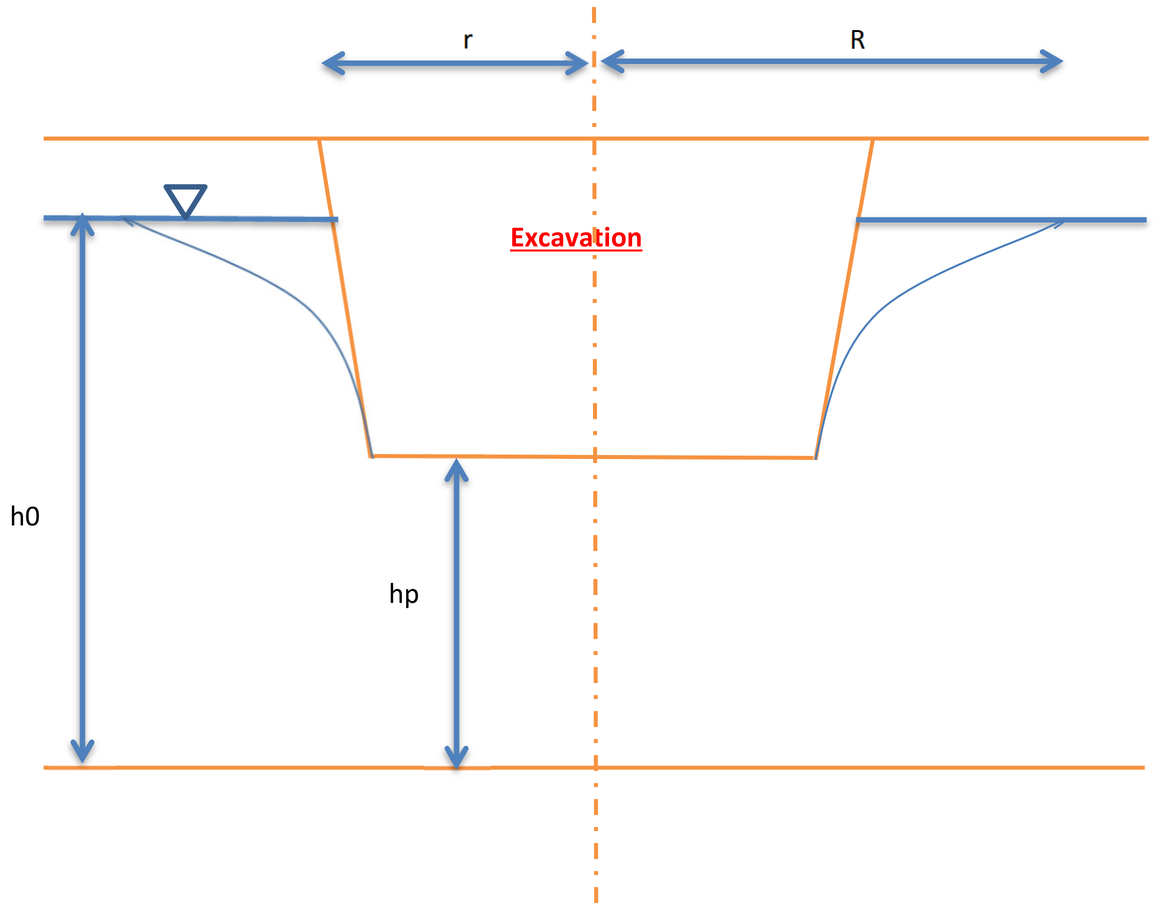
Equivalent Radius of Excavation = A+B=Pi*r

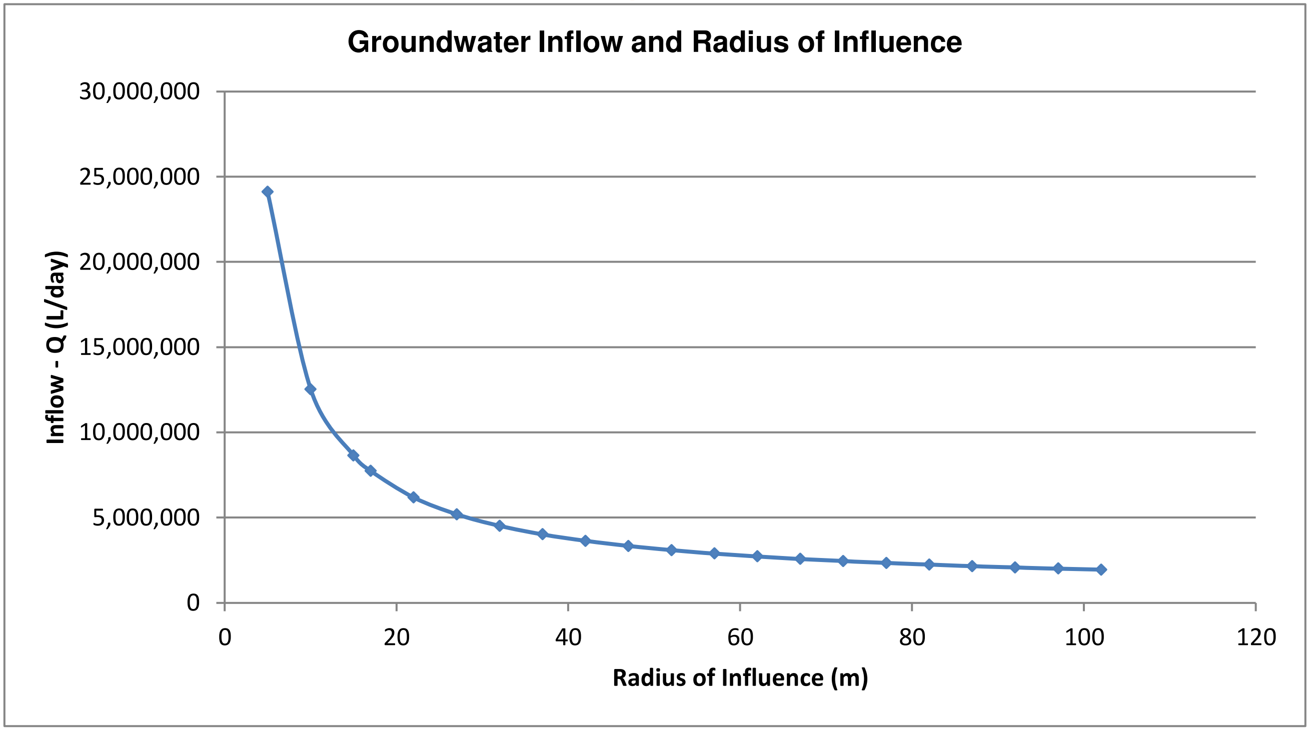
K (m/sec) = 6.00E-04
h0 (m) = 20
hp (m) = 19.7
r (m) = 59.71

Excavation Width (X) = 93.8 m
Excavation Length (Y) = 93.8 m
Perimeter Length = 375.2 m
Equivalent Radius (r) = 59.71 m

| R | Distance to edge of excavation |
|---|---|
| 64.71 | 5.00 |
| 69.71 | 10.00 |
| 74.71 | 15.00 |
| 76.71 | 17.00 |
| **81.71** | **22.00** |
| 86.71 | 27.00 |
| 91.71 | 32.00 |
| 96.71 | 37.00 |
| 101.71 | 42.00 |
| 106.71 | 47.00 |
| 111.71 | 52.00 |
| 116.71 | 57.00 |
| 121.71 | 62.00 |
| 126.71 | 67.00 |
| 131.71 | 72.00 |
| 136.71 | 77.00 |
| 141.71 | 82.00 |
| 146.71 | 87.00 |
| 151.71 | 92.00 |
| 156.71 | 97.00 |
| 161.71 | 102.00 |

| Q (m^3/s) | Q (m^3/day) | Q (L/day) |
|---|---|---|
| 0.2792 | 24,122 | 24,122,225 |
| 0.1450 | 12,528 | 12,527,509 |
| 0.1002 | 8,655 | 8,655,436 |
| 0.0896 | 7,743 | 7,742,731 |
| **0.0716** | **6,184** | **6,184,077** |
| 0.0602 | 5,200 | 5,199,560 |
| 0.0523 | 4,520 | 4,520,276 |
| 0.0466 | 4,023 | 4,022,651 |
| 0.0422 | 3,642 | 3,641,933 |
| 0.0387 | 3,341 | 3,340,914 |
| 0.0358 | 3,097 | 3,096,684 |
| 0.0335 | 2,894 | 2,894,364 |
| 0.0315 | 2,724 | 2,723,867 |
| 0.0298 | 2,578 | 2,578,114 |
| 0.0284 | 2,452 | 2,451,988 |
| 0.0271 | 2,342 | 2,341,697 |
| 0.0260 | 2,244 | 2,244,371 |
| 0.0250 | 2,158 | 2,157,798 |
| 0.0241 | 2,080 | 2,080,245 |
| 0.0233 | 2,010 | 2,010,335 |
| 0.0225 | 1,947 | 1,946,960 |


r
R
Excavation
h0
hp


Groundwater Inflow and Radius of Influence
Inflow - Q (L/day)
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
0
20
40
60
80
100
120
Radius of Influence (m)

## Estimated Groundwater Inflow

**Lansdowne Redevelopment - Arena - High Groundwater**

**Dupuit-Forchheimer Equation** **Q= πK((h0^2-hp^2)/ln(R/r))**

Equivalent Radius of Excavation = A+B=Pi + r

K (m/sec) = 6.00E-04

h0 (m) = 20

hp (m) = 18.8

r (m) = 52.20

Excavation Width (X) = 64 m

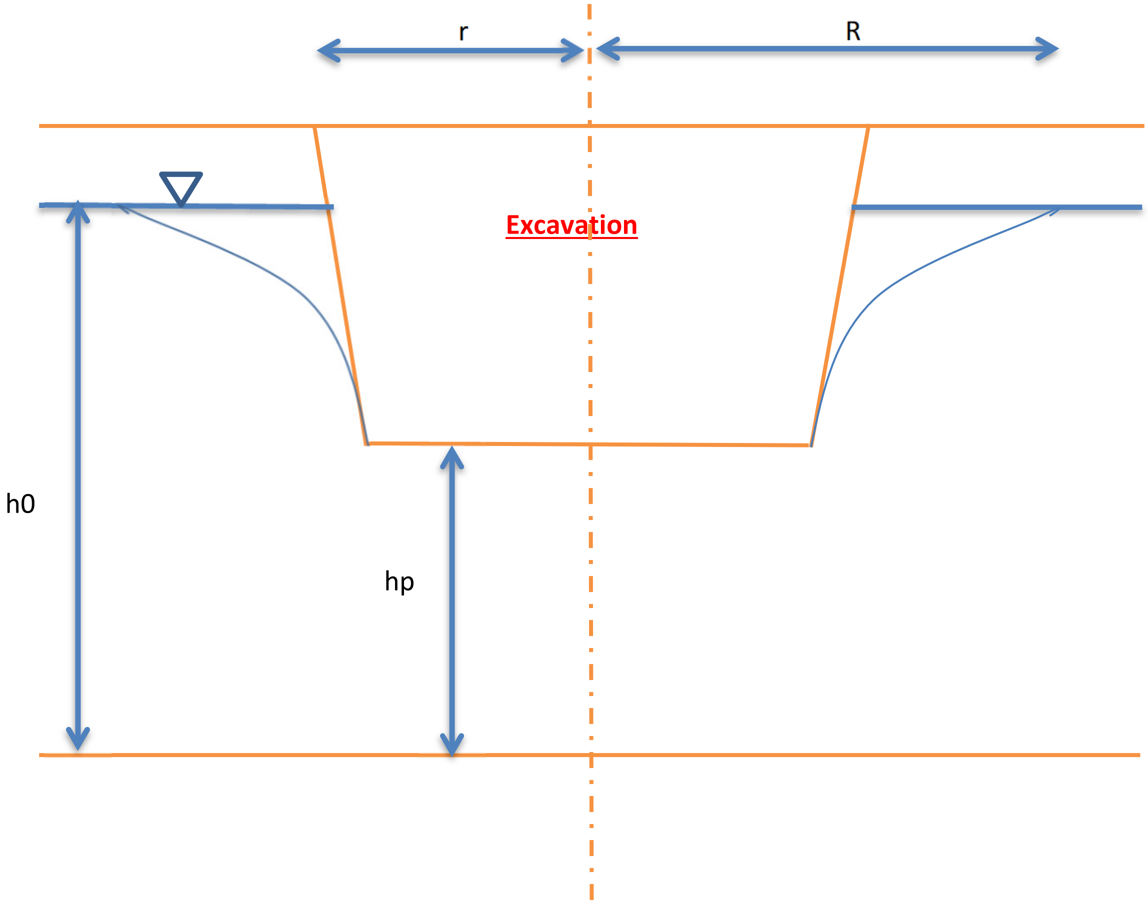
Excavation Length (Y) = 100 m

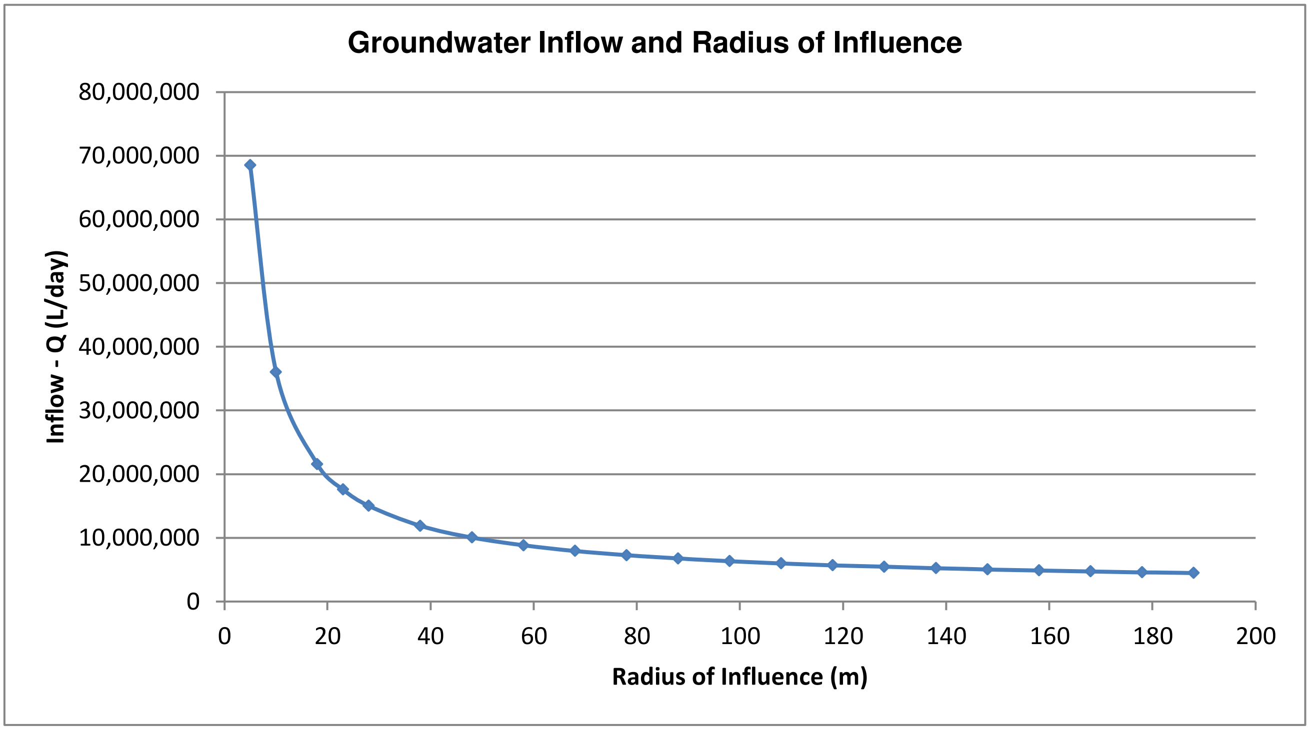
Perimeter Length = 328 m

Equivalent Radius (r) = 52.20 m

| R | Distance to edge of excavation |
|---|---|
| 62.20 | 10.00 |
| 70.20 | 18.00 |
| 80.20 | 28.00 |
| 90.20 | 38.00 |
| 100.20 | 48.00 |
| 110.20 | 58.00 |
| 120.20 | 68.00 |
| 130.20 | 78.00 |
| **140.20** | **88.00** |
| 150.20 | 98.00 |
| 160.20 | 108.00 |
| 170.20 | 118.00 |
| 180.20 | 128.00 |
| 190.20 | 138.00 |
| 200.20 | 148.00 |
| 210.20 | 158.00 |
| 220.20 | 168.00 |
| 230.20 | 178.00 |
| 240.20 | 188.00 |
| 250.20 | 198.00 |
| 260.20 | 208.00 |

| Q (m^3/s) | Q (m^3/day) | Q (L/day) |
|---|---|---|
| 0.5008 | 43,265 | 43,264,887 |
| 0.2962 | 25,596 | 25,595,676 |
| 0.2044 | 17,658 | 17,658,077 |
| 0.1605 | 13,864 | 13,864,389 |
| 0.1346 | 11,629 | 11,628,947 |
| 0.1175 | 10,148 | 10,148,436 |
| 0.1052 | 9,092 | 9,091,570 |
| 0.0960 | 8,297 | 8,296,638 |
| **0.0888** | **7,675** | **7,675,228** |
| 0.0830 | 7,175 | 7,174,878 |
| 0.0783 | 6,762 | 6,762,456 |
| 0.0743 | 6,416 | 6,415,994 |
| 0.0708 | 6,120 | 6,120,336 |
| 0.0679 | 5,865 | 5,864,684 |
| 0.0653 | 5,641 | 5,641,125 |
| 0.0630 | 5,444 | 5,443,730 |
| 0.0610 | 5,268 | 5,267,961 |
| 0.0591 | 5,110 | 5,110,288 |
| 0.0575 | 4,968 | 4,967,919 |
| 0.0560 | 4,839 | 4,838,618 |
| 0.0546 | 4,721 | 4,720,570 |


r
R
Excavation
h0
hp


Groundwater Inflow and Radius of Influence
Inflow - Q (L/day)
80,000,000
70,000,000
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
0
20
40
60
80
100
120
140
160
180
200
Radius of Influence (m)

## Estimated Groundwater Inflow

## Lansdowne Redevelopment - Building OPS/Storage - High groundwater

**Dupuit-Forchheimer Equation** **Q= πK((h0^2-hp^2)/ln(R/r))**

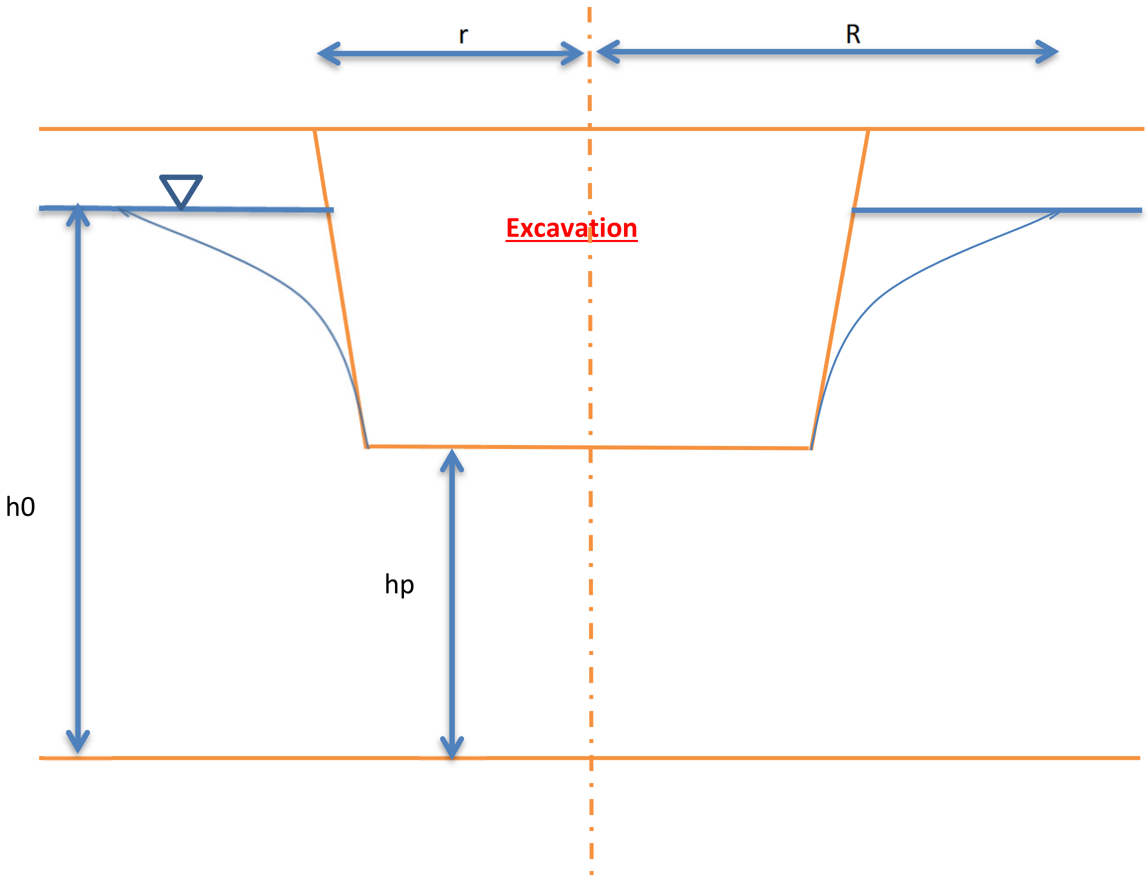
K (m/sec) = 6.00E-04
h0 (m) = 20
hp (m) = 18.8
r (m) = 22.28

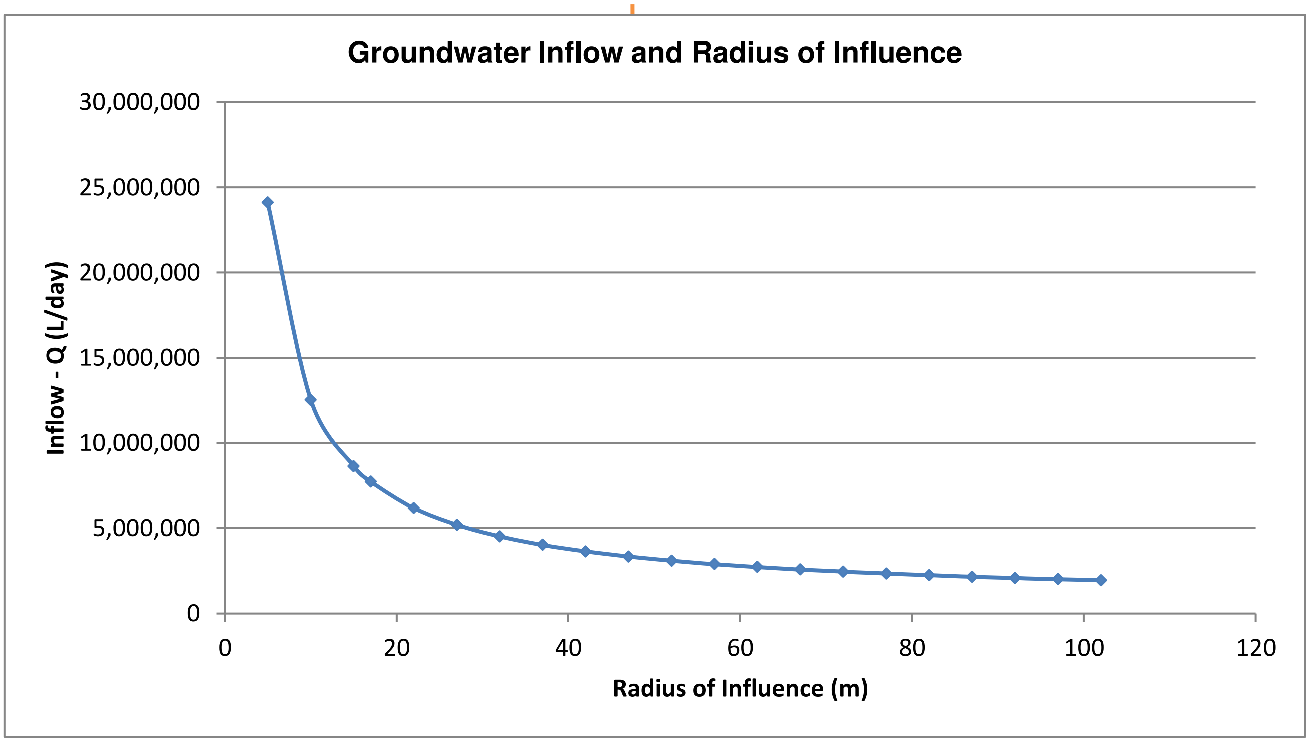
Equivalent Radius of Excavation = A+B=Pi + r

Excavation Width (X) = 30 m
Excavation Length (Y) = 40 m
Perimeter Length = 140 m
Equivalent Radius (r) = 22.28 m

| R | Distance to edge of excavation |
|---|---|
| 32.28 | 10.00 |
| 40.28 | 18.00 |
| 50.28 | 28.00 |
| 60.28 | 38.00 |
| 70.28 | 48.00 |
| 80.28 | 58.00 |
| 90.28 | 68.00 |
| 100.28 | 78.00 |
| **110.28** | **88.00** |
| 120.28 | 98.00 |
| 130.28 | 108.00 |
| 140.28 | 118.00 |
| 150.28 | 128.00 |
| 160.28 | 138.00 |
| 170.28 | 148.00 |
| 180.28 | 158.00 |
| 190.28 | 168.00 |
| 200.28 | 178.00 |
| 210.28 | 188.00 |
| 220.28 | 198.00 |
| 230.28 | 208.00 |

| Q (m^3/s) | Q (m^3/day) | Q (L/day) |
|---|---|---|
| 0.2367 | 20,453 | 20,453,346 |
| 0.1482 | 12,806 | 12,805,882 |
| 0.1078 | 9,317 | 9,316,864 |
| 0.0882 | 7,619 | 7,618,859 |
| 0.0764 | 6,601 | 6,600,910 |
| 0.0685 | 5,916 | 5,915,829 |
| 0.0627 | 5,419 | 5,419,479 |
| 0.0583 | 5,041 | 5,041,005 |
| **0.0549** | **4,741** | **4,741,386** |
| 0.0521 | 4,497 | 4,497,301 |
| 0.0497 | 4,294 | 4,293,915 |
| 0.0477 | 4,121 | 4,121,323 |
| 0.0460 | 3,973 | 3,972,644 |
| 0.0445 | 3,843 | 3,842,943 |
| 0.0432 | 3,729 | 3,728,579 |
| 0.0420 | 3,627 | 3,626,809 |
| 0.0409 | 3,536 | 3,535,519 |
| 0.0400 | 3,453 | 3,453,055 |
| 0.0391 | 3,378 | 3,378,103 |
| 0.0383 | 3,310 | 3,309,603 |
| 0.0376 | 3,247 | 3,246,691 |


r
R
Excavation
h0
hp


Groundwater Inflow and Radius of Influence
Inflow - Q (L/day)
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
0
20
40
60
80
100
120
Radius of Influence (m)

# APPENDIX 4

Trinity – Lansdowne Park Redevelopment Drawings Feb 9,2023

Trinity – Lansdowne Park – Revised Podium Concept (No Music Hall) Aug 17,2023

# LANSDOWNE PARK REDEVELOPMENT

## AREA SUMMARY:

| LEVEL | RESI TGFA | | | | RETAIL GFA | MULTI-STOREY ENTERTAINMENT VENUE | COMMERCIAL RETAIL | NORTH STANDS GFA |
|---|---|---|---|---|---|---|---|---|
| | PODIUM (6 STY) (SF) | TOWER 1 (40 STY) (SF) | TOWER 2 (34 STY) (SF) | TOWER 3 (29 STY) (SF) | (SF) | (SF) | (SF) | (SF) |
| LVL P1 | | 691 | 1,146 | 847 | 1,504 | 17,499 | | 14,400 |
| LVL 01 | | 5,935 | 4,621 | 4,683 | 27,599 | 14,184 | | 48,520 |
| LVL 01.5 | | 568 | 464 | 4,683 | | | | 33,253 |
| LVL 02 | | 763 | 802 | 12,453 | 50,073 | | 8,089 | 42,300 |
| LVL 03 | 37,279 | | | 10,490 | | | | 40,423 |
| LVL 04 | 37,147 | | | 10,490 | | | | 6,740 |
| LVL 05 | 37,147 | | | 10,490 | | | | |
| LVL 06 | 37,147 | | | 10,490 | | | | |
| LVL 07 | | 14,246 | 13,943 | 8,331 | | | | |
| LVL 08-27 | | 192,780 | 192,780 | 166,620 | | | | |
| LVL 28-29 | | 19,278 | 19,278 | 16,662 | | | | |
| LVL 30-34 | | 48,195 | 48,195 | | | | | |
| LVL 35-40 | | 57,834 | | | | | | |
| | **148,720** | **340,290** | **281,229** | **256,239** | **79,176** | **31,683** | **8,089** | **185,636** |
| **TOTAL TGFA** | **1,331,062** | | | | | | | |

| UNIT COUNT PER FLOOR | | | |
|---|---|---|---|
| PODIUM (6 STY) | TOWER 1 (40 STY) | TOWER 2 (34 STY) | TOWER 3 (29 STY) |
| | | | |
| | | | |
| | | | |
| | | | |
| 33 | | | 12 |
| 42 | | | 12 |
| 42 | | | 12 |
| 42 | | | 12 |
| | | | 12 |
| | 260 | 260 | 200 |
| | 26 | 26 | |
| | 65 | 65 | |
| | 78 | | |
| **159** | **429** | **351** | **260** |
| **TOTAL UNITS** | **1,199** | | |

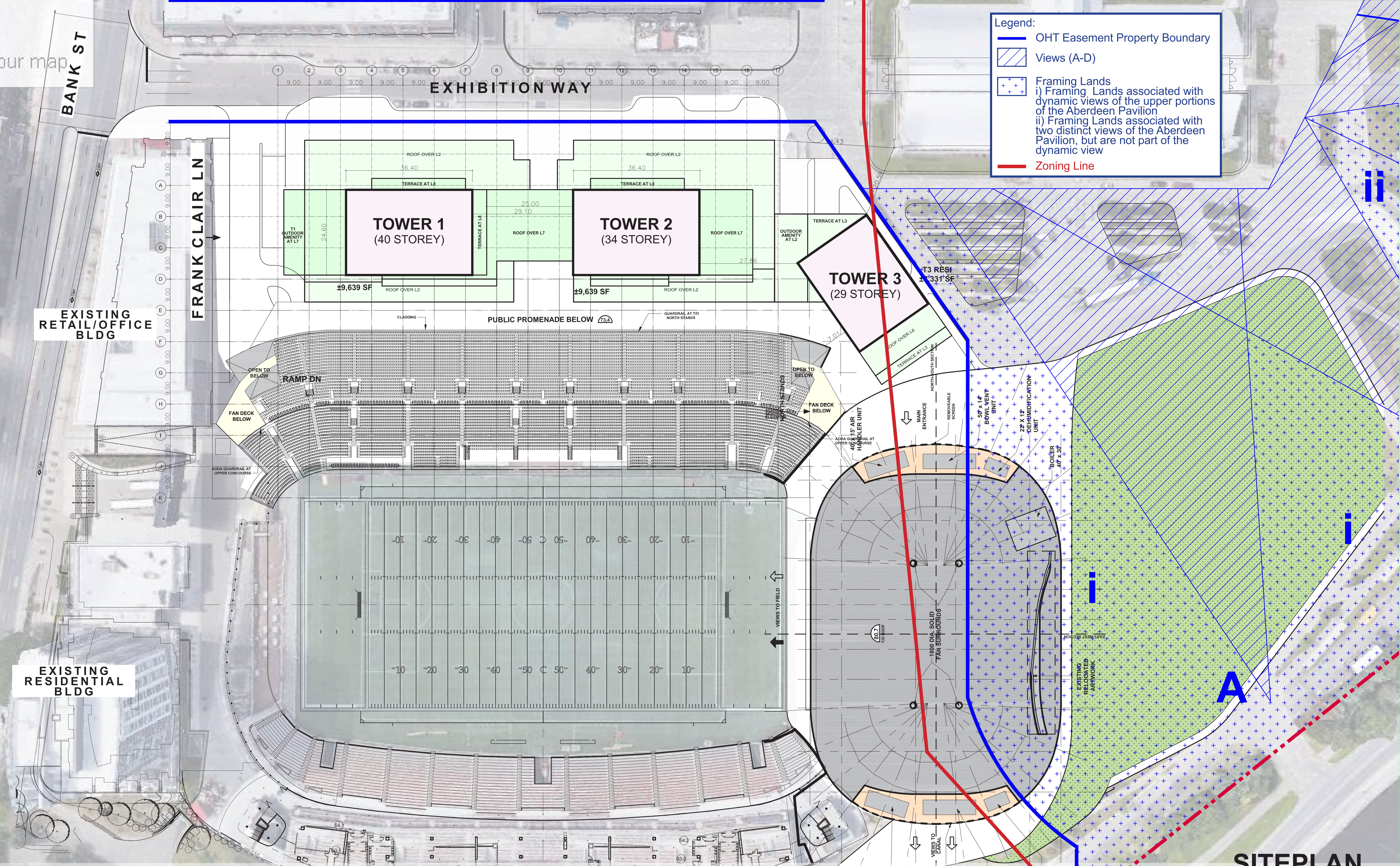
| TGFA SUMMARY | |
|---|---|
| AREA | (SF) |
| RESI | 1,026,478 |
| RETAIL | 79,176 |
| ENT. VENUE | 31,683 |
| COMM'L RETAIL | 8,089 |
| NORTH STANDS* | 185,636 |
| TOTAL TGFA | 1,331,062 |

| | |
|---|---|
| ARENA | 160,000 |
| TOTAL incl. ARENA | 1,491,062 |

*Note:*
*Residential units*
*approx.700sf average size*

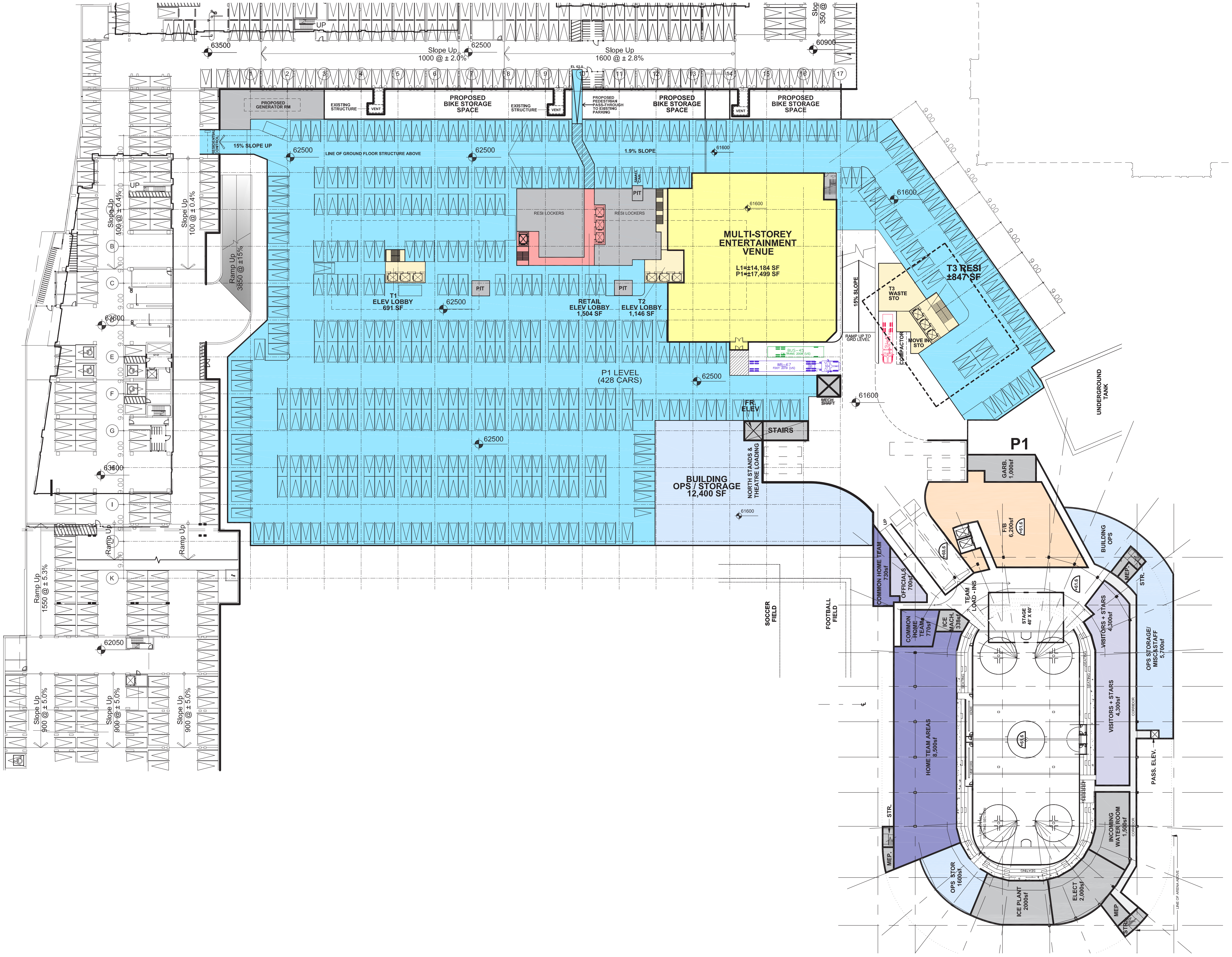
## PARKING SUMMARY:

| WEST PARKING | | | | |
|---|---|---|---|---|
| AREA | RATIO | (SF) | PARKING REQUIRED | PARKING PROVIDED |
| SPORTS FIELD | - | 12,000 seats | ALREADY INCL. IN EXISTING PARKING | *** INCL. IN EXISTING PARKING |
| RETAIL/ ENTERTAINMENT VENUE | 1.25 per 100 SM (1,076 SF) GFA | 110,859 | ALREADY INCL. IN EXISTING PARKING | *** INCL. IN EXISTING PARKING |
| DWELLING IN MIXED USE BUILDING | 0.51 per DU T1+T2 (rental) | approx 950 units | 481 | 481 |
| | 1.00 per DU T3 (condo) | approx 258 units | 258 | 258 |
| **TOTAL** | | | **739** | **739** |



## LANSDOWNE PARK REDEV

## SITEPLAN
## Showing OHT Setting Lands, Views & Framing Lands



**PARKING COUNT :**

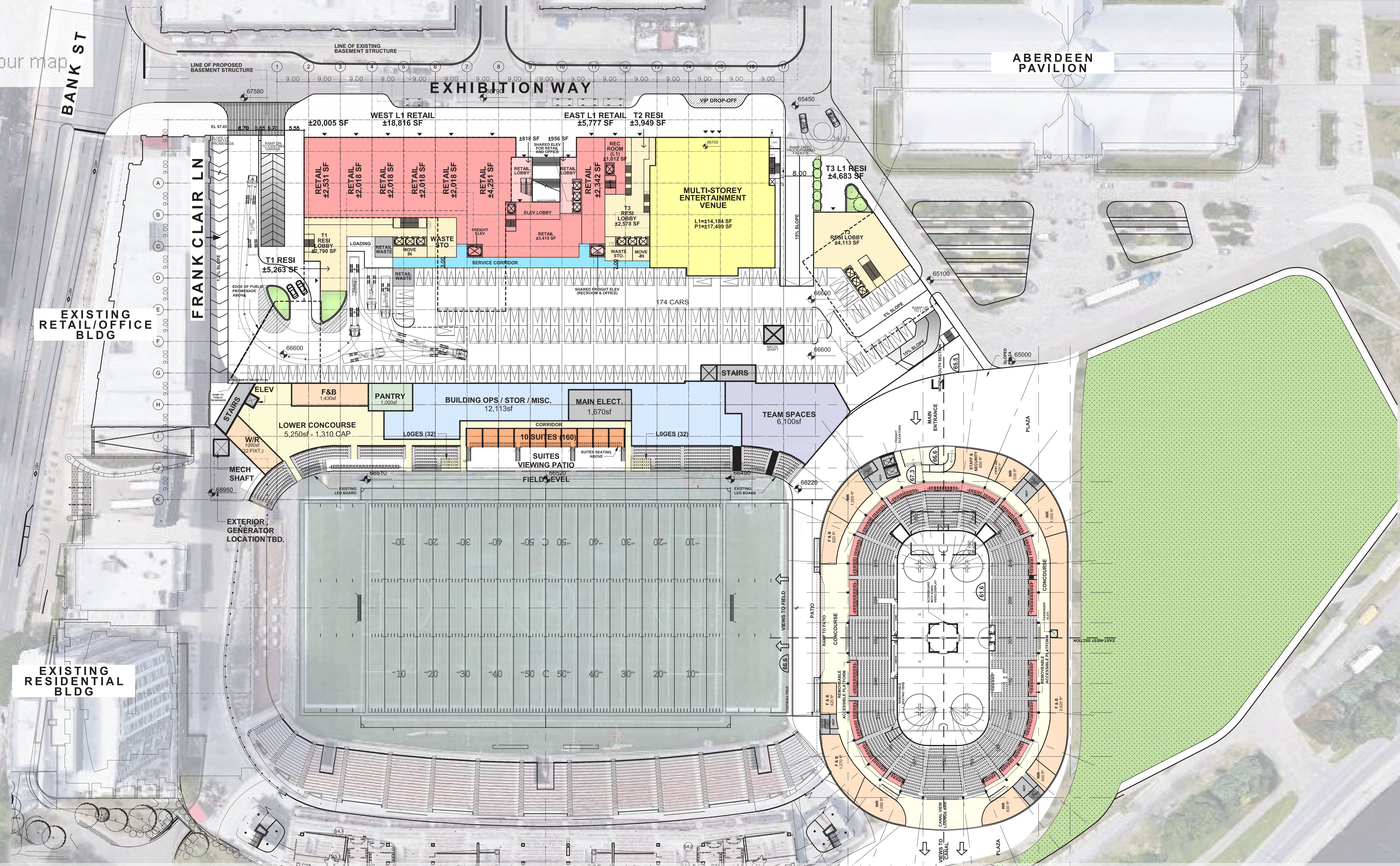
| | NORTH STANDS |
|---|---|
| L1 | 174 |
| L1.5 (mezz) | 149 |
| P1 | 423 |
| TOTAL PARKING | 746 |

TRINITY

# LANSDOWNE PARK REDEV

February 9, 2023

**P1**

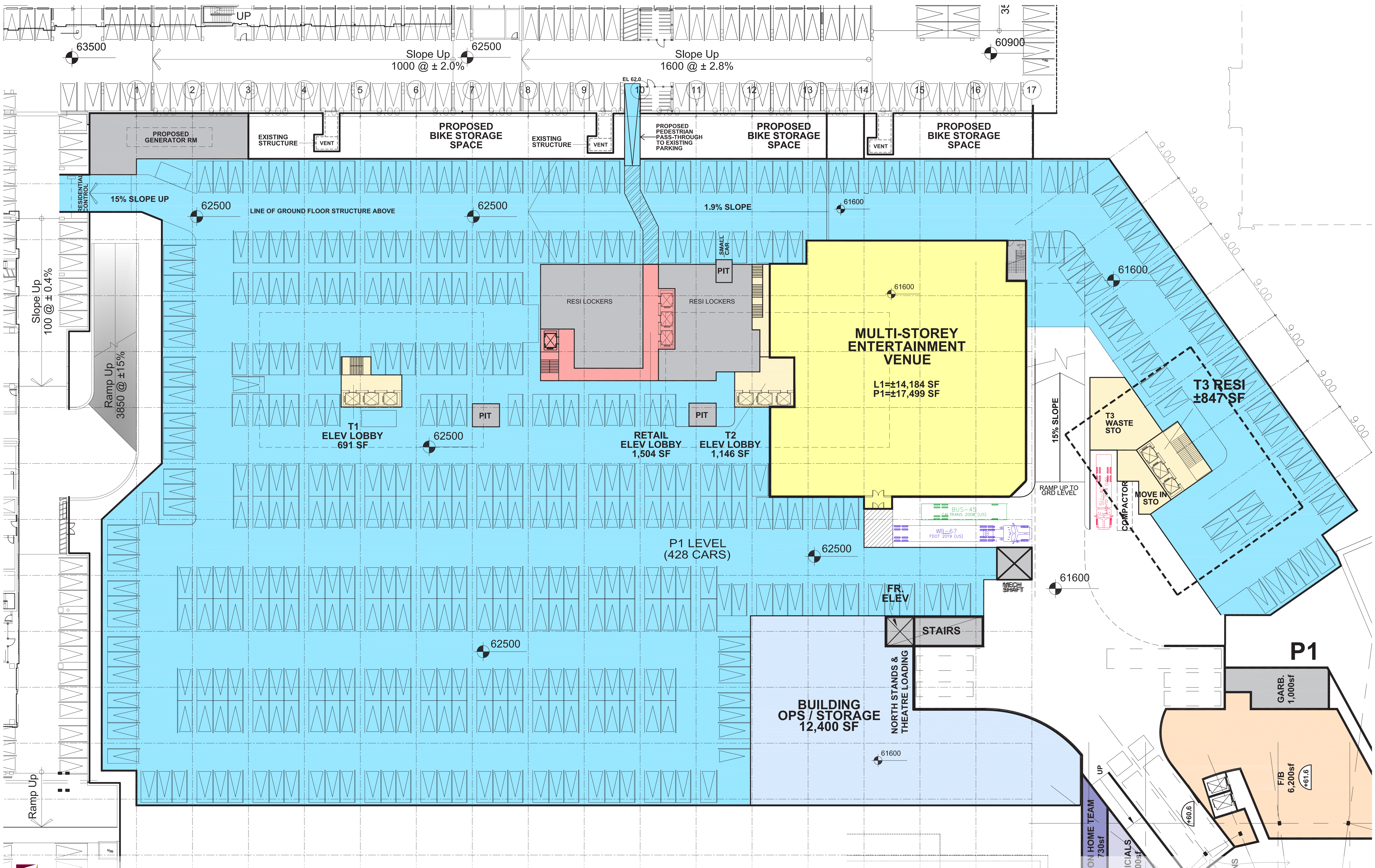


**TRINITY**

# LANSDOWNE PARK REDEV

February 9, 2023

L1

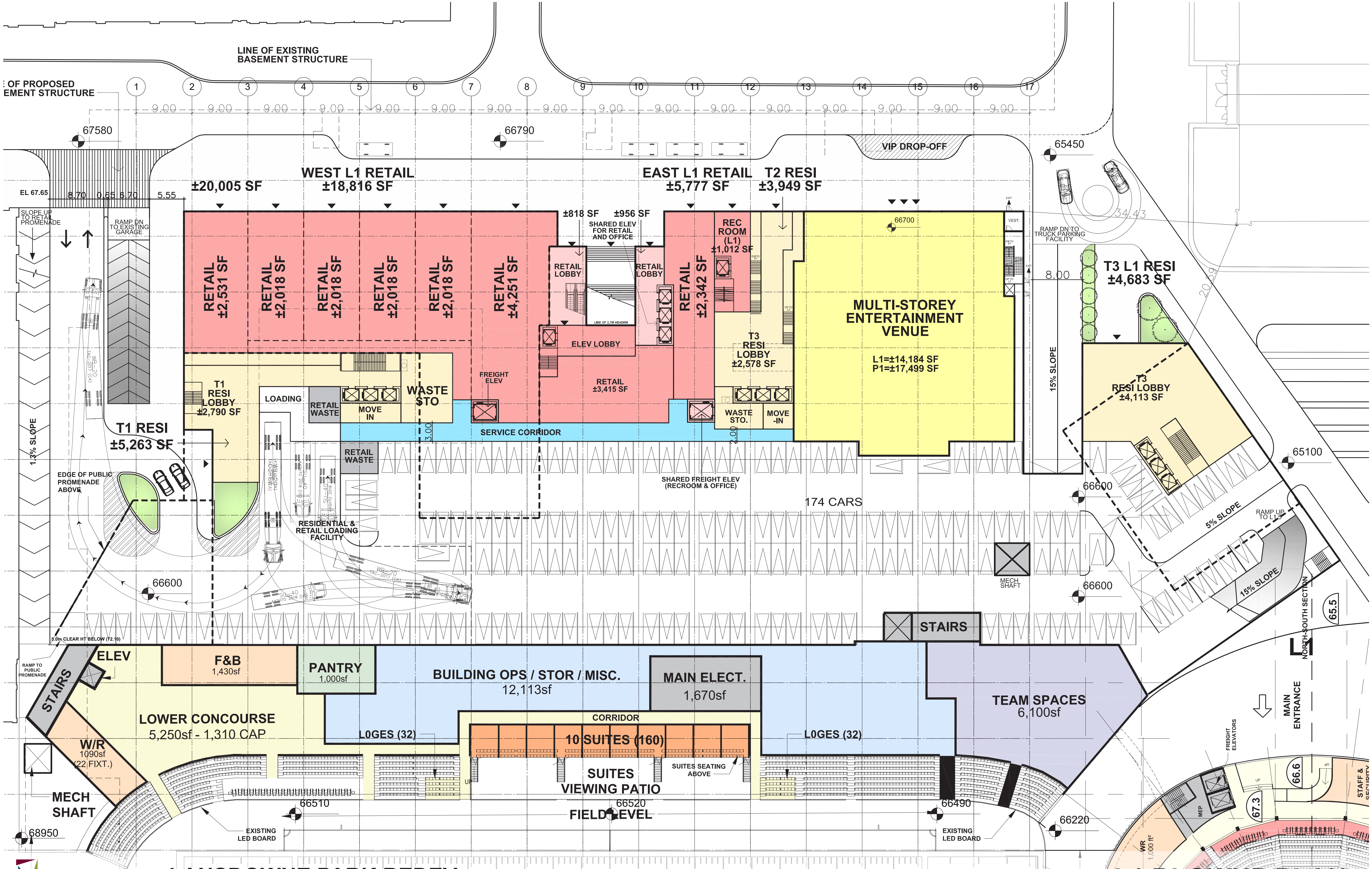


TRINITY

## LANSDOWNE PARK REDEV

February 9, 2023

## P1 BLOWUP PLAN

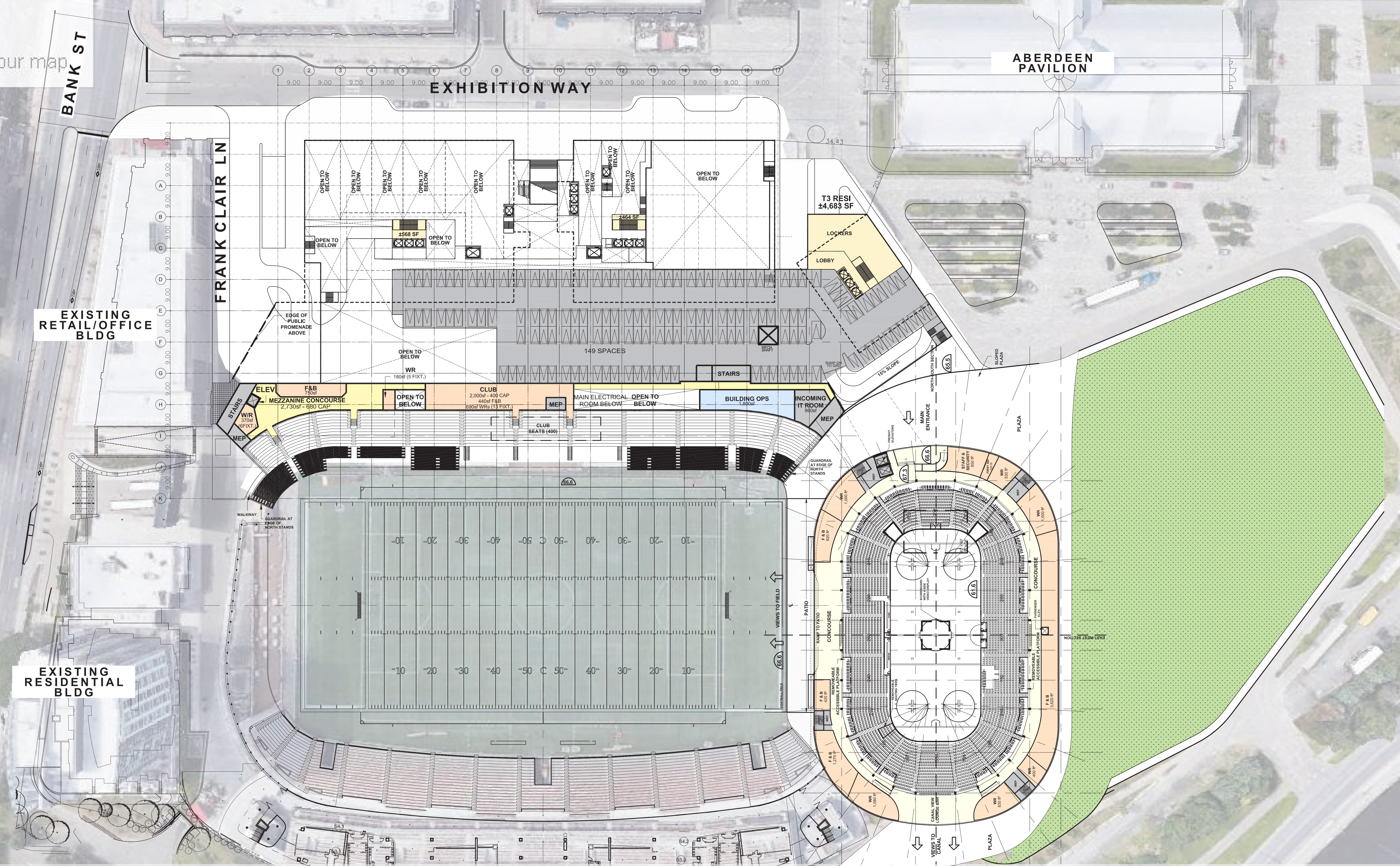


TRINITY

# LANSDOWNE PARK REDEV

February 9, 2023

# L1 BLOWUP PLAN

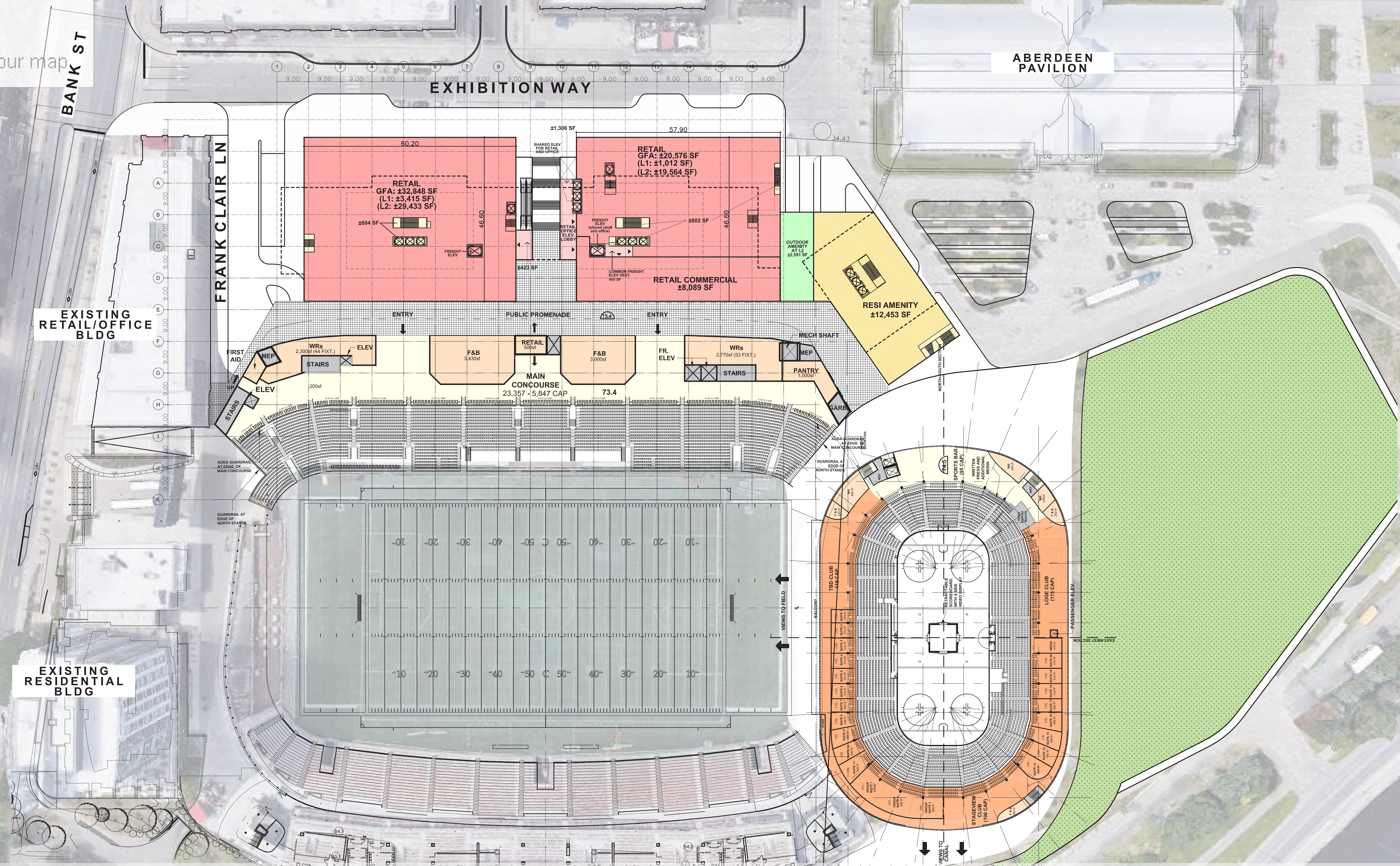


**TRINITY**

# LANSDOWNE PARK REDEV

February 9, 2023

## L1.5 MEZZ

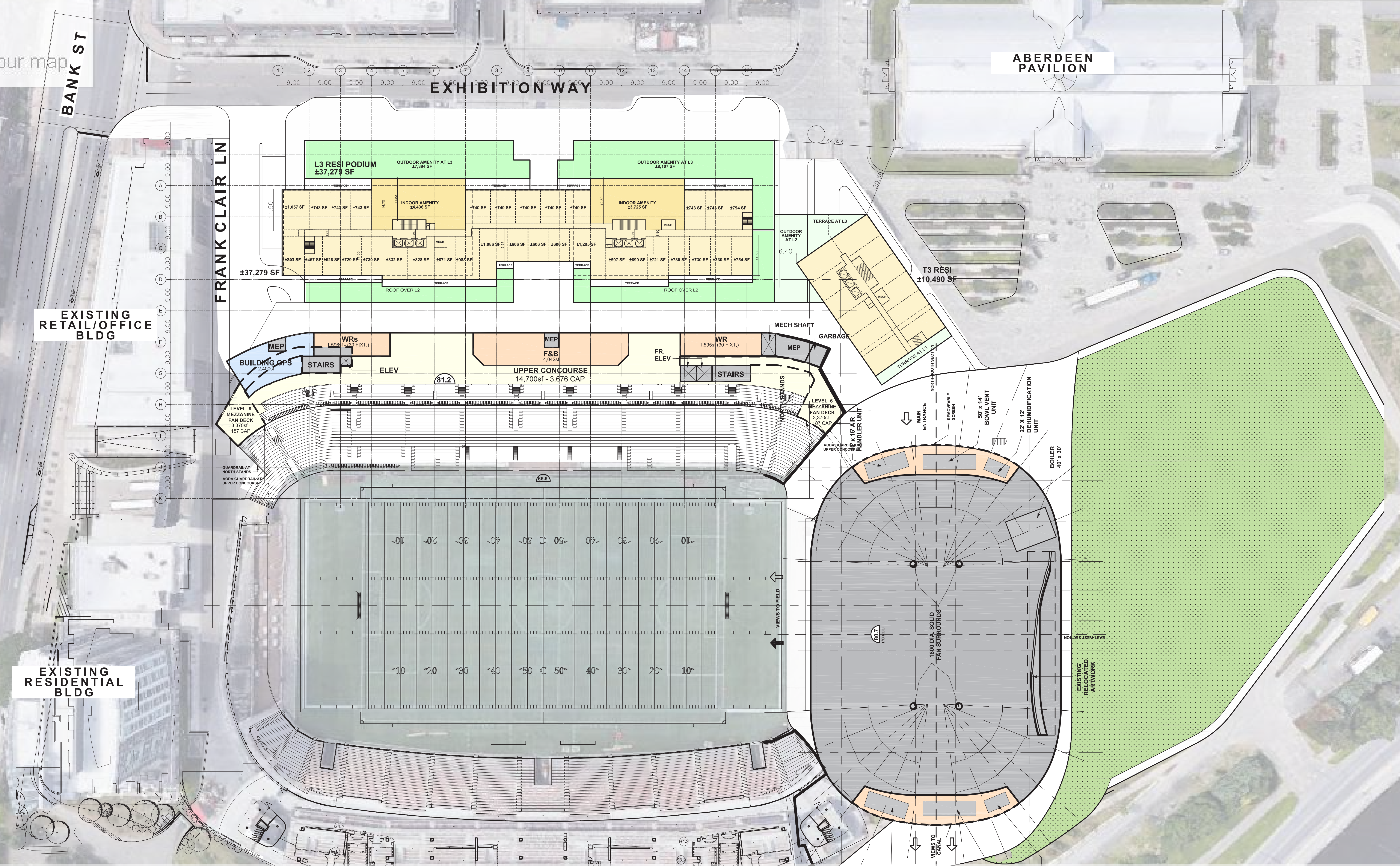


TRINITY

# LANSDOWNE PARK REDEV

February 9, 2023

**L2**

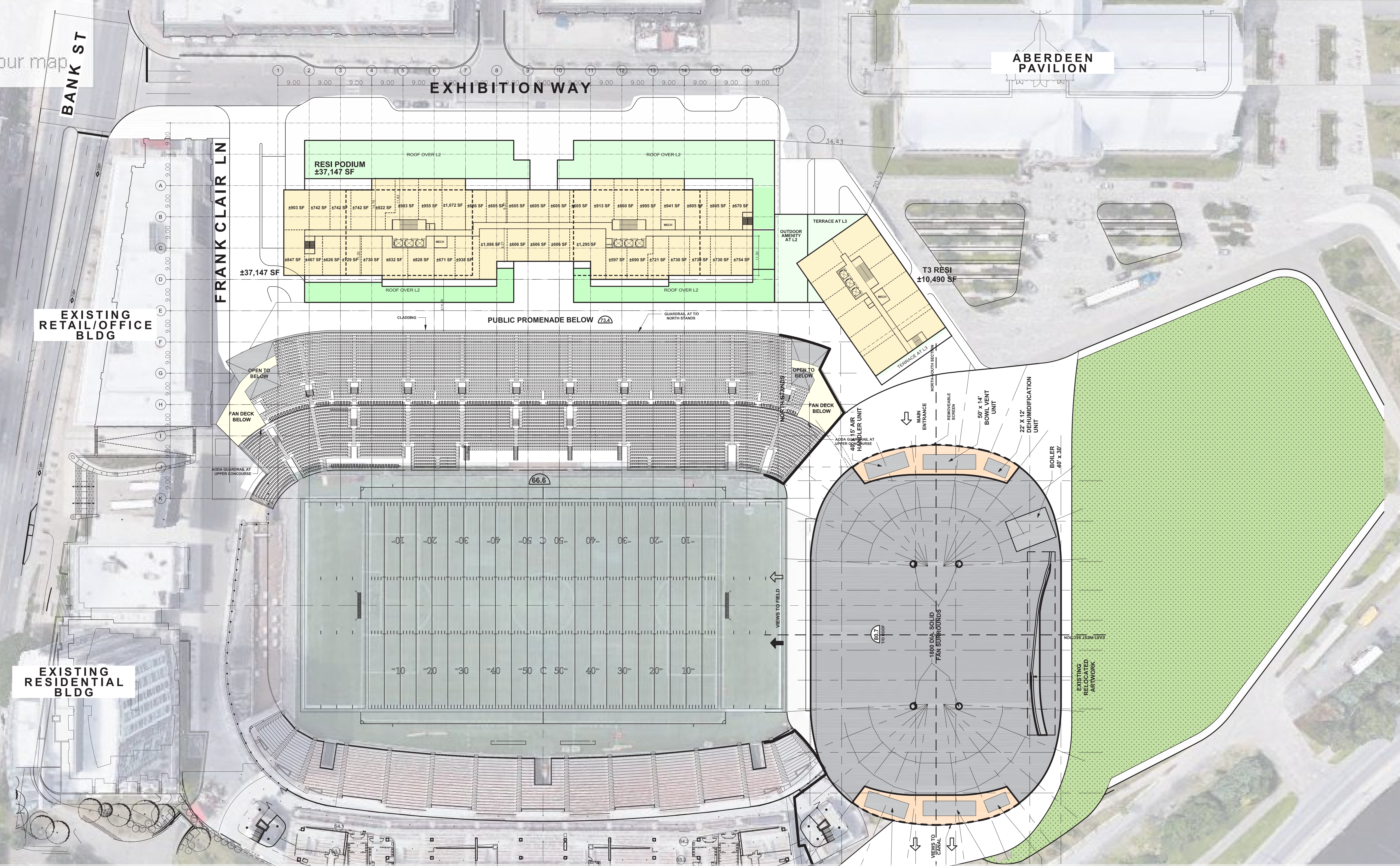


TRINITY

# LANSDOWNE PARK REDEV

February 9, 2023

L3

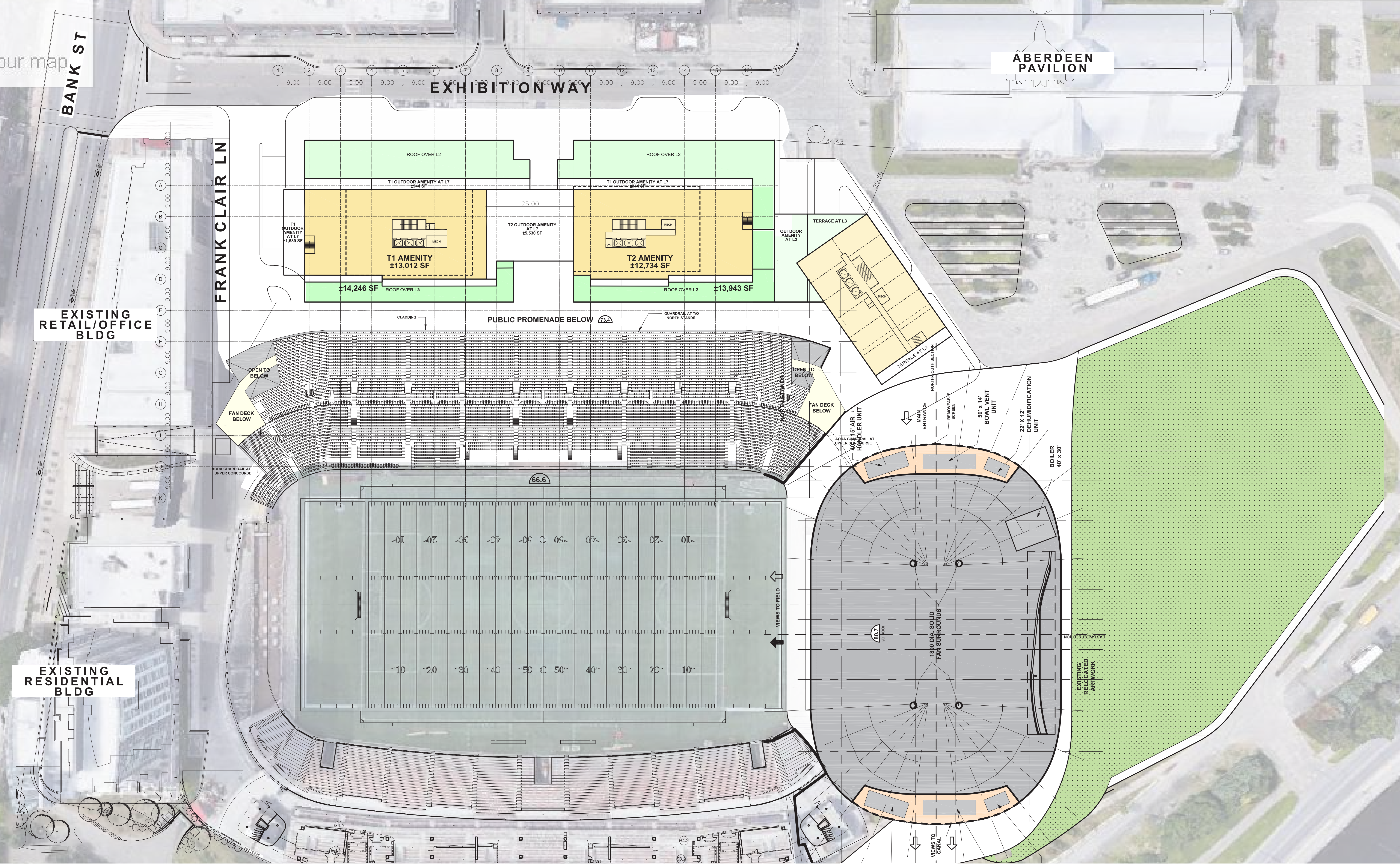


TRINITY

# LANSDOWNE PARK REDEV

February 9, 2023

**L4-L6** 10

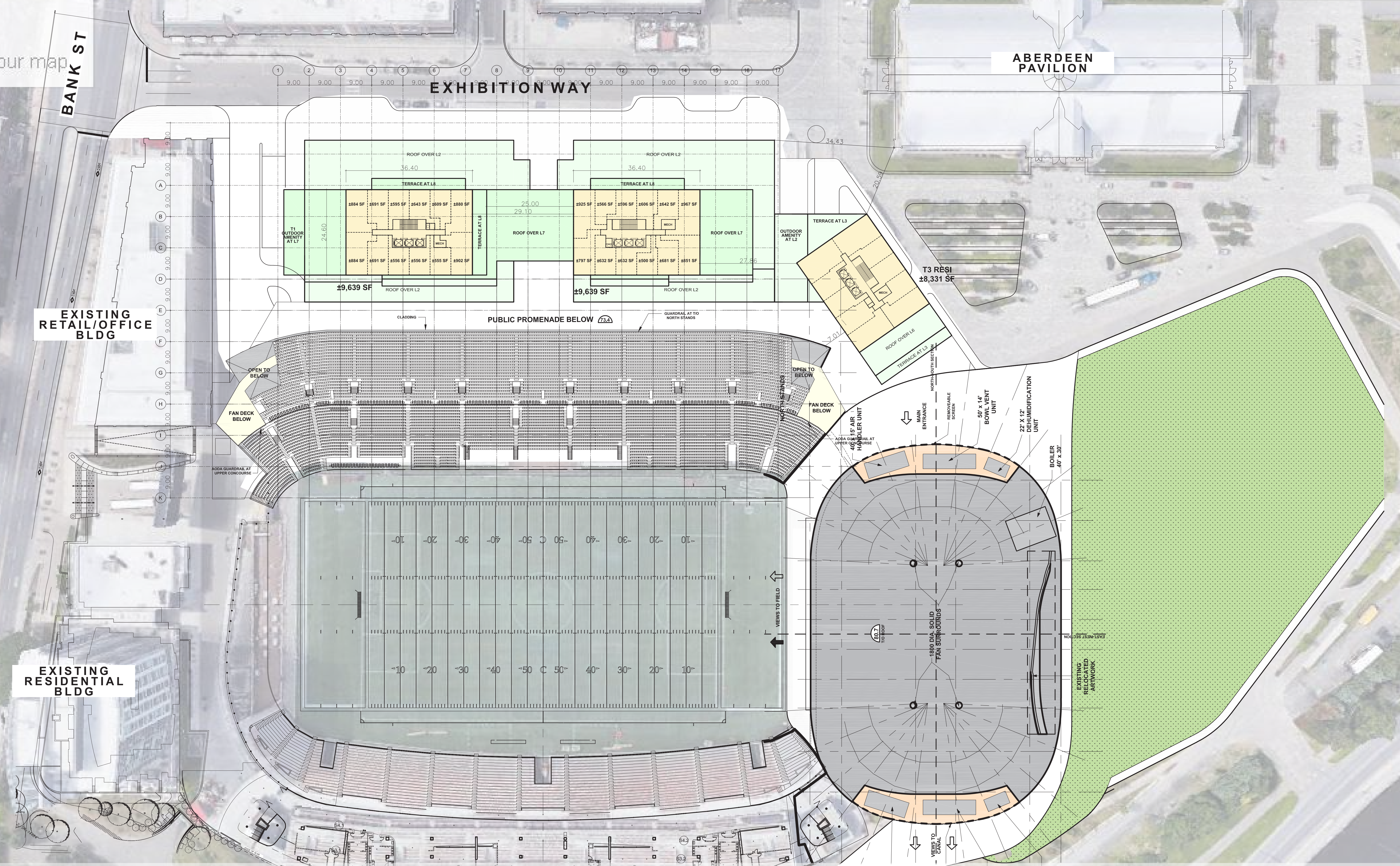


**TRINITY**

## LANSDOWNE PARK REDEV

February 9, 2023

**L7**

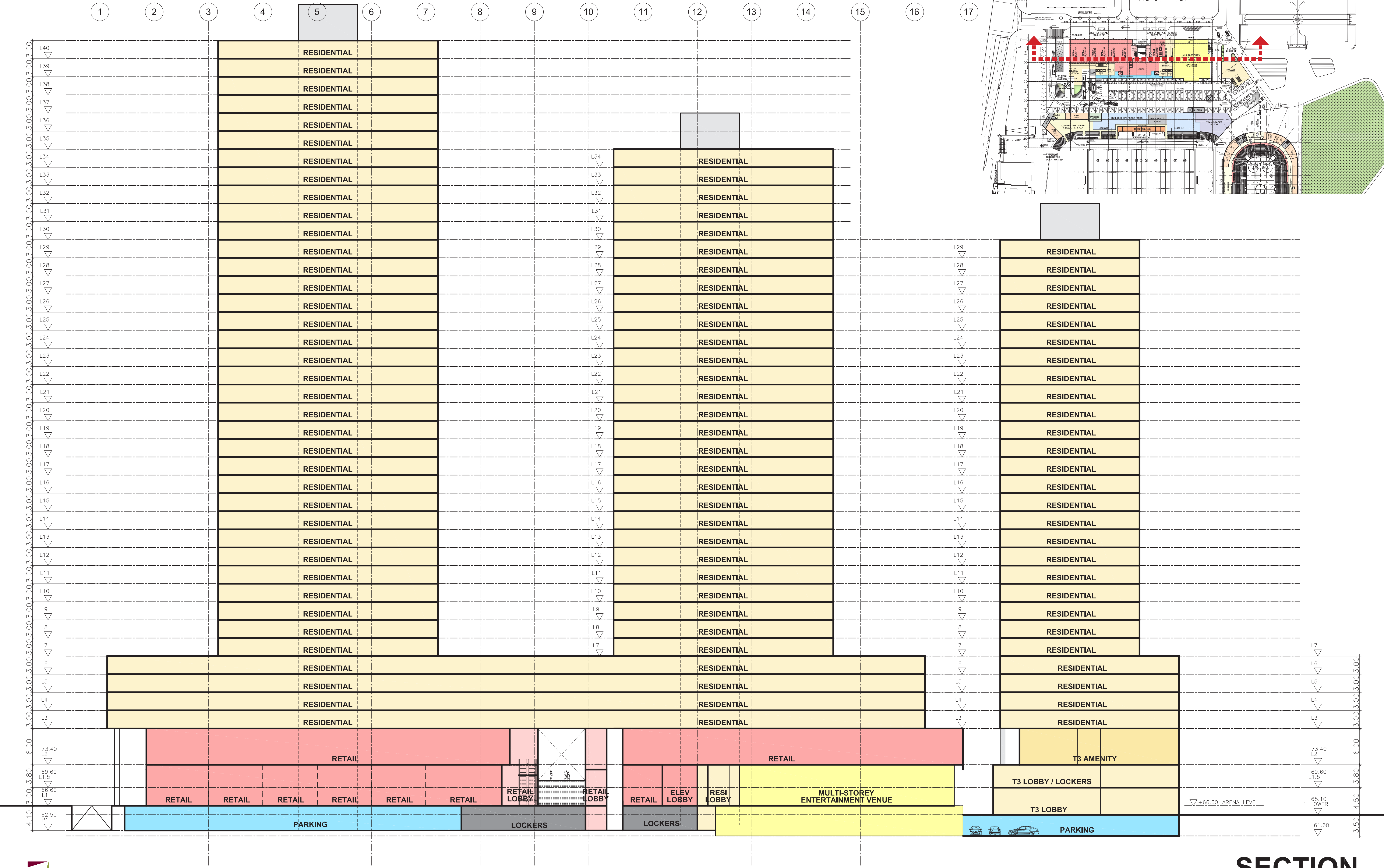


TRINITY

**LANSDOWNE PARK REDEV**

February 9, 2023

**TYP TOWER**

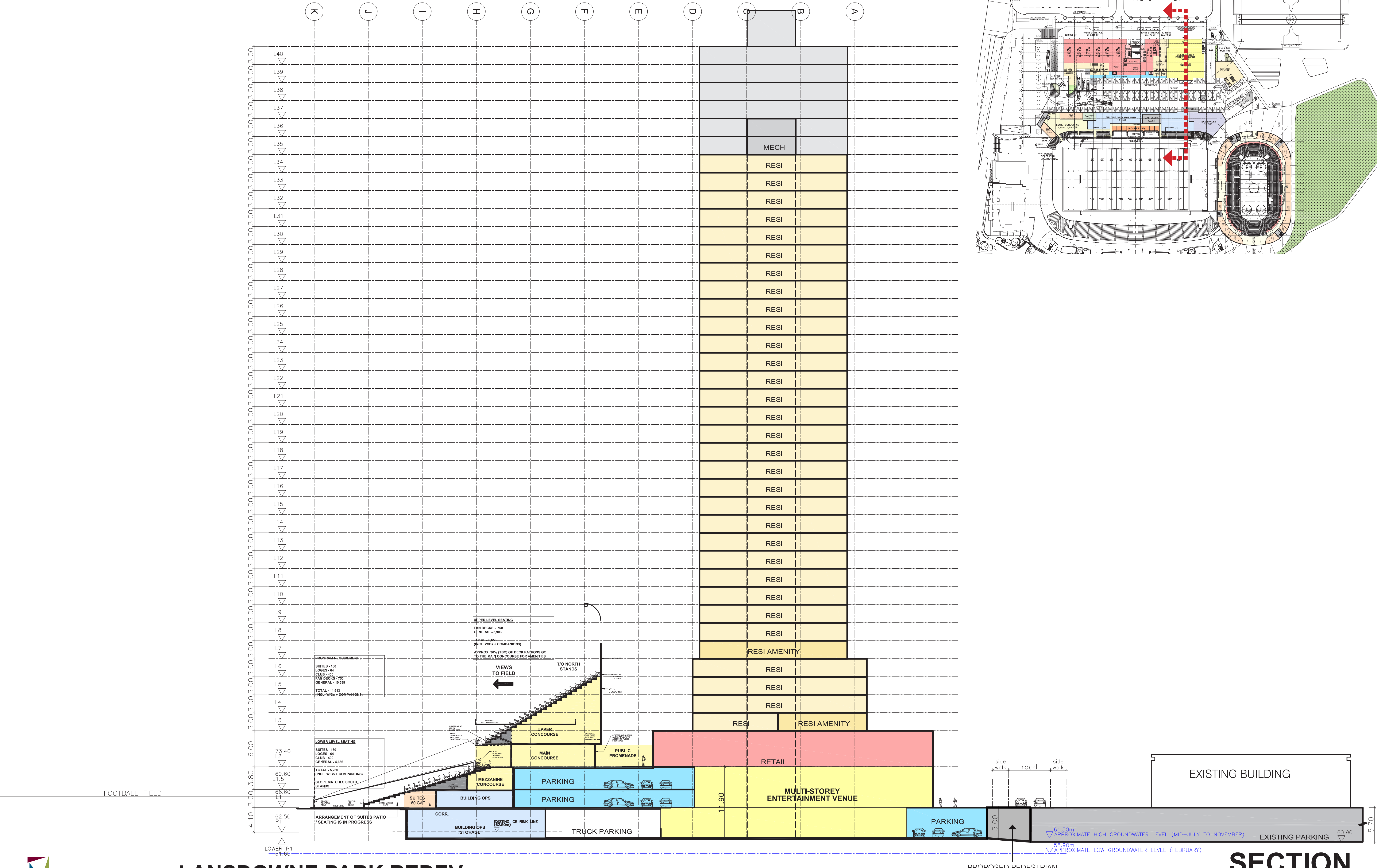


TRINITY

# LANSDOWNE PARK REDEV

February 9, 2023

# SECTION



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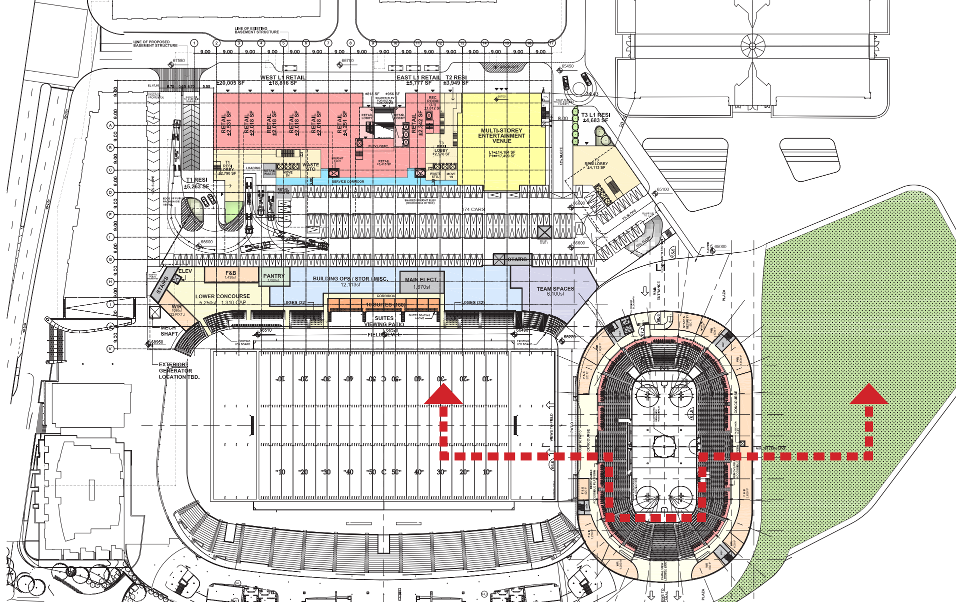
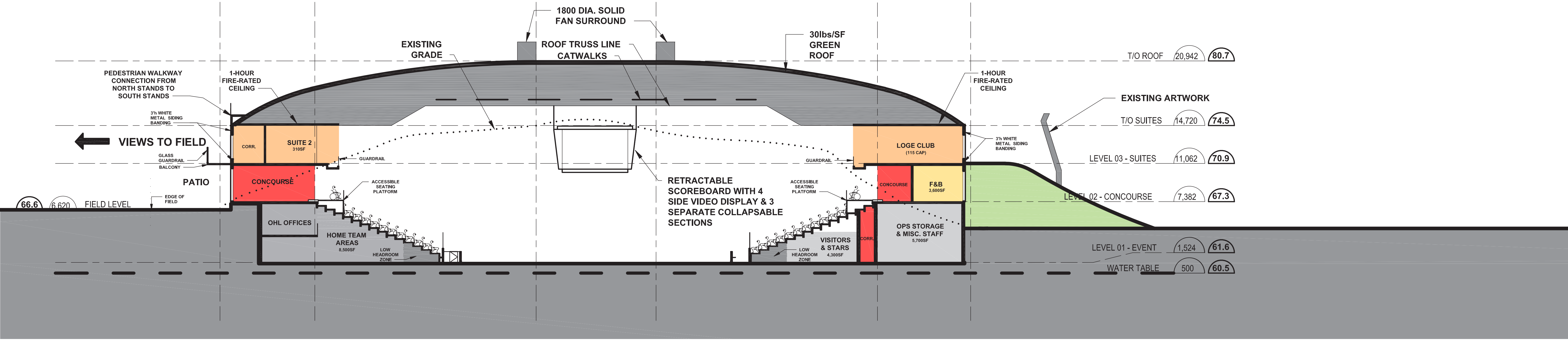
# LANSDOWNE PARK REDEV

February 9, 2023

## SECTION





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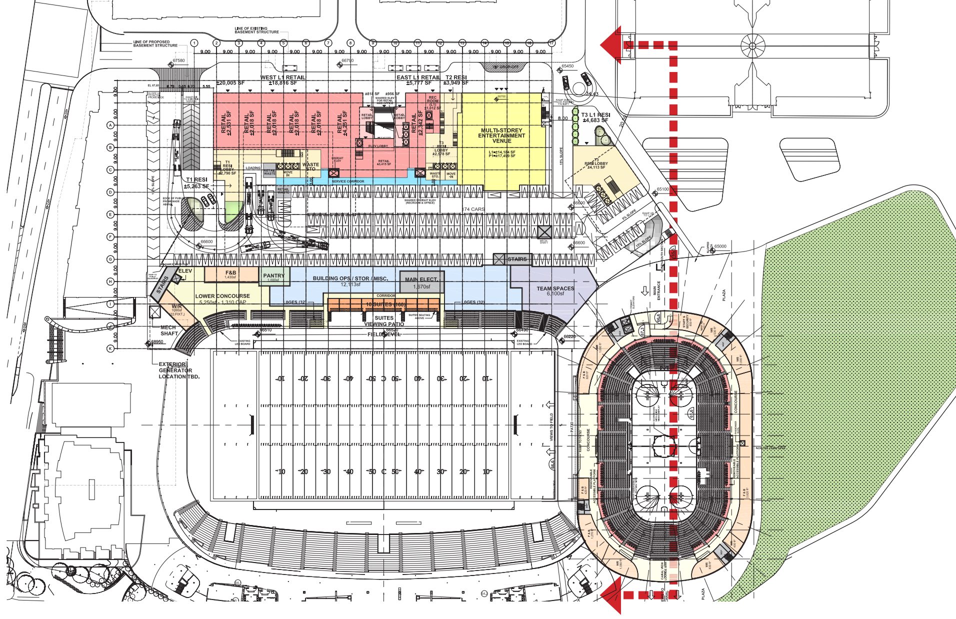
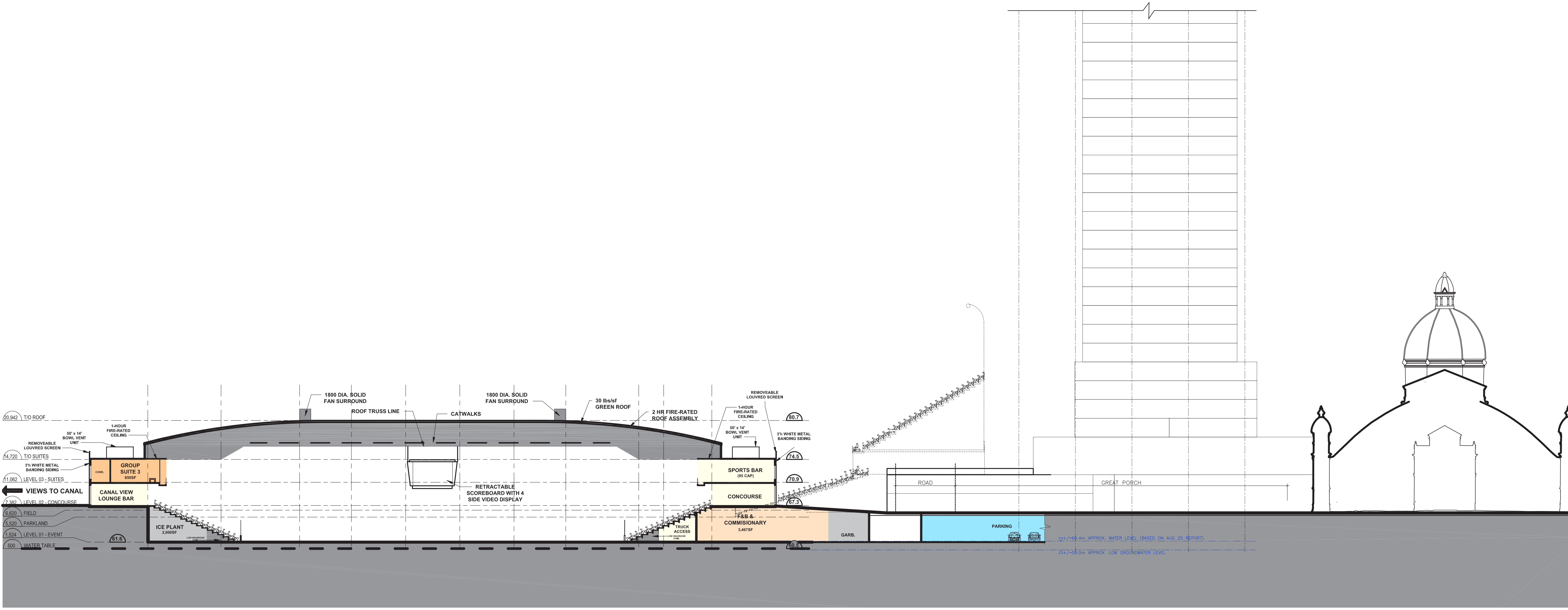
# LANSDOWNE PARK REDEV

February 9, 2023

# SECTION ACROSS ARENA





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# LANSDOWNE PARK REDEV

February 9, 2023

# SECTION ACROSS PROPOSED ARENA & ABERDEEN

Legend:

- — — OHT Easement Property Boundary
- — — Views (A-D)
- (i) Framing Lands associated with dynamic views of the upper portions of the Aberdeen Pavilion
  ii) Framing Lands associated with two distinct views of the Aberdeen Pavilion, but are not part of the dynamic view

# ARENA AERIAL VIEW

## Showing OHT Setting Lands, Views & Framing Lands

# LANSDOWNE PARK REDEVELOPMENT

## AREA SUMMARY:

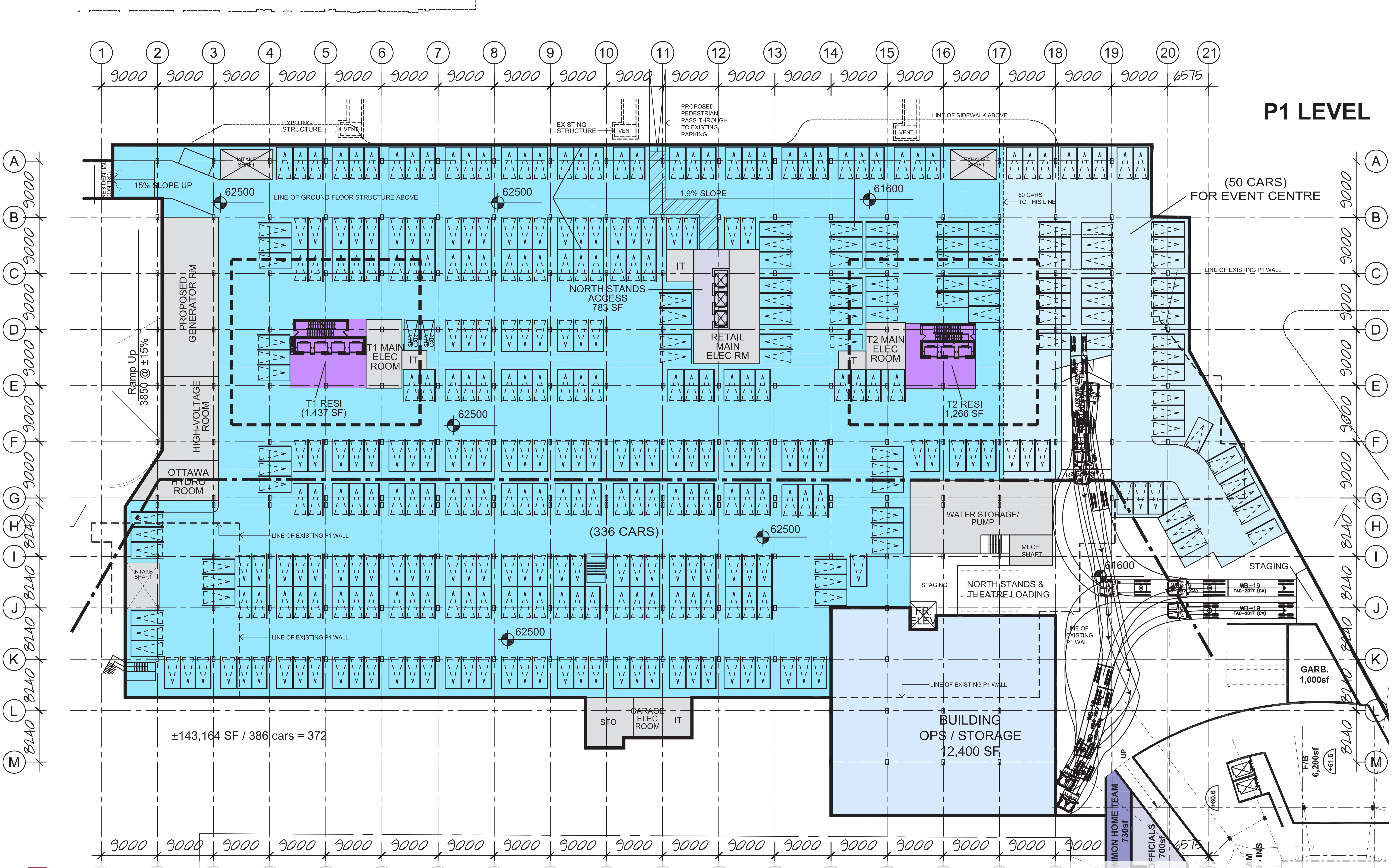
| LEVEL | RESI TGFA | | | SHARED SERVICE & COMMON AREAS | RETAIL GFA | NORTH STANDS ACCESS | NORTH STANDS GFA | OSEG OFFICE |
|---|---|---|---|---|---|---|---|---|
| | PODIUM (SF) | TOWER 1 (40 STY) (SF) | TOWER 2 (25 STY) (SF) | (SF) | (SF) | (SF) | (SF) | (SF) |
| LVL P1 | | 1,437 | 1,266 | | | 783 | 14,400 | |
| LVL 01 | | 6,011 | 6,896 | 3,086 | 23,979 | 1,460 | 48,520 | 29,086 |
| LVL 02 | | 676 | 17,378 | | 25,656 | 1,680 | 33,253 | |
| LVL 03 | 34,592 | | | | | | 50,000 | |
| LVL 04 | 34,592 | | | | | | 40,423 | |
| LVL 05 | | 8,815 | 8,613 | | | | 6,740 | |
| LVL 06 | | 8,815 | 8,613 | | | | | |
| LVL 07-25 | | 167,485 | 163,647 | | | | | |
| LVL 26-40 | | 132,225 | | | | | | |
| | **69,184** | **325,464** | **206,413** | **3,086** | **49,635** | **3,923** | **193,336** | **29,086** |
| **TOTAL TGFA** | **880,127** | | | | | | | |

| LEVEL | UNIT COUNT PER FLOOR | | |
|---|---|---|---|
| | PODIUM | TOWER 1 (40 STY) | TOWER 2 (25 STY) |
| LVL P1 | | | |
| LVL 01 | | | |
| LVL 02 | | | amenity |
| LVL 03 | 46 | | |
| LVL 04 | 46 | | |
| LVL 05 | | amenity | 12 |
| LVL 06 | | amenity | 12 |
| LVL 07-25 | | 228 | 228 |
| LVL 26-40 | | 180 | |
| | **92** | **408** | **252** |
| **TOTAL UNITS** | **752** | | |

| TGFA SUMMARY | | |
|---|---|---|
| A | **PODIUM (P1 L1, L2)** | **72,930** |
| | A.1) Retail | *49,635* |
| | A.2) Residential | *16,286* |
| | A.3) North Stands Access Lobbies | *3,923* |
| | A.4) Service and Common Areas | *3,086* |
| B | **TOWER** | **584,775** |
| | B.1) Tower 1 (L2-L40) | *351,932* |
| | B.2) Tower 2 (L2-L25) | *232,843* |
| C | **NORTH STANDS** | **222,422** |
| | C.1) Stadium | *193,336* |
| | C.2) OSEG Office | *25,000* |
| | C.3) Exit Corridor | *4,086* |
| D | **ARENA** | **160,000** |
| | **TOTAL** | **1,040,127** |

Notes:
1) Total no. of units is 752
2) Parking total: 386
   - Residential parking ratio at 0.45 (336 cars)
   - 50 parking spaces alloted to Events Centre
3) Driveway/open space area (26,708 sf) at level 1 is not included in total area summary
4) Underground parking area at 143,164 sf, excluding residential and retail vestibules, lobbies, and exit stairs

# P1 LEVEL



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**LANSDOWNE PARK REDEV**

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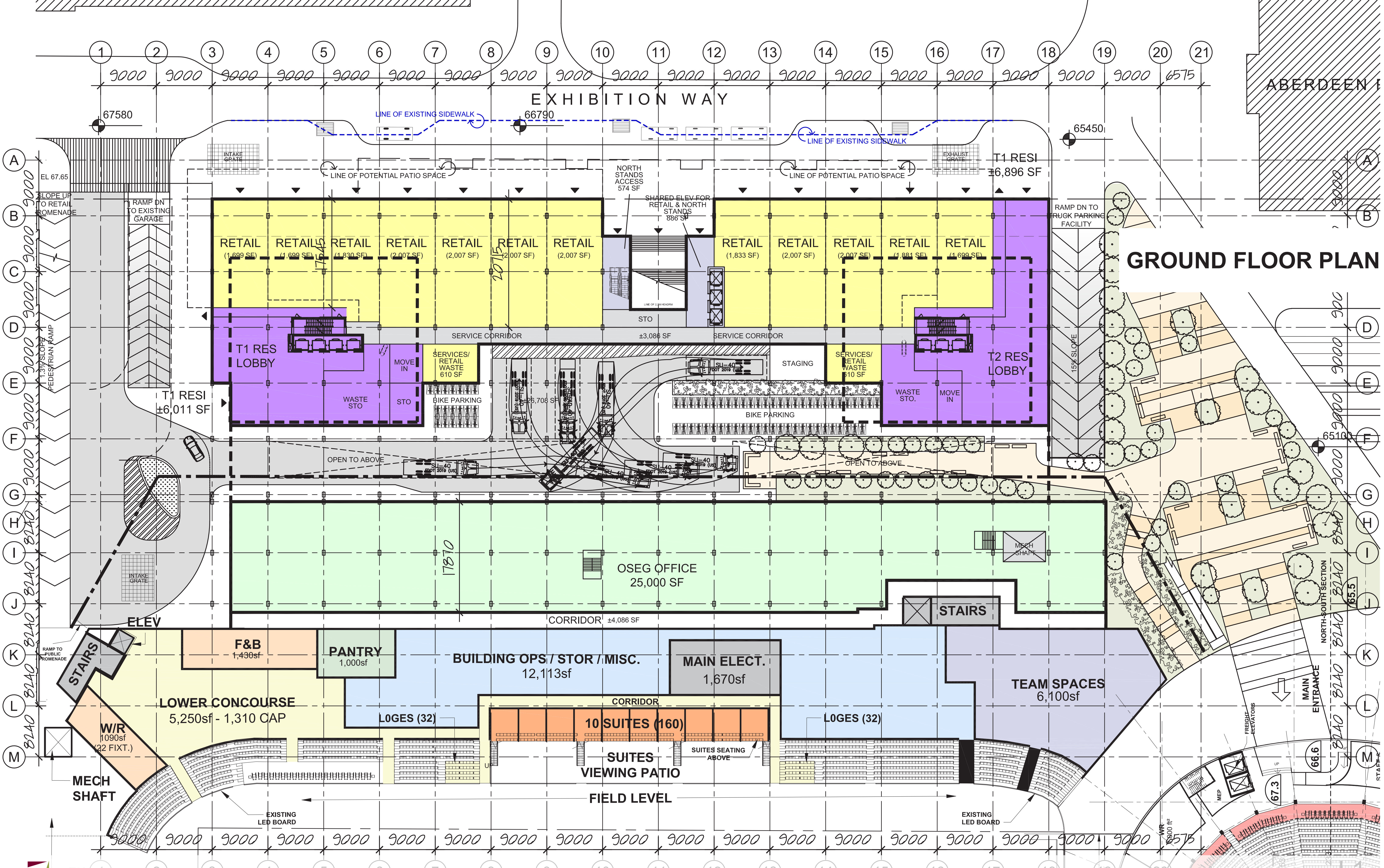
# GROUND FLOOR PLAN



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**LANSDOWNE PARK REDEV**

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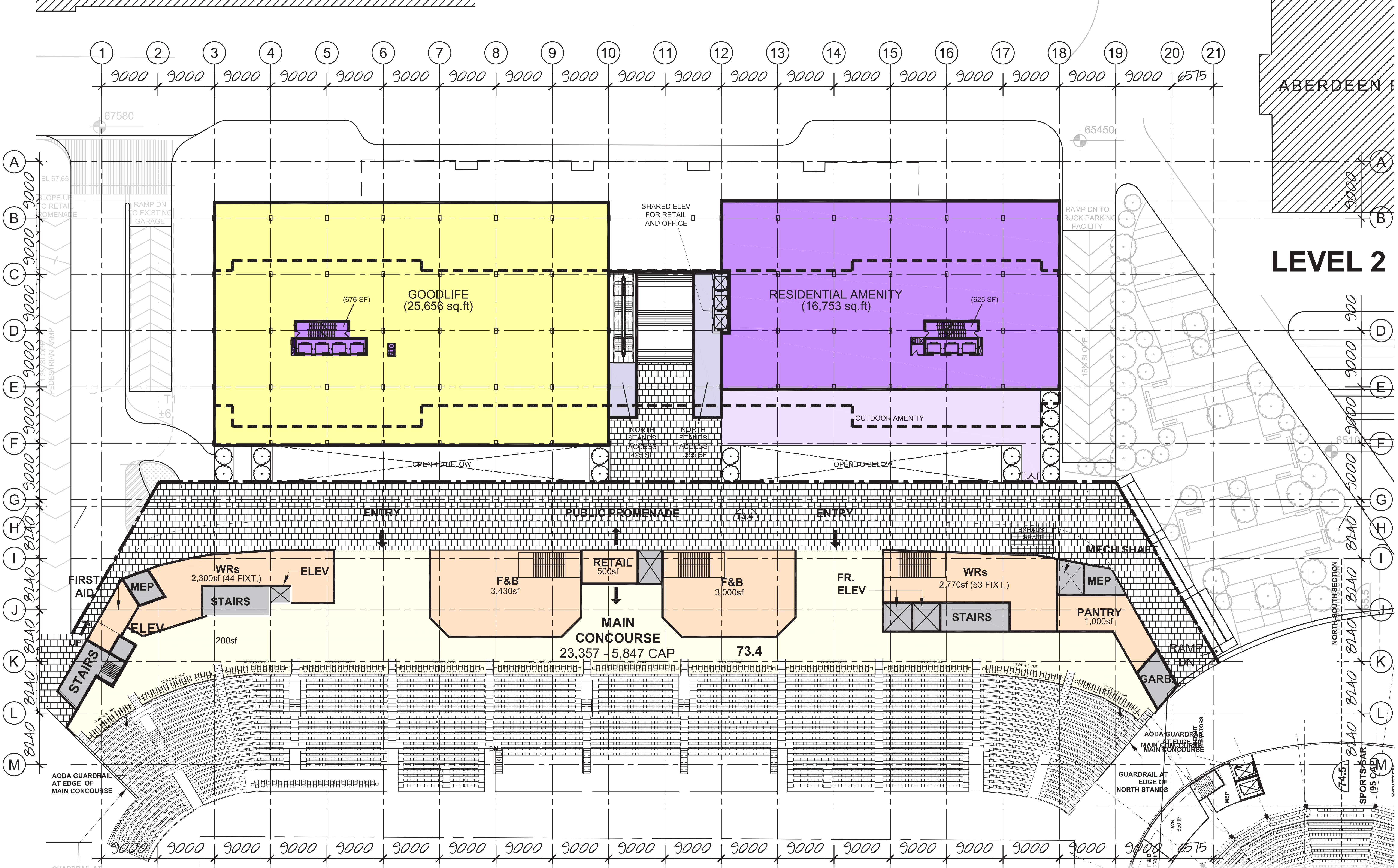
# LEVEL 2



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## LANSDOWNE PARK REDEV

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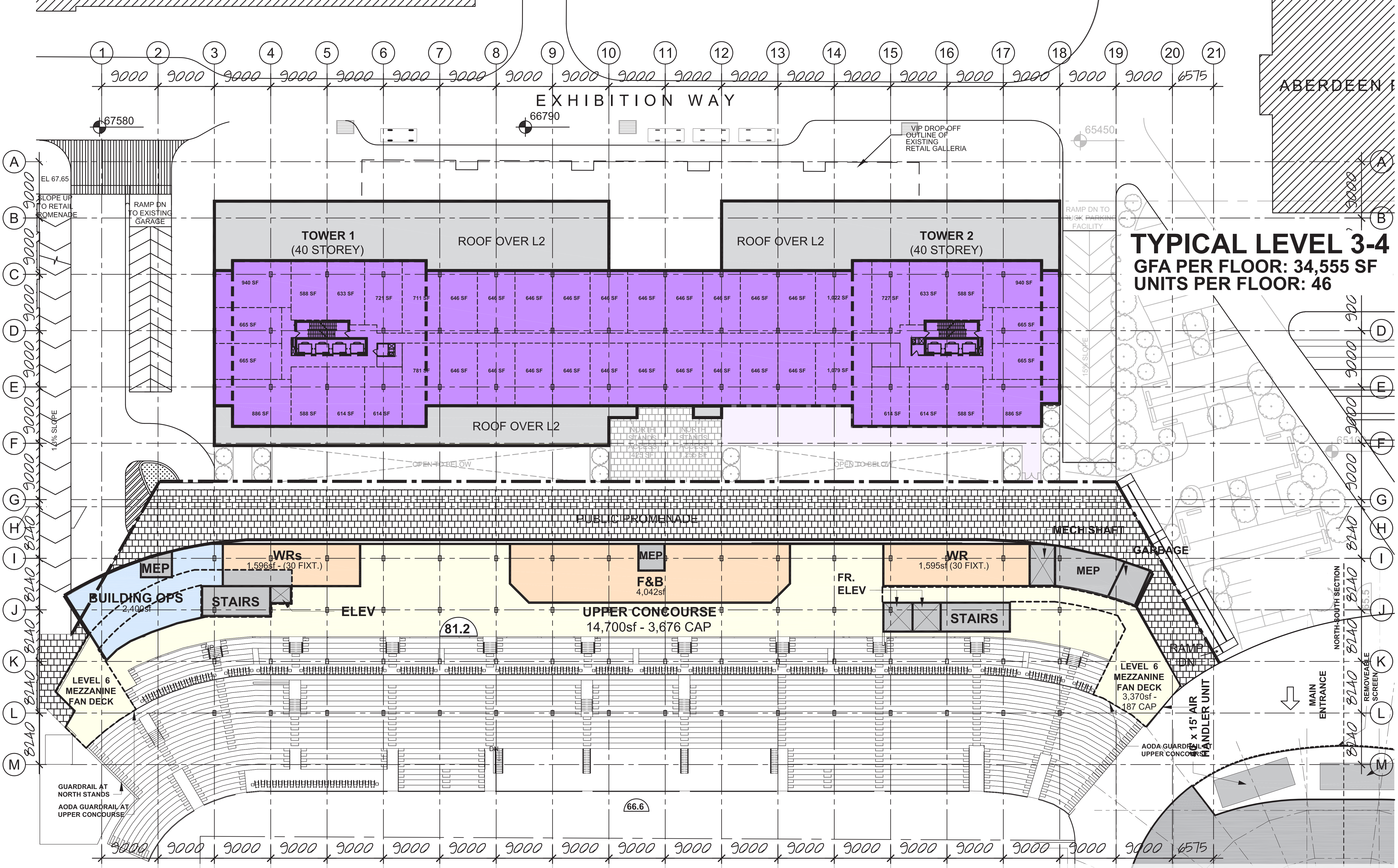
# TYPICAL LEVEL 3-4

## GFA PER FLOOR: 34,555 SF

## UNITS PER FLOOR: 46



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**LANSDOWNE PARK REDEV**

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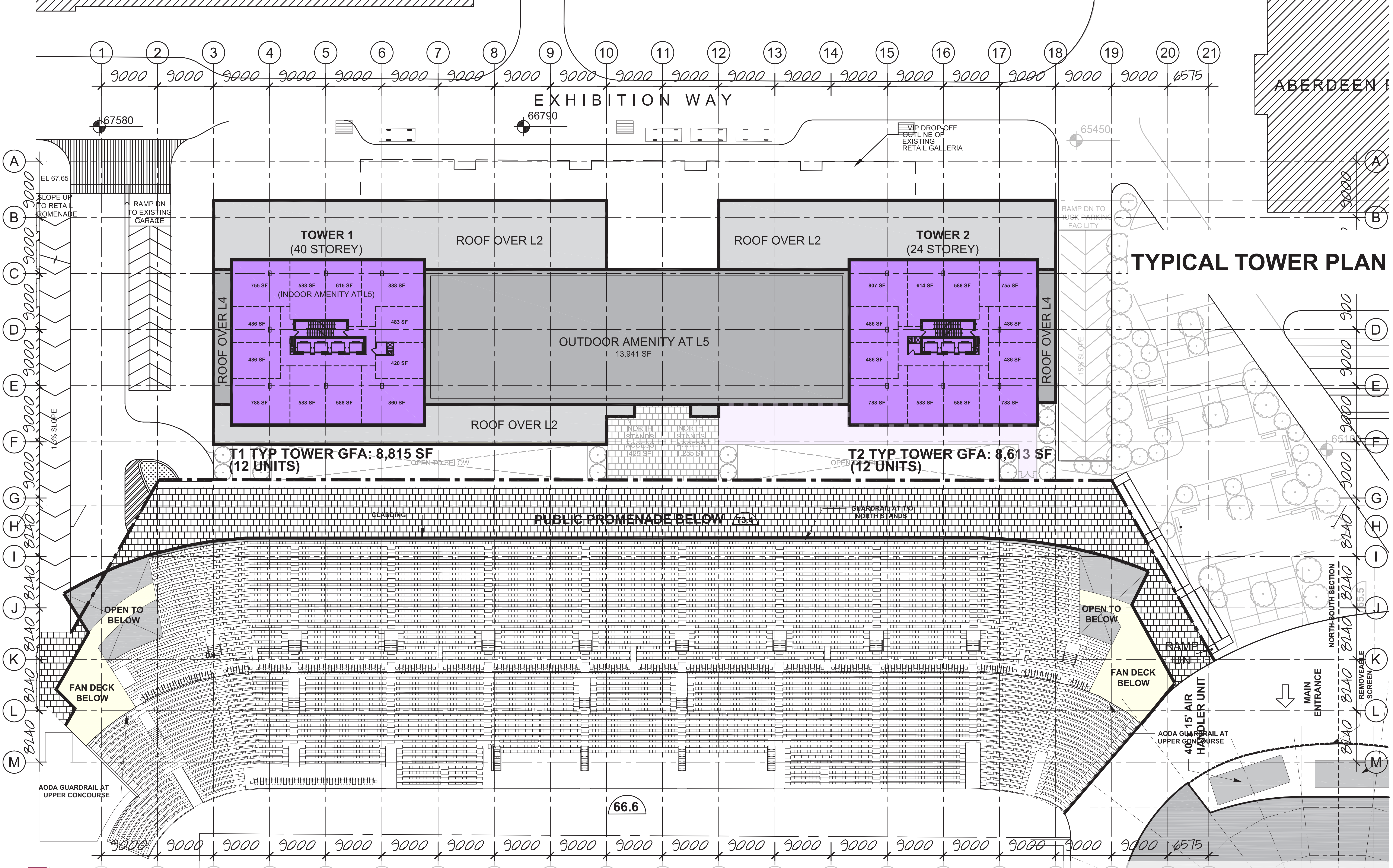
# TYPICAL TOWER PLAN



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**LANSDOWNE PARK REDEV**

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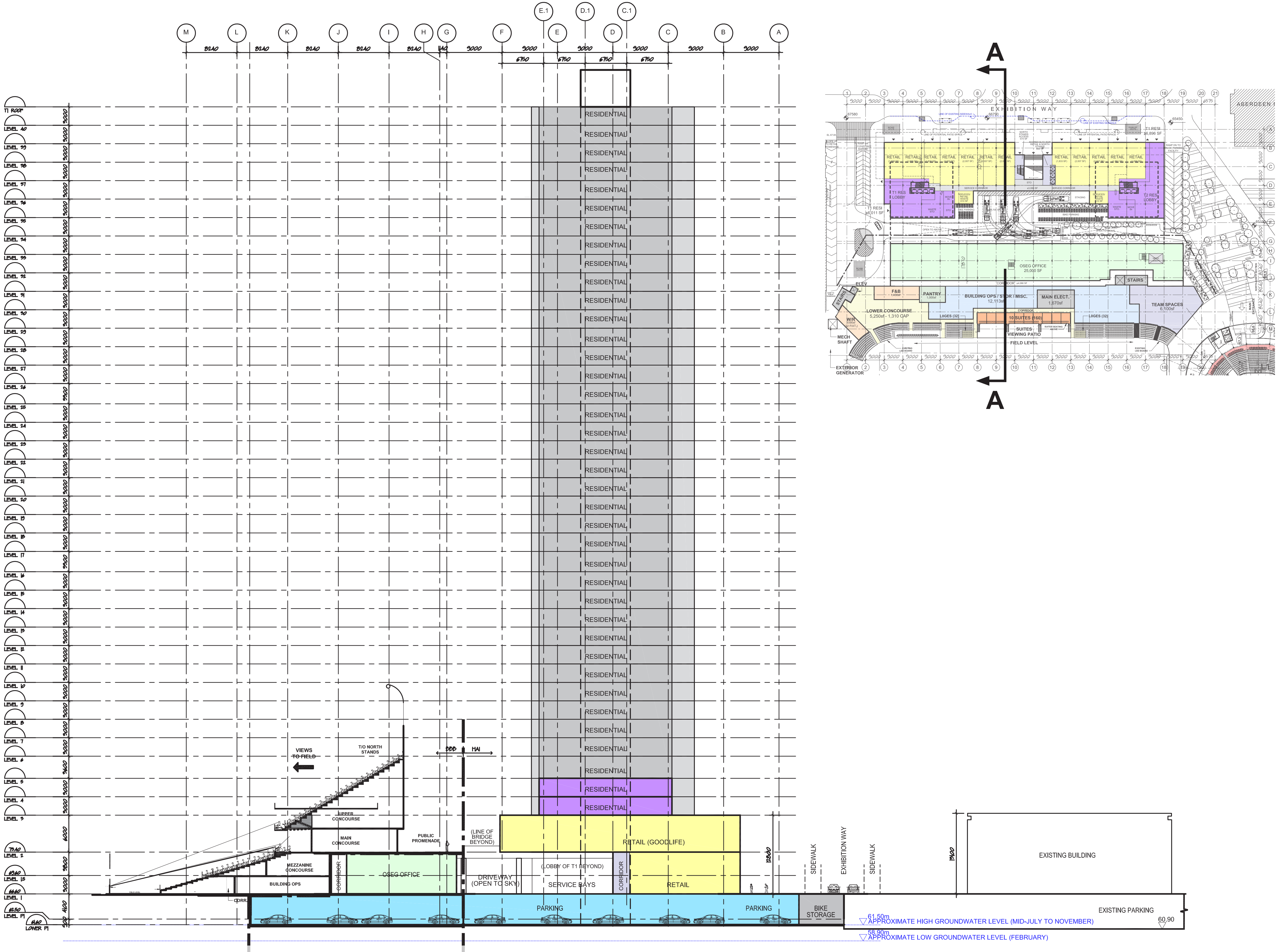

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# LANSDOWNE PARK REDEV

August 17, 2023

# SECTION A-A