# Forest Green Homes

## Proposed Residential Development

## 150 Rutledge Road
## Mississauga, Ontario

### Derailment Protection Report

CP Galt Subdivision
(Mile 21)

Prepared by:


JSW+ associates

Consulting Engineers and Landscape Architects
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44 East Beaver Creek, Unit 1
Richmond Hill, Ontario, L4B 1G6


November 23rd, 2022
Project No. 22-44

# VIC2

## Proposed Residential Development

## 150 Rutledge Road
## Mississauga, Ontario

### Derailment Protection Report

CP Galt Subdivision
(Mile 21)

**Summary of Issues/Revisions**

| No. | Date | Description |
|---|---|---|
| 1 | November 23rd, 2022 | 1st Submission to CP |

Johnson Sustronk Weinstein + Associates
44 East Beaver Creek Road, Unit 1
Richmond Hill, Ontario, L4B 1G6

Project No. 22-44

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# 1.0 INTRODUCTION

## 1.1 Objectives

This report has been prepared as supporting documentation for the redevelopment of the property at 150 Rutledge Road in the City of Mississauga, Ontario. The report shall be supplemental to the documentation included for a Site Plan Amendment (SPA). The redevelopment of the subject site will consist of a residential condominium that comprises of one (1) residential tower and four (4) townhouse units at grade.

## 1.2 Scope of Report

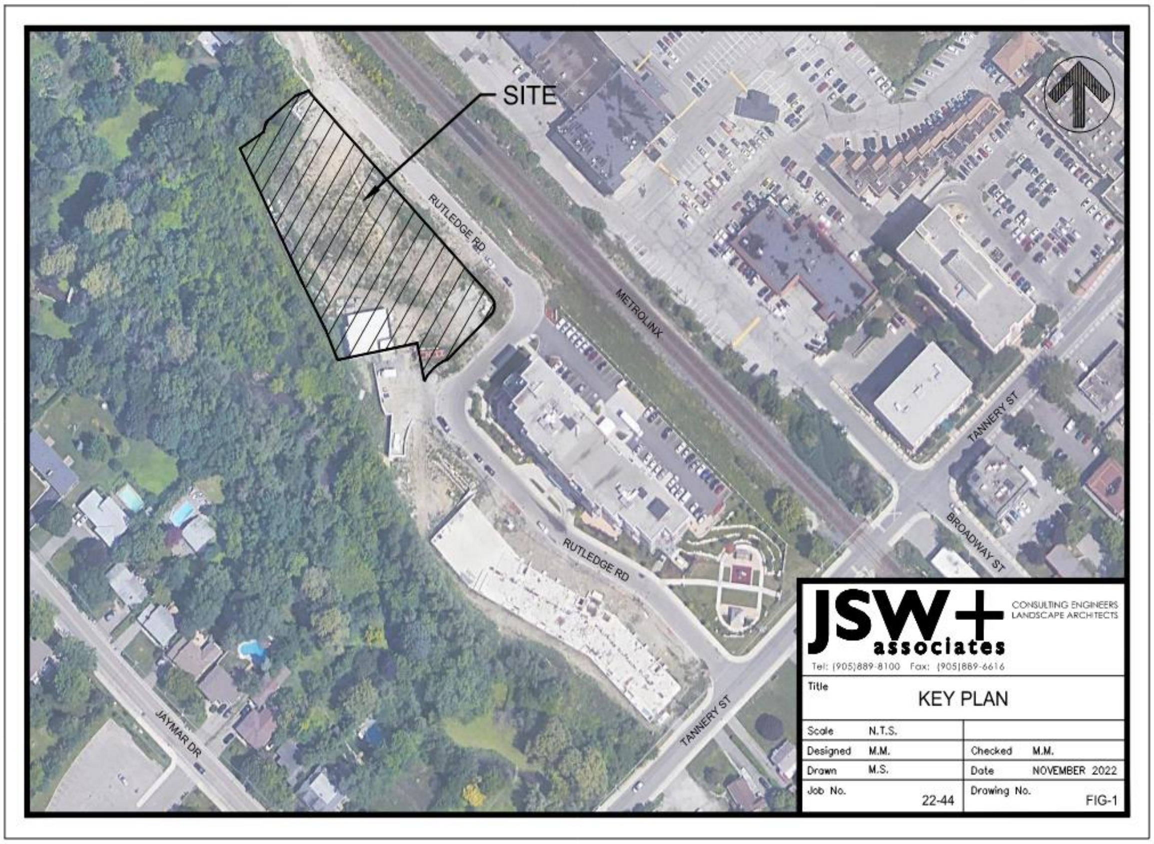
Since 1980, railway companies have established a set of criteria for new developments adjacent to their respective rail corridors. Based on the adjacent railway track's function and volume of traffic, each track is compartmentalized into different classifications. With each railway classification, a stringent set of guidelines and regulations are applied to the development to safeguard against train derailment.

As per the existing site conditions, proposed site features and railway elements, the proposed development will be analyzed in accordance with the guidelines of the Railway Association of Canada (RAC), the Federation of Canadian Municipalities (FCM) and AECOM's Submission Guidelines. Once the development has been analyzed, the necessary protection measures will be recommended accordingly.

## 1.3 Study Area

The subject site is located within the City of Mississauga, Ontario; in close proximity to the intersection of Tannery Street and Broadway Street (see ***Figure 1*** for details). The proposed development gross site area is an irregular shaped plot of land that totals 0.62 hectares (1.54 acres). Presently, the majority of the lot consists of undeveloped land. However, there is one (1) commercial building located on the southwest corner of the site. Bordering the subject site to the north and west is a plot of undeveloped land which contains tall trees and shrubbery. Further north and west of this, are residential developments. To the south, a portion of the subject site is adjacent to Rutledge Road, and another portion of the subject site is adjacent to a plot of undeveloped land. Further south of Rutledge Road is a retirement residence. Directly adjacent to the east of the subject site is Rutledge Road; further east of Rutledge Road is a rail corridor which is presently owned and operated by Canadian Pacific Railway (CP).

**Figure 1 - Key Plan**




In terms of CP's operation, the railway corridor is utilized solely for freight transport. The subject site is located at mile 21 within 300 meters of the CP Galt Subdivision. Running rights within this subject rail corridor have been granted to Metrolinx. In terms of Metrolinx's operation, the railway corridor is utilized solely for passenger transport. CP has provided a response that they will no longer provide rail data and to assume a maximum track design speed of 60mph.

Within this corridor, there are two (2) existing tracks, with both tracks being classified as Principle Mainline tracks. Each track runs in parallel with one another and traverses in a north-south fashion. Furthermore, there is one (1) crossover and one (1) switch in the immediate vicinity of the study area.

## 1.4 Development Concept

Forest Green Homes is proposing to develop the site at 150 Rutledge Road to a residential condominium that comprises of one (1) residential tower and four (4) townhouse units at grade. The proposed residential tower will be ten storeys in height. Furthermore, there are three (3) proposed below grade levels to accommodate the parking requirements of the development. This underground parking configuration is situated beneath all proposed buildings. The site will consist of a combined total GFA of 23,561 $m^2$, excluding the parking below grade.

In order to provide additional clarity as to the scope of the development, ***Table 1*** was prepared below to illustrate the extent of the development.

**Table 1** – Projected Site Statistics

| *Buildings* | *Building Footprint (ha)* | *Number of Units* | *Site Coverage (%)* |
|---|---|---|---|
| Residential Tower | 0.25 | 258 | 40 |
| Townhouses | 0.0225 | 4 | 4 |
| **Total** | **0.2725** | **262** | **44** |

# 2.0 DERAILMENT PROTECTION AND SETBACK

## 2.1 Derailment Protection Criteria

The Federation of Canadian Municipalities (FCM) criteria for derailment protection is based on the classification on the track to which the development is adjacent. The track classification indicates the specific design requirements of the derailment protection measure and the setback distance from the property line to the proposed building.

If the development is to be used in conjunction with an earth berm, the minimum setbacks are dependent on the classification of the track. The proposed development is adjacent to a principle main line which typically requires a 2.5-meter-high berm with a 30-meter setback. Exceptions to the aforementioned setback requirements can be permitted by the railway company with a maximum reduction up to 5.0 meters to the setback distance (i.e., 25 meters). However, the height of the berm must be increased to accommodate the reduction in setback distance. Berm height is taken relative to the grade along the property line of the railway corridor.

Although an earth berm would provide adequate derailment protection, the use of a crash wall would be an approved equivalent. However, standard crash wall heights and thicknesses cannot be recommended due to varying site conditions, setback distances and crash wall designs. In order to design the crash wall, the criteria set out in the FCM/RAC Guidelines and AECOM's memorandum are to be referenced. Based on this criterion, one of two methods may be used to engineer the crash wall. These methods are as follows:

- *Method 1 (Minimum Point Load)*
    - The wall may be designed for a minimum point load of 600 kip (2700 kN) applied horizontally and normal to the face at any point along the wall.
        - The point load shall be applied at a height of 6 feet (1.8 meters) above the top of rail for walls up to 25 feet (7.6 meters) from the centerline of track, or a height of 6 feet (1.8 meters) above the groundline for walls farther than 25 feet (7.6 meters) from the centerline of the track.
        - This method may be applied where track speeds do not exceed 50 mph (80 km/hr) for freight or 70 mph (112 km/hr) for passenger trains; where speeds exceed these limits, Method 2 shall be used.
- *Method 2 (Energy balance approach)*

- An energy balance approach considering collision by glancing blow and single car rotation my be used to determine the design load. The following four (4) cases must be considered:

  - *<u>Freight Train Load Case 1</u>* – Glancing Blow: nine cars weighing 143 tons (129,700 kg) each, impacting the wall at an angle $\Theta_G$. The angle of impact will be a function of track curvature, and for tangent track may be taken as 3.5 degrees.

  - *<u>Freight Train Load Case 2</u>* – Single Car Impact: single weighing 143 tons (129,700 kg) impacting the wall as it undergoes rotation about its center. The angle of rotation at impact is:

    $$\Theta_f = \text{asin}\left(\frac{d_{CL}}{8.5}\right) \qquad \text{[Equation 1]}$$

    Where;

    $D_{CL}$ is the distance from the cash wall to the centerline of track in meters. The closest existing or future track is to be used. Where $d_{CL}$ is greater than 8.5 meters, this load case need not be considered.

  - *<u>Passenger Train Load Case 3</u>* – Glancing Blow eight (8) cars weighing 74 tons (67,120 kg) each impacting the wall at an angle, $\Theta_G$. The angle of impact will be function of track curvature, and for tangent track may be taken as 3.5 degrees.

  - *<u>Passenger Train Load Case 4</u>* – Single Car Impact: single car weighing 74 tons (67,120 kg) impacting the wall as it undergoes rotation about its center. The angle of rotation at impact is:

    $$\Theta_f = \text{asin}\left(\frac{d_{CL}}{13}\right) \qquad \text{[Equation 2]}$$

    Where $D_{CL}$ is greater than 13 meters, this load case need not be considered.

- In all of the above cases, the following parameters are to be considered:
  - Speed of derailed units impacting the wall must be equivalent to the track speed.
  - Height of the application of impact force must be applied at 3 feet above the ground.

- For energy dissipation assume:
  - Plastic deformation of individual cars, due to direct impact, are applied at a maximum of 1 foot.
  - Compression of linkages of three (3) locomotives and six (6) cars consist of a maximum of 5 feet.
  - Deflection of the wall is to be determined by the designer. The design must incorporate horizontal and vertical continuity to distribute the impact loads from the derailed train.

AECOM's memorandum dated March 25, 2013 and AECOM's Crash Wall Guidelines Revision 2, dated July 29, 2014 (see copy of both in ***Appendix 'B'***) also defines structural assessment criteria presented above.

## 2.2 Proposed Setback

In order to provide an additional level of protection, building setbacks are used in conjunction with protection features to further safeguard against the possibility of train derailment. Building setbacks are measured from the proposed building façade to the property line adjacent the rail corridor. This setback is often misconstrued as a setback limit for the closest existing railway track – which is erroneous; this is because the operating company maintains the right to install tracks anywhere within their property, if required. These setbacks are intended to provide a dissipation buffer for several different factors such as rail-oriented emissions, noise, vibrations and ultimately velocity reduction in the event of a train derailment. Although an extensively long buffer would be preferred, it is not always feasible or practical to implement due to site conditions and constraints. Therefore, the site must undergo an assessment to evaluate a suitable protection feature and setback distance to safeguard the development.

Typically, when a protection feature (earth berm or crash wall) satisfies the vertical requirements, reviewing agencies can authorize a reduction in horizontal setback limits (Guidelines for new Development in Proximity to Railway Operations – Prepared for the FCM and the RAC, May 2013). Since the railway corridor is a principal mainline, the required building setback from the property line is to be 30 meters. In accordance with page 27 of the FCM/RAC Guidelines, horizontal setback requirements may be substantially reduced with the construction of a crash wall. Based on this clause, a reduction in horizontal set back requirements is plausible for this site as the proposed protection feature is a crash wall (see ***Section 2.3*** for details). Thus, by utilizing a crash wall of 2.135 meters, the total setback can be reduced to 25 meters. Furthermore, to satisfy the minimum total setback, a combination of horizontal setbacks, and vertical or protection feature setbacks (whichever setback is greater) will be provided to satisfy this criterion (see ***Figure 2*** below).

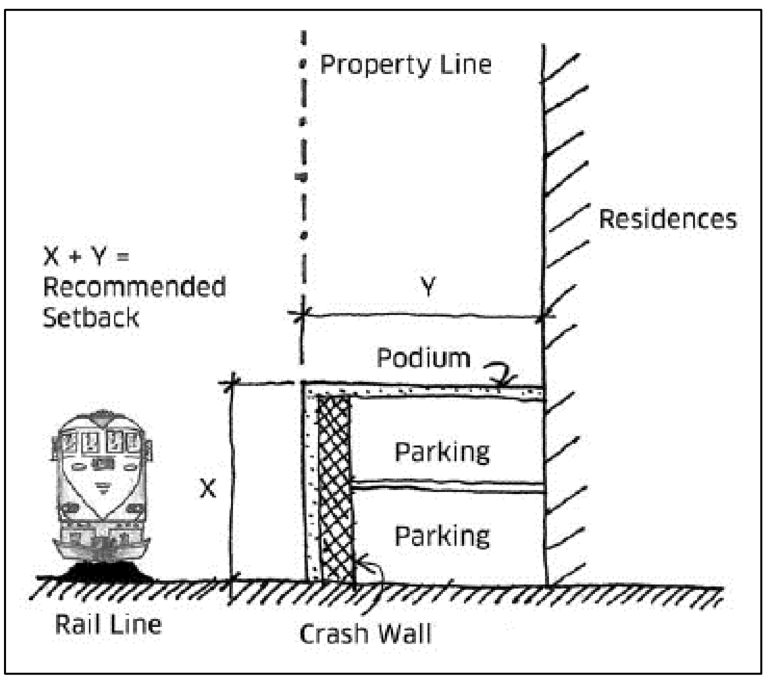



**Figure 2 - Incorporating a Crash Wall into a Development (J.E. Coulter Associates Limited, May 2013)**

In order to further understand the setback limits throughout the subject site, ***Table 2*** has been prepared below to provide additional clarity. The *Protection Feature Setback*[1] defines the setback from the centerline of the westernmost existing track to the rail corridor's property line. Although this setback distance is not accounted for in the required setback limits, this supplemental information is helpful because it provides additional levels of safety when the existing track is setback further from the subject property line. The *Minimum Horizontal Setback*[2] defines the minimum horizontal distance from the rail corridor's property line to the building façade (referencing the closest point of the building to the property line). The *Vertical Setback*[3] defines the vertical height of each floor, of the proposed development, above the *ground floor*. The *Protection Feature Height*[4] defines the vertical height of the protection feature. The *Minimum Total Setback*[5] is defined by the combination of the *Minimum Horizontal Setback*[2] and the *Vertical Setback*[3] or *Protection Feature Height*[4] (whichever setback is greater). It is also to be noted that the setback criteria(s) were measured as the worst-case condition for each building (the closest points).

**Table 2 - Proposed Site Setbacks**

| ***Building Level*** | ***Protection Feature Setback[1] (m)*** | ***Minimum Horizontal Setback[2] (m)*** | ***Vertical Setback[3] (m)*** | ***Protection Feature Height[4] (m)*** | ***Minimum Total Setback[5] (m)*** |
|---|---|---|---|---|---|
| **Residential Tower (Ground Floor)** | 12.3 | 27.9 | 0 | 2.135 | **30.035** |

The setbacks were determined for the residential tower to ensure that the entirety of the sensitive use areas complied with the 25 m total setback requirement. As seen above in ***Table 2,*** the *Minimum Total Setback*[5] to the residential tower's ground floor is 30.035 m. Therefore, the entirety of the subject site exceeds the 25 m required total setback for this type of programming.

## 2.3 Proposed Derailment Protection Feature

For the subject site, the principal derailment protection feature that will be utilized in the post-development condition will be a crash wall. The purpose of the derailment protection feature is to provide energy attenuation from a derailed train; ultimately safeguarding the inhabitants and the contents of the proposed development (refer to the ***Derailment Protection Drawing – DP-1***).

The aforementioned crash wall will be constructed along the City right-of-way's eastern property line, which fronts the subject site. The crash wall is to be designed based on the maximum permissible train speeds in the corridor, site configuration, and corridor proximity. In the post-development condition, the proposed crash wall will be installed independent of any structural elements of the proposed development, such that the wall will be sacrificial in nature. In the event of a train derailment, the wall can be replaced and rebuilt without impacting accessibility and use of the proposed development. As per AECOM Guidelines the crash wall must be smooth and continuous with no openings in the wall.

The proposed crash wall will be designed to be 2.135m in height above the existing adjacent grade at the rail corridor's property line, minimum 450mm thick and 159.236m in length. The crash wall will also be installed with anti-graffiti spray.

In terms of derailment protection from the flank, there is an existing berm which currently provides derailment protection for the retirement home located south of the subject site. This berm will act as a return for the subject site's southern flank, providing adequate derailment protection for the site from any train that derails travelling northbound and were to rotate about the existing tracks at 3.5 degrees or less. In terms of a return to the north, the existing roadway converges towards the property line which does not allow for a return crash wall. Therefore, the crash wall has been extended to the north by 23m past the projection of the property line to act as a return crash wall and restrict any derailed trains from entering the site if the incident occurs beyond the projection limits of our site.

### 2.1 Rail Corridor Security

To safeguard against trespassing, the rail corridor will be cordoned off with a chain link security fence installed atop the proposed crash wall. The link fence will be 0.3 meters in height (meeting the minimum security fence height of 2.43m in addition to the proposed crash wall height) and will possess non-cut and non-climb chain link fabric; this fence will be installed along the rail corridor property line (see ***Appendix 'D'*** for details).

### 2.2 Risk Assessment

As outlined in the 2013 CFM Guidelines, the individual risks for the proposed development must be identified and evaluated. Each risk shall outline mitigation measures which are proposed or planned to address these risks. Such risks may include injury, loss of life and/or damage to public or private infrastructure. ***Table 3*** (See ***Appendix 'C'*** for details) summarizes potential risk generated from developing 150 Rutledge Road adjacent to a rail corridor.

### 2.3 Life Cycle and Operations

In order to ensure that the derailment protection feature(s) continuously operate as per the intended design, scheduled inspection will be required on an ongoing basis to determine the adequacy of said item(s). Although a majority (if not all) of the design features are 'set-it-and-forget it' items, it is prudent to investigate any deficiencies that may occur due to weathering, erosion, fatigue and/or human interference. Based on the aforementioned, ***Table 4*** has been prepared as a rough approximation in terms of life cycle, inspection frequency and maintenance requirements.

**Table 4 –** Protection Feature Life Cycle and Operations

| Item | Life Expectancy (years) | Required Inspection Frequency | Maintenance/Inspection Requirements |
|---|---|---|---|
| Chain Link Fence | 35 | Monthly | -Repair visible cuts or openings in fence fabric, as soon they are evident.<br>-Repaint fence with rust paint every 5 years<br>-Ensure fence posts are upright |
| Crash Wall | 100+ | Biannually | -Inspect for over excessive wall batter<br>-Analyze wall for crumbling, structural fractures and warping |

## 3.0 CONCLUSIONS AND SUMMARY

a) The subject site will be developed into a residential comprises of one (1) residential tower and four (4) townhouse units at grade. The proposed residential tower will contain ten storeys. Furthermore, there are three (3) proposed below grade levels to service the parking requirements of the development.

b) The site presently, and will be, protected by a principal protection feature in the form of a crash wall. The crash wall is situated along a section of the rail corridor's western property line, which fronts the subject site. The proposed crash wall will be designed to be 2.135m in height above the existing adjacent grade at the rail corridor's property line, a minimum 450mm thick and 159.236m in length.

c) In terms of derailment protection from the flank, there is an existing berm which currently provides derailment protection for the retirement home located south of the subject site. This berm will act as a return for the subject site's southern flank, providing adequate derailment protection for the site from any train that derails travelling northbound and were to rotate about the existing tracks at 3.5 degrees or less. To the north, the crash wall will be extended by 23m past the projection of the site limits in lieu of a return crash wall.

d) A 0.3m high non-cut, non-climb chain link fence will be installed atop of the proposed crash wall to safeguard against trespassing; ultimately providing a total height of 2.43m high barrier.

e) The subject site adheres to the FCM/RCA total setback criteria of 25-meters by providing a minimum total setback of 30.035 meters to the residential tower.

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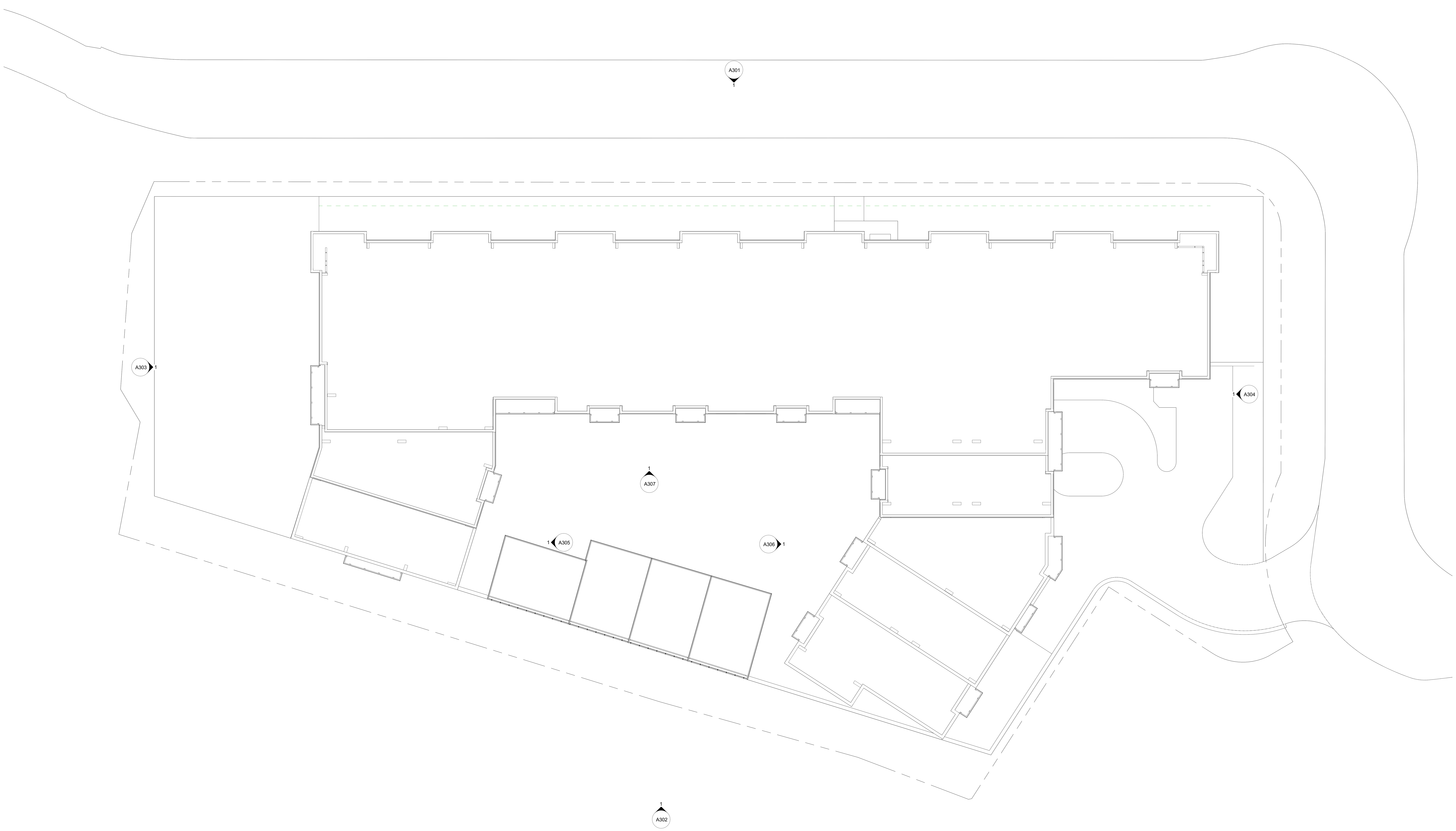
# APPENDIX ‘A’

Architectural Drawing Set

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DWG. TITLE
SITE ROOF PLAN

PROJECT NO.
22-03
A101

| GFA | | |
|---|---|---|
| Name | Area | Area (SF) |
| | | |
| GFA 1st | 2526 m² | 27193 ft² |
| GFA 2nd | 2526 m² | 27193 ft² |
| GFA 3rd | 2526 m² | 27193 ft² |
| GFA 4th | 2526 m² | 27193 ft² |
| GFA 5th | 2526 m² | 27193 ft² |
| GFA 6th | 2526 m² | 27193 ft² |
| GFA 7th | 2394 m² | 25765 ft² |
| GFA 8th | 2274 m² | 24477 ft² |
| GFA 9th | 1999 m² | 21513 ft² |
| GFA 10th | 1737 m² | 18700 ft² |
| TOTAL | 23561 m² | 253610 ft² |

| SITE COVERAGE | | |
|---|---|---|
| Name | Area | Percent Coverage |
| | | |
| BUILDING COVERAGE | | |
| BUILDING COVERAGE | 2725 m² | 44% |
| | 2725 m² | 44% |
| LANDSCAPE AREA | | |
| LANDSCAPE AREA | 29 m² | 0% |
| LANDSCAPE AREA | 44 m² | 1% |
| LANDSCAPE AREA | 3038 m² | 49% |
| | 3111 m² | 50% |
| PAVEMENT COVERAGE | | |
| PAVEMENT COVERAGE | 402 m² | 6% |
| | 402 m² | 6% |
| PROPERTY AREA | 6237 m² | 100% |

| Suite Types | |
|---|---|
| Unit Type | Count |
| Level 01 - Ground | |
| | 3 |
| | 2 |
| 1B | 6 |
| 1B+D | 3 |
| 2B | 7 |
| 2B+D | 4 |
| 2BI | 8 |
| | 33 |
| Level 02 | |
| 1B | 6 |
| 1B+D | 5 |
| 2B | 9 |
| 2B+D | 4 |
| 2BI | 9 |
| | 33 |
| Level 03 | |
| 1B | 6 |
| 1B+D | 5 |
| 2B | 9 |
| 2B+D | 4 |
| 2BI | 9 |
| | 33 |
| Level 04 | |
| 1B | 6 |
| 1B+D | 5 |
| 2B | 9 |
| 2B+D | 4 |
| 2BI | 9 |
| | 33 |
| Level 05 | |
| 1B | 6 |
| 1B+D | 5 |
| 2B | 9 |
| 2B+D | 4 |
| 2BI | 9 |
| | 33 |
| Level 06 | |
| 1B | 6 |
| 1B+D | 5 |
| 2B | 9 |
| 2B+D | 4 |
| 2BI | 9 |
| | 33 |
| Level 07 | |
| 1B | 8 |
| 1B+D | 4 |
| 2B | 5 |
| 2B+D | 4 |
| 2B+d | 1 |
| 2BI | 9 |
| | 31 |
| Level 08 | |
| | 1 |
| 1B | 5 |
| 1B+D | 5 |
| 2B | 4 |
| 2B+D | 6 |
| 2BI | 8 |
| | 29 |
| Grand total | 258 |


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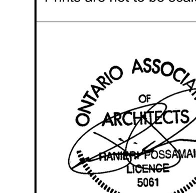


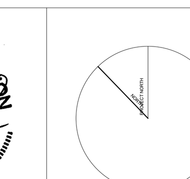


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RUTLEDGE RD.

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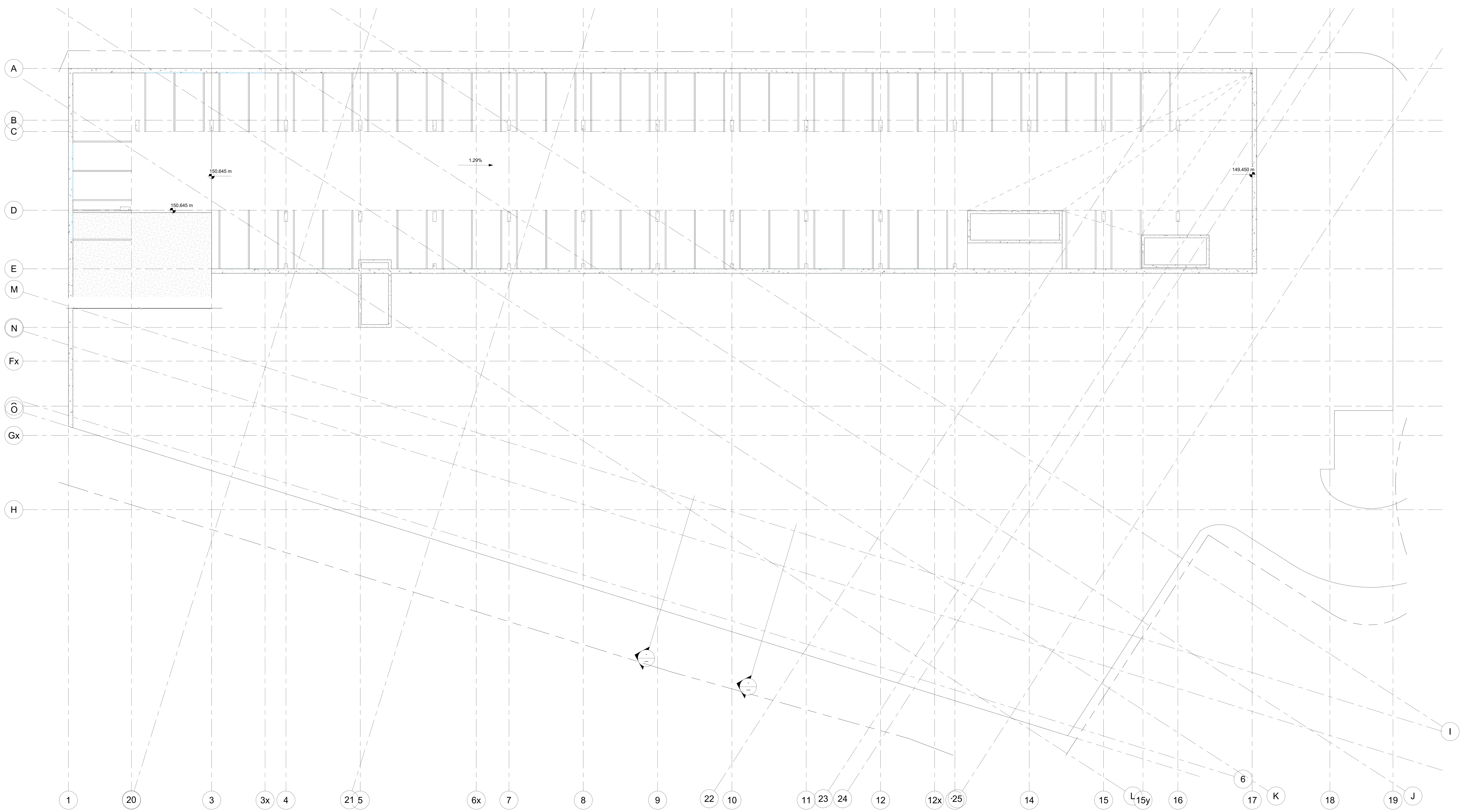
DWG. TITLE

# SITE GROUND PLAN

PROJECT NO.
22-03

A103

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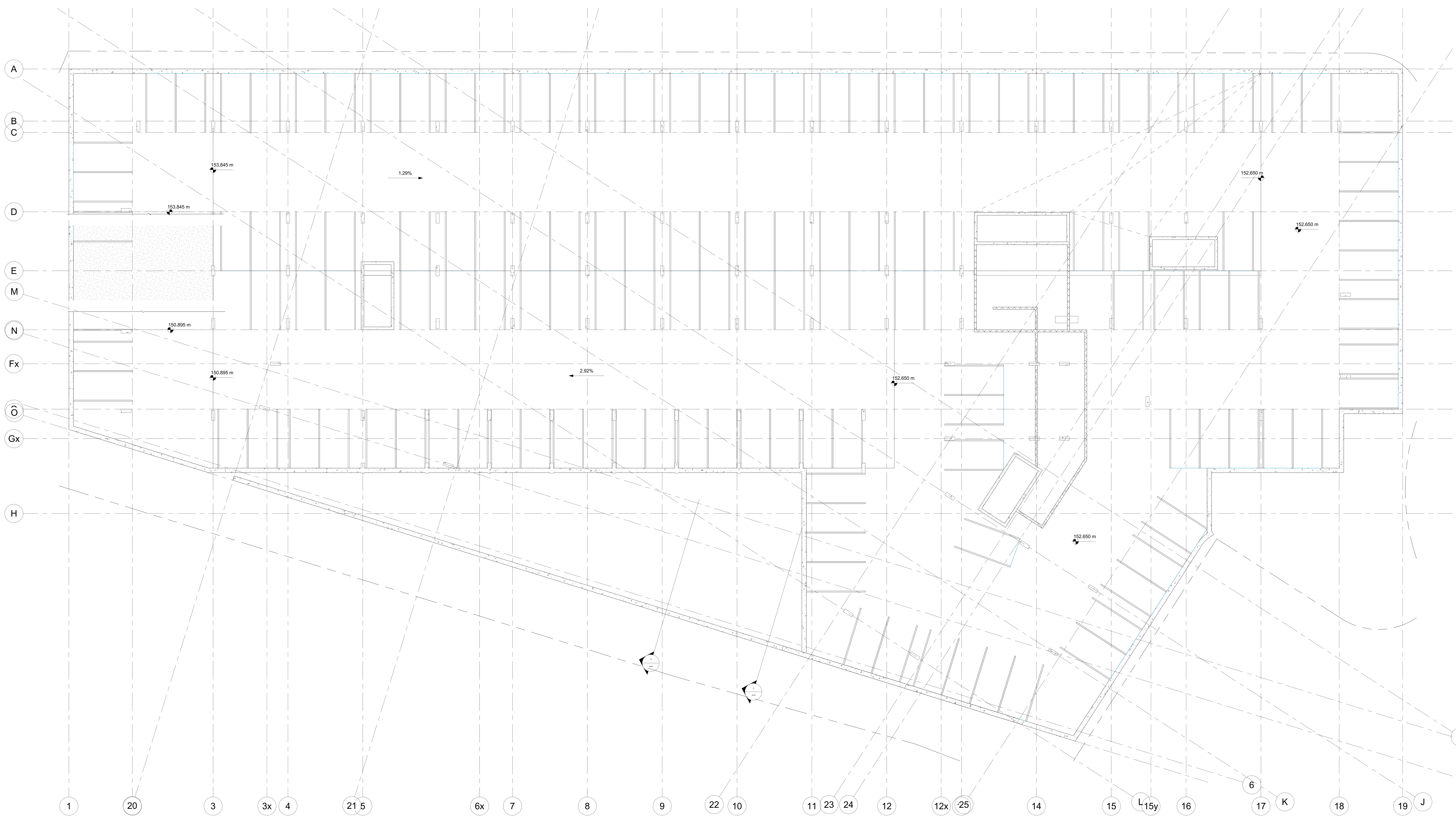
DWG. TITLE
# P4 PLAN

PROJECT NO. 22-03

A200

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|---|---|
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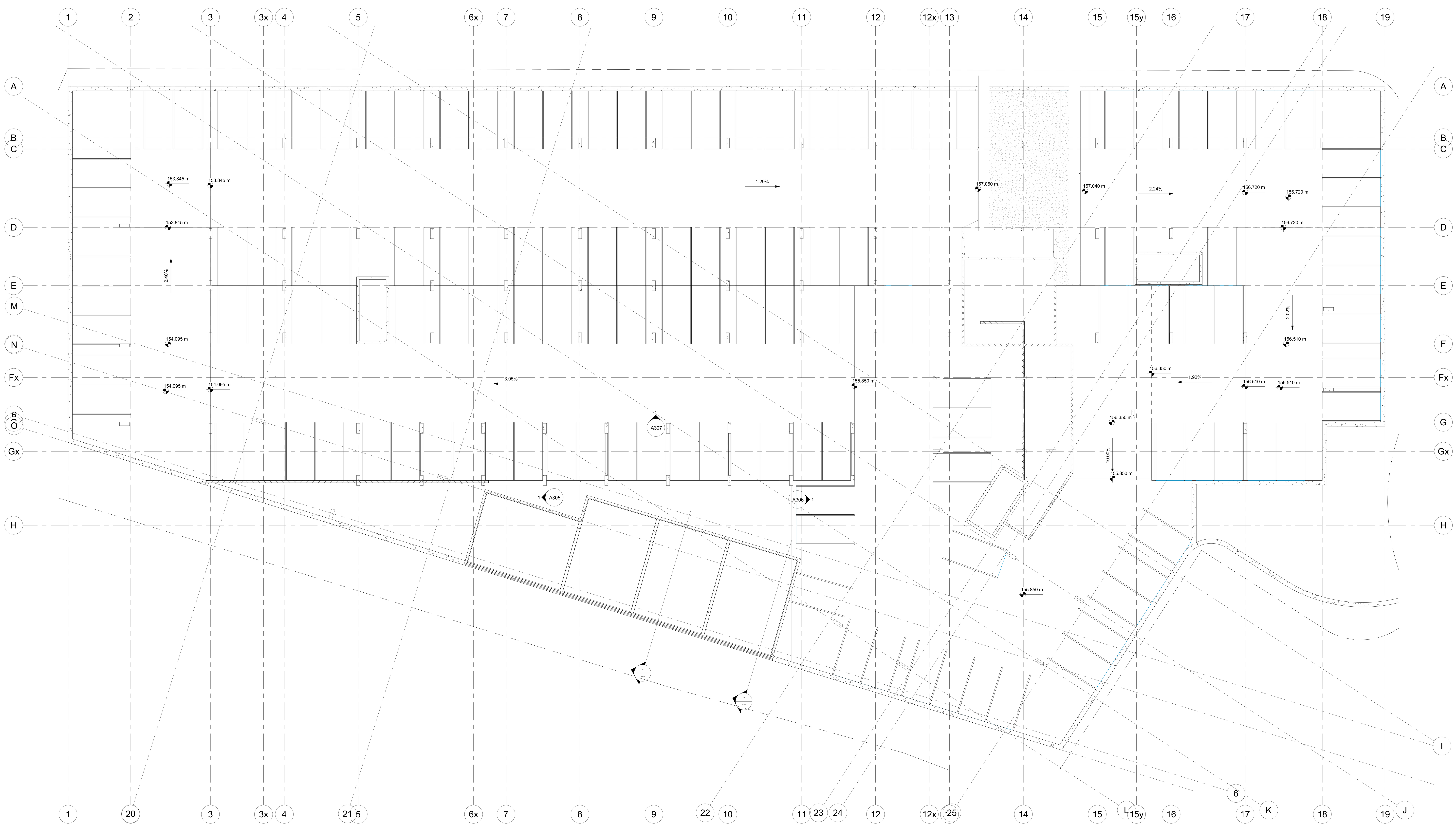
| DRAWN BY | CM |
| CHECKED BY | RP, PP |
| DATE | 04/28/22 |
| SCALE | 1 : 125 |
| DWG. TITLE | P3 PLAN |
| PROJECT NO. 22-03 | A201 |

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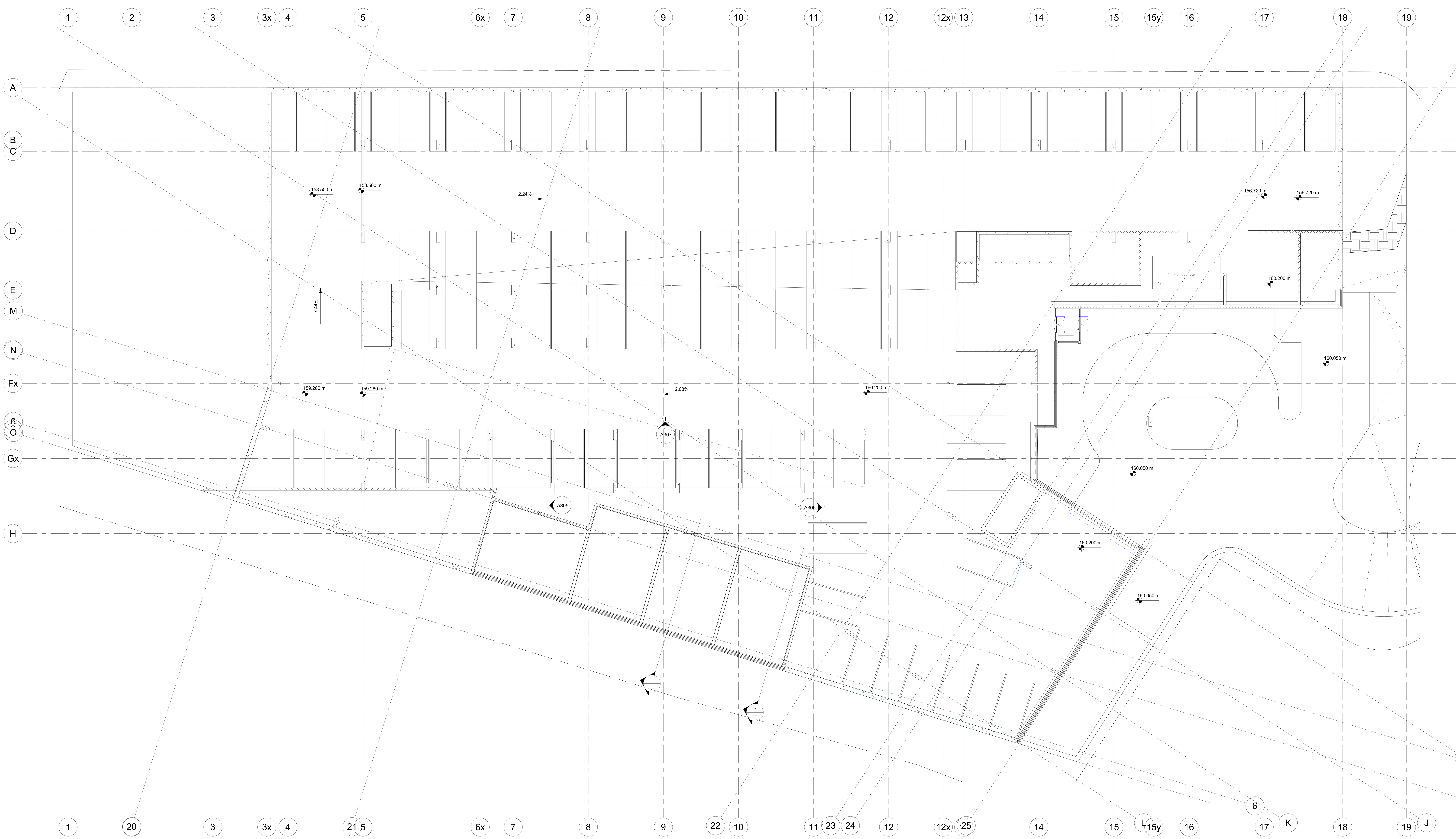
DWG. TITLE

# P2 PLAN

PROJECT NO. 22-03

A202

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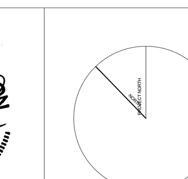


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ph: 416 256 4440 fx: 416 256 4449

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DWG. TITLE

P1 PLAN

PROJECT NO. 22-03

A203

## Suite Types

| Unit Type | Count |
|---|---|
| Level 01 - Ground | |
| | 3 |
| | 2 |
| 1B | 6 |
| 1B+D | 3 |
| 2B | 7 |
| 2B+D | 4 |
| 2BI | 8 |
| | 33 |

## Units per level

| Number | GAI_Unit Type | Area | Area (SF) |
|---|---|---|---|
| Level 01 - Ground | | | |
| 101 | 2B | 80 m² | 865 ft² |
| 102 | 1B+D | 59 m² | 637 ft² |
| 103 | 2BI | 64 m² | 684 ft² |
| 104 | 2BI | 64 m² | 684 ft² |
| 105 | 2BI | 64 m² | 684 ft² |
| 106 | 2BI | 64 m² | 684 ft² |
| 107 | 2BI | 64 m² | 684 ft² |
| 108 | 2BI | 64 m² | 687 ft² |
| 109 | | 64 m² | 687 ft² |
| 110 | | 54 m² | 579 ft² |
| 111 | | 61 m² | 655 ft² |
| 112 | 2BI | 66 m² | 716 ft² |
| 113 | 1B | 51 m² | 544 ft² |
| 114 | 1B | 59 m² | 636 ft² |
| 115 | 1B | 61 m² | 660 ft² |
| 116 | 2BI | 73 m² | 786 ft² |
| 117 | 1B | 52 m² | 563 ft² |
| 118 | 1B+D | 53 m² | 571 ft² |
| 119 | 2B | 75 m² | 811 ft² |
| 120 | 2B+D | 84 m² | 906 ft² |
| 121 | 2B+D | 90 m² | 972 ft² |
| 122 | 2B | 53 m² | 575 ft² |
| 123 | | 123 m² | 1327 ft² |
| 124 | | 34 m² | 366 ft² |
| 125 | 2B | 68 m² | 731 ft² |
| 126 | 2B | 68 m² | 728 ft² |
| 127 | 2B | 68 m² | 728 ft² |
| 128 | 2B | 86 m² | 927 ft² |
| 129 | 1B | 51 m² | 550 ft² |
| 130 | 2B+D | 89 m² | 958 ft² |
| 131 | 2B+D | 89 m² | 954 ft² |
| 132 | 1B+D | 61 m² | 656 ft² |
| 133 | 1B | 55 m² | 597 ft² |


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DWG. TITLE

# GROUND FLOOR PLAN

PROJECT NO.

22-03

A204

| DATE | ISSUED FOR |
| --- | --- |

# Suite Types

| Unit Type | Count |
| --- | --- |
| Level 02 | |
| 1B | 6 |
| 1B+D | 5 |
| 2B | 9 |
| 2B+D | 4 |
| 2BI | 9 |
| | 33 |

# Units per level

| Number | GAI_Unit Type | Area | Area (SF) |
| --- | --- | --- | --- |
| Level 02 | | | |
| 201 | 2B | 80 m² | 865 ft² |
| 202 | 1B+D | 59 m² | 638 ft² |
| 203 | 2BI | 64 m² | 684 ft² |
| 204 | 2BI | 64 m² | 684 ft² |
| 205 | 2BI | 64 m² | 684 ft² |
| 206 | 2BI | 64 m² | 684 ft² |
| 207 | 2BI | 64 m² | 684 ft² |
| 208 | 2BI | 64 m² | 684 ft² |
| 209 | 2BI | 64 m² | 684 ft² |
| 210 | 1B | 54 m² | 579 ft² |
| 211 | 1B | 61 m² | 655 ft² |
| 212 | 2BI | 66 m² | 716 ft² |
| 213 | 1B | 51 m² | 544 ft² |
| 214 | 1B | 59 m² | 636 ft² |
| 215 | 1B+D | 61 m² | 660 ft² |
| 216 | 2BI | 73 m² | 786 ft² |
| 217 | 1B | 52 m² | 563 ft² |
| 218 | 1B+D | 53 m² | 571 ft² |
| 219 | 2B | 75 m² | 811 ft² |
| 220 | 2B+D | 84 m² | 906 ft² |
| 221 | 2B+D | 90 m² | 972 ft² |
| 222 | 2B | 69 m² | 746 ft² |
| 223 | 2B | 81 m² | 871 ft² |
| 224 | 2B | 102 m² | 1099 ft² |
| 225 | 2B | 68 m² | 731 ft² |
| 226 | 2B | 68 m² | 728 ft² |
| 227 | 2B | 68 m² | 728 ft² |
| 228 | 2B | 86 m² | 927 ft² |
| 229 | 1B | 51 m² | 550 ft² |
| 230 | 2B+D | 89 m² | 959 ft² |
| 231 | 2B+D | 89 m² | 958 ft² |
| 232 | 1B+D | 61 m² | 652 ft² |
| 233 | 1B+D | 55 m² | 597 ft² |


| NO. | DATE | DESCRIPTION |
| --- | --- | --- |
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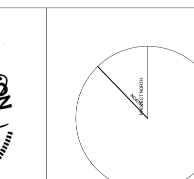


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DWG. TITLE

## 2nd FLOOR PLAN

PROJECT NO.

22-03

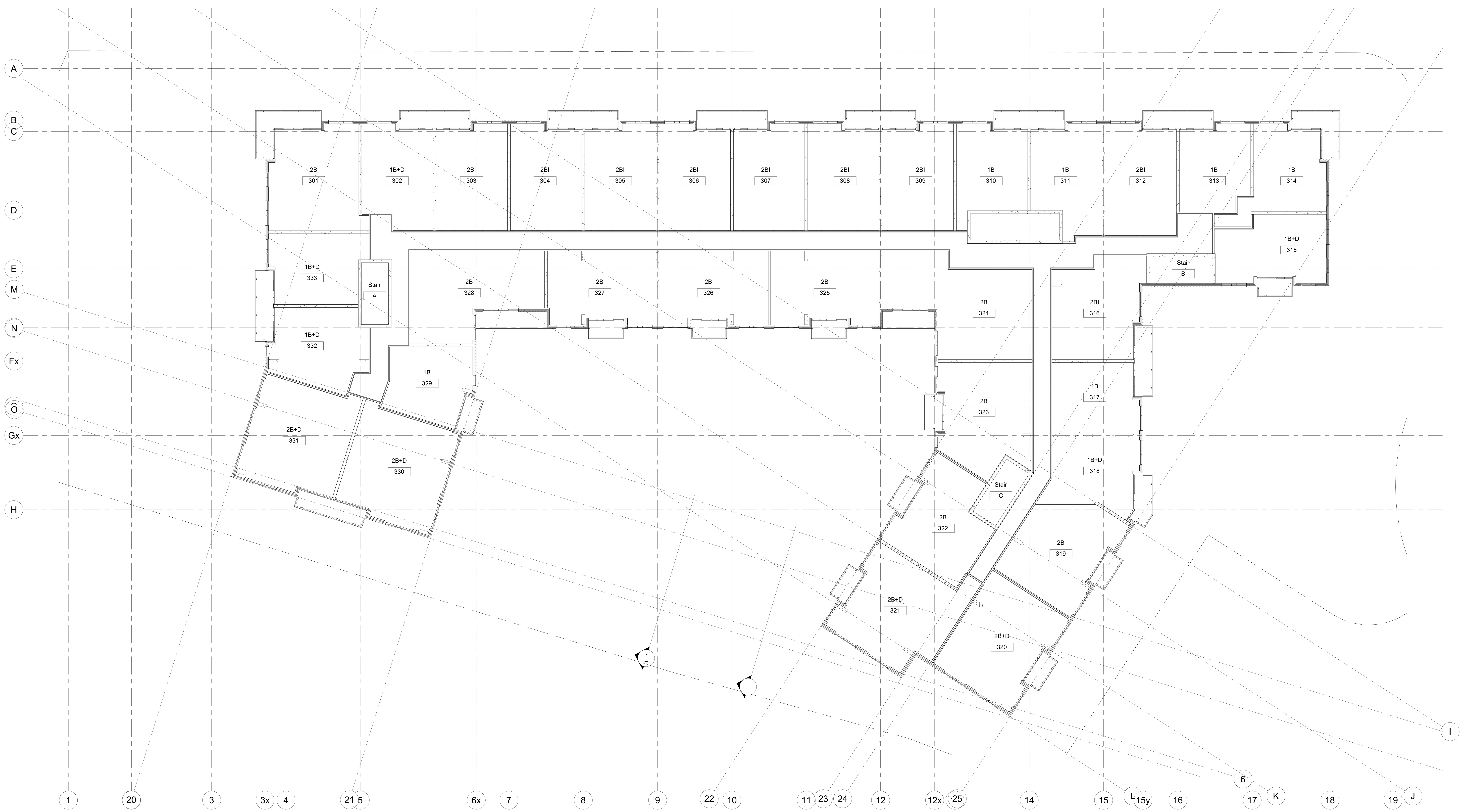
A205

## Suite Types

| Unit Type | Count |
|---|---|
| Level 03 | |
| 1B | 6 |
| 1B+D | 5 |
| 2B | 9 |
| 2B+D | 4 |
| 2BI | 9 |
| | 33 |

## Units per level

| Number | GAI_Unit Type | Area | Area (SF) |
|---|---|---|---|
| Level 03 | | | |
| 301 | 2B | 80 m² | 865 ft² |
| 302 | 1B+D | 59 m² | 637 ft² |
| 303 | 2BI | 64 m² | 684 ft² |
| 304 | 2BI | 64 m² | 684 ft² |
| 305 | 2BI | 64 m² | 684 ft² |
| 306 | 2BI | 64 m² | 684 ft² |
| 307 | 2BI | 64 m² | 684 ft² |
| 308 | 2BI | 64 m² | 684 ft² |
| 309 | 2BI | 64 m² | 684 ft² |
| 310 | 1B | 54 m² | 579 ft² |
| 311 | 1B | 61 m² | 655 ft² |
| 312 | 2BI | 67 m² | 716 ft² |
| 313 | 1B | 50 m² | 543 ft² |
| 314 | 1B | 59 m² | 637 ft² |
| 315 | 1B+D | 61 m² | 660 ft² |
| 316 | 2BI | 73 m² | 786 ft² |
| 317 | 1B | 52 m² | 563 ft² |
| 318 | 1B+D | 53 m² | 571 ft² |
| 319 | 2B | 75 m² | 811 ft² |
| 320 | 2B+D | 84 m² | 906 ft² |
| 321 | 2B+D | 90 m² | 972 ft² |
| 322 | 2B | 69 m² | 746 ft² |
| 323 | 2B | 81 m² | 871 ft² |
| 324 | 2B | 102 m² | 1099 ft² |
| 325 | 2B | 68 m² | 731 ft² |
| 326 | 2B | 68 m² | 728 ft² |
| 327 | 2B | 68 m² | 728 ft² |
| 328 | 2B | 86 m² | 927 ft² |
| 329 | 1B | 51 m² | 550 ft² |
| 330 | 2B+D | 89 m² | 959 ft² |
| 331 | 2B+D | 89 m² | 958 ft² |
| 332 | 1B+D | 61 m² | 652 ft² |
| 333 | 1B+D | 55 m² | 597 ft² |

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DWG. TITLE
# 3rd FLOOR PLAN

PROJECT NO.
22-03

A206

## Suite Types

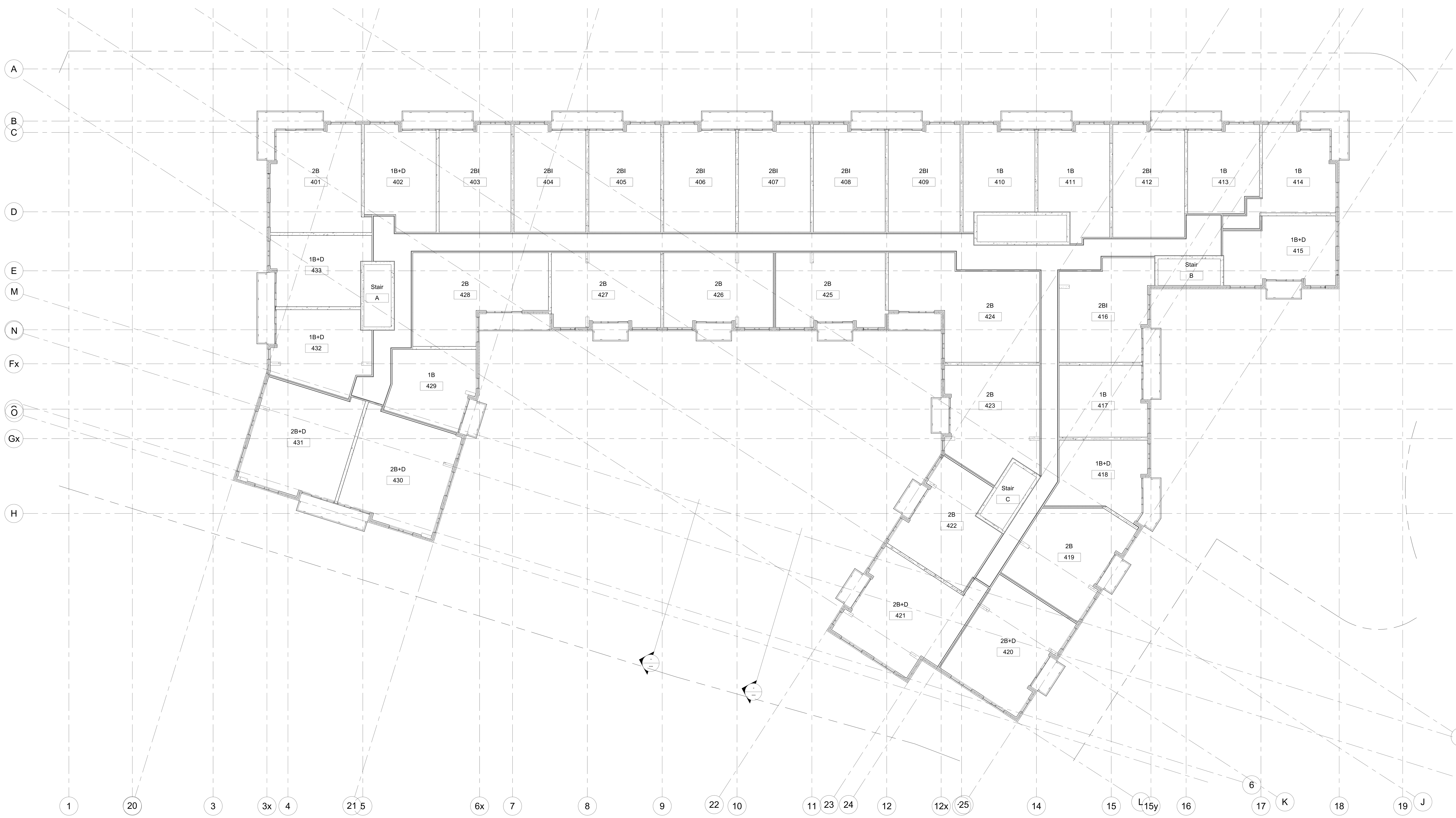
Level 04

| Unit Type | Count |
|---|---|
| 1B | 6 |
| 1B+D | 5 |
| 2B | 9 |
| 2B+D | 4 |
| 2BI | 9 |
| | 33 |

## Units per level

Level 04

| Number | GAI_Unit Type | Area | Area (SF) |
|---|---|---|---|
| 401 | 2B | 80 m² | 865 ft² |
| 402 | 1B+D | 59 m² | 637 ft² |
| 403 | 2BI | 64 m² | 684 ft² |
| 404 | 2BI | 64 m² | 684 ft² |
| 405 | 2BI | 64 m² | 684 ft² |
| 406 | 2BI | 64 m² | 684 ft² |
| 407 | 2BI | 64 m² | 684 ft² |
| 408 | 2BI | 64 m² | 684 ft² |
| 409 | 2BI | 64 m² | 684 ft² |
| 410 | 1B | 54 m² | 579 ft² |
| 411 | 1B | 61 m² | 655 ft² |
| 412 | 2BI | 67 m² | 716 ft² |
| 413 | 1B | 50 m² | 543 ft² |
| 414 | 1B | 59 m² | 637 ft² |
| 415 | 1B+D | 61 m² | 660 ft² |
| 416 | 2BI | 73 m² | 786 ft² |
| 417 | 1B | 52 m² | 563 ft² |
| 418 | 1B+D | 53 m² | 571 ft² |
| 419 | 2B | 75 m² | 811 ft² |
| 420 | 2B+D | 84 m² | 906 ft² |
| 421 | 2B+D | 90 m² | 972 ft² |
| 422 | 2B | 69 m² | 746 ft² |
| 423 | 2B | 81 m² | 871 ft² |
| 424 | 2B | 102 m² | 1099 ft² |
| 425 | 2B | 68 m² | 731 ft² |
| 426 | 2B | 68 m² | 728 ft² |
| 427 | 2B | 68 m² | 728 ft² |
| 428 | 2B | 86 m² | 927 ft² |
| 429 | 1B | 51 m² | 550 ft² |
| 430 | 2B+D | 89 m² | 959 ft² |
| 431 | 2B+D | 89 m² | 958 ft² |
| 432 | 1B+D | 61 m² | 652 ft² |
| 433 | 1B+D | 55 m² | 597 ft² |

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DWG. TITLE

# 4th FLOOR PLAN

PROJECT NO.

22-03

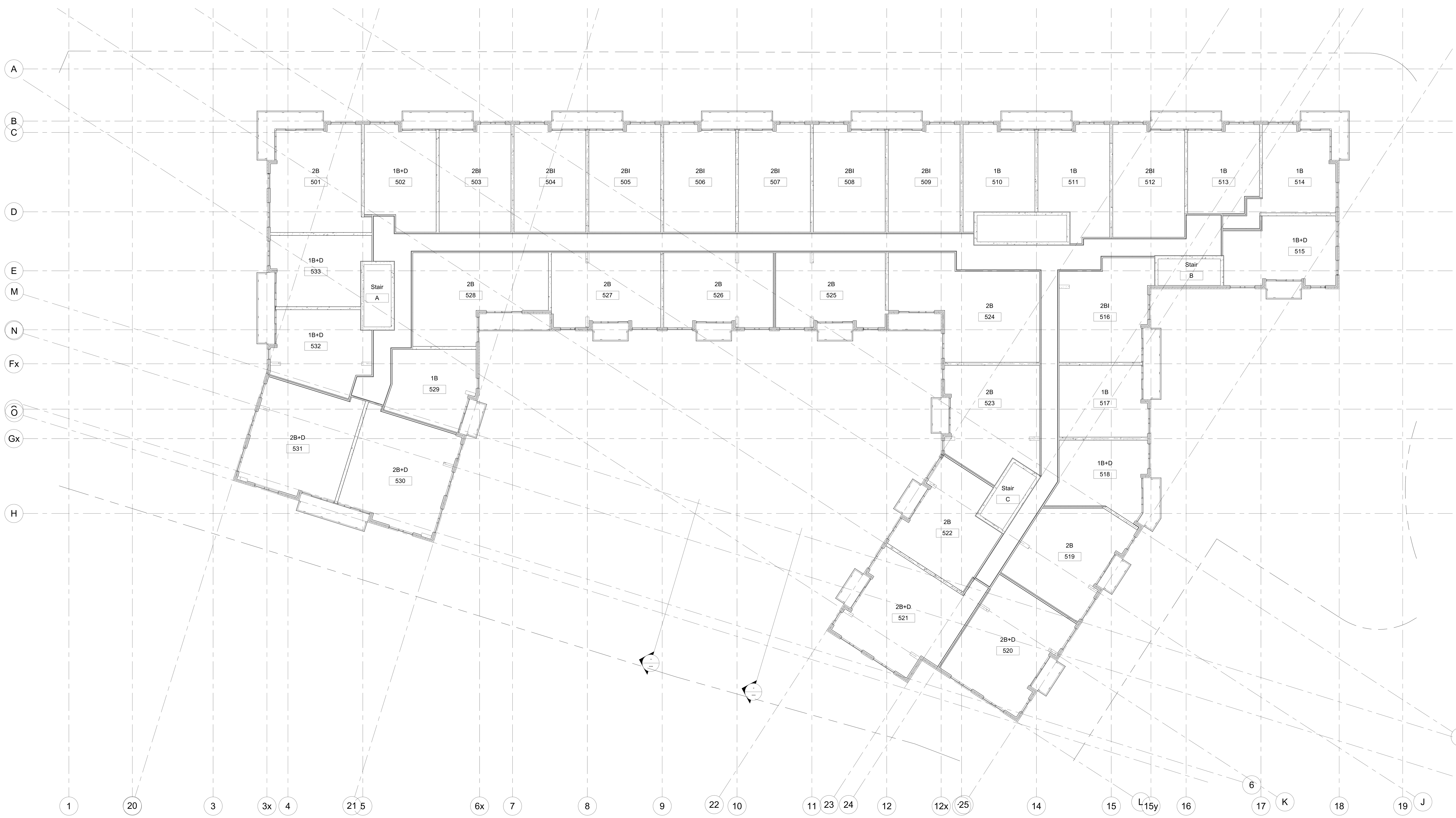
A207

## Suite Types

| Unit Type | Count |
|---|---|
| Level 05 | |
| 1B | 6 |
| 1B+D | 5 |
| 2B | 9 |
| 2B+D | 4 |
| 2BI | 9 |
| | 33 |

## Units per level

| Number | GAI_Unit Type | Area | Area (SF) |
|---|---|---|---|
| Level 05 | | | |
| 501 | 2B | 80 m² | 865 ft² |
| 502 | 1B+D | 59 m² | 637 ft² |
| 503 | 2BI | 64 m² | 684 ft² |
| 504 | 2BI | 64 m² | 684 ft² |
| 505 | 2BI | 64 m² | 684 ft² |
| 506 | 2BI | 64 m² | 684 ft² |
| 507 | 2BI | 64 m² | 684 ft² |
| 508 | 2BI | 64 m² | 684 ft² |
| 509 | 2BI | 64 m² | 684 ft² |
| 510 | 1B | 54 m² | 579 ft² |
| 511 | 1B | 61 m² | 655 ft² |
| 512 | 2BI | 67 m² | 716 ft² |
| 513 | 1B | 50 m² | 543 ft² |
| 514 | 1B | 59 m² | 637 ft² |
| 515 | 1B+D | 61 m² | 660 ft² |
| 516 | 2BI | 73 m² | 786 ft² |
| 517 | 1B | 52 m² | 563 ft² |
| 518 | 1B+D | 53 m² | 571 ft² |
| 519 | 2B | 75 m² | 811 ft² |
| 520 | 2B+D | 84 m² | 906 ft² |
| 521 | 2B+D | 90 m² | 972 ft² |
| 522 | 2B | 69 m² | 746 ft² |
| 523 | 2B | 81 m² | 871 ft² |
| 524 | 2B | 102 m² | 1099 ft² |
| 525 | 2B | 68 m² | 731 ft² |
| 526 | 2B | 68 m² | 728 ft² |
| 527 | 2B | 68 m² | 728 ft² |
| 528 | 2B | 86 m² | 927 ft² |
| 529 | 1B | 51 m² | 550 ft² |
| 530 | 2B+D | 89 m² | 959 ft² |
| 531 | 2B+D | 89 m² | 958 ft² |
| 532 | 1B+D | 61 m² | 652 ft² |
| 533 | 1B+D | 55 m² | 597 ft² |

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DWG. TITLE

# 5th FLOOR PLAN

PROJECT NO.

22-03

A208

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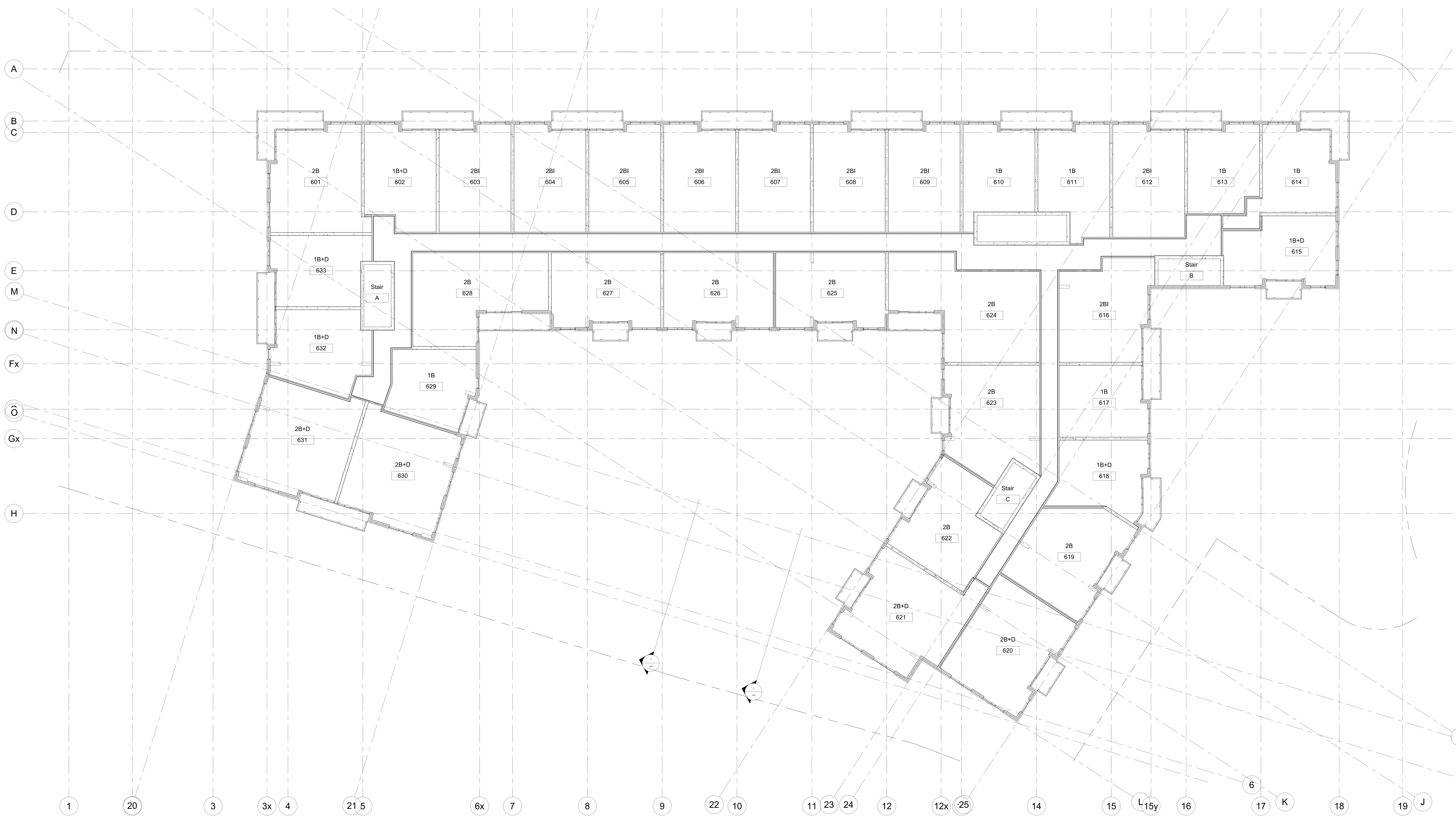
# Suite Types

| Unit Type | Count |
| --- | --- |
| Level 06 | |
| 1B | 6 |
| 1B+D | 5 |
| 2B | 9 |
| 2B+D | 4 |
| 2BI | 9 |
| | 33 |

# Units per level

| Number | GAI_Unit Type | Area | Area (SF) |
| --- | --- | --- | --- |
| Level 06 | | | |
| 601 | 2B | 80 m² | 865 ft² |
| 602 | 1B+D | 59 m² | 637 ft² |
| 603 | 2BI | 64 m² | 684 ft² |
| 604 | 2BI | 64 m² | 684 ft² |
| 605 | 2BI | 64 m² | 684 ft² |
| 606 | 2BI | 64 m² | 684 ft² |
| 607 | 2BI | 64 m² | 684 ft² |
| 608 | 2BI | 64 m² | 684 ft² |
| 609 | 2BI | 64 m² | 684 ft² |
| 610 | 1B | 54 m² | 579 ft² |
| 611 | 1B | 61 m² | 655 ft² |
| 612 | 2BI | 67 m² | 716 ft² |
| 613 | 1B | 50 m² | 543 ft² |
| 614 | 1B | 59 m² | 637 ft² |
| 615 | 1B+D | 61 m² | 660 ft² |
| 616 | 2BI | 73 m² | 786 ft² |
| 617 | 1B | 52 m² | 563 ft² |
| 618 | 1B+D | 53 m² | 571 ft² |
| 619 | 2B | 75 m² | 811 ft² |
| 620 | 2B+D | 84 m² | 906 ft² |
| 621 | 2B+D | 90 m² | 972 ft² |
| 622 | 2B | 69 m² | 746 ft² |
| 623 | 2B | 81 m² | 871 ft² |
| 624 | 2B | 102 m² | 1099 ft² |
| 625 | 2B | 68 m² | 731 ft² |
| 626 | 2B | 68 m² | 728 ft² |
| 627 | 2B | 68 m² | 728 ft² |
| 628 | 2B | 86 m² | 927 ft² |
| 629 | 1B | 51 m² | 550 ft² |
| 630 | 2B+D | 89 m² | 959 ft² |
| 631 | 2B+D | 89 m² | 958 ft² |
| 632 | 1B+D | 61 m² | 652 ft² |
| 633 | 1B+D | 55 m² | 597 ft² |

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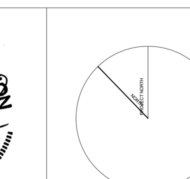



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DWG. TITLE

## 6th FLOOR PLAN

PROJECT NO.

22-03

A209

## Suite Types

| Unit Type | Count |
|---|---|
| Level 07 | |
| 1B | 8 |
| 1B+D | 4 |
| 2B | 5 |
| 2B+D | 4 |
| 2B+d | 1 |
| 2BI | 9 |
| | 31 |

## Units per level

| Number | GAI_Unit Type | Area | Area (SF) |
|---|---|---|---|
| Level 07 | | | |
| 701 | 2B+d | 80 m² | 865 ft² |
| 702 | 1B+D | 59 m² | 637 ft² |
| 703 | 2BI | 64 m² | 684 ft² |
| 704 | 2BI | 64 m² | 684 ft² |
| 705 | 2BI | 64 m² | 684 ft² |
| 706 | 2BI | 64 m² | 684 ft² |
| 707 | 2BI | 64 m² | 684 ft² |
| 708 | 2BI | 64 m² | 684 ft² |
| 709 | 2BI | 64 m² | 684 ft² |
| 710 | 1B | 54 m² | 579 ft² |
| 711 | 1B | 61 m² | 655 ft² |
| 712 | 2BI | 67 m² | 716 ft² |
| 713 | 1B | 50 m² | 543 ft² |
| 714 | 1B | 59 m² | 637 ft² |
| 715 | 1B | 61 m² | 660 ft² |
| 716 | 2BI | 73 m² | 786 ft² |
| 717 | 1B | 52 m² | 563 ft² |
| 718 | 1B+D | 74 m² | 798 ft² |
| 719 | 2B+D | 88 m² | 946 ft² |
| 720 | 2B | 84 m² | 909 ft² |
| 721 | 1B+D | 81 m² | 871 ft² |
| 722 | 2B+D | 102 m² | 1099 ft² |
| 723 | 2B | 68 m² | 731 ft² |
| 724 | 2B | 68 m² | 728 ft² |
| 725 | 2B | 68 m² | 728 ft² |
| 726 | 2B | 86 m² | 927 ft² |
| 727 | 1B | 51 m² | 550 ft² |
| 728 | 2B+D | 89 m² | 959 ft² |
| 729 | 2B+D | 89 m² | 958 ft² |
| 730 | 1B+D | 61 m² | 652 ft² |
| 731 | 1B | 55 m² | 597 ft² |


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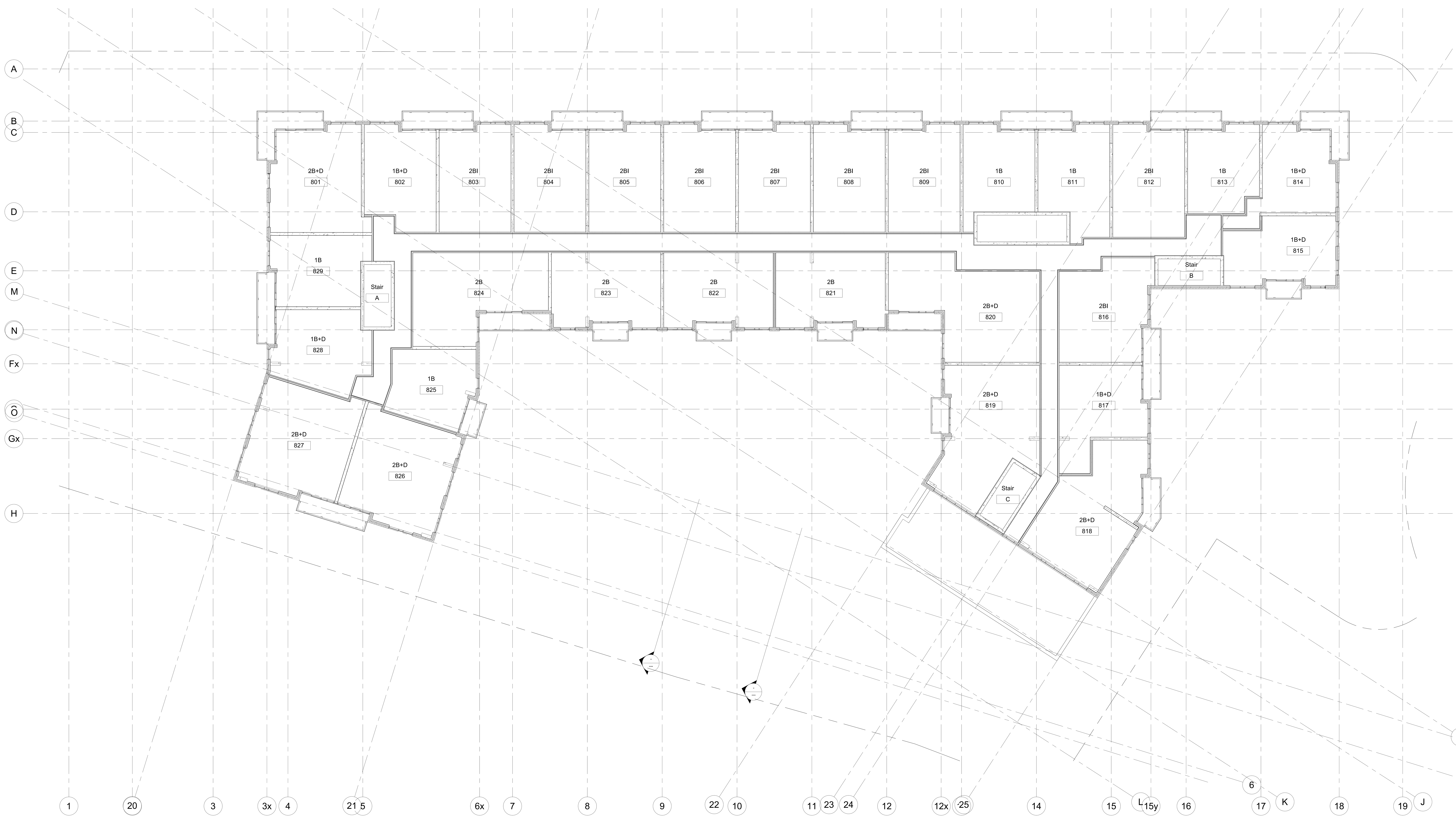
DWG. TITLE

# 7th FLOOR PLAN

PROJECT NO.

22-03

A210




## Suite Types

Level 08

| Unit Type | Count |
|---|---|
| | 1 |
| 1B | 5 |
| 1B+D | 5 |
| 2B | 4 |
| 2B+D | 6 |
| 2BI | 8 |
| | 29 |

## Units per level

Level 08

| Number | GAI_Unit Type | Area | Area (SF) |
|---|---|---|---|
| 801 | 2B+D | 80 m² | 865 ft² |
| 802 | 1B+D | 59 m² | 637 ft² |
| 803 | 2BI | 64 m² | 684 ft² |
| 804 | 2BI | 64 m² | 684 ft² |
| 805 | 2BI | 64 m² | 684 ft² |
| 806 | 2BI | 64 m² | 684 ft² |
| 807 | 2BI | 64 m² | 684 ft² |
| 808 | 2BI | 64 m² | 684 ft² |
| 809 | 2BI | 64 m² | 684 ft² |
| 810 | 1B | 54 m² | 579 ft² |
| 811 | 1B | 61 m² | 655 ft² |
| 812 | 2BI | 67 m² | 716 ft² |
| 813 | 1B | 50 m² | 543 ft² |
| 814 | 1B+D | 59 m² | 637 ft² |
| 815 | 1B+D | 61 m² | 660 ft² |
| 816 | | 73 m² | 786 ft² |
| 817 | 1B+D | 62 m² | 666 ft² |
| 818 | 2B+D | 97 m² | 1043 ft² |
| 819 | 2B+D | 100 m² | 1071 ft² |
| 820 | 2B+D | 102 m² | 1099 ft² |
| 821 | 2B | 68 m² | 731 ft² |
| 822 | 2B | 68 m² | 728 ft² |
| 823 | 2B | 68 m² | 728 ft² |
| 824 | 2B | 86 m² | 927 ft² |
| 825 | 1B | 51 m² | 550 ft² |
| 826 | 2B+D | 89 m² | 959 ft² |
| 827 | 2B+D | 89 m² | 958 ft² |
| 828 | 1B+D | 61 m² | 652 ft² |
| 829 | 1B | 55 m² | 597 ft² |

| DATE | ISSUED FOR |
|---|---|

| NO. | DATE | DESCRIPTION |
|---|---|---|
| 1 | | |

REVISIONS

Contractor must check and verify all dimensions and be responsible for same. Reporting any discrpancies to the Architect before commencing work.

All drawings, prints and specifications are the property of the ARchitect and must be returned to him on completion of work. Latest drawings only to be used for construction.

Prints are not to be scaled.

ONTARIO ASSOCIATION OF ARCHITECTS
RANIERI POSSAMAI
LICENCE
5061

PROJECT NORTH
NORTH

GLOBAL ARCHITECT INC.
6 Leswyn Road, Toronto, Ontario M6A 1K2
ph: 416 256 4440 fx: 416 256 4449

CLIENT

PROJECT NAME Vic 2
RUTLEDGE RD.

| | |
|---|---|
| DRAWN BY | CM |
| CHECKED BY | RP, PP |
| DATE | 04/28/22 |
| SCALE | 1 : 125 |

DWG. TITLE

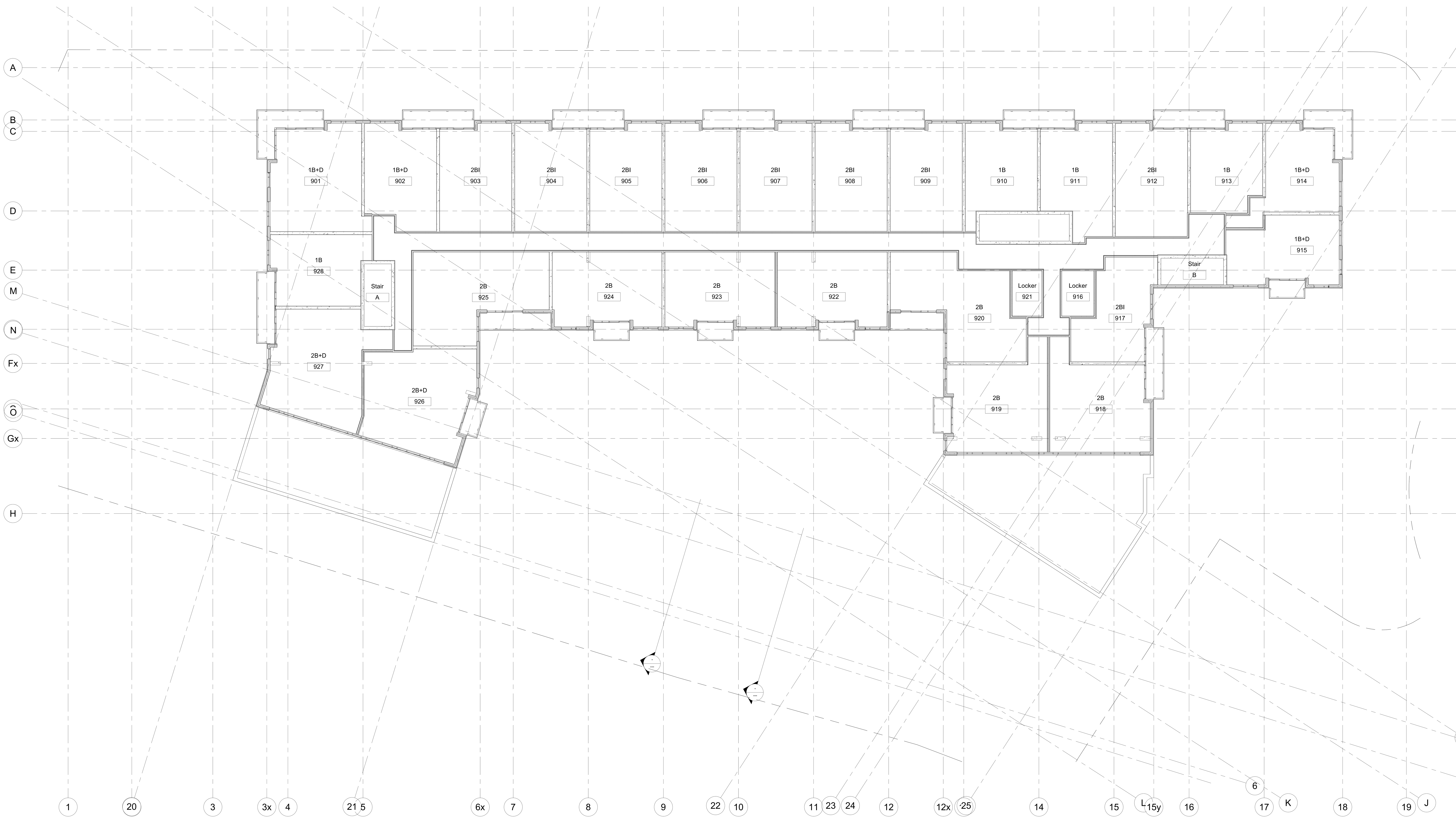
8th FLOOR PLAN

PROJECT NO.

22-03 A211

| Suite Types | |
|---|---|
| Unit Type | Count |
| Grand total | 258 |

| Units per level | | | |
|---|---|---|---|
| Number | GAI_Unit Type | Area | Area (SF) |




| DATE | ISSUED FOR |
|---|---|

| NO. | DATE | DESCRIPTION |
|---|---|---|
| 1 | | |

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CLIENT

PROJECT NAME
Vic 2
RUTLEDGE RD.

| | |
|---|---|
| DRAWN BY | CM |
| CHECKED BY | RP, PP |
| DATE | 04/26/22 |
| SCALE | 1 : 125 |

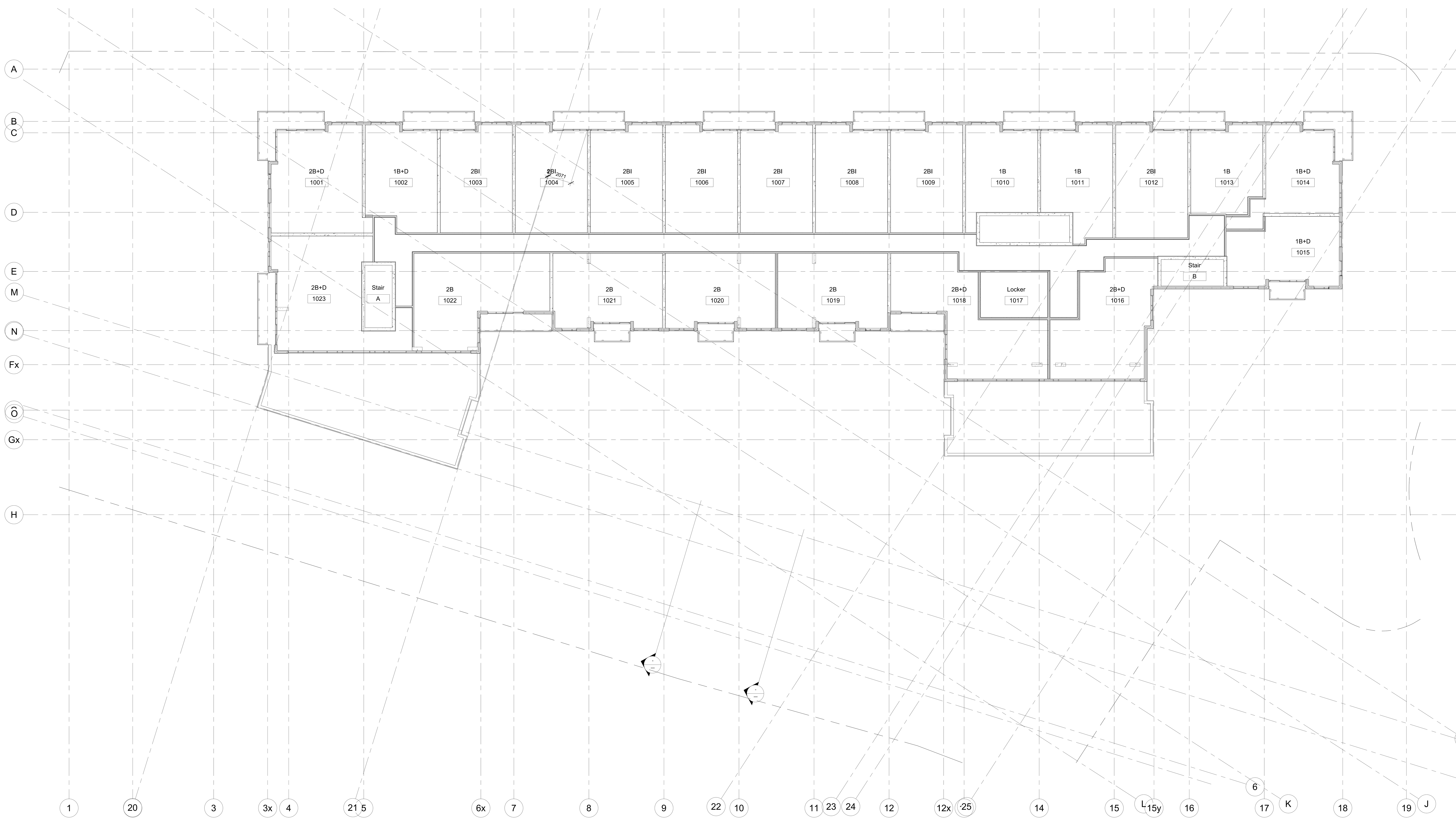
DWG. TITLE
9th FLOOR PLAN

PROJECT NO.
22-03

A212

| Suite Types | |
|---|---|
| Unit Type | Count |

| Units per level | | | |
|---|---|---|---|
| Number | GAI_Unit Type | Area | Area (SF) |




| DATE | ISSUED FOR |
|---|---|

| NO. | DATE | DESCRIPTION |
|---|---|---|
| 1 | | |

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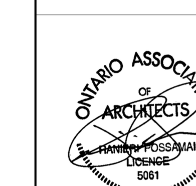



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CLIENT

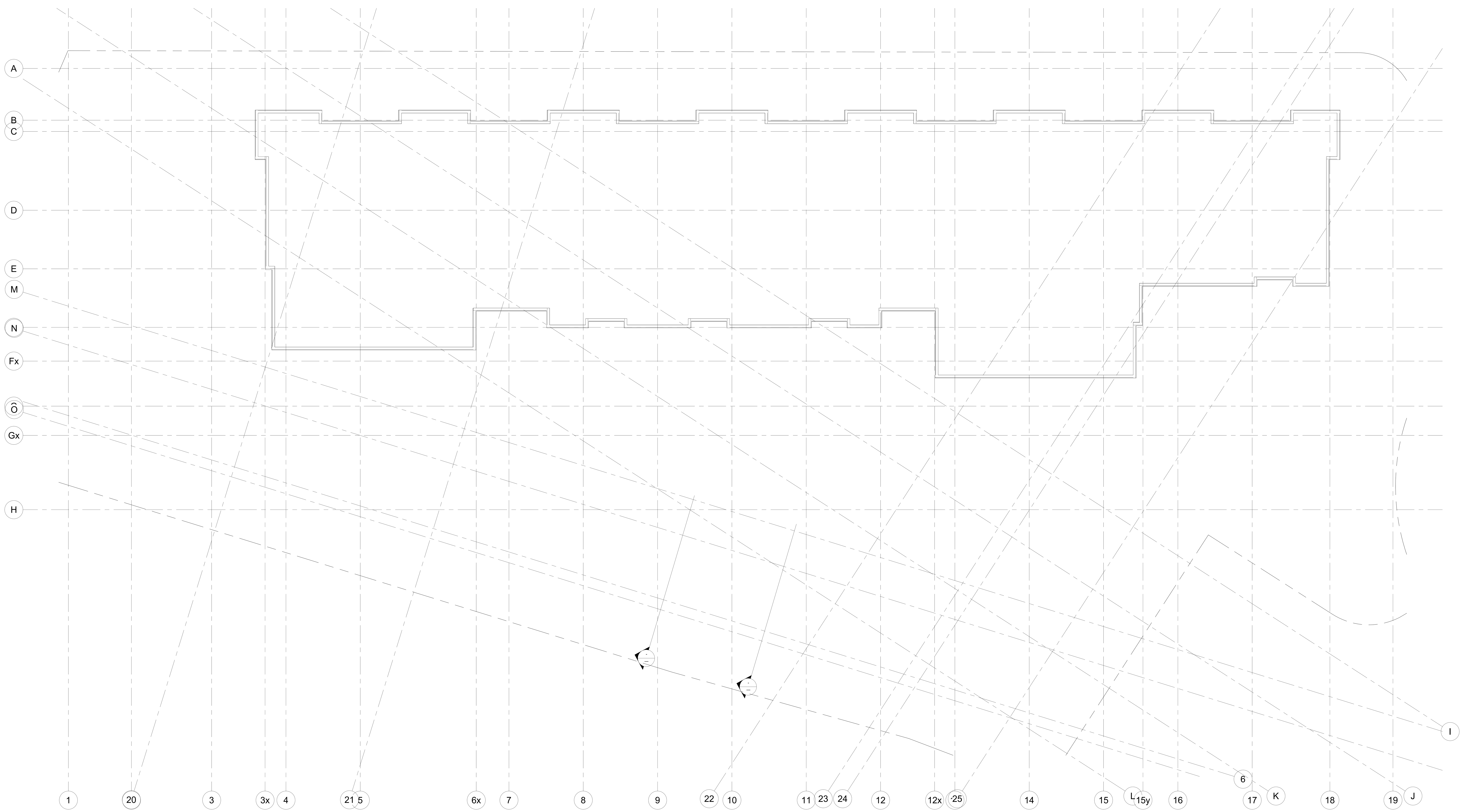
PROJECT NAME Vic 2
RUTLEDGE RD.

DRAWN BY CM
CHECKED BY RP, PP
DATE 04/28/22
SCALE 1 : 125

DWG. TITLE
10th FLOOR PLAN

PROJECT NO.
22-03

A213




| DATE | ISSUED FOR |
|---|---|

| NO. | DATE | DESCRIPTION |
|---|---|---|
| 1 | | |

REVISIONS

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PROJECT NORTH
NORTH


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CLIENT

PROJECT NAME Vic 2
RUTLEDGE RD.

| | |
|---|---|
| DRAWN BY | CM |
| CHECKED BY | RP, PP |
| DATE | 04/28/22 |
| SCALE | 1 : 125 |

DWG. TITLE

# 11th FLOOR PLAN

PROJECT NO.

22-03

A214

| DATE | ISSUED FOR |
|---|---|

| NO. | DATE | DESCRIPTION |
|---|---|---|
| 1 | | |

REVISIONS

Contractor must check and verify all dimensions and be responsible for same. Reporting any discrpancies to the Architect before commencing work.

All drawings, prints and specifications are the property of the ARchitect and must be returned to him on completion of work. Latest drawings only to be used for construction.

Prints are not to be scaled.

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RANIERI POSSAMAI
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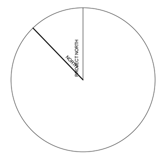
5061





GLOBAL ARCHITECT INC.
6 Leswyn Road, Toronto, Ontario M6A 1K2
ph: 416 256 4440 fx: 416 256 4449


CLIENT

PROJECT NAME: Vic 2, RUTLEDGE RD.

| | |
|---|---|
| DRAWN BY | CM |
| CHECKED BY | RP, PP |
| DATE | 04/28/22 |
| SCALE | |

DWG. TITLE

# ROOF PLAN

PROJECT NO. 22-03

A215

# APPENDIX ‘B’

## AECOM Crash Wall Guidelines

## Submission Guidelines for Crash Walls

Crash walls may be required for the protection of overhead structures, and in some cases the Railway may consider a crash wall as an alternative to an earthen berm for the protection of structures or facilities adjacent to the track. When proposing or designing such a structure, the following components should be in the submission. Where there is a discrepancy between the requirements here and those provided by the client Railway or AREMA, the more stringent shall govern.

1. Covering Letter

    - Summary of items enclosed,
    - Location and date of previous, approved, similar designs by this designer, if any,
    - Where the crash wall is proposed as an alternative to an earthen berm: alternative materials / configurations considered and benefits of this design,
    - A Location or Key Plan. This will be used to identify the mileage and subdivision, the classification of the rail line, and the maximum speed for freight and passenger rail traffic, all obtained from AECOM Canada for CP and CN-owned corridors or from GO Transit for GO-owned corridors.
    - Name, phone, fax and e-mail address of your contact.

2. Geotechnical Report - (2 copies)

    - Soil properties used in design, and how determined,
    - Borehole logs including location plan, if required to support these properties,
    - Narrative report describing soil and ground water conditions, if required as above.

3. Design of Crash Walls

    - One of the following methods may be chosen, or an alternative design load may be selected and if it can be justified by the engineer responsible for the design. The simplified approach of Method 1 may be used in most cases. Method 2 may be used to optimize the design, or where factors such as distance from the track to the wall, track speeds, side slopes along the track, consequences of collision or others may justify a different load.
    - **Method 1**: The wall may be designed for a minimum point load of 600 kip (2700 kN) applied horizontally and normal to the face at any point along the wall
        - The point load shall be applied at a height of 6 feet (1.8 m) *above the top of rail* for walls up to 25 feet (7.6 m) from the centerline of track, or a height of 6 feet (1.8 m) *above the groundline* for walls farther than 25 feet (7.6 m) from the centerline of track.

  - This method may be applied where track speeds do not exceed 50 mph (80 km/hr) for freight or 70 mph (112 km/hr) for passenger trains; where speeds exceed these limits, Method 2 shall be used.

- **Method 2**: an energy balance approach considering collision by glancing blow and single car rotation may be used to determine the design load. The following four cases must be considered:

  - Freight Train Load Case 1 - Glancing Blow: nine cars weighing 143 tons (129 700 kg) each, impacting the wall at an angle, $\theta_G$. The angle of impact will be a function of track curvature, and for tangent track may be taken as 3.5 degrees.

  - Freight Train Load Case 2 - Single Car Impact: single car weighing 143 tons (129 700 kg) impacting the wall as it undergoes rotation about its center. The angle of rotation at impact is:

    $$\theta_f = \operatorname{asin}\left(\frac{d_{CL}}{8.5}\right) \qquad [1]$$

    where $d_{CL}$ is the distance from the crash wall to the centerline of track in m. The closest existing or future track is to be used. Where $d_{CL}$ is greater than 8.5 m, this load case need not be considered.

  - Passenger Train Load Case 3 - Glancing Blow: eight cars weighing 74 tons (67120 kg) each impacting the wall at an angle, $\theta_G$. The angle of impact will be a function of track curvature, and for tangent track may be taken as 3.5 degrees.

  - Passenger Train Load Case 4 - Single Car Impact: single car weighing 74 tons (67120 kg) impacting the wall as it undergoes rotation about its center. The angle of rotation at impact is:

    $$\theta_f = asin\left(\frac{d_{CL}}{13}\right) \qquad [2]$$

    Where $d_{CL}$ is greater than 13 m, this load case need not be considered.

  - The analysis should reflect the specified track speeds for passenger and/or freight trains applicable within the subject corridor.

  - To assist in designing the structure for the above load cases, use:

    - For the glancing blow load cases, the speed of derailed equipment impacting the wall is reduced from the track speed, $v_o$, to

      $$v_G = \sqrt{v_o^2 + 2a\left(\frac{d_{CL}-1.625}{\sin\theta_G}\right)} \text{ [m/s]} \qquad [3]$$

      Where $d_{CL}$ is the distance from the crash wall to the centerline of track in m.

      $v_o$ is the track speed in m/s

      $\theta_G$ is the angle of impact

$\mathrm{a}$ is the acceleration in m/s, calculated as $-9.8(.25 + \mathrm{G})$

$\mathrm{G}$ is the grade in decimal unit of the groundline in the direction of travel defined by the angle of impact relative to the centerline of track; calculated as $\frac{Groundline\ at\ wall - Base\ of\ Rail}{d_{CL}/_{sin\theta_G}}$.

- For the single car load cases, the speed of derailed equipment impacting the wall is

$$v_A = \frac{2.3\theta_f}{\sqrt{1 - \cos\theta_f}} \left[\frac{m}{s}\right] for\ freight\ cars \qquad [4]$$

$$v_A = \frac{2.9\theta_f}{\sqrt{1 - \cos\theta_f}} \left[\frac{m}{s}\right] for\ passenger\ cars \qquad [5]$$

Where $\theta_f$ is the angle of impact, in radians, defined in [1] and [2].

- For energy dissipation, assume:
  - Contact with the wall stops all movement in the direction perpendicular to the wall, but not along its length
  - Plastic deformation of individual car due to direct impact is 1 foot (.3048 m) maximum,
  - Total compression of linkages and equipment of the 8 or 9 car consist is 10 feet (3.048 m) maximum,
  - Deflection of wall is considered negligible in equations [6] to [9]. Where the designer wishes to include it, those equations may be modified.
  - In lieu of more rigorous analysis, these energy balance equations may be used to determine the design load perpendicular to the wall. The design load acts along the given length of wall.
    - For the glancing blow load cases

$$F_G = \frac{\frac{1}{2}m(v_G \sin\theta_G)^2}{d_G} \qquad [6]$$

And the load is considered to act along the length $l_G$ in m:

$$l_G = \frac{3.048}{\cos\theta_G} \qquad [7]$$

Where $m$ is the mass of the derailed cars in kg.

$v_G$ is the impact speed in m/s, defined in [3]

$\theta_G$ is the angle of impact

$d_G$ is the deformation of the consist in the direction of the applied force, and $d_G = 3.048 \sin\theta_G$ , in m

- For the single car impact

$$F_A = \frac{\frac{1}{2} m (v_A \cos\theta_f)^2}{d_A} \quad [8]$$

And the load is considered to act along the length $l_A$ in m:

$$l_A = \frac{.3048}{\sin\theta_f} \quad [9]$$

Where $m$ is the mass of the derailed cars in kg.

$v_A$ is the impact speed in m/s, defined in [4] or [5]

$\theta_f$ is the angle of rotation at impact defined in [1] or [2]

$d_A$ is the deformation of the consist in the direction of the applied force, and $d_A = .3048 \cos\theta_f$, in m

Where the influence areas of two sequential cars in an accordion style of derailment overlap, the wall must be designed for the simultaneous impact of both cars.

- Regardless of the method selected, the following guidelines must be followed:
  - The minimum thickness for walls up to 25 feet (7.6 m) from the centerline of track shall be 2'-6" (.760 m); minimum thickness for walls farther than 25 feet (7.6 m) from the centerline of track shall be 18 inches (.45 m).
  - Crash walls less than 12 feet (3.6 m) from the centerline of track shall be a minimum of 12 feet (3.6 m) above the top of rail. Crash walls between 12 feet (3.6 m) and 25 feet (7.6 m) from the centerline of track shall be a minimum of 7 feet (2.135 m) *above the top of rail*. Crash walls greater than 25 feet (7.6 m) from the centerline of track shall be a minimum of 7 feet (2.135 m) *above the adjacent groundline*.
  - The face of the crash wall shall be smooth and continuous, and shall extend a minimum of 6 inches (0.15 m) beyond the face of the structure (such as a building column or bridge pier) parallel to the track.
  - The design must incorporate horizontal and vertical continuity to distribute the loads from the derailed train.
  - The wall must be of solid, heavy construction, and separate precast blocks or stones will not be permitted.

4. Drawings - (2 hard copies as well as .pdf format)

   - Site plan clearly showing property line, location of wall structure, centerline and elevation of nearest rail track,
   - Layout and structural details of proposed structure, including all material notes and specs and construction procedures/phasing. All drawings signed and sealed by a professional engineer registered in the province having jurisdiction at the project location.
   - Extent and treatment of any temporary excavations on railway property.

5. Cheque

   - A cheque payable to AECOM will be required for the cost of this review. Please contact AECOM for current pricing. Cost will take into consideration number of submissions, site visits, meetings, and alternative or unusually complex designs.

6. Post-Construction Certificate - (1 copy)

   - Engineer's certificate of completion describing actual construction, and certifying that the structure was built as per approved drawings,
   - Copy of as-built drawings, as part of the engineer's certification of completion.

## Access to Railway Operating Rights-of-Way

Permits **MUST** be obtained before entering into any Railway Operating right-of-way.

Some or all of the following may also be required: - proper railway flagging protection, cable locates, liability insurance, release of liability, safety training.

AECOM Canada Ltd. will provide guidance as to the proper process to be followed in this regard. Fees will be established based on the nature and extent of the work being proposed.

## Communication for Submissions

All correspondence during the review process should be directed to AECOM Canada Ltd.

Upon completion of our review, a confidential report on our findings will be made to the railway company, who will subsequently contact the applicant.

The applicant will be notified when the report has been submitted to the railway.

## Liability and Responsibility

The review will be undertaken with the understanding that neither the railway nor AECOM Canada Ltd. shall have any responsibility nor liability whatsoever for the design or adequacy of the crash wall, notwithstanding that any plans or specifications may have been reviewed by the railway nor AECOM Canada Ltd. No such review shall be deemed to limit the applicant's full responsibility for the design and construction adequacy of the works.

AECOM Canada Ltd.

Mississauga, Ont.

July 2005 Revised July 29, 2014

# APPENDIX ‘C’

## Risk Assessment

## Risk Assessment Matrix

Table No. 3.0

| | |
|---|---|
| **Prepared by (name & company):** | JSW+ Associates |
| **Site:** | 150 Rutledge Road |
| **Adjacent Rail Corridor:** | Principle mainline Mile: 21, Galt Subdivision |
| **Date:** | November-17-22 |
| **Revision:** | 1 |

**General Notes**
1) The railway corridor is a principal mainline. Rail corridor is owned by CP so freight trains transporting hazardous and flammable materials are considered.
2) Dangerous good trains operate at reduced mainline speeds compared to other freight trains.
3) The crash wall is only intended to restrain physical forces of train derailment. Crash wall provides little or no protection against explosion, fire, or releases of hazardous goods. Emergency forces may decide evacuation is required in this event.
4) There is one switch and one crossover in close proximity to the site. The track design speed is 60mph (97 km/h).

| # | Frequency | Severity |
|---|---|---|
| 1 | Improbable | Negligible |
| 2 | Remote | Marginal |
| 3 | Occasional | Serious |
| 4 | Probable | Critical |
| 5 | Frequent | Catastrophic |

| Ref | Initial Risk | | | | | | Current (Residual) Risk | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Hazard** | **Consequence** | **Frequency** | **Severity** | **Initial Risk** | **Risk Classification** | **Safeguard/ Mitigation Measure** (Describe the measure put in place which results in a reduction in likelihood and/or severity of the hazard) | **Assumptions/Comments** (Provide additional information relevant to the assessment of the revised ratings for Frequency and severity, as relevant) | **Frequency** | **Severity** | **Current Rank** | **Risk Classification** |
| 1 | Derailment of freight train carrying flammable or hazardous materials. | On collision with proposed crash wall on site, rail cars with flammable/hazardous materials cause explosion ignite, explode or are released adjacent to the building causing injuries and/or fatalities to occupants. | 3 | 3 | 9 | Tolerable | Subject site possess a derailment protection feature (crash wall) as well as providing the required setback of 25m to all sensitive use. | 1) Dangerous good trains operate at reduced mainline speeds compared to other freight trains.<br>2) This rail corridor is designated for passenger trains and freight as Metrolinx has running rights in this corridor. Freight trains carrying flammable and hazaous materials would be considered frequent.<br>3) Emergency services may decide evacuation is required in any major event.<br>4) History of fire on this rail corridor has resulted in 0 casualties thus far, since this data has been collected from 1983. | 3 | 2 | 6 | Tolerable |
| 2 | Derailment of freight or passenger train at speed greater than maximum line speed with berm/crash wall in place. | Collision of freight or passenger train with crash wall. The crash wall attenuates more than design allowance. The crash wall and connecting sacrificial structures experience more damage than design expectation. | 4 | 3 | 12 | Intolerable | The crash wall will be designed to specified railway design loading limits. | The rail corridor has a track design speed of 60mph (97km/h). Based on past history from this particular rail corridor, speeding accidents did not record a single casualty since data has been collect in 1983.<br>Note that train speeds in excess of posted maximum mainline speeds can only be mitigated through the action by others. | 4 | 2 | 8 | Tolerable |
| 3 | Derailment of freight train | Transfer of derailment loads/forces to the auxiliary and principal building structures causes moderate to significant damage and possible collapse. | 4 | 3 | 12 | Intolerable | Firstly, the site will be safeguarded with a derailment protection feature (crash wall) that is to mitigate and/or minimize significant damage to the building structure(s). Secondly, the proposed development was designed with adequate total setback distances. | The protection features are designed to provide the energy attenuation required in the event of a train derailment. The data illustrate that there has been no fatalities on this rail corridor from derailment since data was collected in 1983. Additionally, see comments in item 1. | 4 | 2 | 8 | Tolerable |
| 4 | Energy of derailed train deflected back from the crash wall into rail cars. | Transfer of forces caused by sudden deceleration results in higher risk of equipment rupture and/or sparking, potentially causing fire or explosion. | 3 | 4 | 12 | Intolerable | See item 1 mitigation measures. | Historical data on this rail corridor suggests that the event described in Ref 4 for the entire subdivision is rare and resulted in 0 casualties thus far. Additionally, see comments in Item 1 and Item 2. | 4 | 2 | 8 | Tolerable |
| 5 | Derailment of freight train into corners of proposed development property or berm/crash wall. | Derailed freight cars or passenger cars enter the site from an angle (i.e. either from north or south approaches), bypassing the protection along the property line, and colliding with buildings on the site or hitting the corner of the crash wall. | 4 | 4 | 16 | Intolerable | The southern flank of the subject site is protected by an exisiting berm. The derailment would experience adequate energy attenuation from the berm. | See comments in item 1 to 3. | 4 | 2 | 8 | Tolerable |
| 6 | Top level of sea-can (double stack intermodal) freight car becomes airborne in a derailment. | Airborne freight car over sails the crash wall and collides with the building. | 3 | 4 | 12 | Intolerable | The entire development is setback greater than 25m from the rail corridor property line, so if there were to be airbourne freight cars the crash wall, and the horizontal setbacks would protect the development. | Double stack freight cars are locked in place during the loading phase. If the locks are rigid during impact, the double stack shipment would act as a single unit. See comments in item 1-3. | 3 | 2 | 6 | Tolerable |
| 7 | Trespassing onto railroad | Interference with railway operations, vandalism, and danger to the trespasser(s) from moving trains. | 4 | 5 | 20 | Intolerable | The crash wall along the rail corridor property line will be designed a minimum of 2.135m in height. A proposed 0.3 meter high, non-climb, non-cut, chainlink fence to be installed atop of the crash wall to meet the minimum security fence height of 2.43m. | No access from the site to the rail corridor is possible in the future condition, as the development will be providing non-cut and non-climb fencing atop the crash wall that will separate the subject site from the rail corridor. | 1 | 5 | 5 | Tolerable |

**Table 1 - Risk Classification Matrix**

| FREQUENCY | | SEVERITY<br>Catastrophic<br>5 | Critical<br>4 | Serious<br>3 | Marginal<br>2 | Negligible<br>1 |
|---|---|---|---|---|---|---|
| Frequent | 5 | 25 | 20 | 15 | 10 | 5 |
| Probable | 4 | 20 | 16 | 12 | 8 | 4 |
| Occasional | 3 | 15 | 12 | 9 | 6 | 3 |
| Remote | 2 | 10 | 8 | 6 | 4 | 2 |
| Improbable | 1 | 5 | 4 | 3 | 2 | 1 |

**Table 2 - Risk Category & Mitigation Strategy**

| Risk<br>(Frequency x Severity) | | Risk Category | Mitigation Strategy |
|---|---|---|---|
| Low | 1 to 4 | Broadly Acceptable | Risk is acceptable. No further mitigation required. |
| Medium | 4 to 10 | Tolerable | Risk is considered tolerable if agreed that the risk is reduced to a level considered ALARP* |
| High | 10 to 25 | Intolerable | Risk shall be eliminated/reduced. |

**As low as reasonably practicable.*

**Table 3 - Definition of Safety Hazard Severity Criteria**

| Hazard Rating | | Consequence to Personnel or General Public | Consequence to the Environment | Consequence to the Rail System and Operation |
|---|---|---|---|---|
| 1 | **Negligible** | Non-reportable injury | None | Monetary loss less than $10k. |
| 2 | **Marginal** | Single minor injury | Reversible minor environmental impact | Minor operational delays<br>Dangerous goods involved without release of product;<br>Monetary loss between $10 k and $100 k. |
| 3 | **Serious** | Single permanent partial or temporary total disabling injury;<br>Multiple minor injuries. | Reversible moderate environmental impact | Significant system loss, severely restricting operations;<br>Dangerous goods release not resulting in evacuation;<br>Monetary loss between $100 k and $1 million. |
| 4 | **Critical** | Single fatality;<br>Single instances of permanent total disability;<br>Multiple instances of permanent partial or temporary total disabling injuries. | Reversible significant environmental impact | Major loss of system / sub-system resulting in not being able to continue operations;<br>Dangerous goods release resulting in evacuation;<br>Monetary loss between $1 million and $10 million. |
| 5 | **Catastrophic** | Multiple fatalities;<br>Multiple instances of permanent total disability | Irreversible significant environmental impact | Total loss of services;<br>Dangerous goods release resulting in major evacuation;<br>Monetary loss esceeding $10million. |

Table 4 - Definition of Hazard Frequency Criteria

| Rating | | Qualitative Interpretation | Interpreted for Lifecycle |
|---|---|---|---|
| 1 | Improbable | Unlikely to occur, but possible. It can be assumed the event is unlikely to occur. | 100 years to 1000 years |
| 2 | Remote | Likely to occur sometime in the rail system lifecycle. It can reasonably be expected to occur several times. | 10 years to 100 years |
| 3 | Occasional | Likely to occur several times. The event can be expected to occur several times. | Yearly to every 10 years |
| 4 | Probable | Will occur several times. The event can be expected to occur frequently. | Monthly to yearly |
| 5 | Frequent | The event will be continually experienced | Daily to monthly |

# APPENDIX ‘D’

## Rail Corridor High Security Fencing

***High Security Fencing***

The high security fence height above ground shall be 2.4 m.

The panel mesh shall consist of a minimum 4mm diameter high tensile wire, with aperture sizes (openings) 76.2mm x 12.7mm on centre or smaller fastened to suitable posts that allow for a minimum foundation depth of 1200 mm. The fence panels shall be strengthened with factory formed undulations within each mesh panel. Mechanical Fasteners shall be tamperproof, and factory galvanized. Fastening hardware shall be concealed from the face of each panel and post. The mesh, posts, clamps and associated hardware are to be galvanized with an exterior finish coating capable of withstanding repeat climate variances within Southern Ontario.

1.1 High Security Fence

(a) When directed by Metrolinx the Contractor shall install high security fencing at ROW limits, at layover yards and at other locations instructed by Metrolinx. The manufacturer and product name of approved High Security fencing are listed below. Proposed equivalents recommended by the contractor will be subject to approval by Metrolinx prior to installation.

(i) Cochrane–ClearVu

(ii) BETAFENCE- Securifor 3D

(iii) CLD- Securus Profiled

(iv) Bear Mountain – Bear Securi Mesh Barrier

(b) The high security fence height above ground shall be 2.4 m.

(c) The panel mesh shall consist of a minimum 4mm diameter high tensile wire, with aperture sizes (openings) 76.2 x 12.7 mm centers or smaller fastened to suitable posts that allow for a minimum foundation depth of 1200 mm.

(d) The fence panels shall be strengthened with factory formed undulations within each mesh panel. Mechanical Fasteners – Shall be tamper proof and mechanically galvanized. Fastening Hardware shall be concealed from the non-rail side of each panel and post.

(e) Mesh to be galvanized with an exterior finish coating capable of withstanding typical climate variances within Southern Ontario.

(f) Specification sheets and breach testing results for any proposed alternate products and materials shall be submitted to Metrolinx staff for approval.