December 22, 2022

Liverpool Road LP
178 Hopedale Avenue
Toronto, Ontario
M4K 3N2

Attn: Greg Silas

RE: Coastal Study
640 Liverpool Road, Pickering
Project No. 2204589

GEI Consultants (GEI) is pleased to provide a coastal study in support of the proposed residential development to be constructed at 640 Liverpool Road in Pickering, Ontario.

1. INTRODUCTION

The proposed development area consists of the properties of 640 Liverpool Road, 607 & 609 Annland Street and 1276, 1288, 1290, 1292 & 1294 Wharf Street. The development area is bounded by Liverpool Road to the east, Wharf Street to the south, Annland Street to the north, and residential properties, a private driveway access and Frenchman's Bay to the west. The total development area is 1.171 ha in size. The development area generally currently consists of residential or parking areas.

GEI was provided with the following drawings and documents for review in preparation of this letter, and are provided as Enclosure 1 for reference:

- "*Site Plan*", Project No. 2022-10, Drawing No. A101, dated Nov. 2022, by Cassidy & Co. Architectural Technologists.
- "*Plan of Survey Showing Topography of Part of Lots 6 and 7 and Lots 5, 8, 9, 10, 11, 12 and 16, Registered Plan M-89 (Geographic Township of Pickering), now in the City of Pickering, Regional Municipality of Durham*", Reference No. 22-25-053-01, dated 5/31/2022, by J.D. Barnes Limited.

The proposed development will consist of 10 townhouse blocks with 4 to 6 townhouses per block (for a total of 51 townhouse units) connected by internal private laneways. The majority of the development (1.136 ha) is setback on the order of 40 metres east of Frenchman's Bay where the residential condominium development will be constructed. There is a small parcel of land (0.035

ha) that is directly adjacent to Frenchman's Bay but is proposed to be maintained as passive open space.

The client had a pre-consultation meeting with the City of Pickering on May 19, 2022. One of the comments from this meeting was that one of the studies required as part of the application was to be a Natural Hazard Study and/or Coastal Engineering Study. It was noted that the Terms of Refence for this study would be provided by the Toronto and Region Conservation Authority (TRCA) prior to submission. GEI had this consultation with the TRCA on December 12, 2022 and confirmed the requirements of the coastal terms of reference.

Based on the above, GEI's scope of work for this project generally consists of:

- Conduct a review of all publicly available background information including details on Frenchman's Bay (depth, size, means of protection, etc.), design wind directions and speeds, design lake level elevations, etc.
- Conduct a visual inspection of the property, paying particular attention to the parcel of land adjacent to the shoreline. Details such as topography, existing coastal protection, depth of lake level and bottom of bay at the coastal protection, signs of erosion, etc. will be reviewed and documented.
- A wave run-up analysis will be conducted with 100-year lake level and 10-year wind speeds.
- A letter report will be prepared detailing the results of the background review, visual inspection, commentary on the existing coastal protection, the wave run-up analysis and whether the development as currently proposed is setback sufficiently from the shoreline, and if not, what mitigation measures or changes in the development would be required.

2. VISUAL INSPECTION OF PROPERTY

Alexander Winkelmann, P.Eng. of GEI visited the site on December 3, 2022. The purpose of this site visit was to conduct a visual inspection of the existing shoreline, coastal protection present and overall site in support of a coastal study. General photographs taken during the inspection are enclosed.

The 0.035 ha parcel of land adjacent to the shoreline of Frenchman's Bay is approximately 12 metres wide (north to south) and 31 metres long (east to west). This parcel is bounded by Frenchman's Bay to the west, a private access laneway to the east and residential properties to the north and south. The property has a very gentle slope upwards to the east, going from approximately Elev 75.7 metres adjacent to the shoreline to approximately Elev 76.4 metres adjacent to the private access laneway. This parcel of land is vacant and grassed.

Directly adjacent to the shoreline, there exists a 4.5-metre-wide concrete slab on ground surface. The 2-metre section of the concrete slab adjacent to the shoreline has settled, cracked and separated from the remaining portion of the concrete slab which is still in relatively good condition. The furthest west portion of the slab (directly adjacent to the shoreline) is supported by concrete masonry blocks. The masonry blocks supporting the north side of the slab are in poor condition

but are still supporting the slab. The masonry blocks on the south side of the slab have essentially deteriorated to rubble.

The width of the concrete masonry blocks (from the north to the south property line) are supported on a cast-in-place concrete foundation that has been protected from erosion by a thin metal sheet. Further investigation would be required to determine the level of competency of this foundation and if it could be left in place for any future potential rehabilitation of this area during development.

The top of the concrete slab to the base of the coastal protection ranges between 1.0 to 1.2 metres in height. At the base of the coastal protection exists a mixture of algae and rubble that gently slopes down to the surface water level (over about a 1 metre span). The grade below the water appears to continue its gentle slope into Frenchman's Bay. Directly to the south of this parcel of land there exists a dock, and directly to the north of this parcel of land there exists a mixture of blocks and rubble that jut slightly out into Frenchman's Bay.

At approximately noon on Dec. 3, 2022, the wind speed was 43 km/hr and was coming from a direction of 290 degrees. Based on visual observations only, the wave height was estimated at 0.3 metres. Based on publicly available data, the surface water elevation within Frenchman's Bay was 74.4 metres which is about 1.7 metres lower than the 100-year maximum flood level.

The larger 1.135 ha parcel of land where the proposed condominiums will be constructed is located approximately 38 metres east of Frenchman's Bay, directly east of the private access laneway. This parcel is approximately 78 metres wide (north to south) and 144 metres long (east to west). This parcel is bounded by Liverpool Road to the east, Annland Street to the north, Wharf Street to the south and the private access laneway to the west.

This parcel of land contains low-density residential and commercial buildings with a private parking lot. The property has a very gentle slope upwards to the east, going from approximately Elev 76.7 metres adjacent to the shoreline to approximately Elev 80.2 metres adjacent to the Liverpool Road.

3. TRCA REGULATORY REQUIREMENTS

The property is within Toronto and Region Conservation Authority (TRCA) jurisdiction. The TRCA has prepared the following policy guideline document: "*The Living City Policies for Planning and Development in the Watersheds of the Toronto and Region Conservation Authority*", dated November 28, 2014.

As per Section 7.4.3.4 of the aforementioned document, it states that any proposed infrastructure should be located outside of the Lake Ontario shoreline hazard which is determined by delineating the farthest combined landward extent of the three key shoreline hazards:

(1) Lake Ontario Flood Hazard includes a combined effect of the following:

a) The 100-year Lake Ontario Flood Level of 76.2 metres IGLD85 (converted to the appropriate vertical datum for the project);
b) The appropriate wave uprush allowance; and
c) The appropriate allowance for other water related hazards.

(2) Lake Ontario Shoreline Erosion Hazard includes a combined effect of the following:
a) A stable slope allowance projected from the stable toe of slope; and
b) The 100-year recession rate or an erosion allowance of 30m.

(3) The Lake Ontario Shoreline Dynamic Beach Hazard includes a combined effect of the following:
a) The Lake Ontario Shoreline Flood Hazard; and
b) A dynamic beach allowance of 30m.

At this site, only the Lake Ontario Flood Hazard applies. The Lake Ontario Shoreline Erosion Hazard does not apply as there is no appreciable slope at this site, and the Lake Ontario Shoreline Dynamic Beach Hazard does not apply as there is no beach located on site.

4. LAKE ONTARIO FLOOD HAZARD & WAVE RUN-UP ANALYSIS

As per the TRCA Living City Policy guideline, the following definitions apply in determination of the Lake Ontario Flood Hazard:

- The 100-year flood is defined as the peak instantaneous still water level that has a probability of occurrence of one per cent during any given year. TRCA has provided this elevation as 76.2 metres IGLD85 for the purposes of this analysis.
- Wave uprush is defined as the rush of water up onto a shoreline or structure following the breaking of a wave. The limit of wave uprush is the point of furthest landward rush of water onto the shoreline.

Wave height and wave uprush at the site are calculated below using U.S. Army Corps of Engineers (USACE) methods[1]. Unless specified, all elevations are referenced to the Canadian Geodetic Vertical Datum of 1928 (CGVD28) in metres. The following datum conversion was used to convert between IGLD85 and CGVD28, based on a benchmark on the north side of Frenchman's Bay[2]:

IGLD85 – 0.08 metres = CGVD28

The site's location on the east side of Frenchman's Bay is relatively protected from wind and waves. Representative wind fetch lines are provided within Enclosure 3. The longest uninterrupted wind fetch is 1.2 kilometers with winds from the northwest.

The stillwater elevation for this analysis was the 100-year Lake Ontario Flood level, which was provided by TRCA as Elev 76.2 metres IGLD85, which GEI converted to Elev 76.12 metres CGVD28. At the 100-year lake level, the maximum depth in the bay would be approximately 5.5 metres[3], and the water would reach approximately 25 to 30 metres inland at the site, submerging

most of the 0.035 ha open space parcel. For comparison, the long-term average Lake Ontario water level is 74.69 metres[4]. This information is presented graphically within Enclosure 3 for reference.

The windspeed selected for this analysis was the 10-year wind, for a conservative evaluation of maximum wave uprush. The 10-year wind for Lake Ontario is 34 m/s[5]. Winds coming from the northwest (longest fetch) at 10-year wind speeds would produce waves with a height of 0.6 metres and a wave period (the time between peaks) of 2.1 seconds.

Site geometry is based on survey data collected May 31, 2022 by J.D. Barnes Limited. The ground near the 100-year lake level has a fairly shallow slope up to the east, at approximately 17.5:1 (H:V) between elevations 76 metres and 77 metres.

At 100-year lake levels and 10-year windspeed the maximum wave uprush height is 0.6 metres, and the wave uprush elevation is 76.51 metres. This maximum uprush would reach the road between the open space parcel and the development parcel but would not reach the proposed development area.

100-Year Lake Level (m)	Wind Speed (m/s)	Wave Uprush Height (m)	Wave Uprush Elevation (m)
76.21	34	0.6	76.51

5. RECOMMENDATIONS

The wave uprush elevation was determined to be 76.51 metres. This elevation line and setback was annotated on the topographic survey of the property provided within Enclosure 1. The wave uprush does not encroach onto the proposed condominium development area and therefore additional provisions for floodproofing are not required for this particular development.

It is understood that the parcel of land closest to the shoreline will not be developed and will be left as a passive land use. There may be a portion of the stormwater management for the development that is directed onto this parcel, which would be determined during detailed design. Regardless, the existing coastal protection is in a poor state of repair, and as part of any development, it would be prudent to include reconstruction of the shoreline protection.

6. REFERENCES

[1] U.S. Army Corps of Engineers (USACE), 1989. Water Levels and Wave Heights for Coastal Engineering Design, EM 1110-2-1414, Dated July 1989.

[2] Canadian Geodetic Survey. Station 10U181. Retrieved 12/13/2022 from: https://webapp.csrs-scrs.nrcan-rncan.gc.ca/geod/data-donnees/station/report-rapport.php?id=10U181

[3] van Hengstum, Pete & Reinhardt, Eduard & Boyce, Joseph & Clark, C.. (2007). Changing sedimentation patterns due to historical land-use change in Frenchman's Bay, Pickering, Canada:

Evidence from high-resolution textural analysis. Journal of Paleolimnology. 37. 603-618. 10.1007/s10933-006-9057-y

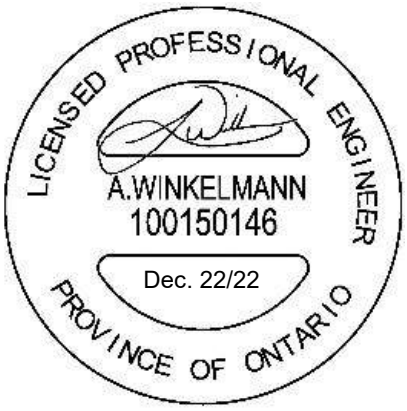
[4] U.S. Army Corps of Engineers Detroit District. Monthly Mean Lakewide Average Water Levels. https://www.lre.usace.army.mil/Portals/69/docs/GreatLakesInfo/docs/WaterLevels/GLWL_MM_Metric.pdf?ver=IaKgwvacVqEodbjSoaUolg%3d%3d

[5] ASCE/SEI, 2006. Minimum Design Loads for Buildings and Other Structures. American Society of Civil Engineers/Structural Engineering Institute, Reston, VA.

7. CONCLUSION

We trust this information is sufficient for your present purposes. Should you have any questions concerning the above, or can be of any further assistance, please do not hesitate to contact the undersigned.

Yours truly,
GEI Consultants



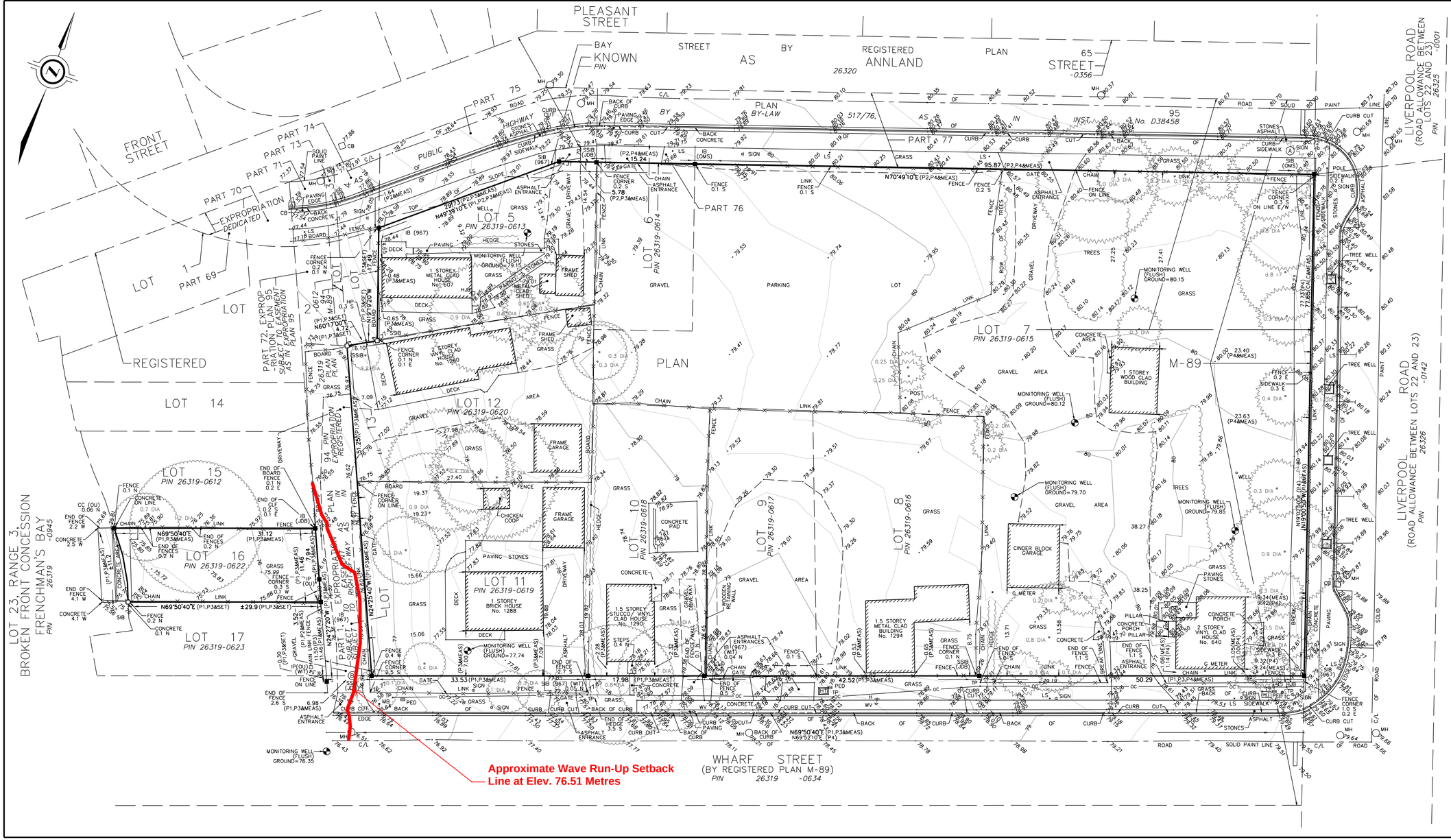
Emma Giese	Alexander Winkelmann, P.Eng.
Water Resources Engineer	Geotechnical & Earth Sciences Manager

Enclosures (3)

Enclosure 1: Background Drawings (Site Plan & Topographical Survey)
Enclosure 2: Coastal Inspection/Site Visit Photographs (Dec. 3, 2022)
Enclosure 3: Wind Fetch Distances & Lake Ontario Water Levels

ENCLOSURE 1

Background Drawings (Site Plan & Topographical Survey)



PLAN OF SURVEY SHOWING TOPOGRAPHY OF

PART OF LOTS 6 AND 7 AND LOTS 5, 8, 9, 10, 11, 12 AND 16 REGISTERED PLAN M-89

(GEOGRAPHIC TOWNSHIP OF PICKERING)
NOW IN THE
CITY OF PICKERING
REGIONAL MUNICIPALITY OF DURHAM

SCALE 1 : 300

5 0 5 10 20 metres

J.D. BARNES LIMITED

METRIC DISTANCES AND/OR COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

BENCHMARK

ELEVATIONS HERON ARE GEODETIC AND ARE REFERRED TO CITY OF PICKERING BENCHMARK No. R-39, HAVING A PUBLISHED ELEVATION OF 82.555m, (CVGD-1928:1978)

NOTES

BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A AND B, BY REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0).

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999884.

FOR BEARING COMPARISONS, A COUNTER-CLOCKWISE ROTATION OF 1°21'10" WAS APPLIED TO P1, P2 AND P4 TO CONVERT TO GRID BEARINGS.

INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORPs): UTM ZONE 17, NAD83 (CSRS) (2010.0).

COORDINATES TO URBAN ACCURACY PER SECTION 14 (2) OF O.REG 216/10.

POINT ID	EASTING	NORTHING
ORP (A)	654 233.57	4 853 302.56
ORP (B)	654 123.40	4 853 179.41

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

THE RESULTANT TIE BETWEEN ORP (A) AND ORP (B) IS 165.25m, N41°49'00"E.

LEGEND

■	DENOTES	SURVEY MONUMENT FOUND
□	DENOTES	SURVEY MONUMENT SET
SIB	DENOTES	STANDARD IRON BAR
SSIB	DENOTES	SHORT STANDARD IRON BAR
IB	DENOTES	IRON BAR
IP	DENOTES	IRON PIPE
CC	DENOTES	CUT CROSS
WIT	DENOTES	WITNESS
MEAS	DENOTES	MEASURED
JDB	DENOTES	J.D. BARNES LIMITED
OMS	DENOTES	OMARI MWINYI SURVEYING LTD., O.L.S.
OU	DENOTES	ORIGIN UNKNOWN
967	DENOTES	W.N. WILDMAN, O.L.S.
P1	DENOTES	REGISTERED PLAN M-89
P2	DENOTES	EXPROPRIATION PLAN No. 95
P3	DENOTES	PLAN OF SURVEY BY J.D. BARNES LIMITED, DATED NOVEMBER 19, 2015 (REF No. 15-25-097-00)
P4	DENOTES	SURVEYOR'S REAL PROPERTY REPORT BY OMARI MWINYI SURVEYING LTD., O.L.S. DATED OCTOBER 1, 2021 (PROJECT No. 21-085-S).
CALC	DENOTES	CALCULATED FROM PLANS P1 & P2
□ CB	DENOTES	CATCHBASIN
● TC	DENOTES	TELEPHONE CHAMBER
□ HJB	DENOTES	HYDRO JUNCTION BOX
HT	DENOTES	HYDRO TRANSFORMER ON CONCRETE PAD
○ G METER	DENOTES	GAS METER
○ MH	DENOTES	MANHOLE
• HP	DENOTES	HYDRO POLE
• LS	DENOTES	LIGHT STANDARD
• TP	DENOTES	TELEPHONE POLE
⊠ PED	DENOTES	TELEPHONE PEDESTAL
⊕ H	DENOTES	FIRE HYDRANT
⊕ WV	DENOTES	WATER VALVE
⊕ WELL	DENOTES	WELL
⚑ MB	DENOTES	MAILBOX
OC	DENOTES	OVERHEAD CABLES
	DENOTES	CONIFEROUS TREE
	DENOTES	DECIDUOUS TREE

ALL SURVEYED LIMITS HAVE BEEN CONFIRMED BY BOUNDARIES ACT PLAN 128

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON MAY 5, 2022.

DATE

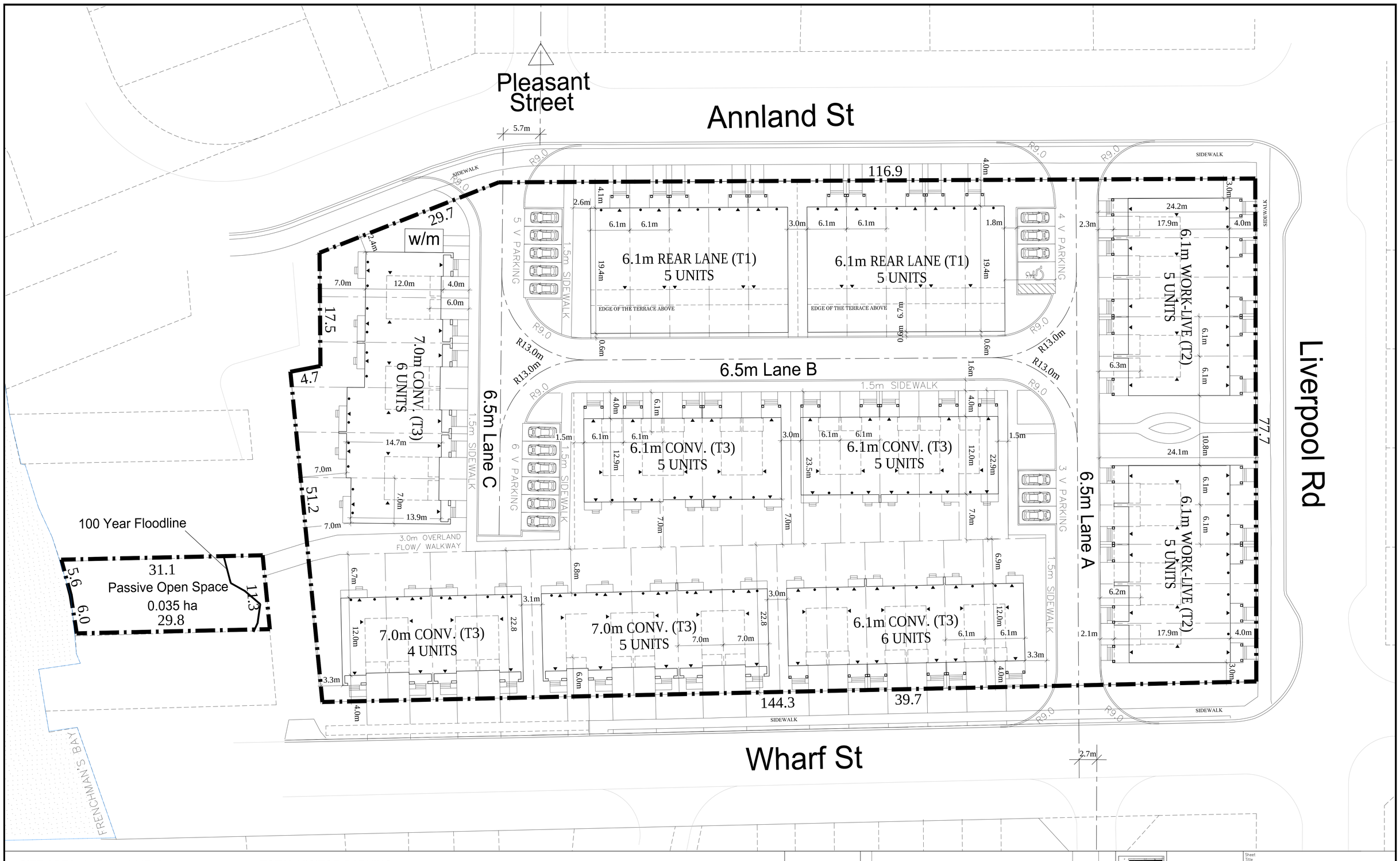
G.C. LAFRAMBOISE
ONTARIO LAND SURVEYOR

J.D. BARNES LIMITED
SURVEYING MAPPING GIS
LAND INFORMATION SPECIALISTS
110 SCOTIA COURT, UNIT 38, WHITBY, ON L1N 8Y7
T: (905) 723-1212 F: (905) 723-4234 www.jdbarnes.com

DRAWN BY:	CHECKED BY:	REFERENCE NO.:
M.R.	G.C.L.	22-25-053-01

FILE: G:\22-25-053\01\22-25-053-01.dgn DATED: 5/31/2022

PLOTTED: 6/6/2022



SITE AREA: 1.171 ha / 11710 sm
CONDOMINIUM: 1.136 ha (11,365.62 sm)
COVERAGE: 4643.86 sm 40.86%
NUMBER OF UNITS: 51
DENSITY: 45 upha

TOTAL VISITOR PARKING:
PARKING REQUIRED: 13 SPACES
PARKING PROVIDED: 18 SPACES
RESIDENCE PARKING (2 SPACES PER UNIT) =102 SPACES
TOTAL PARKING PROVIDED: 120 SPACES

NO.	DESCRIPTION	DATE	REV.
2	ISSUED FOR CLIENT REVIEW	NOV. 25, 2022	JWL
1	ISSUED FOR CLIENT REVIEW	NOV. 18, 2022	JWL

CASSIDY & CO. ARCHITECTURAL TECHNOLOGISTS
60 RANDALL DRIVE
SUITE 11
AJAX, ONTARIO
L1S 6L3
PH (905) 619-1270
DESIGN@CASSIDYCO.COM
WWW.CASSIDYCO.COM

Sheet Title: SITE PLAN
Drawn by: JWL | Checked by: SA | Date: NOV. 2022
Scale: 1 : 250
Drawing No.: A101
Project No.: 2022-10

ENCLOSURE 2

Coastal Inspection/Site Visit Photographs (Dec. 3, 2022)

PHOTOGRAPH 1

(GEI 2022)

Description:
On Wharf Street, looking west towards Frenchman's Bay.

PHOTOGRAPH 2

(GEI 2022)

Description:
Looking north along the private access road that runs parallel to the shoreline of Frenchman's Bay, approximately 30 metres east of Frenchman's Bay.

PHOTOGRAPH 3

(GEI 2022)

Description:
View looking west on the 0.035 ha parcel of vacant land that is adjacent to the shoreline (remainder of property is not directly adjacent to shoreline and is to the east of the private access road).

PHOTOGRAPH 4

(GEI 2022)

Description:
View of the south side of the 0.035 ha parcel of land adjacent to the shoreline.

PHOTOGRAPH 5

(GEI 2022)

Description:
View of the north side of the 0.035 ha parcel of land adjacent to the shoreline.

PHOTOGRAPH 6

(GEI 2022)

Description:
View looking directly out to Frenchman's Bay with the concrete structure visible that is directly adjacent to the shoreline.

PHOTOGRAPH 7

(GEI 2022)

Description:
View looking south along the concrete structure adjacent to the shoreline. The portion of the concrete slab on the west side has separated and settled.

PHOTOGRAPH 8

(GEI 2022)

Description:
Another view of the top of the concrete structure that is adjacent to the shoreline.

PHOTOGRAPH 9

(GEI 2022)

Description:
View looking directly out to Frenchman's Bay. Wind speeds in excess of 40 km/hr occurred during inspection causing waves on the order of 0.3 metres high.

PHOTOGRAPH 10

(GEI 2022)

Description:
View of the shoreline consisting of shallow beach with algae and rubble, along with the concrete structure in poor state of repair.

PHOTOGRAPH 11

(GEI 2022)

Description:
View looking across the concrete structure adjacent to the shoreline.

PHOTOGRAPH 12

(GEI 2022)

Description:
The concrete structure consists of a concrete slab supported by partially disintegrated or rubbilized concrete blocks.

PHOTOGRAPH 13

(GEI 2022)

Description:
The partially disintegrated concrete blocks are support by what appears to be a concrete foundation that has not been undermined nor has been significantly eroded.

PHOTOGRAPH 14

(GEI 2022)

Description:
View looking east up along the 0.035 ha parcel of land towards the larger development area to the east.

PHOTOGRAPH 15

(GEI 2022)

Description:
View looking east near the north end of the proposed development area, just east of the private access road near the shoreline.

PHOTOGRAPH 16

(GEI 2022)

Description:
View looking east near the centre of the proposed development area, just east of the private access road near the shoreline.

PHOTOGRAPH 17

(GEI 2022)

Description:
View looking east up Wharf Street, with the proposed development to the north of Wharf Street.

PHOTOGRAPH 18

(GEI 2022)

Description:
View looking along Liverpool Road, with the proposed development to the west of Liverpool Road.

PHOTOGRAPH 19

(GEI 2022)

Description:
View looking along Annland Street, with the proposed development to the west of Annland Street.

PHOTOGRAPH 20

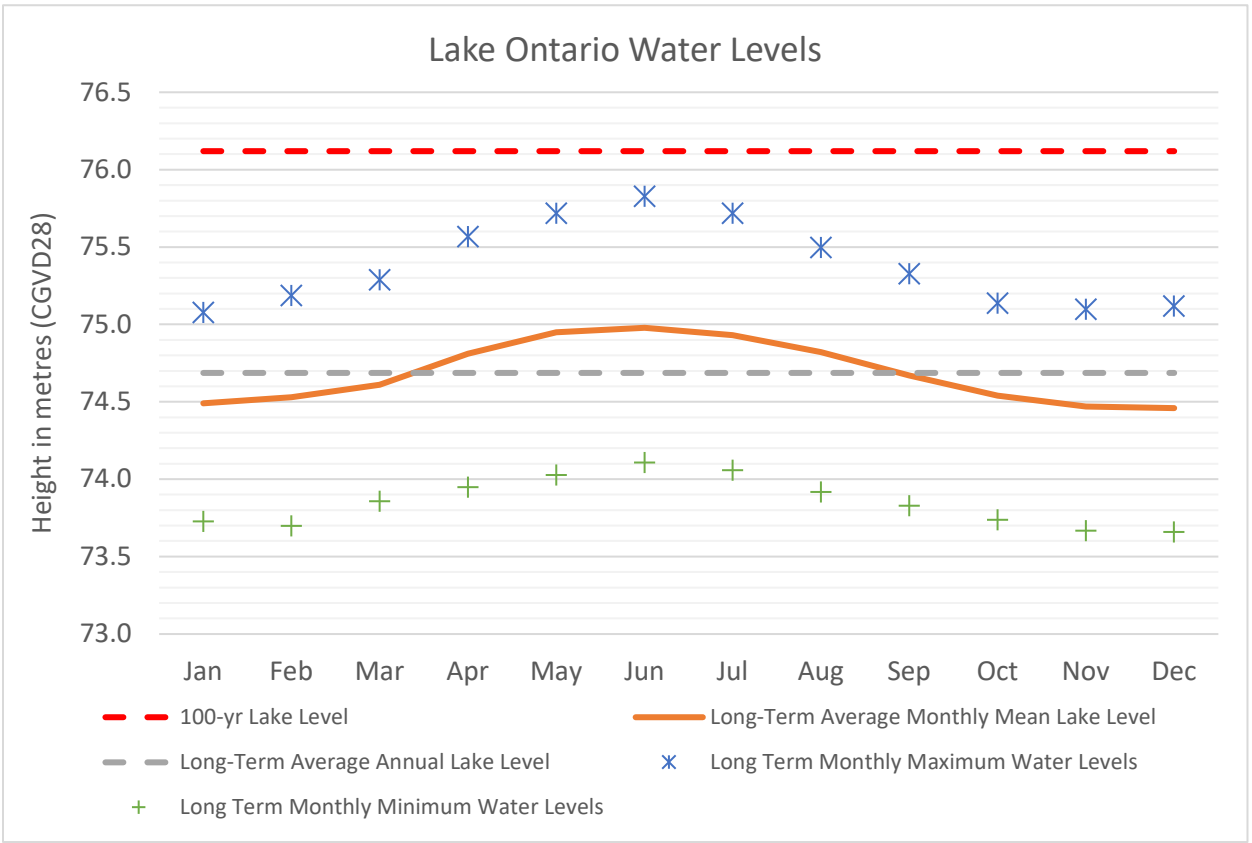
(GEI 2022)

Description:
View from the shoreline north of the 0.035 ha parcel of land adjacent to the shoreline, looking south.

ENCLOSURE 3

Wind Fetch Distances & Lake Ontario Water Levels


640 Liverpool Rd Wind Fetch Lines
1.2 km
1.1 km
1 km
0.4 km
640 Liverpool Rd
Google Earth
600 m
N


Lake Ontario Water Levels
Height in metres (CGVD28)
76.5
76.0
75.5
75.0
74.5
74.0
73.5
73.0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
100-yr Lake Level
Long-Term Average Monthly Mean Lake Level
Long-Term Average Annual Lake Level
Long Term Monthly Maximum Water Levels
Long Term Monthly Minimum Water Levels