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HYDROGEOLOGICAL INVESTIGATION



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Prepared for:

Infinity Development Group

Project No. FE-P 20-10329H

August 17, 2020

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Project Address:	40-70 Plains Road East, Burlington, ON.
Project Number:	FE-P 20-10329H
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TABLE OF CONTENTS

1. INTRODUCTION **2**

2. SITE AND PROJECT DESCRIPTIONS **2**

3. SCOPE OF HYDROGEOLOGICAL INVESTIGATION **3**

4. FIELD AND LABORATORY WORKS **4**

5. SUBSOIL CONDITIONS **5**

6. HYDROGEOLOGICAL STUDY **6**

6.1 HYDROGEOLOGICAL CONDITIONS 6
6.2 HYDRAULIC CONDUCTIVITY K MODELING RESULTS 8

7. CONSTRUCTION DEWATERING & PERMANENT DRAINAGE **8**

7.1 CONSTRUCTION DEWATERING 8
7.2 PERMANENT DRAINAGE 9
7.3 PERMIT TO TAKE WATER (PTTW) 10
7.4 GROUNDWATER QUALITY 10
7.5 DEWATERING INFLUENCE ZONE 11
7.6 HYDROGEOLOGICAL IMPACT 12

8. DISCUSSION **12**

9. LIMITATIONS **13**

APPENDIX A – SITE AND LOCATION MAPS AND PLAN ..... **A**

APPENDIX B – LOG OF BOREHOLES ..... **B**

APPENDIX C – MOISTURE CONTENT AND GRAIN SIZE DISTRIBUTION ANALYSES ..... **C**

APPENDIX D – SEWER BYLAW RESULTS ..... **D**

APPENDIX E – HYDRAULIC CONDUCTIVITY ANALYSES ..... **E**

APPENDIX F – CONSTRUCTION DEWATERING AND PERMANENT DRAINAGE ..... **F**

APPENDIX G – BACKFILL AND DRAINAGE DESIGN ..... **G**

1. INTRODUCTION

Fisher Engineering Limited was retained by Infinity Development Group to carry out a Hydrogeological Investigation for the proposed redevelopment at the property located at 40-70 Plains Road East in Burlington, Ontario, hereinafter referred to as the 'Site'.

The purpose of the Hydrogeological Investigation was to evaluate the groundwater conditions with respect to the future redevelopment of the Site.

The report has been prepared specifically and solely for the proposed development regarding hydrogeological aspects for design & construction.

Updates in relation to previous versions of the report are summarized as follows:

- Revised architectural drawings, prepared by RAW, dated April 01, 2021 along with development correspondence indicate that the lowest finish floor elevation for P2 garage level was raised to 95.0m asl instead of 94.20m and 93.14m used in previous reports. Top of deepest footings is 93.60m asl.
- Revised construction groundwater dewatering flowrate of **85.70 m^3/day (85,700 L/day)** was estimated instead of 143.86 m^3/day (143,860 L/day) and 249.08 m^3/day (249,080 L/day) in previous reports.
- Average estimated permanent groundwater drainage flowrate is **26.17 m^3/day (26,170 L/day)** instead of **162.03 m^3/day (162,030 L/day)** and 54.66 m^3/day (54,660 L/day) calculated previously.

2. SITE AND PROJECT DESCRIPTIONS

Site Settings

The subject property is located on the south side of Plains Road East in the predominantly residential neighborhood, south of Highway 403 and east of Waterdown Road, in the City of Burlington and is bounded by a six-storey residential building to the west, residential building to the south and east and Plains Road East to the north. The Site has an approximate area of 6,823m^2 according to the Site Plan provided to Fisher.

At the time of investigation, the Site was occupied by single family dwellings. The property was generally landscaped with mature trees and paved driveways. Solid Gold Inn was observed on the north side of Plains Road East.

Topography

The Site is generally flat and is graded for drainage purposes from east to west along the gutter on Plains Road East as shown in the undated topo survey provided to Fisher.

Proposed Development

The proposed development will consist of the construction of a midrise residential building with two underground levels extending to the property boundaries. Established grade is 100.50m with P1 at 97.60m and P2 at 95.00m asl according to the Site plan, by RAW Architects, dated April 1, 2021, provided to Fisher for the updated report.

3. SCOPE OF HYDROGEOLOGICAL INVESTIGATION

The Hydrogeological Investigation works were required to:

1) Establish groundwater conditions for the design of dewatering works, if required, prior to construction of the proposed building.
2) Determine the need for permanent drainage and
3) Conduct calculations/analyses of the groundwater quantity and quality to be used for the necessary applications for permits prior to proceeding with construction dewatering and design of permanent drainage, if necessary.

The scope of this work generally consisted of the following:

- **Drilling/locating Monitoring Wells.** Drilling of monitoring wells and reviewing / compiling the borehole logs and onsite / laboratory testing.
- **Data Evaluation.** Evaluating the results of soil types, groundwater static levels, ground surface elevation, groundwater quality, flow direction and other available hydrogeological data for the Site and their potential impact on the proposed development.
- **Hydraulic Conductivity Tests.** Conduct single well response tests in four (4) monitoring wells and record groundwater level drawdown and recovery to model/calculate hydraulic conductivity.

- **Groundwater Quality Analysis.** Carry out laboratory analyses on groundwater to determine compliance with the Ontario Halton Sewer Use Bylaws No. 02-03 (Mar 2003) – Halton Sanitary Sewer and Halton Storm Sewer.
- **Groundwater Level Monitoring.** Conduct long-term monitoring of the groundwater levels to determine the seasonal high-water levels.
- **Hydrogeological Report.** Prepare and submit a report detailing the findings and recommendations of the Hydrogeological Investigation.

4. FIELD AND LABORATORY WORKS

Subsurface exploration for the Hydrogeological Investigation was conducted concurrent with drilling for the Geotechnical Investigation over the period May 26 to June 18, 2020 and consisted of six (6) boreholes advanced to depths of 6.25m to 13.56m below prevailing grades. The approximate locations of the boreholes and elevations are presented in Appendix A - Borehole Location Plan.

All boreholes were instrumented as monitoring wells (MW1 to MW6) with 2" diameter screens on completion of drilling. A clean silica sand pack was placed around the well screens and isolated with bentonite to depths below prevailing grades as shown in the borehole details in Appendix B.

A Track mounted drill rig equipped with hollow stem (for deeper holes) and solid stem augers, supplied by Terra Firma Services, was used for all drilling work.

Laboratory Analyses

Soil samples were taken to the Fisher Environmental laboratory for further visual assessment and classification. Eight (8) representative soil samples from BH1 and BH6 were submitted for moisture content and grain size analyses. One (1) soil sample from BH1 was submitted for pH, chloride and sulphate analyses. The laboratory samples were tested and classified in general accordance with the Unified Soil Classification System, ASTM D 2487, and Standard Practice for Classification of Soil for Engineering Purposes.

One groundwater sample from MW1 was submitted to ALS Environmental laboratory for analyses of water quality under the Ontario Halton Sewer Use Bylaws No. 02-03 (Mar 2003) – Halton Sanitary Sewer and Halton Storm Sewer. The results are presented in Appendix D.

The soil samples recovered during the investigation will be stored in the Fisher Environmental laboratory for a period of 30 days after submitting this report and will be discarded thereafter unless otherwise instructed by the client.

Site Survey

Ground surface elevation at each borehole location was established by interpolation from the topographic survey provided to Fisher during the investigation.

5. SUBSOIL CONDITIONS

Surface and subsurface conditions encountered at borehole locations are shown in Appendix B - Log of Boreholes, and are summarized as follows:

The boreholes logs include soil stratification at borehole locations along with detailed soil descriptions. Variations in the soil stratification may occur and should be expected between borehole locations and elsewhere on the Site.

FILL

Fill soils were found below surficial layer of all boreholes and extended to approximate depths below prevailing grades as shown in Table 1.

The fill generally consisted of dark brown to brown silty sand with some to trace of topsoil/roots and trace of gravel.

Table 1: Fill Depths and Elevations

Borehole No.	BH1	BH2	BH3	BH4	BH5	BH6
Surface Elevation (m asl)	101.35	100.80	100.81	100.85	100.79	100.45
Depth of Borehole (m)	10.67	13.56	12.65	11.13	6.25	13.41
Elevation at Bottom of Borehole (m asl)	90.68	87.24	88.16	89.72	94.54	87.04
Depth of Fill (m)	0.76	1.52	1.37	0.76	1.52	1.98
Elevation at Bottom of Fill (m asl)	100.59	99.28	99.44	100.09	99.27	98.47

Reddish Brown/Brown/Greyish Brown Sand/Silty Sand/Gravelly Sand/Gravel & Sand

Native soils of brown to reddish/greyish brown sand/silty sand/sand and gravel/gravelly sand were found underlying the fill materials. Frequent cobbles/boulders were encountered in the sand and gravel/gravelly sand deposits. Relative density of these soils generally varied from compact to very dense and occasionally loose. Boreholes BH1 and BH3 were terminated in these soils at depths of 10.67m and 12.65m bgs respectively. BH5 terminated in the sand and gravel deposit at 6.25m bgs due to refusal to auguring possibly on boulders/cobbles.

Greyish Brown/Grey Sand/Silty Sand

Greyish brown to grey sand/silty sand were found below the gravelly sand/sand and gravel of boreholes BH2, BH4 and BH6. Relative density of these sandy layers varied from compact to dense. The lower SPT 'N' values, indicating lower relative density, may be due to disturbance caused by auguring and/or hydrostatic pressure.

6. HYDROGEOLOGICAL STUDY

A hydrogeological study for the subject Site was conducted based on the boreholes/wells' exploration, observation and Site/Laboratory testing. Groundwater details from the six (6) newly installed monitoring wells were used in the Hydrogeological Study. The wells were constructed with 3.05m (10') long, 51mm diameter PVC slotted screen pipes, with the bases at approximate depths below existing grade as shown in Appendix B. Clean silica sand packs were placed around each well screen which was isolated with bentonite extending to slightly below existing grade.

Groundwater levels on completion of drilling varied from 7.77m to 8.23m below existing grade. MW5 was dry on completion however caving in of soils to 4.57m bgs was observed.

6.1 Hydrogeological Conditions

Review of the available surficial geological and hydrogeological information for the area shows that the Site is underlain generally with Coarse-textured glaciolacustrine deposits of sand, gravel, minor silt and clay. Underlying bedrock is represented by shale, limestone, dolostone and siltstone of the Queenston Formation and is generally less than 20m below prevailing grade. Surficial geology and bedrock maps are presented in Appendix A.

The subsoils and hydrogeological conditions were observed and recorded during both the Geotechnical and Hydrogeological Investigations. Based on the boreholes/wells' exploration, the saturated soil layers on the Site were dominated by brown sand and gravel to gravelly sand underlain by brown to greyish brown sand to borehole termination.

All monitoring wells were purged/developed and allowed to fully recover prior to carrying out groundwater level measurements and sampling. Measured groundwater depths and elevations are summarized in Table 2.

Table 2: Groundwater Depths and Elevations

No.	Elev. at Ground (m)	Depth of Well, m bgs	On Completion		24-Jun-20		08-Jul-20		22-Jul-20		08-Mar-21		24-Mar-21	
			GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl
MW1	101.35	10.06	8.08	93.27	8.60	92.75	8.59	92.76	8.60	92.75	9.20	92.15	9.78	91.57
MW2	100.80	12.80	7.77	93.03	7.86	92.94	8.05	92.75	8.03	92.77	8.42	92.38	8.45	92.35
MW3	100.81	12.19	Dry	-	8.23	92.58	8.23	92.58	8.25	92.56	8.81	92.00	8.92	91.89
MW4	100.85	9.14	7.77	93.08	7.82	93.03	7.91	92.94	7.96	92.89	8.45	92.40	8.46	92.39
MW5	100.79	5.79	Cave in to 4.57m	-	Dry at 5.63	-	Dry at 5.70	-	Dry at 5.70	-	Dry at 5.70	-	Dry at 5.70	-
MW6	100.45	12.95	8.23	92.22	7.86	-	7.96	92.49	7.99	92.46	8.45	92.00	8.47	91.98

Comments on Table 2:

The following general comments regarding groundwater conditions at the Site are based on the groundwater level data and the Geotechnical Investigation:

- Static groundwater levels were observed at 7.82m to 9.78m below grade (elevations of 92.00m to 93.03m asl). MW5 (depth of 5.79m) was observed to be dry throughout the investigation.
- Pockets of perched water and seepage from more pervious soil may be expected on the Site.
- The nearest body of surface water is the Lake Ontario located approximately 800m southwest of the Site.
- The Site is located in a developed residential/commercial area, with no indication of active domestic wells within a 500m radius measured from the centre of the property. Water supply in the area is via municipal water system.
- Groundwater levels are being monitored over the period March to June 2021 covering the traditional rainy season to determine highwater levels at the site. The report will be updated on completion of the groundwater monitoring programme.

6.2 Hydraulic Conductivity K Modeling Results

Single Well Response Tests

Single well response tests (SWRT) were conducted in MW1, MW3 and MW4 on June 30, 2020. The aquifer mainly consisted of layers of brown sand and gravel to gravelly sand underlain by brown to greyish brown sand and was assumed to be unconfined, homogenous, isotropic and of uniform thickness. It was also assumed that the wells fully penetrated the aquifer. Data from the single well response tests were used to calculate the hydraulic conductivity values using Luthin's method.

Calculated values for hydraulic conductivity (K) are summarized in Table 3 and are representative of the water bearing soil characteristic consisting of sand/ gravelly sand at the screened depths. Details of the hydraulic conductivity analyses are presented in Appendix C.

Table 3: Summary of Single Well Response Tests and Hydraulic Conductivity Results

Test Wells	Well Surface Elevation (m asl)	Groundwater Depth (m)	Screen Elevation (m asl)	Variance of water head created (m)	30 Minutes/ Recovery Percentage	Hydraulic Conductivity, K (Luthin's Method)	
						m/s	m/day
MW1	101.35	8.65	91.29-94.34	0.87	5 min / 99.4%	1.21×10^{-4}	10.46
MW3	100.81	8.23	88.62-91.67	1.44	6.7 min / 90.8%	4.69×10^{-5}	4.053
MW4	100.85	8.92	91.71-94.76	1.04	5 min / 92.6%	5.75×10^{-5}	4.968

7. CONSTRUCTION DEWATERING & PERMANENT DRAINAGE

7.1 Construction Dewatering

It was understood that the development will consist of a proposed midrise residential building with two underground levels. Subsoil conditions were observed to be consistent across the Site. Lowest finished floor elevation for P2 level was taken as 95.00m with top of lowest footings at 93.60m asl. Conventional strip and/or spread footing foundations were recommended at elevations of 92.5m to 93.5m asl in the geotechnical investigation report.

This means that the footings will likely extend below the groundwater levels observed during the investigation. The groundwater level should therefore be lowered to 1m below the designed footing depths to protect the footing subgrade from hydraulic pressure disturbance during construction.

Construction dewatering flowrate of **85.70 m^3/day (85,700 L/day)** is recommended with two underground levels. Factored dewatering rate of **128.55 m^3/day (FS of 1.5)** should be used for planning purposes.

Seasonal High Groundwater Levels

Drilling and installation of the monitoring wells were undertaken during a particularly dry summer season and consequently the seasonal high groundwater levels at the Site were not ascertained during the investigation. The highest groundwater levels, observed during the field investigation, were therefore increased by 0.5m for the calculation of construction dewatering flowrates and by approximately 1m for calculation of permanent drainage rates. Dewatering and permanent drainage volumes will be revised on completion of the groundwater monitoring programme.

Accounting for Accumulated Precipitation

Provisions should be made to pump any accumulated water from the excavation areas during construction, particularly following a period of heavy rainfall. For example, 25mm rainfall in 24 hrs may result in accumulation of up to 170.55m^3 in the excavated area. Subsurface soils at the Site are dominated by sandy materials and consequently some amount of this water will infiltrate into the underlying soils and some will be lost otherwise. A conservative accumulated volume of **40 m^3/day** may therefore be assumed for planning purposes. Accumulated precipitation may be stored on Site for subsequent disposal to an MOECC-licensed facility. If the water is to be discharged into the public sewer system, then an application for the discharge of private water will have to be made to Halton Region. The water quality, at the time of the application, will need to be ascertained to ensure compliance with Ontario Sewer Use Bylaws – Halton Sanitary Sewer Bylaw No. 02-03.

Maximum construction discharge rate, taking into consideration accumulated precipitation volumes, is 125,700 L/day.

7.2 Permanent Drainage

Permanent drainage rate of **26.17 m^3/day (26,170 L/day)** was obtained for two underground levels with the lowest P2 elevation of 95.00m. Factored permanent drainage rate of **39.26 m^3/day (FS of 1.5)** should be used for planning purposes.

An application for permission to discharge to the municipal/regional sewer system will be required unless the subsurface structure of the building is designed as watertight or onsite disposal facilities are implemented.

It is further recommended that the subsurface portion of the elevator shaft, below the P2 level, be designed as watertight to prevent the need to have deeper sump pits for permanent drainage.

7.3 Permit to Take Water (PTTW)

As the calculated groundwater dewatering flowrate for the building is more than 50 m^3/day, registration on the MOECC Environmental Activity and Sector Registry (EASR) for Water Taking will be required. An application for permission to take water (PTTW) is not required as the daily flowrate is less than 400,000 litres.

7.4 Groundwater Quality

The results of analyses for groundwater quality under the Ontario Halton Sanitary Sewer Bylaw No. 02-03 (Mar 2003) show compliance with all parameters except as listed in Table 4.

Table 4: Results from Sewer Use Bylaw tests

Parameters	Guide Limits		Results
	Sanitary Sewer	Storm Sewer	MW1
Total Suspended Solids, mg/L	350	-	9290
Aluminum, mg/L	50	-	73.9
Iron, mg/L	50	-	185
Manganese, mg/L	5	-	17.8

Additional tests were conducted based on parameters and limits proposed for storm sewer guidelines by the Halton Region. The tests revealed compliance with all parameters except those listed in Table 5.

Table 5: Exceedances of Proposed Storm Sewer Limits

Parameters	Proposed Storm Limits	Results (MW1)
Arsenic (Total), mg/L	0.02	0.0479
Chromium (Total), mg/L	0.08	0.146
Copper (Total), mg/L	0.04	0.699
Lead (Total), mg/L	0.12	0.154
Manganese (Total), mg/L	0.05	17.8
Nickel (Total), mg/L	0.08	0.221
Phosphorus (Total), mg/L	0.4	1.81
Total Suspended Solids, mg/L	15	9290

Based on the results, presented in Tables 4 & 5, *pre-treatment of the groundwater will be required prior to discharging to the storm or sanitary sewer system*.

It should be noted however that testing of groundwater at the depths observed during the investigation would not be representative of the water that might accumulate during a high rainfall event. Any accumulation of precipitation occurring in the excavation during construction, that may require offsite discharge, will have to be tested at the time of the event to determine the quality of water for discharge.

7.5 Dewatering Influence Zone

The estimated construction dewatering quantities are based on the worst-case groundwater conditions that might occur during the construction period. Calculated dewatering influence zone is expected to be up to 14.74m from the edge of the dewatering point in the predominantly sandy soils. Based on the field investigation, the soils to the proposed excavation depths are dominated by varying layers of sand/gravely sand. Recharge was observed to be very fast during SWRT. Consequently, a dewatering system may be required if construction is to take place below the observed water table.

7.6 Hydrogeological Impact

During the investigation, it was determined that there will not be any negative impact to the natural environment, Halton Region Sewer works nor surrounding properties due to construction dewatering because of the depth at which groundwater was observed. No groundwater induced depression at surface level is expected. Consequently, it is not expected that construction will impact public infrastructure, the natural environment nor will there be any settlement issues.

8. DISCUSSION

Hydraulic conductivity values (k) calculated from onsite single well response tests are 4.69×10^{-5} to 1.21×10^{-4} m/s (4.053 to 10.460 m/day) in the wells screened within the sand/gravelly sand. These are representative of the water bearing soils comprising sandy material at the expected excavation depths for footings based on the Geotechnical and Hydrogeological field Investigations.

An approximate construction dewatering discharge rate of 85.70 m^3/day will be required for the recommended footing depths for two underground level (lowest at of 93.60). Permanent drainage of 26.17 m^3/day will be required with the lowest P2 TOS at 95.0m asl.

Registration on the MOECP's EASR Website for water taking will be required however an application for PTTW will not be required under conditions observed on the Site during the investigation.

The groundwater quality determined by laboratory analyses revealed exceedances of some parameters of the existing sanitary sewer limits and the proposed storm limits and consequently pre-treatment of the water will be required before it can be discharged to the public storm or sanitary sewer.

It should be noted that if it is intended that any accumulated water, following periods of heavy rainfall, be discharged into the public sewer, then a permit to discharge would be required along with laboratory analyses to ensure compliance with relevant sewer bylaws.

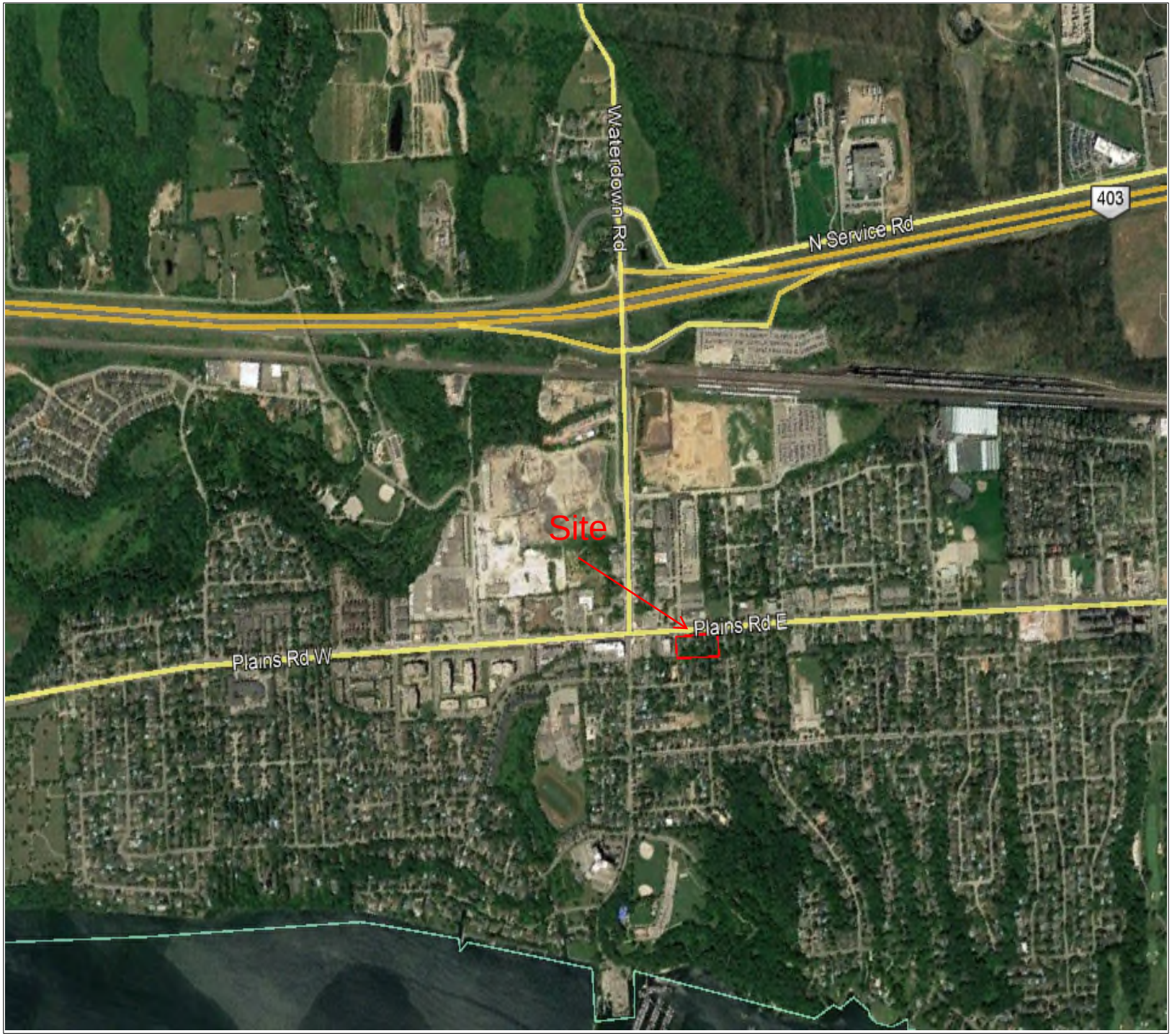
The discharge rates for construction dewatering and permanent drainage, given in the preceding, are based on common practice and reasonable assumption for excavation depths and are subject to further modifications if details of the structures change.

9. LIMITATIONS

This report is limited in scope to those items specifically referenced in the text. The discussions and recommendations presented in this report are intended only as guidance for the named client, design engineers and those directly associated with implementing, regulating and monitoring of the project. The information on which these recommendations are based is subject to confirmation by engineering personnel at the time of construction. Localized variations in the subsoil conditions may be present between and beyond the boreholes and should be verified during construction.

As more specific subsurface information becomes available during excavations on the Site, this report should be updated. Contractors bidding on or undertaking the work should decide on their own investigations, as well as their own interpretations of the factual borehole results. This concern specifically applies to the classification of the subsurface soil and the potential reuse of these soils on/off Site. Contractors should draw their own conclusions as to how the near surface and subsurface conditions may affect them.

APPENDIX A – SITE AND LOCATION MAPS AND PLAN



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NORTH

LEGEND

SITE BOUNDARY

PROJECT NAME AND ADDRESS

HYDROGEOLOGICAL INVESTIGATION

40-70 Plains Road,
BURLINGTON,ONTARIO

FIGURE 1:

SITE LOCATION PLAN

SHEET NO.

A

PROJECT NO.

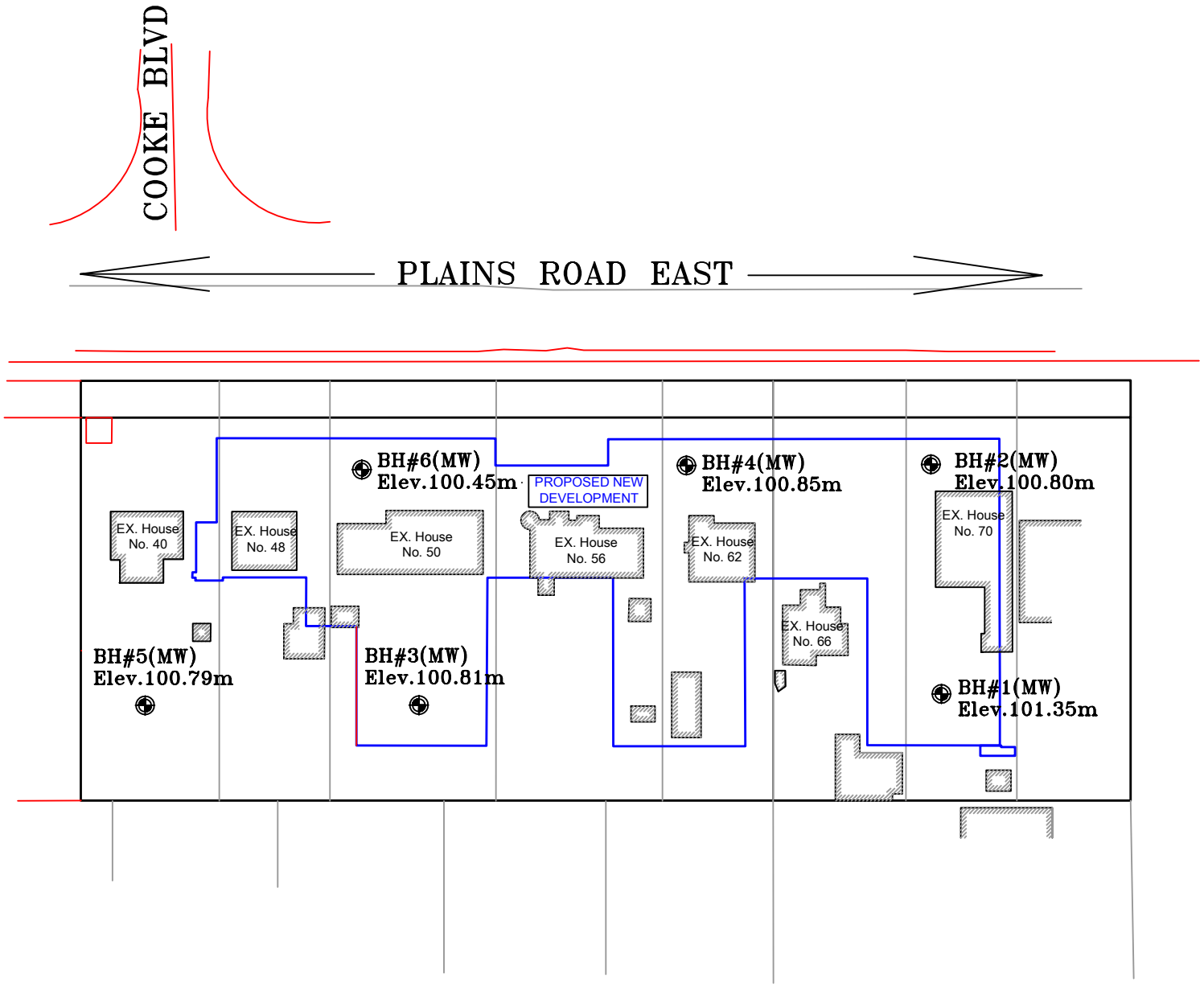
FE-P20-10062

DATE

APRIL 2020

SCALE

AS SHOWN



FISHER ENGINEERING

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NORTH

LEGEND

Borehole with Monitoring Well

PROJECT NAME AND ADDRESS

GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATIONS

40-70 PLAINS RD. E.,
BURLINGTON, ONTARIO

FIGURE 1:

SITE PLAN WITH APPROXIMATE BOREHOLE LOCATIONS

PROJECT NO.	SHEET NO.
FE-P 20-10328/29	1
DATE: JUNE 2020	
SCALE: AS SHOWN	

COOKE BLVD

℄ OF ROAD

BACK OF CURB

GUTTER

STM MH
RIM=99.85
INV IN=97.55 #1.2
INV IN=97.03 #1.3

PLAINS ROAD EAST

(ROAD ALLOWANCE BETWEEN BROKEN FRONT CONCESSION AND CONCESSION 1)

PIN 07122-002

℄ OF ASPHALT

OVERHEAD WIRE

EDGE OF GUTTER

MSC. PLAN 153

SIDEWALK

PART 1
PLAN 20R-310

PART 11
PLAN 20R-789

PART 10
PLAN 20R-789

PART 9
PLAN 20R-789

PART 8
PLAN 20R-789

PART 7
PLAN 20R-789

PART 6
PLAN 20R-789

PART 5
PLAN 20R-789

PART 4
PLAN 20R-789

167.69

19.05

15.24

22.86

N43°34'30"E

22.91

15.24

18.29

15.54

144.67

52.73

1 1/2 STOREY BRICK & VINYL DWELLING # 40

1 1/2 STOREY BRICK & VINYL DWELLING # 46

1 1/2 STOREY BRICK & VINYL DWELLING # 50

1 1/2 STOREY BRICK & VINYL BUILDING # 50

2 STOREY STUCCO BUILDING # 56

1 STOREY STONE BUILDING # 62

1 STOREY STONE BUILDING # 66

1 1/2 STOREY BRICK BUILDING # 70

1 STOREY STONE BUILDING # 992

1 1/2 STOREY VINYL BUILDING # 982

PIN 07117-0050

PIN 07117-0051

PIN 07117-0052

PIN 07117-0053

PIN 07117-0054

PIN 07117-0055

PIN 07117-0056

PIN 07117-0003

PIN 07117-0004

PIN 07117-0005

LOT 16
PIN 07117-0065

LOT 15

LOT 14
PIN 07117-0067

LOT 13
PIN 07117-0068

LOT 12
PIN 07117-0069

LOT 1

LOT 2

LOT 3

PART OF LOT 6

BROKEN FRONT CONCESSION

REGISTERED PLAN 779 (PF)

BIRCHWOOD AVENUE

N46°25'30"W

N46°29'30"W

N46°20'05"E

N46°59'30"E

152.40

22.81

15.84

Benchmark Note:

CITY OF BURLINGTON BENCHMARK No. 298
ELEVATION = 97.915 METRES CGVD 1928:1978 ADJUSTMENT

BENCHMARK SET ON CITY PLATE N SOUTH FACE AT SOUTHEAST CORNER OF GLENVIEW PUBLIC SCHOOL, No. 143 TOWNSEND AVENUE.

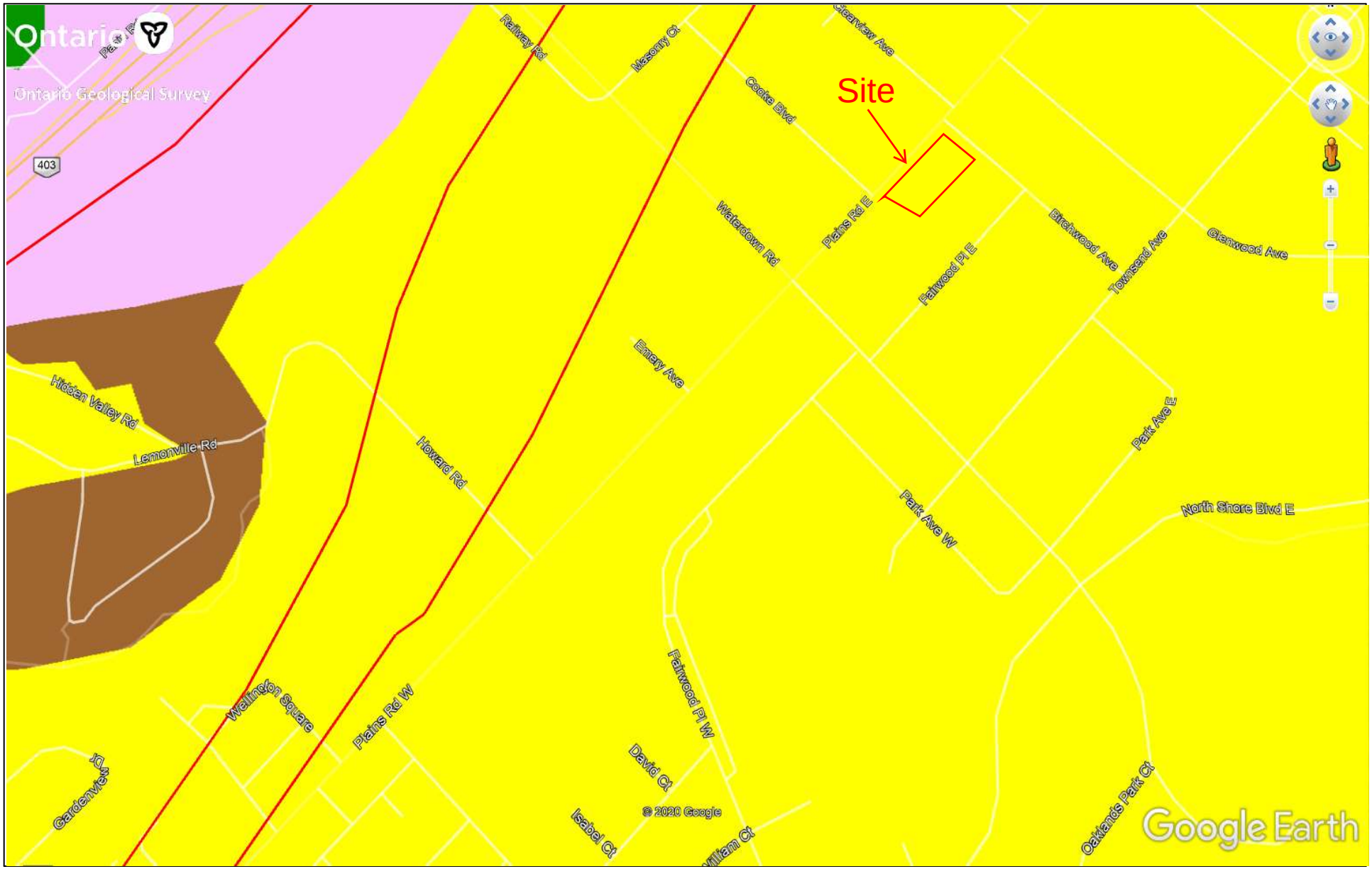
Legend :

- ⌀ DENOTES ROUND
- ℄ DENOTES CENTRE LINE
- SAN MH DENOTES SANITARY MANHOLE
- STM MH DENOTES STORM MANHOLE
- CB DENOTES CATCH BASIN
- BMH DENOTES BELL MANHOLE
- LS DENOTES LIGHT STANDARD
- HP DENOTES HYDRO POLE
- GW DENOTES GUY WIRE
- WV DENOTES WATER VALVE
- AC DENOTES AIR CONDITIONER
- MB DENOTES MAIL BOXES
- MB DENOTES MAIL BOX
- FH DENOTES FIRE HYDRANT

FFE DENOTES FIRST FLOOR ELEVATION
GM DENOTES GAS MARKER
GMR DENOTES GAS METRE

DENOTES DECIDUOUS TREE

DENOTES CONIFER TREE



Fisher Environmental Ltd.

400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

KEY PLAN

N

LEGEND

Coarse-textured glaciolacustrine deposits: sand, gravel, minor silt and clay

PROJECT NAME AND ADDRESS

HYDROGEOLOGICAL INVESTIGATION

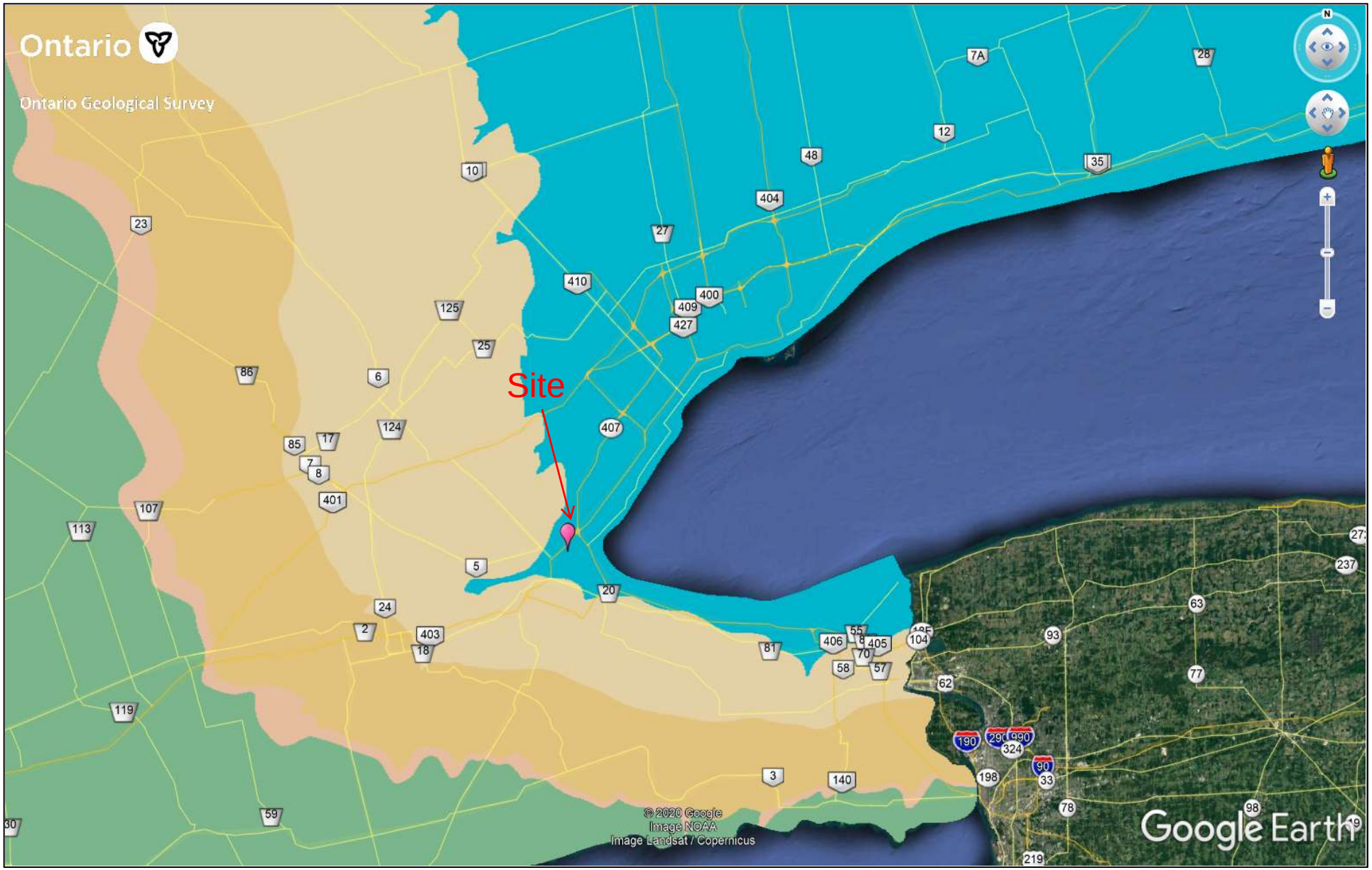
40-70 Plains Road,
Burlington, Ontario

PROJECT NO.
FE-P 20-10329-H

DATE
AUGUST 17, 2020

SCALE

Surficial Geology Map



Fisher Environmental Ltd.
400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2
Tel: 905 475-7755
Fax: 905 475-7718

KEY PLAN

LEGEND

PROJECT NAME AND ADDRESS

HYDROGEOLOGICAL INVESTIGATION

40-70 Plains Road,
Burlington, Ontario

PROJECT NO.
FE-P 20-10329-H

DATE
AUGUST 17, 2020

SCALE

Bedrock Geology Map

18035 Plains Road

40-70 Plains Rd E, Burlington ON

Project: 18035
Date: APRIL 01, 2021
Issued for: REZONING



ARCHITECTURAL DRAWING LIST	
SHEET NUMBER	SHEET NAME
A001	COVER / DRAWING LIST
A002	3D VIEWS
A003	CONTEXT PLAN
A100	SITE PLAN
A101	PARKING LEVEL 01
A102	PARKING LEVEL 02
A201	GROUND FLOOR PLAN
A202	2ND FLOOR PLAN
A203	3RD FLOOR PLAN
A204	4TH FLOOR PLAN
A205	5TH FLOOR PLAN
A206	6TH FLOOR PLAN
A207	7TH FLOOR PLAN
A208	8TH FLOOR PLAN
A209	9TH FLOOR PLAN
A210	PH FLOOR PLAN
A211	ROOF PLAN
A401	NORTH ELEVATION
A402	EAST ELEVATION
A403	SOUTH ELEVATION
A404	WEST ELEVATION
A451	NORTH COLOURED ELEVATION
A452	EAST-WEST COLOURED ELEVATIONS
A453	SOUTH COLOURED ELEVATION
A501	BUILDING SECTIONS
A502	BUILDING SECTIONS
A503	BUILDING SECTIONS

405-317 ADELAIDE ST. W.
TORONTO CANADA M5V 1P9
+1 416 599 9729
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SITE STATISTICS **COMPLETE**
4 November 2020

18035
40-70 Plains Road East
Burlington ON

Official Plan	Medium Density		GROSS SITE AREA	6823.0	sq.m.	73,445	sq.ft.
Avenue Width	20		WIDENING		sq.m.	0	sq.ft.
Character Area	N/A		NET SITE AREA	6823.0	sq.m.	73,445	sq.ft.
Policy Area			AVG UNIT SIZE	69.95	sq.m. NET	752.96312	sq.ft. NET
Established District				82.29	sq.m. GROSS	885.83896	sq.ft. GROSS
Current Zoning		FSI Retail	**0.00**	Residential	**4.34** Total	**4.34**	
By-Law		UPH	**527.527**				

AREA CALCULATIONS

FLOOR	UNITS STUDIO	1B	1B+D	2B	3B	TOTAL	GCA RETAIL sq.m.	RETAIL sq.ft.	RESIDENTIAL sq.m.	RESIDENTIAL sq.ft.	TOTAL sq.m.	TOTAL sq.ft.	NSA RETAIL sq.m.	RETAIL sq.ft.	RESIDENTIAL sq.m.	RESIDENTIAL sq.ft.	TOTAL sq.m.	TOTAL sq.ft.
1	5	17		14		**36**		-	**3,371**	36,286	3,371	36,286	-	-				
2	0	13		27		**40**			**3,315**	35,682	3,313	35,663		-				
3	1	13		34		**48**			**3,946**	42,476	3,946	42,476		-				
4	0	20		28		**48**			**3,748**	40,344	3,748	40,344		-				
5	0	28		20		**48**			**3,532**	38,019	3,532	38,019						
6	2	30		16		**48**			**3,316**	35,694	3,316	35,694						
7	0	24		12		**36**			**2,622**	28,224	2,622	28,224						
8	0	8		20		**28**			**2,420**	26,050	2,420	26,050		-				
9	0	14		14		**28**			**2,220**	23,897	2,220	23,897						
						0			**1138**	12,250	1,138	12,250						
TOTAL	**8**	**167**	**0**	**185**	**0**	**360**	**0**	-	**29,626**	318,902	**29,626**	318,902	**0**	-				
Mix	2%	46%	0%	51%	0%													

Common Amenity	Provided			
Indoor Amenity	1095	sq.m.	11,787	sq.ft.
Outdoor Amenity	1052	sq.m.	11,324	sq.ft.
Landscape Open Space	Provided			
	1060	sq.m.	11,410	sq.ft.

5.96 m2 Per Unit

2.94 m2 Per Unit

VEHICLE PARKING

RATIO PROPOSED		0.25	1.00	TOTAL		PROVIDED	Surface	P1	P2	Total
	RESIDENT		360			Resident	0	193	217	410
	VISITOR	90				Visitor	14	0	0	14
	TOTAL	90	360	450		**TOTAL**	14	193	217	**424**

BICYCLE PARKING

		REQUIRED	PROVIDED
RESIDENTIAL	ALL LEVELS	**180**	232
Long Term (0.5/UNIT)	*AT GRADE*		*58*
VISITOR	AT GRADE	18	20
Short term(0.05/UNIT)			
TOTAL		**198**	**252**

ISSUE RECORD

REVISION RECORD

North

RAW

405-317 ADELAIDE STREET
WEST
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18035

18035 Plains Road

INFINITY GROUP

COVER / DRAWING LIST

A001

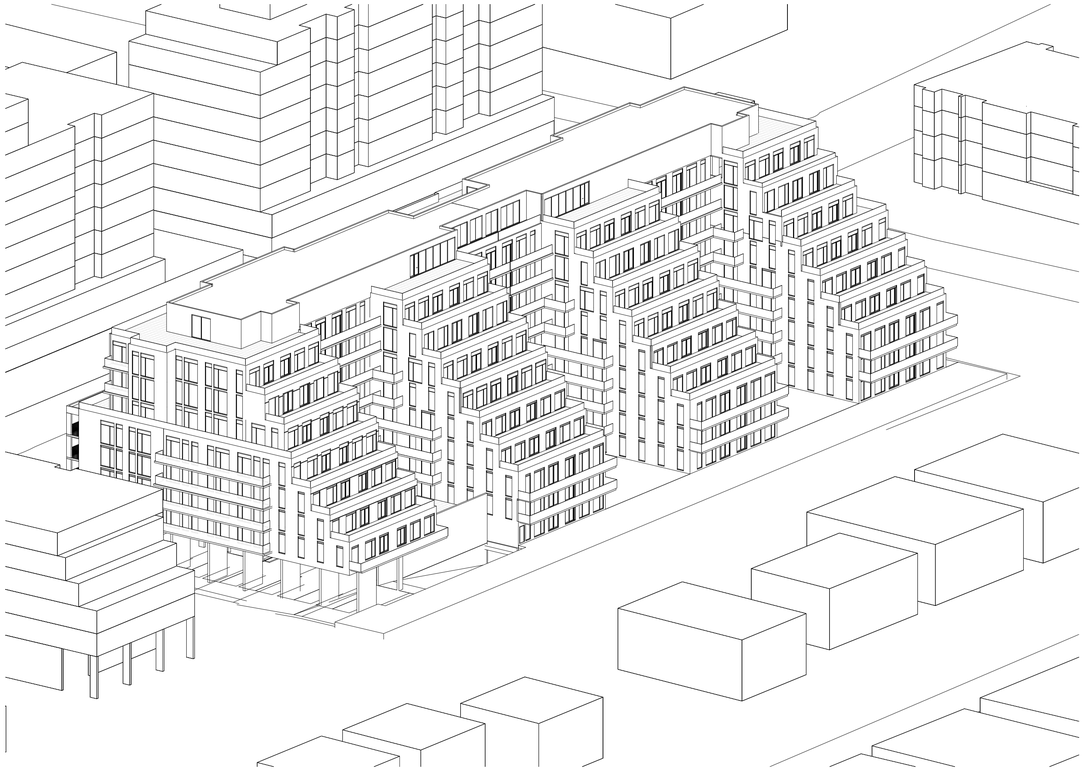
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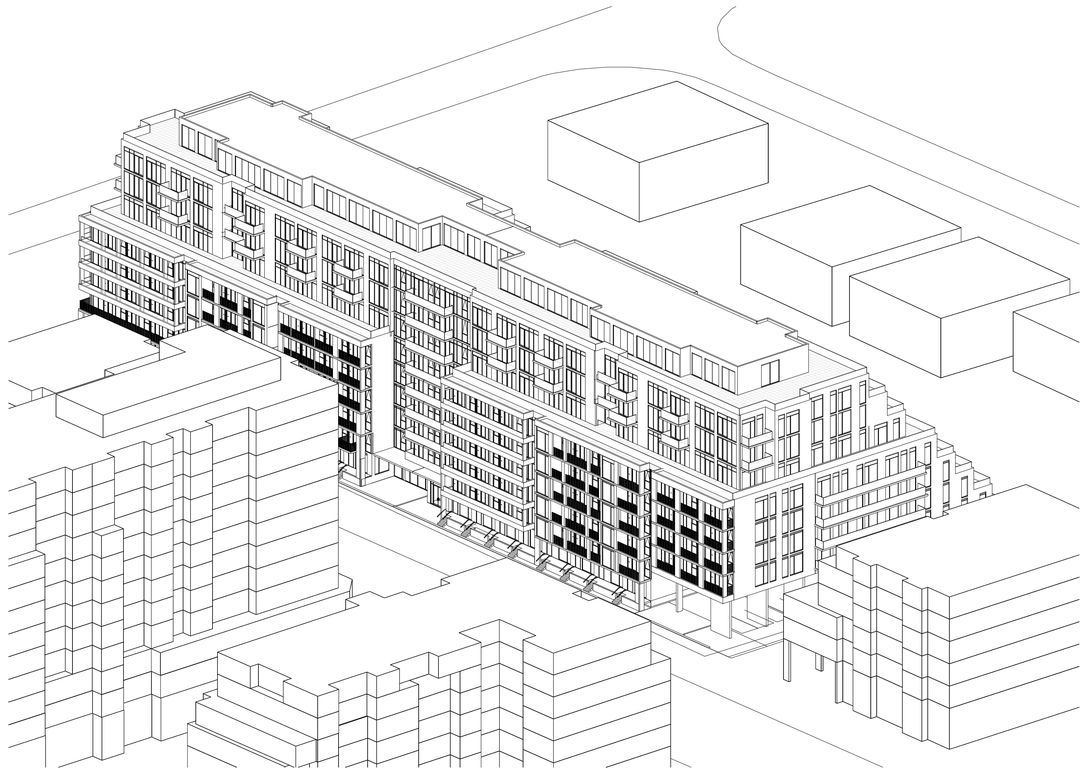
2 A002 NORTH-EAST AXO



1 A002 SOUTH-EAST AXO



3 A002 SOUTH-WEST AXO



4 A002 NORTH-WEST AXO

ISSUE RECORD

REVISION RECORD

North

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18035

18035 Plains Road

INFINITY 2NT GROUP

3D VIEWS

A002

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2021-04-05 9:41:30 AM



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INFINITY 2NT GROUP

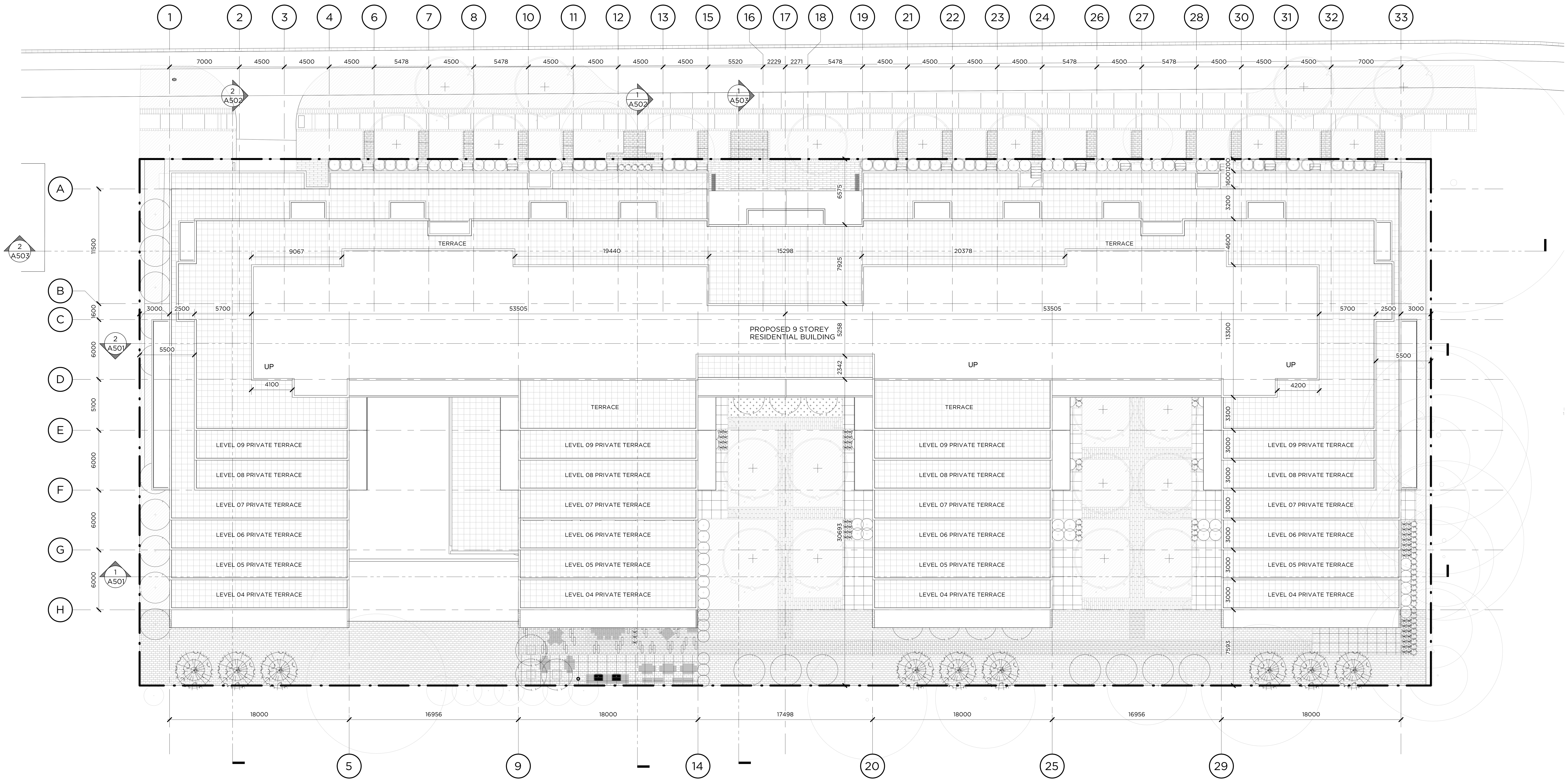
CONTEXT PLAN

1 : 1000

A003

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18035 Plains Road

INFINITY GROUP

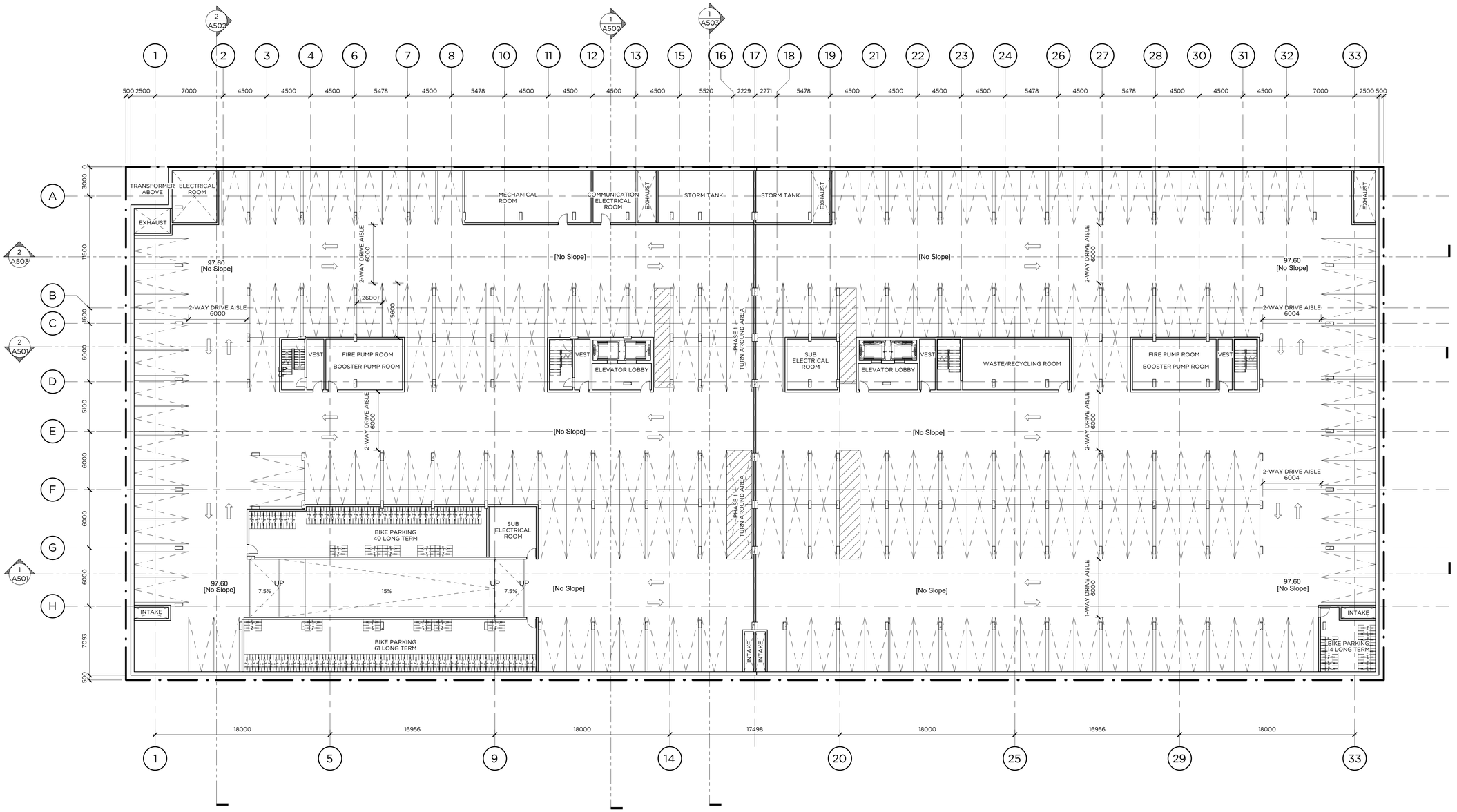
SITE PLAN

1 : 200

A100

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18035 Plains Road

INFINITY GROUP

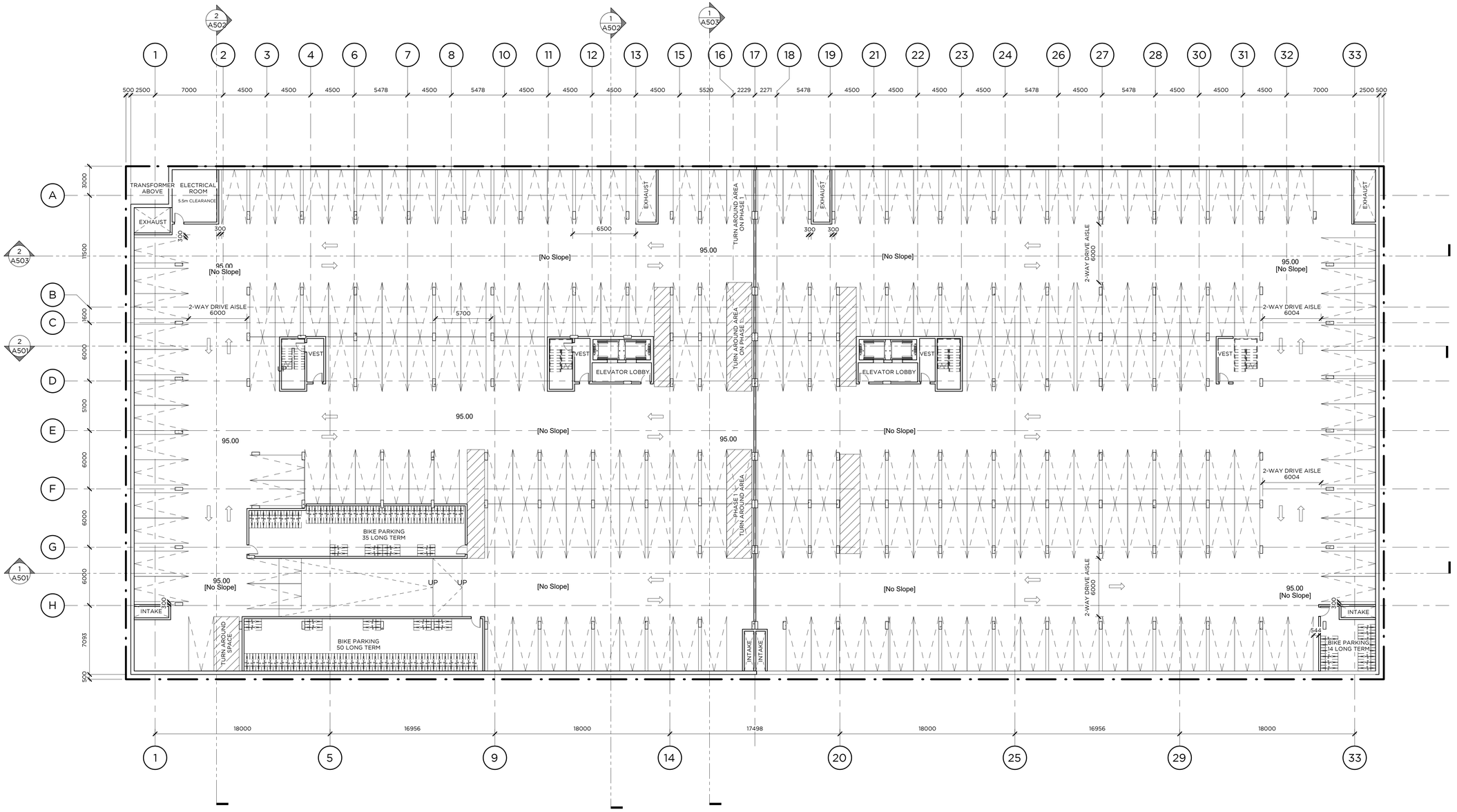
PARKING LEVEL 01

1 : 200

A101

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18035 Plains Road

INFINITY 2NT GROUP

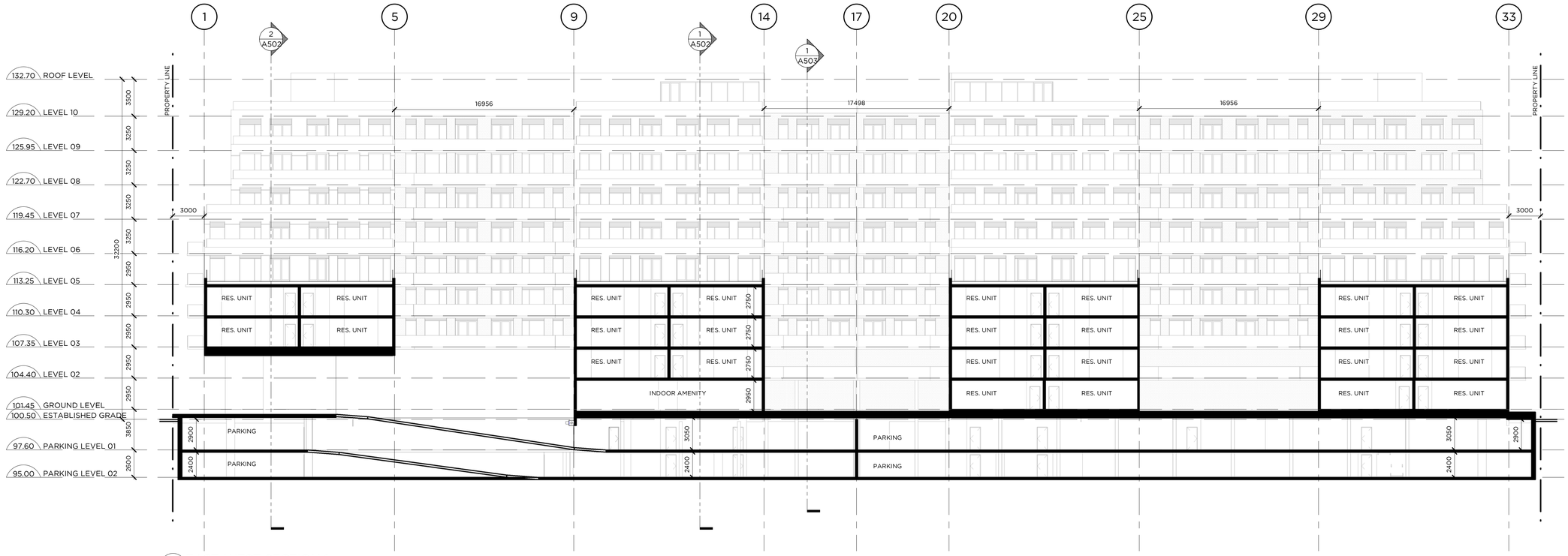
PARKING LEVEL 02

1 : 200

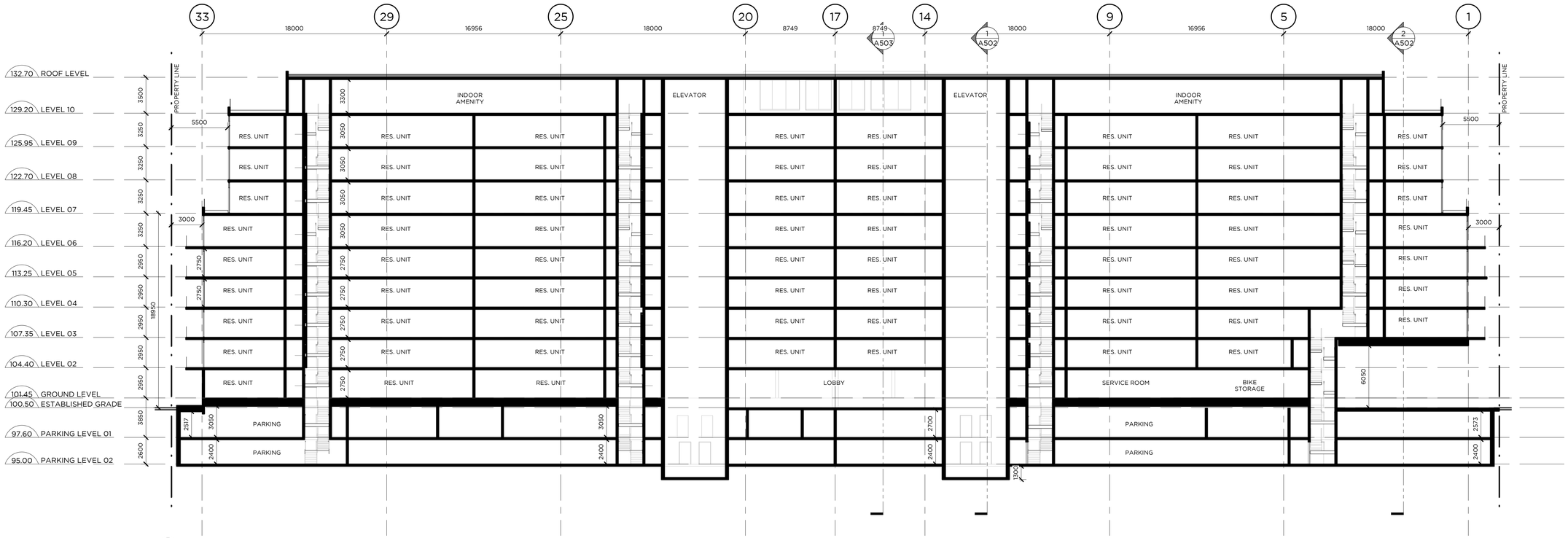
A102

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1 A501 EAST-WEST SECTION 1
1 : 200



2 A501 EAST-WEST SECTION 2
1 : 200

2021-04-05 9:49:12 AM

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18035

18035 Plains Road

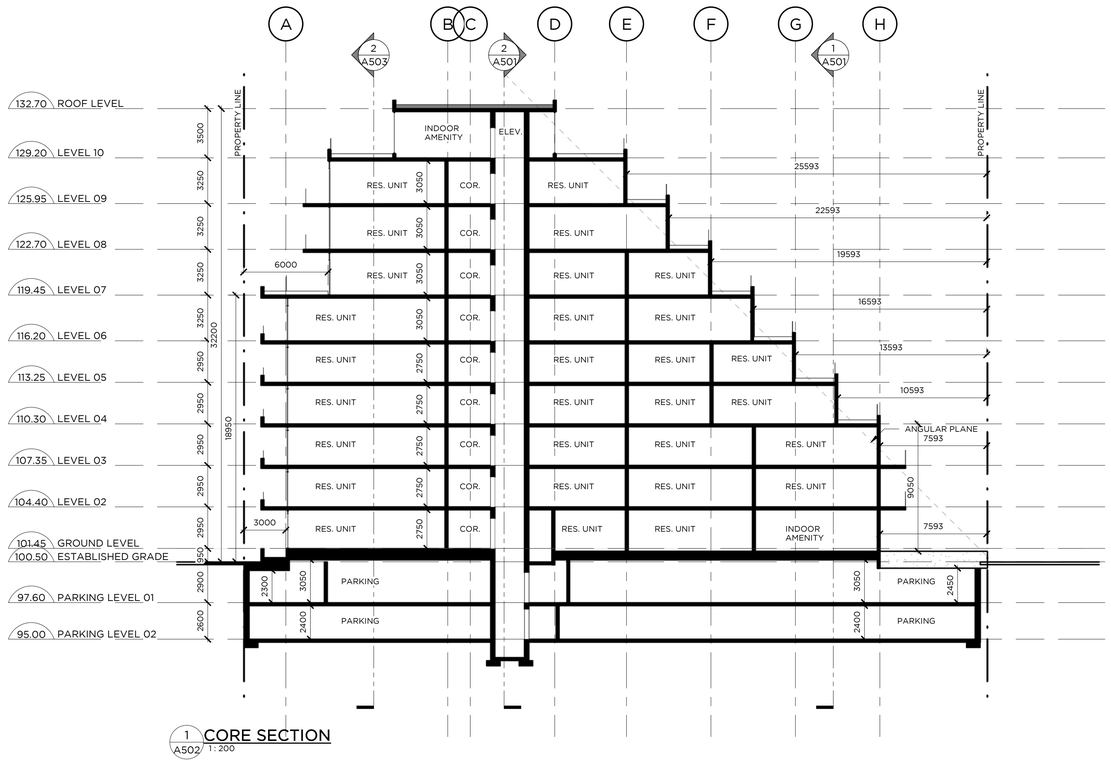
INFINITY GROUP

BUILDING SECTIONS

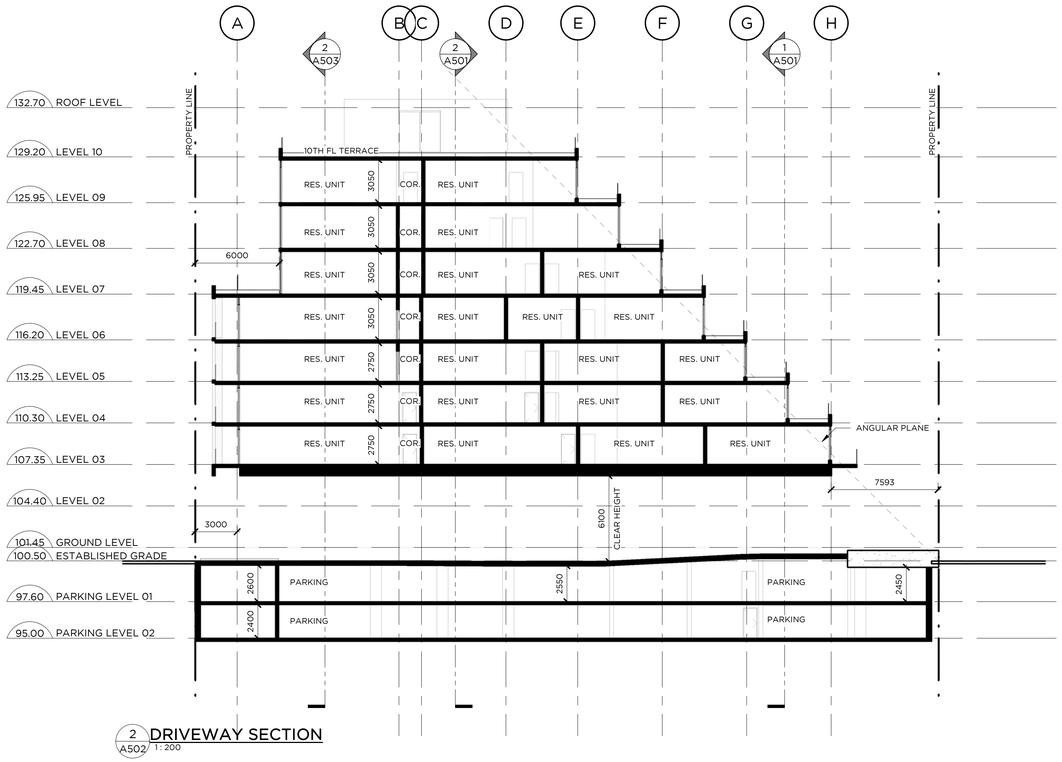
1 : 200

A501

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1 A502 **CORE SECTION**
1 : 200



2 A502 **DRIVEWAY SECTION**
1 : 200

ISSUE RECORD

REVISION RECORD

North

RAW

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18035

18035 Plains Road

INFINITY 2NT GROUP

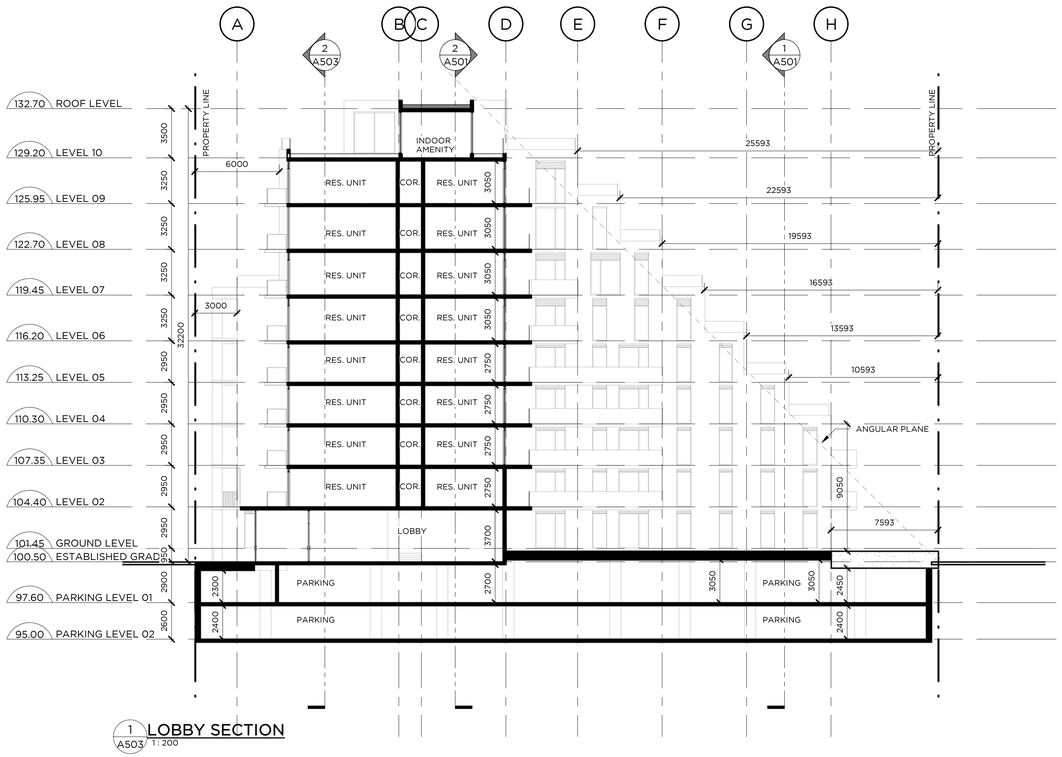
BUILDING SECTIONS

1 : 200

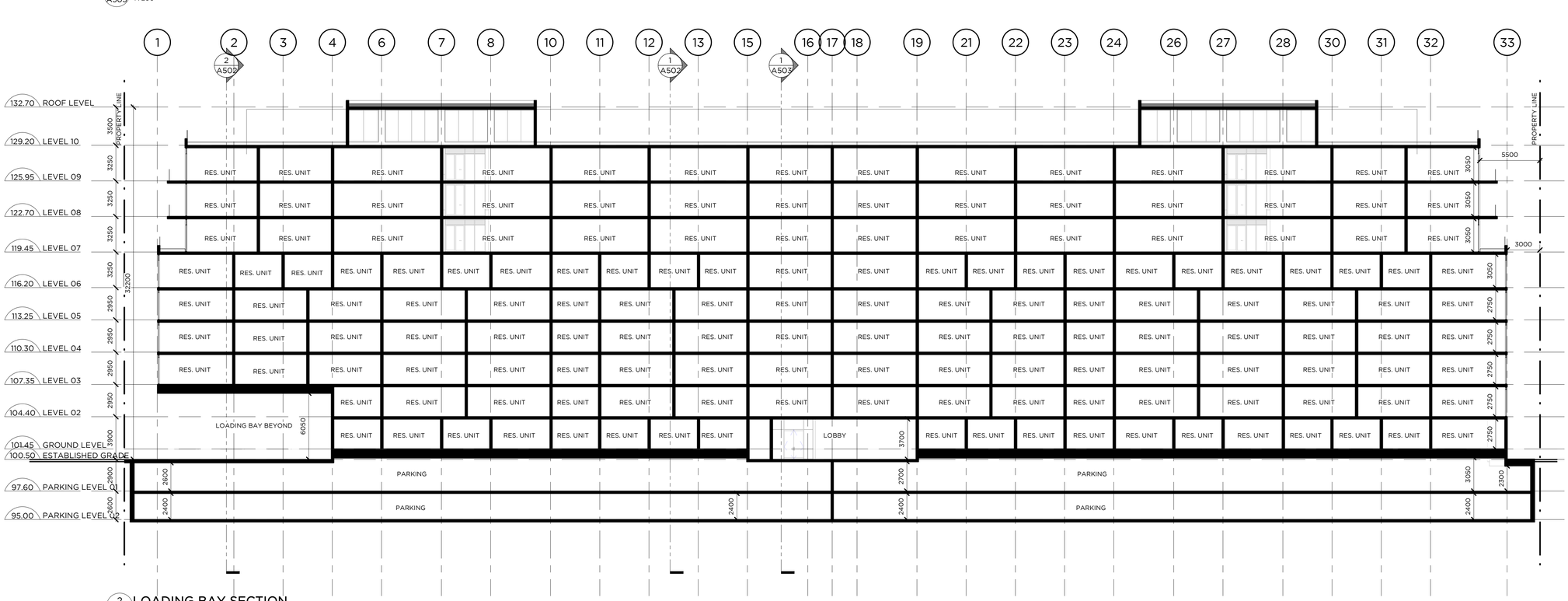
A502

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1 A503 LOBBY SECTION
1 : 200



2 A503 LOADING BAY SECTION
1 : 200

ISSUE RECORD

REVISION RECORD

North

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18035

18035 Plains Road

INFINITY GROUP

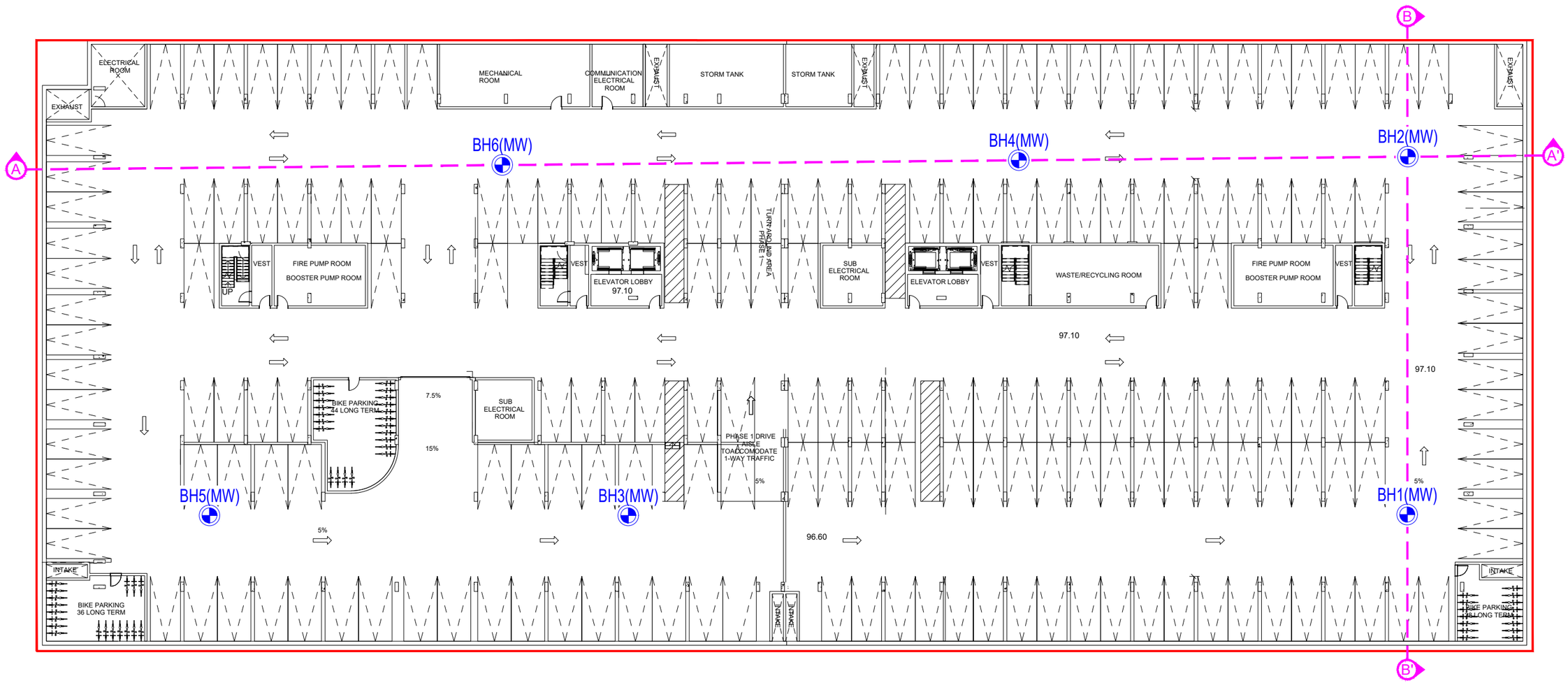
BUILDING SECTIONS

1 : 200

A503

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400 Esna Park Dr., #15
Markham, Ontario
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NORTH

LEGEND

SITE BOUNDARY

BOREHOLE/ MONITORING WELL

CROSS SECTION MARK

PROJECT NAME AND ADDRESS

HYDROGEOLOGICAL & GEOTECHNICAL INVESTIGATIONS

40-70 Plains Rd. East,.
Burlington, Ontario

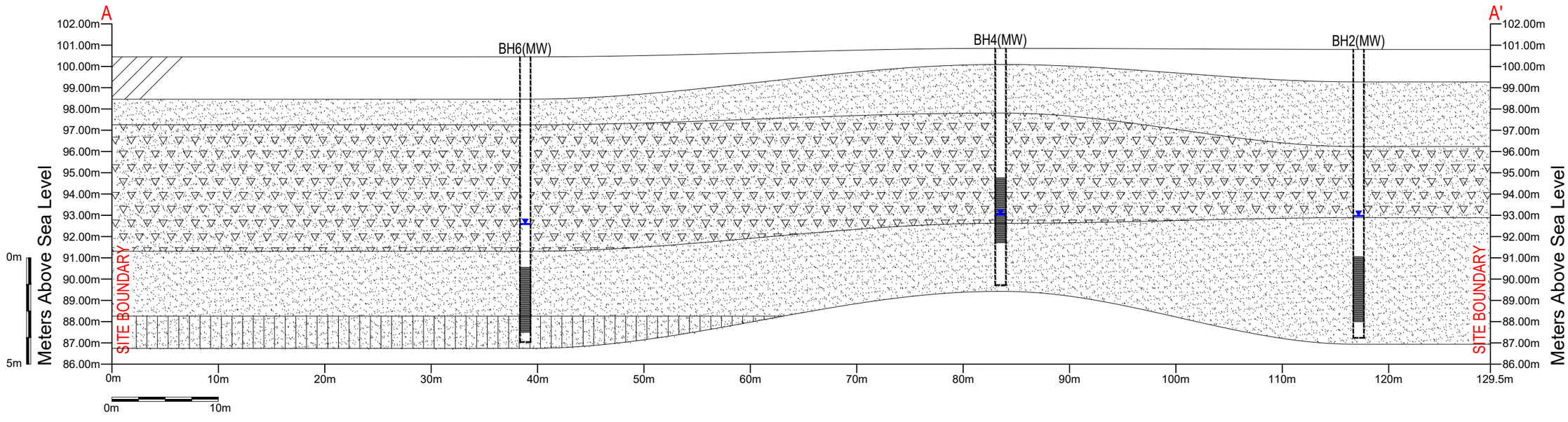
PROJECT NO. FE-P 20-10328

DATE. 11 March 2021

SCALE. AS SHOWN

FIGURE 1: Site Plan With Approximate Borehole Locations

SHEET NO. 1



FISHER ENGINEERING

400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

NORTH

LEGEND

FILL
SILT
SAND
GROUNDWATER POTENTIOMETRIC LEVEL
GRAVEL

PROJECT NAME AND ADDRESS

GEOTECHNICAL INVESTIGATION

40-70 Plains Rd. East,.
Burlington, Ontario

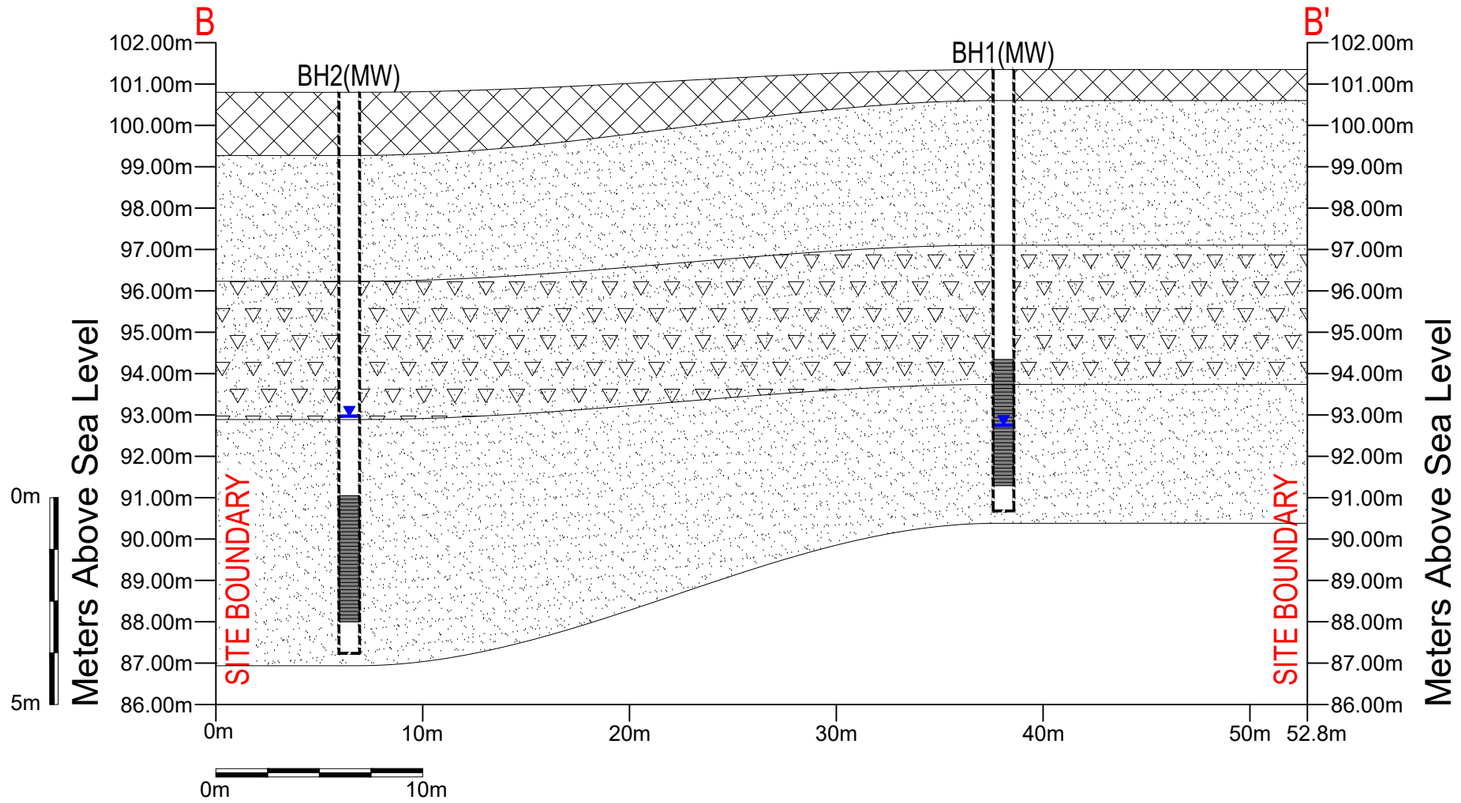
PROJECT NO.
FE-P 20-10328

DATE.
22 July 2020

SCALE.
AS SHOWN

FIGURE 2:
CROSS SECTION A-A'

SHEET NO.
2



FISHER ENGINEERING

400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

NORTH

LEGEND

FILL

SAND

GRAVEL

GROUNDWATER POTENTIOMETRIC LEVEL

PROJECT NAME AND ADDRESS

GEOTECHNICAL INVESTIGATION

40-70 Plains Rd. East,.
Burlington, Ontario

PROJECT NO.
FE-P 20-10328

DATE.
22 July 2020

SCALE.
AS SHOWN

FIGURE 3:
CROSS SECTION B-B'

SHEET NO.
3

APPENDIX B – LOG OF BOREHOLES

FISHER ENGINEERING

LOG OF BOREHOLE NO. BH1(MW) SHEET. 1 of 1

PROJECT NO.: FE-P 20-10328 & 20-10329

PROJECT NAME: Geotechnical and Hydrogeological Investigations

LOCATION: 40-70 Plains Road. E., Burlington, ON.

DRILLING METHOD: D-50, Hollow Stem

DRILLING DATE: May 26, 2020

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	"N" VALUE
0	0	GROUND SURFACE (m asl)		101.35			
		FILL: dark brown to brown silty sand, some to trace of topsoil/roots, moist.				SS-1	4
		0.76m		100.59			
						SS-2	11
		REDDISH BROWN TO BROWN FINE TO MEDIUM SAND: trace to some silt, moist, compact.				SS-3	19
						SS-4	29
						SS-5	25
		4.27m		97.08			
		BROWN SAND & GRAVEL TO GRAVELLY SAND: moist, very dense.				SS-6	100+
						SS-7	100+
		7.62m		93.73			
		BROWN TO GREYISH BROWN SAND: some to trace of gravel/silt, moist, wet below 9.14m, very dense to compact.				SS-8	58
						SS-9	17
		10.67m		90.68			
		End of Borehole					

PENETRATION TESTING (SPT) ▲ 20 40 60 80
SHEAR STRENGTH (Kpa) ✤ 40 80 120 160
(Possibly Disturbed)

VAPOUR READING (ppm) □ 20 40 60 80
MOISTURE CONTENT (%) ● 10 20 30 40
5.6%
6.0%
3.4%
3.7%

PIEZOMETER OR WELL CONSTRUCTION
Flush Mount Cover
Bentonite Pellets
50mm blank PVC
50mm Slotted Pipe
Silica Sand
10.06m

Groundwater Depth on completion: 8.08m; on June 24, 2020: 8.60m, on July 8, 2020: 8.59m; on July 22, 2020: 8.60m

LOGGED: FF CHECKED: RC

FISHER ENGINEERING

LOG OF BOREHOLE NO. BH2(MW) SHEET. 1 of 1

PROJECT NO.: FE-P 20-10328 & 20-10329

PROJECT NAME: Geotechnical and Hydrogeological Investigations

LOCATION: 40-70 Plains Road. E., Burlington, ON.

DRILLING METHOD: CME-75, Hollow Stem

DRILLING DATE: June 4, 2020

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	"N" VALUE	PENETRATION TESTING (SPT) ▲ 20 40 60 80 / SHEAR STRENGTH (Kpa) ✤ 40 80 120 160	VAPOUR READING (ppm) □ 20 40 60 80 / MOISTURE CONTENT (%) ● 10 20 30 40	PIEZOMETER OR WELL CONSTRUCTION
		GROUND SURFACE (m asl)		100.80						
0	0	FILL: dark brown to brown silty sand, some to trace of topsoil/roots, moist.				SS-1	6			
2										
4	1					SS-2	10			
		1.52m		99.28						
6	2	BROWN FINE TO MEDIUM SAND: trace to some silt/gravel, occasional cobbles, moist, compact to very dense.				SS-3	11			
8						SS-4	37			
10	3					SS-5	100+			
12										
14	4									
		4.57m		96.23						
16	5	BROWN SAND & GRAVEL TO GRAVELLY SAND: trace to some silt, moist, very dense.				SS-6	100+			
18										
20	6					SS-7	100+			
22										
24	7									
		7.92m		92.88						
26	8	GREYISH BROWN TO GREY SAND: trace to some silt/gravel, wet, dense to compact.				SS-8	42			
28										
30	9					SS-9	25			
32										
34	10									
36	11					SS-10	16	(Possibly Disturbed)		
38										
40	12					SS-11	15	(Possibly Disturbed)		
42										
44	13					SS-12	21	(Possibly Disturbed)		
		13.56m		87.24						
46	14	End of Borehole								
48										
50	15									
52	16									
54										
56										

PIEZOMETER OR WELL CONSTRUCTION: Flush Mount Cover; Bentonite Pellets; 50mm blank PVC; 8.03; 50mm Slotted Pipe; Silica Sand; 12.80m

Groundwater Depth on completion: 7.77m; on June 24, 2020: 7.86m; on July 8, 2020: 8.05; on July 22, 2020: 8.03m

LOGGED: CW CHECKED: RC

FISHER ENGINEERING

LOG OF BOREHOLE NO. BH3(MW) SHEET. 1 of 1

PROJECT NO.: FE-P 20-10328 & 20-10329

PROJECT NAME: Geotechnical and Hydrogeological Investigations

LOCATION: 40-70 Plains Road. E., Burlington, ON.

DRILLING METHOD: Bombadier, Hollow Stem

DRILLING DATE: June 18, 2020

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	"N" VALUE
		GROUND SURFACE (m asl)		100.81			
0	0	FILL: dark brown to brown silty sand, some to trace of topsoil/roots, moist.				SS-1	7
4	1					SS-2	4
4	1	1.37m		99.44			
6	2	REDDISH BROWN TO BROWN SAND: trace to some silt, occasional seam of very moist/wet sandy silt, moist, compact.				SS-3	11
8	2					SS-4	19
10	3					SS-5	15
10	3	3.35m		97.46			
12	4	BROWN SAND AND GRAVEL TO GRAVELLY SAND: trace to some silt, occasional cobbles, moist, compact to very dense.					
14	4						
16	5					SS-6	100+
18	5						
20	6					SS-7	100+
22	7						
24	7	7.62m		93.19			
26	8	BROWN SAND: trace to some silt/gravel, layers of silt/sandy silt below 9.14m, moist, wet below 9.14m, dense to compact.				SS-8	37
28	9						
30	9					SS-9	20
32	10						
34	10						
36	11					SS-10	23
38	12						
40	12					SS-11	40
42	13	12.65m		88.16			
42	13	End of Borehole					
44	13						
46	14						
48	15						
50	15						
52	16						
54	16						
56							

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✙ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

(Possibly Disturbed)

(Possibly Disturbed)

PIEZOMETER OR WELL CONSTRUCTION

Flush Mount Cover

50mm blank PVC

Bentonite Pellets

8.25

50mm Slotted Pipe

Silica Sand

12.19m

Groundwater Depth on completion: dry; on June 24, 2020: 8.23m; on July 8, 2020: 8.23m; on July 22, 2020: 8.25m

LOGGED: CW

CHECKED: RC

FISHER ENGINEERING

LOG OF BOREHOLE NO. BH4(MW) SHEET. 1 of 1

PROJECT NO.: FE-P 20-10328 & 20-10329

PROJECT NAME: Geotechnical and Hydrogeological Investigations

LOCATION: 40-70 Plains Road. E., Burlington, ON.

DRILLING METHOD: CME-75, Hollow Stem

DRILLING DATE: June 4, 2020

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES LAB ID	SAMPLES Type NO.	SAMPLES "N" VALUE
0	0	GROUND SURFACE (m asl)		100.85			
		FILL: dark brown to brown silty sand, some to trace of topsoil/roots, moist.				SS-1	5
0.76m				100.09			
2							
4	1	BROWN FINE TO MEDIUM SAND: trace to some silt, occasional trace of gravel, moist, compact.				SS-2	12
6	2					SS-3	18
8						SS-4	13
10	3						
3.05m				97.80			
		BROWN SAND & GRAVEL TO GRAVELLY SAND: trace to some silt, occasional cobbles/boulders, dry to moist, very dense.				SS-5	52
12	4						
14							
16	5					SS-6	100+
18							
20	6					SS-7	100+
22	7						
24							
26	8					SS-8	100+
8.23m				92.62			
28		GREYISH BROWN TO GREY SAND: trace of gravel/silt, wet, compact.					
30	9					SS-9	28
32	10						
34							
36	11					SS-10	30
11.13m				89.72			
		End of Borehole					
38	12						
40							
42	13						
44							
46	14						
48							
50	15						
52	16						
54							
56							

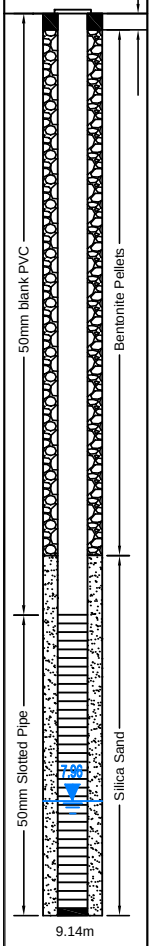
PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✤ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER OR WELL CONSTRUCTION



Groundwater Depth on completion: 7.77m; on June 24, 2020: 7.82m; on July 8, 2020: 7.91m; on July 22, 2020: 7.96m

LOGGED: CW

CHECKED: RC

FISHER ENGINEERING

LOG OF BOREHOLE NO. BH5(MW) SHEET. 1 of 1

PROJECT NO.: FE-P 20-10328 & 20-10329

PROJECT NAME: Geotechnical and Hydrogeological Investigations

LOCATION: 40-70 Plains Road. E., Burlington, ON.

DRILLING METHOD: Bombadier, Hollow Stem

DRILLING DATE: June 18, 2020

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	"N" VALUE
0	0	GROUND SURFACE (m asl)		100.79			
0	0	FILL: dark brown to brown silty sand, some to trace of topsoil/roots, moist.				SS-1	7
4	1					SS-2	2
5	1.52m			99.27			
6	2	REDDISH BROWN SAND: trace to some silt/gravel, moist, loose.				SS-3	9
8	2.74m			98.05		SS-4	7
10	3	BROWN SAND & GRAVEL TO GRAVELLY SAND: trace to some silt, layers of cobbles/boulders below 4.5m, moist, very dense.				SS-5	100+
14	4.57m			96.22			
16	5	GRAVEL AND COBBLES: some brown sand, moist, very dense.				SS-6	100+
20	6.25m			94.54		SS-7	79
		End of Borehole					
		Refusal to augering possibly due to boulder at 6.25m.					
		BH caved in to 4.57m on completion.					

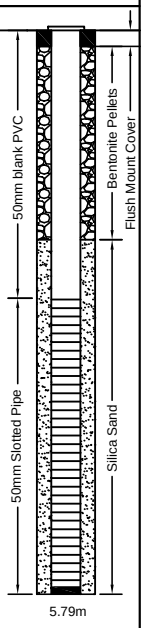
PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✙ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER OR WELL CONSTRUCTION



Groundwater Depth on completion:

LOGGED: CW

CHECKED: RC

FISHER ENGINEERING

LOG OF BOREHOLE NO. BH6(MW) SHEET. 1 of 1

PROJECT NO.: FE-P 20-10328 & 20-10329

PROJECT NAME: Geotechnical and Hydrogeological Investigations

LOCATION: 40-70 Plains Road. E., Burlington, ON.

DRILLING METHOD: CME-75, Hollow Stem

DRILLING DATE: June 5, 2020

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	"N" VALUE
		GROUND SURFACE (m asl)		100.45			
0	0	FILL: dark brown to brown silty sand, some to trace of topsoil/roots, moist.				SS-1	7
4	1					SS-2	3
6	2					SS-3	3
		1.98m		98.47			
8	2	BROWN SAND: trace of gravel, some silt, moist, compact.				SS-4	13
10	3					SS-5	62
		3.20m		97.25			
12	4	BROWN SAND & GRAVEL TO GRAVELLY SAND: trace to some silt, occasional cobbles, moist to very moist, very dense.					
14	4						
16	5					SS-6	100+
18	5						
20	6					SS-7	100+
22	7						
24	7						
26	8					SS-8	100+
28	8						
30	9					SS-9	100+
		9.14m		91.31			
32	10	GREYISH BROWN MEDIUM SAND: some silt, wet, very dense.					
34	10						
36	11					SS-10	69
38	11						
40	12						
		12.19m		88.26			
42	13	GREY SILTY SAND: trace of gravel, wet, dense.				SS-11	48
		13.41m		87.04			
44	13	End of Borehole				SS-12	44
46	14						
48	14						
50	15						
52	16						
54	16						
56							

PENETRATION TESTING (SPT) ▲ 20 40 60 80
SHEAR STRENGTH (Kpa) ✙ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80
MOISTURE CONTENT (%) ● 10 20 30 40

9.0%
5.2%
5.5%
13.0%

PIEZOMETER OR WELL CONSTRUCTION

Flush Mount Cover
50mm blank PVC
Bentonite Pellets
7.99
50mm Slotted Pipe
Silica Sand
12.95m

Groundwater Depth on completion: 8.23m; on June 24, 2020: 7.86m; on July 8, 2020: 7.96m; on July 22, 2020: 7.99m

LOGGED: CW CHECKED: RC

APPENDIX C – MOISTURE CONTENT AND GRAIN SIZE DISTRIBUTION ANALYSES

FISHER ENVIRONMENTAL LABORATORIES

FULL RANGE ANALYTICAL SERVICES • SOIL/WATER/AIR TESTING • ENVIRONMENTAL COMPLIANCE PACKAGES • 24 HOUR EMERGENCY RESPONSE • CALA ACCREDITED

400 ESNA PARK DRIVE #15
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FAX: 905 475-7718
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Client: 40-70 Plains Road
Address:

Tel.:
Email:
Attn.:

F.E. Job #: 20-4617
Project Name: 40-70 Plains Road
Project ID: FE-P 20-10328
Date Sampled: 5-Jun-2020
Date Received: 5-Jun-2020
Date Reported: 15-Jun-2020
Location: 40-70 Plains Road
Toronto, ON

Certificate of Analysis

Analyses	Matrix	Quantity	Date Extracted	Date Analyzed	Lab SOP	Method Reference
pH	Soil	1	9-Jun-20	9-Jun-20	pH-EC-SAR F-16	SW-846, 9045D
Chloride	Soil	1	N/A	15-Jun-20	Chloride F-20	SM 4500-Cl-E
Sulphate	Soil	1	9-Jun-20	15-Jun-20	Sulphate F-21	SM 4500-SO_4
Moisture Content	Soil	8	N/A	5-Jun-20	Support Procedures F-99	Carter (1993)
Grain Size	Soil	8	N/A	9-Jun-20	Grain Size F-28	ASTM D6913-04

Fisher Environmental Laboratories is accredited by CALA (the Canadian Association for Laboratory Accreditation Inc.) for specific parameters as required by Ontario Regulation 153/04. All analytical testing has been performed in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act published by Ontario Ministry of the Environment.

Authorized by:

Roger Lin, Ph. D., C. Chem.
Laboratory Manager

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Ronggen (Roger) Lin
CHEMIST

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	Sulphate, Chloride, pH, Moisture Content, Grain Size
Sample Description:	8 Soil Samples

Parameter	***20-4617-6*** BH1 SS5					**Soil Standards** *
pH *(pH unit)*	9.31					(5-11) 5-9

* Surface soil pH value from 5 - 9, Sub-surface soil pH value from 5-11.

QA/QC Report

Parameter	**LCS**	**AR**	**Duplicate**	**AR**		
	Absolute Difference *(pH Unit)*					
pH *(pH unit)*	7.05	6.90-7.20	0.15	<0.3		

LEGEND:
LCS - Laboratory Control Sample
AR - Acceptable Range

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	Sulphate, Chloride, pH, Moisture Content, Grain Size
Sample Description:	8 Soil Samples

Parameter	***20-4617-6*** BH1 SS5					
	Concentration (µg/g)					
Chloride in Soil	2.8					

< result obtained was below RL (Reporting Limit).

QA/QC Report

Parameter	**Blank**	**RL**	**LCS**	**AR**	**MS**	**AR**
	(µg/g)		**Recovery (%)**		**Recovery (%)**	
Chloride in Soil	<10	10	94	70-130	110	70-130

Parameter	**Duplicate**	**AR**				
	RPD (%)					
Chloride in Soil	3.6	0-20				

LEGEND:

RL - Reporting Limit
LCS - Laboratory Control Sample
MS - Matrix Spike
AR - Acceptable Range
RPD - Relative Percent Difference

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	Sulphate, Chloride, pH, Moisture Content, Grain Size
Sample Description:	8 Soil Samples

Parameter	***20-4617-6*** BH1 SS5					
Sulphate *(mg/kg)*	9.4					

QA/QC Report

Parameter	**Blank**	**RL**	**LCS/Spike**	**AR**	**Duplicate**	**AR**
	(mg/kg)		**Recovery (%)**		**RPD (%)**	
Sulphate	9.4	1	95	70-130	15	0-30

LEGEND:
RL - Reporting Limit
LCS - Laboratory Control Sample
AR - Acceptable Range
RPD - Relative Percent Difference

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	Sulphate, Chloride, pH, Moisture Content, Grain Size
Sample Description:	8 Soil Samples

Parameter	***20-4617-1*** MW6 1.50-1.95m	***20-4617-2*** MW6 3.00-3.45m	***20-4617-3*** MW6 4.55-5.00m	***20-4617-4*** MW6 7.55-8.05m	***20-4617-5*** BH1 SS3	***20-4617-6*** BH1 SS5
Moisture Content (%)	9.0	5.2	5.5	13	5.6	6.0

Parameter	***20-4617-7*** BH1 SS7	***20-4617-8*** BH1 SS8				
Moisture Content (%)	3.4	3.7				

QA/QC Report

Parameter	**Blank**	**RL**	**LCS**	**AR**	**Duplicate**	**AR**
			Recovery (%)		**RPD (%)**	
Moisture Content (%)	<0.1	0.1	100	70-130	10.6	0-20

LEGEND:
RL - Reporting Limit
LCS - Laboratory Control Sample
AR - Acceptable Range
RPD - Relative Percent Difference

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	Sulphate, Chloride, pH, Moisture Content, Grain Size
Sample Description:	8 Soil Samples

Parameter	***20-4617-1*** MW6 1.50-1.95m	***20-4617-2*** MW6 3.00-3.45m	***20-4617-3*** MW6 4.55-5.00m	***20-4617-4*** MW6 7.55-8.05m	***20-4617-5*** BH1 SS3	***20-4617-6*** BH1 SS5
Grain Size (%)						
>19mm	0.0	0.0	0.0	0.0	0.0	0.0
9.5mm-19mm	9.3	0.0	2.0	2.9	0.0	0.0
4.75mm-9.5mm	5.0	3.1	10.3	3.2	0.7	1.5
1.18m-4.75mmm	7.8	6.7	34.3	4.6	2.7	1.9
300um-1.18mm	15.3	19.6	15.9	14.9	40.4	64.6
75um-300um	41.0	52.8	20.4	53.0	39.1	20.5
<75um	21.6	17.8	17.2	21.4	17.0	11.4
Clay & Silt	**22**	**18**	**17**	**21**	**17**	**11**
Sand	**64**	**79**	**70**	**72**	**82**	**87**
Gravel	**14**	**3**	**12**	**6**	**1**	**2**

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	Sulphate, Chloride, pH, Moisture Content, Grain Size
Sample Description:	8 Soil Samples

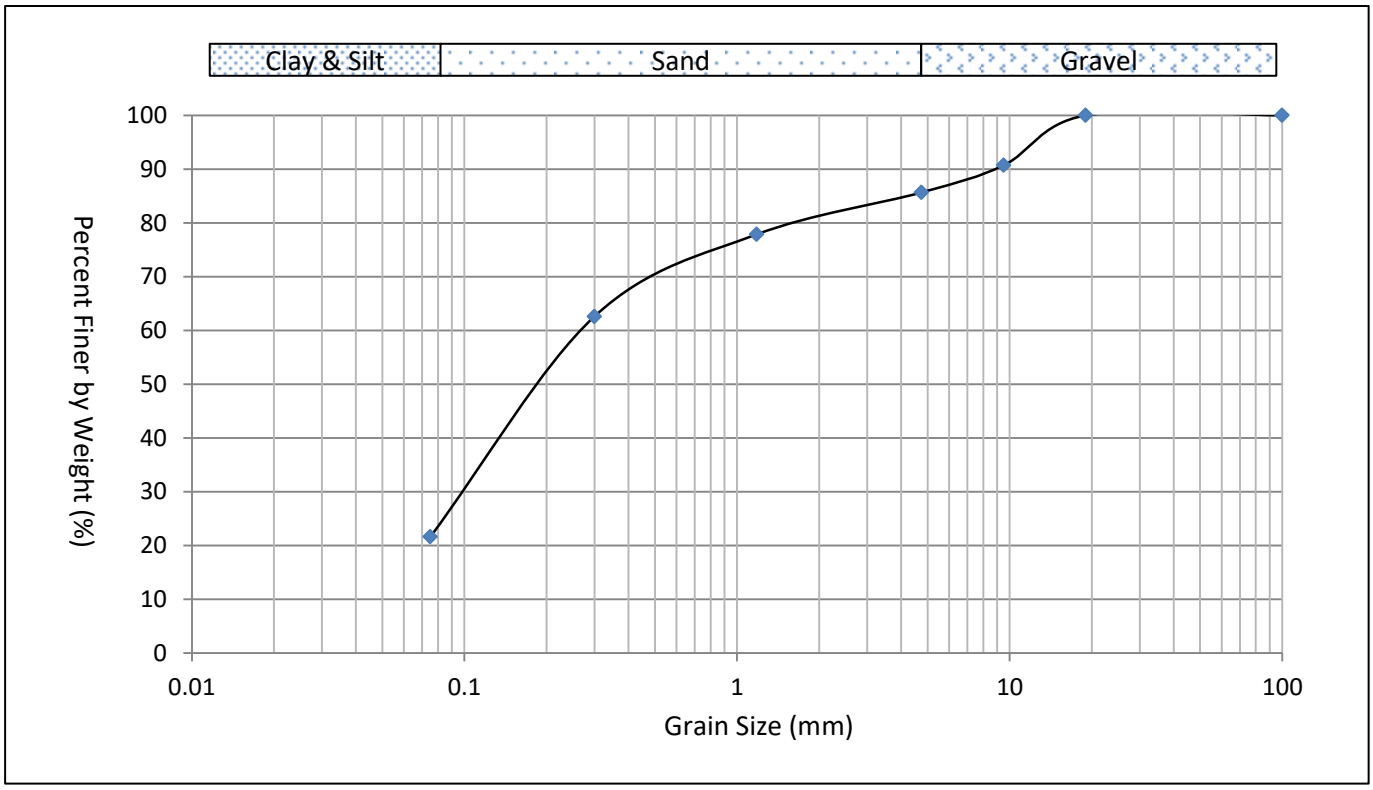
Parameter	***20-4617-7*** BH1 SS7	***20-4617-8*** BH1 SS8				
Grain Size (%)						
>19mm	0.0	0.0				
9.5mm-19mm	2.2	3.2				
4.75mm-9.5mm	16.8	10.9				
1.18m-4.75mmm	35.5	26.8				
300um-1.18mm	23.2	22.5				
75um-300um	7.4	24.7				
<75um	14.9	11.9				
Clay & Silt	**15**	**12**				
Sand	**66**	**74**				
Gravel	**19**	**14**				

Results related only to the items tested

Grain Size Distribution

Sample ID: 20-4617-1 MW6 1.50-1.95m

Clay & Silt: 22% Sand: 64% Gravel: 14%

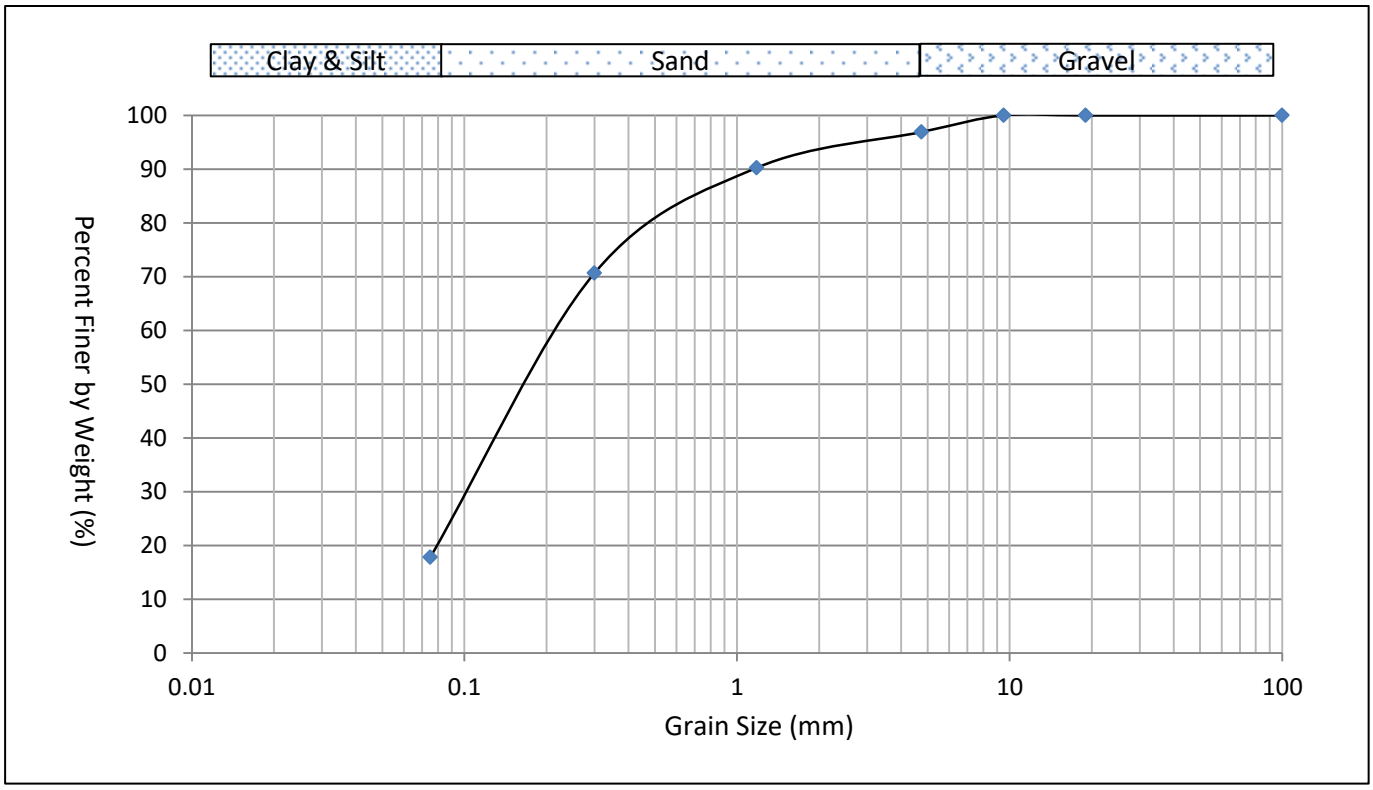


Results related only to the items tested

Grain Size Distribution

Sample ID: 20-4617-2 MW6 3.00-3.45m

Clay & Silt: 18% Sand: 79% Gravel: 3%

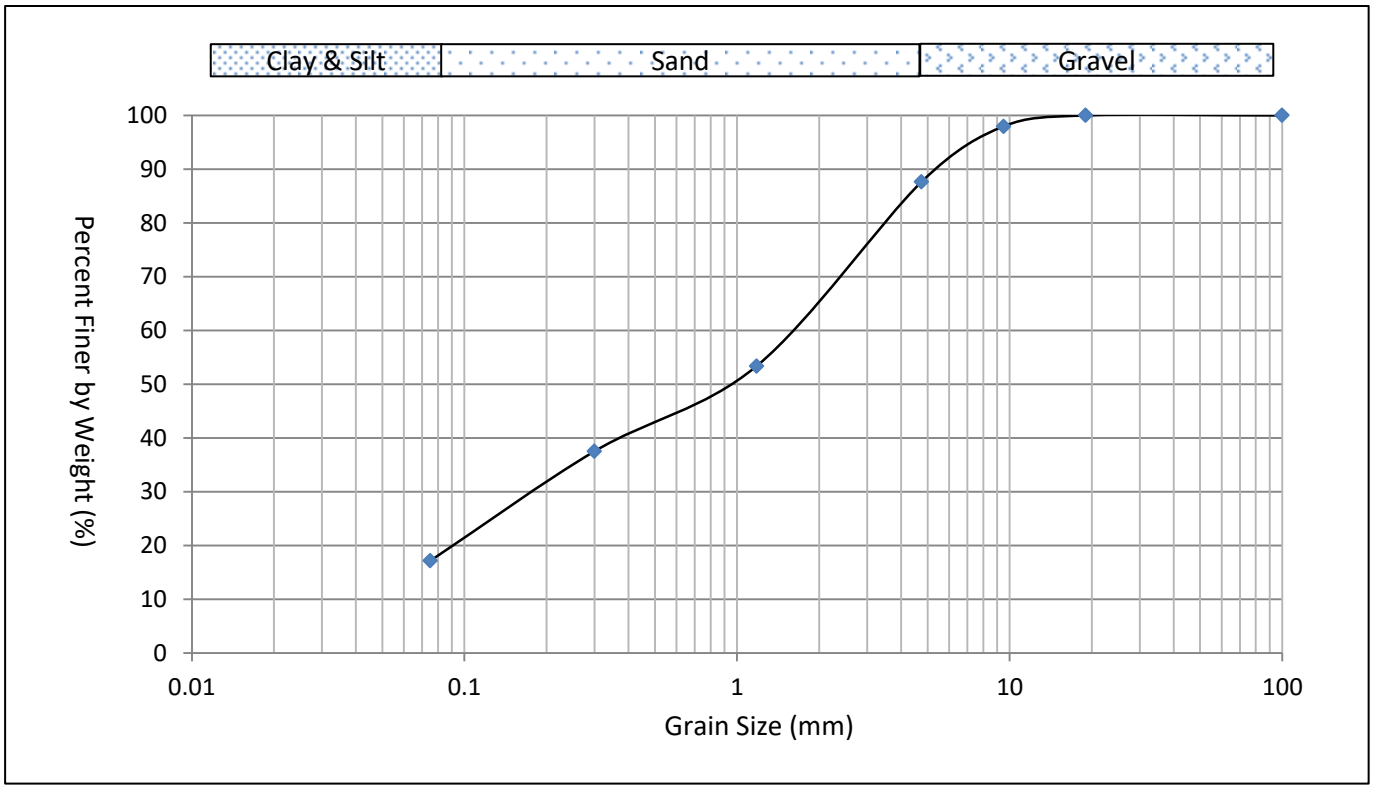


Results related only to the items tested

Grain Size Distribution

Sample ID: 20-4617-3 MW6 4.55-5.00m

Clay & Silt: 17% Sand: 70% Gravel: 12%

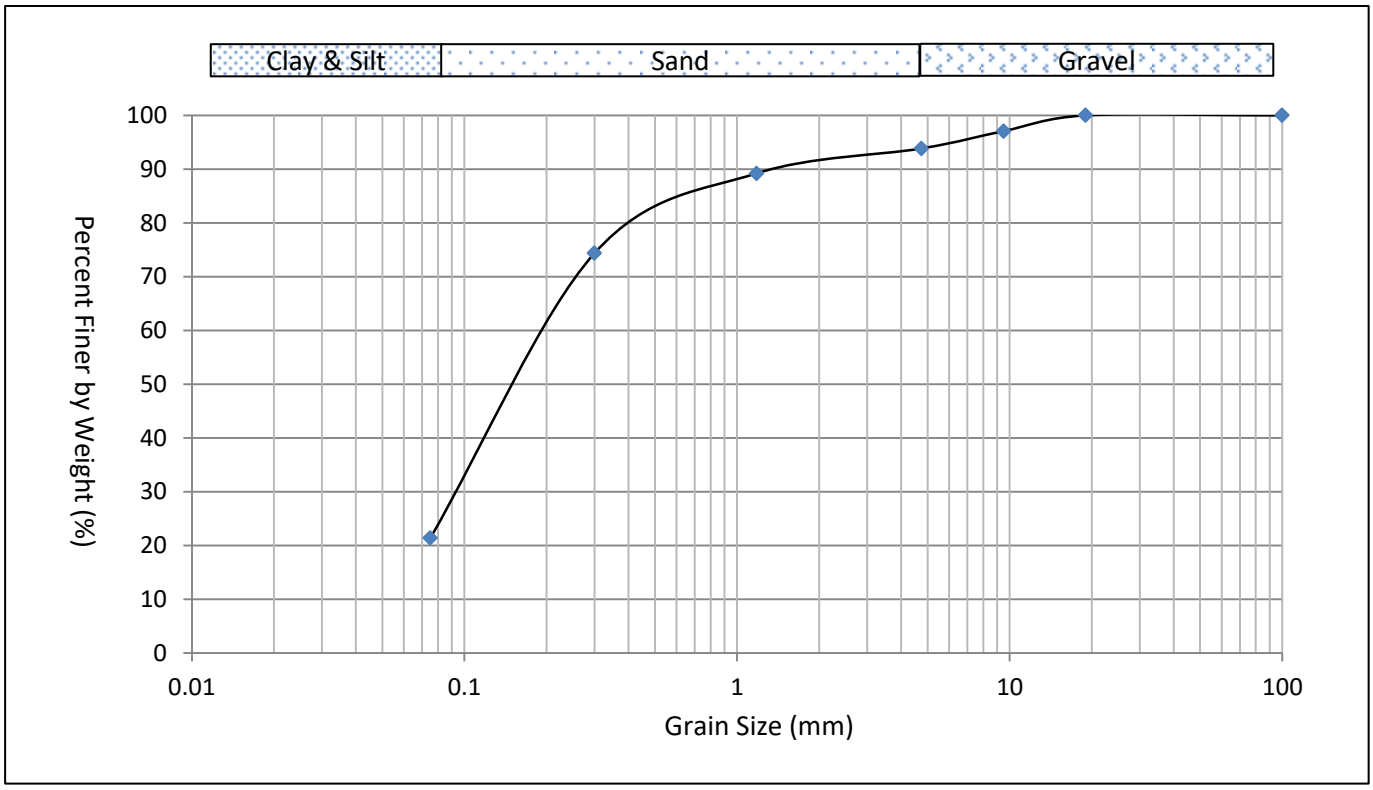


Results related only to the items tested

Grain Size Distribution

Sample ID: 20-4617-4 MW6 7.55-8.05m

Clay & Silt: 21% Sand: 72% Gravel: 6%

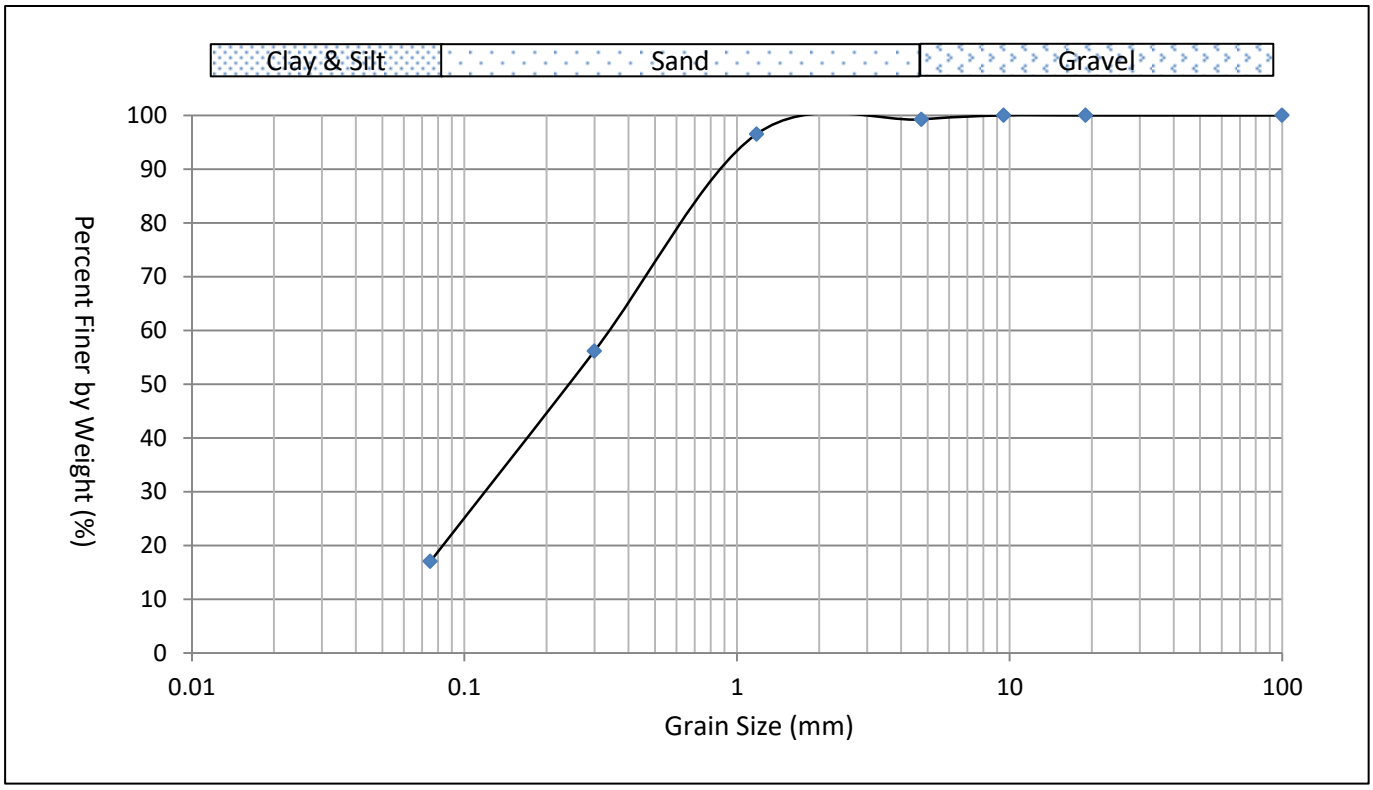


Results related only to the items tested

Grain Size Distribution

Sample ID: 20-4617-5 BH1 SS3

Clay & Silt: 17% Sand: 82% Gravel: 1%

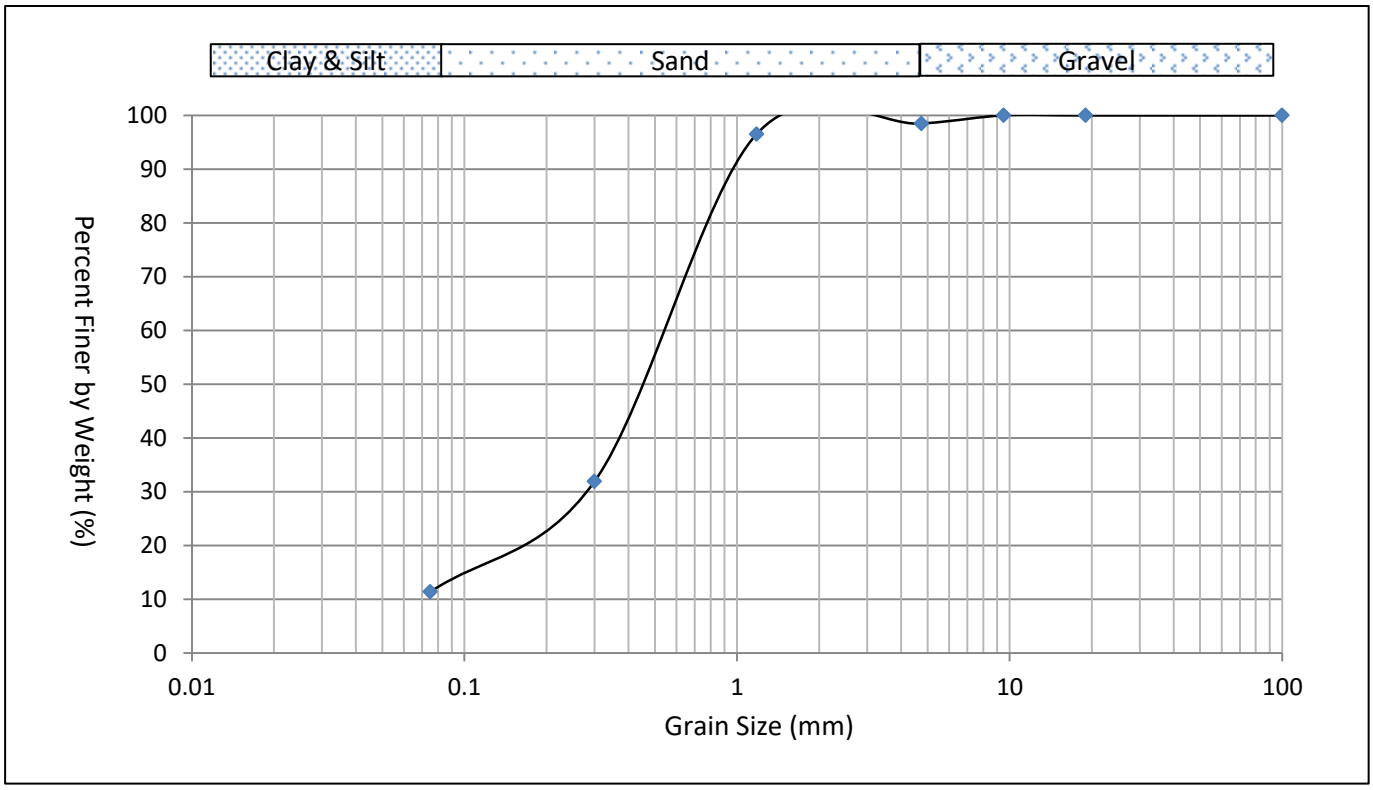


Results related only to the items tested

Grain Size Distribution

Sample ID: 20-4617-6 BH1 SS5

Clay & Silt: 11% Sand: 87% Gravel: 2%

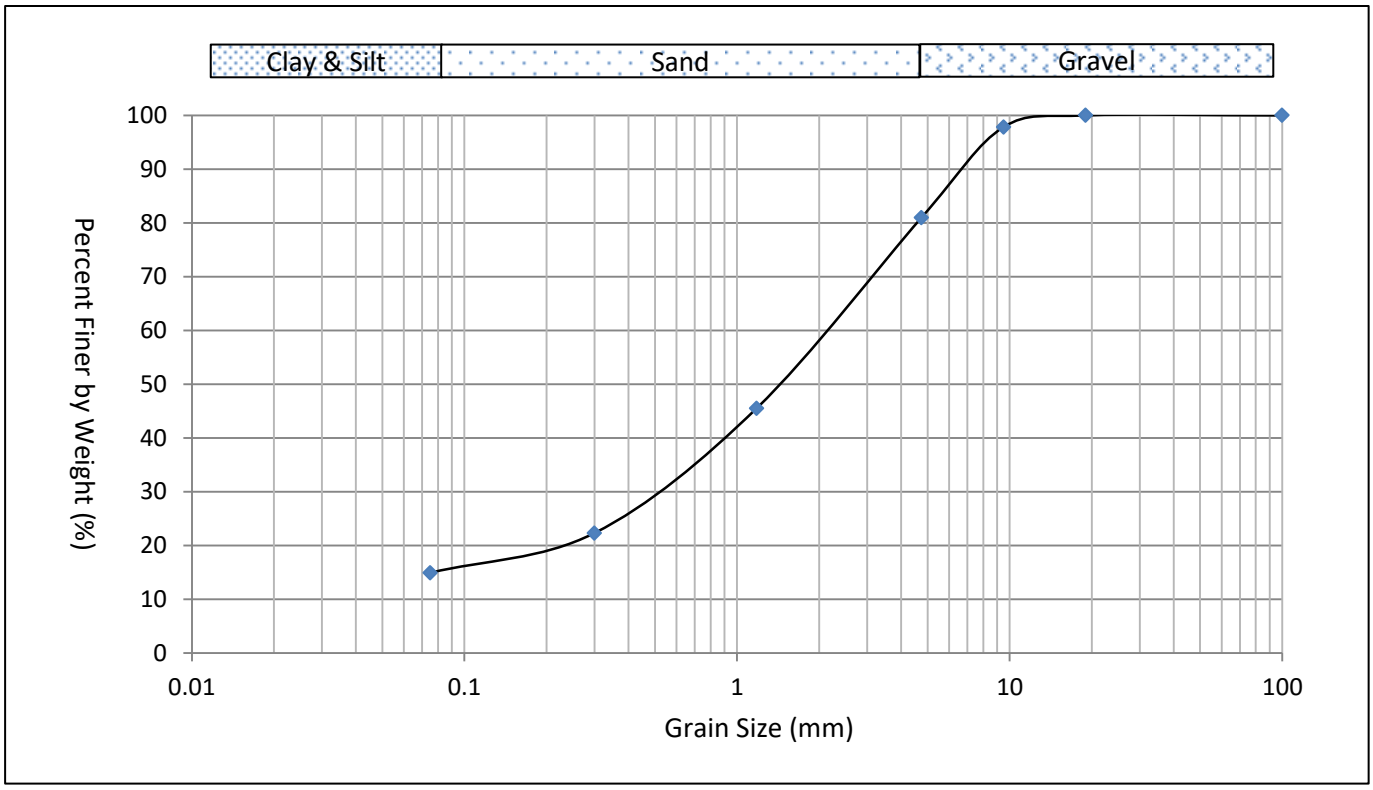


Results related only to the items tested

Grain Size Distribution

Sample ID: 20-4617-7 BH1 SS7

Clay & Silt: 66% Sand: 15% Gravel: 66%

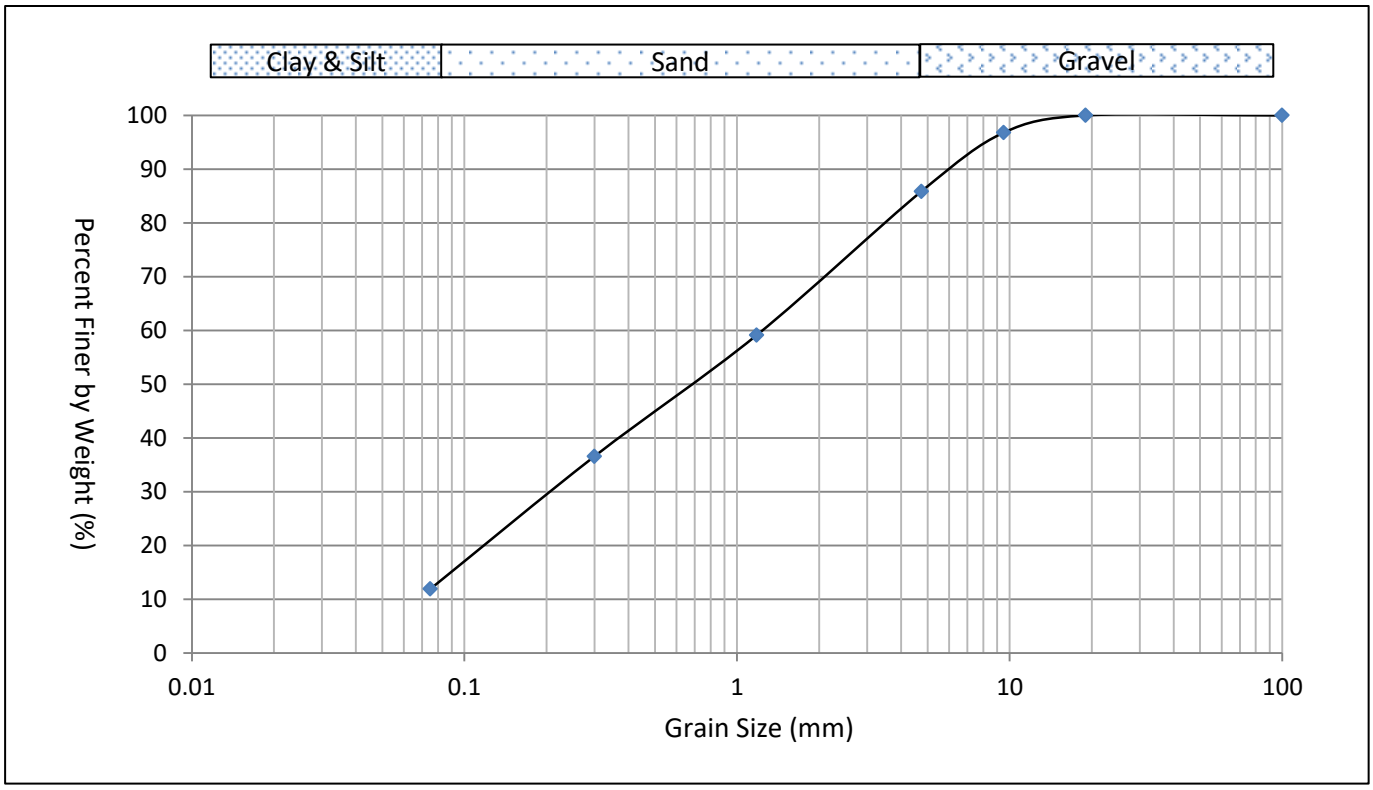


Results related only to the items tested

Grain Size Distribution

Sample ID: 20-4617-8 BH1 SS8

Clay & Silt: 12% Sand: 74% Gravel: 14%



Results related only to the items tested

APPENDIX D – SEWER BYLAW RESULTS

FISHER ENVIRONMENTAL
ATTN: Frank/Clive
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2

Date Received: 22-JUN-20
Report Date: 30-JUN-20 08:42 (MT)
Version: FINAL REV. 2

Client Phone: 905-475-7755

Certificate of Analysis

Lab Work Order #: L2464585

Project P.O. #: NOT SUBMITTED
Job Reference: 20-10329H
C of C Numbers: 17-796667
Legal Site Desc:

Emily Hansen
Account Manager

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Summary of Guideline Exceedances

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Ontario Halton Santitary Sewer By-law No. 02-03 (MAR, 2003) - Halton Sanitary Sewer By-Law No. 02-03						
L2464585-1	40-70 PLAINS RD. BURLINGTON	Physical Tests	Total Suspended Solids	9290	350	mg/L
		Total Metals	Aluminum (Al)-Total	73.9	50	mg/L
			Iron (Fe)-Total	185	50	mg/L
			Manganese (Mn)-Total	17.8	5	mg/L
Ontario Halton Santitary Sewer By-law No. 02-03 (MAR, 2003) - Halton Storm Sewer By-Law No, 02-03						
(No parameter exceedances)						

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Physical Tests - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2464585-1 Sample Date: 22-JUN-20 Sample ID: 40-70 PLAINS RD. BURLINGTON
pH	pH units	6.00-10.0	6.5-8.5	7.52
Total Suspended Solids	mg/L	350	-	9290 DLHC

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Anions and Nutrients - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2464585-1 Sample Date: 22-JUN-20 Sample ID: 40-70 PLAINS RD. BURLINGTON
Fluoride (F)	mg/L	10	-	<0.10 DLDS
Total Kjeldahl Nitrogen	mg/L	100	-	1.34
Phosphorus, Total	mg/L	10.0	-	1.81 DLHC
Sulfate (SO4)	mg/L	1500	-	57.0 DLDS

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Cyanides - WATER

			Lab ID	L2464585-1
			Sample Date	22-JUN-20
			Sample ID	40-70 PLAINS RD. BURLINGTON
		Guide Limits		
Analyte	**Unit**	**#1**	**#2**	
Cyanide, Total	mg/L	2	-	<0.0020

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Bacteriological Tests - WATER

			Lab ID	L2464585-1
			Sample Date	22-JUN-20
			Sample ID	40-70 PLAINS RD. BURLINGTON
		Guide Limits		
Analyte	**Unit**	**#1**	**#2**	
E. Coli	CFU/100mL	-	200	0

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Total Metals - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2464585-1 Sample Date: 22-JUN-20 Sample ID: 40-70 PLAINS RD. BURLINGTON
Aluminum (Al)-Total	mg/L	50	-	73.9 DLHC
Antimony (Sb)-Total	mg/L	5	-	<0.0010 DLHC
Arsenic (As)-Total	mg/L	1	-	0.0479 DLHC
Beryllium (Be)-Total	mg/L	5	-	0.0046 DLHC
Cadmium (Cd)-Total	mg/L	1	-	0.00119 DLHC
Chromium (Cr)-Total	mg/L	3	-	0.146 DLHC
Cobalt (Co)-Total	mg/L	5	-	0.116 DLHC
Copper (Cu)-Total	mg/L	3	-	0.699 DLHC
Iron (Fe)-Total	mg/L	50	-	185 DLHC
Lead (Pb)-Total	mg/L	3	-	0.154 DLHC
Manganese (Mn)-Total	mg/L	5	-	17.8 DLHC
Mercury (Hg)-Total	mg/L	0.05	-	0.0000294
Molybdenum (Mo)-Total	mg/L	5	-	0.00190 DLHC
Nickel (Ni)-Total	mg/L	3	-	0.221 DLHC
Selenium (Se)-Total	mg/L	5	-	0.00097 DLHC
Silver (Ag)-Total	mg/L	5	-	<0.00050 DLHC
Tin (Sn)-Total	mg/L	5	-	0.0017 DLHC
Titanium (Ti)-Total	mg/L	5	-	0.410 DLHC
Zinc (Zn)-Total	mg/L	3	-	0.538 DLHC

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Aggregate Organics - WATER

			Lab ID	L2464585-1
			Sample Date	22-JUN-20
			Sample ID	40-70 PLAINS RD. BURLINGTON
Analyte	**Unit**	**Guide Limits #1**	**#2**	
BOD Carbonaceous	mg/L	300	-	<3.0 BODL
Oil and Grease, Total	mg/L	-	-	<5.0
Animal/Veg Oil & Grease	mg/L	150	-	<5.0
Mineral Oil and Grease	mg/L	15	-	<2.5
Phenols (4AAP)	mg/L	1.0	-	<0.0010

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

Volatile Organic Compounds - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2464585-1 Sample Date: 22-JUN-20 Sample ID: 40-70 PLAINS RD. BURLINGTON
Benzene	ug/L	10	-	<0.50 OWP
Chloroform	ug/L	40	-	<1.0 OWP
1,4-Dichlorobenzene	ug/L	80	-	<0.50 OWP
Dichloromethane	ug/L	2000	-	<2.0 OWP
Ethylbenzene	ug/L	160	-	<0.50 OWP
Tetrachloroethylene	ug/L	1000	-	<0.50 OWP
Toluene	ug/L	16	-	0.57 OWP
Trichloroethylene	ug/L	400	-	<0.50 OWP
Surrogate: 4-Bromofluorobenzene	%	-	-	95.7
Surrogate: 1,4-Difluorobenzene	%	-	-	97.9

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Polycyclic Aromatic Hydrocarbons - WATER

			Lab ID	L2464585-1
			Sample Date	22-JUN-20
			Sample ID	40-70 PLAINS RD. BURLINGTON
		Guide Limits		
Analyte	**Unit**	**#1**	**#2**	
Naphthalene	ug/L	140	-	<0.020
Surrogate: d8-Naphthalene	%	-	-	107.5

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
BODL	Limit of Reporting for BOD was increased to account for the largest volume of sample tested.
OWP	Organic water sample contained visible sediment (must be included as part of analysis). Measured concentrations of organic substances in water can be biased high due to presence of

Reference Information

sediment.

DLHC Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-C-WT	Water	BOD Carbonaceous	APHA 5210 B (CBOD)

This analysis is carried out using procedures adapted from APHA Method 5210B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

CN-TOT-WT	Water	Cyanide, Total	ISO 14403-2

Total cyanide is determined by the combination of UV digestion and distillation. Cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

When using this method, high levels of thiocyanate in samples can cause false positives at ~1-2% of the thiocyanate concentration. For samples with detectable cyanide analyzed by this method, ALS recommends analysis for thiocyanate to check for this potential interference

EC-SCREEN-WT	Water	Conductivity Screen (Internal Use Only)	APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

EC-WW-MF-WT	Water	E. Coli	SM 9222D

A 100 mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h. Method ID: WT-TM-1200

F-IC-N-WT	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HG-T-CVAA-WT	Water	Total Mercury in Water by CVAAS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.

MET-T-CCMS-WT	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

OGG-SPEC-CALC-WT	Water	Speciated Oil and Grease A/V Calc	CALCULATION

Sample is extracted with hexane, sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.

OGG-SPEC-WT	Water	Speciated Oil and Grease-Gravimetric	APHA 5520 B

The procedure involves an extraction of the entire water sample with hexane. Sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically after persulphate digestion of the sample.			
PAH-NAPHTHALENE-WT	Water	Polyaromatic Hydrocarbons (PAHs)	SW846 8270
Sample is extracted at neutral pH using separate aliquots of dichloromethane with a modified separatory funnel technique, extracts are then concentrated and analyzed by GC/MSD.			
PH-WT	Water	pH	APHA 4500 H-Electrode
Water samples are analyzed directly by a calibrated pH meter.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days			
PHENOLS-4AAP-WT	Water	Phenol (4AAP)	EPA 9066
An automated method is used to distill the sample. The distillate is then buffered to pH 9.4 which reacts with 4AAP and potassium ferricyanide to form a red complex which is measured colorimetrically.			
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric
A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.			
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg D
This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 Celsius with analysis using an automated colorimetric method.			
VOC-ROU-HS-WT	Water	Volatile Organic Compounds	SW846 8260
Aqueous samples are analyzed by headspace-GC/MS.			

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

17-796667

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Quality Control Report

Workorder: L2464585 Report Date: 30-JUN-20

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2

Contact: Frank/Clive

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BOD-C-WT	**Water**							
Batch R5135940								
WG3349154-2 DUP		**L2464132-2**						
BOD Carbonaceous		<3.0	<3.0	RPD-NA	mg/L	N/A	30	24-JUN-20
WG3349154-3 LCS								
BOD Carbonaceous			88.9		%		85-115	24-JUN-20
WG3349154-1 MB								
BOD Carbonaceous			<2.0		mg/L		2	24-JUN-20
CN-TOT-WT	**Water**							
Batch R5131678								
WG3349098-3 DUP		**L2464585-1**						
Cyanide, Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	24-JUN-20
WG3349098-2 LCS								
Cyanide, Total			94.6		%		80-120	24-JUN-20
WG3349098-1 MB								
Cyanide, Total			<0.0020		mg/L		0.002	24-JUN-20
WG3349098-4 MS		**L2464585-1**						
Cyanide, Total			96.1		%		70-130	24-JUN-20
EC-WW-MF-WT	**Water**							
Batch R5131775								
WG3348917-3 DUP		**L2464458-1**						
E. Coli		0	0		CFU/100mL	0.0	65	24-JUN-20
WG3348917-4 DUP		**L2464441-1**						
E. Coli		0	<10	RPD-NA	CFU/100mL	N/A	65	24-JUN-20
WG3348917-1 MB								
E. Coli			0		CFU/100mL		1	24-JUN-20
F-IC-N-WT	**Water**							
Batch R5134337								
WG3350386-10 DUP		**WG3350386-8**						
Fluoride (F)		0.087	0.089		mg/L	2.6	20	25-JUN-20
WG3350386-7 LCS								
Fluoride (F)			102.6		%		90-110	25-JUN-20
WG3350386-6 MB								
Fluoride (F)			<0.020		mg/L		0.02	25-JUN-20
WG3350386-9 MS		**WG3350386-8**						
Fluoride (F)			100.2		%		75-125	25-JUN-20
HG-T-CVAA-WT	**Water**							

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: Frank/Clive

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-T-CVAA-WT	**Water**							
Batch R5131148								
WG3348841-3 DUP		**L2464778-1**						
Mercury (Hg)-Total		0.0000070	0.0000067		mg/L	4.4	20	24-JUN-20
WG3348841-2 LCS								
Mercury (Hg)-Total			101.0		%		80-120	24-JUN-20
WG3348841-1 MB								
Mercury (Hg)-Total			<0.000005(		mg/L		0.000005	24-JUN-20
WG3348841-5 MS		**L2461690-1**						
Mercury (Hg)-Total			99.6		%		70-130	24-JUN-20
MET-T-CCMS-WT	**Water**							
Batch R5131002								
WG3348601-4 DUP		**WG3348601-3**						
Aluminum (Al)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	24-JUN-20
Antimony (Sb)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	24-JUN-20
Arsenic (As)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	24-JUN-20
Beryllium (Be)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	24-JUN-20
Cadmium (Cd)-Total		0.000138	0.000121		mg/L	13	20	24-JUN-20
Chromium (Cr)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	24-JUN-20
Cobalt (Co)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	24-JUN-20
Copper (Cu)-Total		0.0145	0.0145		mg/L	0.2	20	24-JUN-20
Iron (Fe)-Total		0.18	0.18		mg/L	2.1	20	24-JUN-20
Lead (Pb)-Total		0.00563	0.00548		mg/L	2.6	20	24-JUN-20
Manganese (Mn)-Total		0.0471	0.0449		mg/L	4.8	20	24-JUN-20
Molybdenum (Mo)-Total		0.00596	0.00590		mg/L	1.0	20	24-JUN-20
Nickel (Ni)-Total		0.0051	<0.0050	RPD-NA	mg/L	N/A	20	24-JUN-20
Selenium (Se)-Total		0.00196	0.00181		mg/L	7.8	20	24-JUN-20
Silver (Ag)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	24-JUN-20
Tin (Sn)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	24-JUN-20
Titanium (Ti)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	24-JUN-20
Zinc (Zn)-Total		0.235	0.236		mg/L	0.5	20	24-JUN-20
WG3348601-2 LCS								
Aluminum (Al)-Total			101.8		%		80-120	24-JUN-20
Antimony (Sb)-Total			100.7		%		80-120	24-JUN-20
Arsenic (As)-Total			99.4		%		80-120	24-JUN-20
Beryllium (Be)-Total			101.3		%		80-120	24-JUN-20
Cadmium (Cd)-Total			99.3		%		80-120	24-JUN-20

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: Frank/Clive

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5131002								
WG3348601-2 LCS								
Chromium (Cr)-Total			101.5		%		80-120	24-JUN-20
Cobalt (Co)-Total			99.8		%		80-120	24-JUN-20
Copper (Cu)-Total			100.3		%		80-120	24-JUN-20
Iron (Fe)-Total			100.4		%		80-120	24-JUN-20
Lead (Pb)-Total			99.7		%		80-120	24-JUN-20
Manganese (Mn)-Total			100.7		%		80-120	24-JUN-20
Molybdenum (Mo)-Total			98.1		%		80-120	24-JUN-20
Nickel (Ni)-Total			99.9		%		80-120	24-JUN-20
Selenium (Se)-Total			97.3		%		80-120	24-JUN-20
Silver (Ag)-Total			96.4		%		80-120	24-JUN-20
Tin (Sn)-Total			95.8		%		80-120	24-JUN-20
Titanium (Ti)-Total			94.4		%		80-120	24-JUN-20
Zinc (Zn)-Total			99.9		%		80-120	24-JUN-20
WG3348601-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	24-JUN-20
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	24-JUN-20
Arsenic (As)-Total			<0.00010		mg/L		0.0001	24-JUN-20
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	24-JUN-20
Cadmium (Cd)-Total			<0.000005C		mg/L		0.000005	24-JUN-20
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	24-JUN-20
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	24-JUN-20
Copper (Cu)-Total			<0.00050		mg/L		0.0005	24-JUN-20
Iron (Fe)-Total			<0.010		mg/L		0.01	24-JUN-20
Lead (Pb)-Total			<0.000050		mg/L		0.00005	24-JUN-20
Manganese (Mn)-Total			<0.00050		mg/L		0.0005	24-JUN-20
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	24-JUN-20
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	24-JUN-20
Selenium (Se)-Total			<0.000050		mg/L		0.00005	24-JUN-20
Silver (Ag)-Total			<0.000050		mg/L		0.00005	24-JUN-20
Tin (Sn)-Total			<0.00010		mg/L		0.0001	24-JUN-20
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	24-JUN-20
Zinc (Zn)-Total			<0.0030		mg/L		0.003	24-JUN-20
WG3348601-5 MS		**WG3348601-3**						
Aluminum (Al)-Total			111.3		%		70-130	24-JUN-20

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: Frank/Clive

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5131002								
WG3348601-5 MS		**WG3348601-3**						
Antimony (Sb)-Total			96.5		%		70-130	24-JUN-20
Arsenic (As)-Total			100.8		%		70-130	24-JUN-20
Beryllium (Be)-Total			107.8		%		70-130	24-JUN-20
Cadmium (Cd)-Total			98.2		%		70-130	24-JUN-20
Chromium (Cr)-Total			99.1		%		70-130	24-JUN-20
Cobalt (Co)-Total			99.9		%		70-130	24-JUN-20
Copper (Cu)-Total			N/A	MS-B	%		-	24-JUN-20
Iron (Fe)-Total			N/A	MS-B	%		-	24-JUN-20
Lead (Pb)-Total			94.3		%		70-130	24-JUN-20
Manganese (Mn)-Total			N/A	MS-B	%		-	24-JUN-20
Molybdenum (Mo)-Total			99.1		%		70-130	24-JUN-20
Nickel (Ni)-Total			95.7		%		70-130	24-JUN-20
Selenium (Se)-Total			95.9		%		70-130	24-JUN-20
Silver (Ag)-Total			92.8		%		70-130	24-JUN-20
Tin (Sn)-Total			95.4		%		70-130	24-JUN-20
Titanium (Ti)-Total			102.0		%		70-130	24-JUN-20
Zinc (Zn)-Total			N/A	MS-B	%		-	24-JUN-20
OGG-SPEC-WT	**Water**							
Batch R5131544								
WG3348557-2 LCS								
Oil and Grease, Total			90.3		%		70-130	24-JUN-20
Mineral Oil and Grease			87.0		%		70-130	24-JUN-20
WG3348557-1 MB								
Oil and Grease, Total			<5.0		mg/L		5	24-JUN-20
Mineral Oil and Grease			<2.5		mg/L		2.5	24-JUN-20
P-T-COL-WT	**Water**							
Batch R5133741								
WG3349311-3 DUP		**L2464706-2**						
Phosphorus, Total		2.04	2.01		mg/L	1.2	20	26-JUN-20
WG3349311-2 LCS								
Phosphorus, Total			100.4		%		80-120	26-JUN-20
WG3349311-1 MB								
Phosphorus, Total			<0.0030		mg/L		0.003	26-JUN-20
WG3349311-4 MS		**L2464706-2**						
Phosphorus, Total			N/A	MS-B	%		-	26-JUN-20

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: Frank/Clive

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-NAPHTHALENE-WT	**Water**							
Batch R5135574								
WG3350074-2 LCS								
Naphthalene			92.7		%		50-130	29-JUN-20
WG3350074-1 MB								
Naphthalene			<0.020		ug/L		0.02	29-JUN-20
Surrogate: d8-Naphthalene			98.6		%		60-140	29-JUN-20
PH-WT	**Water**							
Batch R5131856								
WG3349180-4 DUP		**WG3349180-3**						
pH		8.03	8.02	J	pH units	0.01	0.2	24-JUN-20
WG3349180-2 LCS								
pH			7.03		pH units		6.9-7.1	24-JUN-20
PHENOLS-4AAP-WT	**Water**							
Batch R5131531								
WG3349330-3 DUP		**L2464575-2**						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	24-JUN-20
WG3349330-2 LCS								
Phenols (4AAP)			102.0		%		85-115	24-JUN-20
WG3349330-1 MB								
Phenols (4AAP)			<0.0010		mg/L		0.001	24-JUN-20
WG3349330-4 MS		**L2464575-2**						
Phenols (4AAP)			104.3		%		75-125	24-JUN-20
SO4-IC-N-WT	**Water**							
Batch R5134337								
WG3350386-10 DUP		**WG3350386-8**						
Sulfate (SO4)		10.9	10.9		mg/L	0.3	20	25-JUN-20
WG3350386-7 LCS								
Sulfate (SO4)			102.0		%		90-110	25-JUN-20
WG3350386-6 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	25-JUN-20
WG3350386-9 MS		**WG3350386-8**						
Sulfate (SO4)			106.4		%		75-125	25-JUN-20
SOLIDS-TSS-WT	**Water**							
Batch R5133018								
WG3348760-3 DUP		**WG3348760-4**						
Total Suspended Solids		4940	4920		mg/L	0.3	20	26-JUN-20
WG3348760-2 LCS								
Total Suspended Solids			98.0		%		85-115	26-JUN-20

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: Frank/Clive

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TSS-WT	**Water**							
Batch R5133018								
WG3348760-1 MB								
Total Suspended Solids			<2.0		mg/L		2	26-JUN-20
TKN-WT	**Water**							
Batch R5132248								
WG3349334-3 DUP		**L2464700-3**						
Total Kjeldahl Nitrogen		7.54	8.35		mg/L	10	20	25-JUN-20
WG3349334-2 LCS								
Total Kjeldahl Nitrogen			120.6		%		75-125	25-JUN-20
WG3349334-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	25-JUN-20
WG3349334-4 MS		**L2464700-3**						
Total Kjeldahl Nitrogen			N/A	MS-B	%		-	25-JUN-20
VOC-ROU-HS-WT	**Water**							
Batch R5135488								
WG3351276-4 DUP		**WG3351276-3**						
1,4-Dichlorobenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	29-JUN-20
Benzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	29-JUN-20
Chloroform		<1.0	<1.0	RPD-NA	ug/L	N/A	30	29-JUN-20
Dichloromethane		<2.0	<2.0	RPD-NA	ug/L	N/A	30	29-JUN-20
Ethylbenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	29-JUN-20
Tetrachloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	29-JUN-20
Toluene		<0.40	<0.40	RPD-NA	ug/L	N/A	30	29-JUN-20
Trichloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	29-JUN-20
WG3351276-1 LCS								
1,4-Dichlorobenzene			109.8		%		70-130	29-JUN-20
Benzene			115.1		%		70-130	29-JUN-20
Chloroform			123.7		%		70-130	29-JUN-20
Dichloromethane			117.9		%		70-130	29-JUN-20
Ethylbenzene			113.0		%		70-130	29-JUN-20
Tetrachloroethylene			111.1		%		70-130	29-JUN-20
Toluene			113.5		%		70-130	29-JUN-20
Trichloroethylene			113.2		%		70-130	29-JUN-20
WG3351276-2 MB								
1,4-Dichlorobenzene			<0.50		ug/L		0.5	29-JUN-20
Benzene			<0.50		ug/L		0.5	29-JUN-20

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: Frank/Clive

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-ROU-HS-WT	**Water**							
Batch R5135488								
WG3351276-2 MB								
Chloroform			<1.0		ug/L		1	29-JUN-20
Dichloromethane			<2.0		ug/L		2	29-JUN-20
Ethylbenzene			<0.50		ug/L		0.5	29-JUN-20
Tetrachloroethylene			<0.50		ug/L		0.5	29-JUN-20
Toluene			<0.40		ug/L		0.4	29-JUN-20
Trichloroethylene			<0.50		ug/L		0.5	29-JUN-20
Surrogate: 1,4-Difluorobenzene			99.3		%		70-130	29-JUN-20
Surrogate: 4-Bromofluorobenzene			95.4		%		70-130	29-JUN-20
WG3351276-5 MS		**WG3351276-3**						
1,4-Dichlorobenzene			109.4		%		50-150	29-JUN-20
Benzene			115.3		%		50-150	29-JUN-20
Chloroform			124.1		%		50-150	29-JUN-20
Dichloromethane			117.9		%		50-150	29-JUN-20
Ethylbenzene			112.4		%		50-150	29-JUN-20
Tetrachloroethylene			110.4		%		50-150	29-JUN-20
Toluene			113.4		%		50-150	29-JUN-20
Trichloroethylene			112.2		%		50-150	29-JUN-20

Quality Control Report

Workorder: L2464585 Report Date: 30-JUN-20

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: Frank/Clive

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analyti Request Form

Canada Toll Free: 1 800 668 9878

L2464585-COFC

COC Number: 17 - 796667

Page of

MA

Report To	Contact and company name below will appear on the final report
Company:	Fisher Environmental
Contact:	Frank / Clive
Phone:	416 738 0716
	Company address below will appear on the final report
Street:	
City/Province:	
Postal Code:	

Invoice To		
	Same as Report To	[X] YES [ ] NO
	Copy of Invoice with Report	[X] YES [ ] NO
Company:		
Contact:		

Project Information	
ALS Account # / Quote #:	
Job #:	
PO / AFE:	
LSD:	

ALS Lab Work Order # (lab use only): L2464585 MA

Report Format / Distribution

Select Report Format: [ ] PDF [ ] EXCEL [ ] EDD (DIGITAL)

Quality Control (QC) Report with Report [ ] YES [ ] NO

[ ] Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: [ ] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax

Email 2 Frank@FisherEnvironmental.com cc to clive.

Email 3

Invoice Distribution

Select Invoice Distribution: [ ] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax

Email 2

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Contact: EH **Sampler:**

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] [X] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] [ ]; 3 day [P3-25%] [ ]; 2 day [P2-50%] [ ]

EMERGENCY: 1 Business day [E - 100%] [ ]; Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] [ ]

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

NUMBER OF CONTAINERS — Sewer bylaws

SAMPLES ON HOLD

SUSPECTED HAZARD (see Special Instructions)

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type
	40-70 Plains Rd. Burlington Job # 20-10329 H	22/6/2020	2:30Pm	Water

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [ ] NO

Are samples for human consumption/ use? [ ] YES [ ] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]

Ice Packs [ ] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
9.1				8.9			

SHIPMENT RELEASE (client use)

Released by: Frank Date: June 22.2020 Time: 3:40pm

INITIAL SHIPMENT RECEPTION (lab use only)

Received by: JS Date: June 22/20 Time: 15:40

FINAL SHIPMENT RECEPTION (lab use only)

Received by: MA Date: June 22/20 Time: 1906

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2018 FRONT

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

SIF

APPENDIX E – HYDRAULIC CONDUCTIVITY ANALYSES

FISHER ENGINEERING

HYDRAULIC CONDUCTIVITY ANALYSIS

Location: *40-70 Plains Rd E, Burlington*
Project: *FE-P-20-10329 HydroGeo*
Test Date: *2020-06-30*
Well No. *MW1*

Equilibrium Water level (from top of pipe) HE	*865*	*cm*
Initial Water level (from top of pipe) Ho	*952*	*cm*
Monitoring well inner diameter d	*0.05*	*m*
Initial Time offset To	*5*	*second*
Reverse of Luthin's reference system Ru = Ho - HE	*87.00*	*cm*
Slope of Log((ho-he)/(ht-he)) / T	*8.00E-03*	
G = Ru / (HT - HE)		

Hydraulic conductivity computed k =

0.0121064	**cm/s**
1.21E-04	**m/s**
10.460	**m/day**

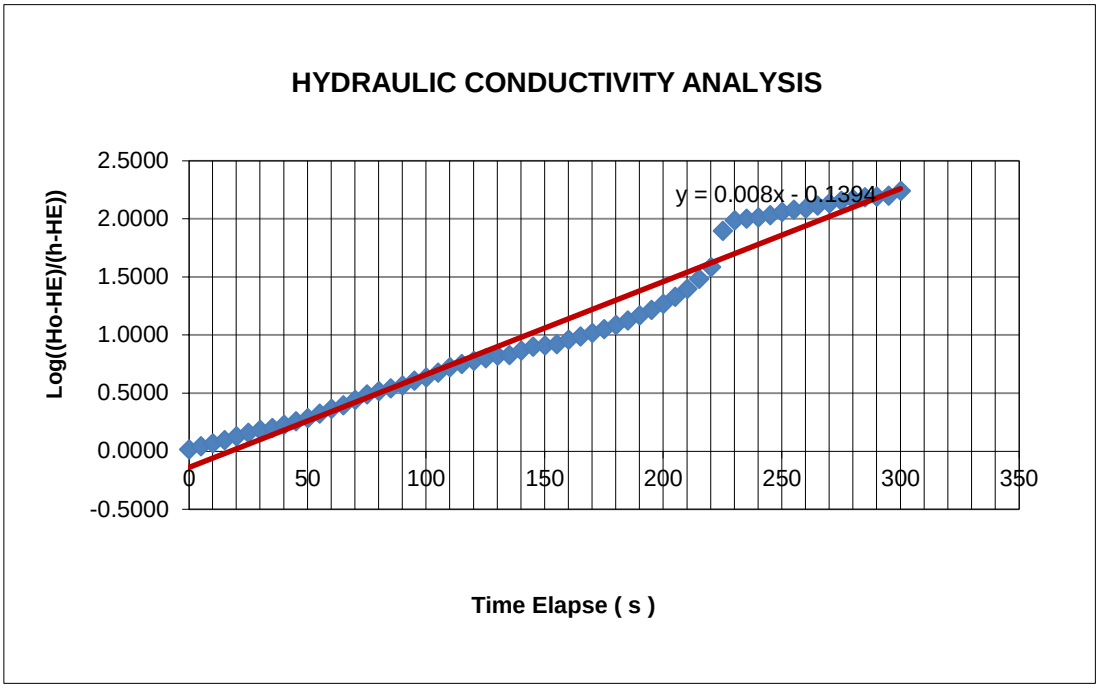
Time		HT (Water Drop)		G	LOG (G)
(Interval s)	(Elapsed s)	(m)	(cm)		
5	**0**	9.520	952.000	1.0000	0.0147
5	5	9.442	944.200	1.0985	0.0408
5	10	9.395	939.500	1.1678	0.0674
5	15	9.352	935.200	1.2393	0.0932
5	20	9.299	929.900	1.3405	0.1273
5	25	9.255	925.500	1.4380	0.1578
5	30	9.224	922.350	1.5170	0.1810
5	35	9.200	920.010	1.5815	0.1991
5	40	9.166	916.550	1.6877	0.2273
5	45	9.133	913.250	1.8031	0.2560
5	50	9.101	910.120	1.9282	0.2852
5	55	9.065	906.500	2.0964	0.3215
5	60	9.028	902.750	2.3046	0.3626
5	65	9.000	900.000	2.4857	0.3955
5	70	8.965	896.500	2.7619	0.4412
5	75	8.934	893.350	3.0688	0.4870
5	80	8.915	891.500	3.2830	0.5163
5	85	8.902	890.150	3.4592	0.5390
5	90	8.887	888.650	3.6786	0.5657
5	95	8.866	886.550	4.0371	0.6061
5	100	8.853	885.250	4.2963	0.6331
5	105	8.833	883.330	4.7463	0.6764
5	110	8.816	881.550	5.2568	0.7207
5	115	8.805	880.500	5.6129	0.7492
5	120	8.796	879.550	5.9794	0.7767
5	125	8.789	878.850	6.2816	0.7981
5	130	8.782	878.150	6.6160	0.8206
5	135	8.780	877.950	6.7181	0.8272

5	140	8.769	876.850	7.3418	0.8658
5	145	8.760	876.010	7.9019	0.8977
5	150	8.758	875.750	8.0930	0.9081
5	155	8.755	875.450	8.3254	0.9204
5	160	8.746	874.572	9.0890	0.9585
5	165	8.740	873.962	9.7077	0.9871
5	170	8.734	873.352	10.4167	1.0177
5	175	8.727	872.742	11.2374	1.0507
5	180	8.721	872.132	12.1985	1.0863
5	185	8.715	871.522	13.3395	1.1251
5	190	8.709	870.912	14.7158	1.1678
5	195	8.703	870.302	16.4089	1.2151
5	200	8.697	869.690	18.5501	1.2683
5	205	8.691	869.089	21.2766	1.3279
5	210	8.685	868.480	25.0000	1.3979
5	215	8.679	867.870	30.3136	1.4816
5	220	8.673	867.260	38.4956	1.5854
5	225	8.661	866.110	78.3784	1.8942
5	230	8.659	865.900	96.6667	1.9853
5	235	8.659	865.870	100.0000	2.0000
5	240	8.659	865.850	102.3529	2.0101
5	245	8.658	865.810	107.4074	2.0310
5	250	8.658	865.760	114.4737	2.0587
5	255	8.657	865.730	119.1781	2.0762
5	260	8.657	865.710	122.5352	2.0883
5	265	8.657	865.670	129.8507	2.1134
5	270	8.656	865.640	135.9375	2.1333
5	275	8.656	865.610	142.6230	2.1542
5	280	8.656	865.590	147.4576	2.1687
5	285	8.656	865.570	152.6316	2.1836
5	290	8.656	865.560	155.3571	2.1913
5	295	8.656	865.550	158.1818	2.1992
5	300	8.655	865.500	174.0000	2.2405

FISHER ENGINEERING

HYDRAULIC CONDUCTIVITY ANALYSIS

Location: *40-70 Plains Rd E, Burlington*
Project: *FE-P-20-10329 HydroGeo*
Test Date: *2020-06-30*
Well No. *MW1*



FISHER ENGINEERING

HYDRAULIC CONDUCTIVITY ANALYSIS

Location: *40-70 Plains Rd E, Burlington*
Project: *FE-P-20-10329 HydroGeo*
Test Date: *2020-06-30*
Well No. *MW3*

Equilibrium Water level (from top of pipe) HE	*823*	*cm*
Initial Water level (from top of pipe) Ho	*967*	*cm*
Monitoring well inner diameter d	*0.05*	*m*
Initial Time offset To	*1*	*second*
Reverse of Luthin's reference system Ru = Ho - HE	*144.00*	*cm*
Slope of Log((ho-he)/(ht-he)) / T	*3.10E-03*	
G = Ru / (HT - HE)		

Hydraulic conductivity computed k =

0.0046912	**cm/s**
4.69E-05	**m/s**
4.053	**m/day**

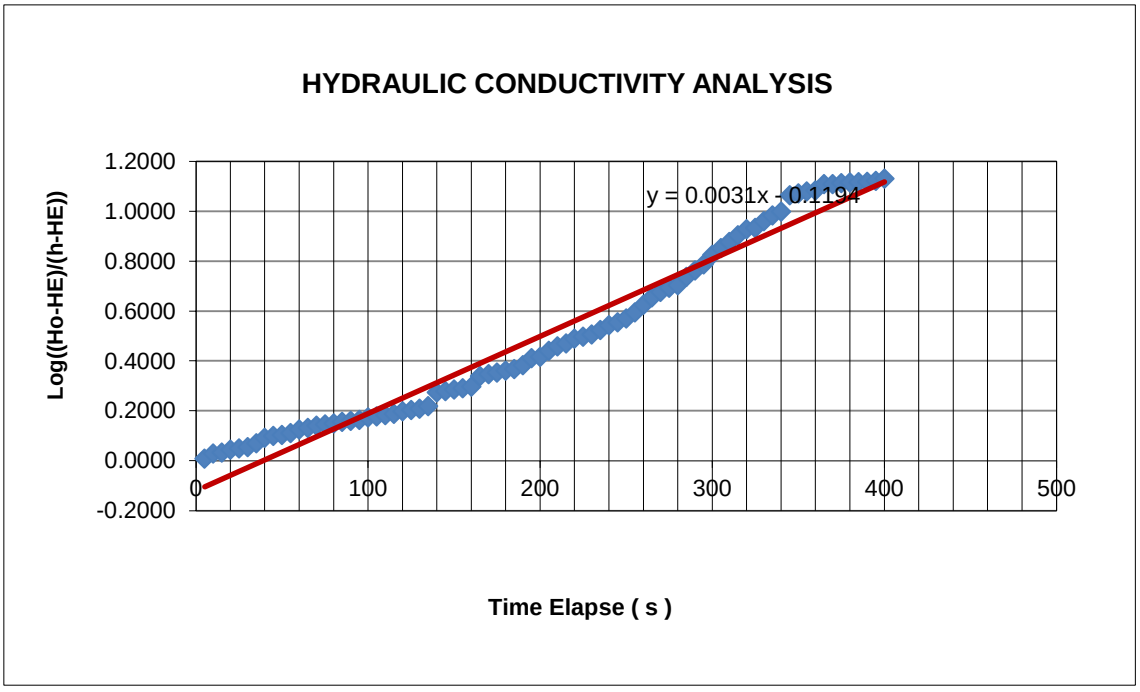
Time		HT (Water Drop)		G	LOG (G)
(Interval s)	(Elapsed s)	(m)	(cm)		
5	0	9.670			
5	5	9.644	964.43	1.0182	0.0078
5	10	9.577	957.74	1.0687	0.0289
5	15	9.567	956.67	1.0772	0.0323
5	20	9.530	953.00	1.1077	0.0444
5	25	9.516	951.56	1.1201	0.0493
5	30	9.502	950.15	1.1325	0.0540
5	35	9.456	945.64	1.1742	0.0697
5	40	9.398	939.75	1.2334	0.0911
5	45	9.378	937.75	1.2549	0.0986
5	50	9.366	936.56	1.2680	0.1031
5	55	9.345	934.51	1.2913	0.1110
5	60	9.311	931.12	1.3319	0.1245
5	65	9.293	929.35	1.3541	0.1316
5	70	9.273	927.29	1.3807	0.1401
5	75	9.259	925.91	1.3992	0.1459
5	80	9.252	925.17	1.4094	0.1490
5	85	9.236	923.58	1.4318	0.1559
5	90	9.229	922.86	1.4421	0.1590
5	95	9.220	921.95	1.4552	0.1629
5	100	9.197	919.66	1.4898	0.1731
5	105	9.188	918.76	1.5038	0.1772
5	110	9.177	917.65	1.5214	0.1822
5	115	9.165	916.52	1.5397	0.1874
5	120	9.143	914.26	1.5780	0.1981
5	125	9.132	913.20	1.5965	0.2032
5	130	9.122	912.20	1.6144	0.2080
5	135	9.102	910.20	1.6515	0.2179

5	140	8.997	899.70	1.8776	0.2736
5	145	8.988	898.80	1.8998	0.2787
5	150	8.977	897.70	1.9278	0.2851
5	155	8.967	896.70	1.9540	0.2909
5	160	8.957	895.66	1.9820	0.2971
5	165	8.890	888.96	2.1830	0.3391
5	170	8.879	887.88	2.2196	0.3463
5	175	8.868	886.84	2.2557	0.3533
5	180	8.857	885.74	2.2953	0.3608
5	185	8.847	884.74	2.3325	0.3678
5	190	8.827	882.65	2.4141	0.3828
5	195	8.789	878.93	2.5748	0.4107
5	200	8.783	878.27	2.6056	0.4159
5	205	8.753	875.29	2.7541	0.4400
5	210	8.731	873.13	2.8726	0.4583
5	215	8.718	871.82	2.9497	0.4698
5	220	8.697	869.68	3.0846	0.4892
5	225	8.689	868.89	3.1377	0.4966
5	230	8.679	867.89	3.2076	0.5062
5	235	8.661	866.13	3.3387	0.5236
5	240	8.643	864.30	3.4870	0.5425
5	245	8.632	863.20	3.5823	0.5542
5	250	8.618	861.76	3.7149	0.5699
5	255	8.596	859.63	3.9312	0.5945
5	260	8.572	857.18	4.2130	0.6246
5	265	8.549	854.94	4.5085	0.6540
5	270	8.533	853.30	4.7531	0.6770
5	275	8.522	852.22	4.9285	0.6927
5	280	8.515	851.49	5.0537	0.7036
5	285	8.494	849.42	5.4508	0.7365
5	290	8.479	847.87	5.7901	0.7627
5	295	8.465	846.53	6.1193	0.7867
5	300	8.446	844.56	6.6784	0.8247
5	305	8.432	843.22	7.1221	0.8526
5	310	8.421	842.12	7.5326	0.8769
5	315	8.410	841.01	7.9963	0.9029
5	320	8.400	840.00	8.4715	0.9280
5	325	8.398	839.80	8.5711	0.9330
5	330	8.388	838.78	9.1237	0.9602
5	335	8.380	837.99	9.6092	0.9827
5	340	8.375	837.47	9.9537	0.9980
5	345	8.354	835.43	11.5821	1.0638
5	350	8.352	835.23	11.7737	1.0709
5	355	8.350	834.99	12.0080	1.0795
5	360	8.349	834.89	12.1110	1.0832
5	365	8.342	834.22	12.8331	1.1083
5	370	8.342	834.20	12.8583	1.1092
5	375	8.341	834.11	12.9601	1.1126
5	380	8.341	834.07	13.0128	1.1144
5	385	8.340	834.02	13.0660	1.1161
5	390	8.340	833.99	13.1028	1.1174
5	395	8.339	833.89	13.2231	1.1213
5	400	8.337	833.68	13.4831	1.1298

FISHER ENGINEERING

HYDRAULIC CONDUCTIVITY ANALYSIS

Location: *40-70 Plains Rd E, Burlington*
Project: *FE-P-20-10329 HydroGeo*
Test Date: *2020-06-30*
Well No. *MW3*



FISHER ENGINEERING

HYDRAULIC CONDUCTIVITY ANALYSIS

Location: *40-70 Plains Rd E, Burlington*
Project: *FE-P-20-10329 HydroGeo*
Test Date: *2020-06-30*
Well No. *MW4*

Equilibrium Water level (from top of pipe) HE	*788*	*cm*
Initial Water level (from top of pipe) Ho	*892*	*cm*
Monitoring well inner diameter d	*0.05*	*m*
Initial Time offset To	*5*	*second*
Reverse of Luthin's reference system Ru = Ho - HE	*104.00*	*cm*
Slope of Log((ho-he)/(ht-he)) / T	*3.80E-03*	
G = Ru / (HT - HE)		

Hydraulic conductivity computed k =

0.0057505	**cm/s**
5.75E-05	**m/s**
4.968	**m/day**

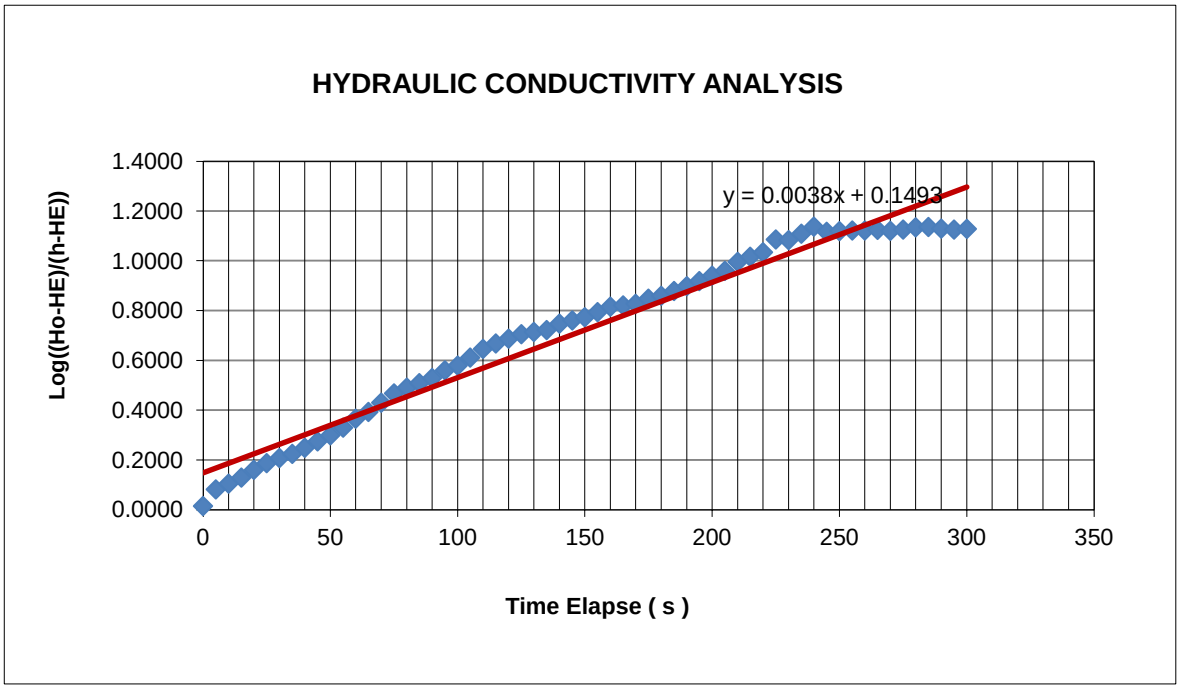
Time		HT (Water Drop)		G	LOG (G)
(Interval s)	(Elapsed s)	(m)	(cm)		
5	**0**	8.920	892.000	1.0000	0.0147
5	5	8.743	874.343	1.2045	0.0808
5	10	8.696	869.643	1.2738	0.1051
5	15	8.653	865.343	1.3447	0.1286
5	20	8.600	860.043	1.4436	0.1594
5	25	8.556	855.643	1.5375	0.1868
5	30	8.525	852.493	1.6126	0.2075
5	35	8.502	850.153	1.6733	0.2236
5	40	8.467	846.693	1.7719	0.2484
5	45	8.434	843.393	1.8775	0.2736
5	50	8.403	840.263	1.9899	0.2988
5	55	8.366	836.643	2.1380	0.3300
5	60	8.329	832.893	2.3166	0.3649
5	65	8.301	830.143	2.4678	0.3923
5	70	8.266	826.643	2.6913	0.4300
5	75	8.235	823.493	2.9302	0.4669
5	80	8.216	821.643	3.0913	0.4901
5	85	8.203	820.293	3.2205	0.5079
5	90	8.188	818.793	3.3774	0.5286
5	95	8.167	816.693	3.6246	0.5593
5	100	8.154	815.393	3.7966	0.5794
5	105	8.135	813.473	4.0828	0.6110
5	110	8.115	811.493	4.4269	0.6461
5	115	8.103	810.343	4.6547	0.6679
5	120	8.094	809.393	4.8614	0.6868
5	125	8.085	808.493	5.0749	0.7054
5	130	8.081	808.103	5.1734	0.7138

5	135	8.077	807.730	5.2712	0.7219
5	140	8.066	806.613	5.5875	0.7472
5	145	8.060	806.043	5.7640	0.7607
5	150	8.056	805.553	5.9249	0.7727
5	155	8.047	804.713	6.2227	0.7940
5	160	8.039	803.905	6.5388	0.8155
5	165	8.037	803.740	6.6073	0.8200
5	170	8.035	803.495	6.7118	0.8268
5	175	8.028	802.785	7.0342	0.8472
5	180	8.024	802.375	7.2348	0.8594
5	185	8.018	801.765	7.5554	0.8783
5	190	8.012	801.155	7.9057	0.8979
5	195	8.005	800.545	8.2902	0.9186
5	200	7.999	799.933	8.7153	0.9403
5	205	7.994	799.432	9.0973	0.9589
5	210	7.985	798.523	9.8831	0.9949
5	215	7.980	798.013	10.3865	1.0165
5	220	7.976	797.603	10.8299	1.0346
5	225	7.966	796.553	12.1595	1.0849
5	230	7.966	796.604	12.0870	1.0823
5	235	7.961	796.101	12.8374	1.1085
5	240	7.956	795.599	13.6855	1.1363
5	245	7.960	795.953	13.0768	1.1165
5	250	7.959	795.903	13.1596	1.1192
5	255	7.959	795.873	13.2097	1.1209
5	260	7.959	795.853	13.2433	1.1220
5	265	7.958	795.813	13.3111	1.1242
5	270	7.959	795.883	13.1929	1.1203
5	275	7.958	795.783	13.3625	1.1259
5	280	7.956	795.633	13.6250	1.1343
5	285	7.956	795.613	13.6608	1.1355
5	290	7.957	795.730	13.4536	1.1288
5	295	7.958	795.793	13.3453	1.1253
5	300	7.957	795.743	13.4315	1.1281

FISHER ENGINEERING

HYDRAULIC CONDUCTIVITY ANALYSIS

Location: ***40-70 Plains Rd E, Burlington***
Project: ***FE-P-20-10329 HydroGeo***
Test Date: ***2020-06-30***
Well No. ***MW4***



APPENDIX F – CONSTRUCTION DEWATERING AND PERMANENT DRAINAGE

Construction Dewatering Calculation

Location: *40-70 Plains Rd E, Burlington*
Project: *FE-P-20-10329 HydroGeo*
Date: *2021-03-11*

Dupuit Forcheimer for Radial Flow to a Closely Welled System or Excavation

Construction Units	Lowest P2 elevation (m asl)	Established Grade (m asl)	Lowest Footing Elevation (m asl)	Required Dewatering Elevation (m asl)	Static water level		Well base elevation	H (m)	h_w (m)	H-h_w (m)	R_0 (m)		r_w	ab (m^2)	K (m/s)	H^2-h_w^2	lnR_0	lnr_w	Q, (m^3/s)	Q, (m^3/day)
					BGS (m)	Elevation (m asl)	(m)				Model	Adjusted								
Midrise building with Two Underground Levels	94.80	100.50	93.60	92.60		93.27	92.40	0.87	0.2	0.67	14.74	61.34	46.60	6822	1.21E-04	0.72	4.12	3.84	9.92E-04	85.70

Dupuit Forcheimer Equation

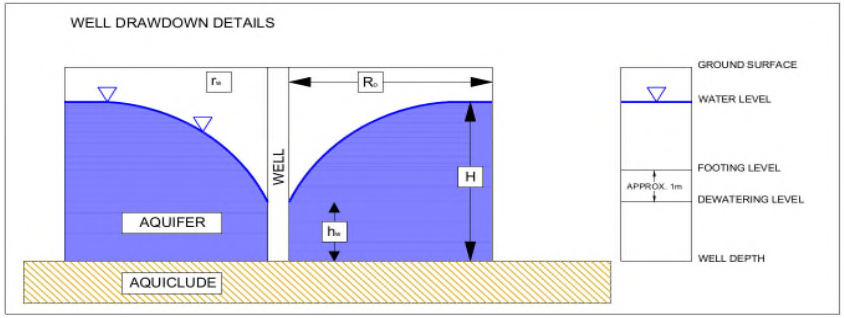
$$Q = \frac{\pi K(H^2 - h_w{}^2)}{lnR_0 - lnr_w}$$

Equivalent radius of well, r_w

$$r_w = \sqrt{\frac{ab}{\pi}}$$

Radius of influence in m, calculated from Sichardt's equation

$$R_0 = 2000(H - h_w)\sqrt{k}$$



Whe

r_w = equivalent radius of the well in m,

H = hydraulic head of the original water table (total saturated aquifer thickness) in m,

h_w = hydraulic head at maximum dewatering (proposed drawdown) in m,

R_0 = radius of influence in m, calculated from Sichardt's equation, and

K = hydraulic conductivity, in m/s
a = length of excavation area in m
b = width of excavation area in m

Permanent Drainage Rates

Location: *40-70 Plains Rd E, Burlington*
Project: *FE-P-20-10329 HydroGeo*
Date: *2020-07-17*

Dupuit Forcheimer for Radial Flow to a Closely Welled System or Excavation

Construction Units	Underside of P2 elevation (m asl)	Ground Surface Elev. (m asl)	Lowest Footing Elevation (m asl)	Required Dewatering Elevation (m asl)	Static water level		Well base elevation (m asl)	H (m)	h_w (m)	H-h_w (m)	R_0 (m)		r_w	ab (m^2)	K (m/s)	H^2-h_w^2	lnR_0	lnr_w	Q, (m^3/s)	Q, (m^3/day)
					BGS (m)	Elevation (m asl)					Model	Adjusted								
Midrise building with Two Underground Levels	94.80	100.50	93.60	94.20	-	94.27	94.05	0.22	0.15	0.07	1.54	48.14	46.60	6822	1.21E-04	0.03	3.87	3.84	3.03E-04	26.17

Dupuit Forcheimer Equation

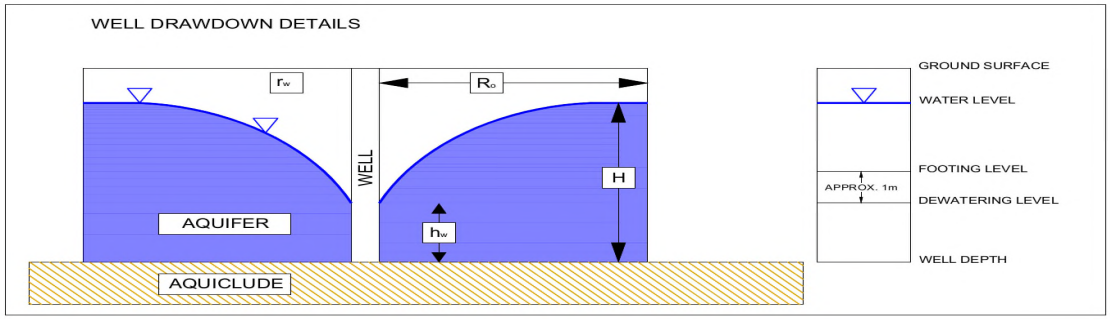
$$Q = \frac{\pi K(H^2 - h_w{}^2)}{lnR_0 - lnr_w}$$

Equivalent radius of well, r_w

$$r_w = \sqrt{\frac{ab}{\pi}}$$

Radius of influence in m, calculated from Sichardt's equation

$$R_0 = 2000(H - h_w)\sqrt{k}$$

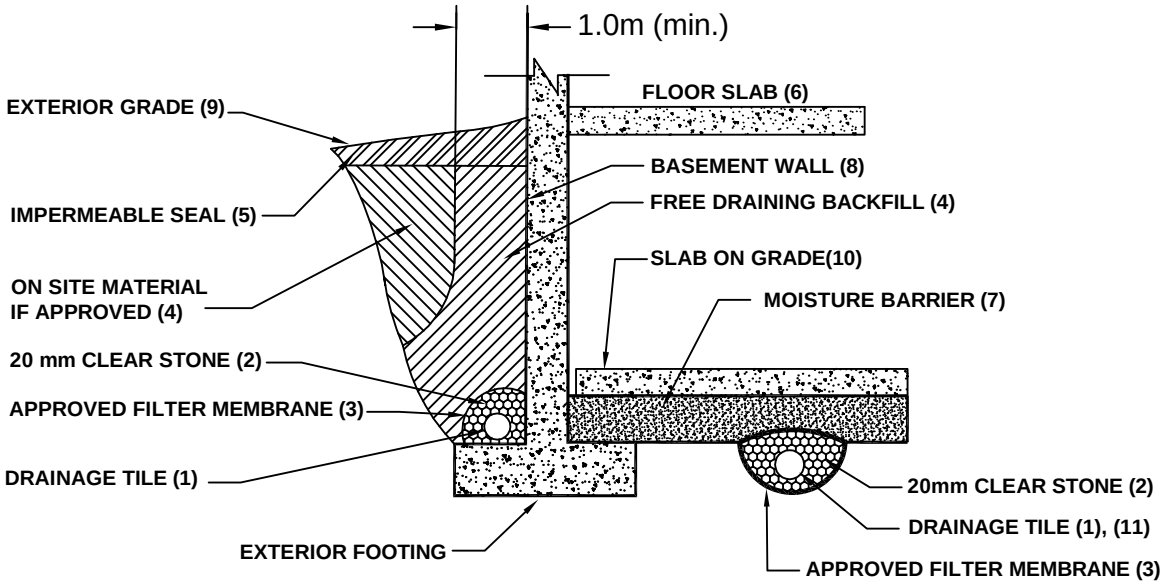


Whe

r_w = equivalent radius of the well in m,
H = hydraulic head of the original water table (total saturated aquifer thickness) in m,
h_w = hydraulic head at maximum dewatering (proposed drawdown) in m,
R_0 = radius of influence in m, calculated from Sichardt's equation, and
K = hydraulic conductivity, in m/s
a = length of excavation area in m
b = width of excavation area in m

APPENDIX G – BACKFILL AND DRAINAGE DESIGN

FISHER ENGINEERING



NOTES:

(1) DRAINAGE TILE TO CONSIST OF 100mm (4") DIAMETER WEEPING TILE OR EQUIVALENT PERFORATED PIPE LEADING TO A POSITIVE SUMP OR OUTLET.

(2) 20mm (3/4") CLEAR STONE - 150mm (6") TOP AND SIDE OF DRAIN. IF DRAIN IS NOT ON FOOTING, PLACE 100mm (4") OF STONE BELOW DRAIN.

(3) WRAP THE CLEAR STONE WITH AN APPROVED FILTER MEMBRANE (TERRAFIX 279R OR EQUIVALENT).

(4) FREE DRAINING BACKFILL - OPSS GRANULAR B OR EQUIVALENT COMPACTED TO THE SPECIFIED DENSITY. DO NOT USE HEAVY COMPACTION EQUIPMENT WITHIN 1.8m (6') OF WALL.

(5) IMPERMEABLE BACKFILL SEAL - COMPACTED CLAY, CLAYEY SILT OR EQUIVALENT. IF ORIGINAL SOIL IS FREE-DRAINING, SEAL MAY BE OMITTED. MAXIMUM THICKNESS OF SEAL TO BE 0.5m.

(6) DO NOT BACKFILL UNTIL WALL IS SUPPORTED BY BASEMENT AND FLOOR SLABS OR ADEQUATE BRACING.

(7) MOISTURE BARRIER TO BE AT LEAST 200mm (8") OF COMPACTED CLEAR 20mm (3/4") STONE OR EQUIVALENT FREE DRAINING MATERIAL. A VAPOUR BARRIER MAY BE REQUIRED FOR SPECIALTY FLOORS.

(8) BASEMENT WALL TO BE DAMP PROOFED.

(9) EXTERIOR GRADE TO SLOPE AWAY FROM BUILDING.

(10) SLAB ON GRADE SHOULD NOT BE STRUCTURALLY CONNECTED TO THE WALL OR FOOTING

(11) UNDERFLOOR DRAIN INVERT TO BE AT LEAST 300mm (12") BELOW UNDERSIDE OF FLOOR SLAB. DRAINAGE TILE PLACED IN PARALLEL ROWS 6 TO 8m (20-25') CENTERS ONE WAY. PLACE DRAIN ON 100mm (4") CLEAR STONE WITH 150mm (6") OF CLEAR STONE ON TOP AND SIDES. ENCLOSE STONE WITH FILTER FABRIC AS NOTED IN (3)

(12) THE ENTIRE SUBGRADE TO BE SEALED WITH APPROVED FILER FABRIC (TERRAFIX 270R OR EQUIVALENT) IF NON-COHESIVE(SANDY) SOILS BELOW GROUND WATER TABLE ENCOUNTERED.

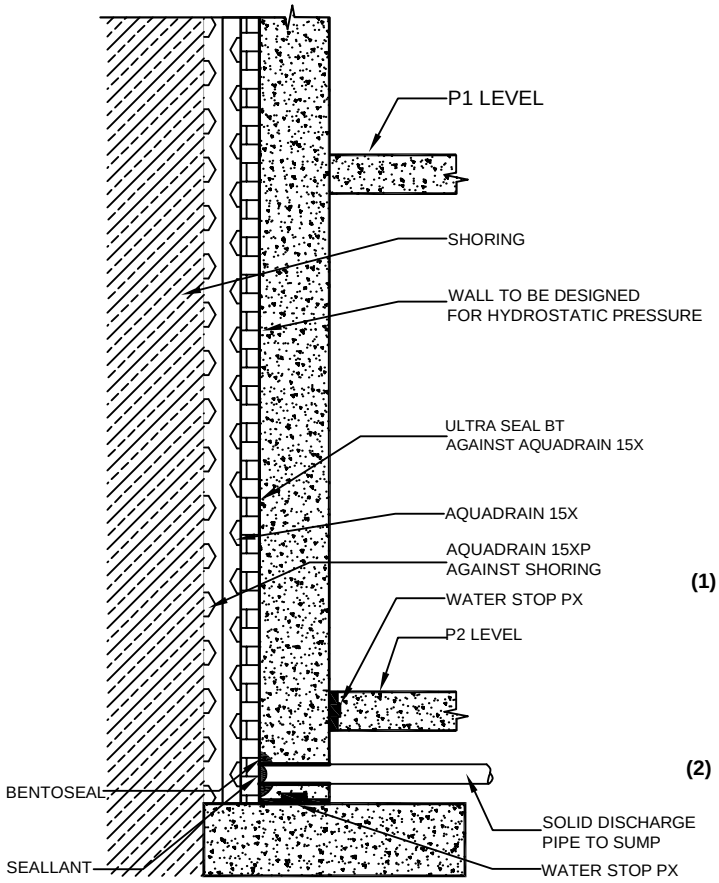
(13) DO NOT CONNECT THE UNDERFLOOR DRAINS TO PERIMETER DRAINS.

(14) REVIEW THE GEOTECHNICAL REPORT FOR SPECIFIC DETAILS.

DRAINAGE AND BACKFILL RECOMMENDATIONS

BASEMENT WITH UNDERFLOOR DRAINAGE

(NOT TO SCALE)



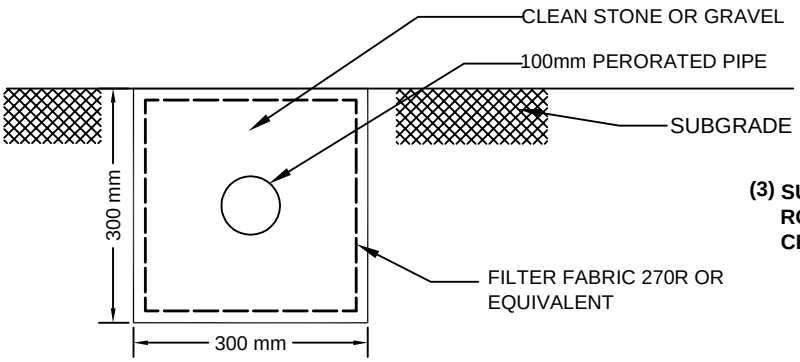
NOTES:

(1) ALL PERMANENT DRAINAGE PIPES MUST HAVE GEOTEXTILE FILTER SLEEVE TO PREVENT LONG TERM SILTING. TO FURTHER MINIMIZE SILTATION OF THE DRAINAGE SYSTEM, ALL DRAINAGE PIPE CONNECTION MUST BE SOLID PVC ELBOWS AND Ts. NO "BUTT" END CONNECTIONS SHOULD BE PERMITTED.

(2) PERIMETER COLLECTION PIPE TO BE SOLID PIPE,

SUGGESTED EXTERIOR DRAINAGE AGAINST SHORING

(NOT TO SCALE)



(3) SUBGRADE DRAIN TO BE PLACED IN PARALLEL ROWS 6-8 m (20'-25'), FROM CENTERLINE TO CENTERLINE.

DETAIL OF SUBGRADE DRAIN

(NOT TO SCALE)