December 15th, 2023

SERVICING BRIEF

397 3RD AVENUE TEMPORARY DORMS

PID: 031-214-754

Client: BC Housing

L&M Project No.: 1620-02

L&M Engineering Limited
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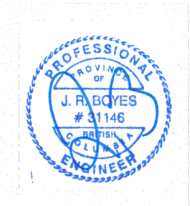

2023-12-15

Permit to Practice No.: 1002375

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1.0 INTRODUCTION

On behalf of BC Housing, L&M Engineering has prepared this Servicing Brief for the subject property located at 397 3rd Avenue. The subject property is currently designated as Parks and Open Space as the Future Land Use in the *City of Prince George Official Community Plan Bylaw No. 8383, 2011* (OCP) and is currently zoned as M1 – Light Industrial. The subject property is currently under application for a temporary use permit to allow for 44 units of temporary housing. This Servicing Brief has been prepared to summarize the existing municipal infrastructure in the surrounding area and demonstrate how the property can be serviced with municipal water, sanitary, and storm infrastructure. The subject property is approximately 0.33 ha in size and is located within the municipal boundaries of the City of Prince George.

2.0 BACKGROUND DATA AND REPORTS

L&M Engineering has reviewed the following reports in relation to the subject property development:

- City of Prince George – 2017 Sanitary Sewer Services Master Plan prepared by AECOM;
- City of Prince George – 2014 Water Service Network Plan prepared by Opus Dayton Knight;
- City of Prince George – Development Services Department: Design Guidelines;
- PG Map and Lot History Sheets; and

3.0 SITE TOPOGRAPHY & SITE ACCESS

As shown on the enclosed drawing C001, the subject property varies in elevation from 567.20m at the southwest corner to 568.00m near the center of the lot. The 1 in 200-year flood construction elevation in the area is 570.50m and the 1 in 20 year return period storm event elevation is 568.80m. Due to the temporary nature of the development, Geonorth Engineering has recommended that the underside of the temporary dorms be situated at the 1 in 20-year return flood elevation of 568.80m.

Where buildings are to be located, the site shoul be raised with imported gravel to the 567.80m contour elevation so that a maximum of 1m of cribbing is used to achieve the desired 568.80m elevation to the underside of the buildings.

4.0 DESIGN POPULATION

The site design population has been calculated based on the proposed 44-unit dorms which can provide occupancy for up to 2 people per dorm or a maximum population of 88 people.

5.0 WATER DISTRIBUTION SYSTEM

5.1 Existing System

L&M Engineering conducted a review of the existing municipal water main infrastructure in the vicinity of the subject property. The City's water main network on PG Map indicates a 150 mm dia. watermain on London Street and 300mm dia. watermain along Lower Patricia Boulevard both of which are part of Pressure Zone PZ1. There is no existing water service to the subject property.

5.2 Domestic Water Demands

The water demand has been calculated using rates published in the City of Prince George's Design Guidelines. Table 1 outlines the calculation of the water demand.

Table 1: Estimated Water Demands

Variable	Result		Notes
Design Population	88	people	2 People per Dorm
Domestic Avg Daily per Capita	475	l/d	Refer to Section 3.1.3 CoPG Design Guidelines
Average Daily Demand (ADD)	41800	l/d	= Population * Avg. Flow per Capita
MDD - Peak Factor	3.1		Refer to Section 3.1.4 CoPG Design Guidelines
PHD - Peak Factor	4.25		Refer to Section 3.1.4 CoPG Design Guidelines
Summary			
Average Daily Demand (ADD)	0.48	l/s	
Maximum Daily Demand (MDD)	1.50	l/s	
Peak Hour Demand (PHD)	2.06	l/s	

5.3 Water Modeling Results

L&M Engineering submitted design parameters to the City of Prince George for water modelling. The City's water model was analyzed under Average Day Demand (ADD), Maximum Day Demand (MDD), and Peak Hour Demand (PHD) conditions. Maximum Day conditions represent the highest recorded daily demand on the water system and Peak Hour flow conditions represent the highest demand on the system during the course of a day.

The City of Prince George conducted fire hydrant flow tests on November 6th and November 10th, 2023 and provided this information in an email dated December 5th 2023. Four hydrants surrounding the site were tested to determine the approximate fire flow available. The flow testing gave a range of approximate available flows from 67 L/s to 71 L/s. Static pressure was also measured and ranged from 82 psi to 90 psi.

5.4 Fire Protection Demands

In addition to the domestic water demand, an allowance for fire protection must be made. The document titled Water Supply for Public Fire Protection, produced by the Fire Underwriters Survey (FUS) is the de-facto standard in Canada for establishing fire protection requirements in municipal waterworks system design. This document presents a fire flow estimate that accounts for factors such as building construction, total floor area, material combustibility, automatic sprinkling, building separation, and occupancy.

We understand that BC Housing is planning on installing a fire suppression system in all buildings and we have calculated the required fire flow to be 50 L/s which is less than the available fire flow of 67 L/s. In accordance with the BC Building Code, the proposed fire department connection on each building must be within 45m of a fire hydrant. The two dorm buildings can have fire department connections located within 45m of the existing fire hydrant located at the corner of 4th Avenue and London Street. However, the proposed kitchen building will require an additional fire hydrant to be located within the intersection of 3rd Avenue and London Street to meet the minimum 45m spacing requirements.

5.5 Proposed Water Servicing

To accommodate a fire suppression system, a new 150mm dia. service connection should be provided from the existing 150mm dia. water main on Queensway to meet the required pressure and flow demands. Since the development is privately owned, the site will also require a backflow preventer and a water meter for the future building(s). As the site is bisected by the existing BC Hydro power poles and right-of-way, two water services are planned and therefore each water service will require a backflow preventer and a water meter.

6.0 SANITARY COLLECTION SYSTEM

6.1 Existing System

The existing sanitary network in the vicinity of the subject property consists of 450 mm dia. mains within the adjacent London Street and 4th Avenue and 200mm dia. mains along 3rd Avenue. These mains gravity feed to the existing lift station (PW102). There is no existing sanitary sewer service to the subject property.

6.2 Existing Capacity

L&M Engineering reviewed the City of Prince George's 2017 Sanitary Sewer Services Master Plan (prepared by AECOM) and PGMap for information related to the capacity of the existing sanitary system. The studies reviewed the existing, zoning, and OCP model scenarios for the sanitary network.

L&M utilized the 2017 Master Plan to review the downstream capacity of the mains from the subject property to the existing lift station which is located adjacent to the property on Lower Patricia Boulevard. The existing gravity sewer model indicates that the 450mm dia. pipe with the least amount of capacity is city Asset ID: 7139 which has an existing flow of 37.88 L/s and a total pipe capacity of 127.70 L/s and the 200mm dia. pipe along 3rd Avenue which is city Asset ID: 8888 has an existing flow of 0.06 L/s and a total pipe capacity of 17.9 L/s.

6.3 Sanitary Design Flows

The City of Prince George's Design Guidelines (Section 4.2) outlines the procedure required to determine the sanitary sewer design flows. The calculations for the design flows are summarized in the table below.

Estimated Sewage Design Flow Demands			
Variable	**Result**		**Notes**
Population	88	ppl	Based on Population Calculation
Domestic Avg Daily per Capita	380	l/d	Refer to Section 4.2.2.6 CoPG Design Guidelines
Total Avg. Daily Flow	33440	l/d	Population * Avg. Flow per Capita
Peak Factor	4.26		Harman Equation
Total Peak Design Flow (Qs)	142454	l/d	Total Avg. Daily Design Flow * Peak Factor
Total Peak Design Flow (Qs)	1.65	l/s	Total Avg. Daily Design Flow * Peak Factor
Infiltration and Inflow			
Development Area	0.33	ha	
Infiltration Rate	11200	l/ha/d	Refer to section 4.2.2.4 (11,200 L/ha)
Infiltration (Qi)	3744	l/d	= Development Area x Infiltration Rate
Infiltration (Qi)	0.04	l/s	= Development Area x Infiltration Rate
Total Design Flow (Qs + Qi)	146198	l/d	(Qs + Qi)
Total Design Flow (Qs + Qi)	1.69	l/s	(Qs + Qi)

Based on the design flow of 1.69 L/s, the mains between the subject property and the sanitary sewer trunk main have sufficient capacity to accommodate the development. A review of the downstream system confirmed the lowest available flow is with Asset ID: 7139, which has a total capacity of 127.70 L/s and an available capacity of 51.51 L/s which is more than sufficient to handle the increased flow of 1.69 L/s. A review of the existing lift station (PW102) also shows available capacity of 55 L/s with the current pumps which can accommodate the existing flows and the small increase in flow from this development.

6.4 Proposed Sanitary Servicing

The proposed sanitary sewer service size for this property is calculated utilizing the total fixture unit count in accordance with the BC Building Code.

Fixture Unit Count for 44 Dorms and Kitchen			
Fixture Description	**Quantity**	**Fixture Units / Fixture**	**Fixture Units**
Private - Shower head, 9.5 LPM or less per head	22	1.4	30.8
Public - Sink, kitchen commercial, per faucet	2	4	8
Public - Sink, laundry (1 or 2 compartments)	2	1.4	2.8
Public - Sink, kitchen domestic, greater than 8.3 LPM	1	2	2
Private - Water closet, 6 LPF or less with flush tank	24	2.2	52.8
Private - Lavatory, 8.3 LPM or less	44	0.7	30.8
		Total Fixture Units	**127.2**

Based on 127 fixture units and utilizing table 7.4.10.6.C from the BC Building Code, a 100mm dia. sanitary sewer service at a minimum grade of 1% would be sufficient to handle 180 fixture units. However, the City of Prince George Subdivision and Development Servicing Bylaw No. 8618,2014 stipulates that all services at 1% grade must be 150mm in diameter, therefore we recommend a minimum service size of 150mm dia. at a minimum slope of 1%. As a result of the existing BC Hydro power poles and right-of-way which bisects the property, two sanitary sewer services will be required. The service for the southern portion of the property can be installed from the existing manhole located at the end of 4th Avenue (City asset ID: 790). The service for the northern half of the property will connect to the existing sanitary main with 3rd Avenue and will require a new manhole as shown on drawing C001.

7.0 STORMWATER SYSTEM

7.1 Existing System

The existing storm network in the vicinity of the subject site consists of a 450 mm dia. storm main located within 4th Avenue adjacent to the site. The 4th Avenue storm main flows into a 1650mm dia. trunk main which runs east along Lower Patricia Boulevard across Highway 16 East and into the Fraser River. There are no existing storm services to this property.

7.2 Proposed Storm Servicing

As per Table 1 of the CoPG's Subdivision and Development Servicing Bylaw No 8618, 2014, parcels in the Urban designated areas as shown on Schedule B are required to have a storm connection to the City storm network. However, where possible, the City of Prince George encourages new development to manage stormwater onsite and dispose of runoff through infiltration.

The soil substrate in this area generally consists of permeable sand and gravel. The proposed plan to manage the onsite stormwater runoff is to utilize the native sand and gravel soils to dispose of runoff from the development with several recharge chambers. The onsite recharge chambers should be designed to handle post-development run-off flow rates for storms up to the 10-year rainfall design event which would then infiltrate into the native granular soils. To accommodate flows greater than the 1 in 10-year storm event, the site should be graded to avoid the potential of localized flooding which may impact the proposed use.

HydroCAD software was used to estimate the post development peak runoffs generated during a 10 year 24-hour return period storm. The following inputs were used during the analysis:

Post-Development

- Average Curve Number = 97
- Concentration Time = 0 minutes
- Storm Type: City of Prince George's 24hr Hyetograph – IDF curves provided by the IDF_CC Tool with a projection from 2023 to 2100 to factor in climate change (RCP 8.5 Scenario)
- Area = 0.33 ha (Subject Property)

As the site is relatively small in area and the soils are generally free draining, the pre-development runoff flow rates from an undeveloped state would be considered insignificant or very minimal. In addition, it is recommended that the post development flow rates for any new development be disposed of via infiltration as per table 3 values below.

To ensure no storm flows would leave the site during 2, 5, and 10-year storm events, approximately 5 recharge chambers with a drain rock base of 4.5m diameter, 1.2m tall with 1:1 side slope and utilizing a 200 mm/hr infiltration rate was modeled. The infiltration rate

will need to be confirmed during the detailed design phase and is subject to additional geotechnical investigation. The table below summarizes the results from the Hydro analysis for a 10-year storm event and the resulting flows within the site. A copy of the HydroCAD Storm Water Modeling is attached under Appendix B.

HydroCAD Results					
Post Development Flow Rate (m^3/s)					
Catchment Area (Ha)	Pre- Development Flow (m^3/s)	Without Recharge Chamber	Exfiltration Rate	Required Storage (m^3)	Available Storage (m^3)
10-Year Storm					
0.3343	N/A	0.055	0.0076	43.8	49.3

8.0 SUMMARY

In summary, the proposed temporary dorms located at 397 3rd Avenue can be adequately serviced with the nearby water and sanitary sewer infrastructure and via onsite stormwater infiltration. This servicing brief assumes the maximum design population based on the proposed use and the surrounding city infrastructure can adequately service the proposed land use.

9.0 CLOSURE

This Servicing Brief has been prepared for the City of Prince George and BC Housing as the intended users. Any use that a third party makes of this report or any reliance on or decisions to be made based on it are the responsibility of such third parties. L&M Engineering Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this study. The information and data contained within this document represent L&M Engineering Limited's professional judgement in accordance with the knowledge and information available to L&M Engineering Limited at the time of the report preparation. No other warranty, expressed or implied, is made.

Sincerely,

L&M ENGINEERING LTD

Prepared by:

Jason R. Boyes, P.Eng

Vice President

L&M Engineering Limited

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APPENDIX A

FUS CALCULATIONS

FIRE UNDERWRITERS SURVEY

FIRE FLOW ESTIMATE

City: City of Prince George

Date: Dec 14th 2023

Engineer: Jason R. Boyes, P.Eng

Job No: 1620-02

Project: BC Housing Temporary Dorms

Address: 397 3rd Avenue

Building: South Dorm

Fire Area Considered

Types of Construction: Wood Frame

C: 1.5

Ground floor area (ft^2): 3261 **No. of Stories:** 1

(m^2): 303

Total floor area (m^2)(if needed): 303

Fire flow from table (=220*C*$A^{0.5}$): 5744 L/m (a)

Occupancy:	Non-Combustible	**Add or Subtract**	-25	%		-1436	
					Sub Total	4308	L/m (b)
Automatic sprinklers:	Yes	Subtract	-50	%	x b =	-2154	
					Sub Total	2154	L/m

Exposures :	**Exposure Distance (m)**					
1. North	9	Add	16	%		
2. West	>45		0	%		
3. South	>45		0	%		
4. East	>45		0	%		
		Total	16	%		
		Use	16	% x b =	689	L/m
				Total	2843	L/m
		Fire Flow Required(Rounded to the nearest 1000 L/m)			3000	L/m

50 L/s

FIRE UNDERWRITERS SURVEY

FIRE FLOW ESTIMATE

City: City of Prince George

Date: Dec 14th 2023

Engineer: Jason R. Boyes, P.Eng

Job No: 1620-02

Project: BC Housing Temporary Dorms

Address: 397 3rd Avenue

Building: Middle Dorm

Fire Area Considered

Types of Construction: Wood Frame

C: 1.5

Ground floor area (ft^2): 3068 **No. of Stories:** 1

(m^2): 285

Total floor area (m^2)(if needed): 285

Fire flow from table (=220*C*$A^{0.5}$): 5571 L/m (a)

Occupancy:	Non-Combustible	**Add or Subtract**	-25	%		-1392.8
					Sub Total	4178 L/m (b)
Automatic sprinklers:	Yes	Subtract	-50	%	x b =	-2089
					Sub Total	2089 L/m

Exposures :	**Exposure Distance (m)**					
1. North	17	Add	11	%		
2. West	>45		0	%		
3. South	9		16	%		
4. East	>45		0	%		
		Total	27	%		
		Use	27	% x b =		1128 L/m
					Total	3217 L/m
		Fire Flow Required(Rounded to the nearest 1000 L/m)				3000 L/m

50 L/s

FIRE UNDERWRITERS SURVEY

FIRE FLOW ESTIMATE

City: City of Prince George

Date: Dec 14th 2023

Engineer: Jason R. Boyes, P.Eng

Job No: 1620-02

Project: BC Housing Temporary Dorms

Address: 397 3rd Avenue

Building: South Dorm

Fire Area Considered

Types of Construction: Wood Frame

C: 1.5

Ground floor area (ft^2): 3261 **No. of Stories:** 1

(m^2): 303

Total floor area (m^2)(if needed): 303

Fire flow from table (=220*C*$A^{0.5}$): 5744 L/m (a)

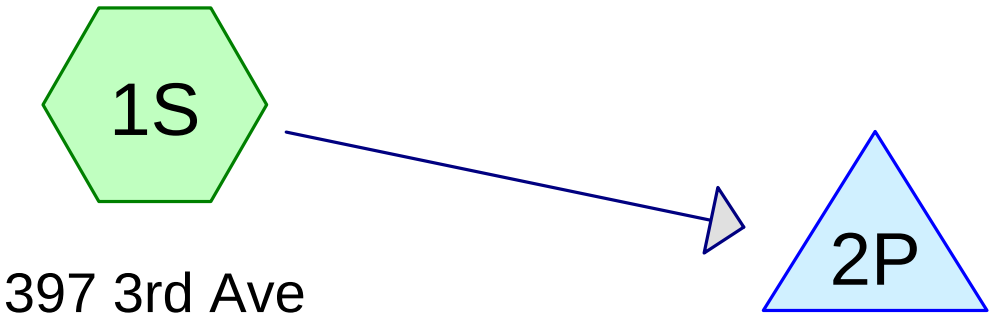
Occupancy:	Non-Combustible	**Add or Subtract**	-25	%		-1436	
					Sub Total	4308	L/m (b)
Automatic sprinklers:	Yes	Subtract	-50	%	x b =	-2154	
					Sub Total	2154	L/m

Exposures :	**Exposure Distance (m)**					
1. North	9	Add	16	%		
2. West	>45		0	%		
3. South	>45		0	%		
4. East	>45		0	%		
		Total	16	%		
		Use	16	% x b =	689	L/m
				Total	2843	L/m
		Fire Flow Required(Rounded to the nearest 1000 L/m)			3000	L/m

50 L/s

APPENDIX B

HYDROCAD STORMWATER MODELLING



397 3rd Ave

Recharge Lawn Basin

Subcat Reach Pond Link

Routing Diagram for 1620-02 - 397 3rd Ave HydroCAD
Prepared by L&M Engineering Limited, Printed 2023-12-15

Area Listing (all nodes)

Area (hectares)	CN	Description (subcatchment-numbers)
0.2342	96	Gravel surface, HSG C (1S)
0.1000	98	Unconnected roofs, HSG C (1S)
0.3342	**97**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.3342	HSG C	1S
0.0000	HSG D	
0.0000	Other	
0.3342		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchment Numbers
0.0000	0.0000	0.2342	0.0000	0.0000	0.2342	Gravel surface	1S
0.0000	0.0000	0.1000	0.0000	0.0000	0.1000	Unconnected roofs	1S
0.0000	**0.0000**	**0.3342**	**0.0000**	**0.0000**	**0.3342**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: 397 3rd Ave Runoff Area=3,342.0 m² 29.92% Impervious Runoff Depth>32 mm
Tc=0.0 min UI Adjusted CN=96 Runoff=0.0550 m³/s 0.106 Ml

Pond 2P: Recharge Lawn Basin Peak Elev=101.104 m Storage=43.8 m³ Inflow=0.0550 m³/s 0.106 Ml
Outflow=0.0076 m³/s 0.103 Ml

Total Runoff Area = 0.3342 ha Runoff Volume = 0.106 Ml Average Runoff Depth = 32 mm
70.08% Pervious = 0.2342 ha 29.92% Impervious = 0.1000 ha

Summary for Subcatchment 1S: 397 3rd Ave

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

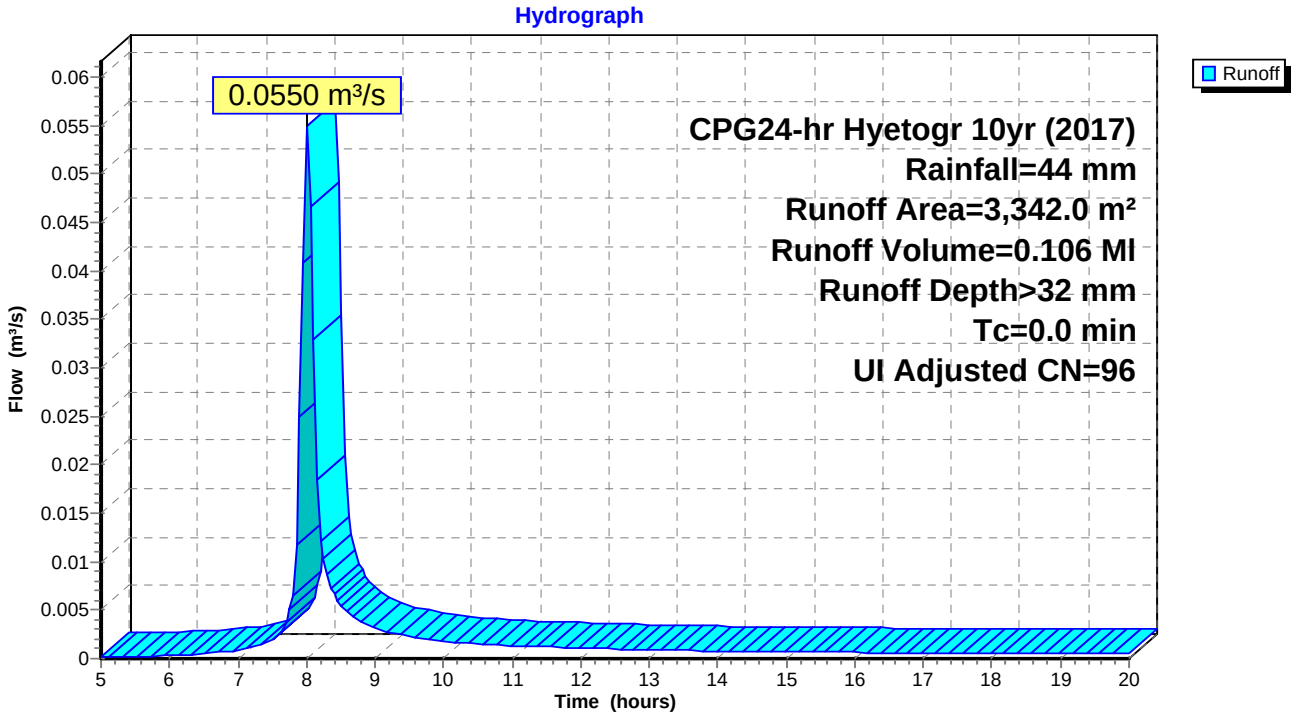
Runoff = 0.0550 m³/s @ 8.01 hrs, Volume= 0.106 Ml, Depth> 32 mm
Routed to Pond 2P : Recharge Lawn Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr (2017) Rainfall=44 mm

Area (m²)	CN	Adj	Description
1,000.0	98		Unconnected roofs, HSG C
2,342.0	96		Gravel surface, HSG C
3,342.0	97	96	Weighted Average, UI Adjusted
2,342.0			70.08% Pervious Area
1,000.0			29.92% Impervious Area
1,000.0			100.00% Unconnected

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
0.0					**Direct Entry,**

Subcatchment 1S: 397 3rd Ave



Summary for Pond 2P: Recharge Lawn Basin

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.3342 ha, 29.92% Impervious, Inflow Depth > 32 mm
Inflow = 0.0550 m³/s @ 8.01 hrs, Volume= 0.106 Ml
Outflow = 0.0076 m³/s @ 8.34 hrs, Volume= 0.103 Ml, Atten= 86%, Lag= 20.0 min
Discarded = 0.0076 m³/s @ 8.34 hrs, Volume= 0.103 Ml

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 101.104 m @ 8.34 hrs Surf.Area= 176.7 m² Storage= 43.8 m³

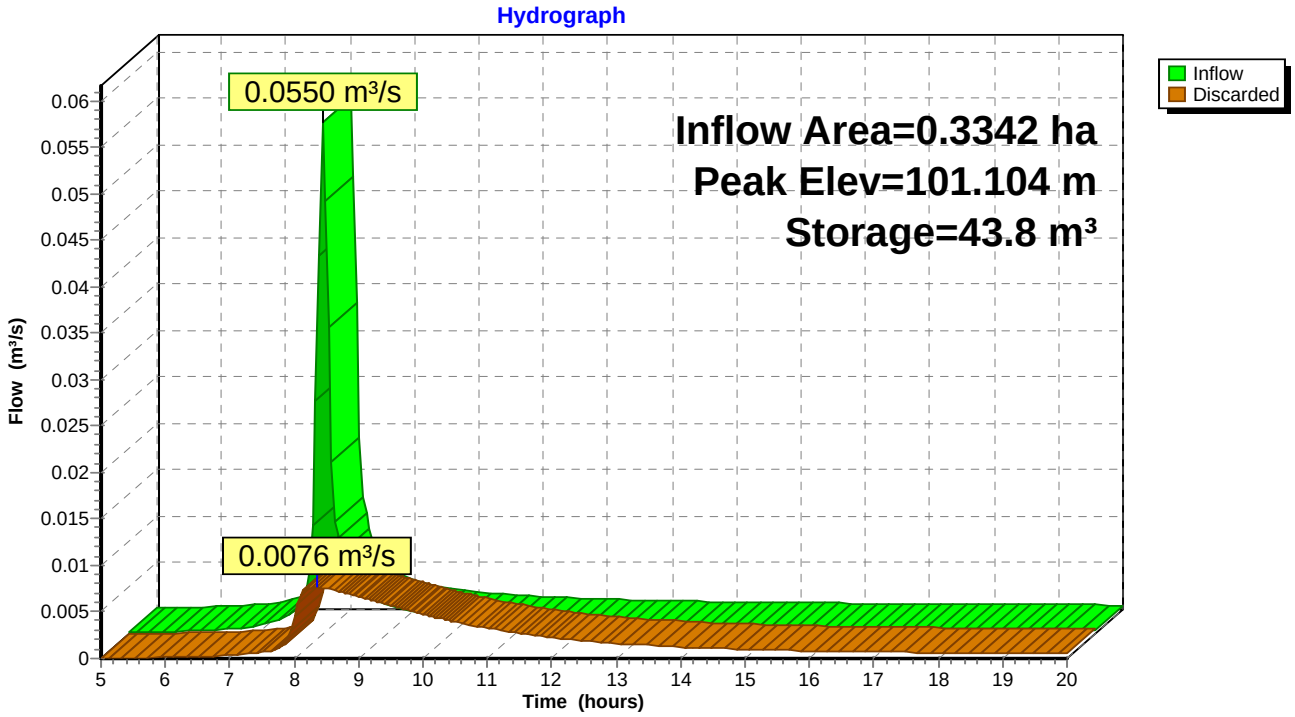
Plug-Flow detention time= 87.1 min calculated for 0.103 Ml (97% of inflow)
Center-of-Mass det. time= 73.3 min (659.7 - 586.3)

Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	9.1 m³	**4.50 mD x 1.20 mH Vertical Cone/Cylinder Z=1.0** 31.1 m³ Overall - 0.8 m³ Embedded = 30.3 m³ x 30.0% Voids
#2	100.000 m	0.8 m³	**0.90 mD x 1.20 mH Vertical Cone/Cylinder** Inside #1
#3	100.000 m	9.1 m³	**4.50 mD x 1.20 mH Vertical Cone/Cylinder Z=1.0** 31.1 m³ Overall - 0.8 m³ Embedded = 30.3 m³ x 30.0% Voids
#4	100.000 m	0.8 m³	**0.90 mD x 1.20 mH Vertical Cone/Cylinder** Inside #3
#5	100.000 m	9.1 m³	**4.50 mD x 1.20 mH Vertical Cone/Cylinder Z=1.0** 31.1 m³ Overall - 0.8 m³ Embedded = 30.3 m³ x 30.0% Voids
#6	100.000 m	0.8 m³	**0.90 mD x 1.20 mH Vertical Cone/Cylinder** Inside #5
#7	100.000 m	9.1 m³	**4.50 mD x 1.20 mH Vertical Cone/Cylinder Z=1.0** 31.1 m³ Overall - 0.8 m³ Embedded = 30.3 m³ x 30.0% Voids
#8	100.000 m	0.8 m³	**0.90 mD x 1.20 mH Vertical Cone/Cylinder** Inside #7
#9	100.000 m	9.1 m³	**4.50 mD x 1.20 mH Vertical Cone/Cylinder Z=1.0** 31.1 m³ Overall - 0.8 m³ Embedded = 30.3 m³ x 30.0% Voids
#10	100.000 m	0.8 m³	**0.90 mD x 1.20 mH Vertical Cone/Cylinder** Inside #9
		49.3 m³	Total Available Storage

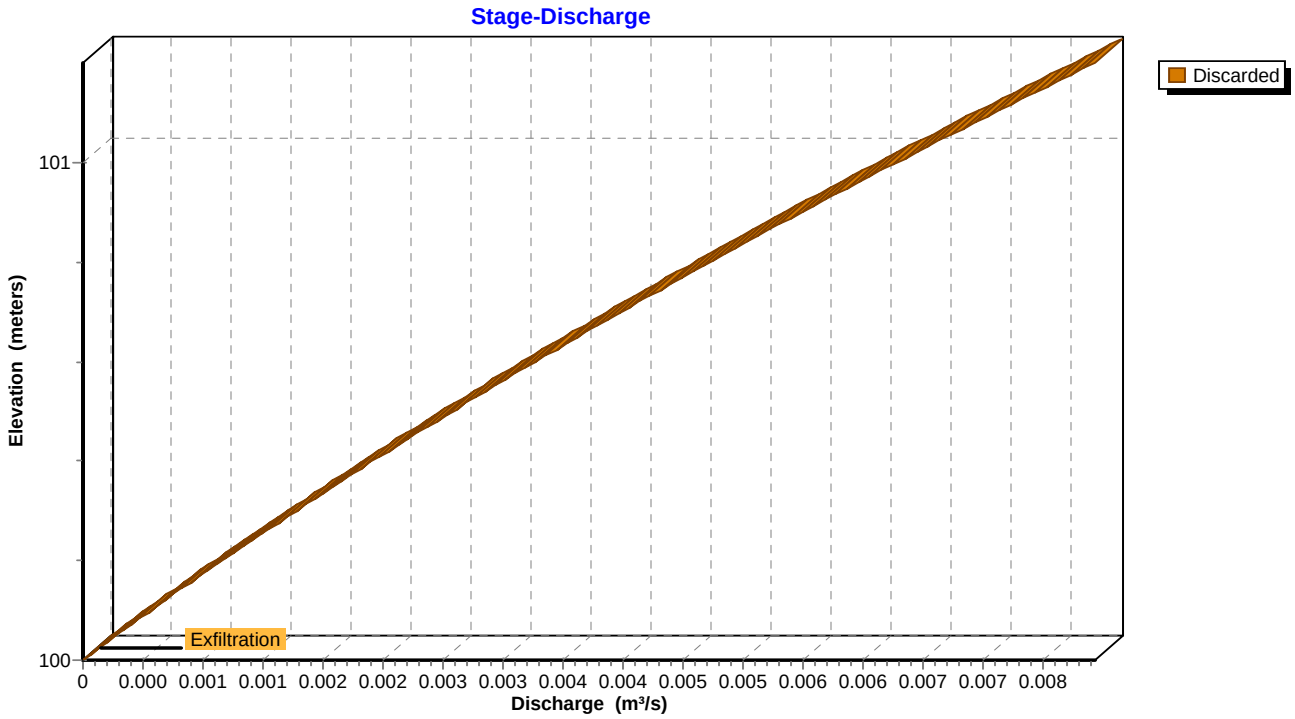
Device	Routing	Invert	Outlet Devices
#1	Discarded	100.000 m	**200.00 mm/hr Exfiltration over Wetted area from 100.000 m - 101.200 m** Excluded Wetted area = 79.5 m²

Discarded OutFlow Max=0.0076 m³/s @ 8.34 hrs HW=101.104 m (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.0076 m³/s)

Pond 2P: Recharge Lawn Basin



Pond 2P: Recharge Lawn Basin



APPENDIX C

GEOTECHNICAL LETTER

GEONORTH ENGINEERING LTD
3975 18th Avenue | Prince George | V2N 1B2
250-564-4304 | mail@geonorth.ca | www.geonorth.ca

November 15, 2023

Ms. Ruby Chow, Development Manager
BC Housing
1701-4555 Kingsway
Burnaby, BC V5H 4VB

Project No. 38372

Dear Ms. Chow:

Re: Geotechnical Recommendations for Proposed Temporary Housing Development, 397 3rd Avenue, Prince George, BC

1.0 Introduction

BC Housing is planning to locate up to 30 pre-manufactured units for temporary housing at the property noted above, and commissioned Geonorth Engineering Ltd. (GeoNorth) to carry out a site investigation and provide geotechnical recommendations for the installation of the units. You authorized us to proceed with the work in an email dated August 3, 2023, based on the scope of work of our proposal dated July 25, 2023.

The proposed development is expected to be temporary, with a lifespan of between 3 and 5 years, and is expected to be completed in December 2023. The property is bordered by 3rd Avenue to the north, London Street to the west, 4th Avenue to the south, and undeveloped, City of Prince George (CoPG) owned lots to the east.

At your request, we carried out a review of historical groundwater data and provided a summary of the findings in our Memo 37372-1, Rev 0, dated October 20, 2023. As outlined in our memo, the site is about 2.7 m below the 1 in 200 year flood construction level (FCL) of 570.5 m elevation. Due to the temporary nature of the development, we recommended raising the site grade to the 1 in 20 year return period flood level (without freeboard), elevation 568.8 m, and supporting the premanufactured units on skids. We also recommended all electrical equipment and connections be kept above this elevation.

2.0 Background

A review of historical airphotos show that in 1963, Lower Patricia Blvd did not connect to 1st Ave, and the property was undeveloped and occupied with a backwater channel aligned east-west across the site. Airphotos dated 1977 show the lot was filled in and Lower Patricia Blvd was

constructed to the east, with a large circular feature on the property, potentially a pile of fill. Orthophotos dated 1997 to 2020 available on PG Map, a website maintained by the CoPG, show the property remained undeveloped with several stockpiles of fill located on the lot.

Geological Survey of Canada, Bulletin 196 and Surficial Geology Map 1288A by H.W. Tipper indicates that downtown Prince George is within a large meltwater or outwash channel. Meltwater or outwash deposits typically consist of layered sand and gravel and occasionally silt. Our previous investigations in the downtown area encountered outwash deposits and have also occasionally encountered buried backwater channels.

3.0 Site Investigation

On October 17 and 18, 2023, personnel from our office observed soil and groundwater conditions in six drill holes, designated DH23-01 to 06. The drill holes were advanced to between 3.0 and 14.6 m depth using air-rotary drilling methods and a combination of hollow and solid stem augers using truck-mounted drill rigs contracted from Uniwide Drilling Co. Ltd. of Prince George, B.C. The drill holes were located along the edges of the property, except DH23-03, which was located near the centre. Drill hole locations are shown on Drawing 38372-A1.

We logged soil and groundwater conditions as the drill holes were advanced and obtained representative samples for laboratory testing. Drill logs describing subsurface conditions are shown on Plates 38372-B1 to B6, attached, and are followed by an explanation of terms and symbols used on the logs. All samples were returned to our laboratory and tested to determine natural moisture content (ASTM D2216). We carried out grain size distribution tests (ASTM C117 and C136) on selected samples. The moisture content results are shown on the drill hole logs, and the grain size distribution test results are included on Plates 38372-C1 to C4, attached.

4.0 Subsurface Conditions

The drill holes encountered similar conditions, consisting of the following five soil units:

Unit 1: Sand and gravel fill, to between 1.5 and 2.3 m depth, over

Unit 2: Natural, stiff to very stiff, silty clay of a low plasticity to between 2.2 and 3.0 m depth, over

Unit 3: Compact sand with a trace of fines and variable gravel content to between 2.8 and 4.4 m depth, over

Unit 4: Sandy gravel with a trace of fines to between 8.5 and 9.1 m depth, over

Unit 5: Loose to compact, fine-grained sand with a trace to some fines to the bottom of the drill holes.

Units 2 and 3 were not observed in DH23-04, in the northwest corner of the property. Groundwater seepage was observed between 2.7 and 3.8 m in all drill holes except DH23-06.

Grain size analysis tests on the sand and gravel fill (Unit 1) shows it consists of an average of 41% gravel, 47% sand, and 12% fines. A test on the natural sand with some gravel (Unit 3) at 2.6 m depth in DH23-05 consists of 79% sand, 15% gravel, and 6% fines, and a test on the natural fine-grained sand at 11.0 m depth in DH23-04 consists of 0% gravel, 90% sand, and 10% fines. A summary of Atterberg limits test results on samples of the clay is shown in Table 1, below:

Table 1 - Summary of Laboratory Atterberg Limit Test Results on Clay Samples

Drill Hole	Depth (m)	Soil Classification	Liquid Limit %	Plastic Limit %	Moisture Content %	Liquidity Index
DH23-03	2.3	CL	28	21	27.4	0.92
DH23-06	2.4	CL	29	21	28.2	0.9

The Liquidity Index, shown above, provides an indication of soil behaviour; soil with a Liquidity Index greater than 1 will have properties similar to viscous liquid, soil with a Liquidity Index between 0 and 1 will behave as a plastic material, and soil with a Liquidity Index less than zero will behave as a semi-solid material.

5.0 Discussion and Recommendations

The results of the investigation show that the site was previously brought to grade using gravel fill, likely during construction of Lower Patricia Boulevard.

The natural soil layers underlying the fill have moderate bearing capacity and a moderate susceptibility for settlement under the expected loads. The existing fill was found to be consistent and generally dense to very dense. Gravel fill placed in an uncontrolled manner can cover or contain deleterious materials and can have variable gradation and compaction characteristics resulting in properties of moderate compressibility and moderate to high susceptibility to the formation of ice lenses that cause frost heave. Typically, fill placed in this manner is not suitable for support of building foundations. It was not the intent of the investigation to delineate the complete extents of fill across the site.

As the units are temporary and will be constructed on timber skids that can be raised or lowered as required, we recommend leaving the fill in place. Ground conditions are adequate for support of the premanufactured housing units on adjustable foundations.

The recommendations in this report are based on the necessary assumption that soil conditions encountered in the drill holes are representative of soil conditions elsewhere on the site. Please contact our office for additional recommendations if you encounter conditions that differ in any way from those described in this report.

5.1 Site Preparation

To prepare ground conditions below the housing units, we recommend the following:

- Remove all organic materials, debris, or garbage from the surface of the lot.
- Compact the surface with at least six passes in each direction using a vibratory drum roller weighing at least 450 kg.
- Excavate areas that rut or deform due to the compaction.
- Bring the site grade to at least elevation 568.8 m using structural fill that meets the gradation specifications for Select Granular Subbase (SGSB), defined in Table 2, below. Place fill in uniform layers and compact each layer to at least 100% Standard Proctor Density (SPD). Layer thickness will depend on several factors, including the size and weight of the compactor, and the moisture content and temperature of the soil, but do not exceed a layer thickness of 300 mm.

Table 2 - Specified Gradation For Granular Fill

Sieve Size (mm)	Percentage Passing	
	Well Graded Base	Select Granular Subbase
100	-	100
75	-	95-100
25	100	-
19	80-100	35-100

9.5	50-85	-
4.75	35-70	15-60
2.36	25-50	-
1.18	15-35	-
0.3	5-20	3-15
0.075	0-5	0-5

For WGB, use crushed and screened material that meets the requirements of BCMoT Standard Specifications. The SGSB can be a pit run material that meets the above gradation. Use durable aggregate that will not degrade from exposure to water, freeze-thaw cycles or handling, spreading or compacting. It must not contain organic materials or an excess of flat or elongate stones. Do not place fill that is frozen and do not place fill on frozen ground.

5.2 Premanufactured Home Foundations

Design foundations placed on compacted SGSB using a factored geotechnical resistance of 150 kPa (for limit states design), and an allowable bearing capacity of 100 kPa (for serviceability conditions).

As noted above, gravel fill, as encountered in the drill holes, has a relatively high allowable bearing capacity. We expect settlement to be minimal within the design life of this development. Variability of the existing fill is unknown, however, and it is possible that loose or soft areas may exist. We recommend the housing units be relevelled as necessary if settlement is observed.

Install utilities such as water and sewer prior to constructing foundations. Excavations below foundations or within a 1H:1V line extending down from the bottom outside edge of the skids will reduce support, which can cause settlement. Backfill around buried utilities that are within a 1H:1V line extending down from the building foundations using the placement procedures described above.

5.3 Buried Utilities

We recommend installing water and sewage pipes in advance of placing structural fill. To protect against freezing, we recommend using the City of Prince George standard of 2.4 m of soil cover over sanitary and stormwater sewer lines and 3.0 m over water lines measured perpendicular to the ground surface. Alternatively, protect the pipes from freezing by using rigid board insulation. A detail for the use of insulation to protect buried service pipes against freezing is on Drawing 38372-D1, attached.

As noted above, we recommend installing electrical equipment and connections above 568.8 m elevation.

Use temporary side slopes for trench excavations that meet WorkSafeBC requirements, and that are no steeper than 1H:1V, although if trenches encounter loose soil, excavation slopes might need to be 1.5H:1V or flatter. We recommend that a geotechnical engineer review trench excavations where they are deeper than 6 m, if loose pockets of soil are encountered, or if signs of instability develop.

Excavate the trench bottom to a width equal to the pipe diameter plus at least 500 mm, but no more then 900 mm on each side of the pipe to allow room for compaction equipment. For bedding around buried pipes, use Well Graded Base (WGB), defined in Table 2 above, or sand containing less than 10% fines, or other backfill materials approved by the pipe manufacturer. For trench backfill use mineral soil free of organic material and debris, with a maximum particle size of 150 mm. Place all trench backfill in thin, uniform layers and compact each layer to at least 98% SPD. Add water or dry the soil used for trench fill to within 2% of optimum moisture content before it is compacted.

The maximum layer thickness for compaction will depend on several factors, including compactor type, size and energy, and the soil type and moisture content, but do not exceed a layer thickness of 300 mm. We suggest working with an experienced geotechnical technician to optimize placement procedures.

6.0 Construction Review

We recommend that an experienced geotechnical technician, under the direction of an geotechnical engineer, review the compaction of all structural fill used to bring the site to grade.

7.0 Closure

This report was prepared by GeoNorth Engineering Ltd. for the use of BC Housing and their consultants. The material in it reflects GeoNorth Engineering's judgement in light of the information available to us at the time of preparation. Any use which Third Parties make of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. GeoNorth Engineering Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Please call the writers if you have any questions or would like to discuss any aspects of this letter.

Yours truly,
GeoNorth Engineering Ltd.

Per: G. Dakus, EIT

Reviewed by,
GeoNorth Engineering Ltd.

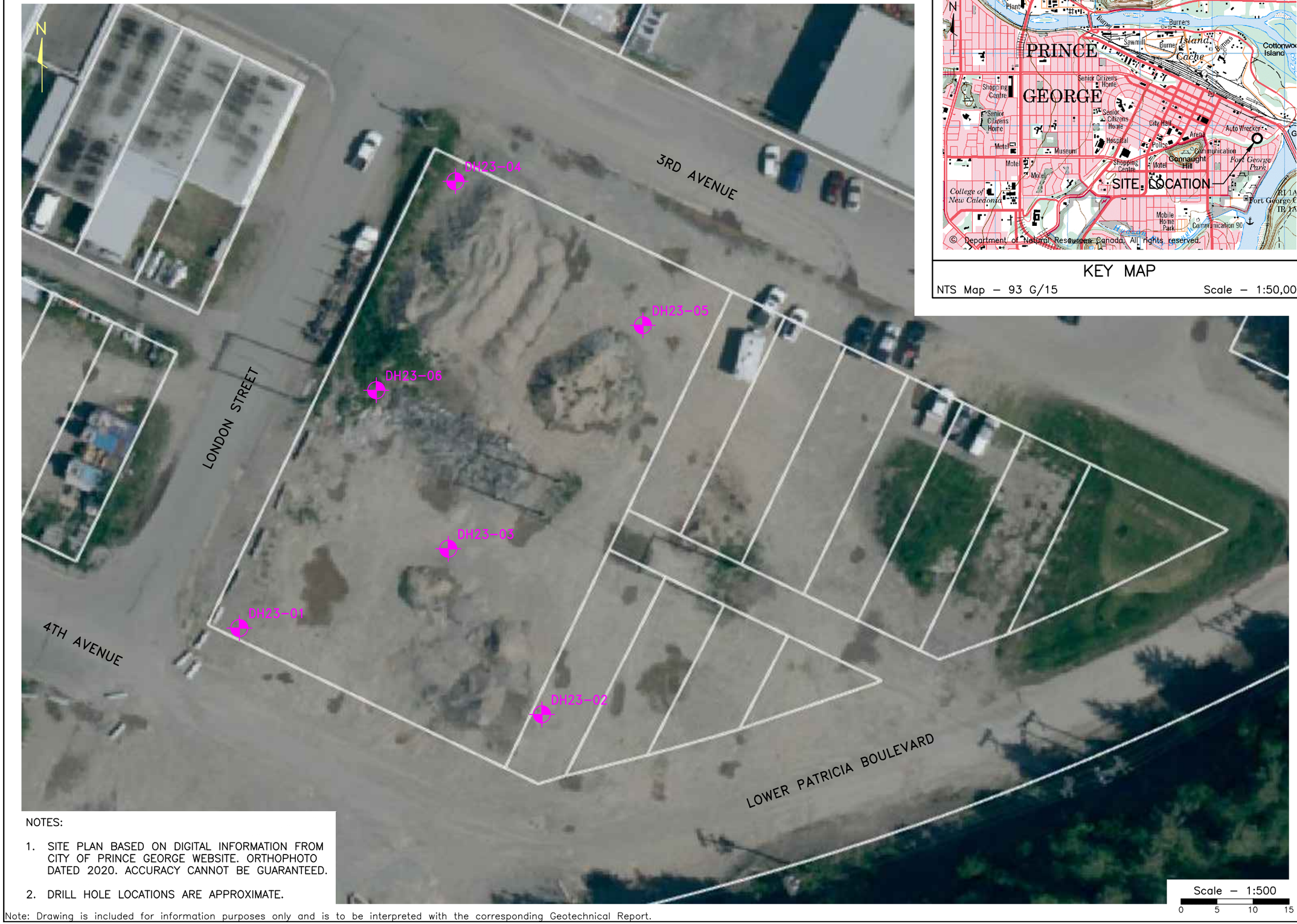
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
L. G. B. MacPHAIL
51335

2023/11/15

Per: L.G.B MacPhail, M.Eng., P.Eng.

Enclosures:

Drawing 38372-A1, Site Plan Showing Test Pit Locations
Plates 38372-B1 to B6, Test Pit Logs
Explanation of Terms and Conditions Used on Test Pit Logs, 3 pages
Plate 38372-C1 to C4, Grain Size Distribution Tests
Plate 38372-D1, Insulation Detail For Trenches In Soil Less Than Design Frost Depth



KEY MAP

NTS Map – 93 G/15 Scale – 1:50,000

NOTES:

1. SITE PLAN BASED ON DIGITAL INFORMATION FROM CITY OF PRINCE GEORGE WEBSITE. ORTHOPHOTO DATED 2020. ACCURACY CANNOT BE GUARANTEED.
2. DRILL HOLE LOCATIONS ARE APPROXIMATE.

Scale – 1:500

0 5 10 15

Note: Drawing is included for information purposes only and is to be interpreted with the corresponding Geotechnical Report.

GEONORTH ENGINEERING LTD
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BC HOUSING
TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.
SITE PLAN SHOWING DRILL HOLE LOCATIONS

SCALE: 1:500	APPROVED:
DATE: 2023/11/15	
DRAWN BY: LU	
REVIEWED BY: DJM	REVISION: –
DRAWING NO: 38372-A1	PROJECT NO: 38372

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3975 18th Avenue
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Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH23-01

CLIENT: BC HOUSING

PROJECT: TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.

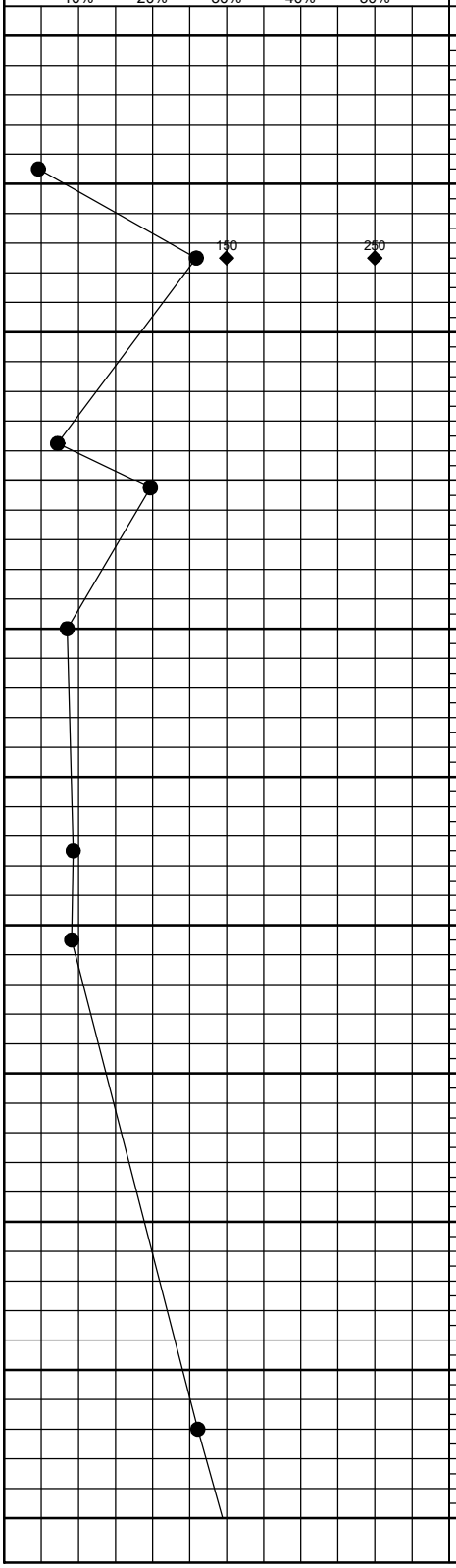
LOGGED: GD | FILE NO: 38372 | DRILL: Enviro-hammer | DATE OF INVEST: 2023/10/17

LOCATION: 10U 517594E 5973792N

SURFACE ELEVATION (m): N/A

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%



DEPTH (m) | SYMBOL

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	SOIL DESCRIPTION	SPT. BLOWS PER 152 mm	SPT 'N'	RECOVERY (mm)	COMMENTS
0		GRAVEL, sandy, trace to some fines, no visible structure, very dense, brown, damp (FILL).	43 33 29 18		62/440	
1.5		CLAY, silty, trace sand, no visible structure, stiff to very stiff, low to intermediate plasticity, blue-grey, isolated organics, Wn>Wp.	10 6 9 12		15/300	
2.2		SAND, trace fines, no visible structure, compact, grey, damp.	8 6 8 7		14/360	
2.8		GRAVEL, sandy, trace fines, no visible structure, compact, grey, wet.	9 14 11 8		25/300	
		- below 3.6 m, loose.	13 5 3 3		8/-	
			8 3 2 6		5/0	
		- below 5.3 m, some sand, dense,	33 23 24 43		47/250	
		- below 5.8 m, sandy, very dense.	37 35 36		71/210	
			37 38 41 42		79/0	
8.5		SAND, fine to medium grained, trace fines, no visible structure, loose, grey, wet.	5 1 4 5		5/620	Sand heaving below 9.7 m

(continued on next page)

PLATE NO. 38372 - B1

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Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH23-01

CLIENT: BC HOUSING

PROJECT: TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.

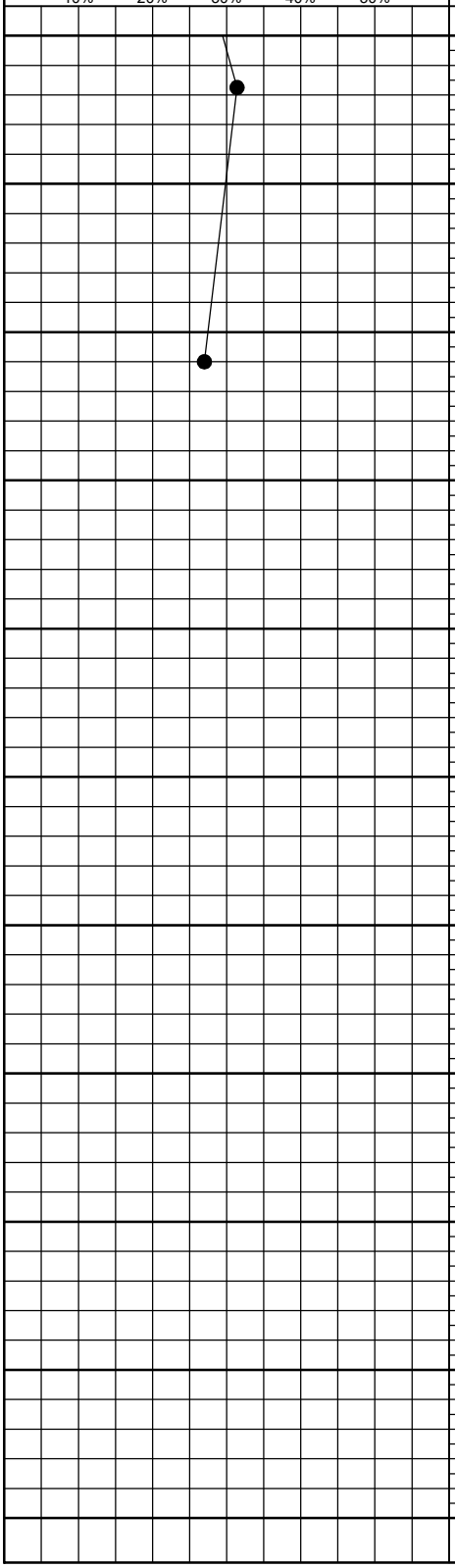
LOGGED: GD | FILE NO: 38372 | DRILL: Enviro-hammer | DATE OF INVEST: 2023/10/17

LOCATION: 10U 517594E 5973792N

SURFACE ELEVATION (m): N/A

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%



DEPTH (m) | SYMBOL | SAMPLES | SPT, BLOWS PER 152 mm | SPT 'N' / RECOVERY (mm) | COMMENTS

SOIL DESCRIPTION

DEPTH (m) ELEV (m)

SAND, fine to medium grained, trace fines, no visible structure, loose, grey, wet. *(continued)*

- below 12.2 m, isolated cobbles.

14.6

End of drill hole at 14.6 m.
Seepage at 2.8 m.

PLATE NO. 38372 - B2

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Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH23-02

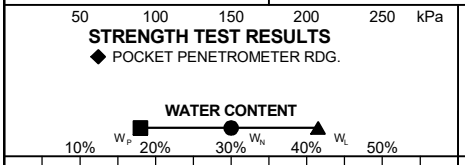
CLIENT: BC HOUSING

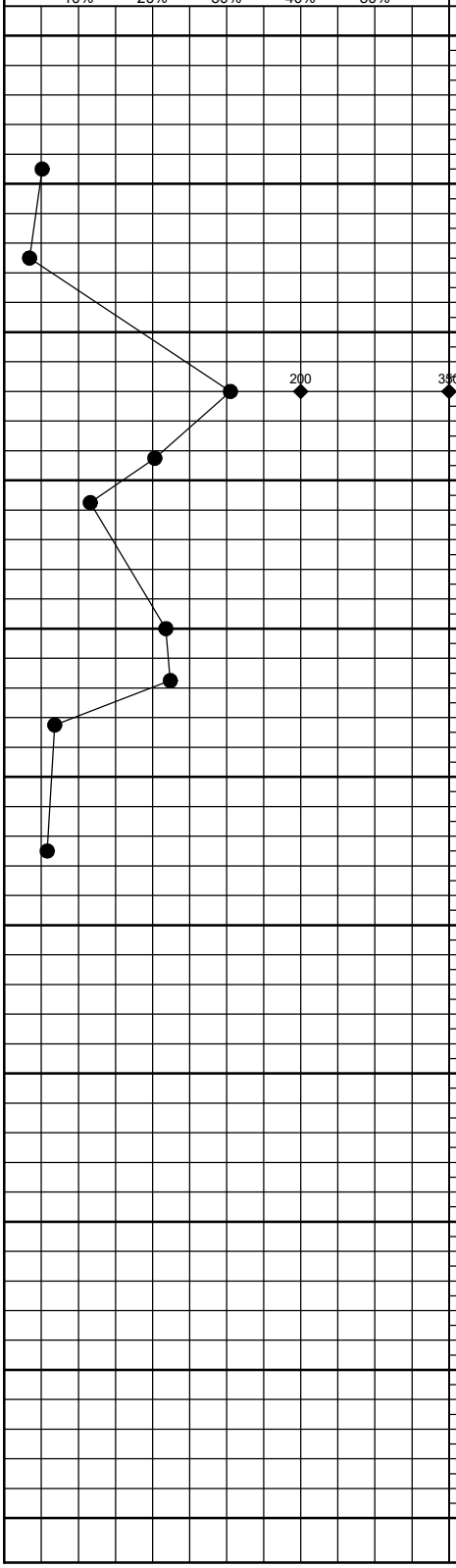
PROJECT: TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.

LOGGED: GD | FILE NO: 38372 | DRILL: Enviro-hammer | DATE OF INVEST: 2023/10/17

LOCATION: 10U 517636E 5973780N

SURFACE ELEVATION (m): N/A





DEPTH (m) | SYMBOL | SOIL DESCRIPTION | SAMPLES | SPT, BLOWS PER 152 mm | SPT 'N' / RECOVERY (mm) | COMMENTS

DEPTH (m)	ELEV (m)	SOIL DESCRIPTION	SPT, BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)	COMMENTS
0		GRAVEL, and sand, some fines, no visible structure, very dense, brown, damp (FILL).	44 34 32 37	66/530	- Grain Size Analysis, See Plate 38372-C1
		- below 1.4 m, dark brown.	58 52 35 36	87/540	
2.1		CLAY, silty, trace sand, layered, very stiff, low to intermediate plasticity, blue-grey, Wn>Wp.	7 10 10 9	20/540	
		- below 2.7 m, sandy, stiff.	8 6 8 7	14/520	
3.0		SAND, trace gravel, no visible structure, compact, grey, damp. - at 3.1 m, organic silt layer 50 mm thick.			
		- below 3.7, wet.	10 8 10 11	18/480	
4.4		GRAVEL, sandy, trace fines, no visible structure, compact, grey, wet.	5 10 17 17	27/420	
5.8		End of drill hole at 5.8 m. Seepage at 3.7 m.	24 33 33 29	66/290	

PLATE NO. 38372 - B3

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3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH23-03

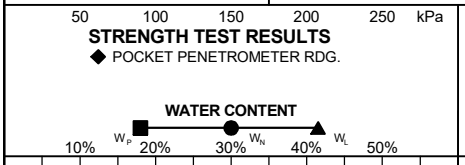
CLIENT: BC HOUSING

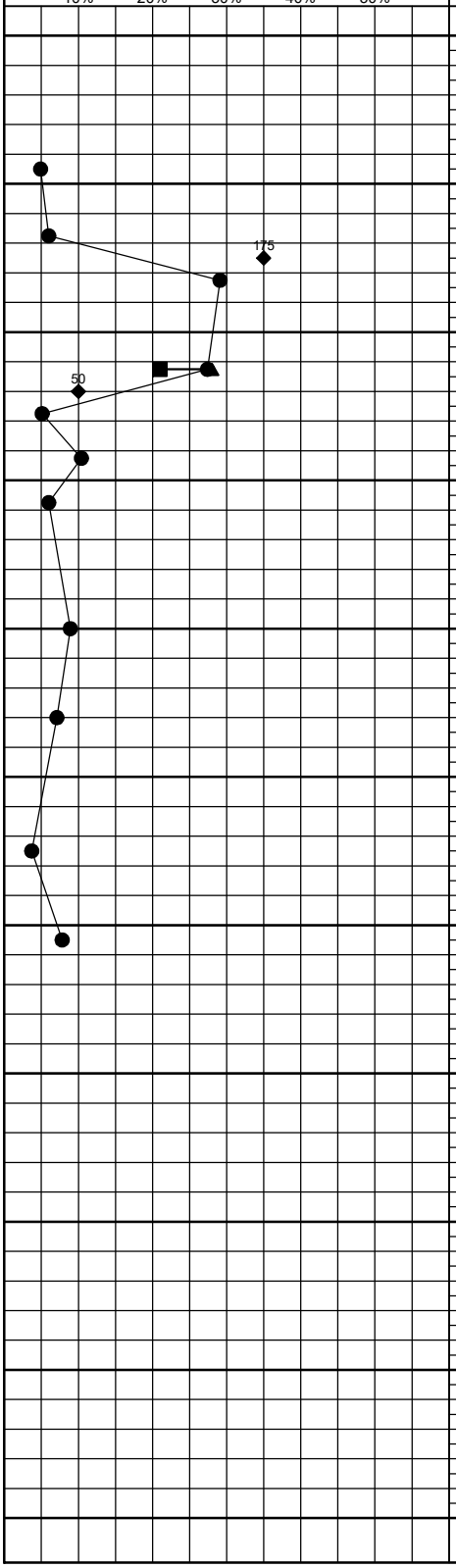
PROJECT: TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.

LOGGED: GD | FILE NO: 38372 | DRILL: Enviro-hammer | DATE OF INVEST: 2023/10/17

LOCATION: 10U 517623E 5973803N

SURFACE ELEVATION (m): N/A





DEPTH (m) | SYMBOL

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	SOIL DESCRIPTION
0		GRAVEL, and sand, trace to some fines, no visible structure, very dense, brown, damp (FILL).
1.5		- below 1.3 m, trace to some fines, dark brown.
		CLAY, silty, trace sand, no visible structure, stiff, low plasticity, grey, isolated organics, Wn>Wp.
		- below 2.1 m, firm to soft, Wn nearing WL.
2.4		SAND, fine to medium grained, trace fines, no visible structure, compact, grey, damp.
3.0		GRAVEL, sandy, trace fines, no visible structure, compact, grey, moist.
		- below 5.2 m, some sand, very dense.
		- below 5.8 m, sandy, trace to some fines.
7.3		End of drill hole at 7.3 m. Seepage at 3.5 m.

SAMPLES	SPT, BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)
	30 32 35 24	67/400
	24 11 6 5	17/420
	4 5 10 9	15/490
	10 10 15 7	25/370
	6 9 10 10	19/240
	20 13 12 12	25/170
	20 26 28 50	54/190
	44 35 27 20	62/230

COMMENTS

PLATE NO. 38372 - B4

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Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH23-04

CLIENT: BC HOUSING

PROJECT: TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.

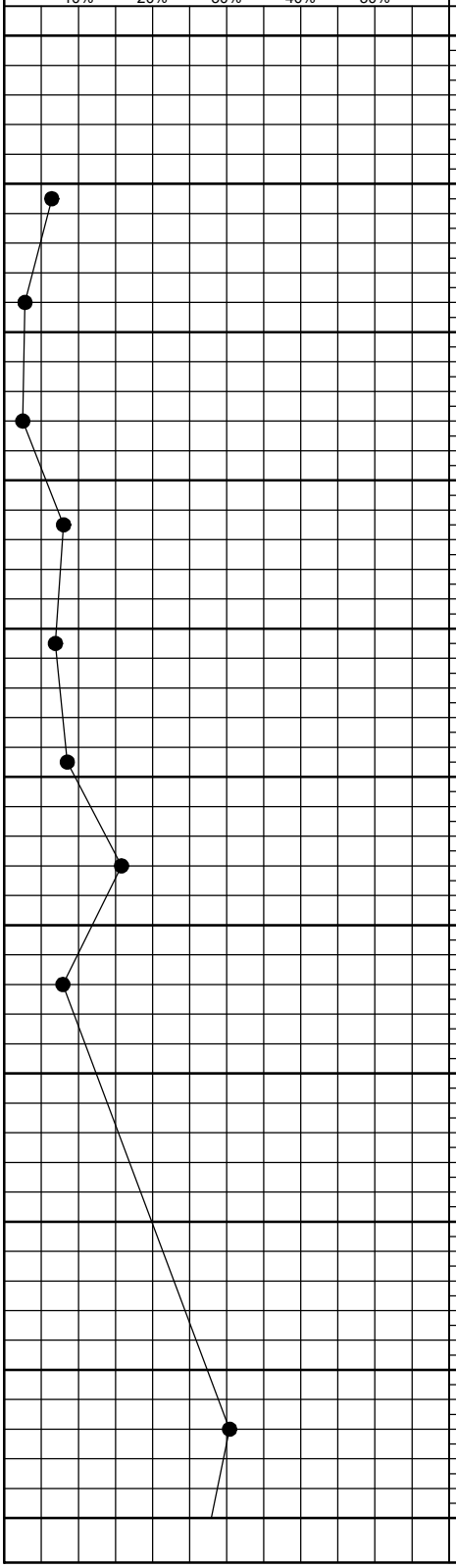
LOGGED: GD | FILE NO: 38372 | DRILL: Hollow Stem Auger | DATE OF INVEST: 2023/10/18

LOCATION: 10U 517624E 5973854N

SURFACE ELEVATION (m): N/A

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%



DEPTH (m) | SYMBOL | SAMPLES | SPT, BLOWS PER 152 mm | SPT 'N' / RECOVERY (mm) | COMMENTS

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	Description	SPT, BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)
0		GRAVEL, and sand, trace to some fines, no visible structure, dense, brown, damp (FILL).	6, 22, 17, 19	39/340
1.6		SAND, fine to medium grained, gravelly, no visible structure, compact, grey, damp (FILL).	8, 8, 6, 8	14/410
		- below 2.3 m, compact to dense.	11, 16, 14, 14	30/380
3.0		GRAVEL, sandy, trace fines, no visible structure, compact, brown, wet.	9, 7, 7, 6	14/220
			4, 7, 10, 9	17/260
			8, 12, 11, 8	23/280
		- below 5.3 m, loose.	2, 4, 4, 5	8/250
			4, 4, 4, 9	8/240
		- below 7.6 m, dense.	14, 19, 17, 10	36/0
9.1		SAND, fine grained, trace to some fines, no visible structure, loose, grey, wet.	1, 4, 5, 5	9/250

(continued on next page)

PLATE NO. 38372 - B5

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Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH23-04

CLIENT: BC HOUSING

PROJECT: TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.

LOGGED: GD | FILE NO: 38372 | DRILL: Hollow Stem Auger | DATE OF INVEST: 2023/10/18

LOCATION: 10U 517624E 5973854N

SURFACE ELEVATION (m): N/A

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%

DEPTH (m) | SYMBOL

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	SAMPLES	SPT, BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)	COMMENTS
			1 4 12 24	16 540	- Grain Size Analysis, See Plate 38372-C2
			0 8 15 38	23 560	
12.8					

SAND, fine grained, trace to some fines, no visible structure, loose, grey, wet. *(continued)*

End of drill hole at 12.8 m.
Seepage at 3.0 m.

PLATE NO. 38372 - B6

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Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH23-05

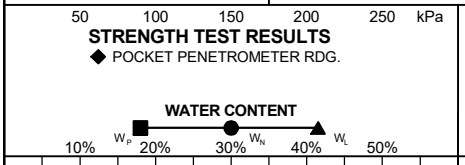
CLIENT: BC HOUSING

PROJECT: TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.

LOGGED: GD | FILE NO: 38372 | DRILL: Hollow Stem Auger | DATE OF INVEST: 2023/10/18

LOCATION: 10U 517650E 5973834N

SURFACE ELEVATION (m): N/A



SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	SYMBOL	SAMPLES	SPT BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)	COMMENTS
0.0						
				14 14 12 12	26/480	
						- below 1.1 m, grey.
				8 5 4 4	9/490	
						- below 1.5 m, brown.
1.7						
						CLAY, silty, trace sand, trace gravel, no visible structure, very stiff, low plasticity, grey, Wn>Wp.
2.3						
				10 8 7 7	15/420	- Grain Size Analysis, See Plate 38372-C3
						SAND, some gravel, trace fines, no visible structure, compact, brown, damp.
						- below 3.0 m, wet.
				8 8 4 4	12/430	
3.8						
				4 4 12 11	16/290	GRAVEL, sandy, trace fines, no visible structure, compact, grey, wet.
						- below 4.5 m, some sand.
				1 3 4 10	7/210	
				3 3 3 3	6/210	
						- below 6.1 m, sandy.
				4 6 6 5	12/180	
				5 4 5 5	9/0	
				5 3 2 5	5/120	
9.8						
						End of drill hole at 9.8 m. Seepage at 3.0 m.

PLATE NO. 38372 - B7

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH23-06

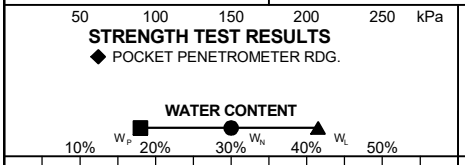
CLIENT: BC HOUSING

PROJECT: TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.

LOGGED: GD | FILE NO: 38372 | DRILL: Solid Stem Auger | DATE OF INVEST: 2023/10/18

LOCATION: 10U 517613E 5973825N

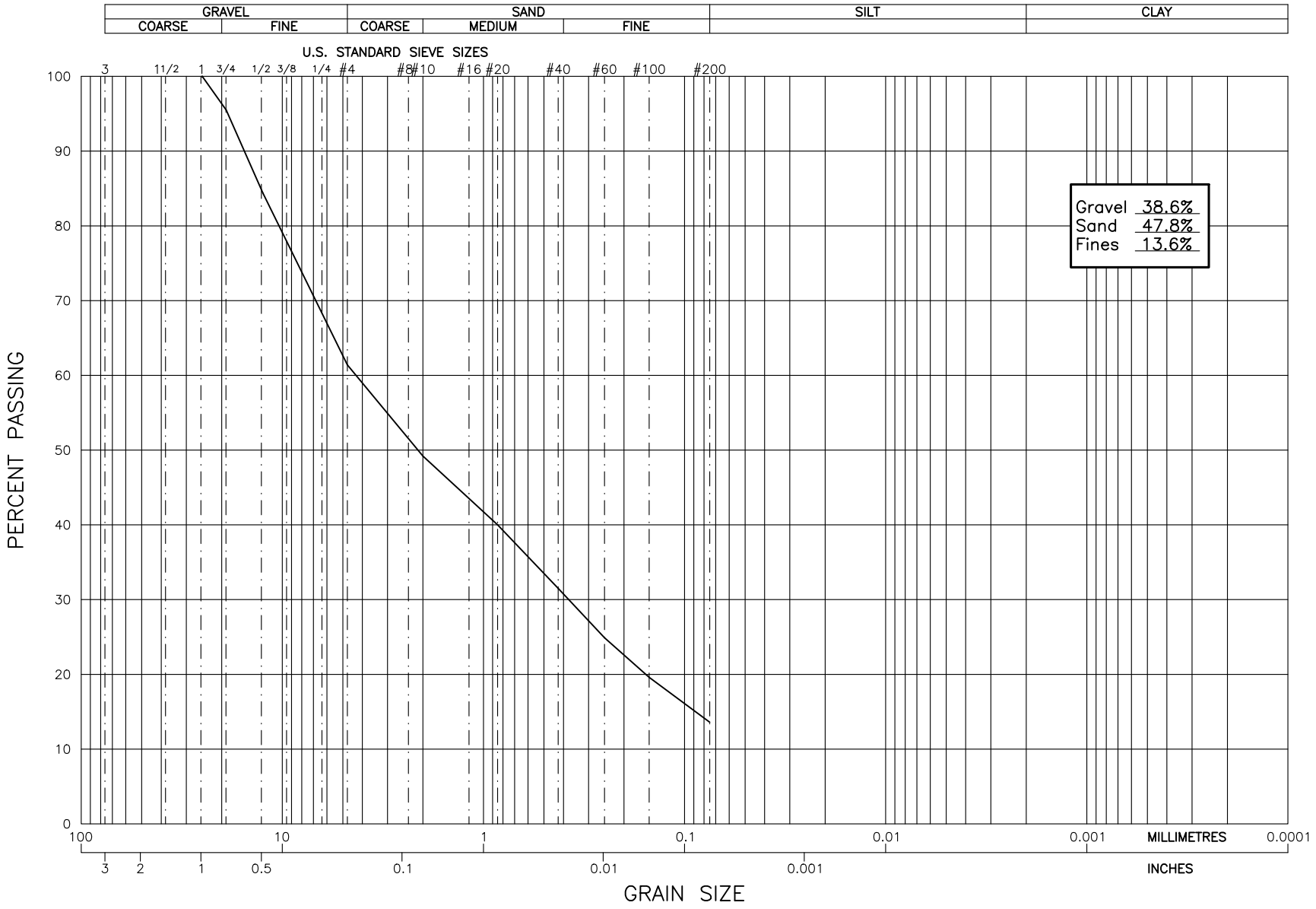
SURFACE ELEVATION (m): N/A



SOIL DESCRIPTION

DEPTH (m)	SYMBOL	SOIL DESCRIPTION	ELEV (m)	SAMPLES	COMMENTS
0		GRAVEL, sandy, trace to some fines, no visible structure, dense, brown, damp (FILL).			
					- Grain Size Analysis, See Plate 38372-C4
		- below 1.5 m, dark brown.			
2.3		CLAY, silty, trace sand, trace gravel, no visible structure, low to intermediate plasticity, dark grey, Wn nearing WL.			
2.8		SAND, trace fines, compact, dark grey, damp.			
3.0		End of drill hole at 3.0 m.			

PLATE NO. 38372 - B8

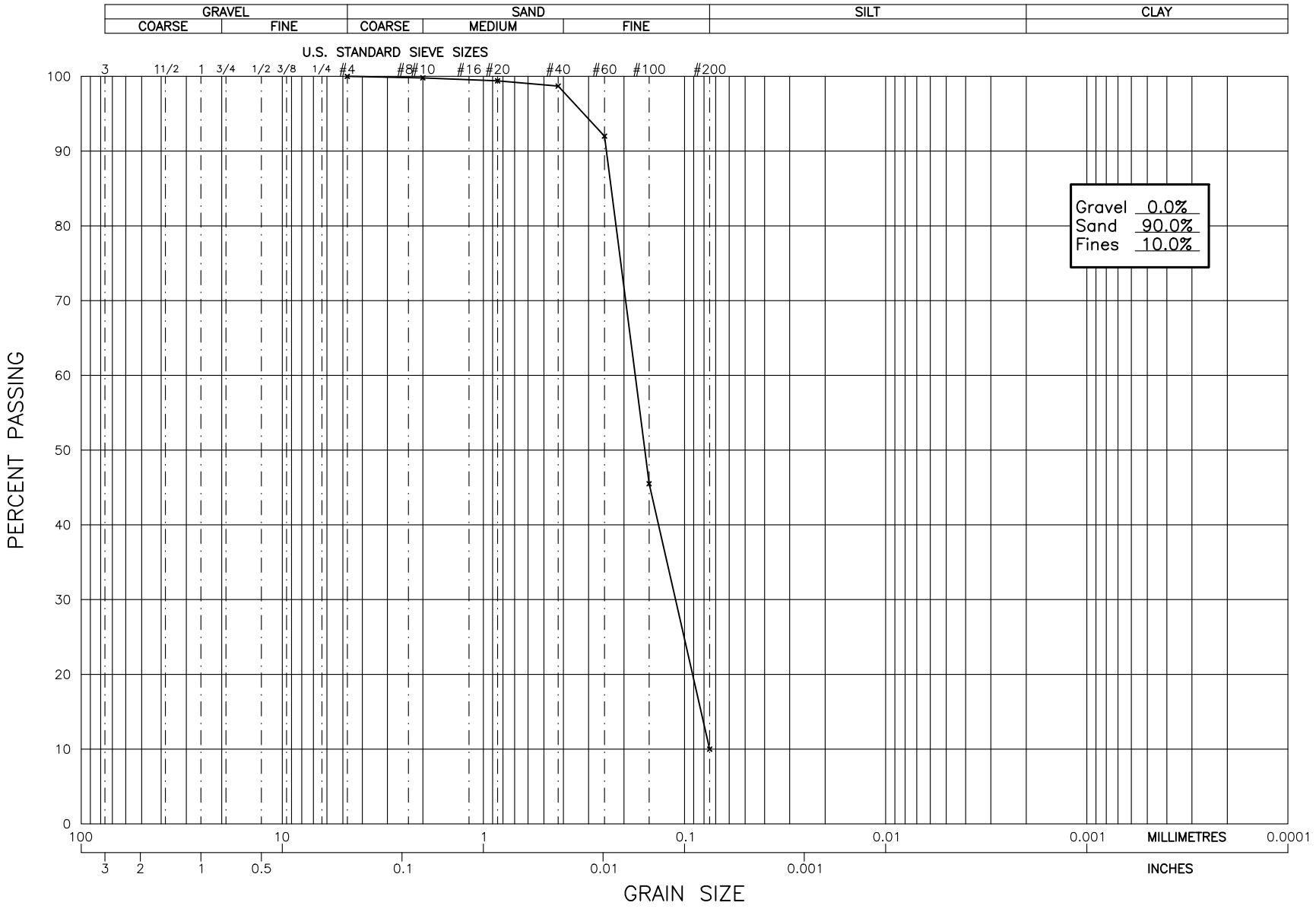


GEONORTH ENGINEERING LTD
3975 18th Avenue, Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

BC HOUSING
TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.
GRAIN SIZE ANALYSIS OF DH23-02, 0.6-1.2 m DEPTH

PROJECT NO. 38372

PLATE NO. 38372-C1



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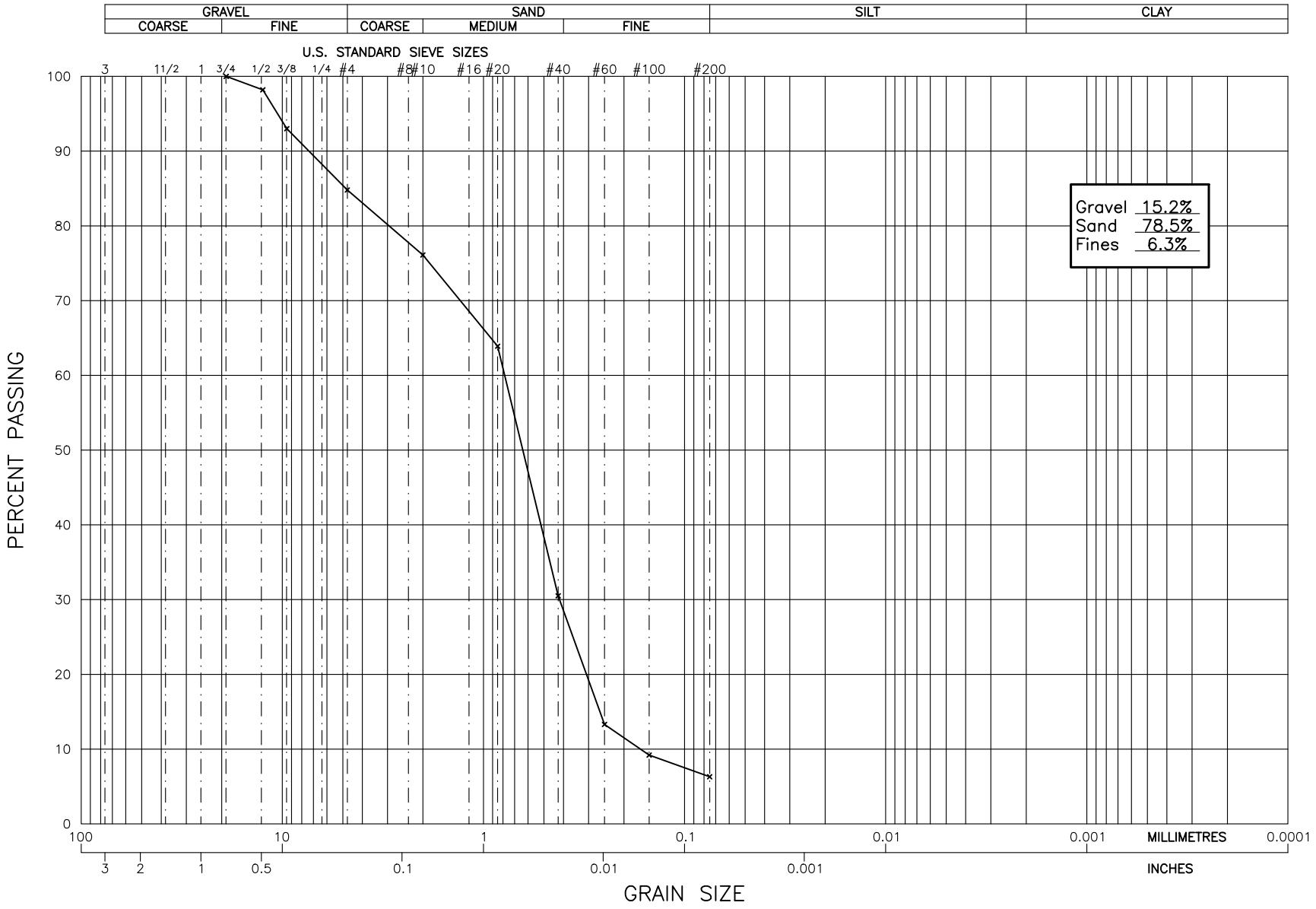
BC HOUSING
TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.
GRAIN SIZE ANALYSIS OF DH23-04, 10.7-11.3 m DEPTH

PROJECT NO.
38372

PLATE NO.
38372-C2



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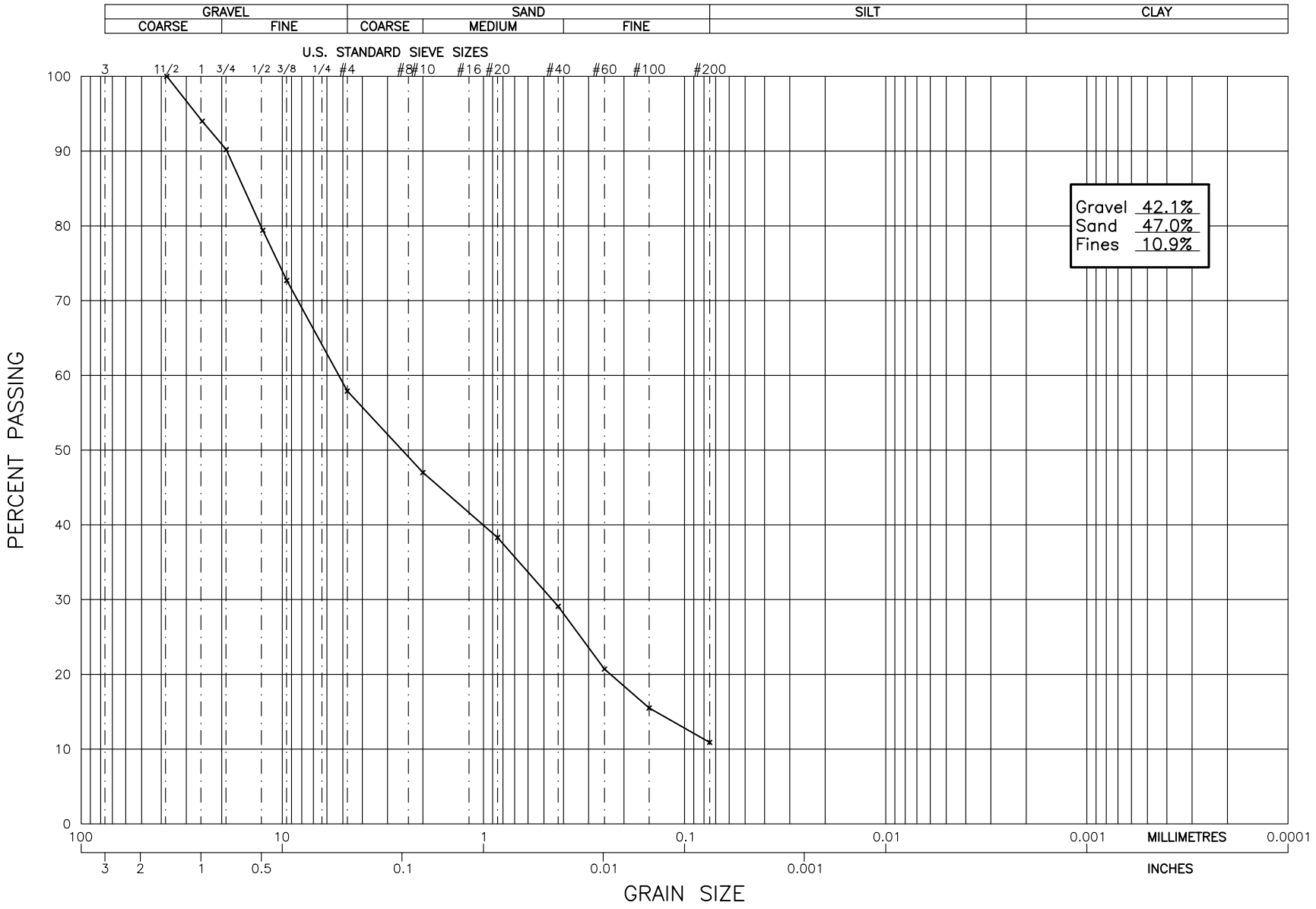
BC HOUSING
TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.
GRAIN SIZE ANALYSIS OF DH23-05, 2.3-2.9 m DEPTH

PROJECT NO.
38372

PLATE NO.
38372-C3



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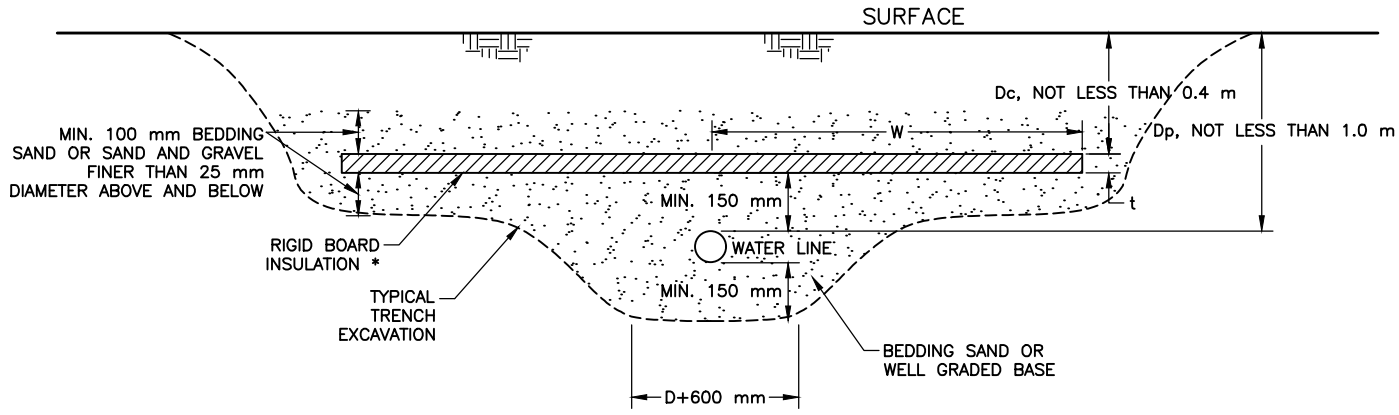
BC HOUSING
TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.
GRAIN SIZE ANALYSIS OF DH23-06, 0.8 m DEPTH

PROJECT NO.
38372

PLATE NO.
38372-C4



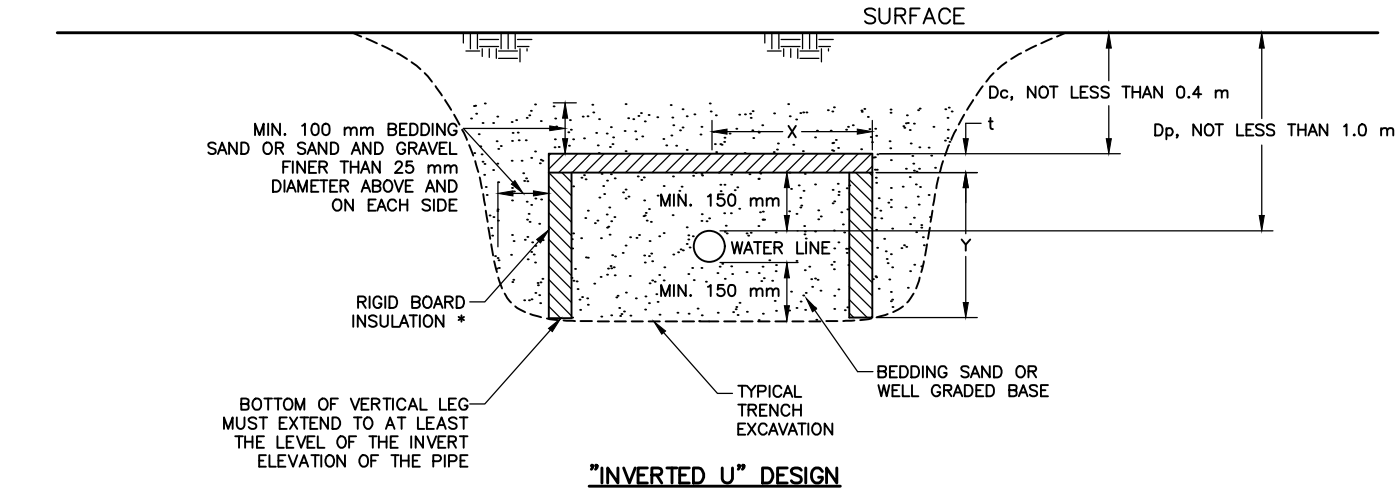
STANDARD DESIGN

* USE STYROFOAM SM, OR EQUIVALENT IN AREAS OF NO TRAFFIC. USE STYROFOAM HI 40, OR EQUIVALENT UNDER THE ACCESS ROAD

W = 2.7 m − Dc

Dp = DEPTH OF TOP OF PIPE
Dc = DEPTH OF COVER OVER INSULATION

IF Dc IS LESS THAN 0.9 m, t = 100 mm
IF Dc IS 0.9 m TO 1.5 m, t = 75 mm
IF Dc IS GREATER THAN 1.5 m, t = 50 mm



"INVERTED U" DESIGN

* USE STYROFOAM SM, OR EQUIVALENT IN AREAS OF NO TRAFFIC. USE STYROFOAM HI 40, OR EQUIVALENT UNDER THE ACCESS ROAD

W = (X+Y) = 2.7 m − Dc
Dp = DEPTH OF TOP OF PIPE
Dc = DEPTH OF COVER OVER INSULATION

IF Dc IS LESS THAN 0.9 m, t = 100 mm
IF Dc IS 0.9 m TO 1.5 m, t = 75 mm
IF Dc IS GREATER THAN 1.5 m, t = 50 mm

Note: Drawing is included for information purposes only and is to be interpreted with the corresponding Geotechnical Report.

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BC HOUSING
TEMPORARY HOUSING DEVELOPMENT
397 3RD AVENUE, PRINCE GEORGE, B.C.
INSULATION DETAIL FOR TRENCHES IN SOIL
LESS THAN DESIGN FROST DEPTH

SCALE: N.T.S.	DATE: 2023/11/15	DRAWN: LU	REVIEWED: DJM	PROJ: 38372	DWG: 38372-D1

APPENDIX D

DRAWING C001 CONCEPTUAL SERVICING PLAN

CIVIC ADRESS
397 3rd Ave,
PRINCE GEORGE, BC
V2L 5B6

LEGAL DESCRIPTION
LOT A BLK DL 343 PL EPP102681
PID: 031-214-754

PROPERTY AREA
3345.4m² (0.33 ha)

EXISTING ZONING
M1 – LIGHT INDUSTRIAL

SURVEY NOTES:

1. TOPOGRAPHIC AND PLANIMETRIC SURVEY PERFORMED OCT, 2023 BY L&M ENGINEERING LTD.

2. 1 IN 20 YEAR RETURN PERIOD = 568.80m

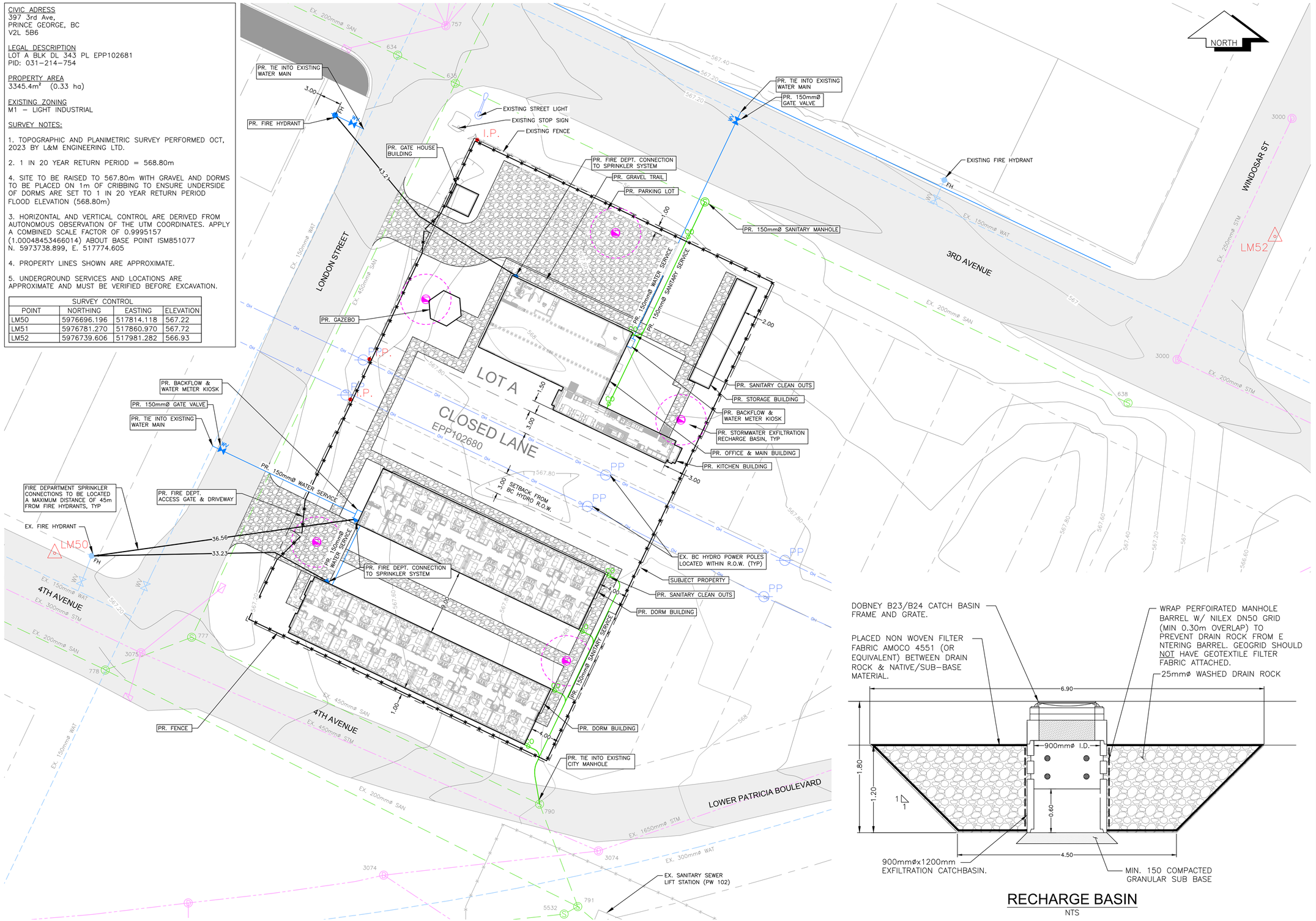
4. SITE TO BE RAISED TO 567.80m WITH GRAVEL AND DORMS TO BE PLACED ON 1m OF CRIBBING TO ENSURE UNDERSIDE OF DORMS ARE SET TO 1 IN 20 YEAR RETURN PERIOD FLOOD ELEVATION (568.80m)

3. HORIZONTAL AND VERTICAL CONTROL ARE DERIVED FROM AUTONOMOUS OBSERVATION OF THE UTM COORDINATES. APPLY A COMBINED SCALE FACTOR OF 0.9995157 (1.00048453466014) ABOUT BASE POINT ISM851077 N. 5973738.899, E. 517774.605

4. PROPERTY LINES SHOWN ARE APPROXIMATE.

5. UNDERGROUND SERVICES AND LOCATIONS ARE APPROXIMATE AND MUST BE VERIFIED BEFORE EXCAVATION.

SURVEY CONTROL			
POINT	NORTHING	EASTING	ELEVATION
LM50	5976696.196	517814.118	567.22
LM51	5976781.270	517860.970	567.72
LM52	5976739.606	517981.282	566.93



SITE PLAN
FULL: 1:250 HALF: 1:500

RECHARGE BASIN
NTS

LEGEND

EXISTING
- EX. TEST PIT & DRILL HOLE
- EX. BENCHMARK & SURVEY HUBS
- EX. IP's & ISM's
- EX. LEGAL LINE
- EX. LEGAL R.O.W. & EASEMENT
- EX. SANITARY & MANHOLE
- EX. SANITARY FORCE MAIN
- EX. STORM & MANHOLE
- EX. SINGLE & DOUBLE CATCHBASIN c/w CB LEADS
- EX. CATCHBASIN MANHOLE
- EX. FIRE HYDRANT & VALVE ASSEMBLY
- EX. WATERMAIN & VALVE
- EX. BLOW-OFF ASSEMBLY
- EX. CURB STOP
- EX. ROAD & SIDEWALK
- EX. ROAD SIGN(s)
- EX. FENCE
- EX. OVERHEAD LINES
- EX. UNDERGROUND LINES
- EX. POWER POLE & ANCHOR

PROPOSED
- PR. LEGAL LINE
- PR. LEGAL R.O.W. & EASEMENT
- PR. STRUCTURE
- PR. SANITARY & MANHOLE
- PR. STORM & MANHOLE
- PR. SINGLE & DOUBLE CATCHBASIN c/w CB LEADS
- PR. RECHARGE BASIN
- PR. CULVERT
- PR. DITCH or SWALE
- PR. FIRE HYDRANT & VALVE ASSEMBLY
- PR. WATERMAIN & VALVE
- PR. GRAVEL SHOULDER
- PR. ASPHALT
- PR. CURB & SIDEWALK
- PR. ROAD SIGN(s)
- PR. GRAVEL DRIVEWAY
- PR. FENCE

NO.	DATE (D/M/Y)	REVISION	BY

NOT FOR CONSTRUCTION

L&M ENGINEERING LIMITED

CITY OF PRINCE GEORGE
Development Services

CONSULTANTS PROJECT No.:	1620-02
DRAWN: AM	
CHECKED: JRB	
ENGINEER: JRB	
DATE: 15/12/23	
SCALES: FULL 1:250	
SCALES: HALF 1:500	

ATCO
397 3rd AVENUE
BC HOUSING TEMPORARY DORMS

CONCEPTUAL SERVICING PLAN

DRAWING No.
C001

0 7 14 Meters

G:\Job Files\1600\1620 - ATCO\02 - 397 3rd Ave\02 - Design\03 - CAD Files\c3d23 1620-02 CONCEPTUAL DESIGN.dwg