STORMWATER MANAGEMENT & SERVICING REPORT

3555 BORRISOKANE ROAD, BARRHAVEN City of Ottawa



PEARSONENG.COM

(Revised February 2025) July 2023 22099



TABLE OF CONTENTS

1.	INTR	ODUCTION	1
2.	SUP	PORTING DOCUMENTS	1
3.	WAT	ER SUPPLY AND DISTRIBUTION	1
	3.1. 3.2. 3.3.	WATER SERVICING DESIGN CRITERIA INTERNAL WATER DISTRIBUTION SYSTEM FIRE FIGHTING REQUIREMENTS	2
4.	SAN	ITARY SERVICING	2
	4.1. 4.2.	SANITARY DESIGN CRITERIA INTERNAL SANITARY SEWER SYSTEM	3 3
5.	STO	RMWATER MANAGEMENT	3
	5.1. 5.2. 5.3. 5.4. 5.5. 5.5.1 5.5.2		4 5 6
6.	CON	ICLUSIONS	7

APPENDICES

- Appendix A Water Servicing and Fire Flow Calculations
- Appendix B Sanitary Servicing Calculations
- Appendix C Stormwater Management Calculations
- **Appendix D** OGS Unit Manufacturer specifications and TSS removal table.
- Appendix E DSEL Storm Drainage Plan
- Appendix F Design Brief for the Half Moon Bay West Subdivision Phase 3, prepared by DSEL, dated November 18, 2021
- Appendix G Hydraulic Capacity and Modeling Analysis (Completed by Geo Advice)
- Appendix H Ottawa Servicing Report Checklist
- **Appendix I** Pre-Consultation Summary
- Appendix J Correspondence with MECP
- **Appendix K** Pearson Engineering Drawings



LIST OF FIGURES & DRAWINGS

- Figure 1 Site Location Plan
- Dwg SG-1 Site Grading Plan
- Dwg SS-1 Site Servicing Plan
- Dwg STM-1 Pre-Development Storm Catchment Plan
- **Dwg STM-2** Post-Development Storm Catchment Plan
- Dwg EPR-1 Erosion Protection and Removals Plan



STORMWATER MANAGEMENT & SERVICING REPORT 3555 BORRISOKANE ROAD, BARRHAVEN

1. INTRODUCTION

PEARSON Engineering Ltd. has been retained by the Ottawa Korean Community Church (Client) to prepare a Stormwater Management (SWM) & Servicing Report in support of a proposed church facility. The development is located at 3555 Borrisokane Road, Barrhaven in the City of Ottawa (City).

The subject property is approximately 1.39 ha in size and fronts onto Borrisokane Road to the west, vacant industrial lot to the north, drainage course to the east and environmentally protected lands to the south. The Project site currently consists of a vacant lot and proposes the development of a single-storey church and associated parking lot. The location of the site can be seen on Figure 1.

The objective of this report is to assess the existing municipal infrastructure in the vicinity of the Project, the onsite Stormwater Management (SWM) facilities and internal services required to service the proposed Project. The report also includes design calculations and a brief outline of the proposed internal services, as well as comments regarding the ability of the various secondary utilities to service the site.

2. SUPPORTING DOCUMENTS

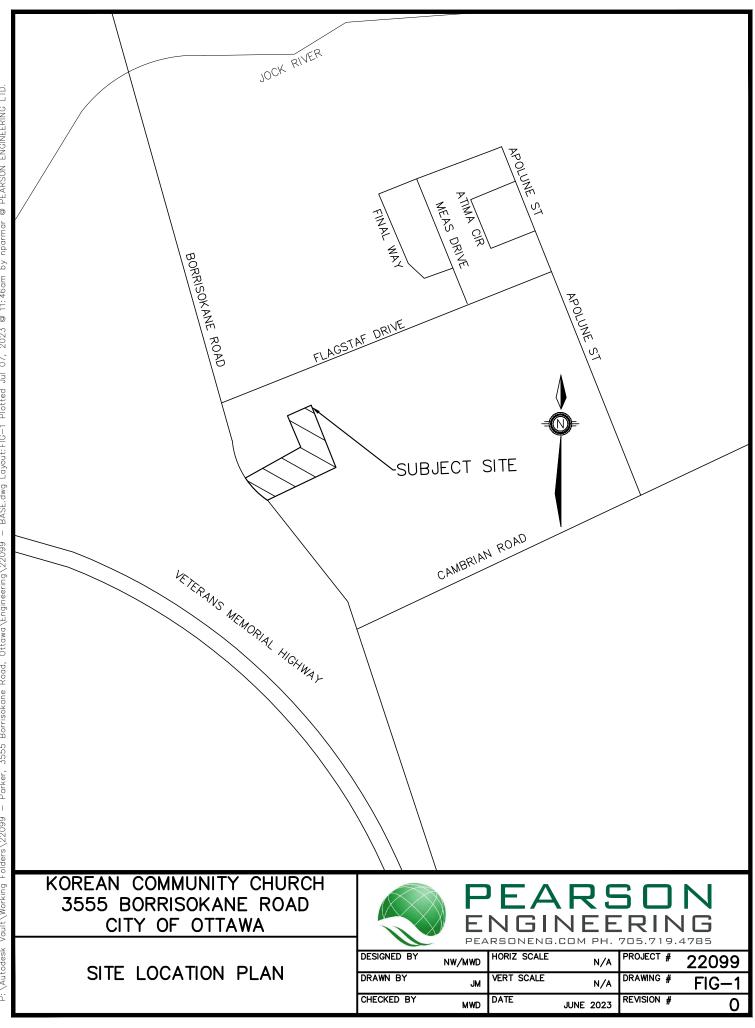
The following documents have been referenced in the preparation of this report:

- Ministry of the Environment, Design Guidelines for Sewage Works, 2008
- Ministry of the Environment, Design Guidelines for Drinking-Water Systems, 2008
- Ministry of the Environment, Stormwater Management Planning and Design Manual, March 2003
- City of Ottawa Sewer Design Guidelines, October 2012
- City of Ottawa Water Distribution Design Guidelines, July 2010

3. WATER SUPPLY AND DISTRIBUTION

3.1. WATER SERVICING DESIGN CRITERIA

The site is to have an Institutional land use area of approximately 1.39 ha. Utilizing the City of Ottawa Water Distribution Design Guidelines for Commercial and Institutional Use of 28,000 L/ha/day, an Average Day Demand (ADD) of 0.45 L/s was calculated. A Peak Rate factor of 1.80 was used in calculating a Peak Hour Demand (PHD) of 1.22 L/s for the development. Calculations for the domestic water requirements for the site can be found in Appendix A.





3.2. INTERNAL WATER DISTRIBUTION SYSTEM

As part of the Half Moon Bay West Subdivision, watermain was installed on Flaggstaff Drive and service stubs were provided for the proposed development block that will contain a car wash, the Korean Church and future development block. The Project will be serviced by extending the existing 200mm diameter water service stubs through the access/servicing easement past the future development site to the property line of the Korean Church site which provide domestic and fire flows. A 50 mm diameter water service for domestic use and a 150 mm diameter water service for fire use are proposed for the development from the property line to the Church building. An internal fire hydrant is proposed to provide adequate firefighting coverage as per City standards. Proposed layout of the water services can be seen on SS-1 Drawing in Appendix K.

3.3. FIRE FIGHTING REQUIREMENTS

Fire Flow calculations have been conducted as per FUS guidelines and resulted in a required fire flow of 133 L/s (2112 GPM). As per Figure F.1 of the Hydraulic Capacity and Modeling Analysis completed by GeoAdvice Engineering Inc. in support of Phase 3 of the Half Moon Bay Subdivision, the available fire flow at the watermain junction closest to the project site, J-82, is 372 L/s. The Hydraulic Capacity and Modeling Analysis Report can be seen in Appendix G.

The Boundary Conditions for the site were provided by the City of Ottawa using the project's domestic and fire flow demands. Water pressures shown in Table 1A and Table 1B were calculated based on the Hydraulic Grade Lines (HGL) provided by the City for existing and future conditions respectively. When comparing to the minimum and maximum allowable water pressures from City of Ottawa Water Design Guidelines, it can be seen that the site water pressures fall within City limits for the future conditions. Fire flow analysis, water pressure conversion and boundary conditions supplied by the City for both existing and future conditions can be found in Appendix A.

Design Parameter	Demand (L/s)	HGL (m)	Pressure (PSI)	Pressure (kPa)	City of Ottawa minimum (kPa)	City of Ottawa maximum (kPa)
Average Daily Demand	N/A	156.5	89.2	614.7	-	552
Peak Hour	N/A	142.6	69.4	478.5	276	552
Max Day + Fire Flow	N/A	137.7	62.4	430.4	140	552

Table 1A: Existing Boundary Conditions

Table 1B: Proposed Boundary Conditions

Design Parameter	Demand (L/s)	HGL (m)	Pressure (PSI)	Pressure (kPa)	City of Ottawa minimum (kPa)	City of Ottawa maximum (kPa)
Average Daily Demand	0.45	146.8	75.4	519.6	-	552
Peak Hour	1.22	142.8	69.7	480.4	276	552
Max Day + Fire Flow	133.7	142.4	69.1	476.5	140	552



4. SANITARY SERVICING

4.1. SANITARY DESIGN CRITERIA

The site is to have an Institutional land use area of approximately 1.39 ha. Utilizing the City of Ottawa Sewer Design Guidelines for Commercial and Institutional Use of 28,000 L/ha/day, an Average Day Demand (ADD) of 0.45 L/s was calculated. Using a Peak Rate factor of 1.50 and an infiltration allowance of 0.33 L/ha/s, a peak flow of 1.13 L/s was calculated for the proposed development. Calculations for the sanitary flows for the site can be found in Appendix B.

4.2. INTERNAL SANITARY SEWER SYSTEM

The sanitary sewers will be constructed in accordance with the City of Ottawa's Sewer Design Guidelines and the Ministry of the Environment, Conservation and Parks (MECP) guidelines in order to service the Project. Similar to the water servicing for the project, the existing sanitary sewer stub will be extended to the Korean Church property line through an access/servicing easement. A proposed 200 mm diameter sanitary sewer system for this Project is to convey sanitary flow to the proposed sanitary stub provided by the Carwash project which connects to monitoring MH1A and ultimately to the 300 mm diameter sanitary sewer on the Flagstaff Drive.

The actual velocity was calculated as per the City of Ottawa Sewer Guidelines for all sanitary sewers that have a flow depth of less than 30% of the diameter. Results provided in Appendix B demonstrate that an actual velocity of 0.60 m/s to 0.82 m/s is provided for the Project's proposed sanitary sewers, which is meeting the City's minimum velocity criteria of 0.60 m/s. Therefore, the Project's sanitary sewers will provide adequate self-cleansing velocities.

As per the Sanitary Sewer Calculation Sheet completed by DSEL for Flagstaff Drive, a future residential flow of 8.31 L/s was calculated from the east of the project site. The 300 mm diameter sanitary sewer on Flagstaff Drive runs east to west and has a capacity of 43.3 L/s at a slope of 0.20%. The Carwash Project (Part 1), future light industrial (Part 3), and the project site will therefore utilize approximately 20.5% of the sewer's capacity. As the proposed peak flow from the project site is 2.6 % of the current capacity of the existing sewer, it is expected to have sufficient capacity to convey the sanitary design flows. Refer to Drawing SS-1 for the proposed sanitary servicing layout in Appendix K.

5. STORMWATER MANAGEMENT

A key component of the development is the need to address environmental and related SWM issues. These are examined in a framework aimed at meeting the City of Ottawa and MECP requirements. This report focuses on the necessary measures to satisfy the MECP's SWM requirements.

It is understood the objectives of the SWM plan are to:

- Protect life and property from flooding and erosion;
- Maintain water quality for ecological integrity, recreational opportunities, etc.;
- Protect and maintain groundwater flow regime(s);
- Protect aquatic and fishery communities and habitats; and
- Maintain and protect significant natural features.



5.1. ANALYSIS METHODOLOGY

The design of the SWM Facilities for this site has been conducted in accordance with:

- The Ministry of the Environment, Stormwater Management Planning and Design Manual, March 2003
- City of Ottawa, Sewer Design Guidelines, October 2012

In order to design the facilities to meet these requirements, it is essential to select the appropriate modeling methodology for the storm system design. Given the size of the site, the Rational Method is appropriate for the design for the SWM system.

5.2. EXISTING DRAINAGE CONDITIONS

The Project site consists of a cleared lot with a temporary drainage channel along the south side of the property. Most of the site drains overland to a ditch along Borrisokane Road, the rest of the site drains overland to a water course immediately east of the site, in the Half Moon Bay West Subdivision. Both ultimately leading to Jock River. Details of existing storm drainage conditions are shown on Drawing STM-1 in Appendix K.

Paterson Group completed a geotechnical investigation for the site dated March 7th, 2019. The investigation revealed that the site consists of a layer of peat followed by brown silty sand with clay and this layer is followed by grey silty clay. There was no Groundwater found below the existing ground surface.

The site is located within the Half Moon Bay West Phase 3 subdivision. From the DSEL Storm Drainage Plan, dated August 2022, the allowable runoff coefficient for the site is 0.80. The Modified Rational Method and the City of Ottawa IDF curve parameters were used to determine allowable peak flows for the site and can be seen in Table 2 below. DSEL Storm Drainage Plan can be found in Appendix E. Detailed calculations for the existing drainage conditions can be found in Appendix C.

	2 Year	5 Year	100 Year
	Storm	Storm	Storm
Allowable Peak Flows (L/s)	225.8	306.4	306.4

Table 2: Allowable Peak Flows

5.3. PROPOSED STORM DRAINAGE SYSTEM

Post-development drainage patterns for the site will generally follow pre-development drainage conditions. The majority of the paved areas will be conveyed overland to a catchbasin and storm sewer system, sized for the 5-year storm event located throughout the site. A portion to the south of the proposed building will flow uncontrolled towards the existing ditch on Borrisokane Road and to the woodland area to the east. Stormwater from the building will drain via a roof leader to the storm sewer which outlets to the existing ditch on Borrisokane Road.

The project's storm sewer was sized for the minor storm event, defined as all storms up to and including the 5-year storm event, using the rational method. An orifice plate will be implemented downstream of CBMH3 to reduce the post-development peak flows leaving the site, causing stormwater to back up onto the surface. Surface ponding on the parking lot provides a total of 178 m³ of storage volume and underground structures provide a 24.62 m³ of volume. In the event of a storm greater than 100-year storm and/or if the orifice plate becomes blocked, stormwater will be conveyed overland through the top of curb weir located in the northwest corner of the parking lot towards the existing roadside ditch on Borrisokane Road.



Rideau Valley Conservation Authority (RVCA) requested to mimic the site's hydrological cycle. However, due to the soils present on site, infiltration would not be feasible. As such, best efforts have been implemented to recharge groundwater by proposing a bioretention trench. The runoff of approximately 0.11 ha area, from the southeast corner of the project site will be directed towards bioretention trench to infiltrate the stormwater into the ground.

A 900 mm diameter driveway culvert has been proposed beneath the driveway to Borrisokane Road to convey flows from the roadside ditch on the east side of Borrisokane Road. The culvert sizing was completed based on flow data from the Design Brief for the Half Moon Bay West Subdivision Phase 3, prepared by DSEL, dated November 18, 2021. DSEL calculated a flow of 0.77 m³/s for 100-year storm event, which was incorporated in the sizing of driveway culvert. Detailed culvert sizing calculations and the Design Brief completed by DSEL can be found in Appendix C and Appendix F respectively.

As per the City of Ottawa Sewer Design Guidelines, the 100-year plus 20% stress test event was considered to convey the flows without negatively affecting the building. A 10.0 m wide emergency weir located in the northwest corner of the parking lot will convey storm flows greater than the 100-year storm event. Calculations in Appendix C demonstrate that the separation between the 20% stress test conveyance elevation and the finished floor elevation of the church building will be 0.23 m. Post-development storm drainage patterns can be found on Drawing STM-2 in Appendix K.

5.4. STORMWATER QUANTITY CONTROL

The proposed development will increase the imperviousness of the site and as such the post development peak flows will increase. The calculated post-development runoff coefficient of 0.63 is smaller than the allowable runoff coefficient (as per DSEL Drawings) of 0.80. However, as per the City of Ottawa Sewer Design Guidelines, the 100-year post-development runoff is required to be controlled to the 5-year allowable flow values.

Quantity control on site will be provided through the use of surface ponding throughout the parking lot. A 240 mm diameter orifice plate will be implemented downstream of CBMH3 to reduce the post-development peak flows leaving the site, causing stormwater to back up onto the surface. Calculations in Appendix C demonstrate that 160 m³ of volume is required to control the 100-year storm event to the 5-year pre-development values. The site has been graded to provide a total of 178 m³ of storage in form of surface ponding and 24.6 m³ within underground structures with a maximum depth of 0.30 m as per the SSD calculations sheet in Appendix C. Table 3 summarizes post-development peak flows for the development.

	2 Year Storm	5 Year Storm	10 Year Storm	25 Year Storm	50 Year Storm	100 Year Storm
Controlled Peak Flows (L/s)	104.6	141.5	150.9	155.5	157.8	159.0
Uncontrolled Flows (L/s)	49.6	67.0	78.5	102.3	124.6	143.5
Total Flows (L/s)	154.2	208.5	229.4	257.8	282.4	302.5

 Table 3: Post-Development Peak Flows

By comparing Table 2 and 3, it can be seen that the post-development peak flows for the 2-year to 100-year storm has been reduced to at below 5-year allowable flow values.



5.5. STORMWATER QUALITY CONTROL

The MECP in March 2003 issued a "Stormwater Management Planning and Design Manual". This manual has been adopted by a variety of agencies including the City of Ottawa. The objective of the Stormwater Quality Control will be to ensure Enhanced Protection quality control as stated in the MECP manual. To achieve enhanced protection, permanent and temporary control of erosion and sediment transport are proposed and are discussed in the following sections.

5.5.1. PERMANENT QUALITY CONTROL

The development's active parking facilities pose a risk to stormwater quality through the collection of grit, salt, sand and oils on the paved surface. A CDS Oil/Grit Separator or equivalent treatment unit is proposed in order to treat the stormwater released from the site to MECP's Enhanced or Level 1 Protection standards. The MECP standards stipulates a Total Suspended Solids (TSS) removal of at least 80%. The CDS 2020-5-C unit will treat the post-development flows to the required MECP quality standard, achieving 81% TSS removal. Refer to Appendix D for OGS Unit Manufacturer specifications and TSS removal table.

5.5.2. QUALITY CONTROL DURING CONSTRUCTION ACTIVITIES

During construction, earth grading and excavation will create the potential for soil erosion and sedimentation. It is imperative that effective environmental and sedimentation controls are in place and maintained throughout the duration of construction activities to ensure stormwater runoff's quality.

Therefore, the following recommendations shall be implemented and maintained during construction to achieve acceptable stormwater runoff quality:

- Installation of silt fence along the entire perimeter of the site to reduce sediment migration onto surrounding properties;
- Restoration of exposed surfaces with vegetative and non-vegetative material as soon as construction schedules permit. The duration in which surfaces are disturbed/exposed shall not exceed 30 days;
- Reduce stormwater drainage velocities where possible; and,
- Minimize the amount of existing vegetation removed.



6. CONCLUSIONS

The proposed development will require the connection of sanitary and watermain services to the existing services.

Quantity control for the site is provided through surface ponding which will reduce the 100-year post development peak flows to the 5-year allowable peak flow levels.

An OGS unit is provided for the required quality control to satisfy the MECP Enhanced level requirements.

All of which is respectfully submitted,

PEARSON ENGINEERING LTD.

by ahled

Taylor Arkell, P.Eng. Senior Project Manager

Mike Dejean, P.Eng. Partner, Manager of Engineering Services





APPENDIX A

WATER SERVICING AND FIRE FLOW CALCULATIONS



3555 Borrisokane Road, Barrhaven Water Flow Calculations - Part 5

Design Criteria:

Average Water Consumption Rate (Q): Max. Daily Factor: Max. Hour Factor:

28,000 L/ha/d1.50 (From, Table 4.2, Ottawa Design1.80 Guidelines for Water DIstribution)

Site Data:

Description	De	nsity	5	Site Area		Flow Rate	Peaking Fac	tors
Institutional	13,923	m²		1.39 ha	a	28,000 L/ha/d	Max Daily Factor*	1.50
							Max Hour Factor*	1.80
							*From Ottawa Design	Guidelines
							based on Institutiona	l Land Use
Calculate Average Day Dem	and:							
ADD	=	28,000		х	1.39			
ADD	=	38,984	L/day					
ADD	=	0.45	L/s					
Calculate Max Daily Flow								
MDF	=	0.45		х	1.50			
MDF	=	0.68	L/s					
Calculate Max Hour Demand	ł							
PHD		0.68		х	1.80			
PHD	=	1.22	L/s					
PHD	=	19.30	GPM					



3555 Borrisokane Road, Barrhaven Fire Flow Calculations

Required fire flow calculations as per the Fire Underwritors Survey's Water Supply for Public Fire Protection - 2020:

Location:				ad, Barrhave	en		Project I	Date: Project: Number:	7/3/20 Korean Commu 2209	inity Church
OBC Occupancy:		A-2	- Churc	nes			•			
Building Foot		2					Туре	Cons	truction Class	Charge
Print:	2,914	· m²					5	W	ood Frame	1.50
							4	Heav	y Timber (A-D)	0.80 - 1.50
# of Stories:		1					3		Ordinary	1.00
							2	Non	-Combustible	0.80
							1		e Resistive	0.60
Construct	ion Clas	e.	Type 2	Non-C	Combustible	1	I		0 1100/01/10	0.00
0011311 401		5.	Type 2		Joinbustible				Contents	Charge
Automated Sprin	aklar Dra	taction		Credit	Total				-Combustible	
Automated Sprin			NL.		Total					-25%
NFPA 13 sprir			No	0%	00/				ed Combustible	-15%
Standard W			No	0%	0%			-	ombustible	0%
Fully Superv	used Sys	tem	No	0%					ee Burning	15%
								Ra	pid Burning	25%
Contents Fac	ctor:		L	imited Corr	nbustible		Cha	rge:	-15%	
Exposure S	ide	Length	- Height	Distance	e to Exposure	Charge			Separation	Charge
& Building	g	Ra	tio	Buil	lding (m)	Charge			Distance	Charge
North		. 1	00		>30	0%			0.0 - 3.0 m	10%
Prop. Comme	ercial	>	00		>30	0%			3.1 - 10.0 m	8%
East			00			00/			10.1 - 20.0 m	5%
Ex. Cleared	lot	> 1	00	>30		0%			20.1 - 30.0 m	3%
South							1		> 30.1 m	0%
Ex. Woodland	Area	> 1	00	>30		0%				
West										
Ex. Cleared	lot	> 1	00		>30	0%				
					Total:	0%				
					Total.	070	J			
Are Buildings	s Contigi	ious?	No]						
Fire Resista	nt Build	ing:	Are vertical	openings and e	exterior vertical comm	unications pro	otected with a	minimum or	e (1) hr rating?	
.			~			· • ·	<i>c</i> 1.1			
Calcula	ations:		<i>C</i> =	0.8	No	n-Combus	stible			
F	Required	Fire Flow	RFF	= 220 x C x	√A Where:	RFF= re	quired fire	e flow in li	ters per minute	
						C=Coef	ficient rela	ated to the	e type of construct	ion
Т	otal Effec	ctive Area	<i>A</i> =	2,914	m²				uare meters (exclu	
			A –	2,314			nts in build			luing
						Dasemer			uereu)	
			RFF =	9,500	L/min					
Round to Near	est 1000	L/min	RFF =	9,000	L/min	* Mu	ist be > 2,	000 L/mir	n or < 45,000 L/mir	า
Correction	n Factor	s:								
501100101		s. ts Charge		-1,350	L/min					
RFF Adju		-	F -			or "Mator	Supply fo	r Public E	ire Protection" no	20 note H·
			E =		-	er water		RFF = E -	Fire Protection" pg.	
RFF w/ S		Sprinkler	F =		L/min				1 7 0	
INFE W/ 3				7,650	L/min					



Exposure Charge	G =	0	L/min
RFF w/ Exposure Charge		7,650	L/min

Required Fire Flow:

Round to Nearest 1,000 L/min RFF = 8,000 L/min

RFF=	2,112	GPM
RFF =	133	L/s

RFF = 7,650 L/min

RFF = 7650 L/min - 0 L/min + 0 L/min RFF = 7650 L/min



3555 Borrisokane Road, Barrhaven Existing Boundary Conditions Unit Conversion

		5	,	Project	:	Korean Community Church
				Project Number:	:	22099
Street:	Borrisokane Road				Ground Elev (m):	93.8
	Height (m)	m H₂O	PSI	kPa	_	
Avg. Day	156.5	62.7	89.2	614.7		
Peak Hour	142.6	48.8	69.4	478.5		

62.4

430.4

Max Day + Fire Flow

137.7

43.9



3555 Borrisokane Road, Barrhaven Proposed Boundary Conditions Unit Conversion Project:

				Project:	Korean Community Church
				Project Number:	22099
Street:	Borrisokane Road			<u>Ground Elev (m):</u>	93.8
	Height (m)	m H₂O	PSI	kPa	
Avg. Day	146.8	53.0	75.4	519.6	
Peak Hour	142.8	49.0	69.7	480.4	

69.1

476.5

Max Day + Fire Flow

142.4

48.6



APPENDIX B

SANITARY SERVICING CALCULATIONS



3555 Borrisokane Road, Barrhaven Sanitary Flow Calculations - Part 5

Design Criteria

Average Water Consumption Rate (Q):	28,000	L/ha/d
Peak Flow	Qp = P * Q	* M / 86,400
Peaking Factor (M)	1.50	(From Ottawa Design Guidelines based on Institutional Land Use)
Infiltration Allowance (I _A):	0.33	L/ha/s

Site Data

Description	Den	sity	Site	Area	Flo	w Rate	
Institutional	13,923	m²	1.39 h	na	28,000	L/ha/d	
Calculate Average Daily Domand							
Calculate Average Daily Demand ADD	<u> </u>	28,000	х	1.39			
			86,400		-		
ADD	=	0.45	L/s				
Infiltration Allowance:	=	0.33	х	1.39			
	=	0.46	L/s				
Calculate Peak Flow:							
Qp	=	0.45	х	1.50			
	=	0.68	L/s				
Calculate Peak Flow (with Infiltrat	ion Allowand	<u>ce</u>					
Qp (with I _A)	=	0.46	+	0.68			
	=	1.14	L/s				



3555 Borrisokane Road, Barrhaven Sanitary Sewer Design Sheet

n = 0.013

 $\mathsf{M} = \mathsf{1} \! + \! (\mathsf{14} \! / \! (\mathsf{4} \! + \! (\mathsf{P} \! / \! \mathsf{1000})^{0.5}))$

Q_i = 0.23 L/ha/day

 $Q_{Industrial} = 35 \text{ m}^3/\text{ha}/\text{day}$ $Q_{tot} = Q_{Industrial} + Q_i$

Date:	3-Jul-24
File:	22099
Contract/Project:	3555 Borrisokane Rd., Barrhaven

_	Mar	nhole	Area	Area		Industrial	Length	Qi	Total	D	S	Q	V	V	Percent
Areas	From	То			М	Flow	-	(ACC.)	Q	(2020)	(0/)	Full	Actual	Full	Full
	From	10	(ha)	(ACC.)		(L/s)	(m)	(L/s)	(L/s)	(mm)	(%)	(L/s)	(m/s)	(m/s)	(%)
Part 5	SAN CAP	MH4A	1.39	0.00	4.00	0.00	22.3	0.46	1.14	200	0.56	24.5	0.60	0.78	4.6
	MH4A	МНЗА	0.00	0.00	4.00	0.00	33.8	0.00	1.14	200	0.56	24.5	0.60	0.78	4.6
Part 3	МНЗА	MH2A	0.38	0.38	4.00	1.32	56.1	0.13	2.58	200	0.65	26.4	0.82	0.84	9.8
Part 1	MH2A	MH1A	0.53	0.53	4.00	6.14	22.1	0.18	8.90	200	0.65	26.4	*	0.84	33.6
	MH1A	TEE	-	-	4.00	0.00	14.0	0.00	8.90	200	0.65	26.4	*	0.84	33.6
	EX MH 338A	EX MH 339A	-	-	-	-	49.5	-	17.21	300	0.20	43.3	*	0.61	39.8

Note: * indicates that the actual velocity calculation is not required as the flow depth is more than 0.30 m.

The Flow of 17.21 L/s = 8.90 L/s (Part 5, Part 3, Part 1) + 8.31 L/s (Future residential to the east as per DSEL Sanitary Catchments)

(1.5 <= M <= 4)



APPENDIX C

STORMWATER MANAGEMENT CALCULATIONS



3555 Borrisokane Rd, Barrhaven Calculation of Runoff Coefficients

Runoff Coefficient	=	0.20	0.90	0.90	0.80	0.90		Weighted
Surface Cover	=	Grass	Asphalt	Building	Gravel	Conc.		Runoff Coefficient
Allowable	Total Area	Area	Area	Area	Area	Area		
Allowable	(m ²)							
1	13232	13232	0	0	0	0		0.80
Pre Total	13232	13232	0	0	0	0		0.80
							1 1	
Post-Development	Total Area	Area	Area	Area	Area	Area	1 1	
Post-Development	(m ²)							
1	1453	0	0	1453	0	0		0.90
2	6092	946	4422	40	0	685	1	0.79
3	5686	4005	0	1501	0	181		0.41
Post Total	13232	4950	4422	2994	0	866	1	0.64

Note: As per DSEL Half Moon Bay West Phase 3 Storm Drainage Plan, an allowable runoff coefficient of 0.80 was used in calculating Pre-development peak flows.



3555 Borrisokane Rd, Barrhaven **Allowable Peak Flows**

City c	of Ottawa					
Storm Event (yrs)	Coeff A	Coeff B	Coeff C			
2	732.95	6.20	0.81			
5	998.07	6.05	0.81			
10	1174.18	6.01	0.82			
25	1402.88	6.02	0.82			
50	1569.58	6.01	0.82			
100	1735.69	6.01	0.82			
Area Number		1				
Area	1.32 ha					
Duraff Caafficiant	0.00	*				
Runoff Coefficient	0.80					
Time of Concentration	10	10 min				
Return Rate	2	year				
Peaking Coefficient (Ci)	1.00	jou				
Rainfall Intensity	76.81	mm/hr				
Allowable Peak Flow	225.8	L/s				
Return Rate	5	year				
Peaking Coefficient (Ci)	1.00	ycai				
Rainfall Intensity	104.19	mm/hr				
Allowable Peak Flow	306.4					

Modified Rational Method Q = CiCIA / 360

Where:

- Q Flow Rate (m³/s)
- C Rational Method Runoff Coefficient
- I Storm Intensity (mm/hr)
- A Area (ha.) Ci Peaking Coefficient

Note: As per DSEL Half Moon Bay West Phase 3 Storm Drainage Plan, an allowable runoff coefficient of 0.80 was used in calculating peak flows.



3555 Borrisokane Rd, Barrhaven **Post-Development Peak Flows**

Storm Event (yrs)	City of Ottawa Coeff A	Coeff B	Coeff C		Modified Ra Q = CiCIA /
2 5 10 25 50 100	732.95 998.07 1174.18 1402.88 1569.58 1735.69	6.20 6.05 6.01 6.02 6.01 6.01	0.81 0.81 0.82 0.82 0.82 0.82 0.82		Where: Q C I A Ci
Area Number Area	Controll 1 to 0.75	o 2	Uncontro 3 0.57	3	
Runoff Coefficient	0.81		0.41		
Time of Concentration	10	min	10	min	
Return Rate Peaking Coefficient (Ci) Rainfall Intensity Post-Development Peak Flow	1.00	year mm/hr L/s	1.00	year mm/hr L/s	
Return Rate Peaking Coefficient (Ci) Rainfall Intensity Post-Development Peak Flow	1.00	year mm/hr L/s	5 1.00 104.19 67.0		
Return Rate Peaking Coefficient (Ci) Rainfall Intensity Post-Development Peak Flow	1.00	year mm/hr L/s	1.00	year mm/hr L/s	
Return Rate Peaking Coefficient (Ci) Rainfall Intensity Post-Development Peak Flow	1.10	year mm/hr L/s	1.10	year mm/hr L/s	
Return Rate Peaking Coefficient (Ci) Rainfall Intensity Post-Development Peak Flow	50 1.20 161.47 329.9	mm/hr	1.20	year mm/hr L/s	
Return Rate Peaking Coefficient (Ci) Rainfall Intensity Post-Development Peak Flow	1.25	mm/hr	1.25	year mm/hr L/s	
Return Rate Peaking Coefficient (Ci) Rainfall Intensity Post-Development Peak Flow	1.50	mm/hr	1.50	year + 20% s mm/hr L/s	

- Q Flow Rate (m³/s)
 C Rational Method Runoff Coefficient
 I Storm Intensity (mm/hr)
- A Area (ha.)
- Ci Peaking Coefficient



3555 Borrisokane Rd, Barrhaven Stage-Storage-Discharge Table

Elevation	Volume	Cum. Vol.	Orifice Head	Orifice Flow	Weir Head	Weir Flow	Total Flow
(m)	(m ³)	(m ³)	(m)	(L/s)	(m)	(L/s)	(L/s)
90.97	0	0	0.000	0.0	0.000	0.0	0.0
91.78	23.2	23.2	0.690	104.9	0.000	0.0	104.9
92.40	0.0	23.2	1.310	144.5	0.000	0.0	144.5
92.45	0.8	24.0	1.360	147.2	0.000	0.0	147.2
92.50	5.0	29.0	1.410	149.9	0.000	0.0	149.9
92.55	14.0	42.9	1.460	152.5	0.000	0.0	152.5
92.60	29.1	72.1	1.510	155.1	0.000	0.0	155.1
92.65	49.6	121.7	1.560	157.7	0.000	0.0	157.7
92.66	13.0	134.6	1.570	158.2	0.000	0.0	158.2
92.67	14.2	148.9	1.580	158.7	0.000	0.0	158.7
92.68	15.8	164.6	1.590	159.2	0.000	0.0	159.2
92.69	17.5	182.1	1.600	159.7	0.000	0.0	159.7
92.70	19.3	201.4	1.610	160.2	0.000	0.0	160.2
92.75	0	201	1.660	162.7	0.050	47.5	210.2
92.80	0	201	1.710	165.1	0.100	134.4	299.5
92.85	0	201	1.760	167.5	0.150	246.9	414.4
92.90	0	201	1.810	169.8	0.200	380.1	550.0
92.95	0	201	1.860	172.2	0.250	531.3	703.4
93.00	0	201	1.910	174.5	0.300	698.3	872.8

Orifice Plate					
Diameter	240 mm				
Invert Elevation	90.97				
Orifice Constant	0.63				
Orifice Centroid	91.09				
Orifice Flow Formula	0.63π(D/2,000)2 x (2x9.81xH)0.5				

Emergency Overflow Weir				
Width	5.00 m			
Invert of Weir	92.70 m			
Weir Flow Formula	1.7WH ^{1.5}			

Note: * indicates the 100-year + 20% stress test event flows which will be conveyed through the emergency overflow weir at 0.23 m below the finished floor elevation.

Modified Rational Method Parameters

Pre Development Area (ha)	Post Development Area (ha)	Time of Concentration (min)	Time Increments (min)	Pre Development Runoff Coefficient	Post Development Runoff Coefficient
1.32	0.75	10	1	0.80	0.81

Note: Refer to page Calculation of Runoff Coefficients for detailed calculations of Modified Rational Method parameters.

Pre-Development Runoff Rate

	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
С	0.80	0.80	0.80	0.88	0.96	1.00
I	76.81	104.19	122.14	144.69	161.47	178.56
Α	1.32	1.32	1.32	1.32	1.32	1.32
Q	225.8	306.4	359.2	468.0	569.8	656.3

Note: Q = 0.00278CIA

Rainfall Station	City of Ottawa

		2	Year				5 Year			10	Year				25 \	Year				50 Y	Year				100	Year		
Time	Intensity	Inflow	Outflow	Storage	Difference	Intensity	Inflow Outflow Storage	Difference	Intensity	Inflow	Outflow	Storage	Difference	Intensity	Inflow	Outflow	Storage	Difference	Intensity		Outflow	Storage	Difference	Intensity			Storage	Difference
(min)	mm/hr	L/s	L/s	m ³	Binoronoo	mm/hr	L/s L/s m ³	Dinoronico	mm/hr	L/s	L/s	m ³	Dinoronico	mm/hr	L/s	L/s	m ³	Binoronioo	mm/hr	L/s	L/s	m ³	Dinoronoo	mm/hr	L/s	L/s	m ³	Dinoronoo
		Ľ, Ŭ	L 0	111						20	20	111			2,0	2,0				20	2,0				20	2,0		<u> </u>
1	148.14	252.4	104.6	-19	9	203.51	346.5 141.5 -26	12	239.57	407.8	150.9	-25	15	284.43	532.6	155.5	-19	21	317.75	649.1	157.8	-13	26	351.38	736.5	159.0	-8	30
2	133.33	227.2	104.6	-10	7	182.69	311.0 141.5 -14	9	214.88	365.8	150.9	-10	11	255.03	477.6	155.5	1	16	284.86	581.9	157.8	13	21	315.00	660.2	159.0	22	24
3	121.46	206.9	104.6	-4	5	166.09	282.8 141.5 -4	7	195.22	332.3	150.9	1	9	231.63	433.8	155.5	17	13	258.67	528.5	157.8	34	16	286.05	599.5	159.0	46	19
4	111.72	190.4	104.6	2	4	152.51	259.6 141.5 3	6	179.16	305.0	150.9	10	7	212.51	398.0	155.5	30	10	237.29	484.8	157.8	50	13	262.41	550.0	159.0	65	16
5	103.57	176.5	104.6	6	3	141.18	240.3 141.5 8	4	165.77	282.2	150.9	17	5	196.58	368.1	155.5	40	8	219.48	448.4	157.8	64	11	242.70	508.7	159.0	81	13
6	96.64	164.7	104.6	9	2	131.57	224.0 141.5 13	3	154.42	262.9	150.9	22	4	183.08	342.8	155.5	49	7	204.38	417.5	157.8	75	9	226.01	473.7	159.0	94	11
7	90.66	154.5	104.6	12	2	123.30	209.9 141.5 16	2	144.67	246.3	150.9	26	3	171.48	321.1	155.5	56	6	191.41	391.0	157.8	84	8	211.67	443.6	159.0	105	9
8	85.46	145.6	104.6	13	1	116.11	197.7 141.5 18	2	136.19	231.9	150.9	30	3	161.39	302.2	155.5	61	5	180.14	368.0	157.8	91	6	199.20	417.5	159.0	115	8
9	80.87	137.8	104.6	15	1	109.79	186.9 141.5 20	1	128.74	219.2	150.9	32	2	152.54	285.7	155.5	66	4	170.24	347.8	157.8	98	5	188.25	394.6	159.0	122	7
10	76.81	130.9	104.6	16	1	104.19	177.4 141.5 22	1	122.14	207.9	150.9	34	1	144.69	271.0	155.5	69	3	161.47	329.9	157.8	103	5	178.56	374.2	159.0	129	6
11	73.17	124.7	104.6	16	0	99.19	168.9 141.5 22	0	116.25	197.9	150.9	36	1	137.69	257.9	155.5	72	2	153.65	313.9	157.8	108	4	169.91	356.1	159.0	135	5
12	69.89	119.1	104.6	17	0	94.70	161.2 141.5 23	0	110.96	188.9	150.9	36	0	131.40	246.1	155.5	75	2	146.62	299.5	157.8	112	3	162.13	339.8	159.0	140	4
13	66.93	114.0	104.6	17	0	90.63	154.3 141.5 23	0	106.17	180.8	150.9	37	0	125.71	235.4	155.5	76	1	140.26	286.5	157.8	115	3	155.11	325.1	159.0	144	3
14	64.23	109.4	104.6	17	0	86.93	148.0 141.5 22	-1	101.82	173.3	150.9	37	0	120.55	225.7	155.5	78	1	134.49	274.8	157.8	117	2	148.72	311.7	159.0	147	3
15	61.77	105.2	104.6	16	-16	83.56	142.3 141.5 22	-22	97.85	166.6	150.9	37	0	115.83	216.9	155.5	79	1	129.22	264.0	157.8	119	2	142.89	299.5	159.0	150	2
16	59.50	101.4	0.0	0	0	80.46	137.0 0.0 0	0	94.21	160.4	150.9	36	-1	111.50	208.8	155.5	79	0	124.39	254.1	157.8	121	1	137.55	288.3	159.0	153	2
17	57.42	97.8	0.0	0	0	77.61	132.1 0.0 0	0	90.86	154.7	150.9	36	-36	107.52	201.4	155.5	79	0	119.94	245.0	157.8	122	1	132.63	278.0	159.0	155	2
18	55.49	94.5	0.0	0	0	74.97	127.6 0.0 0	0	87.76	149.4	0.0	0	0	103.84	194.5	155.5	79	0	115.83	236.6	157.8	123	1	128.08	268.4	159.0	156	1
19	53.70	91.5	0.0	0	0	72.53	123.5 0.0 0	0	84.88	144.5	0.0	0	0	100.43	188.1	155.5	79	-1	112.01	228.8	157.8	124	0	123.87	259.6	159.0	158	1
20	52.03	88.7	0.0	0	0	70.25	119.6 0.0 0	0	82.21	140.0	0.0	0	0	97.26	182.1	155.5	79	-1	108.47	221.6	157.8	124	0	119.95	251.4	159.0	159	1
21	50.48	86.0	0.0	0	0	68.13	116.0 0.0 0	0	79.72	135.7	0.0	0	0	94.30	176.6	155.5	78	-1	105.17	214.8	157.8	124	0	116.30	243.7	159.0	159	0
22	49.02	83.5	0.0	0	0	66.15	112.6 0.0 0	0	77.39	131.7	0.0	0	0	91.53	171.4	155.5	77	-1	102.08	208.5	157.8	124	0	112.88	236.6	159.0	160	0
23	47.66	81.2	0.0	0	0	64.29	109.4 0.0 0	0	75.21	128.0	0.0	0	0	88.94	166.6	155.5	76	-1	99.18	202.6	157.8	123	-1	109.68	229.9	159.0	160	0
24	46.37	79.0	0.0	0	0	62.54	106.5 0.0 0	0	73.15	124.5	0.0	0	0	86.51	162.0	155.5	75	-1	96.47	197.1	157.8	123	-1	106.68	223.6	159.0	160	0
25	45.17	77.0	0.0	0	0	60.90	103.7 0.0 0	0	71.22	121.3	0.0	0	0	84.22	157.7	155.5	73	-73	93.91	191.8	157.8	122	-1	103.85	217.7	159.0	160	0
26	44.03	75.0	0.0	0	0	59.35	101.0 0.0 0	0	69.40	118.2	0.0	0	0	82.05	153.7	0.0	0	0	91.50	186.9	157.8	121	-1	101.18	212.1	159.0	159	-1
27	42.95	73.2	0.0	0	0	57.88	98.5 0.0 0	0	67.68	115.2	0.0	0	0	80.01	149.8	0.0	0	0	89.22	182.3	157.8	120	-1	98.66	206.8	159.0	158	-1
28	41.93	71.4	0.0	0	0	56.49	96.2 0.0 0	0	66.05	112.5	0.0	0	0	78.08	146.2	0.0	0	0	87.06	177.9	157.8	119	-1	96.27	201.8	159.0	158	-1
29	40.96	69.8	0.0	0	0	55.18	93.9 0.0 0	0	64.51	109.8	0.0	0	0	76.25	142.8	0.0	0	0	85.02	173.7	157.8	118	-1	94.01	197.0	159.0	157	-1
30	40.04	68.2	0.0	0	0	53.93	91.8 0.0 0	0	63.05	107.3	0.0	0	0	74.51	139.5	0.0	0	0	83.08	169.7	157.8	116	-2	91.87	192.5	159.0	156	-1
31	39.17	66.7	0.0	0	0	52.74	89.8 0.0 0	0	61.65	105.0	0.0	0	0	72.86	136.4	0.0	0	0	81.23	165.9	157.8	115	-2	89.83	188.3	159.0	155	-1

: Maximum Storage Volume

3555 Borrisokane Rd, Barrhaven **Quantity Control Volume Calculations**

Surface Ponding Design Inputs

Storm Event (yrs)	Rational Method Coefficient A	Rational Method Coefficient B	Rational Method Coefficient C	Controlled Peak Flows (L/s)	Post Development Runoff Coefficient
2	732.95	6.20	0.81	104.6	0.81
5	998.07	6.05	0.81	141.5	0.81
10	1174.18	6.01	0.82	150.9	0.81
25	1402.88	6.02	0.82	155.5	0.89
50	1569.58	6.01	0.82	157.8	0.97
100	1735.69	6.01	0.82	159.0	1

Storm	Storage	Time				
Event (yrs)	(m ³)	(min)				
2	17	13				
5	23	13				
10	37	14				
25	79	17				
50	124	21				
100	160	23				

Note: Storage volume calculated as per Hydrology Handbook, Second Edition, American Society of Civil Engineers, 1996



DATE: FILE: CONTRACT/PROJECT: COMPLETED BY:

04-Oct-24
22099
3555 Borrisokane Rd, Barrhaven
NP



 $Q = 0.0028 C^{1}A (m^{3}/s)$ C = Runoff Coefficient

I = Rainfall Intensity = A/(Time+B)^C

A = Area (ha)

3555 Borrisokane Rd, Barrhaven DATE: 03-Oct-24 Storm Sewer Design Sheet FILE: 22099 5-Year Storm Event CONTRACT/PROJECT

3555 Borrisokane Road

	Mar	hole	Length		Increment		Total		Time		Total Q	S	D	Q	V	%
Areas	From	То	(m)	С	А	CA	CA	(m TO	iin) IN	(mm/h)	(L/s)	(%)	(mm)	Full (L/s)	Full (m/s)	Full
2	CB1	CBMH1	24.0	0.83	0.19	0.16	0.16	10.00	0.27	104.19	46.0	1.50	250	72.8	1.48	63.1%
	0004114	0004110	05.0	0.04	0.40	0.11	0.07	10.07	0.00	100 70		0.50	075	101.0	4.40	00.70/
2	CBMH1	CBMH2	25.3	0.84	0.13	0.11	0.27	10.27	0.38	102.79	77.7	0.50	375	124.0	1.12	62.7%
2	CBMH2	CBMH5	43.5	0.72	0.08	0.06	0.33	10.64	0.65	100.91	92.5	0.50	375	124.0	1.12	74.6%
	ODIVITIZ	ODINI 10	40.0	0.12	0.00	0.00	0.00	10.04	0.00	100.01	02.0	0.00	010	12-1.0	1.12	14.070
1	BLD	CBMH3	15.7	0.90	0.07	0.06	0.06	10.00	0.21	104.19	17.4	2.00	150	21.5	1.22	80.7%
	r	r	r	r			[r	[1	· · · · ·	r	1	r	r	r – –
1	BLD	TEE	13.7	0.90	0.06	0.05	0.05	10.00	0.14	104.19	15.7	3.50	150	28.5	1.61	54.9%
																0.11070
2	CBMH3	CBMH4	27.3	0.78	0.06	0.05	0.16	10.21	0.47	103.07	46.3	0.50	300	68.4	0.97	67.8%
2	CBMH4	MH1	16.2	0.82	0.08	0.06	0.22	10.68	0.24	100.71	62.5	0.50	375	124.0	1.12	50.4%
2	CDIVIN4		10.2	0.02	0.06	0.00	0.22	10.00	0.24	100.71	02.0	0.50	575	124.0	1.12	50.4%
2	MH1	CBMH5	21.4	0.00	0.00	0.00	0.22	10.93	0.32	99.54	61.8	0.50	375	124.0	1.12	49.9%
										1	1		1			
	ODMUS	000	5.0	0.70	0.00	0.00	0.04	44.00	0.07	07.04	444.5.*	0.50	505	204.4	4.40	40.50/
-	CBMH5	OGS	5.8	0.72	0.08	0.06	0.61	11.29	0.07	97.84	141.5 *	0.50	525	304.1	1.40	46.5%
-	OGS	OUTLET	18.4	0.00	0.00	0.00	0.61	11.36	0.22	97.52	141.5 *	0.50	525	304.1	1.40	46.5%
_	000	JUILLI	10.4	0.00	0.00	0.00	0.01	11.50	0.22	51.52	141.5	0.00	525	507.1	1.40	-0.070

Note: * indicates orifice plate flow



3555 Borrisokane Rd, Barrhaven Bioretention Filter Calculations

Use Infiltration volumes from Table 3.2 to size Bioretention Filter From Table 3.2 Water Quality Storage Requirements are as follows:

Design Area Imperviousness Storage Volume	=	0.11 4 15.0	ha % m ³ /ha	(Enhanced 80% long-term S.S. removal)
Storage Volume Required	= =	0.11 1.7	x m ³	15.0

Use Equation 4.12 to find Area of Bioretention Filter

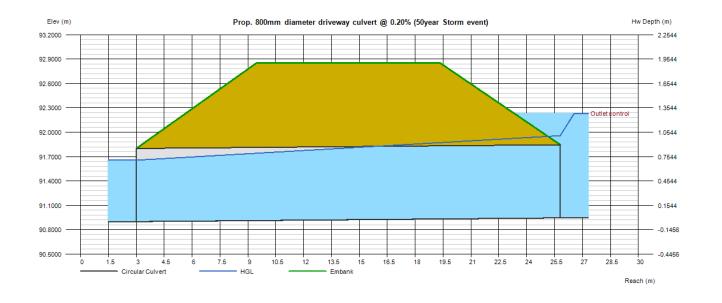
Design Volume (V) Depth of Controlling Filter Medium (d) Coefficient of Permeability of the Controlling Filter Media (k)	= =	1.7 0.5 45.0	m ³ m mm/hr				
Operating Head of Water On the Filter (h) Design Drawdown Time (t)	= =	0.15 36	m hr				
Surface Area Of Filter (A)	= _ =	1000Vd k(h+d)t 0.8	— m²				
Surface Area	=	Required 0.8	m²	Provided 10.0 m ²	Propose 10	d Dimens x	sions 1

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Prop. 800mm diameter driveway culvert @ 0.20% (50year Storm event)

Invert Elev Dn (m) Pipe Length (m) Slope (%) Invert Elev Up (m) Rise (mm)	= 90.9000 = 22.8000 = 0.2000 = 90.9456 = 900.0	Calculations Qmin (cms) Qmax (cms) Tailwater Elev (m)	= 1.0700 = 1.0700 = (dc+D)/2
Shape	= Circular	Highlighted	
Span (mm)	= 900.0	Qtotal (cms)	= 1.0700
No. Barrels	= 1	Qpipe (cms)	= 1.0700
n-Value	= 0.024	Qovertop (cms)	= 0.0000
Culvert Type	= Circular Corrugate Metal Pipe	Veloc Dn (m/s)	= 1.8759
Culvert Entrance	= Projecting	Veloc Up (m/s)	= 1.6819
Coeff. K,M,c,Y,k	= 0.034, 1.5, 0.0553, 0.54, 0.9	HGL Dn (m)	= 91.6559
		HGL Up (m)	= 91.9570
Embankment		Hw Elev (m)	= 92.2312
Top Elevation (m)	= 92.8500	Hw/D (m)	= 1.4284
Top Width (m)	= 9.9000	Flow Regime	= Outlet Control
Crest Width (m)	= 9.9000	-	





APPENDIX D

OGS UNIT MANUFACTURER SPECIFICATIONS AND TSS REMOVAL TABLE



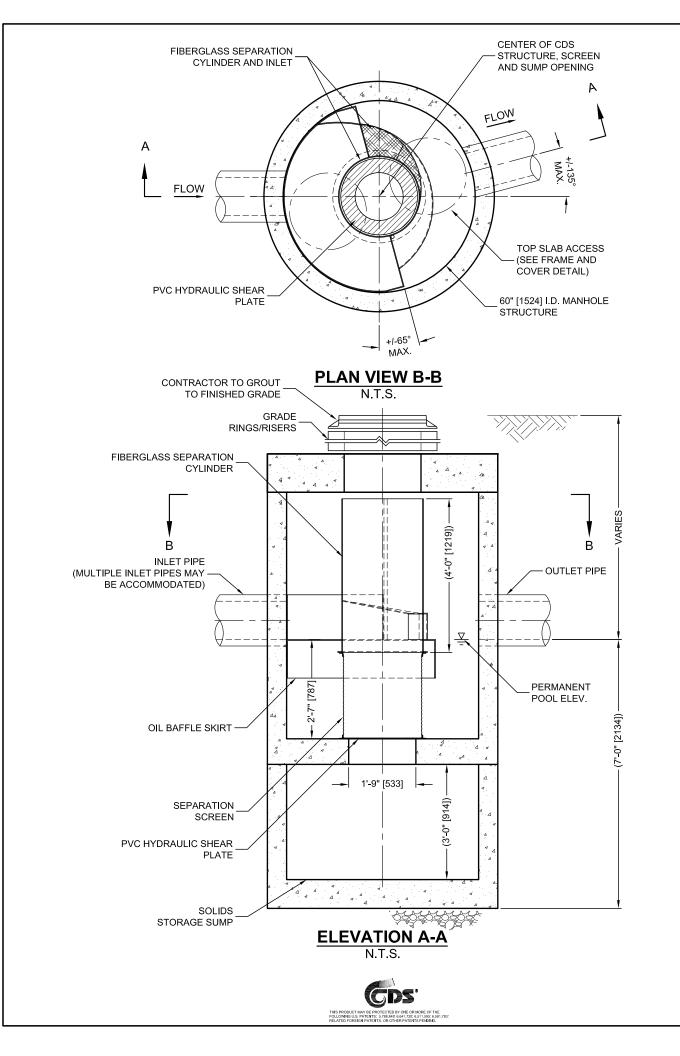
CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD BASED ON A FINE PARTICLE SIZE DISTRIBUTION



Project Name:	3555 Borrisoka	ane Rd		Engineer:	Pearson Engi	neering				
Location:	Ottawa, ON			Contact:	Nikhil Parmar	E.I.T.				
OGS #:	OGS			Report Date:	26-Jun-23					
	000				20 0411 20					
Area	0.97	ha		Rainfall Statio	n #	215				
Weighted C	0.76			Particle Size D	Distribution	FINE				
CDS Model	2020			CDS Treatmer	l/s					
Rainfall	Percent	Cumulative	Total	1		Removal				
Intensity ¹	Rainfall	Rainfall	Flowrate	Treated	Operating	Efficiency	Incrementa			
(mm/hr)	Volume ¹	Volume	(l/s)	Flowrate (I/s)	<u>Rate (%)</u>	<u>(%)</u>	Removal (%			
(11111/111)	Volume	volume	(//5)			(70)				
0.5	9.2%	9.2%	1.0	1.0	3.3	97.9	9.0			
1.0	10.6%	19.8%	2.0	2.0	6.6	97.0	10.3			
1.5	9.9%	29.7%	3.1	3.1	9.9	96.0	9.5			
2.0	8.4%	38.1%	4.1	4.1	13.2	95.1	8.0			
2.5	7.7%	45.8%	5.1	5.1	16.4	94.1	7.2			
3.0	5.9%	51.7%	6.1	6.1	19.7	93.2	5.5			
3.5	4.4%	56.1%	7.2	7.2	23.0	92.3	4.0			
4.0	4.7%	60.7%	8.2	8.2	26.3	91.3	4.3			
4.5	3.3%	64.0%	9.2	9.2	29.6	90.4	3.0			
5.0	3.0%	67.1%	10.2	10.2	32.9	89.4	2.7			
6.0	5.4%	72.4%	12.3	12.3	39.5	87.5	4.7			
7.0	4.4%	76.8%	14.3	14.3	46.1	85.7	3.7			
8.0	3.5%	80.3%	16.4	16.4	52.6	83.8	3.0			
9.0	2.8%	83.2%	18.4	18.4	59.2	81.9	2.3			
10.0	2.2%	85.3%	20.5	20.5	65.8	80.0	1.7			
15.0	7.0%	92.3%	30.7	30.7	98.7	70.6	4.9			
20.0	4.5%	96.9%	41.0	31.2	100.0	53.3	2.4			
25.0	1.4%	98.3%	51.2	31.2	100.0	42.7	0.6			
30.0	0.7%	99.0%	61.5	31.2	100.0	35.6	0.2			
35.0	0.5%	99.5%	71.7	31.2	100.0	30.5	0.1			
40.0	0.5%	100.0%	82.0	31.2	100.0	26.7	0.1			
45.0	0.0%	100.0%	92.2	31.2	100.0	23.7	0.0			
50.0	0.0%	100.0%	102.5	31.2	100.0	21.3	0.0			
							87.5			
Removal Efficiency Adjustment ² =										
Predicted Net Annual Load Removal Efficiency =										
Predicted % Annual Rainfall Treated =										

* CDS Efficiency based on testing conducted at the University of Central Florida

** CDS design flowrate and scaling based on standard manufacturer model & product specifications

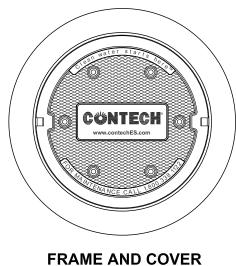


CDS PMSU2020-5-C DESIGN NOTES

THE STANDARD CDS PMSU2020-5-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION

GRATED INLET ONLY (NO INLET PIPE)	
GRATED INLET WITH INLET PIPE OR PIPES	
CURB INLET ONLY (NO INLET PIPE)	
CURB INLET WITH INLET PIPE OR PIPES	
CUSTOMIZABLE SUMP DEPTH AVAILABLE	
ANTI-FLOTATION DESIGN AVAILABLE UPON REQUEST	



(DIAMETER VARIES) N.T.S.

GENERAL NOTES

- 1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- 2. DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
- SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
- MAINTENANCE CLEANING.

INSTALLATION NOTES

- SPECIFIED BY ENGINEER OF RECORD.
- в. (LIFTING CLUTCHES PROVIDED).
- CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE. C.
- D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
- Ε. SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.



CDS PMSU2020-5-C **INLINE CDS** STANDARD DETAIL

CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS

CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE

4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. 5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. 6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING

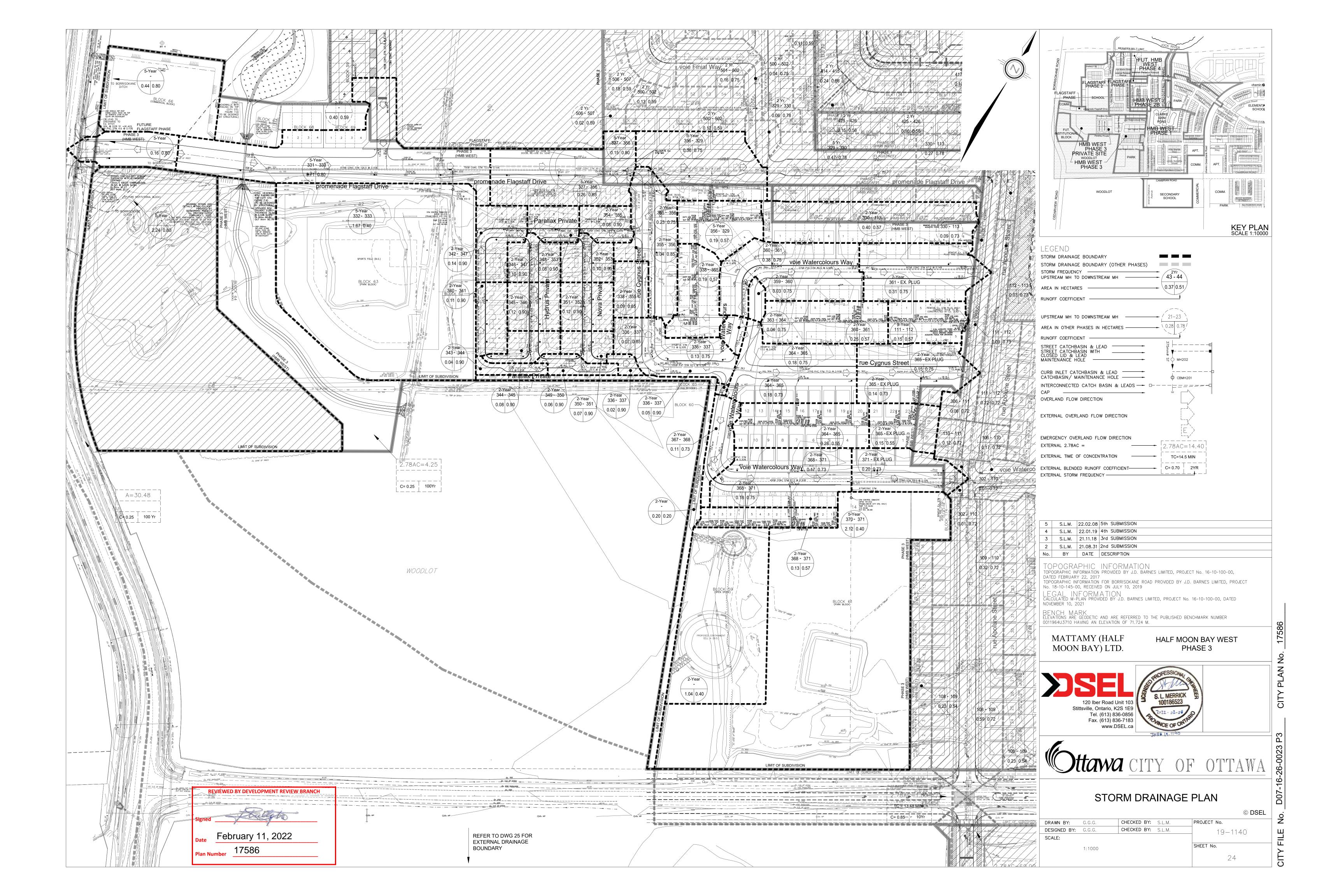
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED

SITE SPECIFIC DATA REQUIREMENTS											
STRUCTURE ID											
WATER QUALITY FLOW RATE (CFS OR L/s) *											
PEAK FLOW RATE (CFS OR L/s) *											
RETURN PERIOD		*									
SCREEN APERTU		*									
PIPE DATA:	DIAMETER										
INLET PIPE 1	*										
INLET PIPE 2	*		*		*						
OUTLET PIPE	*		*		*						
RIM ELEVATION					*						
ANTI-FLOTATION	BALLAST		WIDTH	Т	HEIGHT						
	ANTI-FLOTATION BALLAST WIDTH										
NOTES/SPECIAL REQUIREMENTS:											
* PER ENGINEER	OF RECOF	RD									



APPENDIX E

DSEL STORM DRAINAGE PLAN





APPENDIX F

DESIGN BRIEF FOR THE HALF MOON BAY WEST SUBDIVISION PHASE 3, PREPARED BY DSEL, DATED NOVEMBER 18, 2021



David Schaeffer Engineering Ltd. 120 Iber Road, Suite 103 Stittsville, ON K2S 1E9 613-836-0856 dsel.ca

DESIGN BRIEF

FOR THE

HALF MOON BAY WEST SUBDIVISION PHASE 3

MATTAMY (HALF MOON BAY) LIMITED

CITY OF OTTAWA

PROJECT NO.: 19-1140

NOVEMBER 18, 2021 3RD SUBMISSION © DSEL

DESIGN BRIEF FOR THE HALF MOON BAY WEST SUBDIVISION PHASE 3

MATTAMY (HALF MOON BAY) LIMITED

PROJECT NO: 19-1140

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	Existing Conditions	3
1.2	Existing Permits / Approvals	5
1.3	Required Permits / Approvals	6
2.0	GUIDELINES, PREVIOUS STUDIES, AND REPORTS	7
2.1	Existing Studies, Guidelines, and Reports	7
3.0	WATER SUPPLY SERVICING	11
3.1	Existing Water Supply Services	11
3.2	Proposed Water Supply	11
	3.2.1 Fire Flow Demand	
	3.2.2 Boundary Conditions3.2.3 Water Demands	
	3.2.4 Summary of Hydraulic Modeling Analysis	
3.3	MSS Conformance	16
3.4	Water Supply Conclusion	16
4.0	WASTEWATER SERVICING	17
4.1	Existing Wastewater Services	17
4.2	Wastewater Design	17
	4.2.1 Design Flows	18
4.3	MSS Conformance	
4.4	Wastewater Servicing Conclusion	20
5.0	STORMWATER CONVEYANCE	21
5.1	Existing Conditions	21
5.2	Minor System	21
5.3	Major System	24

19-1140

- 4		~ 4
5.4	Sump Pumps	24
5.5	Submerged Sewers	26
5.6	Proposed Outlet – Stormwater Management (SWM) Pond	27
5.7	Flagstaff Drive Culvert Crossing at Borrisokane	27
5.8	Flagstaff Drive Habitat Channel Culvert Crossing	27
5.9	MSS Conformance	28
5.10	Stormwater Conveyance Conclusion	28
6.0	SITE GRADING	30
6.1	Grading and Drainage	30
6.2	Grading Criteria	31
7.0	EROSION AND SEDIMENT CONTROL	32
8.0	CONCLUSIONS AND RECOMMENDATIONS	33

FIGURES

Figure 1	Key Plan
Figure 2	Subdivision Plan
Figure 3	Water Servicing
Figure 4	Sanitary Servicing
Figure 5	Storm Servicing

TABLES

- Table 1.1Development Statistics for HMB West Phase 3
- Table 1.2Existing Approvals
- Table 1.3Required Permits and Approvals
- Table 3.1Water Supply Design Criteria
- Table 3.2Boundary Conditions
- Table 3.3Summary of Water Demands in HMB West Phase 3
- Table 3.4Summary of Available System Pressures
- Table 3.5Summary of Available Fire Flows
- Table 4.1Wastewater Design Criteria
- Table 4.2External Areas to the North Outlet
- Table 4.3Peak Flows to the South Outlet
- Table 5.1Storm Sewer Design Criteria
- Table 5.2Sump Pump Design Criteria

19-1140

APPENDICES

Appendix A	Existing Approvals
Appendix B	Water Distribution Network Boundary Condition Request for Flagstaff and Half Moon Bay West (GeoAdvice, March 11, 2021) Hydraulic Capacity and Modeling Analysis for Half Moon Bay West Phase 3 – Final Report (GeoAdvice, May 31, 2021)
Appendix C	 HMB West Phase 3 Sanitary Drainage Area Plans (DSEL, November 18, 2021) HMB West Phase 3 Sanitary Design Sheets (DSEL, November 18, 2021) Glenview Flagstaff Phase 1 Sanitary Drainage Area Plan (DSEL, March 27, 2020) Glenview Flagstaff Phase 1 Sanitary Design Sheets (DSEL, March 27, 2020) HMB West Phase 1 Sanitary Drainage Area Plan (DSEL, October 29, 2018) HMB West Phase 1 Sanitary Design Sheets (DSEL, October 29, 2018)
Appendix D	 HMB West Phase 3 Storm Drainage Area Plans (DSEL, November 18, 2021) HMB West Phase 3 Storm Design Sheets (DSEL, November 18, 2021) Phase 3 of the Half Moon Bay West Subdivision / Proposed Culvert under Flagstaff Drive (JFSA, June 3, 2021) Runoff Coefficient Calculations (DSEL, May 2021)
Appendix E	Phase 2 of the Flagstaff Subdivision / Cambrian Woods Natural Channel Design (JFSA, September 28, 2021) Geotechnical recommendations – Frost Protection and for Natural Channel Crossings, PG2246- MEMO.71 Revision 1 (Paterson Group, November 8, 2021)
Appendix F	Sump Pump Feasibility Report, PG4073-LET.02 Revision 6 (Paterson Group, August 25, 2021)

DESIGN BRIEF FOR THE HALF MOON BAY WEST SUBDIVISION PHASE 3

MATTAMY (HALF MOON BAY) LIMITED

PROJECT NO: 19-1140

1.0 INTRODUCTION

This design brief is submitted in support of Half Moon Bay West Phase 3 on behalf of Mattamy (Half Moon Bay) Limited.

The Mattamy Half Moon Bay Lands are located in the Barrhaven South Community in the City of Ottawa. The Half Moon Bay (HMB) West Subdivision is more specifically located west of the Future Greenbank Road, east of Borrisokane Road, south of the Jock River and north of Cambrian Road, as shown on *Figure 1*. The Clarke SWM Pond and Outlet Channel, HMB West Phase 1, and HMB West Phase 2 are currently constructed and this report describes the servicing of the HMB West Phase 3 development. North of the site is the Flagstaff Subdivision, currently under development by Glenview Homes (Cedarview) Limited.

In addition to HMB West Phase 3, the M-Plan (JD Barnes, November 10, 2021) includes the extension of Flagstaff Drive to Borrisokane Road, Commercial Block 66, and Glenview Homes (Cedarview) Limited townhouse Blocks 68 and 69, on the north side of Flagstaff Drive. The design also provides servicing for the future institutional block on the south side of Flagstaff Drive, adjacent to Borrisokane Road.

HMB West Phase 3 is comprised of the following, as presented on *Figure 2* and presented in *Table 1.1*.

19-1140

Land Use	Total Area (ha)	Projected Residential Units		Residential Population per Unit*	Projected Population*
Residential & Roads	4.84	Singles	23	3.4	79
Residential & Roads	4.04	Towns	103	2.7	279
Private Site Block	1.46	Back-to-back Towns	94	2.7	254
Walkway/Servicing Block 58 & 62	0.05				
Artesian Block 59	0.73				
5 m Woodlot Buffer Block 60	0.13				
Park Block 61	2.12				
Park Block 63	1.65				
Natural Corridor Block 64	0.80				
Residential (Glenview)	0.18	Towns	8	2.7	22
Natural Corridor Block 67 (Flagstaff – North)	0.13		1		
Commercial Block 66 (Flagstaff – North)	0.44				
TOTAL – M-Plan M-Plan (JD Barnes, 2021-11-10)	12.53	228			634
Future Institutional Block (Flagstaff – South)	2.24				
TOTAL – M-Plan + Others	14.77	228			634

Table 1.1: Development Statistics for HMB West Phase 3

*Note: Population projections may differ from population estimates used in other studies. Population projection and residential population per unit values are based on City of Ottawa and MECP design criteria for servicing demand calculations.

The subject property is within the study area of the **Barrhaven South Master Servicing Study** (Stantec, June 2007) and the **Barrhaven South Master Servicing Study Addendum** (Stantec, October 12, 2017), which is considered to best represent current servicing for the subject property and adjacent developments.

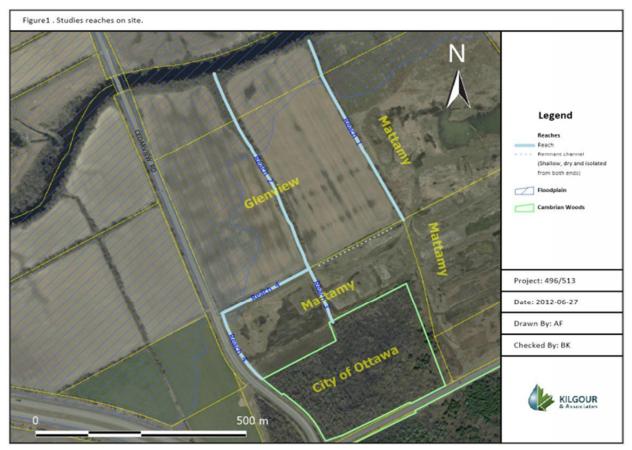
The Private Site Block is included as part of the engineering design for Half Moon Bay West Phase 3; however, it has been presented as a separate drawing set for presentation purposes. This report should be read in conjunction with the *Engineering Drawings* for Half Moon Bay West Phase 3 (DSEL, November 18, 2021) and the *Engineering Drawings* for Half Moon Bay West Phase 3 – Private Site (DSEL, November 18, 2021).

This design brief is provided to demonstrate conformance with the design criteria of the City of Ottawa, background studies, including the Master Servicing Study, Master Servicing Study Addendum, and general industry practice.

19-1140

1.1 Existing Conditions

The majority of the overall HMB West site has been stripped of topsoil and earth has been moved over the past 10 years. The overall site previously consisted of agricultural fields, with the exception of the southern portion of the site where a treed area formerly existed. The existing elevations within the proposed overall development area generally range between 91.5 m to 94.0 m. Existing ditches crossed HMB West Phase 3 along with the adjacent Glenview Flagstaff development and are detailed in the *Headwater Drainage Feature Assessment* (Kilgour & Associates Ltd., July 2016). Mitigation requirements were reported for Reach 2 and 3, which are on Mattamy and Glenview property, respectively, as shown on the excerpt below from the *HDFA*.



Glenview Homes and Mattamy Homes have received permission from the Rideau Valley Conservation Authority (RVCA) for the relocation of these existing features to a new natural corridor west of Glenview's Flagstaff Phase 2. The new natural corridor will allow for development of Flagstaff Phase 2 and HMBW Phase 3 per the Draft Plan of Subdivisions for the two developments. The natural corridor has been designed by others.

19-1140

HMB West Phase 3 is within the Jock River watershed and is under the jurisdiction of the Rideau Valley Conservation Authority (RVCA).

Throughout the site, the soil consists of silty sand to silty clay fill or topsoil at ground surface underlain by a relatively deep deposit of silty clay overlying glacial till. The Clarke SWM Pond, Outlet Channel and HMB West Phase 1 and 2 are approved and have been constructed.

HMB West Phase 3 is subject to grade raise restrictions with permissible being between 93.6 m and 93.9 m for the road and between 93.3 m and 93.6 m for the housing, based on the *Geotechnical Investigation* by Paterson Group (PG2246-1, Revision 7, April 19, 2021). The grading and servicing have been designed to keep grades as low as possible due to the grade raise restrictions in the area.

19-1140

1.2 Existing Permits / Approvals

The existing approvals related to the HMB West Phase 3 development are presented in *Table 1.2* and the approvals are enclosed in *Appendix A*.

Agency	Approval Type	Approval Number	Remarks
Ministry of the Environment, Conservation and Parks (MECP)	Permit To Take Water	3205-A4ZLZ6 January 27, 2016	Permit to take water for overall Half Moon Bay Subdivision
Ministry of the Environment, Conservation and Parks (MECP)	Environmental Compliance Approval	3029-ACNJPT August 12, 2016	Construction of sanitary and storm sewers in Half Moon Bay North Phase 7 Subdivision
Ministry of the Environment, Conservation and Parks (MECP)	Environmental Compliance Approval	6068-AWUPL5 April 11, 2018	Construction of Clarke stormwater management pond (SWM Pond) and outlet channel
Ministry of the Environment, Conservation and Parks (MECP)	Environmental Compliance Approval	2725-B5VKYF October 30, 2018	Construction of sanitary and storm sewers, temporary diversion ditch and temporary culvert in Half Moon Bay West Phase 1 Subdivision
Ministry of the Environment, Conservation and Parks (MECP)	Environmental Compliance Approval	3997-BF2GWX August 16, 2019	Construction of sanitary and storm sewers, temporary diversion ditch and temporary culvert in Half Moon Bay West Phase 2A Subdivision
Ministry of the Environment, Conservation and Parks (MECP)	Environmental Compliance Approval	3263-BKWJW9 January 28, 2020	Construction of sanitary and storm sewers in Half Moon Bay West Phase 2B Subdivision
Rideau Valley Conservation Authority (RVCA)	Alteration of Waterways Permit	RV5-01/18 March 15, 2018	Permit for Clarke SWM Pond and outlet channel design
Rideau Valley Conservation Authority (RVCA)	Alteration of Waterways Permit	RV5-1421 June 2, 2020	Permit for closure and relocation of an existing headwater drainage feature, with the new design featuring natural channel design principles and habitat features.
Department of Fisheries and Oceans (DFO)	Authorization	PR-05-1840	Authorization was attained to authorize the harmful alteration, disruption or destruction of fish habitat due to infilling of the existing drain channels and realignment of the West Clarke, East Clarke, Todd and Corrigan Drains.

Table 1.2 – Existing Approvals

19-1140

1.3 Required Permits / Approvals

HMB West Phase 3 is subject to the following permits and approvals, presented in *Table 1.3*:

Agency	Approval Type	Trigger	Remarks
City of Ottawa	Commence Work Notification (CWN)	Construction of new sanitary and storm sewers throughout the subdivision.	The City of Ottawa will issue a commence work notification for construction of the sanitary and storm sewers in Phase 3 once an ECA is issued by the MECP.
City of Ottawa	MECP Form 1 – Record of Watermains Authorized as a Future Alteration	Construction of watermains throughout the subdivision.	The City of Ottawa will review the watermains on behalf of the MECP through the Form 1 - Record of Watermains Authorized as a Future Alteration.
Ministry of the Environment, Conservation and Parks (MECP)	Environmental Compliance Approval (ECA) for sanitary and storm sewers in Phase 3 – Subdivision, artesian containment cells, and outlet ditch	Construction of new sanitary and storm sewers throughout the subdivision. Construction of artesian containment cells and associated outlet ditch.	The MECP will review and approve the sanitary sewer, storm sewer, artesian containment cell, and outlet ditch designs through the Transfer of Review Program.
Ministry of the Environment, Conservation and Parks (MECP)	Environmental Compliance Approval (ECA) for sanitary and storm sewers in Phase 3 – Private Site	Construction of new sanitary and storm sewers throughout the private site.	Submitted separate application for Private site. The MECP will review and approve the sanitary and storm sewer design for through the Transfer of Review Program.

Table 1.3: Required Permits and Approvals

19-1140

2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

2.1 Existing Studies, Guidelines, and Reports

The following studies were utilized in the preparation of this report.

- Ottawa Sewer Design Guidelines
 City of Ottawa, October 2012
 (Sewer Design Guidelines)
 - Technical Bulletin ISDTB-2014-01 City of Ottawa, February 5, 2014 (*ITSB-2014-01*)
 - Technical Bulletin PIEDTB-2016-01
 City of Ottawa, September 6, 2016
 (PIEDTB-2016-01)
 - Technical Bulletin ISTB-2018-01
 City of Ottawa, March 21, 2018
 (ISTB-2018-01)
 - Technical Bulletin ISTB-2018-04 City of Ottawa, June 27, 2018 (ISTB-2018-04)
 - Technical Bulletin ISTB-2019-02 City of Ottawa, July 8, 2019 (ISTB-2019-02)
- Ottawa Design Guidelines Water Distribution City of Ottawa, July 2010 (Water Supply Guidelines)
 - Technical Bulletin ISD-2010-2 City of Ottawa, December 15, 2010 (ISDTB-2010-2)
 - Technical Bulletin ISDTB-2014-02 City of Ottawa, May 27, 2014 (ISDTB-2014-02)
 - Technical Bulletin ISTB-2018-02 City of Ottawa, March 21, 2018 (ISTB-2018-02)
 - Technical Bulletin ISTB-2021-03 City of Ottawa, August 18, 2021 (ISTB-2021-03)

19-1140

- City of Ottawa Official Plan adopted by Council 2003. (Official Plan)
- Stormwater Management Planning and Design Manual Ministry of Environment, March 2003 (SWMP Design Manual)
- Erosion & Sediment Control Guidelines for Urban Construction TRCA, 2019 (*E&S Guidelines*)
- Barrhaven South Master Servicing Study Stantec, June 2007 (MSS)
- Barrhaven South Master Servicing Study Addendum Stantec, October 12, 2017 (Stantec MSS Addendum)
- Design Brief for the Clarke Stormwater Management Pond JFSA and DSEL, October 19, 2017 (*Clarke PDB*)
- Half Moon Bay West Subdivision / Hydraulic Analysis of the Proposed Outlet Channel for the Clarke Pond JFSA, September 23, 2019 (Outlet Channel Memo)
- Headwater Drainage Feature Assessment Kilgour Associates Ltd., July 22, 2016 (HDFA)
- Functional Servicing and Stormwater Management Report for the Half Moon Bay West Subdivision DSEL, March 8, 2019 (FSR)
- Changes from Approved Draft Plan Half Moon Bay West Subdivision Phase 3 DSEL, May 17, 2021 (Draft Plan Changes Letter)

19-1140

- Design Brief for the Half Moon Bay West Subdivision Phase 1 DSEL, October 29, 2018 (Phase 1 Design Brief)
- Design Brief for the Half Moon Bay West Subdivision Phase 2A/2B DSEL, November 6, 2019 (Phase 2A/2B Design Brief)
- Barrhaven South Master Servicing Study Addendum, HMB West Phase 1 DSEL, September 5, 2018 (DSEL MSS Addendum)
- Hydraulic Capacity and Modeling Analysis Mattamy Half Moon Bay West Phase 3

GeoAdvice, May 31, 2021 (*GeoAdvice Report*)

- Geotechnical Investigation for Proposed Residential Development Half Moon Bay West, PG2246-1 Revision 7 Paterson Group, April 19, 2021 (Geotechnical Investigation)
- Geotechnical Design Artesian Point Source Drainage System and Containment Cell Construction, PG22560-MEMO52 Revision 11 Paterson Group, August 26, 2021 (Artesian Memo)
- Geotechnical Recommendations Artesian Point Source Contingency Plan, PG2246-MEMO.77 Revision 1 Paterson Group, November 16, 2021 (Artesian Contingency Plan)
- Sump Pump Feasibility Report, PG4073-LET.02 Revision 6 Paterson Group, August 25, 2021 (Sump Pump Memo)
- Stormwater Management Report for Phase 3 the Half Moon Bay West Subdivision JFSA, November 2021 (SWM Report)

19-1140

- Phase 3 of the Half Moon Bay West Subdivision / Use of Modified Imperviousness in DDSWMM Models for Rear Yard Drainage JFSA, August 30, 2021 (Imperviousness Memo)
- HMB Detailed Design PCSWMM Width Parameter JFSA, November 4, 2021 (Width Parameter Memo)

19-1140

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

HMB West Phase 3 is located within Zone 3SW. The development will be connecting to existing watermains at the following locations:

- Existing 300 mm diameter watermain on Apolune Street within HMB West Phase 1 at three locations (Street 1 for two connections and Cygnus Street (former Street A); and
- Existing 300 mm diameter watermain on Flagstaff Drive, which was extended from Apolune Street through the development of Glenview's Flagstaff Phase 1 and Mattamy's HMB West Phase 10.

The existing watermain network is depicted on *Figure 3*.

The City has plans to change the Barrhaven South area to a different pressure zone, South Urban Community (Zone SUC). The timeline is for the reconfiguration is currently unknown.

3.2 **Proposed Water Supply**

Potable water will be delivered to the proposed development area through the extension of new watermains from the existing watermains. HMB West Phase 3 will connect to existing infrastructure at the locations identified in **Section 3.1**.

The existing 300 mm diameter watermain on Flagstaff Drive will be extended westward to Borrisokane Road. An automatic flushing chamber is to be installed near the interim dead-end 300 mm diameter watermain at Borrisokane Road per City Detail W3.2, included on **Sheet 3 – Details and Table**. The flushing system is intended to keep the water fresh until the looping of the watermain is completed in the future. The location of the flushing system is shown on **Sheet 14 – Plan and Profile of Flagstaff Drive**.

The remainder of the subdivision will be serviced by a network of new 150 mm, 200 mm and 300 mm diameter watermains designed in accordance with City of Ottawa Guidelines as summarized in *Table 3.1*.

19-1140

Design Parameter	Value				
Residential – Single Family	3.4 p/unit				
Residential – Townhome	2.7 p/unit				
Residential – Average Daily Demand	280 L/p/day				
Residential – Maximum Daily Demand	2.5 x Average Daily Demand				
Residential – Maximum Hourly Demand	2.2 x Maximum Daily Demand				
Residential – Minimum Hourly Demand	0.5 x Average Daily Demand				
Commercial / Institutional Average Daily Demand	28,000 L/ha/day				
Park Average Daily Demand	28,000 L/ha/day				
Commercial / Institutional / Park Maximum Daily	1.5 x Average Daily Demand				
Demand					
Commercial / Institutional / Park Maximum Hour	1.8 x Maximum Daily Demand				
Demand					
Commercial / Institutional / Park Minimum Hour Demand	0.5 x Average Daily Demand				
Fire Flow	Calculated as per the Fire Underwriter's				
	Survey 1999 and as amended by ISTB-				
	2014-02 & ISTB-2018-02)				
Minimum Watermain Size	150 mm diameter				
Service Lateral Size	19 mm dia. Copper or equivalent				
Minimum Depth of Cover	2.4 m from top of watermain to finished				
	grade				
Peak hourly demand operating pressure	275 kPa and 552 kPa				
Fire flow operating pressure minimum	140 kPa				
Extracted from Section 4: Ottawa Design Guidelines, Water	Extracted from Section 4: Ottawa Design Guidelines, Water Distribution (July 2010) and Technical Bulletins				

Table 3.1: Water Supply Design Criteria

The proposed water supply network is depicted on *Figure 3*. In addition to providing servicing for HMB West Phase 3, the design includes Blocks 61 and 62 (formerly known as Block 68 and 69) by Glenview Homes (Cedarview) Limited, which are fronting Flagstaff Drive.

A complete hydraulic analysis has been prepared for the proposed water distribution network to confirm that water supply is available within the required pressure range under the anticipated demand during average day, peak hour and fire flow conditions. Refer to the *Hydraulic Capacity and Modeling Analysis, Mattamy Half Moon Bay West Phase 3* prepared by GeoAdvice Engineering Inc. dated May 31, 2021 (GeoAdvice Report), enclosed in *Appendix B*.

3.2.1 Fire Flow Demand

Fire flow calculations for single detached dwellings and townhouses are detailed in the *GeoAdvice Report*, enclosed in *Appendix B*. Calculations for the single detached dwellings and traditional townhomes reached the City of Ottawa's cap of 10,000 L/min (167 L/s) as outlined in *ISDTB-2014-02*. For the townhouse units where the 10,000 L/min cap could not be applied, the FUS calculations yielded the following required fire flows:

19-1140

- Block 40: 11,000 L/min (183 L/s)
- Block 33: 16,000 L/min (267 L/s)

The FUS calculations for the back-to-back townhouse blocks yielded the following required fire flows:

- 12-unit back-to-back townhouse:14,000 L/min (233 L/s), accounts for one firewall
- 10-unit back-to-back townhouse:14,000 L/min (233 L/s), accounts for one firewall
- 8-unit back-to-back townhouse: 16,000 L/min (267 L/s), no firewall accounted for

At this time, there is not enough information available to calculate the required fire flows of the park. It is assumed that a fire flow of 167 L/s is required for the parks based on previously completed projects.

The fire flows are calculated in accordance with the Fire Underwriters Survey's Water Supply for Public Fire Protection Guideline (1999) and Technical Bulletins ISDTB-2014-02 and ISTB-2018-02.

3.2.2 Boundary Conditions

Boundary conditions were requested from the City of Ottawa by GeoAdvice Engineering for Peak Hour, Max Day Plus Fire Flow and Maximum HGL (high pressure check) conditions. Please refer to the *Water Distribution Network Boundary Condition Request – Flagstaff and Half Moon Bay West (GeoAdvice, March 11, 2021),* enclosed in *Appendix B*.

The City of Ottawa anticipates reconfiguring the pressure zone feeding the development; as such, boundary conditions were provided under two (2) separate pressure zone configurations; existing and post reconfiguration.

The City of Ottawa provided boundary conditions at Cambrian Road and at Perseus Avenue, just west of Future Greenbank Road. Specifically, boundary conditions have been provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: Perseus Avenue (300 mm diameter)
- Connection 2: Cambrian Road (400 mm diameter)

The demands from Flagstaff Phase 1 and HMB West Phases 1, 2 and 10 were included in the boundary condition request as they are located downstream of the connection locations under existing conditions. Refer the *GeoAdvice Report* in *Appendix B* for details.

19-1140

A hybrid of the existing and future pressure zone configuration results were used in the GeoAdvice Report to ensure that the most conservative results were considered for the Peak Hour, Maximum Day Plus Fire Flow and Maximum HGL conditions. The boundary conditions used in the *GeoAdvice Report* are summarized in *Table 3.2*.

Table 3.2: Boundary Conditions

	Connection 1 Perseus Avenue			ection 2 an Road
Condition	HGL (m)	HGL (m) Pressure (psi)		Pressure (psi)
Maximum HGL *	157.0	89.6	157.0	90.3
Peak Hour * (min pressure)	136.9	61.0	136.9	61.8
Max Day + Fire (167 L/s) **	140.7	66.5	140.9	67.6
Max Day + Fire (233 L/s) **	137.3	61.6	137.7	62.9
Max Day + Fire (250 L/s) **	134.3	57.3	134.8	58.9

*Existing pressure zone condition results provided by the City of Ottawa

** Zone reconfiguration condition results provided by the City of Ottawa

3.2.3 Water Demands

A summary of water demands considered for HMB West Phase 3 is in Table 3.3.

 Table 3.3 – Summary of Water Demands in HMB West Phase 3

		Рор	pulation			Max	Peak	Min
Dwelling Type	Number of Units	Persons per unit	Population with 10% Contingency*	Allocated Demand	Avg Day (L/s)	Day 2.5 x Avg Day (L/s)	Hour 2.2 x Max Day (L/s)	Hour 0.5 x Avg Day (L/s)
Single Detached	23	3.4	87	280 L/c/d	0.28	0.71	1.55	0.15
Townhomes	205	2.7	610	280 L/c/d	1.98	4.94	10.87	0.98
Total	228		697		2.26	5.65	12.42	1.13
Land Use Type	Area			Allocated Demand	Avg Day (L/s)	Max Day 1.5 x Avg Day (L/s)	Peak Hour 1.8 x Max Day (L/s)	Min Hour 0.5 x Avg Day (L/s)
Park	2.85 ha			28,000 L/ha/d	0.92	1.39	2.49	0.46
Park	1.67 ha			28,000 L/ha/d	0.54	0.27	0.49	0.09
Total	4.52				1.46	1.66	2.98	0.55

19-1140

3.2.4 Summary of Hydraulic Modeling Analysis

A complete watermain analysis has been prepared to confirm that the network is sized adequately, which is the greater of maximum day plus fire and maximum hour. Refer to the *GeoAdvice Report*, enclosed in *Appendix B*.

The modeling indicates that the development can be adequately serviced by the proposed watermain network. Modeled service pressures for the development are summarized in *Table 3.4*. The detailed pipe and junction tables are contained in the *GeoAdvice Report*, enclosed in *Appendix B*.

Table 3.4: Summary of Available System Pressures

	Minimum Hour Demand Maximum Pressure		Peak Hour Demand Minimum Pressure	
	kPa	kPa psi		psi
HMB West Phase 3	640	93	418	61

The generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi) as outlined in the City of Ottawa Design Guidelines. Based on the anticipated service pressures, pressure reducing valves may be required in the development where elevations are lower than 102 m until the existing pressure zone reconfiguration but may not be required after the pressure zone reconfiguration.

The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire. A summary of the available fire flows is presented in *Table 3.5*. The detailed fire flow results are found in the *GeoAdvice Report* enclosed in *Appendix B*.

Required Fire Flow (L/s)	Minimum Available Flow (L/s)	Junction ID
167	372	J-82
183	510	J-89
233	277	J-99
267	353	J-91

Table 3.5: Summary of Minimum Available Fire Flows

As shown in *Table 3.5*, the model predicts the network will be able to provide the required fire flows at all junctions within the study area.

19-1140

3.3 MSS Conformance

The extension of the 300 mm diameter watermain on Flagstaff Drive to Borrisokane Road conforms to the *Stantec MSS Addendum* and has not been oversized. The looping for the subdivision will be made via connections to the Glenview development to the north (Flagstaff Subdivision).

3.4 Water Supply Conclusion

The proposed watermain network must meet maximum hour and maximum day plus fire flow demands. Detailed analysis for the network indicates that the 150 mm, 200 mm and 300 mm diameter sizes satisfy these demands, with connections to existing watermains on Apolune Street and Flagstaff Drive.

Water supply will be available within the required pressure range under the anticipated demand during average day and peak hour conditions. Water supply for fire flow conditions will be adequate at all junctions within HMB West Phase 3.

The proposed water supply design conforms to all relevant City guidelines and policies and conforms to current guidelines.

The extension of the 300 mm diameter watermain on Flagstaff Drive to Borrisokane Road conforms to the *Stantec MSS Addendum*. The extension of the 300 mm diameter watermain Flagstaff Drive will remain as dead end in the interim and a flushing system has been added to keep the water fresh until the watermain is looped in the future.

19-1140

4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

The existing South Nepean Collector (SNC) will provide the sanitary outlet for the entire Barrhaven South Community, which includes the HMB West Subdivision. The **MSS** determined that the sewer is able to accommodate sanitary flows from approximately 26,000 people in the Barrhaven South Community.

Trunk sanitary sewers exist within the existing HMB North and HMB West developments to the east. The following connections and outlets are available for HMB West Phase 3:

- North Outlet: Existing 300 mm diameter sanitary sewer on Flagstaff Drive, discharging to Perseus Road to the north, the trunk sanitary on Future Greenbank Road through HMB North Phase 7 and, ultimately, the SNC; and
- South Outlet: Existing 250 mm diameter sanitary sewer on Apolune Street, discharging to the trunk sanitary on Cambrian Road to the south and, ultimately, the SNC.

4.2 Wastewater Design

The entire HMB West subdivision, including Phase 3 will be serviced by a network of new gravity sewers designed in accordance with City of Ottawa design criteria and will outlet to the existing sanitary sewers described in **Section 4.1**. The proposed sanitary sewer layout is depicted on **Figure 4**. There are two outlets for the sanitary sewer design described below to service HMB West Phase 3.

North Outlet

A proposed sanitary sewer will be extended west along Flagstaff Drive to Borrisokane Drive from its current termination approximately 250 m west of Apolune Drive. The proposed sanitary sewers and sanitary trunk sewer extension are depicted on *Figure 4.*

South Outlet

There are three proposed connections to the existing sanitary 250 mm diameter on Apolune Drive. The proposed sanitary sewers and connections to existing are depicted on *Figure 4*.

The proposed sanitary sewer design uses the sanitary design parameters per Technical Bulletin ISTB-2018-01 (March 21, 2018) of the **Sewer Design Guidelines**, which is updated from the parameters used in the **FSR**. The peak flows are lower with the updated parameters and should be considered acceptable.

19-1140

Table 4.1 summarizes the *Sewer Design Guidelines* employed in the design of the proposed wastewater sewer system.

Design Parameter	Value	
Residential – Detached Single	3.4 p/unit	
Residential – Townhouse	2.7 p/unit	
Residential – Apartment	1.8 p/unit	
Peak Wastewater Generation per Person	280 L/p/d	
Peaking Factor Applied	Harmon's Equation, where K = 0.8	
Commercial / Institutional Flows	28,000 L/ha/day	
Commercial / Institutional Peaking Factor	1.5 if contribution area > 20%, otherwise 1.0	
Infiltration and Inflow Allowance	0.33 L/s/ha	
Park Flows	9,300 L/ha/day	
Park Peaking Factor	1.0	
Sanitary sewers are to be sized employing the	$Q = \frac{1}{2} A R^{\frac{2}{3}} S^{\frac{1}{2}}$	
Manning's Equation	$Q = -\frac{1}{n}AK + S$	
Minimum Sewer Size	200 mm diameter	
Minimum Manning's 'n'	0.013	
Service Lateral Size	135 mm dia PVC SDR 28 with a minimum slope	
	of 1.0%	
Minimum Depth of Cover	2.5 m from crown of sewer to grade	
Minimum Full Flowing Velocity	0.6 m/s	
Maximum Full Flowing Velocity	3.0 m/s	
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012 and Technical Bulletins		

Table 4.1: Wastewater Design Criteria

4.2.1 Design Flows

Sanitary drainage area plans and design sheets are enclosed in *Appendix C* for reference.

Wastewater flows from the study area were considered as part of previous phases of HMB West and HMB North, as well as existing downstream infrastructure, per the **MSS**.

North Outlet

With the extension of the sanitary sewer along Flagstaff Drive to Borrisokane Road, areas external to the HMB West Phase 3 development have been considered in the design per the **MSS**. The external areas to the north outlet are summarized in **Table 4.2**.

19-1140

Land Use	Connecting Location	Area (ha)	Population
Residential	MH 373A on Flagstaff Drive extension	6.55	559
Commercial Block 71	MH 336A to MH 388A on Flagstaff Drive extension	0.44	
Institutional	MH 337A to MH 338A on Flagstaff Drive extension	2.24	
Residential Blocks 68 and 69 (Glenview)	MH339A to MH341A on Flagstaff Drive extension	0.18	22

The peak sanitary flow from HMB West Phase 3 to the north outlet, including external flows is 15.82 L/s (MH 355A to existing 333A). This length of sewer was previously constructed with the Glenview Flagstaff Phase 1 development as MH 332A to 333A. The peak sanitary flow was anticipated to be 19.92 L/s. Refer to the Glenview Flagstaff Phase 1 sanitary drainage area plan and design sheet, included in *Appendix C*. MH 355A has been added based on updated lotting for the HMB West Phase 3 lots.

South Outlet

There are no external lands directed to the existing sanitary sewer on Apolune Street.

The peak flows from HMB West Phase 3 to Apolune Street at the three connection locations are presented in *Table 4.3*, as compared to anticipated flows at the time of the detailed design of HMB West Phase 1.

Street Name	Connecting Location	Phase 3 Peak Flow (L/s)	Phase 1 Anticipated Peak Flow (L/s)
Watercolours Way (north leg)	MH 360A to existing MH122A on Apolune Street	1.87	1.28
Cygnus Street (former Street A)	MH 365A to existing MH 123A on Apolune Street	1.44	1.86
Watercolours Way (south leg)	MH 371A to existing MH 125A on Apolune Street	1.29	2.43
Total		4.60	5.57

Table 4.3: Peak Flows to the South Outlet

The proposed peak flow based on the current design is less than what was anticipated through the design of HMB West Phase 1. This confirms that there is capacity in the downstream infrastructure for the proposed development.

19-1140

4.3 MSS Conformance

The proposed sanitary sewer system generally conforms to the **Stantec MSS Addendum**. The proposed trunk sewer along the extension of Flagstaff Drive was contemplated as a 450 mm diameter pipe in the **Stantec MSS Addendum**, but due to updated sewer design guidelines per Technical Bulletin ISTB-2018-01 (March 21, 2018) and sanitary rerouting, it has been updated to 250 mm and 300 mm. Based on the current design, the sanitary sewers remain slightly oversized to keep the sewer as flat as possible to cross under the habitat channel at Flagstaff Drive. If the sizes were reduced, the minimum slope would be steepened, reducing the clearance between the sanitary sewer and the culvert in the habitat channel.

4.4 Wastewater Servicing Conclusion

HMB West Phase 3 will be serviced by two outlets; the north outlet to Perseus Drive, Future Greenbank Road and through HMB North Phase 7; and the south outlet to Apolune Drive to Cambrian Road. Ultimately the flows are directed to the South Nepean Collector.

It has been confirmed that there is capacity in the downstream sanitary sewer system to accommodate HMB West Phase 3 including external drainage areas.

The proposed sanitary sewer system generally conforms to the **Stantec MSS Addendum**. The proposed trunk sewer along the extension of Flagstaff Drive was contemplated as a 450 mm diameter pipe in the **Stantec MSS Addendum**, but due to updated sewer design guidelines per Technical Bulletin ISTB-2018-01 (March 21, 2018) and sanitary rerouting, it has been updated to 250 mm and 300 mm. The sanitary sewers remain slightly oversized to keep the sewer as flat as possible to cross under the habitat channel at Flagstaff Drive.

19-1140

5.0 STORMWATER CONVEYANCE

5.1 Existing Conditions

The Half Moon Bay West Subdivision is located within Jock River Watershed and is under the jurisdiction of the Rideau Valley Conservation Authority (RVCA).

Currently, the majority of the overall HMB West site has been stripped of topsoil and earthworks have been undertaken over the past 10 years. The overall site previously consisted of agricultural fields, with the exception of the southern portion of the site where a treed area formerly existed. The existing elevations within the overall proposed development area generally range between 91.5 m to 94.0 m.

The West Clarke Drain, which was identified in previous studies as fish habitat, has been redirected and infilled according to the Authorization developed between the Barrhaven South Landowners Group (BSLO) and the Department of Fisheries and Oceans (DFO). The Clarke SWM Pond and Outlet Channel and HMB West Phase 1, and HMB West Phase 2 are constructed. The Flagstaff Subdivision by Glenview Homes (Cedarview) Limited is north of HMB West Phase 3, with Phase 1 constructed and Phase 2 under engineering review.

A new natural corridor is to be provided to link the existing woodlot south of the subject property to the Jock River north of the site. Further details are contained in **Section 1.1**

There are existing storm sewers along Apolune Street and Flagstaff Drive, all discharging to the existing Clarke SWM Pond.

Refer to *Figure 5* for the existing storm sewer network.

5.2 Minor System

HMB West Phase 3 will be serviced by a storm sewer system designed in accordance with the amendment to the storm sewer and stormwater management elements of the Ottawa Design Guidelines – Sewer (Technical Bulletin PIEDTB-2016-01).

The minor storm sewer system has been sized as follows:

- 2-year event for local streets without any ponding;
- > 5-year event for collector streets (Flagstaff Drive) without any ponding; and
- 5-year event for commercial and park blocks.

The storm sewers will outlet to the Clarke SWM Pond, within the HMB West Lands, and discharge from the pond to the Jock River via a naturalized channel. The Clarke SWM Pond has been designed to service a large drainage area, including the HMB West Phase 3 Lands. Refer to the *Clarke PDB* for details. The proposed storm sewer layout is

19-1140

depicted on *Figure 5.* Refer to Storm Design Sheet and Storm Drainage Plans, located in *Appendix D*.

Table 5.1 summarizes the relevant *Sewer Design Guidelines* employed in the design of the proposed storm sewer system referred to as the minor system.

Design Parameter	Value
Minor System Design Return Period	2-Year (Local Streets), 5-Year (Collector Streets),
	per PIEDTB-2016-01
	5-Year for Commercial and Park Blocks
Major System Design Return Period	100-Year
Intensity Duration Frequency Curve (IDF)	A
2-year storm event:	$i = \frac{A}{(t + B)^{c}}$
A = 723.951, B = 6.199, C = 0.810	$(t_c + B)^{\circ}$
5-year storm event:	
A = 998.071, B = 6.053, C = 0.814	
Initial Time of Concentration	10 minutes
Rational Method	Q = CiA
Runoff coefficient for paved and roof areas	0.9
Runoff coefficient for landscaped areas	0.2
Storm sewers are to be sized employing the	$Q = \frac{1}{2} A R^{\frac{2}{3}} S^{\frac{1}{2}}$
Manning's Equation	$Q = -AR^{3}S^{2}$
Minimum Sewer Size	250 mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.0 m from crown of sewer to grade, unless
	circumstances require lower
Minimum Full Flowing Velocity	0.8 m/s
Maximum Full Flowing Velocity	6.0 m/s (above 3.0 m/s may require protection
	against displacement by sudden jarring)
Clearance from 100-Year HGL	Should not be above ground surface
Clearance from 100-Year Grade Line to Building	0.30 m
Opening	
Max Allowable Flow Depth on Municipal Roads	35 cm above gutter (PIEDTB-2016-01)
Extracted from Sections 5, 6 and 8 of the City of Ottawa Sewer De	esign Guidelines, October 2012 and Technical Bulletins.

 Table 5.1: Storm Sewer Design Criteria

The paved area and grassed area runoff coefficients of 0.90 and 0.20 were used to calculate average runoff coefficients that were applied across the site. Detailed runoff coefficient calculations based on the maximum zoning envelopes, storm drainage area plans and storm design sheets are enclosed in *Appendix D* for reference.

Based on the Rational Method, the peak flows from the proposed development to the existing storm sewers are as follows:

- > 727 L/s to the existing 975 mm diameter storm pipe on Flagstaff Drive;
- 302 L/s to the existing 3000 mm diameter storm pipe on Apolune Drive at Watercolours Way (south leg);

19-1140

- 149 L/s to the existing 3000 mm diameter storm pipe on Apolune Drive at Cygnus Street; and
- 132 L/s to the existing 3000 mm diameter storm pipe on Apolune Drive at Watercolours Way (north leg)

All flows are conveyed to the existing Clarke SWM Pond via the existing 3000 mm diameter storm trunk on Apolune Street to the existing west inlet.

A minor system analysis was completed using the XPSWMM program based on the peak flows captured during the rainfall events, as calculated with the DDWSWMM and SWMHYMO programs. The complete analysis is contained in the **Stormwater Management Report for Phase 3 of the Half Moon Bay West Subdivision (HMB West Phase 3 SWM Report)** by J.F. Sabourin and Associates dated November 2021.

The total 2-year, 5-year and 100-year DDSWMM/XPSWMM minor system flow to the Clarke SWM Pond based on the current simulation is 9,266 L/s, 13,350 L/s and 26,773 L/s, respectively.

The proposed design for HMB West Phase 3, future phases of HMB West, and external drainage areas to the Clarke SWM Pond assumes that no ICDs or capture limitations are imposed, with a few exceptions, as discussed and supported in the *HMB West Phase 3 SWM Report.*

A comparison of the 100-year 24-hour SCS Type II design storm pond inflows, levels and storage between the current design and the *Clarke PDB* is included in the *HMB West Phase 3 SWM Report.* The current design indicates that the 100-year 24-hour SCS Type II design storm inflow to the Clarke Pond is 23.7629 m³/s and the SCS storm pond level is 92.072 m (33,621 m³) active storage. In comparison, in the *Clarke PDB*, the 100-year 24-hour SCS Type II design storm inflow to the Clarke Pond is 20.119 m³/s and the SCS storm pond level of 92.089 m (34,058 m³ active storage). The difference in the inflows is due to the removal of ICDs and subsequent reduction in attenuation by surface storage. Refer to the *HMB West Phase 3 SWM Report* for further justification.

Note that a less than a freeboard of 0 m between the 100-year hydraulic grade line and the top of catch basin grate elevations is simulated throughout HMB West Phase 1-3. The water depths over catch basins are simulated dynamically in XPSWMM and are driven by a combination of backwater from the 100-year HGL in the main storm sewer, the restriction of the lead pipe and catch basin grate, and the available surface storage in road ponding areas. The 100-year water depths on the road are less than 0.35 m above the catch basin top of grade elevation as detailed in the **HMB West Phase 3 SWM Report**.

19-1140

5.3 Major System

The pond is a quality control pond only and is not intended to provide quantity control treatment. Note major system inflow to the pond occurs only during large rainfall events, and do not include the "frequent event" flows requiring quality treatment, which will be conveyed to the pond via the minor system. Safe conveyance of 100-year flows through the pond is provided. The major system has generally been designed with sufficient road surface storage to allow the excess runoff of a 100-year storm to be retained within road ponding areas. Excess major system flows will outlet directly to the pond.

The major system is to be designed in accordance with the amendment to the storm sewer and stormwater management elements of the Ottawa Design Guidelines – Sewer (Technical Bulletin PIEDTB-2016-01). Road ponding areas up to 35 cm deep were used to fully contain the 100-year major system flows. It is proposed that there be no inlet control devices or capture limitations for HMB West Phase 3, as discussed in the *HMB West Phase 3 SWM Report*.

The maximum depth of flow on local and collector streets is 0.35 m during the 100-year event. The depth of flow may extend adjacent to the right-of-way provided that the water level must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event (100 year + 20%). There must be at least 15 cm of vertical clearance between the spill elevation on the street and the ground elevation at the nearest building envelope. There must be at least 30 cm of vertical clearance between the rear yard spill elevation and the ground elevation at the adjacent building envelope.

Excess major system flows up to the 100-year return period are to be retained on-site in development blocks such as parks. The minor system release rate from the park blocks and the commercial blocks was limited to the 5-year flow.

5.4 Sump Pumps

The proposed centerline of road grades do not allow for standard basements with a gravity connection to the storm sewer system. It is proposed that the subdivision be serviced entirely by sump pumps due to site constraints imposed by grade raise restrictions and the proximity to Jock River stormwater outlet. The *Stantec MSS Addendum* specifically considered the use of private sump pumps for the development of areas with grade raise restrictions (including Half Moon Bay West), but did not carry forward this alternative solution based on City policy at the time of preparation of the study; however, the City has published Technical Bulletins ISTB-2018-04 (June 27, 2018) and ISTB-2019-02 (July, 8, 2019), which outline the criteria for sump pumps, the requirements for hydrogeological assessments areas with sump pumps, and revised information on HGL for storm sewers with sump pumps. The proposed design for sump pumps is consistent with the approach previously used in HMB West Phase 1 and 2 and conforms to Technical Bulletins ISTB-2018-04 (June 27, 2018) and ISTB-2019-02 (July 8, 2019).

19-1140

The proposed use of sump pumps within HMB West Phase 3 is addressed in the *Sump Pump Feasibility Report, PG4073-LET.02* (Paterson Group, August 25, 2021), enclosed in *Appendix F*. The sump pump detail can be found on Details, Sheet 3. The sump pump components and requirements are outlined in *Table 5.2*.

Component	Requirements
Sump Pump	Shall be:
(General)	o In accordance with City of Ottawa Technical Bulletin ISTB-2018-04
	(June 27, 2018) and ISTB-2019-02 (July 8, 2019);
	 A submersible pump;
	 Automatically controlled and set to maintain the water level at the same
	elevation as the foundation drain; capable of discharging a minimum
	flow of 0.9 L/s at 3.6 m head.
Sump Pump	Shall be:
(Primary)	 CSA Approved;
	\circ Connected to an electrical circuit that supplies no other outlets,
	switches or equipment;
	 Equipped with a self-resetting thermal overload protection switch;
	 Rated for continuous duty.
Sump Pump	Shall be:
(Backup)	 CSA Approved;
	• Connected to an electrical circuit that supplies no other outlets,
	switches or equipment except: A) Charging equipment for backup
	power and B) Alarm system for primary pump and power failure;
	 Equipped with a self-resetting thermal overload protection switch;
	 Rated for continuous duty;
	 Equipped with an audible failure alarm to notify homeowner that the primary nume has failed or the newer supply has been interrupted;
	 primary pump has failed or the power supply has been interrupted; Capable of discharging a minimum capacity of 0.90 L/s at 3.6 m head;
	 Powered by a deep-cycle lead-acid battery with a minimum ampere-
	hour (AH) rating of 100 AH.
Sump Pit	Shall:
Oumprix	• Have walls and bottoms constructed of concrete polyethylene,
	polypropylene, or fiberglass;
	 Be provided with a sealed cover;
	 Have a cover which must be secured in a manner acceptable to the
	authority having jurisdiction;
	\circ Be vented to the outdoors.
Discharge Pipe	Shall:
System from	○ Be in accordance with <i>Appendix</i> 9 – Standard Sump Pump
Sump Pump	Configuration in Greenfield Subdivisions with Clay Soils on Full
	Municipal Services;
	 Consist of materials and be installed in conformance with the Ontario
	Building Code;
	• Have a minimum internal diameter of 38 mm (1-1/2") from the sump
	pump to the 100 mm (4") storm building drain;
	 Have a union, a check valve and a shut-off valve installed in that
	sequence in the direction of discharge outside of the sump pit;

Table 5.2: Sump Pump Design Criteria

19-1140

	 Have a goose neck with a height of no more than 250 mm below the top of the foundation wall and discharge into the vertical leg of the storm building drain; Have a minimum dimension of 600 mm from the vertical leg of the storm discharge pipe to the horizontal offset upstream of the backwater valve; Include a CSA approved backwater valve for the stormwater discharge; Include an emergency discharge pipe to the outside ground surface; Be vented to the outdoors; Rodent guard/screen to be provided at both the end of the overflow (emergency discharge) pipe and vent pipe; Be graded or otherwise protected to prevent the freezing of water in the system.
Connections	• Only the perimeter foundation drainage system will be connected to
	 the sump pit. Eaves trough, surface exterior drainage, swimming pool backwash, floor drains and any other water sources shall not be connected to the sump pit; All new residences with installed sump pump systems must include: Eaves troughs discharging to the surface with appropriate drainage away from the house at the time of the original sale; Drainage layer as per the Ontario Building Code; Clay backfill placed against the drainage layer for all sides of the foundation except around service laterals where backfill has been placed in service trench per City Standard S6 and S7 unless otherwise specified in an approved geotechnical report; Impervious backfill capping at the ground surface surrounding the perimeter of the residence area and slope away from the building after settling of backfill; except in areas where window wells are required by Ontario Building Code; Sewer laterals that pass through porch foundations must have no joints for a length of 0.6 m measured from the exterior porch wall;

5.5 Submerged Sewers

As indicated in the **Stantec MSS Addendum**, due to grade raise restrictions and lack of relief in the Barrhaven South area, portions of the minor system to the Greenbank and Cedarview Ponds may be partially or fully submerged throughout the year. There are partially submerged sewers in the minor system to the Clarke Pond. The **Stantec MSS Addendum** states appropriate solutions, that are acceptable to the City, are required to avoid and/or manage the accumulation of sediments for sewers subject to standing water.

Through the detailed design of HMB West Phase 1, submerged sewers for storm trunks tributary to the Clarke SWM Pond were reviewed and approved by the City of Ottawa and the MECP.

19-1140

Revisions have been made to the Clarke SWM Pond inlets to allow for isolation of the submerged trunk storm sewers for the purposes of cleaning.

Based on the Clarke SWM Pond permanent pool elevation of 89.55 m, it is anticipated that the proposed storm sewers within HMB West Phase 3 will be submerged at the following limited locations:

- > First leg of the 675 mm diameter storm sewer on Watercolours Way (north leg)
- > First leg of the 900 mm diameter storm sewer on Flagstaff Drive

5.6 Proposed Outlet – Stormwater Management (SWM) Pond

The Clarke SWM Pond was identified in the *Stantec MSS Addendum* to service the Mattamy Half Moon Bay West Development and the external lands. The Clarke SWM Pond and Outlet Channel have been constructed. Further details of the design can be found in the *Clarke PDB*. The Clarke SWM Pond is located within the Jock River Watershed and is designed with water quality targets as per the MECP Enhanced Level of Protection (80% TSS removal). No quantity control storage is required for flood control purposes, as the hydrograph from the sub-watershed will peak before the upstream peak in the Jock River; however, as per the *HMB West Phase 3 SWM Report*, surface storage will be provided at the low point of road segments.

5.7 Flagstaff Drive Culvert Crossing at Borrisokane

The design of HMB West Phase 3 includes the extension of Flagstaff Drive to Borrisokane Road where it crosses an existing ditch on the east side of Borrisokane Road. A 900 mm diameter CSP culvert has been designed at this location. The sizing of the culvert is detailed in the Phase 3 of the *Half Moon Bay West Subdivision / Proposed Culvert under Flagstaff Drive* memo by J.F. Sabourin and Associates dated June 3, 2021, enclosed in *Appendix D*.

5.8 Flagstaff Drive Habitat Channel Culvert Crossing

As noted in **Section 1.1**, Glenview Homes and Mattamy Homes previously made a joint permit application to the Rideau Valley Conservation Authority (RVCA) for the relocation of existing features to a new natural corridor, which included an interim culvert at Flagstaff Drive. The design of the ultimate Flagstaff Drive culvert crossing, required for the natural habitat channel, is included with the design of HMB West Phase 3 with the Flagstaff Drive extension. The permit application for the ultimate culvert is currently underway with the Rideau Valley Conservation Authority (RVCA). The crossing is depicted on **Sheet 15** – **Plan and Profile of Flagstaff Drive** and is comprised of a 1200 mm x 900 mm concrete box culvert.

19-1140

The sizing of the ultimate culvert crossing is detailed in the *Phase 2 of the Flagstaff Subdivision / Cambrian Wood Natural Channel Design* memo by J.F. Sabourin and Associates dated September 28, 2021, enclosed in *Appendix E*. The memo provides results for the proposed 1200 mm x 900 mm box culvert. The capacity of the ultimate culvert has been confirmed to be sufficient as Flagstaff Drive will not be overtopped by flows in an 100-year storm. This exceeds the 25-year storm requirement for collector roads, outlined in the *Ottawa Sewer Design Guidelines*.

A geotechnical review of watermain and sanitary services crossing the culvert is detailed in *Geotechnical Recommendations – Frost Protection Recommendations for Natural Channel Crossings*, PG2246-MEMO.71 Revision 1 by Paterson Group dated November 8, 2021, enclosed in *Appendix E*.

5.9 MSS Conformance

In general, the location of the Clarke Pond and drainage boundaries are all in conformance with the *Stantec MSS Addendum*, but the design has since been updated to reflect City of Ottawa guidelines that were revised subsequent to the approval of the report. Additional support for the deviation is documented in the *DSEL MSS Addendum*.

5.10 Stormwater Conveyance Conclusion

The storm sewers are designed as per the City of Ottawa guidelines, including the amendment to the guidelines per Technical Bulletin PIEDTB-2016-01 (Sept 6, 2016).

The storm flows will discharge to the existing 900 mm diameter storm sewer on Flagstaff Drive and to the existing 3000 mm diameter trunk sewer on Apolune Street. The storm sewers outlet to the west inlet of the existing Clarke SWM Pond, where the flows will be treated for quality prior to discharging to the Jock River.

The Clarke SWM Pond is designed to provide quality control treatment to achieve an enhanced level of protection (80% TSS removal per MECP guidelines). There are no quantity control requirements tributary to the Jock River.

The minor system has been designed to accommodate a minimum of the 2-year postdevelopment flows from within the site plus 5-year flows on collector roads (Flagstaff Drive) and for park and commercial blocks.

The proposed design of HMB West Phase 3, future phases of HMB West and external drainage areas to the Clarke SWM Pond assumes that no ICDs or capture limitations are imposed, with a few exceptions.

A freeboard of less than 0 m between the 100-year hydraulic grade line and the top of catch basin grade elevations was simulated throughout HMB West Phase 1-3. The water

19-1140

depths over catch basins are simulated dynamically in XPSWMM and are driven by a combination of backwater from the 100-year HGL in the main storm sewer, the restriction of the lead pipe and catch basin grate, and the available surface storage in road ponding areas. The 100-year water depths on the road are less than 0.35 m above the catch basin top of grade elevation.

The proposed design for sump pumps is consistent with the approach previously used in HMB West Phase 1 and conforms to Technical Bulletins ISTB-2018-04 (June 27, 2018) and ISTB-2019-02 (July 8, 2019). Further information is detailed in the *Sump Pump Memo.*

The product of the velocity and depth of flow does not exceed the maximum allowable 0.60 m^2 /s for the simulated 100-year storm.

The maximum extent of surface water during the 100-year + 20% stress test will not touch the building envelopes.

Full pipe velocities are between 0.80 m/s and 6.0 m/s for all proposed pipes.

The design includes a proposed 900 mm diameter CSP culvert for the extension of Flagstaff Drive to Borrisokane Road where it crosses an existing ditch on the east side of Borrisokane Road.

The design also includes a 1200 mm x 900 mm concrete box culvert for the ultimate crossing of the natural corridor under Flagstaff Drive. The natural corridor was designed by others.

In general, the location of the Clarke SWM Pond, drainage boundaries and storm servicing are all in conformance with the *Stantec MSS Addendum*, but the design has since been updated to reflect City of Ottawa guidelines that were revised subsequent to the approval of the report. Additional support for the deviation is documented in the *DSEL MSS Addendum*.

19-1140

6.0 SITE GRADING

6.1 Grading and Drainage

The grading for HMB West Phase 3 is restricted by the existing adjacent subdivisions and the Clarke SWM Pond (based on the Jock River water levels).

The *Stantec MSS Addendum* indicates that proposed centerline of road grades for the overall HMB West subdivision will vary between approximately 92.50 m and 94.50 m. Detailed grading confirms that the proposed centerline of road grades for HMB West Phase 3 will vary between approximately 92.50 m and 93.60 m.

To achieve the planned storm drainage and meet City of Ottawa and MECP guidelines, fill is required from existing ground for the proposed development. The proposed finished grades range between 92.75 m and 93.75 m. It is noted in the *Geotechnical Investigation* by Paterson Group (April 19, 2021) that the permissible grade raise elevations vary from 93.3 m to 93.6 m (houses) and from 93.6 m to 93.9 m (roads) within HMB West Phase 3.

Based on the conditions on-site, a surcharge program is underway and lightweight fill and/or other measures will be employed to reduce the risks of long-term differential settlement. Despite the proposed surcharge program and the proposed storm drainage schemes, the proposed centerline of road grades do not allow for standard basements with a gravity connection to the storm sewer system. As such, sump pumps are proposed to be installed for all residential blocks and residential lots with basements. The proposed design approach for the subdivision is consistent with the approach previously used in HMB West Phase 1 and 2 and conforms to Technical Bulletins ISTB-2018-04 (June 27, 2018) and ISTB-2019-02 (July 8, 2019).

In September 2018, several artesian point sources were discovered within Block 54 by Paterson Group during the topsoil removal program. The point sources are proposed to be captured within designed containment cells with artesian flows discharging to the existing roadside ditch on the north side of Cambrian Road as shown on *Figure 5* and *Sheet 20 – Grading Plan*. The design of the containment cells is detailed in the *Artesian Memo* by Paterson Group (August 26, 2021). Recommendations have been provided in the *Artesian Contingency Plan* by Paterson Group (November 16, 2021), should new artesian point sources be discovered during construction,

19-1140

6.2 Grading Criteria

The following grading criteria and guidelines will be applied at the time of detailed design as per City of Ottawa Guidelines:

- Maximum slope in grassed areas between 2% and 5%;
- ➢ Grades in excess of 7% require terracing to a maximum of a 3:1 slope;
- Driveway grades between 2% and 6%;
- Drainage ditches and swales should have a minimum slope of 1.5%;
- > Perforated pipe is required for swales less than 1.5% in slope; and
- Swales are to be 0.15 m deep with 3:1 side slopes unless otherwise indicated.

19-1140

7.0 EROSION AND SEDIMENT CONTROL

Soil erosion occurs naturally and is a function of soil type, climate and topography. The extent of erosion losses is exaggerated during construction where the vegetation has been removed and the top layer of soil is disturbed.

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

- > Limit extent of exposed soils at any given time.
- Re-vegetate exposed areas as soon as possible.
- Minimize the area to be cleared and grubbed.
- > Protect exposed slopes with plastic or synthetic mulches.
- Install silt fence to prevent sediment from entering existing ditches.
- > No refueling or cleaning of equipment near existing watercourses.
- Provide sediment traps and basins during dewatering.
- Install filter cloth between catch basins and frames.
- Installation of mud mats at construction accesses.
- Construction of temporary sedimentation ponds to treat water prior to outletting to existing wetlands and watercourses.
- > Plan construction at proper time to avoid flooding.

A detailed erosion and sediment control plan will be implemented for HMB West Phase 3 prior to construction to ensure there are no negative impacts on existing stormwater works and natural areas, including the Clarke SWM Pond and Jock River. Refer to **Sheet 30** – **Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 1** and **Sheet 31 – Erosion and Sediment Control Plan – Stage 3** for details.

19-1140

8.0 CONCLUSIONS AND RECOMMENDATIONS

A summary of the Design Brief for the HMB West Phase 3 Subdivision is as follows:

- HMB West Phase 3 includes the extension of Flagstaff Drive to Borrisokane Road, residential development, including the Private Site Block, and parks.
- HMB West Phase 1 and 2 are approved and constructed. The Flagstaff Subdivision by Glenview Homes (Cedarview) Limited is to the north with Phase 1 constructed and the design of Phase 2 underway.
- Several approvals are in place for the proposed subdivision. Approvals will be required from the City of Ottawa and Ministry of the Environment, Conservation and Parks (MECP) and Rideau Valley Conservation Authority (RVCA).
- Watermains are designed as per the City of Ottawa guidelines and connect to existing watermains on existing Flagstaff Drive and Apolune Drive.
- The site is proposed to be serviced by 200 mm and 300 mm watermains. Water supply will be available within the required pressure range under the anticipated demand during average day and peak hour conditions. Water supply for fire flow conditions will be adequate at all junctions.
- The extension of the 300 mm diameter watermain on Flagstaff Drive to Borrisokane Road conforms to the Stantec MSS Addendum. The extension of the 300 mm diameter watermain Flagstaff Drive will remain as dead end in the interim and a flushing system has been added to keep the water fresh until the watermain is looped in the future.
- HMB West Phase 3 will be serviced by two sanitary outlets; the north outlet to Perseus Drive, Future Greenbank Road and through HMB North Phase 7; and the south outlet to Apolune Drive and Cambrian Road. Ultimately the flows are directed to the South Nepean Collector.
- The proposed sanitary sewer system generally conforms to the Stantec MSS Addendum. The proposed trunk sewer along the extension of Flagstaff Drive was contemplated as a 450 mm diameter pipe in the Stantec MSS Addendum, but due to updated design standards, the diameter of the pipes was revised to 250 mm and 300 mm. The proposed trunk sewer along the extension of Flagstaff Drive is oversized based on updated design standards to keep it as flat as possible to cross under the natural habitat channel.
- The storm sewers are designed as per the City of Ottawa guidelines, including the amendment to the guidelines per Technical Bulletin PIEDTB-2016-01 (September 6, 2016).
- The storm flows will discharge to the existing 900 mm diameter storm sewer on Flagstaff Drive and to the existing 3000 mm diameter trunk sewer on Apolune

MATTAMY (HALF MOON BAY) LIMITED

19-1140

Street. The storm sewers outlet to the west inlet of the existing Clarke SWM Pond, where the flows will be treated for quality prior to discharging to the Jock River.

- The Clarke SWM Pond is designed to provide quality control treatment to achieve an enhanced level of protection (80% TSS removal per MECP guidelines). There are no quantity control requirements tributary to the Jock River. Based on the current design, the overall drainage area to the Clarke Pond is smaller and the percent imperviousness is lower when compared to the approved design. This confirms that there is capacity in the existing Clarke Pond for HMB West Phase 3.
- The minor system has been designed to accommodate a minimum of the 2-year post-development flows from within the site plus 5-year flows on collector roads (Flagstaff Drive) and for park and commercial blocks.
- The proposed design of HMB West Phase 3, future phases of HMB West and external drainage areas to the Clarke SWM Pond assumes that no ICDs or capture limitations are imposed, with a few exceptions.
- A freeboard of less than 0 m between the 100-year hydraulic grade line and the top of catch basin grade elevations was simulated throughout HMB West Phase 1-3 is provided. The water depths over catch basins are simulated dynamically in XPSWMM and are driven by a combination of backwater from the 100-year HGL in the main storm sewer, the restriction of the lead pipe and catch basin grate, and the available surface storage in road ponding areas. The 100-year water depths on the road are less than 0.35 m above the catch basin top of grade elevation.
- The proposed design for sump pumps is consistent with the approach previously used in HMB West Phase 1 and conforms to Technical Bulletins ISTB-2018-04 (June 27, 2018) and ISTB-2019-02 (July 8, 2019). The sump pump design is detailed in the *Sump Pump Memo*.
- The product of the velocity and depth of flow does not exceed the maximum allowable 0.60 m²/s for the simulated 100-year storm.
- The maximum extent of surface water during the 100-year + 20% stress test will not touch the building envelopes.
- > Full pipe velocities are between 0.80 m/s and 6.0 m/s for all proposed pipes.
- The design includes a proposed 900 mm diameter CSP culvert for the extension of Flagstaff Drive to Borrisokane Road where it crosses the existing ditch and a concrete 1200 mm x 900 mm box culvert for the crossing of the natural corridor under Flagstaff Drive. The natural corridor was designed by others.
- In general, the location of the Clarke SWM Pond, drainage boundaries and storm servicing are all in conformance with the Stantec MSS Addendum, but the design has since been updated to reflect City of Ottawa guidelines that were revised subsequent to the approval of the report as documented in the DSEL MSS Addendum.

MATTAMY (HALF MOON BAY) LIMITED

19-1140

- There are permissible grade raise restrictions for the site as further discussed in the *Geotechnical Investigation*. Due to conditions on-site, measures may be required for lots to reduce the risks of long-term differential settlement.
- Erosion and sediment control measures will be implemented and maintained throughout construction. The Clarke SWM Pond, Jock River and all other watercourses will be protected from any negative impacts from construction.
- The design of HMB West Phase 3 has been completed in general conformance with the City of Ottawa Design Guidelines and criteria presented in other background study documents.

DESIGN BRIEF HALF MOON BAY WEST SUBDIVISION PHASE 3

MATTAMY (HALF MOON BAY) LIMITED

19-1140

Prepared by, **David Schaeffer Engineering Ltd.**

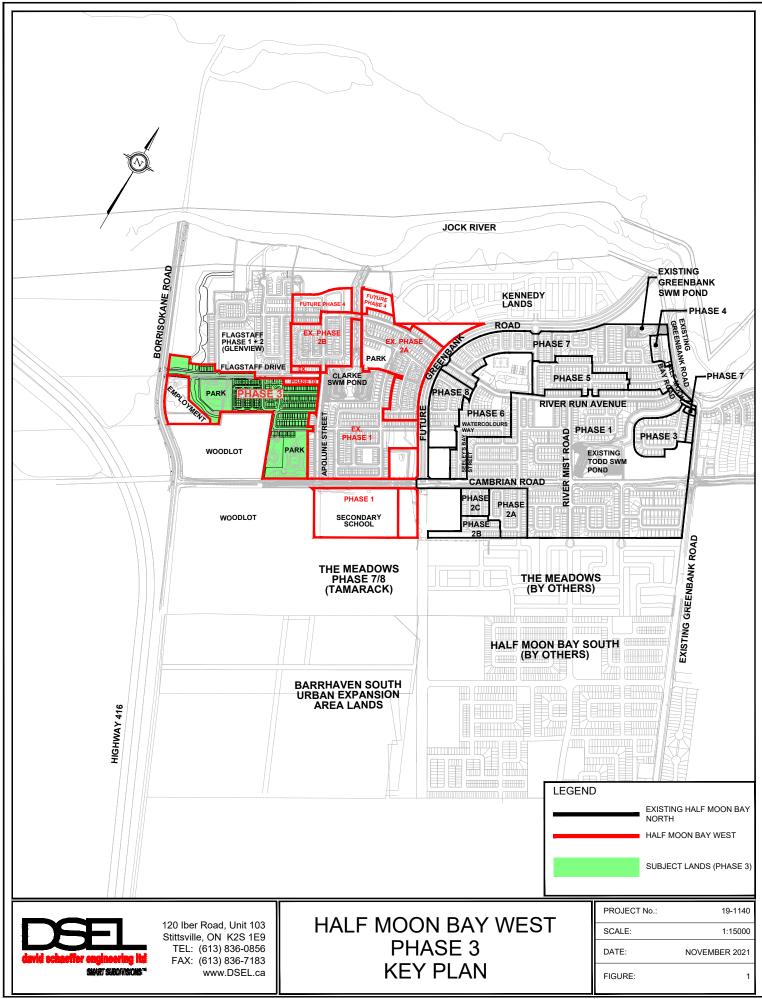


aile

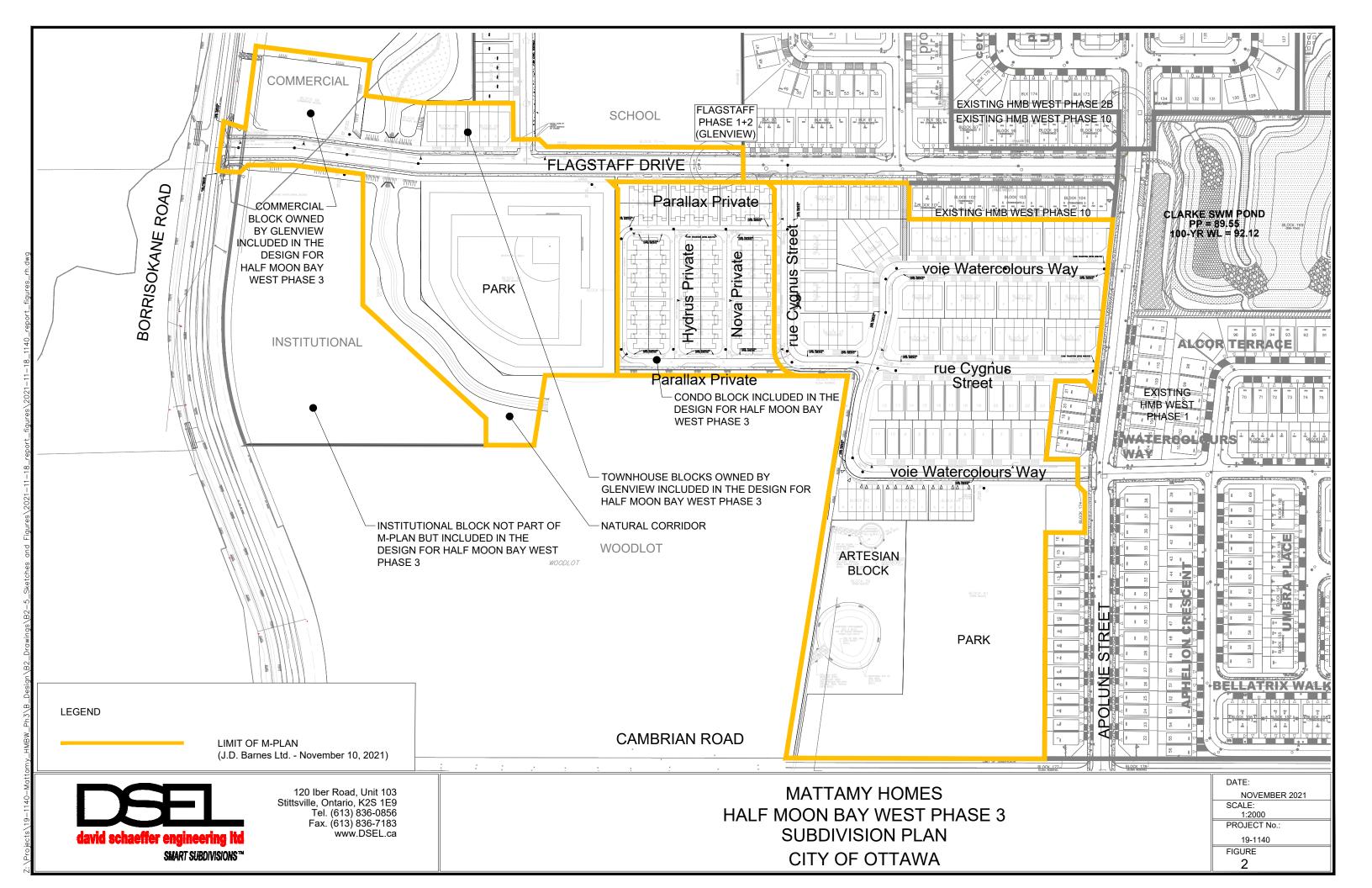
Per: Jennifer Ailey, P.Eng.

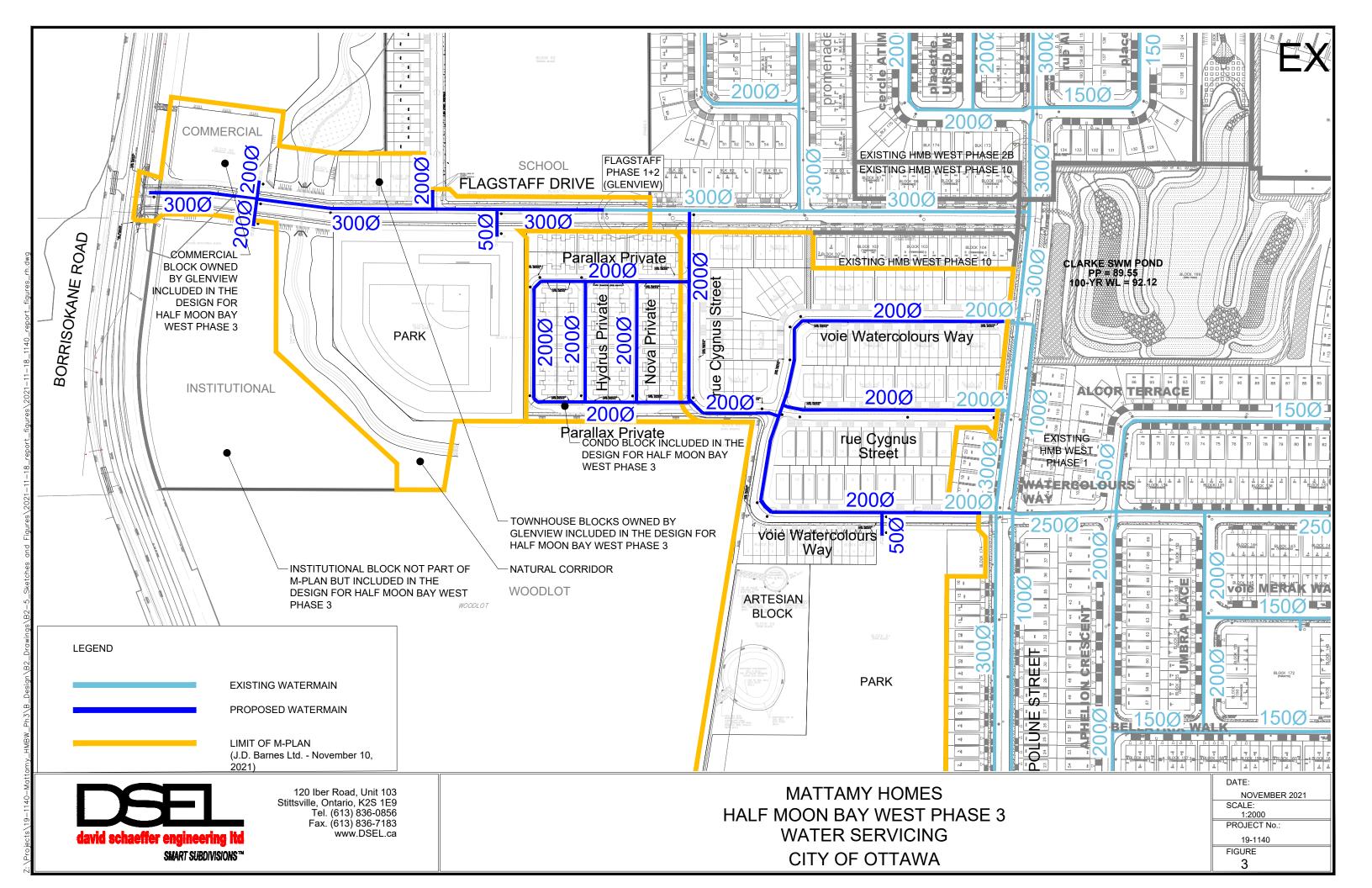
© DSEL

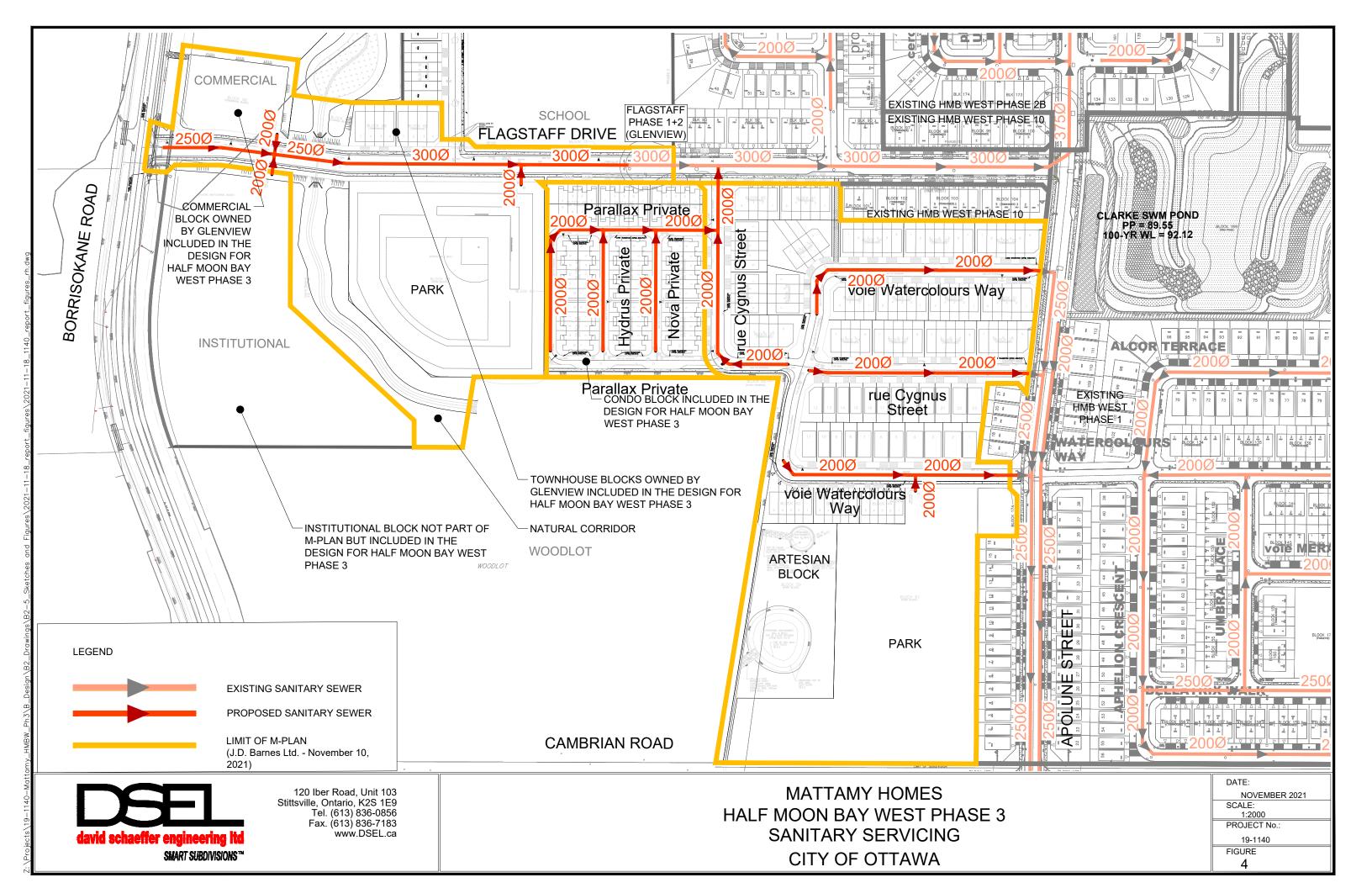
Z:\Projects\19-1140-Mattamy_HMBW_Ph3\B_Design\B3_Reports\B3-2_Servicing (DSEL)\2 - Detailed Design\3rd Submission\Design Brief\2021-11-18_Design_Brief_3rd_Submission.docx

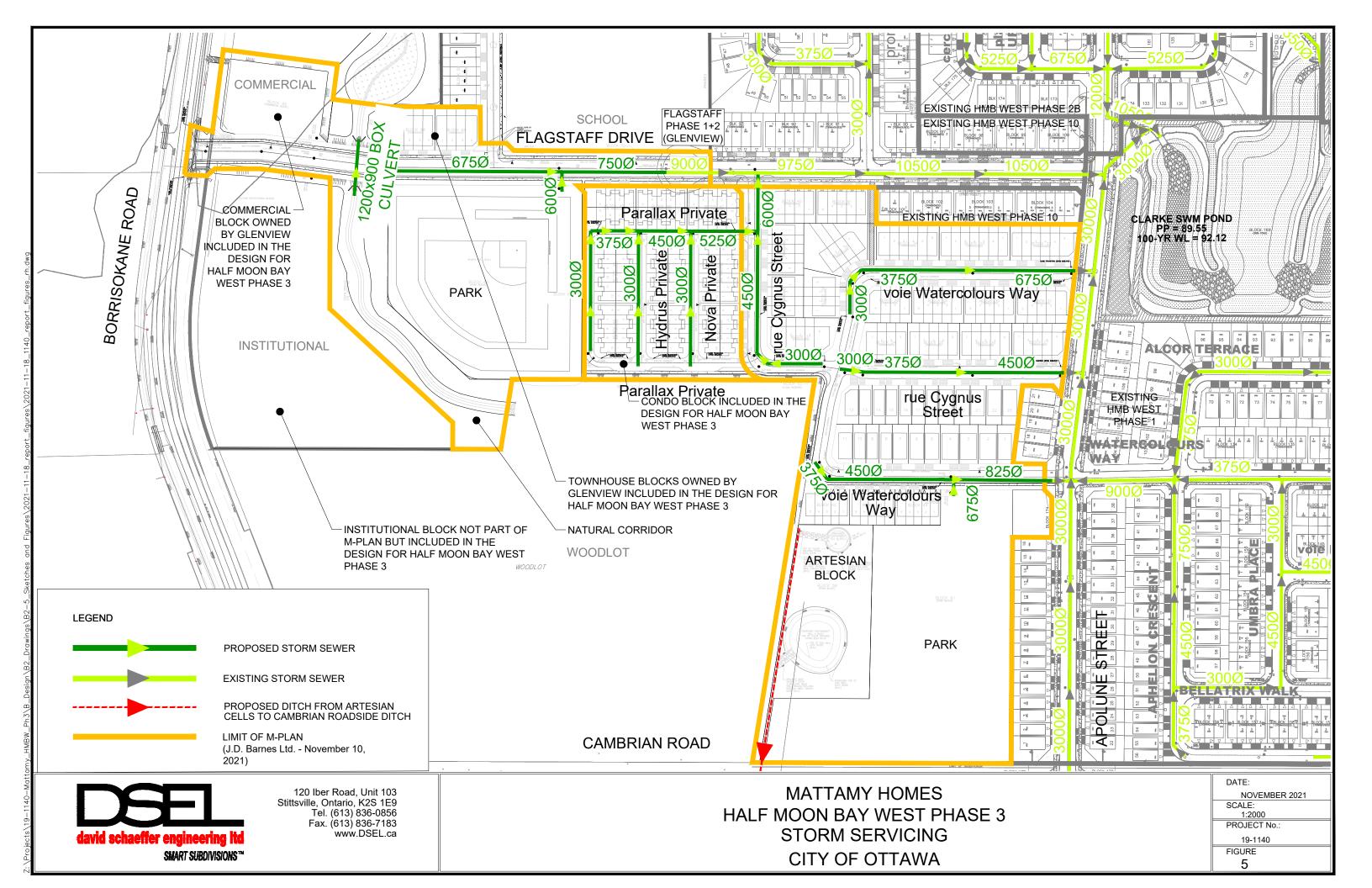


z:\projects\19-1140-mattamy_hmbw_ph3\b_design\b2_drawings\b2-5_sketches and figures\2021-08-27_report_figures\2021-11-18_1140_key_plan_rh.dwg









APPENDIX A

EXISTING APPROVALS

Ministry of the Environment and Climate Change

Eastern Region Technical Support Section Water Resources 1259 Gardiners Rd, PO Box 22032 Kingston, ON K7P 3J6 Tel: (613) 549-4000

Ministère de l'Environnement et de l'Action en matière de changement climatique

Direction régionale de l'Est Section du Soutien Technique Ressource en eau 1259 Chemin Gardiners, CP 22032 Kingston, ON K7P 3J6 Tél:(613) 549-4000



January 27, 2016

Bronwyn Anderson Mattamy (Half Moon Bay) Limited 2360 Bristol Circle Oakville, Ontario L6H 6M5

Dear Sir/Madam:

RE: Permit To Take Water 3205-A4ZLZ6 Proposed Multi-Use Development - Half Moon Bay Lot: 8-12, Concession: 3 Geographic Township of Nepean Ottawa Reference Number 6071-A3PQPJ

Please find attached Permit to Take Water 3205-A4ZLZ6 which authorizes the withdrawal of water in accordance with the application for this Permit to Take Water, dated October 7, 2015 and signed by Bronwyn Anderson.

Please note this Permit expires December 31, 2025 and cancels and replaces Permit 1413-8H9LLY. This Permit has been amended to more accurately reflect the water takings at the site.

Please also note that it is the responsibility of the Permit Holder to ensure that all other approvals required by law are obtained for this project. Such approvals may include but are not limited to a Section 53, Ontario Water Resources Act, R.S.O. 1990 (Sewage Works Environmental Compliance Approval).

Ontario Regulation 387/04 (Water Taking and Transfer) requires all water takers to report daily water taking amounts to the Water Taking Reporting System (WTRS) electronic database (https://www.lrcsde.lrc.gov.on.ca/wtrs/). Daily water taking must be reported on a calendar year basis. If no water is taken, then a "no taking" report must be entered. Please consult the Regulation and Section 4 of this Permit for monitoring requirements.

If you have questions about reporting requirements, please call the WTRS Help Desk at 416-235-6322 (toll free: 1-877-344-2011) or by email, <u>WTRSHelpdesk@ontario.ca</u>. It is preferred that you submit your data directly and electronically to the WTRS. Where this is impracticable, please contact the WTRS Help Desk to arrange for written submission of your data.

Please note that the contact information for the Environmental Review Tribunal has recently changed. The Environmental Review Tribunal's new contact information is as follows:

New public inquiry telephone number: (416) 212-6349; toll free: 1 (866) 448-2248 New fax number: (416) 326-5370; toll free: 1 (844) 213-3474

Take notice that in issuing this Permit, terms and conditions pertaining to the taking of water and to the results of the taking have been imposed. The terms and conditions have been designed to allow for the development of water resources, while providing reasonable protection to existing water uses and users.

Yours truly,

Greg Faaren Director, Section 34.1, Ontario Water Resources Act, R.S.O. 1990 Eastern Region

File Storage Number: SI OT 3205 220 (TS)

c: Michael Laflamme, Paterson Group, mlaflamme@patersongroup.ca

Ottawa District Office



AMENDED PERMIT TO TAKE WATER Surface and Ground Water NUMBER 3205-A4ZLZ6

Pursuant to Section 34.1 of the <u>Ontario Water Resources Act</u>, R.S.O. 1990 this Permit To Take Water is hereby issued to:

Mattamy (Half Moon Bay) Limited 2360 Bristol Circle Oakville, Ontario L6H 6M5 Canada

For the water

taking from:	Housing Excavation - North (S1)
	Site Servicing Excavation - North (S2)
	Greenbank Stormwater Management Pond Excavation (S3)
	Housing Excavation - West (S4)
	Site Servicing Excavation - West (S5)
	Clarke Stormwater Management Pond Excavation (S6)
	Housing Excavation - South (S7)
	Site Servicing Excavation - South (S8)
	6

Located at: Lot 8-12, Concession 3, Geographic Township of Nepean Ottawa

For the purposes of this Permit, and the terms and conditions specified below, the following definitions apply:

DEFINITIONS

- (a) "Director" means any person appointed in writing as a Director pursuant to section 5 of the OWRA for the purposes of section 34.1, OWRA.
- (b) "Provincial Officer" means any person designated in writing by the Minister as a Provincial Officer pursuant to section 5 of the OWRA.
- (c) "Ministry" means Ontario Ministry of the Environment and Climate Change.
- (d) "District Office" means the Ottawa District Office.
- (e) "Permit" means this Permit to Take Water No. 3205-A4ZLZ6 including its Schedules, if any, issued in accordance with Section 34.1 of the OWRA.

- (f) "Permit Holder" means Mattamy (Half Moon Bay) Limited.
- (g) "OWRA" means the *Ontario Water Resources Act*, R.S.O. 1990, c. O. 40, as amended.

You are hereby notified that this Permit is issued subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. Compliance with Permit

- 1.1 Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, dated October 7, 2015 and signed by Bronwyn Anderson, and all Schedules included in this Permit.
- 1.2 The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.
- 1.3 Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.
- 1.4 This Permit is not transferable to another person.
- 1.5 This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.
- 1.6 The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.
- 1.7 The Permit Holder shall report any changes of address to the Director within thirty days of any such change. The Permit Holder shall report any change of ownership of the property for which this Permit is issued within thirty days of any such change. A change in ownership in the property shall cause this Permit to be cancelled.

2. General Conditions and Interpretation

2.1 Inspections

The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the OWRA, the *Environmental Protection Act*, R.S.O. 1990, the *Pesticides Act*, R.S.O. 1990, or the *Safe Drinking Water Act*, S. O. 2002.

2.2 Other Approvals

The issuance of, and compliance with this Permit, does not:

(a) relieve the Permit Holder or any other person from any obligation to comply with any other applicable legal requirements, including the provisions of the *Ontario Water Resources Act*, and the *Environmental Protection Act*, and any regulations made thereunder; or

(b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.3 Information

The receipt of any information by the Ministry, the failure of the Ministry to take any action or require any person to take any action in relation to the information, or the failure of a Provincial Officer to prosecute any person in relation to the information, shall not be construed as:

(a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or

(b) acceptance by the Ministry of the information's completeness or accuracy.

2.4 Rights of Action

The issuance of, and compliance with this Permit shall not be construed as precluding or limiting any legal claims or rights of action that any person, including the Crown in right of Ontario or any agency thereof, has or may have against the Permit Holder, its officers, employees, agents, and contractors.

2.5 Severability

The requirements of this Permit are severable. If any requirements of this Permit, or the application of any requirements of this Permit to any circumstance, is held invalid or unenforceable, the application of such requirements to other circumstances and the remainder of this Permit shall not be affected thereby.

2.6 Conflicts

Where there is a conflict between a provision of any submitted document referred to in this Permit, including its Schedules, and the conditions of this Permit, the conditions in this Permit shall take precedence.

3. Water Takings Authorized by This Permit

3.1 Expiry

This Permit expires on **December 31, 2025**. No water shall be taken under authority of this Permit after the expiry date.

3.2 Amounts of Taking Permitted

The Permit Holder shall only take water from the source, during the periods and at the rates and amounts of taking specified in Table A. Water takings are authorized only for the purposes specified in Table A.

<u>Table A</u>

	Source Name	Source:	Taking	Taking	Max.	Max. Num.	Max. Taken	Max. Num. of	Zone/
	/ Description:	Туре:	Specific Purpose:	Major Category:	Taken per Minute (litres):	of Hrs Taken per Day:	per Day (litres):	Days Taken per Year:	Easting/ Northing:
1	Housing Excavation - North (S1)	Pond Dugout	Other - Dewatering	Dewatering	8,500	24	5,000,000	365	18 441394 5011476
2	Site Servicing Excavation - North (S2)	Pond Dugout	Other - Dewatering	Dewatering	8,500	24	6,000,000	210	18 441394 5011476
3	Greenbank Stormwater Management Pond Excavation (S3)	Pond Dugout	Other - Dewatering	Dewatering	5,000	24	2,000,000	210	18 441840 5011790
4	Housing Excavation - West (S4)	Pond Dugout	Other - Dewatering	Dewatering	8,500	24	5,000,000	365	18 440999 5010853
5	Site Servicing Excavation - West (S5)	Pond Dugout	Other - Dewatering	Dewatering	8,500	24	5,000,000	210	18 440999 5010853
6	Clarke Stormwater Management Pond Excavation (S6)	Pond Dugout	Other - Dewatering	Dewatering	5,000	24	3,500,000	210	18 440817 5010974
7	Housing Excavation - South (S7)	Pond Dugout	Other - Dewatering	Dewatering	8,500	24	6,000,000	365	18 442168 5010109
8	Site Servicing Excavation - South (S8)	Pond Dugout	Other - Dewatering	Dewatering	8,500	24	6,000,000	210	18 442168 5010109
	I				1	Total Taking:	38,500,000		

3.3 Notwithstanding Table A above, water shall only be taken from the Stormwater Management Ponds (Source 3 and Source 6) during construction of the ponds for construction purposes.

4. Monitoring

4.1 The Permit Holder shall maintain a record of all water takings. This record shall include the dates and times of water takings, the rates of taking and an estimated calculation of the total amounts of water taken per day for each day that water is taken under the authorization of this Permit. A separate record shall be maintained for each source. The Permit Holder shall keep all required records up to date and available at or near the site of the taking and shall produce the records immediately for inspection by a Provincial Officer upon his or her request.

5. Impacts of the Water Taking

5.1 Notification

The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060.

5.2 For Surface-Water Takings

The taking of water (including the taking of water into storage and the subsequent or simultaneous withdrawal from storage) shall be carried out in such a manner that streamflow is not stopped and is not reduced to a rate that will cause interference with downstream uses of water or with the natural functions of the stream.

For Groundwater Takings

If the taking of water is observed to cause any negative impact to other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit Holder shall take such action necessary to make available to those affected, a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking to prevent or alleviate the observed negative impact. Pending permanent restoration of the affected supplies, the Permit Holder shall provide, to those affected, temporary water supplies adequate to meet their normal requirements, or shall compensate such persons for their reasonable costs of doing so.

If permanent interference is caused by the water taking, the Permit Holder shall restore the water supplies of those permanently affected.

5.3 Prevention of Adverse Effects:

The Permit Holder shall ensure the taking of water under authority of this Permit does not result in an adverse effect on area waters.

5.4 Prevention of Structural Adverse Effects:

The Permit Holder shall take all measures necessary to prevent damage to buildings, bridges, structures, roads and/or railway lines that may be impacted either directly or indirectly by this taking.

- 5.5 The Permit Holder shall ensure that any water that is taken for dewatering purposes and discharged to the City of Ottawa sewer system is in accordance with a City of Ottawa Sewer Use Agreement.
- 5.6 The Permit Holder shall ensure that any water that is taken for dewatering purposes and discharged to the on-site Stormwater Management Ponds is in accordance with an Environmental Compliance Approval issued by this Ministry.
- 5.7 The Permit Holder shall ensure that any water that is taken for dewatering purposes and discharged to the temporary holding ponds labelled as Housing or Site Services Excavation ponds and numbered as Sources S1, S2, S4, S5, S7 and S8 in Section 3.0 of this Permit is analyzed for turbidity and meets the criteria in Condition 5.12 prior to discharge to the Jock River or the requirements in Condition 5.5 if discharged to the City of Ottawa sewer system.
- 5.8 The Permit Holder shall keep a record of all discharge dates to either the Jock River or the City of Ottawa sewer system from either the housing excavation or site servicing ponds and/or the Greenbank and Clarke Stormwater Management Ponds as well as a record of the water quality analyses conducted to determine if the discharge water quality meets the requirements of Condition 5.5 and Condition 5.12.
- 5.9 Discharge Control Measures for Water that is Discharged to the Natural Environment: Siltation control measures shall be installed at the discharge site(s) and shall be sufficient to control the volumes. Continuous care shall be taken to properly maintain the siltation control devices.
- 5.10 The discharge of water shall be controlled in such a way as to avoid erosion and sedimentation in the receiving stream.
- 5.11 The Permit Holder shall ensure that any water discharged to the natural environment does not result in scouring, erosion or physical alteration of stream channels or banks and that there is no flooding in the receiving area or water body, downstream water bodies, ditches or properties caused or worsened by this discharge.
- 5.12 The Permit Holder shall not discharge turbid water to any watercourse. Turbid water shall be defined as any discharge water from the excavation or diverted water with a maximum increase of 8 NTUs above the receiving stream's background levels.

6. Director May Amend Permit

The Director may amend this Permit by letter requiring the Permit Holder to suspend or reduce the taking to an amount or threshold specified by the Director in the letter. The suspension or reduction in taking shall be effective immediately and may be revoked at any time upon notification by the Director. This condition does not affect your right to appeal the suspension or reduction in taking to the Environmental Review Tribunal under the *Ontario Water Resources Act*, Section 100 (4).

The reasons for the imposition of these terms and conditions are as follows:

- 1. Condition 1 is included to ensure that the conditions in this Permit are complied with and can be enforced.
- 2. Condition 2 is included to clarify the legal interpretation of aspects of this Permit.
- 3. Conditions 3 through 6 are included to protect the quality of the natural environment so as to safeguard the ecosystem and human health and foster efficient use and conservation of waters. These conditions allow for the beneficial use of waters while ensuring the fair sharing, conservation and sustainable use of the waters of Ontario. The conditions also specify the water takings that are authorized by this Permit and the scope of this Permit.

In accordance with Section 100 of the <u>Ontario Water Resources Act</u>, R.S.O. 1990, you may by written notice served upon me, the Environmental Review Tribunal and the Environmental Commissioner, **Environmental Bill of Rights**, R.S.O. 1993, Chapter 28, within 15 days after receipt of this Notice, require a hearing by the Tribunal. The Environmental Commissioner will place notice of your appeal on the Environmental Registry. Section 101 of the <u>Ontario Water Resources Act</u>, as amended provides that the Notice requiring a hearing shall state:

- 1. The portions of the Permit or each term or condition in the Permit in respect of which the hearing is required, and;
- 2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

In addition to these legal requirements, the Notice should also include:

- 3. The name of the appellant;
- 4. The address of the appellant;
- 5. The Permit to Take Water number;
- 6. The date of the Permit to Take Water;
- 7. The name of the Director;
- 8. The municipality within which the works are located;

This notice must be served upon:

The Secretary Environmental Review Tribunal 655 Bay Street, 15th Floor Toronto ON M5G 1E5	<u>AND</u>	The Environmental Commissioner 1075 Bay Street 6th Floor, Suite 605 Toronto, Ontario M5S 2W5	<u>AND</u>	The Director, Section 34.1, Ministry of the Environment and Climate Change 1259 Gardiners Rd, PO Box 22032
Fax: (416) 326-5370 Email:				Kingston, ON K7P 3J6
ERTTribunalsecretary@ontario.ca				

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal:

by Telephone at	by Fax at	by e-mail at
(416) 212-6349	(416) 326-5370	www.ert.gov.on.ca
Toll Free 1(866) 448-2248	Toll Free 1(844) 213-3474	

This instrument is subject to Section 38 of the **Environmental Bill of Rights** that allows residents of Ontario to seek leave to appeal the decision on this instrument. Residents of Ontario may seek to appeal for 15 days from the date this decision is placed on the Environmental Registry. By accessing the Environmental Registry, you can determine when the leave to appeal period ends.

This Permit cancels and replaces Permit Number 1413-8H9LLY, issued on 2011/05/30.

Dated at Kingston this 27th day of January, 2016.

Greg Faaren Director, Section 34.1 Ontario Water Resources Act, R.S.O. 1990

Schedule A

This Schedule "A" forms part of Permit To Take Water 3205-A4ZLZ6, dated January 27, 2016.



Ministry of the Environment and Climate Change Ministère de l'Environnement et de l'Action en matière de changement climatique

ENVIRONMENTAL COMPLIANCE APPROVAL NUMBER 3029-ACNJPT Issue Date: August 12, 2016

Mattamy (Half Moon Bay) Limited 50 Hines Road, Unit 100 Kanata, Ontario K2K 2M5

Site Location: Half Moon Bay North Phases 4 and 7 Part of Lots 10, 11 and 12, Concession 3 (Rideau Front) City of Ottawa

You have applied under section 20.2 of Part II.1 of the <u>Environmental Protection Act</u>, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

storm and sanitary sewers to be constructed in the City of Ottawa, on River Run Avenue (from 0+031.6 to 0+167.9), Burbot Street (from 0-001.6 to 0+351.5), Brassy Minnow Crescent (from 0+004.2 to 0+292.7), Pumpkinseed Crescent (from 0+002.1 to 0+175.4), Riverboat Heights (from 0+023.8 to 0+138.7), Logperch Circle (from 0+001.2 to 0+421.9), Pearl Dave Crescent (from 0-002.0 to 0+370.9), Finescale Way (from 0+000.0 to 132.1), Millars Sound Way (from 0-000.6 to 0+287.3), River Landing Avenue (from 0+011.7 to 0+160.0), Block 203 (from 0-002.3 to 0+070.9), Block 204 (from 0+015.5 to 0+090.5), Block 205 (from 0+000.0 to 0+156.3), Half Moon Bay Road (from 0+014.7 to 0+234.4), Greenbank Storm Pond Inlet (0-000.4 to 0+013.4), Greenbank Storm Pond Outlet (from 0+000.0 to 0+030.0);

all in accordance with the application from Mattamy (Half Moon Bay) Limited, dated July 28, 2016, including final plans and specifications prepared by David Schaeffer Engineering Ltd..

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

- 1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
- 2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

- 3. The name of the appellant;
- 4. The address of the appellant;
- 5. The environmental compliance approval number;
- 6. The date of the environmental compliance approval;
- 7. The name of the Director, and;
- 8. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary* Environmental Review Tribunal 655 Bay Street, Suite 1500 Toronto, Ontario M5G 1E5

AND

The Director appointed for the purposes of Part II.1 of the Environmental Protection Act Ministry of the Environment and Climate Change 135 St. Clair Avenue West, 1st Floor Toronto, Ontario M4V 1P5

* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 12th day of August, 2016

Gregory Zimmer, P.Eng. Director appointed for the purposes of Part II.1 of the *Environmental Protection Act*

AF/

c: District Manager, MOECC Ottawa
 M. Rick O'Connor, City Clerk, City of Ottawa
 Jeff Shillington, Project Manger, Development Review City of Ottawa (File No. D07-16-13-0019)
 Linda Carkner, Program Manager, Infrastructure Services, City of Ottawa
 Jennifer Ailey, P. Eng., David Schaeffer Engineering Limited (DSEL)



Ministry of the Environment and Climate Change Ministère de l'Environnement et de l'Action en matière de changement climatique

AMENDED ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 6068-AWUPL5 Issue Date: April 11, 2018

Mattamy (Half Moon Bay) Limited 50 Hines Road, Suite 100 Kanata, Ontario K2K 2M5

Site Location:

Half Moon Bay West – Clarke Stormwater Management Pond Part of Lot 10, 11, 12, Concession 3 (Rideau Front) City of Ottawa, Ontario

You have applied under section 20.2 of Part II.1 of the <u>Environmental Protection Act</u>, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

An amendment to the interim stormwater management system with the replacement of the existing sediment control pond, temporary drainage swales and erosion and sediment control measures with the establishment of the proposed wet pond and outlet channel serving Half Moon Bay West, Half Moon Bay North, Meadows in Half Moon Bay and Half Moon Bay South in Barrhaven South, located in the vicinity of Cambrian Road, east of Borrisokane Road (formerly Cedarview Road), for the collection, transmission, treatment and disposal of stormwater run-off from a total catchment area of approximately 123.41 ha, within the Jock River watershed, in the City of Ottawa providing Enhanced Level water quality control, consisting of the following:

Proposed Works:

one (1) wet pond, located within the Half Moon Bay West lands, serving a total drainage area of 123.41 hectares and having a total length of 180 m and a total width of 160 m, consisting of:

- two (2) riprap-lined sediment forebays that have a minimum length-to-width ratio of 2:1, a depth of 2.0 m, and are separated from the main cell via a berm;
- a main cell that has a minimum permanent storage volume of 22400 m3, a minimum active storage volume of 6803 m3, a maximum permanent pool depth of 3.0 m and a maximum available depth of 5.543 m, including a freeboard of 0.3 m;

- an inlet structure consisting of a 3000 mm diameter storm inlet pipe and a concrete headwall;
- an inlet structure consisting of a 1800 mm diameter storm inlet pipe, a 2700 mm diameter storm inlet pipe and a concrete headwall;
- two (2) overland flow routes with 5 m bottom width and erosion control mat located on the east and west side of the pond;
- a low flow outlet structure comprised of a 1350 mm diameter storm outlet pipe equipped with a 250 mm diameter orifice plate and a 700 mm long weir, allowing a maximum discharge of 1389 L/s under the 100-year storm event to a proposed outlet channel and the Jock River located north of the pond;
- a high flow outlet structure consisting of a 50 m long broad crested weir, spillway and scour pool. Outlet structure to include toe wall and concrete block surface treatment. Designed to convey flows of 0.469 m3/s (2 year event) to 17.946 m3/s (100 year event) and to function as an emergency overflow.

AND

• an outlet channel, 340 m long, with 15.0 m bottom width, 0.1% longitudinal slope and 3:1 side slopes, complete with a 9000 mm x 2400 mm culvert crossing under Street 18.

Previous Works:

Interim West Clarke Drain realignment (catchment area approximately 109 hectares):

- construction of a new ditch to redirect the West Clarke Drain flows consisting of:
- a ditch approximately 1.0 m deep with a 4.0 m wide bottom and 3:1 side slopes, with approximately 595 m at a slope of 0.12% and approximately 572.5 m at a slope of 0.10%, designed to convey the 100-year flows of 4.62 m³/s and 4.85 m³/s respectively;

including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the submitted application and supporting documents listed in Schedule "A" forming part of this approval.

For the purpose of this environmental compliance approval, the following definitions apply:

1. "Approval " means this entire document and any schedules attached to it, and the application;

- 2. "*Director* " means a person appointed by the Minister pursuant to section 5 of the *EPA* for the purposes of Part II.1 of the *EPA*;
- 3. "*District Manager* " means the District Manager of the appropriate local District Office of the *Ministry*, where the *Works* are geographically located;}
- 4. "EPA" means the Environmental Protection Act, R.S.O. 1990, c.E.19, as amended;
- 5. "*Equivalent* " means a substituted oil and grit separator that meets the required quality and performance standards of the approved oil and grit separator;
- 6. "*Interim Works*" means the interim stormwater management works, described in this *Approval* and that are to be used for short-term purposes only in accordance with this *Approval*, until otherwise approval for an extension of this period has been granted;
- 7. "*Ministry* " means the ministry of the government of Ontario responsible for the *EPA* and *OWRA* and includes all officials, employees or other persons acting on its behalf;
- 8. "Owner " means Mattamy (Half Moon Bay) Limited, and includes its successors and assignees;
- 9. "OWRA" means the Ontario Water Resources Act, R.S.O. 1990, c. O.40, as amended;
- 10. "*Previous Works* " means those portions of the sewage Works previously approved under an Approval;
- 11. "Proposed Works " means the sewage works described in the Owner's application, this Approval, to the extent approved by this Approval;
- 12. "Works " means the sewage Works described in the Owner's application, and this Approval, and includes Proposed Works and Previous Work.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL CONDITIONS

1. The *Owner* shall ensure that any person authorized to carry out work on or operate any aspect of the *Works* is notified of this *Approval* and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

- 2. Except as otherwise provided by these Conditions, the *Owner* shall design, build, install, operate and maintain the *Works* in accordance with the description given in this *Approval*, and the application for approval of the *Works*.
- 3. Where there is a conflict between a provision of any document in the schedule referred to in this *Approval* and the conditions of this *Approval*, the conditions in this *Approval* shall take precedence, and where there is a conflict between the documents in the schedule, the document bearing the most recent date shall prevail.
- 4. Where there is a conflict between the documents listed in Schedule "A" and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.
- 5. The conditions of this *Approval* are severable. If any condition of this *Approval*, or the application of any requirement of this *Approval* to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this *Approval* shall not be affected thereby.
- 6. The issuance of, and compliance with the conditions of, this *Approval* does not:
 - a. relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement, including, but not limited to, the obligation to obtain approval from the local conservation authority/MNR necessary to construct or operate the sewage works; or
 - b. limit in any way the authority of the *Ministry* to require certain steps be taken to require the *Owner* to furnish any further information related to compliance with this *Approval*.

2. EXPIRY OF APPROVAL

- 1. This *Approval* will cease to apply to those parts of the Work which have not been constructed within five (5) years of the date of this *Approval*.
- 2. In the event that completion and commissioning of any portion of the *Works* is anticipated to be delayed beyond the specified expiry period, the *Owner* shall submit an application of extension to the expiry period, at least twelve (12) months prior to the end of the period. The application for extension shall include the reason(s) for the delay, whether there is any design change(s) and a review of whether the standards applicable at the time of Approval of the *Works* are still applicable at the time of request for extension, to ensure the ongoing protection of the environment.
- 3. This Approval to the Interim Works shall become null and void on March 21, 2023.

3. CHANGE OF OWNER

- 1. The *Owner* shall notify the *District Manager* and the *Director*, in writing, of any of the following changes within thirty (30) days of the change occurring:
 - a. change of Owner;
 - b. change of address of the Owner;
 - c. change of partners where the *Owner* is or at any time becomes a partnership, and a copy of the most recent declaration filed under the <u>Business Names Act</u>, R.S.O. 1990, c.B17 shall be included in the notification to the *District Manager*; or
 - d. change of name of the corporation where the *Owner* is or at any time becomes a corporation, and a copy of the most current information filed under the <u>Corporations Information Act</u>, R.S.O. 1990, c. C39 shall be included in the notification to the *District Manager*.
- 2. In the event of any change in ownership of the *Works*, other than a change to a successor municipality, the *Owner* shall notify in writing the succeeding owner of the existence of this *Approval*, and a copy of such notice shall be forwarded to the *District Manager* and the *Director*.
- 3. The *Owner* shall ensure that all communications made pursuant to this condition refer to the number at the top of this *Approval*.
- 4. Notwithstanding any other requirements in this *Approval*, upon transfer of the ownership or assumption of the *Works* to a municipality if applicable, any reference to the *District Manager* shall be replaced with the *Water Supervisor*.

4. OPERATION AND MAINTENANCE

- 1. If applicable, any proposed storm sewers or other stormwater conveyance in this *Approval* can be constructed but not operated until the proposed stormwater management facilities in this *Approval* or any other *Approval* that are designed to service the storm sewers or other stormwater conveyance are in operation.
- 2. The *Owner* shall make all necessary investigations, take all necessary steps and obtain all necessary approvals so as to ensure that the physical structure, siting and operations of the *Works* do not constitute a safety or health hazard to the general public.
- 3. The *Owner* shall inspect and ensure that the design minimum liquid retention volume is maintained in the *Works* at all times, except when maintenance is required.

- 4. The *Owner* shall undertake an inspection of the condition of the *Works*, at least once a year, and undertake any necessary cleaning and maintenance to ensure that sediment, debris and excessive decaying vegetation are removed from the *Works* to prevent the excessive build-up of sediment, oil/grit, debris and/or decaying vegetation, to avoid reduction of the capacity and/or permeability of the *Works*, as applicable. The *Owner* shall also regularly inspect and clean out the inlet to and outlet from the *Works* to ensure that these are not obstructed.
- 5. The *Owner* shall design, construct and operate the *Works* with the objective that the effluent from the *Works* is essentially free of floating and settleable solids and does not contain oil or any other substance in amounts sufficient to create a visible film, sheen, foam or discoloration on the receiving waters.
- 6. The *Owner* shall maintain a logbook to record the results of these inspections and any cleaning and maintenance operations undertaken, and shall keep the logbook at the *Owner's* administration office for inspection by the *Ministry*. The logbook shall include the following:
 - a. the name of the Works; and
 - b. the date and results of each inspection, maintenance and cleaning, including an estimate of the quantity of any materials removed and method of clean-out of the *Works*.
- 7. The *Owner* shall prepare an operations manual prior to the commencement of operation of the *Works* that includes, but is not necessarily limited to, the following information:
 - a. operating and maintenance procedures for routine operation of the Works ;
 - b. inspection programs, including frequency of inspection, for the *Works* and the methods or tests employed to detect when maintenance is necessary;
 - c. repair and maintenance programs, including the frequency of repair and maintenance for the *Works* ;
 - d. contingency plans and procedures for dealing with potential spills and any other abnormal situations and for notifying the *District Manager*; and
 - e. procedures for receiving, responding and recording public complaints, including recording any follow-up actions taken.
- 8. The *Owner* shall maintain the operations manual current and retain a copy at the location of the *Works* for the operational life of the *Works*. Upon request, the *Owner* shall make the manual available to *Ministry* staff.

5. <u>TEMPORARY EROSION AND SEDIMENT CONTROL</u>

- 1. The *Owner* shall install and maintain temporary sediment and erosion control measures during construction and conduct inspections once every two (2) weeks and after each significant storm event (a significant storm event is defined as a minimum of 25 mm of rain in any 24 hours period). The inspections and maintenance of the temporary sediment and erosion control measures shall continue until they are no longer required and at which time they shall be removed and all disturbed areas reinstated properly.
- 2. The *Owner* shall maintain records of inspections and maintenance which shall be made available for inspection by the *Ministry*, upon request. The record shall include the name of the inspector, date of inspection, and the remedial measures. if any, undertaken to maintain the temporary sediment and erosion control measures.

6. MONITORING AND RECORDING

The *Owner* shall, upon commencement of operation of the *Works*, carry out the following monitoring program:

- 1. All samples and measurements taken for the purposes of this *Approval* are to be taken at a time and in a location characteristic of the quality and quantity of the effluent stream over the time period being monitored.
- 2. Samples shall be collected at the following sampling points, at the frequency specified, by means of the specified sample type and analyzed for each parameter listed and all results recorded, as outlined in Schedule "B".
- 3. The methods and protocols for sampling, analysis and recording shall conform, in order of precedence, to the methods and protocols specified in the following:
 - a. the *Ministry's* Procedure F-10-1, "Procedures for Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works (Liquid Waste Streams Only)", as amended from time to time by more recently published editions;
 - b. the *Ministry's* publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (January 1999), ISBN 0-7778-1880-9, as amended from time to time by more recently published editions; and
 - c. the publication "Standard Methods for the Examination of Water and Wastewater" (21st edition), as amended from time to time by more recently published editions.

7. <u>REPORTING</u>

- 1. One (1) week prior to the start-up of the operation of the *Works*, the *Owner* shall notify the *District Manager* (in writing) of the pending start-up date.
- 2. The *Owner* shall, upon request, make all manuals, plans, records, data, procedures and supporting documentation available to *Ministry* staff.
- 3. The *Owner* shall prepare and submit a performance report to the *District Manager* on an annual basis, within ninety (90) days following the end of the period being reported upon. The first such report shall cover the first annual period following the commencement of operation of the *Works* and subsequent reports shall be submitted to cover successive annual periods following thereafter. The reports shall contain, but shall not be limited to, the following information:
 - a. a summary and interpretation of all monitoring data and an overview of the success and adequacy of the *Works*, including demonstration using the monitoring data that the appropriate level of quality control has been achieved;
 - b. a description of any operating problems encountered and corrective actions taken;
 - c. a summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the *Works*, including an estimate of the quantity of any materials removed from the *Works*;
 - d. a summary of the calibration and maintenance carried out on all monitoring equipment;
 - e. a summary of any complaints received during the reporting period and any steps taken to address the complaints;
 - f. a summary of all spill or abnormal discharge events; and
 - g. any other information the District Manager requires from time to time.

SCHEDULE "A"

- 1. Application for Approval of Sewage Works, dated November 2, 2012, submitted by Mark Parsons, President of Mattamy (Half Moon Bay) Limited, and supporting documentation;
- 2. Email from Jennifer Ailey of David Schaeffer Engineering Ltd. to the Ministry, dated February 1, 2013;
- 3. Application for Approval of Municipal and Private Sewage Works, dated December 4, 2013 and received on February 28, 2014, submitted by the City of Ottawa;
- 4. Copy of letter from Jennifer Ailey of David Schaeffer Engineering Ltd. to the City of Ottawa, dated February 24, 2013, and supporting documentation;
- 5. Erosion Control Plan, Sheet 1 and Siltation Control Plan Details, Sheet 2, dated January 20, 2014, prepared by David Schaeffer Engineering Ltd.;
- 6. E-mail from Jennifer Ailey of David Schaeffer Engineering Ltd. to the Ministry, dated May 30, 2014;
- 7. Application for Approval of Municipal and Private Sewage Works, dated June 7, 2016 and received on June 9, 2016, submitted by the Mattamy (Half Moon Bay) Limited;
- 8. Application for Environmental Compliance Approval, dated February 13, 2018, and received on February 15, 2018, including final plans and specifications prepared by David Schaeffer Engineering Ltd.;
- 9. Transfer of Review Letter of Recommendation, dated February 9, 2018 and signed by Charles Warnock, Program Manager, Development Review, City of Ottawa.
- Emails from Jennifer Ailey, David Schaeffer Engineering Ltd., dated March 19, 2018 and Jeffrey Shillington, dated March 20, 2018 and March 21, 2018 responses to draft ECA sent by Ricki Allum, Ministry of the Environment and Climate Change dated March 16, 2018.

SCHEDULE "B"

 Table 1: Effluent Monitoring

 (Samples to be collected from the influent and effluent streams of the Half Moon Bay West - Clarke Stormwater
 Management Pond)

Sample Type	Grab		
Frequency	Three (3) rainfall Wet Events per year, with two (2) of the events occurring		
	between May and September		
Parameters	Total Suspended Solids, Phosphorus and Temperature		

Page 10 - NUMBER 6068-AWUPL5

The reasons for the imposition of these terms and conditions are as follows:

- 1. Condition 1 is imposed to ensure that the *Works* are constructed and operated in the manner in which they were described and upon which approval was granted. This condition is also included to emphasize the precedence of conditions in the *Approval* and the practice that the *Approval* is based on the most current document, if several conflicting documents are submitted for review. Condition 1.6 is included to emphasize that the issuance of this *Approval* does not diminish any other statutory and regulatory obligations to which the *Owner* is subject in the construction, maintenance and operation of the *Works*. The Condition specifically highlights the need to obtain any necessary conservation authority approvals. The Condition also emphasizes the fact that this *Approval* doesn't limit the authority of the *Ministry* to require further information.
- 2. Condition 2 is included to ensure that, when the *Works* are constructed, the *Works* will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.
- 3. Condition 3 is included to ensure that the *Ministry* records are kept accurate and current with respect to approved Works and to ensure that subsequent owners of the *Works* are made aware of the *Approval* and continue to operate the *Works* in compliance with it.
- 4. Condition 4 is included to prevent the operation of stormwater pipes and other conveyance until such time that their required associated stormwater management *Works* are also constructed. This Condition is included as regular inspection and necessary removal of sediment and excessive decaying vegetation from the *Works* are required to mitigate the impact of sediment, debris and/or decaying vegetation on the treatment capacity of the *Works*. The Condition also ensures that adequate storage is maintained in the *Works* at all times as required by the design. Furthermore, this Condition is included to ensure that the *Works* are operated and maintained to function as designed.
- 5. Condition 5 is included as installation, regular inspection and maintenance of the temporary sediment and erosion control measures is required to mitigate the impact on the downstream receiving watercourse during construction until they are no longer required.
- 6. Condition 6 is included to enable the *Owner* to evaluate and demonstrate the performance of the *Works*, on a continual basis, so that the *Works* are properly operated and maintained at a level which is consistent with the design objectives specified in the *Approval* and that the *Works* do not cause any impairment to the receiving watercourse or the environment.
- 7. Condition 7 is included to provide a performance record for future references, to ensure that the *Ministry* is made aware of problems as they arise, and to provide a compliance record for all the terms and conditions outlined in this *Approval*, so that the *Ministry* can work with the *Owner* in resolving any problems in a timely manner.

Upon issuance of the environmental compliance approval, I hereby revoke Approval No(s). 1153-ACHP3E issued on August 17, 2016

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

- a. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
- b. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

Pursuant to subsection 139(3) of the Environmental Protection Act, a hearing may not be required with respect to any terms and conditions in this environmental compliance approval, if the terms and conditions are substantially the same as those contained in an approval that is amended or revoked by this environmental compliance approval.

The Notice should also include:

- 1. The name of the appellant;
- 2. The address of the appellant;
- 3. The environmental compliance approval number;
- 4. The date of the environmental compliance approval;
- 5. The name of the Director, and;
- 6. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*		The Director appointed for the purposes of Part II.1 of
Environmental Review Tribunal		the Environmental Protection Act
		Ministry of the Environment and Climate Change
655 Bay Street, Suite 1500	AND	135 St. Clair Avenue West, 1st Floor
Toronto, Ontario		Toronto, Ontario
M5G 1E5		M4V 1P5

* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 11th day of April, 2018

IFIID	APPROVAL WAS MAILED
ON_	APR 1 2 2018
	Mr.
	(Signed)

C. Labaye

Christina Labarge, P.Eng. Director

Page 12 - NUMBER 6068-AWUPL5

appointed for the purposes of Part II.1 of the *Environmental Protection Act*

RA/

c: District Manager, MOECC Ottawa Jason Rumer, Mattamy (Half Moon Bay) Limited Jeffery Shillington, City of Ottawa Jennifer Ailey, David Schaeffer Engineering Ltd.



Ministry of the Environment, Conservation and Parks Ministère de l'Environnement, de la Protection de la nature et des Parcs

ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 2725-B5VKYF Issue Date: October 30, 2018

Mattamy (Half Moon Bay) Limited 50 Hines Road, Suite 100 Ottawa, Ontario K2K 2M5

Site Location:

Half Moon Bay West – Phase 1 Lots 10-12, Concession 3 (Rideau Front) City of Ottawa, Ontario

You have applied under section 20.2 of Part II.1 of the <u>Environmental Protection Act</u>, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

the establishment of wastewater infrastructure Works located in the City of Ottawa, consisting of the following:

- storm sewers on rue Apolune Street (from Station 0-021.13 to Station 0+466.68), croissant Aphelion Crescent (West Leg) (from Station 0-005.38 to Station 0+186.83), croissant Aphelion Crescent (South Leg) (from Station 0-005.74 to Station 0+171.59), croissant Aphelion Crescent (East Leg) (from Station 0-021.38 to Station 0+189.60), place Umbra Place (from Station 0+002.00 to Station 0+146.41), chemin Greenbank Road (from Station 4+976.10 to Station 5+387.68), cours Bellatrix Walk (from Station 0-001.99 to Station 0+175.00), voie Merak Way (from Station 0+002.00 to Station 0+104.49), voie Watercolours Way (from Station 0-011.89 to Station 0+386.39), bois Celestial Grove (from Station 0-001.99 to Station 0+235.66), terrasse Alcor Terrace (from Station 0-002.84 to Station 0+242.86), Cambrian Road (from Station 0+812.53 to Station 971.08), Stormwater Management Pond Inlet Headwall 2 and Servicing Block (from Station 0+000.00 to Station 0+221.12), and Stormwater Management Pond Inlet Headwall 1 (from Station 0-000.714 to Station 0+060.00), discharging to the Clarke Stormwater Management Pond, located in Half Moon Bay West;
- sanitary sewers on rue Apolune Street (from Station 0-004.67 to Station 0+356.20), croissant Aphelion Crescent (West Leg) (from Station 0-005.05 to Station 0+189.60), croissant Aphelion Crescent (South Leg) (from Station 0-005.74 to Station 0+171.59), croissant Aphelion Crescent (East Leg) (from Station 0-020.00 to Station 0+189.60), place Umbra Place (from Station 0+000.00 to Station 0+148.41), cours Bellatrix Walk (from Station 0+000.00 to Station 0+177.03), voie Merak Way (from Station 0+000.00 to Station 0+100.00 to Station 0+106.51), voie Watercolours Way (from Station 0-011.89 to Station 0+388.55), bois Celestial Grove (from Station 0+000.00 to Station 0+214.79), terrasse Alcor Terrace (from Station 0-000.57 to Station 0+242.86), and Cambrian Road (from Station 0+556.66 to Station 950.81), discharging to existing sanitary sewers, located on Cambrian Road;

- temporary diversion ditch in Half Moon Bay West Phase 1, discharging to the Clarke Stormwater Management Pond located in Half Moon Bay West: Leg 1 – approximately 413.0 metres long at 0.32% average bottom slope, 3:1 side slopes, approximately 2.0 metres bottom width; Leg 2 – approximately 32.0 metres long at 0.79% average bottom slope, 2.5:1 side slopes, approximately 4.0 metres bottom width; Leg 3 – approximately 136.7 metres long at 1.80% average bottom slope, 3:1 side slopes, approximately 4.0 metres bottom width; and
- temporary culvert in Half Moon Bay West Phase 1, 1600 millimetre diameter, approximately 39.0 metres long at 0.50% slope, discharging to the temporary diversion ditch and Clarke Stormwater Management Pond, located in Half Moon Bay West;

including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the submitted application and supporting documents listed in Schedule "A" forming part of this approval.

For the purpose of this environmental compliance approval, the following definitions apply:

- 1. "Approval" means this entire document and any schedules attached to it, and the application;
- 2. "Director" means a person appointed by the Minister pursuant to section 5 of the EPA for the purposes of Part II.1 of the EPA;
- 3. "District Manager" means the District Manager of the appropriate local District Office of the Ministry, where the Works are geographically located;
- 4. "EPA" means the Environmental Protection Act, R.S.O. 1990, c.E.19, as amended;
- 5. "Interim Works" means the interim Works, described in this Approval and that are to be used for short-term purposes only in accordance with this Approval, until otherwise approval for an extension of this period has been granted;
- 6. "Ministry" means the ministry of the government of Ontario responsible for the EPA and OWRA and includes all officials, employees or other persons acting on its behalf;
- 7. "Owner" means Mattamy (Half Moon Bay) Limited, and includes its successors and assignees;
- 8. "OWRA" means the Ontario Water Resources Act, R.S.O. 1990, c. O.40, as amended;
- 9. "Works" means the sewage Works described in the Owner's application, and this Approval.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL CONDITIONS

- 1. The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.
- 2. Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Approval, and the application for approval of the Works.
- 3. Where there is a conflict between a provision of any document in the schedule referred to in this Approval and the conditions of this Approval, the conditions in this Approval shall take precedence, and where there is a conflict between the documents in the schedule, the document bearing the most recent date shall prevail.
- 4. Where there is a conflict between the documents listed in Schedule "A" and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.
- 5. The conditions of this Approval are severable. If any condition of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this Approval shall not be affected thereby.

2. EXPIRY OF APPROVAL

- 1. This Approval will cease to apply to those parts of the Works which have not been constructed within five (5) years of the date of this Approval.
- 2. In the event that completion and commissioning of any portion of the Works is anticipated to be delayed beyond the specified expiry period, the Owner shall submit an application of extension to the expiry period, at least twelve (12) months prior to the end of the period. The application for extension shall include the reason(s) for the delay, whether there is any design change(s) and a review of whether the standards applicable at the time of Approval of the Works are still applicable at the time of request for extension, to ensure the ongoing protection of the environment.
- 3. This Approval to the Interim Works shall expire and become null and void on October

26, 2023.

3. CHANGE OF OWNER

- 1. The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within thirty (30) days of the change occurring:
 - a. change of Owner;
 - b. change of address of the Owner;
 - c. change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the *Business Names Act*, R.S.O. 1990, c.B17 shall be included in the notification to the District Manager; or
 - d. change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the District Manager.
- 2. In the event of any change in ownership of the Works, other than a change to a successor municipality, the Owner shall notify in writing the succeeding owner of the existence of this Approval, and a copy of such notice shall be forwarded to the District Manager and the Director.
- 3. The Owner shall ensure that all communications made pursuant to this condition refer to the number at the top of this Approval.

4. OPERATION AND MAINTENANCE

1. If applicable, any proposed storm sewers or other stormwater conveyance in this Approval can be constructed but not operated until the proposed stormwater management facilities in this Approval or any other Approval that are designed to service the storm sewers or other stormwater conveyance are in operation.

Schedule "A"

- 1. Application for Environmental Compliance Approval, dated October 4, 2018, received on October 11, 2018, submitted by Mattamy (Half Moon Bay) Limited;
- 2. Transfer of Review Letter of Recommendation, dated October 9, 2018 and signed by Jeff Shillington, P.Eng., Project Manager, Development Review, Planning, Infrastructure and Economic Development Department, City of Ottawa;
 - a. Final Plans and Specifications prepared by David Schaeffer Engineering Ltd.
 - b. Pipe Data Form Watermain, Storm Sewer, Sanitary Sewer, and Forcemain Design Supplement to Application for Approval for Water and Sewage Works.
 - c. Hydraulic Design Sheets prepared by David Schaeffer Engineering Ltd.
- 3. Emails dated October 24, 2018 and October 25, 2018 from Jeff Shillington, P.Eng., Project Manager, Development Review, Planning, Infrastructure and Economic Development Department, City of Ottawa to Florence Poon, MECP.

The reasons for the imposition of these terms and conditions are as follows:

- 1. Condition 1 is imposed to ensure that the Works are constructed and operated in the manner in which they were described and upon which approval was granted. This condition is also included to emphasize the precedence of conditions in the Approval and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.
- 2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.
- 3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to the approved Works and to ensure that subsequent owners of the Works are made aware of the Approval and continue to operate the Works in compliance with it.
- 4. Condition 4 is included to prevent the operation of stormwater pipes and other conveyance until such time that their required associated stormwater management Works are also constructed.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

- a. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
- b. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

- 1. The name of the appellant;
- 2. The address of the appellant;
- 3. The environmental compliance approval number;
- 4. The date of the environmental compliance approval;
- 5. The name of the Director, and;
- 6. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary* Environmental Review Tribunal 655 Bay Street, Suite 1500 Toronto, Ontario M5G 1E5

AND

The Director appointed for the purposes of Part II.1 of the Environmental Protection Act Ministry of the Environment, Conservation and Parks 135 St. Clair Avenue West, 1st Floor Toronto, Ontario M4V 1P5

Page 6 - NUMBER 2725-B5VKYF

* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 30th day of October, 2018

This Approval was Mailei				
the s	N OCT 3 1 2019			
-	50			
	(Signed)			

C. Labaye

Christina Labarge, P.Eng. Director appointed for the purposes of Part II.1 of the *Environmental Protection Act*

FP/

c: District Manager, MECP Ottawa

Clerk, City of Ottawa (File No. D07-16-16-0023)

Jeff Shillington, P.Eng., Project Manager, City of Ottawa

Peter McKay, Infrastructure Renewal Program Manager, Infrastructure Assessment - Water Resources, City of Ottawa

Jennifer Ailey, P.Eng., David Schaeffer Engineering Ltd.



Ministry of the Environment, Conservation and Parks Ministère de l'Environnement, de la Protection de la nature et des Parcs

ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 3997-BF2GWX Issue Date: August 16, 2019

Mattamy (Half Moon Bay) Limited 50 Hines Road, Unit 100 Kanata, Ontario K2K 2M5

Site Location: Half Moon Bay West Subdivision, Phase 2A Part of Lot 11 and 12, Concession 3 (Rideau Front) City of Ottawa, Ontario

You have applied under section 20.2 of Part II.1 of the <u>Environmental Protection Act</u>, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

the establishment of wastewater infrastructure Works located in the City of Ottawa, consisting of the following:

- sanitary sewers on Proxima Terrace (from approximately 77 metres southeast of Perseus Avenue to Megrez Way), Celestial Grove (from approximately 95 metres south of Proxima Terrace to Perseus Avenue), Perseus Avenue (from Proxima Terrace to Greenbank Road, Perseus Avenue (from approximately 69 metres east of Proxima Terrace to Greenbank Road), Regulus Ridge (from approximately 126 metres north of Alcor Terrace to Alcor Terrace), Regulus Ridge (from approximately 77 metres south of Proxima Terrace to Proxima Terrace), Megrez Way (from approximately 100 metres north of Alcor Terrace to Alcor Terrace), Megrez Way (from approximately 100 metres north of Alcor Terrace to Alcor Terrace), Megrez Way (from approximately 100 metres north of Alcor Terrace), Alcor Terrace (from Megrez Way to Celestial Grove) and Greenbank Road (from Perseus Avenue to Pearl Dace Crescent), discharging to existing sewers, located on Pearl Dace Crescent; and
- storm sewers on Proxima Terrace (from approximately 47 metres southeast of Perseus Avenue to Megrez Way), Celestial Grove (from Perseus Avenue to approximately 86 metres south of Proxima Terrace), Perseus Avenue (from approximately 70 metres east of Proxima Terrace to approximately 35.5 metres west of Greenbank Road), Regulus Ridge (from approximately 125 metres north of Alcor Terrace to Alcor Terrace), Regulus Ridge (from approximately 77 metres south of Proxima Terrace to Proxima Terrace), Megrez Way (from approximately 103 metres north of Alcor Terrace to Alcor Terrace), Megrez Way (from approximately 28 metres south of Proxima Terrace to Proxima Terrace, Alcor Terrace (from Megrez Way to Celestial Grove), discharging to existing sewers, located on Half

Moon Bay West Subdivision, Phase 1;

including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the submitted application and supporting documents listed in Schedule "A" forming part of this approval.

For the purpose of this environmental compliance approval, the following definitions apply:

DEFINITIONS

- 1. "Approval" means this entire document and any schedules attached to it, and the application;
- 2. "Director" means a person appointed by the Minister pursuant to section 5 of the EPA for the purposes of Part II.1 of the EPA;
- 3. "District Manager" means the District Manager of the appropriate local District Office of the Ministry, where the Works are geographically located;
- 4. "EPA" means the Environmental Protection Act, R.S.O. 1990, c.E.19, as amended;
- 5. "Ministry" means the ministry of the government of Ontario responsible for the EPA and OWRA and includes all officials, employees or other persons acting on its behalf;
- 6. "Owner" means Mattamy (Half Moon Bay) Limited, and includes its successors and assignees;
- 7. "OWRA" means the Ontario Water Resources Act, R.S.O. 1990, c. O.40, as amended;
- 8. "Works" means the sewage Works described in the Owner's application, and this Approval.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

<u>1. GENERAL CONDITIONS</u>

- 1. The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.
- 2. Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Approval,

and the application for approval of the Works.

- 3. Where there is a conflict between a provision of any document in the schedule referred to in this Approval and the conditions of this Approval, the conditions in this Approval shall take precedence, and where there is a conflict between the documents in the schedule, the document bearing the most recent date shall prevail.
- 4. Where there is a conflict between the documents listed in Schedule "A" and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.
- 5. The conditions of this Approval are severable. If any condition of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this Approval shall not be affected thereby.

2. EXPIRY OF APPROVAL

- 1. This Approval will cease to apply to those parts of the Works which have not been constructed within five (5) years of the date of this Approval.
- 2. In the event that completion and commissioning of any portion of the Works is anticipated to be delayed beyond the specified expiry period, the Owner shall submit an application of extension to the expiry period, at least twelve (12) months prior to the end of the period. The application for extension shall include the reason(s) for the delay, whether there is any design change(s) and a review of whether the standards applicable at the time of Approval of the Works are still applicable at the time of request for extension, to ensure the ongoing protection of the environment.

3. CHANGE OF OWNER

- 1. The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within thirty (30) days of the change occurring:
 - a. change of Owner;
 - b. change of address of the Owner;
 - c. change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the *Business Names Act*, R.S.O. 1990, c.B17 shall be included in the notification to the District Manager; or
 - d. change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the

District Manager.

- 2. In the event of any change in ownership of the Works, other than a change to a successor municipality, the Owner shall notify in writing the succeeding owner of the existence of this Approval, and a copy of such notice shall be forwarded to the District Manager and the Director.
- 3. The Owner shall ensure that all communications made pursuant to this condition refer to the number at the top of this Approval.

4. OPERATION AND MAINTENANCE

1. If applicable, any proposed storm sewers or other stormwater conveyance in this Approval can be constructed but not operated until the proposed stormwater management facilities in this Approval or any other Approval that are designed to service the storm sewers or other stormwater conveyance are in operation.

Schedule "A"

- 1. Application for Environmental Compliance Approval, dated July 11, 2019, received on July 30. 2019, submitted by Mattamy (Half Moon Bay) Limited;
- Transfer of Review Letter of Recommendation, dated July 26, 2019, and revised on August 13, 2019, and signed by Jeff Shillington, P.Eng., Project Manager, Planning, Infrastructure and Economic Development Department, City of Ottawa;
 - a. Final Plans and Specifications prepared by David Schaeffer Engineering Ltd.
 - b. Pipe Data Form Watermain, Storm Sewer, Sanitary Sewer, and Forcemain Design Supplement to Application for Approval for Water and Sewage Works.
 - c. Hydraulic Design Sheets prepared by David Schaeffer Engineering Ltd.
- 3. Emails dated August 12, 2019 and August 13, 2019 from Shillington, P.Eng., Project Manager, Planning, Infrastructure and Economic Development Department, City of Ottawa.

Page 5 - NUMBER 3997-BF2GWX

The reasons for the imposition of these terms and conditions are as follows:

- 1. Condition 1 is imposed to ensure that the Works are constructed and operated in the manner in which they were described and upon which approval was granted. This condition is also included to emphasize the precedence of conditions in the Approval and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.
- 2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.
- 3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to the approved Works and to ensure that subsequent owners of the Works are made aware of the Approval and continue to operate the Works in compliance with it.
- 4. Condition 4 is included to prevent the operation of stormwater pipes and other conveyance until such time that their required associated stormwater management Works are also constructed.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

- a. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
- b. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

- 1. The name of the appellant;
- 2. The address of the appellant;
- 3. The environmental compliance approval number;
- 4. The date of the environmental compliance approval;
- 5. The name of the Director, and;
- 6. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary* Environmental Review Tribunal 655 Bay Street, Suite 1500 Toronto, Ontario M5G 1E5

<u>AND</u>

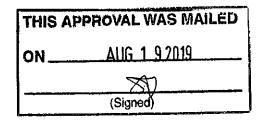
The Director appointed for the purposes of Part II.1 of the Environmental Protection Act Ministry of the Environment, Conservation and Parks 135 St. Clair Avenue West, 1st Floor Toronto, Ontario M4V 1P5

* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the

Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 16th day of August, 2019



Youssouf Kalogo, P.Eng. Director appointed for the purposes of Part II.1 of the *Environmental Protection Act*

RB/

c: District Manager, MECP Ottawa

Lily Xu, Manager, DR South Branch

Clerk, City of Ottawa (File No. D07-16-16-0023)

Jennifer Ailey, David Schaeffer Engineeirng Ltd.

Jeff Shillington, P.Eng., Project Manager, Planning, Infrastructure and Economic Development Department, City of Ottawa

Peter McKay, Infrastructure Renewal Program Manager, Infrastructure Assessment- Water Resources Asses Unit (MC 26-61)



Ministry of the Environment, Conservation and Parks Ministère de l'Environnement, de la Protection de la nature et des Parcs

ENVIRONMENTAL COMPLIANCE APPROVAL NUMBER 3263-BKWJW9

Issue Date: January 28, 2020

Mattamy (Half Moon Bay) Limited 50 Hines Road, Suite 100 Kanata, Ontario K2K 2M5

Site Location:

Half Moon Bay West - Phase 2B Lots 10 - 12, Concession 3 (Rideau Front) City of Ottawa

You have applied under section 20.2 of Part II.1 of the <u>Environmental Protection Act</u>, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

the establishment of wastewater infrastructure Works located in the City of Ottawa, consisting of the following:

- sanitary sewers on Ursid Mews (from approximately 14 metres southeast of Atima Circle (north leg) to Atima Circle (south leg)), Atima Circle (north leg) (from Atima Circle (west leg) to Apolune Street), Atima Circle (west leg) (from Atima Circle (north leg) to Apolune Street), Apolune Street (from approximately 79 metres southeast of Atima Circle (south leg) to approximately 17 metres northwest of Perseus Avenue), Nokomis Place (from approximately 15 metres northeast of Apolune Street to approximately 14 metres northwest of Perseus Avenue (from approximately 10 metres southwest of Apolune Street to Proxima Terrace and from approximately 14 metres east of Proxima Terrace to approximately 71 metres east of Perseus Avenue, Network, Proxima Terrace (from approximately 14 metres northwest of Perseus Avenue), Street to Proxima Terrace, Proxima Terrace (from approximately 14 metres northwest of Perseus Avenue), Apolune Street of Perseus Avenue, Network, Perseus Avenue, Proxima Terrace (from approximately 14 metres northwest of Perseus Avenue), Apolune Street of Perseus Avenue, Pe
- **storm** sewers on Ursid Mews (from approximately 10 metres southeast of Atima Circle (north leg) to Atima Circle (south leg)), Atima Circle (north leg) (from Atima Circle (west leg) to Apolune Street), Atima Circle (west leg) (from Atima Circle (north leg) to Atima Circle (south leg)), Atima Circle (south leg) (from Atima Circle (west leg) to Apolune Street), Apolune Street (from approximately 16 metres northwest of Perseus Avenue to approximately 29 metres east of Apolune Street), Nokomis Place (from approximately 11 metres northwest of Perseus Avenue to Perseus Avenue and from approximately 15 metres southeast of Perseus Avenue to Apolune Street), Perseus

Page 1 - NUMBER 3263-BKWJW9

Avenue (from approximately 12 metres southwest of Apolune Street to Nokomis Place and from Proxima Terrace to approximately 71 metres east of Proxima Terrace), Proxima Terrace (from approximately 11 metres northwest of Perseus Avenue to Perseus Avenue), discharging to existing storm sewers, located on the Clarke Stormwater Management Pond Block;

• **storm sewers** on Greenbank Road (from approximately 40 metres south of Cambrian Road to approximately 20 metres south of Cambrian Road), discharging to existing sewers, located on Greenbank Road;

including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the submitted application and supporting documents listed in Schedule "A" forming part of this approval.

For the purpose of this environmental compliance approval, the following definitions apply:

DEFINITIONS

- 1. "Approval" means this entire document and any schedules attached to it, and the application;
- 2. "Director" means a person appointed by the Minister pursuant to section 5 of the EPA for the purposes of Part II.1 of the EPA;
- 3. "District Manager" means the District Manager of the appropriate local District Office of the Ministry, where the Works are geographically located;
- 4. "EPA" means the Environmental Protection Act, R.S.O. 1990, c.E.19, as amended;
- 5. "Ministry" means the ministry of the government of Ontario responsible for the EPA and OWRA and includes all officials, employees or other persons acting on its behalf;
- 6. "Owner" means Mattamy (Half Moon Bay) Limited, and includes its successors and assignees;
- 7. "OWRA" means the Ontario Water Resources Act, R.S.O. 1990, c. O.40, as amended;
- 8. "Works" means the sewage Works described in the Owner's application, and this Approval.(applicable definitions pasted in or entered by Reviewer)

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS and CONDITIONS:

<u>1.</u> GENERAL CONDITIONS

- 1. The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.
- 2. Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Approval, and the application for approval of the Works.
- 3. Where there is a conflict between a provision of any document in the schedule referred to in this Approval and the conditions of this Approval, the conditions in this Approval shall take precedence, and where there is a conflict between the documents in the schedule, the document bearing the most recent date shall prevail.
- 4. Where there is a conflict between the documents listed in Schedule "A" and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.
- 5. The conditions of this Approval are severable. If any condition of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this Approval shall not be affected thereby.

2. EXPIRY OF APPROVAL

- 1. This Approval will cease to apply to those parts of the Works which have not been constructed within five (5) years of the date of this Approval.
- 2. In the event that completion and commissioning of any portion of the Works is anticipated to be delayed beyond the specified expiry period, the Owner shall submit an application of extension to the expiry period, at least twelve (12) months prior to the end of the period. The application for extension shall include the reason(s) for the delay, whether there is any design change(s) and a review of whether the standards applicable at the time of Approval of the Works are still applicable at the time of request for extension, to ensure the ongoing protection of the environment.

3. CHANGE OF OWNER

1. The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within thirty (30) days of the change occurring:

- a. change of Owner;
- b. change of address of the Owner;
- c. change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the *Business Names Act*, R.S.O. 1990, c.B17 shall be included in the notification to the District Manager; or
- d. change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the District Manager.
- 2. In the event of any change in ownership of the Works, other than a change to a successor municipality, the Owner shall notify in writing the succeeding owner of the existence of this Approval, and a copy of such notice shall be forwarded to the District Manager and the Director.
- 3. The Owner shall ensure that all communications made pursuant to this condition refer to the number at the top of this Approval.

4. OPERATION AND MAINTENANCE

1. If applicable, any proposed storm sewers or other stormwater conveyance in this Approval can be constructed but not operated until the proposed stormwater management facilities in this Approval or any other Approval that are designed to service the storm sewers or other stormwater conveyance are in operation.

Schedule "A"

1. Application for Environmental Compliance Approval, dated December 19, 2019, received on January 3, 2020, submitted by Mattamy (Half Moon Bay) Limited;

 Transfer of Review Letter of Recommendation, dated December 20, 2019 and signed by Jeff Shillington, P.Eng., Project Manager, Development Review, South Branch, Planning and Infrastructure Portfolio, Planning, Infrastructure & Economic Development Department, City of Ottawa;

- a. Final Plans and Specifications prepared by David Schaeffer Engineering Ltd.
- b. Pipe Data Form Watermain, Storm Sewer, Sanitary Sewer, and Forcemain Design Supplement to Application for Approval for Water and Sewage Works.
- c. Hydraulic Design Sheets prepared by David Schaeffer Engineering Ltd.
- 3. Email dated January 20, 2020, from Anthony Temelini, P.Eng., Junior Project Manager, David Schaeffer Engineering Ltd.

1. Sec. 19 19

The reasons for the imposition of these terms and conditions are as follows:

REASONS:

- 1. Condition 1 is imposed to ensure that the Works are constructed and operated in the manner in which they were described and upon which approval was granted. This condition is also included to emphasize the precedence of conditions in the Approval and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.
- 2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.
- 3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to the approved Works and to ensure that subsequent owners of the Works are made aware of the Approval and continue to operate the Works in compliance with it.
- 4. Condition 4 is included to prevent the operation of stormwater pipes and other conveyance until such time that their required associated stormwater management Works are also constructed.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

- a. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
- b. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

- 1. The name of the appellant;
- 2. The address of the appellant;
- 3. The environmental compliance approval number;
- 4. The date of the environmental compliance approval;
- 5. The name of the Director, and;
- 6. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary* Environmental Review Tribunal The Director appointed for the purposes of Part II.1 of the Environmental Protection Act Ministry of the Environment,

Page 6 - NUMBER 3263-BKWJW9

655 Bay Street, Suite 1500 Toronto, Ontario M5G 1E5

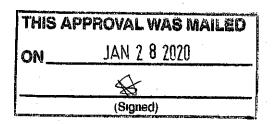
<u>AND</u>

Conservation and Parks 135 St. Clair Avenue West, 1st Floor Toronto, Ontario M4V 1P5

* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 28th day of January, 2020



1. Ahmed

Aziz Ahmed, P.Eng. Director appointed for the purposes of Part II.1 of the *Environmental Protection Act*

OS/

c: District Manager, MECP Ottawa

Clerk, City of Ottawa

Jennifer Ailey, David Schaeffer Engineering Ltd. (jailey@dsel.ca) Anthony Temelini, David Schaeffer Engineering Ltd. (atemelini@dsel.ca) Jeff Shillington, Project Manager, Development Review, South Branch, Planning and Infrastructure Portfolio, Planning, Infrastructure & Economic Development Department, City of Ottawa (jeff.shillington@ottawa.ca)

(File No.: D07-16-16-0023)



3889 Rideau Valley Drive, P.O. Box 599, Manotick, ON K4M 1A5 tel 613-692-3571 | 1-800-267-3504 | fax 613-692-0831 | www.rvca.ca

LETTER OF PERMISSION - ONTARIO REGULATION 174/06, SECTION 28 CONSERVATION AUTHORITIES ACT 1990, AS AMENDED.

 Date
 March 15, 2018

 File:
 RV5-01/18

 Contact:
 Hal Stimson

 (613) 692-3571 ext. 1127

 hal.stimson@rvca.ca

A member of Conservation

Mr. Jason Rumer Mattamy (Half Moon Bay) Ltd 50 Hines Road, Suite 100 Ottawa, Ontario K2K 2M5

Permit to alter a waterway under Section 28 of the Conservation Authorities Act for stormwater outlet at Lot 11-13 Concession 3, former City of Nepean, and now in the City of Ottawa

Dear Mr. Jason Rumer

The Rideau Valley Conservation Authority has reviewed your application on behalf of Mattamy Ltd. and understands the proposal to be for the construction of an outlet channel for a proposed storm water management facility which will outlet/connect the proposed Clarke Storm Water Management Pond to the Jock River

This proposal was reviewed under Ontario Regulation 174/06, the "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses" regulation.

PERMISSION AND CONDITIONS

By this letter the Rideau Valley Authority hereby grants you approval to undertake this project as outlined in your permit application but subject to the following conditions:

1. Approval is subject to the understanding of the project as described above and outlined in the application and submitted drawings including:

- Drawing Nos. P2, P4, P7, P8, (4 sheets) for Project No. 16-888 titled Half Moon Bay West Clarke SWM Pond, all revision No. 4, dated 17-12-07 as prepared by DSEL Engineering Ltd. and stamped by W. Liu, P. Eng.
- Drawing Nos. GEO-1, GEO-2, DET-1, DET-2 (4 sheets) for Project No. 17125 titled Half Moon Bay West Mattamy Homes, all revision No. 1, dated Dec 17 as prepared by GEOMorphix and stamped by Paul V. Villard, P. Geo.
- Drawing Sheet L0, L1, L2 (3 sheets) for Job No. 18-012 titled Mattamy Homes Clarke Pond Half Moon Bay West, all revision No. 1, dated Jan. 15/18 as prepared by NAK Design Strategies and stamped by Silvano Tardella, L.A.
- Report titled Design Brief for the Clarke Stormwater Management Pond for the Half Moon Bay West Subdivision Davidson Lands by DSEL Project No. 16-888 dated Revised October 19, 2017.
- Report titled Technical Design Brief: Clarke SWM Pond Outlet Channel and Spillway Design by Geomorphix, dated December 1, 2017.
 No conditions are subject to change/revision by the on-site contractor(s).

2. A De-watering Plan and Sediment and Erosion Control Plan must be submitted to this office by the contractor for review prior to construction activities.

- 3. Any excess excavated material, as a result of the work, must be disposed of in a suitable location outside any regulatory floodplain and fill regulated area.
- 4. It is recommended that you retain the services of a professional engineer to conduct on-site inspections to ensure adequacy of the work, verify stability of the final grade and slopes and confirm all imported fill is of suitable type and has been adequately placed and compacted.
- 5. There will be no in-water works between March 15 and June 30, of any given year to protect local aquatic species populations during their spawning and nursery time periods.
- 6. It is recommended that you ensure your contractor(s) are provided with a copy of this letter so as to ensure compliance with the conditions listed herein.
- 7. Work in-water shall not be conducted at times when flows are elevated due to local rain events, storms or seasonal floods. Existing stream flows must be maintained downstream of the de-watered work area without interruption, during all stages of the work. There must be no increase in water levels upstream of the de-watered work area.
- 8. Any aquatic species (fish, turtles) trapped within an enclosed work area are to be safely relocated outside of the enclosed area to the main watercourse downstream of the work zone.
- 9. All in-stream work should be completed in the dry by de-watering the work area and diverting and/or pumping any flows around cofferdams placed at the limits of the work area. Silt or debris that has accumulated around the temporary cofferdams should be cautiously removed prior to their withdrawal. No channel modifications or dredging is permitted or implied by this letter.

RV5-01/18 15-Mar-18 Page **2** of **4**

- 10. Sediment barriers should be used on site in an appropriate method according to the Ontario Provincial Standard Specifications (OPSS) for silt barriers as a minimum. Soil type, slope of land, drainage area, weather, predicted sediment load and deposition should be considered when selecting the type of sediment/erosion control.
- 11. Sediment and erosion control measures shall be in place before any excavation or construction works commence. All sediment/erosion control measures are to be monitored regularly by experienced personnel and maintained as necessary. In the event that the erosion and sedimentation control measures are deemed not to be performing adequately, the contractor shall undertake immediate additional measures as appropriate to the situation to the satisfaction of the Conservation Authority.
- 12. The waters of the creek/drain are NOT to be considered as machine staging areas. Activities such as equipment refuelling and maintenance must be conducted away from the water to prevent entry of petroleum products, debris, or other deleterious substances into the water. Operate machinery from outside the water, or on the water in a manner that minimizes disturbance to the banks or bed of the watercourse. Equipment shall not be cleaned in the watercourse or where wash-water can enter any watercourse. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
- 13. Demolition or construction debris is not to be deposited in the waters of any creek; inert concrete/asphalt debris will be considered a deleterious substance. An emergency spill kit should be kept on site in case of fluid leaks or spills from machinery.
- 14. All disturbed soil areas must be appropriately stabilized to prevent erosion.
- 15. Only clean material free from particulate matter may be placed in the water.
- 16. Develop a response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance. This plan is to include measures to: a) stop work, contain sediment-laden water and other deleterious substances and prevent their further migration into the watercourse and downstream receiving watercourses; b) notify the RVCA and all applicable authorities in the area c) promptly clean-up and appropriately dispose of the sediment-laden water and deleterious substances; and d) ensure clean-up measures are suitably applied so as not to result in further alteration of the bed and/or banks of the watercourse.
- 17. The RVCA is to receive 48 hours' notice of the proposed commencement of the works to ensure compliance with all conditions. The applicant agrees that Authority staff may visit the subject property, before, during and after project completion, to ensure compliance with the conditions as set out in this letter of permission.
- 18. A new application must be submitted should any work as specified in this letter be ongoing or planned for or after March 15, 2020.

RV5-01/18 15-Mar-18 Page **3** of **4** 19. All other approvals as might be required from the Municipality, and/or other Provincial or Federal Agencies must be obtained prior to initiation of work. This includes but is not limited to the Drainage Act, the Endangered Species Act, the Ontario Water Resources Act, Environmental Protection Act, Public Lands Act, or the Fisheries Act.

By this letter the Rideau Valley Conservation Authority assumes no responsibility or liability for any flood, erosion, or slope failure damage which may occur either to your property or the structures on it or if any activity undertaken by you adversely affects the property or interests of adjacent landowners. This letter does not relieve you of the necessity or responsibility for obtaining any other federal, provincial or municipal permits. This permit is not transferable to subsequent property owners.

Should you have any questions regarding this letter, please contact Hal Stimson at our Manotick office.

Terry A. Davidson

Terry K. Davidson P.Eng Conservation Authority S. 28 Signing delegate O. Reg. 174/06

c.c: J. Ailey, P. Eng. DSEL

- Pursuant to the provisions of S. 28(12) of the Conservation Authorities Act (R.S.O.1990, as amended.) any or all of the conditions set out above may be appealed to the Executive Committee of the Conservation Authority in the event that they are not satisfactory or cannot be complied with.
- Failure to comply with the conditions of approval or the scope of the project may result in the cancelling of the permission and/or initiation of legal action under S. 28(16) of the Act.
- This letter of permission does not come into full force and effect until the attached copy of this letter is returned to the Authority offices in Manotick signed and dated which return shall be taken as indicating acceptance of the conditions of the Authority's approval and acknowledgement that the details of the proposal as described in this letter are a fair and accurate representation of the proposed undertaking.

Name: _____ (print)

Signed: _____

Date:

RV5-01/18 15-Mar-18 Page 4 of 4

RVCA Letter of Permission -

Ont. Reg. 174/06, S. 28 *Conservation Authorities Act* 1990, As Amended.

June 2, 2020 File: RV5-1421 Contact: hal.stimson@rvca.ca (613) 692-3571 Ext 1127



3889 Rideau Valley Drive PO Box 599, Manotick ON K4M 1A5 T 613-692-3571 | 1-800-267-3504 F 613-692-0831 | www.rvca.ca

Jillian Normand Glenview Homes (Cedarview) Ltd. 190 O'Connor St. 11th Flr Ottawa, Ontario K2P 2R3

Permit to alter a waterway under Section 28 of the *Conservation Authorities Act* for headwater drain relocation at Lot 11 & 12, Concession 3, former City of Nepean, now in the City of Ottawa.

Dear Jillian Normand,

The Rideau Valley Conservation Authority has reviewed your application on behalf of Glenview Homes and understands the proposal to be for:

The closure and relocation of an existing headwater drainage feature. The watercourse is a tributary of the Jock River and is being relocated to accommodate area development. The new design features natural channel design principles and habitat features and upon completion may reconfigure the existing flood plain. Final grades will need to be confirmed and submitted prior to RVCA accepting a change to the regulatory flood plain limits.

This proposal was reviewed under Ontario Regulation 174/06, the "*Development, Interference with Wetlands, and Alteration to Watercourse and Shorelines*" regulation and the RVCA Development Policies (approved by the RVCA, Board of Directors), specifically Section 3.0 Alteration to Waterways. The proposal is not expected to impact the control of flooding, pollution, erosion or conservation of land providing conditions are followed.

PERMISSION AND CONDITIONS

By this letter the Rideau Valley Authority hereby grants you approval to undertake this project as outlined in your permit application but subject to the following conditions:

- 1. Approval is subject to the understanding of the project as described above and outlined in the application and submitted plans including:
 - Cover letter dated April 14, 2021 from L. Maxwell, B. Sc., M. Pl. of DSEL describing the project.
 - Landscape drawings by CSW titled Flagstaff HMB all revision 3, dated 18 May 2021, including Drawings, L1.0, L1.1, L1.2, L1.3, L2.1 (5 pages).

- Drawings titled Bioswale and Amphibian Habitat, Project No. 17119, all revision no. 3, dated 21/05/17, (6 pgs.) including Drawing Nos. GEO-1, GEO-2, GEO-3, DET-1, DET-2, and DET-3 as prepared by Geo Morphix and stamped by Paul V. Villard, PhD, P. Geo.
- Letter report dated April 14, 2021 from Geo Morphix Ltd. (13 pgs.)
- Drawings by DSEL titled Erosion Sediment Control Figure, Project 15-809, dated April 2021 and Temp Grading & Erosion Sediment. Drawing Figure 1, also dated April 2021.
- Monitoring program Report by Kilgour & Associates (12 Pgs.) dated April 12, 2021 signed by A. Francis, PhD.
- Patterson Group memo titled Geotechnical Recommendations dated May 18, 2021 (5 pgs.) stamped by D. J. Gilbert, P.Eng.
- Patterson Group memo titled Geotechnical Summary of Design Details dated May 5, 2021 (9 pgs.) stamped by D. J. Gilbert, P.Eng.
- 2. Any excess excavated material, as a result of the work must be disposed of in a suitable location outside any regulatory floodplain and fill regulated area. RVCA must be consulted to ensure fill is not placed elsewhere within a flood plain.
- 3. It is recommended that you retain the services of a professional engineer to conduct onsite inspections to ensure adequacy of the work, verify stability of the final grade and slopes and confirm all imported fill is of suitable type and has been adequately placed and compacted.
- 4. Prior to connecting the new channel and decommissioning the former channel an inspection will be completed by the RVCA and the contractor to ensure that the new channel is stable for the connection to be made.
- 5. A final as built drawing of the re-aligned channel including a grading plan shall be submitted upon completion of the approved works prepared by an Ontario Land Surveyor or Professional Engineer licensed to practice in Ontario indicating that grades achieved on the site conform to those indicated on the approved plan and that the flood plain storage volumes are maintained.
- 6. The detailed post effectiveness monitoring plan titled "Monitoring Program for the Realignment of a Minor Watercourse in Glenview's Flagstaff Community and Mattamy's Halfmoon Bay West," prepared by Kilgour and Associates, dated April 12, 2021". Shall be implemented as designed. Any proposed modifications to the monitoring plan are to be discussed with the RVCA prior to implementation.
- As per the monitoring plan the program will be focused on monitoring the channel realignment over a six-year period including the year of construction (2021). Post construction monitoring is scheduled as follows: Year 1 (2022), 3 (2024), and 5 (2026) to ensure the compensation works are functioning as intended.

- Work in-water shall not be conducted at times when flows are elevated due to local rain events, storms or seasonal floods. Existing stream flows must be maintained during all stages of the work.
- 9. Only clean non-contaminated fill material will be used, and all work is to occur on your property, or if on other property, only with full authorization of the owner(s).
- 10. Sediment barriers should be used on site in an appropriate method according to the Ontario Provincial Standard Specifications (OPSS) for silt barriers as a minimum. If the sediment and erosion control methods include silt fence it should be placed along the shoreline to prevent overland flow on disturbed areas from entering the watercourse. Soil type, slope of land, drainage area, weather, predicted sediment load and deposition should be considered when selecting the type of sediment/erosion control.
- 11. Demolition or construction debris is not to be deposited in the waters of any creek; inert concrete/asphalt debris will be considered a deleterious substance. An emergency spill kit should be kept on site in case of fluid leaks or spills from machinery.
- 12. Sediment and erosion control measures shall be in place before any excavation or construction works commence. All sediment/erosion control measures are to be monitored regularly by experienced personnel and maintained as necessary to ensure good working order. If the erosion and sedimentation control measures are deemed not to be performing adequately, the contractor shall undertake immediate additional measures as appropriate to the situation to the satisfaction of the Conservation Authority.
- 13. All materials and equipment used for the purpose of site preparation and project completion must be operated and stored in a manner that prevents any deleterious substance (e.g. petroleum products, silt, debris etc.) from entering the water.
- 14. The waters of the creek are NOT to be considered as machine staging areas. Activities such as equipment refuelling, and maintenance must be conducted away from the water to prevent entry of petroleum products, debris, or other deleterious substances into the water. All in-stream work on the new channel should be completed in the dry.
- 15. All equipment that is to be used near water will arrive on-site in a clean state; In order to mitigate the potential risk for invasive species recolonization within the newly excavated areas please follow the guidance in the Clean Equipment Protocol Document https://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/07/Clean-Equipment-Protocol_June2016_D3_WEB-1.pdf
- 16. Operate machinery from outside the water, or on the water in a manner that minimizes disturbance to the banks or bed of the watercourse. Equipment shall not be cleaned in the watercourse or where wash-water can enter any watercourse. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
- 17. All disturbed soil areas must be appropriately stabilized to prevent erosion.

- 18. It is recommended that you ensure your contractor(s) are provided with a copy of this letter to ensure compliance with the conditions listed herein.
- 19. Develop a response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance. This plan is to include measures to: a) stop work, contain sediment-laden water and other deleterious substances and prevent their further migration into the watercourse and downstream receiving watercourses; b) notify the RVCA and all applicable authorities in the area c) promptly clean-up and appropriately dispose of the sediment-laden water and deleterious substances; and d) ensure clean-up measures are suitably applied so as not to result in further alteration of the bed and/or banks of the watercourse.
- 20. There will be no in-water works between March 15 and June 30, of any given year to protect local aquatic species populations during their spawning and nursery time periods.
- 21. Any aquatic species (fish, turtles) trapped within an enclosed work area are to be safely relocated outside of the enclosed area to the main watercourse downstream of the work zone.
- 22. The RVCA is to receive 48 hours' notice of the proposed commencement of the works to ensure compliance with all conditions. The applicant agrees that Authority staff may visit the subject property before, during and after project completion to ensure compliance with the conditions as set out in this letter of permission.
- 23. A new application must be submitted should any work as specified in this letter be ongoing or planned for or after June 2, 2022.

All other approvals as might be required from the Municipality, and/or other Provincial or Federal Agencies must be obtained prior to initiation of work. This includes but is not limited to the Drainage Act, the Endangered Species Act, the Ontario Water Resources Act, Environmental Protection Act, Public Lands Act, or the Fisheries Act.

By this letter the Rideau Valley Conservation Authority assumes no responsibility or liability for any flood, erosion, or slope failure damage which may occur either to your property or the structures on it or if any activity undertaken by you adversely affects the property or interests of adjacent landowners. This letter does not relieve you of the necessity or responsibility for obtaining any other federal, provincial or municipal permits. This permit is not transferable to subsequent property owners. Should you have any questions regarding this letter, please contact Hal Stimson.

Tewy L. Davidson

Terry K. Davidson P.Eng Conservation Authority S. 28 Signing delegate O. Reg. 174/06

c.c. L. Maxwell, B. Sc., M.Pl., DSEL

- Pursuant to the provisions of S. 28(12) of the Conservation Authorities Act (R.S.O.1990, as amended.) any or all of the conditions set out above may be appealed to the Executive Committee of the Conservation Authority in the event that they are not satisfactory or cannot be complied with.
- Failure to comply with the conditions of approval or the scope of the project may result in the cancelling of the permission and/or initiation of legal action under S. 28(16) of the Act.
- Commencement of the work **and/or** a signed and dated copy of this letter indicates acknowledgement and acceptance of the conditions of the RVCA's approval letter concerning the application and the undertaking and scope of the project.

Name	(nrint)	
Name: (print)	

Signed: _____ Date: _____



Fisheries and Oceans Pêches et Océans Canada

Canada

Central and Arctic Region 520 Exmouth Street Sarnia, Ontario N7T 8B1

Région du centre et de l'arctique 520 rue Exmouth Sarnia (Ontario) N7T 8B1

APR 0 8 2015

05-HCAA-CA4-01840

Mattamy Homes 50 Hines Road Ottawa, Ontario K2K 2M5 Attention: Kevin Murphy – Project Manager, Land Development

Dear Mr. Murphy:

Notification of modifications to dates in conditions of Paragraph 35(2)(b)Subject: Fisheries Act authorization (PR-05-1840)

The Fisheries Protection Program (the Program) of Fisheries and Oceans Canada hereby modifies the conditions that relate to the period during which the work, undertaking or activity that will result in serious harm to fish can be carried on, for the authorization issued to you under paragraph 35(2)(b) of the Fisheries Act on October 26, 2013.

The period during which the work, undertaking, or activity can be carried on is modified as follows:

From To Date of Issuance December 31, 2017

The Program also acknowledges that the proponent name and contact information for this project has changed from Barrhaven South Land Owners Inc. to Mattamy Homes. At your request, we are re-issuing the original letter sent to you on February 6, 2015 with the correct proponent information.

The Program has determined that the modification of the dates in the conditions of authorization will not increase the level of harm to fish and habitat described in the authorization.

A copy of this authorization and a copy of this letter must be kept on site while the work is in progress. Work crews must be familiar with and able to adhere to the conditions.

Failure to comply with the conditions of the authorization may lead to prosecution under the *Fisheries Act*.

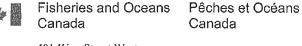
If you or anyone conducting work on your behalf have any questions, please contact Gary Cooper at our Burlington office at 905-336-6248, or by email at gary.cooper@dfo-mpo.gc.ca.

Sincerely,

David Burden Regional Director General Central and Arctic Region Fisheries and Oceans Canada

ATTACHMENT: AUTHORIZATION

c.c.: Gary Cooper – DFO Liza Hamilton – Kilgour & Associates Ltd.



401 King Street West Prescott, ON K0E 1T0

October 21, 2010

Your file Votre référence

Our file Notre référence 05-HCAA-CA4-01840

Barrhaven South Land Owners Inc Ursula K. Melinz 427 Laurier Ave West. Suite 900 Ottawa, Ontario K1R Y72 Dear Ms. Melinz:

Subject: Amendment to Fisheries Act Authorization

Fisheries and Oceans Canada is hereby amending the *Fisheries Act* Authorization issued to you on November 13, 2007 and amended on April 14, 2009.

The changes to the Authorization 05-HCAA-CA4-01840 covered by this Amendment include:

The valid authorization period for the harmful alteration, disruption or destruction of fish habitat associated with the work or undertaking is:

From	То
Date of Issuance	December 31, 2013

We have determined that the extent of the changes to the Authorization will not result in any impacts to fish and fish habitat greater than previously authorized nor significantly alter the mitigation measures. Therefore an additional environmental assessment is not required. The changes described above have been included on the attached original *Fisheries Act* Authorization.

Failure to comply with all the conditions of the amended Authorization may lead to prosecution under the *Fisheries Act*.

A copy of this Authorization should be kept on site while the work is in progress. Work crews should be familiar with and able to adhere to the conditions.

Canadä

.../2 .

2

If you or anyone conducting work on your behalf have any questions, please contact Mark Ferguson at our Prescott office at (613) 925-2865 ext 145, by fax at (613) 925-2245, or by email at <u>Mark.Ferguson@dfo-mpo.gc.ca</u>.

Yours sincerely, Karen Ralph

A/Director, Ontario Great Lake Area Fisheries & Oceans Canada ATTACHMENT-AUTHORIZATION **₩**

DFO File No.: 05-HCAA-CA4-000-001840 Veferral File No.: PR-05-1840 Authorization 2 No.:

AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT

Authorization issued to:

Barrhaven South Land Owners Inc. 427 Laurier Avenue West, Suite 900 Ottawa, ON K1R 7Y2

-d

Location of Project

The work or undertaking is located at

East Clarke Municipal Drain From Latitude: 45°15'26.4" Longitude: 75° 45'3.1"to Latitude: 45°14'41.6" Longitude: 75° 44'26.4

West Clarke Municipal Drain From Latitude: 45 ° 15'16.6" Longitude: 75 ° 45'16.8" to Latitude: 45 ° 14'42.4" Longitude: 75 ° 44'43.9"

Todd Municipal Drain From Latitude: 45° 15'23" Longitude: 75° 44'20" to Latitude: 45° 15'4" Longitude: 75° 44'26"

Corrigan Drain From Latitude: 45° 15'28.1"Longitude: 75° 44'9.7"to Latitude: 45° 15'16.1" Longitude: 75° 44'0.3"

In the City of Ottawa, Ontario

Canadä

.../2

Valid Authorization Period

The valid authorization period for the harmful alteration, disruption or destruction of fish habitat associated with the work or undertaking is:

From

Date of Issuance

To December 31, 2013

The valid authorization periods for other conditions of the authorization are as set out below.

Description of Works or Undertakings (Type of work, schedule, etc.)

The harmful alteration, disruption or destruction of fish habitat hereby authorized is the destruction of 13268m² of fish habitat due to infilling of the existing drain channels and realignment of West Clarke Municipal Drain, East Clarke Municipal Drain, Todd Municipal Drain and Corrigan Drain.

Conditions of Authorization

- 1. The conditions of this Authorization notwithstanding, should the above works or undertaking, due to weather conditions, different soil or other natural conditions, or for any other reason, appear, in the opinion of the Department of Fisheries and Oceans ("DFO") likely to cause greater impacts than the parties previously contemplated, then DFO may direct Barrhaven South Land Owners Inc and City of Ottawa ("the Proponent") and its agents and contractors, to suspend or alter works and activities associated with the project, to avoid or mitigate adverse impacts to fisheries resources. DFO may also direct the Proponent and its agents and contractors, to carry out at the Proponent's expense any works or activities deemed necessary by DFO to avoid or mitigate further adverse impacts to fisheries resources. In circumstances where DFO is of the view that greater impacts may occur than were contemplated by the parties DFO may also modify or rescind this authorization. If the authorization is to be changed the Proponent will be given an opportunity to discuss any proposed modifications or rescission.
- 2. Conditions that relate to the **Proponent plan**:
 - 2.1 The Proponent confirms that all plans and specifications relating to this authorization have been duly prepared and reviewed by appropriate professionals working on behalf of the Proponent. The Proponent acknowledges that (s)he is solely responsible for all design, safety and workmanship aspects of all the works associated with this Authorization.
 - 2.2 The construction must comply with those criteria as identified within this Authorization. Harmful alteration, disruption or destruction of fish habitat other than that specifically identified within this Authorization is not permitted.
 - 2.3 Works will be conducted following the practices outlined in the following reports:
 - 2.3.1 Application for the Authorization for works or undertakings affecting fish habitat, submitted by Barrhaven South Land Owners Inc., signed by Alan Cohen and dated October 4, 2007.
 - 2.3.2 Application for the Authorization for works or undertakings affecting fish habitat,

submitted by the City of Ottawa, signed by Gordon MacNair and dated October 4, 2007.

- 2.3.3 Barrhaven South Development and Fish Habitat Compensation, Department of Fisheries and Oceans Canada Permit Application, Prepared by Stantec Consulting Ltd, August 2007.
- 2.3.4 Barrhaven South Fish Compensation, Clarke Pond Tributary Design, "Clarke 3" prepared by Stantec Consulting Ltd. July 2007.
- 2.3.5 Barrhaven South Fish Compensation, Todd Pond Tributary Design "Todd 3" prepared by Stantec Consulting Ltd. July 2007.
- 2.3.6 Barrhaven South Fish Habitat Compensation, Plan and Profile Fish Habitat Compensation Pond, Prepared by Stantec Consulting Ltd.
- 3. Conditions that relate to the **mitigation** of potential harmful alteration, disruption or destruction of fish habitat. The following measures shall be implemented:
 - 3.1 No in-water work shall occur from March 15th to June 30th to protect local fish populations during their spawning and nursery periods.
 - 3.2 All materials and equipment used for the purpose of site preparation and project completion shall be operated and stored in a manner that prevents any deleterious substance (e.g. petroleum products, debris etc.) from entering the water.
 - 3.2.1 Any stockpiled materials shall be stored and stabilized away from the water.
 - 3.2.2 Vehicle and equipment re-fuelling and maintenance shall be conducted in a controlled manner so as to prevent fuel spillage and away from the water where feasible.
 - 3.2.3 Any part of equipment entering the water shall be free of fluid leaks and externally cleaned/degreased to prevent any deleterious substance from entering the water.
 - 3.2.4 Vehicles or heavy machinery operating at a watercourse shall be equipped with a spill kit.
 - 3.2.5 Only clean material free of fine particulate matter shall be placed in the water.
 - 3.2.6 A spill kit shall be kept on site during construction.
 - 3.3 Sediment and erosion control measures shall be implemented prior to work and maintained during the work phase, to prevent entry of sediment into the water.
 - 3.3.1 All sediment and erosion control measures shall be inspected daily to ensure that they are functioning properly and are maintained and/or upgraded as required.
 - 3.3.2 If the sediment and erosion control measures are not functioning properly, no further work shall occur until the sediment and/or erosion problem is addressed.
 - 3.3.3 Sediment and erosion control measures shall be left in place until all disturbed areas have been stabilized.
 - 3.3.4 All disturbed areas susceptible to erosion/soil loss with potential for transport into the

.../4

water, shall be stabilized and re-vegetated as required upon completion of work and restored to a pre-disturbed state or better.

- 3.3.5 To prevent sediment release earthen "plugs" shall be maintained at the upstream and downstream limits of the newly constructed channel during construction phases and shall be removed only after the newly constructed channel and riparian vegetative cover is established and the site stabilized before permanent flows are directed to the channel.
- 3.4 Except material used to restore the streambed, materials used for the project shall not be taken from the shoreline or bed of any water body.
- 3.5 Dredged or excavated material shall be disposed of on land above the high water level and suitably contained/stabilized to prevent the material from re-entering the water.
- 3.6 All in-stream work shall be completed *in the dry* by de-watering the work area and diverting and/or pumping flows around cofferdams placed at the limits of the work area.
 - 3.6.1 Existing stream flows shall be maintained downstream of the de-watered work area without interruption, during all stages of the work.
 - 3.6.2 A fish stranding program shall be implemented if necessary by a qualified fisheries person, who is experienced in this area, immediately following isolation and prior to de-watering to ensure that fish are removed from any dewatered area and released alive immediately downstream of the work area.
 - 3.6.3 Flow dissipaters and/or filter bags, or equivalent, shall be placed at water discharge points to prevent erosion and sediment release.
 - 3.6.4 Silt or debris that has accumulated around the temporary cofferdams shall be removed prior to their withdrawal.
- 3.7 Construction debris and litter shall not be allowed to enter the water or left on the shoreline.
- 3.8 An environmental inspector with fish habitat experience shall be on site to verify all in-water fish habitat compensation and restoration works are constructed as designed.
- 4. Conditions that relate to the **compensation** for the loss of 13268m² of fish habitat.
 - 4.1 A new outlet channel from the Clarke stormwater management pond will be constructed using principles of natural channel design. It will be 400m in length and 1m wide therefore 400m² of fish habitat will be created. This channel will be a linear wetland interspersed with refugia pools. At the confluence with the Jock River there will be an embayment designed to promote submergent plant growth. The riparian zone will be revegetated with a variety of native shrubs and trees to provide > 70% canopy cover.
 - 4.2 A new outlet channel from the Todd stormwater management pond will be constructed using the principles of natural channel design. It will be 400m in length and 1 m wide therefore 400m² of fish habitat will be created. This channel will contain rock riffle and pool habitats. At the confluence with the Jock River the channel will be wider and shallower to promote emergent macrophyte growth. The riparian zone will be revegetated with a variety of native shrubs and trees to provide >70% canopy cover.

4.3 A new outlet channel from the Corrigan stormwater management pond will be constructed using principles of natural channel design. It will be 300m in length and 2m in width therefore 600m² of fish habitat will be created. The channel design, embayment and riparian planting will be similar to the outlet channel from the Todd stormwater management pond.

4.3.1 Detailed design drawings for the Corrigan outlet channel shall be submitted to DFO by November 30, 2007 for review.

- 4.4 A habitat pond will be constructed within the floodplain of the Jock River. The new pond will have an approximate surface area of 8930m² at the high water mark. This pond will be designed to provide spawning and nursery habitat for northern pike and muskellunge in the spring and nursery and refugia habitat in the summer and fall.
 - 4.4.1 The pond will be connected to the Jock River by way of 1m deep inlet and outlet channels to provide inflow and outflow of water year round.
 - 4.4.2 The depth of the pond will match the Jock River adjacent to the site. The deepest area of the pond will be on the south side with bank slopes between 3:1 and 5:1. On the north side of the pond slopes will gradually decrease to between 1:10 and 1:20 with 2m wide finger channels throughout leading to grassy hummocks of Carex sp. or meadow grass. The hummocks will be partially submerged during spring flows.
 - 4.4.3 The pond will contain large woody debris consisting of tree trunks with root wads attached.
 - 4.4.4 The pond margins and finger channel banks will be planted with native lowland riparian plant species including red osier dogwood, speckled alder, white cedar and Salix sp.
- 5. Conditions that relate to the **monitoring** of the **Proponent plan**, the mitigation and the compensation, the "Monitoring Program".

A monitoring program shall be implemented from start of construction to the end of the two year post-construction monitoring to ensure that the compensation and mitigation measures are installed, maintained and function as intended. The monitoring program shall include the following:

Construction Phase Monitoring

- 5.1 The monitoring program shall be conducted by an environmental inspector with fish habitat experience. The environmental inspector must be present on site during in water works and implementation of the compensation measures.
- 5.2 The effectiveness of the sediment and erosion controls will be inspected a minimum of once a week. Additional inspections will be undertaken after and/or in anticipation of rain events.
- 5.3 A photographic record showing that all works and undertakings have been completed according to the plan and conditions of this Authorization shall be prepared.
 - 5.3.1 The photographic record shall include, but not be limited to, a record of existing conditions, the work phase including sediment and erosion control measures, and completed works including compensation measures, site stabilization and restoration.
 - 5.3.2 The photographs for each period of documentation shall be taken from the same vantage

point(s), direction and angle of view.

- 5.3.3 All photographs shall be clearly labelled with the date, location and viewing direction. The photographic locations and viewing directions shall be indicated on a plan view drawing of the work site and clearly indexed to the photographs.
- 5.4 Copies of the construction monitoring reports prepared by the environmental inspector shall be provided by fax or email to the Prescott Office of DFO within two working days of the date of the inspection.
- 5.5 Construction phase monitoring shall end when all fish habitat compensation measures are completed and site is stabilized.

Post-construction Monitoring:

- 5.6 A photographic record of completed fish habitat compensation measures and site stabilization measures as outlined in section 5.3.3 of construction phase monitoring.
- 5.7 A survey of fish presence and use of the fish habitat compensation measures shall be conducted each spring and summer for 2 years following construction.
- 5.8 An assessment of the stability of newly constructed channels, habitat pond and the fish habitat structures.
- 5.9 The success of all vegetative plantings shall be assessed not less than once each spring and fall for 2 years following planting. If at any time during monitoring any plantings are dead or dying, measures shall be implemented to reduce the risk of future failure and the plants shall be replaced and monitoring continued.
- 5.10 A written report and the photographic record summarizing the above monitoring results shall be submitted to the Prescott Office of DFO on or before November 30 for each year of the monitoring program.
- 6 Notification of the commencement of in-water works or undertaking shall be provided the Prescott Office of DFO via facsimile (fax) at (613) 925-2245, within ten days prior to the initiation of the works or undertaking.
 - 6.1. The notification shall include the Section 35 Authorization number, PR-05-1840 and the date when in-water works or undertakings are scheduled to take place.
- 7. Any deviation from the approved plan, work schedule or compensation and mitigation measures stated above, shall be discussed with and approved in writing by the Prescott Office of DFO, prior to implementation.
- 8. All compensation and mitigation measures shall be implemented to the satisfaction of the Prescott Office of DFO.

The holder of this authorization is hereby authorized under the authority of section 35(2) of the <u>Fisheries Act</u>. R.S.C., 1985, c.F. 14, to carry out the work or undertaking described herein. This authorization is valid only with respect to fish habitat and for no other purposes. It does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

Failure to comply with any condition of this authorization may result in charges being laid under the <u>Fisheries Act</u>.

This authorization form should be held on site and work crews should be made familiar with the conditions attached.

Date of Issuance: Oct 26 2010 Approved by: en-Ralph Ka A/Area Director, Ontario Great Lakes Area Central & Arctic Region Fisheries and Oceans Canada

APPENDIX B

WATER DISTRIBUTION NETWORK BOUNDARY CONDITION REQUEST FOR FLAGSTAFF AND HALF MOON BAY WEST (GEOADVICE, MARCH 11, 2021)

HYDRAULIC CAPACITY AND MODELING ANALYSIS FOR HALF MOON BAY WEST PHASE 3 – FINAL REPORT (GEOADVICE, MAY 31, 2021) March 11, 2021

Sent by email: <u>BKaminski@dsel.ca</u>



David Schaeffer Engineering Ltd. 120 Iber Road, Unit 103 Stittsville, ON K2S 1E9

Attention:Mr. Braden Kaminski, E.I.T.
Junior Project ManagerRe:Water Distribution Network Boundary Condition Request
Flagstaff and Half Moon Bay West (HMBW)

GeoAdvice Project ID: 2021-023-DSE

Dear Mr. Kaminski,

In order to carry out the watermain analysis and hydraulic modeling for the Flagstaff Phase 2 development in the City of Ottawa, we request the hydraulic boundary conditions (HGL) for the proposed connection points as shown on the attached schematic. Flow conditions are outlined in the attached consumer water demand calculations.

Scenario 1 – (Flagstaff Phases 1 + 2, HMBW Phases 1 + 2)

Boundary conditions at the connection points 1 and 2 are required for the Scenario 1 demand conditions:

- Minimum hour demand = 6.71 L/s
- Maximum day demand = 29.26 L/s
- Maximum day demand + fire flow (167 L/s) = 196.26 L/s
- Maximum day demand + fire flow (217 L/s) = 246.26 L/s
- Maximum day demand + fire flow (233 L/s) = 262.26 L/s
- Maximum day demand + fire flow (283 L/s) = 312.26 L/s
- Peak hour demand = 61.80 L/s

Scenario 2 – (Flagstaff Phase 1, HMBW Phases 1 + 2 + 3)

Boundary conditions at the connection points 1 and 2 are required for the Scenario 2 demand conditions:

- Minimum hour demand = 8.19 L/s
- Maximum day demand = 35.29 L/s
- Maximum day demand + fire flow (167 L/s) = 202.29 L/s
- Maximum day demand + fire flow (217 L/s) = 252.29 L/s
- Maximum day demand + fire flow (233 L/s) = 268.29 L/s
- Maximum day demand + fire flow (283 L/s) = 318.29 L/s
- Peak hour demand = 74.26 L/s

Scenario 3 – (Flagstaff Phases 1 + 2, HMBW Phases 1 + 2 + 3 + 4)

Boundary conditions at the connection points 1 and 2 are required for the Scenario 3 demand conditions:

- Minimum hour demand = 9.65 L/s
- Maximum day demand = 41.65 L/s
- Maximum day demand + fire flow (167 L/s) = 208.65 L/s
- Maximum day demand + fire flow (217 L/s) = 258.65 L/s
- Maximum day demand + fire flow (233 L/s) = 274.65 L/s
- Maximum day demand + fire flow (283 L/s) = 324.65 L/s
- Peak hour demand = 87.65 L/s



Scenario 4 – (Flagstaff Phases 1 + 2 Full Build Out, HMBW Phases 1 + 2 + 3 + 4)

Boundary conditions at the connection points 1 and 2 are required for the Scenario 4 demand conditions:

- Minimum hour demand = 10.21 L/s
- Maximum day demand = 44.05 L/s
- Maximum day demand + fire flow (167 L/s) = 211.05 L/s
- Maximum day demand + fire flow (217 L/s) = 261.05 L/s
- Maximum day demand + fire flow (233 L/s) = 277.05 L/s
- Maximum day demand + fire flow (283 L/s) = 327.05 L/s
- Peak hour demand = 92.72 L/s

Please note the following:

- The above demands and fire flows should be applied equally between Connection Points 1 and 2.
- FUS calculations will be completed for the single-family units and traditional townhomes not complying with the conditions of City of Ottawa Technical Bulletin ISDTB-2018-02.

For the maximum day demand plus fire flow scenarios, the HGLs for the lowest (167 L/s) and highest (283 L/s) fire flow requirement scenarios could be provided. In this case, the HGLs of the intermediate fire flow scenarios will be interpolated. If there are any pumps feeding the development area and any additional pumps turning on during any of these intermediate scenarios, the HGLs <u>cannot</u> be interpolate or extrapolated. A previous iteration of boundary conditions provided by the City required additional pumps to be turned on at the Barrhaven Pump Station for some of the fire flow scenarios, which affect the ability to interpolate intermediate fire flow scenarios. The additional pump was turned on at the Barrhaven Pump Station to increase the HGLs at the connections from approximately 120 m to approximately 137 m under the 10,000 L/min (167 L/s) fire flow scenario. Please confirm the number of pumps in operation for each scenario.

Finally, the previous iteration of boundary conditions provided by the City, HGLs were provided for before and after the proposed pressure zone realignment in the BARR (3SW) and the 3C (SUC) pressure zones. Please confirm which boundary condition results most accurately reflect the system operation.

If you have any questions, please do not hesitate to contact me.

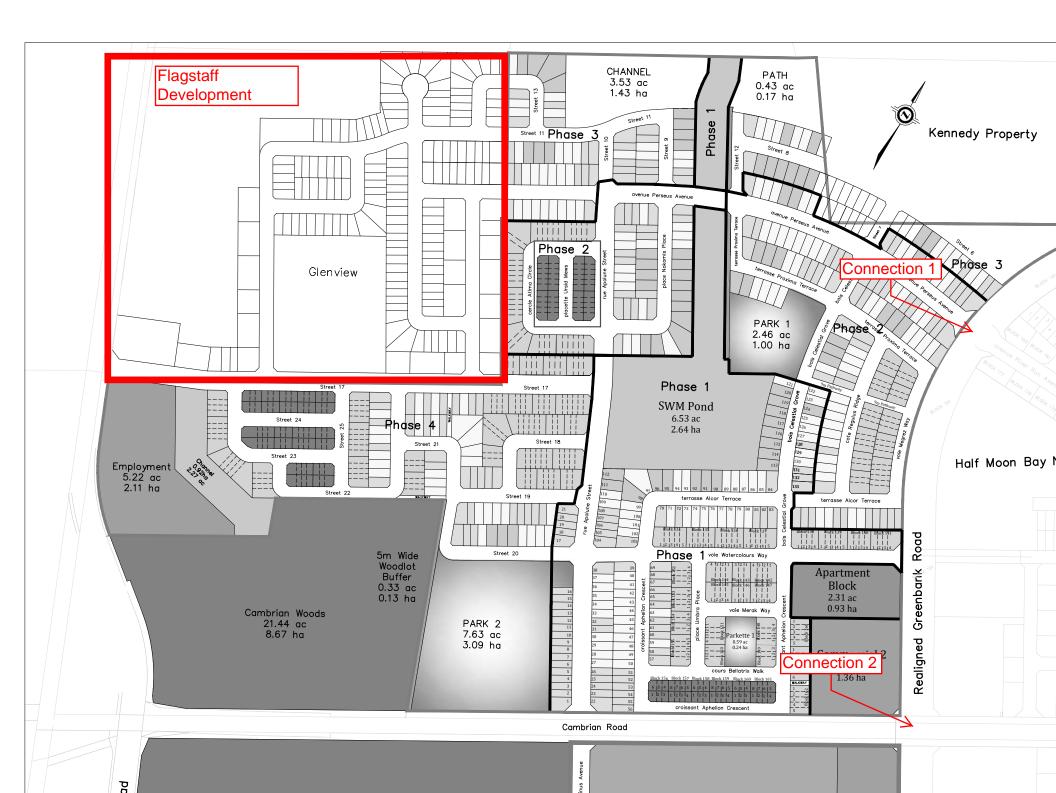
Yours truly,

GeoAdvice Engineering Inc.

Wenn de Shoche

Werner de Schaetzen, Ph.D., P.Eng. President and Chief Executive Officer werner@geoadvice.com GeoAdvice Engineering Inc.

Attachments: Mark up for connection locations and demand calculations



Consumer Water Demands

Flagstaff Phase 1 Residential Demands

	Number of		Population	Average Day Demand			Max Day	Fire Flow	Peak Hour	Min Hour
Dwelling Type	Number of Units	Persons per	Population Per Dwelling	(L/c/d)	(L/d)	(L/s)	2.5 x Avg. Day		2.2 x Max Day	0.5 x Avg. Day
	Units	Unit	Туре	(L/C/U)	(L/U)	(L/S)	(L/s)	(L/s)	(L/s)	(L/s)
Single Detached	94	3.4	320	280	89,600	1.04	2.59		5.70	0.52
Traditional Townhome	61	2.7	165	280	46,200	0.53	1.34		2.94	0.27
Subtotal	155		485		135,800	1.57	3.93		8.64	0.79

Flagstaff Phase 2 Residential Demands

	Number of		Population	Ave	rage Day Dem	and	Max Day	Fire Flow	Peak Hour	Min Hour
Dwelling Type		Persons per	Population Per Dwelling	(L/c/d)	(L/d)	(L/s)	2.5 x Avg. Day	(L/s)	2.2 x Max Day	0.5 x Avg. Day
	Units	Unit	Туре	(L/C/U)	(L/U)	(L/S)	(L/s)	(L/S)	(L/s)	(L/s)
Single Detached	42	3.4	143	280	40,040	0.46	1.16		2.55	0.23
Traditional Townhome	34	2.7	92	280	25,760	0.30	0.75		1.64	0.15
Subtotal	76		235		65,800	0.76	1.90		4.19	0.38

Flagstaff Phase 2 Non Residential Demands

	Area	Ave	rage Day Dem	and	Max Day	Fire Flow	Peak Hour	Min Hour
Property Type	(ha)	(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	(L/s)	1.8 x Max Day (L/s)	0.5 x Avg. Day (L/s)
Commercial	0.42	28,000	11,760	0.14	0.20		0.37	0.07
Institutional	2.40	28,000	67,200	0.78	1.17		2.10	0.39
Parkette	0.20	28,000	5,600	0.06	0.10		0.18	0.03
Subtotal	3.02		84,560	0.98	1.47		2.64	0.49

Flagstaff Phase 2 Alternate Residential Demands

	Number of		Population*	Average Day Demand			Max Day	Fire Flow	Peak Hour	Min Hour
Dwelling Type	Number of Units	Persons per	Population Per Dwelling	(L/c/d)	(1. (d)	(1./c)	2.5 x Avg. Day		2.2 x Max Day	0.5 x Avg. Day
	Units	Unit	Туре	(L/C/U)	(L/d)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
Single Detached	42	3.4	172		48,160	0.56	1.39		3.07	0.28
Traditional Townhome	34	2.7	111	280	31,080	0.36	0.90		1.98	0.18
School Converted to Residential			182		51,072	0.59	1.48		3.25	0.30
Subtotal	76		465		130,312	1.51	3.77		8.30	0.75

Flagstaff Phase 2 Alternate Non Residential Demands

	Area	Ave	rage Day Dem	and	Max Day	Fire Flow	Peak Hour	Min Hour
Property Type		(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day	(L/s)	1.8 x Max Day	0.5 x Avg. Day
	(ha)	(L/IId/U)	(L/U)	(L/S)	(L/s)	(L/S)	(L/s)	(L/s)
Commercial	0.42	28,000	11,760	0.14	0.20		0.37	0.07
Park	3.50	28,000	98,000	1.13	1.70		3.06	0.57
Parkette	0.20	28,000	5,600	0.06	0.10		0.18	0.03
Subtotal	4.12		115,360	1.34	2.00		3.61	0.67

HMBW Phase 1 Residential Demands

	Number of	Population		Average Day Demand			Max Day	Fire Flow	Peak Hour	Min Hour
Dwelling Type	Units	Persons per	Population Per Dwelling	(L/c/d)	(1 (d)	(1/c)	2.5 x Avg. Day		2.2 x Max Day	0.5 x Avg. Day
	Units	Unit	Туре	(L/C/U)	(L/d)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
Single Detached	133	3.4	453		126,840	1.47	3.67		8.07	0.73
Traditional Townhome	106	2.7	287	280	80,360	0.93	2.33		5.12	0.47
Back-to-back Townhome	42	2.7	114	260	31,920	0.37	0.92		2.03	0.18
Apartment Block	72	2.7	195		54,600	0.63	1.58		3.48	0.32
Subtotal	353		1,049		293,720	3.40	8.50		18.70	1.70

HMBW Phase 1 Non Residential Demands

	Area	Ave	rage Day Dem	and	Max Day	Fire Flow	Peak Hour	Min Hour
Property Type	(ha)	(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day	(L/s)	1.8 x Max Day	0.5 x Avg. Day
					(L/s)		(L/s)	(L/s)
Commercial	2.87	28,000	80,360	0.93	1.40		2.51	0.47
School	6.07	28,000	169,960	1.97	2.95		5.31	0.98
Park	0.24	28,000	6,720	0.08	0.12		0.21	0.04
Subtotal	9.18		257,040	2.98	4.46		8.03	1.49

HMBW Phase 2A Residential Demands

	Number of		Population	Average Day Demand			Max Day	Fire Flow	Peak Hour	Min Hour
Dwelling Type	Number of Units	Persons per	Population Per Dwelling	(L/c/d)	(L/d)	(L/s)	2.5 x Avg. Day		2.2 x Max Day	0.5 x Avg. Day
	Units	Unit	Туре	(L/C/U)	(L/U)	(L/S)	(L/s)	(L/s)	(L/s)	(L/s)
Single Detached	115	3.4	391	280	109,480	1.27	3.17		6.97	0.63
Traditional Townhome	41	2.7	111	260	31,080	0.36	0.90		1.98	0.18
Subtotal	156		502		140,560	1.63	4.07		8.95	0.81

HMBW Phase 2A Non Residential Demands

		Area		Aver	age Day Dema	and	Max Day	Fire Flow	Peak Hour	Min Hour
	Property Type		4	(1 / h a / d)	(1 (4)	(1. (2)	1.5 x Avg. Day		1.8 x Max Day	0.5 x Avg. Day
		(ha)	((L/ha/d)	(L/d)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
Park		1.00		28,000	28,000	0.32	0.49		0.88	0.16
	Subtotal	1.00			28,000	0.32	0.49		0.88	0.16

HMBW Phase 2B Residential Demands

	Number of		Population	Average Day Demand			Max Day	Fire Flow	Peak Hour	Min Hour
Dwelling Type	Units	Persons per	Population Per Dwelling	(1 / a / d)	(1 (4)	(1. /2)	2.5 x Avg. Day		2.2 x Max Day	0.5 x Avg. Day
	Units	Unit	Туре	(L/c/d)	(L/d)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
Single Detached	46	3.4	157		43,960	0.51	1.27		2.80	0.25
Traditional Townhome	39	2.7	106	280	29,680	0.34	0.86		1.89	0.17
Back-to-Back Townhome	42	2.7	114		31,920	0.37	0.92		2.03	0.18
Subtota	127		377		105,560	1.22	3.05		6.72	0.61

HMBW Phase 10 Residential Demands

	Number of	Population		Average Day Demand			Max Day	Fire Flow	Peak Hour	Min Hour
Dwelling Type		Persons per	Population Per Dwelling	(L/c/d)	(L/d)	(L/s)	2.5 x Avg. Day	(L/s)	2.2 x Max Day	0.5 x Avg. Day
	Units	Unit	Туре	(L/C/U)	(L/U)	(L/S)	(L/s)	(L/S)	(L/s)	(L/s)
Single Detached	11	3.4	38	280	10,640	0.12	0.31		0.68	0.06
Traditional Townhome	49	2.7	133	280	37,240	0.43	1.08		2.37	0.22
Subtotal	60		171		47,880	0.55	1.39		3.05	0.28

HMBW Phase 3 Residential Demands

	Number of		Population*	Ave	rage Day Dem	and	Max Day Fire Flow	Peak Hour	Min Hour	
Dwelling Type	Number of	Persons per	Population Per Dwelling	(1 / 2 / 2)	(1 (-1)	(1. / a)	2.5 x Avg. Day		2.2 x Max Day	0.5 x Avg. Day
	Units	Unit	Туре	(L/c/d)	(L/d)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
Single Detached	23	3.4	94		26,320	0.30	0.76		1.68	0.15
Traditional Townhome	101	2.7	328	280	91,840	1.06	2.66		5.85	0.53
Back-to-Back Townhome	94	2.7	305		85,400	0.99	2.47		5.44	0.49
Subtotal	218		727		203,560	2.36	5.89		12.96	1.18

HMBW Phase 3 Non Residential Demands

	Area *		Average Day Demand			Max Day	Fire Flow	Peak Hour	Min Hour
Property Type			(1 / h a / d)	a (d) (1 (d)	(L/d) (L/s)	15 χ Δνσ Dav	(L/s)	1.8 x Max Day	0.5 x Avg. Day
(ha)		(L/ha/	(L/ha/d) (L/d)	(L/U) (L/S)	(L/s)	(L/S)	(L/s)	(L/s)	
Employment	2.68		28,000	75,040	0.87	1.30		2.35	0.43
Park	4.56		28,000	127,680	1.48	2.22		3.99	0.74
Subtotal	7.24			202,720	2.35	3.52		6.34	1.17

HMBW Phase 4 Residential Demands

	Number of		Population*		Average Day Demand		Max Day	Fire Flow	Peak Hour	Min Hour
Dwelling Type	Units Units	Population Per Dwelling	(L/c/d)	(L/d)	(L/d) (L/s)	25 x Avg Dav	2.2 x Max Day	0.5 x Avg. Day		
		Unit	Туре	(L/C/U)	(L/d)	(L/S)	(L/s)	(L/s)	(L/s)	(L/s)
Single Detached	90	3.4	368	280	103,040	1.19	2.98		6.56	0.60
Subtotal	90		368		103,040	1.19	2.98		6.56	0.60

Flagstaff	ADD	MDD	PHD	MHD
Phase 1 Total Demand:	1.57	3.93	8.64	0.79
Phase 2 Total Demand:	1.74	3.37	6.83	0.87
Phase 2 Alternate Total Demand*	2.84	5.77	11.90	1.42
Half Moon Bay West	ADD	MDD	PHD	MHD
Phase 1 Total Demand:	6.37	12.96	26.73	3.19
Phase 2A Total Demand:	1.95	4.55	9.82	0.98
Phase 2B Total Demand:	1.22	3.05	6.72	0.64
	1.22	5.05	0.72	0.61

Total	16.00	34.35	72.17	8.00
Phase 4 Total Demand*:	1.19	2.98	6.56	0.60
Phase 3 Total Demand*:	4.70	9.41	19.29	2.35
Phase 10 Total Demand:	0.55	1.39	3.05	0.28
Phase 2B Total Demand:	1.22	3.05	6.72	0.61

Scenario Totals	ADD	MDD	PHD	MHD
Scenario 1	13.41	29.26	61.80	6.71
Scenario 2	16.38	35.29	74.26	8.19
Scenario 3	19.31	41.65	87.65	9.65
Scenario 4	20.41	44.05	92.72	10.21

*20% increase applied to account for possible future refinements in concept plan, as per DSEL



Hydraulic Capacity and Modeling Analysis Mattamy Half Moon Bay West Phase 3

Final Report

Prepared for: David Schaeffer Engineering Ltd. 120 Iber Road, Unit 103 Stittsville, ON K2S 1E9

Prepared by: GeoAdvice Engineering Inc. Unit 203, 2502 St. John's Street Port Moody, BC V3H 2B4

Submission Date: May 31, 2021

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng. **Project:** 2021-033-DSE

Copyright © 2021 GeoAdvice Engineering Inc.







Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
RO	May 11, 2021	Draft	Ben Loewen	Werner de Schaetzen
R1	May 25, 2021	Updated Draft	Ben Loewen	Werner de Schaetzen
R2	May 31, 2021	Final	Ben Loewen	Werner de Schaetzen

Confidentiality and Copyright

This document was prepared by GeoAdvice Engineering Inc. for David Schaeffer Engineering Ltd. The material in this document reflects the best judgment of GeoAdvice in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. GeoAdvice accepts no responsibility for damages, if any, suffered by any third party as a result of decision made or actions based on this document. Information in this document is to be considered the intellectual property of GeoAdvice Engineering Inc. in accordance with Canadian copyright law.

Statement of Qualifications and Limitations

This document represents GeoAdvice Engineering Inc. best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by a member of the engineering profession currently practicing under similar conditions. No warranty, express or implied is made.

Project ID: 2021-033-DSE





Page | 2



Contents

1	Inti	oducti	on4						
2	Мо	deling	Considerations6						
	2.1	Water	ater Main Configuration						
	2.2	Elevat	ions 6						
	2.3	Consu	mer Demands 6						
	2.4	Fire Fl	ow Demand8						
	2.5	Bound	ary Conditions9						
3	Нус	draulic	Capacity Design Criteria 11						
	3.1	Pipe C	haracteristics						
	3.2	Pressu	re Requirements						
4	Нус	draulic	Capacity Analysis 12						
	4.1	Develo	ppment Pressure Analysis 12						
	4.2	Develo	ppment Fire Flow Analysis 12						
5	Oth	ner Serv	vicing Considerations14						
	5.1	Water	Supply Security14						
	5.2	Valves							
	5.3	Hydra	nts 15						
	5.4	Water	Quality						
6	Cor	nclusio	ns16						
Δ	ppendi	iv A	Domestic Water Demand Calculations and Allocation						
	ppendi		FUS Fire Flow Calculations and Allocation						
	ppendix C Boundary Conditions ppendix D Pipe and Junction Model Inputs								
	••		Pipe and Junction Model Inputs						
	ppendi		MHD and PHD Model Results						
Α	Appendix F MDD+FF Model Results								







Introduction 1

GeoAdvice Engineering Inc. ("GeoAdvice") was retained by David Schaeffer Engineering Ltd. ("DSEL") to size the proposed water main network for Phase 3 of the Mattamy Half Moon Bay West (HMBW) development ("Development") in the City of Ottawa, ON ("City").

Analysis for one (1) scenario of the Mattamy HMBW Phase 3 development was completed using boundary conditions provided by the City (Scenario 2 in Appendix C) and is discussed within this report. The analysis includes the demands for the following existing developments in addition to the proposed Mattamy HMBW Phase 3 demands:

Mattamy HMBW Phases 1, 2, and 10, Flagstaff Phase 1 (Glenview Homes development)

The development will have two (2) connections to the City water distribution system along the realigned Greenbank Road:

- Connection 1: Perseus Avenue
- Connection 2: Cambrian Road

HMBW Phase 3 will connect east to Apolune Street in Mattamy HMBW Phase 1 and north to Flagstaff Drive.

The development site is shown in Figure 1.1 on the following page, with the final recommended pipe diameters.

This report describes the assumptions and results of the hydraulic modeling and capacity analysis using InfoWater (Innovyze), a GIS water distribution system modeling and management software application.

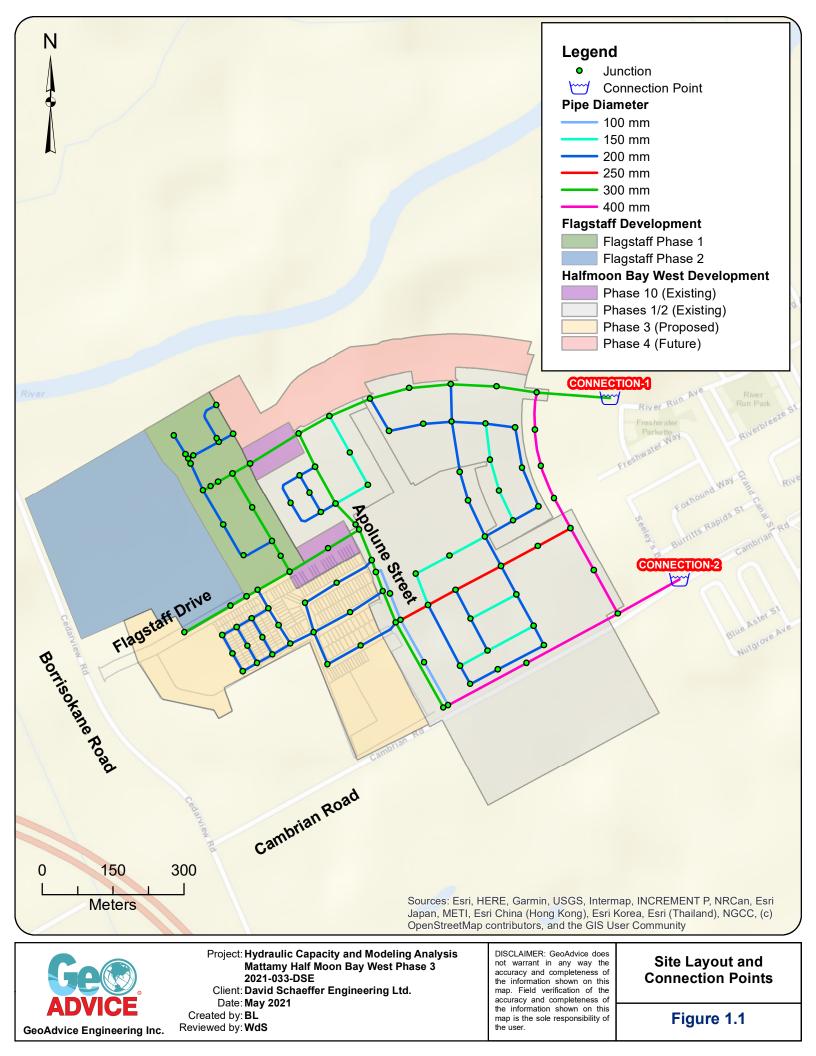
The results presented in this report are based on the analysis of steady state simulations. The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. No extended period simulations were completed in this analysis to assess the water quality or to assess the hydraulic impact on storage and pumping.

Project ID: 2021-033-DSE





Page | 4





2 Modeling Considerations

2.1 Water Main Configuration

The water main network was modeled based on drawings prepared by DSEL (16-10-100_M-Plan PH3 (April22-21).dwg) and provided to GeoAdvice on April 26th, 2021.

The 300 mm water main on Flagstaff Drive is expected to extend to Borrisokane Road as per the Barrhaven South Master Servicing Study. No analysis was conducted for the water main west of pipe P-102 shown in **Appendix D**.

2.2 Elevations

Elevations of the modeled junctions were assigned according to a preliminary site grading plan prepared by DSEL (2020-12-04_1140_grad_wcs.dwg) and provided to GeoAdvice on April 26th, 2021. The preliminary site grading plan provided was based on a different road alignment from that of the final road alignment of the development and as such, the allocation of the elevations was approximated using best judgement.

2.3 Consumer Demands

The existing residential demands (Mattamy HMBW Phases 1, 2, 10 and Flagstaff Phase 1) and the proposed residential demands for the Mattamy HMBW Phase 3 development were based on a demand rate of 280 L/cap/d as per City of Ottawa technical bulletin ISTB 2018-01. The park rate of 28,000 L/ha/d was assumed as per the City of Ottawa design guidelines and are consistent with similar previously completed developments within the City of Ottawa. Demand factors used for this analysis were taken according to the City of Ottawa 2010 Design Guidelines *Table 4.2 Consumption Rate for Subdivisions of 501 to 3,000 Persons*. Population densities were assigned according to *Table 4.1 Per Unit Populations* from the City of Ottawa Design Guidelines. A summary of these tables highlighting relevant data for this development is shown in **Table 2.1**.

Finally, the Mattamy HMBW Phase 3 water main network was also analyzed for an ultimate condition including the demands for the planned future Mattamy Phase 4 of the HMBW development and Flagstaff Phase 2 using boundary conditions provided by the City (Scenario 3 in **Appendix C**). The proposed water main network was confirmed to not require any changes in this ultimate condition.







Table 2.1: City of Ottawa Demand Factors

Demand Type	Amount	Units
Average Day Demand		
Residential	280	L/c/d
Park	28,000	L/ha/d
Maximum Daily Demand		
Residential	2.5 x avg. day	L/c/d
Park	1.5 x avg. day	L/ha/d
Peak Hour Demand		
Residential	2.2 x max. day	L/c/d
Park	1.8 x max. day	L/ha/d
Minimum Hour Demand		
Residential	0.5 x avg. day	L/c/d
Park	0.5 x avg. day	L/ha/d

 Table 2.2 to Table 2.3 summarize the water demand calculations for Mattamy HMBW Phase 3.

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Single Detached	23	3.4	87	0.28	0.70	1.55	0.14
Traditional Townhome	111	2.7	330	1.07	2.67	5.88	0.53
Back-to-Back Townhouse	94	2.7	280	0.91	2.27	4.99	0.45
Total	228		697	2.26	5.65	12.42	1.13

Table 2.2: Development Population and Demand Calculations – Mattamy HMBW Phase 3

*City of Ottawa Design Guidelines.







Land Use Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
	(IIa)	(L/S)	(L/S)	(L/S)	(L/S)
Park	4.52	1.46	2.20	3.96	0.73

Table 2.3: Non Residential Demand Calculations – Mattamy HMBW Phase 3

Demands were grouped into demand polygons then uniformly distributed to the model nodes located within each polygon. Detailed calculations of demands as well as the illustrated allocation areas are shown in **Appendix A**.

2.4 Fire Flow Demand

Fire flow calculations were completed in accordance with the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (1999) and City of Ottawa Technical Bulletin ISTB-2018-02. The required fire flow for single detached and traditional townhomes that meet Technical Bulletin ISTB-2018-02 requirements are to be capped at 10,000 L/min (167 L/s). For the townhouse units where the 10,000 L/min cap could not be applied, the FUS calculations yielded the following required fire flows:

- Block 40: 11,000 L/min (183 L/s)
- Block 33: 16,000 L/min (267 L/s)

The FUS calculations for the back-to-back townhouse blocks yielded the following required fire flows:

- 12-unit back-to-back townhouse: 14,000 L/min (233 L/s), accounts for one (1) firewall
- 10-unit back-to-back townhouse: 14,000 L/min (233 L/s), accounts for one (1) firewall
- 8-unit back-to-back townhouse: 16,000 L/min (267 L/s), no firewall accounted for

At this time, there is not enough information available to calculate the required fire flows of the park. As such, the following required fire flow was assumed, based on similar information from previously completed projects:

• Park: 167 L/s

Fire flow simulations were completed at each model node. The locations of nodes do not necessarily represent hydrant locations.

Detailed FUS fire flow calculations as well as the illustrated spatial allocation of the required fire flows are shown in **Appendix B**.







2.5 Boundary Conditions

The boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: Perseus Avenue
- Connection 2: Cambrian Road

The above connection points are illustrated in Figure 1.1.

Boundary conditions were provided for Peak Hour (PHD), Maximum Day plus Fire (MDD+FF) and Minimum Hour (high pressure check, MHD) demand conditions.

Under existing conditions, the Mattamy HMBW development will be serviced by the Barrhaven pressure zone (zone BARR); however, in the future, it will be serviced by the South Urban Community (SUC) pressure zone. The future pressure realignment for the SUC pressure zone includes the previous 3C pressure zone, portions of the current adjacent pressure zones, and the portion of the BARR pressure zone where the Mattamy HMBW development is located. The future SUC pressure zone is expected to be serviced by additional pumps and storage tanks.

Boundary conditions were provided under the existing and future pressure zone configurations. As the timeline for the pressure zone realignment is unconfirmed at this time, a hybrid approach was used to ensure that the most conservative option was selected for each of the PHD, MDD+FF and MHD scenarios.

The results presented in this report are based on this hybrid approach, which uses the most conservative HGLs for the PHD, MDD+FF and MHD scenarios from both of the existing and future boundary conditions as outlined below:

- The HGLs provided by the City for the PHD and MHD scenarios under the existing condition are more conservative than those of the SUC Zone reconfiguration condition.
- The HGLs provided by the City for the MDD+FF scenarios are more conservative under the SUC Zone reconfiguration condition than those of the existing condition.

The City boundary conditions were provided to GeoAdvice on April 9, 2021 and can be found in **Appendix C**.

The demands from the Flagstaff Phase 1 and the Mattamy Half Moon Bay West Phases 1, 2, 3 and 10 were included in the boundary condition request as they are located downstream from the connection points used in the boundary conditions.

Table 2.4 summarizes the City of Ottawa boundary conditions used (Scenario 2) to size thewater network.







Table 2.4: Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)
Min Hour (max. pressure)	158.3*	158.3*
Peak Hour (min. pressure)	136.4*	136.4*
Max Day + Fire Flow (167 L/s)	140.5**	140.7**
Max Day + Fire Flow (183 L/s)	137.9**	138.3**
Max Day + Fire Flow (233 L/s)	137.0**	137.4**
Max Day + Fire Flow (267 L/s)	134.0**	134.5**

*Based on the existing boundary conditions provided by the City of Ottawa.

** Based on the SUC Zone reconfiguration boundary conditions provided by the City of Ottawa.







3 Hydraulic Capacity Design Criteria

3.1 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 3.1** below.

Nominal Diameter (mm)	ID PVC (mm)	Hazen Williams C-Factor (/)
150	155	100
200	204	110
250	250	110
300	297	120
400	400	120

Table 3.1: Model Pipe Characteristics

3.2 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 3.2**.

Table 3.2: Pressure Requirements

Demand Condition	Minimum	Pressure	Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	350	50	480	70
Peak Hour Demand (minimum allowable pressure)	276	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	552	80
Maximum Distribution Pressure (minimum hour check)	-	-	552	80
Maximum Day Plus Fire	140	20	-	-







4 Hydraulic Capacity Analysis

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for minimum hour, peak hour and maximum day plus fire flow using InfoWater.

Detailed pipe and junction model input data can be found in **Appendix D**.

4.1 Development Pressure Analysis

The modeling results indicate that the Mattamy HMBW Phase 3 development can be adequately serviced by the proposed water main layout shown in **Figure 1.1**. Modeled service pressures for the Mattamy HMBW Phase 3 development are summarized in **Table 4.1** below.

Table 4.1: Summary of Mattamy HMBW Phase 3 Available Service Pressures

Minimum Hour Demand	Peak Hour Demand
Maximum Pressure	Minimum Pressure
93 psi (640 kPa)	61 psi (418 kPa)

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). As such, based on the City boundary conditions for the minimum hour demand, pressure reducing valves may be required throughout Mattamy HMBW Phase 3. In summary:

- Under the existing pressure zone conditions, any location with elevation lower than 102 m may experience high pressures (≥ 80 psi).
- Under the future pressure zone conditions, any location with the elevation lower than 91.5 m may experience high pressures (≥ 80 psi).

Detailed pipe and junction result tables and maps can be found in **Appendix E**.

4.2 Development Fire Flow Analysis

Summaries of the minimum available fire flows in Mattamy HMBW Phase 3 is shown in Table 4.2.







Required Fire Flow	Minimum Available Flow*	Junction ID
167 L/s	372 L/s	J-82
183 L/s	510 L/s	J-89
233 L/s	277 L/s	J-99
267 L/s	353 L/s	J-91

Table 4.2: Summary of the Mattamy HMBW Phase 3 Minimum Available Fire Flows

*The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. High available fire flows (>500 L/s) are theoretical values. Actual available fire flow is limited by the hydraulic losses through the hydrant lateral and hydrant port sizes.

As shown in **Table 4.2**, the fire flow requirements can be met at all junctions within the development.

Summaries of the residual pressures in Mattamy HMBW Phase 3 is shown below in **Table 4.3**. The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire.

Table 4.3: Summary	of the Mattamy	HMBW Phase 3	Residual Pressures	(MDD + FF)	
--------------------	----------------	--------------	---------------------------	------------	--

M	laximum Residual	Average Residual	Minimum Residual
	Pressure	Pressure	Pressure
	59 psi (405 kPa)	45 psi (312 kPa)	32 psi (217 kPa)

As shown in **Table 4.3**, there is sufficient residual pressure at all the junctions within the development.

Detailed fire flow results and figures illustrating the fire flow results can be found in **Appendix F**.







5 Other Servicing Considerations

5.1 Water Supply Security

The City of Ottawa Design Guidelines allow single feed systems for developments up to a total average day demand of 50 m³/day and require two (2) feeds if the development exceeds 50 m³/day for supply security, according to Technical Bulletin ISDTB-2018-02.

The HMBW Phase 3 development services a total average day demand of 322 m³/day; as such, two (2) feeds are required. Four (4) feeds to the Mattamy HMBW Phase 3 development from Apolune Street and Flagstaff Drive were modeled as part of the analysis.

5.2 Valves

No comment has been made in this report with respect to exact placement of isolation valves within the distribution network for the development other than to summarize the City of Ottawa Design Guidelines for number, location, and spacing of isolation valves:

- Tee intersection two (2) valves
- Cross intersection three (3) valves
- Valves shall be located 2 m away from the intersection
- 300 m spacing for 150 mm to 400 mm diameter valves
- Gate valves for 100 mm to 300 mm diameter mains
- Butterfly valves for 400 mm and larger diameter mains

Drain valves are not strictly required under the City of Ottawa Design Guidelines for water mains under 600 mm in diameter. The Guidelines indicate that "small diameter water mains shall be drained through hydrant via pumping if needed."

Air valves are not strictly required under the City of Ottawa Design Guidelines for water mains up to and including 400 mm in diameter. The Guidelines indicate that air removal "can be accomplished by the strategic positioning of hydrant at the high points to remove the air or by installing or utilizing available 50 mm chlorination nozzles in 300 mm and 400 mm chambers."

The detailed engineering drawings for the Mattamy HMBW Phase 3 development are expected to identify valves in accordance with the requirements noted above.







5.3 Hydrants

No additional comment has been made in this report with respect to exact placement of hydrants within the distribution network for the development other than to summarize the City of Ottawa Design Guidelines for maximum hydrant spacing:

- 125 m for single family unit residential areas on lots where frontage at the street line is 15 m or longer
- 110 m for single family unit residential areas on lots where frontage at the street line is less than 15 m and for residential areas zoned for row housing, doubles or duplexes
- 90 m for institutional, commercial, industrial, apartments and high-density areas

Additionally, based on the FUS document *Water Supply for Public Fire Protection (1999)*, the hydrant coverage areas for the following fire flows are:

- 167 L/s: 12,000 m² (radial coverage of 62 m)
- 183 L/s: 11,500 m² (radial coverage of 61 m)
- 233 L/s: 10,000 m² (radial coverage of 56 m)
- 267 L/s: 9,500 m² (radial coverage of 55 m)

The detailed engineering drawings for the Mattamy HMBW Phase 3 development are expected to identify hydrant locations in accordance with the requirements noted above.

5.4 Water Quality

The turnover rate of the water within the Mattamy HMBW Phase 3 development network, calculated from the connections to the development is about 5 hours (ADD is 322 m³/day).

The above rate is based on the volume of the development network and the development average day demand.







6 Conclusions

The hydraulic capacity and modeling analysis of the Mattamy HMBW Phase 3 development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows, with service pressures expected to range between 61 psi (418 kPa) and 93 psi (640 kPa).
- The proposed water main network is able to deliver fire flows at all junctions.
- Pressure reducing valves may be required, since maximum pressures are predicted to exceed the City of Ottawa Design Guidelines (> 80 psi).
 - O Under the existing pressure zone conditions, any location with elevation lower than 102 m may experience high pressures (≥ 80 psi).
 - Under the future pressure zone conditions, any location with the elevation lower than 91.5 m may experience high pressures (≥ 80 psi).
- Hydraulic modeling was completed using a hybrid format of the boundary conditions provided, using the most conservative HGLs from the existing and SUC Zone reconfiguration conditions for the PHD, MDD+FF and MHD scenarios.
 - The HGLs for the PHD and MHD scenarios under the existing condition are more conservative than those of the SUC Zone reconfiguration condition.
 - The HGLs for the MDD+FF scenarios are more conservative under the SUC Zone reconfiguration condition than those of the existing condition.





Hydraulic Capacity and Modeling Analysis Mattamy Half Moon Bay West Phase 3 • •

Submission

R

Prepared by:

Benjaming Luen

Ben Loewen, E.I.T. Hydraulic Modeler / Project Engineer

Approved by: OFESSIONAL N Werner de Schaetzen, Ph.D., P.Eng. Senior Modeling Review / Project Manager EOF







Appendix A Domestic Water Demand Calculations and Allocation





Consumer Water Demands

HMBW P	Phase 3	Residential	Demands
--------	---------	-------------	---------

	Number of		Population*	*	Averag	ge Day Demano	b	Max Day	Fire Flow	Peak Hour	Min Hour
Dwelling Type	Units	Persons per Unit		Per Dwelling ype	(L/c/d)	(L/d)	(L/s)	2.5 x Avg. Day (L/s)	(L/s)	2.2 x Max Day (L/s)	0.5 x Avg. Day (L/s)
Single Detached	23	3.4		87		24,360	0.28	0.70		1.55	0.14
Traditional Townhome	111	2.7		330	280	92,400	1.07	2.67		5.88	0.53
Back-to-Back Townhome	94	2.7		280		78,400	0.91	2.27		4.99	0.45
Subtotal	228			697		195,160	2.26	5.65		12.42	1.13
HMBW Phase 3 Non Residential Dem	nands										
	Area				Averag	e Day Deman	b	Max Day	Fire Flow	Peak Hour	Min Hour
Property Type	(ha)				(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	(L/s)	1.8 x Max Day (L/s)	0.5 x Avg. Day (L/s)
Park	4.52				28,000	126,560	1.46	2.20		3.96	0.73
Subtotal	4.52					126.560	1.46	2.20		3.96	0.73
Flagstaff	Number	of Units	Population	Non Residenti	al Area (ha)			ADD	MDD	PHD	MHD
Phase 1 Total Demand:		155	485					1.57	3.93	8.64	0.79
Half Moon Bay West	Number	of Units	Population	Non Residenti	al Area (ba)			ADD	MDD	PHD	MHD
Phase 1 Total Demand:	Number	353	1,049	NOT Residenti	9.18			6.37		26.73	3.19
Phase 2A Total Demand:		156	502		1.00			1.95		9.82	0.98
Phase 2B Total Demand:		130	377		1.00			1.33		6.72	0.61
Phase 10 Total Demand:		60	171	1				0.55		3.05	0.28
Phase 3 Total Demand*:		228	697		4.52			3.72		16.38	1.86
Scenario Totals								ADD	MDD	РНО	MHD
Scenario Totals Scenario 2	Flagstaff Phas		hasos 1 - 24 - 1	20 2 10				ADD 15.40	MDD 33.73	PHD 71.34	MHD 7.70

 $^{*10\%}$ increase applied to account for possible future refinements in concept plan, as per DSEL

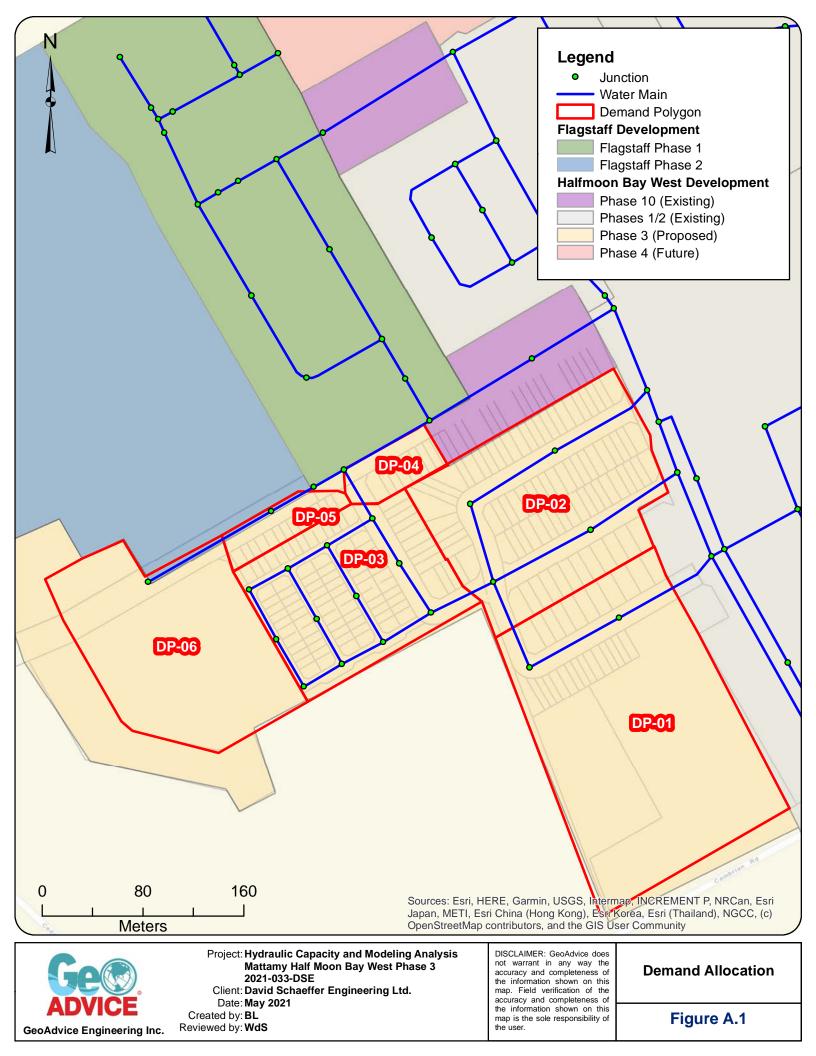
Domestic Demand Calculations and Allocation

HMBW Phase 3 Domestic Demands

Demand Polygon	Junction ID	unction ID Dwelling Type	Number of Units	Population	A	verage Day Dema	verage Day Demand		Peak Hour 2.2 x Max Day	Min Hour 0.5 x Avg. Day			
					L/c/d	L/d	L/s	(L/s)	(L/s)	(L/s)			
1	J-87	Single Detached	11	42	280	12,068	0.14	0.35	0.77	0.07			
· ·	J-88	Traditional Townhouse	15	45	280	12,068	0.14	0.35	0.77	0.07			
	J-89	Single Detected	12	45	280	17,121	0.20	0.50	1.09	0.10			
<u> </u>	J-90	Single Detached	12	45	200	17,121	0.20	0.50	1.09	0.10			
2	J-91	Traditional Townhouse	67	199	280	17,121	0.20	0.50	1.09	0.10			
	J-92	Traditional Townhouse	67	199	200	17,121	0.20	0.50	1.09	0.10			
	J-93	Traditional Townhouse		36	36 280	6,393	0.07	0.18	0.41	0.04			
	J-94		12			6,393	0.07	0.18	0.41	0.04			
	J-95					6,393	0.07	0.18	0.41	0.04			
	J-96					6,393	0.07	0.18	0.41	0.04			
	J-97					l			6,393	0.07	0.18	0.41	0.04
3	J-98					6,393	0.07	0.18	0.41	0.04			
3	J-99					6,393	0.07	0.18	0.41	0.04			
	J-100					6,393	0.07	0.18	0.41	0.04			
	J-101	Deals to Deals Tawahawaa	00	000	000	6,393	0.07	0.18	0.41	0.04			
	J-102	Back-to-Back Townhouse	80	238	280	6,393	0.07	0.18	0.41	0.04			
	J-103					6,393	0.07	0.18	0.41	0.04			
	J-104	1				6,393	0.07	0.18	0.41	0.04			
4	J-105	Traditional Townhouse	9	27	280	7,492	0.09	0.22	0.48	0.04			
5	J-107	Back-to-Back Townhouse	14	42	280	11,677	0.14	0.34	0.74	0.07			
7	J-82	Traditional Townhouse	8	24	280	6,659	0.08	0.19	0.42	0.04			
	Total:		228	697		195,160	2.26	5.65	12.42	1.13			

HMBW Phase 3 Non-Domestic Demands

				Average Day Demand		Max Day	Peak Hour	Min Hour	
Property Type	Junction ID	Phase	Area (ha)	(L/ha/d)	(1 /d)	(1./2)	1.5 x Avg. Day	1.8 x Max Day	0.5 x Avg. Day
				(L/na/u)	(L/d)	(L/s)	(L/s)	(L/s)	(L/s)
Park	J-87	Phase 3	2.85	28,000	79,800	0.92	1.39	2.49	0.46
Park	J-82	Phase 3	1.67	28,000	46,760	0.54	0.27	0.49	0.09
	Total:		4.52		126,560	1.46	1.66	2.98	0.55

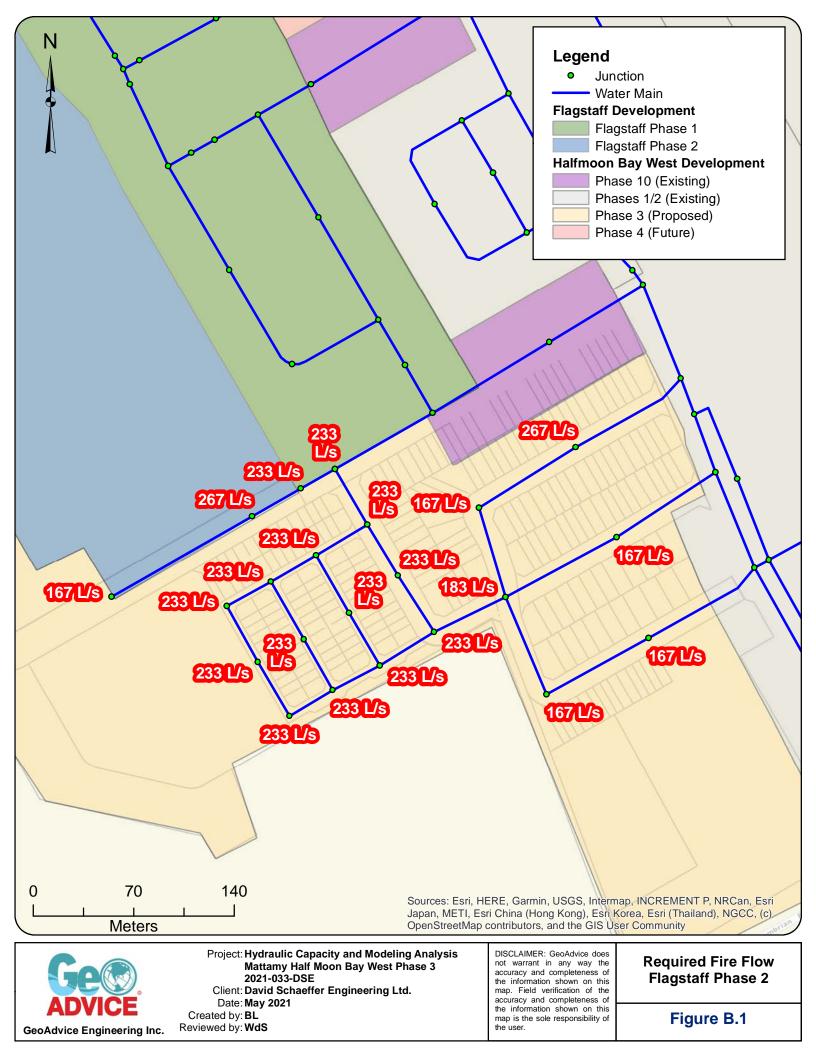




Appendix B FUS Fire Flow Calculations and Allocation







FUS Required Fire Flow Calculation Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999. Client: David Schaeffer Engineering Ltd. Project: 2021-033-DSE Development: Half Moon Bay West Phase 3 **Townhouse Block 40** Zoning: Multi Family Residential Note: For other townhouse blocks that do not comply with the City of Ottawa Technical Bulletin ISDTB-2018-02 4.2, a similar fire flow as calculated below will be used (Block 37). Date: May 10, 2021 A. Type of Construction: Wood Frame Construction **B.** Ground Floor Area: 358 m⁴ C. Number of Storeys: 2 $F = 220C\sqrt{A}$ D. Required Fire Flow*: C: Coefficient related to the type of construction 1.5 C = 715 m² A: Effective area The total floor area in m^2 in the building being considered 8,826 L/min 9,000 L/min* E. Occupancy Limited Combustible Occupancy content hazard -15 % of **D** -1,350 L/min 7,650 L/min F. Sprinkler Protection Automatic sprinkler protection None % of **E** 0 L/min 7,650 L/min G. Exposures Separation Length-Height Factor -Side **Construction Type - Adjacent Structure** Distance Adjacent Structure Exposure North 30.1 to 45 m Wood Frame or Non-Combustible 5% 31-60 m-storeys Wood Frame or Non-Combustible 17% East 3.1 to 10 m 0-30 m-storeys South 3.1 to 10 m Wood Frame or Non-Combustible 17% 0-30 m-storeys West 20.1 to 30 m 31-60 m-storeys Wood Frame or Non-Combustible 8% 47% Total

H. Wood Shake Charge

For wood shingle or shake roofs

Total Fire Flow Required	11,000	L/min**
	183	L/s
Required Duration of Fire Flow	2.25	Hrs
Required Volume of Fire Flow	1,485	m³

% of E + 3,596 L/min

0 L/min

11,246 L/min

11,246 L/min

G =

H =

*Rounded to the nearest 1,000 L/min

No

The Total Required Fire Flow for the Half Moon Bay West Phase 3 development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

^{**} Rounded to the nearest 1,000 L/min

FUS Required Fire Flow Calculation				Calculations Based on "Water			
Client:	David Schaeffer E	ngineering Lt	d.	Protection", Fire Underwriters Surv	/ey, 1999.		
	2021-033-DSE						CF
	Half Moon Bay We		Townhouse Block 33				
-	Multi Family Reside	ential		e blocks that do not comply w		a Technical Bull	etin
Date:	May 10, 2021		ISDTB-2018-02 4.2, a simil	ar fire flow as calculated belov	v will be used.		
A.	Type of Construction	on:	Wood Frame Construction	I			
В.	Ground Floor Area	:	609 m	Note: Block 33 h	as 7 units		
C.	Number of Storeys	:	2				
D.	Required Fire Flow	*:	$F = 220C\sqrt{A}$				
	C: Coefficient relate		of construction	C = 1.5			
	A: Effective area			A = 1218	m ²		
	The total floor area in r	n ² in the building	being considered				
				F = 11,517	L/min	D = 12,000	L/min*
E.	Occupancy						
	Occupancy content	hazard	Limited Combustible	15% of D1,800L/min		E = 10,200	L/min
F.	F. Sprinkler Protection						
	Automatic sprinkle		None	0 % of E 0 L/min		F = 10,200	L/min
G.	Exposures						
	Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adja	cent Structure	Exposur	e
		10.1 to 20 m	61-90 m-storeys	Wood Frame or No		14%	
		3.1 to 10 m	0-30 m-storeys	Wood Frame or No		17%	
		20.1 to 30 m	61-90 m-storeys	Wood Frame or No		9%	
	west	3.1 to 10 m	0-30 m-storeys	Wood Frame or No	n-Compustible	17% Total 57%	=
				% of E	+ 5,814 L/min	G = 16,014	 L/min
					- 		
H.	Wood Shake Charg		No	0	L/min	H = 16,014	L/min
	For wood shingle o	r snake roots					
				Total Fire Flow Required	16,000 L/min**		
					267 L/s		
			Requ	uired Duration of Fire Flow	3.5 Hrs		
			Rec	quired Volume of Fire Flow	3,360 m ³		

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Half Moon Bay West Phase 3 development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

^{**} Rounded to the nearest 1,000 L/min

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.

Project: 2021-033-DSE Development: Half Moon Bay West Phase 3

Date: May 10, 2021

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.



12-unit Back-to-Back Townhouse Zoning: Multi Family Residential Firewall located in the middle of the block.

Wood Frame Construction

A. Type of Construction: **B.** Ground Floor Area: 353 m⁴ C. Number of Storeys: 3 $F = 220C\sqrt{A}$ D. Required Fire Flow*: C: Coefficient related to the type of construction C = 1.5 1059 m² A: Effective area The total floor area in m² in the building being considered F = 10,738 L/min 11,000 L/min* E. Occupancy Limited Combustible Occupancy content hazard -15 % of **D** -1,650 L/min 9.350 L/min F. Sprinkler Protection Automatic sprinkler protection % of **E** None 0 L/min 9,350 L/min G. Exposures Separation Length-Height Factor -Side **Construction Type - Adjacent Structure** Distance **Adjacent Structure** Exposure North Firewall Wood Frame or Non-Combustible 10% 61-90 m-storeys East 10.1 to 20 m Wood Frame or Non-Combustible 31-60 m-storeys 13% South 3.1 to 10 m Wood Frame or Non-Combustible 19% 61-90 m-storeys West 10.1 to 20 m 31-60 m-storeys Wood Frame or Non-Combustible 13% 55% Total % of E + 5,143 L/min 14,493 L/min G = H. Wood Shake Charge No 0 L/min 14,493 L/min H = For wood shingle or shake roofs Total Fire Flow Required 14,000 L/min* L/s 233 **Required Duration of Fire Flow** 3 Hrs

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Half Moon Bay West Phase 3 development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Required Volume of Fire Flow

m³

2.520

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

^{**} Rounded to the nearest 1,000 L/min



12-unit Back-to-Back Townhouse

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.

Project: 2021-033-DSE

Development: Half Moon Bay West Phase 3

Zoning: Multi Family Residential

10-unit Back-to-Back Townhouse Firewall located with 6 units on one side and 4 units on the other.

Calculations Based on "Water Supply for Public Fire

m³

2.520

Protection", Fire Underwriters Survey, 1999.



Date: May 10, 2021 A. Type of Construction: Wood Frame Construction **B.** Ground Floor Area: 357 m² C. Number of Storeys: 3 $F = 220C\sqrt{A}$ D. Required Fire Flow*: C: Coefficient related to the type of construction **C** = 1.5 1071 m² A: Effective area The total floor area in m² in the building being considered F = 10,798 L/min 11,000 L/min* E. Occupancy Limited Combustible Occupancy content hazard -15 % of **D** -1,650 L/min 9.350 L/min F. Sprinkler Protection Automatic sprinkler protection % of **E** None 0 L/min 9,350 L/min G. Exposures Separation Length-Height Factor -Side **Construction Type - Adjacent Structure** Distance Adjacent Structure Exposure North 3.1 to 10 m Wood Frame or Non-Combustible 19% 61-90 m-storeys Wood Frame or Non-Combustible East 10.1 to 20 m 31-60 m-storeys 13% Wood Frame or Non-Combustible 10% South Firewall 61-90 m-storeys West 10.1 to 20 m 31-60 m-storeys Wood Frame or Non-Combustible 13% 55% Total % of E + 5,143 L/min 14,493 L/min G = H. Wood Shake Charge No 0 L/min 14,493 L/min For wood shingle or shake roofs Total Fire Flow Required 14,000 L/min* L/s 233 **Required Duration of Fire Flow** 3 Hrs

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Half Moon Bay West Phase 3 development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

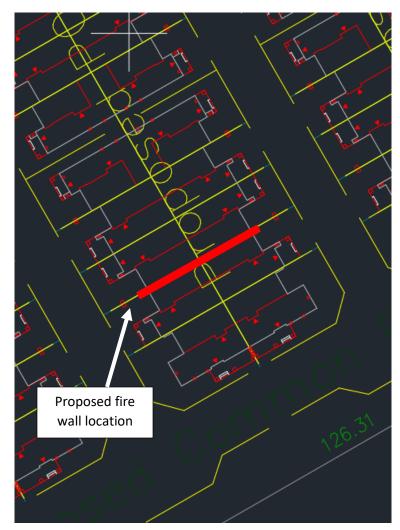
Required Volume of Fire Flow

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

^{**} Rounded to the nearest 1,000 L/min

10-unit Back-to-Back Townhouse



FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.

Project: 2021-033-DSE Development: Half Moon Bay West Phase 3

Date: May 10, 2021

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.



opment: Half Moon Bay West Phase 38-unit Back-to-Back TownhouseZoning: Multi Family ResidentialNo Firewall

A. Type of Construction:	Wood Frame Construction	
B. Ground Floor Area:	481 m ²	Note: The exposure to the School block
C. Number of Storeys:	3	located to the North was taken at the property line to be conservative.
D. Required Fire Flow*:	$F = 220C\sqrt{A}$	
C: Coefficient related to the type		C = 1.5
A: Effective area		$A = 1444 m^2$
The total floor area in m ² in the buildir	g being considered	
		F = 12,538 L/min D = 13,000 L/mir
E. Occupancy		
Occupancy content hazard	Limited Combustible	<u>-15</u> % of D <u>-1,950</u> L/min E = 11,050 L/mir
F. Sprinkler Protection		
Automatic sprinkler protection	None	% of E L/min F = 11,050 L/mir
G. Exposures		
Side Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure Exposure
North 20.1 to 30 r		Wood Frame or Non-Combustible 8%
East 3.1 to 10 m	61-90 m-storeys	Wood Frame or Non-Combustible 19%
South 10.1 to 20 r	n 61-90 m-storeys	Wood Frame or Non-Combustible 14%
West Beyond 45 r	n 0-30 m-storeys	Wood Frame or Non-Combustible 0%
		Total 41%
		% of E <u>+ 4,531</u> L/min G = 15,581 L/mir
H. Wood Shake Charge	No	L/min H = 15,581 L/mir
For wood shingle or shake roofs		
		Total Fire Flow Required 16,000 L/min**
		267 L/s
	Requi	red Duration of Fire Flow 3.5 Hrs
	Requ	ired Volume of Fire Flow 3,360 m ³

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Half Moon Bay West Phase 3 development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

^{**} Rounded to the nearest 1,000 L/min

Back-to-Back Townhouse Proposed Fire Wall Locations

Fire wall locations are based off the FUS calculations completed, which were the worst-case scenarios for each townhouse block type (8-unit, 10-unit, 12-unit). It is possible that by completing additional FUS calculations, the fire wall recommendations may not be the same for the other back-to-back townhouse blocks.



Appendix C Boundary Conditions

Project ID: 2021-023-DSE





Boundary Conditions Flagstaff and Mattamy's Half Moon Bay West

Location



Scenario 1

Provided Information

Scenario 1	Demand		
Scenario	L/min	L/s	
Average Daily Demand	403	6.71	
Maximum Daily Demand	1,756	29.26	
Peak Hour	3,708	61.80	
Fire Flow Demand #1	10,000	166.67	
Fire Flow Demand #2	13,000	216.67	
Fire Flow Demand #3	14,000	233.33	
Fire Flow Demand #4	17,000	283.33	

Results – Existing Conditions

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	157.0	89.6
Peak Hour	136.9	61.0
Max Day plus Fire 1	144.6	72.0
Max Day plus Fire 2	141.0	66.9
Max Day plus Fire 3	139.7	65.0
Max Day plus Fire 4	135.2	58.6

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	157.0	90.3
Peak Hour	136.9	61.8
Max Day plus Fire 1	144.9	73.1
Max Day plus Fire 2	141.4	68.2
Max Day plus Fire 3	140.1	66.3
Max Day plus Fire 4	135.7	60.1

Ground Elevation = 93.5 m

Results – SUC Zone Reconfiguration

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	76.3
Peak Hour	140.9	66.7
Max Day plus Fire 1	140.7	66.5
Max Day plus Fire 2	138.2	62.9
Max Day plus Fire 3	137.3	61.6
Max Day plus Fire 4	134.3	57.3

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	77.1
Peak Hour	140.9	67.5
Max Day plus Fire 1	140.9	67.6
Max Day plus Fire 2	138.6	64.2
Max Day plus Fire 3	137.7	62.9
Max Day plus Fire 4	134.8	58.9

Ground Elevation = 93.5 m

Scenario 2

Provided Information

Scenario 2	Demand		
Scenario 2	L/min	L/s	
Average Daily Demand	491	8.19	
Maximum Daily Demand	2,117	35.29	
Peak Hour	4,456	74.26	
Fire Flow Demand #1	10,000	166.67	
Fire Flow Demand #2	13,000	216.67	
Fire Flow Demand #3	14,000	233.33	
Fire Flow Demand #4	17,000	283.33	

Results – Existing Conditions

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	158.3	91.4
Peak Hour	136.4	60.4
Max Day plus Fire 1	144.2	71.5
Max Day plus Fire 2	140.6	66.2
Max Day plus Fire 3	139.2	64.3
Max Day plus Fire 4	134.6	57.8

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	158.3	92.2
Peak Hour	136.4	61.1
Max Day plus Fire 1	144.5	72.6
Max Day plus Fire 2	140.9	67.5
Max Day plus Fire 3	139.6	65.6
Max Day plus Fire 4	135.2	59.4

Ground Elevation = 93.5 m

Results – SUC Zone Reconfiguration

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	76.3
Peak Hour	140.2	65.8
Max Day plus Fire 1	140.5	66.2
Max Day plus Fire 2	137.9	62.5
Max Day plus Fire 3	137.0	61.2
Max Day plus Fire 4	134.0	56.9

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	77.0
Peak Hour	140.2	66.5
Max Day plus Fire 1	140.7	67.3
Max Day plus Fire 2	138.3	63.8
Max Day plus Fire 3	137.4	62.5
Max Day plus Fire 4	134.5	58.5

Ground Elevation = 93.5 m

Scenario 3

Provided Information

Scenario 3	Demand		
Scenario S	L/min	L/s	
Average Daily Demand	579	9.65	
Maximum Daily Demand	2,499	41.65	
Peak Hour	5,259	87.65	
Fire Flow Demand #1	10,000	166.67	
Fire Flow Demand #2	13,000	216.67	
Fire Flow Demand #3	14,000	233.33	
Fire Flow Demand #4	17,000	283.33	

Results – Existing Conditions

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	159.1	92.7
Peak Hour	135.1	58.4
Max Day plus Fire 1	143.8	70.9
Max Day plus Fire 2	140.1	65.6
Max Day plus Fire 3	138.7	63.6
Max Day plus Fire 4	134.1	57.1

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	159.1	93.4
Peak Hour	135.1	59.2
Max Day plus Fire 1	144.1	72.0
Max Day plus Fire 2	140.5	66.9
Max Day plus Fire 3	139.1	65.0
Max Day plus Fire 4	134.7	58.7

Ground Elevation = 93.5 m

Results – SUC Zone Reconfiguration

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	76.2
Peak Hour	139.5	64.7
Max Day plus Fire 1	140.3	65.8
Max Day plus Fire 2	137.7	62.2
Max Day plus Fire 3	136.7	60.8
Max Day plus Fire 4	133.6	56.4

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	77.0
Peak Hour	139.5	65.5
Max Day plus Fire 1	140.5	66.9
Max Day plus Fire 2	138.0	63.4
Max Day plus Fire 3	137.1	62.2
Max Day plus Fire 4	134.2	58.0

Ground Elevation = 93.5 m

Scenario 4

Provided Information

Scenario 4	Der	nand		
Scenario 4	L/min	L/s		
Average Daily Demand	613	10.21		
Maximum Daily Demand	2,643	44.05		
Peak Hour	5,563	92.72		
Fire Flow Demand #1	10,000	166.67		
Fire Flow Demand #2	13,000	216.67		
Fire Flow Demand #3	14,000	233.33		
Fire Flow Demand #4	17,000	283.33		

Results – Existing Conditions

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	159.1	92.6
Peak Hour	134.5	57.7
Max Day plus Fire 1	143.7	70.7
Max Day plus Fire 2	139.9	65.4
Max Day plus Fire 3	138.5	63.4
Max Day plus Fire 4	133.9	56.8

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	159.1	93.4
Peak Hour	134.5	58.4
Max Day plus Fire 1	143.9	71.8
Max Day plus Fire 2	140.3	66.6
Max Day plus Fire 3	138.9	64.7
Max Day plus Fire 4	134.5	58.4

Ground Elevation = 93.5 m

Results – SUC Zone Reconfiguration

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	76.2
Peak Hour	139.2	64.3
Max Day plus Fire 1	140.2	65.7
Max Day plus Fire 2	137.6	62.0
Max Day plus Fire 3	136.6	60.7
Max Day plus Fire 4	133.5	56.3

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	77.0
Peak Hour	139.2	65.1
Max Day plus Fire 1	140.4	66.8
Max Day plus Fire 2	137.9	63.3
Max Day plus Fire 3	137.0	62.0
Max Day plus Fire 4	134.1	57.9

Ground Elevation = 93.5 m

<u>Notes</u>

- As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
 - a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
 - b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

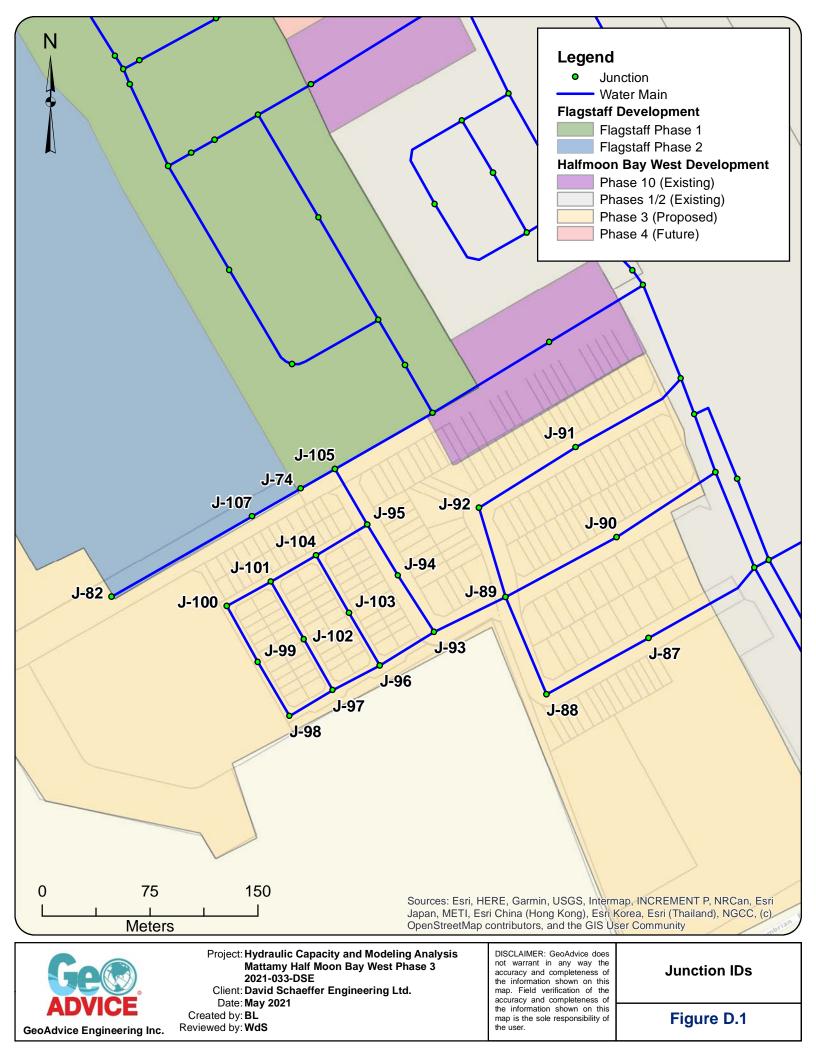


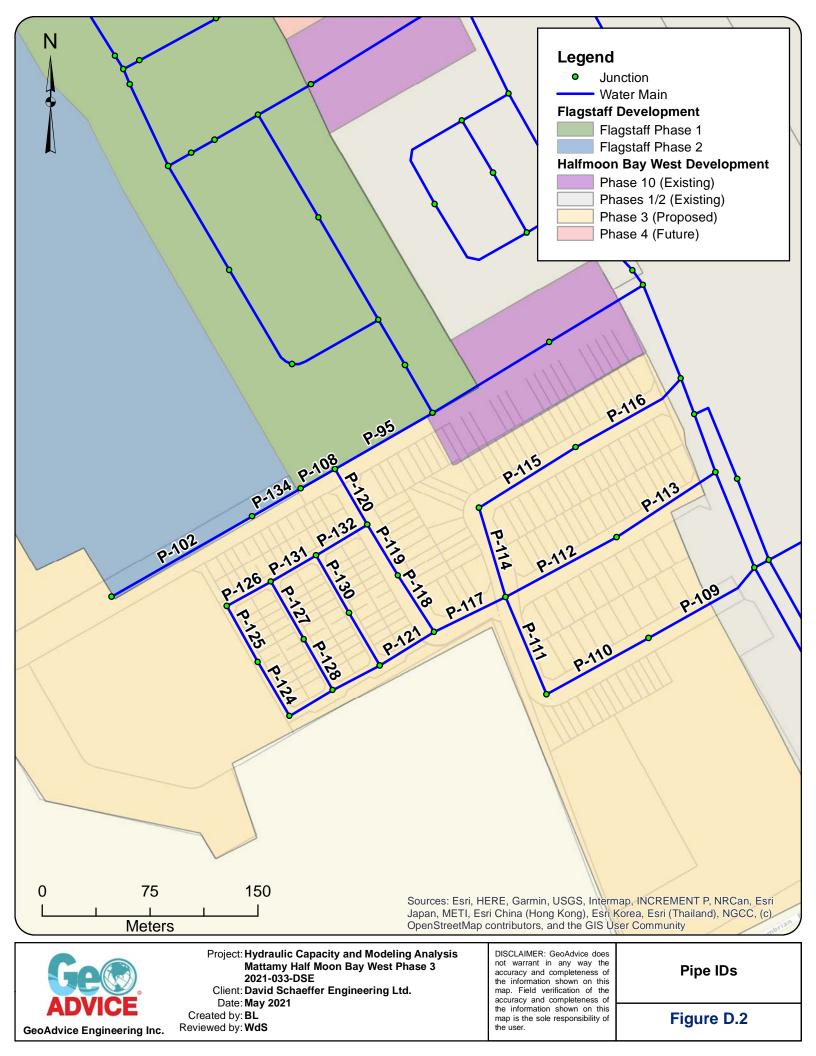
Appendix D Pipe and Junction Model Inputs

Project ID: 2021-023-DSE









Model Inputs

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness ()
P-102	J-82	J-107	112.76	297	120
P-108	J-105	J-74	27.31	297	120
P-109	J-14	J-87	89.29	204	110
P-110	J-87	J-88	81.18	204	110
P-111	J-88	J-89	73.64	204	110
P-112	J-89	J-90	87.69	204	110
P-113	J-90	J-13	82.42	204	110
P-114	J-89	J-92	64.70	204	110
P-115	J-92	J-91	79.40	204	110
P-116	J-91	J-19	88.28	204	110
P-117	J-89	J-93	55.19	204	110
P-118	J-93	J-94	46.56	204	110
P-119	J-94	J-95	41.31	204	110
P-120	J-95	J-105	44.98	204	110
P-121	J-93	J-96	44.58	204	110
P-122	J-96	J-97	37.02	204	110
P-123	J-97	J-98	35.03	204	110
P-124	J-98	J-99	43.48	204	110
P-125	J-99	J-100	44.77	204	110
P-126	J-100	J-101	35.00	204	110
P-127	J-101	J-102	46.13	204	110
P-128	J-102	J-97	40.79	204	110
P-129	J-96	J-103	42.30	204	110
P-130	J-103	J-104	46.37	204	110
P-131	J-104	J-101	36.29	204	110
P-132	J-104	J-95	41.56	204	110
P-134	J-107	J-74	39.00	297	120
P-95	J-73	J-105	78.42	297	120

ID	Elevation (m)
J-100	93.10
J-101	93.40
J-102	93.40
J-103	93.40
J-104	93.30
J-105	93.43
J-107	93.46
J-74	93.46
J-82	93.08
J-87	93.10
J-88	93.30
J-89	93.20
J-90	93.10
J-91	93.00
J-92	93.20
J-93	93.40
J-94	93.30
J-95	93.20
J-96	93.40
J-97	93.50
J-98	93.30
J-99	93.20

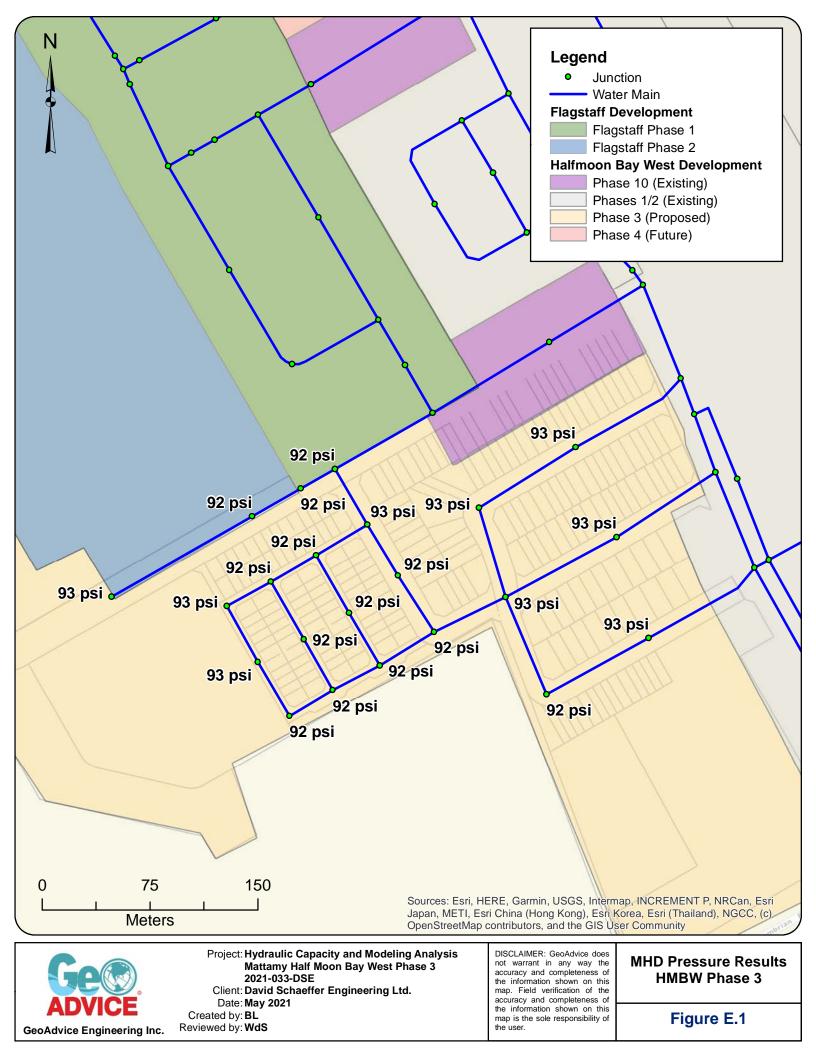


Appendix E MHD and PHD Model Results

Project ID: 2021-023-DSE



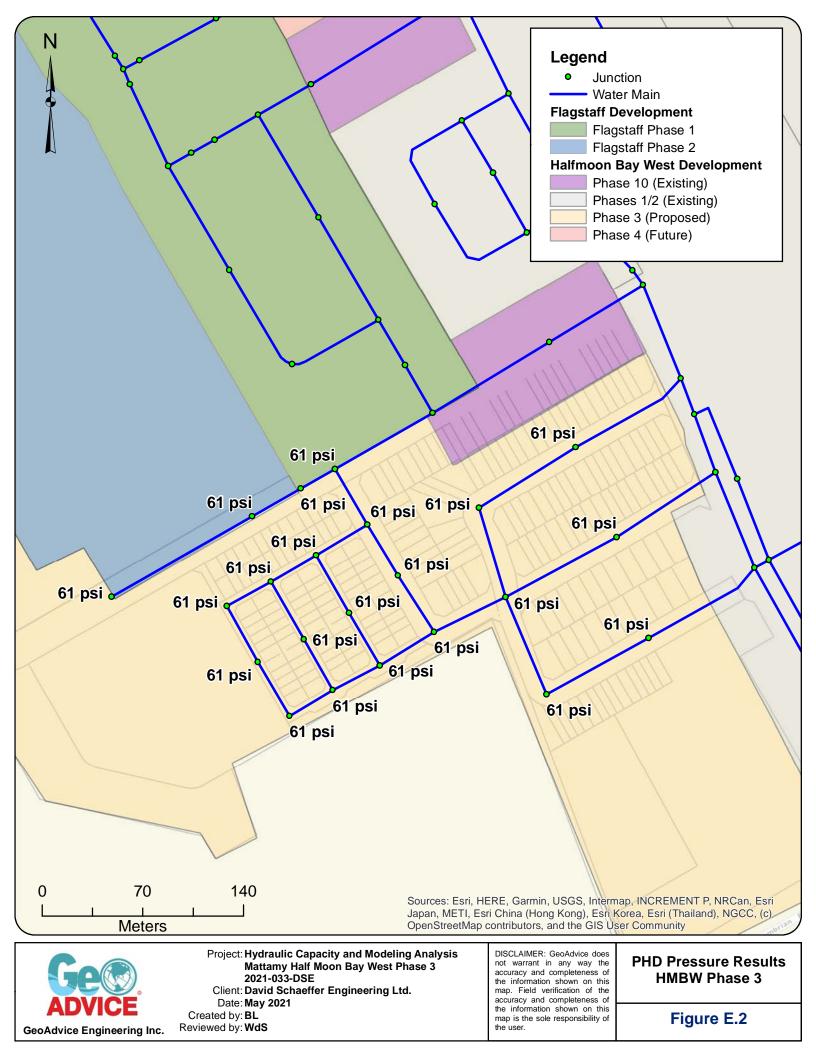




Minimum Hour Demand Modeling Results - Half Moon Bay West Phase 3

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
P-102	J-82	J-107	112.76	297	120	-0.13	0.00	0.00	0.00
P-108	J-105	J-74	27.31	297	120	0.25	0.00	0.00	0.00
P-109	J-14	J-87	89.29	204	110	0.63	0.02	0.00	0.01
P-110	J-87	J-88	81.18	204	110	0.10	0.00	0.00	0.00
P-111	J-88	J-89	73.64	204	110	0.03	0.00	0.00	0.00
P-112	J-89	J-90	87.69	204	110	-0.28	0.01	0.00	0.00
P-113	J-90	J-13	82.42	204	110	-0.38	0.01	0.00	0.00
P-114	J-89	J-92	64.70	204	110	-0.09	0.00	0.00	0.00
P-115	J-92	J-91	79.40	204	110	-0.18	0.01	0.00	0.00
P-116	J-91	J-19	88.28	204	110	-0.28	0.01	0.00	0.00
P-117	J-89	J-93	55.19	204	110	0.29	0.01	0.00	0.00
P-118	J-93	J-94	46.56	204	110	0.08	0.00	0.00	0.00
P-119	J-94	J-95	41.31	204	110	0.04	0.00	0.00	0.00
P-120	J-95	J-105	44.98	204	110	-0.15	0.01	0.00	0.00
P-121	J-93	J-96	44.58	204	110	0.18	0.01	0.00	0.00
P-122	J-96	J-97	37.02	204	110	0.11	0.00	0.00	0.00
P-123	J-97	J-98	35.03	204	110	0.06	0.00	0.00	0.00
P-124	J-98	J-99	43.48	204	110	0.02	0.00	0.00	0.00
P-125	J-99	J-100	44.77	204	110	-0.02	0.00	0.00	0.00
P-126	J-100	J-101	35.00	204	110	-0.06	0.00	0.00	0.00
P-127	J-101	J-102	46.13	204	110	0.02	0.00	0.00	0.00
P-128	J-102	J-97	40.79	204	110	-0.02	0.00	0.00	0.00
P-129	J-96	J-103	42.30	204	110	0.03	0.00	0.00	0.00
P-130	J-103	J-104	46.37	204	110	-0.01	0.00	0.00	0.00
P-131	J-104	J-101	36.29	204	110	0.11	0.00	0.00	0.00
P-132	J-104	J-95	41.56	204	110	-0.16	0.01	0.00	0.00
P-134	J-107	J-74	39.00	297	120	-0.20	0.00	0.00	0.00
P-95	J-73	J-105	78.42	297	120	0.45	0.01	0.00	0.00

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-100	0.04	93.10	158	93
J-101	0.04	93.40	158	92
J-102	0.04	93.40	158	92
J-103	0.04	93.40	158	92
J-104	0.04	93.30	158	92
J-105	0.04	93.43	158	92
J-107	0.07	93.46	158	92
J-74	0.06	93.46	158	92
J-82	0.13	93.08	158	93
J-87	0.53	93.10	158	93
J-88	0.07	93.30	158	92
J-89	0.10	93.20	158	93
J-90	0.10	93.10	158	93
J-91	0.10	93.00	158	93
J-92	0.10	93.20	158	93
J-93	0.04	93.40	158	92
J-94	0.04	93.30	158	92
J-95	0.04	93.20	158	93
J-96	0.04	93.40	158	92
J-97	0.04	93.50	158	92
J-98	0.04	93.30	158	92
J-99	0.04	93.20	158	93



Peak Hour Demand Modeling Results - Half Moon Bay West Phase 3

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
P-102	J-82	J-107	112.76	297	120	-0.91	0.01	0.00	0.00
P-108	J-105	J-74	27.31	297	120	2.28	0.03	0.00	0.01
P-109	J-14	J-87	89.29	204	110	5.68	0.17	0.03	0.28
P-110	J-87	J-88	81.18	204	110	2.42	0.07	0.01	0.06
P-111	J-88	J-89	73.64	204	110	1.65	0.05	0.00	0.03
P-112	J-89	J-90	87.69	204	110	-2.63	0.08	0.01	0.07
P-113	J-90	J-13	82.42	204	110	-3.72	0.11	0.01	0.13
P-114	J-89	J-92	64.70	204	110	-0.46	0.01	0.00	0.00
P-115	J-92	J-91	79.40	204	110	-1.54	0.05	0.00	0.03
P-116	J-91	J-19	88.28	204	110	-2.63	0.08	0.01	0.07
P-117	J-89	J-93	55.19	204	110	3.65	0.11	0.01	0.12
P-118	J-93	J-94	46.56	204	110	1.16	0.04	0.00	0.02
P-119	J-94	J-95	41.31	204	110	0.75	0.02	0.00	0.01
P-120	J-95	J-105	44.98	204	110	-1.24	0.04	0.00	0.02
P-121	J-93	J-96	44.58	204	110	2.08	0.06	0.00	0.04
P-122	J-96	J-97	37.02	204	110	1.26	0.04	0.00	0.02
P-123	J-97	J-98	35.03	204	110	0.62	0.02	0.00	0.01
P-124	J-98	J-99	43.48	204	110	0.21	0.01	0.00	0.00
P-125	J-99	J-100	44.77	204	110	-0.20	0.01	0.00	0.00
P-126	J-100	J-101	35.00	204	110	-0.60	0.02	0.00	0.01
P-127	J-101	J-102	46.13	204	110	0.17	0.01	0.00	0.00
P-128	J-102	J-97	40.79	204	110	-0.23	0.01	0.00	0.00
P-129	J-96	J-103	42.30	204	110	0.42	0.01	0.00	0.00
P-130	J-103	J-104	46.37	204	110	0.01	0.00	0.00	0.00
P-131	J-104	J-101	36.29	204	110	1.18	0.04	0.00	0.02
P-132	J-104	J-95	41.56	204	110	-1.58	0.05	0.00	0.03
P-134	J-107	J-74	39.00	297	120	-1.65	0.02	0.00	0.00
P-95	J-73	J-105	78.42	297	120	4.00	0.06	0.00	0.02

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-100	0.41	93.10	136	61
J-101	0.41	93.40	136	61
J-102	0.41	93.40	136	61
J-103	0.41	93.40	136	61
J-104	0.41	93.30	136	61
J-105	0.48	93.43	136	61
J-107	0.74	93.46	136	61
J-74	0.63	93.46	136	61
J-82	0.91	93.08	136	61
J-87	3.26	93.10	136	61
J-88	0.77	93.30	136	61
J-89	1.09	93.20	136	61
J-90	1.09	93.10	136	61
J-91	1.09	93.00	136	61
J-92	1.09	93.20	136	61
J-93	0.41	93.40	136	61
J-94	0.41	93.30	136	61
J-95	0.41	93.20	136	61
J-96	0.41	93.40	136	61
J-97	0.41	93.50	136	61
J-98	0.41	93.30	136	61
J-99	0.41	93.20	136	61

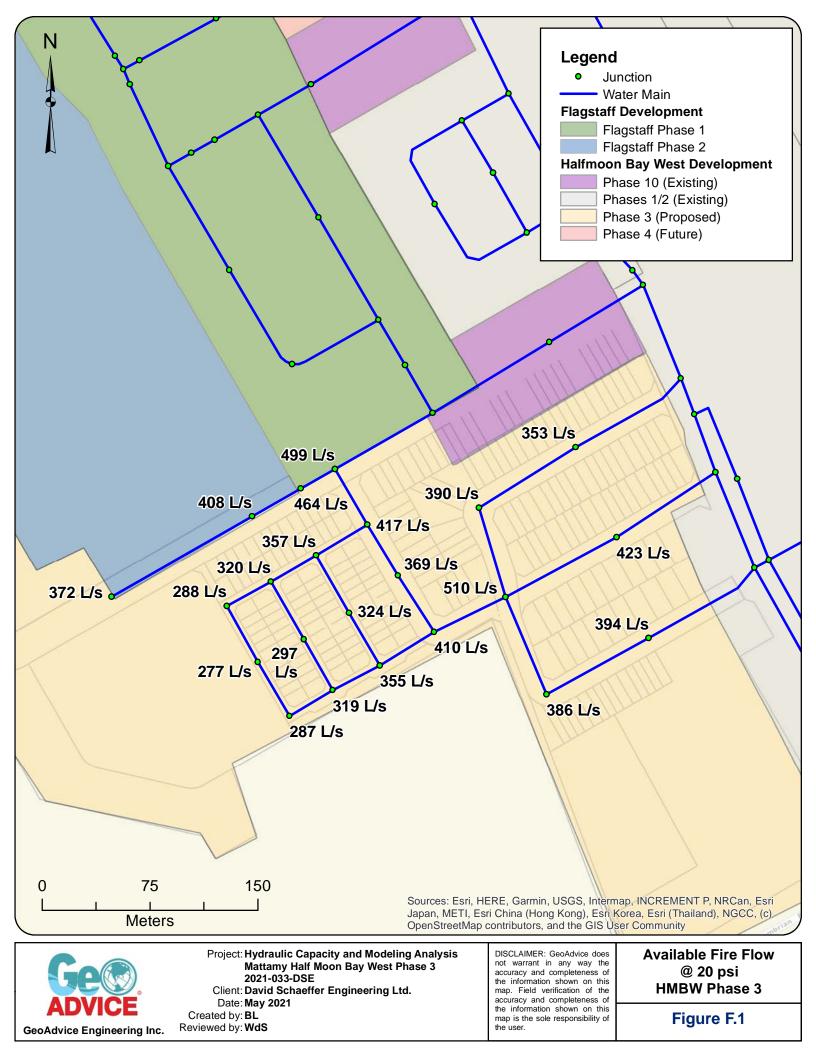


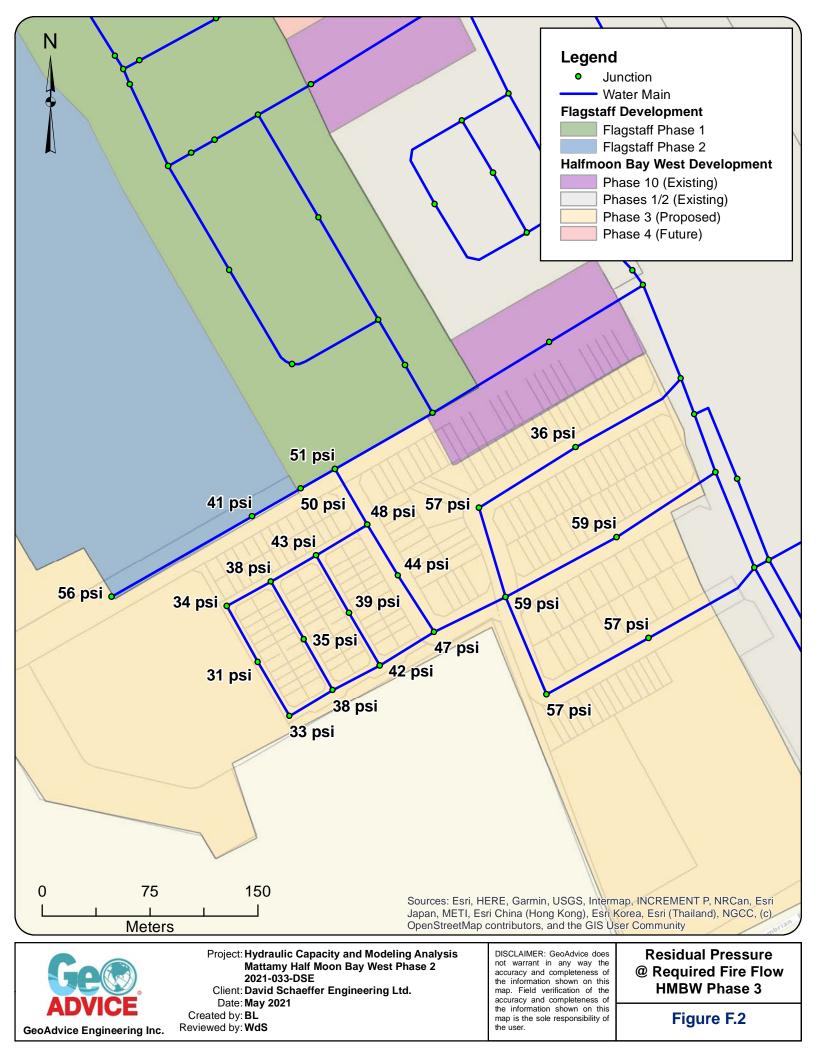
Appendix F MDD+FF Model Results

Project ID: 2021-023-DSE









Fire Flow Modeling Results - Half Moon Bay West Phase 3

ID	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
J-82	0.46	67	141	167	56	372	20
J-87	1.74	67	141	167	57	394	20
J-88	0.35	67	141	167	57	386	20
J-90	0.50	67	141	167	59	423	20
J-92	0.50	67	141	167	57	390	20
J-89	0.50	66	140	183	59	510	20
J-100	0.19	63	137	233	34	288	20
J-101	0.19	62	137	233	38	320	20
J-102	0.19	62	137	233	35	297	20
J-103	0.19	62	137	233	39	324	20
J-104	0.19	62	137	233	43	357	20
J-105	0.22	62	137	233	51	499	20
J-74	0.29	62	137	233	50	464	20
J-93	0.19	62	137	233	47	410	20
J-94	0.19	62	137	233	44	369	20
J-95	0.19	62	137	233	48	417	20
J-96	0.19	62	137	233	42	355	20
J-97	0.19	62	137	233	38	319	20
J-98	0.19	62	137	233	33	287	20
J-99	0.19	62	137	233	31	277	20
J-107	0.34	59	135	267	41	408	20
J-91	0.50	60	135	267	36	353	20

APPENDIX C

HMB WEST PHASE 3 SANITARY DRAINAGE AREA PLANS (DSEL, NOVEMBER 18, 2021)

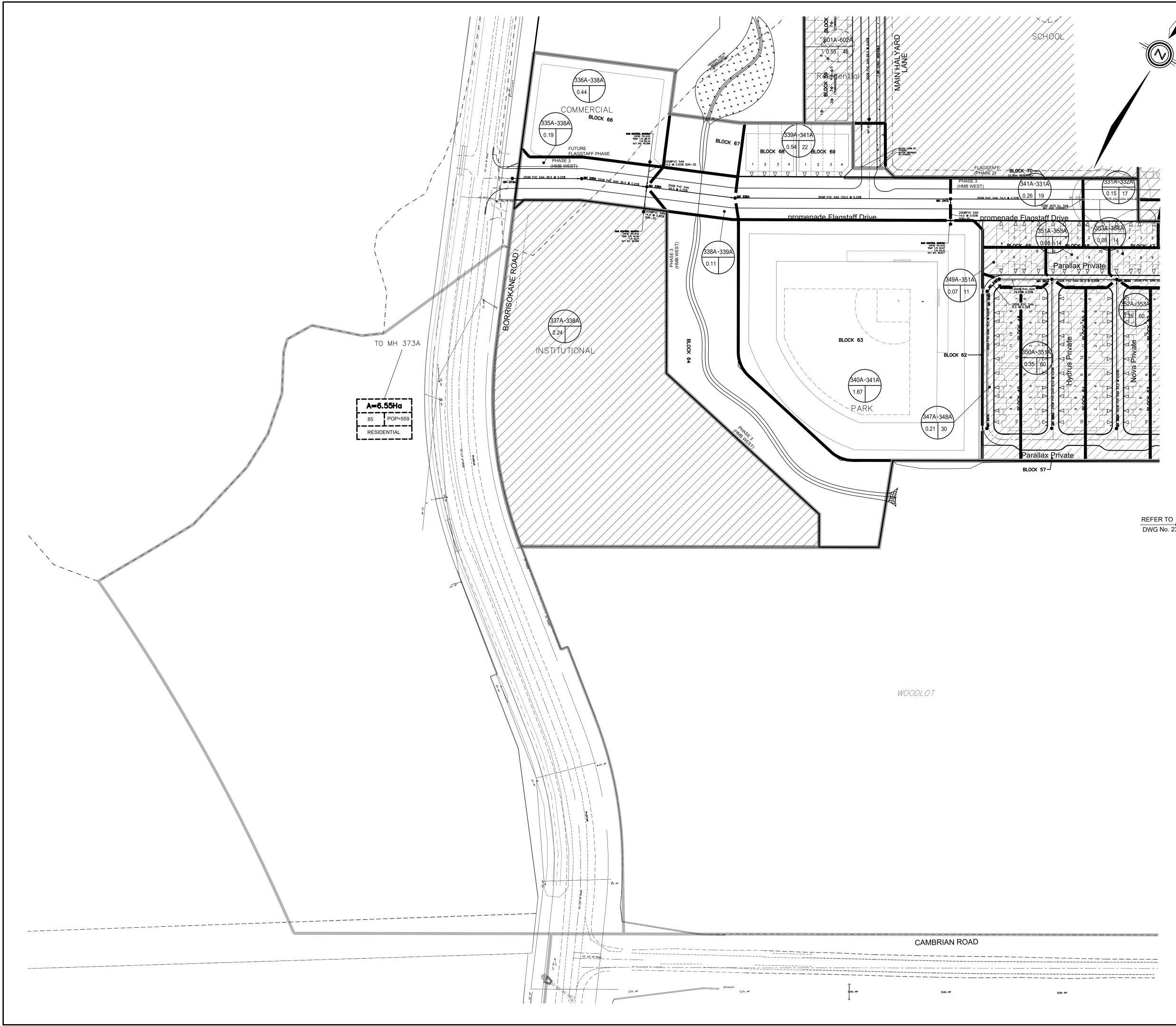
HMB WEST PHASE 3 SANITARY DESIGN SHEETS (DSEL, NOVEMBER 18, 2021)

GLENVIEW FLAGSTAFF PHASE 1 SANITARY DRAINAGE AREA PLAN (DSEL, MARCH 27, 2020)

GLENVIEW FLAGSTAFF PHASE 1 SANITARY DESIGN SHEETS (DSEL, MARCH 27, 2020)

HMB WEST PHASE 1 SANITARY DRAINAGE AREA PLAN (DSEL, OCTOBER 29, 2018)

HMB WEST PHASE 1 SANITARY DESIGN SHEETS (DSEL, OCTOBER 29, 2018)



PHASE LAGSTAFF FLAGSTAFF chemin (FLAGSTAFF PHASE 28 PHASE COMM ELEMENTA SCHOOL HMB WEST PHASE 1 ISTITUTIONA HMB WEST PHAS voie Merak APT. WIRIWAM PRIVATE SITE FOXHOUNDWAY WOODLO HMB WEST -PHASE 3 cours Bellatrix Walk WOODLOT COMM. SECONDARY SCHOOL BLUE ASTER NUTGROVE AVE. PARK KEY PLAN SCALE 1:10000 LEGEND 1001A-602A UPSTREAM MH TO DOWNSTREAM MH -----AREA IN HECTARES 2.40 0 POPULATION ----SCHOOL /507A-508À UPSTREAM MH TO DOWNSTREAM MH PREVIOUS PHASE AREA IN HECTARES ─- _0.18 | 14) POPULATION ----MAINTENANCE HOLE È 🔶 MH202A САР r------ A=53.63 EXTERNAL AREA IN HECTARES -----EXTERNAL POPULATION -_107 POP=5739 DENSITY (PERSONS/HECTARE) -----EXTERNAL LAND USE ------L_____ SANITARY DRAINAGE BOUNDARY SANITARY DRAINAGE SUB-BOUNDARY SANITARY DRAINAGE BOUNDARY (OTHER PHASES) OTHER PHASES NOT PART OF THIS APPLICATION AREA INCLUDED IN SEPERATE DRAWING SET 3 S.L.M. 21.11.18 3rd SUBMISSION

2 S.L.M. 21.08.31 2nd SUBMISSION 1 S.L.M. 21.06.04 1st SUBMISSION No. BY DATE DESCRIPTION TOPOGRAPHIC INFORMATION TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-100-00, DATED FEBRUARY 22, 2017 TOPOGRAPHIC INFORMATION FOR BORRISOKANE ROAD PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 18-10-145-00, RECEIVED ON JULY 10, 2019 LEGAL INFORMATION CALCULATED M-PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-100-00, DATED NOVEMBER 10, 2021 **BENCH MARK.** ELEVATIONS ARE GEODETIC AND ARE REFERRED TO THE PUBLISHED BENCHMARK NUMBER 0011964U3710 HAVING AN ELEVATION OF 71.724 M. MATTAMY (HALF HALF MOON BAY WEST PHASE 3 MOON BAY) LTD. S. L. MERRICK 100186523 120 Iber Road Unit 103 Stittsville, Ontario, K2S 1E9 Tel. (613) 836-0856 Fax. (613) 836-7183 www.DSEL.ca **)ttawa** city of ottawa SANITARY DRAINAGE PLAN © DSEL DRAWN BY: G.G.G. CHECKED BY: S.L.M. PROJECT No. CHECKED BY: S.L.M. DESIGNED BY: G.G.G. 19-1140 111 SCALE: LL SHEET No.

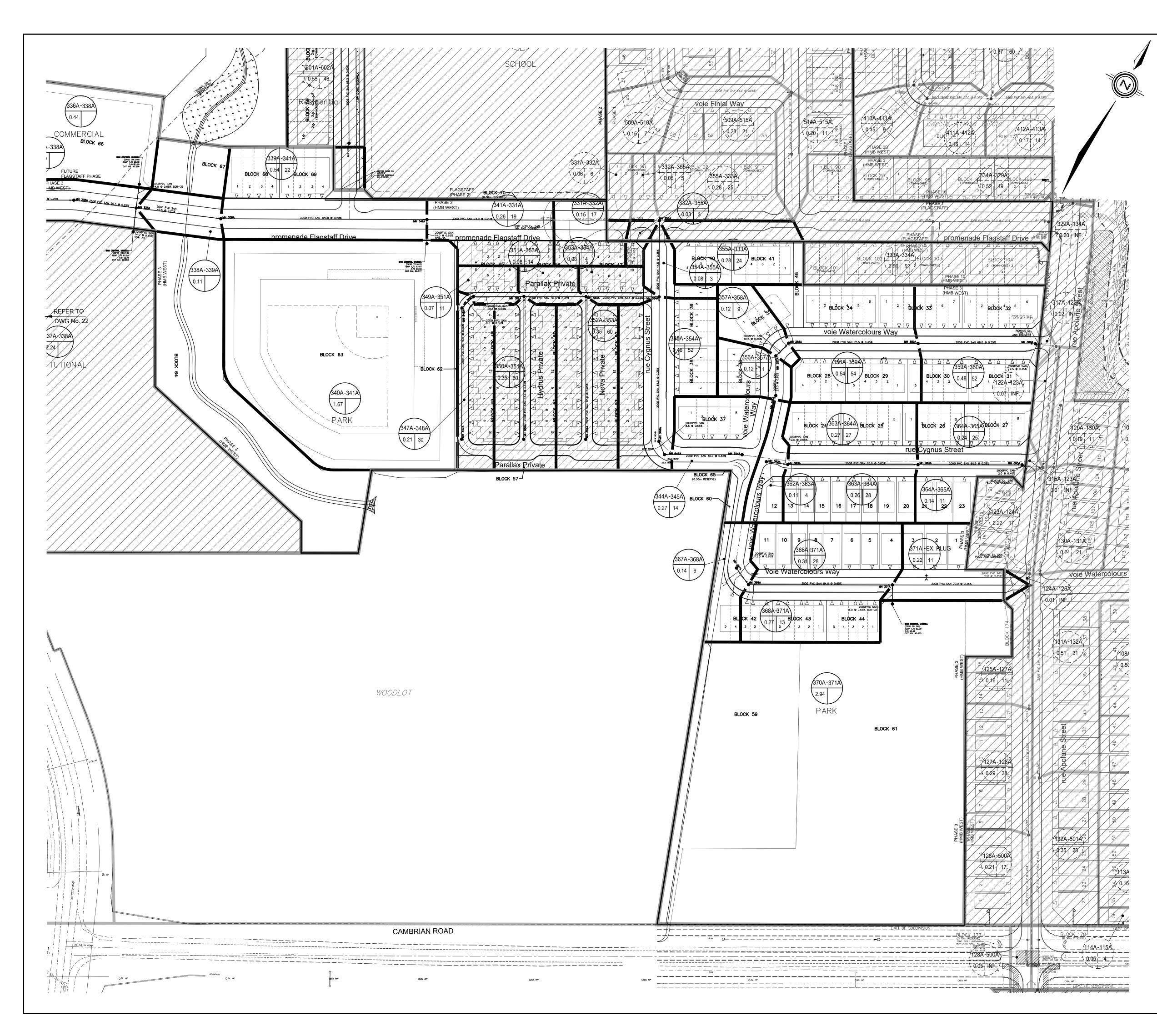
 \succ

()

22

1:1000

REFER TO DWG No. 23

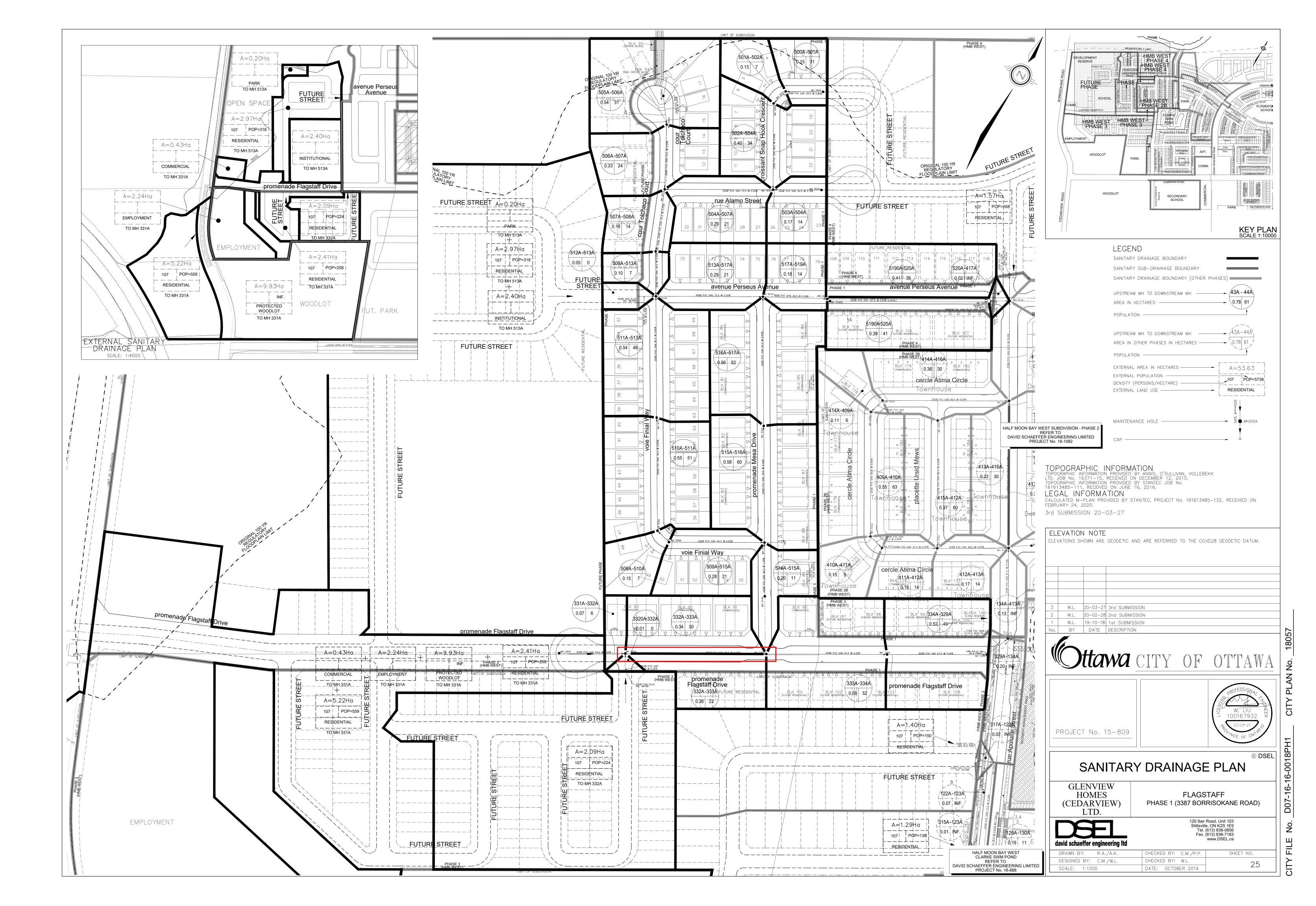


	. <i>)</i>
PHASE 3 PRIVATE SITE W000L0T HMB WEST	APT. MITCHIONE APT.
	SCALE 1:10000
LEGEND UPSTREAM MH TO DOWNSTREAM MH AREA IN HECTARES 2.40 0 POPULATION TRIBUTARY TYPE SCHOOL UPSTREAM MH TO DOWNSTREAM MH PREVIOUS PHASE AREA IN HECTARES 0.18 14 POPULATION MAINTENANCE HOLE CAP EXTERNAL AREA IN HECTARES EXTERNAL OPULATION DENSITY (PERSONS/HECTARE) EXTERNAL LAND USE SANITARY DRAINAGE BOUNDARY SANITARY DRAINAGE SUB-BOUNDARY SANITARY DRAINAGE SUB-BOUNDARY	
3 S.L.M. 21.11.18 3rd SUBMISSION 2 S.L.M. 21.08.31 2nd SUBMISSION	
2 S.L.M. 21.06.01 210 CODIMISSION 1 S.L.M. 21.06.04 1st SUBMISSION No. BY DATE DESCRIPTION	
MOON BAY) LTD. PH. MOON BAY) LTD. PH. MOON BAY) LTD. PH. PH. PH. PH. PH. PH. PH. PH.	BARNES LIMITED, PROJECT 16-10-100-00, DATED ICHMARK NUMBER ON BAY WEST ASE 3
10BH19-1140	
Ottawa city of	F OTTAWA E PLAN
SANITARY DRAINAGE	
DRAWN BY:G.G.G.CHECKED BY:S.L.M.DESIGNED BY:G.G.G.CHECKED BY:S.L.M.	project no. 19-1140
SCALE: 1:1000	PROJECT No. 19-1140 SHEET No. 23

SANITARY SEWER (Manning's n=0.013	ALCULA	TION SHI	EET																								ttav	va	
LOCAT	ON				RESIDENTI	AL AREA AND	POPULATION					CO	MM	INS	TIT	PA	RK	C+I+I	I	NFILTRATIO	N					PIPE			-
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	UNITS Singles	UNITS Townhouse	POP.	CUMU AREA (ha)	POP.	PEAK FACT.	PEAK FLOW (I/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (I/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (/s)	TOTAL FLOW (I/s)	DIST	DIA (mm)	SLOPE (%)	CAP. (FULL) (I/s)	RATIO Q act/Q cap		VEL. (AC
			(nu)					(nu)			(//3)	(na)	(114)	(nu)	(na)	(nu)	(na)	(#3)	(nu)	(na)	(#3)	(#3)	(11)	(1111)	(70)	(83)		(11/3)	
ARK BLOCK 61	370A	371A						0.00					0.00		0.00	2.94	2.94	0.32	2.94	2.94	0.97	1.29	11.0	200	0.65	26.44	0.05	0.84	0.4
voie Watercolours Way, Pipe 3		0/ // (0.00	0				0.00		0.00	2.04	2.94	0.02	2.04	2.94	0.07	1.20	11.0	200	0.00	20.44	0.00	0.04	0.
ie Watercolours Way	367A	368A	0.14	2		2	6	0.14	6	3.75	0.07		0.00		0.00		0.00	0.00	0.14	0.14	0.05	0.12	12.0	200	0.65	26.44	0.00	0.84	0.
			0.27	13		13	36	0.41	42				0.00		0.00		0.00		0.27	0.41									
	368A	371A	0.31	8	8		28	0.72	70	3.63	0.82		0.00		0.00		0.00	0.00	0.31	0.72	0.24	1.06	84.0	200	0.65	26.44	0.04	0.84	0.
ontribution From PARK BLOCK 6	1, Pipe 370A - 3 371A	TA Ex. Plug	0.22	3	3		11	0.00	0 70	3.63	0.82		0.00		0.00		2.94 2.94	0.32	2.94 0.22	3.66 3.88	1.28	2.42	70.0	200	0.35	19.40	0.12	0.62	0.
	3/18	LA. Flug	0.22	5	5			0.94	70	3.05	0.02		0.00		0.00		2.54	0.52	0.22	5.00	1.20	2.42	70.0	200	0.55	19.40	0.12	0.02	0.
	356A	357A	0.12	4		4	11	0.12	11	3.73	0.13		0.00		0.00		0.00	0.00	0.12	0.12	0.04	0.17	23.0	200	0.65	26.44	0.01	0.84	0.
	357A	358A	0.12	3	<u> </u>	3	9	0.24	20	3.70	0.24		0.00		0.00		0.00	0.00	0.12	0.24	0.08	0.32	10.5	200	0.65	26.44	0.01	0.84	0.
	358A 359A	359A 360A	0.54	20 19	+	20 19	54 52	0.78	74 126	3.62 3.57	0.87 1.46		0.00		0.00		0.00 0.00	0.00	0.54 0.48	0.78	0.26	1.13 1.87	75.5 68.0	200 200	0.35	19.40 19.40	0.06	0.62	0.
	360A	Ex. Plug	0.40					1.26	120	3.57	1.46		0.00		0.00		0.00	0.00	0.00	1.20	0.42	1.87	2.5	200	0.35	19.40	0.10	0.62	0.
ygnus Street	362A	363A	0.11	1	1		4	0.11	4	3.76	0.05		0.00		0.00		0.00	0.00	0.11	0.11	0.04	0.08	12.5	200	0.65	26.44	0.00	0.84	0.
	302A	303A	0.26	8	8		28	0.37	32	5.70	0.00		0.00		0.00		0.00	0.00	0.26	0.37	0.04	0.00	12.0	200	0.00	20.44	0.00	0.04	- 0.
	363A	364A	0.27	10		10	27	0.64	59	3.64	0.70		0.00		0.00		0.00	0.00	0.27	0.64	0.21	0.91	76.0	200	0.65	26.44	0.03	0.84	0.
	364A	365A	0.14	3	3	9	11 25	0.78	70 95	3.60	4.44		0.00		0.00		0.00	0.00	0.14	0.78	0.34	1.44	60.5	200	0.05	19.40	0.07	0.00	
	364A 365A	Ex. Plug	0.24	9		9	25	1.02	95	3.60	1.11 1.11		0.00		0.00		0.00		0.24	1.02	0.34	1.44	2.0	200	0.35	20.74	0.07	0.62	0.3
		g																											
lova Private	0504	050.4	0.05					0.05		0.04	0.74		0.00				0.00		0.05	0.05	0.40				0.05	00.44	0.00	0.04	
o Parallax private, Pipe 353A - 35	352A	353A	0.35	22		22	60	0.35	60 60	3.64	0.71		0.00		0.00		0.00	0.00	0.35	0.35	0.12	0.82	83.0	200	0.65	26.44	0.03	0.84	0.3
								0.00	00				0.00		0.00		0.00			0.00									+
ydrus Private																													
o Parallax private, Pipe 351A - 35	350A	351A	0.35	22		22	60	0.35	60 60	3.64	0.71		0.00		0.00		0.00	0.00	0.35	0.35	0.12	0.82	83.0	200	0.65	26.44	0.03	0.84	0.3
o Faraliax private, Fipe 33TA - 33								0.55	00				0.00		0.00		0.00			0.55									+
arallax private																													
	347A 348A	348A 349A	0.21	11	-	11	30	0.21	30 30	3.68 3.68	0.36		0.00		0.00		0.00		0.21	0.21	0.07	0.43	76.5 9.5	200 200	0.65	26.44 19.40	0.02	0.84	0.3
	349A	349A 351A	0.07	4		4	11	0.21	30 41	3.67	0.36		0.00		0.00		0.00		0.00	0.21	0.07	0.43	9.5 29.5	200	0.35	19.40	0.02	0.62	
ontribution From Hydrus Private,		A						0.35	60				0.00		0.00		0.00		0.35	0.63									
ontribution From Nova Private. Pi	351A	353A	0.08	5		5	14	0.71	115 60	3.58	1.33		0.00		0.00		0.00	0.00	0.08	0.71	0.23	1.57	36.0	200	0.35	19.40	0.08	0.62	0.
ontribution From Nova Private, Pr	353A	354A	0.08	5		5	14	1.14	189	3.53	2.16		0.00		0.00			0.00	0.35	1.06	0.38	2.54	42.5	200	0.35	19.40	0.13	0.62	0.4
o Cygnus Street, Pipe 354A - 355		00 // (0.00	Ű		•		1.14	189	0.00	2.10		0.00		0.00		0.00	0.00	0.00	1.14	0.00	2.01	12.0	200	0.00	10.10	0.10	0.02	0.
ygnus Street	344A	345A	0.27	5		5	14	0.27	14	3.72	0.17		0.00		0.00		0.00	0.00	0.27	0.27	0.09	0.26	45.0	200	0.65	26.44	0.01	0.84	0.2
	345A	346A	0.21	5		<u> </u>	14	0.27	14	3.72	0.17		0.00		0.00		0.00		0.00	0.27	0.09	0.26	8.5	200	0.65	26.44	0.01	0.84	0.2
	346A	354A	0.46	19		19	52	0.73	66	3.63	0.78		0.00		0.00		0.00	0.00	0.46	0.73	0.24	1.02	84.0	200	0.35	19.40	0.05	0.62	0.3
				DESIGN	PARAMET	- De									Decier -					PROJECT									
ark Flow =	9300	L/ha/da	0.10764	DESIGN	I/s/Ha	LKO		المتحمر بامط	Deek 5- 1			anh			Designe	J.			GGG	FRUJECI			Matta	amy Half	Moon Ba	/ West Ph	ase 3		
verage Daily Flow = omm/Inst Flow =	280 28000	l/p/day L/ha/da	0.3241		l/s/Ha			Industrial I Extraneou		or = as pe	er MOE Gr 0.330				Checked					LOCATIO	N								
dustrial Flow =	35000	L/ha/da	0.3241		I/s/Ha			Minimum			0.600				CHECKED				SLM	LOUATIO	•.				City of	Ottawa			
lax Res. Peak Factor =	4.00					FESSIO	Ala	Manning's	n =	(Conc)	0.013		0.013												•				
Commercial/Inst./Park Peak Factor = nstitutional =	1.00 0.32	l/s/Ha			opo	AD	W/	Townhous Single hou			2.7 3.4				Dwg. Re			No. 22-23		File Ref:			19-1140	Date:	18 Nov 202		Shee	et No. o	of 2

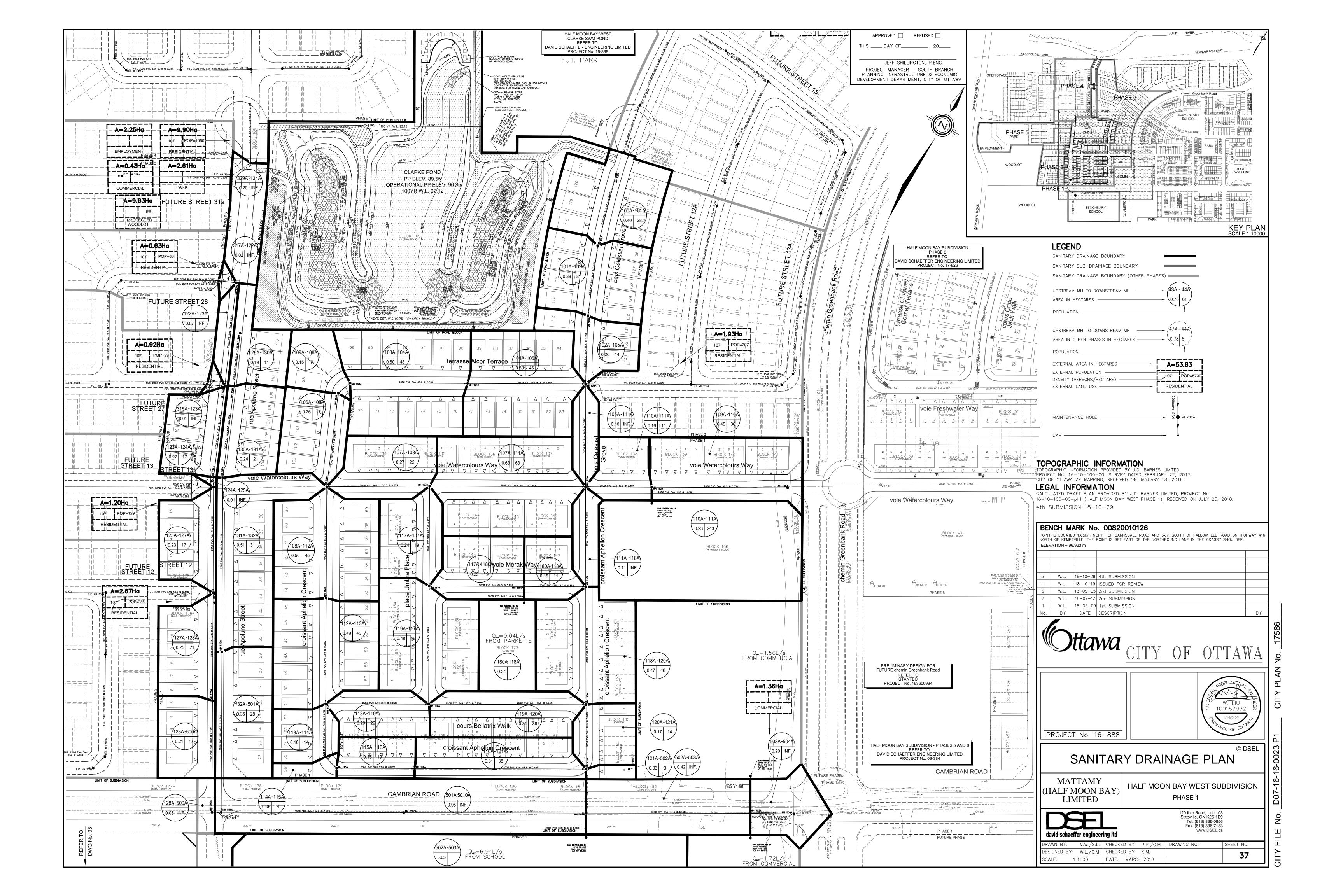


	RY SEWER CAI	CULAT	ION SHE	ET																							6	ttaw	а	
<u>v</u>	M.H. M.H. <th< th=""><th>CO</th><th>омм</th><th>INS</th><th>STIT</th><th>PA</th><th>RK</th><th>C+I+I</th><th></th><th>INFILTRATIO</th><th>N</th><th></th><th></th><th></th><th></th><th>PIPE</th><th></th><th></th><th></th></th<>												CO	омм	INS	STIT	PA	RK	C+I+I		INFILTRATIO	N					PIPE			
	STREET FROM M.H. TO M.H. AREA (ha) UNITS UNITS UNITS Strigen UNITS Towncoad POP. AREA (ha) AREA (ha) Intribution From Parallax private, Pipe 353A - 354A 0.8 1 1 3 1.154 Intribution From Parallax private, Pipe 355A - 5x. 333A 0.8 1 1 3 1.955 Promenade Flagstaff Drive, Pipe 341A - 331A 0.8 1 1 3 1.955 RK BLOCK 63 340A 341A 0.00 0.00 0.00 promenade Flagstaff Drive, Pipe 338A - 339A 0.00 0.00 0.00 0.00 promenade Flagstaff Drive, Pipe 338A - 339A 0.00 0.00 0.00 0.00 promenade Flagstaff Drive 336A 0.55 0.00 0.00 menade Flagstaff Drive 338A 0.55 0.559 6.551 Intribution From COMMERCIAL / INSTITUTIONAL BLOCK, Pipe 337A - 338A 0.00 0.00 0.00 Menade Flagstaff Drive 336A 336A 0.11 0 6.68 11100000 336A 336A												AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	TOTAL FLOW	DIST	DIA	SLOPE	CAP. (FULL)	RATIO Q act/Q cap	(FULL)	/EL. (ACT.)
				(ha)		onigioo	Tommodoo			101.	FACT.	FLOW (I/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)	(%)	(I/s)	a act a cap	(m/s)	(m/s)
Contribution Fr	rom Parallax private, Pipe	353A - 354A							1.14	189				0.00		0.00		0.00		1.14	1.87									
		354A	355A	0.08	1		1	3	1.95	258	3.48	2.91		0.00		0.00		0.00	0.00	0.08	1.95	0.64	3.56	44.5	200	0.35	19.40	0.18	0.62	0.47
To promenade	Flagstaff Drive, Pipe 355	A - Ex. 333A							1.95	258				0.00		0.00		0.00			1.95									
PARK BLOCK	(63																													
			341A											0.00		0.00	1.67	1.67	0.18	1.67	1.67	0.55	0.73	14.0	200	0.65	26.44	0.03	0.84	0.36
To promenade	Flagstaff Drive, Pipe 341	A - 331A							0.00	0				0.00		0.00		1.67			1.67									
COMMERCIAL	L / INSTITUTIONAL BLO	ск																												
			338A										0.44	0.44		0.00		0.00	0.14	0.44	0.44	0.15	0.29	14.0	200	0.65	26.44	0.01	0.84	0.27
To promenade	Flagstaff Drive, Pipe 338	A - 339A							0.00	0		-		0.44		0.00	-	0.00		-	0.44	-		-	-					
		337A	338A						0.00					0.00	2.24	2.24		0.00	0.73	2.24	2.24	0.74	1.47	14.0	200	0.65	26.44	0.06	0.84	0.44
To promenade	Flagstaff Drive, Pipe 338									0				0.00		2.24		0.00			2.24									
promonado El	lagetaff Drivo																													
promenaue Fla	agatan Dire	373A	335A	6.55	-			559	6.55	559	3.36	6.09		0.00		0.00	<u> </u>	0.00	0.00	6.55	6.55	2.16	8.25	38.5	250	0.25	29.73	0.28	0.61	0.52
												6.09		0.00		0.00		0.00	0.00	0.19	6.74	2.22	8.31	36.5	250	0.25	29.73	0.28	0.61	0.52
										0	_			0.44		0.00		0.00		0.44	7.18									
Contribution Fr	rom COMMERCIAL / INS				8A			0			3.36	6.09		0.00		2.24		0.00	0.87	2.24	9.42 9.53	3.14	10.10	49.5	300	0.20	43.25	0.23	0.61	0.50
					8		8			581	3.35	6.31		0.44		2.24		0.00	0.87	0.54	10.07	3.32	10.10	120.0	300	0.20	43.25	0.23	0.61	0.50
Contribution Fr	rom PARK BLOCK 63, Pi									0				0.00		0.00		1.67		1.67	11.74									
		341A	331A								3.35	6.51		0.44		2.24		1.67	1.05	0.26	12.00	3.96	11.51	74.0	300	0.20	43.25	0.27	0.61	0.52
		Ex 331A	Ex 332A								3 34	6.74		0.44		2.24		1.67 1.67	1.05	0.06	12.06 12.21	4.03	11.82	44.5	300	0.21	44.31	0.27	0.63	0.53
		2.001.71	2/1 002/1		-		-			626	0.01	0.1 1		0.44		2.24		1.67		0.03	12.24		11.02		000	0.21		0.2.1	0.00	
			355A	0.05	2		2	5	-		3.34	6.82		0.44		2.24		1.67	1.05	0.05	12.29	4.06	11.93	17.0	300	0.20	43.25	0.28	0.61	0.52
Contribution Fr	rom Cygnus Street, Pipe 3	354A - 355A		0.28	0		0	25						0.00		0.00		0.00		1.95 0.28	14.24 14.52			-	-					
		355A	Ex. 333A		÷		-				3.25	9.89		0.44		2.24		1.67	1.05	0.28	14.32	4.88	15.82	78.0	300	0.20	43.25	0.37	0.61	0.56
	Interest of the original sector o																			-				-	-			-		
	Intervention of the experimental term of the experimente term of the experimental term of the experimental term																													
	LOGATION REGULT REGULT <thregult< th=""> <thregult< th=""> <thregult< <="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></thregult<></thregult<></thregult<>																													
	1 3 1 1 3																													
	373A 335A 6.55 559 6.55 569 Intribution From COMMERCIAL / INSTITUTIONAL BLOCK, Pipe 337A - 338A 0.00 0 6.74 559 Intribution From COMMERCIAL / INSTITUTIONAL BLOCK, Pipe 337A - 338A 0.00 0 0 0 Intribution From COMMERCIAL / INSTITUTIONAL BLOCK, Pipe 337A - 338A 0.00 0																													
	Ex. 331A Ex. 332A 0.15 6 6 17 7.86 62 Image: Constraint of the state																													
	355A Ex.333A 0.28 9 9 24 10.45 938																													
	355A Ex. 333A 0.28 9 9 24 10.45 938																			-										
		A																												
						1	ACF C	FON																						
							Company of the	11/10	+			<u> </u>								+		<u> </u>		1	+			<u> </u>		-
								1-1140		1								1												
Park Flow -										Designe	d:				PROJEC [®]	Т:		Matt		Moor Po	Woot D									
	low =	Industrial	Peak Fac	for = as n	er MOF G	ranh							GGG				watta	anny maif		y West Ph	1036 3									
Comm/Inst Flow				.o. – uo p		L/s/ha			Checked	1:				LOCATIC	N:															
Industrial Flow =				0.600	m/s (Pvc)	0.013						SLM						City of	Ottawa											
		Ex. 331A Ex. 332A 0.06 2 2 6 7.71 6 Ex. 331A Ex. 332A 0.15 6 6 17 7.86 6 Ex. 332A 355A 0.05 2 2 5 7.94 6 ICygnus Street, Pipe 354A - 355A 0.05 2 2 5 7.94 6 355A 0.28 9 9 25 10.17 9 355A Ex. 333A 0.28 9 9 24 10.45 9 355A Ex. 333A 0.28 9 9 24 10.45 9 355A Ex. 333A 0.28 9 9 24 10.45 9 100186523														Dwg. Re	ference:				File Ref:				Date:			Shee	t No.	2
	L/FAIN PEAK FACIOI -	gstaff Drive, Pipe 338A - 339A 0.00 0 taff Drive 373A 335A 6.55 559 6.55 559 335A 338A 0.19 0 6.74 559 6.55 559 COMMERCIAL / INSTITUTIONAL BLOCK, Pipe 336A - 338A 0.00 0 0 0 0 0 COMMERCIAL / INSTITUTIONAL BLOCK, Pipe 336A - 338A 0.00 0 0 6.74 559 SasaA 339A 341A 0.54 8 8 22 7.39 581 PARK BLOCK 63, Pipe 340A - 341A 0.26 7 7 19 7.86 623 Ex. 331A Ex. 332A 0.15 6 6 17 7.86 623 Ex. 331A Ex. 332A 0.05 2 2 5 7.94 631 Cygnus Street, Pipe 354A - 355A 0.028 9 9 24 10.45 938 S5A Ex. 333A 0.28 9 9 24 10.45 938 Cygnus Street, Pipe 355A Ex. 333A 0.28 9 9 24																lan. Dwas	. No. 22-23	3	File Ref:			19-1140	Date.	18 Nov 202	1	Snee	. 110.	f 2



SANITARY SEWER CALC	CULAT	TION SHI	EET																			6	How		
Manning's n=0.013			RE	SIDENTIAL	AREA AND	POPULATIO	DN	co	MM	INS	тіт Г	PA	RK I	C+I+I	I 1	INFILTRATIO	N		1			PIPE	(III)	YИ	
STREET	FROM	то	AREA	UNITS	POP.	CUMU		AREA	ACCU.	AREA	ACCU.	AREA	ACCU.	PEAK	TOTAL	ACCU.	INFILT.	TOTAL	DIST	DIA	SLOPE	CAP.	RATIO	VE	L.
	M.H.	M.H.	(ha)			AREA (ha)	POP.	(ha)	AREA (ha)	(ha)	AREA (ha)	(ha)	AREA (ha)	FLOW (I/s)	AREA (ha)	AREA (ha)	FLOW (I/s)	FLOW (I/s)	(m)	(mm)	(%)	(FULL) (I/s)	Q act/Q cap	(FULL) (m/s)	(ACT.) (m/s)
FUTURE ROAD																									
			0.01		0	0.01	0		0.00		0.00		0.00		0.01	0.01									
To promenade Flagstaff Drive, Pipe 332A -	Plug 3334	332A	2.09		224	2.10 2.10	224 224		0.00		0.00		0.00	0.00	2.09	2.10	0.69	3.24	12.0	250	0.25	29.73	0.11	0.61	0.39
	000A					2.10	227		0.00		0.00		0.00			2.10									
promenade Flagstaff Drive						0.00	0	0.42	0.42		0.00		0.00		0.42	0.42									
						0.00	0	2.24	2.24		0.00		0.00		2.24	2.67									
	Image: Fight of the state of the s																								
	image: state image: state<																								
	stat 0.07 2 6 0.07 6 0.00 0.00 0.07 17.89 - - - From FUTURE STREET. Pipe 330A - 333A 0.26 1 226 7.65 823 267 0.00 0.00 0.07 21.0 22.00 10.02 24.0 0.00 0.00 0.07 21.0 22.00 10.02 24.0 0.00 0.00 0.00 0.07 22.00 10.02 24.0 0.00														300	0.20	43.25	0.38	0.61	0.57					
Contribution From FUTURE STREET, Pipe	Image: Second state																								
	Image: state of the s																	0.46	0.61	<mark>0.60</mark>					
																							0.48	0.61	0.60
	JJ4A	JZYA	0.52	10	49	21.43	1200		2.07		0.00		0.00	0.07	0.52	24.10	1.90	21.20	07.0	300	0.20	43.23	0.49	0.01	0.01
promenade Mesa Drive	Image: state Image: state<															4.05	00.44			0.01					
	agstaff Drive														200	1.35	38.11	0.01	1.21	0.31					
	Image: constraint of the state of																	0.07	0.62	0.36					
		517A	0.56	19	52									0.00	0.56		0.53	2.19	87.0	200	0.65	26.44	0.08	0.84	0.50
	137					1.02	177		0.00		0.00		0.00			1.02									
voie Finial Way	5004	E1EA	0.29	6	01	0.00	01		0.00		0.00		0.00	0.00	0.09	0.29	0.00	0.24	64 E	200	0.65	26.44	0.01	0.94	0.20
To promenade Mesa Drive, Pipe 515A - 510		515A	0.20	0	21									0.00	0.20		0.09	0.34	04.5	200	0.05	20.44	0.01	0.84	0.29
	5004	510.4	0.45	<u>^</u>	-	0.45	_		0.00		0.00				0.45	0.45	0.05	0.40	44.0		0.70	07.44		0.07	0.00
																								0.87	0.22 0.39
	511A					1.24	106		0.00		0.00		0.00			1.24							0.06	0.84	0.46
Toavenue Perseus Avenue, Pipe 513A - 51	Image: constraint of the second state of the seco																								
croissant Snap Hook Crescent	1 514A 515A 0.20 4 11 0.20 11 0.00 0.00 0.00 0.20 0.20 0.20 0.20 36.0 com voie Finial Way, Pipe 509A - 515A 516A 0.56 19 22 0.00 0.00 0.00 0.00 0.28 0.48 78.5 516A 517A 0.56 19 52 1.62 144 0.00 0.00 0.00 0.00 0.56 1.62 0.53 2.19 87.0 seus Avenue, Pipe 517A - 519A 1.62 144 0.00 0.00 0.00 0.00 1.62 - <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>																								
	Oromenade Mesa Drive, Pipe 515A - 516A 0.28 0.28 21 0.00 0.00 0.00 0.28 0.28 0.28 0.00 0.00 0.00 0.00 0.28 0.28 0.28 0.28 0.28 0.28 0.28 0.00 0.013 0.13																			0.93	0.26				
											FESSI												0.01	0.70	0.34
To rue Alamo Street, Pipe 504A - 507A						0.68	52			PRO	FESSI	KA/				0.68									
rue Alamo Street									15	S	h	Ń	51	-	-										
			0.17	4	14				1 51	\mathbb{C}	4		6				0.06	0.22	32.5	200	2.10	47.53	0.00	1.51	0.36
			0.29	6	21				E E		N	U	A				0.38	1.39	73.0	200	0.45	22.00	0.06	0.70	0.39
To cour Tolchaco Court, Pipe 507A - 508A									Ĭ	100	167	932													
cour Tolchaco Court									1-		107	JJZ	-0												
				9							20-03-	21 /	.0										0.02	0.84	0.33
Contribution From rue Alone Street Dire 5			0.33	7	24				17	OL N		A	$\mathbf{}$				0.29	0.94	43.5	250	0.25	29.73	0.03	0.61	0.27
			0.18	4	14					NO	E OF	ONJU					0.72	2.52	42.5	250	0.25	29.73	0.08	0.61	0.37
										~	- 01	/													-
		DESIGN F	PARAMETE	RS							Designed	:			L	PROJECT	[] [:				I	1		I	
		L/ha/da											A.K.						FLAG	STAFF S	SUBDIVIS	ION - PH	ASE 1		
Average Daily Flow = Comm/Inst Flow =			0 3241	l/s/Ha					r MOE Gra		Checked						N								
Industrial Flow =	35000	L/ha/da	0.40509			Minimum \	/elocity =	m/s			enconou.		W.L.			200410	•••				City of	Ottawa			
Max Res. Peak Factor = Commercial/Inst./Park Peak Factor =	4.00 1.00					Manning's Townhous		(Pvc)	0.013		Dwg. Ref	oronco				File Ref:				Date:			1	Sheet No.	1
Institutional =		l/s/Ha				Single hou							an, Dwgs. I	No. 25		rie Kei:		16-809		Date:	Mar 2020			Sheet NO. of	1
						.3.2 .100							, =											01	

	RY SEWER CA	ALCULA	TION SH	EET																			6	Haw	a	
Manning's n=0).013 LOCATION			RI	ESIDENTIA	L AREA ANI	D POPULATIO	ON	CO	мм	IN	STIT	PA	RK	C+I+I	1	NFILTRATIO	N		1			PIPE		<i>M</i>	
	STREET	FROM	то	AREA	UNITS	POP.		ILATIVE	AREA	ACCU.	AREA	ACCU.	AREA	ACCU.	PEAK	TOTAL	ACCU.	INFILT.	TOTAL	DIST	DIA	SLOPE	CAP.	RATIO	V	
		M.H.	M.H.	(ha)			AREA (ha)	POP.	(ha)	AREA (ha)	(ha)	AREA (ha)	(ha)	AREA (ha)	FLOW (I/s)	AREA (ha)	AREA (ha)	FLOW (I/s)	FLOW (I/s)	(m)	(mm)	(%)	(FULL) (I/s)	Q act/Q cap	(FULL) (m/s)	(ACT.) (m/s)
		508A	513A	0.10	2	7	2.29	163		0.00		0.00		0.00	0.00	0.10	2.29	0.76	2.63	30.0	250	0.25	29.73	0.09	0.61	0.37
To avenue Pers	eus Avenue, Pipe 513A		515A	0.10	2	1	2.29	163		0.00		0.00		0.00	0.00	0.10	2.29	0.70	2.00	30.0	200	0.25	29.15	0.09	0.01	0.07
avenue Perseu	is Avenue			-													-									
				0.05		0	0.05	0		0.00	2.40	2.40	0.20	0.20		2.65	2.65									
		512A	513A	2.97		318	3.02	318		0.00		2.40		0.20	0.80	2.97	5.62	1.85	6.21	12.0	300	0.20	43.25	0.14	0.61	0.43
	om cour Tolchaco Court						2.29	163		0.00		0.00		0.00		2.29	7.91									
Contribution Fro	om voie Finial Way, Pip			0.00			1.24	106		0.00		0.00		0.00		1.24	9.15	0.40	40.50	70.0			40.05	0.04	0.04	0.50
Contribution Fro	m promonado Mooo Dr	513A	517A	0.29	6	21	6.84	608		0.00		2.40		0.20	0.80	0.29	9.44	3.12	10.50	72.0	300	0.20	43.25	0.24	0.61	0.50
	om promenade Mesa Dr	ive, ripe 516	A-51/A	0.19	6	17	1.62 8.65	144 769		0.00		0.00 2.40	-	0.00		1.62 0.19	11.06 11.25			1		+	+			-
		517A	519A	0.19	4	17	8.83	783		0.00		2.40		0.20	0.80	0.19	11.25	3.77	12.93	43.5	300	0.20	43.25	0.30	0.61	0.53
├ ───┼			010/1	0.41	11	38	0.41	38		0.00		0.00		0.00	0.00	0.41	0.41	5.77				0.20		0.00	0.01	0.00
		5190A	520A	0.39	15	41	0.80	79		0.00		0.00		0.00	0.00	0.39	0.80	0.26	1.19	107.0	200	0.65	26.44	0.04	0.84	0.42
		519A	520A				8.83	783		0.00		2.40		0.20	0.80	0.00	11.43	3.77	12.93	108.5	300	0.20	43.25	0.30	0.61	0.53
		5190A	520A	0.02		0	9.65	862	ļ	0.00		2.40		0.20	0.80	0.02	12.25	4.04	13.98	68.0	300	0.20	43.25	0.32	0.61	0.55
																					LICENSED	W. 10016	SS/ON/4/2 LIU 57932 0F ON ^T	ENGINEER		
┣────┤		1	+			+	<u> </u>									<u> </u>	<u> </u>					-	-		+	
t t			1				<u> </u>									<u> </u>						1	1		1	
				PARAMETE								Designe	d:				PROJECT	Г:								
Park Flow = Average Daily Flo Comm/Inst Flow = Industrial Flow = Max Res. Peak F Commercial/Inst	=	9300 280 28000 35000 4.00 1.00	L/ha/da l/p/day L/ha/da L/ha/da	0.10764 0.3241 0.40509	l/s/Ha		Extraneou		L/s/ha	r MOE Gr 0.013		Checked Dwg. Re		A.K. W.L.			LOCATIO	N:			Date:		SION - PH	ASE 1	Sheet No.	2
Institutional =	Faik Peak Factor =	0.32	l/s/Ha					se coeff= use coeff=					rerence:)rainage Pl	an, Dwgs.	No. 25		File Ref:		16-809		Date:	Mar 2020			Sheet No. of	



- -

.

Ottawa	

Manning's n=0.0	13																											uuv		
	LOCATION						AL AREA AND	POPULATION					со		INSTIT		ARK	I+C+I+P		NFILTRATIO							PIPE			
	STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	UNITS Singles	UNITS Towahouse	POP.	AREA (ha)	POP.	FACT.	PEAK FLOW (I/s)	AREA (ha)	ACCU AREA (ha)	AREA ACCI ARE (ha) (ha	\	ACCU. AREA (ha)	PEAK FLOW (I/S)	TOTAL ' AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (I/S)	TOTAL FLOW (I/s)	DIST (m)	DIA (Nominal) (MM)	DIA (Actual) (mm)	SLOPE	CAP. (FULL) (i/s)	RATIO Q act/Q cap	(FULL) (m/s)	(AC
									(1	((=/		(- (1				<u> </u>								\square
ce Umbra P	lace																													
		117A	107A	0.24	7		7.00	19	0.24	19	4.00	0.31							0.24	0.24	0.07	0.38	68.0	200	200	0.65	26.44	0.01	0.84	0.
voie Waterc	olours Way, Pipe 107A -	111A							0.24	19							1			0.24										+
				0.10			17.00			10	1.00						_		0.40	0.40	0.40	0.00	00.5	000		0.05		0.02	0.04	<u> </u>
	Mary Dire 1174 11004	119A	117A	0.48	17	· · · · · ·	17.00	46	0.48	46 46	4.00	0.75							0.48	0.48	0.13	0.88	80.5	200	200	0.65	26.44	0.03	0.84	1 0.
	Way, Pipe 117A - 1180A								0.48	40										U.40										+
ie Merak Wa	NV								<u> </u>																					+
	om place Umbra Place, F	- Pipe 119A - 11	7A						0.48	46						-		1	0.48	0.48										<u> </u>
1		117A	1180A	0.25	7		7.00	19	0.73	65	4.00	1.05							0.25	0.73	0.20	1.25	64.5	200	200	0.85	30.24	0.04	0.96	0.
		CTRL 5A	1180A								1					0.24	0.24	0.04	0.24	0.24	0.07	0.11	11.0	200	200	1.00	32.80	0.00	1.04	0.
		1180A	118A	0.15	4		4.00	11	0.88	76	4.00	1.23					0.24	0.04	0,15	1.12	0.31	1.58	42.0	200	200	0.35	19.40	0.08	0.62	0.:
o croissant Ap	helion Crescent, Pipe 11	8A - 120A							0.88	76							0.24			1.12					ļ					
																	_													
voie Watercolo	ours Way	4071	10-1								1.00	0.00	L				_		0.07	0.07		0.47	70.0	000		0.05	00.44	0.00	0.04	0.3
	halion Cronnat, Di 44	107A	108A	0.27	8		8.00	22	0.27	22	4.00	0.36						+	0.27	0.27	0.08	0.44	70.0	200	200	0.65	26.44	0.02	0.84	+ 0.2
TO CROISSANT AP	helion Crescent, Pipe 10	/0A - 112A		-					0.27	22							_			0.27										+
		109A	110A	0.45	13		13.00	36	0.45	36	4.00	0.58					-		0.45	0.45	0.13	0.71	92.5	200	200	0.65	26.44	0.03	0.84	0.3
Apartment Bloc	.k	103/1	-	0.93	90		90.00	243	0.93	243	4.00	3.94						+	0.93	0.93	0.16	4.20	11.0	200	200	1.00	32.80	0.13	1.04	0.7
		110A	111A	0.16	4		4.00	11	1.54	281	4.00								0.16	1.54	0.43	4.98	45.0	200	200	0.40	20.74	0.24	0.66	0.5
To croissant Ap	helion Crescent, Pipe 11								1.54	281										1.54										1
ĺ										İ]
Contribution Fre	om place Umbra Place, F	Pipe 117A - 10	7A						0.24	19									0.24	0.24										
		107A	111A	0.63	23		23.00	63	0.87	82	4.00	1.33							0.63	0.87	0.24	1.57	106.0	200	200	0,65	26.44	0.06	0.84	0.4
To croissant Ap	phelion Crescent, Pipe 11	11A - 118A							0.87	82							_			0.87				ļ	ļ					
	_				Ì				ļ		L					_								1					ļ	
terrasse Alcor	Terrace	100.0	4544	0.00		1100		40	0.00	40	4.00	0.70	<u> </u>			_		Į	0.60	0.80	0.17	0,95	80.0	200	200	0.65	26.44	0.04	0,84	0.40
		103A 104A	104A 105A	0.60	<u>14</u> 13	14.00 13.00	··· ·	48 45	0.60	48 93	4.00	0.78					_		0.60	0.60	0.17	1.83	80.0	200	200	0.65	20.44	0.04	0.66	
To bois Celesti:	al Grove, Pipe 105A - 11			0.00	10	13.00		45	1.13	93	4.00	1.51							0.00	1.13	0.02	1.00	00.0	200	200	0,40	20.14	0.00	0.00	1 0.4
TO BOIS ORIESU						1			1.10	<u> </u>										1.10			1				1			
		103A	106A	0.15	2	2.00		7	0.15	7	4.00	0.11	1				-		0.15	0.15	0.04	0.15	10.5	200	200	0.65	26.44	0.01	0.84	0.2
		106A	108A	0.26	5	5.00		17	0.41	24	4.00								0.26	0.41	0.11	0.50	64.0	200	200	0.65	26.44	0.02	0.84	0.3
To croissant Ap	phelion Crescent, Pipe 10	08A - 112A							0.41	24										0.41				1						
															`															
Contribution Fre	om Phase 3, Pipe PLUG	- 105A							1.93	207						_			1.93	1.93										
		PLUG	105A	1	1				1.93	207	4.00	3.35		THE REAL PROPERTY		-		┥───	0.00	1.93	0.54	3.89	9.0	200	200	0.35	19.40	0.20	0.62	0.4
To bois Celesti	al Grove, Pipe 105A - 11	<u>1A</u>							1.93	207	l			APP C	OLESY	<u> 11 / 200 - 200</u>				1.93										
	. 181-11-		ļ			<u> </u>									C. S. C.						·····							-		
cours Bellatrix	wwaik om croissant Aphelion Ci	l roncont Dino (1120 1120						1.67	136				1: 1: 0 M		<u>K</u>	6 N		1.67	1.67	[+
	oni croissant Aprielion Ci	113A	119A	0.20	8		8.00	22	1.87	158	4.00	2.56			delarazzo estate		13		0.20	1.87	0.52	3.08	70.D	250	250	0.25	29.73	0.10	0.61	0.3
		119A	120A	0.31	13		13.00	36	2.18	194	4.00				W 11	3	RI		0.31	2.18	0.61	3.75	107.0		250	0.25	29.73	0.13	0.61	0.4
To croissant Ap	phelion Crescent, Pipe 12								2.18	194			1 **	<u> </u>	10010 20	00	20)			2.18									1	
											1		N N		100107	0.	Ĭ						Ï							
													STATE		1. L D									· · · ·						
	•				1								395		ICT PI	PS							ļ							
											ļ		¥	3		Carlos Ci	<u> </u>			↓	ļ		1							
		ļ	ļ	1		<u> </u>	L	ļ							WCE OF	William .	¢				1	ļ	 					i	-i	+
		1								<u> </u>				-	C. C.															+
														[ALC: NO.														-	
		1	1	1	DESIGN	PARAME	TERS	ļ	l	1	1	1	1	1	Desi	ned:			1	PROJEC	T:	L		1	1	1	1	<u>. </u>	1	
Park Flow =		9300	L/ha/day		DEGIGIN	, anatant⊾	, 2110									,	P.P.							Half I	Moon Ba	y West - I	Phase 1			
Average Daily F		350	L/p/day							Peak Fact	or≖as p																			
Comm/inst Flow		50000	L/ha/day						Extraneo				L/s/ha		Chei	ked:				LOCATIC	DN:				~					
Industrial Flow = Max Res. Peak		35000	L/ha/day						Minimum Manning	Velocity =		0.600		0.013			W.L.			1					C	ity of Otta	awa			
	Factor = t./Park Peak Factor =	4.00 1.50							Townhou	s II = se coeff=	(Conc)	0.013	(Pvc)	0.013	- Dura	Reference	.			File Ref:				1	Date:				Sheet N	0.
Commercial/IIIS	an ann i can raului -	1.00																				16-888								of 3

SANITARY SEWER CALCULATION SHEET

Ottawa

Manning's n=0.01	13																												uaw	U	
	LOCATION					RESIDENTI	AL AREA AND	POPULATION					cc	мм	IN	STIT	PA	RK	I+C+1+P		NFILTRATIO	N						PIPE			
	STREET	FROM	ŤΟ	AREA	UNITS	UNITS	UNITS	POP.	CUMU		PEAK	PEAK	AREA	ACCU.	AREA	ACCU.	AREA	ACCU.	PEAK	TOTAL	ACCU.	INFILT.	TOTAL	DIST	DIA	DIA	SLOPE	CAP.	RATIO		VEL.
		M.H.	M.H.	(ha)		Singles	Townhouse		AREA (ha)	POP.	FACT.	FLOW (I/S)	(ha)	AREA (ha)	(ha)	AREA (ha)	(ha)	AREA (ha)	FLOW (i/s)	AREA (ha)	AREA (ha)	FLOW (I/S)	FLOW (I/S)	(m)	(Nominal) (mm)	(Actual) (mm)	(%)	(FULL) (I/S)	Q act/Q cap	(FULL) (m/s)	
			·				.																								
bois Celestial (Grove	100A	101A	0,40	8	8.00		28	0.40	28	4 00	0.45								0.40	0.40	0.11	0,56	50.5	200	200	0.65	26.44	0.02	0.84	0.33
		101A	102A	0.38	9	9.00		31	0.78	59	4.00	0.96								0.38	0.78	0.22	1.18	48.0	200	200	0.35	19.40	0.06	0.62	0.34
		102A	105A	0.20	4	4.00		14	0.98	73	4.00	1.18								0.20	0.98	0.27	1.45	46.5	200	200	0.35	19.40	0.07	0.62	0.35
	m terrasse Alcor Terrac								1.13	93										1.13	2.11				Į		<u> </u>				
Contribution Fro	m terrasse Alcor Terrac	2005 Pipe PLUG 105A	<u>- 105A</u> 111A	0.10		· · ·			1.93 4.14	207 373	4.00	6.04						}		1.93 0.10	4.04 4.14	1.16	7.20	70.0	200	200	0.35	19.40	0.37	0.62	0.57
To croissant Apt	helion Crescent, Pipe 11			0.10					4.14	373	4.00	0.04								0.10	4.14	1.10	1.20	70.0	200	200	0.00	18.40	0.07	0.02	
																													1		
croissant Aphe	elion Crescent In terrasse Alcor Terrac	Dine 106A	109A						0.41	24										0.41	0.41										
	m voie Watercolours W								0.41	24						-				0.27	0.68				-				+	+	+
		108A	112A	0.50	13	13.00		45	1,18	91	4.00	1.47								0.50	1.18	0.33	1.80	75.5	200	200	0.35	19.40	0.09	0.62	0.38
		112A	113A	0.49	13	13.00		45	1.67	136	4.00	2.20								0.49	1.67	0.47	2.67	72.0	200	200	0.35	19.40	0.14	0.62	0.43
To cours Bellatri	ix Walk, Pipe 113A - 11	9A	<u> </u>	+ • • •	·				1.67	136					<u> </u>					ļ	1.67									+	
		113A	114A	0.16	4	4.00		14	0.16	14	4.00	0.23								0.16	0.16	0.04	0.27	36.0	200	200	0.65	26.44	0.01	0.84	0.2
		114A	115A	0.05	1	1.00		4	0.21	18	4.00	0.29								0.05	0.21	0.06	0.35	11.0	200	200	0.65	26.44	0.01	0.84	_
		115A	116A	0.15	7		7.00	19	0.36	37	4.00	0.60								0.15	0.36	0.10	0.70	53.0	200	200	0.65	26.44	0.03	0.84	
The One in the T		116A	121A	0.31	14	+	14,00	38	0.67	75	4.00	1.22	ļ		<u> </u>	ļ	<u> </u>	ļ		0.31	0.67	0.19	1.41	116.5	200	200	0.40	20.74	0.07	0.66	0.38
To Cambrian Ro	oad, Pipe 121A - 502A			+					0.67	75											0.67				·		+	1	+	+	+
	m bois Celestial Grove, m voie Watercolours W								4.14 0.87	373 82						ļ				4.14 0.87	4.14 5.01						+				
	m voie Watercolours W			~		· · ·		·	1.54	281										1.54										-	-
		111A	118A	0.11					6.66	736	3.88	11.57								0.11	6.66	1.86	13.43	68.0	300	300	0.20	43.25	0.31	0.61	0.54
Contribution Fro	m voie Merak Way, Pip								0.88	76				ļ	ļ			0.24		1.12	7.78								<u> </u>		
Contribution Fro	om cours Bellatrix Walk,	118A	120A	0.47	17		17.00	46	8.01 2.18	858 194	3.84	13.35		<u> </u>		-		0.24	0.04	0.47	8.25	2.31	15.70	80.0	300	300	0.20	43.25	0.36	0.61	0.56
Contribution FIG	III COUIS Deliaulix Walk,	120A	121A	0.17	5		5.00	14	10.36	1066	3.78	16.32					1	0.24	0.04	0.17	10.43	2.97	19.33	43.5	300	300	0.20	43.25	0.45	0.61	0.59
Contribution Fro	m croissant Aphelion C	rescent, Pipe							0.67	75										0.67	11.27			1			-				
		121A	502A	0.03	1		1.00	3	11.06	1144	3.76	17.42						0.24	0.04	0.03	11.30	3.16	20.62	30.0	300	300	0.20	43.25	0.48	0.61	0.60
To Cambrian Ro	oad, Pipe 502A -503A								11.06	1144								0.24			11.30									-	
rue Apolune Si	treet											-				1															
1		129A	130A	0.19	3	3.00		11	0.19	11	4.00	0.18		1	-				1	0.19	0.19	0.05	0.23	36.5	200	200	0.65	26.44	0.01	0.84	0.27
		130A	131A	0.24	6	6.00		21	0.43	32	4.00	0.52				ŁESS	ONA			0.24	0.43	0.12	0.64	63.0	200	200	0.35	19.40	0.03	0.62	
		131A	132A	0.51	9	9.00		31	0.94	63	4.00	1.02	· · ·		640		A			0.51	0.94	0.26	1.28	118.5	250	250	0.25	29.73	0.04	0.61	0.2
To Cambrian Re	oad, Pipe 501A - 5010A	132A	501A	0.35	8	8.00		28	1.29	91 91	4.00	1.47		18	Parent -			12		0.35	1.29	0.36	1.83	109.0	250	250	0.25	29.73	0.06	0.61	0.3
								1	1					1 Š	C	Dn	<u></u>	6251			/.=•										
Contribution Fro	om Phase 2 Future Stre	<u> </u>							0.63	68				18	2	1	(in 199	1 19	l.	0.63	0.63										
		PLUG	122A	0.02					0.65	68	4.00	1.10		<u> </u>		W.LI	<u>v</u>	<u>m</u>		0.02	0.65	0.18	1.28	10.0	200	200	0.35	19.40		0.62	_
	· · · ·	122A	123A	0.07					0.72	68	4.00	1.10	· · · ·		1(0167	932-		8	0.07	0.72	0.20	1.30	71.0	250	250	0.25	29.73	0.04	0.61	0.2
									<u> </u>						1A	# _ ^	7 411								1	+			+	+	
			1		1									13	JWC	127,	2/11/														_
															0, ~	A NAME OF A	Contraction of the second														
								+	+		<u> </u>			↓ 	×114	¢e ne	OPLIN			Į				· ·		+			+	+	
						-			1							Caracher 1		-		1					+	-				-	
Park Flow =		9300	libe ideo:		DESIGN	PARAME	TERS									Designe	ed:	P.P.			PROJEC	T:			Linif	Moon P-	ay West - I	Dhaes 4			
Park Flow = Average Daily Fl	ow =	9300 350	L/ha/day L/p/day						Industria	Peak Fact	or = as pe	ar MOE G	raph					P.P.							r Hallf I		ay west -	riidse T			
Comm/Inst Flow	=	50000	L/ha/day						Extraneo	us Flow =	p	0.280	L/s/ha			Checke	d:				LOCATIC	DN:									
Industrial Flow =		35000	L/ha/day							Velocity =		0.600				1		W.L.								c	City of Ott	awa			
Max Res. Peak F Commercial/Inst	Factor = ./Park Peak Factor =	4.00 1.50							Manning': Townhou		(Conc)	0.013 2.7	(Pvc)	0.013		Dwo Pe	eference:				File Ref:				1	Date:			- <u>1</u>	Sheet N	Jo
oogineraa/inst		1.00								use coeff=		3.4						Plan, Dwgs	s. No. 36, 37	″& 3B			16-888		i	Date.	October, 20	018		2	of 3

SANITARY SEWER CALCULATION SHEET

-



anning's n=0.01	3																												uw	A	
•	LOCATION					RESIDENTI	AL AREA AND	POPULATION					co	MM	INST	п	PAR}	(I+C+I+P	IN	FILTRATIO	v I					1	PIPE			
	STREET	FROM	то	AREA	UNITS	UNITS	UNITS	POP.		ATIVE	PEAK FACT.	PEAK FLOW	AREA	ACCU.	AREA	ACCU.		ACCU.	PEAK	TOTAL	ACCU.	INFILT.	TOTAL FLOW	DIST	DIA	DIA	SLOPE	CAP.	RATIO Q act/Q cap	V (FULL)	/EL.
		M,H.	M.H.	(ha)		Singles	Townhouse		AREA (ha)	POP.	FAGT.	⊢LOW (I/S)	(ha)	AREA (ha)	(ha)	(ha)		area (ha)	FLOW (I/S)	AREA (ha)	AREA (ha)	FLOW (I/s)	(l/s)	(m)	(Nominal) (mm)	(Actual) (MM)	(%)	(FULL) (I/S)	a actual cap	(m/s)	
distant Error	m Phase 2 Future Street	27. Bino BLU	C 129A						0.92	99									· ·	0.92	1.64										+
	m Phase 2 Future Street	PLUG	123A 123A	0.01					0.92	99	4.00	1.60								0.92	0.93	0.26	1.86	10.0	200	200	0.35	19.40	0.10	0.62	┽
		123A	124A	0.22	5	5.00		17	1.87	184	4.00	2.98								0.22	1.87	0.52	3.50	62.5	250	250	0.25	29.73	0.12	0.61	1
		124A	125A	0.01					1.88	184	4.00	2.98								0,01	1.88	0.53	3.51	6.5	250	250	0.25	29.73	0.12	0.61	
ntribution Fro	m Phase 2 Fut. Street 13		- 125A						1.20	129								ľ		1.20	3.08										
		PLUG	125A						1.20	129	4.00	2.09								0.00	1.20	0.34	2.43	10.0	200	200	0.35	19.40	0.13	0.62	
		125A	127A	0.23	5	5.00		17	3.31	330	4.00	5.35								0.23	3.31	0.93	6.28	72.0	250	250	0,25	29.73	0.21	0.61	+
ntribution Fro	m Phase 2 Fut. Street 12	PLUG PLUG	- 127A 127A						2.67	286 286	4.00	4.63								2.67	5,98 2.67	0.75	5.38	15.0	200	200	0.35	19.40	0.28	0.62	+
		127A	127A 128A	0.25	6	6.00	<u> </u>	21	6.23	637	3.92	10.12								0.00	6.23	1.74	11.86	73.5	250	250	0.35	29.73	0.40	0.61	+
		1217	1204	0.25	Ŭ	0.00		21	6.28	637	0.02	10.12								0.05	6.28		11.00	10.0	200	200	0.20	20.70	0.10	0.01	1
		128A	500A	0.21	5	5.00		17	6.49	654	3.91	10.36								0.21	6.49	1.82	12.18	76.0	250	250	0.25	29.73	0.41	0.61	
Cambrian Ro	oad, Pipe 500A - 501A								6.49	654											6.49										
																			-							<u> </u>					+-
mbrian Road						-			32,44	3473	$\left - \right $							~		32.44	32.44								- u		+
Intribution Fro						<u> </u>	· · · ·		13.44	0.70										13.44	45.88					1					+
	m External (BSUEA)			1					17.26	1179				0,60		1.23		1.21		20.30	66.18										1
ontribution Fro	m rue Apolune Street, P	ipe 128A - 500	A						6.49	654										6.49	72.67		•								
		500A	501A	0.48					70.11	5306	3.22	69.21		0.60		1.23		1.21	1.78			20.48	91.47	6.5	500	500	0.12	130.80	0.70	0.67	
ontribution Fro	m rue Apolune Street, P								1.29	91	0.04	70.40				1 00		1.04	1 70	1.29	74.44	01.14	00.07	404.0	-	600	0.40	400.00	0.74	0.07	+
		501A	5010A	0.95					72.35	5397 5397		70.18 70.18		0.60		1.23		1.21	1.78	0.95	75.39 75.39	21.11 21.11	93.07 93.07	124.0 124.0	500 500	500 500	0.12	130.80	0.71	0.67	+
ntribution Ero	m croissant Aphelion Cr	5010A	502A					<u> </u>	11.06	1144	3,21	70.18		0.60		1.23		0.24	1.78	11.30	86.69	21.11	93.07	124.0	500	500	0.12	130.80	0.71	0.67	+
hool	Ant Groissant Apricitori Ch	escent, ripe i							11.00	11-7-2					6.05	7.28		0.24	6.32	6,05	6,05	1.69	8.01	16.5	200	200	1.00	32.80	0.24	1.04	+
		502A	503A	0.42					83.83	6541	3.13	82.94		0.60		7.28		1.45		0.42	93.16	26.08	116.09	111.5	500	500	0.15	146.24	0.79	0.74	(
ture Commen	cial Block												1.36	1.36					1.18	1.36	1.36	0.38	1.56	25.5	200	200	1.00	32.80	0.05	1.04	(
uture Commer	cial Block												1.50						1.30	1.50	1.50	0.42	1.72	17.0	200	200	1.00	32.80	0.05	1.04	_ (
		503A	504A	0.20		ļ			84.03	6541	3.13	82.94	ļ	3.46		7.28		1.45	9.56	0.20	96.22	26.94	119.44	29.5	500	500	0.15	146.24	0.82	0.74	+
Camprian Ro	oad, Ex. Pipe 504A - 57A	\			<u> </u>	1			84.03	6541				3.46		7.28		1.45			96.22										+
																															+
																		CTATION OF THE OWNER	Contraction of the local division of the loc												
																	A REAL	0252	SION	1000											_
																	<u> </u>	Constanting of the local division of the loc	None of Concession, Name	$\langle \mathbf{O} \rangle$											+
																	SP		A	×2										<u> </u>	
				1													ž/C			12	1										+
				1					1							51		147	-6110	ĥ	11			·· ·		1					
											1						* !			n				1							
																		1001	67932					ļ	ļ	+		ļ			
							<u> </u>				<u> </u>						— C		74 1 1		/				<u> </u>						_
						-										<u> </u>	N.S.	ধ্ব	27,12	Mo.	/										+
																	20						· · · · · · · · · · · · · · · · · · ·			+					+
-						1												NCE	OFON	ALL							Í			1	
														Ì				and the second	Constanting of the local division of the loc	DEC.											
																										1					
								1		· ·		ļ												ļ	<u> </u>	-		<u> </u>			+
						+		-			-										· · ·		······	 	╂				1		+
							<u> </u>	+			+		<u> </u>									<u> </u>			1			1		1	+
						1					1																	<u> </u>	t	1	+
urk Flow =		9300	/ha/day		DESIGN	PARAME	TERS									Designed	t:	P.P.			PROJEC	т:			Half	Moon Ba	West - I	Phase 1			
erage Daily Fl	low =	350	L/p/day						Industriai	Peak Fact	or = as p	er MOE Gi	raph					C.C.							T BALL I		,	1000 1			
mm / Inst Flov	N =	50000	L/ha/day						Extraneo	us Flow =		0.280	L/s/ha		ħ	Checked					LOCATIC)N:									
lustria) Flow =		35000	L/ha/day						Minimum			0.600						W.L.								c	ity of Otta	awa			
ax Res. Peak F	-actor =	4.00							Manning':		(Conc)		(PVC)	0.013	L																
	st. / Park Peak Factor =	1.50							Townhou			2.7			la la	Dwg. Ref	aronoo:				File Ref:		16-888			Date:				Sheet N	in.

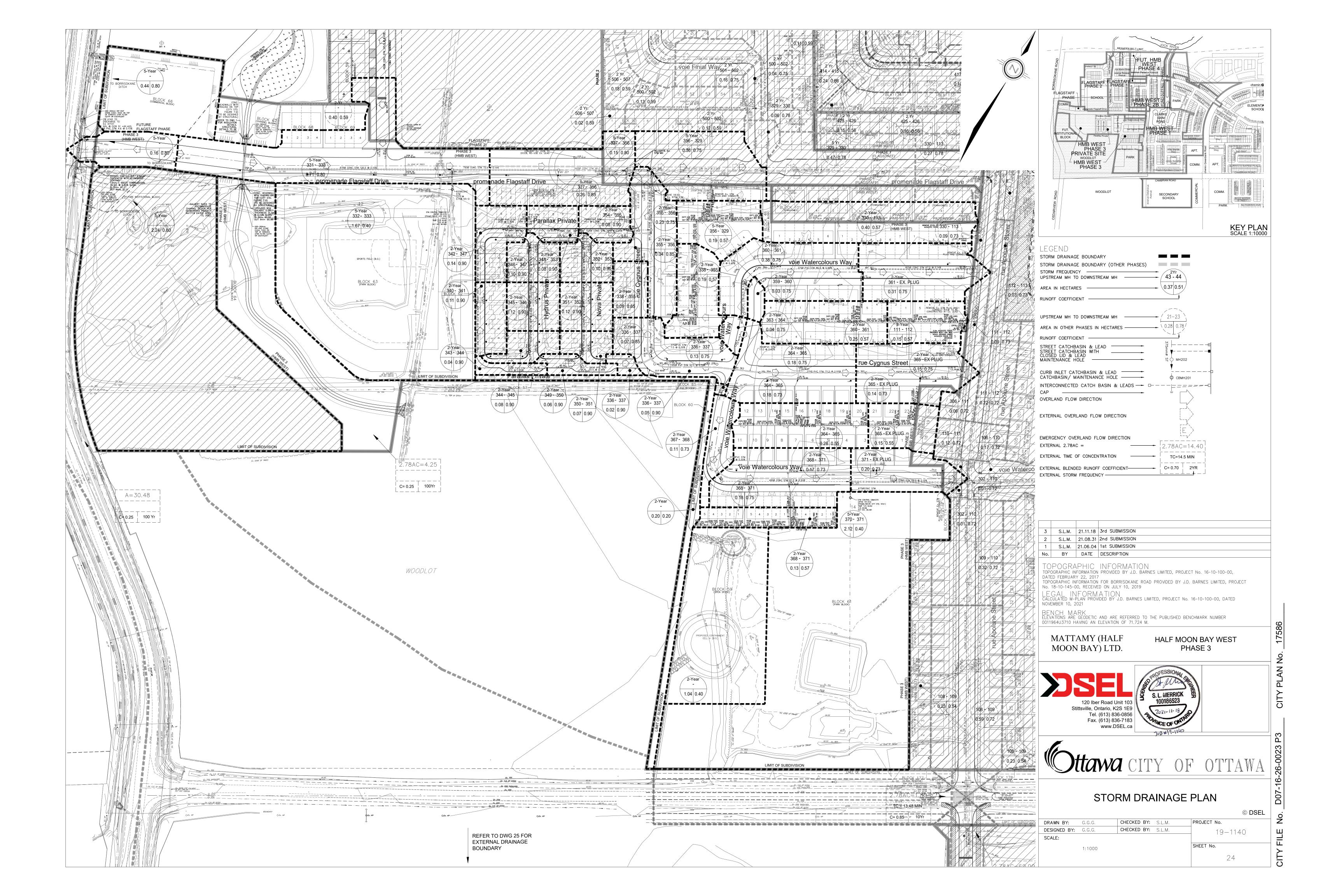
APPENDIX D

HMB WEST PHASE 3 STORM DRAINAGE AREA PLANS (DSEL, NOVEMBER 18, 2021)

HMB WEST PHASE 3 STORM DESIGN SHEETS (DSEL, NOVEMBER 18, 2021)

PHASE 3 OF THE HALF MOON BAY WEST SUBDIVISION / PROPOSED CULVERT UNDER FLAGSTAFF DRIVE (JFSA, JUNE 3, 2021)

RUNOFF COEFFICIENT CALCULATIONS (DSEL, MAY 2021)





EDARVIEW ROAD	WOODLOT		
5			KEY PLAN SCALE 1:10000
EMERGENCY OV EXTERNAL 2.78/ EXTERNAL TIME EXTERNAL BLEN EXTERNAL STOR	VERLAND FLOW DIRECTION AC = OF CONCENTRATION DED RUNOFF COEFFICIENT- M FREQUENCY	[2.78/	
2 S.L.M. 2 1 S.L.M. 2	21.08.31 2nd SUBMISSION 1.06.04 1st SUBMISSION	N	
TOPOGRAPHIC INFO DATED FEBRUARY TOPOGRAPHIC INFO No. 18-10-145-00 LEGAL INF CALCULATED M-PL NOVEMBER 10, 202 BENCH MAF ELEVATIONS ARE O	DRMATION PROVIDED BY J.E 22, 2017 DRMATION FOR BORRISOKAN , RECEIVED ON JULY 10, 20 FORMATION AN PROVIDED BY J.D. BAR 21 RK SEODETIC AND ARE REFERR	D. BARNES LIMITED, PRO NE ROAD PROVIDED BY 019 NES LIMITED, PROJECT ED TO THE PUBLISHED	J.D. BARNES LIMITED, PROJECT No. 16-10-100-00, DATED
MOON	BAY) LTD.	S. L. MERRICK 100186523 ROTESSIONAL S. L. MERRICK 100186523 ROTINACE OF ON	PHASE 3
Cot	tawa 🖸		
		-	© DSEL
	G.G.G. CHECK 1: 3500	ED BY: S.L.M.	19-1140 SHEET No. 25

STORM SEWER CALCULATION SHEET (RATIONAL METHOD) Local Roads Return Frequency = 2 years Collector Roads Return Frequency = 5 years

STORM			Local Roa Collector I	ATION S ds Return Fi Roads Retur	requency = 2 n Frequency	2 years y = 5 years	ONAL I	ИЕТНО	DD)																						Dtt	taw	а
Manning	0.013		Arterial Ro	oads Return	Frequency	= 10 years				ARE	A (Ha)										FL	LOW							SEWER DA				
	LOCA	TION		2 Y	EAR			5 Y	'EAR		()	10 Y	EAR			100 YE	EAR		Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)) TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATI
(ti	From Node	T- N- J-	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Conc. (min)	2 Year (mm/h)	5 Year	10 Year	100 Year	0 (1/-)	(a sturel)	((0/)	((1/-)	(777 /2)	LOW (min	0/0.6
Location	rom node	To Node	(na)		2.76 AC	2.76 AC	(na)		2.76 AC	2.76 AC	(Hd)		2.76 AC	2.76 AC	(na)		2.76 AC	2.76 AC	(min)	(mm/n)	(mm/h)	(mm/h)	(mm/h)	Q (1/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	i Q/Q ii
PARK BL	OCK 61																																
	370	371			0.00	0.00	2.12	0.40	2.36 0.00	2.36 2.36			0.00	0.00			0.00	0.00	14.00 14.00	64.23	86.93	101.82	148.72	205	675	675	CONC	0.15	11.0	325.56	0.91	0.20	0.63
To voie Wa		s Way, Pir	be 371 - 1	10	0.00	0.00			0.00	2.36			0.00	0.00			0.00	0.00	14.00	04.23	00.93	101.02	140.72	205	075	075	CONC	0.15	11.0	320.00	0.91	0.20	0.03
																														!			
oie Wate	rcolours 358	Way 359			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	0.80	22.5	86.49	1.22	0.31	0.00
	359	360	0.03	0.75	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	75.65	104.19	122.14	175.80	5	300	300	PVC	0.40	11.0	61.16	0.87	0.31	0.00
			0.25	0.57	0.40	0.46			0.00	0.00			0.00	0.00			0.00	0.00											1	<u> </u>			
	360 361	361 Ex. Plug	0.37 0.31	0.75	0.77	1.23 1.88			0.00	0.00			0.00	0.00			0.00	0.00	10.52 11.85	74.87 70.35	101.53 95.32	119.01 111.69	173.96 163.21	92 132	375 675	375 675	PVC CONC	0.40	80.5 67.0	110.89 314.52	1.00 0.88	1.34 1.27	0.83
	301	EX. Flug	0.31	0.75	0.05	1.00			0.00	0.00			0.00	0.00			0.00	0.00	11.00	70.55	90.32	111.09	103.21	132	075	075	CONC	0.14	07.0	314.52	0.00	1.27	0.42
	367	368	0.11	0.73	0.22	0.22			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	17	375	375	PVC	0.30	14.5	96.0323	0.8695	0.2779	0.179
			0.13	0.57	0.21	0.43			0.00	0.00			0.00	0.00			0.00	0.00										┿	┿	↓ '			<u> </u>
	368	371	0.17	0.73	0.34	0.77			0.00	0.00			0.00	0.00			0.00	0.00	10.28	75.75	102.75	120.44	176.06	87	450	450	CONC	0.30	87.5	156.1591	0.9819	1.4853	0.558
Contributio	n From P	ARK BLO	CK 61, Pip	be 370 - 37	1	0.00				2.36	l I			0.00				0.00	14.20														
	371	Ex. Plug	0.20	0.73	0.41	1.56	<u> </u>		0.00	2.36			0.00	0.00			0.00	0.00	14.20	63.72	86.23	100.99	147.51	302	825	825	CONC	0.15	68.0	555.94	1.04	1.09	0.54
Cygnus S	treet																												+				
- ,	363	364	0.04	0.75	0.08	0.08			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	6	300	300	PVC	0.60	17.0	74.90	1.06	0.27	0.09
			0.18	0.73	0.37	0.37			0.00	0.00			0.00	0.00			0.00	0.00										<u> </u>		ļ'			
	364	365	0.18	0.73	0.37 0.43	0.37			0.00	0.00			0.00	0.00			0.00	0.00	10.27	75.79	102.80	120.50	176.15	94	375	375	PVC	0.55	72.5	130.03	1.18	1.03	0.72
	004	000	0.14	0.73	0.28	0.28			0.00	0.00			0.00	0.00			0.00	0.00	10.21	10.10	102.00	120.00	170.10		0/0	0/0	1.10	0.00	12.0	100.00	1.10	1.00	0.12
			0.15	0.55	0.23	0.23			0.00	0.00			0.00	0.00			0.00	0.00															
	365	Ex. Plug	0.15	0.75	0.31	2.07			0.00	0.00			0.00	0.00			0.00	0.00	11.29	72.17	97.82	114.64	167.54	149	450	450	CONC	0.40	65.0	180.32	1.13	0.96	0.83
Nova Priv	ate																											-					1
	349	350	0.06	0.90	0.15	0.15			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	12	300	300	PVC	0.35	10.5	57.21	0.81	0.22	0.20
	350 351	351 352	0.07	0.90	0.18	0.33			0.00	0.00			0.00	0.00			0.00	0.00	10.22 10.89	75.98 73.56	103.06 99.74	120.81 116.89	176.61 170.85	25 46	300 300	300 300	PVC PVC	0.35	32.5 39.5	57.21 57.21	0.81	0.67	0.43
	352	353	0.12	0.90	0.30	0.88			0.00	0.00			0.00	0.00			0.00	0.00	11.70	70.84	96.00	112.49	164.39	62	375	375	PVC	0.30	10.0	96.03	0.87	0.01	0.65
To Paralla						0.88				0.00				0.00				0.00	11.89														
Hydrus Pr	ivoto.																											<u> </u>		ļ'			
nyurus Pr	343	344	0.04	0.90	0.10	0.10			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	8	300	300	PVC	0.35	10.5	57.21	0.81	0.22	0.13
	344	345	0.08	0.90	0.20	0.30			0.00	0.00			0.00	0.00			0.00	0.00	10.22	75.98	103.06	120.81	176.61		300	300	PVC	0.35	33.0	57.21	0.81	0.68	0.40
	345 346	346 347	0.12	0.90	0.30	0.60			0.00	0.00			0.00	0.00			0.00	0.00	10.90	73.53 70.81	99.69 95.96	116.84	170.76 164.31	44 60	300 375	300 375	PVC PVC	0.35	39.5	57.21 96.03	0.81	0.81	0.77
To Paralla:				0.90	0.25	0.85			0.00	0.00			0.00	0.00			0.00	0.00	11.71 11.90	70.81	95.90	112.44	104.31	60	3/5	3/5	PVC	0.30	10.0	96.03	0.87	0.19	0.63
Parallax p		240			0.00	0.00	<u> </u>		0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.04	104.40	100.44	170.50	0	200	200	DVC	0.05	22.0	57.04	0.04	0.00	0.00
	339 340	340 341	0.11	0.90	0.00	0.00	1		0.00	0.00			0.00	0.00			0.00	0.00	10.00 10.68	76.81 74.29	104.19 100.74	122.14 118.07	178.56 172.58	0 20	300 300	300 300	PVC PVC	0.35	33.0 50.0	57.21 57.21	0.81	0.68	0.00
	341	342			0.00	0.28			0.00	0.00			0.00	0.00			0.00	0.00	11.71	70.81	95.96	112.44	164.31	19	300	300	PVC	0.35	20.0	57.21	0.81	0.41	0.34
	342	347	0.14	0.90	0.35	0.63			0.00	0.00			0.00	0.00			0.00	0.00	12.12	69.52	94.18	110.35	161.24	43	375	375	PVC	0.30	16.0	96.03	0.87	0.31	0.45
Contributio	on From H 347	ydrus Priv 348	ale, Pipe :	340 - 347	0.00	0.85	+		0.00	0.00			0.00	0.00			0.00	0.00	11.90 12.43	68.59	92.91	108.85	159.04	101	450	450	CONC	0.20	19.0	127.50	0.80	0.39	0.79
	348	353	0.08	0.90	0.20	1.68			0.00	0.00			0.00	0.00			0.00	0.00	12.43	67.43	91.32	106.99	156.30	113	450	450	CONC		17.0	142.55	0.90	0.32	0.79
Contributio		ova Privat	e, Pipe 35	52 - 353	0.00	0.88			0.00	0.00			0.00	0.00				0.00	11.89	00.51	00.10	105.53	45.1.5	470		505	00110			045.00	0.00	0 = 0	
	353 354	354 355	0.08	0.90	0.00	2.55 2.75	+		0.00	0.00	\vdash		0.00	0.00	OF	ESSION	0.00	0.00	13.14 13.64		90.10 88.22		154.18 150.94	170 179	525 525	525 525	CONC	0.25	30.0 16.0	215.03 215.03	0.99	0.50 0.27	0.79
To Cygnus				0.00	0.20	2.75			0.00	0.00			0.00	0.00	PROF	AIT	30	0.00	13.04	55.17	00.22	100.00	100.04	113	020	020	00110	0.20	10.0	210.00	0.00	0.21	0.00
														10	3	-MM	No C												\square				
							+		+					1 ×	Cr	V												+	+	├ ────'			
				1		<u> </u>	1	1	1	1				8		MERRI		ų.				1	<u> </u>				1	+	<u>+</u>	<u>├</u> ───┤		<u> </u>	1
Definitions:				•	-	-	-	•	-				-	13		018652		-	-	-	-	•	-	Designed:			PROJECT				-	-	•
Q = 2.78 Al Q = Peak Fl		e nor coor-	d (1 /e)							Notes:	Rainfall-Inte	neity Cun-			100	0100020								Checked:		GGG	LOCATIC	<u></u>		HALF MOON	BAY WES	T PHASE 3	3
Q = Peak Fl A = Areas i			u (L/S)								Rainfall-Intel				170	21-11-19	8/0							Checked:		SLM	LOCATIC	/1N.		City of C	Ottawa		
l = Rainfall	Intensity (r	nm/h)								,	,			1.	SHOWING		A							Dwg. Refe	rence:		File Ref:			Date:		Sheet No.	
D D CC	Coefficient														Ula.		ar							1		Dwg 22	1		19-1140	18 Nov	2021	SHEET	T 1 OF 2

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years Collector Roads Return Frequency = 5 years Arterial Roads Return Frequency = 10 years

				Roads Retur		y = 5 years																								uu (Л	aw	Я
Manning	0.013		Arterial Ro	oads Return	Frequency	= 10 years				ARE	A (Ha)								1		FI	ow							SEWER DA	та			
	LOCA	ATION		2 Y	EAR			5 Y	'EAR	AILE	A (114)	10 YE	EAR			100 '	YEAR		Time of	Intensity		Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE		CAPACITY	VELOCITY	TIME OF	RATIO
×		T N 1	AREA	R	Indiv.	Accum.		R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year	0.41	(() b		(0/)		(11)		I ONL ()	0/0.6.11
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (1/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
Cygnus S	Street																																
			0.02	0.90	0.05	0.05			0.00	0.00			0.00	0.00			0.00	0.00															
			0.05	0.90	0.13	0.18			0.00	0.00			0.00	0.00			0.00	0.00															
	336	337	0.13		0.27	0.61			0.00	0.00			0.00	0.00			0.00	0.00		76.81		122.14		47	300	300	PVC	0.35	42.5	57.21	0.81	0.88	0.82
	337	338	0.09	0.85	0.00	0.61			0.00	0.00			0.00	0.00			0.00	0.00	10.88	73.60	99.79	116.95	170.94	45	375	375	PVC	0.30	7.5	96.03	0.87	0.14	0.47
	338	355	0.09	0.85	0.21	1.13			0.00	0.00			0.00	0.00			0.00	0.00	11.02	73.10	99.10	116.15	169.75	82	450	450	CONC	0.20	84.0	127.50	0.80	1.75	0.65
Contributi	on From F	arallax pri				2.75				0.00				0.00				0.00	13.91														
	355	356	0.04		0.09	3.97 4.45			0.00	0.00			0.00	0.00			0.00	0.00	13.91	64.46	97.25	102.20	140.27	287	600	600	CONC	0.30	40.5	336.31	1.19	0.57	0.85
To prome		staff Drive			0.40	4.45			0.00	0.00			0.00	0.00			0.00	0.00	14.48	04.40	07.25	102.20	145.27	207	000	000	CONC	0.50	40.5	330.31	1.15	0.57	0.05
PARK BL	OCK 63				0.00	0.00	1.67	0.40	1.86	1.86			0.00	0.00			0.00	0.00	12.00														
	332	333			0.00	0.00	1.07	0.40	0.00	1.86			0.00	0.00			0.00	0.00		69.89	94.70	110.96	162.13	176	600	600	CONC	0.15	13.5	237.81	0.84	0.27	0.74
To prome	nade Flag	staff Drive	, Pipe 333	- 327		0.00				1.86				0.00				0.00	12.27														
promena	de Flagsta	aff Drive				+																											
p. c.nena		333			0.00	0.00	0.71	0.80	1.58	1.58			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	165	675	675	CONC	0.15	126.5	325.56	0.91	2.32	0.51
Contributi				be 332 - 33		0.00			0.00	1.86			0.00	0.00			0.00	0.00	12.27	<u> </u>	02.00	400.00	450.00	201	750	750	00110	0.15	70.5	404.47	0.00	1.04	0.74
	333	Ex. 327			0.00	0.00	0.15	0.80	0.00	3.44 3.77			0.00	0.00			0.00	0.00	12.32	68.92	93.36	109.39	159.83	321	750	750	CONC	0.15	72.5	431.17	0.98	1.24	0.74
	Ex. 327	Ex. 326			0.00	0.00	0.26	0.85	0.61	4.38			0.00	0.00			0.00	0.00	13.56	65.40		103.71		388	900	900	CONC	0.12	46.0	627.11	0.99	0.78	0.62
Constributi	Ex. 326		ant Dine 2	55 250	0.00	0.00	0.00	0.00	0.00	4.38			0.00	0.00			0.00	0.00	14.33	63.39	85.77	100.46	146.72	376	900	900	CONC	0.12	17.0	627.11	0.99	0.29	0.60
Contributi	on From C	ygnus Str	eet, Pipe 3	55 - 356	0.00	4.45 4.45	0.19	0.59	0.31	0.00 4.70			0.00	0.00			0.00	0.00	14.48														
	356	Ex. 329			0.00	4.45				5.45			0.00	0.00			0.00	0.00	15.11	61.51	83.20	97.43	142.28	727	975	975	CONC	0.16	77.0	896.42	1.20	1.07	0.81
																	- COLUMN STR																
															1	ROFES	SIONA																
	-													-			11	01					-	-									
															12	Dra	Nue	(Q)															
						-									1 de la	- 0			<u> </u>														
														1	ð	S.L.M	ERRICH		1														
																1001	36523																
						-												7															
																2021-	11-18	2															
															X																		
	-					-								-		VIACE	DFOR	AN A					-	-									
																1000	6 1140	D															
																JOBE	11-11-																
		<u> </u>				+																<u> </u>											
				1																													
]																						
						1	-																										
						1																											
														E.																			
Definitions		•						•								•	•			•	•			Designed:	•		PROJECT	:	•		•		
Q = 2.78 A Q = Peak F			od (I /s)							Notes:	Rainfall-Inter	neity Curro												Checked:		GGG	LOCATIO	N		HALF MOON	BAY WES	T PHASE 3	
	in hectares		u (L/S)								city = 0.80													Checked:		SLM	LUCATIO			City of C	Ottawa		
I = Rainfal	Intensity (I	mm/h)								,														Dwg. Refe	rence:		File Ref:			Date:		Sheet No.	
R = Runof	Coefficien	t																								Dwg 22			19-1140	18 Nov	2021	SHEET	2 OF 2

)ttawa



J.F. Sabourin and Associates Inc. 52 Springbrook Drive, Ottawa, ON K2S 1B9 T 613-836-3884 F 613-836-0332

Ottawa. ON Paris. ON Gatineau. QC Montréal. QC Québec. QC

jfsa.com

June 03, 2021

Project Number: P598(07)

David Schaeffer Engineering Limited 120 Iber Road, Unit 103 Ottawa, Ontario K2S 1E9

Attention: Ms. Jennifer Ailey, P.Eng.

Subject: Phase 3 of the Half Moon Bay West Subdivision / Proposed Culvert under Flagstaff Drive

As requested by your office, we have evaluated, based on the provided information as described below, the 100-year peak flows to the proposed culvert under Flagstaff Drive to the east of Borrisokane Road, and the culvert diameter required to convey the 100-year flows without overtopping the road. The proposed crossing of Flagstaff Drive is located within the City of Ottawa, in the Half Moon Bay West subdivision.

The drainage area to the proposed culvert includes 30.48 ha of existing drainage from a woodlot and the east side of Borrisokane Road, and 5-year minor system outflows from a 2.239 ha future commercial block. Flows in excess of the 5-year Rational Method flow on the future commercial block are to be stored on-site, in accordance with the June 2021 *Stormwater Management Report for Phase 3 of the Half Moon Bay West Subdivision*.

In order to best represent the infiltration rates over a long simulation period, the SCS procedure was used to simulate infiltration over the 30.48 ha existing drainage area. Calculations for SCS Curve Number (CN) values are presented in Attachment B. The drainage areas are underlaid by Osgoode Loam, Muck, Kars Gravelly Sandy Loam, and Uplands Sand according to Carleton County Ontario Soil Survey Map No. 7, which correspond to hydrologic soil groups ranging between A, B and BC.

A time to peak value for the 30.48 ha existing drainage area was estimated based on topographic data provided by DSEL, using the FAA equation. Time to peak calculations are presented in Attachment B.

A SWMHYMO model of the drainage areas to the culvert was prepared based on the information described above, for the purposes of simulating peak flows in the channel during the 100-year 3-hour Chicago and 100-year 24-hour SCS Type II design storms. Digital SWMHYMO modelling input and output files are attached.

Based on these SWMHYMO simulations, the peak flows under to the proposed culvert under Flagstaff Drive are 685 L/s for the 100-year 3-hour Chicago storm and 769 L/s for the 100-year 24-hour SCS Type II storm.

As provided by DSEL, a 36.5 m long circular CSP culvert is proposed under Flagstaff Drive at a slope of 0.45%, with an upstream invert of 91.39 m and a downstream invert of 91.23 m. We understand from DSEL that the top of road elevation at this location is 92.53 m.



The diameter of culvert required to convey the 100-year flows without overtopping the road was evaluated in the HY-8 program under outlet control, based on the 100-year flood level of 91.83 m at cross-section 6016, per the November 2004 *Jock River Flood Risk Mapping (within the City of Ottawa) Hydraulics Report*. At the proposed road crossing, a 900 mm diameter circular CSP culvert results in a maximum 100-year water level of 92.32 m at the upstream side of the culvert; 0.21 m below the top of road elevation of 92.53 m. Refer to Attachment A for the HY-8 culvert analysis report.

Yours truly, J.F Sabourin and Associates Inc.

int

Laura Pipkins, P.Eng. Project Engineer in Water Resources

cc: J.F Sabourin, M.Eng, P.Eng Director of Water Resources Projects

Attachments

Attachment A: HY-8 Culvert Analysis Report Attachment B: SCS Curve Number and Time to Peak Calculations

Ottawa. ON Paris. ON Gatineau. QC Montréal. QC Québec. QC



Attachment A

HY-8 Culvert Analysis Report

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 1 - Summary of Culvert Flows at Crossing: FlagStaff Drive

Headwater Elevation (m)	Discharge Names	Total Discharge (cms)	FlagStaff Drive Discharge (cms)	Roadway Discharge (cms)	Iterations
92.25	100-Yr 3-Hr Chicago	0.69	0.69	0.00	1
92.32	100-Yr 24-Hr SCS	0.77	0.77	0.00	1
92.53	Overtopping	0.98	0.98	0.00	Overtopping

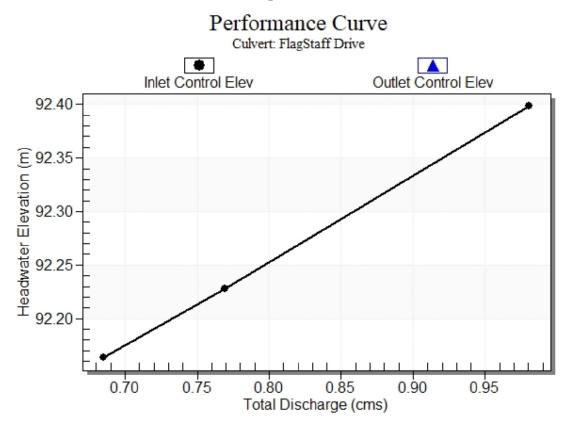
Table 2 - Culvert Summary Table: FlagStaff Drive

Straight Culvert

Inlet Elevation (invert): 91.39 m, Outlet Elevation (invert): 91.23 m

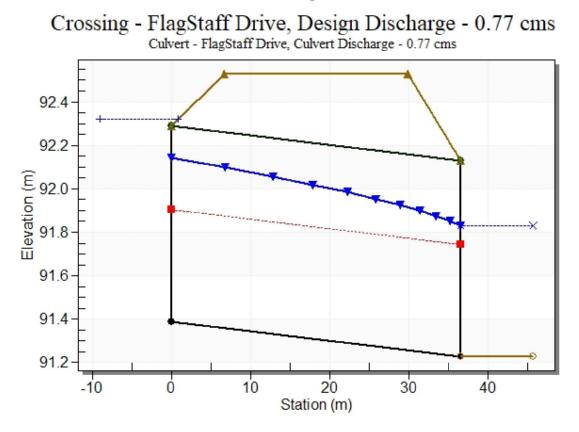
Culvert Length: 36.50 m, Culvert Slope: 0.0044

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
100-Yr 3-Hr Chicago	0.69	0.69	92.25	0.774	0.861	3-M2t	0.900	0.484	0.600	0.600	1.520	0.000
100-Yr 24-Hr SCS	0.77	0.77	92.32	0.838	0.930	3-M2t	0.900	0.515	0.600	0.600	1.707	0.000



Culvert Performance Curve Plot: FlagStaff Drive

Water Surface Profile Plot for Culvert: FlagStaff Drive



Site Data - FlagStaff Drive

Site Data Option: Culvert Invert Data Inlet Station: 0.00 m Inlet Elevation: 91.39 m Outlet Station: 36.50 m Outlet Elevation: 91.23 m Number of Barrels: 1

Culvert Data Summary - FlagStaff Drive

Barrel Shape: Circular Barrel Diameter: 900.00 mm Barrel Material: Corrugated Steel Embedment: 0.00 mm Barrel Manning's n: 0.0240 Culvert Type: Straight Inlet Configuration: Thin Edge Projecting Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: FlagStaff Drive)

Flow (cms)	Water Surface Elev (m)	Depth (m)
24.19	91.83	0.60
27.16	91.83	0.60

Tailwater Channel Data - FlagStaff Drive

Tailwater Channel Option: Enter Constant Tailwater Elevation Constant Tailwater Elevation: 91.83 m

Roadway Data for Crossing: FlagStaff Drive

Roadway Profile Shape: Constant Roadway Elevation Crest Length: 20.00 m Crest Elevation: 92.53 m Roadway Surface: Paved Roadway Top Width: 23.20 m

Ottawa. ON Paris. ON Gatineau. QC Montréal. QC Québec. QC



Attachment B

SCS Curve Number and Time to Peak Calculations

Soil	Land Use ⁽²⁾	% of the Study	Drainage	Soil	Hydrologic	CN ⁽⁴⁾
type ⁽¹⁾		Area ⁽²⁾	Type ⁽¹⁾	Description ⁽¹⁾	Soil Group ⁽³⁾	
Osgoode Loam	Urban Lawn	2%	Imperfect	Loam and Clay Loam	BC	74
Muck	Woods	13%	Imperfect	Decomposed Organic Material	В	60
Kars	Woods	34%	Imperfect	Gravely Sandy Loam	В	60
Uplands Sand	Woods	36%	Imperfect	Gravely Sandy Loam	А	45
Uplands Sand	Urban Lawn	5%	Imperfect	Gravely Sandy Loam	А	49
Uplands Sand	Impervious	10%	Imperfect	Organic Matter and Sand	А	98
Total		100%				58
CN* ⁽⁵⁾]					44

Natural Drainage Area to Proposed Flagstaff Drive Culvert

⁽¹⁾ As per Ontario Soil Survey Map No. 7, Soils of the Carleton County.

⁽²⁾ As per Google Earth Satellite Imagery.

⁽³⁾ As per November 1985 *Ministry of Transporation Drainage Manual*, Chart H2.

⁽⁴⁾ As per SWMHYMO User's Manual , J.F. Sabourin and Associates Inc., May 2000. Assume soils in good/fair condition.

⁽⁵⁾ As per Runoff Curve Number Method: Examination of the Initial Abstraction Ratio (Woodward et. al., 2003).

Table B-2: Calculation of Time to Peak

	UNITS	NAT
Area	(ha)	30.48
Hydrologic Soil Group ⁽¹⁾		A/B/BC
CN ⁽¹⁾		58
C (as per Rational Method)		0.25
Length of Channel ⁽²⁾	(m)	1100
Elevation of Channel Outlet ⁽²⁾	(m)	91.25
Elevation of Channel Headwater ⁽²⁾	(m)	106
Average Slope of Channel	(m/m)	0.0134
$\mathbf{T} = \mathbf{f} \mathbf{O} + \mathbf{f} \mathbf{I} + \mathbf{O} \mathbf{I} + \mathbf{f} \mathbf{I} + \mathbf{O} \mathbf{I} \mathbf{I} + \mathbf{I} \mathbf{I} + \mathbf{O} \mathbf{I} \mathbf{I} \mathbf{I} \mathbf{I} \mathbf{I} \mathbf{I} \mathbf{I} I$		
Time of Concentration Calculations ⁽³⁾		
Kirpich	(min)	23
	(hrs)	0.38
FAA	(min)	83
	(hrs)	1.39
SCS	(min)	139
	(hrs)	2.32
Bransby Williams	(min)	42
	(hrs)	0.71
Time to Peak (=2/3 Tc) ⁽³⁾		
Kirpich	(min)	15
FAA	(min)	56
SCS	(min)	93
Bransby Williams	(min)	28
Final (FAA)	(h)	0.93

⁽¹⁾ As per Table B-1 of Appendix B.

⁽²⁾ As measured based on topographic data provided by DSEL and Google Earth.

⁽³⁾ As per 1997 *Ministry of Transportation Drainage Management Manual,* Ch8.

Tc Equations applicability

- Kirpich Best for rural watersheds with slopes ranging from 3% to10%
- FAA Best for flat drainage areas (was developped for air field drainage) but used frequently for urban watersheds
- SCS Best for Agricultural SW in general and urban SW < 2000 acres
- BW One of the best method for predicting Tc. Especially for good for small culvert design

	Tc Equations and inputs (imperial unless otherwise noted)	Result in	input L as
Kirpich	Tc = 0.0078 L ^{0.77} S ^{-0.385}	(min)	(ft)
FAA	Tc = (1.8(1.1-C)L ^{0.50}) / (S ^{0.333})	(min)	(ft)
SCS Lag	$Tc = (100L^{0.8}((1000/CN)-9)^{0.7} / (1900 S^{0.5})$	(min)	(ft)
BW (metric)	$Tc = (0.605L) / (S^{0.2} A^{0.1})$	(hrs)	(km)

Date: Project: DSEL File:

May 2021 Half Moon Bay West - Phase 3 19-1140

Summary

<u>Townhouses</u>

Lot Type	Number of Lots (#)	Front Lot C	Back Lot C	# x C (Front)	# x C (Back)	Front Area (FA)	Back Area (BA)	# x FA	#
Townhouse 7.8 x 25.00m (TH) - Ext Corner - 18m	5	0.66	0.47	3.32	2.36	156.00	109.20	780.00	54
Townhouse 7.8 x 25.00m (TH) - Ext Corner - 18m w/ Sidewalk	2	0.70	0.47	1.39	0.94	156.00	109.20	312.00	2
Townhouse 8.2 x 25.00m (TH) - Int End - 18m	17	0.70	0.53	11.85	8.96	164.00	114.80	2788.00	19
Townhouse 8.2 x 25.00m (TH) - Int End - 18m - w/ Sidewalk	14	0.73	0.53	10.21	7.38	164.00	114.80	2296.00	16
Townhouse 6.5x 25.00m (TH) - Int - 18m	35	0.77	0.60	26.80	21.00	130.00	91.00	4550.00	31
Townhouse 6.5x 25.00m (TH) - Int - 18m - w/ Sidewalk	21	0.79	0.60	16.68	12.60	130.00	91.00	2730.00	19
Townhouse 6.5x 25.00m (TH) - Int - 24m - w/ Sidewalk	5	0.78	0.60	3.92	3.00	149.50	91.00	747.50	48
Townhouse 8.2 x 25.00m (TH) - IntEnd - 24m - w/ Sidewalk	3	0.72	0.53	2.17	1.58	188.60	114.80	565.80	34
Townhouse 10.05 x 25.00m (TH) - ExtCo - 24m - w/ Sidewalk	1	0.69	0.48	0.69	0.48	188.60	114.80	188.60	1
Sub-Total	103			77.05	58.29	1426.70	950.60	14957.90	103
Average:		0.748	0.566						
	Use	0.75	0.57						
Singles	1082	0.73	0.56						

Lot Type	Number of Lots (#)	Front Lot C	Back Lot C	# x C (Front)	# x C (Back)	Front Area (FA)	Back Area (BA)	# x FA	# x BA
Single 9.14x 27.00m (D) - Int - 18m	3	0.70	0.54	2.10	1.61	191.94	137.10	575.82	411.30
Single 9.14x 27.00m (D) - Int - 18m -w/ Sidewalk	6	0.73	0.54	4.38	3.22	191.94	137.10	1151.64	822.60
Single 13.10 x 27.00m (D) - Int - 18m	3	0.72	0.56	2.17	1.69	275.10	196.50	825.30	589.50
Single 13.10 x 27.00m (D) - Int - 18m w/ Sidewalk	0	0.75	0.56	0.00	0.00	275.10	196.50	0.00	0.00
Single 11.00 x 27.00m (D) - Int - 18m	4	0.73	0.55	2.90	2.21	231.00	165.00	924.00	660.00
Single 11.00 x 27.00m (D) - Int - 18m - w/ Sidewalk	5	0.75	0.55	3.76	2.76	231.00	165.00	1155.00	825.00
Single 13.15 x 27.00m (D) - ExtCo - 18m	1	0.69	0.52	0.69	0.52	276.15	197.25	276.15	197.25
Single 9.62 x 27.00m (D) - ExtCo - 18m w/ Sidewalk	1	0.72	0.48	0.72	0.48	202.02	144.30	202.02	144.30
Sub-Total	23			16.7114525	12.4895502	1874.25	1338.75	5109.93	3649.95
Average:		0.727	0.543						
	Use	0.73	0.55	<round b<="" td="" to="" up=""><td>e conservative an</td><td>d consistant with To</td><td>ownhomes</td><td></td><td></td></round>	e conservative an	d consistant with To	ownhomes		
	1082.00	0.72	0.54						

# x BA	

546.00

218.40

1951.60

1607.20

3185.00

1911.00

455.00

344.40

114.80

10333.40

95

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Townhouse 7.8 x 25.00m (TH) - Ext Corner - 18m

Design Parameters

Pavement Width (PW):	8.50 m	Lot Width (LW):	7.80	m
Boulevard Width (BW):	4.75 m	Lot Depth (LD):	25.00) m
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00) m
Sidewalk Width (SW):	0.00 m	Sideyard Setback 1 (SS1):	2.50	m
		Sideyard Setback 2 (SS2):	0.00	m
		Rearyard Setback (RS):	6.00	m
		Side Path Width (SPW):	0.00) m
		Driveway Width (DW):	3.50	m
		Rear Pad Width (RPW):		m
		Rear Pad Depth (RPD):		m

(See Figure Attached for Configuration Details)

1. Overall Area:

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))			156.00 m ²
2. Impervious Areas:			
a. Half of Road:	= LW * (PW/ 2 + CW + SW)	=	34.71 m ²
b. Half of the House:	= (LD - FS - RS) *	_	42.40 m ²
	(LW - SS1 - SS2)/2	=	42.40 m 26.425 m ²
c. Driveway:	= DW * ((BW - SW- CW) + FS)		
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²
Total Impervious Areas:			103.54 m ²
3. Imperviousness Ratio (%):			66.37 %
4. Runoff Coefficient:			0.66
	Lot Back		
1. Overall Area: Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	109.20 m ²

4. Runoff Coefficient:			0.47
3. Imperviousness Ratio	(%):	=	38.83 %
Total Impervious Areas:			42.40 m ²
b. Rear Pad:	= RPW * RPD	=	0 m ²
2. Impervious Areas: a. Half of the House:	= (LD - FS - RS) * (LW - SS1 - SS2)/2	=	42.40 m ²

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Townhouse 7.8 x 25.00m (TH) - Ext Corner - 18m w/ Sidewalk

Design Parameters

Pavement Width (PW):	8.50 m	Lot Width (LW):	7.8	0 m
Boulevard Width (BW):	4.75 m	Lot Depth (LD):	25.0	0 m
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.0	0 m
Sidewalk Width (SW):	1.60 m	Sideyard Setback 1 (SS1):	2.5	0 m
		Sideyard Setback 2 (SS2):	0.0	0 m
		Rearyard Setback (RS):	6.0	0 m
		Side Path Width (SPW):	0.0	0 m
		Driveway Width (DW):	3.5	0 m
		Rear Pad Width (RPW):		m
		Rear Pad Depth (RPD):		m

(See Figure Attached for Configuration Details)

1. Overall Area:

Calculation Half of the Street and Lot Front

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))			156.00 m ²
2. Impervious Areas:			
a. Half of Road:	= LW * (PW/ 2 + CW + SW)	=	47.19 m ²
b. Half of the House:	= (LD - FS - RS) *		
	(LW - SS1 - SS2)/2	=	42.40 m ²
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	20.825 m ²
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²
Total Impervious Areas:			110.42 m ²
3. Imperviousness Ratio (%):		=	70.78 %
4. Runoff Coefficient:			0.70
d. Side Path:Total Impervious Areas:3. Imperviousness Ratio	= DW * ((BW - SW- CW) + FS) = SPW * (LD - FS - RS) * 2	=	0 m ² 110.42 m ² 70.78 %

Lot Back

1. Overall Area: Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	109.20 m ²
2. Impervious Areas: a. Half of the House:	= (LD - FS - RS) *		
b. Rear Pad:	(LW - SS1 - SS2)/2 = RPW * RPD	=	42.40 m ² 0 m ²
D. Neal Fau.		-	
Total Impervious Areas:			42.40 m ²
3. Imperviousness Ratio (%):		=	38.83 %
4. Runoff Coefficient:			0.47

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Townhouse 8.2 x 25.00m (TH) - Int End - 18m

Design Parameters

Pavement Width (PW):	8.50 m	Lot Width (LW):	8.20	m
Boulevard Width (BW):	4.75 m	Lot Depth (LD):	25.00	m
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00	m
Sidewalk Width (SW):	0.00 m	Sideyard Setback 1 (SS1):	1.50	m
		Sideyard Setback 2 (SS2):	0.00	m
		Rearyard Setback (RS):	6.00	m
		Side Path Width (SPW):	0.00	m
		Driveway Width (DW):	3.50	m
		Rear Pad Width (RPW):		m
		Rear Pad Depth (RPD):		m

(See Figure Attached for Configuration Details)

1. Overall Area:

6.49 m ²
6.40 m^2
0.49 11
3.60 m ²
.425 m ²
0 m ²
6.52 m²
1.05 %
0
4.80 m ²

2. Impervious Areas:			
a. Half of the House:	= (LD - FS - RS) *		
	(LW - SS1 - SS2)/2	=	53.60 m ²
b. Rear Pad:	= RPW * RPD	=	0 m ²
Total Impervious Areas:			53.60 m ²
3. Imperviousness Ratio	0 (%):	=	46.69 %
4. Runoff Coefficient:			0.53

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Townhouse 8.2 x 25.00m (TH) - Int End - 18m - w/ Sidewalk

Design Parameters

Pavement Width (PW):	8.50 m	Lot Width (LW):	8.20 m	
Boulevard Width (BW):	4.75 m	Lot Depth (LD):	25.00 m	
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00 m	
Sidewalk Width (SW):	1.60 m	Sideyard Setback 1 (SS1):	1.50 m	
		Sideyard Setback 2 (SS2):	0.00 m	
		Rearyard Setback (RS):	6.00 m	
		Side Path Width (SPW):	0.00 m	
		Driveway Width (DW):	3.50 m	
		Rear Pad Width (RPW):	m	
		Rear Pad Depth (RPD):	m	

(See Figure Attached for Configuration Details)

1. Overall Area:

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))			164.00 m ²	
2. Impervious Areas:				
a. Half of Road:	= LW * (PW/ 2 + CW + SW)	=	49.61 m ²	
b. Half of the House:	= (LD - FS - RS) *		2	
	(LW - SS1 - SS2)/2	=	53.60 m ²	
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	20.825 m ²	
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²	
Total Impervious Areas:			124.04 m ²	
3. Imperviousness Ratio (%):		=	75.63 %	
4. Runoff Coefficient:			0.73	
	Lot Back			
1. Overall Area:				
Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	114.80 m ²	
2 Imporvious Areas:				

2. Impervious Areas: a. Half of the House: b. Rear Pad:	= (LD - FS - RS) * (LW - SS1 - SS2)/2 = RPW * RPD	= =	53.60 m ² 0 m ²
Total Impervious Areas:			53.60 m ²
3. Imperviousness Ratio (%):		=	46.69 %
4. Runoff Coefficient:			0.53

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Townhouse 6.5x 25.00m (TH) - Int - 18m

Design Parameters

Pavement Width (PW):	8.50 m	Lot Width (LW):	6.50	m
Boulevard Width (BW):	4.75 m	Lot Depth (LD):	25.00	m
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00	m
Sidewalk Width (SW):	0.00 m	Sideyard Setback 1 (SS1):	0.00	m
		Sideyard Setback 2 (SS2):	0.00	m
		Rearyard Setback (RS):	6.00	m
		Side Path Width (SPW):	0.00	m
		Driveway Width (DW):	3.20	m
		Rear Pad Width (RPW):		m
		Rear Pad Depth (RPD):		m

(See Figure Attached for Configuration Details)

1. Overall Area:

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))			130.00 m ²	
2. Impervious Areas:				
a. Half of Road:	= LW * (PW/2 + CW + SW)	=	28.93 m ²	
b. Half of the House:	= (LD - FS - RS) * (LW - SS1 - SS2)/2	=	52.00 m ²	
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	24.16 m^2	
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²	
Total Impervious Areas:			105.09 m ²	
3. Imperviousness Rati	o (%):	=	80.83 %	
4. Runoff Coefficient:			0.77	
	Lot Back			
1. Overall Area: Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	91.00 m ²	
2 Imporvious Areas:				

2. Impervious Areas: a. Half of the House: b. Rear Pad:	= (LD - FS - RS) * (LW - SS1 - SS2)/2 = RPW * RPD	= =	52.00 m ² 0 m ²
Total Impervious Areas:			52.00 m ²
3. Imperviousness Ratio (%):		=	57.14 %
4. Runoff Coefficient:			0.60

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Townhouse 6.5x 25.00m (TH) - Int - 18m - w/ Sidewalk

Design Parameters

Pavement Width (PW):	8.50 m	Lot Width (LW):	6.50 m
Boulevard Width (BW):	4.75 m	Lot Depth (LD):	25.00 m
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00 m
Sidewalk Width (SW):	1.60 m	Sideyard Setback 1 (SS1):	0.00 m
		Sideyard Setback 2 (SS2):	0.00 m
		Rearyard Setback (RS):	6.00 m
		Side Path Width (SPW):	0.00 m
		Driveway Width (DW):	3.20 m
		Rear Pad Width (RPW):	m
		Rear Pad Depth (RPD):	m
		()	

(See Figure Attached for Configuration Details)

1. Overall Area:

Calculation Half of the Street and Lot Front

Half of Road and Lot From	t: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))	=	130.00 m ²
2. Impervious Areas: a. Half of Road: b. Half of the House:	= LW * (PW/ 2 + CW + SW) = (LD - FS - RS) *	=	39.33 m ²
D. Hall of the House.	(LW - SS1 - SS2)/2	=	52.00 m ²
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	19.04 m ²
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²
Total Impervious Areas:			110.37 m ²
3. Imperviousness Ratio (%):		=	84.90 %
4. Runoff Coefficient:			0.79
4. Runoff Coefficient:	Lot Back		0.79
	Lot Back		0.79
 Runoff Coefficient: 1. Overall Area: Lot Back: 	Lot Back = LW * ((LD-FS-RS)/2+RS)	=	0.79 91.00 m ²
1. Overall Area:	= LW * ((LD-FS-RS)/2+RS) = (LD - FS - RS) *		91.00 m ²
 Overall Area: Lot Back: Impervious Areas: a. Half of the House: 	= LW * ((LD-FS-RS)/2+RS) = (LD - FS - RS) * (LW - SS1 - SS2)/2	=	91.00 m ² 52.00 m ²
 Overall Area: Lot Back: Impervious Areas: 	= LW * ((LD-FS-RS)/2+RS) = (LD - FS - RS) *		91.00 m ²

4. Runoff Coefficient:

3. Imperviousness Ratio (%):

0.60

=

57.14 %

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Townhouse 6.5x 25.00m (TH) - Int - 24m - w/ Sidewalk

Design Parameters

11.00 m	Lot Width (LW):	6.50 m
6.50 m	Lot Depth (LD):	25.00 m
0.20 m	Frontyard Setback (FS):	3.00 m
1.80 m	Sideyard Setback 1 (SS1):	0.00 m
	Sideyard Setback 2 (SS2):	0.00 m
	Rearyard Setback (RS):	6.00 m
	Side Path Width (SPW):	0.00 m
	Driveway Width (DW):	3.20 m
	Rear Pad Width (RPW):	m
	Rear Pad Depth (RPD):	m
	6.50 m 0.20 m	6.50 m Lot Depth (LD): 0.20 m Frontyard Setback (FS): 1.80 m Sideyard Setback 1 (SS1): Sideyard Setback 2 (SS2): Rearyard Setback (RS): Side Path Width (SPW): Driveway Width (DW): Rear Pad Width (RPW):

(See Figure Attached for Configuration Details)

1. Overall Area:

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))			
= LW * (PW/ 2 + CW + SW)	=	48.75 m ²	
= (LD - FS - RS) *			
(LW - SS1 - SS2)/2	=		
= DW * ((BW - SW- CW) + FS)	=		
= SPW * (LD - FS - RS) * 2	=	0 m ²	
		124.75 m ²	
o (%):	=	83.44 %	
		0.78	
Lot Back			
		2	
= LW * ((LD-FS-RS)/2+RS)	=	91.00 m²	
	= LW * (PW/2 + CW + SW) = (LD - FS - RS) * (LW - SS1 - SS2)/2 = DW * ((BW - SW- CW) + FS) = SPW * (LD - FS - RS) * 2	= LW * (PW/ 2 + CW + SW) = = (LD - FS - RS) * (LW - SS1 - SS2)/2 = = DW * ((BW - SW- CW) + FS) = = SPW * (LD - FS - RS) * 2 = 0 (%): = Lot Back	$= LW * (PW/2 + CW + SW) = 48.75 m^{2}$ $= (LD - FS - RS) * (LW - SS1 - SS2)/2 = 52.00 m^{2}$ $= DW * ((BW - SW - CW) + FS) = 24 m^{2}$ $= SPW * (LD - FS - RS) * 2 = 0 m^{2}$ 124.75 m ² = 83.44 % 0.78 Lot Back

2. Impervious Areas: a. Half of the House: b. Rear Pad:	= (LD - FS - RS) * (LW - SS1 - SS2)/2 = RPW * RPD	= =	52.00 m ² 0 m ²
Total Impervious Areas:			52.00 m ²
3. Imperviousness Ratio (%):		=	57.14 %
4. Runoff Coefficient:			0.60

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Townhouse 8.2 x 25.00m (TH) - IntEnd - 24m - w/ Sidewalk

Design Parameters

Pavement Width (PW):	11.00 m	Lot Width (LW):	8.20 m
Boulevard Width (BW):	6.50 m	Lot Depth (LD):	25.00 m
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00 m
Sidewalk Width (SW):	1.80 m	Sideyard Setback 1 (SS1):	1.50 m
		Sideyard Setback 2 (SS2):	0.00 m
		Rearyard Setback (RS):	6.00 m
		Side Path Width (SPW):	0.00 m
		Driveway Width (DW):	3.50 m
		Rear Pad Width (RPW):	m
		Rear Pad Depth (RPD):	m

(See Figure Attached for Configuration Details)

1. Overall Area:

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))			188.60 m ²	
2. Impervious Areas:				
a. Half of Road:	= LW * (PW/ 2 + CW + SW)	=	61.50 m ²	
b. Half of the House:	= (LD - FS - RS) *			
	(LW - SS1 - SS2)/2	=	53.60 m ²	
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	26.25 m ²	
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²	
Total Impervious Areas:			141.35 m ²	
3. Imperviousness Ratio (%):		=	74.95 %	
4. Runoff Coefficient:			0.72	
	Lot Back			
1. Overall Area:				
Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	114.80 m ²	
2. Impervious Areas:				

2. Impervious Areas: a. Half of the House: b. Rear Pad:	= (LD - FS - RS) * (LW - SS1 - SS2)/2 = RPW * RPD	= =	53.60 m ² 0 m ²
Total Impervious Areas:			53.60 m ²
3. Imperviousness Ratio (%):		=	46.69 %
4. Runoff Coefficient:			0.53

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Townhouse 10.05 x 25.00m (TH) - ExtCo - 24m - w/ Sidewalk

Design Parameters

Pavement Width (PW):	11.00 m	Lot Width (LW):	8.20 m
Boulevard Width (BW):	6.50 m	Lot Depth (LD):	25.00 m
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00 m
Sidewalk Width (SW):	1.80 m	Sideyard Setback 1 (SS1):	2.50 m
		Sideyard Setback 2 (SS2):	0.00 m
		Rearyard Setback (RS):	6.00 m
		Side Path Width (SPW):	0.00 m
		Driveway Width (DW):	3.50 m
		Rear Pad Width (RPW):	m
		Rear Pad Depth (RPD):	m

(See Figure Attached for Configuration Details)

1. Overall Area:

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))			188.60 m ²		
2. Impervious Areas:					
a. Half of Road:	= LW * (PW/2 + CW + SW)	=	61.50 m ²		
b. Half of the House:	= (LD - FS - RS) * (LW - SS1 - SS2)/2	=	45.60 m ²		
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	26.25 m ²		
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²		
Total Impervious Areas:			133.35 m ²		
3. Imperviousness Ratio (%):		=	70.71 %		
4. Runoff Coefficient:			0.69		
1. Overall Area:					

4. Runoff Coefficient:			0.48
3. Imperviousness Ratio (%):		=	39.72 %
Total Impervious Areas:			45.60 m ²
b. Rear Pad:	(LW - SS1 - SS2)/2 = RPW * RPD	=	45.60 m 0 m ²
2. Impervious Areas: a. Half of the House:	= (LD - FS - RS) *	_	45.60 m ²
Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	114.80 m ²

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Single 9.14x 27.00m (D) - Int - 18m

Design Parameters

Boulevard Width (BW):4.75 mLot Depth (LD):27.00	m
Curb Width (CW): 0.20 m Frontyard Setback (FS): 3.00	m
Sidewalk Width (SW): 0.00 m Sideyard Setback 1 (SS1): 1.20	m
Sideyard Setback 2 (SS2): 0.60	m
Rearyard Setback (RS): 6.00	m
Side Path Width (SPW): 0.00	m
Driveway Width (DW): 4.00	m
Rear Pad Width (RPW):	m
Rear Pad Depth (RPD):	m

(See Figure Attached for Configuration Details)

1. Overall Area:

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))		=	191.94 m ²	
2. Impervious Areas:				
a. Half of Road:	= LW * (PW/ 2 + CW + SW)	=	40.67 m ²	
b. Half of the House:	= (LD - FS - RS) *			
	(LW - SS1 - SS2)/2	=	66.06 m ²	
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	30.2 m ²	
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²	
Total Impervious Areas:			136.93 m ²	
3. Imperviousness Ratio (%):		=	71.34 %	
4. Runoff Coefficient:			0.70	
Lot Back				

1. Overall Area: Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	137.10 m ²
2. Impervious Areas: a. Half of the House:	= (LD - FS - RS) *		
	(LW - SS1 - SS2)/2	=	66.06 m ²
b. Rear Pad:	= RPW * RPD	=	0 m ²
Total Impervious Areas:			66.06 m ²
3. Imperviousness Ratio	(%):	=	48.18 %
4. Runoff Coefficient:			0.54

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Single 9.14x 27.00m (D) - Int - 18m -w/ Sidewalk

Design Parameters

Pavement Width (PW):	8.50 m	Lot Width (LW):	9.14 1	m
Boulevard Width (BW):	4.75 m	Lot Depth (LD):	27.00 г	m
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00 r	m
Sidewalk Width (SW):	1.60 m	Sideyard Setback 1 (SS1):	1.20 г	m
		Sideyard Setback 2 (SS2):	0.60 ו	m
		Rearyard Setback (RS):	6.00 1	m
		Side Path Width (SPW):	1 00.0	m
		Driveway Width (DW):	4.00 r	m
		Rear Pad Width (RPW):	1	m
		Rear Pad Depth (RPD):	ı	m

(See Figure Attached for Configuration Details)

1. Overall Area:

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))			191.94 m ²
2. Impervious Areas:			
a. Half of Road:	= LW * (PW/ 2 + CW + SW)	=	55.30 m ²
b. Half of the House:	= (LD - FS - RS) *		
	(LW - SS1 - SS2)/2	=	66.06 m ²
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	23.8 m ²
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²
Total Impervious Areas:			145.16 m ²
3. Imperviousness Ratio (%):			75.63 %
4. Runoff Coefficient:			0.73
1. Overall Area:	Lot Back		

4. Runoff Coefficient:			0.54
3. Imperviousness Ratio	(%):	=	48.18 %
Total Impervious Areas:			66.06 m ²
b. Rear Pad:	(LW - SS1 - SS2)/2 = RPW * RPD	=	0 m ²
2. Impervious Areas: a. Half of the House:	= (LD - FS - RS) *	_	66.06 m ²
Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	137.10 m ²

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Single 11.00 x 27.00m (D) - Int - 18m

Design Parameters

Pavement Width (PW): 8.50 m Lot Width (LW): 11.00	
Boulevard Width (BW): 4.75 m Lot Depth (LD): 27.00	m
Curb Width (CW): 0.20 m Frontyard Setback (FS): 3.00	m
Sidewalk Width (SW): 0.00 m Sideyard Setback 1 (SS1): 1.20	m
Sideyard Setback 2 (SS2): 0.60	m
Rearyard Setback (RS): 6.00	m
Side Path Width (SPW): 0.00	m
Driveway Width (DW): 5.50	m
Rear Pad Width (RPW):	m
Rear Pad Depth (RPD):	m

(See Figure Attached for Configuration Details)

1. Overall Area:

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))		=	231.00 m ²	
2. Impervious Areas:				
a. Half of Road:	= LW * (PW/ 2 + CW + SW)	=	48.95 m ²	
b. Half of the House:	= (LD - FS - RS) *			
	(LW - SS1 - SS2)/2	=	82.80 m ²	
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	41.525 m ²	
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²	
Total Impervious Areas:			173.28 m ²	
3. Imperviousness Ratio (%):		=	75.01 %	
4. Runoff Coefficient:			0.73	
Lot Back				

1. Overall Area: Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	165.00 m ²
2. Impervious Areas: a. Half of the House:	= (LD - FS - RS) * (LW - SS1 - SS2)/2	=	82.80 m ²
b. Rear Pad:	= RPW * RPD	=	0 m ²
Total Impervious Areas:			82.80 m ²
3. Imperviousness Ratio	(%):	=	50.18 %
4. Runoff Coefficient:			0.55

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Single 11.00 x 27.00m (D) - Int - 18m - w/ Sidewalk

Design Parameters

Pavement Width (PW):	8.50 m	Lot Width (LW):	11.00 m	
Boulevard Width (BW):	4.75 m	Lot Depth (LD):	27.00 m	
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00 m	
Sidewalk Width (SW):	1.60 m	Sideyard Setback 1 (SS1):	1.20 m	
		Sideyard Setback 2 (SS2):	0.60 m	
		Rearyard Setback (RS):	6.00 m	
		Side Path Width (SPW):	0.00 m	
		Driveway Width (DW):	5.50 m	
		Rear Pad Width (RPW):	m	
		Rear Pad Depth (RPD):	m	

(See Figure Attached for Configuration Details)

1. Overall Area:

Calculation Half of the Street and Lot Front

Half of Road and Lot From	t: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))	=	231.00 m ²
2. Impervious Areas:			
a. Half of Road:	= LW * (PW/2 + CW + SW)	=	66.55 m ²
b. Half of the House:	= (LD - FS - RS) * (LW - SS1 - SS2)/2	=	82.80 m ²
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	32.725 m ²
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²
Total Impervious Areas:			182.08 m ²
3. Imperviousness Ratio (%):		=	78.82 %
4. Runoff Coefficient:			0.75
4. Runoff Coefficient:	Lot Back		0.75
4. Runoff Coefficient: 1. Overall Area:	Lot Back		0.75
	Lot Back = LW * ((LD-FS-RS)/2+RS)	=	0.75 165.00 m ²
1. Overall Area:		=	
1. Overall Area: Lot Back:	= LW * ((LD-FS-RS)/2+RS) = (LD - FS - RS) *		165.00 m ²
 Overall Area: Lot Back: Impervious Areas: 	= LW * ((LD-FS-RS)/2+RS)	=	

Total Impervious Areas:

3. Imperviousness Ratio (%):

4. Runoff Coefficient:

82.80 m² 50.18 %

0.55

=

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Single 13.10 x 27.00m (D) - Int - 18m

Design Parameters

Pavement Width (PW): 8.50 m Lot Width (LW): 13.	0 m
Boulevard Width (BW): 4.75 m Lot Depth (LD): 27.	00 m
Curb Width (CW): 0.20 m Frontyard Setback (FS): 3.	00 m
Sidewalk Width (SW): 0.00 m Sideyard Setback 1 (SS1): 0.0	60 m
Sideyard Setback 2 (SS2): 1.	20 m
Rearyard Setback (RS): 6.	00 m
Side Path Width (SPW): 0.	00 m
Driveway Width (DW): 6.	00 m
Rear Pad Width (RPW):	m
Rear Pad Depth (RPD):	m

(See Figure Attached for Configuration Details)

1. Overall Area:

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))			275.10 m ²	
2. Impervious Areas:				
a. Half of Road:	= LW * (PW/ 2 + CW + SW)	=	58.30 m ²	
b. Half of the House:	= (LD - FS - RS) *			
	(LW - SS1 - SS2)/2	=	101.70 m ²	
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	45.3 m ²	
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²	
Total Impervious Areas:			205.30 m ²	
3. Imperviousness Ratio	(%):	=	74.63 %	
4. Runoff Coefficient:			0.72	
	Lot Back			
1. Overall Area:			0	
Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	196.50 m ²	
2. Impervious Areas:				

4. Runoff Coefficient:			0.56
3. Imperviousness Ratio	(%):	=	51.76 %
Total Impervious Areas:			101.70 m ²
b. Rear Pad:	= RPW * RPD	=	0 m ²
a. Half of the House:	= (LD - FS - RS) * (LW - SS1 - SS2)/2	=	101.70 m ²
2. Impervious Areas:			

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Single 13.10 x 27.00m (D) - Int - 18m w/ Sidewalk

Design Parameters

Pavement Width (PW):	8.50 m	Lot Width (LW):	13.10 m
Boulevard Width (BW):	4.75 m	Lot Depth (LD):	27.00 m
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00 m
Sidewalk Width (SW):	1.60 m	Sideyard Setback 1 (SS1):	0.60 m
		Sideyard Setback 2 (SS2):	1.20 m
		Rearyard Setback (RS):	6.00 m
		Side Path Width (SPW):	0.00 m
		Driveway Width (DW):	6.00 m
		Rear Pad Width (RPW):	m
		Rear Pad Depth (RPD):	m

(See Figure Attached for Configuration Details)

1. Overall Area:

Calculation Half of the Street and Lot Front

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS)) =			275.10 m ²	
2. Impervious Areas:				
a. Half of Road:	= LW * (PW/2 + CW + SW)	=	79.26 m ²	
b. Half of the House:	= (LD - FS - RS) * (LW - SS1 - SS2)/2	=	101.70 m ²	
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	35.7 m ²	
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²	
Total Impervious Areas:			216.66 m ²	
3. Imperviousness Rati	o (%):	=	78.75 %	
			0.75	
4. Runoff Coefficient:			0.70	
4. Runoff Coefficient:			0.70	
	Lot Back		0.70	
 Runoff Coefficient: Overall Area: Lot Back: 	Lot Back = LW * ((LD-FS-RS)/2+RS)	=	196.50 m ²	
1. Overall Area:		=		

101.70 m²

101.70 m²

51.76 %

0.56

0 m²

=

=

=

Total Impervious Areas:

b. Rear Pad:

3. Imperviousness Ratio (%):

(LW - SS1 - SS2)/2

= RPW * RPD

4. Runoff Coefficient:

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Single 13.15 x 27.00m (D) - ExtCo - 18m

Design Parameters

	n
Boulevard Width (BW): 4.75 m Lot Depth (LD): 27.00 m	
Curb Width (CW): 0.20 m Frontyard Setback (FS): 3.00 m	n
Sidewalk Width (SW): 0.00 m Sideyard Setback 1 (SS1): 0.60 m	n
Sideyard Setback 2 (SS2): 2.50 m	n
Rearyard Setback (RS): 6.00 n	n
Side Path Width (SPW): 0.00 n	n
Driveway Width (DW): 6.00 n	n
Rear Pad Width (RPW):	n
Rear Pad Depth (RPD):	n

(See Figure Attached for Configuration Details)

1. Overall Area:

Calculation Half of the Street and Lot Front

Half of Road and Lot From	t: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))	=	276.15 m ²
2. Impervious Areas:			
a. Half of Road: b. Half of the House:	= LW * (PW/ 2 + CW + SW) = (LD - FS - RS) *	=	58.52 m ²
	(LW - SS1 - SS2)/2	=	90.45 m ²
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	45.3 m ²
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²
Total Impervious Areas:			194.27 m ²
3. Imperviousness Ratio	(%) :	=	70.35 %
4. Runoff Coefficient:			0.69
	Lot Back		
1. Overall Area:			
Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	197.25 m ²
2. Impervious Areas: a. Half of the House:	= (LD - FS - RS) *		
	(LW - SS1 - SS2)/2	=	90.45 m ²

0 m²

90.45 m²

45.86 %

0.52

=

=

Total Impervious Areas:

= RPW * RPD

3. Imperviousness Ratio (%):

4. Runoff Coefficient:

b. Rear Pad:

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Single 9.62 x 27.00m (D) - ExtCo - 18m w/ Sidewalk

Design Parameters

Pavement Width (PW):	8.50 m	Lot Width (LW):	9.62 m
Boulevard Width (BW):	4.75 m	Lot Depth (LD):	27.00 m
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00 m
Sidewalk Width (SW):	1.60 m	Sideyard Setback 1 (SS1):	0.60 m
		Sideyard Setback 2 (SS2):	2.50 m
		Rearyard Setback (RS):	6.00 m
		Side Path Width (SPW):	0.00 m
		Driveway Width (DW):	5.50 m
		Rear Pad Width (RPW):	m
		Rear Pad Depth (RPD):	m

(See Figure Attached for Configuration Details)

1. Overall Area:

Calculation Half of the Street and Lot Front

Half of Road and Lot From	t: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))	=	202.02 m ²
2. Impervious Areas: a. Half of Road: b. Half of the House:	= LW * (PW/ 2 + CW + SW) = (LD - FS - RS) *	=	58.20 m ²
b. Hall of the House.	(LW - SS1 - SS2)/2	=	58.68 m ²
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	32.725 m ²
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²
Total Impervious Areas:			149.61 m ²
3. Imperviousness Ratio) (%):	=	74.06 %
4. Runoff Coefficient:			0.72
4. Runoff Coefficient:	Lot Back		0.72
1. Overall Area:			
	Lot Back = LW * ((LD-FS-RS)/2+RS)	=	0.72 144.30 m ²
1. Overall Area:	= LW * ((LD-FS-RS)/2+RS) = (LD - FS - RS) *	=	144.30 m ²
 Overall Area: Lot Back: Impervious Areas: a. Half of the House: 	= LW * ((LD-FS-RS)/2+RS) = (LD - FS - RS) * (LW - SS1 - SS2)/2	=	144.30 m ² 58.68 m ²
 Overall Area: Lot Back: Impervious Areas: 	= LW * ((LD-FS-RS)/2+RS) = (LD - FS - RS) *		144.30 m ²

40.67 %

0.48

=

3. Imperviousness Ratio (%):

4. Runoff Coefficient:

Half Moon Bay West - Phase 3 City of Ottawa Calculation of Imperviousness / Runoff Coefficient Back-to-Back 6.4x 14.7m (B2B) - Int - 18m

Design Parameters

Pavement Width (PW):	8.50 m	Lot Width (LW):	6.40 m	
Boulevard Width (BW):	4.75 m	Lot Depth (LD):	14.70 m	
Curb Width (CW):	0.20 m	Frontyard Setback (FS):	3.00 m	
Sidewalk Width (SW):	0.00 m	Sideyard Setback 1 (SS1):	0.00 m	
		Sideyard Setback 2 (SS2):	0.00 m	
		Rearyard Setback (RS):	0.00 m	
		Side Path Width (SPW):	0.00 m	
		Driveway Width (DW):	3.20 m	
		Rear Pad Width (RPW):	m	
		Rear Pad Depth (RPD):	m	
		Driveway Width (DW): Rear Pad Width (RPW):	3.20 m m	

(See Figure Attached for Configuration Details)

1. Overall Area:

Half of Road and Lot Front: = LW * (PW/2+BW+ ((LD-FS-RS)/2+FS))			114.24 m ²
2. Impervious Areas:			
a. Half of Road: b. Half of the House:	= LW * (PW/ 2 + CW + SW) = (LD - FS - RS) *	=	28.48 m ²
	(LW - SS1 - SS2)/2	=	37.44 m ²
c. Driveway:	= DW * ((BW - SW- CW) + FS)	=	24.16 m ²
d. Side Path:	= SPW * (LD - FS - RS) * 2	=	0 m ²
Total Impervious Areas:			90.08 m ²
3. Imperviousness Ratio	(%):	=	78.85 %
4. Runoff Coefficient:			0.75
1. Overall Area:	Lot Back		

4. Runoff Coefficient:			0.90
3. Imperviousness Ratio	(%):	=	100.00 %
Total Impervious Areas:			37.44 m ²
b. Rear Pad:	= RPW * RPD	=	0 m ²
2. Impervious Areas: a. Half of the House:	= (LD - FS - RS) * (LW - SS1 - SS2)/2	=	37.44 m ²
Lot Back:	= LW * ((LD-FS-RS)/2+RS)	=	37.44 m ²

APPENDIX E

PHASE 2 OF THE FLAGSTAFF SUBDIVISION / CAMBRIAN WOODS NATURAL CHANNEL DESIGN (JFSA, SEPTEMBER 28, 2021)

GEOTECHNICAL RECOMMENDATIONS – FROST PROTECTION FOR NATURAL CHANNEL CROSSINGS, PG2246-MEMO.71 REVISION 1 (PATERSON GROUP, NOVEMBER 8, 2021)



J.F. Sabourin and Associates Inc. 52 Springbrook Drive, Ottawa, ON K2S 1B9 T 613-836-3884 F 613-836-0332

s **jfsa.com**

September 28, 2021

Project Number: P598(07)

Ottawa. ON

Gatineau. QC

Montréal. QC Québec. QC

Paris. ON

David Schaeffer Engineering Limited 120 Iber Road, Unit 103 Ottawa, Ontario K2S 1E9

Attention: Ms. Laura Maxwell

Subject: Phase 2 of the Flagstaff Subdivision / Cambrian Woods Natural Channel Design

As requested by your office, we have evaluated, based on the provided information as described below, the 25 mm, 2- to 100-year and average annual peak flows in the proposed natural channel servicing Cambrian Woods under interim and ultimate development conditions. The performances of interim and ultimate culverts in the channel under Flagstaff Drive and a temporary access road have also been evaluated. The proposed natural drainage is located within the City of Ottawa, and drains through the Half Moon Bay West and Flagstaff subdivisions.

The channel alignment and culvert details are presented in Attachment A, as provided by DSEL. Note that the channel is located within the Jock River floodplain; as such, we understand that the channel will be designed by Geo Morphix to provide conveyance for the 2-year flows from the Cambrian Woods and other contributing drainage areas, but will function as part of the larger floodplain during less frequent events.

The drainage area to the channel is 11.97 ha under interim conditions and 9.78 ha under ultimate conditions. The interim drainage area includes a 8.79 ha area of the woodlot and proposed channel south of Flagstaff Drive, a 0.23 ha allowance for a future park block south of Flagstaff Drive (29% imperviousness assumed), a 2.08 ha channel block north of Flagstaff Drive, and a 0.87 ha allowance for proposed Flagstaff Phase 2 and future rearyards north of Flagstaff Drive. Under ultimate conditions, the 8.79 ha area of woodlot and channel south of Flagstaff Drive will be reduced to 6.60 ha.

In order to best represent the infiltration rates over a long simulation period, the SCS procedure was used to simulate infiltration over the both natural and developed areas. Calculations for SCS Curve Number (CN) values are presented in Attachment B. The drainage areas are underlaid by Osgoode Loam, Muck and Kars Gravelly Sandy Loam according to Carleton County Ontario Soil Survey Map No. 7, which correspond to hydrologic soil groups BC and B. Soils in the developed park and rearyard areas will be defined by the characteristics of topsoil, which has a CN of 79 for urban lawns in fair / imperfect condition.

Time to peak values for the natural drainage areas were estimated based on topographic data provided by DSEL, using the FAA equation. Time to peak calculations are presented in Attachment B.



A SWMHYMO model of the drainage areas to the natural channel was prepared based on the information described above, for the purposes of simulating peak flows in the channel during the 25 mm 3-hour Chicago storm and the 2- to 100-year 24-hour SCS Type II design storms. Additionally, by means of 36 years of continuous hydrologic simulations using hourly rainfall data from the Ottawa International Airport from 1967 to 2003 (missing data in 2001), the average annual peak flows to the channel were also computed using the SWMHYMO program. Note that the period of interest is from April 1st to October 31st of each year, as Environment Canada indicates that the hourly rainfall data is typically only available for April to October, with a greater occurrence of missing data (or simply no rainfall) during the winter months. The continuous modelling parameters were set as shown in Table 1.

Parameter	Description
APII = 50 APIK = 0.90/day	Used to compute the Antecedent Precipitation Index during the continuous simulation. Without model calibration, these are the default values.
laRECper = 6 hrs	Time required for the Initial Abstraction over pervious areas to recover during a dry period in undeveloped areas.
SMIN = -1 mm SMAX = -1 mm	The negative values indicate that the storage volume in the SCS procedure will vary between the "S" determined for AMC I and AMC III conditions of the entered CN value in undeveloped and urban areas.
SK=[0.03]/(mm);	A calibration coefficient that can typically vary from 0.01 to 0.3 for undeveloped and urban areas. The higher the value, the more surface runoff generated. To set the baseline for pre-development conditions, a value in the low range was selected.
InitGWResVol = 100 mm GWResK = 0.9 mm/day/mm VhydCond = 1 mm/hr	Parameters that are used to simulate both the groundwater storage and discharge to surface watercourses from undeveloped areas. Without adequate field measurements, these parameters were selected based on previous experience.
laRECper = 3 hrs	Time required for the Initial Abstraction over pervious areas to recover during a dry period in urban areas.
laRECimp = 1.5 hrs	Time required for the Initial Abstraction over impervious areas to recover during a dry period in urban areas.
InterEventTime = 24 hrs	Continuous dry time required to reset the parameters in the SCS procedure to their initial values.

Table 1: Continuous Modelling Parameters

Based on these single event and continuous simulations, the peak flows under interim and ultimate conditions are summarized in Table 2.



Storm	Interim Conditio (m ³ /		Ultimate Conditions Peak Flow (m³/s)		
	South of Flagstaff Drive	North of Flagstaff Drive	South of Flagstaff Drive	North of Flagstaff Drive	
25mm/3hr Chicago	0.021	0.028	0.017	0.024	
2yr/24hr SCS	0.058	0.073	0.047	0.063	
5yr/24hr SCS	0.100	0.125	0.082	0.106	
10yr/24hr SCS	0.133	0.164	0.108	0.139	
25yr/24hr SCS	0.178	0.218	0.144	0.184	
50yr/24hr SCS	0.214	0.263	0.173	0.221	
100yr/24hr SCS	0.256	0.313	0.207	0.263	
Average Annual	0.083	0.110	0.067	0.097	

Table 2: Summary of Peak Flows in the Natural Channel Servicing Cambrian Woods

Detailed continuous modelling results may be found in Attachment C. Digital SWMHYMO modelling input and output files are also attached.

As shown in Attachment A, under interim conditions a 1200 mm circular CSP culvert under Flagstaff Drive, and a 1200 mm circular CSP culvert under a temporary access road, will be installed in the channel. Under ultimate conditions, the temporary access road will be removed, and the 1200 mm circular CSP culvert under Flagstaff Drive will be replaced by a 1200 mm x 900 mm concrete box culvert. All culverts are to be buried by 10% of their diameter.

The performance of these interim and ultimate conditions culverts was assessed in the HY-8 program under outlet control, based on the 100-year flood level of 91.78 m at cross-section 5910, per the November 2004 *Jock River Flood Risk Mapping (within the City of Ottawa) Hydraulics Report.* At the temporary access road, the water level at the upstream side of the crossing is 91.79 m based on 100-year interim conditions flows. At Flagstaff Drive, the water level at the upstream side of the crossing is 91.80 m based on 100-year interim conditions flows and culvert characteristics, and 91.79 m based on 100-year ultimate conditions flows and culvert characteristics. Refer to Attachment D for the HY-8 culvert analysis report.

Yours truly, J.F Sabourin and Associates Inc.

witte

Jonathon Burnett, B.Eng, P.Eng. Water Resources Engineer

cc: J.F Sabourin, M.Eng, P.Eng Director of Water Resources Projects

Attachments

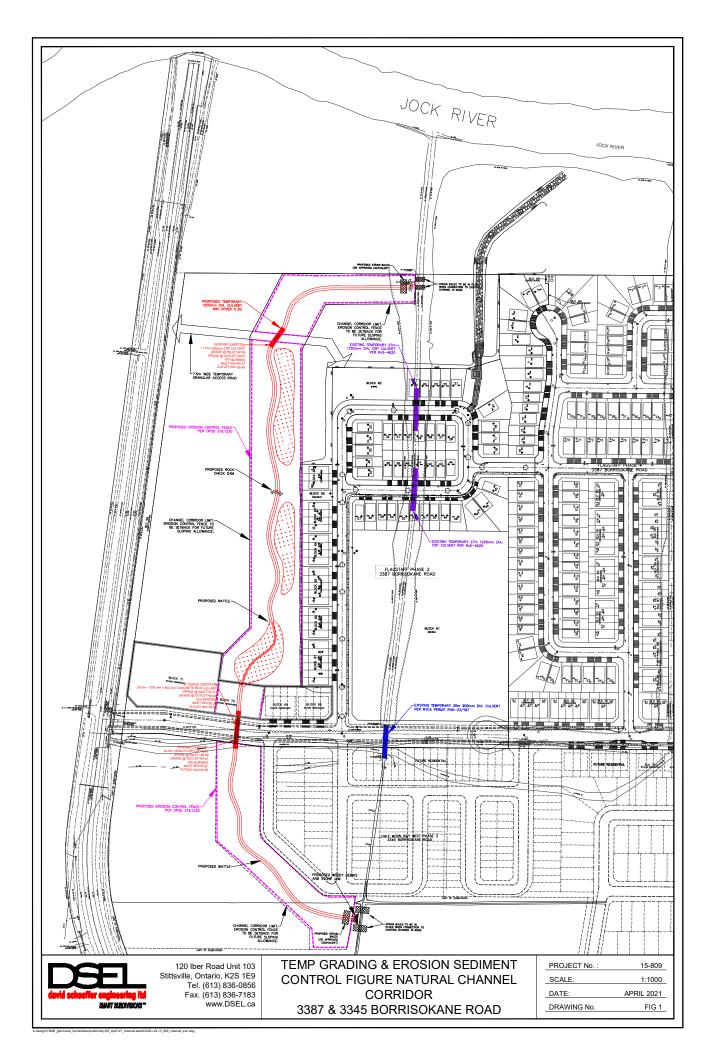
Attachment A:	Natural Channel Corridor Drawing (DSEL, April 2021)
Attachment B:	SCS Curve Number and Time to Peak Calculations
Attachment C:	Summary of Continuous Surface Runoff Volumes
Attachment D:	HY-8 Culvert Analysis Report

Ottawa. ON Paris. ON Gatineau. QC Montréal. QC Québec. QC



Attachment A

Natural Channel Corridor Drawing (DSEL, April 2021)



Ottawa. ON Paris. ON Gatineau. QC Montréal. QC Québec. QC



Attachment B

SCS Curve Number and Time to Peak Calculations

Table B-1: Calculation of SCS Curve Number (CN) and Modified Curve Number (CN*)

Soil type ⁽¹⁾	Land Use ⁽²⁾	% of the Study Area ⁽²⁾	Drainage Type ⁽¹⁾	Soil Description ⁽¹⁾	Hydrologic Soil Group ⁽³⁾	CN ⁽⁴⁾
Muck	Woods	55%	Imperfect	Decomposed Organic Material	В	73
Kars	Woods	10%	Imperfect	Gravely Sandy Loam	В	73
Osgoode Loam	Meadow	35%	Imperfect	Loam and Clay Loam	BC	65
Total		100%		•		70
CN* ⁽⁵⁾						59

Interim Conditions Woodlot and Channel South of Flagstaff Drive (iWL)

Soil type ⁽¹⁾	Land Use ⁽²⁾	% of the Study Area ⁽²⁾	Drainage Type ⁽¹⁾	Soil Description ⁽¹⁾	Hydrologic Soil Group ⁽³⁾	CN ⁽⁴⁾
Muck	Woods	50%	Imperfect	Decomposed Organic Material	В	73
Kars	Woods	10%	Imperfect	Gravely Sandy Loam	В	73
Osgoode Loam	Meadow	40%	Imperfect	Loam and Clay Loam	BC	65
Total		100%				70
CN* ⁽⁵⁾						58

Proposed Conditions Channel North of Flagstaff Drive (pChan)

Soil type ⁽¹⁾	Land Use ⁽²⁾	% of the Study Area ⁽²⁾	Drainage Type ⁽¹⁾	Soil Description ⁽¹⁾	Hydrologic Soil Group ⁽³⁾	CN ⁽⁴⁾
Osgoode Loam	Meadow	100%	Imperfect	Loam and Clay Loam	ВС	65
Total		100%				65
CN* ⁽⁵⁾						51

Post-Development Park (pPK) and Rearyards (pRY)

Soil	Land Use ⁽²⁾	% of the Study	Drainage	Soil	Hydrologic	CN ⁽⁴⁾
type ⁽¹⁾		Area ⁽²⁾	Type ⁽¹⁾	Description ⁽¹⁾	Soil Group ⁽³⁾	
Top Soil	Urban Lawn	100%	Imperfect	Top Soil	С	79
Total		100%				79
CN* ⁽⁵⁾						71

⁽¹⁾ As per Ontario Soil Survey Map No. 7, Soils of the Carleton County.

⁽²⁾ As per Google Earth Satellite Imagery.

⁽³⁾ As per November 1985 *Ministry of Transporation Drainage Manual,* Chart H2.

⁽⁴⁾ As per SWMHYMO User's Manual, J.F. Sabourin and Associates Inc., May 2000. Assume soils in good/fair condition.

⁽⁵⁾ As per Runoff Curve Number Method: Examination of the Initial Abstraction Ratio (Woodward et. al., 2003).

⁽⁶⁾ Standard CN values for urban grassed area over top soil. Assume soils in fair conditions.

Table B-2: Calculation of Time to Peak

	UNITS	uWL	iWL	pChan
Area	(ha)	6.6	8.79	2.08
Hydrologic Soil Group ⁽¹⁾		B/BC	B/BC	BC
CN ⁽¹⁾		70	70	65
C (as per Rational Method)		0.25	0.25	0.25
		400	540	100
Length of Channel ⁽²⁾	(m)	480	540	460
Elevation of Channel Outlet ⁽²⁾	(m)	90.99	90.99	90.17
Elevation of Channel Headwater ⁽²⁾	(m)	92.75	93	90.97
Average Slope of Channel	(m/m)	0.0037	0.0037	0.0017
Time of Concentration Calculations ⁽³⁾				
Kirpich	(min)	20	21	25
	(hrs)	0.33	0.36	0.42
FAA	(min)	85	89	106
	(hrs)	1.41	1.49	1.77
SCS	(min)	101	111	163
	(hrs)	1.68	1.85	2.72
Bransby Williams	(min)	28	30	35
	(hrs)	0.47	0.51	0.58
Time to Peak (=2/3 Tc) ⁽³⁾				
Kirpich	(min)	13	14	17
FAA	(min)	57	60	71
SCS	(min)	67	74	109
Bransby Williams	(min)	19	20	23
Final (FAA)	(h)	0.94	0.99	1.18

⁽¹⁾ As per Table B-1 of Appendix B.

⁽²⁾ As measured based on topographic data provided by DSEL and Google Earth.

⁽³⁾ As per 1997 *Ministry of Transportation Drainage Management Manual,* Ch8.

Tc Equations applicability

- Kirpich Best for rural watersheds with slopes ranging from 3% to 10%
- FAA Best for flat drainage areas (was developped for air field drainage) but used frequently for urban watershed SCS Best for Agricultural SW in general and urban SW < 2000 acres
- BW One of the best method for predicting Tc. Especially for good for small culvert design

	Tc Equations and inputs (imperial unless otherwise noted)	Result in	input L as
Kirpich	Tc = 0.0078 L ^{0.77} S ^{-0.385}	(min)	(ft)
FAA	$Tc = (1.8(1.1-C)L^{0.50}) / (S^{0.333})$	(min)	(ft)
SCS Lag	Tc = (100L ^{0.8} ((1000/CN)-9) ^{0.7} / (1900 S ^{0.5})	(min)	(ft)
BW (metric)	Tc = (0.605L) / (S ^{0.2} A ^{0.1})	(hrs)	(km)

Ottawa. ON Paris. ON Gatineau. QC Montréal. QC Québec. QC



Attachment C

Summary of Continuous Surface Runoff Volumes

Year	South of Flagstaff Drive				North of Flagstaff Drive			
. our	Area	Peak	R.V.	Volume	Area	Peak	R.V.	Volume
		Flow				Flow		
	(ha)	(m ³ /s)	(mm)	(m ³)	(ha)	(m ³ /s)	(mm)	(m ³)
1967	9.02	0.063	57.92	5224	11.97	0.081	57.11	6836
1968	9.02	0.068	63.05	5687	11.97	0.095	62.19	7444
1969	9.02	0.064	45.35	4091	11.97	0.080	44.45	5320
1970	9.02	0.088	51.37	4634	11.97	0.115	50.50	6044
1971	9.02	0.061	46.25	4172	11.97	0.085	45.34	5427
1972	9.02	0.133	112.22	10123	11.97	0.170	111.86	13390
1973	9.02	0.105	81.03	7309	11.97	0.138	80.47	9632
1974	9.02	0.036	28.65	2584	11.97	0.051	27.64	3308
1975	9.02	0.065	54.30	4897	11.97	0.090	53.57	6412
1976	9.02	0.029	43.39	3914	11.97	0.038	42.31	5064
1977	9.02	0.065	56.75	5119	11.97	0.088	55.96	6699
1978	9.02	0.082	44.57	4020	11.97	0.112	43.72	5233
1979	9.02	0.116	100.26	9044	11.97	0.157	99.72	11937
1980	9.02	0.055	54.09	4879	11.97	0.073	53.59	6415
1981	9.02	0.310	148.72	13414	11.97	0.401	148.42	17766
1982	9.02	0.044	40.67	3668	11.97	0.058	39.69	4751
1983	9.02	0.055	50.60	4564	11.97	0.074	49.94	5978
1984	9.02	0.050	48.46	4371	11.97	0.064	47.70	5710
1985	9.02	0.033	41.66	3758	11.97	0.047	40.88	4893
1986	9.02	0.123	114.88	10362	11.97	0.162	114.65	13723
1987	9.02	0.083	65.97	5950	11.97	0.113	65.22	7807
1988	9.02	0.126	64.40	5809	11.97	0.173	63.69	7623
1989	9.02	0.042	43.84	3954	11.97	0.052	42.96	5142
1990	9.02	0.088	78.26	7059	11.97	0.116	77.73	9304
1991	9.02	0.053	47.79	4310	11.97	0.067	47.02	5629
1992	9.02	0.140	66.02	5955	11.97	0.185	65.21	7805
1993	9.02	0.014	41.25	3721	11.97	0.019	40.53	4851
1994	9.02	0.045	59.70	5385	11.97	0.060	58.98	7060
1995	9.02	0.166	54.28	4896	11.97	0.217	53.16	6363
1996	9.02	0.047	40.19	3625	11.97	0.065	39.47	4725
1997	9.02	0.012	28.19	2543	11.97	0.018	27.22	3258
1998	9.02	0.032	41.02	3700	11.97	0.042	40.20	4812
1999	9.02	0.046	55.31	4989	11.97	0.062	54.54	6529
2000	9.02	0.099	57.42	5179	11.97	0.129	56.97	6819
2002	9.02	0.297	98.22	8859	11.97	0.359	97.63	11687
2003	9.02	0.068	74.04	6678	11.97	0.090	73.44	8791
Average		0.083	61.11	5512		0.110	60.38	7227
Minimum		0.012	28.19	2543		0.018	27.22	3258
Maximum		0.310	148.72	13414		0.401	148.42	17766

Table C-1: Continuous Flows in the Natural Channel Servicing Cambrian Woods (Interim Conditions)

Notes: Based on a simulation period from April 1st to October 31st. Rainfall data missing from AES file for 2001.

Year		South of F		North of Flagstaff Drive				
	Area	Peak	R.V.	Volume	Area	Peak	R.V.	Volume
		Flow				Flow		
	(ha)	(m ³ /s)	(mm)	(m ³)	(ha)	(m ³ /s)	(mm)	(m ³)
1967	6.83	0.051	59.38	4055	9.78	0.070	57.95	5667
1968	6.83	0.055	64.97	4437	9.78	0.090	63.34	6194
1969	6.83	0.053	46.62	3184	9.78	0.072	45.13	4414
1970	6.83	0.071	52.89	3612	9.78	0.109	51.36	5023
1971	6.83	0.049	47.62	3252	9.78	0.074	46.09	4507
1972	6.83	0.108	115.57	7893	9.78	0.154	114.11	11160
1973	6.83	0.086	83.52	5704	9.78	0.127	82.07	8027
1974	6.83	0.030	29.32	2003	9.78	0.045	27.88	2727
1975	6.83	0.052	55.84	3814	9.78	0.080	54.48	5328
1976	6.83	0.023	44.60	3046	9.78	0.032	42.90	4196
1977	6.83	0.053	58.54	3998	9.78	0.081	57.04	5579
1978	6.83	0.066	46.00	3142	9.78	0.106	44.53	4355
1979	6.83	0.095	103.22	7050	9.78	0.148	101.66	9943
1980	6.83	0.044	55.84	3814	9.78	0.062	54.70	5350
1981	6.83	0.245	152.66	10427	9.78	0.336	151.11	14779
1982	6.83	0.035	41.91	2862	9.78	0.050	40.34	3945
1983	6.83	0.044	52.17	3563	9.78	0.062	50.89	4977
1984	6.83	0.041	49.76	3398	9.78	0.054	48.44	4737
1985	6.83	0.027	42.97	2935	9.78	0.042	41.62	4070
1986	6.83	0.097	118.41	8087	9.78	0.138	117.06	11448
1987	6.83	0.067	67.91	4638	9.78	0.101	66.41	6495
1988	6.83	0.101	66.38	4533	9.78	0.150	64.91	6348
1989	6.83	0.034	45.13	3082	9.78	0.047	43.67	4271
1990	6.83	0.070	80.66	5509	9.78	0.097	79.29	7754
1991	6.83	0.043	49.25	3364	9.78	0.058	47.87	4682
1992	6.83	0.112	67.96	4642	9.78	0.157	66.39	6493
1993	6.83	0.011	42.73	2919	9.78	0.016	41.40	4049
1994	6.83	0.036	61.53	4202	9.78	0.052	60.10	5877
1995	6.83	0.130	55.23	3772	9.78	0.184	53.58	5240
1996	6.83	0.038	41.40	2828	9.78	0.056	40.16	3928
1997	6.83	0.010	28.93	1976	9.78	0.016	27.52	2691
1998	6.83	0.026	42.26	2886	9.78	0.037	40.89	3999
1999	6.83	0.037	56.83	3882	9.78	0.053	55.44	5422
2000	6.83	0.079	59.24	4046	9.78	0.114	58.13	5685
2002	6.83	0.240	100.94	6894	9.78	0.329	99.40	9721
2003	6.83	0.055	76.30	5211	9.78	0.081	74.88	7323
Average		0.067	62.90	4296		0.097	61.46	6011
Minimum		0.010	28.93	1976		0.016	27.52	2691
Maximum	l	0.245	152.66	10427		0.336	151.11	14779

Table C-2: Continuous Flows in the Natural Channel Servicing Cambrian Woods (Ultimate Conditions)

Notes: Based on a simulation period from April 1st to October 31st. Rainfall data missing from AES file for 2001.

Ottawa. ON Paris. ON Gatineau. QC Montréal. QC Québec. QC



Attachment D

Hy-8 Culvert Analysis Report

HY-8 Culvert Analysis Report

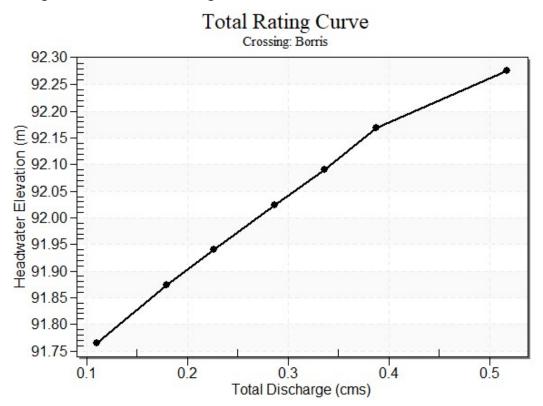
Crossing Discharge Data

Discharge Selection Method: User Defined

	-				
Headwater Elevation (m)	Discharge Names	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
		· · · ·	U ()	0 (<i>'</i>	
91.77	2YrSCS24Hr	0.11	0.11	0.00	1
91.87	5YrSCS24Hr	0.18	0.18	0.00	1
91.94	10YrSCS24Hr	0.23	0.23	0.00	1
92.02	25YrSCS24Hr	0.29	0.29	0.00	1
92.09	50YrSCS24Hr	0.34	0.34	0.00	1
92.17	100YrSCS24Hr	0.39	0.39	0.00	1
92.25	Overtopping	0.43	0.43	0.00	Overtopping

Table 1 - Summary of Culvert Flows at Crossing: Borris

Rating Curve Plot for Crossing: Borris



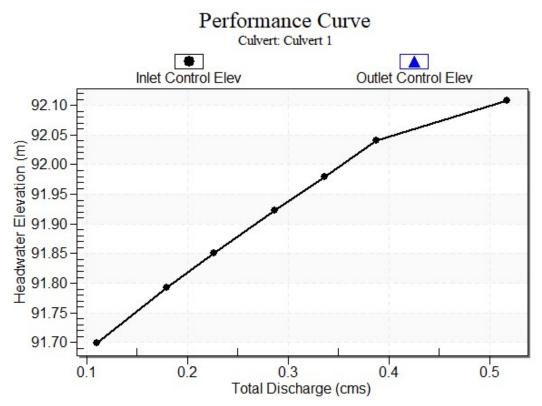
Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)
2YrSCS24Hr	0.11	0.11	91.77	0.304	0.370	2-M2c	0.441	0.204	0.204	0.068	1.203
5YrSCS24Hr	0.18	0.18	91.87	0.397	0.479	2-M2c	0.675	0.263	0.263	0.085	1.387
10YrSCS24H r	0.23	0.23	91.94	0.455	0.545	2-M2c	0.675	0.297	0.297	0.094	1.490
25YrSCS24H r	0.29	0.29	92.02	0.527	0.628	2-M2c	0.675	0.337	0.337	0.105	1.610
50YrSCS24H r	0.34	0.34	92.09	0.584	0.696	7-M2c	0.675	0.365	0.365	0.113	1.699
100YrSCS24 Hr	0.39	0.39	92.17	0.645	0.774	7-M2c	0.675	0.394	0.394	0.121	1.789

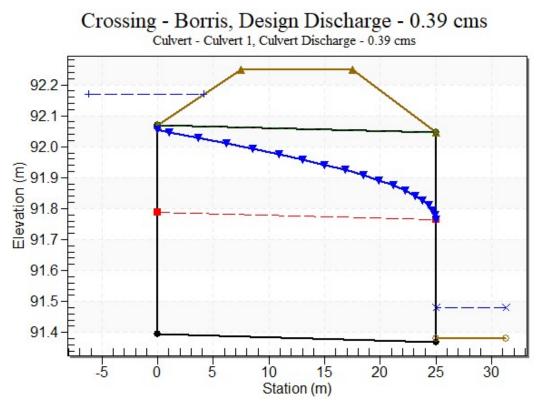
Table 2 - Culvert Summary Table: Culvert 1

Straight Culvert

Inlet Elevation (invert): 91.39 m, Outlet Elevation (invert): 91.37 m Culvert Length: 25.00 m, Culvert Slope: 0.0010







Water Surface Profile Plot for Culvert: Culvert 1

Site Data - Culvert 1

Site Data Option: Culvert Invert Data Inlet Station: 0.00 m Inlet Elevation: 91.39 m Outlet Station: 25.00 m Outlet Elevation: 91.37 m Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular Barrel Diameter: 675.00 mm Barrel Material: Corrugated Steel Embedment: 0.00 mm Barrel Manning's n: 0.0240 Culvert Type: Straight Inlet Configuration: Thin Edge Projecting Inlet Depression: None

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.11	91.44	0.06	0.32	5.66	0.53
0.18	91.45	0.07	0.38	6.98	0.55
0.23	91.46	0.08	0.42	7.72	0.57
0.29	91.47	0.09	0.45	8.58	0.59
0.34	91.47	0.09	0.48	9.21	0.62
0.39	91.48	0.10	0.49	9.84	0.64

Table 3 - Downstream Channel Rating Curve (Crossing: Borris)

Tailwater Channel Data - Borris

Tailwater Channel Option: Irregular Channel

Roadway Data for Crossing: Borris

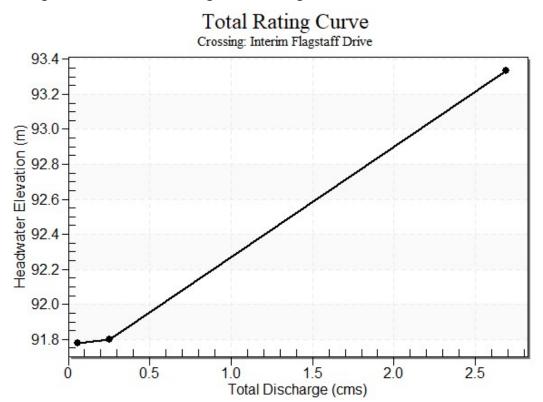
Roadway Profile Shape: Constant Roadway Elevation Crest Length: 10.00 m Crest Elevation: 92.25 m Roadway Surface: Paved Roadway Top Width: 10.00 m

Crossing Discharge Data

Discharge Selection Method: User Defined

Headwater Elevation (m)	Discharge Names	Total Discharge (cms)	Interim Flagstaff Drive Discharge (cms)	Roadway Discharge (cms)	Iterations
91.78	2-Year	0.06	0.06	0.00	1
91.80	100-Year	0.26	0.26	0.00	1
93.33	Overtopping	2.64	2.64	0.00	Overtopping

Table 4 - Summary of Culvert Flows at Crossing: Interim Flagstaff Drive



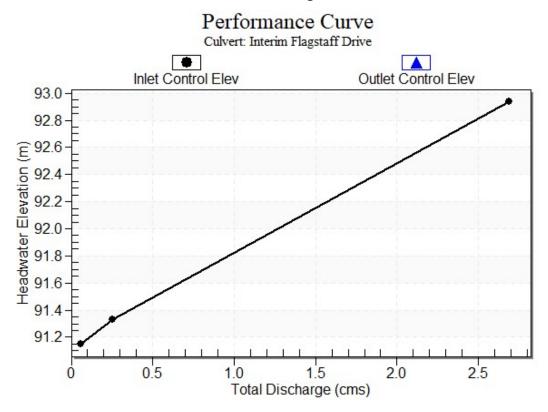
Rating Curve Plot for Crossing: Interim Flagstaff Drive

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)
2-Year	0.06	0.06	91.78	0.158	0.791	3-M1t	0.243	0.084	0.810	0.810	0.066
100-Year	0.26	0.26	91.80	0.338	0.808	3-M1t	0.601	0.210	0.810	0.810	0.292

Table 5 - Culvert Summary Table: Interim Flagstaff Drive

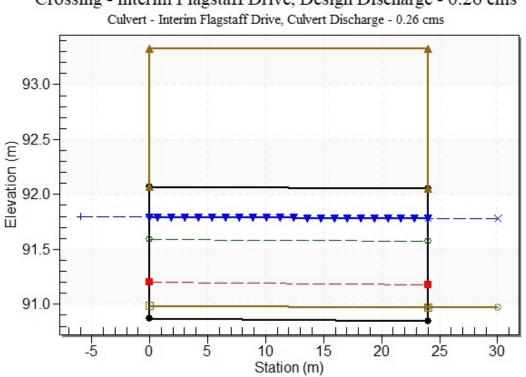
Straight Culvert

Inlet Elevation (invert): 90.99 m, Outlet Elevation (invert): 90.97 m Culvert Length: 24.00 m, Culvert Slope: 0.0008



Culvert Performance Curve Plot: Interim Flagstaff Drive





Crossing - Interim Flagstaff Drive, Design Discharge - 0.26 cms

Site Data - Interim Flagstaff Drive

Site Data Option: Culvert Invert Data Inlet Station: 0.00 m Inlet Elevation: 90.87 m Outlet Station: 24.00 m Outlet Elevation: 90.85 m Number of Barrels: 1

Culvert Data Summary - Interim Flagstaff Drive

Barrel Shape: Circular Barrel Diameter: 1200.00 mm Barrel Material: Corrugated Steel Embedment: 120.00 mm Barrel Manning's n: 0.0240 (top and sides) Manning's n: 0.0350 (bottom) Culvert Type: Straight Inlet Configuration: Thin Edge Projecting Inlet Depression: None

Flow (cms)	Water Surface Elev (m)	Depth (m)
0.06	91.78	0.81
0.26	91.78	0.81

Table 6 - Downstream Channel Rating Curve (Crossing: Interim Flagstaff Drive)

Tailwater Channel Data - Interim Flagstaff Drive

Tailwater Channel Option: Enter Constant Tailwater Elevation Constant Tailwater Elevation: 91.78 m

Roadway Data for Crossing: Interim Flagstaff Drive

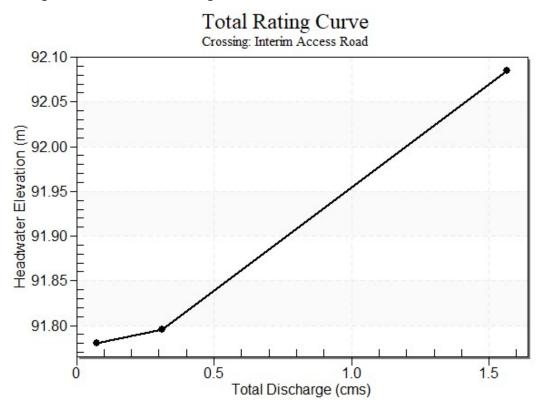
Roadway Profile Shape: Constant Roadway Elevation Crest Length: 40.00 m Crest Elevation: 93.33 m Roadway Surface: Paved Roadway Top Width: 24.00 m

Crossing Discharge Data

Discharge Selection Method: User Defined

Headwater Elevation (m)	Discharge Names	Total Discharge (cms)	Interim Access Road Discharge (cms)	Roadway Discharge (cms)	Iterations
91.78	2-Year	0.07	0.07	0.00	1
91.80	100-Year	0.31	0.31	0.00	1
92.07	Overtopping	1.38	1.38	0.00	Overtopping

Table 7 - Summary of Culvert Flows at Crossing: Interim Access Road



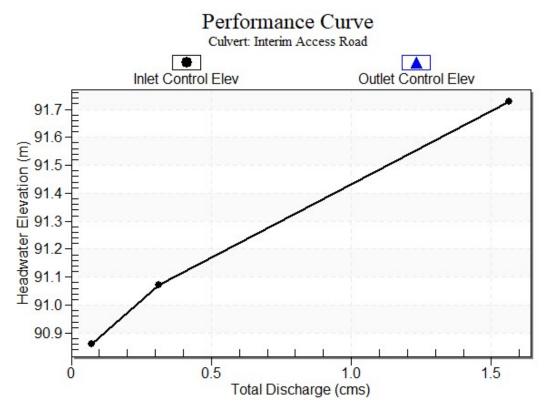
Rating Curve Plot for Crossing: Interim Access Road

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)
2-Year	0.07	0.07	91.78	0.170	1.091	4-FFf	0.149	0.098	1.080	1.170	0.068
100-Year	0.31	0.31	91.80	0.380	1.105	4-FFf	0.353	0.238	1.080	1.170	0.294

Table 8 - Culvert Summary Table: Interim Access Road

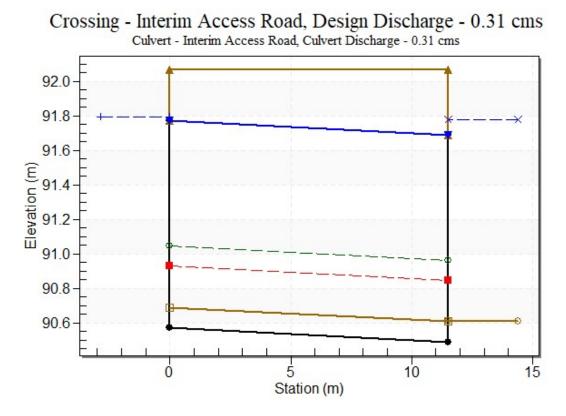
Straight Culvert

Inlet Elevation (invert): 90.69 m, Outlet Elevation (invert): 90.61 m Culvert Length: 11.50 m, Culvert Slope: 0.0070



Culvert Performance Curve Plot: Interim Access Road





Site Data - Interim Access Road

Site Data Option: Culvert Invert Data Inlet Station: 0.00 m Inlet Elevation: 90.57 m Outlet Station: 11.50 m Outlet Elevation: 90.49 m Number of Barrels: 1

Culvert Data Summary - Interim Access Road

Barrel Shape: Circular Barrel Diameter: 1200.00 mm Barrel Material: Corrugated Steel Embedment: 120.00 mm Barrel Manning's n: 0.0240 (top and sides) Manning's n: 0.0350 (bottom) Culvert Type: Straight Inlet Configuration: Thin Edge Projecting Inlet Depression: None

Flow (cms)	Water Surface Elev (m)	Depth (m)
0.07	91.78	1.17
0.31	91.78	1.17

Table 9 - Downstream Channel Rating Curve (Crossing: Interim Access Road)

Tailwater Channel Data - Interim Access Road

Tailwater Channel Option: Enter Constant Tailwater Elevation Constant Tailwater Elevation: 91.78 m

Roadway Data for Crossing: Interim Access Road

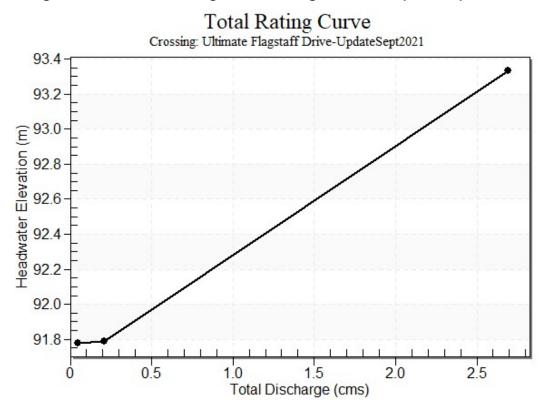
Roadway Profile Shape: Constant Roadway Elevation Crest Length: 47.00 m Crest Elevation: 92.07 m Roadway Surface: Paved Roadway Top Width: 11.50 m

Crossing Discharge Data

Discharge Selection Method: User Defined

Headwater Elevation (m)	Discharge Names	Total Discharge (cms)	Ultimate Flagstaff Drive Discharge (cms)	Roadway Discharge (cms)	Iterations
91.78	2-Year	0.05	0.05	0.00	1
91.79	100-Year	0.21	0.21	0.00	1
93.33	Overtopping	2.65	2.65	0.00	Overtopping

Table 10 - Summary of Culvert Flows at Crossing: Ultimate Flagstaff



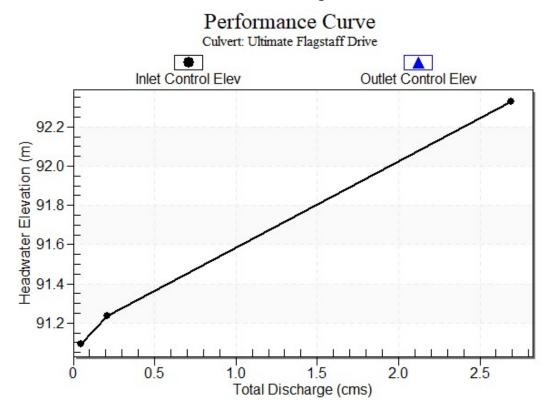
Rating Curve Plot for Crossing: Ultimate Flagstaff Drive-UpdateSept2021

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)
2-Year	0.05	0.05	91.78	0.082	0.770	3-M1t	0.168	0.054	0.800	0.810	0.049
100-Year	0.21	0.21	91.79	0.226	0.777	3-M1t	0.425	0.145	0.800	0.810	0.216

Table 11 - Culvert Summary Table: Ultimate Flagstaff Drive

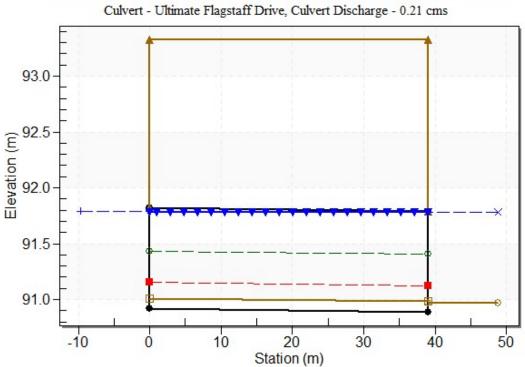
Straight Culvert

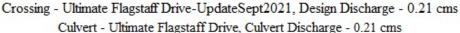
Inlet Elevation (invert): 91.01 m, Outlet Elevation (invert): 90.98 m Culvert Length: 39.00 m, Culvert Slope: 0.0008



Culvert Performance Curve Plot: Ultimate Flagstaff Drive







Site Data - Ultimate Flagstaff Drive

Site Data Option: Culvert Invert Data Inlet Station: 0.00 m Inlet Elevation: 90.92 m Outlet Station: 39.00 m Outlet Elevation: 90.89 m Number of Barrels: 1

Culvert Data Summary - Ultimate Flagstaff Drive

Barrel Shape: Concrete Box Barrel Span: 1200.00 mm Barrel Rise: 900.00 mm Barrel Material: Concrete Embedment: 90.00 mm Barrel Manning's n: 0.0130 (top and sides) Manning's n: 0.0350 (bottom) Culvert Type: Straight Inlet Configuration: 1.5:1 Bevel (90°) Headwall Inlet Depression: None

Drive-	Flow (cms)	Water Surface Elev (m)	Depth (m)
	0.05	91.78	0.81
	0.21	91.78	0.81

Table 12 - Downstream Channel Rating Curve (Crossing: Ultimate Flagstaff Drive Flow (cms) Water Surface Fley (m) Depth (m)

Tailwater Channel Data - Ultimate Flagstaff Drive-UpdateSept2021

Tailwater Channel Option: Enter Constant Tailwater Elevation Constant Tailwater Elevation: 91.78 m

Roadway Data for Crossing: Ultimate Flagstaff Drive-UpdateSept2021

Roadway Profile Shape: Constant Roadway Elevation Crest Length: 40.00 m Crest Elevation: 93.33 m Roadway Surface: Paved Roadway Top Width: 39.00 m

patersongroup

consulting engineers

- re: Geotechnical Recommendations Frost Protection Recommendations for Natural Channel Crossings Proposed Residential Development - Half Moon Bay West - Phase 3 Cambrian Road - Ottawa
- to: Mattamy Homes Mr. Reuben Noel reuben.noel@mattamycorp.com
- cc: DSEL Ms. Jennifer Ailey JAiley@dsel.ca
- date: November 8, 2021
- file: PG2246-MEMO.71 Revision 1

Further to your request and authorization, Paterson Group (Paterson) prepared the current memorandum to provide geotechnical recommendations in consideration of the service alignments anticipated to cross below the future natural channel to be located in Phase 3 of the subject site. This memorandum should be read in conjunction with Paterson Report PG2246-1 Revision 7 dated April 19, 2021.

Background Information

The following site servicing drawings prepared by David Schaeffer Engineering Ltd. (DSEL) for Phase 3 of the aforementioned development were reviewed for this memorandum:

- Plan and Profile of Flagstaff Drive Half Moon Bay West Phase 3 Project No. 19-1140 - Sheet No. 15, Revision 2 dated August 31, 2021
- Cross Section Half Moon Bay West Phase 2 Project 19-1140 Sheet No. 21, Revision 2 dated August 31, 2021

It is understood a 1,200 x 900 mm concrete box culvert crosses below and across Flagstaff Drive and two service alignments consisting of 300 mm diameter PVC watermain and sanitary services.

Geotechnical Recommendations - Service Crossings

Considering both ends of the concrete culvert will be open to ambient temperatures, insufficient soil cover is in place above the crossing watermain and sanitary pipes to provide adequate protection against frost action.

Prior to carrying out the work throughout the area of the pipe crossings, water influx from the future channel should be controlled so that the servicing operations can be conducted "in the dry". Based on the existing test hole coverage, the pipe crossings will be carried out within a deposit of stiff to firm brown silty clay.

Mr. Reuben Noel Page 2 PG2246-MEMO.71 Revision 1

This clay deposit is considered to be of very low permeability, such that it is anticipated that pumping from open excavations will be sufficient to control the minimal groundwater influx throughout the work area. However, due to the overlying permeable layer of sand, the contractor should be prepared for potentially initially moderate influx due to excavations crossing below the permeable sand layer. The contractor should be prepared to direct surface water away from subgrade areas during the construction process.

Protection Against Frost Action

Based on our review, insufficient soil cover is provided to the sanitary service pipe crossings for protection against frost action. It is recommended to insulate above the pipe cover layer for both pipes using the methodology provided in Table 1. It should be noted that the insulation should extend a minimum of 2.0 m beyond the footprint of the culvert crossing and top of the banks for the proposed natural channel along the sanitary pipe.

The recommended City of Ottawa frost protection detail *"Thermal Insulation for Storm and Sanitary Sewer/Services in Shallow Trenches"* is considered acceptable to provide adequate frost protection. However, it should be noted that installing vertical rigid insulation within an excavated trench can be difficult to implement in an efficient manner without introducing gaps which may reduce the effectiveness to protect against the detrimental effects of frost to the underlying service pipe.

The following frost protection criteria outlined in Table 1 below should be followed in lieu of the City of Ottawa standard details with additional recommendations provided for each section below:

Table 1 - Rigid Insulation Recommendations for Sewer Pipes with Reduced Soil Cover										
Thermal	Soil Cover Provided	Insulation Dimensions (mm)								
Condition	D (mm)	t (thickness)	L (extension)							
	Less than 250	Not F	ecommended							
	250 to 500	150	Extend 1,200 mm horizontally beyond edge face of the sewer							
	500 to 750	100	Extend 1,200 mm horizontally beyond edge face of the sewer							
Unheated	750 to 1,100	75	Extend 900 mm horizontally beyond edge face of the sewer							
	1,100 to 1,700	50	Extend 600 mm horizontally beyond edge face of the sewer							
	1,700 to 2,000	25	Extend 300 mm horizontally beyond edge face of the sewer							

patersongroup

Notes: All designs are based on a freezing index of 1000°C-days.

All rigid insulation should consist of either DOW Chemical High-Load 40 (HI-40) or Owens Corning Canada Foamular 400 XPS-type rigid insulation. All rigid insulation placed to improve the frost protection of the above-noted service alignments should be inspected and approved by the geotechnical consultant at the time of construction.

Pipe Bedding and Backfill

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer pipes. The bedding layer should be increased to a minimum of 300 mm where the subgrade consists of a grey silty clay. The alignment of the service pipes located over the culvert structure will require a non-woven geotextile, such as Terrafix 270 or equivalent and biaxial geogrid bedding, such as Geosynthetics TBX2500 or equivalent, to be placed over the top of the culvert structure to permit adequate compaction of the granular bedding. Alternatively, if adequate compaction of the granular bedding layer cannot be obtained, then a lean concrete bedding layer can be provided for the overlying service pipes where the storm culvert crossing occurs. The granular bedding material should extend to the spring line of the pipe. For Cover material, extending from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 99% of the material's standard Proctor maximum dry density.

Temporary Excavation Side Slopes for Pipe Crossings

The excavations for the proposed pipe crossings will be mostly through a stiff silty clay. Where excavations are above the groundwater level to a depth of approximately 3 m, the excavation side slopes should be stable in the short term at 1H:1V. Flatter slopes could be required for deeper excavations or for excavation below the groundwater level. Where such side slopes are not permissible or practical, temporary shoring should be used. The subsoil at this site is considered to be mainly a Type 2 or 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by "cut and cover" methods and excavations will not be left open for extended periods of time.

It is expected that deep service trenches in excess of 3 m will be completed using a temporary shoring system designed by a structural engineer, such as stacked trench boxes in conjunction with steel plates. The trench boxes should be installed to ensure that the excavation sidewalls are tight to the outside of the trench boxes and that the steel plates are extended below the base of the excavation to prevent basal heave (if required).

patersongroup

Mr. Reuben Noel Page 4 PG2246-MEMO.71 Revision 1

It is recommended to reinstate sidewall banks below the culvert crossing using an engineered fill, such as OPSS Granular A or OPSS Granular B Type II crushed stone if a shoring system will not be used. This sidewall reinstatement fill should placed in maximum 300 mm thick loose lifts and compacted to a minimum of 99% of the materials SPMDD.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

We trust that this information satisfies your immediate requirements.

Best Regards,

Paterson Group Inc.

Drew Petahtegoose, B.Eng.



David J. Gilbert, P.Eng.

Paterson Group Inc.

Head Office 154 Colonnade Road South Ottawa - Ontario - K2E 7J5 Tel: (613) 226-7381 Northern Office and Laboratory 63 Gibson Street North Bay - Ontario - P1B 8Z4 Tel: (705) 472-5331 Ottawa Laboratory 28 Concourse Gate - Unit 6 Ottawa - Ontario - K2E 7T7 Tel: (613) 226-7381

APPENDIX F

SUMP PUMP FEASIBILITY REPORT, HALF MOON BAY RESIDENTIAL DEVELOPMENT, PG4073-LET.02, REVISION 6 (PATERSON GROUP, AUGUST 25, 2021)

patersongroup

August 25, 2021 File: PG4073-LET.02 Revision 6

Mattamy Homes

50 Hines Road, Suite 100 Ottawa, Ontario K2K 2M5 **Consulting Engineers**

154 Colonnade Road South Ottawa, Ontario Canada, K2E 7J5 **Tel: (613) 226-7381 Fax: (613) 226-6344**

Geotechnical Engineering Environmental Engineering Hydrogeology Geological Engineering Materials Testing Building Science Noise and Vibration Studies

www.patersongroup.ca

Attention: Mr. Colin Haskin

Subject: Sump Pump Feasibility Report Half Moon Bay West Residential Development Ottawa, Ontario

Dear Sir,

Paterson Group Inc. (Paterson) has prepared the following letter to detail the results of our groundwater monitoring program and provide design recommendations to ensure the current phase of the development meets the City of Ottawa criteria within the technical bulletin for sump pump systems for residential developments. The current report has been updated to include responses to recent City comments prepared for Phase 3 of Half Moon Bay West. Our responses to the comments have been highlighted throughout the report. It should be noted that the investigation coverage area discussed in the current revision of this report includes the current development phase (Phase 3).

The proposed groundwater monitoring program within the developed area was recommended to provide information on the effect that development has on groundwater levels within a former agricultural field over a low permeability soil, such as a deep silty clay deposit. The results of the monitoring program within the developed area will be compared to the pre-construction area within Half Moon Bay West, which is located within the adjacent agricultural field and over the same deep silty clay deposit to provide a more detailed analysis on the loss of the shallow perched water typically observed within agricultural fields over low permeability soils.

Paterson also completed a supplemental soil review consisting of a series of sieve and hydrometer tests on selected soil samples from within the 1.5 m interval below design underside of footing elevation to provide supplemental information regarding the anticipated soil profile. The results of our sieve and hydrometer testing are attached to the present letter report. For additional details regarding soil profiles encountered within the proposed Half Moon Bay West development, reference should be made to our geotechnical investigation report presented under cover Report PG2246-1 Revision 4 dated November 7, 2017. Falling head (slug) testing was also completed at the recently installed monitoring wells as part of our groundwater monitoring program to determine hydraulic conductivity at a 150 m grid spacing as per City recommendations.

Mr. Colin Haskin Page 2 File: PG4073-LET.02 Revision 6

1.0 Groundwater Monitoring Program

The groundwater monitoring wells installed for the monitoring program within the future development of Half Moon Bay West were completed by a licensed well contractor under the supervision of Paterson personnel in April 2017 and July 2018. At that time, the well contractor installed two (2) groundwater monitoring wells at each of the ten (10) well cluster locations (MW 1 to MW 10) and an additional 10 well locations (MW 17 to 24). The monitoring wells were constructed in accordance with design recommendations from City of Ottawa staff. Refer to the attached figures entitled Monitoring Well Details attached for specific details of the monitoring well construction. The monitoring well locations within Half Moon Bay West are presented in Drawing PG4073-1 - Test Hole Location Plan attached. Based on the results of the additional boreholes completed to meet City of Ottawa borehole spacing guidelines, the native silty clay soils within the study area are considered to be laterally continuous. A total of 93 boreholes were completed across the subject site and a silty clay deposit was identified at each borehole location at similar elevations across the proposed Half Moon Bay West development.

Paterson personnel completed the initial groundwater readings at MW 1 to MW 10 on April 27, 2017, at which time continuous groundwater data loggers were installed at each of the monitoring well locations. The data from the data loggers are presented in Figures 13 to 22 from MW 1 to MW 10.

Six monitoring well clusters (MW 11 to MW 16) were also installed within the developed portion of the Half Moon Bay development. Details of the monitoring well construction are presented in the Monitoring Well Details attached. The monitoring well locations within the developed area are presented in Drawing PG4073-1 - Temporary Monitoring Well Location Plan.

Groundwater data loggers were also installed at MW 11 and MW 12 within the developed areas. The recorded data from November 2017 to present is detailed in Figures 24 and 25.

Falling Head (Slug) testing was completed at well locations within the pre-developed area (MW3A, MW6A, MW7A, MW7B, MW8A, MW9A, MW9B and MW10A) on April 19 and 20, 2018, (MW 1A, MW2A, MW2B, MW3A, MW4A, MW5A and MW5B) on June 21, 2018 and (MW17A, MW18B, MW19A, MW20A, MW20B, MW21A, MW22A, MW22B and MW23A) on July 11, 2018. Based on our testing results within the pre-developed area, a horizontal hydraulic conductivity varying between **1.32 x10-6 to 9.13 x10-8 m/sec** was observed at the selected monitoring well locations. Falling Head (Slug) testing was also completed at well locations within the developed area (MW12B, MW13A, MW14A and MW15A).

Based on our testing results within the developed area, a horizontal hydraulic conductivity varying between 2.79 x 10-6 to 1.54 x 10-8 m/sec was observed at the selected monitoring well locations. The results of our testing are attached to the present letter report.

Mr. Colin Haskin Page 3 File: PG4073-LET.02 Revision 6

Based on the results of our falling head (slug) testing program, the soils below the proposed founding elevation are considered to have adequately met the requirement for a low permeability soil to be present below design underside of footing level for the subject buildings where sump pumps are required.

2.0 Site and Groundwater Observations

The existing ground surface throughout the proposed Half Moon Bay West development area has been re-shaped over the years. Topsoil stripping work was completed several years ago and windrows of topsoil were stockpiled on site along with various other large fill piles, which has led to ponding of surface water from precipitation events. It is expected that the re-shaping of the former farm field surface caused a disruption of the original sheet drainage pattern toward the field ditches. Photographs of site conditions are attached.

During the installation of the monitoring wells in 2017, several areas within Half Moon Bay West were noted to have surface water ponded above original ground surface. It should be noted that surface water was not present during our original field investigations between 2003 to 2011. At the time of installation in the spring of 2017, groundwater levels at the monitoring well locations generally ranged from 91 to 93 m above sea level (asl). Over the course of the monitoring program, groundwater levels across the subject site have fluctuated by an average of 0.5 to 1 m. It should be noted that the data retrieved from MW 2B between October 26 and November 30, 2017 is expected to be the result of instrument malfunction and has been excluded from the hydrogeological evaluation presented below.

The range of fluctuations in groundwater elevations is consistent with expectations given the general composition of overburden materials on site. Silty clay has a typical hydraulic conductivity in the range of 1×10^{-7} to 1×10^{-9} m/sec, with the variability provided to account for differences in compaction and majority composition of the material at a given location. Similarly, the transmissivity of the soil, which is dependant on hydraulic conductivity, is also low, resulting in a limited ability for water to travel through the clay. The result of these low hydraulic properties is a minimal potential for groundwater elevation fluctuations, and an elevated probability that surface water will remain at surface rather than infiltrate the low permeability clay soils.

Currently, a temporary drainage ditch running north-south across the central portion of the site was installed to provide drainage for the surface water ponding throughout the site. MW1A/1B and MW5A/5B are located in close proximity to the drainage ditch and surface water drains well after precipitation events in the area of these two well cluster locations. The groundwater level at MW1A/1B and MW5A/5B is approximately 2.2 to 2.3 m below existing ground surface.

Mr. Colin Haskin Page 4 File: PG4073-LET.02 Revision 6

The well clusters installed for the groundwater monitoring program within Half Moon Bay West were installed within raised fill piles to verify the impact that construction activities have had on drainage and surface water issues within the subject site. Recorded water levels were noted to be above original ground surface at the well cluster locations due to the lack of surficial drainage caused by stockpiled materials and construction activities, as well as, the underlying low permeability soils. These pre-development groundwater level readings recorded at our well cluster locations should not be considered for design of footing level for the proposed development. It should be noted that historic groundwater level observations at our borehole locations indicate the long-term groundwater level (pre-development) is located approximately 1 to 2 m below original ground surface (~91.5 to 92.5 m).

To contrast the pre-development conditions within Half Moon Bay West, six well clusters (MW11A/11B to MW16A/16B) were installed within a developed portion of the Half Moon Bay development. These areas were developed within the last 8 years and adequately represent a post-development groundwater level for the Half Moon Bay area. The results of our monitoring within the post-developed area indicate that the water level is located well below existing and original ground surface. The current results of the on-going post-development monitoring program indicate that the groundwater level is approximately 2.7 to 3.4 m below existing ground surface.

The recorded groundwater levels within the developed area are approximately located at or below spring level of the adjacent storm sewer pipes. It is anticipated that this same level of dewatering will occur within Half Moon Bay West, once service pipes have been installed. It is further expected that the proposed building sump pumps will handle water flows from precipitation events and during spring melt only, as per City guidelines. Mr. Colin Haskin Page 5 File: PG4073-LET.02 Revision 6

3.0 Summary and Recommendations

Based on review of grading plans for the overall HMB West development and review of detailed grading plans for Phase 3 of the HMB West development prepared by David Schaeffer Engineering Limited (DSEL), it was noted that design underside of footing elevations will not extend below spring line of storm sewers for Half Moon Bay West. Based on the results of our monitoring program to date, the conceptual design underside of footing elevations are acceptable and will be located above the pre-development long-term groundwater level and post-development groundwater level. Therefore, the use of sump pumps should be permitted for Half Moon Bay West residential development.

It is recommended that a post-development groundwater monitoring program be initiated for Phase 1 of the development. A series of monitoring wells should be installed adjacent to foundations under construction to monitor the dewatering activity, which occurs during the construction period. Long-term monitoring wells can be installed in public right-of-ways to further monitor the groundwater level lowering. Periodic reports summarizing groundwater levels can be submitted for discussion purposes. Additional details can be provided at a later date.

Further to your request and authorization, Paterson Group (Paterson) has completed a review of the foundation drainage infiltration levels anticipated for the proposed buildings to be constructed at the Half Moon Bay West development. The present memorandum summarizes the results of our foundation drainage infiltration review.

4.0 Sump Pump Feasibility and Drainage Infiltration Review

Our sump pump feasibility and foundation drainage infiltration review was completed for two scenarios (transient conditions and long-term Steady State conditions) using several assumptions. The most critical case to be reviewed would be during transient conditions where the pre-development groundwater level is lowered due to the installation of a storm sewer system. For review purposes, a transient groundwater level of 1 m below finished grade was assumed. This value considers that the installation of the services has been completed several months prior to the construction of the proposed building foundation. The presence of the service alignments are anticipated to lower the observed pre-development groundwater levels over the next several months after installation. It is further anticipated that the long-term groundwater level (post-development) will establish below the design footing level. Therefore, the foundation drainage system will only handle water from storm events and spring melt for the long-term scenario.

With respect to the existing fill material present throughout the site, it is expected that this will be stripped as the development progresses and replaced with previously excavated site clay (sourced from the SWMP excavation works) currently stockpiled on site as part of the ongoing surcharge program. Based on current grading plans, the majority of the proposed

patersongroup

Mr. Colin Haskin Page 6 File: PG4073-LET.02 Revision 6

building footings will be founded directly over the native silty clay. However, it is expected that engineered fill could be required for areas where sub-excavation due to disturbed soils is required and/or in areas where native soils are below design footing level. For areas where the proposed footings will be placed on engineered fill, it is recommended extend the engineered fill beyond the footing face to provide a 1.5H:1V slope down and out from the footing to provide adequate lateral support. This granular fill lateral support profile will be capped with a minimum 600 mm thick layer of suitable clay fill along the building perimeter to further ensure that an adequate seal is in place surrounding the proposed building foundation.

The clay backfill, placed with suitable moisture levels to permit adequate compaction, will then be proof-rolled using a small sheepsfoot roller in order to achieve adequate compaction. Once compacted, the backfill is expected to exhibit lower hydraulic properties than the underlying native material. As such, the drainage infiltration calculations included as part of this review utilise the highest hydraulic conductivity obtained from the slug testing completed on site in order to provide the most conservative estimate of groundwater infiltration volumes.

The following items were used in our calculations for both scenarios:

- Typical Single Lot Building Dimensions: 7.5 m x 16 m
- Worst Case Perimeter Drainage Depth below Finished Grade: 3 m
- Groundwater level at 1 m below finished grade.
- Surface Water 100 year, 24 hr. storm event: 115.6 mm
- Infiltration factors of 0.5 based on Topographic factor of 0.25 (1 to 2 m over 1 km), soil factor of 0.15 (clay/clay loam) and cover factor of 0.1 (grass) using the MOE Stormwater Management and Design Manual.
- $\Box \qquad \text{Hydraulic Conductivity: 7.9 x } 10^{-7} \text{ m/sec}$
- Clay backfill against building foundation with composite drainage blanket against exterior foundation wall (typical residential construction).

Using the Dupuit Forchheimer relationship, a volume of approximately 19,000 L/day is anticipated as a worst case scenario under transient groundwater conditions. Surface water infiltration was calculated using an infiltration factor of 0.5 as noted above. Given the relatively impermeable nature of the backfill being used at the subject site, it was conservatively estimated that the only surface water contributions to pumping volumes will result from poor roof drainage infiltrating along the foundation walls. As such, volumes were calculated using the above noted building dimensions of 7.5 m x 16 m. A volume of 7,000 L was calculated for surface water infiltration during a 100 year, 24 hour storm event. Therefore, it is expected that the building's sump pump will handle approximately 26,000 L/Day as a worst case scenario during transient conditions.

An additional sensitivity analysis was completed to determine the maximum potential infiltration volumes during transient conditions for a scenario in which the soils surrounding the foundation were fully saturated. For this scenario, the groundwater level was raised to 0 m below finished grade and the remaining hydraulic properties were kept the same as

patersongroup

Mr. Colin Haskin Page 7 File: PG4073-LET.02 Revision 6

those noted above, which is a conservative estimate given the clay fill being placed at the subject site. The results of the additional analysis provided a groundwater infiltration volume of approximately 21,000 L/day and a total of 28,000 L/day when factoring in surface water volumes, a relatively minimal increase over the previously noted transient condition infiltration volumes.

Upon completion of construction activities, the long-term (post-development) static groundwater table will be located below design footing level. Therefore, the most significant water infiltration for the foundation drainage system will be the surface infiltration volumes during storm events and a temporary increase in groundwater level. Using the same infiltration factor and a more typically occurring 5 year, 1 hour storm event that produces an estimated total of 0.0265 m of precipitation, the building's sump pump will handle a maximum of approximately 1,600 L of water, well below the minimum requirements of the required sump system and backup as outlined in Sections 5.12.2.1 and 5.12.2.4 of City of Ottawa Technical Bulletin ISTB-2018-04.

A sample groundwater infiltration calculation and the intensity duration frequency (IDF) curve used to calculate the surface water infiltration component have been appended to the current report.

Based on our review, a sump pump system can handle the anticipated ingress rates during both transient and static long-term groundwater conditions for a typical house constructed at the Half Moon Bay West development provided that the buildings' sump systems are installed in accordance with City of Ottawa Technical Bulletin ISTB-2018-04.

Criteria for sump pumps for the subject site, including criteria specific to the primary and back-up sump pump are detailed below:

Sump pumps shall be:

- a submersible pump;
- automatically controlled and set to maintain the water level at the same elevation as the foundation drain;
- **capable of discharging a minimum flow of 0.9 L/sec at 3.6 meters head.**

5.0 Clay Seal at Servicing Trench, Impermeable Cap and Drainage Boundary along Foundation

Clay Seal Recommendations

A clay seal within the service trench is required to be placed within the City side of the property line for each residence and placed in accordance with the following recommendations and City of Ottawa Drawing S8 - Clay Seal for Pipe Trenches. The clay

patersongroup

Mr. Colin Haskin Page 8 File: PG4073-LET.02 Revision 6

seal should be at least 1 m long (in the trench direction), and should extend from trench wall to trench wall. Generally, the seals should extend from the underside of the pavement structure and/or bedding layer for sidewalk and fully penetrate the bedding, sub-bedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay approved by the geotechnical consultant at the time of placement and be placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the material's SPMDD. The placement of the clay seal should be reviewed and approved by the geotechnical consultant at the time of placement.

Impermeable Cap

An impermeable cap is recommended to be placed at ground surface and shaped in accordance with the lot grading design. The cap material should consist of an asphalt finish (ie.- driveway areas) or a **minimum 150 mm thick topsoil layer**, which includes a minimum 60% fines content (ie.- less than 0.074 mm/No. 200 sieve). It is recommended that at least 3 representative soil samples of the topsoil layer be collected by the geotechnical consultant at the time of placement to determine suitability for use as the impermeable cap layer. Hydrometer (sieve) testing on the representative soil samples and in-situ permeameter testing are recommended to determine the soil's suitability as an impermeable cap. It is recommended that the impermeable cap material provide a maximum field saturated hydraulic conductivity rate of **1 x10⁻⁶ m/sec** for areas where the topsoil layer is required.

Drainage Boundary along Foundation Walls

It is recommended that the drainage boundary along the exterior side of each building foundation wall consist of minimum 1.5 m wide clay backfill placed in maximum 300 mm loose lifts and lightly compacted. A composite drainage system (such as system Platon or Miradrain G100N) connected to a perimeter drainage system is required to be in place for each exterior wall of the subject building. The clay backfill should extend from the underside of the footing to the subgrade level of the pavement structure or landscaping finishing layer. It should be noted that clay backfill is not required within the garage and front porch. The backfill below the garage and front porch should consist of free draining, non-frost susceptible backfill, such as clear crushed stone, clean sand, Granular B Type I (pit run) or geofoam EPS blocks (lightweight fill).

It is recommended that two representative soil samples of the clay backfill be submitted for hydrometer testing by the geotechnical consultant to determine fines content of the backfill material. The fines content should be no less than 50% for the representative soil sample and 90% of the material should pass through a 2 mm sieve size to be considered suitable for placement within the building's drainage boundary.

Mr. Colin Haskin Page 9 File: PG4073-LET.02 Revision 6

6.0 Artesian Groundwater Pressure encountered within Park Block

It should be noted that the underlying soil profile has been evaluated for the potential impact of an artesian groundwater condition below the proposed buildings located in close proximity to the identified artesian openings (park block). The artesian openings were encountered within the proposed Park Block of Phase 3 during a topsoil removal program and the flowing condition was noted for the past several years. However, it should be noted that the area previously observed as undergoing an artesian groundwater flowing condition has recently stopped flowing as first noted in March 2021. Construction of the artesian containment cell system is still recommended for the area identified in Paterson Report PG2246-MEMO.52 Revision 11 dated August 26, 2021. However, no additional construction precautions are required for the housing (Phase 3) located adjacent to the park block based on our recent investigation for excavation limits. The results of our review of the servicing, sump pump system and housing design details and our recommendations are presented in Report PG2246-MEMO.72 dated July 28, 2021 attached. It should be further noted that no future additional discharge sources are expected based on our investigation observations, absence of active groundwater artesian flow conditions and review of the development design details for the Half Moon Bay West (including Phase 3) development area.

We trust that this information satisfies your requirements.

Best Regards,

Paterson Group Inc.

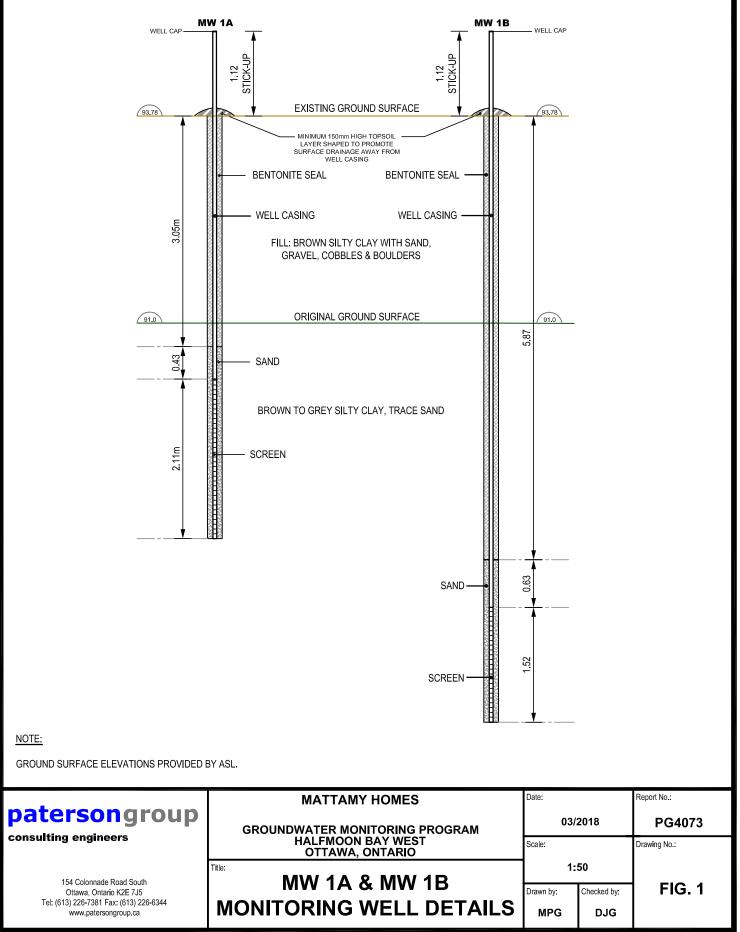
Michael Killam, P.Eng.



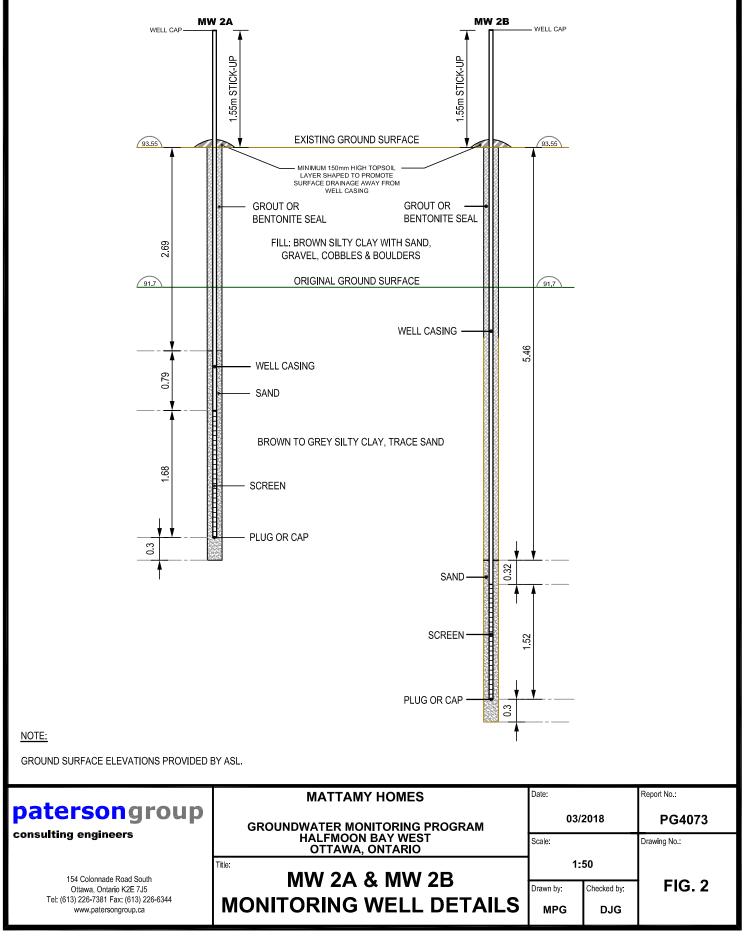
David J. Gilbert, P. Eng.

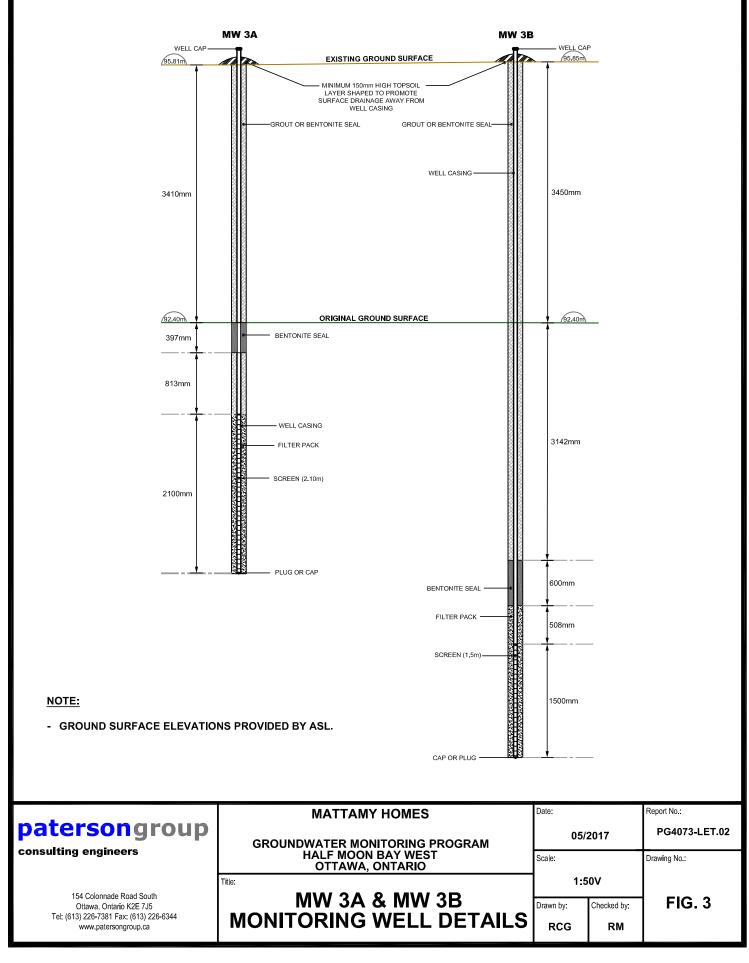
Paterson Group Inc.

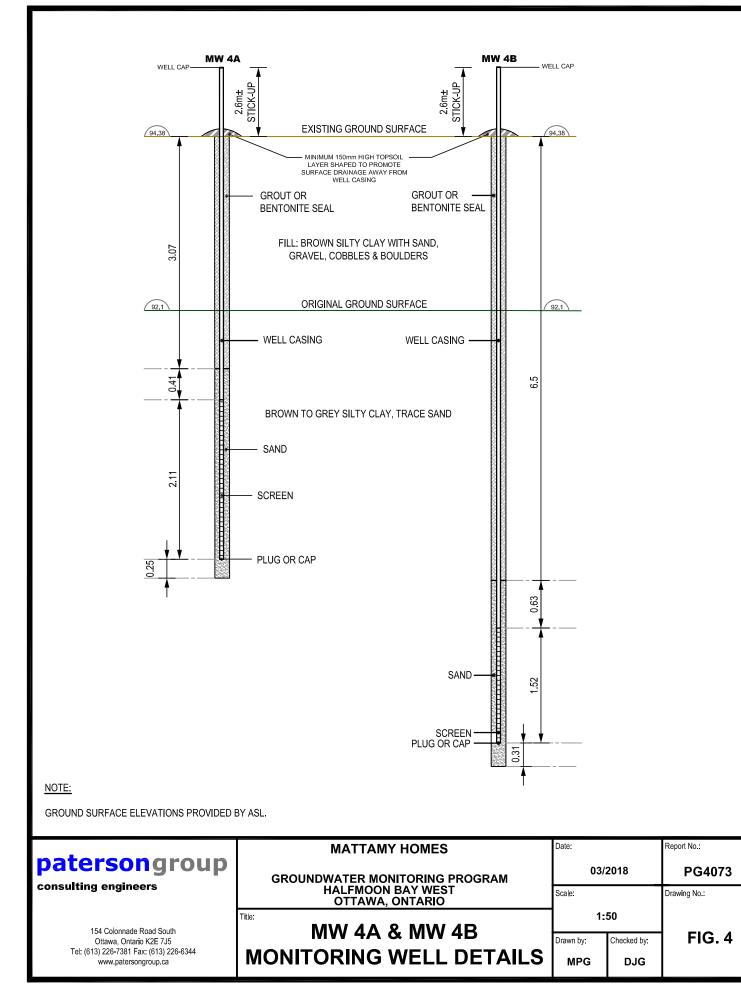
Head Office and Laboratory 154 Colonnade Road South Ottawa - Ontario - K2E 7J5 Tel: (613) 226-7381 Fax: (613) 226-6344 Northern Office and Laboratory 63 Gibson Street North Bay - Ontario - P1B 8Z4 Tel: (705) 472-5331 Fax: (705) 472-2334 **St. Lawrence Office** 993 Princess Street Kingston - Ontario - K7L 1H3 Tel: (613) 542-7381

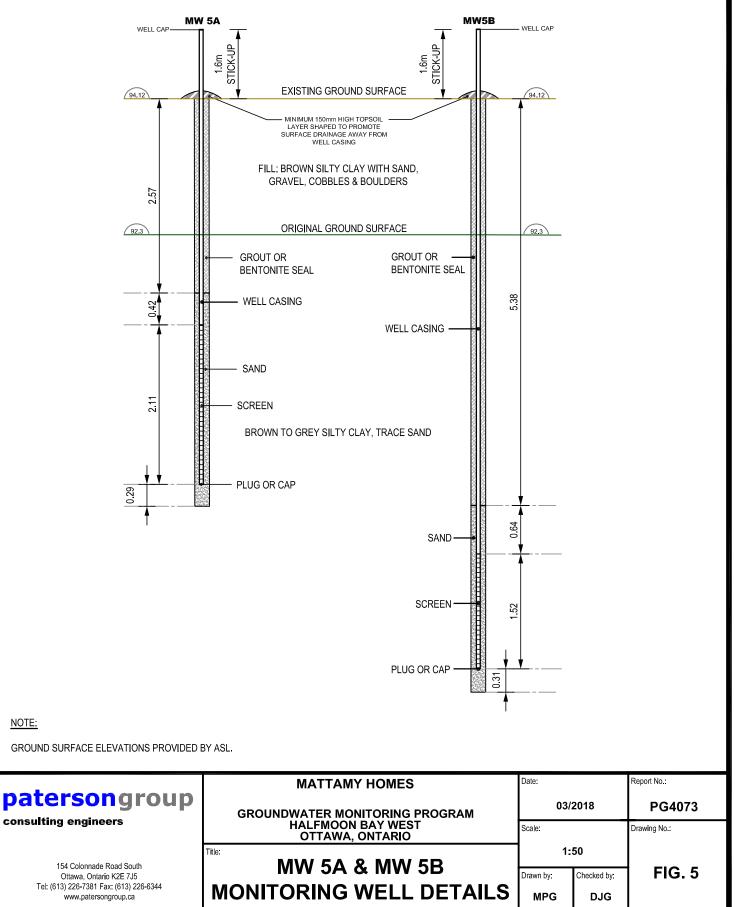


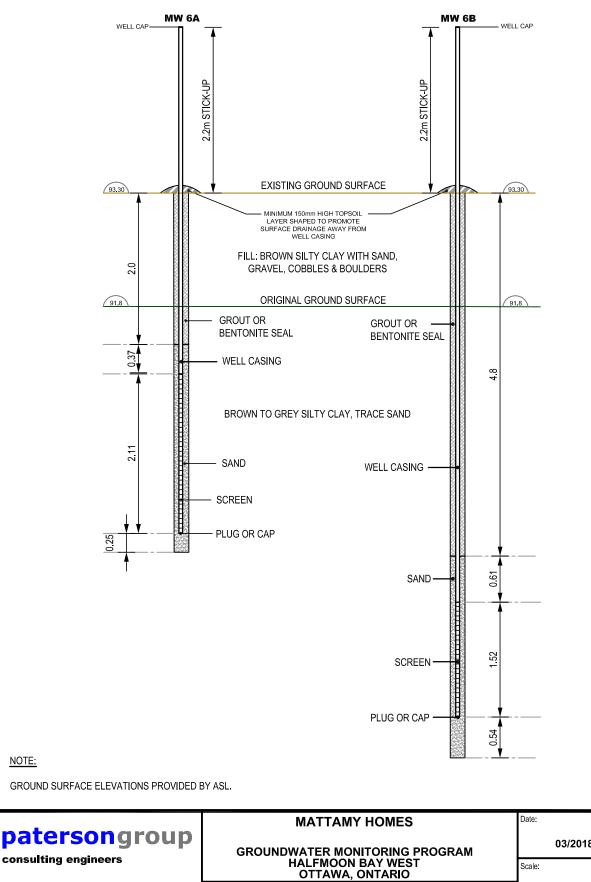
p:\autocad drawings\geotechnica\\pg40xx\pg4073\working monitoring wells dwg











MW 6A & MW 6B

MONITORING WELL DETAILS

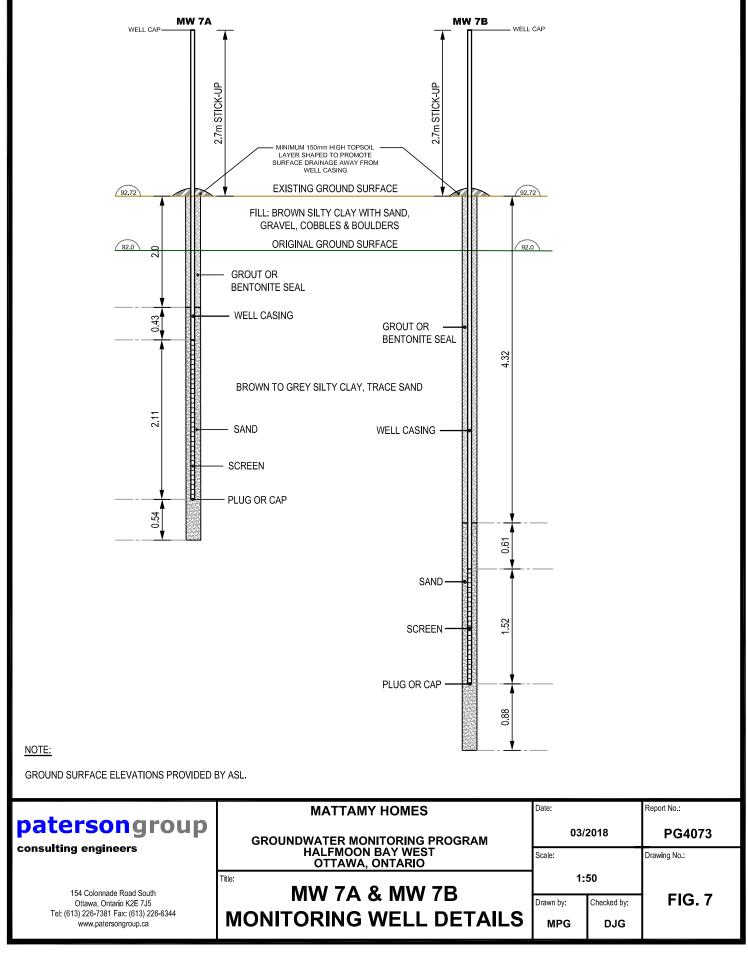
Report No .: 03/2018 PG4073 Drawing No.: 1:50 FIG.6 Drawn by: Checked by: MPG DJG

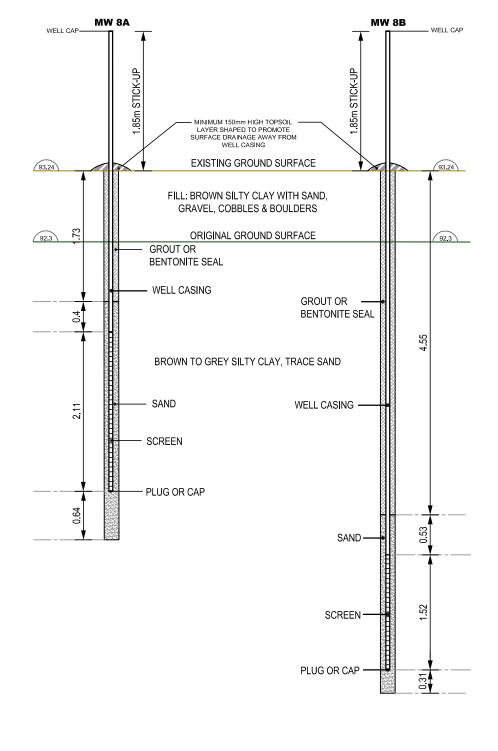
p:\autocad drawings\geotechnica\\pg40xx\pg4073\working monitoring wells dwg

154 Colonnade Road South Ottawa, Ontario K2E 7J5 Tel: (613) 226-7381 Fax: (613) 226-6344 www.patersongroup.ca

Title:

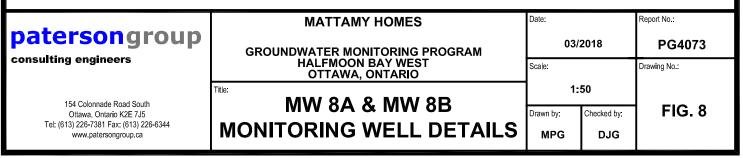
NOTE:

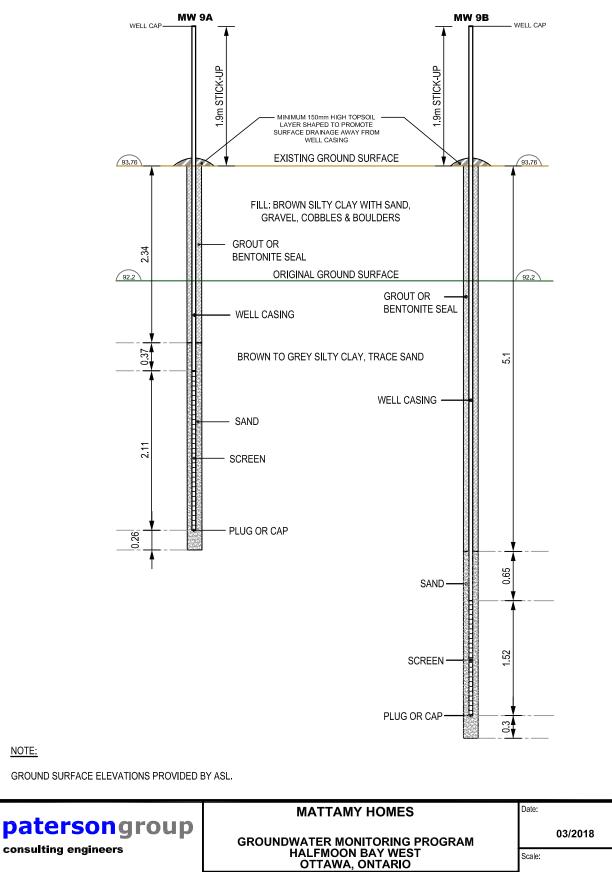




GROUND SURFACE ELEVATIONS PROVIDED BY ASL.

NOTE:





MW 9A & MW 9B

MONITORING WELL DETAILS

NOTE:

consulting engineers

154 Colonnade Road South

Ottawa, Ontario K2E 7J5

Tel: (613) 226-7381 Fax: (613) 226-6344 www.patersongroup.ca

Title:

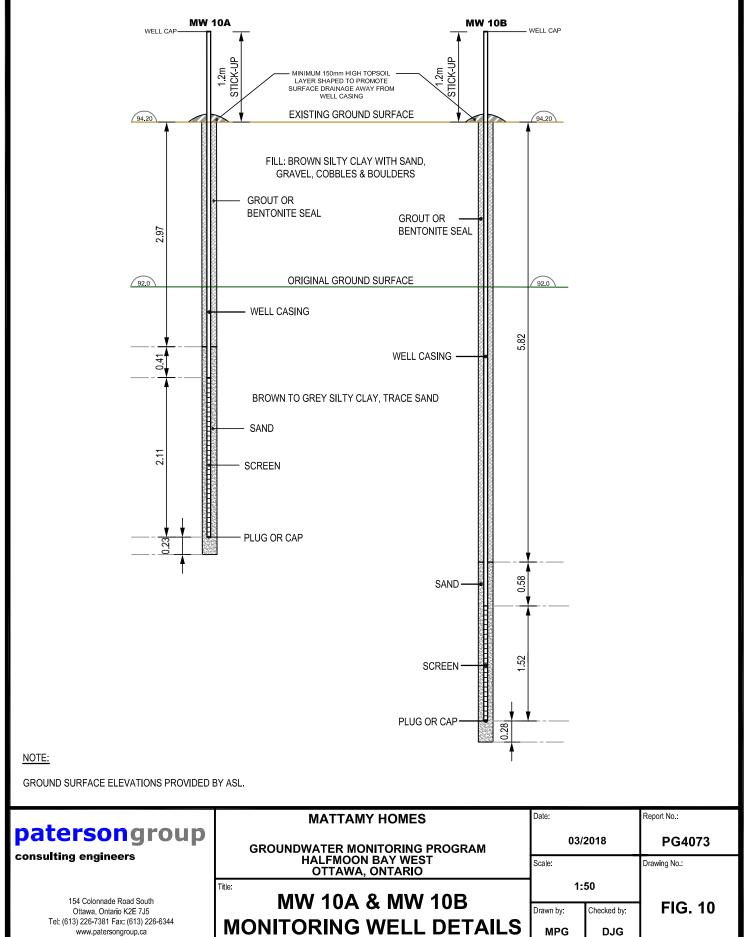
Report No .: PG4073 Drawing No.: 1:50 **FIG. 9** Checked by: DJG

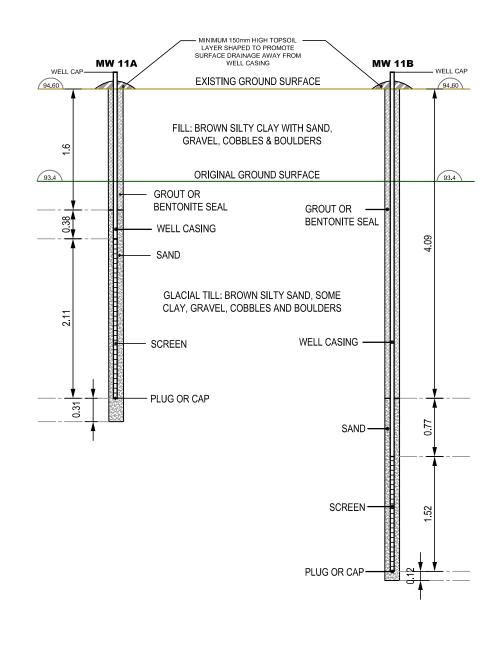
Scale:

Drawn by:

MPG

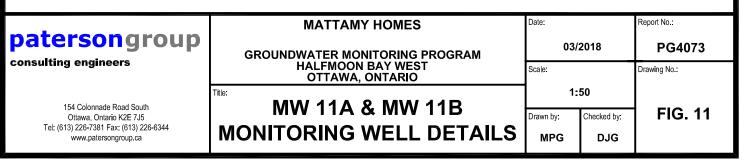
p:\autocad drawings\geotechnica\\pg40xx\pg4073\working monitoring wells dwg

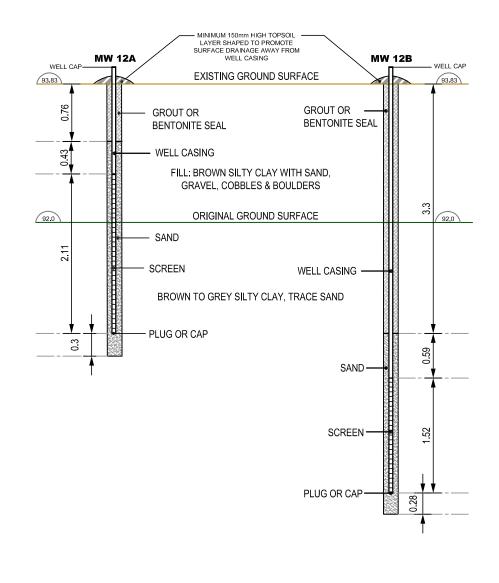




NOTE:

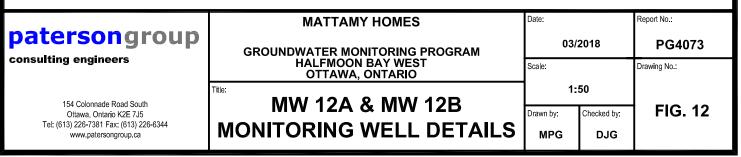
GROUND SURFACE ELEVATIONS PROVIDED BY ASL.

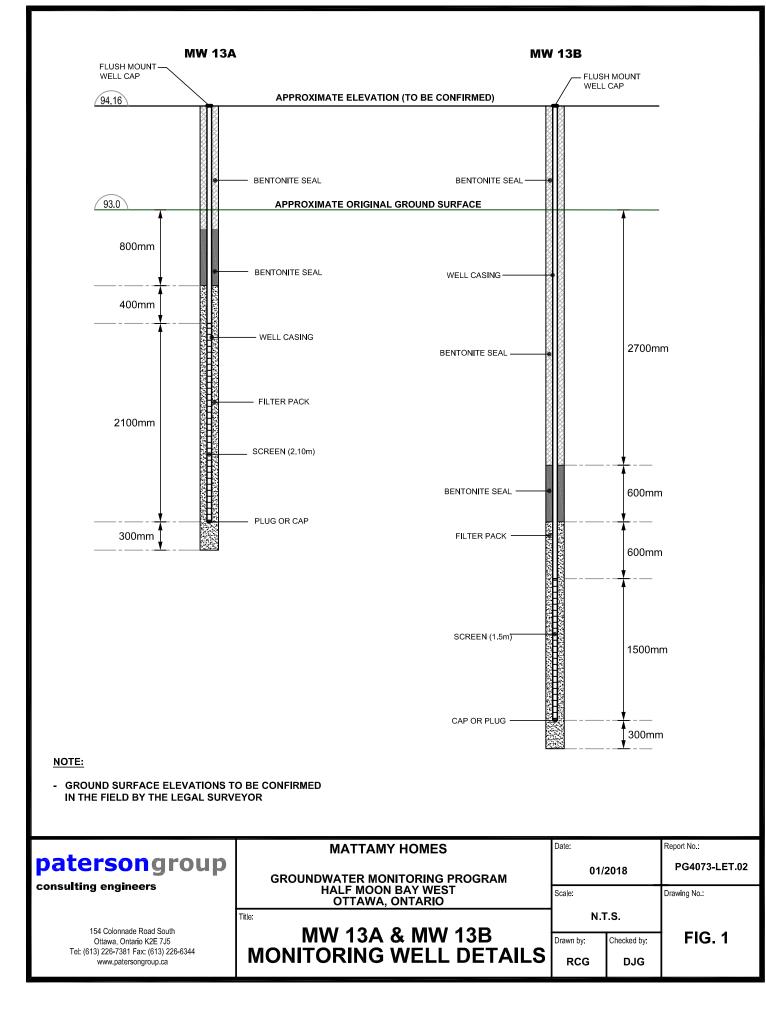


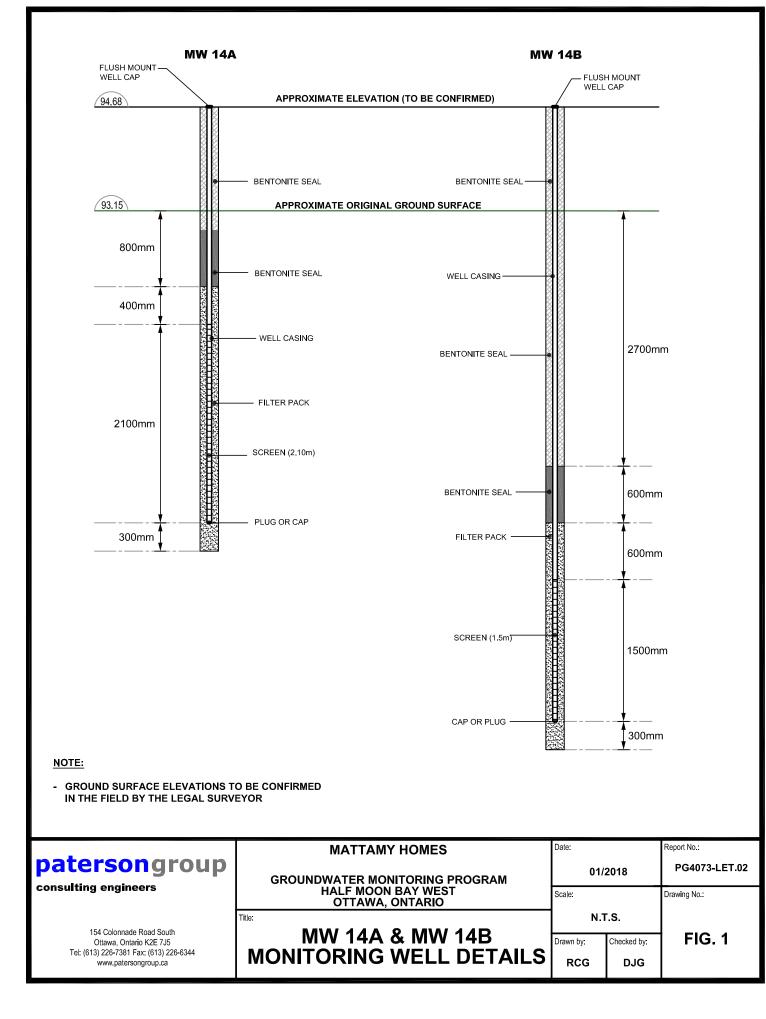


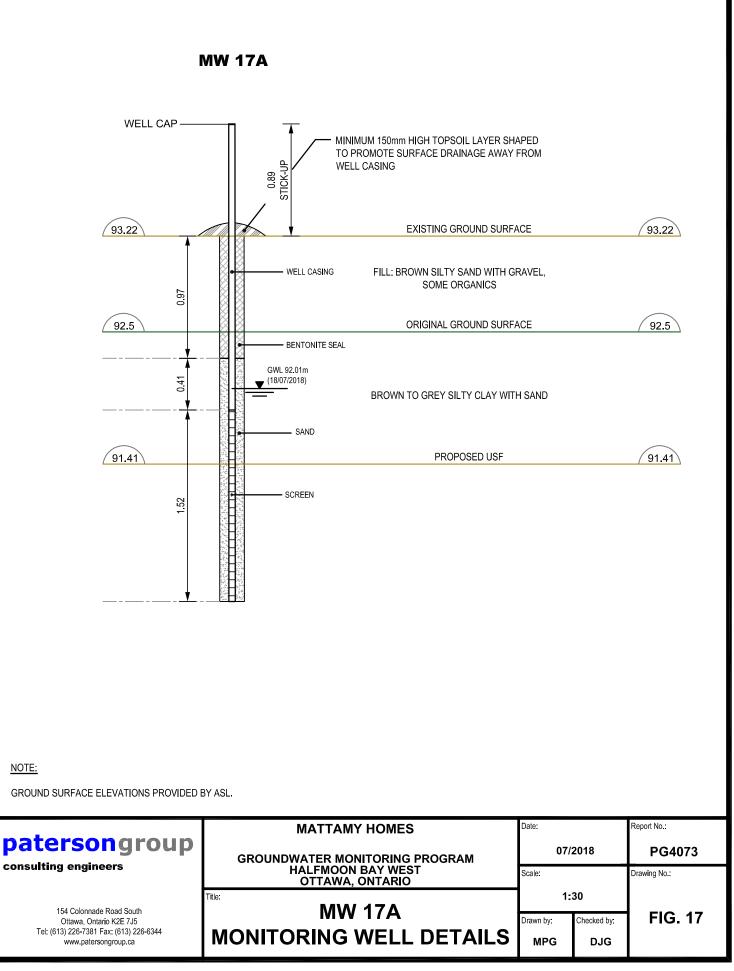
NOTE:

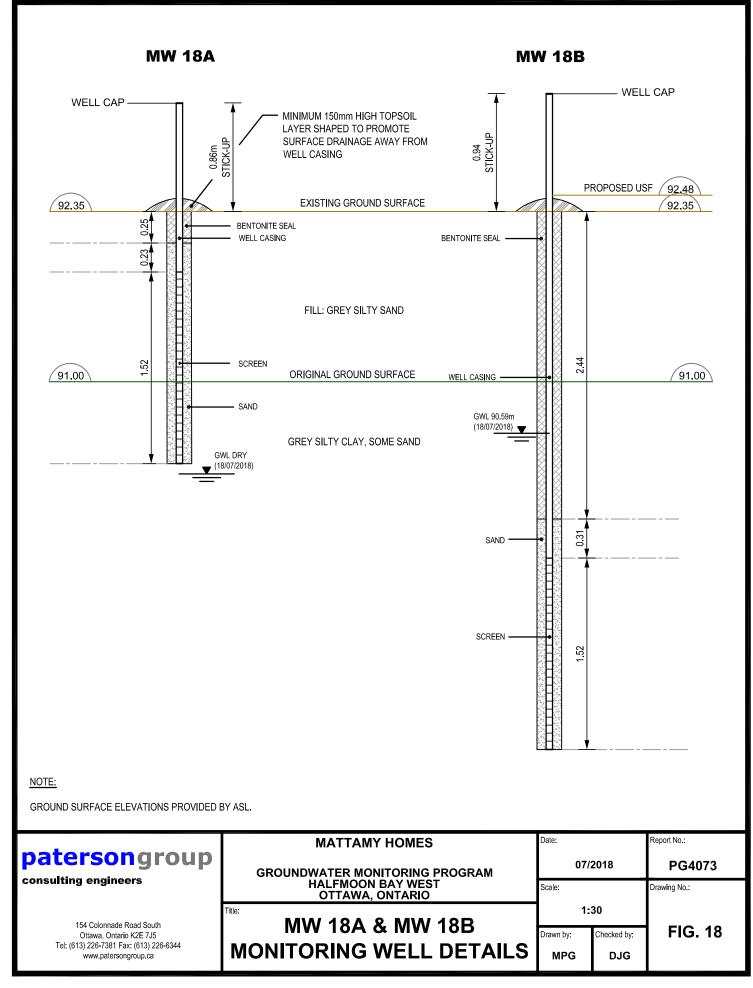
GROUND SURFACE ELEVATIONS PROVIDED BY ASL.



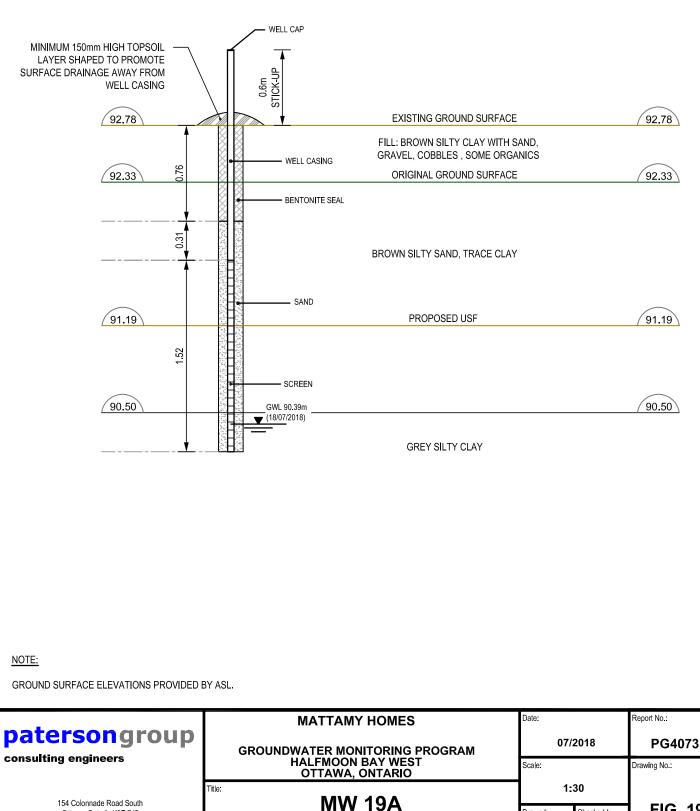












MONITORING WELL DETAILS

154 Colonnade Road South Ottawa, Ontario K2E 7J5 Tel: (613) 226-7381 Fax: (613) 226-6344 www.patersongroup.ca

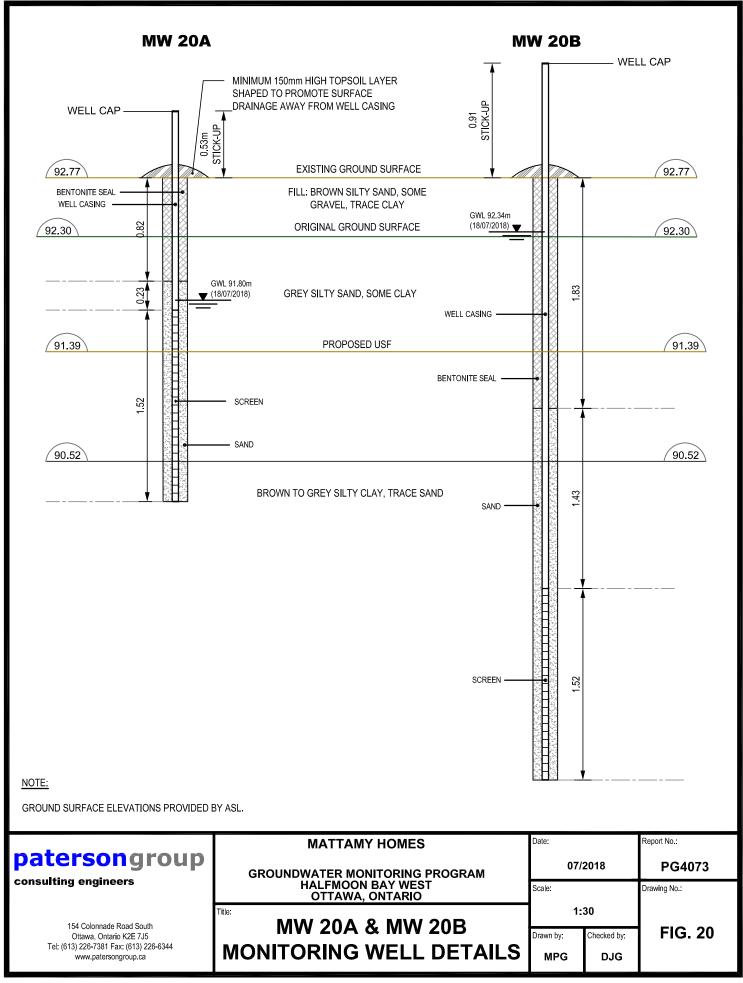
FIG. 19

Drawn by:

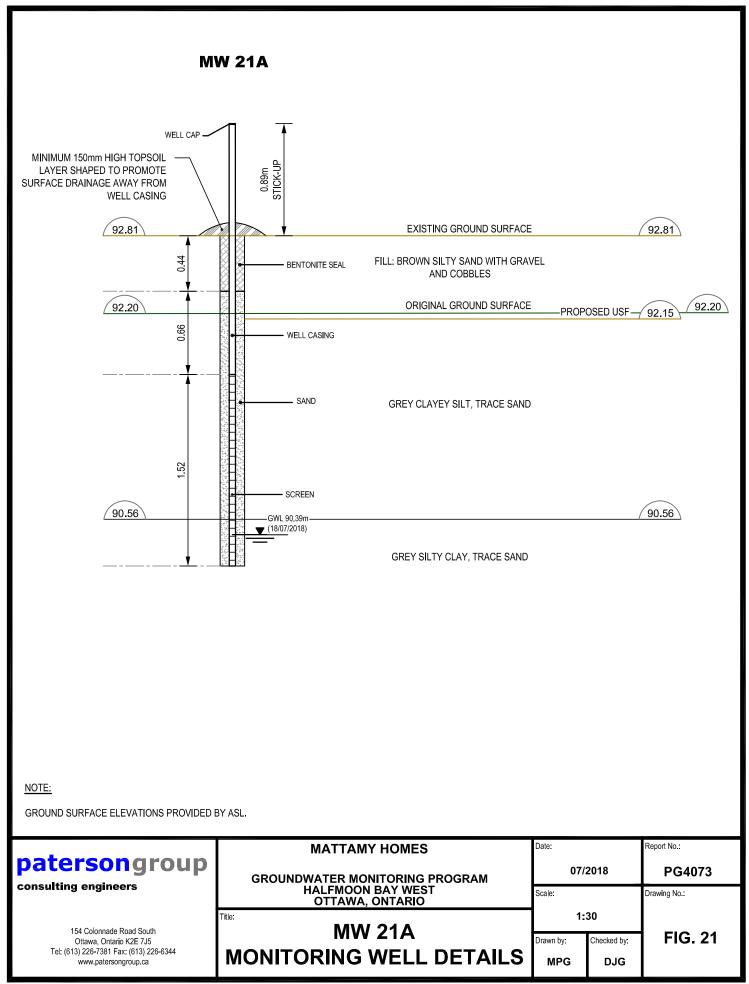
MPG

Checked by:

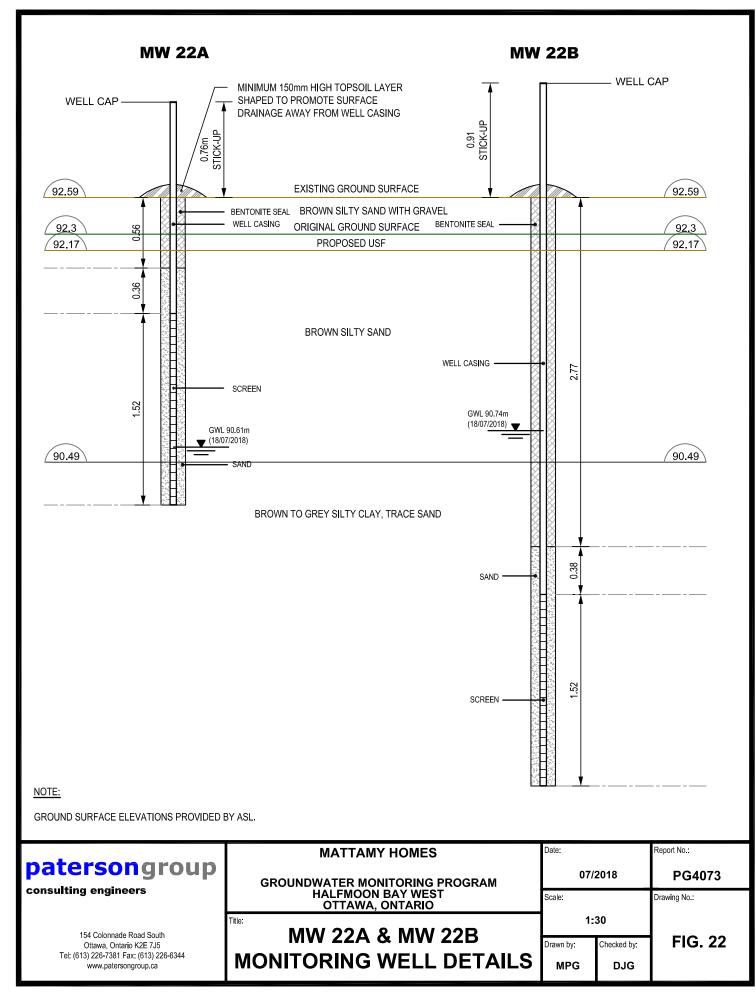
DJG



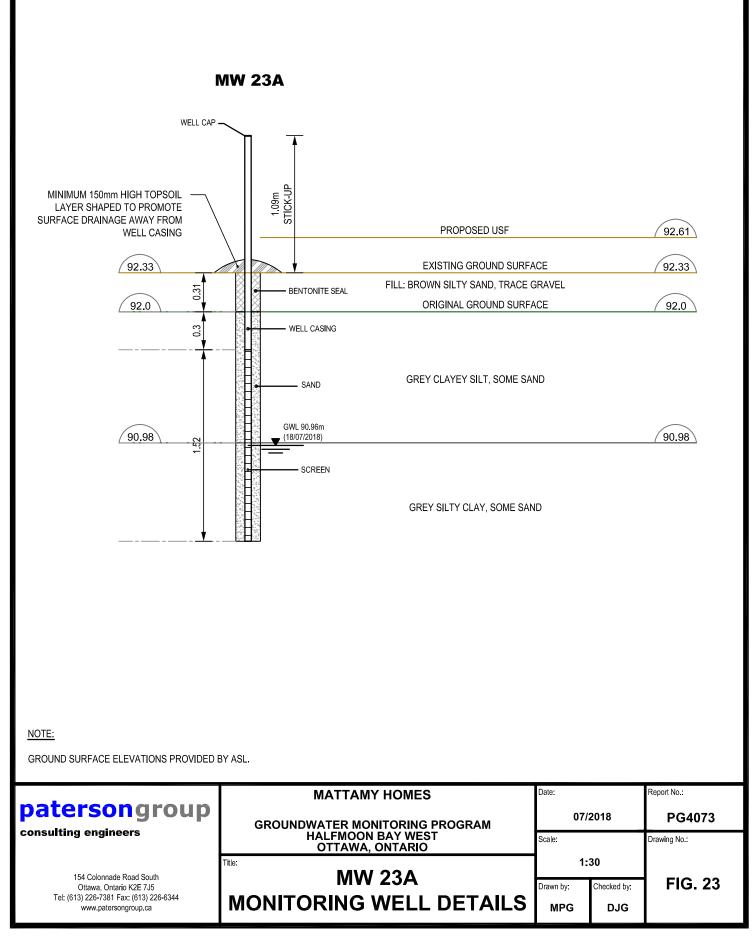
p:\autocad drawings\geotechnica\\pg40xx\pg4073\monitoring wells july 2018.dwg

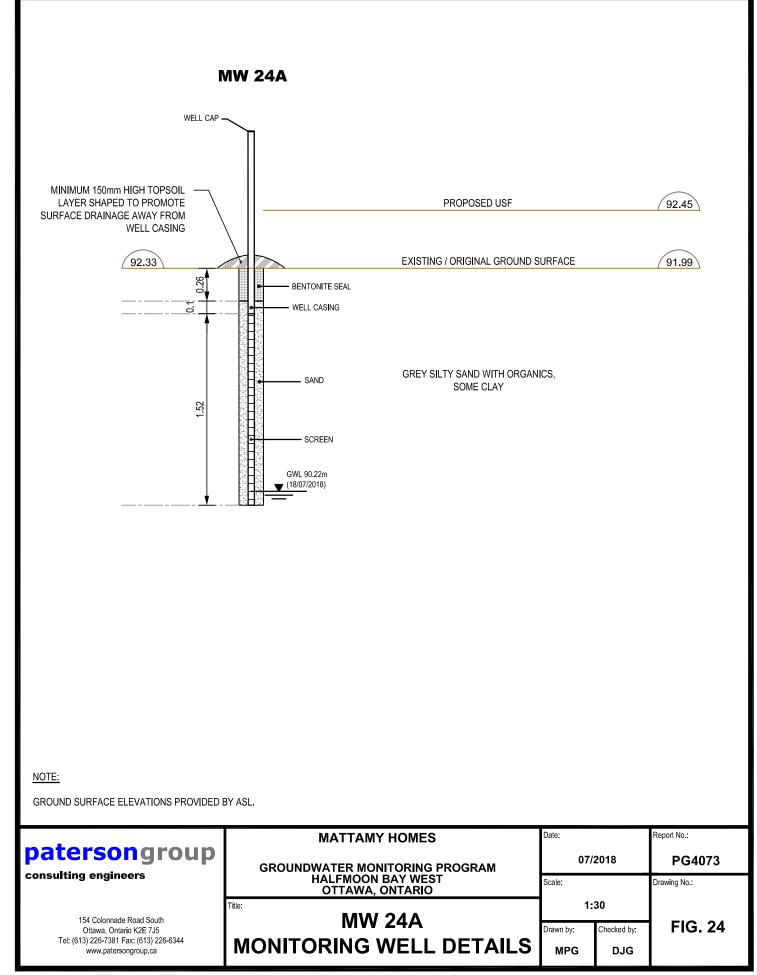


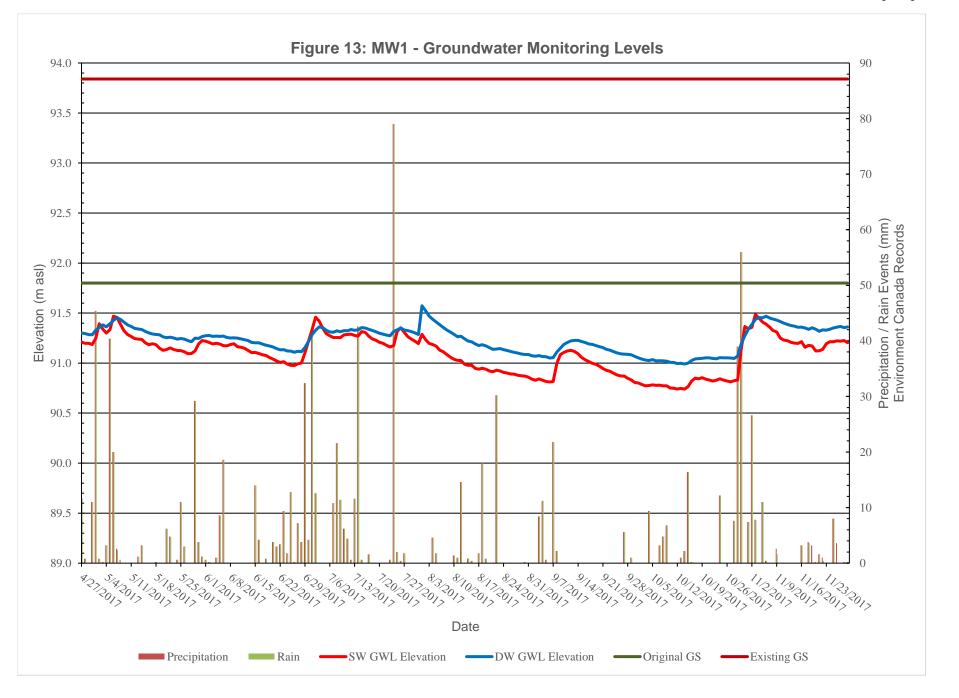
p.\autocad drawings\geotechnica\\pg40xx\pg4073\monitoring wells july 2018.dwg

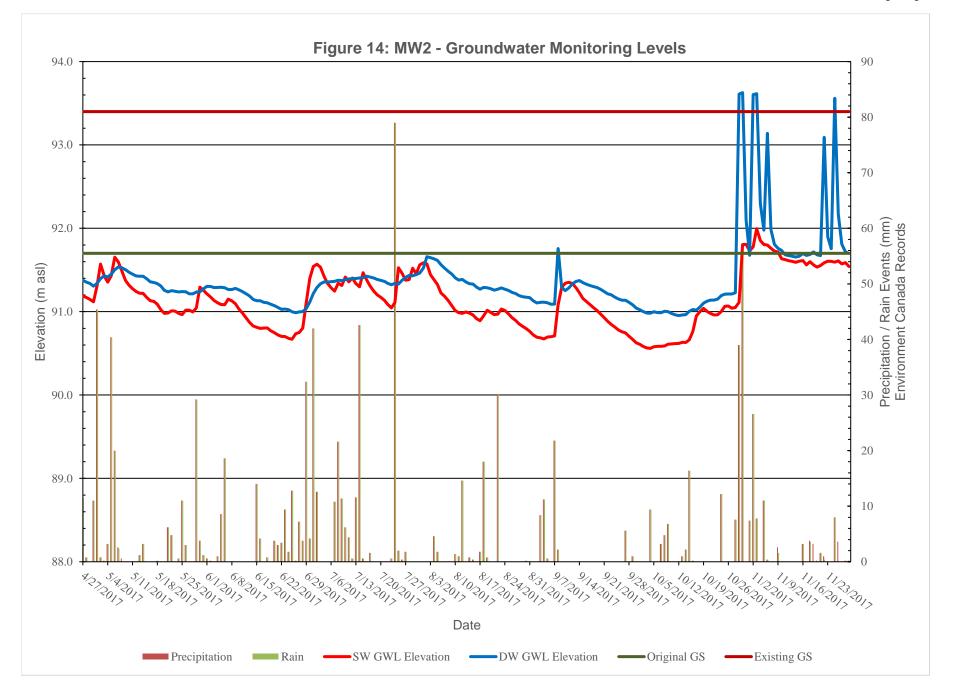


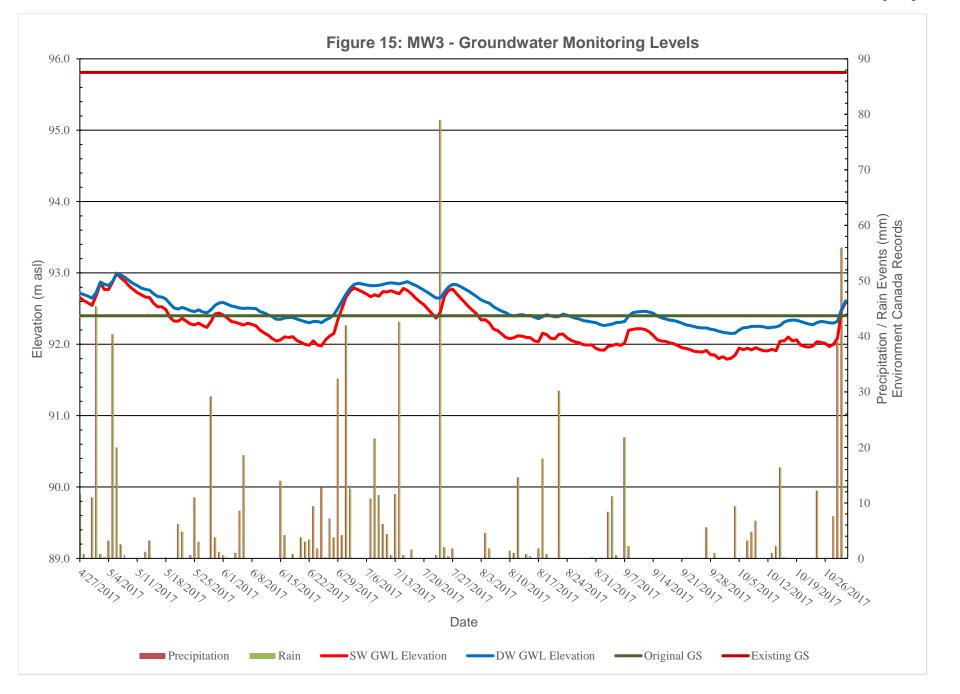
p:\autocad drawings\geotechnical\pg40xx\pg4073\monitoring wells july 2018.dwg

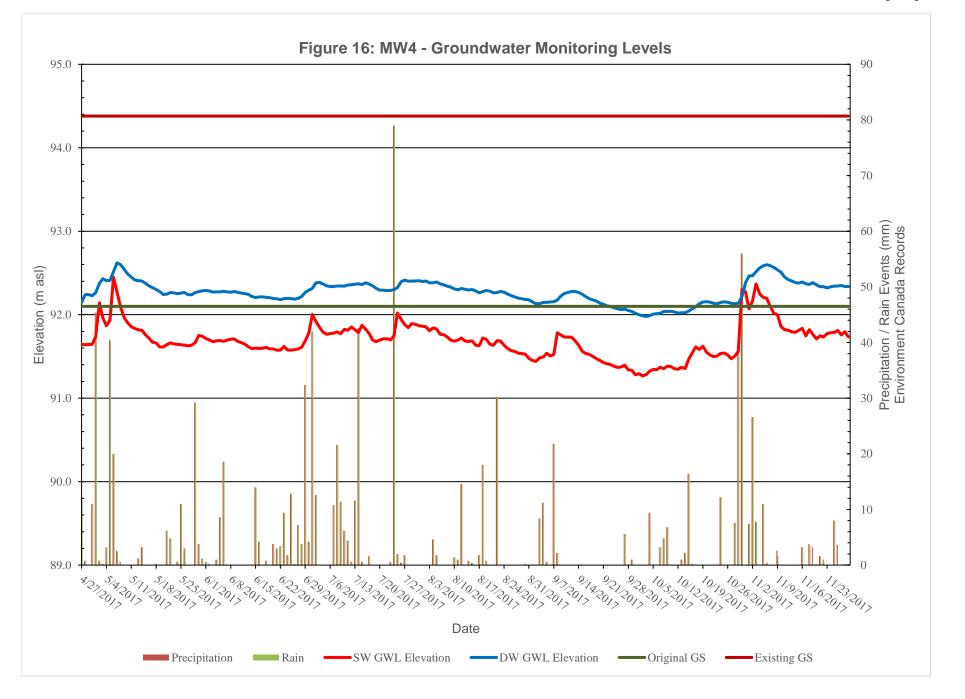


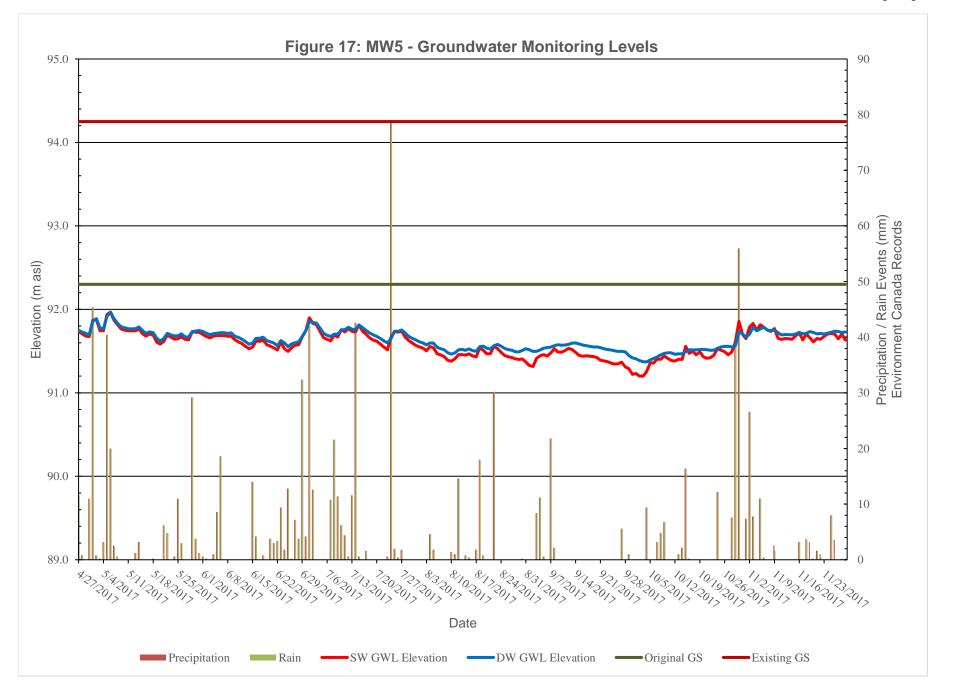


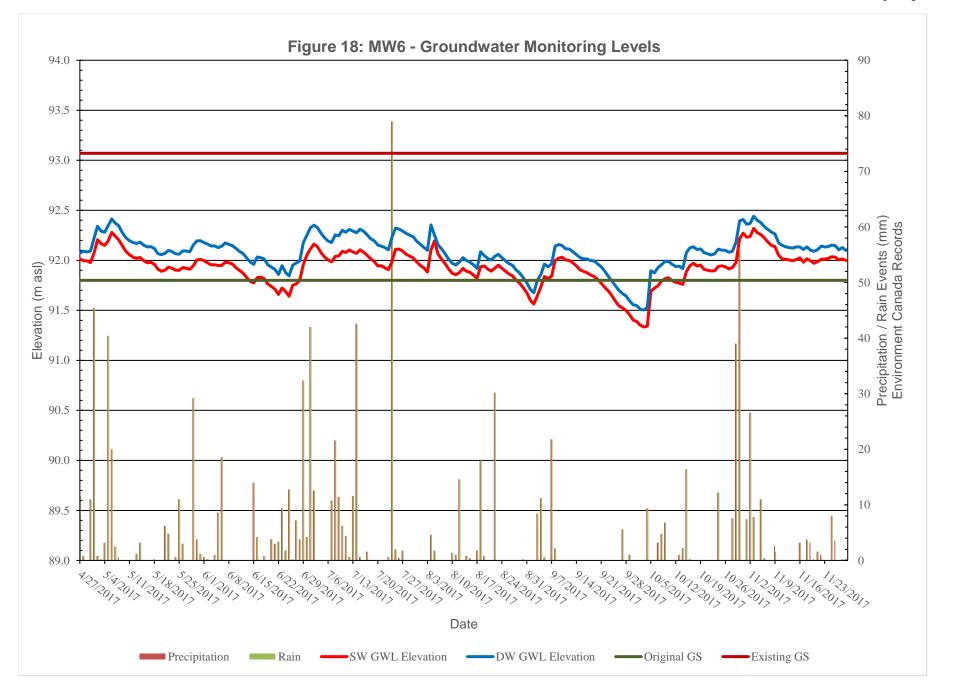


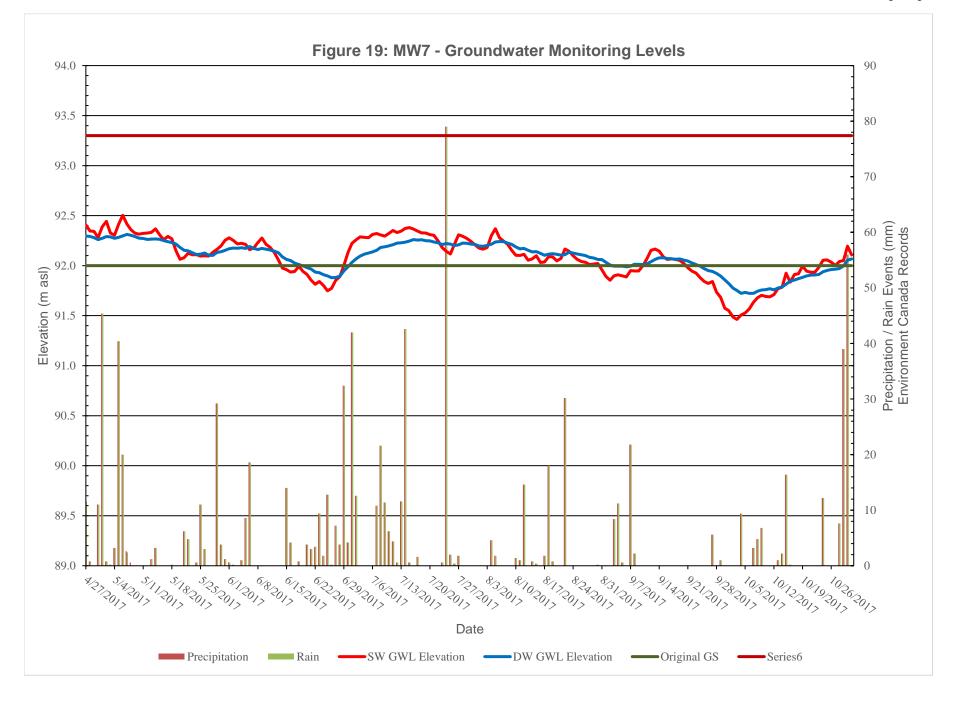


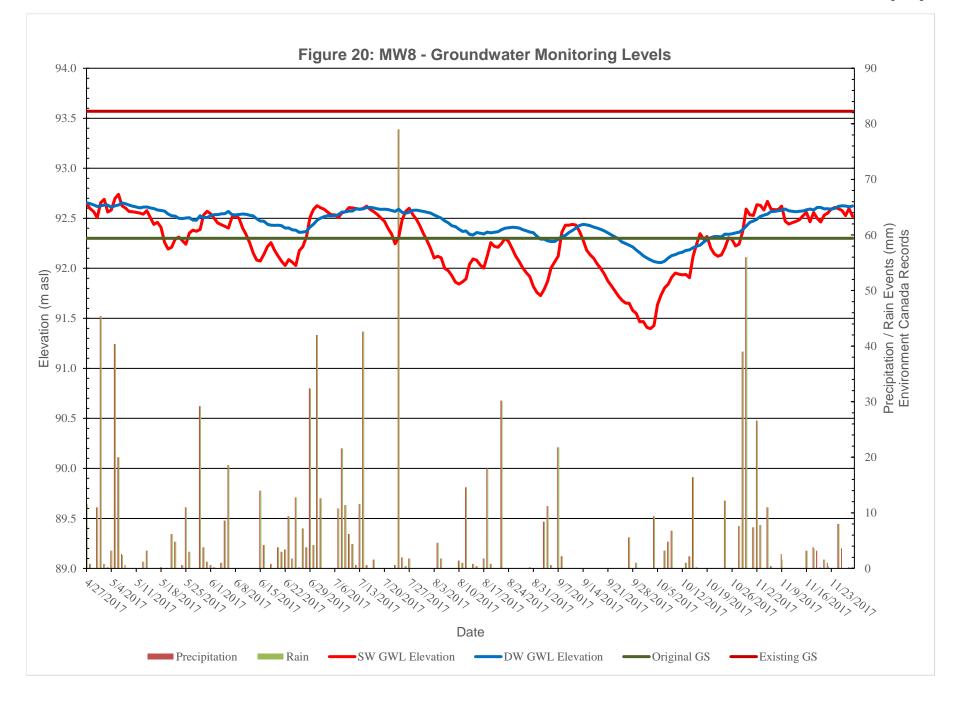


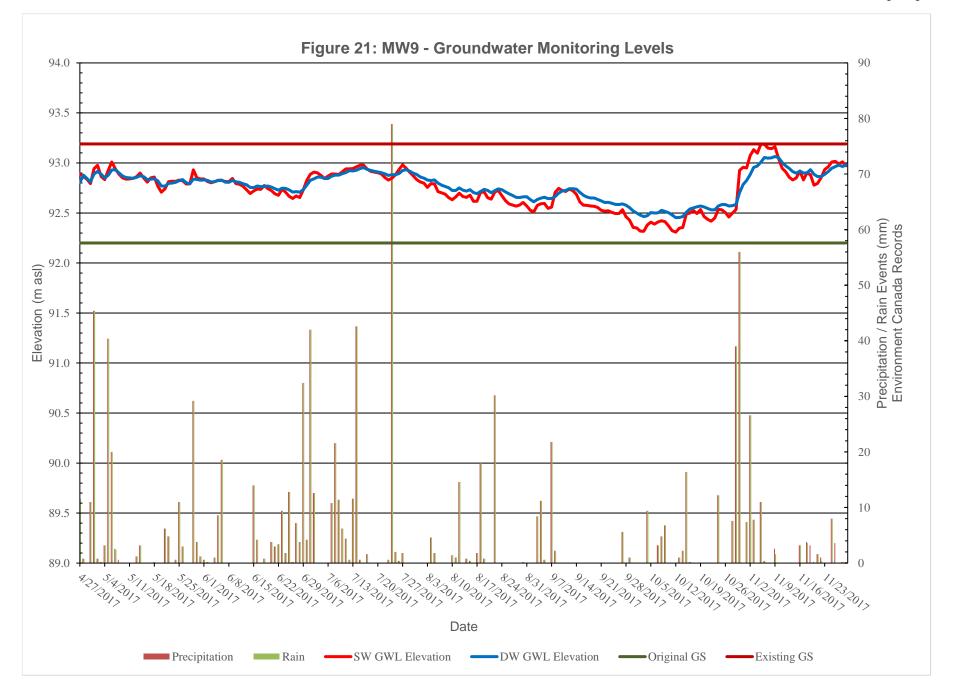




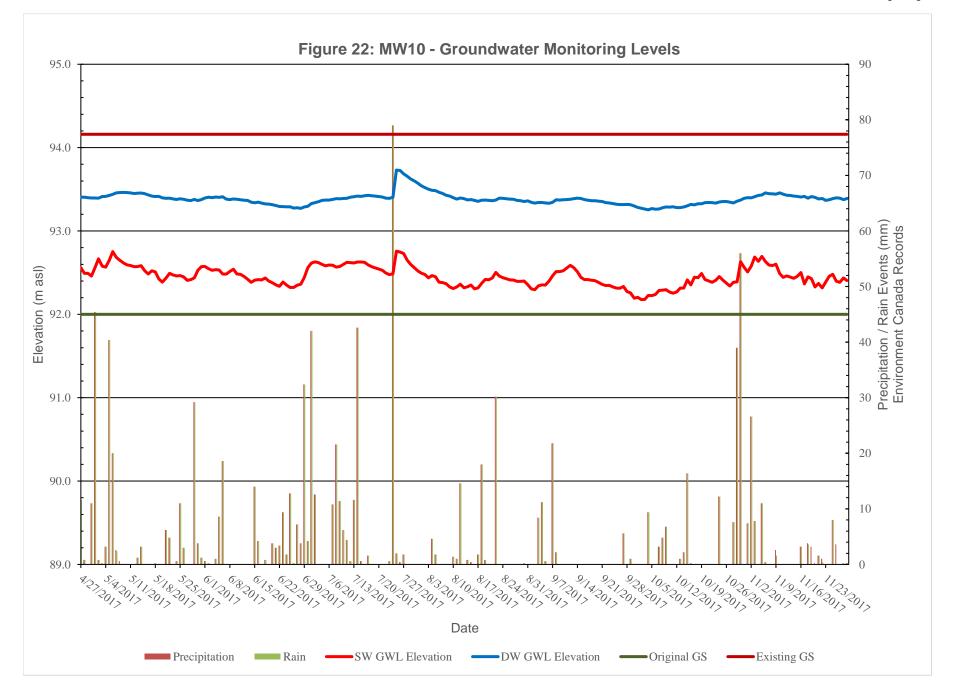


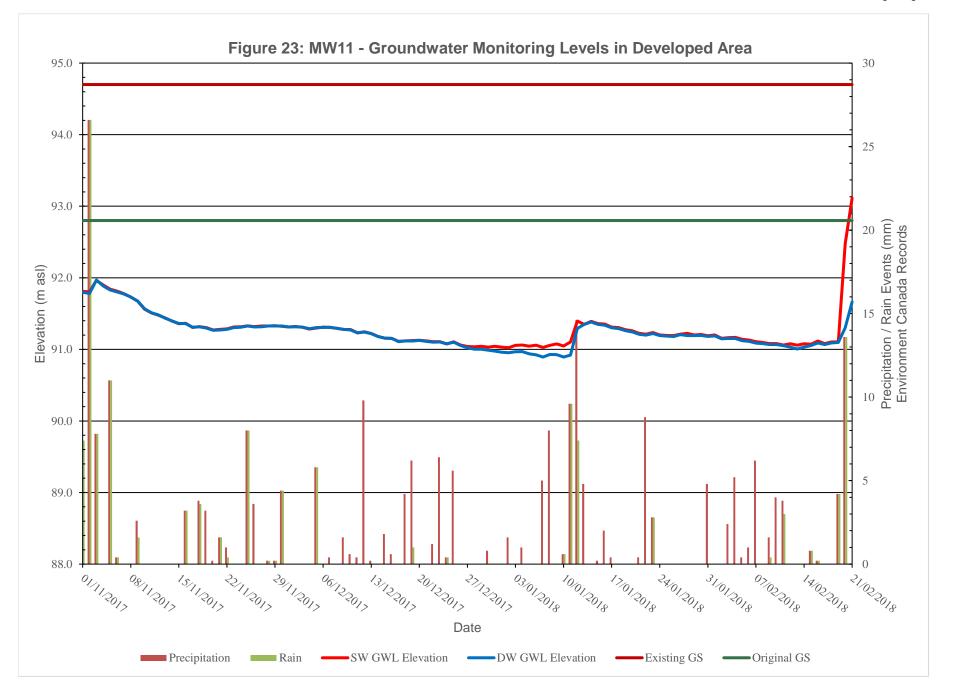


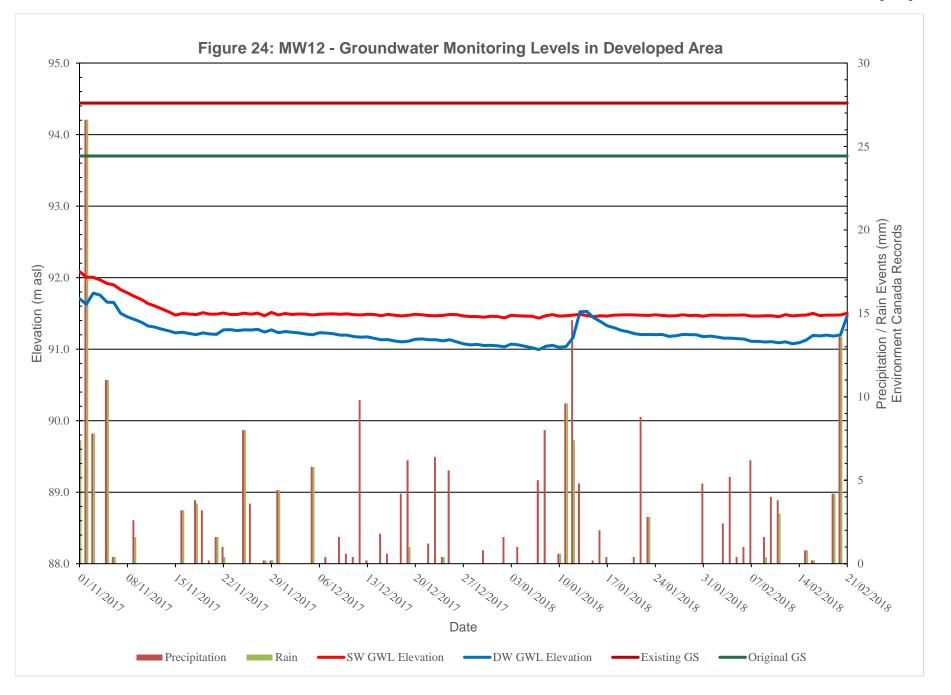




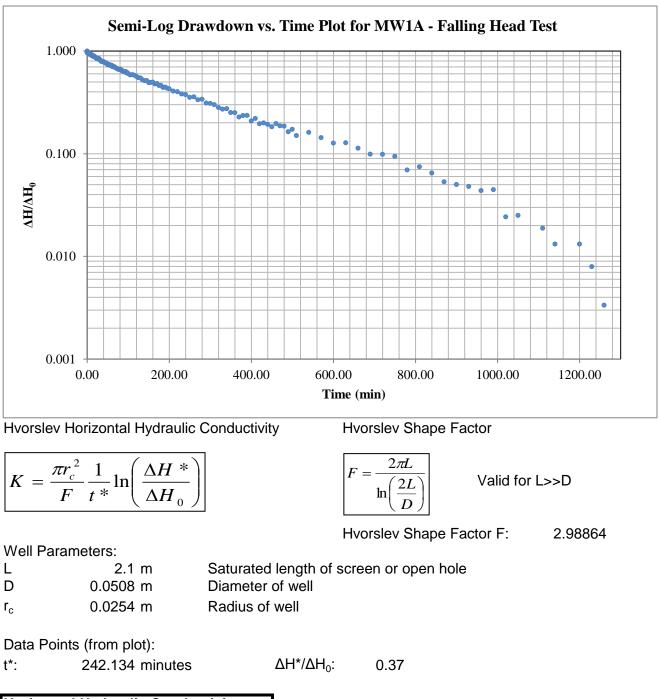
patersongroup





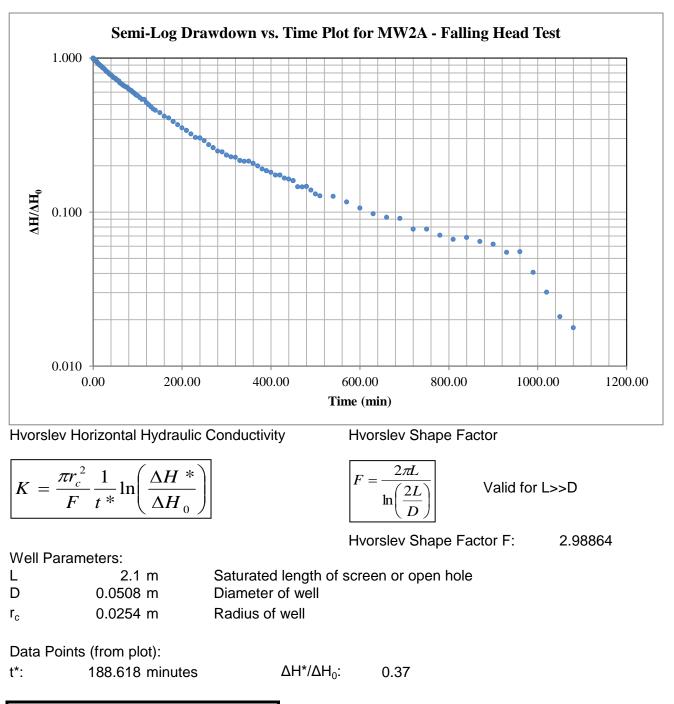


Project: PG4073 - Half Moon Bay West Test Location: MW1A Test: Falling Head Date: June 22, 2018



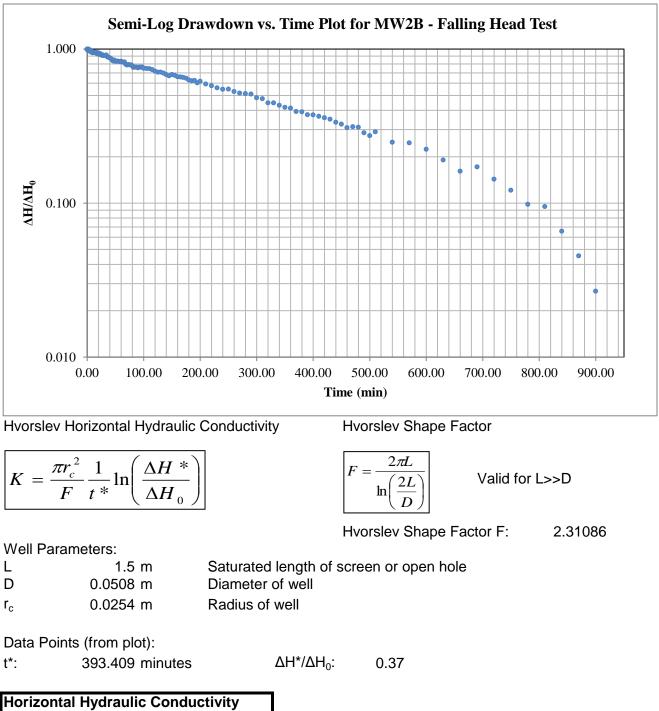
Horizontal Hydraulic Conductivity K = 4.64E-08 m/sec

Project: PG4073 - Half Moon Bay West Test Location: MW2A Test: Falling Head Date: June 21, 2018



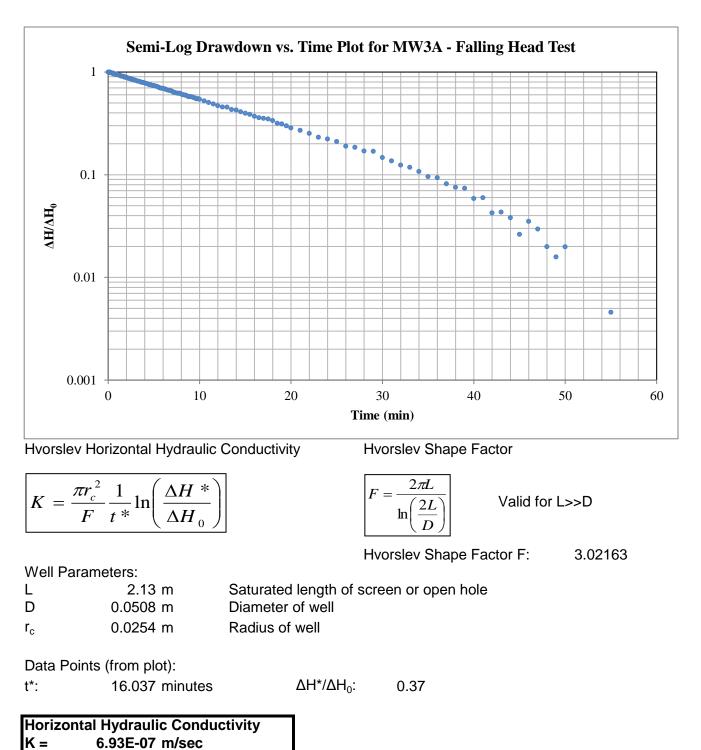
Horizontal Hydraulic Conductivity K = 5.96E-08 m/sec

Project: PG4073 - Half Moon Bay West Test Location: MW2B Test: Falling Head Date: June 21, 2018

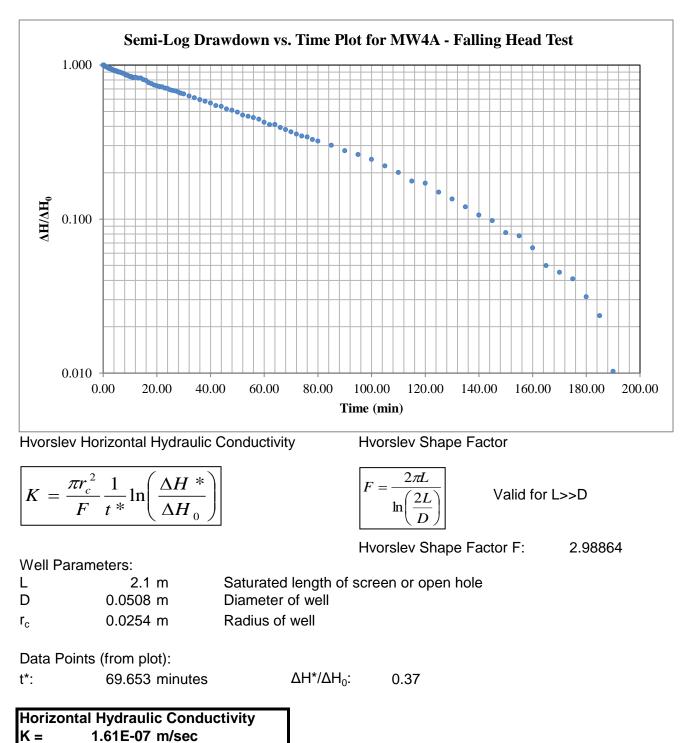


K = 3.69E-08 m/sec

Project: PG4073 - Half Moon Bay West Test Location: MW3A Test: Falling Head Date: April 20, 2018

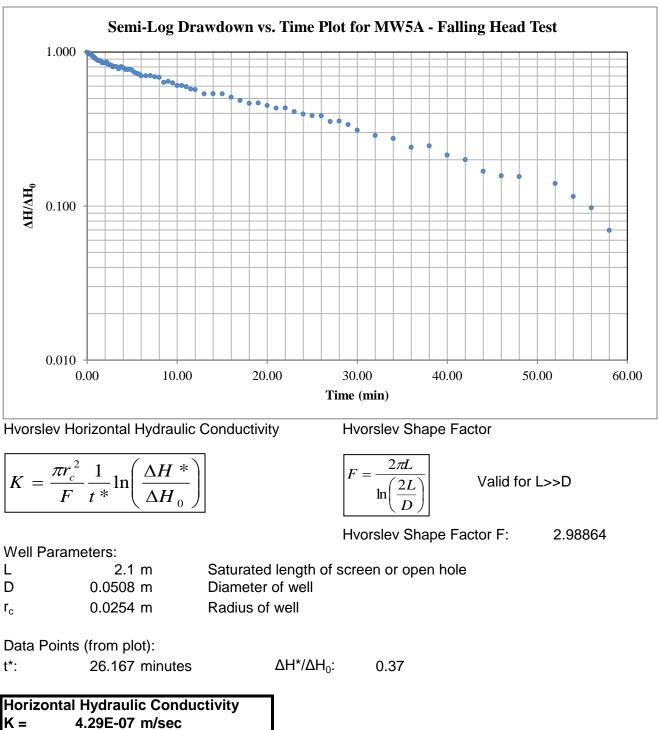


Project: PG4073 - Half Moon Bay West Test Location: MW4A Test: Falling Head Date: June 21, 2018

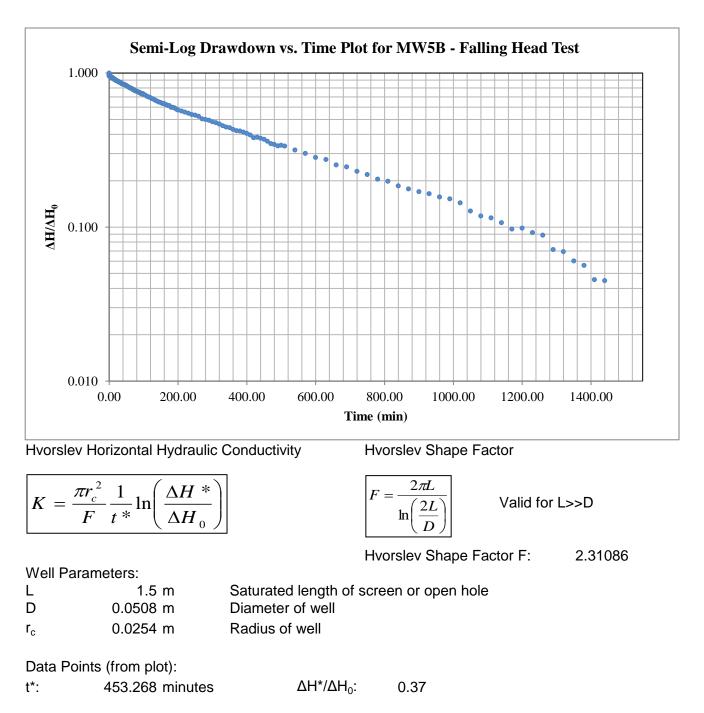


1.01E-07 III/Sec

Project: PG4073 - Half Moon Bay West Test Location: MW5A Test: Falling Head Date: June 22, 2018

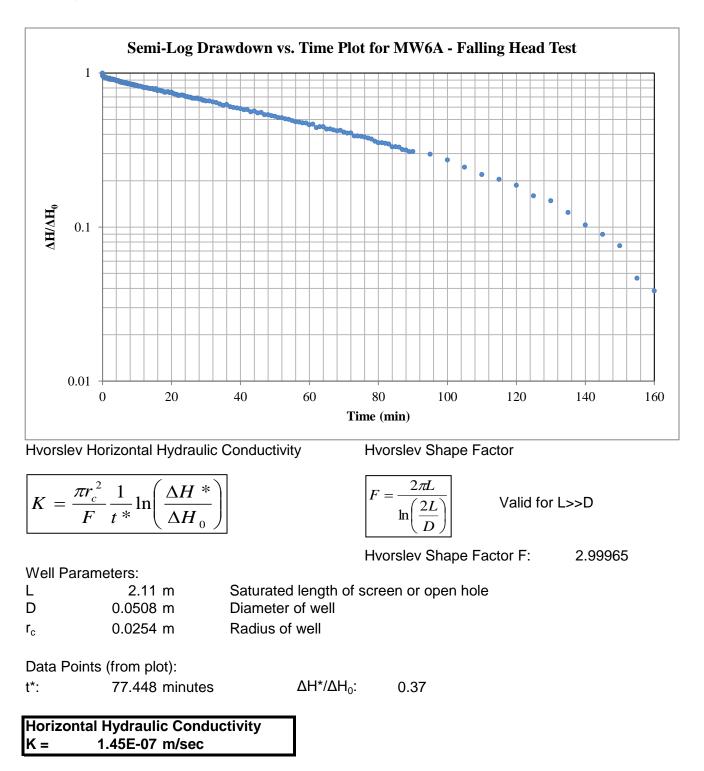


Project: PG4073 - Half Moon Bay West Test Location: MW5B Test: Falling Head Date: June 22, 2018

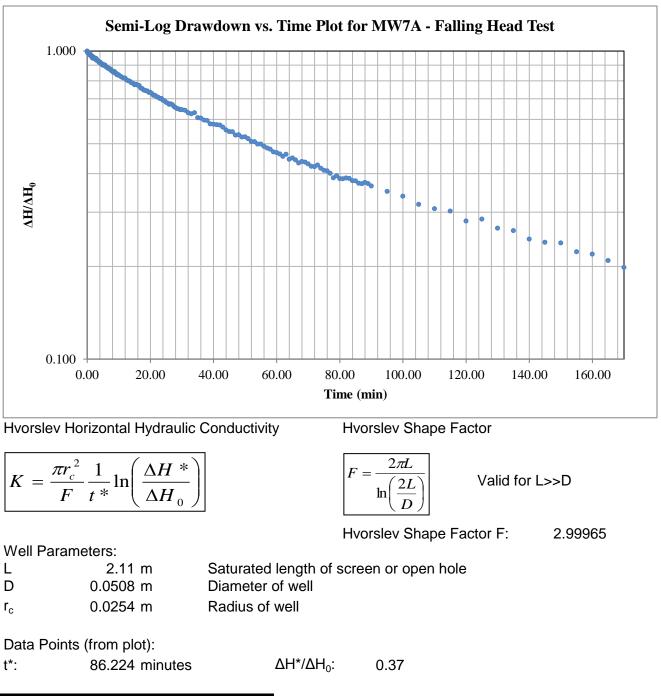


Horizontal Hydraulic Conductivity K = 3.21E-08 m/sec

Project: PG4073 - Half Moon Bay West Test Location: MW6A Test: Falling Head Date: April 19, 2018

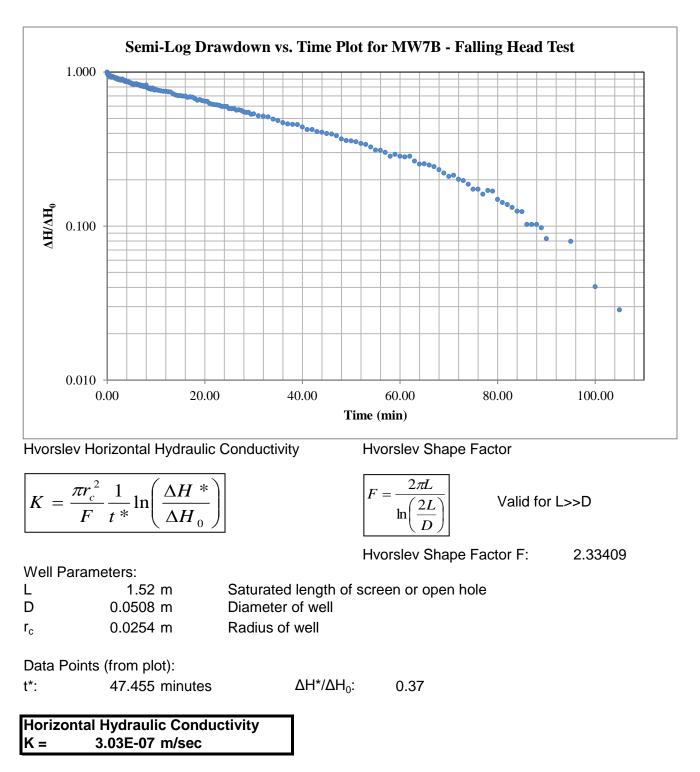


Project: PG4073 - Half Moon Bay West Test Location: MW7A Test: Falling Head Date: April 19, 2018

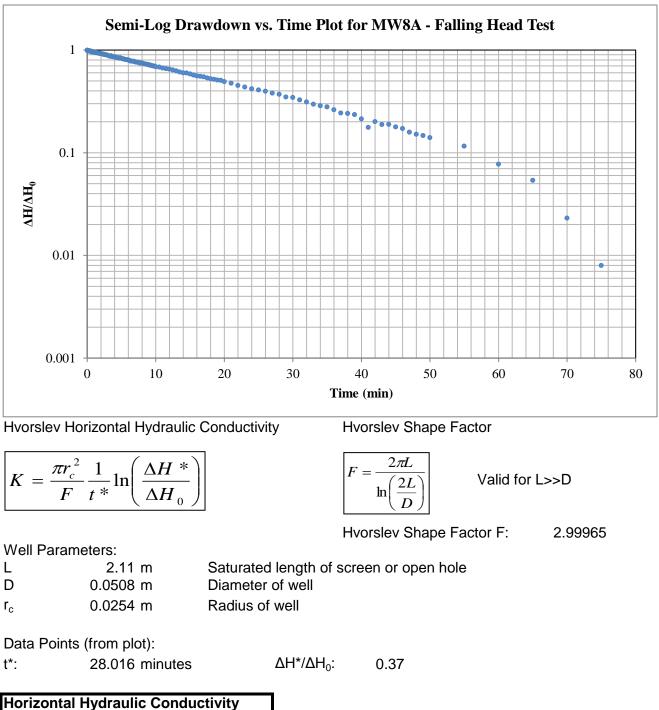


Horizontal Hydraulic Conductivity K = 1.30E-07 m/sec

Project: PG4073 - Half Moon Bay West Test Location: MW7B Test: Falling Head Date: April 19, 2018

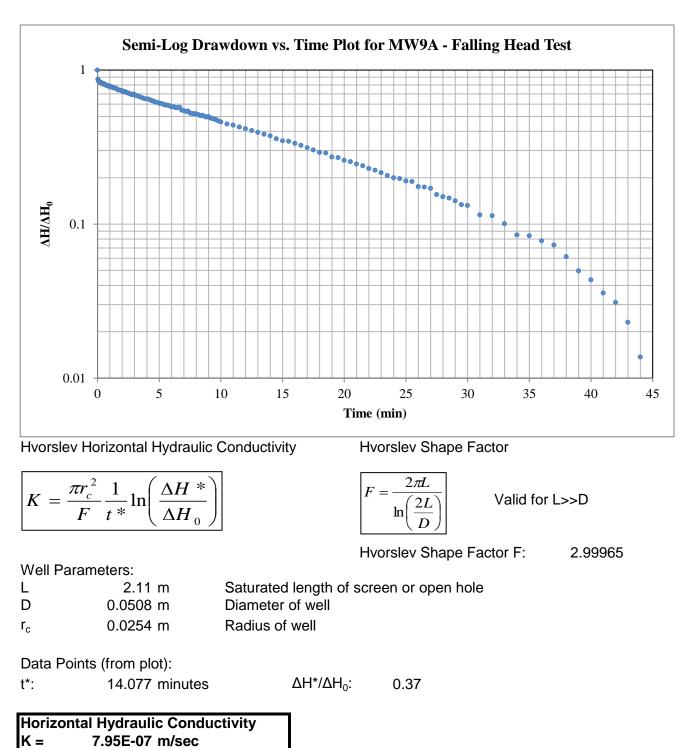


Project: PG4073 - Half Moon Bay West Test Location: MW8A Test: Falling Head Date: April 20, 2018

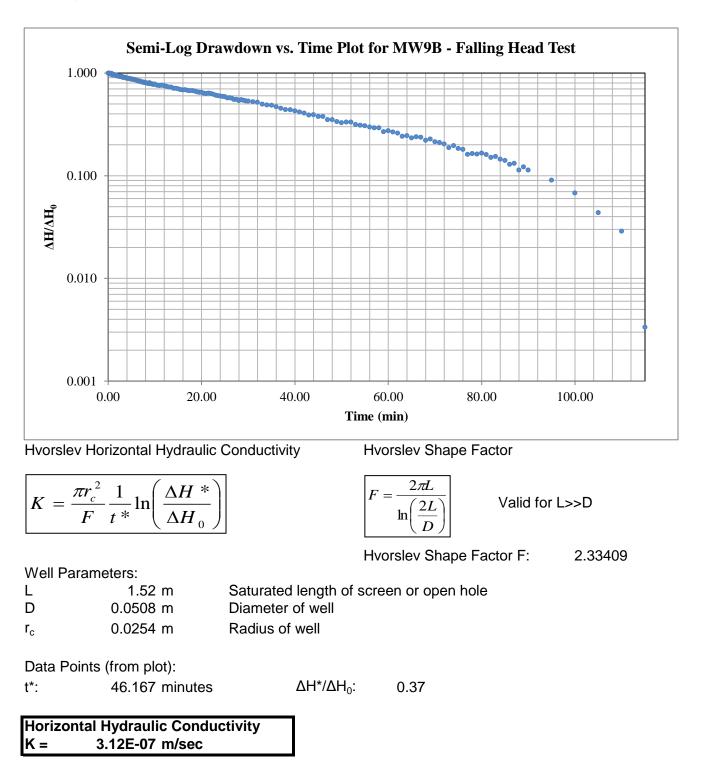


K = 4.00E-07 m/sec

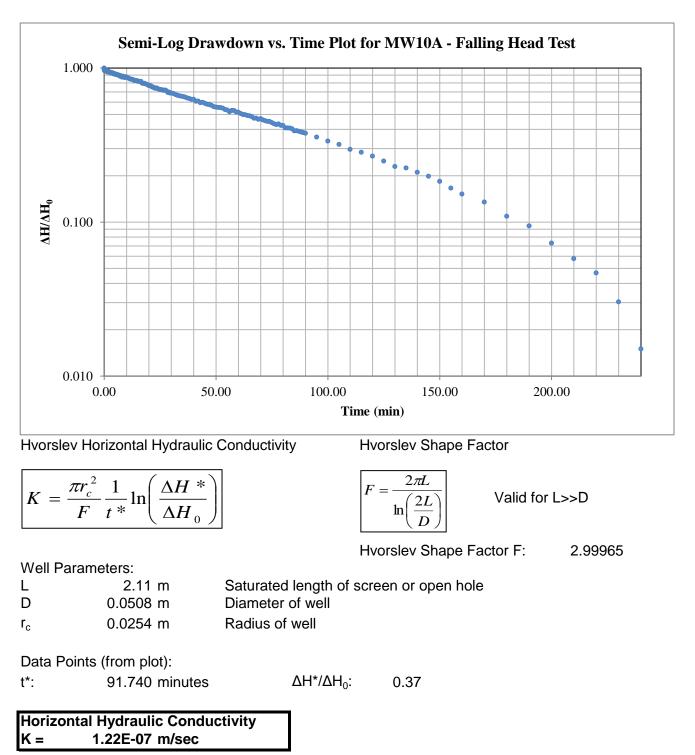
Project: PG4073 - Half Moon Bay West Test Location: MW9A Test: Falling Head Date: April 19, 2018



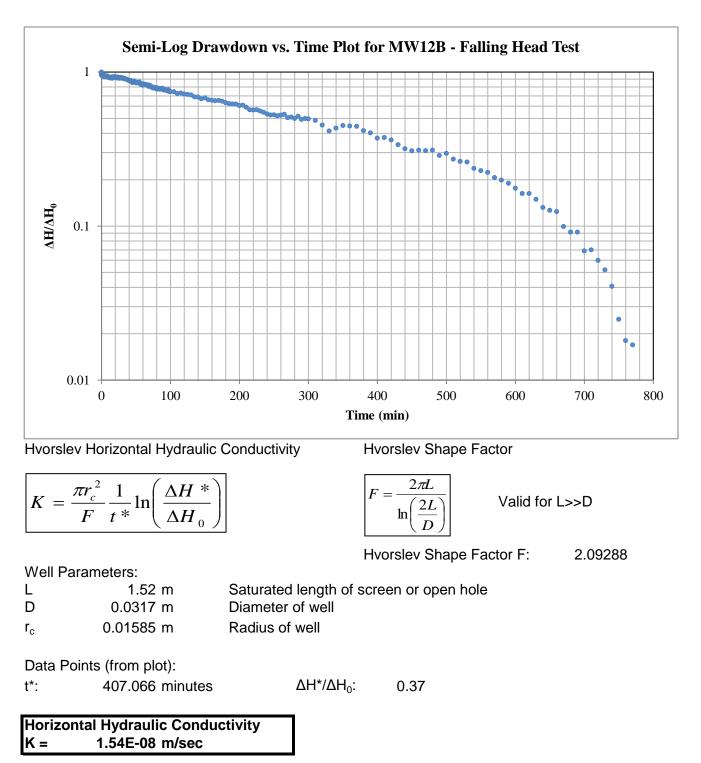
Project: PG4073 - Half Moon Bay West Test Location: MW9B Test: Falling Head Date: April 19, 2018



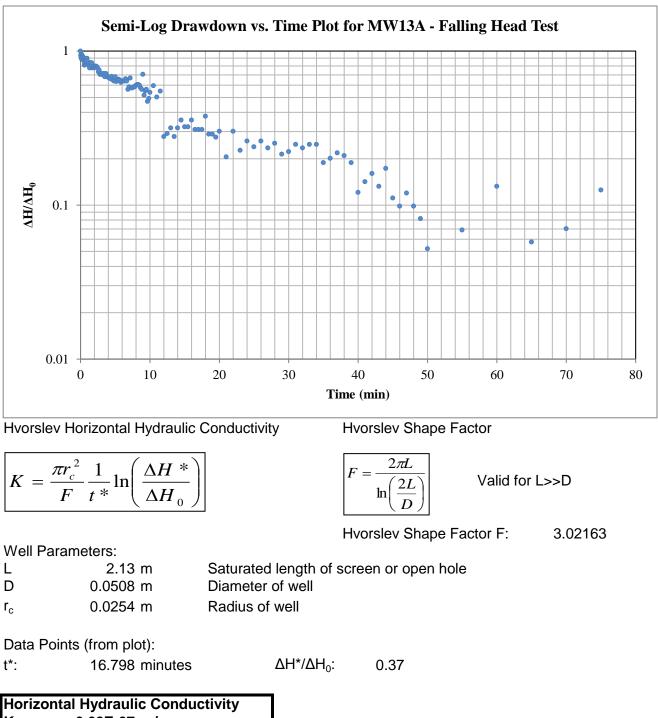
Project: PG4073 - Half Moon Bay West Test Location: MW10A Test: Falling Head Date: April 19, 2018



Project: PG4073 - Half Moon Bay West Test Location: MW12B Test: Falling Head Date: April 20, 2018

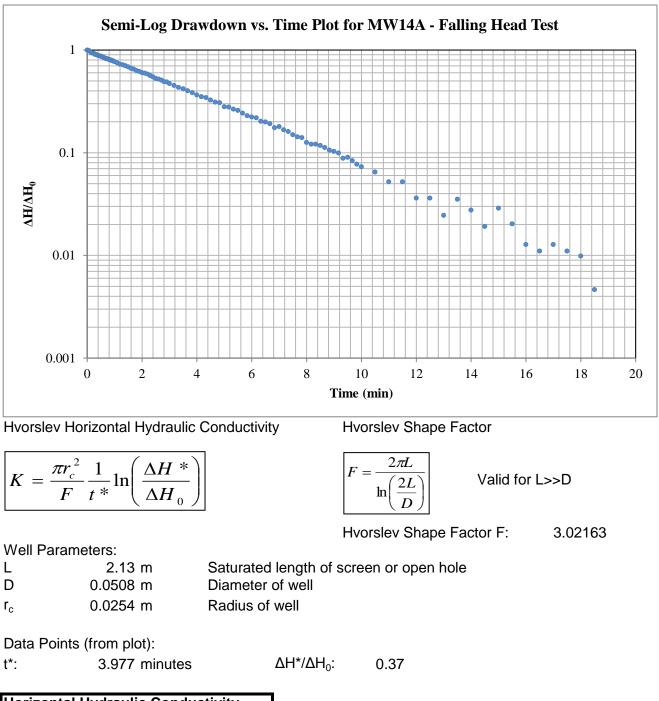


Project: PG4073 - Half Moon Bay West Test Location: MW13A Test: Falling Head Date: April 20, 2018



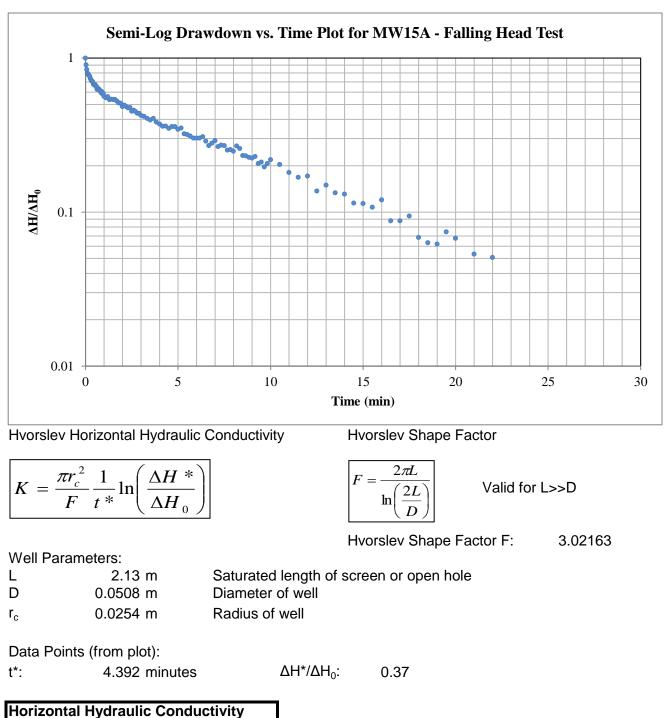
K = 6.62E-07 m/sec

Project: PG4073 - Half Moon Bay West Test Location: MW14A Test: Falling Head Date: April 20, 2018



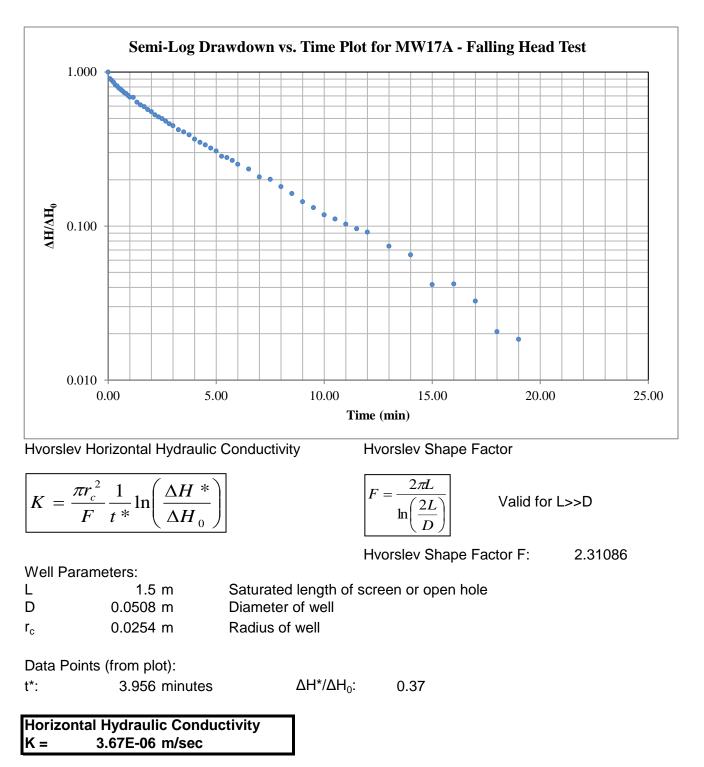
Horizontal Hydraulic Conductivity K = 2.79E-06 m/sec

Project: PG4073 - Half Moon Bay West Test Location: MW15A Test: Falling Head Date: April 20, 2018

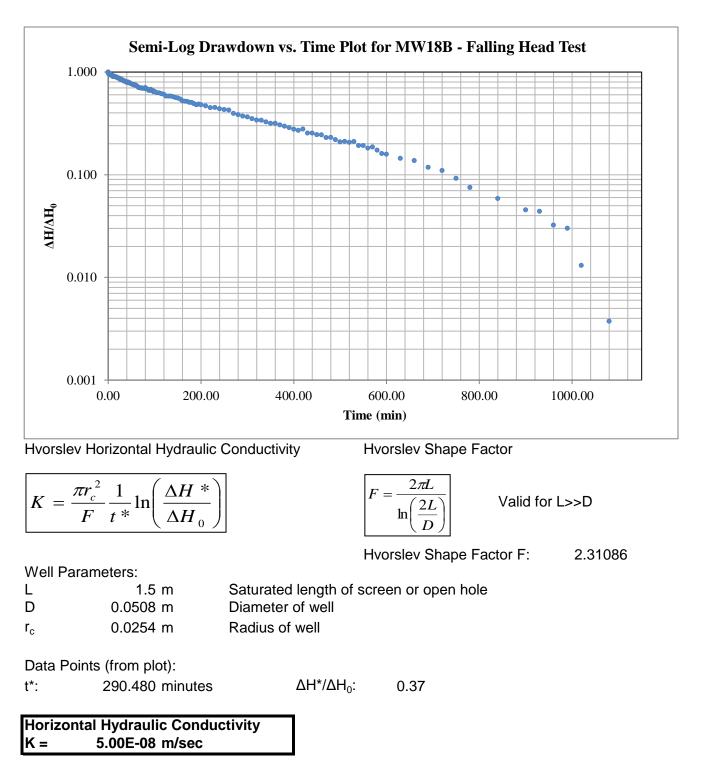


K = 2.53E-06 m/sec

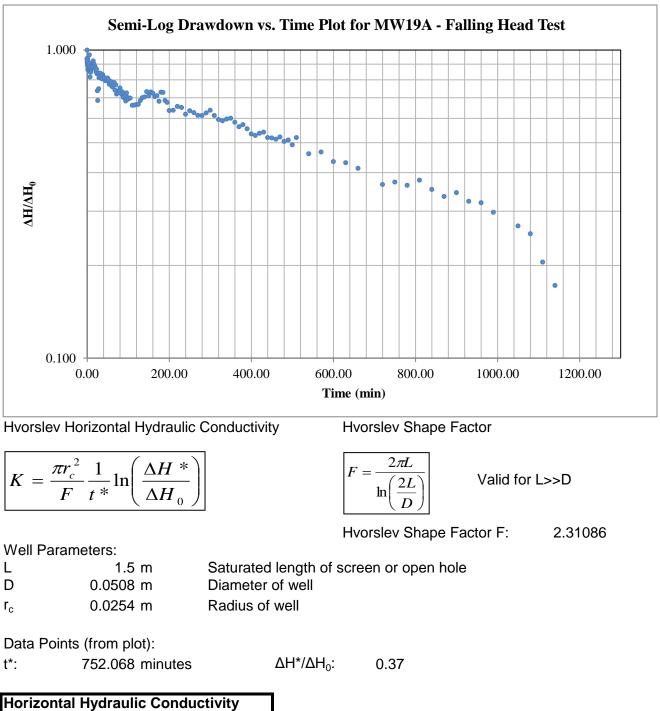
Project: PG4073 - Half Moon Bay West Test Location: MW17A Test: Falling Head Date: July 11, 2018



Project: PG4073 - Half Moon Bay West Test Location: MW18B Test: Falling Head Date: July 12, 2018



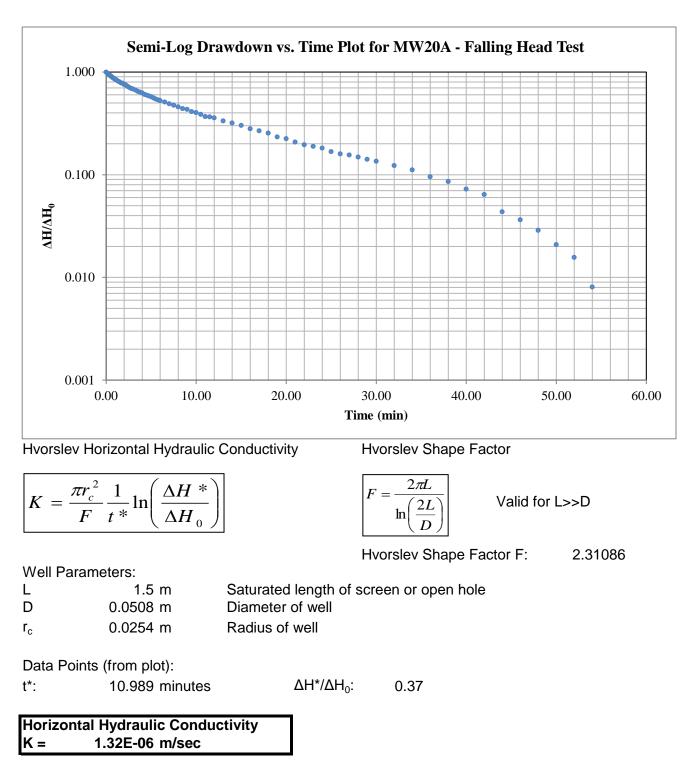
Project: PG4073 - Half Moon Bay West Test Location: MW19A Test: Falling Head Date: July 12, 2018



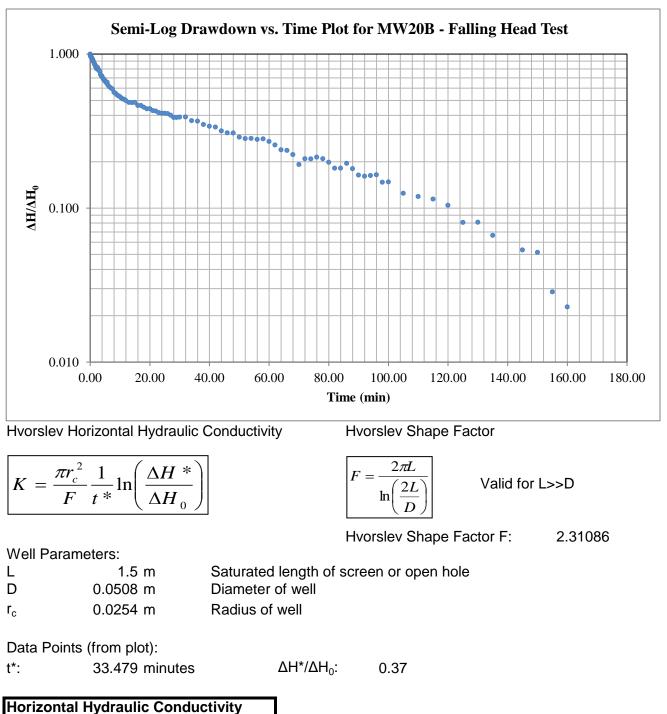
K = 1.93E-08 m/sec

patersongroup

Project: PG4073 - Half Moon Bay West Test Location: MW20A Test: Falling Head Date: July 11, 2018

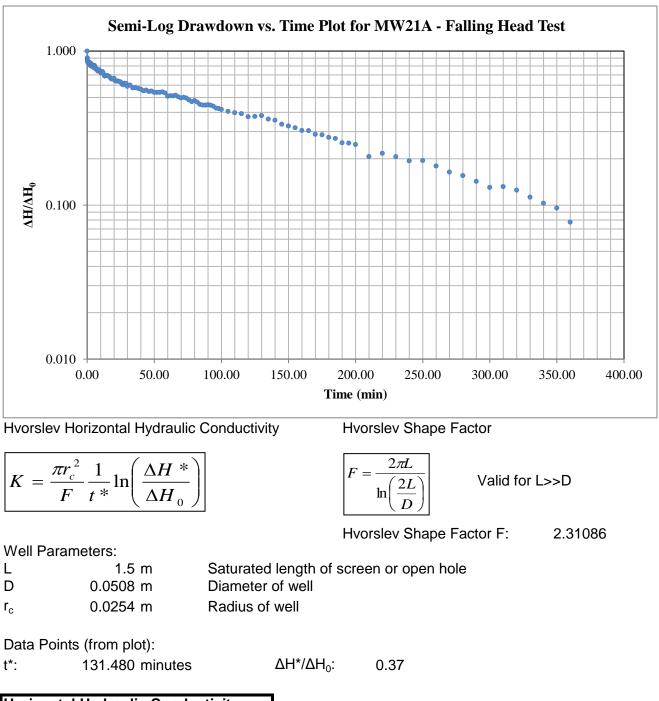


Project: PG4073 - Half Moon Bay West Test Location: MW20B Test: Falling Head Date:July 11, 2018



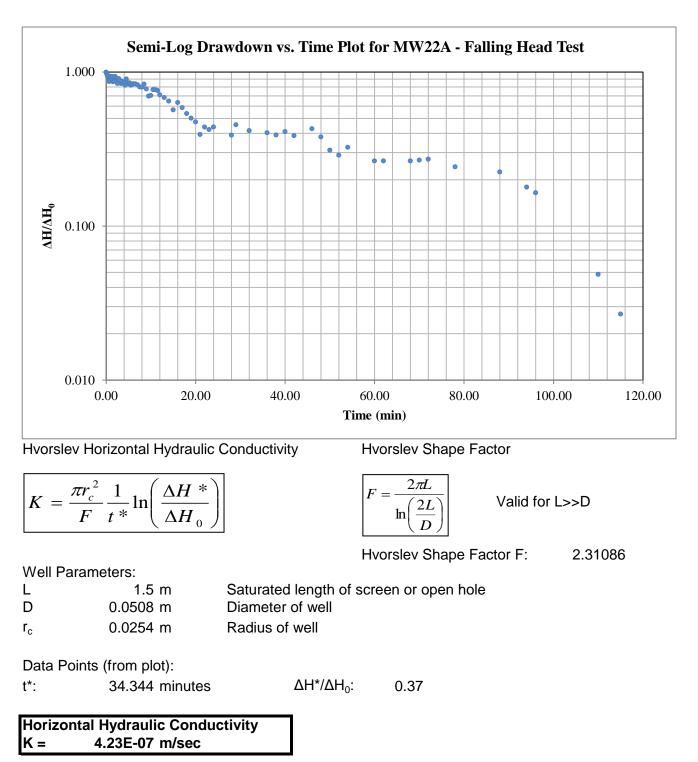
K = 4.34E-07 m/sec

Project: PG4073 - Half Moon Bay West Test Location: MW21A Test: Falling Head Date: July 11, 2018

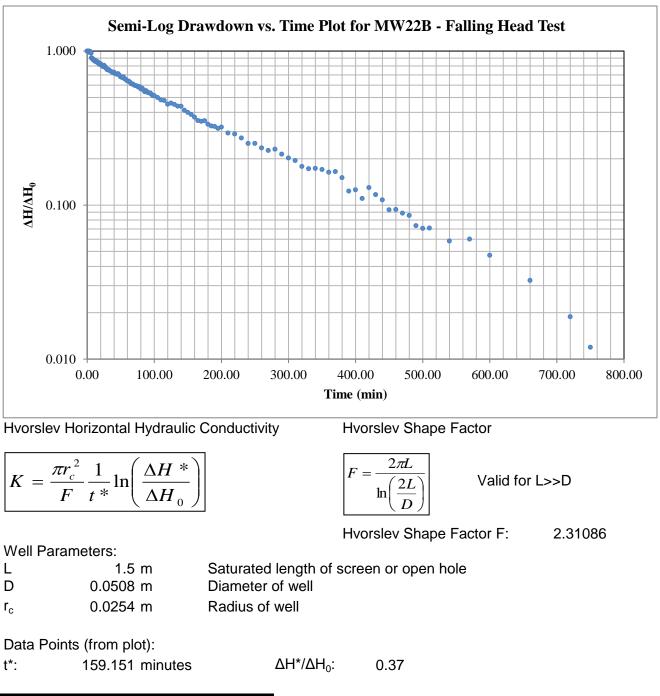


Horizontal Hydraulic Conductivity K = 1.11E-07 m/sec

Project: PG4073 - Half Moon Bay West Test Location: MW22A Test: Falling Head Date: July 11, 2018

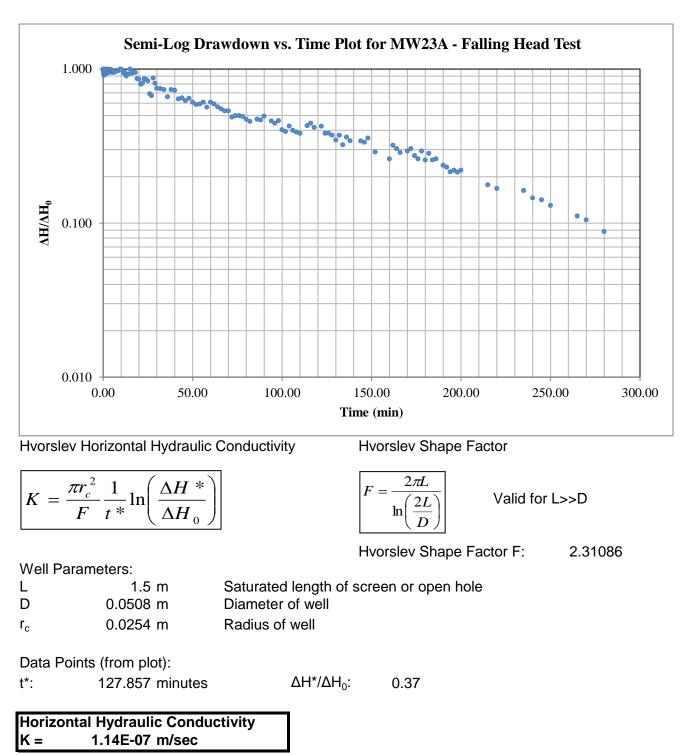


Project: PG4073 - Half Moon Bay West Test Location: MW22B Test: Falling Head Date: July 11, 2018



Horizontal Hydraulic Conductivity K = 9.13E-08 m/sec

Project: PG4073 - Half Moon Bay West Test Location: MW23A Test: Falling Head Date: July 11, 2018

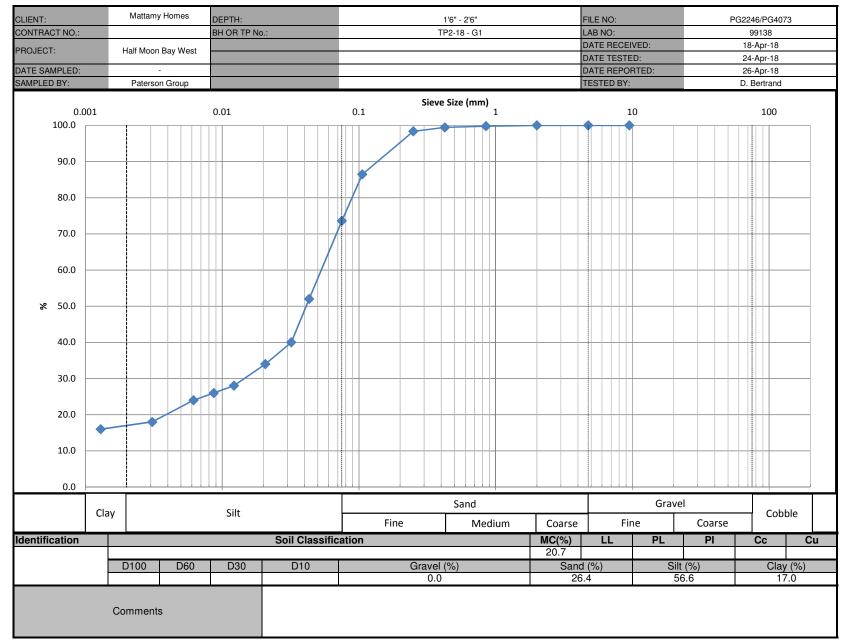


Job ID	Client	BH ID	Sample ID	Depth	Sieve/Hydrometer Analysis								
						-	Silt (%)	Clay (%)	Liquid Limit (%)	Plasticity Index	Group Symbol	Group Name (USCS)	
PG2246	Mattamy Homes	TP1-18	G1	2'6"-3'6"	0	42.9	5	7.1	32.1*	17.7*	CL	Inorganic Sandy Clay of Medium Plasticity	
PG2246	Mattamy Homes	TP1-18	G2	5'-6'	0	10.7	54.8	34.5	32.1	17.7	CL	Inorganic Clay of Medium Plasticity, Some Sand	
PG2246	Mattamy Homes	TP2-18	G1	1'6"-2'6"	0	26.4	56.6	17	28.2*	11.1*	CL	Inorganic Clay of Low Plasticy, with Sand	
G2246	Mattamy Homes	TP2-18	G2	4'-5'		N/	/A		28.2	11.1	CL	Inorganic Clay of Low Plasticy	
G2246	Mattamy Homes	TP2-18	G3	6'-7'	0	7.4	52.1	40.5	28.2*	11.1*	CL	Inorganic Clay of Low Plasticity, Trace Sand	
G2246	Mattamy Homes	TP3-18	G2	4'-5'	0	31.4	50.6	18	37.9*	22.1*	CL	Inorganic Sandy Clay of Medium Plasticity	
G2246	Mattamy Homes	TP3-18	G3	7'-8'		N/	/A		37.9	22.1	CL	Inorganic Clay of Medium Plasticity	
G2246	Mattamy Homes	TP3-18	G3	8'-9'	0	11	52.9	36.1	37.9*	22.1*	CL	Inorganic Clay of Medium Plasticity, Some Sand	
G2246	Mattamy Homes	TP4-18	G4	17'6"-18'6"	0	40.9	36.6	22.5	27.6	12.6	CL	Inorganic Sandy Clay of Low Plasticity	
G2246	Mattamy Homes	TP4-18	G5	15'-16'	0	19.9	54.1	26	27.6*	12.6*	CL	Inorganic Clay of Low Plasticity, Some Sand	
G2246	Mattamy Homes	TP5-18	G2	5'-6'	0	16.7	54.8	28.5	28	8.3	CL	Inorganic Clay of Low Plasticity, Some Sand	
G2246	Mattamy Homes	TP5-18	G3	10'-11'	0	26.7	55.3	18	28*	8.3*	CL	Inorganic Clay of Low Pasticity, with Sand	
G2246	Mattamy Homes	TP6-18	G2	4'-5'	0	31.8	68.2		30*	14.5*	CL	Inorganic Sandy Clay of Low Plasticity	
G2246	Mattamy Homes	TP6-18	G3	6'-7'	0	38.2	40.3	21.5	30*	14.5*	CL	Inorganic Sandy Clay of Low Plasticity	
G2246	Mattamy Homes	TP6-18	G4	8'-9'		N/	N/A		30	14.5	CL	Inorganic Clay of Low Plasticity	
G2246	Mattamy Homes	TP7-18	G2	4'-5'	0	22.2	61.6	16.2	27.3*	11.7*	CL	Inorganic Clay of Low Plasticity, with Sand	
G2246	Mattamy Homes	TP7-18	G3	6'6"-7'6"	0	14.8	55.7	29.5	27.3	11.7	CL	Inorganic Clay of Low Plasticity, some Sand	
G2245	Mattamy Homes	TP8-18	G2	7'-8'	0.5	27.5	49.5	22.5	25.4*	9.9*	CL	Inorganic Clay of Low Plasticity, with Sand	
PG2246	Mattamy Homes	TP8-18	G3	10'-11'	0	25.8	52	22.2	25.4	9.9	CL	Inorganic Clay of Low Plasticity, with Sand	
G2246	Mattamy Homes	TP9-18	G3	8'-9'	0	25.9	74.1		33.9*	21*	CL	Inorganic Clay of Medium Plasticity, with Sand	
G2246	Mattamy Homes	TP9-18	G4	10'-11'	0	34.9	36.6	28.5	33.9	21	CL	Inorganic Sandy Clay of Medium Plasticity	
G2246	Mattamy Homes	TP10-18	G2	2'6"-3'6"	0	70.4	2	9.6	25* 10.6* CL Inorganic Sandy Clay of Low		Inorganic Sandy Clay of Low Plasticity		
G2246	Mattamy Homes	TP10-18	G3	4'-5'	0	39.6	39.7	20.5	25	10.6	CL	Inorganic Sandy Clay of Low Plasticity	
PG4073	Mattamy Homes	MW17A	SS4	7'6"-9'6"	0	34	52	14	-	-	ML	Inorganic Sandy Silt, some Clay	
PG4073	Mattamy Homes	MW18A	SS2	2'6"-4'6"	0	30.9	55.6	13.5	-	-	ML	Inorganic Sandy Silt, some Clay	
PG4073	Mattamy Homes	MW18B	SS5	10'-12'	0	8.3	64.2	27.5	-	-	ML	Inorganic Clayey Silt, trace Sand	
G4073	Mattamy Homes	MW19A	SS3	5'-7'	0	35.1	44.9	20	-	-	ML	Inorganic Sandy Silt, some Clay	
G4073	Mattamy Homes	MW20A	SS3	5'-7'	0	34.6	48.6	16.5	-	-	ML	Inorganic Sandy Silt, some Clay	
PG4073	Mattamy Homes	MW20B	SS6	12'6"-14'6"	0	8.6	55.4	36	-	-	ML	Inorganic Clayey Silt, trace Sand	
PG4073	Mattamy Homes	MW21A	SS3	5'-7'	0	42.6	46.9	10.5	-	-	ML	Inorganic Sandy Silt, trace Clay	
G4073	Mattamy Homes	MW23A	SS2	2'6"-4'6"	0	33.7	55.8	10.5	-	-	ML	Inorganic Sandy Silt, trace Clay	

patersongroup consulting engineers

patersongroup

consulting engineers

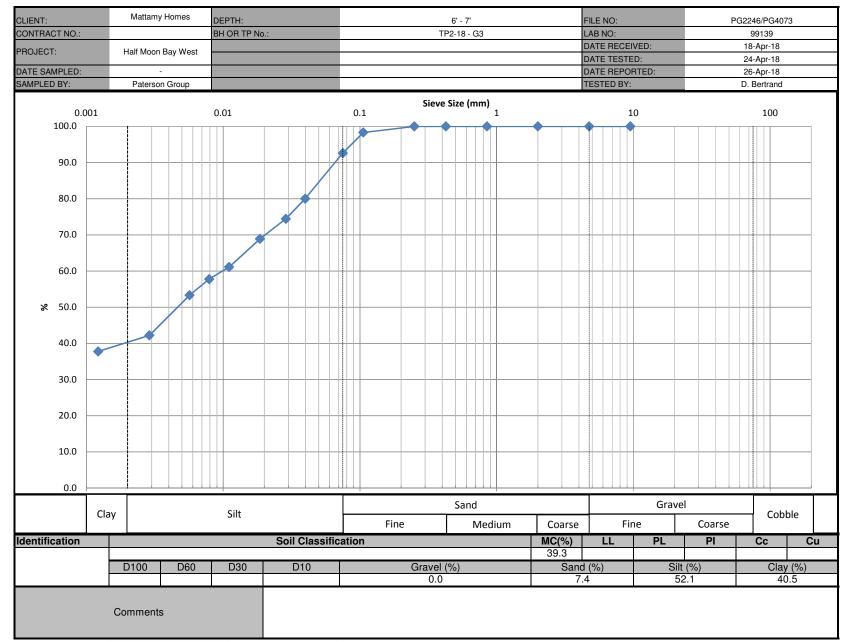


Im hun get

patersongroup consulting engineers

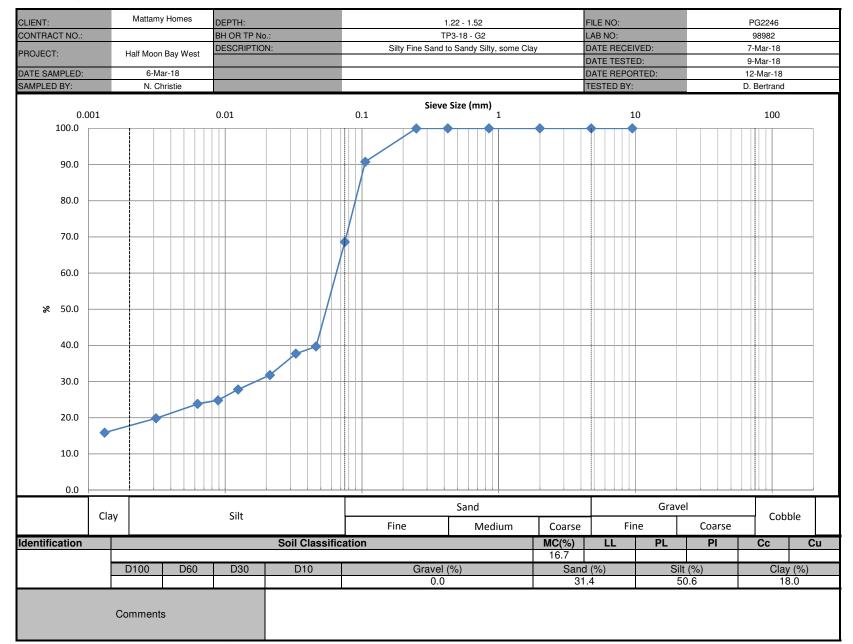
HYDROMETER LS-702 ASTM-422

	Mattamy Homes		DEPTH:	1'6" - 2'6"		FILE NO.:	PG2246/PG4073				
	Half Moon Bay West		BH OR TP No.:	TP2-18 - G1		DATE SAMPLED:	-				
	99138		TESTED BY:	D. Bertrand		DATE RECEIVED:	18-Apr-18				
	Paterson Group		DATE REPT'D:	26-Apr-18		DATE TESTED:	24-Apr-18				
				ION							
16	4.9	50	.00								
AVITY (Gs)	2.700	REMARKS									
	Tare No.										
ITRATION	40 g / L	-									
			ARAIN SIZE ANALY								
VE DIAMETER (m	im)	WEIGHT RI	ETAINED (g)	PERCENT RETAINED		PERCENT PASSING					
63.0											
		0	0	0	0	100	0				
							100.0				
							100.0				
Pan				0	.0						
						-					
0.850				0	.2	99.	99.8				
0.425				0.6		99.4					
0.250				1.6		98.	4				
0.106				13.5		86.	5				
0.075				26.4		73.	6				
Pan											
HECK	0.1										
			HYDROMETER DA	TA	1						
TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	INT PASSING				
9:03	32.0	6.0	22.0	0.0433	52.0	52.	0				
9:04	26.0	6.0	22.0	0.0320	40.0	40.	0				
9:07	23.0	6.0	22.0	0.0207	34.0	34.	0				
9:17	20.0	6.0	22.0	0.0122	28.0	28.	0				
9:32	19.0	6.0	22.0	0.0087	26.0	26.	0				
10:02	18.0	6.0	22.0	0.0062	24.0	24.					
13:12	15.0	6.0	22.0	0.0031	18.0	18.					
9:02	14.0	6.0	22.0	0.0013	16.0	16.	0				
nt = 00.70/			COMMENTS								
nii = 20.1%											
	Curtis Beadow				Joe Forsyth, P. Eng.						
low the	m		APPRO	VED BY:	Jett						
	AVITY (Gs) MOISTURE 50.00 150.00 148.85 0.1 50 49 HBACK SIEVE TRATION /E DIAMETER (m 63.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 4.75 2.0 Pan 0.850 0.425 0.250 0.106 0.075 Pan HECK TIME (24 hours) 9:03 9:04 9:07 9:17 9:32 10:02 13:12 9:02 Ent = 20.7%	Half Moon Bay West 99138 Paterson Group Paterson Group Interson Group AVITY (Gs) 2.700 AVITY (Gs) 2.700 AVITY (Gs) 2.700 MOISTURE Tare No. 50.00 ACTUAL Wt. 150.00 100.00 148.85 98.85 0.95 ACTUAL Wt. 100.00 49.43 BACK SIEVE 20.24 ITATION 40 g / L VEDIAMETER (mm) 63.0 53.0 37.5 2.0 9.5 4.75 2.0 Pan 0.850 0.106 0.250 0.106 0.23.0 <	Half Moon Bay West 99138 Paterson Group S 164.9 50 AVITY (Gs) 2.700 MOISTURE Tare No. 50.00 ACTUAL Wt. 150.00 100.00 148.85 98.85 0.989 50.00 49.43 44 HBACK SIEVE 20.24 TIME TER (mm) WEIGHT RI 63.0 53.0 37.5 26.5 26.5 19.0 16.0 13.2 20 9.5 O 9.5 0 2.0 0 0 9.5 0 0 4.75 0 0.850 0.0 0 0.250 0.0 0 20 0.106 6.0 0 0 9.03 32.0 6.0 0 9.03 32.0 6.0 0	Half Moon Bay West BH OR TP No.: Paterson Group DATE REPTD: SAMPLE INFORMATI 50.00 MVITY (Gs) 2.700 MOISTURE Tare No. 50.00 ACTUAL WI. 150.00 100.00 48.85 98.85 0.989 50.00 49.43 49.43 4 BACK SIEVE 20.24 TRATION 40.g / L GRAIN SIZE ANALY # BACK SIEVE 20.24 TRATION 40.g / L GRAIN SIZE ANALY # BACK SIEVE 20.24 TRATON 40.g / L GRAIN SIZE ANALY # EDIAMETER (mm) WEIGHT RETAINED (g) 63.0 53.0 37.5 20.0 26.5 0.0 19.0 16.0 13.2 0.0 9.5 0.0 0.475 0.0 0.850 0.11 0.425 0.28 0.250 0.62	Haif Moon Bay West BH OR TP No.: TP2-1 9138 TESTED BY: D. Be Paterson Group DATE REPTD: 26.A SAMPE IENFORMATION 50.00 REN MOISTURE 2.700 REN MOISTURE 2.700 REN MOISTURE 164.9 50.00 REN MOISTURE 19.00 100.00 148.85 98.85 0.389 50.00 49.43 HEACK SIEVE 20.24 TRATION 40 g / L GRAIN SIZE ANALYSIS PERCENT #E DIAMETER (mm) WEIGHT RETAINED (g) PERCENT 63.0 37.5 26.5 10.0 19.0 11.0 0.00 0.0 13.2 0.0 0.0 0.0 9.5 0.0 0.0 0.0 2.0 0.0.0 0.0 0.0 9.5 0.0 0.0 0.0 0.425 0.28 0.2 1 0.425 0.28 0.2 1	Hall Mon Bay West BH OR TP No.: TP2-18 - G1 99138 TESTED BY: D. Bentrand Paterson Group DATE REPTD: 28-Apr-18 SAMPLE INFORMATION 164.9 50.00 WITY (Gs) 2.700 PEMARKS SMOID 100.00 148.85 98.85 0.989 50.00 49.43 1 1 1BACK SIEVE 20.24 1 PERCENT RETAINED (g) PERCENT RETAINED 63.0 49.43 1 1 1 1 64.04 // 148.85 98.85 0.06 0.0 1 1 75.5 2 1 1 1 1 77.5 0.0 0.0 0.0 1 1 1 9.5 0.0 0.0 0.0 0.0 1	Haf Maon Bay West BH OR TP No.: TP2-16 - G1 DATE SAMPLED: 9133 TESTED BY: D. Bertand DATE RECEIVED: SAMPLE INFORMATION SAMPLE INFORMATION SAMPLE INFORMATION TESTED BY: D. Bertand DATE RECEIVED: SAMPLE INFORMATION SAMPLE INFORMATION REMARKS OTHER TARNO. GOOD ACTUAL W. SOUD GRAIN SIZE ANALYSIS DERCENT RETAINED PERCENT ACTUAL W. SOUD GRAIN SIZE ANALYSIS CORAMETER (mm) WEICHT RETAINED (g) PERCENT RETAINED SOUD SOUD SOUD GRAIN SIZE ANALYSIS CORECENT RETAINED PERCENT SOUD SOUD				

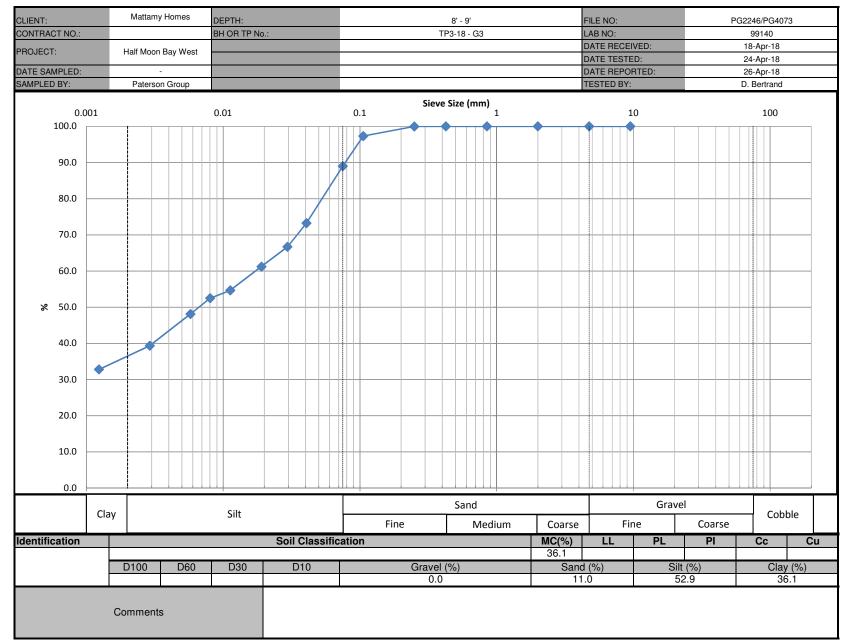


Im hun get

CLIENT:		Mattamy Homes		DEPTH:	6'	- 7'	FILE NO.:	PG2246/PG4073		
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP2-1	8 - G3	DATE SAMPLED:	-		
LAB No. :		99139		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18		
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18		
			S	AMPLE INFORMAT	TION					
SAMPLE MASS	12	20.3	50	0.00						
SPECIFIC G	RAVITY (Gs)	2.700			REN	IARKS				
HYGROSCOP	IC MOISTURE	Tare No.								
TARE Wt.	50.00	ACTUAL Wt.								
AIR DRY (Wa)	150.00	100.00								
OVEN DRY (Wo)	139.00	89.00								
F=(Wo/Wa)		890								
INITIAL Wt. (Ma)		0.00								
Wt. CORRECTED		4.50								
Wt. AFTER WAS		4.13								
SOLUTION CONCE	INTRATION	40 g / L								
				GRAIN SIZE ANALY	'SIS					
SI	EVE DIAMETER (n	าm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING		
	63.0									
	53.0 37.5									
	26.5									
	19.0									
	16.0									
	13.2									
	9.5		0	.0	0	.0	100	0.0		
	4.75			0.0		.0	100			
	2.0			.0		.0	100			
	Pan			0.3	Ŭ					
	0.850			.00	0	.0	100	0.0		
	0.425			.00	0	.0	100	0.0		
	0.250		0.250			.01	0	.0	100	0.0
	0.106			.84	1	.7	98	.3		
	0.075			.69	7	.4	92	.6		
	Pan	1		.12						
SIEVE	CHECK	0.2		= 0.3%						
				HYDROMETER DA		1				
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	ENT PASSING		
1	9:15	42.0	6.0	22.0	0.0398	80.0	80	.0		
2	9:16	39.5	6.0	22.0	0.0288	74.4	74	.4		
5	9:19	37.0	6.0	22.0	0.0186	68.9	68	.9		
15	9:29	33.5	6.0	22.0	0.0111	61.1	61	.1		
30	9:44	32.0	6.0	22.0	0.0079	57.8	57	.8		
60	10:14	30.0	6.0	22.0	0.0057	53.3	53			
250	13:24	25.0	6.0	22.0	0.0029	42.2	42			
1440	9:14	23.0	6.0	22.0	0.0012	37.8	37	.8		
Moisture Cont	tent = 39.3%			COMMENTS						
		Curtis Beadow				Joe Forsyth, P. Eng.				
REVIEWED BY:	for the	m		APPRO	VED BY:		Jette			

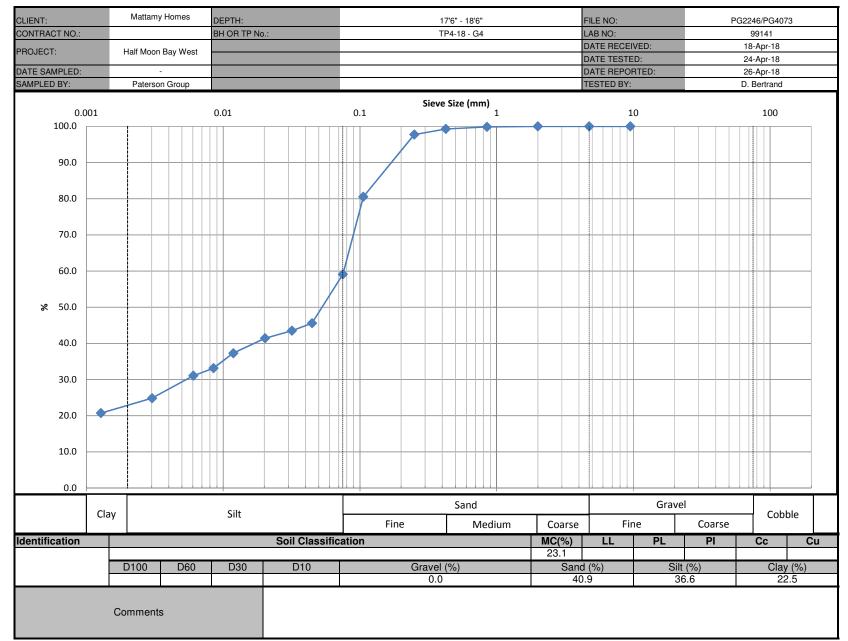


how have gette



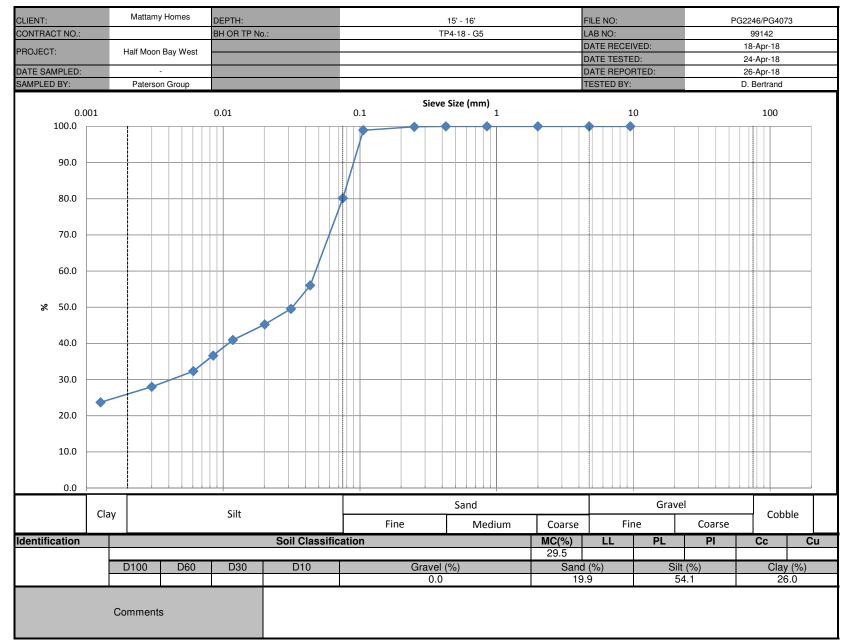
Im hun get

12	Mattamy Homes Half Moon Bay West 99140 Paterson Group		DEPTH: BH OR TP No.:		- 9' 8 - G3	FILE NO.: DATE SAMPLED:	PG2246/PG4073		
12	99140		BH OR TP No.:	TP3-1	8 - G3	DATE SAMPLED			
12				TP3-18 - G3		DATE SAMELED.	-		
12	Paterson Group		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18		
12			DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18		
12		s	AMPLE INFORMAT	ION					
	.7.8	50	.00						
AVITY (Gs)	2.700			REN	IARKS				
MOISTURE	Tare No.								
50.00	ACTUAL Wt.								
150.00	100.00								
140.45	90.45								
NTRATION	40 g / L			212					
			ARAIN SIZE ANALY						
VE DIAMETER (m	ım)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING		
63.0									
9.5		0	.0	0	0	100	.0		
4.75						100	.0		
2.0						100	.0		
Pan		12	7.8						
0.850									
0.425									
		0.250							
				1-	1.0	89.	0		
HECK	0.0			ТА					
TIME	Hs	Нс	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING		
	00 F	0.0		0.0407	70.0	70	0		
	1								
	1								
	1								
	1								
	1								
ent = 36.1.1%)								
	Curtis Beadow			Joe Forsyth P Fra					
Im the			APPRO	VED BY:					
	0.1 50 45 HBACK SIEVE ITRATION /E DIAMETER (m 63.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 4.75 2.0 Pan 0.850 0.425 0.250 0.106 0.075 Pan HECK 7 IME (24 hours) 9:28 9:29 9:32 9:42 9:57 10:27 13:37 9:27 ent = 36.1.1%	0.905 50.00 45.23 HBACK SIEVE 6.48 ITRATION 40 g / L //E DIAMETER (mm) 63.0 53.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 4.75 2.0 9.5 4.75 2.0 Pan 0.850 0.425 0.250 0.106 0.075 Pan 10.0 TIME (24 hours) 9:28 39.5 9:29 36.5 9:32 34.0 9:42 31.0 9:57 30.0 10:27 28.0 13:37 24.0	0.905 50.00 45.23 HBACK SIEVE 6.48 ITRATION 40 g / L 63.0 0 53.0 0 37.5 0 26.5 0 19.0 0 16.0 0 13.2 0 9.5 0 4.75 0 2.0 0 Pan 12 0.850 0.0 0.425 0 0.250 0 0.106 1 0.250 0 0.106 1 0.250 0 0.106 1 0.250 0 0.106 1 0.250 0 0.106 1 9:28 39.5 6.0 9:32 34.0 6.0 9:32 34.0 6.0 9:57 30.0 6.0 9:57 30.0 6.0 9:27 21.0 6.0	0.905 0.00 45.23 40 g / L BACK SIEVE 6.48 ITRATION 40 g / L GRAIN SIZE ANALY CRAIN SIZE ANALY CRAIN SIZE ANALY VEIGHT RETAINED (g) 63.0 53.0 37.5 26.5 19.0 16.0 13.2 0.0 9.5 0.0 4.75 0.0 2.0 0.0 Pan 127.8 0.850 0.00 0.425 0.01 0.250 0.02 0.106 1.34 0.075 5.50 Pan 6.48 HECK 0.0 MAX = 0.3% HYDROMETER DA 11ME Hs Hc Temp. (°C) 9:28 39.5 6.0 22.0 9:29 36.5 6.0 22.0 9:32 34.0 6.0 22.0 9:37 30.0 </td <td>0.995 50.00 45.23 48ACK SIEVE 6.48 ITRATION 40 g / L GRAIN SIZE ANALYSIS ////////////////////////////////////</td> <td>0.905 50.00 45.23 45.23 HEACK SIEVE 6.48 ITRATION 40 g / L CRAIN SIZE ANALYSIS KE DIAMETER (mm) WEIGHT RETAINED (g) PERCENT RETAINED 63.0 0 0 0 53.0 0 0 0 63.0 0 0 0 63.0 0 0 0 75.5 0 0 0 9.5 0.0 0.0 0.0 9.5 0.0 0.0 0.0 9.5 0.00 0.0 0.0 2.0 0.0 0.0 0.0 9.5 0.00 0.0 0.0 2.0 0.0 0.0 0.0 9.5 0.01 0.0 0.0 0.850 0.00 0.00 0.0 0.850 0.00 0.0 0.0 0.425 0.01 0.0 0.0 0.850 0.00 0.0</td> <td>0.905 0.00 45.23 458.CK SIEVE 6.48 ITRATION 40 g / L GRAIN SIZE ANALYSIS PERCENT RETAINED PERCENT 63.0 53.0 0</td>	0.995 50.00 45.23 48ACK SIEVE 6.48 ITRATION 40 g / L GRAIN SIZE ANALYSIS ////////////////////////////////////	0.905 50.00 45.23 45.23 HEACK SIEVE 6.48 ITRATION 40 g / L CRAIN SIZE ANALYSIS KE DIAMETER (mm) WEIGHT RETAINED (g) PERCENT RETAINED 63.0 0 0 0 53.0 0 0 0 63.0 0 0 0 63.0 0 0 0 75.5 0 0 0 9.5 0.0 0.0 0.0 9.5 0.0 0.0 0.0 9.5 0.00 0.0 0.0 2.0 0.0 0.0 0.0 9.5 0.00 0.0 0.0 2.0 0.0 0.0 0.0 9.5 0.01 0.0 0.0 0.850 0.00 0.00 0.0 0.850 0.00 0.0 0.0 0.425 0.01 0.0 0.0 0.850 0.00 0.0	0.905 0.00 45.23 458.CK SIEVE 6.48 ITRATION 40 g / L GRAIN SIZE ANALYSIS PERCENT RETAINED PERCENT 63.0 53.0 0		



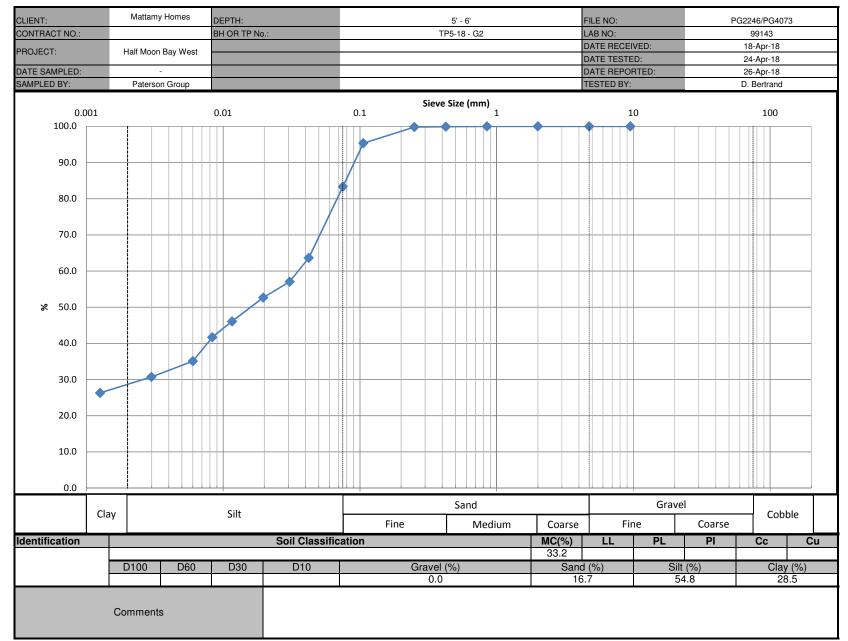
Im hu get

CLIENT:		Mattamy Homes		DEPTH:	17'6"	- 18'6"	FILE NO.:	PG2246/PG4073
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP4 -1	8 - G4	DATE SAMPLED:	-
LAB No. :		99141		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18
				AMPLE INFORMAT	ION			
SAMPLE MASS		69.4	50	.00				
SPECIFIC GF		2.700			REN	/ARKS		
HYGROSCOPI		Tare No.						
TARE Wt.	50.00	ACTUAL Wt.						
AIR DRY (Wa)	150.00	100.00						
OVEN DRY (Wo)	145.45	95.45						
F=(Wo/Wa)		955						
INITIAL Wt. (Ma)		0.00						
Wt. CORRECTED Wt. AFTER WAS		22.25						
SOLUTION CONCE		40 g / L						
SOLUTION CONCL		40 g / L		RAIN SIZE ANALY	2010			
SIE	EVE DIAMETER (m	וm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING
	63.0							
	53.0							
	37.5 26.5							
	19.0							
	16.0							
	13.2							
	9.5		0	.0		0.0	100	0.0
	4.75			.0		0.0	100	
	2.0			.0).0	100	
	Pan			9.5				
	0.850			07	C	0.1	99	.9
	0.425			36	C	0.7	99	.3
	0.250			14	2.3		97	.7
	0.106			74		9.5	80	
	0.075			20.47 40.9 22.25		40.9		.1
	Pan							
SIEVE C	CHECK	0.0		= 0.3%				
				HYDROMETER DA				
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	ENT PASSING
1	9:40	28.0	6.0	22.0	0.0447	45.6	45	.6
2	9:41	27.0	6.0	22.0	0.0318	43.5	43	.5
5	9:44	26.0	6.0	22.0	0.0203	41.4	41	.4
15	9:54	24.0	6.0	22.0	0.0119	37.3	37	.3
30	10:09	22.0	6.0	22.0	0.0085	33.1	33	
60	10:39	21.0	6.0	22.0	0.0061	31.1	31	
250	13:49	18.0	6.0	22.0	0.0030	24.9	24	
1440	9:39	16.0	6.0	22.0	0.0013	20.7	20	.7
Moisture Cont	ent = 23.1%			COMMENTS				
		Curtis Beadow					Joe Forsyth, P. Eng	
REVIEWED BY:	for the	hun		APPRO	VED BY:		genz	
							0	

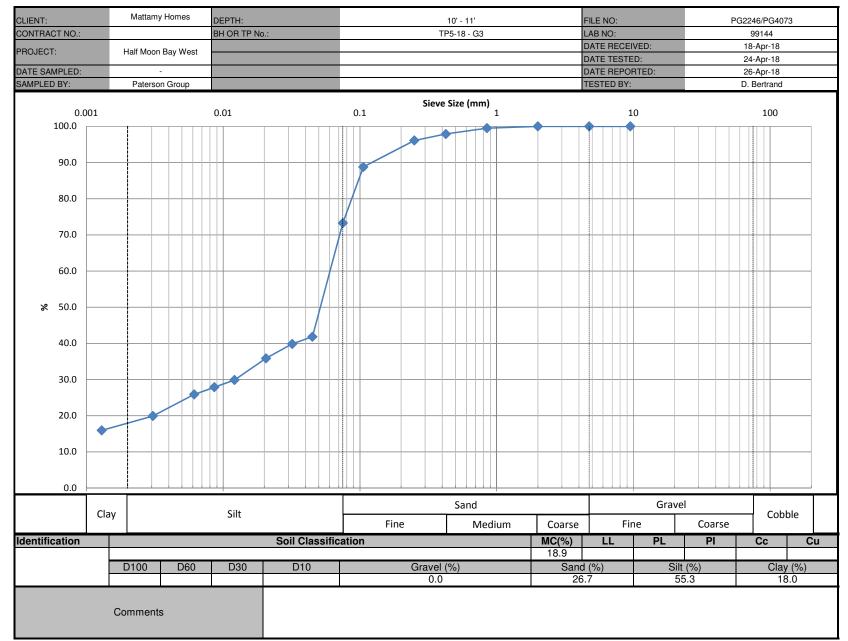


Im hun get

CLIENT:		Mattamy Homes		DEPTH:	15'	- 16'	FILE NO.:	PG2246/PG4073	
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP4-1	8 - G5	DATE SAMPLED:	-	
LAB No. :		99142		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18	
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18	
			S	AMPLE INFORMAT	TION				
SAMPLE MASS	16	63.4	50	.00					
SPECIFIC GI	RAVITY (Gs)	2.700			REN	IARKS			
HYGROSCOP		Tare No.							
TARE Wt.	50.00	ACTUAL Wt.							
AIR DRY (Wa)	150.00	100.00							
OVEN DRY (Wo)	141.80	91.80							
F=(Wo/Wa)		918							
INITIAL Wt. (Ma)		0.00							
Wt. CORRECTED		5.90							
Wt. AFTER WAS		12.56							
SOLUTION CONCE	INTRATION	40 g / L							
				RAIN SIZE ANALY	'SIS				
SIE	EVE DIAMETER (m	וm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING	
	63.0 53.0								
	37.5								
	26.5								
	19.0								
	16.0								
	13.2								
	9.5		0	.0	0	.0	100) ()	
	4.75			.0		.0	100		
	2.0			.0		.0	100		
	Pan			3.4		.0			
	0.850			00		.0	100		
	0.425			01		.0	100		
	0.250			0.06 0.53		.1	99		
	0.106					.1	98		
	0.075			94	19	9.9	80	.1	
	Pan			.56					
SIEVE (CHECK	0.0		= 0.3% HYDROMETER DA	T.A.				
	TIME	Hs	Нс	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	ENT PASSING	
ELAPSED	(24 hours)	00.0			0.0402			0	
1	9:53	32.0	6.0	22.0	0.0433	56.0	56		
2	9:54	29.0	6.0	22.0	0.0313	49.5	49		
5	9:57	27.0	6.0	22.0	0.0201	45.2	45		
15	10:07	25.0	6.0	22.0	0.0118	40.9	40		
30 60	10:22	23.0 21.0	6.0 6.0	22.0 22.0	0.0084	36.6 32.3	36		
250	10:52	19.0	6.0	22.0	0.0081	28.0	28		
250 1440	9:52	17.0	6.0	22.0	0.0030	28.0	28		
1440	9.52	17.0	0.0	COMMENTS	0.0013	20.1	23		
Moisture Cont	tent = 29.5%								
		Curtis Beadow			Joe Forsyth, P. Eng.				
REVIEWED BY:	Im Ke	hu		APPRO	VED BY:	Jett			
	tr.					1 per 12			



Im hun get

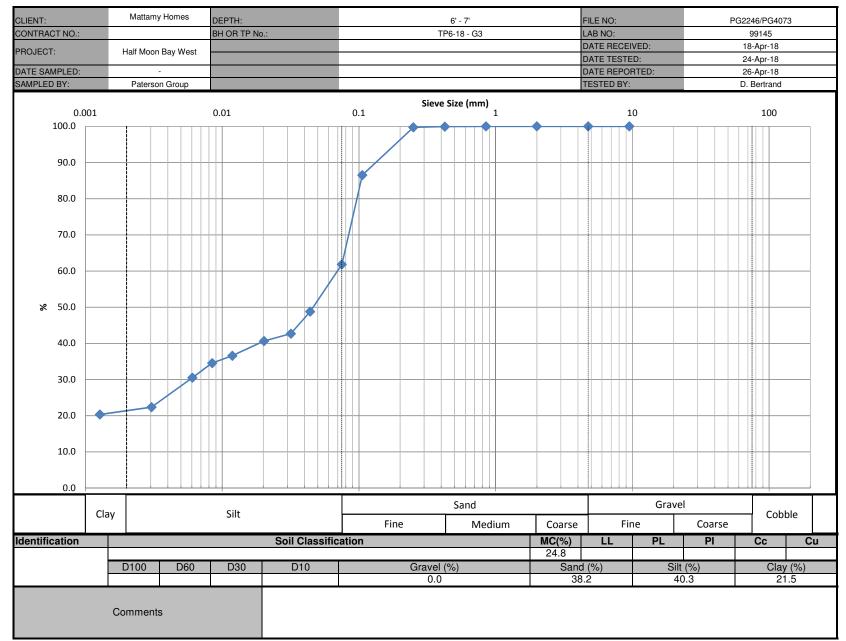


Im hu get

CLIENT:		Mattamy Homes		DEPTH:	10'	- 11'	FILE NO.:	PG2246/PG4073
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP5-1	8 - G3	DATE SAMPLED:	-
LAB No. :		99144		TESTED BY:	D. Be	rtrand	DATE RECEIVED:	18-Apr-18
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18
				AMPLE INFORMAT	ION			
SAMPLE MASS	14	12.6	50	.00				
SPECIFIC GI	RAVITY (Gs)	2.700			REM	IARKS		
HYGROSCOP		Tare No.						
TARE Wt.	50.00	ACTUAL Wt.						
AIR DRY (Wa)	150.00	100.00						
OVEN DRY (Wo)	149.25	99.25						
F=(Wo/Wa)		993						
INITIAL Wt. (Ma)		0.00						
Wt. CORRECTED		9.63						
Wt. AFTER WAS		14.58						
SOLUTION CONCE	INTRATION	40 g / L						
				RAIN SIZE ANALY	515			
SIE	EVE DIAMETER (m	nm)	WEIGHT R	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING
	63.0							
	53.0							
	37.5							
	26.5							
	19.0							
	16.0							
	13.2 9.5		0	.0		-	100	0
	4.75			.0		.0	100	
	2.0			.0		.0	100	
	Pan			2.6	0	.0	100	
	0.850			25	0	.5	99.	.5
	0.425			06	2	.1	97.	.9
	0.250			95	3	.9	96	.1
	0.106		5.61			1.2	88	.8
	0.075			.35	26	6.7	73.	.3
	Pan	1		.56				
SIEVE	CHECK	0.1		= 0.3%	 			
		[[HYDROMETER DA				
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING
1	9:16	27.0	6.0	22.0	0.0450	41.8	41.	.8
2	9:17	26.0	6.0	22.0	0.0320	39.9	39	.9
5	9:20	24.0	6.0	22.0	0.0206	35.9	35	.9
15	9:30	21.0	6.0	22.0	0.0121	29.9	29	.9
30	9:45	20.0	6.0	22.0	0.0086	27.9	27.	.9
60	10:15	19.0	6.0	22.0	0.0061	25.9	25	.9
250	13:25	16.0	6.0	22.0	0.0031	19.9	19	
1440	9:15	14.0	6.0	22.0	0.0013	15.9	15	.9
Moisture Cont	tent = 18.9%			COMMENTS				
		Curtis Beadow					Joe Forsyth, P. Eng.	
	Im the			APPRO		Jenne		

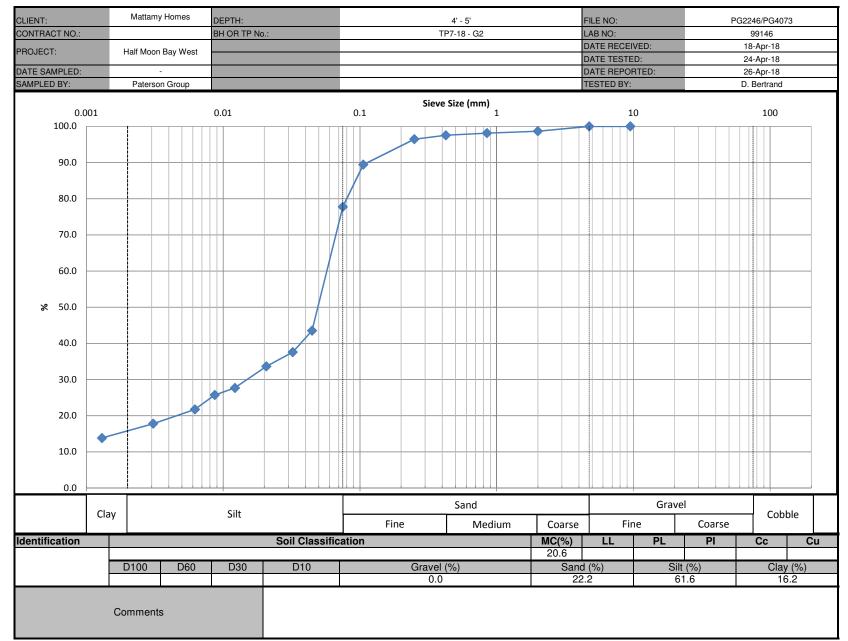
CLIENT:	Mattamy Homes	DESCRIPTIC	ON:		Silty Fine Sar	d to Sandy Sil	ty with Cla	у	FILE NO:			PG2246
CONTRACT NO.:	-	SPECIFICAT				-		-	LAB NO:			98983
PROJECT:	Half Moon Bay West	INTENDED U	JSE:			-			DATE RECE	EIVED:		7-Mar-18
I ROJECT.		PIT OR QUA	RRY:			-			DATE TEST	ED:		8-Mar-18
DATE SAMPLED:	6-Mar-18	SOURCE LC				TP6-18 - G2			DATE REPO			9-Mar-18
SAMPLED BY:	Nathan Christie	SAMPLE LO	CATION:			1.22 to 1.52			TESTED BY	:		D.B
0.01		0.1	L		Siev 1	ve Size (mm)			10			100
100.0												
90.0												
80.0			, 									
70.0												
70.0												
60.0												
× 50.0												
40.0												
30.0												
20.0												
10.0												
0.0												
	Silt and Clay			Sand					Gravel			Cobble
			Fine	Medium	Coar	se		Fine		Coar	se	
Identification			Soil Class	sification				MC(%)	LL	PL	PI	Cc
		D20	D10		Crow	1 (0/)		C-	nd (%)	C:	+ (0/)	0.60
	D100 D60 1.3 0.065	D30 0.028	D10 0.02		Grave 0.0				nd (%) 31.8	SI	t (%) F	Clay (

Low Run Jett



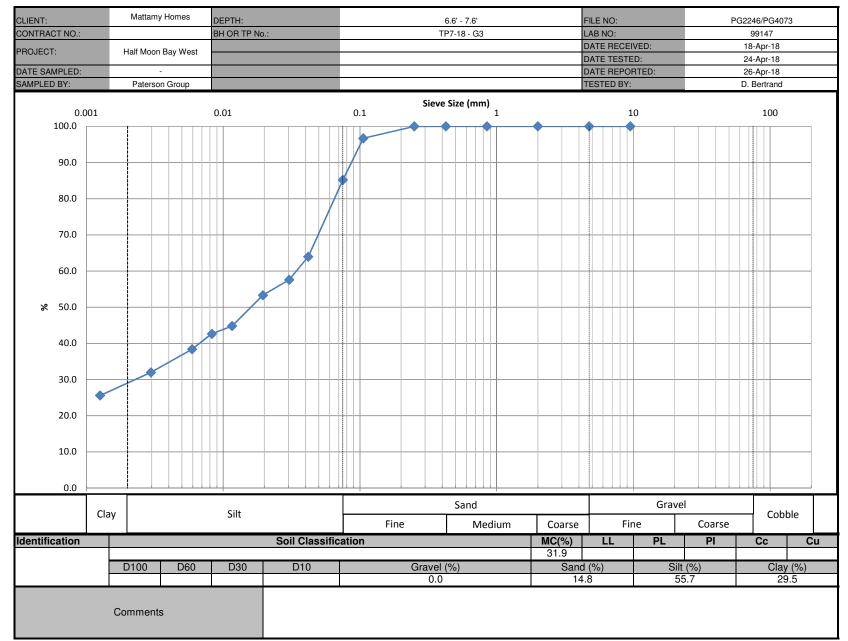
Im hun get

CLIENT:		Mattamy Homes		DEPTH:	6'	- 7'	FILE NO.:	PG2246/PG4073	
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP6-1	8 - G3	DATE SAMPLED:	-	
LAB No. :		99145		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18	
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18	
			S	AMPLE INFORMAT	TION				
SAMPLE MASS	17	71.9	50	.00					
SPECIFIC GF	RAVITY (Gs)	2.700			REM	IARKS			
HYGROSCOPI		Tare No.							
TARE Wt.	50.00	ACTUAL Wt.							
AIR DRY (Wa)	150.00	100.00							
OVEN DRY (Wo)	147.30	97.30							
F=(Wo/Wa)		973							
INITIAL Wt. (Ma)		0.00							
Wt. CORRECTED		3.65							
Wt. AFTER WAS		21.07							
SOLUTION CONCE	NTRATION	40 g / L							
				RAIN SIZE ANALY	'SIS				
SIE	EVE DIAMETER (m	וm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING	
	63.0								
	53.0 37.5								
	26.5								
	19.0								
	16.0								
	13.2								
	9.5		0	.0		.0	100) ()	
	4.75			.0		.0	100		
	2.0			.0		.0	100		
	Pan			1.9		.0			
					-		- T		
	0.850			01	C	.0	100	0.0	
	0.425			04	C	.1	99	.9	
	0.250			14	C	.3	99	.7	
	0.106			74		3.5	86	.5	
	0.075			.09	3	3.2	61	.8	
	Pan			.07					
SIEVE (CHECK	0.0		= 0.3%					
		1		HYDROMETER DA		1	-		
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	ENT PASSING	
1	9:28	30.0	6.0	22.0	0.0440	48.8	48	.8	
2	9:29	27.0	6.0	22.0	0.0318	42.7	42	.7	
5	9:32	26.0	6.0	22.0	0.0203	40.6	40	.6	
15	9:42	24.0	6.0	22.0	0.0119	36.6	36	.6	
30	9:57	23.0	6.0	22.0	0.0084	34.6	34	.6	
60	10:27	21.0	6.0	22.0	0.0061	30.5	30	.5	
250	13:37	17.0	6.0	22.0	0.0030	22.4	22	.4	
1440	9:27	16.0	6.0	22.0	0.0013	20.3	20	.3	
Moisture Cont	ent - 24 8%			COMMENTS					
	SIII - 27.0 /0								
		Curtis Beadow					Joe Forsyth, P. Eng	• <u> </u>	
REVIEWED BY:	for the	h		APPRO	VED BY:	Jean			



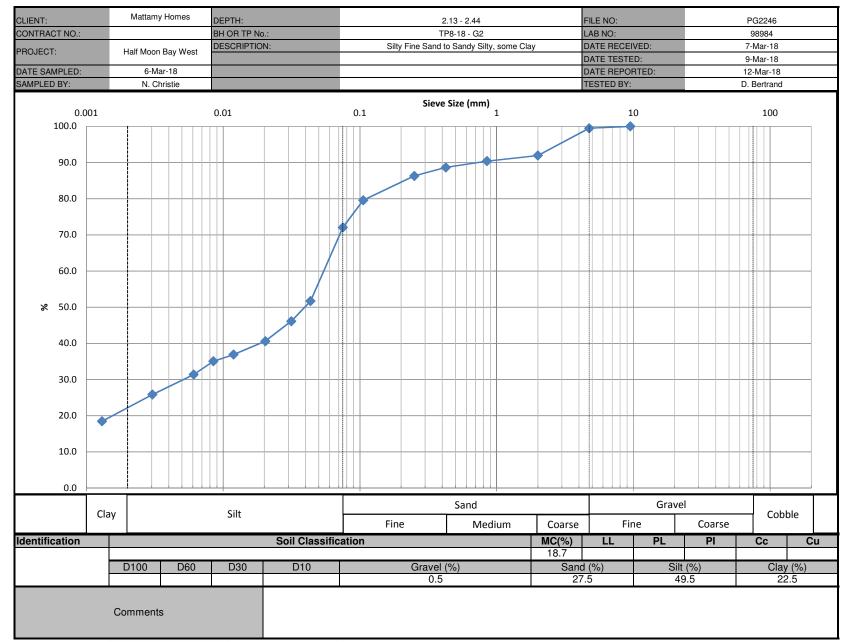
Im hu get

CLIENT:		Mattamy Homes		DEPTH:	4'	- 5'	FILE NO.:	PG2246/PG4073		
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP7-1	8 - G2	DATE SAMPLED:	-		
LAB No. :		99146		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18		
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18		
			S	AMPLE INFORMAT	TION					
SAMPLE MASS	17	77.7	50	.00						
SPECIFIC GR	· · ·	2.700			REN	MARKS				
HYGROSCOPI	C MOISTURE	Tare No.								
TARE Wt.	50.00	ACTUAL Wt.								
AIR DRY (Wa)	150.00	100.00								
OVEN DRY (Wo)	148.63	98.63								
F=(Wo/Wa)	0.	986								
INITIAL Wt. (Ma)	50).00								
Wt. CORRECTED	49	9.32								
Wt. AFTER WAS	H BACK SIEVE	12.6								
SOLUTION CONCE	NTRATION	40 g / L								
			0	GRAIN SIZE ANALY	'SIS					
SIE	EVE DIAMETER (m	ım)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING		
	63.0									
	53.0									
	37.5									
	26.5									
	19.0									
	13.2									
	9.5		0	.0			100	0		
	4.75			.0		.0	100			
	2.0					.0	98.			
	Pan			5.3		.4				
					T					
	0.850			26	1	.9	98	.1		
	0.425			57	2.5		97.	.5		
	0.250					12		.6	96.	.4
	0.106			68		0.6	89.			
	0.075			.59	22.2		77.	.8		
	Pan	1		.58						
SIEVE (CHECK	0.2		= 0.3%	<u> </u>					
		1		HYDROMETER DA		1				
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	INT PASSING		
1	9:41	28.0	6.0	22.0	0.0447	44.1	43.	5		
2	9:42	25.0	6.0	22.0	0.0323	38.1	37.	.6		
5	9:45	23.0	6.0	22.0	0.0207	34.1	33	.6		
15	9:55	20.0	6.0	22.0	0.0122	28.1	27.			
30	10:10	19.0	6.0	22.0	0.0087	26.1	25			
60	10:40	17.0	6.0	22.0	0.0062	22.1	21.			
250	13:50	15.0	6.0	22.0	0.0031	18.0	17.			
1440	9:40	13.0	6.0	22.0	0.0013	14.0	13	.8		
Moisture Cont	ent = 20.6%			COMMENTS						
		Curtis Beadow			Joe Forsyth, P. Eng.					
REVIEWED BY:	for the			APPRO	VED BY:	Je All				

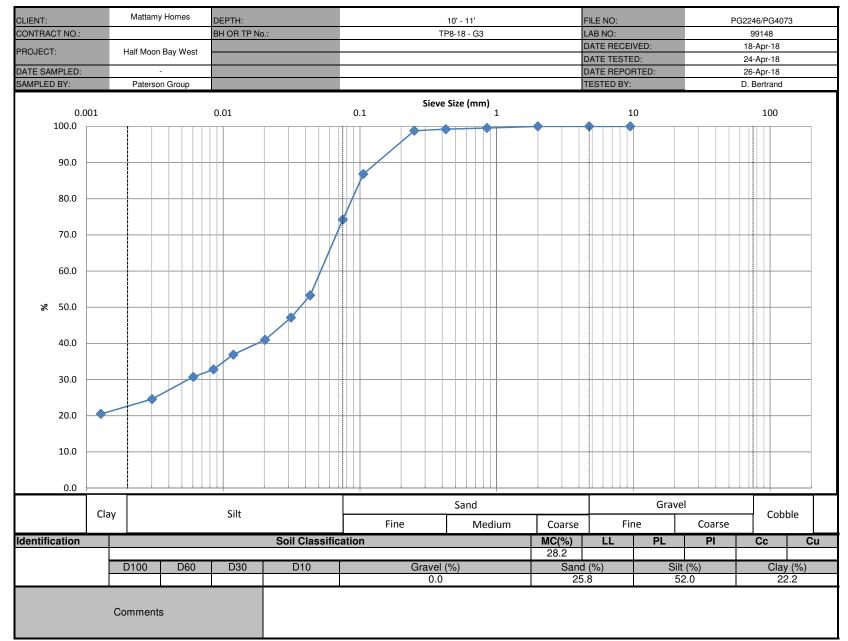


Im hun get

CLIENT:		Mattamy Homes		DEPTH:	6.6'	- 7.6'	FILE NO.:	PG2246/PG4073
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP7 -1	8 - G3	DATE SAMPLED:	-
LAB No. :		99147		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18
			s		ΓΙΟΝ			
SAMPLE MASS	18	37.9	50	0.00				
SPECIFIC G	RAVITY (Gs)	2.700			REM	MARKS		
HYGROSCOP	IC MOISTURE	Tare No.						
TARE Wt.	50.00	ACTUAL Wt.						
AIR DRY (Wa)	150.00	100.00						
OVEN DRY (Wo)	142.75	92.75						
F=(Wo/Wa)		928						
INITIAL Wt. (Ma)		0.00						
Wt. CORRECTED		5.38						
Wt. AFTER WAS		8.95						
SOLUTION CONCE	ENTRATION	40 g / L						
			(GRAIN SIZE ANALY	'SIS			
SI	EVE DIAMETER (n	וm)	WEIGHT R	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING
	63.0							
	53.0							
	37.5							
	26.5							
	19.0							
	16.0 13.2							
	9.5			0.0			100	0
	4.75			0.0		.0	100	
	2.0			0.0		.0	100	
	Pan				L L	.0	100	
	0.850		0.	.00	C	.0	100).0
	0.425		0.	.00	C	.0	100).0
	0.250		0.	.01	0.0		100).0
	0.106		1.	.65	3	.3	96	.7
	0.075				14	4.8	85	.2
	Pan		8.	.93				
SIEVE	CHECK	0.2	MAX	= 0.3%				
				HYDROMETER DA	TA			
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	ENT PASSING
1	9:53	36.0	6.0	22.0	0.0419	64.0	64	.0
2	9:54	33.0	6.0	22.0	0.0304	57.6	57	.6
5	9:57	31.0	6.0	22.0	0.0195	53.3	53	.3
15	10:07	27.0	6.0	22.0	0.0116	44.8	44	.8
30	10:22	26.0	6.0	22.0	0.0083	42.6	42	.6
60	10:52	24.0	6.0	22.0	0.0059	38.4	38	.4
250	14:02	21.0	6.0	22.0	0.0030	32.0	32	.0
1440	9:52	18.0	6.0	22.0	0.0013	25.6	25	.6
				COMMENTS				
Moisture Con	tent = 31.9%							
	Curtis Readow						Joe Forsyth P Fng	_
REVIEWED BY:	Im Ko			APPRO	VED BY:			
Moisture Con	tent = 31.9%	Curtis Beadow		COMMENTS		Joe Forsyth, P. Eng.		



how have get



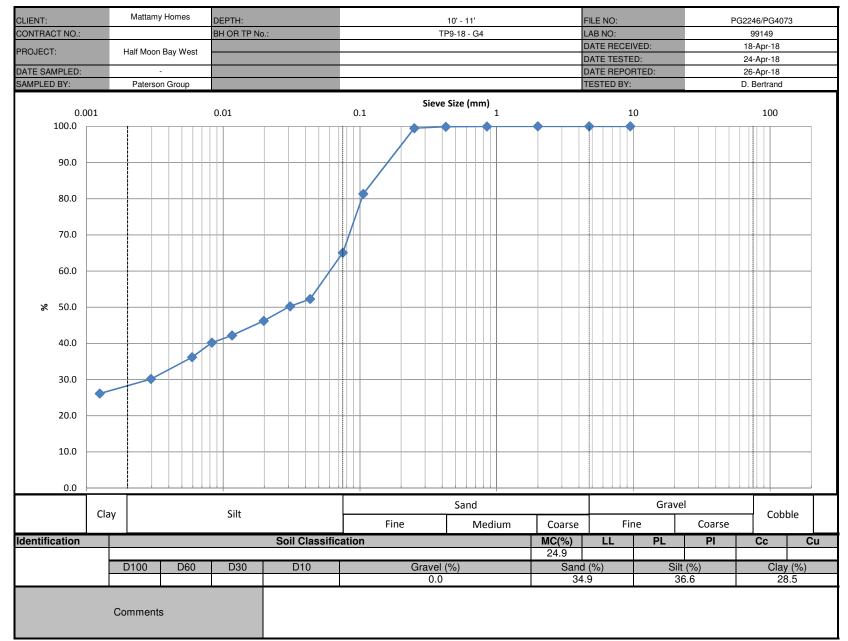
Im hun get

	Mattamy Homes		DEPTH:	10'	- 11'	FILE NO.:	PG2246/PG4073				
	Half Moon Bay West		BH OR TP No.:	TP8-1	8 - G3	DATE SAMPLED:	-				
	99148		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18				
	Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18				
				ION							
	55.1	50	.00								
	2.700			REN	IARKS						
NIRATION	40 g / L	0									
				515							
VE DIAMETER (m	ım)	WEIGHT RE	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING				
63.0											
37.5											
26.5											
19.0											
16.0											
13.2											
9.5		0	.0	0	.0	100	0.0				
4.75		0	.0			100	0.0				
2.0		0	.0	0	.0	100	0.0				
Pan		15	5.1								
0.850				0	.5	99.	.5				
0.425				0	.8	99.	2				
0.250		0.250		0.250				1.2		98.	.8
0.106				10	3.2	86.	.8				
0.075				25	5.8	74.	.2				
Pan	1	13	.75								
HECK	0.0										
			HYDROMETER DA	TA							
TIME (24 hours)	Hs	Нс	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING				
10:06	32.0	6.0	22.0	0.0433	53.3	53.	.3				
10:07	29.0	6.0	22.0	0.0313	47.1	47.	.1				
10:10	26.0	6.0	22.0	0.0203	41.0	41.	.0				
10:20	24.0	6.0	22.0	0.0119	36.9	36.					
10:35	22.0	6.0	22.0	0.0085	32.8	32.					
11:05	21.0	6.0	22.0	0.0061	30.7	30.					
14:15	18.0	6.0	22.0	0.0030		24.					
10:05	16.0	6.0	22.0	0.0013	20.5	20.	.5				
ent = 28.2%			COMMENTS								
	Curtis Beadow					Joe Forsyth, P. Eng.	·				
Im to	hun		APPRO	VED BY:		JeAz	\geq				
	AVITY (Gs) AVITY (Gs) 50.00 150.00 146.50 0. 50.00 146.50 0. 50.00 146.50 0. 48 HBACK SIEVE VE DIAMETER (m 63.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 4.75 2.0 Pan 0.850 0.425 0.250 0.106 0.075 Pan HECK TIME (24 hours) 10:06 10:07 10:10 10:20 10:35 11:05 14:15 10:05 Ent = 28.2%	Half Moon Bay West 99148 99148 Paterson Group 155.1 AVITY (Gs) 2.700 AVITY (Gs) 2.700 OMOISTURE Tare No. 50.00 ACTUAL Wt. 150.00 100.00 146.50 96.50 0.965 SO.00 48.25 HBACK SIEVE 13.75 TIATION 40 g / L VE DIAMETER (mm) G3.0 5 A.75 26.5 19.0 16.0 A.75 2.0 Pan 0.850 0.425 0.250 0 A.75 2.0 Pan HECK 0.0 0 10:06 32.0<	Half Moon Bay West 99148 S 155.1 S 155.1 S AVITY (Gs) 2.700 AVITY (Gs) 2.700 AVITY (Gs) 2.700 AVITY (Gs) 2.700 MOISTURE Tare No. 50.00 ACTUAL Wt. 155.5 O 0.965 S O VEIGHT RE 63.0 S O VEIGHT RE 63.0 S O S O S O S O O S O O	Half Moon Bay West BH OR TP No.: 99148 TESTED BY: Paterson Group DATE REPTD: SAMPLE INFORMAT 50.00 AVITY (Gs) 2.700 2 MOISTURE Tare No. 50.00 ACTUAL WI. 155.00 100.00 48.25 96.50 0.965 50.00 48.25 13.75 4BACK SIEVE 13.75 4BACK SIEVE 13.75 4BACK SIEVE 13.75 26.5	Half Moon Bay West BH OR TP No.: TP8-1 9148 TESTED BY: D. Be Paterson Group DATE REPTD: 26.A SAMPE INFORMATION 155.1 50.00 AVITY (Gs) 2.700 REN MOISTURE Tare No. SAMPE INFORMATION 50.00 ACT IN TARE INFORMATION 50.00 ACT IN TARE INFORMATION SAMPE INFORMATION SAMPE INFORMATION GRAIN SIZE ANALYSIS MOISTURE Tare No. GRAIN SIZE ANALYSIS MOISTURE Tare No. GRAIN SIZE ANALYSIS VEIDAMETER (mm) WEIGHT RETAINED (g) PERCENT 63.0 O.0 O.0 SAMPE INFORMATION GRAIN SIZE ANALYSIS VEIDAMETER (mm) WEIGHT RETAINED (g) 6.0	Hall Moon Bay West BH OR TP No.: TP8-18 - G3 9143 TESTED BY: D. Betrand SAMPLE INFORMATION 155.1 50.00 REMARKS 2MOISTURE Tare No. 50.00 REMARKS 50000 ACTUAL W. France REMARKS 155.0 96.50 0.365 50.00 48.25 48.25 13.75 1BACK SIEVE 13.75 FRATION FRETER (mm) VEIGHT RETAINED (g) PERCENT RETAINED 63.0 53.0 30.0 - - 37.5 0.0 0.0 - 28.5 0.0 0.0 - 18.0 155.1 - - 9.5 0.0 0.0 0.0 28.5 0.39 0.8 0.23 9.5 0.0 0.0 0.0 13.2 0.5 0.0 0.0 9.5 0.0 0.0 1.2 0.155.1 - -	Half Moon Bay West BH OR TP No.: TP8-18 - G3 DATE SAMPLED; 03148 TESTED BY: D.Bertrand DATE REFTC 28-Apr-18 DATE TESTED; SAMPLE INFORMATION BELOW REMARKS SAMPLE INFORMATION Additional State Analysis SAMPLE INFORMATION 40 g/L GRAIN SIZE ANALYSIS VECIDAMETER (mm) WEIGHT RETAINED (g) PERCENT RETAINED PERCENT RETAINED SAMPLE INFORMATION Additional State Analysis SAMPLE INFORMATION SAMPLE INFORMATION SAMPLE INFORMATINE				

IENT:	Mattamy Homes	DESCRIPTIO			Silty Sa			FILE NO:				PG2246	
NTRACT NO.:	· ·	SPECIFICAT			Silty Sand w			LAB NO:			98985		
OJECT:	Half Moon Bay West	INTENDED U			-			DATE RECE		7-Mar-18			
		PIT OR QUAR			-		DATE TESTED:			8-Mar-18			
ATE SAMPLED:	6-Mar-18	SOURCE LO			TP9 - 18			DATE REPO			9-Mar-18		
MPLED BY:	Nathan Christie	SAMPLE LOO	CATION:		2.44 to	2.74		TESTED BY			D.B		
0.01		0.1			Sieve Size	(mm)		10			100		
90.0													
80.0													
70.0													
60.0													
% 50.0													
40.0													
30.0													
20.0													
10.0													
0.0	Silt and Clay			Sand	<u> </u>			Gravel			Cobble		
	Silt and Cidy		Fine	Medium	Coarse		Fine		Coars	e	Connie		
entification			Soil Classi				MC(%)) LL	PL	PI	Cc	Cu	
			0011 012351	illation			1010(/0)			r I	0.65	3.0	
	D100 D60	D30	D10		Gravel (%)		S-1	ind (%)	Silt	(%)	Clay (
	2.5 0.045	0.021	0.015		0.0			25.9	- 311	70) 7	4.1	/0)	
	Comments	0.021	0.010		0.0			20.0	1	1			

Im kn get

paterso consulting e						SIEVE AN	
CLIENT:	Mattam	y Homes	DESCRIPTION:	Siltv	Sand	FILE NO.:	PG2246
CONTRACT NO.:		-	SPECIFICATION:	-	w Some Clay	LAB NO.:	98985
	11-16 N.A		INTENDED USE:	•	-	DATE REC'D:	7-Mar-18
PROJECT:	Half Moo	n Bay West	PIT OR QUARRY: -			DATE TESTED:	8-Mar-18
DATE SAMPLED:	06-N	lar-18	SOURCE LOCATIO	DN:	TP9 - 18 G3	DATE REP'D:	9-Mar-18
SAMPLED BY:	Nathar	n Christie	SAMPLE LOCATIO	DN:	2.44 to 2.74	TESTED BY:	D.B
WEIGHT BEFORE	WASH			A+B		255.5	
WEIGHT AFTER W	/ASH	A	В	A+B		100.4	
SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REMA	NRK
150							
106							
75							
63							
53							
37.5							
26.5							
19							
16							
13.2							
9.5							
6.7							
4.75							
2.36	0.0	0.0	100.0				
1.18	0.1	0.0	100.0				
0.6	0.6	0.2	99.8				
0.3	4.0	1.6	98.4				
0.15	19.0	7.4	92.6				
0.075	66.3	25.9	74.1				
PAN	100.4						
SIEVE CHECK FIN	E	0.00		0.3% max.	•	REFERENCE	MATERIAL
OTHER TESTS					RESULT	LAB NO.	RESULT
		Curtis Beado	w		Joe Fo	rsyth, P. Eng.	•
REVIEWED BY:	In	~ hu				72	



Im hun get

CLIENT:		Mattamy Homes		DEPTH:	10'	- 11'	FILE NO.:	PG2246/PG4073
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP9-1	8 - G4	DATE SAMPLED:	-
LAB No. :		99149		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18
				AMPLE INFORMAT	TION			
SAMPLE MASS	16	64.6	50	0.00				
SPECIFIC GI		2.700			REN	IARKS		
HYGROSCOPI		Tare No.						
TARE Wt.	50.00	ACTUAL Wt.						
AIR DRY (Wa)	150.00	100.00						
OVEN DRY (Wo)	148.40	98.40						
F=(Wo/Wa)		984						
INITIAL Wt. (Ma)		0.00						
Wt. CORRECTED		9.20						
Wt. AFTER WAS		18.83						
SOLUTION CONCE	INTRATION	40 g / L						
				GRAIN SIZE ANALY	515			
SIE	EVE DIAMETER (m	וm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING
	63.0 53.0							
	37.5							
	26.5							
	19.0							
	16.0							
	13.2							
	9.5		0	.0	0	.0	100	0.0
	4.75			0.0		.0	100	
	2.0			.0		.0	100	
	Pan			4.6		.0		
	0.850			.02		.0	100	
	0.425			.06		.1	99.	
	0.250			<u>.26</u> .34		.5	99	
	0.106			.34 '.47		3.7	81.	
	0.075			.47 5.81	34	4.9	65	.1
	Pan	0.1						
SIEVE	JHEUK	0.1		= 0.3% HYDROMETER DA	ΤΔ			
	TIME	Hs	Нс	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING
ELAPSED	(24 hours)	22.0	6.0		0.0420		50	2
1 2	10:20	32.0	6.0	22.0	0.0433	52.3 50.2	52.	
5	10:21	31.0 29.0	6.0 6.0	22.0 22.0	0.0309	50.2 46.2	46	
5 15	10:24	29.0	6.0	22.0	0.0198	46.2	40.	
30	10:49	26.0	6.0	22.0	0.0083	42.2	42	
60	11:19	24.0	6.0	22.0	0.0059	36.2	36	
250	14:29	21.0	6.0	22.0	0.0030	30.1	30	
1440	10:19	19.0	6.0	22.0	0.0013	26.1	26	
				COMMENTS				
Moisture Cont	tent = 24.9%							
		Curtis Beadow				1	Joe Forsyth, P. Eng.	
REVIEWED BY:	Im the			APPRO	VED BY:		Jet Ar	
	for the						0	

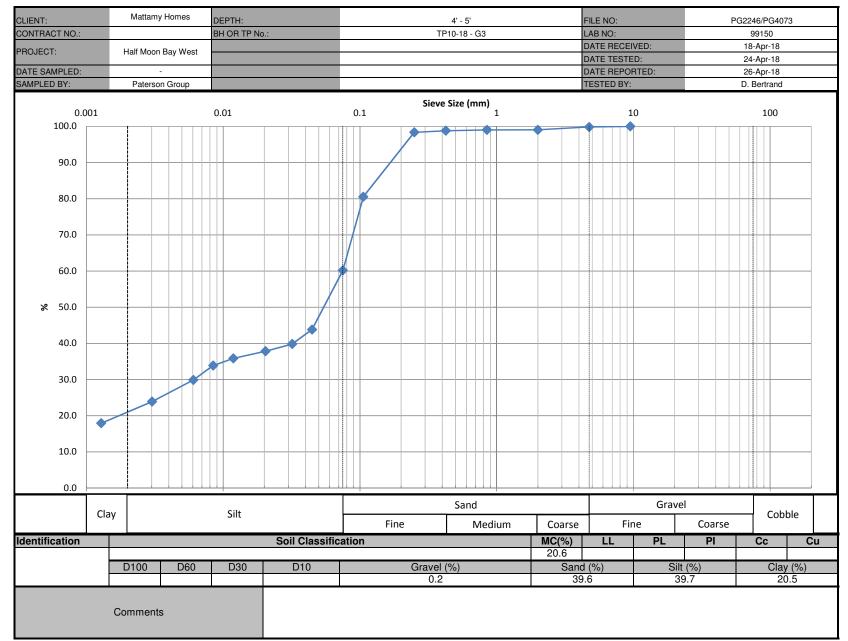
IENT:	Mattamy Homes	DESCRIPTION			Silty S		FILE NO:				PG2246	
NTRACT NO.:	· ·	SPECIFICATIO			Silty Sand w						98985	
OJECT:	Half Moon Bay West	INTENDED USE			-			DATE RECEIVED:			7-Mar-18	
		PIT OR QUARF			-		DATE TESTED:				8-Mar-18	
ATE SAMPLED:	6-Mar-18	SOURCE LOCA			TP9 - 1		DATE REPORTED:				9-Mar-18	
MPLED BY:	Nathan Christie	SAMPLE LOCA	TION:		2.44 to	2.74		TESTED BY	:		D.B	
0.01		0.1		▲	Sieve Size	(mm)		10			100	
90.0												
80.0												
70.0												
60.0												
% 50.0												
40.0												
30.0												
20.0												
10.0												
0.0	Silt and Clay			Sand Gravel								
	Silt and Clay		Fine	Medium	Coarse		Fine		Coars	e	Cobble	
entification			Soil Classi	fication			MC(%)	LL	PL	PI	Cc	Cu
entineation				neation			WC(78)	LL	F L	FI	0.65	3.0
	D100 D60	D30	D10		Gravel (%)		60	nd (%)	Cil+	(%)	Clay (
		0.021	0.015	-	0.0			na (%) 25.9	ગા	(/0)	4.1	/0)
	2.5 0.045						1				4 1	

Im kn get

paterso consulting e						SIEVE AN	
CLIENT:	Mattam	y Homes	DESCRIPTION:	Siltv	Sand	FILE NO.:	PG2246
CONTRACT NO.:		-	SPECIFICATION:	-	w Some Clay	LAB NO.:	98985
	11-16 N.A		INTENDED USE:	•	-	DATE REC'D:	7-Mar-18
PROJECT:	Half Moo	n Bay West	PIT OR QUARRY:		-	DATE TESTED:	8-Mar-18
DATE SAMPLED:	06-N	lar-18	SOURCE LOCATIO	DN:	TP9 - 18 G3	DATE REP'D:	9-Mar-18
SAMPLED BY:	Nathar	n Christie	SAMPLE LOCATIO	N:	2.44 to 2.74	TESTED BY:	D.B
WEIGHT BEFORE	WASH			A+B		255.5	
WEIGHT AFTER W	/ASH	A	В	A+B		100.4	
SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REMA	NRK
150							
106							
75							
63							
53							
37.5							
26.5							
19							
16							
13.2							
9.5							
6.7							
4.75							
2.36	0.0	0.0	100.0				
1.18	0.1	0.0	100.0				
0.6	0.6	0.2	99.8				
0.3	4.0	1.6	98.4				
0.15	19.0	7.4	92.6				
0.075	66.3	25.9	74.1				
PAN	100.4						
SIEVE CHECK FIN	E	0.00		0.3% max.	•	REFERENCE	MATERIAL
OTHER TESTS					RESULT	LAB NO.	RESULT
		Curtis Beado	w		Joe Fo	rsyth, P. Eng.	•
REVIEWED BY:	In	~ hu				72	

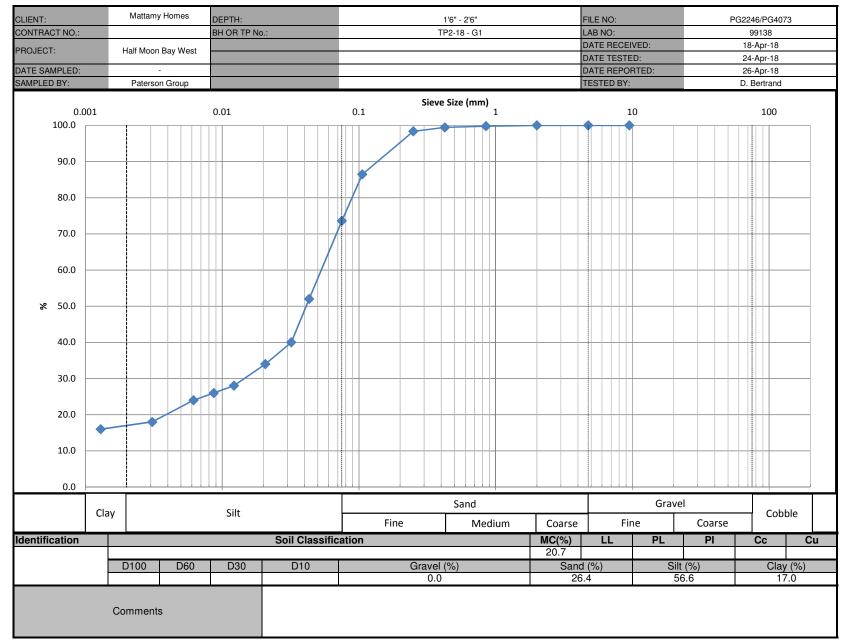
TE SAMPLED:	- alf Moon Bay West 6-Mar-18 Nathan Christie	SPECIFICATI INTENDED U PIT OR QUAI SOURCE LOO SAMPLE LOO 0.1	JSE: RRY: DCATION: CATION:			Sand w Son	3 G2 .07			LAB NO: DATE REC DATE TES DATE REC TESTED F	STED: PORTED:			98986 7-Mar-18 8-Mar-18 9-Mar-18 D.B 100	
O.01 100.0 90.0 80.0 70.0 60.0	6-Mar-18	PIT OR QUAR SOURCE LOO SAMPLE LOO	RRY: DCATION: CATION:			- TP10 - 18 0.76 to 1 Sieve Size	.07			DATE TES DATE REI TESTED E	STED: PORTED:			8-Mar-18 9-Mar-18 D.B	
O.01 100.0 90.0 80.0 70.0 60.0	6-Mar-18	SOURCE LOO SAMPLE LOO	CATION: CATION:			TP10 - 18 0.76 to 1	.07			DATE REI TESTED E	PORTED:			9-Mar-18 D.B	
0.01 100.0 90.0 80.0 70.0 60.0		SAMPLE LOO	CATION:			0.76 to 1	.07			TESTED E				D.B	
0.01 100.0 90.0 80.0 70.0 60.0	Nathan Christie					Sieve Size		•			3Y:				
100.0 90.0 80.0 70.0 60.0						Sieve Size ((mm)			10					
80.0 70.0 60.0															
70.0 60.0															
60.0			•												
			•												
% 50.0															
40.0															
30.0															
20.0															
10.0															
0.0															
	Silt and Clay		Fine	Sand	1	Cooree			ino	Gravel	0			Cobble	e
			Fine	Medium		Coarse			ine			arse			
ntification			Soil Classif	Ication				ľ	AC(%)	LL	PL		PI	Cc 0.95	Cu
		Daa			_				0.5-1						4.9
	100 D60 4.9 0.17	D30 0.075	D10 0.035			ravel (%) 0.0				d (%) 0.4	5	Silt (%	0)	9.6	ay (%)
	nments	0.070	Jee					1	,				L		

paterso consulting er	ngroup					SIEVE AN ASTM	
CLIENT:	Mattam	y Homes	DESCRIPTION:	S	Sand	FILE NO.:	PG2246
CONTRACT NO.:		-	SPECIFICATION:	Sand w	Some Silt	LAB NO.:	98986
PROJECT:	Half Moor	n Bay West	INTENDED USE:		-	DATE REC'D:	7-Mar-18
FROJECT.		T Day West	PIT OR QUARRY:		-	DATE TESTED:	8-Mar-18
DATE SAMPLED:	06-N	lar-18	SOURCE LOCATIC	N:	TP10 - 18 G2	DATE REP'D:	9-Mar-18
SAMPLED BY:	Nathan	Christie	SAMPLE LOCATIO	N:	0.76 to 1.07	TESTED BY:	D.B
WEIGHT BEFORE	WASH			A+B		281.4	
WEIGHT AFTER W	ASH	А	В	A+B		215.9	
SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REM	ARK
150							
106							
75							
63							
53							
37.5							
26.5							
19							
16							
13.2							
9.5							
6.7							
4.75	0.0	0.0	100.0				
2.36	0.2	0.1	99.9				
1.18	0.6	0.2	99.8				
0.6	3.0	1.1	98.9				
0.3	27.3	9.7	90.3				
0.15	126.3	44.9	55.1				
0.075	198.0	70.4	29.6				
PAN	215.5						
SIEVE CHECK FIN	E	0.19		0.3% max.		REFERENCE	MATERIAL
OTHER TESTS					RESULT	LAB NO.	RESULT
		Curtis Beado	W		Joe For	syth, P. Eng.	I
REVIEWED BY:	In	~ h~					



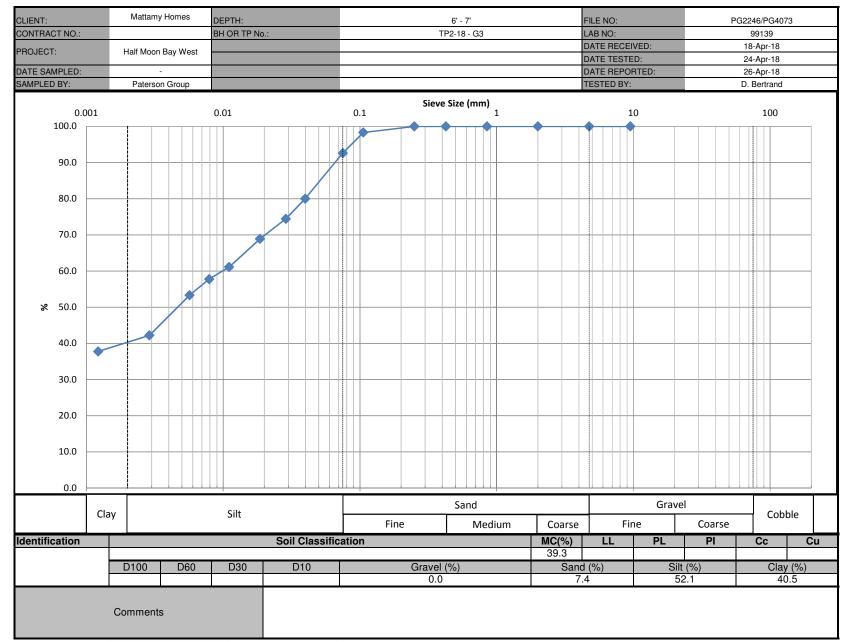
Im hun get

	Mattamy Homes		DEPTH:	4'	- 5'	FILE NO.:	PG2246/PG4073		
	Half Moon Bay West		BH OR TP No.:	TP10-	18 - G3	DATE SAMPLED:	-		
	99150		TESTED BY:	D. Be	rtrand	DATE RECEIVED:	18-Apr-18		
	Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18		
		S	AMPLE INFORMAT	ION					
1	77	50	.00						
RAVITY (Gs)	2.700			REM	IARKS				
C MOISTURE	Tare No.								
50.00	ACTUAL Wt.								
150.00	100.00								
148.35	98.35								
0.	984								
50	0.00								
49	9.18								
H BACK SIEVE	21.13								
NTRATION	40 g / L								
		C	RAIN SIZE ANALY	SIS					
	am)			DEDCENT	RETAINED	DEDCENT	PASSING		
				PERCENT		FERGENT			
63.0									
53.0									
37.5									
26.5									
19.0									
16.0									
13.2									
9.5		0	.0	0	.0	100	.0		
4.75		0	.3	0	.2	99.	8		
2.0		1	.7	1	.0	99.	0		
Pan		17	5.3						
0.850		0.	01	1	.0	99.	0		
0.425		0.	13	1	.2	98.	8		
0.250		0.	35	1	.7	98.	3		
0.106		9.	34	19	9.5	80.	5		
		19	.62						
		21	.12						
	0.0	MAX :	= 0.3%						
	• •			ТА		4			
TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING		
10:32	28.0	6.0	22.0	0.0447	44.2	43.	8		
10:33	26.0	6.0	22.0	0.0320	40.2	39.	8		
10:36	25.0	6.0	22.0	0.0204	38.2	37.			
10:46	24.0	6.0	22.0	0.0119	36.2	35.			
11:01	23.0	6.0	22.0	0.0084	34.2	33.			
11:31	21.0	6.0	22.0	0.0061	30.2	29.			
14:41	18.0	6.0	22.0	0.0030	24.1	23.			
10:31	15.0	6.0	22.0		18.1	17.			
			COMMENTS						
ent = 20.6%									
	Curtis Beadow					Joe Forsyth, P. Eng.			
1			APPRO			Joe Forsyth, P. Eng.			
	AVITY (Gs) C MOISTURE 50.00 150.00 148.35 0. 50 148.35 0. 50 44 H BACK SIEVE NTRATION VE DIAMETER (n 63.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 4.75 2.0 Pan 0.850 0.425 0.250 0.106 0.075 Pan CHECK TIME (24 hours) 10:32 10:33 10:36 10:46 11:01 11:31 14:41 10:31 ent = 20.6%	Half Moon Bay West 99150 Paterson Group Paterson Group COUSTURE Tare No. SO.00 ACTUAL Wt. 150.00 ACTUAL Wt. 150.00 ACTUAL Wt. 150.00 SO.00 ACTUAL Wt. 150.00 44.00 SO.00 44.00 SO.00 44.00 SO.00 44.00 SO.00 44.00 SO.00 SO.00 SO.00 SO.00 SO.00 SO.0 SO.0 SO.0 SO.0 SO.0 SO.0 SO.0 SO.0 SO.0 <th colspa<="" td=""><td>Half Mon Bay West 99150 Paterson Group S 177 50 AVITY (Gs) 2.700 C S 177 50 AVITY (Gs) 2.700 C S 0.00 ACTUAL Wt. 150.00 100.00 148.35 98.35 0.984 50.00 49.18 H MEIGHT RI 63.0 53.0 53.0 0 S C VEIGHT RI 63.0 S O VEIGHT RI 63.0 VEIGHT RI 63.0 S O A O A O O <th c<="" td=""><td>Half Moon Bay West BH OR TP No.: 99150 TESTED BY: DATE REPTD: SAMPLE INFORMAT 177 50.00 RAVITY (Gs) 2.700 C MOISTURE Tare No. 50.00 ACTUAL WI. 150.00 100.00 49.18 40.9.18 HBACK SIEVE 21.13 NTRATION 40.g / L GRAIN SIZE ANALY VE DIAMETER (mm) WEIGHT RETAINED (g) 63.0 53.0 57.5 26.5 19.0 16.0 13.2 0.3 9.5 0.0 44.75 0.3 2.0 1.7 Pan 177.5.3 0.850 0.01 0.425 0.13 0.250 0.35 0.106 9.34 0.075 19.62 Pan 21.12 CHECK 0.0 MAX = 0.3% TIME He He Temp. (°C)</td><td>Half Moon Bay West BH OR TP No.: TP10- TESTED BY: D. Be Paterson Group DATE ERPTD: 26.A SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 REM S0.00 ACTUAL WL. 50.00 REM 180.05 URE T are No. 50.00 ACTUAL WL. 150.00 100.00 148.35 98.35 </td><td>Half Moon Bay West H OR TP No.: TP10-18 - G3 9950 TESTED EY: D. Betrand SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 AVITY (Gs) 2.70 CMOISTURE Tare No. 50.00 ACTUAL W. 150.00 100.00 148.35 98.35 0.034 60.00 49.18 H H BACK SIEVE 21.13 NTRATION 40.9 /L GRAIN SIZE ANALYSIS VE DIAMETER (mm) WEIGHT RETAINED (g) 9.5 0.0 63.0 53.0 37.5 2 26.5 19.0 18.0 0.2 9.5 0.0 0.425 0.13 0.20 1.7 1.0 1.2 0.25 0.01 10.0 0.425 0.13 1.2 0.20 0.35 1.7 1.0 <!--</td--><td>Hart Moon Bay West BH OR TP No.: TPI-0-18 - 0.3 DATE SAMPLED: 9350 TESTED BY. 0. Bertrand DATE RECEIVED: Address Group DATE REPTD: 28.4pr-18 DATE SETED: SAMPLE INFORMATION 50.00 ACTUAL IV. 50.00 NOTE REPTD: 28.4pr-18 GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 REMARKS FEMARKS GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 ACTUAL IV. FEMARKS 40.18 44.39.3 98.35 98.35 98.35 99.4 50.00 40.18 MEE ANALYSIS FERCENT RETAINED (g) PERCENT RETAINED PERCENT 48.30 99.5 0.0 0.0 100 53.0 53.0 10.0 10.0 10.0 54.5 0.0 0.0 100 10.0 10.0 13.2 0.3 0.2 10.0 10.0 10.0 10.0 2.65 0.0 0.0 10.0 10.0 10.0 1.7</td></td></th></td></th>	<td>Half Mon Bay West 99150 Paterson Group S 177 50 AVITY (Gs) 2.700 C S 177 50 AVITY (Gs) 2.700 C S 0.00 ACTUAL Wt. 150.00 100.00 148.35 98.35 0.984 50.00 49.18 H MEIGHT RI 63.0 53.0 53.0 0 S C VEIGHT RI 63.0 S O VEIGHT RI 63.0 VEIGHT RI 63.0 S O A O A O O <th c<="" td=""><td>Half Moon Bay West BH OR TP No.: 99150 TESTED BY: DATE REPTD: SAMPLE INFORMAT 177 50.00 RAVITY (Gs) 2.700 C MOISTURE Tare No. 50.00 ACTUAL WI. 150.00 100.00 49.18 40.9.18 HBACK SIEVE 21.13 NTRATION 40.g / L GRAIN SIZE ANALY VE DIAMETER (mm) WEIGHT RETAINED (g) 63.0 53.0 57.5 26.5 19.0 16.0 13.2 0.3 9.5 0.0 44.75 0.3 2.0 1.7 Pan 177.5.3 0.850 0.01 0.425 0.13 0.250 0.35 0.106 9.34 0.075 19.62 Pan 21.12 CHECK 0.0 MAX = 0.3% TIME He He Temp. (°C)</td><td>Half Moon Bay West BH OR TP No.: TP10- TESTED BY: D. Be Paterson Group DATE ERPTD: 26.A SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 REM S0.00 ACTUAL WL. 50.00 REM 180.05 URE T are No. 50.00 ACTUAL WL. 150.00 100.00 148.35 98.35 </td><td>Half Moon Bay West H OR TP No.: TP10-18 - G3 9950 TESTED EY: D. Betrand SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 AVITY (Gs) 2.70 CMOISTURE Tare No. 50.00 ACTUAL W. 150.00 100.00 148.35 98.35 0.034 60.00 49.18 H H BACK SIEVE 21.13 NTRATION 40.9 /L GRAIN SIZE ANALYSIS VE DIAMETER (mm) WEIGHT RETAINED (g) 9.5 0.0 63.0 53.0 37.5 2 26.5 19.0 18.0 0.2 9.5 0.0 0.425 0.13 0.20 1.7 1.0 1.2 0.25 0.01 10.0 0.425 0.13 1.2 0.20 0.35 1.7 1.0 <!--</td--><td>Hart Moon Bay West BH OR TP No.: TPI-0-18 - 0.3 DATE SAMPLED: 9350 TESTED BY. 0. Bertrand DATE RECEIVED: Address Group DATE REPTD: 28.4pr-18 DATE SETED: SAMPLE INFORMATION 50.00 ACTUAL IV. 50.00 NOTE REPTD: 28.4pr-18 GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 REMARKS FEMARKS GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 ACTUAL IV. FEMARKS 40.18 44.39.3 98.35 98.35 98.35 99.4 50.00 40.18 MEE ANALYSIS FERCENT RETAINED (g) PERCENT RETAINED PERCENT 48.30 99.5 0.0 0.0 100 53.0 53.0 10.0 10.0 10.0 54.5 0.0 0.0 100 10.0 10.0 13.2 0.3 0.2 10.0 10.0 10.0 10.0 2.65 0.0 0.0 10.0 10.0 10.0 1.7</td></td></th></td>	Half Mon Bay West 99150 Paterson Group S 177 50 AVITY (Gs) 2.700 C S 177 50 AVITY (Gs) 2.700 C S 0.00 ACTUAL Wt. 150.00 100.00 148.35 98.35 0.984 50.00 49.18 H MEIGHT RI 63.0 53.0 53.0 0 S C VEIGHT RI 63.0 S O VEIGHT RI 63.0 VEIGHT RI 63.0 S O A O A O O <th c<="" td=""><td>Half Moon Bay West BH OR TP No.: 99150 TESTED BY: DATE REPTD: SAMPLE INFORMAT 177 50.00 RAVITY (Gs) 2.700 C MOISTURE Tare No. 50.00 ACTUAL WI. 150.00 100.00 49.18 40.9.18 HBACK SIEVE 21.13 NTRATION 40.g / L GRAIN SIZE ANALY VE DIAMETER (mm) WEIGHT RETAINED (g) 63.0 53.0 57.5 26.5 19.0 16.0 13.2 0.3 9.5 0.0 44.75 0.3 2.0 1.7 Pan 177.5.3 0.850 0.01 0.425 0.13 0.250 0.35 0.106 9.34 0.075 19.62 Pan 21.12 CHECK 0.0 MAX = 0.3% TIME He He Temp. (°C)</td><td>Half Moon Bay West BH OR TP No.: TP10- TESTED BY: D. Be Paterson Group DATE ERPTD: 26.A SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 REM S0.00 ACTUAL WL. 50.00 REM 180.05 URE T are No. 50.00 ACTUAL WL. 150.00 100.00 148.35 98.35 </td><td>Half Moon Bay West H OR TP No.: TP10-18 - G3 9950 TESTED EY: D. Betrand SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 AVITY (Gs) 2.70 CMOISTURE Tare No. 50.00 ACTUAL W. 150.00 100.00 148.35 98.35 0.034 60.00 49.18 H H BACK SIEVE 21.13 NTRATION 40.9 /L GRAIN SIZE ANALYSIS VE DIAMETER (mm) WEIGHT RETAINED (g) 9.5 0.0 63.0 53.0 37.5 2 26.5 19.0 18.0 0.2 9.5 0.0 0.425 0.13 0.20 1.7 1.0 1.2 0.25 0.01 10.0 0.425 0.13 1.2 0.20 0.35 1.7 1.0 <!--</td--><td>Hart Moon Bay West BH OR TP No.: TPI-0-18 - 0.3 DATE SAMPLED: 9350 TESTED BY. 0. Bertrand DATE RECEIVED: Address Group DATE REPTD: 28.4pr-18 DATE SETED: SAMPLE INFORMATION 50.00 ACTUAL IV. 50.00 NOTE REPTD: 28.4pr-18 GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 REMARKS FEMARKS GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 ACTUAL IV. FEMARKS 40.18 44.39.3 98.35 98.35 98.35 99.4 50.00 40.18 MEE ANALYSIS FERCENT RETAINED (g) PERCENT RETAINED PERCENT 48.30 99.5 0.0 0.0 100 53.0 53.0 10.0 10.0 10.0 54.5 0.0 0.0 100 10.0 10.0 13.2 0.3 0.2 10.0 10.0 10.0 10.0 2.65 0.0 0.0 10.0 10.0 10.0 1.7</td></td></th>	<td>Half Moon Bay West BH OR TP No.: 99150 TESTED BY: DATE REPTD: SAMPLE INFORMAT 177 50.00 RAVITY (Gs) 2.700 C MOISTURE Tare No. 50.00 ACTUAL WI. 150.00 100.00 49.18 40.9.18 HBACK SIEVE 21.13 NTRATION 40.g / L GRAIN SIZE ANALY VE DIAMETER (mm) WEIGHT RETAINED (g) 63.0 53.0 57.5 26.5 19.0 16.0 13.2 0.3 9.5 0.0 44.75 0.3 2.0 1.7 Pan 177.5.3 0.850 0.01 0.425 0.13 0.250 0.35 0.106 9.34 0.075 19.62 Pan 21.12 CHECK 0.0 MAX = 0.3% TIME He He Temp. (°C)</td> <td>Half Moon Bay West BH OR TP No.: TP10- TESTED BY: D. Be Paterson Group DATE ERPTD: 26.A SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 REM S0.00 ACTUAL WL. 50.00 REM 180.05 URE T are No. 50.00 ACTUAL WL. 150.00 100.00 148.35 98.35 </td> <td>Half Moon Bay West H OR TP No.: TP10-18 - G3 9950 TESTED EY: D. Betrand SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 AVITY (Gs) 2.70 CMOISTURE Tare No. 50.00 ACTUAL W. 150.00 100.00 148.35 98.35 0.034 60.00 49.18 H H BACK SIEVE 21.13 NTRATION 40.9 /L GRAIN SIZE ANALYSIS VE DIAMETER (mm) WEIGHT RETAINED (g) 9.5 0.0 63.0 53.0 37.5 2 26.5 19.0 18.0 0.2 9.5 0.0 0.425 0.13 0.20 1.7 1.0 1.2 0.25 0.01 10.0 0.425 0.13 1.2 0.20 0.35 1.7 1.0 <!--</td--><td>Hart Moon Bay West BH OR TP No.: TPI-0-18 - 0.3 DATE SAMPLED: 9350 TESTED BY. 0. Bertrand DATE RECEIVED: Address Group DATE REPTD: 28.4pr-18 DATE SETED: SAMPLE INFORMATION 50.00 ACTUAL IV. 50.00 NOTE REPTD: 28.4pr-18 GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 REMARKS FEMARKS GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 ACTUAL IV. FEMARKS 40.18 44.39.3 98.35 98.35 98.35 99.4 50.00 40.18 MEE ANALYSIS FERCENT RETAINED (g) PERCENT RETAINED PERCENT 48.30 99.5 0.0 0.0 100 53.0 53.0 10.0 10.0 10.0 54.5 0.0 0.0 100 10.0 10.0 13.2 0.3 0.2 10.0 10.0 10.0 10.0 2.65 0.0 0.0 10.0 10.0 10.0 1.7</td></td>	Half Moon Bay West BH OR TP No.: 99150 TESTED BY: DATE REPTD: SAMPLE INFORMAT 177 50.00 RAVITY (Gs) 2.700 C MOISTURE Tare No. 50.00 ACTUAL WI. 150.00 100.00 49.18 40.9.18 HBACK SIEVE 21.13 NTRATION 40.g / L GRAIN SIZE ANALY VE DIAMETER (mm) WEIGHT RETAINED (g) 63.0 53.0 57.5 26.5 19.0 16.0 13.2 0.3 9.5 0.0 44.75 0.3 2.0 1.7 Pan 177.5.3 0.850 0.01 0.425 0.13 0.250 0.35 0.106 9.34 0.075 19.62 Pan 21.12 CHECK 0.0 MAX = 0.3% TIME He He Temp. (°C)	Half Moon Bay West BH OR TP No.: TP10- TESTED BY: D. Be Paterson Group DATE ERPTD: 26.A SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 REM S0.00 ACTUAL WL. 50.00 REM 180.05 URE T are No. 50.00 ACTUAL WL. 150.00 100.00 148.35 98.35	Half Moon Bay West H OR TP No.: TP10-18 - G3 9950 TESTED EY: D. Betrand SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 AVITY (Gs) 2.70 CMOISTURE Tare No. 50.00 ACTUAL W. 150.00 100.00 148.35 98.35 0.034 60.00 49.18 H H BACK SIEVE 21.13 NTRATION 40.9 /L GRAIN SIZE ANALYSIS VE DIAMETER (mm) WEIGHT RETAINED (g) 9.5 0.0 63.0 53.0 37.5 2 26.5 19.0 18.0 0.2 9.5 0.0 0.425 0.13 0.20 1.7 1.0 1.2 0.25 0.01 10.0 0.425 0.13 1.2 0.20 0.35 1.7 1.0 </td <td>Hart Moon Bay West BH OR TP No.: TPI-0-18 - 0.3 DATE SAMPLED: 9350 TESTED BY. 0. Bertrand DATE RECEIVED: Address Group DATE REPTD: 28.4pr-18 DATE SETED: SAMPLE INFORMATION 50.00 ACTUAL IV. 50.00 NOTE REPTD: 28.4pr-18 GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 REMARKS FEMARKS GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 ACTUAL IV. FEMARKS 40.18 44.39.3 98.35 98.35 98.35 99.4 50.00 40.18 MEE ANALYSIS FERCENT RETAINED (g) PERCENT RETAINED PERCENT 48.30 99.5 0.0 0.0 100 53.0 53.0 10.0 10.0 10.0 54.5 0.0 0.0 100 10.0 10.0 13.2 0.3 0.2 10.0 10.0 10.0 10.0 2.65 0.0 0.0 10.0 10.0 10.0 1.7</td>	Hart Moon Bay West BH OR TP No.: TPI-0-18 - 0.3 DATE SAMPLED: 9350 TESTED BY. 0. Bertrand DATE RECEIVED: Address Group DATE REPTD: 28.4pr-18 DATE SETED: SAMPLE INFORMATION 50.00 ACTUAL IV. 50.00 NOTE REPTD: 28.4pr-18 GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 REMARKS FEMARKS GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 ACTUAL IV. FEMARKS 40.18 44.39.3 98.35 98.35 98.35 99.4 50.00 40.18 MEE ANALYSIS FERCENT RETAINED (g) PERCENT RETAINED PERCENT 48.30 99.5 0.0 0.0 100 53.0 53.0 10.0 10.0 10.0 54.5 0.0 0.0 100 10.0 10.0 13.2 0.3 0.2 10.0 10.0 10.0 10.0 2.65 0.0 0.0 10.0 10.0 10.0 1.7



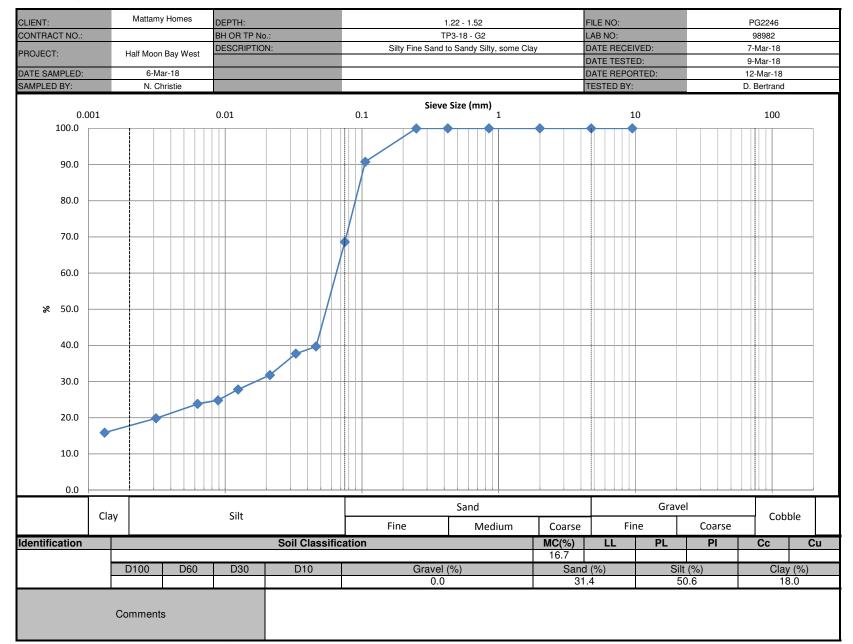
Im hun get

CLIENT:		Mattamy Homes		DEPTH:	1'6"	- 2'6"	FILE NO.:	PG2246/PG4073
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP2-1	8 - G1	DATE SAMPLED:	-
LAB No. :		99138		TESTED BY:	D. Be	rtrand	DATE RECEIVED:	18-Apr-18
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18
				AMPLE INFORMAT	ION			
SAMPLE MASS	16	64.9	50	.00				
SPECIFIC GI		2.700			REM	IARKS		
HYGROSCOP		Tare No.						
TARE Wt.	50.00	ACTUAL Wt.						
AIR DRY (Wa)	150.00	100.00						
OVEN DRY (Wo)	148.85	98.85						
F=(Wo/Wa)		989						
INITIAL Wt. (Ma)		0.00						
Wt. CORRECTED		9.43						
Wt. AFTER WAS		20.24						
SOLUTION CONCE	INTRATION	40 g / L			2010			
				RAIN SIZE ANALY	515			
SIE	EVE DIAMETER (m	חm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING
	63.0							
	53.0							
	37.5 26.5							
	19.0							
	16.0							
	13.2							
	9.5		0	.0	0	.0	100	0
	4.75			.0		.0	100	
	2.0			.0		.0	100	
	Pan			4.9		.0		
	0.850			11	0	.2	99	.8
	0.425			28	0	.6	99	.4
	0.250			82	1	.6	98	.4
	0.106			77	1:	3.5	86	.5
	0.075			.21	26	6.4	73	.6
	Pan	1		.22				
SIEVE	CHECK	0.1		= 0.3%				
		1		HYDROMETER DA	TA	1		
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING
1	9:03	32.0	6.0	22.0	0.0433	52.0	52	.0
2	9:04	26.0	6.0	22.0	0.0320	40.0	40	.0
5	9:07	23.0	6.0	22.0	0.0207	34.0	34	.0
15	9:17	20.0	6.0	22.0	0.0122	28.0	28	.0
30	9:32	19.0	6.0	22.0	0.0087	26.0	26	
60	10:02	18.0	6.0	22.0	0.0062	24.0	24	
250	13:12	15.0	6.0	22.0	0.0031	18.0	18	
1440	9:02	14.0	6.0	22.0	0.0013	16.0	16	.0
Moisture Cont	ont - 20 7%			COMMENTS				
	ent = 20.7%							
		Curtis Beadow					Joe Forsyth, P. Eng	
REVIEWED BY:	for the			APPRO	VED BY:		JeAz	

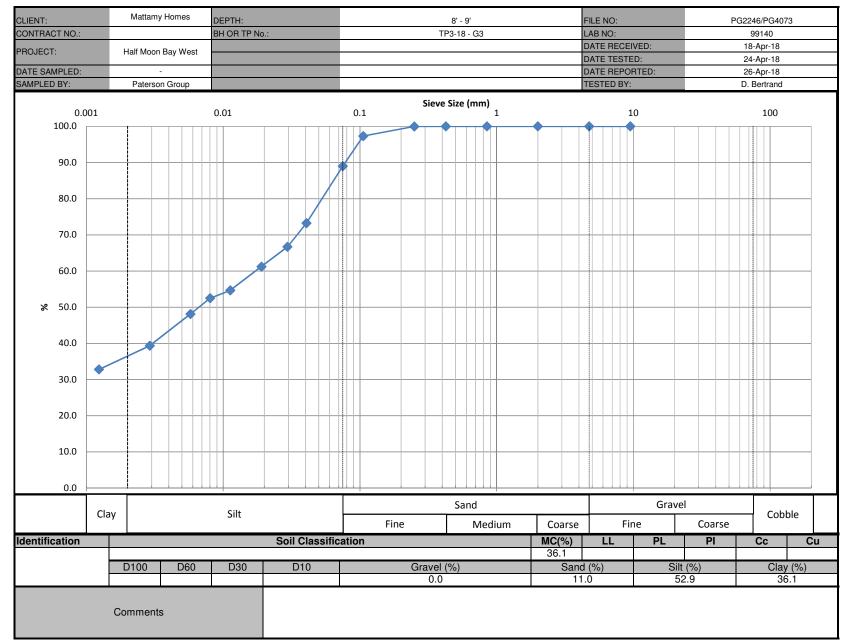


Im hun get

	Mattamy Homes		DEPTH:	6'	- 7'	FILE NO.:	D00040/D04072	
				· ·	•		PG2246/PG4073	
	Half Moon Bay West		BH OR TP No.:	TP2-1	8 - G3	DATE SAMPLED:	-	
	99139		TESTED BY:	D. Be	rtrand	DATE RECEIVED:	18-Apr-18	
	Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18	
		S	AMPLE INFORMAT	ION				
12	20.3	50	.00					
RAVITY (Gs)	2.700			REN	IARKS			
C MOISTURE	Tare No.							
50.00	ACTUAL Wt.							
150.00	100.00							
NTRATION	40 g / L							
			RAIN SIZE ANALY	SIS				
VE DIAMETER (m	ım)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING	
63.0								
		0	.0	0	0	100	.0	
2.0						100		
Pan					.0			
0.850				0	.0	100	.0	
0.425				0	.0	100.0		
0.250				0	.0	100	.0	
0.106				1	.7	98.	3	
0.075				7	.4	92.	6	
Pan	1							
CHECK	0.2							
			HYDROMETER DA					
TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	INT PASSING	
9:15	42.0	6.0	22.0	0.0398	80.0	80.	0	
9:16	39.5	6.0	22.0	0.0288	74.4	74.	4	
9:19	37.0	6.0	22.0	0.0186	68.9	68.	9	
9:29	33.5	6.0	22.0	0.0111	61.1	61.		
9:44	32.0	6.0	22.0	0.0079	57.8	57.		
10:14	30.0	6.0	22.0	0.0057	53.3	53.		
13:24	25.0	6.0	22.0		42.2			
9:14	23.0	6.0		0.0012	37.8	37.	8	
ent = 39.3%			COMMENTS					
	Curtis Beadow					Joe Forsyth. P. Eng.		
for the			APPRO	VED BY:				
	RAVITY (Gs) C MOISTURE 50.00 150.00 139.00 0.1 50 44 H BACK SIEVE NTRATION EVE DIAMETER (m 63.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 4.75 2.0 Pan 0.850 0.425 0.250 0.106 0.075 Pan CHECK TIME (24 hours) 9:15 9:16 9:19 9:29 9:44 10:14 13:24 9:14 ent = 39.3%	C MOISTURE Tare No. 50.00 ACTUAL WI. 150.00 100.00 139.00 89.00 0.890 0.890 50.00 44.50 H BACK SIEVE 4.13 40 g / L NTRATION 40 g / L Structure G3.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 26.5 19.0 16.0 13.2 9.5 4.75 2.0 Pan 0.850 0.425 0.250 0.106 0.250 0.106 0.2 Pan Hs CHECK 0.2 TIME (24 hours) 9:15 42.0 9:16 39.5 9:19 37.0 9:29 33.5 9:44 32.0 10:14 30.0 13:24 25.0 9:14 23.0	120.3 50 RAVITY (Gs) 2.700 C MOISTURE Tare No. 50.00 ACTUAL Wt. 150.00 100.00 139.00 89.00 0.890 50.00 44.50 4.13 NTRATION 40 g / L WEIGHT RI 63.0 0 53.0 0 37.5 0 26.5 1 19.0 1 16.0 1 13.2 0 9.5 0 4.75 0 9.5 0 0.475 0 0.850 0 0.20 0 0.250 0 0.106 0 0.250 0 0.106 0 0.116 39.5 9:15 42.0 6.0 9:16 9:15 42.0 9:16 39.5 9:19 37.0 9:19 37.0 9:14	120.3 50.00 AVITY (Gs) 2.700 C MOISTURE Tare No. 50.00 ACTUAL Wt. 150.00 100.00 139.00 89.00 0.890 50.00 44.50 4113 HBACK SIEVE 4.13 NTRATION 40 g / L GRAIN SIZE ANALY VE DIAMETER (mm) WEIGHT RETAINED (g) 63.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 9.5 0.0 44.75 0.0 2.0 0.0 2.13.2 9.5 9.5 0.0 4.75 0.0 2.0 0.0 0.425 0.00 0.425 0.00 0.250 0.01 0.106 0.84 0.075 3.69 Pan 4.12 VHEORMETER DA TIME Hs <	AVITY (G) 2.700 REM C MOISTURE Tare No. 50.00 ACTUAL Wt. 150.00 100.00 100.00 100.00 139.00 89.00 63.0 63.0 France 0.890 50.00 445.50 HEACK SIEVE 4.13 NTRATION 40 g / L GRAIN SIZE ANALYSIS PERCENT 63.0 53.0 9 5 10 37.5 26.5 10 10 10 19.0 16.0 10 10 10 13.2 0.0 0 0 0 9.5 0.0 0 0 0 2.0 0.0 0 0 0 9.5 0.00 0 0 0 0.850 0.00 0 0 0 0.2550 0.01 0 0 0 0.2550 0.01 0 0 0 0.255 3.69 7 7 <t< td=""><td>120.3 50.00 RAVITY (Gs) 2.700 REMARKS SO.00 ACTUAL WI. 50.00 ACTUAL WI. 150.00 100.00 139.00 89.00 0.890 50.00 44.50 REMARKS HBACK SIEVE 4.13 NTRATION 40 g / L GRAIN SIZE ANALYSIS VE DIAMETER (mm) WEIGHT RETAINED (g) PERCENT RETAINED 63.0 63.0 53.0 </td><td>120.3 50.0 AWTY (G) 2.700 REMARKS WOSTURE Tae No. REMARKS 50.00 ACTUAL Wr. Remarks 150.00 100.00 100.00 0.890 0.890 0.890 44.50 HEACK SIEVE 4.13 HACK SIEVE 4.13 PERCENT RETAINED (g) PERCENT RETAINED 63.0 S3.0 S3.0 S3.0 S3.0 77.5 O.0 0.0 100 19.0 Interval S3.0 S3.0 9.5 O.0 0.0 100 4.75 O.0 0.0 100 2.0 0.00 0.0 100 2.0 0.00 0.0 100 2.0 0.00 0.0 100 2.0 0.00 0.0 100 2.0 0.00 0.0 100 4.75 0.0 0.0 100 0.425 0.00 0.0 100</td></t<>	120.3 50.00 RAVITY (Gs) 2.700 REMARKS SO.00 ACTUAL WI. 50.00 ACTUAL WI. 150.00 100.00 139.00 89.00 0.890 50.00 44.50 REMARKS HBACK SIEVE 4.13 NTRATION 40 g / L GRAIN SIZE ANALYSIS VE DIAMETER (mm) WEIGHT RETAINED (g) PERCENT RETAINED 63.0 63.0 53.0	120.3 50.0 AWTY (G) 2.700 REMARKS WOSTURE Tae No. REMARKS 50.00 ACTUAL Wr. Remarks 150.00 100.00 100.00 0.890 0.890 0.890 44.50 HEACK SIEVE 4.13 HACK SIEVE 4.13 PERCENT RETAINED (g) PERCENT RETAINED 63.0 S3.0 S3.0 S3.0 S3.0 77.5 O.0 0.0 100 19.0 Interval S3.0 S3.0 9.5 O.0 0.0 100 4.75 O.0 0.0 100 2.0 0.00 0.0 100 2.0 0.00 0.0 100 2.0 0.00 0.0 100 2.0 0.00 0.0 100 2.0 0.00 0.0 100 4.75 0.0 0.0 100 0.425 0.00 0.0 100	

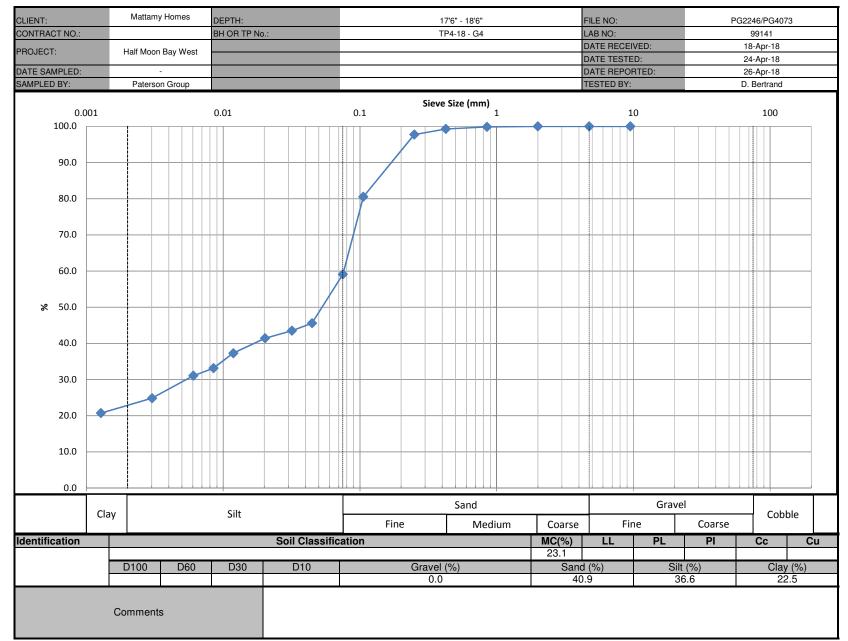


how have gette



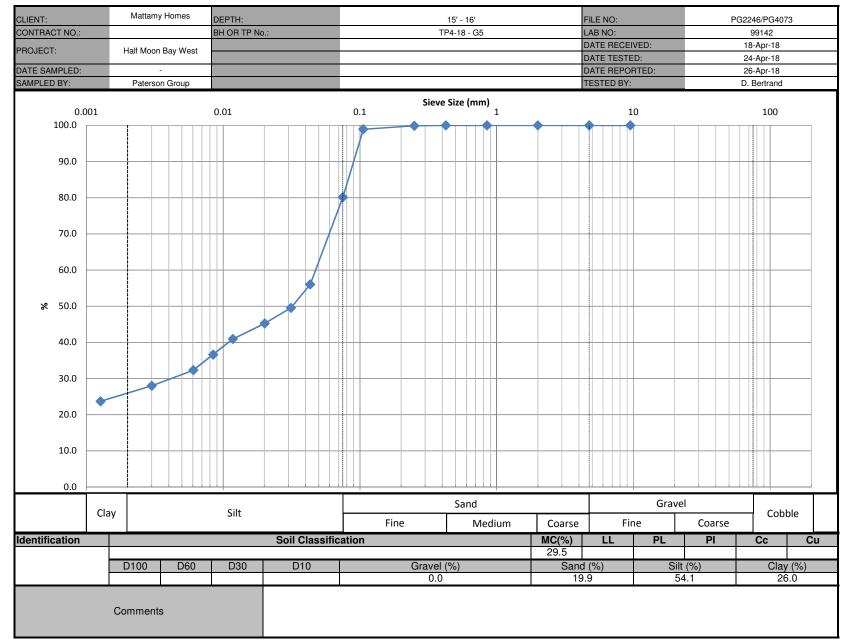
Im hun get

12	Mattamy Homes Half Moon Bay West 99140 Paterson Group		DEPTH: BH OR TP No.:	8' TP3-1	- 9' 8 - G3	FILE NO.: DATE SAMPLED:	PG2246/PG4073
12	99140		BH OR TP No.:	TP3-1	8 - G3	DATE SAMPLED	
12					0 00	DATE SAMELED.	-
12	Paterson Group		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18
12			DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18
12		s	AMPLE INFORMAT	ION			
	.7.8	50	.00				
AVITY (Gs)	2.700			REN	IARKS		
MOISTURE	Tare No.						
50.00	ACTUAL Wt.						
150.00	100.00						
140.45	90.45						
NTRATION	40 g / L			212			
			ARAIN SIZE ANALY				
VE DIAMETER (m	ım)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED PERCENT PASSING		
63.0							
9.5		.0	0	0	100	.0	
						100	.0
2.0						100	.0
Pan		12	7.8				
0.850							
				1-	1.0	89.	0
HECK	0.0			ТА			
TIME	Hs	Нс	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING
	00 F	0.0		0.0407	70.0		0
	1						
	1						
	1						
	1						
	1						
ent = 36.1.1%)						
	Curtis Beadow					Joe Forsyth. P. Eng.	<u></u>
Im the			APPRO	VED BY:			
	0.1 50 45 1 BACK SIEVE 1TRATION /E DIAMETER (m 63.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 4.75 2.0 Pan 0.850 0.425 0.250 0.106 0.075 Pan 4.25 0.250 0.106 0.250 0.106 0.250000000000	0.905 50.00 45.23 H BACK SIEVE 6.48 ITRATION 40 g / L //E DIAMETER (mm) 63.0 53.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 4.75 2.0 9.5 4.75 2.0 Pan 0.850 0.425 0.250 0.106 0.075 Pan 10.0 TIME (24 hours) 9:28 39.5 9:29 36.5 9:32 34.0 9:42 31.0 9:57 30.0 10:27 28.0 13:37 24.0	0.905 50.00 45.23 HBACK SIEVE 6.48 ITRATION 40 g / L 63.0 0 53.0 0 37.5 0 26.5 0 19.0 0 16.0 0 13.2 0 9.5 0 4.75 0 2.0 0 Pan 12 0.850 0.0 0.425 0 0.250 0 0.106 1 0.250 0 0.106 1 0.250 0 0.106 1 0.250 0 0.106 1 0.250 0 0.106 1 9:28 39.5 6.0 9:29 36.5 6.0 9:32 34.0 6.0 9:57 30.0 6.0 9:57 30.0 6.0 9:27 21.0 6.0	0.905 0.00 45.23 40 g / L BACK SIEVE 6.48 ITRATION 40 g / L GRAIN SIZE ANALY CRAIN SIZE ANALY CRAIN SIZE ANALY VEIGHT RETAINED (g) 63.0 53.0 37.5 26.5 19.0 16.0 13.2 0.0 9.5 0.0 4.75 0.0 2.0 0.0 Pan 127.8 0.850 0.00 0.425 0.01 0.250 0.02 0.106 1.34 0.075 5.50 Pan 6.48 HECK 0.0 MAX = 0.3% HYDROMETER DA 11ME Hs Hc Temp. (°C) 9:28 39.5 6.0 22.0 9:29 36.5 6.0 22.0 9:32 34.0 6.0 22.0 9:37 30.0 </td <td>0.995 50.00 45.23 48ACK SIEVE 6.48 ITRATION 40 g / L GRAIN SIZE ANALYSIS ////////////////////////////////////</td> <td>0.905 50.00 45.23 45.23 HEACK SIEVE 6.48 ITRATION 40 g / L CRAIN SIZE ANALYSIS KE DIAMETER (mm) WEIGHT RETAINED (g) PERCENT RETAINED 63.0 0 0 0 53.0 0 0 0 63.0 0 0 0 63.0 0 0 0 75.5 0 0 0 9.5 0.0 0.0 0.0 9.5 0.0 0.0 0.0 9.5 0.00 0.0 0.0 2.0 0.0 0.0 0.0 9.5 0.00 0.0 0.0 2.0 0.0 0.0 0.0 9.5 0.01 0.0 0.0 0.850 0.00 0.00 0.0 0.850 0.00 0.0 0.0 0.425 0.01 0.0 0.0 0.850 0.00 0.0</td> <td>0.905 0.00 45.23 458.CK SIEVE 6.48 ITRATION 40 g / L GRAIN SIZE ANALYSIS PERCENT RETAINED PERCENT 63.0 53.0 0</td>	0.995 50.00 45.23 48ACK SIEVE 6.48 ITRATION 40 g / L GRAIN SIZE ANALYSIS ////////////////////////////////////	0.905 50.00 45.23 45.23 HEACK SIEVE 6.48 ITRATION 40 g / L CRAIN SIZE ANALYSIS KE DIAMETER (mm) WEIGHT RETAINED (g) PERCENT RETAINED 63.0 0 0 0 53.0 0 0 0 63.0 0 0 0 63.0 0 0 0 75.5 0 0 0 9.5 0.0 0.0 0.0 9.5 0.0 0.0 0.0 9.5 0.00 0.0 0.0 2.0 0.0 0.0 0.0 9.5 0.00 0.0 0.0 2.0 0.0 0.0 0.0 9.5 0.01 0.0 0.0 0.850 0.00 0.00 0.0 0.850 0.00 0.0 0.0 0.425 0.01 0.0 0.0 0.850 0.00 0.0	0.905 0.00 45.23 458.CK SIEVE 6.48 ITRATION 40 g / L GRAIN SIZE ANALYSIS PERCENT RETAINED PERCENT 63.0 53.0 0



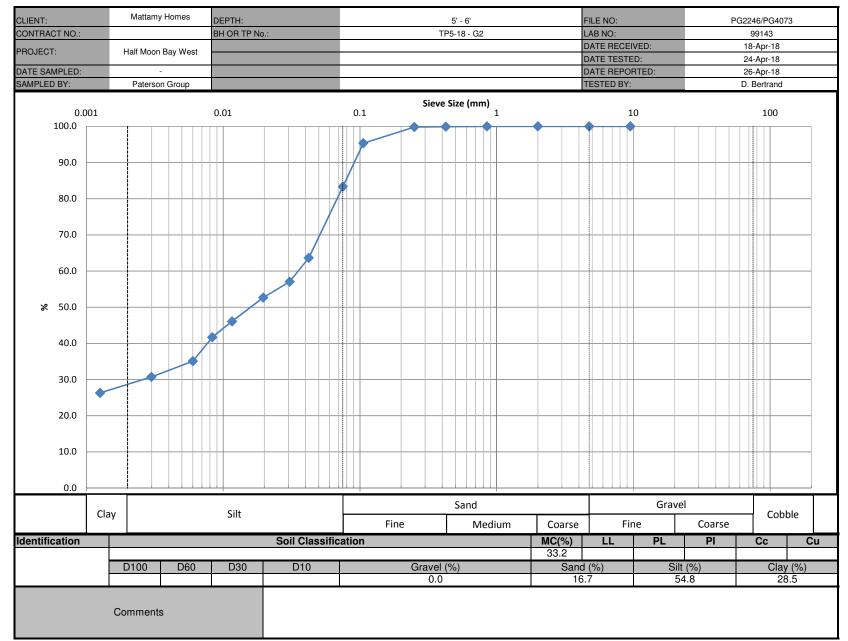
Im hu get

CLIENT:		Mattamy Homes		DEPTH:	17'6"	- 18'6"	FILE NO.:	PG2246/PG4073		
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP4 -1	8 - G4	DATE SAMPLED:	-		
LAB No. :		99141		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18		
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18		
				AMPLE INFORMAT	TION					
SAMPLE MASS		69.4	50	.00						
SPECIFIC GF		2.700			REN	/ARKS				
HYGROSCOPI		Tare No.								
TARE Wt.	50.00	ACTUAL Wt.								
AIR DRY (Wa)	150.00	100.00								
OVEN DRY (Wo)	145.45	95.45								
F=(Wo/Wa)		955								
INITIAL Wt. (Ma)		0.00								
Wt. CORRECTED Wt. AFTER WAS		22.25								
SOLUTION CONCE		40 g / L								
SOLUTION CONCL		40 g / L		RAIN SIZE ANALY	2010					
SIE	EVE DIAMETER (m	וm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING		
	63.0									
	53.0									
	37.5 26.5									
	19.0									
	16.0									
	13.2									
	9.5		0	.0		0.0	100.0			
	4.75			.0		0.0	100			
	2.0			.0		0.0 100.0				
	Pan			9.5			100.0			
	0.850			07	C	0.1	99	.9		
	0.425			36	C	0.7	99	.3		
	0.250			14	2	2.3	97	.7		
	0.106			74		9.5	80			
	0.075			.47	4	0.9	59	.1		
	Pan			.25						
SIEVE C	CHECK	0.0		= 0.3%						
				HYDROMETER DA						
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	ENT PASSING		
1	9:40	28.0	6.0	22.0	0.0447	45.6	45	.6		
2	9:41	27.0	6.0	22.0	0.0318	43.5	43	.5		
5	9:44	26.0	6.0	22.0	0.0203	41.4	41	.4		
15	9:54	24.0	6.0	22.0	0.0119	37.3	37	.3		
30	10:09	22.0	6.0	22.0	0.0085	33.1	33			
60	10:39	21.0	6.0	22.0	0.0061	31.1	31			
250	13:49	18.0	6.0	22.0	0.0030	24.9	24			
1440	9:39	16.0	6.0	22.0	0.0013	20.7	20	.7		
Moisture Cont	ent = 23.1%			COMMENTS						
		Curtis Beadow					Joe Forsyth, P. Eng			
REVIEWED BY:	for the	hun		APPRO	VED BY:		genz			
							0			

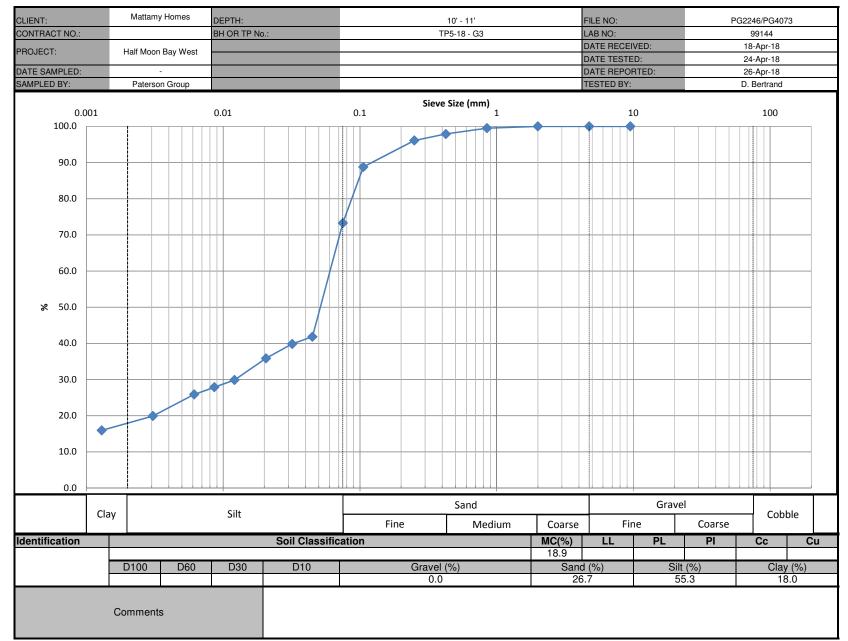


Im hun get

CLIENT:		Mattamy Homes		DEPTH:	15'	- 16'	FILE NO.:	PG2246/PG4073		
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP4-1	8 - G5	DATE SAMPLED:	-		
LAB No. :		99142		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18		
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18		
			S	AMPLE INFORMAT	TION					
SAMPLE MASS	16	63.4	50	.00						
SPECIFIC GI	RAVITY (Gs)	2.700			REN	IARKS				
HYGROSCOP		Tare No.								
TARE Wt.	50.00	ACTUAL Wt.								
AIR DRY (Wa)	150.00	100.00								
OVEN DRY (Wo)	141.80	91.80								
F=(Wo/Wa)		918								
INITIAL Wt. (Ma)		0.00								
Wt. CORRECTED		5.90								
Wt. AFTER WAS		12.56								
SOLUTION CONCE	INTRATION	40 g / L								
				RAIN SIZE ANALY	'SIS					
SIE	EVE DIAMETER (m	וm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	INED PERCENT PASSING			
	63.0 53.0									
	37.5									
	26.5									
	19.0									
	16.0									
	13.2									
	9.5		0	.0		.0	100.0			
	4.75			.0		.0	100			
	2.0			.0		.0).0			
	Pan			3.4		.0				
	0.850			00		.0	100			
	0.425			01		.0	100			
		0.250		0.06		.1	99			
	0.106					.1	.9			
	0.075			94	19	9.9	80	.1		
	Pan			.56						
SIEVE (CHECK	0.0		= 0.3% HYDROMETER DA	T.A.					
	TIME	Hs	Нс	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	ENT PASSING		
ELAPSED	(24 hours)	00.0			0.0402			0		
1	9:53	32.0	6.0	22.0	0.0433	56.0	56			
2	9:54	29.0	6.0	22.0	0.0313	49.5	49			
5	9:57	27.0	6.0	22.0	0.0201	45.2	45			
15	10:07	25.0	6.0	22.0	0.0118	40.9	40			
30 60	10:22	23.0 21.0	6.0 6.0	22.0 22.0	0.0084	36.6 32.3	36			
250	10:52	19.0	6.0	22.0	0.0081	28.0	28			
250 1440	9:52	17.0	6.0	22.0	0.0030	28.0	28			
1440	9.52	17.0	0.0	COMMENTS	0.0013	20.1	23			
Moisture Cont	tent = 29.5%									
		Curtis Beadow			Joe Forsyth, P. Eng.					
REVIEWED BY:	Im Ke	hu		APPRO	VED BY:					
	tr.									



Im hun get

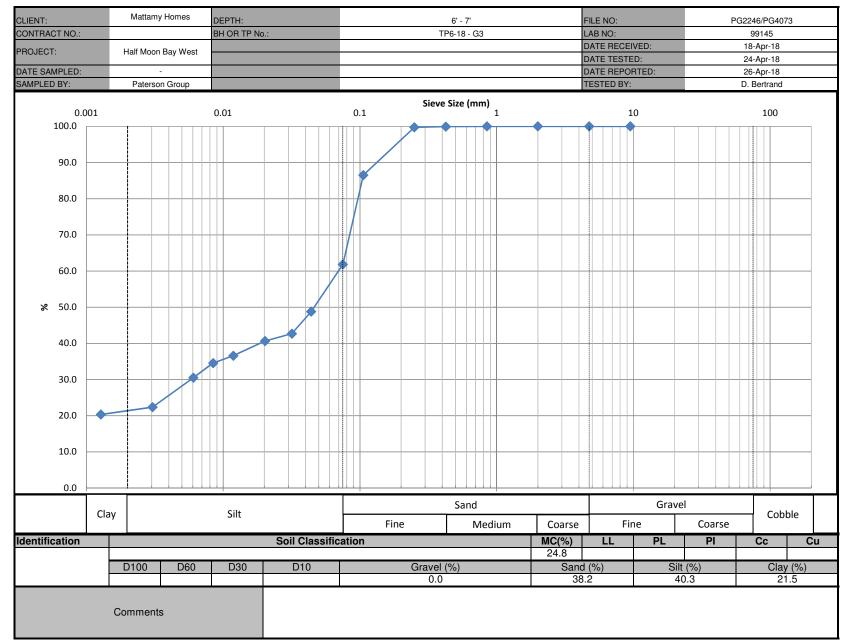


Im hu get

CLIENT:		Mattamy Homes		DEPTH:	10'	- 11'	FILE NO.:	PG2246/PG4073	
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP5-1	8 - G3	DATE SAMPLED:	-	
LAB No. :		99144		TESTED BY:	D. Be	rtrand	DATE RECEIVED:	18-Apr-18	
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18	
				AMPLE INFORMAT	ION				
SAMPLE MASS	14	12.6	50	.00					
SPECIFIC GI	RAVITY (Gs)	2.700			REM	IARKS			
HYGROSCOP		Tare No.							
TARE Wt.	50.00	ACTUAL Wt.							
AIR DRY (Wa)	150.00	100.00							
OVEN DRY (Wo)	149.25	99.25							
F=(Wo/Wa)		993							
INITIAL Wt. (Ma)		0.00							
Wt. CORRECTED		9.63							
Wt. AFTER WAS		14.58							
SOLUTION CONCE	INTRATION	40 g / L							
				RAIN SIZE ANALY	515				
SIE	EVE DIAMETER (m	nm)	WEIGHT R	ETAINED (g)	PERCENT	NT RETAINED PERCENT PASSING			
	63.0								
	53.0								
	37.5								
	26.5								
	19.0								
	16.0								
	13.2 9.5		0	.0		-	100	0	
	4.75			.0		.0	100		
	2.0			.0		.0			
	Pan			2.6	0	0.0 100.0			
	0.850			25	0	.5	99.	.5	
	0.425			06	2	.1	97.	.9	
	0.250			1.95		.9	96	.1	
	0.106			5.61 11.2 13.35 26.7			88	.8	
	0.075				26	6.7	73.	.3	
	Pan	1		.56					
SIEVE	CHECK	0.1		= 0.3%	 				
		[[HYDROMETER DA					
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING	
1	9:16	27.0	6.0	22.0	0.0450	41.8	41.	.8	
2	9:17	26.0	6.0	22.0	0.0320	39.9	39	.9	
5	9:20	24.0	6.0	22.0	0.0206	35.9	35	.9	
15	9:30	21.0	6.0	22.0	0.0121	29.9	29	.9	
30	9:45	20.0	6.0	22.0	0.0086	27.9	27.	.9	
60	10:15	19.0	6.0	22.0	0.0061	25.9	25	.9	
250	13:25	16.0	6.0	22.0	0.0031	19.9	19		
1440	9:15	14.0	6.0	22.0	0.0013	15.9	15	.9	
Moisture Cont	tent = 18.9%			COMMENTS					
		Curtis Beadow					Joe Forsyth, P. Eng.		
	BY: Im Pm			APPRO		Jee Forsyth, P. Eng.			

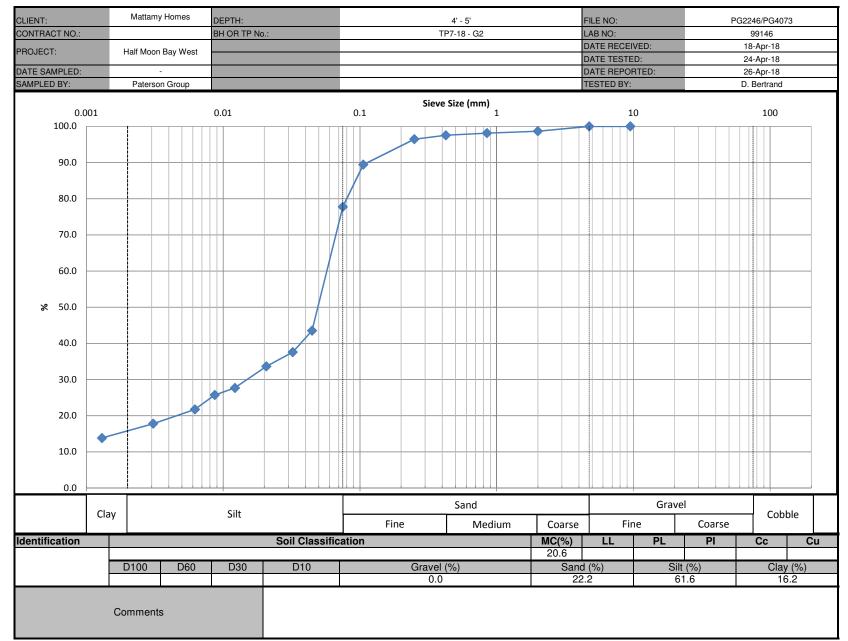
CLIENT:	Mattamy Homes	DESCRIPTIC	ON:		Silty Fine Sar	d to Sandy Sil	ty with Cla	у	FILE NO:			PG2246
CONTRACT NO.:	-	SPECIFICAT				-		-	LAB NO:			98983
PROJECT:	Half Moon Bay West	INTENDED U	JSE:			-			DATE RECE	EIVED:		7-Mar-18
I ROJECT.		PIT OR QUA	RRY:			-			DATE TEST	ED:		8-Mar-18
DATE SAMPLED:	6-Mar-18	SOURCE LC				TP6-18 - G2			DATE REPO			9-Mar-18
SAMPLED BY:	Nathan Christie	SAMPLE LO	CATION:			1.22 to 1.52			TESTED BY	:		D.B
0.01		0.1	L		Siev 1	ve Size (mm)			10			100
100.0												
90.0												
80.0		/	, 									
70.0												
70.0												
60.0												
× 50.0												
40.0												
30.0												
20.0												
10.0												
0.0												
	Silt and Clay			Sand					Gravel			Cobble
			Fine	Medium	Coar	se		Fine		Coar	se	
Identification			Soil Class	sification				MC(%)	LL	PL	PI	Cc
		D20	D10		Crow	1 (0/)		C-	nd (%)	C:	+ (0/)	0.60
	D100 D60 1.3 0.065	D30 0.028	D10 0.02		Grave 0.0				nd (%) 31.8	SI	t (%) F	Clay (

Low Run Jett



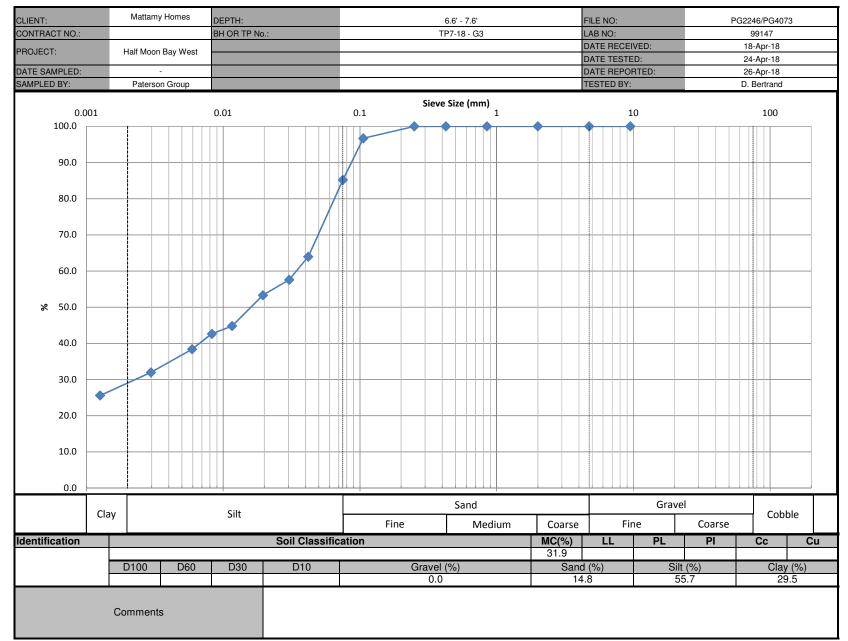
Im hun get

CLIENT:		Mattamy Homes		DEPTH:	6'	- 7'	FILE NO.:	PG2246/PG4073		
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP6-1	8 - G3	DATE SAMPLED:	-		
LAB No. :		99145		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18		
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18		
			S	AMPLE INFORMAT	TION					
SAMPLE MASS	17	71.9	50	.00						
SPECIFIC GF	RAVITY (Gs)	2.700			REM	IARKS				
HYGROSCOPI		Tare No.								
TARE Wt.	50.00	ACTUAL Wt.								
AIR DRY (Wa)	150.00	100.00								
OVEN DRY (Wo)	147.30	97.30								
F=(Wo/Wa)		973								
INITIAL Wt. (Ma)		0.00								
Wt. CORRECTED		3.65								
Wt. AFTER WAS		21.07								
SOLUTION CONCE	NTRATION	40 g / L								
				RAIN SIZE ANALY	'SIS					
SIE	EVE DIAMETER (m	וm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	AINED PERCENT PASSING			
	63.0									
	53.0 37.5									
	26.5									
	19.0									
	16.0									
	13.2									
	9.5		0	.0		.0	100.0			
	4.75			.0		.0	100			
	2.0			.0		.0	100			
	Pan			1.9		.0				
					-		- T			
	0.850			01	C	.0	100	0.0		
	0.425			04	C	.1	99	.9		
	0.250			14	C	.3	99	.7		
	0.106			74		3.5	86	.5		
	0.075			.09	3	3.2	61	.8		
	Pan			.07						
SIEVE (CHECK	0.0		= 0.3%						
		1		HYDROMETER DA		1	-			
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	ENT PASSING		
1	9:28	30.0	6.0	22.0	0.0440	48.8	48	.8		
2	9:29	27.0	6.0	22.0	0.0318	42.7	42	.7		
5	9:32	26.0	6.0	22.0	0.0203	40.6	40	.6		
15	9:42	24.0	6.0	22.0	0.0119	36.6	36	.6		
30	9:57	23.0	6.0	22.0	0.0084	34.6	34	.6		
60	10:27	21.0	6.0	22.0	0.0061	30.5	30	.5		
250	13:37	17.0	6.0	22.0	0.0030	22.4	22	.4		
1440	9:27	16.0	6.0	22.0	0.0013	20.3	20	.3		
Moisture Cont	ent - 24.8%			COMMENTS						
	SIII - 27.0 /0									
		Curtis Beadow					Joe Forsyth, P. Eng	• <u> </u>		
REVIEWED BY:	for the	h		APPRO	VED BY:		Jean			
							0			



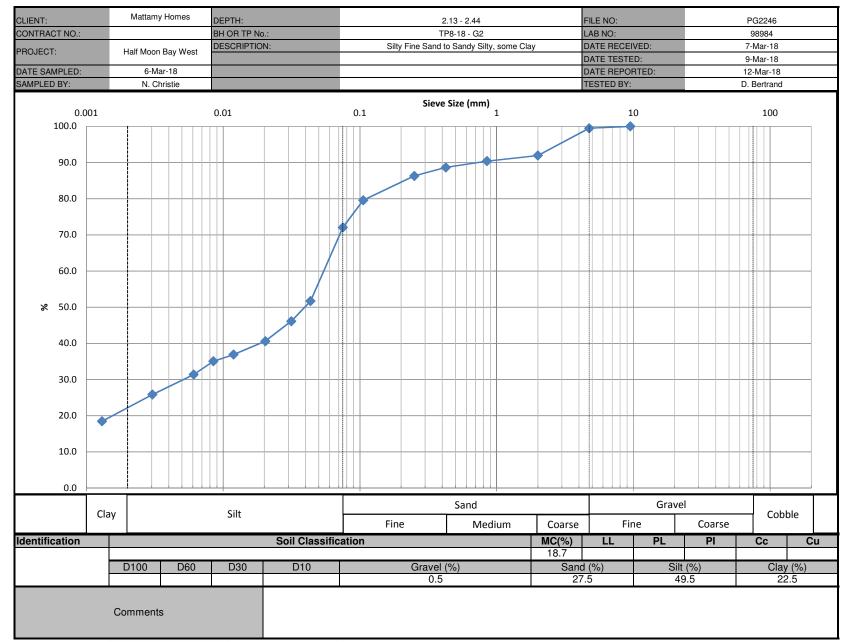
Im hu get

CLIENT:		Mattamy Homes		DEPTH:	4'	- 5'	FILE NO.:	PG2246/PG4073	
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP7-1	8 - G2	DATE SAMPLED:	-	
LAB No. :		99146		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18	
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18	
			S	AMPLE INFORMAT	TION				
SAMPLE MASS	17	77.7	50	.00					
SPECIFIC GR	· · ·	2.700			REN	MARKS			
HYGROSCOPI	C MOISTURE	Tare No.							
TARE Wt.	50.00	ACTUAL Wt.							
AIR DRY (Wa)	150.00	100.00							
OVEN DRY (Wo)	148.63	98.63							
F=(Wo/Wa)	0.	986							
INITIAL Wt. (Ma)	50).00							
Wt. CORRECTED	49	9.32							
Wt. AFTER WAS	H BACK SIEVE	12.6							
SOLUTION CONCE	NTRATION	40 g / L							
			0	GRAIN SIZE ANALY	'SIS				
SIE	EVE DIAMETER (m	ım)	WEIGHT RI	ETAINED (g)	PERCENT	PERCENT RETAINED PERCENT PASS			
	63.0								
	53.0								
	37.5								
	26.5								
	16.0								
	13.2								
	9.5		0	.0			100	0	
	4.75			.0		.0	100		
	2.0					.0	98.		
	Pan			5.3		.4			
					T				
	0.850			26	1	.9	98	.1	
	0.425			57	2	.5	97.	.5	
	0.250			12		.6	96.	.4	
	0.106			68		0.6	89.		
	0.075			10.59 22.2 12.58		2.2	77.	.8	
	Pan	1							
SIEVE (CHECK	0.2		= 0.3%	<u> </u>				
		1		HYDROMETER DA		1			
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	INT PASSING	
1	9:41	28.0	6.0	22.0	0.0447	44.1	43.	5	
2	9:42	25.0	6.0	22.0	0.0323	38.1	37.	.6	
5	9:45	23.0	6.0	22.0	0.0207	34.1	33	.6	
15	9:55	20.0	6.0	22.0	0.0122	28.1	27.		
30	10:10	19.0	6.0	22.0	0.0087	26.1	25		
60	10:40	17.0	6.0	22.0	0.0062	22.1	21.		
250	13:50	15.0	6.0	22.0	0.0031	18.0	17.		
1440	9:40	13.0	6.0	22.0	0.0013	14.0	13	.8	
Moisture Cont	ent = 20.6%			COMMENTS					
		Curtis Beadow					Joe Forsyth, P. Eng.		
REVIEWED BY:	for the			APPRO	VED BY:		Jente		

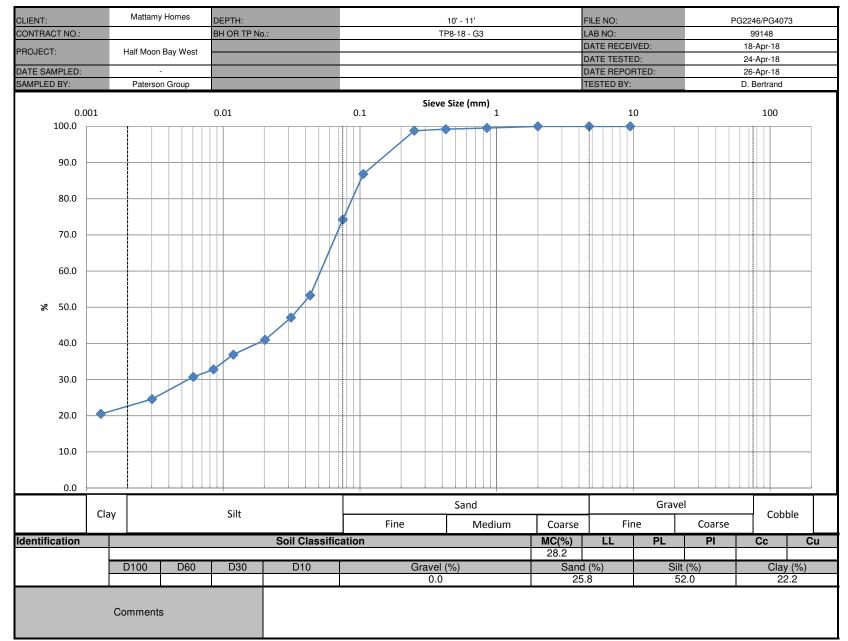


Im hun get

CLIENT:		Mattamy Homes		DEPTH:	6.6'	- 7.6'	FILE NO.:	PG2246/PG4073
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP7-1	8 - G3	DATE SAMPLED:	-
LAB No. :		99147		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18
				AMPLE INFORMAT	ION			
SAMPLE MASS		37.9	50	0.00				
SPECIFIC GF		2.700			REN	IARKS		
HYGROSCOPI		Tare No.						
TARE Wt.	50.00	ACTUAL Wt.						
AIR DRY (Wa)	150.00	100.00						
OVEN DRY (Wo)	142.75	92.75						
F=(Wo/Wa)	0.	928						
INITIAL Wt. (Ma)	50	0.00						
Wt. CORRECTED		5.38						
Wt. AFTER WAS		8.95						
SOLUTION CONCE	NTRATION	40 g / L						
				GRAIN SIZE ANALY	SIS			
SIE	EVE DIAMETER (m	าm)	WEIGHT R	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING
	63.0 53.0							
	37.5							
	26.5							
	19.0							
	16.0							
	13.2							
	9.5		0	0.0		0	100	0
	4.75			0.0		.0	100	
	2.0			0.0		.0	100	
	Pan				0	0.0 100.0		
							I	
	0.850			.00	0	.0	100	0.0
	0.425			.00	0	.0	100	0.0
	0.250			.01		.0	100	
	0.106			.65		.3	96.	.7
	0.075			7.41		1.8	85.	.2
	Pan		8.	.93				
SIEVE C	CHECK	0.2		= 0.3%				
r		1		HYDROMETER DA	TA	1		
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	ENT PASSING
1	9:53	36.0	6.0	22.0	0.0419	64.0	64.	.0
2	9:54	33.0	6.0	22.0	0.0304	57.6	57.	.6
5	9:57	31.0	6.0	22.0	0.0195	53.3	53.	.3
15	10:07	27.0	6.0	22.0	0.0116	44.8	44.	.8
30	10:22	26.0	6.0	22.0	0.0083	42.6	42.	.6
60	10:52	24.0	6.0	22.0	0.0059	38.4	38.	.4
250	14:02	21.0	6.0	22.0	0.0030	32.0	32.	.0
1440	9:52	18.0	6.0	22.0	0.0013	25.6	25.	.6
Moisture Cont	ent = 31.9%			COMMENTS				
		Curtis Beadow					Joe Forsyth, P. Eng.	
							Jenz	



how have get



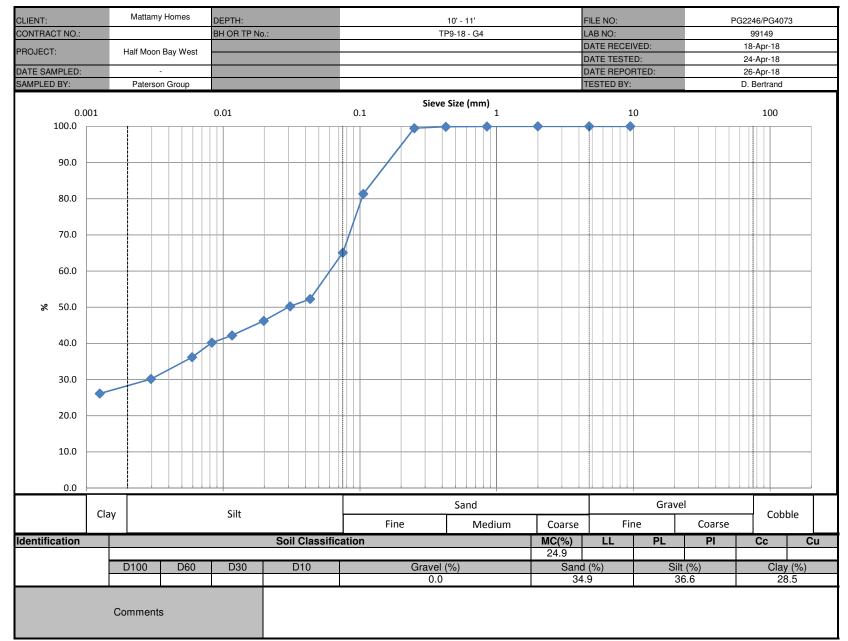
Im hun get

	Mattamy Homes		DEPTH:	10'	- 11'	FILE NO.:	PG2246/PG4073
	Half Moon Bay West		BH OR TP No.:	TP8-1	8 - G3	DATE SAMPLED:	-
	99148		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	18-Apr-18
	Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18
				ION			
	55.1	50	.00				
	2.700			REN	IARKS		
NIRATION	40 g / L	0					
				515			
VE DIAMETER (m	ım)	WEIGHT RE	ETAINED (g)	PERCENT	RETAINED	PERCENT	PASSING
63.0							
37.5							
26.5							
19.0							
16.0							
13.2							
9.5		0	.0	0	.0	100	0.0
4.75			.0			100	0.0
2.0		0	.0	0	.0	100	0.0
Pan		15	5.1				
0.850				0	.5	99.	.5
0.425				0	.8	99.	2
0.250				1	1.2 9		.8
0.106				10	3.2	86.	.8
0.075				25	5.8	74.	.2
Pan	1	13	.75				
HECK	0.0						
			HYDROMETER DA	TA			
TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING
10:06	32.0	6.0	22.0	0.0433	53.3	53.	.3
10:07	29.0	6.0	22.0	0.0313	47.1	47.	.1
10:10	26.0	6.0	22.0	0.0203	41.0	41.	.0
10:20	24.0	6.0	22.0	0.0119	36.9	36.	
10:35	22.0	6.0	22.0	0.0085	32.8	32.	
11:05	21.0	6.0	22.0	0.0061	30.7	30.	
14:15	18.0	6.0	22.0	0.0030		24.	
10:05	16.0	6.0	22.0	0.0013	20.5	20.	.5
ent = 28.2%			COMMENTS				
Curtis Beadow						Joe Forsyth, P. Eng.	·
Im to	hu		APPRO	VED BY:		JeAz	\geq
	AVITY (Gs) AVITY (Gs) 50.00 150.00 146.50 0. 50.00 146.50 0. 50.00 146.50 0. 48 HBACK SIEVE VE DIAMETER (m 63.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 4.75 2.0 Pan 0.850 0.425 0.250 0.106 0.075 Pan HECK TIME (24 hours) 10:06 10:07 10:10 10:20 10:35 11:05 14:15 10:05 Ent = 28.2%	Half Moon Bay West 99148 99148 Paterson Group 155.1 AVITY (Gs) 2.700 AVITY (Gs) 2.700 OMOISTURE Tare No. 50.00 ACTUAL Wt. 150.00 100.00 146.50 96.50 0.965 SO.00 48.25 HBACK SIEVE 13.75 TIATION 40 g / L VE DIAMETER (mm) G3.0 5 A.75 26.5 19.0 16.0 A.75 2.0 Pan 0.850 0.425 0.250 0 A.75 2.0 Pan HECK 0.0 0 10:06 32.0<	Half Moon Bay West 99148 S 155.1 S 155.1 S AVITY (Gs) 2.700 AVITY (Gs) 2.700 AVITY (Gs) 2.700 AVITY (Gs) 2.700 MOISTURE Tare No. 50.00 ACTUAL Wt. 155.5 O 0.965 S O VEIGHT RE 63.0 O VEIGHT RE 63.0 O O O O O O O O O O O O O	Half Moon Bay West BH OR TP No.: 99148 TESTED BY: Paterson Group DATE REPTD: SAMPLE INFORMAT 50.00 AVITY (Gs) 2.700 2 MOISTURE Tare No. 50.00 ACTUAL WI. 155.00 100.00 48.25 96.50 0.965 50.00 48.25 13.75 4BACK SIEVE 13.75 4BACK SIEVE 13.75 4BACK SIEVE 13.75 26.5	Half Moon Bay West BH OR TP No.: TP8-1 9148 TESTED BY: D. Be Paterson Group DATE REPTD: 26.A SAMPE INFORMATION 155.1 50.00 AVITY (Gs) 2.700 REN MOISTURE Tare No. SAMPE INFORMATION 50.00 ACT IN TARE INFORMATION 50.00 ACT IN TARE INFORMATION SAMPE INFORMATION SAMPE INFORMATION GRAIN SIZE ANALYSIS MOISTURE Tare No. GRAIN SIZE ANALYSIS MOISTURE Tare No. GRAIN SIZE ANALYSIS VEIDAMETER (mm) WEIGHT RETAINED (g) PERCENT 63.0 O.0 O.0 SAMPE INFORMATION GRAIN SIZE ANALYSIS VEIDAMETER (mm) WEIGHT RETAINED (g) 6.0	Hall Moon Bay West BH OR TP No.: TP8-18 - G3 9143 TESTED BY: D. Betrand SAMPLE INFORMATION 155.1 50.00 REMARKS 2MOISTURE Tare No. 50.00 REMARKS 50000 ACTUAL W. France REMARKS 155.0 96.50 0.365 50.00 48.25 48.25 13.75 1BACK SIEVE 13.75 FRATION FRETER (mm) VEIGHT RETAINED (g) PERCENT RETAINED 63.0 53.0 30.0 - - 37.5 0.0 0.0 - 28.5 0.0 0.0 - 13.2 - - - 9.5 0.0 0.0 - 13.2 0.0 0.0 - 9.5 0.0 0.0 - 0.425 0.39 0.8 - 0.425 0.39 0.8 - 0.51 - - - <td>Half Moon Bay West BH OR TP No.: TP8-18 - G3 DATE SAMPLED; 03148 TESTED BY: D.Bertrand DATE REFTC 28-Apr-18 DATE TESTED; SAMPLE INFORMATION April 18 - 2700 REMARKS SAMPLE INFORMATION 4000 APRIL 18 - 2700 REMARKS SAMPLE INFORMATION 4000 48.000 APRIL 18 - 2700 REMARKS PERCENT RETAINED PERCENT RETAINED PERCENT RETAINED PERCENT RETAINED 9.0.0.0 0.0.0 0.0</td>	Half Moon Bay West BH OR TP No.: TP8-18 - G3 DATE SAMPLED; 03148 TESTED BY: D.Bertrand DATE REFTC 28-Apr-18 DATE TESTED; SAMPLE INFORMATION April 18 - 2700 REMARKS SAMPLE INFORMATION 4000 APRIL 18 - 2700 REMARKS SAMPLE INFORMATION 4000 48.000 APRIL 18 - 2700 REMARKS PERCENT RETAINED PERCENT RETAINED PERCENT RETAINED PERCENT RETAINED 9.0.0.0 0.0.0 0.0

IENT:	Mattamy Homes	DESCRIPTIO			Silty Sa		FILE NO:				PG2246	
NTRACT NO.:	· ·	SPECIFICAT			Silty Sand w			LAB NO: DATE RECEIVED:			98985	
OJECT:	Half Moon Bay West	INTENDED U			-						7-Mar-18	
		PIT OR QUAR			-			DATE TEST		8-Mar-18		
ATE SAMPLED:	6-Mar-18	SOURCE LO			TP9 - 18 G3			DATE REPO		9-Mar-18		
MPLED BY:	Nathan Christie	SAMPLE LOO	CATION:		2.44 to	2.74		TESTED BY			D.B	
0.01		0.1			Sieve Size	(mm)		10			100	
90.0												
80.0												
70.0												
60.0												
% 50.0												
40.0												
30.0												
20.0												
10.0												
0.0	Silt and Clay			Sand	<u> </u>			Gravel			Cobble	
	Silt and Cidy		Fine	Medium	Coarse		Fine		Coars	e	Connie	
entification			Soil Classi				MC(%)) LL	PL	PI	Cc	Cu
			0011 012351	illation			1010(/0)			r I	0.65	3.0
	D100 D60	D30	D10		Gravel (%)		S-1	ind (%)	Silt	(%)	Clay (
	2.5 0.045	0.021	0.015		0.0			25.9	- 311	70) 7	4.1	/0)
	Comments	0.021	0.010		0.0				1	1		

Im kn get

paterso consulting e						SIEVE AN	
CLIENT:	Mattam	y Homes	DESCRIPTION:	Siltv	Sand	FILE NO.:	PG2246
CONTRACT NO.:		-	SPECIFICATION:	-	w Some Clay	LAB NO.:	98985
	11-16 N.A		INTENDED USE:	•	-	DATE REC'D:	7-Mar-18
PROJECT:	Half Moo	n Bay West	PIT OR QUARRY:		-	DATE TESTED:	8-Mar-18
DATE SAMPLED:	06-N	lar-18	SOURCE LOCATIO	DN:	TP9 - 18 G3	DATE REP'D:	9-Mar-18
SAMPLED BY:	Nathar	n Christie	SAMPLE LOCATIO	N:	TESTED BY:	D.B	
WEIGHT BEFORE	WASH			A+B		255.5	
WEIGHT AFTER W	/ASH	А	B A+B 10				
SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REMA	NRK
150							
106							
75							
63							
53							
37.5							
26.5							
19							
16							
13.2							
9.5							
6.7							
4.75							
2.36	0.0	0.0	100.0				
1.18	0.1	0.0	100.0				
0.6	0.6	0.2	99.8				
0.3	4.0	1.6	98.4				
0.15	19.0	7.4	92.6				
0.075	66.3	25.9	74.1				
PAN	100.4						
SIEVE CHECK FIN	E	0.00		0.3% max.	•	REFERENCE	MATERIAL
OTHER TESTS					RESULT	LAB NO.	RESULT
		Curtis Beado	w		Joe Fo	rsyth, P. Eng.	•
REVIEWED BY:	In	~ hu				72	



Im hun get

CLIENT:		Mattamy Homes		DEPTH:	10'	- 11'	FILE NO.:	PG2246/PG4073	
PROJECT:		Half Moon Bay West		BH OR TP No.:	TP9-1	8 - G4	DATE SAMPLED:	-	
LAB No. :		99149		TESTED BY:	D. Be	rtrand	DATE RECEIVED:	18-Apr-18	
SAMPLED BY:		Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18	
				AMPLE INFORMAT	TION				
SAMPLE MASS	16	64.6	50	0.00					
SPECIFIC GI		2.700			REN	IARKS			
HYGROSCOPI		Tare No.							
TARE Wt.	50.00	ACTUAL Wt.							
AIR DRY (Wa)	150.00	100.00							
OVEN DRY (Wo)	148.40	98.40							
F=(Wo/Wa)		984							
INITIAL Wt. (Ma)		0.00							
Wt. CORRECTED		9.20							
Wt. AFTER WAS		18.83							
SOLUTION CONCE	INTRATION	40 g / L							
				GRAIN SIZE ANALY	515				
SIE	EVE DIAMETER (m	וm)	WEIGHT R	ETAINED (g)	PERCENT	RETAINED	RETAINED PERCENT PASSING		
	63.0 53.0								
	37.5								
	26.5								
	19.0								
	16.0								
	13.2								
	9.5		0	.0	0	.0	100	0.0	
	4.75			0.0		.0	100		
	2.0			.0		.0	100		
	Pan			4.6		.0			
	0.850			.02		.0	100		
	0.425			.06		.1	99.		
	0.250		0.26			.5	99		
	0.106					3.7	81.		
	0.075			.47 5.81	34	1.9	65	.1	
	Pan	0.1							
SIEVE	JHEUK	0.1		= 0.3% HYDROMETER DA	ТА				
	TIME	Hs	Нс	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING	
ELAPSED 1	(24 hours)	22.0	6.0		0.0420		50	2	
1 2	10:20	32.0	6.0	22.0	0.0433	52.3 50.2	52.		
5	10:21	31.0 29.0	6.0 6.0	22.0 22.0	0.0309	50.2 46.2	46		
5 15	10:24	29.0	6.0	22.0	0.0198	46.2	40.		
30	10:49	26.0	6.0	22.0	0.0083	42.2	40		
60	11:19	24.0	6.0	22.0	0.0059	36.2	36		
250	14:29	21.0	6.0	22.0	0.0030	30.1	30		
1440	10:19	19.0	6.0	22.0	0.0013	26.1	26		
				COMMENTS					
Moisture Cont	tent = 24.9%								
		Curtis Beadow					Joe Forsyth, P. Eng.		
REVIEWED BY:	Low He			APPRO	VED BY:		Jet 2		
	in								

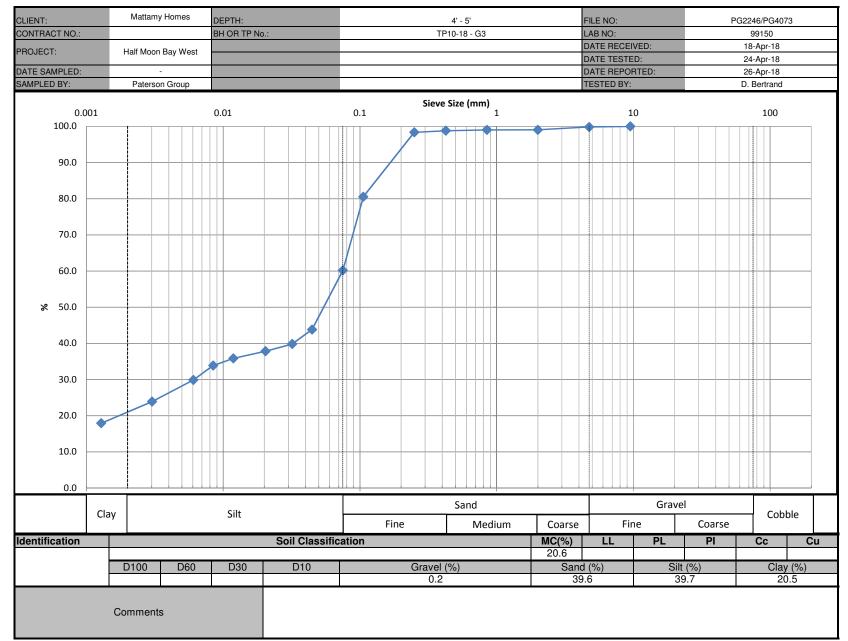
IENT:	Mattamy Homes	DESCRIPTION			Silty Sand			FILE NO:			PG2246	
NTRACT NO.:	· ·	SPECIFICATIO			Silty Sand w Some Clay			LAB NO:		98985		
OJECT:	Half Moon Bay West	INTENDED USE			-			DATE RECEIVED:		7-Mar-18		
		PIT OR QUARF			-			DATE TESTED:			8-Mar-18	
ATE SAMPLED:	6-Mar-18	SOURCE LOCA			TP9 - 1			DATE REPO			9-Mar-18	
MPLED BY:	Nathan Christie	SAMPLE LOCA	TION:		2.44 to	2.74		TESTED BY	:		D.B	
0.01		0.1		▲	Sieve Size	(mm)		10			100	
90.0												
80.0												
70.0												
60.0												
% 50.0												
40.0												
30.0												
20.0												
10.0												
0.0	Silt and Clay			Sand				Gravel			Cobble	
	Silt and Clay		Fine	Medium	Coarse		Fine		Coars	e	CODDIE	
entification			Soil Classi	fication			MC(%)	LL	PL	PI	Cc	Cu
entineation				neation			WO(70)	LL	F L	FI	0.65	3.0
	D100 D60	D30	D10		Gravel (%)		60	nd (%)	Cil+	(%)	Clay (
		0.021	0.015	-	0.0			na (%) 25.9	ગા	(/0)	4.1	/0)
	2.5 0.045						1				4 1	

Im kn get

paterso consulting e						SIEVE AN	
CLIENT:	Mattam	y Homes	DESCRIPTION:	Siltv	Sand	FILE NO.:	PG2246
CONTRACT NO.:		-	SPECIFICATION:	Silty Sand	LAB NO.:	98985	
	11-16 N.A		INTENDED USE:	•	-	DATE REC'D:	7-Mar-18
PROJECT:	Half Moo	n Bay West	PIT OR QUARRY:		-	DATE TESTED:	8-Mar-18
DATE SAMPLED:	06-N	lar-18	SOURCE LOCATIO	DN:	TP9 - 18 G3	DATE REP'D:	9-Mar-18
SAMPLED BY:	Nathar	n Christie	SAMPLE LOCATIO	DN:	2.44 to 2.74	TESTED BY:	D.B
WEIGHT BEFORE	WASH			A+B		255.5	
WEIGHT AFTER W	/ASH	А	В	A+B		100.4	
SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REMA	NRK
150							
106							
75							
63							
53							
37.5							
26.5							
19							
16							
13.2							
9.5							
6.7							
4.75							
2.36	0.0	0.0	100.0				
1.18	0.1	0.0	100.0				
0.6	0.6	0.2	99.8				
0.3	4.0	1.6	98.4				
0.15	19.0	7.4	92.6				
0.075	66.3	25.9	74.1				
PAN	100.4						
SIEVE CHECK FIN	E	0.00		0.3% max.	•	REFERENCE	MATERIAL
OTHER TESTS					RESULT	LAB NO.	RESULT
		Curtis Beado	w		Joe Fo	rsyth, P. Eng.	•
REVIEWED BY:	In	~ hu				72	

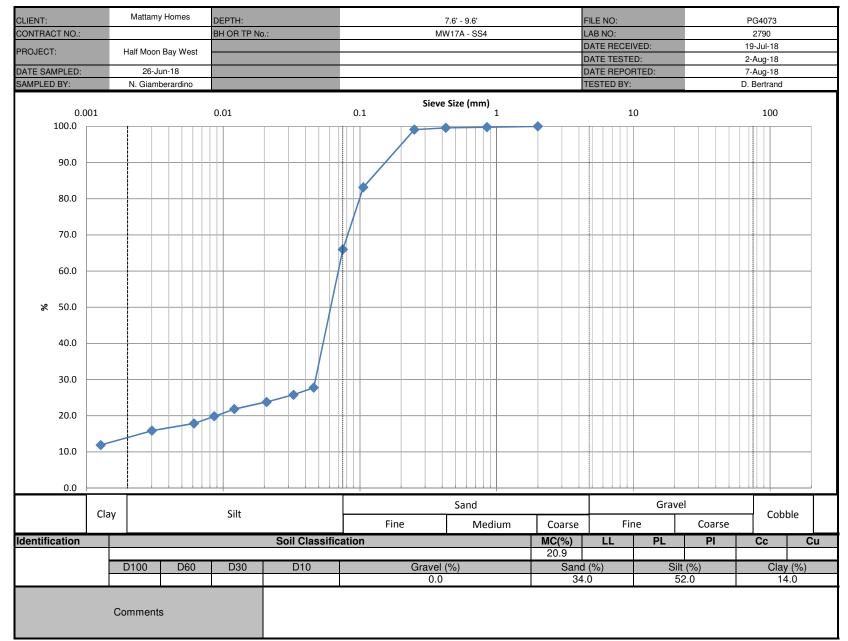
TE SAMPLED:	- alf Moon Bay West 6-Mar-18 Nathan Christie	SPECIFICATI INTENDED U PIT OR QUAI SOURCE LOO SAMPLE LOO 0.1	JSE: RRY: DCATION: CATION:			Sand w Son	3 G2 .07			LAB NO: DATE REC DATE TES DATE REC TESTED F	STED: PORTED:			98986 7-Mar-18 8-Mar-18 9-Mar-18 D.B 100	
O.01 100.0 90.0 80.0 70.0 60.0	6-Mar-18	PIT OR QUAR SOURCE LOO SAMPLE LOO	RRY: DCATION: CATION:			- TP10 - 18 0.76 to 1 Sieve Size	.07			DATE TES DATE REI TESTED E	STED: PORTED:			8-Mar-18 9-Mar-18 D.B	
O.01 100.0 90.0 80.0 70.0 60.0	6-Mar-18	SOURCE LOO SAMPLE LOO	CATION: CATION:			TP10 - 18 0.76 to 1	.07			DATE REI TESTED E	PORTED:			9-Mar-18 D.B	
0.01 100.0 90.0 80.0 70.0 60.0		SAMPLE LOO	CATION:			0.76 to 1	.07			TESTED E				D.B	
0.01 100.0 90.0 80.0 70.0 60.0	Nathan Christie					Sieve Size		•			3Y:				
100.0 90.0 80.0 70.0 60.0						Sieve Size ((mm)			10					
80.0 70.0 60.0															
70.0 60.0															
60.0															
			•												
% 50.0				1 I I											
40.0															
30.0															
20.0															
10.0															
0.0															
	Silt and Clay		Fine	Sand	1	Cooree			ino	Gravel	0			Cobble	e
			Fine	Medium		Coarse			ine			arse			
ntification			Soil Classif	Ication				ľ	AC(%)	LL	PL		PI	Cc 0.95	Cu
		Daa			_			_	0.5-1						4.9
	100 D60 4.9 0.17	D30 0.075	D10 0.035			ravel (%) 0.0				d (%) 0.4	5	Silt (%	0)	9.6	ay (%)
	nments	0.070	Jee					1	,				L		

paterso consulting er	ngroup				SIEVE AN ASTM		
CLIENT:	Mattam	y Homes	DESCRIPTION:	S	Sand	FILE NO.:	PG2246
CONTRACT NO.:		-	SPECIFICATION:	Sand w	Some Silt	LAB NO.:	98986
PROJECT:	Half Moor	n Bay West	INTENDED USE:		-	DATE REC'D:	7-Mar-18
FROJECT.		T Day West	PIT OR QUARRY:		-	DATE TESTED:	8-Mar-18
DATE SAMPLED:	06-N	lar-18	SOURCE LOCATIC	N:	TP10 - 18 G2	DATE REP'D:	9-Mar-18
SAMPLED BY:	Nathan	Christie	SAMPLE LOCATIO	N:	0.76 to 1.07	TESTED BY:	D.B
WEIGHT BEFORE	WASH			A+B		281.4	
WEIGHT AFTER W	ASH	А	В	A+B		215.9	
SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REM	ARK
150							
106							
75							
63							
53							
37.5							
26.5							
19							
16							
13.2							
9.5							
6.7							
4.75	0.0	0.0	100.0				
2.36	0.2	0.1	99.9				
1.18	0.6	0.2	99.8				
0.6	3.0	1.1	98.9				
0.3	27.3	9.7	90.3				
0.15	126.3	44.9	55.1				
0.075	198.0	70.4	29.6				
PAN	215.5						
SIEVE CHECK FIN	E	0.19	0.3% max.		REFERENCE	MATERIAL	
OTHER TESTS					RESULT	LAB NO.	RESULT
		Curtis Beado	W		Joe For	syth, P. Eng.	I
REVIEWED BY:	In	~ h~					



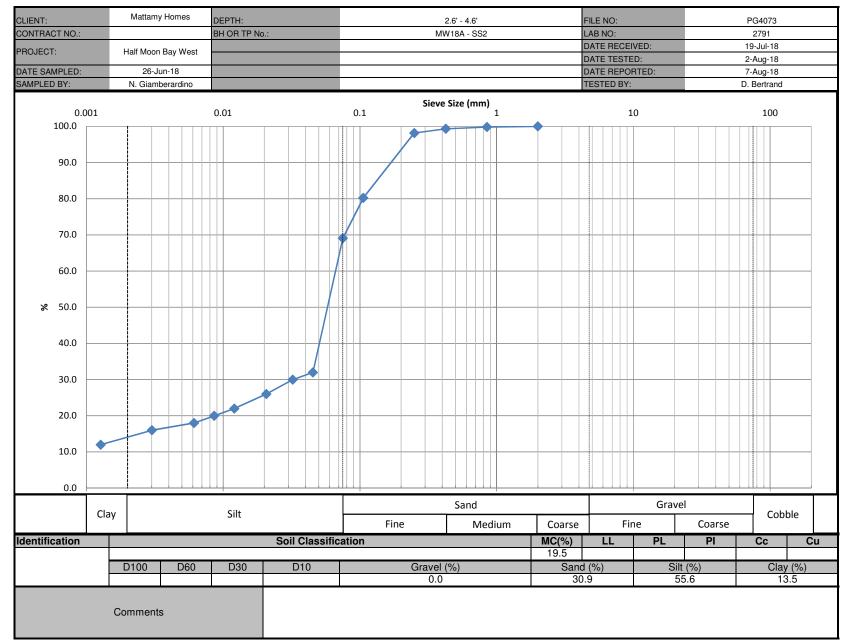
Im hun get

	Mattamy Homes		DEPTH:	4'	- 5'	FILE NO.:	PG2246/PG4073		
	Half Moon Bay West		BH OR TP No.:	TP10-	18 - G3	DATE SAMPLED:	-		
	99150		TESTED BY:	D. Be	rtrand	DATE RECEIVED:	18-Apr-18		
	Paterson Group		DATE REPT'D:	26-A	pr-18	DATE TESTED:	24-Apr-18		
		S	AMPLE INFORMAT	ION					
1	77	50	.00						
RAVITY (Gs)	2.700			REM	IARKS				
C MOISTURE	Tare No.								
50.00	ACTUAL Wt.								
150.00	100.00								
148.35	98.35								
0.	984								
50	0.00								
49	9.18								
H BACK SIEVE	21.13								
NTRATION	40 g / L								
		C	RAIN SIZE ANALY	SIS					
	am)			DEDCENT	RETAINED	DEDCENT	PASSING		
				PERCENT		FERGENT			
63.0									
53.0									
37.5									
26.5									
19.0									
16.0									
13.2									
9.5		0	.0	0	.0	100	.0		
4.75		0	.3	0	.2	99.	8		
2.0			.7	1	.0	99.	0		
Pan		17	5.3						
0.850		0.	01	1	.0	99.	0		
0.425		0.13		1	.2	98.	8		
0.250		0.35		1	.7	98.	3		
0.106		9.	34	19	9.5	80.	5		
		19	.62						
		21	.12						
	0.0	MAX :	= 0.3%						
	• •			ТА		4			
TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING		
10:32	28.0	6.0	22.0	0.0447	44.2	43.	8		
10:33	26.0	6.0	22.0	0.0320	40.2	39.	8		
10:36	25.0	6.0	22.0	0.0204	38.2	37.			
10:46	24.0	6.0	22.0	0.0119	36.2	35.			
11:01	23.0	6.0	22.0	0.0084	34.2	33.			
11:31	21.0	6.0	22.0	0.0061	30.2	29.			
14:41	18.0	6.0	22.0	0.0030	24.1	23.			
10:31	15.0	6.0	22.0		18.1	17.			
			COMMENTS						
ent = 20.6%									
	Curtis Beadow					Joe Forsyth, P. Eng.			
1			APPRO			Joe Forsyth, P. Eng.			
	AVITY (Gs) C MOISTURE 50.00 150.00 148.35 0. 50 148.35 0. 50 44 H BACK SIEVE NTRATION VE DIAMETER (n 63.0 53.0 37.5 26.5 19.0 16.0 13.2 9.5 4.75 2.0 Pan 0.850 0.425 0.250 0.106 0.075 Pan CHECK TIME (24 hours) 10:32 10:33 10:36 10:46 11:01 11:31 14:41 10:31 ent = 20.6%	Half Moon Bay West 99150 Paterson Group Paterson Group COUSTURE Tare No. SO.00 ACTUAL Wt. 150.00 ACTUAL Wt. 150.00 ACTUAL Wt. 150.00 SO.00 ACTUAL Wt. 150.00 44.03 SO.00 44.03 SO.00 44.03 SO.00 44.03 g/L SO.00 44.03 g/L SO.00 63.0 SO.00 SO.0 SO.0 <th< td=""><td>Half Mon Bay West 99150 Paterson Group S 177 50 AVITY (Gs) 2.700 C S 177 50 AVITY (Gs) 2.700 C S 0.00 ACTUAL Wt. 150.00 100.00 148.35 98.35 0.984 50.00 49.18 H MEIGHT RI 63.0 53.0 53.0 37.5 C VEIGHT RI 63.0 0 53.0 0 37.5 0 C VEIGHT RI 6.5 19.0 0 16.0 0 19.0 10.2 0 0.0 0.106 0.250 0.0</td><td>Half Moon Bay West BH OR TP No.: 99150 TESTED BY: DATE REPTD: SAMPLE INFORMAT 177 50.00 RAVITY (Gs) 2.700 C MOISTURE Tare No. 50.00 ACTUAL WI. 150.00 100.00 49.18 40.9.18 HBACK SIEVE 21.13 NTRATION 40.g / L GRAIN SIZE ANALY VE DIAMETER (mm) WEIGHT RETAINED (g) 63.0 53.0 57.5 26.5 19.0 16.0 13.2 0.3 9.5 0.0 44.75 0.3 2.0 1.7 Pan 177.5.3 0.850 0.01 0.425 0.13 0.250 0.35 0.106 9.34 0.075 19.62 Pan 21.12 CHECK 0.0 MAX = 0.3% TIME He He Temp. (°C)</td><td>Half Moon Bay West BH OR TP No.: TP10- TESTED BY: D. Be Paterson Group DATE ERPTD: 26.A SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 REM S0.00 ACTUAL WL. 50.00 REM 180.05 URE T are No. 50.00 ACTUAL WL. 150.00 100.00 148.35 98.35 </td><td>Half Moon Bay West H OR TP No.: TP10-18 - G3 9950 TESTED EY: D. Betrand SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 AVITY (Gs) 2.70 CMOISTURE Tare No. 50.00 ACTUAL WI. 50.00 ACTUAL WI. 198.35 98.35 0.094 60.00 49.18 H H BACK SIEVE 21.13 NTRATION 40.9 /L GRAIN SIZE ANALYSIS VE DIAMETER (mm) WEIGHT RETAINED (g) 9.5 0.0 63.0 53.0 37.5 - 26.5 - 19.0 - 16.0 - 13.2 0.0 9.5 0.0 0.635 1.7 10 - 9.5 0.0 0.425 0.13 0.20 1.7 10 -</td><td>Hart Moon Bay West BH OR TP No.: TPI-0-18 - 0.3 DATE SAMPLED: 9350 TESTED BY. 0. Bertrand DATE RECEIVED: Address Group DATE REPTD: 28.4pr-18 DATE SETED: SAMPLE INFORMATION 50.00 ACTUAL IV. 50.00 NOTE REPTD: 28.4pr-18 GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 REMARKS FEMARKS GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 ACTUAL IV. FEMARKS 40.18 44.39.3 98.35 98.35 98.35 99.4 50.00 40.18 MEE ANALYSIS FERCENT RETAINED (g) PERCENT RETAINED PERCENT 48.30 99.5 0.0 0.0 100 53.0 53.0 10.0 10.0 10.0 54.5 0.0 0.0 100 10.0 10.0 13.2 0.3 0.2 10.0 10.0 10.0 10.0 2.65 0.0 0.0 10.0 10.0 10.0 1.7</td></th<>	Half Mon Bay West 99150 Paterson Group S 177 50 AVITY (Gs) 2.700 C S 177 50 AVITY (Gs) 2.700 C S 0.00 ACTUAL Wt. 150.00 100.00 148.35 98.35 0.984 50.00 49.18 H MEIGHT RI 63.0 53.0 53.0 37.5 C VEIGHT RI 63.0 0 53.0 0 37.5 0 C VEIGHT RI 6.5 19.0 0 16.0 0 19.0 10.2 0 0.0 0.106 0.250 0.0	Half Moon Bay West BH OR TP No.: 99150 TESTED BY: DATE REPTD: SAMPLE INFORMAT 177 50.00 RAVITY (Gs) 2.700 C MOISTURE Tare No. 50.00 ACTUAL WI. 150.00 100.00 49.18 40.9.18 HBACK SIEVE 21.13 NTRATION 40.g / L GRAIN SIZE ANALY VE DIAMETER (mm) WEIGHT RETAINED (g) 63.0 53.0 57.5 26.5 19.0 16.0 13.2 0.3 9.5 0.0 44.75 0.3 2.0 1.7 Pan 177.5.3 0.850 0.01 0.425 0.13 0.250 0.35 0.106 9.34 0.075 19.62 Pan 21.12 CHECK 0.0 MAX = 0.3% TIME He He Temp. (°C)	Half Moon Bay West BH OR TP No.: TP10- TESTED BY: D. Be Paterson Group DATE ERPTD: 26.A SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 REM S0.00 ACTUAL WL. 50.00 REM 180.05 URE T are No. 50.00 ACTUAL WL. 150.00 100.00 148.35 98.35	Half Moon Bay West H OR TP No.: TP10-18 - G3 9950 TESTED EY: D. Betrand SAMPLE INFORMATION SAMPLE INFORMATION 177 50.00 AVITY (Gs) 2.70 CMOISTURE Tare No. 50.00 ACTUAL WI. 50.00 ACTUAL WI. 198.35 98.35 0.094 60.00 49.18 H H BACK SIEVE 21.13 NTRATION 40.9 /L GRAIN SIZE ANALYSIS VE DIAMETER (mm) WEIGHT RETAINED (g) 9.5 0.0 63.0 53.0 37.5 - 26.5 - 19.0 - 16.0 - 13.2 0.0 9.5 0.0 0.635 1.7 10 - 9.5 0.0 0.425 0.13 0.20 1.7 10 -	Hart Moon Bay West BH OR TP No.: TPI-0-18 - 0.3 DATE SAMPLED: 9350 TESTED BY. 0. Bertrand DATE RECEIVED: Address Group DATE REPTD: 28.4pr-18 DATE SETED: SAMPLE INFORMATION 50.00 ACTUAL IV. 50.00 NOTE REPTD: 28.4pr-18 GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 REMARKS FEMARKS GOUD ACTUAL IV. 50.00 ACTUAL IV. 50.00 ACTUAL IV. FEMARKS 40.18 44.39.3 98.35 98.35 98.35 99.4 50.00 40.18 MEE ANALYSIS FERCENT RETAINED (g) PERCENT RETAINED PERCENT 48.30 99.5 0.0 0.0 100 53.0 53.0 10.0 10.0 10.0 54.5 0.0 0.0 100 10.0 10.0 13.2 0.3 0.2 10.0 10.0 10.0 10.0 2.65 0.0 0.0 10.0 10.0 10.0 1.7		



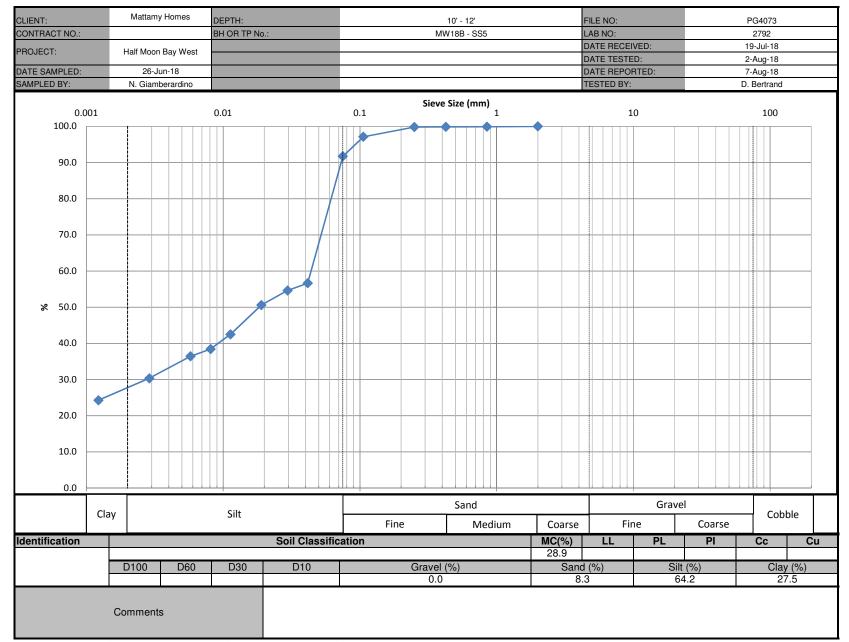
Im hun get

CLIENT:		Mattamy Homes		DEPTH:	7.6'	- 9.6'	FILE NO.:	PG4073	
PROJECT:		Half Moon Bay West		BH OR TP No.:	MW17.	A - SS4	DATE SAMPLED:	26-Jun-18	
LAB No. :		2790		TESTED BY:	D. Be	rtrand	DATE RECEIVED:	19-Jul-18	
SAMPLED BY:		N. Giamberardino		DATE REPT'D:	07-A	ug-18	DATE TESTED:	02-Aug-18	
				AMPLE INFORMAT	ION				
SAMPLE MASS		75.2	50	.00					
SPECIFIC GI		2.700			REN	IARKS			
HYGROSCOP		Tare No.							
TARE Wt.	50.00	ACTUAL Wt.							
AIR DRY (Wa)	150.00	100.00							
OVEN DRY (Wo)	149.70	99.70							
F=(Wo/Wa)		997							
INITIAL Wt. (Ma)		0.00							
Wt. CORRECTED		9.85							
Wt. AFTER WAS		17.87							
		40 g / L		RAIN SIZE ANALY					
SIE	EVE DIAMETER (n	nm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT PASSING		
	63.0								
	53.0								
	37.5								
	26.5								
	19.0								
	16.0								
	13.2								
	9.5								
	4.75			-					
	2.0			.0	0	.0	100.	0	
	Pan		17	5.2					
	0.850			11		.2	99.8		
	0.425		0.20 0.45			.4	99.6		
	0.250			45 42		.9	99.1		
	0.106			42 .01		5.8	83.2		
	0.075			.01 .87	34	4.0	66.0)	
	Pan								
SIEVE	JHECK	0.0		= 0.3% HYDROMETER DA	 ΤΔ				
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCEN	NT PASSING	
1	8:46	19.0	5.0	25.0	0.0459	27.8	27.8	}	
2	8:47	18.0	5.0	25.0	0.0327	25.8	25.8		
5	8:50	17.0	5.0	25.0	0.0208	23.8	23.8		
15	9:00	16.0	5.0	25.0	0.0121	21.8	21.8	3	
30	9:15	15.0	5.0	25.0	0.0086	19.8	19.8	3	
60	9:45	14.0	5.0	25.0	0.0061	17.9	17.9)	
250	12:55	13.0	5.0	25.0	0.0030	15.9	15.9)	
1440	8:45	11.0	5.0	25.0	0.0013	11.9	11.9)	
				COMMENTS					
Moisture Cont	tent = 20.9%								
		Curtis Beadow					Joe Forsyth, P. Eng.		
REVIEWED BY:	for the	1 /			VED BY:		JeAz	>	



Im hun get

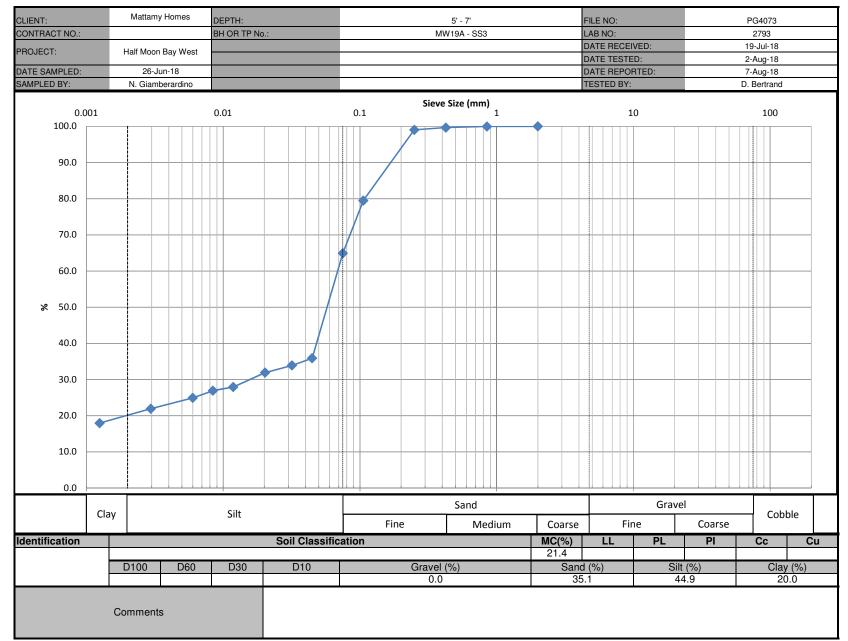
CLIENT:		Mattamy Homes		DEPTH:	2.6'	- 4.6'	FILE NO.:	PG4073	
PROJECT:		Half Moon Bay West		BH OR TP No.:	MW18	A - SS2	DATE SAMPLED:	26-Jun-18	
LAB No. :		2791		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	19-Jul-18	
SAMPLED BY:		N. Giamberardino		DATE REPT'D:	07-A	ug-18	DATE TESTED:	02-Aug-18	
			S		ΓΙΟΝ				
SAMPLE MASS	16	66.3	50	0.00					
SPECIFIC G	RAVITY (Gs)	2.700			REN	IARKS			
HYGROSCOPI	IC MOISTURE	Tare No.							
TARE Wt.	50.00	ACTUAL Wt.							
AIR DRY (Wa)	150.00	100.00							
OVEN DRY (Wo)	148.95	98.95							
F=(Wo/Wa)	0.	990							
INITIAL Wt. (Ma)	50	0.00							
Wt. CORRECTED	49	9.48							
Wt. AFTER WAS	SH BACK SIEVE	16.19							
SOLUTION CONCE	NTRATION	40 g / L							
				GRAIN SIZE ANALY	SIS				
SIE	EVE DIAMETER (m	nm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT PASSING		
	63.0								
	53.0								
	37.5								
	26.5								
	19.0								
	16.0								
	13.2								
	9.5								
	4.75			•			100		
	2.0 Pan			0.0 6.3	0	.0	100.0		
	Fall		10	0.3					
	0.050		0	.10		0	00.0	2	
	0.850					.2	99.8		
	0.425		0.34 0.92			.7	99.3		
	0.250			.89		.8	80.2		
	0.106			.46		9.8).9	69.		
				5.19		5.9		1	
SIEVE (Pan	0.0		= 0.3%					
31LVL (SHEOR	0.0		HYDROMETER DA	ТА				
	TIME	Hs	Нс	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING	
ELAPSED 1	(24 hours) 8:56	21.0	5.0	25.0	0.0453	32.0	32.0)	
2	8:57	20.0	5.0	25.0	0.0323	30.0	30.0		
5	9:00	18.0	5.0	25.0	0.0207	26.0	26.0		
15	9:10	16.0	5.0	25.0	0.0121	22.0	22.0		
30	9:25	15.0	5.0	25.0	0.0086	20.0	20.0		
60	9:55	14.0	5.0	25.0	0.0061	18.0	18.0		
250	13:05	13.0	5.0	25.0	0.0030	16.0	16.0		
1440	8:55	11.0	5.0	25.0	0.0013	12.0	12.0		
				COMMENTS					
Moisture Cont	tent = 19.5%								
		Curtis Beadow					Joe Forsyth, P. Eng.		
	Curtis Beadow NED BY: Image: Reserve to the second s					Joe Forsyth, P. Eng.			



Im hun get

CLIENT:		Mattamy Homes		DEPTH:	10'	- 12'	FILE NO.:	PG4073		
PROJECT:		Half Moon Bay West		BH OR TP No.:	MW18	B - SS5	DATE SAMPLED:	26-Jun-18		
LAB No. :		2792		TESTED BY:	D. Be	rtrand	DATE RECEIVED:	19-Jul-18		
SAMPLED BY:		N. Giamberardino		DATE REPT'D:	07-A	ug-18	DATE TESTED:	02-Aug-18		
			s		TION					
SAMPLE MASS	1	75	50	0.00						
SPECIFIC G	RAVITY (Gs)	2.700			REM	IARKS				
HYGROSCOP	IC MOISTURE	Tare No.								
TARE Wt.	50.00	ACTUAL Wt.								
AIR DRY (Wa)	150.00	100.00								
OVEN DRY (Wo)	147.75	97.75								
F=(Wo/Wa)	0.	978								
INITIAL Wt. (Ma)	50	0.00								
Wt. CORRECTED	48	3.88								
Wt. AFTER WAS	SH BACK SIEVE	4.44								
SOLUTION CONCE	ENTRATION	40 g / L								
			(GRAIN SIZE ANALY	SIS					
SI	EVE DIAMETER (m	ım)	WEIGHT R	ETAINED (g)	PERCENT	RETAINED	PERCENT F	PERCENT PASSING		
	63.0									
	53.0 37.5									
	26.5									
	19.0									
	16.0									
	13.2									
	9.5									
	4.75									
	2.0).0	0	.0	100.	0		
	Pan		1	75	-	-				
			0	05	1					
	0.850			.05		.1	99.9			
	0.425		0.07			.1	99.9			
	0.250					.2	99.8			
	0.106			1.44 2.9 4.14 8.3			97.1			
	0.075			.14 .44	8	.3	91.7	/		
	Pan									
SIEVE	CHECK	0.0	MAX	= 0.3% HYDROMETER DA	TA					
	TIME	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING		
ELAPSED	(24 hours)									
1	9:16	33.0	5.0	25.0	0.0415	56.6	56.6			
2	9:17	32.0	5.0	25.0	0.0296	54.6	54.6			
5	9:20	30.0	5.0	25.0	0.0190	50.6	50.6			
15	9:30	26.0	5.0	25.0	0.0113	42.5	42.5			
30	9:45	24.0	5.0	25.0	0.0081	38.4	38.4			
60	10:15	23.0	5.0	25.0	0.0058	36.4	36.4			
250	13:25	20.0	5.0	25.0	0.0029	30.3	30.3			
1440	9:15	17.0	5.0	25.0	0.0012	24.3	24.3	5		
Moisture Con	tent = 28.9%			COMMENTS						
		Curtis Beadow					Joe Forsyth, P. Eng.			
	Low the				ED BY:					

consulting engineers



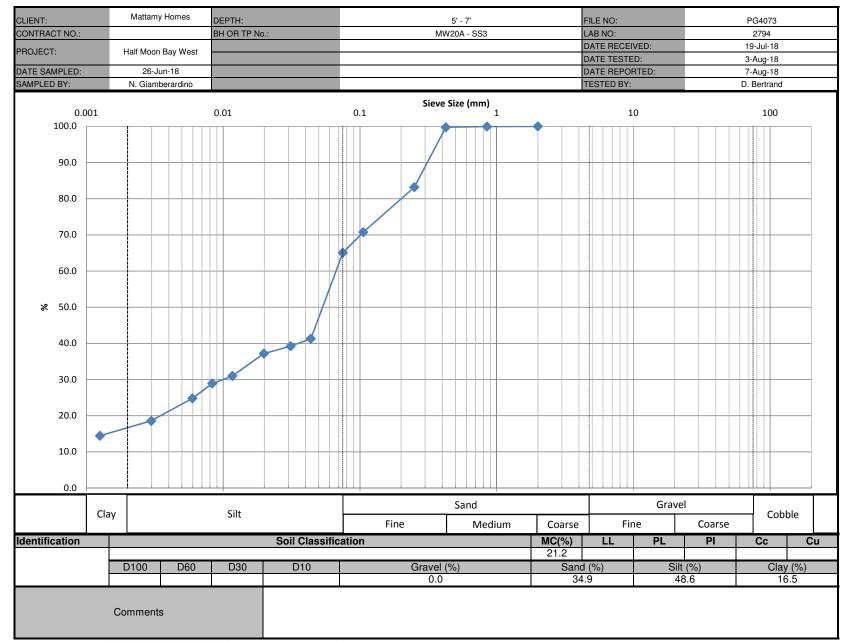
Im hun get

patersongroup consulting engineers

HYDROMETER LS-702 ASTM-422

CLIENT:		Mattamy Homes		DEPTH:	5'	- 7'	FILE NO.:	PG4073
PROJECT:		Half Moon Bay West		BH OR TP No.:	MW19	A - SS3	DATE SAMPLED:	26-Jun-18
LAB No. :		2793		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	19-Jul-18
SAMPLED BY:		N. Giamberardino		DATE REPT'D:	07-A	ug-18	DATE TESTED:	02-Aug-18
			S		ΓΙΟΝ			
SAMPLE MASS	19	94.2	50	0.00				
SPECIFIC G	RAVITY (Gs)	2.700			REM	IARKS		
HYGROSCOP	IC MOISTURE	Tare No.						
TARE Wt.	50.00	ACTUAL Wt.						
AIR DRY (Wa)	150.00	100.00						
OVEN DRY (Wo)	149.15	99.15						
F=(Wo/Wa)	0.	992						
INITIAL Wt. (Ma)	50	0.00						
Wt. CORRECTED	49	9.58						
Wt. AFTER WAS	6H BACK SIEVE	17.83						
SOLUTION CONCE	INTRATION	40 g / L						
			0	GRAIN SIZE ANALY	'SIS		I	
SI	EVE DIAMETER (m	nm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT F	PASSING
	63.0							
	53.0							
	37.5							
	26.5							
	19.0							
	16.0							
	13.2							
	9.5							
	4.75							
	2.0			0.0	C	.0	100.	0
	Pan		19	4.2				
				00				
	0.850			.02		.0	100.	
	0.425			.17		.3	99.7	
	0.250			.48		.0	99.0	
	0.106			0.26		0.5	79.5	
	0.075			7.53 7.83	3	5.1	64.9	9
	Pan							
SIEVE	CHECK	0.0		= 0.3% HYDROMETER DA	Τ.			
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCEI	NT PASSING
1	9:26	23.0	5.0	25.0	0.0447	35.9	35.9	9
2	9:27	22.0	5.0	25.0	0.0318	33.9	33.9	9
5	9:30	21.0	5.0	25.0	0.0203	31.9	31.9	9
15	9:40	19.0	5.0	25.0	0.0119	27.9	27.9	9
30	9:55	18.5	5.0	25.0	0.0084	26.9	26.9	9
60	10:25	17.5	5.0	25.0	0.0060	24.9	24.9	9
250	13:35	16.0	5.0	25.0	0.0030	21.9	21.9	
1440	9:25	14.0	5.0	25.0	0.0012	18.0	18.0)
Moisture Con	tent = 21.4%			COMMENTS				
		Curtis Beadow					Joe Forsyth, P. Eng.	
REVIEWED BY:	for the	h		APPRO	VED BY:		Jette	\geq
	na 🕈 Grad Dana						U	

consulting engineers



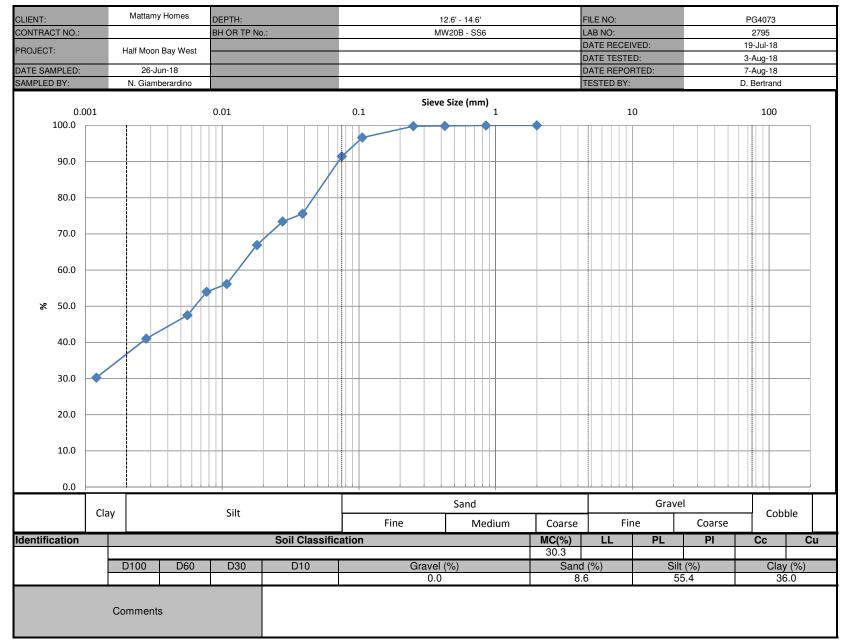
Im hun get

patersongroup consulting engineers

HYDROMETER LS-702 ASTM-422

CLIENT:		Mattamy Homes		DEPTH:	5'	- 7'	FILE NO.:	PG4073	
PROJECT:		Half Moon Bay West		BH OR TP No.:	MW20.	A - SS3	DATE SAMPLED:	26-Jun-18	
AB No. :		2794		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	19-Jul-18	
AMPLED BY:		N. Giamberardino		DATE REPT'D:	07-A	ug-18	DATE TESTED:	03-Aug-18	
			S	AMPLE INFORMAT	ION				
SAMPLE MASS	19	94.2	50	.00					
SPECIFIC GR	RAVITY (Gs)	2.700			REM	MARKS			
HYGROSCOPI	IC MOISTURE	Tare No.							
TARE Wt.	50.00	ACTUAL Wt.							
AIR DRY (Wa)	150.00	100.00							
OVEN DRY (Wo)	145.78	95.78							
F=(Wo/Wa)	0.	958							
INITIAL Wt. (Ma)	50	0.00							
Wt. CORRECTED	47	7.89							
Wt. AFTER WAS	SH BACK SIEVE	19.18							
OLUTION CONCE	NTRATION	40 g / L							
			c	GRAIN SIZE ANALY	SIS		I		
SIE	EVE DIAMETER (m	าm)	WEIGHT R	ETAINED (g)	PERCENT	RETAINED	PERCENT F	PASSING	
	63.0								
	53.0								
	37.5								
	26.5								
	19.0								
	16.0								
	13.2								
	9.5								
	4.75			•				•	
	2.0 Pan			.0 3.1	0	.0	100.	0	
	Fall		15	5.1					
	0.850		0	03	0	.1	99.9	<u>,</u>	
	0.830			13		.3	99.3		
	0.425			41		6.8	83.2		
	0.250			.63		9.3	70.7		
	0.106					9.3 4.9	65.1		
				.18		+.9	05.	1	
SIEVE (Pan	0.0		= 0.3%					
312 VE 0	SHLOR	0.0		= 0.3 % HYDROMETER DA	ТА				
	TIME	Hs	Нс	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING	
ELAPSED 1	(24 hours) 9:59	26.0	6.0	25.0	0.0438	41.3	41.3	2	
2	10:00	25.0	6.0	25.0	0.0438	41.3 39.2	39.2		
5	10:00	23.0	6.0	25.0	0.0312	39.2	39.2		
5 15	10:03	24.0	6.0	25.0	0.0199	37.2	31.0		
30	10:13	21.0	6.0	25.0	0.0083	28.9	28.9		
30 60	10:28	18.0	6.0	25.0	0.0083	28.9	28.5		
250	14:08	15.0	6.0	25.0	0.0080	18.6	18.6		
1440	9:58	13.0	6.0	25.0	0.0030	14.5	14.5		
עדדו	0.00	10.0	0.0	COMMENTS	0.0010	1.5	1 14.	, 	
Moisture Cont	tent = 21.2%								
		Curtis Beadow					Joe Forsyth, P. Eng.		
							Joe Forsyth, P. Eng.		

consulting engineers



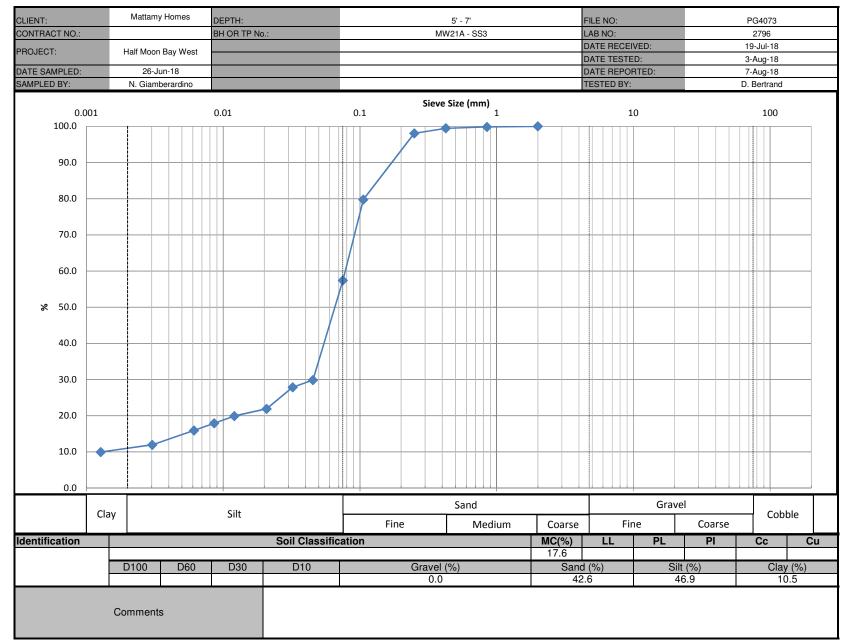
Im hun get

patersongroup consulting engineers

HYDROMETER LS-702 ASTM-422

CLIENT:		Mattamy Homes		DEPTH:	12.6'	- 14.6'	FILE NO.:	PG4073	
PROJECT:		Half Moon Bay West		BH OR TP No.:	MW20	B - SS6	DATE SAMPLED:	26-Jun-18	
LAB No. :		2795		TESTED BY:	D. Be	rtrand	DATE RECEIVED:	19-Jul-18	
SAMPLED BY:		N. Giamberardino		DATE REPT'D:	07-A	ug-18	DATE TESTED:	03-Aug-18	
				AMPLE INFORMAT	ION				
SAMPLE MASS	12	29.9	50	.00					
SPECIFIC G	RAVITY (Gs)	2.700			REN	IARKS			
HYGROSCOP	IC MOISTURE	Tare No.							
TARE Wt.	50.00	ACTUAL Wt.							
AIR DRY (Wa)	150.00	100.00							
OVEN DRY (Wo)	141.60	91.60							
F=(Wo/Wa)		916							
INITIAL Wt. (Ma)		0.00							
Wt. CORRECTED		5.80							
Wt. AFTER WAS		4.61							
SOLUTION CONCE	ENTRATION	40 g / L			2010				
				RAIN SIZE ANALY	515				
SI	EVE DIAMETER (m	ım)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT F	PASSING	
	63.0 52.0								
	53.0								
	37.5								
	26.5 19.0								
	19.0								
	13.2								
	9.5								
	4.75								
	2.0		0	.0	0	.0	100.	0	
	Pan			9.9		.0			
	0.850			02	0	.0	100.	0	
	0.425			08	0	.2	99.8	3	
	0.250			12	0	.2	99.8	3	
	0.106			68		.4	96.6		
	0.075			30	8	.6	91.4	1	
	Pan	1		61					
SIEVE	CHECK	0.0		= 0.3%	 				
				HYDROMETER DA					
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING	
1	10:14	41.0	6.0	25.0	0.0388	75.6	75.6	3	
2	10:15	40.0	6.0	25.0	0.0277	73.4	73.4	1	
5	10:18	37.0	6.0	25.0	0.0180	66.9	66.9	9	
15	10:28	32.0	6.0	25.0	0.0108	56.1	56. ⁻	1	
30	10:43	31.0	6.0	25.0	0.0077	54.0	54.0)	
60	11:13	28.0	6.0	25.0	0.0056	47.5	47.5		
250	14:23	25.0	6.0	25.0	0.0028	41.0	41.0		
1440	10:13	20.0	6.0	25.0	0.0012	30.2	30.2	2	
Moisture Cont	tent = 30.3%			COMMENTS					
		Curtis Beadow					Joe Forsyth, P. Eng.		
REVIEWED BY:	for the			APPRO	VED BY:		Joe Forsyth, P. Eng.		

consulting engineers



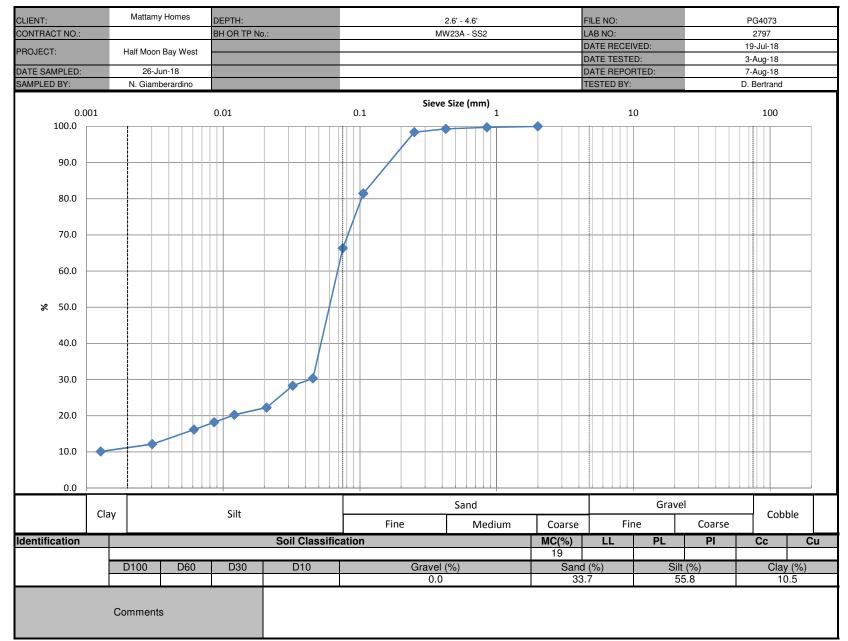
Im hun get

patersongroup consulting engineers

HYDROMETER LS-702 ASTM-422

CLIENT:		Mattamy Homes		DEPTH:	5'	- 7'	FILE NO.:	PG4073
PROJECT:		Half Moon Bay West		BH OR TP No.:	MW21	A - SS3	DATE SAMPLED:	26-Jun-18
LAB No. :		2796		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	19-Jul-18
SAMPLED BY:		N. Giamberardino		DATE REPT'D:	07-A	ug-18	DATE TESTED:	03-Aug-18
			S		ΓΙΟΝ			
SAMPLE MASS	13	39.5	50	.02				
SPECIFIC GI	RAVITY (Gs)	2.700			REN	IARKS		
HYGROSCOPI	C MOISTURE	Tare No.						
TARE Wt.	50.00	ACTUAL Wt.						
AIR DRY (Wa)	150.00	100.00						
OVEN DRY (Wo)	149.30	99.30						
F=(Wo/Wa)	0.	993						
INITIAL Wt. (Ma)	50	0.02						
Wt. CORRECTED	49	9.67						
Wt. AFTER WAS	H BACK SIEVE	25.07						
SOLUTION CONCE	NTRATION	40 g / L						
			0	GRAIN SIZE ANALY	'SIS			
SIE	EVE DIAMETER (m	าm)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT F	PASSING
	63.0							
	53.0							
	37.5							
	26.5							
	19.0							
	16.0							
	13.2							
	9.5							
	4.75		-					
	2.0			.0	0	.0	100.	0
	Pan		13	9.5				
			0	00	•			
	0.850			08 27		.2	99.8	
	0.425					.5	99.5	
	0.250			97		.9	98	
	0.106			.14		0.3	79.7	
	0.075			.31 .07	42	2.6	57.4	1
	Pan							
SIEVE	CHECK	0.0		= 0.3% HYDROMETER DA	τ.			
		1				1		
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING
1	10:26	21.0	6.0	25.0	0.0453	29.9	29.9	9
2	10:27	20.0	6.0	25.0	0.0323	27.9	27.9	9
5	10:30	17.0	6.0	25.0	0.0208	21.9	21.9	9
15	10:40	16.0	6.0	25.0	0.0121	19.9	19.9	9
30	10:55	15.0	6.0	25.0	0.0086	17.9	17.9	9
60	11:25	14.0	6.0	25.0	0.0061	15.9	15.9	9
250	14:35	12.0	6.0	25.0	0.0030	11.9	11.9	9
1440	10:25	11.0	6.0	25.0	0.0013	10.0	10.0)
				COMMENTS				
Moisture Cont	ent = 17.6%							
		Curtis Beadow					Joe Forsyth, P. Eng.	
REVIEWED BY:	Im to			APPRO	VED BY:		JeAz	>
	for ,						Je i	

consulting engineers



Im hun get

patersongroup consulting engineers

HYDROMETER LS-702 ASTM-422

CLIENT:		Mattamy Homes		DEPTH:	2.6'	- 4.6'	FILE NO.:	PG4073		
PROJECT:		Half Moon Bay West		BH OR TP No.:	MW23.	A - SS2	DATE SAMPLED:	26-Jun-18		
.AB No. :		2797		TESTED BY:	D. Be	ertrand	DATE RECEIVED:	19-Jul-18		
AMPLED BY:		N. Giamberardino		DATE REPT'D:	07-A	ug-18	DATE TESTED:	03-Aug-18		
			S	AMPLE INFORMAT	ION					
SAMPLE MASS	13	39.5	50	.02						
SPECIFIC GI	RAVITY (Gs)	2.700			REM	MARKS				
HYGROSCOP	IC MOISTURE	Tare No.								
TARE Wt.	50.00	ACTUAL Wt.								
AIR DRY (Wa)	150.00	100.00								
OVEN DRY (Wo)	147.75	97.75								
F=(Wo/Wa)	0.	978								
INITIAL Wt. (Ma)	50	0.02								
Wt. CORRECTED	48	3.89								
Wt. AFTER WAS	SH BACK SIEVE	17.56								
OLUTION CONCE	INTRATION	40 g / L								
			0	RAIN SIZE ANALY	SIS					
SIE	EVE DIAMETER (m	ım)	WEIGHT RI	ETAINED (g)	PERCENT	RETAINED	PERCENT F	PASSING		
	63.0									
	53.0									
	37.5									
	26.5									
	19.0									
	16.0									
	13.2									
	9.5									
	4.75			•				•		
	2.0 Pan			.0 48	0	.0	100.	0		
	Fail		1.	40						
	0.050		0	14		2	00	7		
	0.850			35		.3	99.7			
	0.425			80		.7	99.3			
	0.250			28		.6	98.4			
		10				3.6 3.7				
	0.075 Pan		0.075 Pan			.56	33	5.7	66.3	5
SIEVE (0.0		= 0.3%						
31272	SHLOR	0.0		HYDROMETER DA	ТА					
	TIME	Hs	Нс	Temp. (°C)	DIAMETER	(P)	TOTAL PERCE	NT PASSING		
ELAPSED 1	(24 hours) 10:40	21.0	6.0	25.0	0.0453	30.3	30.3	2		
2	10:40	20.0	6.0	25.0	0.0455	28.3	28.3			
5	10:41	17.0	6.0	25.0	0.0323	28.3	22.2			
5 15	10:44	16.0	6.0	25.0	0.0208	22.2	22.2			
30	11:09	15.0	6.0	25.0	0.0121	18.2	18.2			
60	11:39	14.0	6.0	25.0	0.0061	16.2	16.2			
250	14:49	12.0	6.0	25.0	0.0081	10.2	12.7			
250 1440	14:49	12.0	6.0	25.0	0.0030	12.1	10.			
UTTU	10.03	11.0	0.0	COMMENTS	0.0013	1.1.1	10.			
Moisture Cont	tent = 19.0%			COMMENTS						
		Curtis Beadow					Joe Forsyth, P. Ena.			
							Joe Forsyth, P. Eng.			



Photo 1: Standing water near Test Fill Pile D in April 2017.

Photo 2: Standing water in east portion of Half Moon Bay West in April 2017.



Site Photographs



Photo 4: Standing water with fill and debris piles in central portion of HMB West on June 29, 2017.



Photo 3: Soil berms and standing water within south portion of HMB West in June 2017.

Site Photographs



Photo 5: Site conditions in southeast portion of site on June 29, 2017.

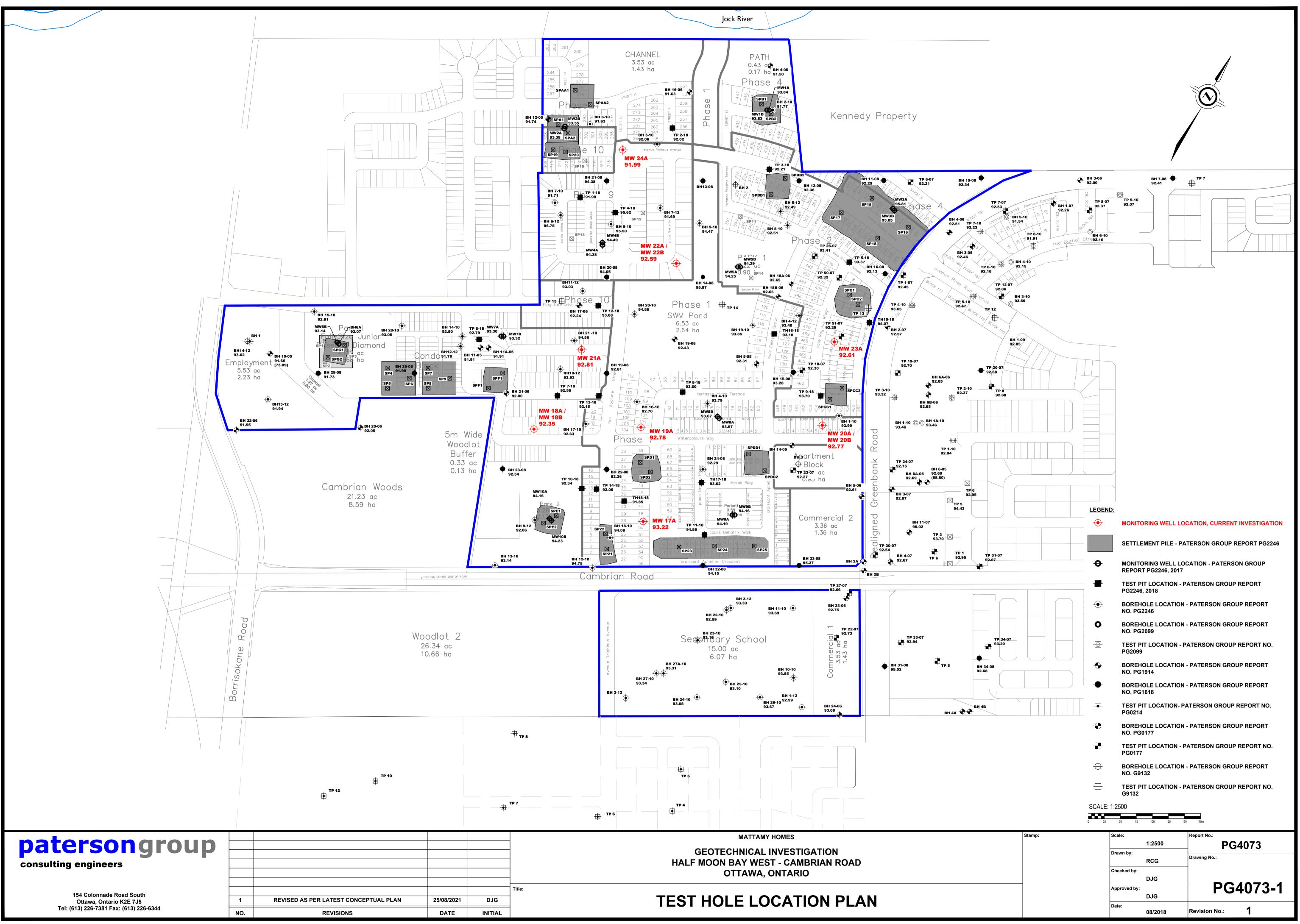
Photo 6: Water in drainage ditch at Cambrian Road crossing in July 2017.

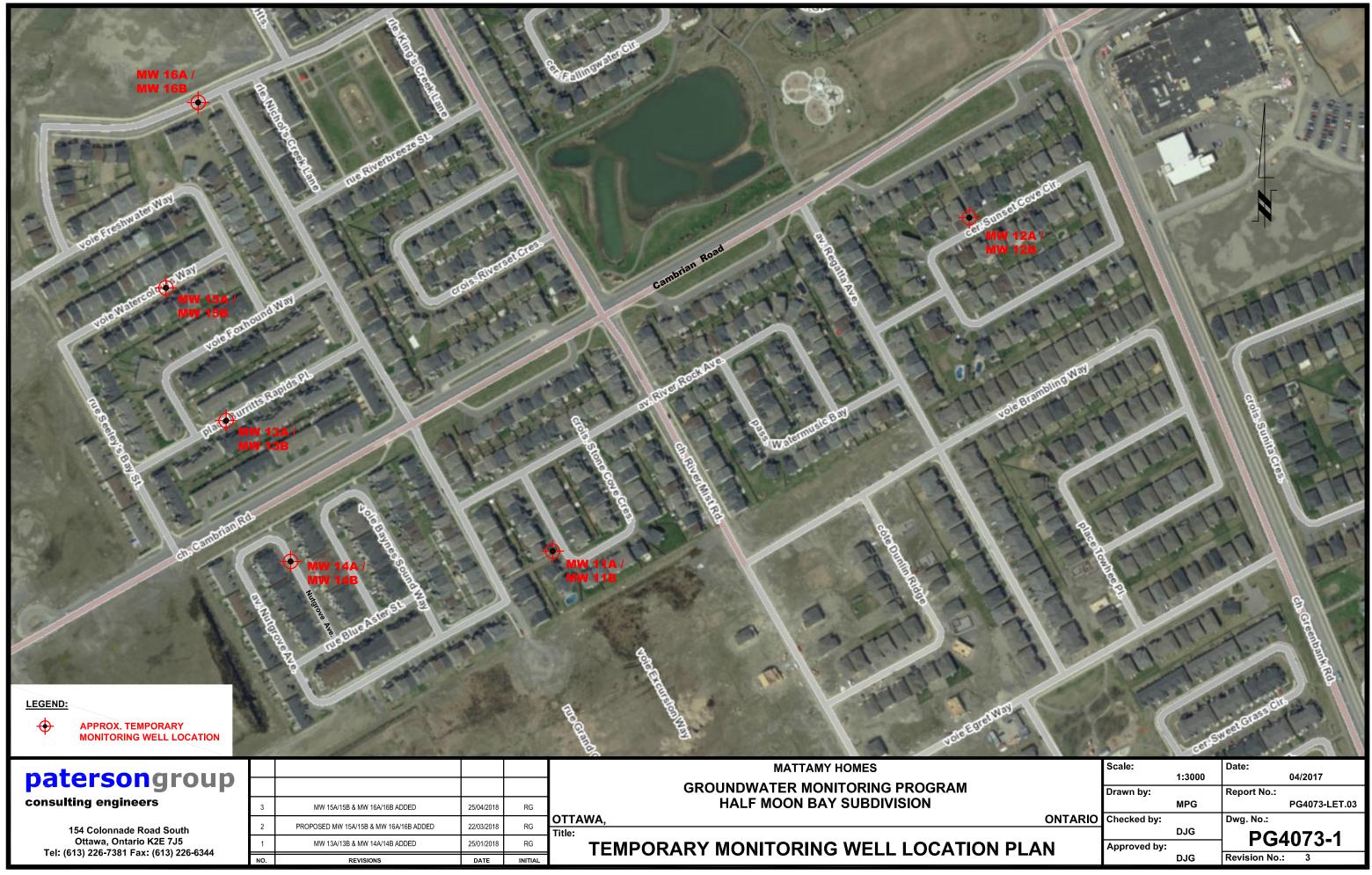


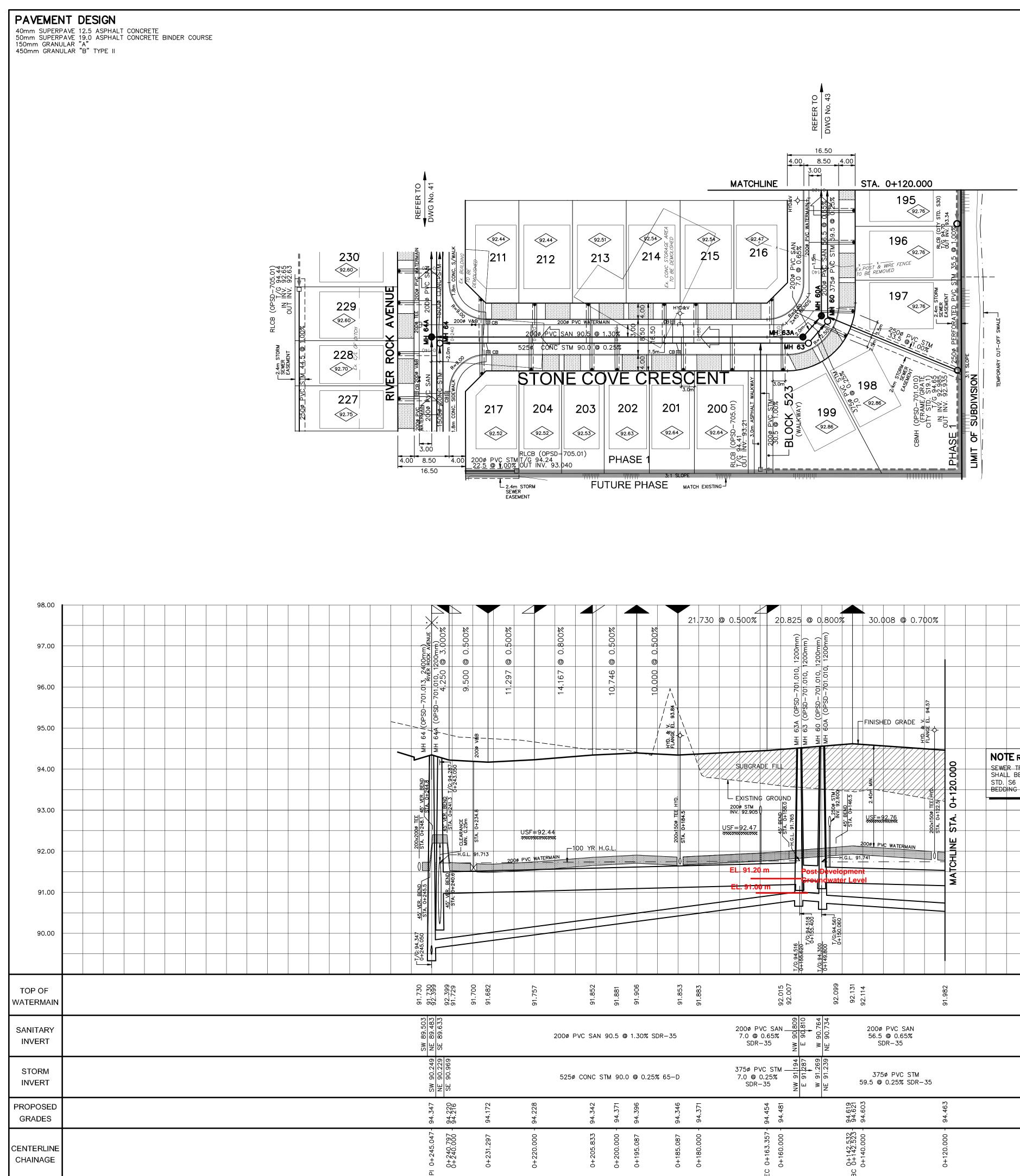
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Photo 9: Standing water near new settlement plate location in central-west portion of site on July 31, 2017.



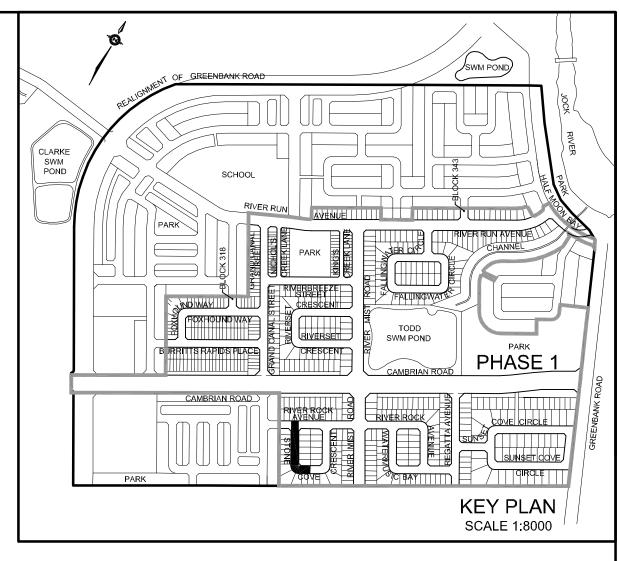






1:1 PM, Jyu,

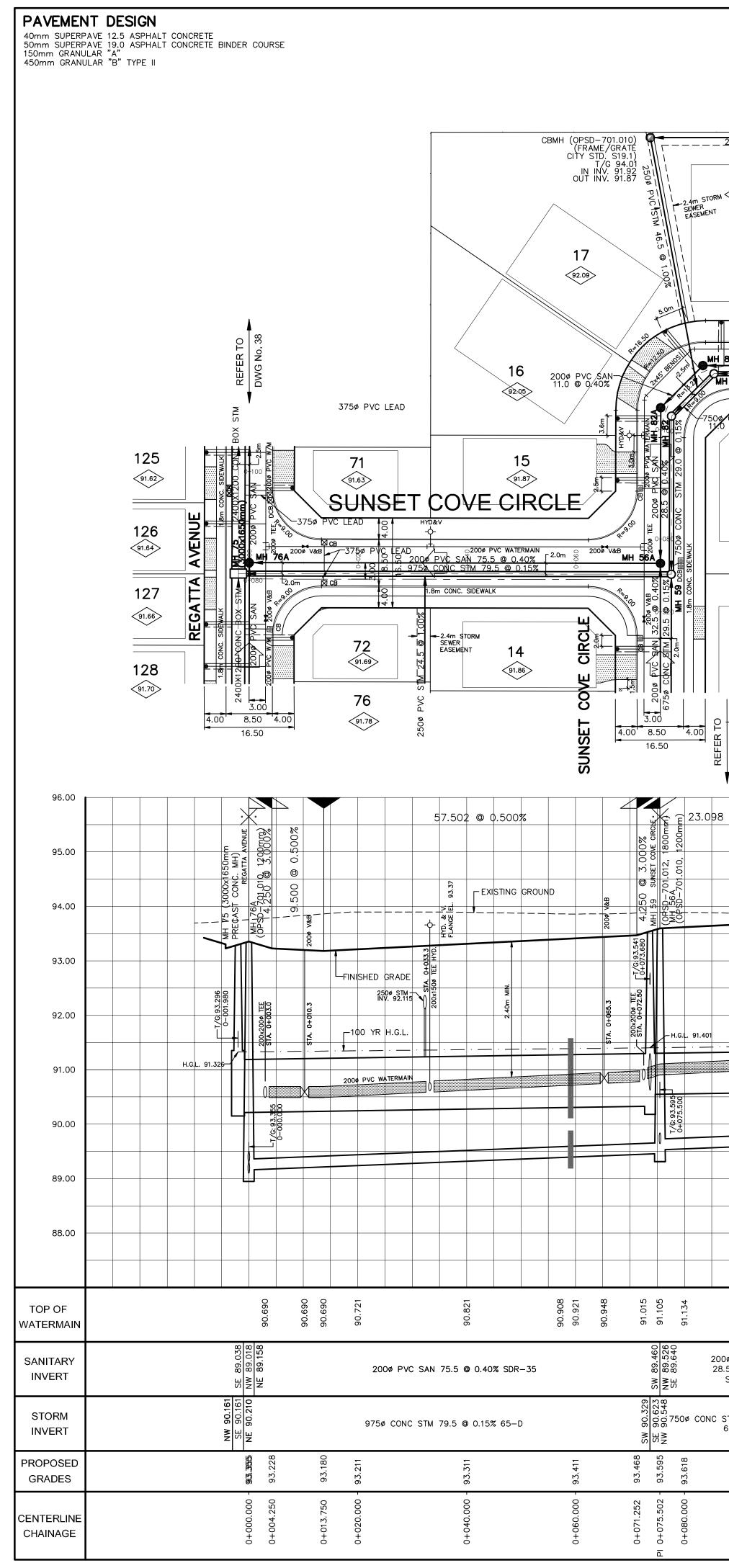
	21.730 @ 0.500% 20.825	© 0.800% 30.008 © 0.700%	76	
0 0	63A (OPSD-701.010, 1200mm)	(mm0021 010.107-0290) 63.408 13.308 13.408 (mm0021 010.107-0290) 608 14.408 14.408 14.408 (mm0021 010.107-0290) 10.1010 10.1010 10.1010 10.1010 10.1010 (mm0021 010.107-0290) 10.1010 10	NOTE RE: SEWER SEWER TRENCH AND E SHALL BE AS PER CIT STD. S6 AND S7, CLA BEDDING UNLESS OTH	
91.853 91.853 91.853	91.883 92.015 92.007	92.099 92.131 92.131 92.114	91.982	
2000 PVC SAN 90.5 @ 1.30% SDR-35	200ø PVC SAN 8 7.0 @ 0.65% 6 SDR-35 8 Z	B B C C C C C C C C C C C C C		
525ø CONC STM 90.0 @ 0.25% 65-D	375¢ PVC STM 7.0 © 0.25% 6 SDR-35 ≥	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		
94.342 94.371 94.396 94.346	94.454 94.454	94.619 94.621 94.603	94.463	
0+205.833 0+205.833 0+195.087 0+185.087	0+180.000 - EC 0+163.357 - 0+160.000 -	BC 0+142.532 0+142.523- 0+140.000	0+120.000 -	



LEGEND

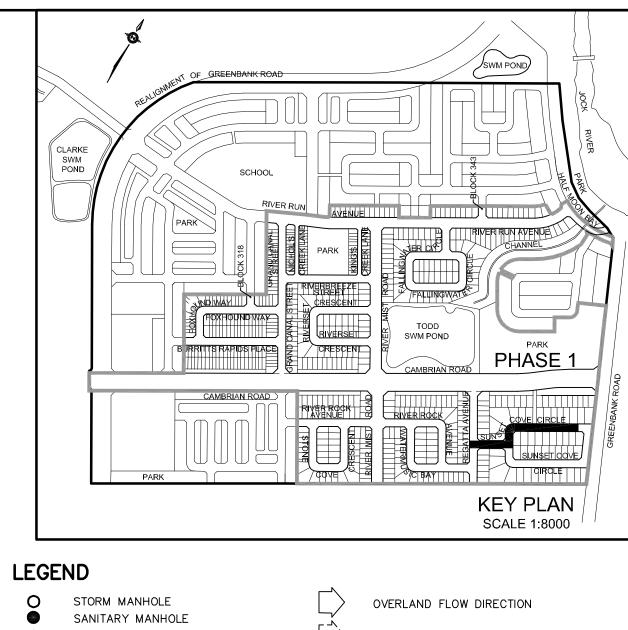
	STORM MANHOLE SANITARY MANHOLE STORM MANHOLE BY OTHERS SANITARY MANHOLE BY OTHERS CATCHBASIN MANHOLE RLCB – ELBOW SECTION (REFER TO CITY STD. S31) RLCB – 'T' SECTION (REFER TO CITY STD. S30) SINGLE STORM HOUSE CONNECTION SINGLE SANITARY HOUSE CONNECTION WATER CONNECTION HYDRANT TEE VALVE AND BOX VALVE & CHAMBER SINGLE/DOUBLE CATCHBASIN CATCHBASINS WITH INLET CONTROL DEVICE TYPE A (Q max = 21.0 1/s) CATCHBASINS WITH INLET CONTROL DEVICE TYPE B (Q max = 28.4 1/s)		OVERLAND FLOW DIRECTION EXTERNAL OVERLAND FLOW DIRECTION 2.0m HIGH ACOUSTIC FENCE (SEE LANDSCAPE DRAWING FOR DETAILS) 2.4m HIGH ACOUSTIC FENCE (SEE LANDSCAPE DRAWING FOR DETAILS) 1.2m HIGH DECORATIVE FENCE (SEE LANDSCAPE DRAWING FOR DETAILS) 1.5m HIGH BLACK VINYL CHAIN LINK FENCE 1.8m HIGH WOOD PRIVACY FENCE (SEE LANDSCAPE DRAWING FOR DETAILS) 250¢ PERFORATED PIPE (REFER TO CITY STD'S S29, S30 FOR REAR YARD TRENCH AND PIPE DETAILS ONLY) BUILDING ENVELOPE
	CATCHBASINS WITH INLET CONTROL DEVICE TYPE D (Q max = 54.0 I/s) CATCHBASINS DENOTED AS 100YR		CLAY SEAL (REFER TO CITY STD. S8, GENERAL NOTES. No.18. 19. ON DWG. No.1, AND GEOTECHNICAL CONSULTANT'S
• LS	INTAKES, WITH STANDARD LEADS UNLESS OTHERWISE NOTED LIGHT STANDARD COMMUNITY MAILBOX AND PAD LOCATION U/S FOOTING ELEVATION		SPECIFICATIONS) RETAINING WALL (SEE NOTES ON DWG. 1 AND STRUCTURAL DWGS FOR DETAILS)
	PHASE LINE		SLAB ON GRADE UNITS

98.00	TOPOGRAPHIC INFORMATION	
97.00	PROJECT No. 06–10–675–00. SURVEY DATED OCTOBER 15, 2007. EGAL INFORMATION CALCULATED M–PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 07–10–767–00–PHASE 1, SURVEY DATED MARCH 18, 2008.	
96.00	BENCH MARK No. 00820010126 POINT IS LOCATED 1.65km NORTH OF BARNSDALE ROAD AND 5km SOUTH OF FALLOWFIELD ROAD ON HIGHW 416 NORTH OF KEMPTVILLE. THE POINT IS SET EAST OF THE NORTHBOUND LANE IN THE GRASSY SHOULDER ELEVATION = 96.923 m	
95.00	Image:	
94.00	Image: Second	
93.00	3 Z.L. 08-02-08 3rd SUBMISSION 2 Z.L. 07-10-16 2nd SUBMISSION 1 Z.L. 07-08-28 1st SUBMISSION No. BY DATE DESCRIPTION	BY
92.00	Ottawa CITY OF OTTAW	
91.00	<u>CITY OF OTTAW</u>	<u>A</u>
90.00		TLIGINEER
TOP OF WATERMAIN	PROJECT No. 07-314	
SANITARY INVERT	PLAN AND PROFILE OF STONE COVE CRESCENT (STA. 0+120.000 TO STA. 0+245.047) © DSI	EL
STORM INVERT	MATTAMY (HALF MOON BAY) LIMITED HASE 1	N
PROPOSED GRADES	600 Alden Road, Suite 500 Markham, Ontario, L3R 0E7 Tel. (905) 475-3080 Fax. (905) 475-3081 www.DSEL.ca	
CENTERLINE CHAINAGE	david schaeffer engineering ItdDRAWN BY:P.P./D.Z.CHECKED BY:K.M.DRAWING NO.SHEET NO.DESIGNED BY:K.M.CHECKED BY:Z.L.42SCALE:H1: 500 ,V 1: 50DATE:AUG. 200742	

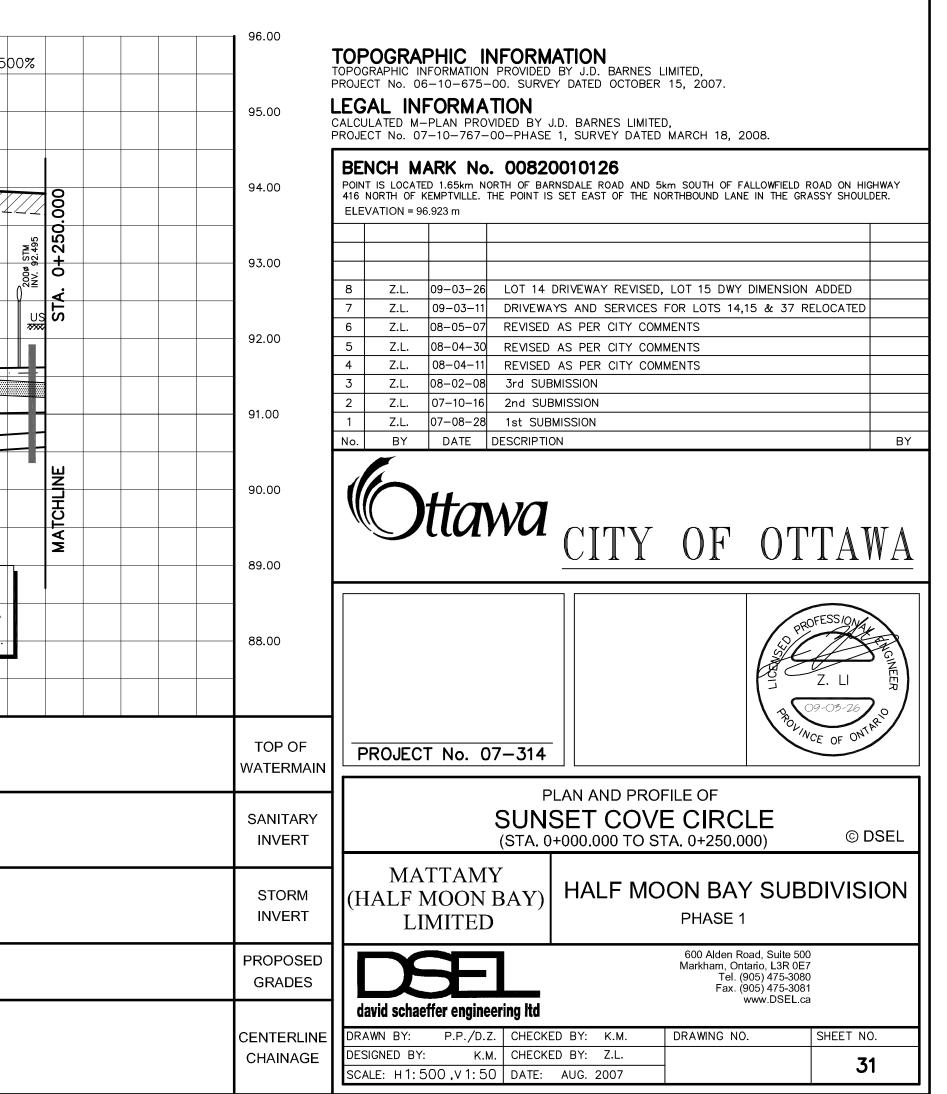


÷

		. •		9 (OPSD-705.01) 94.02 IV. 92.485 INV. 92.465		0		0					
250¢_PVC	STM_54.5 @ 1.00%	2.4m STORM SEWER EASEMENT 92.25 20		250¢ PERFORA STM 33.5 © IC (VWNYW) 92.21 75	1.00%	RLCB (CITY STD. T/G 94.02 OUT INV. 92.82 92.22 22	s31) 92.36 23	RLCB	© (OPSD-705.0 T/G 94. <u>0UT INV. 92.9</u> 92.33 92.33 25	- 24m STOL SEWER EASEMENT SY WILS DO CO SY SY SY SY SY SY SY SY SY SY SY SY SY	۲M		
	2000 PVC SAN 50 DØ CONC STM 50.5 1.8m CONC. SIDEWALK	© 0., 5%					00¢ PVC SAN 1				4.00 8.50 4.00	REFER T DWG No.	
37 92.17 38 92.10		RLCB (OPS T/G 93.84	> 5D-705.01) 92.74	34 92.14 CBMH	33 (OPSD-701.010) (FRAME/GRATE CITY STD. S19.1) IN INV. 92.31 OUT INV. 92.26	EASEMENT 32 92.14	31 92.21 2.4m STORM SEWER EASEMENT PERFORATED P	30 92.21 VC STM 52.0 @ 1.00		92.19	S31		
DWG No. 33		Ê											
98 @ 0.50	HYD. & V. FLANGE EL. 93.80 MH 82A I(OPSD-701.010, 1200mm) MH 82 (OPSD-701.011, 1500mm) 20.793 @ 0.800%	0111 010 010		39.43	7 @ 0.500%	MH 85A (OPSD-701.010, 1200mm) MH 85 (OPSD-701.011, 1500mm)		59.131 @ 0.	500%			596 @ 0.5	500%
USF=9 H.G.I	2,6 × 12 2,1 ×	LT/G:93.847 04115.610	50 200ø pvc		Dø STM 2 92.355 USF=92.11	142.56.50 147.56.50 0+166.610 H.G.L.			-100 YR H.G.L		UBGRADE_FIL		2009 STM 2009 STM
	0+103.800	EL. 91.40 EL. 91.00 EL. 91.00	G	Post-Developme Groundwater Le		T/G: 93,751							
										NOTE RE SEWER TRE SHALL BE STD. S6 AT BEDDING U	SEWER B NCH AND BE AS PER CITY D S7, CLAS NLESS OTHER	BEDDING DDING OF OTTAWA S 'B' RWISE NOTED.	
	91.262 540 91.226 -	714 91.341 774 91.341 91.390 91.390	91.437	91.384 91.377	91.284	976 996 91.237	91.285 91.290	91.390		91.490	91.530	91.467	
2000 PVC SA 28.5 @ 0.40 SDR-35	© % X E 90.592 SE 89.640 V 90.622 N 89.670	*L/L 200ø PVC 68 11.0 0.4 00 0.4 SDR - 31 00 0.9 0.4 00 0.4 SDR - 31 00 0.9 0.4 00 0.6 0.4 00 0.4 0.4 00 0.4 0.4 00 0.4 0.4 00 0.6 0.4	5 DNC STM		◎ 0.40% SDR-35 50.5 ◎ 0.15% 65-1	O SW 89.976 90.744 NE 89.996 90.894				100.5 @ 0.65%			
U-U	93.711 93.722 1	65 63.877 93.880 93.880	93.927 0	- 93.874	- 93.774	93.730 SW	- 93.786	93.886		- 93.986	94.026	- 93.965	
	BC 0+098.600- 0+100.000 -	EC 0+128.383	0+129.393	0+140.000	0+160.000	0+168.830	0+180.000	0+200.000		0+220.000	0+227.961	0+240.000	



0	STORM MANHOLE	\square	OVERLAND FLOW DIRECTION
•	SANITARY MANHOLE	/ 	
0	STORM MANHOLE BY OTHERS		EXTERNAL OVERLAND FLOW DIRECTION
0	SANITARY MANHOLE BY OTHERS	└ ¬∕	2.0m HIGH ACOUSTIC FENCE
0	CATCHBASIN MANHOLE		(SEE LANDSCAPE DRAWING FOR DETAILS)
ο	RLCB – ELBOW SECTION (REFER –		2.4m HIGH ACOUSTIC FENCE
0	RLCB – 'T' SECTION (REFER TO		(SEE LANDSCAPE DRAWING FOR DETAILS) 1.2m HIGH DECORATIVE FENCE
-	CITY STD. S30)	— · —	(SEE LANDSCAPE DRAWING FOR DETAILS)
	SINGLE STORM HOUSE CONNECTION	x	1.5m HIGH BLACK VINYL CHAIN LINK FENCE
	SINGLE SANITARY HOUSE CONNECTION		1.8m HIGH WOOD PRIVACY FENCE
 -८-ग	HYDRANT		(SEE LANDSCAPE DRAWING FOR DETAILS)
γ-π Γ	TEE		250Ø PERFORATED PIPE (REFER TO CITY STD'S S29, S30 FOR REAR
H	VALVE AND BOX		YARD TRENCH AND PIPE DETAILS ONLY)
Θ	VALVE & CHAMBER		TARD INCIDENT AND THE DETAILS ONET
	SINGLE/DOUBLE CATCHBASIN		BUILDING ENVELOPE
	CATCHBASINS WITH INLET CONTROL DEVICE TYPE A (Q max = 21.0 I/s)		
	CATCHBASINS WITH INLET CONTROL DEVICE TYPE B (Q max = 28.4 I/s)		
	CATCHBASINS WITH INLET CONTROL DEVICE TYPE D (Q max = 54.0 I/s)		CLAY SEAL (REFER TO CITY STD. S8,
	CATCHBASINS DENOTED AS 100YR		GENERAL NOTES. No.18. 19. ON DWG. No.1, AND GEOTECHNICAL CONSULTANT'S
	INTAKES, WITH STANDARD LEADS UNLESS OTHERWISE NOTED		SPECIFICATIONS)
• LS	LIGHT STANDARD		
	COMMUNITY MAILBOX AND		RETAINING WALL (SEE NOTES ON DWG. 1
	PAD LOCATION		AND STRUCTURAL DWGS FOR DETAILS)
₹00.00	U/S FOOTING ELEVATION		SLAB ON GRADE UNITS
	PHASE LINE	-	SEAD ON GRADE UNITS



consulting engineers

re:	Geotechnical Review - Excavation Limits in Proximity to Artesian Point Sources Half Moon Bay West Residential Development - Phase 3 Cambrian Road - Ottawa
to:	DSEL - Mr. Anthony Temelini - <u>atemelini@dsel.ca</u>
to: date:	Mattamy Homes - Mr. Reuben Noel - <u>reuben.noel@mattamycorp.com</u> July 28, 2021
file:	PG2246-MEMO.72

Further to your request and authorization, Paterson Group (Paterson) prepared the current memorandum to summarize our review of the founding depths of the proposed infrastructure and buildings within proximity to previously recommended excavation limits. The following memorandum should be read in conjunction with Paterson Report PG2246-1 Revision 7 dated April 19, 2021 and Memorandum PG2246-MEMO.52 Revision 10 dated May 17, 2021 regarding our geotechnical review and recommendations for the Artesian Point Source Drainage System and Containment Cell Construction.

Background Information

Paterson reviewed the following grading plans prepared by DSEL for Phase 3 of the aforementioned residential development:

- General Plan Half Moon Bay West Phase 3 Sheet No. 8 Project No. 19-1140 -Revision 1 dated June 4, 2021
- Watercolours Way Half Moon Bay West Phase 3 Sheet No. 10 Project No. 19-1140 - Revision 1 dated June 4, 2021
- Grading Plan Half Moon Bay West Phase 3 Sheet No. 20 Project No. 19-1140 -Revision 1 dated June 4, 2021
- Sanitary Drainage Plan Half Moon Bay West Phase 3 Sheet No. 23 Project No. 19-1140 - Revision 1 dated June 4, 2021

Geotechnical Review

Based on our review, it is observed that the proposed excavations for the lots and service pipes within the recommended excavation limit zones are considered acceptable with respect to the previously provided recommendations.

Mr. Reuben Noel Page 2 PG2246-MEMO.72

Based on the spout locations and our observations within the area, the alignment of Watercolours Way to the north of the parkland and adjacent housing blocks are considered to be setback sufficiently to avoid any conflict between servicing and the artesian point sources based on our review of the available grading plan.

Conclusion and Recommendations

Based on our review, the recommendations previously provided in PG2246-MEMO.52 Revision 10 dated May 17, 2021 have been incorporated satisfactorily from a geotechnical perspective throughout the subject area. It is recommended that as-built subgrade elevations be obtained by the excavation contractor and reviewed at the time of construction by Paterson personnel during site servicing and building construction stages throughout the subject area. Reference should be made to the attached Drawing PG2246-6 - Artesian Excavation Limits denoting the lateral extent and maximum allowable depth of excavation throughout the subject area.

We trust that the current submission meets your immediate requirements.

Best Regards,

Paterson Group Inc.

Drew Petahtegoose, B.Eng.



David J. Gilbert P.Eng.

Attachments

Drawing PG2246-6 - Artesian Excavation Limits Plan

Paterson Group Inc.

Ottawa Head Office 154 Colonnade Road South Ottawa - Ontario - K2E 7S8 Tel: (613) 226-7381 Ottawa Laboratory 28 Concourse Gate Ottawa - Ontario - K2E 7T7 Tel: (613) 226-7381 Northern Office and Laboratory 63 Gibson Street North Bay - Ontario - P1B 8Z4 Tel: (705) 472-5331

SOIL PROFILE AND TEST DATA

FILE NO.

PG2246

Geotechnical Investigation Half Moon Bay West - Phase 3 - Watercolours Way Ottawa, Ontario

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Geodetic

REMARKS BORINGS BY Excavator				D	ATE 2	2021 Apri	il 5		HOLE NO	^{D.} TP 1-21	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH			Pen. Resist. Blows/0.3 • 50 mm Dia. Cone		
	STRATA P	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD	(m)	(m)		/ater Col		Piezometer Construction
GROUND SURFACE	ي ۲		Ŋ	REC	z ^ö		00.04	20	40	60 80	Co Ei
FILL: Brown silty clay with sand, 0.08 gravel and organics		/-				0-	-92.61				
Brown SILTY SAND with clay		G	1								
		G	2								
Very stiff brown SILTY CLAY		 G	3			1-	-91.61				
1.20 End of Test Pit											
(TP dry upon completion)											
								20 Shea ▲ Undist	r Streng	60 80 11 11 th (kPa) △ Remoulded	00

SOIL PROFILE AND TEST DATA

FILE NO.

Geotechnical Investigation Half Moon Bay West - Phase 3 - Watercolours Way Ottawa, Ontario

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Geodetic

										PG2246	
REMARKS									HOLE	^{•0.} TP 2-21	
BORINGS BY Excavator				D	ATE	2021 Apri	15			IF 2- 21	
SOIL DESCRIPTION	РІОТ		SAN	IPLE		DEPTH	ELEV.			Blows/0.3m ia. Cone	- 5
		GJ	ER	ERY	Ba	(m)	(m)				nete uctic
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			• w	ater Co	ontent %	Piezometer Construction
GROUND SURFACE	S		N	RE	z °		00.50	20	40	60 80	S⊒
FILL: Brown silty sand with clay and gravel	\bigotimes					0-	-92.59				
graver		G	1								-
	\bigotimes	_ 0									
0.60 Very stiff brown SILTY CLAY with		G	2								-
sand 0.85		_ u	2								
Compact brown SILTY SAND some clay, trace gravel		_				1-	-91.59				
1.19 End of Test Pit		G	3								
(Open hole GWL @ 1.06 m depth)											
								20	40		 00
								Shea ▲ Undist		gth (kPa) △ Remoulded	

SOIL PROFILE AND TEST DATA

FILE NO.

PG2246

Geotechnical Investigation Half Moon Bay West - Phase 3 - Watercolours Way Ottawa, Ontario

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Geodetic

REMARKS

REMARKS				_	(HOLE NO	^{).} TP 3-21	
BORINGS BY Excavator					AIE 2	2021 Apri	15				
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH (m)	ELEV. (m)		esist. Bio 0 mm Dia	ows/0.3m a. Cone	م م
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD	(11)	(11)				Piezometer Construction
GROUND SURFACE	STR	ТҮ	MUN	© ∾ ECO	N VP				later Cor		Piezo
FILL: Brown silty clay, with sand and	$\times\!\!\times\!\!\times$					0-	-92.15	20	40 6	60 80	шО
gravel		_									
		_ G	1								
Brown SILTY SAND trace clay and											
gravel 0.75		G	2								
End of Test Pit											
(TP dry upon completion)											
								20 Shea ▲ Undist	r Streng	6 0 80 10 t h (kPa) Remoulded	00

SOIL PROFILE AND TEST DATA

FILE NO.

Geotechnical Investigation Half Moon Bay West - Phase 3 - Watercolours Way Ottawa, Ontario

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Geodetic

										PG2	2246	
REMARKS									HOLE	^{NO.} TP 4	01	
BORINGS BY Excavator	1			D	ATE 2	2021 Apri	15	1		IP 4	-21	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.			Blows/0.3 Dia. Cone		, u
		Fi	R	ΞRΥ	Bg	(m)	(m)					Piezometer Construction
	STRATA	ТҮРЕ	NUMBER	° ≈	N VALUE or RQD			• v	/ater C	Content %		szon nstri
GROUND SURFACE	ß	_	N	RE	zÖ		00.40	20	40	60 80)	Pi€ C
FILL: Brown silty clay trace sand, gravel and organics		∃ G	1			- 0-	-92.48	· · · · · · · · · · · · · · · · · · ·				
		 G	2									
Very stiff to stiff brown SILTY CLAY trace sand		~				1-	-91.48					
1. <u>6</u> 4		_ G	3									
Firm grey SILTY CLAY		_ _ G	4			2-	-90.48		<u>+</u>			
2.48 End of Test Pit	3	G	5						/			
(Open hole GWL @ 1.64 m depth)												
								20 Shea ▲ Undist		60 80 ngth (kPa) △ Remoule)	00

SOIL PROFILE AND TEST DATA

FILE NO.

Geotechnical Investigation Half Moon Bay West - Phase 3 - Watercolours Way Ottawa, Ontario

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Geodetic

										PG2246	
REMARKS									HOLE	^{NO.} TP 5-21	
BORINGS BY Excavator				D	ATE 2	2021 Apri	il 5			19 5-21	
	Ч		SAN	IPLE		DEPTH	ELEV.	Pen. R	esist.	Blows/0.3m	
SOIL DESCRIPTION	РГОТ			к		(m)	(m)	• 5	0 mm	Dia. Cone	tion
	STRATA	ТҮРЕ	NUMBER	° ≈ © © © ©	N VALUE or RQD						Piezometer Construction
	STR	ΤX	MUM		N V2					Content %	iezo
GROUND SURFACE	~~~			24	4	0-	-93.14	20	40	60 80	чо
FILL: Brown silty clay with sand,											
some gravel, cobbles and boulders		0	4								
	\bigotimes	G	1								
		_									
	\bigotimes										
	\bigotimes										
						1-	-92.14				
	\bigotimes										
4.54											
		G	2								
FILL: Grey to brown silty clay with sand, some cobbles and boulders	\bigotimes										
Stiff brown SILTY CLAY trace sand		_ G	3								
Still blown SILTY CLAY trace sand						2-	-91.14				
						-	01.14				
		= G	4						^		
									/		
Firm to poft and grow by 2.2 m depth											
- Firm to soft and grey by 2.2 m depth									/		
		G	5								
						3-	-90.14				
		G	6								
3.75											
End of Test Pit											
(Open hole GWL @ 1.76 m depth)											
								20	40		00
								Sheat		ngth (kPa) △ Remoulded	

SOIL PROFILE AND TEST DATA

FILE NO.

Geotechnical Investigation Half Moon Bay West - Phase 3 - Watercolours Way Ottawa, Ontario

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Geodetic

										PG2246	
REMARKS									HOLE	E NO 0 0 /	
BORINGS BY Excavator				D	ATE 2	2021 Apri	il 5	1		TP 6-21	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.			Blows/0.3m Dia. Cone	. 5
			Ř	RΥ	Ba	(m)	(m)				leter
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			0 N	/ater (Content %	Piezometer Construction
GROUND SURFACE	S.	5.	N	REC	N LO			20	40	60 80	Cot Cot
FILL: Brown silty clay some sand, trace cobbles and boulders						- 0-	-92.85				-
1.13		_ G = G	1			1-	-91.85				
Very stiff to stiff brown SILTY CLAY with sand		- 6	2								
Firm grey SILTY CLAY trace sand		_ G	3			2-	-90.85				
2.85 End of Test Pit		= G 	4								
								20 Shea	40 Ir Stre	60 80 1 90 ngth (kPa)	00

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation Half-Moon Bay West - Cambrian Road Ottawa, Ontario

DATUM Ground surface elevations provided by ASL.										FILE NO. PG2246				
REMARKS									HOLE NO	BH 9-12	•			
BORINGS BY CME 55 Power Auger					ATE	March 1, 2	2012							
SOIL DESCRIPTION	PLOT			IPLE		DEPTH (m)	ELEV. (m)		esist. Blo) mm Dia		Monitoring Well Construction			
	STRATA	ТҮРЕ	NUMBER	° ≈ © © ©	N VALUE or RQD			• w	ater Con	tent %	Sonstr			
GROUND SURFACE		_	ž	RE	zö	0-	-92.06	20	40 6	0 80				
Loose, grey SILTY SAND, 0.80	P I I I I I										<u>իրիիիիիիի</u>			
		ss	1		2	1-	-91.06							
						2-	-90.06							
						3-	-89.06		*					
Firm, grey SILTY CLAY						4-	-88.06		*					
						5-	-87.06	*						
						6-	-86.06							
7.49						7-	-85.06							
End of Borehole									*					

Shear Strength (kPa) ★ Frictionless Vane

60

80

100

40

20

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

FILE NO.

PG2246

Geotechnical Investigation Half-Moon Bay West - Cambrian Road Ottawa, Ontario

DATUM

Ground surface elevation

REMARKS

Ind	surface	elevatio	ons prov	ided by	ASL.	

BORINGS BY CME 55 Power Auger				DATE	Novembe	r 15. 201	0	HOLE NO.	BH13-1	0
	PLOT	SA	MPLE	1	DEPTH	ELEV.	Pen. R	esist. Blov 0 mm Dia.		tion
	STRATA P	NUMBER	% RECOVERY	N VALUE or RQD	(m)	(m)		ater Conte		Piezometer Construction
GROUND SURFACE	S	Z	RE	z o	0.	-93.14	20	40 60	80	
FILL . Drown silty slow with sound	XXX s	5 1	42	2	0	93.14		· · · · · · · · · · · · · · · · · · ·	1 · · · · · · · · · · · · · · · · · · ·	
FILL: Brown silty clay with sand, gravel and cobbles, trace boulders	💥 🕅 S	5 2	12	1	1-	92.14				
2.10	💥 S:	3 3	33	3	2-	-91.14		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
Firm to soft, brown SILTY CLAY 2.97	S:	5 4	92	8						
	s:	5 5	100	2	3-	-90.14		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
	s:	6 8	100	w	4-	89.14		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
					5.	-88.14				
Firm, grey SILTY CLAY with sand						00.14				
					6-	-87.14				
					7-	-86.14			· · · · · · · · · · · · · · · · · · ·	
					8-	-85.14				
9.45	X s	5 7	100		9-	84.14				
End of Borehole										
(GWL @ 1.65m-Jan. 10/11)										
									<u> </u>	-
							20 Shea	40 60 ar Strength	80 1 n (kPa)	00
							▲ Undist		Remoulded	
			1	I	1	1				

Consulting Engineers

SOIL PROFILE AND TEST DATA

Undisturbed

△ Remoulded

Geotechnical Investigation Proposed Residential Development-Half Moon Bay Ottawa, Ontario

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

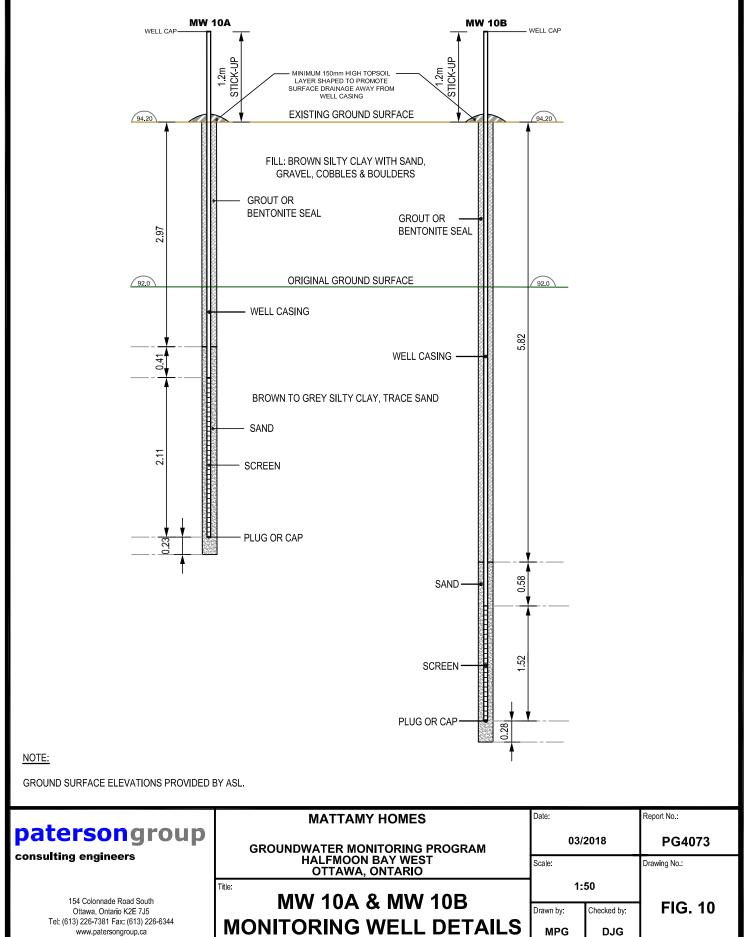
DATUM Ground surface elevation at	FILE NO. PG1618								
REMARKS									
BORINGS BY CME 55 Power Auger		1		D	ATE 2	26 March	2008		BH23-08
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.		esist. Blows/0.3m 0 mm Dia. Cone
SUL DESCHIFTION		ы	BER	TERY	SD LUE	(m)	(m)		struce
GROUND SURFACE	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			0 W 20	Vater Content % <u></u>
FILL: Brown silty sand with		S AU	1			0-	-92.54		
gravel and clay0.91 Brown SILTY SAND with trace		ss	2	50	7	1-	-91.54	· · · · · · · · · · · · · · · · · · ·	
		ss	3	100	2			· · · · · · · · · · · · · · · · · · ·	
		A 22	3	100	2	2-	-90.54		
						3-	-89.54	· A ······	
		TW	4	100					
						4-	-88.54	······································	
Grey SILTY CLAY		тw	5	100		5-	-87.54		
						6-	-86.54		
						7-	-85.54	· · · · · · · · · · · · · · · · · · ·	
						8-	-84.54		
End of Borehole <u>8.84</u>									
(Surfical water surrounding borehole- April 9/08)									
								20 Shea	40 60 80 100 ar Strength (kPa)

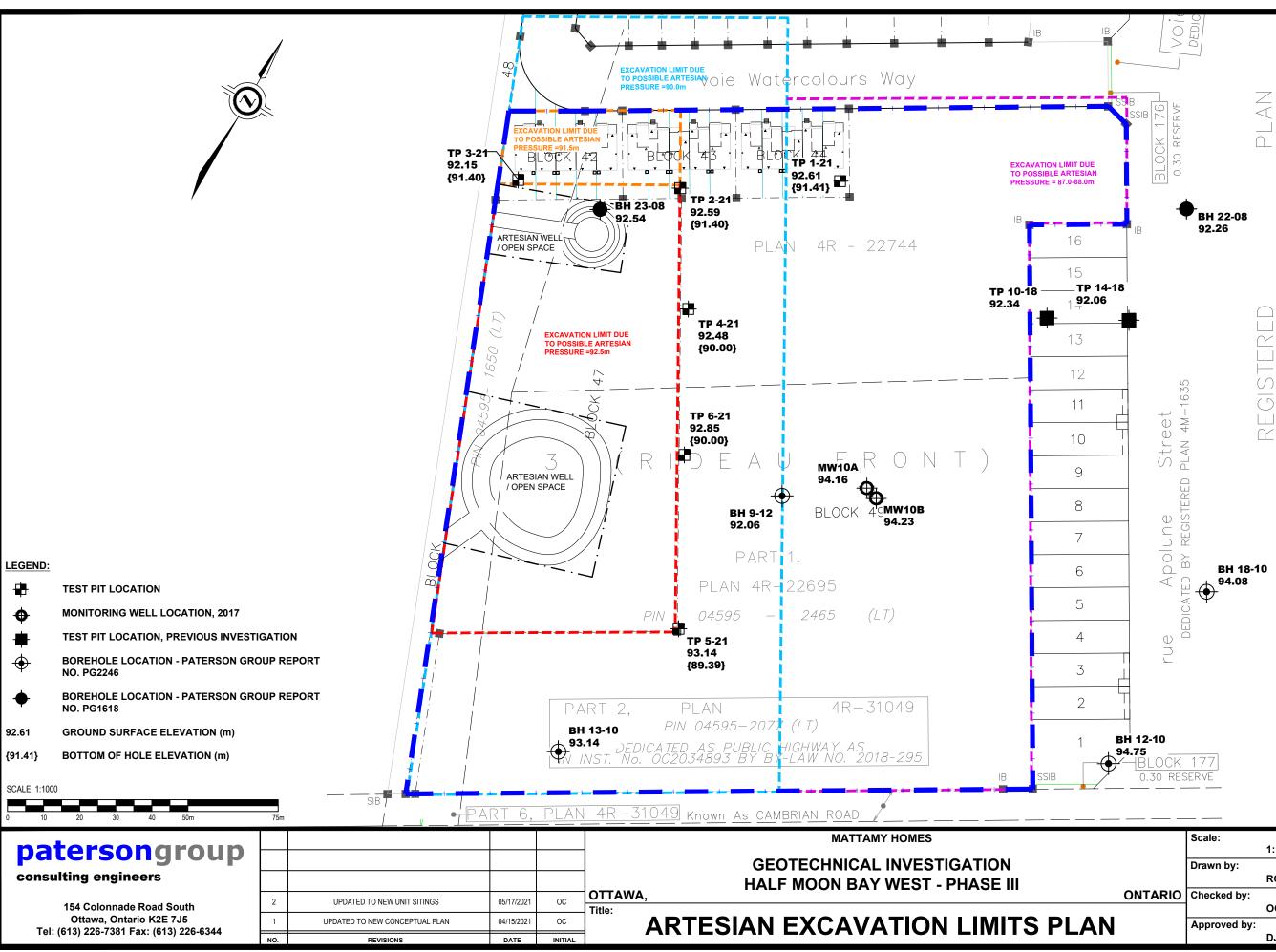
SOIL PROFILE AND TEST DATA

Geotechnical Investigation Half Moon Bay West - Greenbank at Cambrian Road Ottawa, Ontario

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

DATURE Cround ourfood alouations	nrovi	dadh				lawa, Ol	itano			10				
DATUM Ground surface elevations	provi	ueu b	y ASI						FILE	PG2246				
REMARKS									HOLE NO.					
BORINGS BY Hydraulic Excavator				D	ATE	March 6, 2	2018			TP10-18				
SOIL DESCRIPTION	РГОТ		SAN	IPLE		DEPTH (m)	ELEV. (m)		Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone					
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD	(11)	(11)	0	Water C	ontent %	Piezometer Construction			
GROUND SURFACE		H	ЛN	REC	N N OF	0-	-92.34	20	40	60 80	Piez Con			
FILL: Brown sand and gravel, some cobbles, boulders, trace rootlets		- - G	1			0	52.04							
Compact, brown SILTY FINE SAND to SANDY SILT, trace clay		G	2			1-	-91.34							
- clay content increasing with depth		_ _ G	3					0						
- grey by 1.2m depth 1.52			3											
Firm, grey SILTY CLAY , trace to some sand		G	4			2-	-90.34							
2.13 End of Test Pit		-												
								20 She	40 ear Strei	60 80 10 ngth (kPa)	00			
								▲ Undis		△ Remoulded				





	Scale:		Date:
		1:1000	04/2021
	Drawn by:		Report No.:
		RCG	PG2246-1
ONTARIO	Checked by:		Dwg. No.:
		OC	PG2246-6
N	Approved by:		
		DJG	Revision No.: 2



APPENDIX G

HYDRAULIC CAPACITY AND MODELING ANALYSIS (COMPLETED BY GEO ADVICE)



Hydraulic Capacity and Modeling Analysis Mattamy Half Moon Bay West Phase 3

Final Report

Prepared for: David Schaeffer Engineering Ltd. 120 Iber Road, Unit 103 Stittsville, ON K2S 1E9

Prepared by: GeoAdvice Engineering Inc. Unit 203, 2502 St. John's Street Port Moody, BC V3H 2B4

Submission Date: May 31, 2021

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng. **Project:** 2021-033-DSE

Copyright © 2021 GeoAdvice Engineering Inc.

Project ID: 2021-033-DSE







Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
RO	May 11, 2021	Draft	Ben Loewen	Werner de Schaetzen
R1	May 25, 2021	Updated Draft	Ben Loewen	Werner de Schaetzen
R2	May 31, 2021	Final	Ben Loewen	Werner de Schaetzen

Confidentiality and Copyright

This document was prepared by GeoAdvice Engineering Inc. for David Schaeffer Engineering Ltd. The material in this document reflects the best judgment of GeoAdvice in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. GeoAdvice accepts no responsibility for damages, if any, suffered by any third party as a result of decision made or actions based on this document. Information in this document is to be considered the intellectual property of GeoAdvice Engineering Inc. in accordance with Canadian copyright law.

Statement of Qualifications and Limitations

This document represents GeoAdvice Engineering Inc. best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by a member of the engineering profession currently practicing under similar conditions. No warranty, express or implied is made.

Project ID: 2021-033-DSE





Page | 2



Contents

1	Introduction4			
2	Modeling Considerations 6			
	2.1	Water	Main Configuration	
	2.2	Elevat	ions 6	
	2.3	Consu	mer Demands 6	
	2.4	Fire Fl	ow Demand	
	2.5	Bound	ary Conditions9	
3	Нус	draulic Capacity Design Criteria 11		
	3.1	Pipe C	haracteristics	
	3.2	Pressu	re Requirements	
4 Hydraulic Capacity Analysis			Capacity Analysis 12	
	4.1	Develo	ppment Pressure Analysis 12	
	4.2	2 Development Fire Flow Analysis		
5	5 Other Servicing Considerations			
	5.1	Water	Supply Security14	
	5.2	Valves14		
	5.3	Hydrants		
	5.4	Water	Quality	
6	Cor	nclusions16		
Δ	ppendi	iv A	Domestic Water Demand Calculations and Allocation	
Appendix			FUS Fire Flow Calculations and Allocation	
••			Boundary Conditions	
Appendi Appendi			•	
	••		Pipe and Junction Model Inputs	
	ppendi		MHD and PHD Model Results	
Appendix F			MDD+FF Model Results	

Project ID: 2021-033-DSE







Introduction 1

GeoAdvice Engineering Inc. ("GeoAdvice") was retained by David Schaeffer Engineering Ltd. ("DSEL") to size the proposed water main network for Phase 3 of the Mattamy Half Moon Bay West (HMBW) development ("Development") in the City of Ottawa, ON ("City").

Analysis for one (1) scenario of the Mattamy HMBW Phase 3 development was completed using boundary conditions provided by the City (Scenario 2 in Appendix C) and is discussed within this report. The analysis includes the demands for the following existing developments in addition to the proposed Mattamy HMBW Phase 3 demands:

Mattamy HMBW Phases 1, 2, and 10, Flagstaff Phase 1 (Glenview Homes development)

The development will have two (2) connections to the City water distribution system along the realigned Greenbank Road:

- Connection 1: Perseus Avenue
- Connection 2: Cambrian Road

HMBW Phase 3 will connect east to Apolune Street in Mattamy HMBW Phase 1 and north to Flagstaff Drive.

The development site is shown in Figure 1.1 on the following page, with the final recommended pipe diameters.

This report describes the assumptions and results of the hydraulic modeling and capacity analysis using InfoWater (Innovyze), a GIS water distribution system modeling and management software application.

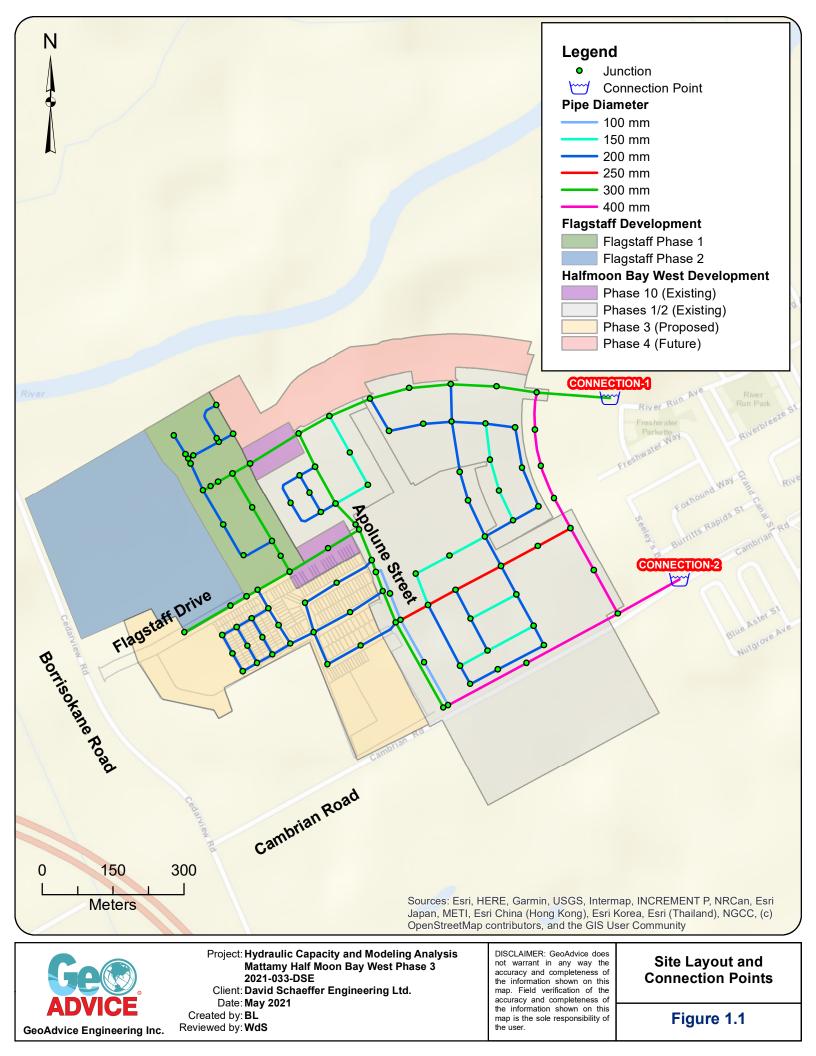
The results presented in this report are based on the analysis of steady state simulations. The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. No extended period simulations were completed in this analysis to assess the water quality or to assess the hydraulic impact on storage and pumping.

Project ID: 2021-033-DSE





Page | 4





2 Modeling Considerations

2.1 Water Main Configuration

The water main network was modeled based on drawings prepared by DSEL (16-10-100_M-Plan PH3 (April22-21).dwg) and provided to GeoAdvice on April 26th, 2021.

The 300 mm water main on Flagstaff Drive is expected to extend to Borrisokane Road as per the Barrhaven South Master Servicing Study. No analysis was conducted for the water main west of pipe P-102 shown in **Appendix D**.

2.2 Elevations

Elevations of the modeled junctions were assigned according to a preliminary site grading plan prepared by DSEL (2020-12-04_1140_grad_wcs.dwg) and provided to GeoAdvice on April 26th, 2021. The preliminary site grading plan provided was based on a different road alignment from that of the final road alignment of the development and as such, the allocation of the elevations was approximated using best judgement.

2.3 Consumer Demands

The existing residential demands (Mattamy HMBW Phases 1, 2, 10 and Flagstaff Phase 1) and the proposed residential demands for the Mattamy HMBW Phase 3 development were based on a demand rate of 280 L/cap/d as per City of Ottawa technical bulletin ISTB 2018-01. The park rate of 28,000 L/ha/d was assumed as per the City of Ottawa design guidelines and are consistent with similar previously completed developments within the City of Ottawa. Demand factors used for this analysis were taken according to the City of Ottawa 2010 Design Guidelines *Table 4.2 Consumption Rate for Subdivisions of 501 to 3,000 Persons*. Population densities were assigned according to *Table 4.1 Per Unit Populations* from the City of Ottawa Design Guidelines. A summary of these tables highlighting relevant data for this development is shown in **Table 2.1**.

Finally, the Mattamy HMBW Phase 3 water main network was also analyzed for an ultimate condition including the demands for the planned future Mattamy Phase 4 of the HMBW development and Flagstaff Phase 2 using boundary conditions provided by the City (Scenario 3 in **Appendix C**). The proposed water main network was confirmed to not require any changes in this ultimate condition.







Table 2.1: City of Ottawa Demand Factors

Demand Type	Amount	Units
Average Day Demand		
Residential	280	L/c/d
Park	28,000	L/ha/d
Maximum Daily Demand		
Residential	2.5 x avg. day	L/c/d
Park	1.5 x avg. day	L/ha/d
Peak Hour Demand		
Residential	2.2 x max. day	L/c/d
Park	1.8 x max. day	L/ha/d
Minimum Hour Demand		
Residential	0.5 x avg. day	L/c/d
Park	0.5 x avg. day	L/ha/d

 Table 2.2 to Table 2.3 summarize the water demand calculations for Mattamy HMBW Phase 3.

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
Single Detached	23	3.4	87	0.28	0.70	1.55	0.14
Traditional Townhome	111	2.7	330	1.07	2.67	5.88	0.53
Back-to-Back Townhouse	94	2.7	280	0.91	2.27	4.99	0.45
Total	228		697	2.26	5.65	12.42	1.13

Table 2.2: Development Population and Demand Calculations – Mattamy HMBW Phase 3

*City of Ottawa Design Guidelines.







Land Use Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Minimum Hour Demand (L/s)
	(IIa)	(L/S)	(L/S)	(L/S)	(L/S)
Park	4.52	1.46	2.20	3.96	0.73

Table 2.3: Non Residential Demand Calculations – Mattamy HMBW Phase 3

Demands were grouped into demand polygons then uniformly distributed to the model nodes located within each polygon. Detailed calculations of demands as well as the illustrated allocation areas are shown in **Appendix A**.

2.4 Fire Flow Demand

Fire flow calculations were completed in accordance with the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (1999) and City of Ottawa Technical Bulletin ISTB-2018-02. The required fire flow for single detached and traditional townhomes that meet Technical Bulletin ISTB-2018-02 requirements are to be capped at 10,000 L/min (167 L/s). For the townhouse units where the 10,000 L/min cap could not be applied, the FUS calculations yielded the following required fire flows:

- Block 40: 11,000 L/min (183 L/s)
- Block 33: 16,000 L/min (267 L/s)

The FUS calculations for the back-to-back townhouse blocks yielded the following required fire flows:

- 12-unit back-to-back townhouse: 14,000 L/min (233 L/s), accounts for one (1) firewall
- 10-unit back-to-back townhouse: 14,000 L/min (233 L/s), accounts for one (1) firewall
- 8-unit back-to-back townhouse: 16,000 L/min (267 L/s), no firewall accounted for

At this time, there is not enough information available to calculate the required fire flows of the park. As such, the following required fire flow was assumed, based on similar information from previously completed projects:

• Park: 167 L/s

Fire flow simulations were completed at each model node. The locations of nodes do not necessarily represent hydrant locations.

Detailed FUS fire flow calculations as well as the illustrated spatial allocation of the required fire flows are shown in **Appendix B**.







2.5 Boundary Conditions

The boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: Perseus Avenue
- Connection 2: Cambrian Road

The above connection points are illustrated in Figure 1.1.

Boundary conditions were provided for Peak Hour (PHD), Maximum Day plus Fire (MDD+FF) and Minimum Hour (high pressure check, MHD) demand conditions.

Under existing conditions, the Mattamy HMBW development will be serviced by the Barrhaven pressure zone (zone BARR); however, in the future, it will be serviced by the South Urban Community (SUC) pressure zone. The future pressure realignment for the SUC pressure zone includes the previous 3C pressure zone, portions of the current adjacent pressure zones, and the portion of the BARR pressure zone where the Mattamy HMBW development is located. The future SUC pressure zone is expected to be serviced by additional pumps and storage tanks.

Boundary conditions were provided under the existing and future pressure zone configurations. As the timeline for the pressure zone realignment is unconfirmed at this time, a hybrid approach was used to ensure that the most conservative option was selected for each of the PHD, MDD+FF and MHD scenarios.

The results presented in this report are based on this hybrid approach, which uses the most conservative HGLs for the PHD, MDD+FF and MHD scenarios from both of the existing and future boundary conditions as outlined below:

- The HGLs provided by the City for the PHD and MHD scenarios under the existing condition are more conservative than those of the SUC Zone reconfiguration condition.
- The HGLs provided by the City for the MDD+FF scenarios are more conservative under the SUC Zone reconfiguration condition than those of the existing condition.

The City boundary conditions were provided to GeoAdvice on April 9, 2021 and can be found in **Appendix C**.

The demands from the Flagstaff Phase 1 and the Mattamy Half Moon Bay West Phases 1, 2, 3 and 10 were included in the boundary condition request as they are located downstream from the connection points used in the boundary conditions.

Table 2.4 summarizes the City of Ottawa boundary conditions used (Scenario 2) to size thewater network.







Table 2.4: Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)
Min Hour (max. pressure)	158.3*	158.3*
Peak Hour (min. pressure)	136.4*	136.4*
Max Day + Fire Flow (167 L/s)	140.5**	140.7**
Max Day + Fire Flow (183 L/s)	137.9**	138.3**
Max Day + Fire Flow (233 L/s)	137.0**	137.4**
Max Day + Fire Flow (267 L/s)	134.0**	134.5**

*Based on the existing boundary conditions provided by the City of Ottawa.

** Based on the SUC Zone reconfiguration boundary conditions provided by the City of Ottawa.







3 Hydraulic Capacity Design Criteria

3.1 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 3.1** below.

Nominal Diameter (mm)	ID PVC (mm)	Hazen Williams C-Factor (/)
150	155	100
200	204	110
250	250	110
300	297	120
400	400	120

Table 3.1: Model Pipe Characteristics

3.2 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 3.2**.

Table 3.2: Pressure Requirements

Demand Condition	Minimum	Pressure	Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	350	50	480	70
Peak Hour Demand (minimum allowable pressure)	276	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	552	80
Maximum Distribution Pressure (minimum hour check)	-	-	552	80
Maximum Day Plus Fire	140	20	-	-







4 Hydraulic Capacity Analysis

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for minimum hour, peak hour and maximum day plus fire flow using InfoWater.

Detailed pipe and junction model input data can be found in **Appendix D**.

4.1 Development Pressure Analysis

The modeling results indicate that the Mattamy HMBW Phase 3 development can be adequately serviced by the proposed water main layout shown in **Figure 1.1**. Modeled service pressures for the Mattamy HMBW Phase 3 development are summarized in **Table 4.1** below.

Table 4.1: Summary of Mattamy HMBW Phase 3 Available Service Pressures

Minimum Hour Demand	Peak Hour Demand
Maximum Pressure	Minimum Pressure
93 psi (640 kPa)	61 psi (418 kPa)

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). As such, based on the City boundary conditions for the minimum hour demand, pressure reducing valves may be required throughout Mattamy HMBW Phase 3. In summary:

- Under the existing pressure zone conditions, any location with elevation lower than 102 m may experience high pressures (≥ 80 psi).
- Under the future pressure zone conditions, any location with the elevation lower than 91.5 m may experience high pressures (≥ 80 psi).

Detailed pipe and junction result tables and maps can be found in **Appendix E**.

4.2 Development Fire Flow Analysis

Summaries of the minimum available fire flows in Mattamy HMBW Phase 3 is shown in Table 4.2.







Required Fire Flow	Minimum Available Flow*	Junction ID
167 L/s	372 L/s	J-82
183 L/s	510 L/s	J-89
233 L/s	277 L/s	J-99
267 L/s	353 L/s	J-91

Table 4.2: Summary of the Mattamy HMBW Phase 3 Minimum Available Fire Flows

*The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. High available fire flows (>500 L/s) are theoretical values. Actual available fire flow is limited by the hydraulic losses through the hydrant lateral and hydrant port sizes.

As shown in **Table 4.2**, the fire flow requirements can be met at all junctions within the development.

Summaries of the residual pressures in Mattamy HMBW Phase 3 is shown below in **Table 4.3**. The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire.

Table 4.3: Summary	of the Mattamy	HMBW Phase 3	Residual Pressures	(MDD + FF)	
--------------------	----------------	--------------	---------------------------	------------	--

	Maximum Residual	Average Residual	Minimum Residual
	Pressure	Pressure	Pressure
Г	59 psi (405 kPa)	45 psi (312 kPa)	32 psi (217 kPa)

As shown in **Table 4.3**, there is sufficient residual pressure at all the junctions within the development.

Detailed fire flow results and figures illustrating the fire flow results can be found in **Appendix F**.







5 Other Servicing Considerations

5.1 Water Supply Security

The City of Ottawa Design Guidelines allow single feed systems for developments up to a total average day demand of 50 m³/day and require two (2) feeds if the development exceeds 50 m³/day for supply security, according to Technical Bulletin ISDTB-2018-02.

The HMBW Phase 3 development services a total average day demand of 322 m³/day; as such, two (2) feeds are required. Four (4) feeds to the Mattamy HMBW Phase 3 development from Apolune Street and Flagstaff Drive were modeled as part of the analysis.

5.2 Valves

No comment has been made in this report with respect to exact placement of isolation valves within the distribution network for the development other than to summarize the City of Ottawa Design Guidelines for number, location, and spacing of isolation valves:

- Tee intersection two (2) valves
- Cross intersection three (3) valves
- Valves shall be located 2 m away from the intersection
- 300 m spacing for 150 mm to 400 mm diameter valves
- Gate valves for 100 mm to 300 mm diameter mains
- Butterfly valves for 400 mm and larger diameter mains

Drain valves are not strictly required under the City of Ottawa Design Guidelines for water mains under 600 mm in diameter. The Guidelines indicate that "small diameter water mains shall be drained through hydrant via pumping if needed."

Air valves are not strictly required under the City of Ottawa Design Guidelines for water mains up to and including 400 mm in diameter. The Guidelines indicate that air removal "can be accomplished by the strategic positioning of hydrant at the high points to remove the air or by installing or utilizing available 50 mm chlorination nozzles in 300 mm and 400 mm chambers."

The detailed engineering drawings for the Mattamy HMBW Phase 3 development are expected to identify valves in accordance with the requirements noted above.







5.3 Hydrants

No additional comment has been made in this report with respect to exact placement of hydrants within the distribution network for the development other than to summarize the City of Ottawa Design Guidelines for maximum hydrant spacing:

- 125 m for single family unit residential areas on lots where frontage at the street line is 15 m or longer
- 110 m for single family unit residential areas on lots where frontage at the street line is less than 15 m and for residential areas zoned for row housing, doubles or duplexes
- 90 m for institutional, commercial, industrial, apartments and high-density areas

Additionally, based on the FUS document *Water Supply for Public Fire Protection (1999)*, the hydrant coverage areas for the following fire flows are:

- 167 L/s: 12,000 m² (radial coverage of 62 m)
- 183 L/s: 11,500 m² (radial coverage of 61 m)
- 233 L/s: 10,000 m² (radial coverage of 56 m)
- 267 L/s: 9,500 m² (radial coverage of 55 m)

The detailed engineering drawings for the Mattamy HMBW Phase 3 development are expected to identify hydrant locations in accordance with the requirements noted above.

5.4 Water Quality

The turnover rate of the water within the Mattamy HMBW Phase 3 development network, calculated from the connections to the development is about 5 hours (ADD is 322 m³/day).

The above rate is based on the volume of the development network and the development average day demand.







6 Conclusions

The hydraulic capacity and modeling analysis of the Mattamy HMBW Phase 3 development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows, with service pressures expected to range between 61 psi (418 kPa) and 93 psi (640 kPa).
- The proposed water main network is able to deliver fire flows at all junctions.
- Pressure reducing valves may be required, since maximum pressures are predicted to exceed the City of Ottawa Design Guidelines (> 80 psi).
 - O Under the existing pressure zone conditions, any location with elevation lower than 102 m may experience high pressures (≥ 80 psi).
 - Under the future pressure zone conditions, any location with the elevation lower than 91.5 m may experience high pressures (≥ 80 psi).
- Hydraulic modeling was completed using a hybrid format of the boundary conditions provided, using the most conservative HGLs from the existing and SUC Zone reconfiguration conditions for the PHD, MDD+FF and MHD scenarios.
 - The HGLs for the PHD and MHD scenarios under the existing condition are more conservative than those of the SUC Zone reconfiguration condition.
 - The HGLs for the MDD+FF scenarios are more conservative under the SUC Zone reconfiguration condition than those of the existing condition.





Hydraulic Capacity and Modeling Analysis Mattamy Half Moon Bay West Phase 3 • •

Submission

R

Prepared by:

Benjaming Luen

Ben Loewen, E.I.T. Hydraulic Modeler / Project Engineer

Approved by: OFESSIONAL N Werner de Schaetzen, Ph.D., P.Eng. Senior Modeling Review / Project Manager EOF







Appendix A Domestic Water Demand Calculations and Allocation





Consumer Water Demands

HMBW P	Phase 3	Residential	Demands
--------	---------	-------------	---------

	Number of		Population*	*	Averag	ge Day Demano	b	Max Day Fire Flow		Peak Hour	Min Hour
Dwelling Type	Units	Persons per Unit		Per Dwelling ype	(L/c/d)	(L/d)	(L/s)	2.5 x Avg. Day (L/s)	(L/s)	2.2 x Max Day (L/s) 1.55 5.88 4.99 12.42 Peak Hour 1.8 x Max Day (L/s) 3.96 3.96	0.5 x Avg. Day (L/s)
Single Detached	23	3.4		87		24,360	0.28	0.70		1.55	0.14
Traditional Townhome	111	2.7		330	280	92,400	1.07	2.67		5.88	0.53
Back-to-Back Townhome	94	2.7		280		78,400	0.91	2.27		4.99	0.45
Subtotal	228			697		195,160	2.26	5.65		12.42	1.13
HMBW Phase 3 Non Residential Dem	ands										
	Area				Averag	e Day Deman	b	Max Day	Fire Flow	Peak Hour	Min Hour
Property Type	(ha)				(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	(L/s)		0.5 x Avg. Day (L/s)
Park	4.52				28,000	126,560	1.46	2.20		3.96	0.73
Subtotal	4.52					126.560	1.46	2.20		3.96	0.73
Flagstaff	Number	of Units	Population	Non Residenti	al Area (ha)			ADD	MDD	PHD	MHD
Phase 1 Total Demand:		155	485					1.57	3.93	8.64	0.79
Half Moon Bay West	Number	of Units	Population	Non Residenti	al Area (ba)			ADD	MDD	PHD	MHD
Phase 1 Total Demand:	Number	353	1,049	NOT Residenti	9.18			ADD 6.37		26.73	3.19
Phase 2A Total Demand:		156	502		1.00			1.95		9.82	0.98
Phase 2B Total Demand:		130	377		1.00			1.33		6.72	0.61
Phase 10 Total Demand:		60	171	1				0.55		3.05	0.28
Phase 3 Total Demand*:		228	697		4.52			3.72		16.38	1.86
Scenario Totals								ADD	MDD	РНО	MHD
Scenario Totals Scenario 2	Flagstaff Phas		hasos 1 - 24 - 1	20 2 10				ADD 15.40	MDD 33.73	PHD 71.34	MHD 7.70

 $^{*10\%}$ increase applied to account for possible future refinements in concept plan, as per DSEL

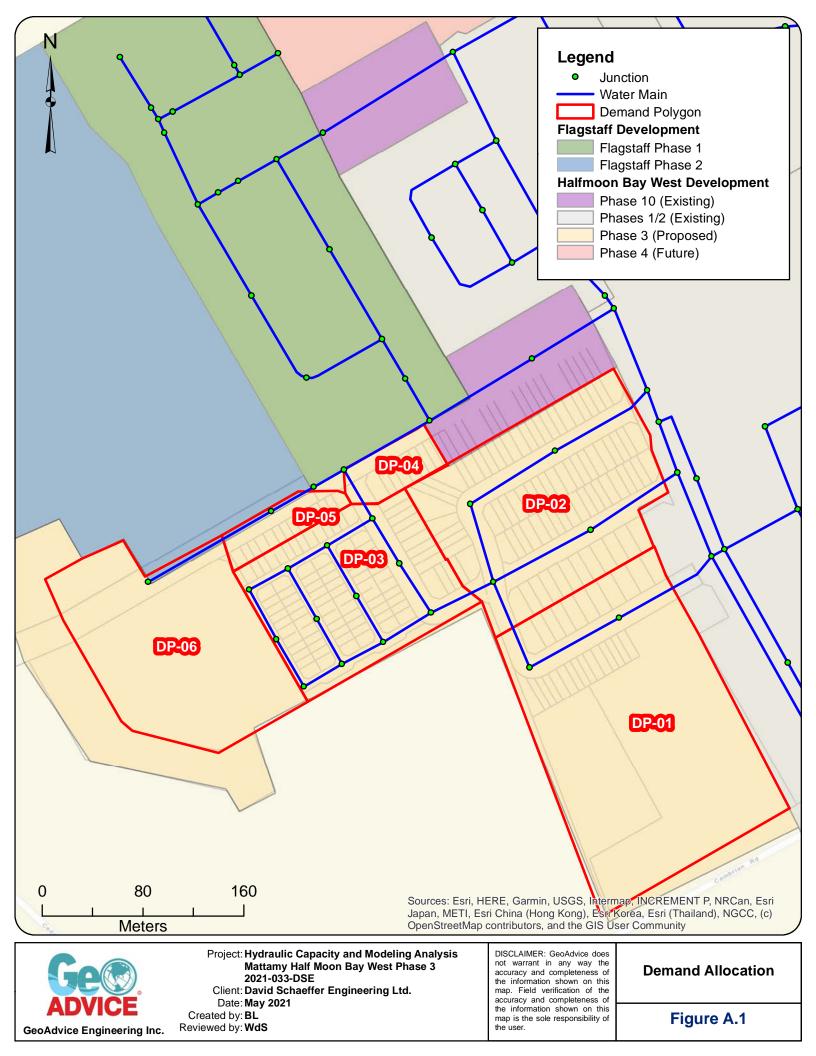
Domestic Demand Calculations and Allocation

HMBW Phase 3 Domestic Demands

Demand Polygon	Junction ID	Dwelling Type	unction ID Dwelling Type	Junction ID Dwelling Type N	Dwelling Type Number of Units Popula	Population	Average Day Demand		Max Day 2.5 x Avg. Day		• •	
					L/c/d	L/d	L/s	(L/s)	(L/s)	(L/s)		
1	J-87	Single Detached	11	42	280	12,068	0.14	0.35	0.77	0.07		
· ·	J-88	Traditional Townhouse	15	45	280	12,068	0.14	0.35	0.77	0.07		
	J-89	Single Detected	12	45	280	17,121	0.20	0.50	1.09	0.10		
<u> </u>	J-90	Single Detached	12	45	200	17,121	0.20	0.50	1.09	0.10		
2	J-91	Traditional Townhouse	67	199	280	17,121	0.20	0.50	1.09	0.10		
	J-92	Traditional Townhouse	67	199	200	17,121	0.20	0.50	1.09	0.10		
	J-93					6,393	0.07	0.18	0.41	0.04		
	J-94			36	280	6,393	0.07	0.18	0.41	0.04		
	J-95	Traditional Townhouse	12			6,393	0.07	0.18	0.41	0.04		
	J-96	Traditional Townhouse	12			6,393	0.07	0.18	0.41	0.04		
	J-97]							6,393	0.07	0.18	0.41
3	J-98					6,393	0.07	0.18	0.41	0.04		
3	J-99					6,393	0.07	0.18	0.41	0.04		
	J-100				238 280	6,393	0.07	0.18	0.41	0.04		
	J-101	Deals to Deals Tawahawaa	00	000		6,393	0.07	0.18	0.41	0.04		
	J-102	Back-to-Back Townhouse	80	238		6,393	0.07	0.18	0.41	0.04		
	J-103					6,393	0.07	0.18	0.41	0.04		
	J-104	1				6,393	0.07	0.18	0.41	0.04		
4	J-105	Traditional Townhouse	9	27	280	7,492	0.09	0.22	0.48	0.04		
5	J-107	Back-to-Back Townhouse	14	42	280	11,677	0.14	0.34	0.74	0.07		
7	J-82	Traditional Townhouse	8	24	280	6,659	0.08	0.19	0.42	0.04		
	Total:		228	697		195,160	2.26	5.65	12.42	1.13		

HMBW Phase 3 Non-Domestic Demands

				A	verage Day Dema	ind	Max Day	Peak Hour	Min Hour
Property Type	Junction ID	Phase	Area (ha)	(1 /ba /d)	(L/d)	(1./2)	1.5 x Avg. Day	1.8 x Max Day	0.5 x Avg. Day
				(L/ha/d)	(L/U)	(L/s)	(L/s)	(L/s)	(L/s)
Park	J-87	Phase 3	2.85	28,000	79,800	0.92	1.39	2.49	0.46
Park	J-82	Phase 3	1.67	28,000	46,760	0.54	0.27	0.49	0.09
	Total:		4.52		126,560	1.46	1.66	2.98	0.55

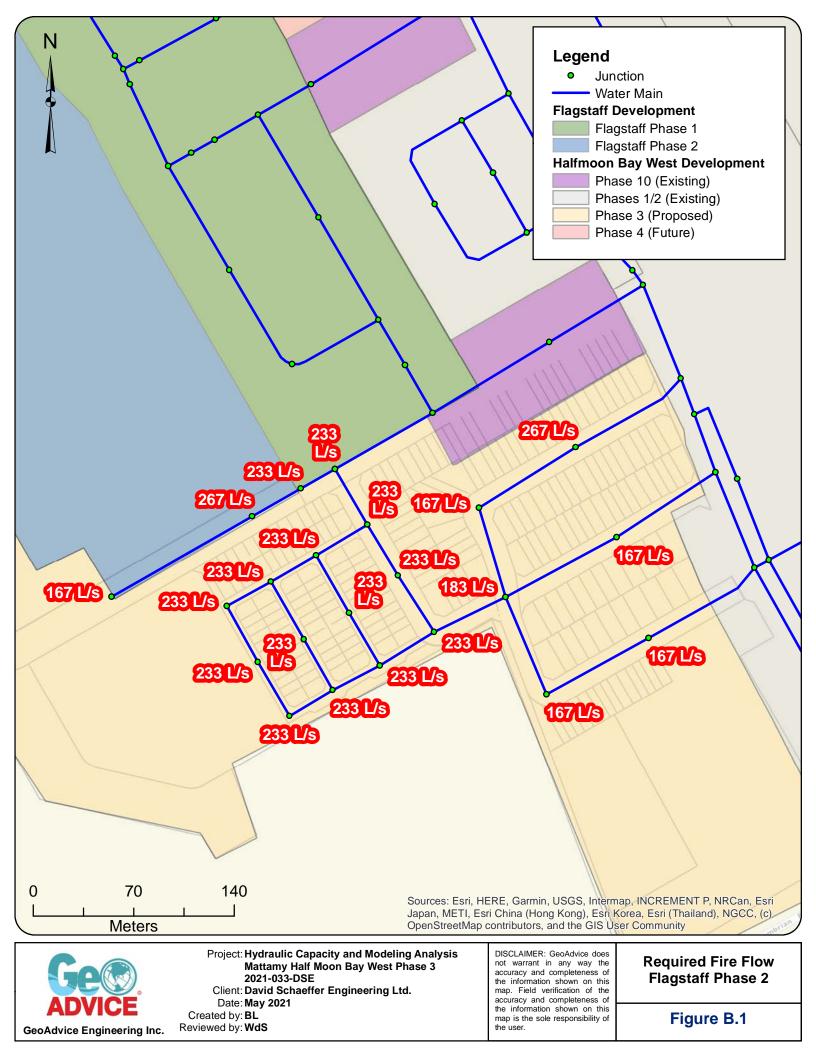




Appendix B FUS Fire Flow Calculations and Allocation







FUS Required Fire Flow Calculation Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999. Client: David Schaeffer Engineering Ltd. Project: 2021-033-DSE Development: Half Moon Bay West Phase 3 **Townhouse Block 40** Zoning: Multi Family Residential Note: For other townhouse blocks that do not comply with the City of Ottawa Technical Bulletin ISDTB-2018-02 4.2, a similar fire flow as calculated below will be used (Block 37). Date: May 10, 2021 A. Type of Construction: Wood Frame Construction **B.** Ground Floor Area: 358 m⁴ C. Number of Storeys: 2 $F = 220C\sqrt{A}$ D. Required Fire Flow*: C: Coefficient related to the type of construction 1.5 C = 715 m² A: Effective area The total floor area in m^2 in the building being considered 8,826 L/min 9,000 L/min* E. Occupancy Limited Combustible Occupancy content hazard -15 % of **D** -1,350 L/min 7,650 L/min F. Sprinkler Protection Automatic sprinkler protection None % of **E** 0 L/min 7,650 L/min G. Exposures Separation Length-Height Factor -Side **Construction Type - Adjacent Structure** Distance Adjacent Structure Exposure North 30.1 to 45 m Wood Frame or Non-Combustible 5% 31-60 m-storeys Wood Frame or Non-Combustible 17% East 3.1 to 10 m 0-30 m-storeys South 3.1 to 10 m Wood Frame or Non-Combustible 17% 0-30 m-storeys West 20.1 to 30 m 31-60 m-storeys Wood Frame or Non-Combustible 8% 47% Total

H. Wood Shake Charge

For wood shingle or shake roofs

Total Fire Flow Required	11,000	L/min**
	183	L/s
Required Duration of Fire Flow	2.25	Hrs
Required Volume of Fire Flow	1,485	m³

% of E + 3,596 L/min

0 L/min

11,246 L/min

11,246 L/min

G =

H =

*Rounded to the nearest 1,000 L/min

No

The Total Required Fire Flow for the Half Moon Bay West Phase 3 development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

^{**} Rounded to the nearest 1,000 L/min

FUS Requi	red Fire Flow	Calculatio	n	Calculations Based on "Water	Supply for Public Fire		
Client:	David Schaeffer E	ngineering Lt	d.	Protection", Fire Underwriters Surv	vey, 1999.		
	2021-033-DSE					ΔΟΥ	ICF
	Half Moon Bay Wes		Townhouse Block 33				
_	Multi Family Reside	ential		e blocks that do not comply wi		a Technical Bu	lletin
Date:	May 10, 2021		ISDTB-2018-02 4.2, a simil	ar fire flow as calculated below	v will be used.		
A.	Type of Construction	on:	Wood Frame Construction				
В.	Ground Floor Area	:	609 m	Note: Block 33 h	as 7 units		
C.	Number of Storeys	:	2				
D.	Required Fire Flow	*:	$F = 220C\sqrt{A}$				
	C: Coefficient relate		of construction	C = 1.5			
	A: Effective area			A = 1218	m ²		
	The total floor area in n	n ² in the building	being considered				
				F = 11,517	L/min	D = 12,00	0 L/min*
E.	Occupancy						
	Occupancy content	hazard	Limited Combustible	<u>-15</u> % of D	-1,800 L/min	E = 10,20	0 L/min
F.	Sprinkler Protectio	n					
	Automatic sprinkler	r protection	None	<u> 0 % of E</u>	0 L/min	F = 10,20	0 L/min
G.	Exposures						
	Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjac	cent Structure	Exposu	ire
		10.1 to 20 m	61-90 m-storeys	Wood Frame or No		14%	
		3.1 to 10 m	0-30 m-storeys	Wood Frame or No		17%	
		20.1 to 30 m 3.1 to 10 m	61-90 m-storeys 0-30 m-storeys	Wood Frame or No Wood Frame or No		9% 17%	
	west	5.1 (0 10 11	0-50 III-Storeys	WOOD Frame of No	n-compustible	Total 57%	
				% of E	+ 5,814 L/min	G = 16,01	4 L/min
	Wood Shake Chara	•	No	^	I /min	U = 10.04	A /main
н.	Wood Shake Charg For wood shingle o		No	0	L/min	H = 16,01	4 L/MIN
	-					_	
				Total Fire Flow Required		c	
					267 L/s		
			-	uired Duration of Fire Flow	3.5 Hrs		
			Rec	quired Volume of Fire Flow	3,360 m ³	l	

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Half Moon Bay West Phase 3 development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

^{**} Rounded to the nearest 1,000 L/min

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.

Project: 2021-033-DSE Development: Half Moon Bay West Phase 3

Date: May 10, 2021

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.



12-unit Back-to-Back Townhouse Zoning: Multi Family Residential Firewall located in the middle of the block.

Wood Frame Construction

A. Type of Construction: **B.** Ground Floor Area: 353 m⁴ C. Number of Storeys: 3 $F = 220C\sqrt{A}$ D. Required Fire Flow*: C: Coefficient related to the type of construction C = 1.5 1059 m² A: Effective area The total floor area in m² in the building being considered F = 10,738 L/min 11,000 L/min* E. Occupancy Limited Combustible Occupancy content hazard -15 % of **D** -1,650 L/min 9.350 L/min F. Sprinkler Protection Automatic sprinkler protection % of **E** None 0 L/min 9,350 L/min G. Exposures Separation Length-Height Factor -Side **Construction Type - Adjacent Structure** Distance **Adjacent Structure** Exposure North Firewall Wood Frame or Non-Combustible 10% 61-90 m-storeys East 10.1 to 20 m Wood Frame or Non-Combustible 31-60 m-storeys 13% South 3.1 to 10 m Wood Frame or Non-Combustible 19% 61-90 m-storeys West 10.1 to 20 m 31-60 m-storeys Wood Frame or Non-Combustible 13% 55% Total % of E + 5,143 L/min 14,493 L/min G = H. Wood Shake Charge No 0 L/min 14,493 L/min H = For wood shingle or shake roofs Total Fire Flow Required 14,000 L/min* L/s 233 **Required Duration of Fire Flow** 3 Hrs

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Half Moon Bay West Phase 3 development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Required Volume of Fire Flow

m³

2.520

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

^{**} Rounded to the nearest 1,000 L/min



12-unit Back-to-Back Townhouse

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.

Project: 2021-033-DSE

Development: Half Moon Bay West Phase 3

Zoning: Multi Family Residential

10-unit Back-to-Back Townhouse Firewall located with 6 units on one side and 4 units on the other.

Calculations Based on "Water Supply for Public Fire

m³

2.520

Protection", Fire Underwriters Survey, 1999.



Date: May 10, 2021 A. Type of Construction: Wood Frame Construction **B.** Ground Floor Area: 357 m² C. Number of Storeys: 3 $F = 220C\sqrt{A}$ D. Required Fire Flow*: C: Coefficient related to the type of construction **C** = 1.5 1071 m² A: Effective area The total floor area in m² in the building being considered F = 10,798 L/min 11,000 L/min* E. Occupancy Limited Combustible Occupancy content hazard -15 % of **D** -1,650 L/min 9.350 L/min F. Sprinkler Protection Automatic sprinkler protection % of **E** None 0 L/min 9,350 L/min G. Exposures Separation Length-Height Factor -Side **Construction Type - Adjacent Structure** Distance Adjacent Structure Exposure North 3.1 to 10 m Wood Frame or Non-Combustible 19% 61-90 m-storeys Wood Frame or Non-Combustible East 10.1 to 20 m 31-60 m-storeys 13% Wood Frame or Non-Combustible 10% South Firewall 61-90 m-storeys West 10.1 to 20 m 31-60 m-storeys Wood Frame or Non-Combustible 13% 55% Total % of E + 5,143 L/min 14,493 L/min G = H. Wood Shake Charge No 0 L/min 14,493 L/min For wood shingle or shake roofs Total Fire Flow Required 14,000 L/min* L/s 233 **Required Duration of Fire Flow** 3 Hrs

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Half Moon Bay West Phase 3 development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

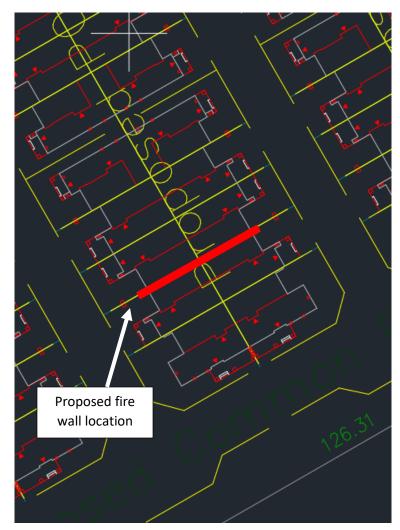
Required Volume of Fire Flow

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

^{**} Rounded to the nearest 1,000 L/min

10-unit Back-to-Back Townhouse



FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.

Project: 2021-033-DSE Development: Half Moon Bay West Phase 3

Date: May 10, 2021

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.



opment: Half Moon Bay West Phase 38-unit Back-to-Back TownhouseZoning: Multi Family ResidentialNo Firewall

A. Type of Construction:	Wood Frame Construction	
B. Ground Floor Area:	481 m ²	Note: The exposure to the School block
C. Number of Storeys:	3	located to the North was taken at the property line to be conservative.
D. Required Fire Flow*:	$F = 220C\sqrt{A}$	
C: Coefficient related to the type		C = 1.5
A: Effective area		$A = 1444 m^2$
The total floor area in m ² in the buildir	g being considered	
		F = 12,538 L/min D = 13,000 L/mir
E. Occupancy		
Occupancy content hazard	Limited Combustible	<u>-15</u> % of D <u>-1,950</u> L/min E = 11,050 L/mir
F. Sprinkler Protection		
Automatic sprinkler protection	None	% of E L/min F = 11,050 L/mir
G. Exposures		
Side Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure Exposure
North 20.1 to 30 r		Wood Frame or Non-Combustible 8%
East 3.1 to 10 m	61-90 m-storeys	Wood Frame or Non-Combustible 19%
South 10.1 to 20 r	n 61-90 m-storeys	Wood Frame or Non-Combustible 14%
West Beyond 45 r	n 0-30 m-storeys	Wood Frame or Non-Combustible 0%
		Total 41%
		% of E <u>+ 4,531</u> L/min G = 15,581 L/mir
H. Wood Shake Charge	No	L/min H = 15,581 L/mir
For wood shingle or shake roofs		
		Total Fire Flow Required 16,000 L/min**
		267 L/s
	Requi	red Duration of Fire Flow 3.5 Hrs
	Requ	ired Volume of Fire Flow 3,360 m ³

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Half Moon Bay West Phase 3 development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

^{**} Rounded to the nearest 1,000 L/min

Back-to-Back Townhouse Proposed Fire Wall Locations

Fire wall locations are based off the FUS calculations completed, which were the worst-case scenarios for each townhouse block type (8-unit, 10-unit, 12-unit). It is possible that by completing additional FUS calculations, the fire wall recommendations may not be the same for the other back-to-back townhouse blocks.



Appendix C Boundary Conditions





Boundary Conditions Flagstaff and Mattamy's Half Moon Bay West

Location



Scenario 1

Provided Information

Scenario 1	Demand		
Scenario	L/min	L/s	
Average Daily Demand	403	6.71	
Maximum Daily Demand	1,756	29.26	
Peak Hour	3,708	61.80	
Fire Flow Demand #1	10,000	166.67	
Fire Flow Demand #2	13,000	216.67	
Fire Flow Demand #3	14,000	233.33	
Fire Flow Demand #4	17,000	283.33	

Results – Existing Conditions

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	157.0	89.6
Peak Hour	136.9	61.0
Max Day plus Fire 1	144.6	72.0
Max Day plus Fire 2	141.0	66.9
Max Day plus Fire 3	139.7	65.0
Max Day plus Fire 4	135.2	58.6

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	157.0	90.3
Peak Hour	136.9	61.8
Max Day plus Fire 1	144.9	73.1
Max Day plus Fire 2	141.4	68.2
Max Day plus Fire 3	140.1	66.3
Max Day plus Fire 4	135.7	60.1

Ground Elevation = 93.5 m

Results – SUC Zone Reconfiguration

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	76.3
Peak Hour	140.9	66.7
Max Day plus Fire 1	140.7	66.5
Max Day plus Fire 2	138.2	62.9
Max Day plus Fire 3	137.3	61.6
Max Day plus Fire 4	134.3	57.3

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	77.1
Peak Hour	140.9	67.5
Max Day plus Fire 1	140.9	67.6
Max Day plus Fire 2	138.6	64.2
Max Day plus Fire 3	137.7	62.9
Max Day plus Fire 4	134.8	58.9

Ground Elevation = 93.5 m

Scenario 2

Provided Information

Scenario 2	Demand			
Scenario 2	L/min	L/s		
Average Daily Demand	491	8.19		
Maximum Daily Demand	2,117	35.29		
Peak Hour	4,456	74.26		
Fire Flow Demand #1	10,000	166.67		
Fire Flow Demand #2	13,000	216.67		
Fire Flow Demand #3	14,000	233.33		
Fire Flow Demand #4	17,000	283.33		

Results – Existing Conditions

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	158.3	91.4
Peak Hour	136.4	60.4
Max Day plus Fire 1	144.2	71.5
Max Day plus Fire 2	140.6	66.2
Max Day plus Fire 3	139.2	64.3
Max Day plus Fire 4	134.6	57.8

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	158.3	92.2
Peak Hour	136.4	61.1
Max Day plus Fire 1	144.5	72.6
Max Day plus Fire 2	140.9	67.5
Max Day plus Fire 3	139.6	65.6
Max Day plus Fire 4	135.2	59.4

Ground Elevation = 93.5 m

Results – SUC Zone Reconfiguration

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	76.3
Peak Hour	140.2	65.8
Max Day plus Fire 1	140.5	66.2
Max Day plus Fire 2	137.9	62.5
Max Day plus Fire 3	137.0	61.2
Max Day plus Fire 4	134.0	56.9

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	77.0
Peak Hour	140.2	66.5
Max Day plus Fire 1	140.7	67.3
Max Day plus Fire 2	138.3	63.8
Max Day plus Fire 3	137.4	62.5
Max Day plus Fire 4	134.5	58.5

Ground Elevation = 93.5 m

Scenario 3

Provided Information

Scenario 3	Der	Demand		
Scenario S	L/min	L/s		
Average Daily Demand	579	9.65		
Maximum Daily Demand	2,499	41.65		
Peak Hour	5,259	87.65		
Fire Flow Demand #1	10,000	166.67		
Fire Flow Demand #2	13,000	216.67		
Fire Flow Demand #3	14,000	233.33		
Fire Flow Demand #4	17,000	283.33		

Results – Existing Conditions

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	159.1	92.7
Peak Hour	135.1	58.4
Max Day plus Fire 1	143.8	70.9
Max Day plus Fire 2	140.1	65.6
Max Day plus Fire 3	138.7	63.6
Max Day plus Fire 4	134.1	57.1

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	159.1	93.4
Peak Hour	135.1	59.2
Max Day plus Fire 1	144.1	72.0
Max Day plus Fire 2	140.5	66.9
Max Day plus Fire 3	139.1	65.0
Max Day plus Fire 4	134.7	58.7

Ground Elevation = 93.5 m

Results – SUC Zone Reconfiguration

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	76.2
Peak Hour	139.5	64.7
Max Day plus Fire 1	140.3	65.8
Max Day plus Fire 2	137.7	62.2
Max Day plus Fire 3	136.7	60.8
Max Day plus Fire 4	133.6	56.4

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	77.0
Peak Hour	139.5	65.5
Max Day plus Fire 1	140.5	66.9
Max Day plus Fire 2	138.0	63.4
Max Day plus Fire 3	137.1	62.2
Max Day plus Fire 4	134.2	58.0

Ground Elevation = 93.5 m

Scenario 4

Provided Information

Scenario 4	Der	Demand		
Scenario 4	L/min	L/s		
Average Daily Demand	613	10.21		
Maximum Daily Demand	2,643	44.05		
Peak Hour	5,563	92.72		
Fire Flow Demand #1	10,000	166.67		
Fire Flow Demand #2	13,000	216.67		
Fire Flow Demand #3	14,000	233.33		
Fire Flow Demand #4	17,000	283.33		

Results – Existing Conditions

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	159.1	92.6
Peak Hour	134.5	57.7
Max Day plus Fire 1	143.7	70.7
Max Day plus Fire 2	139.9	65.4
Max Day plus Fire 3	138.5	63.4
Max Day plus Fire 4	133.9	56.8

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	159.1	93.4
Peak Hour	134.5	58.4
Max Day plus Fire 1	143.9	71.8
Max Day plus Fire 2	140.3	66.6
Max Day plus Fire 3	138.9	64.7
Max Day plus Fire 4	134.5	58.4

Ground Elevation = 93.5 m

Results – SUC Zone Reconfiguration

Connection 1 – Greenbank Road / Cambrian Road

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	76.2
Peak Hour	139.2	64.3
Max Day plus Fire 1	140.2	65.7
Max Day plus Fire 2	137.6	62.0
Max Day plus Fire 3	136.6	60.7
Max Day plus Fire 4	133.5	56.3

Ground Elevation = 94.0 m

Connection 2 – Greenbank Road / Perseus Avenue

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	147.6	77.0
Peak Hour	139.2	65.1
Max Day plus Fire 1	140.4	66.8
Max Day plus Fire 2	137.9	63.3
Max Day plus Fire 3	137.0	62.0
Max Day plus Fire 4	134.1	57.9

Ground Elevation = 93.5 m

<u>Notes</u>

- As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
 - a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
 - b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

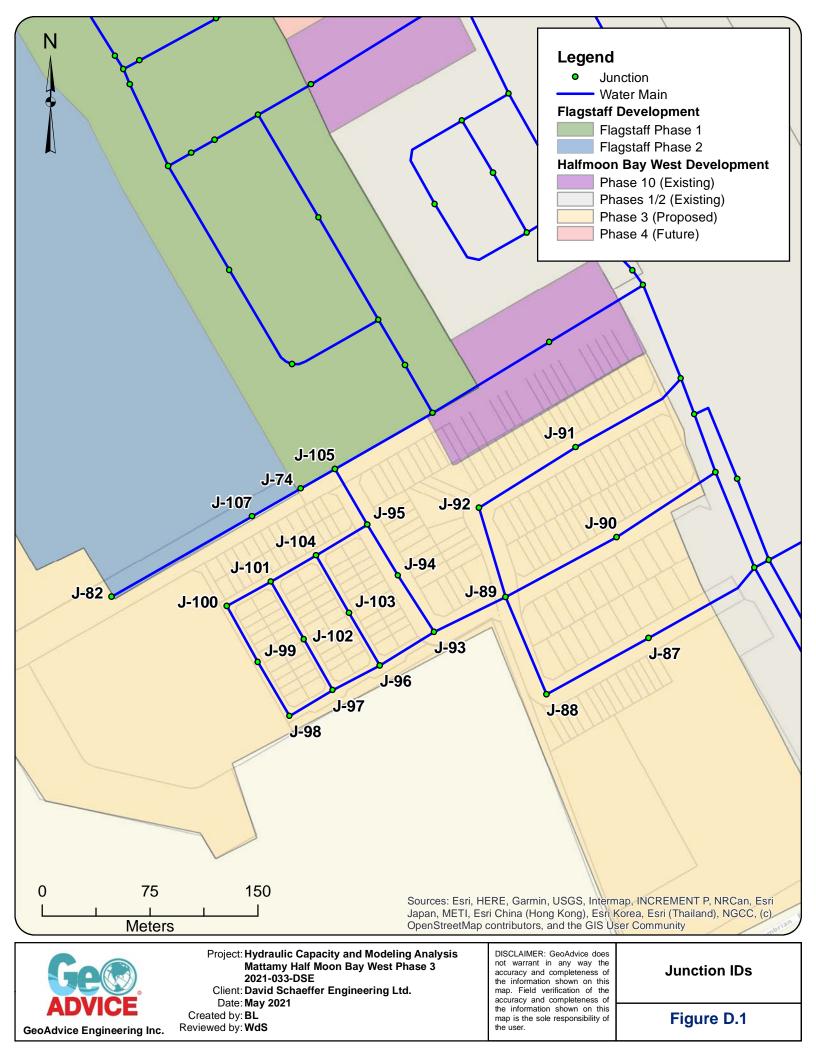


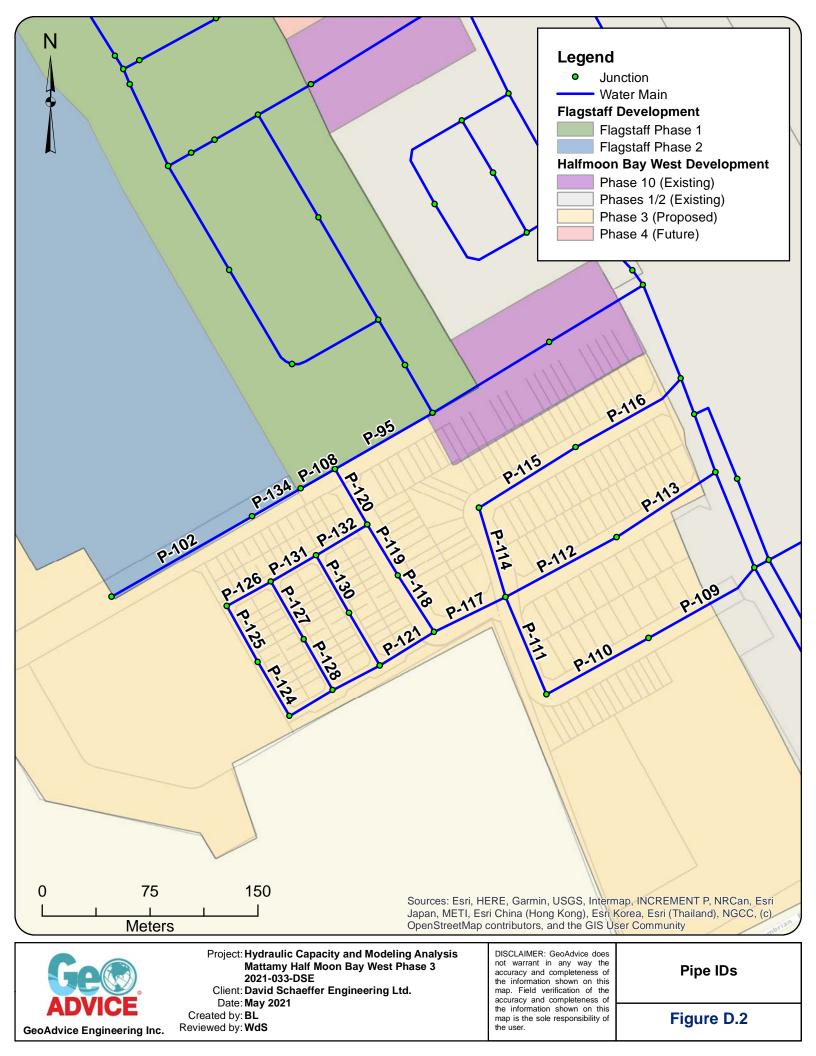
Appendix D Pipe and Junction Model Inputs

Project ID: 2021-023-DSE









Model Inputs

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness ()
P-102	J-82	J-107	112.76	297	120
P-108	J-105	J-74	27.31	297	120
P-109	J-14	J-87	89.29	204	110
P-110	J-87	J-88	81.18	204	110
P-111	J-88	J-89	73.64	204	110
P-112	J-89	J-90	87.69	204	110
P-113	J-90	J-13	82.42	204	110
P-114	J-89	J-92	64.70	204	110
P-115	J-92	J-91	79.40	204	110
P-116	J-91	J-19	88.28	204	110
P-117	J-89	J-93	55.19	204	110
P-118	J-93	J-94	46.56	204	110
P-119	J-94	J-95	41.31	204	110
P-120	J-95	J-105	44.98	204	110
P-121	J-93	J-96	44.58	204	110
P-122	J-96	J-97	37.02	204	110
P-123	J-97	J-98	35.03	204	110
P-124	J-98	J-99	43.48	204	110
P-125	J-99	J-100	44.77	204	110
P-126	J-100	J-101	35.00	204	110
P-127	J-101	J-102	46.13	204	110
P-128	J-102	J-97	40.79	204	110
P-129	J-96	J-103	42.30	204	110
P-130	J-103	J-104	46.37	204	110
P-131	J-104	J-101	36.29	204	110
P-132	J-104	J-95	41.56	204	110
P-134	J-107	J-74	39.00	297	120
P-95	J-73	J-105	78.42	297	120

ID	Elevation (m)
J-100	93.10
J-101	93.40
J-102	93.40
J-103	93.40
J-104	93.30
J-105	93.43
J-107	93.46
J-74	93.46
J-82	93.08
J-87	93.10
J-88	93.30
J-89	93.20
J-90	93.10
J-91	93.00
J-92	93.20
J-93	93.40
J-94	93.30
J-95	93.20
J-96	93.40
J-97	93.50
J-98	93.30
J-99	93.20

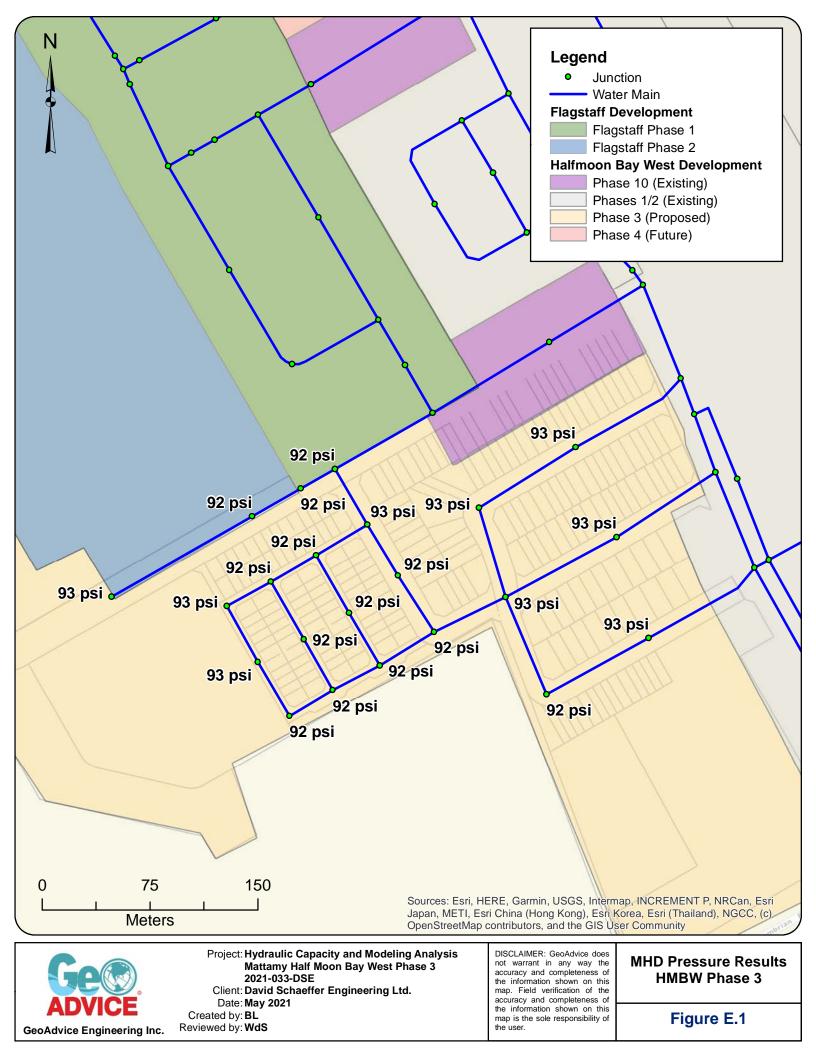


Appendix E MHD and PHD Model Results

Project ID: 2021-023-DSE



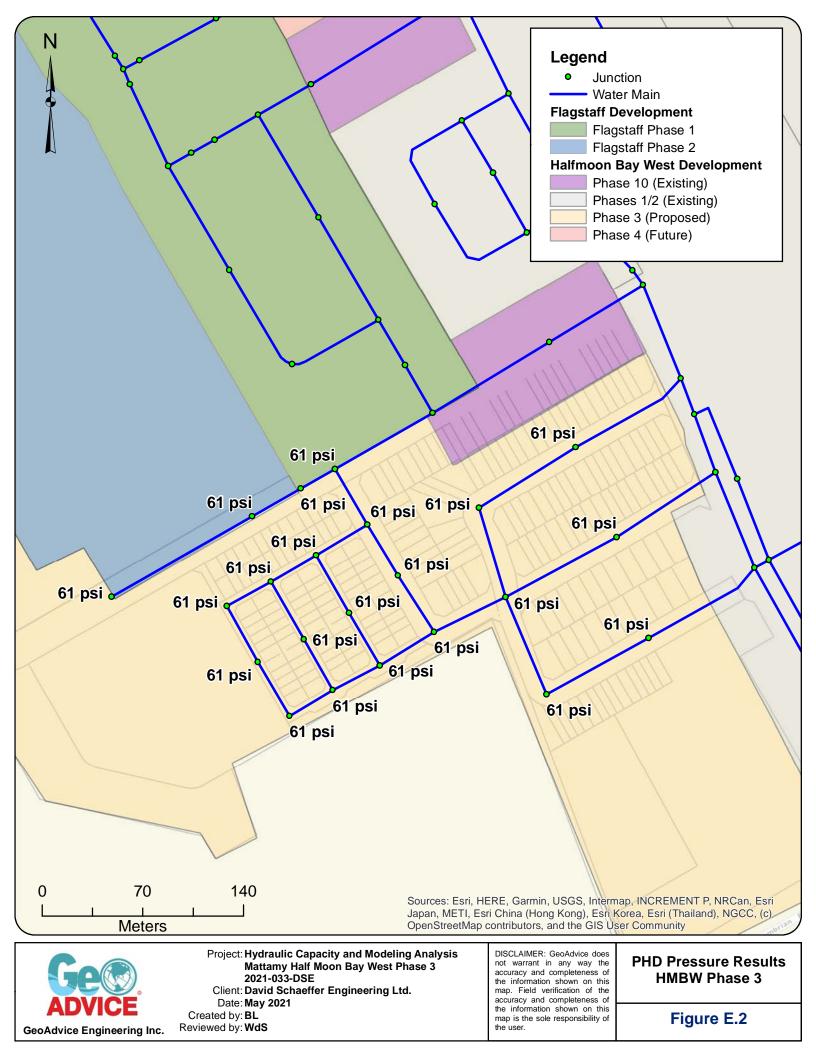




Minimum Hour Demand Modeling Results - Half Moon Bay West Phase 3

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
P-102	J-82	J-107	112.76	297	120	-0.13	0.00	0.00	0.00
P-108	J-105	J-74	27.31	297	120	0.25	0.00	0.00	0.00
P-109	J-14	J-87	89.29	204	110	0.63	0.02	0.00	0.01
P-110	J-87	J-88	81.18	204	110	0.10	0.00	0.00	0.00
P-111	J-88	J-89	73.64	204	110	0.03	0.00	0.00	0.00
P-112	J-89	J-90	87.69	204	110	-0.28	0.01	0.00	0.00
P-113	J-90	J-13	82.42	204	110	-0.38	0.01	0.00	0.00
P-114	J-89	J-92	64.70	204	110	-0.09	0.00	0.00	0.00
P-115	J-92	J-91	79.40	204	110	-0.18	0.01	0.00	0.00
P-116	J-91	J-19	88.28	204	110	-0.28	0.01	0.00	0.00
P-117	J-89	J-93	55.19	204	110	0.29	0.01	0.00	0.00
P-118	J-93	J-94	46.56	204	110	0.08	0.00	0.00	0.00
P-119	J-94	J-95	41.31	204	110	0.04	0.00	0.00	0.00
P-120	J-95	J-105	44.98	204	110	-0.15	0.01	0.00	0.00
P-121	J-93	J-96	44.58	204	110	0.18	0.01	0.00	0.00
P-122	J-96	J-97	37.02	204	110	0.11	0.00	0.00	0.00
P-123	J-97	J-98	35.03	204	110	0.06	0.00	0.00	0.00
P-124	J-98	J-99	43.48	204	110	0.02	0.00	0.00	0.00
P-125	J-99	J-100	44.77	204	110	-0.02	0.00	0.00	0.00
P-126	J-100	J-101	35.00	204	110	-0.06	0.00	0.00	0.00
P-127	J-101	J-102	46.13	204	110	0.02	0.00	0.00	0.00
P-128	J-102	J-97	40.79	204	110	-0.02	0.00	0.00	0.00
P-129	J-96	J-103	42.30	204	110	0.03	0.00	0.00	0.00
P-130	J-103	J-104	46.37	204	110	-0.01	0.00	0.00	0.00
P-131	J-104	J-101	36.29	204	110	0.11	0.00	0.00	0.00
P-132	J-104	J-95	41.56	204	110	-0.16	0.01	0.00	0.00
P-134	J-107	J-74	39.00	297	120	-0.20	0.00	0.00	0.00
P-95	J-73	J-105	78.42	297	120	0.45	0.01	0.00	0.00

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-100	0.04	93.10	158	93
J-101	0.04	93.40	158	92
J-102	0.04	93.40	158	92
J-103	0.04	93.40	158	92
J-104	0.04	93.30	158	92
J-105	0.04	93.43	158	92
J-107	0.07	93.46	158	92
J-74	0.06	93.46	158	92
J-82	0.13	93.08	158	93
J-87	0.53	93.10	158	93
J-88	0.07	93.30	158	92
J-89	0.10	93.20	158	93
J-90	0.10	93.10	158	93
J-91	0.10	93.00	158	93
J-92	0.10	93.20	158	93
J-93	0.04	93.40	158	92
J-94	0.04	93.30	158	92
J-95	0.04	93.20	158	93
J-96	0.04	93.40	158	92
J-97	0.04	93.50	158	92
J-98	0.04	93.30	158	92
J-99	0.04	93.20	158	93



Peak Hour Demand Modeling Results - Half Moon Bay West Phase 3

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
P-102	J-82	J-107	112.76	297	120	-0.91	0.01	0.00	0.00
P-108	J-105	J-74	27.31	297	120	2.28	0.03	0.00	0.01
P-109	J-14	J-87	89.29	204	110	5.68	0.17	0.03	0.28
P-110	J-87	J-88	81.18	204	110	2.42	0.07	0.01	0.06
P-111	J-88	J-89	73.64	204	110	1.65	0.05	0.00	0.03
P-112	J-89	J-90	87.69	204	110	-2.63	0.08	0.01	0.07
P-113	J-90	J-13	82.42	204	110	-3.72	0.11	0.01	0.13
P-114	J-89	J-92	64.70	204	110	-0.46	0.01	0.00	0.00
P-115	J-92	J-91	79.40	204	110	-1.54	0.05	0.00	0.03
P-116	J-91	J-19	88.28	204	110	-2.63	0.08	0.01	0.07
P-117	J-89	J-93	55.19	204	110	3.65	0.11	0.01	0.12
P-118	J-93	J-94	46.56	204	110	1.16	0.04	0.00	0.02
P-119	J-94	J-95	41.31	204	110	0.75	0.02	0.00	0.01
P-120	J-95	J-105	44.98	204	110	-1.24	0.04	0.00	0.02
P-121	J-93	J-96	44.58	204	110	2.08	0.06	0.00	0.04
P-122	J-96	J-97	37.02	204	110	1.26	0.04	0.00	0.02
P-123	J-97	J-98	35.03	204	110	0.62	0.02	0.00	0.01
P-124	J-98	J-99	43.48	204	110	0.21	0.01	0.00	0.00
P-125	J-99	J-100	44.77	204	110	-0.20	0.01	0.00	0.00
P-126	J-100	J-101	35.00	204	110	-0.60	0.02	0.00	0.01
P-127	J-101	J-102	46.13	204	110	0.17	0.01	0.00	0.00
P-128	J-102	J-97	40.79	204	110	-0.23	0.01	0.00	0.00
P-129	J-96	J-103	42.30	204	110	0.42	0.01	0.00	0.00
P-130	J-103	J-104	46.37	204	110	0.01	0.00	0.00	0.00
P-131	J-104	J-101	36.29	204	110	1.18	0.04	0.00	0.02
P-132	J-104	J-95	41.56	204	110	-1.58	0.05	0.00	0.03
P-134	J-107	J-74	39.00	297	120	-1.65	0.02	0.00	0.00
P-95	J-73	J-105	78.42	297	120	4.00	0.06	0.00	0.02

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-100	0.41	93.10	136	61
J-101	0.41	93.40	136	61
J-102	0.41	93.40	136	61
J-103	0.41	93.40	136	61
J-104	0.41	93.30	136	61
J-105	0.48	93.43	136	61
J-107	0.74	93.46	136	61
J-74	0.63	93.46	136	61
J-82	0.91	93.08	136	61
J-87	3.26	93.10	136	61
J-88	0.77	93.30	136	61
J-89	1.09	93.20	136	61
J-90	1.09	93.10	136	61
J-91	1.09	93.00	136	61
J-92	1.09	93.20	136	61
J-93	0.41	93.40	136	61
J-94	0.41	93.30	136	61
J-95	0.41	93.20	136	61
J-96	0.41	93.40	136	61
J-97	0.41	93.50	136	61
J-98	0.41	93.30	136	61
J-99	0.41	93.20	136	61

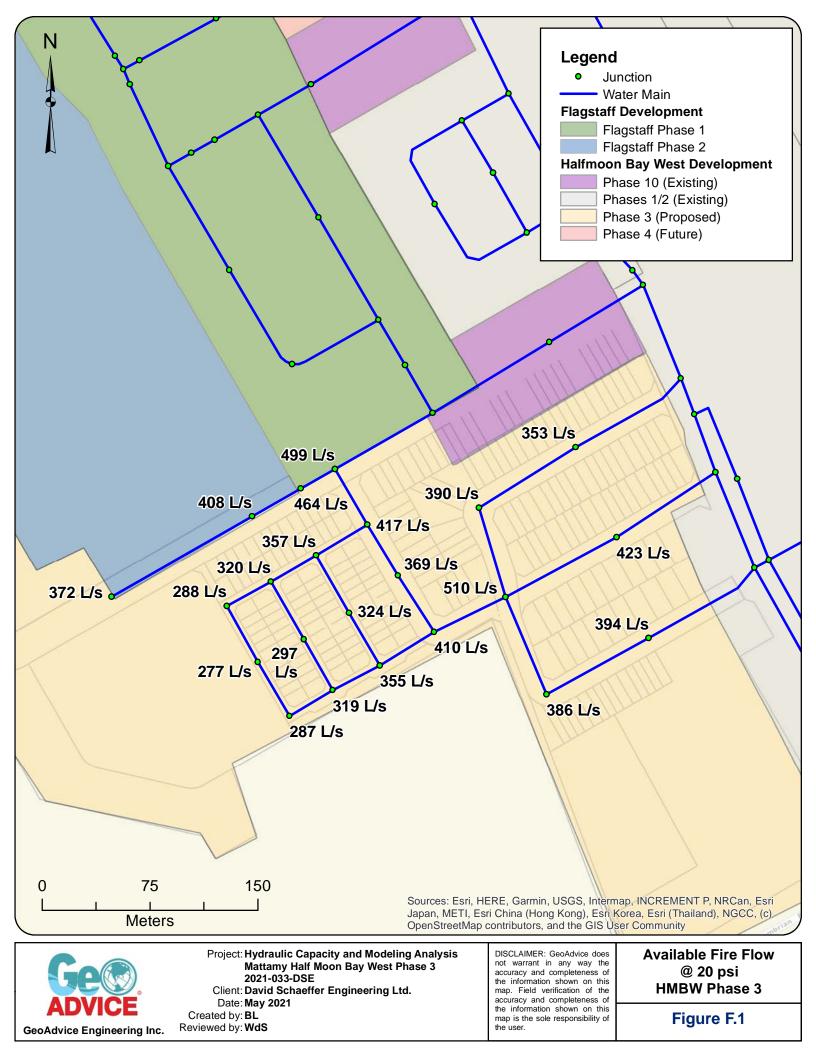


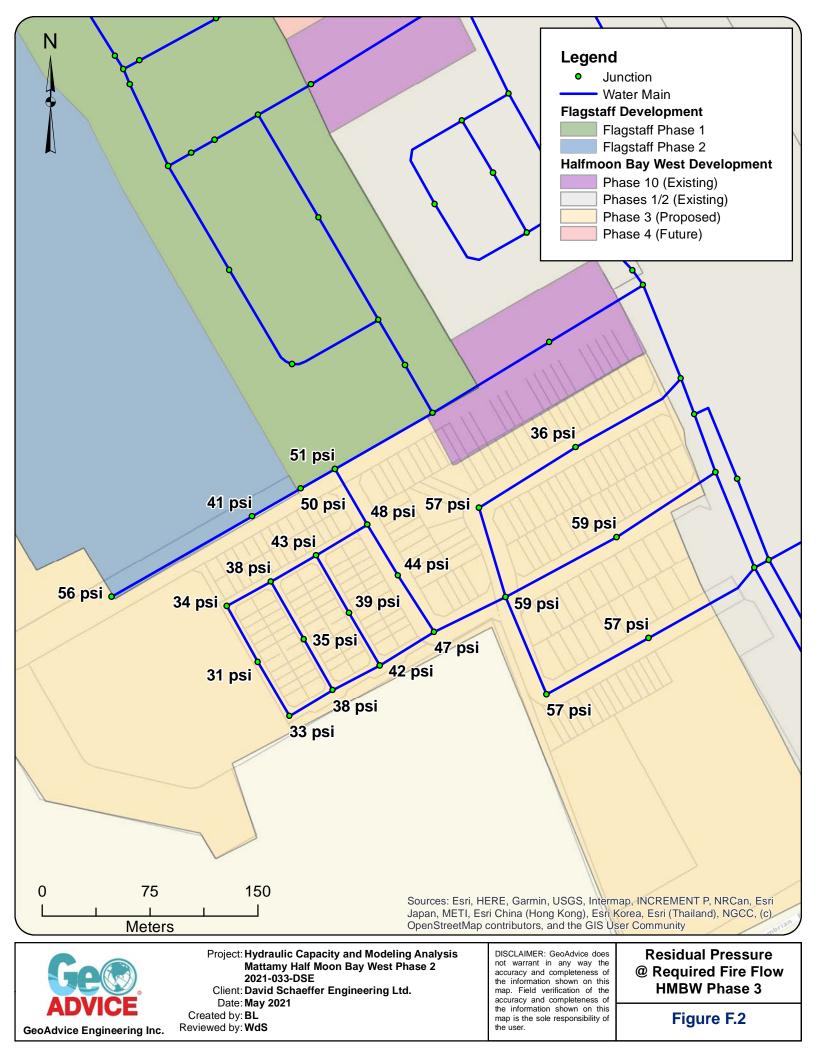
Appendix F MDD+FF Model Results

Project ID: 2021-023-DSE









Fire Flow Modeling Results - Half Moon Bay West Phase 3

ID	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
J-82	0.46	67	141	167	56	372	20
J-87	1.74	67	141	167	57	394	20
J-88	0.35	67	141	167	57	386	20
J-90	0.50	67	141	167	59	423	20
J-92	0.50	67	141	167	57	390	20
J-89	0.50	66	140	183	59	510	20
J-100	0.19	63	137	233	34	288	20
J-101	0.19	62	137	233	38	320	20
J-102	0.19	62	137	233	35	297	20
J-103	0.19	62	137	233	39	324	20
J-104	0.19	62	137	233	43	357	20
J-105	0.22	62	137	233	51	499	20
J-74	0.29	62	137	233	50	464	20
J-93	0.19	62	137	233	47	410	20
J-94	0.19	62	137	233	44	369	20
J-95	0.19	62	137	233	48	417	20
J-96	0.19	62	137	233	42	355	20
J-97	0.19	62	137	233	38	319	20
J-98	0.19	62	137	233	33	287	20
J-99	0.19	62	137	233	31	277	20
J-107	0.34	59	135	267	41	408	20
J-91	0.50	60	135	267	36	353	20



APPENDIX H

OTTAWA SERVICING REPORT CHECKLIST





Servicing study guidelines for development applications

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

- Executive Summary (for larger reports only).
- Date and revision number of the report.
- □ Location map and plan showing municipal address, boundary, and layout of proposed development.
- Plan showing the site and location of all existing services.
- Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.
- □ Summary of Pre-consultation Meetings with City and other approval agencies.
- Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.
- Statement of objectives and servicing criteria.
- □ Identification of existing and proposed infrastructure available in the immediate area.
- Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).
- Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.
- □ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.
- Proposed phasing of the development, if applicable.





- Reference to geotechnical studies and recommendations concerning servicing.
- All preliminary and formal site plan submissions should have the following information:
 Metric scale
 - North arrow (including construction North)
 - Key plan
 - Name and contact information of applicant and property owner
 - Property limits including bearings and dimensions
 - Existing and proposed structures and parking areas
 - · Easements, road widening and rights-of-way
 - Adjacent street names

4.2 Development Servicing Report: Water

- Confirm consistency with Master Servicing Study, if available
- Availability of public infrastructure to service proposed development
- □ Identification of system constraints
- □ Identify boundary conditions
- □ Confirmation of adequate domestic supply and pressure
- □ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.
- Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.
- Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design
- Address reliability requirements such as appropriate location of shut-off valves
- □ Check on the necessity of a pressure zone boundary modification.
- Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range





- Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.
- Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.
- □ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.
- Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

- Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).
- □ Confirm consistency with Master Servicing Study and/or justifications for deviations.
- Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.
- Description of existing sanitary sewer available for discharge of wastewater from proposed development.
- Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)
- □ Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.
- Description of proposed sewer network including sewers, pumping stations, and forcemains.
- Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).
- Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.
- Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.
- □ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.
- Special considerations such as contamination, corrosive environment etc.





4.4 Development Servicing Report: Stormwater Checklist

- Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)
- Analysis of available capacity in existing public infrastructure.
- A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.
- □ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.
- □ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.
- Description of the stormwater management concept with facility locations and descriptions with references and supporting information.
- Set-back from private sewage disposal systems.
- □ Watercourse and hazard lands setbacks.
- □ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.
- □ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.
- Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).
- □ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.
- □ Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.
- Any proposed diversion of drainage catchment areas from one outlet to another.
- □ Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.
- ☐ If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100 year return period storm event.
- □ Identification of potential impacts to receiving watercourses
- □ Identification of municipal drains and related approval requirements.
- Descriptions of how the conveyance and storage capacity will be achieved for the development.
- 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.





- □ Inclusion of hydraulic analysis including hydraulic grade line elevations.
- Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.
- □ Identification of floodplains proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.
- □ Identification of fill constraints related to floodplain and geotechnical investigation.

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

- Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.
- Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.
- □ Changes to Municipal Drains.
- Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

4.6 Conclusion Checklist

- □ Clearly stated conclusions and recommendations
- □ Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.
- All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario



APPENDIX I

PRE-CONSULTATION SUMMARY

Pre-Application Consultation Meeting Notes

Property Address: 3555 Borrisokane PC2023-0038, February 23rd, 2023, MS Teams

Attendees:

Inwon Lee (Owner) David Parker and Carlos (Architect) Patrick McMahon (Transportation Project Manager, City of Ottawa) Sami Rehman (Environmental Planner, Planner II, City of Ottawa) Selma Hassan (Urban Designer, Planner II, City of Ottawa) Jeannette Krabicka (Parks Planner, Planner II, City of Ottawa) Bruce Bramah (Project Manager, City of Ottawa) Stream Shen (File Lead, Planner III, City of Ottawa) Adwoa Achireko (Student Planner, City of Ottawa) Samuel Farkas (Student Planner, City of Ottawa)

Regrets:

- Eric Lalande (Planner, RVCA)
- Mark Richardson (Forester Planner, City of Ottawa)

Subject: 3555 Borrisokane – Korean Community Church

Meeting notes:

Opening & attendee introduction

- Introduction of meeting attendees
- Overview of proposal:
 - 1 storey building for a Korean Community Church
 - The class and office are accessory to the church.
 - Estimated highest attendance to be on Sunday at 500 people.
 - Weekday will be mostly empty.
 - Currently considering renting out part of the space as a day care.
 - Currently no trees on property.
 - There are currently no plan for the parcel north of the church.
 - The church will be building the road along the easterly property line connecting to Flagstaff.

Comments:

Planning (Shen, Stream <u>Stream.Shen@ottawa.ca</u>)

1. This is a pre-consultation for a Site Plan Control application, Complex threshold. Application form, information and fee can be found <u>here.</u> There is a proposed fee increase for April 1, 2023.

- 2. There will be impact to the site plan application process as a result of Bill 109 and Bill 23. Please review the <u>engage Ottawa</u> website for information and reach out to the file lead to confirm the updated process prior to submission.
- 3. Official Plan Neighbourhood designation within the Suburban transect. Urban Natural Feature designation to the south.
- 4. Official Plan Annex 5 area specific policy 4 requires evidence that the owner is party to the barrhaven south cos t sharing agreement and that the owner has paid its share of any costs pursuant to the agreement as a condition of approval.
- 5. <u>Barrhaven South Community Design Plan</u> Employment designation. Please review the CDP for any applicable policies.
- 6. Due to the location within the 500-metre influence area of the Trail Road Waste Facility, Conditions of development approval will include the provision of warning notices on title, noting the site's proximity to the landfill and the potential for odour and litter impacts; and the requirement for sealed, air-conditioned workplace units.
- 7. Zoning Light Industrial, Exception 304 (IL[304]) which allows a place of warship as an additional permitted use.
- 8. Aisle width leading to parking spaces need to be a minimum of 6.7m.
- 9. Bicycle parking required at 1 per 1,500 m2 of gfa.
- 10. Vehicle parking required at 10 per 100m2 of gfa for the assembly area.
- 11. The City is working to implement the High Performance Development Standards by June 1, 2023. Detail information and submission requirements can be found in the attachment.
- 12. Please consult with the Ward Councillor (David Hill) prior to submission.

Urban Design (Hassan, Selma <u>Selma.Hassan@ottawa.ca</u>)

- 13. Design brief is required. Terms of reference is attached.
- 14. Please ensure the site is well landscaped, and new larger canopy trees are provided where possible, and
- 15. Please design the front of the building to have glazing and to address the front of the site appropriately.

Transportation (McMahon, Patrick <u>patrick.mcmahon@ottawa.ca</u>)

- Follow Traffic Impact Assessment Guidelines
 - Start this process as soon as possible.
 - The application will not be deemed complete until the submission of the draft step 1-4, including the functional draft RMA package (if applicable and/or monitoring report (if applicable). Collaboration and communication between development proponents and City staff are required at the end of every step of the TIA process.
- The right of way protection along Borrisokane Road is 37.5m, show this protection on the plan. A widening does not appear to be required.
- Noise Impact Studies required for the following:
 - Road (adjacent to Borrisokane and within 500m of Highway 416)
 - Stationary due to the proximity of an in-stream application for a car wash at the northern edge of the site. The car wash developer will not be responsible for any noise attenuation required.
- The clear throat length for this development along Borrisokane Road should be at least 15m from the edge of the right-of-way.
- Consider providing a pedestrian connection along the internal road to connect to Flagstaff.

- Consider ending the sidewalk along the frontage prior to the Borrisokane Road limits since there are no pedestrian facilities provided along Borrisokane Road.
- On site plan:
 - Show all details of the roads abutting the site up to and including the opposite curb; include such items as pavement markings, accesses and/or sidewalks.
 - Turning templates will be required for all accesses showing the largest vehicle to access the site; required for internal movements and at all access (entering and exiting and going in both directions).
 - Show all curb radii measurements; ensure that all curb radii are reduced as much as possible.
 - Show lane/aisle widths. Aisles must be 6.7m wide.
- As the proposed site is commercial/institutional/industrial and for general public use, AODA legislation applies.
- Consider using the City's Accessibility Design Standards.

Forestry (Richardson, Mark Mark.Richardson@ottawa.ca)

- 1. If trees >10cm in diameter will be impacted, a Tree Conservation Report (TCR) must be supplied for review along with the suite of other plans/reports required by the City
 - a. an approved TCR is a requirement of Site Plan approval.
- 2. Any removal of privately-owned trees 10cm or larger in diameter, or city-owned trees of any diameter requires a tree permit issued under the Tree Protection Bylaw (Bylaw 2020 340); the permit will be based on an approved TCR and made available at or near plan approval.
- 3. The TCR must contain 2 separate plans:
 - b. Plan/Map 1 show existing conditions with tree cover information.
 - c. Plan/Map 2 show proposed development with tree cover information.
 - d. Please ensure retained trees are shown on the landscape plan.
- 4. the TCR must list all trees on site, as well as off-site trees if the CRZ extends into the developed area, by species, diameter and health condition.
- 5. please identify trees by ownership private onsite, private on adjoining site, city owned, coowned (trees on a property line)
 - e. Compensation may be required for the removal of city owned trees.
- 6. If trees are to be removed, the TCR must clearly show where they are, and document the reason they cannot be retained.
- All retained trees must be shown, and all retained trees within the area impacted by the development process must be protected as per City guidelines available at <u>Tree Protection</u> <u>Specification</u> or by searching Ottawa.ca
 - a. the location of tree protection fencing must be shown on the plan.
 - b. show the critical root zone of the retained trees.
- 8. the City encourages the retention of healthy trees; if possible, please seek opportunities for retention of trees that will contribute to the design/function of the site.
- 9. For more information on the process or help with tree retention options, contact Mark Richardson <u>mark.richardson@ottawa.ca</u> or on <u>City of Ottawa</u>

Planning Forester LP tree planting requirements:

Please note that all process for reviewing and approving LP tree planting has changed at the City – in order to effectively review your submission in a timely manner the Planning Forester will need to ensure that all the bullets listed below have been addressed

- 1. Minimum Setbacks
 - Maintain 1.5m from sidewalk or MUP/cycle track or water service laterals.
 - Maintain 2.5m from curb
 - Coniferous species require a minimum 4.5m setback from curb, sidewalk or MUP/cycle track/pathway.
 - Maintain 7.5m between large growing trees, and 4m between small growing trees. Park or open space planting should consider 10m spacing, except where otherwise approved in naturalization / afforestation areas. Adhere to Ottawa Hydro's planting guidelines (species and setbacks) when planting around overhead primary conductors.
- 2. Tree specifications
 - Minimum stock size: 50mm tree caliper for deciduous, 200cm height for coniferous.
 - Maximize the use of large deciduous species wherever possible to maximize future canopy coverage
 - Tree planting on city property shall be in accordance with the City of Ottawa's Tree Planting Specification; and include watering and warranty as described in the specification (can be provided by Forestry Services).
 - Plant native trees whenever possible
 - No root barriers, dead-man anchor systems, or planters are permitted.
 - No tree stakes unless necessary (and only 1 on the prevailing winds side of the tree)
- 3. Hard surface planting
 - Curb style planter is highly recommended
 - No grates are to be used and if guards are required, City of Ottawa standard (which can be provided) shall be used.
 - Trees are to be planted at grade

4. Soil Volume

• Please document on the LP that adequate soil volumes can be met:

Tree Type/Size	Single Tree Soil Volume (m3)	Multiple Tree Soil Volume (m3/tree)
Ornamental	15	9
Columnar	15	9
Small	20	12
Medium	25	15
Large	30	18
Conifer	25	15

Sensitive Marine Clay

• Please follow the City's 2017 Tree Planting in Sensitive Marine Clay guidelines

Engineering (Bramah, Bruce <u>bruce.bramah@ottawa.ca</u>)

Servicing

Please note the Trail Road Waste Facility is near this property. Comments from the Trail Road Facility

will be provided once they are available.

Site servicing conditions/criteria shall be in accordance with HMBW Phase 4 servicing study. Water and Sanitary service stubs off Flagstaff Drive within the existing servicing easement to be used.

Water

Boundary conditions:

Civil consultant must request boundary conditions from the City's assigned Project Manager prior to first submission.

- Water boundary condition requests must include the location of the service(s) and the expected loads required by the proposed developments. Please provide all the following information:
 - Location of service(s)
 - Type of development and the amount of fire flow required (as per FUS, 2020).
 - Average daily demand: ____ l/s.
 - Maximum daily demand: ____l/s.
 - Maximum hourly daily demand: _____ l/s.
- Fire protection (Fire demand, Hydrant Locations)
- A water meter sizing questionnaire (water data card) will have to be completed prior to receiving a water permit (water card will be provided post approval)

Sanitary Sewer

Is a monitoring manhole required on private property? I Yes

• The designer should be aware there may be limited capacity in the downstream sanitary sewer system. The sanitary demand needs to be coordinated with the City Planning Dept. to determine if the existing sanitary sewer system has sufficient capacity to support the proposed rezoning. Provide sanitary demands to the City project manager for coordination.

□ No

• Any premise in which there is commercial or institutional food preparation shall install a grease and oil inceptor on all fixtures.

Storm Sewer

- For concrete sewer pipe, maintenance holes shall be installed when the service is greater than 50% of the diameter of the mainline concrete pipe
- The Environmental Site Assessment (ESA) may provide recommendations where site contamination may be present. The recommendations from the ESA need to be coordinated with the servicing report to ensure compliance with the Sewer Use By-Law.

Stormwater Management

Quality Control:

• The Clarke storm water management pond does provide quality control for HMBW subdivision. The Rideau Valley Conservation Authority to provide any additional quality control requirements for the property.

Quantity Control:

• Provided by servicing study for HMBW Phase 4.

Ministry of Environment, Conservation and Parks (MECP)

All development applications should be considered for an Environmental Compliance Approval, under MECP regulations.

- a. The consultants determine if an approval for sewage works under Section 53 of OWRA is required and determines what type of application. The City's project manager may help confirm and coordinate with the MECP as required.
- b. The project will be either transfer of review (standard), transfer of review (additional), direct submission, or exempt as per O. Reg. 525/98.
- c. Pre-consultation is not required if applying for standard or additional works (Schedule A of the Agreement) under Transfer Review.
- d. Pre-consultation with local District office of MECP is recommended for direct submission.
- e. Consultant completes an MECP request form for a pre-consultation. Sends request to <u>moeccottawasewage@ontario.ca</u>
- f. ECA applications are required to be submitted online through the MECP portal. A business account required to submit ECA application. For more information visit https://www.ontario.ca/page/environmental-compliance-approval
- g. It is unclear if the proposed development will remain as one property. An ECA will be required where the stormwater management services more than one property parcel.

NOTE: Site Plan Approval, or Draft Approval, is required before any Ministry of the Environment and Climate Change (MOECC) application is sent

General Service Design Comments

- The City of Ottawa requests that all new services be located within the existing service trench to minimize necessary road cuts.
- Monitoring manholes should be located within the property near the property line in an accessible location to City forces and free from obstruction (i.e. not a parking).
- Where service length is greater than 30 m between the building and the first maintenance hole / connection, a cleanout is required.
- The City of Ottawa Standard Detail Drawings should be referenced where possible for all work within the Public Right-of-Way.
- The upstream and downstream manhole top of grate and invert elevations are required for all new sewer connections.
- Services crossing the existing watermain or sewers need to clearly provide the obvert/invert elevations to demonstration minimum separation distances. A watermain crossing table may be provided.

Other

Are there are Capital Works Projects scheduled that will impact the application?
Yes No

References and Resources

- As per section 53 of the Professional Engineers Act, O. Reg 941/40, R.S.O. 1990, all documents prepared by engineers must be signed and dated on the seal.
- All required plans are to be submitted on standard A1 size sheets (594mm x 841mm) sheets, utilizing a reasonable and appropriate metric scale as per City of Ottawa Servicing and Grading

Plan Requirements: title blocks are to be placed on the right of the sheets and not along the bottom. Engineering plans may be combined, but the Site Plans must be provided separately. Plans shall include the survey monument used to confirm datum. Information shall be provided to enable a nonsurveyor to locate the survey monument presented by the consultant.

- All required plans & reports are to be provided in *.pdf format (at application submission and for any, and all, re-submissions)
- Please find relevant City of Ottawa Links to Preparing Studies and Plans below: <u>https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans#standards-policies-and-guidelines</u>
- To request City of Ottawa plan(s) or report information please contact the City of Ottawa Information Centre: <u>InformationCentre@ottawa.ca<mailto:InformationCentre@ottawa.ca</u>> (613) 580-2424 ext. 44455
- Geo-Ottawa
 <u>http://maps.ottawa.ca/geoOttawa/</u>

Environmental (Rehman, Sami Sami.Rehman@ottawa.ca)

The subject property is adjacent to an Urban Natural Feature (UNF), "Cambrian Road Woods".

The City's data also identifies a watercourse running through the property (across in west-east direction); what is the nature of the watercourse and will it be relocated?

As such, the proposed development will require an Environmental Impact Study (EIS), as per OP section 4.8.3. The EIS will need to address the following:

-consider the watercourse re-alignment and buffering the impacts to adjacent watercourse/amphibian corridor

-potential impacts of construction and operation of proposal

-some of the impacts include, but not limited to, stormwater, snow storage, noise, lighting, human presence on natural features (i.e. UNF and watercourse/amphibian corridor)

-potential impacts on significant habitat of threatened or endangered species

-adjacent significant woodlands

-adjacent significant wildlife habitat

-review and draw relevant recommendations from the Jock River Reach 1 Subwatershed Plan and Cambrian Wood's Forest Management Plan

-given all the glass and potential design traps proposed with the buildings, review and incorporate design elements from the City's Bird-Safe Design Guidelines into the proposal to avoid bird collisions

- review and draw best practices from the City's Protocol for Wildlife Protection during Construction

- discuss potential impacts from landfill on the proposed development and vice versa; it might be worthwhile seeking input from Trail Rd facility

recommendations to enhance the adjacent natural features and contribute to the urban tree canopy

Please refer to the EIS requirements for further details: <u>Environmental Impact Statement Guidelines</u> (ottawa.ca)

If a Tree Conservation Report (TCR) is required, it can be combined with EIS to avoid duplications. I will default to the Forestry Planner to comment on the TCR requirement.

As for the proposed site plan, the City will be focusing on impacts on the realigned watercourse/amphibian corridor. Generally, we will be looking for a 10m setback. If there is interest in reducing that setback to 5m, then we'd be looking to naturalize the interface between the proposal and the corridor with locally appropriate native trees/shrubs/plants to mitigate impacts.

Staff are encouraged to hear that the proposed development admires the adjacent UNF but also have concerns with lighting and the patio facing the UNF. The proposal should be designed and operated to avoid impacts on the UNF, as well as, avoiding potential future wildlife-human conflicts. This maybe especially relevant if daycare is considered as a future use. Staff will be looking for the EIS to review potential impacts and provide recommendations and setbacks to demonstrate no negative impacts.

I would also recommend consulting with the Rideau Valley Conservation Authority to determine if any permits or approvals are required under their regulations.

Park (Krabicka, Jeannette Jeannette.Krabicka@ottawa.ca)

- a. The amount of parkland dedication that is required is to be calculated as per the City of Ottawa Parkland Dedication By-law No 2022-280.
- Parkland Dedication By-law, Section 11(2)(c) states: No conveyance of land or payment of cash-in-lieu under this by-law is required in the case of the development or redevelopment of:
 - a. a place of worship, excluding any ancillary uses as defined by the Zoning By-law
- c. "Ancillary Use" as defined by the Zoning By-law: Ancillary Use means a listed, permitted land use that is additional, secondary and complementary to a permitted principal use, but not accessory to the permitted principal use.
- d. The potential ancillary uses identified during the pre-application consultation meeting included community rentals and day care. Both of these proposed uses are considered commercial uses; therefore, the spaces attributed to these uses are subject to parkland dedication.
- e. However, Parkland Dedication By-law, Section 11(1) states:

The conveyance of parkland or the payment of cash-in-lieu of parkland is not required for development or redevelopment where it is known, or can be demonstrated, that the required parkland conveyance or cash-in-lieu of parkland, or combination thereof, has been previously satisfied in accordance with the Planning Act, unless:

- a. there is a change in the proposed development or redevelopment that would increase the density providing a net dwelling unit gain;
- b. the proposed development or redevelopment increases the gross floor area of a nonresidential use; or

- c. land originally proposed for development or redevelopment for commercial or industrial purposes is now proposed for development or redevelopment for other purposes that have a higher conveyance requirement pursuant to the rates described herein.
- f. The proposed development is located within a subdivision where the parkland dedication requirement was previously satisfied for the entirety of this parcel/block, calculated at the commercial use rate of 2%. Please refer to the Development Review file D07-16-19-0011 ph3. Furthermore, sub-sections a, b, and c of Section 11(1) do not apply to the proposed development.
- g. Therefore, based on Section 11(1) of the By-law and the proposed use as presented in the Preapplication Consultation meeting, this potential Site Plan Application proposal may be considered exempt from a parkland dedication requirement.
- h. Please note that the park comments are preliminary and will be finalized (and subject to change) upon receipt of the development application. Additionally, if the proposed land use changes then the parkland dedication requirement be re-evaluated accordingly.

City Surveyor

- The determination of property boundaries, minimum setbacks and other regulatory constraints are a critical component of development. An Ontario Land Surveyor (O.L.S.) needs to be consulted at the outset of a project to ensure properties are properly defined and can be used as the geospatial framework for the development.
- Topographic details may also be required for a project and should be either carried out by the O.L.S. that has provided the Legal Survey or done in consultation with the O.L.S. to ensure that the project is integrated to the appropriate control network.

Questions regarding the above requirements can be directed to the City's Surveyor, Bill Harper, at <u>Bill.Harper@ottawa.ca</u>

Submission requirements

- Plans are to be standard A1 size (594 mm x 841 mm) or Arch D size (609.6 mm x 914.4 mm) sheets, dimensioned in metric and utilizing an appropriate Metric scale (1:200, 1:250, 1:300, 1:400 or 1:500).
- All PDF submitted documents are to be unlocked and flattened.
- These pre-con comments are valid for one year. If you submit a development application(s) after this time, you may be required to meet for another pre-consultation meeting and/or the submission requirements may change. You are as well encouraged to contact us for a follow-up meeting if the plan/concept will be further refined.



APPENDIX J

CORRESPONDENCE WITH MECP

Nikhil Parmar

From:	Hook, Jordan (MECP) <jordan.hook@ontario.ca></jordan.hook@ontario.ca>
Sent:	October 6, 2023 9:02 AM
То:	Nicole Wells
Subject:	RE: ECA Application - 3555 Borrisokane Rd, Ottawa

Hi Nicole,

Thank you for the additional information. This will require an ECA.

Thanks,

Jordan

From: Nicole Wells <nwells@pearsoneng.com>
Sent: October 4, 2023 5:03 PM
To: Hook, Jordan (MECP) <Jordan.Hook@ontario.ca>
Subject: RE: ECA Application - 3555 Borrisokane Rd, Ottawa

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Hi Jordan,

Please see my responses below in red. The building is a community church so it would be institutional. Zoning is light industrial with exception 304, which allows a place of worship. Let me know if you need any further info.

Thank you,

Nicole Wells, C.E.T. Project Coordinator/Design Technologist



OTTAWA OFFICE 900 Morrison Drive, Unit 100 Ottawa, ON K2H 8K7 P: 613-416-1232 ext. 249 <u>nwells@pearsoneng.com</u> <u>pearsoneng.com</u>

 BARRIE
 GTA
 OWEN SOUND

 705-719-4785
 905-597-5572
 226-256-2957

From: Hook, Jordan (MECP) <<u>Jordan.Hook@ontario.ca</u>> Sent: Wednesday, October 4, 2023 2:34 PM Hi Nicole,

I was forwarded your email from Kyle. I am an EO at the Ottawa District Office and can answer your question.

I have a few questions for you to help me determine if an ECA is required.

- 1. Will there be a stormwater management facility (based on the attached plans I don't see one)? We are proposing a 300mm orifice tube with surface ponding for quantity control and an OGS for quality control. However, we are in the process of addressing city comments which may result in the addition of some additional underground tanks.
- 2. Is this a combined system or only stormwater being collected and discharged to the one pipe on Borrisokane Road? Only stormwater being discharged.
- 3. Could you confirm if this is one lot or if there are multiple lots that would be part of the one discharge? This is for 1 lot. the other lots would be under separate SPAs.

Thank you,

Jordan

From: Nicole Wells <<u>nwells@pearsoneng.com</u>> Sent: September 25, 2023 2:53 PM To: Straberger, Kyle (He/Him) (MECP) <<u>Kyle.Straberger@ontario.ca</u>> Subject: ECA Application - 3555 Borrisokane Rd, Ottawa

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender. Hi Kyle,

We have a site at 3555 Borrisokane Rd in Ottawa where we are discharging our site's stormwater to the municipal ditch along Borrisokane Rd (Servicing and Catchment plans attached for reference). Can you confirm if we will need an ECA for the proposed outlet and for the flows directed to adjacent properties?

Thank you,

Nicole Wells, C.E.T. Project Coordinator/Design Technologist



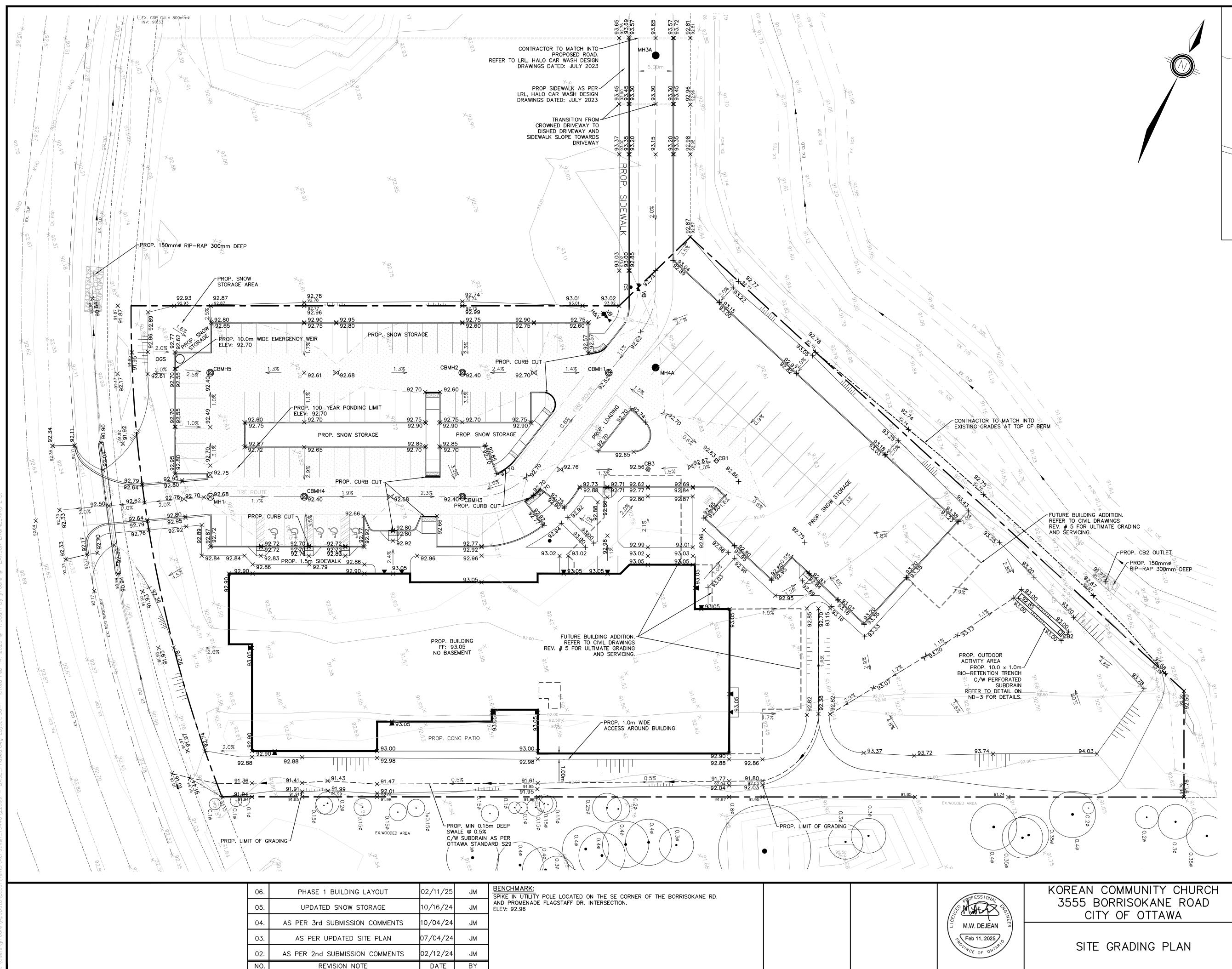
OTTAWA OFFICE 900 Morrison Drive, Unit 100 Ottawa, ON K2H 8K7 P: 613-416-1232 ext. 249 <u>nwells@pearsoneng.com</u> <u>pearsoneng.com</u>

BARRIE	GTA	OWEN SOUND
705-719-4785	905-597-5572	226-256-2957

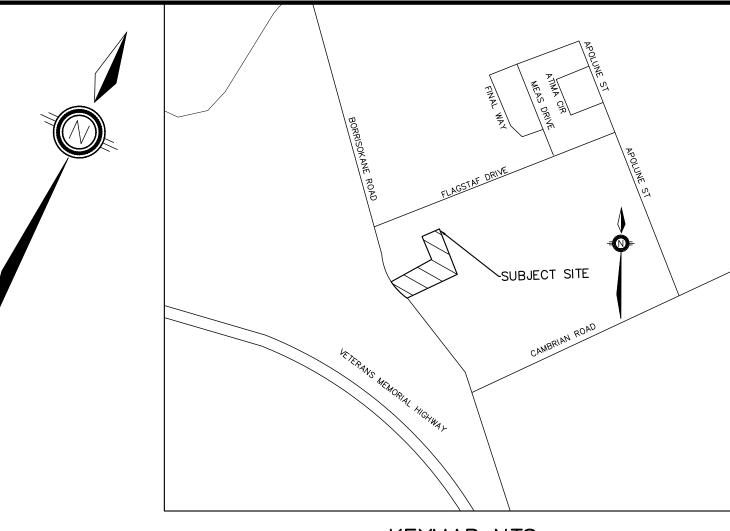


APPENDIX K

PEARSON ENGINEERING DRAWINGS



<u>HMARK:</u> IN UTILITY POLE LOCATED ON THE SE CORNER OF THE BORRISOKANE RD. PROMENADE FLAGSTAFF DR. INTERSECTION. 92.96			PROFESSIONAL CHIGNNER	K
		$\neg M.W. DEJEAN $		



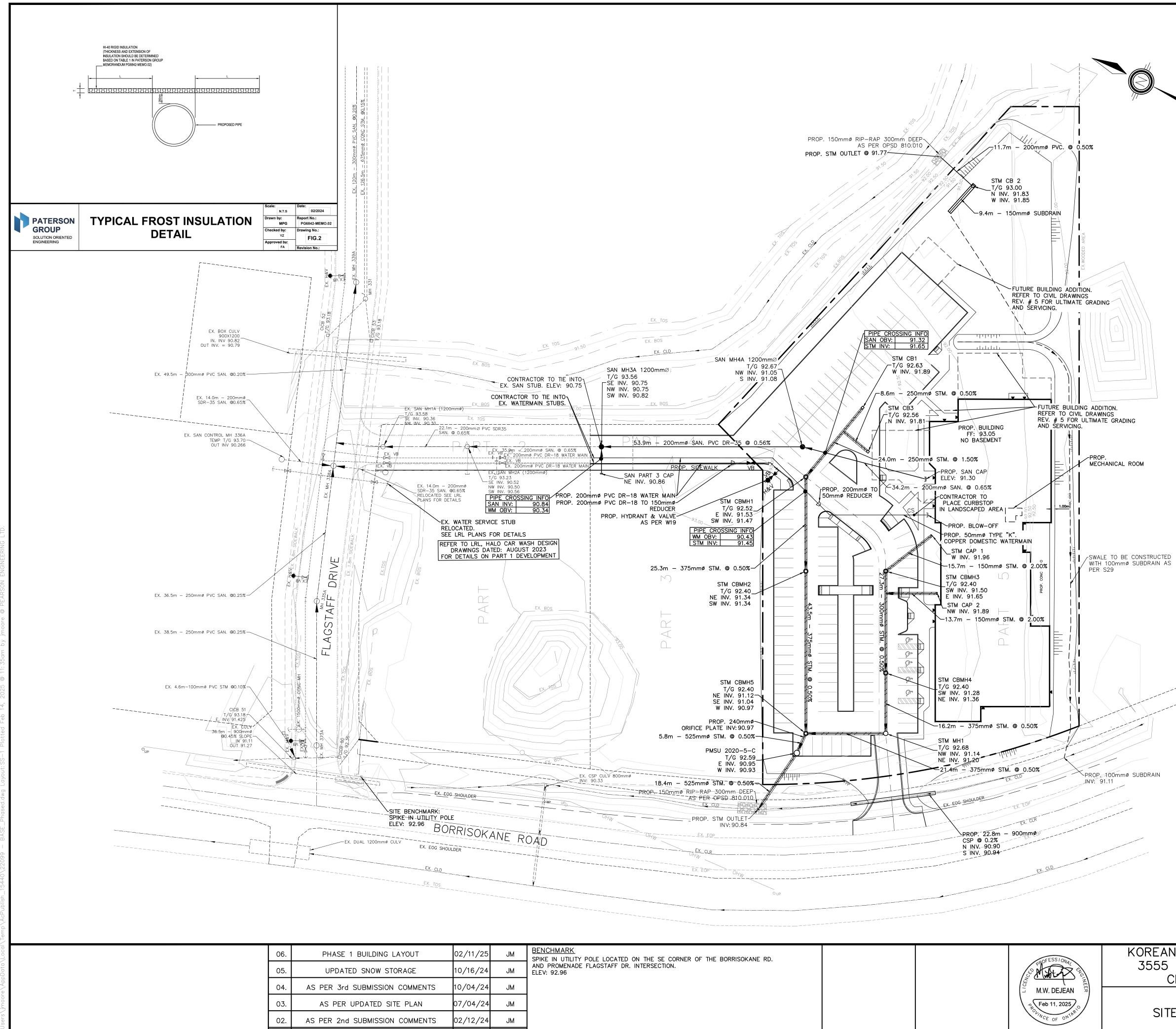
<u>KEYMAP NTS</u>

LEGE	END			
	CATCH BASIN			
	DOUBLE CATCH BASIN			
СВМН	CATCH BASIN			
OMH	STORM MANHOLE			
MH •	SANITARY MANHOLE			
—	SERVICE CAP			
H&∨ ∳	FIRE HYDRANT			
VB	WATER VALVE			
• cs	CURB STOP W/ SERVICE			
×254.63 254.09	PROPOSED ELEVATION EXISTING ELEVATION			
1.5%	PROPOSED DIRECTION AND GRADE			
	-BACK OF CURB			
=	-EDGE OF PAVEMENT			
	CURB CUT LOCATION			
) (HIGH POINT			
	MAX 3:1			
	MATCH LINE			
	100-YEAR PONDING LIMIT ELEV: 92.70			
	TACTILE PLATE			
9 _{7.68}	EX. TOPO ELEVATIONS			
4	OVERHEAD DOOR			
4				
DING NOTES:				

<u>SITE GRADI</u>

- NO EXCESS DRAINAGE, DURING OR AFTER CONSTRUCTION TO BE DIRECTED TOWARDS NEIGHBORING PROPERTIES. 2. EXISTING DRAINAGE PATTERNS TO BE MAINTAINED.
- EXISTING DRAINAGE PATTERNS TO BE MAINTAINED.
 ENSURE POSITIVE DRAINAGE AWAY FROM FOUNDATION
 LANDSCAPE AREAS TO HAVE MINIMUM 2%, MAXIMUM 7% SLOPE UNLESS TERRACED AT 3:1 MAXIMUM.
 NO ALTERATION TO EXISTING GRADES ON PROPERTY LINES.
 USF TO BE MINIMUM 1.5m BELOW FINISHED GRADE OR INSULATION IS REQUIRED.
- OSP TO BE MINIMOM T.SIT BELOW FINISHED GRADE OR INSOLATION IS REQUIRED.
 TOF TO BE MINIMUM 0.15m ABOVE FINISHED GRADE.
 SUNKEN ENTRANCE DRAIN ANNOT CONNECT DIRECTLY TO WEEPING TILE. ANY WATER IN SUNKEN ENTRANCE TO DRAIN DOWN INTO PERMEABLE FILL WHERE IT WILL BE PICKED UP BY WEEPING TILE SYSTEM SYSTEM. 9. REFER TO LANDSCAPING PLAN FOR FENCING DETAILS

	E		NEE	RIN	١G
C	PEAF	RSONENG.	СОМ РН.	705.719	.4785
DESIGNED BY	NW/MWD	HORIZ SCALE	1: 300	PROJECT #	22099
DRAWN BY	JM	VERT SCALE	N/A	DRAWING #	SG-1
CHECKED BY	MWD	DATE	JUNE 2023	REVISION #	6

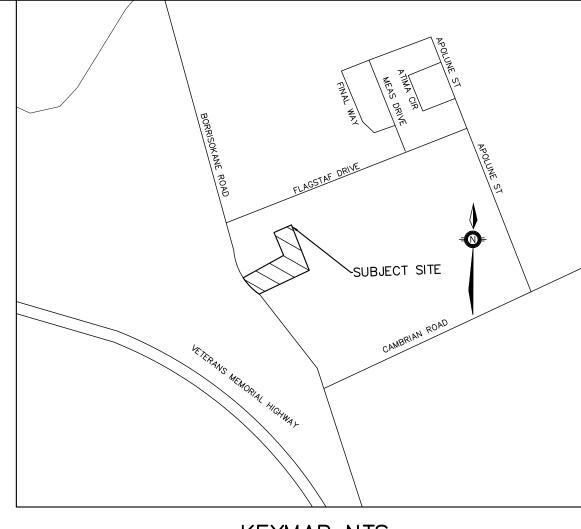


NO.

REVISION NOTE

DATE BY

I <u>CHMARK</u> E IN UTILITY POLE LOCATED ON THE SE CORNER OF THE BORRISOKANE RD. PROMENADE FLAGSTAFF DR. INTERSECTION. /: 92.96		CS A WERE STONAL	k
		Feb 11, 2025	



<u>KEYMAP NTS</u>

<u>LEGEND</u>

	CATCH BASIN
	DOUBLE CATCH BASIN
	CATCH BASIN
OMH	STORM MANHOLE
MH	SANITARY MANHOLE
-	SERVICE CAP
+ ^{H&V}	FIRE HYDRANT
VB	WATER VALVE
• CS	CURB STOP W/ SERVICE
×254.63 _{254.09}	PROPOSED ELEVATION EXISTING ELEVATION
<u>1.5%</u>	PROPOSED DIRECTION AND GRADE
	-BACK OF CURB
	-EDGE OF PAVEMENT
	CURB CUT LOCATION
) (HIGH POINT
	PROPOSED PIPE INSULATION AS PER SS-1 DETAIL
	OVERHEAD DOOR
A 1	ENTRY LOCATION

SITE SERVICING NOTES:

CHECKED BY

1. OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM CITY OF OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM CITY OF OTTAWA BEFORE COMMENCING WORK.
 REFER TO CITY OF OTTAWA STANDARD R10 FOR ASPHALT TIE INS.
 BACKWATER VALVES TO BE INSTALLED AS PER CITY OF OTTAWA STANDARD S14, AND S14.1 OR S14.2
 EXISTING SERVICES TO BE BLANKED AT MAIN.
 THERMAL INSULATION TO BE PROVIDED FOR WATER SERVICES LESS THAN 2.4m FROM OPEN STRUCTURES AS PER CITY OF OTTAWA STANDARD W23.
 WATER SERVICE TO HAVE MORE THAN 2.4m OF COVER OR BE INSULATED AS PER CITY OF OTTAWA STANDARD DRAWING W22.
 SUNKEN ENTRANCE DRAIN CANNOT CONNECT DIRECTLY TO WEEPING TILE. ANY WATER IN SUNKEN ENTRANCE TO DRAIN DOWN INTO PERMEABLE FILL WHERE IT WILL BE PICKED UP BY WEEPING

- INTO PERMEABLE FILL WHERE IT WILL BE PICKED UP BY WEEPING TILE SYSTEM.

KOREAN COMMUNITY CHURCH 3555 BORRISOKANE ROAD CITY OF OTTAWA

SITE SERVICING PLAN

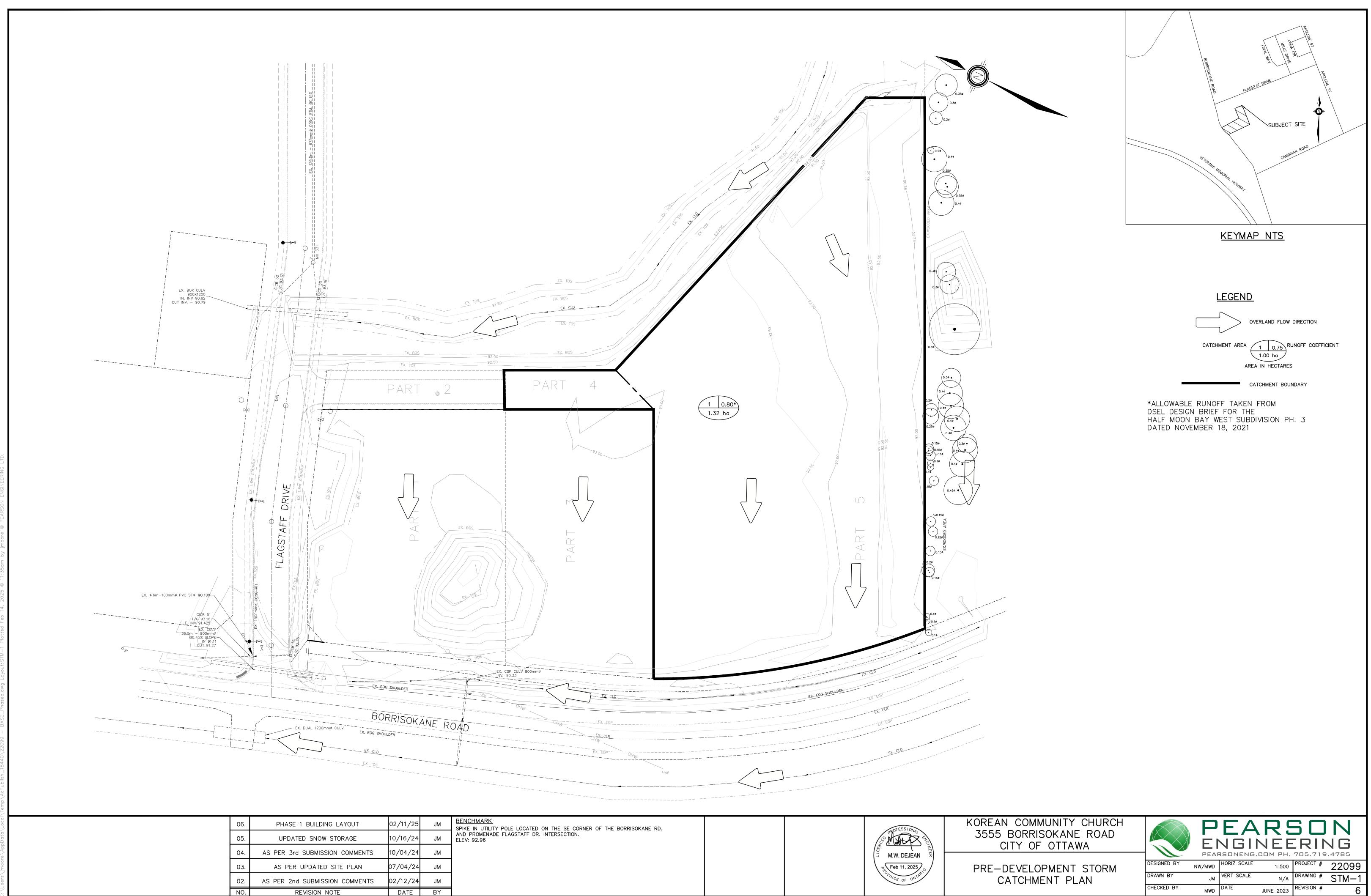
			VÈE	RIN	
C	PEAF	RSONENG.C	COM PH.	705.719	.4785
DESIGNED BY	NW/MWD	HORIZ SCALE	1:500	PROJECT #	22099
DRAWN BY	JM	VERT SCALE	N/A	DRAWING #	SS-1

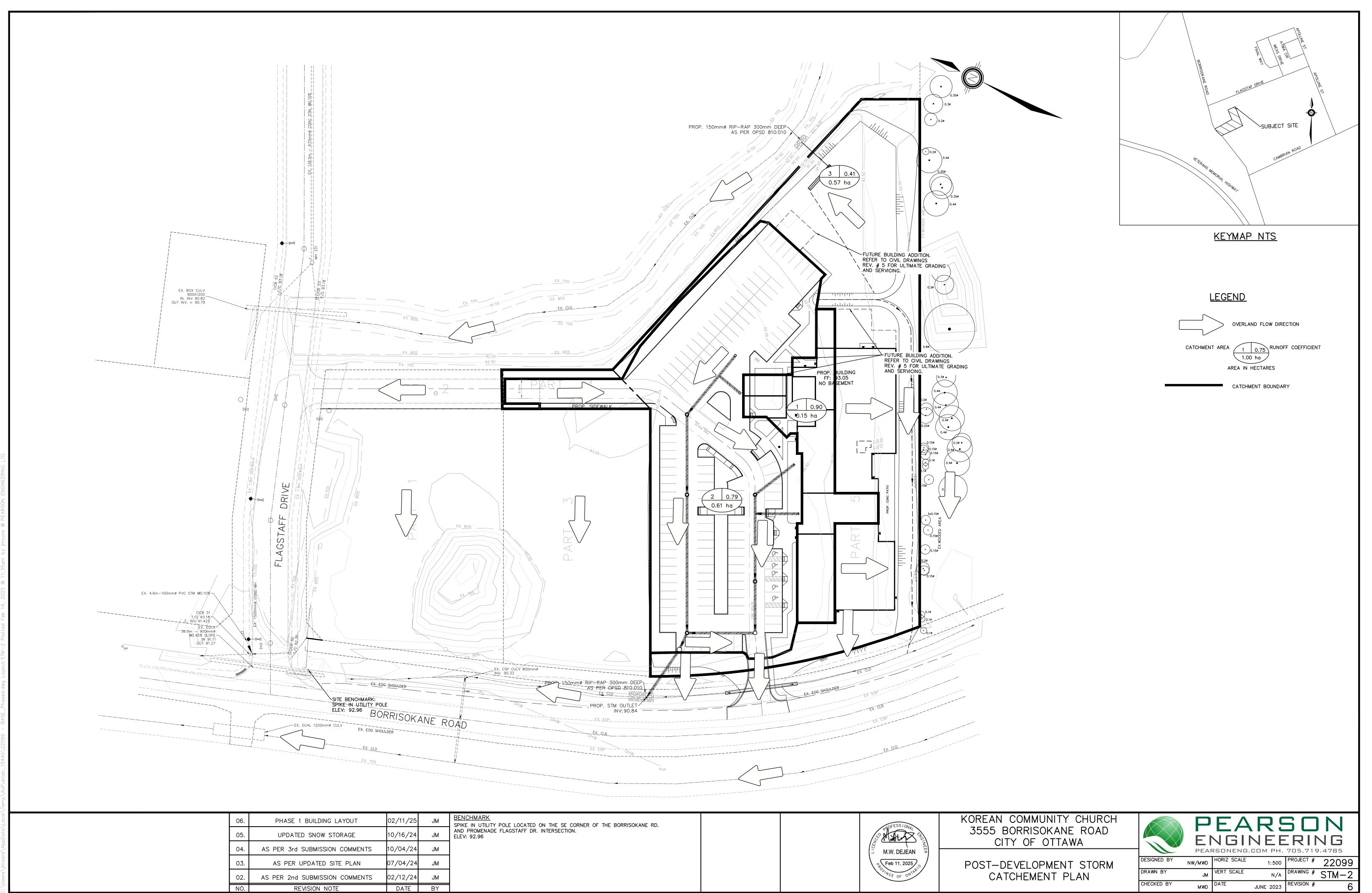
JUNE 2023

DATE

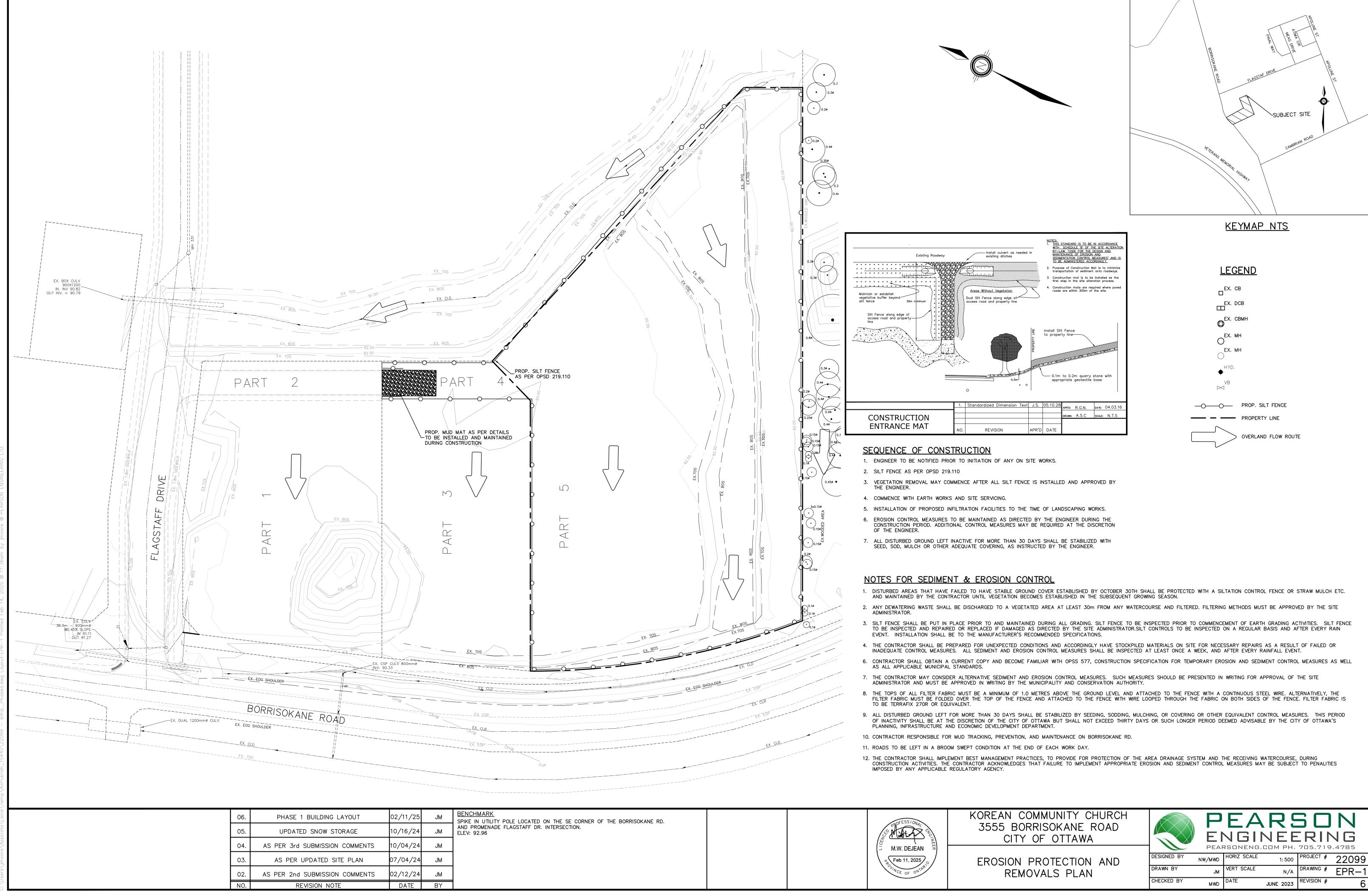
MWD

REVISION #





NCHMARK KE IN UTILITY POLE LOCATED ON THE SE CORNER OF THE BORRISOKANE RD. PROMENADE FLAGSTAFF DR. INTERSECTION. V: 92.96		PBOFESS/ONAL FILE	
		Feb 11, 2025	



ICHMARK	
E IN UTILITY POLE LOCATED ON THE SE CORNER OF THE BORRISOKANE RD.	
PROMENADE FLAGSTAFF DR. INTERSECTION.	
/: 92.96	

				OF THE FENCE		
BE STABILIZED BY SEEDING, SODDING, MULCH TAWA BUT SHALL NOT EXCEED THIRTY DAYS TMENT.	-					
MAINTENANCE ON BORRISOKANE RD.						
OF EACH WORK DAY.						
ES, TO PROVIDE FOR PROTECTION OF THE A						ES
	•					
MUNITY CHURCH		D	FΛ			NI
MUNITY CHURCH RISOKANE ROAD		A	EA			
		A	EA			
RISOKANE ROAD			NGII	NEE	705.719	٧G
RISOKANE ROAD	DESIGNED BY		NGII RSONENG. HORIZ SCALE	NEE	PROJECT #	٧G
RISOKANE ROAD OF OTTAWA	DESIGNED BY DRAWN BY	PEA	NGII	NEE Com ph.	705.719	NG 0.4785
RISOKANE ROAD OF OTTAWA ROTECTION AND			NGII RSONENG. HORIZ SCALE	N Е Е сом рн. 1:500	PROJECT #	22099
RISOKANE ROAD FOTTAWA	DRAWN BY	PEAR NW/MWD JM	NGII RSONENG. HORIZ SCALE VERT SCALE	NЕЕ сомрн. 1:500 N/A	PROJECT #	22099 EPR-1