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File 117159

July 24, 2019

Shawn Postma, BES MCIP RPP
Senior Policy Planner
Town of The Blue Mountains
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Re: Blue Vista Subdivision, Town of The Blue Mountains
Response to Comment for Draft Plan Application

Dear Shawn:

We are in receipt of Town of The Blue Mountains Planning Review Committee Comments for the Blue Vista Application for Zoning By-Law Amendment and Draft Plan of Subdivision for Part Lot 17, Concession 1 in the Town of The Blue Mountains, Town file #P2737, dated June 11, 2019.

We are pleased to respond to the comments in the same order in which they were presented.

GENERAL

a. The developer agrees to provide a Golf Spray Analysis in support of the proposed development and is in the process of engaging a qualified consultant to complete the work. The report will be submitted to the County and Town upon completion.

PARKS AND TRAILS

a. A response will be provided by others under separate cover.

b. A response will be provided by others under separate cover.

ROADS AND TRAFFIC

a. Section 4.5.13 of the Town's Engineering Standards (2009) permit cul-de-sacs on low volume local roads. The developer will propose that Block 141 be constructed and utilized as a secondary access restricted to emergency use only. With the secondary access, the Town's standards permit up to 80 dwelling units on the cul-de-sac. There is a total of 42 lots on Street B.

   The cul-de-sacs are proposed to be constructed in accordance with Town standards which includes a 20 m radius road allowance and a minimum edge of pavement radius of 15 m to allow for solid waste collection and road maintenance.

The developer is proposing to loop the watermain from Street A through Block 142 and Block 141 to provide a connection to Street B. This will also permit for the watermain to be extended north to the Crestview Crescent (Plateau East) subdivision.

b. An appropriately sized culvert in accordance with Town standards will be provided for the water crossing. The watercourse is not considered fish habitat.

c. An addendum letter has been prepared under separate cover to consider the traffic impacts of increasing the density to 180 units. As documented in the addendum letter, there are no changes to the findings of the original TIS when considering the increase 180 units, with the exception of the recommended northbound left turn lane on Grey Road 21 at the site access, the timing for which is accelerated to the 2025 horizon.

d. The intersection of Grey Road 19 with Crosswind Boulevard was not considered in the study recognizing that it had been explicitly considered in the *Windfall Traffic Impact Study*, dated September 25, 2018 (submitted only 5 months prior to the submission of the *Blue Vista TIS*). The *Windfall TIS* was comprehensive in its approach and considered all of the area developments, including Blue Vista (121 single family units), in the derivation of traffic projections contained therein. While it is acknowledged that the number of units will likely increase to 133 (or up to 180 as addressed through the addendum), the resulting increase in traffic volumes will not have a significant bearing on the Grey Road 19/Crosswinds intersection given its location in context of Blue Vista. Furthermore, as noted in the *Windfall TIS*, roundabout control will be implemented at Grey Road 19/Crosswinds Boulevard and excellent levels of service (LOS A with average delays of 3 to 4 seconds) will be provided through the 2035 horizon year.

   With respect to the intersection of Crosswind Boulevard with Street C, the intersection operations were not considered recognizing that the traffic volumes on the local road network serving the various residential subdivisions in the area are not such that would cause poor operating conditions. The intersection is expected to operate as a typical residential intersection under stop control. As per Figure 10 of the *Blue Vista TIS*, 15 to 25 vehicles per hour per direction are expected to proceed westerly from Blue Vista to Street C. In reviewing the 2035 traffic projections on Crosswinds Boulevard as presented in Figure 18 of the *Windfall TIS*, peak hour peak direction volumes are in the order of 250 to 300 vehicles immediately north of Grey Road 19 at the planned roundabout, and 130 to 200 vehicles immediately east of Grey Road 19 at Jozo Weider Boulevard. As there are significant residential draws between these intersections and that of Street C with Crosswinds Boulevard (both within Windfall and Second Nature), volumes will be significantly lower at the intersection and are expected to be reflective of a local street, characterized by the abutting development.

e. Acknowledged. A temporary second access will be considered to provide emergency access until such time that the Second Nature connection is constructed.

f. Table 9 pertains only to the distribution of Blue Vista traffic and thus does not address the use of Blue Vista Street A by Second Nature traffic. While the TIS considered reassignment of area development traffic resulting from the connection of Crosswinds Boulevard, it did not specifically consider the use of Street A by Second Nature (the intent was to maximize the volumes at the respective development primary access points to consider the worst case). As per Figure 13 of the *Blue Vista TIS*, volumes on Street A at Grey Road 21 are in the order of 35 to 60 vehicles per direction; as per Table 12 of the *Blue Vista TIS*, the intersection of Street A and Grey Road 21 is expected to operate at less than 7% capacity in 2025. As such, there is ample capacity on the local road system to readily accommodate any additional volumes associated with Second Nature.

g. Level of Service C is widely accepted as reflecting average to good operating conditions with reasonable delays (15 to 25 seconds at unsignalized intersections and 20 to 35 seconds at signalized intersections). In general, to maintain a Level of Service A or B as network volumes increase would require considerable (and ongoing) infrastructure improvements beyond the reach of local municipalities (or significant overbuild at the time of implementation). As per the reported v/c ratios, all intersection movements will operate at 60% or less of their respective capacities in the 2035 horizon, reflective of considerable remaining capacity.

   With respect to the planned roundabout at the intersection of Grey Road 19 with Grey Road 21 it is noted that construction of such is anticipated in 2020/2021 (design is underway with both Grey County and Simcoe County). Thus, the roundabout will be in place well in advance of the Blue Vista development. Notwithstanding, we have revisited the 2025 horizon (year of full build-out for Blue Vista) considering the current intersection configuration and control, as opposed to a roundabout, and traffic volumes reflective of 180 units at Blue Vista (as per the addendum). The results are as follows (assuming optimized signal timings):

   - Friday peak hour under future background conditions (ie. without Blue Vista): the overall intersection will operate at a level of service E (59 second average delay) with the WB shared movement experiencing LOS E (74 seconds) and the NB left experiencing LOS F (155 seconds);
   - Friday peak hour under future total conditions (ie. with Blue Vista): the overall intersection will operate at a level of service E with the WB shared movement and NB left at LOS F (117 and 167 seconds respectively);
   - Saturday peak hour under future background conditions (ie. without Blue Vista): the overall intersection will operate at a level of service D (48 second average delay) with the WB shared movement experiencing LOS E (60 seconds) and the NB left experiencing LOS F (117 seconds); and
   - Saturday peak hour under future total conditions (ie. with Blue Vista): the overall intersection will operate at LOS E (58 second average delay) with the WB shared movement experiencing LOS E (78 seconds) and the NB left experiencing LOS F (145 seconds).

In comparing the background to the total conditions (ie. without and with Blue Vista), delays are increased as a result of the additional Blue Vista traffic and the critical moves remain as such. While increased delays and LOS E or F are not desirable, they are not uncommon during the peak travel demands in the area; they do further illustrate the need for improvements which will be realized through the roundabout control.

h. We are not aware of any regular monitoring of traffic volumes through the Village area from which a comparison of actual vs projections can be made. This could only be done post development; whereas counts and studies are typically done in support of development.
We do note that the peak periods considered reflect the busy winter season and weekend (eg. Friday PM peak and Saturday peak) and thus can be considered the worst case in that volumes during the remainder of the week, and during the remainder of the year will be somewhat less. The studies undertaken have also traditionally taken conservative approaches to estimating volumes and reflect the information known at the time.

i. The need for and timing of the northbound left turn lane at the Blue Vista access is somewhat dependent on the future traffic volumes on GR21. If volumes are lower than expected, the need for a left turn lane may be delayed; conversely, if the volumes are higher than expected, the need may be accelerated. The initial TIS (which considered 133 units) identified the need for a left turn lane by the 2030 horizon year (i.e. 5-years after full build-out); whereas the addendum letter (which considered 180 units) identified the need in 2025. In this respect, full build-out (or a unit count between 134 and 180) triggers the need for a left turn lane.

FUNCTIONAL SERVICING

a. Acknowledged. Please provide Tatham Engineering with the new sanitary modelling information.

b. Acknowledged. Please provide Tatham Engineering with the Cole Engineering report and model.

c. Looping of watermain on Street ‘B’ is not anticipated to provide any significant improvement to domestic pressures or flows available for firefighting. A watermain loop will provide some redundancy of supply should a watermain break occur along Street ‘B’ and may make it easier for the Town’s operating staff to maintain. Re-designing Street ‘B’ is not warranted from a water servicing standpoint only. The watermain on Street B can be looped via Grey Road 21 to Street A and through Block 137 to Street D as illustrated on the enclosed Fig-4. (Note Block 139 would be shifted to the north side of Lot 66 to provide a more direct connection to Street D).

d. Water demand and watermain network information for Blue Vista were provided to the Town in Appendix B of the FSR. Information from the model for the neighboring Windfall and Second Nature developments can also be provided.

e. A copy of the WaterCAD model used to analyze the Blue Vista water distribution system can be provided to the Town for their use on this file. A future watermain connection to the Crestview Court

subdivision at Grey Road 21 can be included. The future extension of the watermain along Grey Road 19 is illustrated on the enclosed Fig-4.

f. A water and sanitary service can easily be provided to Block 136 via connections to proposed infrastructure on Street A.

PRELIMINARY STORMWATER MANAGEMENT

a. Acknowledged. Access across Block 135 will be resolved with the Town at detailed design.

b. The capacity of the existing 600 mm diameter CSP culvert under Grey Road 21 has been confirmed to be 1.1 m^3/s; equivalent to the existing 1:25-year return storm peak flow. Under proposed conditions the culvert capacity equates to the 1:100-year return storm peak flow. The MTO design flood frequency criteria (Ministry Directive B-100) for Rural Arterial/Collector roads for a culvert of this type is the 1:25-year return storm peak flow. As such, under both existing and proposed conditions, the culvert satisfies the MTO design flood criteria.

   It is noted that this analysis ignores the storage available upstream of Grey Road 21. If the storage is considered, the design flood frequency criteria of the culvert crossing improves under both existing and proposed conditions.

c. As part of the preliminary stormwater management report for the Blue Vista development, we completed a site-specific hydrologic analysis to confirm post development peak flows are attenuated to pre-development levels at both site outlets. For the 25 mm through 1:100-year return storm, post development peak flows are less than or equal to pre-development levels. Subsequently, we have completed a watershed based hydrologic analysis for Watercourse 1 and Silver Creek to evaluate the impact development will have on each watercourse downstream due to known flooding concerns.

   For Watercourse 1, the overall watershed hydrologic analysis upstream of Grey Road 21 prepared in support of the Second Nature development was updated to include the Blue Vista development. It is noted that the runoff from the Blue Vista property draining to Watercourse 1 does so downstream of Grey Road 21 (twin CSP culverts convey the runoff east under Grey Road 21 south of Incinerator Road). The limiting capacity of Watercourse 1 between Grey Road 21 and Highway 26 is 1.7 m^3/s. The results of the hydrologic analysis demonstrate that proposed peak flows, duration of flooding and frequency of flooding are reduced compared to existing conditions (see attached). As such, the proposed stormwater management plan for the Blue Vista development reduces downstream flooding.

   For Silver Creek, a hydrologic analysis of the entire Silver Creek watershed was completed to compare peak flows at various points of interest downstream of the Blue Vista development. Silver Creek has a total drainage area of approximately 2,022 ha and produces Regional (Timmins) storm peak flows of approximately 105 m^3/s as per the MacLaren Plansearch Study (NVCA, May 1988). The Blue Vista property accounts for approximately 13 ha of the overall watershed and produces Regional (Timmins)

storm peak flows of approximately 1.3 m^3/s. Blue Vista accounts for less than 1% of the total drainage area. The results of the hydrologic analysis confirm that the design storm peak flows at the various points of interest along Silver Creek downstream of Grey Road 21 to Georgian Bay are less than pre-development levels. As such, the proposed stormwater management plan for the Blue Vista development reduces peak flows along Silver Creek for the various design storms.

d. We suggest that an updated stormwater management report with the subsequent hydrologic analysis be distributed to the various agencies for review and approval. The submission will elicit comment from each agency.

e. The input files for the hydrologic analysis will be provided with the updated SWM report.

f. The overall pre-development drainage areas draining to the Grey Road 21 culvert crossing are enclosed for reference.

g. The capacity of the existing 600 mm diameter CSP culvert under Grey Road 21 has been confirmed to be 1.1 m^3/s through the MTO design charts (see enclosed).

h. Under both existing and proposed conditions, the culvert satisfies the MTO design flood criteria for rural arterial/collector roads.

i. The Regional (Timmins) water levels along the tributary watercourse upstream of Grey Road 21 have been illustrated on Figures FM-1 and FM-2 enclosed. The developments (Windfall, Le Scandinave Spa and Blue Vista) are located outside the Regulatory floodplain associated with this tributary watercourse.

j. Runoff from the subject property currently drains to two outlets; Watercourse 1 and a tributary of Silver Creek. Under proposed conditions, runoff will continue to be directed to both existing outlets. However, the total drainage area draining to each outlet will be altered under proposed conditions through development. The updated stormwater management report will be distributed to the various agencies for review and approval. A Schedule C Municipal Class Environmental Assessment is not required. The project will proceed through an equivalent process of public consultation as an EA.

k. The depth and velocity of flow through the major overland flow routes throughout the development will be confirmed at detailed design. If necessary, the storm sewer will be sized to convey additional flow to alleviate flow depths and velocities that do not satisfy the safe access/egress criteria imposed by the CA.

l. See response to comment c above. The extent, duration and frequency of flooding on Watercourse 1 will be reduced under proposed conditions. The peak flows at the various points of interest along Silver Creek downstream of Grey Road 21 are less than pre-development levels. As such, it is our opinion that the proposed development will not adversely impact the downstream drainage systems.

m. As per the NVCA Stormwater Technical Guide (2013) and the MECP Stormwater Management Planning and Design Manual (2003), post development peak flow rates must not exceed pre-development rates for the 1:2-year through 1:100-year return storms. The proposed SWMF provides sufficient peak flow attenuation to control the post development peak flows rates to pre-development levels for all design storms. Under proposed conditions, the Regional (Timmins) peak flow leaving the site will increase by approximately 3% (70 L/s). This is less than 0.07% of the total Regional storm peak flow in Silver Creek.

   When considering the storage available upstream of Grey Road 21 in the open space block, the Regional (Timmins) storm peak flows decrease to 1.66 m^3/s and 1.66 m^3/s under pre and post development conditions, respectively. When considering the available storage, the Regional (Timmins) storm peak flows are controlled to pre-development levels.

n. Access to both SWMF's will be provided to Grey Road 21 under the revised designs.

o. Under proposed conditions, the 1:100-year design storm water level in the tributary has been determined to be at an elevation of 205.83 m ignoring the available storage. This water level is below the proposed SWMF outlet. As such, the tributary water levels will not create a backwater condition on the proposed SWMF outlet. If we consider the available storage, the tributary water levels drop and additional freeboard between the tributary water levels and the SWMF outlet is available.

p. The emergency overflow spillway elevation (208.35 m) is 0.52 m above the Regional (Timmins) storm water level upstream of Grey Road 21 and water will not backup into the SWMF; it will spill over Grey Road 21 into the downstream channel at an elevation of 207.70 m.

q. See response to comment o above.

r. See response to comment o above.

s. The oil grit separator and dry SWMF will operate in a treatment train to provide the requisite level of treatment required. The dry SWMF will provide 60% Total Suspended Solids (TSS) removal or basic level treatment. As such, the oil grit separator is only required to provide 60% (TSS) removal to provide the requisite overall 80% TSS removal at the site outlet. The oil grit separator has been designed to provide 80% TSS removal recognizing the results of recent testing by the MECP has confirmed that the treatment efficiency of oil grit separators may be less than advertised.

t. Additional maintenance details will be provided at detailed design. It is noted that the soils at the location of the dry SWMF are sandy and have an infiltration rate of approximately 80 mm/hr as per the preliminary infiltration assessment completed by Peto MacCallum Ltd. (see attached). As such, the dry pond is not expected to hold water due to the high infiltration rates of the native soils.

ENVIRONMENTAL

a. It is acknowledged the Town will be working with the County of Grey and Conservation Authorities to jointly review the submitted Environmental Report.

GEOTECHNICAL

a. The preliminary geotechnical investigation provides a general understanding of the subsurface soil conditions for the property for the purposes of preliminary planning and design of the proposed residential subdivision. The report includes recommendations for earthworks, house foundations, installation of site services and pavement design. Peto MacCallum Limited (PML) recommends that when design details are available, they should be submitted for review by PML to verify the applicability of the recommendations presented in the geotechnical report and to verify if additional investigation or analysis is required. The geotechnical report did not include any findings or suggestions that the existing soil conditions at the site would preclude construction of a residential subdivision on the property. In this regard, the preliminary geotechnical investigation by PML is sufficient for the purposes of draft plan approval; however, further investigations and/or geotechnical recommendations may be required at the time of final detailed engineering design in support of a Subdivision Agreement.

b. Once draft plan approved, PML will complete additional review of the detailed design to ensure the recommendations in the preliminary geotechnical investigation are still applicable and to determine if additional field investigations are required. As suggested above, the preliminary geotechnical investigation by PML is sufficient for the purposes of draft plan approval.

ARCHAEOLOGICAL

a. No comments were provided.

SUMMARY

We trust the above responses to the review committee comments received provides further clarity with respect to the current development proposal. The developer suggests that any necessary changes to the proposed draft plan and supporting documents be completed following the statutory public meeting, such that all feedback received can be fully considered by the developer prior to making any adjustments to the proposed draft plan.

Yours truly,
Tatham Engineering Limited

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Project Manager
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File 117159

June 29, 2019

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Re: Blue Vista, Town of The Blue Mountains
Traffic Impact Study – Addendum Letter

Dear Samer:

Further to your request and that of Grey County, we have reviewed the Blue Vista development plan in consideration of an increase in the total unit count from 133 to 180 residential units (accomplished through changing select single-detached units to semi-detached units. This brief is an update to our initial Traffic Impact Study dated February 27, 2019, and has been prepared to address the potential transportation impacts associated with the increased unit count.

PROPOSED DEVELOPMENT

Site Trips

With the increase in units, the number of vehicle trips generated by the development has been revisited based on the type of use, development size, and trip generation rates as per the *ITE Trip Generation Manual*[1] *10th Edition*. It is noted that ITE manual does not provide specific trip rates for semi-detached units, therefore the *single family detached* land use code has been applied to all 180 units.

The associated trip rates and trip estimates considering both 133 and 180 unit counts are provided in Table 1, as is the net increase in trips resulting from the unit change. Overall, the proposed development, should it be increased to 180 units, is expected to generate 178 trips during the weekday Friday PM peak hour and 167 trips during the Saturday peak hour, resulting in a net increase in the order of 43 to 46 peak hour trips (total of inbound and outbound trips) over the 133 unit count scenario

[1] *ITE Trip Generation Manual, 10th Edition*. Institute of Transportation Engineers, September 2017.

Table 1: Blue Vista Trip Generation

TRIP RATES / ESTIMATES	SIZE	FRIDAY PM PEAK HOUR			SAT PEAK HOUR		
		IN	OUT	TOTAL	IN	OUT	TOTAL
trip rates	per unit	0.62	0.37	0.99	0.50	0.43	0.93
trip estimates	133 units	83	49	132	67	57	124
trip estimates	180 units	112	66	178	90	77	167
difference	**47 units**	**29**	**17**	**46**	**23**	**20**	**43**

Trip Distribution & Assignment

The resulting site generated traffic volumes (for 180 units) are illustrated in Figure 1, following the same distribution patterns set out in the previous traffic impact study.

TRAFFIC IMPACTS

Intersection Operations

To assess the impacts of the increased traffic volumes resulting from the increased unit count, the study area intersections were investigated for the 2035 future total scenario (this is the greatest horizon year and hence has the greatest associated traffic volumes). The 2035 future total volumes are illustrated in Figure 2.

The results of the operational analyses for the 2035 horizon year are provided in Table 2; the operations under 133 units, as presented in the traffic impact study, have been included in Table 3 for comparison purposes. As indicated, the study area intersections will continue to provide good operating conditions (LOS C or better) through 2035 average delays given the projected background growth and additional traffic associated with the Blue Vista development. In comparing the operational analyses, there is little difference in the results (for the most part the associated delays remain comparable) and thus it can be concluded that the traffic generated by the additional 47 residential units will have no appreciable operational impacts on the surrounding road network.

Table 2: Intersection Operations - 2035 Total Traffic Volumes (180 units)

INTERSECTION, CONTROL & MOVEMENT			FRIDAY PEAK HOUR			SATURDAY PEAK HOUR		
			DELAY	LOS	V/C	DELAY	LOS	V/C
Grey Road 19 & Grey Road 21	roundabout	NB	12	B	0.55	9	A	0.47
		WB	5	A	0.59	5	A	0.60
		SB	9	A	0.34	10	A	0.52
		EB	2	A	0.62	3	A	0.59
		overall	5	A	0.62	6	A	0.59
Monterra Road & Grey Road 21	stop	EB	12	B	0.15	23	C	0.49
Site Access & Grey Road 21	stop	EB	11	B	0.08	12	B	0.11

Table 3: Intersection Operations - 2035 Total Traffic Volumes (133 units)

INTERSECTION, CONTROL & MOVEMENT			FRIDAY PEAK HOUR			SATURDAY PEAK HOUR		
			DELAY	LOS	V/C	DELAY	LOS	V/C
Grey Road 19 & Grey Road 21	roundabout	NB	11	B	0.54	9	A	0.47
		WB	5	A	0.57	5	A	0.60
		SB	8	A	0.33	10	A	0.52
		EB	2	A	0.61	3	A	0.59
		overall	5	A	0.61	6	A	0.60
Monterra Road & Grey Road 21	stop	EB	12	B	0.14	23	C	0.48
Site Access & Grey Road 21	stop	EB	11	B	0.05	12	B	0.07

Left Turn Lane Requirements

The need for an exclusive left turn lane on Grey Road 21 at the site access point to serve turning traffic was again reviewed based on MTO warrants. Under previous conditions (applying the MTO left turn nomograph reflecting 10% left turns in the advancing volume and a design speed of 70 km/h), a northbound left turn lane with 15 metres of storage is warranted under the 2030 total conditions.

Considering the increased unit count, based on MTO warrant criteria (applying the MTO left turn nomograph reflecting 15% left turns in the advancing volume and a design speed of 70 km/h), the same

northbound left turn lane with 15 metres of storage is warranted under the 2025 total conditions. It is noted that the same is warranted under 2030 and 2035 and total conditions. The completed warrants are provided in Figure 3.

Based on MTO geometric design standards, a left turn lane on a two-lane highway with a design speed of 70 km/h requires 40 metres of parallel lane and 115 metres of taper in addition to the storage requirement identified in the MTO warrant graphs. Thus, the left turn lane should be constructed to an overall length of 170 metres (15m storage + 40m parallel + 115m taper).

As indicated, the increase in residential units will trigger the MTO left turn warrant in 2025 as opposed to 2030 horizon. As in the previous study, the timing for such should be confirmed through ongoing monitoring, recognizing that the assessment considers fairly conservative background growth assumptions.

SUMMARY

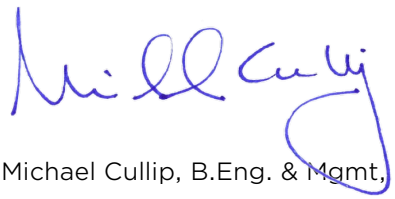
This addendum has assessed the potential traffic impacts associated with the increase from 133 to the upper limit of 180 units, within the Blue Vista residential development. Upon completion and assuming 180 units, the development is expected to generate 178 trips during the weekday Friday PM peak hour and 167 trips during the Saturday peak hour, resulting in a net increase in the order of 43 to 46 peak hour trips (total of inbound and outbound trips) over the 133 unit scenario.

In consideration of the minor trip increase, the unit increase will not have any appreciable operational impacts to the surrounding road network.

With respect to the northbound left turn lane previously warranted under 2030 total volumes, the increase in site traffic will now warrant the same left turn lane under 2025 total volumes. As discussed, the timing for left turn lane should be confirmed through ongoing monitoring.

Should you have any questions or comments on the above, please do not hesitate to contact us.

Yours truly,
Tatham Engineering Limited



Michael Cullip, B.Eng. & Mgmt, M.Eng, P.Eng.
Vice President Head Office Operations
JL/DP

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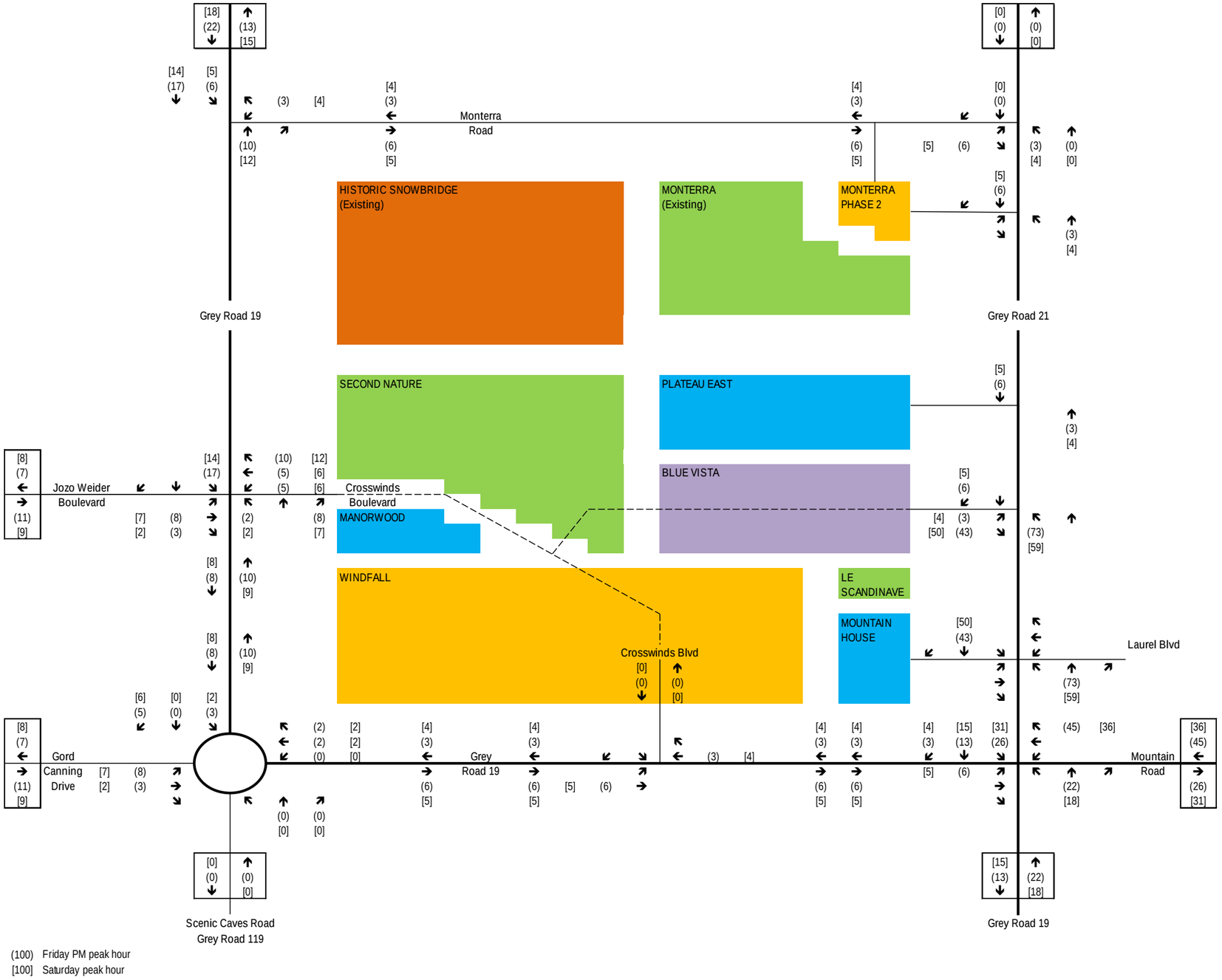
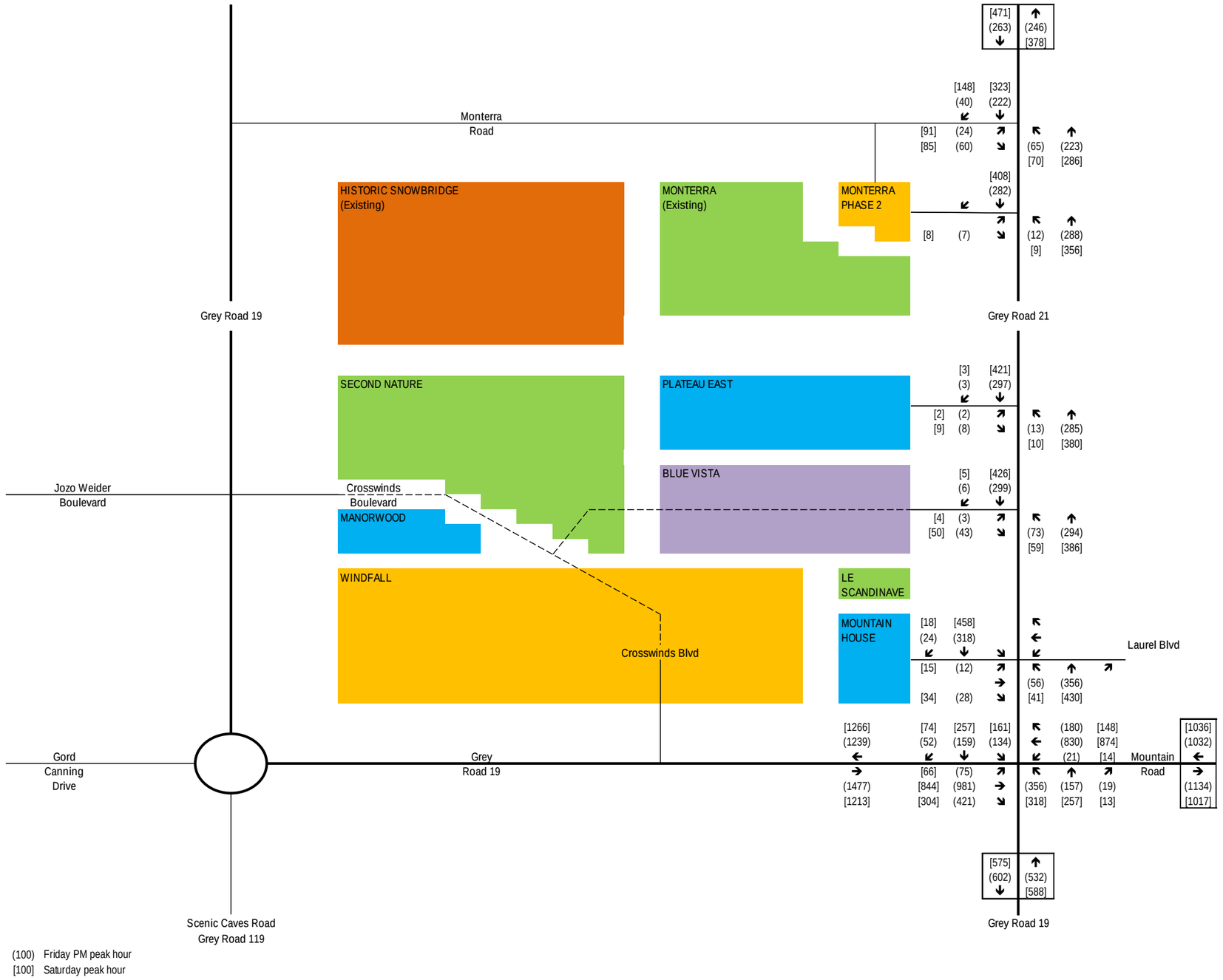


Blue Vista Residential Development

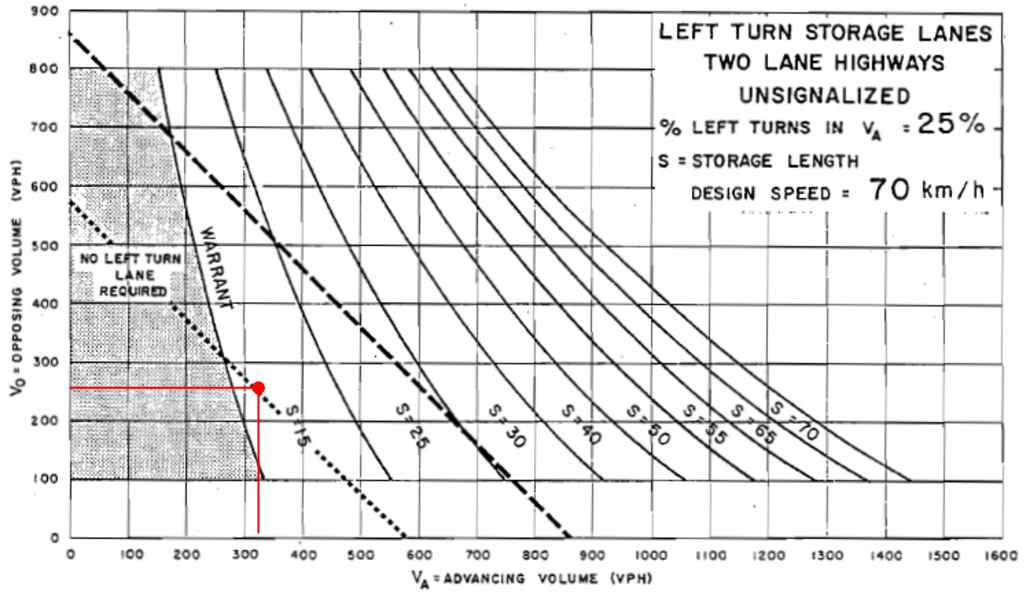
Figure 1: Development Traffic Volumes (180 units)



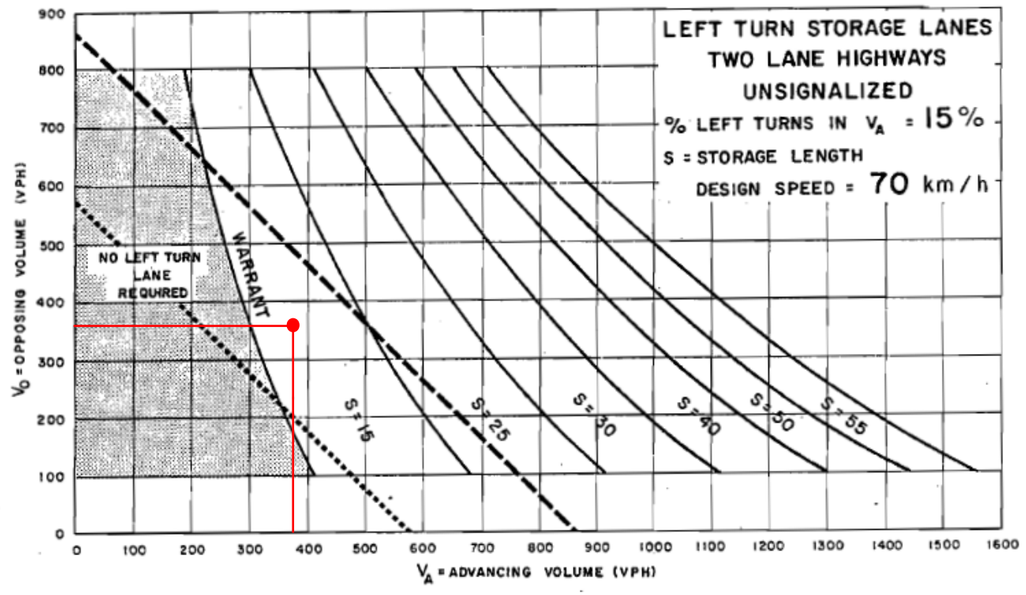
(100) Friday PM peak hour
[100] Saturday peak hour

Blue Vista Residential Development

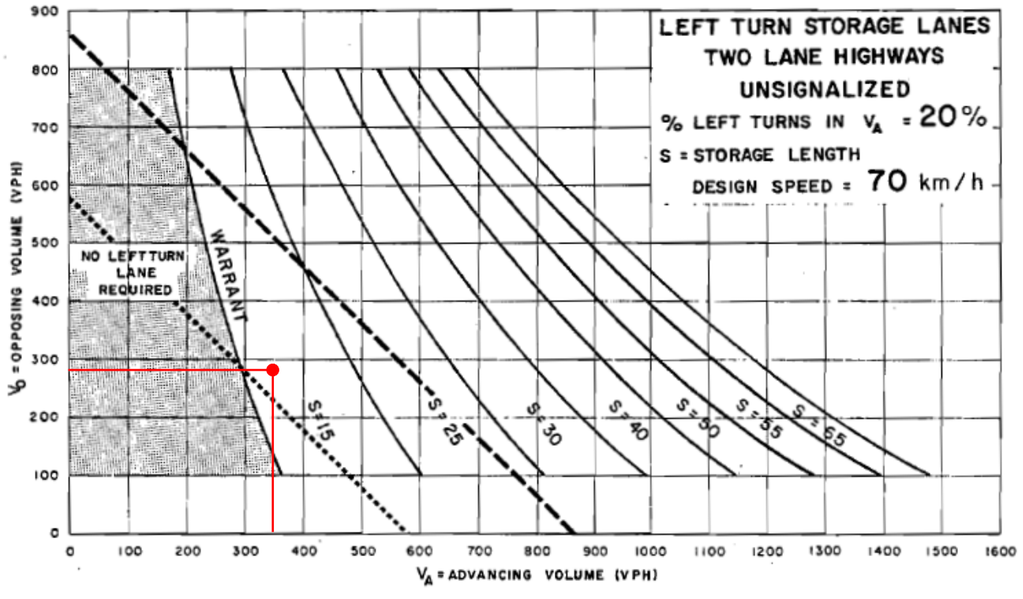
Figure 2: 2035 Total Traffic Volumes



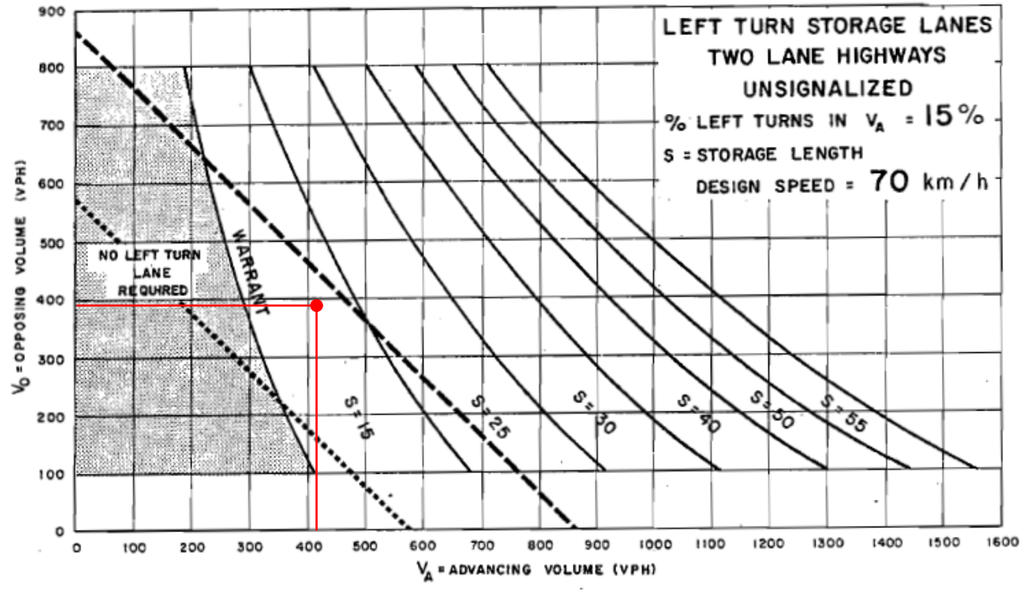
2025 Total Traffic – Friday Peak



2025 Total Traffic – Saturday Peak



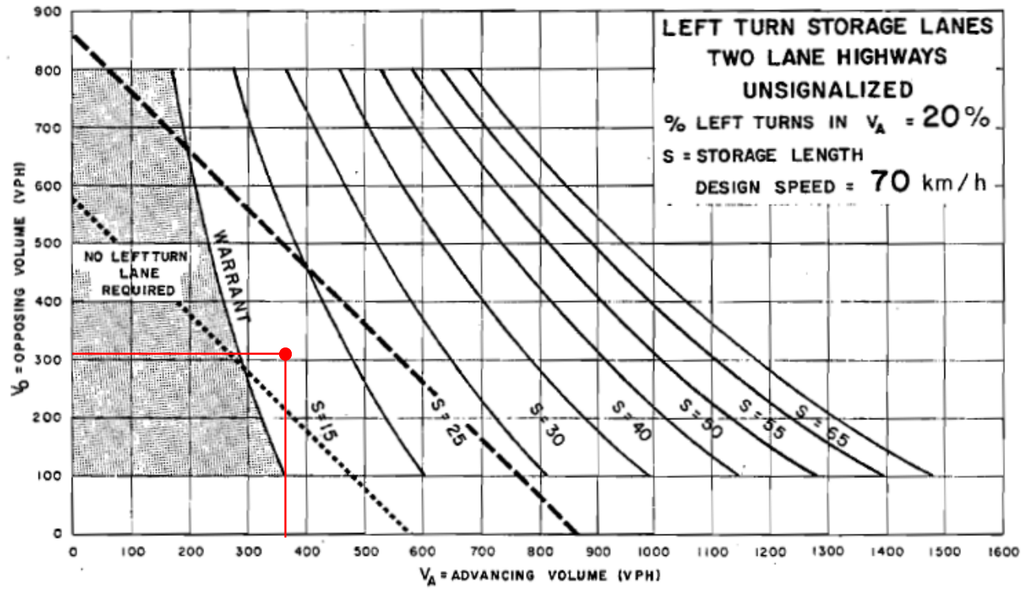
2030 Total Traffic – Friday Peak



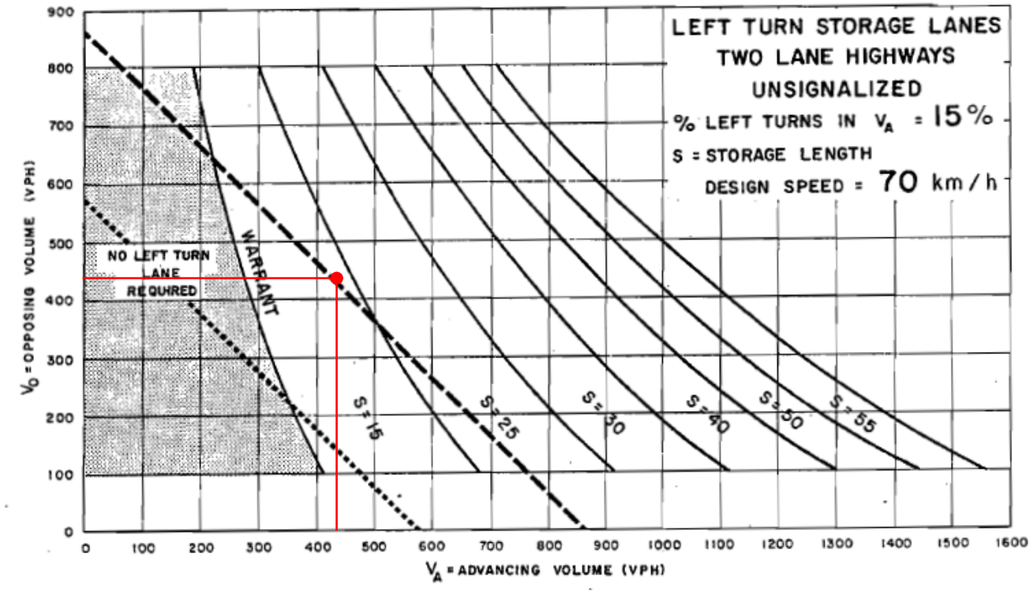
2030 Total Traffic – Saturday Peak

Blue Vista Residential Development

Figure 3A: MTO Left Turn Warrant – GR21 & Site Access



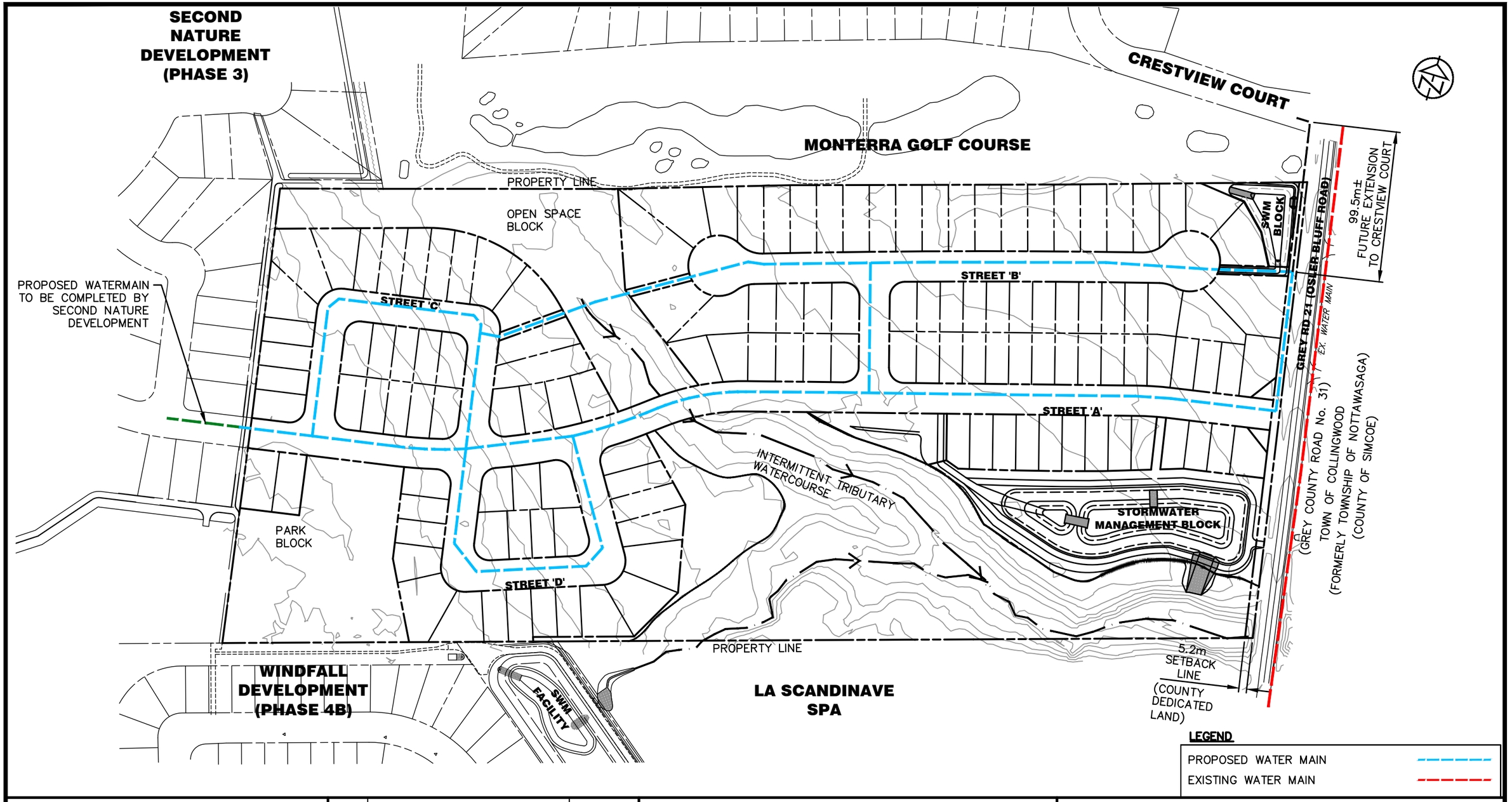
2035 Total Traffic – Friday Peak



2035 Total Traffic – Saturday Peak

Blue Vista Residential Development

Figure 3B: MTO Left Turn Warrant – GR21 & Site Access



NO.	REVISIONS	DATE
2.	TOWN COMMENTS	JULY/19
1.	DRAFT PLAN APPROVAL	FEB/19

BLUE VISTA
TOWN OF THE BLUE MOUNTAINS

OVERALL WATER DISTRIBUTION PLAN

TATHAM ENGINEERING

SCALE:	1 : 2,500		JOB NO. 117159
DESIGN:	JPA	CHECKED: RS	DWG. **FIG-4**
DRAWN:	RD	DATE: NOV/18	

Ministry of Transportation and Communications

Ontario

MINISTRY DIRECTIVE

Program: Provincial Roads

Directive: B-100

Issuing Authority: Executive Director, Highway Engineering Division

Date of Issue: 80 10 16 Effective Date: Immediate

TO: Assistant Deputy Ministers, Executive Directors, Regional Directors, Directors, District Engineers, Regional Managers Drivers and Vehicles, Office Managers

SUBJECT: M.T.C. Design Flood Criteria

ALTERNATIVE INDEX LISTING(S): Design Floods, Design Storms, Flood Criteria, Hydrologic Criteria for Bridges and Other Drainage Facilities.

REFERENCE:
- Ministry of Natural Resources "Provincial Flood Plain Criteria" as approved by Cabinet, 1979 11 02.
- "Proposed Model Policies for Urban Drainage Management", December 1978, produced by Urban Drainage Subcommittee of the Canada-Ontario Agreement on Great Lakes Water Quality.
- Previous statements of M.T.C. flood criteria are hereby cancelled and superseded.

PURPOSE

To state M.T.C. policy on flood criteria for the design of highway structures and other drainage facilities.

BACKGROUND

A need was identified in 1971 for improved M.T.C. design flood criteria. Later, R.E.C.A.P. 11:8 recommended that meetings be held with the Ministry of Natural Resources (M.N.R.) to discuss the effects of its drainage policy on the cost of road drainage facilities. This was done in July 1979.

In the interim, the Ministry had been using design flood criteria which were agreed to by M.N.R. until such time as Cabinet had approved M.N.R.'s own Provincial Flood Plain Criteria. The provincial criteria were approved in November 1979, and the final M.T.C. criteria were subsequently agreed to by M.N.R. in February 1980.

The M.T.C. criteria take account of M.T.C.'s own needs, those of the M.N.R. and those expressed in the Proposed Model Policies for Urban Drainage Management, which are supported by the Ministry of the Environment.

POLICY AND PROCEDURE

The attached M.T.C. Design Flood Criteria will be used for the hydraulic design of M.T.C. water crossings, storm sewers and other drainage facilities.

In cases where a Regional Office is unable to agree with a Conservation Authority or with M.N.R. on mutually acceptable design flood criteria, an opinion and technical support will be obtained from the Drainage and Hydrology Section. If agreement still cannot be reached, the problem will be resolved by discussions between the M.T.C. Highway Engineering Division and the M.N.R. Conservation Authorities Branch.

M.T.C. DESIGN FLOOD CRITERIA

ROAD CLASSIFICATION[5]	BRIDGES & CULVERTS		STORM DRAINAGE SYSTEM[7]		STREAM CHANNELS
	Total span[6] up to 6.0 m	Total span[4] over 6.0 m	Minor System[8]	Major System[8]	
Freeway Urban Arterial	50 year	100 year	10 year	Regional Flood	10 year[9]
Rural Arterial Collector Road	25 year	50 year	2 to 5 year	Regional Flood	2 to 5 year[9]
Local Road	10 year	25 year	2 year	Regional Flood	2 year[9]
Depressed roadways (subways etc)	-	-	10 to 25 year	-	-

NOTES

1. Drainage facilities for provincial highways shall be designed to the criteria shown, except as provided below.

2. Design floods for bridges and culverts shall be based on runoff conditions anticipated 20 years from the time of design, taking full account of present and probable future municipal controls over increases of runoff from new development.

   Design floods for storm drainage systems shall normally be based on existing runoff conditions, but, at the request of the municipality concerned, and subject to the Ministry's cost sharing policies, may be based on the 20-year period as for bridges and culverts.

3. The criteria may be modified in exceptional cases, such as for unusually large structures, unusually low traffic volumes, or for vital routes which must remain useable during regional flood conditions. Use of regional flood criteria in the latter case shall be justified by a cost-benefit analysis.

4. REGIONAL FLOODS

   If a drainage facility designed to the criteria specified in the table would increase flooding of buildings or developable land during a regional flood, the facility shall be designed to the regional flood criteria unless otherwise approved. The overall benefit (tangible and intangible) of designing to the regional flood shall be commensurate with the additional cost of the facility, and the proposal should be discussed with the municipality and with landowners adversely affected.

   A regional flood is a design flood specified by the Ministry of Natural Resources for floodplain management purposes. Regional storms for specific regions are indicated on the attached map.

For the purposes of these criteria, buildings are defined as residential, commercial, institutional or industrial buildings or buildings of comparable value. Developable land is defined as land on which there is a high probability that buildings will be constructed within 20 years of design of the facility.

Relief flow over the roadway during regional floods shall be provided wherever feasible at bridge or culvert crossings required to accommodate such floods.

In a storm drainage system required to accommodate a regional flood, flows exceeding the capacity of the minor system shall be accommodated by the major system.

5. Road classifications are defined as follows.

Freeway	a fully-controlled-access road exclusively for through traffic.
Arterial Road . .	a road primarily for through traffic.
Collector Road . .	a road on which traffic movement and access to property have similar importance.
Local Road . . .	a road primarily for access to property.

If the road classification is likely to be upgraded or downgraded within 5 years of construction, the return period shall be that for the future classification.

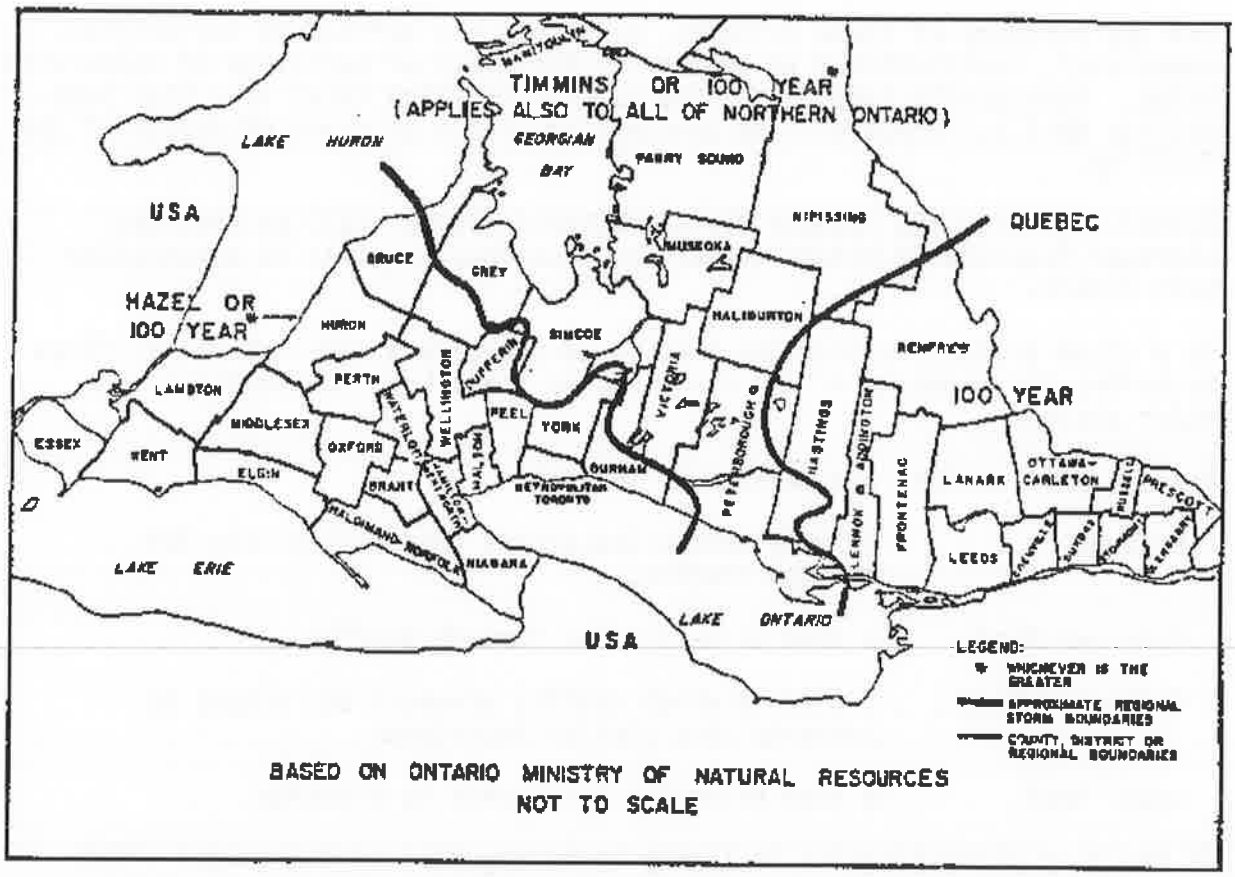
6. For the purpose of selecting design flood criteria, total span is defined as the sum of the individual clear spans or diameters, measured parallel to the centreline of roadway in the case of a bridge, and perpendicular to the longitudinal axis in the case of a culvert.

7. The flood (storm) frequencies for storm drainage systems may be modified to reflect local municipal requirements and adjacent land uses.

8. The minor system of a storm drainage system comprises the road gutters, inlets, storm sewers and minor ditches.

   The major system is the route followed by runoff waters when the capacity of the minor system is exceeded, and generally includes the roadways and major channels.

9. If a stream diversion or stream channelization will alter the storage or discharge characteristics of a channel or floodplain, the channel may be designed for the return period given by the table, but the combined channel and floodplain shall accommodate a 25-year flood except as provided in note 4.



Regional Flood (Storm) Boundaries

-0-

HY-8 Culvert Analysis Report
600 mm Dia. Crossing Osler Bluff Rd.
Existing Conditions

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 1 - Summary of Culvert Flows at Crossing: EX. 600 mm CULVERT (PreDev)

Headwater Elevation (m)	Discharge Names	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
203.49	25mm	0.10	0.10	0.00	1
203.91	2YR-SCS	0.37	0.37	0.00	1
204.79	5YR-SCS	0.63	0.63	0.00	1
205.87	10YR-SCS	0.83	0.83	0.00	1
207.70	25YR-SCS	1.09	1.08	0.00	19
207.74	50YR-SCS	1.29	1.09	0.20	7
207.76	100YR-SCS	1.50	1.09	0.40	5
207.83	REGIONAL	2.26	1.10	1.16	4
207.70	Overtopping	1.08	1.08	0.00	Overtopping

Table 2 - Culvert Summary Table: Culvert 1

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)
25mm	0.10	0.10	203.49	0.304	0.0*	1-S2n	0.199	0.205	0.199	0.102	1.243	0.444
2YR-SCS	0.37	0.37	203.91	0.698	0.719	7-M2c	0.428	0.399	0.399	0.211	1.871	0.673
5YR-SCS	0.63	0.63	204.79	1.259	1.601	7-M2c	0.600	0.514	0.514	0.282	2.455	0.790
10YR-SCS	0.83	0.83	205.87	1.906	2.677	7-M2c	0.600	0.561	0.561	0.325	3.005	0.854
25YR-SCS	1.09	1.08	207.70	3.052	4.510	6-FFc	0.600	0.600	0.600	0.375	3.825	0.924
50YR-SCS	1.29	1.09	207.74	3.078	4.550	6-FFc	0.600	0.600	0.600	0.411	3.843	0.971
100YR-SCS	1.50	1.09	207.76	3.093	4.574	6-FFc	0.600	0.600	0.600	0.444	3.853	1.012
REGIONAL	2.26	1.10	207.83	3.134	4.639	6-FFc	0.600	0.600	0.600	0.547	3.881	1.134

* Full Flow Headwater elevation is below inlet invert.

****

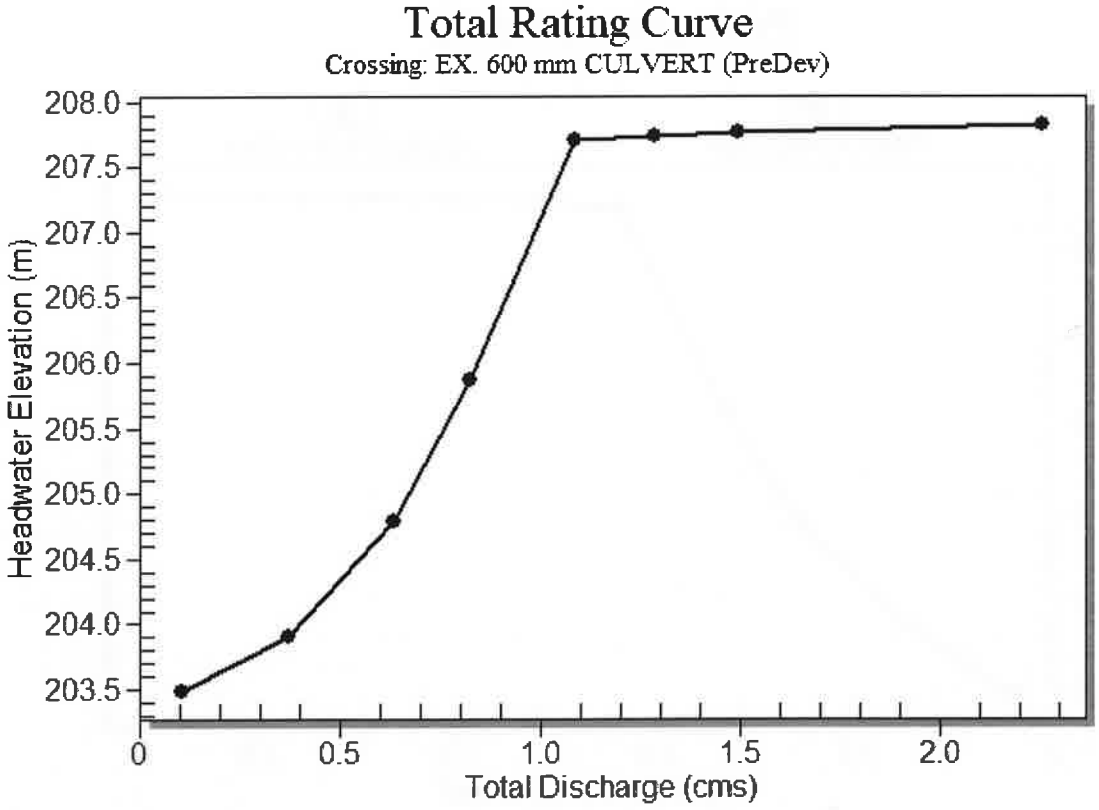
Straight Culvert

Inlet Elevation (invert): 203.19 m, Outlet Elevation (invert): 202.74 m

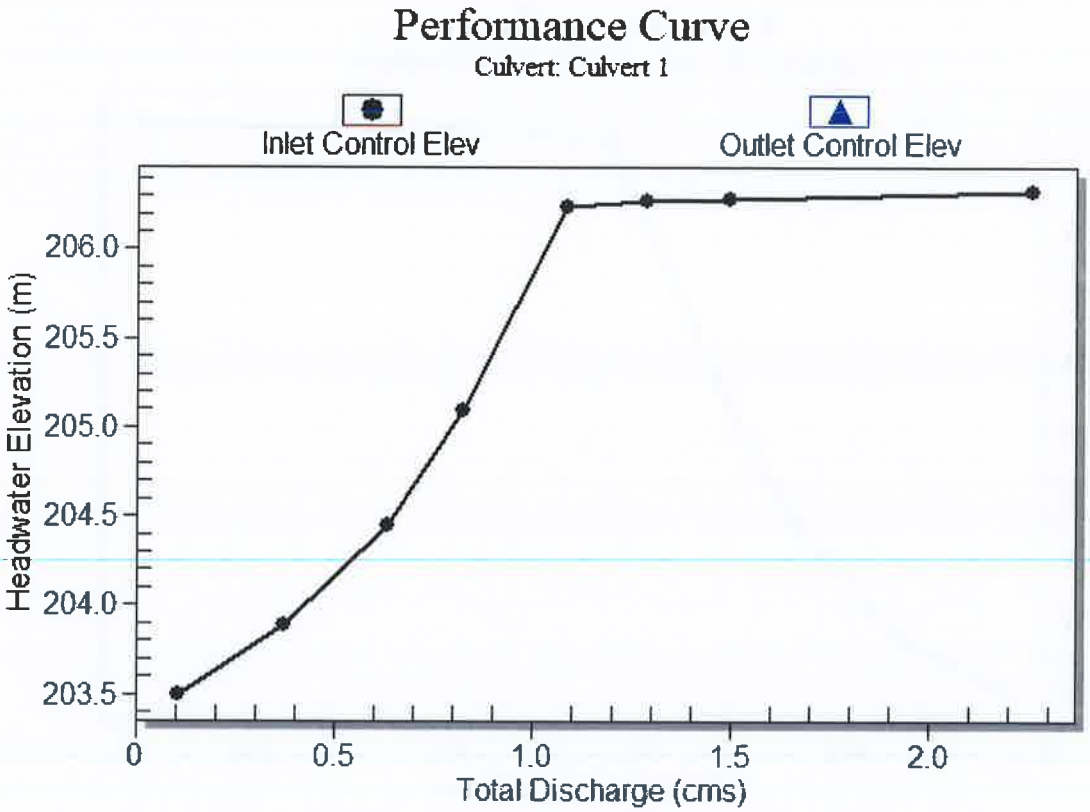
Culvert Length: 28.00 m, Culvert Slope: 0.0161

****

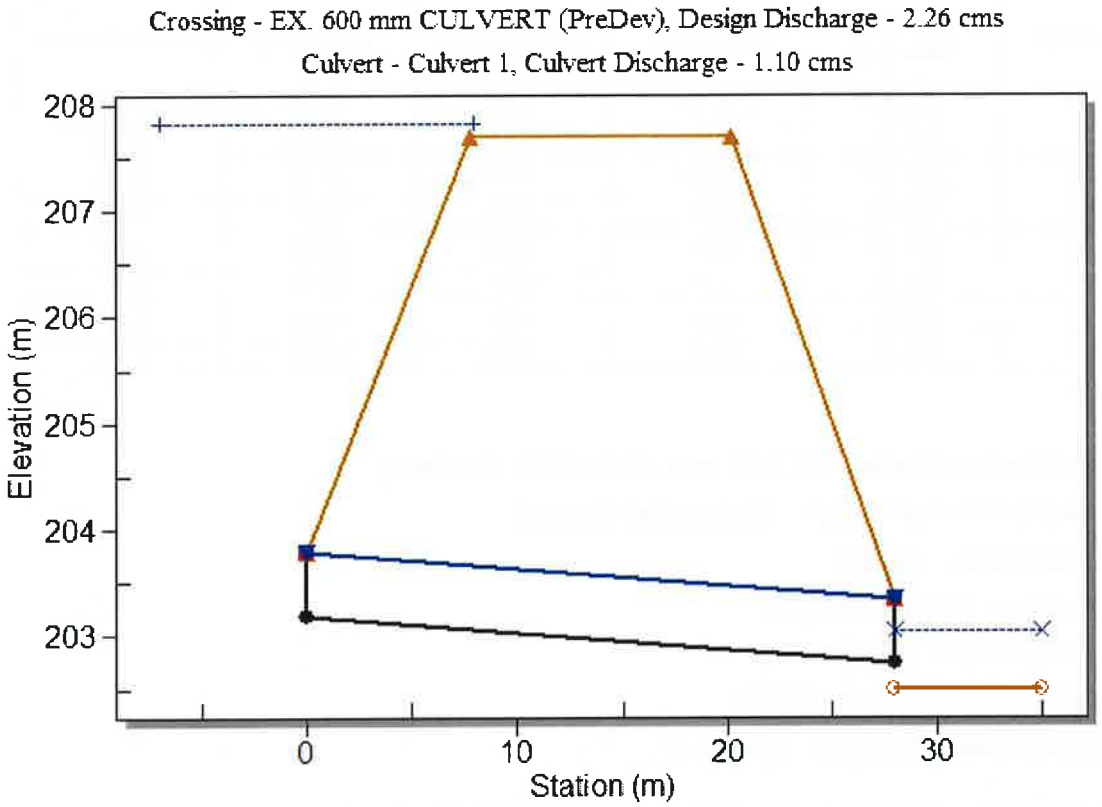
Rating Curve Plot for Crossing: EX. 600 mm CULVERT (PreDev)



Culvert Performance Curve Plot: Culvert 1



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: 203.19 m

Outlet Station: 28.00 m

Outlet Elevation: 202.74 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 600.00 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: EX. 600 mm CULVERT

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.10	202.60	0.10	0.44	10.05	0.47
0.37	202.71	0.21	0.67	20.69	0.52
0.63	202.78	0.28	0.79	27.61	0.54
0.83	202.82	0.32	0.85	31.85	0.55
1.09	202.88	0.38	0.92	36.80	0.56
1.29	202.91	0.41	0.97	40.24	0.57
1.50	202.94	0.44	1.01	43.49	0.57
2.26	203.05	0.55	1.13	53.59	0.59

(PreDev))

Tailwater Channel Data - EX. 600 mm CULVERT (PreDev)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 m

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0450

Channel Invert Elevation: 202.50 m

Roadway Data for Crossing: EX. 600 mm CULVERT (PreDev)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 15.00 m

Crest Elevation: 207.70 m

Roadway Surface: Paved

Roadway Top Width: 12.50 m

HY-8 Culvert Analysis Report
600 mm Dia. Crossing Osler Bluff Rd.
Proposed Conditions

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 1 - Summary of Culvert Flows at Crossing: EX. 600 mm CULVERT (PostDev)

Headwater Elevation (m)	Discharge Names	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
203.36	25mm	0.04	0.04	0.00	1
203.47	2YR-SCS	0.09	0.09	0.00	1
203.68	5YR-SCS	0.23	0.23	0.00	1
203.92	10YR-SCS	0.38	0.38	0.00	1
204.71	25YR-SCS	0.62	0.62	0.00	1
205.77	50YR-SCS	0.81	0.81	0.00	1
207.26	100YR-SCS	1.03	1.03	0.00	1
207.83	Regional	2.30	1.10	1.20	5
207.70	Overtopping	1.08	1.08	0.00	Overtopping

Table 2 - Culvert Summary Table: Culvert 1

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)
25mm	0.04	0.04	203.36	0.173	0.0*	1-S2n	0.115	0.118	0.115	0.055	0.918	0.304
2YR-SCS	0.09	0.09	203.47	0.283	0.0*	1-S2n	0.185	0.192	0.185	0.095	1.195	0.424
5YR-SCS	0.23	0.23	203.68	0.493	0.070	1-S2n	0.312	0.314	0.312	0.163	1.534	0.581
10YR-SCS	0.38	0.38	203.92	0.708	0.726	7-M2c	0.433	0.403	0.403	0.213	1.883	0.676
25YR-SCS	0.62	0.62	204.71	1.212	1.518	7-M2c	0.600	0.508	0.508	0.278	2.412	0.783
50YR-SCS	0.81	0.81	205.77	1.844	2.579	7-M2c	0.600	0.557	0.557	0.322	2.959	0.850
100YR-SCS	1.03	1.03	207.26	2.777	4.074	6-FFc	0.600	0.600	0.600	0.365	3.629	0.910
Regional	2.30	1.10	207.83	3.136	4.642	6-FFc	0.600	0.600	0.600	0.552	3.882	1.140

* Full Flow Headwater elevation is below inlet invert.

****

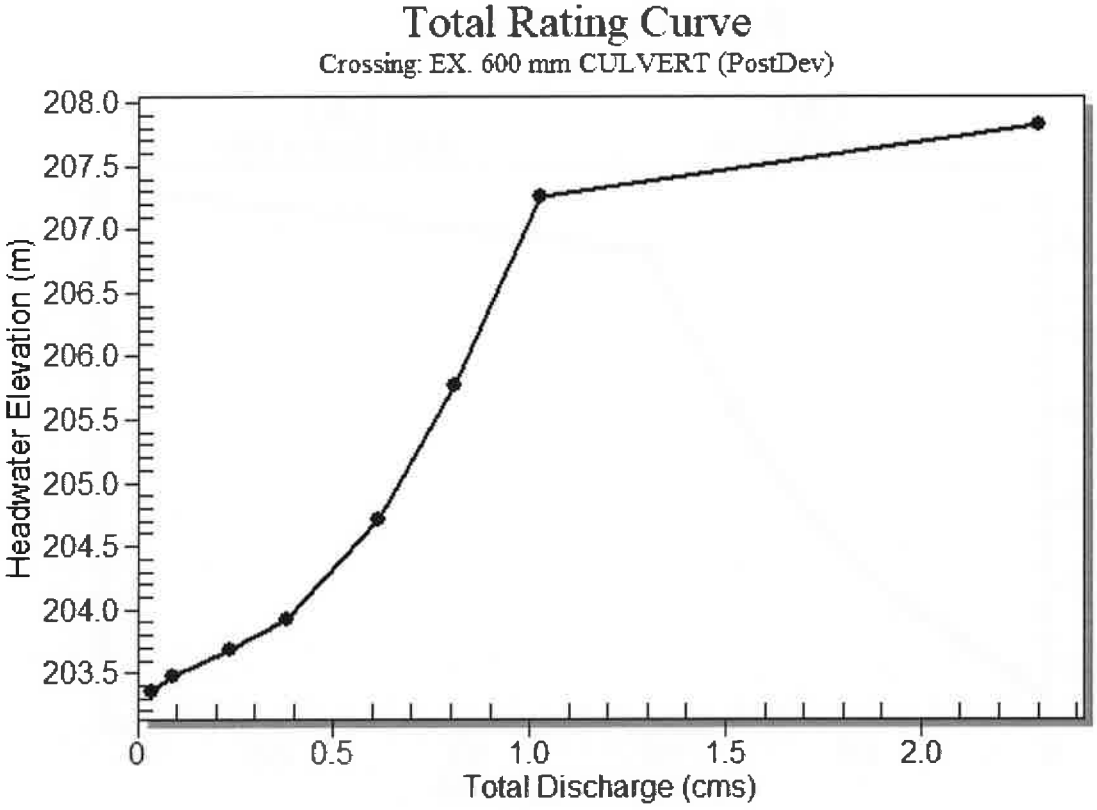
Straight Culvert

Inlet Elevation (invert): 203.19 m, Outlet Elevation (invert): 202.74 m

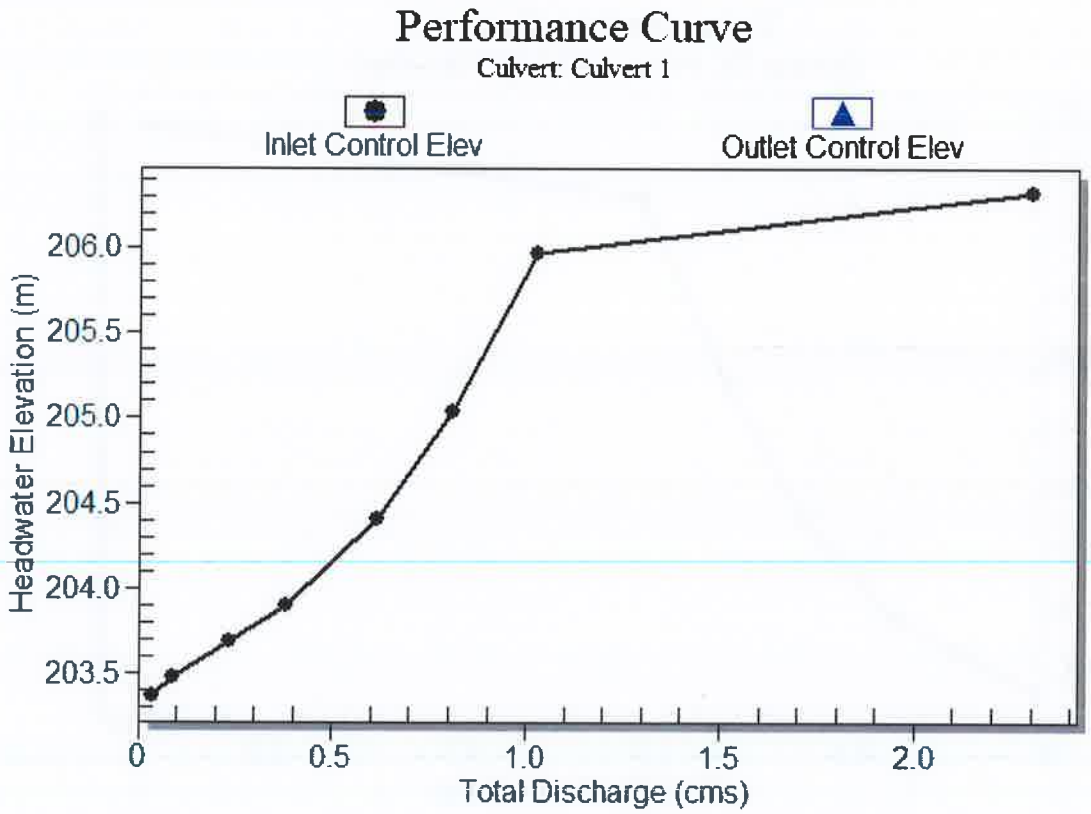
Culvert Length: 28.00 m, Culvert Slope: 0.0161

****

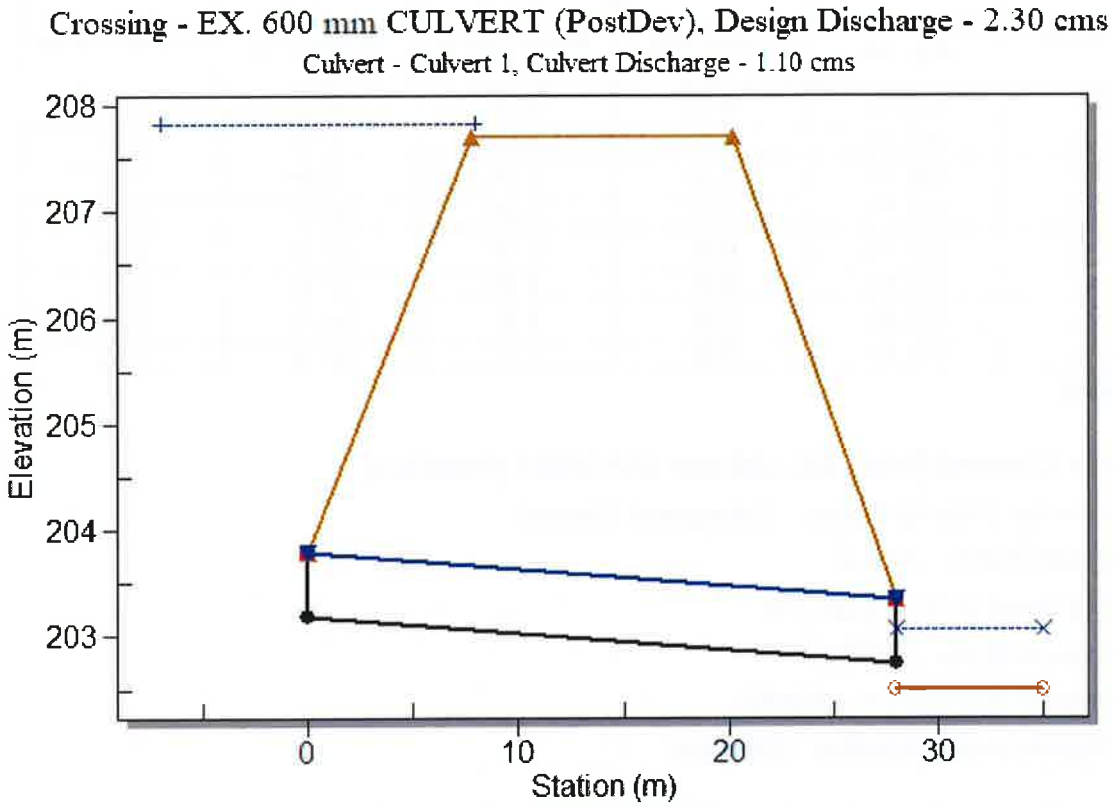
Rating Curve Plot for Crossing: EX. 600 mm CULVERT (PostDev)



Culvert Performance Curve Plot: Culvert 1



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: 203.19 m

Outlet Station: 28.00 m

Outlet Elevation: 202.74 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 600.00 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: EX. 600 mm CULVERT

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.04	202.55	0.05	0.30	5.37	0.43
0.09	202.59	0.09	0.42	9.31	0.47
0.23	202.66	0.16	0.58	15.94	0.50
0.38	202.71	0.21	0.68	20.87	0.52
0.62	202.78	0.28	0.78	27.21	0.54
0.81	202.82	0.32	0.85	31.52	0.55
1.03	202.86	0.36	0.91	35.73	0.56
2.30	203.05	0.55	1.14	54.13	0.59

(PostDev))

Tailwater Channel Data - EX. 600 mm CULVERT (PostDev)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 m

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0450

Channel Invert Elevation: 202.50 m

Roadway Data for Crossing: EX. 600 mm CULVERT (PostDev)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 15.00 m

Crest Elevation: 207.70 m

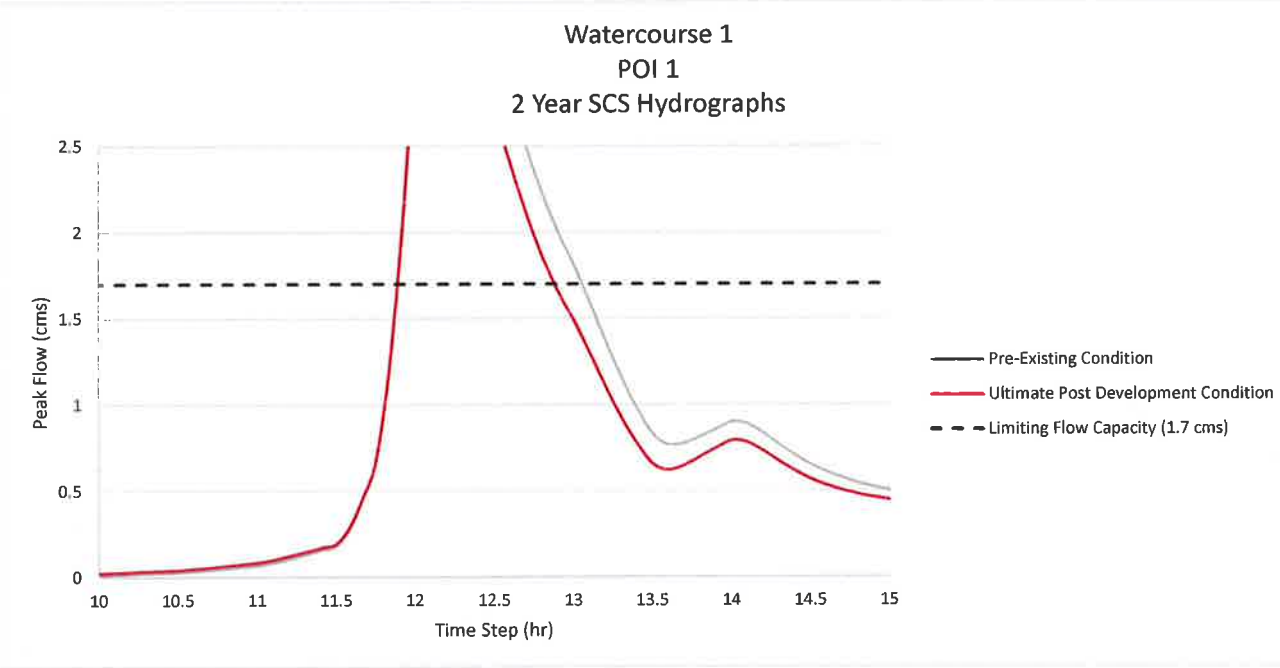
Roadway Surface: Paved

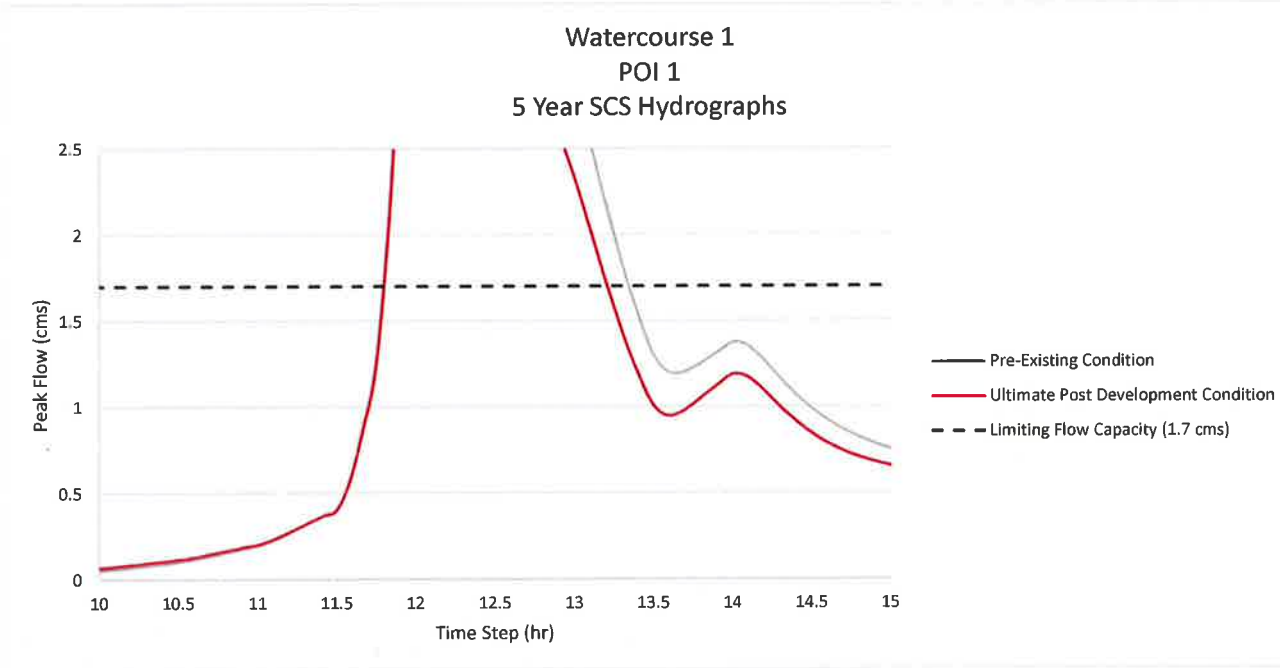
Roadway Top Width: 12.50 m

POI 1- Culvert Near Monterra Rd. Capacity = 1.7 cms

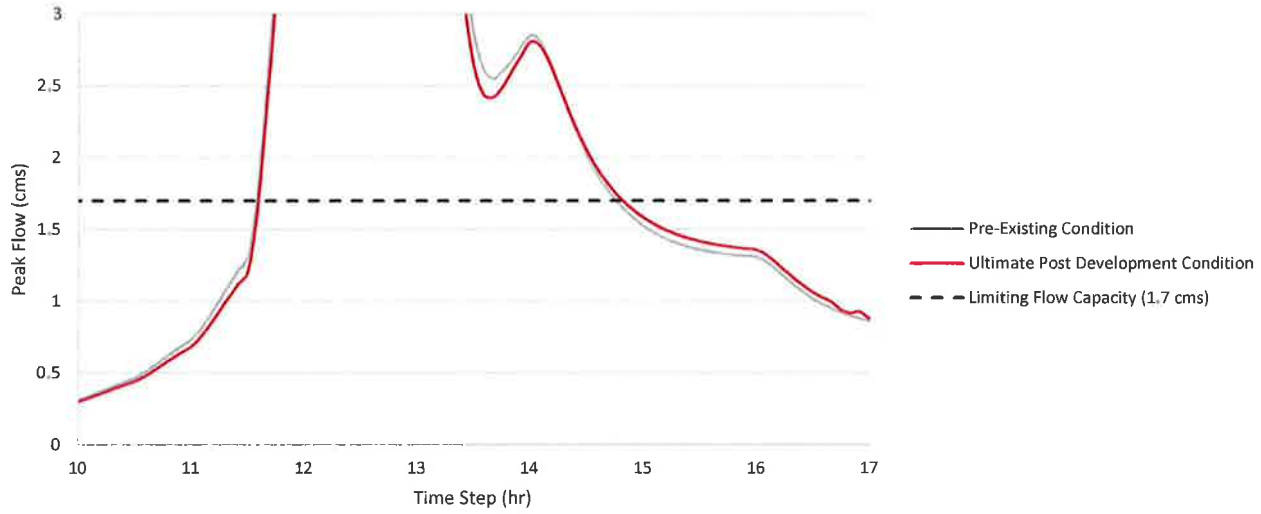
Design Storm	Chicago Design Storms					
	Pre			Post		
	Peak Flow Rate (m^3/s)	Duration of Exceedance (hrs)	Volume of Exceedance (m^3)	Peak Flow Rate (m^3/s)	Duration of Exceedance (hrs)	Volume of Exceedance (m^3)
2- Year	2.63	0.83	2784	2.51	0.70	2026
5- Year	5.00	1.47	17447	4.66	1.28	13606
100- Year	15.91	2.33	119272	14.66	2.31	107816
Regional	20.72	8.52	265304	20.45	8.46	263069

Design Storm	SCS Design Storms					
	Pre			Post		
	Peak Flow Rate (m^3/s)	Duration of Exceedance (hrs)	Volume of Exceedance (m^3)	Peak Flow Rate (m^3/s)	Duration of Exceedance (hrs)	Volume of Exceedance (m^3)
2- Year	3.92	1.17	9381	3.65	1.00	7002
5- Year	6.82	1.56	28725	6.29	1.42	23417
100- Year	17.30	3.19	179161	15.86	3.23	164668

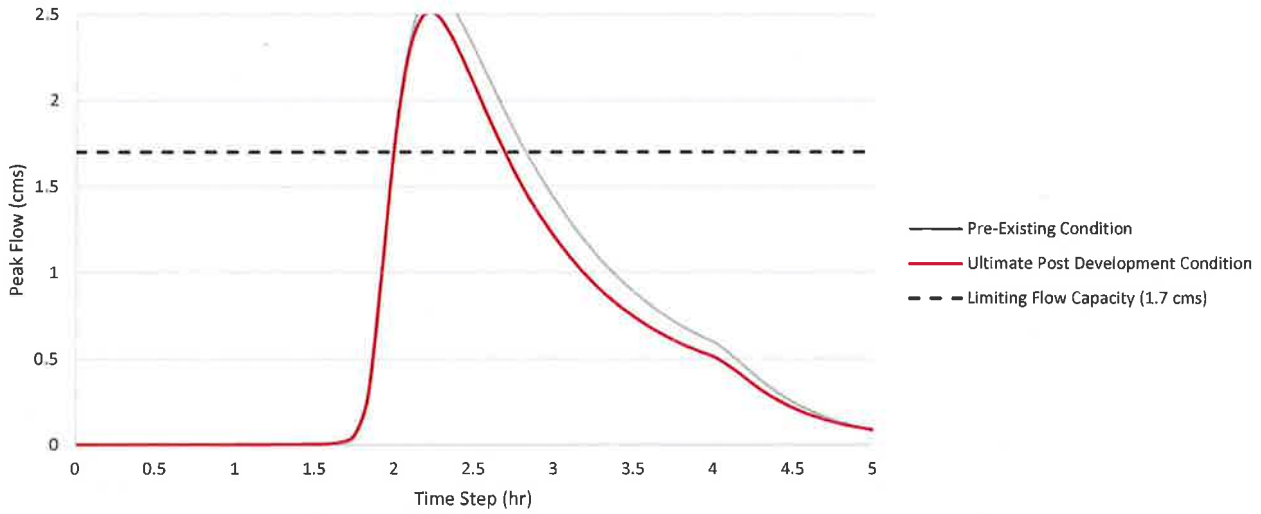

Watercourse 1
POI 1
2 Year SCS Hydrographs
Peak Flow (cms)
2.5
2
1.5
1
0.5
0
10
10.5
11
11.5
12
12.5
13
13.5
14
14.5
15
Time Step (hr)
Pre-Existing Condition
Ultimate Post Development Condition
Limiting Flow Capacity (1.7 cms)


Watercourse 1
POI 1
5 Year SCS Hydrographs
Peak Flow (cms)
2.5
2
1.5
1
0.5
0
10
10.5
11
11.5
12
12.5
13
13.5
14
14.5
15
Time Step (hr)
Pre-Existing Condition
Ultimate Post Development Condition
Limiting Flow Capacity (1.7 cms)

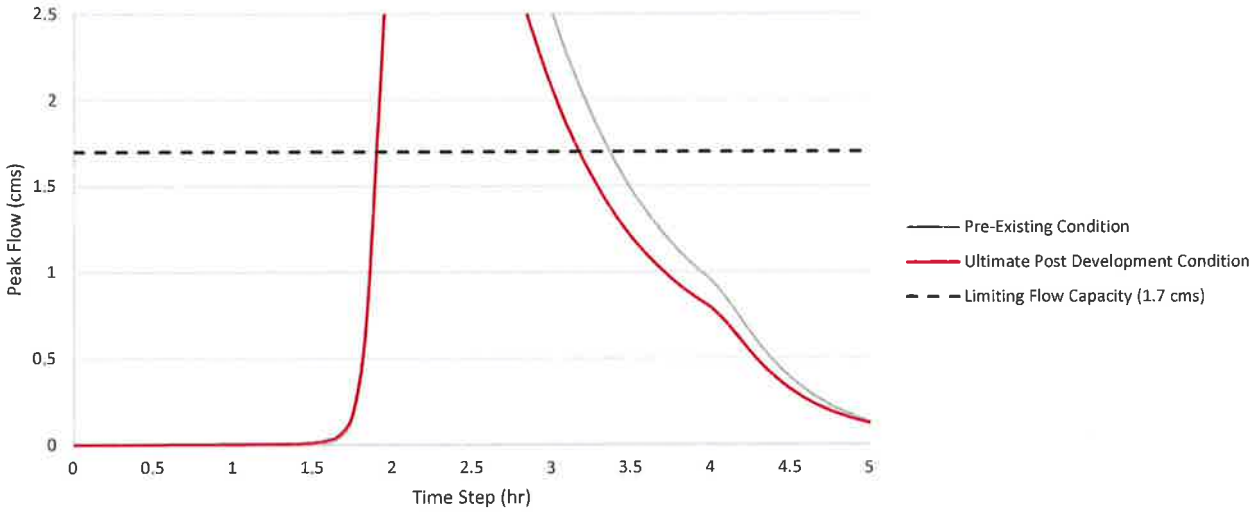
Watercourse 1
POI 1
100 Year SCS Hydrographs



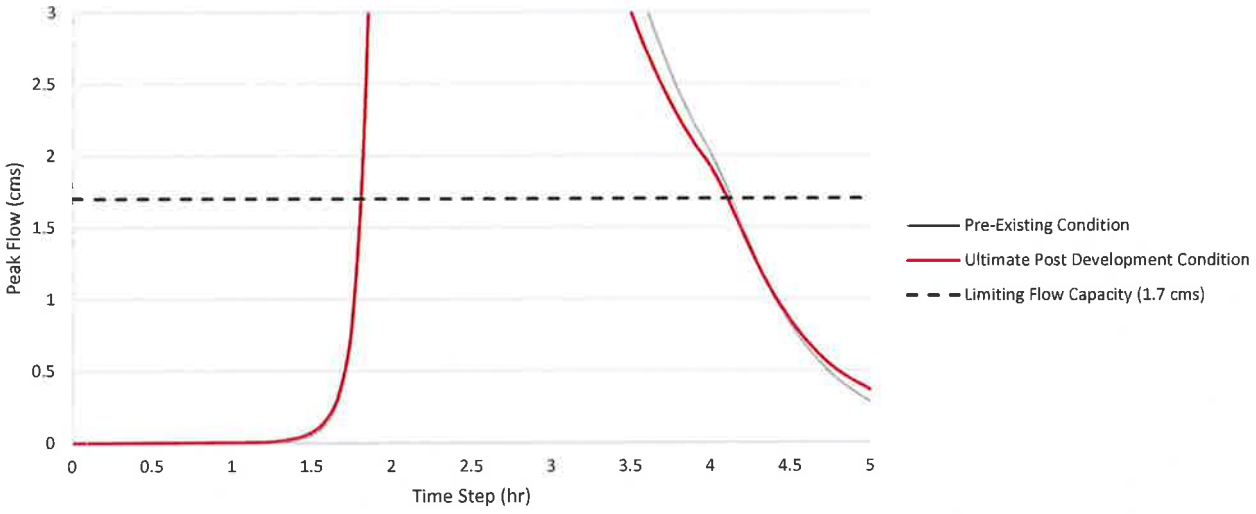
Watercourse 1
POI 1
2 Year Chicago Hydrographs

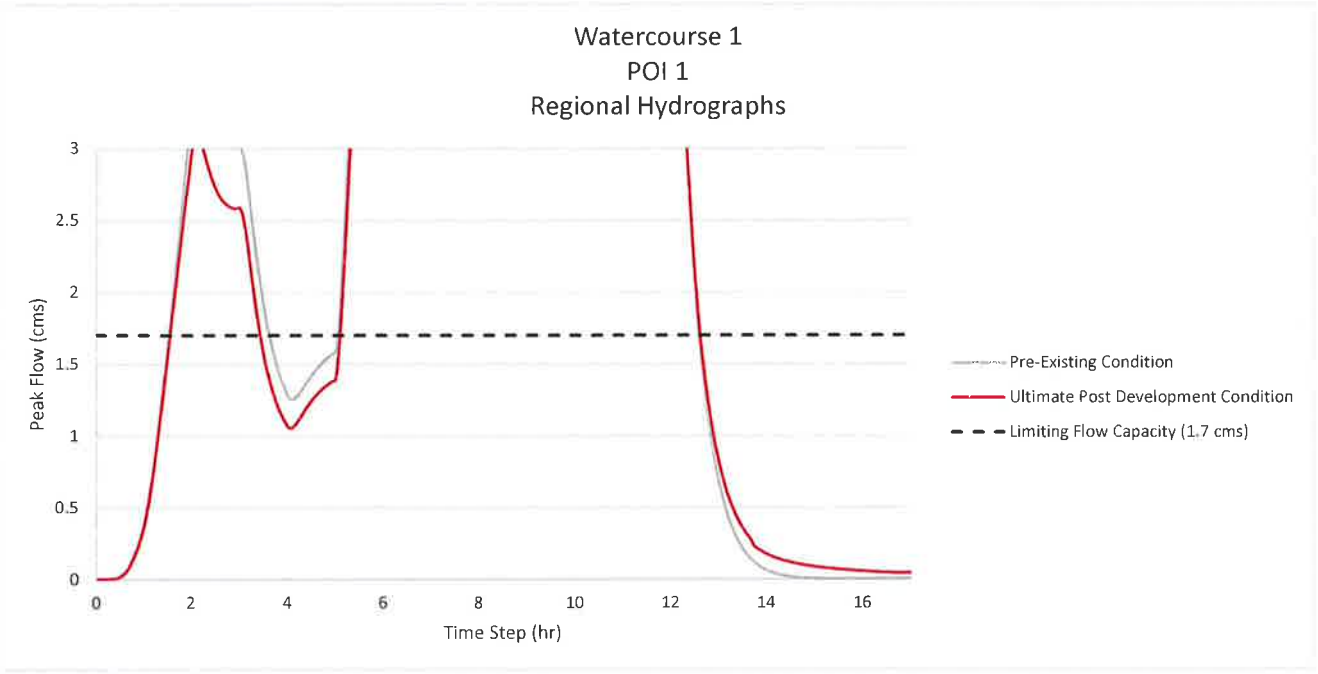


Watercourse 1
POI 1
5 Year Chicago Hydrographs

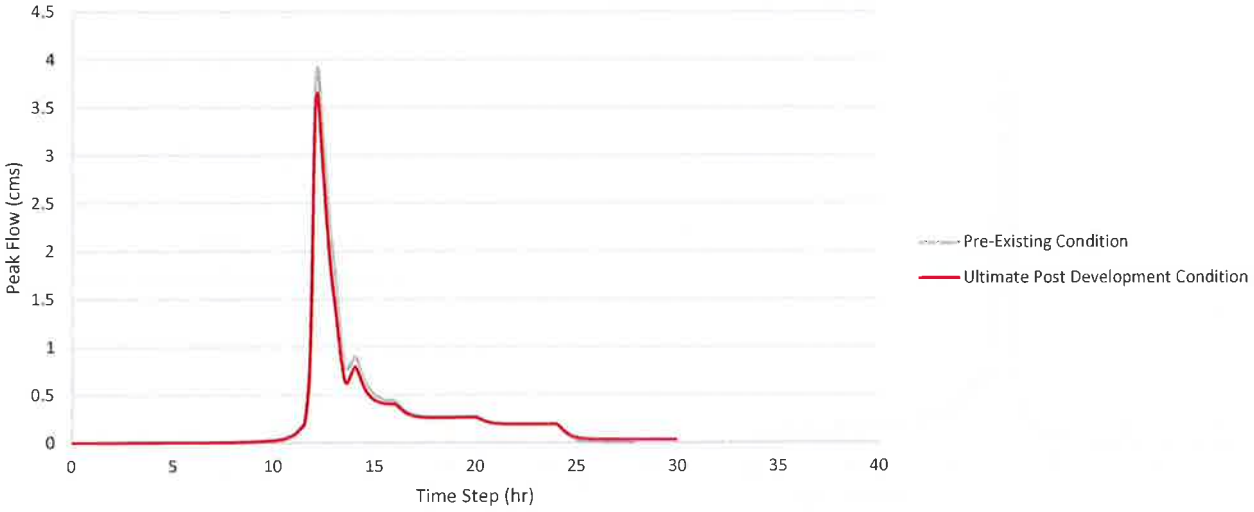


Watercourse 1
POI 1
100 Year Chicago Hydrographs

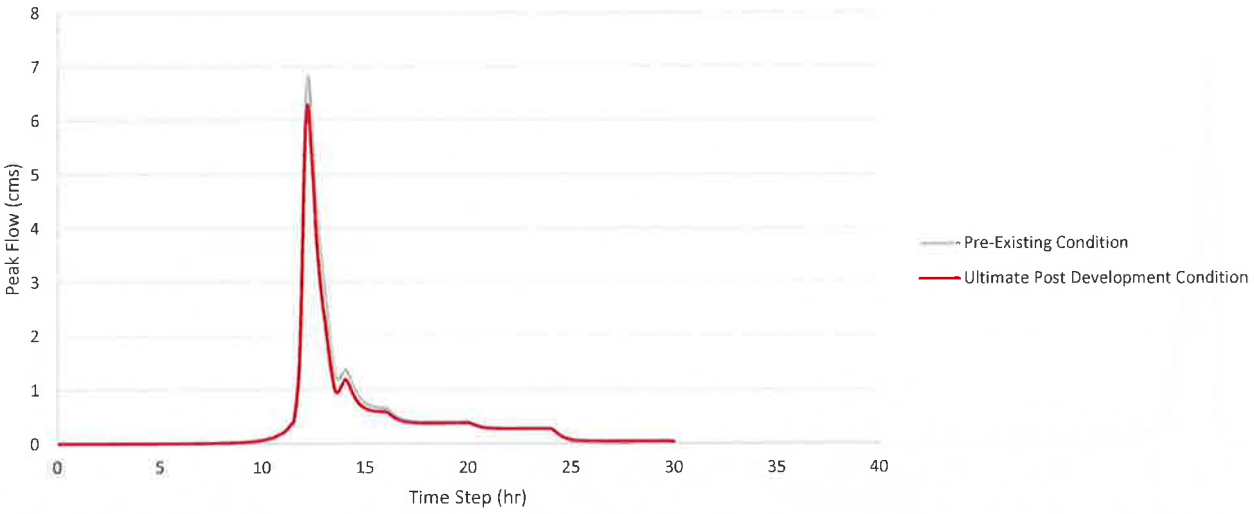



Watercourse 1
POI 1
Regional Hydrographs
Peak Flow (cms)
Time Step (hr)
0
0.5
1
1.5
2
2.5
3
0
2
4
6
8
10
12
14
16
Pre-Existing Condition
Ultimate Post Development Condition
Limiting Flow Capacity (1.7 cms)

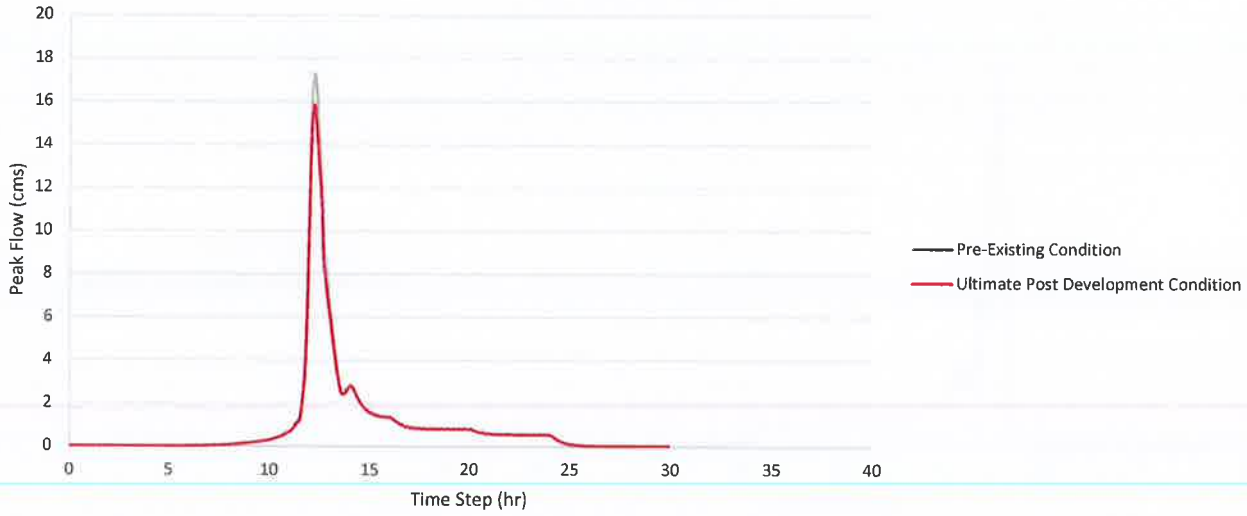
Watercourse 1
POI 1
2 Year SCS Hydrographs



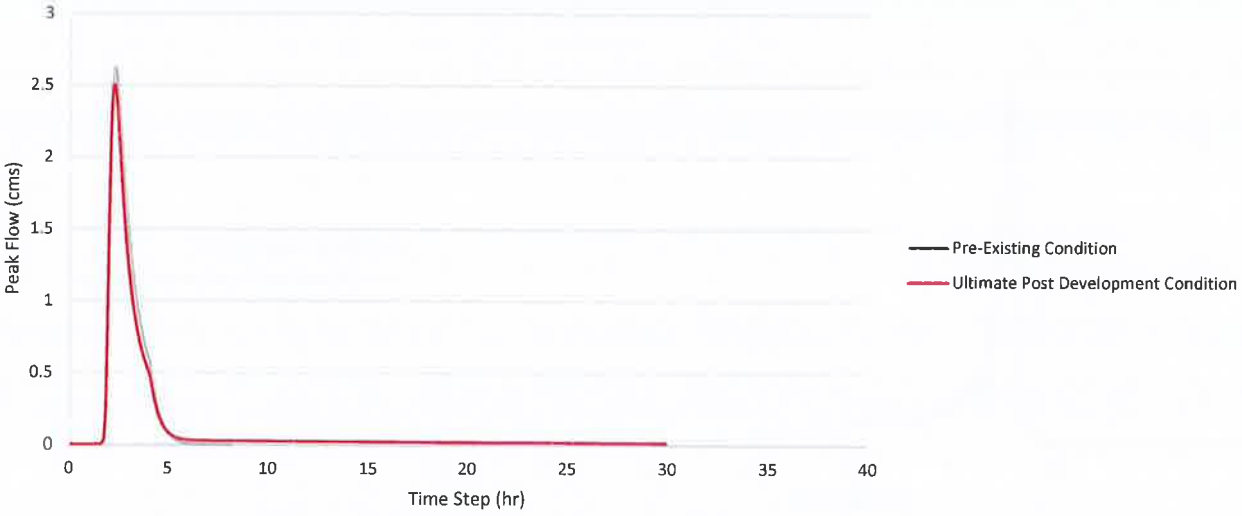
Watercourse 1
POI 1
5 Year SCS Hydrographs



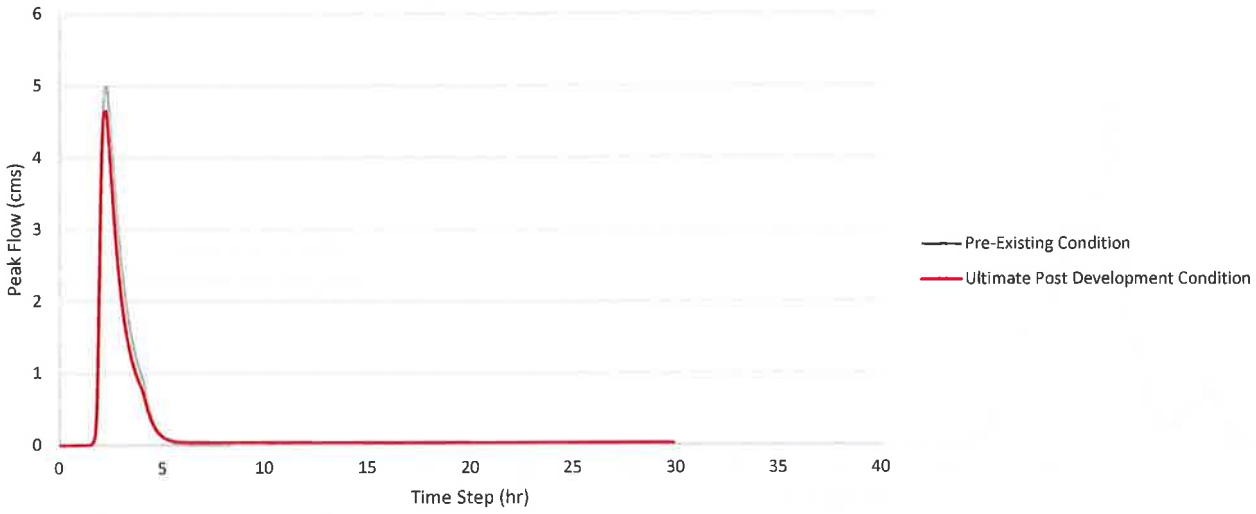
Watercourse 1
POI 1
100 Year SCS Hydrographs



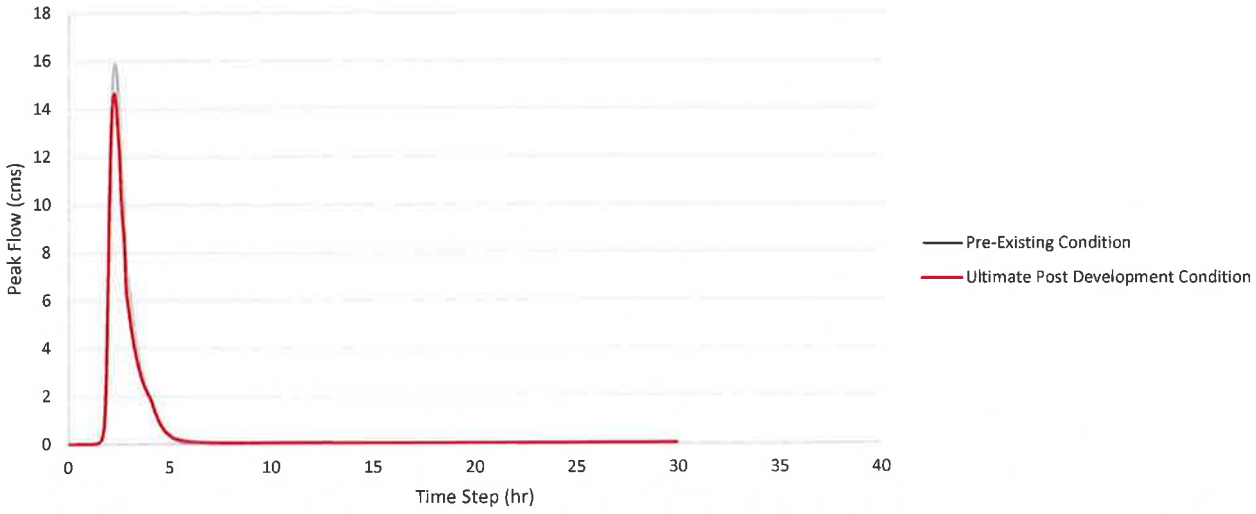
Watercourse 1
POI 1
2 Year Chicago Hydrographs



Watercourse 1
POI 1
5 Year Chicago Hydrographs



Watercourse 1
POI 1
100 Year Chicago Hydrographs



Watercourse 1
POI 1
RegionalHydrographs

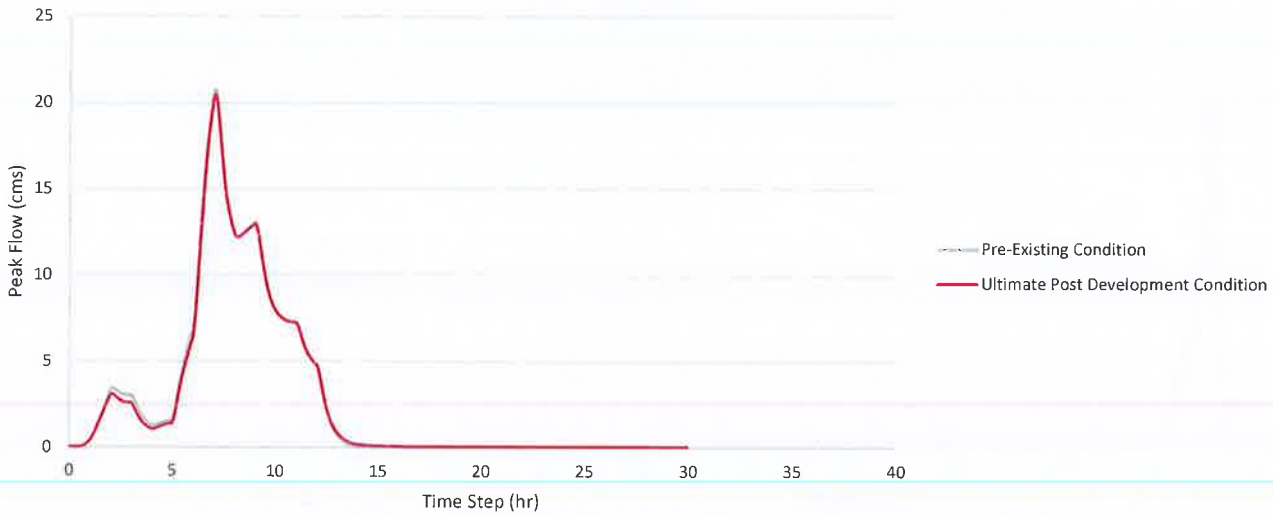


Table 1: Outlet 1 Post Development Peak Flow Summary

STORM EVENT	CHICAGO DESIGN STORMS (m^3/s)	SCS DESIGN STORMS (m^3/s)
25 mm	0.01 *(0.01)*	-
2 Year	0.02 *(0.02)*	0.02 *(0.03)*
5 Year	0.03 *(0.04)*	0.03 *(0.05)*
10 Year	0.03 *(0.05)*	0.03 *(0.06)*
25 Year	0.04 *(0.07)*	0.04 *(0.09)*
50 Year	0.04 *(0.09)*	0.05 *(0.11)*
100 Year	0.05 *(0.11)*	0.06 *(0.13)*
Regional	0.18 *(0.25)*	-

Note: *(0.09)* – Pre Development peak flow rates.

Table 2: Point of Interest 1 (Grey Road 21) Post Development Peak Flow Summary

STORM EVENT	CHICAGO DESIGN STORMS (m^3/s)	SCS DESIGN STORMS (m^3/s)
25 mm	0.04 *(0.10)*	-
2 Year	0.07 *(0.25)*	0.09 *(0.37)*
5 Year	0.15 *(0.48)*	0.24 *(0.63)*
10 Year	0.27 *(0.66)*	0.38 *(0.83)*
25 Year	0.47 *(0.91)*	0.62 *(1.08)*
50 Year	0.66 *(1.13)*	0.81 *(1.29)*
100 Year	0.82 *(1.34)*	1.03 *(1.50)*
Regional	2.30 *(2.23)*	-

Note: *(0.09)* – Pre Development peak flow rates.

Silver Creek Hydrologic Model Results Summary Updated 2019-07-04 11:05

POI 1 - Grey Road 21

	Chicago Design Storms			SCS Design Storms		
Design Storm	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)
25 mm	0.105	0.102	0.036	-	-	-
2- Year	0.25	0.239	0.067	0.374	0.356	0.092
5- Year	0.482	0.456	0.153	0.633	0.595	0.235
10- Year	0.66	0.621	0.267	0.826	0.772	0.38
25- Year	0.914	0.855	0.466	1.085	1.008	0.616
50- Year	1.131	1.054	0.662	1.288	1.192	0.81
100- Year	1.342	1.247	0.82	1.496	1.413	1.026

POI 2 - Confluence of Tributaries

	Chicago Design Storms			SCS Design Storms		
Design Storm	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)
25 mm	1.215	1.211	1.134	-	-	-
2- Year	2.834	2.821	2.51	3.956	3.935	3.42
5- Year	5.152	5.124	4.53	6.664	6.632	5.807
10- Year	7.401	7.369	6.696	8.828	8.781	8.04
25- Year	10.122	10.069	9.379	11.427	11.356	10.541
50- Year	12.383	12.337	11.521	13.394	13.305	12.456
100- Year	14.591	14.53	13.614	15.452	15.375	14.599

POI 3 - Silver Creek Confluence

	Chicago Design Storms			SCS Design Storms		
Design Storm	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)
25 mm	3.707	3.701	3.683	-	-	-
2- Year	8.476	8.457	8.32	12.636	12.592	12.267
5- Year	16.953	16.906	16.665	21.909	21.843	21.608
10- Year	22.759	22.692	22.542	28.623	28.534	28.305
25- Year	31.227	31.129	30.937	37.744	37.595	37.144
50- Year	38.542	38.393	37.977	45.698	45.548	45.055
100- Year	46.36	46.191	45.697	53.868	53.736	53.4

POI 4 - Gerogian Trail (Old Rail Line)

	Chicago Design Storms			SCS Design Storms		
Design Storm	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)
25 mm	3.664	3.658	3.642	-	-	-
2- Year	8.52	8.502	8.363	12.626	12.587	12.32
5- Year	17.051	17.002	16.765	22.154	22.091	21.84
10- Year	23.071	23.006	22.842	29.081	28.995	28.758
25- Year	31.807	31.709	31.506	38.522	38.389	37.989
50- Year	39.388	39.248	38.881	46.59	46.446	45.982
100- Year	47.326	47.174	46.724	54.993	54.873	54.493

POI 5 - HWY 26

Design Storm	Chicago Design Storms			SCS Design Storms		
	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)
25 mm	3.26	3.255	3.242	-	-	-
2- Year	7.554	7.538	7.41	11.46	11.433	11.241
5- Year	15.679	15.638	15.43	20.665	20.603	20.378
10- Year	21.67	21.607	21.451	27.604	27.527	27.354
25- Year	30.383	30.296	30.101	37.108	36.982	36.647
50- Year	38.065	37.939	37.664	44.878	44.746	44.368
100- Year	45.635	45.501	45.157	53.296	53.169	52.818

POI 6 - Outlet at Georgian Bay

Design Storm	Chicago Design Storms			SCS Design Storms		
	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)	Pre-Development	Post Development (Ignoring Winfall/ Mountain House Developments)	Ultimate Post-Development (Blue Vista, Windfall and Mountain House)
25 mm	3.245	3.241	3.228	-	-	-
2- Year	7.536	7.521	7.392	11.428	11.401	11.208
5- Year	15.612	15.566	15.363	20.57	20.509	20.296
10- Year	21.539	21.477	21.336	27.499	27.422	27.26
25- Year	30.23	30.145	29.948	36.915	36.796	36.467
50- Year	37.823	37.701	37.455	44.609	44.483	44.131
100- Year	45.357	45.229	44.887	52.847	52.725	52.426

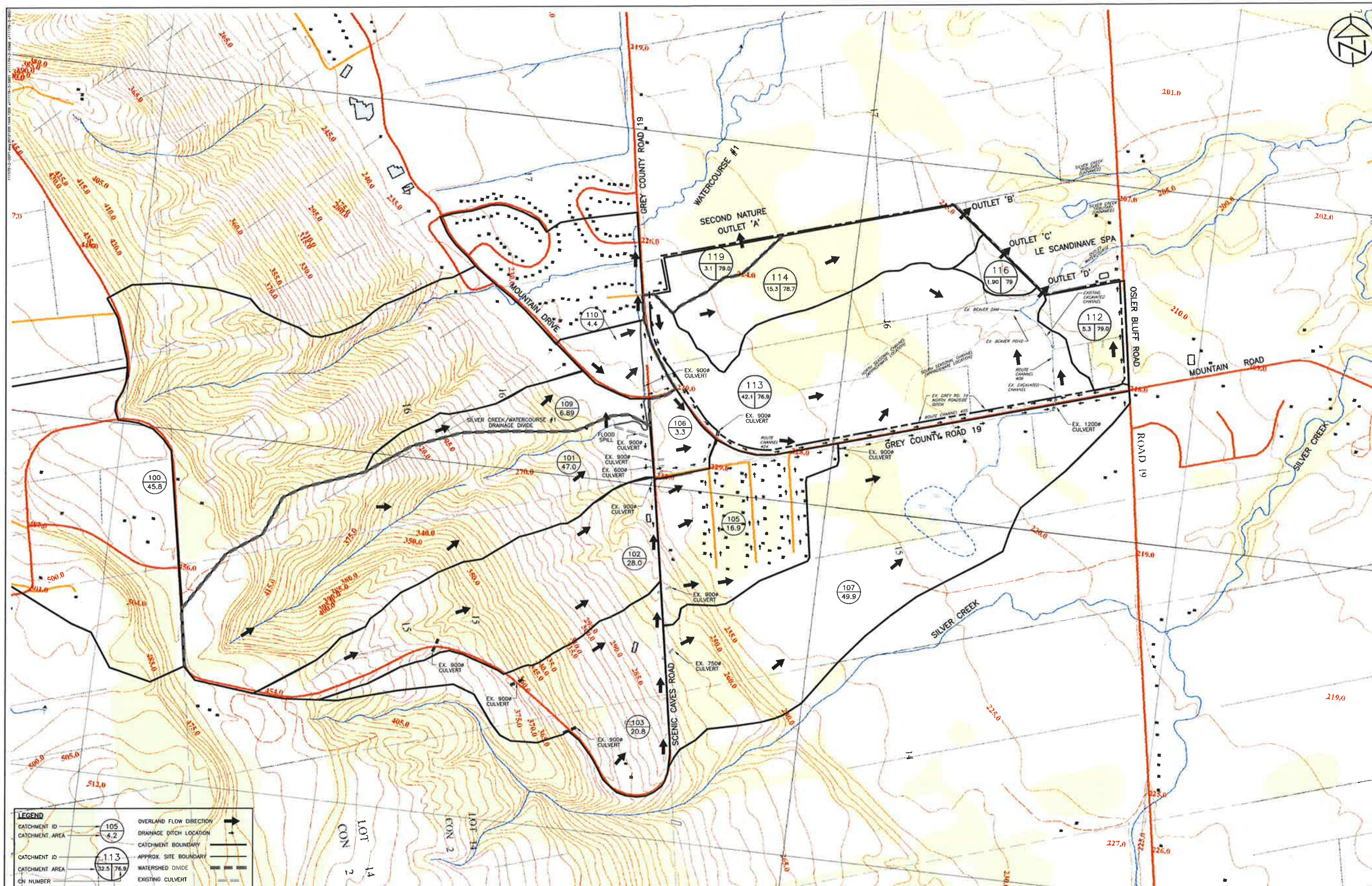
Silver Creek Triputary Water Level Summary

POI 1 - Grey Road 21

Design Storm	Chicago Design Storms							
	Pre-Development (Ignoring Open Space Storage)		Post Development (Ignoring Open Space Storage)		Pre-Development (Including Open Space Storage)		Post Development (Including Open Space Storage)	
	Peak Flow	Elevation	Peak Flow	Elevation	Peak Flow	Elevation	Peak Flow	Elevation
25 mm	0.105	203.49	0.036	203.36	0.104	203.50	0.036	203.50
2- Year	0.250	203.70	0.067	203.43	0.248	203.56	0.067	203.50
5- Year	0.482	204.09	0.153	203.57	0.479	203.72	0.152	203.52
10- Year	0.660	204.93	0.267	203.79	0.647	203.91	0.265	203.57
25- Year	0.914	206.44	0.466	204.05	0.833	204.18	0.463	203.70
50- Year	1.131	207.72	0.662	204.94	0.970	204.43	0.649	203.91
100- Year	1.342	207.75	0.820	205.83	1.095	204.69	0.769	204.08
Regional	2.257	207.83	2.300	207.83	1.660	206.24	1.658	206.23

Design Storm	SCS Design Storms							
	Pre-Development (Ignoring Open Space Storage)		Post Development (Ignoring Open Space Storage)		Pre-Development (Including Open Space Storage)		Post Development (Including Open Space Storage)	
	Peak Flow	Elevation	Peak Flow	Elevation	Peak Flow	Elevation	Peak Flow	Elevation
2- Year	0.374	203.91	0.092	203.47	0.372	203.63	0.092	203.50
5- Year	0.633	204.79	0.235	203.68	0.629	203.89	0.234	203.56
10- Year	0.826	205.87	0.380	203.92	0.763	204.07	0.378	203.64
25- Year	1.085	207.70	0.616	204.71	0.945	204.38	0.613	203.87
50- Year	1.288	207.74	0.810	205.77	1.065	204.62	0.761	204.07
100- Year	1.496	207.76	1.026	207.26	1.172	204.86	0.922	204.34

Silver Creek Watershed Map with Point of Interest



CONTRACT DRAWINGS

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

NO.	REVISIONS	DATE	INITIAL
2.	THIRD SUBMISSION	30/NOV/12	DRT
1.	SECOND SUBMISSION	06/JUN/12	DRT

APPROVED

WINDFALL DEVELOPMENT
GEORGIAN GATE LTD.
TOWN OF THE BLUE MOUNTAINS

OVERALL PRE DEVELOPMENT DRAINAGE PLAN

C.C. Tatham & Associates Ltd.
Consulting Engineers
Collingwood Bracebridge Orillia Barrie

SCALE: 1 : 5000		JOB NO.	111178-3
DESIGN: DRT	CHECKED: DJH/BFS	DWG.	ODP-1
DRAWN: KF	DATE: JAN./12		

MacLaren Plansearch

DESIGN FLOWS:

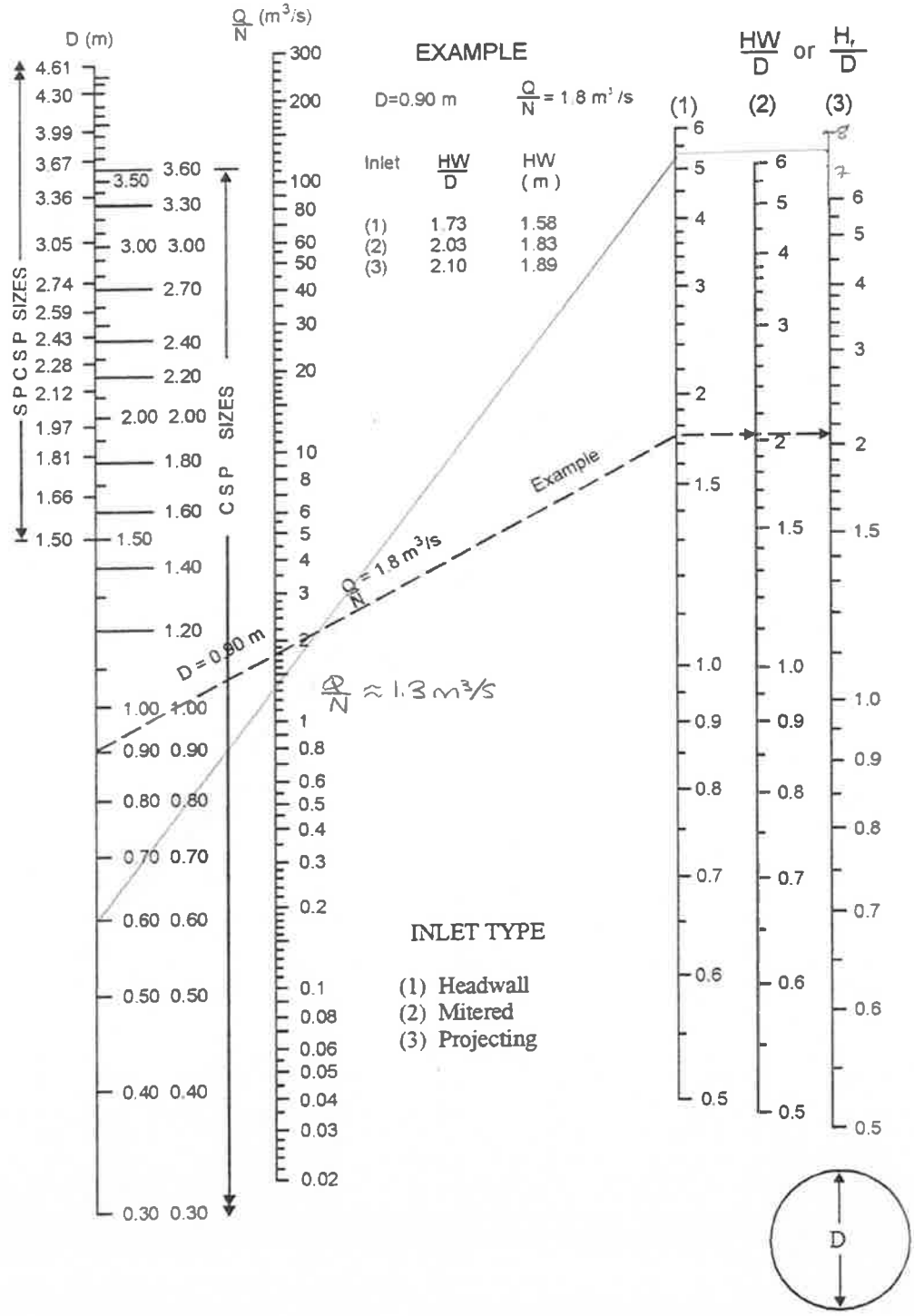
REF. NO.	DESCRIPTION	TRIBUTARY AREA (KM2)	DEVELOPMENT CONDITION	DISCHARGE (M3/S) 5-YR	10-YR	20-YR	50-YR	100-YR	REGIONAL STORM
SILVER CREEK									
900	Outlet from sub-catchment 900	20.3	Present	13.4	17.8	22.1	29.5	35.4	80.8
			Future	13.4	17.8	22.1	29.5	35.4	80.8
90	Total flow at outlet of sub-catchment 901A	22.6	Present	15.6	20.6	25.7	34.4	40.6	81.1
			Future	15.6	20.6	25.7	34.4	40.6	81.1
9012	Outlet of sub-catchment no. 901B	1.65	Present	2.5	3.2	4.0	5.2	6.2	14.5
			Future	2.5	3.2	4.0	5.2	6.2	14.5
9013	Outlet of sub-catchment 901C	0.85	Present	1.4	1.8	2.2	3.0	3.5	8.2
			Future	1.4	1.8	2.2	3.0	3.5	8.2
930	Confluence sub-catchments 901B and 901C	2.5	Present	3.9	5.1	6.2	8.2	9.7	22.7
			Future	3.9	5.1	6.2	8.2	9.7	22.7
91	Outlet of sub-catchment no 901D	2.8	Present	4.2	5.4	6.6	8.7	10.3	22.2
			Future	4.2	5.4	6.6	8.7	10.3	22.2
94	Confluence of Silver Creek and tributary	25.4	Present	18.6	24.0	30.0	39.6	46.9	105.7
			Future	18.6	24.0	30.0	39.6	46.9	105.7
92	At CNR crossing	26.3	Present	19.5	25.0	31.0	40.7	49.6	109.0
			Future	19.5	25.0	31.0	40.7	49.6	109.0
93	At Highway No. 26	26.6	Present	20.2	25.5	31.3	40.8	50.1	113.7
			Future	20.2	25.5	31.3	40.8	50.1	113.7
95	Outlet of Silver Creek	26.8	Present	19.1	24.0	29.7	38.7	47.7	105.1
			Future	19.1	24.0	29.7	38.7	47.7	105.1
9018	Catchment 901H only	0.38	Present	0.22	0.30	0.37	0.46	0.51	1.52
			Future	0.72	0.87	1.03	1.24	1.39	2.27
9019	Catchment 901I only	0.67	Present	0.45	0.58	0.78	1.02	1.21	3.16
			Future	1.21	1.49	1.79	2.17	2.44	4.18

600mm ø CROSSING OSLER BLUFF RD.

ROAD CREST ELEV. = 207.70 m

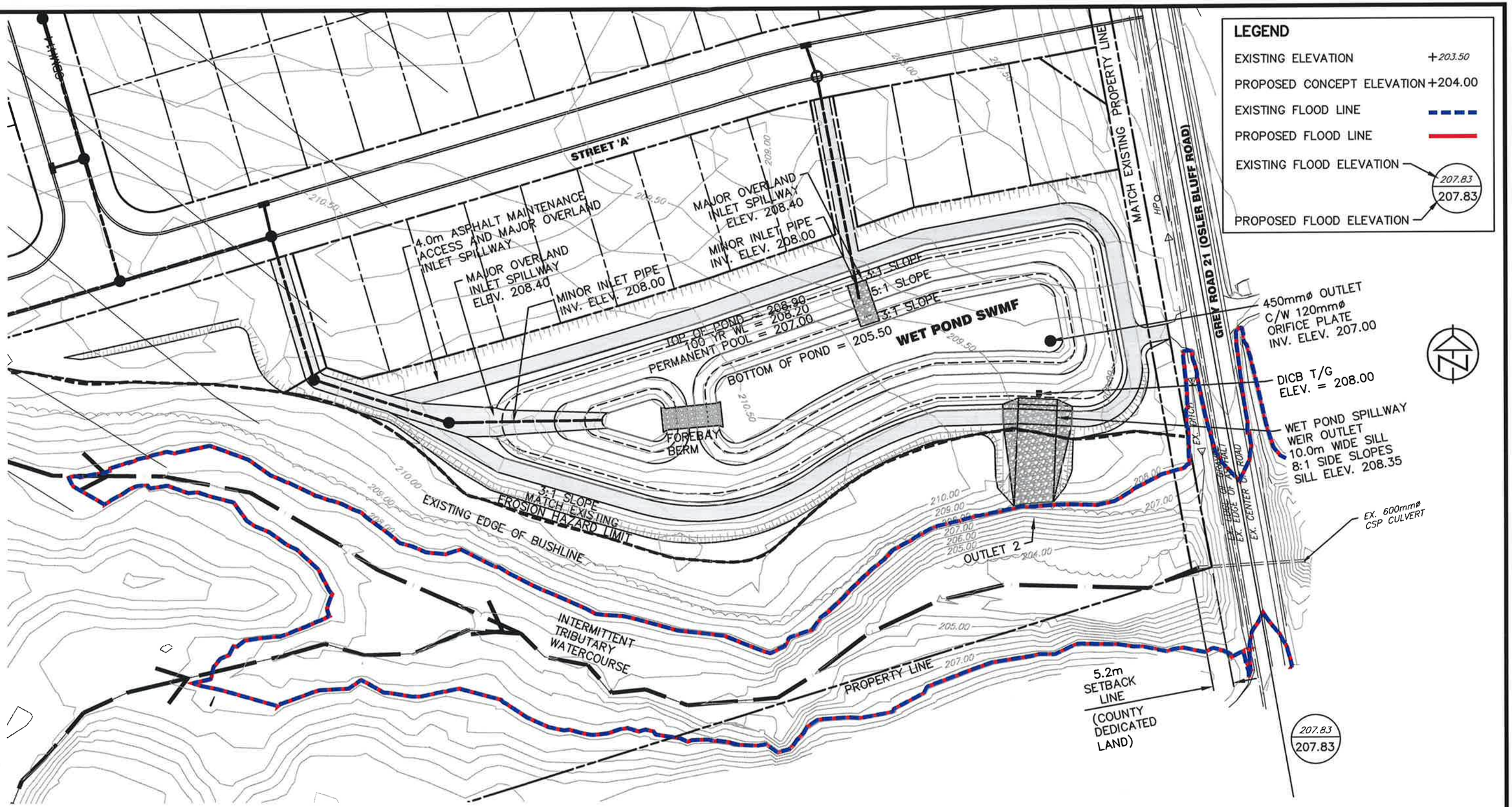
U/S INV. = 203.19 m

Design Chart 2.32: Inlet Control: Circular CSP and SPCSP Culverts



HW/D = 4.51/0.6 = 7.52

Source: Herr (1977)



PRELIMINARY

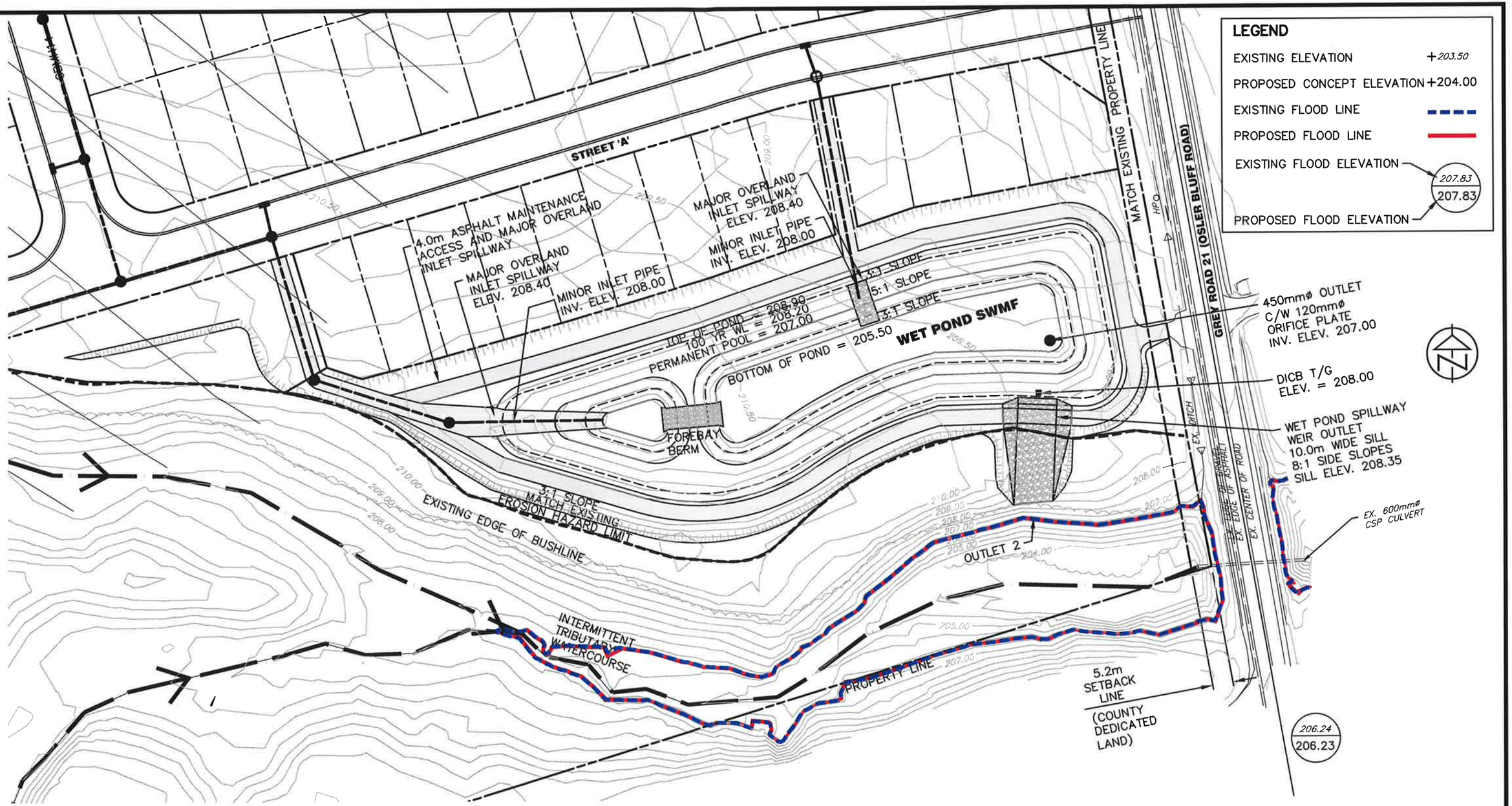
NO.	REVISIONS	DATE
1.	DRAFT PLAN APPROVAL	FEB/19

BLUE VISTA
TOWN OF THE BLUE MOUNTAINS

OPEN SPACE FLOOD LINE NO STORAGE CONSIDERED

TATHAM ENGINEERING

SCALE:	1 : 1000		JOB NO. 117159
DESIGN:	ARO	CHECKED: RS	DWG. **FM-1**
DRAWN:	RD	DATE: JUL/19	



PRELIMINARY

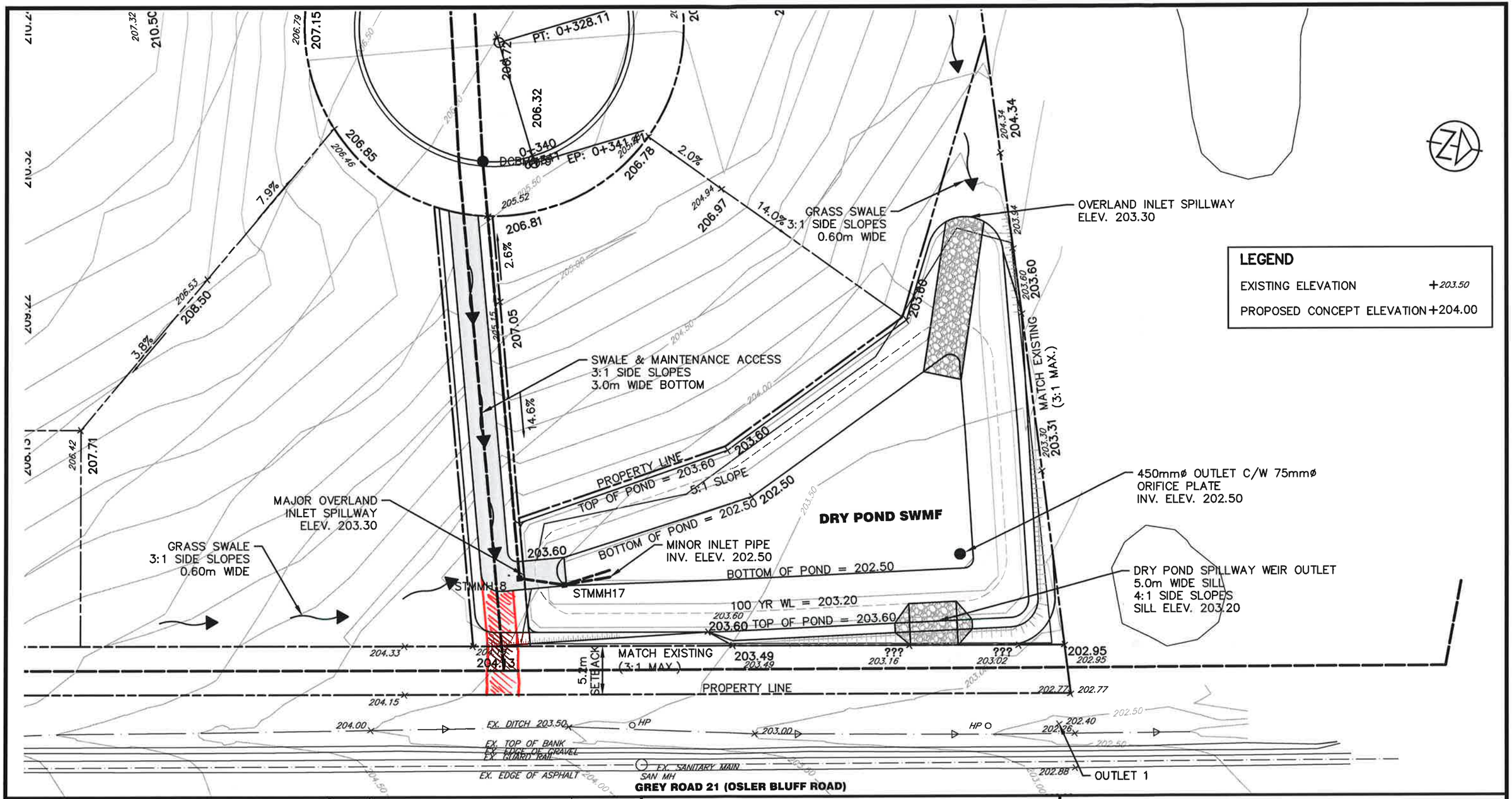
NO.	REVISIONS	DATE
1.	DRAFT PLAN APPROVAL	FEB/19

BLUE VISTA
TOWN OF THE BLUE MOUNTAINS

OPEN SPACE FLOOD LINE STORAGE CONSIDERED

TATHAM ENGINEERING

SCALE:	1 : 1000		JOB NO. 117159
DESIGN:	ARO	CHECKED: RS	DWG. **FM-2**
DRAWN:	RD	DATE: JUL/19	



PRELIMINARY

NO.	REVISIONS	DATE
1.	DRAFT PLAN APPROVAL	FEB/19

BLUE VISTA
TOWN OF THE BLUE MOUNTAINS

DRY POND SWMF CONCEPTUAL DESIGN

TATHAM ENGINEERING

SCALE:	1 : 400		JOB NO. 117159
DESIGN:	ARO	CHECKED: RS	DWG. **SWM-1**
DRAWN:	RD	DATE: NOV/18	

Peto MacCallum Ltd.
CONSULTING ENGINEERS

August 20, 2018

PML Ref.: 18CF004
Report: 2

Mr. Samer Chaaya
Royalton Homes Inc.
10114 Highway 26, Unit 4
Collingwood, Ontario
L9Y 3Z1

Dear Mr. Chaaya

Preliminary Infiltration Assessment
Proposed Residential Subdivision
Grey Road 21
Town of The Blue Mountains, Ontario

Peto MacCallum Ltd. (PML) is pleased to present the results from the preliminary infiltration assessment recently completed for the above noted project site. Authorization for this work was provided by Mr. D. Twigger of C.C. Tatham & Associates Ltd. (CCT) in an email dated June 25, 2018, on behalf of the Client.

A 150 to 200 unit residential subdivision is proposed for the approximate 21 ha parcel of land just north of the Scandinave Spa on the west side of Grey Road 21 in the Town of the Blue Mountains.

Reference is made to Report 1, dated June 19, 2018, where details of the preliminary geotechnical investigation and geotechnical recommendations for the proposed subdivision are provided.

Further to Report 1, a preliminary assessment for near surface infiltration was requested at specific locations.

The purpose of this supplemental work was to conduct near surface Guelph Permeameter (GP) testing at the two locations specified and provide a preliminary assessment for infiltration.

Field Investigation

PML attended site on July 25, 2018 and completed Test Pits 1 and 2 to a depth of 0.5 to 0.7 m below existing grade at the locations shown on Drawing 1, attached. Test pit locations were specified by CCT.

The test pits were hand dug and were backfilled upon completion. In general, the test pits encountered topsoil over brown sand, trace to some silt, trace gravel. Ground water seepage was not observed.

GP testing was completed at the bottom of each test pit. A sample of the native soil encountered in each test pit was collected in order to conduct grain size analysis. Results of grain size analysis are provided in Figure 1, appended.

25 Sandford Fleming Drive, Unit 2, Collingwood, Ontario L9Y 5A6
Tel: (705) 445-0005
E-mail: collingwood@petomaccallum.com
BARRIE, COLLINGWOOD, HAMILTON, KITCHENER, LONDON, TORONTO

Geotechnical Engineering Considerations

Guelph Permeameter Testing

GP tests were completed to determine the field saturated hydraulic conductivity at depths of 0.7 and 0.5 m in Test Pit 1 and Test Pit 2, respectively. During each GP test, the water level drop in the GP chamber was visually monitored and recorded until a steady infiltration rate was reached.

The field saturated hydraulic conductivity, K_{fs}, was determined utilizing the Zhang et al. (1998) method as follows:

$$K_{fs} = \frac{C_1 x Q_1}{2\pi {H_1}^2 + \pi a^2 C_1 + 2\pi \left(\frac{H_1}{a^*}\right)}$$

Where:

C = shape factor
Q = the steady-state rate of fall of water in reservoir (cm/s)
H = hydraulic head (cm)
α = borehole radius (cm)

Utilizing the method in the Toronto Region Conservation Authority (TRCA) LID Storm Water Management Planning and Design Guide, the K_{fs} value was utilized to established/determine infiltration rates based on the following equation:

$$Infiltrate\ Rate = \sqrt[3.7363]{\frac{K_{fs}}{6\ x\ 10^{-11}}}$$

The results of the GP testing are summarized below:

TEST PIT	TEST DEPTH (m)	MATERIAL TYPE	K_{fs} (cm/sec)	INFILTRATION RATE (mm/hr)
1	0.7	Sand	8.0×10^{-4}	80
2	0.5	Sand	9.0×10^{-4}	83

The TRCA Management Planning and Design Guide recommends applying a safety correction factor. To determine the appropriate safety correction factor GP tests completed at deeper depths would be required, otherwise a safety correction factor can be selected from Table C2 of the TRCA Management Planning and Design Guide.

Particle Size Distribution

Two soil samples were submitted for grain size analysis and Hydraulic Conductivity (K) was estimated based on the particle size distribution. The results of the laboratory testing are included in Figure 1 and the estimate of Hydraulic Conductivity is summarized in the table below.

SAMPLE	DEPTH (m)	SOIL TYPE	ESTIMATED K (cm/sec)
TP1	0.7	Sand, Trace Silt, Trace Gravel	10^{-3} to 10^{-4}
TP2	0.5	Sand, Some Sand, Trace Gravel	10^{-3} to 10^{-4}

The Vukovic & Soro method was used to assess K.

The K value derived from the particle size distribution curve does not take into consideration site specific details such as compaction, soil structure, organic content and/or the degree of saturation.

We trust this report is complete within our Terms of Reference. Please do not hesitate to call if you have any questions.

Sincerely

Peto MacCallum Ltd.

Alicia Kimberley, M.Sc., P.Geo.
Project Geoscientist, Geoenvironmental and Hydrogeological Services

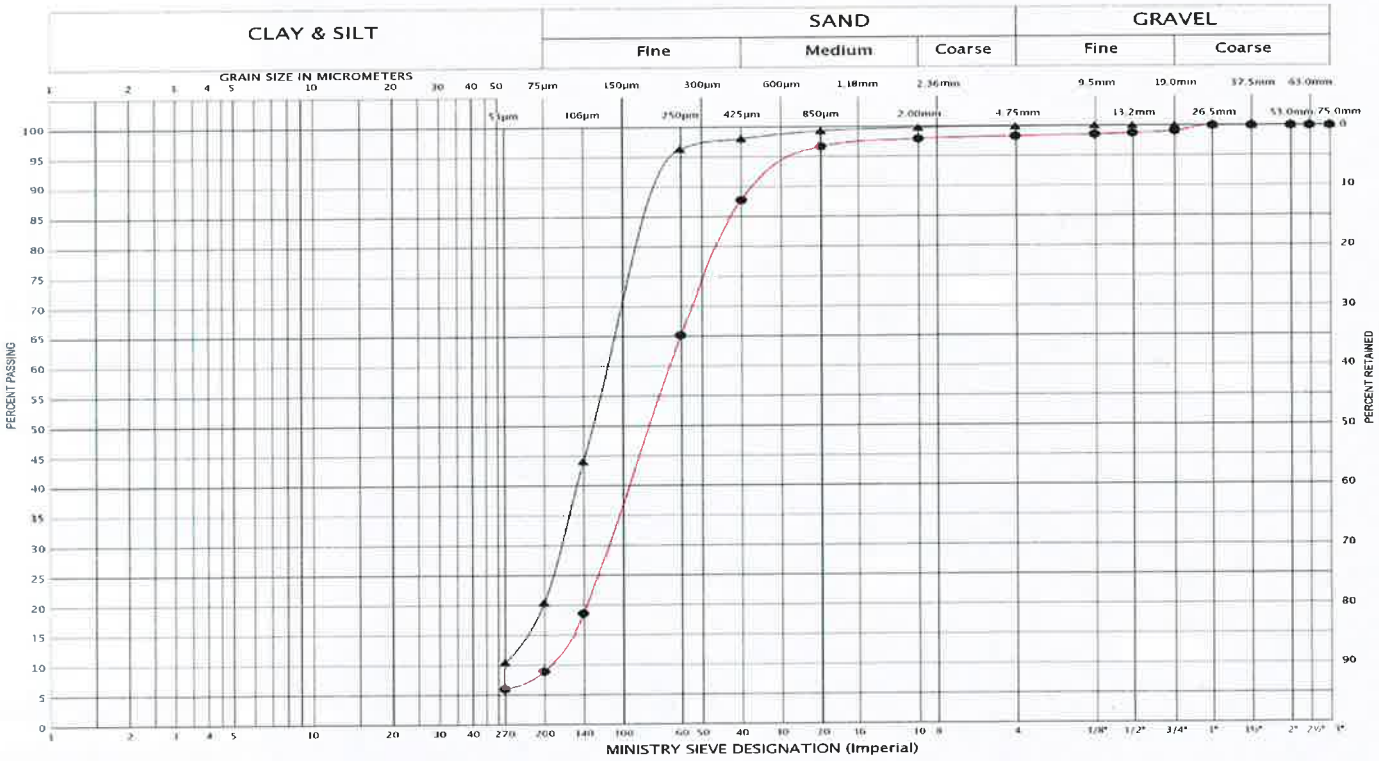
Geoffrey R. White, P.Eng.
Associate
Manager, Geotechnical and Geoenvironmental Services

AK/GRW:jlb/tc

Enclosure(s):
Figure 1 – Grain Size Distribution
Drawing 2-1 – Borehole/Test Pit Location Plan

Distribution:
1 cc: Royalton Homes Inc. (+email)
1 cc: C.C. Tatham & Associates Ltd. (+email)
1 cc: PML Barrie

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	1	2
	SAMPLE	1	1
	SYMBOL	◆	▲

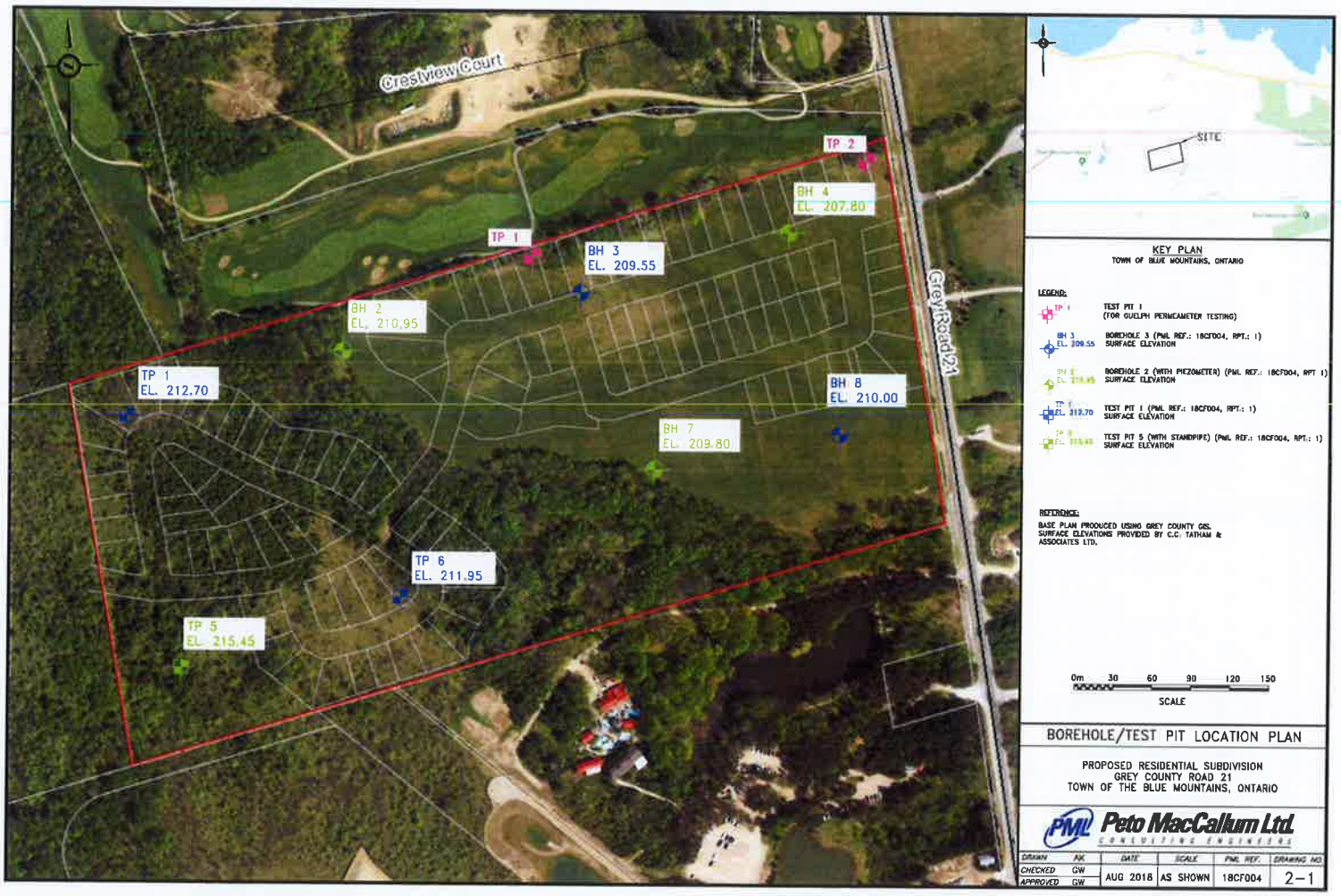
PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

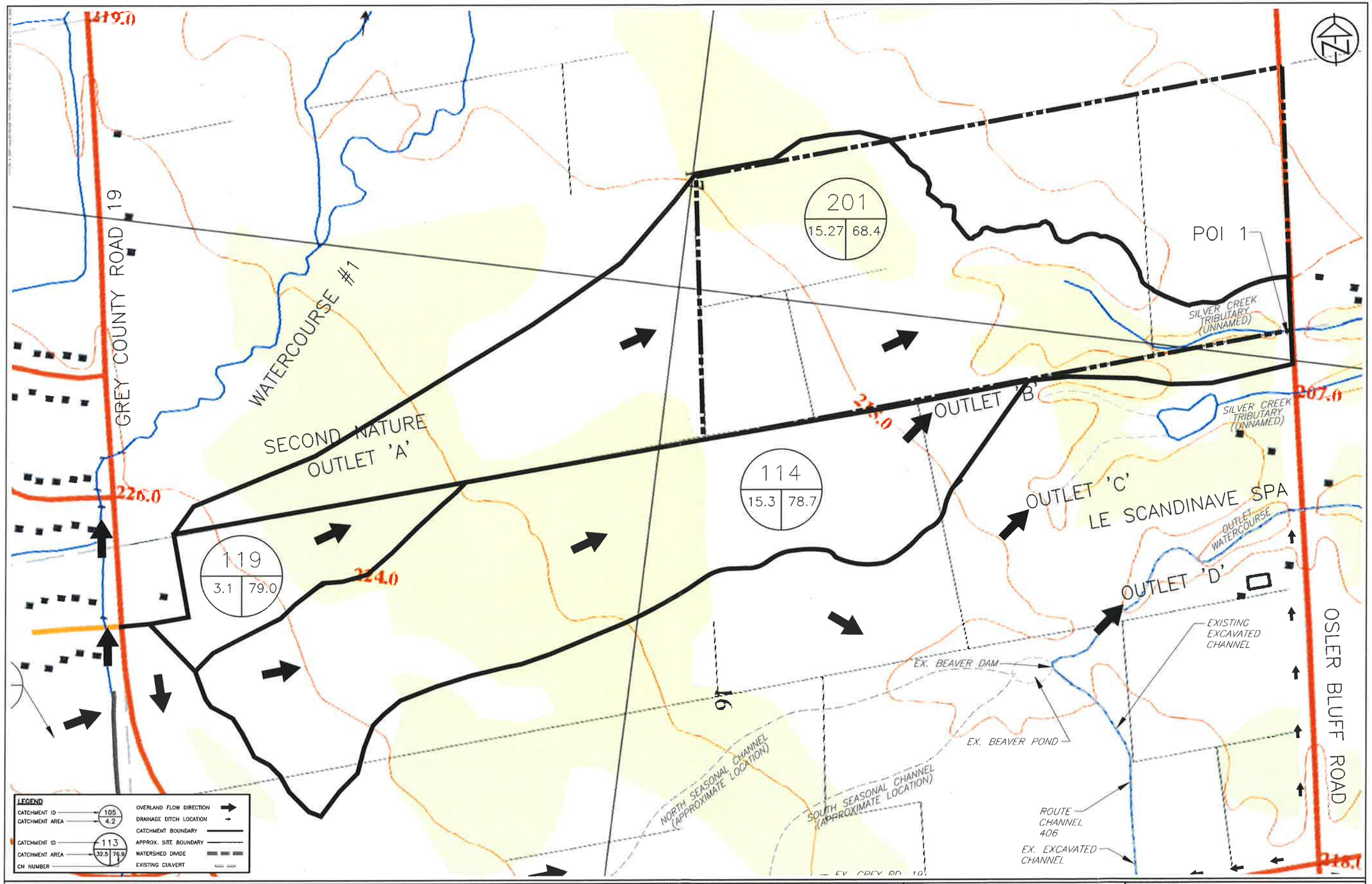
GRAIN SIZE DISTRIBUTION

SAND, Trace to Some Silt, Trace Gravel

FIG No.: 1

Project No.: 18CF004


Crestview Court
Grey Road 21
TP 1
EL. 212.70
TP 2
BH 2
EL. 210.95
BH 3
EL. 209.55
BH 4
EL. 207.80
BH 7
EL. 209.80
BH 8
EL. 210.00
TP 5
EL. 215.45
TP 6
EL. 211.95
SITE
KEY PLAN
TOWN OF BLUE MOUNTAINS, ONTARIO
LEGEND:
TEST PIT 1
(FOR GUELPH PERMEAMETER TESTING)
BOREHOLE 3 (PML REF.: 18CF004, RPT.: 1)
SURFACE ELEVATION
BOREHOLE 2 (WITH PIEZOMETER) (PML REF.: 18CF004, RPT 1)
SURFACE ELEVATION
TEST PIT 1 (PML REF.: 18CF004, RPT.: 1)
SURFACE ELEVATION
TEST PIT 5 (WITH STANDPIPE) (PML REF.: 18CF004, RPT.: 1)
SURFACE ELEVATION
REFERENCE:
BASE PLAN PRODUCED USING GREY COUNTY GIS.
SURFACE ELEVATIONS PROVIDED BY C.C. TATHAM & ASSOCIATES LTD.
0m 30 60 90 120 150
SCALE
BOREHOLE/TEST PIT LOCATION PLAN
PROPOSED RESIDENTIAL SUBDIVISION
GREY COUNTY ROAD 21
TOWN OF THE BLUE MOUNTAINS, ONTARIO
Peto MacCallum Ltd.
CONSULTING ENGINEERS
DRAWN AK
CHECKED GW
APPROVED GW
DATE AUG 2018
SCALE AS SHOWN
PML REF. 18CF004
DRAWING NO. 2-1



CONTRACT DRAWINGS

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

NO.	REVISIONS	DATE	INITIAL

APPROVED

BLUE VISTA
TOWN OF THE BLUE MOUNTAINS

OVERALL PRE DEVELOPMENT DRAINAGE PLAN

C.C. Tatham & Associates Ltd.
Consulting Engineers
Collingwood Bracebridge Orillia Barrie

SCALE: 1 : 2000
JOB NO. 117159
DESIGN: ARO
CHECKED:
DRAWN: DRT
DATE: JUL/19
DWG. **ODP-1**