FUNCTIONAL SERVICING & STORMWATER MANAGEMENT REPORT

125 ARTHUR STREET

TOWN OF THE BLUE MOUNTAINS
GREY COUNTY

PREPARED FOR:

THE BLUE MEADOWS INC.

PREPARED BY:

C.F. CROZIER & ASSOCIATES INC.
1 FIRST STREET, SUITE 200
COLLINGWOOD, ON L9Y 1A1

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Rev.0	December 2021	Issued for Client Review
Rev.1	February 2022	Draft Plan Application – 1st Submission

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1.0 Introduction

C.F. Crozier & Associates Inc. (Crozier) was retained by The Blue Meadows Inc. (Blue Meadows) to complete a Functional Servicing and Stormwater Management Report in support of the relevant planning applications for the proposed residential development located at 125 Arthur Street West.

The Subject Lands are legally described as part of Lots 40 to 47 on the Southwest side of Arthur Street; all of Lots 40 to 44 and part of Lots 46 to 49 on the Northeast side of Louisa Street; all of Park Lots 11 to 14 on the Southwest side of Louisa Street; part of Park Lots 11 to 12 and all of Park Lots 13 to 15 on the Northeast side of Alice Street; part of Louisa Street; part of Minto Street; and, part of Albert Street. The Subject Lands are bounded by Arthur Street West to the north, Lansdowne Street South to the east, Alice Street West to the south and Little Beaver Creek to the west in the Town of The Blue Mountains (Town), Grey County. Refer to **Figure 1** for the Site Location Plan.

The purpose of this report is to demonstrate that Subject Lands can be developed in accordance with the Town of The Blue Mountains and Grey Sauble Conservation Authority (GSCA) guidelines from a functional servicing & stormwater management perspective.

2.0 General Site Description

The Subject Lands are approximately 5.59 ha in size and are designated as Hazard, Downtown Area and Community Living Area in the Town of The Blue Mountains Official Plan (June 2016). The site is zoned as Development (D) and Residential One (R1-1) in the Town of The Blue Mountains Zoning By-Law (2018). Currently, the site consists of open lots and two existing homes, one fronting onto Arthur Street and the other fronting onto Lansdowne Street. The Little Beaver Creek is located to the west of the Subject Lands and features moderate tree cover within the riparian corridor. The Creek traverses the site from south to north, entering and exiting the site via 6.10 m span by 3.5 m rise box culverts at Alice Street West and Arthur Street West, respectively.

The proposed development will include approximately 2.08 ha of residential development, 0.94 ha of mixed commercial / residential development, 0.18 ha of park space, 0.82 ha of open space, and a 0.26 ha stormwater management block. The Concept Plan, prepared by Montgomery Philips King Architects Inc. February 2022, proposes 13 blocks of residential rowhouses, 3 blocks of commercial/residential townhouses, and 2 blocks of commercial buildings/residential condominiums. A park land block and a stormwater retention block are also included in the plan. The residential unit count can be seen in **Table 1** below.

Table 1: Proposed Residential Unit Count

Unit Type	Number of Units
Rowhouses	98
Commercial/Residential Townhouses	18
Apartment Units	75
Total	**191**

3.0 Sanitary Servicing

The following subsections provide an analysis of the sanitary servicing strategy for the proposed development of the Subject Lands.

3.1 Existing Sanitary Servicing Infrastructure

The As-Constructed drawings indicate that the following infrastructure is available to service the Site:

- An existing 450 mm diameter sanitary sewer on Arthur Street West.
- An existing 200 mm diameter sanitary sewer stub at the intersection of Arthur Street West and Lansdowne Street South.

From Arthur Street West, sewage is conveyed to the trunk sanitary sewer on Huron Street West where an inverted siphon crosses the Beaver River to the Bay/Mill Street Sewage Pumping Station and the Thornbury Wastewater Treatment Plant (WWTP) via forcemain.

Refer to **Appendix A** for the As-Recorded Drawings provided by the Town.

3.2 Sanitary Demand Calculations

Design Criteria (The Blue Mountains Engineering Standards, April 2009). A per capita sewage flow of 450 L/C/day was used with an occupancy density of 2.3 persons/unit. Infiltration flow of 0.23 L/sec/ha and a peaking factor of 4.0 was applied to the sewage flow rate to obtain the total estimated design sewage flow for the Subject Lands. A summary of the design flows is presented in **Table 2** below and detailed calculations have been provided in **Appendix B**.

Table 2: Estimated Sanitary Design Flows

Standard	**Average Flow** (L/sec)	**Peaking Factor**	**Peak Flow** (L/sec)	**Infiltration Flow** (L/sec)	**Total Estimated Design Flow** (L/sec)
Town of The Blue Mountains	2.44	4.0	9.73	1.10	10.84

The proposed sanitary system will be sized to convey a peak sanitary flow of 10.84 L/sec for the development.

3.3 Proposed Sanitary Servicing Strategy

Under proposed conditions, the site will be entirely serviced by gravity sewer. The proposed routing of the internal sanitary sewer will generally follow the alignment of the internal roadways at an adequate depth to provide service to the proposed units. Sanitary sewers will also be installed within the existing Lansdowne Street South and Alice Street West Right-of-Ways (ROW) to service the proposed lots fronting onto the Municipal roadways.

Sanitary maintenance holes will be installed with spacing consistent with Municipal standards. The proposed 200mm diameter internal sanitary sewer will be designed with sufficient slope to provide cleansing velocity within the sewer to reduce required maintenance post-construction. Gravity service connections (125mm dia.) are proposed to be provided to each unit.
Refer to **Figure 2** for the Sanitary Servicing Plan.

4.0 Water Servicing

The following subsections provide an analysis of the water servicing and fire protection strategy proposed for the Subject Lands.

4.1 Existing Water Servicing Infrastructure

The existing water distribution infrastructure at or near the Subject Site includes the following:

- An existing 150 mm diameter watermain on Arthur Street West
- An existing 150 mm diameter tee connection at the intersection of Arthur Street West and Lansdowne Street South
- A sub-standard size watermain on Alice Street West

Refer to **Appendix A** for the As-Recorded Drawings provided by the Town.

4.2 Water Demand Calculations

The Town of The Blue Mountains Design Criteria (The Blue Mountains Engineering Standards, April 2009) and the MECP Design Guidelines for Drinking Water Systems (2008) were referenced to calculate water demand flows for the proposed development. A per capita water demand of 450 L/C/day was used with an occupancy density of 2.3 persons/unit. The maximum peak day factor of 2.75 and peak hour factor of 4.50 were applied to the average daily demand flow of 2.44 L/sec to obtain max daily demand and peak hour demand flows. A summary of the results is presented in **Table 3** below and detailed calculations have been provided in **Appendix C**.

Table 3: Estimated Design Water Demand

Standard	**Average Daily Demand** (L/sec)	**Maximum Daily Demand** (L/sec)	**Peak Hourly Demand** (L/sec)
Town of The Blue Mountains	2.44	6.71	10.98

4.3 Fire Flow Demand Calculations

The Fire Underwriters Survey (FUS) and Ontario Building Code (OBC) methods were used to estimate the fire flow requirements for the proposed development. Based on the most recent Concept Plan (February 2022), fire flow requirements were calculated for the largest commercial building (Commercial Building #2) and the largest block of row houses. **Table 4** summarizes the fire flow under both OBC and FUS approaches for these buildings.

Table 4: Estimated Fire Demand Flows

Building Type	**Demand Flow - OBC** (L/sec)	**Demand Flow - FUS** (L/sec)
Commercial Building	105	183.3
Row House	105	200

The design flow (Max Day + fire flow) for the Subject Site is **206.7 L/s**, subject to detailed design. Refer to **Appendix C** for potable water servicing demand and fire flow demand calculations.

4.4 Proposed Water Servicing Strategy

The proposed water servicing strategy will include the extension of the 150 mm diameter watermain on Arthur Street West, along the Site's frontage on Lansdowne Street South and Alice Street West, terminating at a proposed hydrant east of the Little Beaver River. The watermain internal to the Site will be looped with connections at Arthur Street West, Lansdowne Street South, and Alice Street West.

The watermain for the Site is proposed to be municipally owned and operated. The watermain will be constructed within the roadway per Town standards for a typical road section. Fire protection for the residential units will be provided by fire hydrants spaced as per Town Standards.

Refer to **Figure 3** for the Water Distribution Plan.

5.0 Stormwater Management

Management of stormwater and site drainage for the proposed development will proceed in conformance with the standards provided by the Town of The Blue Mountains, Grey Sauble Conservation Authority (GSCA), and Ministry of the Environment, Conservation and Parks (MECP).

A stormwater management (SWM) strategy and accompanying recommendations regarding the proposed development have been included below.

- Water Quantity Control
  - Control of the post-development peak flows to pre-development levels for all storms up to and including the 100-year event.

- Water Quality Control
  - "Enhanced Protection" of 80% TSS Removal for 90% of the annual runoff volume given Georgian Bay as the ultimate receiver.

- Erosion Control
  - Erosion Control for the 25mm storm event.

- Development Standard
  - Urban cross section within 20-meter right-of-way
  - Lot grading at 2% optimum
  - Minor/major drainage system to convey frequent rainfall/runoff events

5.1 Existing Drainage Conditions

The Ontario Soil Survey Complex (2020) classifies the soils on site as Brighton Sand, which is classified as Hydrologic Soil Group A. This soil type has been generally confirmed in the Geotechnical Report by Palmer, which identified onsite soils as predominantly silt / sandy silt overlying silty clay / clayey silt.

Based on the topographic survey completed by Rudy Mak Surveying Ltd. (June 2020), the existing elevation of the site ranges from approximately 190.00m to 196.50m. Approximately 3.91 ha of the Site drains via sheet flow to low point located at the north-east corner of the Site, where it is collected by an inlet headwall and 600 mm diameter storm sewer. The remaining 1.68 ha of the Site drains via Sheet Flow to the Little Beaver River. **Table 5** below summarizes the existing drainage conditions on Site.

Table 5: Pre-Development Drainage Summary

Catchment ID	Catchment Area (ha)	Land Use	Runoff Coefficient	Outlet
100	1.68	Unimproved Open Space (less than 7%)	0.25	Little Beaver River
101	3.91	Unimproved Open Space (less than 7%) + 2 dwellings	0.27	Headwall and 600 mm diameter storm sewer at the Arthur Street West / Lansdowne Street South intersection.
EXT-1	0.31	Residential Lot	0.46	Headwall and 600 mm diameter storm sewer at the Arthur Street West / Lansdowne Street South intersection.

Refer to **Figure 4** for the Pre-Development Drainage Plan.

The Subject Lands were included in the study area of the Thornbury West Drainage Study completed by Tatham Engineering (Tatham) in March 2019. Our office coordinated with Tatham to update the hydrologic/hydraulic model of the Thornbury West storm sewer system based on the pre-development drainage conditions identified in the topographic survey. Refer to **Appendix D** to review the technical memo by Tatham.

Tatham recommended that to avoid exacerbating the known capacity issues within the system, flows from the Subject Lands should be controlled down to the lesser of the pre-development flows or the constrained capacity of 0.44 m^3/s in the first two sections of the sewer downstream of the subject site on Arthur Street West. Section 5.3.2 outlines the target pre-development flows for the catchments draining towards Lansdown.

5.2 Proposed Drainage Conditions

The proposed development consists of an urban cross section roadway complete with curb and gutter with an internal storm sewer system. Front yards, side yards and rooftops will be graded to direct runoff towards the ROW where they will be collected by catchbasins and conveyed through the proposed storm sewer system, up to and including the 5-year storm event. Major storm events (greater than a 5-year storm event) will be conveyed by overland flow routes via roadways and overland channels/swales. To promote stormwater drainage towards proposed catchbasins throughout the site, the internal paved areas will be graded with slopes ranging from 0.5% - 5.0%. Refer to **Figure 5** and **Figure 6** for the General Grading Plan and Storm Sewer Drainage Plan, respectively.

Runoff from the Site will be conveyed to two (2) outlets under post-development conditions:

- Outlet #1 – The Little Beaver River.
- Outlet #2 – The existing 600 mm diameter storm sewer at the intersection of Arthur Street West and Lansdowne Street South.

The majority of the drainage from proposed developed areas of the Site will be directed to a dry pond (SWM Facility #1) located at the north-east corner of the Site. SWM Facility #1 will receive runoff from approximately 3.06 ha of the development area. Major overland flows from the development area will be graded to fall to a roadway low point adjacent to SWM Facility #1 where all flow will be directed into the pond. Stormwater will outlet at the north-east corner of the pond through a control structure and Oil-Grit Separator prior to reaching Outlet #2.

Surface storage is proposed in the Open Space block located in the south-east corner of the Site (SWM Facility #2). The block will be graded to create a low point in the center, which will collect the runoff from the adjacent rear yards of the proposed townhome blocks during minor and major storm events. A control structure, complete with orifice plate, will be placed at the low point to reduce the peak flows leaving the Site to pre-development levels at Outlet #2. Per the Town's Engineering Standards, the maximum depth of the ponding in this area will be 0.3m.

Surface storage in combination with super pipes are proposed at the west end of the Louisa Street ROW (SWM Facility #3). SWM Facility #3 will receive runoff from a portion of Street B (approximately 0.83 ha) before discharging to the Little Beaver River (Outlet #1). During minor storm events, the proposed storm sewers within Street B will connect to a control structure in SWM Facility #3, complete with orifice plate. The control structure will ensure the flow rate exiting the site are equal to or less than pre-development levels by utilizing the storage volume with the storm sewers upstream. SWM Facility #3 will be graded to allow overland flows from Street B to enter the facility during major storm events where a combination of underground and surface storage will control the flow rates exiting the Site at Outlet #1.

Refer to **Figure 7** for the Post-Development Drainage Plan.

5.3 Stormwater Quantity Control

Quantity control for the development will be provided by the three (3) proposed SWM Facilities on-site. Outflow from these SWM Facilities will be controlled by an orifice plate to ensure the post development peak flow rates at each outlet are equal to or less than pre-development levels for all storm events (up to and including the 100-year storm event).

Given the small area of the drainage catchments within the proposed development property, the analysis of on-site quantity control requirements was performed using the Rational Method, per industry standard.

5.3.1 Outlet #1 – The Little Beaver River

Quantity control for Outlet #1 will be provided by SWM Facility #3 in combination with super pipes, as described in Section 5.2. SWM Facility #3 will control the runoff from drainage catchment 201 in post development conditions (Refer to **Figure 7** for the Post-Development Drainage Plan). Since drainage Catchments 200 and 210 discharge un-controlled to Outlet #1, SWM Facility #3 must provide sufficient storage to ensure the combined controlled and un-controlled discharge is equal to or less than the pre-development flow rate.

To determine the volume of storage required within SWM Facility #3, the Rational Method was used. A composite runoff coefficient for the existing and proposed site conditions was calculated using values found in the Town of The Blue Mountains Design Standards (The Blue Mountains Engineering Standards, April 2009) and MTO Standards (MTO Drainage Management Manual, 1997). **Table 6** illustrates the determination of pre- and post-development runoff coefficients.

Table 6: Pre- and Post-Development Conditions Composite Runoff Coefficient (Outlet #1)

	Pre-Development			Post-Development					
Land Use	**Area (ha)**	**Runoff Coefficient***	**A x C**	**Area (ha)**	**Runoff Coefficient***	**A x C**	**Area (ha)**	**Runoff Coefficient***	**A x C**
Catchment	**Pre-Development**			**Uncontrolled (200, 210)**			**Controlled (201)**		
Asphalt/Roof	0.00	0.90	0.0	0.10	0.90	0.09	0.52	0.90	0.47
Landscape	0.00	0.30	0.0	0.17	0.30	0.05	0.31	0.30	0.09
Unimproved	1.68	0.25	0.42	0.8	0.25	0.2	0.00	0.25	0.00
Composite	1.68	0.25	**0.42**	1.07	0.32	**0.34**	0.83	0.67	**0.56**

The calculated composite runoff coefficients were used in the Rational Method calculations. Rainfall events were modelled using City of Owen Sound IDF data, and a 15-minute time of concentration. Note that runoff coefficients for the 100-year storms were adjusted per the Town of The Blue Mountains Engineering Standards. The results of the analysis are presented in **Table 7**. Detailed calculations have been provided in **Appendix E**.

Table 7: Rational Method Storage Volume Results (Outlet #1)

Storm	**Pre-Development (m^3/sec)**	**Post Development (m^3/sec)**			**Required Storage (m^3)**
	Total	**Uncontrolled (200, 210)**	**Controlled (201)**	**Total**	
5-year*	0.09	0.07	0.02	0.09	129
100-year	0.39	0.26	0.13	0.39	117

*The 5-year governed and is likely due to the nature of the 100-yr runoff coefficient modifier as per Town of The Blue Mountains Engineering Standards.

Based on the preliminary grading shown on **Figure 6**, SWM Facility #3 can be graded to provide up to 90 m^3 of surface storage. SWM Facility #3 surface storage in combination with proposed 50m^3 of super pipes is sufficient to control peak flows on site.

5.3.2 Outlet #2 – Existing 600 mm diameter Storm Sewer

Per the Town's Engineering Standards, storm sewers are designed to convey peak flow rates from minor storm events (up to and including the 5-year storm event). Since Outlet #2 is an existing storm sewer, the peak flow rates exiting the Site post-development during all major storm events (up to and including the 100-year storm event) must be controlled to the pre-development 5-year storm event.

Quantity control for Outlet #2 will be provided by SWM Facility #1 and SWM Facility #2, as described in Section 5.2. SWM Facility #1 will control the runoff from drainage catchment 202, 204, 205 and 209 in post development conditions (Refer to **Figure 7** for the Post-Development Drainage Plan). SWM Facility #2 will control the runoff from drainage catchment 207 in post development conditions. Since drainage Catchments 203, 206, and 208 discharge un-controlled to Outlet #2, the two SWM Facilities must provide sufficient storage to ensure the combined controlled and un-controlled discharge is equal to or less than the pre-development flow rate.

To determine the volume of storage required within SWM Facility #1 and SWM Facility #2, the Rational Method was used. A composite runoff coefficient for the existing and proposed site conditions was calculated using values found in the Town of The Blue Mountains Design Standards (The Blue

Mountains Engineering Standards, April 2009) and MTO Standards (MTO Drainage Management Manual, 1997). **Table 8** illustrates the determination of pre- and post-development runoff coefficients.

Table 8: Pre- and Post-Development Conditions Composite Runoff Coefficient (Outlet #2)

	Pre-Development			Post-Development					
Land Use	**Area (ha)**	**Runoff Coefficient***	**A x C**	**Area (ha)**	**Runoff Coefficient***	**A x C**	**Area (ha)**	**Runoff Coefficient***	**A x C**
Catchment	**Pre-Development**			**Uncontrolled (203, 206, 208)**			**Controlled (202, 204, 205, 209)**		
Asphalt/Roof	0.12	0.90	0.11	0.32	0.90	0.29	1.97	0.90	1.77
Landscape	0.60	0.30	0.18	0.31	0.30	0.09	1.39	0.30	0.42
Gravel	0.08	0.75	0.06	0.00	0.75	0.00	0.00	0.75	0.00
Unimproved	3.42	0.25	0.86	0.00	0.25	0.00	0.00	0.25	0.00
Composite	4.22	0.29	**1.22**	0.63	0.60	**0.38**	3.36	0.65	**2.18**

The calculated composite runoff coefficients were used in the Rational Method calculations. Rainfall events were modelled using City of Owen Sound IDF data, and a 15-minute time of concentration. Note that runoff coefficients for the 100-year storms were adjusted per the Town of The Blue Mountains Engineering Standards. The results of the analysis are presented in **Table 9**. Detailed calculations have been provided in **Appendix E**.

Table 9: Rational Method Storage Volume Results (Outlet #2)

Pre-Development – 5-Year Storm (m^3/sec)	**Post Development – 100-Year Storm (m^3/sec)**				
Total	**Uncontrolled (203, 206, 208)**	**Controlled (202, 204, 205, 209)**	**Required Storage (m^3)**	**Controlled (207)**	**Required Storage (m^3)**
0.27	0.19	0.05	1,394	0.03	53

Based on the preliminary grading for SWM Facility #1 shown on **Figure 8**, the proposed dry pond can provide up to 1,420 m^3 of surface storage, which exceeds the required storage volume. The preliminary grading for SWM Facility #2 shown on **Figure 6** shows that the open space block can be graded to provide 60 m^3 of surface storage, without ponding deeper than 0.3 m. Therefore, the two proposed SWM Facilities are adequate to provide quantity controls for the Site.

As seen in Table 9 the target discharge rate from Outlet #2 (draining to towards Lansdown St.) is 0.27 m^3/s. This target quantity is less than the storm system capacity limit of 0.44 m^3/s stated in the technical memo by Tatham.

5.4 Stormwater Quality Control

It will be necessary to implement stormwater management practices to address the water quality control requirements of the regulatory agencies. Since Georgian Bay is the ultimate receiver of drainage from the proposed development, the development will incorporate measures to provide "enhanced protection" per the MOE (2003) guidelines. "Enhanced" water quality protection involves the removal of at least 80% of suspended solids from 90% of the annual runoff volume.

Quality control for the development will primarily be achieved by implementation of a treatment train approach. Catchbasin capture devices (CB Shields, and CBMH Shields), an oil grit separator, a

Jellyfish Filter (or equivalent), stormwater management facilities, and enhanced grass swales will be used in combination to achieve the stormwater quality requirements for the development. The stormwater quality treatment for each outlet is as follows:

5.4.1 Outlet #1 – The Little Beaver River

The flows outletting to the Little Beaver River will be treated with a Jellyfish Filter or an equivalent product. The Jellyfish Filter will be installed prior to the surface storage and control structure in which it will treat and convey flows to the Little Beaver River and ultimately to Georgian Bay. The Jellyfish Filter will treat 0.83 ha as the rest of the contributing drainage areas are made up of rear yards and roof area. These areas are assumed to produce clean runoff that will sheet flow directly to Outlet #1 and will not drain to the storm sewer system or the Jellyfish Filter unit.

Jellyfish Filters or equivalent units are typically credited with at least 80% TSS removal. Refer to **Table 10** for further information.

Table 10: SWM Facility #3 Quality Control Characteristics

Location	OGS Type	Drainage Area (ha)	Total Suspended Solids Removal	Percent of Runoff Volume Treated
Intersection of Street B and Louisa Street	Jellyfish Filter	0.83	>80%	>90%

5.4.2 Outlet #2 – Existing 600 mm diameter Storm Sewer

The treatment train discharging to Outlet #2 will use a combination of an oil grit separators and SWM Facility #1 to achieve the quality requirements. The drainage catchment for SWM Facility #2 is comprised of rear yard and roof runoff, which is assumed to produce clean stormwater; therefore, quality controls are not required.

The oil grit separator will be installed at the outlet of SWM Facility #1the storm sewer systems prior to the control structure within the SWM facility for further treatment and conveyance to the Little Beaver River and ultimately to Georgian Bay. The oil grit separator will treat the 3.06 ha of developed areas that drain to SWM Facility #1. The rest of the contributing drainage areas for Outlet #1 are made up of rear yards and roof area. These areas are assumed to produce clean runoff that will sheet flow directly to Outlet #1 and will not drain to the internal storm sewer system or the oil grit separator.

A Stormceptor EFO10 has been specified as it has been designed for 80% TSS removal and will maximize the TSS removal from stormwater discharging to the SWM Facility. However, based previous conversations with the Town, oil grit separators are credited with 50% TSS removal.

The SWM facility has be designed to be a "Dry" facility as no permanent pool is specified. As such, the SWM facility will provide 60% TSS removal, which is consistent with the MECP removal efficiency of a Dry Pond.

The equation for treatment practices in series was used to determine the removal efficiency for the proposed treatment train.

$$R = A + B - \left[\frac{A \times B}{100}\right]$$

$$R = Combined\ Removal\ Efficiency$$
$$A = Oil\ Grit\ Seperator\ Removal\ Efficiency - 50\%$$
$$B = SWM\ Facility\ Removal\ Efficiency - 60\%$$

Based on the equation above the proposed treatment train will provide an 80% TSS removal for Outlet #2.

6.0 Utilities

The Subject Development will be serviced with natural gas, telephone, hydro and cable TV. The design of such utilities will be coordinated with the local utility companies servicing the Town. Utilities are proposed to follow the alignment of the internal road network, with individual service connections to each lot. Coordination with the aforementioned utilities will be undertaken during the detailed design phases to confirm utility design capacity and connection locations.

7.0 Erosion & Sediment Controls

All sediment and erosion controls will be installed before the commencement of any earthworks and maintained throughout until the site is stabilized or as directed by the Engineer, GSCA and/or Town. Controls are to be inspected regularly, after each significant rainfall and maintained in proper working condition. Erosion and sediment control measures to be considered include, but are not limited to, the following:

- Silt Fence

Silt fencing will be installed where required to intercept sheet flow. Heavy-duty silt fence will be located around the perimeter of the work zone limits. It should be noted that additional silt fencing may be added based on field decisions by the Site Engineer and Owner before, during and following construction.

- Mud Mat

A mud mat will be installed at the main access points to the site to reduce the amount of mud tracking onto existing paved roadways during site servicing operations.

- Dust Suppression

During earthwork activities, the Contractor will ensure that measures for dust suppression are provided as required, such as the application of water or lime.

8.0 Conclusions & Recommendations

Based on the foregoing we conclude that the proposed development can be adequately serviced.

1. An extension of the existing sanitary sewer located at the intersection of Arthur Street West and Lansdowne Street South is required to service the proposed development. An internal sanitary sewer system will follow the alignments of the proposed roadways and provide gravity servicing to all individual units.
2. An extension of the existing 150 mm diameter watermain on Arthur Street West is required to service the proposed lots fronting onto the existing Lansdowne Street South and Alice Street West Right-of-Ways. A public watermain will be looped through the proposed development along with connections to the watermain on Lansdowne Street South and Alice Street West.
3. Preliminary grading has indicated that a majority of the development will drain towards the internal roadway/storm sewer network and stormwater will be conveyed to the proposed SWM Facilities. The remaining areas will maintain existing drainage patterns as much as possible. Final grading will be determined during detailed design.
4. Three (3) stormwater management facilities are required to service the proposed development. The land set aside for the SWM facilities is adequate to provide stormwater quality and quantity control of the urban drainage emanating from the site.
5. Utilities including hydro, gas, telephone, and cable services are available to service the development since existing plants are located on the perimeter roads surrounding the subject lands.

Therefore, we recommend approval of the Planning Applications for the site from the perspective of engineering servicing requirements.

Respectfully submitted,

C.F. CROZIER & ASSOCIATES INC.

Ian Blechta, E.I.T.
Engineering Intern

C.F. CROZIER & ASSOCIATES INC.

George Cooper, P. Eng.
Project Engineer

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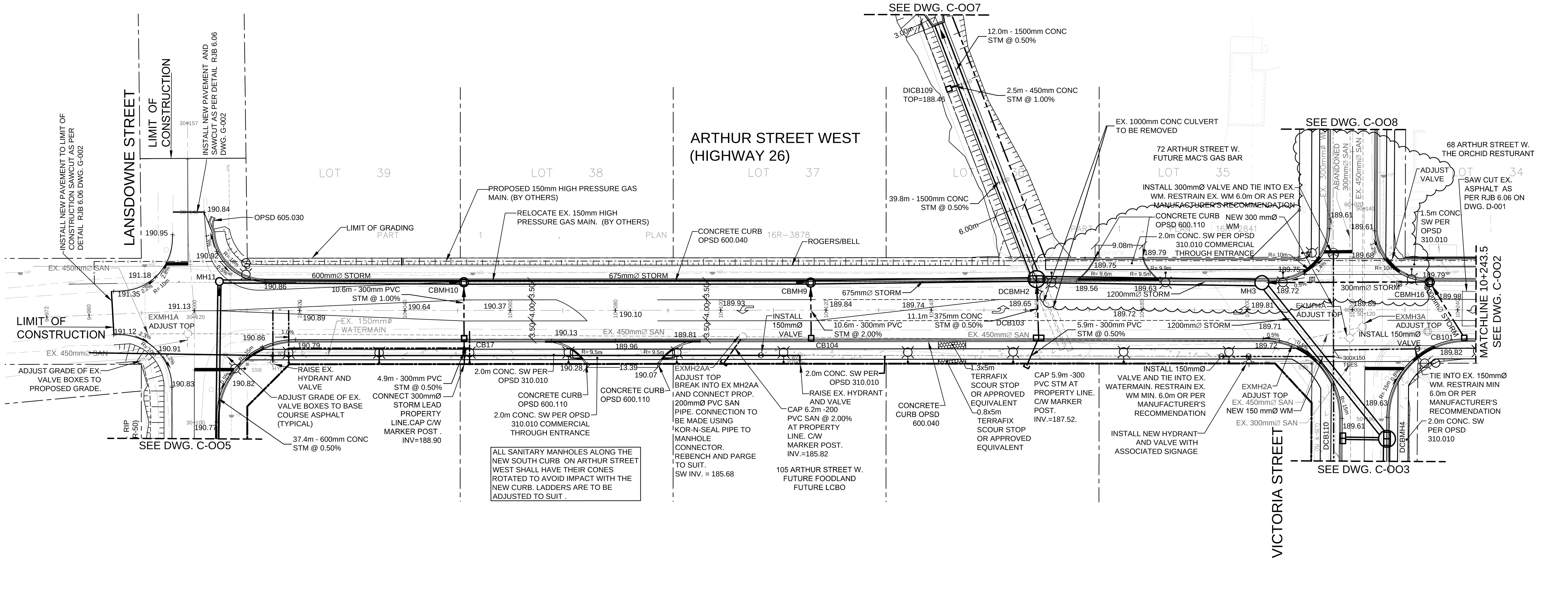
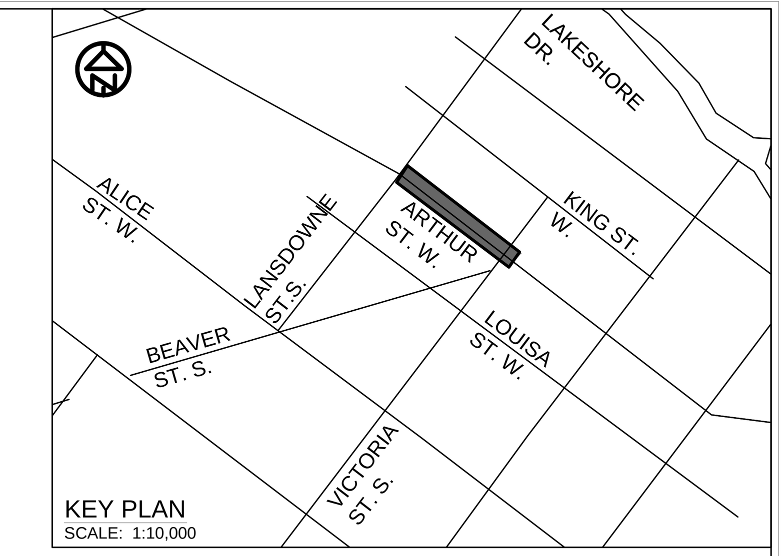
Appendix A

As-Recorded Drawings



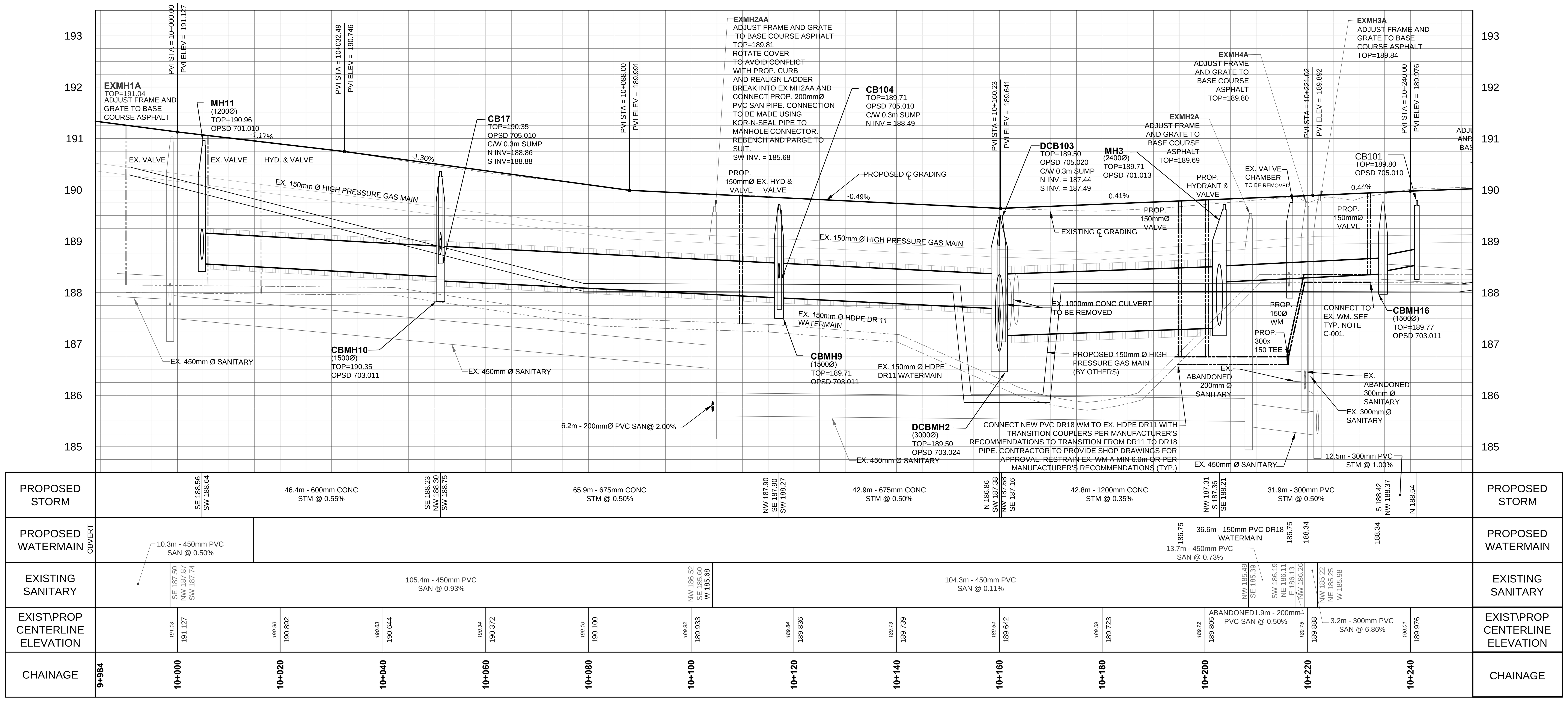


LEGEND

- PROPOSED STORM SEWER/ MANHOLE
- EXISTING LARGE STORM SEWER (OVER 675mm)
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING WATERMAIN
- EXISTING HYDRANT
- PROPOSED CATCH BASIN / DOUBLE CATCH BASIN
- PROPOSED STORM CATCHBASIN MANHOLE
- EXISTING CATCHBASIN
- 190.23 PROPOSED FINISHED GRADE ELEVATION
- 1.8% PROPOSED SLOPE
- CONCRETE SIDEWALK AS PER OPSD 310.010
- RESTORE ASPHALT SHOULDER/DRIVEWAY

NOTE:

CATCHBASINS CB17, CB104, AND CB103 ARE TO HAVE 0.3m SUMPS AND SHALL BE INSTALLED A MINIMUM OF 1.0m ABOVE THE OBVERT OF THE EXISTING SANITARY SEWER.



BENCHMARK

HEREON ARE GEODETIC AND REFERRED TO THE GEODETIC MONUMENT NO. 01972U301, ELEVATION 178.318. SITE BENCHMARK HAS BEEN DETERMINED TO WITHIN 10mm OF LOCAL GEODETIC BENCHMARK. BENCHMARK LOCATION: WHARF, AT FOOT OF BRUCE STREET, TABLET IN TOP OF CONCRETE RETAINING WALL, 39m SOUTH OF SOUTH END OF WHARF PROPER, 7.9m NORTH OF POINT WHERE RETAINING WALL TURNS EAST, 3.2m SOUTHEAST OF MOST SOUTHERLY OF 3 BOLLARDS LOCATED ON 3 SEPARATE PIERS OUT OF WALL AND 45cm WEST OF EAST EDGE OF WALL.

Notes

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2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to this office prior to construction.
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

No.	Issue / Revision	Date	Auth.
2	SECOND SUBMISSION	3/14/2014	DA
3	THIRD SUBMISSION	6/09/2014	DA
4	FOR DISCUSSION	9/5/2014	DA
5	FOURTH SUBMISSION	11/10/14	DA
6	FIFTH SUBMISSION	1/16/2015	DA
7	SIXTH SUBMISSION	2/25/2015	DA
8	ISSUED FOR TENDER	3/30/2015	DA
9	ISSUED FOR ADDENDUM 1	4/20/2015	DA

LICENSED PROFESSIONAL ENGINEER D. G. ARQUE PROVINCE OF ONTARIO

TOWN OF THE BLUE MOUNTAINS

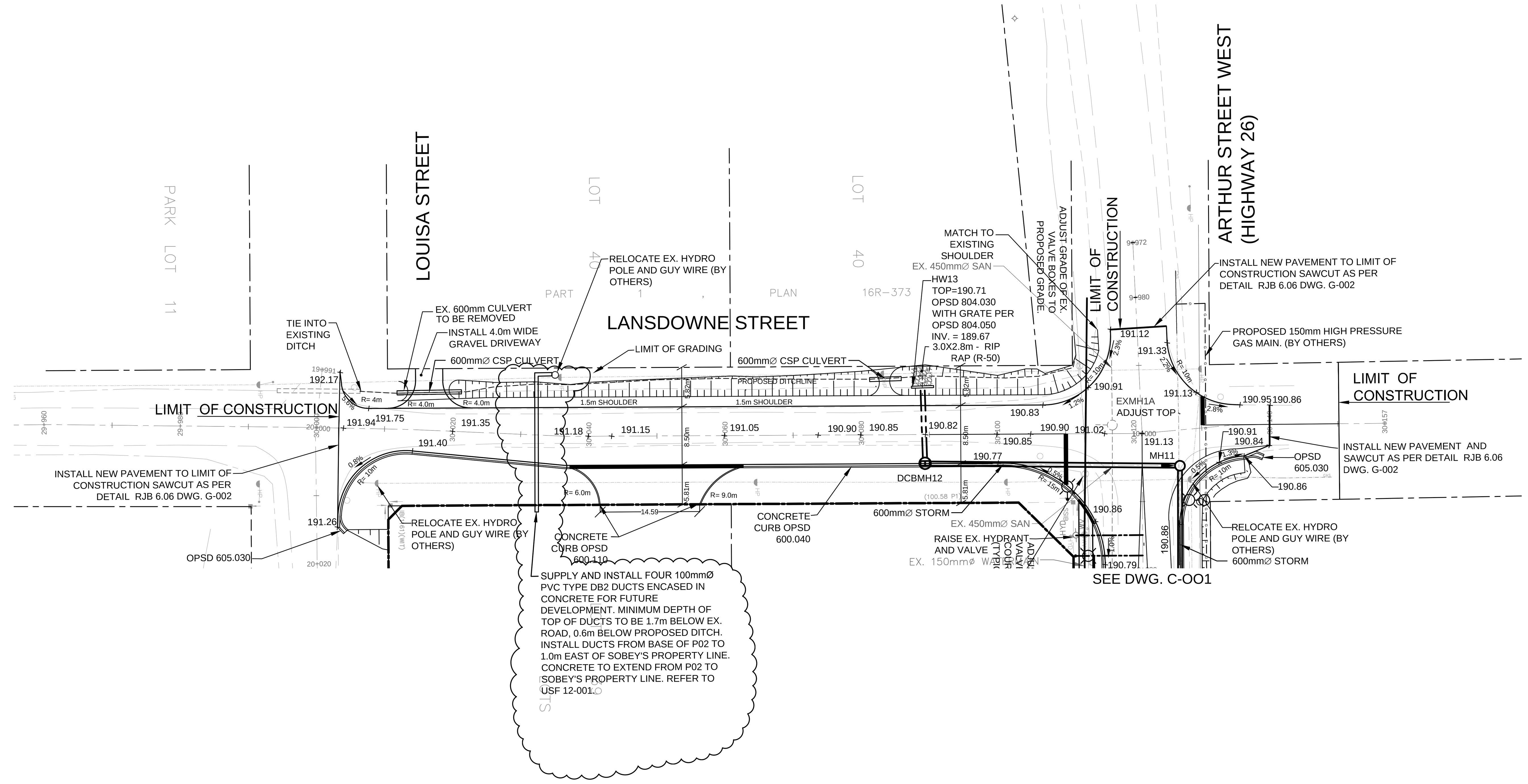
BURNSIDE

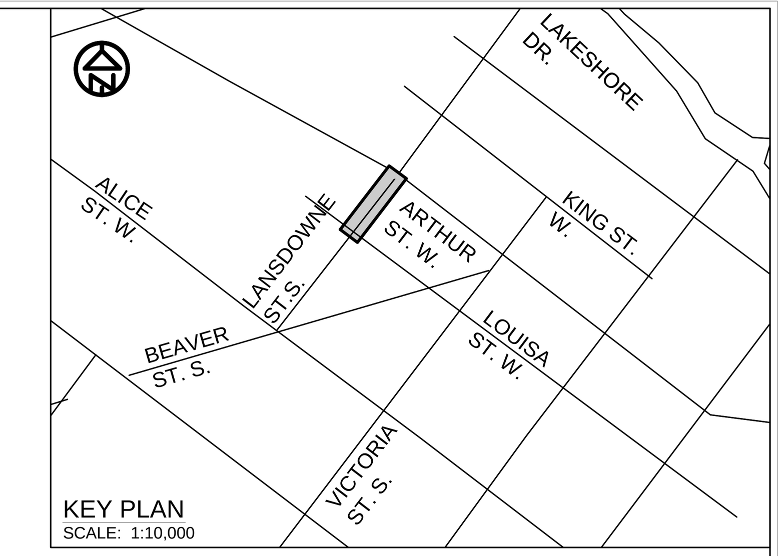
R.J. Burnside & Associates Limited
3 Ronell Crescent,
Collingwood, Ontario, L9Y 4J6
telephone (705) 446-0515
fax (705) 446-2399
web www.rjburnside.com

Client
TOWN OF THE BLUE MOUNTAINS
32 MILL STREET, BOX 310
THORNBURY, ONTARIO
N0H 2P0

Drawing Title
THORNBURY WEST END ROAD IMPROVEMENT PROJECT
PLAN AND PROFILE
ARTHUR STREET STA. 09+984.7 TO 10+241

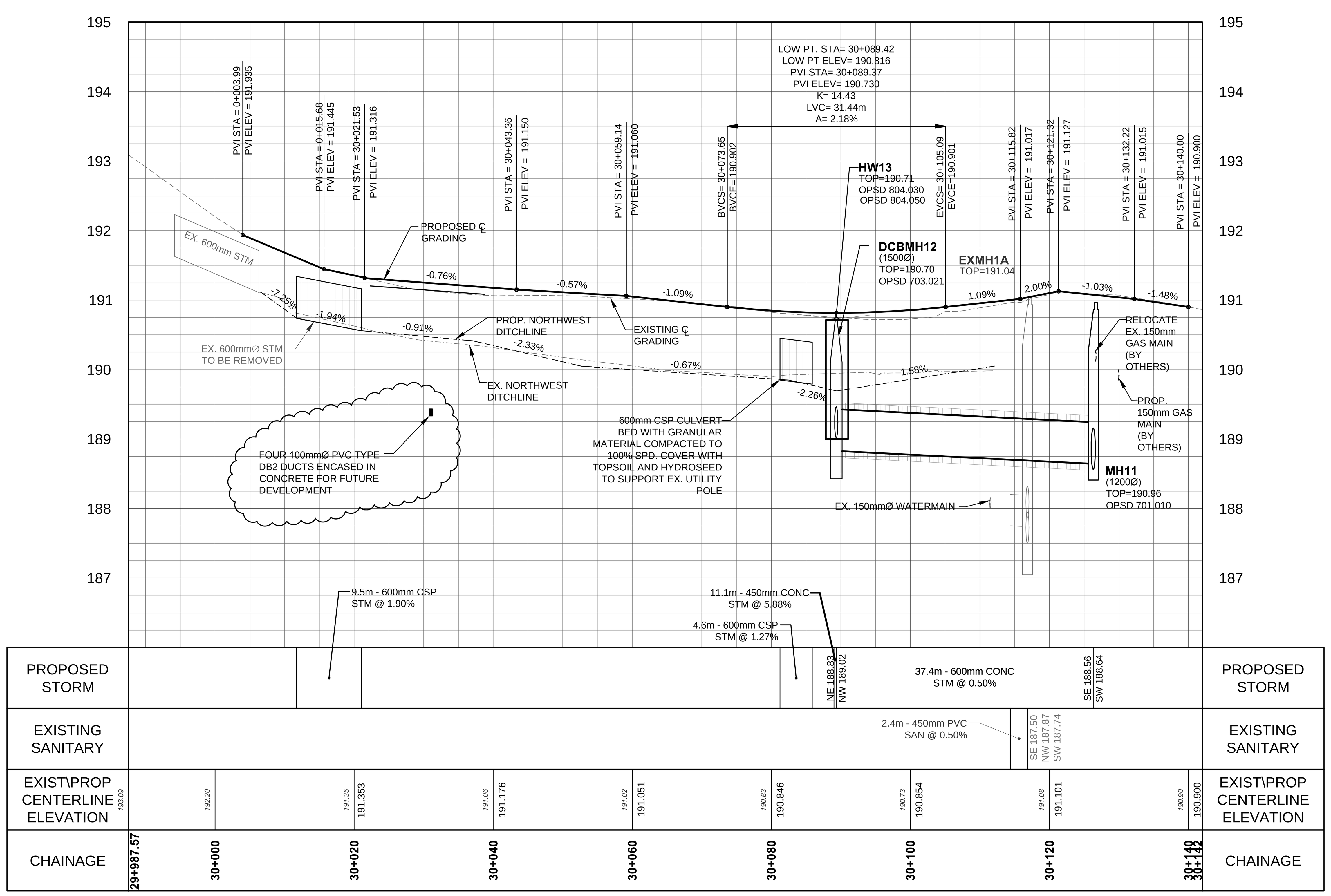
Drawn	Checked	Designed	Checked	Date	Drawing No.
S.K.	D.A.	S.K.	D.A.	14/01/20	C-001
Project No. PWD018621		Contract No. 2015-08-T-EPW		Revision No. 0	
Scale H 1:500 V 1:50					





LEGEND

- PROPOSED STORM SEWER/ MANHOLE
- EXISTING LARGE STORM SEWER (OVER 675mm)
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING WATERMAIN
- EXISTING HYDRANT
- PROPOSED CATCH BASIN / DOUBLE CATCH BASIN
- PROPOSED STORM CATCHBASIN MANHOLE
- EXISTING CATCHBASIN
- PROPOSED FINISHED GRADE ELEVATION
- PROPOSED SLOPE
- CONCRETE SIDEWALK AS PER OPSD 310.010
- RESTORE ASPHALT SHOULDER/DRIVEWAY



BENCHMARK

HEREON ARE GEODETIC AND REFERRED TO THE GEODETIC MONUMENT NO. 01972U301, ELEVATION 178.318. SITE BENCHMARK HAS BEEN DETERMINED TO WITHIN 10mm OF LOCAL GEODETIC BENCHMARK. BENCHMARK LOCATION: WHARF, AT FOOT OF BRUCE STREET, TABLET IN TOP OF CONCRETE RETAINING WALL, 39m SOUTH OF SOUTH END OF WHARF PROPER, 7.9m NORTH OF POINT WHERE RETAINING WALL TURNS EAST, 3.2m SOUTHEAST OF MOST SOUTHERLY OF 3 BOLLARDS LOCATED ON 3 SEPARATE PIERS OUT OF WALL AND 45cm WEST OF EAST EDGE OF WALL.

Notes

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3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

No.	Issue / Revision	Date	Auth.
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6	FIFTH SUBMISSION	1/16/2015	DA
7	SIXTH SUBMISSION	2/25/2015	DA
8	ISSUED FOR TENDER	3/30/2015	DA
9	ISSUED FOR ADDENDUM 1	4/20/2015	DA

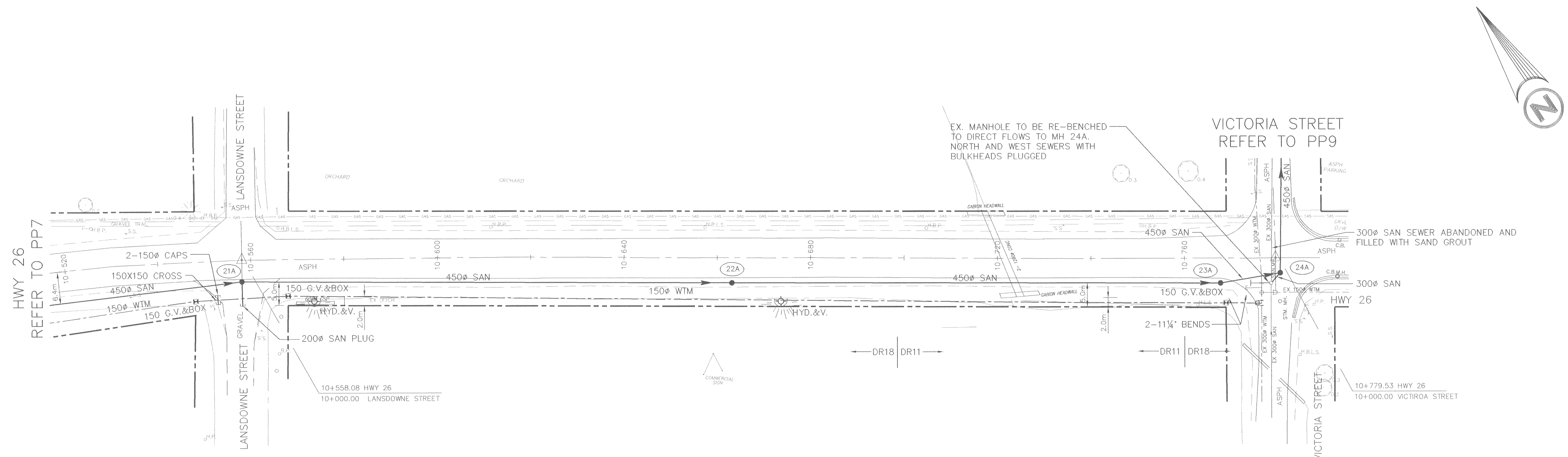
LICENSED PROFESSIONAL ENGINEER D. G. ARGUE PROVINCE OF ONTARIO

R.J. Burnside & Associates Limited
3 Ronell Crescent,
Collingwood, Ontario, L9Y 4J6
telephone (705) 446-0515
fax (705) 446-2399
web www.rjburnside.com

Client
TOWN OF THE BLUE MOUNTAINS
32 MILL STREET, BOX 310
THORNBURY, ONTARIO
N0H 2P0

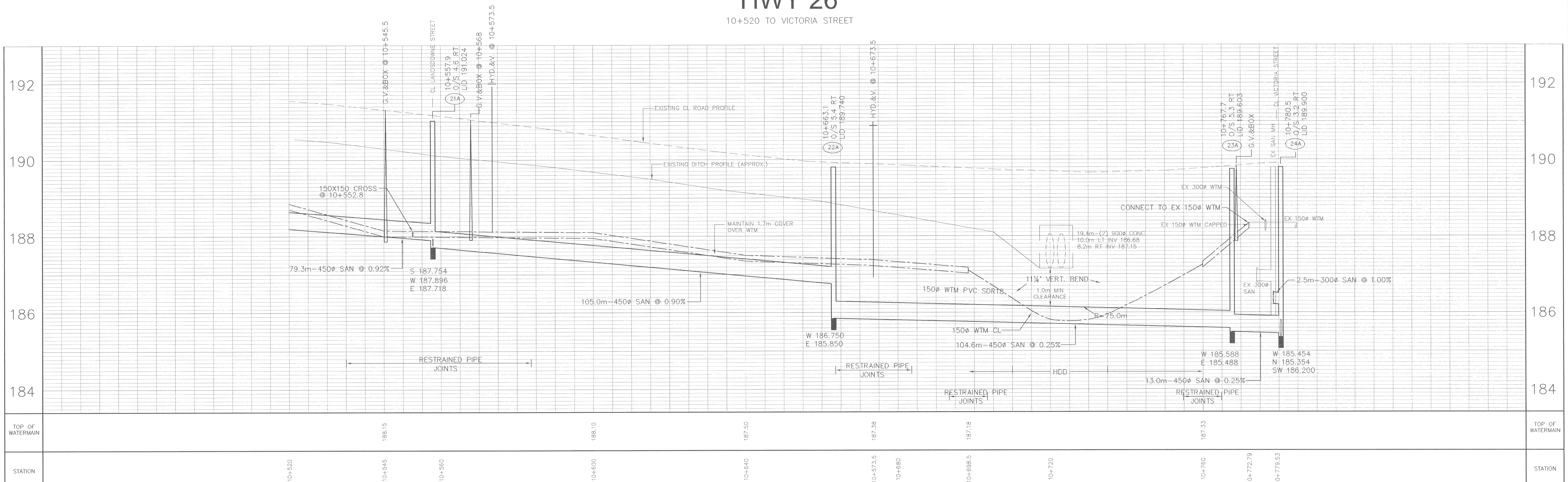
Drawing Title
THORNBURY WEST END ROAD IMPROVEMENT PROJECT
PLAN AND PROFILE
LANSDOWNE STREET

Drawn	Checked	Designed	Checked	Date	Drawing No.
S.K.	D.A.	S.K.	D.A.	14/01/20	C-005
Project No. PWD018621		Contract No. 2015-08-T-EPW		Revision No. 0	
Scale 1:500					



HWY 26

10+520 TO VICTORIA STREET



FOR BENCH MARK INFORMATION & GENERAL NOTES REFER TO DWG. NO. PP1

NO.	DESCRIPTION	BY	DATE	APP'D	DATE
0	FOR COMMENT	RG	AUG/04	E.C.	AUG/04
1	FOR MOE APPROVAL	JB	DEC/04	E.C.	DEC/04
2	FOR TENDER	KA	FEB/05	E.C.	FEB/05
3	FOR CONSTRUCTION	KA	APR/05	E.C.	APR/05
4	AS CONSTRUCTED	MM	AUG/05	E.C.	AUG/05

STAMPS

CIVIL | STRUCTURAL

CLIENT
TOWN OF THE BLUE MOUNTAINS

PROJECT
LORA BAY & THORNBURY WATER AND SEWER SERVICING PHASE 1(a)

AWS Engineers & Planners Corp.
76 DIVISION STREET WELLAND ONTARIO L3B-3Z7
(905) 714-4322 FAX 714-4327

TOWN OF THE BLUE MOUNTAINS
ENVIRONMENT SERVICES DEPARTMENT

HWY 26

DWG. No. PP8
REV. No. 3
FILE No.
DATE: AUG/04
DRAWN BY: R.G.
HORZ 1:500
VERT 1:50
APPROVED BY: E. CHAJKA

APPENDIX B

Sanitary Peak Flow Calculations

CROZIER CONSULTING ENGINEERS

File: 2142-6059
Date: 2022.02.23
By: IB
Check By: GC

125 Arthur Street Sanitary Demand

Developed Site Area	4.8	ha
Number of Residential Units and Land Usage		
1) Townhouses Residential (Includes Townhouses within the Commercial/Townhouses)	**116**	**Units**
2) Apartment Residential	**75**	**Units**
3) Commercial	**0.29**	**ha**
Person Per Residential Unit		
1) Townhouse (per TOBM Engineering Standards, 2018)	2.3	persons/unit
2) Apartment (per TOBM Engineering Standards, 2018)	2.3	persons/unit
3) Commercial (per TOBM Engineering Standards, 2018)	100.0	person/ha
Total Equivalent Residential Population	469	Persons
Unit Sewage flows		
Residential/Commercial (per TOBM Engineering Standards, 2018)	450	L/C-day
Infiltration (per TOBM Engineering Standards, 2018)	0.23	L/s/ha
Total Design Sewage Flows		
Infiltration/Inflow Residential	1.10	L/sec
Average Daily Residential Flow	2.44	L/sec
Residential Peak Factor (Harmon Formula)	3.99	
Max Peak Flow	9.73	L/sec
Total Peak Daily Flow	**10.84**	**L/sec**

Appendix C

Domestic and Fire Flow Calculations

Water Demand Calculations
Fire Flow Calculations

CROZIER CONSULTING ENGINEERS

File: 2142-6059
Date: 2022.02.23
By: IB
Check By: GC

125 Arthur Street Water Demand

Developed Site Area	4.8	ha
Number of Residential Units and Land Usage		
1) Townhouses Residential (Includes Townhouses within the Commercic	**116**	**Units**
2) Apartment Residential	**75**	**Units**
3) Commercial	**0.29**	**ha**
Person Per Residential Unit		
1) Townhouse (per TOBM Engineering Standards, 2018)	2.3	persons/unit
2) Apartment (per TOBM Engineering Standards, 2018)	2.3	persons/unit
3) Commercial (per TOBM Engineering Standards, 2018)	100.0	person/ha
Total Equivalent Residential Population	469	Persons
Domestic Water Design Flows		
Residential (Per TOBM Engineering Standards, 2018)	450	L/C-day
Total Domestic Water Design Flows		
Average Residential Daily Flow	2.44	L/sec
Max Day Peak Factor (per MOE Design of Water Works Table 3-1)	2.75	
Max Day Demand Flow	**6.71**	L/sec
Peak Hour Factor (Per TOBM Engineering Standards, 2018)	4.50	
Peak Hour Flow	**10.98**	L/sec
Fire Flow Demand (per Fire Underwriters Survey)	200.00	L/sec
Peak Residential Design Flow (Fire Flow + Max Day)	**206.71**	L/sec

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

Townhouse Block of 10 Units (Assume 1 Fire Wall)

1. An estimate of fire flow required for a given area may be determined by the formula:

F = 220 * C * sqrt A

where

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

Proposed Buildings — Ordinary

3 number of floors — 1.0 C
547.5 sq.m. floor area (Assumed firebreak between half of units)
1642.5 sq.m. total floor area

Therefore F= 9,000 L/min (rounded to nearest 1000 L/min)

Fire flow determined above shall not exceed:
30,000 L/min for wood frame construction
30,000 L/min for ordinary construction
25,000 L/min for non-combustible construction
25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Burning	25%
Combustible	No Charge		

Limited Combustible — -15% reduction

-1,350 L/min reduction

Note: Flow determined shall not be less than 2,000 L/min

3. Sprinklers - The value obtained in No. 2 above maybe reduce by up to 50% for complete automatic sprinkler protection.

With sprinklers (typical 30% reduction) ->Will Not Have Sprinkler Protection

0 L/min reduction

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

Separation	Charge	Separation	Charge
0 to 3 m	25%	20.1 to 30 m	10%
3.1 to 10 m	20%	30.1 to 45 m	5%
10.1 to 20 m	15%		

Exposed buildings

Name		**Distance**		
North	Adjacent Dwelling	0	25%	1912.5
East	Adjacent Dwelling	8	20%	1530
South	Adjacent Dwelling	46	0%	0
West	Adjacent Dwelling	30	10%	765
				4,208 L/min Surcharge

Total percentage shall not exceed 75%

Calculated 55%

Determine Required Fire Flow

No.1	9,000	
No. 2	-1,350	reduction
No. 3	0	reduction
No. 4	4,208	surcharge

Required Flow: **11,858 L/min**

Rounded to nearest 1000l/min: **12,000 L/min** or 200.0 L/s

Governs

Determine Required Fire Storage Volume

Flow from above 12,000 L/min

Required duration 2.50 hours

Therefore: 1,800,000 Litres or
1,800 cu.m. is the required fire storage volume.

Required Duration of Fire Flow

Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

Fire Protection Water Supply Guideline
Part 3 of the Ontario Building Code (2006)

$$Q = KVS_{TOT}$$

Q = minimum supply of water in litres (L)
K = water supply coefficient
V = total building volume in cubic metres
S_{TOT} = total of spatial coefficient values from property line exposures on all sides

K =	23.0	Group C building with combustible construction (Table 1)
V =	4927.5	1642.5sqm total floor area by 3m height
S_{TOT} =	2	S_{TOT} Need Not Exceed 2.0

Q = 226665 L

Based on ranges listed in Table 2, the required minimum water supply flow rate is **6300 L/min**

105 L/s

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey
Part II - Guide for Determination of Required Fire Flow

Commercial/Apartment Block - located North East Corner (Largest of the two)

1. An estimate of fire flow required for a given area may be determined by the formula:

F = 220 * C * sqrt A

where

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

Proposed Buildings — Ordinary

4	number of floors	1.0 C
975	sq.m. floor area	
3900	sq.m. total floor area	

Therefore F= 14,000 L/min (rounded to nearest 1000 L/min)

Fire flow determined above shall not exceed:
30,000 L/min for wood frame construction
30,000 L/min for ordinary construction
25,000 L/min for non-combustible construction
25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Burning	25%
Combustible	No Charge		

Limited Combustible -15% reduction
-2,100 L/min reduction

Note: Flow determined shall not be less than 2,000 L/min

3. Sprinklers - The value obtained in No. 2 above maybe reduce by up to 50% for complete automatic sprinkler protection.
With sprinklers (typical 30% reduction) ->Assume will have Sprinkler Protection
-3,570 L/min reduction

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

Separation	Charge	Separation	Charge
0 to 3 m	25%	20.1 to 30 m	10%
3.1 to 10 m	20%	30.1 to 45 m	5%
10.1 to 20 m	15%		

Exposed buildings

Name		**Distance**		
North	Adjacent Dwelling	46	0%	0
East	Adjacent Dwelling	46	0%	0
South	Adjacent Dwelling	17	15%	1785
West	Adjacent Dwelling	29	10%	1190
				2,975 L/min Surcharge

Total percentage shall not exceed 75%

Calculated 25%

Determine Required Fire Flow

No.1	14,000	
No. 2	-2,100	reduction
No. 3	-3,570	reduction
No. 4	2,975	surcharge
Required Flow:	**11,305 L/min**	
Rounded to nearest 1000l/min:	**11,000 L/min**	or 183.3 L/s

Determine Required Fire Storage Volume

Flow from above 11,000 L/min

Required duration 2.00 hours

Therefore: 1,320,000 Litres or
1,320 cu.m. is the required fire storage volume.

Required Duration of Fire Flow	
Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

Fire Protection Water Supply Guideline
Part 3 of the Ontario Building Code (2006)

$$Q = KVS_{TOT}$$

Q = minimum supply of water in litres (L)
K = water supply coefficient
V = total building volume in cubic metres
S_{TOT} = total of spatial coefficient values from property line exposures on all sides

K =	23.0	Group C building with combustible construction (Table 1)
V =	11700	3900sqm total floor area by 3m height
S_{TOT} =	1	S_{TOT} Need Not Exceed 2.0

Q = 269100 L

Based on ranges listed in Table 2, the required minimum water supply flow rate is **6300 L/min**

105 L/s

APPENDIX D

Thornbury West Drainage Study – Model Update Memo

TATHAM ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com

tathameng.com

File 121371

February 8, 2022

Shekhar Dalal
The Blue Meadows Inc.
24 Marydale Avenue
Markham, Ontario L3S 3N4

Re: 125 Arthur Street, Town of The Blue Mountains
Town Model update for Proposed Development

Dear Shekhar:

As per your request we have updated the Thornbury West Drainage Master Plan (TWDMP) PCSWMM hydrologic/hydraulic model to determine peak flows established for the 125 Arthur Street development property to assist in the site's stormwater management design. Tatham originally developed the PCSWMM model for the Town of The Blue Mountains as part of the Thornbury West Drainage Master Plan (TWDMP) study. We have updated the PCSWMM model and revised the subcatchment boundaries delineated across the development site to match the delineation provided by Crozier Consulting Engineers. This letter has been prepared to summarize the model updates and findings.

EXISTING CONDITIONS

The development site is located at 125 Arthur Street and covers approximately 4.22 ha of land. The site is bounded by Alice Street West to the South, the little Beaver River to the West, Arthur Street West to the North and Lansdowne Street South to the East. The development site consists of six parcels, two of which contain existing residential dwellings. A third existing residential dwelling exists in a parcel surrounded by the proposed development which is not included in the development site. The existing landcover of the development site consists predominantly of open grass field and the lands generally drain overland as sheet flow to the north-west.

In the original PCSWMM model, the development site is covered by subcatchment S12035, which drains north-east to the intersection of Lansdowne Street South and Arthur Street West.

Drainage from the study area enters the storm sewer at Junction DCBMH_12035, which flows from Lansdowne Street South to Arthur Street West and discharges to a tributary of the Little Beaver River. This tributary flows through culverts across the Georgian Trail, King Street West, and Lansdowne Street North and ultimately discharges to the Little Beaver River via a culvert along Huron Street West.

The study area drainage conditions are illustrated on Figure 1 enclosed for reference.

PCSWMM MODEL UPDATES

To determine existing condition peak flow targets for the proposed development, the existing PCSWMM hydrologic/hydraulic model was updated to revise the catchment boundaries and percent impervious to match those delineated by Crozier Consulting Engineers as shown in Figure 2 enclosed for reference. The existing hydrologic properties of the subcatchment are provided in Table 1.

Table 1: Existing Conditions Subcatchment Parameter Summary

PARAMETER	125 ARTHUR STREET SUBCATCHMENT
Catchment ID	S12035
Catchment Area (ha)	4.22
Percent Impervious (%)	5
Percent Routed (%)	20
Slope (%)	2
Impervious Area Depression Storage (mm)	2
Pervious Area Depression Storage (mm)	5

The Blue Mountains Engineering Standards (2009) were used to generate the 1:2-year, 1:5-year, 1:25-year and 1:100-year 3.0- and 3.5-hours Chicago Storms and 1:2-year, 1:5-year, 1:10-year, 1:25-year, 1:50-year and 1:100-year 24-hour SCS Storms. These storms were analysed to quantify the runoff from the site under the existing conditions. The existing condition peak flows are summarized in the following table.

Table 2: Existing Conditions Peak Flow Summary

SCENARIO	CHICAGO STORM PEAK FLOW (m^3/s)	SCS STORM PEAK FLOW (m^3/s)
1:2-year	0.05	0.08
1:5-year	0.12	0.24
1:10-year	-	0.39
1:25-year	0.32	0.65
1:50-year	-	0.77
1:100-year	0.55	0.89

The existing storm sewer system downstream of the development was also modeled in PCSWMM to confirm capacity limitations. The results indicate the first two lengths of conduit from the site to Arthur Steet have a limiting capacity of 0.44 m^3/s which is equivalent to approximately the existing 1:10-year storm flow from the site. Figure 3 enclosed illustrates the performance of the storm sewer under the 1:5-year peak flow.

Given the Little Beaver River tributary downstream of the storm sewer outlet has several known capacity deficiencies identified through the TWDMP analysis to avoid exacerbating these deficiencies we recommend post-development peak flows be controlled to the lesser of pre-development peak flows or the constraining capacity of the storm system of 0.44 m^3/s unless additional available capacity can be identified through further downstream analysis.

CLOSING

We trust this letter meets your needs. If you have any questions or comments regarding the assessment, please do not hesitate to contact the undersigned.

Yours truly,
Tatham Engineering Limited

Jacob Macdonald, B.A.Sc.
Engineering Intern

Dan Hurley, B.A.Sc., P.Eng., LEED AP
President

KKS/JM:rlh

I:\2021 Projects\121371 - 125 Arthur Street, TOBM\Documents\Technical Memo\Memo (125 Arthur Street)

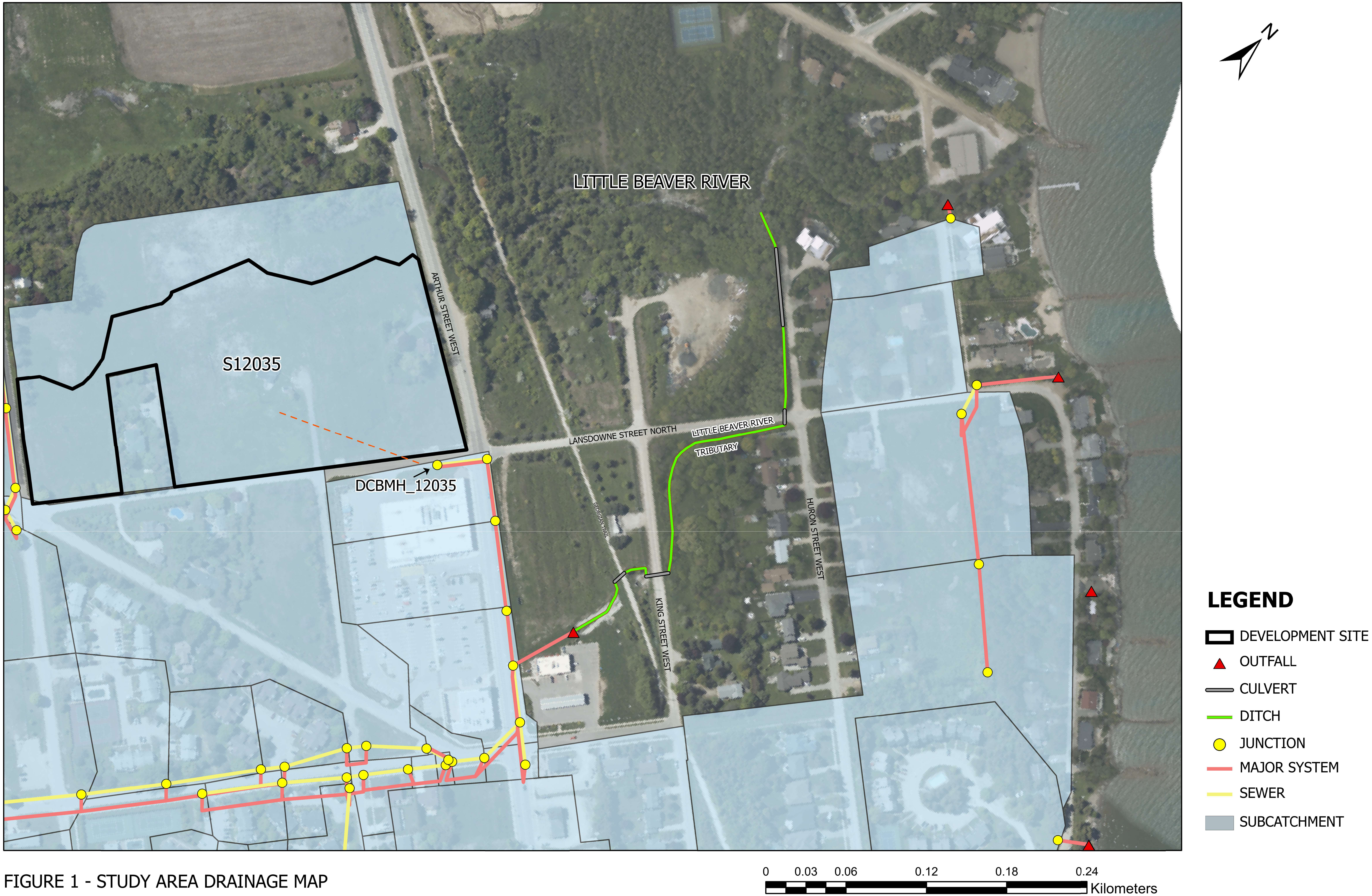


FIGURE 1 - STUDY AREA DRAINAGE MAP

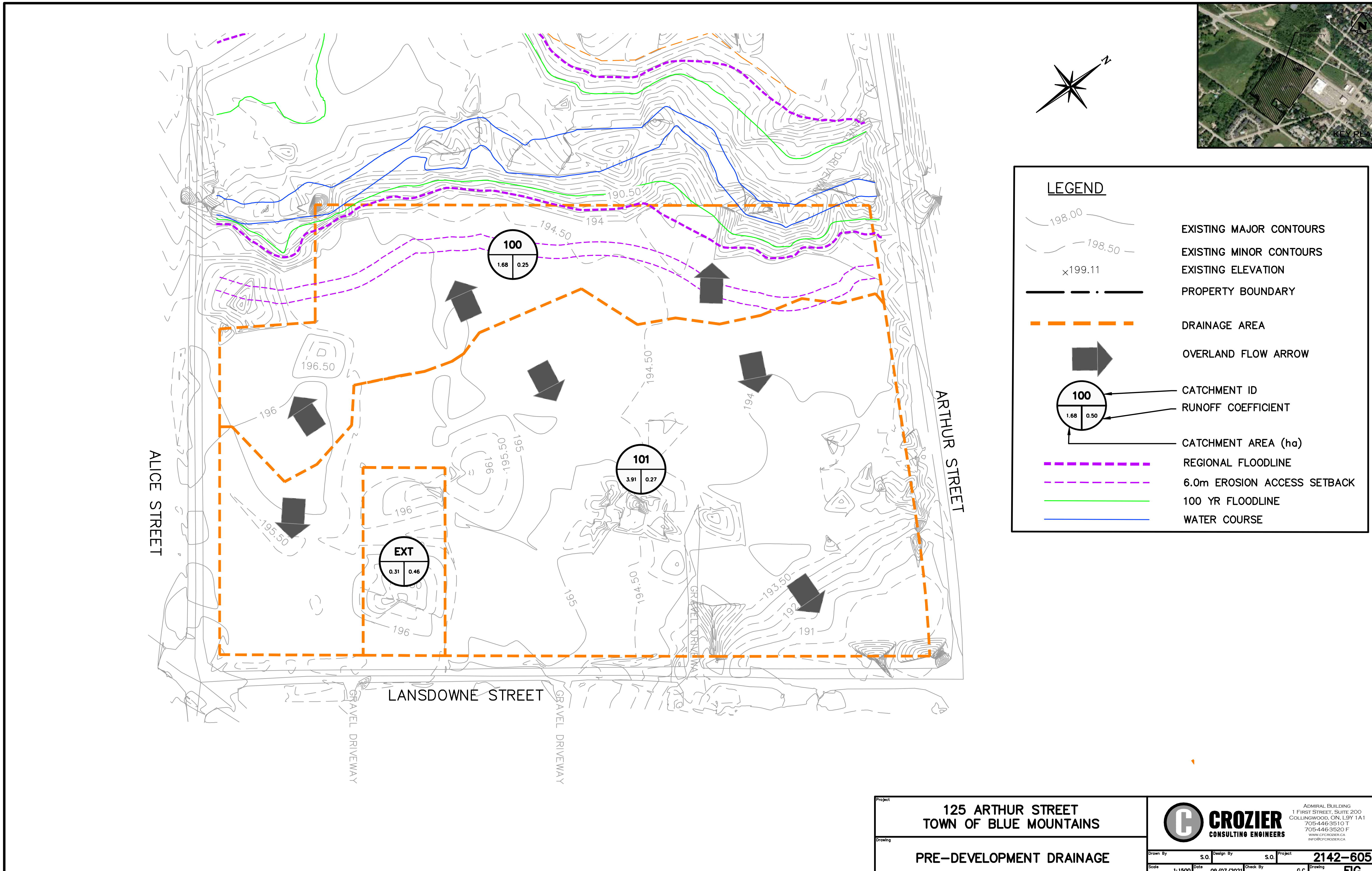
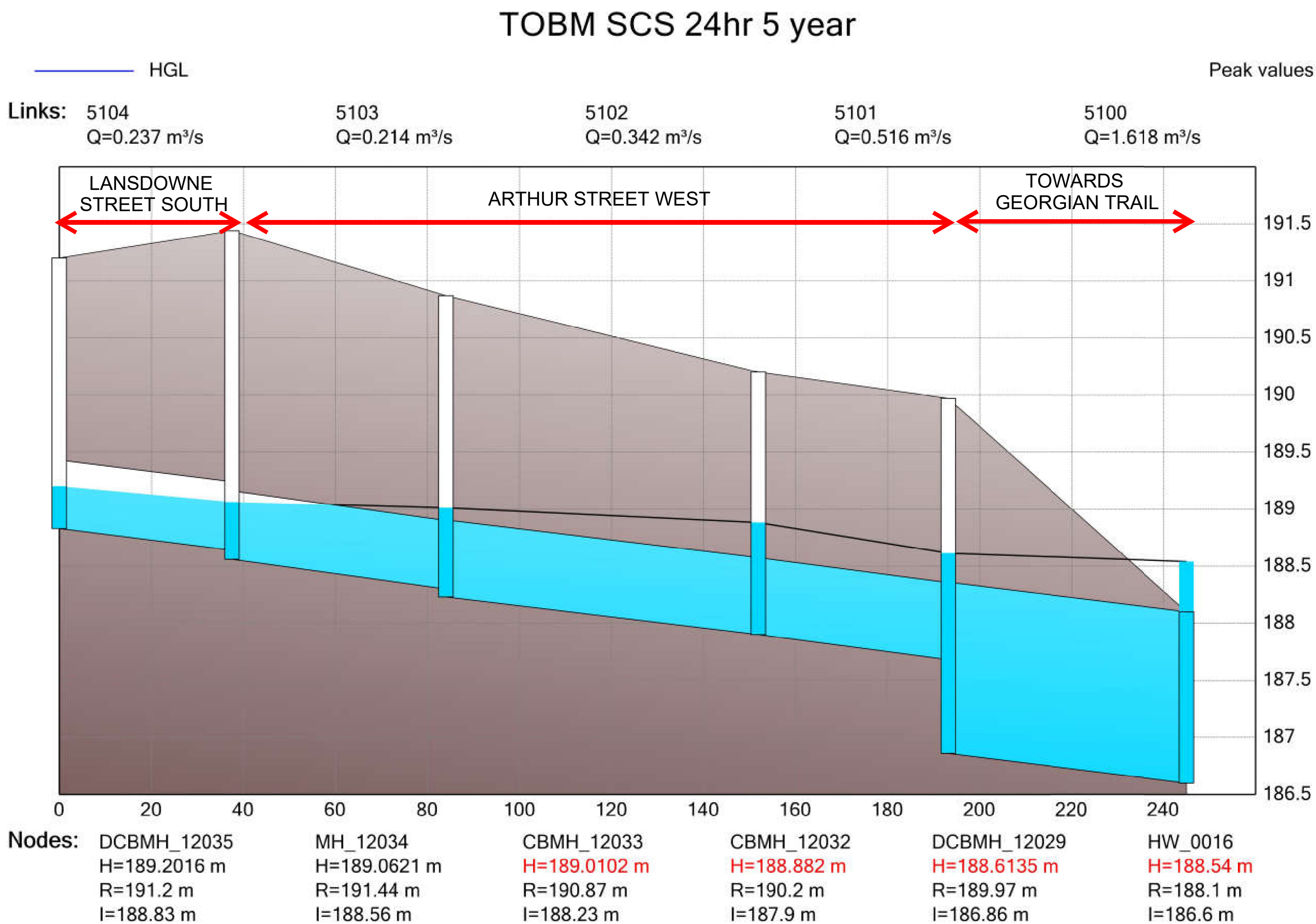


FIGURE 2 - DEVELOPMENT SITEBY CROZIER CONSULTING ENGINEERS


TOBM SCS 24hr 5 year
HGL
Peak values
Links:
5104
Q=0.237 m³/s
5103
Q=0.214 m³/s
5102
Q=0.342 m³/s
5101
Q=0.516 m³/s
5100
Q=1.618 m³/s
LANSDOWNE STREET SOUTH
ARTHUR STREET WEST
TOWARDS GEORGIAN TRAIL
191.5
191
190.5
190
189.5
189
188.5
188
187.5
187
186.5
0
20
40
60
80
100
120
140
160
180
200
220
240
Nodes:
DCBMH_12035
H=189.2016 m
R=191.2 m
I=188.83 m
MH_12034
H=189.0621 m
R=191.44 m
I=188.56 m
CBMH_12033
H=189.0102 m
R=190.87 m
I=188.23 m
CBMH_12032
H=188.882 m
R=190.2 m
I=187.9 m
DCBMH_12029
H=188.6135 m
R=189.97 m
I=186.86 m
HW_0016
H=188.54 m
R=188.1 m
I=186.6 m

APPENDIX E

Stormwater Management Calculations

Modified Rational Method - Storage Sizing

CROZIER CONSULTING ENGINEERS

PROJECT: 125 Arthur St.
PROJECT No.: 2142-6059
DATE: 2022.02.23
DESIGN: IB
CHECK: BH

Modified Rational Method Storage Sizing

Runoff Coefficient Calculation - Pre Dev

Total Site Area = 5.59 ha

To Lansdowne

Surface	Catchment 101	
	Area (ha)	Runoff Coefficient
Unimproved	3.42	0.25
Sodded Area	0.36	0.30
Building Area	0.04	0.90
Gravel	0.08	0.75
Total	**3.91**	**0.27**

Lansdowne Composite RC	
Area (ha)	Runoff Coefficient
4.22	**0.29**

To Lansdowne

Surface	Catchment EXT - 1	
	Area (ha)	Runoff Coefficient
Landscapes	0.23	0.30
Asphalt/Building	0.08	0.90
Total	**0.31**	**0.46**

To The Little Beaver River

Surface	Catchment 100	
	Area (ha)	Runoff Coefficient
Unimproved	1.68	0.25
Asphalt/Building	0.00	0.90
Total	**1.68**	**0.25**

Runoff Coefficient Calculation - Post Dev

To Lansdowne

Surface	203 (Uncontrolled)	
	Area (ha)	Runoff Coefficient
Landscape	0.03	0.30
Asphalt/Building	0.06	0.90
Total	**0.09**	**0.71**

Surface	206 (Uncontrolled)	
	Area (ha)	Runoff Coefficient
Landscape	0.03	0.30
Asphalt/Building	0.01	0.90
Total	**0.04**	**0.45**

Surface	208 (Uncontrolled)	
	Area (ha)	Runoff Coefficient
Landscape	0.26	0.30
Asphalt/Building	0.24	0.90
Total	**0.50**	**0.59**

Surface	204 (Controlled)	
	Area (ha)	Runoff Coefficient
Landscape	0.04	0.30
Asphalt/Building	0.38	0.90
Total	**0.42**	**0.84**

Surface	207 (Controlled)	
	Area (ha)	Runoff Coefficient
Landscape	0.18	0.30
Asphalt/Building	0.12	0.90
Total	**0.30**	**0.54**

Surface	209 (Controlled)	
	Area (ha)	Runoff Coefficient
Landscape	0.26	0.30
Asphalt/Building	0.00	0.90
Total	**0.26**	**0.30**

Surface	205 (Controlled)	
	Area (ha)	Runoff Coefficient
Landscape	0.86	0.30
Asphalt/Building	1.15	0.90
Total	**2.01**	**0.64**

Surface	202 (Controlled)	
	Area (ha)	Runoff Coefficient
Landscape	0.05	0.30
Asphalt/Building	0.32	0.90
Total	**0.37**	**0.82**

AREA	Composite RC	
	Area (ha)	Runoff Coefficient
Controlled	3.36	0.65
Uncontrolled	0.63	0.60
TOTAL	**3.99**	**0.64**
204/205/209/202	3.06	0.66

To The Little Beaver River

Surface	200 (Uncontrolled)	
	Area (ha)	Runoff Coefficient
Landscape	0.15	0.30
Asphalt/Building	0.06	0.90
Unimp. Open Spac	0.80	0.25
Total	**1.01**	**0.30**

Surface	210 (Uncontrolled)	
	Area (ha)	Runoff Coefficient
Landscape	0.02	0.30
Asphalt/Building	0.04	0.90
Total	**0.06**	**0.71**

Surface	201 (Controlled)	
	Area (ha)	Runoff Coefficient
Landscape	0.31	0.30
Asphalt/Building	0.52	0.90
Total	**0.83**	**0.67**

AREA	Composite RC	
	Area (ha)	Runoff Coefficient
Controlled	**0.83**	**0.67**
Uncontrolled	**1.07**	**0.32**
TOTAL	**1.90**	**0.47**

CROZIER CONSULTING ENGINEERS

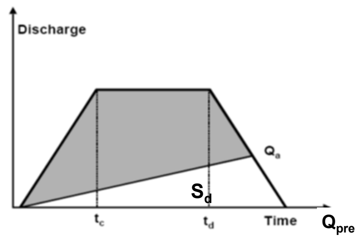
PROJECT: 125 Arthur St.
PROJECT No.: 2142-6059
DATE: 2022.02.23
DESIGN: IB
CHECK: BH

Modified Rational Method Storage Sizing

Peak Flow
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(Td)} \cdot A$

Intensity
$i_{(Td)} = A\,(T_d)^{B}$

Storage
$S_d = Q_{post} \cdot T_d - Q_{pre}\,(T_d + T_c) / 2$



Lansdowne Outlet

Pre-Dev Drainage Towards Lansdowne - 5 Yr

Pre-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	79.39
Return Period	5 yr		
Time of Concentration (min)	15		
Coeff A	29.1		
Coeff B	-0.724		
Runoff Coeff (Unadjusted)	0.29	Uncont. Flow (m^3/s)	0.27
Runoff Coefficient (Adjusted)	0.29		
Area (ha)	4.22		

Owen Sound IDF		
Storm	**A**	**B**
2 yr	22.3	-0.714
5 yr	29.1	-0.724
10 yr	33.6	-0.729
25 yr	39.3	-0.734
50 yr	43.5	-0.736
100 yr	47.7	-0.738

Pre-Dev Drainage Towards Lansdowne - 100 Yr

Pre-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	132.69
Return Period	100 yr		
Time of Concentration (min)	15		
Coeff A	47.7		
Coeff B	-0.738		
Runoff Coeff (unadjusted)	0.29	Uncont. Flow (m^3/s)	1.01
Runoff Coefficient (Adjusted)	0.64		
Area (ha)	4.22		

Control Post-Dev Flows to the 5r Year Pre-Dev Flows

The Little Beaver River Outlet

Pre-Dev Drainage Towards River - 5 Yr

Pre-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	79.39
Return Period	5 yr		
Time of Concentration (min)	15		
Coeff A	29.1		
Coeff B	-0.724		
Runoff Coeff (Unadjusted)	0.25	Uncont. Flow (m^3/s)	0.09
Runoff Coefficient (Adjusted)	0.25		
Area (ha)	1.68		

Pre-Dev Drainage Towards River - 100 Yr

Pre-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	132.69
Return Period	100 yr		
Time of Concentration (min)	15		
Coeff A	47.7		
Coeff B	-0.738		
Runoff Coeff (unadjusted)	0.25	Uncont. Flow (m^3/s)	0.39
Runoff Coefficient (Adjusted)	0.63		
Area (ha)	1.68		

Control Post-Dev Flows to the Pre-Dev Flows

CROZIER
CONSULTING ENGINEERS

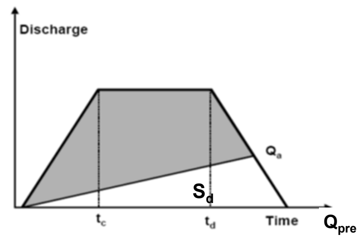
PROJECT: 125 Arthur St.
PROJECT No.: 2142-6059
DATE: 2022.02.23
DESIGN: IB
CHECK: BH

Modified Rational Method Storage Sizing

Peak Flow
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(T_d)} \cdot A$

Intensity
$i_{(T_d)} = A\,(T_d)^{B}$

Storage
$S_d = Q_{post} \cdot T_d - Q_{pre}\,(T_d + T_c) / 2$



Post-Dev Drainage To Lansdowne

Uncontrolled Areas (203, 206, 208)

Post-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	132.69
Return Period	100 yr		
Time of Concentration (min)	15		
Coeff A	47.7		
Coeff B	-0.738		
Runoff Coeff (Unadjusted)	0.60	Flow (m^3/s)	0.19
Runoff Coefficient (Adjusted)	0.80		
Area (ha)	0.63		

Owen Sound IDF		
Storm	**A**	**B**
2 yr	22.3	-0.714
5 yr	29.1	-0.724
10 yr	33.6	-0.729
25 yr	39.3	-0.734
50 yr	43.5	-0.736
100 yr	47.7	-0.738

Catchment 202, 204, 205, 209 - To be Controlled by Main Dry Pond (SWM Facility #1)

Post-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	132.69
Return Period	100 yr		
Time of Concentration (min)	15		
Coeff A	47.7		
Coeff B	-0.738		
Runoff Coeff (Unadjusted)	0.66	Flow (m^3/s)	0.94
Runoff Coefficient (Adjusted)	0.83		
Area (ha)	3.06		

Catchment 207 - To be Controlled by Rear Yard Surface Storage (SWM Facility #2)

Post-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	132.69
Return Period	100 yr		
Time of Concentration (min)	15		
Coeff A	47.7		
Coeff B	-0.738		
Runoff Coeff (Unadjusted)	0.54	Flow (m^3/s)	0.09
Runoff Coefficient (Adjusted)	0.77		
Area (ha)	0.30		

Target Flow (m^3/s)	0.27	5yr pre

Target Flow - Uncontrolled Flow = Target Control Flows

Target Control Flow (5 yr) =	0.08	(m^3/s)	--> must = Post Dev Flows from Controlled Areas (202, 204, 205, 207, 209)

Allocating Target Flows

	Area (ha)	Target Flow (m^3/s)
Catch. 207	0.30	0.03
Catch. 202/204/205/209	3.06	0.05
Total		0.08 (m^3/s)

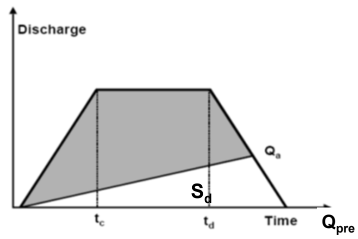
PROJECT: 125 Arthur St.
PROJECT No.: 2142-6059
DATE: 2022.02.23
DESIGN: IB
CHECK: BH

Modified Rational Method Storage Sizing

Peak Flow
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(T_d)} \cdot A$

Intensity
$i_{(T_d)} = A\,(T_d)^{B}$

Storage
$S_d = Q_{post} \cdot T_d - Q_{pre}\,(T_d + T_c) / 2$



SWM Facility #1 - Dry Pond Storage (202/204/205/209)

Post-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	132.69
Return Period	100 yr		
Time of Concentration (min)	15		
Coeff A	47.7		
Coeffic B	-0.738		
Runoff Coeff (unadjusted)	0.66	Uncont. Flow (m^3/s)	0.94
Runoff Coefficient (Adjusted)	0.83		
Area (ha)	3.06		

Target Flow (m^3/s)	0.05

REQUIRED STORAGE VOLUME (m^3):	**1394**	5yr pre

Storage Volume Determination (Detailed)				
T_d	i	T_d	Q_{Uncont}	S_d
min	mm/hr	sec	m^3/s	m^3
15	132.69	900	0.945	805.4
20	107.31	1200	0.764	864.4
25	91.02	1500	0.648	912.1
30	79.56	1800	0.567	952.2
35	71.00	2100	0.506	986.7
195	19.99	11700	0.142	1350.2
200	19.62	12000	0.140	1353.7
205	19.26	12300	0.137	1357.1
210	18.92	12600	0.135	1360.3
215	18.60	12900	0.132	1363.3
220	18.28	13200	0.130	1366.1
225	17.98	13500	0.128	1368.8
230	17.69	13800	0.126	1371.3
235	17.42	14100	0.124	1373.6
240	17.15	14400	0.122	1375.8
245	16.89	14700	0.120	1377.8
250	16.64	15000	0.118	1379.7
255	16.40	15300	0.117	1381.4
260	16.16	15600	0.115	1383.0
265	15.94	15900	0.113	1384.5
270	15.72	16200	0.112	1385.9
275	15.51	16500	0.110	1387.1
280	15.30	16800	0.109	1388.2
285	15.10	17100	0.108	1389.2
290	14.91	17400	0.106	1390.1
295	14.73	17700	0.105	1390.9
300	14.54	18000	0.104	1391.6
305	14.37	18300	0.102	1392.2
310	14.20	18600	0.101	1392.7
315	14.03	18900	0.100	1393.1
320	13.87	19200	0.099	1393.4
325	13.71	19500	0.098	1393.6
330	13.56	19800	0.097	1393.7
335	13.41	20100	0.095	1393.8
340	13.26	20400	0.094	1393.8
345	13.12	20700	0.093	1393.6
350	12.98	21000	0.092	1393.4

Modified Rational Method Storage Sizing

Peak Flow

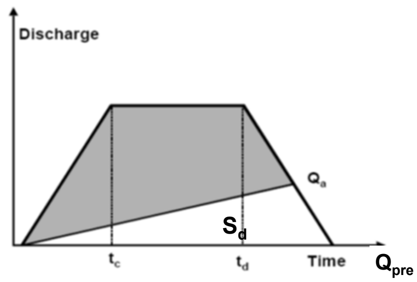
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(T_d)} \cdot A$

Intensity

$i_{(T_d)} = A\,(T_d)^{B}$

Storage

$S_d = Q_{post} \cdot T_d - Q_{pre}\,(T_d + T_c) / 2$



SWM Facility #2 - Rear Yard Surface Storage (207)

Post-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	132.69
Return Period	100 yr		
Time of Concentration (min)	15		
Coeff A	47.7		
Coeffic B	-0.738		
Runoff Coeff (unadjusted)	0.54	Uncont. Flow (m^3/s)	0.09
Runoff Coefficient (Adjusted)	0.77		
Area (ha)	0.30		

Target Flow (m^3/s)	0.03

REQUIRED STORAGE VOLUME (m^3):	**52.5**	5yr pre

Storage Volume Determination (Detailed)				
T_d	i	T_d	Q_{Uncont}	S_d
min	*mm/hr*	*sec*	*m^3/s*	*m^3*
15	132.69	900	0.086	50.4
20	107.31	1200	0.070	52.0
25	91.02	1500	0.059	52.5
30	79.56	1800	0.052	52.4
35	71.00	2100	0.046	51.7
40	64.34	2400	0.042	50.6
45	58.98	2700	0.038	49.3
50	54.57	3000	0.035	47.7
55	50.86	3300	0.033	45.8
60	47.70	3600	0.031	43.9
65	44.96	3900	0.029	41.7
70	42.57	4200	0.028	39.4
75	40.46	4500	0.026	37.1
80	38.58	4800	0.025	34.6
85	36.89	5100	0.024	32.0

CROZIER CONSULTING ENGINEERS

PROJECT: 125 Arthur St.
PROJECT No.: 2142-6059
DATE: 2022.02.23
DESIGN: IB
CHECK: BH

Modified Rational Method Storage Sizing

Peak Flow

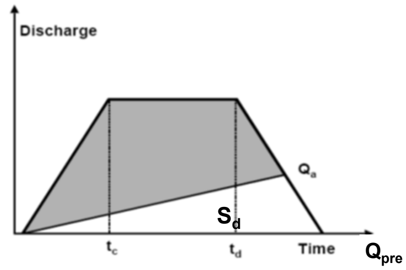
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(T_d)} \cdot A$

Intensity

$i_{(T_d)} = A\,(T_d)^{B}$

Storage

$S_d = Q_{post} \cdot T_d - Q_{pre}\,(T_d + T_c) / 2$



Post-Dev Drainage To The Little Beaver River

Uncontrolled Areas (200, 210)

Post-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	132.69
Return Period	100 yr		
Time of Concentration (min)	15		
Coeff A	47.7		
Coeff B	-0.738		
Runoff Coeff (Unadjusted)	0.32	Flow (m^3/s)	0.26
Runoff Coefficient (Adjusted)	0.66		
Area (ha)	1.07		

Owen Sound IDF		
Storm	**A**	**B**
2 yr	22.3	-0.714
5 yr	29.1	-0.724
10 yr	33.6	-0.729
25 yr	39.3	-0.734
50 yr	43.5	-0.736
100 yr	47.7	-0.738

Catchment 201 - to be Controlled by Surface Storage (SWM Facility #3)

Post-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	132.69
Return Period	100 yr		
Time of Concentration (min)	15		
Coeff A	47.7		
Coeff B	-0.738		
Runoff Coeff (Unadjusted)	0.67	Flow (m^3/s)	0.26
Runoff Coefficient (Adjusted)	0.84		
Area (ha)	0.83		

Target Flow (m^3/s)	0.39	100yr pre

Target Flow - Uncontrolled Flow = Target Control Flows

Target Control Flow (5 yr) =	0.13	(m^3/s)	--> must = Post Dev Flows from Catchment 201

Allocating Target Flows

	Area (ha)	Target Flow	
Post Dev 201	0.83	0.13	(m^3/s)
Total		0.13	(m^3/s)

CROZIER CONSULTING ENGINEERS

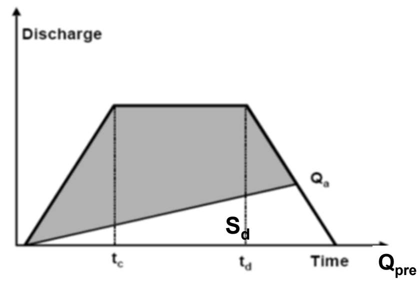
PROJECT: 125 Arthur St.
PROJECT No.: 2142-6059
DATE: 2022.02.23
DESIGN: IB
CHECK: BH

Modified Rational Method Storage Sizing

Peak Flow
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(T_d)} \cdot A$

Intensity
$i_{(T_d)} = A\,(T_d)^{B}$

Storage
$S_d = Q_{post} \cdot T_d - Q_{pre}\,(T_d + T_c) / 2$



Catchment 201 - to be Controlled by Surface Storage and Super Pipe (SWM Facility #3)

Post-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	132.69
Return Period	100 yr		
Time of Concentration (min)	15		
Coeff A	47.7		
Coeffic B	-0.738		
Runoff Coeff (unadjusted)	0.67	Uncont. Flow (m^3/s)	0.26
Runoff Coefficient (Adjusted)	0.84		
Area (ha)	0.83		

Target Flow (m^3/s)	0.13
REQUIRED STORAGE VOLUME:	**117.4** 100yr pre

Storage Volume Determination (Detailed)				
T_d	i	T_d	Q_{Uncont}	S_d
min	*mm/hr*	*sec*	*m^3/s*	*m^3*
15	132.69	900	0.258	117.4
20	107.31	1200	0.209	116.4
25	91.02	1500	0.177	112.3
30	79.56	1800	0.155	106.1
35	71.00	2100	0.138	98.5
40	64.34	2400	0.125	89.6
45	58.98	2700	0.115	79.9
50	54.57	3000	0.106	69.4
55	50.86	3300	0.099	58.3
60	47.70	3600	0.093	46.6
65	44.96	3900	0.088	34.5
70	42.57	4200	0.083	22.0
75	40.46	4500	0.079	9.2
80	38.58	4800	0.075	-3.9
85	36.89	5100	0.072	-17.3
90	35.36	5400	0.069	-31.0

CROZIER CONSULTING ENGINEERS

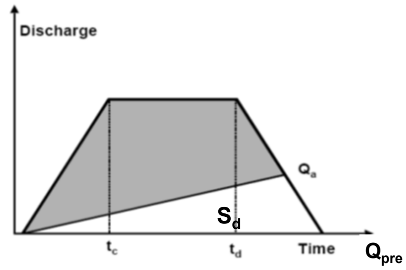
PROJECT: 125 Arthur St.
PROJECT No.: 2142-6059
DATE: 2022.02.23
DESIGN: IB
CHECK: BH

Modified Rational Method Storage Sizing

Peak Flow
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(T_d)} \cdot A$

Intensity
$i_{(T_d)} = A\,(T_d)^B$

Storage
$S_d = Q_{post} \cdot T_d - Q_{pre}\,(T_d + T_c) / 2$



Post-Dev Drainage To The Little Beaver River

Uncontrolled Areas (200, 210)

Post-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	79.39
Return Period	5 yr		
Time of Concentration (min)	15		
Coeff A	29.1		
Coeff B	-0.724		
Runoff Coeff (Unadjusted)	0.32	Flow (m^3/s)	0.08
Runoff Coefficient (Adjusted)	0.32		
Area (ha)	1.07		

Owen Sound IDF

Storm	A	B
2 yr	22.3	-0.714
5 yr	29.1	-0.724
10 yr	33.6	-0.729
25 yr	39.3	-0.734
50 yr	43.5	-0.736
100 yr	47.7	-0.738

Catchment 201 - to be Controlled by Surface Storage (SWM Facility #3)

Post-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	79.39
Return Period	5 yr		
Time of Concentration (min)	15		
Coeff A	29.1		
Coeff B	-0.724		
Runoff Coeff (Unadjusted)	0.67	Flow (m^3/s)	0.12
Runoff Coefficient (Adjusted)	0.67		
Area (ha)	0.83		

Target Flow (m^3/s)	0.09	5yr pre

Target Flow - Uncontrolled Flow = Target Control Flows

Target Control Flow (5 yr) =	0.02	(m^3/s)	--> must = Post Dev Flows from Catchment 201

Allocating Target Flows

	Area (ha)	Target Flow	
Post Dev 201	0.83	0.02	(m^3/s)
Total		0.02	(m^3/s)

PROJECT: 125 Arthur St.
PROJECT No.: 2142-6059
DATE: 2022.02.23
DESIGN: IB
CHECK: BH

Modified Rational Method Storage Sizing

Peak Flow

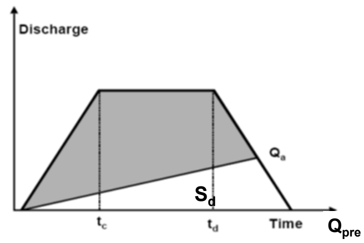
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(T_d)} \cdot A$

Intensity

$i_{(T_d)} = A\,(T_d)^{B}$

Storage

$S_d = Q_{post} \cdot T_d - Q_{pre}\,(T_d + T_c) / 2$



Catchment 201 - to be Controlled by Surface Storage and Super Pipe (SWM Facility #3)

Post-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Owen Sound	Intensity (mm/hr):	79.39
Return Period	5 yr		
Time of Concentration (min)	15		
Coeff A	29.1		
Coeffic B	-0.724		
Runoff Coeff (unadjusted)	0.67	Uncont. Flow (m^3/s)	0.12
Runoff Coefficient (Adjusted)	0.67		
Area (ha)	0.83		

Target Flow (m^3/s)	0.02

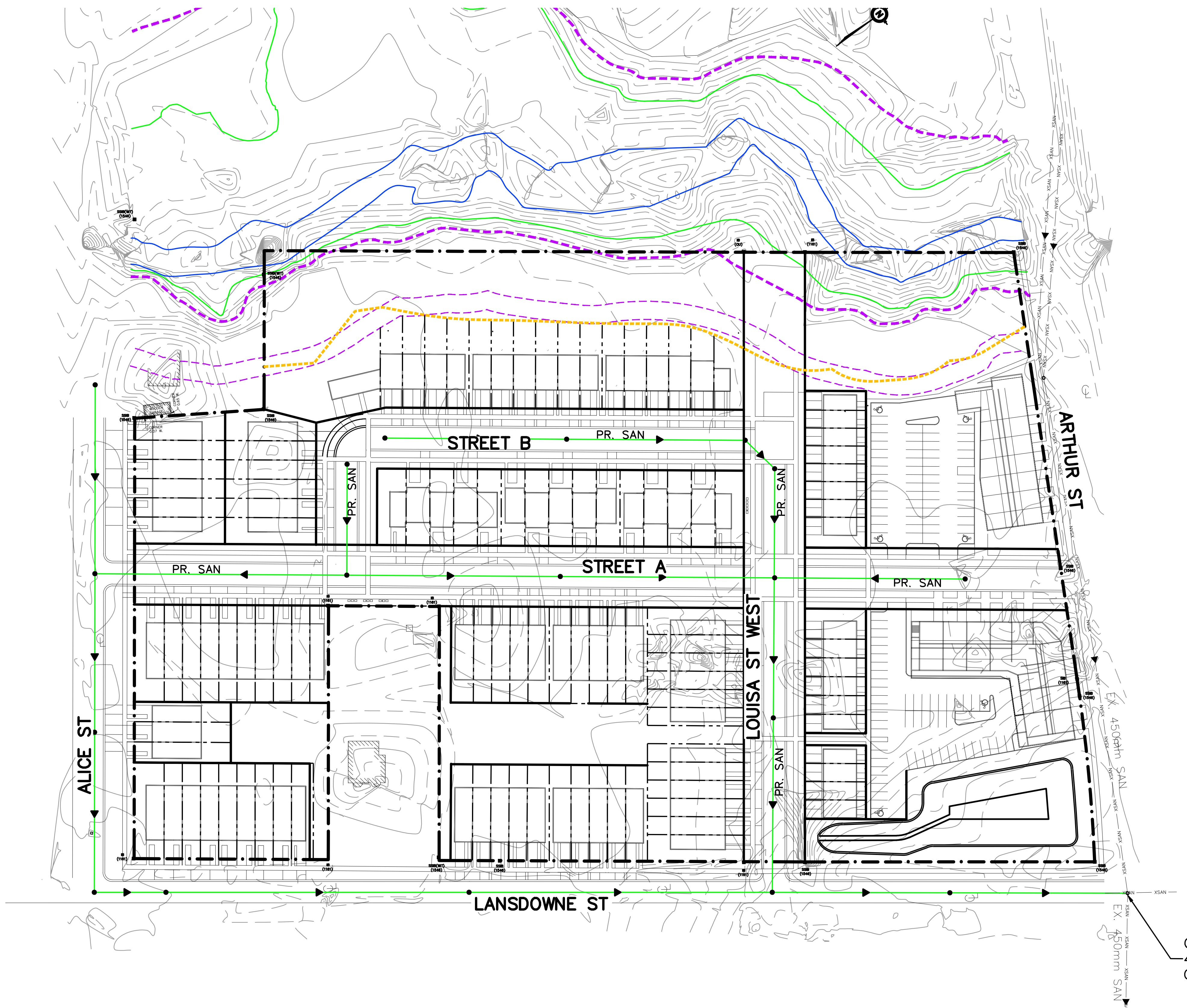
REQUIRED STORAGE VOLUME:	**129.3**	5yr pre

Storage Volume Determination (Detailed)				
T_d	i	T_d	Q_{Uncont}	S_d
min	*mm/hr*	*sec*	*m^3/s*	*m^3*
15	79.39	900	0.125	96.5
20	64.47	1200	0.101	103.1
25	54.85	1500	0.086	108.2
30	48.07	1800	0.075	112.3
35	42.99	2100	0.067	115.6
40	39.03	2400	0.061	118.3
45	35.84	2700	0.056	120.5
50	33.21	3000	0.052	122.4
55	30.99	3300	0.049	124.0
60	29.10	3600	0.046	125.3
65	27.46	3900	0.043	126.3
70	26.03	4200	0.041	127.2
75	24.76	4500	0.039	127.9
80	23.63	4800	0.037	128.4
85	22.61	5100	0.035	128.8
90	21.70	5400	0.034	129.1
95	20.86	5700	0.033	129.3
100	20.10	6000	0.032	129.3
105	19.41	6300	0.030	129.3
110	18.76	6600	0.029	129.2
115	18.17	6900	0.028	128.9
120	17.62	7200	0.028	128.7
125	17.10	7500	0.027	128.3
130	16.63	7800	0.026	127.9
135	16.18	8100	0.025	127.4
140	15.76	8400	0.025	126.9
145	15.36	8700	0.024	126.3
150	14.99	9000	0.024	125.7
155	14.64	9300	0.023	125.0
160	14.31	9600	0.022	124.3
165	13.99	9900	0.022	123.5
170	13.69	10200	0.021	122.7
175	13.41	10500	0.021	121.9

LIST OF FIGURES

Legend	Project	
= SUBJECT LANDS	125 ARTHUR STREET TOWN OF BLUE MOUNTAINS	CROZIER CONSULTING ENGINEERS ADMIRAL BUILDING 1 FIRST STREET, SUITE 200 COLLINGWOOD, ON, L9Y 1A1 705-446-3510 T 705-446-3520 F WWW.CFCROZIER.CA INFO@CFCROZIER.CA
	Drawing: SITE LOCATION	Drawn By: S.O. / Design By: S.O. / Project: 2142–6059 Scale: N.T.S. / Date: 09/07/2021 / Check By: G.C. / Drawing: FIG.1

J:\2100\2142- The Blue Meadows Inc\6059- 125 Arthur St, TOBM\CAD\Civil_Sheets\FIGURES\6059_FIG.1.dwg, FIG.1, 2022-02-22 11:20:18 AM, nlefebvre



LEGEND

- PROPOSED SANITARY SEWER
- PROPOSED LOT LINES
- PROPERTY LIMITS
- EXISTING WATERMAIN
- EXISTING SANITARY SEWER
- CALCULATED FLOODLINE
- 6.0m EROSION ACCESS SETBACK
- MEANDER BELT
- WATER COURSE
- 15m TOP OF BANK SETBACK (PROVIDED BY AZIMUTH)

50 0m 50 100

SCALE: 1:1500

Blue Meadows

Project	125 ARTHUR STREET TOWN OF BLUE MOUNTAINS
Drawing	SANITARY SERVICING PLAN

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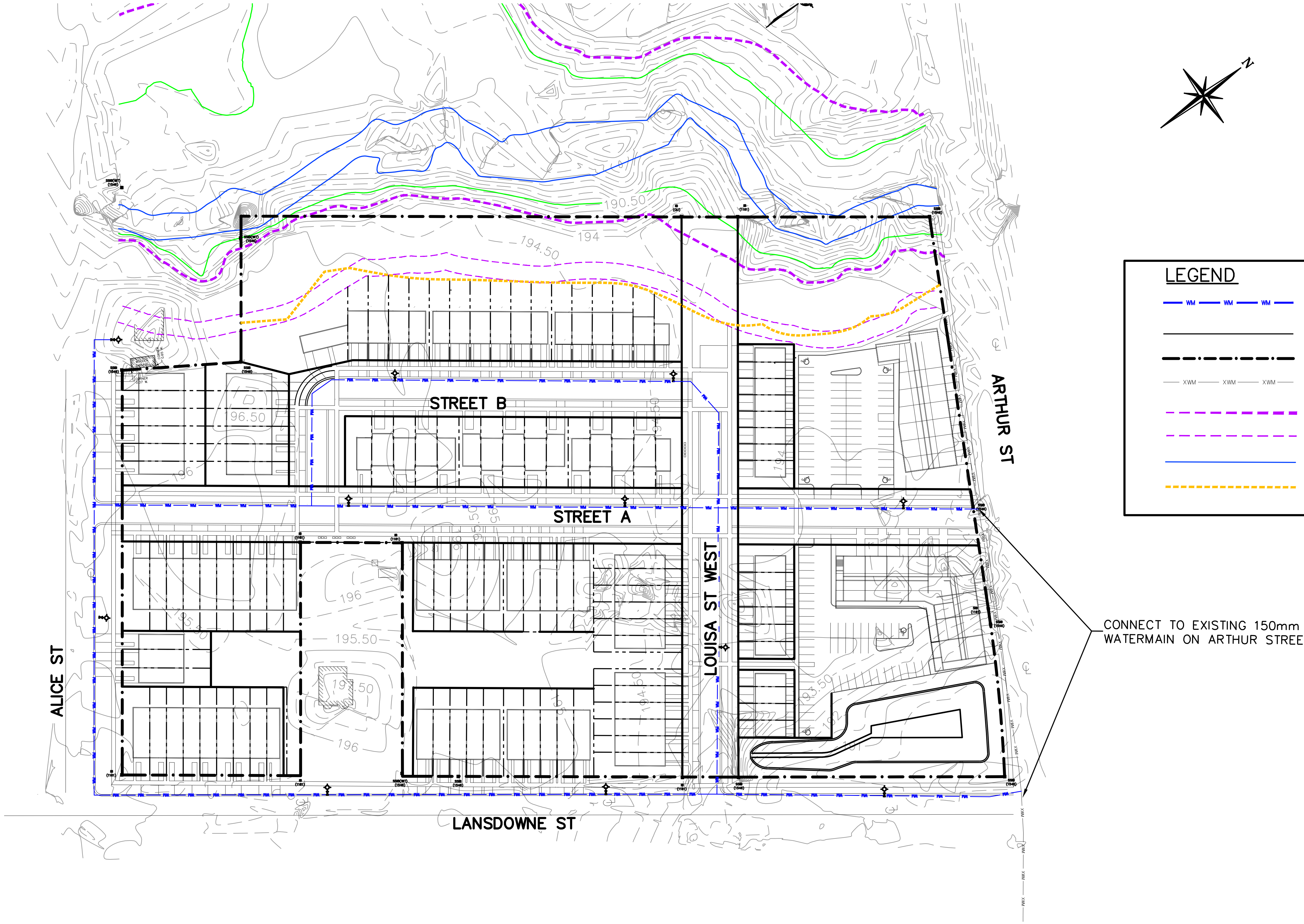
Admiral Building
1 First Street, Suite 200
Collingwood, ON, L9Y 1A1
705-446-3510 T
705-446-3520 F
www.cfcrozier.ca
info@cfcrozier.ca

Drawn By	Design By	Project
S.O./N.L.	S.O./N.L.	2142-6059

Scale	Date	Check By	Drawing
1:1500	09/07/2021	G.C.	FIG. 2



LEGEND

— WM — WM —	PROPOSED WATERMAIN
———	PROPOSED LOT LINES
— · — · —	PROPERTY LIMITS
— XWM — XWM —	EXISTING WATERMAIN
- - - -	CALCULATED FLOODLINE
- - - -	6.0m EROSION ACCESS SETBACK
———	WATER COURSE
- - - -	15m TOP OF BANK SETBACK (PROVIDED BY AZIMUTH)

50 0m 50 100

SCALE: 1:1500

Project: 125 ARTHUR STREET
TOWN OF BLUE MOUNTAINS

Drawing: WATER DISTRIBUTION PLAN

Blue Meadows

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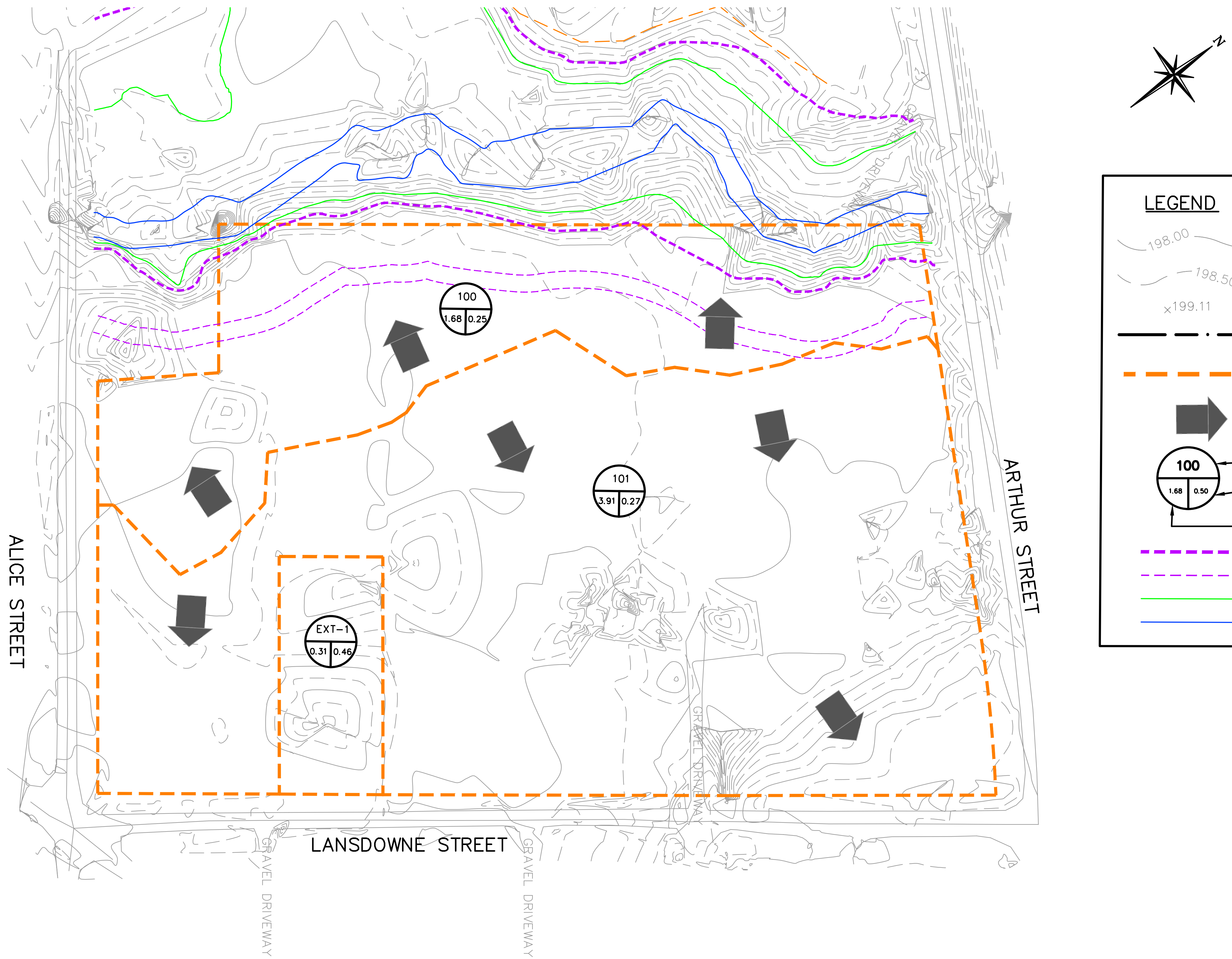
Collingwood, ON, L9Y 1A1
705-446-3510 T
705-446-3520 F
www.cfcrozier.ca
info@cfcrozier.ca

Drawn By	Design By	Project
S.O./N.L.	S.O./N.L.	2142-6059

Scale	Date	Check By	Drawing
1:1500	09/07/2021	G.C.	FIG. 3



LEGEND

198.00	EXISTING MAJOR CONTOURS
198.50	EXISTING MINOR CONTOURS
×199.11	EXISTING ELEVATION
	PROPERTY BOUNDARY
	DRAINAGE AREA
	OVERLAND FLOW ARROW
100	CATCHMENT ID
0.50	RUNOFF COEFFICIENT
1.68	CATCHMENT AREA (ha)
	REGIONAL FLOODLINE
	6.0m EROSION ACCESS SETBACK
	100 YR FLOODLINE
	WATER COURSE

50 0m 50 100

SCALE: 1:1500

Project: 125 ARTHUR STREET
TOWN OF BLUE MOUNTAINS

Drawing: PRE-DEVELOPMENT DRAINAGE

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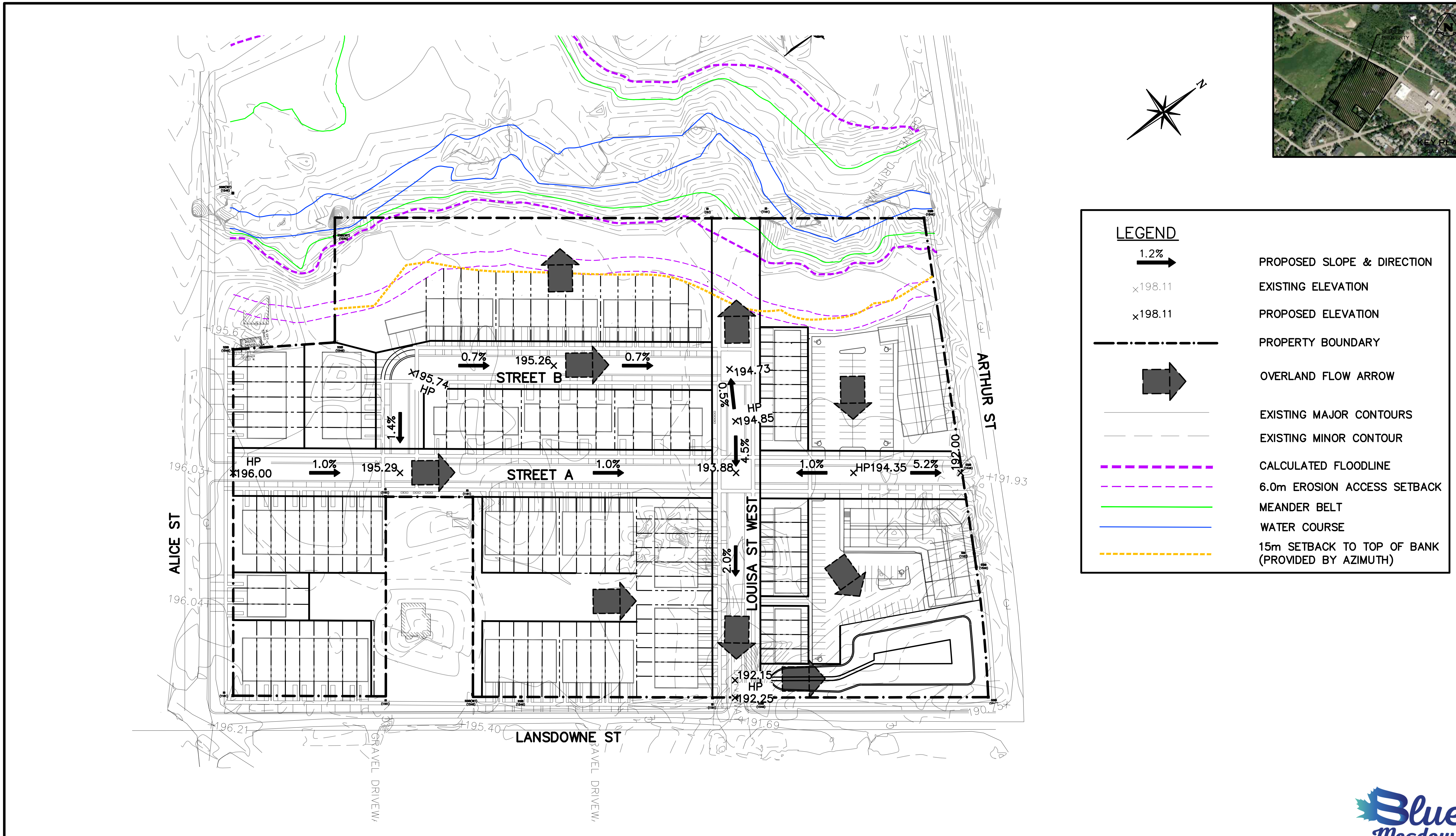
Admiral Building
1 First Street, Suite 200
Collingwood, ON, L9Y 1A1
705-446-3510 T
705-446-3520 F
www.cfcrozier.ca
info@cfcrozier.ca

Drawn By S.O./N.L.	Design By S.O./N.L.	Project 2142–6059	
Scale 1:1500	Date 09/07/2021	Check By G.C.	Drawing FIG. 4



50 0m 50 100

SCALE: 1:1500

Project: 125 ARTHUR STREET
TOWN OF BLUE MOUNTAINS

Drawing: GENERAL GRADING

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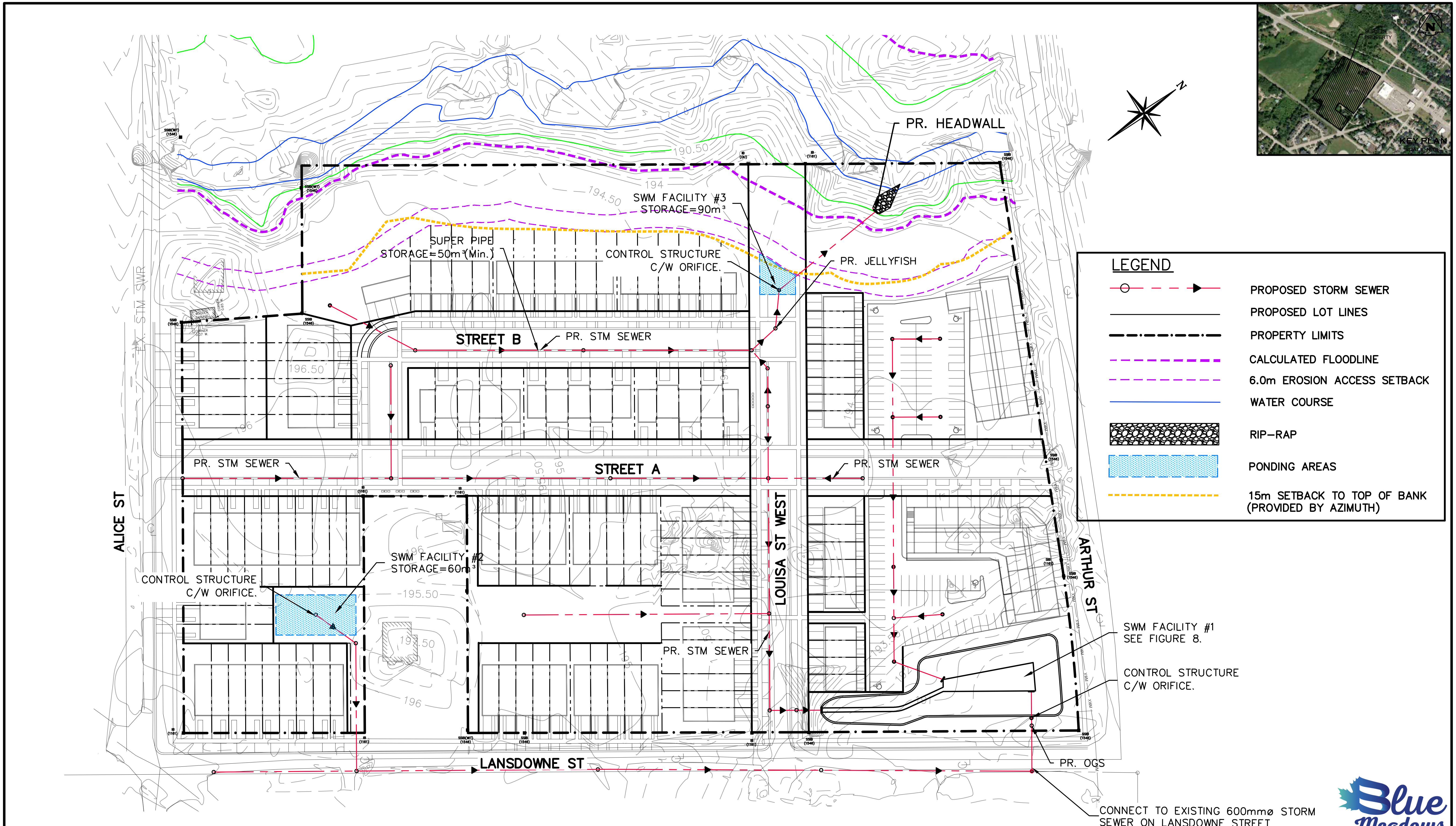
1 FIRST STREET, SUITE 200
COLLINGWOOD, ON, L9Y 1A1
705-446-3510 T
705-446-3520 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	S.O./N.L.	Design By	S.O./N.L.	Project	2142–6059
Scale	1:1500	Date	09/07/2021	Check By	G.C.	Drawing	FIG. 5

J:\2100\2142- The Blue Meadows Inc\6059- 125 Arthur St, TOBM\CAD\Civil_Sheets\FIGURES\6059_FIG.4.dwg, FIG. 5, 2022-02-22 11:23:27 AM, nlefebvre



Project
125 ARTHUR STREET
TOWN OF BLUE MOUNTAINS

Drawing
STORM SEWER DRAINAGE PLAN

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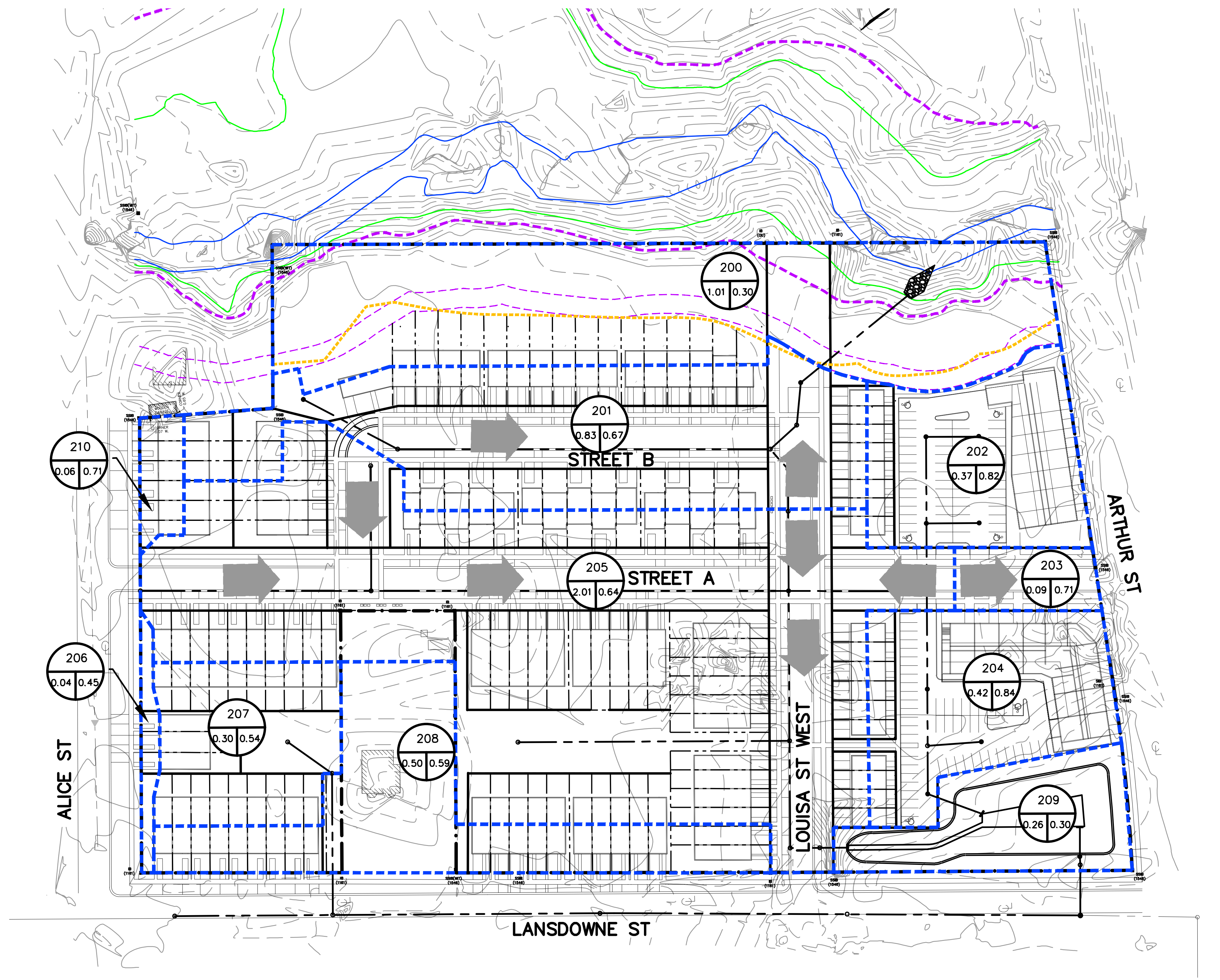
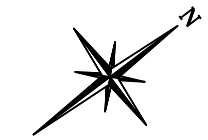
COLLINGWOOD, ON, L9Y 1A1
705-446-3510 T
705-446-3520 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project
S.O./N.L.	S.O./N.L.	2142–6059

Scale	Date	Check By	Drawing
1:1500	09/07/2021	G.C.	FIG. 6

J:\2100\2142- The Blue Meadows Inc\6059- 125 Arthur St, TOBM\CAD\Civil_Sheets\FIGURES\6059_FIG.7.dwg, FIG. 6, 2022-02-22 11:24:15 AM, nlefebvre





LEGEND

- 198.00 — EXISTING MAJOR CONTOURS
- 198.50 — EXISTING MINOR CONTOURS
- ×199.11 — EXISTING ELEVATION
- PROPERTY BOUNDARY
- DRAINAGE AREA
- OVERLAND FLOW ARROW
- 100 — CATCHMENT ID
- 0.50 — RUNOFF COEFFICIENT
- 1.68 — CATCHMENT AREA (ha)
- REGIONAL FLOODLINE
- 6.0m EROSION ACCESS SETBACK
- 100 YR FLOODLINE
- WATER COURSE
- PROPOSED STORM SEWER
- 15m TOP OF BANK SETBACK (PROVIDED BY AZIMUTH)

50 0m 50 100

SCALE: 1:1500

Blue Meadows

Project

125 ARTHUR STREET
TOWN OF BLUE MOUNTAINS

Drawing

POST-DEVELOPMENT DRAINAGE

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1 First Street, Suite 200
Collingwood, ON, L9Y 1A1
705-446-3510 T
705-446-3520 F
www.cfcrozier.ca
info@cfcrozier.ca

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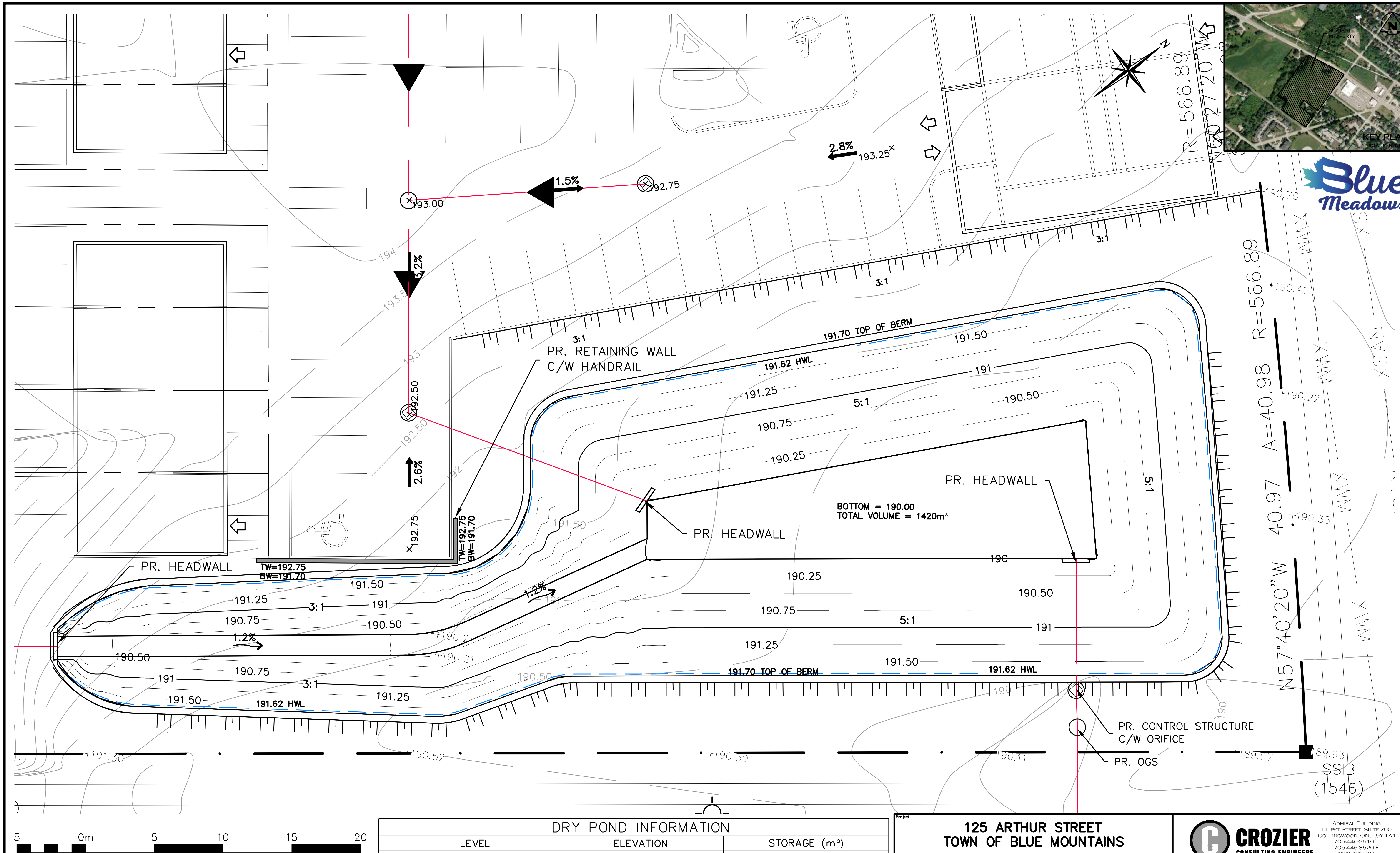
Scale	1:1500	Date	09/07/2021	Check By	G.C.	Drawing	FIG. 7



SCALE: 1:250

DRY POND INFORMATION		
LEVEL	ELEVATION	STORAGE (m³)
BOTTOM OF POND	190.00m	0m³
100 YEAR HWL	191.68m	1394m³ (ACTIVE)
TOP OF BERM	191.70m	1420m³ (ACTIVE)

Project
125 ARTHUR STREET
TOWN OF BLUE MOUNTAINS

Drawing
SWM FACILITY #1

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1 FIRST STREET, SUITE 200
COLLINGWOOD, ON, L9Y 1A1
705-446-3510 T
705-446-3520 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

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Scale	Date	Check By	Drawing
1:250	09/07/2021	G.C.	FIG. 8