FUNCTIONAL SERVICING REPORT

Westview Townhouses
Grand Valley, Ontario

October 14, 2021 **Project # 21-1531**

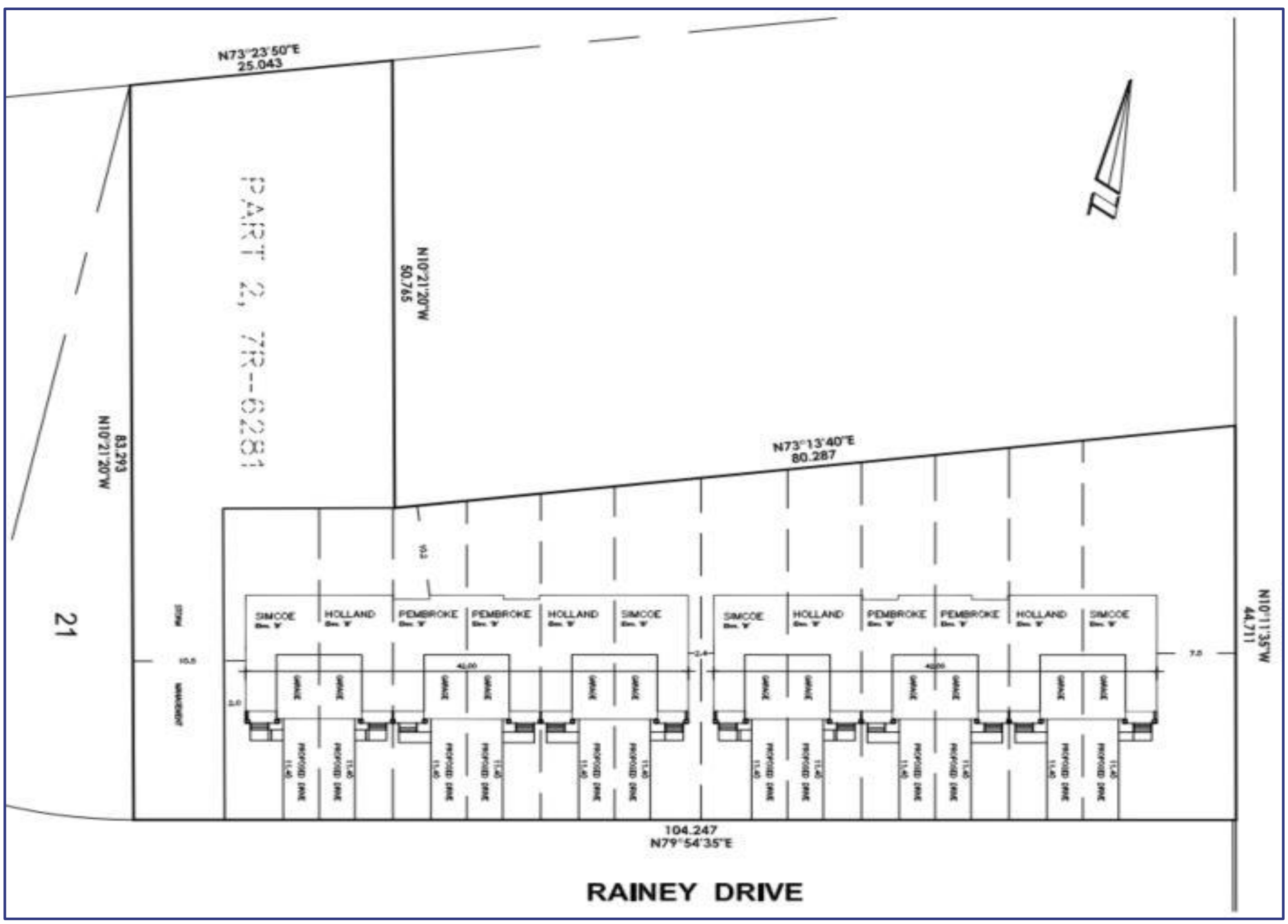


TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

TULLOCH Engineering has been retained by the Westview Construction to prepare a functional servicing report in support of the proposed Westview Townhouse Development to be located in the Town of Grand Valley.

The subject property is approximately 0.53 hectares in size located at the corner of Main Street and Rainey Drive, being Part 2 of Registered Plan 7R-6281 in the Town of Grand Valley, County of Dufferin. The proposed development will consist of (12) twelve townhouse lots fronting onto Rainey Drive, occupying approximately 0.41 hectares of the overall subject property.

The following preliminary functional servicing review includes preliminary design elements for municipal water and sewer connections, utilities, municipal roadway access and storm water management strategy. The report is prepared in conjunction with the Draft Plan of Subdivision being prepared by others.

2. GENERAL SERVICING INFORMATION

The site is located within the urban servicing boundary for the Town of Grand Valley and municipal water and sanitary sewer infrastructure is owned and operated by the municipality. As such, water and sewer servicing provided for the development are required to meet applicable standards set out by the Town of Grand Valley and Ministry of the Environment Conservation and Parks. In addition, municipal roadways and storm drainage are owned and operated by the Town of Grand Valley, requiring site development access and drainage design to meet with Town approval.

The proposed development will contain 12 townhouse units fronting onto Rainy Drive. However, a sanitary service main does not currently exist along the development frontage, so a sanitary sewer will need to be constructed on Rainey Drive to connect townhouse service laterals to the Main Street sanitary sewer. Water service laterals for the proposed units can be connected to the existing watermain constructed on the south side of Rainey Street. A capacity analysis of the municipal infrastructure will be necessary in support of the proposed development.

3. MUNICIPAL WATER AND SANITARY SEWER SERVICING

The following outlines the preliminary design requirements for the 10-unit townhouse plan.

3.1 Sanitary Sewerage

There is an existing large diameter gravity sanitary sewer running along Main Street (diameter to be verified) that could provide connection for a new sanitary service main from the townhouses at the intersection of Main St. and Rainey Drive. Location of existing and proposed sanitary sewers are shown on the appended preliminary servicing drawing. Final sewer design and sizing for the addition of a sanitary sewer on Rainey Drive is subject to an initial capacity review by the municipality for the Main Street sanitary sewer and related wastewater infrastructure.

The following outlines the wastewater flows expected from the proposed development.

3.1.1 Preliminary Sanitary Criteria and Design Flows

Sanitary design flow contributions were determined based upon the Ministry of the Environment Conservation and Parks (MECP) Design Guidelines for Sewage Works 2008 edition. MECP design criteria as re-sated in the Town of Grand Valley Engineering Standards are as follows:

Average Day Flow (ADF)	450 L/capita/day
Infiltration	0. 20 L/s/ha Population
	4.0 people/unit
Peaking Factor (Harmon)	M = 1+14/(4+(P/1000)^0.5) Peak
Population Flow	Q(p) = PqM/86.4
Peak Extraneous Flow	Q(i) = 0.20l/s/ha
Peak Design Flow	Q(d) = Q(p) + Q(i)

Total design flow from the site has been summarized in Table 1.

Table 1: Sanitary Design Flows

Units	Population	Average Flow (L/s)	Peaking Factor	Peak Flow (L/s)	Drainage Area (Ha.)	Infiltration (L/ha/s)	Peak Extraneous Flow	Design Flow (L/s)
12	48	0.250	4.32	1.080	0.41	0.20	0.082	1.162

The total area of the twelve proposed townhouse lots fronting Rainey Drive is 0.41 hectares, which has been considered as the contributing sanitary drainage area. A 200mm diameter sanitary sewer with a grade line of 0.4% could achieve the design flow of 1.162 L/s meeting minimum full flow velocity. With final design of the Rainey Drive sanitary sewer it would be necessary to add a connection manhole at the Main Street sewer, which will require cutting a new manhole into the existing line.

All proposed units would be serviced by individual 125mm diameter sanitary service laterals meeting Ontario Provincial design standards having a minimum preferred gradient of 2% with connection to the sanitary sewer main constructed along Rainey Drive. The preliminary review indicates that the service laterals will not be able to service the depth of a full 3 metre deep foundation, so it is anticipated that serviced basements would require sewage pumps. Sanitary sewer pipe diameters and slopes are to be validated with final design. See preliminary servicing drawing appended for details.

3.2 Water Supply

There is an existing 250mm diameter municipal watermain constructed along the south side of Rainey Drive opposite the townhouse development frontage. We understand that the newly constructed watermain has not yet been assumed by the municipality as part of the Cachet Subdivision construction. Final watermain sizing and capacity for addition of proposed townhouse development is subject to a capacity review by the municipality.

The following outlines the design flow demands required by the proposed 12 townhouse units.

3.2.1 Preliminary Water Demand

A minimum fire flow requirement of 38 Lps at 20 psi was selected for this development based on the Ministry of the Environment Conservation and Parks (MCEP) design guideline Table 8-1 for fire flow requirements related to reservoir sizing of 500 – 1000 population. The flow set out by MECP is only one of the sources that determine fire demand requirements, and it will be up to the Municipality to accept the MECP flow determination. However, considering that there is an existing fire hydrant located on Rainey Drive opposite the proposed townhouses, it is unlikely that a further capacity assessment for this requirement will be required.

Domestic water demand design flows are based upon the MECP Design Guidelines for Drinking Water Systems (2008), with an average flow of 450 L/capita/day. In addition, a peaking factor was taken from the MOE table of peaking factors for developments of under 500 people and resulted in a maximum day peaking factor of 9.5 and a peak hour factor of 14.3 based on the equivalent population of the development. Average day, maximum day, peak hour flow, and fire flow plus maximum day can be seen in the Table 2.

Table 2: Water Demand

Units	Population	Average Flow (L/s)	Max Day Flow (L/s)	Peak Hour Flow (L/s)	Fire Flow (38 L/s) Plus Max Day Flow (L/s)
12	48	0.25	2.38	3.58	40.38

All proposed units would be serviced by individual 25mm diameter water service laterals meeting Ontario Provincial design standards having a curb stop at property line and main stop with saddle at the watermain. Frost cover on the services would conform to the Provincial Standards having minimum cover of 1.8m. See preliminary servicing drawing appended for details.

4. ROADWAY AND ACCESS

4.1 Municipal Roadway

With the proposed townhouses fronting on Rainey Drive, proposed driveway access for each of the twelve units would access the street line with maximum gradients of 4%. Preliminary driveway grading has been shown on the appended preliminary grading plan.

It is our understanding that Rainey Drive is currently under construction and has not been assumed by the municipality. Subject to final assumption of the roadway, it would be necessary for the townhouse development to restore the roadway, curbs and boulevard to finished condition after installation of servicing, utilities and driveways as needed. All driveways would require curb cuts matching the Town's standard requiring curb and gutter as per the Provincial Standard as demonstrated on the Town's typical roadway section included on the preliminary servicing plans details page as appended.

5. UTILITIES

With the proposed townhouses fronting on Rainey Drive, proposed utility access will be from the utility corridor within the fronting boulevard. It is expected that a hydro design will need to be completed to the satisfaction of the hydro authority (Orangeville Hydro) which is likely to require additional transformer(s) and infrastructure to be constructed in the fronting boulevard. A preliminary utility plan has not been provided with the preliminary servicing plans but would be provided as needed with final design submission.

6. STORMWATER MANAGEMENT

6.1 General

A preliminary review of the adjacent subdivision stormwater designs for Cachet and Mayberry indicates that allowances were made for an external drainage catchment (101) of 0.6 hectares relating to the subject property and neighbouring cemetery. The Cachet Subdivision FSR indicates that storm sewers within the development roadways and drainage easements in the northeast corner of the subdivision (Phase 2) have been designed to convey stormwater runoff to the Mayberry stormwater pond located on Hilborn Street southwest of the Cachet development. Conveying storm sewers through the Cachet subdivision have been designed for the 5-year storm event with all greater storm events being conveyed through the subdivision by way of the roadway corridors and drainage easements towards the Mayberry Subdivision stormwater pond and then on to the Grand River via. the Leeson Street storm sewer. Specifically, as the Cachet FSR relates to external drainage area 101, this area has been assigned a runoff of 0.2 in the Cachet storm sewer design, leaving future development of this area to address any change in these criteria.

The subject property that makes up approximately 0.53 hectares of previously addressed drainage area 101 was formerly occupied by a church and parking lot prior to 2013. With the remainder of area 101 being cemetery lands draining towards the northeast corner of the Cachet Subdivision lands. The Cachet FSR indicates that the Rainey Drive storm sewer is to receive stormwater via a ditch inlet catchbasin (Ex.DICB) located at the southwest corner of the subject property for area 101. It also appears that the Rainey Drive storm sewer was designed to surcharge from the DICB onto the subject property under the major storm event since the DICB inlet was set below the elevation of Rainey Drive. This is evident as shown on approved subdivision drawing D1 as appended. Surcharging stormwater then surcharges up to a maximum level as determined by the existing topography before running away towards the northwest where overland flows are directed to the rear yard drainage swale at the back of the subdivision lots – north boundary. The Cachet design calculations reviewed seem to indicate that the Rainey Drive storm sewer has been designed to capture all of area 101 at the DICB and do not provide a split outlet for the area. When in fact the introduction of a catch basin at the southwest corner of the subject property has created a split in area 101 runoff that has become apparent with an updated topographic survey of the subject property. As such, the following preliminary stormwater management review will review increases in the subject property's post development runoff coefficient and check storm sewer capacity in the Rainey Drive storm sewers under the minor storm event, with major storm event conveyance being directed north towards the subdivisions rear yard swale.

6.2 Existing Soils Conditions

Localized site soils can be categorized as clayey silt to silty clay with traces of gravel, with the native soils having poor permeability. Borehole results have been appended from the soils report completed by SPL Consultants dated July 2015 for the adjacent subdivision. Boreholes 15-01 and 15-02 indicate locations adjacent to the subject property – see appended soils information.

The borehole logs indicate that water table is approximately 4m below exiting grade in proximity of the site and preliminary observances of the site do not indicate evidence of a high-water table.

6.3 Preliminary Design Criteria

Design criteria to be met for the development property are summarized as follows:

- Stormwater management for the property is to be developed in accordance with Town of Grand Valley and Ministry of the Environment, Conservation and Parks (MECP) Standards;
- Post development quantity control is not required if safe conveyance of the major storm even can be provided directing overland flow up to the 100yr Storm event;
- Water quality control for the proposed townhouse development is to be provided to satisfy MECP "Normal" Level criteria for outlet to an online storm sewer, and;
- Storm sewer sizing to accommodate the minor return storm event – 5-year.

6.4 Hydrology

The rational method was used to estimate the peak runoff rates for the 5- and 100-year storm events, as presented in Table 3 and 4. Rational method calculations are found in Appendix A. Pre-development and post-development catchment areas are found on the Catchment area drawings appended.

6.4.1 Model Selection

When assessing storm sewer conveyance and channel flows, the rational method was selected to derive peak run-off flows. This designed catchment(s) for pre and post development total 0.60 ha between Areas 101A&B & 201A&B as demonstrated on appended catchment drawings.

When assessing run-off attenuation volumes for catchment 201A, Visual Ottymo Version 6.1 was used to complete a hydrographic rainfall model utilizing the 3-hour Chicago storm distribution as set out in the Town of Grand Valley's standards.

6.4.2 Design Storms

We have selected the following design storms as part of our evaluation:

- 5-year design storm
- 100-year design storm

Rainfall Intensity – Duration – Frequency, *IDF*, curves for the Fergus Shand Dam location were utilized to determine the rainfall intensity, mm/hr, for the selected return period storm events. The IDF curves used were published online by the MTO IDF Curve Lookup Tool and are the most up to date rainfall data available for the selected location.

6.4.3 Drainage Catchments

Two (2) pre-development and two (2) post-development catchments have been identified for the site in order to estimate the peak runoff rates for the proposed development. Catchment area 101A and 201A encompass the proposed townhouse site. Under pre-development and post development conditions stormwater run-off from these areas flow to the southwest corner of the subject site where they are received by an existing ditch inlet catchbasin (Ex.DICB) in the Rainey Drive right of way. Catchment area 101B and 201B include external lands from the adjacent cemetery to the north and a portion of the northwest corner of the development lands that will remain undeveloped. Run-off from area 101B and 201B flows naturally towards the northeast corner of the Cachet Subdivision lands where it is picked up by a rear yard drainage swale as indicated on the approved subdivision design drawings.

6.5 Preliminary Development Runoff Rates

The rational method was used to estimate the peak runoff rates for the 5- and 100-year storm events, as presented in Table 3. Rational method calculations are found in Appendix A. Pre-development and post-development catchment areas are found on Drawings D1 & D2 in Appendix C.

Table 2: **PEAK FLOWS (m^3/s)**

Catchment ID	Outlet Point	Area	Runoff Rate (m^3/s)		
			5-year	100-year	
101A	Southwest boundary Ex. DICB	0.41	0.02		Pre-Development
201A	Southwest boundary Ex. DICB	0.41	0.05		Post-Development
101A+101B+ Cachet 37	Northwest boundary Ex. Rear Yd. Swale	1.05		0.19	Pre-Development
201A+201B+ Cachet 37	Northwest boundary Ex. Rear Yd. Swale	1.05		0.24	Post-Development

Peak runoff rates from catchment 101 to 201 increase in all cases.

Peak run-off rates for catchment 201A were used in evaluation of the existing storm sewer capacity on Rainy Drive for the 5-year event, combining the subject site's flows with design pipe flows calculated from the approved Cachet Subdivision drawings using pipe design and drainage areas indicated on the plans. The storm sewer capacity review is addressed further later in the report. Storm sewer review spread sheets are included in Appendix A.

Peak run-off rates for catchment 201A & 201B were used in evaluating the 100-year event capacity for the rear yard swale that receives run-off along the north subdivision boundary on Rainy Drive. In keeping with the Cachet Subdivision approved drawings, original catchment area 101 as identified on the subdivision plans (now areas 201A&201B) captures overflow from the subject site's drainage in the rear yard swale. Subdivision Drawing D1 indicates that run-off that cannot be captured by the existing catchbasin at the southwest corner of the subject site overflows to northwest and is captured by the rear yard subdivision swale. The rear yard swale capacity is addressed further later int eh report. Swale review calculations are included in Appendix A.

6.6 Storm Sewer Capacity Review

A preliminary review of the storm sewers directly adjacent to the site and one leg downgrade show that there is not enough capacity for the 5-year storm runoff rate increases from the 0.41Ha developed portion of the site (Area 201A). The preliminary storm sewer calculations indicate that the existing storm sewer is running at 87% capacity on Rainey Drive and that increased runoff rates from the subject site will cause the sewer to surcharge with the required flow rate being 110% of capacity. Storm sewer capacity review spread sheet calculations are appended for reference.

The existing storm sewer system information was taken from approved design drawings for the Cachet Subdivision dated August 26, 2019. Copy of the plans have not been reproduced with this preliminary report.

6.7 Flow Conveyance and Stormwater Quantity Management

6.7.1 5 Year Storm Event Surcharging

Under the post-development model reviewed, stormwater runoff from the proposed townhouse lots and stormwater management block (Catchment 201A) being 0.41Ha. in size will drain to the existing DICB at the southwest corner of the property. As pre-determined by the preliminary pipe capacity review the Rainey Drive storm sewer will surcharge during the 5-year storm event. A preliminary runoff model was completed using Visual Ottymo Version 6.1 to determine preliminary storage volumes for both the 5 year and 100-year events as presented in Table 4 below. Copy of the preliminary otthymo model is appended.

Table 4: Retention Swale Control Details Catchment 101A and 201A

Return Period/Storm Event	Total Allowable Swale Discharge (m^3/s)	Uncontrolled Flow into Dry Pond (m^3/s)	Required Pond Storage Volume (m^3)	Controlled Pond Discharge (m^3/s)
5 Year	0.02	0.05	40.55	0.02 to Ex.DICB
100 Year	0.05	0.10	75.55	0.05 to Ex.DICB / or overflow to the northwest

The five-year surcharge volume can be attenuated within a side yard retention swale constructed in the stormwater management block situated along the westerly boundary of the subject site as shown on the preliminary SWM Plan – Drawing C1 . The preliminary grass lined retention swale has a flat 2 metre wide flat bottom and 3:1 side slopes with a maximum depth of 0.7m to make it easily maintainable.

6.7.2 100 Year Storm Event Conveyance (Preferred Option)

The Cachet Subdivision FSR prepared by Urbtech Engineering was unclear as to how they established a hydraulic grade line for conveyance of the 100year storm event along the roadway corridors and swales within the subdivision. The report indicates that all storm events greater than the 5-year event will surcharge and be conveyed via roadway corridors and swales leading downstream. Attenuation of the major event was not provided within the subdivision and major storm flows were reported to be received by the Leeson Street Truck sewer that eventually outlets to the Grand River.

In keeping with the Cachet Subdivision approved drawings, original catchment area 101 as identified on the subdivision plan Drawing D1 (now areas 201A&201B) captures major storm event overflow from the subject site's drainage within a rear yard swale shown along the north boundary of lots on Rainey Drive. Cachet Drawing D1 indicates that run-off that cannot be captured by the existing catchbasin at the s-w corner of the subject site overflows northwest and is captured by the rear yard subdivision swale.

A preliminary conveyance evaluation was completed for the year yard swale based on the typical cross section detail provided in the approved subdivision drawings. The swale gradient is reported to be 0.5% with a bottom width of 0.5m and 3:1 side slopes. The average depth of swale is indicated to be approximately 0.6m below existing grade and grade relief up to the rear of the building envelopes is an additional 0.65 metres on average. The point of cross section reviewed was taken at the location of CB23 as identified on the Cachet Drawing D1.

Based on post-development rational method peak flow calculations the 100-year storm event can be conveyed within the rear yard swale at a depth of 0.45m and a velocity of 0.29m/s. The preliminary review is based on simple conservative rational and does not account for flow splitting to take the minor stormwater flow through the rear yard storm sewers during the 100-year event. Copy of the preliminary calculation are appended for reference.

Subject to a final design review of the hydraulic grade line at the lower limits of the subdivision, it appears that the 100-year storm event flows discharging from the northwest corner of the proposed townhouse development can be conveyed down the subdivision rear yard swale.

6.7.3 100 Year Storm Event Attenuation (Optional if needed)

An alternative review of the 100-year storm event was completed to show that the townhouse development remains viable as presented for draft plan approval even if attenuation of the 100-year run-off flow is found to be necessary for the subject property. A preliminary runoff model was completed using Visual Ottymo Version 6.1 and storage volumes for both the 5 year and 100-year events were derived using a 3-hour Chicago storm rain fall hydrograph as presented in Table 4. above. Copy of the preliminary otthymo model is appended. Similar to the 5-year surcharge volume described above, a 100-year attenuation volume can be accommodated within the same side yard retention swale constructed in the stormwater management block situated along the westerly boundary of the development as shown on the preliminary SWM Plan. The preliminary grass lined retention swale would require a 2 metre wide flat bottom and 3:1 side slopes with a maximum depth of 0.7m to make it easily maintainable. Overtopping of the retention swale would be directed to the northwest to be captured by the rear yard subdivision swale on adjacent lands.

6.8 Stormwater Quality Control

A preliminary review of the available Cachet Subdivision FSR and Mayberry Subdivision design brief is inconclusive that quality control volume is available in the Mayberry quality control pond to service the subject site's imperviousness increases. At first look it appears that the Cachet Subdivision has already revisited the Mayberry Pond volume and used up availably capacity based on a reduced level of imperviousness for the Cachet lands of 53%. It also appears that to reduce the subdivisions overall level of imperviousness, the subject property's imperviousness was set at 20% relative to the existing condition runoff coefficient. Therefore, subject to a more in-depth review of the Mayberry Pond's capacity with final design we have opted to provide preliminary sizing for an oil grit separator manhole (OGS) to service the subject property as part of this preliminary SWM plan.

In keeping with the Mayberry quality pond objective that was set relative to the proximity of the subdivision to the Grand River, an "Enhanced" level of protection has been used in accordance with the MECP Stormwater Management Planning and Design Manual. The level of quality treatment required is assessed based on the sensitivity of receiving waters, which in this case is the adjacent Rainey Drive storm sewer that ultimately flows the Grand River approximately 1 Kilometer down stream. According to Table 3.2 of the design manual (copy appended), enhanced water quality treatment of stormwater requires 80% total suspended solids (*TSS)* removal.

As indicated in the MECP Stormwater Management Guidelines, Oil grit separators are appropriate for catchments under 2 hectares in size. In this case the subject townhouse site catchment is 0.41 Hectares. The placement of an OGS unit would work well at the southwest corner of the site, being installed between the ditch inlet catchbasin and the receiving storm sewer. A proposed OGS in this case would be considered an online unit sized to handle flow for the 5-year storm. Preliminary OGS sizing calculation are appended to the report resulting in a Stormceptor EF-4, manufactured by Imbrium, sizing and manufacturer will be confirmed at final design.

It should also be mentioned that final design would include low impact design elements in the property grading around the townhouse units that can considered quality conveyance controls for runoff. *LID* practices such as: Porous Pavement, Rainwater Harvesting, Planting Tree Clusters, Grass Swales, Filter Strip/Snow Treatment Areas, Rooftop Disconnection and Soakaway Pits in combination with landscaped gardens and features including indigenous type trees, shrubs and grasses should be considered.

6.9 Erosion and Sediment Controls (Construction Mitigation)

Erosion and sediment control measures should be provided with final design plans and implemented for all construction activities within the development including vegetation clearing, topsoil stripping, grading, import of fill material and stockpiling of materials. The basic principles considered to minimize erosion and sedimentation and resultant negative environmental impacts include:

- Silt control fences to be erected before any grading operations to control sediment movement, and their locations should be reviewed with the engineer prior to site work commencing.
- As a minimum, silt fencing should be heavy duty type with reinforced backing located along top of bank of all drainage swales and the watercourse down gradient of the development area.
- The use of sediment control flow check should be employed in all drainage ditches and watercourses within the site and their locations should be reviewed with the engineer prior to site work commencing.
- Expose the smallest possible land area to erosion for the shortest possible time.
- Immediately institute erosion control measures as required.
- Reinstate all disturbed areas upon completion of work.
- Confine refueling and servicing of equipment to areas well away from the drainage systems.
- Regular inspection of control measures should be instituted through a mitigation plan involving monitoring and regular maintenance. Bi-weekly inspections of the site erosion and sediment control should be completed. Inspections should be conducted after any major storm event.

6.9.1 During Construction

Silt control barrier noted above should be in place prior to construction start.

Temporary installations of silt fence or related sediment and erosion control measures may be required during grading operations to minimize sediment migration. The measures may need to be removed and replaced or relocated during the construction period to achieve a desirable result.

During construction all stockpiled material is to be placed up-gradient of the silt controls.

All site work left in place over the winter and spring months should be reviewed and maintained to ensure that the facilities are adequate and in good working order. The owner is responsible for maintenance of the silt controls and should contact the engineer and contractor for regular review of the measures in place.

All reasonable methods to control erosion and sediment should be employed by the contractor and owner during construction.

6.9.2 Monitoring and Maintenance

It is the responsibility of the owner and contractor to maintain all siltation control devices until all surfaces are stabilized and suitable vegetation cover has been established.

A regular review of the siltation control facilities should be conducted by the contractor during the construction period to ensure that they are properly performing. Regular maintenance, repair and replacement should be completed as needed.

Inspection and maintenance of the facilities should be carried out after significant rainstorm events. Damaged or poor performing siltation devices should be repaired immediately, and additional devices installed as needed to achieve proper control.

6.9.3 Contingency Plan

Should erosion control and silt control measures fail causing sediment migration beyond the control limits, the following measures should be taken as a minimum response:

- The Town of Grand Valley should be notified of the event. The control breach will be assessed and cleaned up to the satisfaction of the overseeing agencies.
- Additional erosion control and silt control facilities should be installed in the failed area, as well a down gradient to contain any sediment migration.
- The Grand River Conservation authority should be contacted in the event that sediment or silt reaches any adjacent water bodies, creeks or streams.

7. CONCLUSIONS AND RECOMMENDATIONS

In accordance with the above noted preliminary functional servicing report including preliminary design calculations. The proposed development can be considered viable for the property's location and proposed townhouse plan. Subject to draft plan approval for the proposed land use, final design approval will need to speak to final development of preliminary design criteria and proposed design elements included in this report.

Should there be any questions, please contact the office of the undersigned.

Respectfully submitted,
TULLOCH Engineering Inc.

Prepared by:

Ben Belfry, E.I.T.
Engineer-In-Training

Reviewed by:

Ted Maurer, C.E.T.
Project Manager

APPENDIX A

Preliminary

Stormwater Management – Storm Sewer Review Information

- *Rational Method Design Calculations*
- *Storm Sewer Design Sheet (Prelim. Capacity Review)*
- *Trapezoidal Channel Review Calculations (100 Year Event)*
- *Otthymo hydrographic review with preliminary stage storage volumes*
- *Oil Grit Separator – Stormceptor Sizing Report*

Active coordinate

43° 44' 15" N, 80° 20' 14" W (43.737500,-80.337500) Fergus Shand Dam

Retrieved: Thu, 14 Oct 2021 22:55:55 GMT

Location summary

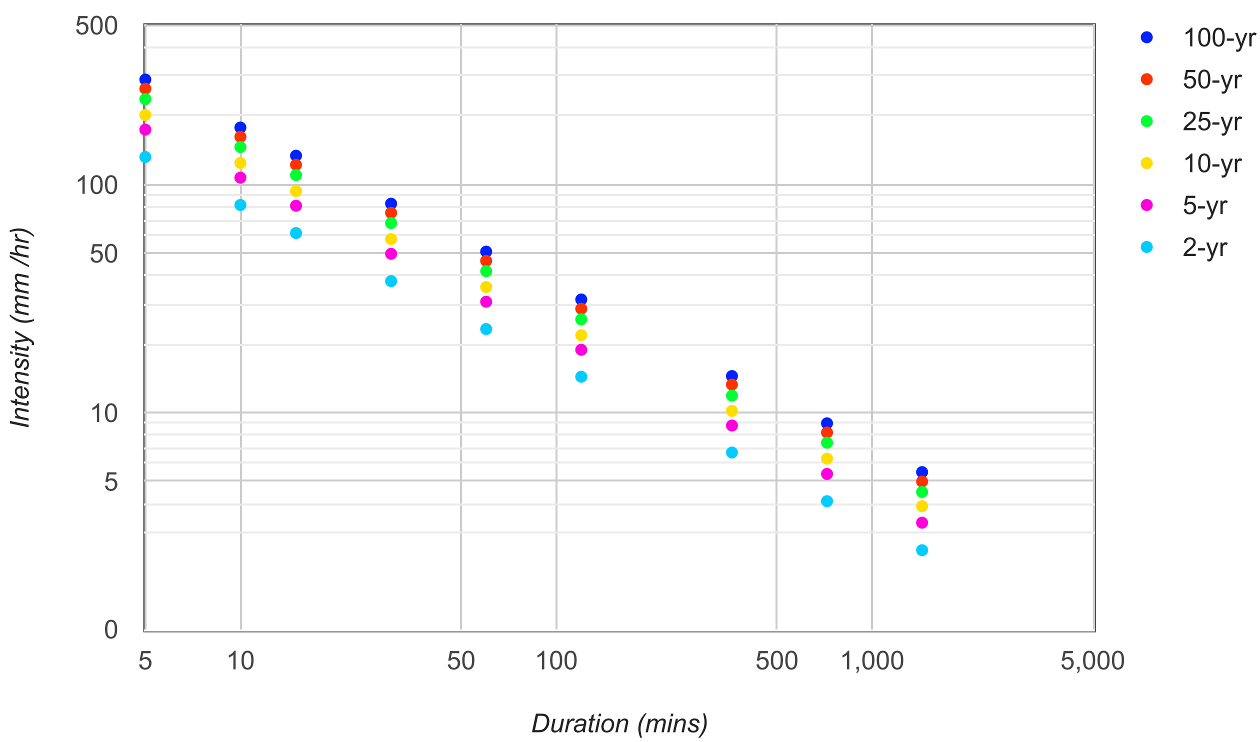
These are the locations in the selection.

IDF Curve: 43° 44' 15" N, 80° 20' 14" W (43.737500,-80.337500)

Results

An IDF curve was found.

Coordinate: 43.737500, -80.337500
IDF curve year: 2010



Coefficient summary

IDF Curve: 43° 44' 15" N, 80° 20' 14" W (43.737500,-80.337500)

Retrieved: Thu, 14 Oct 2021 22:55:55 GMT

Data year: 2010
IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	23.3	30.7	35.6	41.8	46.4	50.9
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	132.3	81.5	61.4	37.8	23.3	14.4	6.7	4.1	2.5
5-yr	174.4	107.4	80.9	49.8	30.7	18.9	8.8	5.4	3.3
10-yr	202.2	124.6	93.8	57.8	35.6	21.9	10.2	6.3	3.9
25-yr	237.4	146.3	110.2	67.9	41.8	25.7	11.9	7.4	4.5
50-yr	263.6	162.3	122.3	75.3	46.4	28.6	13.3	8.2	5.0
100-yr	289.1	178.1	134.1	82.6	50.9	31.4	14.5	9.0	5.5

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	11.0	13.6	15.4	18.9	23.3	28.7	40.0	49.2	60.6
5-yr	14.5	17.9	20.2	24.9	30.7	37.8	52.6	64.9	79.9
10-yr	16.9	20.8	23.5	28.9	35.6	43.9	61.0	75.2	92.7
25-yr	19.8	24.4	27.5	33.9	41.8	51.5	71.7	88.3	108.8
50-yr	22.0	27.1	30.6	37.7	46.4	57.2	79.6	98.0	120.8
100-yr	24.1	29.7	33.5	41.3	50.9	62.7	87.3	107.5	132.5

Terms of Use

TULLOCH	Project: Westview Townhouses	Date: 14-Oct-21
	File No: 21-1531	Designed: BB
	Subject: Catchment 101A With Church Building	Checked: TM
	Rational Method for Calculating Peak Flows	

Airport Formula	**Bransby-Williams Formula**	**Peak Flow Calculation**
$t_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}}$	$t_c = \frac{0.057 * L}{S_W^{0.2} * A^{0.1}}$	$Q = 0.0028 * C * i * A$
where: t_c = time of concentration *C = runoff coefficient* *L = watershed length (m)* *S_w = watershed slope (%)*	*where: t_c = time of concentration* *L = watershed length (m)* *S_w = watershed slope (%)* *A = watershed area (ha)*	*where: C = runoff coefficient* *C = runoff coefficient* *i = rainfall intensity (mm/h)* *A = watershed area (ha)*
source: MTO Drainage Manual 8.16	*source: MTO Drainage Manual 8.15*	*source: MTO Drainage Manual 8.19*

Watershed Characteristics

Watershed Length, L (m) = 111.00 Watershed Fall (m) = 1.54 Watershed Slope, S_w = 1.85%

Area Number	Area (ha)	Runnoff Coefficient	Description
1	0.04	0.83	*Building/Roof*
2	0.08	0.50	*Gravel Road/Lot*
3	0.29	0.15	*Lawn <2% (Clayey Soils)*
	from ACAD Drawing	*Design Chart 1.07*	*Design Chart 1.07*

Watershed Calculations

Total Area	Weighted Runoff Coefficient	Time of Concentration Formula
$A_{total} = A_1 + A_2 + A_3$ = 0.41	$C_w = \frac{A_1*C_1 + A_2*C_2 + A_3*C_3}{A_{total}}$ 0.28	*If C_w < 0.4 - use Airport Formula* *If C_w ≥ 0.4 - use Bransby-Williams Formula*
	source: MTO Drainage Manual	source: MTO Drainage Manual

Peak Flow Calculations

Storm Frequency	Adjusted Runoff Coefficient	T_c Formula	T_c (min)	i, Intensity (mm/h)	Q, Peak Flow
2	0.28	Airport	22.95	49.60	**0.02** m^3/s
5	0.28	Airport	22.95	65.35	**0.02** m^3/s
10	0.28	Airport	22.95	75.80	**0.02** m^3/s
25	0.31	Airport	22.16	93.28	**0.03** m^3/s
50	0.34	Airport	21.37	103.50	**0.04** m^3/s
100	0.35	Airport	20.97	118.65	**0.05** m^3/s

TULLOCH

Project:	Westview Townhouses	Date:	14-Oct-21
File No:	21-1531	Designed:	BB
Subject:	Catchment 101B	Checked:	TM

Rational Method for Calculating Peak Flows

Airport Formula	Bransby-Williams Formula	Peak Flow Calculation
$t_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}}$	$t_c = \frac{0.057 * L}{S_W^{0.2} * A^{0.1}}$	$Q = 0.0028 * C * i * A$
where: t_c = time of concentration	*where: t_c = time of concentration*	*where: C = runoff coefficient*
C = runoff coefficient	*L = watershed length (m)*	*C = runoff coefficient*
L = watershed length (m)	*S_w = watershed slope (%)*	*i = rainfall intensity (mm/h)*
S_w = watershed slope (%)	*A = watershed area (ha)*	*A = watershed area (ha)*
source: MTO Drainage Manual 8.16	*source: MTO Drainage Manual 8.15*	*source: MTO Drainage Manual 8.19*

Watershed Characteristics

Watershed Length, L (m) = 150.00 Watershed Fall (m) = 0.25 Watershed Slope, S_w = 0.22%

Area Number	Area (ha)	Runnoff Coefficient	Description
1	0.04	0.40	*Pasture <5% (Clay Loam Soils)*
2	0.15	0.15	*Lawn <2% (Clayey Soils)*
	from ACAD Drawing	*Design Chart 1.07*	*Design Chart 1.07*

Watershed Calculations

Total Area	Weighted Runoff Coefficient	Time of Concentration Formula
$A_{total} = A_1 + A_2 + A_3$	$C_w = \frac{A_1*C_1 + A_2*C_2 + A_3*C_3}{A_{total}}$	*If C_w < 0.4 - use Airport Formula*
= 0.19	0.20	*If C_w ≥ 0.4 - use Bransby-Williams Formula*
	source: MTO Drainage Manual	source: MTO Drainage Manual

Peak Flow Calculations

Storm Frequency	Adjusted Runoff Coefficient	T_c Formula	T_c (min)	i, Intensity (mm/h)	Q, Peak Flow
2	0.20	Airport	59.05	24.75	**0.003** m^3/s
5	0.20	Airport	59.05	32.61	**0.004** m^3/s
10	0.20	Airport	59.05	37.82	**0.004** m^3/s
25	0.22	Airport	57.72	44.41	**0.005** m^3/s
50	0.24	Airport	56.39	52.18	**0.007** m^3/s
100	0.25	Airport	55.72	57.24	**0.008** m^3/s

TULLOCH	**Project:**	Westview Townhouses	**Date:**	14-Oct-21
	File No:	21-1531	**Designed:**	BB
	Subject:	Catchment 201A	**Checked:**	TM

Rational Method for Calculating Peak Flows

Airport Formula	**Bransby-Williams Formula**	**Peak Flow Calculation**
$t_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}}$	$t_c = \frac{0.057 * L}{S_W^{0.2} * A^{0.1}}$	$Q = 0.0028 * C * i * A$
where: t_c = time of concentration *C = runoff coefficient* *L = watershed length (m)* *S_w = watershed slope (%)*	*where: t_c = time of concentration* *L = watershed length (m)* *S_w = watershed slope (%)* *A = watershed area (ha)*	*where: C = runoff coefficient* *C = runoff coefficient* *i = rainfall intensity (mm/h)* *A = watershed area (ha)*
source: MTO Drainage Manual 8.16	*source: MTO Drainage Manual 8.15*	*source: MTO Drainage Manual 8.19*

Watershed Characteristics

Watershed Length, L (m) = 183.51 Watershed Fall (m) = 1.15 Watershed Slope, S_w = 0.84%

Area Number	Area (ha)	Runnoff Coefficient	Description
1	0.12	0.83	*Buildings/Roofs*
2	0.04	0.88	*Asphalt Driveways*
3	0.25	0.15	*Lawn <2% (Clayey Soils)*
	from ACAD Drawing	*Design Chart 1.07*	*Design Chart 1.07*

Watershed Calculations

Total Area	Weighted Runoff Coefficient	Time of Concentration Formula
$A_{total} = A_1 + A_2 + A_3$ = 0.41	$C_w = \frac{A_1*C_1 + A_2*C_2 + A_3*C_3}{A_{total}}$ 0.42	*If C_w < 0.4 - use Airport Formula* *If $C_w \geq 0.4$ - use Bransby-Williams Formula*
	source: MTO Drainage Manual	source: MTO Drainage Manual

Peak Flow Calculations

Storm Frequency	Adjusted Runoff Coefficient	T_c Formula	T_c (min)	i, Intensity (mm/h)	Q, Peak Flow
2	0.42	Bransby-Williams	11.84	75.47	**0.04** m^3/s
5	0.42	Bransby-Williams	11.84	99.45	**0.05** m^3/s
10	0.42	Bransby-Williams	11.84	115.36	**0.06** m^3/s
25	0.46	Bransby-Williams	11.84	135.47	**0.07** m^3/s
50	0.50	Bransby-Williams	11.84	150.30	**0.09** m^3/s
100	0.53	Bransby-Williams	11.84	164.90	**0.10** m^3/s

TULLOCH	Project: Westview Townhouses File No: 21-1531 Subject: Catchment 201B	Date: 14-Oct-21 Designed: BB Checked: TM

Rational Method for Calculating Peak Flows

Airport Formula	Bransby-Williams Formula	Peak Flow Calculation
$t_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}}$	$t_c = \frac{0.057 * L}{S_W^{0.2} * A^{0.1}}$	$Q = 0.0028 * C * i * A$
where: t_c = time of concentration C = runoff coefficient L = watershed length (m) S_w = watershed slope (%)	*where: t_c = time of concentration L = watershed length (m) S_w = watershed slope (%) A = watershed area (ha)*	*where: C = runoff coefficient C = runoff coefficient i = rainfall intensity (mm/h) A = watershed area (ha)*
source: MTO Drainage Manual 8.16	*source: MTO Drainage Manual 8.15*	*source: MTO Drainage Manual 8.19*

Watershed Characteristics

Watershed Length, L (m) = 150.00 Watershed Fall (m) = 0.25 Watershed Slope, S_w = 0.22%

Area Number	Area (ha)	Runnoff Coefficient	Description
1	0.04	0.40	*Pasture <5% (Clay Loam Soils)*
2	0.15	0.15	*Lawn <2% (Clayey Soils)*
	from ACAD Drawing	*Design Chart 1.07*	*Design Chart 1.07*

Watershed Calculations

Total Area	Weighted Runoff Coefficient	Time of Concentration Formula
$A_{total} = A_1 + A_2 + A_3$ = 0.19	$C_w = \frac{A_1 * C_1 + A_2 * C_2 + A_3 * C_3}{A_{total}}$ 0.20	*If C_w < 0.4 - use Airport Formula If $C_w \geq 0.4$ - use Bransby-Williams Formula*
	source: MTO Drainage Manual	source: MTO Drainage Manual

Peak Flow Calculations

Storm Frequency	Adjusted Runoff Coefficient	T_c Formula	T_c (min)	i, Intensity (mm/h)	Q, Peak Flow
2	0.20	Airport	59.05	24.75	**0.003** m^3/s
5	0.20	Airport	59.05	32.61	**0.004** m^3/s
10	0.20	Airport	59.05	37.82	**0.004** m^3/s
25	0.22	Airport	57.72	44.41	**0.005** m^3/s
50	0.24	Airport	56.39	52.18	**0.007** m^3/s
100	0.25	Airport	55.72	57.24	**0.008** m^3/s

TULLOCH	**Project:** Westview Townhouses	**Date:** 14-Oct-21
	File No: 21-1531	**Designed:** BB
	Subject: Initial Cachet Hydrology Catchment 37	**Checked:** TM

Rational Method for Calculating Peak Flows

Airport Formula	Bransby-Williams Formula	Peak Flow Calculation
$t_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}}$	$t_c = \frac{0.057 * L}{S_W^{0.2} * A^{0.1}}$	$Q = 0.0028 * C * i * A$
where: t_c = time of concentration	*where: t_c = time of concentration*	*where: C = runoff coefficient*
C = runoff coefficient	*L = watershed length (m)*	*C = runoff coefficient*
L = watershed length (m)	*S_w = watershed slope (%)*	*i = rainfall intensity (mm/h)*
S_w = watershed slope (%)	*A = watershed area (ha)*	*A = watershed area (ha)*
source: MTO Drainage Manual 8.16	*source: MTO Drainage Manual 8.15*	*source: MTO Drainage Manual 8.19*

Watershed Characteristics

Watershed Length, L (m) = 117.00 Watershed Fall (m) = 2.35 Watershed Slope, S_w = 2.01%

Area Number	Area (ha)	Runnoff Coefficient	Description
37	0.32	0.45	*Exisitng Catchment 37 (Refer to Cachet Drawing D1 in Appendix A)*
	from ACAD Drawing	*Design Chart 1.07*	*Design Chart 1.07*

Watershed Calculations

Total Area	Weighted Runoff Coefficient	Time of Concentration Formula
$A_{total} = A_1 + A_2 + A_3$	$C_w = \frac{A_1*C_1 + A_2*C_2 + A_3*C_3}{A_{total}}$	*If C_w < 0.4 - use Airport Formula*
= 0.32	0.45	*If C_w ≥ 0.4 - use Bransby-Williams Formula*
	source: MTO Drainage Manual	source: MTO Drainage Manual

Peak Flow Calculations

Storm Frequency	Adjusted Runoff Coefficient	T_c Formula	T_c (min)	i, Intensity (mm/h)	Q, Peak Flow
2	0.45	Bransby-Williams	6.50	122.14	**0.049** m^3/s
5	0.45	Bransby-Williams	6.50	161.00	**0.065** m^3/s
10	0.45	Bransby-Williams	6.50	186.68	**0.076** m^3/s
25	0.50	Bransby-Williams	6.50	219.18	**0.098** m^3/s
50	0.54	Bransby-Williams	6.50	243.34	**0.118** m^3/s
100	0.56	Bransby-Williams	6.50	266.90	**0.135** m^3/s

TULLOCH	Project: Westview Townhouses	Date: 14-Oct-21
	File No: 21-1531	Designed: BB
	Subject: Initial Cachet Hydrology Catchment 101	Checked: TM

Rational Method for Calculating Peak Flows

Airport Formula	Bransby-Williams Formula	Peak Flow Calculation
$t_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}}$	$t_c = \frac{0.057 * L}{S_W^{0.2} * A^{0.1}}$	$Q = 0.0028 * C * i * A$
where: t_c = time of concentration *C = runoff coefficient* *L = watershed length (m)* *S_w = watershed slope (%)*	*where: t_c = time of concentration* *L = watershed length (m)* *S_w = watershed slope (%)* *A = watershed area (ha)*	*where: C = runoff coefficient* *C = runoff coefficient* *i = rainfall intensity (mm/h)* *A = watershed area (ha)*
source: MTO Drainage Manual 8.16	*source: MTO Drainage Manual 8.15*	*source: MTO Drainage Manual 8.19*

Watershed Characteristics

Watershed Length, L (m) = 110.00   Watershed Fall (m) = 1.76   Watershed Slope, S_w = 1.60%

Area Number	Area (ha)	Runnoff Coefficient	Description
1	0.60	0.20	*Unimproved Areas ('Exisitng Catchment 37, Refer to Cachet Drawing D1 in Appendix A)*
	from ACAD Drawing	*Design Chart 1.07*	*Design Chart 1.07*

Watershed Calculations

Total Area	Weighted Runoff Coefficient	Time of Concentration Formula
$A_{total} = A_1 + A_2 + A_3$ = 0.60	$C_w = \frac{A_1*C_1 + A_2*C_2 + A_3*C_3}{A_{total}}$ 0.20	*If C_w < 0.4 - use Airport Formula* *If C_w ≥ 0.4 - use Bransby-Williams Formula*
	source: MTO Drainage Manual	source: MTO Drainage Manual

Peak Flow Calculations

Storm Frequency	Adjusted Runoff Coefficient	T_c Formula	T_c (min)	i, Intensity (mm/h)	Q, Peak Flow
2	0.20	Airport	26.35	44.88	**0.02** m^3/s
5	0.20	Airport	26.35	59.13	**0.02** m^3/s
10	0.20	Airport	26.35	68.60	**0.02** m^3/s
25	0.22	Airport	25.77	80.59	**0.03** m^3/s
50	0.24	Airport	25.18	94.10	**0.04** m^3/s
100	0.25	Airport	24.89	103.20	**0.04** m^3/s

	SHEET			
TULLOCH	1	TULLOCH ENGINEERING Westview Townhouses - 21-1531 Storm Sewer Design Sheet -5 Year Pre-Development	DATE: DESIGN/CHECK: PROJECT NO:	*2021-10-14* *BB/ TM* *21-1531*

Equations and Constants

Peak Flow

$Q = 0.00278 \cdot A \cdot i \cdot C$

where: A = catchment area (ha)
i = 100 yr rainfall intensity (mm/h)
C = weighted runoff coefficient

Source: *MTO DMM Equation 8.19*

Hydraulic Radius

$R = \frac{D}{4}$

where: D = Pipe diameter

Source: *MTO DMM Design Chart 2.29*

Full Pipe Velocity

$V = \frac{R^{0.667} S^{0.5}}{n}$

where: R = Hydraulic Radius
S = Pipe Slope
n = Manning's n

Source: *MTO DMM Design Chart 2.29*

Pipe Capacity

$Q_{full} = V \cdot area$

where: V = Velocity
$area = \pi r^2$

Source: *MTO DMM Design Chart 2.29*

Bransby-Williams Formula

$T_c = \frac{0.057 \cdot L}{S_w^{0.2} \cdot A^{0.1}}$

where: L = Watershed length
S_w = Watershed slope
A = Watershed area

Source: *MTO DMM Design Equation 8.15*

Airport Formula

$T_c = \frac{3.26(1.1-C) \cdot L^{0.5}}{S_w^{0.33}}$

where: L = Watershed length
S_w = Watershed slope
C = Runoff coefficient

Source: *MTO DMM Design Equation 8.16*

Manning's n

Smooth-walled poly-pipe = 0.013

Source: *MTO GPD Guidelines Appendix C*

Runoff Constants

Grass <2% (Clayey Soils)=	***0.15***
Pavement Roadway/Driveway =	***0.88***
Roof=	***0.83***
Gravel=	***0.50***
Pasture <5% (Clay Loam)=	***0.40***

Source: *MTO DMM Design Chart 1.07*

Weighted Runnoff Constant

$C_w = \frac{(C_1A_1)+(C_2A_2)+...}{A_{total}}$

where: 1, 2,.. = Drainage sub-areas

Source: *MTO DMM Design Equation 8.10*

Rainfall Intensity (i)

Interpolated values from MTO IDF Curve Lookup Tool for Huntsville

Source: http://www.mto.gov.on.ca/IDF_Curves

Catchment Area	LOCATION			DRAINAGE AREA			RUNOFF					PIPE SELECTION									
	Street	From	To	Area (A) (ha)	Cum. Area (A) (ha)	Weighted Runoff C (const.)	A*C (ha)	T_c (min)	i (mm/h)	$Q_{catchment}$ (m^3/s)	Q_{total} (m^3/s)	Pipe Length (m)	Pipe Start (masl)	Pipe End (masl)	Pipe Slope (m/m)	Pipe Diameter (m)	Hydraulic Radius (m)	Full Pipe Velocity (m/s)	Pipe Capacity (m^3/s)	% Capacity	Actual Velocity (m/s)
31	Rainey Street	MH20	MH19	0.17	0.17	0.70	0.12	11.9	99.5	0.03	0.03	63.0	475.99	475.67	0.005	0.300	0.075	0.97	0.07	0.48	0.95
101	Existing Vacant Lot	EX. DICB	MH19	0.60	0.60	0.20	0.12	26.4	59.1	0.02	0.02	12.0	475.79	475.67	0.010	0.300	0.075	1.37	0.10	0.21	1.04
32	Rainey Street	MH19	MH18	0.08	0.84	0.45	0.03	5.0	174.4	0.02	0.07	34.0	475.59	475.49	0.003	0.375	0.094	0.86	0.10	0.73	0.95
33	Rainey Street	MH18	MH17	0.11	0.95	0.45	0.05	5.0	174.4	0.02	0.09	33.0	475.46	475.33	0.004	0.375	0.094	1.00	0.11	0.85	1.13

Notes: *All flows are based on a 5-year storm event*

DMM- Drainage Management Manual, GPDG- Gravity Pipe Design Guidelines

TULLOCH	SHEET 1	TULLOCH ENGINEERING Westview Townhouses - 21-1531 Storm Sewer Design Sheet - 5 Year Post-Development	DATE: 2021-10-14 DESIGN/CHECK: BB/ TM PROJECT NO: 21-1531

Equations and Constants

Peak Flow

$Q = 0.00278 \cdot A \cdot i \cdot C$

where: A = catchment area (ha)
i = 100 yr rainfall intensity (mm/h)
C = weighted runoff coefficient

Source: *MTO DMM Equation 8.19*

Hydraulic Radius

$R = \frac{D}{4}$

where: D = Pipe diameter

Source: *MTO DMM Design Chart 2.29*

Full Pipe Velocity

$V = \frac{R^{0.667} S^{0.5}}{n}$

where: R = Hydraulic Radius
S = Pipe Slope
n = Manning's n

Source: *MTO DMM Design Chart 2.29*

Pipe Capacity

$Q_{full} = V \cdot area$

where: V = Velocity
area = πr^2

Source: *MTO DMM Design Chart 2.29*

Bransby-Williams Formula

$T_c = \frac{0.057 \cdot L}{S_w^{0.2} \cdot A^{0.1}}$

where: L = Watershed length
S_w = Watershed slope
A = Watershed area

Source: *MTO DMM Design Equation 8.15*

Airport Formula

$T_c = \frac{3.26(1.1-C) \cdot L^{0.5}}{S_w^{0.33}}$

where: L = Watershed length
S_w = Watershed slope
C = Runoff coefficient

Source: *MTO DMM Design Equation 8.16*

Manning's n

Smooth-walled poly-pipe = 0.013

Source: *MTO GPD Guidelines Appendix C*

Runoff Constants

Grass <2% (Clayey Soils)=	*0.15*
Pavement Roadway/Driveway =	*0.88*
Roof=	*0.83*
Gravel=	*0.50*

Source: *MTO DMM Design Chart 1.07*

Weighted Runoff Constant

$C_w = \frac{(C_1A_1)+(C_2A_2)+\ldots}{A_{total}}$

where: 1, 2,.. = Drainage sub-areas

Source: *MTO DMM Design Equation 8.10*

Rainfall Intensity (i)

Interpolated values from MTO IDF Curve Lookup Tool for Huntsville

Source: http://www.mto.gov.on.ca/IDF_Curves

Catchment Area	LOCATION			DRAINAGE AREA				RUNOFF				PIPE SELECTION									
	Street	From	To	Area (A) (ha)	Cum. Area (A) (ha)	Weighted Runoff C (const.)	A*C (ha)	T_c (min)	i (mm/h)	$Q_{catchment}$ (m^3/s)	Q_{total} (m^3/s)	Pipe Length (m)	Pipe Start (masl)	Pipe End (masl)	Pipe Slope (m/m)	Pipe Diameter (m)	Hydraulic Radius (m)	Full Pipe Velocity (m/s)	Pipe Capacity (m^3/s)	% Capacity	Actual Velocity (m/s)
31	Rainey Street	MH20	MH19	0.17	0.17	0.70	0.12	11.9	99.5	0.03	0.03	63.0	475.99	475.67	0.005	0.300	0.075	0.97	0.07	0.48	0.95
201A	Westview Townhouses	EX. DICB	MH19	0.41	0.41	0.42	0.17	11.8	99.5	0.05	0.05	12.0	475.79	475.67	0.010	0.300	0.075	1.37	0.10	0.50	1.35
32	Rainey Street	MH19	MH18	0.08	0.65	0.45	0.03	5.0	174.4	0.02	0.10	34.0	475.59	475.49	0.003	0.375	0.094	0.86	0.10	1.03	1.00
33	Rainey Street	MH18	MH17	0.11	0.76	0.45	0.05	5.0	174.4	0.02	0.12	33.0	475.46	475.33	0.004	0.375	0.094	1.00	0.11	1.10	1.13

Notes: *All flows are based on a 5-year storm event*
DMM- Drainage Management Manual, GPDG- Gravity Pipe Design Guidelines

Ditch Inlet at 2:1 Grate Slope Capacity

Structure	*Design Inlet Flow Capacity (m^3/s)*	*Flow Depth / Depth of Ponding (m)*
EX. DICB	*0.10*	0.13

Source: MTO DMM Design Chart 4.20

TULLOCH	Project:	Westview Townhouses	Date:	14-Oct-21
	File No:	21-1531	Designed:	BB
	Subject:	North Limit Rear Yard Swale	Checked:	TM

Ditch Description - **North Limit Rear Yard Swale - Northwest of proposed development flowing west. Cross section location is CB 23.**

Ditch Characteristics

Channel Depth	Channel Type	Manning's n	Base Width	Side Slopes	Max. Slope
0.60 m	Grass Lined	0.095	0.50 m	3H : 1V	0.50%

Storm Conditions		Ditch Flow Conditions					
Return Period	Peak Flow (m^3/s)	Flow Depth (m)	Area (m^2)	WP	R	Q (m^3/s)	V (m/s)
100 Year	0.24	0.45	0.83	3.35	0.25	0.245	0.29

Comments:

Max. flow depth is <0.45 m, therefore it is acceptable. Allowing for 0.150 m in freeboard can still be constructed 1m deep.

Max. velocity does not exceed 1.5 m/s, therefore existing grass lining is acceptable.

Ditch Sizing Based on Manning's Equation

$Q = (1.00/n)AR^{2/3}S^{1/2}$

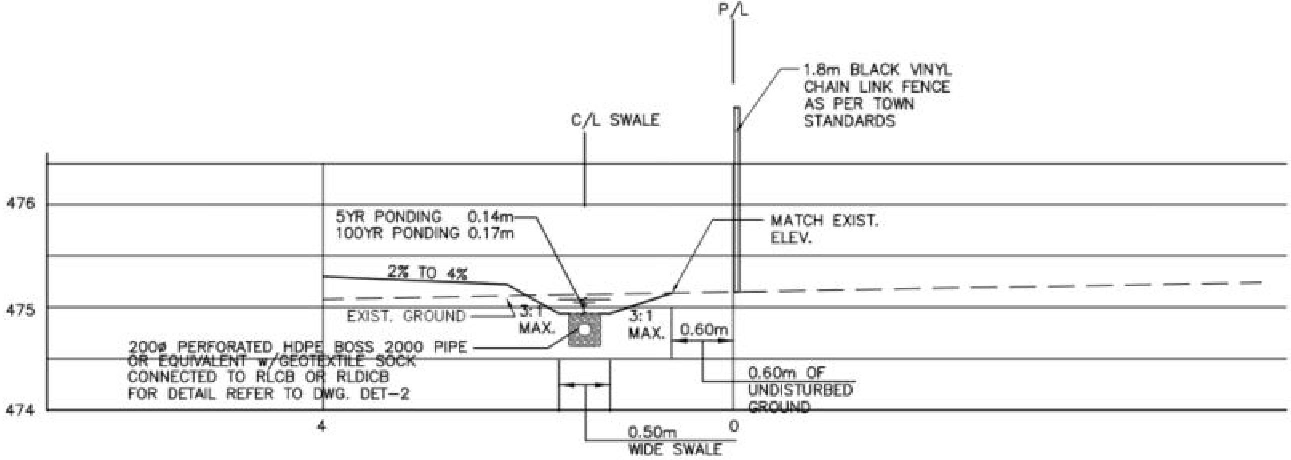
Where Q = Peak Flow (m^3)

n = Roughness Coefficient

A = Cross Sectional Area (m^2)

R = Hydraulic Radius

S = Channel Slope (m/m)



SECTION K-K
TYPICAL SWALE AT
SOUTH AND EAST PROPERTY LINE

SCALE: H 1:50
V 1:50

Westview Townhouses OTTHYMO Results

```
 *********************************************
 ** SIMULATION : 100yr 3hr 5min Chicago       **
 *********************************************


--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1046.449
| Ptotal= 71.92 mm |                         B=   1.500
--------------------                     C=   0.726
                  used in:   INTENSITY =  A / (t + B)^C

                  Duration of storm  =  3.00 hrs
                  Storm time step    =  5.00 min
                  Time to peak ratio =  0.33

             TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
              hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
             0.08    7.24 |  0.83   28.82 |  1.58   16.72 |  2.33    9.01
             0.17    7.78 |  0.92   60.77 |  1.67   15.12 |  2.42    8.62
             0.25    8.43 |  1.00  268.87 |  1.75   13.84 |  2.50    8.26
             0.33    9.23 |  1.08   77.50 |  1.83   12.79 |  2.58    7.94
             0.42   10.22 |  1.17   44.12 |  1.92   11.91 |  2.67    7.64
             0.50   11.52 |  1.25   32.05 |  2.00   11.16 |  2.75    7.37
             0.58   13.30 |  1.33   25.64 |  2.08   10.52 |  2.83    7.12
             0.67   15.91 |  1.42   21.60 |  2.17    9.95 |  2.92    6.89
             0.75   20.18 |  1.50   18.80 |  2.25    9.46 |  3.00    6.68


-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD ( 0001)|   Area    (ha)=   0.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  39.00   Dir. Conn.(%)=  10.00
--------------------
                      IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.16        0.25
    Dep. Storage     (mm)=       1.00        1.00
    Average Slope     (%)=       0.50        0.84
    Length            (m)=      52.28      183.51
    Mannings n          =      0.013       0.032

    Max.Eff.Inten.(mm/hr)=     268.87      190.65
             over (min)        5.00       10.00
    Storage Coeff.  (min)=       1.43 (ii)    6.62 (ii)
    Unit Hyd. Tpeak (min)=       5.00       10.00
```

```
   Unit Hyd. peak  (cms)=      0.33        0.14
                                              *TOTALS*
   PEAK FLOW       (cms)=      0.03        0.11         0.115 (iii)
   TIME TO PEAK    (hrs)=      1.00        1.08         1.08
   RUNOFF VOLUME    (mm)=     70.92       50.89        52.88
   TOTAL RAINFALL   (mm)=     71.92       71.92        71.92
   RUNOFF COEFFICIENT   =      0.99        0.71         0.74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
          YOU SHOULD CONSIDER SPLITTING THE AREA.

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN*  =  85.8    Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0002)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000    0.0000    |   0.0500     0.0076
                          0.0200    0.0041    |   0.0000     0.0000

                             AREA     QPEAK     TPEAK      R.V.
                             (ha)     (cms)     (hrs)      (mm)
  INFLOW : ID= 2 (  0001)     0.410     0.115      1.08      52.88
  OUTFLOW: ID= 1 (  0002)     0.410     0.050      1.33      52.77

             PEAK   FLOW   REDUCTION [Qout/Qin](%)= 43.59
             TIME SHIFT OF PEAK FLOW        (min)= 15.00
             MAXIMUM  STORAGE   USED      (ha.m.)=  0.0077

------------------------------------------------------------------------------

 ***********************************************
 ** SIMULATION : 5yr 3hr 5min Chicago         **
 ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 632.438
| Ptotal= 43.46 mm |                          B=   1.500
--------------------                          C=   0.726
                    used in:   INTENSITY =  A / (t + B)^C
```

Duration of storm = 3.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	4.38	0.83	17.42	1.58	10.11	2.33	5.45
0.17	4.70	0.92	36.73	1.67	9.14	2.42	5.21
0.25	5.10	1.00	162.50	1.75	8.36	2.50	4.99
0.33	5.58	1.08	46.84	1.83	7.73	2.58	4.80
0.42	6.18	1.17	26.67	1.92	7.20	2.67	4.62
0.50	6.96	1.25	19.37	2.00	6.75	2.75	4.46
0.58	8.04	1.33	15.49	2.08	6.36	2.83	4.31
0.67	9.61	1.42	13.05	2.17	6.02	2.92	4.17
0.75	12.19	1.50	11.36	2.25	5.71	3.00	4.04

| CALIB |
| STANDHYD (0001)| Area (ha)= 0.41
|ID= 1 DT= 5.0 min | Total Imp(%)= 39.00 Dir. Conn.(%)= 10.00

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.16	0.25	
Dep. Storage (mm)=	1.00	1.00	
Average Slope (%)=	0.50	0.84	
Length (m)=	52.28	183.51	
Mannings n =	0.013	0.032	
Max.Eff.Inten.(mm/hr)=	162.50	93.73	
over (min)	5.00	10.00	
Storage Coeff. (min)=	1.76 (ii)	8.65 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.32	0.12	
			TOTALS
PEAK FLOW (cms)=	0.02	0.04	0.051 (iii)
TIME TO PEAK (hrs)=	1.00	1.08	1.08
RUNOFF VOLUME (mm)=	42.46	25.68	27.35
TOTAL RAINFALL (mm)=	43.46	43.46	43.46
RUNOFF COEFFICIENT =	0.98	0.59	0.63

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.8 Ia = Dep. Storage (Above)

```
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0002)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                    0.0000    0.0000   |   0.0500     0.0076
                    0.0200    0.0041   |   0.0000     0.0000

                         AREA     QPEAK     TPEAK      R.V.
                         (ha)     (cms)     (hrs)      (mm)
  INFLOW : ID= 2 (  0001)      0.410      0.051      1.08      27.35
  OUTFLOW: ID= 1 (  0002)      0.410      0.020      1.42      27.24

              PEAK   FLOW   REDUCTION [Qout/Qin](%)= 39.60
              TIME SHIFT OF PEAK FLOW        (min)= 20.00
              MAXIMUM  STORAGE   USED      (ha.m.)=  0.0041

------------------------------------------------------------------------------
FINISH
```

3.3.2 Water Quality Sizing Criteria

The volumetric water quality criteria are presented in Table 3.2. The values are based on a 24 hour drawdown time and a design which conforms to the guidance provided in this manual. Requirements differ with SWMP type to reflect differences in removal efficiencies. Of the specified storage volume for wet facilities, 40 m^3/ha is extended detention, while the remainder represents the permanent pool.

Table 3.2 Water Quality Storage Requirements based on Receiving Waters[1, 2]

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35%	55%	70%	85%
Enhanced 80% long-term S.S. removal	Infiltration	25	30	35	40
	Wetlands	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long-term S.S. removal	Infiltration	20	20	25	30
	Wetlands	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. removal	Infiltration	20	20	20	20
	Wetlands	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

[1]*Table 3.2 does not include every available SWMP type. Any SWMP type that can be demonstrated to the approval agencies to meet the required long-term suspended solids removal for the selected protection levels under the conditions of the site is acceptable for water quality objectives. The sizing for these SWMP types is to be determined based on performance results that have been peer-reviewed. The designer and those who review the design should be fully aware of the assumptions and sampling methodologies used in formulating performance predictions and their implications for the design.*

[2]*Hybrid Wet Pond/Wetland systems have 50-60% of their permanent pool volume in deeper portions of the facility (e.g., forebay, wet pond).*

STORMCEPTOR®

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION 10/14/2021

Province:	Ontario
City:	Grand Valley
Nearest Rainfall Station:	WATERLOO WELLINGTON AP
Climate Station Id:	6149387
Years of Rainfall Data:	34
Site Name:	Westview Townhouses
Drainage Area (ha):	0.60
Runoff Coefficient 'c':	0.20
Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	4.78
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	Yes
Upstream Orifice Control Flow Rate to Stormceptor (L/s):	20.00
Peak Conveyance (maximum) Flow Rate (L/s):	20.00
Site Sediment Transport Rate (kg/ha/yr):	480.00
Estimated Average Annual Sediment Load (kg/yr):	57.60

Project Name:	Westview Townhouses
Project Number:	21-1531
Designer Name:	Ben Belfry
Designer Company:	Tulloch Engineering Inc.
Designer Email:	ben.belfry@tulloch.ca
Designer Phone:	705-789-7851
EOR Name:	Ben Belfry
EOR Company:	Tulloch Engineering Inc.
EOR Email:	ben.belfry@tulloch.ca
EOR Phone:	705-789-7851

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	87
EF6	91
EF8	92
EF10	93
EF12	93

Recommended Stormceptor EF Model:	**EF4**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**87**
Water Quality Runoff Volume Capture (%):	**> 90**

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

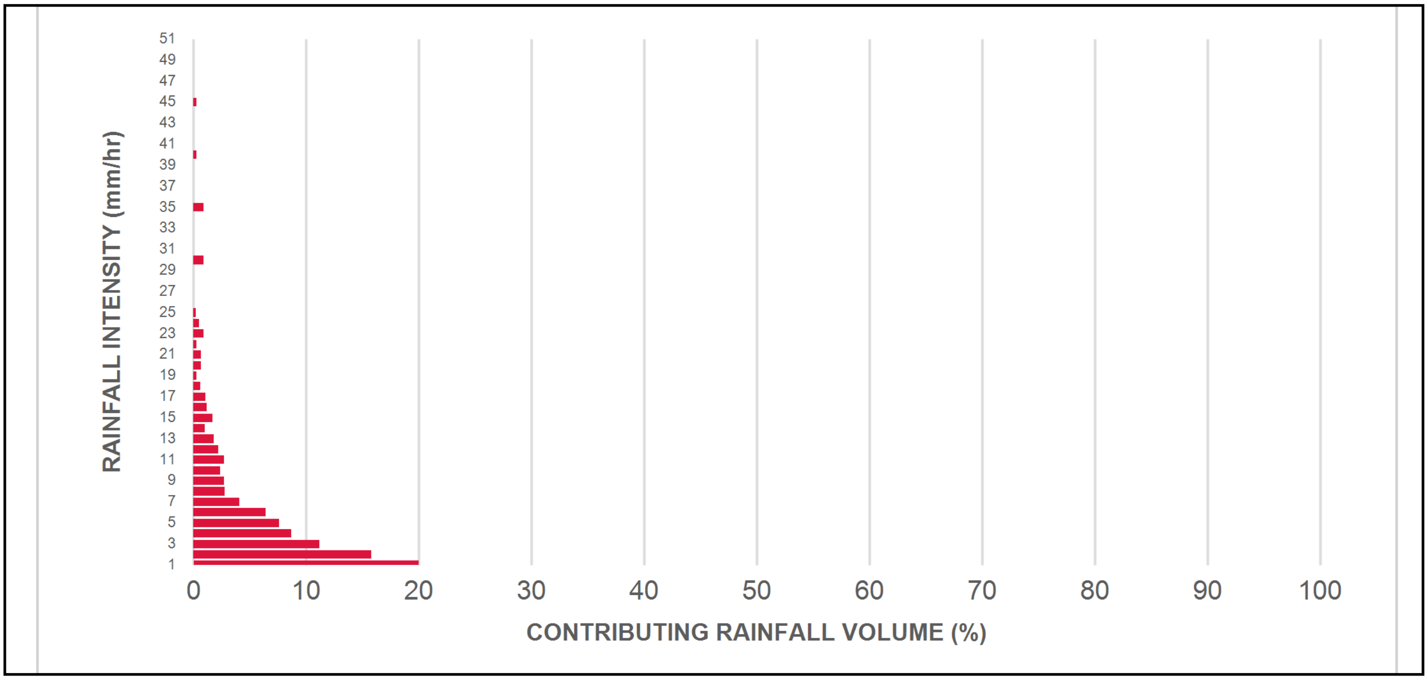
Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Upstream Flow Controlled Results

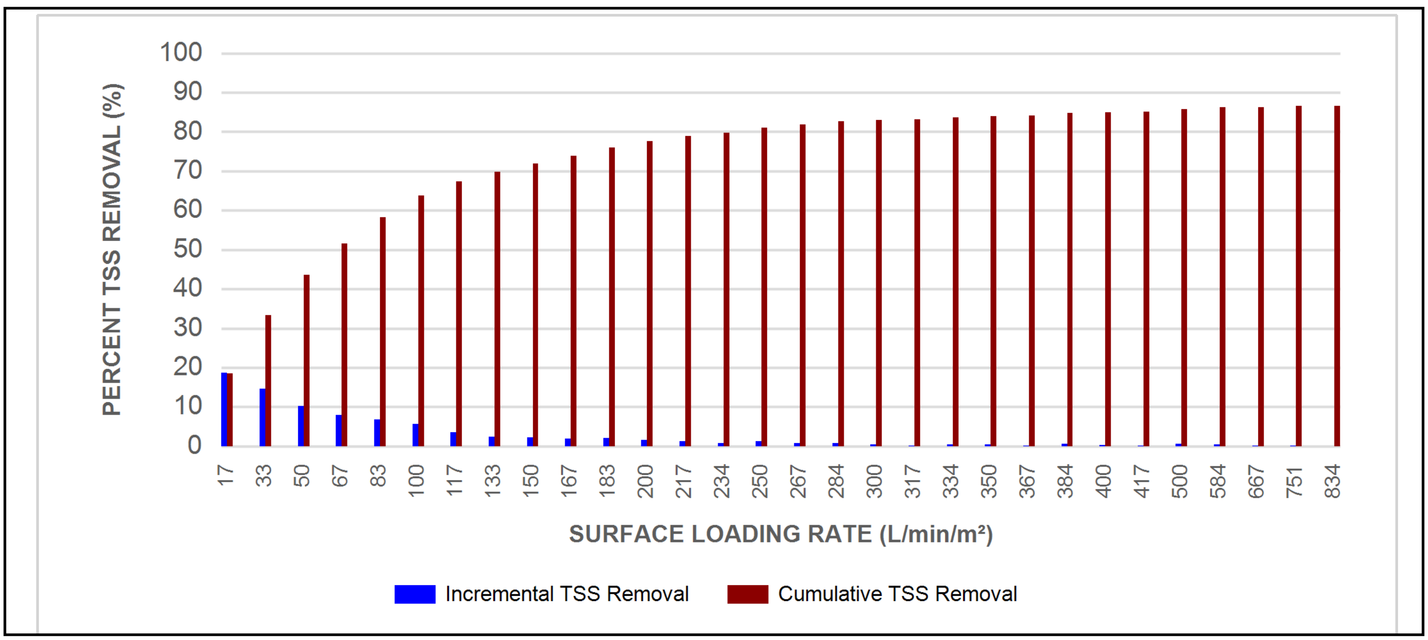
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	20.0	20.0	0.33	20.0	17.0	93	18.6	18.6
2	15.8	35.8	0.67	40.0	33.0	93	14.7	33.3
3	11.2	47.0	1.00	60.0	50.0	92	10.3	43.6
4	8.7	55.7	1.33	80.0	67.0	91	8.0	51.5
5	7.6	63.3	1.67	100.0	83.0	89	6.7	58.2
6	6.4	69.7	2.00	120.0	100.0	87	5.6	63.8
7	4.1	73.8	2.34	140.0	117.0	86	3.6	67.4
8	2.8	76.7	2.67	160.0	133.0	84	2.4	69.8
9	2.7	79.4	3.00	180.0	150.0	81	2.2	72.0
10	2.4	81.7	3.34	200.0	167.0	80	1.9	73.9
11	2.7	84.5	3.67	220.0	183.0	78	2.1	76.0
12	2.2	86.7	4.00	240.0	200.0	76	1.7	77.6
13	1.8	88.4	4.34	260.0	217.0	75	1.3	79.0
14	1.0	89.5	4.67	280.0	234.0	73	0.8	79.7
15	1.7	91.2	5.00	300.0	250.0	72	1.2	81.0
16	1.2	92.3	5.34	320.0	267.0	71	0.8	81.8
17	1.1	93.5	5.67	340.0	284.0	69	0.8	82.6
18	0.6	94.1	6.00	360.0	300.0	67	0.4	83.0
19	0.3	94.3	6.34	380.0	317.0	66	0.2	83.1
20	0.7	95.0	6.67	400.0	334.0	64	0.4	83.6
21	0.7	95.7	7.01	420.0	350.0	63	0.4	84.0
22	0.3	96.0	7.34	440.0	367.0	62	0.2	84.2
23	0.9	96.9	7.67	460.0	384.0	60	0.6	84.8
24	0.5	97.4	8.01	480.0	400.0	58	0.3	85.0
25	0.2	97.6	8.34	500.0	417.0	58	0.1	85.1
30	0.9	98.5	10.01	600.0	500.0	57	0.5	85.7
35	0.9	99.4	11.68	701.0	584.0	56	0.5	86.2
40	0.3	99.7	13.34	801.0	667.0	56	0.1	86.3
45	0.3	100.0	15.01	901.0	751.0	55	0.2	86.5
50	0.0	100.0	16.68	1001.0	834.0	55	0.0	86.5
Estimated Net Annual Sediment (TSS) Load Reduction =								**86 %**

Climate Station ID: 6149387 *Years of Rainfall Data*: 34

RAINFALL DATA FROM WATERLOO WELLINGTON AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

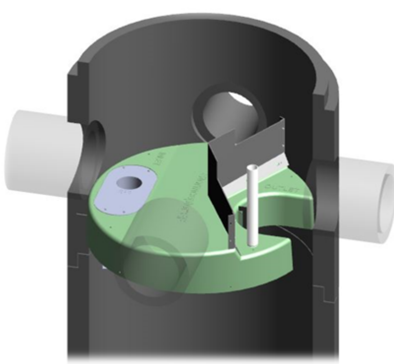
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

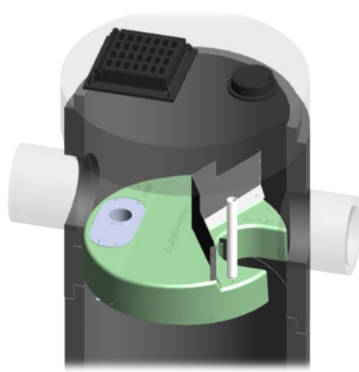
DESIGN FLEXIBILITY

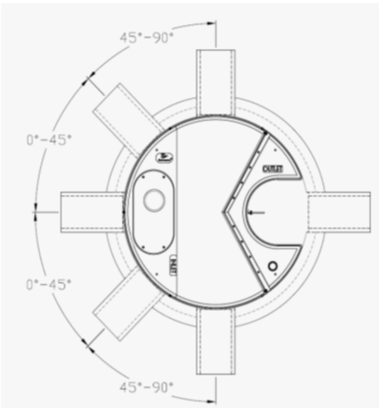
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The **minimum** sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

MINOR DRAINGE AREA

Drainage Area Outlet Location	Drainage Area No. as Shown on D 1	Area in hectares
To the Existing Quality Pond on Mayberry Hill		
Phase 1	1 to 10	1.622
Phase 2	31 to 44	2.159
External	101 to 104	0.810
Total		**4.591**
To Proposed SWM at Blk 31		
	11	0.368
	13	0.198
Townhouse	21	0.028
Total		**0.594**
To the existing 1200x1500 CSP on Lesson Street		
	12	0.113
	20, 22 to 26 and 28	0.659
External	106	0.160
Total		**0.932**
To existing DICB 18 on Mayberry Hill		
	27	0.086
	906	0.350
Total		**0.436**

For Drainage Areas refert to drawing D-1 and D-2

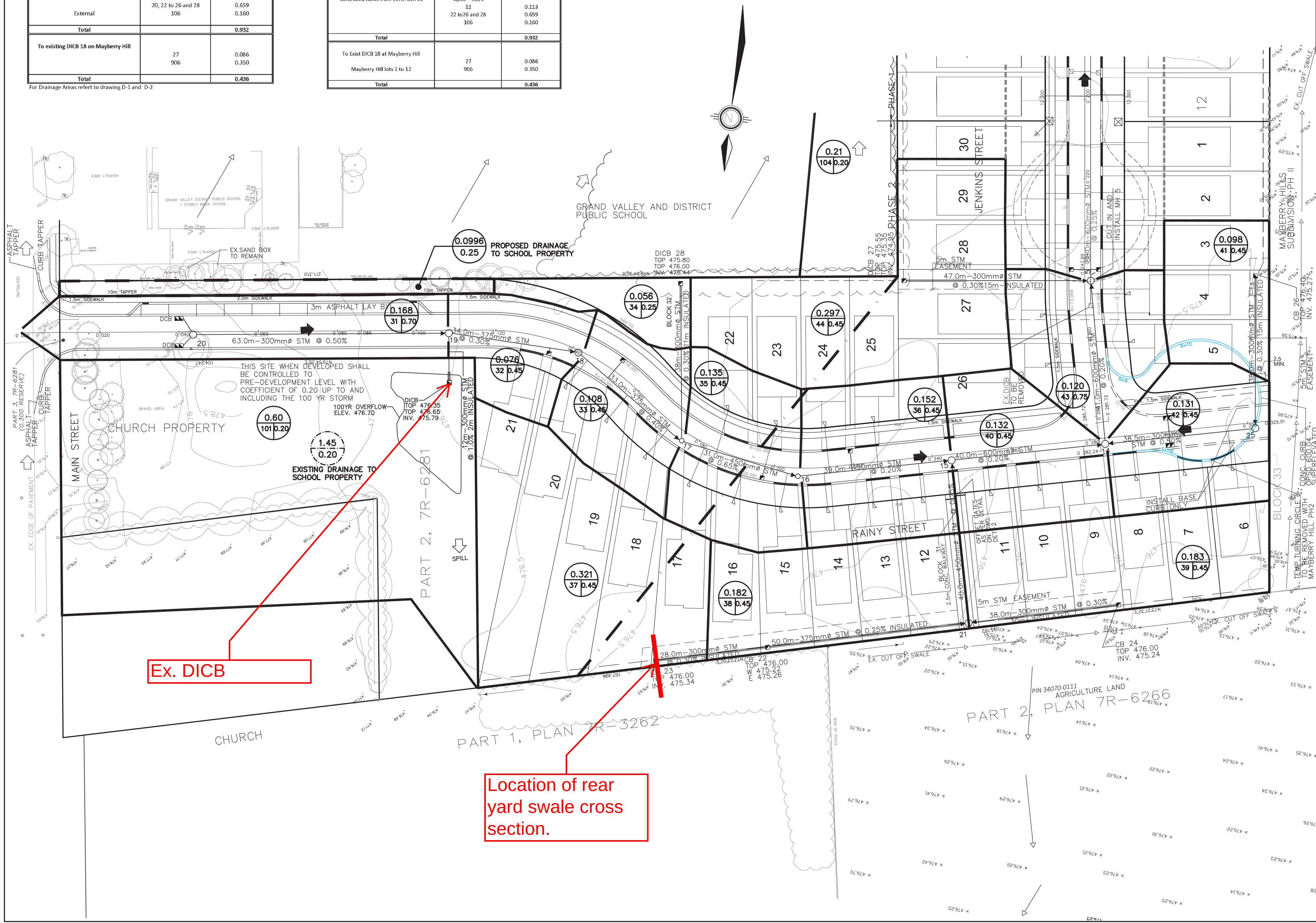
MAJOR DRAINGE AREA

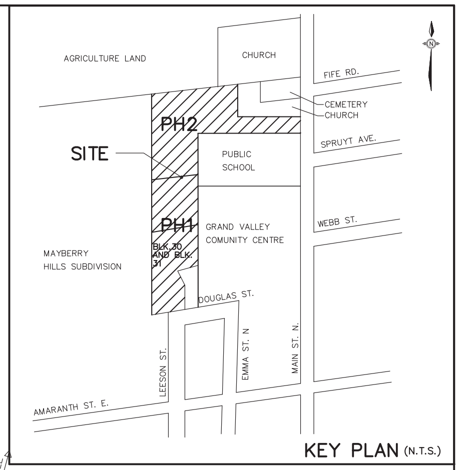
Drainage Area Outlet Location	Drainage Area No. as	Area in hectares
To the Existing Quality Pond on Mayberry Hill		
Phase 1	1,2, 5, 6, 7, 8, 9, 10	1.317
Phase 2	31 to 33, 35 to 43	1.781
External	101	0.600
Total		**3.698**
To Proposed SWM at Blk 31		
Phase 1	3, 4, 11 and 13	0.871
Phase 2	34 and 44	0.673
External	104 and 207	4.640
Townhouse	21	0.028
Total		**6.212**
To the existing 1200x1500 CSP on Lesson Street		
Controlled flows from SWM BLK 31	Q100 = 56l/s	
	12	0.113
	22 to26 and 28	0.659
	106	0.160
Total		**0.932**
To Exist DICB 18 at Mayberry Hill		
	27	0.086
Mayberry Hill lots 1 to 12	906	0.350
Total		**0.436**

THE GRADING WITHIN GVDPS LANDS CAN ONLY COMMENTS BETWEEN JULY 1 TO AUGUST 31.

A TEMPORARY SNOW FENCE MUST BE ERECTED AT THE LIMITS OF CONSTRUCTION WITHIN GVDPS LANDS PRIOR TO GRADING OPERATION AND REMOVED, ONCE THE CONSTRUCTION AND RESTORATION IS COMPLETED.

HE OVERLAND FLOWS FROM LOTS 6 TO 21 WILL DISCHARGE THROUGH THE UNDEVELOPED LANDS TO THE NORTH. THIS OVERLAND FLOW ROUTE MUST BE MAINTAINED IN THE FUTURE, WHEN THE LANDS TO THE NORTH DEVELOP.





LEGEND

- DRAINAGE AREA NO. / AREA (HECTARES) / RUN OFF COEFFICIENT
- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN (SINGLE)
- PROPOSED STORM CATCHBASIN (DOUBLE)
- CATCHMENT BOUNDARY
- MAJOR OVERLAND FLOW ROUTE
- EXISTING SURFACE DRAINAGE DIRECTION
- EXISTING OVERLAND FLOW
- PRE-DEVELOPMENT BOUNDARY LINE DRAINAGE TO SCHOOL GROUNDS

GENERAL NOTES:

FOR GENERAL NOTES REFER TO DWG. N1

SUBMISSIONS: 1st ____ 2nd ____ 3rd ____

DATE: OCT. 19 Interim ____ Final V

REVISIONS

DATE	DETAILS	INIT.
JAN. 30 19	REVISED AS PER COMMENTS	GJ
MARCH 30 19	REVISED AS PER COMMENTS	GJ
APR 19 19	REVISED GRADING AT THE REAR	GJ
MAY 28 19	REVISED AS PER COMMENTS	GJ
JULY 17 19	ISSUED FOR CONSTRUCTION	GJ
OCT 04 19	REVISED AS PER COMMENTS	GJ

BENCH MARK

CUT CROSS ON HEADWALL
GEODETIC ELEVATION 472.788m
NORTHING=4861010.595 EASTING= 554567.323

LICENSED PROFESSIONAL ENGINEER — OCT. 04 19 — A. JAWORSKI 100108267 — PROVINCE OF ONTARIO

DESIGNED BY
A. JAWORSKI P.Eng.

REVIEWED BY THE TOWN OF GRAND VALLEY

DATE

DIRECTOR OF PUBLIC WORKS

Urbtech Engineering Inc.
1200 Speers Road, Suite 8, Oakville, Ontario, L6L 2X4
Telephone: 905 896 4696

CACHET ESTATE HOMES (GRAND VALLEY) INC.
PHASE 2
PROPOSED RESIDENTIAL DEVELOPMENT
PART OF LOT 30, CONCESSION 3
TOWN OF GRAND VALLEY

DRAFT PLAN 22T-149562

STORM DRAINAGE PLAN

SCALE	1:500	AREA	GRAND VALLEY	PROJECT No.	18-416
DRAWN BY	G.J.	DESIGN BY	A.J.	PLAN No.	D1

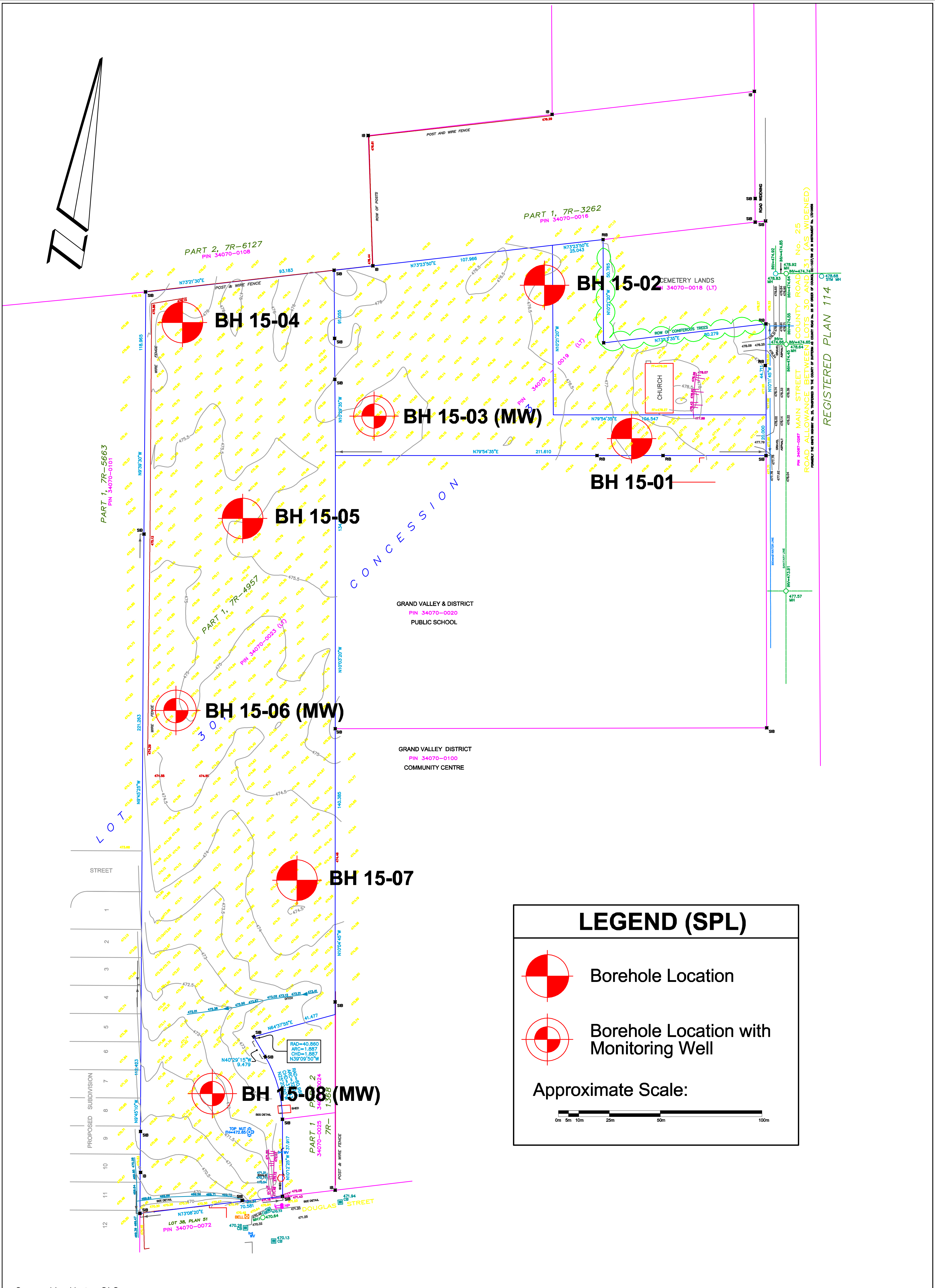
APPENDIX B

Soils Information

Geotechnical Investigation
Proposed Hollenbeck Residential Subdivision
Town of Grand Valley, Ontario.

Prepared For:
Brentwood Building Group Limited
c/o C.C. Tatham & Associates Ltd.
115 Sandford Fleming Road, #200
Collingwood, Ontario
L9Y 5A6

SPL Project No.: 10001580
Report Date: July 14, 2015



Source: Van Harten OLS

Client:	C.C. TATHAM & ASSOCIATES LTD.		Project No.:	10001568	Drawing No.:	1
Drawn:	MV	Approved: GJ	Title:	BOREHOLE LOCATION PLAN		
Date:	APRIL, 2015	Scale: AS SHOWN	Project:	GEOTECHNICAL INVESTIGATION HOLLENBECK SUBDIVISION, GRAND VALLEY, ONTARIO		
Original Size:	Tabloid	Rev: N/A	SPL Consultants Limited | ENGINEERING SOLUTIONS			

LOG OF BOREHOLE BH 15-01

PROJECT: Geotechnical Investigation - Hollenbeck Residential Subdivision
CLIENT: Brentwood Building Group Limited
PROJECT LOCATION: Town of Grand Valley, Ontario
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150
Date: Mar/19/2015

REF. NO.: 10001568
ENCL NO.: 2

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	NATURAL MOISTURE CONTENT	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
477.0 / 0.0	**FILL**: sand and gravel, trace silt, trace clay, light brown, frozen, inclusive of rootlets	1	SS	frozen		
476.4 / 0.6	**CLAYEY SILT**: some sand, some gravel, light brown, disturbed and inclusive of rootlets	2	SS	frozen	○	
475.5 / 1.5	**CLAYEY SILT to SILTY CLAY**: some sand, some gravel, light brown, moist, stiff	3	SS	15	○	
474.7 / 2.3	**CLAYEY SILT to SILTY CLAY**: trace to some sand, some gravel, stratified, brown, moist, very stiff	4	SS	20	○	7 9 57 27
474.0 / 3.1	hard, trace sand ------- occassional sand seams	5	SS	33	○	
		6	SS	36	○	
471.8 / 5.2	**END OF BOREHOLE** Notes: 1) Borehole was open and wet at bottom upon completion of drilling.					

Column headings: SOIL PROFILE; STRATA PLOT; SAMPLES; GROUND WATER CONDITIONS; ELEVATION (476, 475, 474, 473, 472); DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10 20 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH 15-02

PROJECT: Geotechnical Investigation - Hollenbeck Residential Subdivision
CLIENT: Brentwood Building Group Limited
PROJECT LOCATION: Town of Grand Valley, Ontario
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150
Date: Mar/19/2015

REF. NO.: 10001568
ENCL NO.: 3

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	WATER CONTENT (%) (approx.)
476.5 / 0.0	**TOPSOIL**: 480 mm	1	SS	frozen	
476.1 / 0.5	**CLAYEY SILT**: some sand, trace to some gravel, trace topsoil and organics, brown, moist, firm, disturbed and inclusive of rootlets	2	SS	frozen	o
475.0 / 1.5	**CLAYEY SILT TO to SILTY CLAY**: trace sand, trace gravel, occasional cobble pieces, some oxidization, brown, moist, stiff	3	SS	11	o
474.3 / 2.3	very stiff	4	SS	18	o
473.5 / 3.1	-------- sand seam grey, very moist	5	SS	16	o
		6	SS	21	o
471.4 / 5.2	**END OF BOREHOLE** Notes: 1) Water level was 4.26 mbg in borehole upon completion 2) Borehole was open upon completion				

Column headings: SOIL PROFILE; SAMPLES; GROUND WATER CONDITIONS; ELEVATION (476, 475, 474, 473, 472); DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m³); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

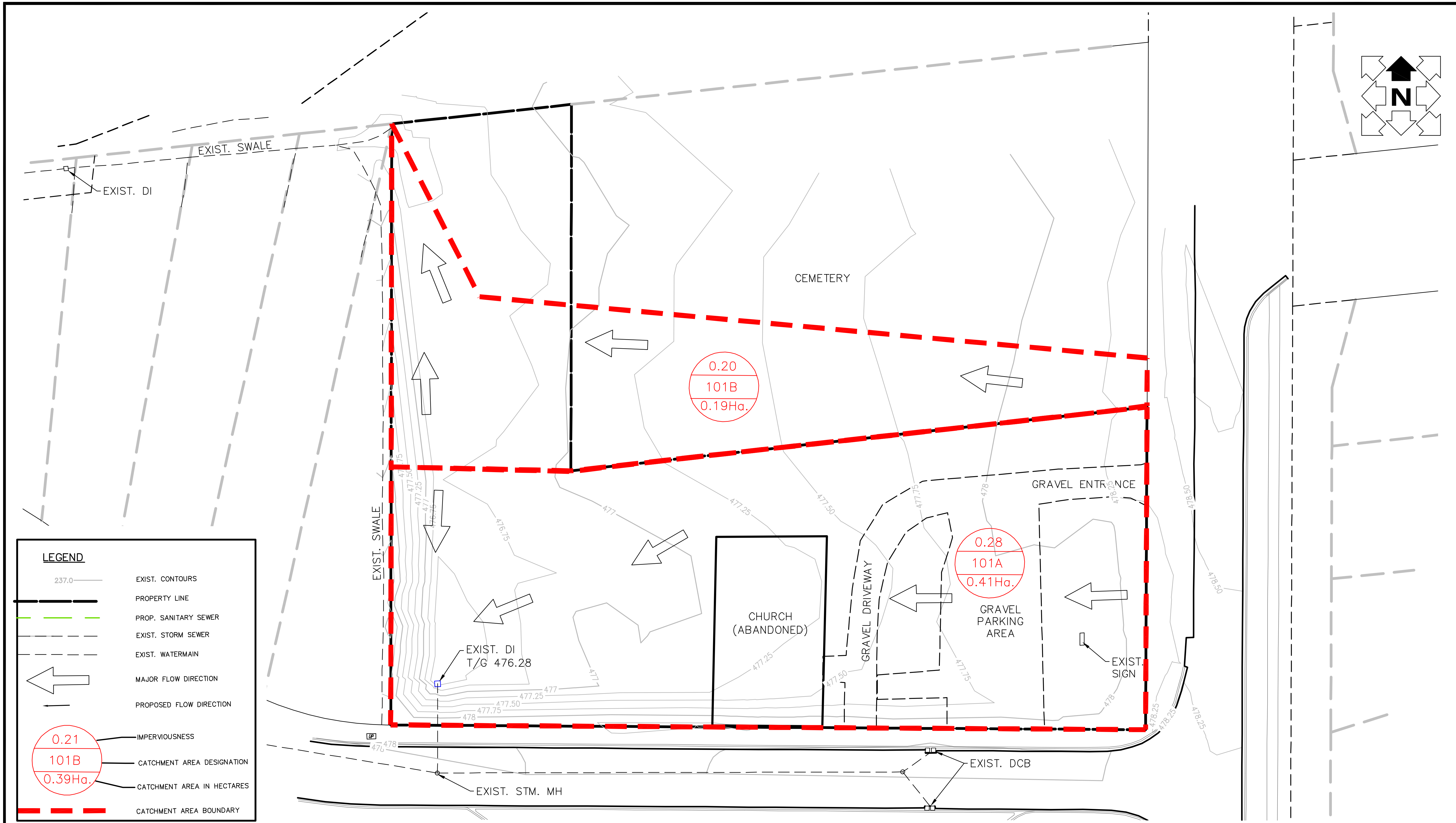
GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

APPENDIX C

Preliminary Design Drawings

- *D1 Pre-Development Plan*
- *D2 Post-Development Plan*
- *C1 Serving / Grading / Stormwater Management Plan*
- *C2 Details and Notes*
- *Draft Plan - Copy*



No.	DATE	BY	ISSUES / REVISIONS
1	OCT. 14, 2021	T.M.	PRELIMINARY DESIGN FOR FSR REPORT

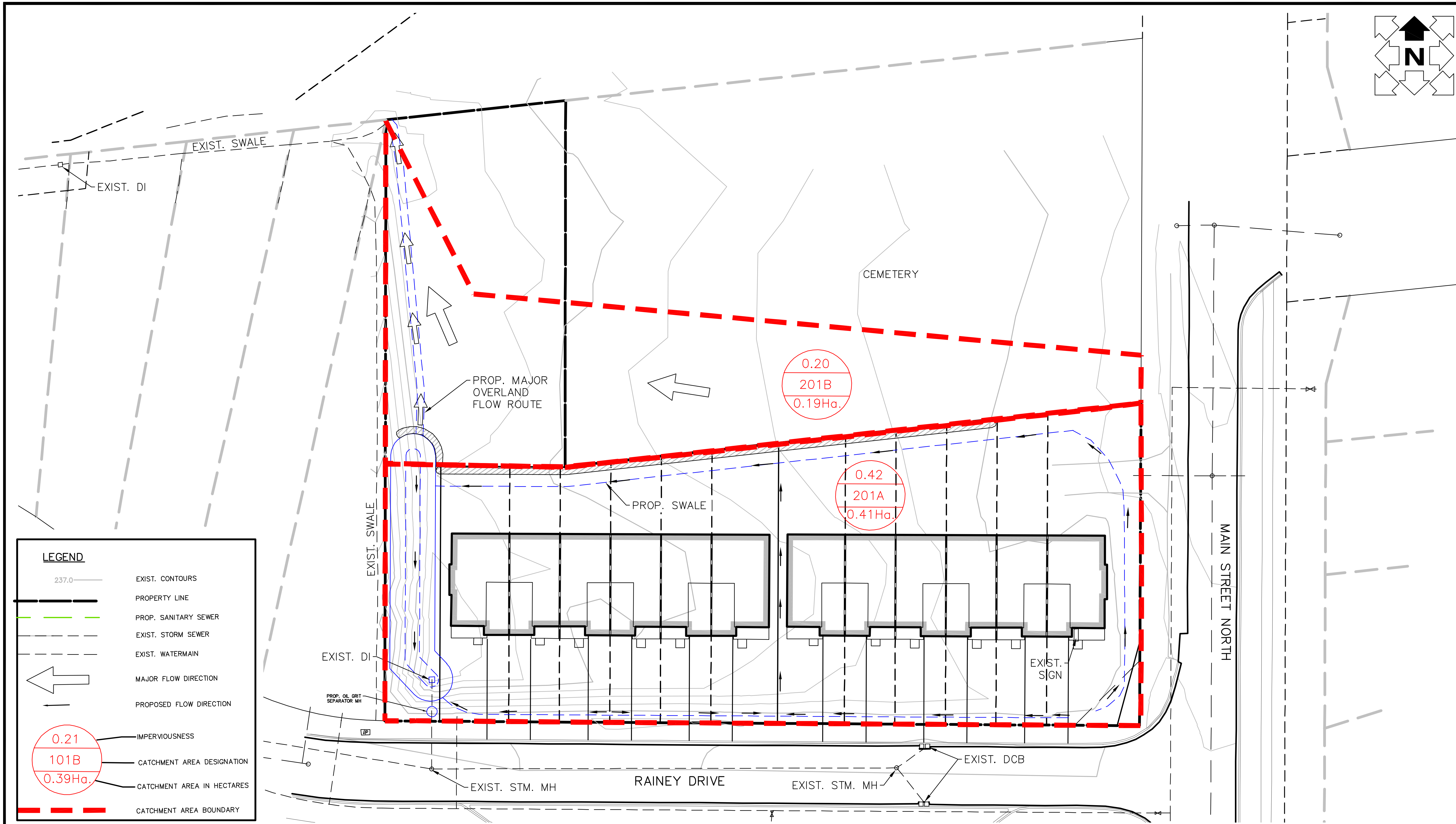
PRELIMINARY
NOT FOR CONSTRUCTION
OCT. 14, 2021

TULLOCH ENGINEERING

DRAWING: PRE-DEVELOPMENT PLAN

PROJECT: **WESTVIEW TOWNHOUSES**
RAINEY DRIVE, GRAND VALLEY

DRAWN BY:	CHECKED BY:	PROJECT No.:
D.R.	T.M.	21-1531
DESIGNED BY: D.R.	APPROVED BY: --	DRAWING No.: D1
SCALE: 1:500	DATE: OCT. 14, 2021	REVISION No.: 0



No.	DATE	BY	ISSUES / REVISIONS
1	OCT. 14, 2021	T.M.	PRELIMINARY DESIGN FOR FSR REPORT

PRELIMINARY
NOT FOR CONSTRUCTION
OCT. 14, 2021

TULLOCH ENGINEERING

DRAWING: POST DEVELOPMENT PLAN

PROJECT: **WESTVIEW TOWNHOUSES**
RAINEY DRIVE, GRAND VALLEY

DRAWN BY:	CHECKED BY:	PROJECT No.:
D.R.	T.M.	21-1531
DESIGNED BY: D.R.	APPROVED BY: --	DRAWING No.: D2
SCALE: 1:500	DATE: OCT. 14, 2021	REVISION No.: 0

LEGEND

PROPERTY LINE	EXISTING CONTOURS
WATER MAIN	CURB STOP (CS)
SANITARY SEWER	HEAVY DUTY SILT FENCE
STORM SEWER	STRAW BALE CHECK DAM (CD)
FIRE HYDRANT (FH)	
PROPOSED ELEVATION + 306.05	
EXISTING ELEVATION + 306.05	
PROPOSED GRADE 3.2%	

REVISION:	No.	DATE	BY
PRELIMINARY DESIGN FOR FSR REPORT	1	OCT. 14, 2021	T.M.

PRELIMINARY
NOT FOR CONSTRUCTION
OCT. 14, 2021

TULLOCH ENGINEERING

WESTVIEW TOWNHOUSES
RAINEY DRIVE, GRAND VALLEY

SERVICING PLAN / GRADING PLAN / STORMWATER MANAGEMENT PLAN

ENGINEER'S SEAL

SCALE	HORZ. 1:200 VERT. 1:50
DRAWN	DR
CHECKED	TM
DATE	OCT. 14, 2021
PROJECT No.	21-1531
SHEET	C1

GENERAL NOTES:

1. DO NOT SCALE DRAWINGS.
2. ALL STANDARDS SHALL TO BE IN ACCORDANCE WITH CURRENT ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD) AND ONTARIO PROVINCIAL STANDARD SPECIFICATIONS (OPSS) UNLESS OTHERWISE NOTED.
3. NOTIFY ALL UTILITIES AND MUNICIPAL AUTHORITIES 72 HOURS PRIOR TO COMMENCEMENT OF CONSTRUCTION. UTILITY PERSONNEL TO BE ON SITE WHEN EXCAVATING ADJACENT TO UNDERGROUND UTILITIES. SUPPORT UTILITIES IN ACCORDANCE WITH THE DIRECTIONS AND GUIDELINES OF THE IMPACTED UTILITY.
4. COMPLETE ALL TRENCHING IN ACCORDANCE WITH THE CURRENT OCCUPATIONAL HEALTH AND SAFETY ACT.
5. THE LOCATION OF UTILITIES AND SERVICES SHOWN ON DRAWINGS IS APPROXIMATE AND MAY BE INCOMPLETE. CONFIRM EXACT LOCATION OF UTILITIES WITH MINISTRY, MUNICIPALITY OR UTILITIES. THE CONTRACTOR IS RESPONSIBLE TO DETERMINE LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION AND WILL BE RESPONSIBLE FOR PROTECTING AGAINST DAMAGE. THE CONTRACTOR ASSUMES ALL LIABILITY FOR DAMAGE TO UTILITY AND ROAD WORKS.
6. CONTRACTOR IS RESPONSIBLE TO COORDINATE ANY REQUIRED UTILITY (GAS, HYDRO, COMMUNICATIONS, ETC.) RELOCATIONS WITH LOCAL UTILITY AGENCIES. ANY REQUIRED RELOCATIONS MUST BE PERFORMED BY AN APPROVED SUB-CONTRACTOR RETAINED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER. CONTRACTOR SHALL SUPPORT EXISTING UTILITIES AND SERVICES THAT REMAIN DURING CONSTRUCTION IN ACCORDANCE WITH LOCAL UTILITY AGENCY RECOMMENDATIONS. UTILITIES SHALL NOT BE DISRUPTED TO EXISTING BUILDINGS WITHOUT PRIOR WRITTEN NOTIFICATION AND APPROVAL OF THE OWNER.
7. COMPLY WITH THE REQUIREMENTS OF THE COUNTY OF DUFFERIN AND THE TOWN OF GRAND VALLEY IN REGARDS TO TRAFFIC FLOW ON MUNICIPAL STREETS.
8. ALL INSTALLATIONS ARE TO BE COMPLETED TO THE SATISFACTION OF THE OWNERS ENGINEER AND THE COUNTY OF DUFFERIN IN ACCORDANCE WITH THE SERVICING DRAWINGS.
9. ALL DIMENSIONS ARE IN METERS, EXCEPT PIPE DIAMETERS, WHICH ARE IN MILLIMETERS, UNLESS SPECIFIED OTHERWISE.
10. THE CONTRACTOR IS RESPONSIBLE FOR ALL DETAILED LAYOUT WORK AT NO ADDITIONAL COST TO THE OWNER.
11. THE CONTRACTOR TO SUPPLY SHOP DRAWINGS TO OWNERS ENGINEER FOR ALL SANITARY MAINTENANCE HOLES PRIOR TO ORDERING OR MANUFACTURING ITEMS.
12. TEMPORARY SEDIMENT AND EROSION CONTROL IN ACCORDANCE WITH OPSS 805 AND AS DIRECTED BY THE OWNERS ENGINEER. CONTROLS SHOWN ON DRAWING ARE MINIMUM. ALL SILTATION AND EROSION CONTROL MEASURES ARE TO BE IN PLACE PRIOR TO CONSTRUCTION AND SHALL REMAIN IN PLACE UNTIL THE DISTURBED AREAS ARE REINSTATED TO THE EXISTING CONDITION OR BETTER.
13. ALL SILT CONTROL AND EROSION PROTECTION DEVICES ARE TO BE IN PLACE PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL REMAIN IN PLACE UNTIL THE DISTURBED AREAS ARE REVEGETATED AND STABLE AS DETERMINED BY THE OWNERS ENGINEER.
14. TRENCH BACKFILL TO BE NATIVE MATERIAL OR IMPORTED SELECT SUBGRADE MATERIAL AS DIRECTED BY THE OWNERS ENGINEER. NATIVE MATERIAL SHALL BE PLACED IN 200mm LIFTS AND COMPACTED TO 95% OF THE MATERIALS STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD) AND WITHIN 500mm OF SUBGRADE IT SHALL BE COMPACTED TO 98% OF THE MATERIALS SPMDD. GRANULAR 'A' AND 'B' SHALL BE PLACED IN MAXIMUM 150mm LIFTS AND COMPACTED TO 100% OF THE MATERIALS SPMDD. UNSUITABLE MATERIALS SHALL BE REMOVED FROM THE SITE AS SPECIFIED BY THE OWNERS ENGINEER.
15. CONTRACTOR IS RESPONSIBLE TO VERIFY ALL EXISTING WATER, SANITARY AND STORM SEWER TIE CONNECTIONS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE CONFIRMED BY THE OWNERS ENGINEER PRIOR TO CONSTRUCTION.
16. THE CONTRACTOR IS RESPONSIBLE FOR ALL DE-WATERING IN ACCORDANCE WITH OPSS 517.
17. ALL PIPING AND THEIR APPURTENANCES ARE TO BE INSTALLED AS PER MANUFACTURERS RECOMMENDATIONS.
18. LATEST APPROVED DRAWINGS TO BE USED FOR CONSTRUCTION AND ALL DISCREPANCIES REPORTED TO THE ENGINEER.
19. PIPE LENGTH AS LABELED IS MEASURED HORIZONTALLY ALONG PIPE CENTRE LINE AND MAY DIFFER FROM BASELINE CHAINAGE WHERE BASELINE IS NOT PARALLEL TO PIPE.
20. CONTRACTOR IS RESPONSIBLE FOR MANAGEMENT OF ALL EXCESS MATERIALS IN ACCORDANCE WITH OPSS 180.

SANITARY SEWER NOTES:

1. SANITARY SEWERS SHALL BE INSTALLED AS PER OPSS 401, 402 AND 410.
2. SANITARY SEWER PIPE SHALL BE SDR35 PVC PIPE – OPSS 1841.
3. SANITARY SERVICE LATERALS (GRAVITY) – 125mmø SDR 28 PVC PIPE – OPSD 1006.020.
4. MAINTENANCE HOLES SHALL BE 1200mmø – OPSD 701.010.
5. EQUIP MAINTENANCE HOLES WITH STEPS – OPSD 405.020.
6. COMPLETE BENCHING OF MAINTENANCE HOLES – OPSD 701.021.
7. ALL MAINTENANCE HOLES SHALL HAVE KOR-N-SEAL BOOTS.
8. ALL MAINTENANCE HOLES SHALL HAVE TYPE A-CLOSED COVER – (OPSD 401.010), MAINTENANCE HOLE STEPS (OPSD 405.020) AND FROST STRAPS (AS PER T.E. – 3 DETAIL).
9. IF VERTICAL SEPARATION BETWEEN SANITARY SEWER AND OTHER STRUCTURES, PIPING OR UTILITIES IS LESS THEN 300MM, INSTALL MIN 50mm HI-60 INSULATION DIRECTED BY THE CONTRACT ADMINISTRATOR – OPSS 1605.
10. MAINTAIN MINIMUM CLEAR SEPARATION OF 2.5m HORIZONTAL BETWEEN SANITARY SEWER AND WATERMAIN UNLESS OTHERWISE NOTED ON THE DRAWINGS.
11. WORK SHALL CONFORM TO OPSS 410. PIPE EMBEDMENT AND BACKFILL SHALL CONFORM TO OPSD 802.010 AND 802.013. PIPE EMBEDMENT MATERIAL TO SPRINGLINE SHALL CONSIST OF GRANULAR "A" OR 19MM DIAMETER CLEAR STONE, SPRINGLINE TO 300MM ABOVE PIPE SHALL CONSIST OF SAND. TRENCH BACKFILL TO ROAD SUBGRADE ELEVATION SHALL CONSIST OF APPROVED NATIVE MATERIAL COMPACTED TO 95% SPD.
12. INSTALL COATED NO.12 GAUGE TRACER WIRE ON ALL LOW PRESSURE SEWERS AND SERVICES AS PER COUNTY OF DUFFERIN STANDARD.

MUNICIPAL ROAD RESTORATION NOTES:

1. REINSTATE ROADS TO PREVIOUS CONDITION OR BETTER WHEN DISTURBED.
2. CONTRACTOR TO RESTORE DRIVEWAYS AND DITCH WORK IN AREAS DISTURBED BY CONSTRUCTION TO EQUAL OR BETTER CONDITIONS.
3. ALL GRASSED AREAS DISTURBED DURING CONSTRUCTION SHALL BE RESTORED WITH 50MM TOPSOIL AND HYDRO SEED AND MULCHED AS PER OPSS 507. MAINTAIN UNTIL ESTABLISHED GROWTH.
4. ALL RESTORATION WORK TO BE COMPLETED TO THE SATISFACTION OF THE OWNERS ENGINEER.
5. PLACE 150MM DIA. RIP RAP AT ALL CULVERT INLETS AND OUTLETS PER OPSD 810.01.
6. FROST TAPERS AT CULVERTS TO BE PER OPSD 803.030.

STORM SEWER NOTES:

1. STORM SEWERS SHALL BE INSTALLED TO OPSS 410, 404, 401 AND 402.
2. STORM SEWER SHALL BE IPEX ULTRA-RIB PVC PIPE WITH BELL AND SPIGOT JOINTS COMPLETE WITH GASKETS WITH MINIMUM PIPE STIFFNESS OF 320 kpa OR APPROVED EQUAL. PIPE SHALL BE INSTALLED AS PER OPSD 802.010.
3. MAINTENANCE HOLES AND CATCH BASINS TO OPSD 705.010 AND OPSD 701.010 INCLUDING FROSTS STRAPS.
4. EMBEDMENT AND COVER OF STORM SEWERS – OPSD 802.010. 19mm CLEARSTONE OR GRANULAR A BEDDING WITH EMBEDMENT TO SPRING LINE OF PIPE. COVER MATERIAL TO BE SAND WITH NO STONES >25mm.
5. IF SEPARATION BETWEEN STORM SEWER AND OTHER STRUCTURES, PIPING OR UTILITIES IS LESS THEN 300mm INSTALL MIN 100mm HI-60 INSULATION DIRECTED BY THE OWNERS ENGINEER – OPSS 316 & 1605.
6. MAINTAIN MINIMUM CLEAR SEPARATION OF 2.5m HORIZONTAL BETWEEN STORM SEWER AND WATERMAIN UNLESS OTHERWISE NOTED ON THE DRAWINGS.
7. PROVIDE INSULATION PROTECTION AS REQUIRED – OPSS 316 & 1605 (SEE TRENCH INSULATION DETAIL).
8. OIL GRIT SEPARATOR MANHOLE SHALL BE STORMCEPTER EF4 BY IMBRIUM OR APPROVED EQUIVALENT.

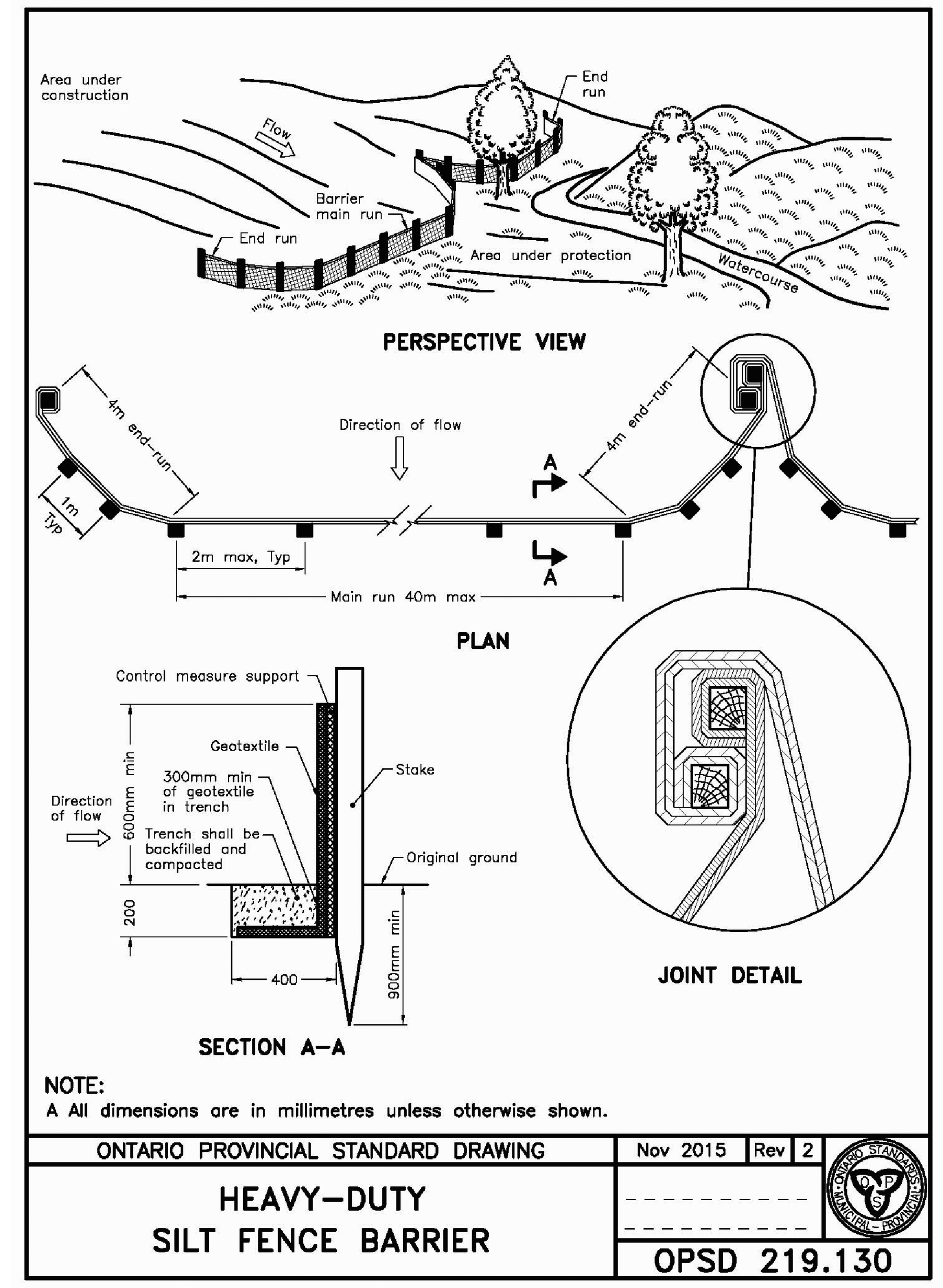
WATERMAIN NOTES:

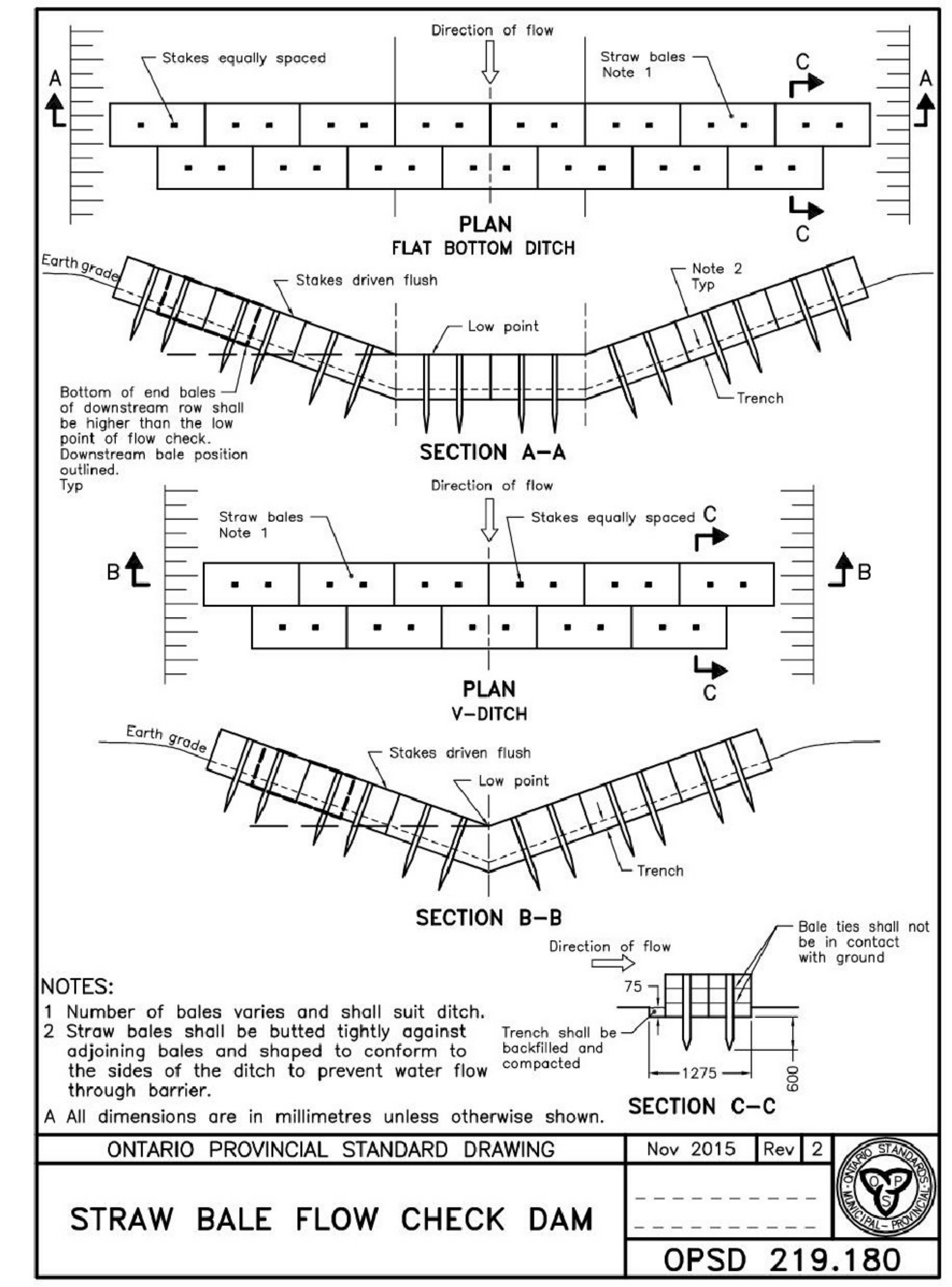
1. WATERMAINS AND ALL APPURTENANCES SHALL BE INSTALLED IN ACCORDANCE WITH OPSS 401, 403, 404, 441, 442 AND, 490.
2. WATER SERVICE FITTINGS TO BE AS FOLLOWS:
   - 25mm & 31mm MAIN STOP – MUELLER SERIES 300N, CAMBRIDGE BRASS 301NL OR FORD FB1000-X-NL.
   - 25mm & 31mm CURB STOP – MUELLER SERIES 300, CAMBRIDGE BRASS 202NL OR FORD B44 NL / BH 44-233G NL.
   - WATER SERVICE BOX – EPOXY COATED EXTENSION TYPE, BIBBY VSB1/B2, CLOW D1/D2, MUELLER A726/A728, SIGMACORP #8 OR STAR SB-5001/5002, C/W STAINLESS STEEL RODS.
3. TAPPING SLEEVES – STAINLESS STEEL MECHANICAL JOINT OUTLET, FULL SURROUND GIRDED GASKET, SMITH BLAIR 663 SS, ROBAR 6606 OR FORD FAST TAP.
4. TAPPING VALVES – DUCTILE IRON, EPOXY COATED INTERIOR / EXTERIOR, MECHANICAL JOINT, RESILIENT SEAT, CLOW 2639, MUELLER T-2360 MJXFL OR AVK TYPE 25/31.
5. WHEN WATER SERVICES MUST BE INSTALLED BELOW A SANITARY SEWER, NO JOINTS IN THE WATER SERVICES WILL BE PERMITTED, BETWEEN THE MAIN AND THE PROPERTY LINE.
6. ALL WATER SERVICES ARE TO BE 25mm DIA. SERIES 160 HDPE AS SHOWN ON PLANS IN ACCORDANCE WITH OPSD 1104.010 UNLESS OTHERWISE NOTED. PROVIDE 1.8m COVER FOR WATER SERVICES. PIPE EMBEDMENT AND BACKFILL SHALL BE IN ACCORDANCE WITH OPSD 802.010, 802.013 AND 802.014.
7. ALL WATER SERVICE CONNECTIONS TO MAIN WITH ROBAR 2616 BOSS PAD, SMITH BLAIR 372 DB OR CAMBRIDGE BRASS 372 (DB) STAINLESS STEEL SADDLES.
8. INSTALL MAIN STOPS AND CURB STOPS FOR ALL LATERALS AND INCLUDE A "GOOSE NECK" ORIENTED HORIZONTALLY TO ALLOW FOR EXPANSION AND CONTRACTION. DIRECT TAPPING OF PVC MAIN IS NOT ACCEPTABLE. DOUBLE STUDDED BROAD BAND STAINLESS STEEL SERVICE SADDLES SHALL BE USED FOR ALL SERVICE CONNECTIONS.
9. PROVIDE INSULATION PROTECTION IN AREAS OF LESS THAN 1.8m COVER – 850mm WIDE OF EXTRUDED POLYSTYRENE INSULATION IN ACCORDANCE WITH OPSS 1605, PLACED 100mm ABOVE WATER PIPE 50mm THICK FOR EACH 300mm ABOVE MINIMUM COVER.

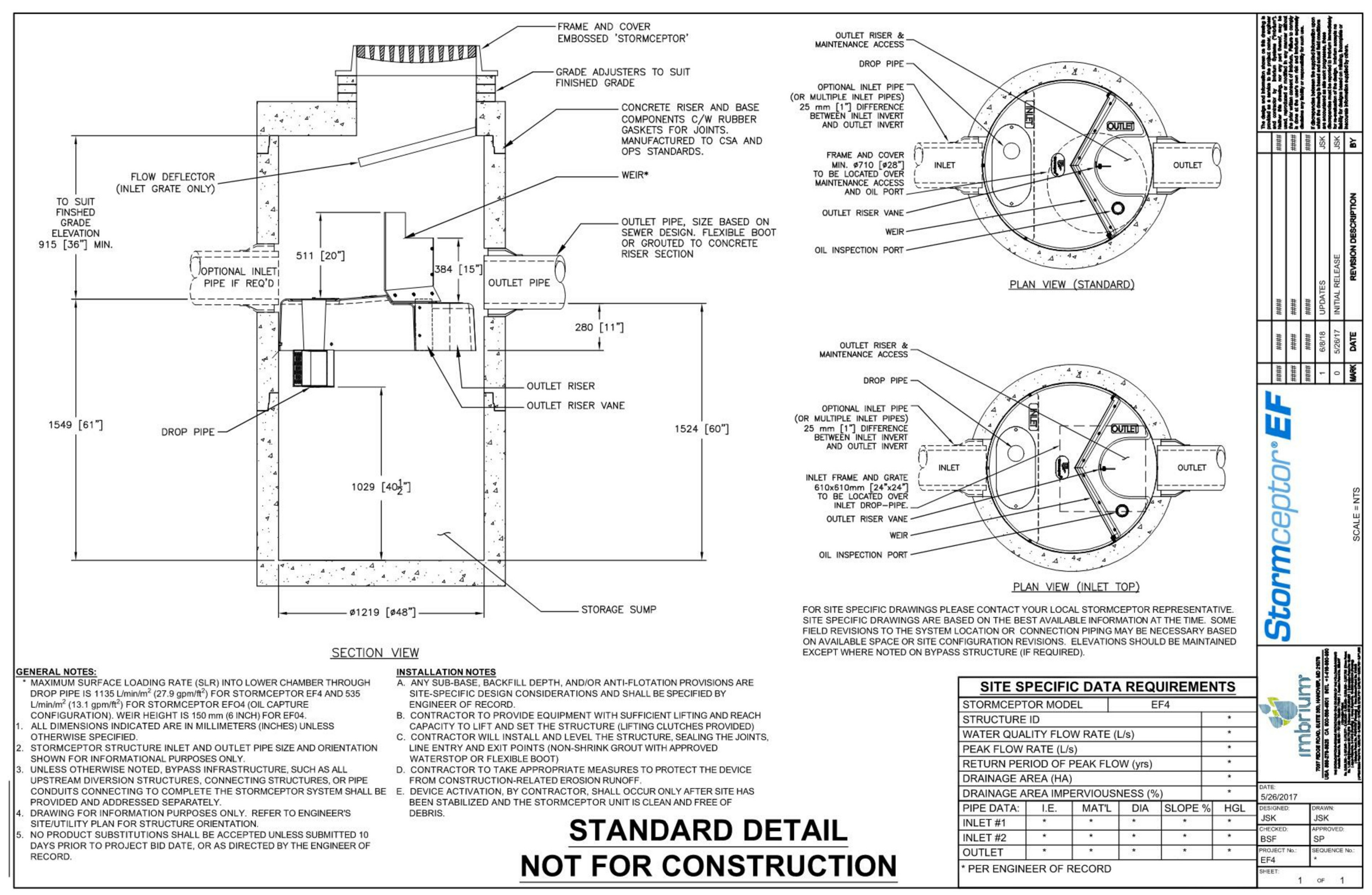
CONSTRUCTION MITIGATION:

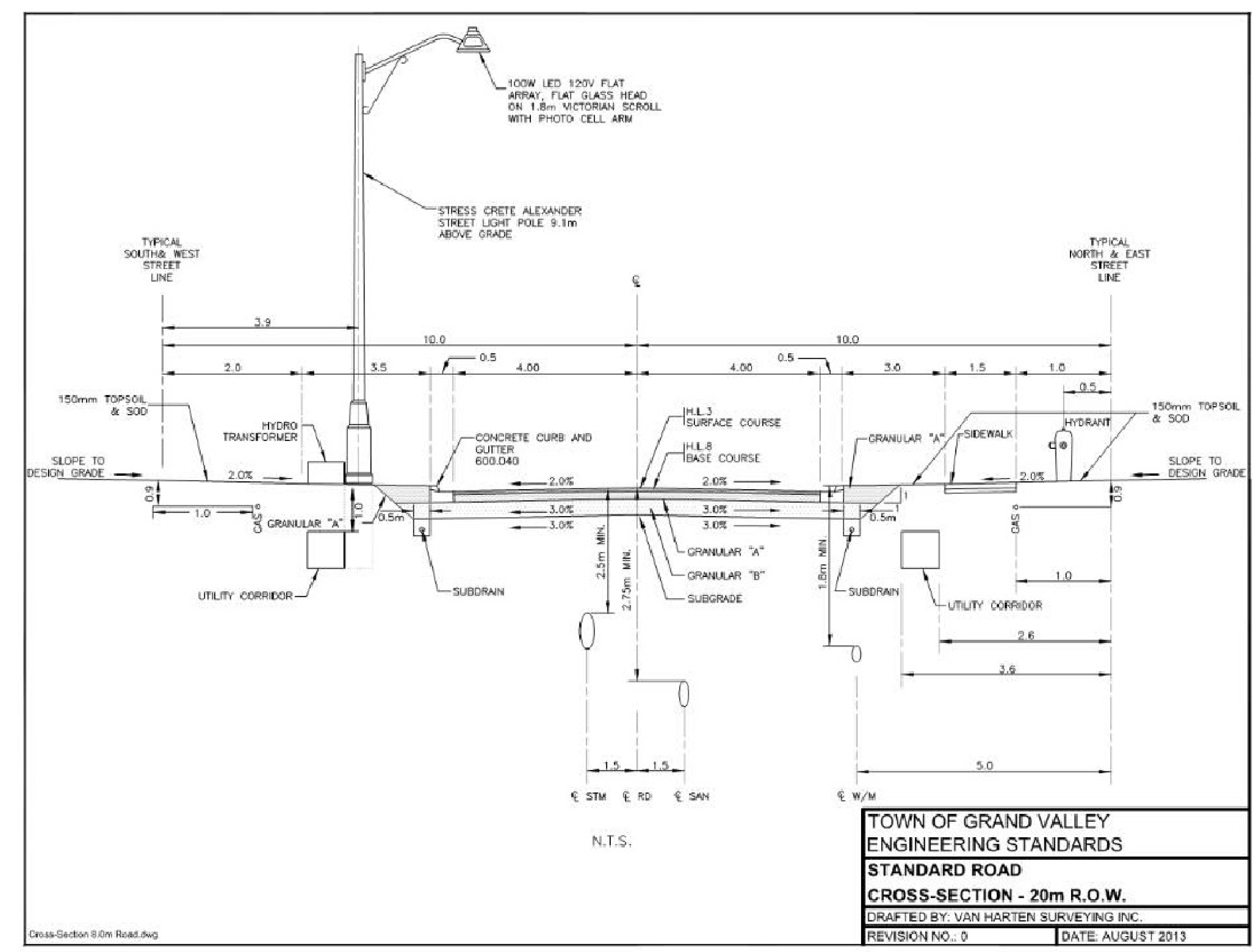
FINAL MEASURES TO INCLUDE THE FOLLOWING:

1. ALL SEDIMENT CONTROL FENCING IS TO BE INSTALLED PRIOR TO ANY GRADING OR EXCAVATION.
2. EROSION CONTROL FENCING TO BE INSTALLED AROUND THE BASE OF ALL STOCKPILES.
3. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS SITE DEVELOPMENT PROGRESSES. CONTRACTOR TO PROVIDE ALL ADDITIONAL EROSION CONTROL STRUCTURES, AS NEEDED.
4. TULLOCH ENGINEERING INC. IS TO MONITOR EROSION CONTROL STRUCTURES TO ENSURE FENCING IS INSTALLED AND MAINTENANCE IS PERFORMED TO TOWN REQUIREMENTS.
5. EROSION CONTROL STRUCTURES ARE TO BE MONITORED REGULARLY AND ANY DAMAGE REPAIRED IMMEDIATELY. SEDIMENT IS TO BE REMOVED WHEN ACCUMULATIONS BUILD UP INSIDE THE CONTROL FENCE.
6. ALL EROSION CONTROL STRUCTURES ARE TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND HAS BEEN RESTABLIZED EITHER BY GRAVEL OR RESTORATION OF VEGETATIVE GROUND COVER.
7. NO ALTERNATE METHODS OF EROSION PROTECTION SHALL BE PERMITTED UNLESS APPROVED BY THE ENGINEER AND THE DEPARTMENT OF PUBLIC WORKS.
8. THE CONTRACTOR IS RESPONSIBLE FOR MUNICIPAL ROADWAY AND SIDEWALKS TO BE CLEARED OF ALL SEDIMENT TRACKED BY VEHICLES AT THE END OF EACH DAY.
9. THE CONTRACTOR IS RESPONSIBLE TO REMOVE ANY SEDIMENT THAT HAS TRACKED OFF SITE ONTO ADJACENT PROPERTY OWNED BY OTHERS. RESTORATION AND/OR MAINTENANCE TO ADJACENT PROPERTY MUST BE COMPLETED TO EQUAL OR BETTER CONDITION.









REVISION:	No.	DATE	BY
PRELIMINARY DESIGN FOR FSR REPORT	1	OCT. 14, 2021	T.M.

TULLOCH ENGINEERING
PRELIMINARY
NOT FOR CONSTRUCTION
OCT. 14, 2021

TULLOCH
ENGINEERING

WESTVIEW TOWNHOUSES
RAINEY DRIVE, GRAND VALLEY

DETAILS AND NOTES

ENGINEER'S SEAL

SCALE	HORZ. 1:200 VERT. 1:50
DRAWN	DR
CHECKED	TM
DATE	OCT. 14, 2021
PROJECT No.	21-1531
SHEET	C1