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Drainage Master Plan

WEST END DRAINAGE ASSESSMENT

Town of Wasaga Beach

Document Control

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Issue	Date	Description
1	June 24, 2022	First Submission
2	August 3, 2022	Second Submission

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1 Introduction

Tatham Engineering Limited (Tatham) has been retained by the Town of Wasaga Beach (Town) to complete a Drainage Master Plan (DMP) following Approach #2 of the Master Planning process outlined in the Municipal Engineering Associations (MEA) *Municipal Class Environmental Assessment Document* (October 2000, as amended in 2007, 2011, and 2015). As part of the DMP project, we have undertaken a detailed assessment of the drainage systems in the west end of the Town. This report summarizes the existing drainage conditions and issues and provides recommended alternative solutions to improve the drainage systems and reduce flooding in the study area.

1.1 STUDY AREA

The study area is located at the west end of the Town and is generally bound by Bluewater Gate to the west, Highway 26 to the south, 74th Street to the east, and Georgian Bay to the north. The study area is illustrated on the Hydraulic Model Schematic (SCH-1) enclosed in Appendix B for reference.

1.2 BACKGROUND

The study area has a history of nuisance drainage and flooding issues which prompted the Town undertake a more detailed assessment of the area than would be conducted through the typical DMP process. The Town is currently undertaking other drainage improvement projects within the study area (refer to Section 4.1) which have also been taken into consideration for the purposes of this report and the development of the alternative solutions.

In October 2021, the Town received a Drainage Petition from the residents of Marilyn Avenue South, George Street, Robert Street and Beachwood Road seeking a resolution to the drainage issues and flooding in the study area. In the petition, the residents noted four significant floods occurred between January 2020 and September 2021 caused by heavy or prolonged rainfall, snowmelt, or a combination of the two. During these events, the residents noted flooded basements, garages, roadways, and driveways causing issues with access/egress, property damage and safety issues. Through the petition, the residents requested action to resolve the drainage issues and flooding in the study area. The Drainage Petition is included in Appendix A for reference.

In response to the Drainage Petition, the Town consulted the Nottawasaga Valley Conservation Authority (NVCA) and retained Tatham to undertake this assessment. Through consultation with the NVCA, it was confirmed that a detailed 2D hydraulic assessment be completed given the



complexity of the drainage systems and flooding in the study area. Tatham agrees that this is the appropriate approach for the study area. As such, a 2D hydraulic assessment has been completed.

As mentioned, the Town is currently engaged in three additional drainage improvement projects in the study area which were considered in the development and assessment of the alternative solutions described herein. The three additional drainage improvement projects are as follows and are described further in section 4.1 of this report:

- *Constance Boulevard Drainage Improvements Schedule C Municipal Class Environmental Assessment;*
- *Drainage Improvements, Shore Lane - Inverkip Road to 74th Street; and*
- *West End Water Tower and Public Works Depot.*

1.3 OBJECTIVES

The primary objectives of this report are as follows:

- Assess the existing drainage conditions throughout the study area and identify issues from the model results and background information;
- Describe the methodology used to assess the existing drainage conditions in the study area;
- Propose alternative drainage solutions and summarize the assessment of each alternative; and
- Present the recommended drainage solutions for the study area.



2 Study Methodology

As discussed, it was agreed the assessment of the existing drainage systems in the study area be completed using a 2D hydraulic analysis. The 2D hydraulic model analysis methodology is described in the following sections.

2.1 HYDROLOGIC ANALYSIS

The model results from the Drainage Master Plan major drainage system hydrologic analysis were used for this assessment. The drainage catchments delineated for the DMP are illustrated on the Overall Drainage Plan (Drawing ODP-1) included in Appendix B for reference. For this assessment, subcatchments were delineated to key points of interest in the study area and flows for these subcatchments were prorated based on drainage area from the overall DMP subcatchment flows. The subcatchment delineation and model inflow locations are illustrated on the Subcatchment Drainage Plan (Drawing ODP-2) included in Appendix B for reference.

2.2 HYDRAULIC ANALYSIS

Due to the complex nature of the drainage systems and flooding in the study area, including flow spilling laterally in multiple directions, significant ponding, backwater conditions, and hydraulic connectivity between multiple outlets, the hydraulic analysis of the study area was conducted using a 2D HEC-RAS hydraulic model.

Analysis with a 2D hydraulic model allows the model to more accurately route flow spilling from watercourses to the appropriate downstream location than conventional 1D hydraulic analysis. The 2D hydraulic model is an unsteady flow model, meaning streamflow is represented as a time dependent hydrograph rather than the single instantaneous peak flow for a conventional 1D model. Conducting an unsteady 2D analysis allows the model to account for flood storage in the drainage system which can attenuate flows downstream of storage areas. This is particularly applicable for the study area as Beachwood Road creates a backwater condition causing flow to disperse laterally and pond upstream attenuating peak flows.

The 2D HEC-RAS hydraulic model was generated from the LiDAR topographic data collected for the DMP and supplemented with topographic survey. The road crossing and driveway culverts in the study area were included in the model. The required culvert information was obtained from record/as-built drawings, field investigations and topographic survey. Manning's roughness coefficients were set throughout the study area based on existing land uses and the model's downstream boundary condition was set at 177.50 m or the Georgian Bay high water level.



3 Existing Drainage Conditions

The existing culverts and storm sewers included in the 2D HEC-RAS model are illustrated on the Culvert Inventory Plan (Drawing CUL-1) included in Appendix B for reference which should be referred to when reviewing this section of the report.

The main drainage feature within the study area is the watercourse which crosses Highway 26 approximately 200 m east of Robert Street. The watercourse flows north across private property towards Beachwood Road and culvert crossing #38 which discharges to the Thomas Street roadside ditch. Flow from the watercourse continues north through the Thomas Street roadside ditch, crosses Betty Boulevard via culvert crossing #113, and flows to Constance Boulevard where it then crosses Thomas Street via culvert crossing #114 and flows through the Constance Boulevard roadside ditch (through several driveway culverts) and ultimately outlets to Georgian Bay via culvert crossing #36 at the north end of Bayswater Drive.

It has been reported and observed that flow from the watercourse between Highway 26 and Beachwood Road frequently spills west towards Robert Street, flowing across private properties and enters the Robert Street east roadside ditch. Flow in the Robert Street roadside ditch drains to the north and crosses Beachwood Road via an existing storm sewer (#136) which discharges to the Bayswater Drive east roadside ditch. Flow then continues north in the Bayswater Drive roadside ditch through several driveway culverts, crosses Betty Boulevard via culvert crossing #6, continues north and ultimately outlets to Georgian Bay via culvert crossing #36. Culvert crossing #36 is the main outlet for the study area and much of the flow from the watercourse entering the study area discharges to Georgian Bay via this culvert.

It is also noted that flow from this watercourse spills east along the Beachwood Road south roadside ditch to culvert crossing #23 where it crosses Beachwood Road and flows north across private property towards the unopened Betty Boulevard road allowance. There is an existing trail along the unopened road allowance with two 300 mm diameter culvert crossings (#118 and #119) which blocks flow and directs it north towards Shore Lane via an overflow channel shared between properties 2237 and 2243 Shore Lane. Approximately 60 m east of the overflow channel, flow outlets to Georgian Bay via culvert #132 which runs beneath the driveway of 2222 Shore Lane. Records show the driveway at 2222 Shore Lane was engineered to function as an overland flow route for flow exceeding the capacity of the culvert outlet. Some of the flow which crosses the trail in the unopened Betty Boulevard ROW enters the Shore Lane roadside ditch and flows north then west ultimately draining to Georgian Bay via a storm sewer (#121) at the west end of Shore Lane. The flow which does not enter the Shore Lane roadside ditch flows along the rear of



the properties along the south side of Shore Lane before ultimately draining to Georgian Bay via culvert #120 at the west end of Shore Lane.

Local drainage from Marilyn Avenue South is conveyed north via roadside ditches to Beachwood Road where significant ponding occurs in the ditch due to a lack of positive drainage in either direction in the existing Beachwood Road roadside ditch. Local drainage from Marilyn Avenue North and Constance Boulevard west of Marilyn Avenue is conveyed north via roadside ditches until it ultimately drains to Georgian Bay downstream of culvert crossing #1.

Local drainage from George Avenue is conveyed north via roadside ditches to Beachwood Road and then west via the Beachwood Road south roadside ditch until flow enters the storm sewer (#7) crossing Beachwood Road approximately 145 m west of Constance Boulevard. Flow is conveyed by this storm sewer system through the Blue Water development and ultimately discharges to Georgian Bay.

3.1 HYDROLOGIC MODEL RESULTS

The results of the hydrologic analysis completed for the Drainage Master Plan were used in this drainage assessment. The hydrologic analysis determined the 24-hour SCS design storm to be the governing rainfall distribution for the study area. Therefore, the flows used for analysis and presented in this report are those resulting from the 24-hour SCS design storm distribution. As previously discuss, the flows for the subcatchments delineated within the study area were prorated based on area from the DMP catchments and assigned to inflow locations within the hydraulic model. Peak flows at each model inflow location are summarized in Table 1 below. For details of the hydrologic analysis and the parameters of the study area drainage catchments, please refer to the *Drainage Master Plan Existing Conditions Report* (Tatham Engineering Limited, July 2022).



Table 1: 2D HEC-RAS Model Inflow Locations Peak Flow Summary

LOCATION	PEAK FLOW (m ³ /s)			
	1:5 YEAR	1:25 YEAR	1:100 YEAR	TIMMINS
Watercourse at Highway 26 (HG1)	3.32	5.89	8.39	13.01
Culvert at Highway 26 (HG12)	0.15	0.28	0.40	0.51
Culvert at Highway 26 (HG13)	0.06	0.11	0.16	0.20
Robert Street (HG5)	0.80	1.26	1.95	1.09
Marilyn Avenue South (HG9)	0.02	0.03	0.04	0.05
George Avenue (HG10)	0.15	0.27	0.39	0.51
Watercourse at Beachwood Road (HG2)	0.09	0.17	0.26	0.35
Thomas Street at Betty Blvd. (HG3)	0.09	0.16	0.23	0.17
Thomas Street at Constance Blvd. (HG4)	0.07	0.12	0.16	0.09
Bayswater Drive at Betty Blvd. (HG6)	0.15	0.24	0.37	0.21
Bayswater Drive at Constance Blvd. (HG7)	0.31	0.52	0.76	0.42
Marilyn Avenue North at Constance Blvd. (HG8)	0.41	0.70	0.97	0.52
Beachwood Road at culvert crossing 290 m east of Thomas Street (HG14)	0.15	0.27	0.41	0.60
Beachwood Road at culvert crossing 90 m west of 75 th Street South (HG15)	0.13	0.24	0.36	0.52
East of 2211 Shore Lane (HG16)	0.06	0.12	0.18	0.26
South of unopened Betty Blvd. behind 2245 Shore Lane (HG17)	0.06	0.12	0.18	0.26
Tributary west of George Avenue (HG11)	0.42	0.83	1.28	2.86



3.2 HYDRAULIC MODEL RESULTS

As discussed, the 2D hydraulic model allows for more accurate routing of lateral flows between drainage courses and accounts for the storage provided in floodplains and ponding upstream of culverts. The area included within the 2D hydraulic model, the model inflow locations, and outflow locations are illustrated on the Hydraulic Model Schematic (Drawing SCH-1) included in Appendix B for reference. To provide an indication of the maximum flows conveyed through different locations within the study area, the peak flows at key points of interest throughout the study area under the 1:100-year return frequency design storm are summarized in Table 2.

Table 2: Existing Condition Peak Flow Summary

LOCATION (CULVERT ID#)	EXISTING CULVERT DESCRIPTION	1:100 YEAR PEAK FLOW (m ³ /s)		
		CULVERT	OVER- TOPPING	TOTAL
Beachwood Road (#7)	900 mm Dia. Conc.	0.9	0.0	0.9
Beachwood Road @ Robert Street (#136)	800 mm Dia. CSP Storm Sewer	0.7	0.0	0.7
Beachwood Road @ Thomas Street (#38)	1250 mm x 900 mm Conc. Box	2.2	0.0	2.2
Beachwood Road (#23)	1120 mm x 1060 mm Conc. Box	2.3	0.0	2.3
Beachwood Road (#47)	1220 mm x 800 mm Conc. Box	0.6	0.0	0.6
Bayswater Drive @ Betty Boulevard (#6)	925 mm Dia. CSP	1.0	0.0	1.0
61 Constance Boulevard Driveway Culvert (#135)	1000 mm Dia. CSP	0.7	0.2	0.9
Thomas Street @ Betty Boulevard (#113)	1630 mm x 1120 mm CSPA	2.2	0.0	2.2
Thomas Street Relief Culvert (#46)	650 mm Dia. CSP	0.1	0.0	0.1
Thomas Street @ Constance Boulevard (#114)	1880 mm x 1260 mm CSPA	1.4	1.0	2.4
Outlet @ Bayswater Drive (#36)	2130 mm x 1400 mm CSPA	1.2	0.7	1.9
Outlet @ West End of Constance Street (#1)	2-400 mm Dia. CSPs	0.1	0.2	0.3



LOCATION (CULVERT ID#)	EXISTING CULVERT DESCRIPTION	1:100 YEAR PEAK FLOW (m ³ /s)		
		CULVERT	OVER- TOPPING	TOTAL
Culvert @ West End of Shore Lane (#120)	900 mm Dia. CSP	0.3	0.0	0.3
Storm Sewer @ West End of Shore Lane (#121)	600 mm Dia. Conc. Storm Sewer	0.1	0.0	0.1
Outlet @ 2222 Shore Lane (#132)	800 mm Dia. CSP	1.0	1.5	2.5

3.3 EXISTING DRAINAGE ISSUES

The drainage issues identified throughout the study area are described on a street-by-street basis in the following sections. Flood Extents Maps illustrating the existing (and proposed) condition flood extents for the 1:5-year, 1:10-year and 1:100-year return frequency design storms are included in Appendix B and should be referenced when reviewing this section of the report.

Thomas Street

Flooding has been frequently observed at the intersection of Thomas Street and Constance Boulevard and the Town is currently undertaking a separate project to reduce this flooding and improve drainage conditions at this location. The existing conditions hydraulic model verified the issues at this location as it determined flooding of Constance Boulevard occurs under all design storms greater than the 1:2-year return frequency design storm. This flooding is caused by the limiting capacity of the culvert crossing Thomas Street at this location (#114) and the driveway culverts along the Constance Boulevard roadside ditch between Thomas Street and Bayswater Drive.

The hydraulic model also determined water will overtop Thomas Street immediately south of 3 Thomas Street under the 1:100-year return frequency design storm due to the limiting capacity of the existing driveway culvert (#39) at 3 Thomas Street.

Bayswater Drive

It is expected that water will spill from the Bayswater Drive roadside ditch onto private property at 61 Constance Boulevard under the 1:25-year and greater return frequency design storms due to the limiting capacity of the driveway culvert (#135) providing access to 61 Constance Boulevard from Bayswater Drive. Also under the 1:100-year return frequency design storm, water



will overtop Bayswater Drive at its intersection with Constance Boulevard due to the limiting capacity of the culvert crossing Constance Boulevard (#36)

It is also expected that water in the Bayswater Drive roadside ditch between Beachwood Road and Betty Boulevard will back up into the side yard swales between 11 & 13, 13 & 15, and 15 & 17 Bayswater Drive under the 1:25-year and greater return frequency design storms due to the low elevations of the side yard swales.

Constance Boulevard

As indicated in the previous two sections, flooding of Constance Boulevard will occur at Thomas Street and Bayswater Drive under the 1:5-year and greater and 1:100-year and greater return frequency design storms, respectively. It was also determined through the hydraulic model that flooding of Constance Boulevard between Bayswater Drive and Marilyn Avenue will occur under the 1:5-year and greater return frequency design storms.

Robert Street

Flooding of Robert Street immediately south of its intersection with Beachwood Road occurs under the 1:10-year and greater return frequency design storms. It was also determined that flooding of Robert Street near 43 Robert Street occurs under the 1:10-year and greater design storms with water spilling west from the west roadside ditch under the 1:5-year and greater return frequency design storms and resulting in significant ponding occurring on 34 Robert Street and 33 Marilyn Avenue.

It is expected that water spills west from the watercourse through several properties along the east side of Robert Street and enters the Robert Street east roadside ditch contributing to the issues observed at Robert Street under all return frequency design storms. The properties which receive the greatest amount of spill from the watercourse are 43 and 29 Robert Street which currently remain undeveloped.

Marilyn Avenue

Flooding of Marilyn Avenue has been frequently observed immediately south of its intersection with Beachwood Road. It has also been reported that ponding in the ditches in this area can last for several days before dissipating. The existing conditions hydraulic model verified the drainage issues at this location as flooding of Marilyn Avenue occurs under the 1:5-year and greater return frequency design storms. The model also verified the ditches in this area lack positive drainage as once they are ponded in the model, the ditches will not completely drain.

The hydraulic model also determined the roadside ditches lack capacity in two locations and allow water to spill onto private property under the 1:5-year and greater return frequency design



storms. The locations where this occurs are the currently vacant lots of 39 and 33 Marilyn Avenue, and near the rear of 8985 Beachwood Road.

George Avenue

The George Avenue roadside ditches lack capacity in two locations and allow water to spill onto private property under the 1:5-year and greater return frequency design storms. The locations where this occurs are the currently vacant lot of 23 George Avenue, and the unopened road allowance north of 22 George Avenue.

Beachwood Road

The existing conditions hydraulic model determined that Beachwood Road is a significant contributor to the drainage issues observed in the study area. It is noted that Beachwood Road was formerly Highway 26 and remains under the jurisdiction of the MTO. The high profile of Beachwood Road relative to the surrounding area causes water to pond to significant depths and to spill/spread laterally in both directions on the upstream side of the road. The lack of culverts crossing Beachwood Road at the north ends of Marilyn Avenue and George Avenue coupled with the relatively flat slope, or complete lack of slope, in the Beachwood Road roadside ditch result in ponding observed in the ditch and contribute significantly to the drainage issues observed at Marilyn Avenue.

The culverts crossing Beachwood Road at Thomas Street and Bayswater Avenue create a backwater effect upstream of Beachwood Road which causes water to spread out laterally during the 1:5-year and greater return frequency design storms. The lack of a defined roadside ditch and undersized or non-existent driveway culverts in this area result in water spilling onto private property upstream of these culvert crossings.

Shore Lane

The Shore Lane south roadside ditch and the culvert outlet at 2222 Shore Lane have insufficient capacity resulting in flooding of Shore Lane in the area between the unopened Betty Boulevard ROW and 2199 Shore Lane during the 1:5-year and greater return frequency design storms. Also during the 1:2-year and greater return frequency design storms, water flows from the rear of several private properties along Shore Lane, through side yard swales to the Shore Lane south roadside ditch. The properties affected are 2211-2245 Shore Lane, and the vacant properties north of 2247 Shore Lane.



4 Proposed Alternative Solutions

Through our review of the existing conditions model and the drainage deficiencies identified therein, proposed alternative solutions were developed and assessed via a proposed conditions hydraulic model of the study area. This section of the report describes the proposed alternative solutions on a street-by-street basis and provides a brief assessment of each alternative.

4.1 DRAINAGE IMPROVEMENT PROJECTS BY OTHERS

We note the Town is currently undertaking additional drainage improvement projects within the study area including:

- *Constance Boulevard Drainage Improvements Schedule C Municipal Class Environmental Assessment* which involves creation of a new outlet to Georgian Bay from the Thomas Street roadside ditch through 18 Constance Boulevard (to be confirmed through ongoing Municipal Class EA)
- *Drainage Improvements, Shore Lane - Inverkip Road to 74th Street* which involves installation of new storm sewer and culverts along Shore Lane from the unopened Betty Boulevard road allowance to 74th Street North and creation of a new outlet at the north end of 74th Street North.
- The Town is also proceeding with its *West End Water Tower and Public Works Depot* project which will include development of an approximately 4.2 ha site west of 75th Street and south of Beachwood Road and construction of a drainage outlet from the proposed development site north to Georgian Bay.

We reviewed the available background material for the drainage improvement projects described above within the study area and incorporated the proposed improvements in our proposed conditions analysis and models to ensure the impact of these drainage improvements is accounted for in our proposed alternative solutions analysis.

4.2 THOMAS STREET

Option 1A - Do Nothing (Thomas Street)

This option allows for the consideration of not implementing any changes to the existing Thomas Street drainage system. Due to the significant flooding issues at the intersection of Thomas Street and Constance Boulevard frequently observed and confirmed through the hydraulic model, this option is not preferred.



Option 1B - Create New Outlet at North End of Thomas Street

As previously mentioned, the Town is currently undertaking the *Constance Boulevard Drainage Improvements Schedule C Municipal Class Environmental Assessment* project which includes considering the creation of a new outlet to Georgian Bay from the Thomas Street roadside ditch through 18 Constance Boulevard. Tatham has been provided the preliminary design of the proposed outlet and incorporated the new outlet into our proposed conditions model and analysis. The proposed outlet consists of an 1800 mm x 900 mm concrete box culvert which we have determined will have a capacity of approximately 3.5 m³/s before water overtops Constance Boulevard.

Option 1C - Upgrade Thomas Street Culverts

This option is analyzed under the assumption that Option 1B is implemented. This option involves improving the culvert crossing Beachwood Road at Thomas Street and the culverts along the Thomas Street roadside ditch to maximize utilization of the new outlet proposed under Option 1B. The Option 1B outlet has a capacity of approximately 3.5 m³/s and the existing culvert crossing Thomas Street at Constance Boulevard has a capacity of approximately 1.0 m³/s for a total of 4.5 m³/s.

Proposed culverts for this option were sized based on the total available capacity at Thomas Street and Constance Boulevard. An 1800 mm x 900 mm concrete box culvert crossing Beachwood Road is proposed and would convey approximately 3.4 m³/s of flow under the 1:100-year return frequency design storm. The existing 1200 mm CSP driveway culvert at 3 Thomas Street is proposed to be replaced with an 1800 mm x 1200 mm concrete box culvert. Minor regrading of the ditch is required to accommodate the new driveway culvert. The existing 1630 mm x 1120 mm CSPA culvert at Betty Boulevard is proposed to be replaced with an 1800 mm by 1200 mm concrete box culvert. The two existing driveway culverts between Betty Boulevard and Constance Boulevard are proposed to be replaced with 1800 mm x 1200 mm concrete box culverts. To accommodate the proposed culverts at these driveways, significant regrading of the ditch is required including installation of a retaining wall along the east side of the ditch.

Option 1D - Remove Driveway Culverts Between Betty Boulevard and Constance Boulevard

This option involves removal of the two existing driveway culverts between Betty Boulevard and Constance Boulevard. These driveways provide access to 34 Betty Boulevard and 21 Constance Boulevard, both of which also have access from the streets on which they front. This option eliminates the need for the significant regrading work required to accommodate upgrades to the Thomas Street driveway culverts. However, this option will eliminate access to the existing garage at 34 Betty Boulevard.



Option 1E - Upgrade Relief Culvert and Betty Boulevard Driveway Culverts and Ditch

This option involves upgrading the existing relief culvert which directs flow from the Thomas Street Roadside ditch to the Betty Boulevard south roadside ditch. As part of this option upgrades would be required to the nine existing driveway culverts along this section of the Betty Boulevard ditch.

4.3 BAYSWATER DRIVE

Option 2A - Do Nothing (Bayswater Drive)

This option allows for the consideration of not implementing any changes to the existing Thomas Street drainage system.

Option 2B - Upgrade Bayswater Drive Culverts

This option is analyzed under the assumption that Option 1B is implemented, and therefore flow is diverted from the existing outlet at the north end of Bayswater Drive. This option involves improving the culvert crossing Beachwood Road at Bayswater Drive, upgrading the driveway culvert along the Bayswater Drive roadside ditch from Beachwood Road to Constance Boulevard and upgrading the culvert crossing Betty Boulevard to maximize utilization of the existing Bayswater Drive outlet. The existing 2130 mm x 1400 mm CSPA outlet culvert has a maximum capacity of approximately 3.1 m³/s before water overtops Constance Boulevard. With the Constance Boulevard roadside ditch conveying approximately 1.0 m³/s to the Bayswater Drive outlet from Thomas Street, that allows for the Bayswater Drive roadside ditch to contribute approximately 2.1 m³/s of flow.

It is proposed to remove the existing 800 mm CSP storm sewer crossing Beachwood Road which discharges to Bayswater Drive and replace it with a 1200 mm diameter CSP culvert. This culvert will convey approximately 2.0 m³/s of flow under the 1:100-year return frequency design storm. The four 850 mm CSP driveway culverts between Beachwood Road and Betty Boulevard are proposed to be replaced with 1630 mm x 1120 mm CSPA culverts. To accommodate these culvert improvements, it is required to regrade and lower the ditch which would result in side slopes steeper than 2:1 (H:V). The existing 925 mm CSP culvert crossing Betty Boulevard and the driveway culvert at 61 Constance Boulevard are proposed to be replaced with 1880 mm x 1260 mm CSPA culverts.

Option 2C - Construct Storm Sewer Along Bayswater Drive

This option involves removing the four existing driveway culverts between Betty Boulevard and Beachwood Road and the culvert crossing Betty Boulevard and installing a storm sewer from upstream of the first driveway to approximately 40 m downstream of Betty Boulevard. The storm



sewer will consist of a 1525 mm x 965 mm elliptical concrete storm sewer, with a maintenance hole at the intersection of Bayswater Drive and Betty Boulevard to connect the existing 700 mm diameter CSP culvert from the Betty Boulevard roadside ditch, and a second leg consisting of a 1725 mm x 1090 mm elliptical concrete storm sewer downstream. Removing the driveway culverts and installing a storm sewer will allow the roadside ditch to be filled in and replaced with a small swale above the storm sewer with inlets upstream of each driveway to collect road drainage. Inlets to the sewer will also be provided at each side yard swale location.

Installing a storm sewer as described above also allows for the 1200 mm diameter CSP culvert to be installed at Beachwood Road as described in Option 2B, which will convey approximately 2.0 m³/s of flow under the 1:100-year return frequency design storm. The storm sewer as described above is sized to convey this flow without surcharging.

Option 2D – Improve Bayswater Drive Outlet to Georgian Bay

This option involves improving the existing outlet to Georgian Bay at Bayswater Drive. Doing so would allow for more flow to be directed to this outlet via the Bayswater Drive and Constance Boulevard (and by association Thomas Street) roadside ditches. Assuming Option 1B is implemented, the existing outlet has sufficient capacity to allow for Options 1C and 2B or 2C to be implemented, both of which significantly improve conveyance of flows from south of Beachwood Road to Georgian Bay and both of which provide near the maximum possible conveyance capacity within the spatial constraints of the existing ROWs. As such, if the Bayswater Drive outlet was improved, there is limited opportunity to convey more flow to the outlet to utilize the full conveyance capacity of the improved outlet.

Option 2E – Cleanout Existing Bayswater Drive Outlet to Georgian Bay

This option consists of cleaning out accumulated sediment from the existing Bayswater Drive outlet culvert to maximize the capacity of the existing culvert.

4.4 CONSTANCE BOULEVARD

Option 3A – Do Nothing (Constance Boulevard)

This option allows for the consideration of not implementing any changes to the existing Constance Boulevard drainage system.

Option 3B – Improve Driveway Culverts and Roadside Ditch Between Bayswater Drive and Thomas Street

This option involves improving the culvert crossing Thomas Street at Constance Boulevard and the roadside ditch and six existing driveway culverts along Constance Boulevard between Bayswater Drive and Thomas Street. Implementing this option would allow for more flow to be



conveyed to the Bayswater Drive outlet. Due to the very flat grade of this section of roadside ditch the backwater caused by each driveway culvert will affect the upstream culverts in a “chain reaction” that limits the capacity of all culverts within this section of roadside ditch making improving the capacity of this system very difficult. This option was also investigated through the *Constance Boulevard Drainage Improvements Schedule C Municipal Class Environmental Assessment* project which determined this option would not reduce flooding to the same extent as Option 1B, would require significant increase to the width of the ditch, and would potentially impact private properties.

Option 3C - Cleanout/Maintenance of Driveway Culverts and Roadside Ditch Between Bayswater Drive and Thomas Street

This option involves performing maintenance of the Constance Boulevard roadside ditch between Bayswater Drive and Thomas Street. The maintenance would include removal of accumulated sediment from the roadside ditch and driveway culverts to maximize the capacity of the existing drainage system.

4.5 ROBERT STREET

Option 4A - Do Nothing (Robert Street)

This option allows for the consideration of not implementing any changes to the existing Robert Street drainage system.

Option 4B - Improve Robert Street Eastern Roadside Ditch and Driveway Culverts

This option involves improving the eastern roadside ditch and driveway culverts along Robert Street from 43 Robert Street to Beachwood Road. Minor regrading to lower the roadside ditch would allow the existing 600 mm diameter CSP driveway culverts to be replaced with 1150 mm x 820 mm CSPA culverts which will convey approximately twice as much flow as the existing culverts (0.6 m³/s) before overtopping.

Option 4C - Improve Robert Street Western Roadside Ditch and Driveway Culverts

This option involves improving the western roadside ditch and driveway culverts along Robert Street from 40 Robert Street to Beachwood Road. Minor regrading to lower the roadside ditch would allow the existing 400 mm diameter CSP driveway culverts to be replaced with 910 mm x 660 mm CSPA culverts which will convey significantly more flow than the existing culverts before overtopping.



Option 4D – Construct Berm Along Rear of Private Properties on East Side of Robert Street

This option involves creation of a berm along the rear of the properties on the east side of Robert Street to prevent flow spilling from the watercourse from reaching the Robert Street eastern roadside ditch. Implementing this option would greatly reduce the amount of flow in the Robert Street roadside ditch and the frequency of flooding at Robert Street. However, if flow was blocked from reaching Robert Street, flooding issues would simply arise in new locations on private properties further downstream (i.e. the properties fronting on Beachwood Road east of Robert Street).

4.6 MARILYN AVENUE

Option 5A – Do Nothing (Marilyn Avenue)

This option allows for the consideration of not implementing any changes to the existing Marilyn Avenue drainage system.

Option 5B – Improve Marilyn Avenue South Roadside Ditches and Driveway Culverts

This option involves regrading the Marilyn Avenue South roadside ditches and lowering the existing driveway culverts to improve the capacity of the roadside ditches. Implementing this option will reduce the frequency of flow spilling from the roadside ditches onto private property. However, this option alone will not address the frequent flooding of Marilyn Avenue or the prolonged ponding in the roadside ditches.

Option 5C – Install New Culvert Crossing Beachwood Road at Marilyn Avenue (Per MTO Standards)

This option involves installing a new culvert crossing Beachwood Road at Marilyn Avenue. To satisfy MTO design standards (conveyance capacity equal to or greater than the 1:25-year design storm peak flow) for culvert crossings, a 500 mm CSP crossing Beachwood Road at Marilyn Avenue would be required. MTO design standards specify a 600 mm diameter culvert as the minimum culvert size for Rural Arterial and Collector Road crossings as dictated by maintenance considerations. Installing a 600 mm culvert would alleviate the frequent ponding observed in the ditches at the Marilyn Avenue and Beachwood Road intersection and satisfy the MTO design flood frequency criteria. Installing this culvert would require improvements to the downstream roadside ditch and the driveway and road crossing culverts on one side of the road due to an increase in flow through this area. It was determined that the driveway and road crossing culverts are required to be 700 mm diameter CSP culverts downstream of the proposed new culvert crossing Beachwood Road and 750 mm diameter CSP culverts for the culvert crossing Betty Boulevard and the driveway culverts downstream. To accommodate the additional flow directed down Marilyn Avenue North, improvements should also be made to the outlet culverts at the Constance Boulevard pumping station.



Option 5D – Install New Storm Sewer Crossing Beachwood Road along Marilyn Avenue

Like Option 5C, this option involves installing a new storm sewer crossing Beachwood Road and discharging to the Marilyn Avenue North roadside ditch. This option is considered due to the noted high groundwater elevations along Marilyn Avenue South immediately south of Beachwood Road. To maximize the improvement under Option 5C the proposed culvert should be installed approximately 0.4 - 0.5 m below existing grade and the ditch should be regraded to provide positive drainage to the outlet. Due to the high groundwater elevations, lowering the ditch may result in groundwater seepage to the ditch. Installing a storm sewer with a ditch inlet at the existing ditch elevation at Beachwood Road would avoid lowering the ditch and potentially causing groundwater seepage into the ditch.

Option 5E – Install Two 300 mm Culverts Crossing Beachwood Road at Marilyn Avenue

This option involves installing 300 mm CSP culverts crossing Beachwood Road on both sides of Marilyn Avenue North to alleviate the frequent ponding observed in the ditches at the Marilyn Avenue and Beachwood Road intersection without requiring upgrades to the ditches and driveway culverts downstream on Marilyn Avenue. However, these culverts would not satisfy the MTO culvert design criteria for flood frequency or minimum culvert size. 300 mm diameter culverts would also pose a greater risk for obstruction and would require more frequent maintenance. However, recognizing this option would be a significant cost savings to the Town (as downstream roadside ditch and culvert improvements would not be required), the Town may wish to discuss with the MTO the potential of accepting the sub-standard culvert size.

Option 5F – Improve Outlet to Georgian Bay at Constance Boulevard Pumping Station

This option involves improving the existing culverts and outlet ditch to Georgian Bay at the Constance Boulevard Pumping Station. Implementation of this option is required if either Options 5C or 5D are implemented but would not be required if Option 5E is implemented. For this option it is proposed to replace the existing twin 400 mm diameter CSP culverts at the outlet with 3-675 mm diameter CSP culverts. It is also proposed to improve the outlet ditch from the proposed culverts to Georgian Bay to accommodate the additional flow directed to this outlet. It was confirmed through the proposed hydraulic model that implementing this option would also eliminate the flooding of Constance Boulevard observed in the existing conditions hydraulic model under all return frequency design storms.

Option 5G – Regrade Beachwood Road Roadside Ditch to Direct Drainage West Towards George Street

This option involves improving and regrading the Beachwood Road south roadside ditch at a slope of 0.5% to drain away from Marilyn Street in both directions. The ditch east of Marilyn Street would be regraded to drain to the culvert crossing Beachwood Road at Robert Street. The ditch



west of Marilyn would be regraded to drain to the culvert crossing Beachwood Road approximately 200 m west of George Street. It is noted that 0.5% is a relatively flat slope and it is expected ponding would still be observed in the roadside ditch at this slope.

Option 5H - Raise Roadside Ditch Banks at Flooding Locations

This option involves building up the top of the roadside ditch bank along the far side of the ditch at locations where water spills from the ditch towards private property under existing conditions. Implementation of this option would consist of constructing a small berm along the east side of the Marilyn Avenue South eastern roadside ditch to provide a minimum depth of 0.5 m within the ditch in front of the currently vacant lots of 39 and 33 Marilyn Avenue South. When these lots are developed in the future, the lots can be filled to match the new ditch top of bank elevations created by the proposed berm.

4.7 GEORGE AVENUE

Option 6A - Do Nothing (George Avenue)

This option allows for the consideration of not implementing any changes to the existing George Avenue drainage system.

Option 6B - Improve George Street Roadside Ditches and Driveway Culverts

This option involves regrading the George Avenue roadside ditches and lowering the existing driveway culverts to improve the capacity of the roadside ditches. Implementing this option will reduce the frequency of flow spilling from the roadside ditches onto private property. However, to accommodate this option it is required to regrade the Beachwood Road south roadside ditch from George Avenue approximately 200 m to the west to the existing storm sewer crossing Beachwood Road.

Option 6C - Raise Roadside Ditch Banks at Flooding Locations

This option involves building up the top of the roadside ditch bank along the far side of the ditch at locations where water spills from the ditch towards private property under existing conditions. Implementation of this option would consist of constructing a small berm along the far side of the George Avenue roadside ditches to provide a minimum depth of 0.5 m within the ditch in front of the currently vacant lot of 23 George Avenue, and at the unopened road allowance north of 22 George Avenue. When these areas are developed in the future, the lot can be filled to match the new ditch top of bank elevation created by the proposed berm, and the proposed road will be constructed to an elevation consistent with the existing George Avenue profile.



Option 6D – Install New Culvert Crossing Beachwood Road at George Avenue/Constance Boulevard

This option involves installing a new culvert crossing Beachwood Road and discharging to the Constance Boulevard east roadside ditch. As noted in Option 5B, MTO design standards specify a 600 mm diameter culvert as the minimum culvert size for Rural Arterial and Collector Road crossings as dictated by maintenance considerations. To accommodate the additional flow from the new culvert crossing Beachwood Road, the roadside ditch and driveway culverts along Constance Boulevard from Beachwood Road to Marilyn Avenue North would need to be improved as well as the outlet at the Constance Boulevard pumping station. Similar to Option 5C, the existing driveway culverts along this section of Constance Boulevard would need to be replaced with 700 mm diameter CSP culverts. If both this Option and Option 5C or 5D or 5E are implemented, further upgrades to the outlet at the Constance Boulevard pumping station than those described in Option 5F may be required.

4.8 BEACHWOOD ROAD**Option 7A – Do Nothing (Beachwood Road)**

This option allows for the consideration of not implementing any changes to the existing Beachwood Road drainage system.

Option 7B – Improve Roadside Ditch and Driveway Culverts from Robert Street to Thomas Street

This option involves regrading and deepening the roadside ditch, upgrading an existing driveway culvert, and installing a new driveway culvert along the south side of Beachwood Road from Robert Street to Thomas Street. Implementing this option will allow for flow to move laterally between the culverts crossing Beachwood Road at Thomas Street and Robert Street which will help distribute peak flows between the two culvert crossings. This consists of significant regrading to create a roadside ditch with a minimum depth of approximately 1.0 m between the two culverts crossing Beachwood Road. It is proposed to replace the existing 600 mm diameter CSP driveway culvert at 8901 Beachwood Road with a 1390 mm x 970 mm CSPA, and to install a new 1390 mm x 970 mm CSPA driveway culvert at 8911 Beachwood Road where there is no existing driveway culvert. The hydraulic model determined this proposed new driveway culvert will allow up to 1.6 m³/s of flow to be conveyed towards the culvert crossing Beachwood Road at Robert Street.

Option 7C – Improve Roadside Ditch and Culverts from Marilyn Avenue to Robert Street

This option involves improving the roadside ditch and existing driveway culverts between Marilyn Avenue and Robert Street and improving the existing culverts crossing Marilyn Avenue and Robert Street at Beachwood Road. Implementing this option will allow flow to distribute more easily between the culvert crossing Beachwood Road at Robert Street and the culvert crossing



Beachwood Road at Marilyn Avenue proposed under Option 5C or 5D. The existing 650 mm diameter culvert crossing Robert Street is proposed to be replaced with a 1000 mm diameter CSP culvert. The existing 450 mm diameter CSP east driveway culvert and 400 mm diameter CSP west driveway culvert at 8951 Beachwood Road are proposed to be replaced with 1000 mm diameter and 700 mm diameter CSP culverts, respectively. It is proposed to lower the existing 600 mm diameter culvert crossing Marilyn Avenue by approximately 0.5 m.

Option 7D - Regrade Roadside Ditch to Direct Portion of Watercourse Flows East to Proposed Outlet Channel

This option involves regrading the Beachwood Road south roadside ditch and installing a new driveway culvert at 8895 Beachwood Road to convey flow east from the watercourse to the Beachwood Road south roadside ditch. Implementing this option will allow for more flow to move east along Beachwood Road to the existing culvert crossing Beachwood Road approximately 290 m east of Thomas Street. As part of the proposed *West End Water Tower and Public Works Depot* project, a new outlet channel will be constructed from the existing culvert crossing Beachwood Road to Georgian Bay. This option would utilize the proposed outlet channel to convey additional flow from the watercourse to Georgian Bay.

It was determined through the hydraulic model that the proposed outlet channel does not have capacity to convey additional flows from the watercourse without overtopping and spilling east and north towards private property and Shore Lane. Without implementing the improvement proposed under this option, the outlet channel already receives some flow which spills from the watercourse further south of Beachwood Road.

4.9 SHORE LANE

Option 8A - Do Nothing (Shore Lane)

This option allows for the consideration of not implementing any changes to the existing Shore Lane drainage system.

Option 8B - Construct New Storm Sewer on Shore Lane with Outlet at 74th Street North

The Town is currently undertaking the *Drainage Improvements, Shore Lane - Inverkip Road to 74th Street* project and Tatham has been provided with the 60% design information to incorporate into our proposed alternatives analysis. This option involves drainage improvements including upgrades to existing culverts and storm sewers and construction of a new storm sewer between the unopened Betty Boulevard road allowance and 74th Street North. The existing culvert and sewer upgrades will be made from the unopened Betty Boulevard road allowance to the existing outlet at 2222 Shore Lane to improve conveyance to this outlet. The proposed storm sewer will be installed below the south roadside ditch starting from immediately east of 2211 Shore Lane



and draining east to 74th Street where the sewer will then change direction to extend north along 74th Street North ultimately discharging to Georgian Bay at the north end of 74th Street North. These proposed improvements were analyzed in the proposed conditions hydraulic model, and it was determined the proposed outlet storm sewer helps reduce flooding of Shore Lane under the 1:5-year return frequency design storm.



5 Recommended Solutions

Each of the proposed drainage improvement alternatives was assessed with respect to feasibility, magnitude of improvement, and cost. The options recommended for implementation to improve drainage conditions in the study area are summarized in Table 3 below and illustrated on the Conceptual Improvement Plans included in Appendix C for reference.

Table 3: Summary of Recommended Options

LOCATION	OPTION	RECOMMENDATION COMMENTS
Thomas Street	1B	This option is recommended to be implemented as described subject to the results of the ongoing <i>Constance Boulevard Drainage Improvements Schedule C Municipal Class Environmental Assessment</i>
	1C	This option is recommended to be implemented as described.
Bayswater Drive	2C	This option is recommended to be implemented as described.
	2E	This option is recommended to be implemented as described.
Constance Boulevard	3C	This option is recommended to be implemented as described.
Robert Street	4B	This option is recommended to be implemented as described.
	4C	This option is recommended to be implemented as described.
Marilyn Avenue	5B	This option is recommended to be implemented as described along with Option 5C or 5D which will allow the ditches to be regraded to lower elevations.
	5C or 5D or 5E	Option 5C is recommended to be implemented as described subject to determination of groundwater levels in the immediate surrounding area at the time of detailed design. If high groundwater levels are encountered, it is recommended Option 5D be implemented to avoid groundwater seepage into the surface drainage system. Alternatively, should the MTO be agreeable to two 300 mm culverts, then Option 5D would be a more cost-efficient solution for the Town.
	5F	This option is recommended to be implemented as described if Option 5C or 5D is implemented. This option is not required if Option 5E is implemented.
	5H	This option is recommended to be implemented as described.



LOCATION	OPTION	RECOMMENDATION COMMENTS
George Street	6C	This option is recommended to be implemented as described.
Beachwood Road	7B	This option is recommended to be implemented as described in conjunction with Options 1B and 2C.
	7C	This option is recommended to be implemented as described in conjunction with Options 2C and 5C or 5D or 5E.
Shore Lane	8B	This option is recommended to be implemented as described.

To provide an indication of the maximum flows conveyed through different locations within the study area under proposed conditions with all recommended improvements implemented, the existing culvert sizes and peak flows at key points throughout the study area under the 1:100-year return frequency design storm are summarized in Table 4 below.

Table 4: Peak Flow Summary - Recommended Improvements

LOCATION (CULVERT ID#)	EXISTING CULVERT DESCRIPTION	1:100 YEAR PEAK FLOW (m ³ /s)		
		CULVERT	OVER- TOPPING	TOTAL
Beachwood Road (#7)	900 mm Dia. Conc.	0.6	0.0	0.6
Beachwood Road @ Marilyn Street (NEW, Option 5B)	600 mm Dia. CSP	0.4	0.0	0.4
Beachwood Road @ Robert Street (#136)	1200 mm Dia. CSP	2.1	0.0	2.1
Beachwood Road @ Thomas Street (#38)	1800 mm x 900 mm Conc. Box	3.4	0.0	3.4
Beachwood Road (#23)	1120 mm x 1060 mm Conc. Box	2.4	0.0	2.4
Beachwood Road (#47)	1220 mm x 800 mm Conc. Box	0.8	0.0	0.8
Bayswater Drive @ Betty Boulevard (#6)	1725 mm x 1090 mm Conc. Storm Sewer	2.1	0.0	2.1
61 Constance Boulevard Driveway Culvert (#135)	1880 mm x 1260 mm CSPA	2.1	0.0	2.1



LOCATION (CULVERT ID#)	EXISTING CULVERT DESCRIPTION	1:100 YEAR PEAK FLOW (m ³ /s)		
		CULVERT	OVER- TOPPING	TOTAL
Thomas Street @ Betty Boulevard (#113)	1800 mm x 1200 mm Conc. Box	3.4	0.0	3.4
Thomas Street Relief Culvert (#46)	600 mm Dia. CSP	0.1	0.0	0.1
Thomas Street Outlet (NEW, Option 1A)	1800 mm x 900 mm Conc. Box	2.5	0.0	2.5
Thomas Street @ Constance Boulevard (#114)	1880 mm x 1260 mm CSPA	0.9	0.0	0.9
Outlet @ Bayswater Drive (#36)	2130 mm x 1400 mm CSPA	3.0	0.0	3.0
Outlet @ West End of Constance Street (#1)	3-675 mm Dia. CSPs	0.9	0.0	0.9
West End Depot Channel Outlet (NEW)	Trapezoidal Open Channel	-	-	1.6
Culvert @ West End of Shore Lane (#120)	900 mm Dia. CSP	0.2	0.0	0.2
Storm Sewer @ West End of Shore Lane (#121)	600 mm Dia. Conc. Storm Sewer	0.2	0.0	0.2
Outlet @ 2222 Shore Lane (#132)	800 mm Dia. CSP	0.9	0.2	1.1
Outlet @ 74 th Street North (NEW, Option 8A)	675 mm Dia. Storm Sewer	0.5	0.0	0.5

The flooding extents under proposed conditions with all recommended improvements implemented are illustrated on the Flood Extent Maps included in Appendix B for reference.

5.1 RECOMMENDED ORDER OF IMPLEMENTATION

It is assumed that the *Constance Boulevard Drainage Improvements Schedule C Municipal Class Environmental Assessment* (Option 1B), *Drainage Improvements, Shore Lane - Inverkip Road to 74th Street* (Option 8B) and the *West End Water Tower and Public Works Depot* projects will proceed independently of this study and prior to the remaining drainage improvement options recommended herein. Therefore, the order of implementation outlined in this section focuses on the remaining works recommended for the study area.



The general procedure for implementing drainage improvements is to begin with improving the downstream end of the system and work towards the upstream end. Recognizing there are several different conveyance paths for drainage within this drainage system, there is some flexibility to the order in which the improvements can be implemented, and consideration can be given to those areas which currently have the most severe drainage deficiencies. Many of the recommended drainage projects are related to each other and therefore are recommended to be grouped together into Phases. As such the recommended order of implementation is as follows:

Phase 1

- Option 5F - Improve Outlet to Georgian Bay at Constance Boulevard Pumping Station (not required if MTO is agreeable to implementing Option 5E);
- Option 5C - Install New Culvert Crossing Beachwood Road at Marilyn Avenue (Per MTO Standards); or Option 5D - Install New Storm Sewer Crossing Beachwood Road along Marilyn Avenue; or Option 5E - Install Two 300 mm Culverts Crossing Beachwood Road at Marilyn Avenue;
- Option 5B - Improve Marilyn Avenue South Roadside Ditches and Driveway Culverts; and
- Option 5H - Raise Roadside Ditch Banks at Flooding Locations.

Phase 2

- Option 2E - Cleanout Existing Bayswater Drive Outlet to Georgian Bay; and
- Option 2C - Construct Storm Sewer Along Bayswater Drive.

Phase 3

- Option 4B - Improve Robert Street Eastern Roadside Ditch and Driveway Culverts; and
- Option 4C - Improve Robert Street Western Roadside Ditch and Driveway Culverts.

Phase 4

- Option 3C - Cleanout/Maintenance of Driveway Culverts and Roadside Ditch Between Bayswater Drive and Thomas Street; and
- Option 1C - Upgrade Thomas Street Culverts.

Phase 5

- Option 7B - Improve Roadside Ditch and Driveway Culverts from Robert Street to Thomas Street;



- Option 7C - Improve Roadside Ditch and Culverts from Marilyn Avenue to Robert Street; and
- Option 6C - Raise Roadside Ditch Banks at Flooding Locations.

5.2 RECOMMENDED SOLUTIONS COST ESTIMATION

Cost estimates have been prepared for each phase of the recommended for implementation. The cost estimates are summarized in Table 5 below and detailed cost estimates are included in Appendix D for reference.

Table 5: Summary of Estimated Costs - Recommended Options

PHASE/OPTION	ESTIMATED COST
Phase 1	\$605,000
General Items	\$22,000
Option 5B - Improve Marilyn Avenue South Roadside Ditches and Driveway Culverts	\$114,000
Option 5C - Install New Culvert Crossing Beachwood Road at Marilyn Avenue (Per MTO Standards)	\$212,000
Option 5F - Improve Outlet to Georgian Bay at Constance Boulevard Pumping Station	\$50,000
Option 5H - Raise Roadside Ditch Banks at Flooding Locations	\$4,000
Provisional Items and Allowances	\$202,000
Alternatively, if MTO is agreeable to Option 5E the total Phase 1 cost is: (Resulting in a cost savings to the Town of \$295,000)	\$310,000
If high groundwater levels are encountered and the MTO is not agreeable to Option 5E, it is recommended that Option 5D be implemented at a total Phase 1 cost of:	\$635,000
Phase 2	\$935,000
General Costs	\$22,000
Option 2C - Construct Storm Sewer Along Bayswater Drive	\$624,000
Option 2E - Cleanout Existing Bayswater Drive Outlet to Georgian Bay	\$15,000
Provisional Items and Allowances	\$272,000



PHASE/OPTION	ESTIMATED COST
Phase 3	\$345,000
General Costs	\$22,000
Option 4B - Improve Robert Street Eastern Roadside Ditch and Driveway Culverts	\$120,000
Option 4C - Improve Robert Street Western Roadside Ditch and Driveway Culverts	\$80,000
Provisional Items and Allowances	\$122,000
Phase 4	\$750,000
General Costs	\$22,000
Option 1C - Upgrade Thomas Street Culverts	\$457,000
Option 3C - Cleanout/Maintenance of Driveway Culverts and Roadside Ditch Between Bayswater Drive and Thomas Street	\$60,000
Provisional Items and Allowances	\$207,000
Phase 5	\$360,000
General Costs	\$22,000
Option 6C - Raise Roadside Ditch Banks at Flooding Locations	\$25,000
Option 7B - Improve Roadside Ditch and Driveway Culverts from Robert Street to Thomas Street	\$83,000
Option 7C - Improve Roadside Ditch and Culverts from Marilyn Avenue to Robert Street	\$107,000
Provisional Items and Allowances	\$119,000
Total Estimated Cost (Phases 1 through 5)	\$2,995,000
Total Estimated Cost (Phases 1 through 5) if MTO is agreeable to Option 5E	\$2,700,000 Savings of \$295,000
Total Estimated Cost (Phases 1 through 5) if MTO is not agreeable to Option 5E and high groundwater levels are encountered	\$3,025,000



6 Summary

As part of the Town of Wasaga Beach Drainage Master Plan project, Tatham Engineering has undertaken a detailed assessment of the drainage systems in the west end of the Town. The assessed study area is located at the west end of the Town and is generally bound by Bluewater Gate to the west, Highway 26 to the south, 74th Street to the east, and Georgian Bay to the north

The analysis methodology used to assess the existing drainage conditions and proposed alternative solutions is described. The existing drainage conditions are described, and the results of the existing condition hydrologic and hydraulic analyses are presented. Based on the results of these analyses, existing drainage issues were identified and described. Maps illustrating the existing extents of flooding under the 1:5-year, 1:10-year and 1:100-year return frequency design storms are included in Appendix B.

Proposed drainage improvement alternative solutions were developed and assessed and are described in this report. Based on the assessment of the alternative solutions, recommended options were selected and are summarized in this report. A recommended order of implementation, and preliminary construction cost estimates (included in Appendix D) are provided for the recommended improvement options. Conceptual Plans illustrating the recommended options are included in Appendix C and maps illustrating the extents of flooding under proposed conditions with all recommended options implemented are included in Appendix B.



Appendix A: Drainage Petition

Your Worship Mayor Bifulchi and Council Members,

My name is Robert Hawkin. I making this submission together with Cindy Cleary. We are both residents of Marilyn Avenue South, Wasaga Beach. Cindy has been a resident for over thirty years. I have lived here since 2017. We are making this submission on behalf of 50 of our neighbours on Marilyn Avenue South, George Street, Robert Street and Beachwood Road. We appreciate the opportunity to present to you today. We have been impacted for over 10 years by flooding in our area and are seeking Council's assistance in getting the issues addressed as a matter of priority. The actions taken to date by government officials have been very passive.

Appendix A to this submission contains a copy of the petition which was previously filed with the Town of Wasaga Beach.

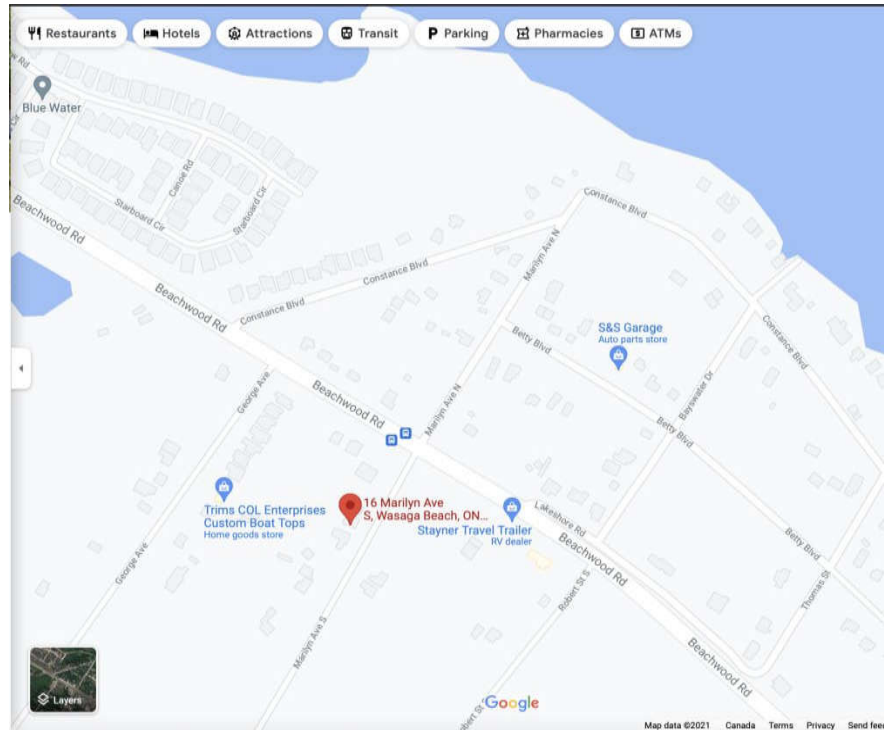
The repeated flooding in our area poses threats to people, property and the environment.

In just the last 21 months, we have had four major floods: January 10, 2020; March 11, 2021; June 27, 2021; September 23, 2021.

As both an individual resident, and on behalf of the residents who have signed this petition, I have made numerous requests over the last 3 years to many officials in the Town of Wasaga Beach. The Town has taken little action to address either the urgent impacts of the flooding or the sustained damage it has caused. The did remove ice chunks that were blocking water flow to drains but that actually increased the water level on Marilyn Ave S. before dissipating.

There has been no corrective action taken to address the road flooding, other than passively referring the matter to MTO. In spite of the ongoing flooding issues, we note that the Planning Department continues to approve development in the area without seeming to take corrective measures to address the flooding. The additional housing adds to the flooding burden.

In order to give you a visual perspective of the area we are discussing, I am providing this map.



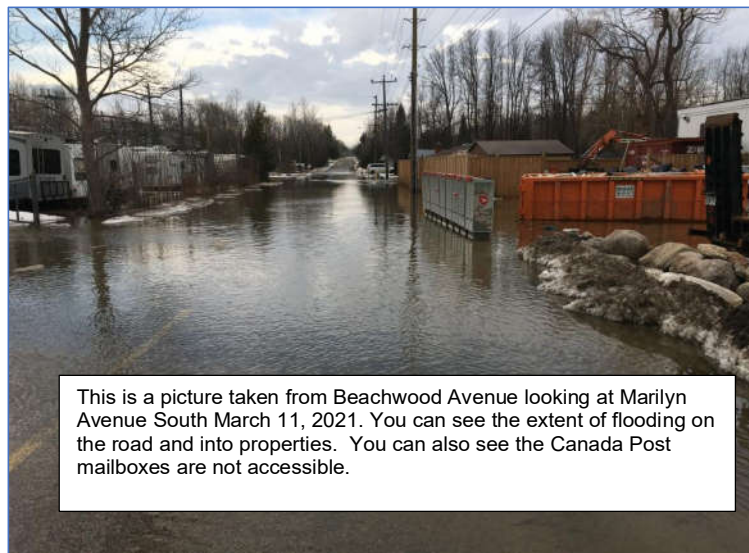
Source of the Problem:

The source of the problem seems to be insufficient drainage from Beachwood Road - a provincial highway -- that impacts the Town roads of Marilyn Avenue South, Robert St., George St., and Beachwood Road. Beachwood Road is also known as *provincial highway 7148*. It's the old Highway 26.

Flooding is often the result of heavy or prolonged rainfall, snowmelt, or a combination of these two. Flooding also occurs when we receive high intensity, short duration rainfalls often associated with severe thunderstorms. Ice jams associated with ice formation and/or spring break up have also resulted in severe flooding in our neighbourhood. We seem to also be impacted by high water levels and/or high winds on Georgian Bay.

In my particular case on Marilyn Avenue, previous owners on Beachwood filled in the culvert behind their home and I am experiencing flooding throughout my backyard as well. I'm uncertain whether their actions were required to be done under permit, but the impact has been significant. Two of my other neighbours similarly experience flooding in their backyards. The Appendix provides some photos.

As property owners, the residents have tried to mitigate the impacts from flooding by contacting the City of Wasaga Beach Public Works Department. We have also taken steps to prepare ourselves for storms and to reduce potential losses, for example, storing valuable goods off the floor in garages and basements and by ensuring all sump pumps in good working condition. I own two sump pumps: one in my garage and one in my crawl space. But when the water levels get so high, it becomes futile to pump the water out because there is nowhere dry enough for the water to drain to.



This is a picture taken from Beachwood Avenue looking at Marilyn Avenue South March 11, 2021. You can see the extent of flooding on the road and into properties. You can also see the Canada Post mailboxes are not accessible.

Impacts of the Problem:

In spite of our efforts, the systemic flooding issue in our neighbourhood results in basements being flooded multiple times a year, roads that are not passable because of water issues, driveways that are under water, garages and basements that are flooded, mold issues, property damage, and stagnant water that has nowhere to drain. The flooding has impacted hydro poles as well. One of our neighbours has a disability and relies on his electric wheelchair to get around. The flooding on the roads makes it impassable and dangerous for him. The Canada Post mail box area gets flooded making it impossible for us to retrieve mail. The flooding in houses and garages poses huge electrical and other health threats to residents, many of whom have young children. The flooding and freezing issues during the Winter and early Spring pose driving risks from frozen water over the roads. With the ongoing and sustained impact, this is a hazard and a public health and safety issue.

Although I only moved into the neighbourhood in 2017, I'm told by the neighbours that they have been trying to get the matter solved for at least 10 years. I have been actively pursuing a solution to the issue since 2019. To give you an idea of some of the anomalies, my property is at the lowest elevation on my street. It doesn't make sense that my driveway storm drain measures 12" and the one that crosses

Marilyn Ave next to this one is 16". Newer homes that are elevated higher than mine measure a minimum of 18 inches.

We have requested emergency services during flooding events, but received absolutely nothing. Calls to the emergency hotline were met with no action other than ice removal and just comments that there is too much water to divert. If it's too much for the Town to address, what hope is there for individual homeowners to address it? We note that other communities during flooding events are given sandbags and other community supports including financial aid.

The fact that this flooding issue hasn't been addressed for over 10 years is incomprehensible to us as is that fact that neither the Town of Wasaga Beach nor the province are stepping up to address the source of the problem or the damage it has caused.

To the right is a picture of my garage I had **7" of water** in my garage from the March 11, 2021 Spring thaw. I am attaching pictures of other floods so that you can see the sustained issues we are dealing with. Please see Appendix C. In the Appendix are some pictures of floods from:

- January 11, 2020
- March 11, 2021
- June 27, 2021
- September 23, 2021

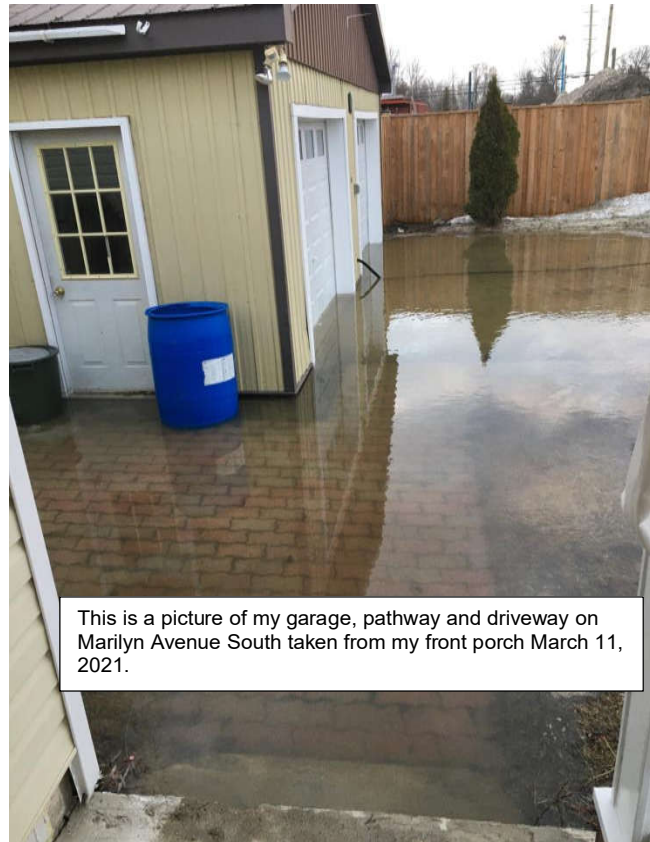
We want to show you what we are facing on an ongoing repeated basis. On September 23rd, I had **5" of water from that storm.**

Actions that we have taken to date:

I have made numerous attempts to have the flooding issues resolved by the Town of Wasaga Beach but to no avail. I attach a summary of some of my contacts to date. I keep getting told that it is a provincial matter because Beachwood is a provincial highway, and that the Town has referred it to MTO and to its road contractor. But the province has done nothing to address it. The Town advised us that MTO continues to sit on the matter indicating that they haven't received many complaints. We need the Town to move this matter forward to the province. The flooding from the provincial road is impacting the Town's roads and its ratepayers' properties. The Town has the right to expect the province to address drainage issues in order to preserve its property (i.e. roads).

We wonder if the minimum standards of the province's Highway Drainage Design Standards are being met and if not, is this not a concern of the Town of Wasaga Beach in protection of its own roads and on behalf of its ratepayers? Is there not a roads agreement with the province that can be called upon?

We recently asked the Planning Department to provide us with any analysis of the flooding impact that was done by them before development proposals were approved in our area. We've also asked them for



This is a picture of my garage, pathway and driveway on Marilyn Avenue South taken from my front porch March 11, 2021.

any mitigative strategies or recommendations that were made to address the systemic problems in the neighbourhood. We have not received a response to our request as yet.

Given that approved housing is near the provincial road we are curious as to whether there was any requirement to consult with the province under the *Public Transportation and Highway Improvement Act* or the province's Highway Access Management policies, or Stormwater Management guidelines.



Taken from the road in front of 16 Marilyn Ave S. Note the hydro pole is leaning and rotting and was supposed to be replaced.

I've also contacted my MPP, the MTO on behalf of the petitioners but have not received any response as yet.

Since 2019 I have made multiple requests to the Public Works Department and to the Mayor to have this addressed. I've sent pictures of the flooding so that they are aware of the extent of the damage. I've made urgent requests for help when the flooding occurs but I get only excuses, absolutely no action other than ice removal. Most recently, I have sent requests to the Minister of Transportation in charge of provincial roads and the Minister of Northern Development, Mines, Natural Resources and

Forestry in charge of flooding matters. I've also sent requests to the Nottawasaga Valley Conservation Authority. Appendix B provides a chronology of contacts that I have made to government authorities over recent years in order to address the flooding issues. Three example letters are included in appendices D, E, F for your information.

The Potential Solution:

Flood management involves multiple agencies across governments. We understand that this matter might need a coordinated approach between the province and the Town of Wasaga Beach, and possibly others. As ratepayers we have made the Town aware of the matter and its impact on numerous occasions. We contacted various departments to request action. We have contacted numerous provincial authorities and government Ministers. But as individual residents we have no power or authority to build the required collaborative approach between governments here in order to mitigate the risks and manage the solutions that have to be taken. We need the Town of Wasaga Beach to do this, and to do it quickly. The Public Works Department agrees that there is a problem here.



This pic was taken on Robert St looking north to Beachwood. To the right of the stop is a drain that goes into Georgian Bay.

The solution to the problem might be to have the culverts extended under Beachwood Rd on both sides of Marilyn Ave South to Marilyn Ave North. Currently the water has to travel along Beachwood Road to Robert Street before it gets diverted. Also, the water from George St. travels in the same direction.

The solution would also benefit from a temporary hold on future housing development in this area until the impact of the development on the flooding is fully analyzed, addressed and mitigated so as not to further compound the problem.

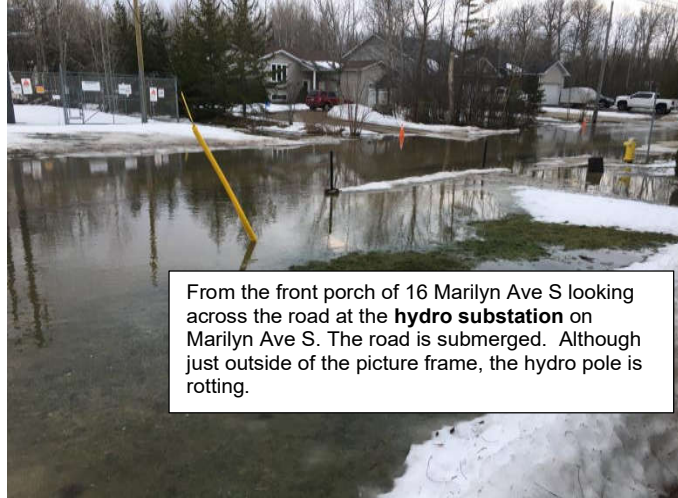
On behalf of myself and other area residents we are seeking a permanent solution to this constant problem. As an interim measure until the road and drainage can be addressed, we are asking you to ensure that efficient and effective services are in place to respond to our flood-related emergencies when they occur. For example, what options are there to exercise any rights under the Emergency Management and Civil Protection Act?

Our request:

We need your help to solve this.

We respectfully request of Your Worship Mayor Bifolchi and Council Members that the Town of Wasaga Beach take immediate corrective action to address the flooding issue.

We have taken the advice of the Public Works Department and contacted various MTO officials, as well as others. If there is another action that council recommends we take, we would appreciate the advice.



From the front porch of 16 Marilyn Ave S looking across the road at the **hydro substation** on Marilyn Ave S. The road is submerged. Although just outside of the picture frame, the hydro pole is rotting.



The solution involves collaboration amongst government bodies not individual ratepayers or temporary signs.

Appendix A – Petition on Behalf of the Residents of George Avenue, Marilyn Avenue South, Robert Street South and Beachwood Road. The original petition was filed with the Town offices with a copy given to MPP Jim Wilson.

Appendix B – Chronology of Requests Made to Government Authorities Related to Flooding around Marilyn Avenue South

Appendix C – Photos of Flooding

Appendix D – letter to Hon. Greg Rickford, Minister of Northern Development, Mines, Natural Resources and Forestry
copy to Hon. Caroline Mulroney, Minister of Transportation (email)

Appendix E – letter Doug Herron, Town of Wasaga Beach (email via website)

Appendix F – Letter to Mark Hartley, Nottawasaga Valley Conservation Authority (email)

This is NOT A Solution To Street Flooding!



September 7, 2021 at 7:01 pm Marilyn Ave South



March 11, 2021 Marilyn Ave South

We the residents on Marilyn Ave South, George St, Robert St and Beachwood Rd demand a permanent solution to our frequent flooding problem.

The Public Works Department of Wasaga Beach need to work with the MTO and address this issue immediately. At present there is only one storm drain under Beechwood Road at Robert Street that provides drainage for 4 streets and that is not enough to handle the water flow. The infrastructure in place cannot handle the excessive rainfall. Adding more residential homes with sump pumps also negatively impacts drainage in our current culverts.

This petition will be sent to the Wasaga Beach Public Works Dept. and our Mayor Ms. Nina Bifolchi.

Thank you residents for your cooperation.
Bob Hawkin 16 Marilyn Ave South
bobhawkin@rogers.com for updates


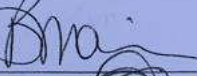




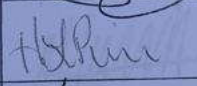

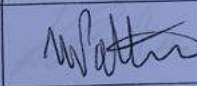
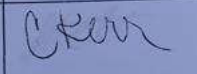



Robert St. March 11, 2021 after
Wasaga Beach Public Works were
advised of flooding

We the residents on Marilyn Ave South, George Street,
Robert Street and Beachwood Road demand a
permanent solution to our frequent flooding problem

Name	Signatures	Address / Email	Date
Bob Hawkin	Bob Hawkin	16 MARILYN AVES bobhawkin@logos.com	Sept 24/21
William Thomas	William Thomas	20 Marilyn Ave williamthomas1413@outlook.com	Sept 24/21
Dolores Thomas	Dolores Thomas	thomas57144@outlook.com	Sept 24/21
Kortney Thomas	Kortney Thomas	20 Marilyn ave S Kortneythomas@hotmail.com	Sept 24/21
TED THOMAS	TED THOMAS	20 MARILYN WASHINGTON BEACH THOMAS 5043 @ OUTLOOK.COM	SEPT 24 2021
Cindy Cleary	Cindy Cleary	32 MARILYN AVE ccleary61@icloud.com	Sept 24 2021
Mike Bollyant	Mike Bollyant	42 Marilyn Ave	Sept 24 2021
Kimberly Prince George Berny	Kimberly Prince George Berny	36 Marilyn Ave	Sept 24/21
Dean Memfee	Dean Memfee	68 Marilyn Ave S	Sept 24
Fatma Lago	Fatma Lago	66 Marilyn Ave S	Sept 24
Bruce Switzer	Bruce Switzer	72 MARILYN AVE	Sept 24

We the residents on Marilyn Ave South, George Street,
 Robert Street and Beachwood Road demand a
 permanent solution to our frequent flooding problem

Name	Signatures	Address / Email	Date
Finn Buck		72 Marilyn Ave annkimberley92@optusnet.com.au South	24 Sep 21
Brenda Martin		74 Marilyn Ave S Wassaga Beach	24 Sept 21
Janie Chaffter		82 Marilyn Ave S Wassaga Beach	Sept 24/21
Joey PASHUK		84 MARILYN AVE S. Joey.PASHUK@EMAIL.COM	SEP 24/21
Andrew Kicks		84 Marilyn Ave S kicksandrew@hotmail.com	Sept 24/21
BOES COLOGNA		86 MARILYN AVE S	SEP 24/21
Haley Piwiorak		83 Marilyn Ave S Haley.piwiorak@hotmail.com	sept 24/21
Pete Dumarcic		Petedumarcic@gmail.com	Sept 24/21
Mike Patterson		73 Marilyn Ave S.	Sept. 24/21
CINDY KERR		71 Marilyn Ave S.	sept 24/21
Keri Wellhausen		21 Marilyn Ave S	SEP 24/21

We the residents on Marilyn Ave South, George Street,
Robert Street and Beachwood Road demand a
permanent solution to our frequent flooding problem

Name	Signatures	Address / Email	Date
SALUNAS LENAUSKAS	S. Lunas	29 MARILYN slenauskas@gmail.com	
Jean Dorson	J. Dorson	55 Marilyn Ave	Sept 24/21
Leo Renda	L. Renda	27 Marilyn Ave S lalka@hotmail.com	Sept 24/21
Julie Kalka	J. Kalka	27 Marilyn Ave S leo.renda@hotmail.com	" "
LISA MARSHALL	L. Marshall	65 Marilyn Ave S leatherbylisa1995@gmail.com	
Jennifer Wilkins	J. Wilkins	77 Marilyn Ave S jennwilkins92@icloud.com	Sept 25 2021
MARTY WILKINS	M. Wilkins	77 MARILYN AVE S MARTY WILKINS ROBERTS LEN	SEPT 25/21
S. Rain	S. Rain	76 Marilyn Ave	Sept 25/21
Laura Phillips	L. Phillips	8985 Beachwood Rd	Sept 25/21
Andy Lett	A. Lett	8985 Beachwood Rd	Sept 25/21
Ray Pugh	R. Pugh		

We the residents on Marilyn Ave South, George Street,
Robert Street and Beachwood Road demand a
permanent solution to our frequent flooding problem

Name	Signatures	Address / Email	Date
MIKE THREAGER		9019 BEACHWOOD	9-25-21
Wendy Hawthorne		45 Marilyn Ave S wah216@gmail.com	27/2/21
Marilyn MRIDULA GULAB BRIJINDER		51 MARILYN AVE SOUTH a1.laplois1@gmail.com	9/27/21
Chris HOLBY		8995 BEACHWOOD LN WASAGA BEACH	9/27/21
Adam + Ann Brown Canglois adam.brown@belnet.ca		11 George Ave Wasaga Beach	9/27/21
JOE FUSCO		39 Marilyn Ave South	9/27/21
Marc Van Der Heyden		10 GEORGE AVE	9/27/21
Carrington Levan		29 George Ave	9/27/21
Will Moreau		15 George Ave carrington.levan26@gmail.com	9/28/21
Ray Brigham		26 ROBERT ST. S. WAMI957@HOTMAIL.COM	9/29/21
		22 Robert St	9-29-21

We the residents on Marilyn Ave South, George Street,
Robert Street and Beachwood Road demand a
permanent solution to our frequent flooding problem

Name	Signatures	Address / Email	Date
BRENDA + DAVID OUIMET	<i>B. Ouimet</i> <i>D. Ouimet</i>	35 Robert St. S. davidouimet@Pogers.com.	Sept 29/21
IVG NAOMI ZIEDINS	<i>[Signature]</i>	49 Robert st S lurmynaomi@gmail.com	Sept 29/21
Patricia Cameron	<i>P. Cameron</i>	8951 Beachwood Rd. 4th. patricia@nored.ca.	Oct 1/21

Appendix B – Summary of Some Recent Contacts on the Flooding

Date	Contact and Request
Various dates	Calls to Public Works regarding the flooding
January 11, 2019	<p>Dave from the Public Works Department came out to look at the problem on January 11, 2019.</p> <p>Dave indicated that it's an MTO issue not a Wasaga Beach issue.</p> <p>I sent him and Kevin Lalonde numerous pictures of the flooding and pleaded with the department to address it.</p> <p>Dave committed to working through this and that he would have a reply for me within a week. A reply was not received.</p>
January 19, 2020	<p>I sent an email to Public Works to follow up on email from Doug in Public Works who was to outline the flooding and lack of proper drainage and forward his report to the MTO.</p> <p>I requested a copy of report r but never received it, nor did I receive and acknowledgement that it had even been sent. I again requested to be informed of the steps required to permanently fix this ongoing flooding problems.</p> <p>No response received.</p>
March 11, 2021	<p>Sent an email to Mayor Nina Bifulchi informing her that 16 Marilyn Ave S, house, garage, property and street are flooded with all culverts full. I also called the emergency hotline and was told that there is too much water to be able to divert it. No action was provided by the Town.</p> <p>Mayor Bifulchi forwarded the request to Public Works.</p> <p>Public Works advised there is nothing they can do as the issue is runoff volume. A sign "Water on Road" was erected. He advised that staff and equipment remain in the area to monitor and assist with opening the ends of municipal culverts should they become plugged (with ice chunks). These culverts are operating at full flow capacity. He indicated that Emcon has also been advised of roadside drainage issues along Beachwood Road, as this remains a Provincial Highway - and Emcon is their area maintenance contractor.</p> <p>Follow-up request to the Mayor to request a permanent solution.</p>
March 12, 2021	<p>Email to Mayor Bifulchi with pictures of flooding and water damage.</p> <p>The Mayor referred the matter to Public Works.</p> <p>Requested that a proactive approach be implemented</p>
March 26, 2021	<p>Public Works department employee came out to look at the flooding problem. Emcon employee Ralph looked at flooding and was to advise.</p> <p>No action taken nor follow ups on my requests</p>
June 25, 2021	<p>With the upcoming heavy rainfall, I sent email to public works to see if there a plan to prevent Marilyn Ave South and Beachwood Avenue from flooding. I advised them of the concern that with new construction more homeowners are diverting water from their sump pits into the storm sewers which directly impacts home, garage and sheds from flooding. I expressed concern with the present</p>

Date	Contact and Request
	<p>infrastructure and that it cannot accommodate more water flows from these properties. Also flooding from Beechwood Avenue backs up into my backyard as well as my 2 neighbors. I advised of past property damage.</p> <p>I once again requested a plan to please come up with a solution to prevent further damage.</p>
June 27, 2021	Sent email to Public Works department officials with pictures of flooding. No action taken
June 29, 2021	<p>Sent email to Mayor Nina Bifulchi requesting a review of all the emails and photos I have sent to your Public Works Department.</p> <p>Kevin Lalonde opening sentence unacceptable. He states "Unfortunately, there is very little we can do, as it is a function of runoff volume (flood waters) Further he makes it clear that Beachwood is under Provincial jurisdiction so basically as I understand there is nothing your Public Works Department will do to permanently resolve this flooding issue on Marilyn Ave South, George St, Beachwood and Robert St.</p> <p>Since my property is at the lowest elevation on my street it doesn't make sense that my driveway storm drain measures 12" and the one that crosses Marilyn Ave next to this one is 16". Newer homes that are elevated higher than mine measure a minimum of 18 inches.</p> <p>I've been trying for a couple years now to have the town address the flooding at 16 Marilyn Street South. It's caused me significant effort, time and money to mitigate the damage that it is causing to my home. The Public Works department agrees that there is a problem but I can't get them to work with the MTO to come up with a permanent solution. They want me to work with the MTO. This is ridiculous and Public Works Department hasn't responded to all my email queries either.</p> <p>By way of background, I've contacted the Public Works department on numerous occasions and sent emails with pictures that show the flooding on Marilyn Street South. The water was flooded over Beachwood in front of Stayner RV camp as well. The water has nowhere to go. So, it backs sewage into my crawl space. Dave from the Public Works Department came out to look at the problem on January 11, 2019 and an employee on March 26, 2021</p> <p>In my conversations with Dave he indicated that it's an MTO issue not a Wasaga Beach issue. I've sent him and Kevin Lalonde numerous pictures of the flooding and pleaded with the department to address it. Dave committed to working through this and that he would have a reply for me within a week. That was January 11th. I sent a follow up request January 19th, 2019 To date I have not received any information or a report.</p> <p>Dave was to send an email or report to MTO about the flooding and lack of proper drainage and to provide me with a copy of that report.</p> <p>Who is responsible for ensuring that MTO gets this addressed on a timely basis? Can you please confirm that MTO was made aware of the situation and send me a copy of the report? Can you also please advise what the plan is to address this? As a taxpayer, what options do I have in order to ensure this gets dealt with? It's causing damage to my property.</p>
July 5, 2021	<p>Email from Mayor Nina to advise Mr. George Valeboncoeur is following up with your Public Works Department.</p> <p>No response from Mr. Valeboncoeur</p>

Date	Contact and Request
July 14, 2021	<p>Email to Mayor Nina to follow up on her correspondence of July 5, 2021, requesting</p> <p>1) Where is the report your Public Works Department sent to the MTO around January 11, 2019?</p> <p>2) Can you confirm this report was sent to the MTO? Did a report from the MTO get sent back in 2019? If so I would like both copies of these reports.</p> <p>3) What plan of action is the City of Wasaga Beach going to provide to rectify the flooding on Marilyn Ave South? I believe it's necessary to upgrade the present unsatisfactory infrastructure. Some options may be to dig deeper ditches and install larger storm drains. Install storm sewers. Repave and regrade the street to prevent water from travelling across the road. All of this is municipal land owned by the City of Wasaga Beach.</p> <p>I feel there should be transparency by providing me with information on past communications with t</p>
August 26, 2021	<p>Sent follow up email to Mayor</p>
September 23, 2021	<p>Email by Bob Hawkin to the Mayor to advise urgent help is needed as street is flooded as is Bob's basement and crawlspace</p> <p>The Mayor referred the message to town staff for response. Kevin sent a response.</p> <p>No redress on urgent request by town staff.</p>
October 1, 2021	<p>John Van Voorst MTO Drainage Engineer</p> <p>Awaiting Response</p>
October 1, 2021	<p>Petition submitted to Mayor Nina Bifulchi and Director of Public Works Kevin Lalonde.</p> <p>Petition represented 50 names that encompasses Marilyn Ave South, George St, Robert St and Beachwood Rd.</p> <p>MPP Jim Wilson was provided a copy of the petition package</p>
October 4, 2021	<p>Update from Mr. Lalonde's recent meeting with the MTO and advised that nothing has been received from MTO and that residents should continue to make their concerns known to them as they don't have many complaints on file. In response to our request Mr. Lalonde also provided contact information for MTO. MTO contacts below.</p> <p>Manager, Grobel, Lukasz (MTO) Lukasz.Grobel@ontario.ca</p> <p>Project Engineer, Salim Noorulain (MTO) Noorulain.Salim@ontario.ca</p> <p>Road Superintendent, Watkinson, Shawn (MTO) Shawn.Watkinson@ontario.ca</p> <p>Drainage Engineer, Van Voorst, John (MTO) John.VanVoorst@Ontario.ca</p> <p>Emailed all 4 MTO staff. Awaiting Response.</p>

Date	Contact and Request
October 12, 2021	<p>October 12, 2021 Honourable Greg Rickford Minister of Northern Development, Mines, Natural Resources and Forestry</p> <p>Sent by email: greg.rickford@pc.ola.org</p> <p>Copy To: Hon. Caroline Mulroney Minister of Transportation Sent by email: minister.mto@ontario.ca</p> <p>Letter in Appendix D</p> <p>Minister Mulroney's office acknowledged receipt on October 12, 2021 indicating that it would forward the letter to the appropriate office. Received reply from his constituency office providing his mail address as Minister. Sent request to Minister's office.</p> <p>Resent to minister.mnrf@ontario.ca October 18, 2021. Awaiting response.</p>
October 12, 2021	<p>Doug Herron Director of Planning & Economic Initiatives Town of Wasaga Beach 30 Lewis Street, Wasaga Beach Ontario, Canada L9Z 1A1 Sent by email from City of Wasaga Beach website</p> <p>Sent email via Wasaga Beach website. See Appendix D</p> <p>Awaiting response</p>
October 14, 2021	<p>Mr. Mark Hartley, Senior Engineer Nottawasaga Valley Conservation Authority 8195 8th Line, Utopia, Ontario L0M 1T0</p> <p>Mr. John Van Voorst MTO Drainage Engineer John.VanVoorst@ontario.ca</p> <p>Mr. Lukasz Grobel MTO Manager Lukasz.Grobel@ontario.ca</p> <p>Mr. Noorulain Salim MTO Project Engineer Noorulain.Salim@ontario.ca</p> <p>Mr. Shawn Watkinson MTO Roads Superintendent Shawn.Watkinson@ontario.ca</p> <p>minister.mto@ontario.ca, jwilson-co@ola.org, John.VanVoorst@ontario.ca, Lukasz.Grobel@ontario.ca, Noorulain.Salim@ontario.ca, Shawn.Watkinson@ontario.ca</p> <p>Emailed on behalf of petitioners regarding the Pretty River Dyke Maintenance Vegetation removal plan. It was stated the concept is "to protect the residence and properties in urbanized areas " from flooding. That same plan is required here in my neighbourhood of Wasaga Beach. Climate change as</p>

Date	Contact and Request
	<p>well creates a disastrous situation. New property developments will put added pressure on our outdated and inefficient water drainage infrastructure in Wasaga Beach.</p> <p>Help to permanently resolve our frequent flooding problems is needed now! The email also included the petition, pictures and a copy of email sent to provincial ministers.</p>

Appendix C – Photos of Flooding

January 11, 2020. You can see that the road culverts are completely flooded.





Photos of flooding taken January 11, 2020



Submission to Council

Residents of Marilyn Ave S, George Street
Robert Street, Beachwood Road

- 19 -
October 2021



Submission to Council

Residents of Marilyn Ave S, George Street
Robert Street, Beachwood Road

- 20 -
October 2021



Backyard flooding. March 11, 2021



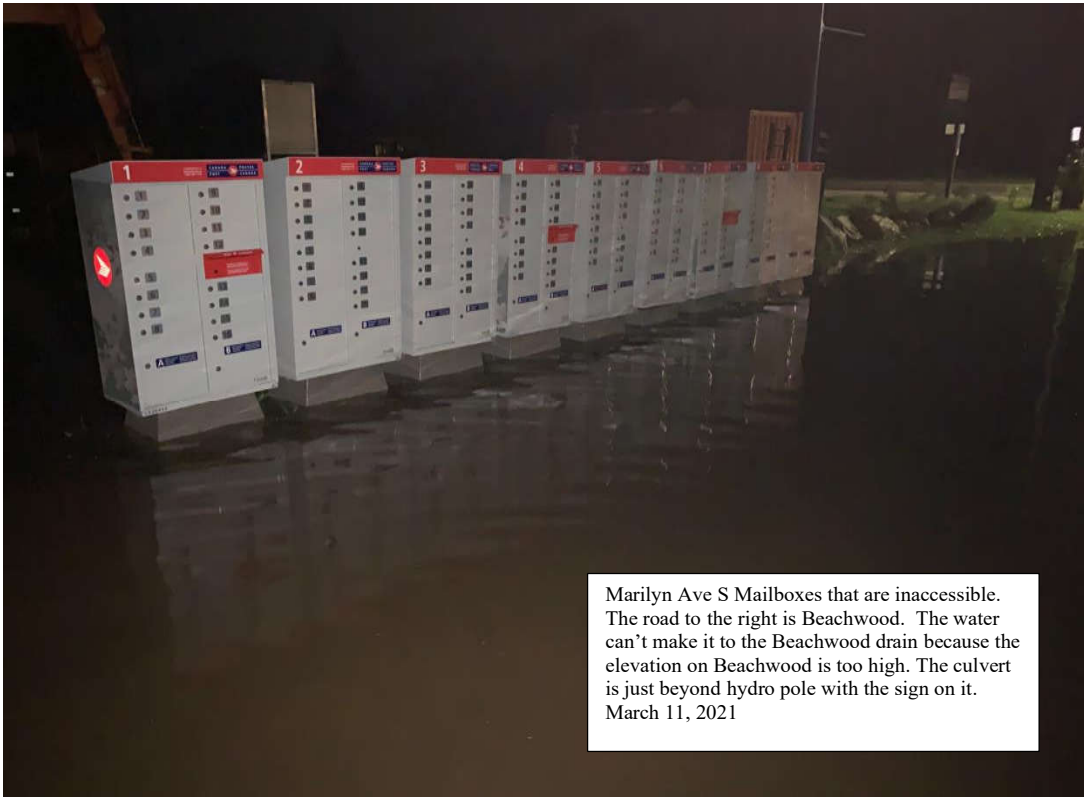
Stayner Travel Trailer Ltd on Beachwood Road. The drains are backed-up. Marilyn Ave S is just beyond that last trailer. The water can't make it to/through the culverts.



Marilyn Avenue South March 11, 2021. The road is underwater. The picture is taken from inside the garage at 16 Marilyn Ave S. Note the hydro substation.



Marilyn Avenue South March 11, 2021



June 27, 2021 Flooding. Mailboxes are not accessible without standing in the water. Roads flooded again. These photos were taken after water had subsided somewhat.



Submission to Council

Residents of Marilyn Ave S, George Street
Robert Street, Beachwood Road

- 24 -
October 2021

Photos of September 23, 2021
Back Yard Flooding



Submission to Council

Residents of Marilyn Ave S, George Street
Robert Street, Beachwood Road

- 25 -
October 2021



September 23, 2021, Marilyn Ave S flooded again. Note the driveway flooding, the depth of the water and how it is encroaching on the house on the right and this is after the storm had subsided. The flooding was worse but we don't have a picture of that.



Photo taken Oct 18, 2021 on Marilyn Ave North looking towards Georgian Bay. The pumping station is on the left side at the end of the street.



Photo taken from Marilyn Ave North looking at stop sign at Beachwood. Note the steep slope towards Georgian Bay. This shows the possibility that a drain on both sides of Marilyn may enable the water to flow down towards that Bay.

Appendix D – Letter to Honourable Greg Rickford and Honourable Caroline Mulroney

October 12, 2021 (resent October 18, 2021)

Honourable Greg Rickford
Minister of Northern Development, Mines, Natural Resources and Forestry
Sent by email: minister.mnrf@ontario.ca

Dear Honourable Minister Rickford,

I am writing to seek your assistance in an unaddressed sustained flooding matter that is posing threat to people, property and the environment. I am writing on behalf of myself and 50 of my neighbours who are directly impacted.

I read with great interest Ontario's flooding strategy, particularly the mitigation strategy that involves multiple government authorities working together to mitigate flooding issues. My challenge is finding the appropriate authority who will lead a resolution to a systemic flooding issue in our neighbourhood that results in basements being flooded multiple times a year, roads that are not passable because of water issues, garages that are flooded, mold issues, property damage, and stagnant water that has no where to drain. One of our neighbours has a disability and relies on his electric wheelchair to get around. The flooding on the roads makes it impassable and dangerous for him. The flooding in houses and garages poses huge electrical and other health threats to residents, many of whom have young children. The flooding approaches the hydro substation. Although I only moved into the neighbourhood in 2017 I'm told by the neighbours that they have been trying to get it solved for at least 10 years. In the last two years we have had four major floods.

I have been pursuing a solution to the issue for the past 3 years.

The source of the problem is insufficient drainage from a provincial road that impacts a township road. The township has sent requests to MTO who continue to sit on the matter indicating that they haven't received many complaints. I submitted a petition to council on behalf of 50 residents. Every home owner I contacted signed this petition and there were many more homes I didn't visit. The flooding is exacerbated by the township's continued approval for more housing in this area putting even more strain on this drainage without solving the problem first.

By way of background, I live in Wasaga Beach and have made numerous attempts to have the flooding issues resolved by the township but to no avail. I keep getting told that it is a provincial matter. But the province has done nothing to address it in spite of having been reported to MTO and their road contractor. I've contacted my MPP and MTO but have not received any response as yet. Since 2019 I have made multiple requests to have this addressed. I've sent pictures of the flooding so that they are aware of the extent of the damage. I've made urgent requests for help when the flooding occurs but I get only excuses, absolutely no action.

On behalf of myself and other area residences we are seeking a permanent solution to this constant problem. The solution to the problem seems to be to have the culverts extended under Beachwood Rd on both sides of Marilyn Ave South to Marilyn Ave North. Currently the water has to travel along Beechwood Road to Robert Street before it gets diverted. Also the water from George Street travels in the same direction. In my particular case, previous owners on Beechwood filled in the culvert behind their home and I am experiencing flooding throughout my backyard as well.

The fact that this hasn't been addressed for over 10 years is incomprehensible as is that fact that neither the Town of Wasaga Beach nor the province are stepping up to address the source of the problem or the damage it has caused.

Submission to Council

Residents of Marilyn Ave S, George Street
Robert Street, Beachwood Road

- 28 -
October 2021

I am including some pictures of flooding on March 11, 2021 and September 23, 2021 so that you can get a sense of what we are facing. For example, I had 5" of water in my garage from the September storm and 7" on March 11, 2021 from an early thaw.

We really need your help getting a solution and finding who is ultimately responsible for leading the various government bodies responsible for the matter. I would welcome an email response or phone call at your earliest convenience as I will be presenting the petition to the City of Wasaga Beach's council on October 26, 2021.

Yours truly

Bob Hawkin

On behalf of the residents of Marilyn Ave South, George St, Robert St and Beachwood Rd,
Wasaga Beach, 705-308-7555 16 Marilyn Ave South L9Z 2X9

Copy: Hon. Caroline Mulroney, Minister of Transportation

Appendix E – Letter to Doug Herron, Town of Wasaga Beach

October 12, 2021

Doug Herron
Director of Planning & Economic Initiatives
Town of Wasaga Beach
30 Lewis Street, Wasaga Beach
Ontario, Canada L9Z 1A1
Sent by email from City of Wasaga Beach website

Dear Mr. Herron,

I am writing to seek your assistance in an unaddressed sustained flooding matter that is posing threat to people, property and the environment. I am writing on behalf of myself and 50 of my neighbours who are directly impacted. We are making a submission and presentation to City Council on October 26, 2021. We are resident of the City of Wasaga Beach in the area of Marilyn Ave South, George St, Robert St and Beachwood Road.

We have been dealing with flooding issues for over ten years. The City has taken no action to address either the urgent impacts of the flooding or the sustained damage. There has been no corrective action take to address the road flooding, other than referring the matter to MTO.

We note that the Planning Department continues to approve development in the area without seeming to take corrective measures to address the flooding. The additional housing seems to add to the flooding burden.

Can you please inform us of any analysis of the flooding impact that was done by your department before development proposals were approved in this area? Can you also please advise of any mitigative strategies or recommendations that were made to address the systemic problems?

The systemic flooding issue in our neighbourhood results in basements being flooding multiple times a year, roads that are not passable because of water issues, garages that are flooded, mold issues, property damage, and stagnant water that has no where to drain. One of our neighbours has a disability and relies on his electric wheelchair to get around. The flooding on the roads makes it impassable and dangerous for him. The mail pick up area gets flooded making it impossible for us to retrieve mail. The flooding in houses and garages poses huge electrical and other health threats to residents, many of whom have young children. Although I only moved into the neighbourhood in 2017, I'm told by the neighbours that they have been trying to get it solved for at least 10 years. I have been pursuing a solution to the issue since 2019

The source of the problem seems to be insufficient drainage from a provincial road that impacts a township road. The township has sent requests to MTO who continue to sit on the matter indicating that they haven't received many complaints. I submitted a petition to council on behalf of 50 residents. The flooding is exacerbated by the township's continued approval for more housing in this area putting even more strain on this drainage without solving the problem first.

I have made numerous attempts to have the flooding issues resolved by the roads department but to no avail. I keep getting told that it is a provincial matter. But the province has done nothing to address it in spite of having been reported to MTO and their road contractor. I've contacted my MPP and MTO but have not received any response as yet. Since 2019 I have made multiple requests to the City and most recently to the Mayor to have this addressed. I've sent pictures of the flooding so that they are aware of the extent of the damage. I've made urgent requests for help when the flooding occurs but I get only excuses, absolutely no action. Most recently, I have sent requests to the Minister of Transportation and the Minister of Northern Development, Mines, Natural Resources and Forestry.

Submission to Council

Residents of Marilyn Ave S, George Street
Robert Street, Beachwood Road

- 30 -
October 2021

On behalf of myself and other area residences we are seeking a permanent solution to this constant problem. The solution to the problem seems to be to have the culverts extended under Beachwood Rd on both sides of Marilyn Ave South to Marilyn Ave North. Currently the water has to travel along Beechwood Road to Robert Street before it gets diverted. Also the water from George Street travels in the same direction. In my particular case, previous owners on Beechwood filled in the culvert behind their home and I am experiencing flooding throughout my backyard as well. I'm uncertain whether that was required to be done under permit, but the impact has been significant.

The fact that this flooding issue hasn't been addressed for over 10 years is incomprehensible to me as is that fact that neither the City of Wasaga Beach nor the province are stepping up to address the source of the problem or the damage it has caused.

I am including some pictures of recent flooding of September 23, 2021 so that you can get a sense of what we are facing. For example, I had 5" of water in my garage from that storm and 7" on March 11, 2021.

I would welcome an email response or phone call at your earliest convenience as I would like know in advance of my presentation to Council on October 26th, of any analysis done by the Planning Department to address the flooding in our area.

Yours truly

Bob Hawkin
On behalf of the residents of
Marilyn Ave South, George St, Robert St and Beachwood Rd, Wasaga Beach
705-308-7555
16 Marilyn Avenue South
Wasaga Beach, ON
L9Z 2X9

Appendix F – Letter to Mark Hartley, Nottawasaga Valley Conservation Authority

October 14, 2021

Mr. Mark Hartley, Senior Engineer
Nottawasaga Valley Conservation Authority
8195 8th Line, Utopia, Ontario
L0M 1T0

Attention: Mr. Hartley

Copy To: minister.mto@ontario.ca
jwilson-co@ola.org
John.VanVoorst@ontario.ca
Lukasz.Grobel@ontario.ca
Noorulain.Salim@ontario.ca
Shawn.Watkinson@ontario.ca

Subject: Frequent flooding in Wasaga Beach on 4 Streets: Marilyn Ave South, Robert St, George St and Beachwood Rd 4 pics attached

I am writing to seek your assistance in an unaddressed sustained flooding matter that is posing threat to people, property and the environment. I am writing on behalf of myself and 50 of my neighbours who are directly impacted. This petition was received by the City of Wasaga Beach and our MPP Hon. Mr. Jim Wilson on October 1, 2021. Also, stakeholders that have been informed are as follows with this same email. As of today's date October 14, 2021 have received no reply from any of these individuals.

Mr. John Van Voorst MTO Drainage Engineer
John.VanVoorst@ontario.ca

Mr. Lukasz Grobel MTO Manager
Lukasz.Grobel@ontario.ca

Mr. Noorulain Salim MTO Project Engineer
Noorulain.Salim@ontario.ca

Mr. Shawn Watkinson MTO Roads Superintendent
Shawn.Watkinson@ontario.ca

I received your letter regarding the Pretty River Dyke Maintenance Vegetation removal plan. It was stated the concept is "to protect the residence and properties in urbanized areas. " from flooding. That same plan is required here in my neighbourhood of Wasaga Beach.

Climate change as well creates a disastrous situation. New property developments will put added pressure on our outdated and inefficient water drainage infrastructure in Wasaga Beach. Help to permanently resolve our frequent flooding problems is needed now!

Here is the email I sent on behalf of our petitioners.

I read with great interest Ontario's flooding strategy, particularly the mitigation strategy that involves multiple government authorities working together to mitigate flooding issues. My challenge is finding the appropriate authority who will lead a resolution to a systemic flooding issue in our neighbourhood that results in basements being flooded multiple times a year, roads that are not passable because of water issues, garages that are flooded, mold issues, property damage, and stagnant water that has no where to drain. One of our neighbours has a disability and relies on his electric wheelchair to get around. The flooding on the roads makes it impassable and dangerous for him. The flooding in houses and garages

Submission to Council

Residents of Marilyn Ave S, George Street
Robert Street, Beachwood Road

- 32 -
October 2021

poses huge electrical and other health threats to residents, many of whom have young children. Although I only moved into the neighbourhood in 2017 I'm told by the neighbours that they have been trying to get it solved for at least 10 years. I have been pursuing a solution to the issue for the past 3 years.

The source of the problem is insufficient drainage from a provincial road that impacts a township road. The township has sent requests to MTO who continue to sit on the matter indicating that they haven't received many complaints. I submitted a petition to council on behalf of 50 residents. Every home owner I contacted signed this petition and there were many more homes I didn't visit. The flooding is exacerbated by the township's continued approval for more housing in this area putting even more strain on this drainage without solving the problem first.

By way of background, I live in Wasaga Beach and have made numerous attempts to have the flooding issues resolved by the township but to no avail. I keep getting told that it is a provincial matter. But the province has done nothing to address it in spite of having been reported to MTO and their road contractor. I've contacted my MPP and MTO but have not received any response as yet. Since 2019 I have made multiple requests to have this addressed. I've sent pictures of the flooding so that they are aware of the extent of the damage. I've made urgent requests for help when the flooding occurs but I get only excuses, absolutely no action.

On behalf of myself and other area residences we are seeking a permanent solution to this constant problem. The solution to the problem seems to be to have the culverts extended under Beachwood Rd on both sides of Marilyn Ave South to Marilyn Ave North. Currently the water has to travel along Beechwood Road to Robert Street before it gets diverted. Also the water from George Street travels in the same direction. In my particular case, previous owners on Beechwood filled in the culvert behind their home and I am experiencing flooding throughout my backyard as well.

The fact that this hasn't been addressed for over 10 years is incomprehensible as is that fact that neither the City of Wasaga Beach nor the province are stepping up to address the source of the problem or the damage it has caused.

I am including some pictures of recent flooding of September 23, 2021 so that you can get a sense of what we are facing. For example, I had 5" of water in my garage from that storm and 7" on March 11, 2021 from an early thaw.

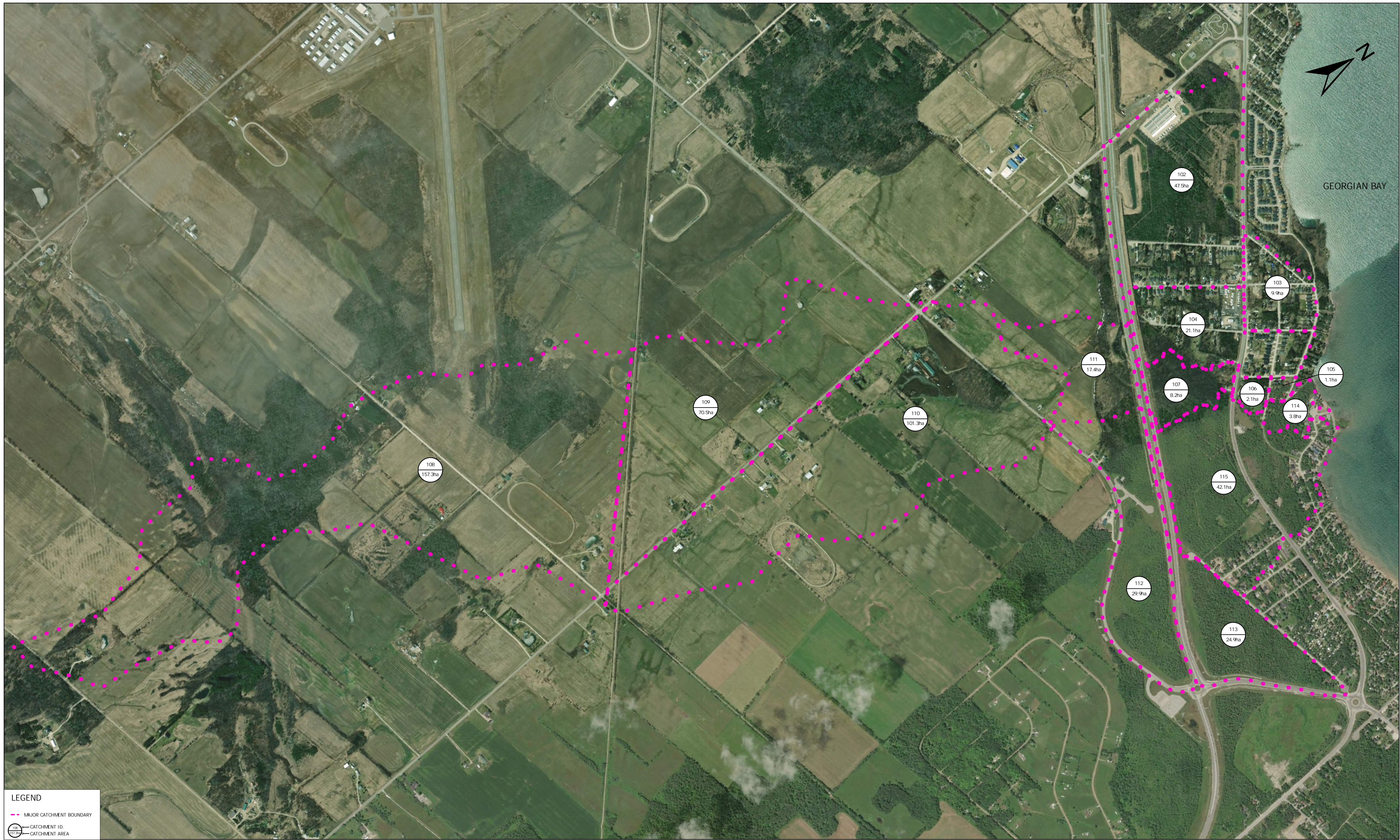
We really need your help getting a solution and finding who is ultimately responsible for leading the various government bodies responsible for the matter. I would welcome an email response or phone call at your earliest convenience as I will be presenting the petition to the City of Wasaga Beach's council on October 26, 2021.

Yours truly

Bob Hawkin

On behalf of the residents of
Marilyn Ave South, George St, Robert St and Beachwood Rd, Wasaga Beach
705-308-7555 16 Marilyn Ave South L9Z 2X9

Appendix B: Supporting Maps/Drawings



LEGEND

- - - MAJOR CATCHMENT BOUNDARY
- CATCHMENT ID
- CATCHMENT AREA



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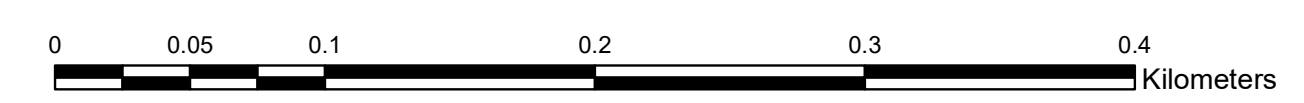
No.	REVISION DESCRIPTION	DATE	ENGINEERS STAMP
1.	FIRST SUBMISSION	JUN. 2022	
2.	SECOND SUBMISSION	JUL. 2022	

**TOWN OF WASAGA BEACH
 MASTER DRAINAGE STUDY**

**WEST END DRAINAGE ASSESSMENT
 OVERALL DRAINAGE PLAN**

TATHAM ENGINEERING

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DRAWN: KKS	DATE: JUN 2022	ODP - 1
CHECK: DRT	SCALE: 1:7,500	



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**TOWN OF WASAGA BEACH
 MASTER DRAINAGE STUDY**
 WEST END DRAINAGE ASSESSMENT
 SUBCATCHMENT DRAINAGE PLAN

TATHAM ENGINEERING

DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN 2022	ODP-2
CHECK: DRT	SCALE: 1:2,500	



CULVERT ID	MATERIAL	TYPE	LENGTH (M)	DIMENSION (M)
1	CSP	CIRCULAR	17.3	2.0x0.4m
2	CSP	ARCH	6.1	0.9m x 0.81m
3	CSP	ARCH	6.8	0.9m x 0.81m
4	CSP	CIRCULAR	7.1	0.85m
5	CSP	CIRCULAR	8.4	0.85m
6	CSP	CIRCULAR	17.9	0.925m
7	CSP	CIRCULAR	32.7	0.9m
8	CSP	CIRCULAR	8.1	0.6m
9	CSP	CIRCULAR	8.6	0.6m
10	CSP	CIRCULAR	13.7	0.6m
11	CSP	CIRCULAR	9.5	0.4m
12	CSP	CIRCULAR	9	0.4m
13	CSP	CIRCULAR	9.3	0.4m
14	CSP	CIRCULAR	11.3	0.6m
15	CSP	CIRCULAR	13.5	0.6m
16	CSP	CIRCULAR	11.5	0.4m
17	CSP	CIRCULAR	15.9	0.4m
18	CSP	CIRCULAR	9.3	0.4m
19	CSP	CIRCULAR	9.6	0.4m
20	CSP	CIRCULAR	27	0.3m
21	CSP	CIRCULAR	13.9	0.6m
22	CSP	CIRCULAR	15.9	0.6m
23	CSP	CIRCULAR	22.2	1.12m x 1.02m
24	CSP	BOX	5.3	0.7m
25	CSP	CIRCULAR	5.3	0.7m

CULVERT ID	MATERIAL	TYPE	LENGTH (M)	DIMENSION (M)
26	CSP	CIRCULAR	5.3	0.7m
27	CSP	CIRCULAR	5.3	0.7m
28	CSP	CIRCULAR	5.3	0.7m
29	CSP	CIRCULAR	5.6	0.7m
30	CSP	CIRCULAR	5.4	0.7m
31	CSP	CIRCULAR	5.5	0.7m
32	CSP	CIRCULAR	5.3	0.7m
33	CSP	CIRCULAR	13.2	0.6m
34	CSP	CIRCULAR	15.2	0.625m
35	CSP	CIRCULAR	21.1	0.75m
36	CSPA	CIRCULAR	22.1	2.13m x 1.4m
38	CSP	CIRCULAR	22.4	1.25m x 0.9m
39	CSP	CIRCULAR	6.9	1.2m
40	CSP	ARCH	11.4	2.0m x 1.0m
41	CSP	ARCH	11.6	2.0m x 1.0m
42	CSP	ARCH	11.8	2.0m x 1.0m
43	CSP	ARCH	10.2	2.0m x 1.0m
44	CSP	CIRCULAR	19.2	0.45m
45	CSP	CIRCULAR	18.6	0.4m
46	CSP	CIRCULAR	13	0.65m
47	CONC	BOX	19.8	1.22m x 0.8m
48	CSP	ARCH	14.2	1.39m x 0.97m
49	CSP	CIRCULAR	11.6	1.39m x 0.97m
50	CSP	CIRCULAR	13.4	0.65m
51	CSP	ARCH	11.2	2.0m x 1.0m

CULVERT ID	MATERIAL	TYPE	LENGTH (M)	DIMENSION (M)
52	CSP	ARCH	7.6	2.0m x 1.13m
53	CSP	CIRCULAR	7.1	0.65m
54	CSP	ARCH	10.2	1.88m x 1.26m
55	CSP	CIRCULAR	8.3	0.4m
56	CSP	CIRCULAR	9.9	0.4m
57	CSP	CIRCULAR	8	0.4m
58	CSP	CIRCULAR	11.1	0.4m
59	CSP	CIRCULAR	8.6	0.4m
60	CSP	CIRCULAR	7.8	0.4m
61	CSP	CIRCULAR	22.5	0.4m
62	CSP	CIRCULAR	9.2	0.4m
63	CSP	CIRCULAR	9.3	0.4m
64	CSP	CIRCULAR	30.9	0.4m
65	CSP	CIRCULAR	11.3	0.4m
66	CSP	CIRCULAR	13.7	0.4m
67	CSP	CIRCULAR	8.1	0.4m
68	CSP	CIRCULAR	8.1	0.4m
69	CSP	CIRCULAR	7.3	0.4m
70	CSP	CIRCULAR	8.5	0.4m
71	CSP	CIRCULAR	9.2	0.4m
72	CSP	CIRCULAR	11.5	0.4m
73	CSP	CIRCULAR	11.8	0.4m
74	CSP	CIRCULAR	10.8	0.4m
75	CSP	CIRCULAR	9	0.4m
76	CSP	CIRCULAR	13.8	0.4m

CULVERT ID	MATERIAL	TYPE	LENGTH (M)	DIMENSION (M)
77	CSP	CIRCULAR	4.1	0.4m
78	CSP	CIRCULAR	7.1	0.4m
79	CSP	CIRCULAR	9.1	0.4m
80	CSP	CIRCULAR	8.3	0.4m
81	CSP	CIRCULAR	8.1	0.4m
82	CSP	CIRCULAR	16.1	0.4m
83	CSP	CIRCULAR	14.1	0.4m
84	CSP	CIRCULAR	8.7	0.4m
85	CSP	CIRCULAR	14.5	0.4m
86	CSP	CIRCULAR	8.4	0.4m
87	CSP	CIRCULAR	18.7	0.4m
88	CSP	CIRCULAR	16.3	0.4m
89	CSP	CIRCULAR	8.2	0.4m
90	CSP	CIRCULAR	12.6	0.4m
91	CSP	CIRCULAR	9.3	0.4m
92	CSP	CIRCULAR	9.2	0.4m
93	CSP	CIRCULAR	8.5	0.4m
94	CSP	CIRCULAR	8.6	0.4m
95	CSP	CIRCULAR	7	0.6m
96	CSP	CIRCULAR	6.9	0.6m
97	CSP	CIRCULAR	8.9	0.6m
98	CSP	CIRCULAR	8.1	0.6m
99	CSP	CIRCULAR	9.3	0.6m
100	CSP	CIRCULAR	11	0.6m
101	CSP	CIRCULAR	8.8	0.4m

CULVERT ID	MATERIAL	TYPE	LENGTH (M)	DIMENSION (M)
102	CSP	CIRCULAR	11.2	0.4m
103	CSP	CIRCULAR	10.2	0.4m
104	CSP	CIRCULAR	12.2	0.4m
105	CSP	CIRCULAR	9.6	0.4m
106	CSP	CIRCULAR	8.6	0.4m
107	CSP	CIRCULAR	12.2	0.4m
108	CSP	CIRCULAR	19.9	0.4m
109	CSP	CIRCULAR	11.2	0.4m
110	CSP	CIRCULAR	11.1	0.4m
111	CSP	CIRCULAR	6.9	0.6m
112	CSP	CIRCULAR	9.5	0.4m
113	CSP	ARCH	14.3	1.63m x 1.12m
114	CSP	ARCH	25.6	1.88m x 1.26m
115	CSP	CIRCULAR	10.5	0.4m
116	CSP	ARCH	9.2	1.88m x 1.26m
117	CSP	CIRCULAR	0.6	0.625m
118	CSP	CIRCULAR	8.4	0.3m
119	CSP	CIRCULAR	11.8	0.3m
120	CONC	CIRCULAR	16.7	0.92m
121	CONC	CIRCULAR	88.1	0.6m
122	CONC	CIRCULAR	18.1	0.6m
123	CSP	CIRCULAR	34.1	0.9m
124	CSP	CIRCULAR	9.1	0.6m
125	CSP	CIRCULAR	16.4	0.45m
126	CSP	CIRCULAR	9.4	0.3m

CULVERT ID	MATERIAL	TYPE	LENGTH (M)	DIMENSION (M)
127	CSP	CIRCULAR	6.5	0.25m
128	HDPE	CIRCULAR	38.7	0.4m
129	HDPE	CIRCULAR	36.1	0.4m
131	CSP	CIRCULAR	7.6	2x0.35m
132	HDPE	CIRCULAR	68.1	0.8m
133	CSP	CIRCULAR	38.4	0.6m
134	PVC	CIRCULAR	13.8	0.3m
135	CSP	CIRCULAR	9.1	1.0m
136	CONC	CIRCULAR	40.2	0.8m
137	CSP	CIRCULAR	16.6	0.6m
138	CSP	CIRCULAR	7.8	0.4m
139	CSP	CIRCULAR	9.3	0.4m
140	CSP	CIRCULAR	7.7	0.4m
141	CSP	CIRCULAR	7.8	0.4m
142	HDPE	CIRCULAR	55.7	0.45m
143	CSP	CIRCULAR	7.8	0.15m
144	CONC	CIRCULAR	17.1	0.9m

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2.	SECOND SUBMISSION	JUL. 2022	

TOWN OF WASAGA BEACH
 MASTER DRAINAGE PLAN
 ROBERT STREET FLOOD STUDY
 CULVERT INVENTORY



DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN. 2022	CUL-1
CHECK: DRT	SCALE: 1:2,000	



LEGEND

- ↗ INFLOW BOUNDARY CONDITION
- ↗ OUTFLOW BOUNDARY CONDITION
- FLOW DIRECTION
- SUBCATCHMENT BOUNDARY
- ROAD
- 2D HYDRAULIC MODEL STUDY AREA BOUNDARY



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**TOWN OF WASAGA BEACH
 MASTER DRAINAGE STUDY**
 ROBERT STREET FLOOD STUDY
 HYDRAULIC MODEL SCHEMATIC

TATHAM ENGINEERING		DWG:
DESIGN: KKS	FILE: 120200	
DRAWN: KKS	DATE: JUN 2022	SCH - 1
CHECK: DRT	SCALE: 1:2,500	



LEGEND

- EXISTING CULVERT
- PROPOSED NEW CULVERT
- PROPOSED CULVERT UPGRADE
- FLOODPLAIN EXTENTS - EXISTING 5-YR
- FLOODPLAIN EXTENTS - PROPOSED 5-YR
- ROAD
- 2D HYDRAULIC MODEL STUDY AREA BOUNDARY



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**TOWN OF WASAGA BEACH
 MASTER DRAINAGE STUDY**
 WEST END DRAINAGE ASSESSMENT
 5YR FLOOD EXTENTS

TATHAM ENGINEERING		
DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN 2022	FLD - 5YR
CHECK: DRT	SCALE: 1:2,500	



LEGEND

- EXISTING CULVERT
- PROPOSED NEW CULVERT
- PROPOSED CULVERT UPGRADE
- FLOODPLAIN EXTENTS - EXISTING 10-YR
- FLOODPLAIN EXTENTS - PROPOSED 10-YR
- ROAD
- 2D HYDRAULIC MODEL STUDY AREA BOUNDARY



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**TOWN OF WASAGA BEACH
 MASTER DRAINAGE STUDY**

WEST END DRAINAGE ASSESSMENT
 10YR FLOOD EXTENTS



DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN 2022	FLD - 10YR
CHECK: DRT	SCALE: 1:2,500	



LEGEND

- EXISTING CULVERT
- PROPOSED NEW CULVERT
- PROPOSED CULVERT UPGRADE
- FLOODPLAIN EXTENTS - EXISTING 100-YR
- FLOODPLAIN EXTENTS - PROPOSED 100-YR
- ROAD
- 2D HYDRAULIC MODEL STUDY AREA BOUNDARY



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**TOWN OF WASAGA BEACH
 MASTER DRAINAGE STUDY**
 WEST END DRAINAGE ASSESSMENT
 100YR FLOOD EXTENTS



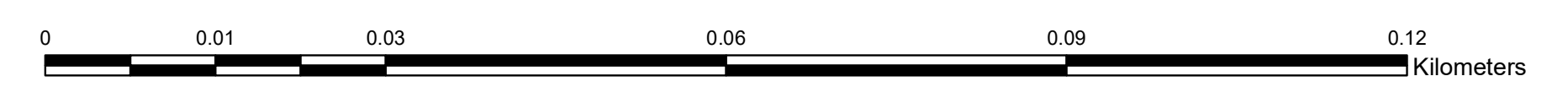
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DRAWN: KKS	DATE: JUN 2022	FLD - 100YR
CHECK: DRT	SCALE: 1:2,500	

**Appendix C:
Conceptual Improvement Plans
(Recommended Options)**



LEGEND

- EXISTING CULVERT (TO REMAIN)
- PROPOSED NEW CULVERT
- PROPOSED CULVERT UPGRADE
- - - DITCH REGRAIDING



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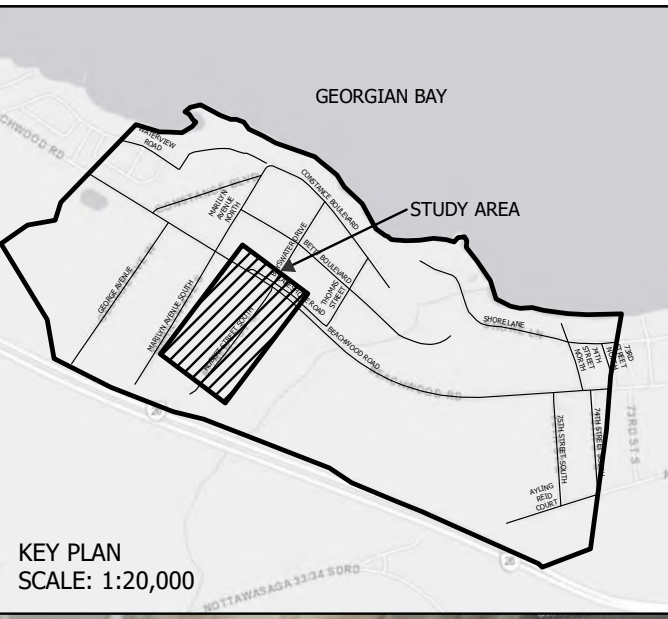
No.	REVISION DESCRIPTION	DATE	ENGINEERS STAMP
1.	FIRST SUBMISSION	JUN. 2022	
2.	SECOND SUBMISSION	JUL. 2022	

**TOWN OF WASAGA BEACH
MASTER DRAINAGE PLAN**

THOMAS STREET
CONCEPTUAL IMPROVEMENT PLAN

TATHAM ENGINEERING

DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN 2022	CIP-1
CHECK: DRT	SCALE: 1:500	



LEGEND

- EXISTING CULVERT (TO REMAIN)
- PROPOSED NEW CULVERT
- PROPOSED CULVERT UPGRADE
- - - DITCH REGRADEING



DISCLAIMER AND COPYRIGHT
 CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.
 TATHAM ENGINEERING LIMITED CLAIMS COPYRIGHT TO THIS DRAWING WHICH MAY NOT BE USED FOR ANY PURPOSE OTHER THAN THAT PROVIDED IN THE CONTRACT BETWEEN THE OWNER/CLIENT AND THE ENGINEER WITHOUT THE EXPRESS CONSENT OF TATHAM ENGINEERING LIMITED.

No.	REVISION DESCRIPTION	DATE	ENGINEERS STAMP
1.	FIRST SUBMISSION	JUN. 2022	
2.	SECOND SUBMISSION	JUL. 2022	

**TOWN OF WASAGA BEACH
 MASTER DRAINAGE PLAN**

ROBERT STREET
 CONCEPTUAL IMPROVEMENT PLAN

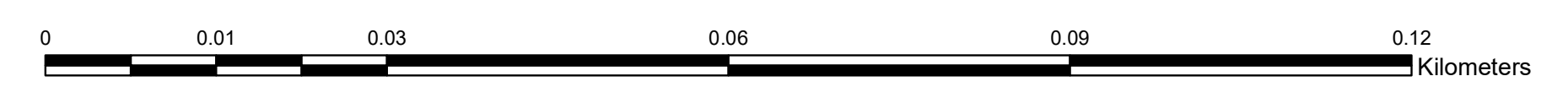
TATHAM ENGINEERING

DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN 2022	CIP-2
CHECK: DRT	SCALE: 1:500	



LEGEND

- EXISTING CULVERT (TO REMAIN)
- PROPOSED NEW CULVERT
- PROPOSED CULVERT UPGRADE
- DITCH REGRADING
- CATCH BASIN



DISCLAIMER AND COPYRIGHT
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No.	REVISION DESCRIPTION	DATE	ENGINEERS STAMP
1.	FIRST SUBMISSION	JUN. 2022	
2.	SECOND SUBMISSION	JUL. 2022	

**TOWN OF WASAGA BEACH
 MASTER DRAINAGE PLAN**

BAYSWATER STREET
 CONCEPTUAL IMPROVEMENT PLAN

TATHAM ENGINEERING

DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN 2022	CIP-3
CHECK: DRT	SCALE: 1:500	



DISCLAIMER AND COPYRIGHT
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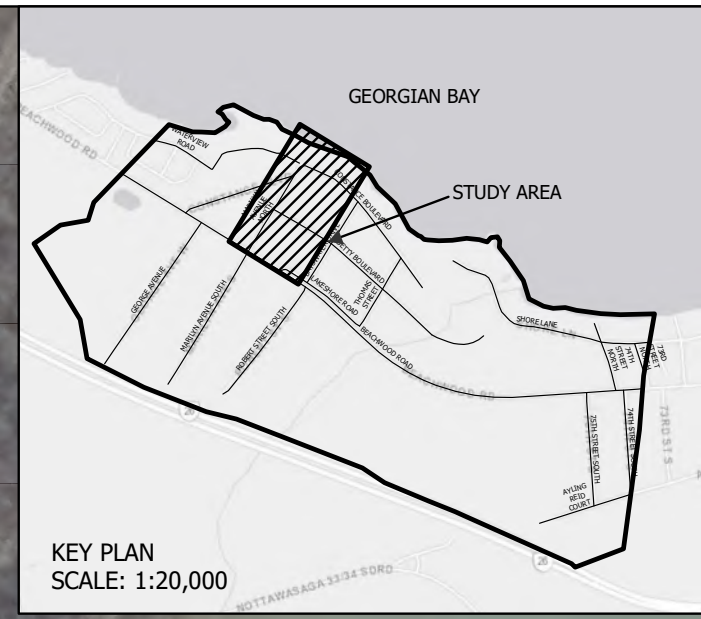
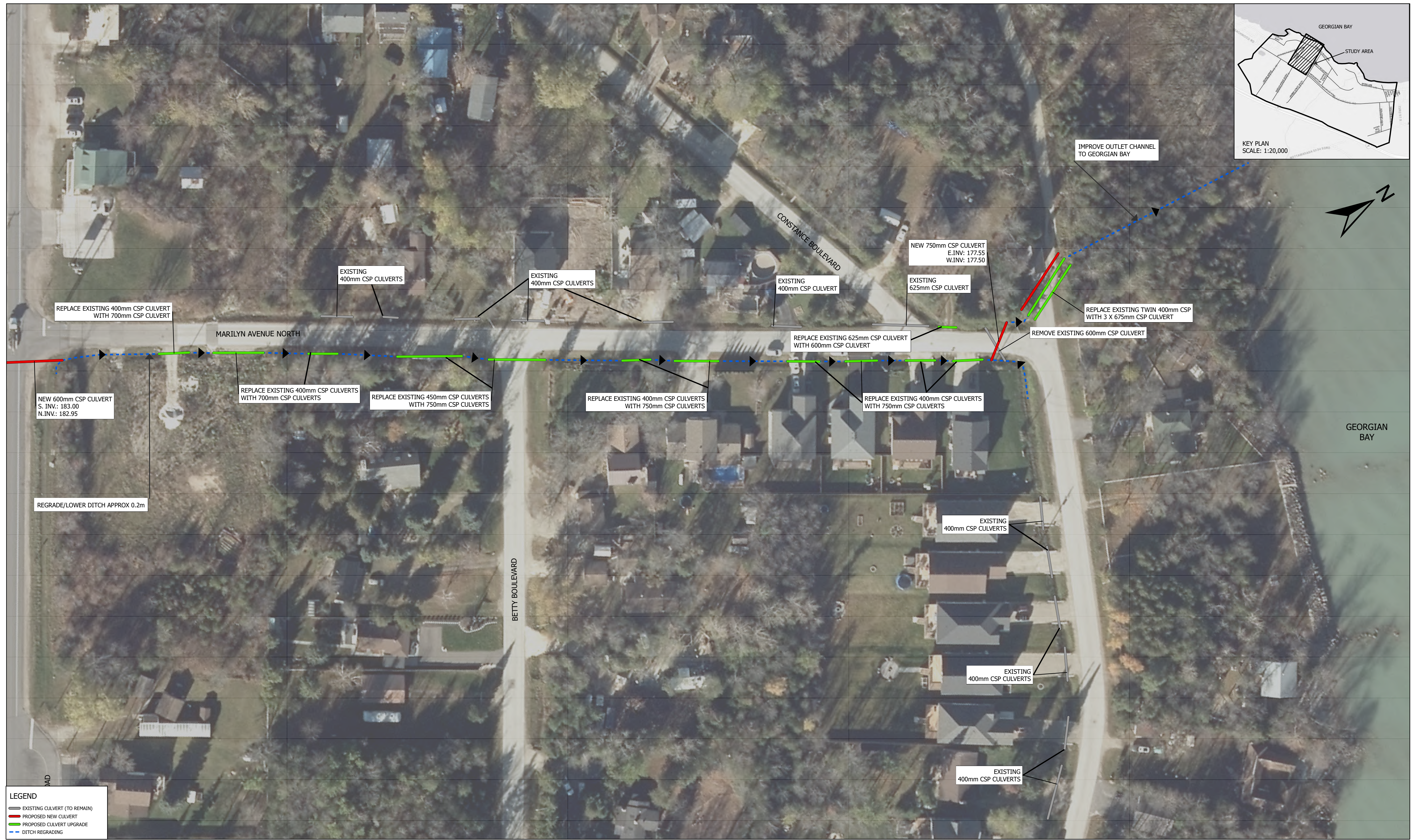
No.	REVISION DESCRIPTION	DATE	ENGINEERS STAMP
1.	FIRST SUBMISSION	JUN. 2022	
2.	SECOND SUBMISSION	JUL. 2022	

**TOWN OF WASAGA BEACH
 MASTER DRAINAGE PLAN**

MARILYN AVENUE SOUTH
 CONCEPTUAL IMPROVEMENT PLAN

TATHAM ENGINEERING

DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN 2022	CIP-4
CHECK: DRT	SCALE: 1:500	



LEGEND

- EXISTING CULVERT (TO REMAIN)
- PROPOSED NEW CULVERT
- PROPOSED CULVERT UPGRADE
- - - DITCH REGRAIDING



DISCLAIMER AND COPYRIGHT
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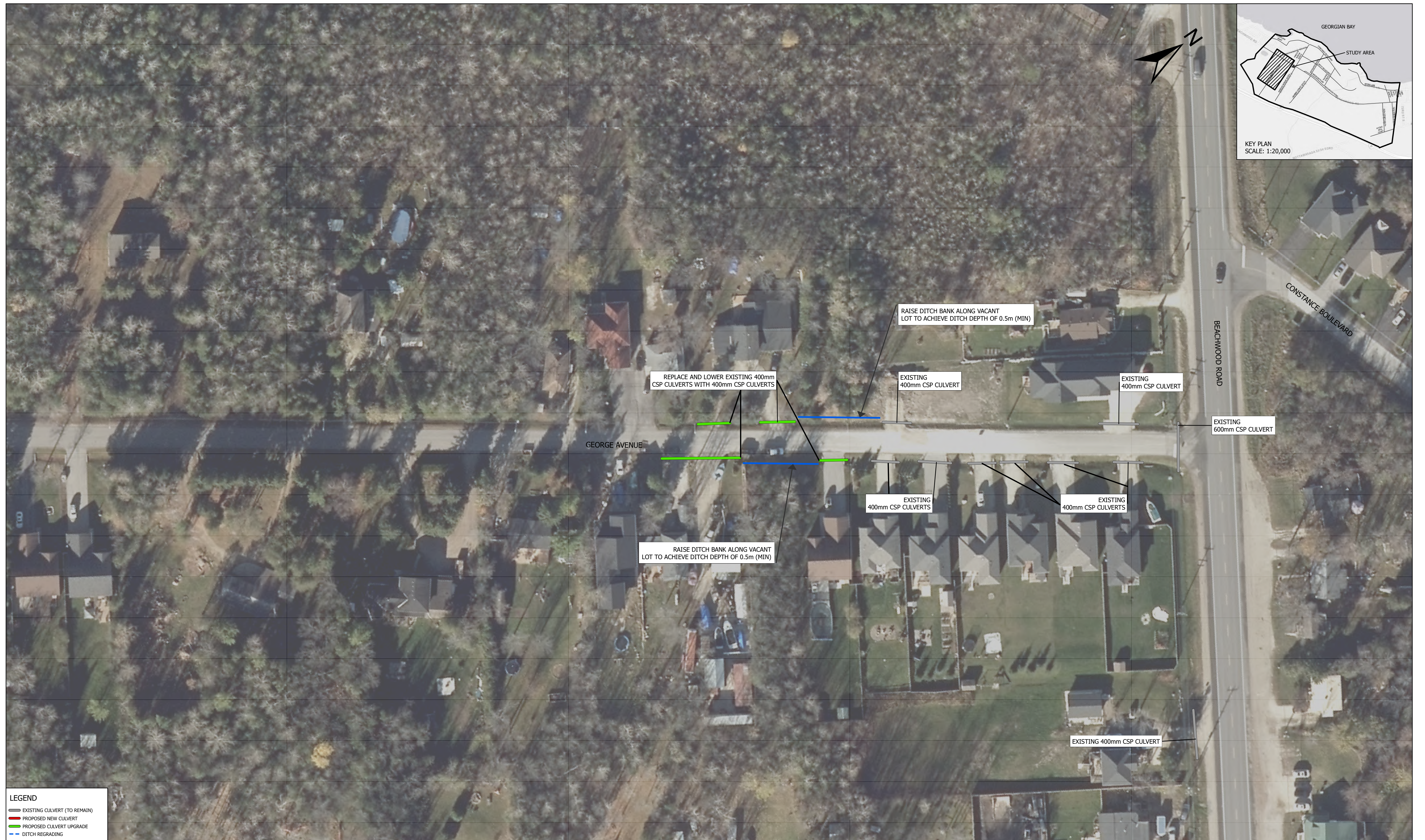
No.	REVISION DESCRIPTION	DATE	ENGINEERS STAMP
1.	FIRST SUBMISSION	JUN. 2022	
2.	SECOND SUBMISSION	JUL. 2022	

**TOWN OF WASAGA BEACH
 MASTER DRAINAGE PLAN**

MARILYN STREET NORTH
 CONCEPTUAL IMPROVEMENT PLAN

TATHAM ENGINEERING

DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN 2022	CIP-5
CHECK: DRT	SCALE: 1:500	



LEGEND

- EXISTING CULVERT (TO REMAIN)
- PROPOSED NEW CULVERT
- PROPOSED CULVERT UPGRADE
- DITCH REGRADE



DISCLAIMER AND COPYRIGHT
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2.	SECOND SUBMISSION	JUL. 2022	

**TOWN OF WASAGA BEACH
 MASTER DRAINAGE PLAN**
 GEORGE AVENUE
 CONCEPTUAL IMPROVEMENT PLAN

TATHAM ENGINEERING

DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN 2022	CIP-6
CHECK: DRT	SCALE: 1:500	



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

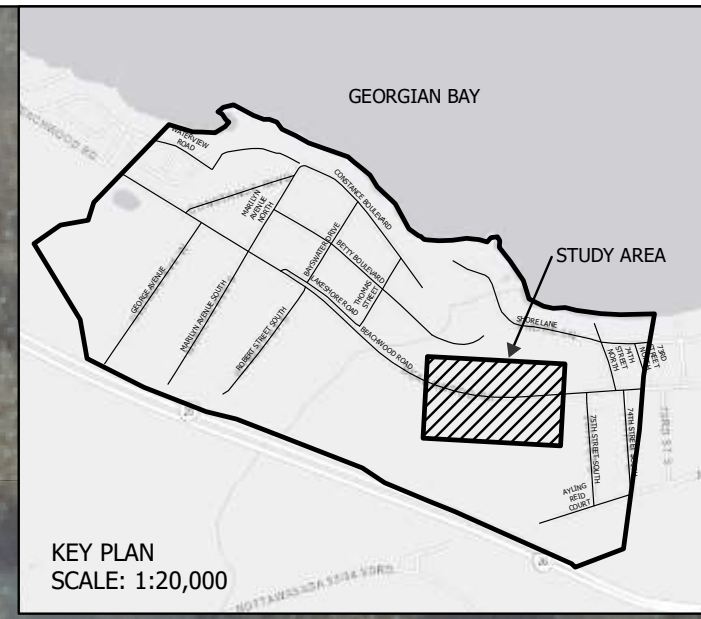
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2.	SECOND SUBMISSION	JUL. 2022	

**TOWN OF WASAGA BEACH
MASTER DRAINAGE PLAN**

DEPOT OUTLET & SHORE LANE
CONCEPTUAL IMPROVEMENT PLAN

TATHAM ENGINEERING		DWG:
DESIGN: KKS	FILE: 120200	CIP-7
DRAWN: KKS	DATE: JUN 2022	
CHECK: DRT	SCALE: 1:500	



DISCLAIMER AND COPYRIGHT
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No.	REVISION DESCRIPTION	DATE	ENGINEERS STAMP
1.	FIRST SUBMISSION	JUN. 2022	
2.	SECOND SUBMISSION	JUL. 2022	

**TOWN OF WASAGA BEACH
 MASTER DRAINAGE PLAN**

DEPOT OUTLET
 CONCEPTUAL IMPROVEMENT PLAN

TATHAM ENGINEERING

DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN 2022	CIP-8
CHECK: DRT	SCALE: 1:500	



LEGEND

- EXISTING CULVERT (TO REMAIN)
- PROPOSED NEW CULVERT
- PROPOSED CULVERT UPGRADE
- - - DITCH REGRAIDING



DISCLAIMER AND COPYRIGHT
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No.	REVISION DESCRIPTION	DATE	ENGINEERS STAMP
1.	FIRST SUBMISSION	JUN. 2022	
2.	SECOND SUBMISSION	JUL. 2022	

**TOWN OF WASAGA BEACH
 MASTER DRAINAGE PLAN**

SHORE LANE
 CONCEPTUAL IMPROVEMENT PLAN

TATHAM ENGINEERING

DESIGN: KKS	FILE: 120200	DWG:
DRAWN: KKS	DATE: JUN 2022	CIP-9
CHECK: DRT	SCALE: 1:500	

**Appendix D:
Preliminary Opinion of Probable
Costs**

PHASE 1
 MARILYN AVENUE IMPROVEMENTS

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
1.0 GENERAL ITEMS					
1.01	Mobilization & Demobilization	LS	1	\$ 20,000.00	\$ 20,000.00
1.02	Traffic Control	LS	1	\$ 2,000.00	\$ 2,000.00
SUBTOTAL GENERAL ITEMS					\$ 22,000.00
2.0 OPTION 5B - IMPROVE MARILYN AVENUE SOUTH ROADSIDE DITCHES AND DRIVEWAY CULVERTS					
2.01	Supply, Install, Maintain, & Remove Temporary Straw Bale Check Dam	ea	4	\$ 500.00	\$ 2,000.00
2.02	Remove & Dispose Existing Driveway (For Culvert Works)	ea	13	\$ 500.00	\$ 6,500.00
2.03	Supply & Install 400 mm Dia. Culvert	m	115	\$ 500.00	\$ 57,500.00
2.04	Excavate, Grade, Topsoil, & Seed Drainage Ditch	m	210	\$ 125.00	\$ 26,250.00
2.05	Remove & Dispose Existing Road Asphalt and Granulars	sq.m	25	\$ 17.00	\$ 425.00
2.06	Supply & Install 400 mm Dia. Culvert	m	10	\$ 500.00	\$ 5,000.00
2.07	Reinstate Driveways to Existing Conditions	ea	13	\$ 1,000.00	\$ 13,000.00
2.08	Reinstate Roadway (300 mm Granular 'B', 150 mm Granular 'A', 50 mm HL4 Base Course Asphalt, & 40 mm HL3 Top Course Asphalt)	sq.m.	25	\$ 102.00	\$ 2,550.00
SUBTOTAL OPTION 5B					\$ 114,000.00
3.0 OPTION 5C - INSTALL NEW CULVERT CROSSING BEACHWOOD ROAD AT MARILYN AVENUE (PER MTO STANDARDS)					
3.01	Supply, Install, Maintain, & Remove Temporary Straw Bale Check Dam	ea	4	\$ 500.00	\$ 2,000.00
3.02	Remove & Dispose Existing Road Asphalt and Granulars	sq.m	90	\$ 17.00	\$ 1,530.00
3.03	Remove & Dispose Existing Driveway (For Culvert Works)	ea	10	\$ 500.00	\$ 5,000.00
3.04	Remove & Dispose Existing Culvert (Including Culvert Headwalls)	m	125	\$ 90.00	\$ 11,250.00
3.05	Excavate, Grade, Topsoil, & Seed Drainage Ditch	m	140	\$ 125.00	\$ 17,500.00
3.06	Supply & Install 1500 mm Dia. Maintenance Hole	ea	1	\$ 12,330.00	\$ 12,330.00
3.07	Supply & Install 600 mm Dia. Culvert	m	32	\$ 800.00	\$ 25,600.00
3.08	Supply & Install 700 mm Dia. Culvert	m	60	\$ 870.00	\$ 52,200.00
3.09	Supply & Install 800 mm Dia. Culvert	m	65	\$ 1,000.00	\$ 65,000.00
3.10	Reinstate Roadway (300 mm Granular 'B', 150 mm Granular 'A', 50 mm HL4 Base Course Asphalt, & 40 mm HL3 Top Course Asphalt)	sq.m.	90	\$ 102.00	\$ 9,180.00
3.11	Reinstate Driveways to Existing Conditions	ea	10	\$ 1,000.00	\$ 10,000.00
SUBTOTAL OPTION 5C					\$ 212,000.00

TOWN OF WASGAGA BEACH DRAINAGE MASTER PLAN - WEST END DRAINAGE ASSESSMENT
PRELIMINARY OPINION OF PROBABLE COSTS



PROJECT: 120200

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT	
4.0	OPTION 5D - INSTALL NEW STORM SEWER CROSSING BEACHWOOD ROAD ALONG MARILYN AVENUE					
4.01	Supply, Install, Maintain, & Remove Temporary Straw Bale Check Dam	ea	4	\$ 500.00	\$ 2,000.00	
4.02	Remove & Dispose Existing Road Asphalt and Granulars	sq.m	90	\$ 17.00	\$ 1,530.00	
4.03	Remove & Dispose Existing Driveway (For Culvert Works)	ea	10	\$ 500.00	\$ 5,000.00	
4.04	Remove & Dispose Existing Culvert (Including Culvert Headwalls)	m	125	\$ 90.00	\$ 11,250.00	
4.05	Supply & Install 600 x 600 mm Ditch Inlet Catchbasin	ea	1	\$ 4,800.00	\$ 4,800.00	
4.06	Supply & Install 600 mm Dia. Storm Sewer	m	60	\$ 680.00	\$ 40,800.00	
4.07	Supply & Install Concrete Headwall - 600 mm Dia.	ea	1	\$ 19,830.00	\$ 19,830.00	
4.08	Excavate, Grade, Topsoil, & Seed Drainage Ditch	m	113	\$ 125.00	\$ 14,125.00	
4.09	Supply & Install 700 mm Dia. Culvert	m	52	\$ 870.00	\$ 45,240.00	
4.10	Supply & Install 800 mm Dia. Culvert	m	65	\$ 1,000.00	\$ 65,000.00	
4.11	Reinstate Roadway (300 mm Granular 'B', 150 mm Granular 'A', 50 mm HL4 Base Course Asphalt, & 40 mm HL3 Top Course Asphalt)	sq.m.	90	\$ 102.00	\$ 9,180.00	
4.12	Reinstate Driveways to Existing Conditions	ea	10	\$ 1,000.00	\$ 10,000.00	
					\$ 229,000.00	
	SUBTOTAL OPTION 5D					
5.0	OPTION 5E - INSTALL TWO 300 mm CULVERTS CROSSING BEACHWOOD ROAD AT MARILYN AVENUE					
5.01	Supply, Install, Maintain, & Remove Temporary Straw Bale Check Dam	ea	2	\$ 500.00	\$ 1,000.00	
5.02	Remove & Dispose Existing Road Asphalt and Granulars	sq.m	65	\$ 17.00	\$ 1,105.00	
5.03	Supply & Install 300 mm Dia. Culvert	m	50	\$ 420.00	\$ 21,000.00	
5.04	Excavate, Grade, Topsoil, & Seed Drainage Ditch	m	100	\$ 125.00	\$ 12,500.00	
5.05	Reinstate Roadway (300 mm Granular 'B', 150 mm Granular 'A', 50 mm HL4 Base Course Asphalt, & 40 mm HL3 Top Course Asphalt)	sq.m.	65	\$ 102.00	\$ 6,630.00	
					\$ 43,000.00	
	SUBTOTAL OPTION 5E					
6.0	OPTION 5F - IMPROVE OUTLET TO GEORGIAN BAY AT CONSTANCE BOULEVARD PUMPING STATION					
6.01	Supply, Install, Maintain, & Remove Temporary Heavy Duty Silt Fence	m	20	\$ 26.00	\$ 520.00	
6.02	Supply, Install, Maintain, & Remove Temporary Straw Bale Check Dam	ea	2	\$ 500.00	\$ 1,000.00	
6.03	Remove & Dispose Existing Road Asphalt and Granulars	sq.m	85	\$ 17.00	\$ 1,445.00	
6.04	Remove & Dispose Existing Culvert (Including Culvert Headwalls)	m	30	\$ 90.00	\$ 2,700.00	
6.05	Supply & Install 700 mm Dia. Culvert	m	45	\$ 870.00	\$ 39,150.00	
6.06	Reinstate Asphalt Driveway / Trail (50 mm Depth HL-3 Asphalt)	sq.m	85	\$ 60.00	\$ 5,100.00	
					\$ 50,000.00	
	SUBTOTAL OPTION 5F					
7.0	OPTION 5G - RAISE ROADSIDE DITCH BANKS AT FLOODING LOCATIONS					
7.01	Supply, Install, Maintain, & Remove Temporary Heavy Duty Silt Fence	m	50	\$ 26.00	\$ 1,300.00	
7.02	Supply, Place, & Compact Imported Fill for Berm	cu.m	35	\$ 35.00	\$ 1,225.00	
7.03	Reinstate Area with Topsoil & Seed	sq.m	90	\$ 15.00	\$ 1,350.00	
					\$ 4,000.00	
	SUBTOTAL OPTION 5G					
	SUBTOTAL PHASE 1 CONSTRUCTION COSTS (OPTION 5B + 5C + 5F + 5G)					\$ 402,000.00
	SUBTOTAL PHASE 1 CONSTRUCTION COSTS (OPTION 5B + 5D + 5F + 5G)					\$ 419,000.00
	SUBTOTAL PHASE 1 CONSTRUCTION COSTS (OPTION 5B + 5E + 5F + 5G)					\$ 183,000.00

TOWN OF WASGAGA BEACH DRAINAGE MASTER PLAN - WEST END DRAINAGE ASSESSMENT
 PRELIMINARY OPINION OF PROBABLE COSTS



ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
8.0 PROVISIONAL ITEMS					
8.01	Flow Diversion - Install/Uninstall	LS	2	\$ 10,000.00	\$ 20,000.00
8.02	Flow Diversion - Operation and Maintenance	day	10	\$ 1,250.00	\$ 12,500.00
8.03	Geotechnical Sampling for Off-site Disposal	per sample	2	\$ 1,500.00	\$ 3,000.00
8.04	Remove & Dispose of Contaminated Excess Material (Provisional)	cu.m	75	\$ 100.00	\$ 7,500.00
8.05	Remove & Reinstall/Relocate Existing Traffic Signs/Mail Boxes	ea	5	\$ 315.00	\$ 1,575.00
SUBTOTAL PROVISIONAL ITEMS					\$ 45,000.00
9.0 ALLOWANCE ITEMS					
9.01	Construction Contingency (OPTION 5B + 5C + 5F + 5G)			20%	\$ 89,400.00
9.02	Utilities / Services Relocation Cost (OPTION 5B + 5C + 5F + 5G)			15%	\$ 67,050.00
SUBTOTAL ALLOWANCE ITEMS (WITH OPTION 5C)					\$ 157,000.00
9.03	Construction Contingency (OPTION 5B + 5D + 5F + 5G)			20%	\$ 92,800.00
9.04	Utilities / Services Relocation Cost (OPTION 5B + 5D + 5F + 5G)			15%	\$ 76,260.00
SUBTOTAL ALLOWANCE ITEMS (WITH OPTION 5D)					\$ 170,000.00
9.05	Construction Contingency (OPTION 5B + 5E + 5F + 5G)			20%	\$ 45,600.00
9.06	Utilities / Services Relocation Cost (OPTION 5B + 5E + 5F + 5G)			15%	\$ 34,200.00
SUBTOTAL ALLOWANCE ITEMS (WITH OPTION 5E)					\$ 80,000.00
TOTAL COSTS (OPTION 5B + 5C + 5F + 5G) EXCLUDING HST (INCLUDING PROVISIONAL & ALLOWANCE ITEMS)					\$ 605,000.00
TOTAL COSTS (OPTION 5B + 5D + 5F + 5G) EXCLUDING HST (INCLUDING PROVISIONAL & ALLOWANCE ITEMS)					\$ 635,000.00
TOTAL COSTS (OPTION 5B + 5E + 5F + 5G) EXCLUDING HST (INCLUDING PROVISIONAL & ALLOWANCE ITEMS)					\$ 310,000.00

PHASE 2
BAYSWATER DRIVE IMPROVEMENTS

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
1.0 GENERAL ITEMS					
1.01	Mobilization & Demobilization	LS	1	\$ 20,000.00	\$ 20,000.00
1.02	Traffic Control	LS	1	\$ 2,000.00	\$ 2,000.00
SUBTOTAL GENERAL ITEMS					\$ 22,000.00
2.0 OPTION 2C - CONSTRUCT STORM SEWER ALONG BAYSWATER DRIVE					
2.01	Supply, Install, Maintain, & Remove Temporary Straw Bale Check Dam	ea	2	\$ 500.00	\$ 1,000.00
2.02	Remove & Dispose Existing Storm Sewer	m	41	\$ 80.00	\$ 3,280.00
2.03	Remove & Dispose Existing Maintenance Holes	ea	1	\$ 1,500.00	\$ 1,500.00
2.04	Remove & Dispose Existing Driveway (For Culvert Works)	ea	5	\$ 500.00	\$ 2,500.00
2.05	Remove & Dispose Existing Culvert (Including Culvert Headwalls)	m	49	\$ 90.00	\$ 4,410.00
2.06	Remove & Dispose Existing Road Asphalt and Granulars	sq.m	139	\$ 17.00	\$ 2,363.00
2.07	Ditching	m	100	\$ 60.00	\$ 6,000.00
2.08	Supply & Install 150-300mm Riverstone (450mm depth)	sq.m	200	\$ 85.00	\$ 17,000.00
2.09	Supply & Install 1525 x 965 mm Dia. Storm Sewer	m	85	\$ 1,950.00	\$ 165,750.00
2.10	Supply & Install 1725 x 1090 mm Dia. Storm Sewer	m	43	\$ 2,250.00	\$ 96,750.00
2.11	Supply, Place, & Compact Imported Fill	cu.m	320	\$ 35.00	\$ 11,200.00
2.12	Reinstate Area with Topsoil & Seed	sq.m	160	\$ 15.00	\$ 2,400.00
2.13	Supply & Install 3000 mm Dia. Maintenance Hole	ea	1	\$ 39,040.00	\$ 39,040.00
2.14	Supply & Install Concrete Headwall - 1500 mm Dia.	ea	1	\$ 65,350.00	\$ 65,350.00
2.15	Supply & Install Concrete Headwall - 1800 mm Dia.	ea	1	\$ 86,390.00	\$ 86,390.00
2.16	Supply & Install 600 x 600 mm Ditch Inlet Catchbasin	ea	7	\$ 4,800.00	\$ 33,600.00
2.17	Supply & Install 1880 x 1260 mm CSPA	m	8	\$ 2,772.00	\$ 22,176.00
2.18	Supply & Install 1200 mm Dia. CSP Culvert	m	29	\$ 1,500.00	\$ 43,500.00
2.17	Reinstate Roadway (300 mm Granular 'B', 150 mm Granular 'A', 50 mm HL4 Base Course Asphalt, & 40 mm HL3 Top Course Asphalt)	sq.m.	139	\$ 102.00	\$ 14,178.00
2.18	Reinstate Driveways to Existing Conditions	ea	5	\$ 1,000.00	\$ 5,000.00
SUBTOTAL OPTION 2C					\$ 624,000.00
3.0 OPTION 2E - CLEANOUT EXISTING BAYSWATER DRIVE OUTLET TO GEORGIAN BAY					
3.01	Flow Diversion - Install/Uninstall	LS	1	\$ 10,000.00	\$ 10,000.00
3.02	Flow Diversion - Operation and Maintenance	day	1	\$ 1,250.00	\$ 1,250.00
3.03	Flush & Clean Existing Culverts	hr	8	\$ 400.00	\$ 3,200.00
SUBTOTAL OPTION 2E					\$ 15,000.00
SUBTOTAL CONSTRUCTION COSTS					\$ 661,000.00

TOWN OF WASGAGA BEACH DRAINAGE MASTER PLAN - WEST END DRAINAGE ASSESSMENT
PRELIMINARY OPINION OF PROBABLE COSTS



PROJECT: 120200

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
7.0	PROVISIONAL ITEMS				
7.01	Flow Diversion - Install/Uninstall	LS	1	\$ 10,000.00	\$ 10,000.00
7.02	Flow Diversion - Operation and Maintenance	day	20	\$ 1,250.00	\$ 25,000.00
7.03	Geotechnical Sampling for Off-site Disposal	per sample	1	\$ 1,500.00	\$ 1,500.00
7.04	Remove & Dispose of Contaminated Excess Material (Provisional)	cu.m	10	\$ 100.00	\$ 1,000.00
7.05	Remove & Reinstall/Relocate Existing Traffic Signs/Mail Boxes	ea	5	\$ 315.00	\$ 1,575.00
	SUBTOTAL PROVISIONAL ITEMS				\$ 40,000.00
8.0	ALLOWANCE ITEMS				
8.01	Construction Contingency			20%	\$ 132,200.00
8.02	Utilities / Services Relocation Cost			15%	\$ 99,150.00
	SUBTOTAL ALLOWANCE ITEMS				\$ 232,000.00
TOTAL COSTS EXCLUDING HST (INCLUDING PROVISIONAL & ALLOWANCE ITEMS)					\$ 935,000.00

PHASE 3
ROBERT STREET IMPROVEMENTS

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
1.0 GENERAL ITEMS					
1.01	Mobilization & Demobilization	LS	1	\$ 20,000.00	\$ 20,000.00
1.02	Traffic Control	LS	1	\$ 2,000.00	\$ 2,000.00
SUBTOTAL GENERAL ITEMS					\$ 22,000.00
2.0 OPTION 4B - IMPROVE ROBERT STREET EASTERN ROADSIDE DITCH AND DRIVEWAY CULVERTS					
2.01	Supply, Install, Maintain, & Remove Temporary Straw Bale Check Dam	ea	3	\$ 500.00	\$ 1,500.00
2.02	Remove & Dispose Existing Driveway (For Culvert Works)	ea	7	\$ 500.00	\$ 3,500.00
2.03	Remove & Dispose Existing Culvert (Including Culvert Headwalls)	m	54	\$ 90.00	\$ 4,860.00
2.04	Excavate, Grade, Topsoil, & Seed Drainage Ditch	m	150	\$ 125.00	\$ 18,750.00
2.05	Supply & Install 1150 x 820 mm CSPA	m	54	\$ 1,560.00	\$ 84,240.00
2.06	Reinstate Driveways to Existing Conditions	ea	7	\$ 1,000.00	\$ 7,000.00
SUBTOTAL OPTION 5B					\$ 120,000.00
3.0 OPTION 4C - IMPROVE ROBERT STREET WESTERN ROADSIDE DITCH AND DRIVEWAY CULVERTS					
3.01	Supply, Install, Maintain, & Remove Temporary Straw Bale Check Dam	ea	3	\$ 500.00	\$ 1,500.00
3.02	Remove & Dispose Existing Driveway (For Culvert Works)	ea	4	\$ 500.00	\$ 2,000.00
3.03	Remove & Dispose Existing Culvert (Including Culvert Headwalls)	m	40	\$ 90.00	\$ 3,600.00
3.04	Excavate, Grade, Topsoil, & Seed Drainage Ditch	m	165	\$ 125.00	\$ 20,625.00
3.05	Supply & Install 910 x 660 mm CSPA	m	40	\$ 1,200.00	\$ 48,000.00
3.06	Reinstate Driveways to Existing Conditions	ea	4	\$ 1,000.00	\$ 4,000.00
SUBTOTAL OPTION 5C					\$ 80,000.00
SUBTOTAL CONSTRUCTION COSTS					\$ 222,000.00
4.0 PROVISIONAL ITEMS					
4.01	Flow Diversion - Install/Uninstall	LS	1	\$ 10,000.00	\$ 10,000.00
4.02	Flow Diversion - Operation and Maintenance	day	5	\$ 1,250.00	\$ 6,250.00
4.03	Geotechnical Sampling for Off-site Disposal	per sample	1	\$ 1,500.00	\$ 1,500.00
4.04	Remove & Dispose of Contaminated Excess Material (Provisional)	cu.m	240	\$ 100.00	\$ 24,000.00
4.05	Remove & Reinstall/Relocate Existing Traffic Signs/Mail Boxes	ea	5	\$ 315.00	\$ 1,575.00
SUBTOTAL PROVISIONAL ITEMS					\$ 44,000.00

TOWN OF WASGAGA BEACH DRAINAGE MASTER PLAN - WEST END DRAINAGE ASSESSMENT
PRELIMINARY OPINION OF PROBABLE COSTS



PROJECT: 120200

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
5.0	ALLOWANCE ITEMS				
5.01	Construction Contingency			20%	\$ 44,400.00
5.02	Utilities / Services Relocation Cost			15%	\$ 33,300.00
				SUBTOTAL ALLOWANCE ITEMS	\$ 78,000.00
TOTAL COSTS EXCLUDING HST (INCLUDING PROVISIONAL & ALLOWANCE ITEMS)					\$ 345,000.00

PHASE 4
 THOMAS STREET IMPROVEMENTS

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
1.0	GENERAL ITEMS				
1.01	Mobilization & Demobilization	LS	1	\$ 20,000.00	\$ 20,000.00
1.02	Traffic Control	LS	1	\$ 2,000.00	\$ 2,000.00
SUBTOTAL GENERAL ITEMS					\$ 22,000.00
2.0	OPTION 1C - UPGRADE THOMAS STREET CULVERTS				
2.01	Flow Diversion - Install/Uninstall	LS	1	\$ 10,000.00	\$ 10,000.00
2.02	Flow Diversion - Operation and Maintenance	day	15	\$ 1,250.00	\$ 18,750.00
2.03	Remove & Dispose Existing Road Asphalt and Granulars	sq.m	90	\$ 17.00	\$ 1,530.00
2.04	Remove & Dispose Existing Driveway (For Culvert Works)	ea	3	\$ 500.00	\$ 1,500.00
2.05	Remove & Dispose Existing Culvert (Including Culvert Headwalls)	m	35	\$ 90.00	\$ 3,150.00
2.06	Ditching	m	135	\$ 60.00	\$ 8,100.00
2.07	Supply & Install 150-300mm Riverstone (450mm depth)	sq.m	190	\$ 85.00	\$ 16,150.00
2.08	Supply & Install 1800 x 900 mm Conc. Box Culvert	m	20	\$ 5,100.00	\$ 102,000.00
2.09	Supply & Install 1800 x 1200 mm Conc. Box Culvert	m	35	\$ 5,600.00	\$ 196,000.00
2.10	Reinstate Driveways to Existing Conditions	ea	3	\$ 1,000.00	\$ 3,000.00
2.11	Additional Reinstatement of 3 Thomas Street Driveway	LS	1	\$ 5,000.00	\$ 5,000.00
2.12	Supply & Install Concrete Headwall / Wingwalls	ea	10	\$ 8,210.00	\$ 82,100.00
2.13	Reinstate Roadway (300 mm Granular 'B', 150 mm Granular 'A', 50 mm HL4 Base Course Asphalt, & 40 mm HL3 Top Course Asphalt)	sq.m.	90	\$ 102.00	\$ 9,180.00
SUBTOTAL OPTION 1C					\$ 457,000.00
3.0	OPTION 3C - CLEANOUT DRIVEWAY CULVERTS AND ROADSIDE DITCH BETWEEN BAYSWATER DRIVE AND THOMAS STREET				
3.01	Supply, Install, Maintain, & Remove Temporary Cofferdam	ea	2	\$ 635.00	\$ 1,270.00
3.02	Flow Diversion - Install/Uninstall	LS	1	\$ 10,000.00	\$ 10,000.00
3.03	Flow Diversion - Operation and Maintenance	day	3	\$ 1,250.00	\$ 3,750.00
3.04	Flush & Clean Existing Culverts	hr	24	\$ 400.00	\$ 9,600.00
3.05	Ditching	m	150	\$ 60.00	\$ 9,000.00
3.06	Supply & Install 150-300mm Riverstone (450mm depth)	sq.m	300	\$ 85.00	\$ 25,500.00
SUBTOTAL OPTION 3C					\$ 60,000.00
SUBTOTAL CONSTRUCTION COSTS					\$ 539,000.00

TOWN OF WASGAGA BEACH DRAINAGE MASTER PLAN - WEST END DRAINAGE ASSESSMENT
PRELIMINARY OPINION OF PROBABLE COSTS



ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
8.0 PROVISIONAL ITEMS					
8.01	Geotechnical Sampling for Off-site Disposal	per sample	1	\$ 1,500.00	\$ 1,500.00
8.02	Remove & Dispose of Contaminated Excess Material (Provisional)	cu.m	100	\$ 100.00	\$ 10,000.00
8.03	Remove & Reinstall/Relocate Existing Traffic Signs/Mail Boxes	ea	3	\$ 315.00	\$ 945.00
SUBTOTAL PROVISIONAL ITEMS					\$ 13,000.00
9.0 ALLOWANCE ITEMS					
9.01	Construction Contingency			20%	\$ 110,400.00
9.02	Utilities / Services Relocation Cost			15%	\$ 82,800.00
SUBTOTAL ALLOWANCE ITEMS (WITH OPTION 1C)					\$ 194,000.00
TOTAL COSTS EXCLUDING HST (INCLUDING PROVISIONAL & ALLOWANCE ITEMS)					\$ 750,000.00

PHASE 5
 GEORGE AVENUE AND BEACHWOOD ROAD IMPROVEMENTS

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
1.0 GENERAL ITEMS					
1.01	Mobilization & Demobilization	LS	1	\$ 20,000.00	\$ 20,000.00
1.02	Traffic Control	LS	1	\$ 2,000.00	\$ 2,000.00
SUBTOTAL GENERAL ITEMS					\$ 22,000.00
2.0 OPTION 6C - RAISE ROADSIDE DITCH BANKS AT FLOODING LOCATIONS AT GEORGE AVENUE					
2.01	Supply, Install, Maintain, & Remove Temporary Heavy Duty Silt Fence	m	50	\$ 26.00	\$ 1,300.00
2.02	Supply & Install 400 mm Dia. Culvert	m	41	\$ 500.00	\$ 20,500.00
2.03	Supply, Place, & Compact Imported Fill for Berm	cu.m	30	\$ 35.00	\$ 1,050.00
2.04	Reinstate Area with Topsoil & Seed	sq.m	120	\$ 15.00	\$ 1,800.00
SUBTOTAL OPTION 6C					\$ 25,000.00
3.0 OPTION 7B - IMPROVE ROADSIDE DITCH AND DRIVEWAY CULVERTS FROM ROBERT STREET TO THOMAS STREET					
3.01	Supply, Install, Maintain, & Remove Temporary Straw Bale Check Dam	ea	5	\$ 500.00	\$ 2,500.00
3.02	Remove & Dispose Existing Driveway (For Culvert Works)	ea	3	\$ 500.00	\$ 1,500.00
3.03	Remove & Dispose Existing Culvert (Including Culvert Headwalls)	m	20	\$ 90.00	\$ 1,800.00
3.04	Excavate, Grade, Topsoil, & Seed Drainage Ditch	m	155	\$ 125.00	\$ 19,375.00
3.05	Supply & Install 1390 x 970 mm CSPA	m	30	\$ 1,800.00	\$ 54,000.00
3.06	Reinstate Driveways to Existing Conditions	ea	3	\$ 1,000.00	\$ 3,000.00
SUBTOTAL OPTION 5C					\$ 83,000.00
4.0 OPTION 7C - IMPROVE ROADSIDE DITCH AND CULVERTS FROM MARILYN AVENUE TO ROBERT STREET					
4.01	Supply, Install, Maintain, & Remove Temporary Straw Bale Check Dam	ea	5	\$ 500.00	\$ 2,500.00
4.02	Remove & Dispose Existing Road Asphalt and Granulars	sq.m	40	\$ 17.00	\$ 680.00
4.03	Remove & Dispose Existing Driveway (For Culvert Works)	ea	2	\$ 500.00	\$ 1,000.00
4.04	Remove & Dispose Existing Culvert (Including Culvert Headwalls)	m	53	\$ 90.00	\$ 4,770.00
4.05	Supply & Install 1000 mm Dia. Culvert	m	33	\$ 1,300.00	\$ 42,900.00
4.06	Supply & Install 700 mm Dia. Culvert	m	20	\$ 870.00	\$ 17,400.00
4.07	Supply & Install 600 mm Dia. Culvert	m	15	\$ 800.00	\$ 12,000.00
4.08	Excavate, Grade, Topsoil, & Seed Drainage Ditch	m	150	\$ 125.00	\$ 18,750.00
4.09	Reinstate Roadway (300 mm Granular 'B', 150 mm Granular 'A', 50 mm HL4 Base Course Asphalt, & 40 mm HL3 Top Course Asphalt)	sq.m.	45	\$ 102.00	\$ 4,590.00
4.10	Reinstate Driveways to Existing Conditions	ea	2	\$ 1,000.00	\$ 2,000.00
SUBTOTAL OPTION 5D					\$ 107,000.00
SUBTOTAL CONSTRUCTION COSTS					\$ 237,000.00

TOWN OF WASGAGA BEACH DRAINAGE MASTER PLAN - WEST END DRAINAGE ASSESSMENT
 PRELIMINARY OPINION OF PROBABLE COSTS



PROJECT: 120200

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
8.0 PROVISIONAL ITEMS					
8.01	Flow Diversion - Install/Uninstall	LS	1	\$ 10,000.00	\$ 10,000.00
8.02	Flow Diversion - Operation and Maintenance	day	5	\$ 1,250.00	\$ 6,250.00
8.03	Geotechnical Sampling for Off-site Disposal	per sample	1	\$ 1,500.00	\$ 1,500.00
8.04	Remove & Dispose of Contaminated Excess Material (Provisional)	cu.m	60	\$ 100.00	\$ 6,000.00
8.05	Remove & Reinstall/Relocate Existing Traffic Signs/Mail Boxes	ea	7	\$ 315.00	\$ 2,205.00
SUBTOTAL PROVISIONAL ITEMS					\$ 26,000.00
9.0 ALLOWANCE ITEMS					
9.01	Construction Contingency			20%	\$ 52,600.00
9.02	Utilities / Services Relocation Cost			15%	\$ 39,450.00
SUBTOTAL ALLOWANCE ITEMS (WITH OPTION 6C)					\$ 93,000.00
TOTAL COSTS EXCLUDING HST (INCLUDING PROVISIONAL & ALLOWANCE ITEMS)					\$ 360,000.00