Stormwater Needs Study: Chesley

Municipality of Arran-Elderslie

Project 21-103

August, 2025

Prepared By:

GSS Engineering Consultants Ltd.

Unit 230, 945 3rd Avenue East

Owen Sound, ON N4K 2K8

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1 INTRODUCTION & PURPOSE OF STUDY

GSS Engineering Consultants Ltd. was retained by the Municipality of Arran-Elderslie to undertake a stormwater needs study for three communities: Paisley, Chesley and Tara. This report focuses on the evaluation of the Stormwater System for Chesley.

Chesley is located north of both Walkerton on Bruce Road 19 and north of Hanover along Bruce County Road 10. Chesley has a population of approximately 1,879 and includes 866 dwellings (as per 2021 census). Chesley is spread over approximately 1.91 km^2 of land.

The North Saugeen River winds through Chesley, entering from the east and travelling to the west end of the community and continues to the west to meet the Saugeen River. The majority of Chesley slopes toward the North Saugeen River, however few stormwater networks in north and southernmost part of Chesley slope in a direction opposite from the river.

Figure 1 overleaf provides an aerial view of Chesley, and the North Saugeen River complete with 1.0 m contours as provided by Bruce County.

The aim of the stormwater needs study is to identify assets of the existing stormwater System (sewers, structures, overland flow paths, outlets, etc.) that are deficient in capacity, and propose upgrades to mitigate the identified deficiencies. The report further outlines priority of upgrades and preliminary cost estimates.

The report focuses on eliminating the flooding over the storm structures during 1:5-year storm, while permitting some surcharging within storm sewers and structures. The provincial guidelines recommend the design and construction of storm sewers without any hydraulic overloading. However, for Chesley's stormwater System, this effort may lead to the need for exceptionally large capital, which may not be very practical or affordable. Therefore, eliminating flooding was the primary focus of the study for 1:5-year rainfall events.

Due to the size of the storm water system, each figure in this report has been broken down into three segments for easy reading.

This report is intended to be a "living document" and is suggested to be updated as the storm sewer system is upgraded and/or when new data is available.

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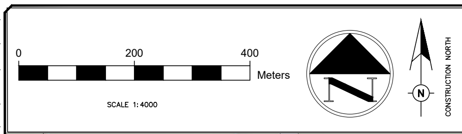

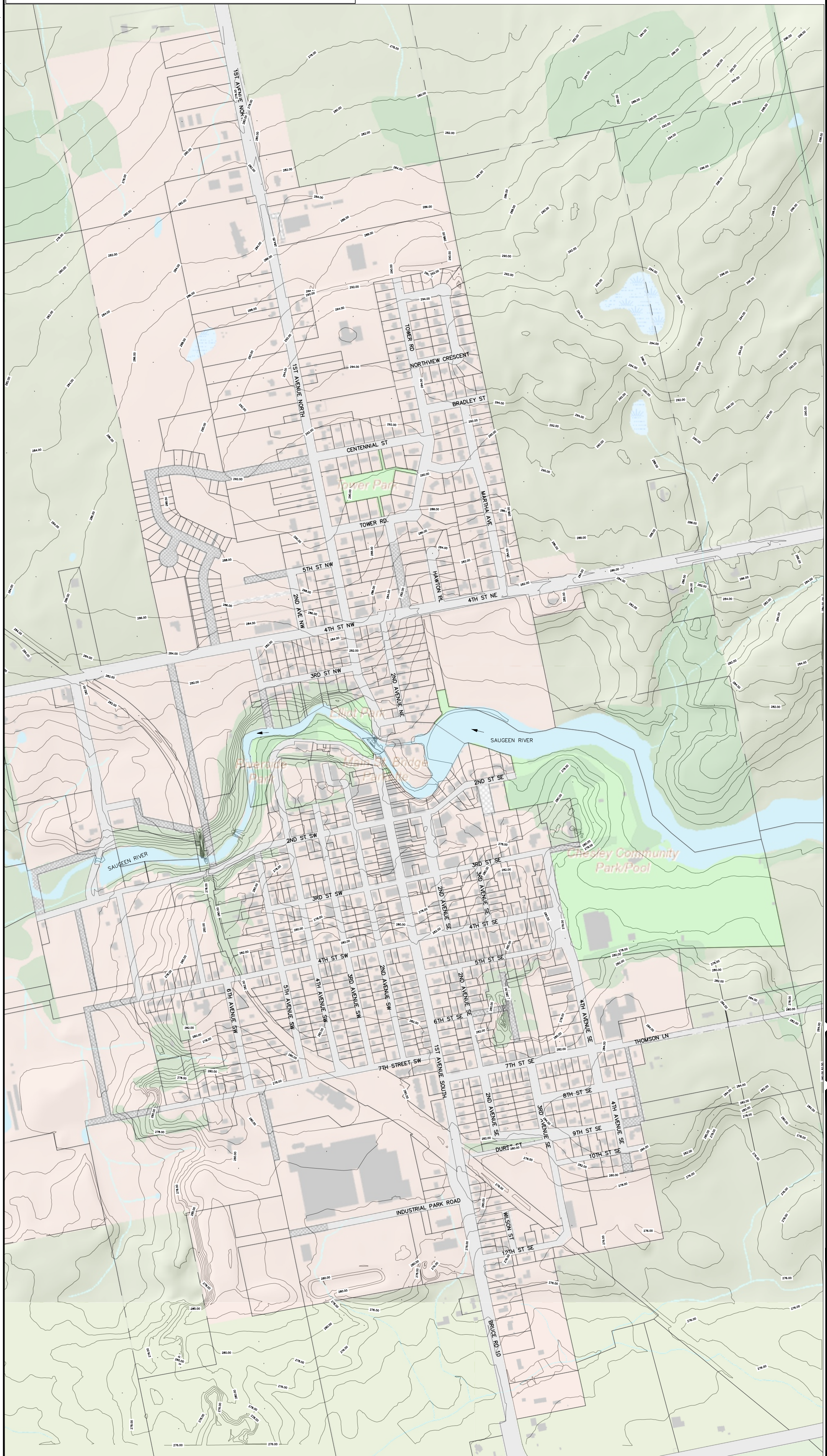

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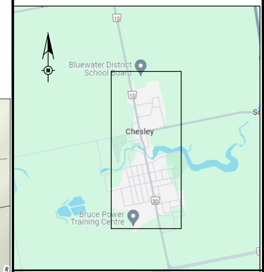

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GSS ENGINEERING CONSULTANTS LTD

945–3rd Ave. East, Unit #230, Owen Sound, ON, N4K 2K8
Telephone: (519) 372-4828

Title:
AERIAL VIEW OF CHESLEY C/W TOPOGRAPHIC CONTOURS CHESLEY STORMWATER STUDY

Client: MUNICIPALITY OF ARRAN ELDERSLIE

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Drawing No. 21-103-Fig. 1

2 EXISTING STORMWATER SYSTEM

In general, catchbasins collect stormwater runoff, and carry it through storm sewers to a dedicated outlet. Such runoff transportation network is termed as *minor stormwater system*. The minor Stormwater System is generally designed to carry runoff from a 1:2-year or 1:5-year storm event. For larger storms, the excess stormwater runoff (that cannot be conveyed by the minor System) is carried overland (usually within road corridors and ditches) to a dedicated outlet. This is referred to as the *major stormwater system*.

The stormwater system in Chesley consists of storm structures, sewers, ditches and road corridors. As outlined in **Section 1**, the majority of Chesley naturally slopes toward the North Saugeen River, therefore, most of the stormwater system outlets to the river.

The following sub-sections provide details regarding the minor and major stormwater systems in Chesley as well as general deficiencies affecting them. **Figure 2** overleaf provides a depiction of the existing stormwater system (all sewers and structures), with a few select attributes highlighted and described as follows:

- There are some existing storm sewers that have reverse slopes. They are identified in "red."
- There are various catch basins with missing information. They are identified in "orange."
- Some storm sewers and appurtenances are located on private properties with no easements. They are indicated in "blue."
- All roads without curb and gutter are highlighted in yellow. Absence of curb & gutter or roadside ditches could pose challenges related to carrying a major storm runoff.

2.1 Minor Stormwater System: Sewers and Structures

The Chesley stormwater system contains approximately 12.7 km of storm sewer with sizes ranging from 100 mm ø to 1050 mm ø. **Table 2.1** outlines the approximate length of each sewer size.

As per **Table 2.1,** 300 mm ø sewer is the most abundant and 55.8 % of all sewers are 300 mm ø or less. MECP Design Guidelines require that storm sewers should be minimum 200 mm ø in size.

As previously stated, the minor stormwater system is generally designed to convey the runoff from the 1:5-year (or sometime the 1:2-year) return storm.

As noted later in this report, the most common causes of insufficient capacity of sewers appear to be small diameter pipes or not a large enough slope. At some locations, sewers possess a reverse slope, therefore, water will not flow by gravity and must back up in the system to develop enough head to flow through the sewer. Sewers that have a reverse slope are shown in red in **Figure 2**.

The stormwater system currently contains approximately 465 storm structures. **Table 2.2** provides a breakdown of the quantity of each structure type in the existing stormwater system.

Storm structures denoted as a catchbasin (CB, CBMH, DICB, DCB, DDICB, TDICB) possess a grate cover and are intended to collect surface runoff for conveyance through connecting sewers.

TABLE 2.1

Storm Sewer Sizes and Lengths
Chesley Stormwater System

Storm Sewer Diameter (mm)	Total Length of Sewer (m)
100	19
150	116
200	423
250	697
300	5849
350	310
375	654
400	395
450	1319
500	110
525	240
600	1390
750	516
800	17
900	613
1050	62
Total	12,730

TABLE 2.2

Storm Structures
Chesley Stormwater System

Storm Structure Type	Storm Structure Legend	Quantity
Catch Basin	CB	287
Catch Basin Manhole	CBMH	112
Double Catch Basin	DCB	7
Double Catch Basin Manhole	DCBMH	7
Double Ditch Inlet Catch Basin	DDICB	2
Ditch Inlet Catch Basin	DICB	10
Ditch Inlet Catch Basin Manhole	DICBMH	5
Storm Manhole	STMH	30
Twin Ditch Inlet Catch Basin	TDICB	2
Unknown	Unknown	3
Total		465

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0 100 200 Meters

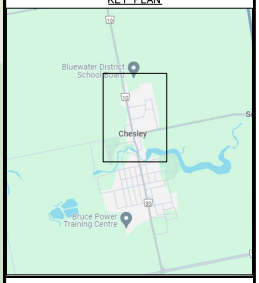
SCALE 1:2000

CONSTRUCTION NORTH

FLOODED STORM STRUCTURES HAVE BEEN DEPICTED IN RED,
WHILE SURCHARGED STRUCTURES AND SEWERS HAVE BEEN DEPICTED IN ORANGE.
UPGRADED STORM SYSTEM HAVE BEEN DEPICTED IN GREEN.
STORMS STRUCTURES LOCATED ON PRIVATE PROPERTIES WITH NO EASEMENTS HAVE BEEN DEPICTED IN BLUE

1ST AVENUE NORTH
TOWER RD
NORTHVIEW CRESCENT
BRADLEY ST
CENTENNIAL ST
MARTHA AVE
HANNON PL
5TH ST NW
2ND AVE NW
4TH ST NW
3RD ST NW
2ND AVENUE NE
4TH ST NE
2ND ST SE
SAUGEEN RIVER
Tower Park
Elliot Park
Riverside Park

KEY PLAN



LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA CATCHMENT AREA
- CB CATCHBASIN
- CBMH CATCHBASIN MANHOLE
- STMMH STORM MANHOLE
- DICB DITCH INLET CATCHBASIN
- 231.00 CONTOUR (1.0m)
- ROAD LACKING CURB AND GUTTER

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945-3rd Ave. East, Unit #230, Owen Sound, ON, N4K 2K8
Telephone: (519) 372-4828

Title:

EXISTING STORM NETWORK CONDITIONS CHESLEY, ON

Client: MUNICIPALITY OF ARRAN ELDERSLIE

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Drawing No. 21-103-Fig. 2A

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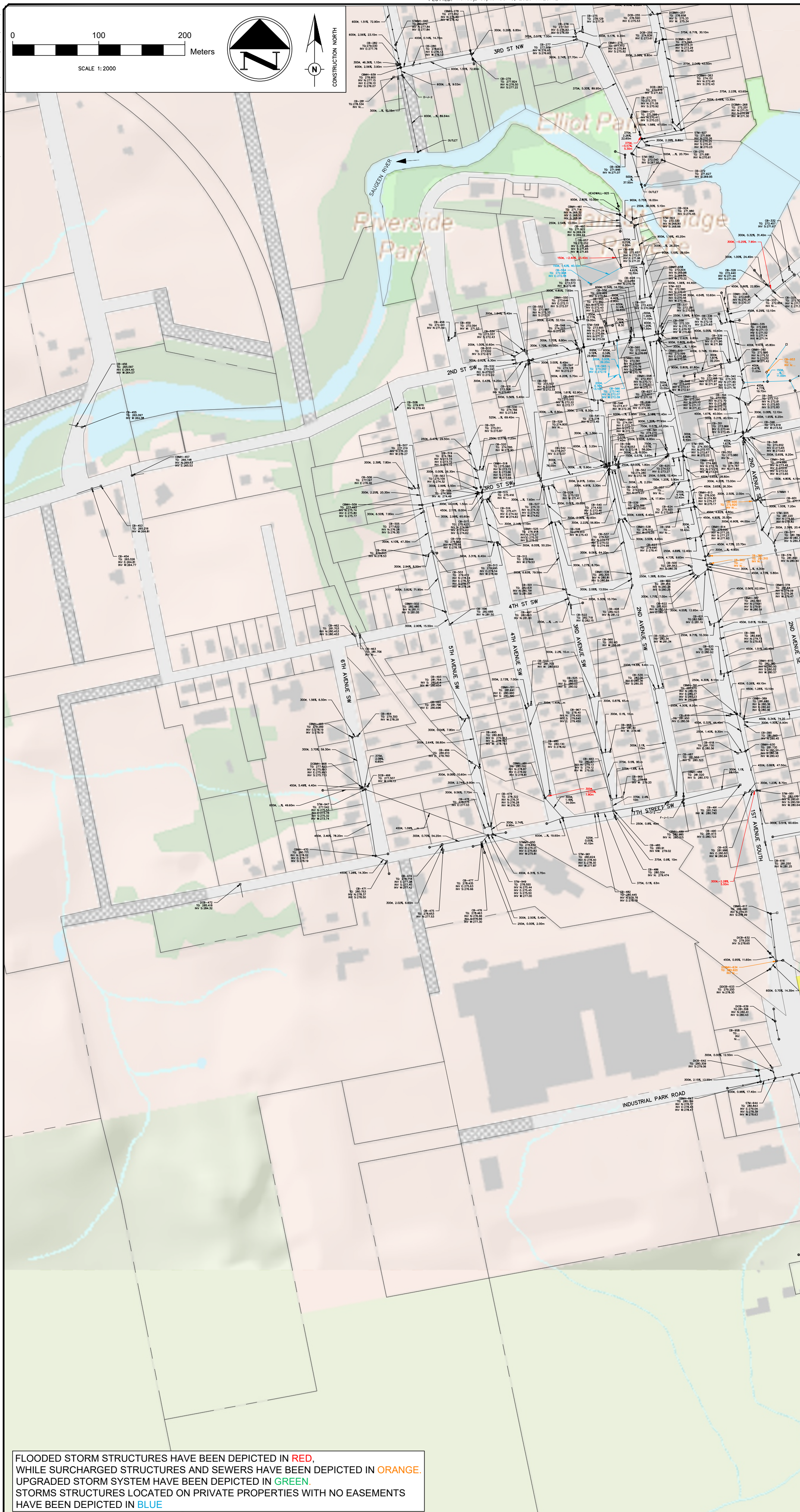

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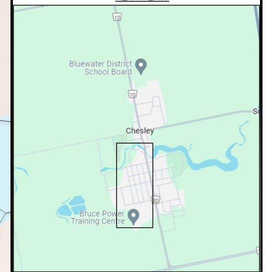

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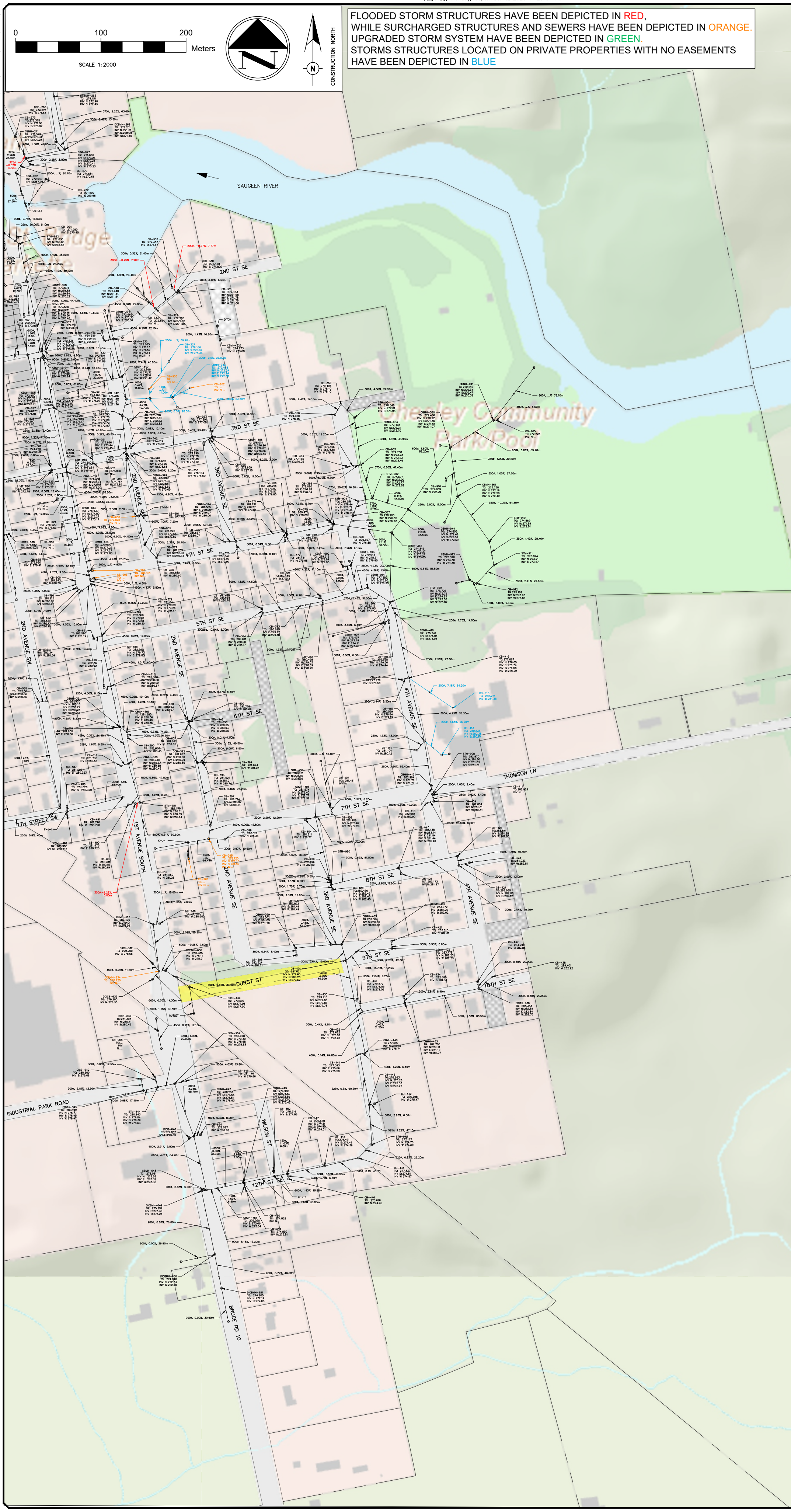

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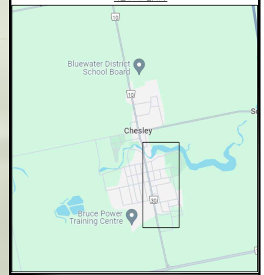

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Drawing No. 21–103–Fig. 2C

Remaining structures (STMMH) possess pick cover (or similar). These structures are not intended to collect runoff but rather provide a junction in which multiple sewers can be connected to converge.

2.2 Major Stormwater System

When stormwater runoff exceeds the capacity of the minor stormwater system, the excess runoff must be conveyed overland to an appropriate outlet. The overland conveyance is considered as the major stormwater system. An inadequate major stormwater system can lead to flooding of buildings and streets and can be catastrophic during large rainfall events.

During larger rainfall events the flooding of catchbasins occurs, thereby leading to spilling of runoff onto road corridors. The road corridors are sloped to convey the floodwater to an appropriate outlet. However, this is only viable where the catchbasins are within the road corridor and the road corridor contains proper curb and gutter. On streets without curb and gutters the runoff is normally collected within roadside ditches and is carried to an outlet. However, like with storm structures if the roadside ditches do not have a proper outlet, the runoff can back up and cause flooding of adjacent lands and that may include residences.

Most existing roads in Chesley contain curbs and gutter or roadside ditches, or a proper outlet for the major stormwater event. At some locations, there are no curbs. Such locations are highlighted in yellow on **Figure 2A, 2B and 2C.**

2.3 Stormwater System on Private Property

Municipal storm structures, sewers, minor system outlets, and major system outlets should all be located within property (roadway) owned by the municipality. However, there are various areas in the Chesley Stormwater System where stormwater assets are located on private property as highlighted in blue on **Figure 2A, 2B and 2C.**

3 LIMITATIONS OF THE STUDY

The stormwater system was investigated to identify deficiencies as accurately as reasonably possible. However, there are limitations that somewhat hinder accuracy of this report. They are as follows:

- Insufficient or potentially incorrect information recorded in municipal database. Suitable assumptions were made for such areas.

- There may be potential for blockages, collapsed sewers and plugged outlets that are currently not known but can be identified only with intensive CCTV inspection of the sewer system.

- The computer model prepared for this investigation was not checked for calibration to determine its accuracy. The only way to verify calibration of the model is by way of flow monitoring and local rainfall data collection. The flow monitoring is an expensive and time consuming exercise.

4 METHODOLOGY

4.1 Existing Stormwater System Information Collection

The existing storm sewer system attributes (storm structure top of grades, inverts, sewer slopes, diameter and lengths, etc.) were collected from various sources.

An overall map of the stormwater system prepared by Genivar in 2013 was used as the basis for the storm structure locations. An excel file with the storm sewer and storm structures information was provided by the municipality based on a previous field survey performed with a laser meter and a GPS survey unit.

All of the stormwater system information was provided by the municipality (maps, survey data, and record drawings), etc.

By incorporating information from above mentioned sources, a stormwater system map was prepared as outlined in **Figure 2A, 2B and 2C.**

4.2 Existing Stormwater Catchment Areas and Hydrology

For analyzing the stormwater system, the entire storm sewer system was divided into 11 drainage basin/catchment areas. These basins were labeled using alphabetical series, “CA-A” to “CA-K”, starting in the north end of Chesley and ending in the south. The basins were further delineated into catchment areas of storm structures (catchbasin, ditch inlets, etc.) as much as possible.

The catchment area for each storm structure was defined based on the surrounding area sloping to structure as per 1 m topography contours and accounting for any drainage block, such as a roadway with no culvert.

Figure 3A, 3B and 3C overleaf provides a layout of the various drainage basins utilized to breakdown the Chesley stormwater system for modelling. The overall drainage area of the Chesley stormwater system is approximately 114.37 ha.

The overland flow length and slope for each catchment area was determined from the contours. The percentage of impervious area for each catchment area was determined from aerial photography. **Appendix A** provides the attributes for each catchment area, which were utilized in the model.

From soil maps as shown on **Figure 4** (in **Appendix B**) it was determined that the soil in Chesley consists mainly of loam and silt loam, with good drainage. It was assumed that the Chesley drainage area belongs to soil group B. This soil group indicates a moderate infiltration rate with moderately well drained soils.

A runoff SCS curve number of 75 was utilized for the pervious area in Chesley, indicative of residential area in soil group B.

4.3 Return Storms and Rainfall Data

As noted in **Section 2,** the minor stormwater system (sewers and structures) should convey the 1:5-year storm. Accordingly, the stormwater system was evaluated for 1:5-year storm to determine if the storm sewer system has adequate capacity. The system was also evaluated for the 1:100-year storm to determine areas that can be expected to experience large amounts of

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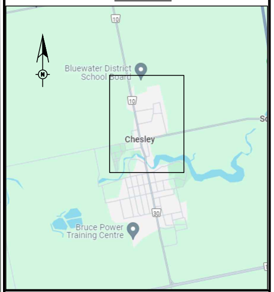

LEGEND

□	CATCHBASIN
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Title:

DELINEATION OF CATCHMENT AREAS, EXISTING STORM NETWORK CHESLEY, ON

Client: MUNICIPALITY OF ARRAN ELDERSLIE

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Drawing No. 21–103–Fig. 3A

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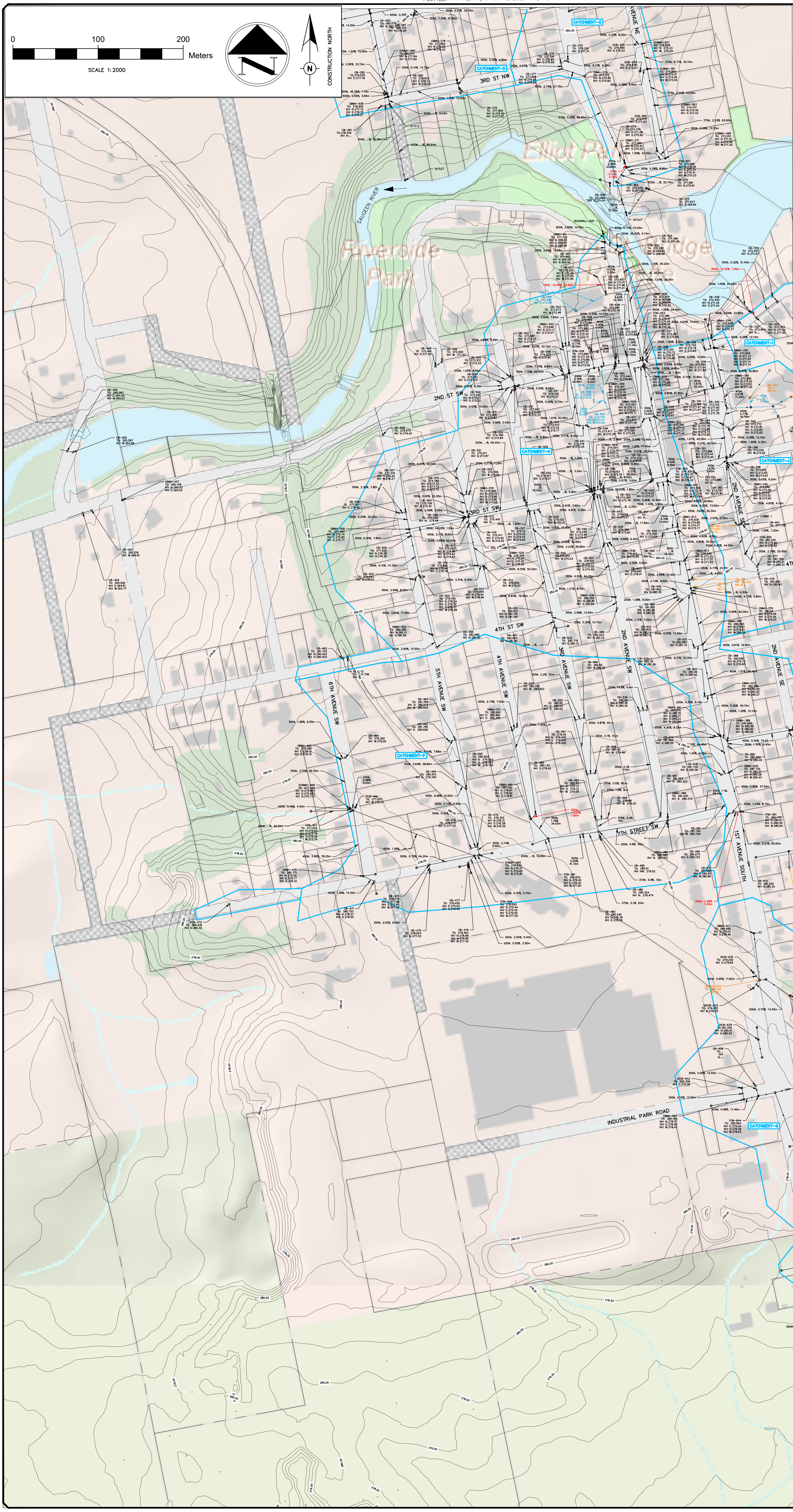

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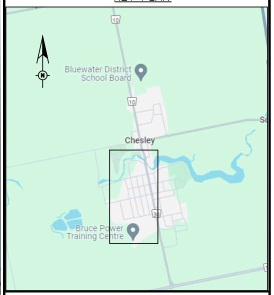

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DELINEATION OF CATCHMENT AREAS, EXISTING STORM SYSTEM CHESLEY, ON

Client: MUNICIPALITY OF ARRAN ELDERSLIE

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Drawing No. 21–103–Fig. 3B

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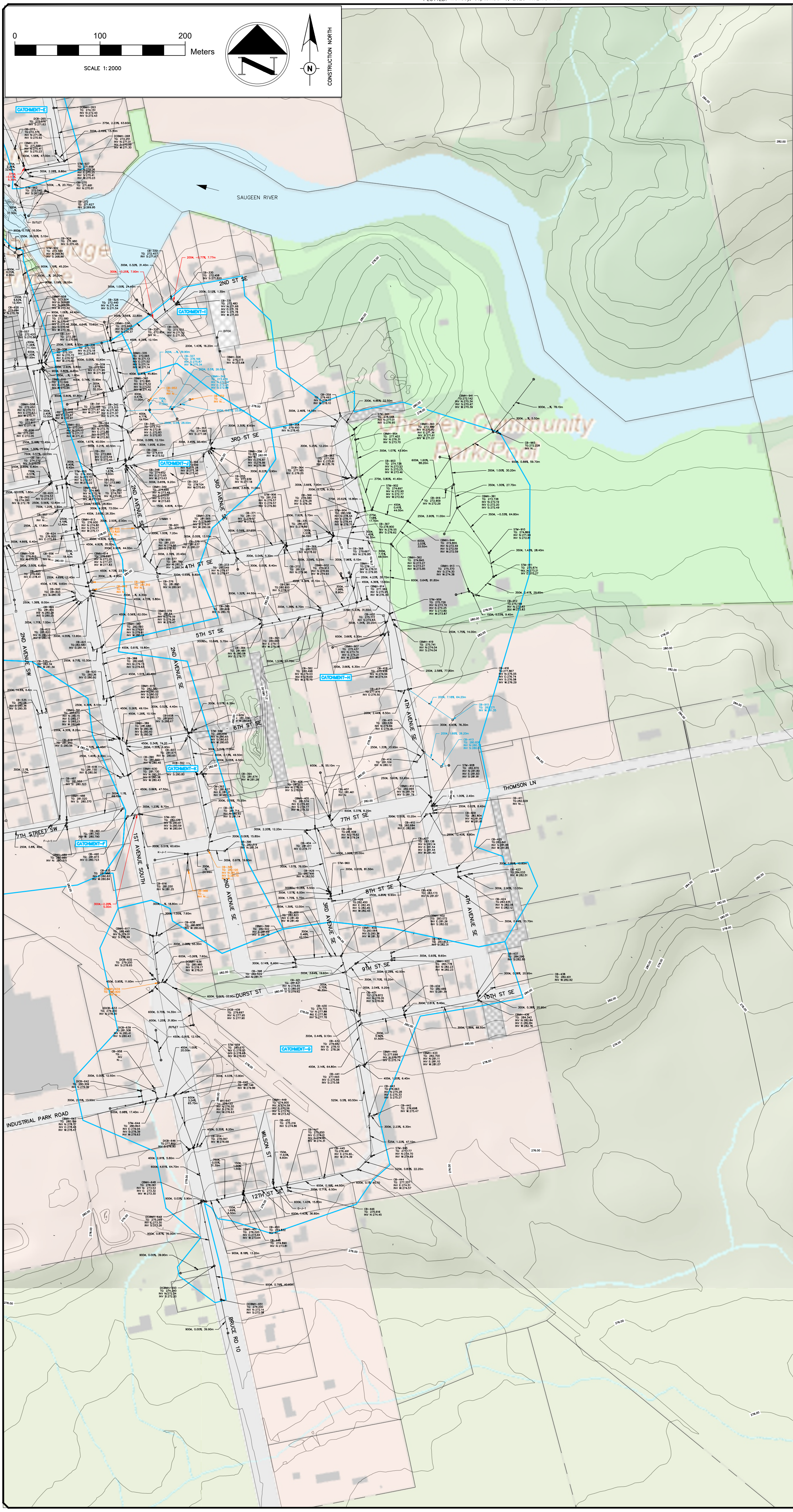

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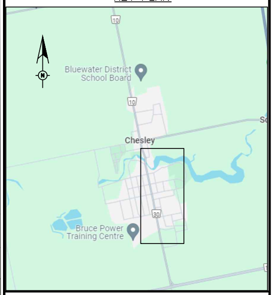

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Drawing No. 21–103–Fig. 3C

flooding during a severe storm event. Both storm events were modelled as 12-hour Chicago storms with the rainfall data obtained by the MTO's IDF Curve Lookup tool. **Table 4.1** summarizes the information from MTO's website.

The rainfall distribution was also derived using VO-SWMM 5.2 software for the 1:5-year return storm, which is indicated in **Table 4.2.**

The rainfall distribution was also derived using VO-SWMM 5.2 software for the 1:100-year return storm, which is indicated in **Table 4.3.**

4.4 Stormwater System Modelling

The stormwater system was modelled with VO-SWMM version 5.2 software. The model output helped in identifying storm sewers that surcharge and storm structures that surcharge or flood for the 1:5-year and the 1:100-year storms. The results of this analysis are discussed further in **Section 5.1**.

Storm sewer surcharge occurs when the maximum flow to be conveyed by the sewer exceeds the capacity of the sewer. The capacity of the sewer is influenced by inlet losses, outlet losses, water levels in upstream and downstream storm structures, pipe materials, etc.

Surcharging of a storm structure occurs when the water level in the structure exceeds the elevation of the sewer obvert. Flooding of a storm structure occurs when the water level exceeds the top of grate elevation of the structure. For structures that flood, the model estimates the total volume of flooding for the given rainfall event.

Based on the modelling results, stormwater system upgrades were identified to eliminate flooding of all storm structures during the 1:5-year storm. The stormwater system with the identified upgrades was re-modelled to verify the adequacy of the upgrades. The results of this analysis are discussed in **Section 5.3**.

TABLE 4.1

12-Hour Duration Rainfall Data
From MTO's IDF Curve Lookup

Storm Event Return Period	Average Rainfall Intensity (mm/hr.)	Peak Rainfall Intensity (mm/hr.)
1:5-year	5.24	78.5338
1:100-year	8.75	131.2410

TABLE 4.2

1:5-year Return Storm, 12-hour Duration, Chicago

Rainfall Distribution

Time (hours)	Rainfall Intensity (mm/hr.)	Total Rainfall Depth (mm)
1	2.02	2.02
2	2.76	4.79
3	5.14	9.93
4	29.80	39.73
5	6.31	46.04
6	3.98	50.02
7	3.03	53.05
8	2.50	55.55
9	2.15	57.70
10	1.90	59.60
11	1.71	61.30
12	1.56	62.86

TABLE 4.3

1:100-year Return Storm, 12-hour Duration, Chicago

Rainfall Distribution

Time (hours)	Rainfall Intensity (mm/hr.)	Total Rainfall Depth (mm)
1	3.38	3.38
2	4.62	8.00
3	8.59	16.59
4	49.80	66.39
5	10.55	76.94
6	6.65	83.58
7	5.07	88.66
8	4.18	92.83
9	3.59	96.42
10	3.17	99.59
11	2.85	102.45
12	2.60	105.05

5 DISCUSSION OF RESULTS

The stormwater system was modelled as outlined in **Section 4 - Methodology**, of this report. The analysis results are discussed in **Section 5.1**.

Proposed upgrades to eliminate stormwater system flooding for the 1:5-year storm is discussed in **Section 5.2** and the results of modelling the upgraded systems are outlined in **Section 5.3**.

5.1 Existing Conditions Model Results

Figure 5A, 5B and 5C overleaf provides the 1:5-year storm modelling results for the entire system. The flooded structures are shown in red and surcharged structures and sewers are shown in orange.

The modelling results indicate that 15 out of 465 storm structures will flood during the 1:5-year storm and 139 structures and associated storm sewers will surcharge. The total estimated volume of flooding water is 403 m^3. The structures with a large flood volume are: CBMH 208 (Centennial St.,107 m^3), CBMH 212 (Tower Rd., 68 m^3), CBMH 233 (Martha Ave, 46 m^3), and CBMH 203 (Tower Rd., 31 m^3). These 4 structures experience the largest amount of flooding and account for a total of 252 m^3 of flooding or 62% of total flooding. The suggested upgrades to mitigate storm structure flooding during the 5-year flood are outlined in **Section 5.2**.

As indicated in **Figure 5A**, Tower Road, Martha Ave., Centennial St. and 1st Ave North has the majority the of the surcharging and flooding structures.

Figure 6A, 6B and 6C depicts the modelling results for the 1:100-year storm.

During the 1:100-year storm, 81 structures will flood, and 270 structures will surcharge. A high proportion of flooding and surcharging is expected for the 1:100-year storm as the minor stormwater system is designed to convey 1:5-year storm only. The model indicates that 5,503 m^3 of flooding is expected for the 1:100-year storm. The four (4) structures, CB 907 (4th Ave SE, 486 m^3), CB 937 (Centennial St., 357 m^3), CBMH 208 (Centennial St, 333 m^3), and CBMH 212 (Tower Rd, 312 m^3), experience the largest amount of flooding. These four structures account for a total of 1,488 m^3 of flooding or 27% of total flooding.

As noted earlier, during heavy rainfall events such as the 1:100-year storm, stormwater flooding from structures is to be conveyed overland, within the road corridor or roadside ditches to an appropriate outlet. In some areas, such as the southern part of Tower Rd., and 4th St. NE, significant flooding is expected during the 1:100-year storm, but no curb & gutter or sufficient ditches exist. This outlines the need for proper curb & gutter or roadside ditches, during any road reconstruction project. Furthermore, a survey of finished ground floor elevations or basement opening is required to confirm the flooding impact on residential properties, if any, during major storms.

5.2 Proposed Upgrades

Based on the modelling results for the existing conditions of stormwater system and as discussed in **Section 5.1,** seven (7) storm sewer system upgrades have been identified to mitigate flooding during the 1:5-year storm.

0 100 200 Meters

SCALE 1:2000

CONSTRUCTION NORTH

FLOODED STORM STRUCTURES HAVE BEEN DEPICTED IN RED,
WHILE SURCHARGED STRUCTURES AND SEWERS HAVE BEEN DEPICTED IN ORANGE.

KEY PLAN

LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA CATCHMENT AREA
- CB CATCHBASIN
- CBMH CATCHBASIN MANHOLE
- STMH STORM MANHOLE
- DICB DITCH INLET CATCHBASIN
- 231.00 CONTOUR (1.0m)

1ST AVENUE NORTH
TOWER RD
NORTHVIEW CRESCENT
BRADLEY ST
CENTENNIAL ST
MARTHA AVE
HAMILTON PL
5TH ST NW
2ND AVE NW
4TH ST NW
4TH ST NE
2ND AVENUE NE
3RD ST NW
2ND ST SE
SAUGEEN RIVER
Tower Park
Elliot Park
Riverside Park
Heritage Bridge

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Client: MUNICIPALITY OF ARRAN ELDERSLIE

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Drawing No. 21-103-Fig. 5A

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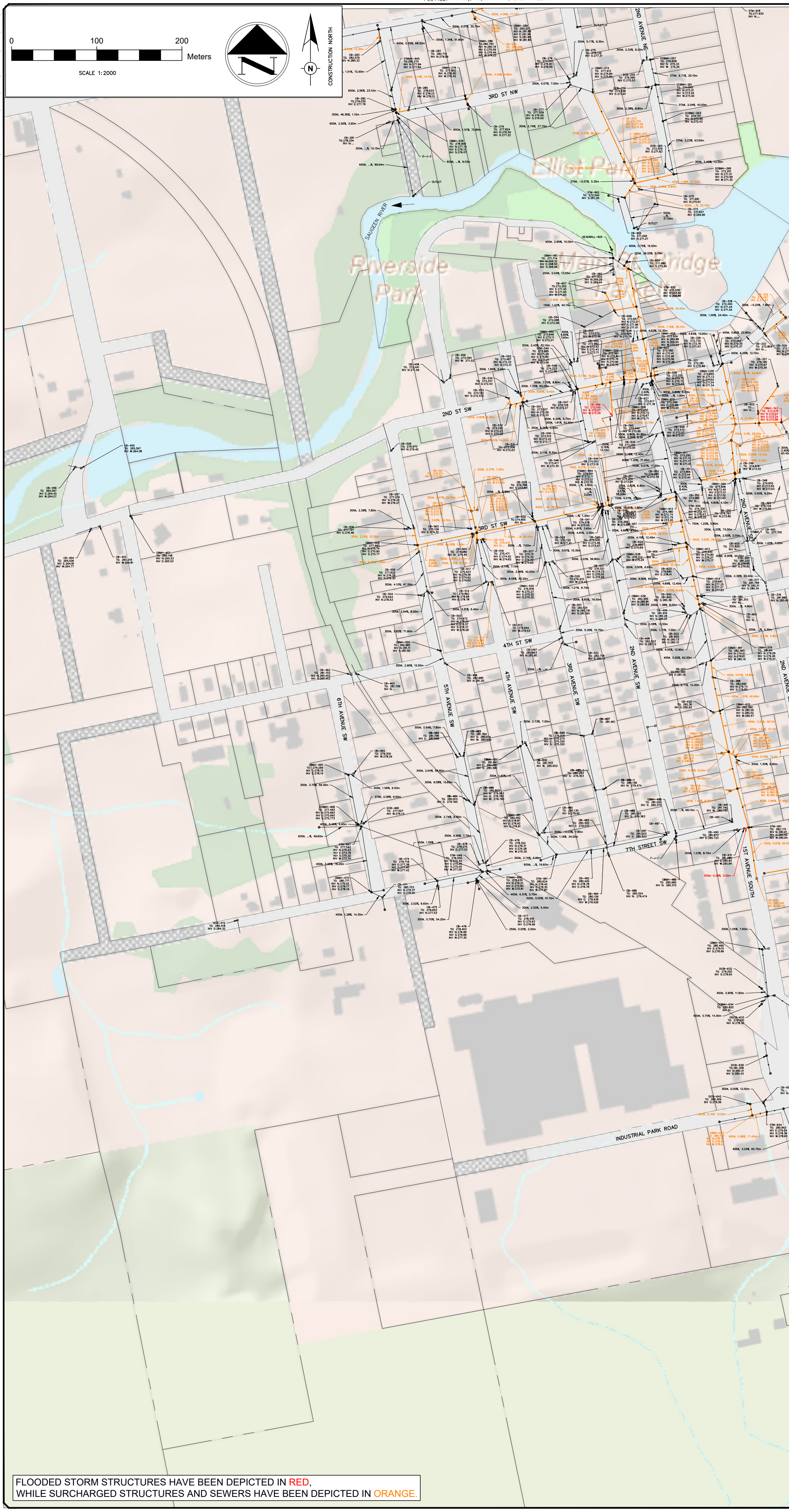

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KEY PLAN

Bluewater District School Board
Chesley
Bruce Power Training Centre

LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA CATCHMENT AREA
- CB CATCHBASIN
- CBMH CATCHBASIN MANHOLE
- STMMH STORM MANHOLE
- DICB DITCH INLET CATCHBASIN
- 231.00 CONTOUR (1.0m)

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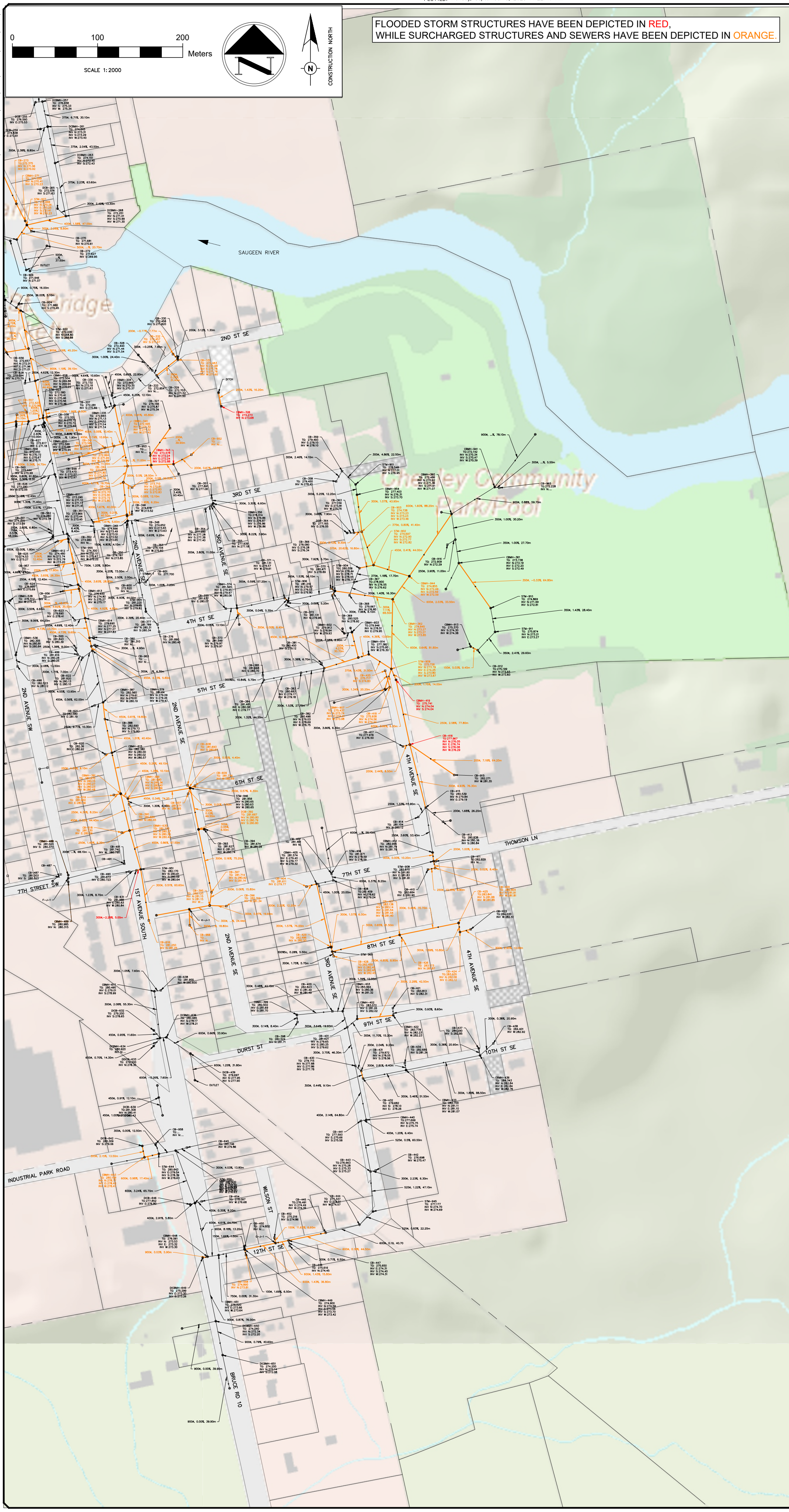

KEY PLAN

LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA — CATCHMENT AREA
- CB — CATCHBASIN
- CBMH — CATCHBASIN MANHOLE
- STMMH — STORM MANHOLE
- DICB — DITCH INLET CATCHBASIN
- 231.00 — CONTOUR (1.0m)

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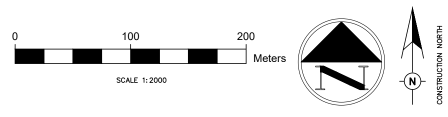

FLOODED STORM STRUCTURES HAVE BEEN DEPICTED IN RED,
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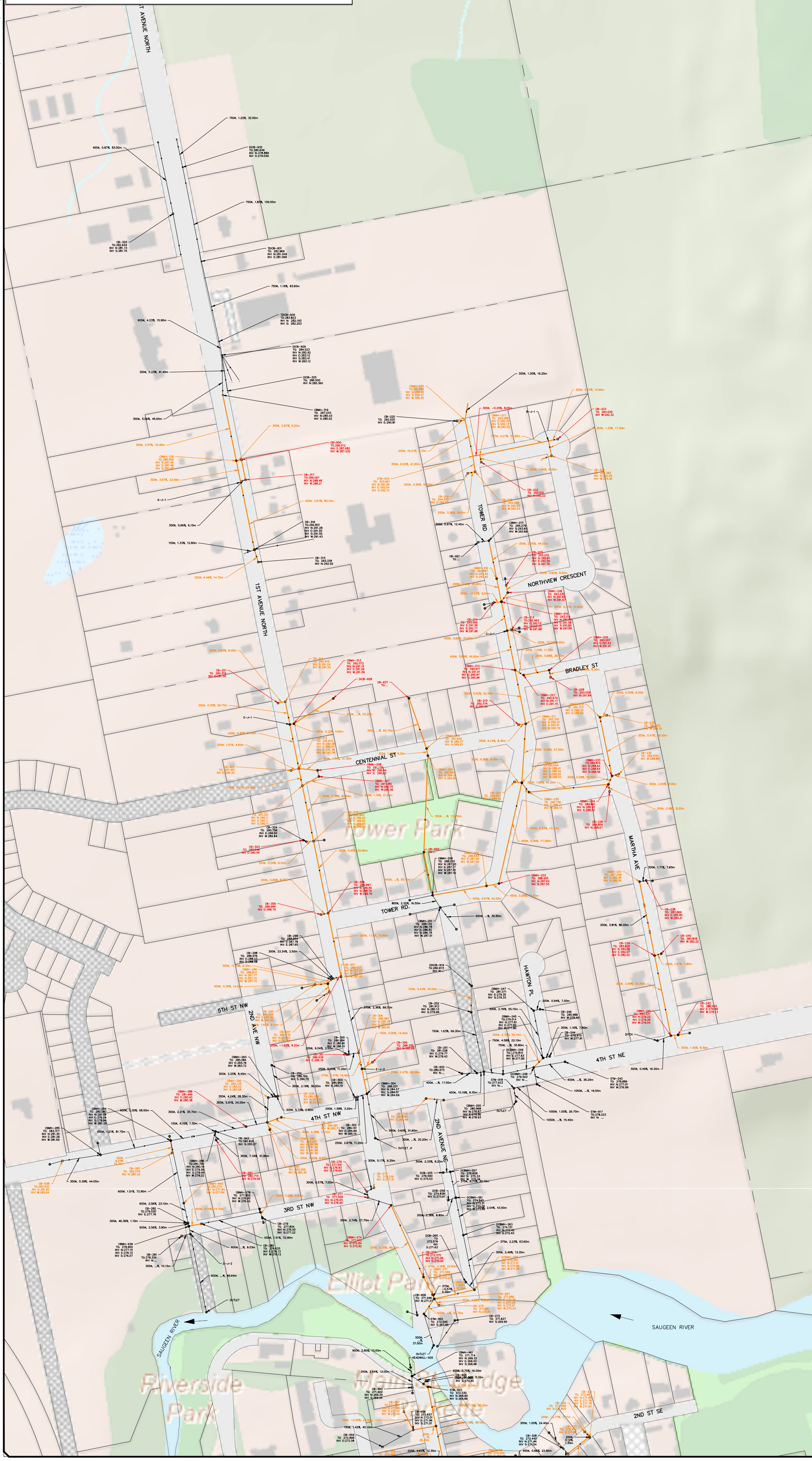

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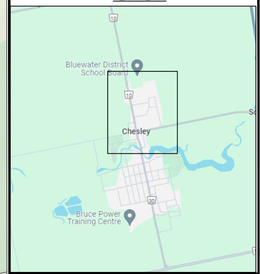

LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA CATCHMENT AREA
- CB CATCHBASIN
- CBMH CATCHBASIN MANHOLE
- STMMH STORM MANHOLE
- DICB DITCH INLET CATCHBASIN
- 231.00 CONTOUR (1.0m)

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EXISTING STORM NETWORK
CHESLEY, ON

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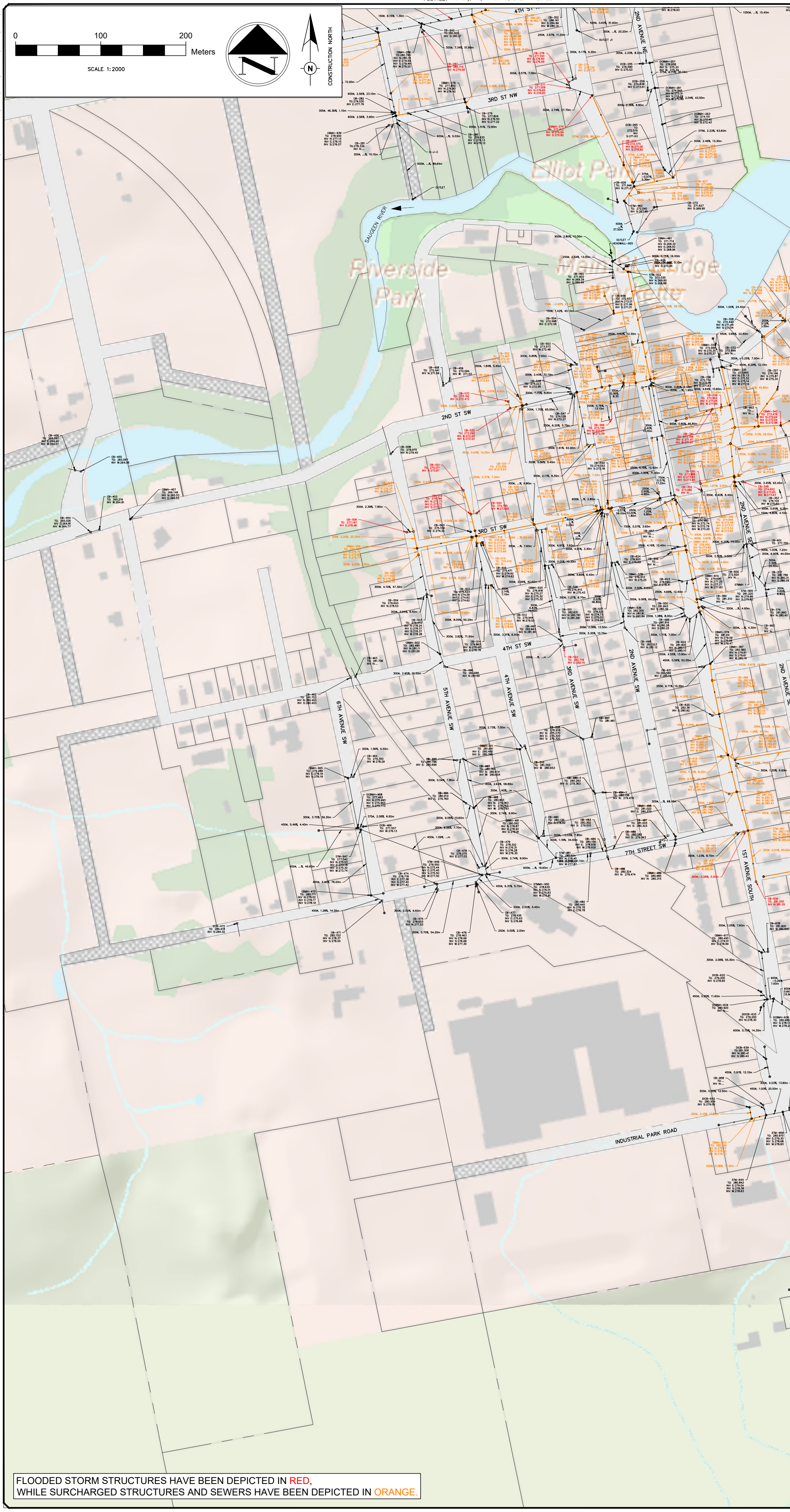

FLOODED STORM STRUCTURES HAVE BEEN DEPICTED IN RED,
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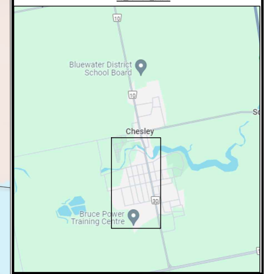
KEY PLAN



LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA — CATCHMENT AREA
- CB — CATCHBASIN
- CBMH — CATCHBASIN MANHOLE
- STMMH — STORM MANHOLE
- DICB — DITCH INLET CATCHBASIN
- 231.00 — CONTOUR (1.0m)

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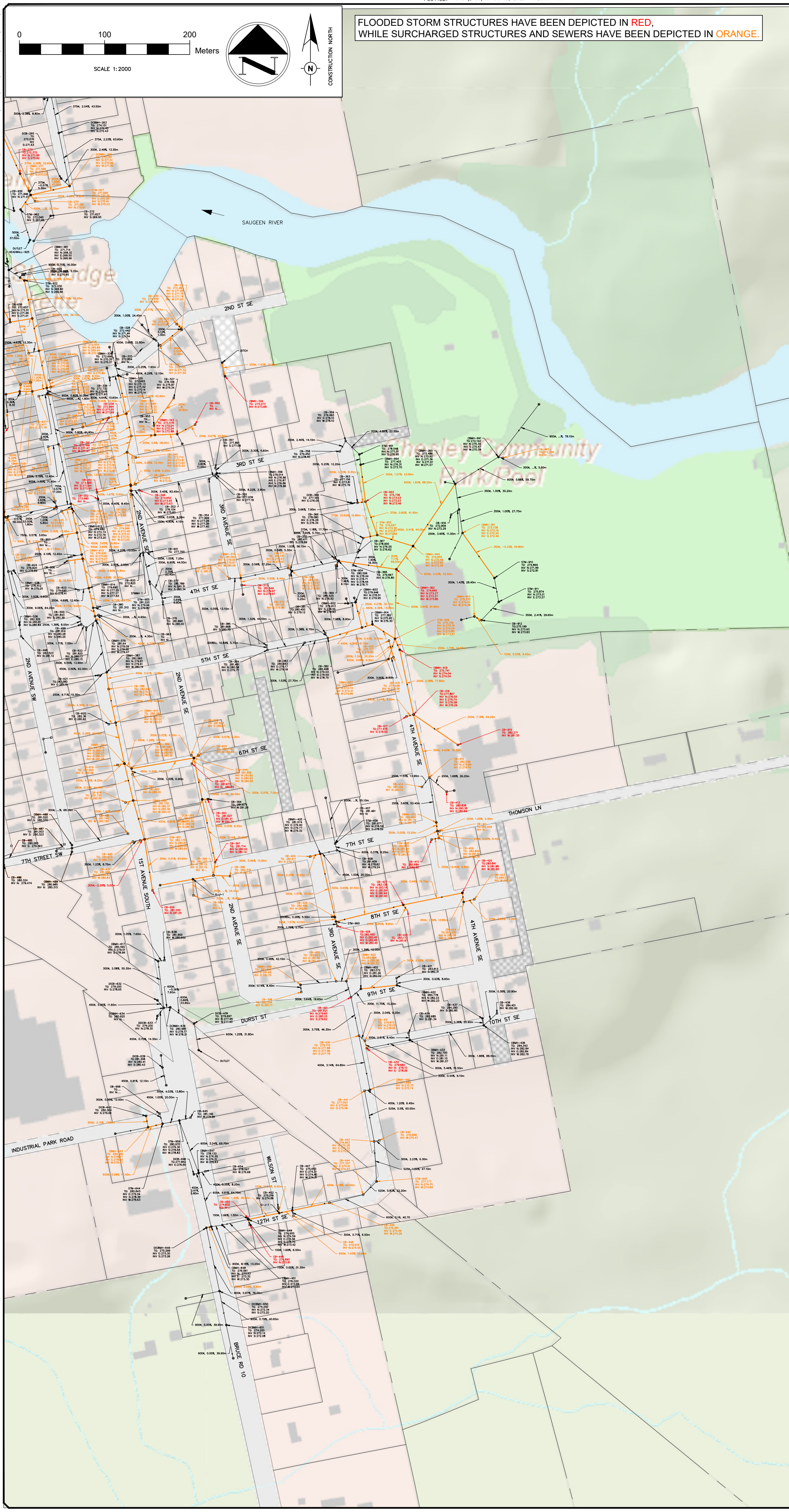

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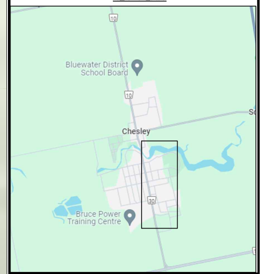

LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA CATCHMENT AREA
- CB CATCHBASIN
- CBMH CATCHBASIN MANHOLE
- STMMH STORM MANHOLE
- DICB DITCH INLET CATCHBASIN
- 231.00 CONTOUR (1.0m)
- DITCH CONNECTION

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TABLE 5.1

Priority of Stormwater System Upgrades Without Cost Estimates

Chesley Stormwater Needs Study

June, 2024

Priority Ranking*	Description of Upgrade	New Structures (#)		Length of New Sewers (m)								Catchment Area	C/G	unit price		DITCHES	unit price		Location	Reduction in Flooding Volume 1:5-year Storm (m^3)	Existing Structures Experiencing Flooding
				300 mm ø	375 mm ø	450 mm ø	unit price	600 mm ø	525 mm ø	750 mm ø	900 mm ø										
1	Road reconstruction and storm sewer replacement	12	5000	-	-	428.3	450	194.7	-	-	-	CA-C	623	125	77875	0	180	0	Tower Road	210	CB-213, CB-242, CB-937, CBMH-203, CBMH-233, CBMH-212
2	Road reconstruction and storm sewer replacement **(Bruce County)**	14	5000	78.6	-	471.9	450	-	-	-	-	CA-E	550.5	125	68812.5	0	180	0	1st Ave North	114	DICB-928, CBMH-207, CBMH-208
3	Storm sewer replacement	2	5000	-	-	39.29	450	-	-	-	-	CA-K	0	125	0	0	180	0	2nd St SW	27	CB-566
4	Storm sewer replacement/Ditch rehabilitation	2	5000	-	-	-		-	-	-	-	CA-II	0	125	0	100	180	18000	2nd St SE	26	CBMH-326
5	Storm sewer replacement	3	5000	-	54	-		-	-	-	-	CA-J	0	125	0	0	180	0	2nd Ave. SE	11	CBMH-343
6	Storm sewer replacement	3	5000	-	-	91.8	450	-	-	-	-	CA-H	91.8	125	11475	0	180	0	4th Ave. SE	8	CBMH-419, CB-416
7	Storm sewer replacement/Ditch rehabilitation **(Bruce County)**	3	5000	-	-	122	450	-	-	-	-	CA-A	122	125	15250	0	180	0	1st Ave North	7	CB-900

* Priority ranking based solely on reduction in flooding during 1:5-year storm

The seven (7) identified system upgrades are depicted in green on **Figure 7A, 7B and 7C. Table 5.1** provides a priority list of the seven (7) proposed upgrades, strictly based on the volume of flooding eliminated. Note that two (2) of the upgrades are on Bruce County and it is their responsibility to upgrade them. The table includes a brief description of each upgrade.

5.3 Upgraded System Model Results

Figure 8A, 8B and 8C overleaf depicts the modelling results for 1:5-year rainfall event with the proposed upgrades. The results indicate that with the proposed upgrades, no storm structure will experience flooding. 112 storm structures will surcharge, in the remainder of the storm network, which is reduced from 139 structures. The model indicates that the proposed upgrades will eliminate flooding of storm structures in Chesley for the 1:5-year rainfall event.

Figure 9A, 9B and 9C depicts the storm modelling results for the 1:100-year rainfall event with the proposed upgrades. The results indicate that 74 structures will experience flooding (down from 81) and 274 storm structures will surcharge (up from 270) during the 1:100-year storm. The increase in number of surcharging structures is due to reduction in the flooding volume, and more storage of runoff volume in the large diameter sewers. This will lead to surcharging of increased number of structures.

The total storm flooding volume is reduced from 5,503 m^3 to 4,427 m^3 for 1:100-year storm event. As noted earlier, the storm sewer system is not designed to convey the 1:100-year storm, however, the upgrades, if implemented, will greatly improve the conveyance of the 1:100-year storm and reduction in the flooding.

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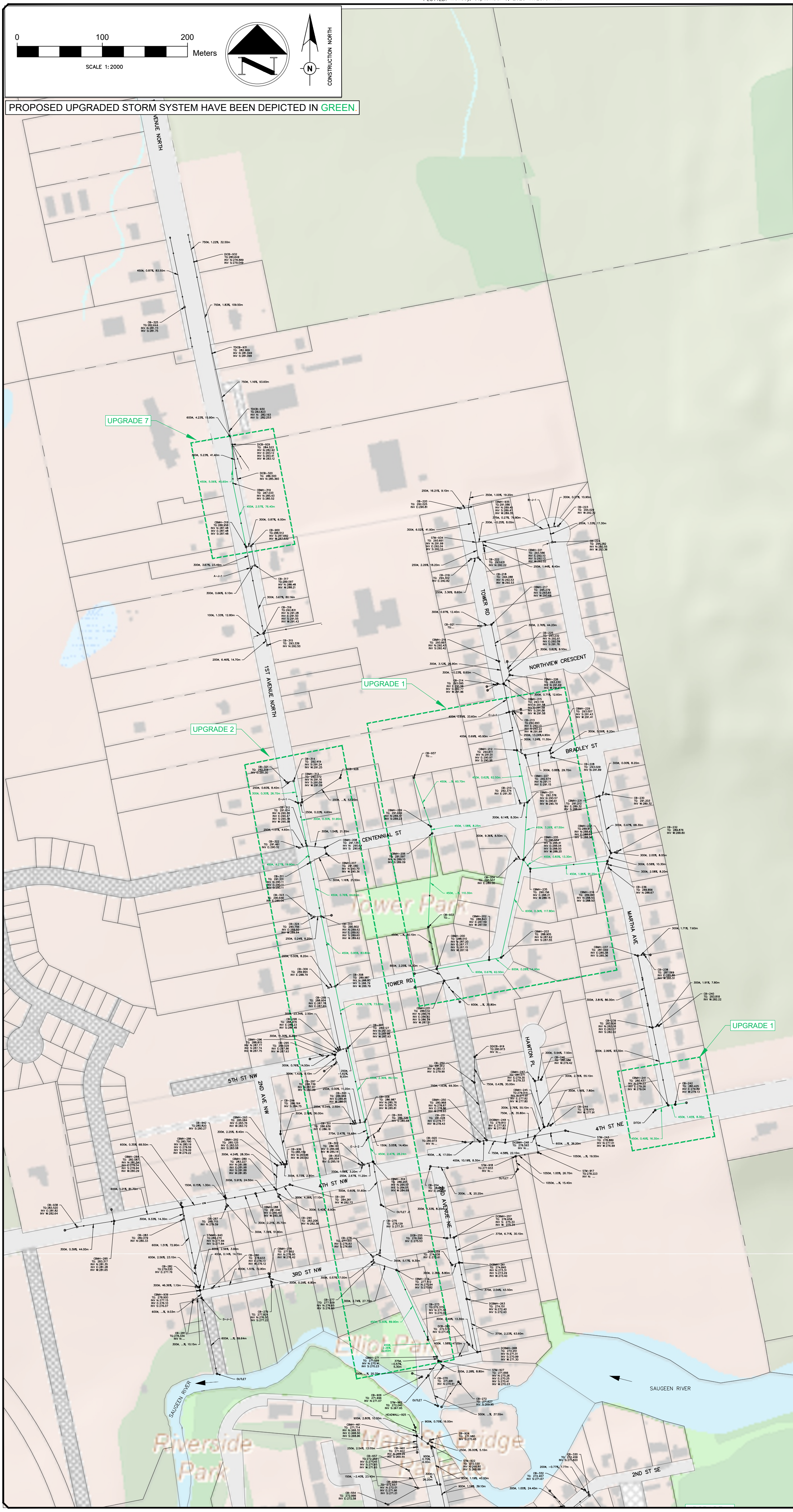

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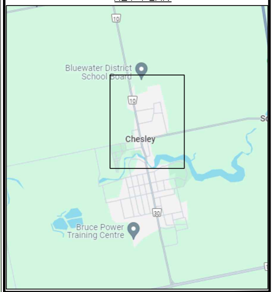

LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA — CATCHMENT AREA
- CB — CATCHBASIN
- CBMH — CATCHBASIN MANHOLE
- STMH — STORM MANHOLE
- DICB — DITCH INLET CATCHBASIN
- 231.00 — CONTOUR (1.0m)

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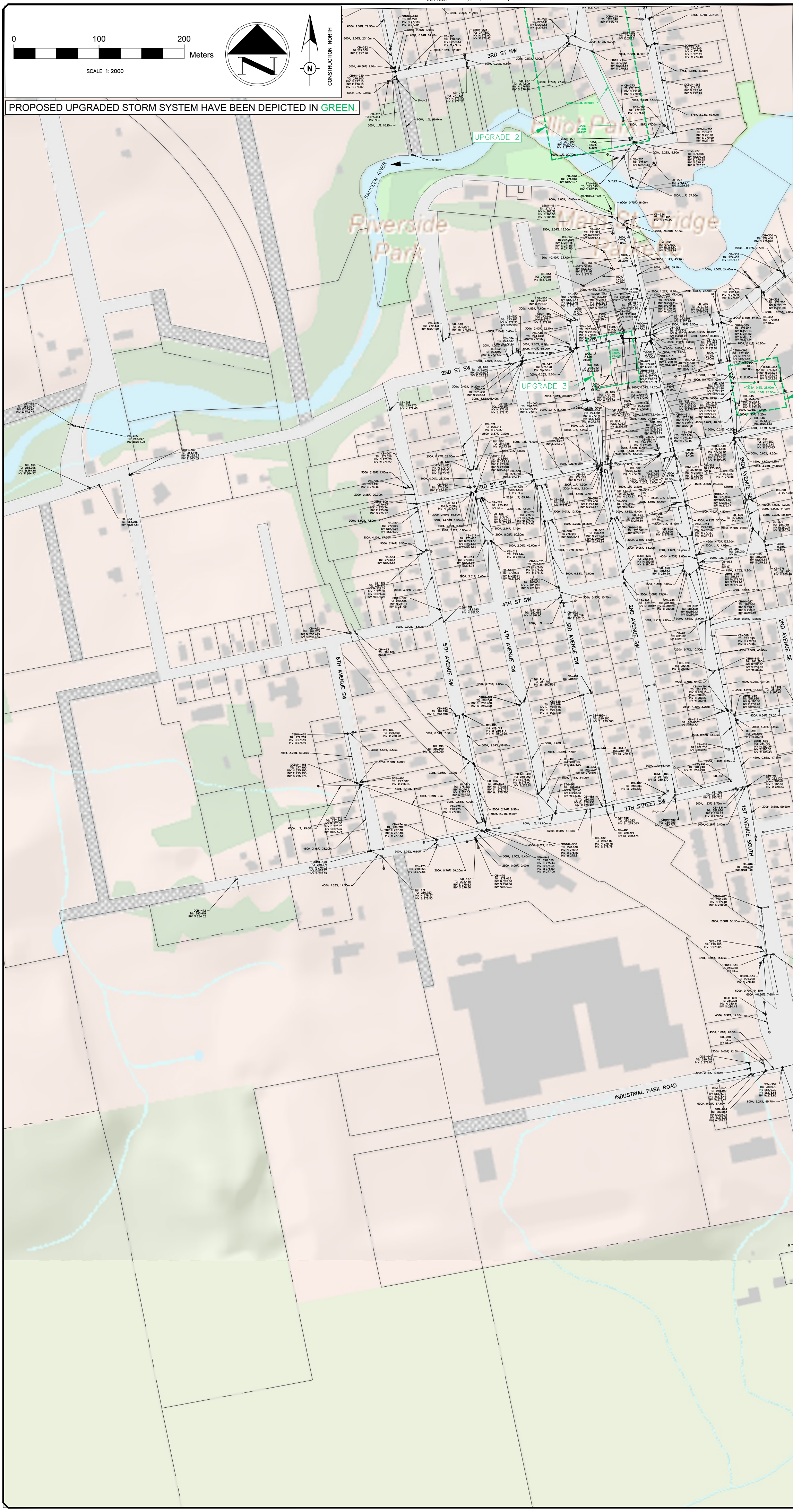

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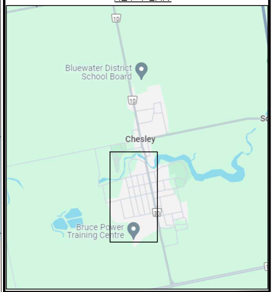

LEGEND

□	CATCHBASIN
○	STORM MANHOLE
>	STORM SEWER (FLOW DIRECTION)
CA	CATCHMENT AREA
CB	CATCHBASIN
CBMH	CATCHBASIN MANHOLE
STMMH	STORM MANHOLE
DICB	DITCH INLET CATCHBASIN
231.00	CONTOUR (1.0m)

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Client: MUNICIPALITY OF ARRAN ELDERSLIE

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Drawing No. 21–103–Fig. 7B

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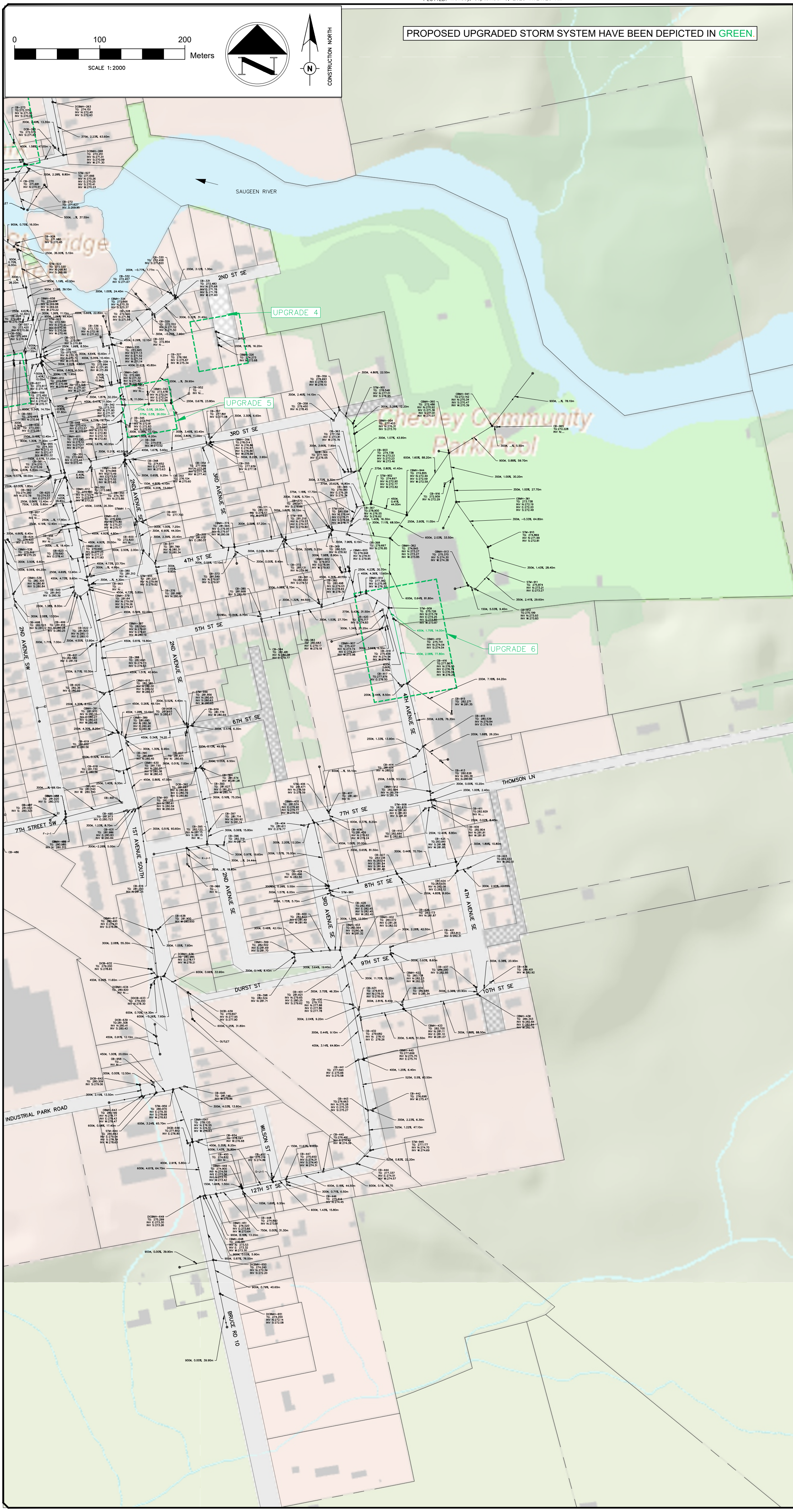

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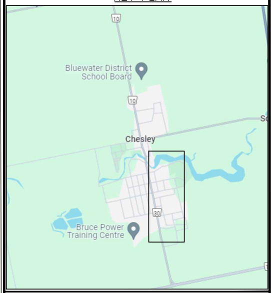

LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA — CATCHMENT AREA
- CB — CATCHBASIN
- CBMH — CATCHBASIN MANHOLE
- STMMH — STORM MANHOLE
- DICB — DITCH INLET CATCHBASIN
- 231.00 — CONTOUR (1.0m)

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GSS ENGINEERING CONSULTANTS LTD

945–3rd Ave. East, Unit #230, Owen Sound, ON, N4K 2K8
Telephone: (519) 372–4828

Title:

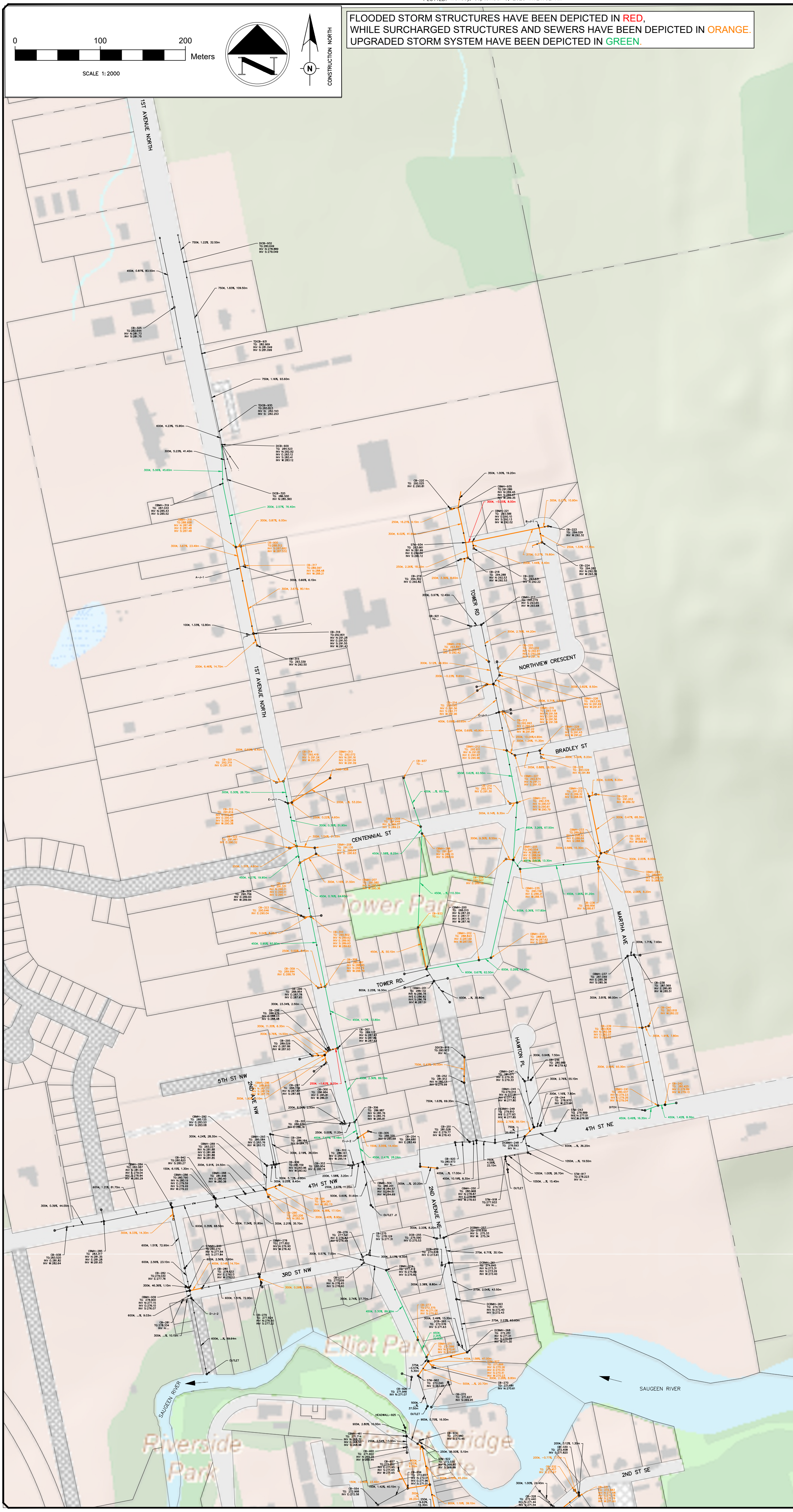
PROPOSED UPGRADES FOR EXISTING STORM NETWORK CHESLEY, ON

Client: MUNICIPALITY OF ARRAN ELDERSLIE

Design:	MK	Scale:	1:2000
Drawn:	MK	Approved:	Design Engineer
Checked:	RS		
Date:	JUNE 2024		

Drawing No. 21–103–Fig. 7C

FLOODED STORM STRUCTURES HAVE BEEN DEPICTED IN RED,
WHILE SURCHARGED STRUCTURES AND SEWERS HAVE BEEN DEPICTED IN ORANGE.
UPGRADED STORM SYSTEM HAVE BEEN DEPICTED IN GREEN.



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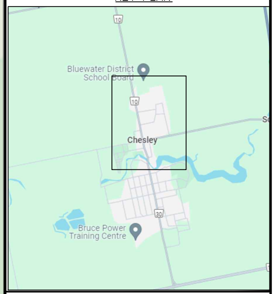

LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA CATCHMENT AREA
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- CBMH CATCHBASIN MANHOLE
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- DICB DITCH INLET CATCHBASIN
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GSS ENGINEERING CONSULTANTS LTD
945–3rd Ave. East, Unit #230, Owen Sound, ON, N4K 2K8
Telephone: (519) 372–4828

Title:
5 YEAR STORM MODELLING RESULTS PROPOSED STORM NETWORK CHESLEY, ON

Client: MUNICIPALITY OF ARRAN ELDERSLIE

Design:	MK	Scale:	1:2000
Drawn:	MK	Approved:	Design Engineer
Checked:	RS		
Date:	JUNE 2024		
Drawing No.	21–103–Fig. 8A		

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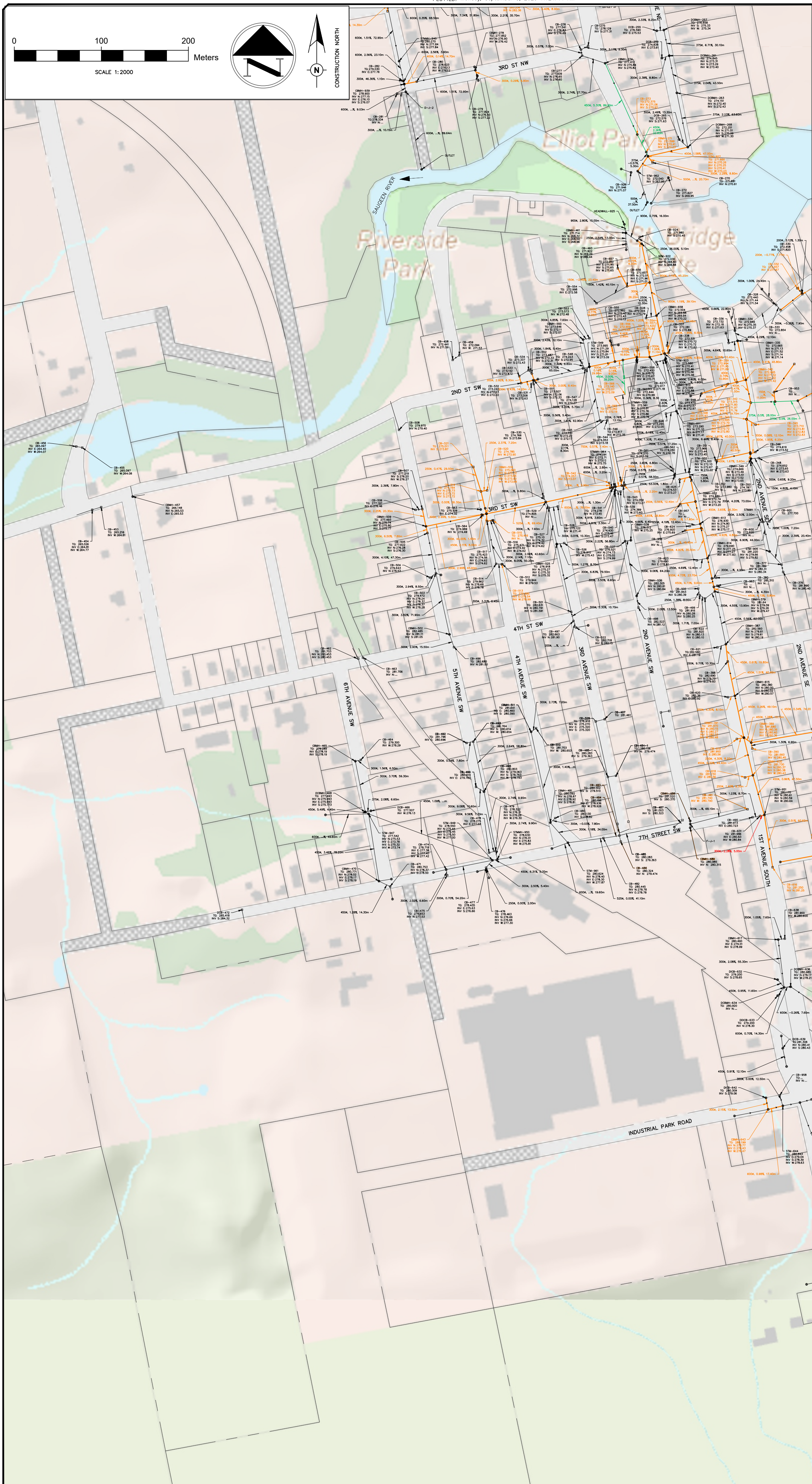

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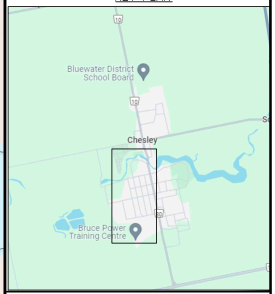

LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA CATCHMENT AREA
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Title:

5 YEAR STORM MODELLING RESULTS PROPOSED STORM NETWORK CHESLEY, ON

Client: MUNICIPALITY OF ARRAN ELDERSLIE

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Drawn:	MK	Approved:	Design Engineer
Checked:	RS		
Date:	JUNE 2024		

Drawing No. 21–103–Fig. 8B

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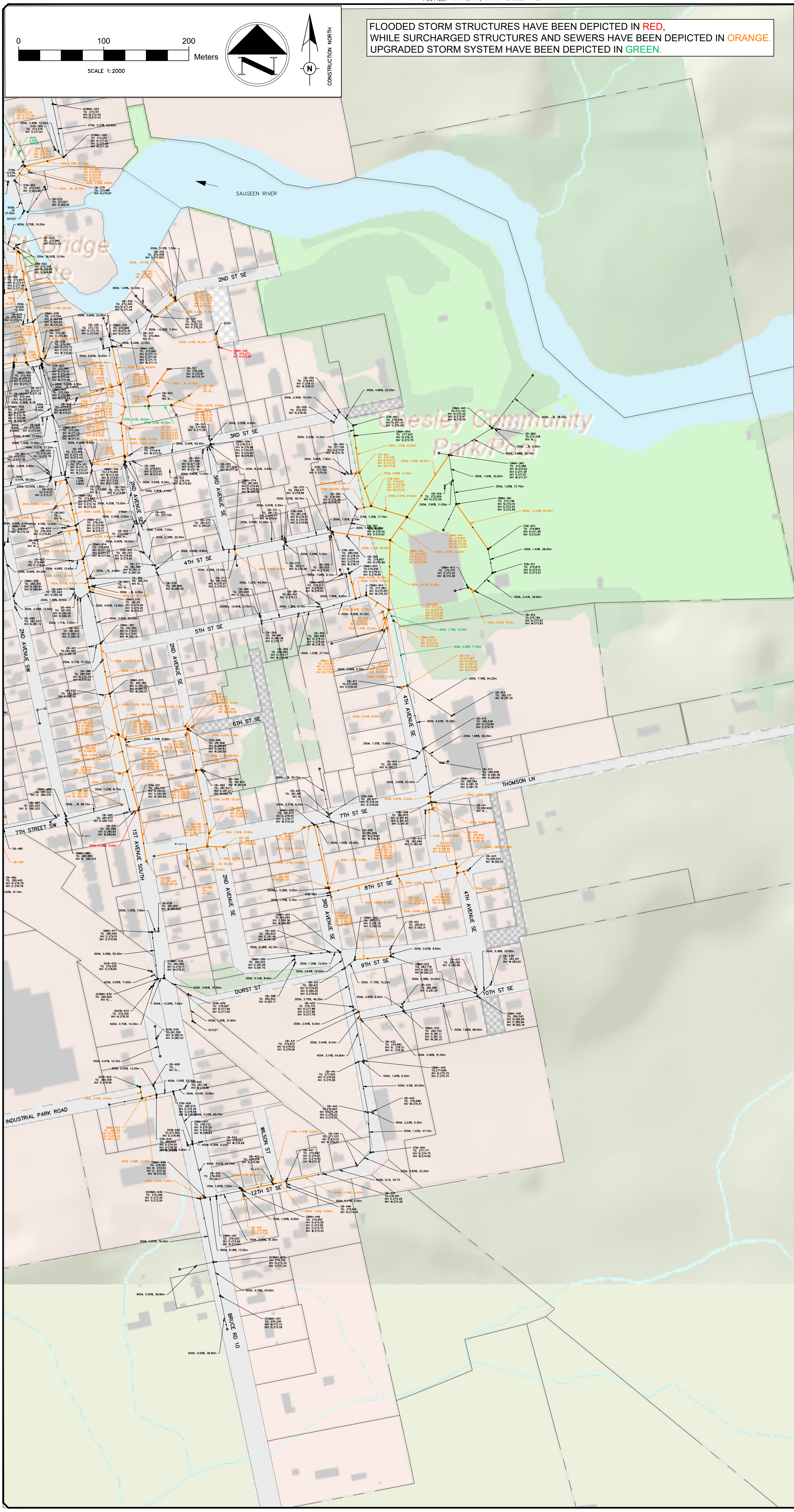

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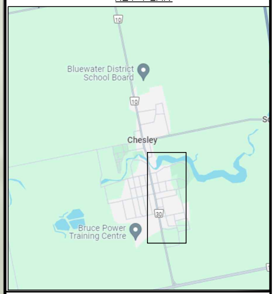

LEGEND

- CATCHBASIN
- STORM MANHOLE
- STORM SEWER (FLOW DIRECTION)
- CA — CATCHMENT AREA
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Telephone: (519) 372–4828

Title:
5 YEAR STORM
MODELLING RESULTS
PROPOSED STORM NETWORK
CHESLEY, ON

Client: MUNICIPALITY OF ARRAN ELDERSLIE

Design:	MK	Scale:	1:2000
Drawn:	MK	Approved:	Design Engineer
Checked:	RS		
Date:	JUNE 2024		

Drawing No. 21–103–Fig. 8C

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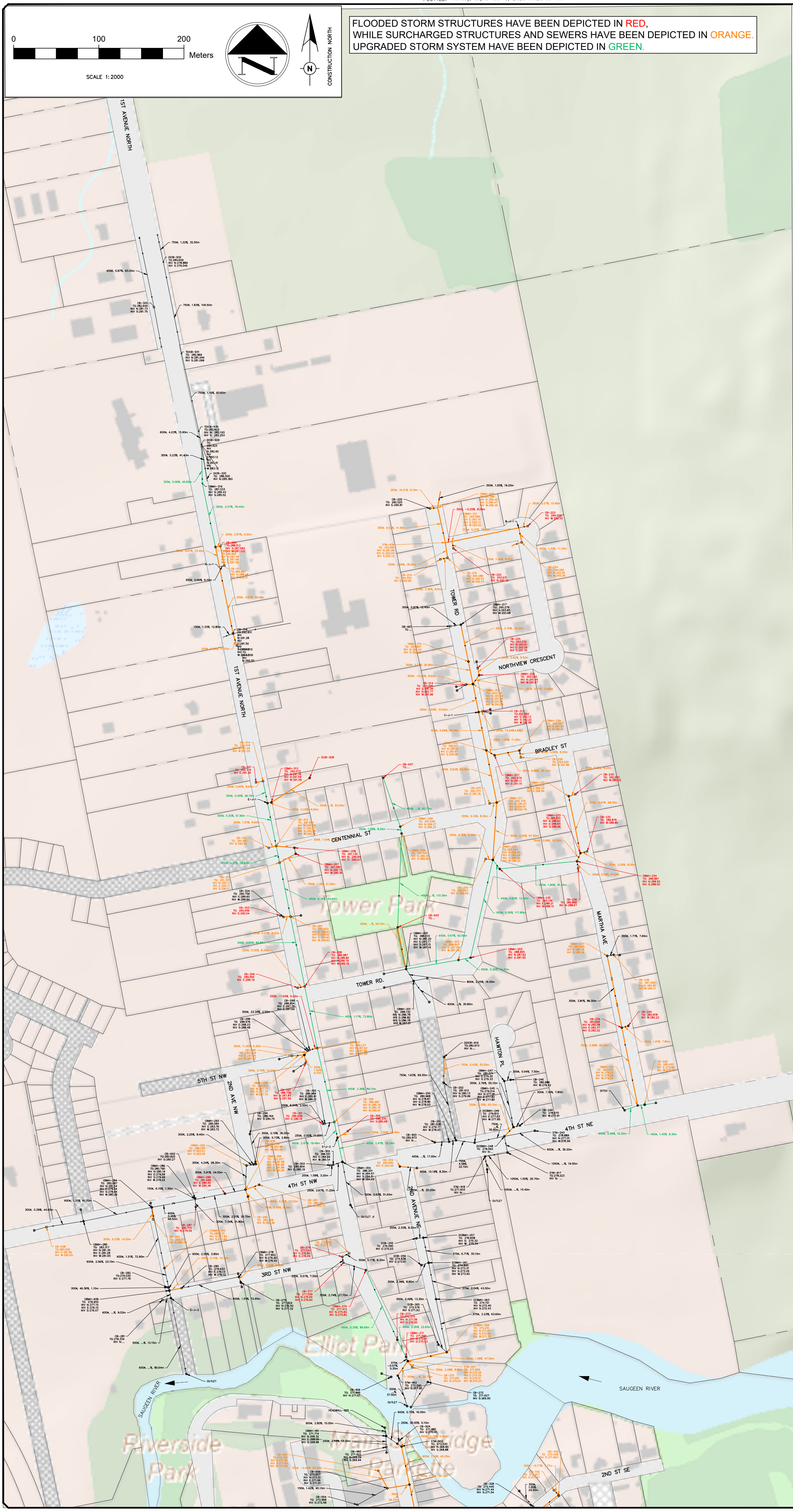

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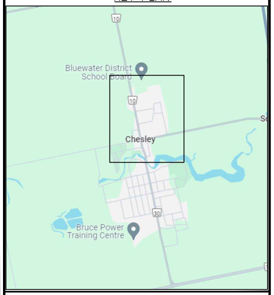

LEGEND

□	CATCHBASIN
○	STORM MANHOLE
>	STORM SEWER (FLOW DIRECTION)
CA	CATCHMENT AREA
CB	CATCHBASIN
CBMH	CATCHBASIN MANHOLE
STMMH	STORM MANHOLE
DICB	DITCH INLET CATCHBASIN
231.00	CONTOUR (1.0m)

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100 YEAR STORM MODELLING RESULTS PROPOSED STORM NETWORK CHESLEY, ON

Client: MUNICIPALITY OF ARRAN ELDERSLIE

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Date:	JUNE 2024		

Drawing No. 21–103–Fig. 9A

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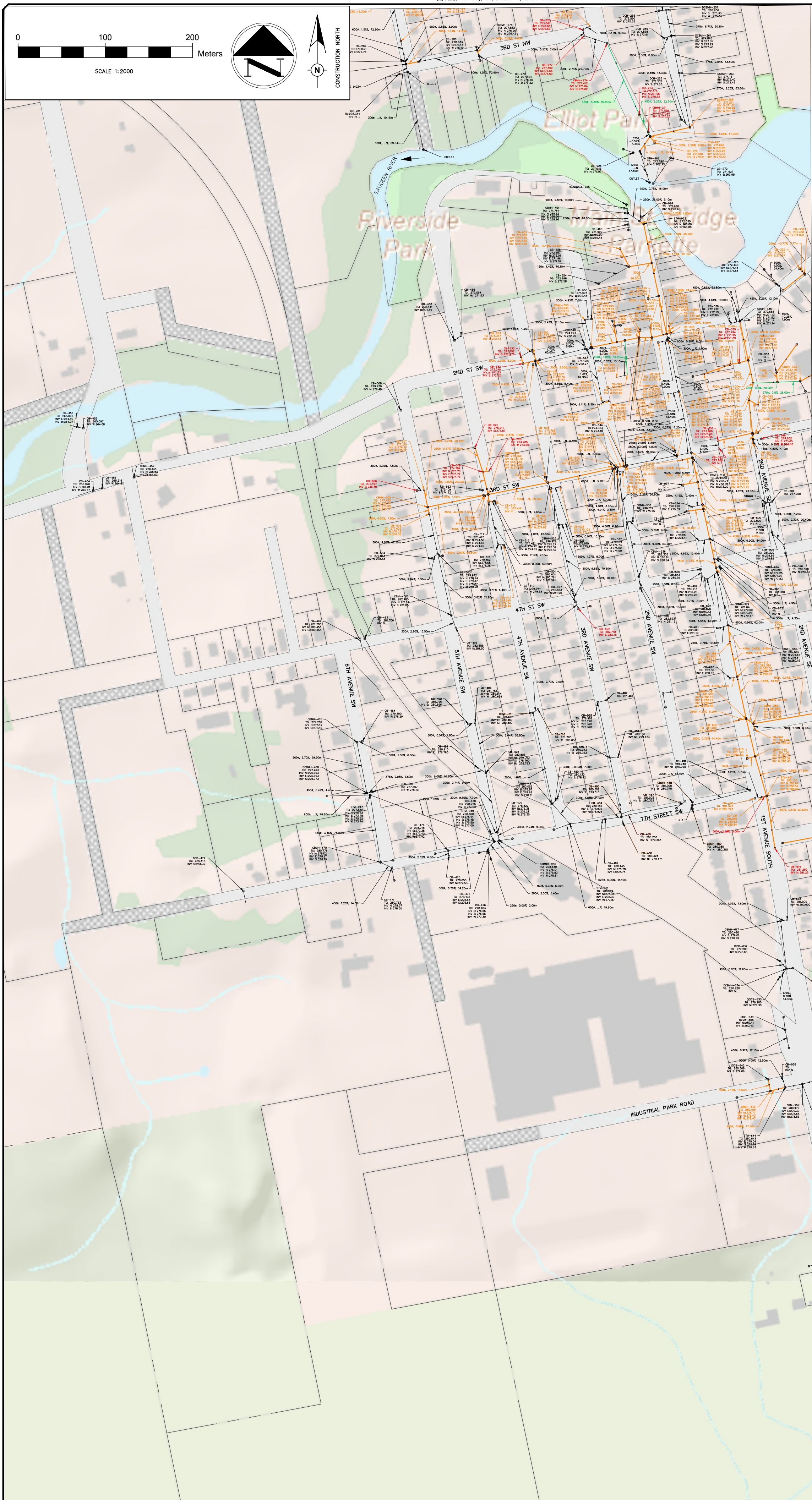

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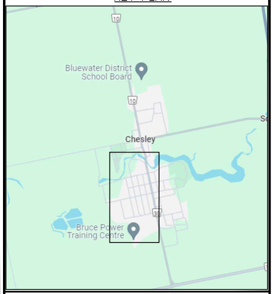

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Drawing No. 21–103–Fig. 9B

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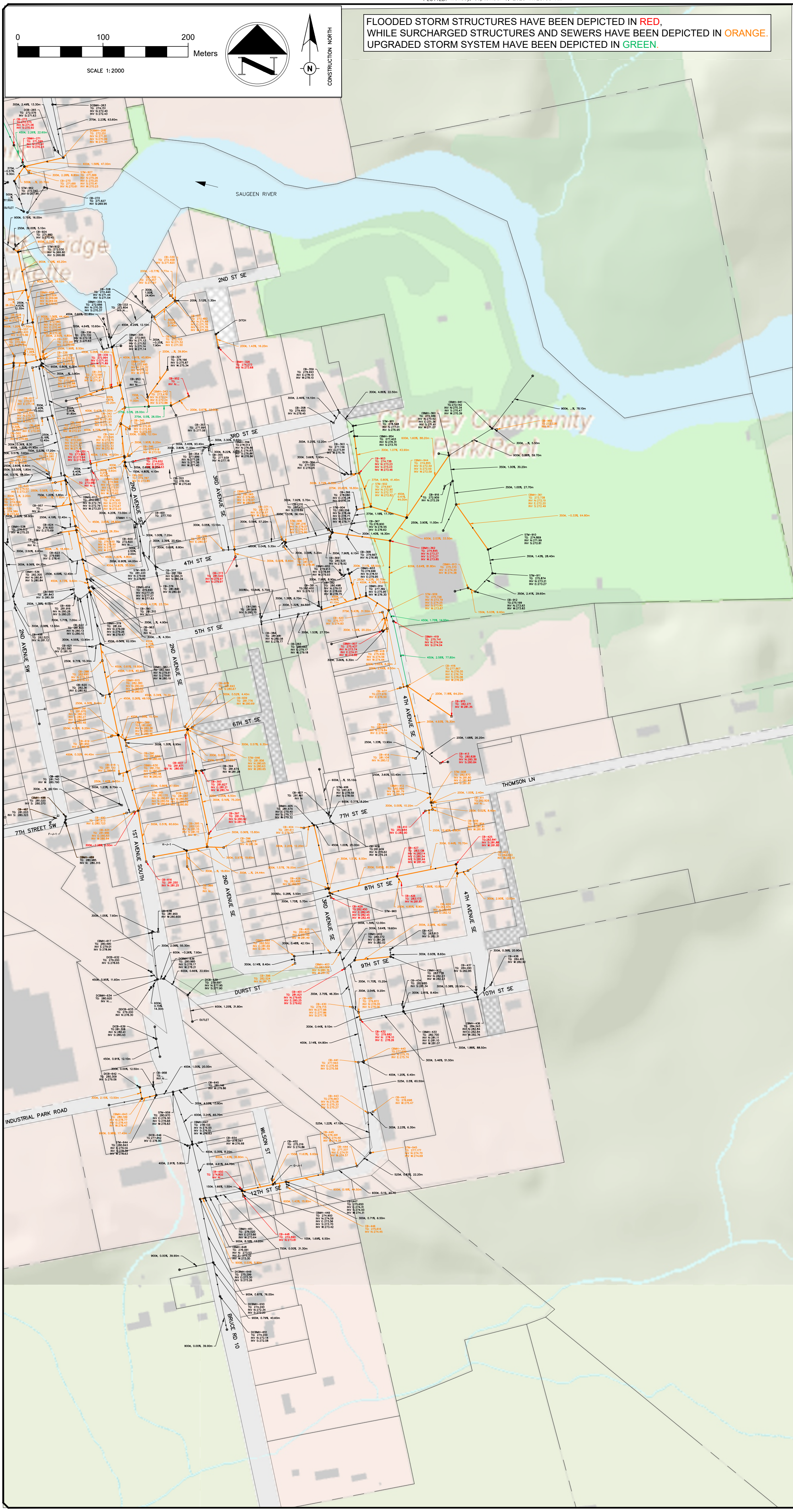

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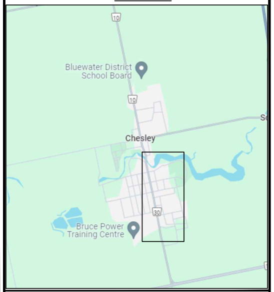

LEGEND

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Client: MUNICIPALITY OF ARRAN ELDERSLIE

Design:	MK	Scale:	1:2000
Drawn:	MK	Approved:	Design Engineer
Checked:	RS		
Date:	JUNE 2024		

Drawing No. 21–103–Fig. 9C

6 STORM INFRASTRUCTURE COST ESTIMATES

An approximate cost estimate of entire stormwater system was prepared by utilizing current replacement value of storm sewers, storm structures, curb & gutter, and culverts. An estimate of ditch construction cost was also included in the total asset cost. At some locations, the ditches have been filled in by residents. However, the cost estimate includes ditches, as the roads without curb & gutters and storm sewers, must have road ditches for proper handling of surface runoff.

Table 6.1 provides a streetwise breakdown of replacement cost of the existing storm infrastructure and excludes the cost of assets within Bruce County ROW. The unit prices included are based on the most recent prices in tendered project. The total asset value is estimated at $ 12.46 Million approximately. Any future use of indicated prices should be based on price adjustments for construction inflation, which tend to be much higher than posted inflation rate by StatsCan. The County Assets cost is estimated at $ 3.9 million approximately. Refer to **Table 6.2.**

Table 6.3 provides a cost estimate of five (5) infrastructure improvements recommended in **Table 5.1** which are municipal assets. The table is self-explanatory. The total improvement cost based on 2024 dollar value is $ 746,863, including engineering and contingencies. Note that this estimate does not include any road reconstruction or road restoration estimates. As noted above, the dollar amounts should be adjusted for construction inflation when used in future. It should be borne in mind, that there are a numerous structures and storm sewers that are currently experiencing surcharging. They are not high priority but will require replacement whenever street reconstruction will take place at those locations.

Considering that all five (5) projects cannot be implemented simultaneously and other future upgrades will be required, the municipality can consider an annual fund contribution of $300,000 per year towards storm infrastructure improvements.

TABLE 6.1
Cost Estimate
Chesley Storm Sewer System: Existing Conditions

Street Name	Street		Pipe Size ø	Pipe Length (m)	Unit Price Per m Length ($)	Total Cost ($)	Total Cost (Storm Sewer) ($)	Number of Storm Structures	Unit Cost (Storm Structure) ($)	Total Cost (Storm Structure) ($)	Curb & Gutter			Ditches			Grand Total Cost ($)
	From	To									Length	Unit Price	Cost	Length (m)	Unit Price	Cost	
Tower Road	1st Ave N	Northview Cres N	350	19.2	$400.00	$7,680.00	$305,135.00	14	$5,000.00	$70,000.00	1644	$125.00	$205,500.00	370	$180.00	$66,600.00	$647,235.00
			250	9.1	$225.00	$2,047.50											
			300	41.9	$375.00	$15,712.50											
	Northview Cres N	Northview Cres S	250	18.2	$225.00	$4,095.00											
			250	8.6	$225.00	$1,935.00											
			300	12.4	$375.00	$4,650.00											
			300	44.2	$375.00	$16,575.00											
			300	26.9	$375.00	$10,087.50											
	Northview Cres S	Bradley St	300	8.6	$375.00	$3,225.00											
			400	33.6	$425.00	$14,280.00											
			300	12.6	$375.00	$4,725.00											
			250	4.9	$225.00	$1,102.50											
			400	45.9	$425.00	$19,507.50											
	Bradley St	Fairview Dr	300	62.5	$375.00	$23,437.50											
			300	8.3	$375.00	$3,112.50											
			300	8.5	$375.00	$3,187.50											
			300	13.3	$375.00	$4,987.50											
			300	67.5	$375.00	$25,312.50											
	Fairview Dr	1st Ave N	450	117.8	$450.00	$53,010.00											
			450	14.4	$450.00	$6,480.00											
			450	62.5	$450.00	$28,125.00											
			800	16.5	$750.00	$12,375.00											
			600	30.8	$550.00	$16,940.00											
			450	50.1	$450.00	$22,545.00											
Centennial St	1st Ave N	Tower Rd	300	8.25	$375.00	$3,093.75	$86,026.25	4	$5,000.00	$20,000.00	516	$125.00	$64,500.00	0	$180.00	$0.00	$170,526.25
			300	60.7	$375.00	$22,762.50											
			300	21.3	$375.00	$7,987.50											
			300	21.5	$375.00	$8,062.50											
			350	110.3	$400.00	$44,120.00											
Bradley St	Tower Rd	Fairview Dr	300	11.3	$375.00	$4,237.50	$18,450.00	3	$5,000.00	$15,000.00	296	$125.00	$37,000.00	0	$180.00	$0.00	$70,450.00
			300	29.7	$375.00	$11,137.50											
			300	8.2	$375.00	$3,075.00											
	Fairview Dr	East end	- - -	- - -	- - -	- - -											
Northview Cres	Tower Rd N	Tower Rd S	300	8	$375.00	$3,000.00	$47,578.50	6	$5,000.00	$30,000.00	678	$125.00	$84,750.00	0	$180.00	$0.00	$162,328.50
			250	8.4	$225.00	$1,890.00											
			375	79.8	$395.00	$31,521.00											
			300	10.9	$375.00	$4,087.50											
			250	17.3	$225.00	$3,892.50											
			300	8.5	$375.00	$3,187.50											
Fairview Dr	Tower Rd	Bradley St	300	91.2	$375.00	$34,200.00	$72,825.00	7	$5,000.00	$35,000.00	510	$125.00	$63,750.00	0	$180.00	$0.00	$171,575.00
			300	10.3	$375.00	$3,862.50											
			300	8.2	$375.00	$3,075.00											
			300	8.0	$375.00	$3,000.00											
			300	68.3	$375.00	$25,612.50											
			300	8.2	$375.00	$3,075.00											
Martha Ave	Fairview Dr	Bruce Rd 10	300	7.6	$375.00	$2,850.00	$73,012.50	6	$5,000.00	$30,000.00	596	$125.00	$74,500.00	0	$180.00	$0.00	$177,512.50
			300	86	$375.00	$32,250.00											
			300	7.8	$375.00	$2,925.00											
			300	93.3	$375.00	$34,987.50											
Hawton Pl	Bruce Rd 10	North end	300	7.5	$375.00	$2,812.50	$26,400.00	6	$5,000.00	$30,000.00	242	$125.00	$30,250.00	0	$180.00	$0.00	$86,650.00
			300	55.1	$375.00	$20,662.50											
			300	7.8	$375.00	$2,925.00											
Palmer Marie Ln	West end	East end	- - -	- - -	- - -	- - -	$0.00	0	$5,000.00	$0.00	0	$125.00	$0.00	0	$180.00	$0.00	$0.00
5th St NW	2nd Ave NW	Bruce Rd 10	300	14.5	$375.00	$5,437.50	$12,150.00	2	$5,000.00	$10,000.00	188	$125.00	$23,500.00	0	$180.00	$0.00	$45,650.00
			300	9.1	$375.00	$3,412.50											
			300	6.3	$375.00	$2,362.50											
			300	2.5	$375.00	$937.50											

TABLE 6.1
Cost Estimate
Chesley Storm Sewer System: Existing Conditions

21-103-01A 21-103

Street Name	Street		Pipe Size ø	Pipe Length (m)	Unit Price Per m Length ($)	Total Cost ($)	Total Cost (Storm Sewer) ($)	Number of Storm Structures	Unit Cost (Storm Structure) ($)	Total Cost (Storm Structure) ($)	Curb & Gutter			Ditches			Grand Total Cost ($)
	From	To									Length	Unit Price	Cost	Length (m)	Unit Price	Cost	
2nd Ave NW	5th St Nw	4th St NW	300	36	$375.00	$13,500.00	$28,312.50	5	$5,000.00	$25,000.00	280	$125.00	$35,000.00	0	$180.00	$0.00	$88,312.50
			300	8.4	$375.00	$3,150.00											
			300	2.8	$375.00	$1,050.00											
			300	28.3	$375.00	$10,612.50											
2nd Ave NE	4th St NW	2nd St NE	300	8.2	$375.00	$3,075.00	$60,569.00	7	$5,000.00	$35,000.00	460	$125.00	$57,500.00	0	$180.00	$0.00	$153,069.00
			375	30.1	$395.00	$11,889.50											
			300	8.8	$375.00	$3,300.00											
			375	43.5	$395.00	$17,182.50											
			375	63.6	$395.00	$25,122.00											
2nd St NE	1st Ave N	2nd Ave NE	300	13.3	$375.00	$4,987.50	$24,962.50	3	$5,000.00	$15,000.00	102	$125.00	$12,750.00	0	$180.00	$0.00	$52,712.50
			400	47	$425.00	$19,975.00											
Hawkins St	4th St NW	3rd St NW	300	14.3	$375.00	$5,362.50	$199,517.25	5	$5,000.00	$25,000.00	192	$125.00	$24,000.00	0	$180.00	$0.00	$248,517.25
			600	72.9	$550.00	$40,095.00											
			600	23.1	$550.00	$12,705.00											
			300	1.1	$375.00	$412.50											
			400	14.7	$425.00	$6,247.50											
			600	3.9	$550.00	$2,145.00											
			600	9.0	$550.00	$4,966.50											
			300	10.2	$375.00	$3,806.25											
			600	89.6	$550.00	$49,302.00											
	West of Hawkins		750	30.0	$750.00	$22,500.00											
			750	69.3	$750.00	$51,975.00											
3rd St NW	1st Ave N	Hawkins St	600	72.9	$550.00	$40,095.00	$59,145.00	6	$5,000.00	$30,000.00	430	$125.00	$53,750.00	0	$180.00	$0.00	$142,895.00
			300	6.8	$375.00	$2,550.00											
			300	7	$375.00	$2,625.00											
			300	9.3	$375.00	$3,487.50											
			300	27.7	$375.00	$10,387.50											
Riverside Dr	4th Ave SW	1st Ave N	250	13	$225.00	$2,925.00	$10,425.00	2	$5,000.00	$10,000.00	0	$125.00	$0.00	520	$180.00	$93,600.00	$114,025.00
			900	10	$750.00	$7,500.00											
4th Ave SW	Riverside Dr	2nd St W	- - -	- - -	- - -	- - -	$106,282.50	16	$5,000.00	$80,000.00	1140	$125.00	$142,500.00	398	$180.00	$71,640.00	$400,422.50
	2nd St W	3rd St SW	250	29.5	$225.00	$6,637.50											
			250	7.2	$225.00	$1,620.00											
			300	26.3	$375.00	$9,862.50											
			300	5.5	$375.00	$2,062.50											
	3rd St SW	4th St SW	300	1.5	$375.00	$562.50											
			450	8	$450.00	$3,600.00											
			300	7.1	$375.00	$2,662.50											
			300	50.2	$375.00	$18,825.00											
			300	6.4	$375.00	$2,400.00											
	4th St SW	7th St SW	300	7	$375.00	$2,625.00											
			300	106	$375.00	$39,750.00											
			300	7.8	$375.00	$2,925.00											
			300	34	$375.00	$12,750.00											
5th Ave SW	2nd St W	3rd St SW	300	7.8	$375.00	$2,925.00	$106,425.00	16	$5,000.00	$80,000.00	916	$125.00	$114,500.00	150	$180.00	$27,000.00	$327,925.00
			300	20.3	$375.00	$7,612.50											
	3rd St SW	4th St SW	300	7.8	$375.00	$2,925.00											
			300	47.3	$375.00	$17,737.50											
			300	8.5	$375.00	$3,187.50											
			300	71.9	$375.00	$26,962.50											
			300	15.5	$375.00	$5,812.50											
	4th St SW	7th St SW	300	7.8	$375.00	$2,925.00											
			300	58.8	$375.00	$22,050.00											
			300	10.6	$375.00	$3,975.00											
			300	9.9	$375.00	$3,712.50											
			300	7.7	$375.00	$2,887.50											
			300	9.9	$375.00	$3,712.50											

TABLE 6.1

Cost Estimate

Chesley Storm Sewer System: Existing Conditions

21-103-01A 21-103

Street Name	Street		Pipe Size ø	Pipe Length (m)	Unit Price Per m Length ($)	Total Cost ($)	Total Cost (Storm Sewer) ($)	Number of Storm Structures	Unit Cost (Storm Structure) ($)	Total Cost (Storm Structure) ($)	Curb & Gutter			Ditches			Grand Total Cost ($)
	From	To									Length	Unit Price	Cost	Length (m)	Unit Price	Cost	
3rd Ave SW	North End	2nd St W	200	6.6	$215.00	$1,419.00	$146,504.00	15	$5,000.00	$75,000.00	1192	$125.00	$149,000.00	0	$180.00	$0.00	$370,504.00
			300	5.4	$375.00	$2,025.00											
			300	8.4	$375.00	$3,150.00											
			300	8.3	$375.00	$3,112.50											
	2nd St W	3rd St SW	300	6.8	$375.00	$2,550.00											
	3rd St SW	4th St SW	300	7.6	$375.00	$2,850.00											
			300	10.3	$375.00	$3,862.50											
			300	42.6	$375.00	$15,975.00											
			300	8.7	$375.00	$3,262.50											
			300	79.5	$375.00	$29,812.50											
	4th St SW	7th St SW	300	65	$375.00	$24,375.00											
			300	10	$375.00	$3,750.00											
			300	10	$375.00	$3,750.00											
			375	90	$395.00	$35,550.00											
			375	10	$395.00	$3,950.00											
			375	8	$395.00	$3,160.00											
			375	10	$395.00	$3,950.00											
2nd Ave SW	North End	2nd St W	300	7.6	$375.00	$2,850.00	$154,320.35	18	$5,000.00	$90,000.00	1216	$125.00	$152,000.00	226	$180.00	$40,680.00	$437,000.35
			300	32.1	$375.00	$12,037.50											
	2nd St W	3rd St SW	300	62.9	$375.00	$23,587.50											
			200	39.29	$215.00	$8,447.35											
			200	13.1	$215.00	$2,816.50											
			300	8.3	$375.00	$3,112.50											
	3rd St SW	4th St SW	300	56.8	$375.00	$21,300.00											
			300	6.6	$375.00	$2,475.00											
			300	64.2	$375.00	$24,075.00											
			300	13.5	$375.00	$5,062.50											
	4th St SW	7th St SW	200	6.6	$215.00	$1,419.00											
			300	3.6	$375.00	$1,350.00											
			300	12.1	$375.00	$4,537.50											
			300	110	$375.00	$41,250.00											
Alexandra St	North end	4th St SW	- - -	- - -	- - -	$0.00	$0.00	0	$5,000.00	$0.00	0	$125.00	$0.00	357	$180.00	$64,260.00	$64,260.00
Janet St	Thomas Rd	East end	- - -	- - -	- - -	$0.00	$0.00	0	$5,000.00	$0.00	0	$125.00	$0.00	102	$180.00	$18,360.00	$18,360.00
Thomas Rd	4th St NW	2nd St SW	300	14	$375.00	$5,250.00	$26,737.50	0	$5,000.00	$0.00	0	$125.00	$0.00	1486	$180.00	$267,480.00	$294,217.50
			300	12.2	$375.00	$4,575.00											
			300	10.9	$375.00	$4,087.50											
			300	18.7	$375.00	$7,012.50											
			300	7	$375.00	$2,625.00											
			300	8.5	$375.00	$3,187.50											
	2nd St SW	4th St SW	- - -	- - -	- - -	- - -											
6th Ave SW	4th St SW	7th St SW	300	6.5	$375.00	$2,437.50	$160,132.00	6	$5,000.00	$30,000.00	500	$125.00	$62,500.00	0	$180.00	$0.00	$252,632.00
			300	59.3	$375.00	$22,237.50											
			375	6.6	$395.00	$2,607.00											
			450	4.4	$450.00	$1,980.00											
			600	49.6	$550.00	$27,280.00											
			450	78.2	$450.00	$35,190.00											
			450	152	$450.00	$68,400.00											
Bearman St	West end	Thomas Rd	- - -	- - -	- - -	$0.00	$0.00	0	$5,000.00	$0.00	0	$125.00	$0.00	350	$180.00	$63,000.00	$63,000.00
2nd St SW	Thomas Rd	5th Ave SW	- - -	- - -	- - -	- - -	$96,350.00	12	$5,000.00	$60,000.00	448	$125.00	$56,000.00	814	$180.00	$146,520.00	$358,870.00
	5th Ave SW	4th Ave SW	- - -	- - -	- - -	- - -											
	4th Ave SW	3rd Ave SW	- - -	- - -	- - -	- - -											
	3rd Ave SW	2nd Ave SW	300	14.2	$375.00	$5,325.00											
			300	5.4	$375.00	$2,025.00											
			300	65.0	$375.00	$24,375.00											
			300	8.8	$375.00	$3,300.00											
			300	5.7	$375.00	$2,137.50											
	2nd Ave SW	1st Ave S	200	19	$215.00	$4,085.00											
			300	2.9	$375.00	$1,087.50											
			600	16.6	$550.00	$9,130.00											
			600	29.9	$550.00	$16,445.00											
			600	9.2	$550.00	$5,060.00											
			300	8.3	$375.00	$3,112.50											
			600	14.7	$550.00	$8,085.00											
			300	11.1	$375.00	$4,162.50											
			150	40.1	$200.00	$8,020.00											

TABLE 6.1

Cost Estimate

Chesley Storm Sewer System: Existing Conditions

21-103-01A 21-103

Street Name	Street		Pipe Size ø	Pipe Length (m)	Unit Price Per m Length ($)	Total Cost ($)	Total Cost (Storm Sewer) ($)	Number of Storm Structures	Unit Cost (Storm Structure) ($)	Total Cost (Storm Structure) ($)	Curb & Gutter			Ditches			Grand Total Cost ($)
	From	To									Length	Unit Price	Cost	Length (m)	Unit Price	Cost	
4th St SW	Thomas Rd	6th Ave SW	- - -	- - -	- - -	- - -	$10,157.50	7	$5,000.00	$35,000.00	1256	$125.00	$157,000.00	0	$180.00	$0.00	$202,157.50
	6th Ave SW	5th Ave SW	- - -	- - -	- - -	- - -											
	5th Ave SW	4th Ave SW	- - -	- - -	- - -	- - -											
	4th Ave SW	3rd Ave SW	200	8	$215.00	$1,720.00											
			300	10.7	$375.00	$4,012.50											
	3rd Ave SW	2nd Ave SW	- - -	- - -	- - -	$0.00											
	2nd Ave SW	1st Ave S	250	8	$225.00	$1,800.00											
			300	7	$375.00	$2,625.00											
3rd St SW	5th Ave SW	4th Ave SW	300	65.6	$375.00	$24,600.00	$141,002.50	11	$5,000.00	$55,000.00	600	$125.00	$75,000.00	0	$180.00	$0.00	$271,002.50
	4th Ave SW	3rd Ave SW	525	69.4	$475.00	$32,965.00											
	3rd Ave SW	2nd Ave SW	600	3.2	$550.00	$1,760.00											
			300	5.9	$375.00	$2,212.50											
			300	1.3	$375.00	$487.50											
			300	3.6	$375.00	$1,350.00											
			300	3.3	$375.00	$1,237.50											
			300	6.4	$375.00	$2,400.00											
	2nd Ave SW	1st Ave S	300	2.2	$375.00	$825.00											
			750	58	$750.00	$43,500.00											
			750	3.6	$750.00	$2,700.00											
			300	6	$375.00	$2,250.00											
			600	2.8	$550.00	$1,540.00											
			750	7.4	$750.00	$5,550.00											
			250	6.8	$225.00	$1,530.00											
			250	1.8	$225.00	$405.00											
			250	12.4	$225.00	$2,790.00											
			750	17.2	$750.00	$12,900.00											
7th St SW	West end	6th Ave SW	450	14.3	$450.00	$6,435.00	$99,115.00	15	$5,000.00	$75,000.00	1004	$125.00	$125,500.00	202	$180.00	$36,360.00	$335,975.00
	6th Ave SW	5th Ave SW	300	6.6	$375.00	$2,475.00											
			300	54.2	$375.00	$20,325.00											
			250	2	$225.00	$450.00											
	5th Ave SW	4th Ave SW	300	5.4	$375.00	$2,025.00											
			450	5.7	$450.00	$2,565.00											
	4th Ave SW	3rd Ave SW	600	19.6	$550.00	$10,780.00											
			525	41.1	$475.00	$19,522.50											
	3rd Ave SW	2nd Ave SW	250	40	$225.00	$9,000.00											
	2nd Ave SW	1st Ave S	300	68.1	$375.00	$25,537.50											
2nd St SE	1st Ave S	2nd Ave SE	- - -	- - -	- - -	- - -	$49,000.55	13	$5,000.00	$65,000.00	478	$125.00	$59,750.00	0	$180.00	$0.00	$173,750.55
	2nd Ave SE	East end	300	10.6	$375.00	$3,975.00											
			450	22.8	$450.00	$10,260.00											
			450	12.1	$450.00	$5,445.00											
			300	7.9	$375.00	$2,962.50											
			300	24.4	$375.00	$9,150.00											
			300	31.4	$375.00	$11,775.00											
			200	1.3	$215.00	$279.50											
			200	7.77	$215.00	$1,670.55											
			200	16.2	$215.00	$3,483.00											
3rd St SE	1st Ave S	2nd Ave SE	300	8.4	$375.00	$3,150.00	$70,400.00	9	$5,000.00	$45,000.00	666	$125.00	$83,250.00	0	$180.00	$0.00	$198,650.00
			300	40.5	$375.00	$15,187.50											
			400	5.6	$425.00	$2,380.00											
			150	4.1	$200.00	$820.00											
	2nd Ave SE	3rd Ave SE	300	9.2	$375.00	$3,450.00											
			300	6.2	$375.00	$2,325.00											
			300	93.4	$375.00	$35,025.00											
			300	11	$375.00	$4,125.00											
	3rd Ave SE	4th Ave SE	300	3.9	$375.00	$1,462.50											
			300	6.6	$375.00	$2,475.00											
4th St SE	1st Ave S	2nd Ave SE	- - -	- - -	- - -	- - -	$62,212.50	14	$5,000.00	$70,000.00	644	$125.00	$80,500.00	0	$180.00	$0.00	$212,712.50
	2nd Ave SE	3rd Ave SE	300	8.8	$375.00	$3,300.00											
	3rd Ave SE	4th Ave SE	300	13.1	$375.00	$4,912.50											
			300	8.4	$375.00	$3,150.00											
			300	57.2	$375.00	$21,450.00											
			300	5.3	$375.00	$1,987.50											
			300	5.2	$375.00	$1,950.00											
			300	56.1	$375.00	$21,037.50											
			300	6.1	$375.00	$2,287.50											
			300	5.7	$375.00	$2,137.50											
5th St SE	1st Ave S	4th St SE	300	5.7	$375.00	$2,137.50	$60,465.00	7	$5,000.00	$35,000.00	738	$125.00	$92,250.00	0	$180.00	$0.00	$187,715.00
			300	44.5	$375.00	$16,687.50											
			300	6.7	$375.00	$2,512.50											
			300	27.7	$375.00	$10,387.50											
			450	41.1	$450.00	$18,495.00											
			300	8.9	$375.00	$3,337.50											
			250	30.7	$225.00	$6,907.50											

TABLE 6.1

Cost Estimate

Chesley Storm Sewer System: Existing Conditions

Street Name	Street		Pipe Size ø	Pipe Length (m)	Unit Price Per m Length ($)	Total Cost ($)	Total Cost (Storm Sewer) ($)	Number of Storm Structures	Unit Cost (Storm Structure) ($)	Total Cost (Storm Structure) ($)	Curb & Gutter			Ditches			Grand Total Cost ($)
	From	To									Length	Unit Price	Cost	Length (m)	Unit Price	Cost	
6th St SE	1st Ave S	2nd Ave SE	300	6.9	$375.00	$2,587.50	$37,627.50	4	$5,000.00	$20,000.00	158	$125.00	$19,750.00	0	$180.00	$0.00	$77,377.50
			450	74.2	$450.00	$33,390.00											
			300	4.4	$375.00	$1,650.00											
7th St SE	1st Ave S	2nd Ave SE	300	18.8	$375.00	$7,050.00	$86,076.00	16	$5,000.00	$80,000.00	802	$125.00	$100,250.00	0	$180.00	$0.00	$266,326.00
			300	24.4	$375.00	$9,150.00											
			300	19.6	$375.00	$7,350.00											
			300	15.8	$375.00	$5,925.00											
	2nd Ave SE	3rd Ave SE	300	12.2	$375.00	$4,575.00											
	3rd Ave SE	4th Ave SE	450	20	$450.00	$9,000.00											
			600	8.2	$550.00	$4,510.00											
			600	55.1	$550.00	$30,305.00											
	4th Ave SE	East end	250	8.8	$225.00	$1,980.00											
			250	8.4	$225.00	$1,890.00											
			300	10.2	$375.00	$3,825.00											
			200	2.4	$215.00	$516.00											
Thomson Ln	7th St SE	East end	- - -	- - -	- - -	- - -	$0.00	0	$5,000.00	$0.00	0	$125.00	$0.00	1210	$180.00	$217,800.00	$217,800.00
2nd Ave SE	2nd St SE	3rd St SE	400	45.8	$425.00	$19,465.00	$211,845.50	19	$5,000.00	$95,000.00	740	$125.00	$92,500.00	0	$180.00	$0.00	$399,345.50
			400	10.4	$425.00	$4,420.00											
			400	10.9	$425.00	$4,632.50											
			300	32.2	$375.00	$12,075.00											
			400	11	$425.00	$4,675.00											
			400	19.7	$425.00	$8,372.50											
			300	12.1	$375.00	$4,537.50											
			400	40	$425.00	$17,000.00											
			200	28	$215.00	$6,020.00											
			200	26	$215.00	$5,590.00											
			150	11	$200.00	$2,200.00											
			200	39.9	$215.00	$8,578.50											
			200	23.8	$215.00	$5,117.00											
	3rd St SE	4th St SE	300	73	$375.00	$27,375.00											
			300	2	$375.00	$750.00											
			300	7.2	$375.00	$2,700.00											
			300	44	$375.00	$16,500.00											
			300	20.4	$375.00	$7,650.00											
	5th St SE	6th St SE	- - -	- - -	- - -	$0.00											
	6th St SE	7th St SE	300	6.3	$375.00	$2,362.50											
			300	7	$375.00	$2,625.00											
			300	49.5	$375.00	$18,562.50											
			300	6.5	$375.00	$2,437.50											
			300	75.2	$375.00	$28,200.00											
	7th St SE	9th St SE	- - -	- - -	- - -	- - -											
3rd Ave SE	3rd St SE	4th St SE	- - -	- - -	- - -	- - -	$168,752.50	13	$5,000.00	$65,000.00	1084	$125.00	$135,500.00	0	$180.00	$0.00	$369,252.50
	7th St SE	8th St SE	300	76	$375.00	$28,500.00											
	8th St SE	9th St SE	300	5.5	$375.00	$2,062.50											
			300	5.7	$375.00	$2,137.50											
			300	12	$375.00	$4,500.00											
	9th St SE	12th St SE	300	19.6	$375.00	$7,350.00											
			300	15.2	$375.00	$5,700.00											
			300	46.3	$375.00	$17,362.50											
			300	9.2	$375.00	$3,450.00											
			300	9.1	$375.00	$3,412.50											
			400	64.8	$425.00	$27,540.00											
			400	6.4	$425.00	$2,720.00											
			525	60.5	$475.00	$28,737.50											
			300	6.3	$375.00	$2,362.50											
			525	47.1	$475.00	$22,372.50											
			525	22.2	$475.00	$10,545.00											
12th St SE	1st Ave S	3rd Ave SE	600	40.7	$550.00	$22,385.00	$104,460.00	8	$5,000.00	$40,000.00	356	$125.00	$44,500.00	0	$180.00	$0.00	$188,960.00
			600	44.5	$550.00	$24,475.00											
			300	6.5	$375.00	$2,437.50											
			150	6.6	$200.00	$1,320.00											
			600	15.8	$550.00	$8,690.00											
			600	36.8	$550.00	$20,240.00											
			100	6.5	$175.00	$1,137.50											
			150	1.5	$200.00	$300.00											
			750	31.3	$750.00	$23,475.00											

TABLE 6.1

Cost Estimate

Chesley Storm Sewer System: Existing Conditions

21-103-01A 21-103

Street Name	Street		Pipe Size ø	Pipe Length (m)	Unit Price Per m Length ($)	Total Cost ($)	Total Cost (Storm Sewer) ($)	Number of Storm Structures	Unit Cost (Storm Structure) ($)	Total Cost (Storm Structure) ($)	Curb & Gutter			Ditches			Grand Total Cost ($)
	From	To									Length	Unit Price	Cost	Length (m)	Unit Price	Cost	
4th Ave SE	3rd St SE	4th St SE	300	14.1	$375.00	$5,287.50	$524,938.00	36	$5,000.00	$180,000.00	1362	$125.00	$170,250.00	0	$180.00	$0.00	$875,188.00
			300	22.5	$375.00	$8,437.50											
			300	12.2	$375.00	$4,575.00											
			300	43.9	$375.00	$16,462.50											
			300	7.98	$375.00	$2,992.50											
			300	9.3	$375.00	$3,487.50											
			375	41.4	$395.00	$16,353.00											
			375	16.8	$395.00	$6,636.00											
			375	17.7	$395.00	$6,991.50											
			375	16.3	$395.00	$6,438.50											
	4th St SE	Creek	450	44	$450.00	$19,800.00											
			300	68.5	$375.00	$25,687.50											
			600	33.5	$550.00	$18,425.00											
			600	81.8	$550.00	$44,990.00											
			600	88.2	$550.00	$48,510.00											
			350	30.2	$400.00	$12,080.00											
			350	27.7	$400.00	$11,080.00											
			250	11	$225.00	$2,475.00											
			900	59.7	$750.00	$44,775.00											
			300	5.5	$375.00	$2,062.50											
			900	78.1	$750.00	$58,575.00											
			350	64.8	$400.00	$25,920.00											
			350	28.4	$400.00	$11,360.00											
			350	29.6	$400.00	$11,840.00											
			150	9.4	$200.00	$1,880.00											
	4th St SE	7th St SE	450	13.6	$450.00	$6,120.00											
			375	31.5	$395.00	$12,442.50											
			300	20.2	$375.00	$7,575.00											
			250	14	$225.00	$3,150.00											
			600	6.3	$550.00	$3,465.00											
			300	6.3	$375.00	$2,362.50											
			250	77.8	$225.00	$17,505.00											
			200	8.5	$215.00	$1,827.50											
			200	64.2	$215.00	$13,803.00											
			300	76.3	$375.00	$28,612.50											
			250	13.9	$225.00	$3,127.50											
			200	26.2	$215.00	$5,633.00											
			200	10.2	$215.00	$2,193.00											
	7th St SE	8th St SE	- - -	- - -	- - -	- - -											
	8th St SE	9th St SE	- - -	- - -	- - -	- - -											
	9th St SE	10th St SE	- - -	- - -	- - -	- - -											
8th St SE	3rd Ave SE	East end	300	6	$375.00	$2,250.00	$66,202.50	2	$5,000.00	$10,000.00	414	$125.00	$51,750.00	0	$180.00	$0.00	$127,952.50
			300	81.5	$375.00	$30,562.50											
			250	8.9	$225.00	$2,002.50											
			300	70.7	$375.00	$26,512.50											
			300	13	$375.00	$4,875.00											
9th St SE	7th St SE	4th Ave SE	300	8.4	$375.00	$3,150.00	$38,100.00	5	$5,000.00	$25,000.00	534	$125.00	$66,750.00	0	$180.00	$0.00	$129,850.00
			300	42.1	$375.00	$15,787.50											
			300	42.5	$375.00	$15,937.50											
			300	8.6	$375.00	$3,225.00											
10th St SE	3rd Ave SE	East end	300	8.4	$375.00	$3,150.00	$71,325.00	4	$5,000.00	$20,000.00	391	$125.00	$48,875.00	0	$180.00	$0.00	$140,200.00
			300	51.5	$375.00	$19,312.50											
			300	88.5	$375.00	$33,187.50											
			300	20.9	$375.00	$7,837.50											
			300	20.9	$375.00	$7,837.50											
Durst St	1st Ave S	3rd Ave SE	600	33.9	$550.00	$18,645.00	$36,135.00	1	$5,000.00	$5,000.00	0	$125.00	$0.00	425	$180.00	$76,500.00	$117,635.00
			600	31.8	$550.00	$17,490.00											
Industrial Park Rd	West end	1st Ave S	300	13.5	$375.00	$5,062.50	$28,320.00	4	$5,000.00	$20,000.00	0	$125.00	$0.00	536	$180.00	$96,480.00	$144,800.00
			600	17.4	$550.00	$9,570.00											
			300	12.5	$375.00	$4,687.50											
			450	20	$450.00	$9,000.00											
4th St NW	West end	1st Ave	300	44	$375.00	$16,500.00	$151,120.00	10	$5,000.00	$50,000.00	827	$125.00	$103,375.00	409	$180.00	$73,620.00	$378,115.00
			600	81.7	$550.00	$44,935.00											
			150	1.3	$200.00	$260.00											
			600	68.5	$550.00	$37,675.00											
			300	51.8	$375.00	$19,425.00											
			300	35.7	$375.00	$13,387.50											
			300	24.5	$375.00	$9,187.50											
			300	17.1	$375.00	$6,412.50											
			300	8.9	$375.00	$3,337.50											
Wilson St	North End	12th St SE	- - -	- - -	- - -	- - -	$0.00	0	$5,000.00	$0.00	0	$125.00	$0.00	200	$180.00	$36,000.00	$36,000.00

?? culverts @ ? m each, total length is ??m @ 300$/m

Asset Construction Cost	$9,969,414.90
Engineering & Contingencies @ 25%	$2,492,353.73
Total Asset Cost (Excluding HST)	$12,461,768.63

TABLE 6.2
Cost Estimate County Road Portion of
Chesley Storm Sewer System

21-103-01A 21-103

Street Name	Street		Pipe Size ø	Pipe Length (m)	Unit Price Per m Length ($)	Total Cost ($)	Number of Storm Structures	Unit Cost ($)	Total Cost ($)	Curb & Gutter			Ditches			Grand Total Cost ($)
	From	To								Length	Unit Price	Cost	Length (m)	Unit Price	Cost	
	North end	Tower Rd	750	93.6	$750.00											
			750	32.5	$750.00											
			450	83.5	$450.00											
			750	109.5	$750.00											
			600	15.9	$550.00											
			300	41.4	$375.00											
			300	46.6	$375.00											
			300	76.4	$375.00											
			300	6	$375.00											
			300	23.49	$375.00											
			300	6.1	$375.00											
			300	80.14	$375.00											
			100	12.8	$175.00											
			200	14.7	$215.00											
			250	8.4	$225.00											
			250	26.7	$225.00											
			200	53.2	$215.00											
			250	4.6	$225.00											
			250	51.9	$225.00											
			250	4.6	$225.00											
			250	19.9	$225.00											
			300	64.6	$375.00											
			250	8.2	$225.00											
			300	83.8	$375.00											
			250	8.2	$225.00											
	Tower Rd N	Tower Rd S	300	73.8	$375.00											
			250	9.2	$225.00											
	Tower Rd S	4th St NW	375	89.1	$400.00											
			200	2.5	$215.00											
			250	11.2	$225.00											
			375	19.48	$400.00											
			150	14.4	$200.00											
			375	28.24	$400.00											

Bruce Rd 10 (1st Ave)	4th St NW	2nd St NE	200	3.2	$215.00	$1,422,690.75	83	$5,000.00	$415,000.00	2861	$125.00	$357,625.00	2243	$180.00	$403,740.00	$2,599,055.75
			250	11.2	$225.00											
			500	51.6	$475.00											
			375	89.9	$400.00											
			375	22.6	$400.00											
			375	5.3	$400.00											
			300	8.8	$375.00											
			500	20.7	$475.00											
			500	37.5	$475.00											
	2nd St NE	2nd St SE	900	16	$750.00											
			250	5.1	$225.00											
			900	6	$750.00											
			900	45.2	$750.00											
			150	23.4	$200.00											
			300	26.2	$375.00											
			900	39.1	$750.00											
			250	12.3	$225.00											
			600	17.5	$550.00											
			900	44.4	$750.00											
			250	8.5	$225.00											
	2nd St SE	3rd St SE	300	4.8	$375.00											
			900	6	$750.00											
			300	1.9	$375.00											
			300	10	$375.00											
			900	61.8	$750.00											
			250	12.4	$225.00											
			900	71.4	$750.00											
	3rd St SE	4th St SE	750	5.8	$750.00											
			250	17.8	$225.00											
			450	28.8	$450.00											
			250	12.3	$225.00											
			450	26.3	$450.00											
			450	4.8	$450.00											
			300	18.4	$375.00											
			450	35.5	$450.00											
			250	12.4	$225.00											
			450	23.7	$450.00											
			450	9.6	$450.00											
			300	4.3	$375.00											
			300	4.9	$375.00											
			450	5.8	$450.00											
	4th St SE	6th St SE	300	13.9	$375.00											
			450	62	$450.00											
			250	10.3	$225.00											
			450	19.8	$450.00											
			450	40.4	$450.00											
			250	8.1	$225.00											
			450	49.1	$450.00											
			250	8.2	$225.00											
			450	10.1	$450.00											
	6th St SE	7th St SE	450	44.4	$450.00											
			250	9.3	$225.00											
			450	47.5	$450.00											
			300	8.7	$375.00											
			300	5	$375.00											
			300	60.6	$375.00											
			300	7.6	$375.00											

	7th St SE	Durst St	300	55.3	$375.00											
			600	7.6	$550.00											
			450	11.6	$450.00											
			600	14.3	$550.00											
			450	12.1	$450.00											
	Durst St	South end	300	13.8	$375.00											
			600	65.7	$550.00											
			400	5.8	$425.00											
			400	8.2	$425.00											
			600	64.7	$550.00											
			900	5.9	$750.00											
			900	13.2	$750.00											
			900	76	$750.00											
			900	39.9	$750.00											
			900	40.6	$750.00											
			900	39.9	$750.00											
Bruce Rd 10 (4th St NE)	1st Ave N	2nd Ave NE	300	20.2	$375.00	$171,610.00	9	$5,000.00	$45,000.00	144	$125.00	$18,000.00	1580	$180.00	$284,400.00	$519,010.00
	2nd Ave NE	Hawton Pl	400	17	$425.00											
			400	8.3	$425.00											
			750	22.1	$750.00											
			1050	15.4	$975.00											
			1050	26.7	$975.00											
			750	35.8	$750.00											
			300	55.1	$375.00											
			1050	19.5	$975.00											
	Hawton Pl	Martha Ave	600	36.2	$550.00											
			300	16.3	$375.00											
			300	8.3	$375.00											
	Martha Ave	East end	- - -	- - -	- - -											
?? culverts @ ? m each, total length is ??m @ 300$/m																

Asset Construction Cost	$3,118,065.75
Engineering & Contingencies @ 25%	$779,516.44
Total Asset Cost (Excluding HST)	$3,897,582.19

TABLE 6.3

Priority of Stormwater System Upgrades

Chesley Stormwater Needs Study

June, 2024 21-103

Priority Ranking*	Upgrade as Identified in Table 5.1	Catchment Area	Location	Budget Project Cost (Includes Storm Sewers, Structures, Curb & Gutter Removal and Replacement)
1	Road reconstruction and storm sewer replacement	CA-C	Tower Road	$437,695
2	Storm sewer replacement	CA-K	2nd St SW	$27,681
3	Storm sewer replacement/Ditch rehabilitation	CA-II	2nd St SE	$28,000
4	Storm sewer replacement	CA-J	2nd Ave. SE	$36,330
5	Storm sewer replacement	CA-H	4th Ave. SE	$67,785
			Total Construction Cost	**$597,491**
			Engineering & Contingencies @ 25%	**$149,373**
			Total Project Cost (Excluding HST)	**$746,864**

* Priority ranking based solely on reduction in flooding during 1:5-year storm. Projects on Bruce County roads are excluded from this spreadsheet.

7 CONCLUSIONS

1) Chesley stormwater system database, which was utilized for the study has data gaps, some of which were eliminated during this study. However, there is a need to continue to reform the database.

2) Storm Sewer system has deficiencies related to reverse slopes of storm sewers, storm structures without outlet and storm infrastructure on private properties that require municipality's attention. Municipality can consider eliminating storm infrastructure from private properties.

3) Investigation Study was completed by undertaking computer modelling. No CCTV inspection of sewers or storm structures was completed as part of the investigation.

4) Storm Sewer System created in the VO-SWMM version 5.2 computer model could not be checked for calibration for reasons as outlined in section 3.0 of this report.

5) The modelling results indicate that, in existing conditions, 15 storm structures experience flooding with a total volume of 403 m^3 during the 1:5-year storm. And 81 storm structures experienced flooding with a total volume of 5,503 m^3 for the 1:100-year storm.

6) During the 5-year storm, 139 structures and associated storm sewers experience surcharging. Elimination of hydraulic surcharging will be cost prohibitive. With proposed upgrades, surcharging will be reduced to 112 structures and associated storm sewers.

7) Total cost of stormwater assets (excluding Bruce County assets) is estimated at $ 12.5 million based on 2024 construction cost.

8) Five (5) upgrades to the stormwater system are proposed totaling $746,863 as indicated in **Table 6.3**.

9) The proposed upgrades (including the Bruce County assets), if implemented, are anticipated to eliminate flooding of all storm structures during the 1:5-year storm and decrease flooding from 5,503 m^3 to 4,427 m^3 during the 1:100-year storm. Most of the flooding during 1:100-year storm remains on Tower Rd and Martha Ave.

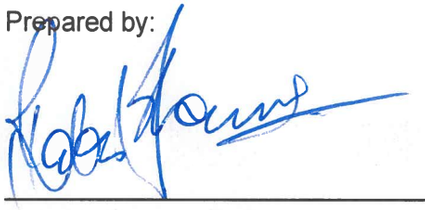
8 RECOMMENDATIONS

The following recommendations are presented:

1) The five (5) system upgrades identified in this report and summarized in **Table 6.1** are recommended to be prioritized to eliminate flooding during the 1:5-year storm. However, they should be combined with future road reconstructions, watermain and sanitary sewer projects. Proper curb & gutter or roadside ditches are recommended to be added (if nonexistent) to the project(s) to ensure flooding during severe storms, is conveyed to a sufficient outlet.

2) Arran-Elderslie is advised to consider an annual arbitrary fund amount of $ 300,000 towards storm sewer system upgrades, in order that deficiencies are eliminated by way of sustained effort to bring about improvements and to maintain sufficient reserves for future upgrades.

Prepared by:

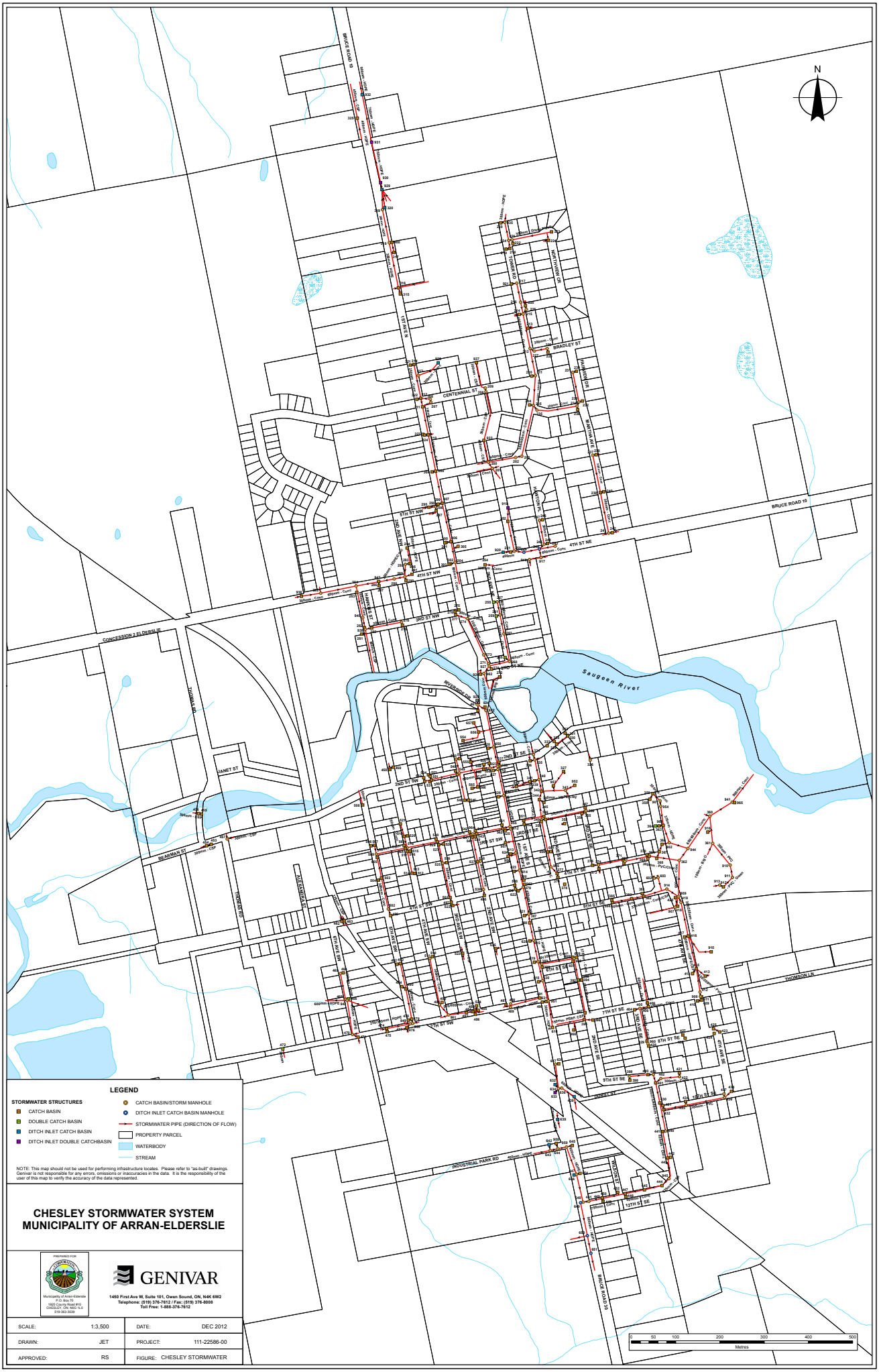


Rakesh Sharma, P. Eng.
Designated Consulting Engineer

RS/mg

APPENDIX A

Existing Stormwater System Information, Data,
and Record Drawings



LEGEND

STORMWATER STRUCTURES

- CATCH BASIN
- DOUBLE CATCH BASIN
- DITCH INLET CATCH BASIN
- DITCH INLET DOUBLE CATCHBASIN
- CATCH BASIN/STORM MANHOLE
- DITCH INLET CATCH BASIN MANHOLE
- STORMWATER PIPE (DIRECTION OF FLOW)
- PROPERTY PARCEL
- WATERBODY
- STREAM

NOTE: This map should not be used for performing infrastructure locates. Please refer to "as-built" drawings. Genivar is not responsible for any errors, omissions or inaccuracies in the data. It is the responsibility of the user of this map to verify the accuracy of the data represented.

CHESLEY STORMWATER SYSTEM
MUNICIPALITY OF ARRAN-ELDERSLIE

PREPARED FOR
Municipality of Arran-Elderslie
Box 70
1925 Concession Road #10
CHESLEY, ON N0G 1L0
519-363-3039

GENIVAR
1450 First Ave W, Suite 101, Owen Sound, ON, N4K 6W2
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Toll Free: 1-888-376-7612

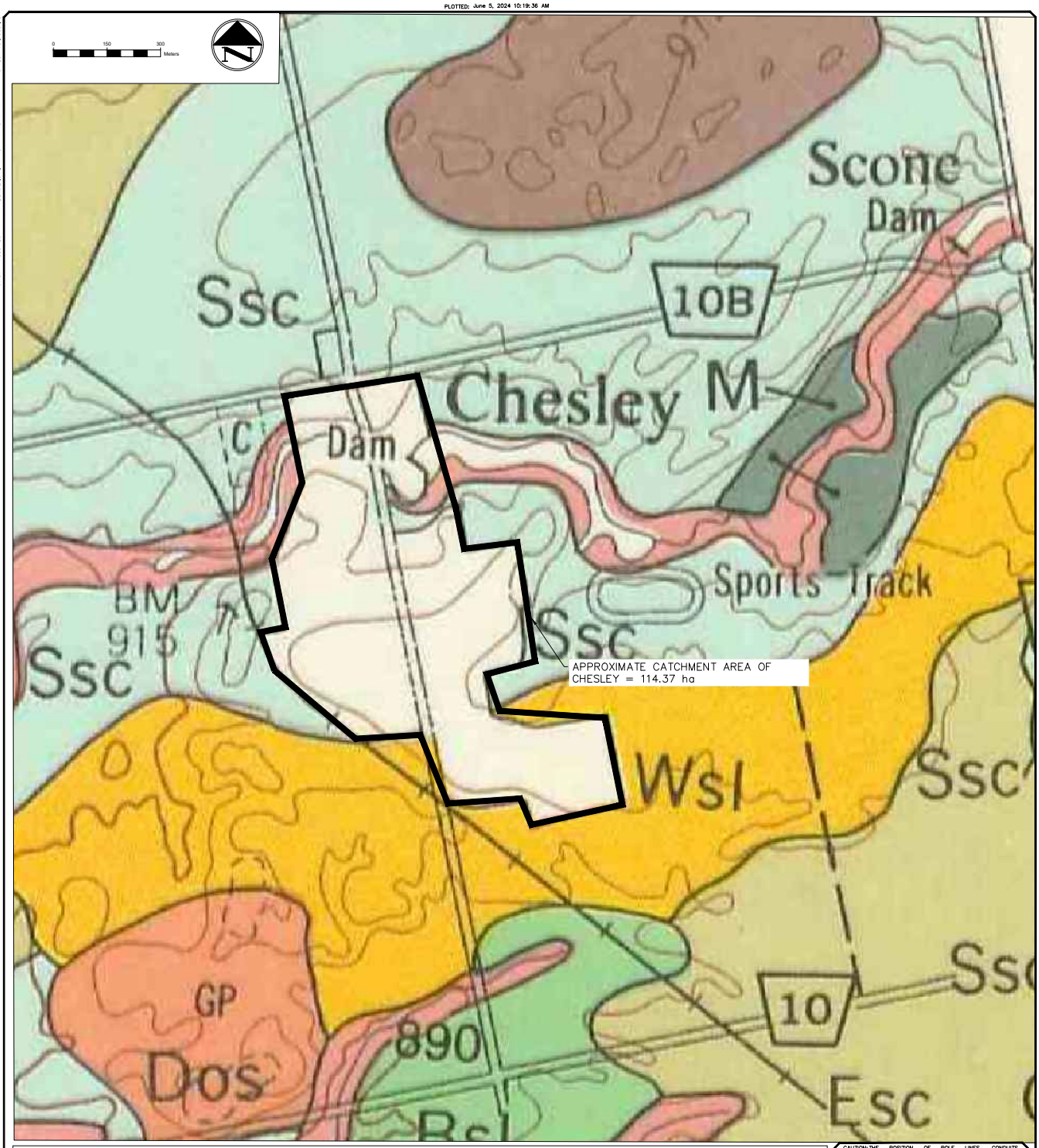
SCALE:	1:3,500	DATE:	DEC 2012
DRAWN:	JET	PROJECT:	111-22586-00
APPROVED:	RS	FIGURE:	CHESLEY STORMWATER

APPENDIX B

Catchment Area Information

APPENDIX C

Figure 4 – Soil Map



SOIL LEGEND

COLOUR	SYMBOL	SOIL SERIES AND TYPE		GREAT GROUP	SOIL MATERIALS	DRAINAGE	TOPOGRAPHY AND SURFACE STONINESS	PROFILE DESCRIPTION
	Pal Pal-s Pas Pas-s	Parkhill	loam loam, stony phase silt loam silt loam, stony phase	Dark Grey Gleisolic	Medium textured till	Poor	Smooth, very gently sloping. Few to moderate stones	6 to 8 inches very dark brown to black loam or silt loam over poorly defined horizons. Mottling increases with depth. Pale yellow-brown to grey parent material calcareous, moderately stony.
	Pc Ps	Perth	clay loam silt loam	Grey-Brown Podzolic	Heavy textured limestone and shale till	Imperfect	Smooth, gently sloping. Few stones	6 inches very dark grey clay loam or silt loam surface soil; lower A_2 and B horizons mottled; gritty clay parent material; pale brown in colour.
	Pls	Plainfield	sand	Dry Sands	Well sorted sandy outwash	Excessive	Smooth, gently sloping. Stonefree	3 inches brown sand over well defined B horizon; A_2 horizon is usually missing; profile consists of loose sand throughout.
	Sc Ssc Ss	Saugeen	clay loam silty clay loam silt loam	Brown Forest (Grey-Brown Podzolic Intergrade)	Lacustrine	Good	Smooth, moderately sloping. Stonefree	4 inches grey silty clay loam, clay loam or silt loam over stonefree horizons; A_2 horizon is shallow; B horizon is shallow and well defined; parent material is stonefree clay material.

REFERENCE: Published by Agriculture Canada (1983)
Soil survey by the Department of Soils,
Ontario Agricultural College, Guelph, and
the Experimental Farm Service, Dominion
Department of Agriculture Ottawa
Soils of Bruce County South Sheet, Ontario,
Soil Survey Report No. 16

CAUTION: THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS, PROPERTY LINES AND OTHER UNDERGROUND AND OVERGROUND UTILITIES ARE STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES, PROPERTY LINES & STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES, PROPERTY LINES & STRUCTURES, AND SHOULD ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

DD/MM/YY	
	TENDER ISSUE
DD/MM/YY	DESCRIPTION
	REVISION / ISSUE

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Telephone: (519) 372-4828

Title: DRAINAGE AREA AND SOIL CHARACTERISTICS CHESLEY

Client: MUNICIPALITY OF ARRAN ELDERSLIE

Design:	MK	Scale:	1:5000
Drawn:	MK	Approved:	Design Engineer
Checked:	RS		
Date:	JUNE 2024		

Drawing No. FIGURE 4