MCLAUGHLIN ROAD IMPROVEMENTS
FROM BRISTOL ROAD TO BRITANNIA ROAD
CITY OF MISSISSAUGA, REGION OF PEEL
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT STUDY
IBI GROUP REF: 24RX12.0246

STORMWATER MANAGEMENT
EXISTING CONDITION REPORT

DECEMBER 11, 2012

IBI Group Professional Engineering services

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1. INTRODUCTION

1.1 Background

IBI Group has been retained by the City of Mississauga to conduct a Class Environmental Assessment (EA) study for improvements to McLaughlin Road between Bristol Road West and Britannia Road West. The McLaughlin Road study corridor is located in the north-central part of the City of Mississauga, Ontario. The road is orientated in a northwest-southeast direction. The location of the study area is shown on **Figure 1**.

McLaughlin Road is an important north-south route in the City of Mississauga and currently consists of a 4-Lane cross section, except for the section between Bristol Road West and Britannia Road West. Within the study area between Bristol Road West and Britannia Road West, McLaughlin Road generally exists as a 2-lane urban cross section with sidewalks, curbs and gutter including exclusive left turn and right turn lanes. A posted speed limit of 50 km/hr is defined for this stretch.

In this area, McLaughlin Road intersects with Bristol Road West and Matheson Boulevard West which are two major collectors under the City of Mississauga jurisdiction. McLaughlin Road also intersects with Britannia Road West which is an arterial road under the Region of Peel jurisdiction. As per the City's Official Plan, McLaughlin Road from Bristol Road West to Matheson Blvd. West is identified as a major collector road and a Scenic Route with an ultimate right-of-way (R.O.W) of 26m and the section between Matheson Blvd. West and Britannia Road West is identified as a major collector road with an ultimate ROW of 30m.

The purpose this EA is to study the following:

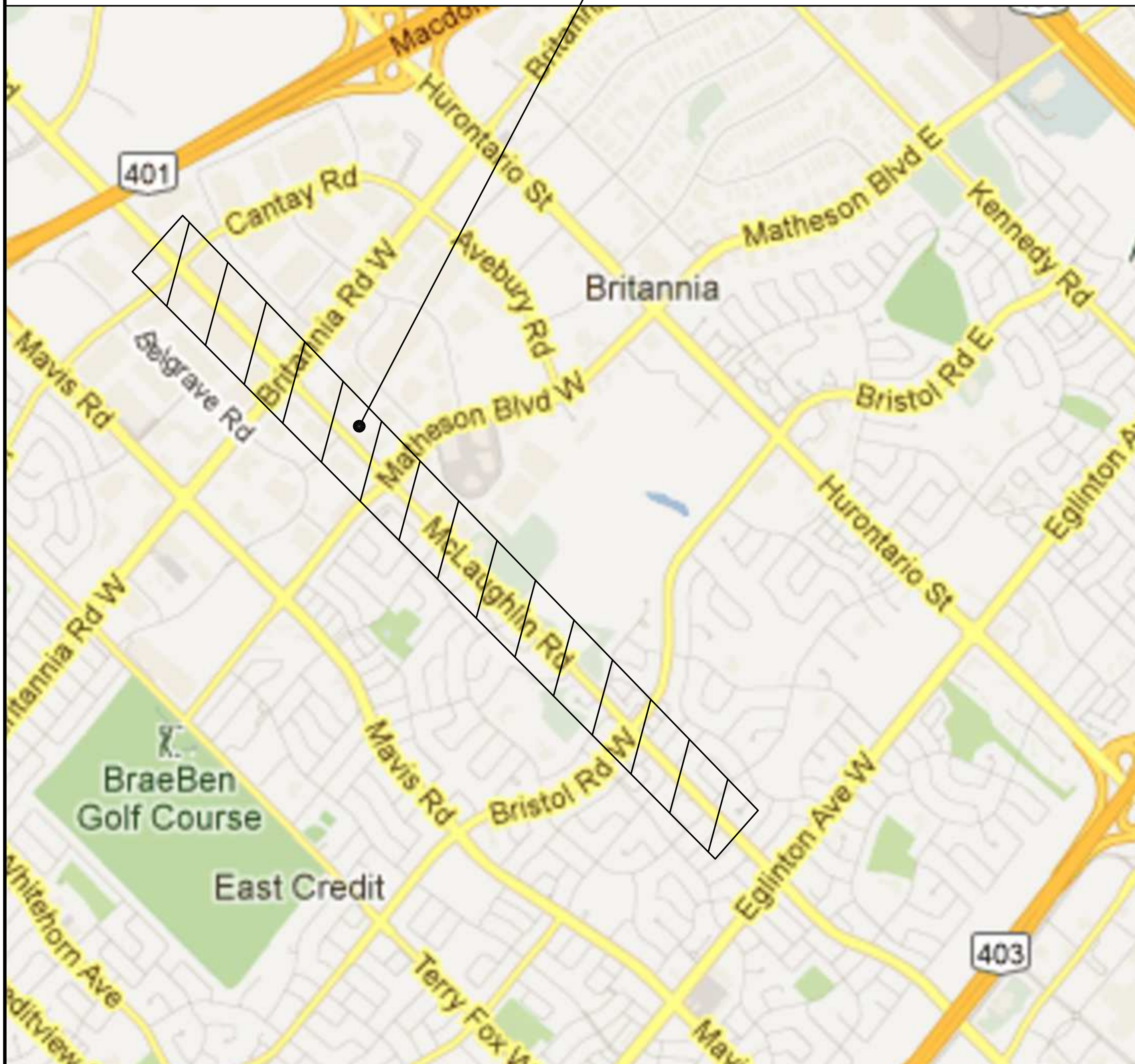
- Identify and evaluate an improvement that will satisfy future travel demands;
- Make McLaughlin Road a "Complete Street" that safely serves all users;
- Widening McLaughlin Road, allowing for an additional lane of traffic in each direction with bicycle facilities (on-road or off-road) i.e. widening of study area from 2-lane to 4-lane urban sections, and/or;
- Widening McLaughlin Road, allowing for an additional continuous central left turn lane with bicycle facilities (on-road or off-road).

Currently, there is on-road bicycle facility all along McLaughlin Road except for a section between north of Eglinton Avenue West and Cantay Road. It is the City's intention to complete the bicycle facility along McLaughlin Road as a primary on-road bicycle route.

This Stormwater Management Existing Condition Report (SWMR) is a supporting document to the Class EA for the reconstruction of McLaughlin Road from Bristol Road west to Britannia Road West.

The objective of this report is to summarize the drainage and stormwater management conditions that currently exist within the study limits.

STUDY AREA
MCLAUGHLIN ROAD IMPROVEMENT



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Date	Issued For	Rev.

Client CITY OF MISSISSAUGA, ONTARIO

Project MCLAUGHLIN IMPROVEMENT, CITY OF MISSISSAUGA

Drawing Title
STUDY AREA

Project No.
24RX12.0246

Drawing No.
FIGURE 1

1.2 Existing Drainage Infrastructure

As part of McLaughlin Road EA the following drainage component were identified:

- Storm sewers in McLaughlin Road convey minor system drainage; while major system flows overland on McLaughlin Road. The diameter of storm sewers range from approximately 450mm to 2550mm;

- There are three low points located at McLaughlin Road which provide overland flow route to major system runoff.

- Roadside ditches at two locations (north of Cantay Road and South of Avonwick Avenue) connecting to the roadway storm sewers via ditch inlets currently exist.

- Storm runoff from McLaughlin Road ultimately drains in to a network of trunk sewers and conveyed to Cooksville Creek east of McLaughlin Road.

- There are no cross drainage culverts currently exist within the study corridor.

- There are no storm water management facilities adjacent to the project corridor.

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2. SITE DESCRIPTION

2.1 Existing Soil Conditions and Physiography

The study area falls within the South Slope physiographic region of Ontario. This region comprises the southern slope of the Oak Ridges Moraine (Chapman and Putnam 1984:172-174). The South Slope meets the moraine at heights of approximately 300 m above sea level (asl) and descends southward toward Lake Ontario, ending at elevations around 150 m asl at some areas. The South Slope extends from the Niagara Escarpment to the Trent River and covers approximately 2435 square kilometres (Chapman and Putnam 1984: 172). Numerous streams descend the South Slope, which have cut deep valleys into the till.

Soils in the study area consist of Chinguacousy clay loam, Jeddo clay loam, Oneida clay loam and Bottom Land soils (Hoffman and Richards 1953). These soils are described below.

Oneida clay loam is well drained and has smooth moderately sloping topography. These soils are susceptible to erosion.Oneida clay loam soils are located throughout the study limits (Hoffman and Richards 1953).

Jeddo clay loam is poorly drained and has smooth very gently sloping topography. A band of Jeddo clay loam soils crosses McLaughlin Road in an west-east direction, just north of Bristol Road (Hoffman and Richards 1953).

Chingacousey clay loam soils are the imperfectly drained member of the Oneida catena. Areas with this soil series are typically smooth and gently topography. In the study area, Chingacousey soils are recorded adjacent to the Bottom Lands, at Matheson Boulevard West and Regal Drive (Hoffman and Richards 1953).

Bottom lands are associated with low lying areas along stream courses. Bottom land soils are prone to flooding, are poorly drained and show little soil horizon differentiation. These soils are recorded in a band that crosses McLaughlin Road between Matheson Boulevard West and Regal Drive. Bottom Land soils occur along stream courses, which are subject to flooding. It should be noted that there is no longer a watercourse or valleyland at this location (Hoffman and Richards 1953). The drainage varies but is generally poor.

The soil information is presented in **Figure 2**.

The natural vegetation consists mainly of elm and soft maple with ash and oak also occurring. Oak, sugar maple, pine, beech, cedar and elm are commonly found in woodlots.

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SOILS IN THE STUDY AREA

MCLAUGHLIN ROAD

FIGURE 2

2.2 Description of Study Area

From Matheson Boulevard West to Britannia Road West, the west side of the street is composed of commercial establishments surrounded by parking lot, while the east side is composed of a combination of light industrial, office, and commercial buildings. One undeveloped property, just south of Britannia Road West, was noted. Exceptions were noted at the northeast corner of the intersection of Matheson Boulevard West and Mclaughlin Road, where a single residence is located on a large property parcel, and a row of townhouses fronts on to McLaughlin Road north of Ceremonial Drive. The east side of McLaughlin Road, south of Matheson Boulevard West is a continuation of a combination of light industrial and office space. The Britannia Sugarbush, a large woodlot located on a large undeveloped land parcel owned by the Peel Board of Education, is located onthe east side of McLaughlin Road until just north of Faith Drive. A townhouse development that backs on to McLaughlin Road is located between Faith Drive and Bristol Road West.

The study area also features a number of old trees and woodlots, which indicate that while some areas have been recently developed some parcels of land may have remained relatively undisturbed.

This section of McLaughlin Road features a sidewalk on either side of the roadway; however, the sidewalk on the west side of the road has a standard width which is much wider than the sidewalk on the east side of the road. Additionally, the sidewalk on the east side of the road is situated immediately adjacent to the curb of the road, while the sidewalk on the west side of the road is generally situated away from the road, often separated by a grass boulevard.

At Bristol Road West, McLaughlin Road features two lanes each of northbound and southbound traffic, with a southbound turning lane and central concrete median. About 100 m north of Bristol Road West, McLaughlin Road narrows to a single lane of traffic in each direction, and a middle turning lane. From north of Faith Drive to just south of Ceremonial Drive, the road narrows to two lanes of traffic in total, with no turning lane. McLaughlin Road returns to a single lane of traffic each for northbound and southbound traffic with a middle turning lane from Ceremonial Drive north to Britannia Road West. Approaching Britannia Road West, the roadway widens to four lanes of traffic with a middle turning lane at the intersection.

2.3 Existing Drainage Conditions

The study area is located within the Cooksville Creek sub-watershed of the Credit River watershed; and the closest watercourse is located approximately 650 m east of the study area and runs roughly parallel to McLaughlin Road. Based on a review of Credit Valley Conservation sub-watershed mapping, there are no watercourses located within the study limits. The location of Cooksville Creek is shown in **Figure 3**.

The general slope of McLaughlin Road, within the project limits, is from north to south, with three low points at the road.

Under present conditions, runoff from McLaughlin Road is collected by catchbasins and conveyed primarily by existing storm sewer systems which discharge into municipal trunk sewers. The size of the existing storm sewer system ranges from 450 mm to 2550 mm. The current sewer system details are provided in **Table 1**. The existing storm sewer system layout within the project limits and storm outlet locations are shown on **Figures 4A to 4J**.

The road section is fitted with curb and gutter and catch basin inlets that direct drainage to storm sewers. Roadway drainage between Britannia and Matheson is connected to Matheson trunk sewer at the intersection, while Roadway drainage between Matheson and Bristol is connected to Bristol trunk sewer at the intersection. There are no cross drainage culverts within the study corridor.

Figure 3 illustrates location of storm sewers, including associated drainage areas.

2.4 Existing Drainage Areas

A review of available topographic and storm sewer mapping was undertaken to determine drainage boundaries. Based on this assessment, and the combining of the drainage boundaries used in the information provided by the City, delineations of drainage areas have been made to establish drainage boundaries. The study area has been divided into 4 separate catchments to better reflect the drainage contributions to storm sewers. **Figure 3** shows location of sub-catchments and associated drainage areas. Roadside ditching has been used at some locations to direct drainage to nearest storm sewer outlets.

2.5 Existing Drainage Elements

2.5.1 STORM SEWERS

Under existing conditions, runoff from McLaughlin Road is primarily collected by catchbasins and conveyed to storm sewers. The size of storm sewers range from 450mm to 2550mm.The location of storm sewers including outlet points are shown on **Figure 3** and details are provided in **Table 1**.

Outlet 1 (Cantay Road - Municipal Trunk Sewer)

- 800 mm diameter McLaughlin Road storm sewer collecting runoff from north of Cantay Road and draining to a 975 mm diameter Cantay Road storm sewer. The Cantay Road storm sewer ultimately discharges into Matheson Boulevard West trunk sewer system before draining into Cooksville Creek at Matheson Boulevard Culvert crossing.

Outlet 2 (Matheson Boulevard West - Municipal Trunk Sewer)

- 2550 mm diameter McLaughlin Road storm sewer discharging to a 2700 mm diameter Matheson Boulevard West storm sewer which collects storm runoff between Britannia and 450 m south of Matheson and drains to the Cooksville Creek Culvert located across Matheson Boulevard.

Outlet 3 (Bristol Road West - Municipal Trunk Sewer)

- 1500 mm diameter McLaughlin Road storm sewer draining into a 1650 mm diameter Bristol Road West storm sewer which collects runoff between Bristol and 450 m south of Matheson Boulevard and eventually discharges into Cooksville Creek Culvert at Bristol Road West.

Outlet 4 (Eglinton Avenue West - Municipal Trunk Sewer)

- 750 mm diameter McLaughlin storm sewer draining to a 1200mm Eglinton Avenue West Trunk sewer which eventually discharge into Cooksville Creek Culvert at Eglinton Avenue West.

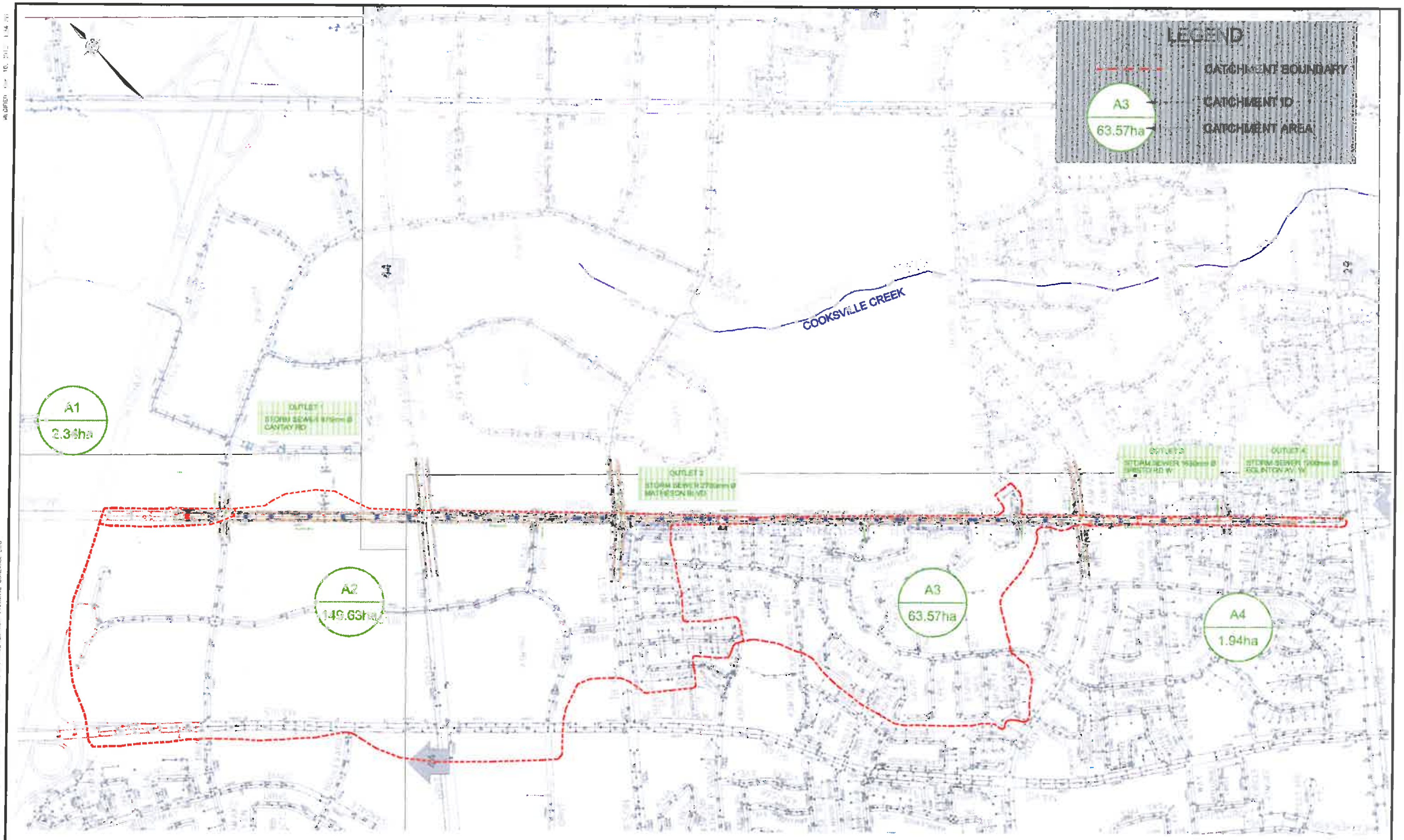
2.5.2 DRAINAGE DITCHES

V-shaped ditches currently exist at two locations (north of Cantay Road and South of Avonwick Avenue) and connected to the roadway storm sewers.

Table 1 - Existing Storm Sewer Systems

Sewer Reach	Length (m)	Size /Diameter (mm)	Slope	Receiving System
11+970 to 12+155	185	1200	0.35%	2700 mm Matheson Blvd West Trunk Storm Sewer
11+790 to 11+970	180	1350	0.40%	
11+670 to 11+790	120	2550	0.48%	
11+524 to 11+670	146	2550	0.48%	
11+435 to 11+524	88.5	525	2.3%	
11+340 to 11+435	95	450	1.8%	
11+245 to 11+340	95	450	1.0%	
11+135 to 11+245	110	450	0.6%	
10+930 to 11+020	90	450	0.8%	1650mm Bristol Road West Trunk Storm Sewer
10+840 to 10+930	90	450	1.5%	
10+750 to 10+840	90	450	1.6%	
10+660 to 10+750	90	525	1.30%	
10+570 to 10+660	90	600	0.80%	
10+470 to 10+570	100	675	0.60%	
10+370 to 10+470	100	750	0.60%	
10+000 to 10+370	370	1500	0.50%	

Note: 1. Refer Figures 4A to 4J for sewer location.



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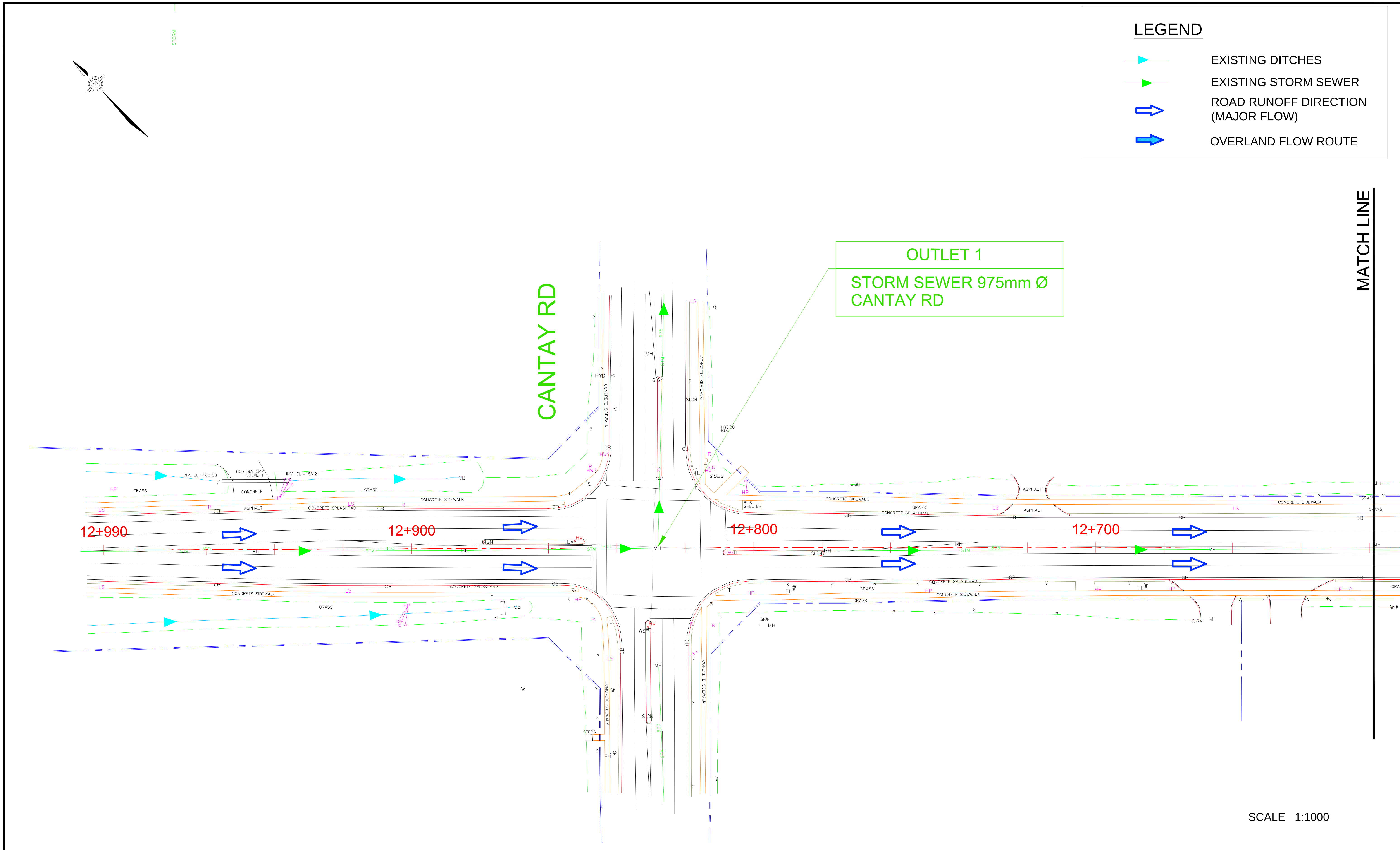
EXISTING DRAINAGE CONDITION

MCLAUGHLIN ROAD

FIGURE 3



EXISTING DRAINAGE CONDITION

MCLAUGHLIN ROAD

FIGURE 4A

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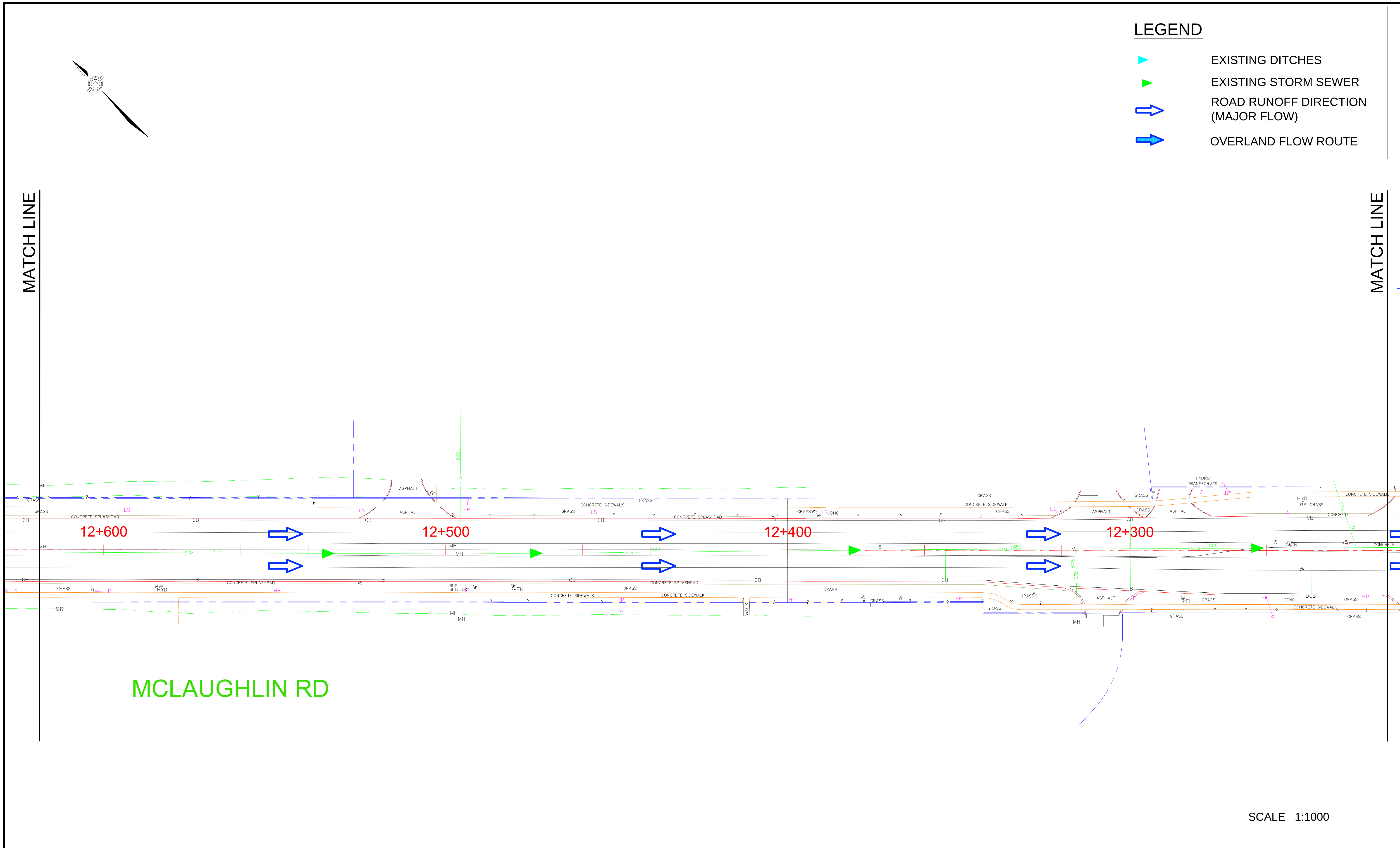
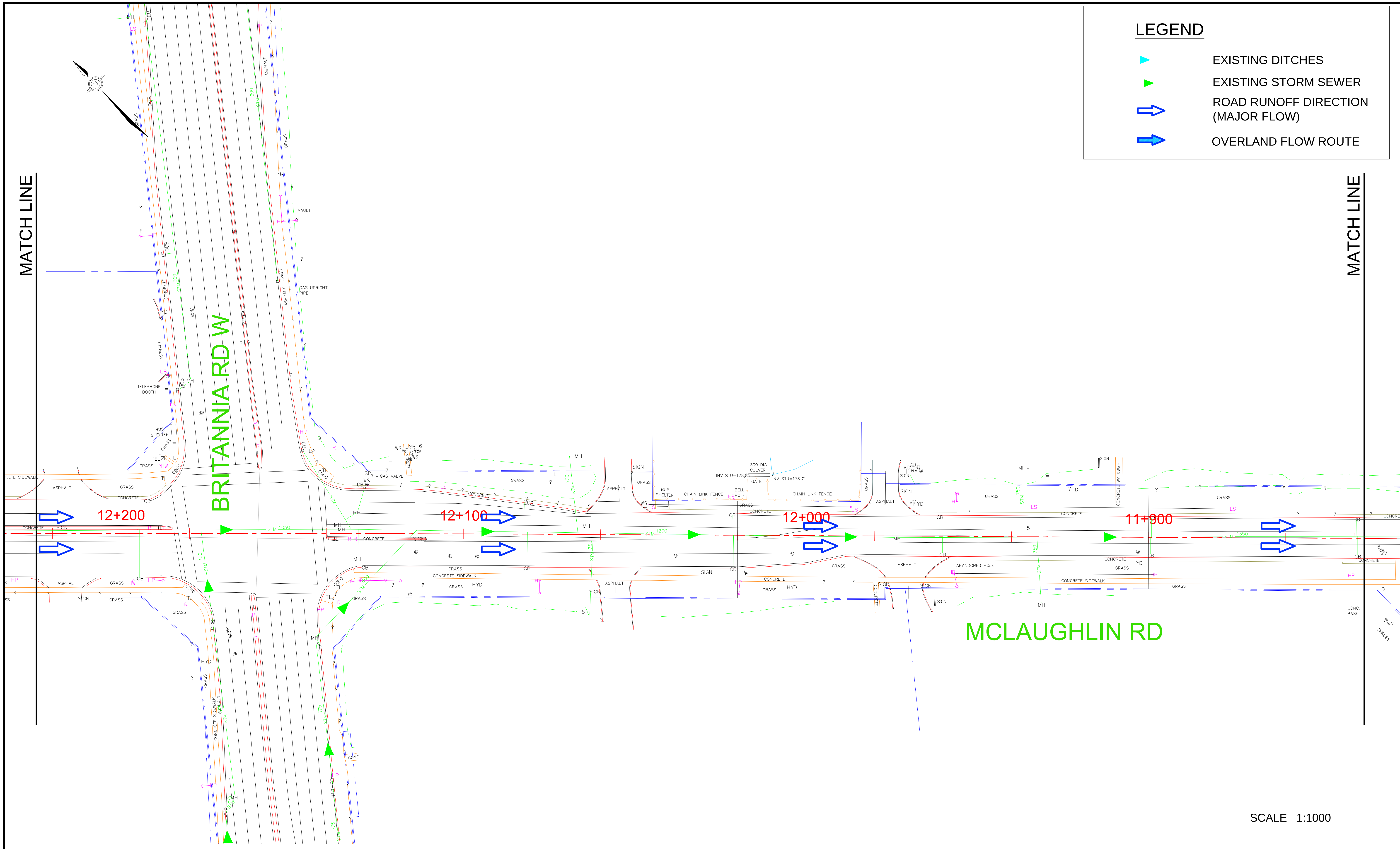


EXISTING DRAINAGE CONDITION

MCLAUGHLIN ROAD

FIGURE 4B



LEGEND

- EXISTING DITCHES
- EXISTING STORM SEWER
- ROAD RUNOFF DIRECTION (MAJOR FLOW)
- OVERLAND FLOW ROUTE

SCALE 1:1000

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EXISTING DRAINAGE CONDITION

MCLAUGHLIN ROAD

FIGURE 4C

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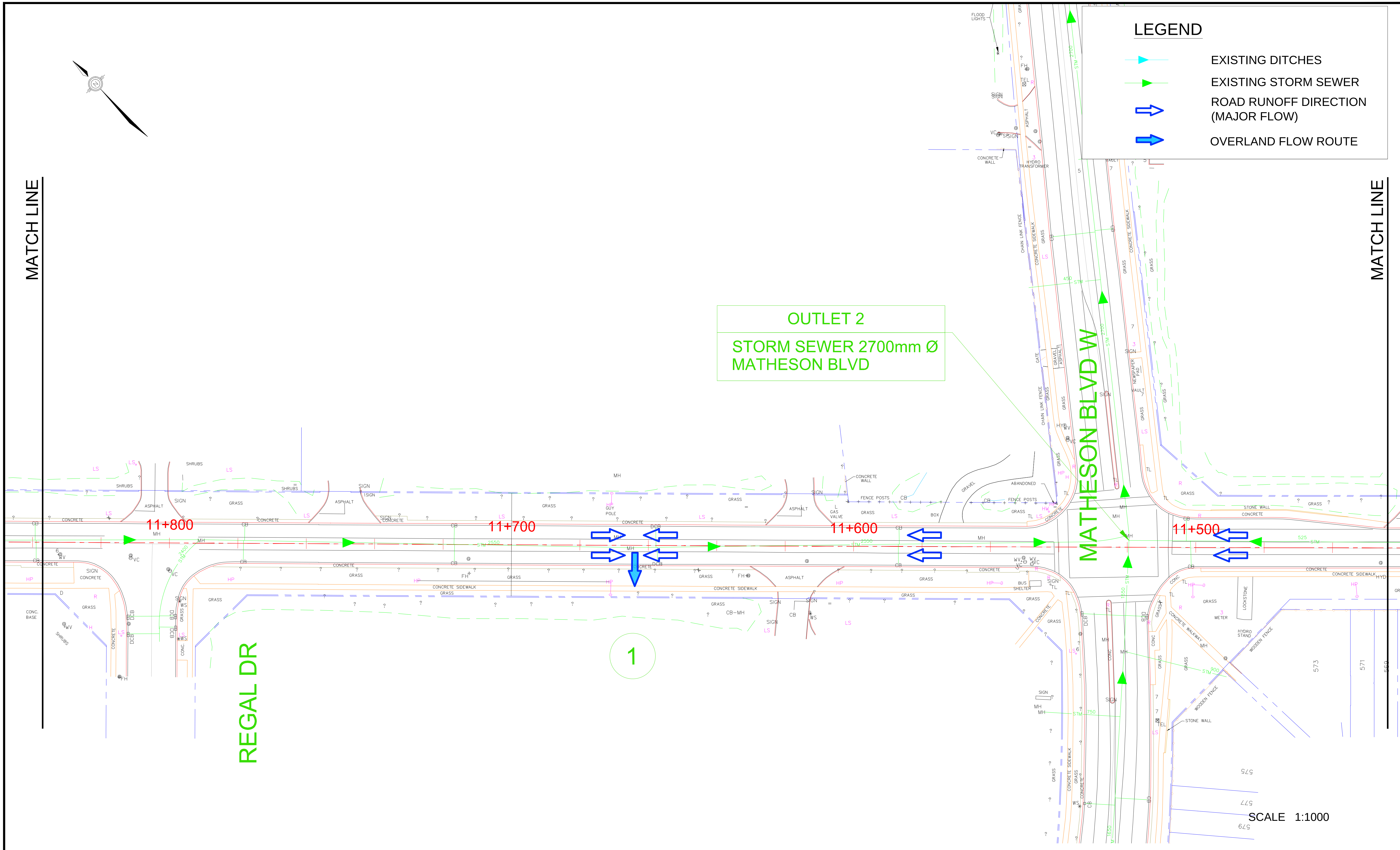

EXISTING DRAINAGE CONDITION

MCLAUGHLIN ROAD

FIGURE 4D

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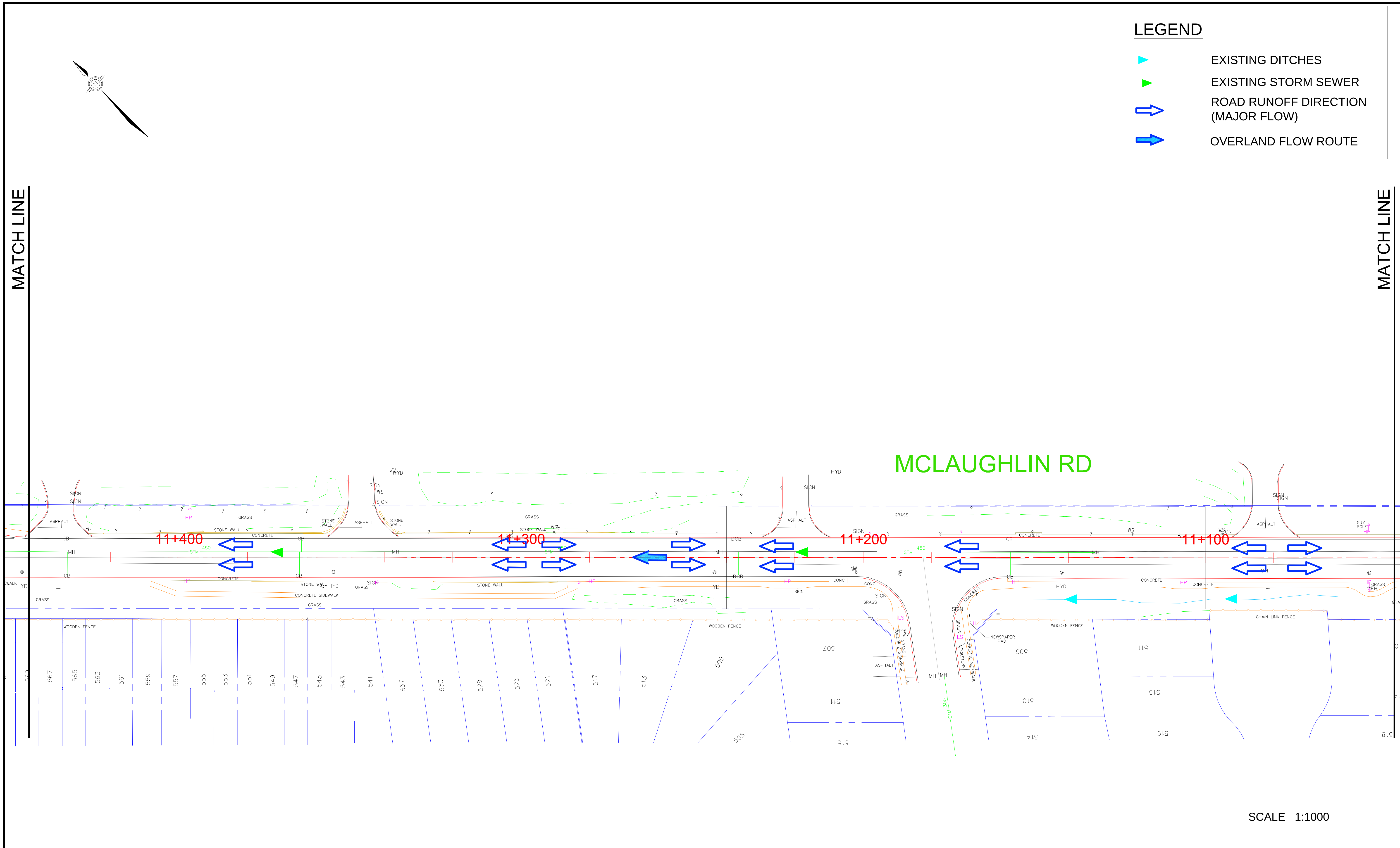

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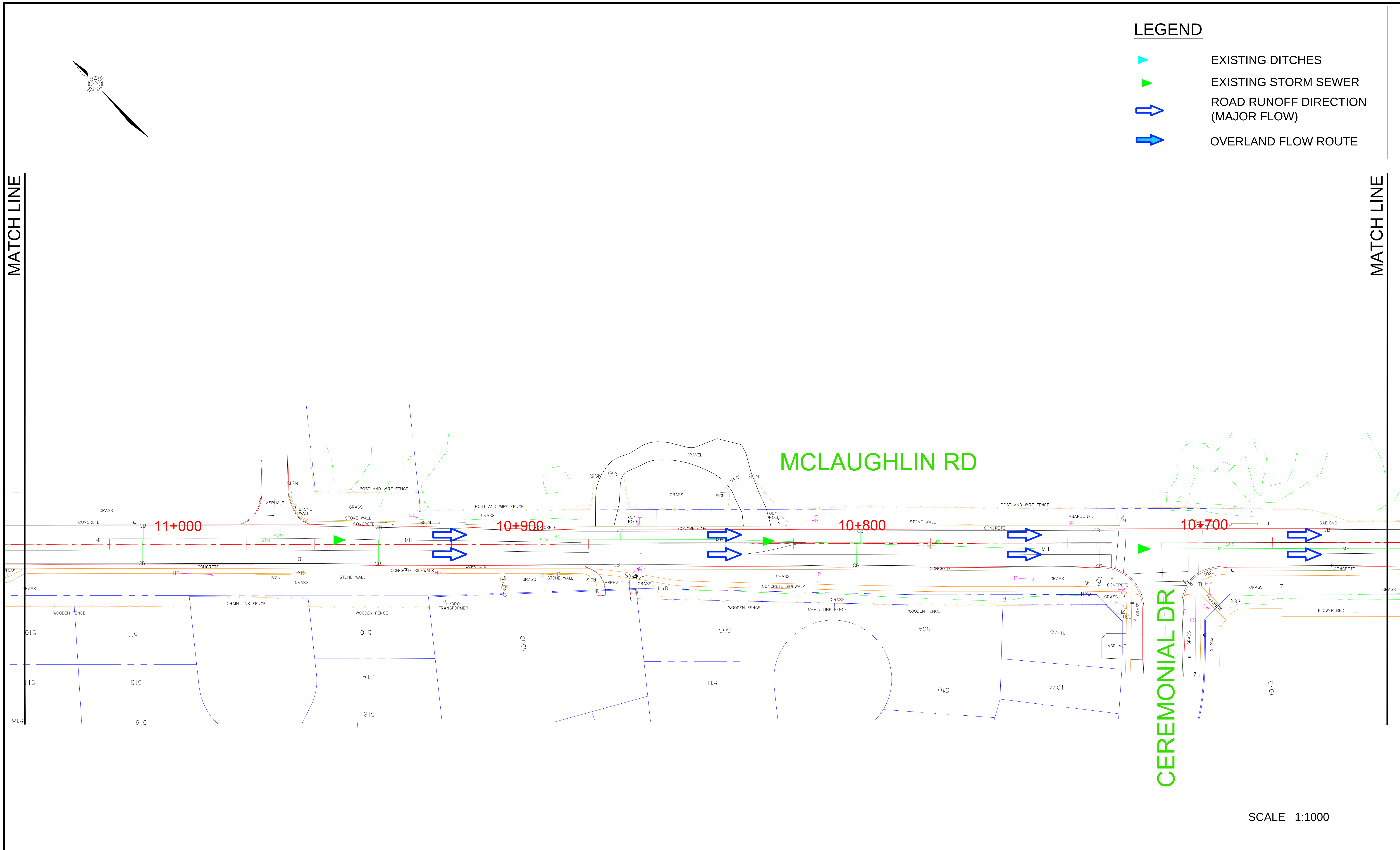
EXISTING DRAINAGE CONDITION

MCLAUGHLIN ROAD

FIGURE 4E



IBI GROUP

EXISTING DRAINAGE CONDITION

MCLAUGHLIN ROAD

FIGURE 4F

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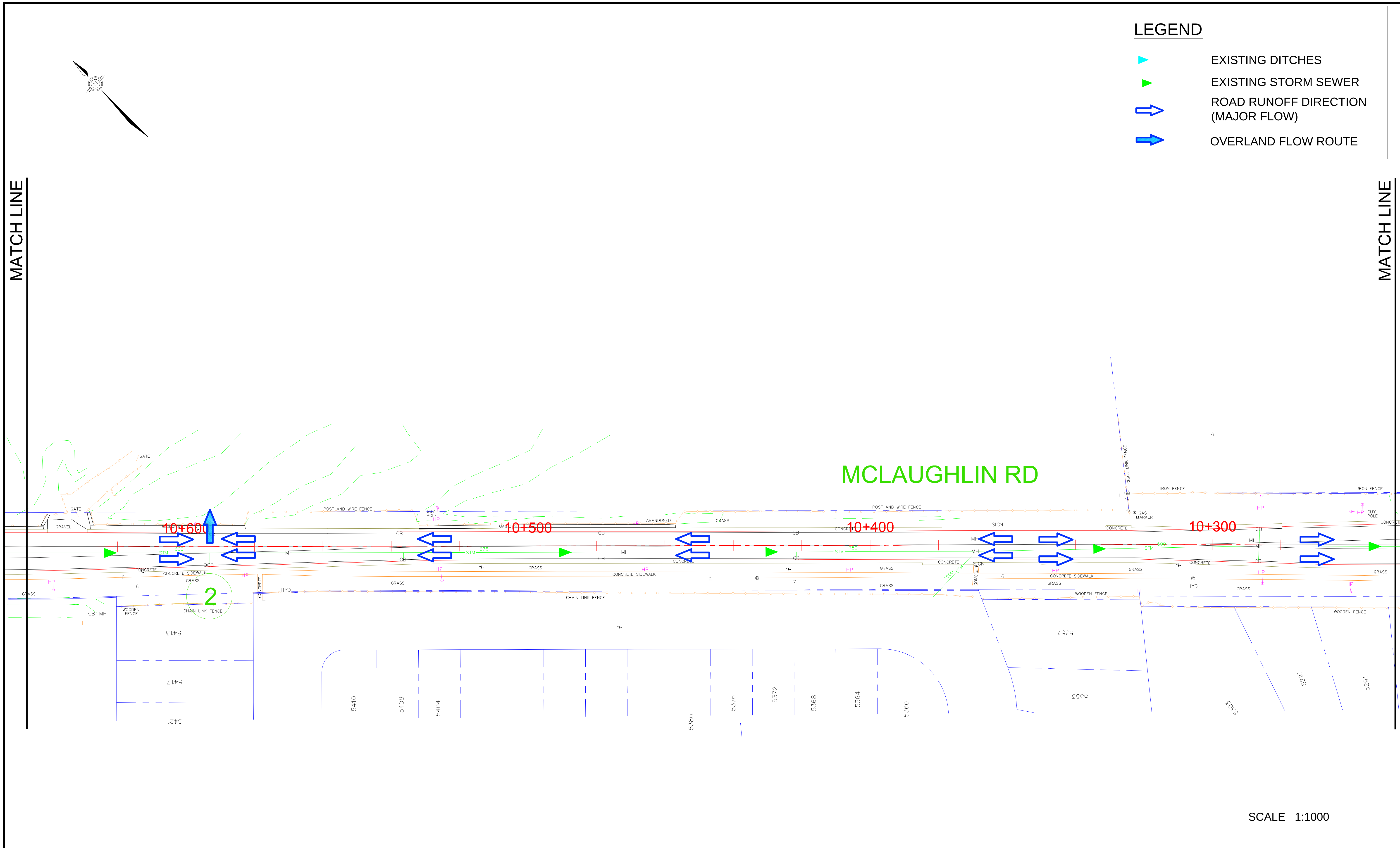

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EXISTING DRAINAGE CONDITION

MCLAUGHLIN ROAD

FIGURE 4G

IBI GROUP

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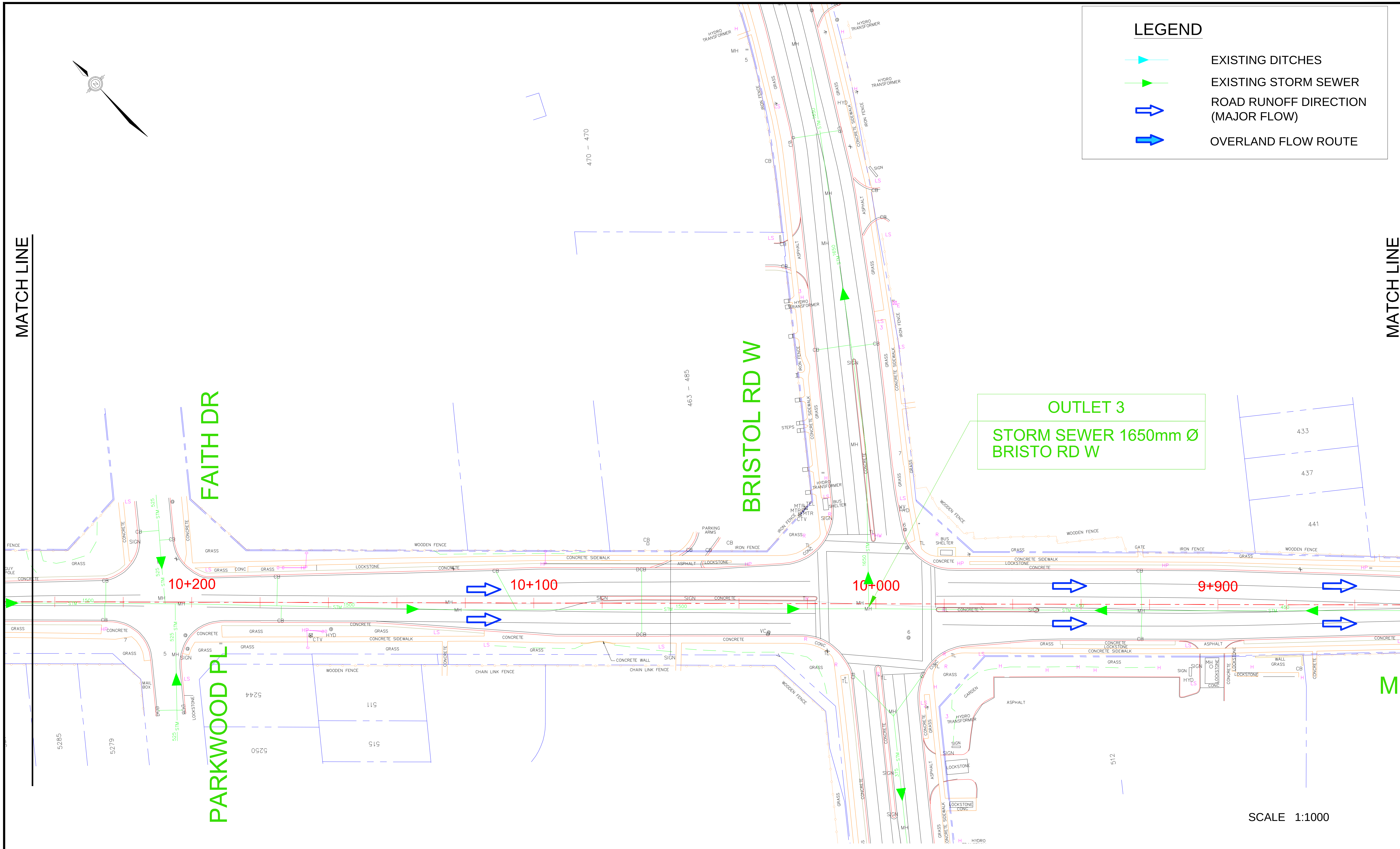

EXISTING DRAINAGE CONDITION

MCLAUGHLIN ROAD

FIGURE 4H

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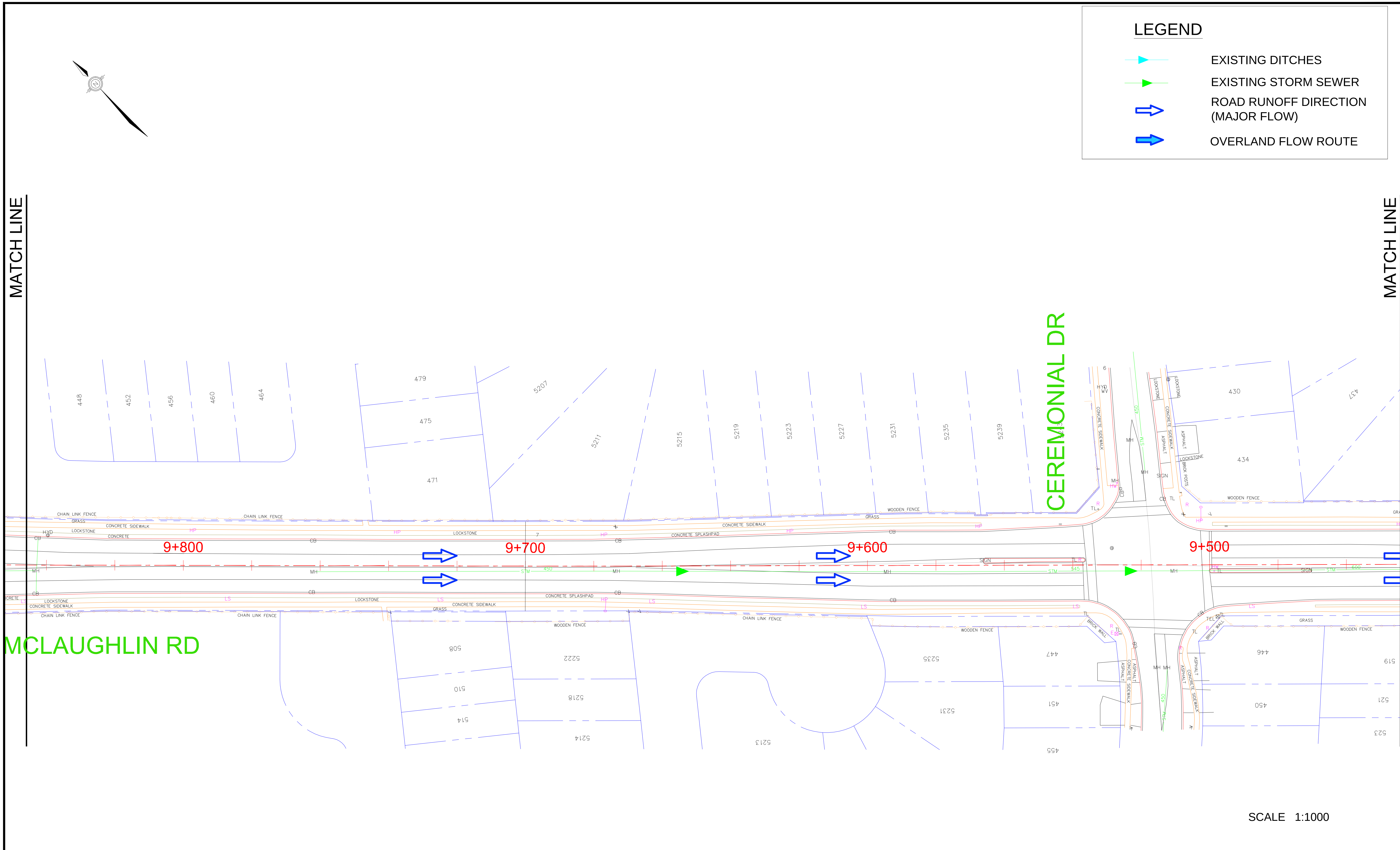
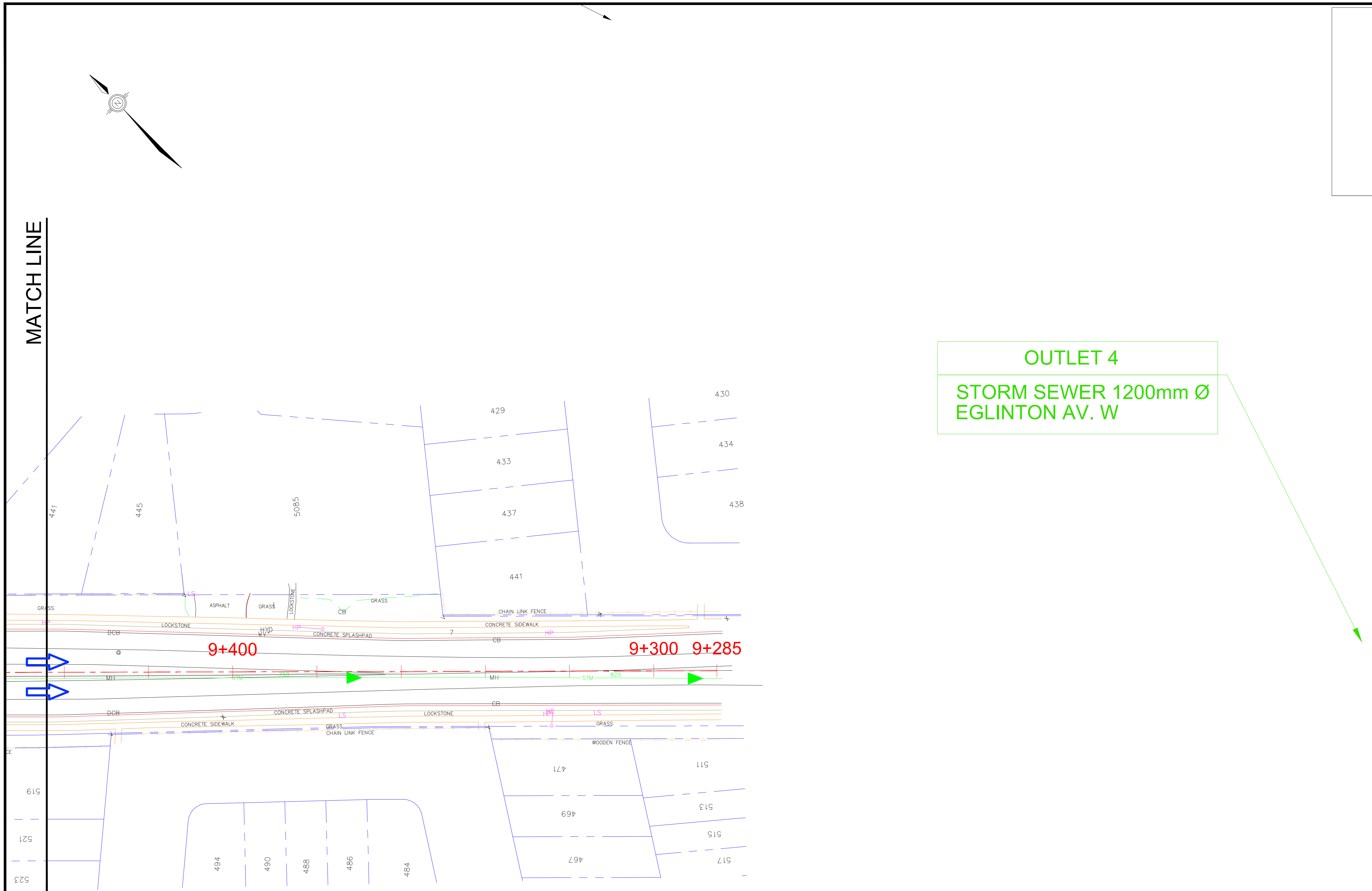


EXISTING DRAINAGE CONDITION

MCLAUGHLIN ROAD

FIGURE 4I



LEGEND

- EXISTING DITCHES
- EXISTING STORM SEWER
- ROAD RUNOFF DIRECTION (MAJOR FLOW)
- OVERLAND FLOW ROUTE

SCALE 1:1000

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EXISTING DRAINAGE CONDITION

MCLAUGHLIN ROAD

FIGURE 4J

3. EXISTING DRAINAGE DESIGN AND STORMWATER MANAGEMENT

Based on the review of the information provided by City of Mississauga, it could be concluded that the 30m road right-of-way for McLaughlin Road was included in drainage subcatchment and development plans for areas along MacLaughlin Road. The areas that had been modelled in the storm sewer design used a typical runoff coefficient of 0.75, reflective of an urban road section.

Previous development of the lands adjacent to study area has resulted in the loss of drainage system headwater channels. The headwater channels have been replaced with storm sewer systems and particularly a number of trunk sewer pipes. There is no direct discharge of surface runoff from this section of McLaughlin Road into any watercourses. The proposed upgrading of McLaughlin Road will not alter this situation. The existing drainage system has been designed to address the minor and major system flow routes. These are shown of **Figures 4A to 4J**.

No specific water quality treatment measures currently exist within the project limits.

4. DRAINAGE AND STORMWATER MANAGEMENT ISSUES

The proposed improvements will increase the pavement area however; flows to the existing storm sewer do include future widening with a 30m R-O-W. Therefore, the proposed widening would not increase the design flows significantly and will not impact storm sewer system conveyance.

It is to be noted that the entire drainage along McLaughlin Road (within the study limits) is accommodated through numerous piped storm sewers. These storm sewers discharge into trunk sewer systems. The trunk sewers ultimately outlet into a drainage system i.e. Cooksville Creek. No direct discharge of drainage from McLaughlin Road into Cooksville Creek is being considered and all surface runoff is collected into various local storm sewers and trunk sewer systems.

Under future condition, it is not feasible to treat individual lead connections collecting runoff from the widened foot print of the roadway. The areas conveyed by the trunk sewers are very large as they collect large residential areas to the west i.e. approximately 64ha to 150 ha and OGS units are not effective if drainage area is more than 2.0 ha. The drainage areas are so large that any treatment provided to the upstream roadway runoff will not be visible downstream and it will have minimal impact on the existing overall water quality.

In light of the above it can be concluded that the proposed addition of lanes and impervious surfaces do not justify installation of stormwater management facilities; due to the lack of space, current state of full development and more importantly given that the minor drainage system is collected and piped through a series of storm sewer systems.

Best efforts should be considered to maintain the grassed boulevard and drainage swales that presently exist. In addition, the various stormwater management measures such as providing sump for all new catchbasins and permeable paving (low impact development techniques) on sidewalks, creating more green space within the R-O-W should be considered.

For major system runoff; it is expected that the quantity of runoff from the improved section of the roads will not result in a significant increase in runoff, and as such, specific techniques to reduce the quantity and rate of runoff may not be considered warranted. This is due to the fact that the peak flows generated from the upstream catchments are much greater than the peak flows generated from smaller roadway paved areas, which occur earlier. Due to this lagging effect a small increase in the peak flow generated by the roadway does not result in an appreciable increase in the peak flow of the overall hydrograph.

5. DESIGN CRITERIA

In conformance with the City's current policies and guidelines the following design criteria will be adopted in the development of drainage and stormwater management strategies for this project.

Culverts

There are no cross-drainage culverts within the project limits.

Storm Sewer System

Minor drainage system is to be sized to convey runoff from a 10 year storm with a minimum inlet time of 15 minutes, as per City of Mississauga Standards.

Major System Drainage

- Major system flows (i.e. storms in excess of a 10 year event) to be conveyed overland to receiving drainage watercourses.

Water Quality

- Water quality measures to be designed according to the Ministry of the Environment (MOE) 'Enhanced' Level Of Protection (i.e. 80 percent long-term suspended solid removal);

- Grass Swales are to be designed to meet the following MOE criteria for quality control:

Minimum length of swale:	60 m
Allowable velocity (25 mm Chicago Storm):	0.5 m/s
Minimum bottom width of swale:	0.75 m
Maximum Drainage Area:	2 ha

6. CONCLUSION

The following summarizes the existing drainage and stormwater management conditions that have been investigated in support of McLaughlin Road EA:

- The diameter of storm sewers under McLaughlin Road range from approximately 450mm to 2550mm diameters;

- Physical condition of storm sewers is not known and need to be established either by existing/future CCTV/Video inspection report (if available with the City) to determine its structural condition. CCTV inspection is to be completed during detail design.

- The existing minor system capacity was confirmed and it could be concluded that the existing storm sewers have enough capacities to convey 10-yr event flows for an average 30m paved R-O-W. However, all storm outlet system must be checked for surcharging and pipe capacity if the proposed R-O-W width increases more than 30m.

- Presently all drainage systems from Mclaughlin Road outlets through a series of existing storm sewers, prior to discharging into an existing watercourse. This situation will remain and no new systems are expected to be put in place. There is no direct discharge into receiving stream or water body.

- Overland flow routes have been identified. The major system, in excess of those captured by the minor system, is conveyed overland on McLaughlin Road. Depth of flooding at the low points (sag) is to be determined during a 100-yr storm event to ensure that all flow depths on the roads will remain less than 0.3 above the gutter. Depth of ponding at the low points is to be determined during detail design. Overland flow route has been shown on Figures 4A to 4J.

- It is expected that the quantity of runoff from the improved section of the roads will not result in a significant increase in runoff, and as such, specific techniques to reduce the quantity and rate of runoff may not be considered warranted.

- There are no culverts currently exist within the project limits.

- For outlet 1, and 2 the proposed City's Pond at Matheson Blvd. will capture those catchments, however for outlet 3, and 4, a quality control measure is required. Possibility of treating outlets 3 and 4 by OGS units and sizing will be done during detail design.

APPENDIX A

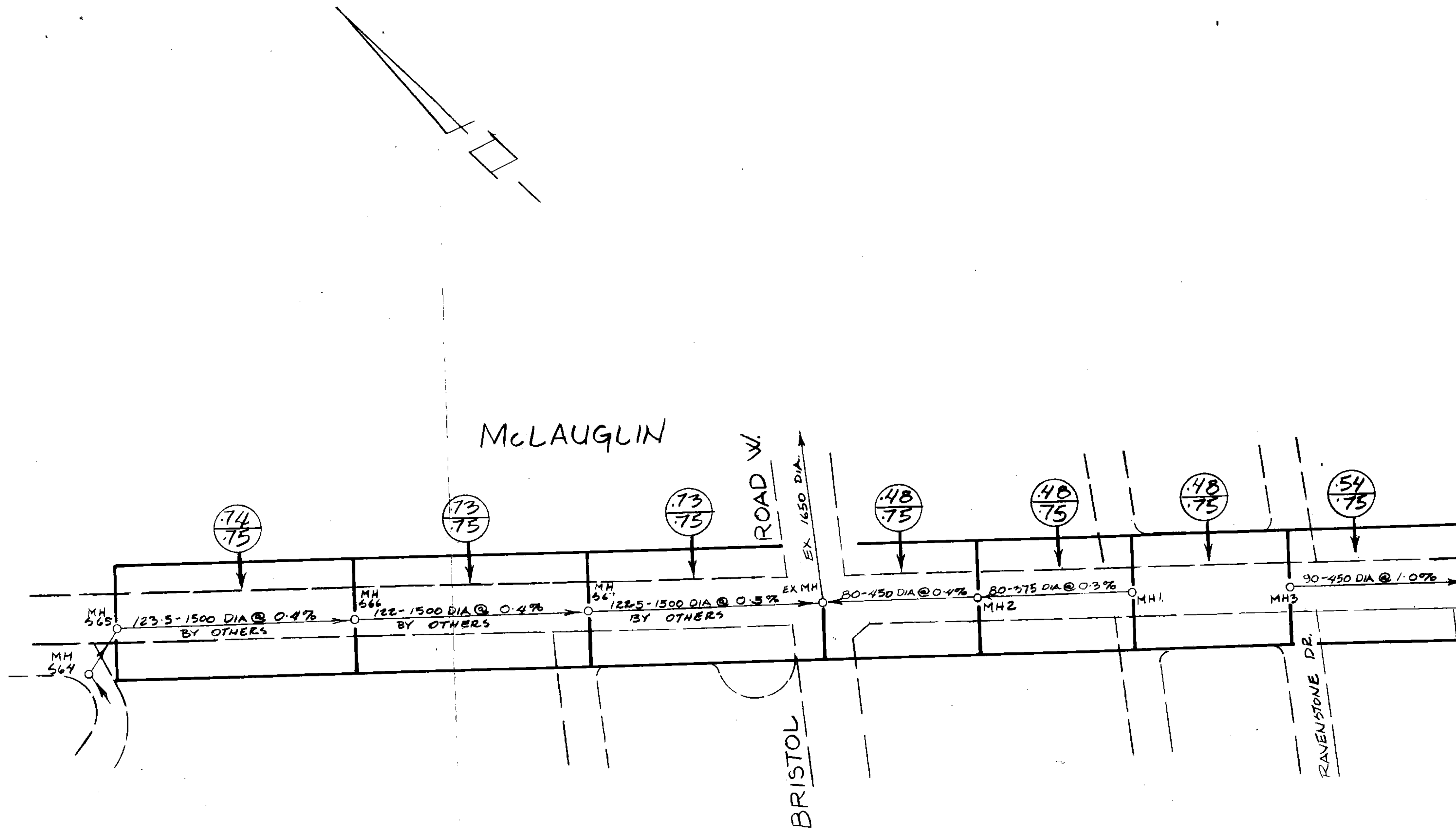
PHOTOGRAPHS

McLaughlin Road Configuration

Low points and High points on McLaughlin Road

APPENDIX B

STORM SEWER DRAINAGE AREAS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ROAD W.
EX 1650 DIA.
BRISTOL
RAVENSTONE DR.
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.73/.75
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.48/.75
.48/.75
.48/.75
.54/.75
MH 565
MH 564
MH 566
MH 567
EX MH
MH 2
MH 1.
MH3
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BY OTHERS
122 - 1500 DIA @ 0.4%
BY OTHERS
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BY OTHERS
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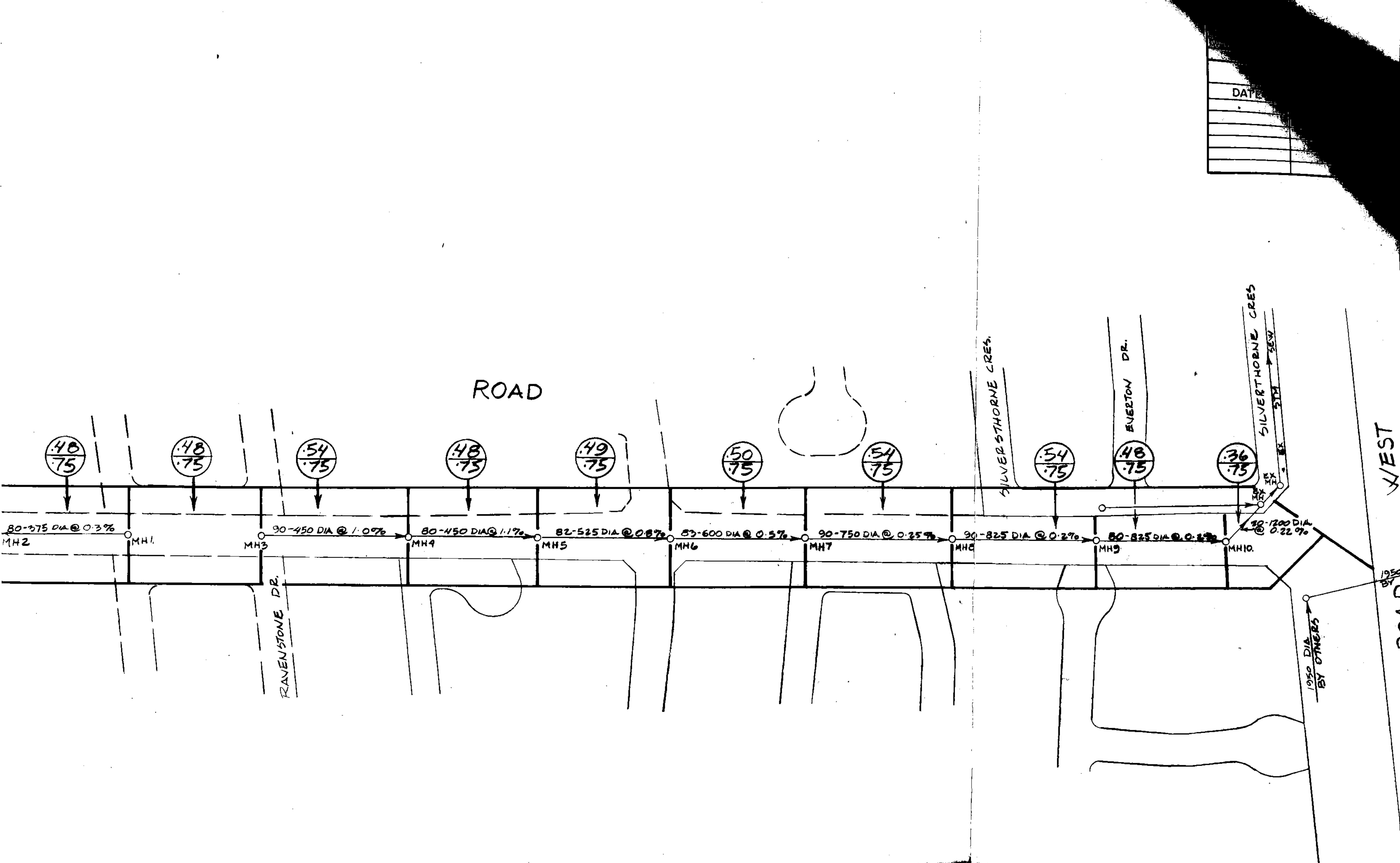
80-375 DIA @ 0.3%
90-450 DIA @ 1.0%



DATE
ROAD
RAVENSTONE DR.
SILVERSTHORNE CRES.
EVERTON DR.
SILVERTHORNE CRES
WEST
80-375 DIA @ 0.3%
90-450 DIA @ 1.0%
80-450 DIA @ 1.1%
82-525 DIA @ 0.8%
83-600 DIA @ 0.5%
90-750 DIA @ 0.25%
90-825 DIA @ 0.2%
80-825 DIA @ 0.2%
30-1200 DIA @ 0.22%
1950 DIA BY OTHERS
MH2
MH1
MH3
MH4
MH5
MH6
MH7
MH8
MH9
MH10
EX MH

SUBDIVISION Mc LAUGHLIN Rd.
CONSULTANT CITY OF MISSISSAUGA
MAJOR DRAINAGE AREA COOKSVILLE CREEK Z-37

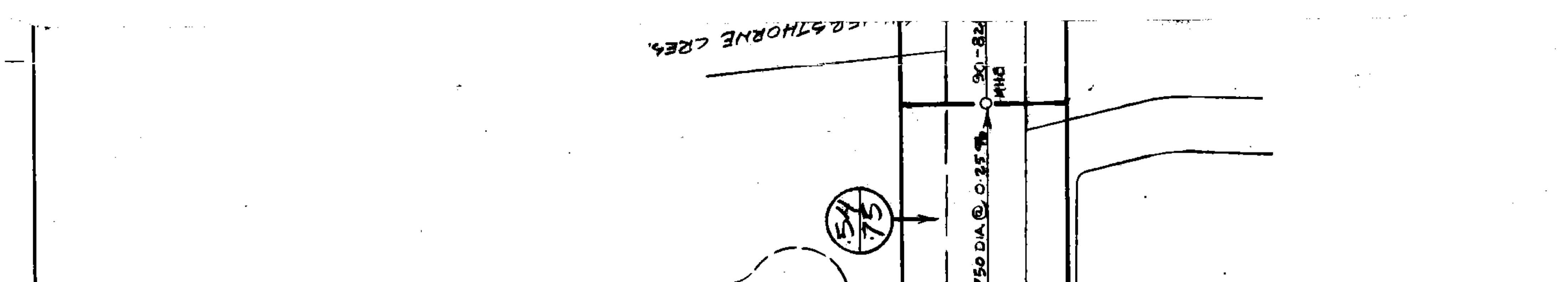
CITY OF MISSISSAUGA

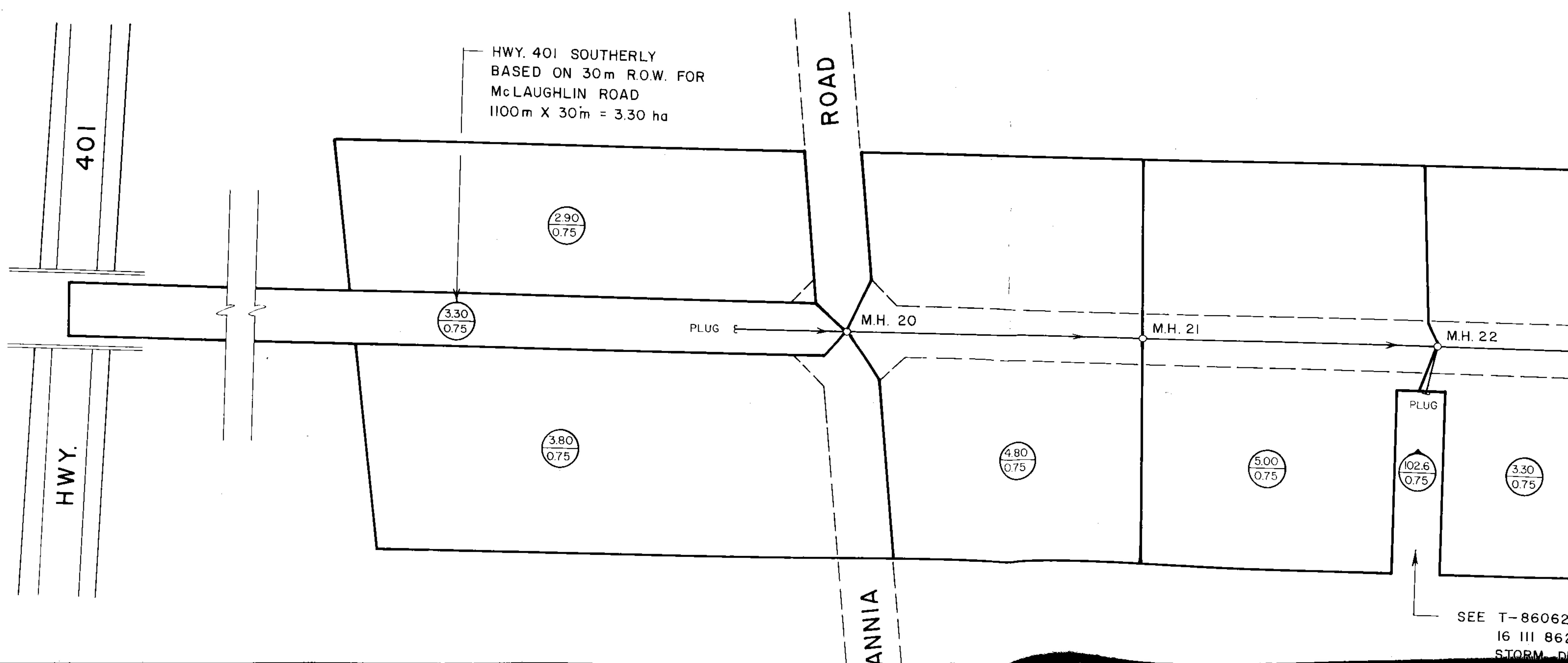
STORM DRAINAGE DESIGN CHART FOR CIRCULAR DRAINS FLOWING FULL

SHEET No. 1 OF 1 DATE 15/03/87
PROJECT No. 36-126
DESIGNED BY I.F.G.

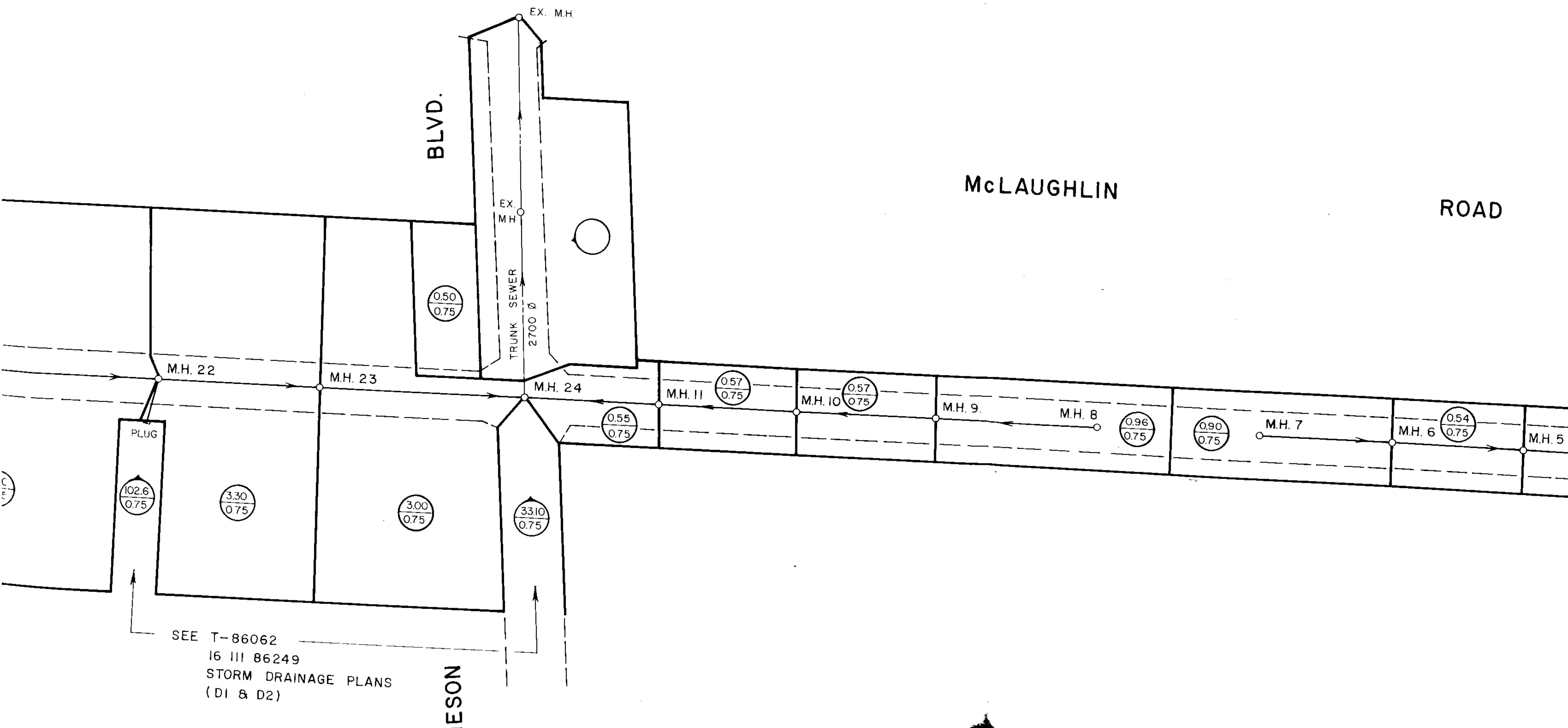
LOCATION OF SECTION	FROM UPSTREAM MH#	TO DOWNSTREAM MH#	ADJACENT CONTRIBUTARY AREA A_A (ha)	RUNOFF COEFFICIENT C_A	$A_A \times C_A$	ACCUMULATIVE AREA DRAINED BY SECTION $A = \Sigma A_A$ (ha)	ACCUMULATIVE AREA TIMES RUNOFF COEFFICIENT FOR SECTION $A \times C = \Sigma A_A \times C_A$	FLOW TIME TO SECTION (FROM EXTREME UPSTREAM INLET) t_{cf} (min)	INITIAL TIME OF CONCENTRATION AT EXTREME UPSTREAM INLET t_{ci} (min)	TIME OF CONCENTRATION AT UPSTEAM END OF SECTION $t_c = t_{cf} + t_{ci}$ min	INTENSITY OF RAINFALL I mm/hr	QUANTITY OF FLOW TO BE ACCOMMODATED IN SECTION $Q = \frac{IAC}{360}$ m³/SEC	TYPE OF PIPE	MANNINGS ROUGHNESS COEFFICIENT n	SLOPE S %	DIAMETER D mm	LENGTH OF SECTION L m	VELOCITY OF FLOW WITH PIPE FLOWING FULL V m/SEC	CAPACITY OF PIPE FLOWING FULL Q m³/SEC	PIPE INVERT AT UPSTREAM MH m	PIPE INVERT AT DOWNSTREAM MH m	TIME OF FLOW IN SECTION $t = \frac{L}{V \times 60}$ min
McLAUGHLIN Rd.	1	2	.48	.75	.36	.48	.36	–	15	15	99	.099	Conc.	.013	0.3	375	80	.88	.100	171.80	171.56	1.5
To BRISTOL Rd.	2	Ex.	.48	.75	.36	.96	.72	1.5	15	16.5	94	.188	Conc.	.013	0.4	450	80	1.15	.188	171.48	171.16	1.2
McLAUGHLIN Rd.	TO	3	.48	.75	.36																	
To EGLINTON AVE.	3	4	.54	.75	.40	1.02	.76	–	15	15	99	.209	Conc.	.013	1.0	450	90	1.81	.297	170.50	169.60	[illegible]
— " —	4	5	.48	.75	.36	1.50	1.12	.8	15	15.8	96	.299	Conc.	.013	1.1	450	80	1.90	.312	169.60	168.72	.7
— " —	5	6	.49	.75	.37	1.99	1.39	1.5	15	16.5	94	.363	Conc.	.013	.8	525	82	1.80	.401	168.65	168.00	.7
— " —	6	7	.50	.75	.38	2.49	1.77	2.2	15	17.2	92	.452	Conc.	.013	.5	600	83	1.55	.453	167.92	167.50	.9
— " —	7	8	.54	.75	.40	3.03	2.17	3.1	15	18.1	89	.536	Conc.	.013	.25	750	90	1.27	.581	167.34	167.12	1.2
— " —	8	9	.54	.75	.40	3.57	2.57	4.3	15	19.3	86	.614	Conc.	.013	.20	825	90	1.21	.676	167.05	166.87	1.2
— " —	9	10	.48	.75	.36	4.05	2.93	5.5	15	20.5	82	.667	Conc.	.013	.20	825	80	1.21	.670	166.87	166.71	1.1
— " —	10	Ex.	.36	.75	.27	4.41	3.20	6.6	15	21.6	82	.729	Conc.	.013	.22	1200	20	1.63	1.91	166.61	166.57	.2
								6.8	15	21.9												

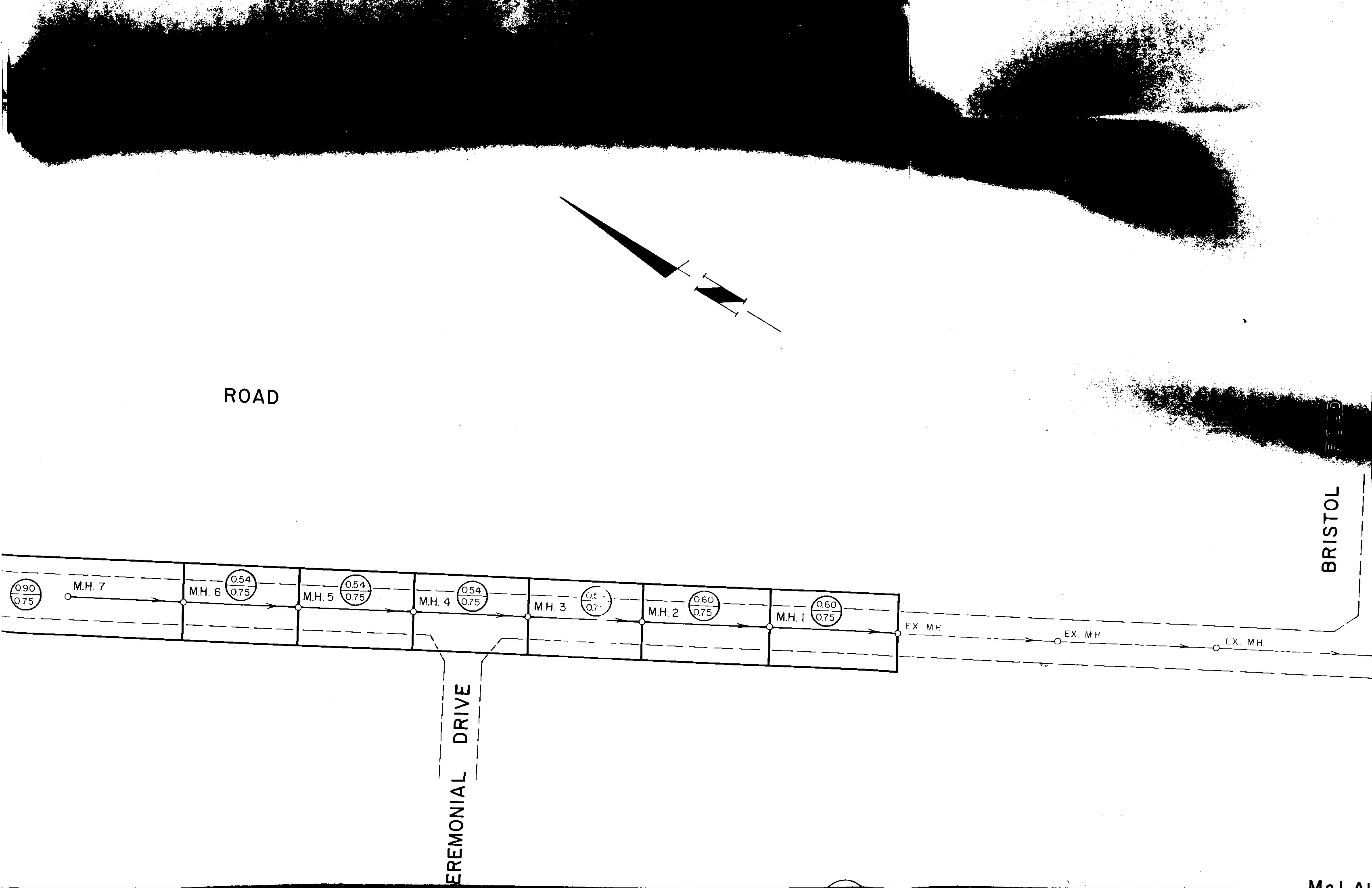
EFFECTIVE DATE 79 03 PLAN No 2-1-5
REVISED DATE 79 09 A-6221



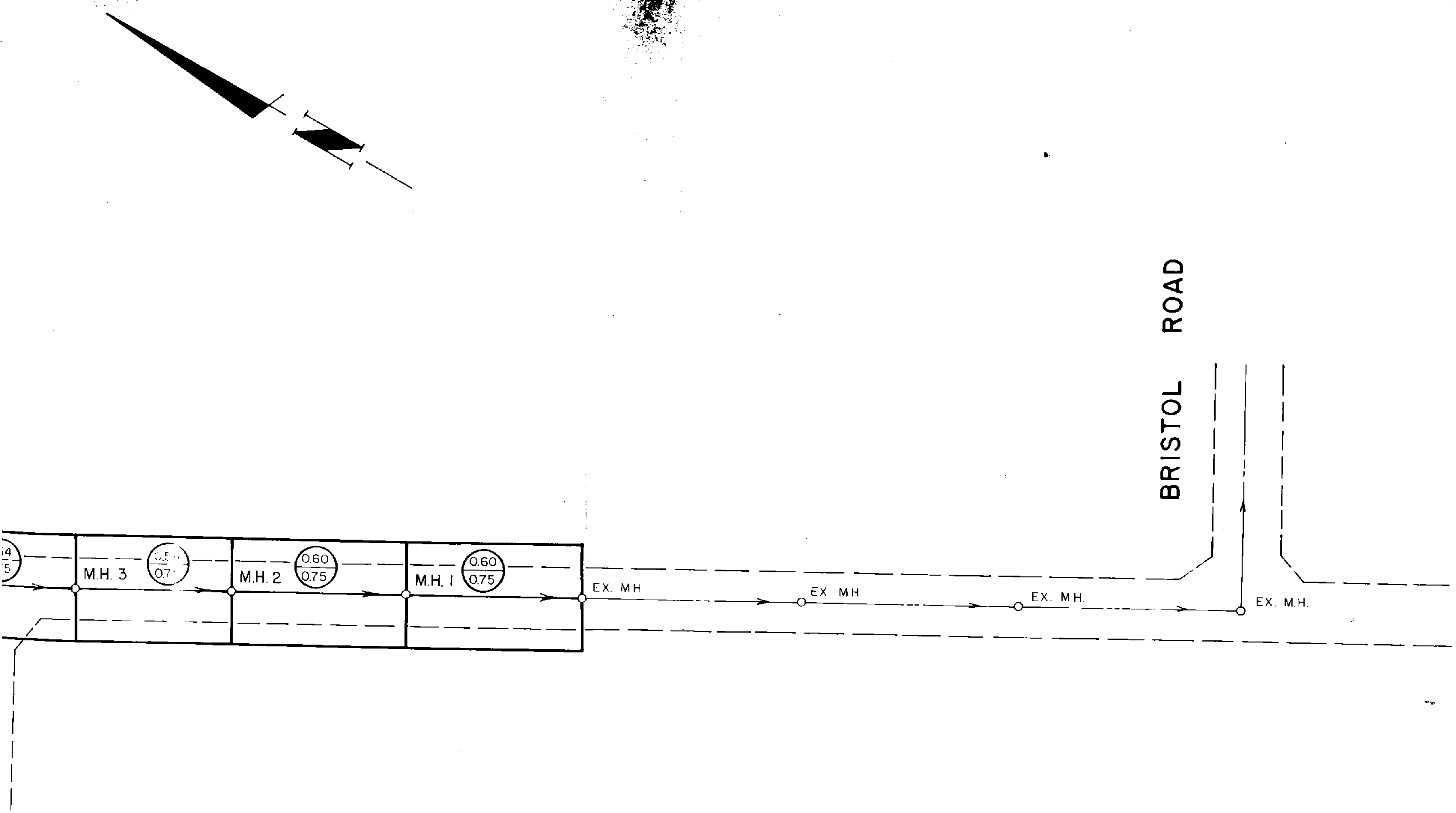


HWY. 401 SOUTHERLY
BASED ON 30m R.O.W. FOR
McLAUGHLIN ROAD
1100m X 30m = 3.30 ha
ROAD
401
HWY.
2.90
0.75
3.30
0.75
3.80
0.75
PLUG
M.H. 20
M.H. 21
M.H. 22
4.80
0.75
5.00
0.75
PLUG
102.6
0.75
3.30
0.75
ANNIA
SEE T-86062
16 III 862
STORM


EX. M.H.
BLVD.
McLAUGHLIN
ROAD
EX. M.H.
TRUNK SEWER
2700 Ø
0.50 / 0.75
M.H. 22
M.H. 23
M.H. 24
M.H. 11
M.H. 10
M.H. 9.
M.H. 8
M.H. 7
M.H. 6
M.H. 5
0.57 / 0.75
0.57 / 0.75
0.55 / 0.75
0.96 / 0.75
0.90 / 0.75
0.54 / 0.75
PLUG
102.6 / 0.75
3.30 / 0.75
3.00 / 0.75
33.10 / 0.75
SEE T-86062
16 III 86249
STORM DRAINAGE PLANS
(D1 & D2)
HESON



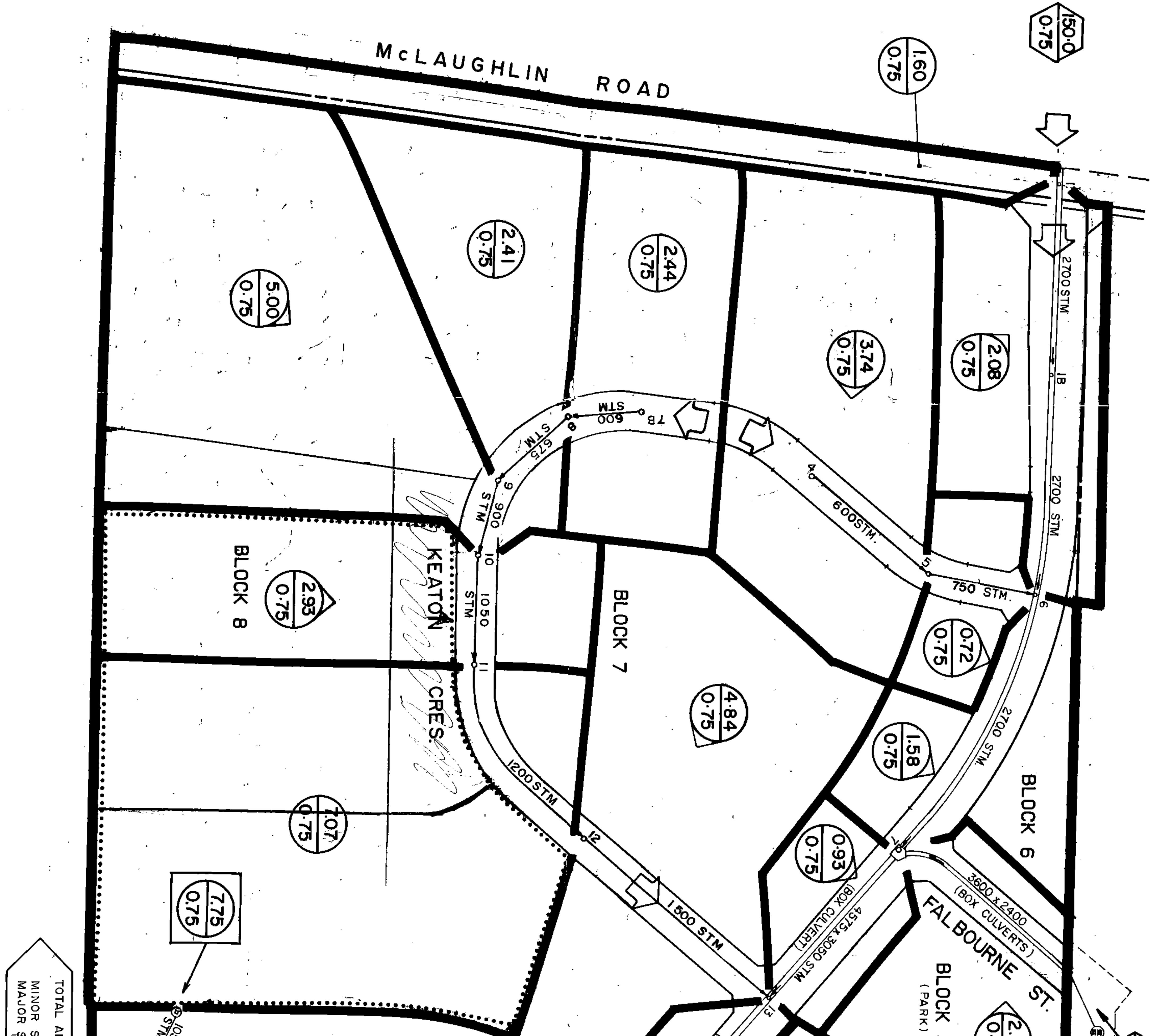
ROAD
0.90
0.75
M.H. 7
M.H. 6
0.54
0.75
M.H. 5
0.54
0.75
M.H. 4
0.54
0.75
M.H. 3
M.H. 2
0.60
0.75
M.H. 1
0.60
0.75
EX. MH
EX. MH
EX. MH.
BRISTOL
EREMONIAL DRIVE



0.60 / 0.75 AREA (ha) COEFFICIENT

McLAUGHLIN ROAD

DRAINAGE AREAS P.N. 87-137



McLAUGHLIN ROAD
150.0 0.75
1.60 0.75
5.00 0.75
2.41 0.75
2.44 0.75
3.74 0.75
2.08 0.75
2700 STM
675 STM
600 STM
900 STM
1050 STM
600STM.
750 STM.
BLOCK 8
KEATON CRES.
2.93 0.75
BLOCK 7
4.84 0.75
0.72 0.75
1.58 0.75
7.07 0.75
1200 STM
1500 STM
7.75 0.75
0.93 0.75
BLOCK 6
4575 x 3050 STM (BOX CULVERT)
3600 x 2400 (BOX CULVERTS)
FALBOURNE ST.
BLOCK (PARK)

7.75
10.7
3.85

SUBDIVISION Heartland - Phase 1
CONSULTANT R. E. Winter Associates Ltd
MAJOR DRAINAGE AREA

CITY OF MISSISSAUGA

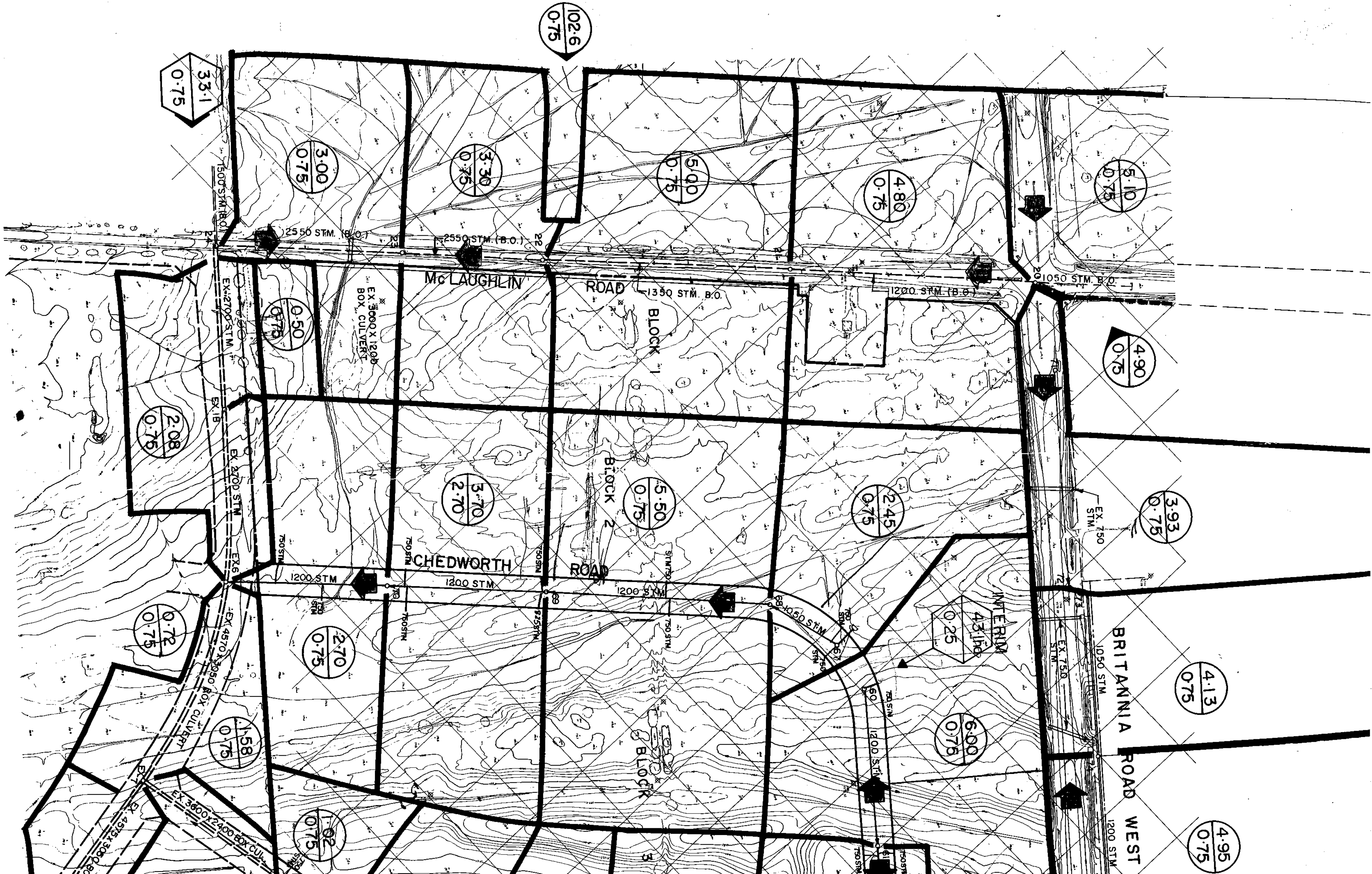
STORM DRAINAGE DESIGN CHART FOR CIRCULAR DRAINS FLOWING FULL

SHEET No. 1 OF 5 DATE Rev Nov 25/87
PROJECT No. 7922 21T-86028 16 III 86246
DESIGNED BY [signature]

RETURN TO FILE
~~DRAINAGE 37E~~

LOCATION OF SECTION	FROM UPSTREAM	TO DOWNSTREAM	ADJACENT CONTRIBUTARY AREA	RUNOFF COEFFICIENT		ACCUMULATIVE AREA DRAINED BY SECTION	ACCUMULATIVE AREA TIMES RUNOFF COEFFICIENT FOR SECTION	FLOW TIME TO SECTION (FROM EXTREME UPSTREAM INLET)	INITIAL TIME OF CONCENTRATION AT EXTREME UPSTREAM INLET	TIME OF CONCENTRATION AT UPSTREAM END OF SECTION	INTENSITY OF RAINFALL	QUANTITY OF FLOW TO BE ACCOMMODATED IN SECTION	TYPE OF PIPE	MANNINGS ROUGHNESS COEFFICIENT	SLOPE	DIAMETER	LENGTH OF SECTION	VELOCITY OF FLOW WITH PIPE FLOWING FULL	CAPACITY OF PIPE FLOWING FULL	PIPE INVERT AT UPSTREAM M.H.	PIPE INVERT AT DOWNSTREAM M.H.	TIME OF FLOW IN SECTION
	MH#	MH#	A_A	C_A	$A_A x C_A$	$A = \Sigma A_A$	$A x C = \Sigma A_A x C_A$	t_{cf}	t_{ci}	$t_c = t_{cf} + t_{ci}$	I	$Q = \frac{IAC}{360}$		n	S	D	L	V	Q			$t = \frac{L}{V x 60}$
			(ha)			(ha)		(min)	(min)	min	mm/hr	m³/SEC			%	mm	m	m/SEC	m³/SEC	m	m	min
			EXTERNAL		AREAS	FROM	NORTH +	NORTH	WEST	AT	Mc. LAUGHLIN	RD + MATHESON										
			L =	2000	-50	m @ 2	m/s ∴ Tc	= 15	+ 16.3	= 31.3 mins			(25 YR	I.D.F)								
Matheson Blvd	Plug	1	150.0 1.6	0.75	113.7	151.60	113.70			31.3	71	22.42			0.45	2700	14	4.00	23.71			0.1
-do-	1	6	2.08	0.75	1.56	153.68	115.26			31.3	71	22.73			0.45	2700	269	4.00	23.71			1.1
										32.4												
					MINOR	DRAINAGE	10 YR	IDF														
Keaton Cres	4	5	3.74	0.75	2.81	3.74	2.81			15	100	0.780			2.50	600	98.5	3.46	1.011			0.5
-do-	5	6	0.72	0.75	0.54	4.46	3.35			15.5	98.0	0.911			1.00	750	68.0	2.55	1.161			0.4
										15.9												
Matheson Blvd	6	7	1.58	0.75	1.19	159.72	119.80			32.4	70.5	23.46			0.45	2700	164.0	4.00	23.71			0.8
						AREAS FROM	NORTH	A =	236.0	ha	C =	0.75										
						L = 2520	-50 m @	2 m/s		Tc =	15 +	20.6 =	35.6 min		25 YR	IDF						
Falbourne St	Plug	7	2.02	0.75	1.52	238.52	178.89			35.6	66.0	32.80			0.30	Box 3600 x 2400	135	4.29	37.06			0.5
Matheson Blvd	7	13	0.93	0.75	0.70	399.17	299.39			36.1	66.0	54.88			0.30	4575 x 3050	117	5.03	70.2			0.4
						160 m -	50 m @	2 m/s		Tc = 15 +	0.9	= 15.9										
Keaton Cres	7B	8	2.44	0.75	1.83	2.44	1.83			15.9	100	0.508			2.00	600	46	3.08	0.903			0.3
-do-	8	9	2.41	0.75	1.81	4.85	3.64			16.2	95.2	0.962			2.00	675	55.5	3.35	1.237			0.3
-do-	9	10	5.00	0.75	3.75	9.85	7.39			16.5	94.0	1.929			1.10	900	50	3.01	1.976			0.3
-do-	10	11	2.93	0.75	2.20	12.78	9.59			16.8	92.8	2.472			0.80	1050	69	2.85	2.546			0.4
										17.2												

FOR EXTERNAL DRAINAGE
SEE DWG. D-2



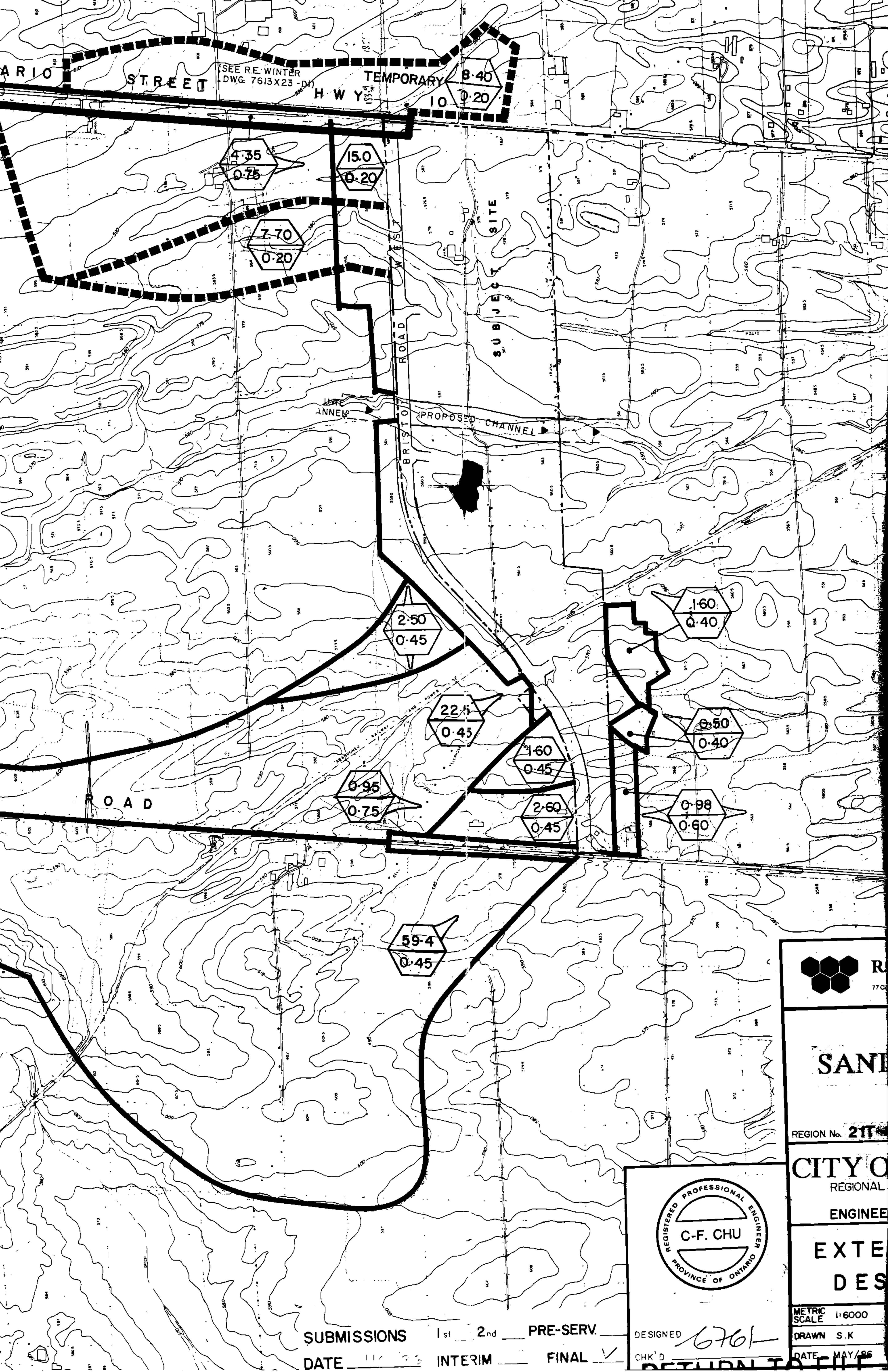
SUBDIVISION Orlando Industrial
CONSULTANT R.E. Winter & Associates
MAJOR DRAINAGE AREA Z - 37E

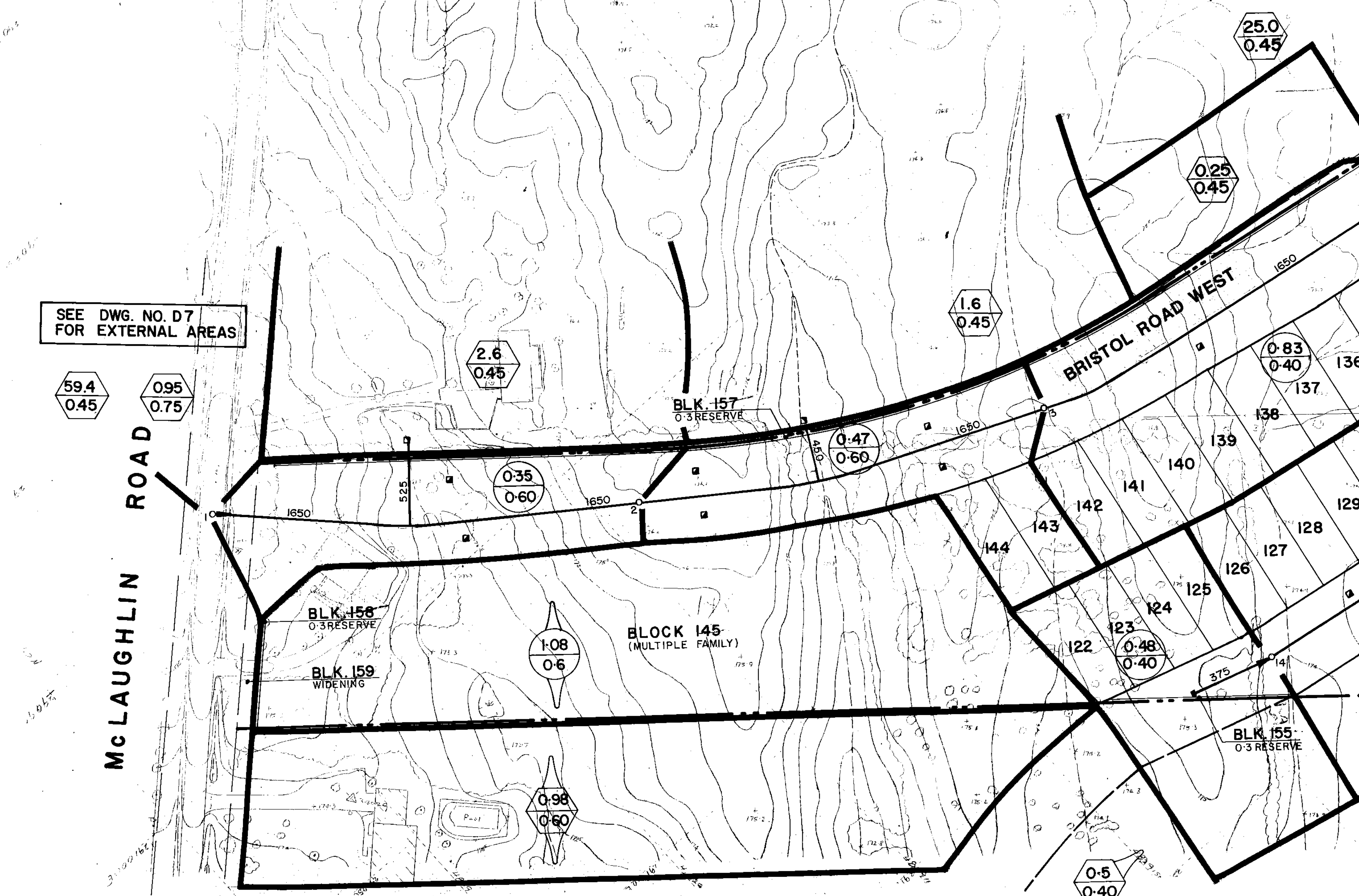
CITY OF MISSISSAUGA

STORM DRAINAGE DESIGN CHART FOR CIRCULAR DRAINS FLOWING FULL

SHEET No. 2 OF 2 DATE April 27/88
PROJECT No. 8256 x 2 16.111.86249
DESIGNED BY Ram

LOCATION OF SECTION	FROM UPSTREAM	TO DOWNSTREAM	ADJACENT CONTRIBUTARY AREA	RUNOFF COEFFICIENT		ACCUMULATIVE AREA DRAINED BY SECTION	ACCUMULATIVE AREA TIMES RUNOFF COEFFICIENT FOR SECTION	FLOW TIME TO SECTION (FROM EXTREME UPSTREAM INLET)	INITIAL TIME OF CONCENTRATION AT EXTREME UPSTREAM INLET	TIME OF CONCENTRATION AT UPSTEAM END OF SECTION	INTENSITY OF RAINFALL	QUANTITY OF FLOW TO BE ACCOMMODATED IN SECTION.	TYPE OF PIPE	MANNINGS ROUGHNESS COEFFICIENT	SLOPE	DIAMETER	LENGTH OF SECTION	VELOCITY OF FLOW WITH PIPE FLOWING FULL	CAPACITY OF PIPE FLOWING FULL	PIPE INVERT AT UPSTREAM M.H.	PIPE INVERT AT DOWNSTREAM M.H.	TIME OF FLOW IN SECTION
	MH#	MH#	A_A	C_A	$A_A x C_A$	$A = \Sigma A_A$	$A x C = \Sigma A_A x C_A$	t_{cf}	t_{ci}	$t_c = t_{cf} + t_{ci}$	I	$Q = \frac{IAC}{360}$		n	S	D	L	V	Q			$t = \frac{L}{V x 60}$
			(ha)			(ha)		(min)	(min)	min	mm/hr	m^3/SEC			%	mm	m	m/SEC	m^3/SEC	m	m	min
					External Area		A = 10.0	C = 0.75			t_{cf} = (1100 @ 2m/s)				= 9.17 mins			(Q_{10})				
McLaughlin Road	Plug	20	10.00	0.75	7.50	10.00	7.50	9.17	15.0	24.17	73.6	1.533		0.013	0.40	1050	75	2.31	1.804			0.54
-do-	20	21	4.80	0.75	3.60	14.80	11.10			24.71	72.6	2.239		0.013	0.35	1200	185	2.36	2.406			1.31
-do-	21	22	5.00	0.75	3.75	19.80	14.85			26.02	70.0	3.850		0.013	0.40	1350	180	2.72	3.522			1.10
												(87.9 + 14.7)										
				Areas from mid-block (west)					A = 102.6 ha			C = 0.75		Tcf = (2200 - 50) @ 2m/s =						17.9 mins (Q_{25})		
	Plug	22	102.60	0.75	76.95	102.60	76.95	17.9	15.0	32.9	70.0	14.92		0.013	0.45	2400	28	4.233	17.288			0.110
McLaughlin Road	22	23	3.30	0.75	2.48	125.70	94.28			30.36	75.0	19.64		0.013	0.48	2550	120	3.95	20.160			0.51
-do-	23	24	3.50	0.75	2.63	129.20	96.90			30.87	74.0	19.92		0.013	0.48	2550	146	3.95	20.160			0.62
				Areas	from	West	A = 33.1 ha	C = 0.75			Tcf =	(560 - 50) @		2 m/s	= 4.25 mins			(Q_{10})				
				Areas	from	South (ROW)	A = 1.6 ha	C = 0.75			Tcf =	(600 - 50) @		2 m/s	= 4.58 mins							
Fut Matheson Blvd	Plug	24	33.10	0.75	24.83	33.10	24.83	4.25	15.0	19.25	85.4	5.89		0.013	0.45	1650	18	2.92	6.113			0.10
Mc Laughlin Rd	South	1650 STM	1.60	0.75	1.200	1.60	1.20	4.58	15.0	19.58	84.20	0.281		0.013	2.3	525	88.5	3.02	0.678			
Matheson Blvd	24	Ex 1	0.0	0.75	0.00	163.90	122.93			33.0	70.0	23.903		0.013	0.45	2700	2.4	4.06	22.733	(Q_{25})		
																		(	Actual pipe diameter: 108 ins			
																			Q =	24.00 cms)		


ARIO STREET
(SEE R.E. WINTER DWG. 7613X23-DI)
TEMPORARY HWY 10
8·40
0·20
4·35
0·75
15.0
0·20
7·70
0·20
SUBJECT SITE
WEST BRISTOL ROAD
PROPOSED CHANNEL
2·50
0·45
22·1
0·45
1·60
0·45
2·60
0·45
0·95
0·75
1·60
0·40
0·50
0·40
0·98
0·60
ROAD
59·4
0·45
SANI
REGION No. 21T
CITY O
REGIONAL
ENGINEE
EXTE
DES
REGISTERED PROFESSIONAL ENGINEER
C-F. CHU
PROVINCE OF ONTARIO
METRIC SCALE 1:6000
DRAWN S.K
DATE MAY/86
DESIGNED 6761
CHK'D
SUBMISSIONS 1st 2nd PRE-SERV.
DATE INTERIM FINAL ✓



SEE DWG. NO. D7
FOR EXTERNAL AREAS
McLAUGHLIN ROAD
BRISTOL ROAD WEST
BLOCK 145
(MULTIPLE FAMILY)
BLK. 157
0·3 RESERVE
BLK. 158
0·3 RESERVE
BLK. 159
WIDENING
BLK. 155
0·3 RESERVE
59.4
0.45
0.95
0.75
2.6
0.45
1.6
0.45
25.0
0.45
0.25
0.45
0·83
0·40
0·47
0·60
0·35
0·60
1·08
0·6
0·98
0·60
0·48
0·40
0·5
0·40
1650
525
450
375
122
123
124
125
126
127
128
129
136
137
138
139
140
141
142
143
144

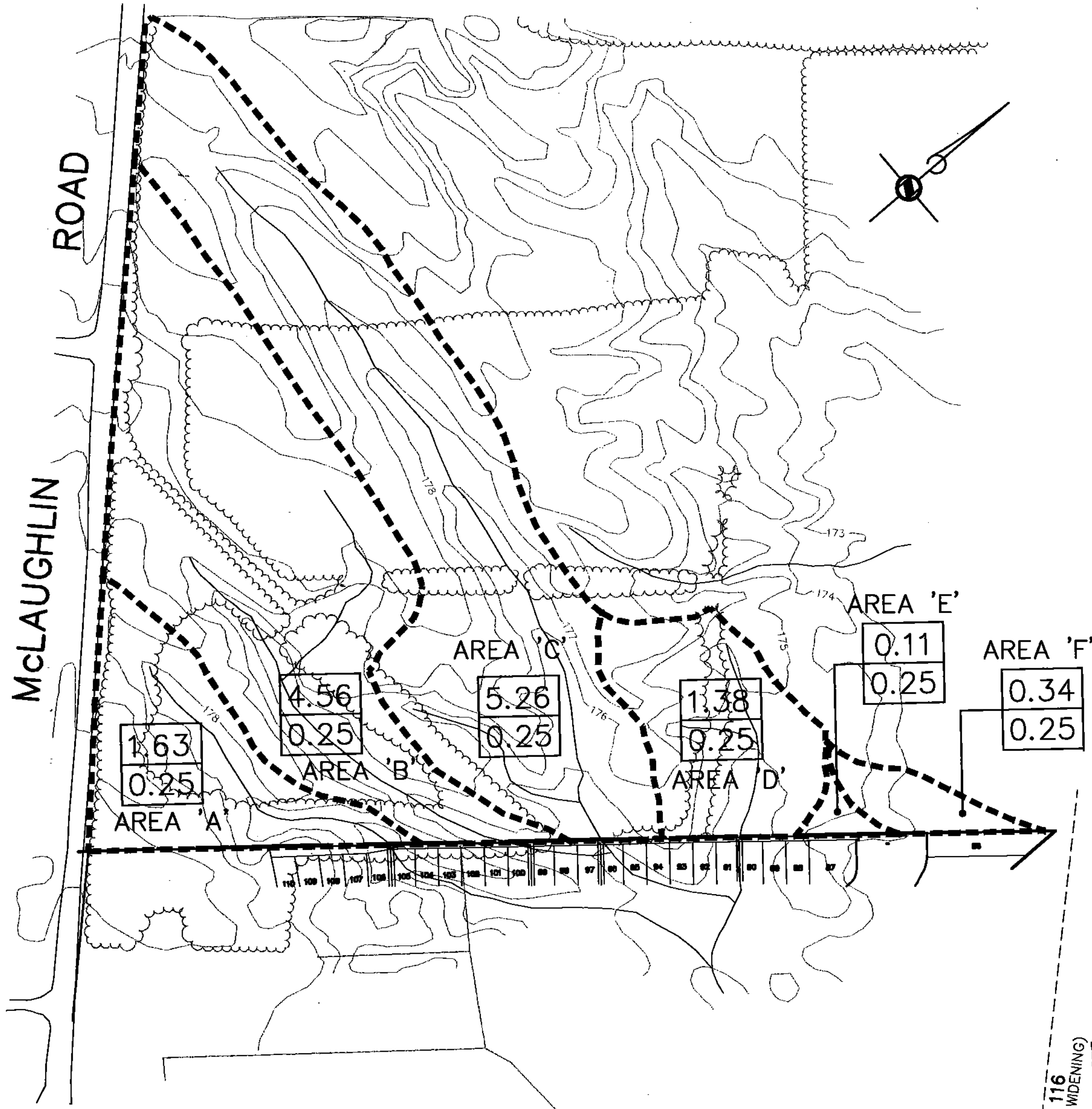
RETURN TO FILE

SUBDIVISION SANDALWOOD 4
CONSULTANT R.E. WINTER & ASSOCIATES LTD.
MAJOR DRAINAGE AREA Z-37

12 31 CIP9037
CITY OF MISSISSAUGA
STORM DRAINAGE DESIGN CHART
FOR CIRCULAR DRAINS FLOWING FULL

SHEET No. 1 OF 8 DATE 86-07
PROJECT No. 7613×21
DESIGNED BY CFC

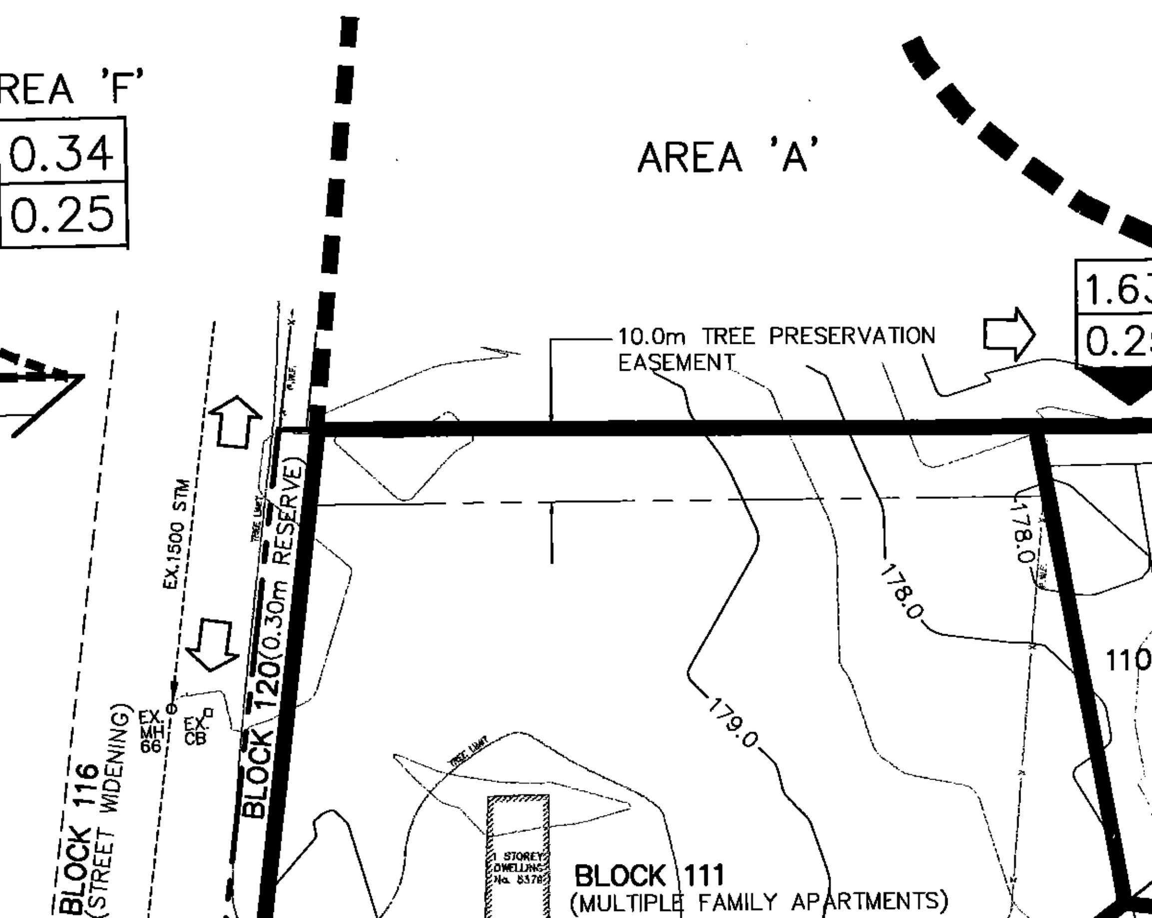
LOCATION OF SECTION	FROM UPSTREAM	TO DOWNSTREAM	ADJACENT CONTRIBUTARY AREA	RUNOFF COEFFICIENT		ACCUMULATIVE AREA DRAINED BY SECTION	ACCUMULATIVE AREA TIMES RUNOFF COEFFICIENT FOR SECTION	FLOW TIME TO SECTION (FROM EXTREME UPSTREAM INLET)	INITIAL TIME OF CONCENTRATION AT EXTREME UPSTREAM INLET	TIME OF CONCENTRATION AT UPSTEAM END OF SECTION	INTENSITY OF RAINFALL	QUANTITY OF FLOW TO BE ACCOMMODATED IN SECTION	TYPE OF PIPE	MANNINGS ROUGHNESS COEFFICIENT	SLOPE	DIAMETER	LENGTH OF SECTION	VELOCITY OF FLOW WITH PIPE FLOWING FULL	CAPACITY OF PIPE FLOWING FULL	PIPE INVERT AT UPSTREAM M.H.	PIPE INVERT AT DOWNSTREAM M.H.	TIME OF FLOW IN SECTION
	MH#	MH#	A_A	C_A	$A_A \times C_A$	$A = \Sigma A_A$	$A \times C = \Sigma A_A \times C_A$	t_{c_f}	t_{c_i}	$t_c = t_{c_f} + t_{c_i}$	I	$Q = \frac{IAC}{360}$		n	S	D	L	V	Q			$t = \frac{L}{V \times 60}$
			(ha)			(ha)		(min)	(min)	min	mm/hr	m^3/SEC		0.013	%	mm	m	m/SEC	m^3/SEC	m	m	min
McLAUGHLIN RD	EXTERNAL	1	59.4	0.45	26.73																	
	R.O.W.	1	0.95	0.75	0.713			15.0	(1)	23.7	75											
BRISTOL ROAD W		TEMP CB	2.6	0.45	1.170				(2)	16.8	92	0.299			1.0	525	23.0	2.01	0.449			
	1	2	0.35 1.08	0.60 0.60	0.210 1.680	65.36	31.091			23.7	75	6.477			0.52	1650	119.5	3.11	6.857	169.921	169.300	0.6
	EXTERNAL		0.98	0.60	0.588																	
	2	3	1.6	0.45	0.720				(3)	16.2	94	0.188				450						
			0.47	0.60	0.282	67.43	32.093			24.3	73	6.508			0.52	1650	120.0	3.11	6.857	169.300	16[illegible].676	0.6
			0.83	0.40	0.332																	
	3	4	0.25	0.45	0.113	68.51	32.538			24.9 (25.6)	72	6.508			0.52	1650	130.0	3.11	6.857	168.676	168.000	0.7
	PLUG	4	25.0	0.45	11.250				(4)	25.0	72	2.25			0.50	1200	14.5	2.460	2.876		168.394	
	4	5	1.67	0.40	0.668	95.18	44.456			25.6	70	8.644			0.40	1950	161.0	3.046	9.390	167.644	167.000	0.9
	5	6	1.74	0.40	0.696	96.92	45.152			26.5	69	8.654			0.40	1950	161.5	3.046	9.390	167.000	166.354	0.9
	6	7	2.10	0.40	0.648	99.02	45.800			27.4	67	8.524			0.40	1950	156.0	3.046	9.390	166.354	165.730	0.9
	7	OUTLET	—			99.02	45.800			28.3 (28.7)	66	8.397			0.40	1950	70.0	3.046	9.390	165.620	165.340	0.4

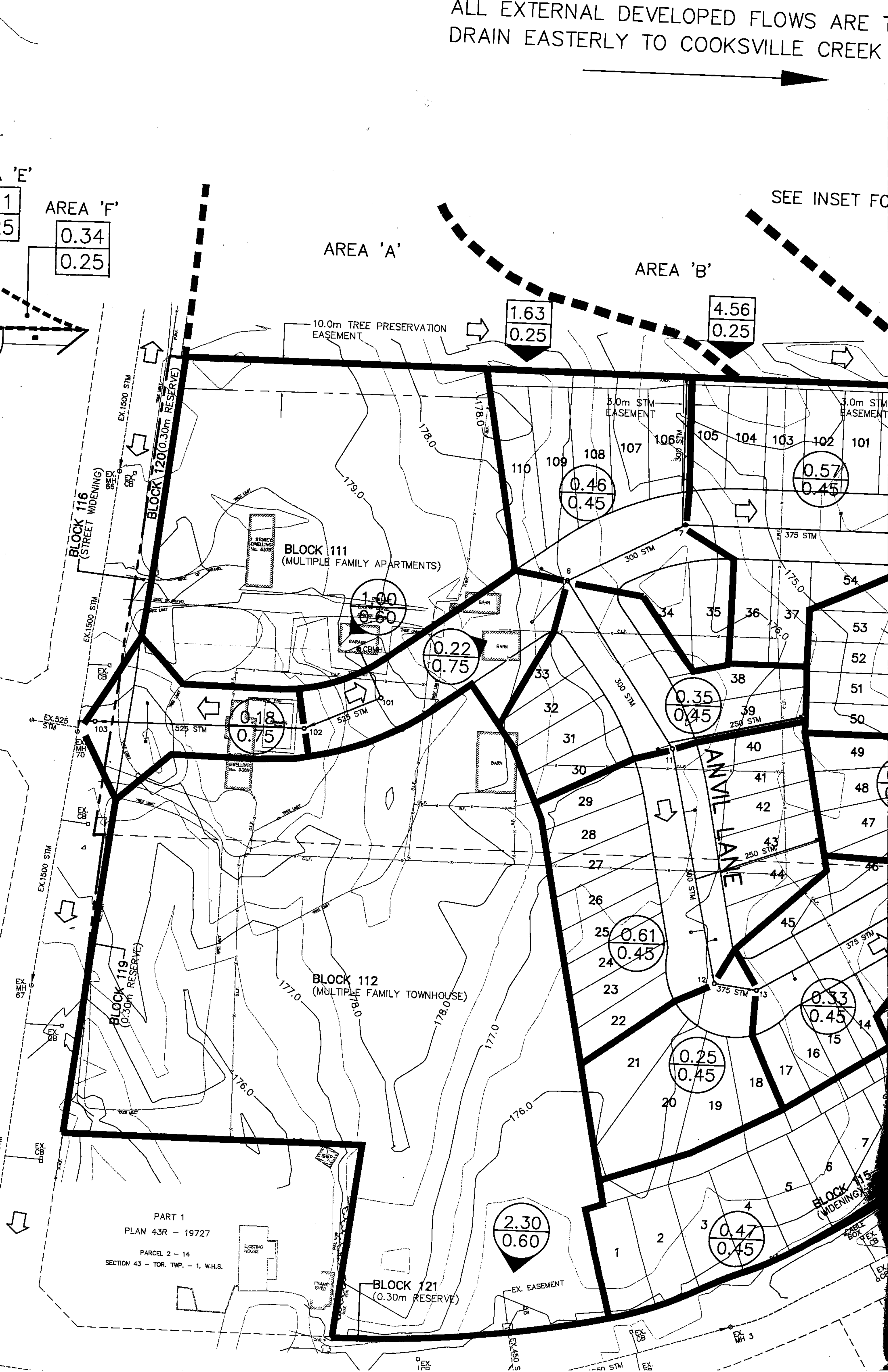


EXTERNAL STORM DESIGN AREAS

1:2500

ALL EXTER
DRAIN EAS





ALL EXTERNAL DEVELOPED FLOWS ARE
DRAIN EASTERLY TO COOKSVILLE CREEK
SEE INSET FO
AREA 'A'
AREA 'B'
AREA 'F'
0.34
0.25
1.63
0.25
4.56
0.25
10.0m TREE PRESERVATION EASEMENT
3.0m STM EASEMENT
BLOCK 111
(MULTIPLE FAMILY APARTMENTS)
BLOCK 112
(MULTIPLE FAMILY TOWNHOUSE)
BLOCK 116
(STREET WIDENING)
BLOCK 120(0.30m RESERVE)
BLOCK 119
(0.30m RESERVE)
BLOCK 121
(0.30m RESERVE)
BLOCK 115
(WIDENING)
ANVIL LANE
2.30
0.60
EX. EASEMENT
EX.1500 STM
EX.525 STM
525 STM
300 STM
375 STM
250 STM
PART 1
PLAN 43R – 19727
PARCEL 2 – 14
SECTION 43 – TOR. TWP. – 1, W.H.S.