

TECHNICAL MEMORANDUM

DATE December 9, 2021 **Reference No.** GAL-001-19126124-TM

TO James Jorgensen, BSc, CWEM, CENV, MIAM
GM BluePlan Engineering Ltd.

CC Jean-Marc Crew (Golder Associates), Jim Harnum (GM BluePlan)

FROM Matt Bowman, PGeo **EMAIL** mbowman@golder.com
John Piersol, PGeo jpiersol@golder.com

REGIONAL ROAD STORMWATER INFRASTRUCTURE MASTER PLAN – PRELIMINARY INFILTRATION CONSTRAINTS ASSESSMENT, REGION OF PEEL, ONTARIO

Golder Associates Ltd. (Golder), a member of WSP, has prepared this memorandum for GM BluePlan Limited (GMBP) to assist in the preparation of a stormwater infrastructure master plan for the Region of Peel's (the Region) regional road stormwater infrastructure. This memorandum presents the preliminary assessment of potential infiltration constraints to stormwater infrastructure in the Region based on a desktop investigation using publicly available regional mapping data. Key data considered for this assessment included:

- depth to bedrock;
- depth to water table;
- surficial geology; and,
- source protection mapping, including Wellhead Protection Areas (WHPA), Issue Contributing Areas (ICA), Highly Vulnerable Aquifers (HVA) and Floodplains.

This data is presented on the attached Figures 1, 2, and 3. A summary of the data is provided herein.

Infiltration refers to the processes through which surface water enters the subsurface by gravity flow. The rate that water can enter the subsurface depends on several properties including hydraulic conductivity, soil moisture, topography and vegetation. Higher hydraulic conductivities will allow water to flow through the subsurface faster than low hydraulic conductivities and consequently can allow more water to infiltrate within a given timeframe.

Stormwater management criteria developed by the two conservation authorities that manage most of the Region's area (Credit Valley Conservation Authority and Toronto and Region Conservation Authority) note that engineered infiltration features are generally not considered suitable in areas that:

- have high slopes
- have the water table within 1 m of the bottom of the infiltration feature
- have bedrock within 1 m of the bottom of the infiltration feature
- have soils with an infiltration rate of less than 15 mm/hr

- are within floodplains
- are close to points of concern such as landfills or water supply wells
- are in HVA if the infiltrated water is potentially contaminated
- are in the higher risk WHPA unless additional controls are in place

Figures 1A and 1B show the surficial geology across the Region.

- Areas with coarse-grained deposits like sands and gravels would be expected to have relatively higher hydraulic conductivity values and to be more conducive to infiltration. These areas are coloured in oranges and yellows on the figures.
- Areas with fine-grained deposits like silts and clays would be expected to have relatively lower hydraulic conductivity values and to be more restrictive to infiltration. These areas are coloured dark green and light blues on the figures.
- Areas with medium-grained deposits like silts and sands would be expected to have moderate hydraulic conductivity values and to be potentially conducive to infiltration. These areas are coloured light green on the figures.
- The remaining areas are not expected to be conducive to infiltration due to shallow bedrock depths and water saturated soils.

Figures 2A and 2B show the estimated depths to the water table and to the bedrock.

- Areas where the estimated depth to the water table is less than 1 m and/or less than 5 m below ground surface are shown with dark and light blue shading, respectively. These areas may have less capacity for infiltration due to the shallow water table depths, which leave limited thicknesses of unsaturated soils to accept infiltrated water.
- Areas where the estimated depth to bedrock is less than 5 m below ground surface are shown with yellow hatching. In these areas infiltration may be restricted by the shallow bedrock, which typically has less water storage capacity than soils and across most of the Region (aside from the northwest corner, above the Niagara Escarpment) is comprised of low hydraulic conductivity shale.

Figures 3A and 3B show a selection of the mapped areas delineated by the drinking water Source Protection Plans across the Region.

- WHPA are shown on the figures in brown to yellow colours. These areas represent the horizontal extents of municipal water well groundwater capture areas based on risk ratings and modelled time of travel for groundwater supplying each well. To protect the groundwater supplies of these wells, certain activities may be restricted or prohibited in the WHPA, including discharge or infiltration of stormwater.
- ICA are shown on the figures with red hatching. These are areas that the Source Protection Plans have identified as vulnerable to certain drinking water threats due to existing issues for water quality occurring in the area. In the Region, the ICAs have identified threats due to nutrients, pathogens and chloride, which are all potentially present in stormwater.

- HVA are shown on the figures with pink hatching. These are areas with aquifers that the Source Protection Plans have identified as vulnerable to groundwater contamination due to their close connection to surface water and infiltration. The vulnerable aquifers are considered closely connected to surface due to either shallow depth and/or highly conductive subsurface materials between the surface and the aquifer.
- Floodplain areas are shown on the figures in blue colour. Floodplain areas are not considered suitable for infiltration due to their limited infiltration capacity, which becomes even more limited during highwater periods when infiltration capacity is most needed.

Source Protection Plans, Municipal Official Plans, provincial conservation plans (e.g., Oak Ridges Moraine Conservation Plan, Niagara Escarpment Plan, Greenbelt Plan) and Conservation Authority guidance contain further rules and guidance on siting stormwater and infiltration features based on risk and specific feature designs.

We trust that this technical memorandum meets your current needs. Please contact the undersigned if you have any further questions.



Matt Bowman, BSc, PGeo
Hydrogeologist

MB/JP/wlw

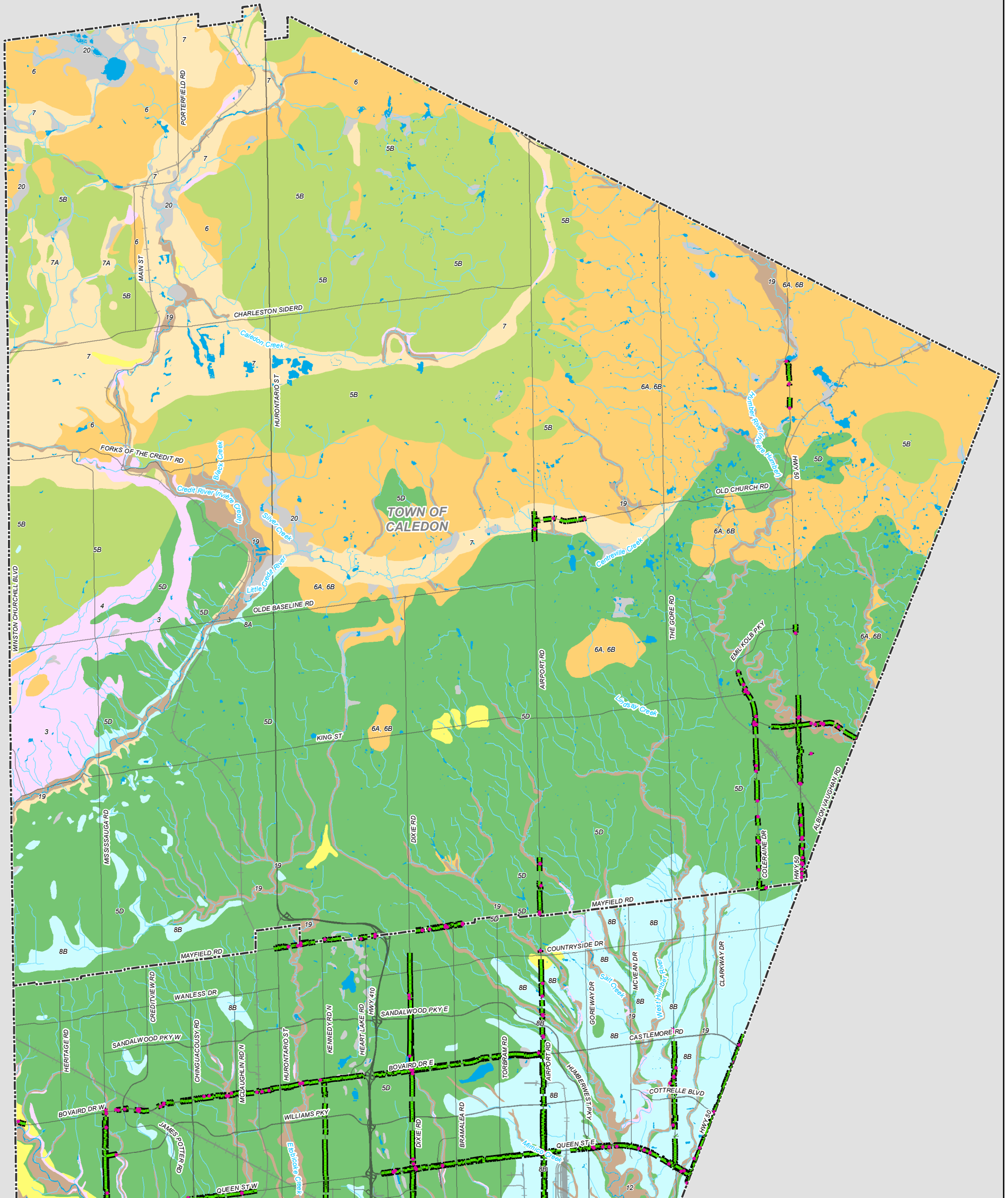
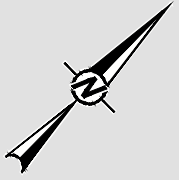


John Piersol, MSc, PGeo
Associate, Senior Hydrogeologist

Attachments: Figures 1A, 1B, 2A, 2B, 3A, 3B

[https://golderassociates.sharepoint.com/sites/111670/project files/6 deliverables/infiltration tm/final/gal-001-19126124-tm-rev0- prelim infiltration constraints 09dec2021.docx](https://golderassociates.sharepoint.com/sites/111670/project%20files/6%20deliverables/infiltration%20tm/final/gal-001-19126124-tm-rev0-prelim%20infiltration%20constraints%2009dec2021.docx)

FIGURES



- LEGEND**
- Highway
 - Main Road
 - +— Railway Track
 - Watercourse
 - Waterbody
 - - - City / Town Boundary
 - Stormwater Infrastructure**
 - Storm Outflow
 - ▲ Storm Pumping Station
 - Storm Mains / Inlet Leads
 - Surficial Geology**
 - 3: Paleozoic bedrock
 - 4: Paleozoic bedrock-drift complex
 - 5b: Stone-poor, carbonate-derived silty to sandy till
 - 5d: Glaciolacustrine-derived silty to clayey till
 - 6: Ice-contact stratified deposits
 - 7: Glaciofluvial deposits
 - 7a: Sandy deposits
 - 7b: Gravelly deposits
 - 8a: Massive-well laminated
 - 8b: Interbedded flow till, rainout deposits and silt and clay
 - 9a: Deltaic deposits
 - 9b: Littoral-foreshore deposits
 - 9c: Foreshore-basinal deposits
 - 12: Older alluvial deposits
 - 19: Modern alluvial deposits
 - 20: Organic deposits

REFERENCE(S)

1. BASE DATA - MNRF LIO, 2019.
2. STORM WATER INFRASTRUCTURE PROVIDED BY GM BLUE PLAN AND REGION OF PEEL, MAY 2020
3. SURFICIAL GEOLOGY - MINISTRY OF NORTHERN DEVELOPMENT AND MINES, 1:250 000. SCALE SURFICIAL GEOLOGY OF ONTARIO; ONTARIO GEOLOGICAL SURVEY
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
GM BLUEPLAN ENGINEERING LIMITED

PROJECT
PEEL REGION STORMWATER INFRASTRUCTURE

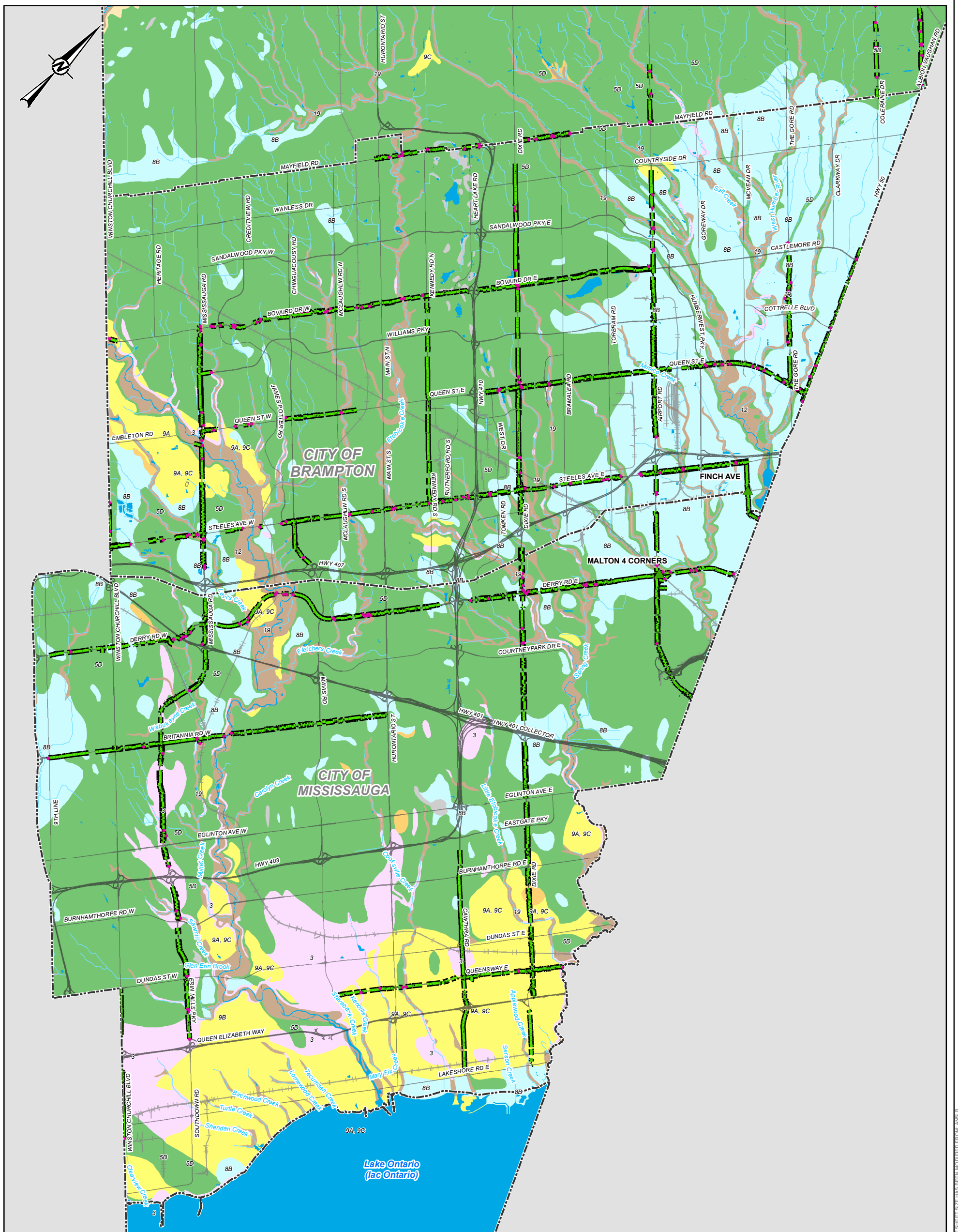
TITLE
SURFICIAL GEOLOGY

CONSULTANT	DATE	REVISION
GOLDER MEMBER OF WSP	YYYY-MM-DD	2021-12-07
	DESIGNED	PR
	PREPARED	PR
	REVIEWED	MB
	APPROVED	JC



PROJECT NO. 19126124 CONTROL 0001 REV. 0 FIGURE 1A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A4 (ANSI B)



LEGEND

— Highway	4: Paleozoic bedrock-drift complex	8b: Interbedded flow till, rainout deposits and silt and clay
— Main Road	5b: Stone-poor, carbonate-derived silty to sandy till	9: Coarse-textured glaciolacustrine deposits
— Railway Track	5d: Glaciolacustrine-derived silty to clayey till	9a: Deltaic deposits
— Watercourse	6: Ice-contact stratified deposits	9b: Littoral-foreshore deposits
Waterbody	7: Glaciofluvial deposits	9c: Foreshore-basinal deposits
City / Town Boundary	7b: Gravelly deposits	12: Older alluvial deposits
Stormwater Infrastructure	8a: Massive-well laminated	19: Modern alluvial deposits
• Storm Outflow		20: Organic deposits
▲ Storm Pumping Station		
— Storm Mains / Inlet Leads		
Surficial Geology		
3: Paleozoic bedrock		

REFERENCE(S)

1. BASE DATA - MNRF LIO, 2019.
2. STORM WATER INFRASTRUCTURE PROVIDED BY GM BLUE PLAN AND REGION OF PEEL, MAY 2020
3. SURFICIAL GEOLOGY - MINISTRY OF NORTHERN DEVELOPMENT AND MINES, 1:250 000. SCALE SURFICIAL GEOLOGY OF ONTARIO; ONTARIO GEOLOGICAL SURVEY
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CLIENT
GM BLUEPLAN ENGINEERING LIMITED

PROJECT
PEEL REGION STORMWATER INFRASTRUCTURE

TITLE
SURFICIAL GEOLOGY

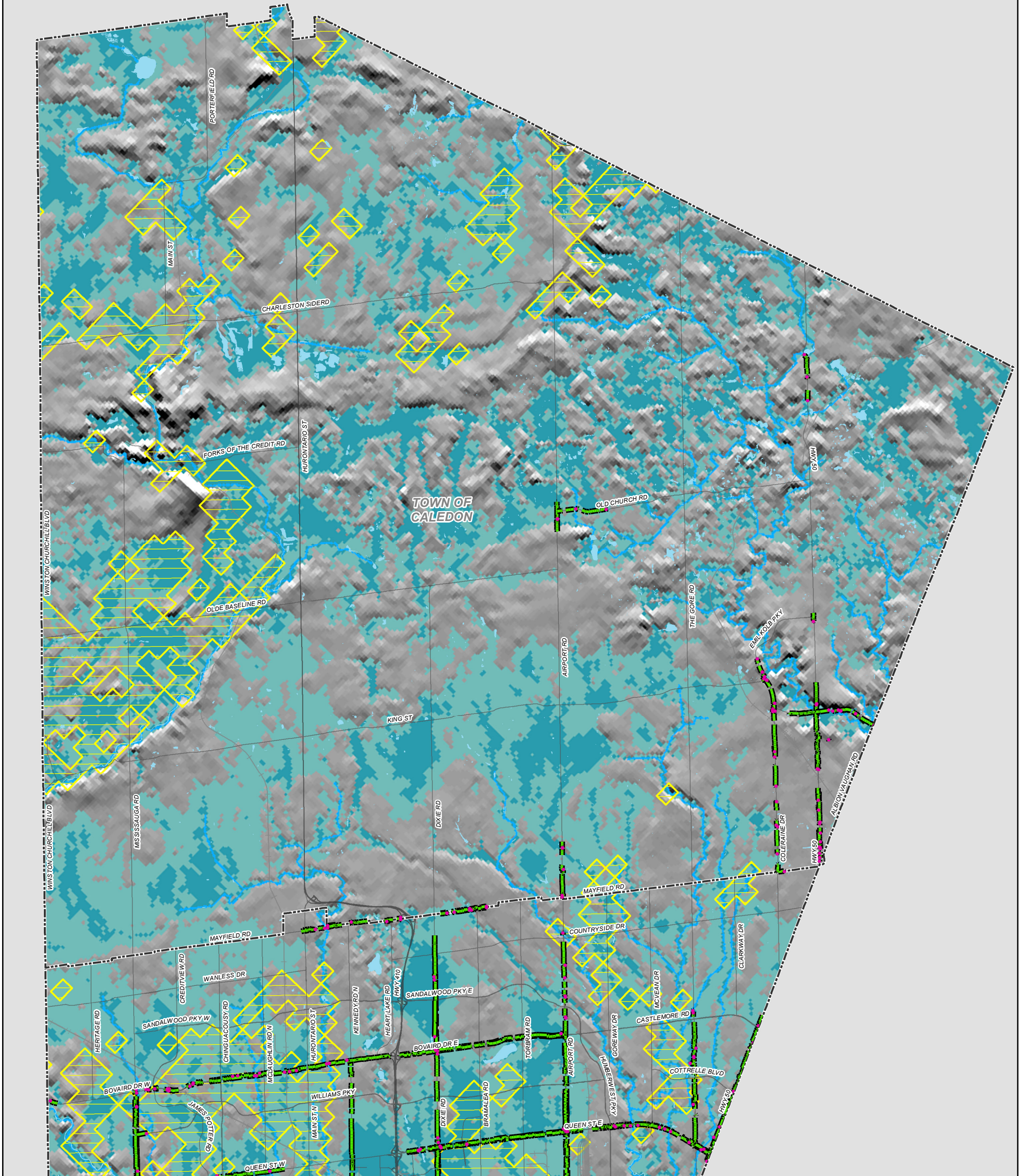
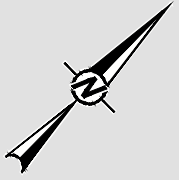
CONSULTANT	YYYY-MM-DD	2021-12-07
	DESIGNED	PR
	PREPARED	PR
	REVIEWED	MB
	APPROVED	JC



PROJECT NO.	CONTROL	REV.	FIGURE
19126124	0001	0	1B

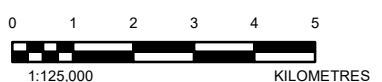


IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A4 (210x297mm)



- LEGEND**
- Highway
 - Main Road
 - Railway Track
 - City / Town Boundary
 - Depth to Bedrock < 5 m
- Stormwater Infrastructure**
- Storm Outflow
 - ▲ Storm Pumping Station
 - Storm Mains / Inlet Leads

- ORMGP Water Table**
- Water Bodies
 - Streams - 100m - Strahler gt3
 - Depth Water Table <1m
 - Depth Water Table <5m



- REFERENCE(S)**
1. BASE DATA - MNRF LIO, 2019.
 2. STORM WATER INFRASTRUCTURE PROVIDED BY GM BLUE PLAN AND REGION OF PEEL, MAY 2020
 3. © OAK RIDGES MORAINÉ GROUNDWATER PROGRAM, MAP OBTAINED JUNE, 2020
 4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
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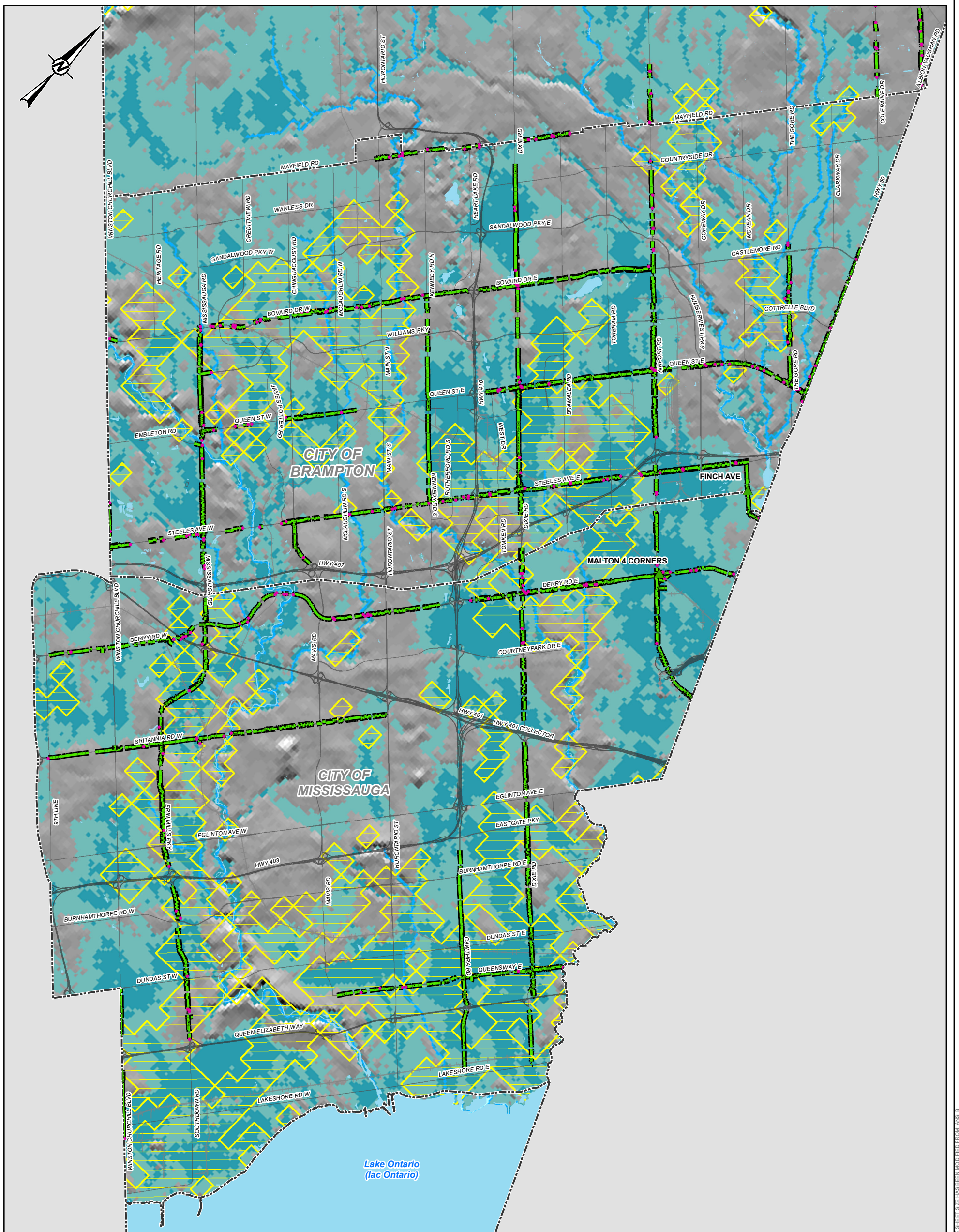
PROJECT
PEEL REGION STORMWATER INFRASTRUCTURE

TITLE
AREAS WITH SHALLOW WATER TABLE OR SHALLOW BEDROCK

CONSULTANT	DATE	REVISION
 GOLDER MEMBER OF WSP	YYYY-MM-DD	2021-12-07
	DESIGNED	PR
	PREPARED	PR
	REVIEWED	MB
	APPROVED	JC

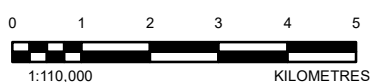
PROJECT NO.	CONTROL	REV.	FIGURE
19126124	0001	0	2A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A4 (ANSI B)



- LEGEND**
- Highway
 - Main Road
 - Railway Track
 - City / Town Boundary
 - ▨ Depth to Bedrock < 5 m
- Stormwater Infrastructure**
- Storm Outflow
 - ▲ Storm Pumping Station
 - Storm Mains / Inlet Leads

- ORMGP Water Table**
- Water Bodies
 - Streams - 100m - Strahler gt3
 - Depth Water Table <1m
 - Depth Water Table <5m



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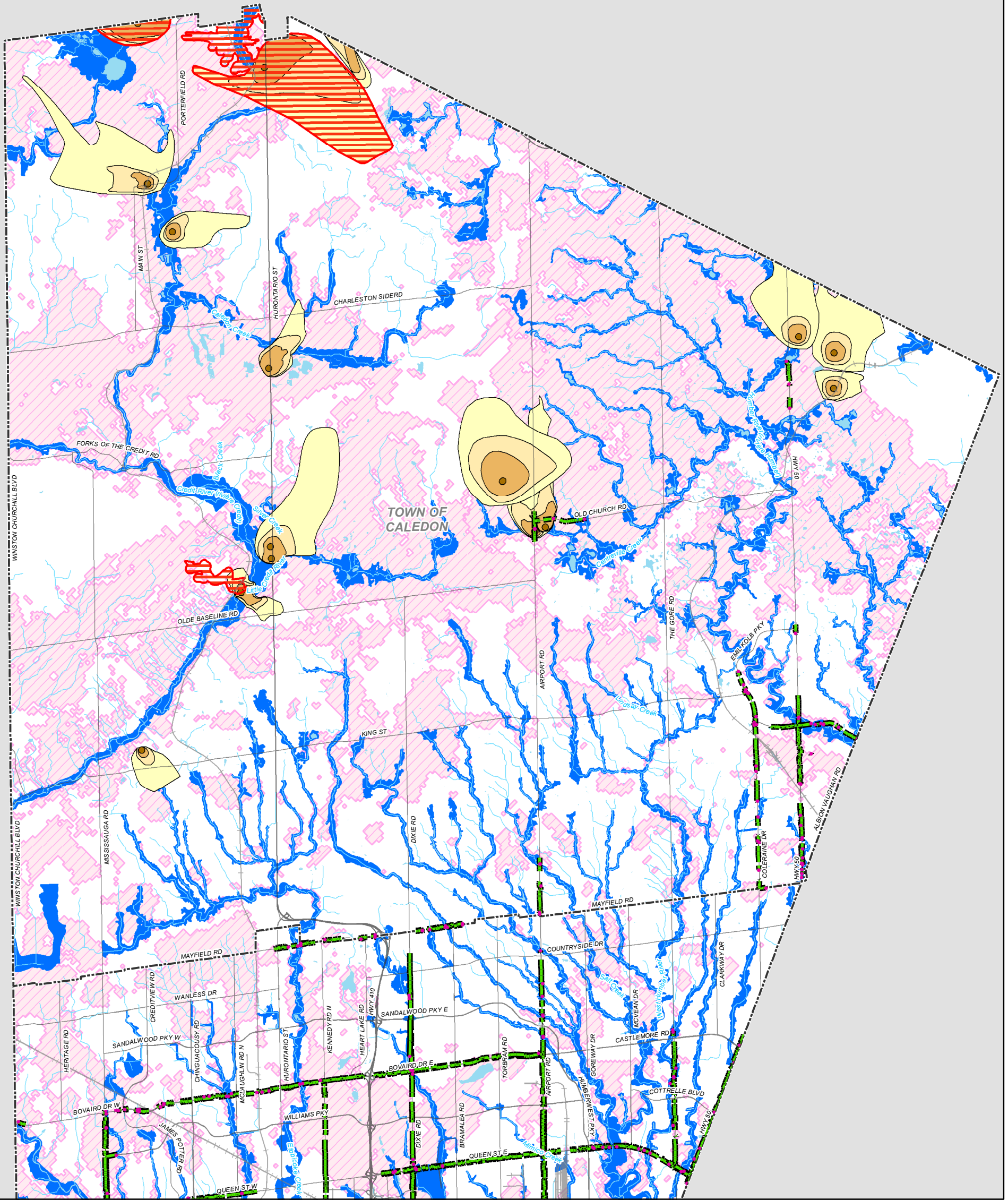
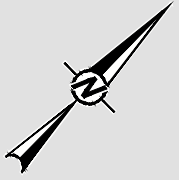
PROJECT
PEEL REGION STORMWATER INFRASTRUCTURE

TITLE
AREAS WITH SHALLOW WATER TABLE OR SHALLOW BEDROCK

CONSULTANT	DATE	REVISION
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	DESIGNED	PR
	PREPARED	PR
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PROJECT NO. 19126124 CONTROL 0001 REV. 0 FIGURE 2B

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A4 (ANSI B)



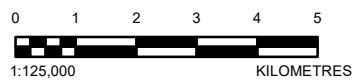
- LEGEND**
- Highway
 - Main Road
 - Railway Track
 - Watercourse
 - Waterbody
 - City / Town Boundary
 - Flood Line Area
 - ▨ Issue Contributing Area
 - ▨ Highly Vulnerable Aquifer

Wellhead Protection Area (WHPA)

- WHPA-A
- WHPA-B
- WHPA-C
- WHPA-D

Stormwater Infrastructure

- Storm Outflow
- ▲ Storm Pumping Station
- Storm Mains / Inlet Leads



- REFERENCE(S)**
1. BASE DATA - MNR F LIO, 2019.
 2. STORM WATER INFRASTRUCTURE PROVIDED BY GM BLUE PLAN AND REGION OF PEEL, MAY 2020
 3. SOURCE WATER PROTECTION DATA PROVIDED BY GM BLUE PLAN AND REGION OF PEEL, JULY 2020
 4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

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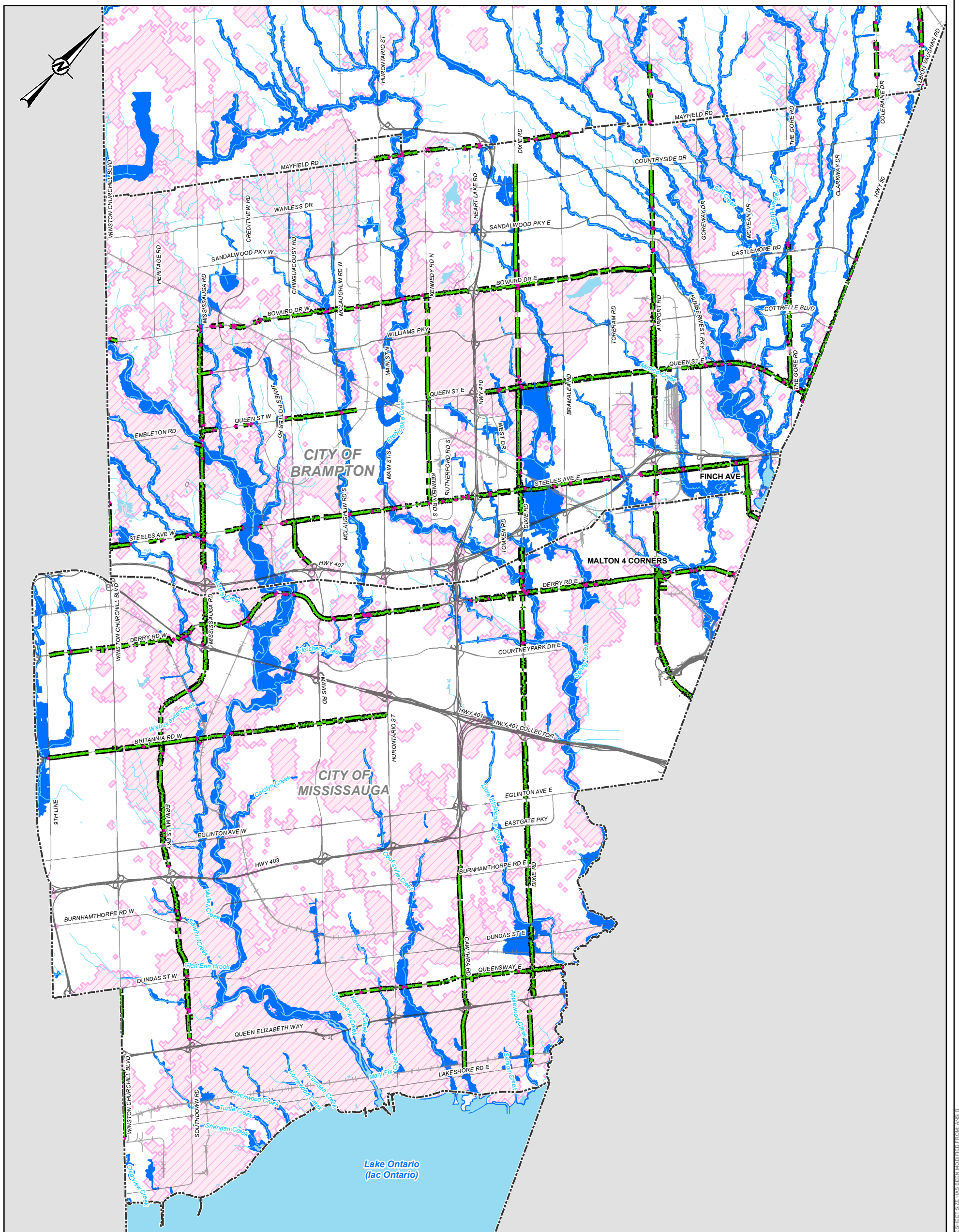
PROJECT
PEEL REGION STORMWATER INFRASTRUCTURE

TITLE
SOURCE PROTECTION AREAS

CONSULTANT	YYYY-MM-DD	2021-12-07
	DESIGNED	PR
	PREPARED	PR
	REVIEWED	MB
	APPROVED	JC



PROJECT NO. 19126124 CONTROL 0001 REV. 0 FIGURE 3A



- LEGEND**
- Highway
 - Main Road
 - Railway Track
 - Watercourse
 - Waterbody
 - City / Town Boundary
 - Flood Line Area
 - Issue Contributing Area
 - Highly Vulnerable Aquifer

- Wellhead Protection Area (WHPA)**
- WHPA-A
 - WHPA-B
 - WHPA-C
 - WHPA-D
- Stormwater Infrastructure**
- Storm Outflow
 - ▲ Storm Pumping Station
 - Storm Mains / Inlet Leads



REFERENCE(S)

1. BASE DATA - MNR F LIO, 2019.
2. STORM WATER INFRASTRUCTURE PROVIDED BY GM BLUE PLAN AND REGION OF PEEL, MAY 2020
3. SOURCE WATER PROTECTION DATA PROVIDED BY GM BLUE PLAN AND REGION OF PEEL, JULY 2020
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

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GM BLUEPLAN ENGINEERING LIMITED

PROJECT
PEEL REGION STORMWATER INFRASTRUCTURE

TITLE
SOURCE PROTECTION AREAS

CONSULTANT	YYYY-MM-DD	2021-12-07
	DESIGNED	PR
	PREPARED	PR
	REVIEWED	MB
	APPROVED	JC



PROJECT NO. 19126124 CONTROL 0001 REV. 0 FIGURE 3B

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3S18