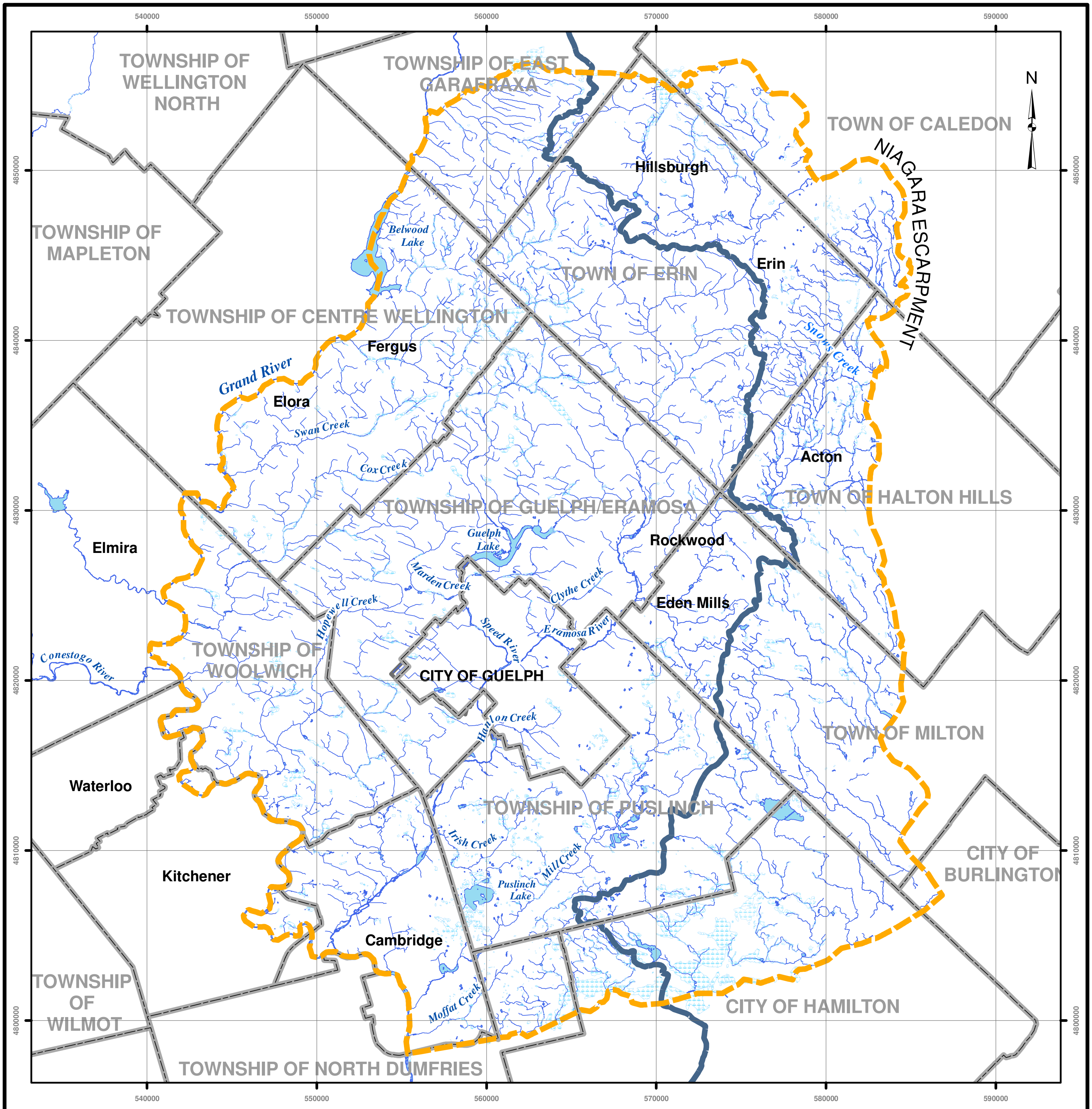

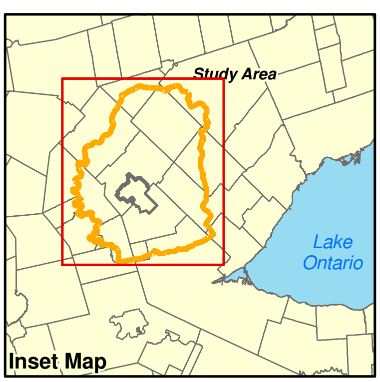

LEGEND

- Rivers / Streams
- Wetland Area, Permanent
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary
- LTier_Municipality

Scale 1:310,000

0 2.5 5 10 15 20

Kilometres

REFERENCES:
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Map Version: 2; Map Date: 4-May-2010; Created By: CC

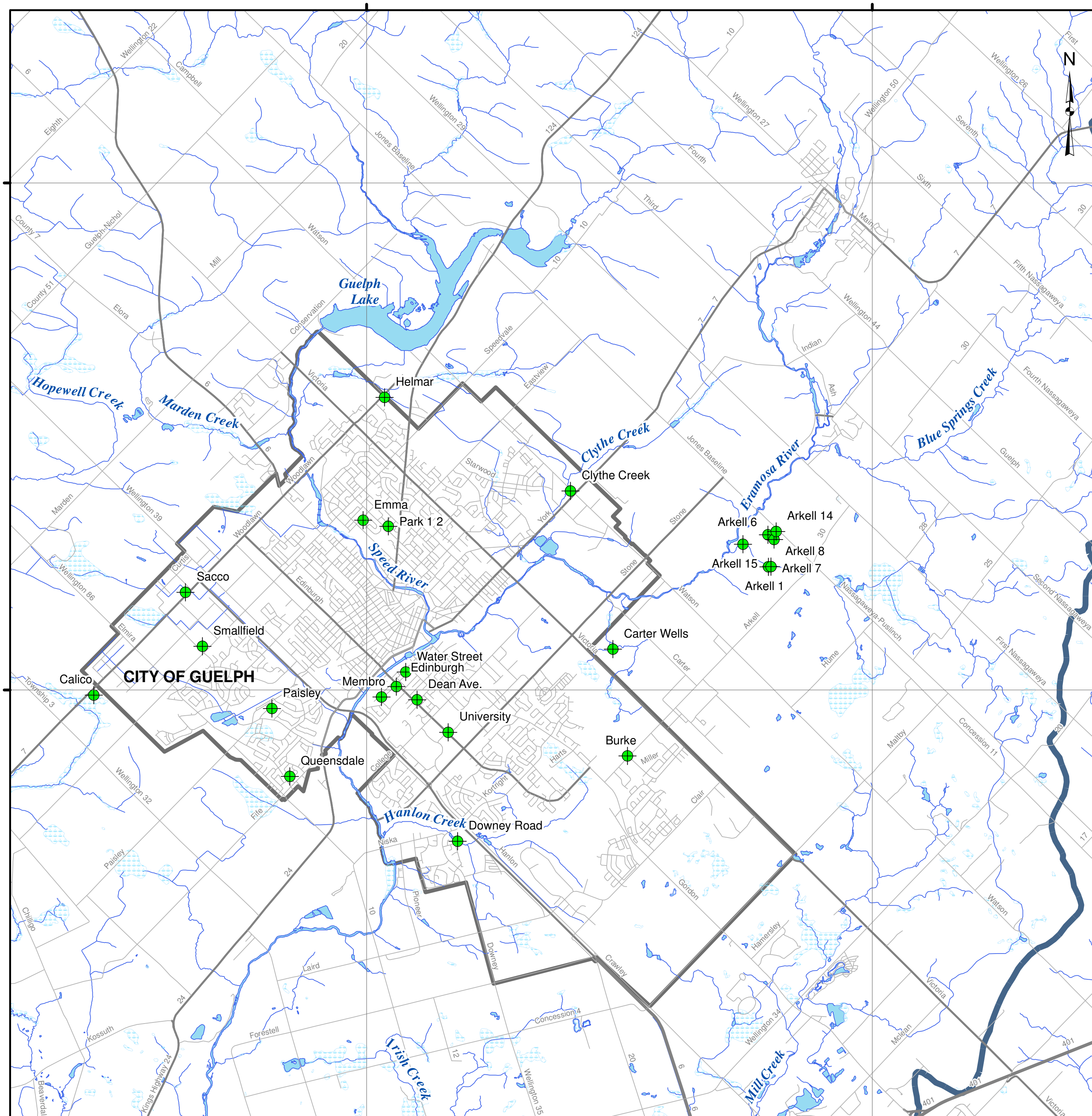
Tier Three Local Area Risk Assessment

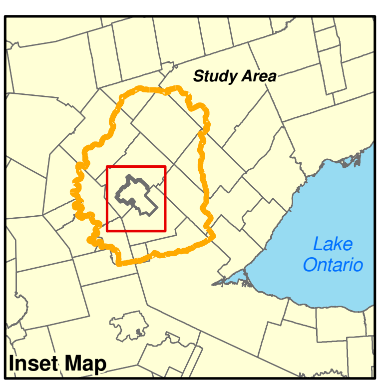
City of Guelph
Making a Difference

Produced by Aquaresource Inc. and Golder Associates Ltd.

Figure 1-1

Study Area





LEGEND
- Guelph Water Supply Wells
- Roads (collector)
- Major Roads / Highways
- Rivers / Streams
- Wetland Area, Permanent
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Scale 1:110,000

0 2.5 5

Kilometres

REFERENCES:
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Tier Three Local Area Risk Assessment

City of Guelph
Making a Difference

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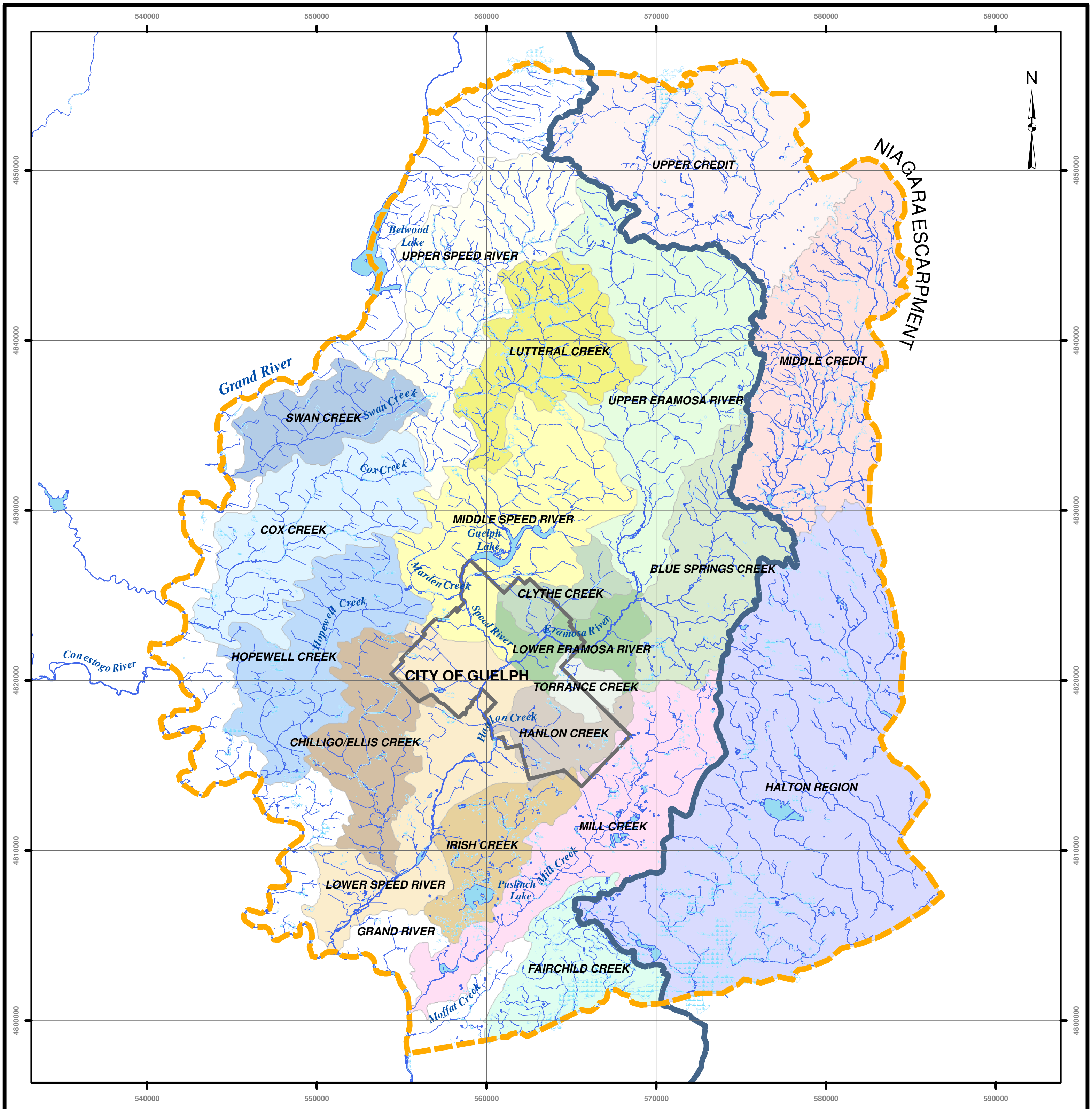
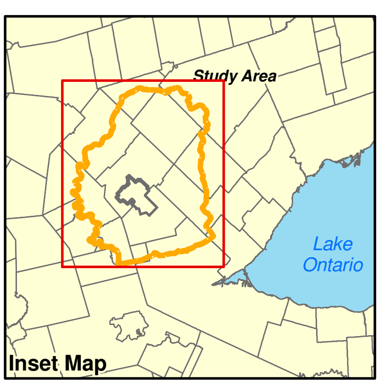
Figure 1-2

City of Guelph
Water Supply Wells





LEGEND

- Rivers / Streams
- Wetland Area, Permanent
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Scale 1:310,000

0 2.5 5 10 15 20

Kilometres

REFERENCES:

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Tier Three Local Area Risk Assessment

City of Guelph — Making a Difference

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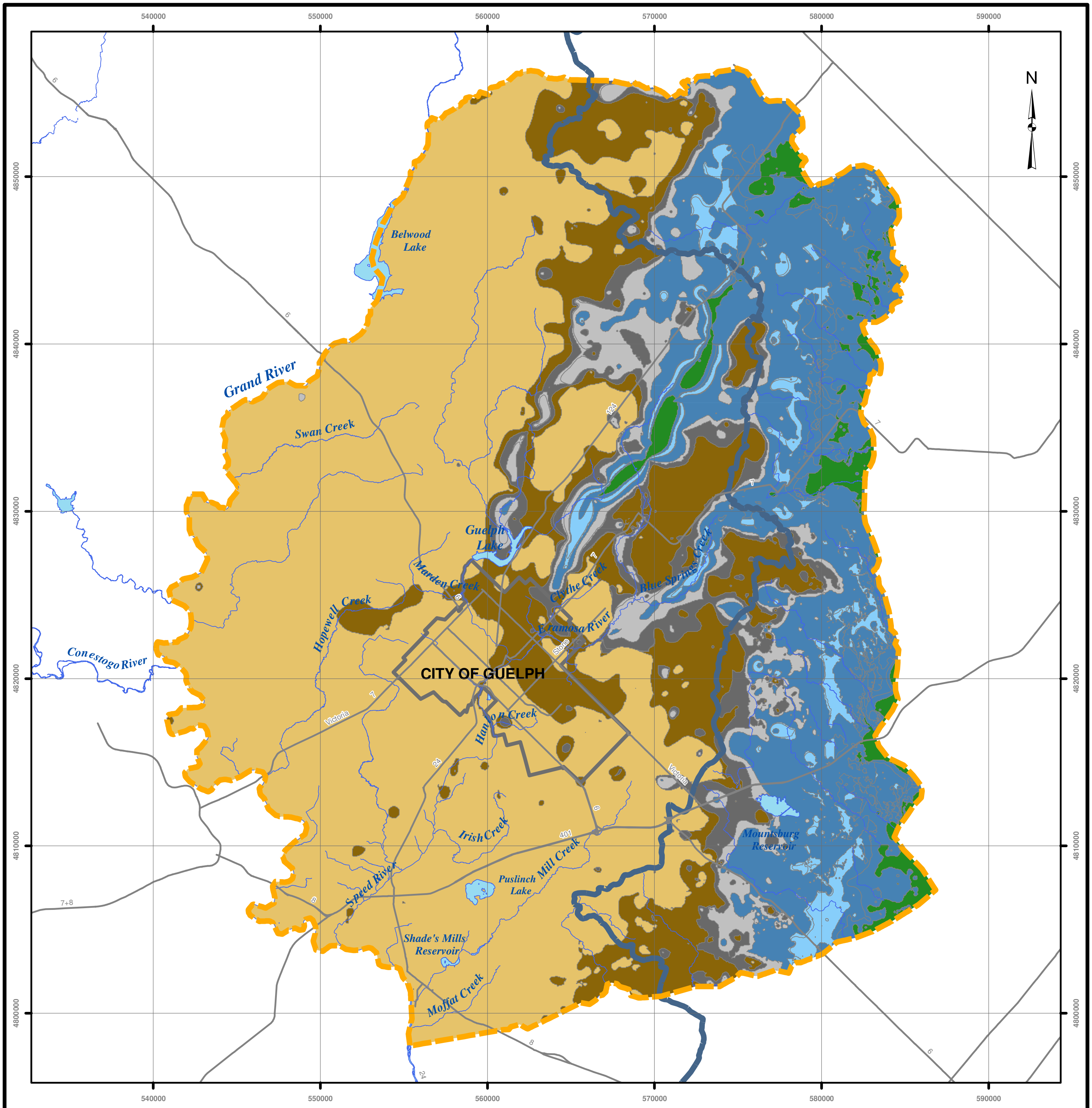
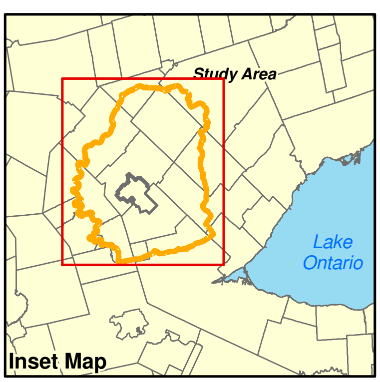
Figure 2-1

Surface Water Hydrology





LEGEND

- Major Roads / Highways
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Bedrock Geology

- Guelph Fm
- Eramosa Fm - Reformatory Quarry
- Eramosa Fm - Vinemount
- Goat Island Fm
- Gasport Fm (Upper Unit)
- Gasport Fm (Middle Unit)
- Gasport Fm (Lower Unit)
- Cabot Head Fm

Scale 1:315,000

0 2.5 5 10 15 20

Kilometres

REFERENCES:

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Map Version: 2; Map Date: 4-May-2010; Created By: CC

Tier Three Local Area Risk Assessment

Guelph

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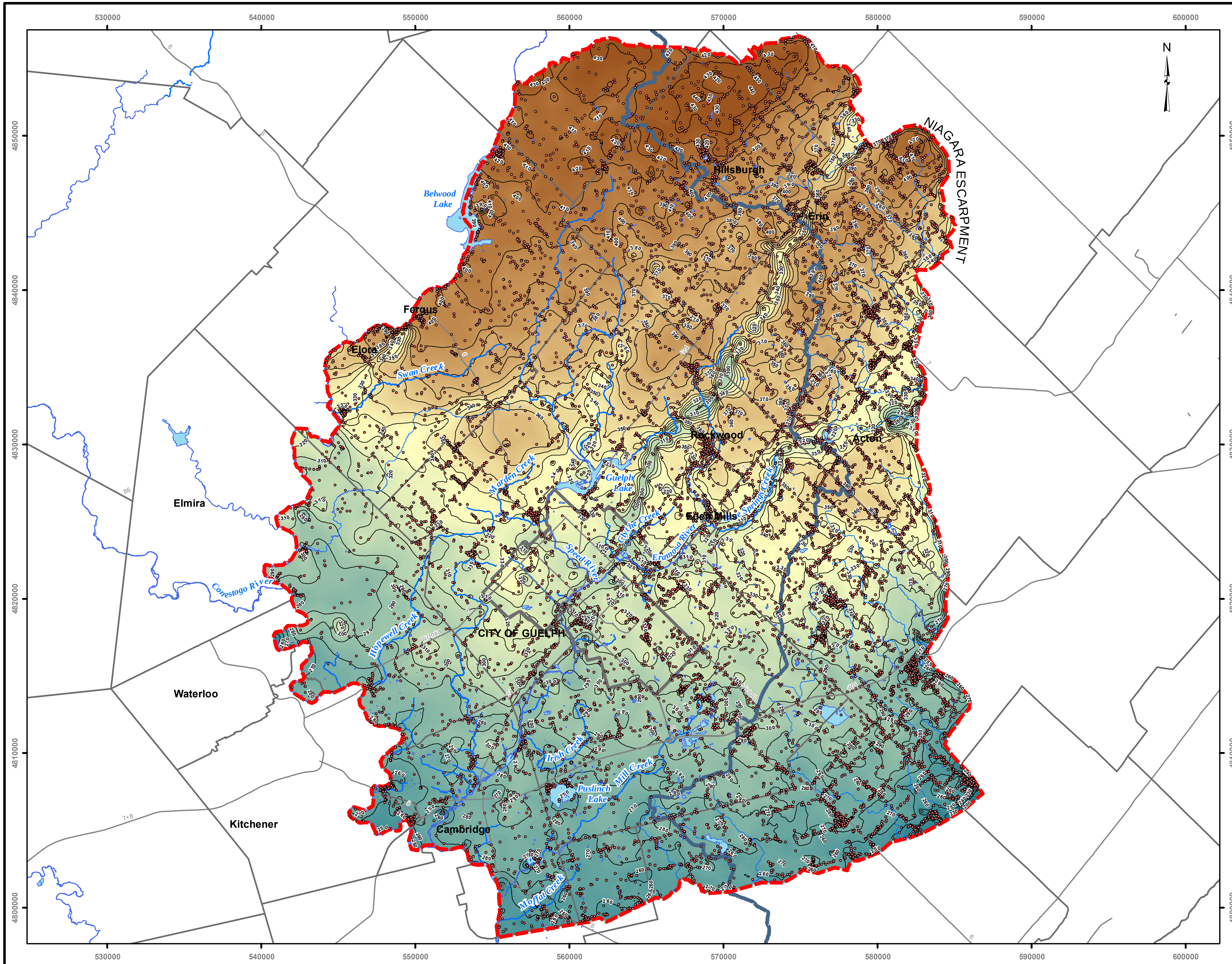
Figure 2-2

Bedrock Geology



Tier Three Local Area Risk Assessment

City of Guelph
Making a Difference

LEGEND

- Data Point
- Major Roads / Highways
- Bedrock Surface Contour (masl)
- Rivers / Streams
- Open Water
- Guelph Tier III Model Boundary
- GRCA Watershed Boundary
- City of Guelph Boundary
- Municipal Boundaries

Elevation (masl)

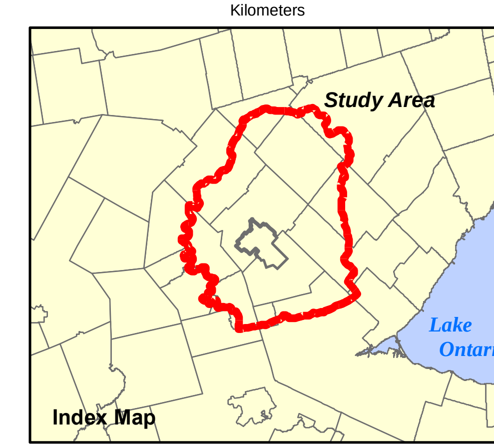
High : 450

Low : 195

Scale 1:240,000

2.5 0 2.5 5

Kilometers



REFERENCES:
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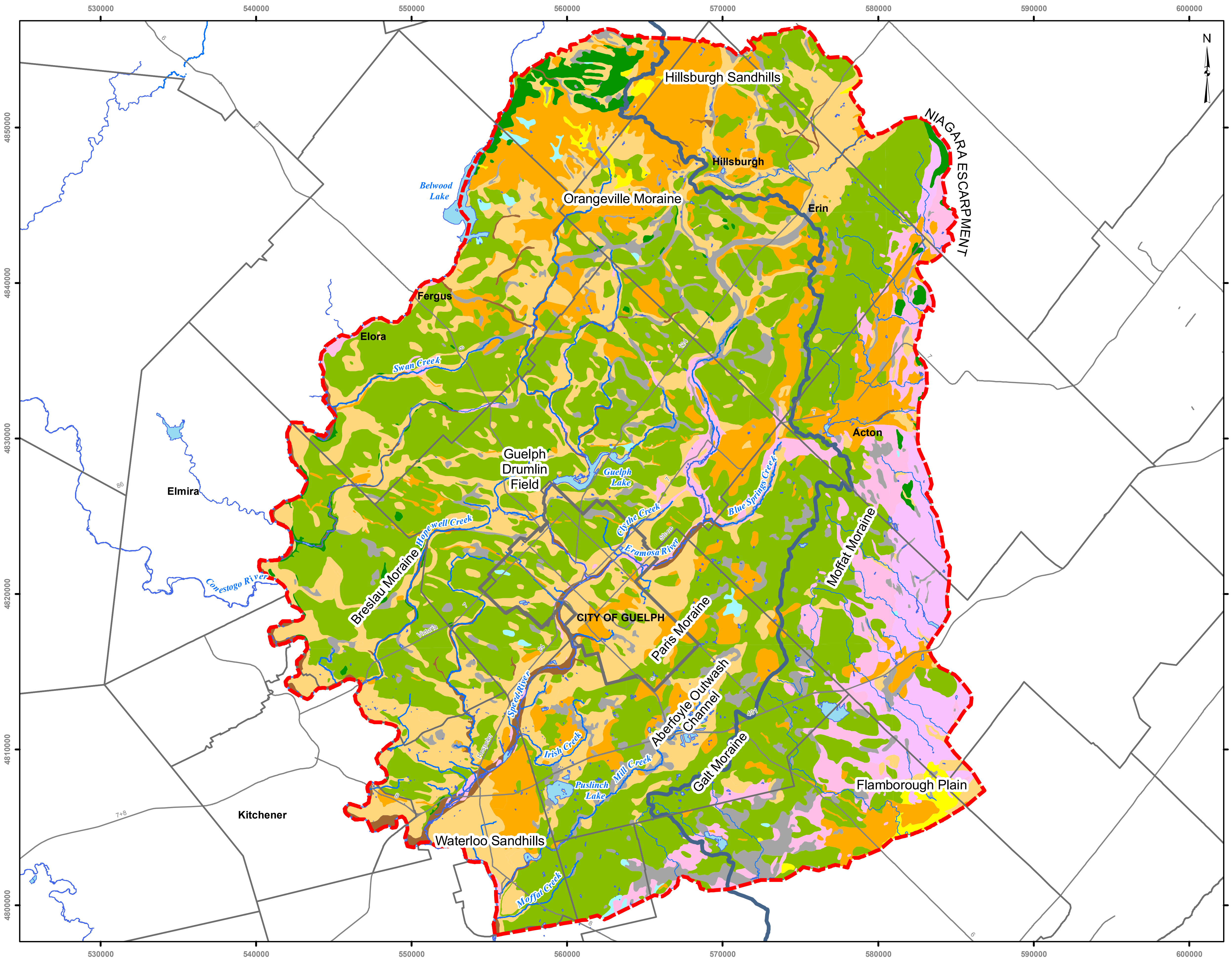
FIGURE: 2-3 *DRAFT*

BEDROCK SURFACE



Tier Three Local Area Risk Assessment

Guelph
Making a Difference

LEGEND

- Major Roads / Highways
- Rivers / Streams
- Open Water
- Guelph Tier 3 Model Boundary
- GRCA Watershed Boundary
- City of Guelph Boundary
- Municipal Boundaries

Surficial Geology

- 3: Paleozoic bedrock
- 4: Paleozoic bedrock-drift complex
- 4a: Mainly till veneer
- 5a: Shield-derived silty to sandy till
- 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
- 8: Fine-textured glaciolacustrine deposits
- 8a: Massive-well laminated
- 8b: Interbedded flow till, rainout deposits and silt and clay
- 9: Coarse-textured glaciolacustrine deposits
- 9c: Foreshore-basinal deposits
- 19: Modern alluvial deposits
- 20: Organic deposits

Scale 1:240,000
2.5 0 2.5 5
Kilometers

REFERENCES:
Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008
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Map Version: 1; Map Date: 15-Mar-10; Created By: CC/KD

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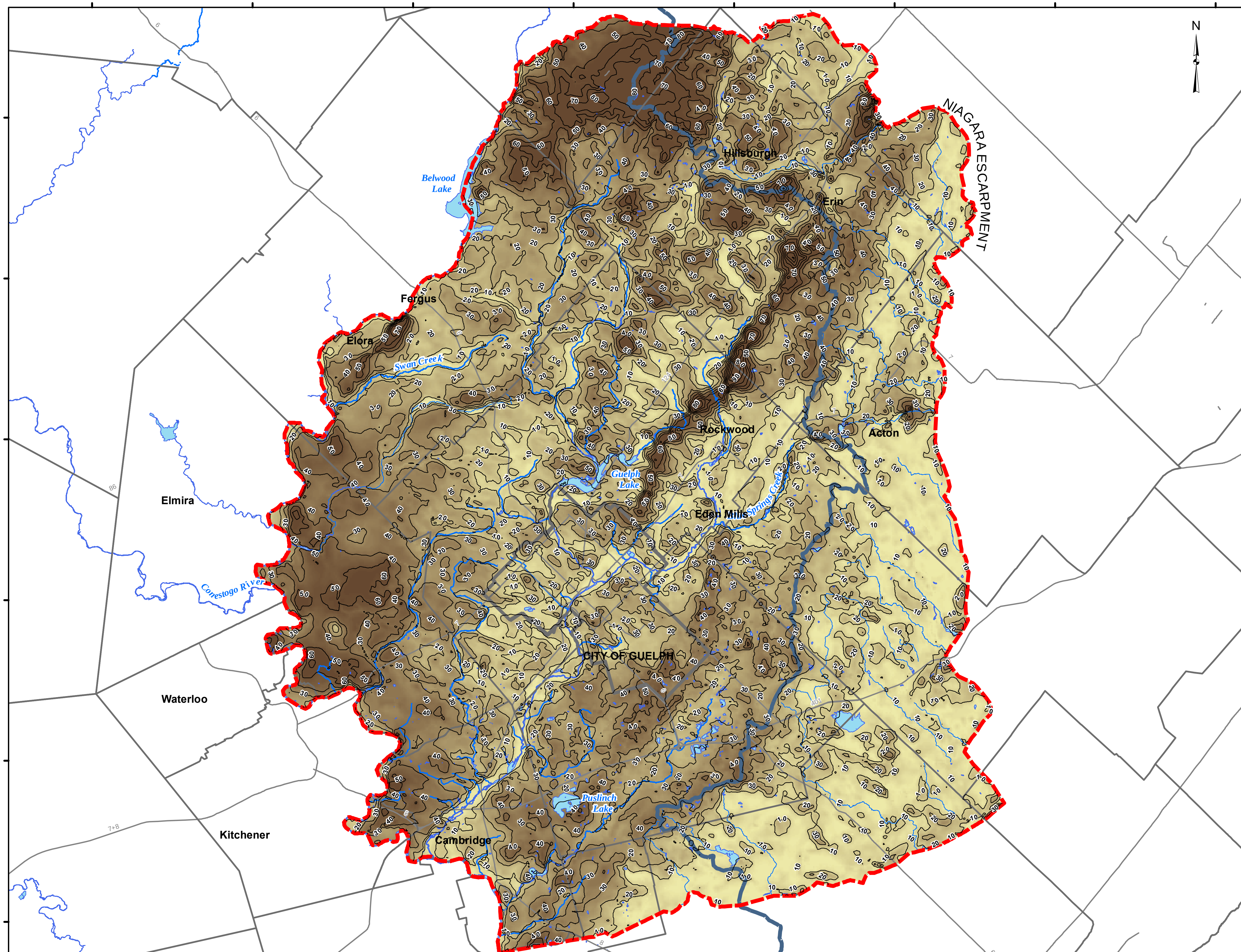
FIGURE: 2-4 DRAFT

SURFICIAL GEOLOGY



Tier Three Local Area Risk Assessment

Guelph

LEGEND

- Major Roads / Highways
- Overburden Isopach Contour (m)
- Rivers / Streams
- Open Water
- Guelph Tier III Model Boundary
- GRCA Watershed Boundary
- City of Guelph Boundary
- Municipal Boundaries

Thickness (m)

High : 100

Low : 0

Scale 1:240,000

2.5 0 2.5 5

Kilometers

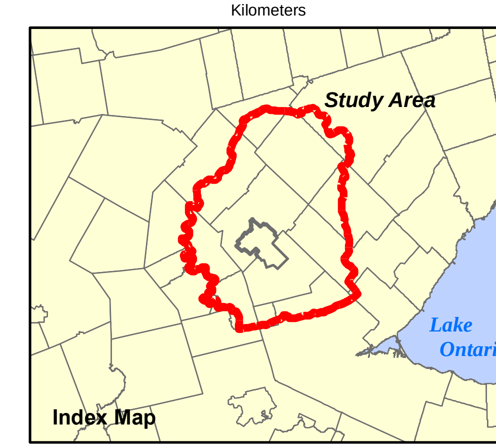


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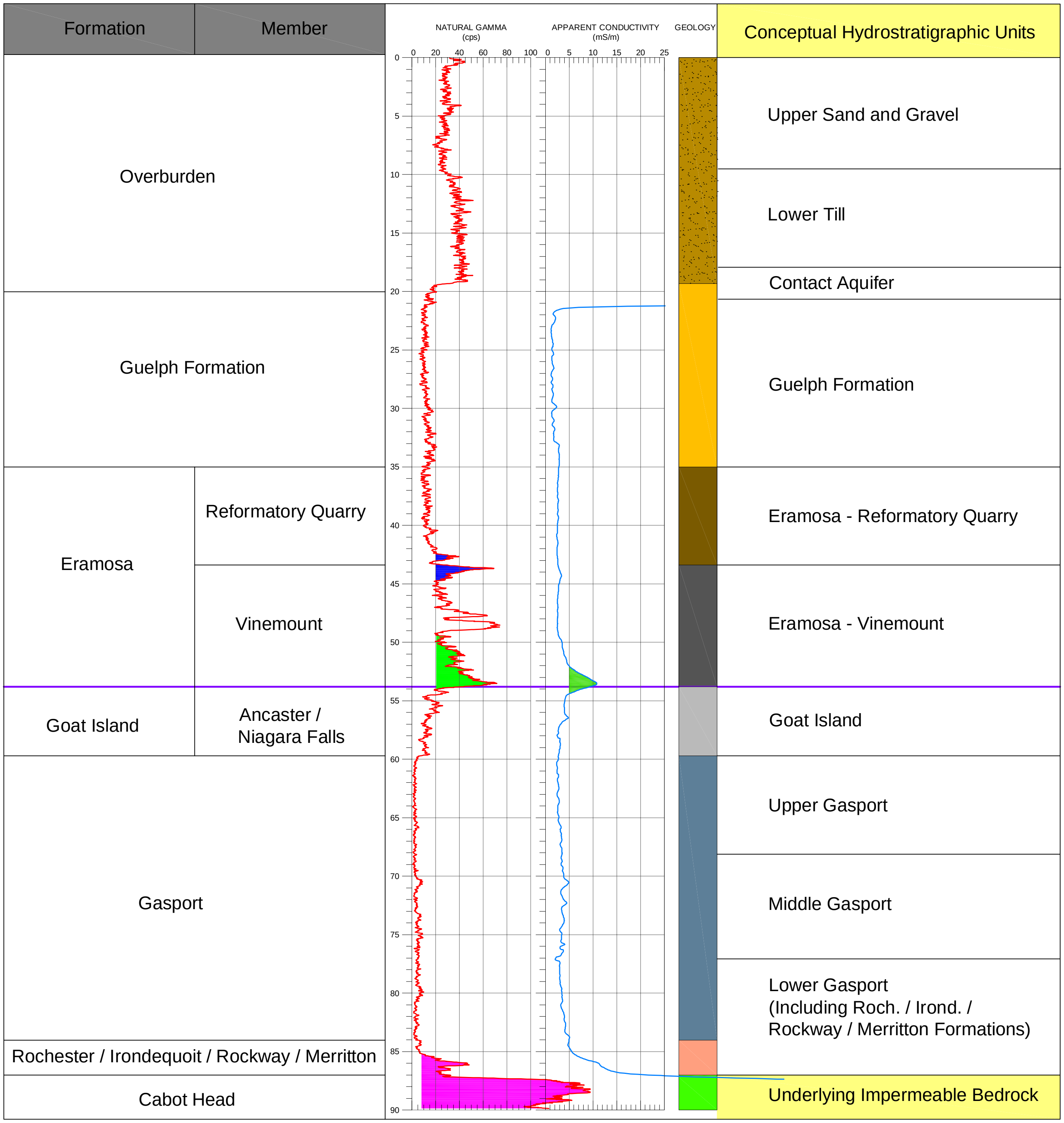
FIGURE: 2-5 DRAFT

OVERBURDEN ISOPACH



GEOPHYSICAL LOG LEGEND:

- NATURAL GAMMA LOG
- APPARENT CONDUCTIVITY LOG
- LOG SIGNATURE REFERENCE LINE (BASE OF ERAMOSA MEMBER)
- GEOPHYSICAL MARKER BED 1
- GEOPHYSICAL MARKER BED 2
- GEOPHYSICAL MARKER BED 3

PROJECT

Tier Three Local Area Risk Assessment

City of Guelph — Making a Difference

TITLE

CONCEPTUAL HYDROGEOLOGICAL MODEL

Produced by Aquaresource Inc. and Golder Associates

PROJECT No.		08-1112-0021
DESIGN	KD	8/4/2009
CAD	KD	5/7/2010
CHECK	JP	5/7/2010
REVIEW		5/7/2010

FILE No. 0811120021DA00.dwg
SCALE AS SHOWN REV. A

Figure **2-6**

PLOT DATE: May 7, 2010
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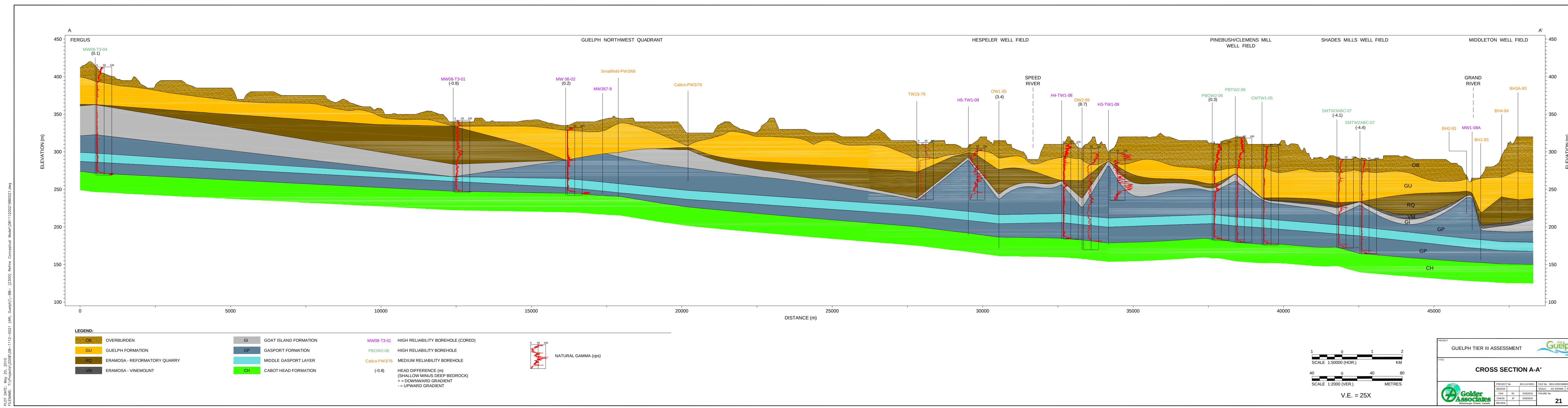

A
A'
FERGUS
GUELPH NORTHWEST QUADRANT
HESPELER WELL FIELD
PINEBUSH/CLEMENS MILL WELL FIELD
SHADES MILLS WELL FIELD
MIDDLETON WELL FIELD
SPEED RIVER
GRAND RIVER
MW08-T3-04 (0.1)
MW08-T3-01 (-0.8)
MW 06-02 (0.2)
MW367-9
Smallfield-PW3/66
Calico-PW3/76
TW15-79
H5-TW1-09
OW1-95 (3.4)
H4-TW1-08
OW2-95 (8.7)
H3-TW1-09
PBOW2-06 (0.3)
PBTW2-06
CMTW1-05
SMTW3ABC-07 (-4.1)
SMTW2ABC-07 (-4.4)
BH2-93
MW1-08A
BH1-93
BH4-94
BH3A-93
OB
GU
RQ
VM
GI
GP
CH
ELEVATION (m)
DISTANCE (m)
LEGEND:
OB OVERBURDEN
GU GUELPH FORMATION
RQ ERAMOSA - REFORMATORY QUARRY
VM ERAMOSA - VINEMOUNT
GI GOAT ISLAND FORMATION
GP GASPORT FORMATION
MIDDLE GASPORT LAYER
CH CABOT HEAD FORMATION
MW08-T3-01 HIGH RELIABILITY BOREHOLE (CORED)
PBOW2-06 HIGH RELIABILITY BOREHOLE
Calico-PW3/76 MEDIUM RELIABILITY BOREHOLE
(-0.8) HEAD DIFFERENCE (m)
(SHALLOW MINUS DEEP BEDROCK)
+ = DOWNWARD GRADIENT
- = UPWARD GRADIENT
NATURAL GAMMA (cps)
SCALE 1:50000 (HOR.) KM
SCALE 1:2000 (VER.) METRES
V.E. = 25X
PROJECT
GUELPH TIER III ASSESSMENT
TITLE
CROSS SECTION A-A'
Golder Associates
Mississauga, Ontario, Canada
PROJECT No. 08-1112-0021
FILE No. 0811120021BB0021.dwg
DESIGN
SCALE AS SHOWN
REV.
CAD RJ 5/20/2010
CHECK JP 5/20/2010
REVIEW
FIGURE No.
21

Figure 2-7

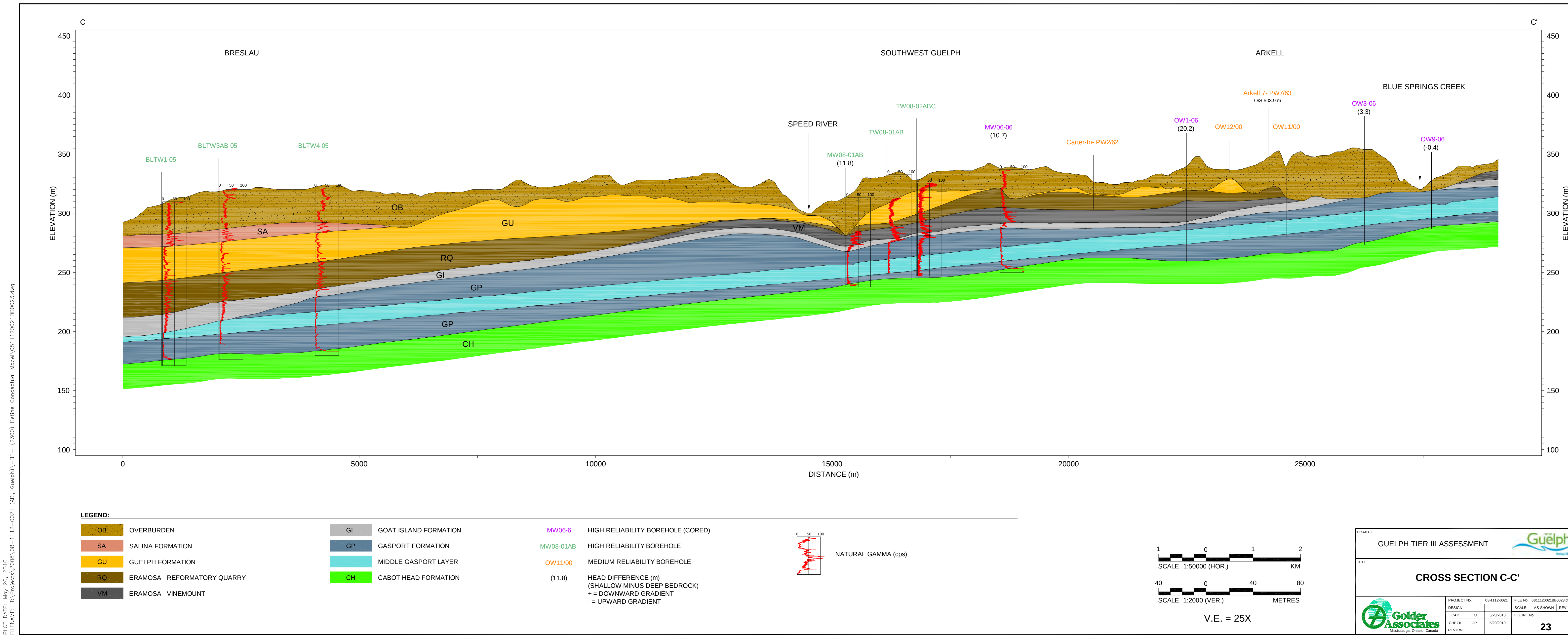
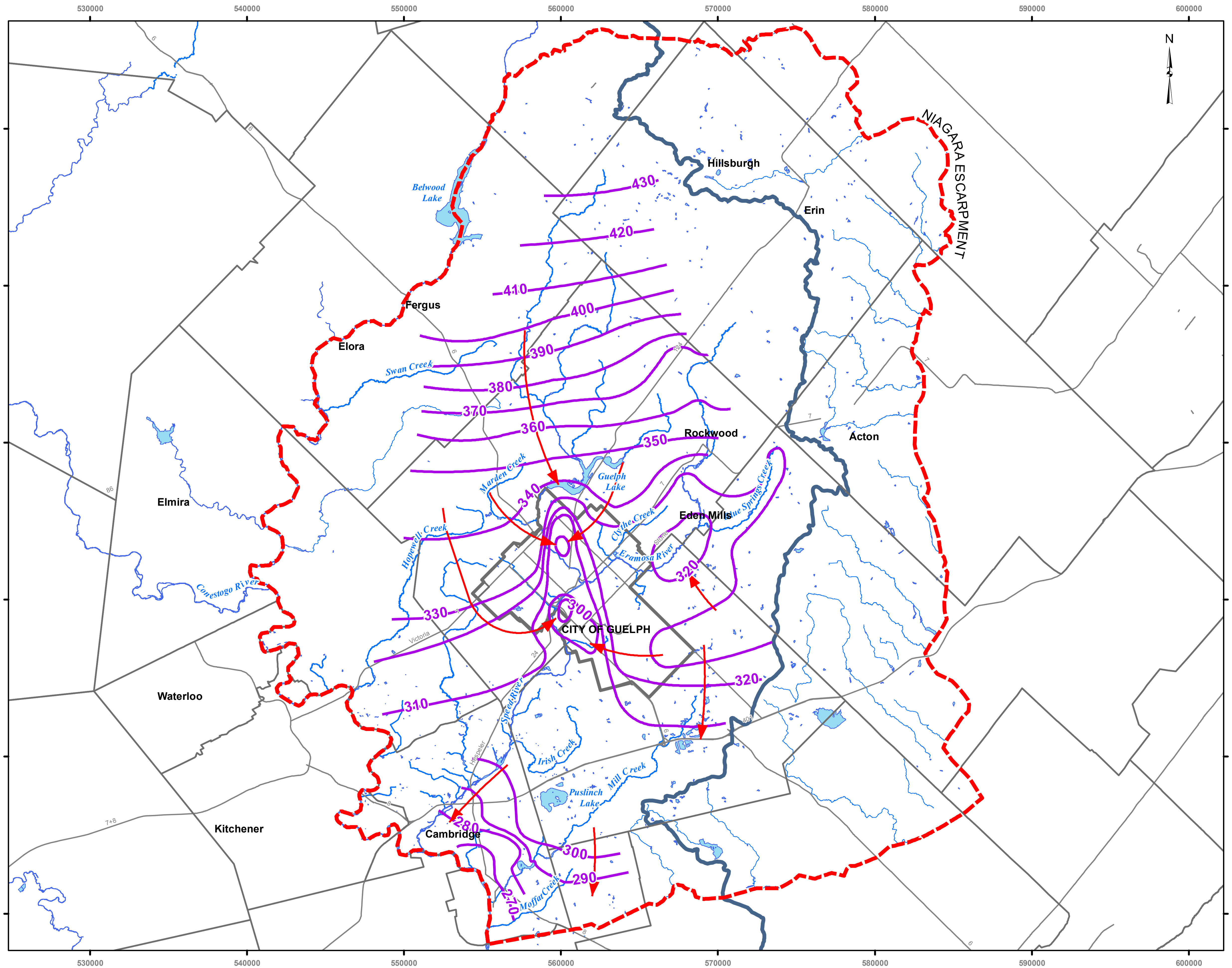

C
C'
BRESLAU
SOUTHWEST GUELPH
ARKELL
BLUE SPRINGS CREEK
SPEED RIVER
BLTW1-05
BLTW3AB-05
BLTW4-05
MW08-01AB
(11.8)
TW08-01AB
TW08-02ABC
MW06-06
(10.7)
Carter-In- PW2/62
OW1-06
(20.2)
OW12/00
Arkell 7- PW7/63
O/S 503.9 m
OW11/00
OW3-06
(3.3)
OW9-06
(-0.4)
OB
SA
GU
RQ
GI
GP
VM
GP
CH
ELEVATION (m)
DISTANCE (m)
LEGEND:
OB OVERBURDEN
SA SALINA FORMATION
GU GUELPH FORMATION
RQ ERAMOSA - REFORMATORY QUARRY
VM ERAMOSA - VINEMOUNT
GI GOAT ISLAND FORMATION
GP GASPORT FORMATION
MIDDLE GASPORT LAYER
CH CABOT HEAD FORMATION
MW06-6 HIGH RELIABILITY BOREHOLE (CORED)
MW08-01AB HIGH RELIABILITY BOREHOLE
OW11/00 MEDIUM RELIABILITY BOREHOLE
(11.8) HEAD DIFFERENCE (m)
(SHALLOW MINUS DEEP BEDROCK)
+ = DOWNWARD GRADIENT
- = UPWARD GRADIENT
NATURAL GAMMA (cps)
SCALE 1:50000 (HOR.) KM
SCALE 1:2000 (VER.) METRES
V.E. = 25X
GUELPH TIER III ASSESSMENT
CROSS SECTION C-C'
Golder Associates
Mississauga, Ontario, Canada
23

Figure 2-8



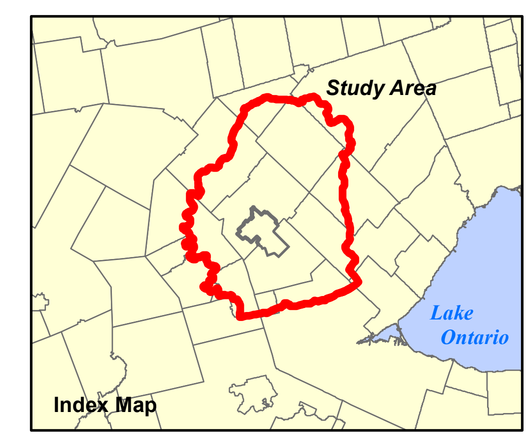
Tier Three Local Area Risk Assessment

Guelph

Making a Difference

LEGEND

- Groundwater Elevation Contour (10 m)
- Inferred Groundwater Flow Direction
- Major Roads / Highways
- Rivers / Streams
- Open Water
- Guelph Tier III Model Boundary
- GRCA Watershed Boundary
- City of Guelph Boundary
- Municipal Boundaries



REFERENCES:

Projection: UTM Zone 17N, NAD 83
Map Version: 1; Map Date: 15-Mar-10; Created By: CC/KD

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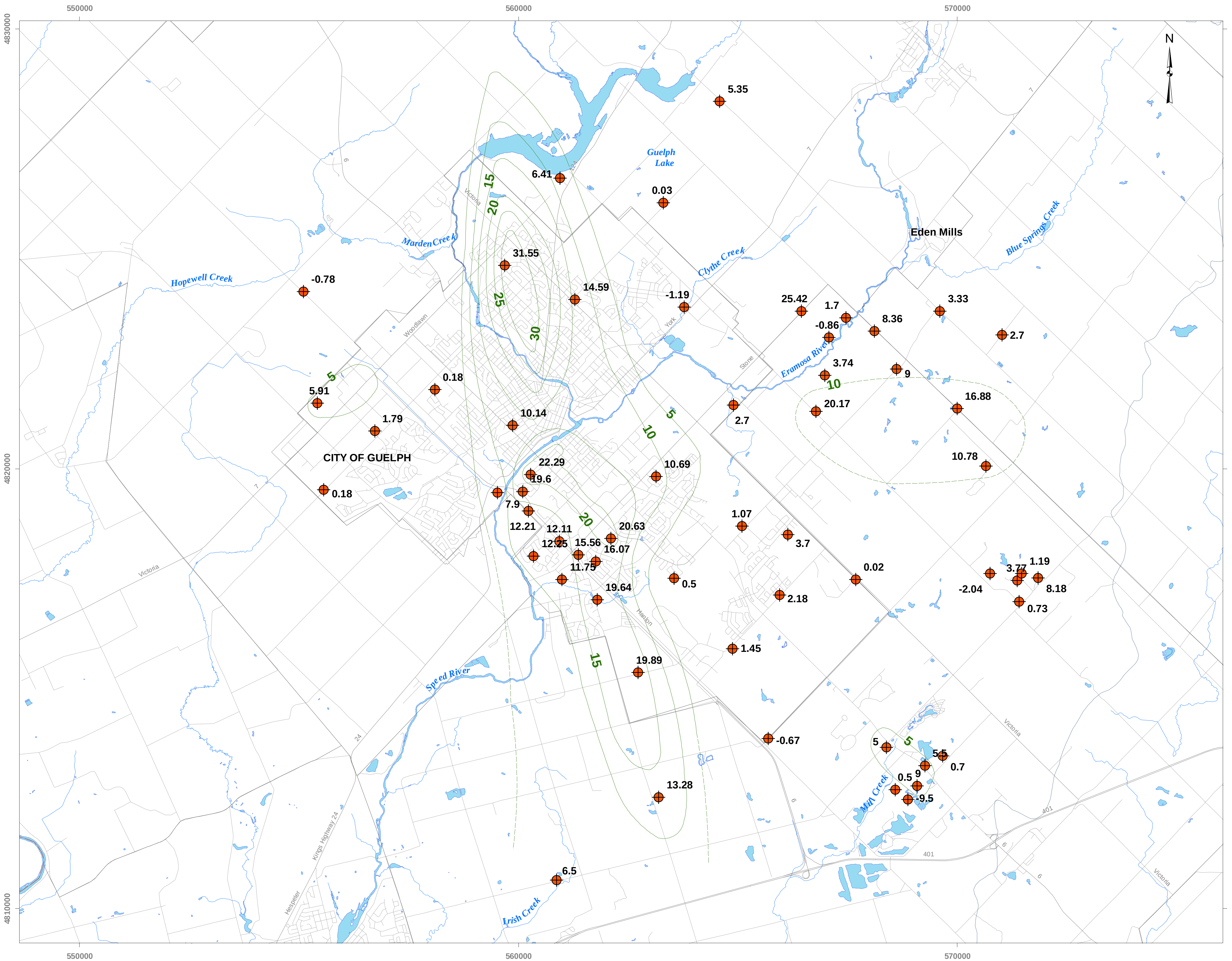
FIGURE: 2-9

DEEP AQUIFER POTENTIOMETRIC SURFACE (GASPORT FM)



Tier Three Local Area Risk Assessment

Guelph

Making a Difference

LEGEND

- Groundwater Contours Difference Amabel
- Inferred Groundwater Contours Difference Amabel
- Collector Roads / Local Roads
- Major Roads / Highways
- Rivers / Streams
- Open Water
- Guelph Tier III Model Boundary
- GRCA Watershed Boundary
- City of Guelph Boundary
- Municipal Boundaries

1.19 = Head Difference Value (shallow minus deep bedrock hydraulic head (m)
+ = Downward gradient
- = Upward gradient

Scale 1:85,000

1.5 0 1.5 3

Kilometers

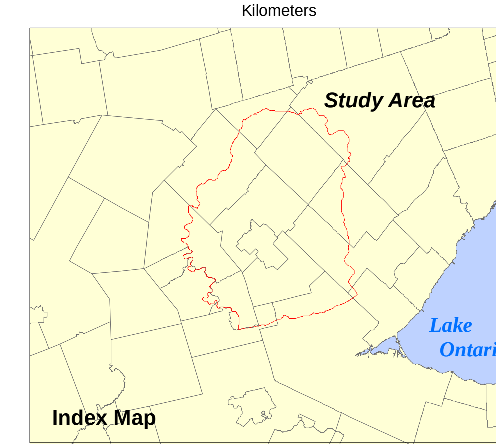


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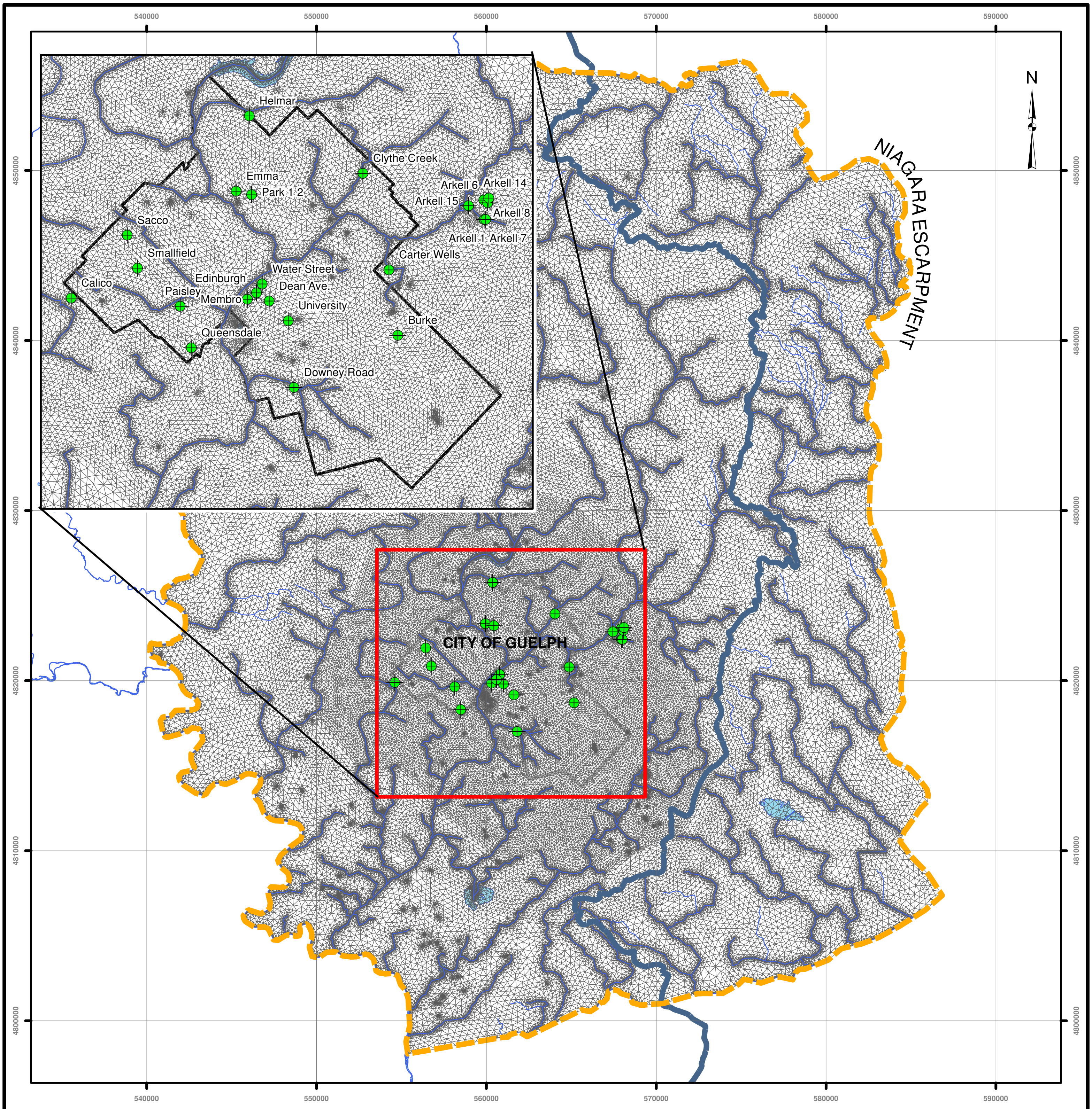
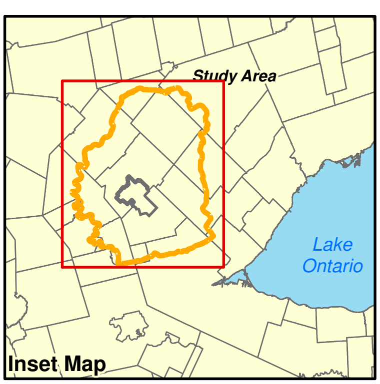
FIGURE: 2-10

HYDRAULIC HEAD DIFFERENCE BETWEEN SHALLOW AND DEEP BEDROCK

G:\Projects\2008\08-1112-0021_Guelph_TierIII\GIS\MXDs\Draft\Modelling_Report\Vertical_Hydraulic_Gradients_Bedrock.mxd

Project: 08-1112-0021_Guelph_Tier3





LEGEND

- Guelph Water Supply Wells
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary
- Finite Element Grid

Scale 1:310,000

0 2.5 5 10 15 20

Kilometres

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Map Version: 3; Map Date: 19-Jul-11; Created By: CC

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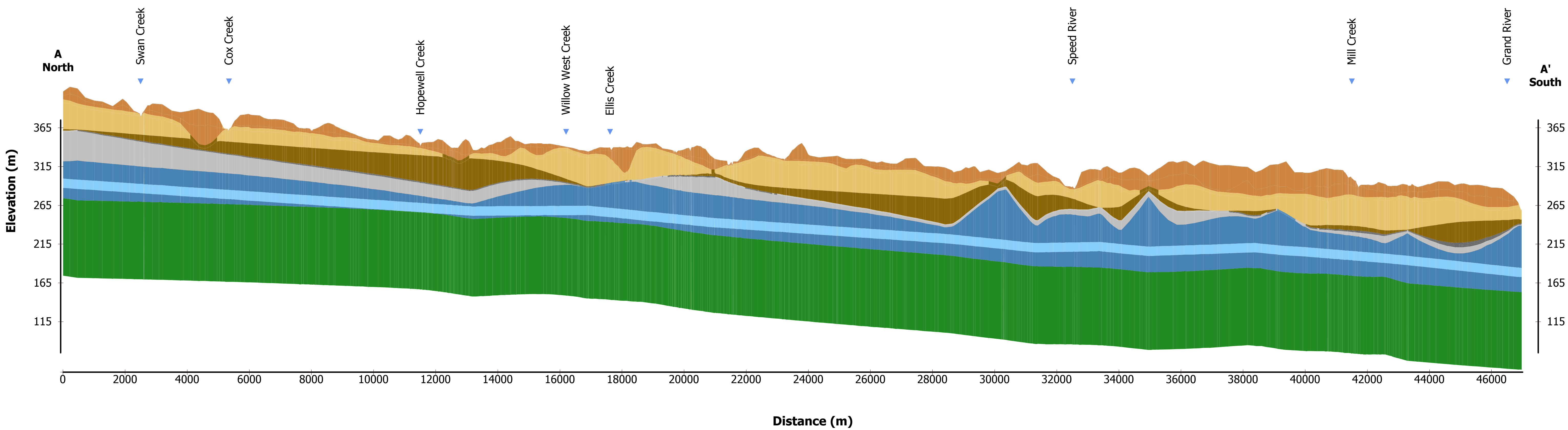
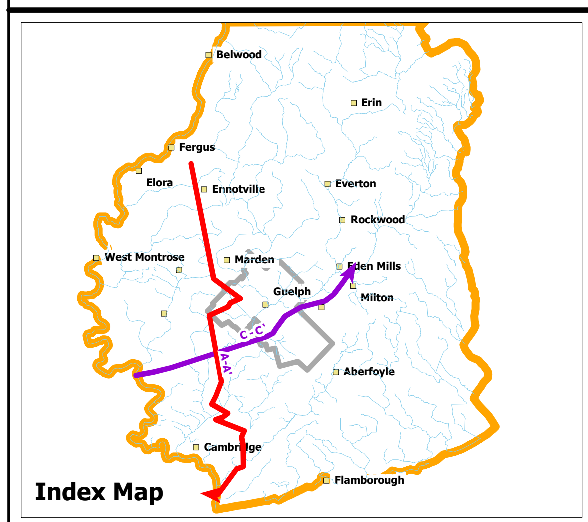
Figure 2-11

Model Domain and Finite Element Mesh





LEGEND

- Overburden
- Guelph Fm
- Eramosa Fm - Reformatory Quarry
- Eramosa Fm - Vinemount
- Goat Island Fm
- Gasport Fm (Upper Unit)
- Gasport Fm (Middle Unit)
- Gasport Fm (Lower Unit)
- Cabot Head Fm

Vertical Exaggeration 25x

Tier Three Local Area Risk Assessment

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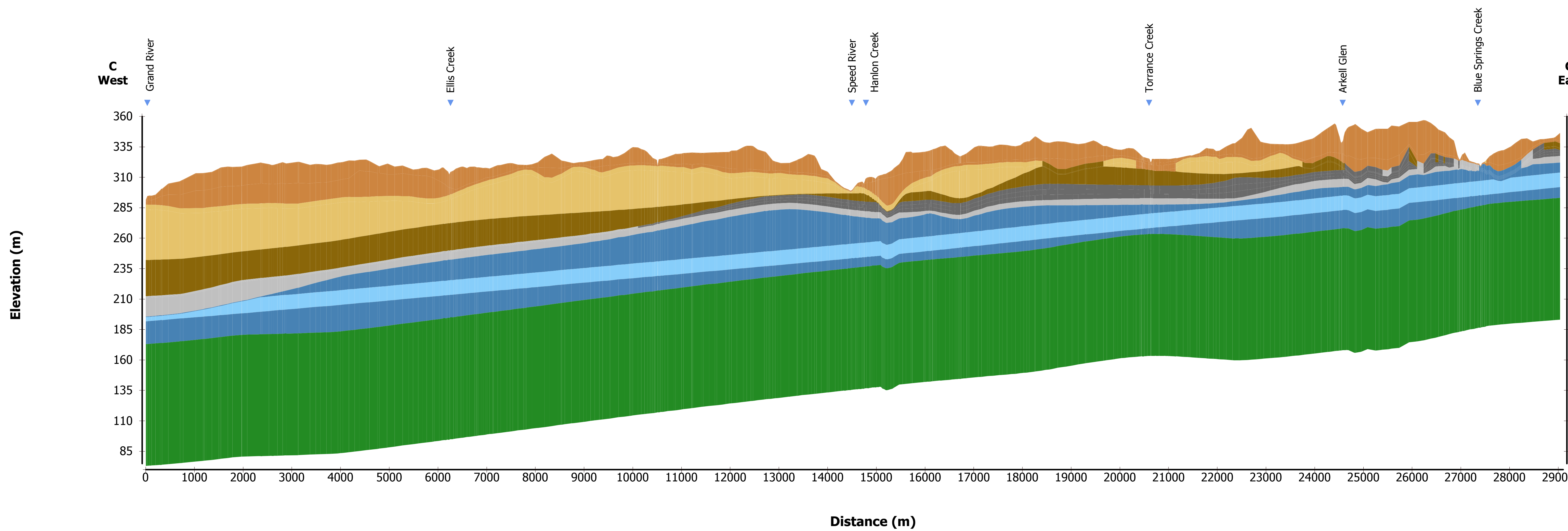
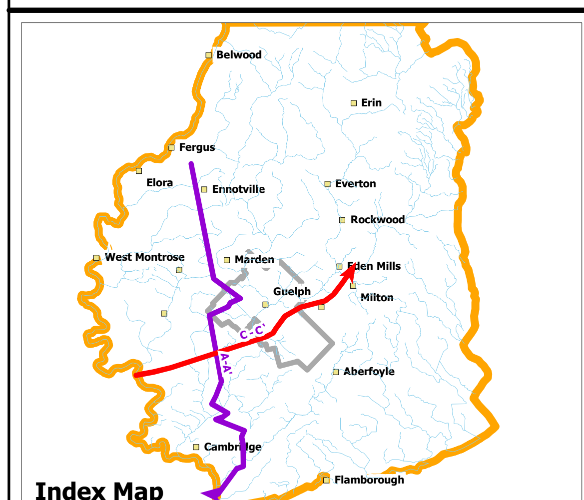
Figure 2-12

Model Cross-Section A-A'





LEGEND

- Overburden
- Guelph Fm
- Eramosa Fm - Reformatory Quarry
- Eramosa Fm - Vinemount
- Goat Island Fm
- Gasport Fm (Upper Unit)
- Gasport Fm (Middle Unit)
- Gasport Fm (Lower Unit)
- Cabot Head Fm

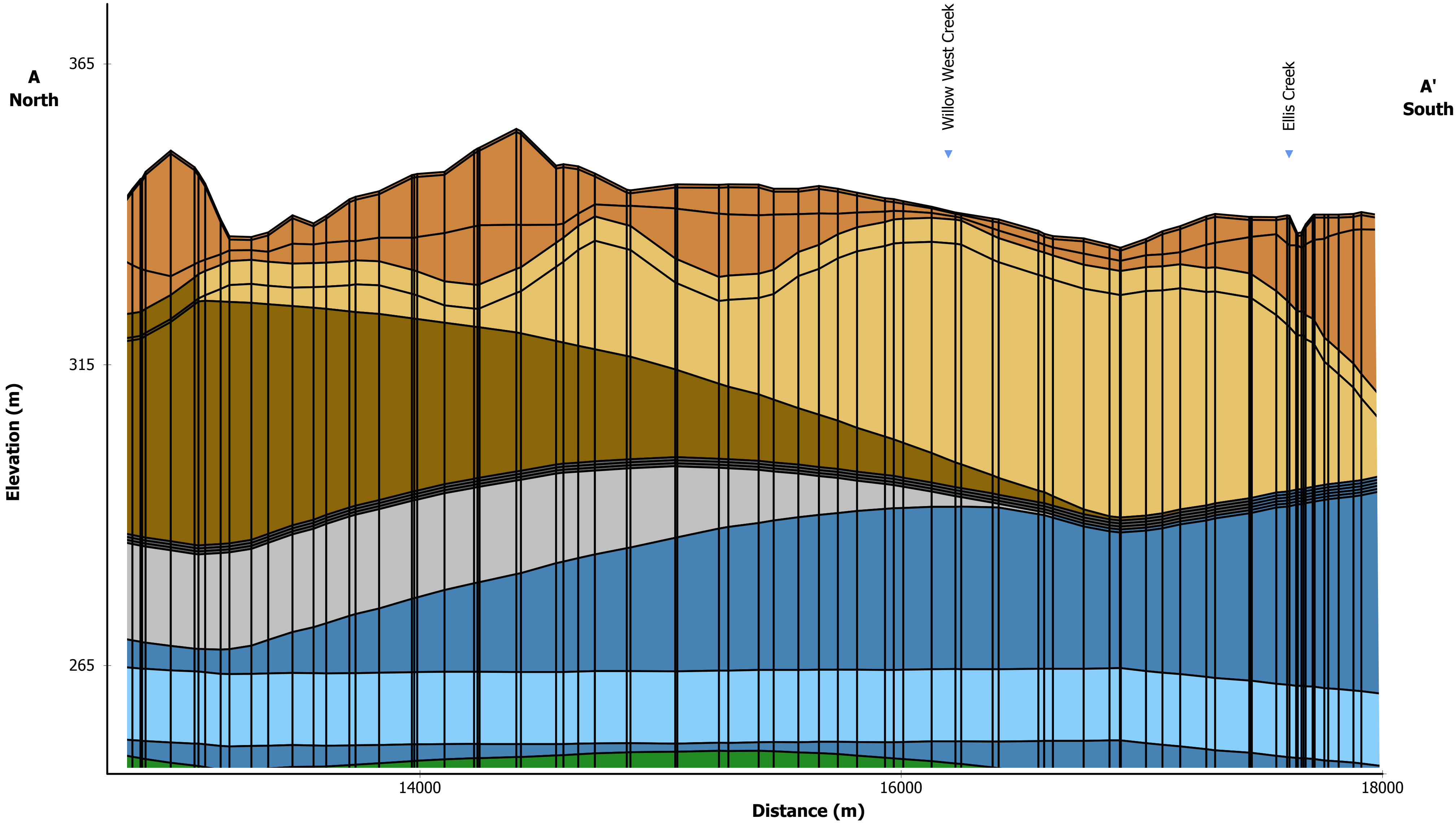
Vertical Exaggeration 25x

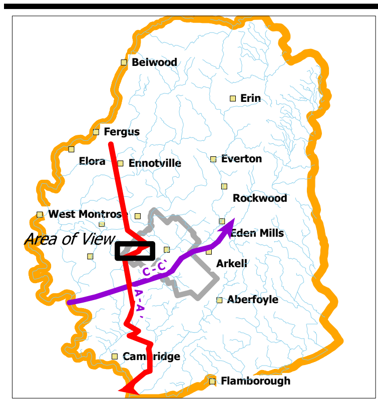
Tier Three Local Area Risk Assessment

Produced by Aquaresource Inc. and Golder Associates Ltd.

Figure 2-13

Model Cross-Section C-C'





LEGEND

- Overburden
- Guelph Fm
- Eramosa Fm - Reformatory Quarry
- Eramosa Fm - Vinemount
- Goat Island Fm
- Gasport Fm (Upper Unit)
- Gasport Fm (Middle Unit)
- Gasport Fm (Lower Unit)
- Cabot Head Fm

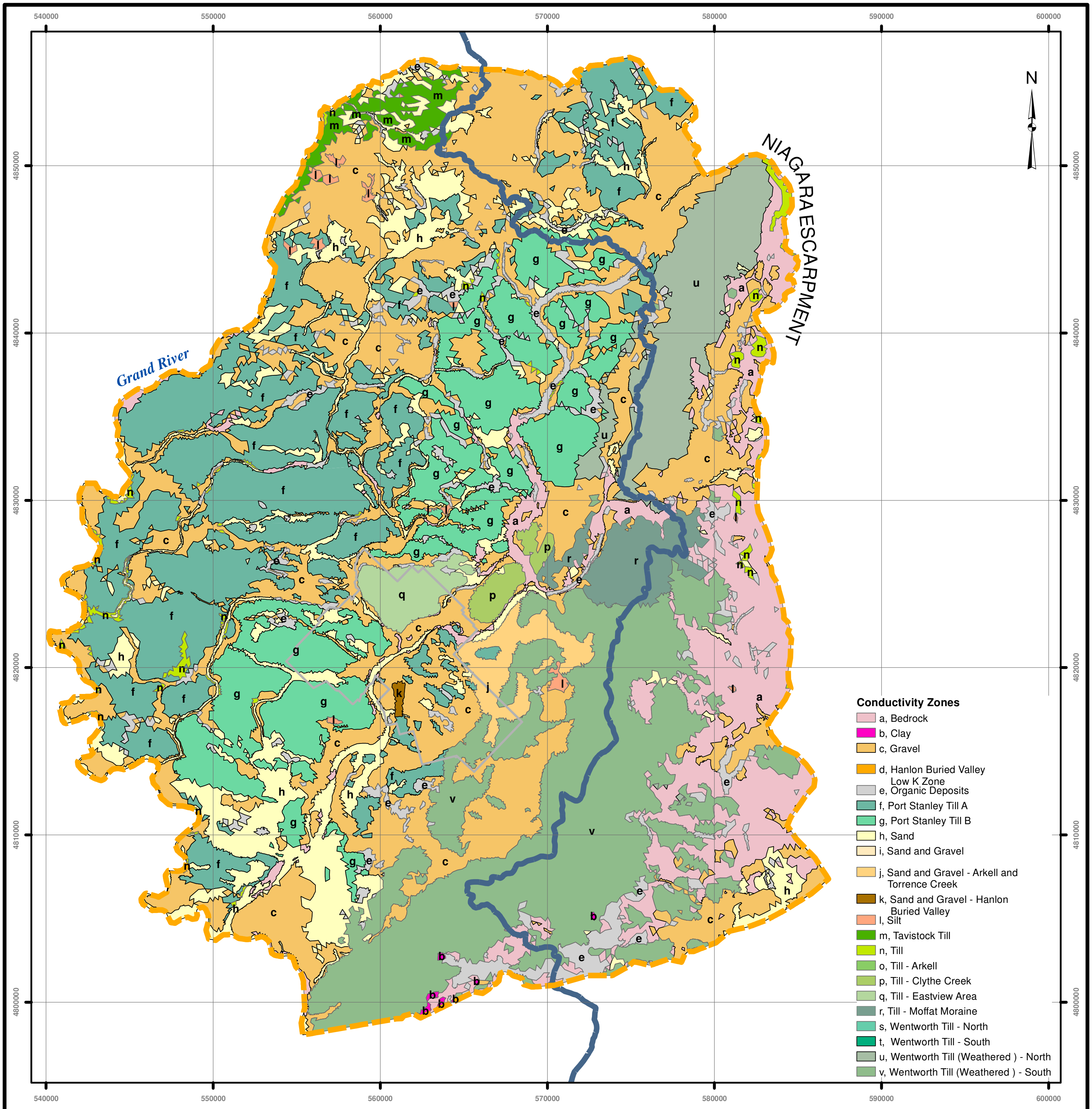
Vertical Exaggeration 25x

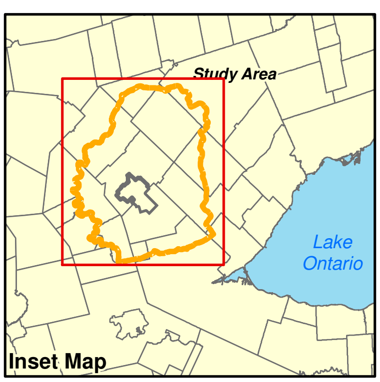
Tier Three Local Area Risk Assessment

Produced by Aquaresource Inc. and Golder Associates Ltd.

Figure 2-14

Model Cross-Section A-A' Detail Through NW Guelph





LEGEND

Model Boundary
Grand River Watershed Boundary
City of Guelph Boundary

Scale 1:315,000

0 2.5 5 10 15 20
Kilometres

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Tier Three Local Area Risk Assessment

Guelph
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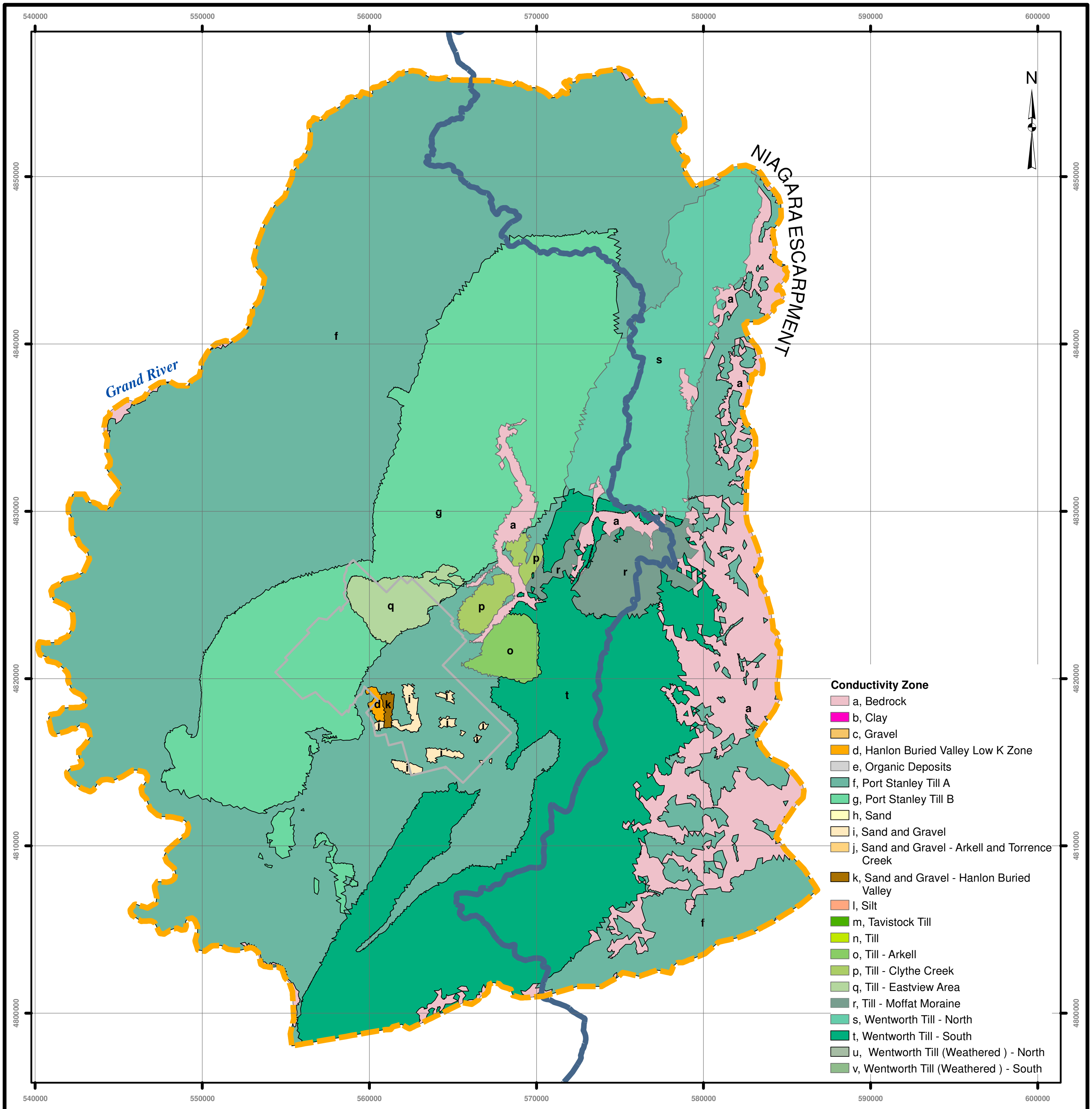
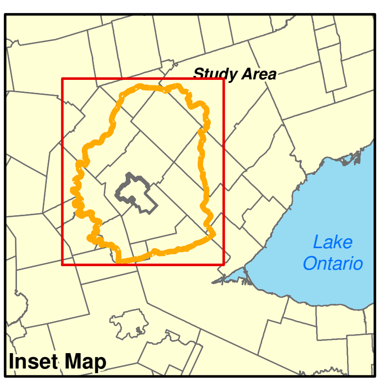
Figure 2-15

Hydraulic Conductivity Distribution - Layers 1 & 2 - Overburden A





LEGEND

Model Boundary

Grand River Watershed Boundary

City of Guelph Boundary

Scale 1:315,000

0 2.5 5 10 15 20

Kilometres

REFERENCES:

Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008

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Map Version: 3; Map Date: 19-Jul-11; Created By: CC

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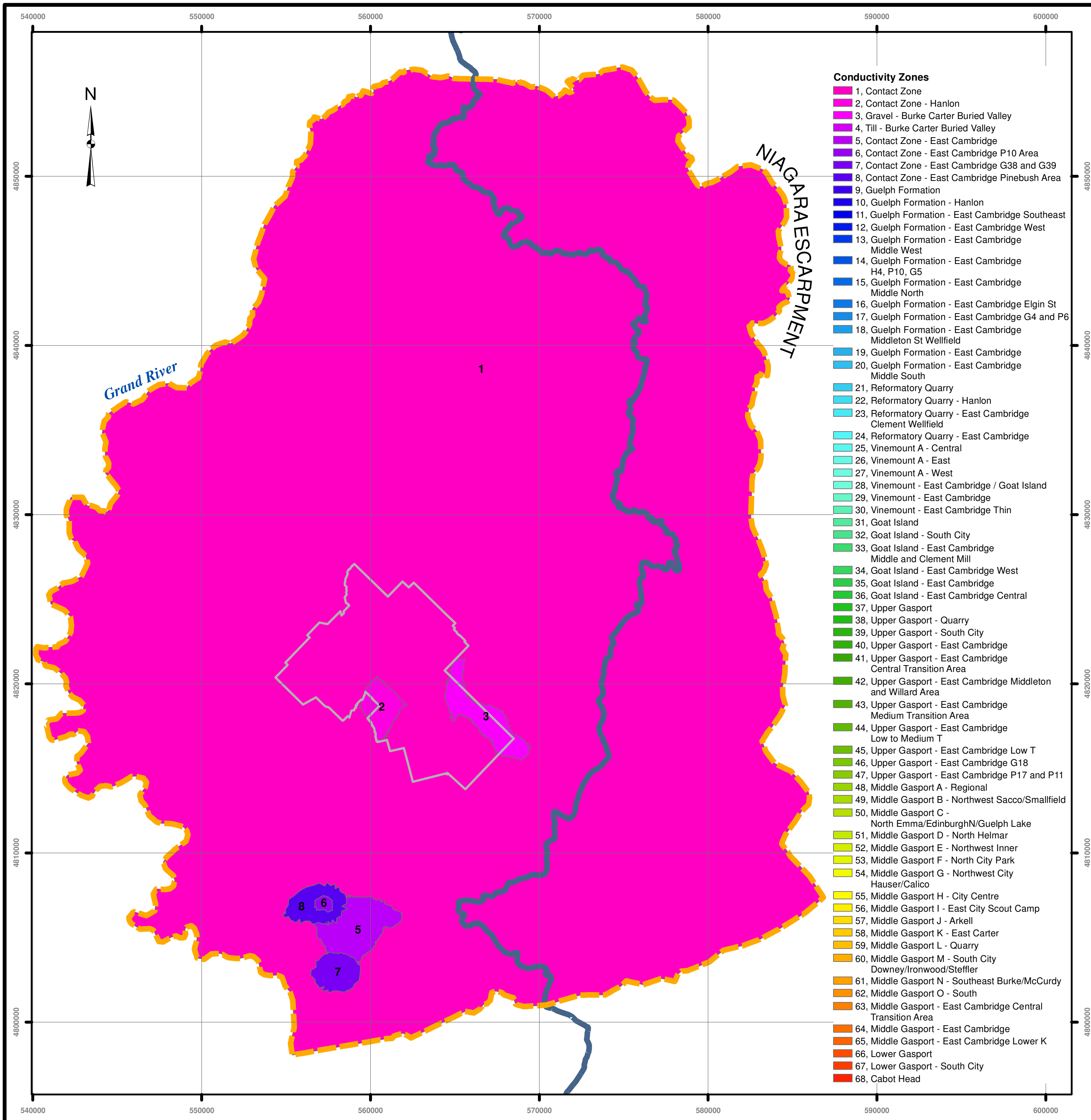
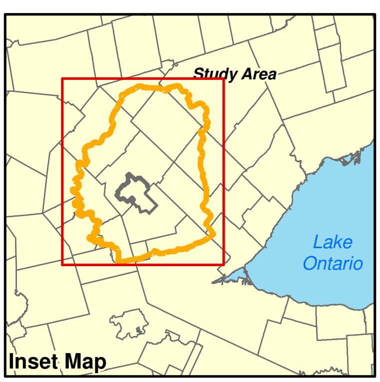
Figure 2-16

Hydraulic Conductivity Distribution - Layer 3 - Overburden B

C:\Projects\2008003_Guelph_Tier3\GIS\ArcView\MXDs\ModelReport\Updates_April2010\Fig2-16_HydraulicConductivity_Layer3_OB_C.mxd

Project: 2008003_Guelph_Tier3





LEGEND

Model Boundary

Grand River Watershed Boundary

City of Guelph Boundary

Scale 1:315,000

0 2.5 5 10 15 20

Kilometres

REFERENCES:

Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008

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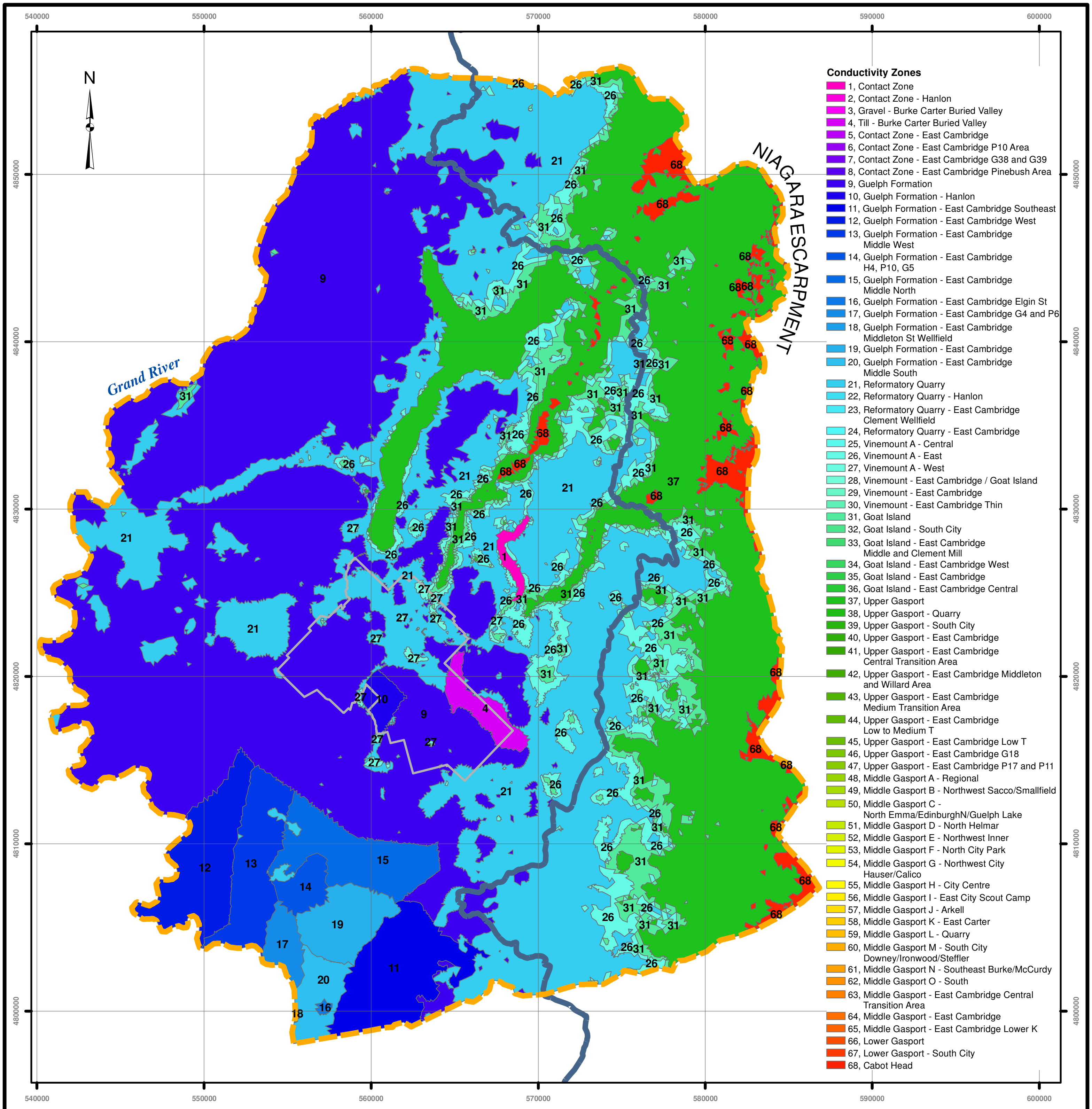
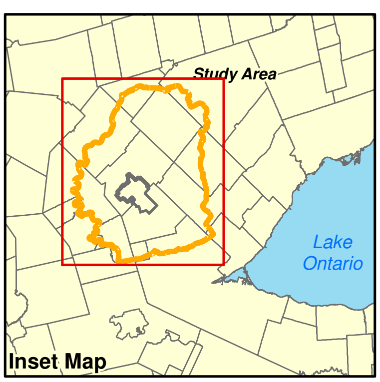
Figure 2-17

Hydraulic Conductivity Distribution - Layer 4 - Contact Zone





LEGEND
Model Boundary
Grand River Watershed Boundary
City of Guelph Boundary

Scale 1:315,000
0 2.5 5 10 15 20
Kilometres

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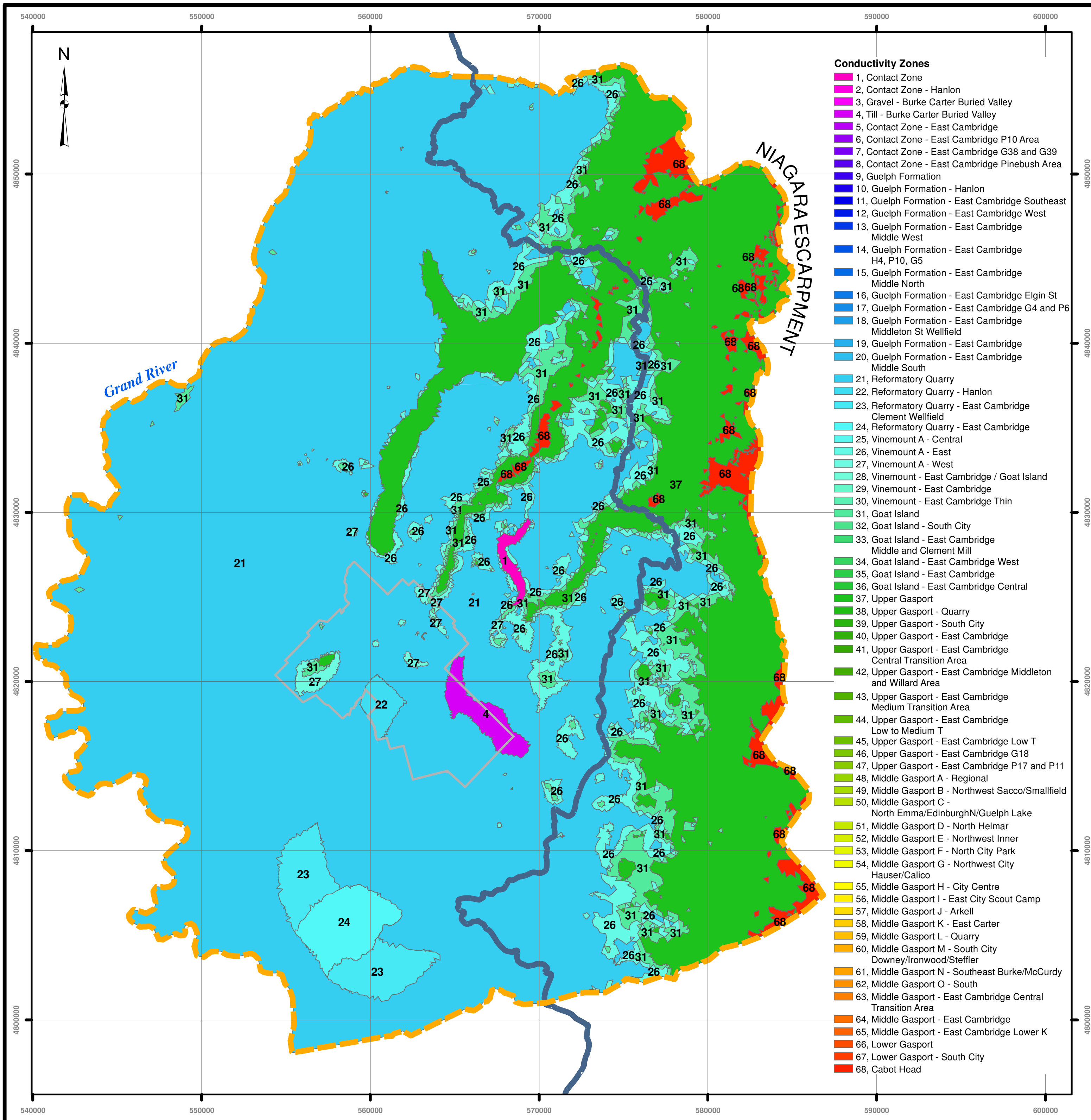
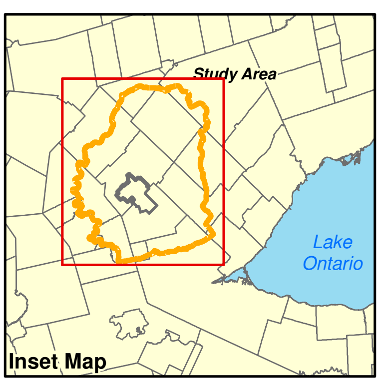
Figure 2-18

Hydraulic Conductivity Distribution - Layer 5 - Guelph Formation





LEGEND
Model Boundary
Grand River Watershed Boundary
City of Guelph Boundary

Scale 1:315,000
0 2.5 5 10 15 20
Kilometres

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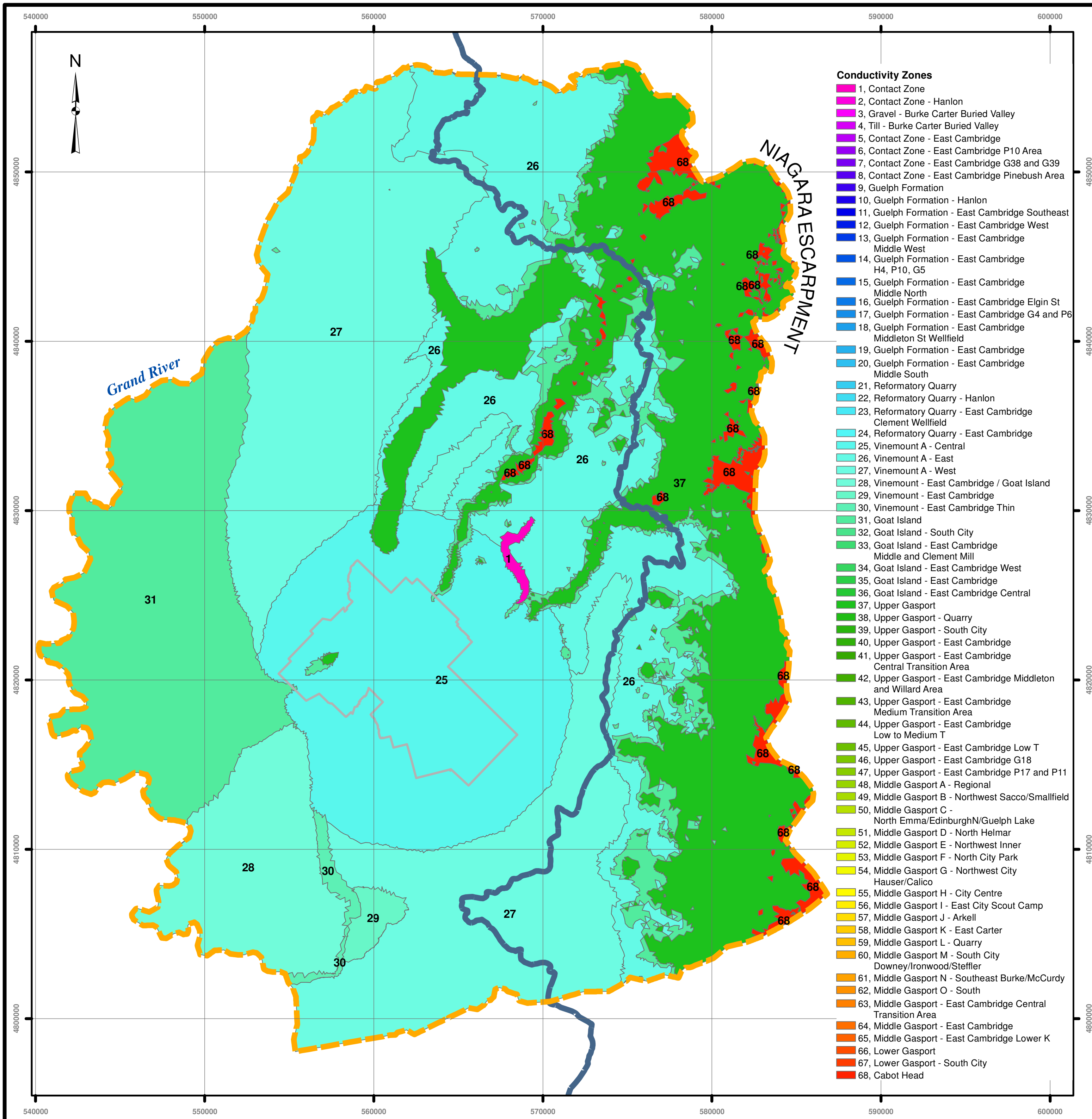
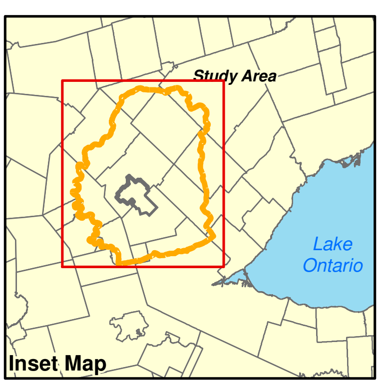
Figure 2-19

Hydraulic Conductivity Distribution - Layer 6 - Reformatory Quarry





LEGEND
Model Boundary
Grand River Watershed Boundary
City of Guelph Boundary

Scale 1:315,000
0 2.5 5 10 15 20
Kilometres

REFERENCES:
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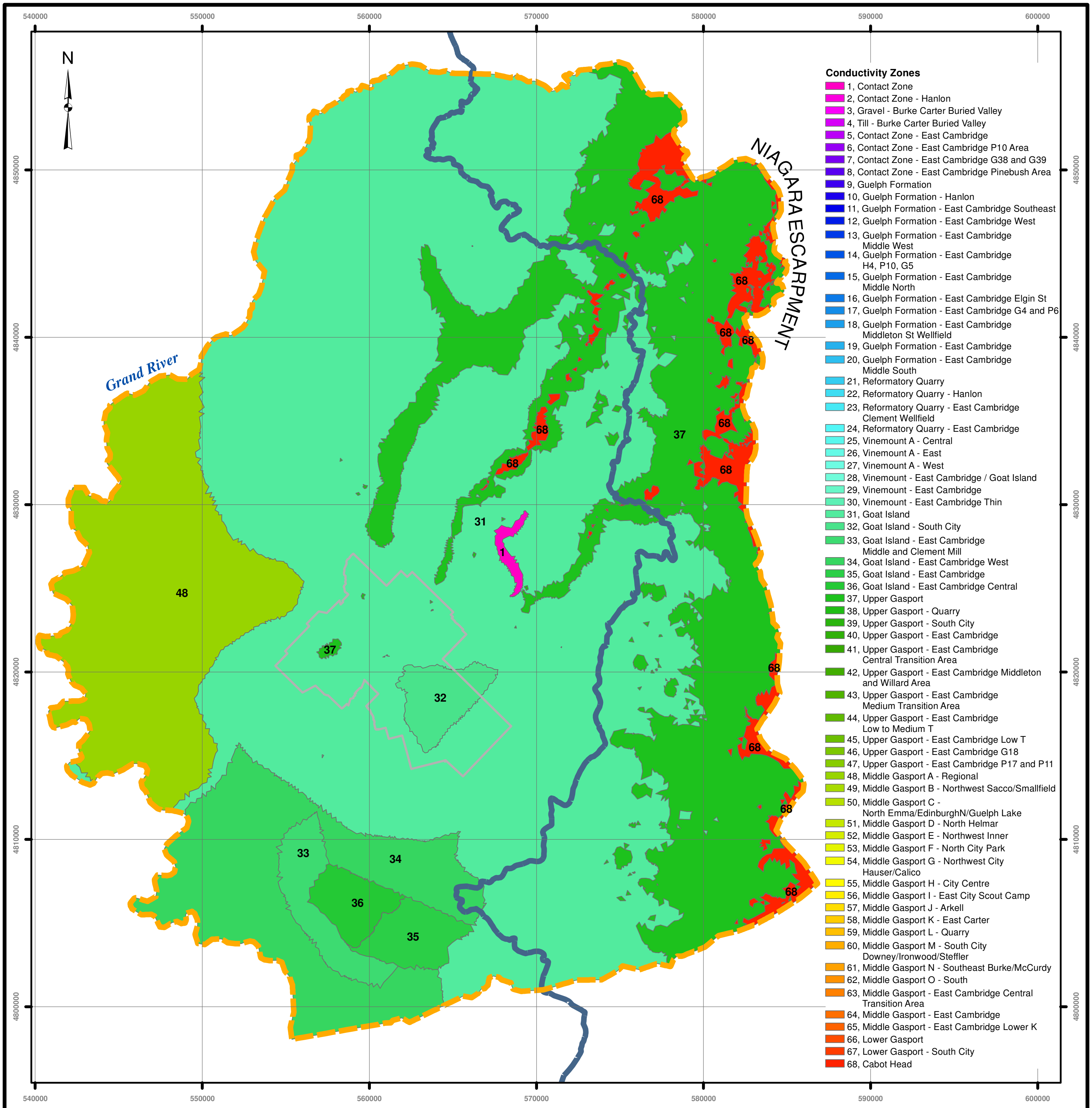
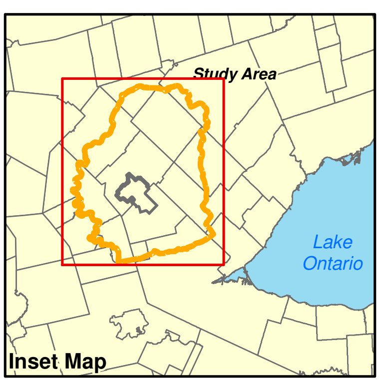
Figure 2-20

Hydraulic Conductivity Distribution - Layers 7 to 9 - Vinemount

C:\Projects\2008003_Guelph_Tier3\GIS\ArcView\MXDs\ModelReport\Updates_April2010\Fig2-20_HydraulicConductivity_Layer7to9_Vinemount.mxd

Project: 2008003_Guelph_Tier3





LEGEND

Model Boundary

Grand River Watershed Boundary

City of Guelph Boundary

Scale 1:315,000

0 2.5 5 10 15 20

Kilometres

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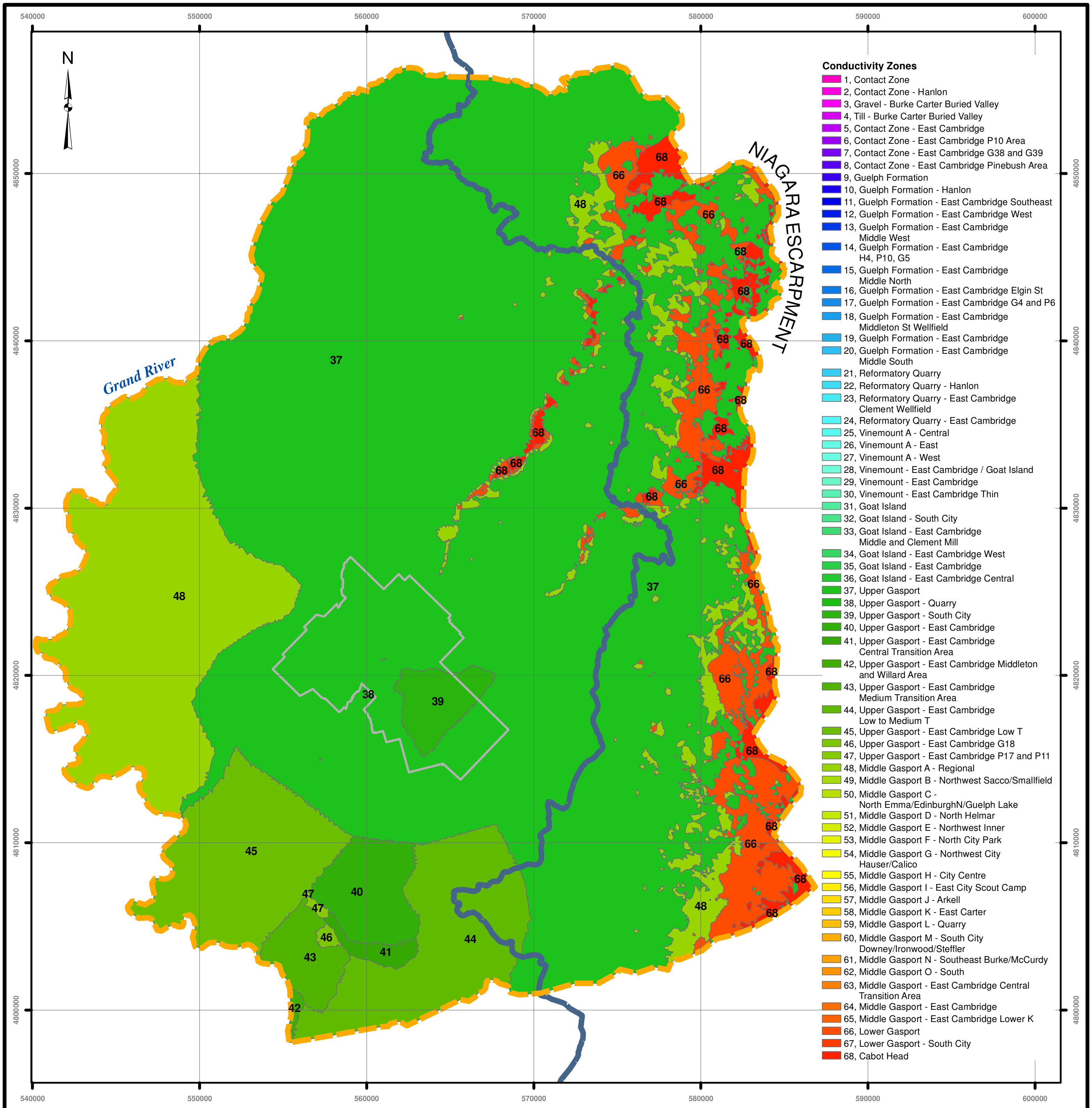
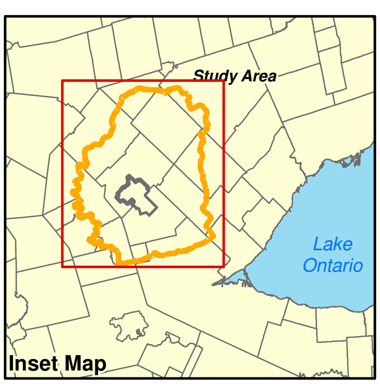
Figure 2-21

Hydraulic Conductivity Distribution - Layer 10 - Goat Island

C:\Projects\2008003_Guelph_Tier3\GIS\ArcView\MXDs\ModelReport\Updates_April2010\Fig2-21_HydraulicConductivity_Layer10_Goat.mxd

Project: 2008003_Guelph_Tier3





LEGEND

Model Boundary

Grand River Watershed Boundary

City of Guelph Boundary

Scale 1:315,000

0 2.5 5 10 15 20

Kilometres

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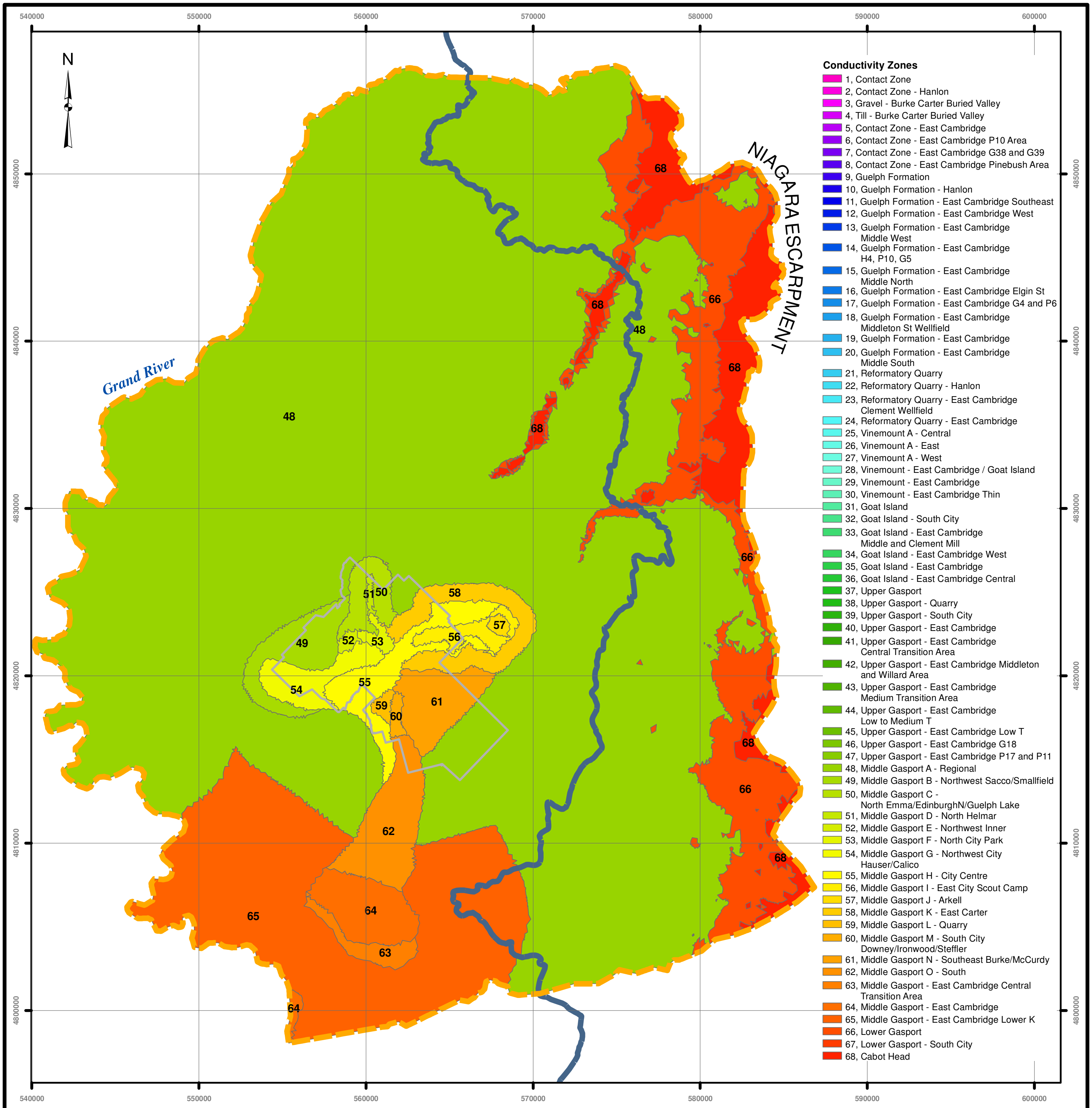
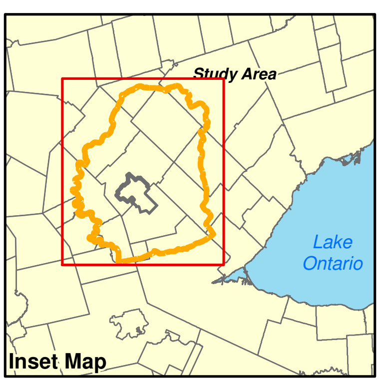
Figure 2-22

Hydraulic Conductivity Distribution - Layer 11 - Upper Gasport





LEGEND

Model Boundary

Grand River Watershed Boundary

City of Guelph Boundary

Scale 1:315,000

0 2.5 5 10 15 20

Kilometres

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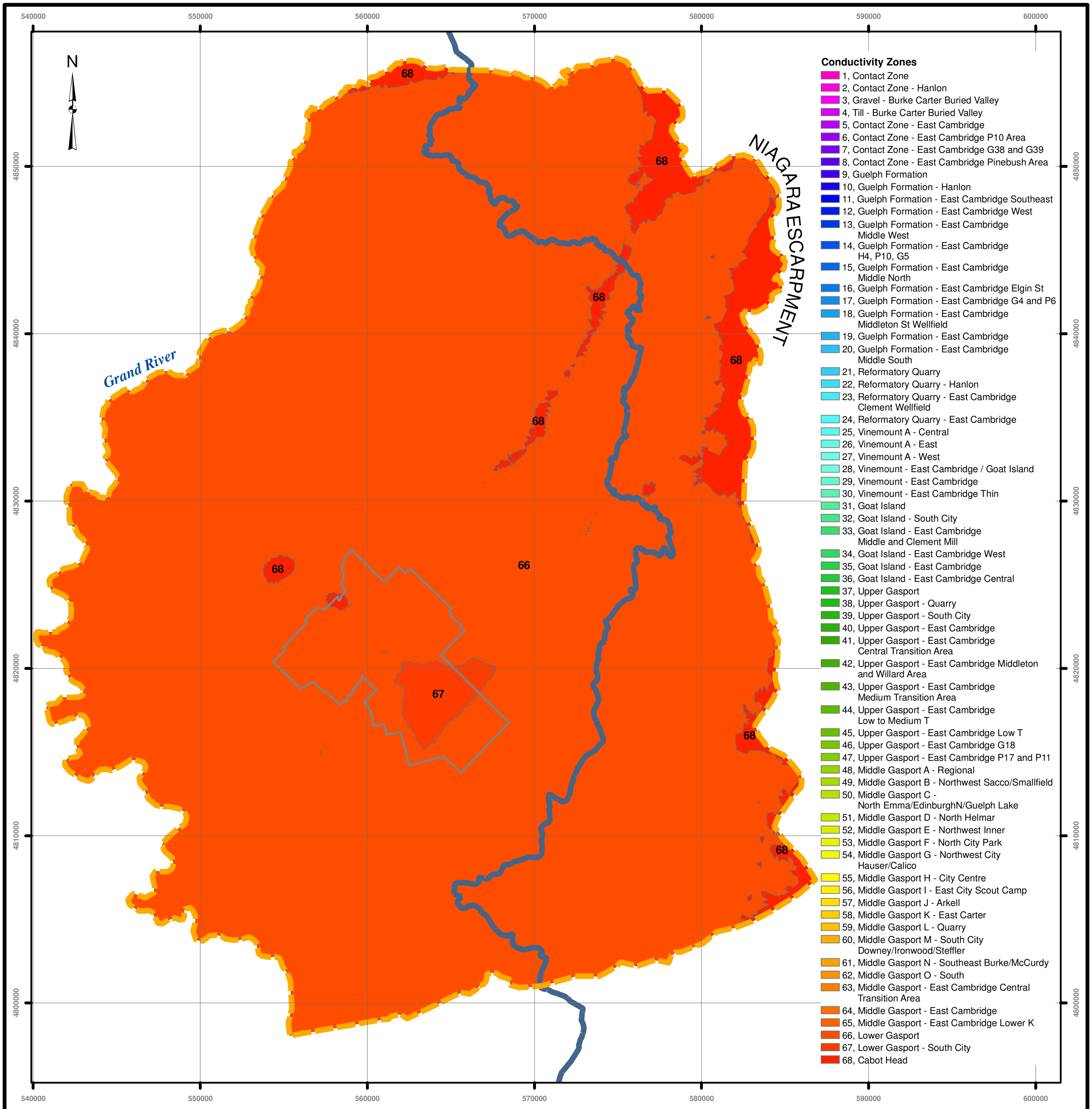
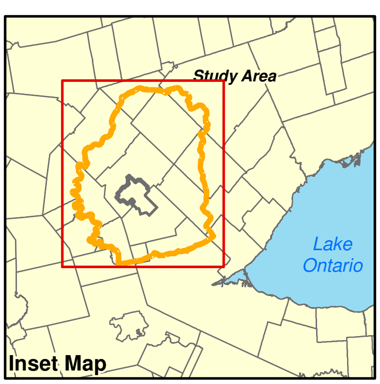
Figure 2-23

Hydraulic Conductivity Distribution - Layer 12 - Middle Gasport





LEGEND

Model Boundary

Grand River Watershed Boundary

City of Guelph Boundary

Scale 1:315,000

0 2.5 5 10 15 20

Kilometres

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Map Version: 3; Map Date: 19-Jul-11 Created By: CC

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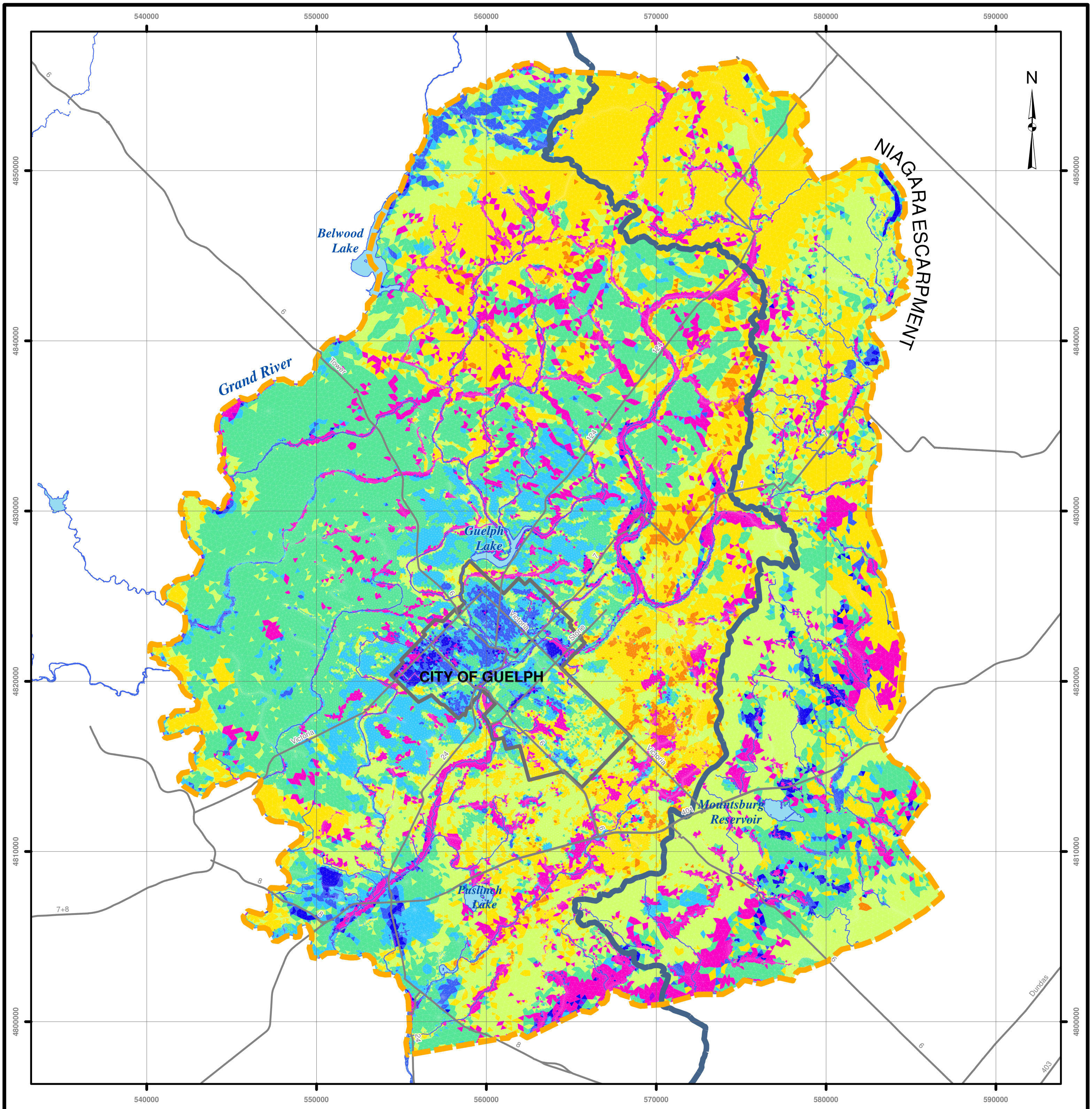
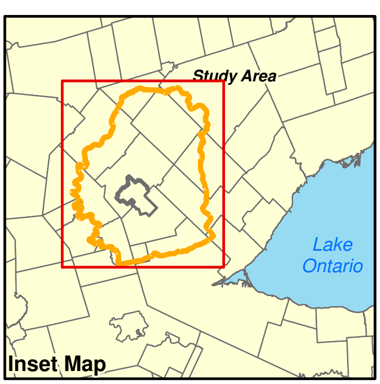
Figure 2-24

Hydraulic Conductivity Distribution - Layer 13 - Lower Gasport

C:\Projects\2008003_Guelph_Tier3\GIS\ArcView\MXDs\ModelReport\Updates_April2010\Fig2-24_HydraulicConductivity_Layer13_LowerGasport.mxd

Project: 2008003_Guelph_Tier3





LEGEND

- Major Roads / Highways
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Average Annual Groundwater Recharge (mm/yr)

< 5	100 - 200
5 - 10	200 - 300
10 - 20	300 - 400
20 - 50	400 - 500
50 - 100	> 500

Scale 1:310,000

0 2.5 5 10 15 20

Kilometres

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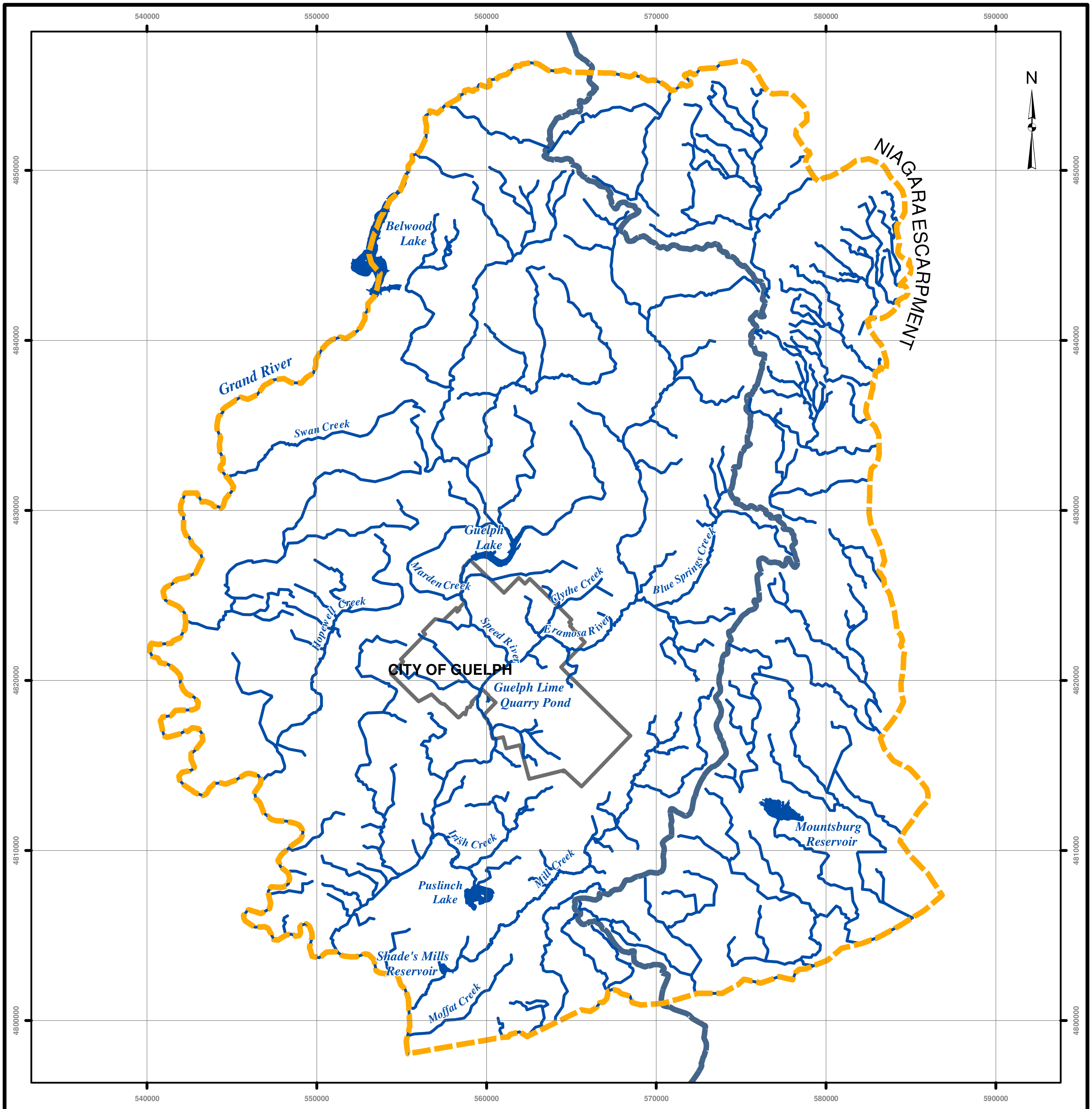
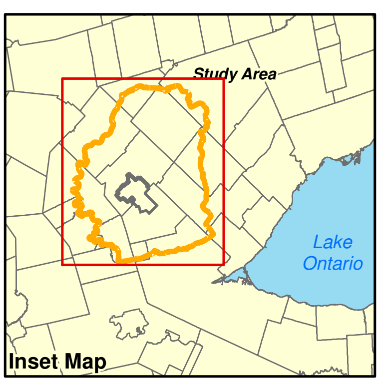
Figure 2-25

Average Annual Groundwater Recharge





LEGEND

- Modelled Streams
- Modelled Lakes
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Scale 1:310,000

0 2.5 5 10 15 20

Kilometres

REFERENCES:
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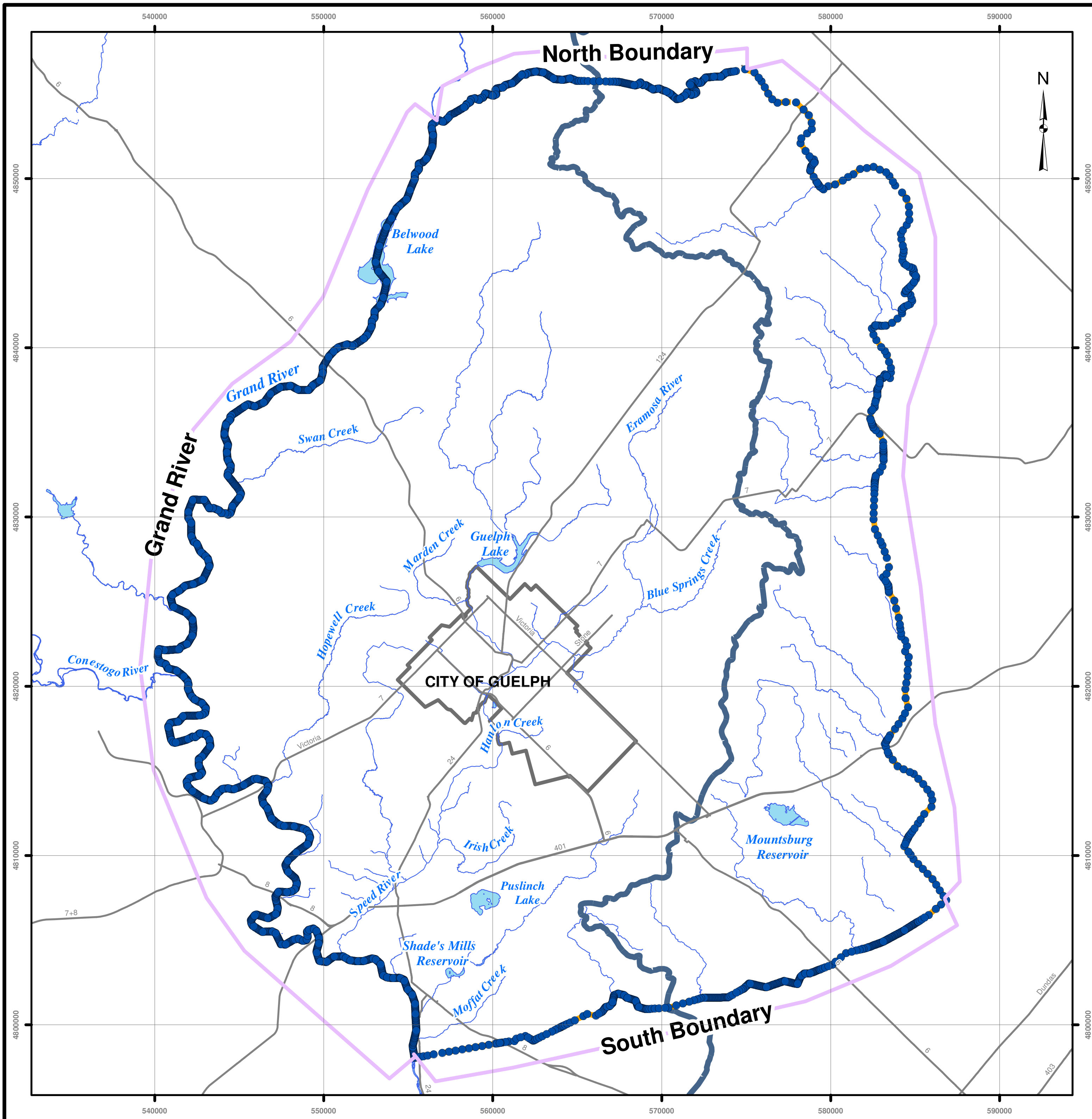
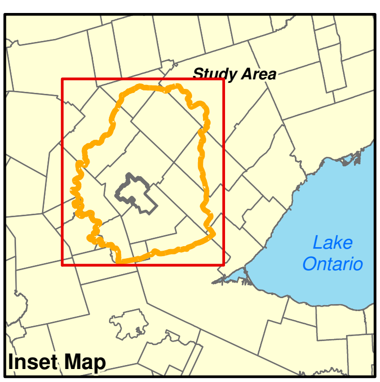
Figure 2-26

Top Surface Water Boundary Conditions

C:\Projects\2008003_Guelph_Tier3\GIS\ArcView\MXDs\ModelReport\Updates_April2010\Fig2-26_TopSurfaceBoundaryConditions.mxd

Project: 2008003_Guelph_Tier3





LEGEND

- Specified Head Boundary
- Major Roads / Highways
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Scale 1:315,000

0 2.5 5 10 15 Kilometres

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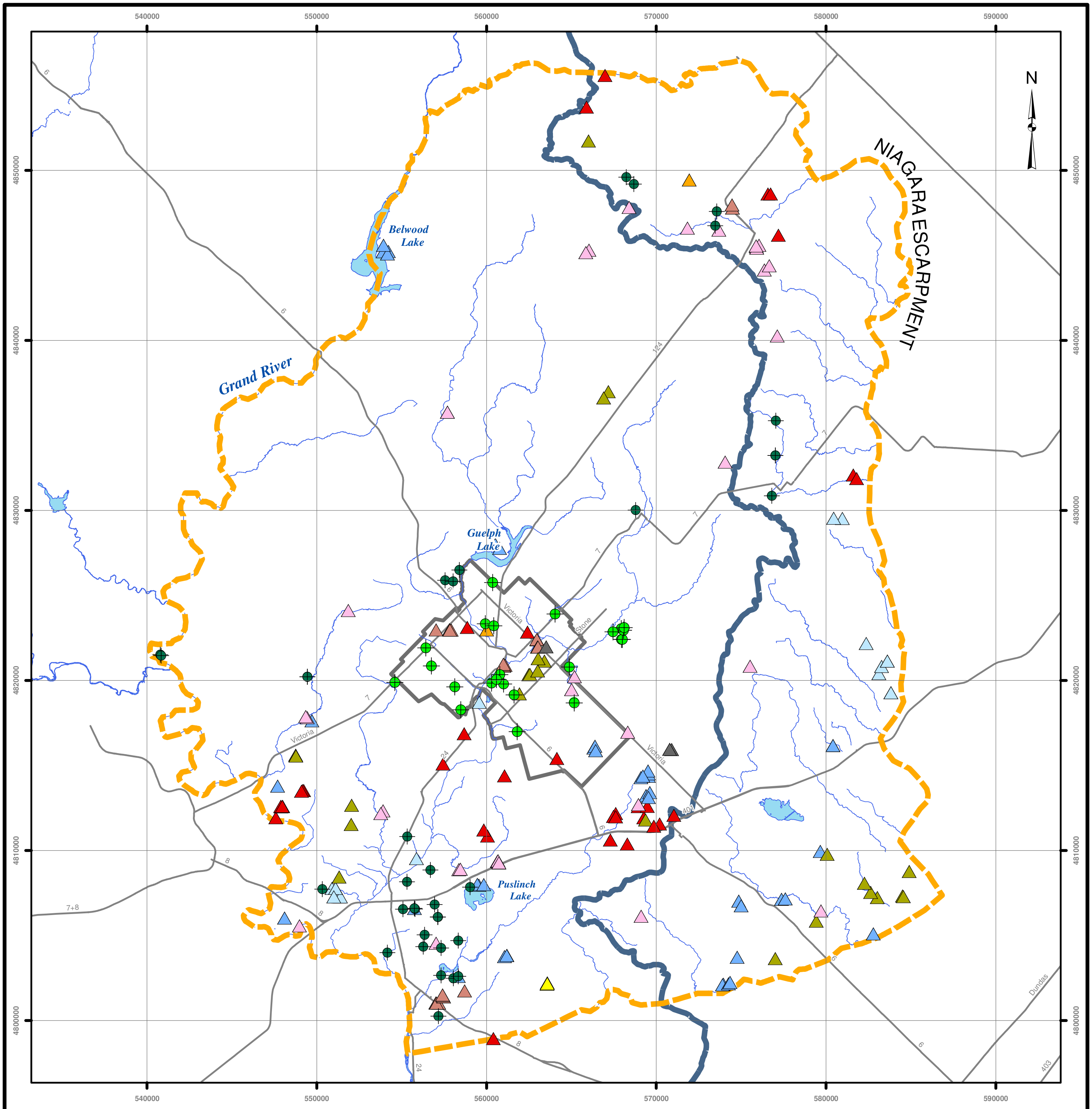
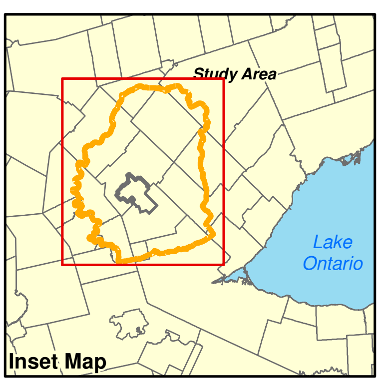
Figure 2-27

Perimeter Boundary Conditions





LEGEND

- Guelph Water Supply Wells
- Other Municipal Water Supply Wells
- Agricultural
- Commercial
- Construction
- Dewatering
- Industrial
- Institutional
- Miscellaneous
- Recreational
- Remediation
- Water Supply
- Major Roads / Highways
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Scale 1:310,000

0 2.5 5 10 15 20

Kilometres

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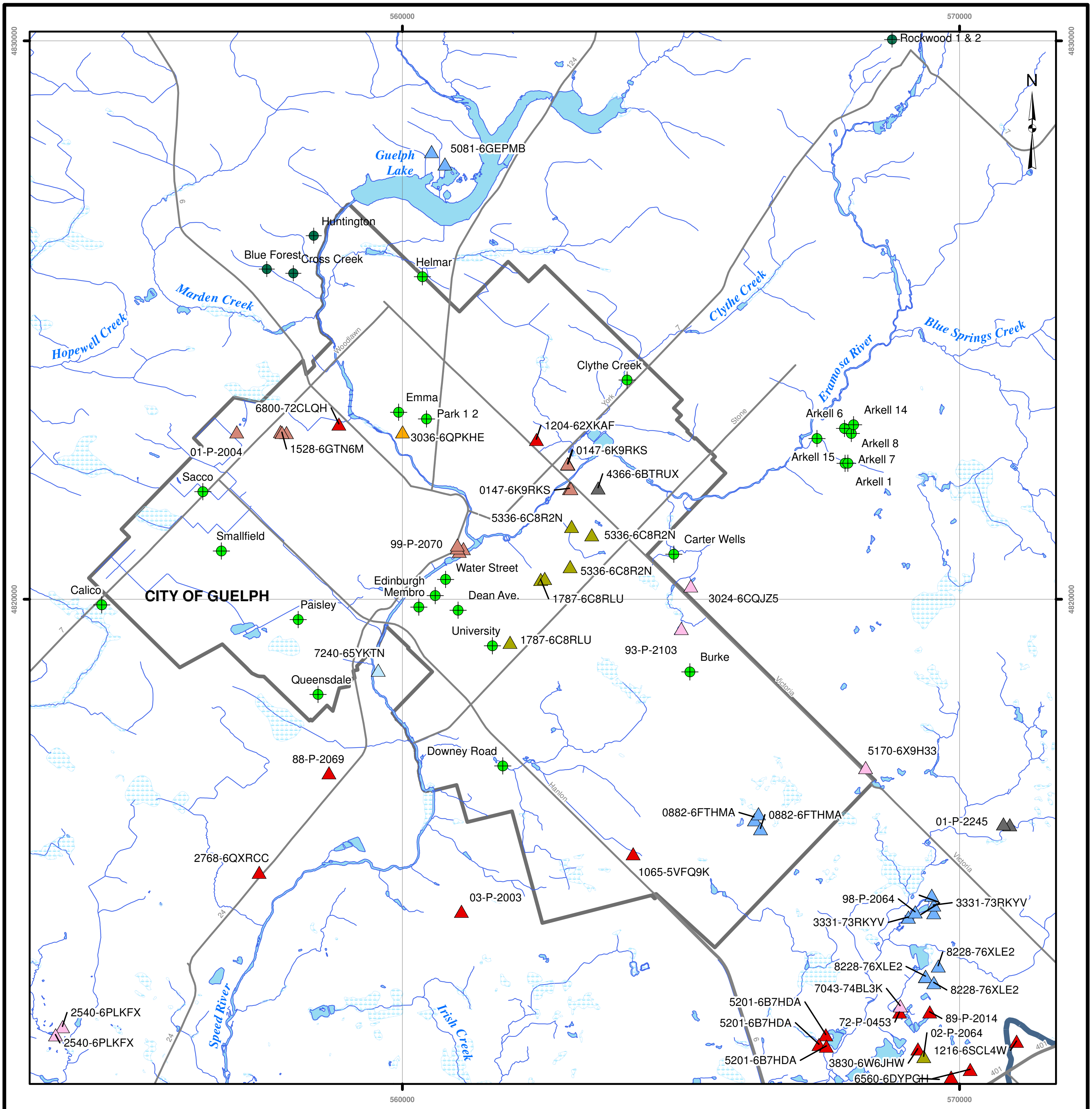
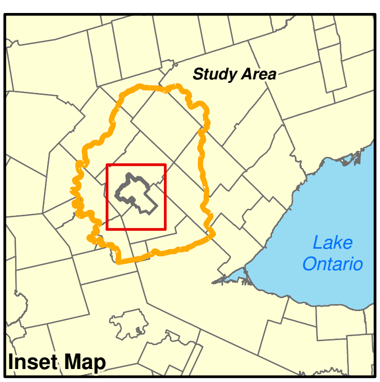
Figure 2-28

Municipal and Non-municipal Groundwater Takings

C:\Projects\2008003_Guelph_Tier3\GIS\ArcView\MXDs\ModelReport\Updates_April2010\Fig2-28_Municipal_Non-municipal_GWTakings.mxd

Project: 2008003_Guelph_Tier3





LEGEND

- Guelph Water Supply Wells
- Other Municipal Water Supply Wells
- Agricultural
- Commercial
- Construction
- Dewatering
- Industrial
- Institutional
- Miscellaneous
- Recreational
- Remediation
- Water Supply
- Major Roads / Highways
- Rivers / Streams
- Wetland Area, Permanent
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Scale 1:94,500

REFERENCES:
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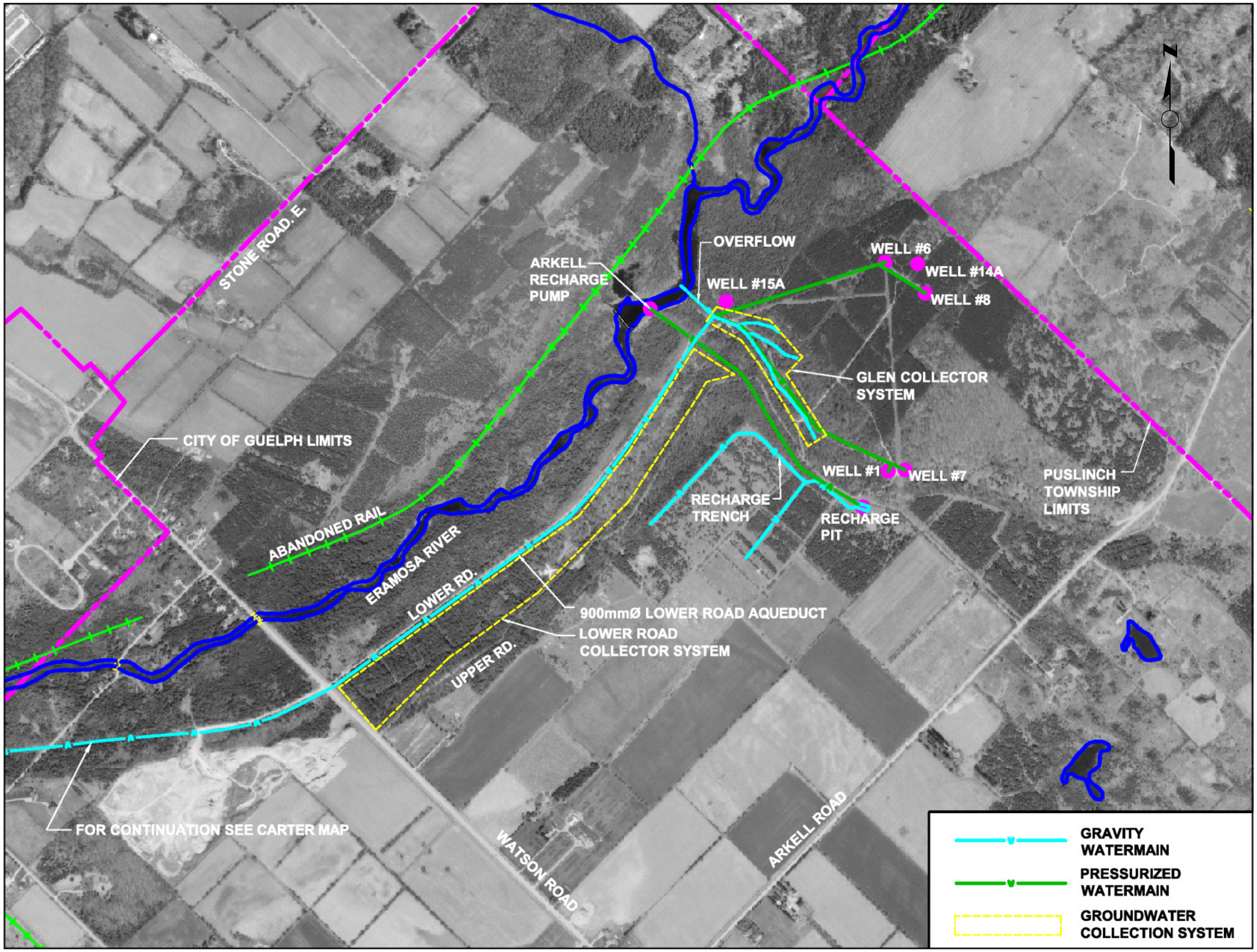
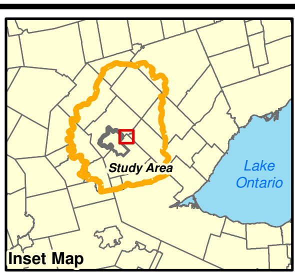
Figure 2-29

Groundwater Takings Near City of Guelph





Note: Lower Road Collector System removed from service in 2001

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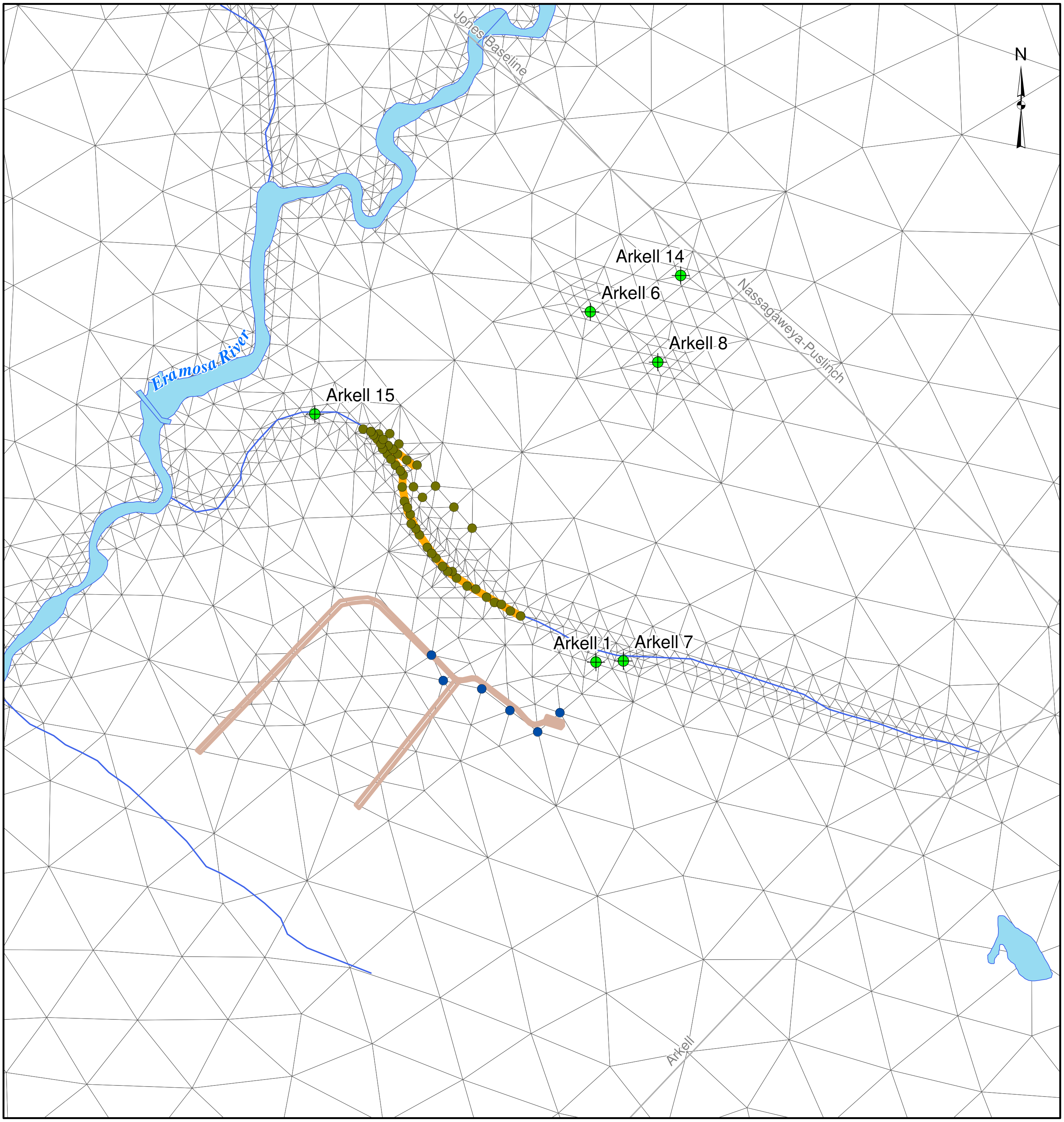
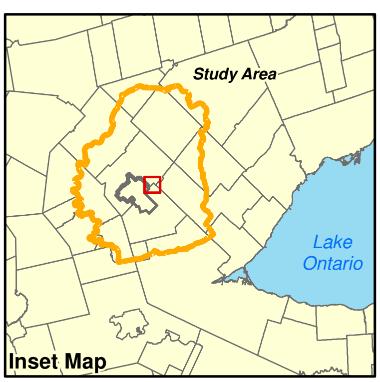
Figure 2-30

Eramosa Intake and Arkell Spring Grounds





LEGEND

- Arkell Recharge - Specified Flux Nodes
- Glen Collector - Specified Head Nodes (Slice 3)
- Guelph Water Supply Wells
- Glen Collector - Approximate Location
- Arkell Recharge Trench and Pit
- Roads (collector)
- Major Roads / Highways
- Rivers / Streams
- Open Water
- City of Guelph Boundary
- Finite Element Grid Detail

Scale 1:10,000

0 100 200 300

Metres

REFERENCES:
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Map Version: 3; Map Date: 14-Jul-11; Created By: CC

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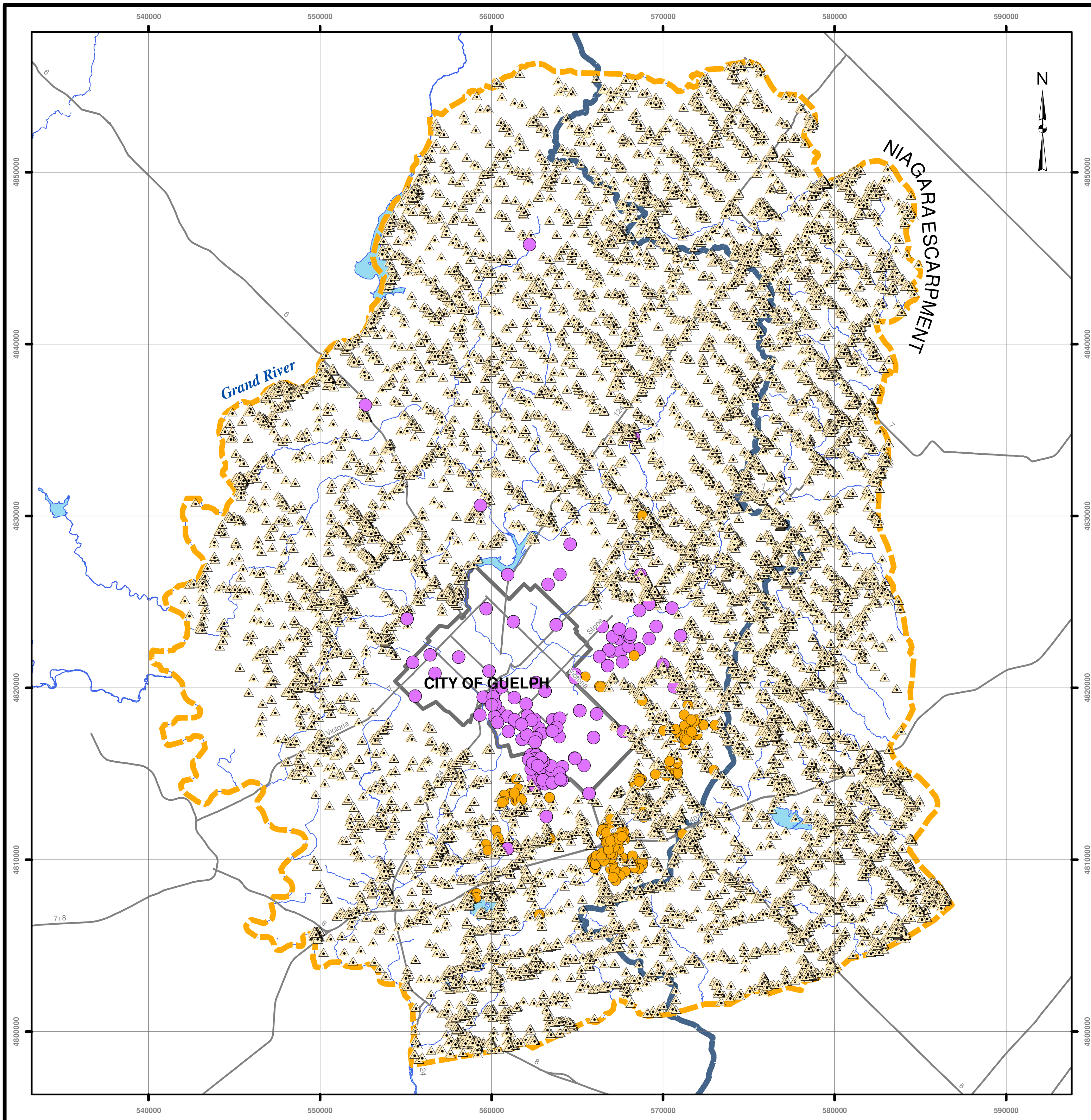
Figure 2-31

Finite Element Mesh in Arkell Spring Grounds



LEGEND

- High Quality - City of Guelph
- High Quality - Other
- MOE Water Well Records
- Major Roads / Highways
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Scale 1:310,000

0 2.5 5 10 15 20

Kilometres

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City of Guelph Making a Difference

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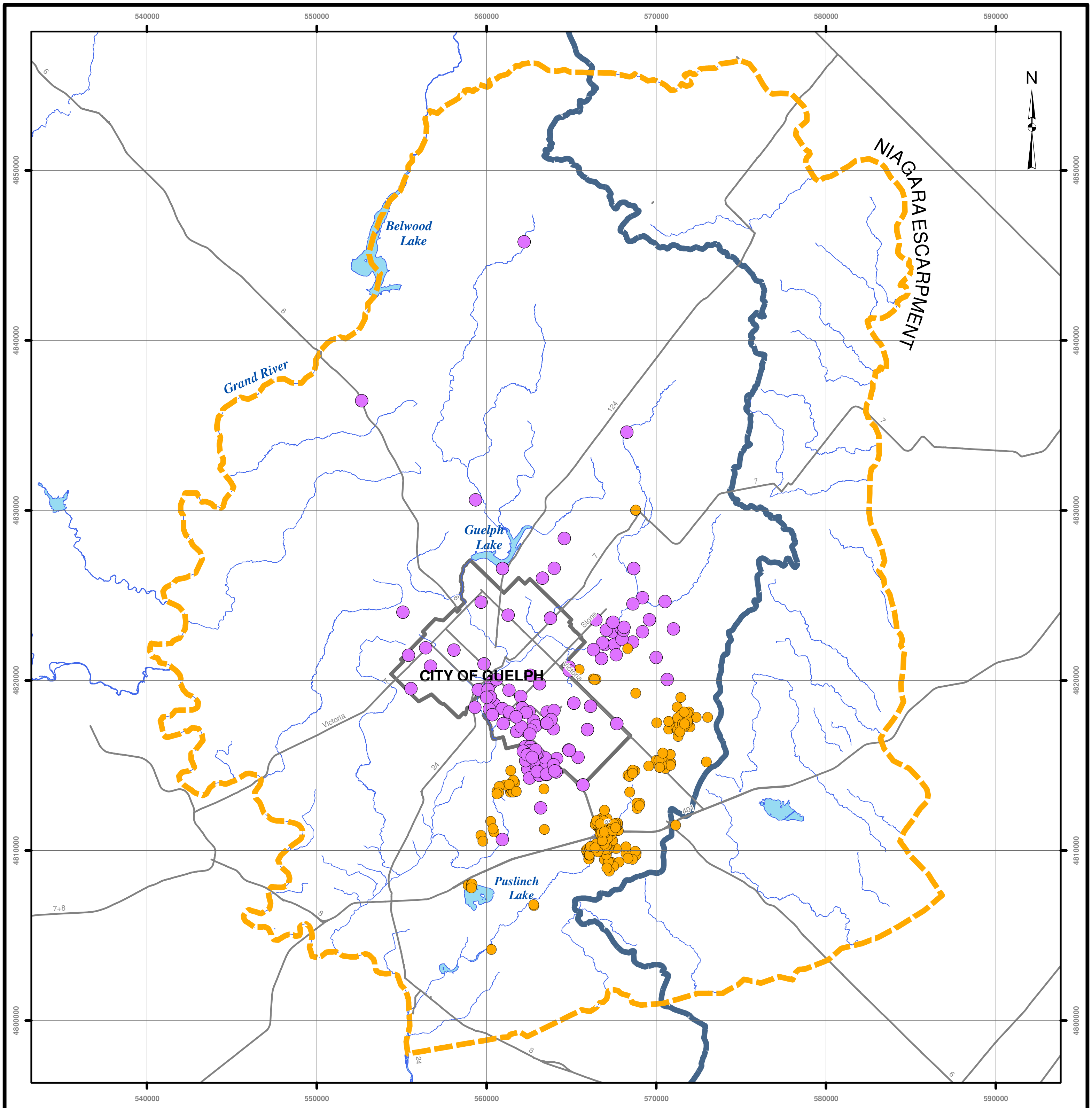
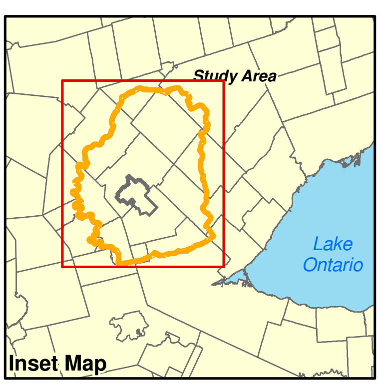
Figure 3-1

Calibration Targets





LEGEND

- High Quality - City of Guelph
- High Quality - Other
- Major Roads / Highways
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Scale 1:310,000

0 2.5 5 10 15 20

Kilometres

REFERENCES:
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Map Version: 2; Map Date: 4-May-2010; Created By: CC

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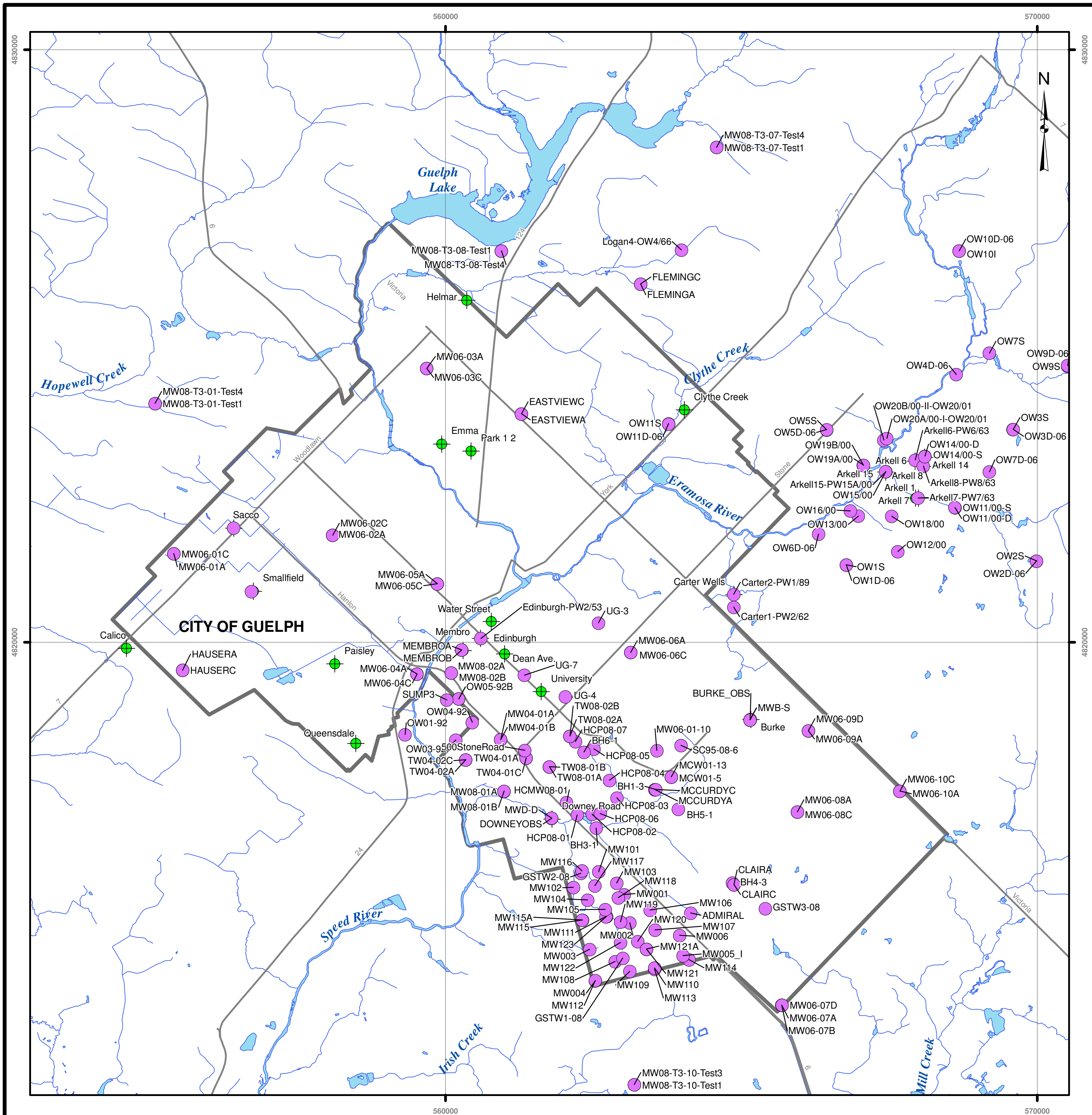
Golder Associates Ltd.

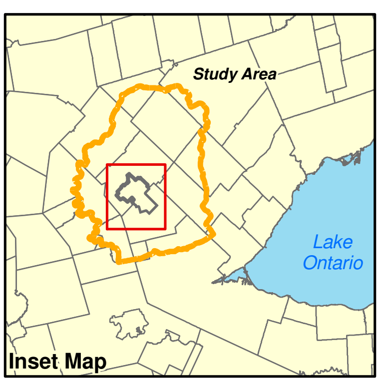
Figure 3-2

High Quality Calibration Targets (Model Scale)

C:\Projects\2008003_Guelph_Tier3\GIS\ArcView\MXDs\ModelReport\Updates_April2010\HQ_CalibrationTargets_Model.mxd

Project: 2008003_Guelph_Tier3





LEGEND

- High Quality - City of Guelph
- Guelph Water Supply Wells
- Major Roads/Highways
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Scale 1:89,142

0 0.5 1 2 3

Kilometres

REFERENCES:

Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008

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Projection: UTM Zone 17N, NAD 83

Map Version: 2; Map Date: 4-May-2010; Created By: CC

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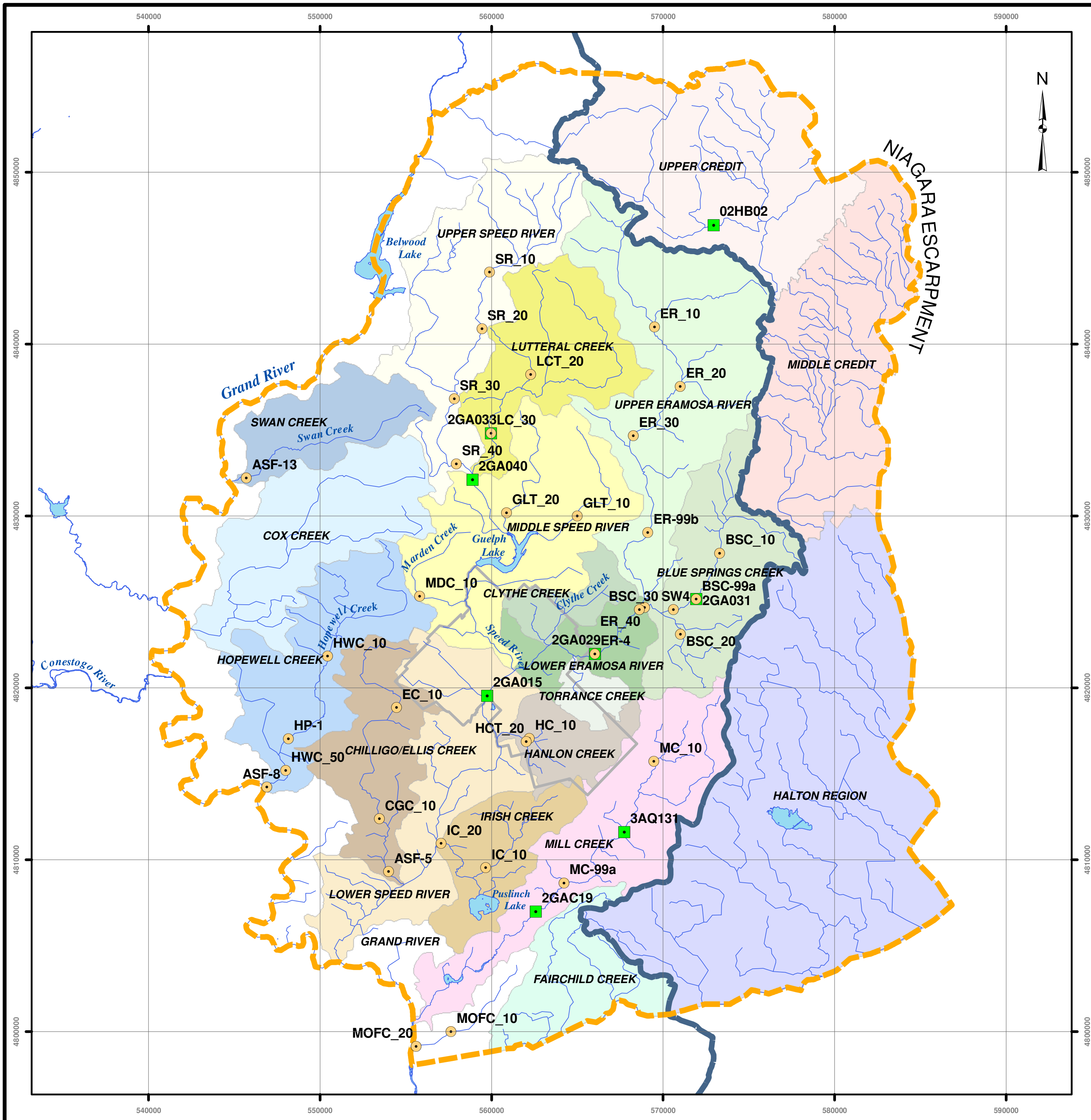
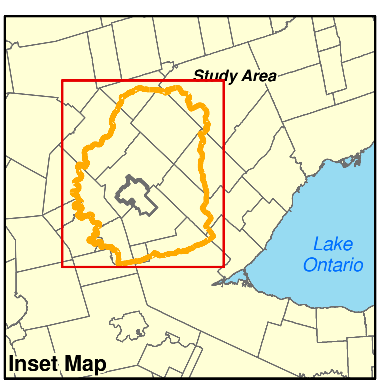
Figure 3-3

High Quality Calibration Targets (City of Guelph)





LEGEND

- Spotflow Locations
- Gauge Locations
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary

Scale 1:310,000

0 2.5 5 10 15 20

Kilometres

REFERENCES:
Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008
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Tier Three Local Area Risk Assessment

City of Guelph
Making a Difference

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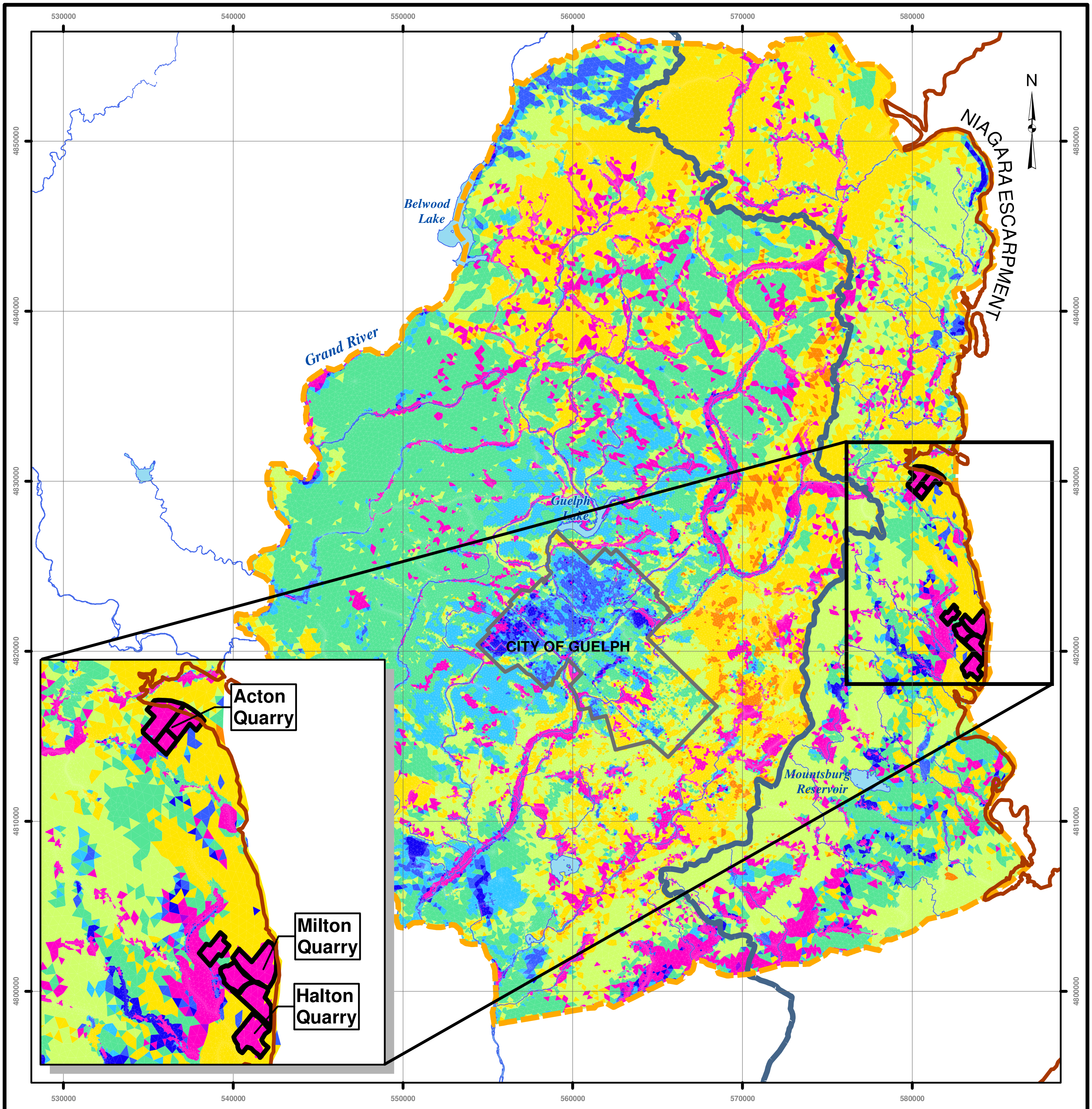
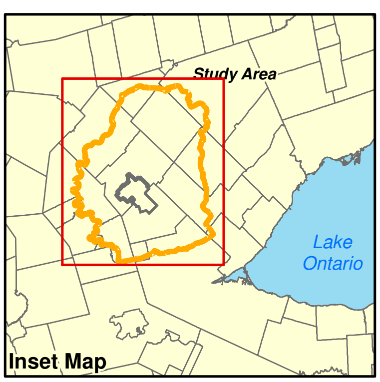
Figure 3-4

Baseflow Calibration Locations





LEGEND

- Niagara Escarpment
- Major Roads / Highways
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary
- Quarries

Average Annual Groundwater Recharge (mm/yr)

- < 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200
- 200 - 300
- 300 - 400
- 400 - 500
- > 500

Scale 1:310,000

0 2.5 5 10 15 20

Kilometres

REFERENCES:
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Map Version: 3; Map Date: 19-Jul-11; Created By: CC

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Figure 3-5

Niagara Escarpment Quarry Locations with Recharge

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City of Guelph
Making a Difference

LEGEND

- Watercourse
- Waterbody
- Wetland
- Guelph City Limit

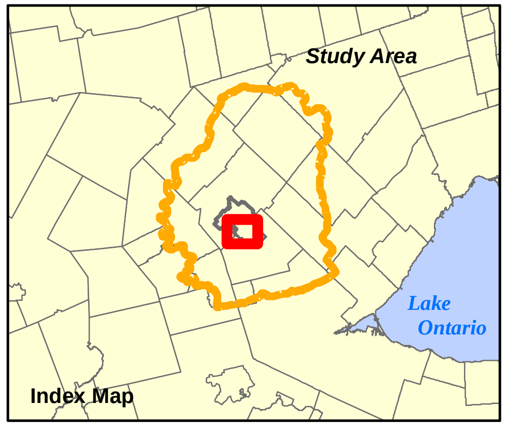
Municipal Test Well Locations

- Municipal Test Well
- Municipal Production Well
- University of Guelph Production Wells
- Municipal Monitoring Well
- Guelph-Lime Quarry Monitoring Well
- Hanlon Creek Watershed Study Monitoring Wells
- Hanlon Creek Proposed Business Park Monitoring Well
- Shallow Overburden Piezometer
- Surface Water Staff Gauge
- Surface Water Flow Monitoring Station

Scale 1:25,000

0.5 0 0.5 1

Kilometers



REFERENCES:

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Projection: UTM Zone 17N, NAD 83
Map Version: 1; Map Date: 03-May-03; Created By: KD

Produced by Aquaresource Inc. and Golder Associates

Figure 3-6 *DRAFT*

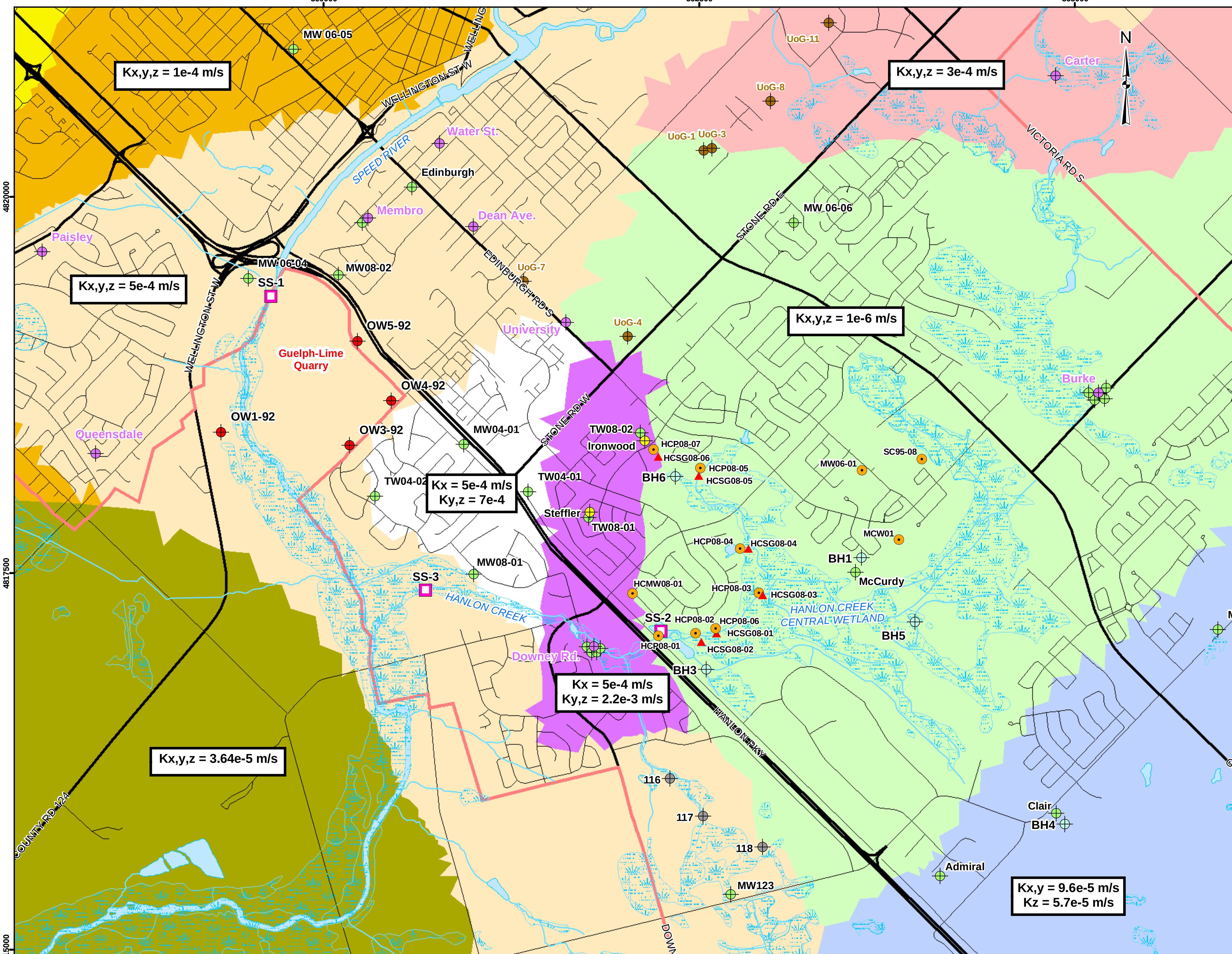
Southwest Quadrant - Observation Well Locations

G:\Projects\2008\08-1112-0021_Guelph_TierIII\GIS\MXDs\Draft\Modelling_Report\Instrumentation.mxd

Project: 2008003_Guelph_Tier3

Tier Three Local Area Risk Assessment

Guelph
Making a Difference



LEGEND

- Watercourse
- Waterbody
- Wetland
- Guelph City Limit

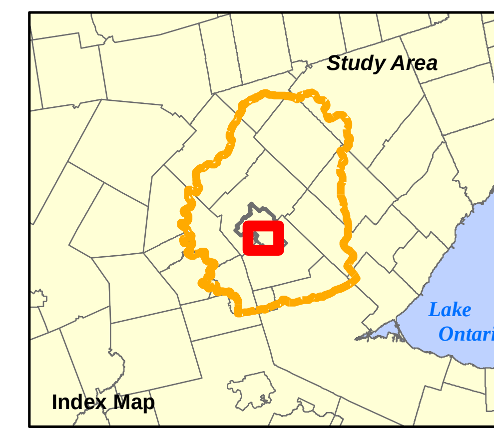
Municipal Test Well Locations

- Municipal Test Well
- Municipal Production Well
- University of Guelph Production Wells
- Municipal Monitoring Well
- Guelph-Lime Quarry Monitoring Well
- Hanlon Creek Watershed Study Monitoring Wells
- Hanlon Creek Proposed Business Park Monitoring Well
- Shallow Overburden Piezometer
- Surface Water Staff Gauge
- Surface Water Flow Monitoring Station

Scale 1:25,000

0.5 0 0.5 1

Kilometers



REFERENCES:

Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008
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Projection: UTM Zone 17N, NAD 83
Map Version: 1; Map Date: 03-May-03; Created By: KD

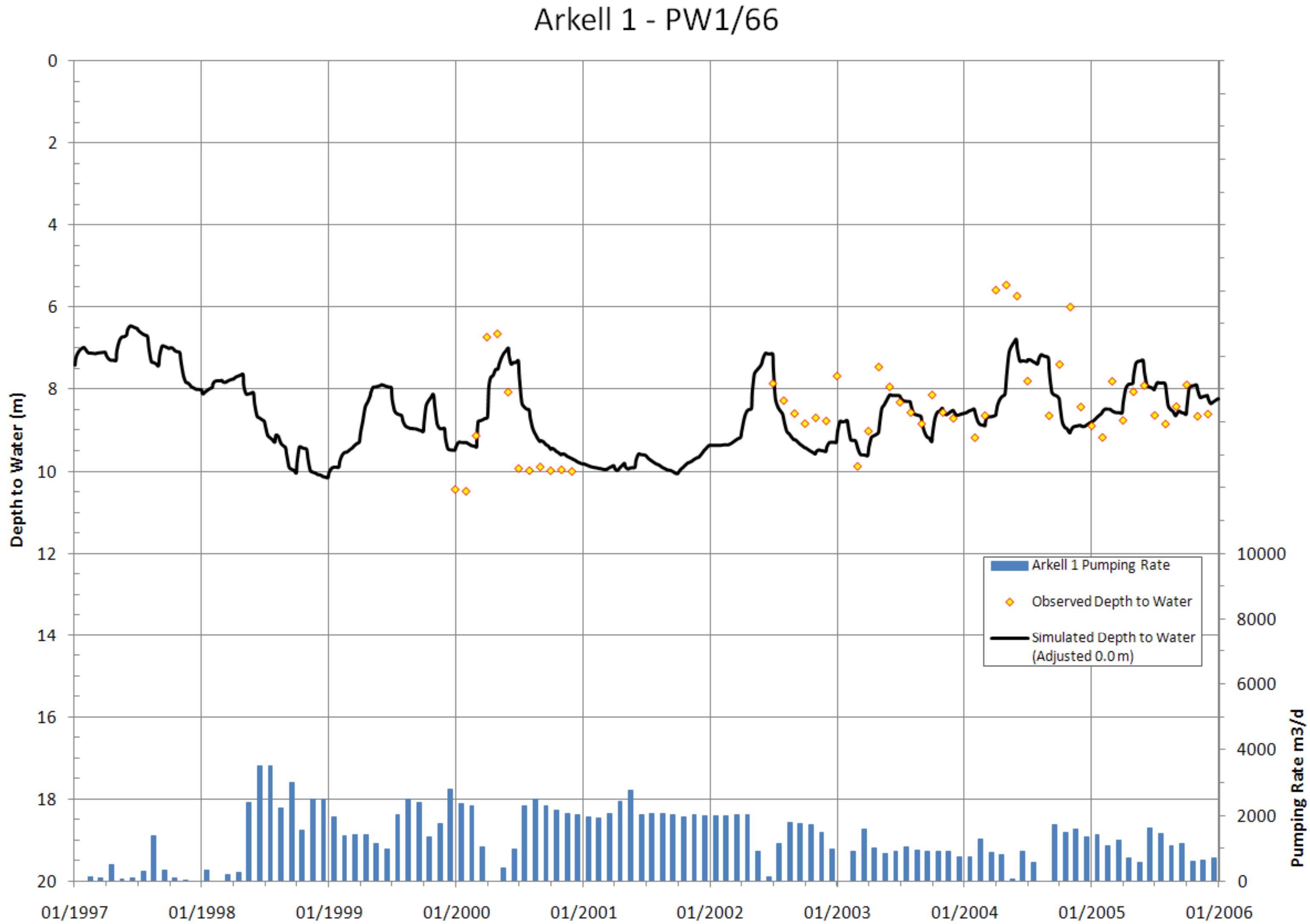
Produced by
Aquaresource Inc. and
Golder Associates

Figure 3-7 *DRAFT*

Southwest Quadrant - Transient Calibration Results

G:\Projects\2007\07-1112-0059_City_of_Guelph\GIS\MXDs\Draft\Phase_1000\Report\K_Values.mxd

Project: 2008003_Guelph_Tier3



Tier Three Local Area Risk Assessment

Produced by Aquaresource Inc. and Golder Associates Ltd.

Figure 3-8a

Transient Verification Results – Arkell 1

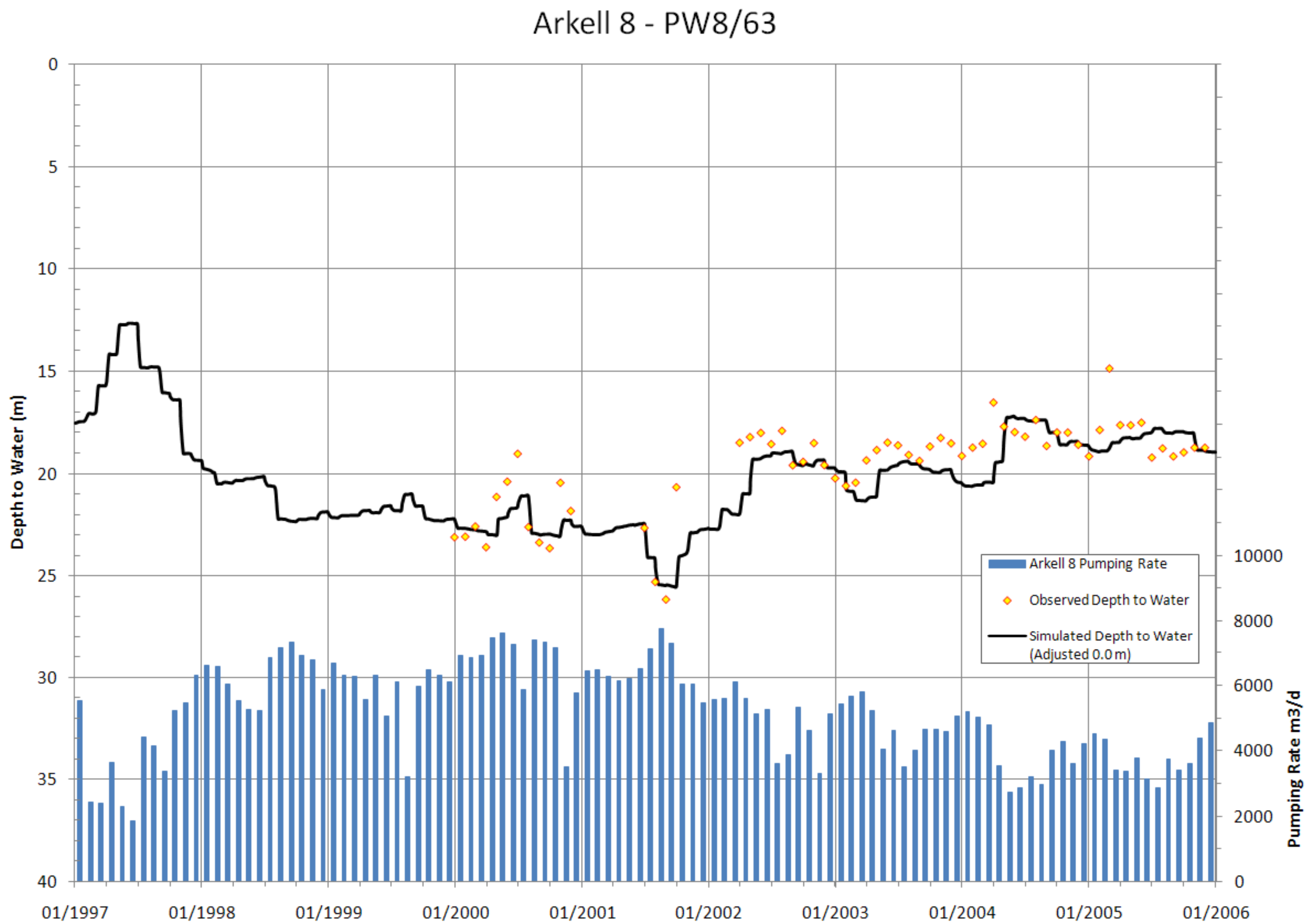


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Figure 3-8b
Transient Verification Results – Arkell 8

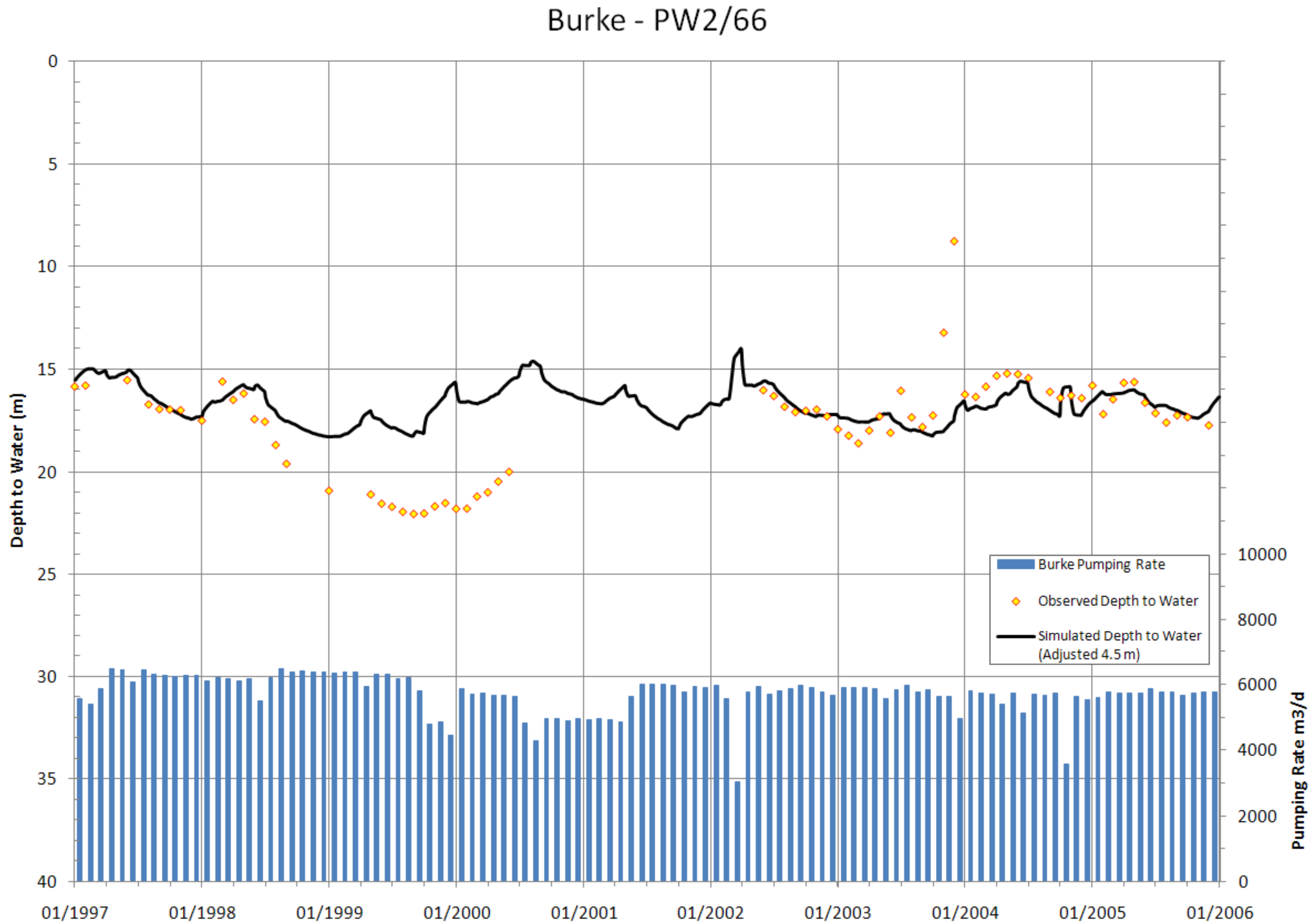

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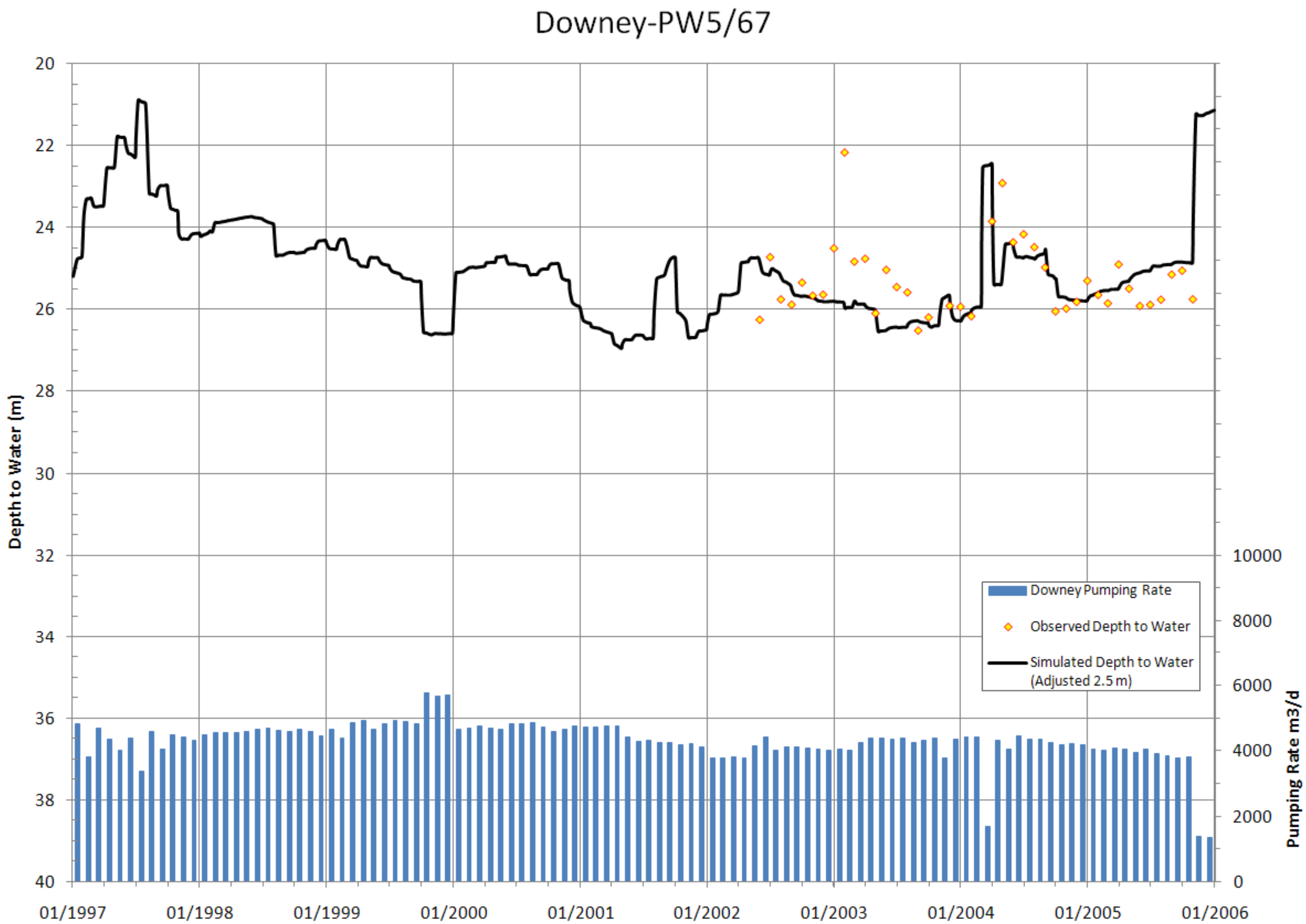
Figure 3-8c
Transient Verification Results – Burke



Tier Three Local Area Risk Assessment

Guelph

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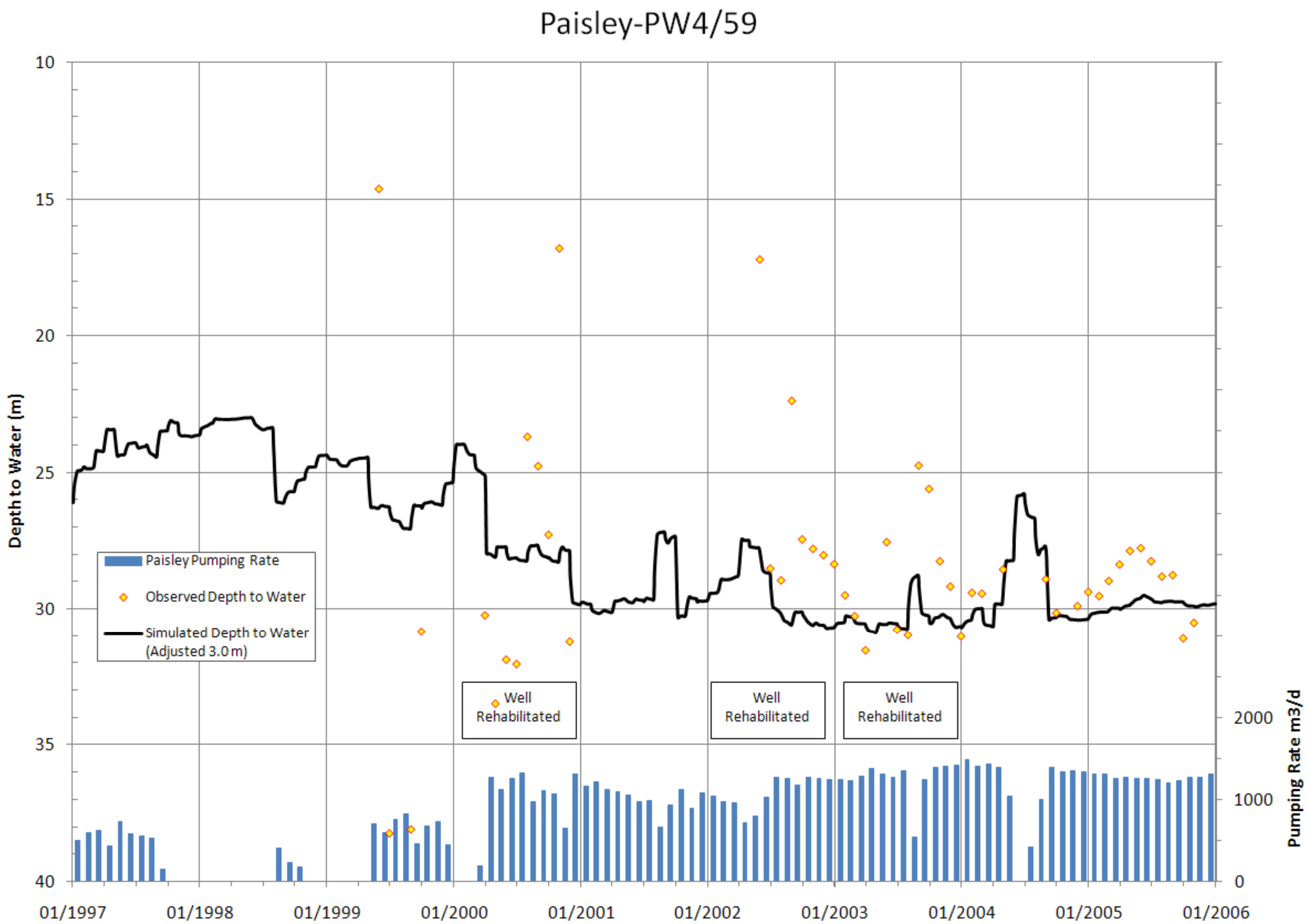
Figure 3-8d
Transient Verification Results – Downey



Tier Three Local Area Risk Assessment

Guelph

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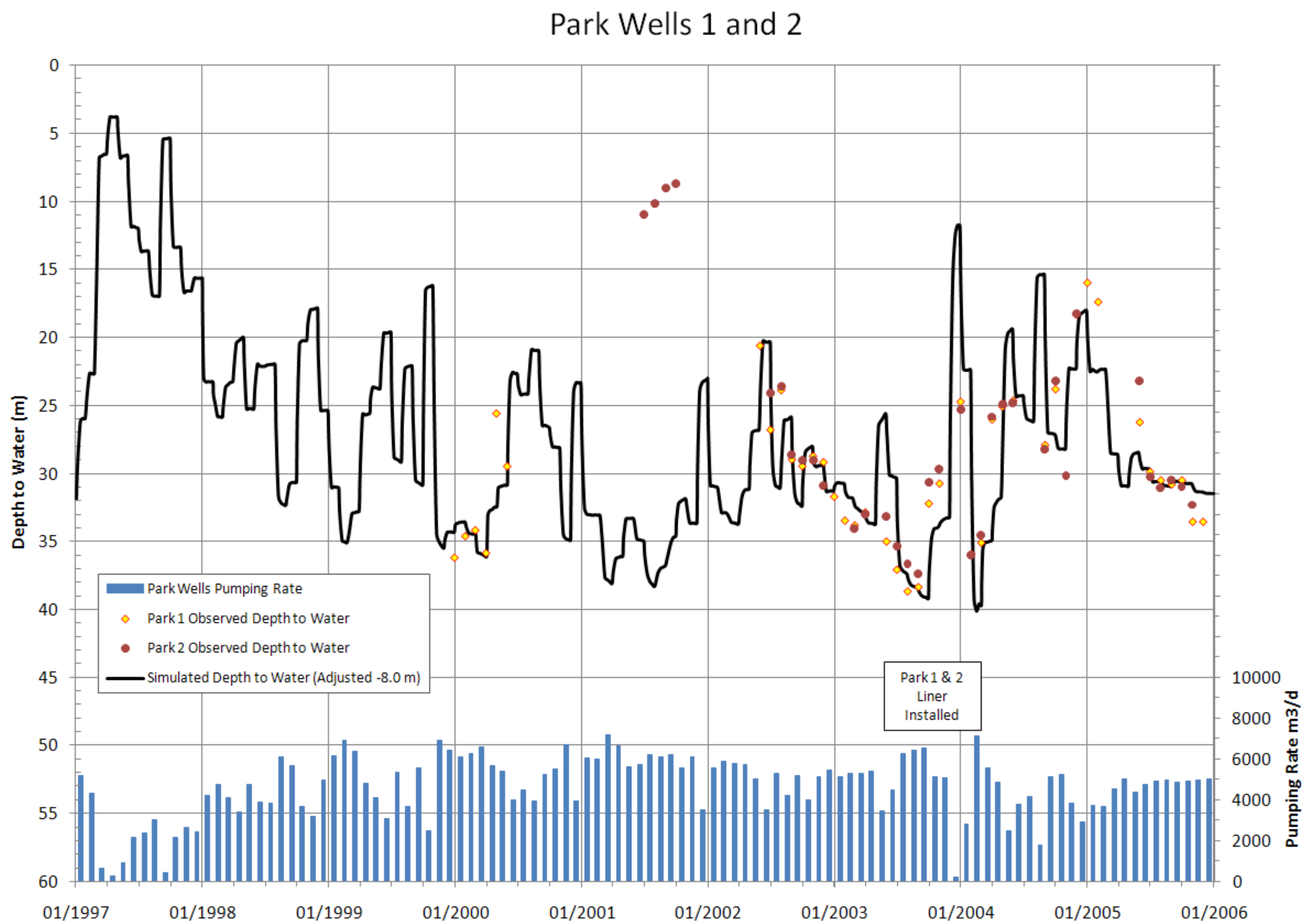
Figure 3-8e

Transient Verification Results – Paisley

Project: 2008003_Guelph_Tier3



Tier Three Local Area Risk Assessment

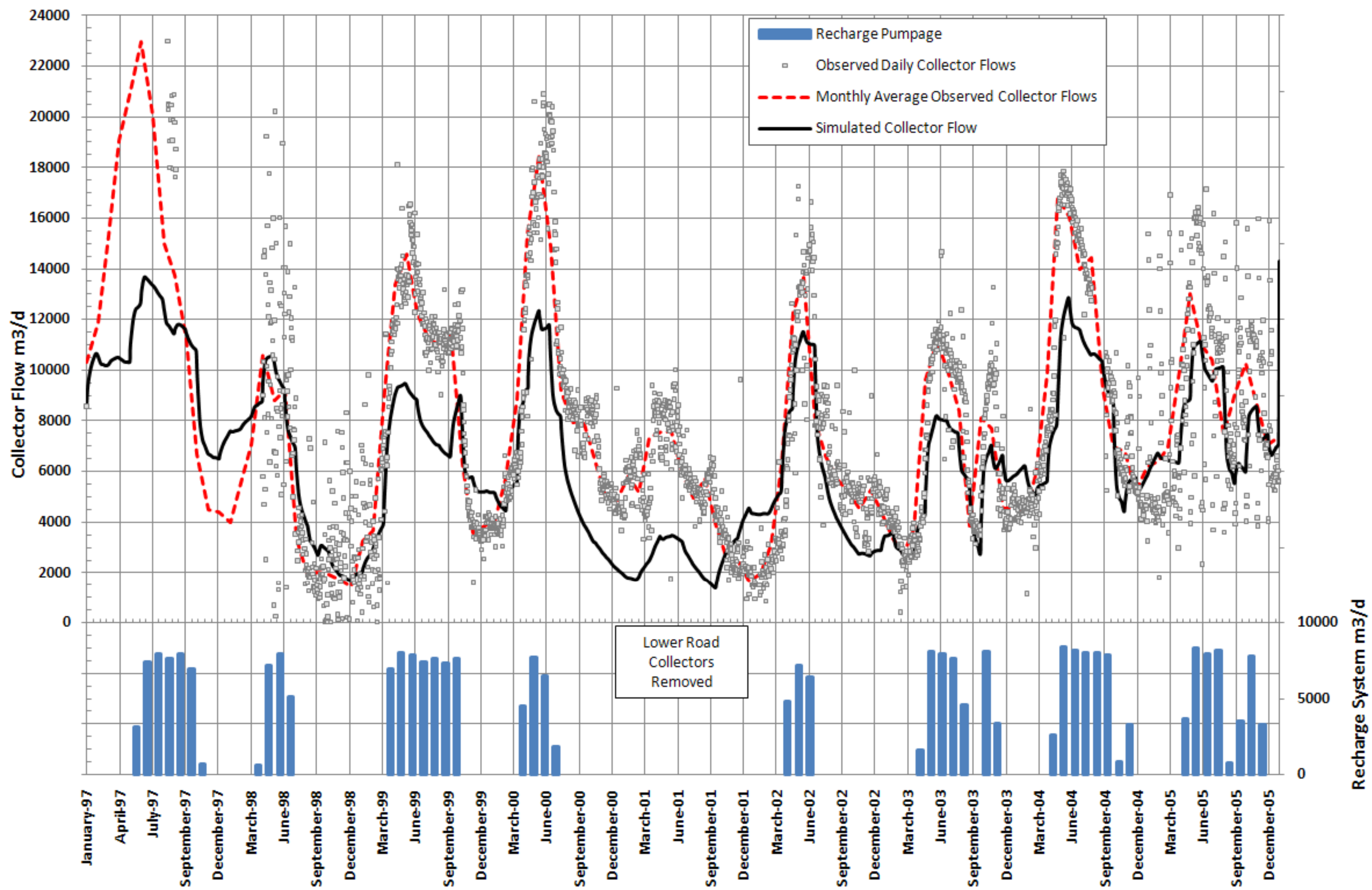
Guelph

Produced by Aquaresource Inc. and Golder Associates Ltd.

Figure 3-8f

Transient Verification Results – Park Wells

Arkell Glen Collector Flows - Simulated vs. Observed



Tier Three Local Area Risk Assessment

Guelph

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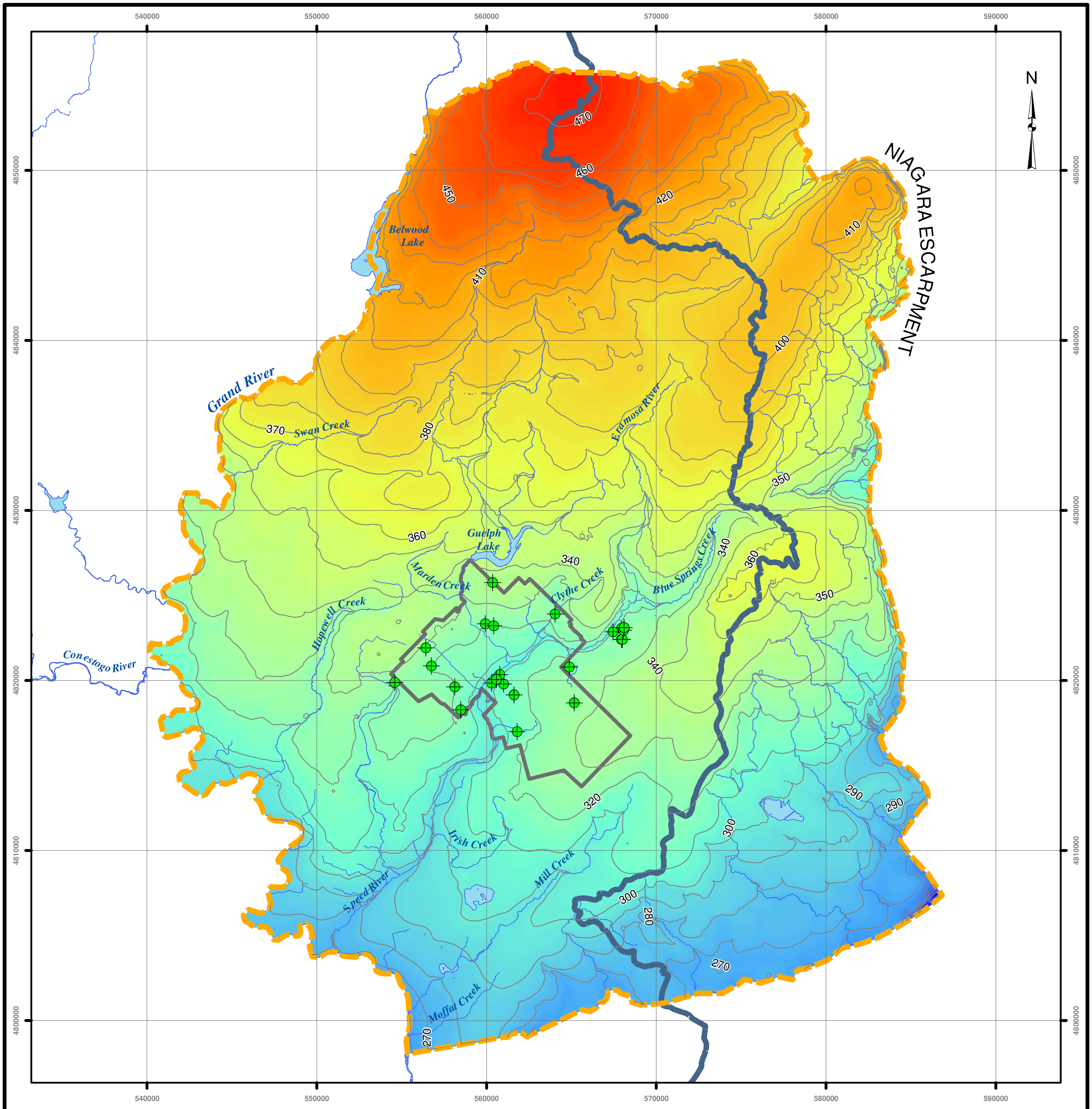
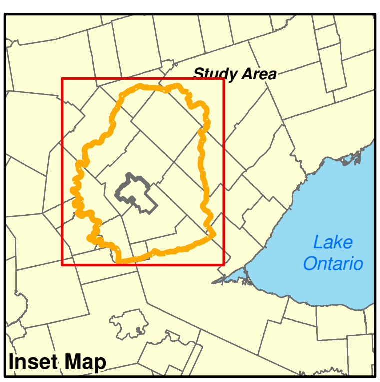
Figure 3-9

Transient Verification Results – Glen Collector Flows





LEGEND

- Guelph Water Supply Wells
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary
- Water Table Contour Interval 10m

Water Table (masl)

High: 475

Low: 200

Scale 1:310,000

0 2.5 5 10 15

Kilometres

Tier Three Local Area Risk Assessment

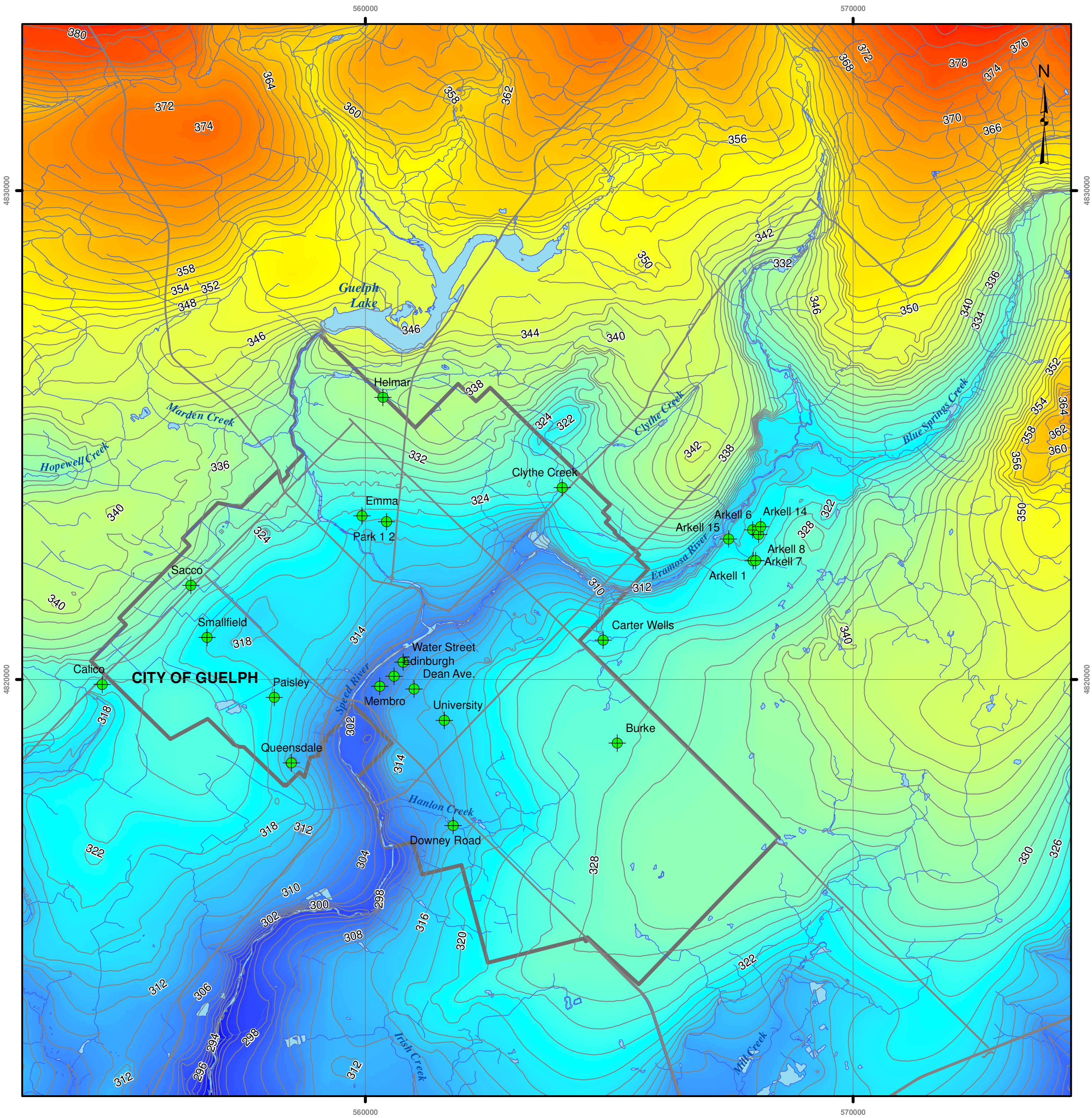
Produced by Aquaresource Inc. and Golder Associates Ltd.

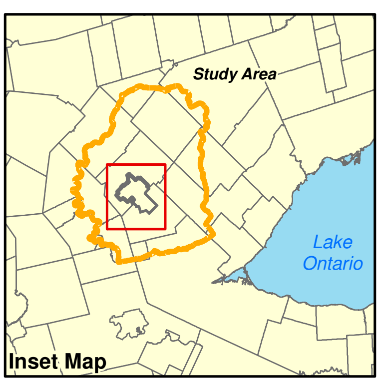
Figure 3-10

Model Predicted Water Table Surface (Overburden)

REFERENCES:
Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008

Projection: UTM Zone 17N, NAD 83
Map Version: 3; Map Date: 28-Jul-11; Created By: CC





LEGEND

Guelph Water Supply Wells

Rivers / Streams

Open Water

City of Guelph Boundary

Water Table Contour Interval 2m

Water Table (masl)

High : 384

Low : 290

Scale 1:110,000

0 2.5 5

Kilometres

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Map Version: 3; Map Date: 28-Jul-11; Created By: CC

Tier Three Local Area Risk Assessment

City of Guelph Making a Difference

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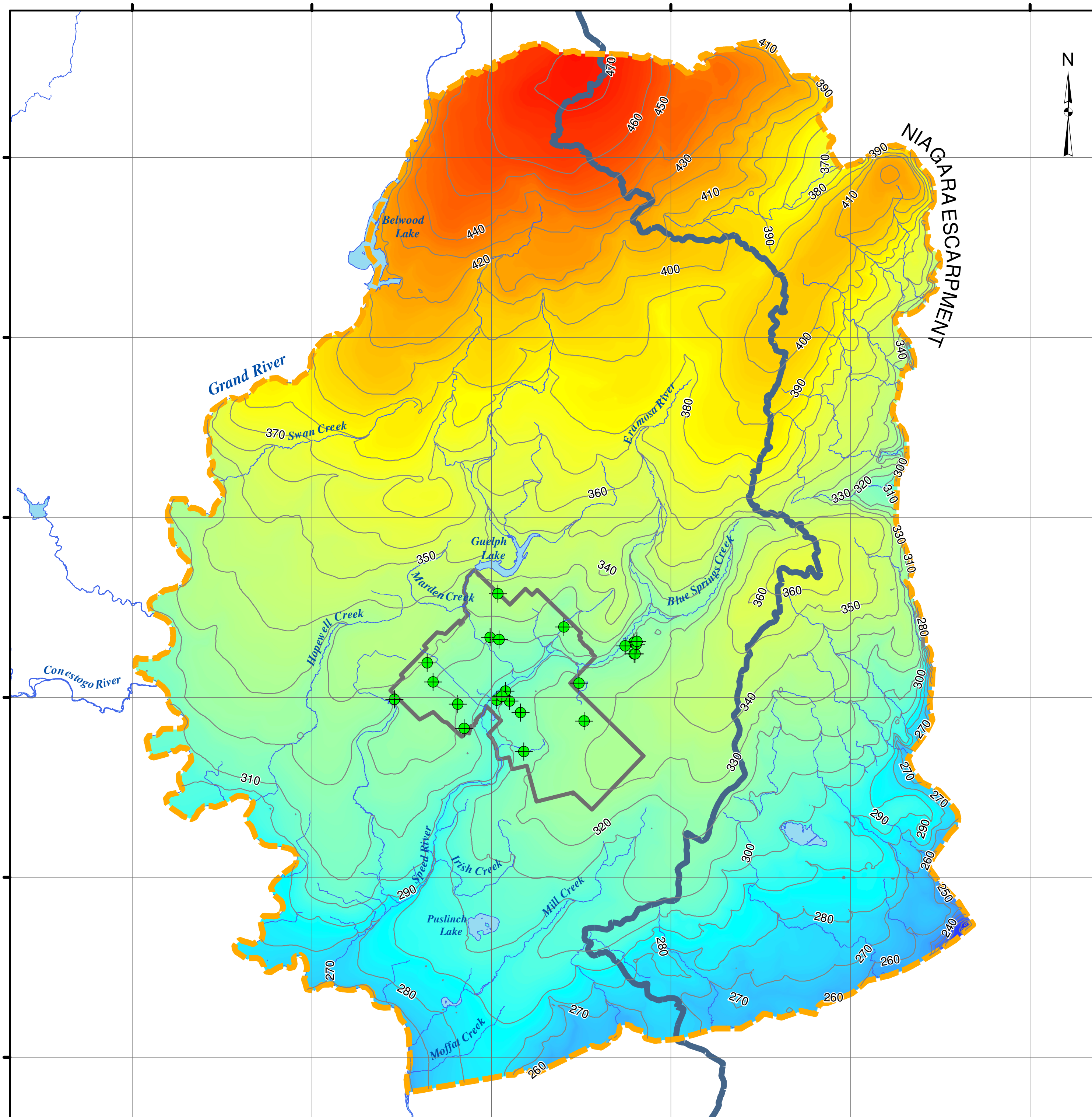
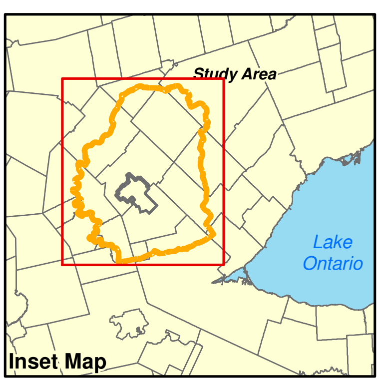
Figure 3-11

Model Predicted Water Table Surface (Overburden) - City of Guelph





LEGEND

- Guelph Water Supply Wells
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary
- Potentiometric Surface Contour Interval 10m

Potentiometric Surface (m)

High : 475

Low : 195

Scale 1:310,000

0 2.5 5 10 15

Kilometres

REFERENCES:

Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008

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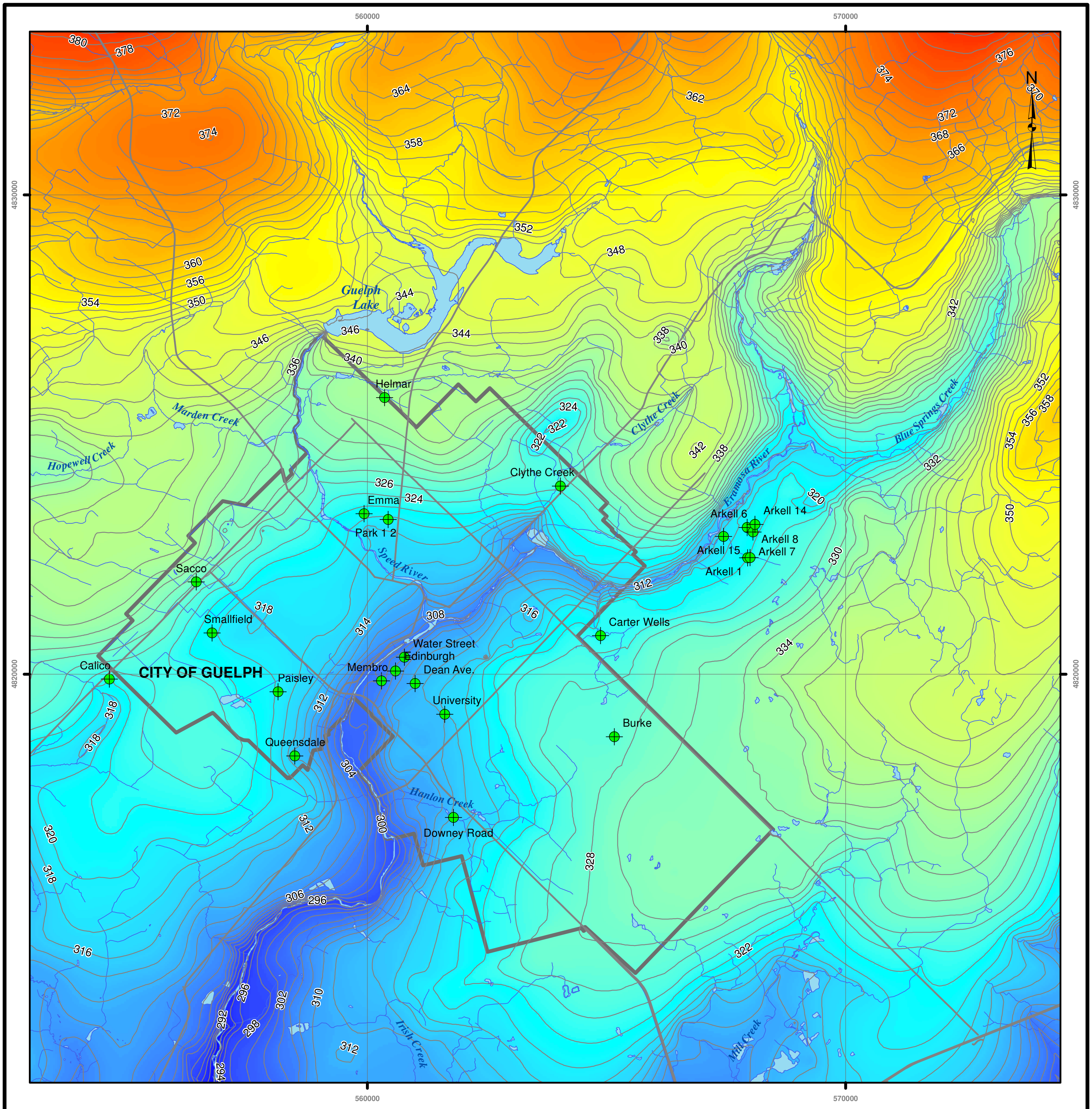
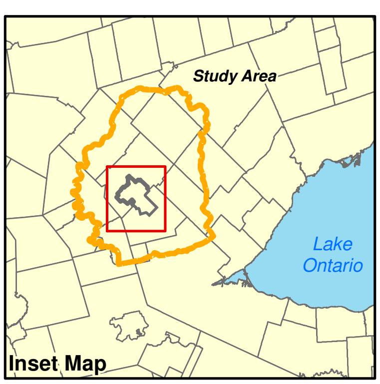
Figure 3-12

Model Predicted Slice 5 (Contact Zone) Potentiometric Surface





LEGEND

- Guelph Water Supply Wells
- Rivers / Streams
- Open Water
- City of Guelph Boundary
- Potentiometric Surface Contour Interval 2m

Potentiometric Surface (m)

High : 385

Low : 290

Scale 1:110,000

0 2.5 5

Kilometres

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Tier Three Local Area Risk Assessment

City of Guelph
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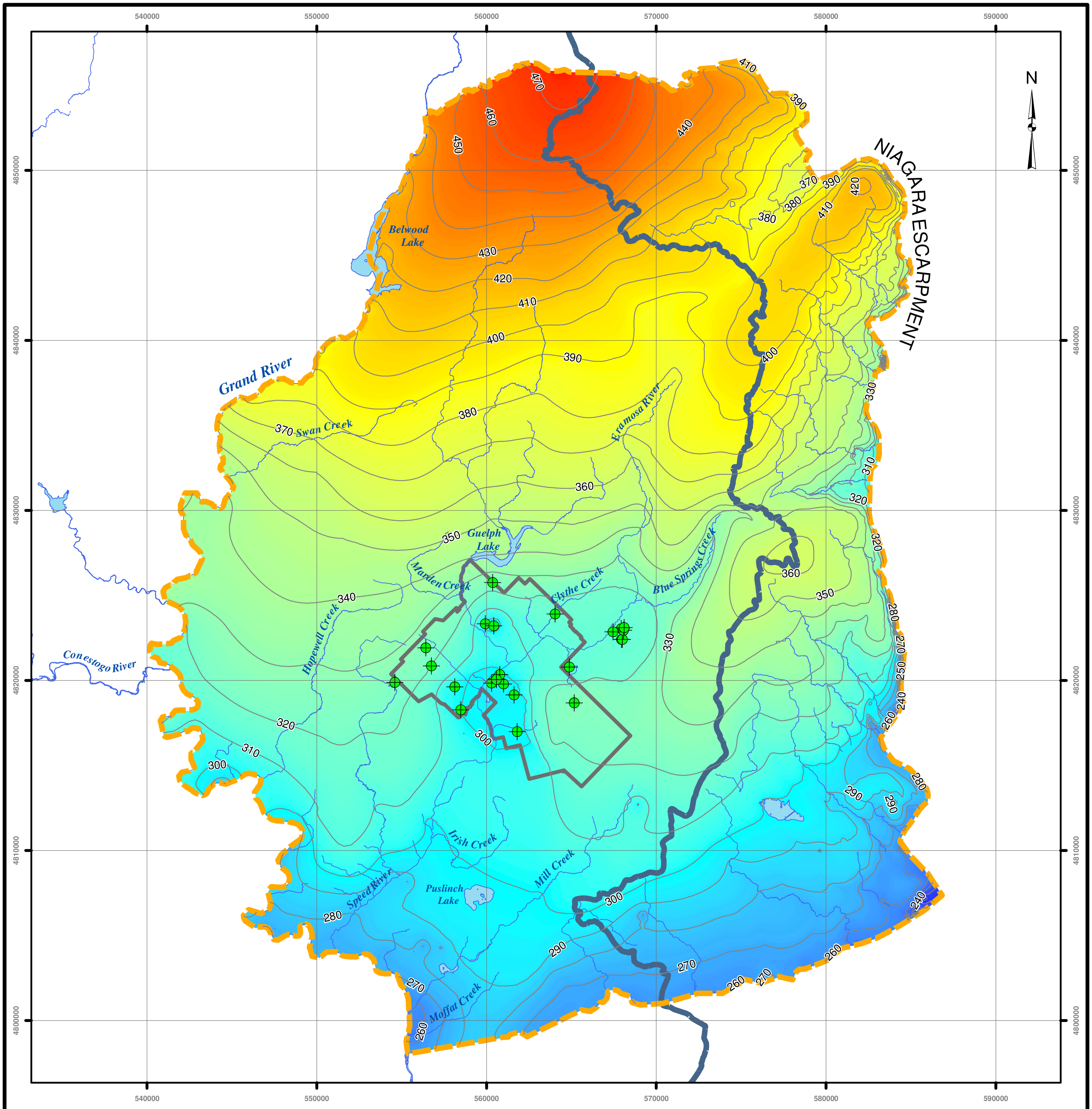
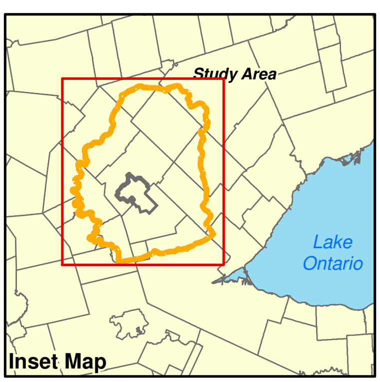
Figure 3-13

Model Predicted Slice 5 (Contact Zone) Potentiometric Surface - City of Guelph





LEGEND

- Guelph Water Supply Wells
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary
- Potentiometric Surface Contour Interval 10m

Potentiometric Surface (m)

High : 480

Low : 210

Scale 1:310,000

0 2.5 5 10 15

Kilometres

REFERENCES:

Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008

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Map Version: 3; Map Date: 28-Jul-11; Created By: CC

Tier Three Local Area Risk Assessment

City of Guelph — Making a Difference

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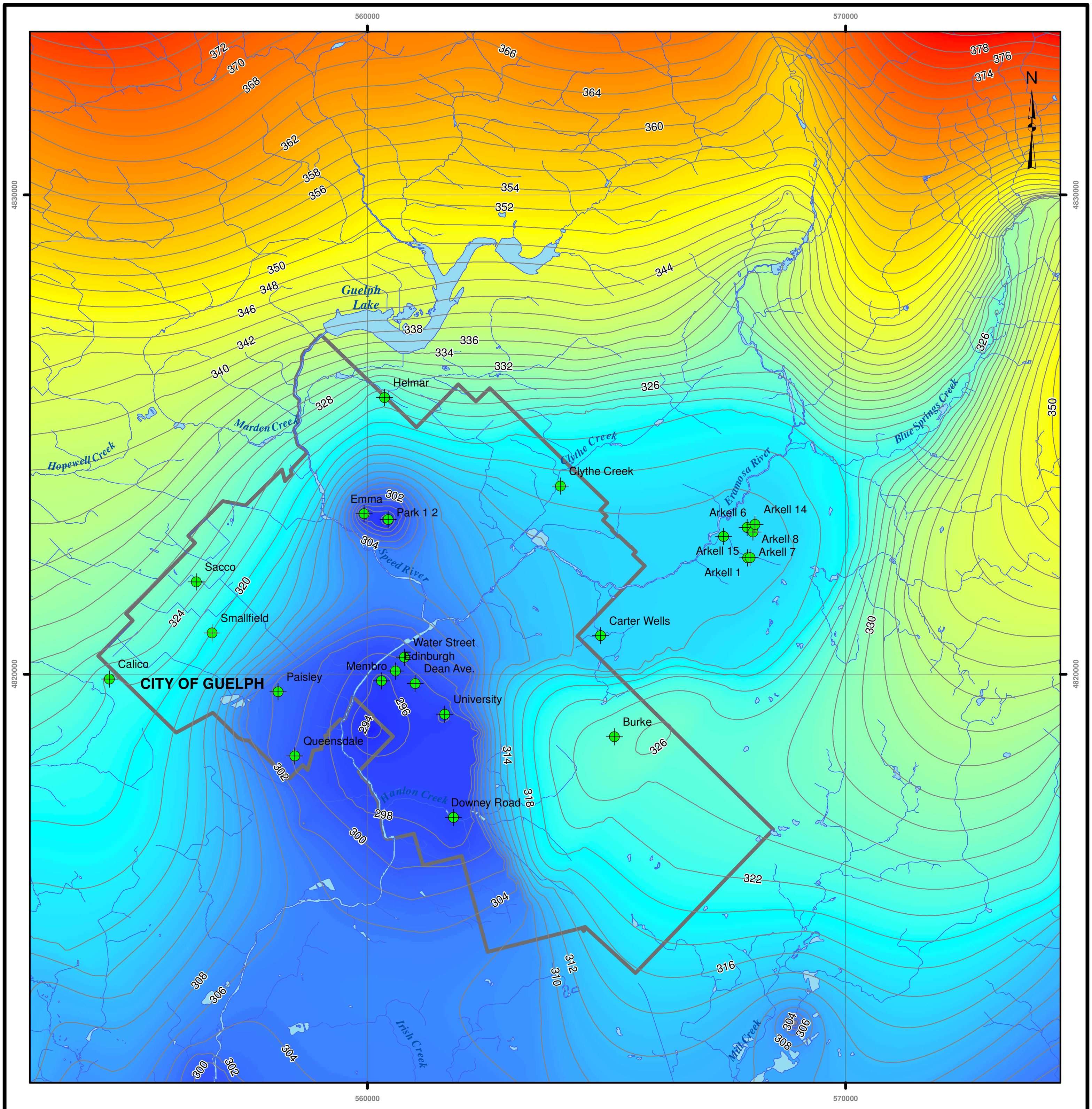
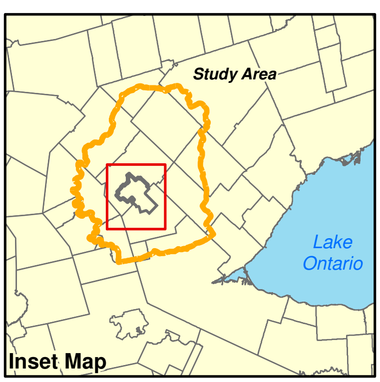
Figure 3-14

Model Predicted Slice 12 (Gasport) Potentiometric Surface





LEGEND

Guelph Water Supply Wells

Rivers / Streams

Open Water

City of Guelph Boundary

Potentiometric Surface Contour Interval 2m

Potentiometric Surface (m)

High : 380

Low : 290

Scale 1:110,000

0 2.5 5

Kilometres

REFERENCES:

Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008

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Projection: UTM Zone 17N, NAD 83

Map Version: 3; Map Date: 28-Jul-11; Created By: CC

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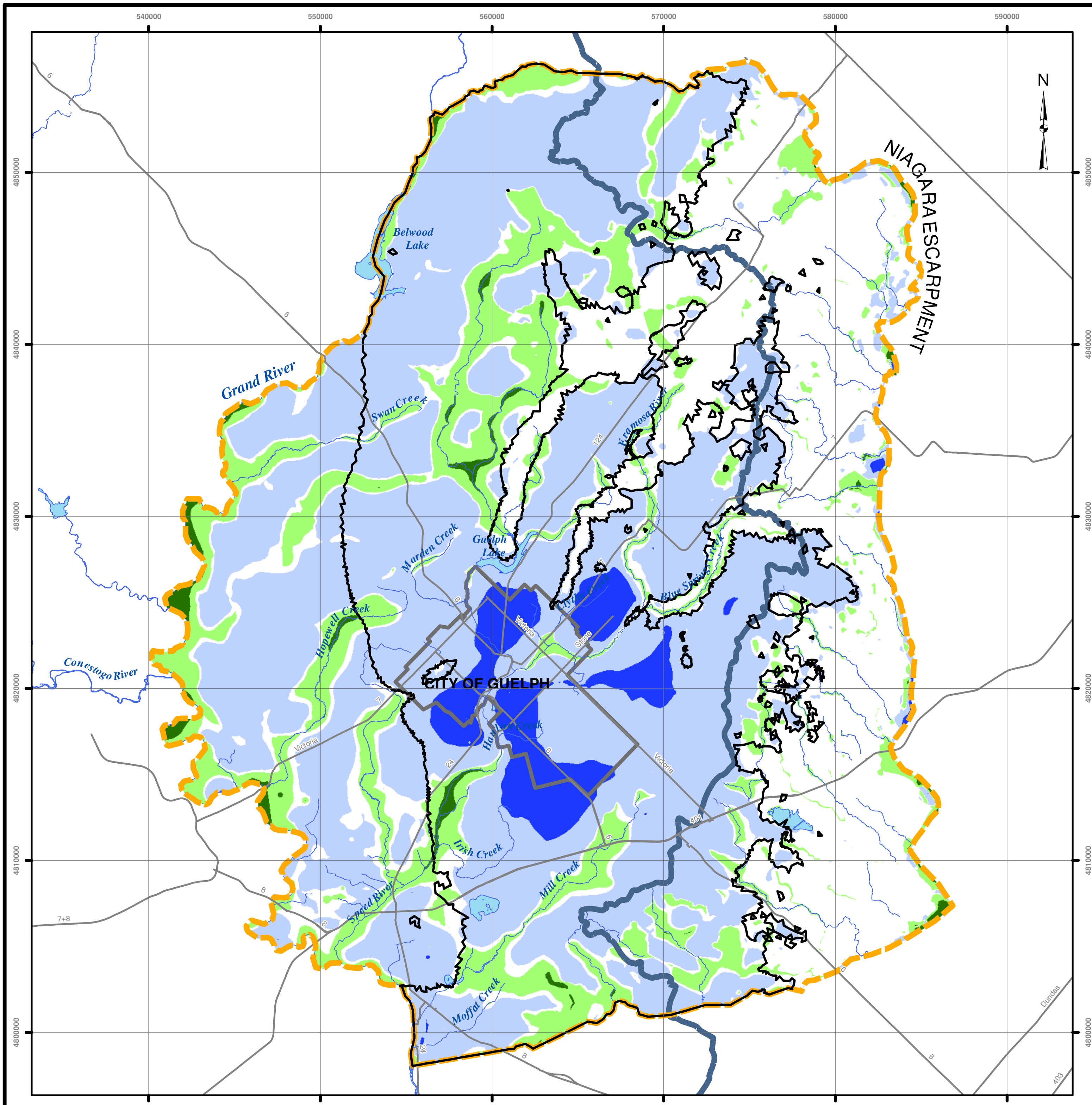
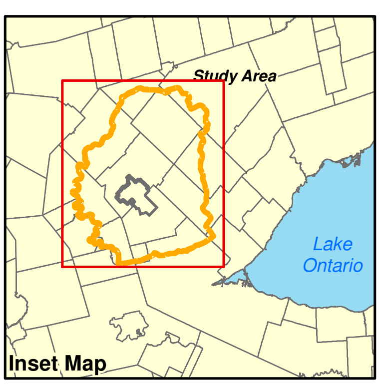
Figure 3-15

Model Predicted Slice 12 (Gasport) Potentiometric Surface - City of Guelph





LEGEND

- Major Roads / Highways
- Rivers / Streams
- Model Boundary
- Open Water
- Grand River Watershed Boundary
- City of Guelph Boundary
- Vinemount Formation

Vertical Gradient

- Strong Downwards Gradient
- Downwards Gradient
- 0
- Upwards Gradient
- Strong Upwards Gradient

Scale 1:310,000

0 2.5 5 10 15

Kilometres

REFERENCES:
Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008
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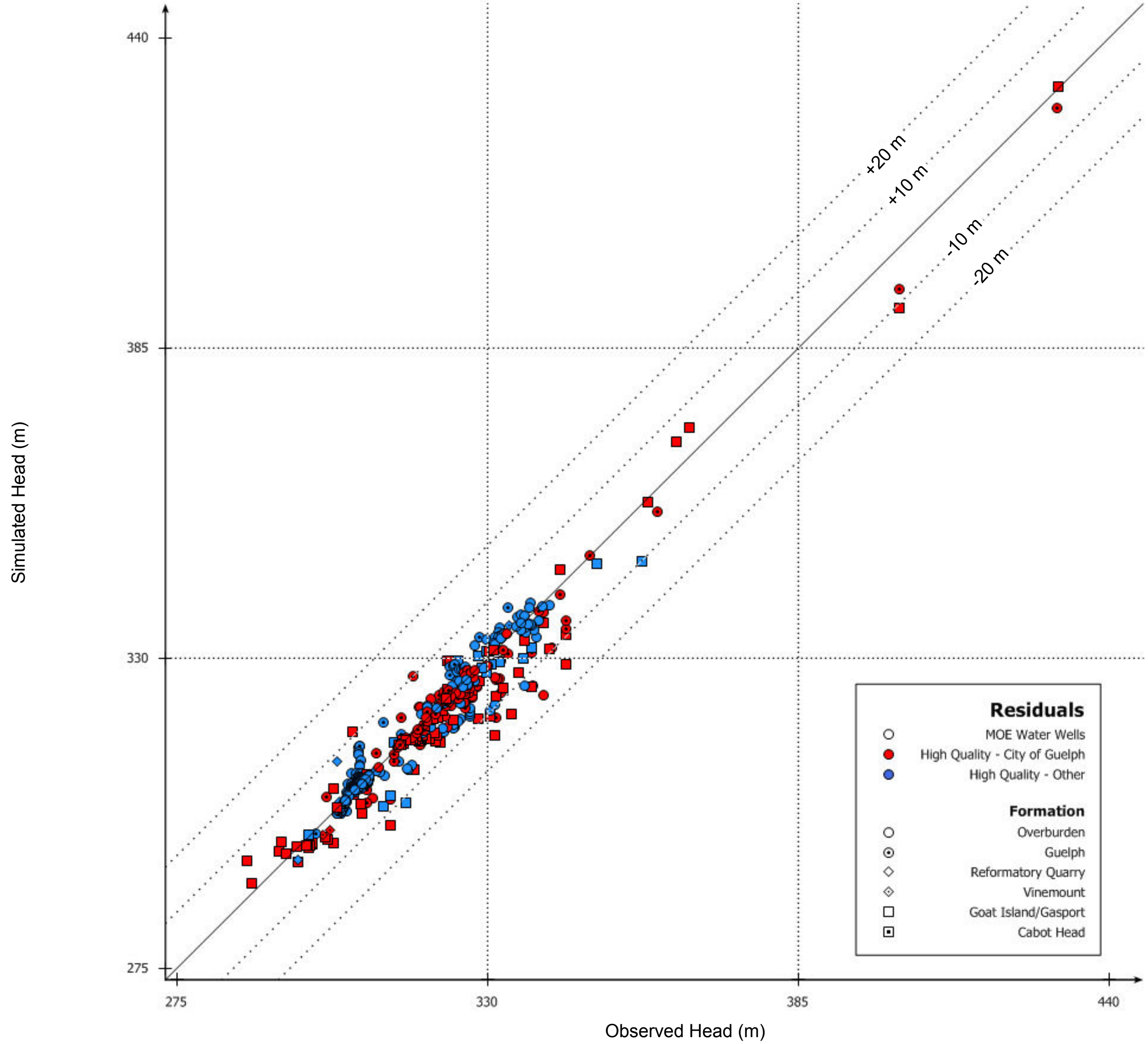
Figure 3-16

Vertical Hydraulic Gradient Across Slices 5-12



Tier Three Local Area Risk Assessment

Guelph

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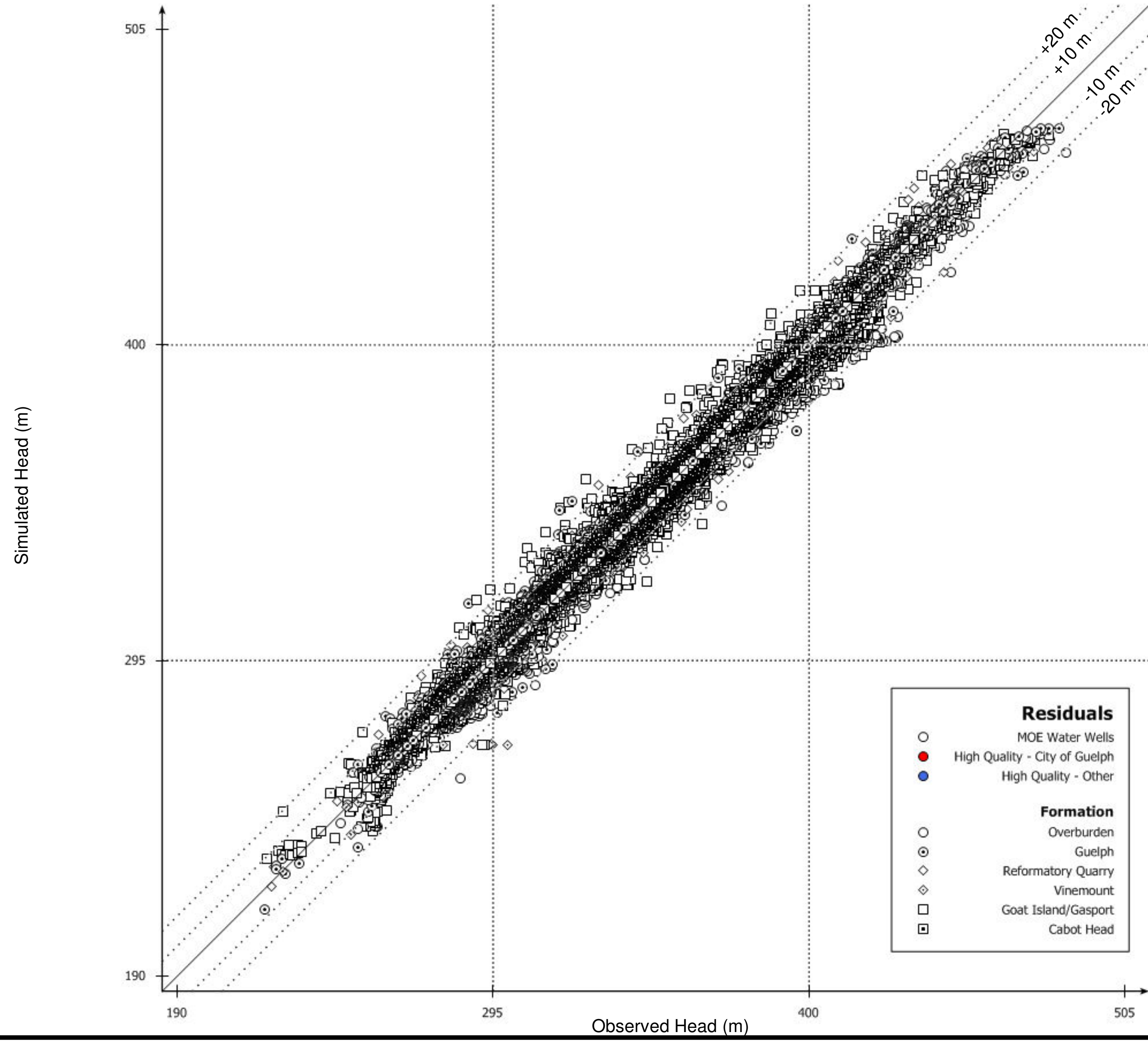
Figure 3-17

Simulated vs. Observed Heads-High Quality Wells



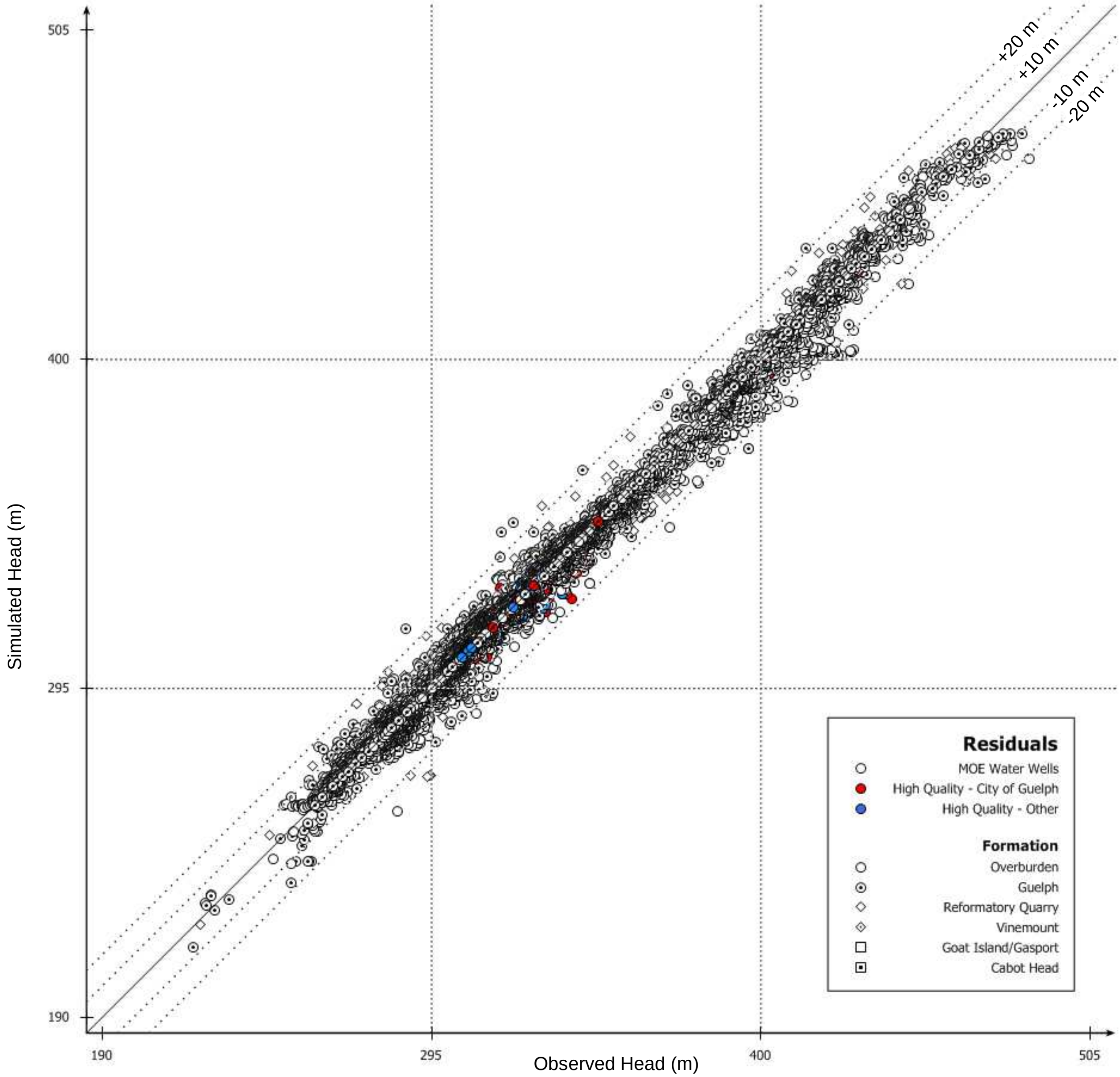
Tier Three Local Area Risk Assessment

Guelph

Produced by Aquaresource Inc. and Golder Associates Ltd.

Figure 3-18

Simulated vs. Observed Heads- MOE Wells



Tier Three Local Area Risk Assessment

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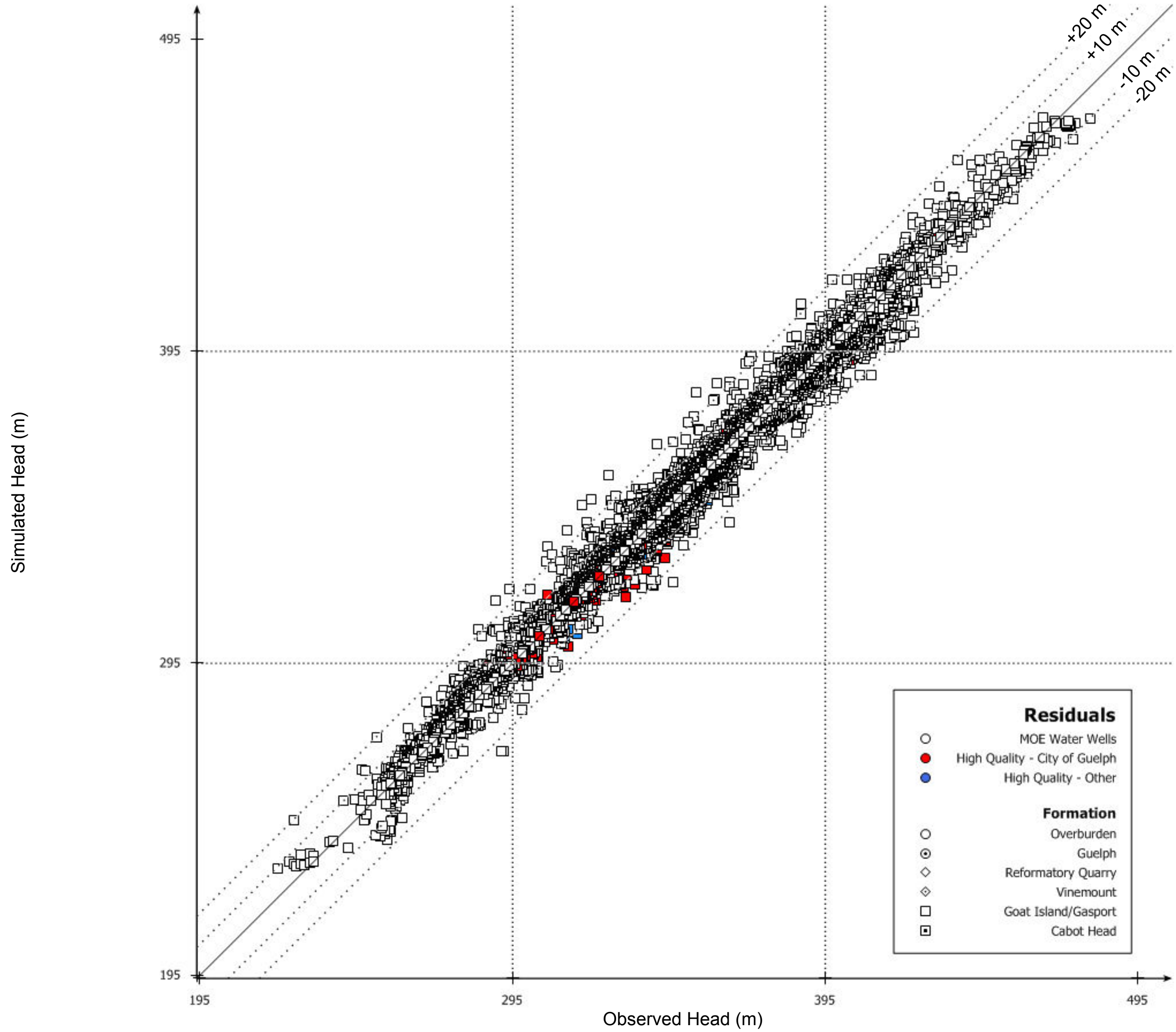
Figure 3-19

Simulated vs. Observed Heads-Above Vinemount



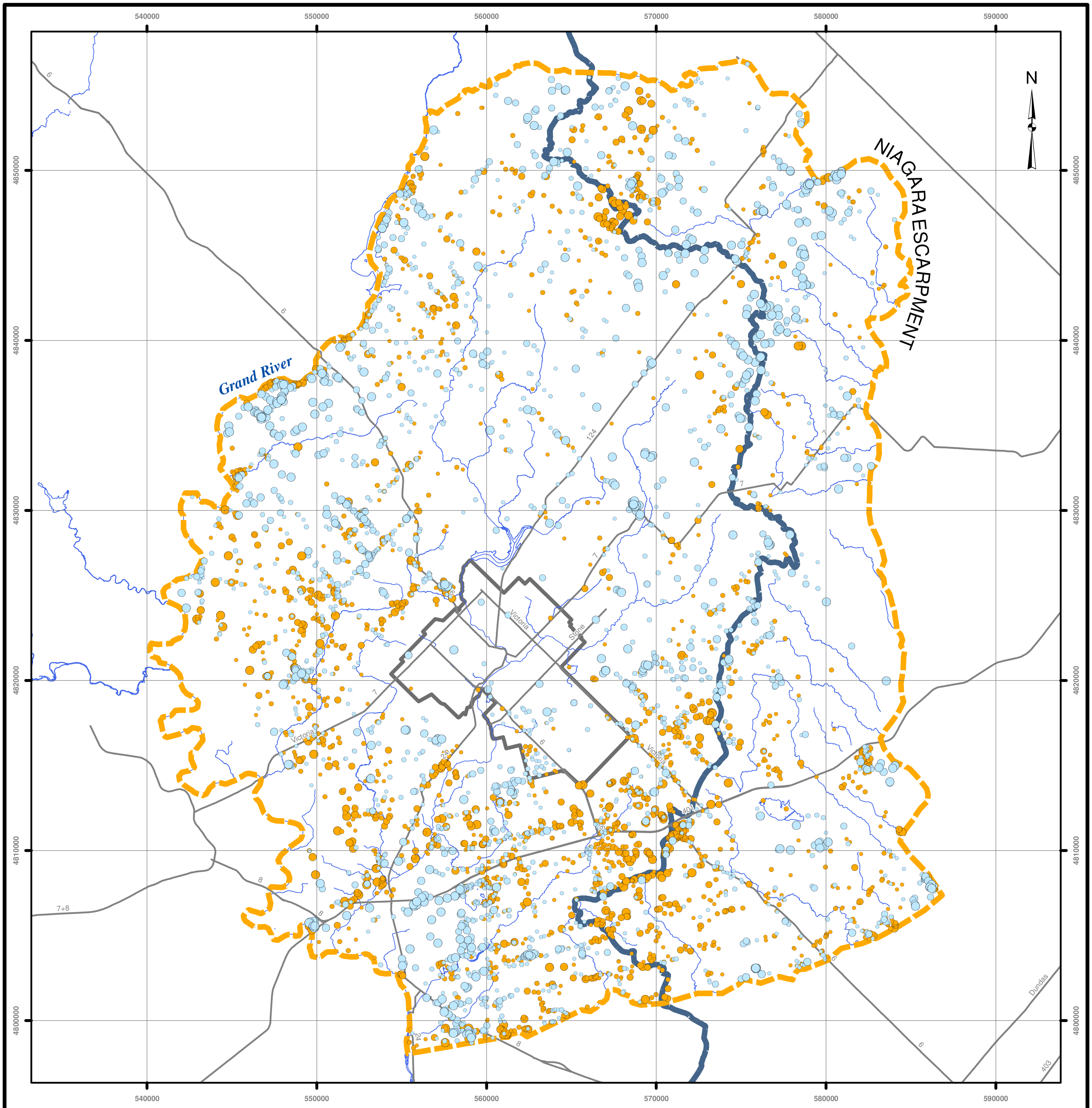
Tier Three Local Area Risk Assessment

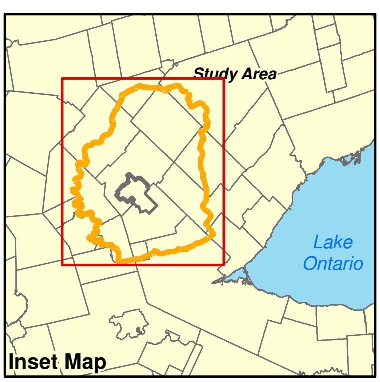
Guelph

Produced by Aquaresource Inc. and Golder Associates Ltd.

Figure 3-20

Simulated vs. Observed Heads- Below Vinemount





LEGEND

Major Roads / Highways
Rivers / Streams
Open Water
Model Boundary
Grand River Watershed Boundary
City of Guelph Boundary

Simulated Head - Observed Head (m)

- < -10.0
- -10.0 - -7.5
- -7.5 - -5.0
- -5.0 - -2.5
- -2.5 - 0.0
- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- > 10.0

Scale 1:310,000

0 2.5 5 10 15 20
Kilometres

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Projection: UTM Zone 17N, NAD 83
Map Version: 2; Map Date: 28-Jul-11; Created By: CC

Tier Three Local Area Risk Assessment

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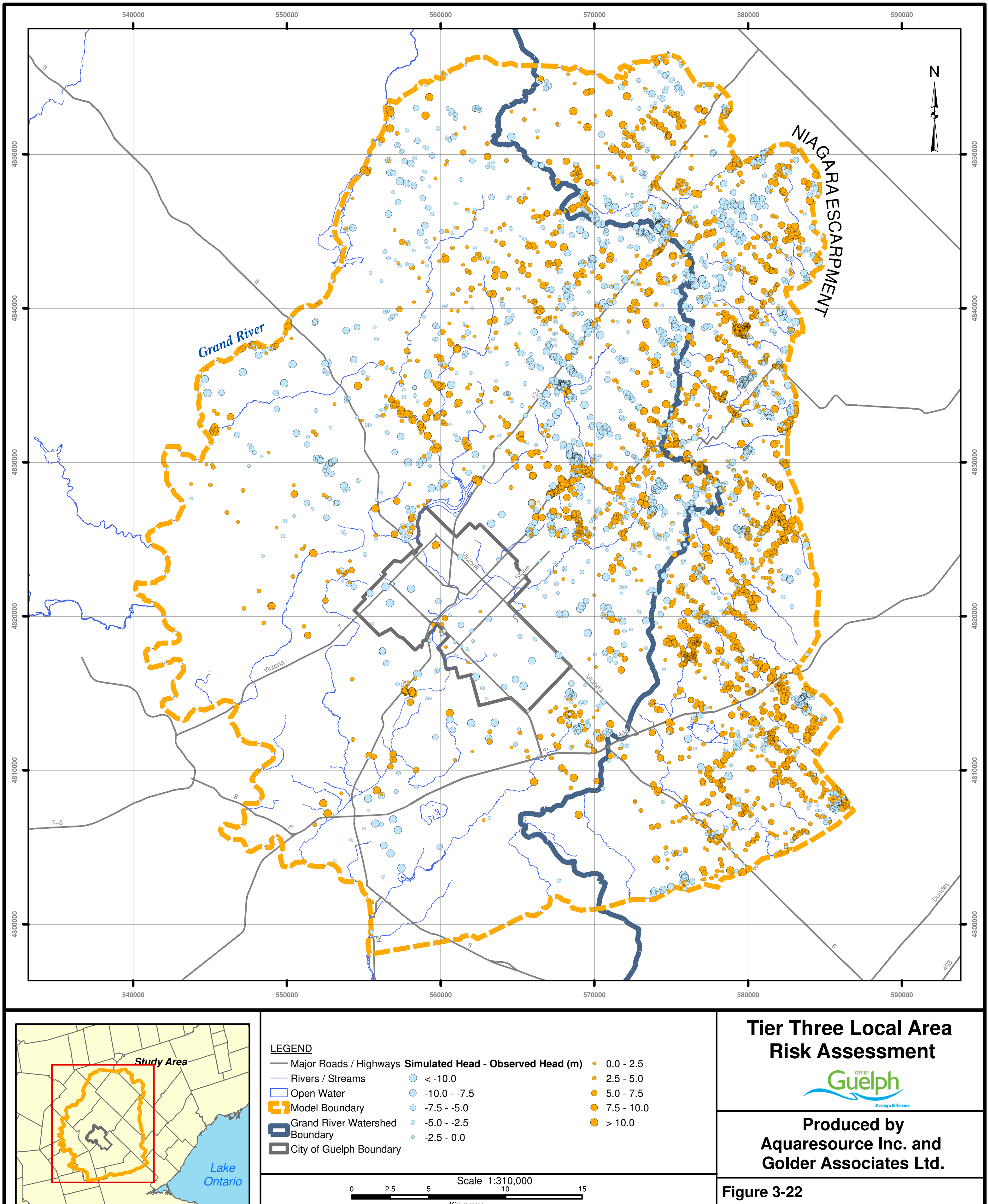
Figure 3-21

Spatial Distribution of Calibration Residuals - Above Vinemount



REFERENCES:
Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008
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Tier Three Local Area Risk Assessment

Guelph

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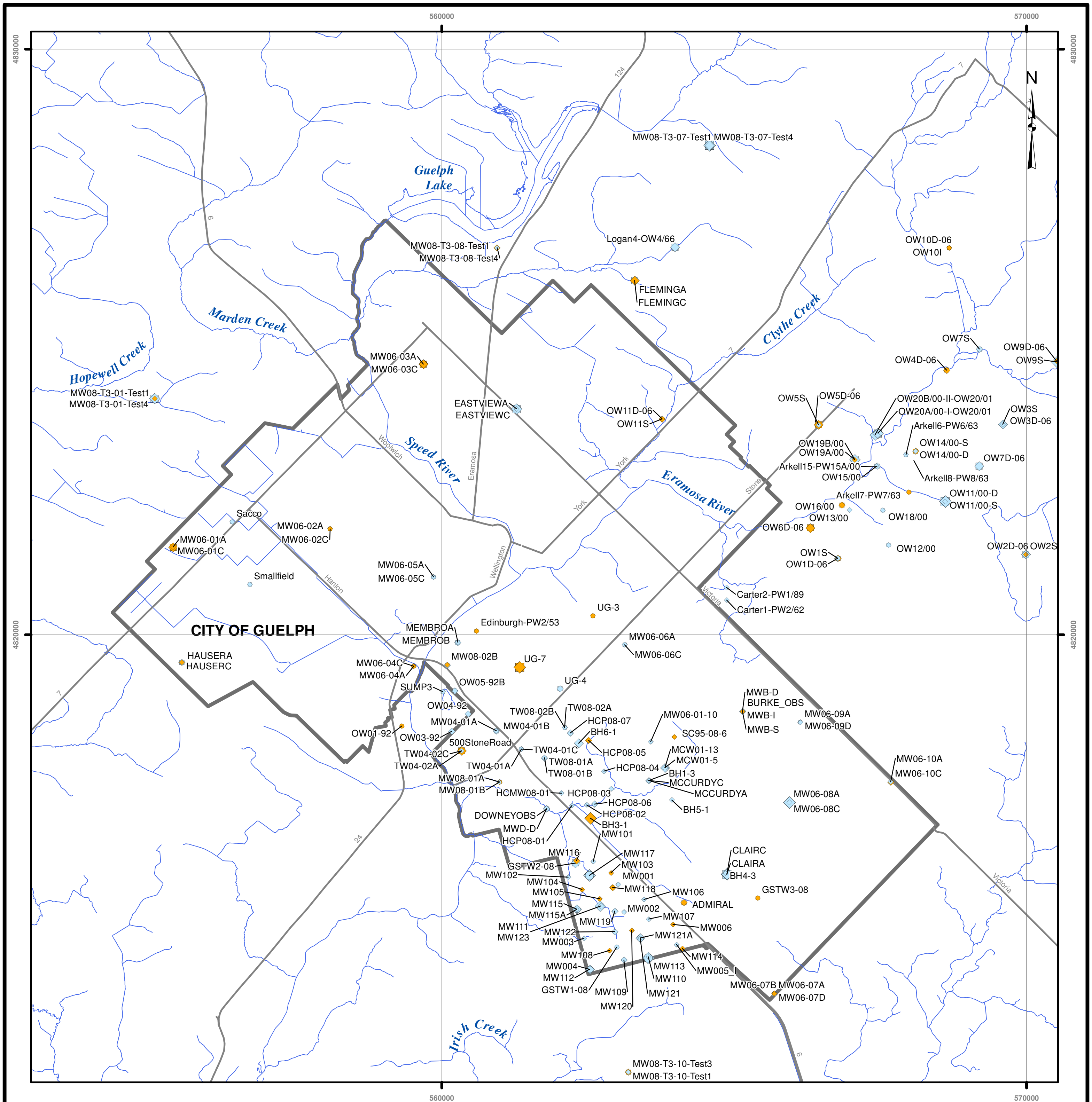
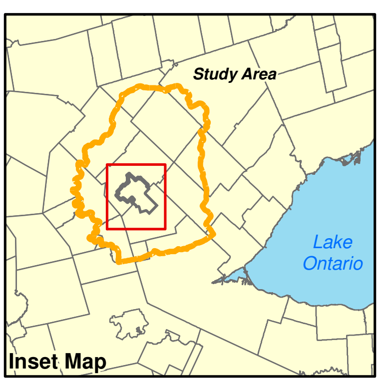
Figure 3-22

Spatial Distribution of Calibration Residuals - Below Vinemount

C:\Projects\2008003_Guelph_Tier3\GIS\ArcView\MXDs\ModelReport\Updates_April2010\Fig3-22_CalibrationResiduals_BelowVinemount.mxd

Project: 2008003_Guelph_Tier3





LEGEND

- Major Roads/Highways
- Rivers / Streams
- Open Water
- Model Boundary
- Grand River Watershed Boundary
- City of Guelph Boundary
- Municipal Boundaries

Formation

- Overburden
- Shallow Bedrock
- Deep Bedrock

Simulated Head - Observed Head (m)

- < -10.0
- -10.0 - -7.5
- -7.5 - -5.0
- -5.0 - -2.5
- -2.5 - 0.0
- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- > 10.0

Scale 1:90,000

0 1 2 3

Kilometres

REFERENCES:
Base Data - City of Guelph, 2009; GRCA, 2008, CVC, 2008, Ministry of Natural Resources, 2008
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Figure 3-23

Spatial Distribution of Calibration Residuals - High Quality (City of Guelph)

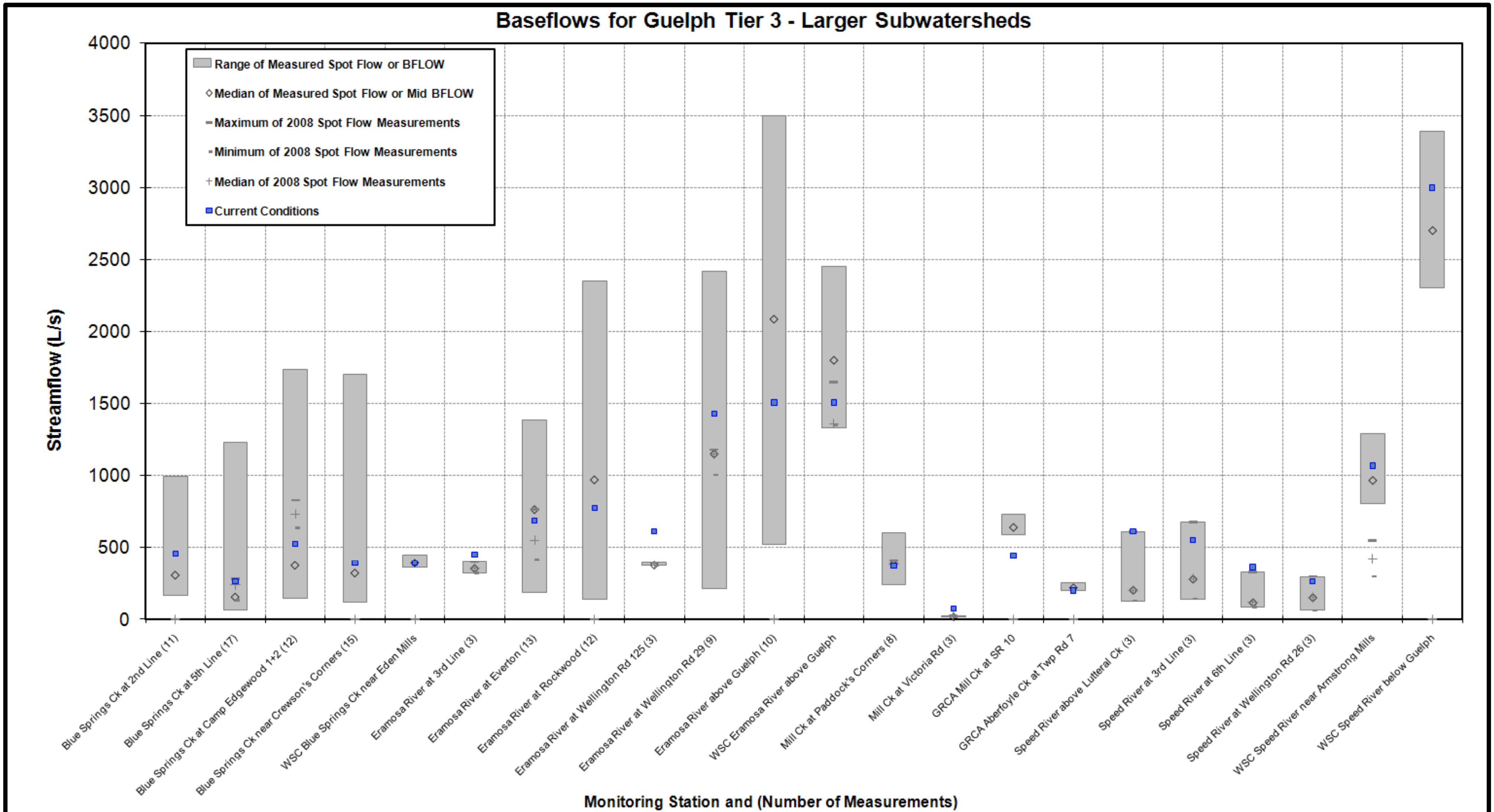

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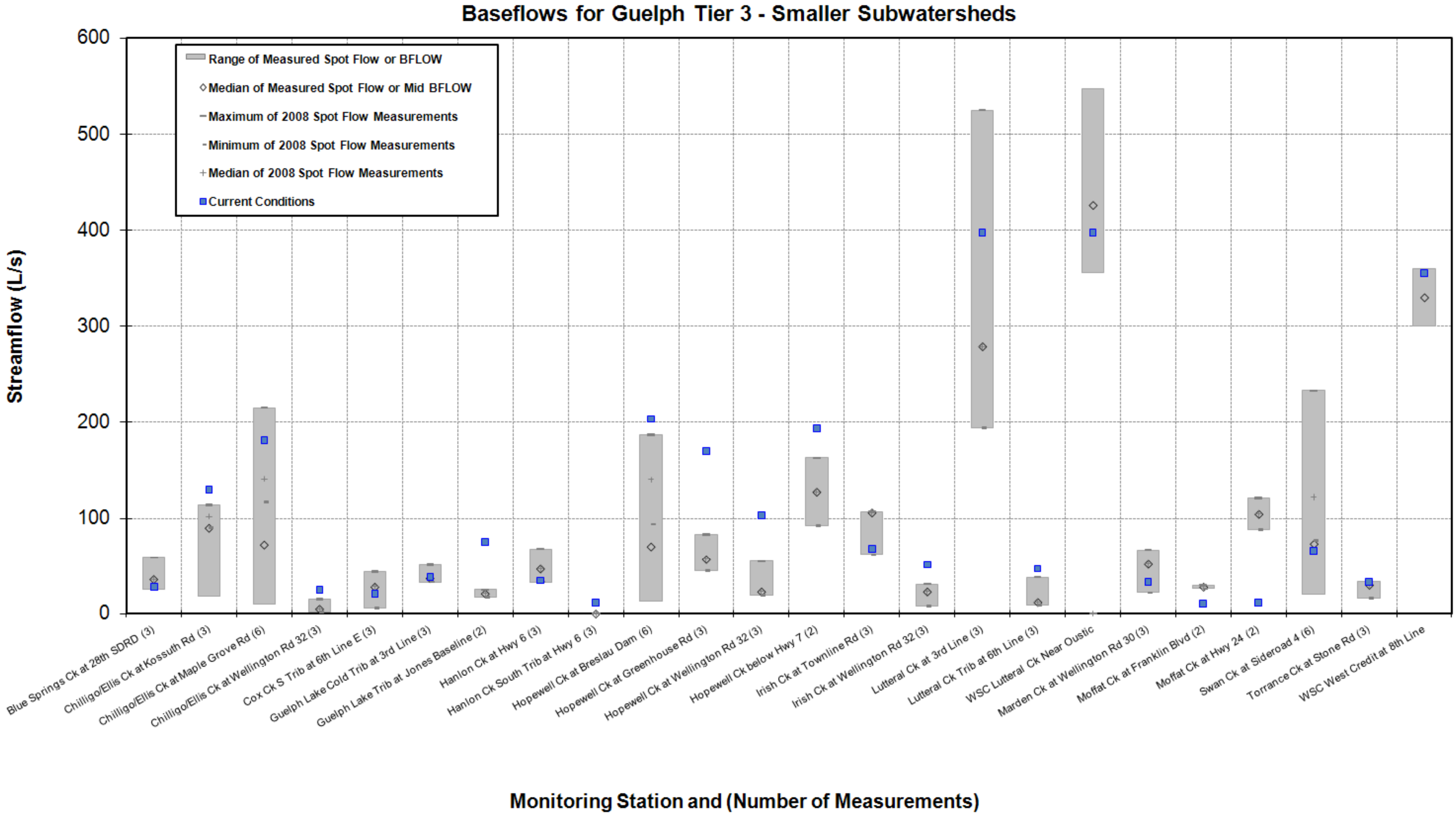
Figure 3-24
Baseflow Calibration Results – Larger Subwatersheds

Project: 2008003_Guelph_Tier3



Tier Three Local Area Risk Assessment

Guelph

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Figure 3-25
Baseflow Calibration Results – Smaller Subwatersheds

Project: 2008003_Guelph_Tier3