Van Harten
SURVEYING INC.

LAND SURVEYORS and ENGINEERS

December 21, 2015
21203-13

Dunnink Homes
4988 Jones Base Line
GUELPH, Ontario
N1H 6H8

Attention: John Dunnink

Dear Sir:

Re: Functional Servicing and
Stormwater Management Report
Hyland Road and Glenburnie Drive Extensions
City of Guelph, Ontario

1.0 General

Van Harten is pleased to submit this report regarding the proposed residential development located in the northeast section of Guelph. This work was authorized by Mr. John Dunnink of Dunnink Homes.

The project involves the proposed construction of eleven (11) fully serviced single family homes as an extension of Hyland Road and an additional eight (8) fully serviced single family homes as an extension of Glenburnie Drive. The purpose of this functional servicing and stormwater management report is to outline the proposed supply and distribution of municipal water; outline the proposed sanitary sewer collection system; and provide a description of the general surface drainage characteristics of the development along with pre-development and post-development runoff rates.

2.0 Site Location and Existing Conditions

The subject lands are located near Eramosa Road and Victoria Road in the northeast section of Guelph. The northern part of this development will be an eastern extension of Hyland Road and the southern part will be an eastern extension of Glenburnie Drive. The proposed Hyland Road extension is abutting existing residential developments and surface drainage is generally directed to an existing 450 mm diameter culvert in the southeast corner that conveys water to protected wetlands to the south. The proposed Glenburnie Drive extension is abutting existing residential developments to the north, west and south with overland surface flow towards the aforementioned protected wetlands to the east. The wetlands, east of the proposed development, are presently owned by the applicant.

3.0 Proposed Development

The subject lands are located at the eastern limit of fully serviced and established residential subdivisions in the northeast section of Guelph. The Hyland Road extension covers 0.96 ha and includes the development of eleven (11) lots. An existing frame garage at 46 Hyland Road and an existing single family residence 47 Hyland Road are to be removed as part of this development. The existing cul-de-sac at the east limit of Glenburnie Drive is to be extended further east to accommodate eight (8) new single family residences on 0.53 ha of land.

The lots off of the Hyland Road extension and Glenburnie Drive extension will be zoned R1B.

4.0 Water Supply

Both the Hyland Road lots and Glenburnie Drive lots will be serviced by an extension of the existing 150 mm diameter watermains. Fire hydrants will be added to satisfy spacing requirements of the municipality and Ontario Building Code. Domestic service connections (25 mm diameter copper) will be provided for each individual home as per City of Guelph standards.

423 Woolwich Street, Guelph ON N1H 3X3
Phone: (519) 821-2763 • Fax: (519) 821-2770
www.vanharten.com
660 Riddell Road, Unit 1, Orangeville ON L9W 5G5
Phone: (519) 940-4110 • Fax: (519) 940-4113

R.P. Magahay, B.A. J.E. Buisman, B.E.S., B.Sc., O.L.S. R.M. Mak, B.Sc., O.L.S. J. M. Laws, O.L.S. J.M. Duffy, P.Eng.

5.0 Sanitary Servicing

There are existing sanitary sewers on Hyland Road and Glenburnie Drive that will service the proposed residential building lots. The following subsections of this report provide a brief description of each proposal.

5.1 Hyland Road

- The existing sanitary sewer is shallow and a direct gravity connection is not feasible.
- It is proposed to service these lots by individual E/ONE grinder pump systems with connection to the existing manhole on Hyland Road.

5.2 Glenburnie Drive

- It is proposed to extend the existing 200 mm diameter sanitary sewer from the terminus manhole to a new installed manhole in the proposed cul-de-sac extension. The proposed homes will be serviced with individual 100 mm diameter gravity service connections.

6.0 Stormwater Management Plan

Preliminary stormwater modeling has been completed using MIDUSS with IDF parameters obtained from the Environment Canada database of Short Duration Rainfall Intensity-Duration-Frequency Data. The station used was the Guelph Turfgrass CS. Please refer to Appendix A for pre and post development catchment areas for each of the two proposed development areas and to Appendix B for MIDUSS output data.

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6.1 Hyland Road

- The pre-development drainage is generally towards the southeast with an outlet (450 mm diameter culvert) crossing Hyland Road into the existing wetland.
- The post-development drainage remains identical to the pre-development. Preliminary runoff calculations for a 10 year rain event indicate that the existing culvert is to be replaced with a 600 mm diameter culvert.
- A ditch inlet is proposed on the north side of Hyland Road at the inlet of the new culvert. The development runoff and road drainage will be conveyed to this structure via a grass lined swale. The grass swale and structure will minimize sediment runoff to the wetland.
- Roof drainage will discharge to grass swales leading to the ditch inlet and wetlands.
- The major system will be conveyed overland to the wetlands via Hyland Road.

6.2 Glenburnie Drive

- The pre-development drainage is to the wetlands, located east of the proposed development. The post development drainage is divided into two drainage areas. One area is directed to the extended 300 mm diameter storm sewer on Glenburnie Drive and the second area is directed to the wetlands, east of the proposed development.
- It is proposed to extend the existing 300 mm diameter storm sewer into the newly constructed cul-de-sac to receive the right-of-way run-off, the front yards of the newly established lots, and the individual foundation drains via sump pumps. The side and rear lots will surface drain towards the existing wetlands, east of this development. Roof drainage will be discharged on the vegetative surface towards the wetlands.
- The major storm system will be conveyed overland to the wetlands to the east of the development and to Glenburnie Drive.

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6.3 Peak Flow Data

A summary of the peak flow rates are illustrated below. Please refer to Appendix B for MIDUSS output data.

Stormwater Modeling Result							
Peak Flow Rate (m^3/sec)							
Storm Event	Hyland Road			Glenburnie Drive			
	To Wetlands			To Wetlands		To Storm Sewer	
	Pre-Dev. Flow	Post-Dev. Flow		Pre-Dev. Flow	Post-Dev. Flow	Pre-Dev. Flow	Post-Dev. Flow
2yrs	0.002	0.044		0.002	0.010	0	0.026
10yrs	0.073	0.085		0.060	0.056	0	0.043
100yrs	0.216	0.170		0.156	0.127	0	0.080

- The infill development is adjacent to the existing wetlands and generally storage facilities are not provided due to insufficient area available.
- Water quality control will be provided through the use of catch basins with sumps and by directing rooftop areas to vegetative swales. A ditch inlet installed on the north side of Hyland Road will further reduce sediment runoff to the wetland.
- Prior to construction, a heavy duty silt fence will be installed along the perimeter to protect the existing wetlands as well as straw bales at the inlet of the ditch inlet to minimize the potential of silt from entering the structure and wetlands. The sediment and erosion control measures employed will be inspected during the construction process and will remain in place until grass growth has been established.

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6.4 Water Balance

The water balance of runoff into the wetlands based on pre and post development runoff volumes is summarized as follows:

Water Balance							
Runoff Volume (m^3)							
Storm Event	**Hyland Road**			**Glenburnie Drive**			
	To Wetlands			To Wetlands			
	Pre-Dev. Volume	Post-Dev. Volume	Increase/ Decrease	Pre-Dev. Volume	Post-Dev. Volume	Increase/ Decrease	Net Increase/ Decrease
2yrs	6.48	63.40	56.92	3.95	13.08	9.13	66.05
10yrs	122.80	194.18	71.38	74.41	59.49	-14.92	56.46
100yrs	315.05	395.43	80.38	191.06	133.44	-57.62	22.76

The MIDUSS model shows a net volume increase of 66.05 m^3, 56.46 m^3 and 22.76 m^3 for 2 year, 10 year and 100 year storm events, respectively.

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7.0 Conclusions

Dunnink Homes is applying for the infill development as eastern extensions of the existing Hyland Road and Glenburnie Drive residential subdivisions. This report has been prepared to support the application and concludes that municipal services are available for the sites as follows:

- Road access may be provided from Hyland Road and Glenburnie Drive.
- Municipal water supply for domestic use and fire protection will be provided from the existing 150 mm diameter watermains on Hyland Road and Glenburnie Drive.
- Sanitary sewers services will be provided to the existing sanitary sewers on Hyland Road and Glenburnie Drive.
- Storm drainage will be provided via back yard swale directed to the wetlands and storm sewer.
- Quality control will be provided through the use of catch basins with sumps and directing rooftop areas to vegetative swales. A ditch inlet will be installed on the north side of Hyland Road that will further reduce sediment runoff to the wetland.

I trust that this report has been completed within our terms of reference and is suitable for your present requirements. Please contact our office if you have any questions or require further consultation.

Van Harten Surveying Inc.

Cope Otten, P. Eng

LICENSED PROFESSIONAL ENGINEER
J. M. DUFFY
Dec 22-15
PROVINCE OF ONTARIO

John Duffy, P. Eng.
Consulting Engineer

Encl. Reduced Preliminary Grading and Servicing Plan – Hyland Road Extension
Encl. Reduced Preliminary Grading and Servicing Plan – Glenburnie Drive Extension
Encl. Appendix A – Pre and Post Development Catchment Areas
Encl. Appendix B - MIDUSS Output

ec Ryan Archer, M.Sc., NRSI

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APPENDIX A
PRE AND POST DEVELOPMENT CATCHMENT AREAS

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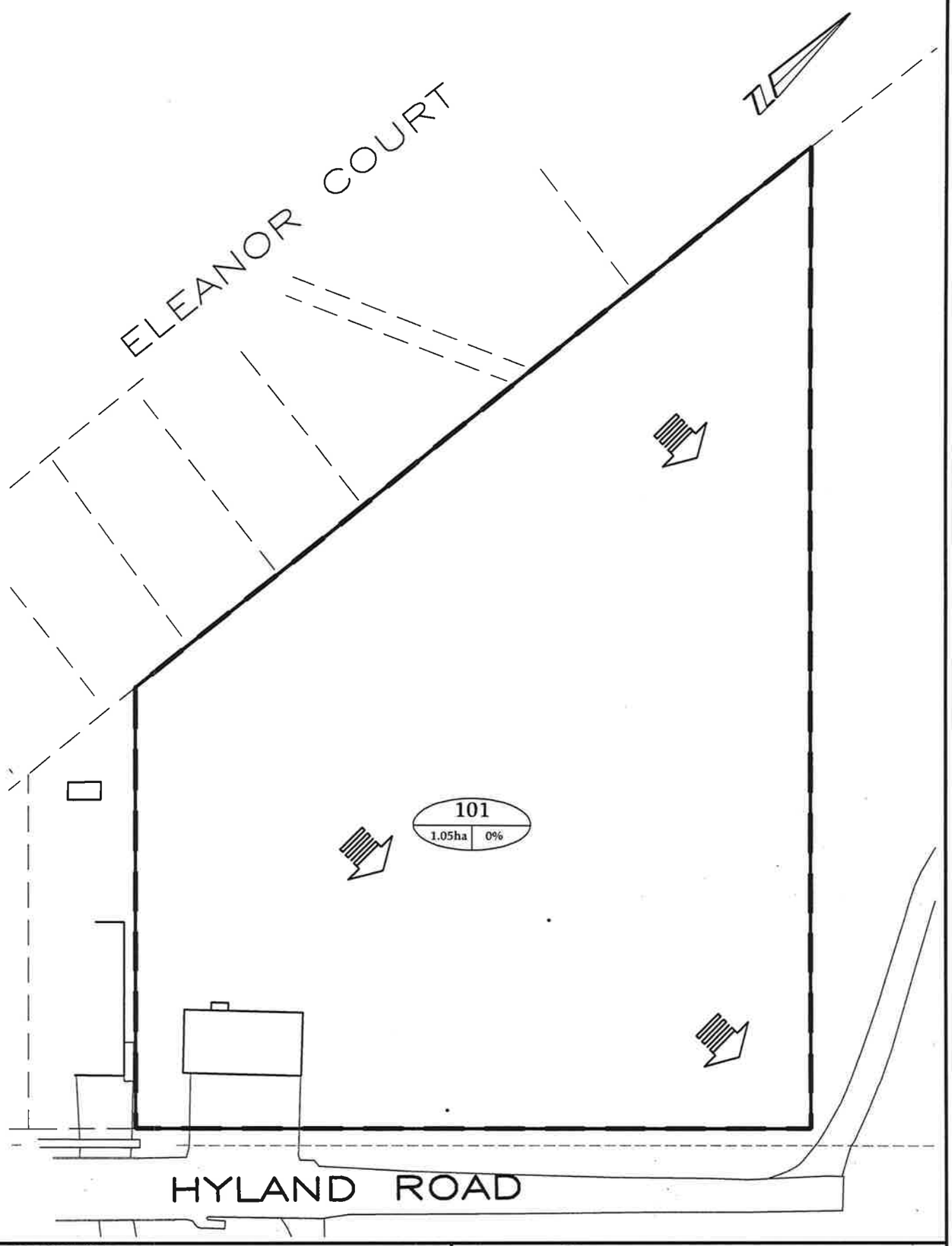
PRE DEVELOPMENT
DRAINAGE CATCHMENT AREAS
PROPOSED HYLAND ROAD CUL-DE-SAC
PART OF LOT 12, REGISTERED PLAN 359

DRAWING SCALE 1 : 750



LEGEND

MAJOR STORM OVERLAND FLOW ROUTE

CATCHMENT

C201 | 0.25ha | 75%

AREA | % IMPERVIOUS

DRAINAGE AREA BOUNDARY

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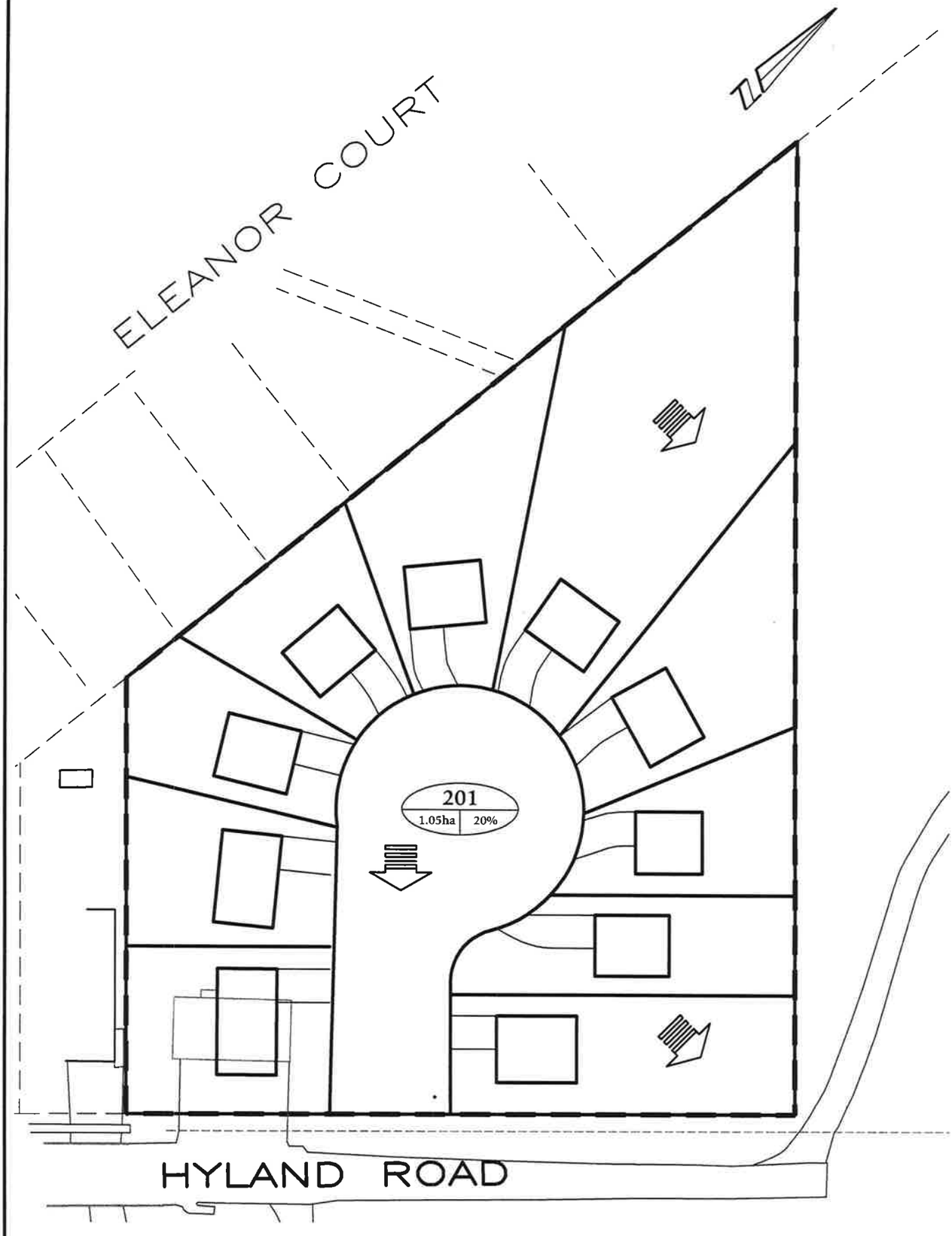
DRAWN BY: M.V. | CHECKED BY: J.M.D. | PROJECT No. 21203–13

Mar 06,2015–2:22pm
L:\Guelph\359\catchments (87 HYLAND ROAD) UTM 2010.dwg

POST DEVELOPMENT
DRAINAGE CATCHMENT AREAS
PROPOSED HYLAND ROAD CUL-DE-SAC
PART OF LOT 12, REGISTERED PLAN 359
DRAWING SCALE 1 : 750



LEGEND

MAJOR STORM OVERLAND FLOW ROUTE

CATCHMENT

C2
0.25ha | 75%

AREA % IMPERVIOUS

DRAINAGE AREA BOUNDARY

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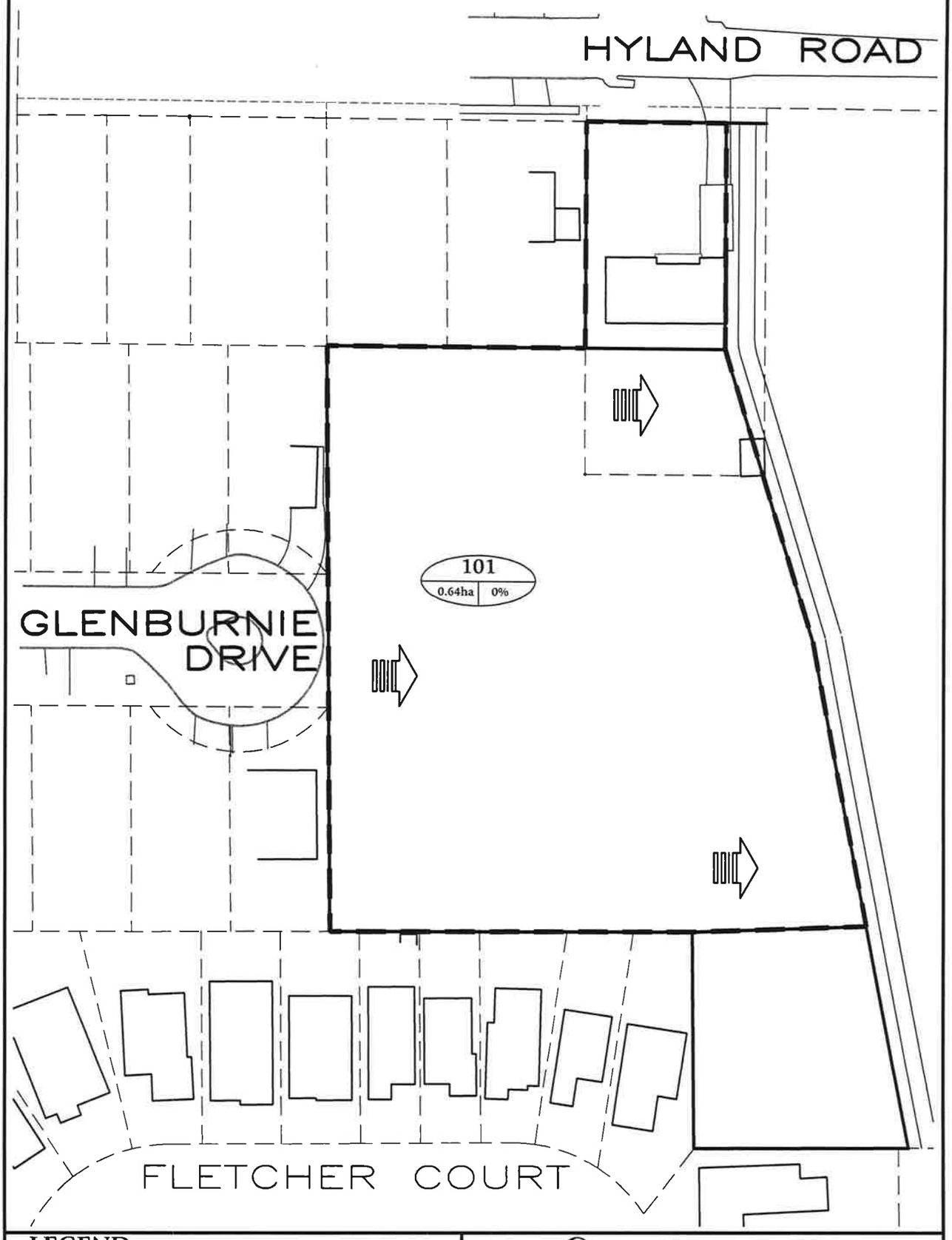
PRE DEVELOPMENT
DRAINAGE CATCHMENT AREAS
PROPOSED GLENBURNIE DRIVE EXTENSION
PART OF LOTS 4 & 5, REGISTERED PLAN 359

DRAWING SCALE 1 : 750



LEGEND

MAJOR STORM OVERLAND FLOW ROUTE

CATCHMENT

C201 | 0.25ha | 75%

AREA | % IMPERVIOUS

DRAINAGE AREA BOUNDARY

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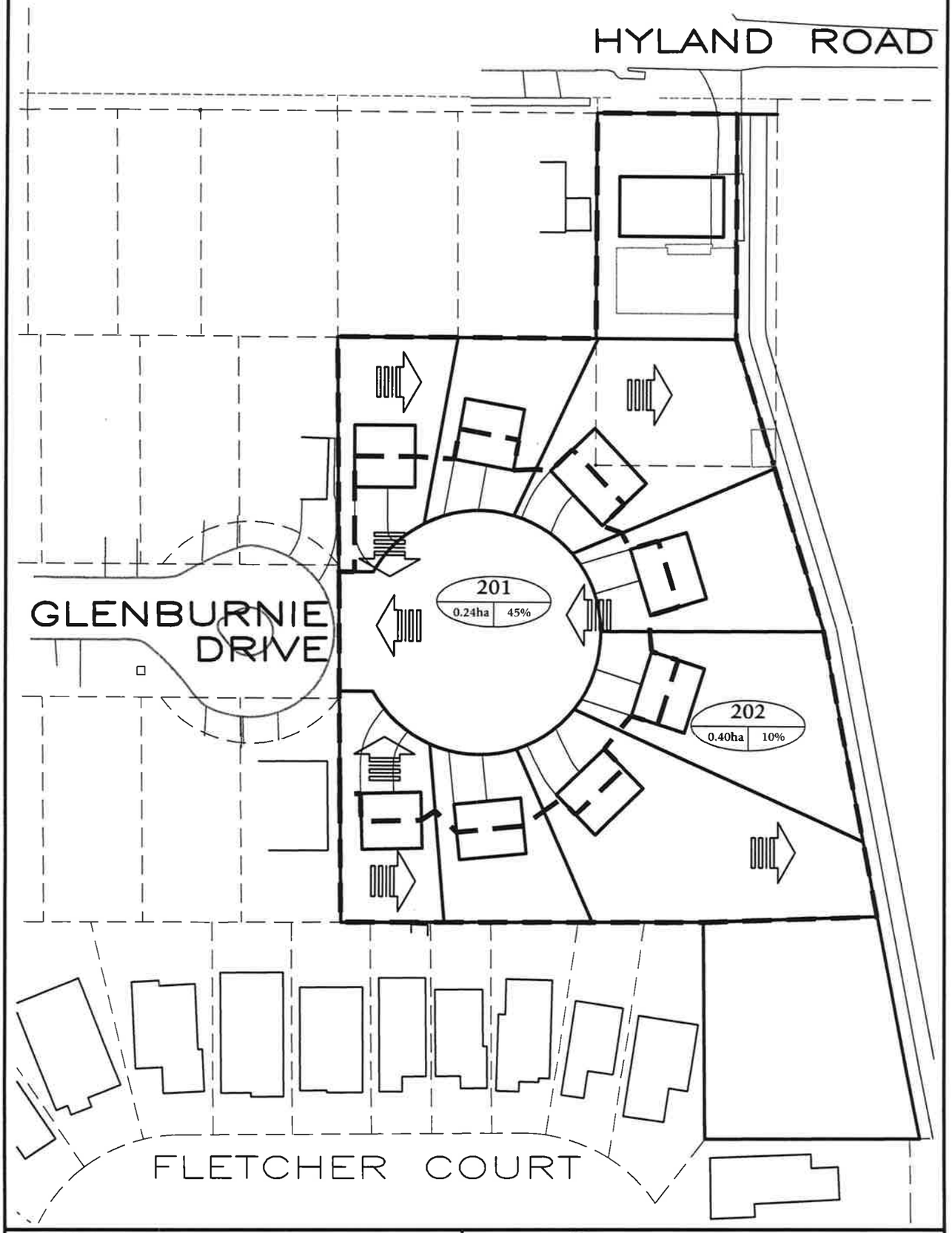
POST DEVELOPMENT
DRAINAGE CATCHMENT AREAS
PROPOSED GLENBURNIE DRIVE EXTENSION
PART OF LOTS 4 & 5, REGISTERED PLAN 359
DRAWING SCALE 1 : 750



LEGEND

MAJOR STORM OVERLAND FLOW ROUTE

CATCHMENT

C201 | 0.25ha | 75%

AREA | % IMPERVIOUS

DRAINAGE AREA BOUNDARY

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APPENDIX B
MIDUSS OUTPUT

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"                Output filename:                          2-yr HYLAND ROAD EX.out"
"                Licensee name:                                        Mike.Vaughan"
"                Company                                                          "
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"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1500.000   Max. Hydrograph"
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"             1   1=rain; 2=imperv; 3=perv"
"              2-YEAR GUELPH TURGRASS CS.stm"
"              2-year storm - Guelph Turfgrass CS"
"              New storm defined"
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"              Maximum intensity            108.409    mm/hr"
"              Duration                     180.000   minutes"
"                   0.000     0.000     0.000     0.000 c.m/sec"
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"             1   Triangular SCS"
"             1   Equal length"
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"         1.050   Total Area"
"       100.000   Flow length"
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"         1.050   Pervious Area"
"       100.000   Pervious length"
"         5.000   Pervious slope"
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"       100.000   Impervious length"
"         5.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
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"         5.000   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
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"         0.000   Impervious Min.infiltration"
"         0.050   Impervious Lag constant (hours)"
"         1.500   Impervious Depression storage"
"                     0.002     0.000     0.000     0.000 c.m/sec"
"              Catchment 101          Pervious   Impervious Total Area "
"              Surface Area           1.050      0.000      1.050      hectare"
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"              Time to Centroid       127.950    91.023     127.948    minutes"
"              Rainfall depth         29.554     29.554     29.554     mm"
"              Rainfall volume        310.32     0.00       310.32     c.m"
"              Rainfall losses        28.937     2.028      28.937     mm"
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"              Runoff volume          6.48       0.00       6.48       c.m"
"              Runoff coefficient     0.021      0.000      0.021      "
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"              Total % impervious                          0.000"
" 19           EXIT"
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"           1   1=rain; 2=imperv; 3=perv"
"            2-YEAR GUELPH TURGRASS CS.stm"
"            2-year storm - Guelph Turfgrass CS"
"            New storm defined"
"            Total depth                   29.554    mm"
"            Maximum intensity            108.409    mm/hr"
"            Duration                     180.000   minutes"
"                 0.000     0.000     0.000     0.000 c.m/sec"
"           6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"           1   Triangular SCS"
"           1   Equal length"
"           2   Horton equation"
"         201   C101 - HYLAND ROAD PROPERTY POST DEVELOPMENT"
"      20.000   % Impervious"
"       1.050   Total Area"
"     100.000   Flow length"
"       2.000   Overland Slope"
"       0.840   Pervious Area"
"     100.000   Pervious length"
"       2.000   Pervious slope"
"       0.210   Impervious Area"
"     100.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.015   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.050   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                   0.044     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.840      0.210      1.050      hectare"
"            Time of concentration  82.313     4.423      10.788     minutes"
"            Time to Centroid       144.014    92.653     96.850     minutes"
"            Rainfall depth         29.554     29.554     29.554     mm"
"            Rainfall volume        248.25     62.06      310.32     c.m"
"            Rainfall losses        28.937     1.830      23.516     mm"
"            Runoff depth           0.617      27.724     6.038      mm"
"            Runoff volume          5.18       58.22      63.40      c.m"
"            Runoff coefficient     0.021      0.938      0.204      "
"            Maximum flow           0.001      0.044      0.044      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
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```
"            4   Add Runoff "
"                    0.044     0.044     0.000     0.000"
" 38          START/RE-START TOTALS 201"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      1.050    hectare"
"             Total Impervious area                     0.210    hectare"
"             Total % impervious                       20.000"
" 19          EXIT"
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"          10   Units used:                                              ie METRIC"
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"               Output filename:                          10-yr HYLAND ROAD EX.out"
"               Licensee name:                                        Mike.Vaughan"
"               Company                                                           "
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"   1500.000    Max. Hydrograph"
" 47          FILEI_O Read/Open 10-YEAR GUELPH TURGRASS CS.stm"
"           1   1=read/open; 2=write/save"
"           1   1=rainfall; 2=hydrograph"
"           1   1=rain; 2=imperv; 3=perv"
"            10-YEAR GUELPH TURGRASS CS.stm"
"            10-yr storm guelph turfgrass"
"            New storm defined"
"            Total depth                   48.049    mm"
"            Maximum intensity            159.688    mm/hr"
"            Duration                     180.000   minutes"
"                 0.000     0.000     0.000     0.000 c.m/sec"
"           5   10hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"           1   Triangular SCS"
"           1   Equal length"
"           2   Horton equation"
"         101   C101 - HYLAND ROAD PROPERTY EX"
"       0.000   % Impervious"
"       1.050   Total Area"
"     100.000   Flow length"
"       5.000   Overland Slope"
"       1.050   Pervious Area"
"     100.000   Pervious length"
"       5.000   Pervious slope"
"       0.000   Impervious Area"
"     100.000   Impervious length"
"       5.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.015   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.050   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                   0.073     0.000     0.000     0.000 c.m/sec"
"            Catchment 101          Pervious   Impervious Total Area "
"            Surface Area           1.050      0.000      1.050      hectare"
"            Time of concentration  20.156     2.878      20.156     minutes"
"            Time to Centroid       96.907     0.000      96.907     minutes"
"            Rainfall depth         48.049     48.049     48.049     mm"
"            Rainfall volume        504.51     0.00       504.51     c.m"
"            Rainfall losses        36.354     48.049     36.354     mm"
"            Runoff depth           11.695     0.000      11.695     mm"
"            Runoff volume          122.80     0.00       122.80     c.m"
"            Runoff coefficient     0.243      0.000      0.243      "
"            Maximum flow           0.073      0.000      0.073      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"             4   Add Runoff "
"                     0.073     0.073     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                        1.050    hectare"
"              Total Impervious area                       0.000    hectare"
"              Total % impervious                          0.000"
" 19           EXIT"
```

```
"               MIDUSS Output ------------------------------------------------>"
"               MIDUSS version                                  Version 2.25  rev. 465"
"               MIDUSS created                               Tuesday, February 05, 2008"
"          10   Units used:                                                ie METRIC"
"               Job folder:                  Q:\13-212\21203-13 (Dunnink - Hyland)"
"               Output filename:                          10-yr HYLAND ROAD UNC.out"
"               Licensee name:                                        Mike.Vaughan"
"               Company                                                             "
"               Date & Time last used:                     2/27/2015 at 12:18:34 PM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1500.000   Max. Hydrograph"
" 47          FILEI_O Read/Open 10-YEAR GUELPH TURGRASS CS.stm"
"           1   1=read/open; 2=write/save"
"           1   1=rainfall; 2=hydrograph"
"           1   1=rain; 2=imperv; 3=perv"
"            10-YEAR GUELPH TURGRASS CS.stm"
"            10-yr storm guelph turfgrass"
"            New storm defined"
"            Total depth                    48.049    mm"
"            Maximum intensity             159.688    mm/hr"
"            Duration                      180.000   minutes"
"                 0.000     0.000     0.000     0.000 c.m/sec"
"           5   10hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"           1   Triangular SCS"
"           1   Equal length"
"           2   Horton equation"
"         201   C101 - HYLAND ROAD PROPERTY POST DEVELOPMENT"
"      20.000   % Impervious"
"       1.050   Total Area"
"     100.000   Flow length"
"       2.000   Overland Slope"
"       0.840   Pervious Area"
"     100.000   Pervious length"
"       2.000   Pervious slope"
"       0.210   Impervious Area"
"     100.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.015   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.050   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                   0.085     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.840      0.210      1.050      hectare"
"            Time of concentration  26.532     3.788      15.295     minutes"
"            Time to Centroid       102.797    89.991     96.470     minutes"
"            Rainfall depth         48.049     48.049     48.049     mm"
"            Rainfall volume        403.61     100.90     504.51     c.m"
"            Rainfall losses        36.353     2.363      29.555     mm"
"            Runoff depth           11.696     45.686     18.494     mm"
"            Runoff volume          98.24      95.94      194.18     c.m"
"            Runoff coefficient     0.243      0.951      0.385      "
"            Maximum flow           0.047      0.067      0.085      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.085     0.085     0.000     0.000"
" 38          START/RE-START TOTALS 201"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      1.050    hectare"
"             Total Impervious area                     0.210    hectare"
"             Total % impervious                       20.000"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                                  Version 2.25  rev. 465"
"                MIDUSS created                            Tuesday, February 05, 2008"
"           10   Units used:                                                ie METRIC"
"                Job folder:                  Q:\13-212\21203-13 (Dunnink - Hyland)"
"                Output filename:                          100-yr HYLAND ROAD EX.out"
"                Licensee name:                                        Mike.Vaughan"
"                Company                                                            "
"                Date & Time last used:                     2/27/2015 at 12:16:35 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 47          FILEI_O Read/Open 100-YEAR GUELPH TURGRASS CS.stm"
"             1   1=read/open; 2=write/save"
"             1   1=rainfall; 2=hydrograph"
"             1   1=rain; 2=imperv; 3=perv"
"              100-YEAR GUELPH TURGRASS CS.stm"
"              100-YEAR GUELPH TURFGRASS CS STORM"
"              New storm defined"
"              Total depth                    71.219    mm"
"              Maximum intensity             224.737    mm/hr"
"              Duration                      180.000   minutes"
"                   0.000     0.000     0.000     0.000 c.m/sec"
"             6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"             1   Triangular SCS"
"             1   Equal length"
"             2   Horton equation"
"           101   C101 - HYLAND ROAD PROPERTY EX"
"         0.000   % Impervious"
"         1.050   Total Area"
"       100.000   Flow length"
"         5.000   Overland Slope"
"         1.050   Pervious Area"
"       100.000   Pervious length"
"         5.000   Pervious slope"
"         0.000   Impervious Area"
"       100.000   Impervious length"
"         5.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
"         0.250   Pervious Lag constant (hours)"
"         5.000   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.050   Impervious Lag constant (hours)"
"         1.500   Impervious Depression storage"
"                     0.216     0.000     0.000     0.000 c.m/sec"
"              Catchment 101          Pervious   Impervious Total Area "
"              Surface Area           1.050      0.000      1.050      hectare"
"              Time of concentration  14.267     2.510      14.267     minutes"
"              Time to Centroid       95.244     87.109     95.244     minutes"
"              Rainfall depth         71.219     71.219     71.219     mm"
"              Rainfall volume        747.80     0.00       747.80     c.m"
"              Rainfall losses        41.214     2.819      41.214     mm"
"              Runoff depth           30.005     68.400     30.005     mm"
"              Runoff volume          315.05     0.00       315.05     c.m"
"              Runoff coefficient     0.421      0.000      0.421      "
"              Maximum flow           0.216      0.000      0.216      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"             4   Add Runoff "
"                      0.216     0.216     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                        1.050    hectare"
"              Total Impervious area                       0.000    hectare"
"              Total % impervious                          0.000"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 465"
"                MIDUSS created                       Tuesday, February 05, 2008"
"           10   Units used:                                          ie METRIC"
"                Job folder:              Q:\13-212\21203-13 (Dunnink - Hyland)"
"                Output filename:                    100-yr HYLAND ROAD UNC.out"
"                Licensee name:                                  Mike.Vaughan"
"                Company                                                      "
"                Date & Time last used:                2/27/2015 at 12:20:52 PM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1500.000   Max. Hydrograph"
" 47          FILEI_O Read/Open 100-YEAR GUELPH TURGRASS CS.stm"
"             1   1=read/open; 2=write/save"
"             1   1=rainfall; 2=hydrograph"
"             1   1=rain; 2=imperv; 3=perv"
"              100-YEAR GUELPH TURGRASS CS.stm"
"              100-YEAR GUELPH TURFGRASS CS STORM"
"              New storm defined"
"              Total depth                  71.219    mm"
"              Maximum intensity           224.737    mm/hr"
"              Duration                    180.000   minutes"
"                   0.000     0.000     0.000     0.000 c.m/sec"
"             6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"             1   Triangular SCS"
"             1   Equal length"
"             2   Horton equation"
"           201   C101 - HYLAND ROAD PROPERTY POST DEVELOPMENT"
"        20.000   % Impervious"
"         1.050   Total Area"
"       100.000   Flow length"
"         2.000   Overland Slope"
"         0.840   Pervious Area"
"       100.000   Pervious length"
"         2.000   Pervious slope"
"         0.210   Impervious Area"
"       100.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
"         0.250   Pervious Lag constant (hours)"
"         5.000   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.050   Impervious Lag constant (hours)"
"         1.500   Impervious Depression storage"
"                     0.170     0.000     0.000     0.000 c.m/sec"
"              Catchment 201          Pervious   Impervious Total Area "
"              Surface Area           0.840      0.210      1.050      hectare"
"              Time of concentration  18.781     3.304      13.154     minutes"
"              Time to Centroid       100.074    88.309     95.796     minutes"
"              Rainfall depth         71.219     71.219     71.219     mm"
"              Rainfall volume        598.24     149.56     747.80     c.m"
"              Rainfall losses        41.259     2.758      33.559     mm"
"              Runoff depth           29.960     68.461     37.660     mm"
"              Runoff volume          251.66     143.77     395.43     c.m"
"              Runoff coefficient     0.421      0.961      0.529      "
"              Maximum flow           0.137      0.096      0.170      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.170     0.170     0.000     0.000"
" 38          START/RE-START TOTALS 201"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    1.050    hectare"
"             Total Impervious area                   0.210    hectare"
"             Total % impervious                     20.000"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 465"
"                MIDUSS created                          Tuesday, February 05, 2008"
"           10   Units used:                                              ie METRIC"
"                Job folder:                 Q:\13-212\21203-13 (Dunnink - Hyland)"
"                Output filename:                            2-yr GLENBURNIE EX.out"
"                Licensee name:                                      Mike.Vaughan"
"                Company                                                         "
"                Date & Time last used:                   3/12/2015 at 3:16:06 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 47          FILEI_O Read/Open 2-YEAR GUELPH TURGRASS CS.stm"
"             1   1=read/open; 2=write/save"
"             1   1=rainfall; 2=hydrograph"
"             1   1=rain; 2=imperv; 3=perv"
"              2-YEAR GUELPH TURGRASS CS.stm"
"              2-year storm - Guelph Turfgrass CS"
"              New storm defined"
"              Total depth                  29.554    mm"
"              Maximum intensity           108.409    mm/hr"
"              Duration                    180.000   minutes"
"                   0.000     0.000     0.000     0.000 c.m/sec"
"             6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"             1   Triangular SCS"
"             1   Equal length"
"             2   Horton equation"
"           101   C101 - GLENBURNIE AVE PROPERTY EX"
"         0.000   % Impervious"
"         0.640   Total Area"
"        70.000   Flow length"
"        11.000   Overland Slope"
"         0.640   Pervious Area"
"        70.000   Pervious length"
"        11.000   Pervious slope"
"         0.000   Impervious Area"
"        70.000   Impervious length"
"        11.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
"         0.250   Pervious Lag constant (hours)"
"         5.000   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.050   Impervious Lag constant (hours)"
"         1.500   Impervious Depression storage"
"                     0.002     0.000     0.000     0.000 c.m/sec"
"               Catchment 101          Pervious   Impervious Total Area "
"               Surface Area           0.640      0.000      0.640      hectare"
"               Time of concentration  39.849     2.141      39.847     minutes"
"               Time to Centroid       109.562    89.051     109.561    minutes"
"               Rainfall depth         29.554     29.554     29.554     mm"
"               Rainfall volume        189.15     0.00       189.15     c.m"
"               Rainfall losses        28.937     1.911      28.937     mm"
"               Runoff depth           0.617      27.643     0.617      mm"
"               Runoff volume          3.95       0.00       3.95       c.m"
"               Runoff coefficient     0.021      0.000      0.021      "
"               Maximum flow           0.002      0.000      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"             4   Add Runoff "
"                     0.002     0.002     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                        0.640    hectare"
"              Total Impervious area                       0.000    hectare"
"              Total % impervious                          0.000"
" 19           EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                              Version 2.25  rev. 465"
"                MIDUSS created                          Tuesday, February 05, 2008"
"           10   Units used:                                              ie METRIC"
"                Job folder:                 Q:\13-212\21203-13 (Dunnink - Hyland)"
"                Output filename:                          2-yr GLENBURNIE UNC2.out"
"                Licensee name:                                      Mike.Vaughan"
"                Company                                                          "
"                Date & Time last used:                   3/12/2015 at 3:17:44 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 47          FILEI_O Read/Open 2-YEAR GUELPH TURGRASS CS.stm"
"             1   1=read/open; 2=write/save"
"             1   1=rainfall; 2=hydrograph"
"             1   1=rain; 2=imperv; 3=perv"
"              2-YEAR GUELPH TURGRASS CS.stm"
"              2-year storm - Guelph Turfgrass CS"
"              New storm defined"
"              Total depth                   29.554    mm"
"              Maximum intensity            108.409    mm/hr"
"              Duration                     180.000   minutes"
"                   0.000     0.000     0.000     0.000 c.m/sec"
"             6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"             1   Triangular SCS"
"             1   Equal length"
"             2   Horton equation"
"           201   C201 - GLENBURNIE AVE PROPERTY TO FRONT"
"        45.000   % Impervious"
"         0.244   Total Area"
"        25.000   Flow length"
"         2.000   Overland Slope"
"         0.134   Pervious Area"
"        25.000   Pervious length"
"         2.000   Pervious slope"
"         0.110   Impervious Area"
"        25.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
"         0.250   Pervious Lag constant (hours)"
"         5.000   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.050   Impervious Lag constant (hours)"
"         1.500   Impervious Depression storage"
"                     0.026     0.000     0.000     0.000 c.m/sec"
"              Catchment 201          Pervious   Impervious Total Area "
"              Surface Area           0.134      0.110      0.244      hectare"
"              Time of concentration  35.829     1.925      2.823      minutes"
"              Time to Centroid       106.267    88.721     89.186     minutes"
"              Rainfall depth         29.554     29.554     29.554     mm"
"              Rainfall volume        39.66      32.45      72.11      c.m"
"              Rainfall losses        28.938     1.863      16.754     mm"
"              Runoff depth           0.616      27.691     12.800     mm"
"              Runoff volume          0.83       30.40      31.23      c.m"
"              Runoff coefficient     0.021      0.937      0.433      "
"              Maximum flow           0.000      0.026      0.026      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.026     0.026     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.026     0.026     0.026     0.000"
" 40          HYDROGRAPH   Combine    34"
"            6   Combine "
"           34   Node #"
"                INTO SEWERS"
"             Maximum flow                  0.026    c.m/sec"
"             Hydrograph volume            31.232    c.m"
"                    0.026     0.026     0.026     0.026"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.026     0.000     0.026     0.026"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          202   C202 - POST DEVELOPMENT FLOW TO WETLAND"
"       10.000   % Impervious"
"        0.396   Total Area"
"       25.000   Flow length"
"        7.000   Overland Slope"
"        0.356   Pervious Area"
"       25.000   Pervious length"
"        7.000   Pervious slope"
"        0.040   Impervious Area"
"       25.000   Impervious length"
"        7.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.010     0.000     0.026     0.026 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.356      0.040      0.396      hectare"
"             Time of concentration  24.604     1.322      5.233      minutes"
"             Time to Centroid       97.208     87.800     89.380     minutes"
"             Rainfall depth         29.554     29.554     29.554     mm"
"             Rainfall volume        105.33     11.70      117.03     c.m"
"             Rainfall losses        28.938     2.074      26.251     mm"
"             Runoff depth           0.616      27.480     3.303      mm"
"             Runoff volume          2.20       10.88      13.08      c.m"
"             Runoff coefficient     0.021      0.930      0.112      "
"             Maximum flow           0.001      0.010      0.010      c.m/sec"
" 38          START/RE-START TOTALS 202"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                        0.244    hectare"
"             Total Impervious area                       0.110    hectare"
"             Total % impervious                         45.000"
" 19          EXIT"
```

```
"               MIDUSS Output ----------------------------------------------->"
"               MIDUSS version                          Version 2.25  rev. 465"
"               MIDUSS created                       Tuesday, February 05, 2008"
"          10   Units used:                                          ie METRIC"
"               Job folder:              Q:\13-212\21203-13 (Dunnink - Hyland)"
"               Output filename:                      10-yr GLENBURNIE EX.out"
"               Licensee name:                                  Mike.Vaughan"
"               Company                                                       "
"               Date & Time last used:              2/27/2015 at 12:40:19 PM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1500.000   Max. Hydrograph"
" 47          FILEI_O Read/Open 10-YEAR GUELPH TURGRASS CS.stm"
"           1   1=read/open; 2=write/save"
"           1   1=rainfall; 2=hydrograph"
"           1   1=rain; 2=imperv; 3=perv"
"            10-YEAR GUELPH TURGRASS CS.stm"
"            10-yr storm guelph turfgrass"
"            New storm defined"
"            Total depth                   48.049    mm"
"            Maximum intensity            159.688    mm/hr"
"            Duration                     180.000   minutes"
"                 0.000     0.000     0.000     0.000 c.m/sec"
"           5   10hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"           1   Triangular SCS"
"           1   Equal length"
"           2   Horton equation"
"         101   C101 - GLENBURNIE AVE PROPERTY EX"
"       0.000   % Impervious"
"       0.640   Total Area"
"      70.000   Flow length"
"      11.000   Overland Slope"
"       0.640   Pervious Area"
"      70.000   Pervious length"
"      11.000   Pervious slope"
"       0.000   Impervious Area"
"      70.000   Impervious length"
"      11.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.015   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.050   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                    0.060     0.000     0.000     0.000 c.m/sec"
"           Catchment 101          Pervious   Impervious Total Area "
"           Surface Area           0.640      0.000      0.640      hectare"
"           Time of concentration  12.845     1.834      12.845     minutes"
"           Time to Centroid       90.088     86.939     90.088     minutes"
"           Rainfall depth         48.049     48.049     48.049     mm"
"           Rainfall volume        307.51     0.00       307.51     c.m"
"           Rainfall losses        36.423     2.127      36.423     mm"
"           Runoff depth           11.626     45.921     11.626     mm"
"           Runoff volume          74.40      0.00       74.41      c.m"
"           Runoff coefficient     0.242      0.000      0.242      "
"           Maximum flow           0.060      0.000      0.060      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.060     0.060     0.000     0.000"
" 38          START/RE-START TOTALS 101"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                        0.640    hectare"
"             Total Impervious area                       0.000    hectare"
"             Total % impervious                          0.000"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 465"
"                MIDUSS created                       Tuesday, February 05, 2008"
"           10   Units used:                                          ie METRIC"
"                Job folder:              Q:\13-212\21203-13 (Dunnink - Hyland)"
"                Output filename:                    10-yr GLENBURNIE UNC2.out"
"                Licensee name:                                   Mike.Vaughan"
"                Company                                                       "
"                Date & Time last used:                2/27/2015 at 2:32:48 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 47          FILEI_O Read/Open 10-YEAR GUELPH TURGRASS CS.stm"
"             1   1=read/open; 2=write/save"
"             1   1=rainfall; 2=hydrograph"
"             1   1=rain; 2=imperv; 3=perv"
"              10-YEAR GUELPH TURGRASS CS.stm"
"              10-yr storm guelph turfgrass"
"              New storm defined"
"              Total depth                  48.049    mm"
"              Maximum intensity           159.688    mm/hr"
"              Duration                    180.000   minutes"
"                   0.000     0.000     0.000     0.000 c.m/sec"
"             5   10hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"             1   Triangular SCS"
"             1   Equal length"
"             2   Horton equation"
"           201   C201 - GLENBURNIE AVE PROPERTY TO FRONT"
"        45.000   % Impervious"
"         0.244   Total Area"
"        25.000   Flow length"
"         2.000   Overland Slope"
"         0.134   Pervious Area"
"        25.000   Pervious length"
"         2.000   Pervious slope"
"         0.110   Impervious Area"
"        25.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
"         0.250   Pervious Lag constant (hours)"
"         5.000   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.050   Impervious Lag constant (hours)"
"         1.500   Impervious Depression storage"
"                     0.043     0.000     0.000     0.000 c.m/sec"
"              Catchment 201          Pervious   Impervious Total Area "
"              Surface Area           0.134      0.110      0.244      hectare"
"              Time of concentration  11.549     1.649      4.000      minutes"
"              Time to Centroid       88.951     86.608     87.164     minutes"
"              Rainfall depth         48.049     48.049     48.049     mm"
"              Rainfall volume        64.56      52.82      117.38     c.m"
"              Rainfall losses        36.356     2.166      20.971     mm"
"              Runoff depth           11.693     45.883     27.078     mm"
"              Runoff volume          15.71      50.44      66.15      c.m"
"              Runoff coefficient     0.243      0.955      0.564      "
"              Maximum flow           0.013      0.040      0.043      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.043     0.043     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.043     0.043     0.043     0.000"
" 40          HYDROGRAPH   Combine    34"
"            6   Combine "
"           34   Node #"
"                INTO SEWERS"
"             Maximum flow                 0.043    c.m/sec"
"             Hydrograph volume           66.152    c.m"
"                    0.043     0.043     0.043     0.043"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.043     0.000     0.043     0.043"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          202   C202 - POST DEVELOPMENT FLOW TO WETLAND"
"       10.000   % Impervious"
"        0.396   Total Area"
"       25.000   Flow length"
"        7.000   Overland Slope"
"        0.356   Pervious Area"
"       25.000   Pervious length"
"        7.000   Pervious slope"
"        0.040   Impervious Area"
"       25.000   Impervious length"
"        7.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.056     0.000     0.043     0.043 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.356      0.040      0.396      hectare"
"             Time of concentration  7.931      1.132      5.881      minutes"
"             Time to Centroid       85.749     85.904     85.796     minutes"
"             Rainfall depth         48.049     48.049     48.049     mm"
"             Rainfall volume        171.12     19.01      190.13     c.m"
"             Rainfall losses        36.380     2.720      33.014     mm"
"             Runoff depth           11.669     45.329     15.035     mm"
"             Runoff volume          41.56      17.94      59.49      c.m"
"             Runoff coefficient     0.243      0.943      0.313      "
"             Maximum flow           0.047      0.015      0.056      c.m/sec"
" 38          START/RE-START TOTALS 202"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.244    hectare"
"             Total Impervious area                     0.110    hectare"
"             Total % impervious                       45.000"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 465"
"                MIDUSS created                          Tuesday, February 05, 2008"
"           10   Units used:                                              ie METRIC"
"                Job folder:                 Q:\13-212\21203-13 (Dunnink - Hyland)"
"                Output filename:                          100-yr GLENBURNIE EX.out"
"                Licensee name:                                      Mike.Vaughan"
"                Company                                                          "
"                Date & Time last used:                    2/27/2015 at 12:32:47 PM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1500.000   Max. Hydrograph"
" 47          FILEI_O Read/Open 100-YEAR GUELPH TURGRASS CS.stm"
"           1   1=read/open; 2=write/save"
"           1   1=rainfall; 2=hydrograph"
"           1   1=rain; 2=imperv; 3=perv"
"            100-YEAR GUELPH TURGRASS CS.stm"
"            100-YEAR GUELPH TURFGRASS CS STORM"
"            New storm defined"
"            Total depth                   71.219    mm"
"            Maximum intensity            224.737    mm/hr"
"            Duration                     180.000   minutes"
"                 0.000     0.000     0.000     0.000 c.m/sec"
"           6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"           1   Triangular SCS"
"           1   Equal length"
"           2   Horton equation"
"         101   C101 - GLENBURNIE AVE PROPERTY EX"
"       0.000   % Impervious"
"       0.640   Total Area"
"      70.000   Flow length"
"      11.000   Overland Slope"
"       0.640   Pervious Area"
"      70.000   Pervious length"
"      11.000   Pervious slope"
"       0.000   Impervious Area"
"      70.000   Impervious length"
"      11.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.015   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.050   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                   0.156     0.000     0.000     0.000 c.m/sec"
"            Catchment 101          Pervious   Impervious Total Area "
"            Surface Area           0.640      0.000      0.640      hectare"
"            Time of concentration  9.092      1.600      9.092      minutes"
"            Time to Centroid       89.575     85.662     89.575     minutes"
"            Rainfall depth         71.219     71.219     71.219     mm"
"            Rainfall volume        455.80     0.00       455.80     c.m"
"            Rainfall losses        41.365     2.498      41.365     mm"
"            Runoff depth           29.853     68.721     29.853     mm"
"            Runoff volume          191.06     0.00       191.06     c.m"
"            Runoff coefficient     0.419      0.000      0.419      "
"            Maximum flow           0.156      0.000      0.156      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.156     0.156     0.000     0.000"
" 38          START/RE-START TOTALS 101"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                        0.640    hectare"
"             Total Impervious area                       0.000    hectare"
"             Total % impervious                          0.000"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 465"
"                MIDUSS created                          Tuesday, February 05, 2008"
"           10   Units used:                                              ie METRIC"
"                Job folder:                 Q:\13-212\21203-13 (Dunnink - Hyland)"
"                Output filename:                        100-yr GLENBURNIE UNC2.out"
"                Licensee name:                                    Mike.Vaughan"
"                Company                                                          "
"                Date & Time last used:                    2/27/2015 at 2:38:05 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 47          FILEI_O Read/Open 100-YEAR GUELPH TURGRASS CS.stm"
"            1   1=read/open; 2=write/save"
"            1   1=rainfall; 2=hydrograph"
"            1   1=rain; 2=imperv; 3=perv"
"             100-YEAR GUELPH TURGRASS CS.stm"
"             100-YEAR GUELPH TURFGRASS CS STORM"
"             New storm defined"
"             Total depth                   71.219    mm"
"             Maximum intensity            224.737    mm/hr"
"             Duration                     180.000   minutes"
"                  0.000     0.000     0.000     0.000 c.m/sec"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          201   C201 - GLENBURNIE AVE PROPERTY TO FRONT"
"       45.000   % Impervious"
"        0.244   Total Area"
"       25.000   Flow length"
"        2.000   Overland Slope"
"        0.134   Pervious Area"
"       25.000   Pervious length"
"        2.000   Pervious slope"
"        0.110   Impervious Area"
"       25.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.080     0.000     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           0.134      0.110      0.244      hectare"
"             Time of concentration  8.175      1.438      3.785      minutes"
"             Time to Centroid       88.816     85.404     86.592     minutes"
"             Rainfall depth         71.219     71.219     71.219     mm"
"             Rainfall volume        95.58      78.20      173.77     c.m"
"             Rainfall losses        41.226     2.623      23.855     mm"
"             Runoff depth           29.992     68.595     47.364     mm"
"             Runoff volume          40.25      75.32      115.57     c.m"
"             Runoff coefficient     0.421      0.963      0.665      "
"             Maximum flow           0.040      0.058      0.080      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.080     0.080     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.080     0.080     0.080     0.000"
" 40          HYDROGRAPH   Combine    34"
"            6   Combine "
"           34   Node #"
"                INTO SEWERS"
"             Maximum flow                  0.080    c.m/sec"
"             Hydrograph volume           115.568    c.m"
"                    0.080     0.080     0.080     0.080"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.080     0.000     0.080     0.080"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          202   C202 - POST DEVELOPMENT FLOW TO WETLAND"
"       10.000   % Impervious"
"        0.396   Total Area"
"       25.000   Flow length"
"        7.000   Overland Slope"
"        0.356   Pervious Area"
"       25.000   Pervious length"
"        7.000   Pervious slope"
"        0.040   Impervious Area"
"       25.000   Impervious length"
"        7.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.127     0.000     0.080     0.080 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.356      0.040      0.396      hectare"
"             Time of concentration  5.614      0.988      4.690      minutes"
"             Time to Centroid       85.994     84.805     85.756     minutes"
"             Rainfall depth         71.219     71.219     71.219     mm"
"             Rainfall volume        253.82     28.20      282.03     c.m"
"             Rainfall losses        41.259     3.886      37.522     mm"
"             Runoff depth           29.960     67.333     33.697     mm"
"             Runoff volume          106.78     26.66      133.44     c.m"
"             Runoff coefficient     0.421      0.945      0.473      "
"             Maximum flow           0.115      0.021      0.127      c.m/sec"
" 38          START/RE-START TOTALS 202"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.244    hectare"
"             Total Impervious area                     0.110    hectare"
"             Total % impervious                       45.000"
" 19          EXIT"
```