

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.

R.P. Magahav, B.A.



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.

R.P. Magahav, B.A.

J. M. Laws, O.L.S.



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 culde-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 (m³/sec)							
Storm	Hyland R	oad		Glenburnie Drive				
Event	To Wetlands			To Wetlands To Storn		To Storm	Sewer	
	Pre- Dev. Flow	Post- Dev. Flow		Pre- Dev. Flow	Post- Dev. Flow	Pre- Dev. Flow	Post-Dev. Flow	
21/20	0.002	0.044		0.002	0.010	0		0.026
2yrs 10yrs	0.002	0.044		0.060	0.016	0		0.020
100yrs	0.216	0.170		0.156	0.127	0	<u>-</u>	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.



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 (m³)							
Storm Event	Hyland Road To Wetlands			Glenburnie Drive To Wetlands				
	Pre- Dev. Volume	Post- Dev. Volume	Increase/ Decreas e	Pre- Dev. Volume	Post- Dev. Volume	Increase/ Decreas e	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 $66.05~\text{m}^3$, $56.46~\text{m}^3$ and $22.76~\text{m}^3$ for 2 year, 10 year and 100 year storm events, respectively.

R.P. Magahay, B.A.

J. M. Laws, O.L.S.



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

Consulting Engineer

John Duffy, P. Eng.

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

8

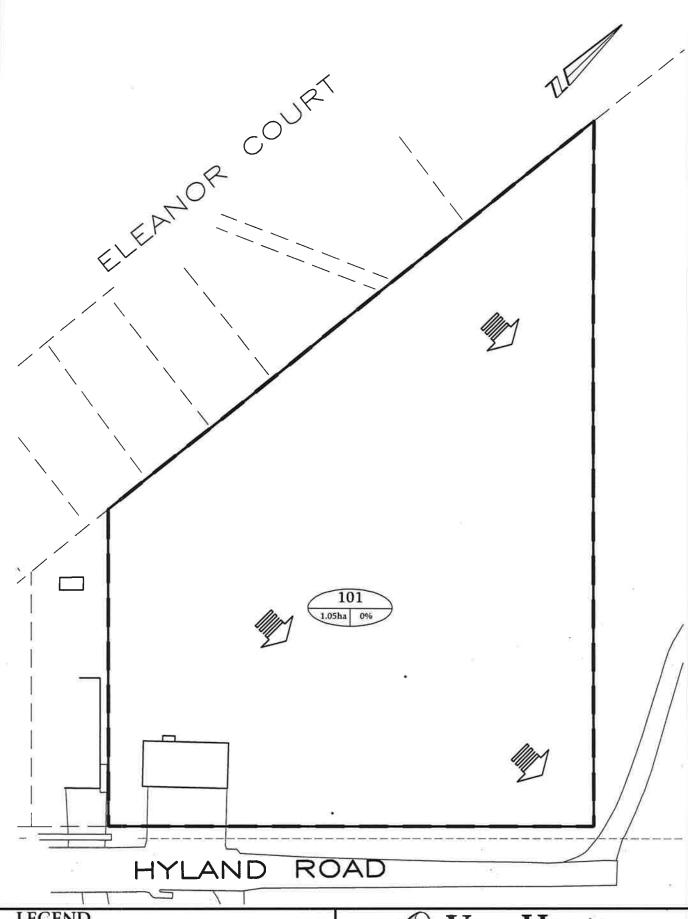
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PRE DEVELOPMENT DRAINAGE CATCHMENT AREAS PROPOSED HYLAND ROAD CUL-DE-SAC PART OF LOT 12, REGISTERED PLAN 359

DRAWING SCALE 1:750







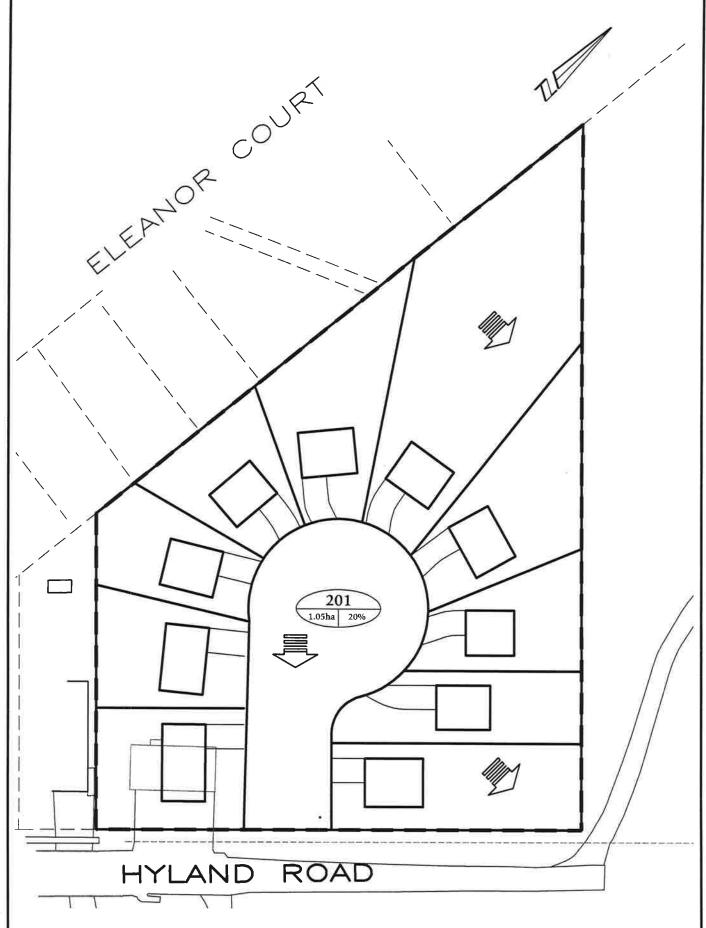
DRAINAGE AREA BOUNDARY

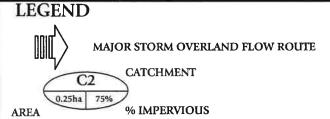


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Mar 06,2015-2:22pmL:\Guelph\359\catchments (87 HYLAND ROAD) UTM 2010.dwg

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





DRAINAGE AREA BOUNDARY



423 WOOLWICH STREET GUELPH - ONTARIO, NIH 3X3 PHONE: (519) 821 - 2763 FAX: 821 - 2770 www.vanharten.com 660 RIDDELL ROAD, UNIT 1 ORANGEVILLE — ONTARIO, L9W 5G5 PHONE: (519) 940 — 4110 FAX: 519 — 940 — 4113 www.vanharten.com

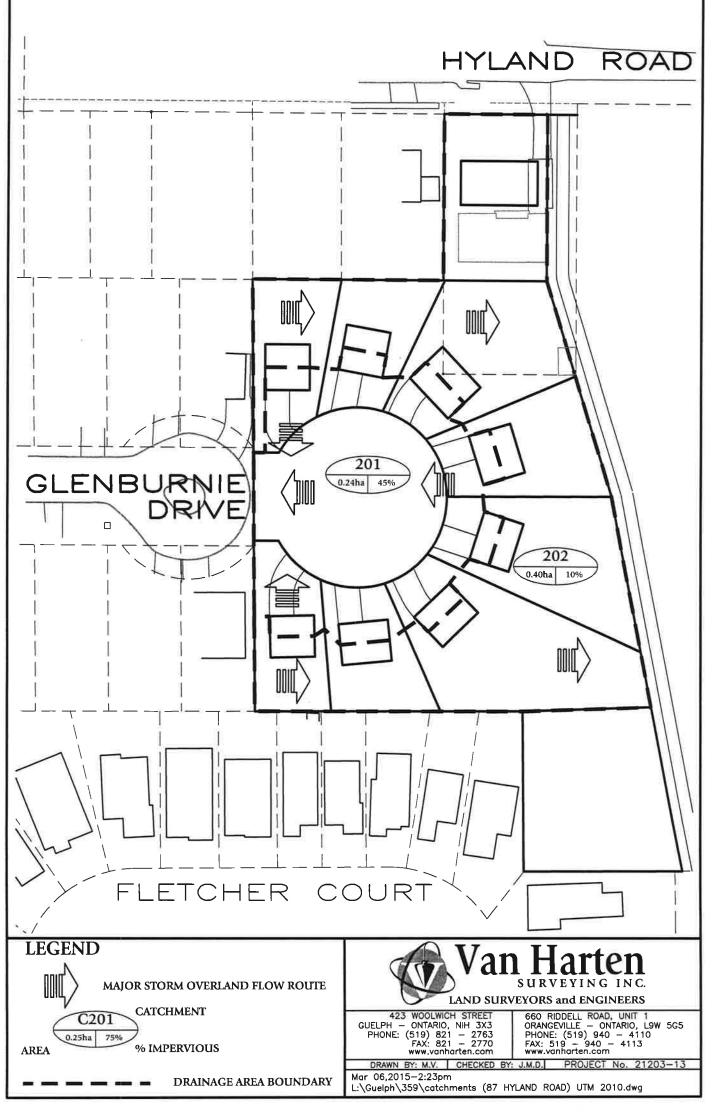
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PRE DEVELOPMENT DRAINAGE CATCHMENT AREAS PROPOSED GLENBURNIE DRIVE EXTENSION PART OF LOTS 4 & 5, REGISTERED PLAN 359 **DRAWING SCALE 1:750** HYLAND ROAD ENBURNIE COURT FLETCHER LEGEND MAJOR STORM OVERLAND FLOW ROUTE SURVEYING INC. LAND SURVEYORS and ENGINEERS CATCHMENT 423 WOOLWICH STREET GUELPH — ONTARIO, NIH 3X3 PHONE: (519) 821 — 2763 FAX: 821 — 2770 www.vanharten.com 660 RIDDELL ROAD, UNIT 1 ORANGEVILLE — ONTARIO, L9W 5G5 PHONE: (519) 940 — 4110 FAX: 519 — 940 — 4113 www.vanharten.com C201 0.25ha 75% % IMPERVIOUS AREA PROJECT No. 21203-13 DRAWN BY: M.V. | CHECKED BY: J.M.D. Mar 06,2015-2:23pm 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





APPENDIX B MIDUSS OUTPUT

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                New storm defined"
               Maximum intensity 108.409 mm/hr"

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Rainfall volume 310.32
Rainfall losses 28.937
Runoff depth 0.617
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               2-YEAR GUELPH TURGRASS CS.stm"
               2-year storm - Guelph Turfgrass CS"
               New storm defined"
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               Rainfall depth
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               Rainfall volume 248.25
Rainfall losses 28.937
Runoff depth 0.617
Runoff volume 5.18
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                  Pervious Lag constant (hours)"
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                  Pervious Depression storage"
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               Time of concentration 20.156
Time to Centroid 96.907
Rainfall depth 48.049
Rainfall volume 504.51
Rainfall losses 36.354
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0.000 0.073
               Maximum flow
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" 40
               HYDROGRAPH Add Runoff "
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10	4 Add Runoff "		
38	0.073 0.073 0.000 START/RE-START TOTALS 101"	0.000"	
ii.	3 Runoff Totals on EXIT"		
"	Total Catchment area	1.050	hectare"
**	Total Impervious area	0.000	hectare"
"	Total % impervious	0.000"	
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MIDUSS Output ----
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                 Company
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                 Time Step"
     180.000 Max. Storm length"
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             1 1=read/open; 2=write/save"
1 1=rainfall; 2=hydrograph"
                 1=rain; 2=imperv; 3=perv"
              10-YEAR GUELPH TURGRASS CS.stm"
              10-yr storm guelph turfgrass'
              New storm defined"
              Total depth
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Maximum intensity
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             5 10hyd Hydrograph extension used in this file" CATCHMENT 201"
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33
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                 Horton equation"
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      201 C101 - HYLAND
20.000 % Impervious"
                 C101 - HYLAND ROAD PROPERTY POST DEVELOPMENT"
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                 Total Area"
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                 Flow length"
        2.000
                 Overland Slope"
     2.000 Overland Slope"
0.840 Pervious Area"
100.000 Pervious length
2.000 Pervious slope"
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        0.210
                 Impervious Area"
     100.000 Impervious length"
2.000 Impervious slope"
       0.250
75.000
                 Pervious Manning 'n'"
                 Pervious Max.infiltration"
      12.500
0.250
                 Pervious Min.infiltration"
                 Pervious Lag constant (hours)"
                 Pervious Depression storage"
Impervious Manning 'n'"
        5.000
       0.015
       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"
                                Pervious Impervious Total Area "
             Catchment 201
                                                                            hectare"
                                                     0.210 1.050
3.788 15.29
              Surface Area
                                        0.840
              Time of concentration 26.532
                                                     3.788
                                                                  15.295
                                                                              minutes"
              Time to Centroid 102.797
Rainfall depth 48.049
Rainfall volume 403.61
Rainfall losses 36.353
Runoff depth 11.696
                                                               96.470
48.049
504 51
                                                     89.991
                                                     48.049
                                                                              mm"
                                                     100.90
                                                                  504.51
                                                                               c.m"
                                                                29.555
                                                     2.363
                                                                               mm "
              Runoff depth
Runoff volume
                                                     45.686
                                                                 18.494
                                                                               mm"
             Runoff coefficient 0.243
Maximum flow
                                        98.24 95.94 194.18
0.243 0.951 0.385
0.047 0.067 0.085
                                                                               c.m"
                                                                              c.m/sec"
             HYDROGRAPH Add Runoff "
```

44	4 Add Runoff "	
11	0.085 0.085 0.00	0.000"
" 38	START/RE-START TOTALS 201"	
H	3 Runoff Totals on EXIT"	
"	Total Catchment area	1.050 hectare"
11	Total Impervious area	0.210 hectare"
**	Total % impervious	20.000"
11 19	FYTT"	

```
MIDUSS Output -----
                     MIDUSS version
                                                                     Version 2.25 rev. 465"
                     MIDUSS created
                                                                  Tuesday, February 05, 2008"
                    Units used:
               10
                                                   ie METRIC"
Q:\13-212\21203-13 (Dunnink - Hyland)"
                     Job folder:
                     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"
                 TIME PARAMETERS"
        5.000 Time Step"
180.000 Max. Storm length"
       1500.000
                     Max. Hydrograph"
               FILEI_O Read/Open 100-YEAR GUELPH TURGRASS CS.stm"
                1 l=read/open; 2=write/save"
1 l=rainfall; 2=hydrograph"
                     1=rain; 2=imperv; 3=perv"
                 100-YEAR GUELPH TURGRASS CS.stm"
                  100-YEAR GUELPH TURFGRASS CS STORM"
                 New storm defined"
                                                   /1.219 mm"
224.737 mm/hr"
180.000 minutes"
                 Total depth
                 Total deptn
Maximum intensity
                 Duration 180.000 minutes"

0.000 0.000 0.000 0.000 c.m/sec"

100hyd Hydrograph extension used in this file"
CATCHMENT 101"
                 Duration
                6
  33
                1 Triangular SCS"
                    Equal length"
                    Horton equation"
             101 C101 - HYLLAN,
.000 % Impervious"
                    C101 - HYLAND ROAD PROPERTY EX"
          0.000
           1.050
        100.000 Flow length"
        5.000 Pervious Area"
100.000 Pervious length
5.000 Pervious slope"
0.000 Tempervious 3
                    Pervious length"
          0.000
                     Impervious Area"
        100.000 Impervious length"
5.000 Impervious slope"
         0.250 Pervious Manning 'n'"
75.000 Pervious Max infiltre
                    Pervious Max.infiltration"
         12.500 Pervious Min.infiltration"
0.250 Pervious Lag constant (hours)"
           5.000
                    Pervious Depression storage"
Impervious Manning 'n'"
          0.015
          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 c.m/sec"
                                     Pervious Impervious Total Area
                 Catchment 101
                                                                                      hectare"
                                                             0.000 1.050
                 Surface Area
                                              1.050
                 Time of concentration 14.267
                                                            2.510
                                                                          14.267
                                                                                        minutes"
                 Time to Centroid 95.244
Rainfall depth 71.219
Rainfall volume 747.80
Rainfall losses 41.214
Runoff depth 30.005
                                                             87.109
                                                                           95.244
                                                            71.219
                                                                           71.219
                                                                                        mm "
                                                            0.00
                                                                          747.80
                                                                                         c.m"
                 Runoff depth 30.005 68.400 30.005
Runoff volume 315.05 0.00 315.05
Runoff coefficient 0.421 0.000 0.421
Maximum flow 0.216 0.000 0.216
HYDROGRAPH Add Runoff "
                                                                                         mm"
                                                                                         mm "
                                                                                         C.m"
                                                                                        c.m/sec"
H 40
```

37	4 Add Runoff "			
17	0.216 0.216	0.000	0.000"	
	38 START/RE-START TOTALS 101"			
**	3 Runoff Totals on EXIT"			
n	Total Catchment area		1.050	hectare"
11	Total Impervious area		0.000	hectare"
11	Total % impervious		0.000"	
11	19 EXIT"			

```
MIDUSS Output ----
                                                                  Version 2.25 rev. 465"
                    MIDUSS version
                    MIDUSS created
                                                                Tuesday, February 05, 2008"
                    Units used:
                                                 ie METRIC"
Q:\13-212\21203-13 (Dunnink - Hyland)"
                    Job folder:
                    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=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
                Maximum intensity
                                                 224.737
                                                                mm/hr"
                                                   180.000 minutes"
                Duration
                    ration 180.000 minutes"
0.000 0.000 0.000 c.m/sec"
100hyd Hydrograph extension used in this file"
               6
* 33
                CATCHMENT 201"
               1 Triangular SCS"
                    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"
п
          0.210
                    Impervious Area"
11
        100.000
                    Impervious length"
TT
         2.000
                    Impervious slope"
11
          0.250
                    Pervious Manning 'n'"
п
         75.000
                    Pervious Max.infiltration"
         12.500
                    Pervious Min.infiltration"
          0.250
                    Pervious Lag constant (hours)"
                    Pervious Depression storage"
          5.000
                    Impervious Manning 'n'"
          0.015
                    Impervious Max.infiltration"
         0.000
          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"
ent 201 Pervious Impervious Total Area "
                Catchment 201
                Time to Centroid

2.1.10US
0.840
18.781
                                                                                 hectare"
                                                          0.210 1.050
3.304 13.154
                                                                        13.154
                                                                                     minutes"
                Time to Centroid 100.074
Rainfall depth 71.219
Rainfall volume 598.24
Rainfall losses 41.259
Runoff depth 29.96C
                                                                    95.796
71.219
                                                          88.309
                                                                                     minutes"
                                                          71.219
                                                                                     mm "

    598.24
    149.56
    747.80

    41.259
    2.758
    33.559

    29.96C
    68.461
    37.660

    251.66
    143.77
    395.43

    0.421
    0.961
    0.529

    0.137
    0.096
    0.170

                                                          149.56
                                                                        747.80
                                                                                     c.m'
                                                                                     mm"
                Runoff depth
Runoff volume
Runoff coefficient
                                                                                     mm"
                                                                                     c.m"
                Maximum flow
                                                                                   c.m/sec"
" 40
                HYDROGRAPH Add Runoff "
```

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

```
MIDUSS Output ---->"
                                                            Version 2.25 rev. 465"
                   MIDUSS version
                   MIDUSS created
                                                         Tuesday, February 05, 2008"
                 Units used:
             10
                                            ie METRIC"
Q:\13-212\21203-13 (Dunnink - Hyland)"
                   Job folder:
                   Output filename:
                                                              2-yr GLENBURNIE EX.out"
                   Licensee name:
                                                                        Mike.Vaughan"
                  Company
Date & Time last used:
                                                             3/12/2015 at 3:16:06 PM"
11
               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 l=read/open; 2=write/save"
                   1=rainfall; 2=hydrograph"
                 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"
                                           108.409 mm/hr"
180.000 minutes"
               Maximum intensity
                    tion 180.000 minutes" 0.000 0.000 0.000 c.m/sec"
               Duration
              0.000 0.000 0.000 0.000 c.m/sec"
6 002hyd Hydrograph extension used in this file"
CATCHMENT 101"
              6
              1 Triangular SCS"
**
                  Equal length"
                  Horton equation"
"
                 C101 - GLENBURNIE AVE PROPERTY EX"
           101
         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"
**
                 Impervious Area"
         0.000
        70.000
                  Impervious length"
**
        11.000
                  Impervious slope"
         0.250
                  Pervious Manning 'n'"
11
                  Pervious Max.infiltration"
        75.000
**
        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"
                                Pervious Impervious Total Area "
0.640 0.000 0.640 h
               Catchment 101
                                                                       hectare"
                                                    0.000 0.640
               Surface Area
               Surface Area
Time of concentration 39.849
Time to Centroid 109.562
Rainfall depth 29.554
                                                    2.141
                                                                39.847
                                                                            minutes"
                                                            109.561
                                                   89.051
                                                    29,554
                                       189.15 0.00 189.15

28.937 1.911 28.937

0.617 27.643 0.617

3.95 0.00 3.95

0.021 0.000 0.021

0.002 0.000 0.002
               Rainfall volume
                                     189.15
28.937
0.617
               Rainfall losses
                                                                            mm"
               Runoff depth
Runoff volume
                                                                            mm"
              Maximum flow
HYDROGRAPH Add P
                                                                            c.m"
                                                                           c.m/sec"
" 40
```

	4 Add Runoff "		
ar .	0.002 0.002 0.00	0 0.000"	
38	START/RE-START TOTALS 101"		
10	3 Runoff Totals on EXIT"		
115	Total Catchment area	0.640	hectare"
11	Total Impervious area	0.000	hectare"
	Total % impervious	0.000"	
11 10	EVITE!		

 $\frac{1}{2}$

```
MIDUSS Output -----
                       MIDUSS version
                                                                           Version 2.25 rev. 465"
                       MIDUSS created
                                                                        Tuesday, February 05, 2008"
                10
                      Units used:
                                                        ie METRIC"
Q:\13-212\21203-13 (Dunnink - Hyland)"
                       Job folder:
                       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 l=read/open; 2=write/save"
1 l=rainfall; 2=hydrograph"
11
                       1=rainfall; 2=hydrograph"
**
                       1=rain; 2=imperv; 3=perv"
11
                   2-YEAR GUELPH TURGRASS CS.stm"
"
                   2-year storm - Guelph Turfgrass CS"
                   New storm defined"
                                                     29.554 mm"
108.409 mm/hr"
180.000 -
                   Total depth
                  Maximum intensity
                  Duration 180.000 minutes"

0.000 0.000 0.000 0.000 c.m/sec"

6 002hyd Hydrograph extension used in this file"

CATCHMENT 201"
                 6
33
                 1 Triangular SCS"
                1
                     Equal length"
                       Horton equation"
                 2
**
         201 C201 - GLENBURNIE AVE PROPERTY TO FRONT"
45.000 % Impervious"
"
            0.244
                      Total Area"
          25.000
                      Flow length"
          2.000
11
                      Overland Slope"
11
                       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 (hour
                      Pervious Lag constant (hours)"
           5.000
                      Pervious Depression storage"
           0.000 Impervious Max.infiltration"
0.000 Impervious Min.infiltration
           0.015
11
          0.050 Impervious Lag constant (hours)"
1.500 Impervious Depression storage"
                                       0.000 0.000 0.000 c.m/sec"

Pervious Impervious Total Area "

0.134 0.110 0.244 he
                             0.026
                  Catchment 201
                  Surface Area
                                                                 0.110 0.244 hectare"
1.925 2.823 minutes"

      Surface Area
      0.134

      Time of concentration
      35.829

      Time to Centroid
      106.267

      Rainfall depth
      29.554

      Rainfall volume
      39.66

      Rainfall losses
      28.938

      Runoff depth
      0.616

      Runoff volume
      0.83

      Runoff coefficient
      0.021

      Maximum flow
      0.000

                                                                                                minutes"
                                                                 88.721
                                                                            89.186
29.554
                                                                                 89.186
                                                                                                minutes"
                                                                  29.554
                                                                                                mm"
                                                                  32.45
                                                                                 72.11
                                                                                                c.m"
                                                  mm"
                                                                                                mm"
                                                                                                c.m"
                  Maximum flow
HYDROGRAPH Add Runoff "
                                                                                              c.m/sec"
```

```
4 Add Runoff "
             HYDROGRAPH Copy to Outflow"
                                                   0.000"
" 40
             8 Copy to Outflow"
0.026 0
             0.026 0.026 0.026
HYDROGRAPH Combine 34"
п
                                                    0.000"
" 40
            34
                 Node #"
                 INTO SEWERS"
              Maximum flow
                                            0.026
                                                     c.m/sec"
              Hydrograph volume
                                           31.232
                                                      c.m"
              0.026 0.026 0.026
HYDROGRAPH Start - New Tributary"
                                                    0.026"
 40
             2 Start - New Tributary"
              0.026 0.000
CATCHMENT 202"
                                          0.026
                                                   0.026"
 33
             1 Triangular SCS"
                 Equal length"
            1
FF
             2
                Horton equation"
          202
                 C202 - POST DEVELOPMENT FLOW TO WETLAND"
       10,000
                 % Impervious"
11
        0.396
                 Total Area"
FF
                Flow length"
Overland Slope"
       25.000
       7.000
17
TŦ
         0.356
                 Pervious Area"
TT
       25.000
                 Pervious length"
11
11
        7.000
                 Pervious slope"
        0.040
                 Impervious Area"
ŦŦ
       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"
77
        0.015
                 Impervious Manning 'n'"
        0.000
                 Impervious Max.infiltration"
97
        0.000
                 Impervious Min.infiltration"
**
        0.050
                 Impervious Lag constant (hours)"
17
        1.500
                 Impervious Depression storage"
п
                  0.010 0.000 0.026
                                                    0.026 c.m/sec"
m
                                    Pervious Impervious Total Area "
              Catchment 202
**
              Surface Area
                                     0.356
                                                0.040 0.396 hectare"
                                                1.322
87.800
                                                                       minutes"
              Time of concentration 24.604
                                                            5.233
              Time to Centroid
                                     97.208
                                                            89.380
                                                                       minutes"
              Rainfall depth
                                     29.554
                                                29.554
                                                          29.554
                                                                       mm"
                                                                       c.m"
              Rainfall volume
                                     105.33
                                                11.70
                                                            117.03
              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"
             START/RE-START TOTALS 202"
 38
             3 Runoff Totals on EXIT"
             Total Catchment area
Total Impervious area
                                                                   hectare"
                                                          0.244
                                                                   hectare"
                                                          0.110
              Total % impervious
                                                         45.000"
" 19
```

```
MIDUSS Output -----
                  MIDUSS version
                                                             Version 2.25 rev. 465"
                  MIDUSS created
                                                          Tuesday, February 05, 2008"
                  Units used:
                                            ie METRIC"
Q:\13-212\21203-13 (Dunnink - Hyland)"
                  Job folder:
                  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 l=read/open; 2=write/save*
1 l=rainfall; 2=hydrograph"
               1 1=rain; 2=imperv; 3=perv"
10-YEAR GUELPH TURGRASS CS.stm"
              1
               10-yr storm guelph turfgrass
               New storm defined"
               Total depth
                                                48.049
                                                          mm "
               Maximum intensity
                                            159.688 mm/hr"
180.000 minutes"
               Duration
                    5 10hyd Hydrograph extension used in this file" CATCHMENT 101"
 33
              1
                  Triangular SCS"
                  Equal length"
             1
              2
                  Horton equation"
           101
                  C101 - GLENBURNIE AVE PROPERTY EX"
        0.000
                  % Impervious"
         0.640
                  Total Area"
Flow length"
        70.000
        11.000 Overland Slope
0.640 Pervious Area"
                  Overland Slope"
       70.000
                  Pervious length"
                  Pervious slope'
        0.000 Impervious Area"
70.000 Impervious length"
        11.000
                  Impervious slope"
                  Pervious Manning 'n'"
         0.250
        75.000
                  Pervious Max.infiltration"
       12.500
0.250
                  Pervious Min.infiltration"
                  Pervious Lag constant (hours)"
         5.000
                  Pervious Depression storage"
Impervious Manning 'n'"
         0.015
                  Impervious Max.infiltration"
         0.000
         0.000
                  Impervious Min.infiltration"
         0.050 Impervious Lag constant (Hours 1.500 Impervious Depression storage" 0.000
                  Impervious Lag constant (hours)"
                                0.000 0.000
                                                         0.000 c.m/sec"
                                  Pervious Impervious Total Area "
               Catchment 101
                                                                          hectare"
                                                     0.000 0.640
                                         0.640
               Surface Area
               Time of concentration 12.845
Time to Centroid 90.088
Rainfall depth 48.049
Rainfall volume 307.51
Rainfall losses 36.423
                                                                              minutes"
                                                     1.834
                                                                  12.845
                                                     86.939
                                                                 90.088
                                                                              minutes"
                                                     48.049 48.049
                                                                              mm "
                                                     0.00
                                                                  307.51
                                                     2.127
                                                                36.423
                                                                              mm"
               Runoff depth
                                         11.626
                                                     45.921
                                                                  11.626
                                                                              \,mm^{\,\prime\prime}
               Runoff volume
Runoff coefficient
                                        74.40 0.00 74.41
0.242 0.000 0.242
0.060 0.000 0.060
                                                                 74.41
                                                                              C.m"
                                       /4.40
0.242
               Maximum flow
                                                                              c.m/sec"
" 40
               HYDROGRAPH Add Runoff "
```

II.	4 Add Runoff "		
•	0.060 0.060 0.0	0.000"	
" 38	START/RE-START TOTALS 101"		
W	3 Runoff Totals on EXIT"		
er.	Total Catchment area	0.640	hectare"
II	Total Impervious area	0.000	hectare"
tt.	Total % impervious	0.000"	
" 19	EXIT"		

```
MIDUSS Output -----
                  MIDUSS version
                                                            Version 2.25 rev. 465"
                  MIDUSS created
                                                         Tuesday, February 05, 2008"
                  Units used:
                                            ie METRIC"
Q:\13-212\21203-13 (Dunnink - Hyland)"
             10
                  Job folder:
                  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"
                                            48.049 mm"
159.688 mm/hr"
180.000 minutes"
               Total depth
               Maximum intensity
               Duration
                   180.000 minutes"
0.000 0.000 0.000 0.000 c.m/sec"
              5 10hyd Hydrograph extension used in this file" CATCHMENT 201"
              5
                  Triangular SCS"
                  Equal length"
                  Horton equation"
            201
                  C201 - GLENBURNIE AVE PROPERTY TO FRONT"
11
        45.000
                  % Impervious"
         0.244
                  Total Area"
        25.000
                  Flow length"
        2.000
                  Overland Slope"
         0.134
                  Pervious Area"
        25.000
2.000
0.110
                  Pervious length"
                  Pervious slope"
                  Impervious Area"
                  Impervious length"
        25.000
         2.000
                  Impervious slope"
         0.250
                  Pervious Manning 'n'"
        75.000
12.500
                  Pervious Max.infiltration"
                  Pervious Min.infiltration"
         0.250
                  Pervious Lag constant (hours)"
         5.000
                  Pervious Depression storage"
         0.015
                  Impervious Manning 'n'"
         0.000
                  Impervious Max.infiltration"
         1.500 Impervious Min.infiltration"

1.500 Impervious Lag constant (hours)"

1.500 Impervious Depression
                  Impervious Depression storage"
                      0.043 0.000 0.000
                                                        0.000 c.m/sec"
                                   Pervious Impervious Total Area "
               Catchment 201
                                                    0.110 0.244 hectare"
1.649 4.000 minutes"
               Surface Area
                                        0.134
               Time of concentration 11.549
Time to Centroid 88.951
Rainfall depth 48.049
                                                             87.164
48.049
                                                    86.608
                                                                             minutes"
                                                    48.049
                                                                             mm "
                                      64.56
36.356
               Rainfall volume
                                                    52.82
2.166
                                                                117.38
                                                                             C.m"
               Rainfall losses
                                                                20.971
                                                                             mm "
                                        11.693 45.883 27.078
15.71 50.44 66.15
0.243 0.955 0.564
0.013 0.040 0.043
               Runoff depth
Runoff volume
                                                                             mm "
                                      15.71
0.243
                                                                             c.m'
               Runoff coefficient
               Maximum flow
                                                                             c.m/sec"
" 40
               HYDROGRAPH Add Runoff "
```

```
4 Add Runoff "
              HYDROGRAPH Copy to Outflow"

Copy to Outflow
                                                     0.000"
" 40
             8 Copy to Outflow"
0.043 0.043
            0.043 0.043 0.043

HYDROGRAPH Combine 34"

6 Combine "

34 Node #"
                                                     0.000"
  40
                 INTO SEWERS"
              Maximum flow
                                             0.043
                                                      c.m/sec"
              Hydrograph volume
                                            66.152
                                                       c.m"
              0.043 0.043 0.043
HYDROGRAPH Start - New Tributary"
                                                      0.043"
 40
             2 Start - New Tributary"
              0.043 0.000
CATCHMENT 202"
                                           0.043
                                                    0.043"
  33
             1
                 Triangular SCS"
                 Equal length"
             1
                 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"
                 Pervious Manning 'n'"
       75.000
         0.250
                 Pervious Max.infiltration"
                 Pervious Min.infiltration"
                 Pervious Lag constant (hours)"
         0.250
         5.000
                 Pervious Depression storage"
17
         0.015
                 Impervious Manning 'n'"
         0.000
                 Impervious Max.infiltration"
Ħ
         0.000
                 Impervious Min.infiltration"
                 Impervious Lag constant (hours)
         0.050
         1.500
                 Impervious Depression storage"
                    0.056 0.000 0.043
                                                     0.043 c.m/sec"
              Catchment 202
                                     Pervious Impervious Total Area "
                                                                   hectare"
              Surface Area
                                      0.356
                                                 0.040 0.396
              Time of concentration 7.931
Time to Centroid 85.749
48.049
                                                 1.132
                                                             5.881
                                                                        minutes"
                                                 85.904
                                                            85.796
                                                                        minutes"
              Rainfall depth
                                      48.049
                                                 48.049
                                                            48.049
                                                                        mm"
                                                 19.01
              Rainfall volume
                                      171.12
                                                             190.13
                                                                        c.m"
              Rainfall losses
                                      36.380
                                                 2.720
                                                             33.014
                                                                        mm"
              Runoff depth
Runoff volume
                                      11.669
                                                                        mm"
                                                 45.329
                                                             15.035
                                     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
                                                                    hectare"
                                                           0.110
              Total % impervious
                                                          45.000"
19
              EXTT"
```

```
MIDUSS version
                                                         Version 2.25 rev. 465"
                 MIDUSS created
                                                       Tuesday, February 05, 2008"
            10
                 Units used:
                                           ie METRIC"
Q:\13-212\21203-13 (Dunnink - Hyland)"
                 Job folder:
                  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"
             FILEI_O Read/Open 100-YEAR GUELPH TURGRASS CS.stm"
             1 1=read/open; 2=write/save"
1 1=rainfall; 2=hydrograph"
                 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 "
                                                     mm/hr"
                                          224.737
              Maximum intensity
              Duration
                 ration 180.000 minutes"
0.000 0.000 0.000 0.000 c.m/sec"
100hyd Hydrograph extension used in this file"
                                            180.000
                                                      minutes"
             6
 33
              CATCHMENT 101"
                Triangular SCS"
             1
                 Equal length"
             2
                 Horton equation"
                 C101 - GLENBURNIE AVE PROPERTY EX"
           101
        0.000
                 % Impervious"
         0.640
                 Total Area"
        70.000
                 Flow length"
       11.000
                 Overland Slope"
         0.640
                 Pervious Area"
        70.000
                 Pervious length"
n
       11.000
                 Pervious slope"
        0.000
                 Impervious Area"
       70.000
                 Impervious length"
       11.000
                 Impervious slope"
                 Pervious Manning 'n'"
        0.250
        75.000
                 Pervious Max.infiltration"
       12.500
                 Pervious Min.infiltration"
        0.250
                 Pervious Lag constant (hours)"
         5.000
                 Pervious Depression storage"
Impervious Manning 'n'"
         0.015
        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"
                               Pervious Impervious Total Area "
              Catchment 101
                                                 0.000 0.640
1.600 9.092
                                                                     hectare"
minutes"
              Surface Area
                                      0.640
              Time of concentration 9.092
              Time to Centroid 89.575 Rainfall depth 71.219
                                                  85.662
                                                             89.575
                                                                         minutes"
              Rainfall depth
                                                 71.219
                                                            71.219
                                                                         mm"
              Rainfall volume
                                      455.80
                                                  0.00
                                                             455.80
                                                                         mm "
              Rainfall losses
                                      41.365
                                                 2.498
                                                             41.365
              Runoff depth
                                      29.853
                                                 68.721
                                                             29.853
                                                                         mm"
                                                 0.00 191.06
0.000 0.419
0.000 0.156
              Runoff volume
Runoff coefficient
                                                                         c.m"
                                      191.06
                                                             191.06
                                    0.419
              Maximum flow
                                                                        c.m/sec"
                                      0.156
              HYDROGRAPH Add Runoff "
```

MIDUSS Output ----

- 0

п	4 Add Runoff "			
1111	0.156 0.156	0.000	0.000"	
" 38	START/RE-START TOTALS 101"			
11	3 Runoff Totals on EXIT"			
11	Total Catchment area		0.640	hectare"
H	Total Impervious area		0,000	hectare"
5 11 .6	Total % impervious		0.000"	
" 19	ロマナマガ			

-

```
MIDUSS Output -----
                  MIDUSS version
                                                          Version 2.25 rev. 465"
                  MIDUSS created
                                                        Tuesday, February 05, 2008"
                 Units used:
            10
                                           ie METRIC" Q:\13-212\21203-13 (Dunnink - Hyland)"
                  Job folder:
                  Output filename:
                                                         100-yr GLENBURNIE UNC2.out"
                  Licensee name:
                                                                        Mike.Vaughan"
                  Company
Date & Time last used:
                                                            2/27/2015 at 2:38:05 PM"
               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 l=read/open; 2=write/save"
1 l=rainfall; 2=hydrograph"
                  1=rainfall; 2=hydrograph"
                 1=rain; 2=imperv; 3=perv"
              100-YEAR GUELPH TURGRASS CS.stm"
               100-YEAR GUELPH TURFGRASS CS STORM"
               New storm defined"
               Total depth
                   mum intensity 224.737 mm/hr"
ation 180.000 minutes"
0.000 0.000 0.000 c.m/sec"
               Maximum intensity
              Duration
              6 100hyd Hy
CATCHMENT 201"
                           Hydrograph extension used in this file"
             6
             1
                  Triangular SCS"
                  Equal length"
                  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"
                 Impervious Area"
         0.110
       25.000
                  Impervious length"
         2.000
                  Impervious slope"
                  Pervious Manning 'n'"
         0.250
        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"
                     0.000 0.000
                                                       0.000 c.m/sec"
                                Pervious Impervious Total Area "
              Catchment 201
              Surface Area 0.134
Time of concentration 8.175
Time to Centroid 88.816
Rainfall depth 71.219
                                                   0.110 0.244 hectare"
                                                                           minutes"
                                                   1.438
                                                               3.785
                                                   71.219 71 210
                                                   85.404
                                                                           minutes"
               Rainfall depth
                                        71.219
                                                                           mm"
                                      95.58
41.226
              Runoff depth
Runoff volume
Runoff coeffic
                                                   78.20
2.623
               Rainfall volume
                                                               173.77
                                                                           c.m"
                                                              23.855
                                                                           mm"
                                       29.992 68.595 47.364
40.25 75.32 115.57
0.421 0.963 0.665
0.040 0.058 0.080
                                                                           mm "
                                     40.25
                                                                           c.m"
              Maximum flow
                                                                          c.m/sec"
" 40
              HYDROGRAPH Add Runoff "
```

```
4 Add Runoff "
              HYDROGRAPH Copy to Outflow"

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