| DA: | To Pond - Section 6 | | |
|---|---|---|---|
| | C-factor | Area (Ac.) | CA |
| Woods | 0.25 | | 0.000 |
| Grass | 0.30 | 1.660 | 0.498 |
| Section 6 Lots | 0.50 | 3.500 | 1.750 |
| Conc | 0.80 | | 0.000 |
| Pavement | 0.90 | 0.730 | 0.657 |
| | | **Area** | **Total C-factor** |
| | | **5.89** | **0.49** |

Tc:

Overland:
Length = 200 ft
Slope = 1.0 %
c-factor = 0.75
tc = 6.7 minutes

Concentrated:
Length = 862 ft
H = 8 ft
9.1 minutes
**Tc = 15.8 minutes**

| | | | |
|---|---|---|---|
| $I_2$ = | 3.83 | $Q_2$ = | 11.13 cfs |
| $I_{10}$ = | 4.94 | $Q_{10}$ = | 14.36 cfs |
| $I_{100}$ = | 6.64 | $Q_{100}$ = | 19.28 cfs |

| DA: | Bypass - Section 6 | | |
|---|---|---|---|
| | C-factor | Area (Ac.) | CA |
| Woods | 0.25 | 36.40 | 9.100 |
| Grass | 0.30 | | 0.000 |
| Section 6 Lots | 0.50 | 2.400 | 1.200 |
| Conc | 0.80 | | 0.000 |
| Pavement | 0.90 | | 0.000 |
| | | **Area** | **Total C-factor** |
| | | **38.80** | **0.27** |

Tc:

Overland:
Length = 200 ft
Slope = 1.0 %
c-factor = 0.30
tc = 16.7 minutes

Concentrated:
Length = 1283 ft
H = 8 ft
14.3 minutes
**Tc = 31.0 minutes**

| | | | |
|---|---|---|---|
| $I_2$ = | 2.63 | $Q_2$ = | 27.08 cfs |
| $I_{10}$ = | 3.49 | $Q_{10}$ = | 35.95 cfs |
| $I_{100}$ = | 4.89 | $Q_{100}$ = | 50.39 cfs |

| DA: | To Pond - Section 7 (Behind Tynee Meadow) | | |
|---|---|---|---|
| | C-factor | Area (Ac.) | CA |
| Woods | 0.25 | 3.31 | 0.828 |
| Grass | 0.30 | 0.761 | 0.228 |
| Section 7 Lots | 0.50 | 4.900 | 2.450 |
| Conc | 0.80 | | 0.000 |
| Pavement | 0.90 | 0.780 | 0.702 |
| | | **Area** | **Total C-factor** |
| | | **9.75** | **0.43** |

Tc:

Overland:
Length = 200 ft
Slope = 1.0 %
c-factor = 0.25
tc = 20.0 minutes

Concentrated:
Length = 659 ft
H = 10 ft
6.1 minutes
**Tc = 26.0 minutes**

| | | | |
|---|---|---|---|
| $I_2$ = | 2.86 | $Q_2$ = | 12.05 cfs |
| $I_{10}$ = | 3.77 | $Q_{10}$ = | 15.88 cfs |
| $I_{100}$ = | 5.23 | $Q_{100}$ = | 22.00 cfs |

| DA: | To Pond - Section 7 (Behind Tinsley Blvd) | | |
|---|---|---|---|
| | C-factor | Area (Ac.) | CA |
| Woods | 0.25 | | 0.000 |
| Grass | 0.30 | 0.320 | 0.096 |
| Section 7 Lots | 0.50 | 3.700 | 1.850 |
| Conc | 0.80 | | 0.000 |
| Pavement | 0.90 | 0.370 | 0.333 |
| | | **Area** | **Total C-factor** |
| | | **4.39** | **0.52** |

Tc:

Overland:
Length = 200 ft
Slope = 1.0 %
c-factor = 0.50
tc = 10.0 minutes

Concentrated:
Length = 800 ft
H = 8 ft
8.4 minutes
**Tc = 18.4 minutes**

| | | | |
|---|---|---|---|
| $I_2$ = | 3.50 | $Q_2$ = | 7.98 cfs |
| $I_{10}$ = | 4.55 | $Q_{10}$ = | 10.36 cfs |
| $I_{100}$ = | 6.15 | $Q_{100}$ = | 14.02 cfs |

| DA: | Bypass - Section 7 | | |
|---|---|---|---|
| | C-factor | Area (Ac.) | CA |
| Woods | 0.25 | 20.08 | 5.020 |
| Grass | 0.30 | | 0.000 |
| Section 6 Lots | 0.50 | 2.400 | 1.200 |
| Section 7 Lots | 0.80 | 2.160 | 1.728 |
| Pavement | 0.90 | | 0.000 |
| | | **Area** | **Total C-factor** |
| | | **24.64** | **0.32** |

Tc:

Overland:
Length = 200 ft
Slope = 1.0 %
c-factor = 0.30
tc = 16.7 minutes

Concentrated:
Length = 1283 ft
H = 8 ft
14.3 minutes
**Tc = 31.0 minutes**

| | | | |
|---|---|---|---|
| $I_2$ = | 2.63 | $Q_2$ = | 20.90 cfs |
| $I_{10}$ = | 3.49 | $Q_{10}$ = | 27.74 cfs |
| $I_{100}$ = | 4.89 | $Q_{100}$ = | 38.88 cfs |

| DA: | To Pond - Section 8 (Combined Pond from Section 6) | | |
|---|---|---|---|
| | C-factor | Area (Ac.) | CA |
| Woods | 0.25 | | 0.000 |
| Grass | 0.30 | 1.210 | 0.363 |
| Section 6 Lots | 0.50 | 3.500 | 1.750 |
| Section 8 Lots | 0.50 | 3.102 | 1.551 |
| Sect 6 Pave | 0.90 | 0.730 | 0.657 |
| Sect 8 Pave | 0.90 | 0.390 | 0.351 |
| | | **Area** | **Total C-factor** |
| | | **8.93** | **0.52** |

Tc:

Overland:
Length = 200 ft
Slope = 1.0 %
c-factor = 0.75
tc = 6.7 minutes

Concentrated:
Length = 862 ft
H = 8 ft
8.9 minutes
**Tc = 15.6 minutes**

| | | | |
|---|---|---|---|
| $I_2$ = | 3.83 | $Q_2$ = | 17.91 cfs |
| $I_{10}$ = | 4.94 | $Q_{10}$ = | 23.09 cfs |
| $I_{100}$ = | 6.64 | $Q_{100}$ = | 31.00 cfs |

| DA: | To Pond - Section 8 (Behind Tinsley Blvd) | | |
|---|---|---|---|
| | C-factor | Area (Ac.) | CA |
| Woods | 0.25 | 0.56 | 0.140 |
| Grass | 0.30 | | 0.000 |
| Section 6 Lots | 0.50 | | 0.000 |
| Section 8 Lots | 0.50 | 2.530 | 1.265 |
| Sect 6 Pave | 0.90 | | 0.000 |
| Sect 8 Pave | 0.90 | 0.351 | 0.316 |
| | | **Area** | **Total C-factor** |
| | | **3.44** | **0.50** |

Tc:

Overland:
Length = 150 ft
Slope = 1.0 %
c-factor = 0.50
tc = 8.9 minutes

Concentrated:
Length = 690 ft
H = 6 ft
7.7 minutes
**Tc = 16.6 minutes**

| | | | |
|---|---|---|---|
| $I_2$ = | 3.72 | $Q_2$ = | 6.39 cfs |
| $I_{10}$ = | 4.80 | $Q_{10}$ = | 8.26 cfs |
| $I_{100}$ = | 6.46 | $Q_{100}$ = | 11.12 cfs |

| DA: | Bypass - Section 8 | | |
|---|---|---|---|
| | C-factor | Area (Ac.) | CA |
| Woods | 0.25 | 15.21 | 3.803 |
| Grass | 0.30 | | 0.000 |
| Section 6 Lots | 0.50 | 2.400 | 1.200 |
| Section 7 Lots | 0.50 | 2.160 | 1.080 |
| Section 8 Lots | 0.50 | | 0.000 |
| Sect 6 Pave | 0.90 | 0.144 | 0.130 |
| Sect 7 Pave | 0.90 | 0.570 | 0.513 |
| | | **Area** | **Total C-factor** |
| | | **20.48** | **0.33** |

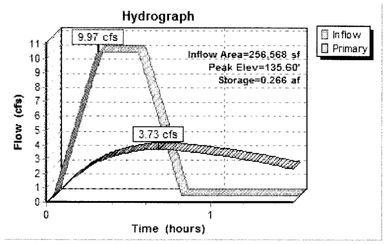
Tc:

Overland:
Length = 200 ft
Slope = 1.0 %
c-factor = 0.30
tc = 16.7 minutes

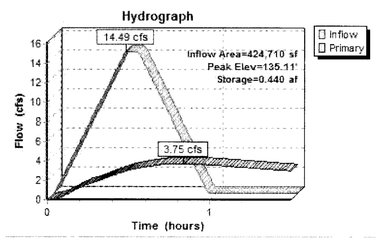
Concentrated:
Length = 1283 ft
H = 8 ft
14.3 minutes
**Tc = 31.0 minutes**

| | | | |
|---|---|---|---|
| $I_2$ = | 2.63 | $Q_2$ = | 17.68 cfs |
| $I_{10}$ = | 3.49 | $Q_{10}$ = | 23.48 cfs |
| $I_{100}$ = | 4.89 | $Q_{100}$ = | 32.90 cfs |

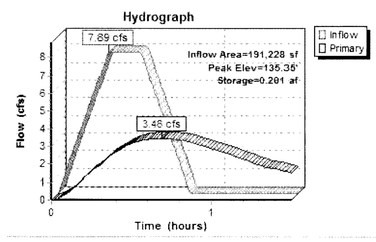
SECTION 6 POND



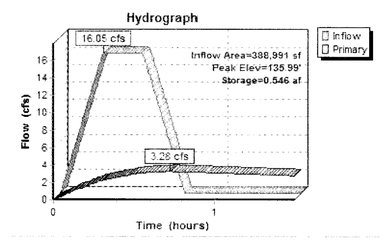

SECTION 7 POND BEHIND TYNEE MEADOW



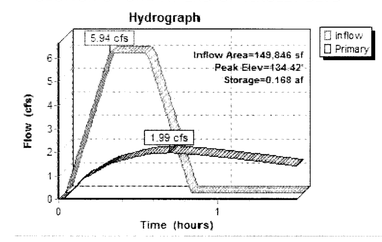

SECTION 7 POND BEHIND TINSLEY BLVD




SECTION 8 POND MIDDLE OF TINSLEY BLVD




SECTION 8 POND AT END OF TINSLEY BLVD




## SECTION 6 POND

Inflow Area = 256,568 sf, 0.00% Impervious, Inflow Depth = 0.87" for 10-Year event
Inflow = 9.97 cfs @ 0.27 hrs, Volume= 18,550 cf
Outflow = 3.73 cfs @ 0.68 hrs, Volume= 15,689 cf, Atten= 63%, Lag= 24.7 min
Primary = 3.73 cfs @ 0.68 hrs, Volume= 15,689 cf

Routing by Stor-Ind method, Time Span= 0.00-1.50 hrs, dt= 0.01 hrs
Peak Elev= 135.60' @ 0.68 hrs Surf.Area= 0.257 ac Storage= 0.266 af

Plug-Flow detention time= 27.7 min calculated for 15,689 cf (85% of inflow)
Center-of-Mass det. time= 25.0 min ( 48.4 - 23.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 133.14' | 0.809 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 133.14 | 0.000 | 0.000 | 0.000 |
| 134.00 | 0.065 | 0.028 | 0.028 |
| 135.00 | 0.161 | 0.113 | 0.141 |
| 136.00 | 0.322 | 0.241 | 0.382 |
| 137.00 | 0.532 | 0.427 | 0.809 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 133.00' | **10.0" Round Culvert** L= 28.0' Ke= 0.500<br>Inlet / Outlet Invert= 133.00' / 132.86' S= 0.0050 '/' Cc= 0.900<br>n= 0.013, Concrete pipe, bends & connections, Flow Area= 0.55 sf |
| #2 | Primary | 135.70' | **Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**<br>Head (feet) 0.00 1.30<br>Width (feet) 4.00 9.20 |

**Primary OutFlow** Max=3.73 cfs @ 0.68 hrs HW=135.60' (Free Discharge)
└**1=Culvert** (Barrel Controls 3.73 cfs @ 6.84 fps)
└**2=Custom Weir/Orifice** ( Controls 0.00 cfs)

## SECTION 7 POND BEHIND TYNEE MEADOW

Inflow Area = 424,710 sf, 0.00% Impervious, Inflow Depth = 0.76" for 10-Year event
Inflow = 14.49 cfs @ 0.44 hrs, Volume= 26,948 cf
Outflow = 3.75 cfs @ 0.84 hrs, Volume= 15,262 cf, Atten= 74%, Lag= 23.9 min
Primary = 3.75 cfs @ 0.84 hrs, Volume= 15,262 cf

Routing by Stor-Ind method, Time Span= 0.00-1.50 hrs, dt= 0.01 hrs
Peak Elev= 135.11' @ 0.84 hrs Surf.Area= 0.232 ac Storage= 0.440 af

Plug-Flow detention time= 32.4 min calculated for 15,262 cf (57% of inflow)
Center-of-Mass det. time= 24.1 min ( 52.6 - 28.5 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 132.20' | 0.814 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 132.20 | 0.000 | 0.000 | 0.000 |
| 133.00 | 0.122 | 0.049 | 0.049 |
| 134.00 | 0.192 | 0.157 | 0.206 |
| 135.00 | 0.226 | 0.209 | 0.415 |
| 136.00 | 0.278 | 0.252 | 0.667 |
| 136.50 | 0.311 | 0.147 | 0.814 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 132.20' | **10.0" Round Culvert** L= 40.0' Ke= 0.500<br>Inlet / Outlet Invert= 132.20' / 132.00' S= 0.0050 '/' Cc= 0.900<br>n= 0.013, Concrete pipe, bends & connections, Flow Area= 0.55 sf |
| #2 | Primary | 135.20' | **Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**<br>Head (feet) 0.00 1.30<br>Width (feet) 2.00 7.20 |

**Primary OutFlow** Max=3.75 cfs @ 0.84 hrs HW=135.11' (Free Discharge)
└**1=Culvert** (Barrel Controls 3.75 cfs @ 6.87 fps)
└**2=Custom Weir/Orifice** ( Controls 0.00 cfs)

## SECTION 7 POND BEHIND TINSLEY BLVD

Inflow Area = 191,228 sf, 0.00% Impervious, Inflow Depth = 0.92" for 10-Year event
Inflow = 7.89 cfs @ 0.31 hrs, Volume= 14,673 cf
Outflow = 3.46 cfs @ 0.69 hrs, Volume= 12,613 cf, Atten= 56%, Lag= 22.7 min
Primary = 3.46 cfs @ 0.69 hrs, Volume= 12,613 cf

Routing by Stor-Ind method, Time Span= 0.00-1.50 hrs, dt= 0.01 hrs
Peak Elev= 135.35' @ 0.69 hrs Surf.Area= 0.152 ac Storage= 0.201 af

Plug-Flow detention time= 26.0 min calculated for 12,529 cf (85% of inflow)
Center-of-Mass det. time= 23.6 min ( 48.3 - 24.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 133.20' | 0.312 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 133.20 | 0.000 | 0.000 | 0.000 |
| 134.00 | 0.095 | 0.038 | 0.038 |
| 135.00 | 0.132 | 0.113 | 0.152 |
| 136.00 | 0.189 | 0.160 | 0.312 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 133.20' | **10.0" Round Culvert** L= 16.0' Ke= 0.500<br>Inlet / Outlet Invert= 133.20' / 133.12' S= 0.0050 '/' Cc= 0.900<br>n= 0.013, Concrete pipe, bends & connections, Flow Area= 0.55 sf |
| #2 | Primary | 135.40' | **Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**<br>Head (feet) 0.00 0.60<br>Width (feet) 2.00 5.00 |

**Primary OutFlow** Max=3.46 cfs @ 0.69 hrs HW=135.35' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.46 cfs @ 6.34 fps)
└**2=Custom Weir/Orifice** ( Controls 0.00 cfs)

## SECTION 8 POND MIDDLE OF TINSLEY BLVD

Inflow Area = 388,991 sf, 0.00% Impervious, Inflow Depth = 0.92" for 10-Year event
Inflow = 16.05 cfs @ 0.27 hrs, Volume= 29,845 cf
Outflow = 3.28 cfs @ 0.73 hrs, Volume= 14,297 cf, Atten= 80%, Lag= 27.4 min
Primary = 3.28 cfs @ 0.73 hrs, Volume= 14,297 cf

Routing by Stor-Ind method, Time Span= 0.00-1.50 hrs, dt= 0.01 hrs
Peak Elev= 135.99' @ 0.73 hrs Surf.Area= 0.310 ac Storage= 0.546 af

Plug-Flow detention time= 35.8 min calculated for 14,202 cf (48% of inflow)
Center-of-Mass det. time= 27.2 min ( 50.6 - 23.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 133.14' | 0.969 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 133.14 | 0.000 | 0.000 | 0.000 |
| 134.00 | 0.148 | 0.064 | 0.064 |
| 135.00 | 0.255 | 0.201 | 0.265 |
| 136.00 | 0.310 | 0.283 | 0.548 |
| 137.00 | 0.532 | 0.421 | 0.969 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 133.00' | **9.0" Round Culvert** L= 28.0' Ke= 0.500<br>Inlet / Outlet Invert= 133.00' / 132.86' S= 0.0050 '/' Cc= 0.900<br>n= 0.013, Concrete pipe, bends & connections, Flow Area= 0.44 sf |
| #2 | Primary | 136.00' | **Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**<br>Head (feet) 0.00 1.30<br>Width (feet) 3.00 8.20 |

**Primary OutFlow** Max=3.28 cfs @ 0.73 hrs HW=135.99' (Free Discharge)
└**1=Culvert** (Barrel Controls 3.28 cfs @ 7.42 fps)
└**2=Custom Weir/Orifice** ( Controls 0.00 cfs)

## SECTION 8 POND AT END OF TINSLEY BLVD

Inflow Area = 149,846 sf, 0.00% Impervious, Inflow Depth = 0.89" for 10-Year event
Inflow = 5.94 cfs @ 0.28 hrs, Volume= 11,056 cf
Outflow = 1.99 cfs @ 0.70 hrs, Volume= 8,484 cf, Atten= 66%, Lag= 25.2 min
Primary = 1.99 cfs @ 0.70 hrs, Volume= 8,484 cf

Routing by Stor-Ind method, Time Span= 0.00-1.50 hrs, dt= 0.01 hrs
Peak Elev= 134.42' @ 0.70 hrs Surf.Area= 0.144 ac Storage= 0.168 af

Plug-Flow detention time= 29.6 min calculated for 8,464 cf (77% of inflow)
Center-of-Mass det. time= 25.5 min ( 49.3 - 23.8 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 132.10' | 0.468 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 132.10 | 0.000 | 0.000 | 0.000 |
| 133.00 | 0.053 | 0.024 | 0.024 |
| 134.00 | 0.123 | 0.088 | 0.112 |
| 135.00 | 0.172 | 0.148 | 0.259 |
| 136.00 | 0.242 | 0.207 | 0.466 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 132.10' | **8.0" Round Culvert** L= 40.0' Ke= 0.500<br>Inlet / Outlet Invert= 132.10' / 131.90' S= 0.0050 '/' Cc= 0.900<br>n= 0.013, Concrete pipe, bends & connections, Flow Area= 0.35 sf |
| #2 | Primary | 135.75' | **Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**<br>Head (feet) 0.00 1.20<br>Width (feet) 0.00 5.00 |

**Primary OutFlow** Max=1.99 cfs @ 0.70 hrs HW=134.42' (Free Discharge)
└**1=Culvert** (Barrel Controls 1.99 cfs @ 5.71 fps)
└**2=Custom Weir/Orifice** ( Controls 0.00 cfs)

## SECTION 6 SUMMARY (10 YEAR STORM)

PREDEVELOPED FLOW= 40.2 cfs

POST DEVELOPED FLOWS
BYPASS FLOW = 36.0 cfs
FROM POND = 3.7 cfs
TOTAL FLOW = 36.0 cfs + 3.7 cfs = 39.7 cfs

POST DEVELOPED FLOW < PREDEVELOPED FLOW

## SECTION 7 SUMMARY (10 YEAR STORM)

PREDEVELOPED FLOW= 40.2 cfs

POST DEVELOPED FLOWS
BYPASS FLOW = 27.7 cfs
FROM POND (SECTION 6) = 3.7 cfs
FROM PONDS (SECTION 7) = 3.8 cfs + 3.5 cfs = 7.3 cfs
TOTAL FLOW = 27.7 cfs + 3.7 cfs + 7.3 cfs = 38.7 cfs

POST DEVELOPED FLOW < PREDEVELOPED FLOW

## SECTION 8 SUMMARY (10 YEAR STORM)

PREDEVELOPED FLOW= 40.2 cfs

POST DEVELOPED FLOWS
BYPASS FLOW = 23.5 cfs
FROM POND (SECTION 6) = 3.7 cfs
FROM PONDS (SECTION 7) = 7.3 cfs
FROM PONDS (SECTION 8) = 3.3 cfs + 2.0 cfs = 5.3 cfs
TOTAL FLOW = 23.5 cfs + 3.7 cfs + 7.3 cfs + 5.3 cfs = 39.8 cfs

POST DEVELOPED FLOW < PREDEVELOPED FLOW

1 SECTION 6 POND ROUTING HYDROGRAPH AND SUMMARY
NO SCALE

2 SECTION 7 POND ROUTING HYDROGRAPHS AND SUMMARIES
NO SCALE

3 SECTION 8 POND ROUTING HYDROGRAPHS AND SUMMARIES
NO SCALE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QUALITY ASSURANCE : STUART LITTLE
PROJECT MANAGER : CHRIS THOMPSON
PROJECT NO. : 10106
SCALE : AS SHOWN

COMMONWEALTH OF VIRGINIA
Stuart G. Little
Lic. No. 39974
04/7/14
PROFESSIONAL ENGINEER

DATE : APRIL 7, 2014

REVISION BLOCK

| DATE | DESCRIPTION |
|---|---|
| - | - |

MWC DEVELOPMENT, LLC
P.O. BOX 694
PRINCE GEORGE, VA 23875
CONTACT: KRIS CUTLER

**TINSLEY CHARTER SUBDIVISION - SECTIONS 6, 7 AND 8**

**STORMWATER MANAGEMENT CALCULATIONS**

SHEET NO.
**C11.0**