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9 MAP 2023

# In the Supreme Court of Pennsylvania

**NO. 9 MAP 2023**

**THE BOROUGH OF WEST CHESTER,**

***APPELLANT,***

***v.***

**PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION, *ET AL.*,**

***APPELLEES.***

**REPRODUCED RECORD**
**Volume 4 of 4 (1747a to 2365a)**

**DIRECT APPEAL FROM ORDER OF**
**THE COMMONWEALTH COURT OF PENNSYLVANIA**
**(DOCKET NO. 260 MD 2018) DATED JANUARY 4, 2023**

WARREN E. KAMPF, ESQUIRE
Attorney I.D. No. 69612
wkampf@buckleyllp.com

MICHAEL S. GILL, ESQUIRE
Attorney I.D. No. 86140
gillm@buckleyllp.com

ALEXANDRA Y. ROBERTS, ESQUIRE
Attorney I.D. No. 327591
aroberts@buckleyllp.com

**BUCKLEY, BRION, MCGUIRE & MORRIS LLP**
118 West Market Street, Suite 300
West Chester, Pennsylvania 19382
610.436.4400

*Attorneys for Appellant*
*The Borough of West Chester*

## TABLE OF CONTENTS

# EXHIBIT A

To Affidavit of Barbara Lionti

## WEST CHESTER BOROUGH STREAM PROTECTION FEE

| Account # | Customer Name | Service Address |
|---|---|---|
| 1-12-0243 | COMMONWEALTH OF PA | 175 UNIVERSITY AVENUE, WEST CHESTER, PA 19382 |
| 1-12-0250 | COMMONWEALTH OF PA | 25 W ROSEDALE AV, WEST CHESTER, PA 19382 |
| 1-12-0243-MH | COMMONWEALTH OF PENNSYLVANIA | 50 SHARPLESS ST, MCCARTHY HALL, WEST CHESTER, PA 19383 |
| 1-12-0244 | COMMONWEALTH OF PA | 25 UNIVERSITY AV, WEST CHESTER, PA 19382 |
| 1-12-0145 | GENERAL STATE AUTH | 300 W NIELDS ST, WEST CHESTER, PA 19382 |
| 1-13-0003 | WEST CHESTER UNIVERSITY OF PA THE STATE SYSTM OF HIGHER EDUC | 733 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-12-0244-1 | COMMONWEALTH OF PA | 675 S CHURCH ST, WEST CHESTER, PA 19382 |
| 1-09-1066 | COMMONWEALTH OF PA | 25 SHARPLESS ST, WEST CHESTER, PA 19382 |
| 1-12-0243-1 | WEST CHESTER UNIVERSITY | 628 S HIGH STREET , WEST CHESTER, PA 19383 |
| 1-12-0250-1 | COMMONWEALTH OF PA | 720 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-09-1085 | WEST CHESTER UNIVERSITY OF PA | 15 SHARPLESS ST, WEST CHESTER, PA 19382 |
| 1-12-0253 | COMMONWEALTH OF PA | 615 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-13-0001 | WEST CHESTER UNIVERSITY OF PA OF THE STATE ETAL | 701 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-13-0002 | WEST CHESTER UNIVERSITY OF PA OF THE STATE ETAL | 703 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-12-0247 | WEST CHESTER UNIVERSITY OF PA STATE SYSTEM OF HIGHER EDUCATI | 624 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-13-0008 | WEST CHESTER UNIVERSITY OF PA OF THE STATE ETAL | 702 S WALNUT ST, WEST CHESTER, PA 19382 |
| 1-12-0246 | COMMONWEALTH OF PA | 13 UNIVERSITY AV, WEST CHESTER, PA 19382 |
| 1-12-0245 | WEST CHESTER UNIVERSITY | 15 UNIVERSITY AV, WEST CHESTER, PA 19382 |

# EXHIBIT B

To Affidavit of Barbara Lionti

DRAFT- VERSION DATED 11-11-2020

# Borough of West Chester
# Preliminary 2021 Budget

DRAFT- VERSION DATED 11-11-2020

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2019 ACTUAL | ACTUAL THRU 9/30/2020 | PROJECTED THRU 12/31/2020 | 2021 BUDGET | 2020 REVISED BUDGET | VARIANCE | % INCREASE/ (DECREASE) FROM P/Y | LINE ITEM DETAIL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| REVENUE | | | | | | | | | | | |
| 16 | 16 | 30000 | REVENUE CARRYOVER | - | - | | 1,050,000 | 507,728 | 542,272 | 107% | PLUM RUN CARRYO |
| 16 | 16 | 35504 | GREENVIEW GRANT CARRYOVER | | | | 60,135 | | | | |
| 16 | 16 | 34100 | INTEREST INCOME | 6,241 | 89 | 100 | 750 | 1,500 | (750) | -50% | |
| 16 | 16 | 38009 | TAX REV - CERTS | 3,715 | 285 | 4,500 | 4,000 | 4,500 | (500) | -11% | |
| 16 | 16 | 38015 | STREAM REVENUE | 1,334,544 | 858,520 | 1,330,000 | 900,000 | 1,330,000 | (430,000) | -32% | |
| TOTAL REVENUE | | | | 1,344,500 | 858,894 | 1,334,600 | 2,014,885 | 1,843,728 | 111,022 | 6% | |
| TOTAL REVENUE | | | | 1,344,500 | 858,894 | 1,334,600 | 2,014,885 | 1,843,728 | 111,022 | 6% | |
| EXPENSES | | | | | | | | | | | |
| PAYROLL RELATED EXPENSES | | | | | | | | | | | |
| 16 | 16 | 49525 | SALARIES SPF | 75,129 | 20,466 | 56,600 | 40,000 | 56,600 | (16,600) | -29% | |
| 16 | 16 | XXXXX | SALARIES SHARED W/ PW | 44,469 | - | - | 95,000 | - | 95,000 | #DIV/0! | |
| 16 | 16 | 48720 | FICA | 5,530 | - | 4,330 | 10,328 | 4,330 | 5,998 | 139% | |
| TOTAL PAYROLL RELATED EXPENSES | | | | 125,127 | 20,466 | 60,930 | 145,328 | 60,930 | 84,398 | 139% | |
| STREAM EXPENSES | | | | | | | | | | | |
| 16 | 16 | 40122 | MUNIBILLING | - | 234 | - | 10,000 | - | 10,000 | #DIV/0! | |
| 16 | 16 | 42007 | PROFESSIONAL FEES | | | | 68,883 | | | | |
| 16 | 16 | 45540 | TREE PLANTING | | 21,692 | 50,000 | 25,000 | 50,000 | (25,000) | -50% | PLUM RUN CARRYO |
| 16 | 16 | 40410 | LEGAL | 2,644 | - | - | 65,000 | - | 65,000 | #DIV/0! | |
| 16 | 16 | 43620 | STORMWATER FACILITIES MAINT. | 6,748 | 16,289 | | 95,000 | - | 95,000 | #DIV/0! | |
| 16 | 16 | 43621 | EMERG STORMWATER FACILITY REPAIRS | 219,495 | - | - | 60,000 | - | 60,000 | #DIV/0! | |
| 16 | 16 | 43622 | NORTH HIGH STREET STORM SEWER PROJECT | - | - | - | 28,750 | - | 28,750 | #DIV/0! | |
| 16 | 16 | 43623 | LINDEN/FRANKLIN CULVERT PROJECT-ENGINEERING | - | - | - | 130,000 | - | 130,000 | #DIV/0! | engineering fees |
| 16 | 16 | 43625 | W. WASH/HANNUM STORM SEWER EXTENSION | - | - | | 230,000 | - | 230,000 | #DIV/0! | |
| 16 | 16 | 43628 | NORTH HILLSIDE/GOSHEN RD | | | | 220,000 | | | | |
| 16 | 16 | 43627 | GREENVIEW ALLEY - CARRYOVER | - | - | | 60,135 | - | 60,135 | #DIV/0! | |
| 16 | 16 | 44925 | PLUM RUN CARRYOVER | | | | 700,000 | | | | |
| 16 | 16 | 48951 | REFUNDS | 995 | 1,995 | 2,000 | 1,500 | 1,000 | 500 | 50% | |
| 16 | 16 | 44921 | INLET REPLACEMENTS | 389,451 | - | 10,647 | 61,507 | - | 61,507 | #DIV/0! | |
| TOTAL STREAM EXPENSES | | | | 619,333 | 40,210 | 62,647 | 1,755,775 | 51,000 | 715,892 | 1404% | |
| INTERFUND OPERATING TRANSFERS | | | | | | | | | | | |
| 16 | 16 | 44570 | TRF TO GENERAL FUND | 595,000 | - | 113,783 | 113,783 | 115,783 | (2,001) | -2% | |
| TOTAL INTERFUND OPERATING TRANSFERS | | | | 595,000 | - | 113,783 | 113,783 | 115,783 | (2,001) | -2% | |
| TOTAL EXPENSES | | | | 1,339,460 | 60,676 | 237,360 | 2,014,885 | 227,713 | - | 0% | |
| NET INCOME/(LOSS) | | | | 5,040 | 798,218 | 1,097,240 | - | 1,616,015 | 111,022 | 7% | |

# EXHIBIT C

To Affidavit of Barbara Lionti

# Borough of West Chester
# Revised 2020 Budget

**2020 Revised Budget Summary of Changes**

Original 2020 Budget: $47,897,327

Revised 2020 Budget: $38,881,187

| | 2020 ORIGINAL | 2020 REVISED | VARIANCE |
|---|---|---|---|
| General Fund | 20,729,737 | 17,785,656 | 2,944,081 |
| Recreation | 938,395 | 447,612 | 490,783 |
| FIRE | 1,242,531 | 1,242,531 | - |
| Parking | 5,468,802 | 3,917,302 | 1,551,500 |
| Waste Water | 6,225,147 | 5,985,041 | 240,106 |
| Capital Improv | 3,521,500 | 1,540,000 | 1,981,500 |
| Stream Protection | 2,965,036 | 1,843,728 | 1,121,308 |
| Highway Aid | 459,630 | 450,706 | 8,924 |
| OPEB | 270,000 | 200,000 | 70,000 |
| EQUIPMENT | 2,585,438 | 2,025,500 | 559,938 |
| POLICE PENSION | 2,476,209 | 2,418,209 | 58,000 |
| NONUNIFORM PENSION | 1,014,902 | 1,024,902 | (10,000) |
| TOTAL | 47,897,327 | 38,881,187 | 9,016,140 |

The 2020 Budget has been revised to account for the following :

- 10% Reduction in Tax Revenues
- 28% reduction in Parking Revenues
- 4% Reduction in Sewer Rentals based on C/Y collections
- Cancellation of all major events
- Reduction to Stream Protection Fund (reallocation of Bond monies for fire truck and loss of grant monies)
- Reduction in Green Light GO Grant Revenue: $688,000
- Reduction in Capital Purchases: $1,344,438
- Reduction in Non-Essential Spending: $1,773,557
- Reduction in Salary Expense (furloughs/layoffs/open pos.): $731,779

# Borough of West Chester 2020 Budget

## -Stream 16-

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2020 REVISED BUDGET | 2020 ORIGINAL BUDGET | 2019 BUDGET |
|---|---|---|---|---|---|---|
| **REVENUE** | | | | | | |
| 16 | 16 | 30000 | REVENUE CARRYOVER | 507,728 | 507,728 | 475,713 |
| 16 | 16 | 34100 | INTEREST INCOME | 1,500 | 2,500 | 60,000 |
| 16 | 16 | 38000 | MISCELLANEOUS REVENUE | - | 1,000 | 1,000 |
| 16 | 16 | 38009 | TAX REV - CERTS | 4,500 | 4,500 | 2,000 |
| 16 | 16 | 38015 | STREAM REVENUE | 1,330,000 | 1,375,000 | 1,400,000 |
| 16 | 16 | 38050 | GRANT - STREAM GREEN (DEP) | - | 260,135 | 534,855 |
| 16 | 16 | 39350 | BOND PROCEEDS - CARRYOVER | - | 814,173 | **750,000** |
| **Total REVENUE** | | | | **1,843,728** | **2,965,036** | **3,223,568** |
| **TOTAL REVENUE** | | | | **1,843,728** | **2,965,036** | **3,223,568** |
| **EXPENSES** | | | | | | |
| **PAYROLL RELATED EXPENSES** | | | | | | |
| 16 | 16 | 49525 | SALARIES SPF | 56,600 | 66,830 | 66,949 |
| 16 | 16 | XXXXX | SALARIES SHARED W/ PW | - | 99,657 | 99,567 |
| 16 | 16 | 48600 | INS WORKERS COMP | - | 14,402 | 12,523 |
| | 16 | 48715 | DEFINED PENSION CONTRIBUTION | 2,830 | 3,342 | - |
| 16 | 16 | 48700 | INS EMPLOYEE BENEFIT | - | 27,775 | 26,707 |
| 16 | 16 | 48720 | FICA | 4,330 | 12,736 | 12,739 |
| **Total PAYROLL RELATED EXPENSES** | | | | **63,760** | **224,742** | **218,485** |
| **STREAM EXPENSES** | | | | | | |
| 16 | 16 | 40121 | OFFICE SUPPLIES/EXPENSE | - | 12,000 | - |
| 16 | 16 | 40122 | POSTAGE/PRINTING | - | 1,000 | - |
| 16 | 16 | 40133 | OTHER EXPENSE | | 750 | - |
| 16 | 16 | 42007 | PROFESSIONAL FEES | 13,185 | 245,000 | 157,950 |
| 16 | 16 | 45540 | TREE MAINTENANCE | 50,000 | 50,000 | - |
| 16 | 16 | XXXXX | LEGAL | - | - | 30,000 |
| 16 | 16 | 43620 | STORM DRAIN MATERIALS | - | 157,500 | - |
| 16 | 16 | 48951 | REFUNDS | 1,000 | 5,000 | - |
| 16 | 16 | XXXXX | INLET REPLACEMENTS | - | - | 525,000 |

# Borough of West Chester 2020 Budget

## -Stream 16-

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2020 REVISED BUDGET | 2020 ORIGINAL BUDGET | 2019 BUDGET |
|---|---|---|---|---|---|---|
| 16 | 16 | 44915 | GREEN STREAM INFRASTRUCTURE-JOHN O GREEN | 750,000 | 750,000 | - |
| 16 | 16 | XXXXX | GOOSE CREEK SEWER MAIN CLEANING | - | 20,000 | |
| 16 | 16 | 48610 | INS GENERAL & LIABILITY - BOROUGH | - | 1,261 | - |
| 16 | 16 | 44920 | STORM SEWER REHAB PROJECTS | - | 532,000 | - |
| 16 | 16 | 44925 | STREAM BANK STABILIZATION PROJECT | 850,000 | 850,000 | - |
| **Total STREAM EXPENSES** | | | | **1,664,185** | **2,624,511** | **712,950** |
| **INTERFUND OPERATING TRANSFERS** | | | | | | |
| 16 | 16 | 44562 | TRF TO EQUIP & TECH FUND | - | - | - |
| 16 | 16 | 44568 | TRF TO CAPITAL IMP FUND | - | - | 2,180,000 |
| 16 | 16 | 44570 | TRF TO GENERAL FUND | 115,783 | 115,783 | 112,133 |
| **TOTAL INTERFUND OPERATING TRANSFERS** | | | | **115,783** | **115,783** | **2,292,133** |
| **Total EXPENSES** | | | | **1,843,728** | **2,965,036** | **3,223,568** |
| **NET INCOME/(LOSS)** | | | | **0** | **-** | **-** |

**Borough of West Chester**
Normal Trial Balance
From 12/31/2020 Through 12/31/2020

| Fund Code | GL Code | Fund Title | GL Title | Debit Balance | Credit Balance |
|---|---|---|---|---|---|
| 16 | 40121 | STREAM FUND | OFFICE SUPPLIES/EXPENSE | 1,482.09 | |
| 16 | 40122 | STREAM FUND | POSTAGE/PRINTING | 233.67 | |
| 16 | 40133 | STREAM FUND | OTHER EXPENSE | 0.00 | |
| 16 | 40140 | STREAM FUND | BANK FEES | 2,004.83 | |
| 16 | 40430 | STREAM FUND | LEGAL OTHER | 0.00 | |
| 16 | 40931 | STREAM FUND | UTILITIES | 130.41 | |
| 16 | 42007 | STREAM FUND | PROFESSIONAL FEES | 47,304.17 | |
| 16 | 42011 | STREAM FUND | CONSULTANTS | 0.00 | |
| 16 | 43013 | STREAM FUND | CAPITAL PURCHASES | 10,647.27 | |
| 16 | 43620 | STREAM FUND | STORM DRAIN MATERIALS | 8,714.51 | |
| 16 | 43825 | STREAM FUND | SALARIES - OT REGULAR | 1,643.30 | |
| 16 | 44570 | STREAM FUND | TRF TO GENERAL FUND | 135,000.00 | |
| 16 | 44915 | STREAM FUND | GREEN STREAM INFRASTRUCTURE | 721,683.84 | |
| 16 | 44920 | STREAM FUND | STORM SEWER REHAB PROJECTS | 0.00 | |
| 16 | 44921 | STREAM FUND | INLET REPLACEMENT | 0.00 | |
| 16 | 44925 | STREAM FUND | STREAM BANK STABILIZATION PROJ | 221,719.25 | |
| 16 | 45540 | STREAM FUND | TREE EXPENSES | 41,926.55 | |
| 16 | 48600 | STREAM FUND | INS WORKERS COMP | 10.62 | |
| 16 | 48610 | STREAM FUND | INS GENERAL & LIABILITY | 618.51 | |
| 16 | 48700 | STREAM FUND | INS EMPLOYEE BENEFIT | 12,651.19 | |
| 16 | 48715 | STREAM FUND | PENSION PAYMENTS | 1,046.06 | |
| 16 | 48720 | STREAM FUND | SOCIAL SECURITY / MEDICARE | 1,354.79 | |
| 16 | 48950 | STREAM FUND | FOREIGN FIRE INSURANCE | 200.00 | |
| 16 | 48951 | STREAM FUND | REFUNDS | 2,077.92 | |
| 16 | 49525 | STREAM FUND | SALARIES STREAM | 18,822.99 | |
| Total 16 | | STREAM FUND | | 1,229,271.97 | 0.00 |
| Report Total | | | | 1,229,271.97 | 0.00 |
| Report Difference | | | | 1,229,271.97 | |

1757a

# EXHIBIT D

To Affidavit of Barbara Lionti

# BOROUGH OF WEST CHESTER

# 2019 LINE ITEM BUDGET

# *FINAL VERSION*

# APPROVED NOVEMBER 21, 2018

# FINAL Budget 2019 Overview

The following is a general overview/summary of the **APPROVED FINAL VERSION** of the 2019 line item budget.

1) **Revenue remained consistent with 2018 except for the following areas**:

- Real Estate Tax Revenue- increased by 4% due to Borough valuation and collection increases. There is **NO TAX RATE** increase in the 2019 proposed budget.
- Earned Income Tax- increased by 4% due to increased wage base in the Borough as well a Municipal **rate increase** (not school district) in the 2019 proposed budget. This **rate increase** goes from **0.50 to 0.75. This will generate approximately $1.7MM which will be restricted to the pay down of the unfunded pension and OPEB liabilities.**
- PW Building Financing- $4MM added for a new Public Works facility
- Fire Inspection Fees Revenue- increased fees to be generated through new Fire Inspector position in the Building and Housing department.

2) **Salaries and Employees:**

- Wage Increases- 3% per contractual increases for AFSCME/Police Brotherhood employees. A "Pay Rate Increase Pool" is budgeted for Non-Uniform employees.
- New Employees Requested-
  - Fire Inspector (Building and Housing)
  - Part-Time Receptionist (Administration)

3) **Employee Benefits:**

- Medical Insurance- 2.6% increase over 2018 actual premiums included.
- Workers Compensation/General Insurance- assumed a 15% increase over 2018 premiums.

## -Stream 16-

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2019 BUDGET | 2018 BUDGET | VARIANCE |
|---|---|---|---|---|---|---|
| **REVENUE** | | | | | | |
| **MISCELLANEOUS REVENUE** | | | | | | |
| 16 | 16 | 30000 | REVENUE CARRYOVER | 475,107 | 774,866 | (299,759) |
| 16 | 16 | 34100 | INTEREST INCOME | 60,000 | 70,000 | (10,000) |
| 16 | 16 | 38000 | MISCELLANEOUS REVENUE | 1,000 | 1,000 | - |
| 16 | 16 | 38009 | TAX REV - CERTS | 2,000 | 2,000 | - |
| 16 | 16 | 38015 | STREAM REVENUE | 1,400,000 | 1,429,000 | (29,000) |
| 16 | 16 | 38050 | GRANT - STREAM GREEN (DEP) | 534,855 | 220,731 | 314,124 |
| 16 | 16 | 39350 | BOND PROCEEDS - CARRYOVER | 750,000 | 460,497 | 289,503 |
| **Total MISCELLANEOUS REVENUE** | | | | **3,222,962** | **2,958,094** | **264,868** |
| **TOTAL REVENUE** | | | | **3,222,962** | **2,958,094** | **264,868** |
| **EXPENSES** | | | | | | |
| **PAYROLL RELATED EXPENSES** | | | | | | |
| 16 | 16 | 49525 | SALARIES SPF PROGRAM COORDINATOR | 66,949 | - | (66,949) |
| 16 | 16 | XXXXX | SALARIES SHARED W/ PW | 99,567 | 70,996 | (28,571) |
| 16 | 16 | 48600 | INS WORKERS COMP | 12,524 | 10,890 | (1,634) |
| 16 | 16 | 48700 | INS EMPLOYEE BENEFIT | 26,102 | 12,779 | (13,322) |
| 16 | 16 | 48720 | FICA | 12,739 | 5,431 | (7,307) |
| **Total PAYROLL RELATED EXPENSES** | | | | **217,880** | **100,096** | **(117,784)** |
| **STREAM EXPENSES** | | | | | | |
| 16 | 16 | 40121 | OFFICE SUPPLIES/EXPENSE | | 800 | 800 |
| 16 | 16 | 40122 | POSTAGE/PRINTING | | 800 | 800 |
| 16 | 16 | 40133 | OTHER EXPENSE | | 800 | 800 |
| 16 | 16 | 42007 | PROFESSIONAL FEES | 157,950 | 95,000 | (62,950) |
| 16 | 16 | XXXXX | LEGAL | 30,000 | - | (30,000) |
| 16 | 16 | 43620 | STORM DRAIN MATERIALS | | 32,000 | 32,000 |
| 16 | 16 | 48951 | REFUNDS | | 1,000 | 1,000 |
| 16 | 16 | XXXXX | INLET REPLACEMENTS | 525,000 | - | (525,000) |
| 16 | 16 | 44915 | GREEN STREAM INFRASTRUCTURE | - | 1,003,316 | 1,003,316 |
| 16 | 16 | 44920 | STORM SEWER REHAB PROJECTS | | 350,000 | 350,000 |

## -Stream 16-

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2019 BUDGET | 2018 BUDGET | VARIANCE |
|---|---|---|---|---|---|---|
| 16 | 16 | 44925 | STREAM BANK STABILIZATION PROJECT | | 579,434 | 579,434 |
| **Total STREAM EXPENSES** | | | | **712,950** | **2,063,150** | **1,350,200** |
| | | | | | | |
| **INTERFUND OPERATING TRANSFERS** | | | | | | |
| 16 | 16 | 44568 | TRF TO CAPITAL IMP FUND | 2,180,000 | - | |
| 16 | 16 | 44570 | TRF TO GENERAL FUND | 112,133 | 794,848 | 682,716 |
| **TOTAL INTERFUND OPERATING TRANSFERS** | | | | **2,292,133** | **794,848** | **(1,497,285)** |
| | | | | | | |
| **Total EXPENSES** | | | | **3,222,963** | **2,958,094** | **(264,868)** |
| | | | | | | |
| **NET INCOME/(LOSS)** | | | | **(1)** | **(0)** | **(0)** |

**Borough of West Chester**
Normal Trial Balance
From 12/31/2019 Through 12/31/2019

| Fund Code | GL Code | Fund Title | GL Title | Debit Balance | Credit Balance |
|---|---|---|---|---|---|
| 16 | 40121 | STREAM FUND | OFFICE SUPPLIES/EXPENSE | 59.87 | |
| 16 | 40133 | STREAM FUND | OTHER EXPENSE | 3,531.15 | |
| 16 | 40140 | STREAM FUND | BANK FEES | 1,511.74 | |
| 16 | 40410 | STREAM FUND | LEGAL FEES - SOLICITOR | 2,201.50 | |
| 16 | 40430 | STREAM FUND | LEGAL OTHER | 442.25 | |
| 16 | 40931 | STREAM FUND | UTILITIES | 50.99 | |
| 16 | 42007 | STREAM FUND | PROFESSIONAL FEES | 146,282.75 | |
| 16 | 42011 | STREAM FUND | CONSULTANTS | 358.00 | |
| 16 | 42722 | STREAM FUND | SAL EXP- SPF ALLOCATION | 44,468.78 | |
| 16 | 43013 | STREAM FUND | CAPITAL PURCHASES | 211,387.35 | |
| 16 | 43620 | STREAM FUND | STORM DRAIN MATERIALS | 6,748.12 | |
| 16 | 43825 | STREAM FUND | SALARIES - OT REGULAR | 7,328.51 | |
| 16 | 44570 | STREAM FUND | TRF TO GENERAL FUND | 595,000.00 | |
| 16 | 44915 | STREAM FUND | GREEN STREAM INFRASTRUCTURE | 462.87 | |
| 16 | 44920 | STREAM FUND | STORM SEWER REHAB PROJECTS | 219,495.49 | |
| 16 | 44921 | STREAM FUND | INLET REPLACEMENT | 178,063.29 | |
| 16 | 44925 | STREAM FUND | STREAM BANK STABILIZATION PROJ | 357.50 | |
| 16 | 45836 | STREAM FUND | TRAINING/MILEAGE | 237.94 | |
| 16 | 48600 | STREAM FUND | INS WORKERS COMP | 4,557.82 | |
| 16 | 48610 | STREAM FUND | INS GENERAL & LIABILITY | 2,625.27 | |
| 16 | 48700 | STREAM FUND | INS EMPLOYEE BENEFIT | 27,007.99 | |
| 16 | 48715 | STREAM FUND | PENSION PAYMENTS | 3,077.00 | |
| 16 | 48720 | STREAM FUND | SOCIAL SECURITY / MEDICARE | 5,529.70 | |
| 16 | 48730 | STREAM FUND | PENSION CONTRIBUTIONS | 128.50 | |
| 16 | 48951 | STREAM FUND | REFUNDS | 994.65 | |
| 16 | 49525 | STREAM FUND | SALARIES STREAM | 67,800.41 | |
| Total 16 | | STREAM FUND | | 1,529,709.44 | 0.00 |
| Report Total | | | | 1,529,709.44 | 0.00 |
| Report Difference | | | | 1,529,709.44 | |

1764a

# EXHIBIT E

To Affidavit of Barbara Lionti

# BOROUGH OF WEST CHESTER

# 2018 BUDGET – FINAL

PREPARED BY:
Michael Perrone, Borough Manager
Jeff DaSilva, Finance Director
Lori Coles, Financial Analyst

# FINAL Budget 2018 Overview

e following is an overview/summary of the FINAL 2018 line item budget.

1) Revenue remained consistent with 2017 except for the following areas:
   - Real Estate Tax Revenue – increased by 3.5% due to Borough valuation and collection increases. There is NO TAX RATE increase in the 2018 budget.
   - Earned Income Tax - increased by 3.5% due to increased wage base in the Borough. There is NO TAX RATE increase in the 2018 budget.
   - Bond Proceeds – $2MM added for Borough Hall renovations.
   - Loan Proceeds – $2.5MM added for Borough Hall renovations.
   - Grant Revenue – increased grant revenues assuming consulting resources utilized.
2) Salaries and Employees:
   Wage Increases –all wage/salary increases applied based on either contractual requirements or Borough Manager/Council directive (specific to non contractual employee status). New Employees Requested – ***No new employees in the 2018 FINAL Budget.***
3) Employee Benefits:
   Medical Insurance – assumed a 0.7% increase over 2017 premiums.
   Workers Compensation - assumed a 21% increase over 2017 premiums. Final increase information will not be available until the end of December time frame.
4) Building Renovations:
   Budget includes $7.0MM for renovations of Borough Hall. Funding derives from the following sources:
   1) 4.5MM from the 2016 Bond Issuance.
   2) 2.5MM from Loan Proceeds but based on recent contractor quotes we may not need to obtain nearly this much.

5.) Capital Budget:
   Includes:
   - $7,000,000 Renovations
   - $ 733,000 Vehicles 8 plus one trailer
   - $ 500,000 PW projects
   - $ 153,000 Park renovations(Recreation)
   - $ 401,000 WW plant upgrades/maintenance projects
   - $ 660,000 Parking garage repairs, tech upgrades or replacements, master parking plan implementation

## Borough of West Chester

# 2018 Budget Package

# Borough of West Chester 2018 Budget - FINAL
## - Stream 16 -

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2018 BUDGET |
|---|---|---|---|---|
| **REVENUE** | | | | |
| **MISCELLANEOUS REVENUE** | | | | |
| 16 | 16 | 30000 | REVENUE CARRYOVER | 774,866 |
| 16 | 16 | 34100 | INTEREST INCOME | 70,000 |
| 16 | 16 | 38000 | MISCELLANEOUS REVENUE | 1,000 |
| 16 | 16 | 38009 | TAX REV - CERTS | 2,000 |
| 16 | 16 | 38015 | STREAM REVENUE | 1,429,000 |
| 16 | 16 | 38050 | GRANT - STREAM GREEN (DEP) | 220,731 |
| 16 | 16 | 39350 | BOND PROCEEDS | 460,497 |
| **Total MISCELLANEOUS REVENUE** | | | | **2,958,094** |
| **TOTAL REVENUE** | | | | **2,958,094** |
| **EXPENSES** | | | | |
| **PAYROLL RELATED EXPENSES** | | | | |
| 16 | 16 | 49525 | SALARIES STREAM | 70,996 |
| 16 | 16 | 48600 | INS WORKERS COMP | 10,890 |
| 16 | 16 | 48700 | INS EMPLOYEE BENEFIT | 12,779 |
| 16 | 16 | 48720 | SOCIAL SECURITY | 5,431 |
| **Total PAYROLL RELATED EXPENSES** | | | | **100,096** |
| **STREAM EXPENSES** | | | | |
| 16 | 16 | 40121 | OFFICE SUPPLIES/EXPENSE | 800 |
| 16 | 16 | 40122 | POSTAGE/PRINTING | 800 |
| 16 | 16 | 40133 | OTHER EXPENSE | 800 |
| 16 | 16 | 42007 | PROFESSIONAL FEES | 95,000 |
| 16 | 16 | 43620 | STORM DRAIN MATERIALS | 32,000 |
| 16 | 16 | 48951 | REFUNDS | 1,000 |
| 16 | 16 | 44915 | GREEN STREAM INFRASTRUCTURE | 1,003,316 |
| 16 | 16 | 44920 | STORM SEWER REHAB PROJECTS | 350,000 |
| 16 | 16 | 44925 | STREAM BANK STABILIZATION PROJECT | 579,434 |

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2018 BUDGET |
|---|---|---|---|---|
| **Total STREAM EXPENSES** | | | | **2,063,150** |
| **INTERFUND OPERATING TRANSFERS** | | | | |
| 16 | 16 | 44570 | TRF TO GENERAL FUND | 794,848 |
| **TOTAL INTERFUND OPERATING TRANSFERS** | | | | **794,848** |
| **Total EXPENSES** | | | | **2,958,094** |
| **NET INCOME/(LOSS)** | | | | **(0)** |

**Borough of West Chester**
Normal Trial Balance
From 12/31/2018 Through 12/31/2018

| Fund Code | GL Code | Fund Title | GL Title | Debit Balance | Credit Balance |
|---|---|---|---|---|---|
| 16 | 40121 | STREAM FUND | OFFICE SUPPLIES/EXPENSE | 453.00 | |
| 16 | 40122 | STREAM FUND | POSTAGE/PRINTING | 2,868.17 | |
| 16 | 40133 | STREAM FUND | OTHER EXPENSE | 369.61 | |
| 16 | 40140 | STREAM FUND | BANK FEES | 4,724.70 | |
| 16 | 40430 | STREAM FUND | LEGAL OTHER | 138.25 | |
| 16 | 42007 | STREAM FUND | PROFESSIONAL FEES | 264,614.78 | |
| 16 | 43020 | STREAM FUND | CAP PURCH - IMPROV OT BLDGS | 132,703.22 | |
| 16 | 43620 | STREAM FUND | STORM DRAIN MATERIALS | 48,296.12 | |
| 16 | 43825 | STREAM FUND | SALARIES - OT REGULAR | 736.61 | |
| 16 | 44570 | STREAM FUND | TRF TO GENERAL FUND | 794,848.00 | |
| 16 | 44915 | STREAM FUND | GREEN STREAM INFRASTRUCTURE | 1,022,401.50 | |
| 16 | 44920 | STREAM FUND | STORM SEWER REHAB PROJECTS | 193,848.93 | |
| 16 | 44921 | STREAM FUND | INLET REPLACEMENT | 1,023.08 | |
| 16 | 45836 | STREAM FUND | TRAINING/MILEAGE | 203.72 | |
| 16 | 48600 | STREAM FUND | INS WORKERS COMP | 2,783.16 | |
| 16 | 48610 | STREAM FUND | INS GENERAL & LIABILITY | 1,096.40 | |
| 16 | 48700 | STREAM FUND | INS EMPLOYEE BENEFIT | 2,267.95 | |
| 16 | 48715 | STREAM FUND | PENSION PAYMENTS | 2,375.00 | |
| 16 | 48720 | STREAM FUND | SOCIAL SECURITY / MEDICARE | 4,176.09 | |
| 16 | 48951 | STREAM FUND | REFUNDS | 2,030.27 | |
| 16 | 49525 | STREAM FUND | SALARIES STREAM | 56,741.38 | |
| Total 16 | | STREAM FUND | | 2,538,699.94 | 0.00 |
| Report Total | | | | 2,538,699.94 | 0.00 |
| Report Difference | | | | 2,538,699.94 | |

1771a

# EXHIBIT F

To Affidavit of Barbara Lionti

# Borough of West Chester

# Approved Budget 2017

# ***FINAL***

# Borough of West Chester
## FINAL Approved Budget 2017
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1774a

FINAL

Borough of West Chester
Departmental Budget 2017
STREAM (Dept 16, Fund 16)

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2017 BUDGET | 2016 BUDGET | PROPOSAL |
|---|---|---|---|---|---|---|
| **REVENUE** | | | | | | |
| MISCELLANEOUS REVENUE | | | | | | |
| 16 | 16 | 38015 | STREAM REVENUE | 1,430,000 | 421,000 | |
| 16 | 16 | 39350 | BOND PROCEEDS | 774,866 | 2,000,000 | |
| Total MISCELLANEOUS REVENUE | | | | 2,204,866 | 2,421,000 | |
| TOTAL REVENUE | | | | 2,204,866 | 2,421,000 | |
| **EXPENSES** | | | | | | |
| PAYROLL RELATED EXPENSES | | | | | | |
| 16 | 16 | 49525 | SALARIES STREAM | 170,996 | 225,000 | |
| 16 | 16 | 48600 | INS WORKERS COMP | 9,000 | - | 600 |
| 16 | 16 | 48700 | INS EMPLOYEE BENEFIT | 30,000 | - | 600 |
| 16 | 16 | 48705 | INS EMPLOYEE VISION | - | - | - n/a - |
| 16 | 16 | 48720 | FICA | 13,081 | - | 800 |
| Total PAYROLL RELATED EXPENSES | | | | 223,077 | 225,000 | |
| STREAM EXENSES | | | | | | |
| 16 | 16 | 43620 | STORM DRAIN MATERIALS | 75,000 | 58,000 | 145 |
| 16 | 16 | 40133 | OTHER EXPENSE | 500 | 42,000 | 145 |
| 16 | 16 | 40121 | OFFICE SUPPLIES | 500 | - | 145 |
| 16 | 16 | 40122 | POSTAGE/PRINTING | 200 | - | 145 |
| 16 | 16 | 42007 | PROFESSIONAL FEES | 50,000 | - | 145 |
| 16 | 16 | 49530 | STREAM PROJECT-- | - | 1,450,000 | - n/a - |
| Total STREAM EXENSES | | | | 126,200 | 1,550,000 | |
| INTERFUND OPERATING TRANSFERS | | | | | | |
| 16 | 16 | 44568 | TRF TO CAPITAL IMP FUND | 560,122 | 371,000 | |

Borough of West Chester 2016 Budget

**-Stream 16-**

**FINAL**

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2017 BUDGET | 2016 BUDGET | PROPOSAL |
|---|---|---|---|---|---|---|
| 16 | 16 | 44560 | TRF TO DEBT SERVICE FUND | 350,000 | 125,000 | |
| 16 | 16 | 44562 | TRF TO EQUIP & TECH FUND | - | 150,000 | - n/a - |
| 16 | 16 | 44570 | TRF TO GENERAL FUND | 945,467 | - | |
| **TOTAL INTERFUND OPERATING TRANSFERS** | | | | **1,855,589** | **646,000** | |
| **Total EXPENSES** | | | | **2,204,866** | **2,421,000** | |
| **NET INCOME/(LOSS)** | | | | 0 | - | |

**Borough of West Chester**
Normal Trial Balance
From 12/31/2017 Through 12/31/2017

| Fund Code | GL Code | Fund Title | GL Title | Debit Balance | Credit Balance |
|---|---|---|---|---|---|
| 16 | 40121 | STREAM FUND | OFFICE SUPPLIES/EXPENSE | 744.82 | |
| 16 | 40122 | STREAM FUND | POSTAGE/PRINTING | 52.50 | |
| 16 | 40133 | STREAM FUND | OTHER EXPENSE | 4,017.13 | |
| 16 | 40140 | STREAM FUND | BANK FEES | 7,363.82 | |
| 16 | 40430 | STREAM FUND | LEGAL OTHER | 1,105.50 | |
| 16 | 42000 | STREAM FUND | ADVERTISING | | 203.17 |
| 16 | 42007 | STREAM FUND | PROFESSIONAL FEES | 305,909.81 | |
| 16 | 43020 | STREAM FUND | CAP PURCH - IMPROV OT BLDGS | 921,878.97 | |
| 16 | 43620 | STREAM FUND | STORM DRAIN MATERIALS | 12,542.64 | |
| 16 | 44920 | STREAM FUND | STORM SEWER REHAB PROJECTS | 0.00 | |
| 16 | 47297 | STREAM FUND | INT EXP- 2016 STREAM | 0.00 | |
| 16 | 48700 | STREAM FUND | INS EMPLOYEE BENEFIT | 4,968.12 | |
| 16 | 48720 | STREAM FUND | SOCIAL SECURITY / MEDICARE | 2,533.73 | |
| 16 | 48951 | STREAM FUND | REFUNDS | 232.78 | |
| 16 | 49100 | STREAM FUND | ADJUSTMENTS - AUDIT & MISC | 2,317.00 | |
| 16 | 49525 | STREAM FUND | SALARIES STREAM | 33,120.73 | |
| 16 | 49530 | STREAM FUND | STREAM PROJECT don't use | 0.00 | |
| Total 16 | | STREAM FUND | | 1,296,787.55 | 203.17 |
| Report Total | | | | 1,296,787.55 | 203.17 |
| Report Difference | | | | 1,296,584.38 | |

# Exhibit C

To Brief

# Expert Report

## Discrete Benefits Provided to West Chester University by the West Chester Borough Stormwater Management System

### West Chester Borough, Chester County, PA

**Prepared For:**

**West Chester Borough**
**401 East Gay Street**
**West Chester, PA 19380**

**June 2021**

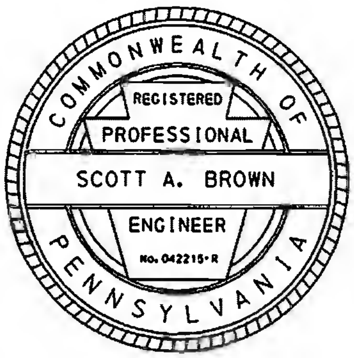
NTM Engineering, Inc.
341 Science Park Road, Ste 203
State College, PA 16803

NEWELL TERESKA & MACKAY ENGINEERING

## Engineer's Certification

**Expert Report**
**Discrete Benefits Provided to West Chester University by the West Chester Borough Stormwater Management System**
**West Chester Borough, Chester County, PA**

"I do hereby certify pursuant to the penalties of 18 PA C.S.A. Sec. 4904 to the best of my knowledge, information and belief, that the information contained in the accompanying report, has been prepared in accordance with accepted engineering practice, and is true and correct."




By: ______________________

Date: June 3, 2021

"I do hereby certify pursuant to the penalties of 18 PA C.S.A. Sec. 4904 to the best of my knowledge, information and belief, that the information contained in the accompanying report, has been prepared in accordance with accepted engineering practice, and is true and correct."


By: ______________________

Date: June 3, 2021

# Expert Report
# Discrete Benefits Provided to West Chester University by the West Chester Borough Stormwater Management System

## EXECUTIVE SUMMARY

NTM Engineering, Inc. (NTM) analyzed the discrete benefits West Chester University and the Pennsylvania State System of Higher Education (collectively referred to in this report as the University or WCU) derived from utilizing the West Chester Borough (Borough) owned and operated Stormwater Management System instead of implementing non-municipal options which the University might have for the collection and conveyance of stormwater from its developed property within the Borough. We conducted that investigation in the context of ongoing litigation between the Borough and the University regarding the obligation of the University to pay the Stream Protection Fee for use of the Borough Stormwater Management System.

As with all properties, during rain events stormwater falls upon University-owned real property located within the jurisdictional limits of the Borough (which is referred to in this report as "North Campus"). As do the owners of all developed properties for their lots, the University must collect that stormwater and ensure that most of it is conveyed away from North Campus to a receiving watercourse. To meet that responsibility, on an annual basis the University discharges an enormous volume of stormwater to the Borough Stormwater Management System.

The Borough Stormwater Management System includes Borough owned, operated, and maintained roads, storm drains, inlets, curbs, gutters, and other conveyance components. To analyze the discrete benefits which the University derives from its use of that system, we evaluated options which the University would have to meet its responsibility to collect stormwater and convey it to a receiving watercourse other than the University's current use of the Borough Stormwater Management System.

We begin with the assumption that, if the University did not use the Borough Stormwater Management System, the University would need to otherwise capture and manage all annual stormwater runoff from North Campus which currently drains to that system.

In this report, NTM presents five (5) conceptual options for capture and management of the stormwater runoff from North Campus which the Borough currently manages (fully or in part) through components of the Borough Stormwater Management System for the benefit of the University. The sixth option which we mention here is the University's continued use of the Borough Stormwater Management System and continued enjoyment of the benefits which the University derives from not having to otherwise address stormwater runoff from North Campus. We completed our analysis using industry standard methodology, programs, and practices, and selected for further development the option (other than payment of the Stream Protection Fee) which would be most economical and beneficial for the University.

We also considered the feasibility of implementation for each option. There, we evaluated the complexity, spatial constraints, general costs, permitting requirements, and overall practicality of each option. The most economically beneficial option for the University (other than continued use of the Borough Stormwater Management System) is Option 3 (*i.e.* design and implementation of a separate University-owned stormwater management system). The design of Option 3 was advanced to a master plan level of detail based on industry standard analysis. Importantly, Option 3 would require substantial additions to, and reworking of, the existing University stormwater management infrastructure and drainage patterns and would necessitate disturbances of almost all portions of North Campus which are adjacent to Borough streets.

Our opinion of the probable costs for the initial design and construction of Option 3 is $4,200,000.00, with estimated annual operation and maintenance costs of $45,600.00. Our design and cost estimates are based on best available data and, in all cases, are based on assumptions which FAVOR the University. As a result, our estimated costs are conservatively low. Those costs, however, still represent a significant required infrastructure investment by the University if it were to seek to replace the benefits which now accrue from the Borough's acceptance of stormwater runoff from North Campus and conveyance of that stormwater to a receiving watercourse on behalf of the University. Our analysis demonstrated, conversely, that the Borough's operation and maintenance of the Borough Stormwater Management System allows the University to realize the significant benefit of not having to make that capital or operational investment.

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# Discrete Benefits Provided to West Chester University by the Borough Stormwater Management System

## I. Authors

This report was prepared by Mr. Scott Brown, PE, D.WRE, and Mr. Aaron Jolin, PE. Mr. Brown is a Senior Engineering Manager at NTM Engineering, Inc. and was the principal author of this report. He has over 40 years of experience as a licensed professional engineer with focus in the areas of stormwater management and drainage design. Mr. Brown's unique expertise and achievements in water resource engineering were acknowledged by the American Academy of Water Resource Engineers in 2013 through award of the credential Diplomat, Water Resource Engineer.

Mr. Jolin provided senior technical support and analysis for this report. Mr. Jolin specializes in design and regulatory permitting of drainage, stormwater management, and erosion and sedimentation control systems. He has over 14 years of experience and has been a licensed professional engineer for over 9 years.

Mr. Brown's Curriculum Vitae and Mr. Jolin's Curriculum Vitae are included in **Appendix F**.

## II. Background

On July 20, 2016, Borough Council (the governing body of the Borough) enacted the Stream Protection Ordinance (Ordinance No. 10-2016).

As defined in the Stream Protection Ordinance, the 'Borough Stormwater Management System' is the system of collection and conveyance, including underground pipe, manholes, outfalls, dams, flood control structure, natural areas, structural and non-structural stormwater best management practices, channels, detention ponds, public streets, curbs, drains and all devices, appliances appurtenances and facilities appurtenant thereto used for collecting, conducting, pumping, conveying, detaining, discharging and/or treating stormwater. The Stormwater Management System is entirely owned and operated by the Borough.

Pursuant to the Stream Protection Ordinance, the Borough charges a service fee (the "Stream Protection Fee") to the owners of all "developed" properties in the Borough.[1] Importantly, the Borough does not charge that service fee to the owners of properties which are not "developed"

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[1] Pursuant to the Stream Protection Ordinance, a developed property is

> property where manmade changes have been made which add impervious surfaces to the property, which changes may include, but are not limited to, buildings or other structures for which a building permit must be obtained under the requirements of the Pennsylvania Building Code and this Code, mining, dredging, filling, grading, paving, excavation or drilling operations, or the storage of equipment or materials.

and which, therefore, do not have impervious surface from which development-related stormwater drains to the Borough Stormwater Management System

The Borough deposits all revenue which it collects from payment of the Stream Protection Fee into the West Chester Borough Stormwater Management Fund. In turn, the Borough uses the Stormwater Management Fund for, amongst other stormwater related purposes, "constructing, operating, and maintaining the Borough Stormwater Management System".

The University is primarily divided into two areas - North Campus and South Campus (See map in **Appendix A**, Exhibit A-1). Portions of North Campus are located in the Borough (See map in **Appendix A**, Exhibit A-2). According to discovery documents WCU000819-820 (Attached in **Appendix B**), the area of North Campus within the Borough is 60.3 acres, where 54.1 Acres (31.5 acres of which is impervious) drains through the Borough Stormwater Management System and, ultimately, discharges to an Unnamed Tributary (UNT) of Plum Run (See map in **Appendix A**, Exhibit A-2). As noted on Exhibit A-6, other portions of North Campus drain to the Borough Stormwater Management System and, ultimately, discharge to other receiving watercourses.

In January of 2018, the Pennsylvania State System of Higher Education informed the Borough that "the University will not be paying the storm water management fee invoices that the Borough sent to the University." The basis for that refusal is the Pennsylvania State System of Higher Education's claim that the Stream Protection Fee "is a tax, from which the University, as a Commonwealth entity, is immune." The Borough then started litigation to challenge that refusal.

In an Opinion dated July 15, 2019, the Commonwealth Court noted that

> questions remain . . . as to . . . whether the . . . that the Borough Stormwater System provides a discrete benefit to [the University and the Pennsylvania State System of Higher Education], as opposed to generally aiding the environment and the public at large [and] whether the value of the [Borough] Stormwater System to [the University and the Pennsylvania State System of Higher Education] is reasonably proportional to the amount of the" Stream Protection Fee.

NTM Engineering, Inc. considered whether, and to what extent, the Borough Stormwater Management System provides a discrete benefit to the University. NTM examined the University's ability to otherwise capture and manage all annual stormwater runoff from North Campus which currently drains to the Borough Stormwater Management System as a means of measuring the benefits which the University enjoys from its present use of that system. NTM then completed its analysis using industry standard methodology, programs, and practices, and selected for further development the option (other than payment of the Stream Protection Fee) which would be most economical and beneficial for the University.

## III. Design Criteria for Options to Manage Stormwater Runoff

NTM began with the assumption that, if it did not benefit from its connection to the Borough Stormwater Management System, the University would need to otherwise capture and manage all annual stormwater runoff from North Campus which currently drains to that system.

By virtue of its ability to access the Borough Stormwater Management System, the University need not design and implement a system of its own which would otherwise need to control (by capturing, storing, reusing, conveying, infiltrating, or other method) all annual runoff (peak rate and volume) up to and including the largest regulatory storm - the 100-yr/24-hour design storm (7.55 inches in 24 hours).

NTM analyzed 10 years of locally available rainfall data to calculate that more than 32,500,000 gallons of stormwater runoff are generated annually by the portion of North Campus draining to the UNT Plum Run Outfall (See **Appendix A**, Exhibit A-1 for location of outfall; See **Appendix B** for annual runoff calculations). This is according to land area delineations which the University produced during the discovery process (WCU000819- WCU000820) which states the University has 22.6 acres of pervious area and 31.5 acres of impervious area to the outfall. We also note that in a 24-hour period, a single 100-year/24-hour design storm (maximum design event per stormwater standard of practice) generates approximately 9,000,000 gallons of runoff from the portion of North Campus considered in the land uses above (See **Appendix B** for calculations).

## IV. Options for Management of Stormwater Runoff

We considered the following options which would be available to the University in lieu of the ability to discharge stormwater runoff from North Campus through the Borough Stormwater Management System (and note the existence of a sixth option . . . continued enjoyment of the benefits of connection to the Borough Stormwater Management System and payment of the Stream Protection Fee):

**Option 1 - Water Reuse:** Design and construct infrastructure to provide for capture, conveyance, storage, treatment, and re-use of all stormwater runoff from North Campus. This would include constructing building plumbing and campus-wide irrigation systems capable of reusing all stormwater runoff from North Campus.

**Option 2 – Storage and Infiltration:** Design and construct a capture, conveyance, and storage system capable of infiltrating/injecting all annual stormwater runoff into the ground on-site.

**Option 3 - University Owned and Operated Stormwater Management System:** Design and construct a storm runoff capture and conveyance system separate from the Borough Stormwater Management System and designed to convey stormwater (up to and including a 100-year/24-hour storm) to one or more off-campus surface water outfall(s) at a receiving watercourse. The most obvious outfall would be to the unnamed tributary (UNT) to Plum Run in the Borough adjacent to the New Street Parking Garage (designated as UNT1 Plum Run in **Appendix A**, Figure A-1).

**Option 4 - Restore the Historic Drainageway:** The University could daylight/restore the existing (now underground) stream which runs through North Campus and provide additional conveyance measures capturing and conveying all contributory drainage areas of the University to outfall into the restored surface waters (See **Appendix A**, Exhibits 3, 4, and 5 for identification of the historic drainageway location). We note that this option would likely require Borough permission to remove the existing (Borough-owned) pipe through which the underground stream flows.

**Option 5 - Remove all Development on Campus:** The University could eliminate North Campus from consideration as a "developed" property (as that term is defined in the Stream Protection Ordinance) by removing from North Campus all impervious surface (as defined in the Stream Protection Ordinance). This would involve restoring the surface cover condition for North Campus to meadow or woods.

## V. Feasibility of Options to Manage Stormwater Runoff

NTM Engineering, Inc. (NTM) considered the feasibility of implementing each of the foregoing options based on complexity, spatial constraints, general costs, permitting requirements, availability of information for analysis, and overall practicality. We determined that options requiring programmatic building removals, or modifications due to space needs for option facilitation, are impractical due to University programing needs and associated costs.

NTM selected Option 3 **(Design and construction of a University Owned and Operated Stormwater Management System)** as the best, most feasible, and least costly option by which the University could replicate the stormwater management-related benefits it receives from its current connection to, and use of, the Borough Stormwater Management System. Overall, Option 3 provides a standard industry approach which could be most reasonable to implement. We discuss below our justification for not selecting other options.

NTM ruled out Option 1 **(Water Reuse)** because of complexity and cost. The most viable reuse options would include landscape irrigation and non-potable water uses in buildings – for example, toilet flushing. This option would require construction of the same or very similar perimeter and trunk line stormwater collection and conveyance facilities as Option 3. In addition, Option 1 would require surface and/or subsurface storage, water treatment, and pumping facilities to manage the over 32,000,000 gallons of runoff generated annually by North Campus (See **Appendix B** for annual runoff volume calculation). Based on the total annual runoff volume to be managed, reuse systems would need to be extensive enough to provide an average demand of more than 89,000 gallons per day. This would require retrofitting most North Campus buildings with reuse plumbing systems as well as landscape irrigation systems for most green spaces in this portion of campus.

NTM ruled out Option 2 **(Storage and Infiltration)** due to cost and space requirements. Option 2 would require construction of the same perimeter stormwater collection and conveyance system as Option 3 and would also likely require pump facilities and additional conveyance to distribute the stored stormwater to separate infiltration and/or irrigation systems. Due to regulatory loading ratios[2] imposed on infiltration facilities and actual site infiltration capacity, the required infiltration facility size would likely exceed available green space on campus. Considering current regulatory guidance specifying a minimum loading ratio of 8:1 (total tributary drainage area to infiltration area) the University would need to dedicate a minimum footprint of 6.76 acres for infiltration facilities (assuming infiltration capability in the first place). Restrictions posed by shallow bedrock may result in additional limitations on available infiltration area. Injection wells could be considered as an alternative; however, use of injection wells would be challenging from a permitting perspective.[3]

NTM recognizes that the University could consider pumping water to parts of North Campus outside the Borough or to South Campus to provide additional areas for infiltration, irrigation, or reuse functions under Option 1 and/or Option 2. That approach, however, would add to project complexity and cost. Using opportunities on South Campus would also require significant easement acquisition for piped conveyance facilities. Maps in **Appendix A** illustrate the locations of North Campus and South Campus with respect to each other and municipal boundaries.

In addition to proposing more complex and costly designs, both Options 1 and 2 would face resistance from permitting agencies with the most significant challenge being the diminution of the volume of water which reaches UNT1 Plum Run by removing from the watershed of that tributary stormwater which naturally falls within the watershed. Based upon our experience, we conclude that permitting agencies would resist any plan which contemplates pumping water to areas outside natural watershed boundaries (for example from UNT1 Plum Run to UNT2 Plum Run – See Figure A-1 in **Appendix A**).

NTM ruled out Option 4 **(Restore the Historic Drainageway)** because of site constraints, project and permitting complexity, and costs, all as demonstrated by the aerial photos in **Appendix A**, Exhibits A-3, A-4, and A-5. This option would require relocation or removal of campus buildings and roadways, construction of required pedestrian and vehicular bridges, utility relocation, and construction of the same perimeter capture and conveyance facilities as identified in Option 3. The associated costs would substantially exceed the cost of Option 3. This option would also result in a reduction of developable space at North Campus, increased costs for building demolition and relocation, and possible land acquisition.

NTM ruled out Option 5 **(Removal of all Development on Campus)** because it would result in the University ceasing educational operations at North Campus. This option is unrealistic but was

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[2] Loading ratios define the regulatory surface area needed for infiltration facilities based on their tributary impervious and total drainage areas.

[3] Injection wells are stormwater drainage wells such as dry wells, bored wells, infiltration galleries, or improved sinkholes designed to accept storm runoff. Injection wells differ from infiltration trenches and or surface/subsurface infiltration impoundments in that their depth is greater than their widest surface dimension. In addition to State and Local stormwater regulations, injection wells are subject to federal requirements under the Safe Drinking Water Act via EPA's Underground Injection Control Program.

included to illustrate an approach where the University could avoid the benefits which accrue to it by virtue of connection to the Borough Stormwater Management System.

# VI. Option 3 Analysis and Design Approach

## Overview

Any fully comprehensive analysis of the costs associated with Option 3 for purposes of construction in accordance with industry standards would require preparation of a detailed hydrologic and hydraulic (H&H) analysis and development of complete construction documents covering all aspects of the design. In particular, development of fully complete construction documents for North Campus would require, but not necessarily be limited to, the following:

- Complete topographic and physical survey of all site features including, but not limited to, buildings, roadways, sidewalks and other impervious surfaces, tree locations, and locations and dimensions of all physical features.
- Site boundary survey.
- Existing storm drain and utility survey defining horizontal and vertical location and feature size.
- Subsurface Utility Engineering (SUE) investigation to define the horizontal and vertical location of all subsurface utilities. This often includes the need for test-pits, dye testing, CCTV, and other exploratory measures. These studies define potential conflicts with newly designed elements and often result in the need for existing utility relocation and associated engineering design.
- Subsurface building foundation investigations.
- Building roof drainage system investigations.
- Geotechnical and soil evaluations including infiltration testing for any associated stormwater management facilities.
- Acquisition of complete stormwater management facility design and as-built reports and plans including stage storage curves, outlet structures configurations, drainage area information, and modeling assumptions for all existing on-site facilities.

To obtain the information outlined above and undertake a complete engineering design for any of the options identified above would be costly. Furthermore, the necessary field investigations and design activities would require more than one year. Those activities would likely interfere with ongoing University functions.

Therefore, in the interests of time and cost, and in consideration of the University's logistical needs, we prepared an advanced conceptual level analysis and design based on the best available information to establish the costs associated with Option 3. The level of detail in this analysis is comparable to a feasibility or master plan level of design. Given that level of analysis, we took a conservative approach to estimating design values and costs. By conservative, we mean that, where assumptions had to be made, they were made to the benefit of the University (*i.e.* assumptions were made that would reduce the comparative costs associated with developing an implementable option to provide to the University the same stormwater management benefits which the University now enjoys by virtue of the ability to discharge stormwater to the Borough Stormwater Management System).

## Data and Information Review

NTM Engineering, Inc. utilized the best available information from discovery and online sources as a basis for developing the analysis and concept design which we present here. We provide at **Appendix C** a list (together with source references) of the information which we consulted. Throughout the document review, we encountered contradictory and/or incomplete information. We made every effort to substantiate the information which we used in our analysis. Additional discussion regarding information and analysis that are known to exist, but were not available as part of discovery, is also reviewed in **Appendix C**.

## Modeling Approach and Assumptions

NTM Engineering, Inc. utilized standard industry approaches and assumptions for analysis, including hydrologic and hydraulic modeling and conceptual design. Every effort was made to provide substantiation for the assumptions which we used in the analysis. Where reliance on professional judgment was required to establish modeling or analysis parameters, our approach was to err toward providing the benefit of the doubt to the University in the form of reduced capital costs. For example, when selecting modeling parameters, we erred toward assumptions which would provide reductions in peak flows and volumes. While this may have resulted in under sizing the conceptual stormwater management system which the University could build to replace its use of the Borough Stormwater Management System - with associated reduced costs - it resulted in a conservatively low estimate of option cost and associated comparative benefit which the University enjoys by virtue of the Borough Stormwater Management System. In the context of this litigation, our conservative approach favors the University. A list of modeling assumptions is provided in **Appendix C**.

## Modeling Results and Concept Design

A full readout of the modeling results (from AutoCAD Storm and Sanitary Analysis) is in **Appendix C** with a drainage area map and a schematic storm drain plan in **Appendix A**, Exhibit A-6. **Table 1** lists the results of the land use analysis for core portions of North Campus. The table includes areas of North Campus which drain to the Borough Stormwater Management System (SMS) at locations other than the outfall to the UNT of Plum Run which (again, conservatively) are not considered as part of our analysis of Option 3. Importantly, any attempt by the University to replicate the benefits which it enjoys by virtue of its ability to discharge stormwater to the Borough Stormwater Management System would need to account for those areas which do not now discharge to the UNT of Plum Run.

**Table 2** provides the land uses and drainage area breakdown which we used to develop our model. The assumptions are summarized in **Appendix C**. We modeled runoff from impervious areas which are currently being managed by University-owned stormwater control facilities (typically surface or subsurface basins or other facilities) associated with recent redevelopment

**Table 1: Area of West Chester University-North Campus within the Borough- Draining to the Borough Stormwater Management System***

| Drainage Area Description | Total Drainage Area (ac.) | Impervious Area (ac.) |
|---|---|---|
| Area of North Campus draining to Borough SMS discharging to UNT of Plum Run in the Borough (Area Studied) | 44.12 | 24.37 |
| Area of North Campus draining to Borough SMS in Goose Creek Watershed | 0.52 | 0.52 |
| Area of North Campus draining to Borough SMS -Rosendale Ave | 7.95 | 3.20 |
| **Total Area of North Campus Draining to Borough of West Chester Stormwater Management System** | **52.59** | **28.09** |

*excludes the parking garages on the corner of Sharpless and South New Street and Sharpless and South Church Street, any properties east of Reynolds Alley and any properties east of South High Street owned by the University

**Table 2: Option 3 Study Area and Modeling Values for WCU North Campus Conveyed to the Borough's Stormwater Management System and Outfall to Unnamed Tributary (UNT) of Plum Run in the Borough**

| Drainage Area | Total Area (ac.) | Impervious Total (ac.) | Impervious Taken as Meadow (ac.) | Impervious Taken as Open Space (ac.) | Meadow Restoration (ac.) | Impervious Area Modeled (ac.) | Total Open Space Modeled (ac.) | Total Meadow Modeled (ac.) |
|---|---|---|---|---|---|---|---|---|
| A1 | 2.08 | 1.37 | 0.00 | 1.02 | 0.00 | 0.35 | 1.73 | 0.00 |
| A1.5 | 0.12 | 0.10 | 0.00 | 0.00 | 0.00 | 0.10 | 0.02 | 0.00 |
| A2 | 2.23 | 0.83 | 0.00 | 0.00 | 0.06 | 0.83 | 1.33 | 0.06 |
| A3 | 2.24 | 0.82 | 0.00 | 0.00 | 0.04 | 0.82 | 1.37 | 0.04 |
| B1 | 1.15 | 0.17 | 0.00 | 0.00 | 0.00 | 0.17 | 0.97 | 0.00 |
| B1.5 | 0.45 | 0.09 | 0.00 | 0.00 | 0.03 | 0.09 | 0.33 | 0.03 |
| B2 | 1.55 | 1.26 | 0.00 | 0.00 | 0.00 | 1.26 | 0.29 | 0.00 |
| B3 | 14.51 | 9.33 | 0.91 | 2.44 | 0.36 | 5.98 | 7.26 | 1.27 |
| B4 | 2.60 | 1.88 | 0.77 | 0.00 | 0.25 | 1.11 | 0.47 | 1.02 |
| B5 | 0.32 | 0.15 | 0.00 | 0.00 | 0.02 | 0.15 | 0.16 | 0.02 |
| B6 | 0.39 | 0.12 | 0.00 | 0.00 | 0.04 | 0.12 | 0.23 | 0.04 |
| B7 | 0.70 | 0.70 | 0.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.70 |
| B8 | 0.23 | 0.07 | 0.00 | 0.00 | 0.12 | 0.07 | 0.05 | 0.12 |
| B9 | 1.74 | 1.08 | 0.00 | 0.00 | 0.02 | 1.08 | 0.64 | 0.02 |
| B10 | 2.26 | 0.93 | 0.00 | 0.00 | 0.00 | 0.93 | 1.33 | 0.00 |
| B11 | 0.77 | 0.20 | 0.00 | 0.00 | 0.02 | 0.20 | 0.55 | 0.02 |
| B12 | 2.70 | 1.44 | 0.00 | 0.59 | 0.00 | 0.85 | 1.84 | 0.00 |
| B13 | 2.37 | 1.56 | 0.00 | 0.00 | 0.00 | 1.56 | 0.82 | 0.00 |
| B14 | 5.71 | 2.27 | 0.00 | 0.00 | 0.00 | 2.27 | 3.44 | 0.00 |
| **TOTAL** | **44.12** | **24.37** | **2.39** | **4.05** | **0.95** | **17.93** | **22.85** | **3.34** |

or new construction on North Campus. In those instances, we used land use curve numbers consistent with the runoff reduction expected by the applicable stormwater ordinance under which that redevelopment or new construction was permitted. Refer to **Appendix A**, Exhibit 6 for the mapped location of the tabulated drainage areas.

As a result of the modeling approach for crediting existing stormwater control measures which the University maintains, 4.05 acres of existing impervious area was reduced to Open Space Good - HSG C and 2.39 acres of existing impervious reduced to Meadow Good- HSG C. These modifications resulted in a reduction in surface runoff to pre-development conditions – another assumption benefitting the University's position.

The storm drain sizes which would be required to manage conveyance of the 100-yr storm for the University in lieu of its use of the Borough Stormwater Management System range from 18 inches to 54 inches, with the largest sizes located at the outfall crossing New Street. The concept design contemplates two (2) new trunk lines parallel to the main Borough line, draining through the superblock section of North Campus, as more fully depicted in **Appendix A** on Exhibit A-6. Based on review of the information we obtained, and vertical constraints due to the location of the existing storm drain, other utilities, and required connections to existing University storm drains, the two parallel trunk storm line approach appeared to be the only way to achieve gravity flow without introducing pumps or undertaking significant additional utility relocations. The two (2) new University-owned trunk lines would need to extend across both South New Street and South Church Street in two (2) locations.

There are significant constraints associated with designing and installing a new system within an already developed area. Based on the level of detail in the information available for use as a basis for conceptual design, we completed pipe sizing for only the two (2) new main trunk lines. In other words, we did not complete pipe sizing for any of the smaller lateral lines which would be necessary for the University to realize the same storm drainage benefits which it presently enjoys through its connection to the Borough Stormwater Management System.

A significant portion of the storm runoff draining from North Campus to the Borough Stormwater Management System is also conveyed via Borough-owned and Borough-maintained street gutter systems. By definition, these gutter systems are also a part of the Borough Stormwater Management System. Replicating the University's beneficial use of the Borough roadway gutter systems would require construction of an alternate means of capture and conveyance for these flows. The alternate means of capture and conveyance used in our analysis area are as follows:

- Where site constraints allow, swales and yard inlets would be used as perimeter capture elements. These perimeter capture elements would consist of grading in swales and installing yard inlets with 12" HDPE conveyance pipes with connections to the dual trunk storm sewer lines. This was considered to be the least costly means of providing capture.
- Where University driveways and sidewalk areas presently drain to the Borough streets, trench drains connected to a perimeter 12" HDPE line would be used to provide the necessary capture and conveyance.

- Where University property slopes steeply toward the Borough street, and swale grading would be difficult, options for either a knee wall with inlets or curb and trench drains connected to 12" HDPE conveyance pipe would be used. We believe this approach to be the least intrusive and least costly option.

The conceptual approach outlined above is illustrated in **Appendix A**, Exhibit 6. More detailed calculations based on extensive field survey and investigations beyond the scope of this effort would be required to size the perimeter conveyance and capture elements to completely control runoff from all storm design events up to and including 100-year events. It is likely that such an analysis would identify that portions of this system would need to be larger than the pipe sizes identified in the assumptions above.

Additional assumptions used in this analysis include:

- Existing storm drain conveyance measures currently owned and maintained by the University are conservatively assumed to have adequate capacity to manage up to a 100-year event.

- Our concept design and opinion of probable cost considers only limited utility relocation impacts. Our assessment of existing utilities based on available discovery information indicates that multiple utility relocations would, at a minimum, be required where perimeter storm drains are installed and where University conveyance facilities would need to cross Borough right-of-way. In these locations, there are multiple utilities (sewer, water, gas, electrical, lighting, *etc*.) which may be in direct conflict with the placement of a new and separate gravity stormwater management conveyance system. Additional information and detailed analysis would be needed to identify the extent and actual cost of utility relocations which could include sheeting and shoring requirements which our estimate does not consider.

## VII. Opinion of Probable Cost

### Capital Costs

The total initial capital cost for Option 3 is estimated to be approximately $4,200,000.00. In other words, in order to meet is responsibility to collect stormwater and convey it to a receiving watercourse other than the University's current use of the Borough Stormwater Management System, the University would need to expend at least $4,200,000.00. We provide a detailed cost breakdown in **Appendix D**.

We estimated costs utilizing unit pricing from PennDOT's ECMS low bid price index, considering District 6 projects or another closest District with relative item pricing. That is a standard method for preparation of opinions of probable cost for public construction projects in PennDOT District 6 (in which the University is located).

The estimate considers pricing for long life concrete pipes for the trunk lines and HDPE for the perimeter control lines. We estimated pavement and sidewalk replacement quantities based on our conceptual design and estimated disturbances required for installation of the required facilities, as shown by mapping in **Appendix B**. The pricing does not consider any tree protection, landscaping, potential for sidewalk replacements where sidewalks extend onto University property, or traffic control requirements.

Where pricing was not available for specific items, an estimate of probable costs was assumed based on professional opinion. For example, the existing Borough-owned outfall to Plum Run would need to be redesigned and replaced to accommodate new storm drain outfalls. The structure is not a standard PennDOT item and special design/construction methods (*e.g.* cast-in-place concrete, bypass pumping, and coffer dams) would be required for installation. We estimated cost for these non-standard elements using costs from projects of similar complexity.

Design, survey, subsurface utility investigations, permitting, erosion and sedimentation control, mobilization, and contingencies were assumed using typical industry standard percentages. It is possible these costs have been underestimated considering that the conceptual project would span the entirety of North Campus and would likely need to be split into several different construction phases over multiple years.

## Operation and Maintenance Costs

With the additional infrastructure the University would be required to construct under Option 3 to recreate the same stormwater discharge benefits which the University enjoys from its connection to the Borough Stormwater Management System, the University would have additional operation and maintenance costs. These costs would include, but are not limited to, maintenance, repair, and cleaning of perimeter inlets and drains. To approximate these costs, NTM reviewed the estimated annual budgetary cost data for the Borough Stormwater Management System which the Borough used when calculating the Stream Protection Fee. We used that information as the basis for estimating operations, maintenance, and other associated costs the University would incur with the new Option 3 system. See **Appendix E** for calculation methodology.

We determined those operations and maintenance costs would be $35,600.00 per mile of pipe. Applying this unit cost to the estimated Option 3 system length of 1.28 miles results in an annual operation and maintenance cost of $45,600.00.

## Annualized Total Cost

A representative total annual cost can be arrived at by considering annualization of the capital costs identified above. Applying a 100-year design life and a 3% long term inflation rate – a value which, again, benefits the University – to the capital costs results in an annualized capital cost of $132,900.00 (using standard financial compounding factors). Adding this to the annual operation and maintenance costs results in a total annualized cost of $178,500.00.

## VIII. Conclusion

NTM analyzed the discrete benefit provided to West Chester University by the Borough of West Chester owned and operated stormwater management system using the best available information. The analysis included areas of North Campus draining to UNT1 Plum Run, as shown by Exhibit A-6 in **Appendix A**. Based on the analysis presented here, it is estimated that the University saves not less than $4,200,000.00 in up-front capital cost and annual maintenance, operations, and replacement costs of approximately $45,600.00 by virtue of the University's ability to use the Borough owned and operated Stormwater Management System.

Annualizing the capital costs and adding to the operation and maintenance costs results in a total annual cost the University would have to incur if it did not have access to the Borough Stormwater Management System. The ability to avoid that cost ($178,500.00 per year) represents a discrete benefit West Chester University and the Pennsylvania State System of Higher Education derive from utilizing the West Chester Borough owned and operated Stormwater Management System.

As explained in the Modeling Approach and Assumptions in **Appendix C** and illustrated in **Appendix A**, Exhibit A-6, the analysis excludes some property owned by the University within the Borough which drains to portions of the Borough owned and operated Stormwater Management System. Had these properties been included in the analysis, benefit to the West Chester University and Pennsylvania State System of Higher Education would have been greater.

# Appendix A

## Maps and Aerial Photos

### West Chester Borough
### Chester County

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# Appendix A

## Exhibit A-1 Overview Map of West Chester Campus

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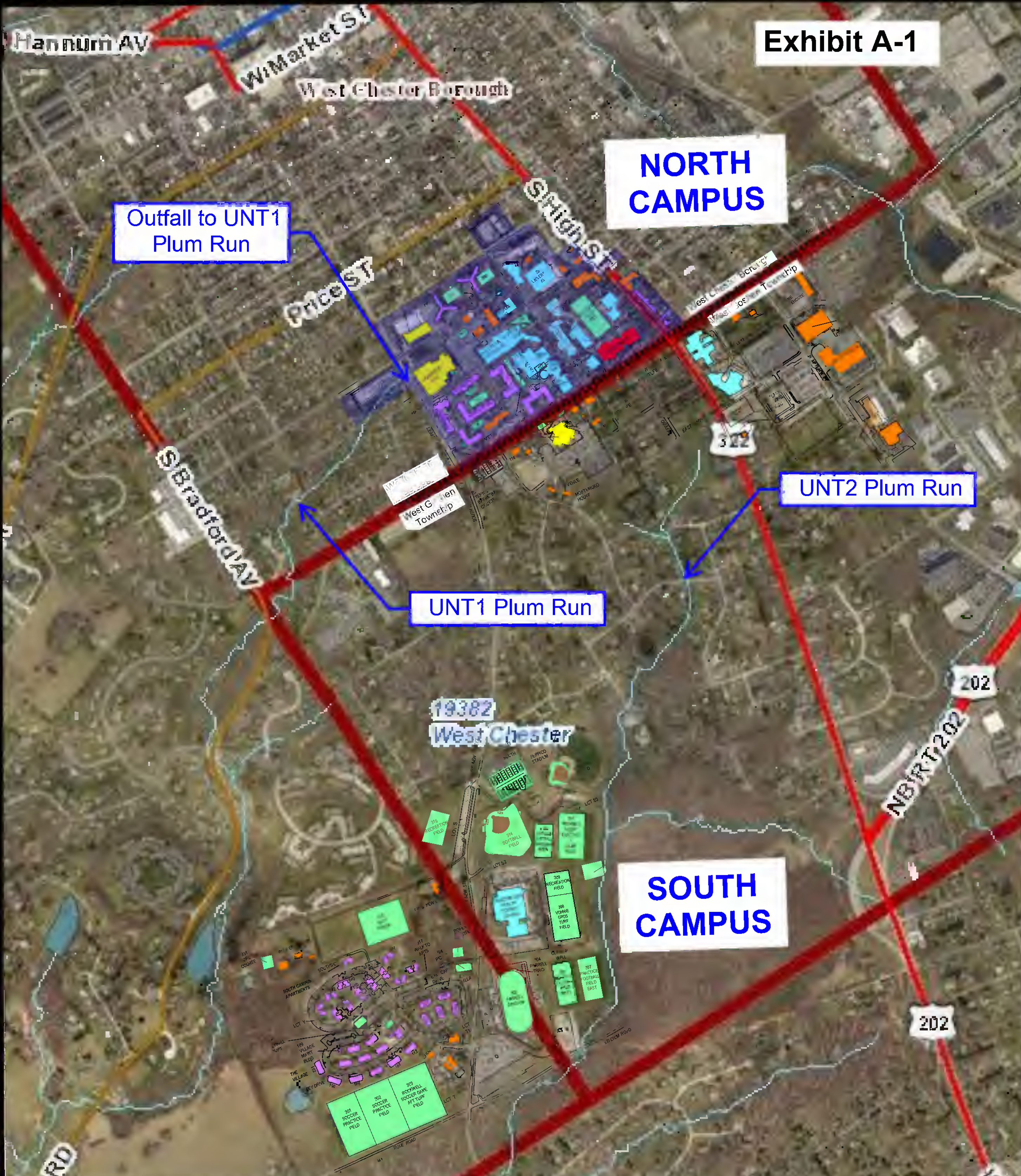


1. Google. (n.d.). [Google Map of West Chester University]. Retrieved May 12, 2021 from https://www.google.com/maps/search/West+Chester+University/@39.946548,-75.6031328,2283m/data=!3m1!1e3
2. West Chester University (n.d.-a). [West Chester University Map of North Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUNorthCampusMap.pdf
3. West Chester University (n.d.-b) [West Chester University Map of South Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUSouthCampusMap.pdf

# Appendix A

## Exhibit A-2 West Chester North Campus in the Borough of West Chester

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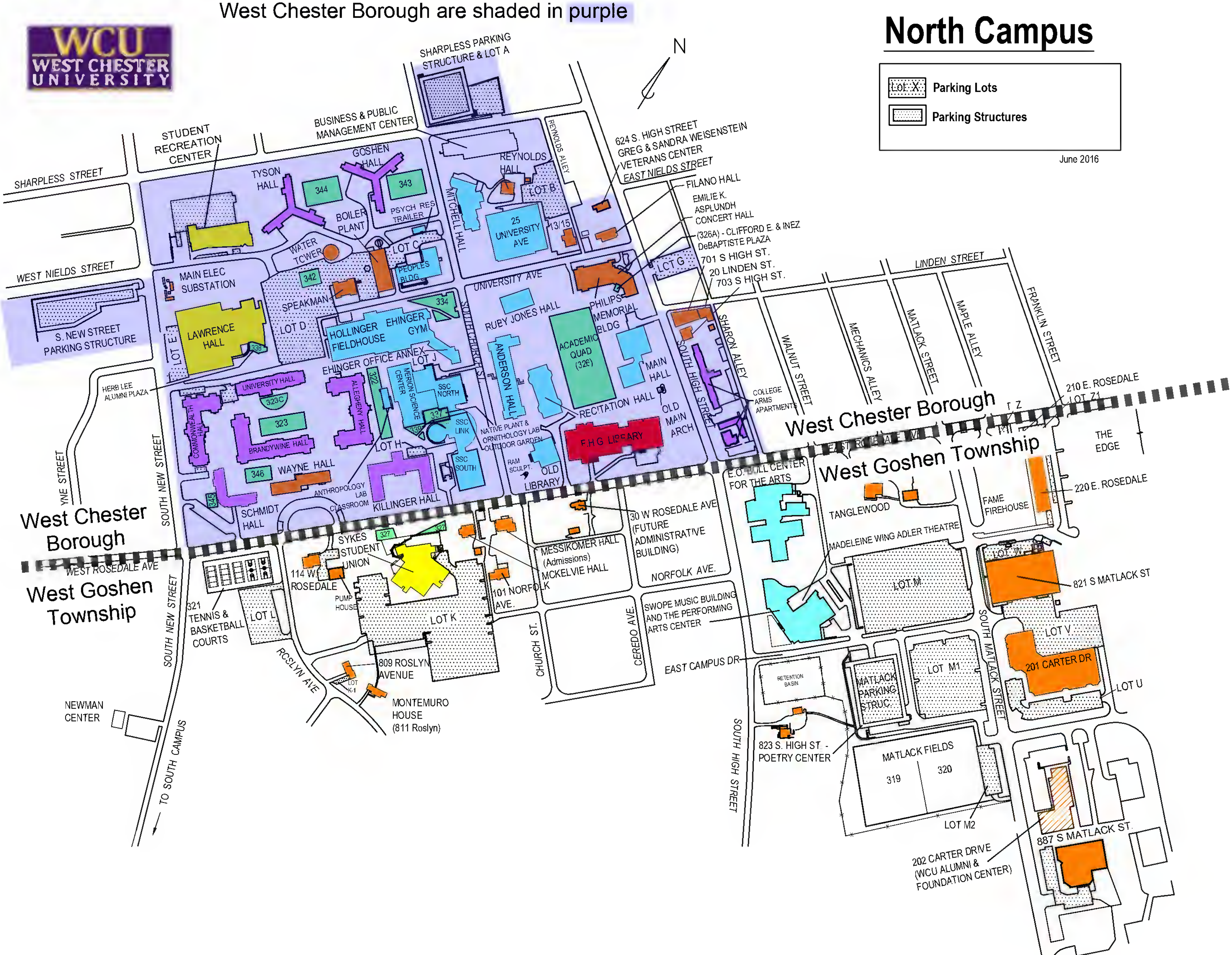
Exhibit A-2

Portions of West Chester North Campus located in West Chester Borough are shaded in purple




West Chester University (n.d.-a). [West Chester University Map of North Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUNorthCampusMap.pdf



1801a

# Appendix A

## Exhibit A-3 Aerial Photo of North Campus from Between 1937-1942 Showing Historic Stream Bed

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1802a


Exhibit A-3: Aerial Photo of North Campus From Between 1937-1942 Showing Historic Stream Bed

PASDA (n.d.-a). [chester 091837 Statewide 1937-1942 B&W (not georeferenced)]. Retrieved from: ftp://ftp.pasda.psu.edu/pub/pennpilotr/era1940/chester_1938_photos_jpg_800/chester_091837_ahk4491

# Appendix A

## Exhibit A-4 Aerial Photo of North Campus From 2018 w/ Historic Stream Bed Added

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PASDA (n.d.-b). [24002570PAS PEMA Orthoimagery Color (1/2 ft)]. Retrieved from: ftp://ftp.pasda.psu.edu/pub/pasda/pema_imagery/cycle1/TIF/South/2018/Survey_Feet/20000000/24002570PAS_PEMA_2018.zip.

# Appendix A

## Exhibit A-5 Aerial Photo of North Campus from Between 1937-1942 Showing Historic Stream Bed w/ Overlay

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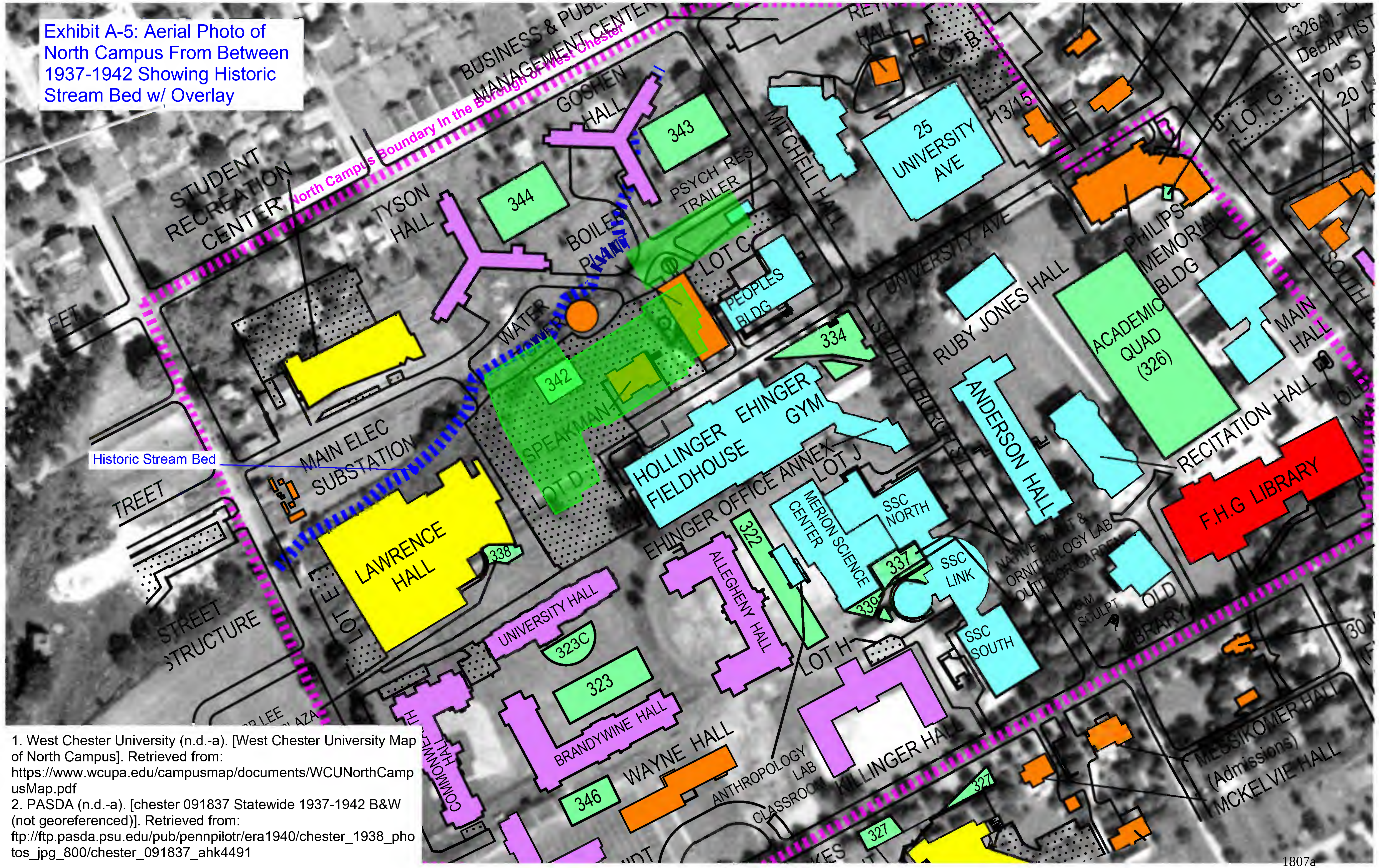
1806a




1. West Chester University (n.d.-a). [West Chester University Map of North Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUNorthCampusMap.pdf
2. PASDA (n.d.-a). [chester 091837 Statewide 1937-1942 B&W (not georeferenced)]. Retrieved from: ftp://ftp.pasda.psu.edu/pub/pennpilotr/era1940/chester_1938_photos_jpg_800/chester_091837_ahk4491

# Appendix A

## Exhibit A-6 Drainage Area Map and Conceptual Design for Option 3

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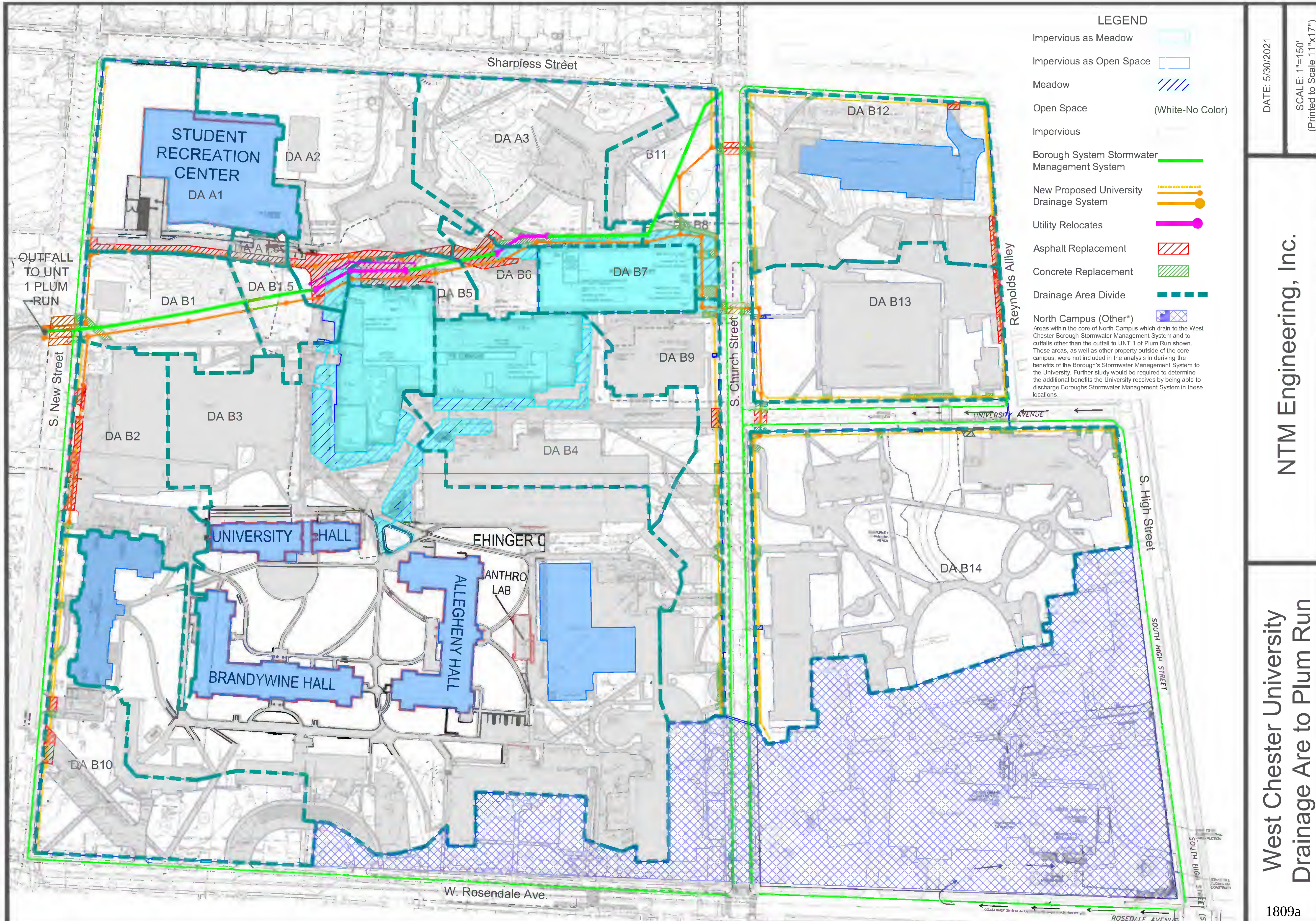

LEGEND
Impervious as Meadow
Impervious as Open Space
Meadow
Open Space
(White-No Color)
Impervious
Borough System Stormwater Management System
New Proposed University Drainage System
Utility Relocates
Asphalt Replacement
Concrete Replacement
Drainage Area Divide
North Campus (Other*)
Areas within the core of North Campus which drain to the West Chester Borough Stormwater Management System and to outfalls other than the outfall to UNT 1 of Plum Run shown. These areas, as well as other property outside of the core campus, were not included in the analysis in deriving the benefits of the Borough's Stormwater Management System to the University. Further study would be required to determine the additional benefits the University receives by being able to discharge Boroughs Stormwater Management System in these locations.
DATE: 5/30/2021
SCALE: 1"=150' (Printed to Scale 11"x17")
NTM Engineering, Inc.
West Chester University Drainage Are to Plum Run
1809a
Sharpless Street
STUDENT RECREATION CENTER
DA A1
DA A2
DA A3
B11
DA B12
DA B13
DA B14
DA B7
DA B6
DA B5
DA B1.5
DA B1
DA B2
DA B3
DA B4
DA B9
DA B10
OUTFALL TO UNT 1 PLUM RUN
S. New Street
S. Church Street
Reynolds Alley
UNIVERSITY AVENUE
S. High Street
SOUTH HIGH STREET
UNIVERSITY HALL
EHINGER
ANTHRO LAB
ALLEGHENY HALL
BRANDYWINE HALL
W. Rosendale Ave.
ROSENDALE AVENUE

# Appendix B

## Miscellaneous Calculations

### West Chester Borough
### Chester County

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# Appendix B

## Calculation of Annual Runoff

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## Calculation of Annual Runoff

To calculate the average annual runoff for the West Chester University Campus to the Outfall of Plum Run in the West Chester Borough (in accordance with discovery document WCU000819-820- stating 54.1 acres, 31.5 acres of which is impervious), continuous simulation monitoring would be the choice methodology. As the apparatus and data are not currently in place (to our knowledge), the following methodology was utilized to estimate the average annual runoff.

The SCS Runoff Equation was applied to the past 10 years of daily (24-hr) rainfall data for two land use conditions, Open Space in Good Condition - HSG C and Impervious - HSG C. (Note: This is the same industry standard methodology described by Worksheet 4 of the PA DEP NPDES Worksheet- used for determining volumetric runoff.)

| **Open Space in Good Condition HSG C** | | **Impervious Area HSG C** | |
|---|---|---|---|
| SCS Curve Number CN | 74 | SCS Curve Number CN | 98 |
| Maximum Retention S ((1000-10CN)/CN) | 3.51 | Maximum Retention S ((1000-10CN)/CN) | 0.20 |
| Initial Abstraction Ia (0.2*S) (inches) | 0.70 | Initial Abstraction Ia (inches) | 0.04 |

For any daily rainfall event, if a 24 hour precipitation exceeded the initial abstraction for the landuse, Q (Runoff-Inches)= (P-.2*S)^2/((P+.8S)

Using data from CoCoRahs (Community Collaboration Rainfall Snow and Hall Network) for the past 10 years, daily rainfall totals for Chester County were analyzed to determine the potential runoff for the assumed land use. Analysis results estimated that 3.12 inches of runoff by Open Space and 35.77 inches of runoff by Impervious Surfaces are generated annually. Considering land areas noted by the WCU, the resulting annual runoff is calculated as 32,508,672 gallons per year.

| **Annual Runoff Calculated for Campus** | Annual Runoff Average (inches) | Area (acres) | Total Runoff (gallons) |
|---|---|---|---|
| Open Space Good HSG C | 3.12 | 22.60 | 1,914,570 |
| Impervious HSG C | 35.77 | 31.50 | 30,594,102 |
| | | **Total-gallons** | **32,508,672** |

Note: This methodology may underestimate the total runoff. Storm events often occur at shorter durations with higher intensity rainfall, which generates significantly more runoff that a rainfall event considered over 24 hours. As any underestimation of the runoff favors WCU, in context of the case theory, the approach is considered acceptable, however further analysis, including factors of safety, would need to be completed for any design option considered by WCU.

Monthly Daily History Geo & Map

Climate West Chester - Pennsylvania

| | Jan | Feb | Mar | Apr | May | Jun |
|---|---|---|---|---|---|---|
| Average high in °F | 39 | 42 | 51 | 63 | 73 | 82 |
| Average low in °F | 19 | 20 | 28 | 38 | 48 | 58 |
| Av. precipitation in inch | 3.45 | 3.22 | 4.30 | 3.79 | 4.21 | 3.79 |
| Av. snowfall in inch | 8 | 11 | 2 | 1 | 0 | 0 |

| | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|
| Average high in °F | 87 | 85 | 78 | 66 | 55 | 44 |
| Average low in °F | 63 | 61 | 53 | 40 | 31 | 23 |
| Av. precipitation in inch | 4.09 | 3.79 | 5.14 | 4.15 | 3.78 | 4.13 |
| Av. snowfall in inch | 0 | 0 | 0 | 0 | 1 | 4 |

Average weather West Chester, PA

| | |
|---|---|
| Annual high temperature | 64°F |
| Annual low temperature | 40°F |
| Average annual precip. | 47.84 inch |
| Av. annual snowfall | 27 inch |

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# Appendix B

## Calculation of Runoff for a 100-year 24-hour Storm

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ENGINEERING
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## Calculation of Runoff for a 100-year 24-hour Storm

| 24 Hour 100-Yr Storm* Runoff Calculated for Campus | Q (Runoff)= (P-.2S)^2/(P+.8S)** (inches) | Area (acres) | Total Runoff (gallons) |
|---|---|---|---|
| Open Space Good HSG C | 4.52 | 22.60 | 2,773,672 |
| Impervious HSG C | 7.31 | 31.50 | 6,252,247 |
| | | **Total-gallons** | **9,025,919** |
| *Precipitation (P) = 7.55 inches in 24 hours | | | |
| ** S for Open Space and Impervious are 3.51 and 0.20 respectively- as previously calculated | | | |

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# Appendix B

## Reference Data for Annual Rainfall

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| Date | Avg Precip in. | Runoff From Open Space (in.) | Date | Avg Precip in. | Runoff From Open Space (in.) | Date | Avg Precip in | Runoff From Open Space (in.) | Date | Avg Precip in. | Runoff From Open Space (in.) | Date | Avg Precip in. | Runoff From Open Space (in.) | ate | Avg Precip in. | Runoff From Open Space (in.) | Date | Avg Precip in. | Runoff From Open Space (in.) | Date | Avg Precip in. | Runoff From Open Space (in.) | Date | Avg Precip in. | Runoff From Open Space (in.) | Date | Avg Precip in | Runoff From Open Space (in.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/5/2020 | 0 | 0 | 4/5/2019 | 0 | 0 | 4/5/2018 | 0.06 | 0 | 4/5/2017 | 0.01 | 0 | 4/5/2016 | 0.14 | 0 | 4/5/2015 | 0 | 0 | 4/5/2014 | 0.05 | 0 | 4/5/2013 | 0.01 | 0 | 4/5/2012 | 0 | 0 | 4/5/2011 | 0.14 | 0 |
| 4/6/2020 | 0 | 0 | 4/6/2019 | 0.16 | 0 | 4/6/2018 | 0.02 | 0 | 4/6/2017 | 0.04 | 0 | 4/6/2016 | 0 | 0 | 4/6/2015 | 0 | 0 | 4/6/2014 | 0 | 0 | 4/6/2013 | 0 | 0 | 4/6/2012 | 0 | 0 | 4/6/2011 | 0.13 | 0 |
| 4/7/2020 | 0 | 0 | 4/7/2019 | 0 | 0 | 4/7/2018 | 0 | 0 | 4/7/2017 | 0.99 | 0.021839 | 4/7/2016 | 0 | 0 | 4/7/2015 | 0 | 0 | 4/7/2014 | 0 | 0 | 4/7/2013 | 0 | 0 | 4/7/2012 | 0 | 0 | 4/7/2011 | 0 | 0 |
| 4/8/2020 | 0.39 | 0 | 4/8/2019 | 0.16 | 0 | 4/8/2018 | 0 | 0 | 4/8/2017 | 0.01 | 0 | 4/8/2016 | 0.46 | 0 | 4/8/2015 | 0.07 | 0 | 4/8/2014 | 0.51 | 0 | 4/8/2013 | 0 | 0 | 4/8/2012 | 0 | 0 | 4/8/2011 | 0.01 | 0 |
| 4/9/2020 | 0.03 | 0 | 4/9/2019 | 0 | 0 | 4/9/2018 | 0 | 0 | 4/9/2017 | 0 | 0 | 4/9/2016 | 0.02 | 0 | 4/9/2015 | 0.05 | 0 | 4/9/2014 | 0.01 | 0 | 4/9/2013 | 0 | 0 | 4/9/2012 | 0 | 0 | 4/9/2011 | 0.76 | 0.000943 |
| 4/10/2020 | 0.06 | 0 | 4/10/2019 | 0 | 0 | 4/10/2018 | 0.04 | 0 | 4/10/2017 | 0 | 0 | 4/10/2016 | 0.35 | 0 | 4/10/2015 | 0.06 | 0 | 4/10/2014 | 0 | 0 | 4/10/2013 | 0 | 0 | 4/10/2012 | 0 | 0 | 4/10/2011 | 0 | 0 |
| 4/11/2020 | 0 | 0 | 4/11/2019 | 0 | 0 | 4/11/2018 | 0 | 0 | 4/11/2017 | 0 | 0 | 4/11/2016 | 0 | 0 | 4/11/2015 | 0.01 | 0 | 4/11/2014 | 0 | 0 | 4/11/2013 | 0.29 | 0 | 4/11/2012 | 0 | 0 | 4/11/2011 | 0 | 0 |
| 4/12/2020 | 0 | 0 | 4/12/2019 | 0 | 0 | 4/12/2018 | 0 | 0 | 4/12/2017 | 0 | 0 | 4/12/2016 | 0.06 | 0 | 4/12/2015 | 0 | 0 | 4/12/2014 | 0.01 | 0 | 4/12/2013 | 0.13 | 0 | 4/12/2012 | 0.01 | 0 | 4/12/2011 | 0 | 0 |
| 4/13/2020 | 1.4 | 0.11578 | 4/13/2019 | 0.43 | 0 | 4/13/2018 | 0 | 0 | 4/13/2017 | 0 | 0 | 4/13/2016 | 0.23 | 0 | 4/13/2015 | 0 | 0 | 4/13/2014 | 0 | 0 | 4/13/2013 | 0.73 | 0.000222 | 4/13/2012 | 0.01 | 0 | 4/13/2011 | 0.98 | 0.020402 |
| 4/14/2020 | 1.12 | 0.044482 | 4/14/2019 | 0.01 | 0 | 4/14/2018 | 0 | 0 | 4/14/2017 | 0 | 0 | 4/14/2016 | 0 | 0 | 4/14/2015 | 0.04 | 0 | 4/14/2014 | 0 | 0 | 4/14/2013 | 0 | 0 | 4/14/2012 | 0.01 | 0 | 4/14/2011 | 0.1 | 0 |
| 4/15/2020 | 0.06 | 0 | 4/15/2019 | 0.44 | 0 | 4/15/2018 | 0 | 0 | 4/15/2017 | 0 | 0 | 4/15/2016 | 0 | 0 | 4/15/2015 | 0.11 | 0 | 4/15/2014 | 0.06 | 0 | 4/15/2013 | 0 | 0 | 4/15/2012 | 0.02 | 0 | 4/15/2011 | 0 | 0 |
| 4/16/2020 | 0 | 0 | 4/16/2019 | 0.01 | 0 | 4/16/2018 | 1.41 | 0.118839 | 4/16/2017 | 0 | 0 | 4/16/2016 | 0 | 0 | 4/16/2015 | 0 | 0 | 4/16/2014 | 2.1 | 0.398208 | 4/16/2013 | 0 | 0 | 4/16/2012 | 0.01 | 0 | 4/16/2011 | 0 | 0 |
| 4/17/2020 | 0 | 0 | 4/17/2019 | 0 | 0 | 4/17/2018 | 0.24 | 0 | 4/17/2017 | 0.01 | 0 | 4/17/2016 | 0 | 0 | 4/17/2015 | 0.12 | 0 | 4/17/2014 | 0 | 0 | 4/17/2013 | 0.01 | 0 | 4/17/2012 | 0 | 0 | 4/17/2011 | 1.81 | 0.265843 |
| 4/18/2020 | 0.07 | 0 | 4/18/2019 | 0 | 0 | 4/18/2018 | 0.01 | 0 | 4/18/2017 | 0.09 | 0 | 4/18/2016 | 0 | 0 | 4/18/2015 | 0 | 0 | 4/18/2014 | 0 | 0 | 4/18/2013 | 0 | 0 | 4/18/2012 | 0.02 | 0 | 4/18/2011 | 0 | 0 |
| 4/19/2020 | 0.02 | 0 | 4/19/2019 | 0 | 0 | 4/19/2018 | 0.02 | 0 | 4/19/2017 | 0 | 0 | 4/19/2016 | 0 | 0 | 4/19/2015 | 0 | 0 | 4/19/2014 | 0 | 0 | 4/19/2013 | 0.1 | 0 | 4/19/2012 | 0.09 | 0 | 4/19/2011 | 0 | 0 |
| 4/20/2020 | 0 | 0 | 4/20/2019 | 1 | 0.02332 | 4/20/2018 | 0.03 | 0 | 4/20/2017 | 0 | 0 | 4/20/2016 | 0 | 0 | 4/20/2015 | 1.19 | 0.059566 | 4/20/2014 | 0 | 0 | 4/20/2013 | 1.01 | 0.024847 | 4/20/2012 | 0 | 0 | 4/20/2011 | 0.12 | 0 |
| 4/21/2020 | 0 | 0 | 4/21/2019 | 0.36 | 0 | 4/21/2018 | 0 | 0 | 4/21/2017 | 0.29 | 0 | 4/21/2016 | 0 | 0 | 4/21/2015 | 0.57 | 0 | 4/21/2014 | 0 | 0 | 4/21/2013 | 0 | 0 | 4/21/2012 | 0 | 0 | 4/21/2011 | 0 | 0 |
| 4/22/2020 | 0.15 | 0 | 4/22/2019 | 0 | 0 | 4/22/2018 | 0 | 0 | 4/22/2017 | 0.2 | 0 | 4/22/2016 | 0 | 0 | 4/22/2015 | 0 | 0 | 4/22/2014 | 0 | 0 | 4/22/2013 | 0 | 0 | 4/22/2012 | 0.33 | 0 | 4/22/2011 | 0 | 0 |
| 4/23/2020 | 0.01 | 0 | 4/23/2019 | 0 | 0 | 4/23/2018 | 0 | 0 | 4/23/2017 | 0.16 | 0 | 4/23/2016 | 0.03 | 0 | 4/23/2015 | 0.14 | 0 | 4/23/2014 | 0.08 | 0 | 4/23/2013 | 0 | 0 | 4/23/2012 | 2.49 | 0.603425 | 4/23/2011 | 0.24 | 0 |
| 4/24/2020 | 0.83 | 0.004504 | 4/24/2019 | 0.01 | 0 | 4/24/2018 | 0 | 0 | 4/24/2017 | 0 | 0 | 4/24/2016 | 0.19 | 0 | 4/24/2015 | 0 | 0 | 4/24/2014 | 0 | 0 | 4/24/2013 | 0 | 0 | 4/24/2012 | 0.03 | 0 | 4/24/2011 | 0.2 | 0 |
| 4/25/2020 | 0.27 | 0 | 4/25/2019 | 0 | 0 | 4/25/2018 | 0.62 | 0 | 4/25/2017 | 0.18 | 0 | 4/25/2016 | 0 | 0 | 4/25/2015 | 0 | 0 | 4/25/2014 | 0 | 0 | 4/25/2013 | 0 | 0 | 4/25/2012 | 0 | 0 | 4/25/2011 | 0.02 | 0 |
| 4/26/2020 | 0.18 | 0 | 4/26/2019 | 0.25 | 0 | 4/26/2018 | 0.04 | 0 | 4/26/2017 | 0.73 | 0.000222 | 4/26/2016 | 0.02 | 0 | 4/26/2015 | 0 | 0 | 4/26/2014 | 0.42 | 0 | 4/26/2013 | 0 | 0 | 4/26/2012 | 0.01 | 0 | 4/26/2011 | 0 | 0 |
| 4/27/2020 | 0.23 | 0 | 4/27/2019 | 0.82 | 0.003838 | 4/27/2018 | 0.21 | 0 | 4/27/2017 | 0.01 | 0 | 4/27/2016 | 0.12 | 0 | 4/27/2015 | 0 | 0 | 4/27/2014 | 0.01 | 0 | 4/27/2013 | 0 | 0 | 4/27/2012 | 0.12 | 0 | 4/27/2011 | 0 | 0 |
| 4/28/2020 | 0.01 | 0 | 4/28/2019 | 0.01 | 0 | 4/28/2018 | 0.04 | 0 | 4/28/2017 | 0 | 0 | 4/28/2016 | 0 | 0 | 4/28/2015 | 0 | 0 | 4/28/2014 | 0 | 0 | 4/28/2013 | 0 | 0 | 4/28/2012 | 0 | 0 | 4/28/2011 | 0.02 | 0 |
| 4/29/2020 | 0 | 0 | 4/29/2019 | 0.03 | 0 | 4/29/2018 | 0.2 | 0 | 4/29/2017 | 0.27 | 0 | 4/29/2016 | 0.18 | 0 | 4/29/2015 | 0 | 0 | 4/29/2014 | 0.05 | 0 | 4/29/2013 | 0.13 | 0 | 4/29/2012 | 0.01 | 0 | 4/29/2011 | 0.15 | 0 |
| 4/30/2020 | 0 | 0 | 4/30/2019 | 0.03 | 0 | 4/30/2018 | 0 | 0 | 4/30/2017 | 0 | 0 | 4/30/2016 | 0.04 | 0 | 4/30/2015 | 0 | 0 | 4/30/2014 | 1.23 | 0.06904 | 4/30/2013 | 0.38 | 0 | 4/30/2012 | 0 | 0 | 4/30/2011 | 0.01 | 0 |
| 5/1/2020 | 1.01 | 0.024847 | 5/1/2019 | 0 | 0 | 5/1/2018 | 0 | 0 | 5/1/2017 | 0 | 0 | 5/1/2016 | 0.21 | 0 | 5/1/2015 | 0 | 0 | 5/1/2014 | 4.53 | 1.996945 | 5/1/2013 | 0 | 0 | 5/1/2012 | 0.21 | 0 | 5/1/2011 | 0 | 0 |
| 5/2/2020 | 0.01 | 0 | 5/2/2019 | 0 | 0 | 5/2/2018 | 0 | 0 | 5/2/2017 | 0.05 | 0 | 5/2/2016 | 0.27 | 0 | 5/2/2015 | 0 | 0 | 5/2/2014 | 0.2 | 0 | 5/2/2013 | 0 | 0 | 5/2/2012 | 0.1 | 0 | 5/2/2011 | 0 | 0 |
| 5/3/2020 | 0.12 | 0 | 5/3/2019 | 0 | 0 | 5/3/2018 | 0 | 0 | 5/3/2017 | 0 | 0 | 5/3/2016 | 0.57 | 0 | 5/3/2015 | 0 | 0 | 5/3/2014 | 0 | 0 | 5/3/2013 | 0 | 0 | 5/3/2012 | 0.28 | 0 | 5/3/2011 | 0 | 0 |
| 5/4/2020 | 0.02 | 0 | 5/4/2019 | 0.08 | 0 | 5/4/2018 | 0 | 0 | 5/4/2017 | 0 | 0 | 5/4/2016 | 0.25 | 0 | 5/4/2015 | 0 | 0 | 5/4/2014 | 0.04 | 0 | 5/4/2013 | 0 | 0 | 5/4/2012 | 0.01 | 0 | 5/4/2011 | 0.38 | 0 |
| 5/5/2020 | 0 | 0 | 5/5/2019 | 0.38 | 0 | 5/5/2018 | 0 | 0 | 5/5/2017 | 0.1 | 0 | 5/5/2016 | 0.02 | 0 | 5/5/2015 | 0 | 0 | 5/5/2014 | 0 | 0 | 5/5/2013 | 0 | 0 | 5/5/2012 | 0.57 | 0 | 5/5/2011 | 0.31 | 0 |
| 5/6/2020 | 0 | 0 | 5/6/2019 | 1.13 | 0.046517 | 5/6/2018 | 0.06 | 0 | 5/6/2017 | 0.92 | 0.012748 | 5/6/2016 | 0.33 | 0 | 5/6/2015 | 0.18 | 0 | 5/6/2014 | 0 | 0 | 5/6/2013 | 0 | 0 | 5/6/2012 | 0.01 | 0 | 5/6/2011 | 0 | 0 |
| 5/7/2020 | 0.15 | 0 | 5/7/2019 | 0.01 | 0 | 5/7/2018 | 0.08 | 0 | 5/7/2017 | 0.08 | 0 | 5/7/2016 | 1.16 | 0.052864 | 5/7/2015 | 0.02 | 0 | 5/7/2014 | 0 | 0 | 5/7/2013 | 0 | 0 | 5/7/2012 | 0 | 0 | 5/7/2011 | 0.1 | 0 |
| 5/8/2020 | 0 | 0 | 5/8/2019 | 0.54 | 0 | 5/8/2018 | 0 | 0 | 5/8/2017 | 0.04 | 0 | 5/8/2016 | 0.15 | 0 | 5/8/2015 | 0 | 0 | 5/8/2014 | 0.02 | 0 | 5/8/2013 | 0.41 | 0 | 5/8/2012 | 0.06 | 0 | 5/8/2011 | 0.05 | 0 |
| 5/9/2020 | 0.51 | 0 | 5/9/2019 | 0.01 | 0 | 5/9/2018 | 0 | 0 | 5/9/2017 | 0 | 0 | 5/9/2016 | 0 | 0 | 5/9/2015 | 0 | 0 | 5/9/2014 | 0 | 0 | 5/9/2013 | 0.44 | 0 | 5/9/2012 | 0.45 | 0 | 5/9/2011 | 0 | 0 |
| 5/10/2020 | 0 | 0 | 5/10/2019 | 0.01 | 0 | 5/10/2018 | 0 | 0 | 5/10/2017 | 0 | 0 | 5/10/2016 | 0.02 | 0 | 5/10/2015 | 0 | 0 | 5/10/2014 | 0 | 0 | 5/10/2013 | 0.01 | 0 | 5/10/2012 | 0.24 | 0 | 5/10/2011 | 0 | 0 |
| 5/11/2020 | 0.03 | 0 | 5/11/2019 | 0.21 | 0 | 5/11/2018 | 0.18 | 0 | 5/11/2017 | 0 | 0 | 5/11/2016 | 0.02 | 0 | 5/11/2015 | 0 | 0 | 5/11/2014 | 0.37 | 0 | 5/11/2013 | 1.3 | 0.087051 | 5/11/2012 | 0 | 0 | 5/11/2011 | 0 | 0 |
| 5/12/2020 | 0.06 | 0 | 5/12/2019 | 0.43 | 0 | 5/12/2018 | 0.63 | 0 | 5/12/2017 | 0.1 | 0 | 5/12/2016 | 0.01 | 0 | 5/12/2015 | 0.17 | 0 | 5/12/2014 | 0 | 0 | 5/12/2013 | 0.31 | 0 | 5/12/2012 | 0 | 0 | 5/12/2011 | 0 | 0 |
| 5/13/2020 | 0 | 0 | 5/13/2019 | 0.96 | 0.017666 | 5/13/2018 | 0.51 | 0 | 5/13/2017 | 0.79 | 0.002152 | 5/13/2016 | 0 | 0 | 5/13/2015 | 0 | 0 | 5/13/2014 | 0.09 | 0 | 5/13/2013 | 0 | 0 | 5/13/2012 | 0 | 0 | 5/13/2011 | 0 | 0 |
| 5/14/2020 | 0 | 0 | 5/14/2019 | 0.69 | 0 | 5/14/2018 | 0.89 | 0.009558 | 5/14/2017 | 0.85 | 0.005988 | 5/14/2016 | 0.11 | 0 | 5/14/2015 | 0 | 0 | 5/14/2014 | 0.12 | 0 | 5/14/2013 | 0 | 0 | 5/14/2012 | 0 | 0 | 5/14/2011 | 0.05 | 0 |
| 5/15/2020 | 0.09 | 0 | 5/15/2019 | 0.02 | 0 | 5/15/2018 | 0.01 | 0 | 5/15/2017 | 0.01 | 0 | 5/15/2016 | 0.11 | 0 | 5/15/2015 | 0 | 0 | 5/15/2014 | 0.02 | 0 | 5/15/2013 | 0.04 | 0 | 5/15/2012 | 0.43 | 0 | 5/15/2011 | 0.38 | 0 |
| 5/16/2020 | 0 | 0 | 5/16/2019 | 0.02 | 0 | 5/16/2018 | 0.6 | 0 | 5/16/2017 | 0 | 0 | 5/16/2016 | 0 | 0 | 5/16/2015 | 0 | 0 | 5/16/2014 | 0.11 | 0 | 5/16/2013 | 0.05 | 0 | 5/16/2012 | 1.06 | 0.033134 | 5/16/2011 | 0.66 | 0 |
| 5/17/2020 | 0 | 0 | 5/17/2019 | 0.01 | 0 | 5/17/2018 | 1.38 | 0.109762 | 5/17/2017 | 0 | 0 | 5/17/2016 | 0 | 0 | 5/17/2015 | 0.27 | 0 | 5/17/2014 | 1.72 | 0.22887 | 5/17/2013 | 0.02 | 0 | 5/17/2012 | 0 | 0 | 5/17/2011 | 0.47 | 0 |
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| 5/19/2020 | 0 | 0 | 5/19/2019 | 0 | 0 | 5/19/2018 | 0.58 | 0 | 5/19/2017 | 0 | 0 | 5/19/2016 | 0.02 | 0 | 5/19/2015 | 0.9 | 0.010573 | 5/19/2014 | 0 | 0 | 5/19/2013 | 0.13 | 0 | 5/19/2012 | 0 | 0 | 5/19/2011 | 0.05 | 0 |
| 5/20/2020 | 0 | 0 | 5/20/2019 | 0.01 | 0 | 5/20/2018 | 0.39 | 0 | 5/20/2017 | 0.03 | 0 | 5/20/2016 | 0 | 0 | 5/20/2015 | 0.1 | 0 | 5/20/2014 | 0 | 0 | 5/20/2013 | 0.03 | 0 | 5/20/2012 | 0 | 0 | 5/20/2011 | 0.38 | 0 |
| 5/21/2020 | 0 | 0 | 5/21/2019 | 0 | 0 | 5/21/2018 | 0.02 | 0 | 5/21/2017 | 0.02 | 0 | 5/21/2016 | 0.01 | 0 | 5/21/2015 | 0 | 0 | 5/21/2014 | 0.03 | 0 | 5/21/2013 | 0.03 | 0 | 5/21/2012 | 0.16 | 0 | 5/21/2011 | 0.26 | 0 |
| 5/22/2020 | 0 | 0 | 5/22/2019 | 0 | 0 | 5/22/2018 | 0 | 0 | 5/22/2017 | 0.07 | 0 | 5/22/2016 | 0.79 | 0.002152 | 5/22/2015 | 0.04 | 0 | 5/22/2014 | 0.16 | 0 | 5/22/2013 | 0 | 0 | 5/22/2012 | 0.02 | 0 | 5/22/2011 | 0 | 0 |
| 5/23/2020 | 1.23 | 0.06904 | 5/23/2019 | 0 | 0 | 5/23/2018 | 0.48 | 0 | 5/23/2017 | 0.19 | 0 | 5/23/2016 | 0.06 | 0 | 5/23/2015 | 0 | 0 | 5/23/2014 | 0.2 | 0 | 5/23/2013 | 0.03 | 0 | 5/23/2012 | 0.01 | 0 | 5/23/2011 | 0.06 | 0 |
| 5/24/2020 | 0.1 | 0 | 5/24/2019 | 0.24 | 0 | 5/24/2018 | 0 | 0 | 5/24/2017 | 0.08 | 0 | 5/24/2016 | 0.19 | 0 | 5/24/2015 | 0 | 0 | 5/24/2014 | 0 | 0 | 5/24/2013 | 0.66 | 0 | 5/24/2012 | 0.02 | 0 | 5/24/2011 | 0.01 | 0 |
| 5/25/2020 | 0 | 0 | 5/25/2019 | 0 | 0 | 5/25/2018 | 0 | 0 | 5/25/2017 | 0.39 | 0 | 5/25/2016 | 0 | 0 | 5/25/2015 | 0 | 0 | 5/25/2014 | 0 | 0 | 5/25/2013 | 0.09 | 0 | 5/25/2012 | 0.09 | 0 | 5/25/2011 | 0 | 0 |
| 5/26/2020 | 0.04 | 0 | 5/26/2019 | 0.05 | 0 | 5/26/2018 | 0 | 0 | 5/26/2017 | 1.21 | 0.064227 | 5/26/2016 | 0 | 0 | 5/26/2015 | 0 | 0 | 5/26/2014 | 0 | 0 | 5/26/2013 | 0 | 0 | 5/26/2012 | 0 | 0 | 5/26/2011 | 0 | 0 |
| 5/27/2020 | 0 | 0 | 5/27/2019 | 0.05 | 0 | 5/27/2018 | 0.14 | 0 | 5/27/2017 | 0 | 0 | 5/27/2016 | 0 | 0 | 5/27/2015 | 0.04 | 0 | 5/27/2014 | 0 | 0 | 5/27/2013 | 0 | 0 | 5/27/2012 | 0.06 | 0 | 5/27/2011 | 0 | 0 |
| 5/28/2020 | 0.04 | 0 | 5/28/2019 | 0 | 0 | 5/28/2018 | 0.16 | 0 | 5/28/2017 | 0.01 | 0 | 5/28/2016 | 0 | 0 | 5/28/2015 | 0.37 | 0 | 5/28/2014 | 0.44 | 0 | 5/28/2013 | 0.02 | 0 | 5/28/2012 | 0 | 0 | 5/28/2011 | 0 | 0 |
| 5/29/2020 | 0.04 | 0 | 5/29/2019 | 0.66 | 0 | 5/29/2018 | 0.01 | 0 | 5/29/2017 | 0.21 | 0 | 5/29/2016 | 0.01 | 0 | 5/29/2015 | 0 | 0 | 5/29/2014 | 0.16 | 0 | 5/29/2013 | 0.21 | 0 | 5/29/2012 | 0 | 0 | 5/29/2011 | 0 | 0 |
| 5/30/2020 | 0.19 | 0 | 5/30/2019 | 0.51 | 0 | 5/30/2018 | 0 | 0 | 5/30/2017 | 0.02 | 0 | 5/30/2016 | 0.68 | 0 | 5/30/2015 | 0 | 0 | 5/30/2014 | 0.1 | 0 | 5/30/2013 | 0 | 0 | 5/30/2012 | 0.52 | 0 | 5/30/2011 | 0 | 0 |
| 5/31/2020 | 0 | 0 | 5/31/2019 | 0.28 | 0 | 5/31/2018 | 0.07 | 0 | 5/31/2017 | 0.05 | 0 | 5/31/2016 | 0 | 0 | 5/31/2015 | 0 | 0 | 5/31/2014 | 0 | 0 | 5/31/2013 | 0 | 0 | 5/31/2012 | 0.01 | 0 | 5/31/2011 | 0 | 0 |
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| 6/2/2020 | 0 | 0 | 6/2/2019 | 0.16 | 0 | 6/2/2018 | 0.2 | 0 | 6/2/2017 | 0 | 0 | 6/2/2016 | 0 | 0 | 6/2/2015 | 1.02 | 0.026417 | 6/2/2014 | 0 | 0 | 6/2/2013 | 0 | 0 | 6/2/2012 | 0.92 | 0.012748 | 6/2/2011 | 0 | 0 |
| 6/3/2020 | 0.03 | 0 | 6/3/2019 | 0.23 | 0 | 6/3/2018 | 1.06 | 0.033134 | 6/3/2017 | 0 | 0 | 6/3/2016 | 0.27 | 0 | 6/3/2015 | 0.13 | 0 | 6/3/2014 | 0 | 0 | 6/3/2013 | 0.49 | 0 | 6/3/2012 | 0 | 0 | 6/3/2011 | 0 | 0 |
| 6/4/2020 | 0.63 | 0 | 6/4/2019 | 0 | 0 | 6/4/2018 | 0.47 | 0 | 6/4/2017 | 0 | 0 | 6/4/2016 | 0.3 | 0 | 6/4/2015 | 0.02 | 0 | 6/4/2014 | 0.17 | 0 | 6/4/2013 | 0.12 | 0 | 6/4/2012 | 0.22 | 0 | 6/4/2011 | 0 | 0 |
| 6/5/2020 | 0.54 | 0 | 6/5/2019 | 0 | 0 | 6/5/2018 | 0 | 0 | 6/5/2017 | 0 | 0 | 6/5/2016 | 0.03 | 0 | 6/5/2015 | 0.26 | 0 | 6/5/2014 | 0.16 | 0 | 6/5/2013 | 0 | 0 | 6/5/2012 | 0.2 | 0 | 6/5/2011 | 0.1 | 0 |
| 6/6/2020 | 0.46 | 0 | 6/6/2019 | 0.34 | 0 | 6/6/2018 | 0.08 | 0 | 6/6/2017 | 0.36 | 0 | 6/6/2016 | 0.53 | 0 | 6/6/2015 | 0.01 | 0 | 6/6/2014 | 0.01 | 0 | 6/6/2013 | 0 | 0 | 6/6/2012 | 0 | 0 | 6/6/2011 | 0.06 | 0 |
| 6/7/2020 | 0 | 0 | 6/7/2019 | 0.01 | 0 | 6/7/2018 | 0 | 0 | 6/7/2017 | 0.16 | 0 | 6/7/2016 | 0 | 0 | 6/7/2015 | 0 | 0 | 6/7/2014 | 0 | 0 | 6/7/2013 | 1.47 | 0.137874 | 6/7/2012 | 0 | 0 | 6/7/2011 | 0 | 0 |
| 6/8/2020 | 0 | 0 | 6/8/2019 | 0 | 0 | 6/8/2018 | 0 | 0 | 6/8/2017 | 0 | 0 | 6/8/2016 | 0.05 | 0 | 6/8/2015 | 0 | 0 | 6/8/2014 | 0 | 0 | 6/8/2013 | 2.5 | 0.609044 | 6/8/2012 | 0.02 | 0 | 6/8/2011 | 0 | 0 |
| 6/9/2020 | 0 | 0 | 6/9/2019 | 0 | 0 | 6/9/2018 | 0 | 0 | 6/9/2017 | 0 | 0 | 6/9/2016 | 0.22 | 0 | 6/9/2015 | 0.89 | 0.009558 | 6/9/2014 | 0.07 | 0 | 6/9/2013 | 0 | 0 | 6/9/2012 | 0 | 0 | 6/9/2011 | 0 | 0 |
| 6/10/2020 | 0 | 0 | 6/10/2019 | 0.26 | 0 | 6/10/2018 | 0 | 0 | 6/10/2017 | 0 | 0 | 6/10/2016 | 0 | 0 | 6/10/2015 | 0 | 0 | 6/10/2014 | 0.39 | 0 | 6/10/2013 | 0.47 | 0 | 6/10/2012 | 0 | 0 | 6/10/2011 | 0.1 | 0 |
| 6/11/2020 | 0.3 | 0 | 6/11/2019 | 1.44 | 0.128212 | 6/11/2018 | 1.8 | 0.261633 | 6/11/2017 | 0 | 0 | 6/11/2016 | 0 | 0 | 6/11/2015 | 0 | 0 | 6/11/2014 | 0.25 | 0 | 6/11/2013 | 1.44 | 0.128212 | 6/11/2012 | 0 | 0 | 6/11/2011 | 0.06 | 0 |
| 6/12/2020 | 0.33 | 0 | 6/12/2019 | 0 | 0 | 6/12/2018 | 0.03 | 0 | 6/12/2017 | 0 | 0 | 6/12/2016 | 0 | 0 | 6/12/2015 | 0 | 0 | 6/12/2014 | 0.18 | 0 | 6/12/2013 | 0.01 | 0 | 6/12/2012 | 0.01 | 0 | 6/12/2011 | 0.71 | 1.82E-05 |
| 6/13/2020 | 0 | 0 | 6/13/2019 | 0.62 | 0 | 6/13/2018 | 0 | 0 | 6/13/2017 | 0 | 0 | 6/13/2016 | 0 | 0 | 6/13/2015 | 0.04 | 0 | 6/13/2014 | 0.99 | 0.021839 | 6/13/2013 | 0 | 0 | 6/13/2012 | 1.61 | 0.186615 | 6/13/2011 | 0.03 | 0 |
| 6/14/2020 | 0 | 0 | 6/14/2019 | 0.43 | 0 | 6/14/2018 | 0 | 0 | 6/14/2017 | 0 | 0 | 6/14/2016 | 0 | 0 | 6/14/2015 | 0.03 | 0 | 6/14/2014 | 0.15 | 0 | 6/14/2013 | 0.58 | 0 | 6/14/2012 | 0 | 0 | 6/14/2011 | 0 | 0 |
| 6/15/2020 | 0 | 0 | 6/15/2019 | 0 | 0 | 6/15/2018 | 0 | 0 | 6/15/2017 | 0 | 0 | 6/15/2016 | 0 | 0 | 6/15/2015 | 0.53 | 0 | 6/15/2014 | 0 | 0 | 6/15/2013 | 0.02 | 0 | 6/15/2012 | 0 | 0 | 6/15/2011 | 0.05 | 0 |
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| 6/17/2020 | 0 | 0 | 6/17/2019 | 0.29 | 0 | 6/17/2018 | 0 | 0 | 6/17/2017 | 0.03 | 0 | 6/17/2016 | 0.36 | 0 | 6/17/2015 | 0.05 | 0 | 6/17/2014 | 0 | 0 | 6/17/2013 | 0.11 | 0 | 6/17/2012 | 0 | 0 | 6/17/2011 | 0.46 | 0 |
| 6/18/2020 | 0.04 | 0 | 6/18/2019 | 0.08 | 0 | 6/18/2018 | 0 | 0 | 6/18/2017 | 0.32 | 0 | 6/18/2016 | 0 | 0 | 6/18/2015 | 0.91 | 0.011636 | 6/18/2014 | 0 | 0 | 6/18/2013 | 0.55 | 0 | 6/18/2012 | 0 | 0 | 6/18/2011 | 0.34 | 0 |
| 6/19/2020 | 0 | 0 | 6/19/2019 | 0.08 | 0 | 6/19/2018 | 0.01 | 0 | 6/19/2017 | 0 | 0 | 6/19/2016 | 0 | 0 | 6/19/2015 | 0.38 | 0 | 6/19/2014 | 0.84 | 0.00522 | 6/19/2013 | 0.5 | 0 | 6/19/2012 | 0.01 | 0 | 6/19/2011 | 0 | 0 |
| 6/20/2020 | 0.15 | 0 | 6/20/2019 | 1.68 | 0.21312 | 6/20/2018 | 0 | 0 | 6/20/2017 | 0.68 | 0 | 6/20/2016 | 0 | 0 | 6/20/2015 | 0.04 | 0 | 6/20/2014 | 0.07 | 0 | 6/20/2013 | 0 | 0 | 6/20/2012 | 0 | 0 | 6/20/2011 | 0 | 0 |
| 6/21/2020 | 0.03 | 0 | 6/21/2019 | 0.67 | 0 | 6/21/2018 | 0.07 | 0 | 6/21/2017 | 0 | 0 | 6/21/2016 | 0.01 | 0 | 6/21/2015 | 0.55 | 0 | 6/21/2014 | 0 | 0 | 6/21/2013 | 0 | 0 | 6/21/2012 | 0 | 0 | 6/21/2011 | 0.23 | 0 |
| 6/22/2020 | 0 | 0 | 6/22/2019 | 0.14 | 0 | 6/22/2018 | 0.02 | 0 | 6/22/2017 | 0.11 | 0 | 6/22/2016 | 0.01 | 0 | 6/22/2015 | 0.01 | 0 | 6/22/2014 | 0.02 | 0 | 6/22/2013 | 0 | 0 | 6/22/2012 | 0 | 0 | 6/22/2011 | 0.19 | 0 |
| 6/23/2020 | 0.07 | 0 | 6/23/2019 | 0 | 0 | 6/23/2018 | 0.07 | 0 | 6/23/2017 | 0.01 | 0 | 6/23/2016 | 0.07 | 0 | 6/23/2015 | 0 | 0 | 6/23/2014 | 0 | 0 | 6/23/2013 | 0 | 0 | 6/23/2012 | 0.25 | 0 | 6/23/2011 | 0 | 0 |
| 6/24/2020 | 0.03 | 0 | 6/24/2019 | 0 | 0 | 6/24/2018 | 0.09 | 0 | 6/24/2017 | 1.5 | 0.147819 | 6/24/2016 | 0.75 | 0.000648 | 6/24/2015 | 0.82 | 0.003838 | 6/24/2014 | 0 | 0 | 6/24/2013 | 0.03 | 0 | 6/24/2012 | 0 | 0 | 6/24/2011 | 0.14 | 0 |

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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/25/2020 | 0 | 0 | 6/25/2019 | 0.05 | 0 | 6/25/2018 | 0.21 | 0 | 6/25/2017 | 0 | 0 | 6/25/2016 | 0.02 | 0 | 6/25/2015 | 0 | 0 | 6/25/2014 | 0 | 0 | 6/25/2013 | 0.44 | 0 | 6/25/2012 | 0.03 | 0 | 6/25/2011 | 0.07 | 0 |
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| 6/27/2020 | 0.06 | 0 | 6/27/2019 | 0 | 0 | 6/27/2018 | 0 | 0 | 6/27/2017 | 0.16 | 0 | 6/27/2016 | 0 | 0 | 6/27/2015 | 0.29 | 0 | 6/27/2014 | 0 | 0 | 6/27/2013 | 0.14 | 0 | 6/27/2012 | 0 | 0 | 6/27/2011 | 0 | 0 |
| 6/28/2020 | 0.05 | 0 | 6/28/2019 | 0 | 0 | 6/28/2018 | 0.43 | 0 | 6/28/2017 | 0 | 0 | 6/28/2016 | 0.18 | 0 | 6/28/2015 | 1.97 | 0.336506 | 6/28/2014 | 0 | 0 | 6/28/2013 | 0.96 | 0.017666 | 6/28/2012 | 0 | 0 | 6/28/2011 | 0 | 0 |
| 6/29/2020 | 0.14 | 0 | 6/29/2019 | 0.08 | 0 | 6/29/2018 | 0.01 | 0 | 6/29/2017 | 0 | 0 | 6/29/2016 | 0.04 | 0 | 6/29/2015 | 0 | 0 | 6/29/2014 | 0 | 0 | 6/29/2013 | 1.32 | 0.09252 | 6/29/2012 | 0.17 | 0 | 6/29/2011 | 0.18 | 0 |
| 6/30/2020 | 0 | 0 | 6/30/2019 | 0.49 | 0 | 6/30/2018 | 0 | 0 | 6/30/2017 | 0 | 0 | 6/30/2016 | 0 | 0 | 6/30/2015 | 0 | 0 | 6/30/2014 | 0 | 0 | 6/30/2013 | 0 | 0 | 6/30/2012 | 0.11 | 0 | 6/30/2011 | 0 | 0 |
| 7/1/2020 | 0.02 | 0 | 7/1/2019 | 0 | 0 | 7/1/2018 | 0 | 0 | 7/1/2017 | 0 | 0 | 7/1/2016 | 0 | 0 | 7/1/2015 | 0.82 | 0.003838 | 7/1/2014 | 0 | 0 | 7/1/2013 | 1.13 | 0.046517 | 7/1/2012 | 0 | 0 | 7/1/2011 | 0 | 0 |
| 7/2/2020 | 0.02 | 0 | 7/2/2019 | 0 | 0 | 7/2/2018 | 0 | 0 | 7/2/2017 | 0.67 | 0 | 7/2/2016 | 0.19 | 0 | 7/2/2015 | 0 | 0 | 7/2/2014 | 0 | 0 | 7/2/2013 | 0.17 | 0 | 7/2/2012 | 0 | 0 | 7/2/2011 | 0 | 0 |
| 7/3/2020 | 0 | 0 | 7/3/2019 | 0.56 | 0 | 7/3/2018 | 0 | 0 | 7/3/2017 | 0 | 0 | 7/3/2016 | 0 | 0 | 7/3/2015 | 0.03 | 0 | 7/3/2014 | 0.3 | 0 | 7/3/2013 | 0.02 | 0 | 7/3/2012 | 0 | 0 | 7/3/2011 | 0.02 | 0 |
| 7/4/2020 | 0.02 | 0 | 7/4/2019 | 0 | 0 | 7/4/2018 | 0.92 | 0.012748 | 7/4/2017 | 0.01 | 0 | 7/4/2016 | 0 | 0 | 7/4/2015 | 0 | 0 | 7/4/2014 | 0.26 | 0 | 7/4/2013 | 0.27 | 0 | 7/4/2012 | 0.01 | 0 | 7/4/2011 | 0.03 | 0 |
| 7/5/2020 | 0 | 0 | 7/5/2019 | 0.22 | 0 | 7/5/2018 | 0.01 | 0 | 7/5/2017 | 0.21 | 0 | 7/5/2016 | 0.48 | 0 | 7/5/2015 | 0.08 | 0 | 7/5/2014 | 0 | 0 | 7/5/2013 | 0 | 0 | 7/5/2012 | 0 | 0 | 7/5/2011 | 0 | 0 |
| 7/6/2020 | 0 | 0 | 7/6/2019 | 0.11 | 0 | 7/6/2018 | 0.12 | 0 | 7/6/2017 | 0.01 | 0 | 7/6/2016 | 0 | 0 | 7/6/2015 | 0 | 0 | 7/6/2014 | 0 | 0 | 7/6/2013 | 0 | 0 | 7/6/2012 | 0 | 0 | 7/6/2011 | 0 | 0 |
| 7/7/2020 | 0.84 | 0.00522 | 7/7/2019 | 0.68 | 0 | 7/7/2018 | 0.17 | 0 | 7/7/2017 | 0.47 | 0 | 7/7/2016 | 0 | 0 | 7/7/2015 | 0.03 | 0 | 7/7/2014 | 0 | 0 | 7/7/2013 | 0 | 0 | 7/7/2012 | 0 | 0 | 7/7/2011 | 0.02 | 0 |
| 7/8/2020 | 0 | 0 | 7/8/2019 | 0.09 | 0 | 7/8/2018 | 0 | 0 | 7/8/2017 | 0.64 | 0 | 7/8/2016 | 0 | 0 | 7/8/2015 | 0 | 0 | 7/8/2014 | 0 | 0 | 7/8/2013 | 0.31 | 0 | 7/8/2012 | 0.06 | 0 | 7/8/2011 | 0.02 | 0 |
| 7/9/2020 | 0.03 | 0 | 7/9/2019 | 0.15 | 0 | 7/9/2018 | 0 | 0 | 7/9/2017 | 0.02 | 0 | 7/9/2016 | 0.03 | 0 | 7/9/2015 | 0.39 | 0 | 7/9/2014 | 0.18 | 0 | 7/9/2013 | 0.42 | 0 | 7/9/2012 | 0 | 0 | 7/9/2011 | 0.78 | 0.001696 |
| 7/10/2020 | 0.1 | 0 | 7/10/2019 | 0 | 0 | 7/10/2018 | 0 | 0 | 7/10/2017 | 0 | 0 | 7/10/2016 | 0.63 | 0 | 7/10/2015 | 0.5 | 0 | 7/10/2014 | 0 | 0 | 7/10/2013 | 0.01 | 0 | 7/10/2012 | 0.04 | 0 | 7/10/2011 | 0.01 | 0 |
| 7/11/2020 | 2.56 | 0.643101 | 7/11/2019 | 0.24 | 0 | 7/11/2018 | 0 | 0 | 7/11/2017 | 0 | 0 | 7/11/2016 | 0 | 0 | 7/11/2015 | 0 | 0 | 7/11/2014 | 0.61 | 0 | 7/11/2013 | 0.06 | 0 | 7/11/2012 | 0 | 0 | 7/11/2011 | 0 | 0 |
| 7/12/2020 | 0 | 0 | 7/12/2019 | 1.84 | 0.278624 | 7/12/2018 | 0 | 0 | 7/12/2017 | 0 | 0 | 7/12/2016 | 0 | 0 | 7/12/2015 | 0 | 0 | 7/12/2014 | 0 | 0 | 7/12/2013 | 0.05 | 0 | 7/12/2012 | 0 | 0 | 7/12/2011 | 0.1 | 0 |
| 7/13/2020 | 0.09 | 0 | 7/13/2019 | 0 | 0 | 7/13/2018 | 0 | 0 | 7/13/2017 | 0.01 | 0 | 7/13/2016 | 0 | 0 | 7/13/2015 | 0 | 0 | 7/13/2014 | 0.02 | 0 | 7/13/2013 | 2.49 | 0.603425 | 7/13/2012 | 0 | 0 | 7/13/2011 | 0 | 0 |
| 7/14/2020 | 0 | 0 | 7/14/2019 | 0 | 0 | 7/14/2018 | 0 | 0 | 7/14/2017 | 0.4 | 0 | 7/14/2016 | 0.46 | 0 | 7/14/2015 | 0.31 | 0 | 7/14/2014 | 0.29 | 0 | 7/14/2013 | 0.03 | 0 | 7/14/2012 | 0.36 | 0 | 7/14/2011 | 0 | 0 |
| 7/15/2020 | 0 | 0 | 7/15/2019 | 0 | 0 | 7/15/2018 | 0 | 0 | 7/15/2017 | 1.21 | 0.064227 | 7/15/2016 | 0 | 0 | 7/15/2015 | 0.82 | 0.003838 | 7/15/2014 | 0.25 | 0 | 7/15/2013 | 0 | 0 | 7/15/2012 | 0.37 | 0 | 7/15/2011 | 0 | 0 |
| 7/16/2020 | 0 | 0 | 7/16/2019 | 0 | 0 | 7/16/2018 | 0.5 | 0 | 7/16/2017 | 0 | 0 | 7/16/2016 | 0 | 0 | 7/16/2015 | 0.3 | 0 | 7/16/2014 | 0.33 | 0 | 7/16/2013 | 0 | 0 | 7/16/2012 | 0.62 | 0 | 7/16/2011 | 0 | 0 |
| 7/17/2020 | 0.02 | 0 | 7/17/2019 | 0.05 | 0 | 7/17/2018 | 0 | 0 | 7/17/2017 | 0 | 0 | 7/17/2016 | 0.11 | 0 | 7/17/2015 | 0 | 0 | 7/17/2014 | 0 | 0 | 7/17/2013 | 0 | 0 | 7/17/2012 | 0 | 0 | 7/17/2011 | 0 | 0 |
| 7/18/2020 | 0 | 0 | 7/18/2019 | 0.54 | 0 | 7/18/2018 | 1.19 | 0.059566 | 7/18/2017 | 0.18 | 0 | 7/18/2016 | 0 | 0 | 7/18/2015 | 0 | 0 | 7/18/2014 | 0 | 0 | 7/18/2013 | 0 | 0 | 7/18/2012 | 0 | 0 | 7/18/2011 | 0 | 0 |
| 7/19/2020 | 0 | 0 | 7/19/2019 | 0.7 | 0 | 7/19/2018 | 0 | 0 | 7/19/2017 | 0 | 0 | 7/19/2016 | 0.5 | 0 | 7/19/2015 | 0 | 0 | 7/19/2014 | 0 | 0 | 7/19/2013 | 0.01 | 0 | 7/19/2012 | 0.03 | 0 | 7/19/2011 | 0 | 0 |
| 7/20/2020 | 0.02 | 0 | 7/20/2019 | 0 | 0 | 7/20/2018 | 0 | 0 | 7/20/2017 | 0 | 0 | 7/20/2016 | 0 | 0 | 7/20/2015 | 0 | 0 | 7/20/2014 | 0.01 | 0 | 7/20/2013 | 0 | 0 | 7/20/2012 | 0.51 | 0 | 7/20/2011 | 0.14 | 0 |
| 7/21/2020 | 0 | 0 | 7/21/2019 | 0 | 0 | 7/21/2018 | 0 | 0 | 7/21/2017 | 0 | 0 | 7/21/2016 | 0 | 0 | 7/21/2015 | 0 | 0 | 7/21/2014 | 0 | 0 | 7/21/2013 | 0.07 | 0 | 7/21/2012 | 0.09 | 0 | 7/21/2011 | 0 | 0 |
| 7/22/2020 | 0.06 | 0 | 7/22/2019 | 0.04 | 0 | 7/22/2018 | 1.78 | 0.253288 | 7/22/2017 | 0 | 0 | 7/22/2016 | 0 | 0 | 7/22/2015 | 0.03 | 0 | 7/22/2014 | 0 | 0 | 7/22/2013 | 0.05 | 0 | 7/22/2012 | 0 | 0 | 7/22/2011 | 0 | 0 |
| 7/23/2020 | 0.35 | 0 | 7/23/2019 | 1.71 | 0.224892 | 7/23/2018 | 1.43 | 0.125055 | 7/23/2017 | 0.24 | 0 | 7/23/2016 | 0 | 0 | 7/23/2015 | 0 | 0 | 7/23/2014 | 0 | 0 | 7/23/2013 | 1.39 | 0.112755 | 7/23/2012 | 0 | 0 | 7/23/2011 | 0 | 0 |
| 7/24/2020 | 0.66 | 0 | 7/24/2019 | 0.02 | 0 | 7/24/2018 | 1.09 | 0.038621 | 7/24/2017 | 1.88 | 0.296008 | 7/24/2016 | 0.1 | 0 | 7/24/2015 | 0 | 0 | 7/24/2014 | 0.55 | 0 | 7/24/2013 | 0.07 | 0 | 7/24/2012 | 0.02 | 0 | 7/24/2011 | 0.01 | 0 |
| 7/25/2020 | 0.05 | 0 | 7/25/2019 | 0 | 0 | 7/25/2018 | 0.75 | 0.000648 | 7/25/2017 | 0.69 | 0 | 7/25/2016 | 0.47 | 0 | 7/25/2015 | 0 | 0 | 7/25/2014 | 0 | 0 | 7/25/2013 | 0 | 0 | 7/25/2012 | 0 | 0 | 7/25/2011 | 0.02 | 0 |
| 7/26/2020 | 0 | 0 | 7/26/2019 | 0 | 0 | 7/26/2018 | 0.54 | 0 | 7/26/2017 | 0.01 | 0 | 7/26/2016 | 0.48 | 0 | 7/26/2015 | 0 | 0 | 7/26/2014 | 0 | 0 | 7/26/2013 | 0 | 0 | 7/26/2012 | 0 | 0 | 7/26/2011 | 1.14 | 0.048593 |
| 7/27/2020 | 0 | 0 | 7/27/2019 | 0 | 0 | 7/27/2018 | 0.01 | 0 | 7/27/2017 | 0 | 0 | 7/27/2016 | 0 | 0 | 7/27/2015 | 0.4 | 0 | 7/27/2014 | 0.05 | 0 | 7/27/2013 | 0 | 0 | 7/27/2012 | 0.54 | 0 | 7/27/2011 | 0.03 | 0 |
| 7/28/2020 | 0 | 0 | 7/28/2019 | 0 | 0 | 7/28/2018 | 0.18 | 0 | 7/28/2017 | 0 | 0 | 7/28/2016 | 0 | 0 | 7/28/2015 | 0 | 0 | 7/28/2014 | 1.26 | 0.07654 | 7/28/2013 | 0.12 | 0 | 7/28/2012 | 0 | 0 | 7/28/2011 | 0 | 0 |
| 7/29/2020 | 0 | 0 | 7/29/2019 | 0 | 0 | 7/29/2018 | 0 | 0 | 7/29/2017 | 0.32 | 0 | 7/29/2016 | 1.07 | 0.034921 | 7/29/2015 | 0 | 0 | 7/29/2014 | 0.01 | 0 | 7/29/2013 | 0.82 | 0.003838 | 7/29/2012 | 0.16 | 0 | 7/29/2011 | 0.28 | 0 |
| 7/30/2020 | 0 | 0 | 7/30/2019 | 0 | 0 | 7/30/2018 | 0 | 0 | 7/30/2017 | 0 | 0 | 7/30/2016 | 0 | 0 | 7/30/2015 | 0 | 0 | 7/30/2014 | 0 | 0 | 7/30/2013 | 0 | 0 | 7/30/2012 | 0.11 | 0 | 7/30/2011 | 0.1 | 0 |
| 7/31/2020 | 0.17 | 0 | 7/31/2019 | 0 | 0 | 7/31/2018 | 0.01 | 0 | 7/31/2017 | 0 | 0 | 7/31/2016 | 1.25 | 0.074003 | 7/31/2015 | 0.67 | 0 | 7/31/2014 | 0 | 0 | 7/31/2013 | 0 | 0 | 7/31/2012 | 0.02 | 0 | 7/31/2011 | 0 | 0 |
| 8/1/2020 | 0.06 | 0 | 8/1/2019 | 0.09 | 0 | 8/1/2018 | 0.05 | 0 | 8/1/2017 | 0 | 0 | 8/1/2016 | 0 | 0 | 8/1/2015 | 0 | 0 | 8/1/2014 | 0 | 0 | 8/1/2013 | 0.31 | 0 | 8/1/2012 | 0.01 | 0 | 8/1/2011 | 0.01 | 0 |
| 8/2/2020 | 0.02 | 0 | 8/2/2019 | 0.17 | 0 | 8/2/2018 | 0.22 | 0 | 8/2/2017 | 0 | 0 | 8/2/2016 | 0.11 | 0 | 8/2/2015 | 0 | 0 | 8/2/2014 | 0.45 | 0 | 8/2/2013 | 1.3 | 0.087051 | 8/2/2012 | 0.11 | 0 | 8/2/2011 | 0.13 | 0 |
| 8/3/2020 | 0 | 0 | 8/3/2019 | 0.07 | 0 | 8/3/2018 | 0.06 | 0 | 8/3/2017 | 0.31 | 0 | 8/3/2016 | 0 | 0 | 8/3/2015 | 0 | 0 | 8/3/2014 | 0.11 | 0 | 8/3/2013 | 0 | 0 | 8/3/2012 | 0 | 0 | 8/3/2011 | 0.03 | 0 |
| 8/4/2020 | 1.21 | 0.064227 | 8/4/2019 | 0.01 | 0 | 8/4/2018 | 1.12 | 0.044482 | 8/4/2017 | 0.03 | 0 | 8/4/2016 | 0 | 0 | 8/4/2015 | 0.2 | 0 | 8/4/2014 | 0.02 | 0 | 8/4/2013 | 0.03 | 0 | 8/4/2012 | 0.03 | 0 | 8/4/2011 | 0.43 | 0 |
| 8/5/2020 | 4.76 | 2.17592 | 8/5/2019 | 0 | 0 | 8/5/2018 | 0.03 | 0 | 8/5/2017 | 0.63 | 0 | 8/5/2016 | 0 | 0 | 8/5/2015 | 0 | 0 | 8/5/2014 | 0 | 0 | 8/5/2013 | 0 | 0 | 8/5/2012 | 0.14 | 0 | 8/5/2011 | 0.02 | 0 |
| 8/6/2020 | 0.05 | 0 | 8/6/2019 | 0 | 0 | 8/6/2018 | 0 | 0 | 8/6/2017 | 0 | 0 | 8/6/2016 | 0 | 0 | 8/6/2015 | 0 | 0 | 8/6/2014 | 0 | 0 | 8/6/2013 | 0 | 0 | 8/6/2012 | 0.31 | 0 | 8/6/2011 | 0 | 0 |
| 8/7/2020 | 0.09 | 0 | 8/7/2019 | 0 | 0 | 8/7/2018 | 0 | 0 | 8/7/2017 | 0.18 | 0 | 8/7/2016 | 0.01 | 0 | 8/7/2015 | 0.06 | 0 | 8/7/2014 | 0.01 | 0 | 8/7/2013 | 0.06 | 0 | 8/7/2012 | 0 | 0 | 8/7/2011 | 0.15 | 0 |
| 8/8/2020 | 1.57 | 0.172093 | 8/8/2019 | 0.19 | 0 | 8/8/2018 | 0.08 | 0 | 8/8/2017 | 0.5 | 0 | 8/8/2016 | 0 | 0 | 8/8/2015 | 0 | 0 | 8/8/2014 | 0 | 0 | 8/8/2013 | 0.25 | 0 | 8/8/2012 | 0 | 0 | 8/8/2011 | 0.01 | 0 |
| 8/9/2020 | 0 | 0 | 8/9/2019 | 0.14 | 0 | 8/9/2018 | 0.14 | 0 | 8/9/2017 | 0 | 0 | 8/9/2016 | 0 | 0 | 8/9/2015 | 0 | 0 | 8/9/2014 | 0 | 0 | 8/9/2013 | 0.04 | 0 | 8/9/2012 | 0 | 0 | 8/9/2011 | 0 | 0 |
| 8/10/2020 | 0.22 | 0 | 8/10/2019 | 0 | 0 | 8/10/2018 | 0 | 0 | 8/10/2017 | 0 | 0 | 8/10/2016 | 0 | 0 | 8/10/2015 | 0.01 | 0 | 8/10/2014 | 0 | 0 | 8/10/2013 | 0.1 | 0 | 8/10/2012 | 0.2 | 0 | 8/10/2011 | 0.98 | 0.020402 |
| 8/11/2020 | 0 | 0 | 8/11/2019 | 0 | 0 | 8/11/2018 | 0.09 | 0 | 8/11/2017 | 0 | 0 | 8/11/2016 | 0 | 0 | 8/11/2015 | 0.58 | 0 | 8/11/2014 | 0 | 0 | 8/11/2013 | 0 | 0 | 8/11/2012 | 0.93 | 0.013907 | 8/11/2011 | 0 | 0 |
| 8/12/2020 | 0 | 0 | 8/12/2019 | 0 | 0 | 8/12/2018 | 0.87 | 0.007674 | 8/12/2017 | 0.03 | 0 | 8/12/2016 | 0.01 | 0 | 8/12/2015 | 0.1 | 0 | 8/12/2014 | 0.11 | 0 | 8/12/2013 | 0 | 0 | 8/12/2012 | 0.05 | 0 | 8/12/2011 | 0 | 0 |
| 8/13/2020 | 0.82 | 0.003838 | 8/13/2019 | 0 | 0 | 8/13/2018 | 1.27 | 0.079113 | 8/13/2017 | 0.06 | 0 | 8/13/2016 | 0.15 | 0 | 8/13/2015 | 0 | 0 | 8/13/2014 | 1.49 | 0.144473 | 8/13/2013 | 1.56 | 0.168536 | 8/13/2012 | 0 | 0 | 8/13/2011 | 0 | 0 |
| 8/14/2020 | 0.17 | 0 | 8/14/2019 | 0.15 | 0 | 8/14/2018 | 1.26 | 0.07654 | 8/14/2017 | 0 | 0 | 8/14/2016 | 0 | 0 | 8/14/2015 | 0 | 0 | 8/14/2014 | 0 | 0 | 8/14/2013 | 0.48 | 0 | 8/14/2012 | 0 | 0 | 8/14/2011 | 1.16 | 0.052864 |
| 8/15/2020 | 0 | 0 | 8/15/2019 | 0.81 | 0.003224 | 8/15/2018 | 0.16 | 0 | 8/15/2017 | 0.07 | 0 | 8/15/2016 | 0.04 | 0 | 8/15/2015 | 0 | 0 | 8/15/2014 | 0.01 | 0 | 8/15/2013 | 0 | 0 | 8/15/2012 | 0.92 | 0.012748 | 8/15/2011 | 1.27 | 0.079113 |
| 8/16/2020 | 0.35 | 0 | 8/16/2019 | 0 | 0 | 8/16/2018 | 0 | 0 | 8/16/2017 | 0.4 | 0 | 8/16/2016 | 0.08 | 0 | 8/16/2015 | 0 | 0 | 8/16/2014 | 0 | 0 | 8/16/2013 | 0 | 0 | 8/16/2012 | 0.01 | 0 | 8/16/2011 | 0.23 | 0 |
| 8/17/2020 | 0.13 | 0 | 8/17/2019 | 0 | 0 | 8/17/2018 | 0 | 0 | 8/17/2017 | 0 | 0 | 8/17/2016 | 0.09 | 0 | 8/17/2015 | 0 | 0 | 8/17/2014 | 0 | 0 | 8/17/2013 | 0 | 0 | 8/17/2012 | 0 | 0 | 8/17/2011 | 0 | 0 |
| 8/18/2020 | 0.33 | 0 | 8/18/2019 | 0 | 0 | 8/18/2018 | 0.26 | 0 | 8/18/2017 | 0 | 0 | 8/18/2016 | 0.25 | 0 | 8/18/2015 | 0 | 0 | 8/18/2014 | 0.01 | 0 | 8/18/2013 | 0.04 | 0 | 8/18/2012 | 1.29 | 0.084369 | 8/18/2011 | 0.6 | 0 |
| 8/19/2020 | 0.01 | 0 | 8/19/2019 | 0.05 | 0 | 8/19/2018 | 0.27 | 0 | 8/19/2017 | 0.87 | 0.007674 | 8/19/2016 | 0.24 | 0 | 8/19/2015 | 0.05 | 0 | 8/19/2014 | 0 | 0 | 8/19/2013 | 0.01 | 0 | 8/19/2012 | 0 | 0 | 8/19/2011 | 0.95 | 0.016366 |
| 8/20/2020 | 0.03 | 0 | 8/20/2019 | 0 | 0 | 8/20/2018 | 1.15 | 0.050708 | 8/20/2017 | 0 | 0 | 8/20/2016 | 0 | 0 | 8/20/2015 | 0.11 | 0 | 8/20/2014 | 0 | 0 | 8/20/2013 | 0 | 0 | 8/20/2012 | 0 | 0 | 8/20/2011 | 0.6 | 0 |
| 8/21/2020 | 0 | 0 | 8/21/2019 | 0 | 0 | 8/21/2018 | 0 | 0 | 8/21/2017 | 0 | 0 | 8/21/2016 | 0 | 0 | 8/21/2015 | 0.99 | 0.021839 | 8/21/2014 | 0 | 0 | 8/21/2013 | 0 | 0 | 8/21/2012 | 0.06 | 0 | 8/21/2011 | 0 | 0 |
| 8/22/2020 | 0 | 0 | 8/22/2019 | 0.35 | 0 | 8/22/2018 | 0.89 | 0.009558 | 8/22/2017 | 0.01 | 0 | 8/22/2016 | 0.8 | 0.002662 | 8/22/2015 | 0 | 0 | 8/22/2014 | 0.11 | 0 | 8/22/2013 | 0.01 | 0 | 8/22/2012 | 0 | 0 | 8/22/2011 | 0.54 | 0 |
| 8/23/2020 | 0 | 0 | 8/23/2019 | 0.14 | 0 | 8/23/2018 | 0 | 0 | 8/23/2017 | 0.97 | 0.019011 | 8/23/2016 | 0 | 0 | 8/23/2015 | 0.07 | 0 | 8/23/2014 | 0 | 0 | 8/23/2013 | 0.13 | 0 | 8/23/2012 | 0 | 0 | 8/23/2011 | 0 | 0 |
| 8/24/2020 | 0.54 | 0 | 8/24/2019 | 0.21 | 0 | 8/24/2018 | 0 | 0 | 8/24/2017 | 0 | 0 | 8/24/2016 | 0 | 0 | 8/24/2015 | 0 | 0 | 8/24/2014 | 0.11 | 0 | 8/24/2013 | 0 | 0 | 8/24/2012 | 0 | 0 | 8/24/2011 | 0 | 0 |
| 8/25/2020 | 0 | 0 | 8/25/2019 | 0 | 0 | 8/25/2018 | 0 | 0 | 8/25/2017 | 0.01 | 0 | 8/25/2016 | 0 | 0 | 8/25/2015 | 0 | 0 | 8/25/2014 | 0 | 0 | 8/25/2013 | 0 | 0 | 8/25/2012 | 0 | 0 | 8/25/2011 | 0 | 0 |
| 8/26/2020 | 0.01 | 0 | 8/26/2019 | 0 | 0 | 8/26/2018 | 0 | 0 | 8/26/2017 | 0 | 0 | 8/26/2016 | 0 | 0 | 8/26/2015 | 0 | 0 | 8/26/2014 | 0 | 0 | 8/26/2013 | 0 | 0 | 8/26/2012 | 0 | 0 | 8/26/2011 | 0.87 | 0.007674 |
| 8/27/2020 | 0 | 0 | 8/27/2019 | 0 | 0 | 8/27/2018 | 0 | 0 | 8/27/2017 | 0 | 0 | 8/27/2016 | 0 | 0 | 8/27/2015 | 0 | 0 | 8/27/2014 | 0 | 0 | 8/27/2013 | 0 | 0 | 8/27/2012 | 0.63 | 0 | 8/27/2011 | 0 | 0 |
| 8/28/2020 | 0 | 0 | 8/28/2019 | 0 | 0 | 8/28/2018 | 0 | 0 | 8/28/2017 | 0 | 0 | 8/28/2016 | 0 | 0 | 8/28/2015 | 0 | 0 | 8/28/2014 | 0 | 0 | 8/28/2013 | 0 | 0 | 8/28/2012 | 0.44 | 0 | 8/28/2011 | 6.37 | 3.500351 |
| 8/29/2020 | 0.48 | 0 | 8/29/2019 | 0.02 | 0 | 8/29/2018 | 0 | 0 | 8/29/2017 | 0 | 0 | 8/29/2016 | 0 | 0 | 8/29/2015 | 0 | 0 | 8/29/2014 | 0 | 0 | 8/29/2013 | 1.14 | 0.048593 | 8/29/2012 | 0.03 | 0 | 8/29/2011 | 0.15 | 0 |
| 8/30/2020 | 0.17 | 0 | 8/30/2019 | 0 | 0 | 8/30/2018 | 0 | 0 | 8/30/2017 | 0.6 | 0 | 8/30/2016 | 0 | 0 | 8/30/2015 | 0 | 0 | 8/30/2014 | 0 | 0 | 8/30/2013 | 0.48 | 0 | 8/30/2012 | 0 | 0 | 8/30/2011 | 0 | 0 |
| 8/31/2020 | 0 | 0 | 8/31/2019 | 0 | 0 | 8/31/2018 | 0 | 0 | 8/31/2017 | 0 | 0 | 8/31/2016 | 0 | 0 | 8/31/2015 | 0 | 0 | 8/31/2014 | 0 | 0 | 8/31/2013 | 0 | 0 | 8/31/2012 | 0 | 0 | 8/31/2011 | 0 | 0 |
| 9/1/2020 | 0.08 | 0 | 9/1/2019 | 0 | 0 | 9/1/2018 | 1.22 | 0.066615 | 9/1/2017 | 0.07 | 0 | 9/1/2016 | 0.34 | 0 | 9/1/2015 | 0.02 | 0 | 9/1/2014 | 1.08 | 0.03675 | 9/1/2013 | 0 | 0 | 9/1/2012 | 0 | 0 | 9/1/2011 | 0 | 0 |
| 9/2/2020 | 0.03 | 0 | 9/2/2019 | 0 | 0 | 9/2/2018 | 0.04 | 0 | 9/2/2017 | 0 | 0 | 9/2/2016 | 0.04 | 0 | 9/2/2015 | 0 | 0 | 9/2/2014 | 0.13 | 0 | 9/2/2013 | 0 | 0 | 9/2/2012 | 0.03 | 0 | 9/2/2011 | 0 | 0 |
| 9/3/2020 | 0.17 | 0 | 9/3/2019 | 0.25 | 0 | 9/3/2018 | 0 | 0 | 9/3/2017 | 1.06 | 0.033134 | 9/3/2016 | 0 | 0 | 9/3/2015 | 0 | 0 | 9/3/2014 | 0.34 | 0 | 9/3/2013 | 0.33 | 0 | 9/3/2012 | 1.19 | 0.059566 | 9/3/2011 | 0 | 0 |
| 9/4/2020 | 0.25 | 0 | 9/4/2019 | 0 | 0 | 9/4/2018 | 0.13 | 0 | 9/4/2017 | 0.01 | 0 | 9/4/2016 | 0 | 0 | 9/4/2015 | 0.14 | 0 | 9/4/2014 | 0 | 0 | 9/4/2013 | 0 | 0 | 9/4/2012 | 1.58 | 0.17568 | 9/4/2011 | 0 | 0 |
| 9/5/2020 | 0 | 0 | 9/5/2019 | 0.06 | 0 | 9/5/2018 | 0 | 0 | 9/5/2017 | 0 | 0 | 9/5/2016 | 0 | 0 | 9/5/2015 | 0.01 | 0 | 9/5/2014 | 0 | 0 | 9/5/2013 | 0 | 0 | 9/5/2012 | 0.24 | 0 | 9/5/2011 | 0.07 | 0 |
| 9/6/2020 | 0 | 0 | 9/6/2019 | 0 | 0 | 9/6/2018 | 0 | 0 | 9/6/2017 | 0.53 | 0 | 9/6/2016 | 0 | 0 | 9/6/2015 | 0 | 0 | 9/6/2014 | 0 | 0 | 9/6/2013 | 0 | 0 | 9/6/2012 | 0.01 | 0 | 9/6/2011 | 1.85 | 0.282933 |
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| 9/8/2020 | 0 | 0 | 9/8/2019 | 0 | 0 | 9/8/2018 | 1.11 | 0.042487 | 9/8/2017 | 0 | 0 | 9/8/2016 | 0 | 0 | 9/8/2015 | 0 | 0 | 9/8/2014 | 0 | 0 | 9/8/2013 | 0.01 | 0 | 9/8/2012 | 0 | 0 | 9/8/2011 | 0.84 | 0.00522 |
| 9/9/2020 | 0 | 0 | 9/9/2019 | 0 | 0 | 9/9/2018 | 1.11 | 0.042487 | 9/9/2017 | 0 | 0 | 9/9/2016 | 0 | 0 | 9/9/2015 | 0 | 0 | 9/9/2014 | 0 | 0 | 9/9/2013 | 0 | 0 | 9/9/2012 | 0.52 | 0 | 9/9/2011 | 0.22 | 0 |
| 9/10/2020 | 0.19 | 0 | 9/10/2019 | 0 | 0 | 9/10/2018 | 1.24 | 0.071503 | 9/10/2017 | 0 | 0 | 9/10/2016 | 0.01 | 0 | 9/10/2015 | 0.2 | 0 | 9/10/2014 | 0 | 0 | 9/10/2013 | 0 | 0 | 9/10/2012 | 0 | 0 | 9/10/2011 | 0.01 | 0 |
| 9/11/2020 | 0.49 | 0 | 9/11/2019 | 0 | 0 | 9/11/2018 | 0.14 | 0 | 9/11/2017 | 0 | 0 | 9/11/2016 | 0 | 0 | 9/11/2015 | 1.16 | 0.052864 | 9/11/2014 | 0 | 0 | 9/11/2013 | 0 | 0 | 9/11/2012 | 0 | 0 | 9/11/2011 | 0 | 0 |
| 9/12/2020 | 0.01 | 0 | 9/12/2019 | 0.15 | 0 | 9/12/2018 | 0.03 | 0 | 9/12/2017 | 0 | 0 | 9/12/2016 | 0 | 0 | 9/12/2015 | 0 | 0 | 9/12/2014 | 0 | 0 | 9/12/2013 | 0 | 0 | 9/12/2012 | 0 | 0 | 9/12/2011 | 0.17 | 0 |
| 9/13/2020 | 0 | 0 | 9/13/2019 | 0.17 | 0 | 9/13/2018 | 0.18 | 0 | 9/13/2017 | 0 | 0 | 9/13/2016 | 0 | 0 | 9/13/2015 | 0.49 | 0 | 9/13/2014 | 0 | 0 | 9/13/2013 | 0.43 | 0 | 9/13/2012 | 0 | 0 | 9/13/2011 | 0 | 0 |
| 9/14/2020 | 0 | 0 | 9/14/2019 | 0 | 0 | 9/14/2018 | 0.01 | 0 | 9/14/2017 | 0.13 | 0 | 9/14/2016 | 0 | 0 | 9/14/2015 | 0 | 0 | 9/14/2014 | 0.28 | 0 | 9/14/2013 | 0 | 0 | 9/14/2012 | 0 | 0 | 9/14/2011 | 0 | 0 |
| 9/15/2020 | 0 | 0 | 9/15/2019 | 0.05 | 0 | 9/15/2018 | 0 | 0 | 9/15/2017 | 0.01 | 0 | 9/15/2016 | 0 | 0 | 9/15/2015 | 0 | 0 | 9/15/2014 | 0 | 0 | 9/15/2013 | 0 | 0 | 9/15/2012 | 0 | 0 | 9/15/2011 | 0 | 0 |
| 9/16/2020 | 0 | 0 | 9/16/2019 | 0 | 0 | 9/16/2018 | 0 | 0 | 9/16/2017 | 0 | 0 | 9/16/2016 | 0 | 0 | 9/16/2015 | 0 | 0 | 9/16/2014 | 0.1 | 0 | 9/16/2013 | 0 | 0 | 9/16/2012 | 0 | 0 | 9/16/2011 | 0.13 | 0 |
| 9/17/2020 | 0 | 0 | 9/17/2019 | 0 | 0 | 9/17/2018 | 0 | 0 | 9/17/2017 | 0.01 | 0 | 9/17/2016 | 0 | 0 | 9/17/2015 | 0 | 0 | 9/17/2014 | 0 | 0 | 9/17/2013 | 0.08 | 0 | 9/17/2012 | 0 | 0 | 9/17/2011 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/18/2020 | 0 | 0 | 9/18/2019 | 0 | 0 | 9/18/2018 | 1.02 | 0.026417 | 9/18/2017 | 0 | 0 | 9/18/2016 | 0 | 0 | 9/18/2015 | 0 | 0 | 9/18/2014 | 0 | 0 | 9/18/2013 | 0 | 0 | 9/18/2012 | 0.57 | 0 | 9/18/2011 | 0.02 | 0 |
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| 9/22/2020 | 0 | 0 | 9/22/2019 | 0 | 0 | 9/22/2018 | 0.02 | 0 | 9/22/2017 | 0 | 0 | 9/22/2016 | 0 | 0 | 9/22/2015 | 0.01 | 0 | 9/22/2014 | 0.08 | 0 | 9/22/2013 | 1.34 | 0.09813 | 9/22/2012 | 0 | 0 | 9/22/2011 | 0.06 | 0 |
| 9/23/2020 | 0 | 0 | 9/23/2019 | 0 | 0 | 9/23/2018 | 0.02 | 0 | 9/23/2017 | 0 | 0 | 9/23/2016 | 0 | 0 | 9/23/2015 | 0 | 0 | 9/23/2014 | 0 | 0 | 9/23/2013 | 0 | 0 | 9/23/2012 | 0.19 | 0 | 9/23/2011 | 0.02 | 0 |
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| 9/30/2020 | 1.21 | 0.064227 | 9/30/2019 | 0 | 0 | 9/30/2018 | 0 | 0 | 9/30/2017 | 0 | 0 | 9/30/2016 | 2.43 | 0.570062 | 9/30/2015 | 1.61 | 0.186615 | 9/30/2014 | 0.03 | 0 | 9/30/2013 | 0 | 0 | 9/30/2012 | 0 | 0 | 9/30/2011 | 0.28 | 0 |
| 10/1/2020 | 0 | 0 | 10/1/2019 | 0 | 0 | 10/1/2018 | 0 | 0 | 10/1/2017 | 0 | 0 | 10/1/2016 | 0.13 | 0 | 10/1/2015 | 0.07 | 0 | 10/1/2014 | 0 | 0 | 10/1/2013 | 0 | 0 | 10/1/2012 | 0.01 | 0 | 10/1/2011 | 0.03 | 0 |
| 10/2/2020 | 0.16 | 0 | 10/2/2019 | 0 | 0 | 10/2/2018 | 0 | 0 | 10/2/2017 | 0 | 0 | 10/2/2016 | 0.07 | 0 | 10/2/2015 | 0.66 | 0 | 10/2/2014 | 0 | 0 | 10/2/2013 | 0 | 0 | 10/2/2012 | 0.01 | 0 | 10/2/2011 | 0.47 | 0 |
| 10/3/2020 | 0.01 | 0 | 10/3/2019 | 0.06 | 0 | 10/3/2018 | 0.27 | 0 | 10/3/2017 | 0 | 0 | 10/3/2016 | 0.02 | 0 | 10/3/2015 | 1.39 | 0.112755 | 10/3/2014 | 0 | 0 | 10/3/2013 | 0 | 0 | 10/3/2012 | 0.85 | 0.005988 | 10/3/2011 | 0.26 | 0 |
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| 10/6/2020 | 0.03 | 0 | 10/6/2019 | 0 | 0 | 10/6/2018 | 0.02 | 0 | 10/6/2017 | 0.01 | 0 | 10/6/2016 | 0 | 0 | 10/6/2015 | 0 | 0 | 10/6/2014 | 0 | 0 | 10/6/2013 | 0 | 0 | 10/6/2012 | 0 | 0 | 10/6/2011 | 0 | 0 |
| 10/7/2020 | 0 | 0 | 10/7/2019 | 0.09 | 0 | 10/7/2018 | 0 | 0 | 10/7/2017 | 0 | 0 | 10/7/2016 | 0 | 0 | 10/7/2015 | 0 | 0 | 10/7/2014 | 0.01 | 0 | 10/7/2013 | 0.01 | 0 | 10/7/2012 | 0.02 | 0 | 10/7/2011 | 0 | 0 |
| 10/8/2020 | 0 | 0 | 10/8/2019 | 0.38 | 0 | 10/8/2018 | 0 | 0 | 10/8/2017 | 0.06 | 0 | 10/8/2016 | 0 | 0 | 10/8/2015 | 0 | 0 | 10/8/2014 | 0.61 | 0 | 10/8/2013 | 0.58 | 0 | 10/8/2012 | 0.11 | 0 | 10/8/2011 | 0 | 0 |
| 10/9/2020 | 0 | 0 | 10/9/2019 | 0.08 | 0 | 10/9/2018 | 0.02 | 0 | 10/9/2017 | 0.16 | 0 | 10/9/2016 | 0.08 | 0 | 10/9/2015 | 0 | 0 | 10/9/2014 | 0 | 0 | 10/9/2013 | 0 | 0 | 10/9/2012 | 0.04 | 0 | 10/9/2011 | 0 | 0 |
| 10/10/2020 | 0 | 0 | 10/10/2019 | 0.08 | 0 | 10/10/201 | 0.01 | 0 | 10/10/2017 | 0.83 | 0.004504 | 10/10/201 | 0.06 | 0 | 10/10/201 | 0.51 | 0 | 10/10/201 | 0 | 0 | 10/10/201 | 0.19 | 0 | 10/10/201 | 0.05 | 0 | 10/10/2011 | 0 | 0 |
| 10/11/2020 | 0 | 0 | 10/11/2019 | 0 | 0 | 10/11/201 | 0.01 | 0 | 10/11/2017 | 0 | 0 | 10/11/201 | 0 | 0 | 10/11/201 | 0.04 | 0 | 10/11/201 | 0.35 | 0 | 10/11/201 | 2.86 | 0.821624 | 10/11/201 | 0 | 0 | 10/11/2011 | 0 | 0 |
| 10/12/2020 | 0.91 | 0.011636 | 10/12/2019 | 0 | 0 | 10/12/201 | 0.71 | 1.82E-05 | 10/12/2017 | 0.4 | 0 | 10/12/201 | 0 | 0 | 10/12/201 | 0 | 0 | 10/12/201 | 0.14 | 0 | 10/12/201 | 0.69 | 0 | 10/12/201 | 0 | 0 | 10/12/2011 | 0.09 | 0 |
| 10/13/2020 | 0.19 | 0 | 10/13/2019 | 0 | 0 | 10/13/201 | 0.07 | 0 | 10/13/2017 | 0.02 | 0 | 10/13/201 | 0 | 0 | 10/13/201 | 0 | 0 | 10/13/201 | 0.01 | 0 | 10/13/201 | 0.01 | 0 | 10/13/201 | 0 | 0 | 10/13/2011 | 0.31 | 0 |
| 10/14/2020 | 0.01 | 0 | 10/14/2019 | 0 | 0 | 10/14/201 | 0.05 | 0 | 10/14/2017 | 0.07 | 0 | 10/14/201 | 0.01 | 0 | 10/14/201 | 0 | 0 | 10/14/201 | 0.06 | 0 | 10/14/201 | 0 | 0 | 10/14/201 | 0 | 0 | 10/14/2011 | 0.16 | 0 |
| 10/15/2020 | 0 | 0 | 10/15/2019 | 0 | 0 | 10/15/201 | 0.06 | 0 | 10/15/2017 | 0.02 | 0 | 10/15/201 | 0 | 0 | 10/15/201 | 0 | 0 | 10/15/201 | 0 | 0 | 10/15/201 | 0 | 0 | 10/15/201 | 0 | 0 | 10/15/2011 | 0.4 | 0 |
| 10/16/2020 | 0 | 0 | 10/16/2019 | 0 | 0 | 10/16/201 | 0.17 | 0 | 10/16/2017 | 0.08 | 0 | 10/16/201 | 0 | 0 | 10/16/201 | 0 | 0 | 10/16/201 | 1.2 | 0.061877 | 10/16/201 | 0 | 0 | 10/16/201 | 0.76 | 0.000943 | 10/16/2011 | 0.08 | 0 |
| 10/17/2020 | 0.27 | 0 | 10/17/2019 | 1.6 | 0.182941 | 10/17/201 | 0 | 0 | 10/17/2017 | 0 | 0 | 10/17/201 | 0 | 0 | 10/17/201 | 0 | 0 | 10/17/201 | 0 | 0 | 10/17/201 | 0 | 0 | 10/17/201 | 0 | 0 | 10/17/2011 | 0 | 0 |
| 10/18/2020 | 0 | 0 | 10/18/2019 | 0 | 0 | 10/18/201 | 0 | 0 | 10/18/2017 | 0 | 0 | 10/18/201 | 0 | 0 | 10/18/201 | 0 | 0 | 10/18/201 | 0 | 0 | 10/18/201 | 0.08 | 0 | 10/18/201 | 0 | 0 | 10/18/2011 | 0 | 0 |
| 10/19/2020 | 0 | 0 | 10/19/2019 | 0 | 0 | 10/19/201 | 0.01 | 0 | 10/19/2017 | 0 | 0 | 10/19/201 | 0 | 0 | 10/19/201 | 0.01 | 0 | 10/19/201 | 0 | 0 | 10/19/201 | 0 | 0 | 10/19/201 | 0.65 | 0 | 10/19/2011 | 0.23 | 0 |
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| 10/21/2020 | 0.01 | 0 | 10/21/2019 | 0.58 | 0 | 10/21/201 | 0.05 | 0 | 10/21/2017 | 0 | 0 | 10/21/201 | 0 | 0 | 10/21/201 | 0 | 0 | 10/21/201 | 0.02 | 0 | 10/21/201 | 0 | 0 | 10/21/201 | 0 | 0 | 10/21/2011 | 0 | 0 |
| 10/22/2020 | 0.02 | 0 | 10/22/2019 | 0.02 | 0 | 10/22/201 | 0 | 0 | 10/22/2017 | 0 | 0 | 10/22/201 | 0.13 | 0 | 10/22/201 | 0 | 0 | 10/22/201 | 0.31 | 0 | 10/22/201 | 0 | 0 | 10/22/201 | 0 | 0 | 10/22/2011 | 0 | 0 |
| 10/23/2020 | 0.01 | 0 | 10/23/2019 | 0.65 | 0 | 10/23/201 | 0 | 0 | 10/23/2017 | 0 | 0 | 10/23/201 | 0.02 | 0 | 10/23/201 | 0 | 0 | 10/23/201 | 0.33 | 0 | 10/23/201 | 0.01 | 0 | 10/23/201 | 0 | 0 | 10/23/2011 | 0 | 0 |
| 10/24/2020 | 0 | 0 | 10/24/2019 | 0 | 0 | 10/24/201 | 0 | 0 | 10/24/2017 | 0.11 | 0 | 10/24/201 | 0.01 | 0 | 10/24/201 | 0 | 0 | 10/24/201 | 0.03 | 0 | 10/24/201 | 0 | 0 | 10/24/201 | 0.01 | 0 | 10/24/2011 | 0 | 0 |
| 10/25/2020 | 0 | 0 | 10/25/2019 | 0 | 0 | 10/25/201 | 0 | 0 | 10/25/2017 | 0.4 | 0 | 10/25/201 | 0 | 0 | 10/25/201 | 0.01 | 0 | 10/25/201 | 0 | 0 | 10/25/201 | 0 | 0 | 10/25/201 | 0 | 0 | 10/25/2011 | 0.03 | 0 |
| 10/26/2020 | 0.11 | 0 | 10/26/2019 | 0 | 0 | 10/26/201 | 0 | 0 | 10/26/2017 | 0 | 0 | 10/26/201 | 0 | 0 | 10/26/201 | 0 | 0 | 10/26/201 | 0 | 0 | 10/26/201 | 0 | 0 | 10/26/201 | 0 | 0 | 10/26/2011 | 0 | 0 |
| 10/27/2020 | 0.08 | 0 | 10/27/2019 | 0.37 | 0 | 10/27/201 | 0.9 | 0.010573 | 10/27/2017 | 0 | 0 | 10/27/201 | 0 | 0 | 10/27/201 | 0 | 0 | 10/27/201 | 0 | 0 | 10/27/201 | 0 | 0 | 10/27/201 | 0 | 0 | 10/27/2011 | 0.06 | 0 |
| 10/28/2020 | 0.01 | 0 | 10/28/2019 | 1.35 | 0.100987 | 10/28/201 | 0.16 | 0 | 10/28/2017 | 0 | 0 | 10/28/201 | 0.43 | 0 | 10/28/201 | 0.04 | 0 | 10/28/201 | 0 | 0 | 10/28/201 | 0 | 0 | 10/28/201 | 0.05 | 0 | 10/28/2011 | 0.15 | 0 |
| 10/29/2020 | 0.38 | 0 | 10/29/2019 | 0.01 | 0 | 10/29/201 | 0.06 | 0 | 10/29/2017 | 0.12 | 0 | 10/29/201 | 0 | 0 | 10/29/201 | 2.08 | 0.388479 | 10/29/201 | 0 | 0 | 10/29/201 | 0 | 0 | 10/29/201 | 1 | 0.02332 | 10/29/2011 | 0.18 | 0 |
| 10/30/2020 | 1.71 | 0.224892 | 10/30/2019 | 0.01 | 0 | 10/30/201 | 0.01 | 0 | 10/30/2017 | 2.33 | 0.51584 | 10/30/201 | 0 | 0 | 10/30/201 | 0 | 0 | 10/30/201 | 0.06 | 0 | 10/30/201 | 0 | 0 | 10/30/201 | 4.35 | 1.859165 | 10/30/2011 | 0.84 | 0.00522 |
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| 11/1/2020 | 0.01 | 0 | 11/1/2019 | 1.03 | 0.028031 | 11/1/2018 | 0 | 0 | 11/1/2017 | 0 | 0 | 11/1/2016 | 0 | 0 | 11/1/2015 | 0 | 0 | 11/1/2014 | 0.18 | 0 | 11/1/2013 | 0.06 | 0 | 11/1/2012 | 0.01 | 0 | 11/1/2011 | 0 | 0 |
| 11/2/2020 | 0.43 | 0 | 11/2/2019 | 0 | 0 | 11/2/2018 | 0.01 | 0 | 11/2/2017 | 0 | 0 | 11/2/2016 | 0 | 0 | 11/2/2015 | 0 | 0 | 11/2/2014 | 0.35 | 0 | 11/2/2013 | 0.22 | 0 | 11/2/2012 | 0 | 0 | 11/2/2011 | 0 | 0 |
| 11/3/2020 | 0 | 0 | 11/3/2019 | 0 | 0 | 11/3/2018 | 1.32 | 0.09252 | 11/3/2017 | 0 | 0 | 11/3/2016 | 0 | 0 | 11/3/2015 | 0 | 0 | 11/3/2014 | 0 | 0 | 11/3/2013 | 0 | 0 | 11/3/2012 | 0 | 0 | 11/3/2011 | 0 | 0 |
| 11/4/2020 | 0 | 0 | 11/4/2019 | 0 | 0 | 11/4/2018 | 0.01 | 0 | 11/4/2017 | 0 | 0 | 11/4/2016 | 0.03 | 0 | 11/4/2015 | 0 | 0 | 11/4/2014 | 0 | 0 | 11/4/2013 | 0 | 0 | 11/4/2012 | 0 | 0 | 11/4/2011 | 0 | 0 |
| 11/5/2020 | 0 | 0 | 11/5/2019 | 0 | 0 | 11/5/2018 | 0.06 | 0 | 11/5/2017 | 0.3 | 0 | 11/5/2016 | 0 | 0 | 11/5/2015 | 0.03 | 0 | 11/5/2014 | 0 | 0 | 11/5/2013 | 0 | 0 | 11/5/2012 | 0 | 0 | 11/5/2011 | 0 | 0 |
| 11/6/2020 | 0 | 0 | 11/6/2019 | 0 | 0 | 11/6/2018 | 0.46 | 0 | 11/6/2017 | 0 | 0 | 11/6/2016 | 0 | 0 | 11/6/2015 | 0.01 | 0 | 11/6/2014 | 0.49 | 0 | 11/6/2013 | 0 | 0 | 11/6/2012 | 0 | 0 | 11/6/2011 | 0 | 0 |
| 11/7/2020 | 0 | 0 | 11/7/2019 | 0 | 0 | 11/7/2018 | 0.65 | 0 | 11/7/2017 | 0.01 | 0 | 11/7/2016 | 0 | 0 | 11/7/2015 | 0 | 0 | 11/7/2014 | 0.22 | 0 | 11/7/2013 | 0 | 0 | 11/7/2012 | 0 | 0 | 11/7/2011 | 0 | 0 |
| 11/8/2020 | 0 | 0 | 11/8/2019 | 0.14 | 0 | 11/8/2018 | 0 | 0 | 11/8/2017 | 0.41 | 0 | 11/8/2016 | 0 | 0 | 11/8/2015 | 0 | 0 | 11/8/2014 | 0.01 | 0 | 11/8/2013 | 0.1 | 0 | 11/8/2012 | 0.15 | 0 | 11/8/2011 | 0 | 0 |
| 11/9/2020 | 0 | 0 | 11/9/2019 | 0 | 0 | 11/9/2018 | 0 | 0 | 11/9/2017 | 0 | 0 | 11/9/2016 | 0.03 | 0 | 11/9/2015 | 0 | 0 | 11/9/2014 | 0 | 0 | 11/9/2013 | 0 | 0 | 11/9/2012 | 0 | 0 | 11/9/2011 | 0 | 0 |
| 11/10/2020 | 0 | 0 | 11/10/2019 | 0 | 0 | 11/10/201 | 0.82 | 0.003838 | 11/10/2017 | 0.02 | 0 | 11/10/201 | 0.37 | 0 | 11/10/201 | 0.3 | 0 | 11/10/201 | 0 | 0 | 11/10/201 | 0 | 0 | 11/10/201 | 0 | 0 | 11/10/2011 | 0 | 0 |
| 11/11/2020 | 0 | 0 | 11/11/2019 | 0 | 0 | 11/11/201 | 0 | 0 | 11/11/2017 | 0 | 0 | 11/11/201 | 0 | 0 | 11/11/201 | 0.33 | 0 | 11/11/201 | 0 | 0 | 11/11/201 | 0 | 0 | 11/11/201 | 0 | 0 | 11/11/2011 | 0.1 | 0 |
| 11/12/2020 | 1.51 | 0.151196 | 11/12/2019 | 0.14 | 0 | 11/12/201 | 0 | 0 | 11/12/2017 | 0 | 0 | 11/12/201 | 0 | 0 | 11/12/201 | 0 | 0 | 11/12/201 | 0 | 0 | 11/12/201 | 0 | 0 | 11/12/201 | 0 | 0 | 11/12/2011 | 0 | 0 |
| 11/13/2020 | 0.19 | 0 | 11/13/2019 | 0.03 | 0 | 11/13/201 | 0.87 | 0.007674 | 11/13/2017 | 0.16 | 0 | 11/13/201 | 0 | 0 | 11/13/201 | 0.15 | 0 | 11/13/201 | 0 | 0 | 11/13/201 | 0 | 0 | 11/13/201 | 0.38 | 0 | 11/13/2011 | 0 | 0 |
| 11/14/2020 | 0.04 | 0 | 11/14/2019 | 0 | 0 | 11/14/201 | 0.05 | 0 | 11/14/2017 | 0.02 | 0 | 11/14/201 | 0 | 0 | 11/14/201 | 0 | 0 | 11/14/201 | 0.18 | 0 | 11/14/201 | 0 | 0 | 11/14/201 | 0.08 | 0 | 11/14/2011 | 0 | 0 |
| 11/15/2020 | 0 | 0 | 11/15/2019 | 0 | 0 | 11/15/201 | 0.07 | 0 | 11/15/2017 | 0 | 0 | 11/15/201 | 0 | 0 | 11/15/201 | 0 | 0 | 11/15/201 | 0 | 0 | 11/15/201 | 0 | 0 | 11/15/201 | 0 | 0 | 11/15/2011 | 0 | 0 |
| 11/16/2020 | 0.28 | 0 | 11/16/2019 | 0 | 0 | 11/16/201 | 1.3 | 0.087051 | 11/16/2017 | 0.01 | 0 | 11/16/201 | 0 | 0 | 11/16/201 | 0 | 0 | 11/16/201 | 0 | 0 | 11/16/201 | 0.05 | 0 | 11/16/201 | 0 | 0 | 11/16/2011 | 0.27 | 0 |
| 11/17/2020 | 0 | 0 | 11/17/2019 | 0 | 0 | 11/17/201 | 0.02 | 0 | 11/17/2017 | 0 | 0 | 11/17/201 | 0 | 0 | 11/17/201 | 0 | 0 | 11/17/201 | 0.37 | 0 | 11/17/201 | 0.01 | 0 | 11/17/201 | 0 | 0 | 11/17/2011 | 0.36 | 0 |
| 11/18/2020 | 0.01 | 0 | 11/18/2019 | 0 | 0 | 11/18/201 | 0 | 0 | 11/18/2017 | 0 | 0 | 11/18/201 | 0 | 0 | 11/18/201 | 0 | 0 | 11/18/201 | 0.75 | 0.000648 | 11/18/201 | 0.09 | 0 | 11/18/201 | 0 | 0 | 11/18/2011 | 0 | 0 |
| 11/19/2020 | 0 | 0 | 11/19/2019 | 0 | 0 | 11/19/201 | 0 | 0 | 11/19/2017 | 0.43 | 0 | 11/19/201 | 0 | 0 | 11/19/201 | 0 | 0 | 11/19/201 | 0 | 0 | 11/19/201 | 0 | 0 | 11/19/201 | 0 | 0 | 11/19/2011 | 0 | 0 |
| 11/20/2020 | 0 | 0 | 11/20/2019 | 0 | 0 | 11/20/201 | 0 | 0 | 11/20/2017 | 0 | 0 | 11/20/201 | 0.1 | 0 | 11/20/201 | 1 | 0.02332 | 11/20/201 | 0 | 0 | 11/20/201 | 0 | 0 | 11/20/201 | 0 | 0 | 11/20/2011 | 0 | 0 |
| 11/21/2020 | 0 | 0 | 11/21/2019 | 0 | 0 | 11/21/201 | 0 | 0 | 11/21/2017 | 0 | 0 | 11/21/201 | 0 | 0 | 11/21/201 | 0 | 0 | 11/21/201 | 0 | 0 | 11/21/201 | 0 | 0 | 11/21/201 | 0 | 0 | 11/21/2011 | 0.31 | 0 |
| 11/22/2020 | 0 | 0 | 11/22/2019 | 0 | 0 | 11/22/201 | 0 | 0 | 11/22/2017 | 0.03 | 0 | 11/22/201 | 0 | 0 | 11/22/201 | 0 | 0 | 11/22/201 | 0 | 0 | 11/22/201 | 0 | 0 | 11/22/201 | 0 | 0 | 11/22/2011 | 0.2 | 0 |
| 11/23/2020 | 0.41 | 0 | 11/23/2019 | 0.08 | 0 | 11/23/201 | 0 | 0 | 11/23/2017 | 0 | 0 | 11/23/201 | 0 | 0 | 11/23/201 | 0 | 0 | 11/23/201 | 0 | 0 | 11/23/201 | 0.04 | 0 | 11/23/201 | 0 | 0 | 11/23/2011 | 1.69 | 0.217017 |
| 11/24/2020 | 0 | 0 | 11/24/2019 | 1.07 | 0.034921 | 11/24/201 | 0 | 0 | 11/24/2017 | 0 | 0 | 11/24/201 | 0 | 0 | 11/24/201 | 0 | 0 | 11/24/201 | 0.74 | 0.000407 | 11/24/201 | 0 | 0 | 11/24/201 | 0 | 0 | 11/24/2011 | 0.05 | 0 |
| 11/25/2020 | 0 | 0 | 11/25/2019 | 0.08 | 0 | 11/25/201 | 2.02 | 0.359802 | 11/25/2017 | 0 | 0 | 11/25/201 | 0 | 0 | 11/25/201 | 0 | 0 | 11/25/201 | 0 | 0 | 11/25/201 | 0 | 0 | 11/25/201 | 0 | 0 | 11/25/2011 | 0 | 0 |
| 11/26/2020 | 0.33 | 0 | 11/26/2019 | 0 | 0 | 11/26/201 | 0 | 0 | 11/26/2017 | 0 | 0 | 11/26/201 | 0 | 0 | 11/26/201 | 0 | 0 | 11/26/201 | 0.24 | 0 | 11/26/201 | 0 | 0 | 11/26/201 | 0 | 0 | 11/26/2011 | 0 | 0 |
| 11/27/2020 | 0 | 0 | 11/27/2019 | 0 | 0 | 11/27/201 | 0.58 | 0 | 11/27/2017 | 0 | 0 | 11/27/201 | 0 | 0 | 11/27/201 | 0 | 0 | 11/27/201 | 1.07 | 0.034921 | 11/27/201 | 2.48 | 0.597822 | 11/27/201 | 0.3 | 0 | 11/27/2011 | 0 | 0 |
| 11/28/2020 | 0 | 0 | 11/28/2019 | 0 | 0 | 11/28/201 | 0 | 0 | 11/28/2017 | 0 | 0 | 11/28/201 | 0 | 0 | 11/28/201 | 0 | 0 | 11/28/201 | 0 | 0 | 11/28/201 | 0.16 | 0 | 11/28/201 | 0.39 | 0 | 11/28/2011 | 0 | 0 |
| 11/29/2020 | 0 | 0 | 11/29/2019 | 0 | 0 | 11/29/201 | 0 | 0 | 11/29/2017 | 0 | 0 | 11/29/201 | 0.08 | 0 | 11/29/201 | 0.11 | 0 | 11/29/201 | 0 | 0 | 11/29/201 | 0 | 0 | 11/29/201 | 0 | 0 | 11/29/2011 | 0.04 | 0 |
| 11/30/2020 | 0.28 | 0 | 11/30/2019 | 0 | 0 | 11/30/201 | 0 | 0 | 11/30/2017 | 0 | 0 | 11/30/201 | 1.07 | 0.034921 | 11/30/201 | 0.02 | 0 | 11/30/201 | 0 | 0 | 11/30/201 | 0 | 0 | 11/30/201 | 0 | 0 | 11/30/2011 | 0.89 | 0.009558 |
| 12/1/2020 | 2.1 | 0.398208 | 12/1/2019 | 0 | 0 | 12/1/2018 | 0.01 | 0 | 12/1/2017 | 0.03 | 0 | 12/1/2016 | 1.36 | 0.103878 | 12/1/2015 | 0.25 | 0 | 12/1/2014 | 0 | 0 | 12/1/2013 | 0 | 0 | 12/1/2012 | 0 | 0 | 12/1/2011 | 0 | 0 |
| 12/2/2020 | 0 | 0 | 12/2/2019 | 0.72 | 9.18E-05 | 12/2/2018 | 0.53 | 0 | 12/2/2017 | 0 | 0 | 12/2/2016 | 0 | 0 | 12/2/2015 | 0.73 | 0.000222 | 12/2/2014 | 0.08 | 0 | 12/2/2013 | 0 | 0 | 12/2/2012 | 0 | 0 | 12/2/2011 | 0 | 0 |
| 12/3/2020 | 0 | 0 | 12/3/2019 | 0.02 | 0 | 12/3/2018 | 0.07 | 0 | 12/3/2017 | 0 | 0 | 12/3/2016 | 0 | 0 | 12/3/2015 | 0.2 | 0 | 12/3/2014 | 0.25 | 0 | 12/3/2013 | 0 | 0 | 12/3/2012 | 0.02 | 0 | 12/3/2011 | 0 | 0 |
| 12/4/2020 | 0 | 0 | 12/4/2019 | 0 | 0 | 12/4/2018 | 0 | 0 | 12/4/2017 | 0 | 0 | 12/4/2016 | 0 | 0 | 12/4/2015 | 0 | 0 | 12/4/2014 | 0.14 | 0 | 12/4/2013 | 0 | 0 | 12/4/2012 | 0 | 0 | 12/4/2011 | 0 | 0 |
| 12/5/2020 | 1.09 | 0.038621 | 12/5/2019 | 0.12 | 0 | 12/5/2018 | 0 | 0 | 12/5/2017 | 0 | 0 | 12/5/2016 | 0.15 | 0 | 12/5/2015 | 0 | 0 | 12/5/2014 | 0 | 0 | 12/5/2013 | 0 | 0 | 12/5/2012 | 0 | 0 | 12/5/2011 | 0 | 0 |
| 12/6/2020 | 0.03 | 0 | 12/6/2019 | 0 | 0 | 12/6/2018 | 0 | 0 | 12/6/2017 | 0.24 | 0 | 12/6/2016 | 0.01 | 0 | 12/6/2015 | 0 | 0 | 12/6/2014 | 0.22 | 0 | 12/6/2013 | 0.2 | 0 | 12/6/2012 | 0 | 0 | 12/6/2011 | 0.04 | 0 |
| 12/7/2020 | 0 | 0 | 12/7/2019 | 0.03 | 0 | 12/7/2018 | 0 | 0 | 12/7/2017 | 0 | 0 | 12/7/2016 | 0.77 | 0.001292 | 12/7/2015 | 0 | 0 | 12/7/2014 | 0.6 | 0 | 12/7/2013 | 0.84 | 0.00522 | 12/7/2012 | 0 | 0 | 12/7/2011 | 0.22 | 0 |
| 12/8/2020 | 0 | 0 | 12/8/2019 | 0 | 0 | 12/8/2018 | 0 | 0 | 12/8/2017 | 0 | 0 | 12/8/2016 | 0.01 | 0 | 12/8/2015 | 0 | 0 | 12/8/2014 | 0 | 0 | 12/8/2013 | 0 | 0 | 12/8/2012 | 0.43 | 0 | 12/8/2011 | 2.16 | 0.427891 |
| 12/9/2020 | 0 | 0 | 12/9/2019 | 0.14 | 0 | 12/9/2018 | 0 | 0 | 12/9/2017 | 0.03 | 0 | 12/9/2016 | 0 | 0 | 12/9/2015 | 0 | 0 | 12/9/2014 | 0.2 | 0 | 12/9/2013 | 0.82 | 0.003838 | 12/9/2012 | 0.03 | 0 | 12/9/2011 | 0 | 0 |
| 12/10/2020 | 0 | 0 | 12/10/2019 | 0.87 | 0.007674 | 12/10/201 | 0 | 0 | 12/10/2017 | 0.31 | 0 | 12/10/201 | 0 | 0 | 12/10/201 | 0.03 | 0 | 12/10/201 | 0.08 | 0 | 12/10/201 | 0.09 | 0 | 12/10/201 | 0.35 | 0 | 12/10/2011 | 0 | 0 |
| 12/11/2020 | 0 | 0 | 12/11/2019 | 0.38 | 0 | 12/11/201 | 0 | 0 | 12/11/2017 | 0 | 0 | 12/11/201 | 0 | 0 | 12/11/201 | 0 | 0 | 12/11/201 | 0.05 | 0 | 12/11/201 | 0.2 | 0 | 12/11/201 | 0.2 | 0 | 12/11/2011 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/12/2020 | 0 | 0 | 12/12/2019 | 0.03 | 0 | 12/12/201 | 0 | 0 | 12/12/2017 | 0 | 0 | 12/12/201 | 0.45 | 0 | 12/12/201 | 0 | 0 | 12/12/201 | 0.02 | 0 | 12/12/201 | 0 | 0 | 12/12/201 | 0 | 0 | 12/12/2011 | 0 | 0 |
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| 12/16/2020 | 0 | 0 | 12/16/2019 | 0 | 0 | 12/16/201 | 1.04 | 0.029689 | 12/16/2017 | 0.16 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/2011 | 0.07 | 0 |
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| 12/18/2020 | 0 | 0 | 12/18/2019 | 0.15 | 0 | 12/18/201 | 0 | 0 | 12/18/2017 | 0 | 0 | 12/18/201 | 0.39 | 0 | 12/18/201 | 0.88 | 0.008591 | 12/18/201 | 0 | 0 | 12/18/201 | 0.03 | 0 | 12/18/201 | 0.17 | 0 | 12/18/2011 | 0 | 0 |
| 12/19/2020 | 0 | 0 | 12/19/2019 | 0 | 0 | 12/19/201 | 0 | 0 | 12/19/2017 | 0 | 0 | 12/19/201 | 0.05 | 0 | 12/19/201 | 0 | 0 | 12/19/201 | 0 | 0 | 12/19/201 | 0 | 0 | 12/19/201 | 0.03 | 0 | 12/19/2011 | 0 | 0 |
| 12/20/2020 | 0 | 0 | 12/20/2019 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/2017 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/2011 | 0 | 0 |
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| 12/24/2020 | 0 | 0 | 12/24/2019 | 0 | 0 | 12/24/201 | 0.07 | 0 | 12/24/2017 | 0.5 | 0 | 12/24/201 | 0.24 | 0 | 12/24/201 | 1.39 | 0.112755 | 12/24/201 | 0.42 | 0 | 12/24/201 | 0.44 | 0 | 12/24/201 | 0 | 0 | 12/24/2011 | 0 | 0 |
| 12/25/2020 | 2.08 | 0.388479 | 12/25/2019 | 0 | 0 | 12/25/201 | 0 | 0 | 12/25/2017 | 0.16 | 0 | 12/25/201 | 0.16 | 0 | 12/25/201 | 0.04 | 0 | 12/25/201 | 0.5 | 0 | 12/25/201 | 0 | 0 | 12/25/201 | 0.2 | 0 | 12/25/2011 | 0 | 0 |
| 12/26/2020 | 0.04 | 0 | 12/26/2019 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/2017 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/201 | 0.3 | 0 | 12/26/201 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/2011 | 0 | 0 |
| 12/27/2020 | 0 | 0 | 12/27/2019 | 0 | 0 | 12/27/201 | 0 | 0 | 12/27/2017 | 0 | 0 | 12/27/201 | 0.01 | 0 | 12/27/201 | 0.04 | 0 | 12/27/201 | 0 | 0 | 12/27/201 | 0 | 0 | 12/27/201 | 1.12 | 0.044482 | 12/27/2011 | 0 | 0 |
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| 12/29/2020 | 0 | 0 | 12/29/2019 | 0 | 0 | 12/29/201 | 0.66 | 0 | 12/29/2017 | 0 | 0 | 12/29/201 | 0.1 | 0 | 12/29/201 | 0.81 | 0.003224 | 12/29/201 | 0.01 | 0 | 12/29/201 | 0.02 | 0 | 12/29/201 | 0 | 0 | 12/29/2011 | 0 | 0 |
| 12/30/2020 | 0 | 0 | 12/30/2019 | 0.69 | 0 | 12/30/201 | 0 | 0 | 12/30/2017 | 0.04 | 0 | 12/30/201 | 0.15 | 0 | 12/30/201 | 0.07 | 0 | 12/30/201 | 0 | 0 | 12/30/201 | 1.15 | 0.050708 | 12/30/201 | 0.27 | 0 | 12/30/2011 | 0 | 0 |
| 12/31/2020 | 0.06 | 0 | 12/31/2019 | 0.23 | 0 | 12/31/201 | 0 | 0 | 12/31/2017 | 0.03 | 0 | 12/31/201 | 0 | 0 | 12/31/201 | 0.18 | 0 | 12/31/201 | 0 | 0 | 12/31/201 | 0 | 0 | 12/31/201 | 0 | 0 | 12/31/2011 | 0.01 | 0 |
| 1/1/2021 | 0.05 | 0 | 1/1/2020 | 0 | 0 | 1/1/2019 | 0.79 | 0.002152 | 1/1/2018 | 0 | 0 | 1/1/2017 | 0 | 0 | 1/1/2016 | 0 | 0 | 1/1/2015 | 0 | 0 | 1/1/2014 | 0 | 0 | 1/1/2013 | 0 | 0 | 1/1/2012 | 0 | 0 |
| 1/2/2021 | 0.98 | 0.020402 | 1/2/2020 | 0 | 0 | 1/2/2019 | 0 | 0 | 1/2/2018 | 0 | 0 | 1/2/2017 | 0.18 | 0 | 1/2/2016 | 0 | 0 | 1/2/2015 | 0 | 0 | 1/2/2014 | 0 | 0 | 1/2/2013 | 0 | 0 | 1/2/2012 | 0.05 | 0 |
| 1/3/2021 | 0.06 | 0 | 1/3/2020 | 0.11 | 0 | 1/3/2019 | 0 | 0 | 1/3/2018 | 0 | 0 | 1/3/2017 | 0.18 | 0 | 1/3/2016 | 0 | 0 | 1/3/2015 | 0 | 0 | 1/3/2014 | 0.51 | 0 | 1/3/2013 | 0 | 0 | 1/3/2012 | 0 | 0 |
| 1/4/2021 | 0.29 | 0 | 1/4/2020 | 0.2 | 0 | 1/4/2019 | 0 | 0 | 1/4/2018 | 0.09 | 0 | 1/4/2017 | 0.56 | 0 | 1/4/2016 | 0 | 0 | 1/4/2015 | 0.95 | 0.016366 | 1/4/2014 | 0 | 0 | 1/4/2013 | 0 | 0 | 1/4/2012 | 0 | 0 |
| 1/5/2021 | 0.01 | 0 | 1/5/2020 | 0.04 | 0 | 1/5/2019 | 0.27 | 0 | 1/5/2018 | 0.12 | 0 | 1/5/2017 | 0 | 0 | 1/5/2016 | 0 | 0 | 1/5/2015 | 0.06 | 0 | 1/5/2014 | 0 | 0 | 1/5/2013 | 0 | 0 | 1/5/2012 | 0 | 0 |
| 1/6/2021 | 0 | 0 | 1/6/2020 | 0 | 0 | 1/6/2019 | 0.12 | 0 | 1/6/2018 | 0 | 0 | 1/6/2017 | 0.14 | 0 | 1/6/2016 | 0 | 0 | 1/6/2015 | 0.05 | 0 | 1/6/2014 | 0.56 | 0 | 1/6/2013 | 0.02 | 0 | 1/6/2012 | 0 | 0 |
| 1/7/2021 | 0 | 0 | 1/7/2020 | 0.03 | 0 | 1/7/2019 | 0 | 0 | 1/7/2018 | 0 | 0 | 1/7/2017 | 0 | 0 | 1/7/2016 | 0 | 0 | 1/7/2015 | 0.11 | 0 | 1/7/2014 | 0.06 | 0 | 1/7/2013 | 0 | 0 | 1/7/2012 | 0 | 0 |
| 1/8/2021 | 0 | 0 | 1/8/2020 | 0.11 | 0 | 1/8/2019 | 0.14 | 0 | 1/8/2018 | 0 | 0 | 1/8/2017 | 0.04 | 0 | 1/8/2016 | 0 | 0 | 1/8/2015 | 0 | 0 | 1/8/2014 | 0 | 0 | 1/8/2013 | 0 | 0 | 1/8/2012 | 0 | 0 |
| 1/9/2021 | 0 | 0 | 1/9/2020 | 0.03 | 0 | 1/9/2019 | 0.2 | 0 | 1/9/2018 | 0.06 | 0 | 1/9/2017 | 0 | 0 | 1/9/2016 | 0.02 | 0 | 1/9/2015 | 0.03 | 0 | 1/9/2014 | 0 | 0 | 1/9/2013 | 0 | 0 | 1/9/2012 | 0 | 0 |
| 1/10/2021 | 0 | 0 | 1/10/2020 | 0 | 0 | 1/10/2019 | 0 | 0 | 1/10/2018 | 0 | 0 | 1/10/2017 | 0 | 0 | 1/10/2016 | 1.15 | 0.050708 | 1/10/2015 | 0 | 0 | 1/10/2014 | 0.01 | 0 | 1/10/2013 | 0 | 0 | 1/10/2012 | 0 | 0 |
| 1/11/2021 | 0 | 0 | 1/11/2020 | 0 | 0 | 1/11/2019 | 0 | 0 | 1/11/2018 | 0 | 0 | 1/11/2017 | 0.28 | 0 | 1/11/2016 | 0.1 | 0 | 1/11/2015 | 0 | 0 | 1/11/2014 | 0.67 | 0 | 1/11/2013 | 0 | 0 | 1/11/2012 | 0 | 0 |
| 1/12/2021 | 0 | 0 | 1/12/2020 | 0.2 | 0 | 1/12/2019 | 0 | 0 | 1/12/2018 | 0.12 | 0 | 1/12/2017 | 0.23 | 0 | 1/12/2016 | 0 | 0 | 1/12/2015 | 0.11 | 0 | 1/12/2014 | 0.68 | 0 | 1/12/2013 | 0.45 | 0 | 1/12/2012 | 1.33 | 0.095308 |
| 1/13/2021 | 0 | 0 | 1/13/2020 | 0 | 0 | 1/13/2019 | 0.15 | 0 | 1/13/2018 | 0.92 | 0.012748 | 1/13/2017 | 0 | 0 | 1/13/2016 | 0 | 0 | 1/13/2015 | 0.56 | 0 | 1/13/2014 | 0 | 0 | 1/13/2013 | 0.01 | 0 | 1/13/2012 | 0.11 | 0 |
| 1/14/2021 | 0.03 | 0 | 1/14/2020 | 0 | 0 | 1/14/2019 | 0 | 0 | 1/14/2018 | 0 | 0 | 1/14/2017 | 0 | 0 | 1/14/2016 | 0 | 0 | 1/14/2015 | 0 | 0 | 1/14/2014 | 0.03 | 0 | 1/14/2013 | 0.03 | 0 | 1/14/2012 | 0 | 0 |
| 1/15/2021 | 0 | 0 | 1/15/2020 | 0.04 | 0 | 1/15/2019 | 0 | 0 | 1/15/2018 | 0 | 0 | 1/15/2017 | 0.04 | 0 | 1/15/2016 | 0 | 0 | 1/15/2015 | 0 | 0 | 1/15/2014 | 0.29 | 0 | 1/15/2013 | 0.4 | 0 | 1/15/2012 | 0.01 | 0 |
| 1/16/2021 | 0.35 | 0 | 1/16/2020 | 0.03 | 0 | 1/16/2019 | 0 | 0 | 1/16/2018 | 0 | 0 | 1/16/2017 | 0 | 0 | 1/16/2016 | 0.25 | 0 | 1/16/2015 | 0 | 0 | 1/16/2014 | 0.04 | 0 | 1/16/2013 | 1.02 | 0.026417 | 1/16/2012 | 0 | 0 |
| 1/17/2021 | 0 | 0 | 1/17/2020 | 0 | 0 | 1/17/2019 | 0 | 0 | 1/17/2018 | 0.11 | 0 | 1/17/2017 | 0 | 0 | 1/17/2016 | 0 | 0 | 1/17/2015 | 0 | 0 | 1/17/2014 | 0 | 0 | 1/17/2013 | 0.08 | 0 | 1/17/2012 | 0.08 | 0 |
| 1/18/2021 | 0 | 0 | 1/18/2020 | 0 | 0 | 1/18/2019 | 0.07 | 0 | 1/18/2018 | 0.04 | 0 | 1/18/2017 | 0.45 | 0 | 1/18/2016 | 0.03 | 0 | 1/18/2015 | 0 | 0 | 1/18/2014 | 0.01 | 0 | 1/18/2013 | 0 | 0 | 1/18/2012 | 0.22 | 0 |
| 1/19/2021 | 0 | 0 | 1/19/2020 | 0.37 | 0 | 1/19/2019 | 0.01 | 0 | 1/19/2018 | 0 | 0 | 1/19/2017 | 0 | 0 | 1/19/2016 | 0 | 0 | 1/19/2015 | 0.99 | 0.021839 | 1/19/2014 | 0 | 0 | 1/19/2013 | 0 | 0 | 1/19/2012 | 0 | 0 |
| 1/20/2021 | 0 | 0 | 1/20/2020 | 0 | 0 | 1/20/2019 | 1.32 | 0.09252 | 1/20/2018 | 0 | 0 | 1/20/2017 | 0 | 0 | 1/20/2016 | 0 | 0 | 1/20/2015 | 0 | 0 | 1/20/2014 | 0 | 0 | 1/20/2013 | 0 | 0 | 1/20/2012 | 0 | 0 |
| 1/21/2021 | 0 | 0 | 1/21/2020 | 0 | 0 | 1/21/2019 | 0.07 | 0 | 1/21/2018 | 0 | 0 | 1/21/2017 | 0.19 | 0 | 1/21/2016 | 0 | 0 | 1/21/2015 | 0 | 0 | 1/21/2014 | 0 | 0 | 1/21/2013 | 0 | 0 | 1/21/2012 | 0.35 | 0 |
| 1/22/2021 | 0 | 0 | 1/22/2020 | 0 | 0 | 1/22/2019 | 0 | 0 | 1/22/2018 | 0 | 0 | 1/22/2017 | 0.01 | 0 | 1/22/2016 | 0 | 0 | 1/22/2015 | 0.05 | 0 | 1/22/2014 | 0.41 | 0 | 1/22/2013 | 0.02 | 0 | 1/22/2012 | 0.08 | 0 |
| 1/23/2021 | 0 | 0 | 1/23/2020 | 0 | 0 | 1/23/2019 | 0 | 0 | 1/23/2018 | 0.25 | 0 | 1/23/2017 | 0.11 | 0 | 1/23/2016 | 1.09 | 0.038621 | 1/23/2015 | 0 | 0 | 1/23/2014 | 0 | 0 | 1/23/2013 | 0 | 0 | 1/23/2012 | 0.01 | 0 |
| 1/24/2021 | 0 | 0 | 1/24/2020 | 0 | 0 | 1/24/2019 | 0.59 | 0 | 1/24/2018 | 0.16 | 0 | 1/24/2017 | 0.64 | 0 | 1/24/2016 | 1.41 | 0.118839 | 1/24/2015 | 0.72 | 9.18E-05 | 1/24/2014 | 0 | 0 | 1/24/2013 | 0 | 0 | 1/24/2012 | 0.22 | 0 |
| 1/25/2021 | 0 | 0 | 1/25/2020 | 0.99 | 0.021839 | 1/25/2019 | 0.9 | 0.010573 | 1/25/2018 | 0 | 0 | 1/25/2017 | 0 | 0 | 1/25/2016 | 0 | 0 | 1/25/2015 | 0 | 0 | 1/25/2014 | 0 | 0 | 1/25/2013 | 0 | 0 | 1/25/2012 | 0 | 0 |
| 1/26/2021 | 0 | 0 | 1/26/2020 | 1.11 | 0.042487 | 1/26/2019 | 0 | 0 | 1/26/2018 | 0 | 0 | 1/26/2017 | 0 | 0 | 1/26/2016 | 0 | 0 | 1/26/2015 | 0.08 | 0 | 1/26/2014 | 0.08 | 0 | 1/26/2013 | 0.04 | 0 | 1/26/2012 | 0 | 0 |
| 1/27/2021 | 0.15 | 0 | 1/27/2020 | 0 | 0 | 1/27/2019 | 0 | 0 | 1/27/2018 | 0 | 0 | 1/27/2017 | 0 | 0 | 1/27/2016 | 0 | 0 | 1/27/2015 | 0.1 | 0 | 1/27/2014 | 0 | 0 | 1/27/2013 | 0 | 0 | 1/27/2012 | 0.14 | 0 |
| 1/28/2021 | 0 | 0 | 1/28/2020 | 0 | 0 | 1/28/2019 | 0 | 0 | 1/28/2018 | 0.11 | 0 | 1/28/2017 | 0 | 0 | 1/28/2016 | 0 | 0 | 1/28/2015 | 0 | 0 | 1/28/2014 | 0 | 0 | 1/28/2013 | 0.01 | 0 | 1/28/2012 | 0.15 | 0 |
| 1/29/2021 | 0 | 0 | 1/29/2020 | 0 | 0 | 1/29/2019 | 0 | 0 | 1/29/2018 | 0.15 | 0 | 1/29/2017 | 0 | 0 | 1/29/2016 | 0 | 0 | 1/29/2015 | 0 | 0 | 1/29/2014 | 0.03 | 0 | 1/29/2013 | 0.12 | 0 | 1/29/2012 | 0 | 0 |
| 1/30/2021 | 0 | 0 | 1/30/2020 | 0 | 0 | 1/30/2019 | 0.29 | 0 | 1/30/2018 | 0.01 | 0 | 1/30/2017 | 0.01 | 0 | 1/30/2016 | 0 | 0 | 1/30/2015 | 0.01 | 0 | 1/30/2014 | 0 | 0 | 1/30/2013 | 0 | 0 | 1/30/2012 | 0 | 0 |
| 1/31/2021 | 0.02 | 0 | 1/31/2020 | 0 | 0 | 1/31/2019 | 0.01 | 0 | 1/31/2018 | 0.07 | 0 | 1/31/2017 | 0.01 | 0 | 1/31/2016 | 0 | 0 | 1/31/2015 | 0.01 | 0 | 1/31/2014 | 0 | 0 | 1/31/2013 | 1.59 | 0.179296 | 1/31/2012 | 0 | 0 |
| 2/1/2021 | 0.41 | 0 | 2/1/2020 | 0.07 | 0 | 2/1/2019 | 0 | 0 | 2/1/2018 | 0 | 0 | 2/1/2017 | 0 | 0 | 2/1/2016 | 0 | 0 | 2/1/2015 | 0 | 0 | 2/1/2014 | 0 | 0 | 2/1/2013 | 0 | 0 | 2/1/2012 | 0.02 | 0 |
| 2/2/2021 | 0.58 | 0 | 2/2/2020 | 0.07 | 0 | 2/2/2019 | 0.08 | 0 | 2/2/2018 | 0.17 | 0 | 2/2/2017 | 0 | 0 | 2/2/2016 | 0.11 | 0 | 2/2/2015 | 0.59 | 0 | 2/2/2014 | 0 | 0 | 2/2/2013 | 0 | 0 | 2/2/2012 | 0 | 0 |
| 2/3/2021 | 0.05 | 0 | 2/3/2020 | 0.01 | 0 | 2/3/2019 | 0 | 0 | 2/3/2018 | 0 | 0 | 2/3/2017 | 0 | 0 | 2/3/2016 | 0.04 | 0 | 2/3/2015 | 0.28 | 0 | 2/3/2014 | 0.7 | 0 | 2/3/2013 | 0.08 | 0 | 2/3/2012 | 0 | 0 |
| 2/4/2021 | 0 | 0 | 2/4/2020 | 0.02 | 0 | 2/4/2019 | 0 | 0 | 2/4/2018 | 0 | 0 | 2/4/2017 | 0 | 0 | 2/4/2016 | 0.77 | 0.001292 | 2/4/2015 | 0 | 0 | 2/4/2014 | 0.59 | 0 | 2/4/2013 | 0.01 | 0 | 2/4/2012 | 0 | 0 |
| 2/5/2021 | 0.05 | 0 | 2/5/2020 | 0.1 | 0 | 2/5/2019 | 0 | 0 | 2/5/2018 | 1.12 | 0.044482 | 2/5/2017 | 0 | 0 | 2/5/2016 | 0.16 | 0 | 2/5/2015 | 0 | 0 | 2/5/2014 | 1.4 | 0.11578 | 2/5/2013 | 0 | 0 | 2/5/2012 | 0.03 | 0 |
| 2/6/2021 | 0.01 | 0 | 2/6/2020 | 0.49 | 0 | 2/6/2019 | 0 | 0 | 2/6/2018 | 0 | 0 | 2/6/2017 | 0 | 0 | 2/6/2016 | 0.01 | 0 | 2/6/2015 | 0 | 0 | 2/6/2014 | 0.18 | 0 | 2/6/2013 | 0.02 | 0 | 2/6/2012 | 0 | 0 |
| 2/7/2021 | 0.16 | 0 | 2/7/2020 | 0.34 | 0 | 2/7/2019 | 0.31 | 0 | 2/7/2018 | 0.04 | 0 | 2/7/2017 | 0 | 0 | 2/7/2016 | 0 | 0 | 2/7/2015 | 0 | 0 | 2/7/2014 | 0 | 0 | 2/7/2013 | 0 | 0 | 2/7/2012 | 0 | 0 |
| 2/8/2021 | 0.37 | 0 | 2/8/2020 | 0.28 | 0 | 2/8/2019 | 0.04 | 0 | 2/8/2018 | 0.76 | 0.000943 | 2/8/2017 | 0.16 | 0 | 2/8/2016 | 0 | 0 | 2/8/2015 | 0 | 0 | 2/8/2014 | 0 | 0 | 2/8/2013 | 0.07 | 0 | 2/8/2012 | 0 | 0 |
| 2/9/2021 | 0 | 0 | 2/9/2020 | 0 | 0 | 2/9/2019 | 0.01 | 0 | 2/9/2018 | 0 | 0 | 2/9/2017 | 0.56 | 0 | 2/9/2016 | 0.16 | 0 | 2/9/2015 | 0 | 0 | 2/9/2014 | 0 | 0 | 2/9/2013 | 0.27 | 0 | 2/9/2012 | 0.15 | 0 |
| 2/10/2021 | 0 | 0 | 2/10/2020 | 0.08 | 0 | 2/10/2019 | 0 | 0 | 2/10/2018 | 0 | 0 | 2/10/2017 | 0.03 | 0 | 2/10/2016 | 0.32 | 0 | 2/10/2015 | 0.02 | 0 | 2/10/2014 | 0.13 | 0 | 2/10/2013 | 0 | 0 | 2/10/2012 | 0 | 0 |
| 2/11/2021 | 0.25 | 0 | 2/11/2020 | 0.61 | 0 | 2/11/2019 | 0.19 | 0 | 2/11/2018 | 1 | 0.02332 | 2/11/2017 | 0 | 0 | 2/11/2016 | 0 | 0 | 2/11/2015 | 0 | 0 | 2/11/2014 | 0 | 0 | 2/11/2013 | 0.34 | 0 | 2/11/2012 | 0.17 | 0 |
| 2/12/2021 | 0 | 0 | 2/12/2020 | 0.06 | 0 | 2/12/2019 | 0.2 | 0 | 2/12/2018 | 0.7 | 0 | 2/12/2017 | 0 | 0 | 2/12/2016 | 0 | 0 | 2/12/2015 | 0 | 0 | 2/12/2014 | 0 | 0 | 2/12/2013 | 0.08 | 0 | 2/12/2012 | 0.09 | 0 |
| 2/13/2021 | 0 | 0 | 2/13/2020 | 0.22 | 0 | 2/13/2019 | 0.84 | 0.00522 | 2/13/2018 | 0 | 0 | 2/13/2017 | 0.22 | 0 | 2/13/2016 | 0.01 | 0 | 2/13/2015 | 0 | 0 | 2/13/2014 | 0.91 | 0.011636 | 2/13/2013 | 0 | 0 | 2/13/2012 | 0 | 0 |
| 2/14/2021 | 0.03 | 0 | 2/14/2020 | 0.09 | 0 | 2/14/2019 | 0 | 0 | 2/14/2018 | 0 | 0 | 2/14/2017 | 0 | 0 | 2/14/2016 | 0 | 0 | 2/14/2015 | 0 | 0 | 2/14/2014 | 1.17 | 0.055059 | 2/14/2013 | 0.23 | 0 | 2/14/2012 | 0 | 0 |
| 2/15/2021 | 0 | 0 | 2/15/2020 | 0 | 0 | 2/15/2019 | 0 | 0 | 2/15/2018 | 0.17 | 0 | 2/15/2017 | 0 | 0 | 2/15/2016 | 0 | 0 | 2/15/2015 | 0.1 | 0 | 2/15/2014 | 0 | 0 | 2/15/2013 | 0 | 0 | 2/15/2012 | 0.01 | 0 |
| 2/16/2021 | 0.78 | 0.001696 | 2/16/2020 | 0 | 0 | 2/16/2019 | 0 | 0 | 2/16/2018 | 0.56 | 0 | 2/16/2017 | 0 | 0 | 2/16/2016 | 0.36 | 0 | 2/16/2015 | 0 | 0 | 2/16/2014 | 0.08 | 0 | 2/16/2013 | 0.15 | 0 | 2/16/2012 | 0 | 0 |
| 2/17/2021 | 0 | 0 | 2/17/2020 | 0 | 0 | 2/17/2019 | 0 | 0 | 2/17/2018 | 0.06 | 0 | 2/17/2017 | 0 | 0 | 2/17/2016 | 0.95 | 0.016366 | 2/17/2015 | 0.2 | 0 | 2/17/2014 | 0 | 0 | 2/17/2013 | 0 | 0 | 2/17/2012 | 0.09 | 0 |
| 2/18/2021 | 0.24 | 0 | 2/18/2020 | 0 | 0 | 2/18/2019 | 0.22 | 0 | 2/18/2018 | 0.38 | 0 | 2/18/2017 | 0 | 0 | 2/18/2016 | 0 | 0 | 2/18/2015 | 0 | 0 | 2/18/2014 | 0.14 | 0 | 2/18/2013 | 0 | 0 | 2/18/2012 | 0 | 0 |
| 2/19/2021 | 0.49 | 0 | 2/19/2020 | 0 | 0 | 2/19/2019 | 0 | 0 | 2/19/2018 | 0 | 0 | 2/19/2017 | 0 | 0 | 2/19/2016 | 0 | 0 | 2/19/2015 | 0 | 0 | 2/19/2014 | 0.03 | 0 | 2/19/2013 | 0 | 0 | 2/19/2012 | 0 | 0 |
| 2/20/2021 | 0.06 | 0 | 2/20/2020 | 0 | 0 | 2/20/2019 | 0 | 0 | 2/20/2018 | 0.03 | 0 | 2/20/2017 | 0 | 0 | 2/20/2016 | 0 | 0 | 2/20/2015 | 0 | 0 | 2/20/2014 | 0.17 | 0 | 2/20/2013 | 0.2 | 0 | 2/20/2012 | 0 | 0 |
| 2/21/2021 | 0 | 0 | 2/21/2020 | 0 | 0 | 2/21/2019 | 0.68 | 0 | 2/21/2018 | 0 | 0 | 2/21/2017 | 0 | 0 | 2/21/2016 | 0 | 0 | 2/21/2015 | 0 | 0 | 2/21/2014 | 0 | 0 | 2/21/2013 | 0 | 0 | 2/21/2012 | 0 | 0 |
| 2/22/2021 | 0.03 | 0 | 2/22/2020 | 0 | 0 | 2/22/2019 | 0 | 0 | 2/22/2018 | 0.03 | 0 | 2/22/2017 | 0 | 0 | 2/22/2016 | 0.06 | 0 | 2/22/2015 | 0.7 | 0 | 2/22/2014 | 0.21 | 0 | 2/22/2013 | 0 | 0 | 2/22/2012 | 0 | 0 |
| 2/23/2021 | 0.35 | 0 | 2/23/2020 | 0 | 0 | 2/23/2019 | 0 | 0 | 2/23/2018 | 0.27 | 0 | 2/23/2017 | 0 | 0 | 2/23/2016 | 0 | 0 | 2/23/2015 | 0 | 0 | 2/23/2014 | 0 | 0 | 2/23/2013 | 0.07 | 0 | 2/23/2012 | 0 | 0 |
| 2/24/2021 | 0 | 0 | 2/24/2020 | 0 | 0 | 2/24/2019 | 0.39 | 0 | 2/24/2018 | 0.15 | 0 | 2/24/2017 | 0 | 0 | 2/24/2016 | 0.53 | 0 | 2/24/2015 | 0 | 0 | 2/24/2014 | 0.01 | 0 | 2/24/2013 | 0.1 | 0 | 2/24/2012 | 0.26 | 0 |
| 2/25/2021 | 0 | 0 | 2/25/2020 | 0.02 | 0 | 2/25/2019 | 0.05 | 0 | 2/25/2018 | 0.54 | 0 | 2/25/2017 | 0 | 0 | 2/25/2016 | 1.6 | 0.182941 | 2/25/2015 | 0 | 0 | 2/25/2014 | 0 | 0 | 2/25/2013 | 0 | 0 | 2/25/2012 | 0.09 | 0 |
| 2/26/2021 | 0 | 0 | 2/26/2020 | 0.2 | 0 | 2/26/2019 | 0 | 0 | 2/26/2018 | 0.18 | 0 | 2/26/2017 | 0.62 | 0 | 2/26/2016 | 0.01 | 0 | 2/26/2015 | 0 | 0 | 2/26/2014 | 0.01 | 0 | 2/26/2013 | 0 | 0 | 2/26/2012 | 0 | 0 |
| 2/27/2021 | 0.35 | 0 | 2/27/2020 | 0.59 | 0 | 2/27/2019 | 0 | 0 | 2/27/2018 | 0 | 0 | 2/27/2017 | 0 | 0 | 2/27/2016 | 0 | 0 | 2/27/2015 | 0.01 | 0 | 2/27/2014 | 0.06 | 0 | 2/27/2013 | 0.58 | 0 | 2/27/2012 | 0 | 0 |
| 2/28/2021 | 0.07 | 0 | 2/28/2020 | 0 | 0 | 2/28/2019 | 0 | 0 | 2/28/2018 | 0 | 0 | 2/28/2017 | 0 | 0 | 2/28/2016 | 0 | 0 | 2/28/2015 | 0 | 0 | 2/28/2014 | 0 | 0 | 2/28/2013 | 0.04 | 0 | 2/28/2012 | 0 | 0 |
| 3/1/2021 | 1.17 | 0.055059 | 2/29/2020 | 0 | 0 | 3/1/2019 | 0.31 | 0 | 3/1/2018 | 0 | 0 | 3/1/2017 | 0.15 | 0 | 2/29/2016 | 0 | 0 | 3/1/2015 | 0 | 0 | 3/1/2014 | 0 | 0 | 3/1/2013 | 0.01 | 0 | 2/29/2012 | 0 | 0 |
| 3/2/2021 | 0.01 | 0 | 3/1/2020 | 0 | 0 | 3/2/2019 | 0.58 | 0 | 3/2/2018 | 1.08 | 0.03675 | 3/2/2017 | 0.01 | 0 | 3/1/2016 | 0 | 0 | 3/2/2015 | 0.52 | 0 | 3/2/2014 | 0 | 0 | 3/2/2013 | 0 | 0 | 3/1/2012 | 0.98 | 0.020402 |
| 3/3/2021 | 0 | 0 | 3/2/2020 | 0 | 0 | 3/3/2019 | 0 | 0 | 3/3/2018 | 0.29 | 0 | 3/3/2017 | 0 | 0 | 3/2/2016 | 0.16 | 0 | 3/3/2015 | 0 | 0 | 3/3/2014 | 0.21 | 0 | 3/3/2013 | 0 | 0 | 3/2/2012 | 0.01 | 0 |
| 3/4/2021 | 0 | 0 | 3/3/2020 | 0.1 | 0 | 3/4/2019 | 0.82 | 0.003838 | 3/4/2018 | 0 | 0 | 3/4/2017 | 0 | 0 | 3/3/2016 | 0 | 0 | 3/4/2015 | 0.55 | 0 | 3/4/2014 | 0.04 | 0 | 3/4/2013 | 0 | 0 | 3/3/2012 | 0.22 | 0 |
| 3/5/2021 | 0 | 0 | 3/4/2020 | 0.23 | 0 | 3/5/2019 | 0 | 0 | 3/5/2018 | 0 | 0 | 3/5/2017 | 0 | 0 | 3/4/2016 | 0.08 | 0 | 3/5/2015 | 0.67 | 0 | 3/5/2014 | 0 | 0 | 3/5/2013 | 0 | 0 | 3/4/2012 | 0.04 | 0 |
| 3/6/2021 | 0 | 0 | 3/5/2020 | 0 | 0 | 3/6/2019 | 0 | 0 | 3/6/2018 | 0 | 0 | 3/6/2017 | 0 | 0 | 3/5/2016 | 0.01 | 0 | 3/6/2015 | 0.63 | 0 | 3/6/2014 | 0 | 0 | 3/6/2013 | 0.1 | 0 | 3/5/2012 | 0 | 0 |

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| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/7/2021 | 0 | 0 | 3/6/2020 | 0 | 0 | 3/7/2019 | 0 | 0 | 3/7/2018 | 0.49 | 0 | 3/7/2017 | 0.02 | 0 |
| 3/8/2021 | 0 | 0 | 3/7/2020 | 0.37 | 0 | 3/8/2019 | 0 | 0 | 3/8/2018 | 0.63 | 0 | 3/8/2017 | 0.04 | 0 |
| 3/9/2021 | 0 | 0 | 3/8/2020 | 0 | 0 | 3/9/2019 | 0.01 | 0 | 3/9/2018 | 0 | 0 | 3/9/2017 | 0 | 0 |
| 3/10/2021 | 0 | 0 | 3/9/2020 | 0.01 | 0 | 3/10/2019 | 0.69 | 0 | 3/10/2018 | 0 | 0 | 3/10/2017 | 0.06 | 0 |
| 3/11/2021 | 0 | 0 | 3/10/2020 | 0 | 0 | 3/11/2019 | 0.08 | 0 | 3/11/2018 | 0 | 0 | 3/11/2017 | 0.28 | 0 |
| 3/12/2021 | 0 | 0 | 3/11/2020 | 0.04 | 0 | 3/12/2019 | 0 | 0 | 3/12/2018 | 0 | 0 | 3/12/2017 | 0 | 0 |
| 3/13/2021 | 0 | 0 | 3/12/2020 | 0.01 | 0 | 3/13/2019 | 0 | 0 | 3/13/2018 | 0.11 | 0 | 3/13/2017 | 0 | 0 |
| 3/14/2021 | 0 | 0 | 3/13/2020 | 0.33 | 0 | 3/14/2019 | 0 | 0 | 3/14/2018 | 0 | 0 | 3/14/2017 | 1.27 | 0.079113 |
| 3/15/2021 | 0 | 0 | 3/14/2020 | 0.01 | 0 | 3/15/2019 | 0 | 0 | 3/15/2018 | 0 | 0 | 3/15/2017 | 0.7 | 0 |
| 3/16/2021 | 0.01 | 0 | 3/15/2020 | 0.06 | 0 | 3/16/2019 | 0.22 | 0 | 3/16/2018 | 0 | 0 | 3/16/2017 | 0.01 | 0 |
| 3/17/2021 | 0.01 | 0 | 3/16/2020 | 0 | 0 | 3/17/2019 | 0 | 0 | 3/17/2018 | 0 | 0 | 3/17/2017 | 0 | 0 |
| 3/18/2021 | 0.13 | 0 | 3/17/2020 | 0.06 | 0 | 3/18/2019 | 0 | 0 | 3/18/2018 | 0 | 0 | 3/18/2017 | 0 | 0 |
| 3/19/2021 | 0.87 | 0.007674 | 3/18/2020 | 0.01 | 0 | 3/19/2019 | 0 | 0 | 3/19/2018 | 0 | 0 | 3/19/2017 | 0.01 | 0 |
| 3/20/2021 | 0 | 0 | 3/19/2020 | 0.82 | 0.003838 | 3/20/2019 | 0 | 0 | 3/20/2018 | 0 | 0 | 3/20/2017 | 0 | 0 |
| 3/21/2021 | 0 | 0 | 3/20/2020 | 0.02 | 0 | 3/21/2019 | 0.05 | 0 | 3/21/2018 | 0.41 | 0 | 3/21/2017 | 0.01 | 0 |
| 3/22/2021 | 0 | 0 | 3/21/2020 | 0.02 | 0 | 3/22/2019 | 2.01 | 0.355098 | 3/22/2018 | 0.63 | 0 | 3/22/2017 | 0 | 0 |
| 3/23/2021 | 0 | 0 | 3/22/2020 | 0 | 0 | 3/23/2019 | 0.04 | 0 | 3/23/2018 | 0 | 0 | 3/23/2017 | 0 | 0 |
| 3/24/2021 | 0.02 | 0 | 3/23/2020 | 0.06 | 0 | 3/24/2019 | 0 | 0 | 3/24/2018 | 0 | 0 | 3/24/2017 | 0 | 0 |
| 3/25/2021 | 1.8 | 0.261633 | 3/24/2020 | 0.71 | 1.82E-05 | 3/25/2019 | 0 | 0 | 3/25/2018 | 0 | 0 | 3/25/2017 | 0 | 0 |
| 3/26/2021 | 0.03 | 0 | 3/25/2020 | 0.01 | 0 | 3/26/2019 | 0.28 | 0 | 3/26/2018 | 0.01 | 0 | 3/26/2017 | 0 | 0 |
| 3/27/2021 | 0 | 0 | 3/26/2020 | 0.05 | 0 | 3/27/2019 | 0 | 0 | 3/27/2018 | 0 | 0 | 3/27/2017 | 0.07 | 0 |
| 3/28/2021 | 0.06 | 0 | 3/27/2020 | 0.02 | 0 | 3/28/2019 | 0 | 0 | 3/28/2018 | 0.02 | 0 | 3/28/2017 | 0.16 | 0 |
| 3/29/2021 | 0.62 | 0 | 3/28/2020 | 0.09 | 0 | 3/29/2019 | 0 | 0 | 3/29/2018 | 0.09 | 0 | 3/29/2017 | 0.48 | 0 |
| 3/30/2021 | 0 | 0 | 3/29/2020 | 1.07 | 0.034921 | 3/30/2019 | 0 | 0 | 3/30/2018 | 0.01 | 0 | 3/30/2017 | 0 | 0 |
| 3/31/2021 | 0 | 0 | 3/30/2020 | 0.02 | 0 | 3/31/2019 | 0 | 0 | 3/31/2018 | 0.12 | 0 | 3/31/2017 | 0.31 | 0 |
| 4/1/2021 | 0.46 | 0 | 3/31/2020 | 0.1 | 0 | 4/1/2019 | 0.08 | 0 | 4/1/2018 | 0 | 0 | 4/1/2017 | 1.41 | 0.118839 |
| 4/2/2021 | 0.01 | 0 | 4/1/2020 | 0.03 | 0 | 4/2/2019 | 0 | 0 | 4/2/2018 | 0.23 | 0 | 4/2/2017 | 0 | 0 |
| 4/3/2021 | 0 | 0 | 4/2/2020 | 0 | 0 | 4/3/2019 | 0 | 0 | 4/3/2018 | 0.04 | 0 | 4/3/2017 | 0 | 0 |
| 4/4/2021 | 0 | 0 | 4/3/2020 | 0 | 0 | 4/4/2019 | 0 | 0 | 4/4/2018 | 0.15 | 0 | 4/4/2017 | 0.25 | 0 |
| 4/5/2021 | 0 | 0 | 4/4/2020 | 0.01 | 0 | 4/5/2019 | 0 | 0 | 4/5/2018 | 0.06 | 0 | 4/5/2017 | 0.01 | 0 |
| Cumulative Runoff (Q) For 1 Year of Daily Rain Events (Inches) | | 4.973833 | | | 1.422009 | | | 2.935977 | | | 1.313634 | | | 1.095486 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/6/2016 | 0 | 0 | 3/7/2015 | 0 | 0 | 3/7/2014 | 0 | 0 | 3/7/2013 | 0.17 | 0 | 3/6/2012 | 0 | 0 |
| 3/7/2016 | 0 | 0 | 3/8/2015 | 0 | 0 | 3/8/2014 | 0 | 0 | 3/8/2013 | 0.01 | 0 | 3/7/2012 | 0 | 0 |
| 3/8/2016 | 0 | 0 | 3/9/2015 | 0 | 0 | 3/9/2014 | 0 | 0 | 3/9/2013 | 0.01 | 0 | 3/8/2012 | 0 | 0 |
| 3/9/2016 | 0 | 0 | 3/10/2015 | 0 | 0 | 3/10/2014 | 0 | 0 | 3/10/2013 | 0 | 0 | 3/9/2012 | 0.05 | 0 |
| 3/10/2016 | 0 | 0 | 3/11/2015 | 0.64 | 0 | 3/11/2014 | 0 | 0 | 3/11/2013 | 0.01 | 0 | 3/10/2012 | 0 | 0 |
| 3/11/2016 | 0 | 0 | 3/12/2015 | 0 | 0 | 3/12/2014 | 0 | 0 | 3/12/2013 | 0.16 | 0 | 3/11/2012 | 0 | 0 |
| 3/12/2016 | 0 | 0 | 3/13/2015 | 0 | 0 | 3/13/2014 | 0.33 | 0 | 3/13/2013 | 0.96 | 0.017666 | 3/12/2012 | 0 | 0 |
| 3/13/2016 | 0 | 0 | 3/14/2015 | 0.71 | 1.82E-05 | 3/14/2014 | 0 | 0 | 3/14/2013 | 0 | 0 | 3/13/2012 | 0.07 | 0 |
| 3/14/2016 | 0.89 | 0.009558 | 3/15/2015 | 0.46 | 0 | 3/15/2014 | 0 | 0 | 3/15/2013 | 0 | 0 | 3/14/2012 | 0 | 0 |
| 3/15/2016 | 0.26 | 0 | 3/16/2015 | 0 | 0 | 3/16/2014 | 0.04 | 0 | 3/16/2013 | 0 | 0 | 3/15/2012 | 0 | 0 |
| 3/16/2016 | 0.04 | 0 | 3/17/2015 | 0 | 0 | 3/17/2014 | 0.16 | 0 | 3/17/2013 | 0.08 | 0 | 3/16/2012 | 0.04 | 0 |
| 3/17/2016 | 0 | 0 | 3/18/2015 | 0 | 0 | 3/18/2014 | 0.01 | 0 | 3/18/2013 | 0 | 0 | 3/17/2012 | 0 | 0 |
| 3/18/2016 | 0.01 | 0 | 3/19/2015 | 0 | 0 | 3/19/2014 | 0 | 0 | 3/19/2013 | 0.75 | 0.000648 | 3/18/2012 | 0 | 0 |
| 3/19/2016 | 0 | 0 | 3/20/2015 | 0.01 | 0 | 3/20/2014 | 0.65 | 0 | 3/20/2013 | 0.02 | 0 | 3/19/2012 | 0 | 0 |
| 3/20/2016 | 0.02 | 0 | 3/21/2015 | 0.53 | 0 | 3/21/2014 | 0 | 0 | 3/21/2013 | 0 | 0 | 3/20/2012 | 0 | 0 |
| 3/21/2016 | 0.02 | 0 | 3/22/2015 | 0 | 0 | 3/22/2014 | 0 | 0 | 3/22/2013 | 0 | 0 | 3/21/2012 | 0 | 0 |
| 3/22/2016 | 0 | 0 | 3/23/2015 | 0 | 0 | 3/23/2014 | 0 | 0 | 3/23/2013 | 0 | 0 | 3/22/2012 | 0 | 0 |
| 3/23/2016 | 0 | 0 | 3/24/2015 | 0 | 0 | 3/24/2014 | 0 | 0 | 3/24/2013 | 0 | 0 | 3/23/2012 | 0 | 0 |
| 3/24/2016 | 0 | 0 | 3/25/2015 | 0 | 0 | 3/25/2014 | 0 | 0 | 3/25/2013 | 0.13 | 0 | 3/24/2012 | 0 | 0 |
| 3/25/2016 | 0 | 0 | 3/26/2015 | 0.04 | 0 | 3/26/2014 | 0.07 | 0 | 3/26/2013 | 0.38 | 0 | 3/25/2012 | 0.17 | 0 |
| 3/26/2016 | 0.01 | 0 | 3/27/2015 | 0.88 | 0.008591 | 3/27/2014 | 0 | 0 | 3/27/2013 | 0.01 | 0 | 3/26/2012 | 0 | 0 |
| 3/27/2016 | 0 | 0 | 3/28/2015 | 0 | 0 | 3/28/2014 | 0 | 0 | 3/28/2013 | 0 | 0 | 3/27/2012 | 0 | 0 |
| 3/28/2016 | 0.47 | 0 | 3/29/2015 | 0.01 | 0 | 3/29/2014 | 0.07 | 0 | 3/29/2013 | 0 | 0 | 3/28/2012 | 0 | 0 |
| 3/29/2016 | 0.09 | 0 | 3/30/2015 | 0 | 0 | 3/30/2014 | 1.07 | 0.034921 | 3/30/2013 | 0 | 0 | 3/29/2012 | 0.01 | 0 |
| 3/30/2016 | 0 | 0 | 3/31/2015 | 0 | 0 | 3/31/2014 | 0.83 | 0.004504 | 3/31/2013 | 0 | 0 | 3/30/2012 | 0 | 0 |
| 3/31/2016 | 0 | 0 | 4/1/2015 | 0.05 | 0 | 4/1/2014 | 0 | 0 | 4/1/2013 | 0.06 | 0 | 3/31/2012 | 0.2 | 0 |
| 4/1/2016 | 0.01 | 0 | 4/2/2015 | 0 | 0 | 4/2/2014 | 0 | 0 | 4/2/2013 | 0 | 0 | 4/1/2012 | 0.01 | 0 |
| 4/2/2016 | 0.25 | 0 | 4/3/2015 | 0 | 0 | 4/3/2014 | 0.04 | 0 | 4/3/2013 | 0 | 0 | 4/2/2012 | 0.23 | 0 |
| 4/3/2016 | 0.12 | 0 | 4/4/2015 | 0.12 | 0 | 4/4/2014 | 0.12 | 0 | 4/4/2013 | 0 | 0 | 4/3/2012 | 0 | 0 |
| 4/4/2016 | 0 | 0 | 4/5/2015 | 0 | 0 | 4/5/2014 | 0.05 | 0 | 4/5/2013 | 0.01 | 0 | 4/4/2012 | 0 | 0 |
| | | 1.794757 | | | 3.150675 | | | 4.007924 | | | 3.736672 | | | 6.79216 |

Average Yearly Runoff (inches) 3.122313

1821a

| Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|
| 4/5/2020 | 0 | 0 |
| 4/6/2020 | 0 | 0 |
| 4/7/2020 | 0 | 0 |
| 4/8/2020 | 0.39 | 0.222727 |
| 4/9/2020 | 0.03 | 0 |
| 4/10/2020 | 0.06 | 0.001818 |
| 4/11/2020 | 0 | 0 |
| 4/12/2020 | 0 | 0 |
| 4/13/2020 | 1.4 | 1.185641 |
| 4/14/2020 | 1.12 | 0.91125 |
| 4/15/2020 | 0.06 | 0.001818 |
| 4/16/2020 | 0 | 0 |
| 4/17/2020 | 0 | 0 |
| 4/18/2020 | 0.07 | 0.003913 |
| 4/19/2020 | 0.02 | 0 |
| 4/20/2020 | 0 | 0 |
| 4/21/2020 | 0 | 0 |
| 4/22/2020 | 0.15 | 0.039032 |
| 4/23/2020 | 0.01 | 0 |
| 4/24/2020 | 0.83 | 0.630404 |
| 4/25/2020 | 0.27 | 0.123023 |
| 4/26/2020 | 0.18 | 0.057647 |
| 4/27/2020 | 0.23 | 0.092564 |
| 4/28/2020 | 0.01 | 0 |
| 4/29/2020 | 0 | 0 |
| 4/30/2020 | 0 | 0 |
| 5/1/2020 | 1.01 | 0.804188 |
| 5/2/2020 | 0.01 | 0 |
| 5/3/2020 | 0.12 | 0.022857 |
| 5/4/2020 | 0.02 | 0 |
| 5/5/2020 | 0 | 0 |
| 5/6/2020 | 0 | 0 |
| 5/7/2020 | 0.15 | 0.039032 |
| 5/8/2020 | 0 | 0 |
| 5/9/2020 | 0.51 | 0.329701 |
| 5/10/2020 | 0 | 0 |
| 5/11/2020 | 0.03 | 0 |
| 5/12/2020 | 0.06 | 0.001818 |
| 5/13/2020 | 0 | 0 |
| 5/14/2020 | 0 | 0 |
| 5/15/2020 | 0.09 | 0.01 |
| 5/16/2020 | 0 | 0 |
| 5/17/2020 | 0 | 0 |
| 5/18/2020 | 0 | 0 |
| 5/19/2020 | 0 | 0 |
| 5/20/2020 | 0 | 0 |
| 5/21/2020 | 0 | 0 |
| 5/22/2020 | 0 | 0 |
| 5/23/2020 | 1.23 | 1.018777 |
| 5/24/2020 | 0.1 | 0.013846 |
| 5/25/2020 | 0 | 0 |
| 5/26/2020 | 0.04 | 2.41E-34 |
| 5/27/2020 | 0 | 0 |
| 5/28/2020 | 0.04 | 2.41E-34 |
| 5/29/2020 | 0.04 | 2.41E-34 |
| 5/30/2020 | 0.19 | 0.064286 |
| 5/31/2020 | 0 | 0 |
| 6/1/2020 | 0 | 0 |
| 6/2/2020 | 0 | 0 |
| 6/3/2020 | 0.03 | 0 |
| 6/4/2020 | 0.63 | 0.440633 |
| 6/5/2020 | 0.54 | 0.357143 |
| 6/6/2020 | 0.46 | 0.284516 |
| 6/7/2020 | 0 | 0 |
| 6/8/2020 | 0 | 0 |
| 6/9/2020 | 0 | 0 |
| 6/10/2020 | 0 | 0 |
| 6/11/2020 | 0.3 | 0.146957 |
| 6/12/2020 | 0.33 | 0.171633 |
| 6/13/2020 | 0 | 0 |
| 6/14/2020 | 0 | 0 |
| 6/15/2020 | 0 | 0 |
| 6/16/2020 | 0 | 0 |
| 6/17/2020 | 0 | 0 |
| 6/18/2020 | 0.04 | 2.41E-34 |
| 6/19/2020 | 0 | 0 |
| 6/20/2020 | 0.15 | 0.039032 |
| 6/21/2020 | 0.03 | 0 |
| 6/22/2020 | 0 | 0 |

| Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|
| 4/5/2019 | 0 | 0 |
| 4/6/2019 | 0.16 | 0.045 |
| 4/7/2019 | 0 | 0 |
| 4/8/2019 | 0.16 | 0.045 |
| 4/9/2019 | 0 | 0 |
| 4/10/2019 | 0 | 0 |
| 4/11/2019 | 0 | 0 |
| 4/12/2019 | 0 | 0 |
| 4/13/2019 | 0.43 | 0.257797 |
| 4/14/2019 | 0.01 | 0 |
| 4/15/2019 | 0.44 | 0.266667 |
| 4/16/2019 | 0.01 | 0 |
| 4/17/2019 | 0 | 0 |
| 4/18/2019 | 0 | 0 |
| 4/19/2019 | 0 | 0 |
| 4/20/2019 | 1 | 0.794483 |
| 4/21/2019 | 0.36 | 0.196923 |
| 4/22/2019 | 0 | 0 |
| 4/23/2019 | 0 | 0 |
| 4/24/2019 | 0.01 | 0 |
| 4/25/2019 | 0 | 0 |
| 4/26/2019 | 0.25 | 0.107561 |
| 4/27/2019 | 0.82 | 0.620816 |
| 4/28/2019 | 0.01 | 0 |
| 4/29/2019 | 0.03 | 0 |
| 4/30/2019 | 0.03 | 0 |
| 5/1/2019 | 0 | 0 |
| 5/2/2019 | 0 | 0 |
| 5/3/2019 | 0 | 0 |
| 5/4/2019 | 0.08 | 0.006667 |
| 5/5/2019 | 0.38 | 0.214074 |
| 5/6/2019 | 1.13 | 0.921008 |
| 5/7/2019 | 0.01 | 0 |
| 5/8/2019 | 0.54 | 0.357143 |
| 5/9/2019 | 0.01 | 0 |
| 5/10/2019 | 0.01 | 0 |
| 5/11/2019 | 0.21 | 0.078108 |
| 5/12/2019 | 0.43 | 0.257797 |
| 5/13/2019 | 0.96 | 0.755714 |
| 5/14/2019 | 0.69 | 0.497059 |
| 5/15/2019 | 0.02 | 0 |
| 5/16/2019 | 0.02 | 0 |
| 5/17/2019 | 0.01 | 0 |
| 5/18/2019 | 0.05 | 0.000476 |
| 5/19/2019 | 0 | 0 |
| 5/20/2019 | 0.01 | 0 |
| 5/21/2019 | 0 | 0 |
| 5/22/2019 | 0 | 0 |
| 5/23/2019 | 0 | 0 |
| 5/24/2019 | 0.24 | 0.1 |
| 5/25/2019 | 0 | 0 |
| 5/26/2019 | 0.05 | 0.000476 |
| 5/27/2019 | 0.05 | 0.000476 |
| 5/28/2019 | 0 | 0 |
| 5/29/2019 | 0.66 | 0.46878 |
| 5/30/2019 | 0.51 | 0.329701 |
| 5/31/2019 | 0.28 | 0.130909 |
| 6/1/2019 | 0 | 0 |
| 6/2/2019 | 0.16 | 0.045 |
| 6/3/2019 | 0.23 | 0.092564 |
| 6/4/2019 | 0 | 0 |
| 6/5/2019 | 0 | 0 |
| 6/6/2019 | 0.34 | 0.18 |
| 6/7/2019 | 0.01 | 0 |
| 6/8/2019 | 0 | 0 |
| 6/9/2019 | 0 | 0 |
| 6/10/2019 | 0.26 | 0.115238 |
| 6/11/2019 | 1.44 | 1.225 |
| 6/12/2019 | 0 | 0 |
| 6/13/2019 | 0.62 | 0.431282 |
| 6/14/2019 | 0.43 | 0.257797 |
| 6/15/2019 | 0 | 0 |
| 6/16/2019 | 0 | 0 |
| 6/17/2019 | 0.29 | 0.138889 |
| 6/18/2019 | 0.08 | 0.006667 |
| 6/19/2019 | 0.08 | 0.006667 |
| 6/20/2019 | 1.68 | 1.461739 |
| 6/21/2019 | 0.67 | 0.478193 |
| 6/22/2019 | 0.14 | 0.033333 |

| Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|
| 4/5/2018 | 0.06 | 0.001818 |
| 4/6/2018 | 0.02 | 0 |
| 4/7/2018 | 0 | 0 |
| 4/8/2018 | 0 | 0 |
| 4/9/2018 | 0 | 0 |
| 4/10/2018 | 0.04 | 2.41E-34 |
| 4/11/2018 | 0 | 0 |
| 4/12/2018 | 0 | 0 |
| 4/13/2018 | 0 | 0 |
| 4/14/2018 | 0 | 0 |
| 4/15/2018 | 0 | 0 |
| 4/16/2018 | 1.41 | 1.195478 |
| 4/17/2018 | 0.24 | 0.1 |
| 4/18/2018 | 0.01 | 0 |
| 4/19/2018 | 0.02 | 0 |
| 4/20/2018 | 0.03 | 0 |
| 4/21/2018 | 0 | 0 |
| 4/22/2018 | 0 | 0 |
| 4/23/2018 | 0 | 0 |
| 4/24/2018 | 0 | 0 |
| 4/25/2018 | 0.62 | 0.431282 |
| 4/26/2018 | 0.04 | 2.41E-34 |
| 4/27/2018 | 0.21 | 0.078108 |
| 4/28/2018 | 0.04 | 2.41E-34 |
| 4/29/2018 | 0.2 | 0.071111 |
| 4/30/2018 | 0 | 0 |
| 5/1/2018 | 0 | 0 |
| 5/2/2018 | 0 | 0 |
| 5/3/2018 | 0 | 0 |
| 5/4/2018 | 0 | 0 |
| 5/5/2018 | 0 | 0 |
| 5/6/2018 | 0.06 | 0.001818 |
| 5/7/2018 | 0.08 | 0.006667 |
| 5/8/2018 | 0 | 0 |
| 5/9/2018 | 0 | 0 |
| 5/10/2018 | 0 | 0 |
| 5/11/2018 | 0.18 | 0.057647 |
| 5/12/2018 | 0.63 | 0.440633 |
| 5/13/2018 | 0.51 | 0.329701 |
| 5/14/2018 | 0.89 | 0.688095 |
| 5/15/2018 | 0.01 | 0 |
| 5/16/2018 | 0.6 | 0.412632 |
| 5/17/2018 | 1.38 | 1.165974 |
| 5/18/2018 | 0.15 | 0.039032 |
| 5/19/2018 | 0.58 | 0.394054 |
| 5/20/2018 | 0.39 | 0.222727 |
| 5/21/2018 | 0.02 | 0 |
| 5/22/2018 | 0 | 0 |
| 5/23/2018 | 0.48 | 0.3025 |
| 5/24/2018 | 0 | 0 |
| 5/25/2018 | 0 | 0 |
| 5/26/2018 | 0 | 0 |
| 5/27/2018 | 0.14 | 0.033333 |
| 5/28/2018 | 0.16 | 0.045 |
| 5/29/2018 | 0.01 | 0 |
| 5/30/2018 | 0 | 0 |
| 5/31/2018 | 0.07 | 0.003913 |
| 6/1/2018 | 0.03 | 0 |
| 6/2/2018 | 0.2 | 0.071111 |
| 6/3/2018 | 1.06 | 0.852787 |
| 6/4/2018 | 0.47 | 0.293492 |
| 6/5/2018 | 0 | 0 |
| 6/6/2018 | 0.08 | 0.006667 |
| 6/7/2018 | 0 | 0 |
| 6/8/2018 | 0 | 0 |
| 6/9/2018 | 0 | 0 |
| 6/10/2018 | 0 | 0 |
| 6/11/2018 | 1.8 | 1.580408 |
| 6/12/2018 | 0.03 | 0 |
| 6/13/2018 | 0 | 0 |
| 6/14/2018 | 0 | 0 |
| 6/15/2018 | 0 | 0 |
| 6/16/2018 | 0 | 0 |
| 6/17/2018 | 0 | 0 |
| 6/18/2018 | 0 | 0 |
| 6/19/2018 | 0.01 | 0 |
| 6/20/2018 | 0 | 0 |
| 6/21/2018 | 0.07 | 0.003913 |
| 6/22/2018 | 0.02 | 0 |

| Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|
| 4/5/2017 | 0.01 | 0 |
| 4/6/2017 | 0.04 | 2.41E-34 |
| 4/7/2017 | 0.99 | 0.784783 |
| 4/8/2017 | 0.01 | 0 |
| 4/9/2017 | 0 | 0 |
| 4/10/2017 | 0 | 0 |
| 4/11/2017 | 0 | 0 |
| 4/12/2017 | 0 | 0 |
| 4/13/2017 | 0 | 0 |
| 4/14/2017 | 0 | 0 |
| 4/15/2017 | 0 | 0 |
| 4/16/2017 | 0 | 0 |
| 4/17/2017 | 0.01 | 0 |
| 4/18/2017 | 0.09 | 0.01 |
| 4/19/2017 | 0 | 0 |
| 4/20/2017 | 0 | 0 |
| 4/21/2017 | 0.29 | 0.138889 |
| 4/22/2017 | 0.2 | 0.071111 |
| 4/23/2017 | 0.16 | 0.045 |
| 4/24/2017 | 0 | 0 |
| 4/25/2017 | 0.18 | 0.057647 |
| 4/26/2017 | 0.73 | 0.534944 |
| 4/27/2017 | 0.01 | 0 |
| 4/28/2017 | 0 | 0 |
| 4/29/2017 | 0.27 | 0.123023 |
| 4/30/2017 | 0 | 0 |
| 5/1/2017 | 0 | 0 |
| 5/2/2017 | 0.05 | 0.000476 |
| 5/3/2017 | 0 | 0 |
| 5/4/2017 | 0 | 0 |
| 5/5/2017 | 0.1 | 0.013846 |
| 5/6/2017 | 0.92 | 0.717037 |
| 5/7/2017 | 0.08 | 0.006667 |
| 5/8/2017 | 0.04 | 2.41E-34 |
| 5/9/2017 | 0 | 0 |
| 5/10/2017 | 0 | 0 |
| 5/11/2017 | 0 | 0 |
| 5/12/2017 | 0.1 | 0.013846 |
| 5/13/2017 | 0.79 | 0.592105 |
| 5/14/2017 | 0.85 | 0.649604 |
| 5/15/2017 | 0.01 | 0 |
| 5/16/2017 | 0 | 0 |
| 5/17/2017 | 0 | 0 |
| 5/18/2017 | 0 | 0 |
| 5/19/2017 | 0 | 0 |
| 5/20/2017 | 0.03 | 0 |
| 5/21/2017 | 0.02 | 0 |
| 5/22/2017 | 0.07 | 0.003913 |
| 5/23/2017 | 0.19 | 0.064286 |
| 5/24/2017 | 0.08 | 0.006667 |
| 5/25/2017 | 0.39 | 0.222727 |
| 5/26/2017 | 1.21 | 0.999197 |
| 5/27/2017 | 0 | 0 |
| 5/28/2017 | 0.01 | 0 |
| 5/29/2017 | 0.21 | 0.078108 |
| 5/30/2017 | 0.02 | 0 |
| 5/31/2017 | 0.05 | 0.000476 |
| 6/1/2017 | 0 | 0 |
| 6/2/2017 | 0 | 0 |
| 6/3/2017 | 0 | 0 |
| 6/4/2017 | 0 | 0 |
| 6/5/2017 | 0 | 0 |
| 6/6/2017 | 0.36 | 0.196923 |
| 6/7/2017 | 0.16 | 0.045 |
| 6/8/2017 | 0 | 0 |
| 6/9/2017 | 0 | 0 |
| 6/10/2017 | 0 | 0 |
| 6/11/2017 | 0 | 0 |
| 6/12/2017 | 0 | 0 |
| 6/13/2017 | 0 | 0 |
| 6/14/2017 | 0 | 0 |
| 6/15/2017 | 0 | 0 |
| 6/16/2017 | 0 | 0 |
| 6/17/2017 | 0.03 | 0 |
| 6/18/2017 | 0.32 | 0.163333 |
| 6/19/2017 | 0 | 0 |
| 6/20/2017 | 0.68 | 0.487619 |
| 6/21/2017 | 0 | 0 |
| 6/22/2017 | 0.11 | 0.018148 |

| Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|
| 4/5/2016 | 0.14 | 0.033333 |
| 4/6/2016 | 0 | 0 |
| 4/7/2016 | 0 | 0 |
| 4/8/2016 | 0.46 | 0.284516 |
| 4/9/2016 | 0.02 | 0 |
| 4/10/2016 | 0.35 | 0.188431 |
| 4/11/2016 | 0 | 0 |
| 4/12/2016 | 0.06 | 0.001818 |
| 4/13/2016 | 0.23 | 0.092564 |
| 4/14/2016 | 0 | 0 |
| 4/15/2016 | 0 | 0 |
| 4/16/2016 | 0 | 0 |
| 4/17/2016 | 0 | 0 |
| 4/18/2016 | 0 | 0 |
| 4/19/2016 | 0 | 0 |
| 4/20/2016 | 0 | 0 |
| 4/21/2016 | 0 | 0 |
| 4/22/2016 | 0 | 0 |
| 4/23/2016 | 0.03 | 0 |
| 4/24/2016 | 0.19 | 0.064286 |
| 4/25/2016 | 0 | 0 |
| 4/26/2016 | 0.02 | 0 |
| 4/27/2016 | 0.12 | 0.022857 |
| 4/28/2016 | 0 | 0 |
| 4/29/2016 | 0.18 | 0.057647 |
| 4/30/2016 | 0.04 | 2.41E-34 |
| 5/1/2016 | 0.21 | 0.078108 |
| 5/2/2016 | 0.27 | 0.123023 |
| 5/3/2016 | 0.57 | 0.384795 |
| 5/4/2016 | 0.25 | 0.107561 |
| 5/5/2016 | 0.02 | 0 |
| 5/6/2016 | 0.33 | 0.171633 |
| 5/7/2016 | 1.16 | 0.950303 |
| 5/8/2016 | 0.15 | 0.039032 |
| 5/9/2016 | 0 | 0 |
| 5/10/2016 | 0.02 | 0 |
| 5/11/2016 | 0.02 | 0 |
| 5/12/2016 | 0.01 | 0 |
| 5/13/2016 | 0 | 0 |
| 5/14/2016 | 0.11 | 0.018148 |
| 5/15/2016 | 0.11 | 0.018148 |
| 5/16/2016 | 0 | 0 |
| 5/17/2016 | 0 | 0 |
| 5/18/2016 | 0.14 | 0.033333 |
| 5/19/2016 | 0.02 | 0 |
| 5/20/2016 | 0 | 0 |
| 5/21/2016 | 0.01 | 0 |
| 5/22/2016 | 0.79 | 0.592105 |
| 5/23/2016 | 0.06 | 0.001818 |
| 5/24/2016 | 0.19 | 0.064286 |
| 5/25/2016 | 0 | 0 |
| 5/26/2016 | 0 | 0 |
| 5/27/2016 | 0 | 0 |
| 5/28/2016 | 0 | 0 |
| 5/29/2016 | 0.01 | 0 |
| 5/30/2016 | 0.68 | 0.487619 |
| 5/31/2016 | 0 | 0 |
| 6/1/2016 | 0 | 0 |
| 6/2/2016 | 0 | 0 |
| 6/3/2016 | 0.27 | 0.123023 |
| 6/4/2016 | 0.3 | 0.146957 |
| 6/5/2016 | 0.03 | 0 |
| 6/6/2016 | 0.53 | 0.347971 |
| 6/7/2016 | 0 | 0 |
| 6/8/2016 | 0.05 | 0.000476 |
| 6/9/2016 | 0.22 | 0.085263 |
| 6/10/2016 | 0 | 0 |
| 6/11/2016 | 0 | 0 |
| 6/12/2016 | 0 | 0 |
| 6/13/2016 | 0 | 0 |
| 6/14/2016 | 0 | 0 |
| 6/15/2016 | 0 | 0 |
| 6/16/2016 | 0.28 | 0.130909 |
| 6/17/2016 | 0.36 | 0.196923 |
| 6/18/2016 | 0 | 0 |
| 6/19/2016 | 0 | 0 |
| 6/20/2016 | 0 | 0 |
| 6/21/2016 | 0.01 | 0 |
| 6/22/2016 | 0.01 | 0 |

| Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|
| 4/5/2015 | 0 | 0 |
| 4/6/2015 | 0 | 0 |
| 4/7/2015 | 0 | 0 |
| 4/8/2015 | 0.07 | 0.003913 |
| 4/9/2015 | 0.05 | 0.000476 |
| 4/10/2015 | 0.06 | 0.001818 |
| 4/11/2015 | 0.01 | 0 |
| 4/12/2015 | 0 | 0 |
| 4/13/2015 | 0 | 0 |
| 4/14/2015 | 0.04 | 2.41E-34 |
| 4/15/2015 | 0.11 | 0.018148 |
| 4/16/2015 | 0 | 0 |
| 4/17/2015 | 0.12 | 0.022857 |
| 4/18/2015 | 0 | 0 |
| 4/19/2015 | 0 | 0 |
| 4/20/2015 | 1.19 | 0.97963 |
| 4/21/2015 | 0.57 | 0.384795 |
| 4/22/2015 | 0 | 0 |
| 4/23/2015 | 0.14 | 0.033333 |
| 4/24/2015 | 0 | 0 |
| 4/25/2015 | 0 | 0 |
| 4/26/2015 | 0 | 0 |
| 4/27/2015 | 0 | 0 |
| 4/28/2015 | 0 | 0 |
| 4/29/2015 | 0 | 0 |
| 4/30/2015 | 0 | 0 |
| 5/1/2015 | 0 | 0 |
| 5/2/2015 | 0 | 0 |
| 5/3/2015 | 0 | 0 |
| 5/4/2015 | 0 | 0 |
| 5/5/2015 | 0 | 0 |
| 5/6/2015 | 0.18 | 0.057647 |
| 5/7/2015 | 0.02 | 0 |
| 5/8/2015 | 0 | 0 |
| 5/9/2015 | 0 | 0 |
| 5/10/2015 | 0 | 0 |
| 5/11/2015 | 0 | 0 |
| 5/12/2015 | 0.17 | 0.051212 |
| 5/13/2015 | 0 | 0 |
| 5/14/2015 | 0 | 0 |
| 5/15/2015 | 0 | 0 |
| 5/16/2015 | 0 | 0 |
| 5/17/2015 | 0.27 | 0.123023 |
| 5/18/2015 | 0.02 | 0 |
| 5/19/2015 | 0.9 | 0.697736 |
| 5/20/2015 | 0.1 | 0.013846 |
| 5/21/2015 | 0 | 0 |
| 5/22/2015 | 0.04 | 2.41E-34 |
| 5/23/2015 | 0 | 0 |
| 5/24/2015 | 0 | 0 |
| 5/25/2015 | 0 | 0 |
| 5/26/2015 | 0 | 0 |
| 5/27/2015 | 0.04 | 2.41E-34 |
| 5/28/2015 | 0.37 | 0.205472 |
| 5/29/2015 | 0 | 0 |
| 5/30/2015 | 0 | 0 |
| 5/31/2015 | 0 | 0 |
| 6/1/2015 | 0.67 | 0.478193 |
| 6/2/2015 | 1.02 | 0.813898 |
| 6/3/2015 | 0.13 | 0.027931 |
| 6/4/2015 | 0.02 | 0 |
| 6/5/2015 | 0.26 | 0.115238 |
| 6/6/2015 | 0.01 | 0 |
| 6/7/2015 | 0 | 0 |
| 6/8/2015 | 0 | 0 |
| 6/9/2015 | 0.89 | 0.688095 |
| 6/10/2015 | 0 | 0 |
| 6/11/2015 | 0 | 0 |
| 6/12/2015 | 0 | 0 |
| 6/13/2015 | 0.04 | 2.41E-34 |
| 6/14/2015 | 0.03 | 0 |
| 6/15/2015 | 0.53 | 0.347971 |
| 6/16/2015 | 0 | 0 |
| 6/17/2015 | 0.05 | 0.000476 |
| 6/18/2015 | 0.91 | 0.707383 |
| 6/19/2015 | 0.38 | 0.214074 |
| 6/20/2015 | 0.04 | 2.41E-34 |
| 6/21/2015 | 0.55 | 0.366338 |
| 6/22/2015 | 0.01 | 0 |

| Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|
| 4/5/2014 | 0.05 | 0.000476 |
| 4/6/2014 | 0 | 0 |
| 4/7/2014 | 0 | 0 |
| 4/8/2014 | 0.51 | 0.329701 |
| 4/9/2014 | 0.01 | 0 |
| 4/10/2014 | 0 | 0 |
| 4/11/2014 | 0 | 0 |
| 4/12/2014 | 0.01 | 0 |
| 4/13/2014 | 0 | 0 |
| 4/14/2014 | 0 | 0 |
| 4/15/2014 | 0.06 | 0.001818 |
| 4/16/2014 | 2.1 | 1.877699 |
| 4/17/2014 | 0 | 0 |
| 4/18/2014 | 0 | 0 |
| 4/19/2014 | 0 | 0 |
| 4/20/2014 | 0 | 0 |
| 4/21/2014 | 0 | 0 |
| 4/22/2014 | 0 | 0 |
| 4/23/2014 | 0.08 | 0.006667 |
| 4/24/2014 | 0 | 0 |
| 4/25/2014 | 0 | 0 |
| 4/26/2014 | 0.42 | 0.248966 |
| 4/27/2014 | 0.01 | 0 |
| 4/28/2014 | 0 | 0 |
| 4/29/2014 | 0.05 | 0.000476 |
| 4/30/2014 | 1.23 | 1.018777 |
| 5/1/2014 | 4.53 | 4.298529 |
| 5/2/2014 | 0.2 | 0.071111 |
| 5/3/2014 | 0 | 0 |
| 5/4/2014 | 0.04 | 2.41E-34 |
| 5/5/2014 | 0 | 0 |
| 5/6/2014 | 0 | 0 |
| 5/7/2014 | 0 | 0 |
| 5/8/2014 | 0.02 | 0 |
| 5/9/2014 | 0 | 0 |
| 5/10/2014 | 0 | 0 |
| 5/11/2014 | 0.37 | 0.205472 |
| 5/12/2014 | 0 | 0 |
| 5/13/2014 | 0.09 | 0.01 |
| 5/14/2014 | 0.12 | 0.022857 |
| 5/15/2014 | 0.02 | 0 |
| 5/16/2014 | 0.11 | 0.018148 |
| 5/17/2014 | 1.72 | 1.501277 |
| 5/18/2014 | 0 | 0 |
| 5/19/2014 | 0 | 0 |
| 5/20/2014 | 0 | 0 |
| 5/21/2014 | 0.03 | 0 |
| 5/22/2014 | 0.16 | 0.045 |
| 5/23/2014 | 0.2 | 0.071111 |
| 5/24/2014 | 0 | 0 |
| 5/25/2014 | 0 | 0 |
| 5/26/2014 | 0 | 0 |
| 5/27/2014 | 0 | 0 |
| 5/28/2014 | 0.44 | 0.266667 |
| 5/29/2014 | 0.16 | 0.045 |
| 5/30/2014 | 0.1 | 0.013846 |
| 5/31/2014 | 0 | 0 |
| 6/1/2014 | 0 | 0 |
| 6/2/2014 | 0 | 0 |
| 6/3/2014 | 0 | 0 |
| 6/4/2014 | 0.17 | 0.051212 |
| 6/5/2014 | 0.16 | 0.045 |
| 6/6/2014 | 0.01 | 0 |
| 6/7/2014 | 0 | 0 |
| 6/8/2014 | 0 | 0 |
| 6/9/2014 | 0.07 | 0.003913 |
| 6/10/2014 | 0.39 | 0.222727 |
| 6/11/2014 | 0.25 | 0.107561 |
| 6/12/2014 | 0.18 | 0.057647 |
| 6/13/2014 | 0.99 | 0.784783 |
| 6/14/2014 | 0.15 | 0.039032 |
| 6/15/2014 | 0 | 0 |
| 6/16/2014 | 0 | 0 |
| 6/17/2014 | 0 | 0 |
| 6/18/2014 | 0 | 0 |
| 6/19/2014 | 0.84 | 0.64 |
| 6/20/2014 | 0.07 | 0.003913 |
| 6/21/2014 | 0 | 0 |
| 6/22/2014 | 0.02 | 0 |

| Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|
| 4/5/2013 | 0.01 | 0 |
| 4/6/2013 | 0 | 0 |
| 4/7/2013 | 0 | 0 |
| 4/8/2013 | 0 | 0 |
| 4/9/2013 | 0 | 0 |
| 4/10/2013 | 0 | 0 |
| 4/11/2013 | 0.29 | 0.138889 |
| 4/12/2013 | 0.13 | 0.027931 |
| 4/13/2013 | 0.73 | 0.534944 |
| 4/14/2013 | 0 | 0 |
| 4/15/2013 | 0 | 0 |
| 4/16/2013 | 0 | 0 |
| 4/17/2013 | 0.01 | 0 |
| 4/18/2013 | 0 | 0 |
| 4/19/2013 | 0.1 | 0.013846 |
| 4/20/2013 | 1.01 | 0.804188 |
| 4/21/2013 | 0 | 0 |
| 4/22/2013 | 0 | 0 |
| 4/23/2013 | 0 | 0 |
| 4/24/2013 | 0 | 0 |
| 4/25/2013 | 0 | 0 |
| 4/26/2013 | 0 | 0 |
| 4/27/2013 | 0 | 0 |
| 4/28/2013 | 0 | 0 |
| 4/29/2013 | 0.13 | 0.027931 |
| 4/30/2013 | 0.38 | 0.214074 |
| 5/1/2013 | 0 | 0 |
| 5/2/2013 | 0 | 0 |
| 5/3/2013 | 0 | 0 |
| 5/4/2013 | 0 | 0 |
| 5/5/2013 | 0 | 0 |
| 5/6/2013 | 0 | 0 |
| 5/7/2013 | 0 | 0 |
| 5/8/2013 | 0.41 | 0.240175 |
| 5/9/2013 | 0.44 | 0.266667 |
| 5/10/2013 | 0.01 | 0 |
| 5/11/2013 | 1.3 | 1.087397 |
| 5/12/2013 | 0.31 | 0.155106 |
| 5/13/2013 | 0 | 0 |
| 5/14/2013 | 0 | 0 |
| 5/15/2013 | 0.04 | 2.41E-34 |
| 5/16/2013 | 0.05 | 0.000476 |
| 5/17/2013 | 0.02 | 0 |
| 5/18/2013 | 0 | 0 |
| 5/19/2013 | 0.13 | 0.027931 |
| 5/20/2013 | 0.03 | 0 |
| 5/21/2013 | 0.03 | 0 |
| 5/22/2013 | 0 | 0 |
| 5/23/2013 | 0.03 | 0 |
| 5/24/2013 | 0.66 | 0.46878 |
| 5/25/2013 | 0.09 | 0.01 |
| 5/26/2013 | 0 | 0 |
| 5/27/2013 | 0 | 0 |
| 5/28/2013 | 0.02 | 0 |
| 5/29/2013 | 0.21 | 0.078108 |
| 5/30/2013 | 0 | 0 |
| 5/31/2013 | 0 | 0 |
| 6/1/2013 | 0 | 0 |
| 6/2/2013 | 0 | 0 |
| 6/3/2013 | 0.49 | 0.311538 |
| 6/4/2013 | 0.12 | 0.022857 |
| 6/5/2013 | 0 | 0 |
| 6/6/2013 | 0 | 0 |
| 6/7/2013 | 1.47 | 1.25454 |
| 6/8/2013 | 2.5 | 2.275038 |
| 6/9/2013 | 0 | 0 |
| 6/10/2013 | 0.47 | 0.293492 |
| 6/11/2013 | 1.44 | 1.225 |
| 6/12/2013 | 0.01 | 0 |
| 6/13/2013 | 0 | 0 |
| 6/14/2013 | 0.58 | 0.394054 |
| 6/15/2013 | 0.02 | 0 |
| 6/16/2013 | 0 | 0 |
| 6/17/2013 | 0.11 | 0.018148 |
| 6/18/2013 | 0.55 | 0.366338 |
| 6/19/2013 | 0.5 | 0.320606 |
| 6/20/2013 | 0 | 0 |
| 6/21/2013 | 0 | 0 |
| 6/22/2013 | 0 | 0 |

| Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|
| 4/5/2012 | 0 | 0 |
| 4/6/2012 | 0 | 0 |
| 4/7/2012 | 0 | 0 |
| 4/8/2012 | 0 | 0 |
| 4/9/2012 | 0 | 0 |
| 4/10/2012 | 0 | 0 |
| 4/11/2012 | 0 | 0 |
| 4/12/2012 | 0.01 | 0 |
| 4/13/2012 | 0.01 | 0 |
| 4/14/2012 | 0.01 | 0 |
| 4/15/2012 | 0.02 | 0 |
| 4/16/2012 | 0.01 | 0 |
| 4/17/2012 | 0 | 0 |
| 4/18/2012 | 0.02 | 0 |
| 4/19/2012 | 0.09 | 0.01 |
| 4/20/2012 | 0 | 0 |
| 4/21/2012 | 0 | 0 |
| 4/22/2012 | 0.33 | 0.171633 |
| 4/23/2012 | 2.49 | 2.265094 |
| 4/24/2012 | 0.03 | 0 |
| 4/25/2012 | 0 | 0 |
| 4/26/2012 | 0.01 | 0 |
| 4/27/2012 | 0.12 | 0.022857 |
| 4/28/2012 | 0 | 0 |
| 4/29/2012 | 0.01 | 0 |
| 4/30/2012 | 0 | 0 |
| 5/1/2012 | 0.21 | 0.078108 |
| 5/2/2012 | 0.1 | 0.013846 |
| 5/3/2012 | 0.28 | 0.130909 |
| 5/4/2012 | 0.01 | 0 |
| 5/5/2012 | 0.57 | 0.384795 |
| 5/6/2012 | 0.01 | 0 |
| 5/7/2012 | 0 | 0 |
| 5/8/2012 | 0.06 | 0.001818 |
| 5/9/2012 | 0.45 | 0.275574 |
| 5/10/2012 | 0.24 | 0.1 |
| 5/11/2012 | 0 | 0 |
| 5/12/2012 | 0 | 0 |
| 5/13/2012 | 0 | 0 |
| 5/14/2012 | 0 | 0 |
| 5/15/2012 | 0.43 | 0.257797 |
| 5/16/2012 | 1.06 | 0.852787 |
| 5/17/2012 | 0 | 0 |
| 5/18/2012 | 0 | 0 |
| 5/19/2012 | 0 | 0 |
| 5/20/2012 | 0 | 0 |
| 5/21/2012 | 0.16 | 0.045 |
| 5/22/2012 | 0.02 | 0 |
| 5/23/2012 | 0.01 | 0 |
| 5/24/2012 | 0.02 | 0 |
| 5/25/2012 | 0.09 | 0.01 |
| 5/26/2012 | 0 | 0 |
| 5/27/2012 | 0.06 | 0.001818 |
| 5/28/2012 | 0 | 0 |
| 5/29/2012 | 0 | 0 |
| 5/30/2012 | 0.52 | 0.338824 |
| 5/31/2012 | 0.01 | 0 |
| 6/1/2012 | 0 | 0 |
| 6/2/2012 | 0.92 | 0.717037 |
| 6/3/2012 | 0 | 0 |
| 6/4/2012 | 0.22 | 0.085263 |
| 6/5/2012 | 0.2 | 0.071111 |
| 6/6/2012 | 0 | 0 |
| 6/7/2012 | 0 | 0 |
| 6/8/2012 | 0.02 | 0 |
| 6/9/2012 | 0 | 0 |
| 6/10/2012 | 0 | 0 |
| 6/11/2012 | 0 | 0 |
| 6/12/2012 | 0.01 | 0 |
| 6/13/2012 | 1.61 | 1.392599 |
| 6/14/2012 | 0 | 0 |
| 6/15/2012 | 0 | 0 |
| 6/16/2012 | 0 | 0 |
| 6/17/2012 | 0 | 0 |
| 6/18/2012 | 0 | 0 |
| 6/19/2012 | 0.01 | 0 |
| 6/20/2012 | 0 | 0 |
| 6/21/2012 | 0 | 0 |
| 6/22/2012 | 0 | 0 |

| Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|
| 4/5/2011 | 0.14 | 0.033333 |
| 4/6/2011 | 0.13 | 0.027931 |
| 4/7/2011 | 0 | 0 |
| 4/8/2011 | 0.01 | 0 |
| 4/9/2011 | 0.76 | 0.563478 |
| 4/10/2011 | 0 | 0 |
| 4/11/2011 | 0 | 0 |
| 4/12/2011 | 0 | 0 |
| 4/13/2011 | 0.98 | 0.775088 |
| 4/14/2011 | 0.1 | 0.013846 |
| 4/15/2011 | 0 | 0 |
| 4/16/2011 | 0 | 0 |
| 4/17/2011 | 1.81 | 1.590305 |
| 4/18/2011 | 0 | 0 |
| 4/19/2011 | 0 | 0 |
| 4/20/2011 | 0.12 | 0.022857 |
| 4/21/2011 | 0 | 0 |
| 4/22/2011 | 0 | 0 |
| 4/23/2011 | 0.24 | 0.1 |
| 4/24/2011 | 0.2 | 0.071111 |
| 4/25/2011 | 0.02 | 0 |
| 4/26/2011 | 0 | 0 |
| 4/27/2011 | 0 | 0 |
| 4/28/2011 | 0.02 | 0 |
| 4/29/2011 | 0.15 | 0.039032 |
| 4/30/2011 | 0.01 | 0 |
| 5/1/2011 | 0 | 0 |
| 5/2/2011 | 0 | 0 |
| 5/3/2011 | 0 | 0 |
| 5/4/2011 | 0.38 | 0.214074 |
| 5/5/2011 | 0.31 | 0.155106 |
| 5/6/2011 | 0 | 0 |
| 5/7/2011 | 0.1 | 0.013846 |
| 5/8/2011 | 0.05 | 0.000476 |
| 5/9/2011 | 0 | 0 |
| 5/10/2011 | 0 | 0 |
| 5/11/2011 | 0 | 0 |
| 5/12/2011 | 0 | 0 |
| 5/13/2011 | 0 | 0 |
| 5/14/2011 | 0.05 | 0.000476 |
| 5/15/2011 | 0.38 | 0.214074 |
| 5/16/2011 | 0.66 | 0.46878 |
| 5/17/2011 | 0.47 | 0.293492 |
| 5/18/2011 | 0.35 | 0.188431 |
| 5/19/2011 | 0.05 | 0.000476 |
| 5/20/2011 | 0.38 | 0.214074 |
| 5/21/2011 | 0.26 | 0.115238 |
| 5/22/2011 | 0 | 0 |
| 5/23/2011 | 0.06 | 0.001818 |
| 5/24/2011 | 0.01 | 0 |
| 5/25/2011 | 0 | 0 |
| 5/26/2011 | 0 | 0 |
| 5/27/2011 | 0 | 0 |
| 5/28/2011 | 0 | 0 |
| 5/29/2011 | 0 | 0 |
| 5/30/2011 | 0 | 0 |
| 5/31/2011 | 0 | 0 |
| 6/1/2011 | 0 | 0 |
| 6/2/2011 | 0 | 0 |
| 6/3/2011 | 0 | 0 |
| 6/4/2011 | 0 | 0 |
| 6/5/2011 | 0.1 | 0.013846 |
| 6/6/2011 | 0.06 | 0.001818 |
| 6/7/2011 | 0 | 0 |
| 6/8/2011 | 0 | 0 |
| 6/9/2011 | 0 | 0 |
| 6/10/2011 | 0.1 | 0.013846 |
| 6/11/2011 | 0.06 | 0.001818 |
| 6/12/2011 | 0.71 | 0.515977 |
| 6/13/2011 | 0.03 | 0 |
| 6/14/2011 | 0 | 0 |
| 6/15/2011 | 0.05 | 0.000476 |
| 6/16/2011 | 0 | 0 |
| 6/17/2011 | 0.46 | 0.284516 |
| 6/18/2011 | 0.34 | 0.18 |
| 6/19/2011 | 0 | 0 |
| 6/20/2011 | 0 | 0 |
| 6/21/2011 | 0.23 | 0.092564 |
| 6/22/2011 | 0.19 | 0.064286 |

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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/23/2020 | 0.07 | 0.003913 | 6/23/2019 | 0 | 0 | 6/23/2018 | 0.07 | 0.003913 | 6/23/2017 | 0.01 | 0 | 6/23/2016 | 0.07 | 0.003913 | 6/23/2015 | 0 | 0 | 6/23/2014 | 0 | 0 | 6/23/2013 | 0 | 0 | 6/23/2012 | 0.25 | 0.107561 | 6/23/2011 | 0 | 0 |
| 6/24/2020 | 0.03 | 0 | 6/24/2019 | 0 | 0 | 6/24/2018 | 0.09 | 0.01 | 6/24/2017 | 1.5 | 1.284096 | 6/24/2016 | 0.75 | 0.553956 | 6/24/2015 | 0.82 | 0.620816 | 6/24/2014 | 0 | 0 | 6/24/2013 | 0.03 | 0 | 6/24/2012 | 0 | 0 | 6/24/2011 | 0.14 | 0.033333 |
| 6/25/2020 | 0 | 0 | 6/25/2019 | 0.05 | 0.000476 | 6/25/2018 | 0.21 | 0.078108 | 6/25/2017 | 0 | 0 | 6/25/2016 | 0.02 | 0 | 6/25/2015 | 0 | 0 | 6/25/2014 | 0 | 0 | 6/25/2013 | 0.44 | 0.266667 | 6/25/2012 | 0.03 | 0 | 6/25/2011 | 0.07 | 0.003913 |
| 6/26/2020 | 0.05 | 0.000476 | 6/26/2019 | 0 | 0 | 6/26/2018 | 0 | 0 | 6/26/2017 | 0 | 0 | 6/26/2016 | 0 | 0 | 6/26/2015 | 0.19 | 0.064286 | 6/26/2014 | 0.47 | 0.293492 | 6/26/2013 | 0.11 | 0.018148 | 6/26/2012 | 0.02 | 0 | 6/26/2011 | 0 | 0 |
| 6/27/2020 | 0.06 | 0.001818 | 6/27/2019 | 0 | 0 | 6/27/2018 | 0 | 0 | 6/27/2017 | 0.16 | 0.045 | 6/27/2016 | 0 | 0 | 6/27/2015 | 0.29 | 0.138889 | 6/27/2014 | 0 | 0 | 6/27/2013 | 0.14 | 0.033333 | 6/27/2012 | 0 | 0 | 6/27/2011 | 0 | 0 |
| 6/28/2020 | 0.05 | 0.000476 | 6/28/2019 | 0 | 0 | 6/28/2018 | 0.43 | 0.257797 | 6/28/2017 | 0 | 0 | 6/28/2016 | 0.18 | 0.057647 | 6/28/2015 | 1.97 | 1.748779 | 6/28/2014 | 0 | 0 | 6/28/2013 | 0.96 | 0.755714 | 6/28/2012 | 0 | 0 | 6/28/2011 | 0 | 0 |
| 6/29/2020 | 0.14 | 0.033333 | 6/29/2019 | 0.08 | 0.006667 | 6/29/2018 | 0.01 | 0 | 6/29/2017 | 0 | 0 | 6/29/2016 | 0.04 | 2.41E-34 | 6/29/2015 | 0 | 0 | 6/29/2014 | 0 | 0 | 6/29/2013 | 1.32 | 1.107027 | 6/29/2012 | 0.17 | 0.051212 | 6/29/2011 | 0.18 | 0.057647 |
| 6/30/2020 | 0 | 0 | 6/30/2019 | 0.49 | 0.311538 | 6/30/2018 | 0 | 0 | 6/30/2017 | 0 | 0 | 6/30/2016 | 0 | 0 | 6/30/2015 | 0 | 0 | 6/30/2014 | 0 | 0 | 6/30/2013 | 0 | 0 | 6/30/2012 | 0.11 | 0.018148 | 6/30/2011 | 0 | 0 |
| 7/1/2020 | 0.02 | 0 | 7/1/2019 | 0 | 0 | 7/1/2018 | 0 | 0 | 7/1/2017 | 0 | 0 | 7/1/2016 | 0 | 0 | 7/1/2015 | 0.82 | 0.620816 | 7/1/2014 | 0 | 0 | 7/1/2013 | 1.13 | 0.921008 | 7/1/2012 | 0 | 0 | 7/1/2011 | 0 | 0 |
| 7/2/2020 | 0.02 | 0 | 7/2/2019 | 0 | 0 | 7/2/2018 | 0 | 0 | 7/2/2017 | 0.67 | 0.478193 | 7/2/2016 | 0.19 | 0.064286 | 7/2/2015 | 0 | 0 | 7/2/2014 | 0 | 0 | 7/2/2013 | 0.17 | 0.051212 | 7/2/2012 | 0 | 0 | 7/2/2011 | 0 | 0 |
| 7/3/2020 | 0 | 0 | 7/3/2019 | 0.56 | 0.375556 | 7/3/2018 | 0 | 0 | 7/3/2017 | 0 | 0 | 7/3/2016 | 0 | 0 | 7/3/2015 | 0.03 | 0 | 7/3/2014 | 0.3 | 0.146957 | 7/3/2013 | 0.02 | 0 | 7/3/2012 | 0 | 0 | 7/3/2011 | 0.02 | 0 |
| 7/4/2020 | 0.02 | 0 | 7/4/2019 | 0 | 0 | 7/4/2018 | 0.92 | 0.717037 | 7/4/2017 | 0.01 | 0 | 7/4/2016 | 0 | 0 | 7/4/2015 | 0 | 0 | 7/4/2014 | 0.26 | 0.115238 | 7/4/2013 | 0.27 | 0.123023 | 7/4/2012 | 0.01 | 0 | 7/4/2011 | 0.03 | 0 |
| 7/5/2020 | 0 | 0 | 7/5/2019 | 0.22 | 0.085263 | 7/5/2018 | 0.01 | 0 | 7/5/2017 | 0.21 | 0.078108 | 7/5/2016 | 0.48 | 0.3025 | 7/5/2015 | 0.08 | 0.006667 | 7/5/2014 | 0 | 0 | 7/5/2013 | 0 | 0 | 7/5/2012 | 0 | 0 | 7/5/2011 | 0 | 0 |
| 7/6/2020 | 0 | 0 | 7/6/2019 | 0.11 | 0.018148 | 7/6/2018 | 0.12 | 0.022857 | 7/6/2017 | 0.01 | 0 | 7/6/2016 | 0 | 0 | 7/6/2015 | 0 | 0 | 7/6/2014 | 0 | 0 | 7/6/2013 | 0 | 0 | 7/6/2012 | 0 | 0 | 7/6/2011 | 0 | 0 |
| 7/7/2020 | 0.84 | 0.64 | 7/7/2019 | 0.68 | 0.487619 | 7/7/2018 | 0.17 | 0.051212 | 7/7/2017 | 0.47 | 0.293492 | 7/7/2016 | 0 | 0 | 7/7/2015 | 0.03 | 0 | 7/7/2014 | 0 | 0 | 7/7/2013 | 0 | 0 | 7/7/2012 | 0 | 0 | 7/7/2011 | 0.02 | 0 |
| 7/8/2020 | 0 | 0 | 7/8/2019 | 0.09 | 0.01 | 7/8/2018 | 0 | 0 | 7/8/2017 | 0.64 | 0.45 | 7/8/2016 | 0 | 0 | 7/8/2015 | 0 | 0 | 7/8/2014 | 0 | 0 | 7/8/2013 | 0.31 | 0.155106 | 7/8/2012 | 0.06 | 0.001818 | 7/8/2011 | 0.02 | 0 |
| 7/9/2020 | 0.03 | 0 | 7/9/2019 | 0.15 | 0.039032 | 7/9/2018 | 0 | 0 | 7/9/2017 | 0.02 | 0 | 7/9/2016 | 0.03 | 0 | 7/9/2015 | 0.39 | 0.222727 | 7/9/2014 | 0.18 | 0.057647 | 7/9/2013 | 0.42 | 0.248966 | 7/9/2012 | 0 | 0 | 7/9/2011 | 0.78 | 0.582553 |
| 7/10/2020 | 0.1 | 0.013846 | 7/10/2019 | 0 | 0 | 7/10/2018 | 0 | 0 | 7/10/2017 | 0 | 0 | 7/10/2016 | 0.63 | 0.440633 | 7/10/2015 | 0.5 | 0.320606 | 7/10/2014 | 0 | 0 | 7/10/2013 | 0.01 | 0 | 7/10/2012 | 0.04 | 2.41E-34 | 7/10/2011 | 0.01 | 0 |
| 7/11/2020 | 2.56 | 2.334706 | 7/11/2019 | 0.24 | 0.1 | 7/11/2018 | 0 | 0 | 7/11/2017 | 0 | 0 | 7/11/2016 | 0 | 0 | 7/11/2015 | 0 | 0 | 7/11/2014 | 0.61 | 0.421948 | 7/11/2013 | 0.06 | 0.001818 | 7/11/2012 | 0 | 0 | 7/11/2011 | 0 | 0 |
| 7/12/2020 | 0 | 0 | 7/12/2019 | 1.84 | 1.62 | 7/12/2018 | 0 | 0 | 7/12/2017 | 0 | 0 | 7/12/2016 | 0 | 0 | 7/12/2015 | 0 | 0 | 7/12/2014 | 0 | 0 | 7/12/2013 | 0.05 | 0.000476 | 7/12/2012 | 0 | 0 | 7/12/2011 | 0.1 | 0.013846 |
| 7/13/2020 | 0.09 | 0.01 | 7/13/2019 | 0 | 0 | 7/13/2018 | 0 | 0 | 7/13/2017 | 0.01 | 0 | 7/13/2016 | 0 | 0 | 7/13/2015 | 0 | 0 | 7/13/2014 | 0.02 | 0 | 7/13/2013 | 2.49 | 2.265094 | 7/13/2012 | 0 | 0 | 7/13/2011 | 0 | 0 |
| 7/14/2020 | 0 | 0 | 7/14/2019 | 0 | 0 | 7/14/2018 | 0 | 0 | 7/14/2017 | 0.4 | 0.231429 | 7/14/2016 | 0.46 | 0.284516 | 7/14/2015 | 0.31 | 0.155106 | 7/14/2014 | 0.29 | 0.138889 | 7/14/2013 | 0.03 | 0 | 7/14/2012 | 0.36 | 0.196923 | 7/14/2011 | 0 | 0 |
| 7/15/2020 | 0 | 0 | 7/15/2019 | 0 | 0 | 7/15/2018 | 0 | 0 | 7/15/2017 | 1.21 | 0.999197 | 7/15/2016 | 0 | 0 | 7/15/2015 | 0.82 | 0.620816 | 7/15/2014 | 0.25 | 0.107561 | 7/15/2013 | 0 | 0 | 7/15/2012 | 0.37 | 0.205472 | 7/15/2011 | 0 | 0 |
| 7/16/2020 | 0 | 0 | 7/16/2019 | 0 | 0 | 7/16/2018 | 0.5 | 0.320606 | 7/16/2017 | 0 | 0 | 7/16/2016 | 0 | 0 | 7/16/2015 | 0.3 | 0.146957 | 7/16/2014 | 0.33 | 0.171633 | 7/16/2013 | 0 | 0 | 7/16/2012 | 0.62 | 0.431282 | 7/16/2011 | 0 | 0 |
| 7/17/2020 | 0.02 | 0 | 7/17/2019 | 0.05 | 0.000476 | 7/17/2018 | 0 | 0 | 7/17/2017 | 0 | 0 | 7/17/2016 | 0.11 | 0.018148 | 7/17/2015 | 0 | 0 | 7/17/2014 | 0 | 0 | 7/17/2013 | 0 | 0 | 7/17/2012 | 0 | 0 | 7/17/2011 | 0 | 0 |
| 7/18/2020 | 0 | 0 | 7/18/2019 | 0.54 | 0.357143 | 7/18/2018 | 1.19 | 0.97963 | 7/18/2017 | 0.18 | 0.057647 | 7/18/2016 | 0 | 0 | 7/18/2015 | 0 | 0 | 7/18/2014 | 0 | 0 | 7/18/2013 | 0 | 0 | 7/18/2012 | 0 | 0 | 7/18/2011 | 0 | 0 |
| 7/19/2020 | 0 | 0 | 7/19/2019 | 0.7 | 0.506512 | 7/19/2018 | 0 | 0 | 7/19/2017 | 0 | 0 | 7/19/2016 | 0.5 | 0.320606 | 7/19/2015 | 0 | 0 | 7/19/2014 | 0 | 0 | 7/19/2013 | 0.01 | 0 | 7/19/2012 | 0.03 | 0 | 7/19/2011 | 0 | 0 |
| 7/20/2020 | 0.02 | 0 | 7/20/2019 | 0 | 0 | 7/20/2018 | 0 | 0 | 7/20/2017 | 0 | 0 | 7/20/2016 | 0 | 0 | 7/20/2015 | 0 | 0 | 7/20/2014 | 0.01 | 0 | 7/20/2013 | 0 | 0 | 7/20/2012 | 0.51 | 0.329701 | 7/20/2011 | 0.14 | 0.033333 |
| 7/21/2020 | 0 | 0 | 7/21/2019 | 0 | 0 | 7/21/2018 | 0 | 0 | 7/21/2017 | 0 | 0 | 7/21/2016 | 0 | 0 | 7/21/2015 | 0 | 0 | 7/21/2014 | 0 | 0 | 7/21/2013 | 0.07 | 0.003913 | 7/21/2012 | 0.09 | 0.01 | 7/21/2011 | 0 | 0 |
| 7/22/2020 | 0.06 | 0.001818 | 7/22/2019 | 0.04 | 2.41E-34 | 7/22/2018 | 1.78 | 1.560619 | 7/22/2017 | 0 | 0 | 7/22/2016 | 0 | 0 | 7/22/2015 | 0.03 | 0 | 7/22/2014 | 0 | 0 | 7/22/2013 | 0.05 | 0.000476 | 7/22/2012 | 0 | 0 | 7/22/2011 | 0 | 0 |
| 7/23/2020 | 0.35 | 0.188431 | 7/23/2019 | 1.71 | 1.49139 | 7/23/2018 | 1.43 | 1.215157 | 7/23/2017 | 0.24 | 0.1 | 7/23/2016 | 0 | 0 | 7/23/2015 | 0 | 0 | 7/23/2014 | 0 | 0 | 7/23/2013 | 1.39 | 1.175806 | 7/23/2012 | 0 | 0 | 7/23/2011 | 0 | 0 |
| 7/24/2020 | 0.66 | 0.46878 | 7/24/2019 | 0.02 | 0 | 7/24/2018 | 1.09 | 0.882 | 7/24/2017 | 1.88 | 1.659608 | 7/24/2016 | 0.1 | 0.013846 | 7/24/2015 | 0 | 0 | 7/24/2014 | 0.55 | 0.366338 | 7/24/2013 | 0.07 | 0.003913 | 7/24/2012 | 0.02 | 0 | 7/24/2011 | 0.01 | 0 |
| 7/25/2020 | 0.05 | 0.000476 | 7/25/2019 | 0 | 0 | 7/25/2018 | 0.75 | 0.553956 | 7/25/2017 | 0.69 | 0.497059 | 7/25/2016 | 0.47 | 0.293492 | 7/25/2015 | 0 | 0 | 7/25/2014 | 0 | 0 | 7/25/2013 | 0 | 0 | 7/25/2012 | 0 | 0 | 7/25/2011 | 0.02 | 0 |
| 7/26/2020 | 0 | 0 | 7/26/2019 | 0 | 0 | 7/26/2018 | 0.54 | 0.357143 | 7/26/2017 | 0.01 | 0 | 7/26/2016 | 0.48 | 0.3025 | 7/26/2015 | 0 | 0 | 7/26/2014 | 0 | 0 | 7/26/2013 | 0 | 0 | 7/26/2012 | 0 | 0 | 7/26/2011 | 1.14 | 0.930769 |
| 7/27/2020 | 0 | 0 | 7/27/2019 | 0 | 0 | 7/27/2018 | 0.01 | 0 | 7/27/2017 | 0 | 0 | 7/27/2016 | 0 | 0 | 7/27/2015 | 0.4 | 0.231429 | 7/27/2014 | 0.05 | 0.000476 | 7/27/2013 | 0 | 0 | 7/27/2012 | 0.54 | 0.357143 | 7/27/2011 | 0.03 | 0 |
| 7/28/2020 | 0 | 0 | 7/28/2019 | 0 | 0 | 7/28/2018 | 0.18 | 0.057647 | 7/28/2017 | 0 | 0 | 7/28/2016 | 0 | 0 | 7/28/2015 | 0 | 0 | 7/28/2014 | 1.26 | 1.048169 | 7/28/2013 | 0.12 | 0.022857 | 7/28/2012 | 0 | 0 | 7/28/2011 | 0 | 0 |
| 7/29/2020 | 0 | 0 | 7/29/2019 | 0 | 0 | 7/29/2018 | 0 | 0 | 7/29/2017 | 0.32 | 0.163333 | 7/29/2016 | 1.07 | 0.86252 | 7/29/2015 | 0 | 0 | 7/29/2014 | 0.01 | 0 | 7/29/2013 | 0.82 | 0.620816 | 7/29/2012 | 0.16 | 0.045 | 7/29/2011 | 0.28 | 0.130909 |
| 7/30/2020 | 0 | 0 | 7/30/2019 | 0 | 0 | 7/30/2018 | 0 | 0 | 7/30/2017 | 0 | 0 | 7/30/2016 | 0 | 0 | 7/30/2015 | 0 | 0 | 7/30/2014 | 0 | 0 | 7/30/2013 | 0 | 0 | 7/30/2012 | 0.11 | 0.018148 | 7/30/2011 | 0.1 | 0.013846 |
| 7/31/2020 | 0.17 | 0.051212 | 7/31/2019 | 0 | 0 | 7/31/2018 | 0.01 | 0 | 7/31/2017 | 0 | 0 | 7/31/2016 | 1.25 | 1.038369 | 7/31/2015 | 0.67 | 0.478193 | 7/31/2014 | 0 | 0 | 7/31/2013 | 0 | 0 | 7/31/2012 | 0.02 | 0 | 7/31/2011 | 0 | 0 |
| 8/1/2020 | 0.06 | 0.001818 | 8/1/2019 | 0.09 | 0.01 | 8/1/2018 | 0.05 | 0.000476 | 8/1/2017 | 0 | 0 | 8/1/2016 | 0 | 0 | 8/1/2015 | 0 | 0 | 8/1/2014 | 0 | 0 | 8/1/2013 | 0.31 | 0.155106 | 8/1/2012 | 0.01 | 0 | 8/1/2011 | 0.01 | 0 |
| 8/2/2020 | 0.02 | 0 | 8/2/2019 | 0.17 | 0.051212 | 8/2/2018 | 0.22 | 0.085263 | 8/2/2017 | 0 | 0 | 8/2/2016 | 0.11 | 0.018148 | 8/2/2015 | 0 | 0 | 8/2/2014 | 0.45 | 0.275574 | 8/2/2013 | 1.3 | 1.087397 | 8/2/2012 | 0.11 | 0.018148 | 8/2/2011 | 0.13 | 0.027931 |
| 8/3/2020 | 0 | 0 | 8/3/2019 | 0.07 | 0.003913 | 8/3/2018 | 0.06 | 0.001818 | 8/3/2017 | 0.31 | 0.155106 | 8/3/2016 | 0 | 0 | 8/3/2015 | 0 | 0 | 8/3/2014 | 0.11 | 0.018148 | 8/3/2013 | 0 | 0 | 8/3/2012 | 0 | 0 | 8/3/2011 | 0.03 | 0 |
| 8/4/2020 | 1.21 | 0.999197 | 8/4/2019 | 0.01 | 0 | 8/4/2018 | 1.12 | 0.91125 | 8/4/2017 | 0.03 | 0 | 8/4/2016 | 0 | 0 | 8/4/2015 | 0.2 | 0.071111 | 8/4/2014 | 0.02 | 0 | 8/4/2013 | 0.03 | 0 | 8/4/2012 | 0.03 | 0 | 8/4/2011 | 0.43 | 0.257797 |
| 8/5/2020 | 4.76 | 4.52813 | 8/5/2019 | 0 | 0 | 8/5/2018 | 0.03 | 0 | 8/5/2017 | 0.63 | 0.440633 | 8/5/2016 | 0 | 0 | 8/5/2015 | 0 | 0 | 8/5/2014 | 0 | 0 | 8/5/2013 | 0 | 0 | 8/5/2012 | 0.14 | 0.033333 | 8/5/2011 | 0.02 | 0 |
| 8/6/2020 | 0.05 | 0.000476 | 8/6/2019 | 0 | 0 | 8/6/2018 | 0 | 0 | 8/6/2017 | 0 | 0 | 8/6/2016 | 0 | 0 | 8/6/2015 | 0 | 0 | 8/6/2014 | 0 | 0 | 8/6/2013 | 0 | 0 | 8/6/2012 | 0.31 | 0.155106 | 8/6/2011 | 0 | 0 |
| 8/7/2020 | 0.09 | 0.01 | 8/7/2019 | 0 | 0 | 8/7/2018 | 0 | 0 | 8/7/2017 | 0.18 | 0.057647 | 8/7/2016 | 0.01 | 0 | 8/7/2015 | 0.06 | 0.001818 | 8/7/2014 | 0.01 | 0 | 8/7/2013 | 0.06 | 0.001818 | 8/7/2012 | 0 | 0 | 8/7/2011 | 0.15 | 0.039032 |
| 8/8/2020 | 1.57 | 1.353121 | 8/8/2019 | 0.19 | 0.064286 | 8/8/2018 | 0.08 | 0.006667 | 8/8/2017 | 0.5 | 0.320606 | 8/8/2016 | 0 | 0 | 8/8/2015 | 0 | 0 | 8/8/2014 | 0 | 0 | 8/8/2013 | 0.25 | 0.107561 | 8/8/2012 | 0 | 0 | 8/8/2011 | 0.01 | 0 |
| 8/9/2020 | 0 | 0 | 8/9/2019 | 0.14 | 0.033333 | 8/9/2018 | 0.14 | 0.033333 | 8/9/2017 | 0 | 0 | 8/9/2016 | 0 | 0 | 8/9/2015 | 0 | 0 | 8/9/2014 | 0 | 0 | 8/9/2013 | 0.04 | 2.41E-34 | 8/9/2012 | 0 | 0 | 8/9/2011 | 0 | 0 |
| 8/10/2020 | 0.22 | 0.085263 | 8/10/2019 | 0 | 0 | 8/10/2018 | 0 | 0 | 8/10/2017 | 0 | 0 | 8/10/2016 | 0 | 0 | 8/10/2015 | 0.01 | 0 | 8/10/2014 | 0 | 0 | 8/10/2013 | 0.1 | 0.013846 | 8/10/2012 | 0.2 | 0.071111 | 8/10/2011 | 0.98 | 0.775088 |
| 8/11/2020 | 0 | 0 | 8/11/2019 | 0 | 0 | 8/11/2018 | 0.09 | 0.01 | 8/11/2017 | 0 | 0 | 8/11/2016 | 0 | 0 | 8/11/2015 | 0.58 | 0.394054 | 8/11/2014 | 0 | 0 | 8/11/2013 | 0 | 0 | 8/11/2012 | 0.93 | 0.726697 | 8/11/2011 | 0 | 0 |
| 8/12/2020 | 0 | 0 | 8/12/2019 | 0 | 0 | 8/12/2018 | 0.87 | 0.668835 | 8/12/2017 | 0.03 | 0 | 8/12/2016 | 0.01 | 0 | 8/12/2015 | 0.1 | 0.013846 | 8/12/2014 | 0.11 | 0.018148 | 8/12/2013 | 0 | 0 | 8/12/2012 | 0.05 | 0.000476 | 8/12/2011 | 0 | 0 |
| 8/13/2020 | 0.82 | 0.620816 | 8/13/2019 | 0 | 0 | 8/13/2018 | 1.27 | 1.057972 | 8/13/2017 | 0.06 | 0.001818 | 8/13/2016 | 0.15 | 0.039032 | 8/13/2015 | 0 | 0 | 8/13/2014 | 1.49 | 1.274242 | 8/13/2013 | 1.56 | 1.343256 | 8/13/2012 | 0 | 0 | 8/13/2011 | 0 | 0 |
| 8/14/2020 | 0.17 | 0.051212 | 8/14/2019 | 0.15 | 0.039032 | 8/14/2018 | 1.26 | 1.048169 | 8/14/2017 | 0 | 0 | 8/14/2016 | 0 | 0 | 8/14/2015 | 0 | 0 | 8/14/2014 | 0 | 0 | 8/14/2013 | 0.48 | 0.3025 | 8/14/2012 | 0 | 0 | 8/14/2011 | 1.16 | 0.950303 |
| 8/15/2020 | 0 | 0 | 8/15/2019 | 0.81 | 0.611237 | 8/15/2018 | 0.16 | 0.045 | 8/15/2017 | 0.07 | 0.003913 | 8/15/2016 | 0.04 | 2.41E-34 | 8/15/2015 | 0 | 0 | 8/15/2014 | 0.01 | 0 | 8/15/2013 | 0 | 0 | 8/15/2012 | 0.92 | 0.717037 | 8/15/2011 | 1.27 | 1.057972 |
| 8/16/2020 | 0.35 | 0.188431 | 8/16/2019 | 0 | 0 | 8/16/2018 | 0 | 0 | 8/16/2017 | 0.4 | 0.231429 | 8/16/2016 | 0.08 | 0.006667 | 8/16/2015 | 0 | 0 | 8/16/2014 | 0 | 0 | 8/16/2013 | 0 | 0 | 8/16/2012 | 0.01 | 0 | 8/16/2011 | 0.23 | 0.092564 |
| 8/17/2020 | 0.13 | 0.027931 | 8/17/2019 | 0 | 0 | 8/17/2018 | 0 | 0 | 8/17/2017 | 0 | 0 | 8/17/2016 | 0.09 | 0.01 | 8/17/2015 | 0 | 0 | 8/17/2014 | 0 | 0 | 8/17/2013 | 0 | 0 | 8/17/2012 | 0 | 0 | 8/17/2011 | 0 | 0 |
| 8/18/2020 | 0.33 | 0.171633 | 8/18/2019 | 0 | 0 | 8/18/2018 | 0.26 | 0.115238 | 8/18/2017 | 0 | 0 | 8/18/2016 | 0.25 | 0.107561 | 8/18/2015 | 0 | 0 | 8/18/2014 | 0.01 | 0 | 8/18/2013 | 0.04 | 2.41E-34 | 8/18/2012 | 1.29 | 1.077586 | 8/18/2011 | 0.6 | 0.412632 |
| 8/19/2020 | 0.01 | 0 | 8/19/2019 | 0.05 | 0.000476 | 8/19/2018 | 0.27 | 0.123023 | 8/19/2017 | 0.87 | 0.668835 | 8/19/2016 | 0.24 | 0.1 | 8/19/2015 | 0.05 | 0.000476 | 8/19/2014 | 0 | 0 | 8/19/2013 | 0.01 | 0 | 8/19/2012 | 0 | 0 | 8/19/2011 | 0.95 | 0.746036 |
| 8/20/2020 | 0.03 | 0 | 8/20/2019 | 0 | 0 | 8/20/2018 | 1.15 | 0.940534 | 8/20/2017 | 0 | 0 | 8/20/2016 | 0 | 0 | 8/20/2015 | 0.11 | 0.018148 | 8/20/2014 | 0 | 0 | 8/20/2013 | 0 | 0 | 8/20/2012 | 0 | 0 | 8/20/2011 | 0.6 | 0.412632 |
| 8/21/2020 | 0 | 0 | 8/21/2019 | 0 | 0 | 8/21/2018 | 0 | 0 | 8/21/2017 | 0 | 0 | 8/21/2016 | 0 | 0 | 8/21/2015 | 0.99 | 0.784783 | 8/21/2014 | 0 | 0 | 8/21/2013 | 0 | 0 | 8/21/2012 | 0.06 | 0.001818 | 8/21/2011 | 0 | 0 |
| 8/22/2020 | 0 | 0 | 8/22/2019 | 0.35 | 0.188431 | 8/22/2018 | 0.89 | 0.688095 | 8/22/2017 | 0.01 | 0 | 8/22/2016 | 0.8 | 0.601667 | 8/22/2015 | 0 | 0 | 8/22/2014 | 0.11 | 0.018148 | 8/22/2013 | 0.01 | 0 | 8/22/2012 | 0 | 0 | 8/22/2011 | 0.54 | 0.357143 |
| 8/23/2020 | 0 | 0 | 8/23/2019 | 0.14 | 0.033333 | 8/23/2018 | 0 | 0 | 8/23/2017 | 0.97 | 0.765398 | 8/23/2016 | 0 | 0 | 8/23/2015 | 0.07 | 0.003913 | 8/23/2014 | 0 | 0 | 8/23/2013 | 0.13 | 0.027931 | 8/23/2012 | 0 | 0 | 8/23/2011 | 0 | 0 |
| 8/24/2020 | 0.54 | 0.357143 | 8/24/2019 | 0.21 | 0.078108 | 8/24/2018 | 0 | 0 | 8/24/2017 | 0 | 0 | 8/24/2016 | 0 | 0 | 8/24/2015 | 0 | 0 | 8/24/2014 | 0.11 | 0.018148 | 8/24/2013 | 0 | 0 | 8/24/2012 | 0 | 0 | 8/24/2011 | 0 | 0 |
| 8/25/2020 | 0 | 0 | 8/25/2019 | 0 | 0 | 8/25/2018 | 0 | 0 | 8/25/2017 | 0.01 | 0 | 8/25/2016 | 0 | 0 | 8/25/2015 | 0 | 0 | 8/25/2014 | 0 | 0 | 8/25/2013 | 0 | 0 | 8/25/2012 | 0 | 0 | 8/25/2011 | 0 | 0 |
| 8/26/2020 | 0.01 | 0 | 8/26/2019 | 0 | 0 | 8/26/2018 | 0 | 0 | 8/26/2017 | 0 | 0 | 8/26/2016 | 0 | 0 | 8/26/2015 | 0 | 0 | 8/26/2014 | 0 | 0 | 8/26/2013 | 0 | 0 | 8/26/2012 | 0 | 0 | 8/26/2011 | 0.87 | 0.668835 |
| 8/27/2020 | 0 | 0 | 8/27/2019 | 0 | 0 | 8/27/2018 | 0 | 0 | 8/27/2017 | 0 | 0 | 8/27/2016 | 0 | 0 | 8/27/2015 | 0 | 0 | 8/27/2014 | 0 | 0 | 8/27/2013 | 0 | 0 | 8/27/2012 | 0.63 | 0.440633 | 8/27/2011 | 0 | 0 |
| 8/28/2020 | 0 | 0 | 8/28/2019 | 0 | 0 | 8/28/2018 | 0 | 0 | 8/28/2017 | 0 | 0 | 8/28/2016 | 0 | 0 | 8/28/2015 | 0 | 0 | 8/28/2014 | 0 | 0 | 8/28/2013 | 0 | 0 | 8/28/2012 | 0.44 | 0.266667 | 8/28/2011 | 6.37 | 6.136126 |
| 8/29/2020 | 0.48 | 0.3025 | 8/29/2019 | 0.02 | 0 | 8/29/2018 | 0 | 0 | 8/29/2017 | 0 | 0 | 8/29/2016 | 0 | 0 | 8/29/2015 | 0 | 0 | 8/29/2014 | 0 | 0 | 8/29/2013 | 1.14 | 0.930769 | 8/29/2012 | 0.03 | 0 | 8/29/2011 | 0.15 | 0.039032 |
| 8/30/2020 | 0.17 | 0.051212 | 8/30/2019 | 0 | 0 | 8/30/2018 | 0 | 0 | 8/30/2017 | 0.6 | 0.412632 | 8/30/2016 | 0 | 0 | 8/30/2015 | 0 | 0 | 8/30/2014 | 0 | 0 | 8/30/2013 | 0.48 | 0.3025 | 8/30/2012 | 0 | 0 | 8/30/2011 | 0 | 0 |
| 8/31/2020 | 0 | 0 | 8/31/2019 | 0 | 0 | 8/31/2018 | 0 | 0 | 8/31/2017 | 0 | 0 | 8/31/2016 | 0 | 0 | 8/31/2015 | 0 | 0 | 8/31/2014 | 0 | 0 | 8/31/2013 | 0 | 0 | 8/31/2012 | 0 | 0 | 8/31/2011 | 0 | 0 |
| 9/1/2020 | 0.08 | 0.006667 | 9/1/2019 | 0 | 0 | 9/1/2018 | 1.22 | 1.008986 | 9/1/2017 | 0.07 | 0.003913 | 9/1/2016 | 0.34 | 0.18 | 9/1/2015 | 0.02 | 0 | 9/1/2014 | 1.08 | 0.872258 | 9/1/2013 | 0 | 0 | 9/1/2012 | 0 | 0 | 9/1/2011 | 0 | 0 |
| 9/2/2020 | 0.03 | 0 | 9/2/2019 | 0 | 0 | 9/2/2018 | 0.04 | 2.41E-34 | 9/2/2017 | 0 | 0 | 9/2/2016 | 0.04 | 2.41E-34 | 9/2/2015 | 0 | 0 | 9/2/2014 | 0.13 | 0.027931 | 9/2/2013 | 0 | 0 | 9/2/2012 | 0.03 | 0 | 9/2/2011 | 0 | 0 |
| 9/3/2020 | 0.17 | 0.051212 | 9/3/2019 | 0.25 | 0.107561 | 9/3/2018 | 0 | 0 | 9/3/2017 | 1.06 | 0.852787 | 9/3/2016 | 0 | 0 | 9/3/2015 | 0 | 0 | 9/3/2014 | 0.34 | 0.18 | 9/3/2013 | 0.33 | 0.171633 | 9/3/2012 | 1.19 | 0.97963 | 9/3/2011 | 0 | 0 |
| 9/4/2020 | 0.25 | 0.107561 | 9/4/2019 | 0 | 0 | 9/4/2018 | 0.13 | 0.027931 | 9/4/2017 | 0.01 | 0 | 9/4/2016 | 0 | 0 | 9/4/2015 | 0.14 | 0.033333 | 9/4/2014 | 0 | 0 | 9/4/2013 | 0 | 0 | 9/4/2012 | 1.58 | 1.362989 | 9/4/2011 | 0 | 0 |
| 9/5/2020 | 0 | 0 | 9/5/2019 | 0.06 | 0.001818 | 9/5/2018 | 0 | 0 | 9/5/2017 | 0 | 0 | 9/5/2016 | 0 | 0 | 9/5/2015 | 0.01 | 0 | 9/5/2014 | 0 | 0 | 9/5/2013 | 0 | 0 | 9/5/2012 | 0.24 | 0.1 | 9/5/2011 | 0.07 | 0.003913 |
| 9/6/2020 | 0 | 0 | 9/6/2019 | 0 | 0 | 9/6/2018 | 0 | 0 | 9/6/2017 | 0.53 | 0.347971 | 9/6/2016 | 0 | 0 | 9/6/2015 | 0 | 0 | 9/6/2014 | 0 | 0 | 9/6/2013 | 0 | 0 | 9/6/2012 | 0.01 | 0 | 9/6/2011 | 1.85 | 1.6299 |
| 9/7/2020 | 0 | 0 | 9/7/2019 | 0.01 | 0 | 9/7/2018 | 0.3 | 0.146957 | 9/7/2017 | 0.39 | 0.222727 | 9/7/2016 | 0 | 0 | 9/7/2015 | 0 | 0 | 9/7/2014 | 1.03 | 0.823613 | 9/7/2013 | 0 | 0 | 9/7/2012 | 0 | 0 | 9/7/2011 | 2.63 | 2.404337 |
| 9/8/2020 | 0 | 0 | 9/8/2019 | 0 | 0 | 9/8/2018 | 1.11 | 0.901496 | 9/8/2017 | 0 | 0 | 9/8/2016 | 0 | 0 | 9/8/2015 | 0 | 0 | 9/8/2014 | 0 | 0 | 9/8/2013 | 0.01 | 0 | 9/8/2012 | 0 | 0 | 9/8/2011 | 0.84 | 0.64 |
| 9/9/2020 | 0 | 0 | 9/9/2019 | 0 | 0 | 9/9/2018 | 1.11 | 0.901496 | 9/9/2017 | 0 | 0 | 9/9/2016 | 0 | 0 | 9/9/2015 | 0 | 0 | 9/9/2014 | 0 | 0 | 9/9/2013 | 0 | 0 | 9/9/2012 | 0.52 | 0.338824 | 9/9/2011 | 0.22 | 0.085263 |
| 9/10/2020 | 0.19 | 0.064286 | 9/10/2019 | 0 | 0 | 9/10/2018 | 1.24 | 1.028571 | 9/10/2017 | 0 | 0 | 9/10/2016 | 0.01 | 0 | 9/10/2015 | 0.2 | 0.071111 | 9/10/2014 | 0 | 0 | 9/10/2013 | 0 | 0 | 9/10/2012 | 0 | 0 | 9/10/2011 | 0.01 | 0 |
| 9/11/2020 | 0.49 | 0.311538 | 9/11/2019 | 0 | 0 | 9/11/2018 | 0.14 | 0.033333 | 9/11/2017 | 0 | 0 | 9/11/2016 | 0 | 0 | 9/11/2015 | 1.16 | 0.950303 | 9/11/2014 | 0 | 0 | 9/11/2013 | 0 | 0 | 9/11/2012 | 0 | 0 | 9/11/2011 | 0 | 0 |
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| 11/4/2020 | 0 | 0 |
| 11/5/2020 | 0 | 0 |
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| 11/17/2020 | 0 | 0 |
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| 9/23/2019 | 0 | 0 |
| 9/24/2019 | 0.02 | 0 |
| 9/25/2019 | 0 | 0 |
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| 9/27/2019 | 0.04 | 2.41E-34 |
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| 10/8/2019 | 0.38 | 0.214074 |
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| 10/19/2019 | 0 | 0 |
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| 9/21/2018 | 0 | 0 |
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| 9/23/2018 | 0.02 | 0 |
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| 9/25/2018 | 0.19 | 0.064286 |
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| 10/7/2018 | 0 | 0 |
| 10/8/2018 | 0 | 0 |
| 10/9/2018 | 0.02 | 0 |
| 10/10/201 | 0.01 | 0 |
| 10/11/201 | 0.01 | 0 |
| 10/12/201 | 0.71 | 0.515977 |
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| 10/15/201 | 0.06 | 0.001818 |
| 10/16/201 | 0.17 | 0.051212 |
| 10/17/201 | 0 | 0 |
| 10/18/201 | 0 | 0 |
| 10/19/201 | 0.01 | 0 |
| 10/20/201 | 0.11 | 0.018148 |
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| 10/23/201 | 0 | 0 |
| 10/24/201 | 0 | 0 |
| 10/25/201 | 0 | 0 |
| 10/26/201 | 0 | 0 |
| 10/27/201 | 0.9 | 0.697736 |
| 10/28/201 | 0.16 | 0.045 |
| 10/29/201 | 0.06 | 0.001818 |
| 10/30/201 | 0.01 | 0 |
| 10/31/201 | 0 | 0 |
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| 11/2/2018 | 0.01 | 0 |
| 11/3/2018 | 1.32 | 1.107027 |
| 11/4/2018 | 0.01 | 0 |
| 11/5/2018 | 0.06 | 0.001818 |
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| 11/7/2018 | 0.65 | 0.459383 |
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| 11/9/2018 | 0 | 0 |
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| 9/23/2017 | 0 | 0 |
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| 9/29/2017 | 0 | 0 |
| 9/30/2017 | 0 | 0 |
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| 10/2/2017 | 0 | 0 |
| 10/3/2017 | 0 | 0 |
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| 10/5/2017 | 0 | 0 |
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| 10/12/2017 | 0.4 | 0.231429 |
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| 10/16/2017 | 0.08 | 0.006667 |
| 10/17/2017 | 0 | 0 |
| 10/18/2017 | 0 | 0 |
| 10/19/2017 | 0 | 0 |
| 10/20/2017 | 0 | 0 |
| 10/21/2017 | 0 | 0 |
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| 10/26/2017 | 0 | 0 |
| 10/27/2017 | 0 | 0 |
| 10/28/2017 | 0 | 0 |
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| 11/2/2017 | 0 | 0 |
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| 11/7/2017 | 0.01 | 0 |
| 11/8/2017 | 0.41 | 0.240175 |
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| 11/10/2017 | 0.02 | 0 |
| 11/11/2017 | 0 | 0 |
| 11/12/2017 | 0 | 0 |
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| 11/16/2017 | 0.01 | 0 |
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| 11/23/2017 | 0 | 0 |
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| 11/25/2017 | 0 | 0 |
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| 12/1/2017 | 0.03 | 0 |
| 12/2/2017 | 0 | 0 |
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| 9/15/2016 | 0 | 0 |
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| 11/5/2016 | 0 | 0 |
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| 9/18/2015 | 0 | 0 |
| 9/19/2015 | 0 | 0 |
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| 9/23/2015 | 0 | 0 |
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| 11/9/2015 | 0 | 0 |
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| 9/22/2014 | 0.08 | 0.006667 |
| 9/23/2014 | 0 | 0 |
| 9/24/2014 | 0 | 0 |
| 9/25/2014 | 0.49 | 0.311538 |
| 9/26/2014 | 0.35 | 0.188431 |
| 9/27/2014 | 0 | 0 |
| 9/28/2014 | 0 | 0 |
| 9/29/2014 | 0 | 0 |
| 9/30/2014 | 0.03 | 0 |
| 10/1/2014 | 0 | 0 |
| 10/2/2014 | 0 | 0 |
| 10/3/2014 | 0 | 0 |
| 10/4/2014 | 0.36 | 0.196923 |
| 10/5/2014 | 0.07 | 0.003913 |
| 10/6/2014 | 0 | 0 |
| 10/7/2014 | 0.01 | 0 |
| 10/8/2014 | 0.61 | 0.421948 |
| 10/9/2014 | 0 | 0 |
| 10/10/201 | 0 | 0 |
| 10/11/201 | 0.35 | 0.188431 |
| 10/12/201 | 0.14 | 0.033333 |
| 10/13/201 | 0.01 | 0 |
| 10/14/201 | 0.06 | 0.001818 |
| 10/15/201 | 0 | 0 |
| 10/16/201 | 1.2 | 0.989412 |
| 10/17/201 | 0 | 0 |
| 10/18/201 | 0 | 0 |
| 10/19/201 | 0 | 0 |
| 10/20/201 | 0 | 0 |
| 10/21/201 | 0.02 | 0 |
| 10/22/201 | 0.31 | 0.155106 |
| 10/23/201 | 0.33 | 0.171633 |
| 10/24/201 | 0.03 | 0 |
| 10/25/201 | 0 | 0 |
| 10/26/201 | 0 | 0 |
| 10/27/201 | 0 | 0 |
| 10/28/201 | 0 | 0 |
| 10/29/201 | 0 | 0 |
| 10/30/201 | 0.06 | 0.001818 |
| 10/31/201 | 0 | 0 |
| 11/1/2014 | 0.18 | 0.057647 |
| 11/2/2014 | 0.35 | 0.188431 |
| 11/3/2014 | 0 | 0 |
| 11/4/2014 | 0 | 0 |
| 11/5/2014 | 0 | 0 |
| 11/6/2014 | 0.49 | 0.311538 |
| 11/7/2014 | 0.22 | 0.085263 |
| 11/8/2014 | 0.01 | 0 |
| 11/9/2014 | 0 | 0 |
| 11/10/201 | 0 | 0 |
| 11/11/201 | 0 | 0 |
| 11/12/201 | 0 | 0 |
| 11/13/201 | 0 | 0 |
| 11/14/201 | 0.18 | 0.057647 |
| 11/15/201 | 0 | 0 |
| 11/16/201 | 0 | 0 |
| 11/17/201 | 0.37 | 0.205472 |
| 11/18/201 | 0.75 | 0.553956 |
| 11/19/201 | 0 | 0 |
| 11/20/201 | 0 | 0 |
| 11/21/201 | 0 | 0 |
| 11/22/201 | 0 | 0 |
| 11/23/201 | 0 | 0 |
| 11/24/201 | 0.74 | 0.544444 |
| 11/25/201 | 0 | 0 |
| 11/26/201 | 0.24 | 0.1 |
| 11/27/201 | 1.07 | 0.86252 |
| 11/28/201 | 0 | 0 |
| 11/29/201 | 0 | 0 |
| 11/30/201 | 0 | 0 |
| 12/1/2014 | 0 | 0 |
| 12/2/2014 | 0.08 | 0.006667 |
| 12/3/2014 | 0.25 | 0.107561 |

| | | |
|---|---|---|
| 9/13/2013 | 0.43 | 0.257797 |
| 9/14/2013 | 0 | 0 |
| 9/15/2013 | 0 | 0 |
| 9/16/2013 | 0 | 0 |
| 9/17/2013 | 0.08 | 0.006667 |
| 9/18/2013 | 0 | 0 |
| 9/19/2013 | 0 | 0 |
| 9/20/2013 | 0 | 0 |
| 9/21/2013 | 0 | 0 |
| 9/22/2013 | 1.34 | 1.126667 |
| 9/23/2013 | 0 | 0 |
| 9/24/2013 | 0 | 0 |
| 9/25/2013 | 0 | 0 |
| 9/26/2013 | 0 | 0 |
| 9/27/2013 | 0 | 0 |
| 9/28/2013 | 0 | 0 |
| 9/29/2013 | 0 | 0 |
| 9/30/2013 | 0 | 0 |
| 10/1/2013 | 0 | 0 |
| 10/2/2013 | 0 | 0 |
| 10/3/2013 | 0 | 0 |
| 10/4/2013 | 0 | 0 |
| 10/5/2013 | 0 | 0 |
| 10/6/2013 | 0 | 0 |
| 10/7/2013 | 0.01 | 0 |
| 10/8/2013 | 0.58 | 0.394054 |
| 10/9/2013 | 0 | 0 |
| 10/10/201 | 0.19 | 0.064286 |
| 10/11/201 | 2.86 | 2.633245 |
| 10/12/201 | 0.69 | 0.497059 |
| 10/13/201 | 0.01 | 0 |
| 10/14/201 | 0 | 0 |
| 10/15/201 | 0 | 0 |
| 10/16/201 | 0 | 0 |
| 10/17/201 | 0 | 0 |
| 10/18/201 | 0.08 | 0.006667 |
| 10/19/201 | 0 | 0 |
| 10/20/201 | 0.11 | 0.018148 |
| 10/21/201 | 0 | 0 |
| 10/22/201 | 0 | 0 |
| 10/23/201 | 0.01 | 0 |
| 10/24/201 | 0 | 0 |
| 10/25/201 | 0 | 0 |
| 10/26/201 | 0 | 0 |
| 10/27/201 | 0 | 0 |
| 10/28/201 | 0 | 0 |
| 10/29/201 | 0 | 0 |
| 10/30/201 | 0 | 0 |
| 10/31/201 | 0.06 | 0.001818 |
| 11/1/2013 | 0.06 | 0.001818 |
| 11/2/2013 | 0.22 | 0.085263 |
| 11/3/2013 | 0 | 0 |
| 11/4/2013 | 0 | 0 |
| 11/5/2013 | 0 | 0 |
| 11/6/2013 | 0 | 0 |
| 11/7/2013 | 0 | 0 |
| 11/8/2013 | 0.1 | 0.013846 |
| 11/9/2013 | 0 | 0 |
| 11/10/201 | 0 | 0 |
| 11/11/201 | 0 | 0 |
| 11/12/201 | 0 | 0 |
| 11/13/201 | 0 | 0 |
| 11/14/201 | 0 | 0 |
| 11/15/201 | 0 | 0 |
| 11/16/201 | 0.05 | 0.000476 |
| 11/17/201 | 0.01 | 0 |
| 11/18/201 | 0.09 | 0.01 |
| 11/19/201 | 0 | 0 |
| 11/20/201 | 0 | 0 |
| 11/21/201 | 0 | 0 |
| 11/22/201 | 0 | 0 |
| 11/23/201 | 0.04 | 2.41E-34 |
| 11/24/201 | 0 | 0 |
| 11/25/201 | 0 | 0 |
| 11/26/201 | 0 | 0 |
| 11/27/201 | 2.48 | 2.255152 |
| 11/28/201 | 0.16 | 0.045 |
| 11/29/201 | 0 | 0 |
| 11/30/201 | 0 | 0 |
| 12/1/2013 | 0 | 0 |
| 12/2/2013 | 0 | 0 |
| 12/3/2013 | 0 | 0 |

| | | |
|---|---|---|
| 9/13/2012 | 0 | 0 |
| 9/14/2012 | 0 | 0 |
| 9/15/2012 | 0 | 0 |
| 9/16/2012 | 0 | 0 |
| 9/17/2012 | 0 | 0 |
| 9/18/2012 | 0.57 | 0.384795 |
| 9/19/2012 | 0.81 | 0.611237 |
| 9/20/2012 | 0 | 0 |
| 9/21/2012 | 0 | 0 |
| 9/22/2012 | 0 | 0 |
| 9/23/2012 | 0.19 | 0.064286 |
| 9/24/2012 | 0 | 0 |
| 9/25/2012 | 0 | 0 |
| 9/26/2012 | 0 | 0 |
| 9/27/2012 | 0.32 | 0.163333 |
| 9/28/2012 | 0.08 | 0.006667 |
| 9/29/2012 | 0.02 | 0 |
| 9/30/2012 | 0 | 0 |
| 10/1/2012 | 0.01 | 0 |
| 10/2/2012 | 0.01 | 0 |
| 10/3/2012 | 0.85 | 0.649604 |
| 10/4/2012 | 0.02 | 0 |
| 10/5/2012 | 0.02 | 0 |
| 10/6/2012 | 0 | 0 |
| 10/7/2012 | 0.02 | 0 |
| 10/8/2012 | 0.11 | 0.018148 |
| 10/9/2012 | 0.04 | 2.41E-34 |
| 10/10/201 | 0.05 | 0.000476 |
| 10/11/201 | 0 | 0 |
| 10/12/201 | 0 | 0 |
| 10/13/201 | 0 | 0 |
| 10/14/201 | 0 | 0 |
| 10/15/201 | 0 | 0 |
| 10/16/201 | 0.76 | 0.563478 |
| 10/17/201 | 0 | 0 |
| 10/18/201 | 0 | 0 |
| 10/19/201 | 0.65 | 0.459383 |
| 10/20/201 | 0.41 | 0.240175 |
| 10/21/201 | 0 | 0 |
| 10/22/201 | 0 | 0 |
| 10/23/201 | 0 | 0 |
| 10/24/201 | 0.01 | 0 |
| 10/25/201 | 0 | 0 |
| 10/26/201 | 0 | 0 |
| 10/27/201 | 0 | 0 |
| 10/28/201 | 0.05 | 0.000476 |
| 10/29/201 | 1 | 0.794483 |
| 10/30/201 | 4.35 | 4.118869 |
| 10/31/201 | 0.45 | 0.275574 |
| 11/1/2012 | 0.01 | 0 |
| 11/2/2012 | 0 | 0 |
| 11/3/2012 | 0 | 0 |
| 11/4/2012 | 0 | 0 |
| 11/5/2012 | 0 | 0 |
| 11/6/2012 | 0 | 0 |
| 11/7/2012 | 0 | 0 |
| 11/8/2012 | 0.15 | 0.039032 |
| 11/9/2012 | 0 | 0 |
| 11/10/201 | 0 | 0 |
| 11/11/201 | 0 | 0 |
| 11/12/201 | 0 | 0 |
| 11/13/201 | 0.38 | 0.214074 |
| 11/14/201 | 0.08 | 0.006667 |
| 11/15/201 | 0 | 0 |
| 11/16/201 | 0 | 0 |
| 11/17/201 | 0 | 0 |
| 11/18/201 | 0 | 0 |
| 11/19/201 | 0 | 0 |
| 11/20/201 | 0 | 0 |
| 11/21/201 | 0 | 0 |
| 11/22/201 | 0 | 0 |
| 11/23/201 | 0 | 0 |
| 11/24/201 | 0 | 0 |
| 11/25/201 | 0 | 0 |
| 11/26/201 | 0 | 0 |
| 11/27/201 | 0.3 | 0.146957 |
| 11/28/201 | 0.39 | 0.222727 |
| 11/29/201 | 0 | 0 |
| 11/30/201 | 0 | 0 |
| 12/1/2012 | 0 | 0 |
| 12/2/2012 | 0 | 0 |
| 12/3/2012 | 0.02 | 0 |

| | | |
|---|---|---|
| 9/13/2011 | 0 | 0 |
| 9/14/2011 | 0 | 0 |
| 9/15/2011 | 0 | 0 |
| 9/16/2011 | 0.13 | 0.027931 |
| 9/17/2011 | 0 | 0 |
| 9/18/2011 | 0.02 | 0 |
| 9/19/2011 | 0 | 0 |
| 9/20/2011 | 0 | 0 |
| 9/21/2011 | 0.07 | 0.003913 |
| 9/22/2011 | 0.06 | 0.001818 |
| 9/23/2011 | 0.02 | 0 |
| 9/24/2011 | 2.97 | 2.74278 |
| 9/25/2011 | 0.01 | 0 |
| 9/26/2011 | 0 | 0 |
| 9/27/2011 | 0 | 0 |
| 9/28/2011 | 0.61 | 0.421948 |
| 9/29/2011 | 0.37 | 0.205472 |
| 9/30/2011 | 0.28 | 0.130909 |
| 10/1/2011 | 0.03 | 0 |
| 10/2/2011 | 0.47 | 0.293492 |
| 10/3/2011 | 0.26 | 0.115238 |
| 10/4/2011 | 0.01 | 0 |
| 10/5/2011 | 0 | 0 |
| 10/6/2011 | 0 | 0 |
| 10/7/2011 | 0 | 0 |
| 10/8/2011 | 0 | 0 |
| 10/9/2011 | 0 | 0 |
| 10/10/2011 | 0 | 0 |
| 10/11/2011 | 0 | 0 |
| 10/12/2011 | 0.09 | 0.01 |
| 10/13/2011 | 0.31 | 0.155106 |
| 10/14/2011 | 0.16 | 0.045 |
| 10/15/2011 | 0.4 | 0.231429 |
| 10/16/2011 | 0.08 | 0.006667 |
| 10/17/2011 | 0 | 0 |
| 10/18/2011 | 0 | 0 |
| 10/19/2011 | 0.23 | 0.092564 |
| 10/20/2011 | 0.36 | 0.196923 |
| 10/21/2011 | 0 | 0 |
| 10/22/2011 | 0 | 0 |
| 10/23/2011 | 0 | 0 |
| 10/24/2011 | 0 | 0 |
| 10/25/2011 | 0.03 | 0 |
| 10/26/2011 | 0 | 0 |
| 10/27/2011 | 0.06 | 0.001818 |
| 10/28/2011 | 0.15 | 0.039032 |
| 10/29/2011 | 0.18 | 0.057647 |
| 10/30/2011 | 0.84 | 0.64 |
| 10/31/2011 | 0 | 0 |
| 11/1/2011 | 0 | 0 |
| 11/2/2011 | 0 | 0 |
| 11/3/2011 | 0 | 0 |
| 11/4/2011 | 0 | 0 |
| 11/5/2011 | 0 | 0 |
| 11/6/2011 | 0 | 0 |
| 11/7/2011 | 0 | 0 |
| 11/8/2011 | 0 | 0 |
| 11/9/2011 | 0 | 0 |
| 11/10/2011 | 0 | 0 |
| 11/11/2011 | 0.1 | 0.013846 |
| 11/12/2011 | 0 | 0 |
| 11/13/2011 | 0 | 0 |
| 11/14/2011 | 0 | 0 |
| 11/15/2011 | 0 | 0 |
| 11/16/2011 | 0.27 | 0.123023 |
| 11/17/2011 | 0.36 | 0.196923 |
| 11/18/2011 | 0 | 0 |
| 11/19/2011 | 0 | 0 |
| 11/20/2011 | 0 | 0 |
| 11/21/2011 | 0.31 | 0.155106 |
| 11/22/2011 | 0.2 | 0.071111 |
| 11/23/2011 | 1.69 | 1.471622 |
| 11/24/2011 | 0.05 | 0.000476 |
| 11/25/2011 | 0 | 0 |
| 11/26/2011 | 0 | 0 |
| 11/27/2011 | 0 | 0 |
| 11/28/2011 | 0 | 0 |
| 11/29/2011 | 0.04 | 2.41E-34 |
| 11/30/2011 | 0.89 | 0.688095 |
| 12/1/2011 | 0 | 0 |
| 12/2/2011 | 0 | 0 |
| 12/[illegible] | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/4/2020 | 0 | 0 | 12/4/2019 | 0 | 0 | 12/4/2018 | 0 | 0 | 12/4/2017 | 0 | 0 | 12/4/2016 | 0 | 0 | 12/4/2015 | 0 | 0 | 12/4/2014 | 0.14 | 0.033333 | 12/4/2013 | 0 | 0 | 12/4/2012 | 0 | 0 | 12/4/2011 | 0 | 0 |
| 12/5/2020 | 1.09 | 0.882 | 12/5/2019 | 0.12 | 0.022857 | 12/5/2018 | 0 | 0 | 12/5/2017 | 0 | 0 | 12/5/2016 | 0.15 | 0.039032 | 12/5/2015 | 0 | 0 | 12/5/2014 | 0 | 0 | 12/5/2013 | 0 | 0 | 12/5/2012 | 0 | 0 | 12/5/2011 | 0 | 0 |
| 12/6/2020 | 0.03 | 0 | 12/6/2019 | 0 | 0 | 12/6/2018 | 0 | 0 | 12/6/2017 | 0.24 | 0.1 | 12/6/2016 | 0.01 | 0 | 12/6/2015 | 0 | 0 | 12/6/2014 | 0.22 | 0.085263 | 12/6/2013 | 0.2 | 0.071111 | 12/6/2012 | 0 | 0 | 12/6/2011 | 0.04 | 2.41E-34 |
| 12/7/2020 | 0 | 0 | 12/7/2019 | 0.03 | 0 | 12/7/2018 | 0 | 0 | 12/7/2017 | 0 | 0 | 12/7/2016 | 0.77 | 0.573011 | 12/7/2015 | 0 | 0 | 12/7/2014 | 0.6 | 0.412632 | 12/7/2013 | 0.84 | 0.64 | 12/7/2012 | 0 | 0 | 12/7/2011 | 0.22 | 0.085263 |
| 12/8/2020 | 0 | 0 | 12/8/2019 | 0 | 0 | 12/8/2018 | 0 | 0 | 12/8/2017 | 0 | 0 | 12/8/2016 | 0.01 | 0 | 12/8/2015 | 0 | 0 | 12/8/2014 | 0 | 0 | 12/8/2013 | 0 | 0 | 12/8/2012 | 0.43 | 0.257797 | 12/8/2011 | 2.16 | 1.937241 |
| 12/9/2020 | 0 | 0 | 12/9/2019 | 0.14 | 0.033333 | 12/9/2018 | 0 | 0 | 12/9/2017 | 0.03 | 0 | 12/9/2016 | 0 | 0 | 12/9/2015 | 0 | 0 | 12/9/2014 | 0.2 | 0.071111 | 12/9/2013 | 0.82 | 0.620816 | 12/9/2012 | 0.03 | 0 | 12/9/2011 | 0 | 0 |
| 12/10/2020 | 0 | 0 | 12/10/2019 | 0.87 | 0.668835 | 12/10/201 | 0 | 0 | 12/10/2017 | 0.31 | 0.155106 | 12/10/201 | 0 | 0 | 12/10/201 | 0.03 | 0 | 12/10/201 | 0.08 | 0.006667 | 12/10/2013 | 0.09 | 0.01 | 12/10/2012 | 0.35 | 0.188431 | 12/10/2011 | 0 | 0 |
| 12/11/2020 | 0 | 0 | 12/11/2019 | 0.38 | 0.214074 | 12/11/201 | 0 | 0 | 12/11/2017 | 0 | 0 | 12/11/201 | 0 | 0 | 12/11/201 | 0 | 0 | 12/11/201 | 0.05 | 0.000476 | 12/11/2013 | 0.2 | 0.071111 | 12/11/2012 | 0.2 | 0.071111 | 12/11/2011 | 0 | 0 |
| 12/12/2020 | 0 | 0 | 12/12/2019 | 0.03 | 0 | 12/12/201 | 0 | 0 | 12/12/2017 | 0 | 0 | 12/12/201 | 0.45 | 0.275574 | 12/12/201 | 0 | 0 | 12/12/201 | 0.02 | 0 | 12/12/2013 | 0 | 0 | 12/12/2012 | 0 | 0 | 12/12/2011 | 0 | 0 |
| 12/13/2020 | 0 | 0 | 12/13/2019 | 0 | 0 | 12/13/201 | 0 | 0 | 12/13/2017 | 0 | 0 | 12/13/201 | 0 | 0 | 12/13/201 | 0 | 0 | 12/13/201 | 0 | 0 | 12/13/2013 | 0 | 0 | 12/13/2012 | 0 | 0 | 12/13/2011 | 0 | 0 |
| 12/14/2020 | 0.07 | 0.003913 | 12/14/2019 | 0.42 | 0.248966 | 12/14/201 | 0 | 0 | 12/14/2017 | 0.08 | 0.006667 | 12/14/201 | 0 | 0 | 12/14/201 | 0 | 0 | 12/14/201 | 0 | 0 | 12/14/2013 | 0 | 0 | 12/14/2012 | 0 | 0 | 12/14/2011 | 0 | 0 |
| 12/15/2020 | 0.84 | 0.64 | 12/15/2019 | 0.08 | 0.006667 | 12/15/201 | 0.26 | 0.115238 | 12/15/2017 | 0 | 0 | 12/15/201 | 0 | 0 | 12/15/201 | 0.27 | 0.123023 | 12/15/201 | 0 | 0 | 12/15/2013 | 1.1 | 0.891746 | 12/15/2012 | 0 | 0 | 12/15/2011 | 0 | 0 |
| 12/16/2020 | 0 | 0 | 12/16/2019 | 0 | 0 | 12/16/201 | 1.04 | 0.833333 | 12/16/2017 | 0.16 | 0.045 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/2013 | 0 | 0 | 12/16/2012 | 0 | 0 | 12/16/2011 | 0.07 | 0.003913 |
| 12/17/2020 | 0.99 | 0.784783 | 12/17/2019 | 1.01 | 0.804188 | 12/17/201 | 0.4 | 0.231429 | 12/17/2017 | 0 | 0 | 12/17/201 | 0.26 | 0.115238 | 12/17/201 | 0 | 0 | 12/17/201 | 0.16 | 0.045 | 12/17/2013 | 0.02 | 0 | 12/17/2012 | 0.13 | 0.027931 | 12/17/2011 | 0 | 0 |
| 12/18/2020 | 0 | 0 | 12/18/2019 | 0.15 | 0.039032 | 12/18/201 | 0 | 0 | 12/18/2017 | 0 | 0 | 12/18/201 | 0.39 | 0.222727 | 12/18/201 | 0.88 | 0.678462 | 12/18/201 | 0 | 0 | 12/18/2013 | 0.03 | 0 | 12/18/2012 | 0.17 | 0.051212 | 12/18/2011 | 0 | 0 |
| 12/19/2020 | 0 | 0 | 12/19/2019 | 0 | 0 | 12/19/201 | 0 | 0 | 12/19/2017 | 0 | 0 | 12/19/201 | 0.05 | 0.000476 | 12/19/201 | 0 | 0 | 12/19/201 | 0 | 0 | 12/19/2013 | 0 | 0 | 12/19/2012 | 0.03 | 0 | 12/19/2011 | 0 | 0 |
| 12/20/2020 | 0 | 0 | 12/20/2019 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/2017 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/2013 | 0 | 0 | 12/20/2012 | 0 | 0 | 12/20/2011 | 0 | 0 |
| 12/21/2020 | 0 | 0 | 12/21/2019 | 0 | 0 | 12/21/201 | 1.81 | 1.590305 | 12/21/2017 | 0 | 0 | 12/21/201 | 0 | 0 | 12/21/201 | 0 | 0 | 12/21/201 | 0 | 0 | 12/21/2013 | 0 | 0 | 12/21/2012 | 2.09 | 1.867778 | 12/21/2011 | 0.05 | 0.000476 |
| 12/22/2020 | 0.07 | 0.003913 | 12/22/2019 | 0 | 0 | 12/22/201 | 0.13 | 0.027931 | 12/22/2017 | 0 | 0 | 12/22/201 | 0 | 0 | 12/22/201 | 0.03 | 0 | 12/22/201 | 0 | 0 | 12/22/2013 | 0.01 | 0 | 12/22/2012 | 0.03 | 0 | 12/22/2011 | 0.11 | 0.018148 |
| 12/23/2020 | 0 | 0 | 12/23/2019 | 0 | 0 | 12/23/201 | 0 | 0 | 12/23/2017 | 0.21 | 0.078108 | 12/23/201 | 0 | 0 | 12/23/201 | 0.05 | 0.000476 | 12/23/201 | 0.15 | 0.039032 | 12/23/2013 | 0.42 | 0.248966 | 12/23/2012 | 0 | 0 | 12/23/2011 | 1.24 | 1.028571 |
| 12/24/2020 | 0 | 0 | 12/24/2019 | 0 | 0 | 12/24/201 | 0.07 | 0.003913 | 12/24/2017 | 0.5 | 0.320606 | 12/24/201 | 0.24 | 0.1 | 12/24/201 | 1.39 | 1.175806 | 12/24/201 | 0.42 | 0.248966 | 12/24/2013 | 0.44 | 0.266667 | 12/24/2012 | 0 | 0 | 12/24/2011 | 0 | 0 |
| 12/25/2020 | 2.08 | 1.857857 | 12/25/2019 | 0 | 0 | 12/25/201 | 0 | 0 | 12/25/2017 | 0.16 | 0.045 | 12/25/201 | 0.16 | 0.045 | 12/25/201 | 0.04 | 2.41E-34 | 12/25/201 | 0.5 | 0.320606 | 12/25/2013 | 0 | 0 | 12/25/2012 | 0.2 | 0.071111 | 12/25/2011 | 0 | 0 |
| 12/26/2020 | 0.04 | 2.41E-34 | 12/26/2019 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/2017 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/201 | 0.3 | 0.146957 | 12/26/201 | 0 | 0 | 12/26/2013 | 0 | 0 | 12/26/2012 | 0 | 0 | 12/26/2011 | 0 | 0 |
| 12/27/2020 | 0 | 0 | 12/27/2019 | 0 | 0 | 12/27/201 | 0 | 0 | 12/27/2017 | 0 | 0 | 12/27/201 | 0.01 | 0 | 12/27/201 | 0.04 | 2.41E-34 | 12/27/201 | 0 | 0 | 12/27/2013 | 0 | 0 | 12/27/2012 | 1.12 | 0.91125 | 12/27/2011 | 0 | 0 |
| 12/28/2020 | 0 | 0 | 12/28/2019 | 0 | 0 | 12/28/201 | 0.68 | 0.487619 | 12/28/2017 | 0 | 0 | 12/28/201 | 0 | 0 | 12/28/201 | 0.11 | 0.018148 | 12/28/201 | 0 | 0 | 12/28/2013 | 0 | 0 | 12/28/2012 | 0 | 0 | 12/28/2011 | 1.23 | 1.018777 |
| 12/29/2020 | 0 | 0 | 12/29/2019 | 0 | 0 | 12/29/201 | 0.66 | 0.46878 | 12/29/2017 | 0 | 0 | 12/29/201 | 0.1 | 0.013846 | 12/29/201 | 0.81 | 0.611237 | 12/29/201 | 0.01 | 0 | 12/29/2013 | 0.02 | 0 | 12/29/2012 | 0 | 0 | 12/29/2011 | 0 | 0 |
| 12/30/2020 | 0 | 0 | 12/30/2019 | 0.69 | 0.497059 | 12/30/201 | 0 | 0 | 12/30/2017 | 0.04 | 2.41E-34 | 12/30/201 | 0.15 | 0.039032 | 12/30/201 | 0.07 | 0.003913 | 12/30/201 | 0 | 0 | 12/30/2013 | 1.15 | 0.940534 | 12/30/2012 | 0.27 | 0.123023 | 12/30/2011 | 0 | 0 |
| 12/31/2020 | 0.06 | 0.001818 | 12/31/2019 | 0.23 | 0.092564 | 12/31/201 | 0 | 0 | 12/31/2017 | 0.03 | 0 | 12/31/201 | 0 | 0 | 12/31/201 | 0.18 | 0.057647 | 12/31/201 | 0 | 0 | 12/31/2013 | 0 | 0 | 12/31/2012 | 0 | 0 | 12/31/2011 | 0.01 | 0 |
| 1/1/2021 | 0.05 | 0.000476 | 1/1/2020 | 0 | 0 | 1/1/2019 | 0.79 | 0.592105 | 1/1/2018 | 0 | 0 | 1/1/2017 | 0 | 0 | 1/1/2016 | 0 | 0 | 1/1/2015 | 0 | 0 | 1/1/2014 | 0 | 0 | 1/1/2013 | 0 | 0 | 1/1/2012 | 0 | 0 |
| 1/2/2021 | 0.98 | 0.775088 | 1/2/2020 | 0 | 0 | 1/2/2019 | 0 | 0 | 1/2/2018 | 0 | 0 | 1/2/2017 | 0.18 | 0.057647 | 1/2/2016 | 0 | 0 | 1/2/2015 | 0 | 0 | 1/2/2014 | 0 | 0 | 1/2/2013 | 0 | 0 | 1/2/2012 | 0.05 | 0.000476 |
| 1/3/2021 | 0.06 | 0.001818 | 1/3/2020 | 0.11 | 0.018148 | 1/3/2019 | 0 | 0 | 1/3/2018 | 0 | 0 | 1/3/2017 | 0.18 | 0.057647 | 1/3/2016 | 0 | 0 | 1/3/2015 | 0 | 0 | 1/3/2014 | 0.51 | 0.329701 | 1/3/2013 | 0 | 0 | 1/3/2012 | 0 | 0 |
| 1/4/2021 | 0.29 | 0.138889 | 1/4/2020 | 0.2 | 0.071111 | 1/4/2019 | 0 | 0 | 1/4/2018 | 0.09 | 0.01 | 1/4/2017 | 0.56 | 0.375556 | 1/4/2016 | 0 | 0 | 1/4/2015 | 0.95 | 0.746036 | 1/4/2014 | 0 | 0 | 1/4/2013 | 0 | 0 | 1/4/2012 | 0 | 0 |
| 1/5/2021 | 0.01 | 0 | 1/5/2020 | 0.04 | 2.41E-34 | 1/5/2019 | 0.27 | 0.123023 | 1/5/2018 | 0.12 | 0.022857 | 1/5/2017 | 0 | 0 | 1/5/2016 | 0 | 0 | 1/5/2015 | 0.06 | 0.001818 | 1/5/2014 | 0 | 0 | 1/5/2013 | 0 | 0 | 1/5/2012 | 0 | 0 |
| 1/6/2021 | 0 | 0 | 1/6/2020 | 0 | 0 | 1/6/2019 | 0.12 | 0.022857 | 1/6/2018 | 0 | 0 | 1/6/2017 | 0.14 | 0.033333 | 1/6/2016 | 0 | 0 | 1/6/2015 | 0.05 | 0.000476 | 1/6/2014 | 0.56 | 0.375556 | 1/6/2013 | 0.02 | 0 | 1/6/2012 | 0 | 0 |
| 1/7/2021 | 0 | 0 | 1/7/2020 | 0.03 | 0 | 1/7/2019 | 0 | 0 | 1/7/2018 | 0 | 0 | 1/7/2017 | 0 | 0 | 1/7/2016 | 0 | 0 | 1/7/2015 | 0.11 | 0.018148 | 1/7/2014 | 0.06 | 0.001818 | 1/7/2013 | 0 | 0 | 1/7/2012 | 0 | 0 |
| 1/8/2021 | 0 | 0 | 1/8/2020 | 0.11 | 0.018148 | 1/8/2019 | 0.14 | 0.033333 | 1/8/2018 | 0 | 0 | 1/8/2017 | 0.04 | 2.41E-34 | 1/8/2016 | 0 | 0 | 1/8/2015 | 0 | 0 | 1/8/2014 | 0 | 0 | 1/8/2013 | 0 | 0 | 1/8/2012 | 0 | 0 |
| 1/9/2021 | 0 | 0 | 1/9/2020 | 0.03 | 0 | 1/9/2019 | 0.2 | 0.071111 | 1/9/2018 | 0.06 | 0.001818 | 1/9/2017 | 0 | 0 | 1/9/2016 | 0.02 | 0 | 1/9/2015 | 0.03 | 0 | 1/9/2014 | 0 | 0 | 1/9/2013 | 0 | 0 | 1/9/2012 | 0 | 0 |
| 1/10/2021 | 0 | 0 | 1/10/2020 | 0 | 0 | 1/10/2019 | 0 | 0 | 1/10/2018 | 0 | 0 | 1/10/2017 | 0 | 0 | 1/10/2016 | 1.15 | 0.940534 | 1/10/2015 | 0 | 0 | 1/10/2014 | 0.01 | 0 | 1/10/2013 | 0 | 0 | 1/10/2012 | 0 | 0 |
| 1/11/2021 | 0 | 0 | 1/11/2020 | 0 | 0 | 1/11/2019 | 0 | 0 | 1/11/2018 | 0 | 0 | 1/11/2017 | 0.28 | 0.130909 | 1/11/2016 | 0.1 | 0.013846 | 1/11/2015 | 0 | 0 | 1/11/2014 | 0.67 | 0.478193 | 1/11/2013 | 0 | 0 | 1/11/2012 | 0 | 0 |
| 1/12/2021 | 0 | 0 | 1/12/2020 | 0.2 | 0.071111 | 1/12/2019 | 0 | 0 | 1/12/2018 | 0.12 | 0.022857 | 1/12/2017 | 0.23 | 0.092564 | 1/12/2016 | 0 | 0 | 1/12/2015 | 0.11 | 0.018148 | 1/12/2014 | 0.68 | 0.487619 | 1/12/2013 | 0.45 | 0.275574 | 1/12/2012 | 1.33 | 1.116846 |
| 1/13/2021 | 0 | 0 | 1/13/2020 | 0 | 0 | 1/13/2019 | 0.15 | 0.039032 | 1/13/2018 | 0.92 | 0.717037 | 1/13/2017 | 0 | 0 | 1/13/2016 | 0 | 0 | 1/13/2015 | 0.56 | 0.375556 | 1/13/2014 | 0 | 0 | 1/13/2013 | 0.01 | 0 | 1/13/2012 | 0.11 | 0.018148 |
| 1/14/2021 | 0.03 | 0 | 1/14/2020 | 0 | 0 | 1/14/2019 | 0 | 0 | 1/14/2018 | 0 | 0 | 1/14/2017 | 0 | 0 | 1/14/2016 | 0 | 0 | 1/14/2015 | 0 | 0 | 1/14/2014 | 0.03 | 0 | 1/14/2013 | 0.03 | 0 | 1/14/2012 | 0 | 0 |
| 1/15/2021 | 0 | 0 | 1/15/2020 | 0.04 | 2.41E-34 | 1/15/2019 | 0 | 0 | 1/15/2018 | 0 | 0 | 1/15/2017 | 0.04 | 2.41E-34 | 1/15/2016 | 0 | 0 | 1/15/2015 | 0 | 0 | 1/15/2014 | 0.29 | 0.138889 | 1/15/2013 | 0.4 | 0.231429 | 1/15/2012 | 0.01 | 0 |
| 1/16/2021 | 0.35 | 0.188431 | 1/16/2020 | 0.03 | 0 | 1/16/2019 | 0 | 0 | 1/16/2018 | 0 | 0 | 1/16/2017 | 0 | 0 | 1/16/2016 | 0.25 | 0.107561 | 1/16/2015 | 0 | 0 | 1/16/2014 | 0.04 | 2.41E-34 | 1/16/2013 | 1.02 | 0.813898 | 1/16/2012 | 0 | 0 |
| 1/17/2021 | 0 | 0 | 1/17/2020 | 0 | 0 | 1/17/2019 | 0 | 0 | 1/17/2018 | 0.11 | 0.018148 | 1/17/2017 | 0 | 0 | 1/17/2016 | 0 | 0 | 1/17/2015 | 0 | 0 | 1/17/2014 | 0 | 0 | 1/17/2013 | 0.08 | 0.006667 | 1/17/2012 | 0.08 | 0.006667 |
| 1/18/2021 | 0 | 0 | 1/18/2020 | 0 | 0 | 1/18/2019 | 0.07 | 0.003913 | 1/18/2018 | 0.04 | 2.41E-34 | 1/18/2017 | 0.45 | 0.275574 | 1/18/2016 | 0.03 | 0 | 1/18/2015 | 0 | 0 | 1/18/2014 | 0.01 | 0 | 1/18/2013 | 0 | 0 | 1/18/2012 | 0.22 | 0.085263 |
| 1/19/2021 | 0 | 0 | 1/19/2020 | 0.37 | 0.205472 | 1/19/2019 | 0.01 | 0 | 1/19/2018 | 0 | 0 | 1/19/2017 | 0 | 0 | 1/19/2016 | 0 | 0 | 1/19/2015 | 0.99 | 0.784783 | 1/19/2014 | 0 | 0 | 1/19/2013 | 0 | 0 | 1/19/2012 | 0 | 0 |
| 1/20/2021 | 0 | 0 | 1/20/2020 | 0 | 0 | 1/20/2019 | 1.32 | 1.107027 | 1/20/2018 | 0 | 0 | 1/20/2017 | 0 | 0 | 1/20/2016 | 0 | 0 | 1/20/2015 | 0 | 0 | 1/20/2014 | 0 | 0 | 1/20/2013 | 0 | 0 | 1/20/2012 | 0 | 0 |
| 1/21/2021 | 0 | 0 | 1/21/2020 | 0 | 0 | 1/21/2019 | 0.07 | 0.003913 | 1/21/2018 | 0 | 0 | 1/21/2017 | 0.19 | 0.064286 | 1/21/2016 | 0 | 0 | 1/21/2015 | 0 | 0 | 1/21/2014 | 0 | 0 | 1/21/2013 | 0 | 0 | 1/21/2012 | 0.35 | 0.188431 |
| 1/22/2021 | 0 | 0 | 1/22/2020 | 0 | 0 | 1/22/2019 | 0 | 0 | 1/22/2018 | 0 | 0 | 1/22/2017 | 0.01 | 0 | 1/22/2016 | 0 | 0 | 1/22/2015 | 0.05 | 0.000476 | 1/22/2014 | 0.41 | 0.240175 | 1/22/2013 | 0.02 | 0 | 1/22/2012 | 0.08 | 0.006667 |
| 1/23/2021 | 0 | 0 | 1/23/2020 | 0 | 0 | 1/23/2019 | 0 | 0 | 1/23/2018 | 0.25 | 0.107561 | 1/23/2017 | 0.11 | 0.018148 | 1/23/2016 | 1.09 | 0.882 | 1/23/2015 | 0 | 0 | 1/23/2014 | 0 | 0 | 1/23/2013 | 0 | 0 | 1/23/2012 | 0.01 | 0 |
| 1/24/2021 | 0 | 0 | 1/24/2020 | 0 | 0 | 1/24/2019 | 0.59 | 0.403333 | 1/24/2018 | 0.16 | 0.045 | 1/24/2017 | 0.64 | 0.45 | 1/24/2016 | 1.41 | 1.195478 | 1/24/2015 | 0.72 | 0.525455 | 1/24/2014 | 0 | 0 | 1/24/2013 | 0 | 0 | 1/24/2012 | 0.22 | 0.085263 |
| 1/25/2021 | 0 | 0 | 1/25/2020 | 0.99 | 0.784783 | 1/25/2019 | 0.9 | 0.697736 | 1/25/2018 | 0 | 0 | 1/25/2017 | 0 | 0 | 1/25/2016 | 0 | 0 | 1/25/2015 | 0 | 0 | 1/25/2014 | 0 | 0 | 1/25/2013 | 0 | 0 | 1/25/2012 | 0 | 0 |
| 1/26/2021 | 0 | 0 | 1/26/2020 | 1.11 | 0.901496 | 1/26/2019 | 0 | 0 | 1/26/2018 | 0 | 0 | 1/26/2017 | 0 | 0 | 1/26/2016 | 0 | 0 | 1/26/2015 | 0.08 | 0.006667 | 1/26/2014 | 0.08 | 0.006667 | 1/26/2013 | 0.04 | 2.41E-34 | 1/26/2012 | 0 | 0 |
| 1/27/2021 | 0.15 | 0.039032 | 1/27/2020 | 0 | 0 | 1/27/2019 | 0 | 0 | 1/27/2018 | 0 | 0 | 1/27/2017 | 0 | 0 | 1/27/2016 | 0 | 0 | 1/27/2015 | 0.1 | 0.013846 | 1/27/2014 | 0 | 0 | 1/27/2013 | 0 | 0 | 1/27/2012 | 0.14 | 0.033333 |
| 1/28/2021 | 0 | 0 | 1/28/2020 | 0 | 0 | 1/28/2019 | 0 | 0 | 1/28/2018 | 0.11 | 0.018148 | 1/28/2017 | 0 | 0 | 1/28/2016 | 0 | 0 | 1/28/2015 | 0 | 0 | 1/28/2014 | 0 | 0 | 1/28/2013 | 0.01 | 0 | 1/28/2012 | 0.15 | 0.039032 |
| 1/29/2021 | 0 | 0 | 1/29/2020 | 0 | 0 | 1/29/2019 | 0 | 0 | 1/29/2018 | 0.15 | 0.039032 | 1/29/2017 | 0 | 0 | 1/29/2016 | 0 | 0 | 1/29/2015 | 0 | 0 | 1/29/2014 | 0.03 | 0 | 1/29/2013 | 0.12 | 0.022857 | 1/29/2012 | 0 | 0 |
| 1/30/2021 | 0 | 0 | 1/30/2020 | 0 | 0 | 1/30/2019 | 0.29 | 0.138889 | 1/30/2018 | 0.01 | 0 | 1/30/2017 | 0.01 | 0 | 1/30/2016 | 0 | 0 | 1/30/2015 | 0.01 | 0 | 1/30/2014 | 0 | 0 | 1/30/2013 | 0 | 0 | 1/30/2012 | 0 | 0 |
| 1/31/2021 | 0.02 | 0 | 1/31/2020 | 0 | 0 | 1/31/2019 | 0.01 | 0 | 1/31/2018 | 0.07 | 0.003913 | 1/31/2017 | 0.01 | 0 | 1/31/2016 | 0 | 0 | 1/31/2015 | 0.01 | 0 | 1/31/2014 | 0 | 0 | 1/31/2013 | 1.59 | 1.372857 | 1/31/2012 | 0 | 0 |
| 2/1/2021 | 0.41 | 0.240175 | 2/1/2020 | 0.07 | 0.003913 | 2/1/2019 | 0 | 0 | 2/1/2018 | 0 | 0 | 2/1/2017 | 0 | 0 | 2/1/2016 | 0 | 0 | 2/1/2015 | 0 | 0 | 2/1/2014 | 0 | 0 | 2/1/2013 | 0 | 0 | 2/1/2012 | 0.02 | 0 |
| 2/2/2021 | 0.58 | 0.394054 | 2/2/2020 | 0.07 | 0.003913 | 2/2/2019 | 0.08 | 0.006667 | 2/2/2018 | 0.17 | 0.051212 | 2/2/2017 | 0 | 0 | 2/2/2016 | 0.11 | 0.018148 | 2/2/2015 | 0.59 | 0.403333 | 2/2/2014 | 0 | 0 | 2/2/2013 | 0 | 0 | 2/2/2012 | 0 | 0 |
| 2/3/2021 | 0.05 | 0.000476 | 2/3/2020 | 0.01 | 0 | 2/3/2019 | 0 | 0 | 2/3/2018 | 0 | 0 | 2/3/2017 | 0 | 0 | 2/3/2016 | 0.04 | 2.41E-34 | 2/3/2015 | 0.28 | 0.130909 | 2/3/2014 | 0.7 | 0.506512 | 2/3/2013 | 0.08 | 0.006667 | 2/3/2012 | 0 | 0 |
| 2/4/2021 | 0 | 0 | 2/4/2020 | 0.02 | 0 | 2/4/2019 | 0 | 0 | 2/4/2018 | 0 | 0 | 2/4/2017 | 0 | 0 | 2/4/2016 | 0.77 | 0.573011 | 2/4/2015 | 0 | 0 | 2/4/2014 | 0.59 | 0.403333 | 2/4/2013 | 0.01 | 0 | 2/4/2012 | 0 | 0 |
| 2/5/2021 | 0.05 | 0.000476 | 2/5/2020 | 0.1 | 0.013846 | 2/5/2019 | 0 | 0 | 2/5/2018 | 1.12 | 0.91125 | 2/5/2017 | 0 | 0 | 2/5/2016 | 0.16 | 0.045 | 2/5/2015 | 0 | 0 | 2/5/2014 | 1.4 | 1.185641 | 2/5/2013 | 0 | 0 | 2/5/2012 | 0.03 | 0 |
| 2/6/2021 | 0.01 | 0 | 2/6/2020 | 0.49 | 0.311538 | 2/6/2019 | 0 | 0 | 2/6/2018 | 0 | 0 | 2/6/2017 | 0 | 0 | 2/6/2016 | 0.01 | 0 | 2/6/2015 | 0 | 0 | 2/6/2014 | 0.18 | 0.057647 | 2/6/2013 | 0.02 | 0 | 2/6/2012 | 0 | 0 |
| 2/7/2021 | 0.16 | 0.045 | 2/7/2020 | 0.34 | 0.18 | 2/7/2019 | 0.31 | 0.155106 | 2/7/2018 | 0.04 | 2.41E-34 | 2/7/2017 | 0 | 0 | 2/7/2016 | 0 | 0 | 2/7/2015 | 0 | 0 | 2/7/2014 | 0 | 0 | 2/7/2013 | 0 | 0 | 2/7/2012 | 0 | 0 |
| 2/8/2021 | 0.37 | 0.205472 | 2/8/2020 | 0.28 | 0.130909 | 2/8/2019 | 0.04 | 2.41E-34 | 2/8/2018 | 0.76 | 0.563478 | 2/8/2017 | 0.16 | 0.045 | 2/8/2016 | 0 | 0 | 2/8/2015 | 0 | 0 | 2/8/2014 | 0 | 0 | 2/8/2013 | 0.07 | 0.003913 | 2/8/2012 | 0 | 0 |
| 2/9/2021 | 0 | 0 | 2/9/2020 | 0 | 0 | 2/9/2019 | 0.01 | 0 | 2/9/2018 | 0 | 0 | 2/9/2017 | 0.56 | 0.375556 | 2/9/2016 | 0.16 | 0.045 | 2/9/2015 | 0 | 0 | 2/9/2014 | 0 | 0 | 2/9/2013 | 0.27 | 0.123023 | 2/9/2012 | 0.15 | 0.039032 |
| 2/10/2021 | 0 | 0 | 2/10/2020 | 0.08 | 0.006667 | 2/10/2019 | 0 | 0 | 2/10/2018 | 0 | 0 | 2/10/2017 | 0.03 | 0 | 2/10/2016 | 0.32 | 0.163333 | 2/10/2015 | 0.02 | 0 | 2/10/2014 | 0.13 | 0.027931 | 2/10/2013 | 0 | 0 | 2/10/2012 | 0 | 0 |
| 2/11/2021 | 0.25 | 0.107561 | 2/11/2020 | 0.61 | 0.421948 | 2/11/2019 | 0.19 | 0.064286 | 2/11/2018 | 1 | 0.794483 | 2/11/2017 | 0 | 0 | 2/11/2016 | 0 | 0 | 2/11/2015 | 0 | 0 | 2/11/2014 | 0 | 0 | 2/11/2013 | 0.34 | 0.18 | 2/11/2012 | 0.17 | 0.051212 |
| 2/12/2021 | 0 | 0 | 2/12/2020 | 0.06 | 0.001818 | 2/12/2019 | 0.2 | 0.071111 | 2/12/2018 | 0.7 | 0.506512 | 2/12/2017 | 0 | 0 | 2/12/2016 | 0 | 0 | 2/12/2015 | 0 | 0 | 2/12/2014 | 0 | 0 | 2/12/2013 | 0.08 | 0.006667 | 2/12/2012 | 0.09 | 0.01 |
| 2/13/2021 | 0 | 0 | 2/13/2020 | 0.22 | 0.085263 | 2/13/2019 | 0.84 | 0.64 | 2/13/2018 | 0 | 0 | 2/13/2017 | 0.22 | 0.085263 | 2/13/2016 | 0.01 | 0 | 2/13/2015 | 0 | 0 | 2/13/2014 | 0.91 | 0.707383 | 2/13/2013 | 0 | 0 | 2/13/2012 | 0 | 0 |
| 2/14/2021 | 0.03 | 0 | 2/14/2020 | 0.09 | 0.01 | 2/14/2019 | 0 | 0 | 2/14/2018 | 0 | 0 | 2/14/2017 | 0 | 0 | 2/14/2016 | 0 | 0 | 2/14/2015 | 0 | 0 | 2/14/2014 | 1.17 | 0.960075 | 2/14/2013 | 0.23 | 0.092564 | 2/14/2012 | 0 | 0 |
| 2/15/2021 | 0 | 0 | 2/15/2020 | 0 | 0 | 2/15/2019 | 0 | 0 | 2/15/2018 | 0.17 | 0.051212 | 2/15/2017 | 0 | 0 | 2/15/2016 | 0 | 0 | 2/15/2015 | 0.1 | 0.013846 | 2/15/2014 | 0 | 0 | 2/15/2013 | 0 | 0 | 2/15/2012 | 0.01 | 0 |
| 2/16/2021 | 0.78 | 0.582553 | 2/16/2020 | 0 | 0 | 2/16/2019 | 0 | 0 | 2/16/2018 | 0.56 | 0.375556 | 2/16/2017 | 0 | 0 | 2/16/2016 | 0.36 | 0.196923 | 2/16/2015 | 0 | 0 | 2/16/2014 | 0.08 | 0.006667 | 2/16/2013 | 0.15 | 0.039032 | 2/16/2012 | 0 | 0 |
| 2/17/2021 | 0 | 0 | 2/17/2020 | 0 | 0 | 2/17/2019 | 0 | 0 | 2/17/2018 | 0.06 | 0.001818 | 2/17/2017 | 0 | 0 | 2/17/2016 | 0.95 | 0.746036 | 2/17/2015 | 0.2 | 0.071111 | 2/17/2014 | 0 | 0 | 2/17/2013 | 0 | 0 | 2/17/2012 | 0.09 | 0.01 |
| 2/18/2021 | 0.24 | 0.1 | 2/18/2020 | 0 | 0 | 2/18/2019 | 0.22 | 0.085263 | 2/18/2018 | 0.38 | 0.214074 | 2/18/2017 | 0 | 0 | 2/18/2016 | 0 | 0 | 2/18/2015 | 0 | 0 | 2/18/2014 | 0.14 | 0.033333 | 2/18/2013 | 0 | 0 | 2/18/2012 | 0 | 0 |
| 2/19/2021 | 0.49 | 0.311538 | 2/19/2020 | 0 | 0 | 2/19/2019 | 0 | 0 | 2/19/2018 | 0 | 0 | 2/19/2017 | 0 | 0 | 2/19/2016 | 0 | 0 | 2/19/2015 | 0 | 0 | 2/19/2014 | 0.03 | 0 | 2/19/2013 | 0 | 0 | 2/19/2012 | 0 | 0 |
| 2/20/2021 | 0.06 | 0.001818 | 2/20/2020 | 0 | 0 | 2/20/2019 | 0 | 0 | 2/20/2018 | 0.03 | 0 | 2/20/2017 | 0 | 0 | 2/20/2016 | 0 | 0 | 2/20/2015 | 0 | 0 | 2/20/2014 | 0.17 | 0.051212 | 2/20/2013 | 0.2 | 0.071111 | 2/20/2012 | 0 | 0 |
| 2/21/2021 | 0 | 0 | 2/21/2020 | 0 | 0 | 2/21/2019 | 0.68 | 0.487619 | 2/21/2018 | 0 | 0 | 2/21/2017 | 0 | 0 | 2/21/2016 | 0 | 0 | 2/21/2015 | 0 | 0 | 2/21/2014 | 0 | 0 | 2/21/2013 | 0 | 0 | 2/21/2012 | 0 | 0 |
| 2/22/2021 | 0.03 | 0 | 2/22/2020 | 0 | 0 | 2/22/2019 | 0 | 0 | 2/22/2018 | 0.03 | 0 | 2/22/2017 | 0 | 0 | 2/22/2016 | 0.06 | 0.001818 | 2/22/2015 | 0.7 | 0.506512 | 2/22/2014 | 0.21 | 0.078108 | 2/22/2013 | 0 | 0 | 2/22/2012 | 0 | 0 |
| 2/23/2021 | 0.35 | 0.188431 | 2/23/2020 | 0 | 0 | 2/23/2019 | 0 | 0 | 2/23/2018 | 0.27 | 0.123023 | 2/23/2017 | 0 | 0 | 2/23/2016 | 0 | 0 | 2/23/2015 | 0 | 0 | 2/23/2014 | 0 | 0 | 2/23/2013 | 0.07 | 0.003913 | 2/23/20[illegible] | 0 | 0 |

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| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2/24/2021 | 0 | 0 | 2/24/2020 | 0 | 0 | 2/24/2019 | 0.39 | 0.222727 | 2/24/2018 | 0.15 | 0.039032 | 2/24/2017 | 0 | 0 |
| 2/25/2021 | 0 | 0 | 2/25/2020 | 0.02 | 0 | 2/25/2019 | 0.05 | 0.000476 | 2/25/2018 | 0.54 | 0.357143 | 2/25/2017 | 0 | 0 |
| 2/26/2021 | 0 | 0 | 2/26/2020 | 0.2 | 0.071111 | 2/26/2019 | 0 | 0 | 2/26/2018 | 0.18 | 0.057647 | 2/26/2017 | 0.62 | 0.431282 |
| 2/27/2021 | 0.35 | 0.188431 | 2/27/2020 | 0.59 | 0.403333 | 2/27/2019 | 0 | 0 | 2/27/2018 | 0 | 0 | 2/27/2017 | 0 | 0 |
| 2/28/2021 | 0.07 | 0.003913 | 2/28/2020 | 0 | 0 | 2/28/2019 | 0 | 0 | 2/28/2018 | 0 | 0 | 2/28/2017 | 0 | 0 |
| 3/1/2021 | 1.17 | 0.960075 | 2/29/2020 | 0 | 0 | 3/1/2019 | 0.31 | 0.155106 | 3/1/2018 | 0 | 0 | 3/1/2017 | 0.15 | 0.039032 |
| 3/2/2021 | 0.01 | 0 | 3/1/2020 | 0 | 0 | 3/2/2019 | 0.58 | 0.394054 | 3/2/2018 | 1.08 | 0.872258 | 3/2/2017 | 0.01 | 0 |
| 3/3/2021 | 0 | 0 | 3/2/2020 | 0 | 0 | 3/3/2019 | 0 | 0 | 3/3/2018 | 0.29 | 0.138889 | 3/3/2017 | 0 | 0 |
| 3/4/2021 | 0 | 0 | 3/3/2020 | 0.1 | 0.013846 | 3/4/2019 | 0.82 | 0.620816 | 3/4/2018 | 0 | 0 | 3/4/2017 | 0 | 0 |
| 3/5/2021 | 0 | 0 | 3/4/2020 | 0.23 | 0.092564 | 3/5/2019 | 0 | 0 | 3/5/2018 | 0 | 0 | 3/5/2017 | 0 | 0 |
| 3/6/2021 | 0 | 0 | 3/5/2020 | 0 | 0 | 3/6/2019 | 0 | 0 | 3/6/2018 | 0 | 0 | 3/6/2017 | 0 | 0 |
| 3/7/2021 | 0 | 0 | 3/6/2020 | 0 | 0 | 3/7/2019 | 0 | 0 | 3/7/2018 | 0.49 | 0.311538 | 3/7/2017 | 0.02 | 0 |
| 3/8/2021 | 0 | 0 | 3/7/2020 | 0.37 | 0.205472 | 3/8/2019 | 0 | 0 | 3/8/2018 | 0.63 | 0.440633 | 3/8/2017 | 0.04 | 2.41E-34 |
| 3/9/2021 | 0 | 0 | 3/8/2020 | 0 | 0 | 3/9/2019 | 0.01 | 0 | 3/9/2018 | 0 | 0 | 3/9/2017 | 0 | 0 |
| 3/10/2021 | 0 | 0 | 3/9/2020 | 0.01 | 0 | 3/10/2019 | 0.69 | 0.497059 | 3/10/2018 | 0 | 0 | 3/10/2017 | 0.06 | 0.001818 |
| 3/11/2021 | 0 | 0 | 3/10/2020 | 0 | 0 | 3/11/2019 | 0.08 | 0.006667 | 3/11/2018 | 0 | 0 | 3/11/2017 | 0.28 | 0.130909 |
| 3/12/2021 | 0 | 0 | 3/11/2020 | 0.04 | 2.41E-34 | 3/12/2019 | 0 | 0 | 3/12/2018 | 0 | 0 | 3/12/2017 | 0 | 0 |
| 3/13/2021 | 0 | 0 | 3/12/2020 | 0.01 | 0 | 3/13/2019 | 0 | 0 | 3/13/2018 | 0.11 | 0.018148 | 3/13/2017 | 0 | 0 |
| 3/14/2021 | 0 | 0 | 3/13/2020 | 0.33 | 0.171633 | 3/14/2019 | 0 | 0 | 3/14/2018 | 0 | 0 | 3/14/2017 | 1.27 | 1.057972 |
| 3/15/2021 | 0 | 0 | 3/14/2020 | 0.01 | 0 | 3/15/2019 | 0 | 0 | 3/15/2018 | 0 | 0 | 3/15/2017 | 0.7 | 0.506512 |
| 3/16/2021 | 0.01 | 0 | 3/15/2020 | 0.06 | 0.001818 | 3/16/2019 | 0.22 | 0.085263 | 3/16/2018 | 0 | 0 | 3/16/2017 | 0.01 | 0 |
| 3/17/2021 | 0.01 | 0 | 3/16/2020 | 0 | 0 | 3/17/2019 | 0 | 0 | 3/17/2018 | 0 | 0 | 3/17/2017 | 0 | 0 |
| 3/18/2021 | 0.13 | 0.027931 | 3/17/2020 | 0.06 | 0.001818 | 3/18/2019 | 0 | 0 | 3/18/2018 | 0 | 0 | 3/18/2017 | 0 | 0 |
| 3/19/2021 | 0.87 | 0.668835 | 3/18/2020 | 0.01 | 0 | 3/19/2019 | 0 | 0 | 3/19/2018 | 0 | 0 | 3/19/2017 | 0.01 | 0 |
| 3/20/2021 | 0 | 0 | 3/19/2020 | 0.82 | 0.620816 | 3/20/2019 | 0 | 0 | 3/20/2018 | 0 | 0 | 3/20/2017 | 0 | 0 |
| 3/21/2021 | 0 | 0 | 3/20/2020 | 0.02 | 0 | 3/21/2019 | 0.05 | 0.000476 | 3/21/2018 | 0.41 | 0.240175 | 3/21/2017 | 0.01 | 0 |
| 3/22/2021 | 0 | 0 | 3/21/2020 | 0.02 | 0 | 3/22/2019 | 2.01 | 1.788433 | 3/22/2018 | 0.63 | 0.440633 | 3/22/2017 | 0 | 0 |
| 3/23/2021 | 0 | 0 | 3/22/2020 | 0 | 0 | 3/23/2019 | 0.04 | 2.41E-34 | 3/23/2018 | 0 | 0 | 3/23/2017 | 0 | 0 |
| 3/24/2021 | 0.02 | 0 | 3/23/2020 | 0.06 | 0.001818 | 3/24/2019 | 0 | 0 | 3/24/2018 | 0 | 0 | 3/24/2017 | 0 | 0 |
| 3/25/2021 | 1.8 | 1.580408 | 3/24/2020 | 0.71 | 0.515977 | 3/25/2019 | 0 | 0 | 3/25/2018 | 0 | 0 | 3/25/2017 | 0 | 0 |
| 3/26/2021 | 0.03 | 0 | 3/25/2020 | 0.01 | 0 | 3/26/2019 | 0.28 | 0.130909 | 3/26/2018 | 0.01 | 0 | 3/26/2017 | 0 | 0 |
| 3/27/2021 | 0 | 0 | 3/26/2020 | 0.05 | 0.000476 | 3/27/2019 | 0 | 0 | 3/27/2018 | 0 | 0 | 3/27/2017 | 0.07 | 0.003913 |
| 3/28/2021 | 0.06 | 0.001818 | 3/27/2020 | 0.02 | 0 | 3/28/2019 | 0 | 0 | 3/28/2018 | 0.02 | 0 | 3/28/2017 | 0.16 | 0.045 |
| 3/29/2021 | 0.62 | 0.431282 | 3/28/2020 | 0.09 | 0.01 | 3/29/2019 | 0 | 0 | 3/29/2018 | 0.09 | 0.01 | 3/29/2017 | 0.48 | 0.3025 |
| 3/30/2021 | 0 | 0 | 3/29/2020 | 1.07 | 0.86252 | 3/30/2019 | 0 | 0 | 3/30/2018 | 0.01 | 0 | 3/30/2017 | 0 | 0 |
| 3/31/2021 | 0 | 0 | 3/30/2020 | 0.02 | 0 | 3/31/2019 | 0 | 0 | 3/31/2018 | 0.12 | 0.022857 | 3/31/2017 | 0.31 | 0.155106 |
| 4/1/2021 | 0.46 | 0.284516 | 3/31/2020 | 0.1 | 0.013846 | 4/1/2019 | 0.08 | 0.006667 | 4/1/2018 | 0 | 0 | 4/1/2017 | 1.41 | 1.195478 |
| 4/2/2021 | 0.01 | 0 | 4/1/2020 | 0.03 | 0 | 4/2/2019 | 0 | 0 | 4/2/2018 | 0.23 | 0.092564 | 4/2/2017 | 0 | 0 |
| 4/3/2021 | 0 | 0 | 4/2/2020 | 0 | 0 | 4/3/2019 | 0 | 0 | 4/3/2018 | 0.04 | 2.41E-34 | 4/3/2017 | 0 | 0 |
| 4/4/2021 | 0 | 0 | 4/3/2020 | 0 | 0 | 4/4/2019 | 0 | 0 | 4/4/2018 | 0.15 | 0.039032 | 4/4/2017 | 0.25 | 0.107561 |
| 4/5/2021 | 0 | 0 | 4/4/2020 | 0.01 | 0 | 4/5/2019 | 0 | 0 | 4/5/2018 | 0.06 | 0.001818 | 4/5/2017 | 0.01 | 0 |
| Cumulative Runoff (Q) For 1 Year of Daily Rain Events (Inches) | | 40.12979 | | | 33.03327 | | | 49.69633 | | | 29.31586 | | | 24.60699 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2/24/2016 | 0.53 | 0.347971 | 2/24/2015 | 0 | 0 | 2/24/2014 | 0.01 | 0 | 2/24/2013 | 0.1 | 0.013846 | 2/24/2012 | 0.26 | 0.115238 |
| 2/25/2016 | 1.6 | 1.382727 | 2/25/2015 | 0 | 0 | 2/25/2014 | 0 | 0 | 2/25/2013 | 0 | 0 | 2/25/2012 | 0.09 | 0.01 |
| 2/26/2016 | 0.01 | 0 | 2/26/2015 | 0 | 0 | 2/26/2014 | 0.01 | 0 | 2/26/2013 | 0 | 0 | 2/26/2012 | 0 | 0 |
| 2/27/2016 | 0 | 0 | 2/27/2015 | 0.01 | 0 | 2/27/2014 | 0.06 | 0.001818 | 2/27/2013 | 0.58 | 0.394054 | 2/27/2012 | 0 | 0 |
| 2/28/2016 | 0 | 0 | 2/28/2015 | 0 | 0 | 2/28/2014 | 0 | 0 | 2/28/2013 | 0.04 | 2.41E-34 | 2/28/2012 | 0 | 0 |
| 2/29/2016 | 0 | 0 | 3/1/2015 | 0 | 0 | 3/1/2014 | 0 | 0 | 3/1/2013 | 0.01 | 0 | 2/29/2012 | 0 | 0 |
| 3/1/2016 | 0 | 0 | 3/2/2015 | 0.52 | 0.338824 | 3/2/2014 | 0 | 0 | 3/2/2013 | 0 | 0 | 3/1/2012 | 0.98 | 0.775088 |
| 3/2/2016 | 0.16 | 0.045 | 3/3/2015 | 0 | 0 | 3/3/2014 | 0.21 | 0.078108 | 3/3/2013 | 0 | 0 | 3/2/2012 | 0.01 | 0 |
| 3/3/2016 | 0 | 0 | 3/4/2015 | 0.55 | 0.366338 | 3/4/2014 | 0.04 | 2.41E-34 | 3/4/2013 | 0 | 0 | 3/3/2012 | 0.22 | 0.085263 |
| 3/4/2016 | 0.08 | 0.006667 | 3/5/2015 | 0.67 | 0.478193 | 3/5/2014 | 0 | 0 | 3/5/2013 | 0 | 0 | 3/4/2012 | 0.04 | 2.41E-34 |
| 3/5/2016 | 0.01 | 0 | 3/6/2015 | 0.63 | 0.440633 | 3/6/2014 | 0 | 0 | 3/6/2013 | 0.1 | 0.013846 | 3/5/2012 | 0 | 0 |
| 3/6/2016 | 0 | 0 | 3/7/2015 | 0 | 0 | 3/7/2014 | 0 | 0 | 3/7/2013 | 0.17 | 0.051212 | 3/6/2012 | 0 | 0 |
| 3/7/2016 | 0 | 0 | 3/8/2015 | 0 | 0 | 3/8/2014 | 0 | 0 | 3/8/2013 | 0.01 | 0 | 3/7/2012 | 0 | 0 |
| 3/8/2016 | 0 | 0 | 3/9/2015 | 0 | 0 | 3/9/2014 | 0 | 0 | 3/9/2013 | 0.01 | 0 | 3/8/2012 | 0 | 0 |
| 3/9/2016 | 0 | 0 | 3/10/2015 | 0 | 0 | 3/10/2014 | 0 | 0 | 3/10/2013 | 0 | 0 | 3/9/2012 | 0.05 | 0.000476 |
| 3/10/2016 | 0 | 0 | 3/11/2015 | 0.64 | 0.45 | 3/11/2014 | 0 | 0 | 3/11/2013 | 0.01 | 0 | 3/10/2012 | 0 | 0 |
| 3/11/2016 | 0 | 0 | 3/12/2015 | 0 | 0 | 3/12/2014 | 0 | 0 | 3/12/2013 | 0.16 | 0.045 | 3/11/2012 | 0 | 0 |
| 3/12/2016 | 0 | 0 | 3/13/2015 | 0 | 0 | 3/13/2014 | 0.33 | 0.171633 | 3/13/2013 | 0.96 | 0.755714 | 3/12/2012 | 0 | 0 |
| 3/13/2016 | 0 | 0 | 3/14/2015 | 0.71 | 0.515977 | 3/14/2014 | 0 | 0 | 3/14/2013 | 0 | 0 | 3/13/2012 | 0.07 | 0.003913 |
| 3/14/2016 | 0.89 | 0.688095 | 3/15/2015 | 0.46 | 0.284516 | 3/15/2014 | 0 | 0 | 3/15/2013 | 0 | 0 | 3/14/2012 | 0 | 0 |
| 3/15/2016 | 0.26 | 0.115238 | 3/16/2015 | 0 | 0 | 3/16/2014 | 0.04 | 2.41E-34 | 3/16/2013 | 0 | 0 | 3/15/2012 | 0 | 0 |
| 3/16/2016 | 0.04 | 2.41E-34 | 3/17/2015 | 0 | 0 | 3/17/2014 | 0.16 | 0.045 | 3/17/2013 | 0.08 | 0.006667 | 3/16/2012 | 0.04 | 2.41E-34 |
| 3/17/2016 | 0 | 0 | 3/18/2015 | 0 | 0 | 3/18/2014 | 0.01 | 0 | 3/18/2013 | 0 | 0 | 3/17/2012 | 0 | 0 |
| 3/18/2016 | 0.01 | 0 | 3/19/2015 | 0 | 0 | 3/19/2014 | 0 | 0 | 3/19/2013 | 0.75 | 0.553956 | 3/18/2012 | 0 | 0 |
| 3/19/2016 | 0 | 0 | 3/20/2015 | 0.01 | 0 | 3/20/2014 | 0.65 | 0.459383 | 3/20/2013 | 0.02 | 0 | 3/19/2012 | 0 | 0 |
| 3/20/2016 | 0.02 | 0 | 3/21/2015 | 0.53 | 0.347971 | 3/21/2014 | 0 | 0 | 3/21/2013 | 0 | 0 | 3/20/2012 | 0 | 0 |
| 3/21/2016 | 0.02 | 0 | 3/22/2015 | 0 | 0 | 3/22/2014 | 0 | 0 | 3/22/2013 | 0 | 0 | 3/21/2012 | 0 | 0 |
| 3/22/2016 | 0 | 0 | 3/23/2015 | 0 | 0 | 3/23/2014 | 0 | 0 | 3/23/2013 | 0 | 0 | 3/22/2012 | 0 | 0 |
| 3/23/2016 | 0 | 0 | 3/24/2015 | 0 | 0 | 3/24/2014 | 0 | 0 | 3/24/2013 | 0 | 0 | 3/23/2012 | 0 | 0 |
| 3/24/2016 | 0 | 0 | 3/25/2015 | 0 | 0 | 3/25/2014 | 0 | 0 | 3/25/2013 | 0.13 | 0.027931 | 3/24/2012 | 0 | 0 |
| 3/25/2016 | 0 | 0 | 3/26/2015 | 0.04 | 2.41E-34 | 3/26/2014 | 0.07 | 0.003913 | 3/26/2013 | 0.38 | 0.214074 | 3/25/2012 | 0.17 | 0.051212 |
| 3/26/2016 | 0.01 | 0 | 3/27/2015 | 0.88 | 0.678462 | 3/27/2014 | 0 | 0 | 3/27/2013 | 0.01 | 0 | 3/26/2012 | 0 | 0 |
| 3/27/2016 | 0 | 0 | 3/28/2015 | 0 | 0 | 3/28/2014 | 0 | 0 | 3/28/2013 | 0 | 0 | 3/27/2012 | 0 | 0 |
| 3/28/2016 | 0.47 | 0.293492 | 3/29/2015 | 0.01 | 0 | 3/29/2014 | 0.07 | 0.003913 | 3/29/2013 | 0 | 0 | 3/28/2012 | 0 | 0 |
| 3/29/2016 | 0.09 | 0.01 | 3/30/2015 | 0 | 0 | 3/30/2014 | 1.07 | 0.86252 | 3/30/2013 | 0 | 0 | 3/29/2012 | 0.01 | 0 |
| 3/30/2016 | 0 | 0 | 3/31/2015 | 0 | 0 | 3/31/2014 | 0.83 | 0.630404 | 3/31/2013 | 0 | 0 | 3/30/2012 | 0 | 0 |
| 3/31/2016 | 0 | 0 | 4/1/2015 | 0.05 | 0.000476 | 4/1/2014 | 0 | 0 | 4/1/2013 | 0.06 | 0.001818 | 3/31/2012 | 0.2 | 0.071111 |
| 4/1/2016 | 0.01 | 0 | 4/2/2015 | 0 | 0 | 4/2/2014 | 0 | 0 | 4/2/2013 | 0 | 0 | 4/1/2012 | 0.01 | 0 |
| 4/2/2016 | 0.25 | 0.107561 | 4/3/2015 | 0 | 0 | 4/3/2014 | 0.04 | 2.41E-34 | 4/3/2013 | 0 | 0 | 4/2/2012 | 0.23 | 0.092564 |
| 4/3/2016 | 0.12 | 0.022857 | 4/4/2015 | 0.12 | 0.022857 | 4/4/2014 | 0.12 | 0.022857 | 4/4/2013 | 0 | 0 | 4/3/2012 | 0 | 0 |
| 4/4/2016 | 0 | 0 | 4/5/2015 | 0 | 0 | 4/5/2014 | 0.05 | 0.000476 | 4/5/2013 | 0.01 | 0 | 4/4/2012 | 0 | 0 |
| Cumulative Runoff (Q) For 1 Year of Daily Rain Events (Inches) | | 32.26052 | | | 33.10527 | | | 42.33315 | | | 33.16771 | | | 40.00191 |

Average Yearly Runoff (inches) 35.76508

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# Appendix B

## WCU000819 through WCU000820

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**West Chester University Campus**

*Pervious vs. Impervious Coverage*

*Storm Water Run-off Calculation*

| | SF | Acres |
|---|---|---|
| Campus **Pervious Area** Feeding West Chester Borugh Plum Run Outfall: | 983,671 | 22.6 |
| Campus **Impervious Area** Feeding West Chester Borugh Plum Run Outfall: | 1,371,897 | 31.5 |
| Campus **TOTAL Area** Feeding West Chester Borough Plum Run Outfall: | 2,355,568 | 54.1 |

**Run-off Volume Calculation**

2 year: 3.26 in / 24 hr

5 year: 4.10 in/ 24 hr

**Volume = SF impervious x rainfall depth/ 12**

| | | |
|---|---|---|
| 1,371,897 sf x 3.26/12 = | 372,699 | CF |
| 1,371,897 sf x 4.10/12 = | 468,731 | CF |

- explain calculations -
- relate to other $H_2O$ which doesn't enter Plum Run.

WCU000819

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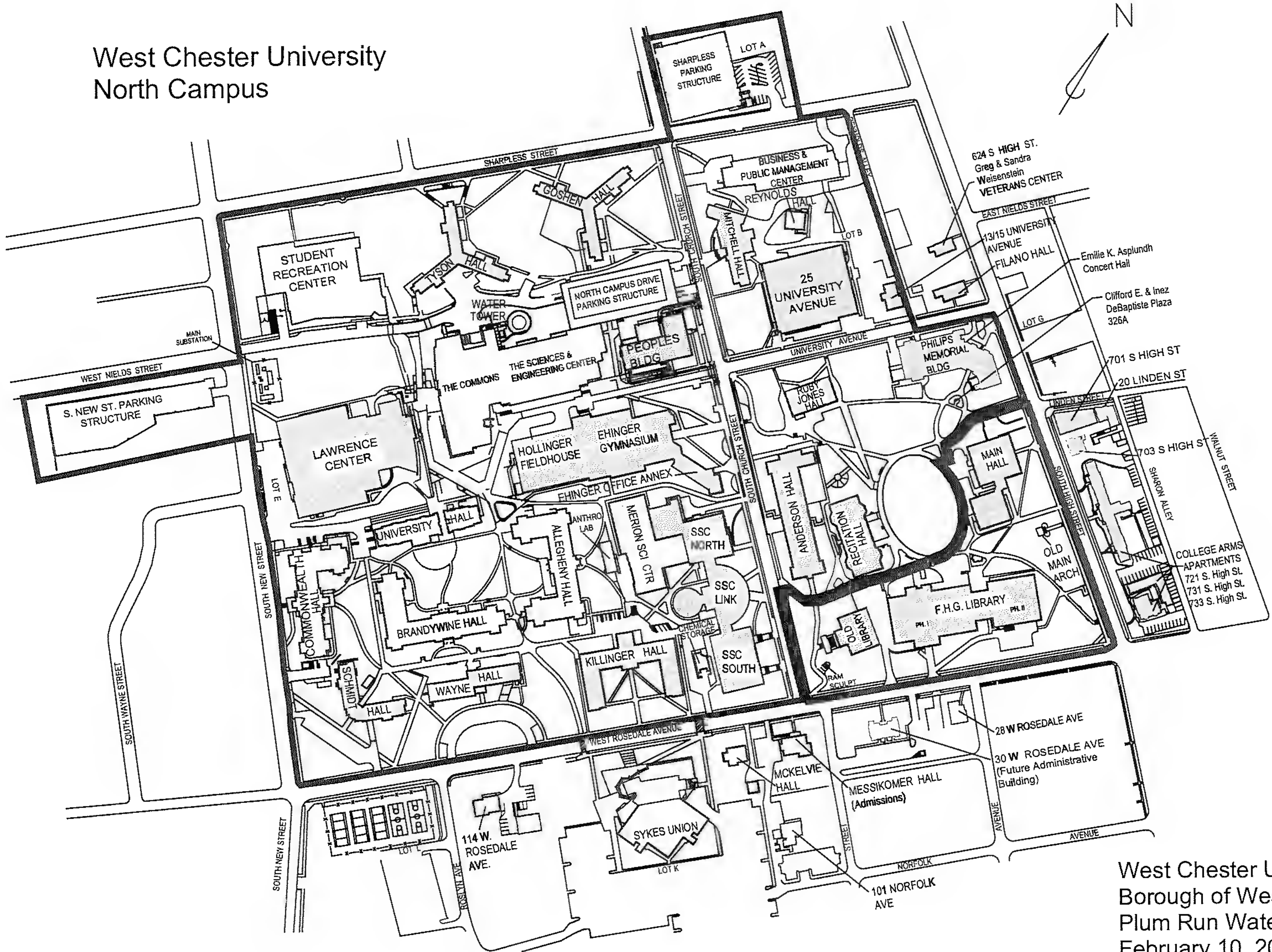
# West Chester University
North Campus




Borough of West Chester - WCU Plum Run Watershed - 2,355,568 sq ft - 54.1 acres
Borough of West Chester - Not Located in Plum Run Watershed - 272,343 sq ft - 6.2 acres
Buildings with No Structural Storm Water Management Systems

West Chester University
Borough of West Chester
Plum Run Watershed
February 10, 2020

WCU000820

% of campus at which SW has managed vs % where it has not managed.

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# Appendix C

## Option 3 Analysis

### West Chester Borough
### Chester County

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# Appendix C

## Data and Information Review



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## Data and Information Review

NTM Engineering, Inc. reviewed the following information for development of the analysis:

- West Chester Borough's current and past stormwater ordinances https://ecode360.com/6469923
- Superblock Survey Sheets - The survey sheets date back to 2007 and include the area bounded by West Rosedale Avenue, South New Street, South Church Street, and Sharpless Avenue. While 2007 may seem recent, the University completed substantial development on North Campus after the survey, including development of the Student Recreation Center, the Commons, the Parking Facility, Commonwealth Hall, Brandywine Hall, and Allegheny Hall. WCU000871-875
- Civil Site and PCSM Plans for The Commons and Parking Facility- (new utility routings and site layout/buildings.) WCU000878-880
- Development Plans for President's Walk (It is our understanding this development project is not advancing). We reviewed the existing conditions plan and grading plan and used those resources for drainage modeling assumptions on the eastern half of North Campus-east of South Church Street). WCU000848
- Civil Site Layout Plan and Grading Plan for West Chester University Student Housing Building "C" (provided by the Borough via counsel)
- Site Layout Plan and Grading Plan for West Chester University Business and Public Affairs Center (provided by the Borough via counsel)
- PASDA Aerial photographs (to review a history of development on campus)

    PASDA (n.d.-a). [chester 091837 Statewide 1937-1942 B&W (not georeferenced)]. Retrieved from: ftp://ftp.pasda.psu.edu/pub/pennpilotr/era1940/chester_1938_photos_jpg_800/chester_091837_ahk4491

    PASDA (n.d.-b). [24002570PAS PEMA Orthoimagery Color (1/2 ft)]. Retrieved from: ftp://ftp.pasda.psu.edu/pub/pasda/pema_imagery/cycle1/TIF/South/2018/Survey_Feet/20000000/24002570PAS_PEMA_2018.zip

- Campus Base Plan (dated 7/19/2020- this map appears to have been made with GIS or AutoCAD and has the most recent sidewalks and drive configurations. This layout shows all new buildings (even if not fully constructed) and apparent storm drain information. An attempt was made to obtain the GIS or CAD file; however it was not available.) Based on existing topography and field review, there appears to be clear discrepancies with connectivity for storm drains in several areas. For instance, Brandywine Hall shows a connection to a stormwater facility in front (south) of Wayne Hall. For this connectivity to occur, the infiltration facility would need to be 18-20 feet deep. Based on downstream connectivity to the inlet, the configuration shown is not possible. WCU000001
- West Chester Borough Stormwater BMP list w/ dates (from the MS4 Permit) 001304-00136
- West Chester Campus Map and Data WCU000817-WCU000824

- West Chester Campus Maps

  1. West Chester University (n.d.-a). [West Chester University Map of North Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUNorthCampusMap.pdf
  2. West Chester University (n.d.-b) [West Chester University Map of South Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUSouthCampusMap.pdf

- West Chester Stream Protection Ordinance https://www.west-chester.com/DocumentCenter/View/13320/2016-Ordinance
- West Chester Borough MS4 Permit PRP https://west-chester.com/DocumentCenter/View/4288/WC-BrandywineBlackhorsePlumTaylor-PRP_Combined-1
- West Chester University MS4 Permit and PRP WCU000002-WCU000816
- NOAA Atlas 14 https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html
- PA StreamStats https://streamstats.usgs.gov/ss/
- Google. (n.d.). [Google Map of West Chester University]. Retrieved May 12, 2021 from https://www.google.com/maps/search/West+Chester+University/@39.946548,-75.6031328,2283m/data=!3m1!1e3
- ChescoViews https://arcweb.chesco.org/cv3/Default_CV.html
- We conducted a field visit on Wednesday May 5, 2021, to confirm general surface drainage area patterns. Existing roof drain tie-ins from buildings to on-campus storm drain conveyance networks could not be reviewed/confirmed in the field. The field visit was conducted during a rain event; therefore, surface drainage patterns were very clearly visible. The area of the Commons was not accessible due to construction, however muddy runoff was visible from the perimeter fence and the outfall to Plum Run was discharging sediment laden runoff, which we thought to originate from the construction site. Subsurface drainage facilities were not reviewable in the field. The University did not provide a representative familiar with the system, to answer questions about the existing system connectivity, or review the condition of inlets, manholes and other subsurface utilities.

**Other information reviewed but not used because of age or utility includes:**

- PASDA 2' Contours (2006-2008)
- Chester County GIS Buildings Layer (2015) (already partially outdated because of recent development on campus)
- West Chester County GIS (Various Layers - sidewalks were not available on campus)
- West Chester Borough GIS Maps (e.g. storm drain)

- Various maps provided with some level of conflicting information (*e.g.* the drainage area map showing the Plum Run drainage divided on North Campus or within the Superblock is not correct based on the plans and storm drain conveyance maps reviewed.)

**Information not available for review (which would have helped with analysis) includes:**

- Approved stormwater management analysis/reports, as-built plans, and drainage area maps for development on campus (since 2004)
- Design information on existing stormwater management facilities not installed as part of a land development project
- University GIS or CAD land use information

# Appendix C

## Modeling Approach and Assumptions

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## Modeling Approach and Assumptions

NTM Engineering, Inc. used the following methodology and general modeling assumptions for development of the H&H models and design.

- We superimposed/aggregated relevant available plan and topographic information provided as PDFs to generate an overall up-to-date layout of West Chester University Campus (See Exhibit A-6).
- Using available topography and existing storm drain maps, we delineated campus subdrainage areas.
- We conducted a field visit on Wednesday May 5, 2021, to confirm general surface drainage area patterns. Existing roof drain tie-ins from buildings to on-campus storm drain conveyance networks could not be reviewed/confirmed in the field. The field visit was conducted during a rain event; therefore, surface drainage patterns were very clearly visible. The area of the Commons was not accessible due to construction, however muddy runoff was visible from the perimeter fence and the outfall to Plum Run was discharging sediment laden runoff, which we thought to originate from the construction site. Subsurface drainage facilities were not reviewable in the field. The University did not provide a representative familiar with the system to answer questions about the existing system connectivity or review the condition of inlets, manholes, and other subsurface utilities.
- The modeling and design consider the area of North Campus which drains to the unnamed tributary of Plum Run located in the Borough (See **Appendix A**, Exhibit A-6). There are additional North Campus drainage areas which flow to the south and to the east, respectively, to Borough ROW and conveyance facilities (which, again, are part of the Borough Stormwater Management System) and ultimately to a different branch of Plum Run or Goose Creek. Modeling of these areas and analysis of the subsequent benefits which the University derives from draining to the Borough Stormwater Management System was not completed as part of this study; however, as more fully discussed in the Conclusion, the University would incur additional costs to provide a similar approach and replication of the existing benefits which the Borough Stormwater Management System provides to the University.
- Because full reports and documentation for existing stormwater facilities were not available, we did not complete detailed modeling for existing stormwater management facilities or storage areas on North Campus. To consider the benefits of the existing University-owned stormwater facilities and resulting potential flow reduction to separate University-owned storm drain conveyance facilities which would replicate the current benefits which arise from connection to the Borough Stormwater Management System, we reviewed the current and previous West Chester Borough stormwater ordinances for stormwater design standards. Stormwater management is designed to reduce a post development peak rate flow resulting from changes in land use, back to an existing or theoretical land use state.

The modeling completed considers that development on North Campus, where stormwater facilities are present, would reduce the peak rates as follows:

  - Buildings completed after 2013 are assumed to have, as a result of stormwater regulations in affect at the time, reduced post development runoff back to existing condition rates, characterized by a drainage area land use of meadow in good condition (hydrologic soil group C soils).
  - Buildings completed between 2004 and 2013 are assumed to have, as a result of stormwater regulations in affect at the time, reduced post development runoff back to existing condition rates, characterized by a drainage area land use of open space in good condition (hydrologic soil group C soils).
  - We modeled portions of North Campus which the University developed prior to implementation of a stormwater management ordinance based on actual land use conditions (hydrologic soil group C soils).

- The conceptual design considers, to the extent possible, the layout and depth of existing storm drain and other utilities where/when known.
- The model does not include a pre/post analysis which would consider potential rate increases due to increased capacity conveyance. This would typically be completed as part of final design and permitting.
- AutoDesk Storm and Sanitary Sewer Analysis were utilized for modeling and design. Basin Modeling was considered as follows:
  - SCS TR-20 methodology was used for hydrologic modeling to consider full capture volumes created by typical design events.
  - Time of Concentration values were calculated using sheet flow calculations based on available topographic data and considering a manning's value of 0.240 for dense grass, shallow concentrated flow considering grass channel and open channel flow- pipe flowing full, where applicable impervious area was not separated out for consideration of flash flows which occur in high impervious environment. The approach may underestimate peak flows in some cases. This approach is conservative from the perspective of the case and benefits WCU.
  - Soils Hydrologic Soil Group (HSG) C Many urban areas have experienced significant soil compaction and are better represented as HSG D. HSG D represents less well drained soils and creates more runoff. This approach may underestimate peak flows. However, as it relates to case context, this approach reduces resulting costs benefiting WCU.
  - Land Use CN-Value
    - Open Space Meadow: 71
    - Open Space: 74
    - Impervious: 98

- Drainage area sub-watershed sizes are based on best available information or an estimated project area.
- Storm Drain Modeling Routing Conditions: Steady State.
- 100-year Design Storm- 7.55 Inches

# Appendix C

## Autodesk Storm and Sanitary Analysis

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## Project Description

File Name ................................................... 2021 05 12 WCU Concept SCS.SPF

## Project Options

Flow Units .................................................. CFS
Elevation Type ........................................... Elevation
Hydrology Method ...................................... SCS TR-20
Time of Concentration (TOC) Method ........ SCS TR-55
Link Routing Method .................................. Steady Flow
Enable Overflow Ponding at Nodes ............ YES
Skip Steady State Analysis Time Periods ... NO

## Analysis Options

| | | |
|---|---|---|
| Start Analysis On ........................................ | Feb 23, 2021 | 00:00:00 |
| End Analysis On .......................................... | Feb 23, 2021 | 23:00:00 |
| Start Reporting On ...................................... | Feb 23, 2021 | 00:00:00 |
| Antecedent Dry Days ................................. | 0 | days |
| Runoff (Dry Weather) Time Step ................ | 0 01:00:00 | days hh:mm:ss |
| Runoff (Wet Weather) Time Step ............... | 0 00:05:00 | days hh:mm:ss |
| Reporting Time Step .................................. | 0 00:05:00 | days hh:mm:ss |
| Routing Time Step ...................................... | 300 | seconds |

## Number of Elements

| | Qty |
|---|---|
| Rain Gages ................................................ | 1 |
| Subbasins.................................................... | 19 |
| Nodes........................................................... | 34 |
| *Junctions* ........................................... | 32 |
| *Outfalls* .............................................. | 2 |
| *Flow Diversions* ................................. | 0 |
| *Inlets* ................................................. | 0 |
| *Storage Nodes* .................................. | 0 |
| Links............................................................ | 32 |
| *Channels* ........................................... | 0 |
| *Pipes* ................................................. | 32 |
| *Pumps* ............................................... | 0 |
| *Orifices* ............................................. | 0 |
| *Weirs* ................................................. | 0 |
| *Outlets* ............................................... | 0 |
| Pollutants .................................................... | 0 |
| Land Uses ................................................... | 0 |

## Rainfall Details

| SN | Rain Gage ID | Data Source | Data Source ID | Rainfall Type | Rain Units | State | County | Return Period (years) | Rainfall Depth (inches) | Rainfall Distribution |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | Time Series | NOAA C | Cumulative | inches | | | | | User Defined |

## Subbasin Summary

| SN | Subbasin ID | Area (ac) | Peak Rate Factor | Weighted Curve Number | Total Rainfall (in) | Total Runoff (in) | Total Runoff Volume (ac-in) | Peak Runoff (cfs) | Time of Concentration (days hh:mm:ss) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | DA A1 | 2.08 | 484.00 | 78.04 | 7.47 | 4.91 | 10.20 | 11.94 | 0 00:09:43 |
| 2 | DA A1.5 | 0.12 | 484.00 | 94.00 | 7.47 | 6.75 | 0.81 | 0.98 | 0 00:06:00 |
| 3 | DA A2 | 2.22 | 484.00 | 82.89 | 7.47 | 5.46 | 12.12 | 13.77 | 0 00:09:58 |
| 4 | DA A3 | 2.24 | 484.00 | 82.84 | 7.47 | 5.45 | 12.21 | 13.31 | 0 00:11:14 |
| 5 | DA B1 | 1.14 | 484.00 | 77.58 | 7.47 | 4.85 | 5.53 | 5.50 | 0 00:14:52 |
| 6 | DA B1.5 | 0.45 | 484.00 | 78.60 | 7.47 | 4.97 | 2.24 | 2.69 | 0 00:08:43 |
| 7 | DA B10 | 2.26 | 484.00 | 83.88 | 7.47 | 5.57 | 12.59 | 12.09 | 0 00:15:21 |
| 8 | DA B11 | 0.77 | 484.00 | 80.16 | 7.47 | 5.15 | 3.96 | 4.55 | 0 00:09:55 |
| 9 | DA B12 | 2.69 | 484.00 | 81.58 | 7.47 | 5.31 | 14.28 | 15.63 | 0 00:11:12 |
| 10 | DA B13 | 2.38 | 484.00 | 89.73 | 7.47 | 6.25 | 14.88 | 14.25 | 0 00:14:08 |
| 11 | DA B14 | 5.71 | 484.00 | 83.54 | 7.47 | 5.53 | 31.59 | 31.95 | 0 00:13:34 |
| 12 | DA B2 | 1.55 | 484.00 | 93.51 | 7.47 | 6.70 | 10.38 | 12.41 | 0 00:06:00 |
| 13 | DA B3 | 14.51 | 484.00 | 83.63 | 7.47 | 5.54 | 80.43 | 77.97 | 0 00:15:00 |
| 14 | DA B4 | 2.60 | 484.00 | 83.07 | 7.47 | 5.48 | 14.24 | 13.86 | 0 00:14:58 |
| 15 | DA B5 | 0.33 | 484.00 | 84.73 | 7.47 | 5.67 | 1.87 | 2.43 | 0 00:06:00 |
| 16 | DA B6 | 0.39 | 484.00 | 73.79 | 7.47 | 4.43 | 1.73 | 2.31 | 0 00:06:18 |
| 17 | DA B7 | 0.70 | 484.00 | 74.00 | 7.47 | 4.45 | 3.12 | 4.19 | 0 00:06:00 |
| 18 | DA B8 | 0.24 | 484.00 | 79.50 | 7.47 | 5.07 | 1.22 | 1.63 | 0 00:06:00 |
| 19 | DA B9 | 1.74 | 484.00 | 88.86 | 7.47 | 6.15 | 10.70 | 10.07 | 0 00:15:00 |

## Node Summary

| SN | Element ID | Element Type | Invert Elevation (ft) | Ground/Rim (Max) Elevation (ft) | Initial Water Elevation (ft) | Surcharge Elevation (ft) | Ponded Area (ft²) | Peak Inflow (cfs) | Max HGL Elevation Attained (ft) | Max Surcharge Depth Attained (ft) | Min Freeboard Attained (ft) | Time of Peak Flooding Occurrence (days hh:mm) | Total Flooded Volume (ac-in) | Total Time Flooded (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S1.01 | Junction | 374.00 | 386.00 | 374.00 | 386.00 | 0.00 | 201.55 | 377.15 | 0.00 | 8.85 | 0 00:00 | 0.00 | 0.00 |
| 2 | S1.02 | Junction | 376.56 | 382.56 | 376.56 | 382.56 | 0.00 | 180.75 | 379.54 | 0.00 | 3.02 | 0 00:00 | 0.00 | 0.00 |
| 3 | S1.03 | Junction | 378.95 | 384.95 | 378.95 | 385.00 | 0.00 | 175.42 | 381.87 | 0.00 | 3.08 | 0 00:00 | 0.00 | 0.00 |
| 4 | S1.04 | Junction | 379.74 | 389.00 | 379.74 | 385.74 | 0.00 | 172.89 | 382.62 | 0.00 | 6.38 | 0 00:00 | 0.00 | 0.00 |
| 5 | S1.05 | Junction | 380.40 | 386.40 | 380.40 | 386.40 | 0.00 | 97.08 | 382.88 | 0.00 | 3.52 | 0 00:00 | 0.00 | 0.00 |
| 6 | S1.06 | Junction | 381.29 | 392.00 | 381.29 | 387.29 | 0.00 | 97.08 | 384.09 | 0.00 | 7.91 | 0 00:00 | 0.00 | 0.00 |
| 7 | S1.07 | Junction | 381.74 | 392.00 | 381.74 | 387.74 | 0.00 | 95.28 | 384.54 | 0.00 | 7.46 | 0 00:00 | 0.00 | 0.00 |
| 8 | S1.08 | Junction | 382.94 | 388.94 | 382.94 | 388.94 | 0.00 | 81.80 | 385.13 | 0.00 | 3.81 | 0 00:00 | 0.00 | 0.00 |
| 9 | S1.09 | Junction | 383.30 | 389.30 | 383.30 | 389.30 | 0.00 | 79.93 | 385.49 | 0.00 | 3.81 | 0 00:00 | 0.00 | 0.00 |
| 10 | S1.10 | Junction | 384.30 | 390.30 | 384.30 | 390.30 | 0.00 | 79.93 | 386.40 | 0.00 | 3.90 | 0 00:00 | 0.00 | 0.00 |
| 11 | S1.11 | Junction | 385.03 | 391.00 | 385.03 | 391.00 | 0.00 | 79.93 | 387.13 | 0.00 | 3.87 | 0 00:00 | 0.00 | 0.00 |
| 12 | S1.12 | Junction | 389.90 | 395.90 | 389.90 | 395.90 | 0.00 | 76.78 | 391.92 | 0.00 | 3.98 | 0 00:00 | 0.00 | 0.00 |
| 13 | S1.13 | Junction | 392.00 | 398.00 | 392.00 | 398.00 | 0.00 | 75.56 | 394.01 | 0.00 | 3.99 | 0 00:00 | 0.00 | 0.00 |
| 14 | S1.14 | Junction | 392.77 | 398.77 | 392.77 | 398.77 | 0.00 | 55.51 | 394.68 | 0.00 | 4.09 | 0 00:00 | 0.00 | 0.00 |
| 15 | S1.15 | Junction | 395.30 | 401.30 | 395.30 | 401.30 | 0.00 | 45.70 | 396.95 | 0.00 | 4.35 | 0 00:00 | 0.00 | 0.00 |
| 16 | S1.16 | Junction | 397.35 | 403.35 | 397.35 | 403.35 | 0.00 | 45.70 | 399.00 | 0.00 | 4.35 | 0 00:00 | 0.00 | 0.00 |
| 17 | S1.17 | Junction | 400.40 | 406.40 | 400.40 | 406.40 | 0.00 | 31.65 | 401.99 | 0.00 | 4.41 | 0 00:00 | 0.00 | 0.00 |
| 18 | S1.18 | Junction | 402.00 | 413.00 | 402.00 | 413.00 | 0.00 | 31.65 | 403.57 | 0.00 | 9.43 | 0 00:00 | 0.00 | 0.00 |
| 19 | S1.19 | Junction | 394.42 | 400.42 | 394.42 | 400.42 | 0.00 | 20.05 | 395.60 | 0.00 | 4.82 | 0 00:00 | 0.00 | 0.00 |
| 20 | S1.20 | Junction | 396.30 | 402.30 | 396.30 | 402.30 | 0.00 | 15.61 | 397.48 | 0.00 | 4.82 | 0 00:00 | 0.00 | 0.00 |
| 21 | S1.21 | Junction | 398.00 | 402.00 | 398.00 | 402.00 | 0.00 | 15.61 | 399.18 | 0.00 | 2.82 | 0 00:00 | 0.00 | 0.00 |
| 22 | S1.22 | Junction | 384.00 | 394.00 | 384.00 | 394.00 | 0.00 | 11.73 | 384.85 | 0.00 | 9.15 | 0 00:00 | 0.00 | 0.00 |
| 23 | S2.01 | Junction | 377.25 | 384.60 | 377.25 | 384.60 | 0.00 | 39.18 | 379.21 | 0.00 | 5.39 | 0 00:00 | 0.00 | 0.00 |
| 24 | S2.02 | Junction | 378.42 | 390.20 | 378.42 | 390.20 | 0.00 | 39.18 | 380.38 | 0.00 | 9.82 | 0 00:00 | 0.00 | 0.00 |
| 25 | S2.03 | Junction | 378.85 | 393.00 | 378.85 | 393.00 | 0.00 | 39.18 | 380.81 | 0.00 | 12.19 | 0 00:00 | 0.00 | 0.00 |
| 26 | S2.05 | Junction | 380.13 | 396.00 | 380.13 | 396.00 | 0.00 | 27.55 | 381.63 | 0.00 | 14.37 | 0 00:00 | 0.00 | 0.00 |
| 27 | S2.06 | Junction | 371.74 | 394.00 | 381.74 | 394.00 | 0.00 | 27.55 | 383.24 | 0.00 | 10.76 | 0 00:00 | 0.00 | 0.00 |
| 28 | S2.07 | Junction | 382.38 | 392.00 | 382.38 | 392.00 | 0.00 | 26.82 | 383.86 | 0.00 | 8.14 | 0 00:00 | 0.00 | 0.00 |
| 29 | S2.08 | Junction | 382.87 | 390.00 | 382.87 | 390.00 | 0.00 | 26.82 | 384.35 | 0.00 | 5.65 | 0 00:00 | 0.00 | 0.00 |
| 30 | S2.09 | Junction | 383.85 | 389.50 | 383.85 | 389.50 | 0.00 | 26.82 | 385.32 | 0.00 | 4.18 | 0 00:00 | 0.00 | 0.00 |
| 31 | S2.10 | Junction | 385.35 | 392.00 | 385.35 | 392.00 | 0.00 | 13.27 | 386.73 | 0.00 | 5.27 | 0 00:00 | 0.00 | 0.00 |
| 32 | S2.11 | Junction | 382.90 | 388.90 | 382.90 | 388.90 | 0.00 | 13.27 | 386.93 | 0.00 | 1.97 | 0 00:00 | 0.00 | 0.00 |
| 33 | Outfall 1 | Outfall | 373.00 | | | | | 201.55 | 376.15 | | | | | |
| 34 | Outfall 2 | Outfall | 373.00 | | | | | 39.18 | 374.00 | | | | | |

## Link Summary

| SN | Element ID | Element Type | From (Inlet) Node | To (Outlet) Node | Length (ft) | Inlet Invert Elevation (ft) | Outlet Invert Elevation (ft) | Average Slope (%) | Diameter or Height (in) | Manning's Roughness | Peak Flow (cfs) | Design Flow Capacity (cfs) | Peak Flow/ Design Flow Ratio | Peak Flow Velocity (ft/sec) | Peak Flow Depth (ft) | Peak Flow Depth/ Total Depth Ratio | Total Time Surcharged (min) | Reported Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | P1.01 | Pipe | S1.01 | Outfall 1 | 66.76 | 374.00 | 373.00 | 1.5000 | 54.000 | 0.0130 | 201.55 | 240.68 | 0.84 | 16.94 | 3.15 | 0.70 | 0.00 | Calculated |
| 2 | P1.02 | Pipe | S1.02 | S1.01 | 183.09 | 376.56 | 374.00 | 1.4000 | 54.000 | 0.0130 | 180.75 | 232.53 | 0.78 | 16.16 | 2.98 | 0.66 | 0.00 | Calculated |
| 3 | P1.03 | Pipe | S1.03 | S1.02 | 170.47 | 378.95 | 376.56 | 1.4000 | 54.000 | 0.0130 | 175.42 | 232.85 | 0.75 | 16.08 | 2.92 | 0.65 | 0.00 | Calculated |
| 4 | P1.04 | Pipe | S1.04 | S1.03 | 56.03 | 379.74 | 378.95 | 1.4100 | 54.000 | 0.0130 | 172.89 | 233.50 | 0.74 | 16.07 | 2.88 | 0.64 | 0.00 | Calculated |
| 5 | P1.05 | Pipe | S1.05 | S1.04 | 64.98 | 380.40 | 379.74 | 1.0200 | 48.000 | 0.0130 | 97.08 | 144.77 | 0.67 | 12.34 | 2.40 | 0.60 | 0.00 | Calculated |
| 6 | P1.06 | Pipe | S1.06 | S1.05 | 97.20 | 381.29 | 380.40 | 0.9200 | 48.000 | 0.0130 | 97.08 | 137.45 | 0.71 | 11.85 | 2.48 | 0.62 | 0.00 | Calculated |
| 7 | P1.07 | Pipe | S1.07 | S1.06 | 47.82 | 381.74 | 381.29 | 0.9400 | 42.000 | 0.0130 | 95.28 | 97.60 | 0.98 | 11.55 | 2.80 | 0.80 | 0.00 | Calculated |
| 8 | P1.08 | Pipe | S1.08 | S1.07 | 86.34 | 382.94 | 381.74 | 1.3900 | 42.000 | 0.0130 | 81.80 | 118.61 | 0.69 | 13.29 | 2.14 | 0.61 | 0.00 | Calculated |
| 9 | P1.09 | Pipe | S1.09 | S1.08 | 29.24 | 383.30 | 382.94 | 1.2300 | 42.000 | 0.0130 | 79.93 | 111.64 | 0.72 | 12.61 | 2.19 | 0.63 | 0.00 | Calculated |
| 10 | P1.10 | Pipe | S1.10 | S1.09 | 68.28 | 384.30 | 383.30 | 1.4600 | 42.000 | 0.0130 | 79.93 | 121.76 | 0.66 | 13.49 | 2.07 | 0.59 | 0.00 | Calculated |
| 11 | P1.11 | Pipe | S1.11 | S1.10 | 52.03 | 385.03 | 384.30 | 1.4000 | 42.000 | 0.0130 | 79.93 | 119.17 | 0.67 | 13.27 | 2.10 | 0.60 | 0.00 | Calculated |
| 12 | P1.12 | Pipe | S1.12 | S1.11 | 135.23 | 389.90 | 385.03 | 3.6000 | 30.000 | 0.0130 | 76.78 | 77.84 | 0.99 | 18.07 | 2.02 | 0.81 | 0.00 | Calculated |
| 13 | P1.13 | Pipe | S1.13 | S1.12 | 59.72 | 392.00 | 389.90 | 3.5200 | 30.000 | 0.0130 | 75.56 | 76.92 | 0.98 | 17.85 | 2.01 | 0.80 | 0.00 | Calculated |
| 14 | P1.14 | Pipe | S1.14 | S1.13 | 36.49 | 392.77 | 392.00 | 2.1100 | 30.000 | 0.0130 | 55.51 | 59.58 | 0.93 | 13.78 | 1.91 | 0.76 | 0.00 | Calculated |
| 15 | P1.15 | Pipe | S1.15 | S1.14 | 119.79 | 395.30 | 392.77 | 2.1100 | 30.000 | 0.0130 | 45.70 | 59.61 | 0.77 | 13.38 | 1.64 | 0.66 | 0.00 | Calculated |
| 16 | P1.16 | Pipe | S1.16 | S1.15 | 98.60 | 397.35 | 395.30 | 2.0800 | 30.000 | 0.0130 | 45.70 | 59.14 | 0.77 | 13.30 | 1.65 | 0.66 | 0.00 | Calculated |
| 17 | P1.17 | Pipe | S1.17 | S1.16 | 146.13 | 400.40 | 397.35 | 2.0900 | 24.000 | 0.0130 | 31.65 | 32.68 | 0.97 | 11.84 | 1.59 | 0.79 | 0.00 | Calculated |
| 18 | P1.18 | Pipe | S1.18 | S1.17 | 74.66 | 402.00 | 400.40 | 2.1400 | 24.000 | 0.0130 | 31.65 | 33.12 | 0.96 | 11.99 | 1.57 | 0.78 | 0.00 | Calculated |
| 19 | P1.19 | Pipe | S1.19 | S1.13 | 98.76 | 394.42 | 392.00 | 2.4500 | 24.000 | 0.0130 | 20.05 | 35.41 | 0.57 | 11.62 | 1.08 | 0.54 | 0.00 | Calculated |
| 20 | P1.20 | Pipe | S1.20 | S1.19 | 78.24 | 396.30 | 394.42 | 2.4000 | 18.000 | 0.0130 | 15.61 | 16.28 | 0.96 | 10.49 | 1.18 | 0.79 | 0.00 | Calculated |
| 21 | P1.21 | Pipe | S1.21 | S1.20 | 71.46 | 398.00 | 396.30 | 2.3800 | 18.000 | 0.0130 | 15.61 | 16.20 | 0.96 | 10.44 | 1.18 | 0.79 | 0.00 | Calculated |
| 22 | P1.22 | Pipe | S1.22 | S1.01 | 299.67 | 384.00 | 374.00 | 3.3400 | 18.000 | 0.0130 | 11.73 | 19.19 | 0.61 | 11.39 | 0.85 | 0.57 | 0.00 | Calculated |
| 23 | P2.01 | Pipe | S2.01 | Outfall 2 | 70.50 | 373.71 | 373.00 | 1.0100 | 36.000 | 0.0130 | 39.18 | 163.76 | 0.24 | 19.00 | 1.00 | 0.33 | 0.00 | Calculated |
| 24 | P2.02 | Pipe | S2.02 | S2.01 | 117.10 | 378.42 | 377.25 | 1.0000 | 30.000 | 0.0130 | 39.18 | 41.00 | 0.96 | 9.50 | 1.96 | 0.78 | 0.00 | Calculated |
| 25 | P2.03 | Pipe | S2.03 | S2.02 | 43.21 | 378.85 | 378.42 | 1.0000 | 30.000 | 0.0130 | 39.18 | 40.92 | 0.96 | 9.49 | 1.96 | 0.78 | 0.00 | Calculated |
| 26 | P2.04 | Pipe | S2.05 | S2.03 | 127.13 | 380.13 | 378.85 | 1.0100 | 30.000 | 0.0130 | 27.55 | 41.16 | 0.67 | 8.98 | 1.50 | 0.60 | 0.00 | Calculated |
| 27 | P2.06 | Pipe | S2.06 | S2.05 | 161.78 | 381.74 | 380.13 | 1.0000 | 30.000 | 0.0130 | 27.55 | 40.92 | 0.67 | 8.94 | 1.50 | 0.60 | 0.00 | Calculated |
| 28 | P2.07 | Pipe | S2.07 | S2.06 | 63.62 | 382.38 | 381.74 | 1.0100 | 30.000 | 0.0130 | 26.82 | 41.14 | 0.65 | 8.92 | 1.47 | 0.59 | 0.00 | Calculated |
| 29 | P2.08 | Pipe | S2.08 | S2.07 | 49.15 | 382.87 | 382.38 | 1.0000 | 30.000 | 0.0130 | 26.82 | 40.95 | 0.65 | 8.89 | 1.48 | 0.59 | 0.00 | Calculated |
| 30 | P2.09 | Pipe | S2.09 | S2.08 | 97.65 | 383.85 | 382.87 | 1.0000 | 30.000 | 0.0130 | 26.82 | 41.09 | 0.65 | 8.91 | 1.47 | 0.59 | 0.00 | Calculated |
| 31 | P2.10 | Pipe | S2.10 | S2.09 | 149.69 | 385.35 | 383.53 | 1.2200 | 24.000 | 0.0130 | 13.27 | 22.65 | 0.59 | 7.49 | 1.10 | 0.55 | 0.00 | Calculated |
| 32 | P2.11 | Pipe | S2.11 | S2.10 | 39.49 | 385.55 | 385.35 | 0.5100 | 24.000 | 0.0130 | 13.27 | 16.10 | 0.82 | 5.72 | 1.38 | 0.69 | 0.00 | Calculated |

# Subbasin Hydrology

## Subbasin : DA A1

### Input Data

Area (ac) ........................................................................ 2.08
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 78.04
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| Paved parking & roofs | 0.35 | C | 98.00 |
| > 75% grass cover, Good | 1.73 | C | 74.00 |
| Composite Area & Weighted CN | 2.08 | | 78.04 |

### Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area ($ft^2$)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | .240 | 0.00 |
| Flow Length (ft) : | 100 | 100 | 0.00 |
| Slope (%) : | 6.67 | 6.67 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 3.26 | 0.00 |
| Velocity (ft/sec) : | 0.19 | 0.19 | 0.00 |
| Computed Flow Time (min) : | 8.73 | 8.73 | 0.00 |

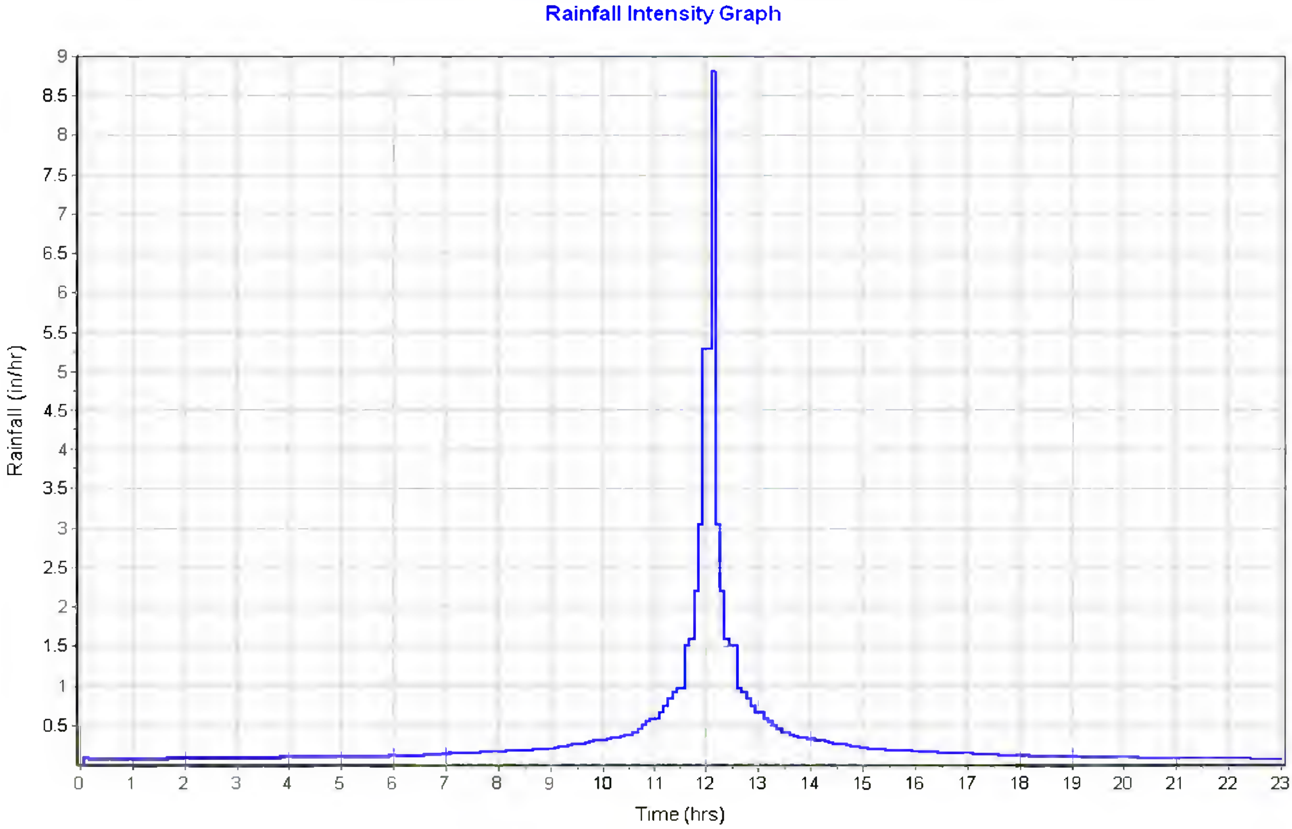
| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 230 | 230 | 0.00 |
| Slope (%) : | 6.67 | 6.67 | 0.00 |
| Surface Type : | Grassed waterway | Grassed waterway | Unpaved |
| Velocity (ft/sec) : | 3.87 | 3.87 | 0.00 |
| Computed Flow Time (min) : | 0.99 | 0.99 | 0.00 |

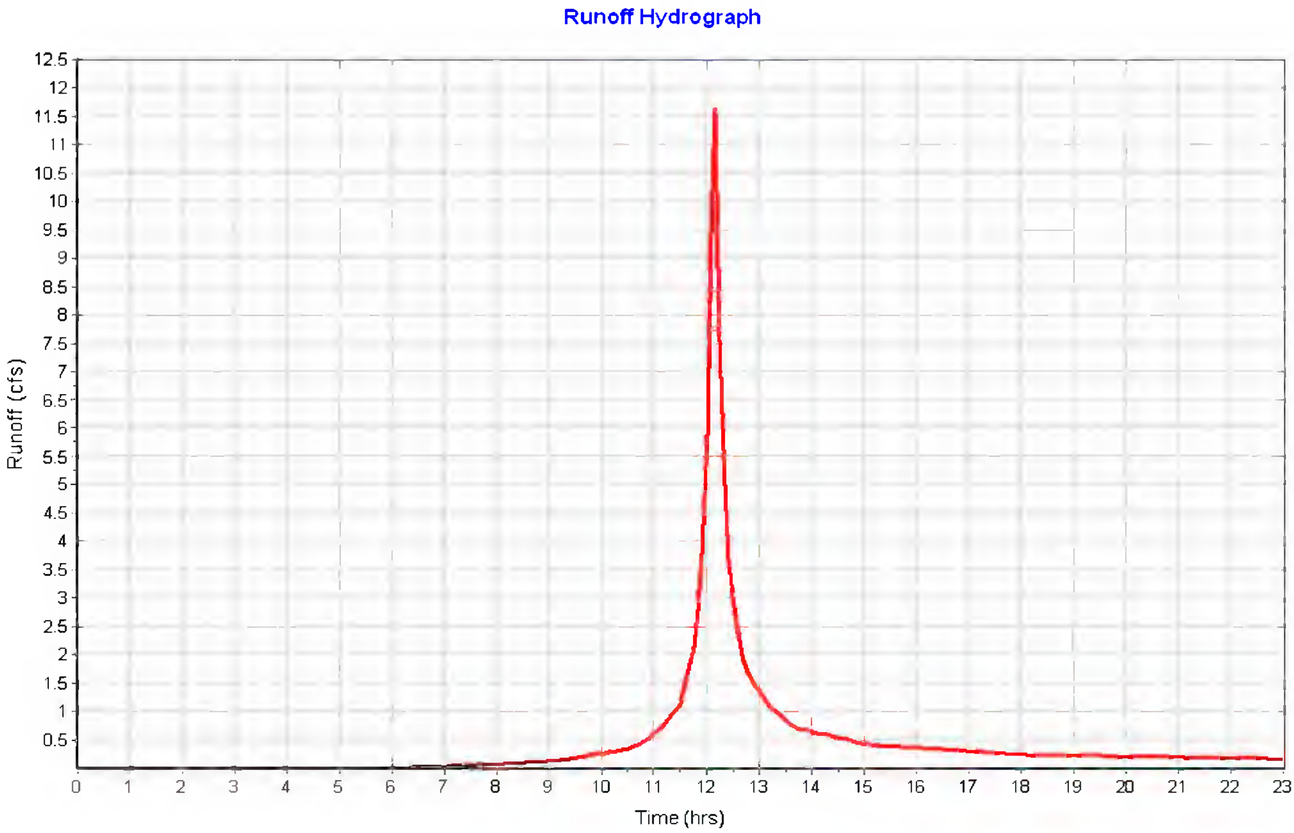
Total TOC (min) ..................9.72

### Subbasin Runoff Results

Total Rainfall (in) ........................................................... 7.47
Total Runoff (in) ............................................................ 4.91
Peak Runoff (cfs) ........................................................... 11.94
Weighted Curve Number ............................................... 78.04
Time of Concentration (days hh:mm:ss) ........................ 0 00:09:43

**Subbasin : DA A1**



## Subbasin : DA A1.5

### Input Data

Area (ac) .......................................................................... 0.12
Peak Rate Factor .......................................................... 484.00
Weighted Curve Number .............................................. 94.00
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.02 | C | 74.00 |
| Paved parking & roofs | 0.10 | C | 98.00 |
| Composite Area & Weighted CN | 0.12 | | 94.00 |

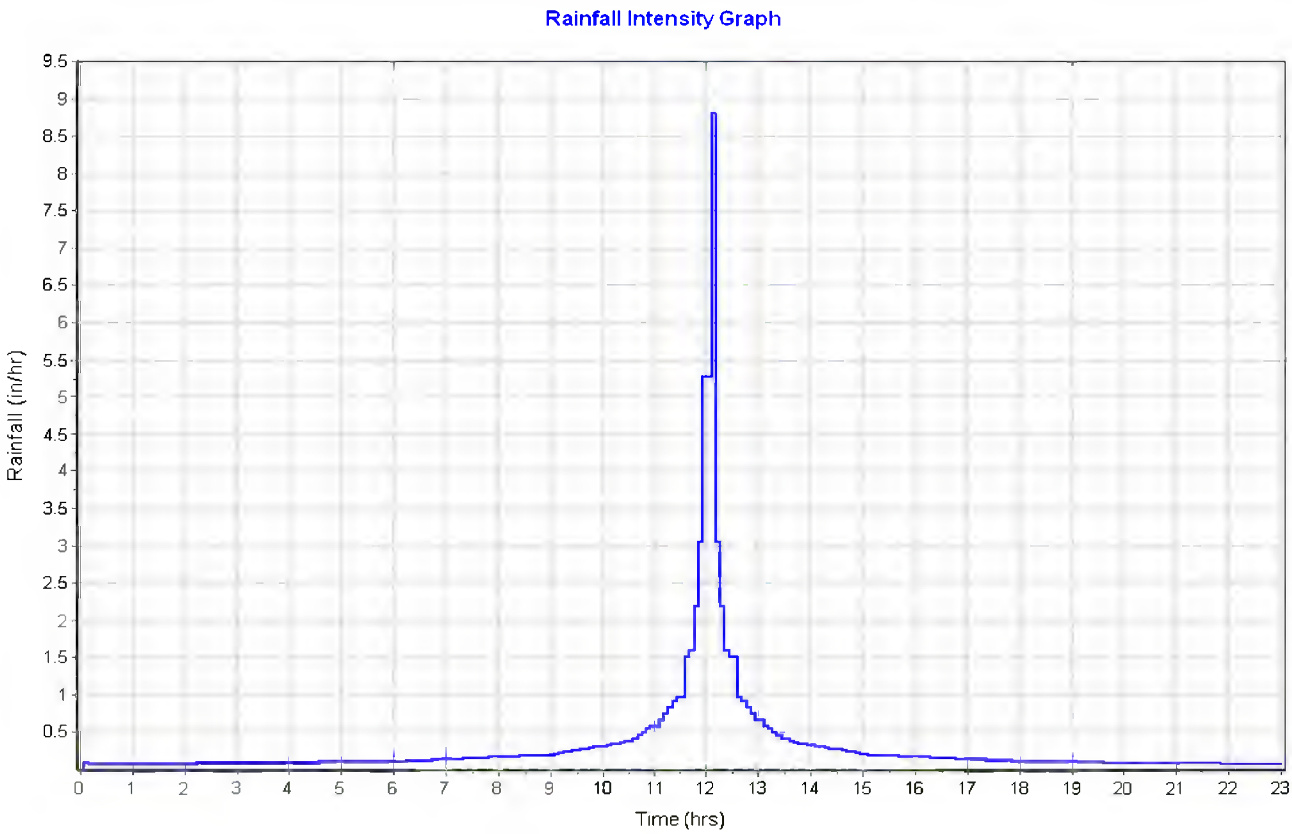
### Time of Concentration

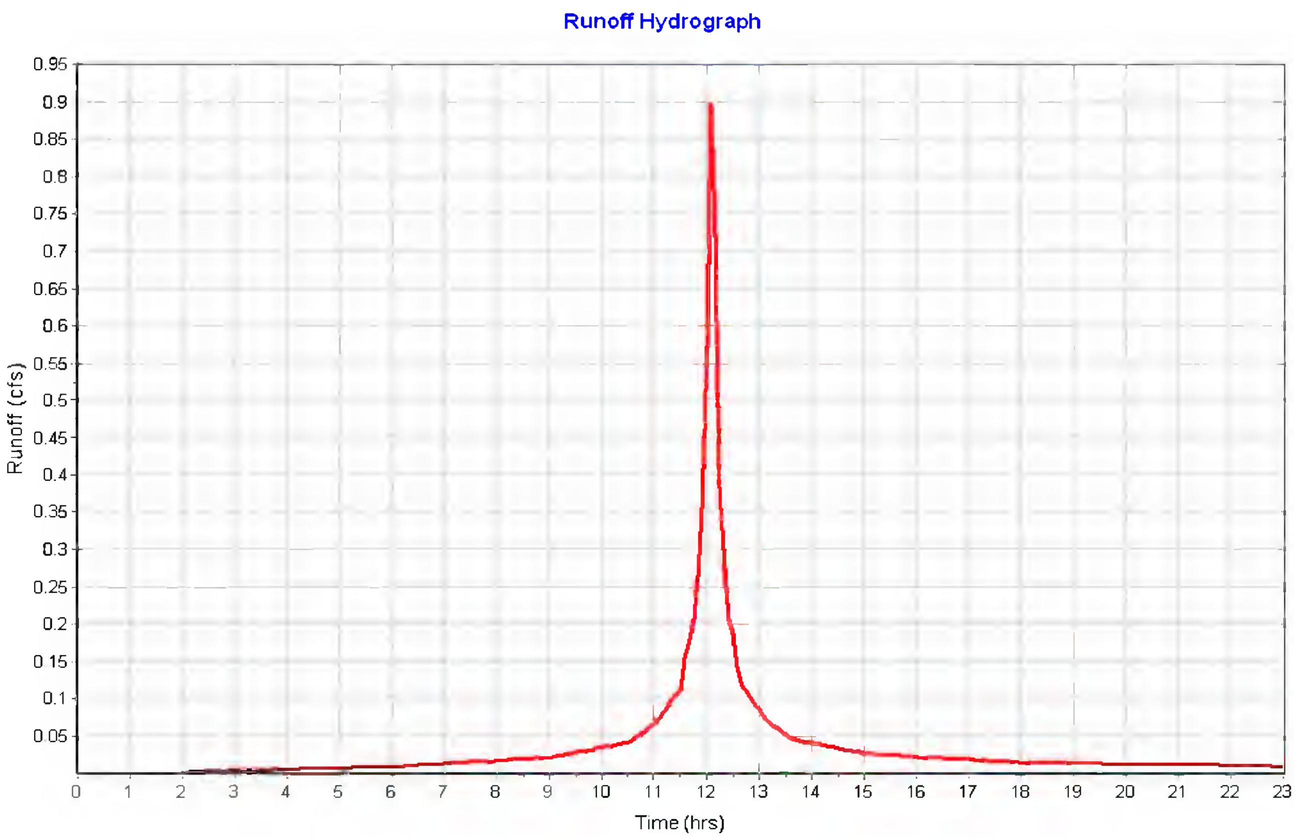
User-Defined TOC override (minutes): 6

### Subbasin Runoff Results

Total Rainfall (in) ........................................................... 7.47
Total Runoff (in) ............................................................. 6.75
Peak Runoff (cfs) ........................................................... 0.98
Weighted Curve Number .............................................. 94.00
Time of Concentration (days hh:mm:ss) ....................... 0 00:06:00

**Subbasin : DA A1.5**



## Subbasin : DA A2

### Input Data

Area (ac) .......................................................................... 2.22
Peak Rate Factor ............................................................. 484.00
Weighted Curve Number ................................................. 82.89
Rain Gage ID ................................................................... *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 1.33 | C | 74.00 |
| Paved parking & roofs | 0.83 | C | 98.00 |
| Meadow, non-grazed | 0.06 | C | 71.00 |
| Composite Area & Weighted CN | 2.22 | | 82.89 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 7 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.19 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 8.57 | 0.00 | 0.00 |

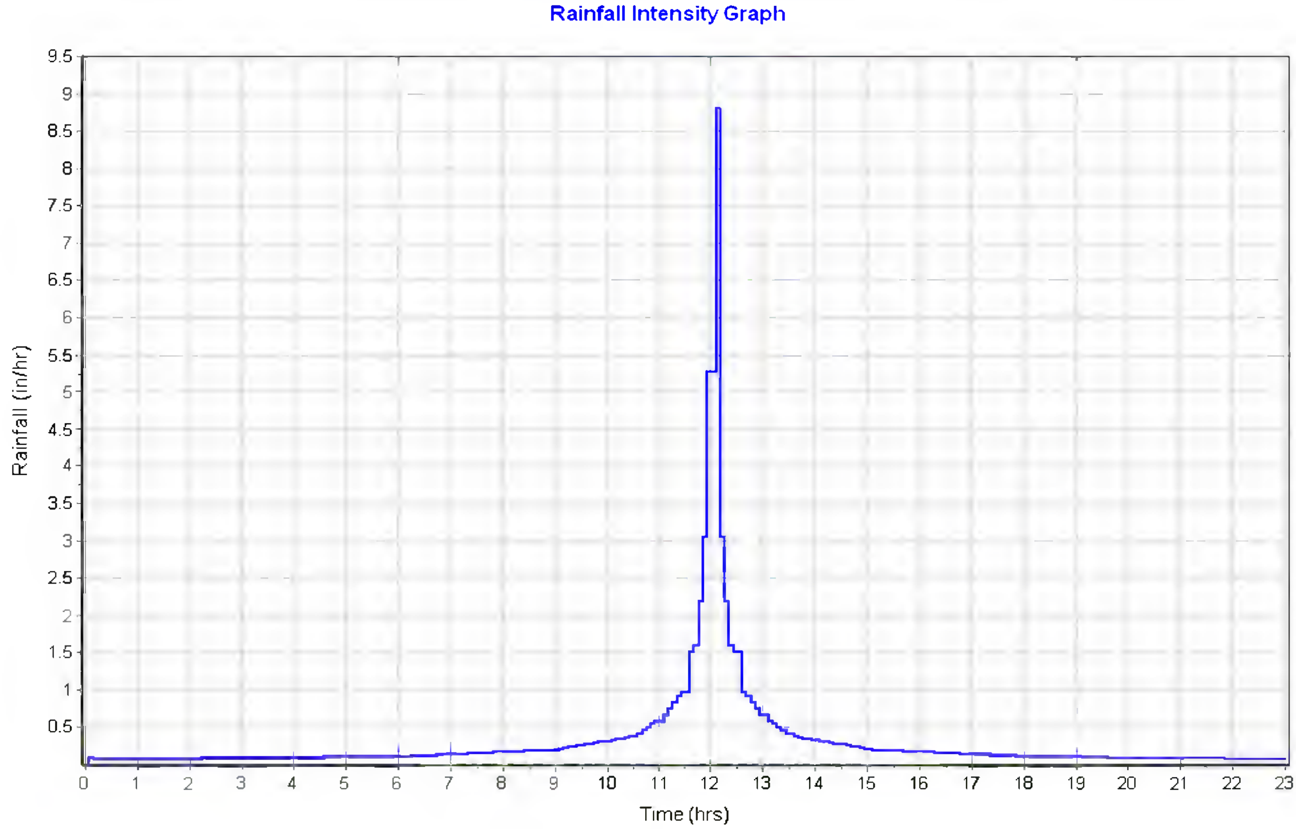
| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 235 | 0.00 | 0.00 |
| Slope (%) : | 3.4 | 0.00 | 0.00 |
| Surface Type : | Grassed waterway | Unpaved | Unpaved |
| Velocity (ft/sec) : | 2.77 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 1.41 | 0.00 | 0.00 |

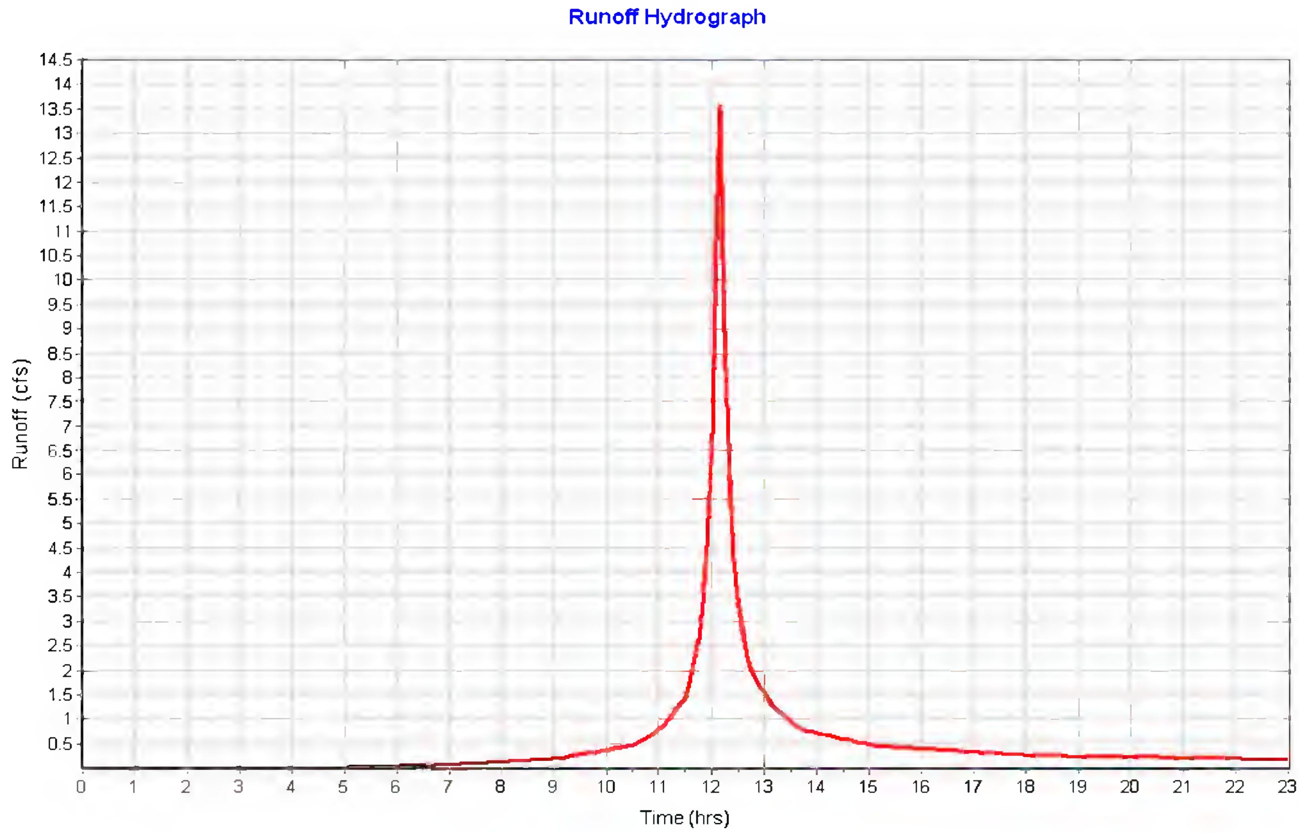
Total TOC (min) ..................9.98

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.46
Peak Runoff (cfs) ............................................................ 13.77
Weighted Curve Number ................................................ 82.89
Time of Concentration (days hh:mm:ss) ........................ 0 00:09:59

**Subbasin : DA A2**



## Subbasin : DA A3

### Input Data

Area (ac) ........................................................................ 2.24
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 82.84
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 1.37 | C | 74.00 |
| Paved parking & roofs | 0.83 | C | 98.00 |
| Meadow, non-grazed | 0.04 | C | 71.00 |
| Composite Area & Weighted CN | 2.24 | | 82.84 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 4.5 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.16 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 10.22 | 0.00 | 0.00 |

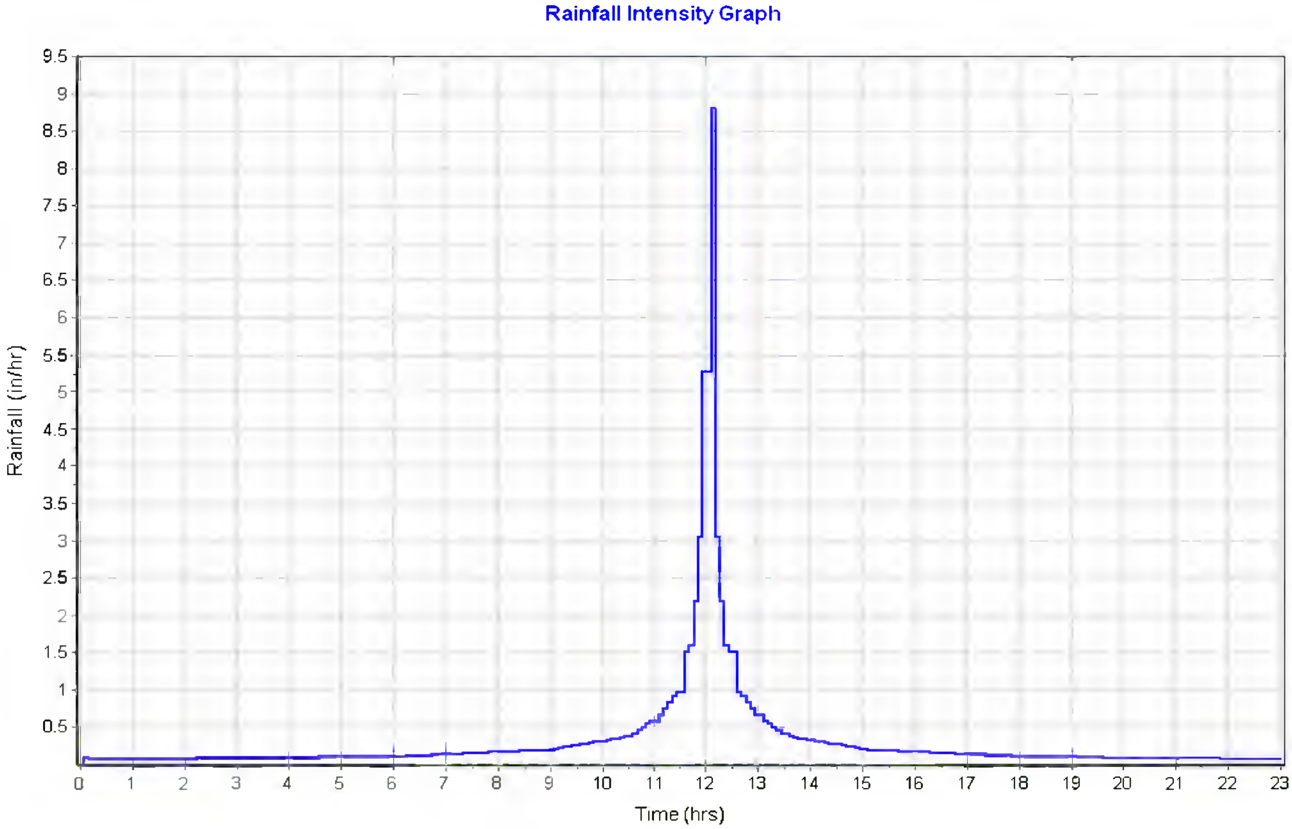
| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 209 | 0.00 | 0.00 |
| Slope (%) : | 5.2 | 0.00 | 0.00 |
| Surface Type : | Grassed waterway | Unpaved | Unpaved |
| Velocity (ft/sec) : | 3.42 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 1.02 | 0.00 | 0.00 |

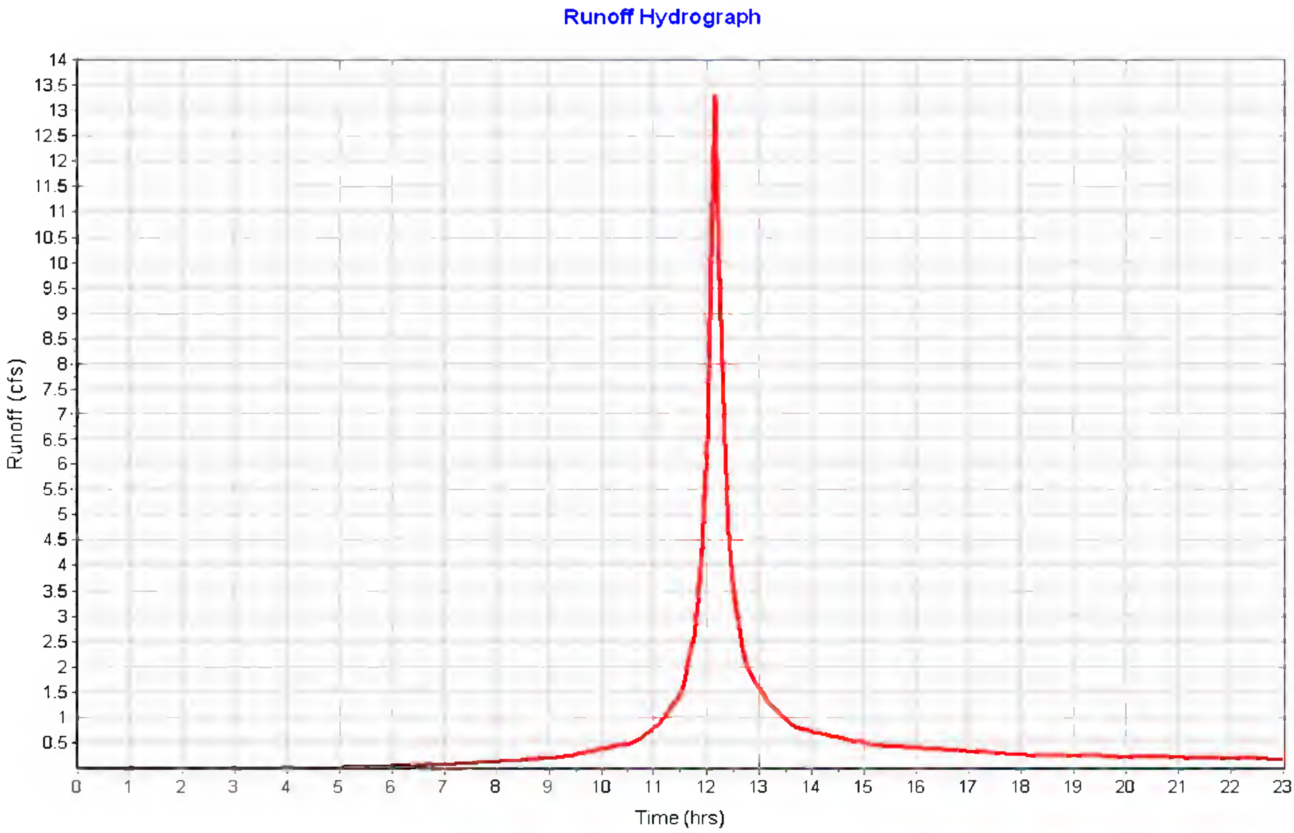
Total TOC (min) ..................11.24

### Subbasin Runoff Results

Total Rainfall (in) ........................................................... 7.47
Total Runoff (in) ............................................................. 5.45
Peak Runoff (cfs) ........................................................... 13.31
Weighted Curve Number ............................................... 82.84
Time of Concentration (days hh:mm:ss) ........................ 0 00:11:14

Subbasin : DA A3



## Subbasin : DA B1

### Input Data

Area (ac) ........................................................................ 1.14
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 77.58
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.97 | C | 74.00 |
| Paved roads with curbs & sewers | 0.17 | C | 98.00 |
| Composite Area & Weighted CN | 1.14 | | 77.58 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 2 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.12 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 14.14 | 0.00 | 0.00 |

| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 120 | 0.00 | 0.00 |
| Slope (%) : | 3.33 | 0.00 | 0.00 |
| Surface Type : | Grassed waterway | Unpaved | Unpaved |
| Velocity (ft/sec) : | 2.74 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 0.73 | 0.00 | 0.00 |

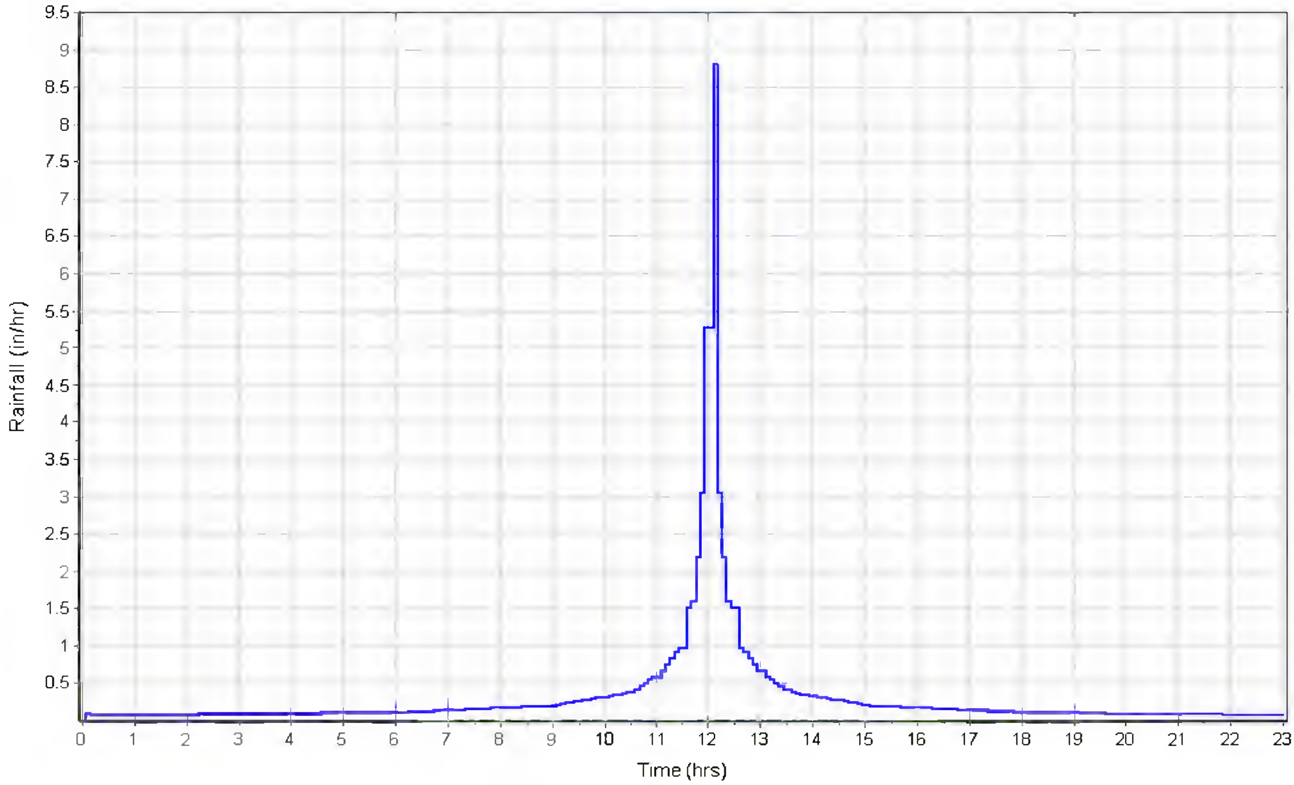
Total TOC (min) ..................14.87

### Subbasin Runoff Results

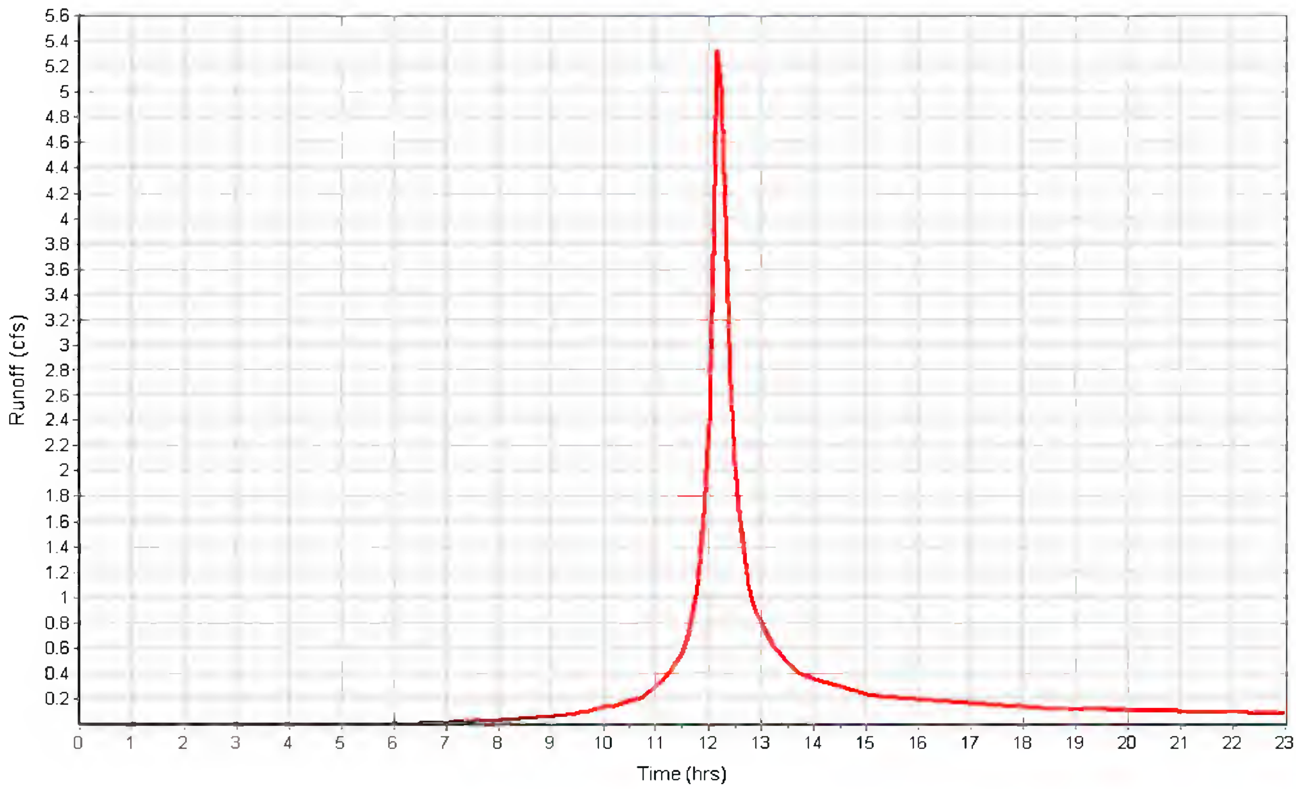
Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 4.85
Peak Runoff (cfs) ........................................................... 5.50
Weighted Curve Number ............................................... 77.58
Time of Concentration (days hh:mm:ss) ........................ 0 00:14:52

**Subbasin : DA B1**

Rainfall Intensity Graph




Runoff Hydrograph



## Subbasin : DA B1.5

### Input Data

Area (ac) .......................................................................... 0.45
Peak Rate Factor .............................................................. 484.00
Weighted Curve Number ................................................ 78.60
Rain Gage ID .................................................................... *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.33 | C | 74.00 |
| Paved roads with curbs & sewers | 0.09 | C | 98.00 |
| Meadow, non-grazed | 0.03 | C | 71.00 |
| Composite Area & Weighted CN | 0.45 | | 78.60 |

### Time of Concentration

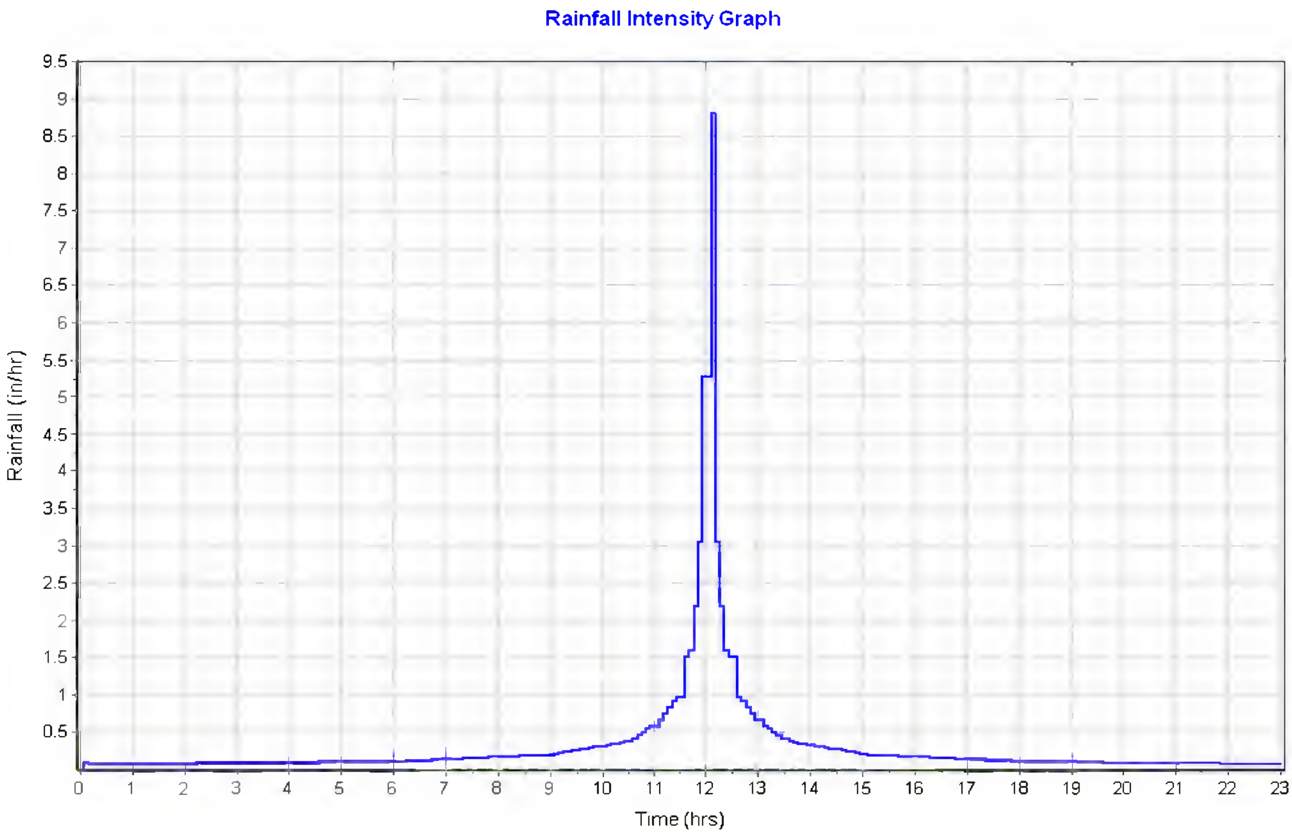
| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 67 | 0.00 | 0.00 |
| Slope (%) : | 3 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.13 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 8.73 | 0.00 | 0.00 |

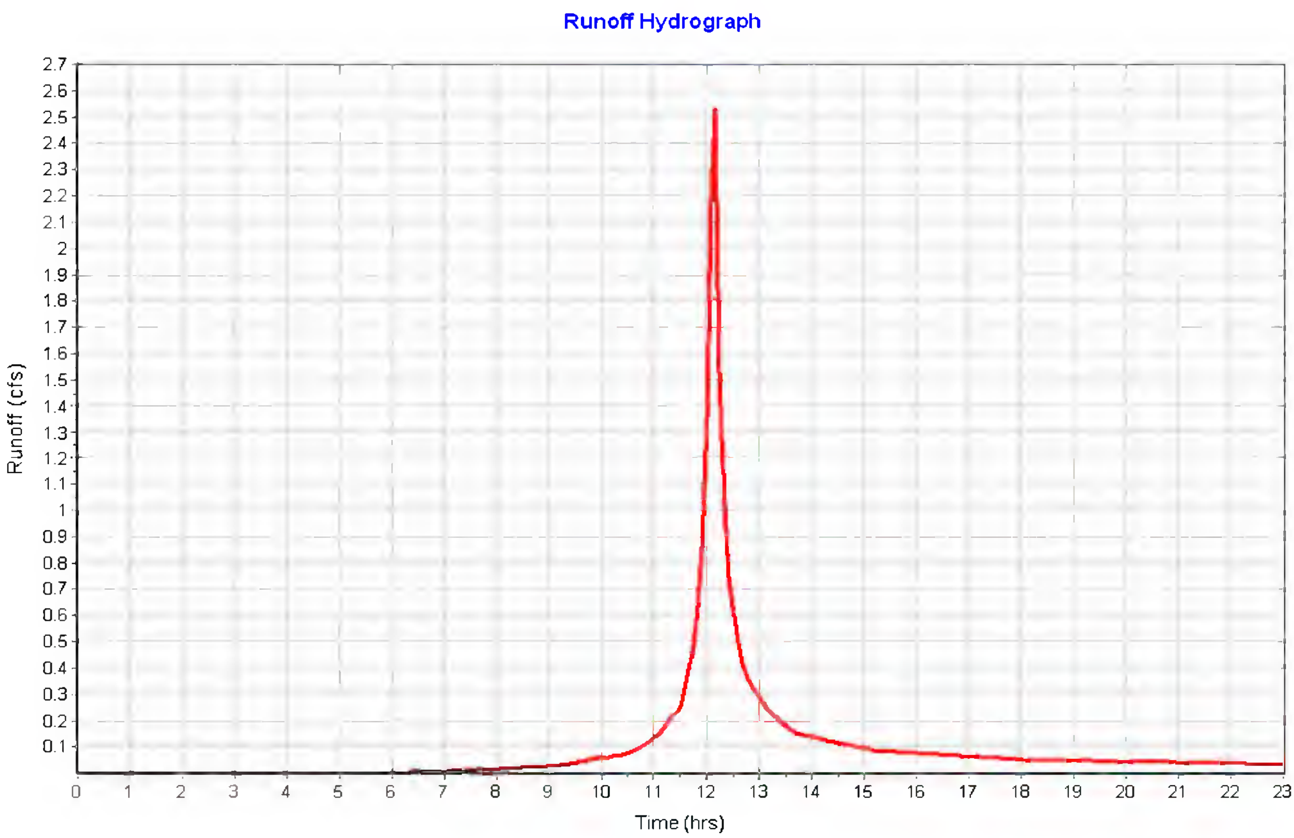
Total TOC (min) ..................8.73

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 4.97
Peak Runoff (cfs) ............................................................ 2.69
Weighted Curve Number ................................................ 78.60
Time of Concentration (days hh:mm:ss) ........................ 0 00:08:44

**Subbasin : DA B1.5**



## Subbasin : DA B10

### Input Data

Area (ac) ........................................................................ 2.26
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 83.88
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 1.33 | C | 74.00 |
| Paved roads with curbs & sewers | 0.93 | C | 98.00 |
| Composite Area & Weighted CN | 2.26 | | 83.88 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 2.5 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.13 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 12.93 | 0.00 | 0.00 |

| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 96 | 0.00 | 0.00 |
| Slope (%) : | 2.5 | 0.00 | 0.00 |
| Surface Type : | Grassed waterway | Unpaved | Unpaved |
| Velocity (ft/sec) : | 2.37 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 0.68 | 0.00 | 0.00 |

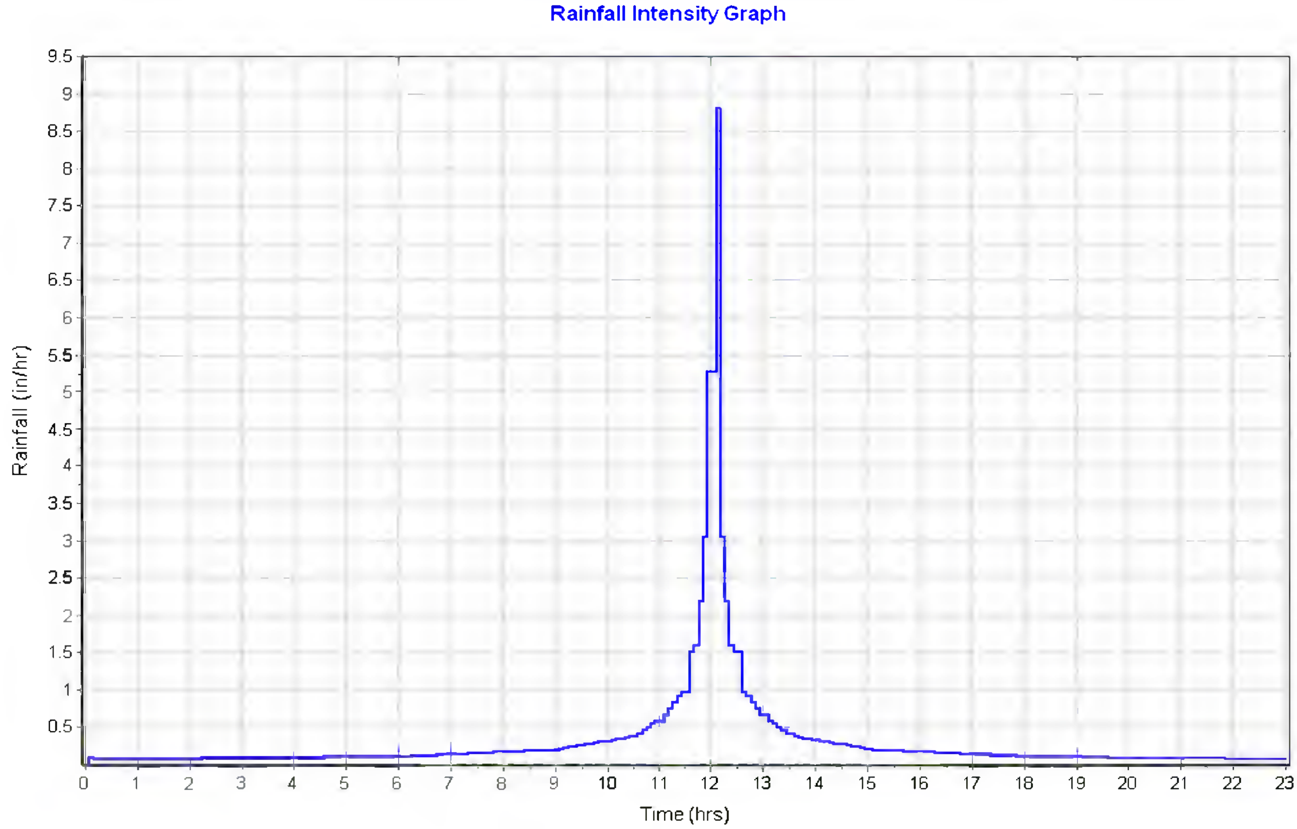
| Channel Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .013 | 0.00 | 0.00 |
| Flow Length (ft) : | 954 | 0.00 | 0.00 |
| Channel Slope (%) : | 4 | 0.00 | 0.00 |
| Cross Section Area ($ft^2$) : | .785 | 0.00 | 0.00 |
| Wetted Perimeter (ft) : | 3.14 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 9.10 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 1.75 | 0.00 | 0.00 |

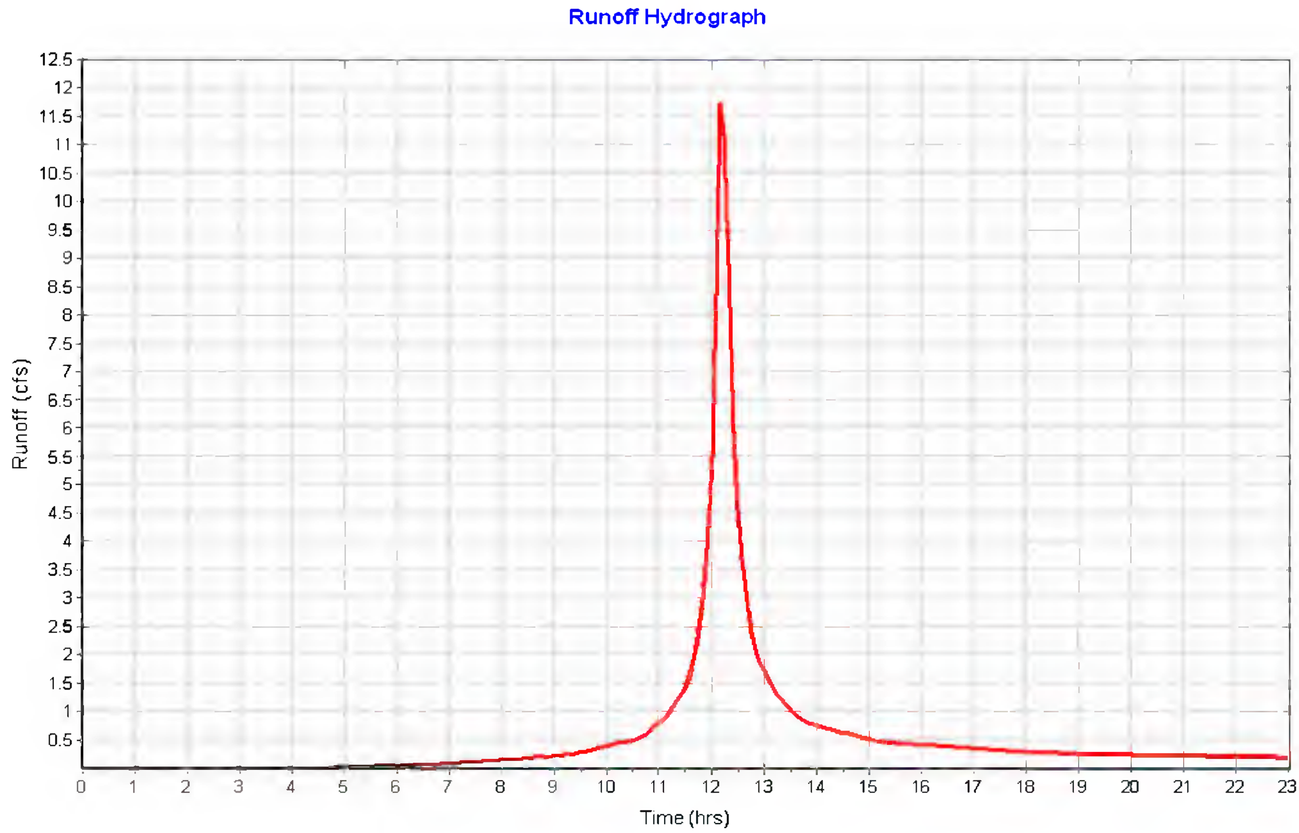
Total TOC (min) ..................15.35

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) .............................................................. 5.57
Peak Runoff (cfs) ............................................................ 12.09
Weighted Curve Number ............................................... 83.88
Time of Concentration (days hh:mm:ss) ........................ 0 00:15:21

**Subbasin : DA B10**



## Subbasin : DA B11

### Input Data

Area (ac) .............................................................. 0.77
Peak Rate Factor ........................................................ 484.00
Weighted Curve Number ............................................... 80.16
Rain Gage ID ............................................................ *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.55 | C | 74.00 |
| Paved roads with curbs & sewers | 0.20 | C | 98.00 |
| Meadow, non-grazed | 0.02 | C | 71.00 |
| Composite Area & Weighted CN | 0.77 | | 80.16 |

### Time of Concentration

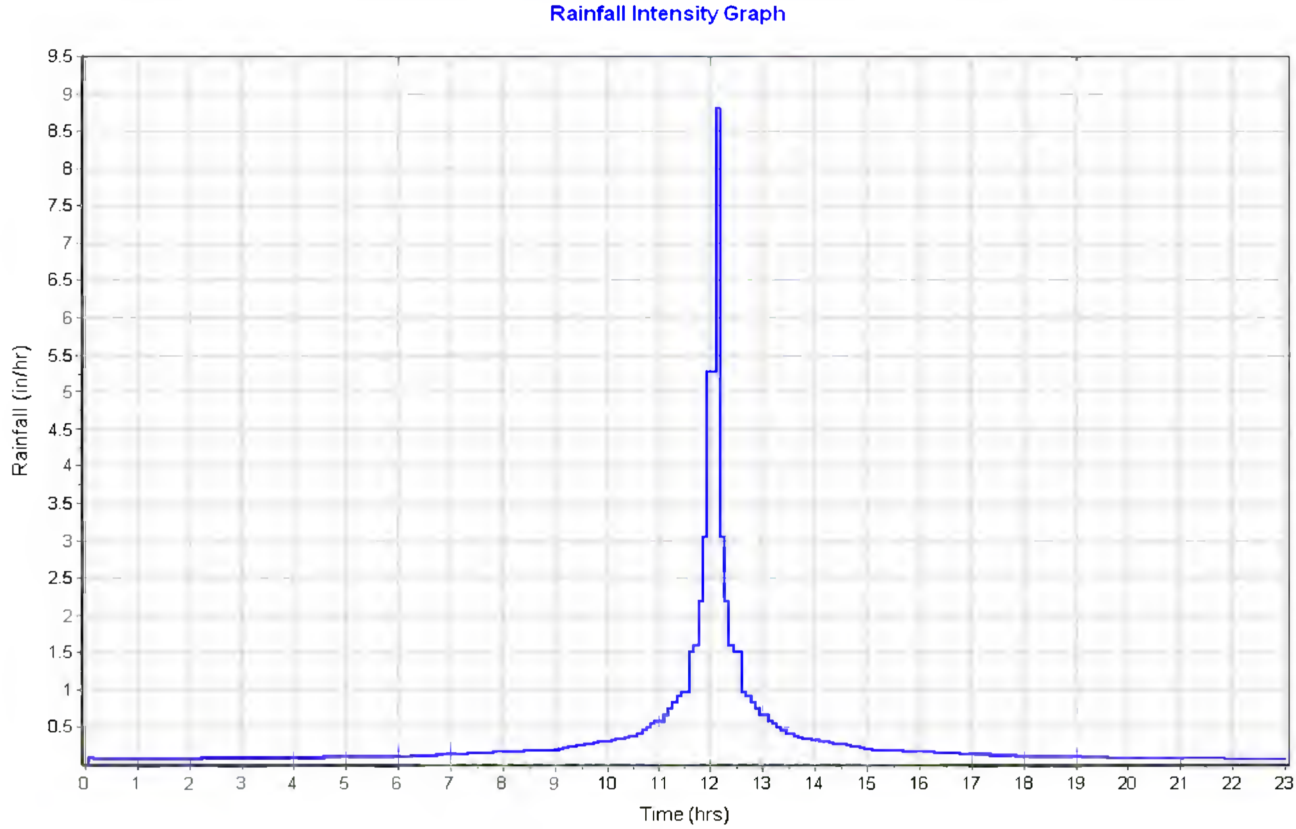
| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 85 | 0.00 | 0.00 |
| Slope (%) : | 3.5 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.14 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 9.92 | 0.00 | 0.00 |

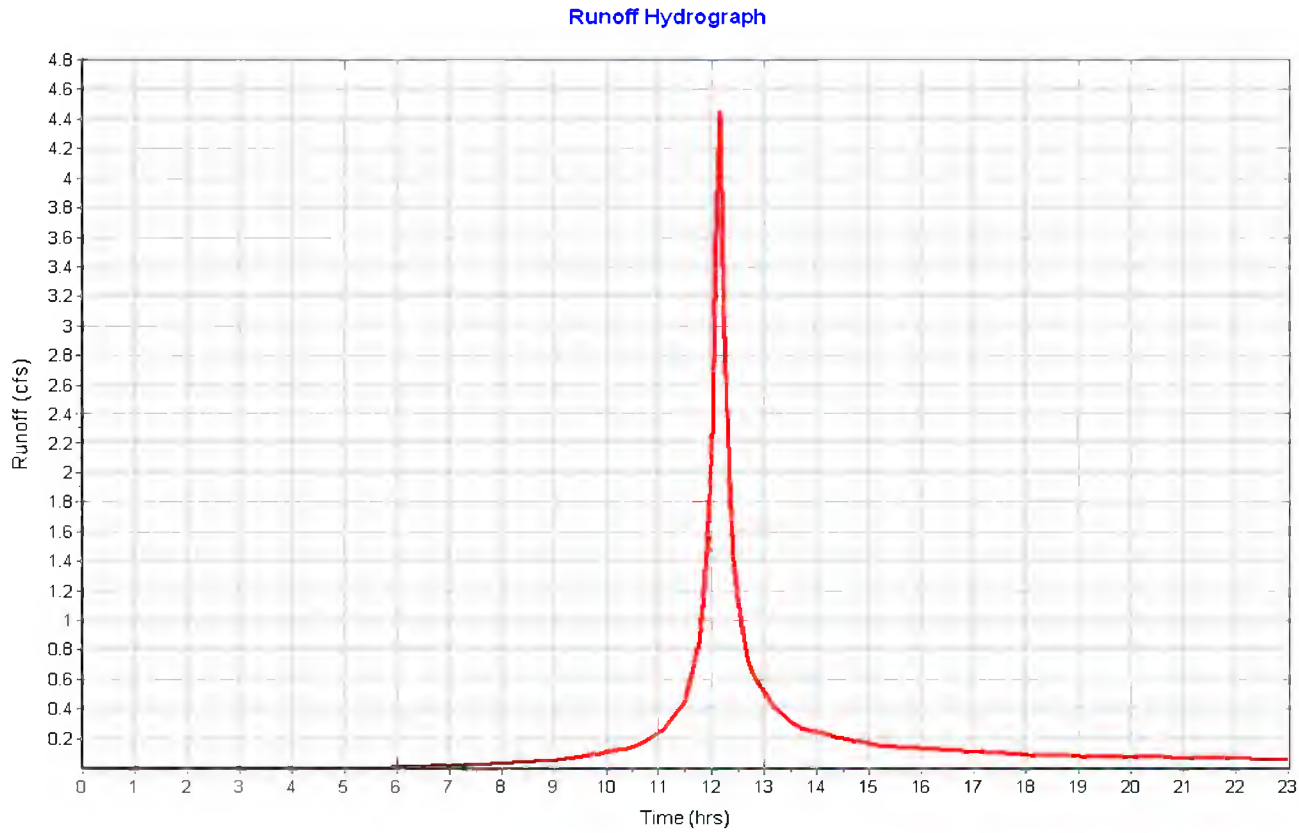
Total TOC (min) ..................9.92

### Subbasin Runoff Results

Total Rainfall (in) ..................................................... 7.47
Total Runoff (in) ....................................................... 5.15
Peak Runoff (cfs) ....................................................... 4.55
Weighted Curve Number ............................................... 80.16
Time of Concentration (days hh:mm:ss) ........................ 0 00:09:55

**Subbasin : DA B11**



## Subbasin : DA B12

### Input Data

Area (ac) .......................................................................... 2.69
Peak Rate Factor .......................................................... 484.00
Weighted Curve Number .............................................. 81.58
Rain Gage ID ................................................................ *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 1.84 | C | 74.00 |
| Paved roads with curbs & sewers | 0.85 | C | 98.00 |
| Composite Area & Weighted CN | 2.69 | | 81.58 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 82 | 0.00 | 0.00 |
| Slope (%) : | 2.4 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.12 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 11.21 | 0.00 | 0.00 |

Total TOC (min) ..................11.21

### Subbasin Runoff Results

Total Rainfall (in) ........................................................... 7.47
Total Runoff (in) ............................................................ 5.31
Peak Runoff (cfs) ........................................................... 15.63
Weighted Curve Number ............................................... 81.58
Time of Concentration (days hh:mm:ss) ........................ 0 00:11:13



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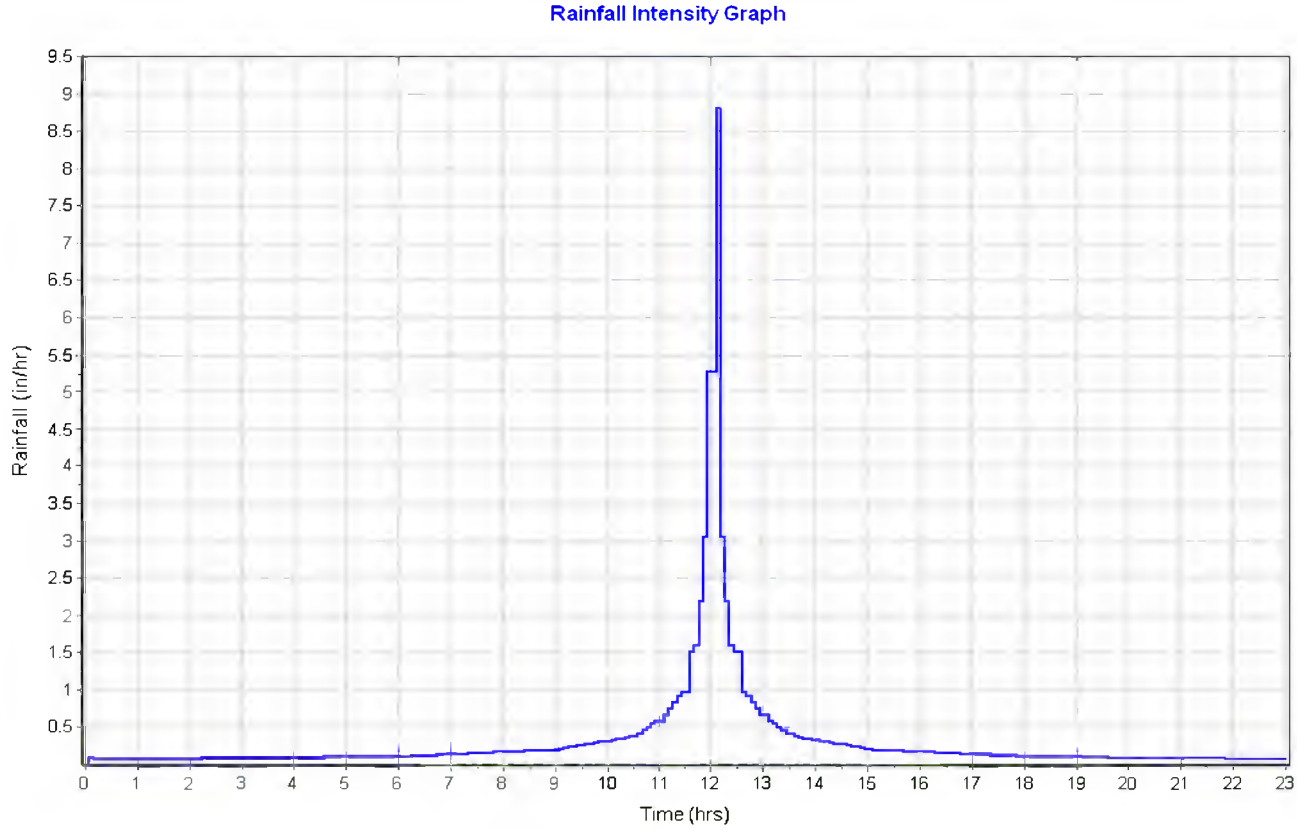
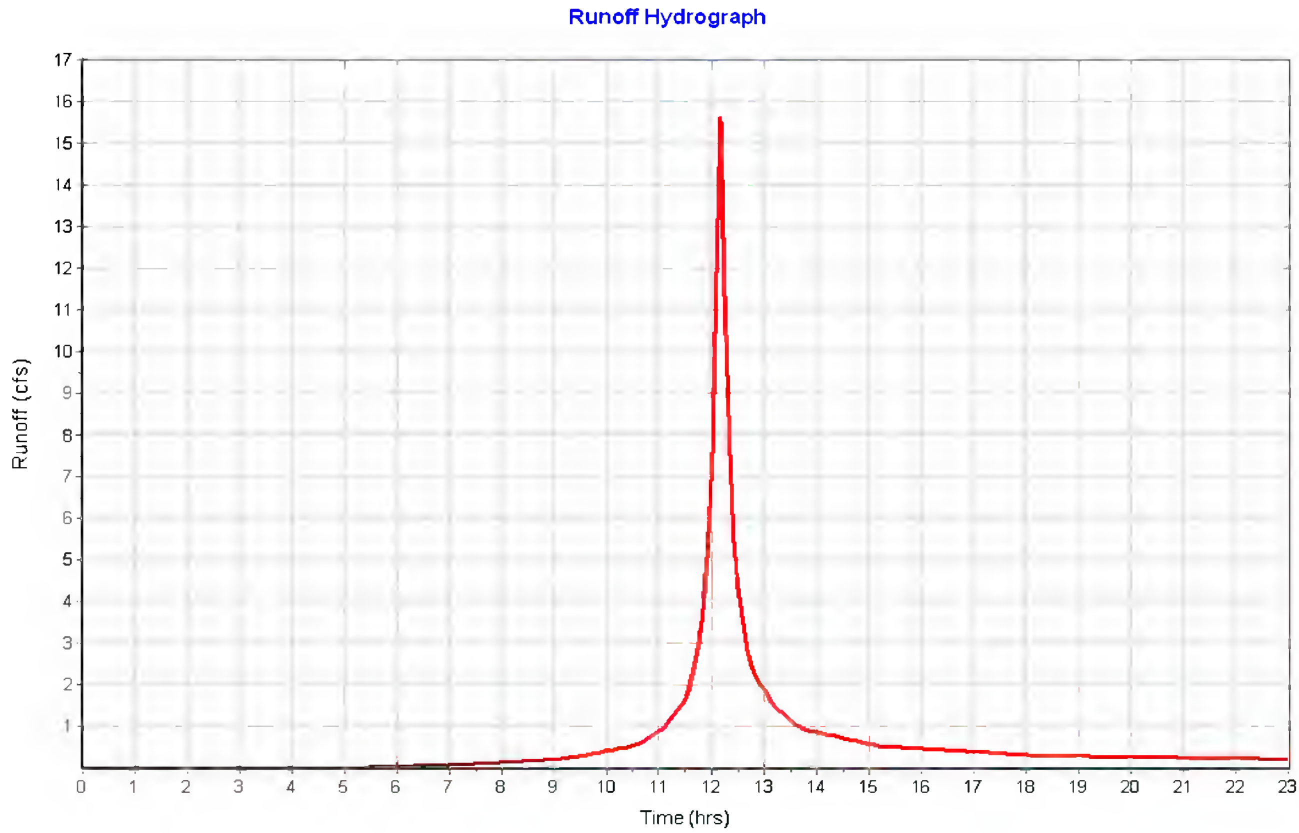
**Subbasin : DA B12**



## Subbasin : DA B13

### Input Data

Area (ac) .......................................................................... 2.38
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 89.73
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.82 | C | 74.00 |
| Paved roads with curbs & sewers | 1.56 | C | 98.00 |
| Composite Area & Weighted CN | 2.38 | | 89.73 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 2 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.12 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 14.14 | 0.00 | 0.00 |

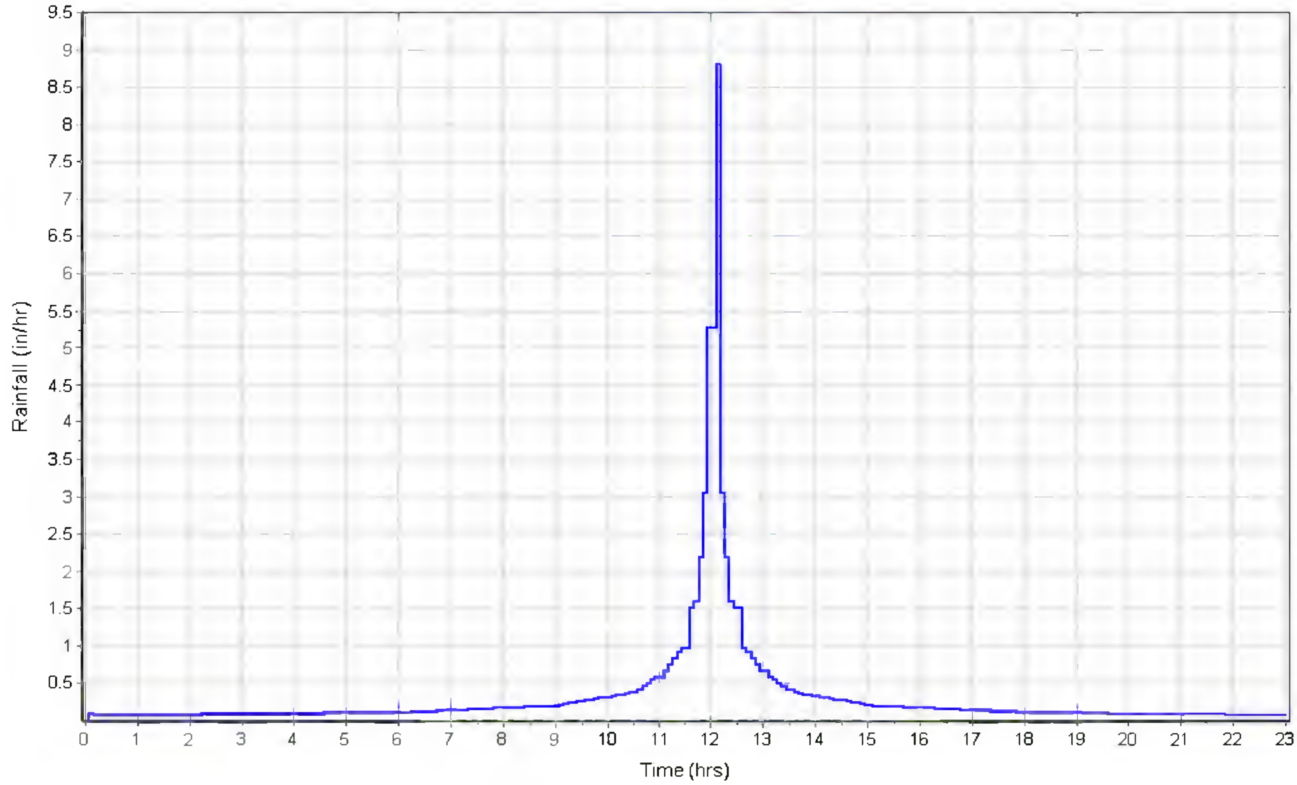
Total TOC (min) ..................14.14

### Subbasin Runoff Results

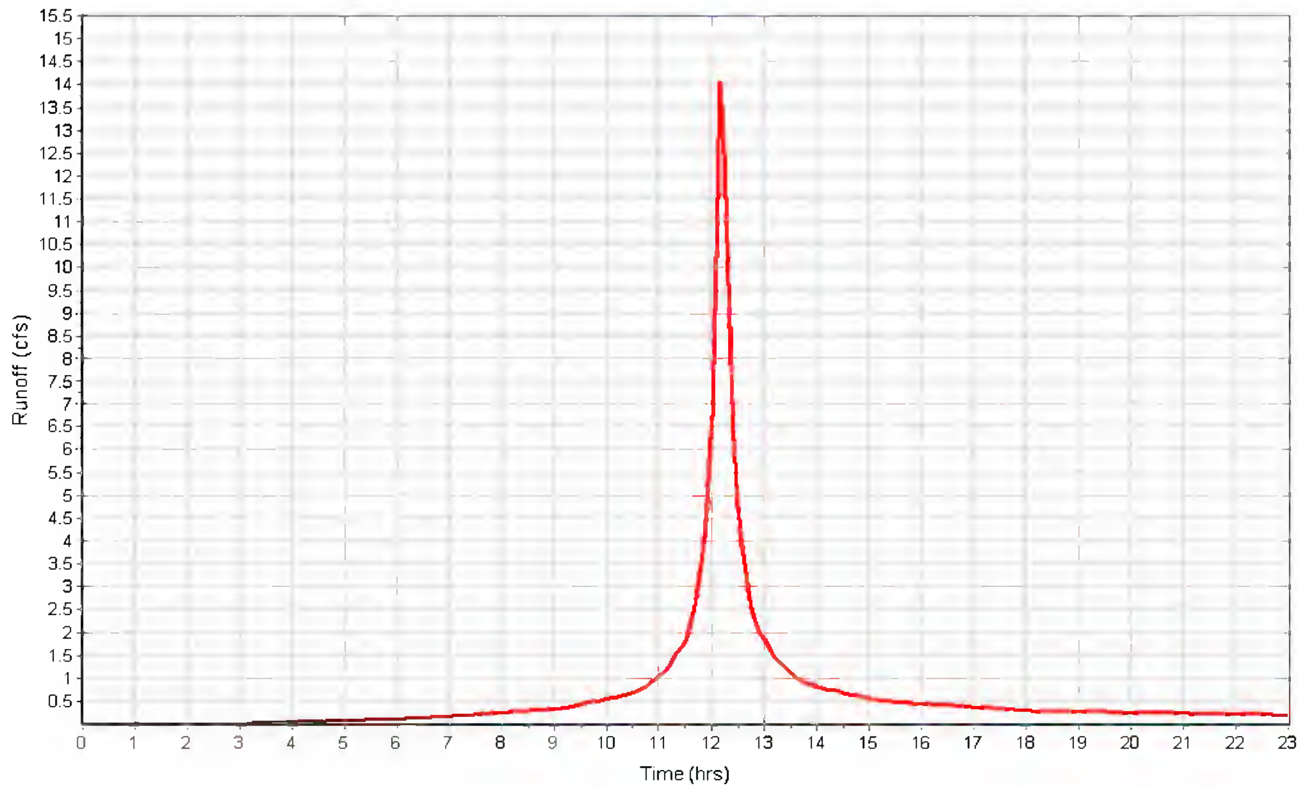
Total Rainfall (in) ........................................................... 7.47
Total Runoff (in) ............................................................. 6.25
Peak Runoff (cfs) ........................................................... 14.25
Weighted Curve Number ............................................... 89.73
Time of Concentration (days hh:mm:ss) ........................ 0 00:14:08

**Subbasin : DA B13**

Rainfall Intensity Graph




Runoff Hydrograph



# Subbasin : DA B14

## Input Data

Area (ac) ........................................................................ 5.71
Peak Rate Factor ............................................................ 484.00
Weighted Curve Number ................................................ 83.54
Rain Gage ID ................................................................... *

## Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 3.44 | C | 74.00 |
| Paved roads with curbs & sewers | 2.27 | C | 98.00 |
| Composite Area & Weighted CN | 5.71 | | 83.54 |

## Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 3 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.14 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 12.02 | 0.00 | 0.00 |

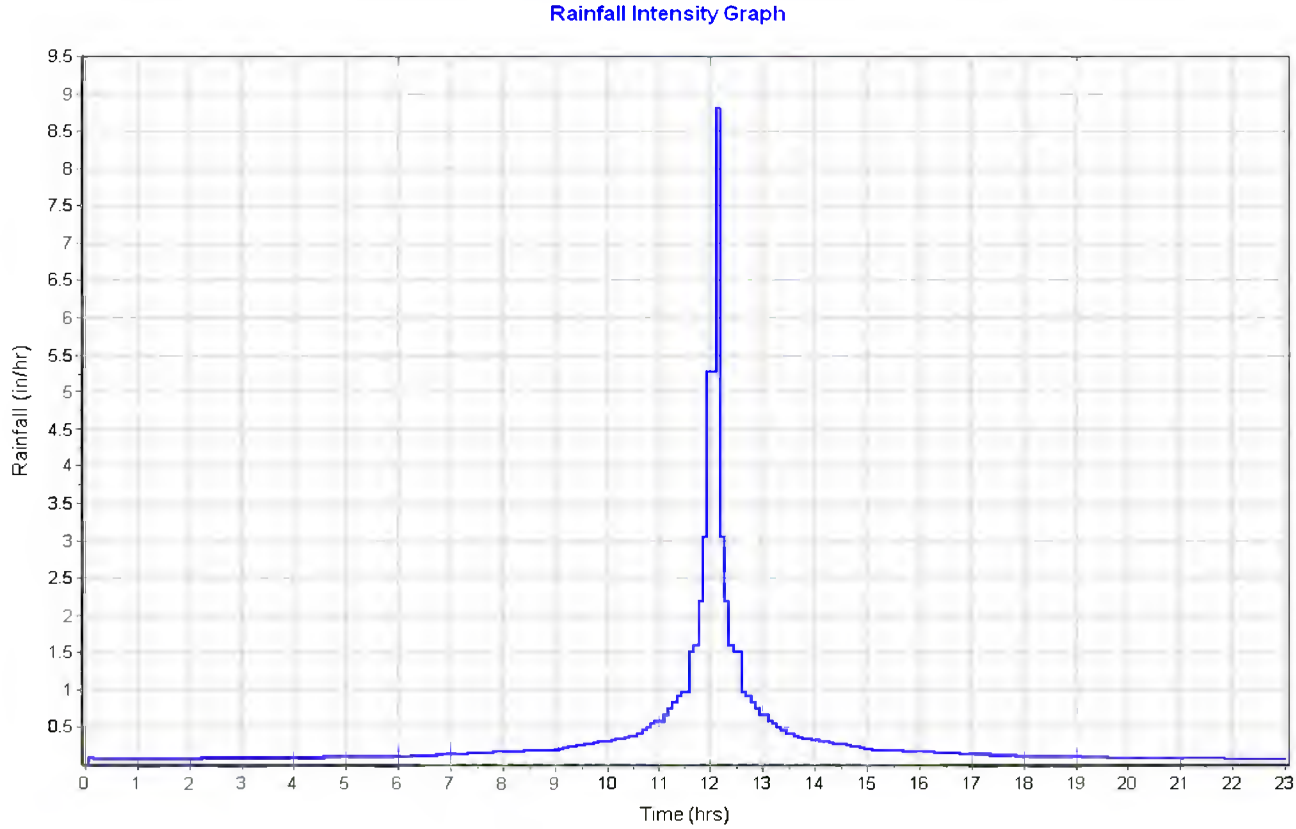
| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 300 | 0.00 | 0.00 |
| Slope (%) : | 4.6 | 0.00 | 0.00 |
| Surface Type : | Grassed waterway | Unpaved | Unpaved |
| Velocity (ft/sec) : | 3.22 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 1.55 | 0.00 | 0.00 |

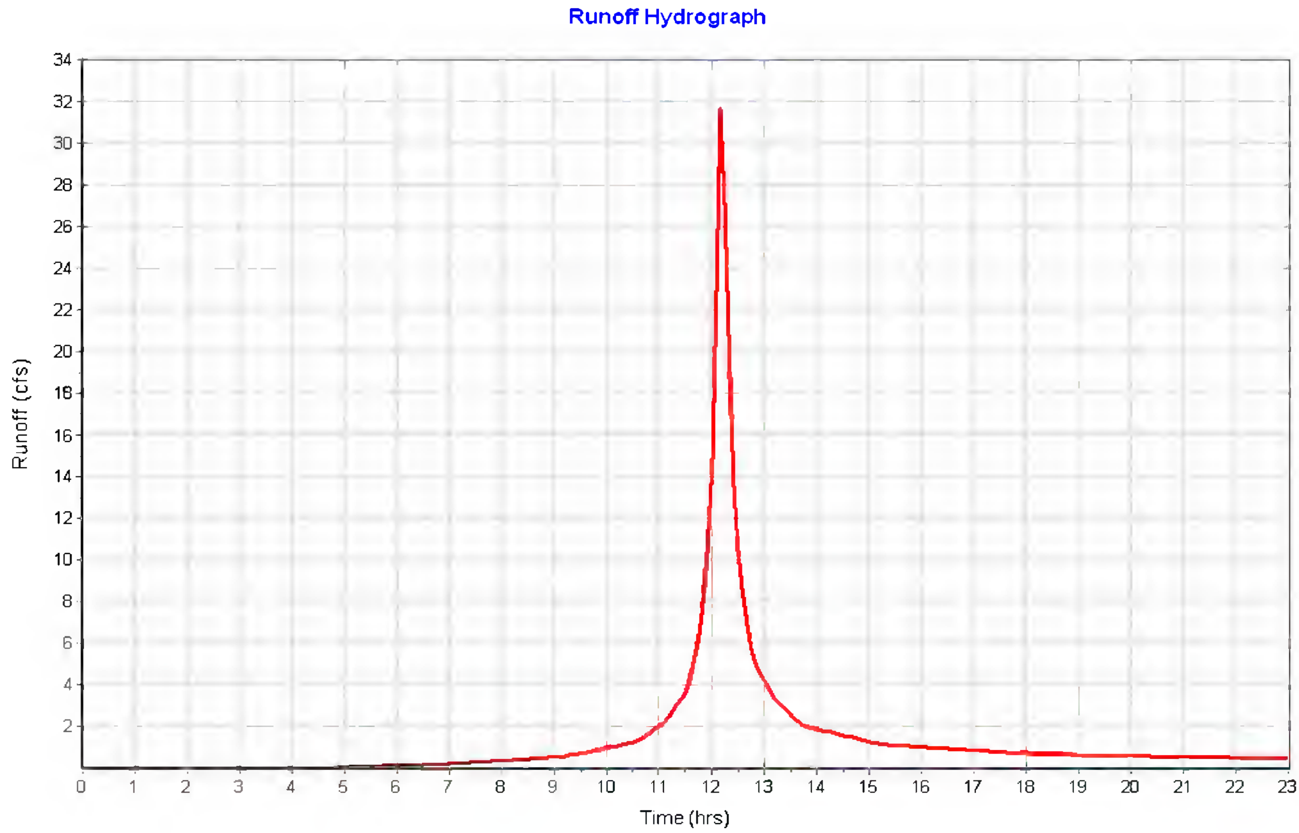
Total TOC (min) ..................13.57

## Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.53
Peak Runoff (cfs) ............................................................ 31.95
Weighted Curve Number ................................................ 83.54
Time of Concentration (days hh:mm:ss) ........................ 0 00:13:34

**Subbasin : DA B14**






1866a

## Subbasin : DA B2

### Input Data

Area (ac) ........................................................................ 1.55
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 93.51
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.29 | C | 74.00 |
| Paved parking & roofs | 1.26 | C | 98.00 |
| Composite Area & Weighted CN | 1.55 | | 93.51 |

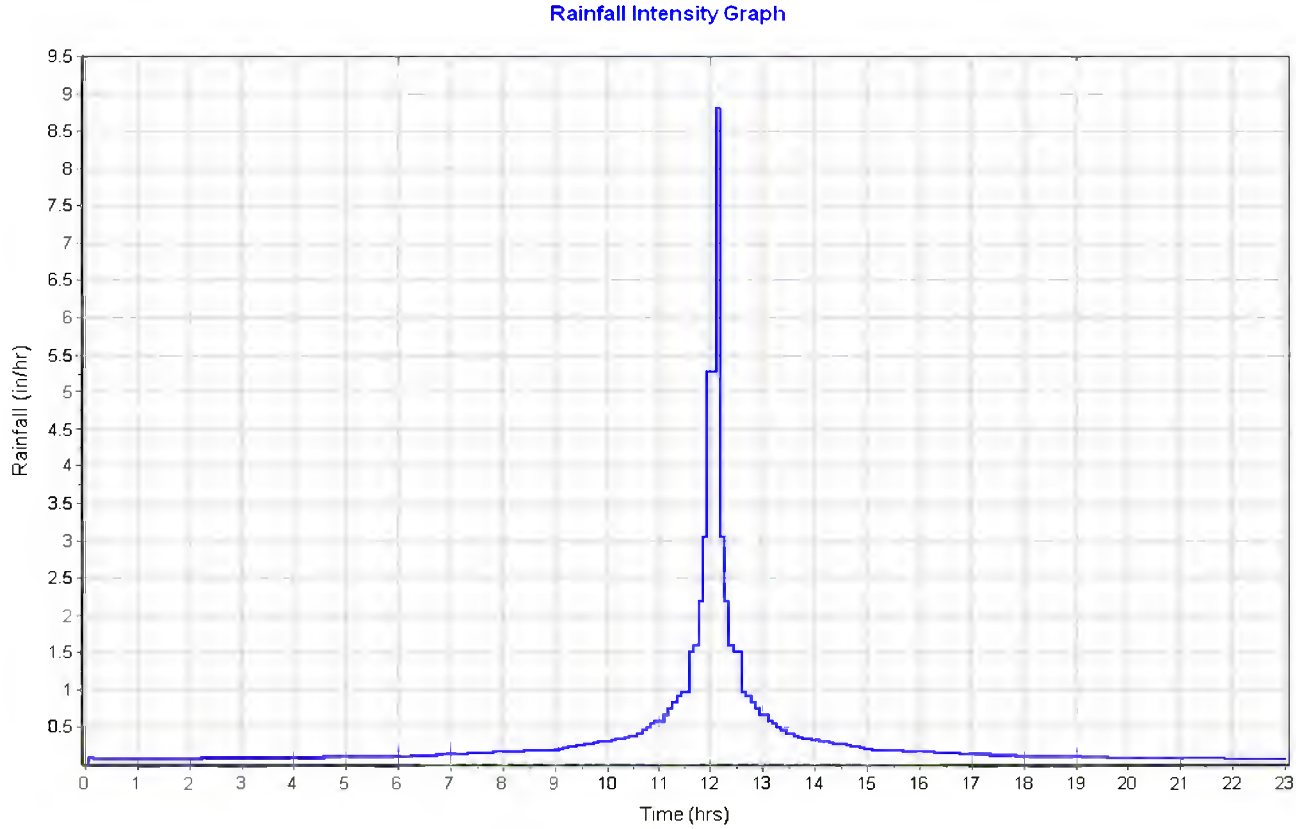
### Time of Concentration

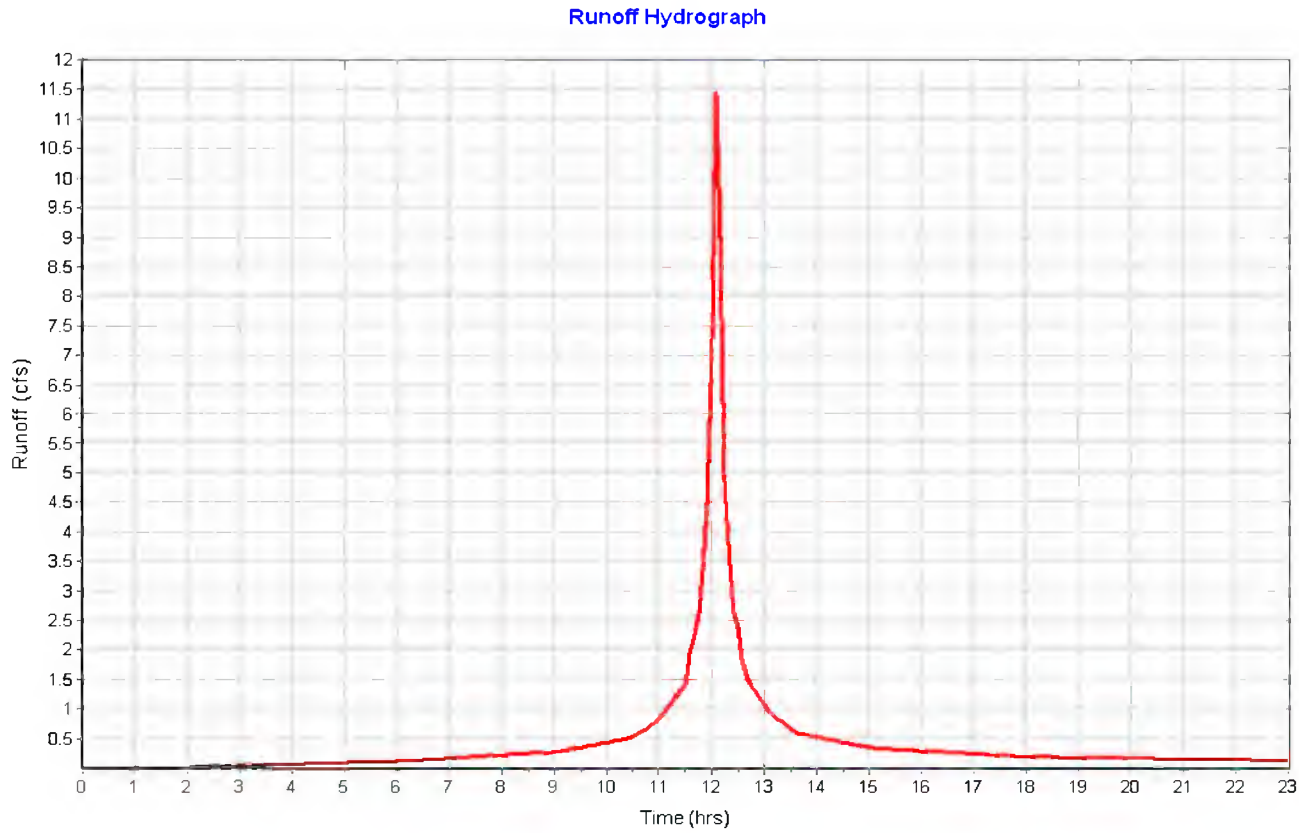
User-Defined TOC override (minutes): 6

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 6.70
Peak Runoff (cfs) ........................................................... 12.41
Weighted Curve Number ............................................... 93.51
Time of Concentration (days hh:mm:ss) ........................ 0 00:06:00

**Subbasin : DA B2**



## Subbasin : DA B3

### Input Data

Area (ac) ........................................................................ 14.51
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 83.63
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 7.26 | C | 74.00 |
| Paved parking & roofs | 5.98 | C | 98.00 |
| Meadow, non-grazed | 1.27 | C | 71.00 |
| Composite Area & Weighted CN | 14.51 | | 83.63 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 2 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.12 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 14.14 | 0.00 | 0.00 |

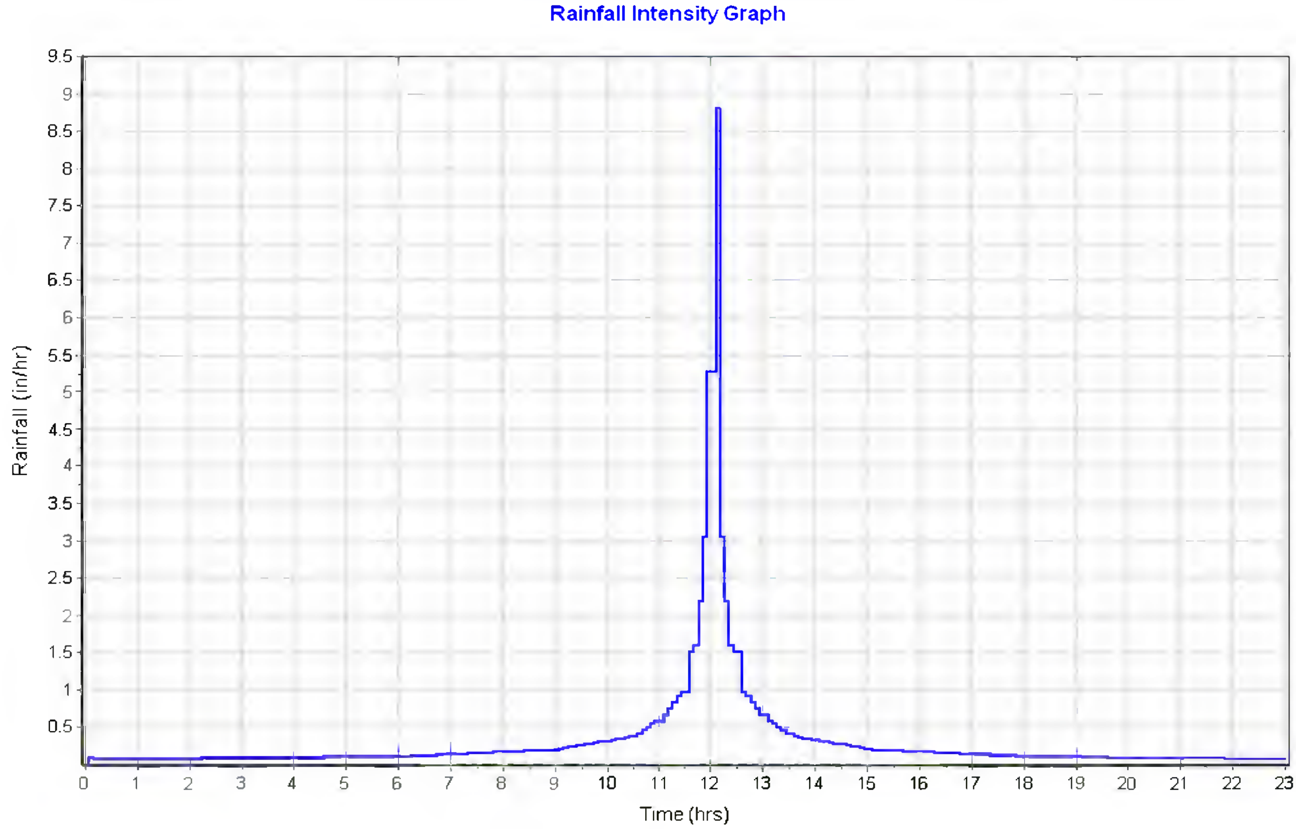
| Channel Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .013 | 0.00 | 0.00 |
| Flow Length (ft) : | 657 | 0.00 | 0.00 |
| Channel Slope (%) : | 3 | 0.00 | 0.00 |
| Cross Section Area ($ft^2$) : | 3.14 | 0.00 | 0.00 |
| Wetted Perimeter (ft) : | 6.28 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 12.51 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 0.88 | 0.00 | 0.00 |

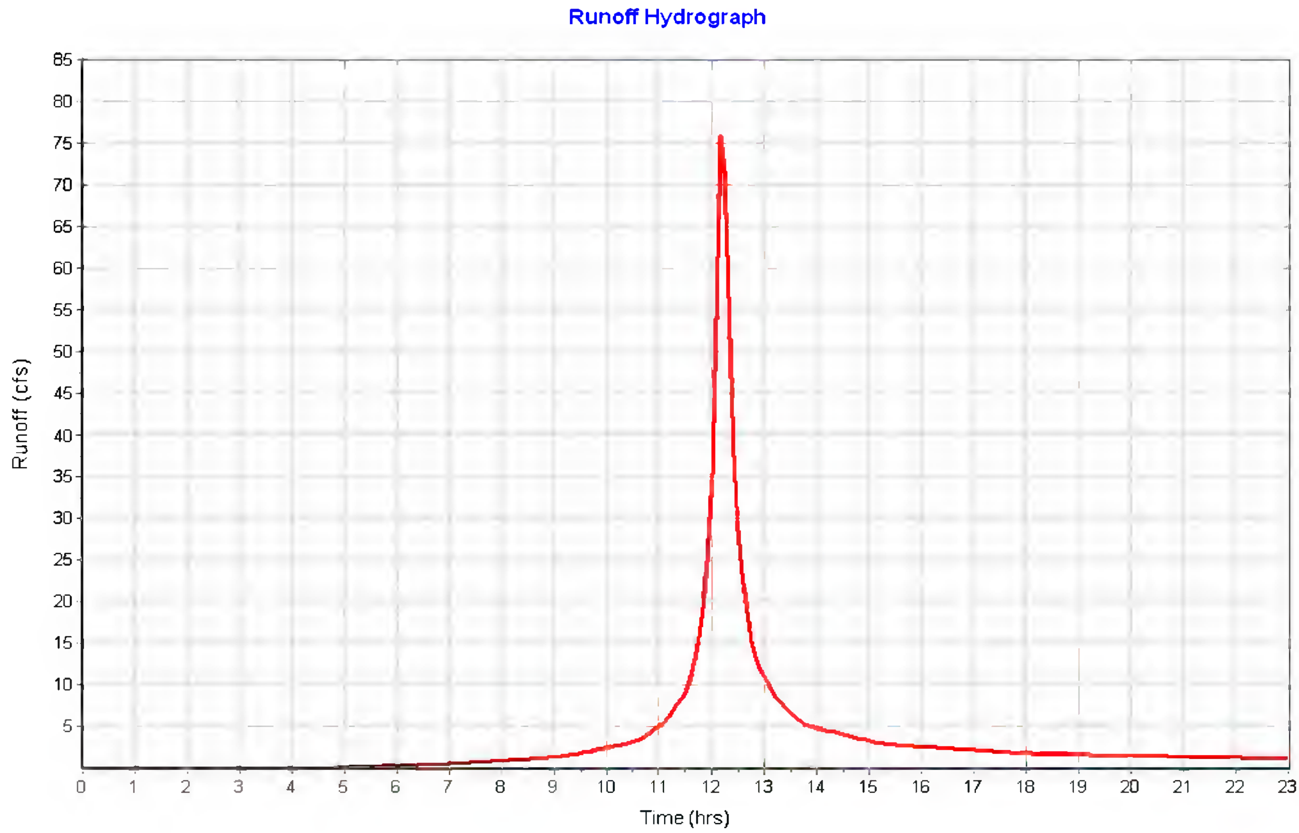
Total TOC (min) ..................15.01

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.54
Peak Runoff (cfs) ........................................................... 77.97
Weighted Curve Number ............................................... 83.63
Time of Concentration (days hh:mm:ss) ........................ 0 00:15:01

**Subbasin : DA B3**



## Subbasin : DA B4

### Input Data

Area (ac) ........................................................................ 2.60
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 83.07
Rain Gage ID .................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.47 | C | 74.00 |
| Paved parking & roofs | 1.11 | C | 98.00 |
| Meadow, non-grazed | 1.02 | C | 71.00 |
| Composite Area & Weighted CN | 2.60 | | 83.07 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 2 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.12 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 14.14 | 0.00 | 0.00 |

| Channel Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .013 | 0.00 | 0.00 |
| Flow Length (ft) : | 590 | 0.00 | 0.00 |
| Channel Slope (%) : | 4 | 0.00 | 0.00 |
| Cross Section Area (ft²) : | 1.76 | 0.00 | 0.00 |
| Wetted Perimeter (ft) : | 4.71 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 11.89 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 0.83 | 0.00 | 0.00 |

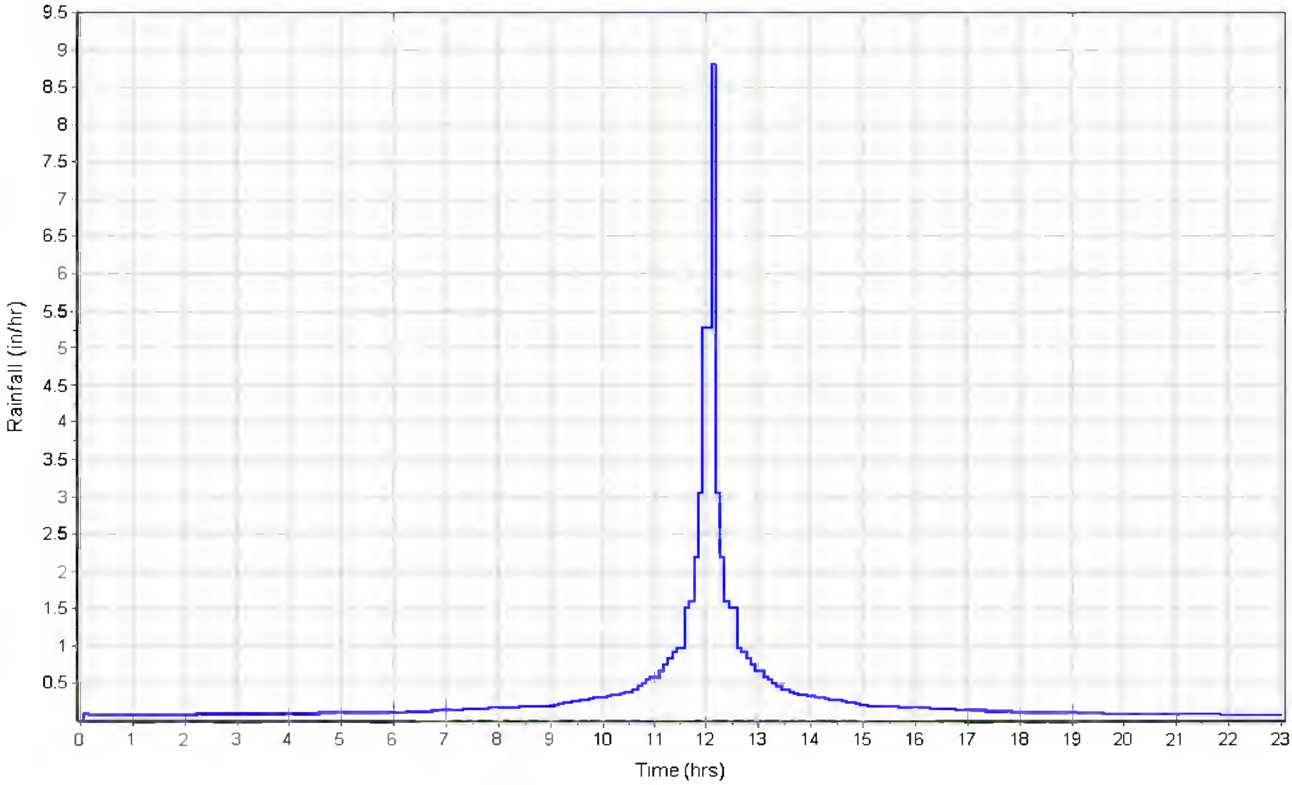
Total TOC (min) ..................14.97

### Subbasin Runoff Results

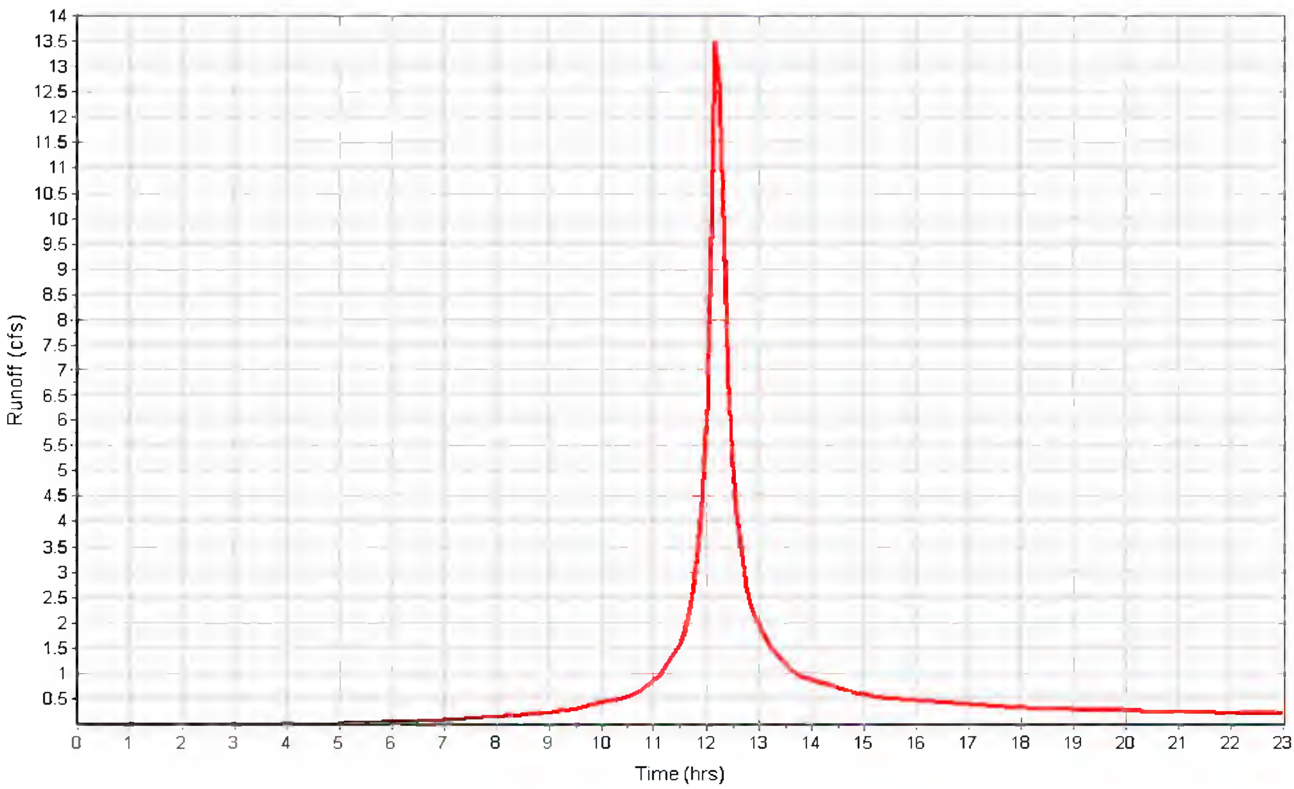
Total Rainfall (in) ........................................................... 7.47
Total Runoff (in) ............................................................. 5.48
Peak Runoff (cfs) ........................................................... 13.86
Weighted Curve Number ............................................... 83.07
Time of Concentration (days hh:mm:ss) ........................ 0 00:14:58

**Subbasin : DA B4**

Rainfall Intensity Graph




Runoff Hydrograph



## Subbasin : DA B5

### Input Data

Area (ac) ........................................................................ 0.33
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 84.73
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.16 | C | 74.00 |
| Paved roads with curbs & sewers | 0.15 | C | 98.00 |
| Meadow, non-grazed | 0.02 | C | 71.00 |
| Composite Area & Weighted CN | 0.33 | | 84.73 |

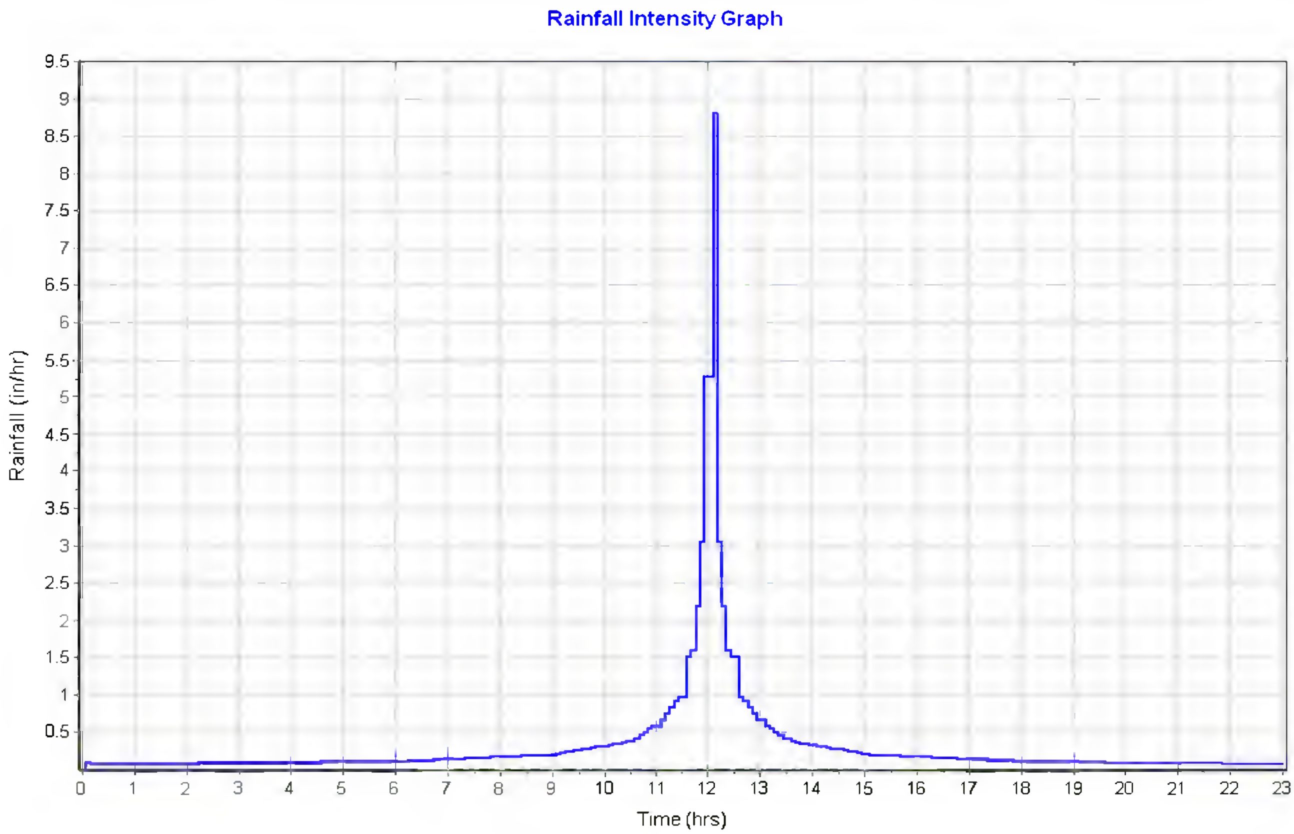
### Time of Concentration

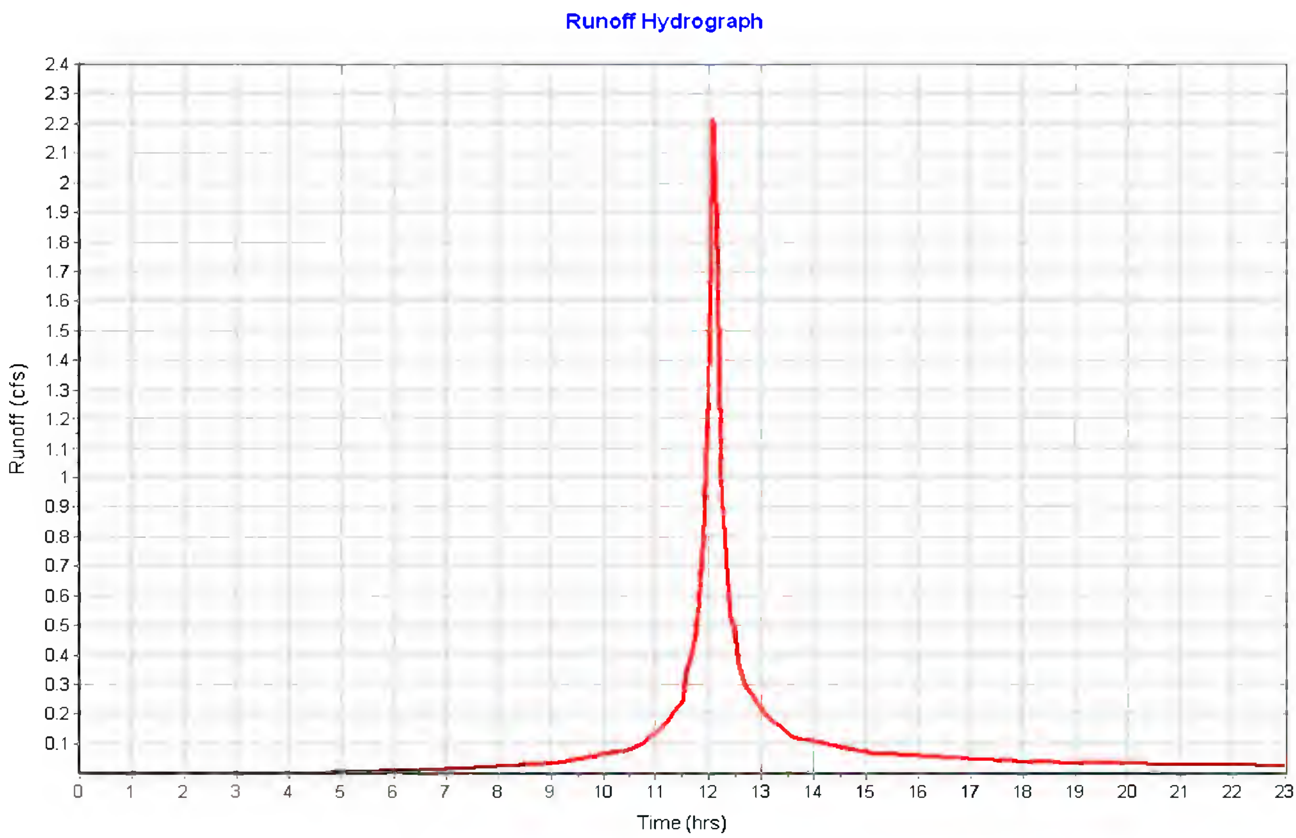
User-Defined TOC override (minutes): 6

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.67
Peak Runoff (cfs) ........................................................... 2.43
Weighted Curve Number ............................................... 84.73
Time of Concentration (days hh:mm:ss) ........................ 0 00:06:00

**Subbasin : DA B5**



## Subbasin : DA B6

### Input Data

Area (ac) .......................................................................... 0.39
Peak Rate Factor .......................................................... 484.00
Weighted Curve Number ............................................... 73.79
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.23 | C | 74.00 |
| Paved parking & roofs | 0.12 | C | 98.00 |
| - | 0.04 | - | 0.00 |
| Composite Area & Weighted CN | 0.39 | | 73.79 |

### Time of Concentration

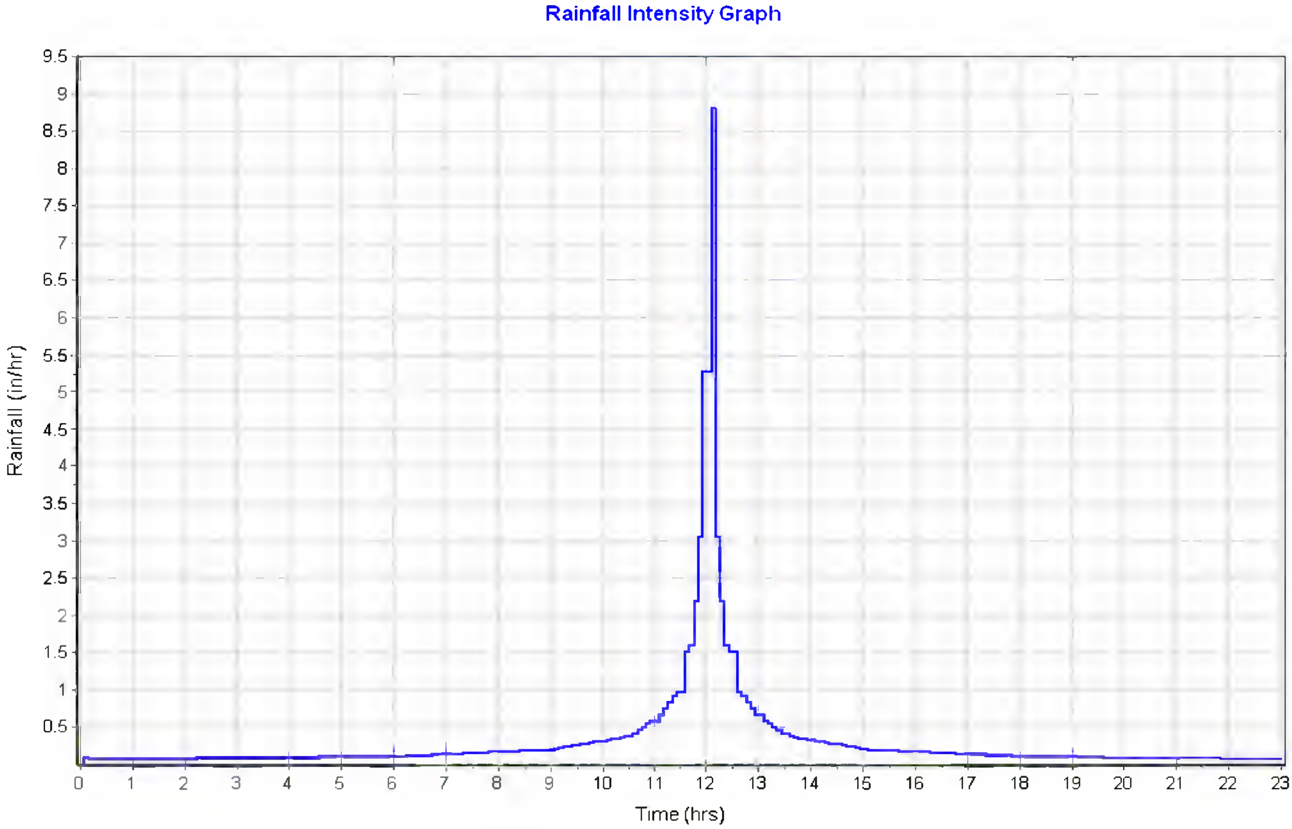
| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 15 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.26 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 6.31 | 0.00 | 0.00 |

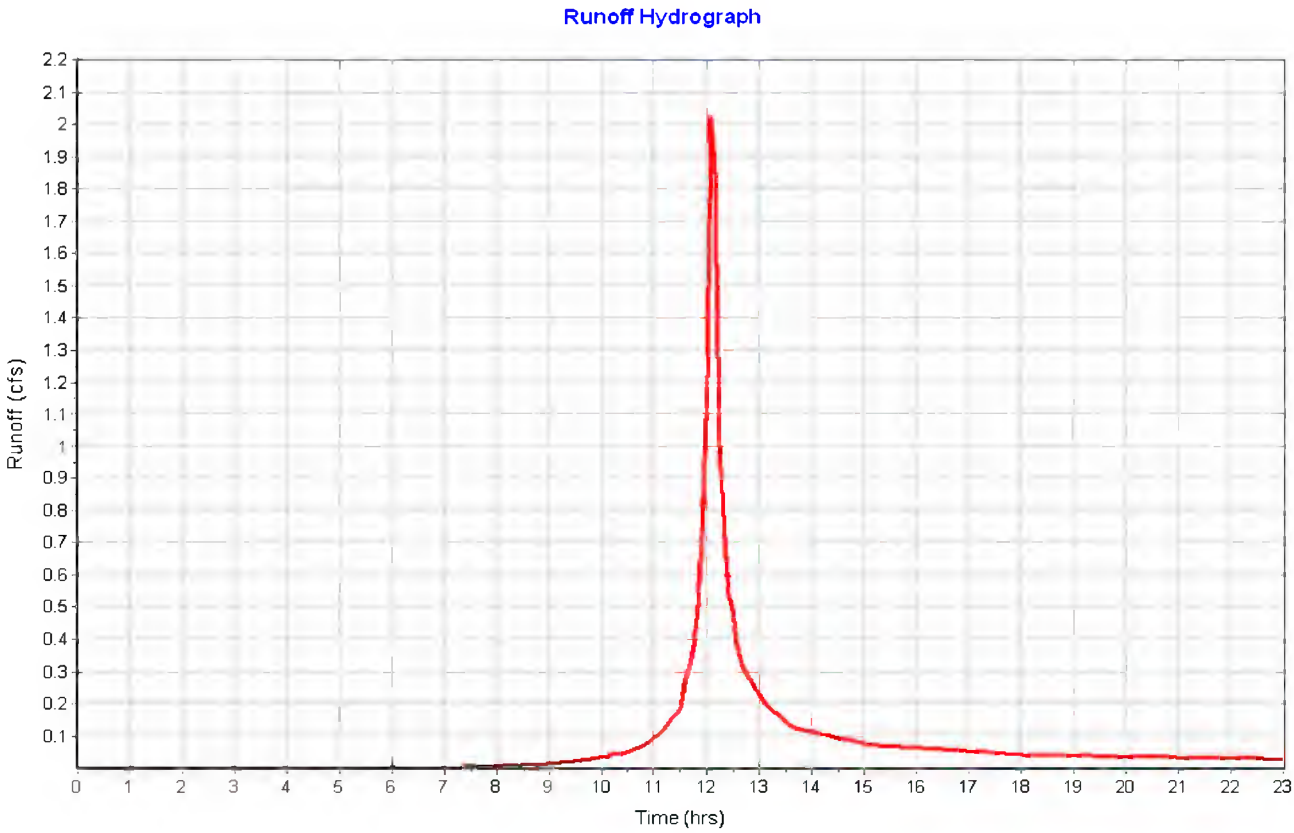
Total TOC (min) ..................6.31

### Subbasin Runoff Results

Total Rainfall (in) ........................................................... 7.47
Total Runoff (in) ............................................................ 4.43
Peak Runoff (cfs) ........................................................... 2.31
Weighted Curve Number ............................................... 73.79
Time of Concentration (days hh:mm:ss) ........................ 0 00:06:19

**Subbasin : DA B6**



## Subbasin : DA B7

### Input Data

Area (ac) ........................................................................ 0.70
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 74.00
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.70 | C | 74.00 |
| Composite Area & Weighted CN | 0.70 | | 74.00 |

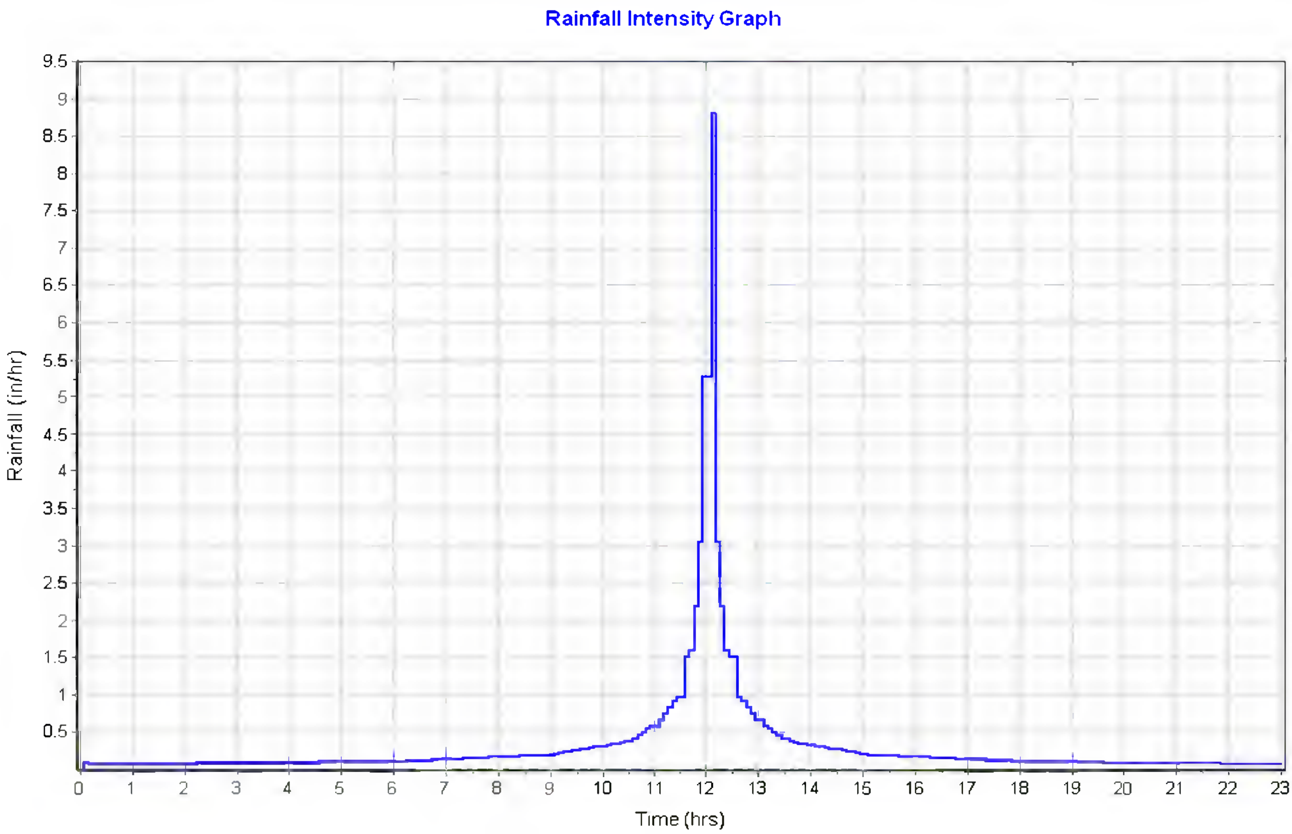
### Time of Concentration

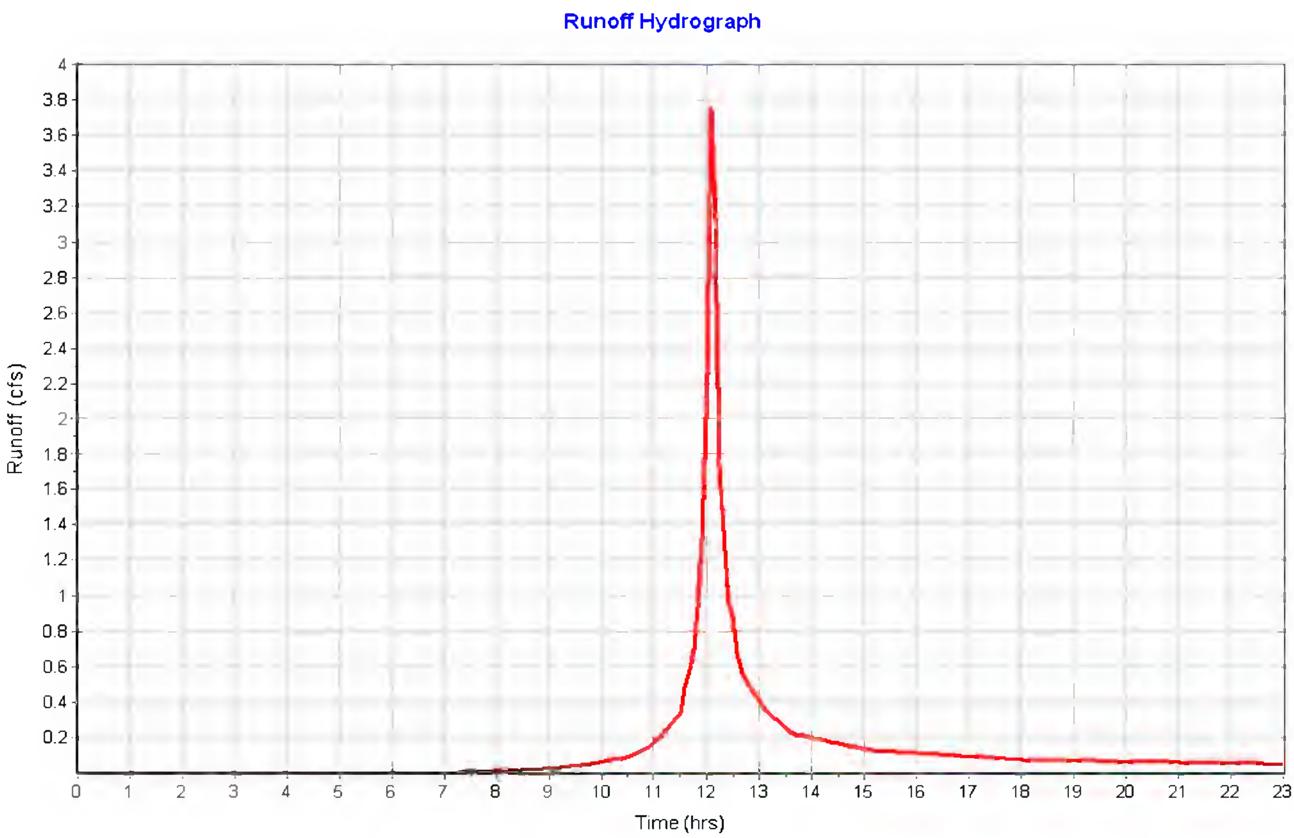
User-Defined TOC override (minutes): 6

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) .............................................................. 4.45
Peak Runoff (cfs) ............................................................ 4.19
Weighted Curve Number ............................................... 74.00
Time of Concentration (days hh:mm:ss) ........................ 0 00:06:00

**Subbasin : DA B7**



## Subbasin : DA B8

### Input Data

Area (ac) ........................................................................ 0.24
Peak Rate Factor ............................................................ 484.00
Weighted Curve Number ................................................ 79.50
Rain Gage ID .................................................................

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.05 | C | 74.00 |
| Paved parking & roofs | 0.07 | C | 98.00 |
| Meadow, non-grazed | 0.12 | C | 71.00 |
| Composite Area & Weighted CN | 0.24 | | 79.50 |

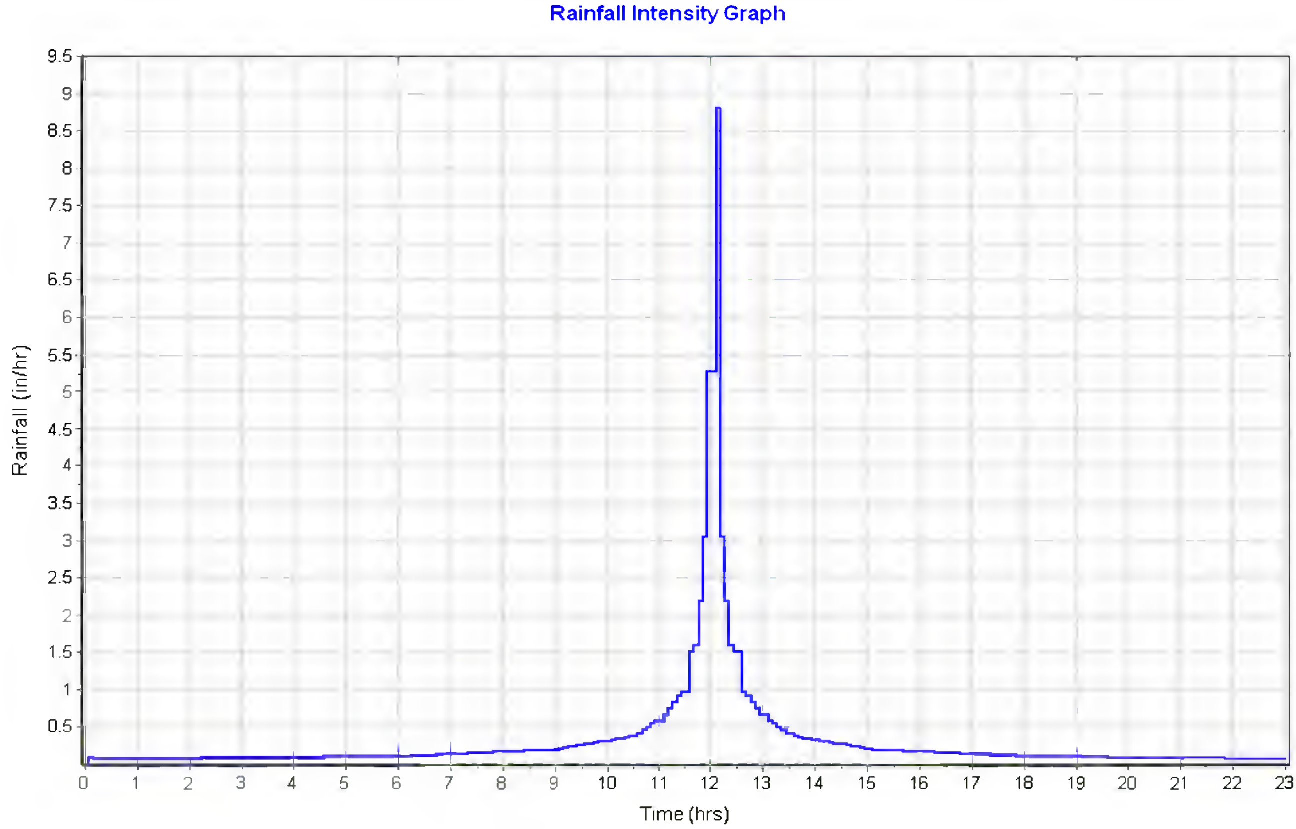
### Time of Concentration

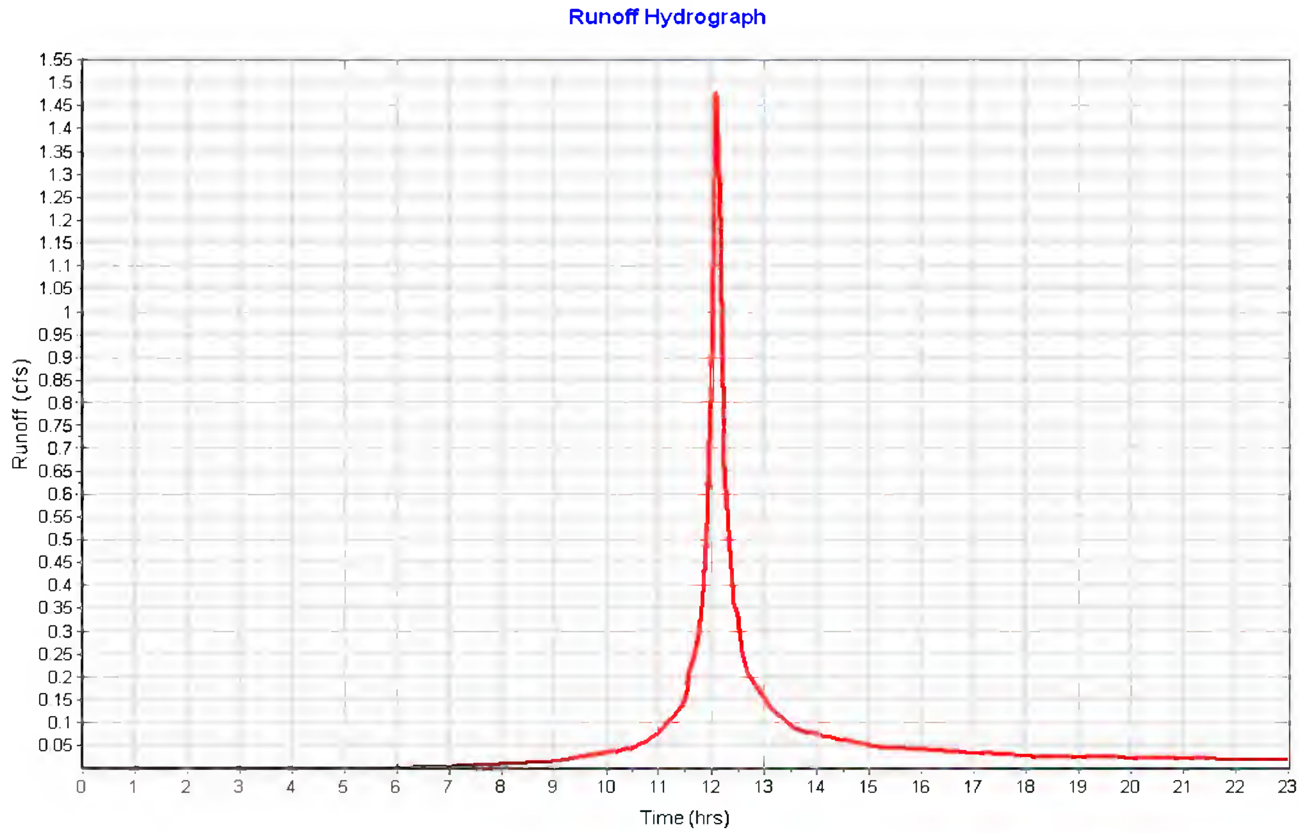
User-Defined TOC override (minutes): 6

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.07
Peak Runoff (cfs) ............................................................ 1.63
Weighted Curve Number ................................................ 79.50
Time of Concentration (days hh:mm:ss) ........................ 0 00:06:00

**Subbasin : DA B8**



## Subbasin : DA B9

### Input Data

Area (ac) ........................................................................ 1.74
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 88.86
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.64 | C | 74.00 |
| Paved roads with curbs & sewers | 1.08 | C | 98.00 |
| Meadow, non-grazed | 0.02 | C | 71.00 |
| Composite Area & Weighted CN | 1.74 | | 88.86 |

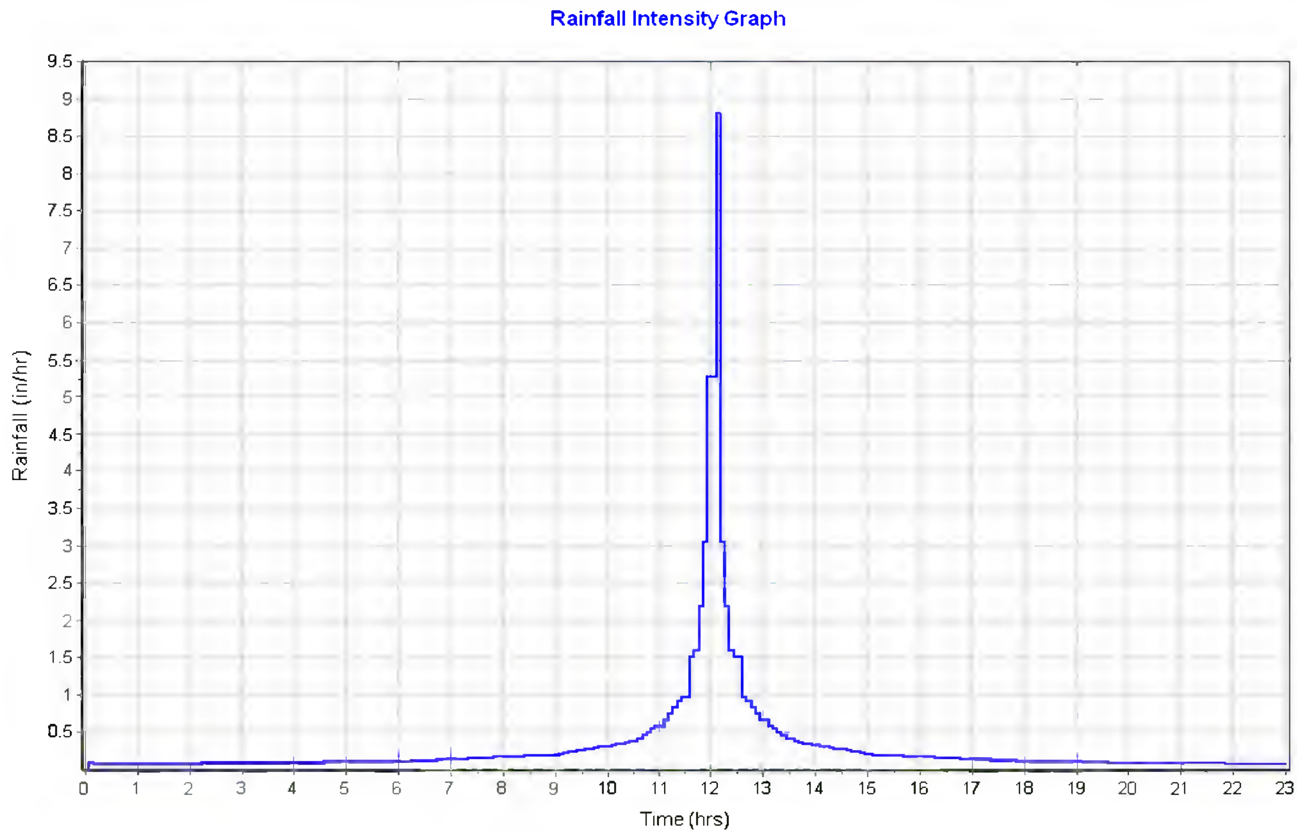
### Time of Concentration

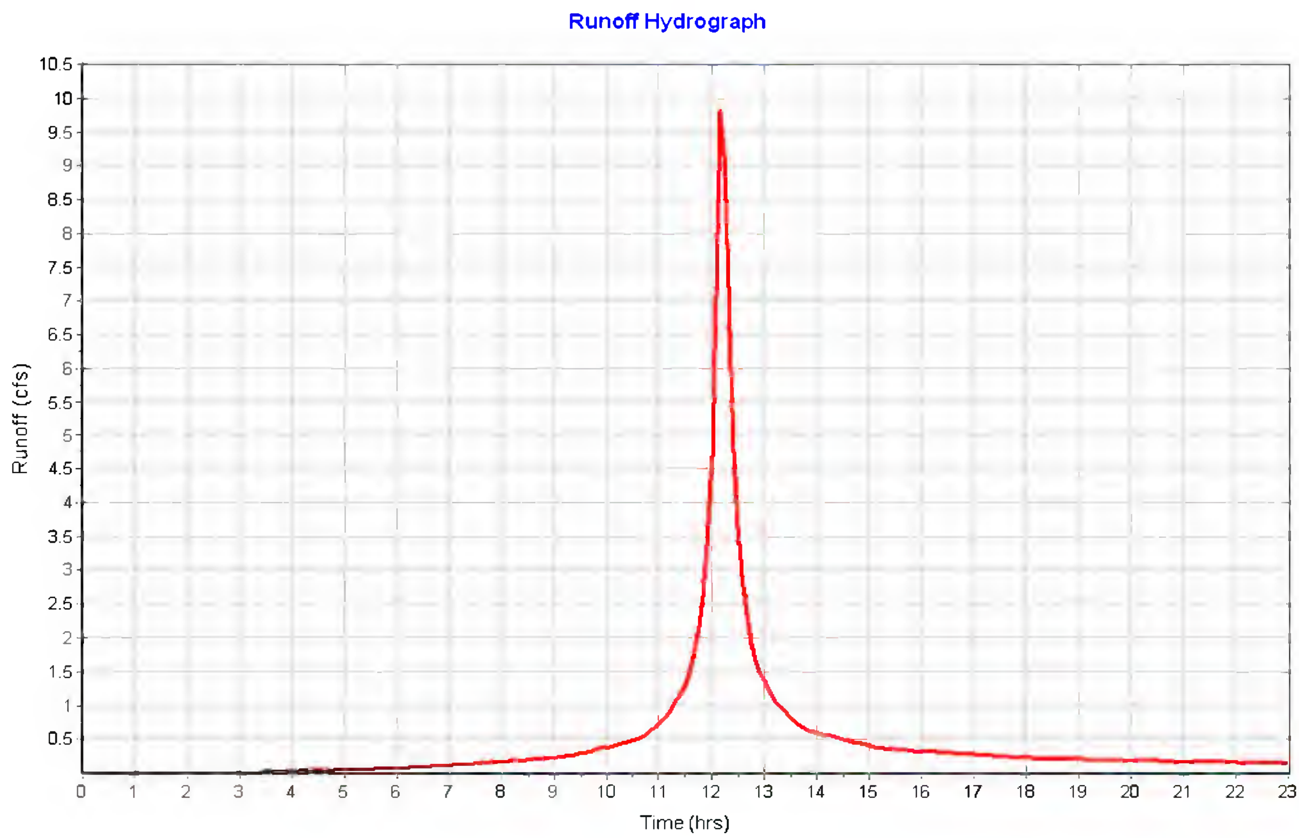
User-Defined TOC override (minutes): 15

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 6.15
Peak Runoff (cfs) ........................................................... 10.07
Weighted Curve Number ............................................... 88.86
Time of Concentration (days hh:mm:ss) ........................ 0 00:15:00

**Subbasin : DA B9**



## Junction Input

| SN | Element ID | Invert Elevation (ft) | Ground/Rim (Max) Elevation (ft) | Ground/Rim (Max) Offset (ft) | Initial Water Elevation (ft) | Initial Water Depth (ft) | Surcharge Elevation (ft) | Surcharge Depth (ft) | Ponded Area (ft²) | Minimum Pipe Cover (in) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S1.01 | 374.00 | 386.00 | 12.00 | 374.00 | 0.00 | 386.00 | 0.00 | 0.00 | 0.00 |
| 2 | S1.02 | 376.56 | 382.56 | 6.00 | 376.56 | 0.00 | 382.56 | 0.00 | 0.00 | 0.00 |
| 3 | S1.03 | 378.95 | 384.95 | 6.00 | 378.95 | 0.00 | 385.00 | 0.05 | 0.00 | 0.00 |
| 4 | S1.04 | 379.74 | 389.00 | 9.26 | 379.74 | 0.00 | 385.74 | -3.26 | 0.00 | 0.00 |
| 5 | S1.05 | 380.40 | 386.40 | 6.00 | 380.40 | 0.00 | 386.40 | 0.00 | 0.00 | 0.00 |
| 6 | S1.06 | 381.29 | 392.00 | 10.71 | 381.29 | 0.00 | 387.29 | -4.71 | 0.00 | 0.00 |
| 7 | S1.07 | 381.74 | 392.00 | 10.26 | 381.74 | 0.00 | 387.74 | -4.26 | 0.00 | 0.00 |
| 8 | S1.08 | 382.94 | 388.94 | 6.00 | 382.94 | 0.00 | 388.94 | 0.00 | 0.00 | 0.00 |
| 9 | S1.09 | 383.30 | 389.30 | 6.00 | 383.30 | 0.00 | 389.30 | 0.00 | 0.00 | 0.00 |
| 10 | S1.10 | 384.30 | 390.30 | 6.00 | 384.30 | 0.00 | 390.30 | 0.00 | 0.00 | 0.00 |
| 11 | S1.11 | 385.03 | 391.00 | 5.97 | 385.03 | 0.00 | 391.00 | 0.00 | 0.00 | 0.00 |
| 12 | S1.12 | 389.90 | 395.90 | 6.00 | 389.90 | 0.00 | 395.90 | 0.00 | 0.00 | 0.00 |
| 13 | S1.13 | 392.00 | 398.00 | 6.00 | 392.00 | 0.00 | 398.00 | 0.00 | 0.00 | 0.00 |
| 14 | S1.14 | 392.77 | 398.77 | 6.00 | 392.77 | 0.00 | 398.77 | 0.00 | 0.00 | 0.00 |
| 15 | S1.15 | 395.30 | 401.30 | 6.00 | 395.30 | 0.00 | 401.30 | 0.00 | 0.00 | 0.00 |
| 16 | S1.16 | 397.35 | 403.35 | 6.00 | 397.35 | 0.00 | 403.35 | 0.00 | 0.00 | 0.00 |
| 17 | S1.17 | 400.40 | 406.40 | 6.00 | 400.40 | 0.00 | 406.40 | 0.00 | 0.00 | 0.00 |
| 18 | S1.18 | 402.00 | 413.00 | 11.00 | 402.00 | 0.00 | 413.00 | 0.00 | 0.00 | 0.00 |
| 19 | S1.19 | 394.42 | 400.42 | 6.00 | 394.42 | 0.00 | 400.42 | 0.00 | 0.00 | 0.00 |
| 20 | S1.20 | 396.30 | 402.30 | 6.00 | 396.30 | 0.00 | 402.30 | 0.00 | 0.00 | 0.00 |
| 21 | S1.21 | 398.00 | 402.00 | 4.00 | 398.00 | 0.00 | 402.00 | 0.00 | 0.00 | 0.00 |
| 22 | S1.22 | 384.00 | 394.00 | 10.00 | 384.00 | 0.00 | 394.00 | 0.00 | 0.00 | 0.00 |
| 23 | S2.01 | 377.25 | 384.60 | 7.35 | 377.25 | 0.00 | 384.60 | 0.00 | 0.00 | 0.00 |
| 24 | S2.02 | 378.42 | 390.20 | 11.78 | 378.42 | 0.00 | 390.20 | 0.00 | 0.00 | 0.00 |
| 25 | S2.03 | 378.85 | 393.00 | 14.15 | 378.85 | 0.00 | 393.00 | 0.00 | 0.00 | 0.00 |
| 26 | S2.05 | 380.13 | 396.00 | 15.87 | 380.13 | 0.00 | 396.00 | 0.00 | 0.00 | 0.00 |
| 27 | S2.06 | 371.74 | 394.00 | 22.26 | 381.74 | 10.00 | 394.00 | 0.00 | 0.00 | 0.00 |
| 28 | S2.07 | 382.38 | 392.00 | 9.62 | 382.38 | 0.00 | 392.00 | 0.00 | 0.00 | 0.00 |
| 29 | S2.08 | 382.87 | 390.00 | 7.13 | 382.87 | 0.00 | 390.00 | 0.00 | 0.00 | 0.00 |
| 30 | S2.09 | 383.85 | 389.50 | 5.65 | 383.85 | 0.00 | 389.50 | 0.00 | 0.00 | 0.00 |
| 31 | S2.10 | 385.35 | 392.00 | 6.65 | 385.35 | 0.00 | 392.00 | 0.00 | 0.00 | 0.00 |
| 32 | S2.11 | 382.90 | 388.90 | 6.00 | 382.90 | 0.00 | 388.90 | 0.00 | 0.00 | 0.00 |

## Junction Results

| SN | Element ID | Peak Inflow (cfs) | Peak Lateral Inflow (cfs) | Max HGL Elevation Attained (ft) | Max HGL Depth Attained (ft) | Max Surcharge Depth Attained (ft) | Min Freeboard Attained (ft) | Average HGL Elevation Attained (ft) | Average HGL Depth Attained (ft) | Time of Max HGL Occurrence (days hh:mm) | Time of Peak Flooding Occurrence (days hh:mm) | Total Flooded Volume (ac-in) | Total Time Flooded (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S1.01 | 201.55 | 11.42 | 377.15 | 3.15 | 0.00 | 8.85 | 374.44 | 0.44 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 2 | S1.02 | 180.75 | 5.33 | 379.54 | 2.98 | 0.00 | 3.02 | 376.98 | 0.42 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 3 | S1.03 | 175.42 | 2.53 | 381.87 | 2.92 | 0.00 | 3.08 | 379.36 | 0.41 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 4 | S1.04 | 172.89 | 75.82 | 382.62 | 2.88 | 0.00 | 6.38 | 380.15 | 0.41 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 5 | S1.05 | 97.08 | 0.00 | 382.88 | 2.48 | 0.00 | 3.52 | 380.75 | 0.35 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 6 | S1.06 | 97.08 | 2.21 | 384.09 | 2.80 | 0.00 | 7.91 | 381.66 | 0.37 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 7 | S1.07 | 95.28 | 13.48 | 384.54 | 2.80 | 0.00 | 7.46 | 382.10 | 0.36 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 8 | S1.08 | 81.80 | 2.02 | 385.13 | 2.19 | 0.00 | 3.81 | 383.25 | 0.31 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 9 | S1.09 | 79.93 | 0.00 | 385.49 | 2.19 | 0.00 | 3.81 | 383.61 | 0.31 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 10 | S1.10 | 79.93 | 0.00 | 386.40 | 2.10 | 0.00 | 3.90 | 384.60 | 0.30 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 11 | S1.11 | 79.93 | 3.75 | 387.13 | 2.10 | 0.00 | 3.87 | 385.33 | 0.30 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 12 | S1.12 | 76.78 | 1.48 | 391.92 | 2.02 | 0.00 | 3.98 | 390.16 | 0.26 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 13 | S1.13 | 75.56 | 0.00 | 394.01 | 2.01 | 0.00 | 3.99 | 392.26 | 0.26 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 14 | S1.14 | 55.51 | 9.80 | 394.68 | 1.91 | 0.00 | 4.09 | 393.03 | 0.26 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 15 | S1.15 | 45.70 | 0.00 | 396.95 | 1.65 | 0.00 | 4.35 | 395.53 | 0.23 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 16 | S1.16 | 45.70 | 14.05 | 399.00 | 1.65 | 0.00 | 4.35 | 397.58 | 0.23 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 17 | S1.17 | 31.65 | 0.00 | 401.99 | 1.59 | 0.00 | 4.41 | 400.60 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 18 | S1.18 | 31.65 | 31.65 | 403.57 | 1.57 | 0.00 | 9.43 | 402.20 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 19 | S1.19 | 20.05 | 4.44 | 395.60 | 1.18 | 0.00 | 4.82 | 394.57 | 0.15 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 20 | S1.20 | 15.61 | 0.00 | 397.48 | 1.18 | 0.00 | 4.82 | 396.44 | 0.14 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 21 | S1.21 | 15.61 | 15.61 | 399.18 | 1.18 | 0.00 | 2.82 | 398.14 | 0.14 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 22 | S1.22 | 11.73 | 11.73 | 384.85 | 0.85 | 0.00 | 9.15 | 384.13 | 0.13 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 23 | S2.01 | 39.18 | 0.00 | 379.21 | 1.96 | 0.00 | 5.39 | 377.49 | 0.24 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 24 | S2.02 | 39.18 | 0.00 | 380.38 | 1.96 | 0.00 | 9.82 | 378.66 | 0.24 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 25 | S2.03 | 39.18 | 11.63 | 380.81 | 1.96 | 0.00 | 12.19 | 379.09 | 0.24 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 26 | S2.05 | 27.55 | 0.00 | 381.63 | 1.50 | 0.00 | 14.37 | 380.33 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 27 | S2.06 | 27.55 | 0.90 | 383.24 | 11.50 | 0.00 | 10.76 | 381.94 | 10.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 28 | S2.07 | 26.82 | 0.00 | 383.86 | 1.48 | 0.00 | 8.14 | 382.58 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 29 | S2.08 | 26.82 | 0.00 | 384.35 | 1.48 | 0.00 | 5.65 | 383.07 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 30 | S2.09 | 26.82 | 13.55 | 385.32 | 1.47 | 0.00 | 4.18 | 384.05 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 31 | S2.10 | 13.27 | 0.00 | 386.73 | 1.38 | 0.00 | 5.27 | 385.53 | 0.18 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 32 | S2.11 | 13.27 | 13.27 | 386.93 | 4.03 | 0.00 | 1.97 | 385.73 | 2.83 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |

## Pipe Input

| SN | Element ID | Length (ft) | Inlet Invert Elevation (ft) | Inlet Invert Offset (ft) | Outlet Invert Elevation (ft) | Outlet Invert Offset (ft) | Total Drop (ft) | Average Slope (%) | Pipe Shape | Pipe Diameter or Height (in) | Pipe Width (in) | Manning's Roughness | Entrance Losses | Exit/Bend Losses | Additional Losses | Initial Flow (cfs) | Flap Gate | No. of Barrels |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | P1.01 | 66.76 | 374.00 | 0.00 | 373.00 | 0.00 | 1.00 | 1.5000 | CIRCULAR | 54.000 | 54.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 2 | P1.02 | 183.09 | 376.56 | 0.00 | 374.00 | 0.00 | 2.56 | 1.4000 | CIRCULAR | 54.000 | 54.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 3 | P1.03 | 170.47 | 378.95 | 0.00 | 376.56 | 0.00 | 2.39 | 1.4000 | CIRCULAR | 54.000 | 54.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 4 | P1.04 | 56.03 | 379.74 | 0.00 | 378.95 | 0.00 | 0.79 | 1.4100 | CIRCULAR | 54.000 | 54.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 5 | P1.05 | 64.98 | 380.40 | 0.00 | 379.74 | 0.00 | 0.66 | 1.0200 | CIRCULAR | 48.000 | 48.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 6 | P1.06 | 97.20 | 381.29 | 0.00 | 380.40 | 0.00 | 0.89 | 0.9200 | CIRCULAR | 48.000 | 48.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 7 | P1.07 | 47.82 | 381.74 | 0.00 | 381.29 | 0.00 | 0.45 | 0.9400 | CIRCULAR | 42.000 | 42.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 8 | P1.08 | 86.34 | 382.94 | 0.00 | 381.74 | 0.00 | 1.20 | 1.3900 | CIRCULAR | 42.000 | 42.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 9 | P1.09 | 29.24 | 383.30 | 0.00 | 382.94 | 0.00 | 0.36 | 1.2300 | CIRCULAR | 42.000 | 42.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 10 | P1.10 | 68.28 | 384.30 | 0.00 | 383.30 | 0.00 | 1.00 | 1.4600 | CIRCULAR | 42.000 | 42.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 11 | P1.11 | 52.03 | 385.03 | 0.00 | 384.30 | 0.00 | 0.73 | 1.4000 | CIRCULAR | 42.000 | 42.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 12 | P1.12 | 135.23 | 389.90 | 0.00 | 385.03 | 0.00 | 4.87 | 3.6000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 13 | P1.13 | 59.72 | 392.00 | 0.00 | 389.90 | 0.00 | 2.10 | 3.5200 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 14 | P1.14 | 36.49 | 392.77 | 0.00 | 392.00 | 0.00 | 0.77 | 2.1100 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 15 | P1.15 | 119.79 | 395.30 | 0.00 | 392.77 | 0.00 | 2.53 | 2.1100 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.8000 | 0.0000 | 0.00 | No | 1 |
| 16 | P1.16 | 98.60 | 397.35 | 0.00 | 395.30 | 0.00 | 2.05 | 2.0800 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.8000 | 0.0000 | 0.00 | No | 1 |
| 17 | P1.17 | 146.13 | 400.40 | 0.00 | 397.35 | 0.00 | 3.05 | 2.0900 | CIRCULAR | 24.000 | 24.000 | 0.0130 | 0.2000 | 0.8000 | 0.0000 | 0.00 | No | 1 |
| 18 | P1.18 | 74.66 | 402.00 | 0.00 | 400.40 | 0.00 | 1.60 | 2.1400 | CIRCULAR | 24.000 | 24.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 19 | P1.19 | 98.76 | 394.42 | 0.00 | 392.00 | 0.00 | 2.42 | 2.4500 | CIRCULAR | 24.000 | 24.000 | 0.0130 | 0.2000 | 0.8000 | 0.0000 | 0.00 | No | 1 |
| 20 | P1.20 | 78.24 | 396.30 | 0.00 | 394.42 | 0.00 | 1.88 | 2.4000 | CIRCULAR | 18.000 | 18.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 21 | P1.21 | 71.46 | 398.00 | 0.00 | 396.30 | 0.00 | 1.70 | 2.3800 | CIRCULAR | 18.000 | 18.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 22 | P1.22 | 299.67 | 384.00 | 0.00 | 374.00 | 0.00 | 10.00 | 3.3400 | CIRCULAR | 18.000 | 18.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 23 | P2.01 | 70.50 | 373.71 | -3.54 | 373.00 | 0.00 | 0.71 | 1.0100 | CIRCULAR | 36.000 | 36.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 24 | P2.02 | 117.10 | 378.42 | 0.00 | 377.25 | 0.00 | 1.17 | 1.0000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 25 | P2.03 | 43.21 | 378.85 | 0.00 | 378.42 | 0.00 | 0.43 | 1.0000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 26 | P2.04 | 127.13 | 380.13 | 0.00 | 378.85 | 0.00 | 1.28 | 1.0100 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 27 | P2.06 | 161.78 | 381.74 | 10.00 | 380.13 | 0.00 | 1.61 | 1.0000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 28 | P2.07 | 63.62 | 382.38 | 0.00 | 381.74 | 10.00 | 0.64 | 1.0100 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 29 | P2.08 | 49.15 | 382.87 | 0.00 | 382.38 | 0.00 | 0.49 | 1.0000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 30 | P2.09 | 97.65 | 383.85 | 0.00 | 382.87 | 0.00 | 0.98 | 1.0000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 31 | P2.10 | 149.69 | 385.35 | 0.00 | 383.53 | -0.32 | 1.82 | 1.2200 | CIRCULAR | 24.000 | 24.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 32 | P2.11 | 39.49 | 385.55 | 2.65 | 385.35 | 0.00 | 0.20 | 0.5100 | CIRCULAR | 24.000 | 24.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |

## Pipe Results

| SN | Element ID | Peak Flow (cfs) | Time of Peak Flow Occurrence (days hh:mm) | Design Flow Capacity (cfs) | Peak Flow/ Design Flow Ratio | Peak Flow Velocity (ft/sec) | Travel Time (min) | Peak Flow Depth (ft) | Peak Flow Depth/ Total Depth Ratio | Total Time Surcharged (min) | Froude Number | Reported Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | P1.01 | 201.55 | 0 12:15 | 240.68 | 0.84 | 16.94 | 0.07 | 3.15 | 0.70 | 0.00 | | Calculated |
| 2 | P1.02 | 180.75 | 0 12:15 | 232.53 | 0.78 | 16.16 | 0.19 | 2.98 | 0.66 | 0.00 | | Calculated |
| 3 | P1.03 | 175.42 | 0 12:15 | 232.85 | 0.75 | 16.08 | 0.18 | 2.92 | 0.65 | 0.00 | | Calculated |
| 4 | P1.04 | 172.89 | 0 12:15 | 233.50 | 0.74 | 16.07 | 0.06 | 2.88 | 0.64 | 0.00 | | Calculated |
| 5 | P1.05 | 97.08 | 0 12:15 | 144.77 | 0.67 | 12.34 | 0.09 | 2.40 | 0.60 | 0.00 | | Calculated |
| 6 | P1.06 | 97.08 | 0 12:15 | 137.45 | 0.71 | 11.85 | 0.14 | 2.48 | 0.62 | 0.00 | | Calculated |
| 7 | P1.07 | 95.28 | 0 12:15 | 97.60 | 0.98 | 11.55 | 0.07 | 2.80 | 0.80 | 0.00 | | Calculated |
| 8 | P1.08 | 81.80 | 0 12:15 | 118.61 | 0.69 | 13.29 | 0.11 | 2.14 | 0.61 | 0.00 | | Calculated |
| 9 | P1.09 | 79.93 | 0 12:15 | 111.64 | 0.72 | 12.61 | 0.04 | 2.19 | 0.63 | 0.00 | | Calculated |
| 10 | P1.10 | 79.93 | 0 12:15 | 121.76 | 0.66 | 13.49 | 0.08 | 2.07 | 0.59 | 0.00 | | Calculated |
| 11 | P1.11 | 79.93 | 0 12:15 | 119.17 | 0.67 | 13.27 | 0.07 | 2.10 | 0.60 | 0.00 | | Calculated |
| 12 | P1.12 | 76.78 | 0 12:15 | 77.84 | 0.99 | 18.07 | 0.12 | 2.02 | 0.81 | 0.00 | | Calculated |
| 13 | P1.13 | 75.56 | 0 12:15 | 76.92 | 0.98 | 17.85 | 0.06 | 2.01 | 0.80 | 0.00 | | Calculated |
| 14 | P1.14 | 55.51 | 0 12:15 | 59.58 | 0.93 | 13.78 | 0.04 | 1.91 | 0.76 | 0.00 | | Calculated |
| 15 | P1.15 | 45.70 | 0 12:15 | 59.61 | 0.77 | 13.38 | 0.15 | 1.64 | 0.66 | 0.00 | | Calculated |
| 16 | P1.16 | 45.70 | 0 12:15 | 59.14 | 0.77 | 13.30 | 0.12 | 1.65 | 0.66 | 0.00 | | Calculated |
| 17 | P1.17 | 31.65 | 0 12:15 | 32.68 | 0.97 | 11.84 | 0.21 | 1.59 | 0.79 | 0.00 | | Calculated |
| 18 | P1.18 | 31.65 | 0 12:15 | 33.12 | 0.96 | 11.99 | 0.10 | 1.57 | 0.78 | 0.00 | | Calculated |
| 19 | P1.19 | 20.05 | 0 12:15 | 35.41 | 0.57 | 11.62 | 0.14 | 1.08 | 0.54 | 0.00 | | Calculated |
| 20 | P1.20 | 15.61 | 0 12:15 | 16.28 | 0.96 | 10.49 | 0.12 | 1.18 | 0.79 | 0.00 | | Calculated |
| 21 | P1.21 | 15.61 | 0 12:15 | 16.20 | 0.96 | 10.44 | 0.11 | 1.18 | 0.79 | 0.00 | | Calculated |
| 22 | P1.22 | 11.73 | 0 12:15 | 19.19 | 0.61 | 11.39 | 0.44 | 0.85 | 0.57 | 0.00 | | Calculated |
| 23 | P2.01 | 39.18 | 0 12:15 | 163.76 | 0.24 | 19.00 | 0.06 | 1.00 | 0.33 | 0.00 | | Calculated |
| 24 | P2.02 | 39.18 | 0 12:15 | 41.00 | 0.96 | 9.50 | 0.21 | 1.96 | 0.78 | 0.00 | | Calculated |
| 25 | P2.03 | 39.18 | 0 12:15 | 40.92 | 0.96 | 9.49 | 0.08 | 1.96 | 0.78 | 0.00 | | Calculated |
| 26 | P2.04 | 27.55 | 0 12:15 | 41.16 | 0.67 | 8.98 | 0.24 | 1.50 | 0.60 | 0.00 | | Calculated |
| 27 | P2.06 | 27.55 | 0 12:15 | 40.92 | 0.67 | 8.94 | 0.30 | 1.50 | 0.60 | 0.00 | | Calculated |
| 28 | P2.07 | 26.82 | 0 12:15 | 41.14 | 0.65 | 8.92 | 0.12 | 1.47 | 0.59 | 0.00 | | Calculated |
| 29 | P2.08 | 26.82 | 0 12:15 | 40.95 | 0.65 | 8.89 | 0.09 | 1.48 | 0.59 | 0.00 | | Calculated |
| 30 | P2.09 | 26.82 | 0 12:15 | 41.09 | 0.65 | 8.91 | 0.18 | 1.47 | 0.59 | 0.00 | | Calculated |
| 31 | P2.10 | 13.27 | 0 12:15 | 22.65 | 0.59 | 7.49 | 0.33 | 1.10 | 0.55 | 0.00 | | Calculated |
| 32 | P2.11 | 13.27 | 0 12:15 | 16.10 | 0.82 | 5.72 | 0.12 | 1.38 | 0.69 | 0.00 | | Calculated |

# Appendix D

## Opinion of Probable Cost

**West Chester Borough**
**Chester County**

NEWELL TERESKA & MACKAY
ENGINEERING

| | | | | | |
|---|---|---|---|---|---|
| CONTRACT NUMBER: | | 21000 | | | |
| COST ESTIMATE: | | Concept | | | |
| TYPE OF CONTRACT: | | Expert Witness | | | |
| LOCATION: | | WCU | | | |
| ESTIMATE BY: | | Aaron Jolin, PE | | | |
| DATE OF ESTIMATE | | 5/20/2021 | | | |
| **WORK SCOPE:** | | WCU Concept Storm Drain System | | | |
| | | And Associated Work | | | |
| **COST BASIS:** | | PennDOT ECMS District 6 | | | |
| **TOTAL COST:** | | Design/Permitting/General/Construction | | $ 4,201,969.59 | |
| **CONTINGENCY:** | | Contingency: 5% | | | |
| **ASSUMPTIONS:** | | Borrow fill material not required for pipe installation | | | |
| | | Pipe cost includes installation | | | |

**ESTIMATE:**

| Item | PennDOT Item Number | Qty | Units | Unit Cost | Total | Division Totals |
|---|---|---|---|---|---|---|
| STORM DRAIN TRUNK SYSTEM CONSTRUCTION | | | | | | |
| TYPE A 18" REINFORCED CONCRETE PIPE (7'-3' FILL 100-YR LIFE S/T.B.) | 0601-7509 | 150 | LF | $ 149.00 | $ 22,350.00 | |
| TYPE A 24" REINFORCED CONCRETE PIPE (7'-3' FILL 100-YR LIFE S/T.B.) | 0601-7517 | 510 | LF | $ 175.00 | $ 89,250.00 | |
| TYPE A 30" REINFORCED CONCRETE PIPE (7'-3' FILL 100-YR LIFE S/T.B.) | 0601-7043 | 1111 | LF | $ 245.00 | $ 272,195.00 | |
| TYPE A 36" REINFORCED CONCRETE PIPE (15'-3' FILL 100-YR LIFE S/T.B.) | 0601-7536 | 71 | LF | $ 300.00 | $ 21,300.00 | |
| TYPE A 42" REINFORCED CONCRETE PIPE (10'-3' FILL 100-YR LIFE S/T.B.) | 0601-7541 | 284 | LF | $ 335.00 | $ 95,140.00 | |
| TYPE A 48" REINFORCED CONCRETE PIPE (7'-3' FILL TRENCH BOX) | 0601-7546 | 162 | LF | $ 345.00 | $ 55,890.00 | |
| TYPE A 54" REINFORCED CONCRETE PIPE (<15" DEPTH) | 0601-7551 | 476 | LF | $ 735.00 | $ 349,860.00 | |
| TYPE M INLET TOP UNIT AND BICYCLE SAFE GRATE | 0605-2731 | 16 | EA. | $ 1,100.00 | $ 17,600.00 | |
| TYPE 6 INLET BOX, HEIGHT </= 10' | 0605-2862 | 6 | EA. | $ 9,000.00 | $ 54,000.00 | |
| TYPE 5 INLET BOX, HEIGHT </=10' | 0605-2858 | 6 | EA. | $ 7,000.00 | $ 42,000.00 | |
| TYPE 4 INLET BOX, HEIGHT </= 10' | 0605-2854 | 19 | EA. | $ 4,500.00 | $ 85,500.00 | |
| SPECIAL ENDWALL- TEAR DOWN AND REBUILD | NO NUMBER | 1 | EA. | $ 100,000.00 | $ 100,000.00 | |
| ROCK APRON | 0851-0003 | 75 | SY | $ 150.00 | $ 11,250.00 | |
| FLOWABLE BACKFILL, TYPE D (INCLUDES PLUGGING PIPE) | 4220-0030 | 64 | CY | $ 220.00 | $ 14,080.00 | |
| PIPE REMOVAL/DEMOLITION (CLASS 2 EXCAVATION) | 0204-0001 | 358 | CY | $ 30.00 | $ 10,740.00 | |
| | **TOTAL - STORM DRAIN TRUNK SYSTEM CONSTRUCTION** | | | | | **$ 1,241,155.00** |
| | | | | | | |
| PERIMETER CAPTURE/CONVEYANCE | | | | | | |
| NYLOPLAST DRAIN BASINS WITH GRATES | NO NUMBER | 83 | EA | $ 1,200.00 | $ 99,600.00 | |
| TRAFFIC RATED TRENCH DRAIN | NO NUMBER | 574 | LF | $ 350.00 | $ 200,900.00 | |

| Item | PennDOT Item Number | Qty | Units | Unit Cost | Total | Division Totals |
|---|---|---|---|---|---|---|
| 12" THERMOPLASTIC GROUP I (15'-1.5' FILL DEPTH) | 0601-0311 | 4009 | LF | $ 90.00 | $ 360,810.00 | |
| CURB-TRENCHDRAIN or KNEEWALL-SWALE | NO NUMBER | 1023 | LF | $ 240.00 | $ 245,520.00 | |
| CLASS 2 EXCAVATION (0.14 cy/lf OF PERIMETER WORK) | 0204-0001 | 358 | CY | $ 30.00 | $ 10,740.00 | |
| SEEDNG AND SOIL SUPPLEMENTS - FORMULA D | 0804-0011 | 580 | LB | $ 13.00 | $ 7,540.00 | |
| SEEDING - FORMULA E | 0804-0004 | 90 | LB | $ 20.00 | $ 1,800.00 | |
| TEMP SHORT TERM MATTING TYPE 2A | 0806-0110 | 7000 | SY | $ 2.00 | $ 14,000.00 | |
| TOPSOIL FURNISHED AND PLACED | 0802-0001 | 732 | CY | $ 93.50 | $ 68,442.00 | |
| | **TOTAL - PERIMTER CAPTURE/CONVEYANCE** | | | | | **$ 1,009,352.00** |
| | | | | | | |
| UTILITY RELOCATION (BASED ON KNOWN INFORMATION) | | | | | | |
| REPLACE BOROUGH INLETS WITH SOLID TOPS AND MANHOLE COVERS | NO NUMBER | 5 | EA. | $ 4,500.00 | $ 22,500.00 | |
| 10" PVC SEWER | NO NUMBER | 188 | LF | $ 150.00 | $ 28,200.00 | |
| SANITARY SEWER MANOLE - 4' DIAM, 4-8' DEEP | NO NUMBER | 3 | EA. | $ 4,000.00 | $ 12,000.00 | |
| TYPE A 48"x78" ELLIPTICAL CONCRETE PIPE (3-2' TYPE B TRENCH BOX) | 0601-6429 | 258 | LF | $ 900.00 | $ 232,200.00 | |
| TYPE 12 STORMWATER MANHOLE >10 <20' Height | 0605-3072 | 6 | EA. | $ 40,000.00 | $ 240,000.00 | |
| | **TOTAL - UTILITY RELOCATION** | | | | | **$ 534,900.00** |
| | | | | | | |
| PAVING AND SIDEWALK RESTORATION | | | | | | |
| 2" SUPERPAVE ASPHALT MIX 12.5 MM SRL-G | 0411-0353 | 3290 | SY | $ 23.27 | $ 76,558.30 | |
| 6" SUPERPAVE BASE 25MM | 0311-0026 | 1645 | SY | $ 38.00 | $ 62,510.00 | |
| SIDEWALK (EXCLUDES SIDEWALK REPLACEMENT REQUIRED FOR KNEE WALLS/TRENCH DRAINS) | 0676-0001 | 1254 | SY | $ 93.50 | $ 117,249.00 | |
| CURB AND GUTTER | 0641-0005 | 80 | LF | $ 85.00 | $ 6,800.00 | |
| SAW-CUTTING AND OVERLAY SEALING | 0515-0001 | 3215 | LF | $ 7.00 | $ 22,505.00 | |
| TACK COAT | 0460-0001 | 4800 | SY | $ 0.50 | $ 2,400.00 | |
| MILLING 2" | 0491-0013 | 2400 | SY | $ 3.58 | $ 8,592.00 | |
| CRUSHED AGGREGATE BASE COURSE (6") | 0310-0003 | 2400 | SY | $ 8.42 | $ 20,208.00 | |
| | **TOTAL- PAVING AND SIDEWALK** | | | | | **$ 316,822.30** |
| | | | | | | |
| | **TOTAL - NET CONSTRUCTION COSTS** | | | | | **$ 3,102,229.30** |
| OTHER PROJECTED COSTS | | | | | | |
| OTHER DEMOLITION AND HAUL OFF (1%) | NA | 1 | LS | $ 31,022.29 | $ 31,022.29 | |
| PERMITTING COSTS (2%) | NA | 1 | LS | $ 62,044.59 | $ 62,044.59 | |
| ENGINEERING, SURVEY, SUE, EASEMENT, CONSTRUCTION ADMIN (15%) | NA | 1 | LS | $ 465,334.40 | $ 465,334.40 | |
| STAGED MOBILIZATION (8%) | NA | 1 | LS | $ 248,178.34 | $ 248,178.34 | |
| E&S COSTS (3%) | NA | 1 | LS | $ 93,066.88 | $ 93,066.88 | |
| | | | | **TOTAL - OTHER COSTS** | | **$ 899,646.50** |
| | | | | | | |
| | | | | ***GRAND TOTAL:*** | | |
| | | | | *Net Costs* | | $ 4,001,875.80 |
| | | | | *5% Estimated Contingency* | | $ 200,093.79 |
| | | | | ***Total Estimated Cost:*** | **==============** | **$ 4,201,969.59** |

# Appendix E

## Operation and Costs Calculations

**West Chester Borough**
**Chester County**

NEWELL TERESKA & MACKAY
ENGINEERING

## Operations and Costs Calculations Methodology

To determine the additional annual operations and costs associated with Option 3, NTM Engineering reviewed the Borough of West Chester Stream Protect Fee Report's projected budgets to determine an annual cost per linear mile of storm drain. West Chester's fee schedule is based on an annual budget of 1.3 million dollars with the breakdown as shown below (taken from the 2017 West Chester Stream Protection Fee Report).

Table 1 below "Medium revised" shows the breakdown of cost estimates for program elements which the current impervious coverage fee (SPF) was projected to support annually, with the projected 6.70/1000 SF/month to fee based rate to generate the estimated $1.3m shown in the "Medium Revised" column.

Level of Service Cost Estimate Summary

| | Estimated Average Annual Costs | | | |
|---|---|---|---|---|
| | Low | Medium (revised) | Medium (original) | High |
| **Operating Costs** | | | | |
| Operations and Maintenance | $324,660 | $357,000 | $357,000 | $387,540 |
| NPDES Permit Activities | $10,880 | $33,100 | $33,100 | $59,580 |
| Administrative | $33,600 | $51,660 | $51,660 | $82,940 |
| Urban Forestry/Parks | $0 | $89,080 | $89,080 | $178,520 |
| Professional Services | $42,300 | $77,300 | $77,300 | $112,300 |
| **Total Operating** | **$411,440** | **$608,140** | **$608,140** | **$820,880** |
| **Capital Costs** | | | | |
| Equipment | $49,200 | $49,200 | $49,200 | $49,200 |
| Pipes | $250,750 | $250,750 | $250,750 | $250,750 |
| Stream Improvements | $320,500 | $320,500 | $320,500 | $320,500 |
| Additional Candidate Project | $0 | $60,000 | $285,600 | $571,000 |
| **Total Capital** | **$620,450** | **$681,450** | **$906,050** | **$1,191,450** |
| **Total Operating and Capital** | **$1,031,890** | **$1,289,590** | **$1,514,190** | **$2,012,330** |

Items not considered relative to West Chester University Costs were removed for consideration of calculating West Chester University's average annual costs as shown below.

**Calculation for Average Annual Operating and Capital Costs (per mile of storm drain)**

| | | |
|---|---|---|
| West Chester Borough Annual Budget for Operating and Capital Costs | $ | 1,289,590.00 |
| West Chester Borough Storm Drain Length (miles) | | 23 |
| West Chester Borough Cost Per Mile | $ | 56,069.13 |
| West Chester Borough Annual Budget Removing Items Not Considered Relative to West Chester University Costs (Removes Costs for Urban Forestry/Parks, Stream and Additional Candidate Projects Additional) | $ | 819,010.00 |
| West Chester University's Cost Per Mile | $ | 35,609.13 |
| Total Additional Miles to Be Maintained by West Chester University for Option 3 | | 1.2827 |
| West Chester University's Additional Annual Operations and Capital Costs | $ | 45,675.83 |

West Chester University's additional annual costs associated with Option 3 would be $45,675.83.

# Appendix F

## Expert Witness CVs

**West Chester Borough**
**Chester County**

NEWELL TERESKA & MACKAY ENGINEERING

# Scott A. Brown, MS, PE, D.WRE

Senior Project Manager

NEWELL TERESKA & MACKAY ENGINEERING

## Professional Experience

Mr. Brown offers over 42 years of professional civil engineering experience specializing in urban drainage design, stormwater management, erosion and sedimentation control, hydrologic and hydraulic (H&H) analysis of river and watershed systems including floodplain analysis, and environmental agency coordination. His background also incudes experience in sustainable site design, utility design, and enviromental permitting including construction period and municipal stormwater NPDES permitting and waterway encroachment permitting. Mr. Brown has been involved with municipal land development plan reviews for code compliance and is actively involved in the development and delivery of stormwater management and drainage design professional training courses and seminars. He was a member of the PA DEP Best Management Practices Manual Technical Oversight Committee and is a Certified PennDOT Instructor, who teaches PennDOT's Highway Drainage Design, Stormwater Design & NPDES Permits, and Introduction to Highway Hydraulics courses. Mr. Brown's unique expertise and achievements in water resource engineering were acknowledged by the American Academy of Water Resource Engineers in 2013 through award of the credential Diplomat, Water Resource Engineer. His specific project experience is outlined below.

**Total Years of Experience: 42**

**Education:**

MS, Civil Engineering – Hydrology and Hydraulics, The Pennsylvania State University, 1979

BS, Civil Engineering, The Pennsylvania State University, 1977

**Licenses/Certifications:**

Professional Engineer:
PA No. PE042215R, 1991
NJ No. 24GE04685100, 2007
OH No. PE58163, 2014
VA No. 0402013334, 1982
WV No. 018145, 2009

National Council of Examiners for Engineering and Surveying (NCEES) Record No. 39398, 2010

ASCE Diplomat, Water Resources Engineer, 00632, 2013

Certified PennDOT Instructor, 2007

*Key Qualifications:*

- *Principal Author, Federal Highway Administration Publication HEC-22, Urban Drainage Design*
- *Co-author, Residential Site Development Standards for the Pennsylvania Housing Research Center*
- *Develops and teaches multiple stormwater management and drainage design courses and seminars*
- *Served as PA DEP Pennsylvania Stormwater Technical Work Group Design Standards Subcommittee Member*
- *Specializes in urban drainage design, stormwater management, and erosion and sediment control*
- *Expertise in H&H analysis of river and watershed systems, including floodplain analysis*
- *Diplomat, Water Resources Engineer*

### Forensic Engineering

**PTC Southern Beltway Section 55B, Peitragallo Gordon Alfano Bosick & Raspanti, LLP, Washington County, PA—*Principal Investigator and Expert*** in a dispute between a property owner and the Pennsylvania Turnpike Commission and their design and construction contractors. The question before the court is whether the Pennsylvania Turnpike Commission and it's contractors are responsible for damages resulting from storm runoff during the construction period. Responsibilities included review of case history and related background information including design reports, plans, specifications, correspondence, construction schedules, communications, and other relevant documentation. Responsibilities also included analysis of regional and local rainfall data and development of an expert report of findings.

**APEX at Kutztown Apartment Complex Infiltration Facility Failure, Kutztown University, Kutztown, PA—*Project Manager and Expert*** for investigation of Infiltration Area 2 failure including the basin overflow spillway at the APEX Student Apartment Complex. The investigation included design drawing and engineering calculations review and assessment, construction contractor interviews, field permeability data analysis, and field observations. The investigation revealed clear errors and omissions by the project's design engineer.

**Barger versus Dalesford Estates Community, Tredyffrin Township, Chester County, PA—*Project Manager and Technical Expert*** for stormwater management evaluations and basin operation and maintenance issues related to sinkhole development in and adjacent to a stormwater basin located on the Barger property.

**Galen Oaks Townhouse Basement Flooding Investigation, State College, PA—*Project Manager and Expert*** for the defense in litigation of basement flooding issues in the Galen Oaks townhouse community. The investigation included site drainage issue field investigation including consideration of the subsurface movement of moisture through soils, potential impacts from site stormwater infiltration practices, and the impact of connecting roof drains to subsurface foundation drains. The outcome was a settlement with the builder/developer to make necessary site improvement to rectify problems.

**Mill Creek Square Sink Hole Investigation, Lancaster County, PA—*Project Manager and Technical Expert*** for the cause evaluation of a sinkhole collapse in a stormwater infiltration/detention facility at a commercial facility along the Route 30 corridor just outside Lancaster City. The failure caused significant damage to adjacent residential properties.

**Pittston Aqueduct Failure, Pittston, PA—*Project Manager and Expert*** for hydraulics and stormwater for plaintiff in litigation related to building damage from the collapse of an over 100-year-old stone arch aqueduct in the City of Pittston. The investigation included hydrologic and hydraulic analysis and modeling to recreate the storm event that caused the failure to assist in determination of the aqueduct collapse cause. The analysis supported the conclusion that pressure and turbulence in the pipe at the failure location were sufficient to cause dislodging of individual arch stones resulting in failure.

**Borough of Sunbury Water Treatment Plant Holding Lagoon Failure, Borough Sunbury, PA—*Project Manager and Expert*** for the defense in litigation against the Borough of Sunbury claiming flood losses caused in part by a holding pond embankment failure at the Borough's water treatment facility during Shamokin Creek flooding. The investigation involved stream system modeling (HEC-RAS), stream stability evaluation, and investigation of embankment failure mode. The outcome was a settlement in favor of the Borough of Sunbury based on the technical report's findings.

## Stormwater Management/Drainage/Stormwater NPDES Permitting

**Pennsylvania Stormwater Technical Work Group, Department of Environmental Protection, Harrisburg, PA—*Subcommittee Member*** who participated on the Design Standards and Special Management Area Subcommittees providing recommendations to the PA DEP relative to needed revisions to the Pennsylvania Stormwater BMP Manual. Provided leadership and input for development of alternative design standard recommendations and assisted in drafting revisions to multiple sections of the "Special Management Areas" chapter.

**Luzerne County Transportation Authority Transit Maintenance and Operations Facility, PennDOT Bureau of Public Transportation, City of Wilkes-Barre, Luzurne County, PA – Project Manager and Technical Lead** for NTM's resopnsibilities as part of the design team. This project involves development of construction documents for all site improvements including roadway, parking, utility, and transit and maintenance facility design. NTM's resonsibilities include storm conveyance system and stormwater management analysis and design, erosion and sedimentation control design, and NPDES permitting.

**PTC I95 Sections A2 and A3 Roadway and Interchange Reconstruction and Widening, The Pennsylvania Turnpike Commission, Bucks County, PA— Project Manager and Technical Lead** for NTM's responsibilities on the project. The project involves development of construction and permit documents for reconstruction and widening of 1.3 miles of the Pennsylvania Turnpike mainline and major interchange ramp modifications at the Bensalem Interchange. NTM's responsibilities include stormwater management, drainage design, and preparation of NPDES permit documents. Challenges included restrictive township stormwater requirements, limited right-of-way, and NPDES permit requirement changes mid-project.

**PTC Milepost 320 – 326 Roadway Reconstruction Stormwatrer, E&S, and NPDES Permit Third Party Review, The Pennsylvania Turnpike Commission, Chester County and Montgomery County, PA—Project Manager and Technical Lead** for NTM's responsibilities on the project. NTM was brought in to the projects Final Design phase as a "third-party reviewer." The project extends from PA 29 in Phoenixville/Malvern Chester County to the Falley Forge exit in Montgomery Copunty. NTM's responsibilities include independently reviewing the previous stormwater design and NPDES permit submissions, evaluating the proposed design and providing improvement recommendations, and in-depth quality review of the fiinal NPDES permit package. The work included providing recommendations for achieving regulatory compliance within 12 separate sub watersheds all tributaries to special protection and impaired waters. Challenges included the carbonate nature of the watersheds, limited right-of-way, and significant public interest.

**PTC Milepost 320 – 326 Roadway Reconstruction NPDES Permit Envionrmental Hearing Board (EHB) Litigation, Buckley Brion McGuire & Morris L.L.P, Chester and Montgomery Counties, PA—Technical Expert** providing consultation and expert witness services to the Pennsylvania Turnpike Commission and Pennsylvania Department of Environmental Protection defense team. Mr. Brown was a key participant in negotiations with the Appellant's technical team. Mr. Brown's knowledge and expertise in stormwater management analysis/design and NPDES permitting were key factors in achieving a negotiated settlement to the EHB litigation brought by Valley Forge Chapter of Trout Unlimited and the National Parks Conservation Association.

**4-091 Transportation Improvement Study Milepost 333 to Milepost 351, Pennsylvania Turnpike Commission, Bucks and Montgomery Counties, PA—/*Project Manager*** and technical lead for NTM's services under a prime's agreement for a Transportation Improvement Study anticipating mainline widening from the Mid-County Interchange to the Bensalem Interchange. NTM's responsibilities included identify stormwater control facility land area needs to achieve regulatory compliance considering applicable 25 Pa Code §102.8 and PADEP stormwater requirements, municipal stormwater ordinances, and Pennsylvania Stormwater Management Act 167 Plans. Work also involved consideration of interchange improvements and overhead bridge replacements.

**SR 0080 Woodland Interchange Reconstruction, Clearfield County, PA—*Project Manager.*** This project involves reconstruction of the SR 80 bridges over SR 970 and ramp improvements at the Woodland Interchange. NTM is providing preliminary drainage system design including facility video inspection, condition assessment, and capacity analysis, final design, and construction period services. Mr. Brown is providing design oversight, QA/QC, and project management for NTM's project responsibilities.

**SR 0183 Bridge Over Norfolk Southern Raliway Replacement, City of Reading, PA – *Project Manager*.** This project involves the replacement of the SR 0183 bridge over the Norfolk Southern Railroad on a new vertical alignment. NTM's responsiblities include final drainge design and stormwater management evaluations. Final drainage design included evaluation of conveyance capacity for diverted flows through a portion of the City Storm conveyance system to the Schuylkill River. Mr. Brown's role includes design oversight, QA/QC, and project management for NTM's project responsibilities.

**Stormwater Reuse Study, The Pennsylvania State University, University Park Campus, Centre County, PA — *Project Manager.*** This project involved the development of a guidance document to assist project design professionals in the evaluation of stormwater reuse options for University Building projects. A key element of this study was development of a stormwater harvesting calculator based on local rainfall records for the the University Park Campus. Consideration was given to existing campus stromwater polanning and karst geology issues, as well as to maintaining uniformity in guidelines for harvesting and use facilities and equipment. Mr. Brown was responsible for project management and technical review and oversight.

**Project Management and Review Assistance for Projects in Berks County, PA, PennDOT District 5-0. — Review Engineer.** This project involved project management and review assistance for highway and bridge projects in Berks County. NTM responsibilities include Project Management, Erosion and Sedimentation Control Plan reviews, Hydraulic and Hydrologic Study reviews, Stormwater Management reviews, and permit document reviews. Mr. Brown provided senior technical review services on this project.

**Centre Region MS4 Partners Pollutant Reduction Plan (PRP) Development, Centre County, PA—*Project Manager*** for development of a joint municipal PRP for Penn State University, State College Borough, and College, Ferguson, Patton, and Harris Townships. The project includes development of a multi-municipal sewershed map, pollutant load modeling using the process based MapShed model, pollutant load evaluation, selection of BMPs, development of an implementation plan for mitigation of the regulatory pollutant load reduction, and assistance with the public participation elements of the plan.

**Pennsylvania Turnpike Commission MS4 Compliance Support, Statewide, PA – *Project Manager,*** for this project providing MS4 permit compliance support to the Pennsylvania Turnpike Commisson. NTM's responsibilities incude developing internal compliance documentaton, training program develoment, training program delivery, standards review, internal document updates, and develoment of new standards and maintenance documents associated with the following minimum control measures: public education and outreach; construction site stormwater runoff control; post-construction stormwater management; pollution prevention and good housekeepoing practices; and pollutant reduction plans. Mr. Brown's role also includes technical oversight and QA/QC responsibilities.

**Egypt Hollow Road Bridge (T-468) Replacement, Grove Township, Warren County, PA – *Project Manager*.** This project involved the replacement of the Egypt Hollow Road Bridge over Akeley Run. NTM provided H&H and waterway permitting, and Erosion & Sediment Pollution Control Plan development and permitting services. Mr. Brown's role included design oversight, QA/QC, and project Management for NTM's project responsibilities.

**McClelland Avenue Bridge (T-405) Replacement, Polk Borough, Venango County, PA – *Project Manager*.** This project involved the replacement of the McClelland Avneue Bridge over Sandy Run. NTM provided H&H and waterway permitting services, wetland delineation, and Erosion & Sediment Pollution Control Plan development and permitting services. Mr. Brown's role included design oversight, QA/QC, and project Management for NTM's project responsibilities.

**Permit and Policy Assistance, PennDOT BOMO, Harrisburg, PA—*Senior Technical Support*** providing review and technical input for development a Combined Pollution Reduction Plan (PRP)/Total Maximum Daily Load (TMDL) Plan for PennDOT's 2016-2021 MS4 Permit renewal application. The effort included developing a technical approach, methodology, and cost estimates for implementing the proposed Chesapeake Bay PRP.

**Suburban Avenue Drainage Improvements, Centre County, PA— *Project Manager and Design Engineer*** for the design of an improved drainage system to alleviate flooding along Suburban Avenue. The project included design of 375 linear feet of enlarged storm drain piping. An inovative drop inlet structure was designed at the upstream end of the conveyance pipe to maximize pipe capacity while meeting restrictive depth and cover condition requirements. Mr. Brown was the project manager technical design lead for this project. (2014 – 2015)

**Stormwater Basin Failure/Sinkhole Remediation Retrofit Plan, Pine Hall Development/Old Gatesburg Road, Ferguson Township, Centre County, PA—*Principle Investigator*** for development of stormwater quantity and quality control alternatives for retrofitting several stormwater infiltration basins that failed through lack of infiltration followed by sinkhole formation. In conjunction with a geotechnical engineer, retrofit alternatives were developed to enhance infiltration while controlling sinkhole development within these basins. (2012-2013)

**3-214 General Consulting Engineer (GCE) Services, Pennsylvania Turnpike Commission, Systemwide, PA—*Project Manager*.** This project involves conducting condition assessments of all Pennsylvania Turnpike Commission Infrastructure including roads, bridges, buildings, etc. NTM's role includes review and assessment of all drainage and stormwater infrastructure. The work involves field evaluations, conducting interviews with maintenance staff, and review of existing records to assess drainage and stormwater infrastructure condition and make recommendations for maintenance or other infrastructure upgrades. Under the same contract, NTM is assisting with developing internal PTC training for its Design Operations Manual. Mr. Brown provides senior oversight and QA/QC for the drainage and stormwater infrastructure condition assessments.

**3-241 Roadway Reconstruction Mileposts 320-326, Pennsylvania Turnpike Commission, Chester and Montgomery Counties, PA—*Project Manager/Quality Assurance Reviewer*** providing stormwater and permitting support services for the PTC's Roadway Reconstruction from PA 29 at Milepost 320 in Phoenixville/Malvern, Chester County, to the Valley Forge exit at Milepost 326, Montgomery County. This section of the Turnpike runs through Valley Creek Watershed, a high-quality karst waterway. Responsible for evaluating the proposed stormwater management design and providing improvement recommendations to meet NPDES permit requirements while respecting the Karst nature of the watershed. Also responsible for providing an in-depth quality review of the final NPDES permit package.

**SR 3014 Atherton Street Corridor Highway Improvement Projects, PennDOT, District 2-0, Centre County, PA—*Project Manager.*** This project includes Preliminary Design, Final Design, and Construction Consultation for various betterment improvement projects along SR 3014 in Patton, College, and Ferguson Townships and the Borough of State College. The improvements include pavement rehabilitation, drainage upgrades, signal upgrades, curb and sidewalk replacement, and the replacement of the cross draiange structure at Big Hollow Run. Critical design elements include draiange issues, utility coordination, public involvement, and maintenance and protection of traffic. NTM's responsibilities include drainage design, stormwater management design, erosion and sedimentation (E&S) control design, waterway hydrologic and hydraulic analysis (H&H), NPDES and waterway permitting, and box culvert design. Mr. Brown's responsibilities included project management for NTM's portions of the project. He also provided senior design guidance and QA/QC for drainage and E&S design.

**Fritz Island Wastewater Treatment Plant Upgrade, City of Reading Wastewater Treatment Plan, Berks County, PA—*Project Manager*** for assisting with the design of the Fritz Island Wastewater Treatment Plant upgrade. NTM developed the Erosion and Sediment Pollution Control (E&SPC) Plan and Post-Construction Stormwater Management (PCSM) Plan and provided a flood Impact assessment and NPDES and waterway permitting documents for this $100 million sewer treatment plant upgrade for the City of Reading. The Fritz Island Wastewater Treatment Plant is located on approximately 118 acres of Fritz Island, which is bounded by the Schuylkill River main channel and a flood relief channel. NTM developed a multi-stage E&SCP Plan to accommodate the need to keep the existing treatment plant in services during an anticipated three-year construction period. NTM selected stormwater best practices to avoid mobilization of contaminants, minimize maintenance, and meet regulatory requirements. The final management practices included seven bioretention basins, several land-scape restoration areas, and multiple grass-lined swales. Critical waterway permit elements included developing wetland and waterway impact mitigation plans, coordinating a Red Belly Turtle mitigation plan, and conducting a waterway H&H analysis to assess floodplain impacts. The hydraulic analysis involved developing a split flow model of the Schuylkill River to accurately assess the island's flood conditions. In addition to demonstrating that the proposed development activities would not impact flood levels in the Schuylkill River, the H&H model would be used to ensure that future plant flooding was minimized.

**Ferguson Township Stormwater Management Engineer, Ferguson Township, Centre County, PA—*Stormwater Management Engineer*** for Ferguson Township, providing review of land development plans and zoning requests to ensure compliance with the Township Stormwater Management Ordinances. Provided primary authorship of multiple revisions to the Township Stormwater Ordinance to address MS4 compliance and potential impacts to local groundwater and the environment resulting from accelerated sinkhole formation in the karst Spring Creek Watershed. Also provides surface drainage recommendations related to sinkhole repair in the Township, and advises the Board of Supervisors on stormwater management and drainage issues. (2007 – Current)

**Selders Lane Drainage Improvements, Ferguson Township, Centre County, PA— *Project Manager and Design Engineer*** for the design of an improved drainage system to alleviate flooding along Selders Lane. The project included design of 375 linear feet of enlarged storm drain piping, enlarged box culvert under Rosemont Drive, and 350 inear feet of conveyance channel. An inovative drop inlet structure was designed at the upstream end of the conveyance pipe to maximize pipe capacity while meeting restrictive depth and cover condition requirements. Mr. Brown was the project manager technical design lead for this project.

**Hydraulics Laboratory Support, Federal Highway Administration, Washington, DC—Manager and Principle Investigator** for highway drainage design investigations at the Federal Highway Administration Turner Fairbank Highway Research Center. Resposible for design and implementation of laboratory experiments related to highway drianage design.

**Spring Creek Stormwater Management Plan, Centre County Planning Office, Centre County, PA—*Project Manager*** for stormwater management planning for the Spring Creek Watershed in accordance with Pennsylvania Act 167. The project included developing an innovative technical standards and criteria to control stormwater runoff from a new development in this predominantly limestone underlain watershed.

**Spring Creek Watershed Water Quality Investigation, Centre County Planning Office, Centre County, PA—*Project Manager*** to select BMPs for treatment and control of urban runoff within this high quality watershed with significant karst influences.

**Clearfield County Stormwater Management Plan, Clearfield County Planning Office, Clearfield County, PA—*Project Manager*** for a stormwater management planning project covering 12 watersheds in Clearfield County. All planning and analysis was in compliance with Pennsylvania Act 167 requirements.

**Houserville Storm Drainage Improvements, College Township Department of Public Works, Centre County, PA—*Project Manager*** for the design of storm sewer conveyance improvements to alleviate nuisance flooding and general drainage problems within this 50-year-old neighborhood. Services included a significant public involvement initiative as well as design of and preparing construction documents for over 3000 linear feet of storm sewer piping and other conveyance components.

**Stormwater Runoff Remediation, Friends Hospital, Philadelphia, PA—*Project Manager*** for technical and conceptual design support for this storm runoff remediation project in the City of Philadelphia. The project goal was to reduce runoff to facilitate stormwater utility fee reductions for the owner.

**Municipal Stormwater Discharge Permit Compliance Activities, Narberth Borough and Lower Merion Township, Montgomery County, PA—*Project Manager*** responsible for the permit document development, annual reporting, and compliance issues associated with stormwater discharge (MS4) permits for both Narberth Borough and Lower Merion Township from 2006 through 2013. Services included illicit discharge detection monitoring and developing a Polychlorinated Biphenyl (PCB) Total Maximum Daily Loads (TMDL) Plan for municipal stormwater discharges to the Schuylkill River. Was responsible for completing the 20013-2018 MS4 permit renewal application.

**TMDL Plan, Lower Merion Township, Montgomery County, PA—*Project Manager*** for development of a Polychlorinated Biphenyl (PCB) Total Maximum Daily Loads (TMDL) Plan for discharges to the Schuylkill River. The plan included a strategy for detecting and mitigating possible pollutant loads in the municipal stormwater system. The TMDL Plan was submitted as part of the Township's 2013-2018 MS4 Permit renewal application.

**TMDL Strategy, Lower Merion Township, Montgomery County, PA— *Project Manager*** for development of a Schuylkill River Polychlorinated Biphenyl (PCB) Total Maximum Daily Loads (TMDL) strategy to address how Lower Merion Township will identify possible sources of PCBs within the Township and, if identified, how to mitigate those PCBs. The TMDL Strategy was submitted as part of the Township's 2013-2018 MS4 Permit renewal application.

**Resort and Water Park, Kalahari, Monroe County, PA—*Project Manager*** for stormwater design and NPDES permitting for this 158-acre resort and waterpark located in Toby Township in the Swiftwater Creek watershed (classified as exceptional value) and immediately adjacent to several exceptional value wetlands. The project included design of 18 surface and subsurface infiltration and stormwater management BMPs to ensure that the hydrologic character of the sensitive exceptional wetlands and stream would not be impacted.

**Stormwater Management Master Plan and Drainage Study, Mercer Borough, Mercer County, PA—*Project Manager*** for a Stormwater Management Master Plan and drainage improvements study for the Borough of Mercer.

**American Revolution Center Stormwater Management Plan, Montgomery County, Montgomery County, PA—*Engineer*** for the stormwater management design and analysis for a proposed museum and educational conference center development on 78 acres of fallow farmland and woodland along the Schuylkill River in Lower Providence Township. The stormwater management practices included use of pervious pavers, rain gardens, green roofs, and woodland and meadow landscape restoration.

**Pennsylvania Fish and Boat Commission Stream Dredging & Maintenance, Pennsylvania Department of General Services for, Erie County, PA—*Project Manager*** for preparing PA DEP and U.S. Army Corps of Engineers permit applications for stream dredging and other maintenance operations covering five Pennsylvania Fish and Boat facilities located at the mouth of tributaries to Lake Erie.

**SCI German Township Site Design and NPDES Permitting, Pennsylvania Department of General Services, Fayette County, PA—*Project Manager*** and design lead for drainage, stormwater management, and erosion and sediment control design and permitting for a 158-acre prison.

**SCI German Township Texas Eastern Gas Transmission Line Relocation Permitting, Pennsylvania Department of General Services, Fayette County, PA—*Project Manager*** for erosion and sediment control permitting (ESCGP-1) to relocate a 2,450-linear-foot gas transmission line.

**SCI Graterford East and West Prison Expansion NPDES Permit Documents, Pennsylvania Department of General Services, Montgomery County, PA—*Quality Assurance Reviewer*** for permit compliance and the design of all stormwater infrastructure. Stormwater elements included multiple stormwater management practices designed to mimic, to the maximum extent practicable, existing site hydrology particularly as it related to maintaining groundwater sources feeding wetlands and stream corridor buffer areas. The site's storm runoff feeds headwater areas to the Perkiomen and Skippack Creek Watersheds in Skippack Township.

**Bigler Sports Complex Stormwater Management Study, The Pennsylvania State University, University Park, PA—*Project Manager*** for this stormwater management study to investigate and define stormwater alternatives for planned development in and surrounding a 15-acre sports complex. Services included complex modeling to define runoff characteristics from both under-drained and non-under-drained fields.

**Fox Hollow/Park Avenue Drainage Improvements, The Pennsylvania State University, University Park, PA—*Project Manager*** for the design of comprehensive stormwater management improvements project for the Fox Hollow/Park Avenue watershed on the University Park campus. The project included developing a watershed hydrologic response model, assessing infrastructure needs within the watershed, developing a stormwater management plan and technical standards manual, and final design of several infrastructure improvement projects. This watershed's karst nature posed unique challenges for developing the plan's water quality and infiltration components.

**Pine Hall Drainage Improvements Study, The Pennsylvania State University, University Park, PA—*Project Manager*** for developing a Stormwater Master Plan and an Infrastructure Improvements Plan for drainage improvements within the Pine Hall drainage basin in Ferguson Township. The project included geotechnical investigations and design for a regional infiltration BMP.

**Convenience Store & Daycare, Trapasso, Monroe County, PA—*Quality Assurance Reviewer*** for the site design and NPDES permitting for a two-lot land development on a steeply sloping site with multiple point of discharge study locations in Pocono Township. Critical elements included non-surface water discharges and meeting conflicting agency regulatory requirements.

**Hotel, Trapasso, Monroe County, PA—*Quality Assurance Reviewer*** for the site design and NPDES permitting for an infill project to develop a hotel on an existing restaurant site in Pocono Township. The development required coordination of existing and proposed features to create a relatively seamless transition between old and new. The stormwater controls designs had to work around the infrastructure that was to remain while maintaining access to the existing building.

**Institutional Stormwater Discharge Permit Compliance Activities, Veterans Administration Medical Center, Martinsburg, WV—*Project Manager*** for developing municipal separate storm sewer (MS4) NPDES permit documents for this 175-acre campus. The effort included developing a stormwater management program to address public education and participation, erosion and sediment control for new construction standards, stormwater management standards, illicit discharge monitoring, and good housekeeping operation and maintenance practices. The program was designed to ensure compliance with local, state, and federal regulations.

## H&H and Waterway Studies

**Texas Creek Road Bridge Replacement, Anadarko Petroleum Corporation, Lycoming County, PA—*Project Manager*** for waterway analysis and permitting to reconstruct bridges over Texas Creek and Hugh's Run and a connecting township road in Pine Township. Services included H&H and scour analyses as well as preparing plans and reports in support of a joint permit application for waterway encroachments related to the project. Services also included preparing a NPDES construction and post-construction stormwater management permit plans and reports.

**Lincoln Woods Floodplain Impact Study, BETN Investment Company, Montgomery County, PA—*Project Manager*** in charge of a Wissahickon Creek floodplain encroachment study associated with permitting for restoring a 50-foot-high by 500-foot-long retaining wall, supporting ground around the Lincoln Woods Apartment complex in Springfield Township. The work involved developing a hydraulic model to assess floodplain and floodway impacts. The study's results were submitted in support of a waterway encroachment permit for the retaining wall restoration.

**River Meander Migration Analysis, Bureau of Indian Affairs, Washington, DC—*Engineer*** for a study to establish the meander migration patterns and migration history for a section of the Missouri River.

**100-200 Berwyn Place Pond Dredging, Brandywine Realty Group, Chester County, PA—*Project Manager*** for design and permit maintenance dredging for a 2-acre in-line pond/stormwater management basin on a 29-acre office complex on Cassett Road in Tredyffrin Township.

**100-200 Berwyn Place Stream Restoration, Brandywine Realty Group, Chester County, PA—*Project Manager*** for the design and permitting of stream restoration improvements to control erosion and reduce sediment discharged to an in-line pond in Tredyffrin Township. Services included H&H analysis, permitting, and preparing construction documents for waterway improvements, including cross-vanes and vegetative plantings to stabilize the waterway.

**Mountain Run, City of Culpepper, Culpepper, VA—*Engineer*** for a detailed floodplain alteration study. Services included applying to FEMA for processing of a flood boundary map amendment.

**Design of Riprap Revetments, Federal Highway Administration, Washington, DC—*Engineer*** for developing revised design guidelines for the design of riprap revetments.

**Stream Channel Degradation and Aggradation, Federal Highway Administration, Washington, DC—*Engineer*** for evaluating highway and bridge stability problems related to stream channel instabilities at over 100 sites nationwide.

**Streambank Stabilization Measures, Federal Highway Administration, Washington, DC—*Engineer*** for investigating the effectiveness of streambank stabilization methods and evaluating flow control structures used at highway bridges.

**Allegheny River Floodplain Encroachment Study for Route 6 Bridge Rehabilitation, Hawbaker Engineering, LLC, Port Allegany, PA—*Project Manager*** for a river floodplain study to identify flood levels for a 2.33-year event. This study was used to define areas outside these flood limits for use as contractor stockpile areas. (2008)

**Buck Run Floodway Determination and Encroachment Study, Hawbaker Engineering LLC, Mifflin County, PA—*Project Manager*** for a floodway determination study for Buck Run in Derry Heights, Brown Township. The study's goal was to establish the Buck Run floodway adjacent to a proposed roadway embankment. This study was submitted to and approved by the PA DEP as part of the waterway permit for the proposed roadway embankment construction.

**Burnham Interchange Floodway Encroachment Study, Hawbaker Engineering LLC, Mifflin County, PA—*Project Manager*** for this floodway encroachment study to establish floodway impacts associated with interchange improvements at the Route 322 interchange at Burnham in Brown Township. The resulting report was submitted to the PA DEP and approved as part of the waterway permit for the interchange improvements.

**Millers Run Floodplain Encroachment Study, Hawbaker Engineering, LLC, Williamsport, PA—*Project Manager*** for a river floodplain study to identify development activities impacts n project flood levels for adjacent levees. The resulting report was submitted to the PA DEP as part of the waterway permit for land development activities proposed adjacent to Millers Run.

**Sandy Lick Creek Floodplain Study, Hawbaker Enginering, LLC, Clearfield County, PA— *Project Manager*** for a study to assess flood level impacts resulting from the construction of a sand unloading and storage facility to be located partially in the Sandy Lick Creek floodplain. The results indicated that construction would have no impact on the 100-year floodplain in Sandy Township. The report was submitted to the PA DEP as part of the project's waterway permit application and approved.

**Turkey Run Floodplain Encroachment Study, Hawbaker Engineering, LLC, Lycoming County, PA—*Project Manager*** for a floodplain encroachment study to evaluate impacts associated with installation of a new culvert at SR 2014. Services involved H&H analysis of the existing and replacement culverts to assess impacts to flood levels along Turkey Run. The study was submitted to and approved by the PA DEP as part of the waterway permit for the proposed improvements.

**Kalahari Resort and Water Park Water Balance Assessment, Kalahari, Monroe County, PA— *Project Manager*** to assess the watershed water balance in support of a groundwater withdrawal permit for an 150-acre waterpark in Toby Township.

**Town Branch Flood Plain Study, Town of Leesburg, Leesburg, VA—*Engineer*** for a detailed floodplain alteration study for Town Branch in the vicinity of Dry Mill Road. Services included applying to FEMA for processing of a flood boundary map amendment.

**Unnamed Tributary to the Potomac River, Loudoun County, VA—*Engineer*** for a detailed floodplain alteration study. Services included applying to FEMA for processing of a flood boundary map amendment.

**Parks' Stormwater Impact Mitigation and Stream Restoration Feasibility Study, Lower Merion Township, Montgomery County, PA—*Project Manager*** for developing conceptual stream and park restoration projects to mitigate impacts caused by uncontrolled urban runoff in 11 Township-owned neighborhood and community parks. The study's goals were to provied preliminary identication of projects to address stream impairments as part of anticipated requirements under the township municipal separate storm sewer (MS4) permit and to also enhance park aesthetic values and environmental education opportunities for residents.

**Soapstone Watershed Assessment, Lower Merion Township, Montgomery County, PA— *Project Manager*** for a watershed assessment to evaluate stream stability and resolve erosion and debris transport issues in this suburban watershed near Philadelphia. Services included field evaluation of erosion and sediment/debris transport characteristics within the watershed and development of alternatives and recommendations for stream stabilization and reduction of debris transport. Developed preliminary cost estimates for each alternative.

**Hydraulic Vulnerability Assessments, NYDOT, Region 6, NY—*Quality Assurance Reviewer*** for hydraulic vulnerability assessments on 1,200 state and local bridges in NYDOT's Region 6.

**Scour Assessments for I-90 over the Buffalo River and Cazenovia Creeks, New York State Thruway Authority, Buffalo, NY—*Engineer*** for the design of scour retrofits to the Cazenovia Creek and Buffalo River Bridges.

**Warren County Bridge No. 04050 over Pullins Kill, Warren County, Warren County, NJ— *Project Manager*** for waterway related impact analysis and preparing permit documents to replace Warren County Bridge No. 04050 in Blairstown Township. Services included H&H modeling to determine flood hazard area impacts, design of stream scour countermeasures, and assessment of net waterway fill. The work also included analysis of construction period impacts resulting from temporary causeways required during construction.

**Consumptive Use Remediation Project, Confidential Client, Centre County, PA—*Project Manager*** for developing the preliminary design concepts and cost estimates for a major water withdrawal and consumptive use remediation project. This project involved providing 30-MGD of make-up water to a major Pennsylvania river basin to offset consumptive use within the watershed by a significant energy provider. Services included the conceptual design of the water withdraw pumping facilities, several miles of conveyance pipe, access roads, and associated infrastructure and support facilities.

**Surface Water Supply Assessment, Confidential Client, Schuylkill County, PA—*Project Manager*** for assessing surface water supply availability to meet a 1.1-MGD consumptive use demand for an energy development project in Reilly Township. Sources of supply evaluated included surface runoff capture, creek/stream withdrawals, mine water withdrawals, and re-use of nearby sewage treatment plant discharges.

**Adler Gymnasium Addition Floodplain Impact Study, The Pennsylvania State University, Altoona, PA—*Project Manager*** in charge of a floodplain encroachment study for Spring Run through the Altoona Campus. The analysis involved developing a hydraulic model for Spring Run to evaluate potential flood level impacts resulting from the anticipated building addition footprint. The study's goal was to define, if applicable, whether local and state regulatory standards for developing within floodplains could be reasonably met given the proposed additions.

## Environmental Studies

**Outfall Dispersion Analysis, GPU Nuclear, Middletown, PA—*Engineer*** for this study to establish dispersion characteristics in the Susquehanna River downstream of the Three Mile Island power plant. Field data was used to calibrate a dispersion model of the study reach for use in future planning studies.

**Outfall Dispersion Analysis, Pennsylvania Power and Light, Berwick, PA—*Engineer*** for this study to establish dispersion characteristics in the North Branch of the Susquehanna River downstream of the Susquehanna Steam Electric Station located near Berwick. Field data was used to calibrate a dispersion model of the study reach for use in future planning studies.

**Dispersion Analysis, U.S. Army Corps of Engineers, Omaha, NE—*Engineer*** on this study to establish dispersion characteristics in several reaches of the Missouri River. Field data was collected and used to calibrate a dispersion model of the study reaches for use in future planning studies.

## Dams

**Wayne Glen Dam, Arcadia Land Company, Narberth, PA—*Project Manager*** for the H&H analysis of this regional flood control dam proposed as part of the Wayne Glen Development located in Tredyffrin Township, Chester County. The project included an H&H analysis in support of the design of the dam structure, reservoir, and spillways to meet established peak flood rate reduction criteria established by Tredyffrin Township. Also performed a dam breach analysis in accordance with PA DEP dam safety regulations.

**Beech Mountain Lakes Dam, Beech Mountain Lakes Association, Luzerne County, PA—*Project Manager*** for the H&H analysis for a new emergency spillway at this recreational dam. Services included modeling numerous spillway configurations in compliance with PA DEP dam safety requirements. The work also involved hydraulic river system modeling of downstream waterways to assess floodplain impacts.

**Echo Lake Dam Restoration and Permitting, Echo Lake Development Owners Association Northampton County, PA—*Project Manager*** for the dam permit and construction documents to restore the Echo Lake Dam in Upper Mt. Bethel Township. Services included redesigning the spillway to meet current regulatory requirements, dam breach analysis, an Emergency Action Plan, wetland impact assessment, and habitat impact assessments. Design work also included developing an Erosion and Sedimentation Pollution Control Plan as well as the necessary dam permit documents.

**Rosegarden Dam Inspection, Removal, and Stream Restoration, LINLO Development Corporation, Cumberland County, PA—*Project Manager*** for a dam inspection and repair investigation for this 100+-year-old dam and two nearby raceway dam/spillways on the Yellow Breaches Creek just south of Mechanicsburg in Lower Allentown Township. The study recommended complete removal of the dam. Services also included assisting the owner with securing funding for the dam removal and developing the dam removal and stream restoration plans and permit documents.

**Knox and Remington Dam Breach Analysis and Emergency Action Plan, Lower Merion Township, Montgomery County, PA—*Project Manager*** for a dam breach analysis and developing an *Emergency Action Plan* for the Knox and Remington Basin Dams owned by Lower Merion Township. All services were completed in accordance with PA DEP requirements.

**Knox, Remington, and Rolling Hill Dam Inspections, Lower Merion Township, Montgomery County, PA—** Performed dam inspections and prepared annual dam inspection reports for submission to PA DEP for Knox, Remington, and Rolling Hill Dam's all owned by Lower Merion Township.

**Carbaugh Run Dam Breach Analysis and *Emergency Action Plan*, Pennsylvania Department of Public Welfare, Adams and Franklin Counties, PA—*Project Manager*** for a dam breach analysis and developing an Emergency Action Plan for the Carbaugh Run Dam in South Mountain. The dam breach analysis and Emergency Action Plan were developed in accordance with PA DEP dam safety regulations.

**Mill Dam Inspection, Breach Analysis, and *Emergency Action Plan*, Pennsylvania Department of Public Welfare, Berks County, PA—*Project Manager*** for multiple dam inspections and developing an Emergency Action Plan in accordance with PA DEP requirements for the Mill Dam on Hospital Run on the property of the Wernersville State Hospital. The Emergency Action Plan included developing a dam breach model to establish the extent of flooding under a specified design dam breach flood event. Also aided the client with determining funding sources for the dam's removal.

## Site Design/Planning/Permitting (Facilities)

**Residential Site Develoment Standandards, Pennsylvania Housing Research Center at Penn State** – Project Manager and Principal Investigator for developent of policies and standards for more sustainable residential site design in Pennsylvania. The project developed model standards and policies that were science based and could be used by municipalities to promote resopnsible and affordable development.

**Fox Hollow Subdivision, Allegheny Township, Blair County, PA—*Project Manager*** for the civil design of a 187-acre, 134-lot subdivision including all site geometry, road design, sanitary sewer collection system design, potable water distribution system design, stormwater management design, erosion and sediment control design, and land development permit processing.

**Christian Missionary Alliance Church, Ferguson Township, Centre County, PA—*Project Manager*** for the site engineering including site geometry, pavement detailing, drainage design, stormwater management design, and sedimentation and erosion control design. Services also included preparing all necessary permit plans and reports.

**North Atherton Shoppes Strip Mall, Ferguson Township, Centre County, PA—*Project Manager*** for the site design for a 60,000-square-foot strip mall. Services included site geometry, pavement design, sanitary sewer and potable water connection design and detailing, stormwater management design, erosion and sediment control design, and land development permit processing.

**Tudek Park Expansion, Ferguson Township, Centre County, PA—*Quality Assurance*** for the site work design and permit document preparation to expand a community park. Services included adding soccer fields, pedestrian trails, and associated infrastructure.

**Pleasant Gap Quarries Surface Facility Expansion, Graymont, Centre County, PA—*Project Manager*** for the site layout, drainage design, and grading for a significant expansion of surface limestone handling facilities for this 150-acre industrial site. The design included relocation of subsurface mine dewatering lines and relocation of material stockpiles and access roadways to accommodate the addition of major new conveyor systems and rock handling facilities.

**Gas Pipeline Highway Occupancy Permits, NiSource, Centre County, PA—*Project Manager*** for developing municipal and PennDOT highway occupancy permit documents for residential gas service line replacements in the State College and Bellefonte.

**Moshannon Valley Correction Facility, Pennsylvania Department of Corrections, Clearfield County, PA—*Project Manager*** for site and infrastructure improvements for a 3,500-bed prison complex in Morris and Decatur Townships. The site design included site layout and grading for a 28-building facility, 2.5 miles of road improvements, approximately 10,000 feet of sanitary sewer main extension, and a 7600-foot water main extension. Services also included preparing applications and support materials for all necessary land development approvals and permits.

**Agricultural Products Storage Facilities Improvements, The Pennsylvania State University, University Park, PA—*Project Manager*** to review and compile state and local land development regulations for improvements to four agricultural product storage areas and a proposed agricultural products digester. These planned projects were located in Benner and College Townships.

**Beaver Stadium Expansion, The Pennsylvania State University, University Park, PA—*Project Manager*** for the land development approvals and utility design to expand Beaver Stadium. Responsible for designing all exterior utility modifications including the water, sewer, and storm sewer systems. Coordinated the land development and erosion control plan approvals through College Township and the Centre County Conservation District.

**Centre County Visitors' Center, The Pennsylvania State University, University Park, PA—*Project Manager*** for the infrastructure design for the Centre County Visitors' Center located adjacent to Beaver Stadium. Coordinated the land development and erosion control plan approvals through College Township and the Centre County Conservation District.

**Coal and Ash Handling Area Improvements, The Pennsylvania State University, University Park, PA—*Project Manager*** for preparing construction plans and specifications to improve the coal and ash handling area at the University's power plant. Services included design of a concrete back-wall for the storage area, concrete pavement for the storage area surface, and installation of a vortex stormwater quality unit to minimize pollutant discharges to the borough storm sewer system. Coordinated the land development and erosion control permitting through the State College Borough and the Centre County Conservation District, respectively. This project was undertaken to improve the quality of storm runoff from the coal and ash handling area.

**Intercollegiate Athletics Hoop Storage Structure, The Pennsylvania State University, University Park, PA—*Project Manager*** for site work design and land development permitting to construct a 7,200-square-foot enclosed hoop storage structure. The design included demolition of an existing site garage, provisions for utility service to the new structure, an access drive, and stormwater management design to meet state NPDES and local municipal ordinance requirements.

**Misciagna Family Arts Center Addition, The Pennsylvania State University, Altoona, PA—*Project Manager*** for the site geometric design, utility modifications, stormwater management design, erosion and sediment control design, and land development permit processing for additions to the Misciagna Family Arts Center on the Altoona Campus.

**Nittany Parking Deck and Landscape Depot, The Pennsylvania State University, University Park, PA—*Project Manager*** for the site geometric design, utility modifications, stormwater management design, erosion and sediment control design, and land development permit processing to expand the Nittany Parking Deck. Services also included the geometric design to expand a surface parking lot for the Nittany Lion Inn adjacent to the Parking Deck. Coordinated the land development and erosion control plan approval through the State College Borough and the Centre County Conservation District.

**Pattee Library – Knowledge Commons Renovation Projects Phase III, The Pennsylvania State University, University Park, PA—*Project Manager*** for the site design and land development permitting to renovate the Pattee Library. The land development approvals were coordinated through the Borough of State College.

**Pollock Commons Renovations, The Pennsylvania State University, University Park, PA—*Project Manager*** for the design and permitting for new a new electric ductbank system to connect multiple buildings within the Pollock student housing area and parking/access area improvements. Services also involved preparation of erosion and sediment control permit documents.

**Steidle Building Renovations, The Pennsylvania State University, University Park, PA—*Project Manager*** for the site work, utility design, and land development permitting for a n118,500-square-foot renovation and expansion of the Steidle Building on the University Park Campus. The design included demolition and reconstruction of approximately 35% of the building's footprint and the addition of a new rear entrance area. Critical site design considerations included development of construction staging areas in a congested area of the campus, as well as meeting municipal water quality requirements for storm runoff.

**Retail Building, OS6-Tricon Development, City of Vineland, NJ—*Engineer*** responsible for the site design and permitting for a commercial development center that included floodplain analysis and surface water resource protection area documentation for NJDEP permitting. The project consisted of a 39,500-square-foot retail building, a 4,580-square-foot restaurant, and associated parking facilities.

**Uranium Mine Surface Facilities, Roca Honda, San Mateo, NM—*Project Manager*** responsible for developing site design elements and permit documents for surface facilities associated with the Roca Honda uranium mine in Cibola County. Services included siting surface ore handling and loading facilities, employee and security support buildings, parking areas, and all associated infrastructure needed to support a major underground uranium mine.

**Williamsburg Square Phases I, II, and III, Shaner Hotel Group, Centre County, PA—*Project Manager*** for site engineering for the three-phase development of a 15-acre hotel and restaurant complex in Patton Township. The site included three hotels, two restaurants, and the national headquarters building for the Shaner Hotel Group. Services included site geometry, pavement design, sanitary sewer and potable water system design, stormwater management design, erosion and sediment control design, and land development permit processing.

**YMCA Natatorium Addition, State College Area YMCA, Centre County, PA—*Project Manager*** for the site design of an 18,000-square-foot natatorium addition to the State College Area YMCA in the Borough of State College. Services included site geometry, pavement design, sanitary sewer and potable water connection design and detailing, stormwater management design, erosion and sediment control design, and land development permit processing.

**Voorhees Corporate Center, Voorhees Township, Camden County, NJ—*Project Manager*** for designing stormwater quality treatment and stormwater quantity control improvements for a commercial development, including a bank, a hotel, and retail sites. Responsibilities included NJPDES stormwater permitting.

**Little League Field Reconfiguration, Walker Township, Centre County, PA—*Project Manager*** for the revised layouts and plans to reconfigure the Walker Township Little League Fields to bring the fields into compliance for tournament play.

**Park Expansion, Walker Township, Centre County, PA—*Project Manager*** for civil engineering input for master planning and developing a conceptual design for a 30-acre expansion to the Walker Township Community Park. The master plan included new facilities for baseball, softball, and multi-use sports (soccer, football, lacrosse); parking; picnic pavilions; playgrounds; horseshoe pits; volleyball; a gazebo; informal play areas; a natural turf amphitheater; a loop pathway system connecting park facilities and the surrounding community; a BMX track; a concession/restroom/ Lowerstorage building; stormwater management; and a future long-term indoor recreation center.

**Water Bottling Plant Feasibility Study, Confidential Client, Blair and Huntington Counties, PA—*Project Manager*** for a plant site feasibility study for a major water bottling company. Services involved potential plan site evaluation based on available site size, zoning, site location relative to spring location, spring water piping versus tanker truck logistical considerations, utility availability, and truck to market accessibility. Considered properties in a two-county area in the general vicinity of an existing spring source.

**The Oaks at Pleasant Gap, Confidential Land Development Client, Centre County, PA—*Project Manager*** for the grading and drainage design for this planned retirement and assisted living community in Spring Township.

### Technical Training & Manual Projects

**Highway Drainage Design Training, NTM and PennDOT, Harrisburg, PA—*Course Developer/Instructor*** for a three and a half day Highway Drainage course. Also assisted with the development of a four-day Stormwater Management and NPDES Permitting course and served as a lead instructor for 12 deliveries of these courses, as a part of PennDOT's Drainage Professional Development Series.

**Stormwater Management Facilities Operation and Maintenance, PennDOT Local Transportation Assistance Program (LTAP) and Pennsylvania State Association of Township Supervisors—*Course Developer/Lead Instructor*** for a four-hour Stormwater Management Facilities Operation and Maintenance course to supplement existing LTAP roadway drainage courses. During the contract, delivered this course over 30 times to local municipal staff and elected officials. Also served as stormwater and drainage technical expert providing support to local municipalities in response to technical assist requests under the LTAP program.

***Best Management Practices Manual* Technical Oversight Committee, Department of Environmental Protection, Pennsylvania—*Committee Member*** providing peer review and oversight during development of Pennsylvania's Stormwater *Best Management Practices Manual.*

**Urban Drainage Design Manual, Federal Highway Administration, Washington, DC—*Project Manager/Principal Investigator*** for development of a comprehensive drainage design manual providing state-of-the-art storm drain design methods and techniques to assist highway engineers in the design of pavement drainage, conveyance, and stormwater management systems. Served as the principal author for the original publication in 1996 and provided input for updates and revisions to more recent editions of the document. This publication is available as FHWA Hydraulic Engineering Circular 22 (HEC-22). The analysis methods in HEC-22 are referenced in DM2-10.

## Professional Organizations

American Society of Civil Engineers (ASCE)
American Public Works Association
American Academy of Water Resources Engineers

## Technical Training & Course Development Experience

Adjunct Professor, The Pennsylvania State University, 1998-2005
- CE 360 – Fluid Mechanics Course
- CE 361 – Hydrology Course
- CE 410W – Sustainable Residential Development Design Senior Capstone Project Course

Developer/Instructor, PennDOT Technical Training and Development Section, 2007-current
- Highway Drainage Design – Developer & Lead Instructor
- Stormwater Design & NPDES Permits – Contributing Developer & Instructor
- Introduction to Highway Hydraulics – Instructor

Developer/Instructor, PennDOT Local Transportation Assistance Program, Various Pennsylvania Municipalities, 2007-current
- Stormwater Management Facilities Operation and Maintenance – Developer & Instructor
- Stormwater Management and NPDES Permitting for Municipal Officials – Developer & Instructor

Developer/Insructor, PennDOT Technical Training 2006
- Stormwater Management in a New Age – Developer and Lead Instructor.

Developer/Instructor, Lorman Educational Series
- Current Issues in Stromwater Management (Harrisburg, 2006)
- Understanding Hydrologic Processes for Better Stormwater Management (Philadelphia, 2007)

Instructor, The Pennsylvania State University Pennsylvania Housing Research Center, 2005
- Stormwater Management in a New Age

Understanding Infiltration Practices

Instructor, ASCE Lehigh Valley Chapter, 1998
- Urban Drainage Design

Instructor, 2012
- Basic Highway Hydraulics

## Modeling Experience

HEC-1, HEC-HMS, HEC-2, and HEC-RAS; HMR 51/52; TR-20 and TR-55; WMS; HY-8; and NWS DAMBRK

## Continuing Education

SWMM Applications, NTM Engineering, Inc., August 2019
Strategic Business Planning, Professional Services Management Journal, February 2018
Supervisor Safety Review Training, Safety Works, Inc., March 2016
Field Safety Review Training, Safety Works, Inc., March 2016
ASHE-PennDOT 2-0 Workshop, ASHE/PennDOT, June 2015

## Employment

NTM Engineering, Inc., Dillsburg, PA, January 2014-Present

Pennoni Associates Inc., State College, PA, September 2007-January 2014
Pennoni Associates Inc., Vineland, NJ, October 2006-September 2007
The Pennsylvania Housing Research Center, The Pennsylvania State University, July 2002-September 2006
Sweetland Engineering & Associates, State College, PA, July 1998-June 2002
TVGA Engineering Surveying, PC, Elma, NY, July 1991-June 1998
Scott A. Brown & Associates, Culpepper, VA, September 1988-June 1991
Kamber Engineering, Leesburg, VA, October 1987-September 1988
Sutron Corporation, Sterling, VA, June 1979-September 1987

## Publications/Presentations

*Residential Site Development Standards*, The Pennsylvania State University Pennsylvania Housing Research Center, Brown, S.A.; K. Foster, M. Rios, April 2007.

"Are Pennsylvania's New Stormwater Regulations a Catch-22 for Townships?," *Pennsylvania Township News*, Pennsylvania State Association of Township Supervisors, Brown, S.A., Vol. 61, No. 5, May, 2008.

"Urban Drainage Design Manual," *Hydraulic Engineering Circular No. 22*, Federal Highway Administration, Washington, DC, Brown S.A.; Schall, J.D.; Morris, J.L.; Doherty, C.L.; Stein, S.M.; and Warner, J.C., September 2009.

"Design of Riprap Revetments," *Hydraulic Engineering Circular No. 11*, Pub. No. FHWA IP-89-016, Federal Highway Administration, Washington, DC, Brown, S.A. and Clyde, E.S., March 1989.

"Application of Natural Stream Characteristics to Riprap Design," *Proceedings 66th Annual Meeting*, Transportation Research Board, National Academy of Sciences, Washington, DC, Brown, S.A. and Blodgett, J.C., January 1987.

"Streambank Stabilization Measures for Highway Engineers," *Report No. FHWA/RD-84/10*, Federal Highway Administration, Washington, DC Brown, S.A., July 1985.

"Design Guidelines for Spur-Type Flow Control Structures," *Report No. FHWA/RD-84/101*, Federal Highway Administration, Washington, DC, Brown, S.A. and McQuivey, R.S., July 1985.

"Prediction of Channel Bed Grade Changes at Highway Stream Crossings," *Proceedings, 61st Annual Meeting*, Transportation Research Board, National Academy of Sciences, Washington, DC, Brown, S.A., December 1982.

"Stream Channel Degradation and Aggradation: Analysis of Impacts to Highway Crossings Final Report," *Report No. FHWA/RD-80/159*, Federal Highway Administration, Washington, DC, Brown, S.A.; McQuivey, R.S.; and Keefer, T.N.; March 1981.

"Loyalsock Creek Model Study Verification of Mathematical and Physical Models in Hydraulic Engineering," *Proceedings of 26th Annual Hydraulics Division Specialty Conference*, University of Maryland, Miller, A.C.; Chadderton, R.A.; and Brown, S.A., August 1978.

# Aaron J. Jolin, PE

## Senior Engineer

NEWELL TERESKA & MACKAY ENGINEERING

### Professional Experience

Mr. Jolin is an engineer who specializes in design and regulatory permitting of drainage, stormwater management and erosion and sedimentation control systems. His experience also includes hydrologic and hydraulic modeling for riverine systems, stream restoration, and dam breach analysis. His background also includes design and permitting for municipal, institutional, commercial, and residential site development projects. He has experience with site layout, grading, stormwater management, storm drainage systems, hydrology and hydraulics, roadways, parking, public right-of-way, floodplains, water, sewer, zoning, environmental, conservation, ADA, and other federal, state, and local code related design and permitting. His related project experience includes:

**Total Years of Experience: 14.5**

**Education:**

BS, Agricultural and Biological Engineering, The Pennsylvania State University, 2009

**Licenses/Certifications:**

Professional Engineer:
PA No. PE090935, 2020
MD No. PE0042435, 2012

*Key Qualifications:*

*Expertise in design and regulatory permitting of urban drainage, stormwater management, and erosion and sediment control*

*Expertise in hydrology and hydraulics modeling and regulatory permitting including riverine systems analysis, stream restoration, bridge/culvert modeling and dam breach analysis*

*Expertise in multi-disciplinary project design development and implementation*

*Expertise in stormwater management assessment and maintenance*

*Expertise in municpal engineering*

*Expertise in design of MS4 water quality facilities and retrofits*

### Forensic Engineering

**PTC Southern Beltway Section 55B, Peitragallo Gordon Alfano Bosick & Raspanti, LLP, Washington County, PA—*Engineer*** responsible for reviewing the case history and background (E&S and PCSM plans, reports, calculations, permits, specifications, violations, rainfall history) and preparation of expert witness report of findings for PTC.

### Stormwater Management, Erosion and Sediment Control, Hydrology and Hydraulics, Drainage and NPDES Permitting

**County of Lackawanna Transportation System (COLTS) Transit Facility, PennDOT Bureau of Public Transportation, Lackawanna County, PA—*Engineer*** responsible for PCSM, E&S and NPDES design and permitting for expansion of Colts Transit Facility.

**Burkittsville Green Streets and Stormwater Master Plan, Burkittsville, MD**, ***Project Manager/Engineer*** responsible for coordinating public meetings for community concerns and feedback, investigation of historic problems in the town relative to stormwater/sewer/potable water, providing preliminary H&H analysis and watershed studies, identifying and providing preliminary stream and drainage restoration options and opportunities, developing preliminary street design options with bike paths/traffic calming/landscaping/lighting/water quality treatment devices-while maintaining historic nature of town, developing cost estimates and assembling a final document to be used for applying for grants.

**Howard County Stormwater Retrofits, Howard County, MD-*Engineer*** responsible for water quality retro-fit design, erosion and sedimentation control and permitting of existing MD-378 registered dams in accordance with Howard County Public Private Partnership for meeting MS-4 pollution reduction goals.

**Montgomery County Stormwater Facility Inspection, Montgomery County, MD- *Engineer,*** working on a team of engineers and with County officials, responsible for reviewing field reports, providing QA/QC and providing direction for required maintenance of County-owned facilities.

**H&H Modeling for Bridge Design, York and Franklin Counties, PA—*Project Designer*** responsible for hydraulic/hydrologic modeling and waterways permitting for bridges in York and Franklin Counties, PA.

Responsible for various aspects of hydrology and hydraulic modeling for PennDOT reviewed County Bridges, plan and report preparation; focus on various methods of hydrology modeling including regression analysis, gauge weighting, and HEC-HMS TR-20 using GIS-based software Watershed Modeling System (Aquaveo), environmental permitting.

**Parkdale High School Green Infrastructure Pilot Study, Riverdale, MD-** ***Engineer*** responsible for developing a small pilot design for comparative analysis of different SWM treatment facilities, including treatment train sampling techniques for Prince George's County School's students at Parkdale High School.

**Manheim Township Detention Basin II Permitting and Design, Manheim Township, Lancaster County, PA—** ***Project Engineer*** for the analysis and design for improvements to a reclassified Chapter 105 Class C hazard dry impoundment in Manheim Township, Lancaster County, PA. Responsible for preparing technical analysis including HEC-HMS hydrologic study for determination of flow rate for probable maximum flood (PMF) event and incremental dam break simulation, unsteady state hydraulic analysis using HEC-RAS for determination of impacts of a dam failure per PA procedural guidelines, interface with PA Dam Safety personnel and project/client manager(s) to develop a cost estimate for required upgrades based on development of multiple mitigation options, design and calculation preparation for spillway, inlet, barrel and energy dissipater using FHWA Circular 14 and HDS 5 Publications, diaphragm filter design, construction plans, permitting and assistance with bidding.

**Gettysburg Borough Stratton Street Storm Drain Feasibility Study, Gettysburg, PA—*Project Designer*** responsible for preliminary design/improvement options for fixing drainage problems in the Gettysburg Borough, including H&H analysis and design, providing exhibits and written narrative for use in budgetary planning.

**Adams County Stormwater Management Ordinance Preparation, Adams County, PA—*Project Designer*** responsible for preparing new stormwater management ordinances in accordance with County Act 167 Plan for Gettysburg/Abbottstown/Fairfield Boroughs, Mount Pleasant, Hamiltonban, Hamilton and Oxford Townships.

**Gettysburg Inner Loop Greenway Master Plan, Gettysburg, PA—*Project Designer*** responsible for coordinating with local trail agency/Borough Engineer/Borough Planner to research and develop layout options, determine engineering design requirements, provide cost estimating, attend steering committee meetings, provide preliminary permitting agency (FEMA/PennDOT/Soil Conservation District) feedback, produce visuals/plan inserts/technical descriptions and preparation of final document for use in applying for grants.

**Municipal Culvert Replacement Projects, York and Franklin-*Project Designer*** responsible for H&H analysis, design, construction drawings and permitting of culverts for various municipalities in York and Adams County

**Mount Pleasant Twp Storm Store Road Stormwater Analysis, Mount Pleasant, PA-*Project Designer*** responsible for hydrologic and hydraulic modeling, analysis of existing problems, development of three alternatives solutions, preparation of exhibits for use by the Township in speaking with local residents about potential solutions requiring work outside of the right-of-way.

**Yokwood NPDES Permit Renewal and Stormwater Management Facilities, Greensburg, PA - *Project Designer*** responsible for (individual) NPDES Permitting renewal within exceptional value watershed, development of a standard BMP sizing sheet that allowed the developer to choose from several options including infiltration berms and drywells along with a combination of non-structural practices within individual lots. (The project had been designed under old design regulations where central stormwater facilities were considered inadequate and NPDES renewal required individual lots implore additional stormwater management BMPs.)

**East Vandergrift Storm Sewer Design, East Vandergrift, PA *Project Designer*** responsible for designing a financially feasible solution for a collapsed storm sewer (combination sewer), preparation of hydraulic/hydrologic analysis, culvert design options for the Borough of East Vandergrift

**Fairfax County Stormwater Facility Inspection, Fairfax, VA- *Inspector*** responsible for field condition assessment for various County-owned stormwater facilities around the County.

**HOA Assessments and Reserve Study Preparation, Fairfax County, VA-** ***Project Designer*** responsible for preparing infrastructure assessment of storm drain systems, stormwater management facilities, parking lots, sidewalks, retaining walls and other infrastructure in preparation for reserve study updates for various home-owner associations.

**Terre Arch Support Development, Terre Hill, PA-** ***Project Designer*** responsible for developing support and user spreadsheets for the Terre Arch Stormwater System for use by industry consultants as well as working with HydroCAD to develop stormwater chambers module.

**Hendrick House Expansion-LEED Gold Certified, University of Illinois-Urbana-Champaign,** ***Project Designer*** responsible for grading, porous pavement design, geometric layout of 30-well closed loop geothermal system, sanitary sewer pump station, erosion and sedimentation pollution control, local permitting (within a detailed FEMA study area on the Boneyard Creek), stormwater pump station, planning and details for green roof, sizing of cisterns for water reuse and civil-related LEED documentation.

**Village of Philo Storm Sewer/Stormwater Management Study, Philo, IL.** ***Project Designer*** responsible for development of feasibility study with design options for mitigating substantial flooding issues-retrofitting portions of the village with storm conveyance, storm sewer and stormwater management infrastructure.

**Clearview Stormwater Modeling, Champaign, IL-*****Project Designer*** responsible for H&H modeling of as-built ponds

## Land Development and Site Design

**Tilden Middle School, Rockville, MD-** ***Project Manager/Engineer*** responsible for technical design including site layout and grading for buildings, parking lots, bus and parent drop-off loops, athletic fields/courts, utility connections and relocations layout, stormwater design, downstream H&H analysis and mitigation, erosion and sediment control, forest review coordination, site grading for ADA, ROW circulation improvements as well as coordinating development requirements with State, County, design team professionals and construction management team.

**Potomac Elementary School, Potomac, MD-** ***Project Manager/Engineer*** responsible for concept and final technical design including site layout and grading, utilities, stormwater management, storm drain-including downstream H&H analysis and mitigation, erosion and sediment control, forest review coordination, site grading-including ADA, ROW circulation and drainage improvements, pre/post floodplain modeling/permitting and hydraulic design for 400 l.f. of stream restoration as well as coordinating development requirements with client, State, County, design team professionals and construction management team.

**Fairmont Heights H.S., Landover, Maryland-** ***Project Manager/Engineer*** responsible for final technical design and permitting of site layout, phased erosion and sediment control-required for qualified brownfield site mitigation, forestation review coordination, site grading including ADA compliance, ROW traffic circulation improvements and signaling upgrades (in coordination with traffic engineer), floodplain mitigation and modeling, SWM as-built documentation as well as coordinating development requirements client, State, County and design team professionals.

**Julius West Middle School, Rockville, MD,** ***Project Manager/Engineer*** responsible for concept development and final technical design and permitting of site layout and grading, utilities, site grading including for ADA compliance, storm drain design, stormwater management design, ROW improvements, bidding and construction administration for school expansion.

**Laurel Library, Laurel MD,** ***Project Manager/Engineer*** responsible for final site civil technical design and permitting of utilities, grading-including for ADA compliance, storm drain design, stormwater management design, ROW improvements and bidding as well as construction administration and certification of stormwater as-builts for school expansion.

**Hyattsville Library, Hyattsville, MD-** ***Project Manager/Engineer*** responsible for concept site civil layout and grading design-including for ADA compliance, storm drain design, stormwater management design, ROW improvements, H&H analysis and floodplain permitting for reconstruction of a new library in Hyattsville MD.

**DC Water Fleet Maintenance Facility, Capitol Heights, MD** ***Project Manager/Engineer*** responsible for concept site layout, grading, stormwater management, H&H analysis and floodplain permitting for reconstruction of a new fleet maintenance facility as well as coordinating development requirements with client, State, County and design team professionals.

**Ten Mile Creek Trail Bridge, Headwaters at Little Seneca Lake, Boyds MD**, ***Project Manager/Engineer*** responsible for site design required for access and staging of an 80-ton truck crane, H&H floodplain/environmental/sediment control permitting, construction administration, ADA bridge approach design required to raise vehicular/walking steel truss bridge for local trail, high enough to avoid creation of debris dams during smaller frequent storm events.

**Seneca Creek Boat House, Boyds, MD**, ***Project Manager/Engineer*** responsible for site layout and grading, civil design, floodplain analysis/permitting and construction administration of an ADA accessible boat launch facility on Little Seneca Lake at Black Hills Regional Park.

**Carroll County Public School Pavement Assessments and Site Parking Designs for Five Schools, Carroll County, MD,** ***Project Manager/Engineer*** responsible for coordinating survey/geotechnical testing, identifying and designing ADA improvement requirements, researching utilities, completing pavement assessment, providing stormwater management design/permitting (as required), site layout and grading, developing plans/specs/bid packages for maintenance and improvement of parking lots/loading areas/bus loops as well as construction administration.

**Prince George's County P3 Program, Prince George's County, MD-** ***Engineer*** responsible for working with a team of professionals to develop standards for desktop analysis, field research requirements, design, implementation and costs of urban outfall and stream bank erosion stabilization for water quality credits associated with P3-MS4 program.

**Red Lion Municipal Authority Water Treatment Site Plan, Windsor Township, York County, PA-*****Project Designer*** responsible for grading, erosion and sedimentation pollution control design, storm drain design, and hydrologic/hydraulic modeling/technical report, NPDES/GP-4 permitting, development of specifications and sequencing plan for mitigating and monitoring the potentially acidic bed rock being excavated for construction for the plant.

**New Enterprise Stone and Lime Turnpike NPDES Fill Somerset County, PA-** ***Project Designer*** responsible for site plan grading, surface modeling, erosion and sedimentation pollution control, stormwater management facility design, NPDES and local permitting, H&H modeling and permitting for fill site.

**Corporate Park Development, Champaign, IL,** ***Project Designer*** responsible for site layout, grading and design of new corporate park, including H&H analysis for 1000 l.f. of channel improvements, a new bridge, incorporated stormwater management design, erosions and sediment control design, local road layout, grading, floodplain and environmental permitting as well as developing plans for permitting and construction.

**Tripi Subdivision Access Road, Gettysburg, PA** ***Project Manager and Designer*** responsible for topographic survey, site design/layout, site grading, utility layout (water and electric), stormwater management design, E&SC Design, NPDES permitting, PA DEP sewer module, municipal meetings/approvals, environmental permitting, wetlands mitigation design, bridge/culvert options analysis, H&H modeling and permitting, technical plan drawing, and attendance of client, State, Township and permitting agency meetings.

**Rice Fruit Company CA Storage Building/Site Reconfiguration, Menallen Township, PA -*****Project Manager and Designer*** responsible for topographic survey, site design/layout, site grading, utility layout, stormwater management design, wetlands mitigation plan and permitting, erosion and sediment control design, NPDES permitting, PennDOT HOP permitting and construction document preparation.

**Aesthetic Pond in Adams County, Hamiltonban Township, PA-** ***Project Manager and Designer*** responsible for H&H analysis, erosions and sediment control design, regulatory permitting through Dam Safety, wetlands mitigation plan, survey, stakeout and technical plan drawing

**Site's Property Access, Hamiltonban Township, Adams County, PA -** ***Project Manager and Designer*** responsible for developing multiple bridge/culvert options, H&H modeling, permitting, E&SC design, historic flood research on neighboring properties and technical plan drawing preparation.

## Municipal Engineering

**Borough ROW Management, State College Borough—*Borough Engineer*** responsible for management of the Borough ROW excavation and occupancy permitting-including sidewalk replacement, utility work, closures, plan review, inspections, traffic control, council approvals and general safety.

**Borough CIP and Fiscal Budgets, State College Borough—*Borough Engineer*** responsible for development of sanitary, storm, street, park, MS4 and other capital improvement projects and budgets.

**Borough MS4, State College Borough—*Borough Engineer*** responsible for managing annual Borough MS4 permitting.

**Borough Development Review, State College Borough—*Borough Engineer*** responsible for managing and completing engineering related development reviews, issuing regulatory approvals and post construction signoff required for occupancy.

**Atherton Street Section 153 Project, State College Borough—*Borough Engineer*** responsible for providing review and coordination of project design development including, reviewing traffic signal replacement, sanitary sewer improvements, pedestrian safety, sidewalk, landscaping and storm drain designs, coordinating approvals of cost additions through Borough Council, coordinating Act 537 special study design and permitting with Borough's planning staff, County and environmental design firm as required for permitting and planning upgrades to the sanitary collection system, associated with the 153 project improvements.

## Continuing Education

OSHA Ten Certification
Leadership Training for Non-Profits through PSU Outreach
HEC-RAS Short Course through PSU
Watershed Modeling System Short Course through PENNDOT

## Employment

NTM Engineering, Inc., Dillsburg, PA, January 2021-Present
State College Borough Engineer, State College, PA, March 2020-January 2021
ADTEK Engineers, Inc. Frederick, MD, April 2014- April 2016, January 2017-March 2020
Stormwater Maintenance and Consulting - Hunt Valley, MD April 2016-January 2017
C.S. Davidson, Inc. Gettysburg, PA, May 2011-April 2014
Tri-County Engineering, LLC., Greensburg, PA, April 2010-April 2011
HDC Engineering, LLC, Champaign, IL, April 2007-September 2008
Wm. F. Hill & Assoc., Inc Gettysburg, PA, August 2005-June 2007

# Exhibit D.1

To Brief

# West Chester Borough Stream Protection Fee Program

# Appeal Policies and Procedures Manual

## Contents

# Introduction

The Borough has established a Stream Protection Fee (SPF) which will provide a dedicated funding source for the ongoing expenses associated with the Borough's stormwater management system and compliance with Pennsylvania Department of Environmental Protection Municipal Separate Stormwater System (MS4) permit requirements. All developed parcels in the Borough will be required to pay the fee, which is based on the impervious coverage of the parcel. Property owners are entitled to appeal the user fee in accordance with the procedures in this manual and the Stream Protection Fee Ordinance ("SPF Ordinance").

## Overview

Property owners are entitled to appeal the user fee, per Section 11 – "Appeals" of the SPF Ordinance. This manual has been prepared to detail the policies and application procedures by which a property owner can appeal the SPF.

# Appeal of Stream Protection Fee

## Objective

The appeal process is established to provide relief if a property owner believes the provisions of the SPF Ordinance have been applied in error. A property owner may appeal in accordance with the provisions described in greater detail in this manual.

## Appeals Policies

The basis for an appeal may include, but is not limited to the following:

1. Incorrect parcel information;
2. Inaccurate impervious area calculation;
3. Inaccurate Tier category assignment;
4. Mathematical error.

A Special Conditions Appeal (SCA) which addresses a circumstance where the property owner can demonstrate that the stormwater runoff from their parcel is not placing the same demand on the Borough system or services provided under the stormwater program as other impervious area. A property owner may appeal their SPF as a Special Conditions Appeal (SCA), provided the owner can demonstrate that:

5. Their parcel(s)'s stormwater runoff impact on the stormwater system or services is significantly less than suggested by its amount of impervious area; and
6. Their parcel or a portion thereof drains completely outside of the Borough.

All applicants must be current with their stormwater fees to be eligible for a SCA.

### Application

For all appeals, the property owner must submit an application using the Appeal Application form provided by the Borough and include supporting documentation as further described herein.

## Appeals Application Procedures

### Application Forms

Application Forms are available in Appendix A as well as in electronic format (Word file) on the Borough's website.

Application Deadline

The appeal application must be filed by March 31st.

Application Fee

There is no fee to file an appeal which alleges an error or inaccuracy within the billing system. The application fee for an appeal alleging an improper Tier classification or for a Stormwater Special Conditions Appeal is listed in accordance with the Borough's current fee schedule. All fees are non-refundable regardless of the outcome of the appeal. Application fees may be paid by check or money order made out to The Borough of West Chester Stormwater Program.

Documentation Requirements

The property owner must provide the following documentation with the appeal

1. A completed and signed application form.
2. A plot plan, map, aerial image or similar information detailing actual impervious surfaces currently on-site.
3. A requested value for the correct impervious area/ associated with the property for which an appeal is being requested.
4. Application Fee (check or money order)

For SCAs, the applicant must provide all the above, and the following additional item:

5. A plot plan, map, aerial image or similar information delineating the drainage areas or patterns on-site.

The Borough may request additional documentation to aid in review of the appeal.

Submission of Appeals Application

The completed application, supporting documentation, and any applicable non-refundable application fee may be submitted via email to spf-program@west-chester.com or by mail to:

Borough of West Chester Stormwater Program

401 E. Gay Street

West Chester, PA 19380

Determination

The Borough will review the required documentation and a written approval or denial of the appeal application will be issued by the Director of Public Works.

Appeal of Determination

In accordance with the SPF Ordinance, any person aggrieved by any decision of the Borough Manager may appeal to the Court of Common Peas of Chester County, Pennsylvania.

Billing Error Corrections

If an appeal alleging a billing error is successful, the Borough staff will correct the associated billing information

Special Condition Appeal Reduction of Stormwater Fee

If a SCA is approved the reduction in fee will only be applied to the portion of the impervious area that the that the property owner has demonstrated has less or no impact on the system or program of services and

drains outside of the Borough. The following calculation will be applied:

Any property which drains completely outside of the Borough is not a developed property and is not responsible for the Stream Protection Fee.

As for those properties which drain partially outside of the Borough & partially inside the Borough, the percentage of impervious area of such property which drains outside of the Borough will be excluded from the calculation made for the purposes of Section 94A-6. B. of this Ordinance.

If an appeal results in the reduction or elimination of the property's SPF, the Borough will provide a refund to the Property Owner, as applicable.

# Appendix A
# Appeal Application

BOROUGH OF WEST CHESTER
CHESTER COUNTY PENNSYLVANIA

# STREAM PROTECTION FEE APPEAL APPLICATION

The Borough has established a Stream Protection Fee (SPF) and all developed parcels in the Borough are required to pay the fee, which is based on the impervious coverage of the parcel. Property owners are entitled to appeal the user fee in accordance with the procedures in the Appeals Manual and the Stream Protection Fee Ordinance 2015-##

*Submit completed form: spf-program@west-chester.com*
*or mail to:*
*Borough of West Chester Stormwater Program*
*401 E. Gay Street, West*
*Chester, PA 19380*

Application Date: ____________________ SPF Account No.: ____________________

Owner Name: ____________________ Mailing Address: ____________________

Property Address: ________________________________________

Phone Number: ____________________ Email Address: ____________________

## Reason for Appeal (Check all that apply):

Incorrect parcel information

Inaccurate impervious area calculation

Inaccurate Tier category assignment

Mathematical error

## Special Condition Appeal

If the applicant is choosing this appeal, both reasons below must be true:

The stormwater runoff impact on the stormwater system or services is significantly less than suggested by its amount of impervious area; and

Applicant's parcel or a portion thereof drains completely outside of the Borough.

## Supporting Documentation Checklist (provide all items listed below)

Copy of SPF Bill

Plot plan, map, aerial image or similar information detailing actual impervious surfaces currently on-site

Requested value for the correct impervious area/ associated with the property for which an appeal is being requested (provide in Description, page 2)

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## Appeal Description

Provide detailed description of the billing error and your interpretation of corrected information. Attach additional sheets as necessary. Photographs are not required, but helpful.

*I attest that the information provided in this Appeal Application is complete and accurate:*

Applicant Signature: ______________________________

## Borough Use Only

Date Received: ______________________________

Reviewed By: ______________________________

Status:
- ☐ Approved
- ☐ Approved with Modifications
- ☐ Additional Information Needed
- ☐ Denied

Notes: ______________________________

______________________________

______________________________

Date Responded: ______________________________

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# Exhibit D.2

To Brief

# West Chester Borough
# Stream Protection Fee Program
# Non-Residential Credit Policies and Procedures Manual

NOVEMBER 2017

# Table of Contents

# Introduction

In 2016, the Borough enacted Ordinance No. 10-2016, titled the "Stream Protection Fee Ordinance" which establishes a Stream Protection Fee (SPF) to provide a dedicated funding source for ongoing expenses associated with the Borough's stormwater management system and compliance with its regulatory permit requirements. All developed parcels (properties), including both residential and non-residential properties, in the Borough are required to pay the stream protection fee, with the fee amount directly proportional to the total impervious surface area of the parcel.

## Overview

The Borough has developed an incentive program ("credit program") for property owners who undertake specific stormwater management activities. The credit program has been developed per Section 10 – "Stormwater Credits" of Ordinance No. 10-2016 to allow owners to apply for credits and/or rebates for implementing and maintaining eligible stormwater management practices (SMPs) on their parcel(s) that mitigate the volume, peak discharge rate or runoff pollution that leaves their parcel. By implementing such measures, property owners are helping to reduce the demand on the existing stormwater management system and related Borough services, and helping to achieve permit compliance. This manual, called the "Stream Protection Fee Program Non-Residential Credit Policies and Procedures Manual ("Credit Manual"), is called for in Section 10 of the SPF Ordinance along with its residential companion, "Residential Credit and Rebate Policies and Procedures Manual."

The primary goals of the Borough's credit program are to:

- Encourage private investment in installing and maintaining private SMPs,
- Ensure the SPF is equitable and fair by recognizing that stormwater management activities on private property can result in cost savings for the Borough which should translate into a reduced fee for the property owner.

## Applicability

The Credit program has two components, a Residential Rebate and Credit Program, and a Non-Residential Credit Program. **This document provides detail on the policy and procedures for the Non-Residential Credit Program only.** Property owners of Residential Properties are permitted to apply for a rebate and/or credit listed under the Residential Rebate/Credit Program or the Non-Residential Credit Program. Property owners of Non-Residential and Multi-Family Residential Properties are permitted to apply for a credit listed under the Non-Residential Credit Program only. For more information about the Residential Credit Program, property owners should view the Stream Protection Fee Page of the West Chester Borough website.

## Definitions

Words used herein shall be defined in accordance with their definition in the SPF Ordinance. If a word used in this manual is not defined in the SPF Ordinance, it shall be defined as follows:

**Apartment** - a building on a separate lot containing three or more dwelling units.

**Credit** - a recurring discount on the SPF which is applied to the property owner's bill to reduce the SPF on a recurring basis. The credit is valid for a set period (currently three years), after which time the property owner must reapply.

**Dwelling Unit** - One or more rooms in a building, designed for occupancy by one family for living purposes and having its own permanently installed cooking and sanitary facilities, with no enclosed space (other than vestibules. entrances or other hallways or porches) in common with any other dwelling unit. No dwelling unit shall have more than 50% of its exterior below the level of the exterior grade. A dwelling unit may be contained in any of the following structures:

A. **SINGLE-FAMILY DETACHED** - A building designed for and occupied exclusively as a residence for only one family and having no party wall in common with an adjacent building.

B. **SINGLE-FAMILY DETACHED, MOBILE HOME** - A transportable single-family detached dwelling unit intended for permanent occupancy, contained in one unit or in two units designed to be joined into one integral unit capable of again being separated for repeated towing, which arrives at a site complete and ready for occupancy except for minor and incidental unpacking and assembly operations and is constructed as permitted in Article VI, with the same, or equivalent, electrical, plumbing and sanitary facilities as for a conventional single-family detached dwelling. A mobile home shall include any addition or accessory structure, such as porches, sheds, decks or additional rooms, which is attached to it. A mobile home does not include recreational vehicles or travel trailers.

C. **SINGLE-FAMILY SEMIDETACHED** - A building designed for and occupied exclusively as a residence for only one family and having one party wall in common with an adjacent building.

D. **SINGLE-FAMILY ATTACHED** - A building designed for and occupied exclusively as a residence for only one family and having two party walls in common with an adjacent building, except for end units.

E. **TWO-FAMILY DETACHED** - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having no party wall in common with an adjacent building.

F. **TWO-FAMILY SEMIDETACHED** - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having one party wall in common with an adjacent building.

G. **TWO-FAMILY ATTACHED** - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having two party walls in common with adjacent buildings.

H. **MULTIFAMILY** - See "apartment."

**Impervious Drainage Area (IA)** – the impervious surfaces within the land contributing runoff to a single point (including but not limited to the point/line of interest used for hydrologic and hydraulic calculations) and that is enclosed by a natural or man-made ridge line.

**Multi-Family Residential Property**- a property which is improved with a building that is used as an apartment of multi family dwelling. Multi-Family Residential Properties are only eligible to apply for a credit under the Non-Residential Credit Program. Apartment units are considered Multi-Family Residential under the SPF Credit Program.

**Non-Residential Property** - a property which is improved with a building that is used in any manner other than as a Residential Property or a Multi-Family Residential Property as defined herein. This term shall include but not be limited to buildings used for commercial, industrial and institutional uses.

**Non-Structural Stormwater Management Practices** or measures – operational and/or behavior-related practices that attempt to minimize the contact of pollutants with stormwater runoff whereas structural SMPs or measures are those that consist of a physical device or practice that is installed to capture and treat stormwater runoff.

**Rebate** - a one-time refund per Residential Property that is issued for installing a stormwater practice. The amount of the refund is based on the drainage area managed and the constructed stormwater management practice. One Residential Property can have multiple rebates.

**Residential Property** - a property which is improved with a building that is used as any form of Dwelling other than a Multi-Family Residential Property.

**Stormwater Management Practice (SMP)** – Activities, facilities, designs, measures, or procedures used to manage stormwater impacts from regulated activities, to provide water quality treatment, infiltration, volume reduction, and/or peak rate control, to promote groundwater recharge, and to otherwise meet the purposes of the Stream Protection Fee Program and associated ordinance. SMPs are commonly grouped into one (1) of two (2) broad categories or measures: "structural" or "non-structural."

**Structural Stormwater Management Practices** or measures - include, but are not limited to, a wide variety of practices and devices from large-scale retention ponds and constructed wetlands to small-scale underground treatment systems, infiltration facilities, filter strips, low impact design, bioretention, wet ponds, permeable paving, grassed swales, riparian or forested buffers, sand filters, detention basins, and manufactured devices. Structural SMPs are permanent appurtenances to the Site.

## Objectives

The objective of the credit program is to provide a way for property owners who install qualifying stormwater management practices (SMPs) on their property to reduce their SPF payment amount. SMPs are measures or facilities that prevent or reduce the transport of pollutants and/or control stormwater runoff volume or rate. Implementing such measures reduces the impact a developed property has on the downstream storm drainage system, which includes both natural features such as streams and man-made features such as pipes.

## Additional Resources

Non-Residential property owners are encouraged to research and utilize the following free resources found online:

- Technical resources for green infrastructure are available in Chapter 6 of the Pennsylvania Stormwater Best Management Practices Manual or Chapter 4 of the City of Philadelphia Water Department Stormwater Management Guidance Manual.
- Further information on peak rate control practices is available in Chapter 6.5 the Pennsylvania Stormwater Best Management Practices Manual.

In addition to the above, the following resources relating primarily to residential based green infrastructure are available online and apply to both Residential and Non-Residential properties:

- Homeowner's Guide to Stormwater Management prepared by the Philadelphia Water Department in 2006
- Homeowner's Guide to Stormwater produced by the Lancaster County Conservation District in 2013

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- The Alliance for the Chesapeake Bay has developed a website, Reduce Your Stormwater, which provides do-it-yourself guidance for SMPs.
- The Chesapeake Stormwater Network has developed a Homeowner Guide that provides excellent step-by-step guidance on designing, constructing and maintaining rain gardens, rain barrels, pervious pavers, and planting trees.

# General Credit Program Policies

The property owner must own and maintain a qualifying stormwater facility or approved non-structural control. Property owners are required to submit an application and documentation of construction or installation, as well as documentation regarding operation and maintenance (O & M) of the stormwater management facility. The property owner must pay their fee in full, and not be past due on their SPF payments. General policies for the Non-Residential credit program are provided below.

## Types of Projects Eligible for Credit

To be eligible for a SPF credit, a property owner must treat impervious area (IA) with a qualifying SMP that is owned and maintained by the property owner. The property owner must have an approved non-structural control, NPDES permit, or other eligible stormwater management feature, as listed in Table 1.

If residential property owners are interested in obtaining credit under the Non-Residential Program, they should reach out to the Public Works Department to discuss their application with staff early in the process.

Table 1.

*Eligible types of SMPs for the Residential and Non-Residential Credit Programs*

| Credit Category | Stormwater Management Practice (SMP) | Residential * | Non-Residential and Multi-Family Residential ** |
|---|---|---|---|
| Green Infrastructure / Runoff Volume Controls | Pervious pavement with infiltration bed | X | X |
| | Infiltration basin | | X |
| | Rain garden/bioretention | X | X |
| | Subsurface infiltration bed | | X |
| | Green Roof | | X |
| | Infiltration trench/ Tree Infiltration Trench | | X |
| | Runoff Capture & Reuse – Cistern or Rain Barrel | X | X |
| | Dry Well/ Seepage Pit | X | X |
| Peak Runoff Rate (Flood) Controls | Constructed wetland | | X |
| | Wet pond/ retention basin | | X |
| | Dry extended detention basin | | X |
| | Special Detention areas (parking lots/roof) | | X |
| Water Quality Treatment | Constructed wetland | | X |
| | Constructed Filter | | X |
| | Proprietary Water Quality Filters & Hydrodynamic Devices | | X |
| | Vegetated Swale | | X |
| | Vegetated Filter Strip | | X |
| Non-Structural Controls | Tree Canopy Cover | X | X |
| | Downspout Disconnection | X | X |
| | Approved Adopt-a-Stream volunteer program | | X |
| | Approved environmental education/outreach program | | X |
| National Pollutant Discharge Elimination System (NPDES) Stormwater Permit | Facilities with an active, fully-compliant NPDES Permit from PADEP | | X |

*Notes:*

** Single family residential property owners are eligible for SMPs listed in the non-residential categories.*

*** Non-residential and multi-family residential are excluded from obtaining the Rain Barrel rebate, but can obtain a cistern credit*

## Maximum Credit Amount

The maximum credit that any one property can receive is 60% percent of their fee. No property will receive 100% credit or reduction of the fee, and the maximum is set at 60% because the Borough needs to fund programmatic elements, public stormwater facilities, and perform standard maintenance, repair and rehabilitation of publicly owned stormwater facilities. Even if a property manages 100% of the stormwater runoff on their site, the Borough still has obligations under its MS4 permit and needs to maintain the public drainage system to protect the health and safety of the public.

# Non-Residential Credit Types

The Non-Residential Credit Program incentivizes owners of any non-residential property (commercial, institutional, industrial, etc.) and multi-family residential property to manage their stormwater on site and reduce IA on their property. This program includes credits which can be applied to the property owner's bill to reduce the SPF on a recurring basis. The credit is valid for a set period (currently three years), after which time the property owner must reapply. The maximum credit is 60% of the SPF if the facility is maintained by the property owner and provides both quantity and/or quality controls. The maximum can be achieved by applying for a credit associated with one or more SMP types.

A non-residential property owner may apply for an eligible SMP type that is listed in Table 3. The amount of financial credit(s) earned for any given property is based on the type of SMP installed. Intensive practices such as green infrastructure are a primary strategy in the Borough's stormwater program due in large part to the multiple benefits they provide above and beyond management of stormwater volume. Therefore, green infrastructure is eligible for a larger credit than less intensive practices such as the non-structural controls category. Table 3 lists the eligible practices for credits under the non-residential program, and includes the specific credit amounts. Requirements for each type of SMP category and example calculations are provided in the following sections.

TABLE 3.
*Credits for Non-Residential Property Credit Types*

| Type of Stormwater Management Practice | Credit (%) | Possible Example Practices |
|---|---|---|
| Green Infrastructure / Runoff Volume Controls | 60% | Rain gardens, bioretention, infiltration trenches, permeable pavements, green roofs |
| Peak Runoff Rate (Flood) Controls | 30% | Constructed wetland, dry extended detention pond, wet/retention pond, underground detention system |
| Water Quality Treatment | 30% | Constructed wetland, constructed filters, vegetated swale/filter strip, proprietary treatment devices |
| Non-Structural Controls | 15% | Tree canopy, downspout disconnection, approved environmental education/outreach program |
| National Pollutant Discharge Elimination System (NPDES) Stormwater Permit | 15% | Facilities with an active and fully-compliant NPDES stormwater permit |

## Calculation of Non-Residential Credits

The Non-Residential Credit is calculated based on the amount of IA treated by stormwater management facilities (also called the *impervious drainage area*) that are owned and maintained by a property owner. For each type of credit summarized in Table 3, the fee associated with the amount of IA treated by a stormwater management facility is reduced by the percent credit for the type of credit. The following equation illustrates the credit calculation:

$$SPF\ Credit\ = \left(\frac{Treated\ IA}{1{,}000}\right) \times Credit\ \%\ by\ Type \times SPF$$

Where:

- Treated IA: amount of impervious area treated by an eligible stormwater facility, $ft^2$
- Credit% by Type: the percent credit allowed for by type of facility (see Table 3)
- SPF: Stream Protection Fee for current levy year, expressed as \$ per 1,000 $ft^2$

Requirements and examples of the credit calculation for each SMP type are detailed below.

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## Stormwater Feature Drainage Area Percentage

To determine the amount of IA treated by a stormwater facility, the drainage area specific to the facility must be determined. Note that if the facility drains IA either on or off the property, the total impervious treated for the purposes of credit calculations typically cannot exceed the amount of IA on the property. This information is generally included in the original design documents (drawings and/or stormwater report) for a facility. If the owner cannot find this information, they may attempt to estimate it through an online mapping package such as the (free) Google Earth or Google Maps program, or hire a registered professional engineer or registered land surveyor.

## Green Infrastructure / Runoff Volume Control Credit

Runoff volume control practices reduce the volume of stormwater runoff entering the public drainage system. Green infrastructure practices can reduce volume and restore the natural hydrologic cycle, in addition to providing several community-related benefits. Green infrastructure employs the following processes to mimic predevelopment conditions:

- Infiltration (allowing water to slowly soak into the soil)
- Evaporation/transpiration using native vegetation
- Rainwater capture and re-use (storing runoff to water plants, flush toilets, etc.)

**Green Infrastructure Credit Requirements**

- Any green infrastructure or volume control practice must capture 1 inch of runoff for full credit. The 1 inch of captured runoff is translated into a volume of water by multiplying it by the captured drainage area. Table 4 provides brief guidance on various green infrastructure technologies, including consideration of design, construction, operation and maintenance. In all cases, retention and detention facilities should be designed to completely drain water within 48 hours.

TABLE 4.
*Green infrastructure types with brief overview of design and construction requirements, as well as operational and maintenance needs.*

| Green Infrastructure Type | Design / Construction Guidance | Operation and Maintenance |
|---|---|---|
| Cisterns/Rain Barrels | Provide overflow to discharge water during large storm events<br>Discharge water before next storm event<br>Consider site topography, placing structure up-gradient of plantings (if applicable) will allow watering to work with gravity and eliminate pumping needs<br>All rain barrel openings must have screens to prevent the growth of mosquitoes (or other vector-control must be provided). | Discharge before next storm event<br>Clean annually and check for loose valves, etc.<br>Winterize the system: may require flow bypass valves during the winter |
| Bioretention/Rain Gardens | Ponding depths of no more than 12 inches and drawdown within 48 hours<br>Native vegetation that is tolerant of hydrologic variability, salts etc.<br>Water Table/ Bedrock Separation: 2-foot minimum, 4-foot recommended<br>Soils: HSG A and B preferred; C & D may require an underdrain | May require watering during establishment<br>Spot weeding, pruning, erosion repair, trash removal, mulch reapplication required 2-3x/growing season<br>Maintenance tasks and costs are generally similar to traditional landscaping but less frequently performed |

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TABLE 4.
*Green infrastructure types with brief overview of design and construction requirements, as well as operational and maintenance needs.*

| Green Infrastructure Type | Design / Construction Guidance | Operation and Maintenance |
|---|---|---|
| | Overflow required to release water during extreme events<br>Maximum loading ratio: 20:1; not more than 1 acre to one rain garden | |
| Green Roofs | 2-6 inches of non-soil engineered media; assemblies that are 4 inches and deeper may include more than one type of engineered media.<br>The roof structure must be evaluated for compatibility with the maximum predicted dead and live loads.<br>Waterproofing must be resistant to biological and root attack.<br>Typically installed on flat or gently-sloping rooftops | Once vegetation is established, spot weeding, replanting, and fertilization as required<br>Maintenance cost is similar to traditional landscaping, $0.30-$1.00 per square foot |
| Permeable Pavements | Level storage bed bottoms, uncompacted permeable subgrade soils<br>Water Table/ Bedrock Separation: 2-foot minimum, 4-foot recommended<br>Provide positive stormwater overflow from bed<br>Surface permeability >20"/hour and drawdown within 48 hours<br>Pretreatment for sediment-laden runoff | Clean inlets/outlets<br>Vacuum twice per year (typically), usually with a street cleaning unit<br>Maintain adjacent landscaping/planting beds to prevent wash-on<br>Periodic replacement of paver blocks<br>During winter, no sand/grit/abrasives and only clean salt or other deicers |
| Tree Trenches | Flexible in size and configuration<br>Native, appropriate tree species selection and spacing and soil volumes<br>Quick drawdown<br>Linear infiltration/storage trench<br>New inlets, curb cuts, or other means to introduce runoff into the trench | Water, mulch, treat diseased trees, and remove litter as needed<br>Annual inspection for erosion, sediment buildup, vegetative conditions<br>Biannual inspection of cleanouts, inlets, outlets, etc. |
| Subsurface Infiltration Practices | Water Table/ Bedrock Separation: 2-foot minimum, 4-foot recommended<br>Level or terraced infiltration surfaces preferred<br>Avoid proximity to buildings, drinking water supplies, karst features, and other sensitive areas<br>Appropriate soil types (permeability, limiting layer, etc.)<br>Drawdown within 48 hours<br>Provide pretreatment and positive overflow in most cases | All pretreatment devices, catch basins, and inlets should be inspected and cleaned at least twice per year<br>If vegetated, the overlying vegetation of subsurface infiltration feature should be maintained in good condition and any bare spots re-vegetated as soon as possible.<br>Vehicular access on vegetated subsurface infiltration areas should be prohibited. |

Further information on green infrastructure is available in Chapter 6 of the Pennsylvania Stormwater Best Management Practices Manual or Chapter 4 of the City of Philadelphia Water Department Stormwater Management Guidance Manual.

### Green Infrastructure Credit Calculation

The following example calculation shows the methodology for the green infrastructure credit. A property has one green infrastructure facility that treats 5,500 sf of IA. Assuming the SPF is $6.70 per 1,000 sf per month, the SPF Credit for that facility would be as follows:

$$SPF\ Credit\ = \left(\frac{5{,}500}{1{,}000}\right) \times 60\% \times \$6.70 = \$22.11$$

## Peak Runoff Rate (Flood) Control Credit

Peak runoff rate control protects against immediate downstream erosion and flooding by detaining runoff to reduce the peak flow. Most designs achieve peak rate control using detention structures. Peak rate control can also be integrated into volume control practices to become "at source" measures for reducing the rate and volume of runoff released during rainfall events.

### Peak Runoff Rate Credit Requirements

Peak rate control practices should aim to maintain the peak rate of runoff from pre-development conditions for the 1-year through 100-year design storm events. Constructed wetlands, dry extended detention ponds, and wet/retention ponds are excellent examples of peak rate control practices. Constructed Wetlands are shallow marsh systems planted with emergent vegetation that are designed to treat stormwater runoff to improve water quality. A dry extended detention basin is an earthen structure constructed either by impoundment of a natural depression or excavation of existing soils, that provides temporary storage of runoff and functions hydraulically to attenuate stormwater runoff peaks. Wet Ponds/Retention Basins are stormwater basins that include a substantial permanent pool for water quality treatment and additional capacity above the permanent pool for temporary runoff storage.

Table 5 has guidance on design, construction, operation and maintenance for these peak rate control practices. In all cases, retention and detention facilities should be designed to completely drain water within 72 hours.

TABLE 5.
*Peak rate control practices with design and construction requirements, as well as operational and maintenance needs.*

| Peak Runoff Rate practice | Design / Construction Guidance | Operation and Maintenance |
|---|---|---|
| Constructed Wetland | Adequate drainage area (usually 5 to 10 acres minimum) or proof of sustained base flow | Periodic sediment removal from the forebay and vegetation maintenance |
| | May require investigation of water supply to ensure a sustained baseflow to maintain the wetland | Inspect and maintain inlet and outlet structures as needed |
| | Maintenance of permanent water surface | |
| | Multiple vegetative growth zones through varying depths | |
| | Robust and diverse vegetation | |
| | Relatively impermeable soils or engineered liner | |
| | Provide for a way to collect and remove sediment | |

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TABLE 5.
*Peak rate control practices with design and construction requirements, as well as operational and maintenance needs.*

| Peak Runoff Rate practice | Design / Construction Guidance | Operation and Maintenance |
|---|---|---|
| | Adjustable permanent pool and dewatering mechanism | |
| Dry Extended Detention Pond | Hydraulic capacity controls effectiveness<br>Ideal in combination with other BMPS<br>Highly structural design features (rip-rap for erosion control, etc.) can be more costly than naturalized basins. | Regular maintenance is necessary including periodic sediment removal and vegetation maintenance |
| Wet/Retention Pond | Adequate drainage area (usually 5 to 10 acres minimum) or proof of sustained baseflow<br>Natural high groundwater table<br>Maintenance of permanent water surface<br>Should have at least 2 to 1 length to width ratio<br>Robust and diverse vegetation surrounding wet pond<br>Relatively impermeable soils<br>Forebay for sediment collection and removal<br>Dewatering mechanism | Outlet control devices should draw from open water areas 5 to 7 feet deep to prevent clogging and allow the WP to be drained for maintenance<br>A pond drain should also be included which allows the permanent pool to be completely drained for maintenance within 24 hours<br>Permanent access must be provided to the forebay, outlet, and embankment areas. It should be at least 9 feet wide, have a maximum slope of 15%, and be stabilized for vehicles. |

Further information on peak rate control practices is available in Chapter 6.5 the Pennsylvania Stormwater Best Management Practices Manual.

### Peak Runoff Rate Credit Calculation

A property with 15,000 square feet (sf) of total IA had retention pond that treats 8,000 sf of IA. The SPF is $6.70 per 1,000 sf per month, the SPF Credit would be as follows:

$$SPF\ Credit\ = \left(\frac{8,000}{1,000}\right) \times 30\% \times \$6.70 = \$16.08$$

The SPF before the credit is $100.50 per month and the net SPF including the credit is $84.42

## Water Quality Treatment Credit

During precipitation events, stormwater is carried over impervious surfaces like roads and rooftops, picking up pollutants including gasoline residue, motor oil, heavy metals, fertilizers, pesticides and more. Practices that provide water quality treatment serve to reduce pollutant loads in runoff.

### Water Quality Treatment Credit Requirements

Water quality functions include reducing suspended solids (TSS), phosphorus (TP), nitrogen (TN) and temperature of runoff. Water quality treatment practices must provide treatment for 1 inch of runoff for full credit. The 1 inch of captured runoff is translated into a volume of water by multiplying it by the captured drainage area and to a flow rate by performing routing calculations.

### Water Quality Treatment Credit Calculation

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A property with 12,000 square feet (sf) of total IA had vegetated swale that treats 10,000 sf of IA. The SPF is $6.70 per 1,000 sf per month, the SPF Credit would be as follows:

$$SPF\ Credit\ = \left(\frac{10{,}000}{1{,}000}\right) \times 30\% \times \$6.70 = \$20.10$$

The SPF before the credit is $80.40 per month and the net SPF including the credit is $60.30.

## Non-Structural Control Credit

Non-structural SMPs can be applied over an entire site and are not necessarily fixed and designed at one location. Non-structural SMPs can be designed to mitigate any number of stormwater impacts: peak rates, total runoff volumes, infiltration and recharge volumes, non-point source water quality loadings and temperature increases. Many of these practices can prevent stormwater generation and not just mitigate stormwater-related impacts once these problems have been generated. Prevention can be achieved by developing land in ways other than through use of standard or conventional development practices.

### Non-Structural Control Credit Requirements

Examples of non-structural controls include tree canopy, downspout disconnection, or an environmental education/outreach program. Design and operation/maintenance requirements vary greatly based on the type of practice and will be evaluated on an individual program/practice basis by the Borough. Several major "areas" of preventive Non-Structural BMPs have been identified in this manual:

### Downspout Disconnection and Tree Planting

Specific non-structural control practices eligible for credit include Downspout Disconnection and Tree Planting. Applicants should refer to the guidance found under the Residential Credit program to determine these requirements.

### Environmental Education/Outreach

A third non-structural control practice eligible for credit includes the Environmental Education/Outreach program category. Education credits are available to all public and private schools or school systems (K-12) and any church or non-profit facility. To receive the education credit, the applicant must implement an educational program that educates and informs the students on the importance of preserving and restoring the source and integrity of water resources (stormwater, ground water and/or surface waters). The educational program may include educational posters, take-home materials, classroom lessons, field trips, etc. Programs may be developed by the PA DEP, the Pennsylvania Department of Conservation and Natural Resources (DCNR), the United States Environmental Protection Agency (EPA), the United States Geological Survey (USGS), or a school official. Programs developed by other organizations may be considered eligible for credit. Some resources and example materials can be found at:

- EPA NPDES Stormwater Outreach Materials and Reference Documents http://cfpub.epa.gov/npdes/stormwatermonth.cfm#materials
- EPA Teacher Resources and Lesson Plans http://www.epa.gov/students/teachers.html
- EPA Water Science and Technology for Students and Educators http://water.epa.gov/learn/resources/
- USGS Education Resources http://education.usgs.gov/

### Non-Structural Control Credit Calculation Example #1

A property with 18,000 square feet (sf) of total IA disconnects downspouts that drain 12,000 sf of IA. The SPF is $6.70 per 1,000 sf per month, the SPF Credit would be as follows:

$$SPF\ Credit\ = \left(\frac{12{,}000}{1{,}000}\right) \times 15\% \times \$6.70 = \$12.06$$

The SPF before the credit is $120.60 per month and the net SPF including the credit is $108.54 per month.

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### Non-Structural Control Credit Calculation Example #2

A property with 18,000 square feet (sf) of total IA undertakes an educational campaign to provide stormwater outreach to the congregants. The SPF is $6.70 per 1,000 sf per month, the SPF Credit would be as follows:

$$SPF\ Credit\ = \left(\frac{18{,}000}{1{,}000}\right) \times 15\% \times \$6.70 = \$18.09$$

The SPF before the credit is $120.60 per month and the net SPF including the credit is $102.51 per month.

## National Pollutant Discharge Elimination System (NPDES) Stormwater Permit Credit

The NPDES Stormwater Permit credit applies to any entity who has an existing current NPDES permit approved by PADEP. The credit applies a 15% reduction to the SPF bill.

### NPDES Stormwater Permit Credit Requirements

This credit applies to any property that has an active, fully-compliant NPDES Permit from PA DEP.

### NPDES Stormwater Permit Credit Calculation

A property with an active, fully compliant NPDES Permit from PADEP has 10,000 square feet (sf) of total IA. The SPF is $6.70 per 1,000 sf per month, the SPF Credit would be as follows:

$$SPF\ Credit\ = 15\% \times \$6.70 \times \frac{10{,}000}{1{,}000} = \$10.05$$

The SPF before the credit is $67.00 per month and the net SPF including the credit is $56.95 per month.

# Credit Program Procedures

The following procedures are common to both the Residential Credit Program and the Non-Residential Credit Program.

## Application Forms

Residential and non-residential application forms are available on the Borough's website www.west-chester.com, searching Stream Protection Fee.

## Application Deadline

The Borough has determined that all approved credits will be applied retroactively based on the year the application was submitted using a deadline of July 31. All rebate/credit applications will be accepted year-round on a rolling basis. If the application is received by July 31, approved credits/rebates will be applied retroactively based on the year of the application submittal date. If the application is received after July 31, then the property owner must wait one year before the credit appears.

## Application Fee

Payment of a Credit Application Fee may be required for Borough review of the credit application. The fee is listed in the Borough's current fee schedule, which is available on the Borough's website. SPF credit application fees are non-refundable regardless of the outcome of the credit application. Borough Council may choose at their discretion to waive the application fee, and **as of November 2017, Council has waived the application fee.**

## Operations and Maintenance (O&M) Agreement

A signed maintenance agreement between the Borough and the property owner is required for credit approval. Under the Operations and Maintenance (O&M) agreement, the owner must allow the Borough access to the site to view and inspect the SMP per the Borough's inspection cycle. The Agreement can be found on the Borough website.

To receive the residential or non-residential SPF credit, a property owner must be able to demonstrate the stormwater facility is being properly maintained. A property owner can demonstrate maintenance of a stormwater facility by including with the SPF Credit Application available maintenance records showing the maintenance activities and date, or the most recent invoice from a qualified maintenance vendor. If the applicant does not maintain the facility as required, the Department of Public Works will notify the property owner in writing that they have 30 days to take corrective action otherwise the credit will be discontinued.

## Application Documentation Requirements

The property owner must provide the following documentation:

- Completed and signed application form.
- Photograph(s) of SMP
- A sketch (site plan, plot plan, map, aerial image or similar illustration) showing parcel lot lines, built features including all impervious areas, and location of the existing/proposed SMPs, and drainage areas to the SMP.
    - Refer to Appendix A: "How to Create a Site Plan" for instructions
    - The property owner should utilize the Borough's online mapping program which allows users to search for their property address and view their mapped parcel and impervious area. The website also allows for the user to print on a page size sheet suitable for inclusion in the application.

- Documentation of purchase and/or installation of the SMP including receipts, invoices, packing slips, or other records if available.
- Calculations or other documentation of impervious drainage area and SMP capacity estimates
- Maintenance logs noting the past inspection and maintenance records (or receipts from vendors hired to perform maintenance), or for newly constructed SMPs, a description of the proposed seasonal maintenance activities that the property owner will undertake.

In the event the credit application is missing information, Borough staff will request additional documentation to aid in review of the credit application.

## Submission of Credit Application

Electronic submissions can be made to spf-program@west-chester.com. Submit a copy of the completed credit application, the checklist, all supporting documentation and the non-refundable application fee (if applicable) to:

Borough of West Chester

Attention: Stream Protection Fee Program – Credit

205 Lacey Street

West Chester, PA 19382

## Determination

Borough staff will review the credit application and issue a determination no later than November 1. The applicant will be notified by letter and/or email of the decision.

## Appeal of Determination

Appeal of the credit determination can be made in accordance with Section 11 – "Appeals" of the Borough's Stream Protection Ordinance. Typically, a credit application will be primarily denied due to technical inadequacies. Should those inadequacies be addressed, the property owner may resubmit their application to the Borough.

## Issuance of Credits

Credits will be applied in the form of a credit and will be applied to subsequent bills.

## Credit Renewal

Non-Residential SPF credits will be valid for three years, after which they will require renewal by the property owner. To continue to receive the SPF credit, property owners are required to reapply before the credit period expires within 3 years. Should the owner fail to submit a renewal application, the credit(s) will expire. When reapplying, the property owner must update their demonstration of stormwater facility maintenance by including sufficient documentation in the application package.

## Site Inspections

Upon receipt of a credit application, the Borough or its designated appointee, may inspect the parcel to verify all information and supporting documentation. Efforts will be made to notify the property owner in advance. If the Borough's site inspection determines that the SMP is not being maintained appropriately, the credit could be denied. The Borough may choose to withhold the credit until the property owner demonstrates that the SMP is being appropriately maintained.

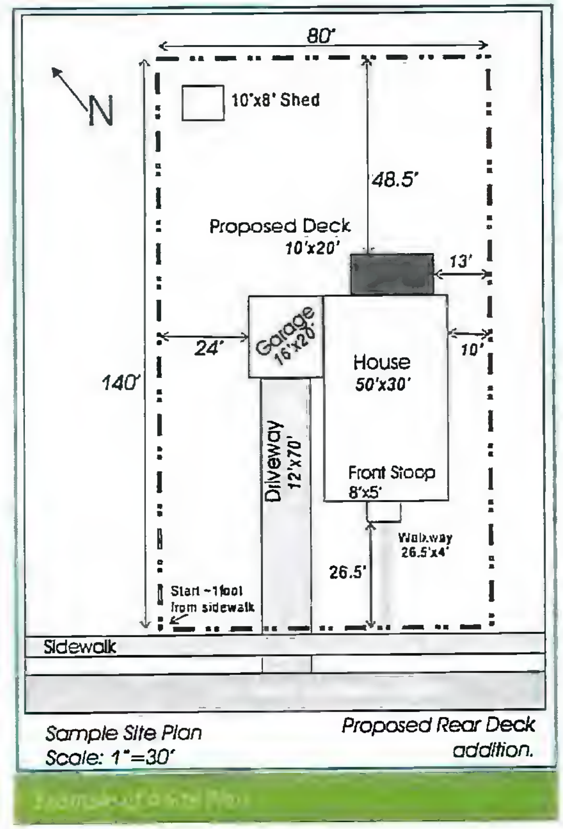
## Termination of Credits

Approved credits may be terminated at any time if the SMPs are found to be not functional, improperly maintained, or if the owner fails to restore the SMPs per Borough notification.

## Change in Property Ownership

If a property is sold and there is a change in ownership, the credit (residential or non-residential) will remain in place until the three-year credit term is completed. The new property owner will be required to resubmit the credit application in accordance with the Credit Renewal policy described in this Manual.

# Appendix A: How to Create a Site Plan




A site plan is a scaled map/diagram that graphically depicts a property's existing and/or proposed physical structures and landscape features. Site plans are drawn showing a bird's eye view of your property as if you were looking down at it from above. A site plan shows significant things that are on your property currently, such as the footprint of any buildings (home, garage, storage shed, or decks) and any other features such as driveways, patios, walkways, fences, swimming pools, etc. on the property.

Dimensions should be included for significant items and be used to show distances between existing items. The drawing should be done to a scale (e.g., 1 inch on the plan is equal to 30 feet on the ground). Site plans also should indicate the orientation of the plan using a North Arrow symbol that indicates which direction North is.

The following steps will help you in preparing your site plan.

**Step 1: Determine your property boundaries and lot dimensions (choose from one listed below).**

*Option 1 – Use Online Tax Assessor's Map*
Using an address or property owner name, you can look up your property on the Chester County Tax Assessor's Map website (accessible through "ChescoViews" application). Assessor's maps are regularly updated maps drawn to scale and based on the latest recorded surveys and plats of the area. The maps have an aerial photography background and they offer a measuring tool so you can measure the dimensions for all sides of your property.

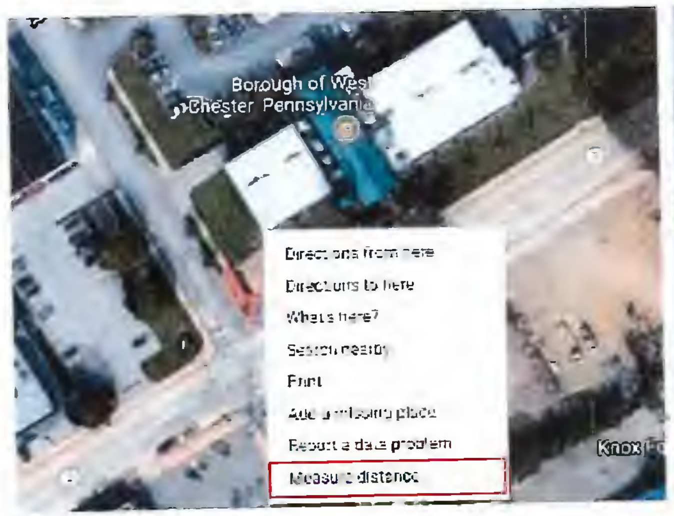
*Option 2 – Use Subdivision Plat Information or Deed Records*
Like the Tax Assessor's map, you may also look up your lot on the recorded plat that your property is within. The legal description of your property, which should be included on the deed, usually contains your property's lot or parcel number and the subdivision name in which your lot is located. In cases where the property is not within a subdivision plat, the legal description will likely be a 'metes and bounds' description that describes the perimeter of the property in greater detail, without reference to a plat. To find a copy of your deed, you can contact the Chester County Historical Society, which has inventories of deeds dating back to 1688. Note – this option is not likely to be the most efficient option, however, it is included here in the even that applicants choose to use it.

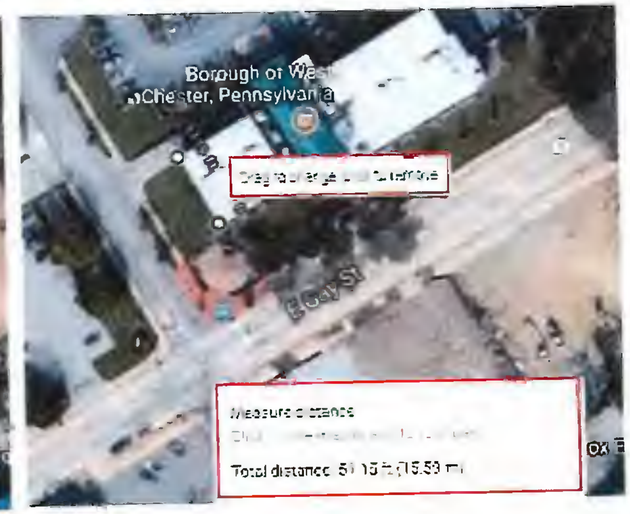
*Option 3 – Use Recent Building Records*
For newer constructed properties, using a previously approved site plan can save time when preparing your documentation. If there is a new structure on the property which required building permits, there is a possibility that the Borough may have an archived copy of the original building plans on file, including a site plan. You should make a request through the Borough's Department of Building, Housing, and Code Enforcement to obtain record site plans.

*Option 4 – Measure Your Property Yourself*
You can do this either by going outside with a tape measure and taking down measurements, or you can use an online program such as Google Maps' Measuring Tool on your computer.

*Directions to Use Measuring Tool in Google Maps:*

1. Open Google Maps in your internet browser.
2. Enter your address to zoom into your property.
3. Make sure you are in Satellite (aerial photography) mode so you can see your property's features.
4. Right-click on your starting point.
5. Choose **Measure distance**.
6. Click anywhere on the map to create and point and measure the distances between the two points. To add another point, click anywhere on the map. Drag the points to change/adjust your measurement or click any of the points to remove.
7. At the bottom of the Measure Distance dialogue box, you'll see the total distance in feet (ft) and/or total area in square feet (sf).
8. Right-click to find the Measuring Tool Menu and select Print. Print to a printer or Print to Save to a PDF if your computer has that option.





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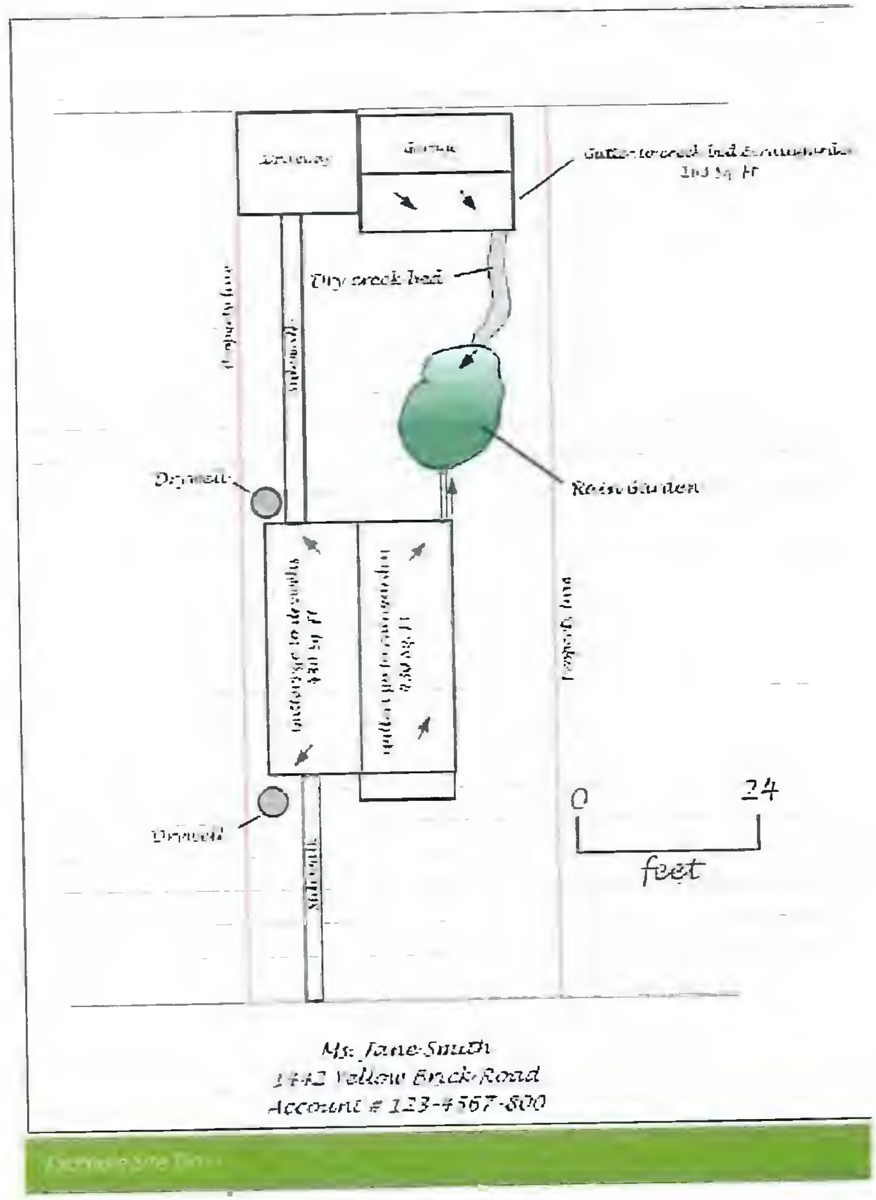
**Step 2: Determine the location of structures and other site features in relation to the property boundaries.**

Using the property boundary location and dimension information gathered in Step 1, you must next determine the location of applicable existing buildings, streets, driveways, sidewalks, trees, and other site features in relation to the property boundaries. Measure the distance from these site features to the surrounding property lines. You can do this either with a tape measure or you can use an online program such as Google Maps' Measuring Tool on your computer.

**Step 3: Draw the plan.**

Use the information gathered in Steps 1 and 2 to prepare your site plan. You may draw your site plan by hand or use a computer graphics or drafting program. An example site plan template is provided in this Appendix for you to print and use if desired.

1. Determine Your Site Plan Scale and Orientation
   a. Using graph paper, choose a scale of measurement for the plan drawing so that one square = X feet. To ensure all information will fit on the page and be easy to read, a good example would be to have each block of the graph paper equal five (5) feet (or 1 inch = 25 feet). After choosing your scale of measurement, draw lines to show the house, driveway and any sidewalks on the plan. Write in the closest distances in feet of the lot lines to the house (i.e. building setbacks), and draw an arrow pointing north.
2. Add other Items that must be on the Plan such as the Property Owner Name and Address.
3. Draw Property Lines and Label all dimensions in feet.
4. Draw all Existing Buildings and Structures on the Plan (i.e., House, Garages, Sheds, etc.). These are your property's impervious areas (IA). Show distances between buildings and property lines. Label all dimensions in feet.
5. Draw Driveways, Parking Areas, Patios, Decks, and Sidewalks on the Plan. These are your property's additional impervious areas. Label all dimensions in feet.
6. Locate Existing Trees and Significant Landscape Elements
   a. Use a dot to indicate the approximate location of the tree and a circle to indicate the canopy coverage
   b. Landscape areas and planting beds can be drawn as solitary masses rather than individual plants/shrubs
7. Identify and draw the area of the site that will contain the existing or proposed SMP (i.e., rain garden, downspout disconnection, permeable pavement/drywell).
8. Then draw arrows depicting the flow direction of water as it runs off the property. The arrows should point downhill in the direction of the storm water flow.



## Aerial Site Sketch

Draw a bird's-eye-view of your property including all impervious surfaces and existing structures. Draw arrows depicting the flow of water on the property and the proposed site of the rain garden.

Scale: 1 square = ______ feet

**KEY**

**Flow of Runoff**

**Structures/Surfaces**

**Rain Garden**

# Appendix B: How to Perform a Drainage Test

1. Know the exact location(s) on your property where you are planning to install your potential SMP(s) such as a rain garden. This potential SMP location will be where you conduct your drainage test. Drainage tests are done to test how fast your soil drains and determine suitability for stormwater SMPs.

2. **Do a PA One-Call at least three (3) business days prior to conducting your drainage test** so they can mark out all buried underground utilities, to reduce the risk of striking a utility line when digging.

   For more information: http://www.pa1call.org/pa811/Public/POCS_Content/About_Us/FAQS/FAQ.aspx or Dial 8-1-1 (or 1-800-242-1776).



3. Gather the following tools near the test location:
   a. Shovel or post-hole digger
   b. Hose and/or bucket (and water source)
   c. Yardstick, tape measure, or ruler
   d. Notepad and pen

<u>Drainage Testing Process</u>

*Note: More elaborate testing procedures per the Pennsylvania Stormwater Manual or other approved guidance documents are also acceptable):*

1. Use the shovel or post-hole digger to dig a hole and remove soil from the hole. Place the excavated soil nearby so the hole can be refilled after the test. Block off or otherwise prominently mark the hole location to prevent people from tripping/falling.

2. Dig a hole that is at least 12 inches deep and at least 4 inches in diameter. If desired, place 2 inches of clean sand or gravel in the bottom of the hole to prevent scour in the bottom when being filled.

3. Using your water source, gently fill the hole with water and let it sit overnight. This saturates the soil and helps give a more accurate test reading.

4. The next day, gently refill the hole to the top with water. Measure the water level by laying a stick, pipe, or other straight edge across the top of the hole, then use a tape measure or yardstick to determine the starting water level. Check what time it is.

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5. After an hour has passed, return to your test location to measure and record the depth of the water in the hole. Ideally, continue taking measurements at hourly increments for a few more hours or until all they water has drained.

6. Check the hole to watch how long it takes to become empty. When it is empty, record the time.

   - If the hole took <u>more than 48 hours</u> to drain completely, this typically indicates the site is <u>not suitable</u> for a stormwater SMP that relies on infiltration. Another site will need to be chosen (and another drainage test conducted).

7. When the testing process is complete, the hole should be immediately backfilled with the excavated soil.

# Exhibit D.3

To Brief

# West Chester Borough Stream Protection Fee Program
# Residential Credit and Rebate
# Policies and Procedures Manual

NOVEMBER 2017

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# Table of Contents



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# Introduction

In 2016, the Borough enacted Ordinance No. 10-2016, titled the "Stream Protection Fee Ordinance" which establishes a Stream Protection Fee (SPF) to provide a dedicated funding source for ongoing expenses associated with the Borough's stormwater management system and compliance with its regulatory permit requirements. All developed parcels (properties), including both residential and non-residential properties, in the Borough are required to pay the stream protection fee, with the fee amount directly proportional to the total impervious surface area of the parcel.

## Overview

The Borough has developed an incentive program ("credit program") for property owners who undertake specific stormwater management activities. The credit program has been developed per Section 10 – "Stormwater Credits" of Ordinance No. 10-2016 to allow owners to apply for credits and/or rebates for implementing and maintaining eligible stormwater management practices (SMPs) on their parcel(s) that mitigate the volume, peak discharge rate or runoff pollution that leaves their parcel. By implementing such measures, property owners are helping to reduce the demand on the existing stormwater management system and related Borough services, and helping to achieve permit compliance. This manual, called the "Stream Protection Fee Program Non-Residential Credit Policies and Procedures Manual ("Credit Manual"), is called for in Section 10 of the SPF Ordinance along with its residential companion, "Residential Credit and Rebate Policies and Procedures Manual."

The primary goals of the Borough's credit program are to:

- Encourage private investment in installing and maintaining private SMPs.
- Ensure the SPF is equitable and fair by recognizing that stormwater management activities on private property can result in cost savings for the Borough which should translate into a reduced fee for the property owner.

## Applicability

The Credit program has two components, a Residential Rebate and Credit Program, and a Non-Residential Credit Program. **This document provides detail on the policy and procedures for the Residential Program.** Property owners of Residential Properties are permitted to apply for a rebate and/or credit listed under the Residential Rebate/Credit Program or the Non-Residential Credit Program. Property owners of Non-Residential and Multi-Family Residential Properties are permitted to apply for a credit listed under the Non-Residential Credit Program only. For more information about the Residential Credit Program, property owners should view the Stream Protection Fee Page of the West Chester Borough website.

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## Definitions

Words used herein shall be defined in accordance with their definition in the SPF Ordinance. If a word used in this manual is not defined in the SPF Ordinance, it shall be defined as follows:

**Apartment** - a building on a separate lot containing three or more dwelling units.

**Credit** - a recurring discount on the SPF which is applied to the property owner's bill to reduce the SPF on a recurring basis. The credit is valid for a set period of time (currently three years), after which time the property owner must reapply.

**Dwelling Unit** - One or more rooms in a building, designed for occupancy by one family for living purposes and having its own permanently installed cooking and sanitary facilities, with no enclosed space (other than vestibules. entrances or other hallways or porches) in common with any other dwelling unit. No dwelling unit shall have more than 50% of its exterior below the level of the exterior grade. A dwelling unit may be contained in any of the following structures:

A. SINGLE-FAMILY DETACHED - A building designed for and occupied exclusively as a residence for only one family and having no party wall in common with an adjacent building.

B. SINGLE-FAMILY DETACHED, MOBILE HOME - A transportable single-family detached dwelling unit intended for permanent occupancy, contained in one unit or in two units designed to be joined into one integral unit capable of again being separated for repeated towing, which arrives at a site complete and ready for occupancy except for minor and incidental unpacking and assembly operations and is constructed as permitted in Article VI, with the same, or equivalent, electrical, plumbing and sanitary facilities as for a conventional single-family detached dwelling. A mobile home shall include any addition or accessory structure, such as porches, sheds, decks or additional rooms, which is attached to it. A mobile home does not include recreational vehicles or travel trailers. 001643

C. SINGLE-FAMILY SEMIDETACHED - A building designed for and occupied exclusively as a residence for only one family and having one party wall in common with an adjacent building.

D. SINGLE-FAMILY ATTACHED - A building designed for and occupied exclusively as a residence for only one family and having two party walls in common with an adjacent building, except for end units.

E. TWO-FAMILY DETACHED - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having no party wall in common with an adjacent building.

F. TWO-FAMILY SEMIDETACHED - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having one party wall in common with an adjacent building.

G. TWO-FAMILY ATTACHED - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having two party walls in common with adjacent buildings.

H. MULTIFAMILY - See "apartment."

**Impervious Drainage Area (IA)** – the impervious surfaces within the land contributing runoff to a single point (including but not limited to the point/line of interest used for hydrologic and hydraulic calculations) and that is enclosed by a natural or man-made ridge line.

**Multi-Family Residential Property**- a property which is improved with a building that is used as an apartment of multi family dwelling. Multi-Family Residential Properties are only eligible to apply for a credit under the Non-Residential Credit Program. Apartment units are considered Multi-Family Residential under the SPF Credit Program.

**Non-Residential Property** - a property which is improved with a building that is used in any manner other than as a Residential Property or a Multi-Family Residential Property as defined herein. This term shall include but not be limited to buildings used for commercial, industrial and institutional uses.

**Non-Structural Stormwater Management Practices** or measures – operational and/or behavior-related practices that attempt to minimize the contact of pollutants with stormwater runoff whereas structural SMPs or measures are those that consist of a physical device or practice that is installed to capture and treat stormwater runoff.

**Rebate** - a one-time refund per Residential Property that is issued for installing a stormwater practice. The amount of the refund is based on the drainage area managed and the constructed stormwater management practice. One Residential Property can have multiple rebates.

**Residential Property** - a property which is improved with a building that is used as any form of Dwelling other than a Multi-Family Dwelling or Apartment.

**Stormwater Management Practice (SMP)** – Activities, facilities, designs, measures, or procedures used to manage stormwater impacts from regulated activities, to provide water quality treatment, infiltration, volume reduction, and/or peak rate control, to promote groundwater recharge, and to otherwise meet the purposes of the Stream Protection Fee Program and associated ordinance. SMPs are commonly grouped into one (1) of two (2) broad categories or measures: "structural" or "non-structural."

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**Structural Stormwater Management Practices** or measures - include, but are not limited to, a wide variety of practices and devices from large-scale retention ponds and constructed wetlands to small-scale underground treatment systems, infiltration facilities, filter strips, low impact design, bioretention, wet ponds, permeable paving, grassed swales, riparian or forested buffers, sand filters, detention basins, and manufactured devices. Structural SMPs are permanent appurtenances to the Site.

## Objectives

The objective of the credit program is to provide a way for property owners who install qualifying stormwater management practices (SMPs) on their property to reduce their SPF payment amount. SMPs are measures or facilities that prevent or reduce the transport of pollutants and/or control stormwater runoff volume or rate. Implementing such measures reduces the impact a developed property has on the downstream storm drainage system, which includes both natural features such as streams and man-made features such as pipes.

## Additional Resources

Property owners are encouraged to research and utilize the following free resources found online:

- ☐ Homeowner's Guide to Stormwater Management prepared by the Philadelphia Water Department in 2006

- Homeowner's Guide to Stormwater produced by the Lancaster County Conservation District in 2013
- The Alliance for the Chesapeake Bay has developed a website, Reduce Your Stormwater, which provides do-it-yourself guidance for SMPs.
- The Chesapeake Stormwater Network has developed a Homeowner Guide that provides excellent step-by-step guidance on designing, constructing and maintaining rain gardens, rain barrels, pervious pavers, and planting trees.

# General Credit Program Policies

The property owner must own and maintain a qualifying stormwater facility or approved non-structural control. Property owners are required to submit an application and documentation of construction or installation, as well as documentation regarding operation and maintenance (O & M) of the stormwater management facility. The property owner must pay their fee in full, and not be past due on their SPF payments. General policies for the Residential credit and rebate program are provided below.

## Types of Projects Eligible for Credit/Rebate

To be eligible for a SPF credit or rebate, a property owner must treat impervious area (IA) with a qualifying stormwater management practice (SMP) that is owned and maintained by the property owner. The property owner must have an approved eligible stormwater management feature, as listed in Table 1. Residential property owners are more likely to have installed one or more of the six SMPs listed in Table 1 due to cost and ease of installation and maintenance, therefore, only those SMPs are described in detail in this Manual. Residential property owners who have or plan to invest in more extensive SMPs, such as those noted for non-residential/multi-family in Table 1, are not excluded from obtaining that credit however, may have to demonstrate a higher degree of engineering feasibility. In the event that residential property owners are interested in obtaining credit under the Non-Residential Program, they should reach out to the Public Works Department to discuss their application with staff early in the process.

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Table 1: Eligible types of SMPs for the Residential and Non-Residential Credit Programs

| Credit Category | Stormwater Management Practice (SMP) | Residential * | Non-Residential and Multi-Family Residential ** |
|---|---|---|---|
| Green Infrastructure / Runoff Volume Controls | Pervious pavement with infiltration bed | X | X |
| | Infiltration basin | | X |
| | Rain garden/bioretention | X | X |
| | Subsurface infiltration bed | | X |
| | Green Roof | | X |
| | Infiltration trench/ Tree Infiltration Trench | | X |
| | Runoff Capture & Reuse – Cistern or Rain Barrel | X | X |
| | Dry Well/ Seepage Pit | X | X |
| Peak Runoff Rate (Flood) Controls | Constructed wetland | | X |
| | Wet pond/ retention basin | | X |
| | Dry extended detention basin | | X |
| | Special Detention areas (parking lots/roof) | | X |
| Water Quality Treatment | Constructed wetlanc | | X |
| | Constructed Filter | | X |
| | Proprietary Water Quality Filters & Hydrodynamic Devices | | X |
| | Vegetated Swale | | X |
| | Vegetated Filter Strip | | X |
| Non-Structural Controls | Tree Canopy Cover | X | X |
| | Downspout Disconnection | X | X |
| | Approved Adopt-a-Stream volunteer program | | X |
| | Approved environmental education/outreach program | | X |
| National Pollutant Discharge Elimination System (NPDES) Stormwater Permit | Facilities with an active, fully-compliant NPDES Permit from PADEP (this is not the same as a NPDES Construction Permit) | | X |

*Notes:*

** Single family residential property owners are eligible for SMPs listed in the non-residential categories.*

*** Non-residential and multi-family residential are excluded from obtaining the Rain Barrel rebate, but can obtain a cistern credit*

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## Maximum Credit Amount

The maximum credit that any one property can receive is 60% percent of their fee. No property will receive 100% credit or reduction of the fee, and the maximum is set at 60% because the Borough needs to fund programmatic elements, public stormwater facilities, and perform standard maintenance, repair and rehabilitation of publicly owned stormwater facilities. Even if a property manages 100% of the stormwater runoff on their site, the Borough still has obligations under its MS4 permit and needs to maintain the public drainage system to protect the health and safety of the public.

## Maximum Rebate Amount

There is no maximum SPF rebate for residential property owners, except within each SMP category as described below. The rebate can only be applied to one SMP for a given area of IA. For example, if a downspout is disconnected to a rain garden, the homeowner is only eligible for one rebate associated with that specific rooftop drainage area (i.e., the homeowner could receive the higher rain garden rebate, but not the disconnection rebate as well). The rebate is a one-time refund, per property. If the property is sold, the new owner is not eligible for an additional rebate.

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# Residential Credit Types

The residential rebate/credit program incentivizes residential property owners to manage their stormwater on site and/or reduce the amount of impervious area (IA) on their property. This program includes two types of incentives which can be applied to reduce a residential property owner's SPF:

**Residential Rebate** - A rebate provides a one-time refund per property per impervious area for installing a stormwater practice. The rebate is applicable to the impervious drainage area managed, and one property can have multiple rebates. The rebate can only be applied to one SMP for a given area of IA. For example, if a downspout is disconnected to a rain garden, the homeowner only receives the rain garden rebate ($100 per 500 SF) for that IA managed, not both a rain garden rebate and a downspout disconnect rebate ($25 per 500 SF). However, if a second downspout that manages a different IA is disconnected to a vegetated area, the homeowner would receive the downspout disconnect rebate ($25 per 500 SF) in addition to the rain garden rebate. In general, Rebates cannot be applied for SMPs built or constructed prior to the enactment of the SPF Ordinance in 2016.

**Residential Credit** - A credit is a recurring discount on the stream protection fee, and is applied to the property owner's bill to reduce the SPF payment amount on a recurring basis. The credit is valid for three years, after which time the property owner must reapply. Using the example above, the homeowner could apply for the rain garden credit ($20 per 500 SF) and the downspout disconnection credit ($5 per 500 SF). Credits can be applied for SMPs built or constructed prior to the enactment of the SPF Ordinance in 2016.

The amount of rebates or credits earned by each SMP is based on the type and capacity of SMP(s) installed. More intensive practices such as rain gardens typically treat a larger amount of stormwater, and therefore give property owners a larger credit. Less intensive practices such as rain barrels are eligible for a smaller incentive proportional to their stormwater management treatment potential. Table 2 lists the eligible practices for rebates/credits under the residential program, and includes the specific rebate and credit amounts per unit area managed. Further detail is provided below for each specific SMP.



Table 2. Rebates & Credits for Residential Properties

| Stormwater Management Practice (SMP) | One-Time Rebate Amount | Annual Recurring Credit Amount | Credit Description |
|---|---|---|---|
| Rain Barrel | $30 | Not Applicable | Rebate is calculated based on per eligible rain barrel and/or tree installed |
| Tree Planting | $50 | Not Applicable | |
| Downspout Disconnection | $25 | $5 | Rebate/Credit is calculated based on per 500 square feet (SF) of IA disconnected or per 500 SF of IA captured |
| Rain Garden | $100 | $20 | |
| Permeable Pavement / Dry Well | $100 | $20 | |

## Calculation of Residential Credits

The Residential Credit is calculated based on the amount of IA treated by one or more SMPs that are owned and maintained by a property owner. For each SMP selected, the fee associated with the amount of IA treated is reduced by the credit applicable to that type of SMP. A description of each SMP type and example calculations for each follow.

## Rain Barrel Rebate

Rain barrels are containers that provide temporary storage of rain water typically for landscape irrigation or other non-potable water needs. Rainwater flows into rain barrels via gutters or downspouts. Collecting rainwater in a rain barrel reduces runoff volumes and can allow for greater infiltration and evaporation of stormwater runoff. For smaller structures, such as shed/garage roofs, rain barrels are typically able to fully manage the stormwater runoff generated during small storm events.

When installing a rain barrel, a property owner must abide by the specific requirements outlined in the table below to qualify for a rebate.

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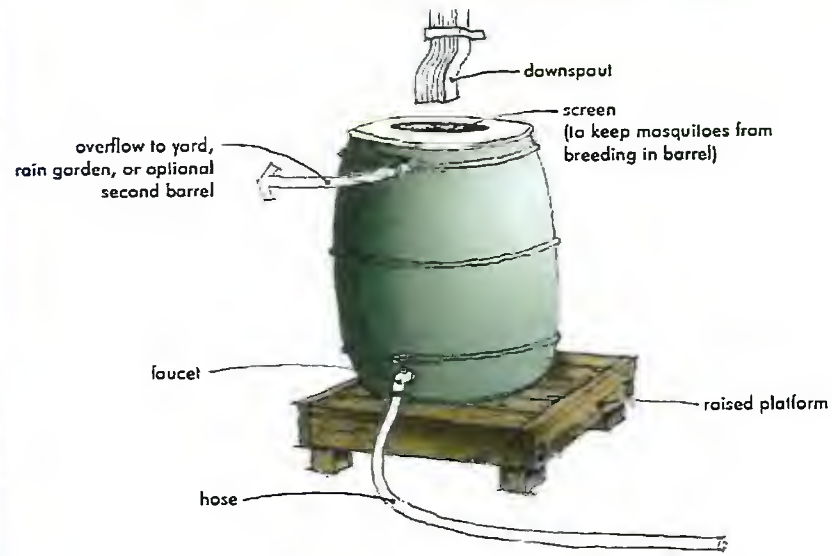
### Rain Barrel Rebate Requirements

| # | Requirement | Summary of Requirement |
|---|---|---|
| 1 | Maximum # of Rain Barrels Eligible for Credit | A maximum of 2 barrels per property will be eligible for rebates. |
| 2 | Rain Barrel Size and Storage Capacity | The rain barrel must have a minimum storage capacity (storage volume) of 45 gallons. This is a typical size among rain barrels that are available for purchase. |
| 3 | Rain Barrel Capture Volume | To qualify for a rebate, each rain barrel must capture runoff from an adjacent roof area of at least 100 square feet (e.g., 10 x 10 feet). |
| 4 | Rain Barrel Overflow | The barrel must provide an overflow outlet near the top of the barrel to discharge excess water during large storm events. |
| 5 | Plan for How to Use Stored Water | There must be a use for the stored water so that the rain barrel's storage capacity is replenished over time. Note that the water collected in rain barrels is not suitable for human consumption. |
| 6 | Rain Barrel Location | When locating the rain barrel, consider site topography. For example, placing a rain barrel up-gradient of a garden will allow watering to work with gravity and enable easy use of stored water. |
| 7 | Mosquito Control | All rain barrel openings must have screens to prevent the growth of mosquitoes (or other vector-control must be provided). |



## Rain Barrel Rebate Calculation Example

A property owner installs two (2) eligible rain barrels to manage runoff from their house roof and garage roof. The following example calculation shows the methodology used to determine this property owner's one-time Rain Barrel rebate.

Total Rain Barrel Rebate = Rain Barrel Rebate Amount ($/barrel) x # of Rain Barrels (Up to 2)

Total Rain Barrel Rebate = $30 × 2

Total Rain Barrel One-Time Rebate = $60

## Application Example

**Rain Barrel Rebate**

Credit limit: Maximum of 2 barrels per property

Number of eligible barrels installed: 2 (2 Max)

Rain Barrel Rebate: $30 per barrel

*Total Rebate = (Rebate, $) x (Number of Barrels)*

Total Rebate: $60

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## Tree Planting Rebate

For the purposes of the Borough's SPF, tree planting refers to the practice of planting trees in areas where trees are likely to thrive and create a tree canopy that intercepts rainfall and reduces stormwater runoff. This means that trees planted in a grassed lawn, not near any impervious area, will not be covered under this Rebate program. Native tree species are preferred and species should be selected that will grow best given the specific site conditions, such as soil conditions and the amount of sun exposure at the planting site. Trees can be planted by either a property owner or a hired landscape contractor. Interested applicants are encouraged, but not required, to work with the Borough Arborist and the Sustainability Advisory Committee to review the Borough's list of preferred trees and consult them regarding species selection prior to planting. Trees purchased and/or installed through the Borough's tree planting program may qualify for the Tree Planting Rebate. Trees planted prior to the enactment of the Stream Protection Fee Ordinance (2016) are not eligible for the tree planting rebate to incentivize additional plantings. A photo must be submitted to verify its location.

When planting trees as part of the Borough's SPF program, a property owner must abide by the specific requirements outlined in the table below to qualify for a rebate.


### Tree Planting Rebate Requirements

| # | Requirement | Summary of Requirement |
|---|---|---|
| 1 | Maximum # of Trees Eligible for Rebate | A maximum of 4 trees per property are eligible for rebates. Only trees planted since 2016 are eligible for a rebate. |
| 2 | Minimum Tree Size at Time of Planting | Trees must have a minimum of a 2-inch caliper at time of planting. Caliper is the diameter of the tree trunk measured at six inches above the ground. (Refer to example image to right.) |
| 3 | Tree Planting Location – Setbacks, Clearances, and Soil Volume | Trees should be planted with adequate overhead clearance (setback from overhead wires) and appropriate root zone area. If the planting site is surrounded by pavement (e.g., between the street and sidewalk), the recommended minimum tree pit size is 4 x 4 feet or 3 x 6 feet. Ideally, tree pits should be larger (e.g., 6 x 6 feet) or trees roots should have access to adjacent landscaped areas to provide more soil volume for root growth. |
| 4 | Tree Canopy Location | A planting location should be selected that will enable the tree canopy to eventually grow and cover an impervious area (IA) such as a sidewalk, driveway, or roof. The maximum distance between the tree trunk and IA should be 25 feet. |
| 5 | Avoiding Underground Utility Conflicts | It is critical that the property owner minimizes any conflict with existing underground utility infrastructure, therefore, owners are required to utilize the Call Before You Dig Pennsylvania One-Call service for utility mark-outs prior to installing a new tree. For more information: http://www.pa1call.org/pa811/Default.aspx. |


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## Tree Planting Rebate Calculation Example

A property owner plants two (2) eligible trees. The following example calculation shows the methodology used to determine the one-time Tree Planting rebate.

Total Tree Planting Rebate = Tree Planting Rebate Amount ($/tree) x # of Trees (Up to 4)

Total Tree Planting Rebate = $50 × 2

Total Tree Planting One-Time Rebate = $100

## Application Example

**Tree Planting Rebate**

Credit limit: Maximum of 4 trees per property

Number of eligible trees planted: 2 (4 Max)

Tree Planting Rebate: $50 per tree

*Total Rebate = (Rebate, $) x (Number of Trees)*

Total Rebate: $100

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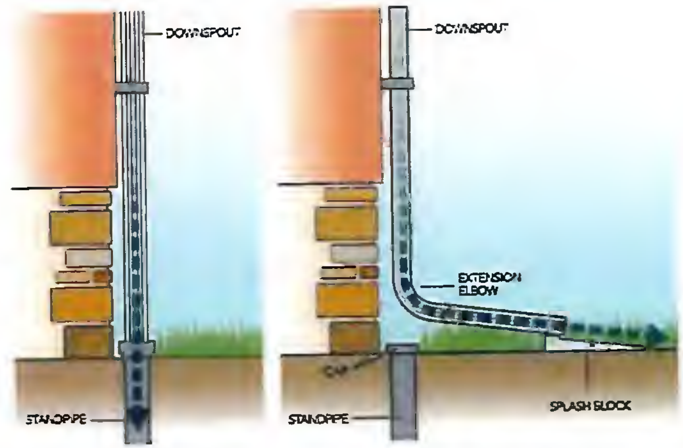
## Downspout Disconnection Rebate/Credit

In West Chester, roof runoff typically is collected in gutters and then flows off the roof via downspouts. Many downspouts are directly connected to the storm sewer system or discharge stormwater onto an impervious surface (i.e., a driveway, sidewalk, or street) that conveys the runoff to a Borough storm inlet. Disconnecting downspouts is the process of physically separating roof downspouts from the sewer system and redirecting roof runoff to discharge onto pervious, landscaped surfaces where the water can naturally infiltrate into the ground. This reduces the amount of directly connected impervious area (IA) on a property. If done correctly, downspout disconnections can reduce peak flow rates, runoff volume, and pollution.

For disconnection to be safe and effective, each downspout must discharge into a suitable receiving area. Roof runoff can be redirected to a garden, yard, planter, or a rain barrel or cistern for eventual reuse. Runoff must not flow toward building foundations or adversely impact adjacent properties.

Note that downspouts that were already adequately disconnected prior to enactment of the Stream Protection Fee Ordinance (2016) are eligible for the credit but not for the rebate. A photo must be submitted to verify the condition of the downspout in question.

When considering a downspout disconnection, a property owner must follow specific design requirements. The Key Design Requirements for downspout disconnections are summarized in the table below.




DOWNSPOUT CONNECTED TO SEWER SYSTEM

DOWNSPOUT DISCONNECTED FROM SEWER SYSTEM

001653

### Downspout Disconnection Rebate/Credit Requirements

| # | Requirement | Summary of Requirement |
|---|---|---|
| 1 | Existing Downspout Characteristics | To qualify for a downspout disconnection rebate, the existing downspout must be currently directly draining into a storm sewer, either flowing via pipe or over impervious surfaces to a storm inlet. Downspouts that are already adequately disconnected are eligible for a credit but not a rebate. |
| 2 | Contributing Rooftop Area | Limit the contributing rooftop area to a maximum of 500 square feet (e.g., 20 x 25 feet) per downspout disconnection. |
| 3 | Required Distance from Structures | After disconnection, the extension, splash block and ground should all discharge water a minimum of 3 feet away from structures (i.e. basements, porch steps, or garages) or discharge directly into a rain barrel, cistern, or other structure. |
| 4 | Splash Block | It is recommended to use a splash block to absorb the energy of falling water, spread the water out, and prevent erosion. (See image for an example of a typical splash block). |

| | | |
|---|---|---|
| 5 | Disconnecting to Stable Slopes | Do not disconnect downspouts to steep slopes over 10% (i.e., areas with a vertical drop of more than 1 foot every 10 feet horizontally) unless the slopes are adequately stabilized. |
| 6 | Disconnecting to Pervious, Landscape Area | Make sure there is enough pervious area for the roof runoff to be absorbed into the ground. The pervious/landscaped area must be at least 20% of the roof area that drains to the disconnected downspout. |

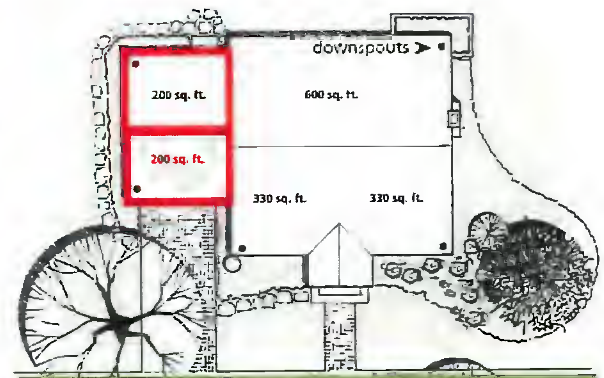


Figure 1: Example site plan noting locations of existing downspouts and their associated roof areas.

## Downspout Disconnection Rebate/Credit Calculation Example

The calculation of the downspout rebate/credit is based on the amount of rooftop area that is disconnected. To estimate the rooftop area draining to a downspout, the property owner should sketch a site plan of the property (refer to Appendix A: How to Create a Site Plan). Sources for an aerial site map include a view from Google or Bing maps or any other online mapping program. The locations of downspouts and the roof line should be marked as shown in the example graphic. The area of the rooftop can be estimated by measuring the area of the roof (length x width). Calculate or estimate the area of rooftop that drains to the downspout that has been selected for disconnection. If there is only one downspout, the property owner can utilize the entire roof area. If there are gutters with downspouts on both ends, assume that half of the roof area drains to each downspout.

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Example: A property owner installs two (2) downspout disconnections draining a total of 400 square feet (SF) of rooftop (e.g., the 2 garage downspouts shown on Figure 1, with their rooftop IA outlined in red). The following example calculation shows the methodology used to determine the downspout disconnection one-time rebate and recurring annual credit.

### Downspout Disconnection Rebate Calculation

Total Rebate = <u>Downspout Disconnection Rebate Amount ($/500 SF)</u> x <u>(Rooftop Area Disconnected ÷ 500 SF)</u>

Total Disconnection Rebate = $25 x (400 square feet ÷ 500 square feet)

Total Disconnection One-Time Rebate = $25 x 0.8 = $20

## Downspout Disconnection Annual Credit Calculation

Total Annual Disconnection Credit = <u>Annual Credit Amount ($/500 SF)</u> x <u>(Impervious Area Disconnected ÷ 500 square feet)</u>

Total Annual Credit = $5 x (400 square feet ÷ 500 square feet)

Total Annual Credit = $5 x 0.8

**Total Annual Disconnection Credit = $4**

## Application Example

**Downspout Disconnection**

Provide sketch of roof area being disconnected, downspout locations, and the vegetated area that will receive the stormwater runoff. Note that only 1 residential credit/rebate can be applied to a given impervious area. For example, if a downspout is disconnected to a rain garden, apply for the higher rain garden credit/rebate below.

Total Rooftop area disconnected: [illegible] square feet

| | | |
|---|---|---|
| Downspout Disconnection Rebate: | $25 | per 500 SF disconnected |
| Downspout Disconnection Annual Credit: | $5 | per 500 SF disconnected |

*Total Rebate = (Rebate, $) x (Rooftop Area Disconnected / 500 SF)*

Total Rebate: $20.00

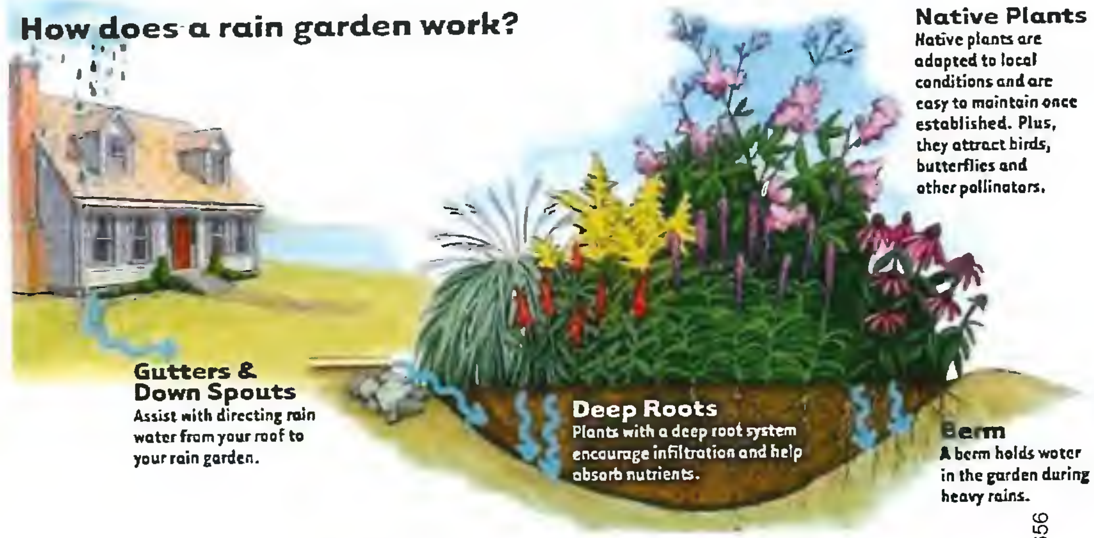
*Total Annual Credit = (Credit, $) x (Impervious Area Disconnected / 500 SF)*

Total Annual Credit: $4.00

001655

## Rain Garden Rebate/Credit

A rain garden (or "bioretention area") is a depressed landscaped area designed to capture and filter stormwater runoff. In addition to managing stormwater runoff volume and mitigating peak discharge rates, a rain garden can improve water quality by removing pollutants as the water percolates through the soil. Rain gardens can be designed with a range of shapes and sizes, allowing for easy integration into many yards/landscapes. Rain gardens typically require relatively little maintenance once established and often replace areas that were previously intensively landscaped. Vegetation for rain gardens should include hardy native plants that are tolerant of varying hydrologic conditions (i.e., both wet and dry conditions) and environmental stressors such as salts (i.e. if there is potential for exposure to deicing salts). Plants should be chosen for the appropriate sun/shade conditions as well.

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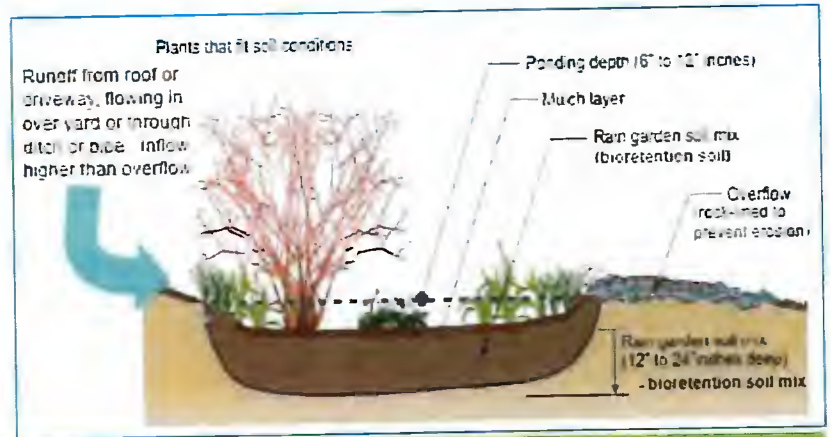
A variety of helpful resources for designing residential rain gardens are available online, including the following:

- Creating Your Rain Garden prepared by Pennsylvania Environmental Council
- Philadelphia Water Department's "How to Build a Rain Garden" online guide
- "Start to Finish Rain Garden Design: A Workbook for Homeowners" from Faribault County, MN

When designing a residential rain garden, a property owner must follow specific design requirements to qualify for a rebate or credit. The Key Design Requirements for a residential rain garden are summarized in the following table and explained in further detail on the following pages.

## Rain Garden Rebate/Credit Requirements

| # | Requirement | Summary of Requirement |
|---|---|---|
| 1 | Rain Garden Size (Square Feet) | Rain garden must be sized appropriately relative to contributing impervious area. *Refer to the Additional Design Information section on the next page.* |
| 2 | Rain Garden Volume (Cubic Feet) | Rain garden must be sized to capture 1" of runoff from contributing IA. *Refer to the Additional Design Information section on the next page.* |
| 3 | Rain Garden Depth (Inches) | Rain garden must have a ponding area depth of no more than 12 inches. |
| 4 | Soil Drainage Testing | Soil drainage tests must be conducted prior to constructing a rain garden to confirm that the rain garden will be able to handle the amount of water draining to it and that the rain garden will empty (drain down) within 48 hours. This is important for public health and safety reasons. *Refer to Appendix B: How to Perform a Drainage Test.* |
| 5 | Rain Garden Overflow | The rain garden should be designed to have a way to release excess water during extreme storm events through a secondary pathway (e.g., a rock channel, an overflow drain, or swale). |
| 6 | Avoiding Underground Utility Conflicts | It is critical that the property owner minimizes any conflict with existing underground utility infrastructure, therefore, owners are **required to utilize the Call Before You Dig Pennsylvania One-Call service** for utility mark-outs prior to digging a rain garden. For more information: http://www.pa1call.org/pa811/Default.aspx. |




001657

**Typical Native Plants for Rain Gardens in Eastern Pennsylvania**

**Perennials**

Bee-balm—*Monarda didyma*
Black-eyed Susan—*Rudbeckia hirta*
Blazing star—*Liatris spicata*
Blue flag iris—*Iris versicolor*
Boneset—*Eupatorium perfoliatum*
Butterfly weed—*Asclepias tuberosa*
Cardinal flower—*Lobelia cardinalis*
Early goldenrod—*Solidago bicolor*
Golden alexander—*Zizia aurea*
Joe-pye weed—*Eupatorium purpureum*
New England aster—*Aster novae-angliae*
New York ironweed—*Veronia novaboracensis*
Obedient plant—*Physostegia virginiana*
Ox-eye—Heliopsis helianthoides
Solomon's seal—*Polygonatum biflorum*
White snakeroot—*Eupatorium rugosum*

**Grasses and Grass-like plants**

Big bluestem—*Andropogon gerardii*
Bottle brush grass—*Elymus hystrix*
Canada wild rye—*Elymus canadensis*
Path rush—*Juncus tenuis*
Purple-top—*Tridens flavus*
Soft rush—*Juncus effusus*
Switch-grass—*Panicum virgatum*
Virginia wild rye—*Elymus virginicus*

**Ferns**

Christmas fern—*Polystichum acrostichoides*
Hay-scented fern—*Dennstaedtia punctilobula*
Rattlesnake fern—*Botrychium virginianum*
Sensitive fern—*Onoclea sensibilis*

**Shrubs**

Gray dogwood—*Cornus racemosa*
Highbush blueberry—*Vaccinium corymbosm*
Mountain laurel—*Kalmia latifolia**
Ninebark—*Physocarpus opulifolius*
Pasture rose—*Rosa carolina*
Red osier dogwood—*Cornus sericea*
Spicebush—*Lindera benzoin*
Sweet pepperbush—*Clethra alnifolia*

*Pennsylvania's state flower

*When purchasing plants, pay close attention to the scientific names to ensure the correct species are selected.*

## Rain Garden Requirements - Additional Design Information

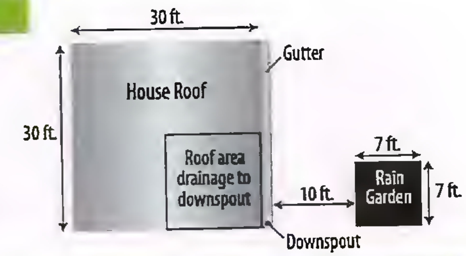
1. Rain Garden Area: The size of the rain garden shall be directly based on the amount of contributing impervious area (IA).
   - The maximum ratio of impervious drainage area (IA) to rain garden area should be 15:1 (e.g., a 50 SF rain garden can manage up to 750 SF of IA).
2. Rain Garden Volume: For full rebate/credit, the rain garden must capture 1 inch of runoff from the impervious area draining to it (a minimum of 0.25 inches must be captured for any credit).
   - One (1) inch of runoff from 500 SF is equivalent to 41.7 cubic feet (312 gallons) of water
     - 500 SF x 1 inch x 1 foot/12 inches = 41.7 cubic feet (CF)

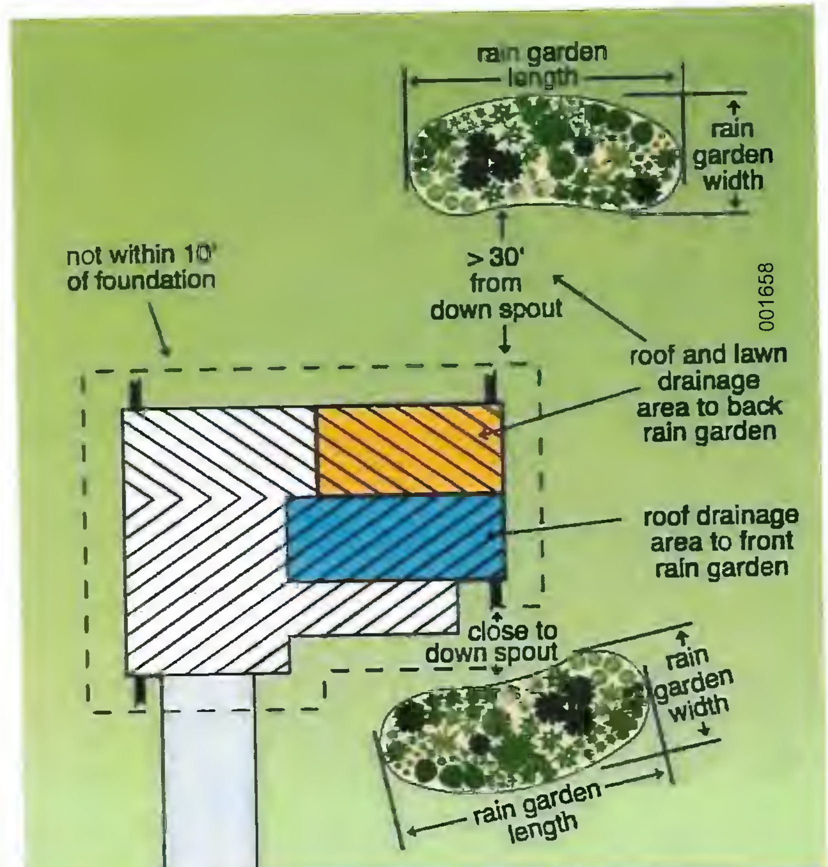
   A simple way to estimate the capacity of the surface rain garden is to take the ponding area and multiply it by ½ of the ponding depth (multiplying by ½ accounts for the fact that there is shallower ponding around the perimeter as the sides slope up from the bottom of the rain garden). The ponding depth should be no more than 12 inches.

   - For example, an 8-foot diameter (50 SF) rain garden with 12 inches (1 foot) of ponding can store approximately 25 CF of runoff on the surface
     - 50 SF x ½ x 1 foot = 25 CF
   - Rain garden soils (12 inches thick) can typically store another 0.25 CF per square foot.
   - Therefore, 50 SF of soil can hold approximately 12.5 CF
     - 50 SF x 0.25 CF per SF = 12.5 CF
   - The total capacity of this example 50 SF rain garden would be 37.5 CF, enough to capture 1 inch of runoff from 450 square feet or 0.9 inches from 500 SF.
     - 25 CF surface storage + 12.5 CF soil storage = 37.5 CF total storage
   - If additional storage is provided through deeper rain garden soils or a gravel storage layer, that storage should be accounted for as well.

**Rain Garden Sizing Example**

If the area of the house is 30 ft. x 30 ft. and ¼ of this area drains to one downspout:
15 ft. x 15 ft. = 225 ft.$^2$
20% of 225 ft.$^2$ = 45 ft.$^2$
30% of 225 ft.$^2$ = 67.5 ft.$^2$
The rain garden area should be between 45 and 67.5 square feet, depending on soil type (use 20% for sandier soils).




Rain Garden Placement Guidelines

## Rain Garden Rebate/Credit Calculation Example

A property owner installs a 50 square foot rain garden draining a total of 750 square feet of IA, capable of capturing 1 inch of runoff from their contributing IA. The following example calculation shows the methodology used to determine the rain garden one-time rebate and recurring credit.

### Rain Garden Rebate Calculation

Total Rebate = Rain Garden Rebate Amount ($/500 SF) x (Impervious Area Captured in square feet ÷ 500 square feet)

Total Rebate = $100 x (750 square feet ÷ 500 square feet)

Total Rebate = $100 x 1.5

**Total One-Time Rebate = $150**

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### Rain Garden Annual Credit Calculation

Total Annual Credit = Annual Credit Amount ($/500 SF) x (Impervious Area Captured in square feet ÷ 500 SF)

Total Annual Credit = $20 x (750 square feet ÷ 500 square feet)

Total Annual Credit = $20 x 1.5

**Total Annual Credit = $30**

Application Example

**Rain Garden Rebate/Credit**

On a separate sheet, provide sketch of the rain garden location and the impervious area being managed by each rain garden. Note that only 1 residential credit/rebate can be applied to a given impervious area.

Contributing impervious area to rain garden(s): 750 square feet

| | | |
|---|---|---|
| Rain Garden Rebate: | $100 | per 500 SF IA captured |
| Rain Garden Annual Credit: | $20 | per 500 SF IA captured |

*Total Rebate = (Rebate, $) x (Impervious Area Captured / 500 SF)*

Total Rebate: $150.00

*Total Annual Credit = (Credit, $) x (Impervious Area Captured / 500 SF)*

Total Annual Credit: $30.00

001660

# Permeable Pavement (Drywell) Rebate/Credit

<u>NOTE:</u> *It is recommended that residential owners who are considering this rebate/credit contact the Public Works Department, as engineering review is strongly encouraged. Due to the likely amount of land disturbance involved for these types of practices, an owner may need to consult with the Building and Housing Department to determine if a permit is required.*

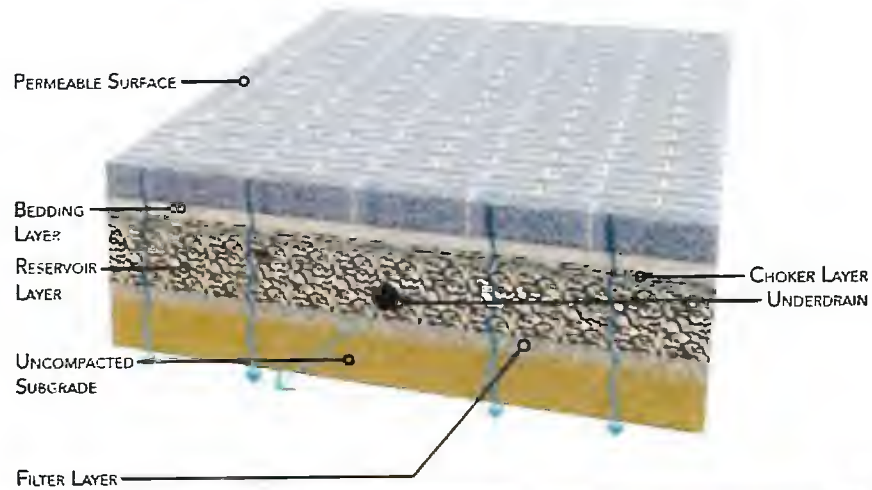
In general, permeable pavements (also called porous or pervious pavements) are designed to allow stormwater to infiltrate through the pavement surface, into an underground gravel/crushed stone storage bed or reservoir, and finally down into the underlying soil.

Dry wells are underground structures or gravel pits that collect rainwater and let it absorb into the soil.

Types of permeable pavements may include paving blocks, grid pavers, pervious concrete, porous asphalt, and a variety of proprietary materials. Installing crushed gravel alone as a surface is not considered permeable pavement and is not eligible for a credit, unless it is designed as part of an engineered system specifically intended for stormwater storage and infiltration. Permeable pavement can potentially be used for driveways, patios, parking lots, walking paths, sidewalks, playgrounds, basketball courts, and other similar uses.

The storage bed should generally be placed on an <u>uncompacted</u> base to facilitate stormwater infiltration. The subsurface storage bed may consist of uniformly graded, clean and washed coarse aggregate (stone or large gravel) with a void space of approximately 40%, or manufactured structural storage units. It is recommended that a qualified engineer and/or installer with knowledge of hydrology and hydraulics be consulted for applications using permeable hardscapes for driveways to ensure desired results and to ensure proper support for vehicles.

When installing a permeable pavement or dry well system on a residential property, the property owner must follow specific design requirements. The Key Design Requirements for a residential permeable pavement system are summarized in the following table and explained in further detail on the following pages.

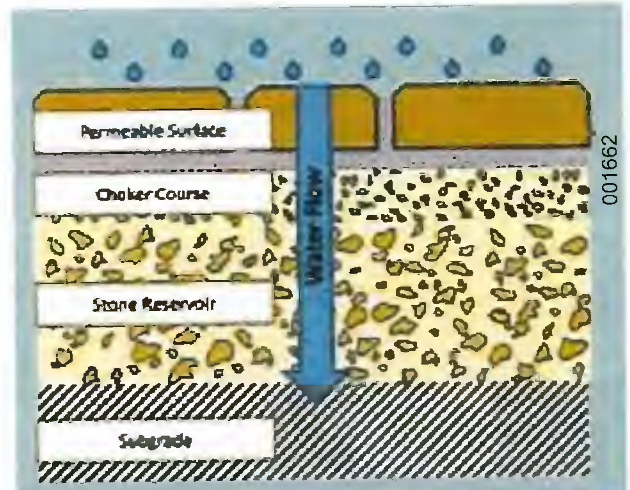




## Permeable Pavement Rebate/Credit Requirements

| # | Requirement | Summary of Requirement |
|---|---|---|
| 1 | Permeable Pavement Area (Square Feet) | Permeable pavement system must be sized appropriately relative to contributing impervious area (IA). *Refer to the Additional Design Information section on the next page.* |
| 2 | System Storage Capacity/Volume (Cubic Feet) | System must be sized to capture 1" of runoff from contributing IA. |
| 3 | Storage Bed Depth (Inches) | Bottom of storage bed must be a minimum of 2 feet above existing water table/bedrock. |
| 4 | Soil Drainage Testing | Rainwater must drain down (percolate) out of the permeable pavement system within 48 hours or less. *Refer to Appendix B: How to Perform a Drainage Test.* |
| 5 | Existing Site Characteristics | Site should have a fairly level or gently sloping surface with uncompacted soils. Provide level or slightly sloping storage beds. |
| 6 | Permeable Pavement System Overflow | Permeable pavement system should have an overflow mechanism to release excess water during extreme storm events. |
| 7 | Permeable Pavement Secondary inflow | A secondary mechanism for introducing water into the system is recommended. |
| 8 | Preventing Surface Clogging | Prevent sources of sediment and debris from clogging the permeable pavement system both during and after construction. |
| 9 | Surface Permeability | Pavement surface material should have a permeability of at least 20 inches per hour. The manufacturer of proprietary materials can provide this information. |
| 10 | Avoiding Underground Utility Conflicts | It is critical that the property owner minimizes any conflict with existing underground utility infrastructure, therefore, owners are required to utilize the **Call Before You Dig Pennsylvania One-Call service** for utility mark-outs prior to digging a rain garden. For more information: http://www.pa1call.org/pa811/Default.aspx. |

Permeable pavers come in a variety of colors and sizes




Typical cross-section of a permeable pavement system

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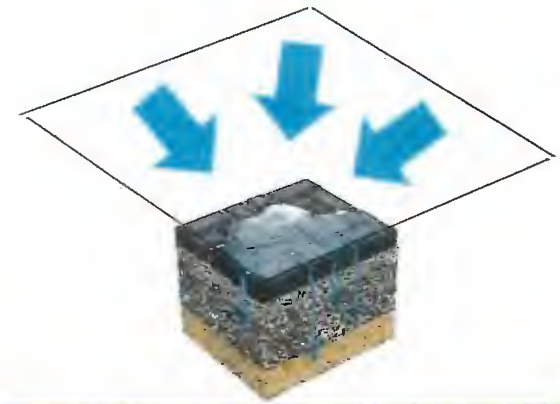
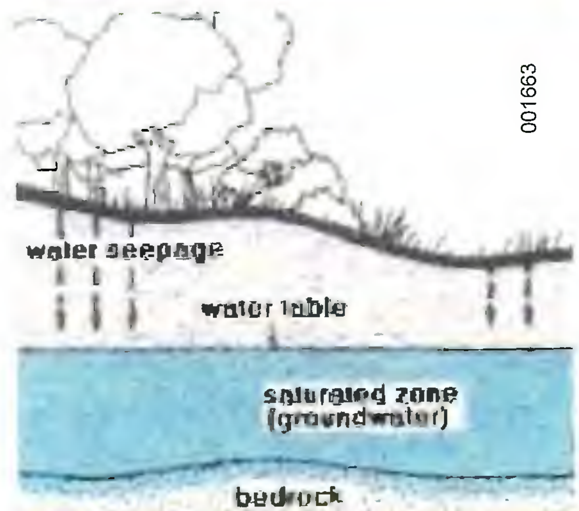
## Permeable Pavement and Drywell Rebate/Credit Requirements – Additional Design Information

1. Permeable Pavement Area: The surface area of the proposed permeable pavement system must be directly based on the amount of contributing impervious area (IA).
    - The maximum ratio of drainage area to permeable pavement should typically be 5:1 (e.g,. a 100 SF permeable pavement surface can manage up to 500 SF of IA).
    - Figure A-3 in Appendix A to the Ch.94 Stormwater Management Ordinance includes a standard seepage bed detail that can be used for drywell sizing.
2. System Storage Capacity/Volume: Permeable pavement systems must have the storage capacity to capture a 1-inch storm event for a full rebate/credit.
    - A good rule of thumb is to consider that 10 inches of clean, uniformly-sized gravel with 40% void space can store 4 inches of water, enough to store 1 inch of stormwater from the pavement area itself plus runoff from an area 3 times as large (for example, an adjacent rooftop).
3. Storage Bed Depth: The bottom of the storage bed and/or dry well should be located at a minimum of 2 feet above the existing water table or bedrock.
    - To check out your property's general soil characteristics (depth to groundwater and depth to bedrock), visit the online USDA NRCS Web Soil Survey
    - If signs of a shallow water table or bedrock are encountered when digging on your property or when conducting a drainage test, consult a professional.
4. Soil Drainage Testing: Soil conditions are variable in an urban environment such as the Borough, and as such, it is required that a soil drainage test be undertaken to confirm that the permeable pavement system can empty within 48 hours. A simple drainage test can be performed per the instructions in Appendix B: How to Perform a Drainage Test.
5. Existing Site Characteristics: Permeable pavement systems should be constructed only on fairly level or gently sloping surfaces. They are not practical on steep slopes.

    During installation, construction equipment should be kept off the soil and other measures taken to prevent compaction of the soil and the accompanying reduction in permeability.

    Provide level or gently sloping storage bed bottoms to maximize storage and infiltration.
6. Permeable Pavement System Overflow: Provide a positive stormwater overflow structure/device from the system to release excess water during extreme storm events.



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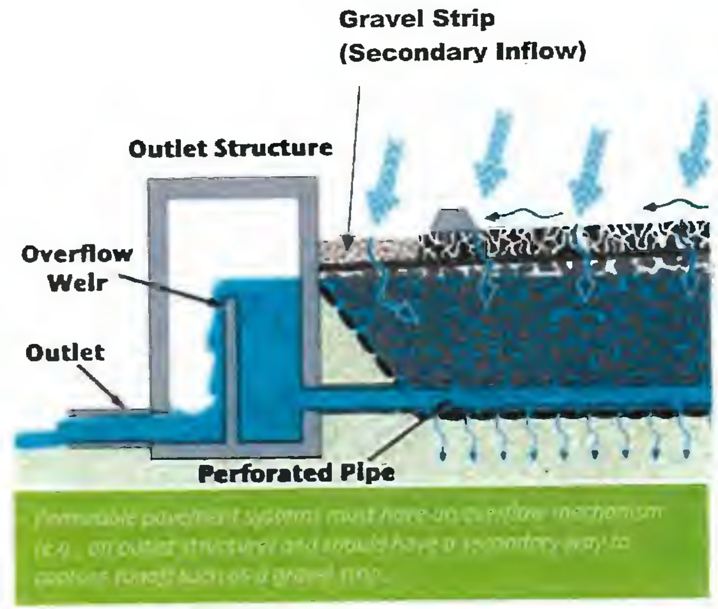
7. Permeable Pavement Secondary Inflow: It is recommended that the permeable pavement system be designed with a secondary inflow mechanism such as a gravel strip along the lower edge or a small area drain that connects to the storage bed under the pavement.

8. Preventing Surface Clogging: Prevent sediment-laden runoff (i.e., from un-stabilized pervious areas) from flowing towards the permeable pavement surface and consider how to prevent and/or remove other sources of debris (leaves, seeds, flowers, pollen, etc.) that may clog the permeable pavement. Avoid locating permeable pavements where they are likely to receive excessive sediment and/or debris.






Permeable Pavement and Drywell Rebate/Credit Calculation Example
A property owner installs a permeable pavement driveway that is 10 feet wide by 25 feet long (250 square feet [SF]). It also manages the runoff flowing out of a garage downspout that collects runoff from 250 SF of the garage rooftop. Therefore, the total IA to be managed is 500 SF (permeable pavement driveway area plus garage rooftop area managed). The following example calculation shows the methodology used to determine the permeable pavement one-time rebate and credit.

Rebate Calculation

Total Rebate = Permeable Pavement Rebate Amount ($/500 SF) x (Impervious Area Replaced or Captured in square feet ÷ 500 square feet)

Total Rebate = $100 x (500 square feet ÷ 500 square feet)

Total Rebate = $100 x 1

Total One-Time Rebate = $100

Annual Credit Calculation

Total Annual Credit = Annual Credit Amount ($/500 SF) x (Impervious Area Replaced or Captured in square feet ÷ 500 square feet)

Total Annual Credit = $20 x (500 square feet ÷ 500 square feet)

Total Annual Credit = $20 x 1

Total Annual Credit = $20

Application Example

**Permeable Pavement / Dry Well**

Provide sketch of the permeable pavement area or dry well and the impervious area being replaced/captured by the permeable pavement or dry well. Note that only 1 residential credit rebate can be applied to a given impervious area.

Replaced / captured impervious area: 500 square feet

| | | |
|---|---|---|
| Permeable Pavement / Dry Well Rebate: | $100 | per 500 SF replaced / captured |
| Permeable Pavement / Dry Well Annual Credit: | $20 | per 500 SF replaced / captured |

*Total Rebate = (Rebate, $) x (Impervious Area Replaced / 500 SF)*

Total Rebate: $100.00

*Total Annual Credit = (Credit, $) x (Impervious Area Captured / 500 SF)*

Total Annual Credit: $20.00

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# Credit Program Procedures

The following procedures are common to both the Residential Credit Program and the Non-Residential Credit Program.

## Application Forms

Residential and non-residential application forms are available on the Borough's website www.west-chester.com, searching Stream Protection Fee.

## Application Deadline

The Borough has determined that all approved credits will be applied retroactively based on the year the application was submitted using a deadline of July 31. All rebate/credit applications will be accepted year-round on a rolling basis. If the application is received by July 31, approved credits/rebates will be applied retroactively based on the year of the application submittal date. If the application is received after July 31, then the property owner must wait one year before the credit appears.

## Application Fee

Payment of a Rebate/Credit Application Fee may be required for Borough review of the credit application. The fee is listed in the Borough's current fee schedule, which is available on the Borough's website. SPF credit application fees are non-refundable regardless of the outcome of the credit application. Borough council may choose at their discretion to waive the application fee, and as of November 2017, Council has waived the application fee.

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## Operations and Maintenance (O&M) Agreement

A signed maintenance agreement between the Borough and the property owner is required for credit approval. Under the Operations and Maintenance (O&M) agreement, the owner must allow the Borough access to the site to view and inspect the SMP according to the Borough's inspection cycle. The Agreement can be found on the Borough website.

To receive the residential or non-residential SPF credit, a property owner must be able to demonstrate the stormwater facility is being properly maintained. A property owner can demonstrate maintenance of a stormwater facility by including with the SPF Credit Application available maintenance records showing the maintenance activities and date, or the most recent invoice from a qualified maintenance vendor. If the applicant does not maintain the facility as required, the Department of Public Works will notify the property owner in writing that they have 30 days to take corrective action otherwise the credit will be discontinued.

## Application Documentation Requirements

The property owner must provide the following documentation:

- Completed and signed application form.
- Photograph(s) of SMP
- A sketch (site plan, plot plan, map, aerial image or similar illustration) showing parcel lot lines, built features including all impervious areas, and location of the existing/proposed SMPs, and drainage areas to the SMP.

- Refer to Appendix A: "How to Create a Site Plan" for instructions
- The property owner should utilize the Borough's online mapping program which allows users to search for their property address and view their mapped parcel and impervious area. The website also allows for the user to print on a page size sheet suitable for inclusion in the application.

- Documentation of purchase and/or installation of the SMP including receipts, invoices, packing slips, or other records if available.
- Calculations or other documentation of impervious drainage area and SMP capacity estimates
- Maintenance logs noting the past inspection and maintenance records (or receipts from vendors hired to perform maintenance), or for newly constructed SMPs, a description of the proposed seasonal maintenance activities that the property owner will undertake.

In the event the credit application is missing information; Borough staff will request additional documentation to aid in review of the credit application.

## Submission of Credit Application

Electronic submissions can be made to spf-program@west-chester.com. Submit a copy of the completed credit application. the checklist. all supporting documentation and the non-refundable application fee (if applicable) to:

Borough of West Chester Department of Public Works

Attention: Stream Protection Fee Program – Credit Program

205 Lacey Street

West Chester, PA 19382

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## Determination

Borough staff will review the credit application and issue a determination no later than November 1. The applicant will be notified by letter and/or email of the decision.

## Appeal of Determination

Appeal of the credit determination can be made in accordance with Section 11 – "Appeals" of the Borough's Stream Protection Ordinance. Typically, a credit application will be primarily denied due to technical inadequacies. Should those inadequacies be addressed, the property owner may resubmit their application to the Borough.

## Issuance of Credits

Rebates and/or Credits will be applied in the form of a credit and will be applied to subsequent bills.

## Credit Renewal

Residential SPF credits will be valid for three years, after which they will require renewal by the property owner. This renewal policy does not apply to the SPF Rebate which is a one-time refund per property. To continue to receive the SPF credit, property owners are required to reapply before the credit period expires within 3 years. Should the owner fail to submit a renewal application, the credit(s) will expire. When reapplying, the property owner must update their demonstration of stormwater facility maintenance by including sufficient documentation in the application package.

## Site Inspections

Upon receipt of a credit application, the Borough or its designated appointee, may inspect the parcel to verify all information and supporting documentation. Efforts will be made to notify the property owner in advance. If the Borough's site inspection determines that the SMP is not being maintained appropriately, the credit could be denied. The Borough may choose to withhold the credit until the property owner demonstrates that the SMP is being appropriately maintained.

## Termination of Credits

Approved credits may be terminated at any time if the SMPs are found to be not functional, improperly maintained, or if the owner fails to restore the SMPs per Borough notification.

## Change in Property Ownership

If a property is sold and there is a change in ownership, the credit (residential or non-residential) will remain in place until the three-year credit term is completed. The new property owner will be required to resubmit the credit application in accordance with the Credit Renewal policy described in this Manual. As the residential rebate is a one-time refund amount provided per property per eligible SMP, a new owner is not eligible for previously awarded rebates once a property changes hands.

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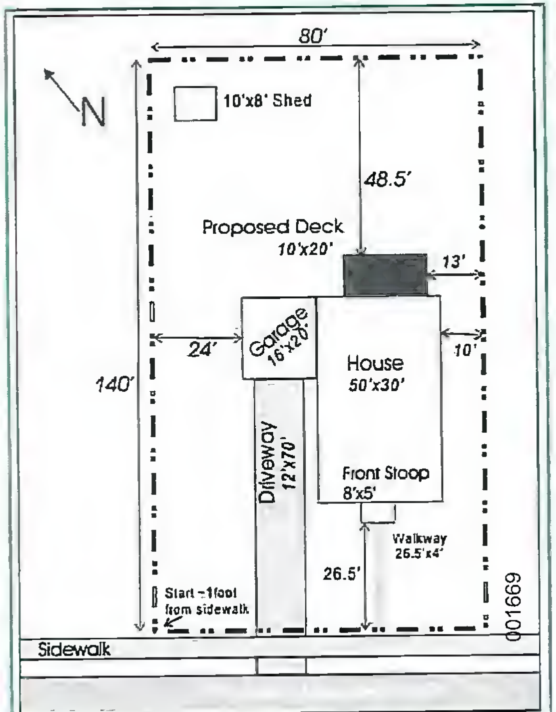
# Appendix A: How to Create a Site Plan




Sample Site Plan
Scale: 1"=30'

Proposed Rear Deck addition.

A site plan is a scaled map/diagram that graphically depicts a property's existing and/or proposed physical structures and landscape features. Site plans are drawn showing a bird's eye view of your property as if you were looking down at it from above. A site plan shows significant things that are on your property currently, such as the footprint of any buildings (home, garage, storage shed, or decks) and any other features such as driveways, patios, walkways, fences, swimming pools, etc. on the property.

Dimensions should be included for significant items and be used to show distances between existing items. The drawing should be done to a scale (e.g., 1 inch on the plan is equal to 30 feet on the ground). Site plans also should indicate the orientation of the plan using a North Arrow symbol that indicates which direction North is.

The following steps will help you in preparing your site plan.

**Step 1: Determine your property boundaries and lot dimensions (choose from one listed below).**

*Option 1 – Use Online Tax Assessor's Map*

Using an address or property owner name, you can look up your property on the Chester County Tax Assessor's Map website (accessible through "ChescoViews" application). Assessor's maps are regularly updated maps drawn to scale and based on the latest recorded surveys and plats of the area. The maps have an aerial photography background and they offer a measuring tool so you can measure the dimensions for all sides of your property.

*Option 2 – Use Subdivision Plat Information or Deed Records*

Like the Tax Assessor's map, you may also look up your lot on the recorded plat that your property is within. The legal description of your property, which should be included on the deed, usually contains your property's lot or parcel number and the subdivision name in which your lot is located. In cases where the property is not within a subdivision plat, the legal description will likely be a 'metes and bounds' description that describes the perimeter of the property in greater detail, without reference to a plat. To find a copy of your deed, you can contact the Chester County Historical Society, which has inventories of deeds dating back to 1688. Note – this option is not likely to be the most efficient option, however, it is included here in the even that applicants choose to use it.

*Option 3 – Use Recent Building Records*

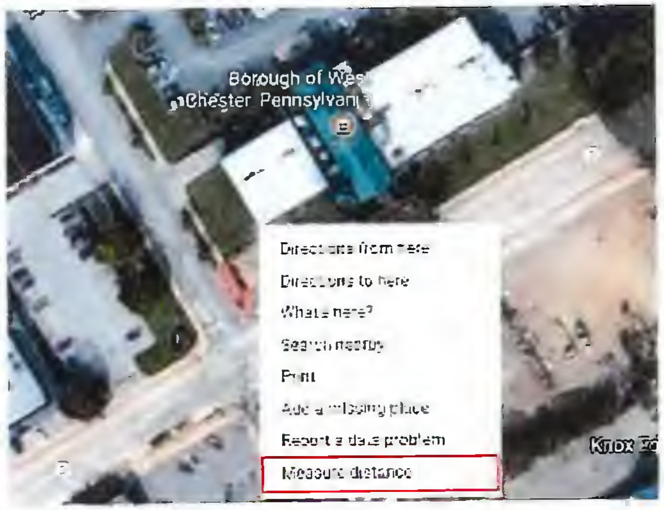
For newer constructed properties, using a previously approved site plan can save time when preparing your documentation. If there is a new structure on the property which required building permits, there is a possibility that the Borough may have an archived copy of the original building plans on file, including a site plan. You should make a request through the Borough's Department of Building, Housing, and Code Enforcement to obtain record site plans.

*Option 4 – Measure Your Property Yourself*

You can do this either by going outside with a tape measure and taking down measurements, or you can use an online program such as Google Maps' Measuring Tool on your computer.

*Directions to Use Measuring Tool in Google Maps*:

1. Open Google Maps in your internet browser.
2. Enter your address to zoom into your property.
3. Make sure you are in Satellite (aerial photography) mode so you can see your property's features.
4. Right-click on your starting point.
5. Choose Measure distance.
6. Click anywhere on the map to create and point and measure the distances between the two points. To add another point, click anywhere on the map. Drag the points to change/adjust your measurement or click any of the points to remove.
7. At the bottom of the Measure Distance dialogue box, you'll see the total distance in feet (ft) and/or total area in square feet (sf).
8. Right-click to find the Measuring Tool Menu and select Print. Print to a printer or Print to Save to a PDF if your computer has that option.






**Step 2: Determine the location of structures and other site features in relation to the property boundaries.**

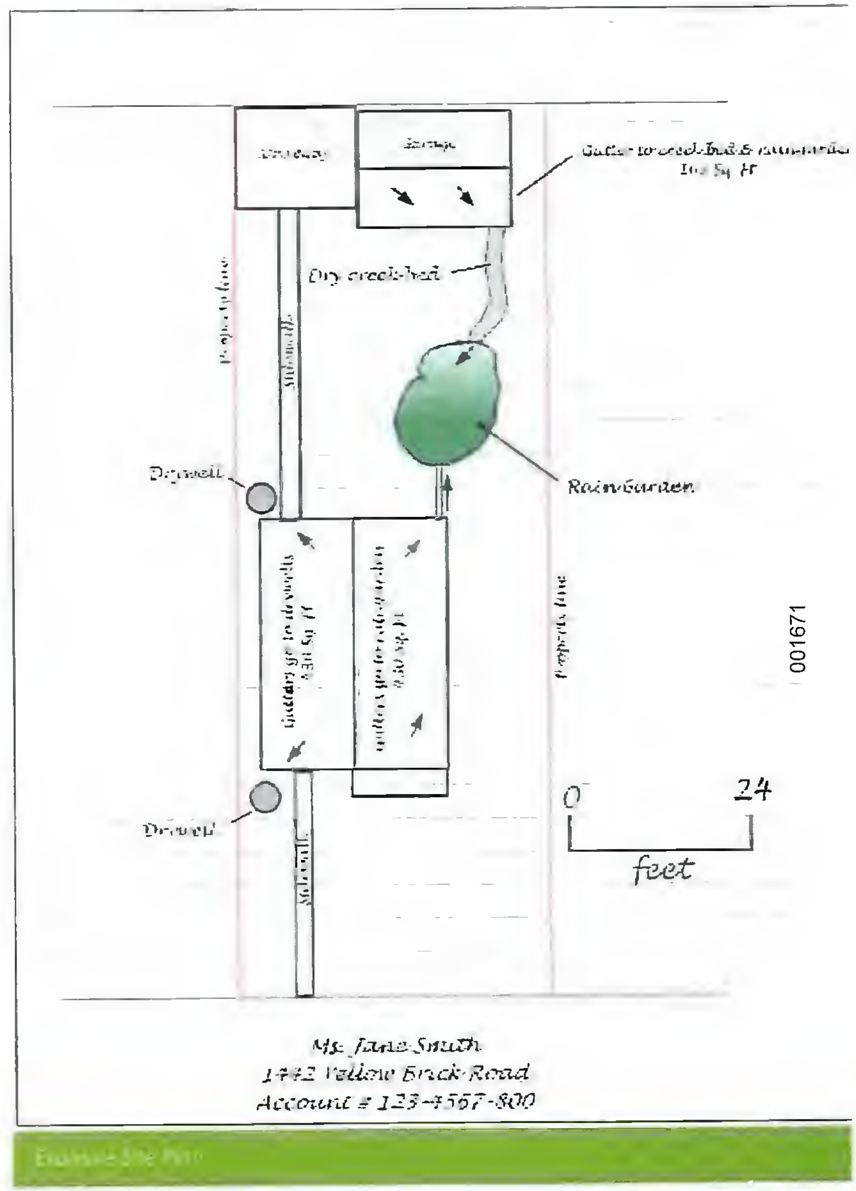
Using the property boundary location and dimension information gathered in Step 1, you must next determine the location of applicable existing buildings, streets, driveways, sidewalks, trees, and other site features in relation to the property boundaries. Measure the distance from these site features to the surrounding property lines. You can do this either with a tape measure or you can use an online program such as Google Maps' Measuring Tool on your computer.

**Step 3: Draw the plan.**

Use the information gathered in Steps 1 and 2 to prepare your site plan. You may draw your site plan by hand or use a computer graphics or drafting program. An example site plan template is provided in this Appendix for you to print and use if desired.

1. Determine Your Site Plan Scale and Orientation
    a. Using graph paper, choose a scale of measurement for the plan drawing so that one square = X feet. To ensure all information will fit on the page and be easy to read, a good example would be to have each block of the graph paper equal five (5) feet (or 1 inch = 25 feet). After choosing your scale of measurement, draw lines to show the house, driveway and any sidewalks on the plan. Write in the closest distances in feet of the lot lines to the house (i.e. building setbacks), and draw an arrow pointing north.

2. Add other Items that must be on the Plan such as the Property Owner Name and Address.
3. Draw Property Lines and Label all dimensions in feet.
4. Draw all Existing Buildings and Structures on the Plan (i.e., House, Garages, Sheds, etc.). These are your property's impervious areas (IA). Show distances between buildings and property lines. Label all dimensions in feet.
5. Draw Driveways, Parking Areas, Patios, Decks, and Sidewalks on the Plan. These are your property's additional impervious areas. Label all dimensions in feet.
6. Locate Existing Trees and Significant Landscape Elements
    a. Use a dot to indicate the approximate location of the tree and a circle to indicate the canopy coverage
    b. Landscape areas and planting beds can be drawn as solitary masses rather than individual plants/shrubs
7. Identify and draw the area of the site that will contain the existing or proposed SMP (i.e., rain garden, downspout disconnection, permeable pavement/drywell).
8. Then draw arrows depicting the flow direction of water as it runs off the property. The arrows should point downhill in the direction of the storm water flow.

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## Aerial Site Sketch

Draw a bird's-eye-view of your property including all impervious surfaces and existing structures. Draw arrows depicting the flow of water on the property and the proposed site of the rain garden.

Scale: 1 square = _______ feet

**KEY**

**Flow of Runoff**

**Structures/Surfaces**

**Rain Garden**

1979a

# Appendix B: How to Perform a Drainage Test

1. Know the exact location(s) on your property where you are planning to install your potential SMP(s) such as a rain garden. This potential SMP location will be where you conduct your drainage test. Drainage tests are done to test how fast your soil drains and determine suitability for stormwater SMPs.

2. **Do a PA One-Call at least three (3) business days prior to conducting your drainage test** so they can mark out all buried underground utilities, to reduce the risk of striking a utility line when digging.

   For more information: http://www.pa1call.org/pa811/Public/POCS_Content/About_Us/FAQS/FAQ.aspx or Dial 8-1-1 (or 1-800-242-1776).

3. Gather the following tools near the test location:
   a. Shovel or post-hole digger
   b. Hose and/or bucket (and water source)
   c. Yardstick, tape measure, or ruler
   d. Notepad and pen

Drainage Testing Process

*Note: More elaborate testing procedures per the Pennsylvania Stormwater Manual or other approved guidance documents are also acceptable):*

1. Use the shovel or post-hole digger to dig a hole and remove soil from the hole. Place the excavated soil nearby so the hole can be refilled after the test. Block off or otherwise prominently mark the hole location to prevent people from tripping/falling.

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2. Dig a hole that is at least 12 inches deep and at least 4 inches in diameter. If desired, place 2 inches of clean sand or gravel in the bottom of the hole to prevent scour in the bottom when being filled.

3. Using your water source, gently fill the hole with water and let it sit overnight. This saturates the soil and helps give a more accurate test reading.

4. The next day, gently refill the hole to the top with water. Measure the water level by laying a stick, pipe, or other straight edge across the top of the hole, then use a tape measure or yardstick to determine the starting water level. Check what time it is.

5. After an hour has passed, return to your test location to measure and record the depth of the water in the hole. Ideally, continue taking measurements at hourly increments for a few more hours or until all they water has drained.

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6. Check the hole to watch how long it takes to become empty. When it is empty, record the time.
   - **If the hole took <u>more than 48 hours</u> to drain completely, this typically indicates the site is <u>not suitable</u> for a stormwater SMP that relies on infiltration.** Another site will need to be chosen (and another drainage test conducted).
7. When the testing process is complete, the hole should be immediately backfilled with the excavated soil

# Exhibit A

To Brief

C.C: BOR COUNCIL, MAYOR
R. CAMP.
O.B. LAING

Pennsylvania's
**STATE SYSTEM**
of Higher Education

GOVERNOR'S OFFICE OF GENERAL COUNSEL
Office of Chief Counsel

RECEIVED
JAN 2 3 2017
BY:

January 18, 2018

Mr. Michael Perrone
Manager
Borough of West Chester
The Spellman Building
829 Paoli Pike
West Chester, PA 19380-4551

Re: Storm Water Management Fee
West Chester University of Pennsylvania

Dear Mr. Perrone:

I am Chief Counsel for Pennsylvania's State System of Higher Education ("State System"). As I am sure you are aware, West Chester University of Pennsylvania ("University") is one of fourteen (14) component universities of the State System.

I am writing to you to formally advise the Borough that the University will not be paying the storm water management fee invoices that the Borough sent to the University. As previously explained, the University is not legally authorized to pay those invoices because: (1) the Borough does not have the statutory authority to impose a storm water management fee on a Commonwealth entity, such as the University; and (2) even if such statutory authority existed, the Borough's storm water management fee is a tax, from which the University, as a Commonwealth entity, is immune.

Pursuant to the State System of Higher Education's enabling statute, the State System and its constituent universities are designated a "government instrumentality." 24 P.S. §20-2002-A(a). As an instrumentality of the Commonwealth, the University is a Commonwealth entity that is immune to local taxation unless the Pennsylvania General Assembly has expressly granted the political subdivision the authority to tax property owned by the Commonwealth.

In *Lehigh-Northampton Airport Authority v. Lehigh County Board of Assessment Appeals*, 889 A.2d 1168, 1172 (Pa. 2005), the Pennsylvania Supreme Court described the Commonwealth's tax immunity as follows:

> Because the power to tax is vested within the General Assembly, real estate is immune from local taxation unless that body has granted taxing authority to political subdivisions. Even where such local taxing power exists, property owned by the Commonwealth and its agencies remains unaffected by—or immune from—such power absent express statutory

> authorization to the contrary. *SEPTA v. Board of Revision of Taxes*, 833 A.2d 710, 713 ("It cannot be presumed that general statutory provisions giving local subdivisions the power to tax local real estate, were meant to include property owned by the Commonwealth..."); *see also Commonwealth v. Dauphin County*, 335 Pa. 177, 180-181, 6 A.2d 870, 872 (1939) (explaining that legislation generally does not affect the sovereign's rights unless it clearly intends to do so, and that, particularly in the context of taxation, any other rule could "upset the orderly processes of government by allowing the sovereign power to be burdened by municipal taxes").

The Borough's storm water management fees are not charges for actual services provided to the University by the Borough. Instead, they are the imposition of a general tax for the improvement and maintenance of the Borough's storm water infrastructure. As a result, these fees are a tax, regardless of what the Borough chooses to call them. The proper characterization of a governmental charge does not depend on what it has been called, but the purposes for which it has been enacted. *See Clement & Muller, Inc. v. Tax Review Board*, 659 A.2d 596 (Pa. Commonwealth Ct., 1995), *aff'd*, 715 A.2d 397 (Pa. 1998) (distinguishing a tax from a regulatory fee); *Philadelphia v. Southeastern Pennsylvania Transportation Authority*, 303 A.2d 247 (Pa. Commonwealth Ct., 1973) (distinguishing a tax from a license fee).

The Commonwealth pays neither for the general operations of local government nor for local infrastructure improvements, even though the Commonwealth may benefit from both. *Pittsburgh v. Sterrett Subdistrict School*, 54 A. 463 (Pa. Supreme Ct., 1903); *see also Southwest Delaware County Municipal Authority v. Aston Township*, 198 A.2d 867 (Pa. Supreme Ct., 1964); *McCandless Township Sanitary Authority v. PennDOT*, 488 A. 2d 367 (Pa. Commonwealth Ct., 1985).

In this case, none of the sources of legal authority for the imposition of storm water management fees stated in the Borough's ordinance contain the express statutory authority required.

Please let me know if there is anything further you need from the University on this matter.

Sincerely,

Andrew C. Lehman
Chief Counsel

ACL:mar

c: Jennifer Whare, Deputy General Counsel
Christopher M. Fiorentino, President
University Legal Counsel

I:\Legal\Protected\Chief Counsel\Misc\WC Borough Storm Water Management Fee.docx

# Exhibit B

To Brief

# IN THE COMMONWEALTH COURT OF PENNSYLVANIA

| | | |
|---|---|---|
| **THE BOROUGH OF WEST CHESTER** | : | |
| | : | |
| Plaintiff | : | Original Jurisdiction |
| | : | |
| *v.* | : | |
| | : | |
| **PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION** | : | |
| | : | |
| & | : | |
| | : | |
| **WEST CHESTER UNIVERSITY OF PENNSYLVANIA OF THE STATE SYSTEM OF HIGHER EDUCATION** | : | |
| | : | |
| Defendants | : | |

## <u>AFFIDAVIT</u>

I, Barbara Lionti, being duly sworn upon oath, depose and state as follows:

1. I am over eighteen (18) years of age and *sui juris*.

2. I have personal knowledge of the matters set forth in this Affidavit and am otherwise competent to testify to the matters and content set forth herein.

3. I hold a Bachelors' Degree in Accounting from Neumann University.

4. I am employed by The Borough of West Chester (the "<u>Borough</u>") as Finance Director for the Borough.

5. My business address is 401 East Gay Street, West Chester, Pennsylvania 19380.

6. I have served in my current position as Finance Director for the Borough since April 29, 2019.

7. Prior to assuming the position of Finance Director for the Borough, I served as Assistant Treasurer for the Borough from February 3, 2003 through June 26, 2017.

8. Prior to assuming the position of Assistant Treasurer for the Borough, I served as Cash Manager for the Borough from June 27, 20017 through April 28, 2019.

9. All told, I have been employed by the Borough in its financial administration for more than eighteen (18) years.

10. In my current position as Finance Director for the Borough, I report directly to the Borough Manager.

11. As part of my responsibilities as Finance Director for the Borough, I am familiar with the substance of Chapter 94A of the Borough Code (the "Stream Protection Ordinance").

12. In my current position as Finance Director for the Borough, I manage and supervise administrative financial aspects of Borough operations including, without limitation, (A) budgeting, (B) accounts receivable, (C) accounts payable, and (D) payroll

13. I am also, and have been since the inception thereof, the Borough employee responsible for billing and collection of the Stream Protection Fee, as defined and authorized pursuant to the Stream Protection Ordinance, and deposits to and payments from the Stormwater Management Fund, as defined and authorized pursuant to the Stream Protection Ordinance.

14. As part of the administration of the Stream Protection Fee under and pursuant to the Stream Protection Ordinance, the Borough established an account for each Developed Property (as that term is defined in the Stream Protection Ordinance) within the Borough.

15. As of the date of this Affidavit, there are 4,343 such accounts established for the purpose of billing and collection of the Stream Protection Fee (each, a "Stream Protection Fee Account" and, plurally, "Stream Protection Fee Accounts").

16. On an annual basis, the Borough transmits invoices for the Stream Protection Fee to the party responsible for payment under each Stream Protection Fee Account (each, a "Stream Protection Fee Invoice" and, plurally, the "Stream Protection Fee Invoices").

17. The amount of the Stream Protection Fee which is due under a given Stream Protection Fee Account is established in the manner as set forth in the Stream Protection Fee Ordinance.

18. As more fully set forth in the Stream Protection Fee Ordinance and, as applicable, (A) the Appeal Policies and Procedures Manual, (B) the West Chester Borough Stream Protection Fee Program Residential Credit and Rebate Policies and Procedures Manual, and (C) the West Chester Borough Stream Protection Fee Program Non-Residential Credit Policies and Procedures Manual (each of which is available on the Borough website at west-chester.com), the party responsible for payment under each Stream Protection Fee Account may apply for and, under certain circumstances, obtain a credit against or rebate of the Stream Protection Fee which is applicable to each Developed Property.

19. The aggregate amount of the Stream Protection Fee for all Stream Protection Fee Accounts in 2021 is One Million Three Hundred Forty Seven Thousand Seven Hundred Four and 66/100 Dollars ($1,347,704.66).

20. The annual average aggregate amount of the Stream Protection Fee for all Stream Protection Fee Accounts between 2017 and 2021 is One Thousand Five Hundred Forty-Three and 83/100 Dollars ($1,543.83).

21. As more fully identified on **Exhibit A** attached hereto and incorporated into this Affidavit, there are eighteen (18) Stream Protection Fee Accounts associated with that portion of the campus of West Chester University which is located within the jurisdictional limits of the

Borough and for which the party bearing payment responsibility is identified as either West Chester University or the Commonwealth of Pennsylvania (the "University-Related Stream Protection Fee Accounts").

22. The Borough prepared and transmitted to the party responsible for the same Stream Protection Fee Invoices for each of the University-Related Stream Protection Fee Accounts for each year between 2017 and 2021 (the "University-Related Stream Protection Fee Invoices").

23. The total aggregate amount of the Stream Protection Fee under and pursuant to all University-Related Stream Protection Fee Invoices between 2017 and 2021 is Six Hundred Sixty Thousand Four Hundred Forty-Three and 40/100 Dollars ($660,443.40).

24. The total amount of the Stream Protection Fee under and pursuant to the University-Related Stream Protection Fee Invoices for 2021 is One Hundred Thirty-Two Thousand Eighty-Eight and 68/100 Dollars ($132,088.68).

25. The total amount of the Stream Protection Fee under and pursuant to the University-Related Stream Protection Fee Invoices for 2020 is One Hundred Thirty-Two Thousand Eighty-Eight and 68/100 Dollars ($132,088.68).

26. The total amount of the Stream Protection Fee under and pursuant to the University-Related Stream Protection Fee Invoices for 2019 is One Hundred Thirty-Two Thousand Eighty-Eight and 68/100 Dollars ($132,088.68).

27. The total amount of the Stream Protection Fee under and pursuant to the University-Related Stream Protection Fee Invoices for 2018 is One Hundred Thirty-Two Thousand Eighty-Eight and 68/100 Dollars ($132,088.68).

28. The total amount of the Stream Protection Fee under and pursuant to the University-Related Stream Protection Fee Invoices for 2017 is One Hundred Thirty-Two Thousand Eighty-Eight and 68/100 Dollars ($132,088.68).

29. As of the date of this Affidavit, the University-Related Stream Protection Fee Invoices remain unpaid and outstanding.

30. The total and aggregate amount of the University-Related Stream Protection Fee Invoices between 2017 and 2021, as aforesaid, constitutes ten percent (10%) of the total and aggregate amount of the Stream Protection Fee for all Stream Protection Fee Accounts between 2017 and 2021.

31. Notwithstanding non-payment of the University-Related Stream Protection Fee Invoices, as aforesaid, the Borough has incurred and paid costs and expenses from the Stormwater Management Fund as contemplated and permitted pursuant to the Stream Protection Ordinance.

32. For 2021, and as more fully set forth on **Exhibit B** attached hereto and incorporated herein by reference, the budgeted expenditures from the Stormwater Management Fund totaled Two Million Fourteen Thousand Eight Hundred Eighty-Five and 00/100 Dollars ($2,014,885.00).

33. For 2020, and as more fully set forth on **Exhibit C** attached hereto and incorporated herein by reference, the budgeted expenditures from the Stormwater Management Fund totaled One Million Eight Hundred Forty-Three Thousand Seven Hundred Twenty Eight and 00/100 Dollars ($1,843,728.00) and the actual expenditures from the Stormwater Management Fund totaled One Million Two Hundred Twenty Nine Thousand Two Hundred Seventy-One and 97/100 Dollars ($1,229,271.97).

34. For 2019, and as more fully set forth on **Exhibit D** attached hereto and incorporated herein by reference, the budgeted expenditures from the Stormwater Management Fund totaled

Three Million Two Hundred Twenty Two Thousand Nine Hundred Sixty-Two and 00/100 Dollars ($3,222,962.00) and the actual expenditures from the Stormwater Management Fund totaled One Million Five Hundred Twenty Nine Thousand Seven Hundred Nine and 44/100 Dollars ($1,529,709.44).

35. For 2018, and as more fully set forth on **Exhibit E** attached hereto and incorporated herein by reference, the budgeted expenditures from the Stormwater Management Fund totaled Two Million Nine Hundred Fifty Eight Thousand Ninety Four and 00/100 Dollars ($2,958,094.00) and the actual expenditures from the Stormwater Management Fund totaled Two Million Five Hundred Thirty Eight Thousand Six Hundred Ninety-Nine and 94/100 Dollars ($2,538,699.94).

36. For 2017, and as more fully set forth on **Exhibit F** attached hereto and incorporated herein by reference, the budgeted expenditures from the Stormwater Management Fund totaled Two Million Two Hundred Four Thousand Eight Hundred Sixty-Six and 00/100 Dollars ($2,204,866.00) and the actual expenditures from the Stormwater Management Fund totaled One Million Two Hundred Ninety-Six Thousand Five Hundred Eighty-Four and 38/100 Dollars ($1,296,584.38).

37. For years 2019 through 2021, the Borough made transfers from the Stormwater Management Fund to reimburse the Borough General Fund for principal and interest expenses related to a 2016 Bond Issuance, the proceeds of which the Borough used for stormwater-related costs and expenses (the "2016 Bond Issuance").

38. For years 2017 and 2018, the Borough made transfers from the Stormwater Management Fund to reimburse the Borough General Fund for costs and expenses which the Borough incurred in establishing and starting operation of the stormwater-related program

contemplated pursuant to the Stream Protection Ordinance, as well as for principal and interest expenses related to the 2016 Bond Issuance.

39. The above information is true and correct to the best of my knowledge, information, and belief.

40. The undersigned understands that this statement is made subject to the penalties of 18 Pa.C.S. § 4904, relating to unsworn falsifications to authorities.

**FURTHER AFFIANT SAYETH NAUGHT.**

Date: July 15, 2021

**BARBARA LIONTI**

Sworn to (or affirmed) and subscribed before me this 15 day of July, 2021.

Notary Public

My Commission Expires: 4/24/2022

Commonwealth of Pennsylvania - Notary Seal
Dana C. DiDomenico, Notary Public
Chester County
My commission expires April 24, 2022
Commission number 1277114
Member, Pennsylvania Association of Notaries

# EXHIBIT A

To Affidavit of Barbara Lionti

**WEST CHESTER BOROUGH STREAM PROTECTION FEE**

| Account # | Customer Name | Service Address |
|---|---|---|
| 1-12-0243 | COMMONWEALTH OF PA | 175 UNIVERSITY AVENUE, WEST CHESTER, PA 19382 |
| 1-12-0250 | COMMONWEALTH OF PA | 25 W ROSEDALE AV, WEST CHESTER, PA 19382 |
| 1-12-0243-MH | COMMONWEALTH OF PENNSYLVANIA | 50 SHARPLESS ST, MCCARTHY HALL, WEST CHESTER, PA 19383 |
| 1-12-0244 | COMMONWEALTH OF PA | 25 UNIVERSITY AV, WEST CHESTER, PA 19382 |
| 1-12-0145 | GENERAL STATE AUTH | 300 W NIELDS ST, WEST CHESTER, PA 19382 |
| 1-13-0003 | WEST CHESTER UNIVERSITY OF PA THE STATE SYSTM OF HIGHER EDUC | 733 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-12-0244-1 | COMMONWEALTH OF PA | 675 S CHURCH ST, WEST CHESTER, PA 19382 |
| 1-09-1066 | COMMONWEALTH OF PA | 25 SHARPLESS ST, WEST CHESTER, PA 19382 |
| 1-12-0243-1 | WEST CHESTER UNIVERSITY | 628 S HIGH STREET , WEST CHESTER, PA 19383 |
| 1-12-0250-1 | COMMONWEALTH OF PA | 720 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-09-1085 | WEST CHESTER UNIVERSITY OF PA | 15 SHARPLESS ST, WEST CHESTER, PA 19382 |
| 1-12-0253 | COMMONWEALTH OF PA | 615 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-13-0001 | WEST CHESTER UNIVERSITY OF PA OF THE STATE ETAL | 701 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-13-0002 | WEST CHESTER UNIVERSITY OF PA OF THE STATE ETAL | 703 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-12-0247 | WEST CHESTER UNIVERSITY OF PA STATE SYSTEM OF HIGHER EDUCATI | 624 S HIGH ST, WEST CHESTER, PA 19382 |
| 1-13-0008 | WEST CHESTER UNIVERSITY OF PA OF THE STATE ETAL | 702 S WALNUT ST, WEST CHESTER, PA 19382 |
| 1-12-0246 | COMMONWEALTH OF PA | 13 UNIVERSITY AV, WEST CHESTER, PA 19382 |
| 1-12-0245 | WEST CHESTER UNIVERSITY | 15 UNIVERSITY AV, WEST CHESTER, PA 19382 |

# EXHIBIT B

To Affidavit of Barbara Lionti

DRAFT- VERSION DATED 11-11-2020

# Borough of West Chester
# Preliminary 2021 Budget

Borough of West Chester 2021 Budget
-Stream 16-

DRAFT- VERSION DATED 11-11-2020

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2019 ACTUAL | ACTUAL THRU 9/30/2020 | PROJECTED THRU 12/31/2020 | 2021 BUDGET | 2020 REVISED BUDGET | VARIANCE | % INCREASE/ (DECREASE) FROM P/Y | LINE ITEM DETAIL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| REVENUE | | | | | | | | | | | |
| 16 | 16 | 30000 | REVENUE CARRYOVER | - | - | | 1,050,000 | 507,728 | 542,272 | 107% | PLUM RUN CARRYO |
| 16 | 16 | 35504 | GREENVIEW GRANT CARRYOVER | | | | 60,135 | | | | |
| 16 | 16 | 34100 | INTEREST INCOME | 6,241 | 89 | 100 | 750 | 1,500 | (750) | -50% | |
| 16 | 16 | 38009 | TAX REV - CERTS | 3,715 | 285 | 4,500 | 4,000 | 4,500 | (500) | -11% | |
| 16 | 16 | 38015 | STREAM REVENUE | 1,334,544 | 858,520 | 1,330,000 | 900,000 | 1,330,000 | (430,000) | -32% | |
| TOTAL REVENUE | | | | 1,344,500 | 858,894 | 1,334,600 | 2,014,885 | 1,843,728 | 111,022 | 6% | |
| TOTAL REVENUE | | | | 1,344,500 | 858,894 | 1,334,600 | 2,014,885 | 1,843,728 | 111,022 | 6% | |
| EXPENSES | | | | | | | | | | | |
| PAYROLL RELATED EXPENSES | | | | | | | | | | | |
| 16 | 16 | 49525 | SALARIES SPF | 75,129 | 20,466 | 56,600 | 40,000 | 56,600 | (16,600) | -29% | |
| 16 | 16 | XXXXX | SALARIES SHARED W/ PW | 44,469 | - | - | 95,000 | - | 95,000 | #DIV/0! | |
| 16 | 16 | 48720 | FICA | 5,530 | - | 4,330 | 10,328 | 4,330 | 5,998 | 139% | |
| TOTAL PAYROLL RELATED EXPENSES | | | | 125,127 | 20,466 | 60,930 | 145,328 | 60,930 | 84,398 | 139% | |
| STREAM EXPENSES | | | | | | | | | | | |
| 16 | 16 | 40122 | MUNIBILLING | - | 234 | - | 10,000 | - | 10,000 | #DIV/0! | |
| 16 | 16 | 42007 | PROFESSIONAL FEES | | | | 68,883 | | | | |
| 16 | 16 | 45540 | TREE PLANTING | | 21,692 | 50,000 | 25,000 | 50,000 | (25,000) | -50% | PLUM RUN CARRYO |
| 16 | 16 | 40410 | LEGAL | 2,644 | - | - | 65,000 | - | 65,000 | #DIV/0! | |
| 16 | 16 | 43620 | STORMWATER FACILITIES MAINT. | 6,748 | 16,289 | | 95,000 | - | 95,000 | #DIV/0! | |
| 16 | 16 | 43621 | EMERG STORMWATER FACILITY REPAIRS | 219,495 | - | - | 60,000 | - | 60,000 | #DIV/0! | |
| 16 | 16 | 43622 | NORTH HIGH STREET STORM SEWER PROJECT | - | - | - | 28,750 | - | 28,750 | #DIV/0! | |
| 16 | 16 | 43623 | LINDEN/FRANKLIN CULVERT PROJECT-ENGINEERING | - | - | - | 130,000 | - | 130,000 | #DIV/0! | engineering fees |
| 16 | 16 | 43625 | W. WASH/HANNUM STORM SEWER EXTENSION | - | - | | 230,000 | - | 230,000 | #DIV/0! | |
| 16 | 16 | 43628 | NORTH HILLSIDE/GOSHEN RD | | | | 220,000 | | | | |
| 16 | 16 | 43627 | GREENVIEW ALLEY - CARRYOVER | - | - | | 60,135 | - | 60,135 | #DIV/0! | |
| 16 | 16 | 44925 | PLUM RUN CARRYOVER | | | | 700,000 | | | | |
| 16 | 16 | 48951 | REFUNDS | 995 | 1,995 | 2,000 | 1,500 | 1,000 | 500 | 50% | |
| 16 | 16 | 44921 | INLET REPLACEMENTS | 389,451 | - | 10,647 | 61,507 | - | 61,507 | #DIV/0! | |
| TOTAL STREAM EXPENSES | | | | 619,333 | 40,210 | 62,647 | 1,755,775 | 51,000 | 715,892 | 1404% | |
| INTERFUND OPERATING TRANSFERS | | | | | | | | | | | |
| 16 | 16 | 44570 | TRF TO GENERAL FUND | 595,000 | - | 113,783 | 113,783 | 115,783 | (2,001) | -2% | |
| TOTAL INTERFUND OPERATING TRANSFERS | | | | 595,000 | - | 113,783 | 113,783 | 115,783 | (2,001) | -2% | |
| TOTAL EXPENSES | | | | 1,339,460 | 60,676 | 237,360 | 2,014,885 | 227,713 | - | 0% | |
| NET INCOME/(LOSS) | | | | 5,040 | 798,218 | 1,097,240 | - | 1,616,015 | 111,022 | 7% | |

# EXHIBIT C

To Affidavit of Barbara Lionti

# Borough of West Chester
# Revised 2020 Budget

**2020 Revised Budget Summary of Changes**

Original 2020 Budget: $47,897,327

Revised 2020 Budget: $38,881,187

| | 2020 ORIGINAL | 2020 REVISED | VARIANCE |
|---|---|---|---|
| General Fund | 20,729,737 | 17,785,656 | 2,944,081 |
| Recreation | 938,395 | 447,612 | 490,783 |
| FIRE | 1,242,531 | 1,242,531 | - |
| Parking | 5,468,802 | 3,917,302 | 1,551,500 |
| Waste Water | 6,225,147 | 5,985,041 | 240,106 |
| Capital Improv | 3,521,500 | 1,540,000 | 1,981,500 |
| Stream Protection | 2,965,036 | 1,843,728 | 1,121,308 |
| Highway Aid | 459,630 | 450,706 | 8,924 |
| OPEB | 270,000 | 200,000 | 70,000 |
| EQUIPMENT | 2,585,438 | 2,025,500 | 559,938 |
| POLICE PENSION | 2,476,209 | 2,418,209 | 58,000 |
| NONUNIFORM PENSION | 1,014,902 | 1,024,902 | (10,000) |
| TOTAL | 47,897,327 | 38,881,187 | 9,016,140 |

The 2020 Budget has been revised to account for the following :

- 10% Reduction in Tax Revenues
- 28% reduction in Parking Revenues
- 4% Reduction in Sewer Rentals based on C/Y collections
- Cancellation of all major events
- Reduction to Stream Protection Fund (reallocation of Bond monies for fire truck and loss of grant monies)
- Reduction in Green Light GO Grant Revenue: $688,000
- Reduction in Capital Purchases: $1,344,438
- Reduction in Non-Essential Spending: $1,773,557
- Reduction in Salary Expense (furloughs/layoffs/open pos.): $731,779

# Borough of West Chester 2020 Budget

## -Stream 16-

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2020 REVISED BUDGET | 2020 ORIGINAL BUDGET | 2019 BUDGET |
|---|---|---|---|---|---|---|
| **REVENUE** | | | | | | |
| 16 | 16 | 30000 | REVENUE CARRYOVER | 507,728 | 507,728 | 475,713 |
| 16 | 16 | 34100 | INTEREST INCOME | 1,500 | 2,500 | 60,000 |
| 16 | 16 | 38000 | MISCELLANEOUS REVENUE | - | 1,000 | 1,000 |
| 16 | 16 | 38009 | TAX REV - CERTS | 4,500 | 4,500 | 2,000 |
| 16 | 16 | 38015 | STREAM REVENUE | 1,330,000 | 1,375,000 | 1,400,000 |
| 16 | 16 | 38050 | GRANT - STREAM GREEN (DEP) | - | 260,135 | 534,855 |
| 16 | 16 | 39350 | BOND PROCEEDS - CARRYOVER | - | 814,173 | **750,000** |
| **Total REVENUE** | | | | **1,843,728** | **2,965,036** | **3,223,568** |
| **TOTAL REVENUE** | | | | **1,843,728** | **2,965,036** | **3,223,568** |
| **EXPENSES** | | | | | | |
| **PAYROLL RELATED EXPENSES** | | | | | | |
| 16 | 16 | 49525 | SALARIES SPF | 56,600 | 66,830 | 66,949 |
| 16 | 16 | XXXXX | SALARIES SHARED W/ PW | - | 99,657 | 99,567 |
| 16 | 16 | 48600 | INS WORKERS COMP | - | 14,402 | 12,523 |
| | 16 | 48715 | DEFINED PENSION CONTRIBUTION | 2,830 | 3,342 | - |
| 16 | 16 | 48700 | INS EMPLOYEE BENEFIT | - | 27,775 | 26,707 |
| 16 | 16 | 48720 | FICA | 4,330 | 12,736 | 12,739 |
| **Total PAYROLL RELATED EXPENSES** | | | | **63,760** | **224,742** | **218,485** |
| **STREAM EXPENSES** | | | | | | |
| 16 | 16 | 40121 | OFFICE SUPPLIES/EXPENSE | - | 12,000 | - |
| 16 | 16 | 40122 | POSTAGE/PRINTING | - | 1,000 | - |
| 16 | 16 | 40133 | OTHER EXPENSE | | 750 | - |
| 16 | 16 | 42007 | PROFESSIONAL FEES | 13,185 | 245,000 | 157,950 |
| 16 | 16 | 45540 | TREE MAINTENANCE | 50,000 | 50,000 | - |
| 16 | 16 | XXXXX | LEGAL | - | - | 30,000 |
| 16 | 16 | 43620 | STORM DRAIN MATERIALS | - | 157,500 | - |
| 16 | 16 | 48951 | REFUNDS | 1,000 | 5,000 | - |
| 16 | 16 | XXXXX | INLET REPLACEMENTS | - | - | 525,000 |

# Borough of West Chester 2020 Budget

## -Stream 16-

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2020 REVISED BUDGET | 2020 ORIGINAL BUDGET | 2019 BUDGET |
|---|---|---|---|---|---|---|
| 16 | 16 | 44915 | GREEN STREAM INFRASTRUCTURE-JOHN O GREEN | 750,000 | 750,000 | - |
| 16 | 16 | XXXXX | GOOSE CREEK SEWER MAIN CLEANING | - | 20,000 | |
| 16 | 16 | 48610 | INS GENERAL & LIABILITY - BOROUGH | - | 1,261 | - |
| 16 | 16 | 44920 | STORM SEWER REHAB PROJECTS | - | 532,000 | - |
| 16 | 16 | 44925 | STREAM BANK STABILIZATION PROJECT | 850,000 | 850,000 | - |
| **Total STREAM EXPENSES** | | | | **1,664,185** | **2,624,511** | **712,950** |
| **INTERFUND OPERATING TRANSFERS** | | | | | | |
| 16 | 16 | 44562 | TRF TO EQUIP & TECH FUND | - | - | - |
| 16 | 16 | 44568 | TRF TO CAPITAL IMP FUND | - | - | 2,180,000 |
| 16 | 16 | 44570 | TRF TO GENERAL FUND | 115,783 | 115,783 | 112,133 |
| **TOTAL INTERFUND OPERATING TRANSFERS** | | | | **115,783** | **115,783** | **2,292,133** |
| **Total EXPENSES** | | | | **1,843,728** | **2,965,036** | **3,223,568** |
| **NET INCOME/(LOSS)** | | | | **0** | **-** | **-** |

**Borough of West Chester**
Normal Trial Balance
From 12/31/2020 Through 12/31/2020

| Fund Code | GL Code | Fund Title | GL Title | Debit Balance | Credit Balance |
|---|---|---|---|---|---|
| 16 | 40121 | STREAM FUND | OFFICE SUPPLIES/EXPENSE | 1,482.09 | |
| 16 | 40122 | STREAM FUND | POSTAGE/PRINTING | 233.67 | |
| 16 | 40133 | STREAM FUND | OTHER EXPENSE | 0.00 | |
| 16 | 40140 | STREAM FUND | BANK FEES | 2,004.83 | |
| 16 | 40430 | STREAM FUND | LEGAL OTHER | 0.00 | |
| 16 | 40931 | STREAM FUND | UTILITIES | 130.41 | |
| 16 | 42007 | STREAM FUND | PROFESSIONAL FEES | 47,304.17 | |
| 16 | 42011 | STREAM FUND | CONSULTANTS | 0.00 | |
| 16 | 43013 | STREAM FUND | CAPITAL PURCHASES | 10,647.27 | |
| 16 | 43620 | STREAM FUND | STORM DRAIN MATERIALS | 8,714.51 | |
| 16 | 43825 | STREAM FUND | SALARIES - OT REGULAR | 1,643.30 | |
| 16 | 44570 | STREAM FUND | TRF TO GENERAL FUND | 135,000.00 | |
| 16 | 44915 | STREAM FUND | GREEN STREAM INFRASTRUCTURE | 721,683.84 | |
| 16 | 44920 | STREAM FUND | STORM SEWER REHAB PROJECTS | 0.00 | |
| 16 | 44921 | STREAM FUND | INLET REPLACEMENT | 0.00 | |
| 16 | 44925 | STREAM FUND | STREAM BANK STABILIZATION PROJ | 221,719.25 | |
| 16 | 45540 | STREAM FUND | TREE EXPENSES | 41,926.55 | |
| 16 | 48600 | STREAM FUND | INS WORKERS COMP | 10.62 | |
| 16 | 48610 | STREAM FUND | INS GENERAL & LIABILITY | 618.51 | |
| 16 | 48700 | STREAM FUND | INS EMPLOYEE BENEFIT | 12,651.19 | |
| 16 | 48715 | STREAM FUND | PENSION PAYMENTS | 1,046.06 | |
| 16 | 48720 | STREAM FUND | SOCIAL SECURITY / MEDICARE | 1,354.79 | |
| 16 | 48950 | STREAM FUND | FOREIGN FIRE INSURANCE | 200.00 | |
| 16 | 48951 | STREAM FUND | REFUNDS | 2,077.92 | |
| 16 | 49525 | STREAM FUND | SALARIES STREAM | 18,822.99 | |
| Total 16 | | STREAM FUND | | 1,229,271.97 | 0.00 |
| Report Total | | | | 1,229,271.97 | 0.00 |
| Report Difference | | | | 1,229,271.97 | |

2003a

# EXHIBIT D

To Affidavit of Barbara Lionti

# BOROUGH OF WEST CHESTER

# 2019 LINE ITEM BUDGET

# *FINAL VERSION*

# APPROVED NOVEMBER 21, 2018

# FINAL Budget 2019 Overview

The following is a general overview/summary of the **APPROVED FINAL VERSION** of the 2019 line item budget.

1) **Revenue remained consistent with 2018 except for the following areas**:

- Real Estate Tax Revenue- increased by 4% due to Borough valuation and collection increases. There is **NO TAX RATE** increase in the 2019 proposed budget.
- Earned Income Tax- increased by 4% due to increased wage base in the Borough as well a Municipal **rate increase** (not school district) in the 2019 proposed budget. This **rate increase** goes from **0.50 to 0.75. This will generate approximately $1.7MM which will be restricted to the pay down of the unfunded pension and OPEB liabilities.**
- PW Building Financing- $4MM added for a new Public Works facility
- Fire Inspection Fees Revenue- increased fees to be generated through new Fire Inspector position in the Building and Housing department.

2) **Salaries and Employees:**

- Wage Increases- 3% per contractual increases for AFSCME/Police Brotherhood employees. A "Pay Rate Increase Pool" is budgeted for Non-Uniform employees.
- New Employees Requested-
  - Fire Inspector (Building and Housing)
  - Part-Time Receptionist (Administration)

3) **Employee Benefits:**

- Medical Insurance- 2.6% increase over 2018 actual premiums included.
- Workers Compensation/General Insurance- assumed a 15% increase over 2018 premiums.

## -Stream 16-

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2019 BUDGET | 2018 BUDGET | VARIANCE |
|---|---|---|---|---|---|---|
| **REVENUE** | | | | | | |
| **MISCELLANEOUS REVENUE** | | | | | | |
| 16 | 16 | 30000 | REVENUE CARRYOVER | 475,107 | 774,866 | (299,759) |
| 16 | 16 | 34100 | INTEREST INCOME | 60,000 | 70,000 | (10,000) |
| 16 | 16 | 38000 | MISCELLANEOUS REVENUE | 1,000 | 1,000 | - |
| 16 | 16 | 38009 | TAX REV - CERTS | 2,000 | 2,000 | - |
| 16 | 16 | 38015 | STREAM REVENUE | 1,400,000 | 1,429,000 | (29,000) |
| 16 | 16 | 38050 | GRANT - STREAM GREEN (DEP) | 534,855 | 220,731 | 314,124 |
| 16 | 16 | 39350 | BOND PROCEEDS - CARRYOVER | 750,000 | 460,497 | 289,503 |
| **Total MISCELLANEOUS REVENUE** | | | | **3,222,962** | **2,958,094** | **264,868** |
| **TOTAL REVENUE** | | | | **3,222,962** | **2,958,094** | **264,868** |
| **EXPENSES** | | | | | | |
| **PAYROLL RELATED EXPENSES** | | | | | | |
| 16 | 16 | 49525 | SALARIES SPF PROGRAM COORDINATOR | 66,949 | - | (66,949) |
| 16 | 16 | XXXXX | SALARIES SHARED W/ PW | 99,567 | 70,996 | (28,571) |
| 16 | 16 | 48600 | INS WORKERS COMP | 12,524 | 10,890 | (1,634) |
| 16 | 16 | 48700 | INS EMPLOYEE BENEFIT | 26,102 | 12,779 | (13,322) |
| 16 | 16 | 48720 | FICA | 12,739 | 5,431 | (7,307) |
| **Total PAYROLL RELATED EXPENSES** | | | | **217,880** | **100,096** | **(117,784)** |
| **STREAM EXPENSES** | | | | | | |
| 16 | 16 | 40121 | OFFICE SUPPLIES/EXPENSE | | 800 | 800 |
| 16 | 16 | 40122 | POSTAGE/PRINTING | | 800 | 800 |
| 16 | 16 | 40133 | OTHER EXPENSE | | 800 | 800 |
| 16 | 16 | 42007 | PROFESSIONAL FEES | 157,950 | 95,000 | (62,950) |
| 16 | 16 | XXXXX | LEGAL | 30,000 | - | (30,000) |
| 16 | 16 | 43620 | STORM DRAIN MATERIALS | | 32,000 | 32,000 |
| 16 | 16 | 48951 | REFUNDS | | 1,000 | 1,000 |
| 16 | 16 | XXXXX | INLET REPLACEMENTS | 525,000 | - | (525,000) |
| 16 | 16 | 44915 | GREEN STREAM INFRASTRUCTURE | - | 1,003,316 | 1,003,316 |
| 16 | 16 | 44920 | STORM SEWER REHAB PROJECTS | | 350,000 | 350,000 |

# -Stream 16-

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2019 BUDGET | 2018 BUDGET | VARIANCE |
|---|---|---|---|---|---|---|
| 16 | 16 | 44925 | STREAM BANK STABILIZATION PROJECT | | 579,434 | 579,434 |
| **Total STREAM EXPENSES** | | | | **712,950** | **2,063,150** | **1,350,200** |
| | | | | | | |
| **INTERFUND OPERATING TRANSFERS** | | | | | | |
| 16 | 16 | 44568 | TRF TO CAPITAL IMP FUND | 2,180,000 | - | |
| 16 | 16 | 44570 | TRF TO GENERAL FUND | 112,133 | 794,848 | 682,716 |
| **TOTAL INTERFUND OPERATING TRANSFERS** | | | | **2,292,133** | **794,848** | **(1,497,285)** |
| | | | | | | |
| **Total EXPENSES** | | | | **3,222,963** | **2,958,094** | **(264,868)** |
| | | | | | | |
| **NET INCOME/(LOSS)** | | | | **(1)** | **(0)** | **(0)** |

**Borough of West Chester**
Normal Trial Balance
From 12/31/2019 Through 12/31/2019

| Fund Code | GL Code | Fund Title | GL Title | Debit Balance | Credit Balance |
|---|---|---|---|---|---|
| 16 | 40121 | STREAM FUND | OFFICE SUPPLIES/EXPENSE | 59.87 | |
| 16 | 40133 | STREAM FUND | OTHER EXPENSE | 3,531.15 | |
| 16 | 40140 | STREAM FUND | BANK FEES | 1,511.74 | |
| 16 | 40410 | STREAM FUND | LEGAL FEES - SOLICITOR | 2,201.50 | |
| 16 | 40430 | STREAM FUND | LEGAL OTHER | 442.25 | |
| 16 | 40931 | STREAM FUND | UTILITIES | 50.99 | |
| 16 | 42007 | STREAM FUND | PROFESSIONAL FEES | 146,282.75 | |
| 16 | 42011 | STREAM FUND | CONSULTANTS | 358.00 | |
| 16 | 42722 | STREAM FUND | SAL EXP- SPF ALLOCATION | 44,468.78 | |
| 16 | 43013 | STREAM FUND | CAPITAL PURCHASES | 211,387.35 | |
| 16 | 43620 | STREAM FUND | STORM DRAIN MATERIALS | 6,748.12 | |
| 16 | 43825 | STREAM FUND | SALARIES - OT REGULAR | 7,328.51 | |
| 16 | 44570 | STREAM FUND | TRF TO GENERAL FUND | 595,000.00 | |
| 16 | 44915 | STREAM FUND | GREEN STREAM INFRASTRUCTURE | 462.87 | |
| 16 | 44920 | STREAM FUND | STORM SEWER REHAB PROJECTS | 219,495.49 | |
| 16 | 44921 | STREAM FUND | INLET REPLACEMENT | 178,063.29 | |
| 16 | 44925 | STREAM FUND | STREAM BANK STABILIZATION PROJ | 357.50 | |
| 16 | 45836 | STREAM FUND | TRAINING/MILEAGE | 237.94 | |
| 16 | 48600 | STREAM FUND | INS WORKERS COMP | 4,557.82 | |
| 16 | 48610 | STREAM FUND | INS GENERAL & LIABILITY | 2,625.27 | |
| 16 | 48700 | STREAM FUND | INS EMPLOYEE BENEFIT | 27,007.99 | |
| 16 | 48715 | STREAM FUND | PENSION PAYMENTS | 3,077.00 | |
| 16 | 48720 | STREAM FUND | SOCIAL SECURITY / MEDICARE | 5,529.70 | |
| 16 | 48730 | STREAM FUND | PENSION CONTRIBUTIONS | 128.50 | |
| 16 | 48951 | STREAM FUND | REFUNDS | 994.65 | |
| 16 | 49525 | STREAM FUND | SALARIES STREAM | 67,800.41 | |
| Total 16 | | STREAM FUND | | 1,529,709.44 | 0.00 |
| Report Total | | | | 1,529,709.44 | 0.00 |
| Report Difference | | | | 1,529,709.44 | |

2010a

# EXHIBIT E

To Affidavit of Barbara Lionti

# BOROUGH OF WEST CHESTER

# 2018 BUDGET – FINAL


**PREPARED BY:**
Michael Perrone, Borough Manager
Jeff DaSilva, Finance Director
Lori Coles, Financial Analyst

# FINAL Budget 2018 Overview

e following is an overview/summary of the FINAL 2018 line item budget.

1) Revenue remained consistent with 2017 except for the following areas:
   - Real Estate Tax Revenue – increased by 3.5% due to Borough valuation and collection increases. There is NO TAX RATE increase in the 2018 budget.
   - Earned Income Tax - increased by 3.5% due to increased wage base in the Borough. There is NO TAX RATE increase in the 2018 budget.
   - Bond Proceeds – $2MM added for Borough Hall renovations.
   - Loan Proceeds – $2.5MM added for Borough Hall renovations.
   - Grant Revenue – increased grant revenues assuming consulting resources utilized.
2) Salaries and Employees:
   Wage Increases –all wage/salary increases applied based on either contractual requirements or Borough Manager/Council directive (specific to non contractual employee status). New Employees Requested – ***No new employees in the 2018 FINAL Budget.***
3) Employee Benefits:
   Medical Insurance – assumed a 0.7% increase over 2017 premiums.
   Workers Compensation - assumed a 21% increase over 2017 premiums. Final increase information will not be available until the end of December time frame.
4) Building Renovations:
   Budget includes $7.0MM for renovations of Borough Hall. Funding derives from the following sources:
   1) 4.5MM from the 2016 Bond Issuance.
   2) 2.5MM from Loan Proceeds but based on recent contractor quotes we may not need to obtain nearly this much.

5.) Capital Budget:
   Includes:
   $7,000,000 Renovations
   $ 733,000 Vehicles 8 plus one trailer
   $ 500,000 PW projects
   $ 153,000 Park renovations(Recreation)
   $ 401,000 WW plant upgrades/maintenance projects
   $ 660,000 Parking garage repairs, tech upgrades or replacements, master parking plan implementation

**Borough of West Chester**

# 2018 Budget Package

# Borough of West Chester 2018 Budget - FINAL
## - Stream 16 -

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2018 BUDGET |
|---|---|---|---|---|
| **REVENUE** | | | | |
| **MISCELLANEOUS REVENUE** | | | | |
| 16 | 16 | 30000 | REVENUE CARRYOVER | 774,866 |
| 16 | 16 | 34100 | INTEREST INCOME | 70,000 |
| 16 | 16 | 38000 | MISCELLANEOUS REVENUE | 1,000 |
| 16 | 16 | 38009 | TAX REV - CERTS | 2,000 |
| 16 | 16 | 38015 | STREAM REVENUE | 1,429,000 |
| 16 | 16 | 38050 | GRANT - STREAM GREEN (DEP) | 220,731 |
| 16 | 16 | 39350 | BOND PROCEEDS | 460,497 |
| **Total MISCELLANEOUS REVENUE** | | | | **2,958,094** |
| **TOTAL REVENUE** | | | | **2,958,094** |
| **EXPENSES** | | | | |
| **PAYROLL RELATED EXPENSES** | | | | |
| 16 | 16 | 49525 | SALARIES STREAM | 70,996 |
| 16 | 16 | 48600 | INS WORKERS COMP | 10,890 |
| 16 | 16 | 48700 | INS EMPLOYEE BENEFIT | 12,779 |
| 16 | 16 | 48720 | SOCIAL SECURITY | 5,431 |
| **Total PAYROLL RELATED EXPENSES** | | | | **100,096** |
| **STREAM EXPENSES** | | | | |
| 16 | 16 | 40121 | OFFICE SUPPLIES/EXPENSE | 800 |
| 16 | 16 | 40122 | POSTAGE/PRINTING | 800 |
| 16 | 16 | 40133 | OTHER EXPENSE | 800 |
| 16 | 16 | 42007 | PROFESSIONAL FEES | 95,000 |
| 16 | 16 | 43620 | STORM DRAIN MATERIALS | 32,000 |
| 16 | 16 | 48951 | REFUNDS | 1,000 |
| 16 | 16 | 44915 | GREEN STREAM INFRASTRUCTURE | 1,003,316 |
| 16 | 16 | 44920 | STORM SEWER REHAB PROJECTS | 350,000 |
| 16 | 16 | 44925 | STREAM BANK STABILIZATION PROJECT | 579,434 |

# Borough of West Chester 2018 Budget - FINAL
## - Stream 16 -

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2018 BUDGET |
|---|---|---|---|---|
| **Total STREAM EXPENSES** | | | | **2,063,150** |
| **INTERFUND OPERATING TRANSFERS** | | | | |
| 16 | 16 | 44570 | TRF TO GENERAL FUND | 794,848 |
| **TOTAL INTERFUND OPERATING TRANSFERS** | | | | **794,848** |
| **Total EXPENSES** | | | | **2,958,094** |
| **NET INCOME/(LOSS)** | | | | **(0)** |

**Borough of West Chester**
Normal Trial Balance
From 12/31/2018 Through 12/31/2018

| Fund Code | GL Code | Fund Title | GL Title | Debit Balance | Credit Balance |
|---|---|---|---|---|---|
| 16 | 40121 | STREAM FUND | OFFICE SUPPLIES/EXPENSE | 453.00 | |
| 16 | 40122 | STREAM FUND | POSTAGE/PRINTING | 2,868.17 | |
| 16 | 40133 | STREAM FUND | OTHER EXPENSE | 369.61 | |
| 16 | 40140 | STREAM FUND | BANK FEES | 4,724.70 | |
| 16 | 40430 | STREAM FUND | LEGAL OTHER | 138.25 | |
| 16 | 42007 | STREAM FUND | PROFESSIONAL FEES | 264,614.78 | |
| 16 | 43020 | STREAM FUND | CAP PURCH - IMPROV OT BLDGS | 132,703.22 | |
| 16 | 43620 | STREAM FUND | STORM DRAIN MATERIALS | 48,296.12 | |
| 16 | 43825 | STREAM FUND | SALARIES - OT REGULAR | 736.61 | |
| 16 | 44570 | STREAM FUND | TRF TO GENERAL FUND | 794,848.00 | |
| 16 | 44915 | STREAM FUND | GREEN STREAM INFRASTRUCTURE | 1,022,401.50 | |
| 16 | 44920 | STREAM FUND | STORM SEWER REHAB PROJECTS | 193,848.93 | |
| 16 | 44921 | STREAM FUND | INLET REPLACEMENT | 1,023.08 | |
| 16 | 45836 | STREAM FUND | TRAINING/MILEAGE | 203.72 | |
| 16 | 48600 | STREAM FUND | INS WORKERS COMP | 2,783.16 | |
| 16 | 48610 | STREAM FUND | INS GENERAL & LIABILITY | 1,096.40 | |
| 16 | 48700 | STREAM FUND | INS EMPLOYEE BENEFIT | 2,267.95 | |
| 16 | 48715 | STREAM FUND | PENSION PAYMENTS | 2,375.00 | |
| 16 | 48720 | STREAM FUND | SOCIAL SECURITY / MEDICARE | 4,176.09 | |
| 16 | 48951 | STREAM FUND | REFUNDS | 2,030.27 | |
| 16 | 49525 | STREAM FUND | SALARIES STREAM | 56,741.38 | |
| Total 16 | | STREAM FUND | | 2,538,699.94 | 0.00 |
| Report Total | | | | 2,538,699.94 | 0.00 |
| Report Difference | | | | 2,538,699.94 | |

2017a

# EXHIBIT F

To Affidavit of Barbara Lionti

# Borough of West Chester

# Approved Budget 2017

# ***FINAL***

# Borough of West Chester
## FINAL Approved Budget 2017
## TABLE OF CONTENTS



2020a

FINAL

Borough of West Chester
Departmental Budget 2017
STREAM (Dept 16, Fund 16)

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2017 BUDGET | 2016 BUDGET | PROPOSAL |
|---|---|---|---|---|---|---|
| REVENUE | | | | | | |
| MISCELLANEOUS REVENUE | | | | | | |
| 16 | 16 | 38015 | STREAM REVENUE | 1,430,000 | 421,000 | |
| 16 | 16 | 39350 | BOND PROCEEDS | 774,866 | 2,000,000 | |
| Total MISCELLANEOUS REVENUE | | | | 2,204,866 | 2,421,000 | |
| TOTAL REVENUE | | | | 2,204,866 | 2,421,000 | |
| EXPENSES | | | | | | |
| PAYROLL RELATED EXPENSES | | | | | | |
| 16 | 16 | 49525 | SALARIES STREAM | 170,996 | 225,000 | |
| 16 | 16 | 48600 | INS WORKERS COMP | 9,000 | - | 600 |
| 16 | 16 | 48700 | INS EMPLOYEE BENEFIT | 30,000 | - | 600 |
| 16 | 16 | 48705 | INS EMPLOYEE VISION | - | - | - n/a - |
| 16 | 16 | 48720 | FICA | 13,081 | - | 800 |
| Total PAYROLL RELATED EXPENSES | | | | 223,077 | 225,000 | |
| STREAM EXENSES | | | | | | |
| 16 | 16 | 43620 | STORM DRAIN MATERIALS | 75,000 | 58,000 | 145 |
| 16 | 16 | 40133 | OTHER EXPENSE | 500 | 42,000 | 145 |
| 16 | 16 | 40121 | OFFICE SUPPLIES | 500 | - | 145 |
| 16 | 16 | 40122 | POSTAGE/PRINTING | 200 | - | 145 |
| 16 | 16 | 42007 | PROFESSIONAL FEES | 50,000 | - | 145 |
| 16 | 16 | 49530 | STREAM PROJECT-- | - | 1,450,000 | - n/a - |
| Total STREAM EXENSES | | | | 126,200 | 1,550,000 | |
| INTERFUND OPERATING TRANSFERS | | | | | | |
| 16 | 16 | 44568 | TRF TO CAPITAL IMP FUND | 560,122 | 371,000 | |

Borough of West Chester 2016 Budget

**-Stream 16-**

**FINAL**

| FUND | DEPT | ACCT # | ACCOUNT NAME | 2017 BUDGET | 2016 BUDGET | PROPOSAL |
|---|---|---|---|---|---|---|
| 16 | 16 | 44560 | TRF TO DEBT SERVICE FUND | 350,000 | 125,000 | |
| 16 | 16 | 44562 | TRF TO EQUIP & TECH FUND | - | 150,000 | - n/a - |
| 16 | 16 | 44570 | TRF TO GENERAL FUND | 945,467 | - | |
| **TOTAL INTERFUND OPERATING TRANSFERS** | | | | **1,855,589** | **646,000** | |
| **Total EXPENSES** | | | | **2,204,866** | **2,421,000** | |
| **NET INCOME/(LOSS)** | | | | 0 | - | |

**Borough of West Chester**
Normal Trial Balance
From 12/31/2017 Through 12/31/2017

| Fund Code | GL Code | Fund Title | GL Title | Debit Balance | Credit Balance |
|---|---|---|---|---|---|
| 16 | 40121 | STREAM FUND | OFFICE SUPPLIES/EXPENSE | 744.82 | |
| 16 | 40122 | STREAM FUND | POSTAGE/PRINTING | 52.50 | |
| 16 | 40133 | STREAM FUND | OTHER EXPENSE | 4,017.13 | |
| 16 | 40140 | STREAM FUND | BANK FEES | 7,363.82 | |
| 16 | 40430 | STREAM FUND | LEGAL OTHER | 1,105.50 | |
| 16 | 42000 | STREAM FUND | ADVERTISING | | 203.17 |
| 16 | 42007 | STREAM FUND | PROFESSIONAL FEES | 305,909.81 | |
| 16 | 43020 | STREAM FUND | CAP PURCH - IMPROV OT BLDGS | 921,878.97 | |
| 16 | 43620 | STREAM FUND | STORM DRAIN MATERIALS | 12,542.64 | |
| 16 | 44920 | STREAM FUND | STORM SEWER REHAB PROJECTS | 0.00 | |
| 16 | 47297 | STREAM FUND | INT EXP- 2016 STREAM | 0.00 | |
| 16 | 48700 | STREAM FUND | INS EMPLOYEE BENEFIT | 4,968.12 | |
| 16 | 48720 | STREAM FUND | SOCIAL SECURITY / MEDICARE | 2,533.73 | |
| 16 | 48951 | STREAM FUND | REFUNDS | 232.78 | |
| 16 | 49100 | STREAM FUND | ADJUSTMENTS - AUDIT & MISC | 2,317.00 | |
| 16 | 49525 | STREAM FUND | SALARIES STREAM | 33,120.73 | |
| 16 | 49530 | STREAM FUND | STREAM PROJECT don't use | 0.00 | |
| Total 16 | | STREAM FUND | | 1,296,787.55 | 203.17 |
| Report Total | | | | 1,296,787.55 | 203.17 |
| Report Difference | | | | 1,296,584.38 | |

# Exhibit C

To Brief

# Expert Report

## Discrete Benefits Provided to West Chester University by the West Chester Borough Stormwater Management System

### West Chester Borough, Chester County, PA

**Prepared For:**

**West Chester Borough**
**401 East Gay Street**
**West Chester, PA 19380**

**June 2021**

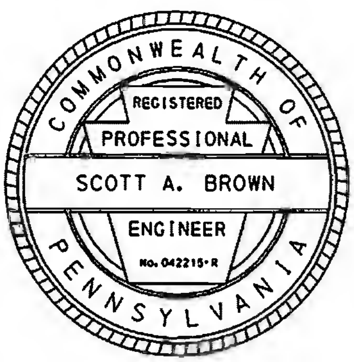
NTM Engineering, Inc.
341 Science Park Road, Ste 203
State College, PA 16803

NEWELL TERESKA & MACKAY ENGINEERING

## Engineer's Certification

**Expert Report**
**Discrete Benefits Provided to West Chester University by the West Chester Borough Stormwater Management System**
**West Chester Borough, Chester County, PA**

"I do hereby certify pursuant to the penalties of 18 PA C.S.A. Sec. 4904 to the best of my knowledge, information and belief, that the information contained in the accompanying report, has been prepared in accordance with accepted engineering practice, and is true and correct."




By: ______________________

Date: June 3, 2021

"I do hereby certify pursuant to the penalties of 18 PA C.S.A. Sec. 4904 to the best of my knowledge, information and belief, that the information contained in the accompanying report, has been prepared in accordance with accepted engineering practice, and is true and correct."


By: ______________________

Date: June 3, 2021

# Expert Report
# Discrete Benefits Provided to West Chester University by the West Chester Borough Stormwater Management System

## EXECUTIVE SUMMARY

NTM Engineering, Inc. (NTM) analyzed the discrete benefits West Chester University and the Pennsylvania State System of Higher Education (collectively referred to in this report as the University or WCU) derived from utilizing the West Chester Borough (Borough) owned and operated Stormwater Management System instead of implementing non-municipal options which the University might have for the collection and conveyance of stormwater from its developed property within the Borough. We conducted that investigation in the context of ongoing litigation between the Borough and the University regarding the obligation of the University to pay the Stream Protection Fee for use of the Borough Stormwater Management System.

As with all properties, during rain events stormwater falls upon University-owned real property located within the jurisdictional limits of the Borough (which is referred to in this report as "North Campus"). As do the owners of all developed properties for their lots, the University must collect that stormwater and ensure that most of it is conveyed away from North Campus to a receiving watercourse. To meet that responsibility, on an annual basis the University discharges an enormous volume of stormwater to the Borough Stormwater Management System.

The Borough Stormwater Management System includes Borough owned, operated, and maintained roads, storm drains, inlets, curbs, gutters, and other conveyance components. To analyze the discrete benefits which the University derives from its use of that system, we evaluated options which the University would have to meet its responsibility to collect stormwater and convey it to a receiving watercourse other than the University's current use of the Borough Stormwater Management System.

We begin with the assumption that, if the University did not use the Borough Stormwater Management System, the University would need to otherwise capture and manage all annual stormwater runoff from North Campus which currently drains to that system.

In this report, NTM presents five (5) conceptual options for capture and management of the stormwater runoff from North Campus which the Borough currently manages (fully or in part) through components of the Borough Stormwater Management System for the benefit of the University. The sixth option which we mention here is the University's continued use of the Borough Stormwater Management System and continued enjoyment of the benefits which the University derives from not having to otherwise address stormwater runoff from North Campus. We completed our analysis using industry standard methodology, programs, and practices, and selected for further development the option (other than payment of the Stream Protection Fee) which would be most economical and beneficial for the University.

We also considered the feasibility of implementation for each option. There, we evaluated the complexity, spatial constraints, general costs, permitting requirements, and overall practicality of each option. The most economically beneficial option for the University (other than continued use of the Borough Stormwater Management System) is Option 3 (*i.e.* design and implementation of a separate University-owned stormwater management system). The design of Option 3 was advanced to a master plan level of detail based on industry standard analysis. Importantly, Option 3 would require substantial additions to, and reworking of, the existing University stormwater management infrastructure and drainage patterns and would necessitate disturbances of almost all portions of North Campus which are adjacent to Borough streets.

Our opinion of the probable costs for the initial design and construction of Option 3 is $4,200,000.00, with estimated annual operation and maintenance costs of $45,600.00. Our design and cost estimates are based on best available data and, in all cases, are based on assumptions which FAVOR the University. As a result, our estimated costs are conservatively low. Those costs, however, still represent a significant required infrastructure investment by the University if it were to seek to replace the benefits which now accrue from the Borough's acceptance of stormwater runoff from North Campus and conveyance of that stormwater to a receiving watercourse on behalf of the University. Our analysis demonstrated, conversely, that the Borough's operation and maintenance of the Borough Stormwater Management System allows the University to realize the significant benefit of not having to make that capital or operational investment.

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# LIST OF TABLES

# LIST OF APPENDICES

# Discrete Benefits Provided to West Chester University by the Borough Stormwater Management System

## I. Authors

This report was prepared by Mr. Scott Brown, PE, D.WRE, and Mr. Aaron Jolin, PE. Mr. Brown is a Senior Engineering Manager at NTM Engineering, Inc. and was the principal author of this report. He has over 40 years of experience as a licensed professional engineer with focus in the areas of stormwater management and drainage design. Mr. Brown's unique expertise and achievements in water resource engineering were acknowledged by the American Academy of Water Resource Engineers in 2013 through award of the credential Diplomat, Water Resource Engineer.

Mr. Jolin provided senior technical support and analysis for this report. Mr. Jolin specializes in design and regulatory permitting of drainage, stormwater management, and erosion and sedimentation control systems. He has over 14 years of experience and has been a licensed professional engineer for over 9 years.

Mr. Brown's Curriculum Vitae and Mr. Jolin's Curriculum Vitae are included in **Appendix F**.

## II. Background

On July 20, 2016, Borough Council (the governing body of the Borough) enacted the Stream Protection Ordinance (Ordinance No. 10-2016).

As defined in the Stream Protection Ordinance, the 'Borough Stormwater Management System' is the system of collection and conveyance, including underground pipe, manholes, outfalls, dams, flood control structure, natural areas, structural and non-structural stormwater best management practices, channels, detention ponds, public streets, curbs, drains and all devices, appliances appurtenances and facilities appurtenant thereto used for collecting, conducting, pumping, conveying, detaining, discharging and/or treating stormwater. The Stormwater Management System is entirely owned and operated by the Borough.

Pursuant to the Stream Protection Ordinance, the Borough charges a service fee (the "Stream Protection Fee") to the owners of all "developed" properties in the Borough.[1] Importantly, the Borough does not charge that service fee to the owners of properties which are not "developed"

[1] Pursuant to the Stream Protection Ordinance, a developed property is

> property where manmade changes have been made which add impervious surfaces to the property, which changes may include, but are not limited to, buildings or other structures for which a building permit must be obtained under the requirements of the Pennsylvania Building Code and this Code, mining, dredging, filling, grading, paving, excavation or drilling operations, or the storage of equipment or materials.

and which, therefore, do not have impervious surface from which development-related stormwater drains to the Borough Stormwater Management System

The Borough deposits all revenue which it collects from payment of the Stream Protection Fee into the West Chester Borough Stormwater Management Fund. In turn, the Borough uses the Stormwater Management Fund for, amongst other stormwater related purposes, "constructing, operating, and maintaining the Borough Stormwater Management System".

The University is primarily divided into two areas - North Campus and South Campus (See map in **Appendix A**, Exhibit A-1). Portions of North Campus are located in the Borough (See map in **Appendix A**, Exhibit A-2). According to discovery documents WCU000819-820 (Attached in **Appendix B**), the area of North Campus within the Borough is 60.3 acres, where 54.1 Acres (31.5 acres of which is impervious) drains through the Borough Stormwater Management System and, ultimately, discharges to an Unnamed Tributary (UNT) of Plum Run (See map in **Appendix A**, Exhibit A-2). As noted on Exhibit A-6, other portions of North Campus drain to the Borough Stormwater Management System and, ultimately, discharge to other receiving watercourses.

In January of 2018, the Pennsylvania State System of Higher Education informed the Borough that "the University will not be paying the storm water management fee invoices that the Borough sent to the University." The basis for that refusal is the Pennsylvania State System of Higher Education's claim that the Stream Protection Fee "is a tax, from which the University, as a Commonwealth entity, is immune." The Borough then started litigation to challenge that refusal.

In an Opinion dated July 15, 2019, the Commonwealth Court noted that

> questions remain . . . as to . . . whether the . . . that the Borough Stormwater System provides a discrete benefit to [the University and the Pennsylvania State System of Higher Education], as opposed to generally aiding the environment and the public at large [and] whether the value of the [Borough] Stormwater System to [the University and the Pennsylvania State System of Higher Education] is reasonably proportional to the amount of the" Stream Protection Fee.

NTM Engineering, Inc. considered whether, and to what extent, the Borough Stormwater Management System provides a discrete benefit to the University. NTM examined the University's ability to otherwise capture and manage all annual stormwater runoff from North Campus which currently drains to the Borough Stormwater Management System as a means of measuring the benefits which the University enjoys from its present use of that system. NTM then completed its analysis using industry standard methodology, programs, and practices, and selected for further development the option (other than payment of the Stream Protection Fee) which would be most economical and beneficial for the University.

## III. Design Criteria for Options to Manage Stormwater Runoff

NTM began with the assumption that, if it did not benefit from its connection to the Borough Stormwater Management System, the University would need to otherwise capture and manage all annual stormwater runoff from North Campus which currently drains to that system.

By virtue of its ability to access the Borough Stormwater Management System, the University need not design and implement a system of its own which would otherwise need to control (by capturing, storing, reusing, conveying, infiltrating, or other method) all annual runoff (peak rate and volume) up to and including the largest regulatory storm - the 100-yr/24-hour design storm (7.55 inches in 24 hours).

NTM analyzed 10 years of locally available rainfall data to calculate that more than 32,500,000 gallons of stormwater runoff are generated annually by the portion of North Campus draining to the UNT Plum Run Outfall (See **Appendix A**, Exhibit A-1 for location of outfall; See **Appendix B** for annual runoff calculations). This is according to land area delineations which the University produced during the discovery process (WCU000819- WCU000820) which states the University has 22.6 acres of pervious area and 31.5 acres of impervious area to the outfall. We also note that in a 24-hour period, a single 100-year/24-hour design storm (maximum design event per stormwater standard of practice) generates approximately 9,000,000 gallons of runoff from the portion of North Campus considered in the land uses above (See **Appendix B** for calculations).

## IV. Options for Management of Stormwater Runoff

We considered the following options which would be available to the University in lieu of the ability to discharge stormwater runoff from North Campus through the Borough Stormwater Management System (and note the existence of a sixth option . . . continued enjoyment of the benefits of connection to the Borough Stormwater Management System and payment of the Stream Protection Fee):

**Option 1 - Water Reuse:** Design and construct infrastructure to provide for capture, conveyance, storage, treatment, and re-use of all stormwater runoff from North Campus. This would include constructing building plumbing and campus-wide irrigation systems capable of reusing all stormwater runoff from North Campus.

**Option 2 – Storage and Infiltration:** Design and construct a capture, conveyance, and storage system capable of infiltrating/injecting all annual stormwater runoff into the ground on-site.

**Option 3 - University Owned and Operated Stormwater Management System:** Design and construct a storm runoff capture and conveyance system separate from the Borough Stormwater Management System and designed to convey stormwater (up to and including a 100-year/24-hour storm) to one or more off-campus surface water outfall(s) at a receiving watercourse. The most obvious outfall would be to the unnamed tributary (UNT) to Plum Run in the Borough adjacent to the New Street Parking Garage (designated as UNT1 Plum Run in **Appendix A**, Figure A-1).

**Option 4 - Restore the Historic Drainageway:** The University could daylight/restore the existing (now underground) stream which runs through North Campus and provide additional conveyance measures capturing and conveying all contributory drainage areas of the University to outfall into the restored surface waters (See **Appendix A**, Exhibits 3, 4, and 5 for identification of the historic drainageway location). We note that this option would likely require Borough permission to remove the existing (Borough-owned) pipe through which the underground stream flows.

**Option 5 - Remove all Development on Campus:** The University could eliminate North Campus from consideration as a "developed" property (as that term is defined in the Stream Protection Ordinance) by removing from North Campus all impervious surface (as defined in the Stream Protection Ordinance). This would involve restoring the surface cover condition for North Campus to meadow or woods.

## V. Feasibility of Options to Manage Stormwater Runoff

NTM Engineering, Inc. (NTM) considered the feasibility of implementing each of the foregoing options based on complexity, spatial constraints, general costs, permitting requirements, availability of information for analysis, and overall practicality. We determined that options requiring programmatic building removals, or modifications due to space needs for option facilitation, are impractical due to University programing needs and associated costs.

NTM selected Option 3 **(Design and construction of a University Owned and Operated Stormwater Management System)** as the best, most feasible, and least costly option by which the University could replicate the stormwater management-related benefits it receives from its current connection to, and use of, the Borough Stormwater Management System. Overall, Option 3 provides a standard industry approach which could be most reasonable to implement. We discuss below our justification for not selecting other options.

NTM ruled out Option 1 **(Water Reuse)** because of complexity and cost. The most viable reuse options would include landscape irrigation and non-potable water uses in buildings – for example, toilet flushing. This option would require construction of the same or very similar perimeter and trunk line stormwater collection and conveyance facilities as Option 3. In addition, Option 1 would require surface and/or subsurface storage, water treatment, and pumping facilities to manage the over 32,000,000 gallons of runoff generated annually by North Campus (See **Appendix B** for annual runoff volume calculation). Based on the total annual runoff volume to be managed, reuse systems would need to be extensive enough to provide an average demand of more than 89,000 gallons per day. This would require retrofitting most North Campus buildings with reuse plumbing systems as well as landscape irrigation systems for most green spaces in this portion of campus.

NTM ruled out Option 2 **(Storage and Infiltration)** due to cost and space requirements. Option 2 would require construction of the same perimeter stormwater collection and conveyance system as Option 3 and would also likely require pump facilities and additional conveyance to distribute the stored stormwater to separate infiltration and/or irrigation systems. Due to regulatory loading ratios[2] imposed on infiltration facilities and actual site infiltration capacity, the required infiltration facility size would likely exceed available green space on campus. Considering current regulatory guidance specifying a minimum loading ratio of 8:1 (total tributary drainage area to infiltration area) the University would need to dedicate a minimum footprint of 6.76 acres for infiltration facilities (assuming infiltration capability in the first place). Restrictions posed by shallow bedrock may result in additional limitations on available infiltration area. Injection wells could be considered as an alternative; however, use of injection wells would be challenging from a permitting perspective.[3]

NTM recognizes that the University could consider pumping water to parts of North Campus outside the Borough or to South Campus to provide additional areas for infiltration, irrigation, or reuse functions under Option 1 and/or Option 2. That approach, however, would add to project complexity and cost. Using opportunities on South Campus would also require significant easement acquisition for piped conveyance facilities. Maps in **Appendix A** illustrate the locations of North Campus and South Campus with respect to each other and municipal boundaries.

In addition to proposing more complex and costly designs, both Options 1 and 2 would face resistance from permitting agencies with the most significant challenge being the diminution of the volume of water which reaches UNT1 Plum Run by removing from the watershed of that tributary stormwater which naturally falls within the watershed. Based upon our experience, we conclude that permitting agencies would resist any plan which contemplates pumping water to areas outside natural watershed boundaries (for example from UNT1 Plum Run to UNT2 Plum Run – See Figure A-1 in **Appendix A**).

NTM ruled out Option 4 **(Restore the Historic Drainageway)** because of site constraints, project and permitting complexity, and costs, all as demonstrated by the aerial photos in **Appendix A**, Exhibits A-3, A-4, and A-5. This option would require relocation or removal of campus buildings and roadways, construction of required pedestrian and vehicular bridges, utility relocation, and construction of the same perimeter capture and conveyance facilities as identified in Option 3. The associated costs would substantially exceed the cost of Option 3. This option would also result in a reduction of developable space at North Campus, increased costs for building demolition and relocation, and possible land acquisition.

NTM ruled out Option 5 **(Removal of all Development on Campus)** because it would result in the University ceasing educational operations at North Campus. This option is unrealistic but was

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[2] Loading ratios define the regulatory surface area needed for infiltration facilities based on their tributary impervious and total drainage areas.

[3] Injection wells are stormwater drainage wells such as dry wells, bored wells, infiltration galleries, or improved sinkholes designed to accept storm runoff. Injection wells differ from infiltration trenches and or surface/subsurface infiltration impoundments in that their depth is greater than their widest surface dimension. In addition to State and Local stormwater regulations, injection wells are subject to federal requirements under the Safe Drinking Water Act via EPA's Underground Injection Control Program.

included to illustrate an approach where the University could avoid the benefits which accrue to it by virtue of connection to the Borough Stormwater Management System.

# VI. Option 3 Analysis and Design Approach

## Overview

Any fully comprehensive analysis of the costs associated with Option 3 for purposes of construction in accordance with industry standards would require preparation of a detailed hydrologic and hydraulic (H&H) analysis and development of complete construction documents covering all aspects of the design. In particular, development of fully complete construction documents for North Campus would require, but not necessarily be limited to, the following:

- Complete topographic and physical survey of all site features including, but not limited to, buildings, roadways, sidewalks and other impervious surfaces, tree locations, and locations and dimensions of all physical features.
- Site boundary survey.
- Existing storm drain and utility survey defining horizontal and vertical location and feature size.
- Subsurface Utility Engineering (SUE) investigation to define the horizontal and vertical location of all subsurface utilities. This often includes the need for test-pits, dye testing, CCTV, and other exploratory measures. These studies define potential conflicts with newly designed elements and often result in the need for existing utility relocation and associated engineering design.
- Subsurface building foundation investigations.
- Building roof drainage system investigations.
- Geotechnical and soil evaluations including infiltration testing for any associated stormwater management facilities.
- Acquisition of complete stormwater management facility design and as-built reports and plans including stage storage curves, outlet structures configurations, drainage area information, and modeling assumptions for all existing on-site facilities.

To obtain the information outlined above and undertake a complete engineering design for any of the options identified above would be costly. Furthermore, the necessary field investigations and design activities would require more than one year. Those activities would likely interfere with ongoing University functions.

Therefore, in the interests of time and cost, and in consideration of the University's logistical needs, we prepared an advanced conceptual level analysis and design based on the best available information to establish the costs associated with Option 3. The level of detail in this analysis is comparable to a feasibility or master plan level of design. Given that level of analysis, we took a conservative approach to estimating design values and costs. By conservative, we mean that, where assumptions had to be made, they were made to the benefit of the University (*i.e.* assumptions were made that would reduce the comparative costs associated with developing an implementable option to provide to the University the same stormwater management benefits which the University now enjoys by virtue of the ability to discharge stormwater to the Borough Stormwater Management System).

## Data and Information Review

NTM Engineering, Inc. utilized the best available information from discovery and online sources as a basis for developing the analysis and concept design which we present here. We provide at **Appendix C** a list (together with source references) of the information which we consulted. Throughout the document review, we encountered contradictory and/or incomplete information. We made every effort to substantiate the information which we used in our analysis. Additional discussion regarding information and analysis that are known to exist, but were not available as part of discovery, is also reviewed in **Appendix C**.

## Modeling Approach and Assumptions

NTM Engineering, Inc. utilized standard industry approaches and assumptions for analysis, including hydrologic and hydraulic modeling and conceptual design. Every effort was made to provide substantiation for the assumptions which we used in the analysis. Where reliance on professional judgment was required to establish modeling or analysis parameters, our approach was to err toward providing the benefit of the doubt to the University in the form of reduced capital costs. For example, when selecting modeling parameters, we erred toward assumptions which would provide reductions in peak flows and volumes. While this may have resulted in under sizing the conceptual stormwater management system which the University could build to replace its use of the Borough Stormwater Management System - with associated reduced costs - it resulted in a conservatively low estimate of option cost and associated comparative benefit which the University enjoys by virtue of the Borough Stormwater Management System. In the context of this litigation, our conservative approach favors the University. A list of modeling assumptions is provided in **Appendix C**.

## Modeling Results and Concept Design

A full readout of the modeling results (from AutoCAD Storm and Sanitary Analysis) is in **Appendix C** with a drainage area map and a schematic storm drain plan in **Appendix A**, Exhibit A-6. **Table 1** lists the results of the land use analysis for core portions of North Campus. The table includes areas of North Campus which drain to the Borough Stormwater Management System (SMS) at locations other than the outfall to the UNT of Plum Run which (again, conservatively) are not considered as part of our analysis of Option 3. Importantly, any attempt by the University to replicate the benefits which it enjoys by virtue of its ability to discharge stormwater to the Borough Stormwater Management System would need to account for those areas which do not now discharge to the UNT of Plum Run.

**Table 2** provides the land uses and drainage area breakdown which we used to develop our model. The assumptions are summarized in **Appendix C**. We modeled runoff from impervious areas which are currently being managed by University-owned stormwater control facilities (typically surface or subsurface basins or other facilities) associated with recent redevelopment

**Table 1: Area of West Chester University-North Campus within the Borough- Draining to the Borough Stormwater Management System***

| Drainage Area Description | Total Drainage Area (ac.) | Impervious Area (ac.) |
|---|---|---|
| Area of North Campus draining to Borough SMS discharging to UNT of Plum Run in the Borough (Area Studied) | 44.12 | 24.37 |
| Area of North Campus draining to Borough SMS in Goose Creek Watershed | 0.52 | 0.52 |
| Area of North Campus draining to Borough SMS -Rosendale Ave | 7.95 | 3.20 |
| **Total Area of North Campus Draining to Borough of West Chester Stormwater Management System** | **52.59** | **28.09** |

*excludes the parking garages on the corner of Sharpless and South New Street and Sharpless and South Church Street, any properties east of Reynolds Alley and any properties east of South High Street owned by the University

**Table 2: Option 3 Study Area and Modeling Values for WCU North Campus Conveyed to the Borough's Stormwater Management System and Outfall to Unnamed Tributary (UNT) of Plum Run in the Borough**

| Drainage Area | Total Area (ac.) | Impervious Total (ac.) | Impervious Taken as Meadow (ac.) | Impervious Taken as Open Space (ac.) | Meadow Restoration (ac.) | Impervious Area Modeled (ac.) | Total Open Space Modeled (ac.) | Total Meadow Modeled (ac.) |
|---|---|---|---|---|---|---|---|---|
| A1 | 2.08 | 1.37 | 0.00 | 1.02 | 0.00 | 0.35 | 1.73 | 0.00 |
| A1.5 | 0.12 | 0.10 | 0.00 | 0.00 | 0.00 | 0.10 | 0.02 | 0.00 |
| A2 | 2.23 | 0.83 | 0.00 | 0.00 | 0.06 | 0.83 | 1.33 | 0.06 |
| A3 | 2.24 | 0.82 | 0.00 | 0.00 | 0.04 | 0.82 | 1.37 | 0.04 |
| B1 | 1.15 | 0.17 | 0.00 | 0.00 | 0.00 | 0.17 | 0.97 | 0.00 |
| B1.5 | 0.45 | 0.09 | 0.00 | 0.00 | 0.03 | 0.09 | 0.33 | 0.03 |
| B2 | 1.55 | 1.26 | 0.00 | 0.00 | 0.00 | 1.26 | 0.29 | 0.00 |
| B3 | 14.51 | 9.33 | 0.91 | 2.44 | 0.36 | 5.98 | 7.26 | 1.27 |
| B4 | 2.60 | 1.88 | 0.77 | 0.00 | 0.25 | 1.11 | 0.47 | 1.02 |
| B5 | 0.32 | 0.15 | 0.00 | 0.00 | 0.02 | 0.15 | 0.16 | 0.02 |
| B6 | 0.39 | 0.12 | 0.00 | 0.00 | 0.04 | 0.12 | 0.23 | 0.04 |
| B7 | 0.70 | 0.70 | 0.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.70 |
| B8 | 0.23 | 0.07 | 0.00 | 0.00 | 0.12 | 0.07 | 0.05 | 0.12 |
| B9 | 1.74 | 1.08 | 0.00 | 0.00 | 0.02 | 1.08 | 0.64 | 0.02 |
| B10 | 2.26 | 0.93 | 0.00 | 0.00 | 0.00 | 0.93 | 1.33 | 0.00 |
| B11 | 0.77 | 0.20 | 0.00 | 0.00 | 0.02 | 0.20 | 0.55 | 0.02 |
| B12 | 2.70 | 1.44 | 0.00 | 0.59 | 0.00 | 0.85 | 1.84 | 0.00 |
| B13 | 2.37 | 1.56 | 0.00 | 0.00 | 0.00 | 1.56 | 0.82 | 0.00 |
| B14 | 5.71 | 2.27 | 0.00 | 0.00 | 0.00 | 2.27 | 3.44 | 0.00 |
| **TOTAL** | **44.12** | **24.37** | **2.39** | **4.05** | **0.95** | **17.93** | **22.85** | **3.34** |

or new construction on North Campus. In those instances, we used land use curve numbers consistent with the runoff reduction expected by the applicable stormwater ordinance under which that redevelopment or new construction was permitted. Refer to **Appendix A**, Exhibit 6 for the mapped location of the tabulated drainage areas.

As a result of the modeling approach for crediting existing stormwater control measures which the University maintains, 4.05 acres of existing impervious area was reduced to Open Space Good - HSG C and 2.39 acres of existing impervious reduced to Meadow Good- HSG C. These modifications resulted in a reduction in surface runoff to pre-development conditions – another assumption benefitting the University's position.

The storm drain sizes which would be required to manage conveyance of the 100-yr storm for the University in lieu of its use of the Borough Stormwater Management System range from 18 inches to 54 inches, with the largest sizes located at the outfall crossing New Street. The concept design contemplates two (2) new trunk lines parallel to the main Borough line, draining through the superblock section of North Campus, as more fully depicted in **Appendix A** on Exhibit A-6. Based on review of the information we obtained, and vertical constraints due to the location of the existing storm drain, other utilities, and required connections to existing University storm drains, the two parallel trunk storm line approach appeared to be the only way to achieve gravity flow without introducing pumps or undertaking significant additional utility relocations. The two (2) new University-owned trunk lines would need to extend across both South New Street and South Church Street in two (2) locations.

There are significant constraints associated with designing and installing a new system within an already developed area. Based on the level of detail in the information available for use as a basis for conceptual design, we completed pipe sizing for only the two (2) new main trunk lines. In other words, we did not complete pipe sizing for any of the smaller lateral lines which would be necessary for the University to realize the same storm drainage benefits which it presently enjoys through its connection to the Borough Stormwater Management System.

A significant portion of the storm runoff draining from North Campus to the Borough Stormwater Management System is also conveyed via Borough-owned and Borough-maintained street gutter systems. By definition, these gutter systems are also a part of the Borough Stormwater Management System. Replicating the University's beneficial use of the Borough roadway gutter systems would require construction of an alternate means of capture and conveyance for these flows. The alternate means of capture and conveyance used in our analysis area are as follows:

- Where site constraints allow, swales and yard inlets would be used as perimeter capture elements. These perimeter capture elements would consist of grading in swales and installing yard inlets with 12" HDPE conveyance pipes with connections to the dual trunk storm sewer lines. This was considered to be the least costly means of providing capture.

- Where University driveways and sidewalk areas presently drain to the Borough streets, trench drains connected to a perimeter 12" HDPE line would be used to provide the necessary capture and conveyance.

- Where University property slopes steeply toward the Borough street, and swale grading would be difficult, options for either a knee wall with inlets or curb and trench drains connected to 12" HDPE conveyance pipe would be used. We believe this approach to be the least intrusive and least costly option.

The conceptual approach outlined above is illustrated in **Appendix A**, Exhibit 6. More detailed calculations based on extensive field survey and investigations beyond the scope of this effort would be required to size the perimeter conveyance and capture elements to completely control runoff from all storm design events up to and including 100-year events. It is likely that such an analysis would identify that portions of this system would need to be larger than the pipe sizes identified in the assumptions above.

Additional assumptions used in this analysis include:

- Existing storm drain conveyance measures currently owned and maintained by the University are conservatively assumed to have adequate capacity to manage up to a 100-year event.

- Our concept design and opinion of probable cost considers only limited utility relocation impacts. Our assessment of existing utilities based on available discovery information indicates that multiple utility relocations would, at a minimum, be required where perimeter storm drains are installed and where University conveyance facilities would need to cross Borough right-of-way. In these locations, there are multiple utilities (sewer, water, gas, electrical, lighting, *etc*.) which may be in direct conflict with the placement of a new and separate gravity stormwater management conveyance system. Additional information and detailed analysis would be needed to identify the extent and actual cost of utility relocations which could include sheeting and shoring requirements which our estimate does not consider.

## VII. Opinion of Probable Cost

### Capital Costs

The total initial capital cost for Option 3 is estimated to be approximately $4,200,000.00. In other words, in order to meet is responsibility to collect stormwater and convey it to a receiving watercourse other than the University's current use of the Borough Stormwater Management System, the University would need to expend at least $4,200,000.00. We provide a detailed cost breakdown in **Appendix D**.

We estimated costs utilizing unit pricing from PennDOT's ECMS low bid price index, considering District 6 projects or another closest District with relative item pricing. That is a standard method for preparation of opinions of probable cost for public construction projects in PennDOT District 6 (in which the University is located).

The estimate considers pricing for long life concrete pipes for the trunk lines and HDPE for the perimeter control lines. We estimated pavement and sidewalk replacement quantities based on our conceptual design and estimated disturbances required for installation of the required facilities, as shown by mapping in **Appendix B**. The pricing does not consider any tree protection, landscaping, potential for sidewalk replacements where sidewalks extend onto University property, or traffic control requirements.

Where pricing was not available for specific items, an estimate of probable costs was assumed based on professional opinion. For example, the existing Borough-owned outfall to Plum Run would need to be redesigned and replaced to accommodate new storm drain outfalls. The structure is not a standard PennDOT item and special design/construction methods (*e.g*. cast-in-place concrete, bypass pumping, and coffer dams) would be required for installation. We estimated cost for these non-standard elements using costs from projects of similar complexity.

Design, survey, subsurface utility investigations, permitting, erosion and sedimentation control, mobilization, and contingencies were assumed using typical industry standard percentages. It is possible these costs have been underestimated considering that the conceptual project would span the entirety of North Campus and would likely need to be split into several different construction phases over multiple years.

## Operation and Maintenance Costs

With the additional infrastructure the University would be required to construct under Option 3 to recreate the same stormwater discharge benefits which the University enjoys from its connection to the Borough Stormwater Management System, the University would have additional operation and maintenance costs. These costs would include, but are not limited to, maintenance, repair, and cleaning of perimeter inlets and drains. To approximate these costs, NTM reviewed the estimated annual budgetary cost data for the Borough Stormwater Management System which the Borough used when calculating the Stream Protection Fee. We used that information as the basis for estimating operations, maintenance, and other associated costs the University would incur with the new Option 3 system. See **Appendix E** for calculation methodology.

We determined those operations and maintenance costs would be $35,600.00 per mile of pipe. Applying this unit cost to the estimated Option 3 system length of 1.28 miles results in an annual operation and maintenance cost of $45,600.00.

## Annualized Total Cost

A representative total annual cost can be arrived at by considering annualization of the capital costs identified above. Applying a 100-year design life and a 3% long term inflation rate – a value which, again, benefits the University – to the capital costs results in an annualized capital cost of $132,900.00 (using standard financial compounding factors). Adding this to the annual operation and maintenance costs results in a total annualized cost of $178,500.00.

## VIII. Conclusion

NTM analyzed the discrete benefit provided to West Chester University by the Borough of West Chester owned and operated stormwater management system using the best available information. The analysis included areas of North Campus draining to UNT1 Plum Run, as shown by Exhibit A-6 in **Appendix A**. Based on the analysis presented here, it is estimated that the University saves not less than $4,200,000.00 in up-front capital cost and annual maintenance, operations, and replacement costs of approximately $45,600.00 by virtue of the University's ability to use the Borough owned and operated Stormwater Management System.

Annualizing the capital costs and adding to the operation and maintenance costs results in a total annual cost the University would have to incur if it did not have access to the Borough Stormwater Management System. The ability to avoid that cost ($178,500.00 per year) represents a discrete benefit West Chester University and the Pennsylvania State System of Higher Education derive from utilizing the West Chester Borough owned and operated Stormwater Management System.

As explained in the Modeling Approach and Assumptions in **Appendix C** and illustrated in **Appendix A**, Exhibit A-6, the analysis excludes some property owned by the University within the Borough which drains to portions of the Borough owned and operated Stormwater Management System. Had these properties been included in the analysis, benefit to the West Chester University and Pennsylvania State System of Higher Education would have been greater.

# Appendix A

## Maps and Aerial Photos

### West Chester Borough
### Chester County

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# Appendix A

## Exhibit A-1 Overview Map of West Chester Campus

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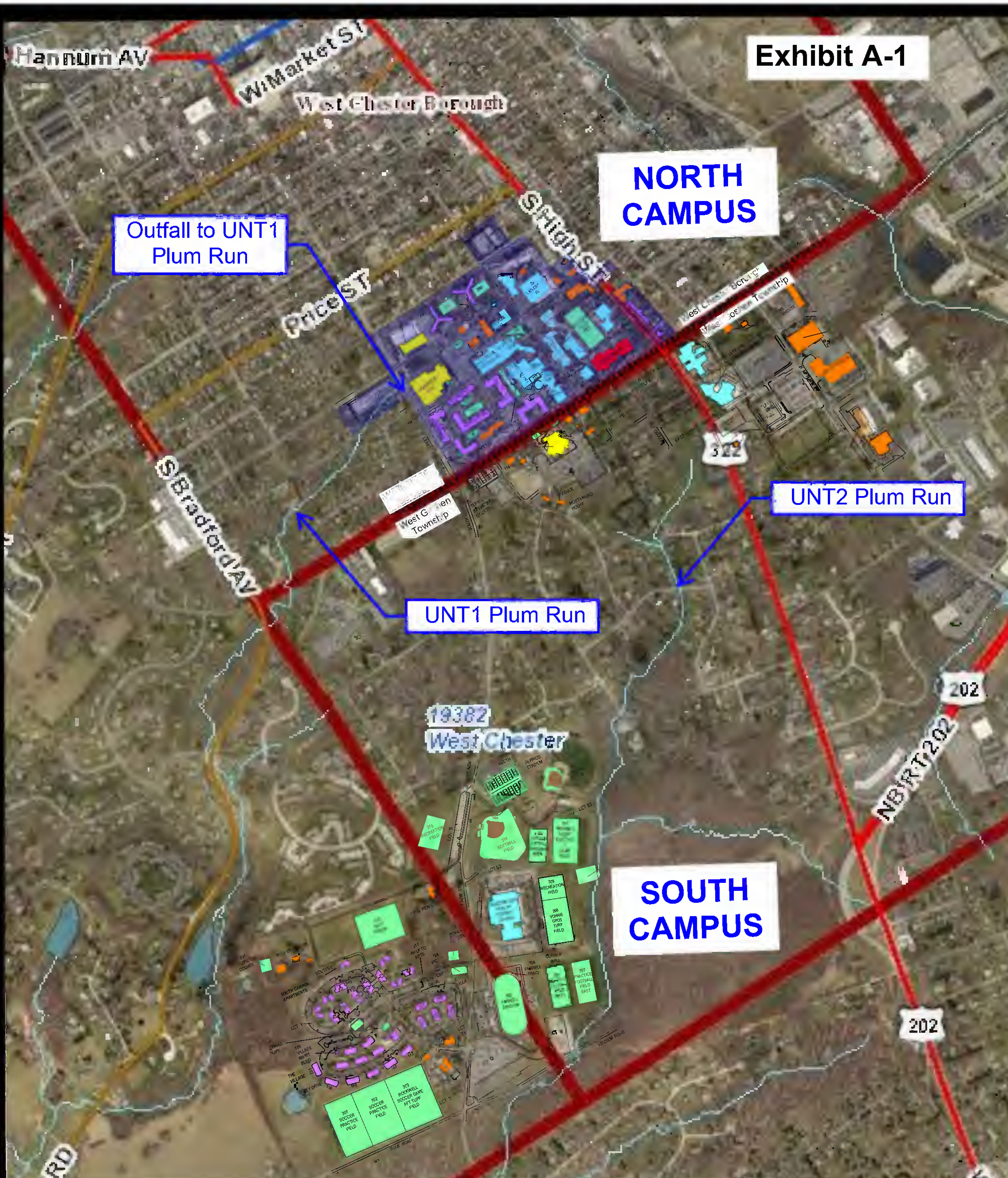


1. Google. (n.d.). [Google Map of West Chester University]. Retrieved May 12, 2021 from https://www.google.com/maps/search/West+Chester+University/@39.946548,-75.6031328,2283m/data=!3m1!1e3
2. West Chester University (n.d.-a). [West Chester University Map of North Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUNorthCampusMap.pdf
3. West Chester University (n.d.-b) [West Chester University Map of South Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUSouthCampusMap.pdf

2045a

# Appendix A

## Exhibit A-2 West Chester North Campus in the Borough of West Chester

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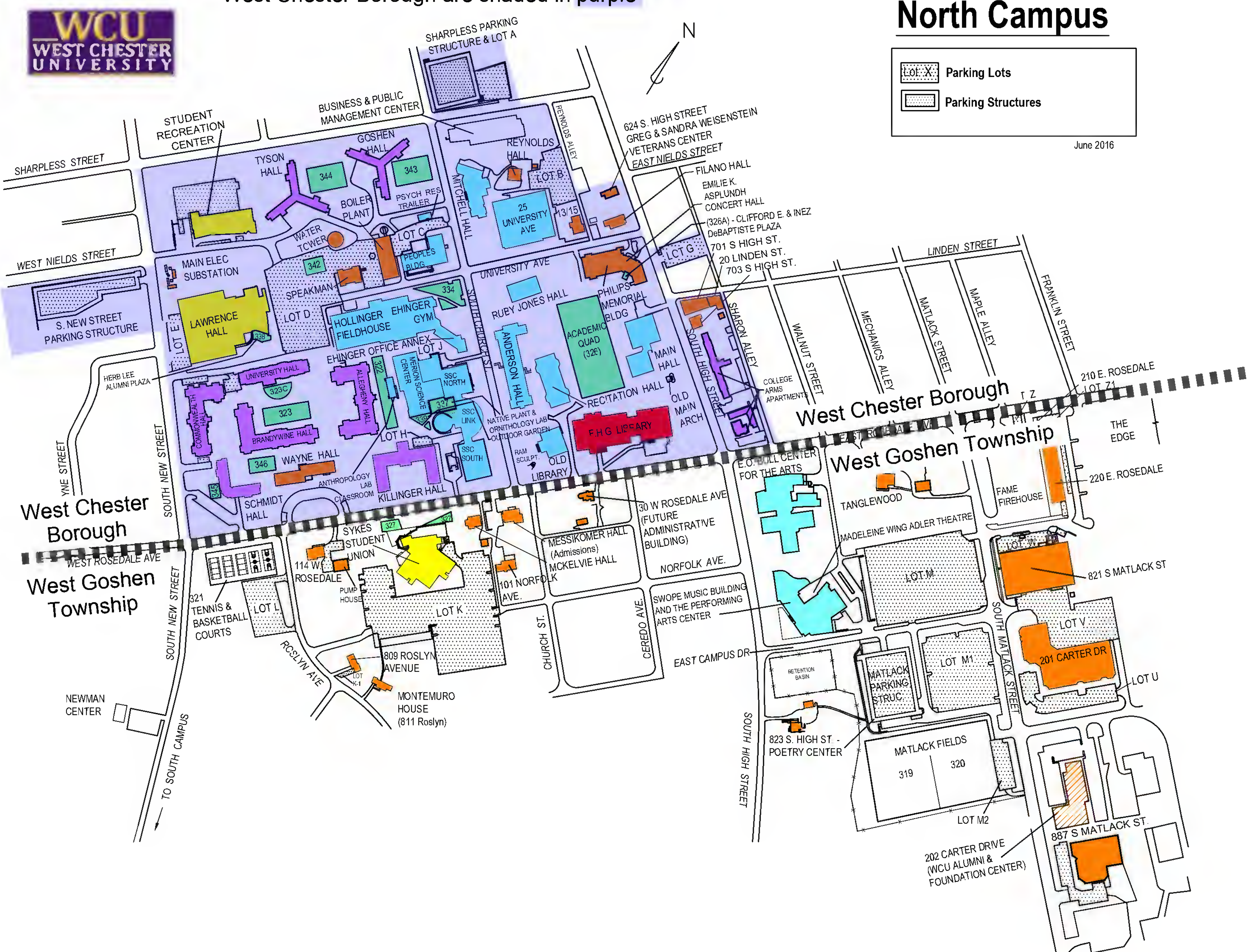
MACKAY
ENGINEERING

2046a

Exhibit A-2

Portions of West Chester North Campus located in West Chester Borough are shaded in purple




A-5

2047a

West Chester University (n.d.-a). [West Chester University Map of North Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUNorthCampusMap.pdf

# Appendix A

## Exhibit A-3 Aerial Photo of North Campus from Between 1937-1942 Showing Historic Stream Bed

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2048a


Exhibit A-3: Aerial Photo of North Campus From Between 1937-1942 Showing Historic Stream Bed

PASDA (n.d.-a). [chester 091837 Statewide 1937-1942 B&W (not georeferenced)]. Retrieved from: ftp://ftp.pasda.psu.edu/pub/pennpilotr/era1940/chester_1938_photos_jpg_800/chester_091837_ahk4491

2049a

# Appendix A

## Exhibit A-4 Aerial Photo of North Campus From 2018 w/ Historic Stream Bed Added

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2050a

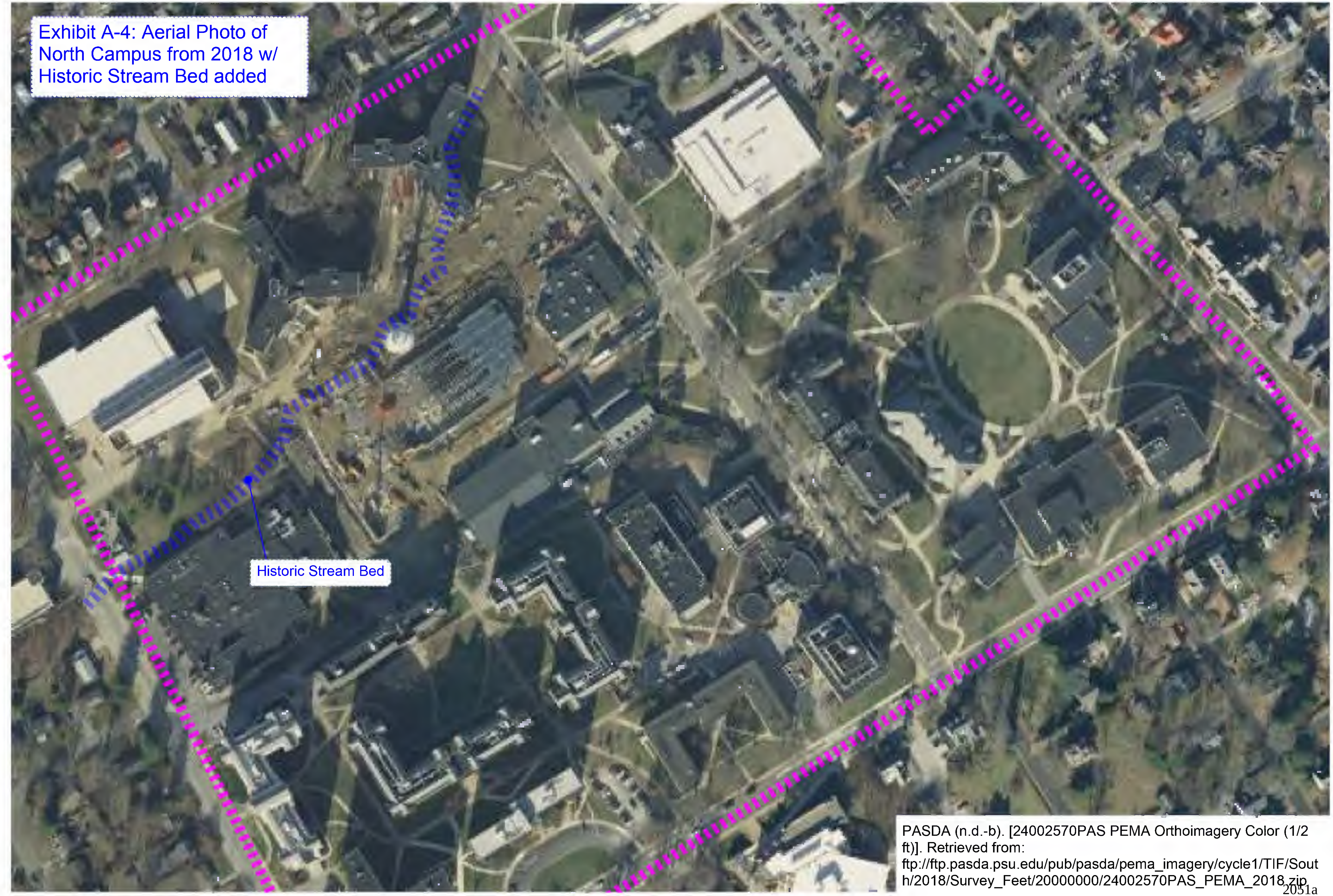
Exhibit A-4: Aerial Photo of North Campus from 2018 w/ Historic Stream Bed added
Historic Stream Bed
PASDA (n.d.-b). [24002570PAS PEMA Orthoimagery Color (1/2 ft)]. Retrieved from: ftp://ftp.pasda.psu.edu/pub/pasda/pema_imagery/cycle1/TIF/South/2018/Survey_Feet/20000000/24002570PAS_PEMA_2018.zip
2051a

# Appendix A

## Exhibit A-5 Aerial Photo of North Campus from Between 1937-1942 Showing Historic Stream Bed w/ Overlay

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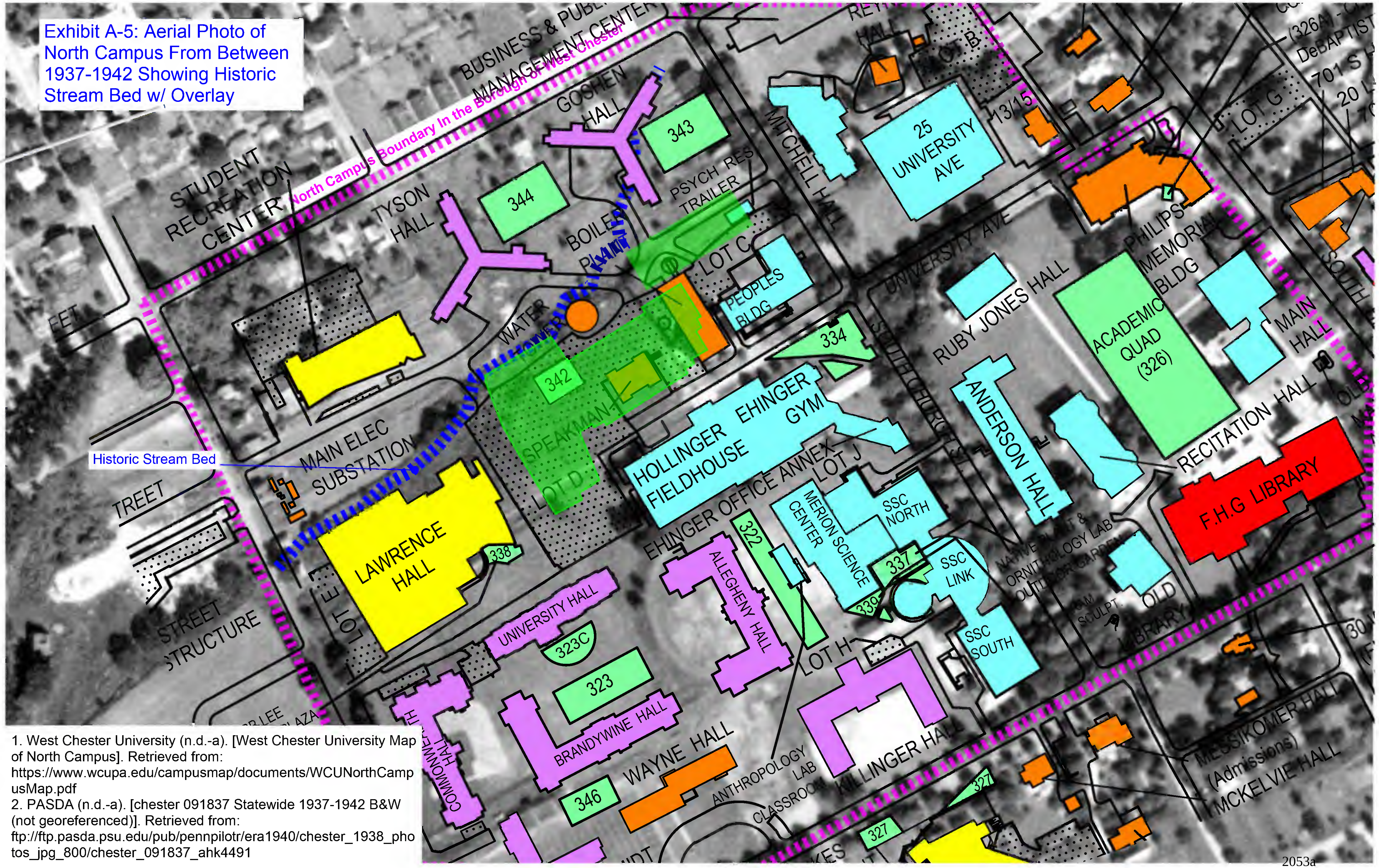
2052a

Exhibit A-5: Aerial Photo of North Campus From Between 1937-1942 Showing Historic Stream Bed w/ Overlay




1. West Chester University (n.d.-a). [West Chester University Map of North Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUNorthCampusMap.pdf
2. PASDA (n.d.-a). [chester 091837 Statewide 1937-1942 B&W (not georeferenced)]. Retrieved from: ftp://ftp.pasda.psu.edu/pub/pennpilotr/era1940/chester_1938_photos_jpg_800/chester_091837_ahk4491

# Appendix A

## Exhibit A-6 Drainage Area Map and Conceptual Design for Option 3

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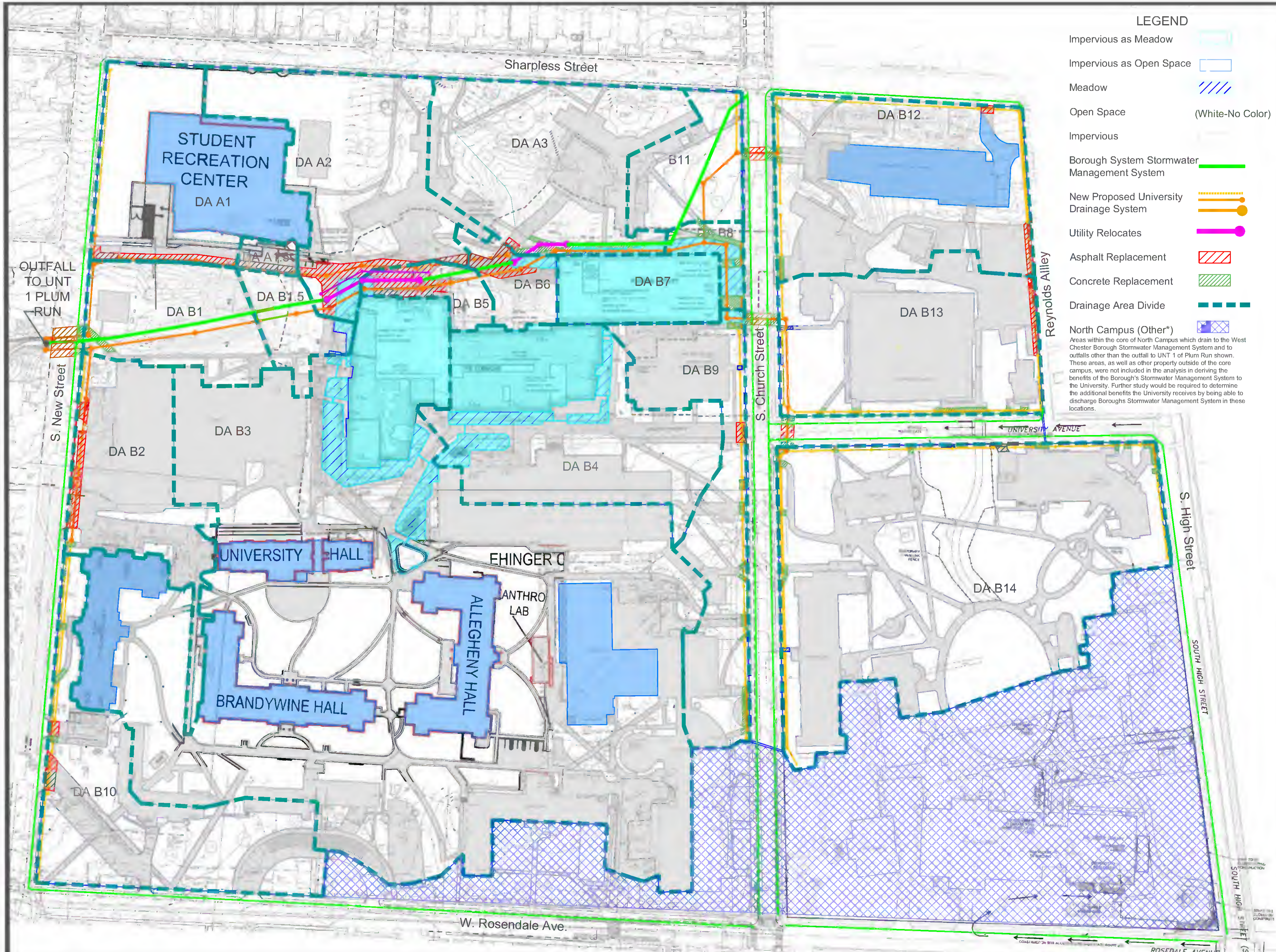


DATE: 5/30/2021

SCALE: 1"=150' (Printed to Scale 11"x17")

NTM Engineering, Inc.

West Chester University Drainage Are to Plum Run

2055a

# Appendix B

## Miscellaneous Calculations

**West Chester Borough**
**Chester County**

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# Appendix B

## Calculation of Annual Runoff

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## Calculation of Annual Runoff

To calculate the average annual runoff for the West Chester University Campus to the Outfall of Plum Run in the West Chester Borough (in accordance with discovery document WCU000819-820- stating 54.1 acres, 31.5 acres of which is impervious), continuous simulation monitoring would be the choice methodology. As the apparatus and data are not currently in place (to our knowledge), the following methodology was utilized to estimate the average annual runoff.

The SCS Runoff Equation was applied to the past 10 years of daily (24-hr) rainfall data for two land use conditions, Open Space in Good Condition - HSG C and Impervious - HSG C. (Note: This is the same industry standard methodology described by Worksheet 4 of the PA DEP NPDES Worksheet- used for determining volumetric runoff.)

| **Open Space in Good Condition HSG C** | | **Impervious Area HSG C** | |
|---|---|---|---|
| SCS Curve Number CN | 74 | SCS Curve Number CN | 98 |
| Maximum Retention S ((1000-10CN)/CN) | 3.51 | Maximum Retention S ((1000-10CN)/CN) | 0.20 |
| Initial Abstraction Ia (0.2*S) (inches) | 0.70 | Initial Abstraction Ia (inches) | 0.04 |

For any daily rainfall event, if a 24 hour precipitation exceeded the initial abstraction for the landuse, Q (Runoff-Inches)= (P-.2*S)^2/((P+.8S)

Using data from CoCoRahs (Community Collaboration Rainfall Snow and Hall Network) for the past 10 years, daily rainfall totals for Chester County were analyzed to determine the potential runoff for the assumed land use. Analysis results estimated that 3.12 inches of runoff by Open Space and 35.77 inches of runoff by Impervious Surfaces are generated annually. Considering land areas noted by the WCU, the resulting annual runoff is calculated as 32,508,672 gallons per year.

| **Annual Runoff Calculated for Campus** | Annual Runoff Average (inches) | Area (acres) | Total Runoff (gallons) |
|---|---|---|---|
| Open Space Good HSG C | 3.12 | 22.60 | 1,914,570 |
| Impervious HSG C | 35.77 | 31.50 | 30,594,102 |
| | | **Total-gallons** | **32,508,672** |

Note: This methodology may underestimate the total runoff. Storm events often occur at shorter durations with higher intensity rainfall, which generates significantly more runoff that a rainfall event considered over 24 hours. As any underestimation of the runoff favors WCU, in context of the case theory, the approach is considered acceptable, however further analysis, including factors of safety, would need to be completed for any design option considered by WCU.

Monthly | Daily | History | Geo & Map

## Climate West Chester - Pennsylvania

| | Jan | Feb | Mar | Apr | May | Jun |
|---|---|---|---|---|---|---|
| Average high in °F | 39 | 42 | 51 | 63 | 73 | 82 |
| Average low in °F | 19 | 20 | 28 | 38 | 48 | 58 |
| Av. precipitation in inch | 3.45 | 3.22 | 4.30 | 3.79 | 4.21 | 3.79 |
| Av. snowfall in inch | 8 | 11 | 2 | 1 | 0 | 0 |

| | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|
| Average high in °F | 87 | 85 | 78 | 66 | 55 | 44 |
| Average low in °F | 63 | 61 | 53 | 40 | 31 | 23 |
| Av. precipitation in inch | 4.09 | 3.79 | 5.14 | 4.15 | 3.78 | 4.13 |
| Av. snowfall in inch | 0 | 0 | 0 | 0 | 1 | 4 |

## Average weather West Chester, PA

| | |
|---|---|
| Annual high temperature | 64°F |
| Annual low temperature | 40°F |
| Average annual precip. | 47.84 inch |
| Av. annual snowfall | 27 inch |

# Appendix B

## Calculation of Runoff for a 100-year 24-hour Storm

NEWELL
TERESKA &
MACKAY
ENGINEERING
2060a

**Calculation of Runoff for a 100-year 24-hour Storm**

| 24 Hour 100-Yr Storm* Runoff Calculated for Campus | Q (Runoff)= (P-.2S)^2/(P+.8S)** (inches) | Area (acres) | Total Runoff (gallons) |
|---|---|---|---|
| Open Space Good HSG C | 4.52 | 22.60 | 2,773,672 |
| Impervious HSG C | 7.31 | 31.50 | 6,252,247 |
| | | **Total-gallons** | **9,025,919** |
| *Precipitation (P) = 7.55 inches in 24 hours | | | |
| ** S for Open Space and Impervious are 3.51 and 0.20 respectively- as previously calculated | | | |

2061a

# Appendix B

## Reference Data for Annual Rainfall

NEWELL TERESKA & MACKAY ENGINEERING

2062a

| Date | Avg Precip in. | Runoff From Open Space (in.) |
|---|---|---|
| 4/5/2020 | 0 | 0 |
| 4/6/2020 | 0 | 0 |
| 4/7/2020 | 0 | 0 |
| 4/8/2020 | 0.39 | 0 |
| 4/9/2020 | 0.03 | 0 |
| 4/10/2020 | 0.06 | 0 |
| 4/11/2020 | 0 | 0 |
| 4/12/2020 | 0 | 0 |
| 4/13/2020 | 1.4 | 0.11578 |
| 4/14/2020 | 1.12 | 0.044482 |
| 4/15/2020 | 0.06 | 0 |
| 4/16/2020 | 0 | 0 |
| 4/17/2020 | 0 | 0 |
| 4/18/2020 | 0.07 | 0 |
| 4/19/2020 | 0.02 | 0 |
| 4/20/2020 | 0 | 0 |
| 4/21/2020 | 0 | 0 |
| 4/22/2020 | 0.15 | 0 |
| 4/23/2020 | 0.01 | 0 |
| 4/24/2020 | 0.83 | 0.004504 |
| 4/25/2020 | 0.27 | 0 |
| 4/26/2020 | 0.18 | 0 |
| 4/27/2020 | 0.23 | 0 |
| 4/28/2020 | 0.01 | 0 |
| 4/29/2020 | 0 | 0 |
| 4/30/2020 | 0 | 0 |
| 5/1/2020 | 1.01 | 0.024847 |
| 5/2/2020 | 0.01 | 0 |
| 5/3/2020 | 0.12 | 0 |
| 5/4/2020 | 0.02 | 0 |
| 5/5/2020 | 0 | 0 |
| 5/6/2020 | 0 | 0 |
| 5/7/2020 | 0.15 | 0 |
| 5/8/2020 | 0 | 0 |
| 5/9/2020 | 0.51 | 0 |
| 5/10/2020 | 0 | 0 |
| 5/11/2020 | 0.03 | 0 |
| 5/12/2020 | 0.06 | 0 |
| 5/13/2020 | 0 | 0 |
| 5/14/2020 | 0 | 0 |
| 5/15/2020 | 0.09 | 0 |
| 5/16/2020 | 0 | 0 |
| 5/17/2020 | 0 | 0 |
| 5/18/2020 | 0 | 0 |
| 5/19/2020 | 0 | 0 |
| 5/20/2020 | 0 | 0 |
| 5/21/2020 | 0 | 0 |
| 5/22/2020 | 0 | 0 |
| 5/23/2020 | 1.23 | 0.06904 |
| 5/24/2020 | 0.1 | 0 |
| 5/25/2020 | 0 | 0 |
| 5/26/2020 | 0.04 | 0 |
| 5/27/2020 | 0 | 0 |
| 5/28/2020 | 0.04 | 0 |
| 5/29/2020 | 0.04 | 0 |
| 5/30/2020 | 0.19 | 0 |
| 5/31/2020 | 0 | 0 |
| 6/1/2020 | 0 | 0 |
| 6/2/2020 | 0 | 0 |
| 6/3/2020 | 0.03 | 0 |
| 6/4/2020 | 0.63 | 0 |
| 6/5/2020 | 0.54 | 0 |
| 6/6/2020 | 0.46 | 0 |
| 6/7/2020 | 0 | 0 |
| 6/8/2020 | 0 | 0 |
| 6/9/2020 | 0 | 0 |
| 6/10/2020 | 0 | 0 |
| 6/11/2020 | 0.3 | 0 |
| 6/12/2020 | 0.33 | 0 |
| 6/13/2020 | 0 | 0 |
| 6/14/2020 | 0 | 0 |
| 6/15/2020 | 0 | 0 |
| 6/16/2020 | 0 | 0 |
| 6/17/2020 | 0 | 0 |
| 6/18/2020 | 0.04 | 0 |
| 6/19/2020 | 0 | 0 |
| 6/20/2020 | 0.15 | 0 |
| 6/21/2020 | 0.03 | 0 |
| 6/22/2020 | 0 | 0 |
| 6/23/2020 | 0.07 | 0 |
| 6/24/2020 | 0.03 | 0 |

| Date | Avg Precip in. | Runoff From Open Space (in.) |
|---|---|---|
| 4/5/2019 | 0 | 0 |
| 4/6/2019 | 0.16 | 0 |
| 4/7/2019 | 0 | 0 |
| 4/8/2019 | 0.16 | 0 |
| 4/9/2019 | 0 | 0 |
| 4/10/2019 | 0 | 0 |
| 4/11/2019 | 0 | 0 |
| 4/12/2019 | 0 | 0 |
| 4/13/2019 | 0.43 | 0 |
| 4/14/2019 | 0.01 | 0 |
| 4/15/2019 | 0.44 | 0 |
| 4/16/2019 | 0.01 | 0 |
| 4/17/2019 | 0 | 0 |
| 4/18/2019 | 0 | 0 |
| 4/19/2019 | 0 | 0 |
| 4/20/2019 | 1 | 0.02332 |
| 4/21/2019 | 0.36 | 0 |
| 4/22/2019 | 0 | 0 |
| 4/23/2019 | 0 | 0 |
| 4/24/2019 | 0.01 | 0 |
| 4/25/2019 | 0 | 0 |
| 4/26/2019 | 0.25 | 0 |
| 4/27/2019 | 0.82 | 0.003838 |
| 4/28/2019 | 0.01 | 0 |
| 4/29/2019 | 0.03 | 0 |
| 4/30/2019 | 0.03 | 0 |
| 5/1/2019 | 0 | 0 |
| 5/2/2019 | 0 | 0 |
| 5/3/2019 | 0 | 0 |
| 5/4/2019 | 0.08 | 0 |
| 5/5/2019 | 0.38 | 0 |
| 5/6/2019 | 1.13 | 0.046517 |
| 5/7/2019 | 0.01 | 0 |
| 5/8/2019 | 0.54 | 0 |
| 5/9/2019 | 0.01 | 0 |
| 5/10/2019 | 0.01 | 0 |
| 5/11/2019 | 0.21 | 0 |
| 5/12/2019 | 0.43 | 0 |
| 5/13/2019 | 0.96 | 0.017666 |
| 5/14/2019 | 0.69 | 0 |
| 5/15/2019 | 0.02 | 0 |
| 5/16/2019 | 0.02 | 0 |
| 5/17/2019 | 0.01 | 0 |
| 5/18/2019 | 0.05 | 0 |
| 5/19/2019 | 0 | 0 |
| 5/20/2019 | 0.01 | 0 |
| 5/21/2019 | 0 | 0 |
| 5/22/2019 | 0 | 0 |
| 5/23/2019 | 0 | 0 |
| 5/24/2019 | 0.24 | 0 |
| 5/25/2019 | 0 | 0 |
| 5/26/2019 | 0.05 | 0 |
| 5/27/2019 | 0.05 | 0 |
| 5/28/2019 | 0 | 0 |
| 5/29/2019 | 0.66 | 0 |
| 5/30/2019 | 0.51 | 0 |
| 5/31/2019 | 0.28 | 0 |
| 6/1/2019 | 0 | 0 |
| 6/2/2019 | 0.16 | 0 |
| 6/3/2019 | 0.23 | 0 |
| 6/4/2019 | 0 | 0 |
| 6/5/2019 | 0 | 0 |
| 6/6/2019 | 0.34 | 0 |
| 6/7/2019 | 0.01 | 0 |
| 6/8/2019 | 0 | 0 |
| 6/9/2019 | 0 | 0 |
| 6/10/2019 | 0.26 | 0 |
| 6/11/2019 | 1.44 | 0.128212 |
| 6/12/2019 | 0 | 0 |
| 6/13/2019 | 0.62 | 0 |
| 6/14/2019 | 0.43 | 0 |
| 6/15/2019 | 0 | 0 |
| 6/16/2019 | 0 | 0 |
| 6/17/2019 | 0.29 | 0 |
| 6/18/2019 | 0.08 | 0 |
| 6/19/2019 | 0.08 | 0 |
| 6/20/2019 | 1.68 | 0.21312 |
| 6/21/2019 | 0.67 | 0 |
| 6/22/2019 | 0.14 | 0 |
| 6/23/2019 | 0 | 0 |
| 6/24/2019 | 0 | 0 |

| Date | Avg Precip in | Runoff From Open Space (in.) |
|---|---|---|
| 4/5/2018 | 0.06 | 0 |
| 4/6/2018 | 0.02 | 0 |
| 4/7/2018 | 0 | 0 |
| 4/8/2018 | 0 | 0 |
| 4/9/2018 | 0 | 0 |
| 4/10/2018 | 0.04 | 0 |
| 4/11/2018 | 0 | 0 |
| 4/12/2018 | 0 | 0 |
| 4/13/2018 | 0 | 0 |
| 4/14/2018 | 0 | 0 |
| 4/15/2018 | 0 | 0 |
| 4/16/2018 | 1.41 | 0.118839 |
| 4/17/2018 | 0.24 | 0 |
| 4/18/2018 | 0.01 | 0 |
| 4/19/2018 | 0.02 | 0 |
| 4/20/2018 | 0.03 | 0 |
| 4/21/2018 | 0 | 0 |
| 4/22/2018 | 0 | 0 |
| 4/23/2018 | 0 | 0 |
| 4/24/2018 | 0 | 0 |
| 4/25/2018 | 0.62 | 0 |
| 4/26/2018 | 0.04 | 0 |
| 4/27/2018 | 0.21 | 0 |
| 4/28/2018 | 0.04 | 0 |
| 4/29/2018 | 0.2 | 0 |
| 4/30/2018 | 0 | 0 |
| 5/1/2018 | 0 | 0 |
| 5/2/2018 | 0 | 0 |
| 5/3/2018 | 0 | 0 |
| 5/4/2018 | 0 | 0 |
| 5/5/2018 | 0 | 0 |
| 5/6/2018 | 0.06 | 0 |
| 5/7/2018 | 0.08 | 0 |
| 5/8/2018 | 0 | 0 |
| 5/9/2018 | 0 | 0 |
| 5/10/2018 | 0 | 0 |
| 5/11/2018 | 0.18 | 0 |
| 5/12/2018 | 0.63 | 0 |
| 5/13/2018 | 0.51 | 0 |
| 5/14/2018 | 0.89 | 0.009558 |
| 5/15/2018 | 0.01 | 0 |
| 5/16/2018 | 0.6 | 0 |
| 5/17/2018 | 1.38 | 0.109762 |
| 5/18/2018 | 0.15 | 0 |
| 5/19/2018 | 0.58 | 0 |
| 5/20/2018 | 0.39 | 0 |
| 5/21/2018 | 0.02 | 0 |
| 5/22/2018 | 0 | 0 |
| 5/23/2018 | 0.48 | 0 |
| 5/24/2018 | 0 | 0 |
| 5/25/2018 | 0 | 0 |
| 5/26/2018 | 0 | 0 |
| 5/27/2018 | 0.14 | 0 |
| 5/28/2018 | 0.16 | 0 |
| 5/29/2018 | 0.01 | 0 |
| 5/30/2018 | 0 | 0 |
| 5/31/2018 | 0.07 | 0 |
| 6/1/2018 | 0.03 | 0 |
| 6/2/2018 | 0.2 | 0 |
| 6/3/2018 | 1.06 | 0.033134 |
| 6/4/2018 | 0.47 | 0 |
| 6/5/2018 | 0 | 0 |
| 6/6/2018 | 0.08 | 0 |
| 6/7/2018 | 0 | 0 |
| 6/8/2018 | 0 | 0 |
| 6/9/2018 | 0 | 0 |
| 6/10/2018 | 0 | 0 |
| 6/11/2018 | 1.8 | 0.261633 |
| 6/12/2018 | 0.03 | 0 |
| 6/13/2018 | 0 | 0 |
| 6/14/2018 | 0 | 0 |
| 6/15/2018 | 0 | 0 |
| 6/16/2018 | 0 | 0 |
| 6/17/2018 | 0 | 0 |
| 6/18/2018 | 0 | 0 |
| 6/19/2018 | 0.01 | 0 |
| 6/20/2018 | 0 | 0 |
| 6/21/2018 | 0.07 | 0 |
| 6/22/2018 | 0.02 | 0 |
| 6/23/2018 | 0.07 | 0 |
| 6/24/2018 | 0.09 | 0 |

| Date | Avg Precip in. | Runoff From Open Space (in.) |
|---|---|---|
| 4/5/2017 | 0.01 | 0 |
| 4/6/2017 | 0.04 | 0 |
| 4/7/2017 | 0.99 | 0.021839 |
| 4/8/2017 | 0.01 | 0 |
| 4/9/2017 | 0 | 0 |
| 4/10/2017 | 0 | 0 |
| 4/11/2017 | 0 | 0 |
| 4/12/2017 | 0 | 0 |
| 4/13/2017 | 0 | 0 |
| 4/14/2017 | 0 | 0 |
| 4/15/2017 | 0 | 0 |
| 4/16/2017 | 0 | 0 |
| 4/17/2017 | 0.01 | 0 |
| 4/18/2017 | 0.09 | 0 |
| 4/19/2017 | 0 | 0 |
| 4/20/2017 | 0 | 0 |
| 4/21/2017 | 0.29 | 0 |
| 4/22/2017 | 0.2 | 0 |
| 4/23/2017 | 0.16 | 0 |
| 4/24/2017 | 0 | 0 |
| 4/25/2017 | 0.18 | 0 |
| 4/26/2017 | 0.73 | 0.000222 |
| 4/27/2017 | 0.01 | 0 |
| 4/28/2017 | 0 | 0 |
| 4/29/2017 | 0.27 | 0 |
| 4/30/2017 | 0 | 0 |
| 5/1/2017 | 0 | 0 |
| 5/2/2017 | 0.05 | 0 |
| 5/3/2017 | 0 | 0 |
| 5/4/2017 | 0 | 0 |
| 5/5/2017 | 0.1 | 0 |
| 5/6/2017 | 0.92 | 0.012748 |
| 5/7/2017 | 0.08 | 0 |
| 5/8/2017 | 0.04 | 0 |
| 5/9/2017 | 0 | 0 |
| 5/10/2017 | 0 | 0 |
| 5/11/2017 | 0 | 0 |
| 5/12/2017 | 0.1 | 0 |
| 5/13/2017 | 0.79 | 0.002152 |
| 5/14/2017 | 0.85 | 0.005988 |
| 5/15/2017 | 0.01 | 0 |
| 5/16/2017 | 0 | 0 |
| 5/17/2017 | 0 | 0 |
| 5/18/2017 | 0 | 0 |
| 5/19/2017 | 0 | 0 |
| 5/20/2017 | 0.03 | 0 |
| 5/21/2017 | 0.02 | 0 |
| 5/22/2017 | 0.07 | 0 |
| 5/23/2017 | 0.19 | 0 |
| 5/24/2017 | 0.08 | 0 |
| 5/25/2017 | 0.39 | 0 |
| 5/26/2017 | 1.21 | 0.064227 |
| 5/27/2017 | 0 | 0 |
| 5/28/2017 | 0.01 | 0 |
| 5/29/2017 | 0.21 | 0 |
| 5/30/2017 | 0.02 | 0 |
| 5/31/2017 | 0.05 | 0 |
| 6/1/2017 | 0 | 0 |
| 6/2/2017 | 0 | 0 |
| 6/3/2017 | 0 | 0 |
| 6/4/2017 | 0 | 0 |
| 6/5/2017 | 0 | 0 |
| 6/6/2017 | 0.36 | 0 |
| 6/7/2017 | 0.16 | 0 |
| 6/8/2017 | 0 | 0 |
| 6/9/2017 | 0 | 0 |
| 6/10/2017 | 0 | 0 |
| 6/11/2017 | 0 | 0 |
| 6/12/2017 | 0 | 0 |
| 6/13/2017 | 0 | 0 |
| 6/14/2017 | 0 | 0 |
| 6/15/2017 | 0 | 0 |
| 6/16/2017 | 0 | 0 |
| 6/17/2017 | 0.03 | 0 |
| 6/18/2017 | 0.32 | 0 |
| 6/19/2017 | 0 | 0 |
| 6/20/2017 | 0.68 | 0 |
| 6/21/2017 | 0 | 0 |
| 6/22/2017 | 0.11 | 0 |
| 6/23/2017 | 0.01 | 0 |
| 6/24/2017 | 1.5 | 0.147819 |

| Date | Avg Precip in. | Runoff From Open Space (in.) |
|---|---|---|
| 4/5/2016 | 0.14 | 0 |
| 4/6/2016 | 0 | 0 |
| 4/7/2016 | 0 | 0 |
| 4/8/2016 | 0.46 | 0 |
| 4/9/2016 | 0.02 | 0 |
| 4/10/2016 | 0.35 | 0 |
| 4/11/2016 | 0 | 0 |
| 4/12/2016 | 0.06 | 0 |
| 4/13/2016 | 0.23 | 0 |
| 4/14/2016 | 0 | 0 |
| 4/15/2016 | 0 | 0 |
| 4/16/2016 | 0 | 0 |
| 4/17/2016 | 0 | 0 |
| 4/18/2016 | 0 | 0 |
| 4/19/2016 | 0 | 0 |
| 4/20/2016 | 0 | 0 |
| 4/21/2016 | 0 | 0 |
| 4/22/2016 | 0 | 0 |
| 4/23/2016 | 0.03 | 0 |
| 4/24/2016 | 0.19 | 0 |
| 4/25/2016 | 0 | 0 |
| 4/26/2016 | 0.02 | 0 |
| 4/27/2016 | 0.12 | 0 |
| 4/28/2016 | 0 | 0 |
| 4/29/2016 | 0.18 | 0 |
| 4/30/2016 | 0.04 | 0 |
| 5/1/2016 | 0.21 | 0 |
| 5/2/2016 | 0.27 | 0 |
| 5/3/2016 | 0.57 | 0 |
| 5/4/2016 | 0.25 | 0 |
| 5/5/2016 | 0.02 | 0 |
| 5/6/2016 | 0.33 | 0 |
| 5/7/2016 | 1.16 | 0.052864 |
| 5/8/2016 | 0.15 | 0 |
| 5/9/2016 | 0 | 0 |
| 5/10/2016 | 0.02 | 0 |
| 5/11/2016 | 0.02 | 0 |
| 5/12/2016 | 0.01 | 0 |
| 5/13/2016 | 0 | 0 |
| 5/14/2016 | 0.11 | 0 |
| 5/15/2016 | 0.11 | 0 |
| 5/16/2016 | 0 | 0 |
| 5/17/2016 | 0 | 0 |
| 5/18/2016 | 0.14 | 0 |
| 5/19/2016 | 0.02 | 0 |
| 5/20/2016 | 0 | 0 |
| 5/21/2016 | 0.01 | 0 |
| 5/22/2016 | 0.79 | 0.002152 |
| 5/23/2016 | 0.06 | 0 |
| 5/24/2016 | 0.19 | 0 |
| 5/25/2016 | 0 | 0 |
| 5/26/2016 | 0 | 0 |
| 5/27/2016 | 0 | 0 |
| 5/28/2016 | 0 | 0 |
| 5/29/2016 | 0.01 | 0 |
| 5/30/2016 | 0.68 | 0 |
| 5/31/2016 | 0 | 0 |
| 6/1/2016 | 0 | 0 |
| 6/2/2016 | 0 | 0 |
| 6/3/2016 | 0.27 | 0 |
| 6/4/2016 | 0.3 | 0 |
| 6/5/2016 | 0.03 | 0 |
| 6/6/2016 | 0.53 | 0 |
| 6/7/2016 | 0 | 0 |
| 6/8/2016 | 0.05 | 0 |
| 6/9/2016 | 0.22 | 0 |
| 6/10/2016 | 0 | 0 |
| 6/11/2016 | 0 | 0 |
| 6/12/2016 | 0 | 0 |
| 6/13/2016 | 0 | 0 |
| 6/14/2016 | 0 | 0 |
| 6/15/2016 | 0 | 0 |
| 6/16/2016 | 0.28 | 0 |
| 6/17/2016 | 0.36 | 0 |
| 6/18/2016 | 0 | 0 |
| 6/19/2016 | 0 | 0 |
| 6/20/2016 | 0 | 0 |
| 6/21/2016 | 0.01 | 0 |
| 6/22/2016 | 0.01 | 0 |
| 6/23/2016 | 0.07 | 0 |
| 6/24/2016 | 0.75 | 0.000648 |

| Date | Avg Precip in. | Runoff From Open Space (in.) |
|---|---|---|
| 4/5/2015 | 0 | 0 |
| 4/6/2015 | 0 | 0 |
| 4/7/2015 | 0 | 0 |
| 4/8/2015 | 0.07 | 0 |
| 4/9/2015 | 0.05 | 0 |
| 4/10/2015 | 0.06 | 0 |
| 4/11/2015 | 0.01 | 0 |
| 4/12/2015 | 0 | 0 |
| 4/13/2015 | 0 | 0 |
| 4/14/2015 | 0.04 | 0 |
| 4/15/2015 | 0.11 | 0 |
| 4/16/2015 | 0 | 0 |
| 4/17/2015 | 0.12 | 0 |
| 4/18/2015 | 0 | 0 |
| 4/19/2015 | 0 | 0 |
| 4/20/2015 | 1.19 | 0.059566 |
| 4/21/2015 | 0.57 | 0 |
| 4/22/2015 | 0 | 0 |
| 4/23/2015 | 0.14 | 0 |
| 4/24/2015 | 0 | 0 |
| 4/25/2015 | 0 | 0 |
| 4/26/2015 | 0 | 0 |
| 4/27/2015 | 0 | 0 |
| 4/28/2015 | 0 | 0 |
| 4/29/2015 | 0 | 0 |
| 4/30/2015 | 0 | 0 |
| 5/1/2015 | 0 | 0 |
| 5/2/2015 | 0 | 0 |
| 5/3/2015 | 0 | 0 |
| 5/4/2015 | 0 | 0 |
| 5/5/2015 | 0 | 0 |
| 5/6/2015 | 0.18 | 0 |
| 5/7/2015 | 0.02 | 0 |
| 5/8/2015 | 0 | 0 |
| 5/9/2015 | 0 | 0 |
| 5/10/2015 | 0 | 0 |
| 5/11/2015 | 0 | 0 |
| 5/12/2015 | 0.17 | 0 |
| 5/13/2015 | 0 | 0 |
| 5/14/2015 | 0 | 0 |
| 5/15/2015 | 0 | 0 |
| 5/16/2015 | 0 | 0 |
| 5/17/2015 | 0.27 | 0 |
| 5/18/2015 | 0.02 | 0 |
| 5/19/2015 | 0.9 | 0.010573 |
| 5/20/2015 | 0.1 | 0 |
| 5/21/2015 | 0 | 0 |
| 5/22/2015 | 0.04 | 0 |
| 5/23/2015 | 0 | 0 |
| 5/24/2015 | 0 | 0 |
| 5/25/2015 | 0 | 0 |
| 5/26/2015 | 0 | 0 |
| 5/27/2015 | 0.04 | 0 |
| 5/28/2015 | 0.37 | 0 |
| 5/29/2015 | 0 | 0 |
| 5/30/2015 | 0 | 0 |
| 5/31/2015 | 0 | 0 |
| 6/1/2015 | 0.67 | 0 |
| 6/2/2015 | 1.02 | 0.026417 |
| 6/3/2015 | 0.13 | 0 |
| 6/4/2015 | 0.02 | 0 |
| 6/5/2015 | 0.26 | 0 |
| 6/6/2015 | 0.01 | 0 |
| 6/7/2015 | 0 | 0 |
| 6/8/2015 | 0 | 0 |
| 6/9/2015 | 0.89 | 0.009558 |
| 6/10/2015 | 0 | 0 |
| 6/11/2015 | 0 | 0 |
| 6/12/2015 | 0 | 0 |
| 6/13/2015 | 0.04 | 0 |
| 6/14/2015 | 0.03 | 0 |
| 6/15/2015 | 0.53 | 0 |
| 6/16/2015 | 0 | 0 |
| 6/17/2015 | 0.05 | 0 |
| 6/18/2015 | 0.91 | 0.011636 |
| 6/19/2015 | 0.38 | 0 |
| 6/20/2015 | 0.04 | 0 |
| 6/21/2015 | 0.55 | 0 |
| 6/22/2015 | 0.01 | 0 |
| 6/23/2015 | 0 | 0 |
| 6/24/2015 | 0.82 | 0.003838 |

| Date | Avg Precip in. | Runoff From Open Space (in.) |
|---|---|---|
| 4/5/2014 | 0.05 | 0 |
| 4/6/2014 | 0 | 0 |
| 4/7/2014 | 0 | 0 |
| 4/8/2014 | 0.51 | 0 |
| 4/9/2014 | 0.01 | 0 |
| 4/10/2014 | 0 | 0 |
| 4/11/2014 | 0 | 0 |
| 4/12/2014 | 0.01 | 0 |
| 4/13/2014 | 0 | 0 |
| 4/14/2014 | 0 | 0 |
| 4/15/2014 | 0.06 | 0 |
| 4/16/2014 | 2.1 | 0.398208 |
| 4/17/2014 | 0 | 0 |
| 4/18/2014 | 0 | 0 |
| 4/19/2014 | 0 | 0 |
| 4/20/2014 | 0 | 0 |
| 4/21/2014 | 0 | 0 |
| 4/22/2014 | 0 | 0 |
| 4/23/2014 | 0.08 | 0 |
| 4/24/2014 | 0 | 0 |
| 4/25/2014 | 0 | 0 |
| 4/26/2014 | 0.42 | 0 |
| 4/27/2014 | 0.01 | 0 |
| 4/28/2014 | 0 | 0 |
| 4/29/2014 | 0.05 | 0 |
| 4/30/2014 | 1.23 | 0.06904 |
| 5/1/2014 | 4.53 | 1.996945 |
| 5/2/2014 | 0.2 | 0 |
| 5/3/2014 | 0 | 0 |
| 5/4/2014 | 0.04 | 0 |
| 5/5/2014 | 0 | 0 |
| 5/6/2014 | 0 | 0 |
| 5/7/2014 | 0 | 0 |
| 5/8/2014 | 0.02 | 0 |
| 5/9/2014 | 0 | 0 |
| 5/10/2014 | 0 | 0 |
| 5/11/2014 | 0.37 | 0 |
| 5/12/2014 | 0 | 0 |
| 5/13/2014 | 0.09 | 0 |
| 5/14/2014 | 0.12 | 0 |
| 5/15/2014 | 0.02 | 0 |
| 5/16/2014 | 0.11 | 0 |
| 5/17/2014 | 1.72 | 0.22887 |
| 5/18/2014 | 0 | 0 |
| 5/19/2014 | 0 | 0 |
| 5/20/2014 | 0 | 0 |
| 5/21/2014 | 0.03 | 0 |
| 5/22/2014 | 0.16 | 0 |
| 5/23/2014 | 0.2 | 0 |
| 5/24/2014 | 0 | 0 |
| 5/25/2014 | 0 | 0 |
| 5/26/2014 | 0 | 0 |
| 5/27/2014 | 0 | 0 |
| 5/28/2014 | 0.44 | 0 |
| 5/29/2014 | 0.16 | 0 |
| 5/30/2014 | 0.1 | 0 |
| 5/31/2014 | 0 | 0 |
| 6/1/2014 | 0 | 0 |
| 6/2/2014 | 0 | 0 |
| 6/3/2014 | 0 | 0 |
| 6/4/2014 | 0.17 | 0 |
| 6/5/2014 | 0.16 | 0 |
| 6/6/2014 | 0.01 | 0 |
| 6/7/2014 | 0 | 0 |
| 6/8/2014 | 0 | 0 |
| 6/9/2014 | 0.07 | 0 |
| 6/10/2014 | 0.39 | 0 |
| 6/11/2014 | 0.25 | 0 |
| 6/12/2014 | 0.18 | 0 |
| 6/13/2014 | 0.99 | 0.021839 |
| 6/14/2014 | 0.15 | 0 |
| 6/15/2014 | 0 | 0 |
| 6/16/2014 | 0 | 0 |
| 6/17/2014 | 0 | 0 |
| 6/18/2014 | 0 | 0 |
| 6/19/2014 | 0.84 | 0.00522 |
| 6/20/2014 | 0.07 | 0 |
| 6/21/2014 | 0 | 0 |
| 6/22/2014 | 0.02 | 0 |
| 6/23/2014 | 0 | 0 |
| 6/24/2014 | 0 | 0 |

| Date | Avg Precip in. | Runoff From Open Space (in.) |
|---|---|---|
| 4/5/2013 | 0.01 | 0 |
| 4/6/2013 | 0 | 0 |
| 4/7/2013 | 0 | 0 |
| 4/8/2013 | 0 | 0 |
| 4/9/2013 | 0 | 0 |
| 4/10/2013 | 0 | 0 |
| 4/11/2013 | 0.29 | 0 |
| 4/12/2013 | 0.13 | 0 |
| 4/13/2013 | 0.73 | 0.000222 |
| 4/14/2013 | 0 | 0 |
| 4/15/2013 | 0 | 0 |
| 4/16/2013 | 0 | 0 |
| 4/17/2013 | 0.01 | 0 |
| 4/18/2013 | 0 | 0 |
| 4/19/2013 | 0.1 | 0 |
| 4/20/2013 | 1.01 | 0.024847 |
| 4/21/2013 | 0 | 0 |
| 4/22/2013 | 0 | 0 |
| 4/23/2013 | 0 | 0 |
| 4/24/2013 | 0 | 0 |
| 4/25/2013 | 0 | 0 |
| 4/26/2013 | 0 | 0 |
| 4/27/2013 | 0 | 0 |
| 4/28/2013 | 0 | 0 |
| 4/29/2013 | 0.13 | 0 |
| 4/30/2013 | 0.38 | 0 |
| 5/1/2013 | 0 | 0 |
| 5/2/2013 | 0 | 0 |
| 5/3/2013 | 0 | 0 |
| 5/4/2013 | 0 | 0 |
| 5/5/2013 | 0 | 0 |
| 5/6/2013 | 0 | 0 |
| 5/7/2013 | 0 | 0 |
| 5/8/2013 | 0.41 | 0 |
| 5/9/2013 | 0.44 | 0 |
| 5/10/2013 | 0.01 | 0 |
| 5/11/2013 | 1.3 | 0.087051 |
| 5/12/2013 | 0.31 | 0 |
| 5/13/2013 | 0 | 0 |
| 5/14/2013 | 0 | 0 |
| 5/15/2013 | 0.04 | 0 |
| 5/16/2013 | 0.05 | 0 |
| 5/17/2013 | 0.02 | 0 |
| 5/18/2013 | 0 | 0 |
| 5/19/2013 | 0.13 | 0 |
| 5/20/2013 | 0.03 | 0 |
| 5/21/2013 | 0.03 | 0 |
| 5/22/2013 | 0 | 0 |
| 5/23/2013 | 0.03 | 0 |
| 5/24/2013 | 0.66 | 0 |
| 5/25/2013 | 0.09 | 0 |
| 5/26/2013 | 0 | 0 |
| 5/27/2013 | 0 | 0 |
| 5/28/2013 | 0.02 | 0 |
| 5/29/2013 | 0.21 | 0 |
| 5/30/2013 | 0 | 0 |
| 5/31/2013 | 0 | 0 |
| 6/1/2013 | 0 | 0 |
| 6/2/2013 | 0 | 0 |
| 6/3/2013 | 0.49 | 0 |
| 6/4/2013 | 0.12 | 0 |
| 6/5/2013 | 0 | 0 |
| 6/6/2013 | 0 | 0 |
| 6/7/2013 | 1.47 | 0.137874 |
| 6/8/2013 | 2.5 | 0.609044 |
| 6/9/2013 | 0 | 0 |
| 6/10/2013 | 0.47 | 0 |
| 6/11/2013 | 1.44 | 0.128212 |
| 6/12/2013 | 0.01 | 0 |
| 6/13/2013 | 0 | 0 |
| 6/14/2013 | 0.58 | 0 |
| 6/15/2013 | 0.02 | 0 |
| 6/16/2013 | 0 | 0 |
| 6/17/2013 | 0.11 | 0 |
| 6/18/2013 | 0.55 | 0 |
| 6/19/2013 | 0.5 | 0 |
| 6/20/2013 | 0 | 0 |
| 6/21/2013 | 0 | 0 |
| 6/22/2013 | 0 | 0 |
| 6/23/2013 | 0 | 0 |
| 6/24/2013 | 0.03 | 0 |

| Date | Avg Precip in. | Runoff From Open Space (in.) |
|---|---|---|
| 4/5/2012 | 0 | 0 |
| 4/6/2012 | 0 | 0 |
| 4/7/2012 | 0 | 0 |
| 4/8/2012 | 0 | 0 |
| 4/9/2012 | 0 | 0 |
| 4/10/2012 | 0 | 0 |
| 4/11/2012 | 0 | 0 |
| 4/12/2012 | 0.01 | 0 |
| 4/13/2012 | 0.01 | 0 |
| 4/14/2012 | 0.01 | 0 |
| 4/15/2012 | 0.02 | 0 |
| 4/16/2012 | 0.01 | 0 |
| 4/17/2012 | 0 | 0 |
| 4/18/2012 | 0.02 | 0 |
| 4/19/2012 | 0.09 | 0 |
| 4/20/2012 | 0 | 0 |
| 4/21/2012 | 0 | 0 |
| 4/22/2012 | 0.33 | 0 |
| 4/23/2012 | 2.49 | 0.603425 |
| 4/24/2012 | 0.03 | 0 |
| 4/25/2012 | 0 | 0 |
| 4/26/2012 | 0.01 | 0 |
| 4/27/2012 | 0.12 | 0 |
| 4/28/2012 | 0 | 0 |
| 4/29/2012 | 0.01 | 0 |
| 4/30/2012 | 0 | 0 |
| 5/1/2012 | 0.21 | 0 |
| 5/2/2012 | 0.1 | 0 |
| 5/3/2012 | 0.28 | 0 |
| 5/4/2012 | 0.01 | 0 |
| 5/5/2012 | 0.57 | 0 |
| 5/6/2012 | 0.01 | 0 |
| 5/7/2012 | 0 | 0 |
| 5/8/2012 | 0.06 | 0 |
| 5/9/2012 | 0.45 | 0 |
| 5/10/2012 | 0.24 | 0 |
| 5/11/2012 | 0 | 0 |
| 5/12/2012 | 0 | 0 |
| 5/13/2012 | 0 | 0 |
| 5/14/2012 | 0 | 0 |
| 5/15/2012 | 0.43 | 0 |
| 5/16/2012 | 1.06 | 0.033134 |
| 5/17/2012 | 0 | 0 |
| 5/18/2012 | 0 | 0 |
| 5/19/2012 | 0 | 0 |
| 5/20/2012 | 0 | 0 |
| 5/21/2012 | 0.16 | 0 |
| 5/22/2012 | 0.02 | 0 |
| 5/23/2012 | 0.01 | 0 |
| 5/24/2012 | 0.02 | 0 |
| 5/25/2012 | 0.09 | 0 |
| 5/26/2012 | 0 | 0 |
| 5/27/2012 | 0.06 | 0 |
| 5/28/2012 | 0 | 0 |
| 5/29/2012 | 0 | 0 |
| 5/30/2012 | 0.52 | 0 |
| 5/31/2012 | 0.01 | 0 |
| 6/1/2012 | 0 | 0 |
| 6/2/2012 | 0.92 | 0.012748 |
| 6/3/2012 | 0 | 0 |
| 6/4/2012 | 0.22 | 0 |
| 6/5/2012 | 0.2 | 0 |
| 6/6/2012 | 0 | 0 |
| 6/7/2012 | 0 | 0 |
| 6/8/2012 | 0.02 | 0 |
| 6/9/2012 | 0 | 0 |
| 6/10/2012 | 0 | 0 |
| 6/11/2012 | 0 | 0 |
| 6/12/2012 | 0.01 | 0 |
| 6/13/2012 | 1.61 | 0.186615 |
| 6/14/2012 | 0 | 0 |
| 6/15/2012 | 0 | 0 |
| 6/16/2012 | 0 | 0 |
| 6/17/2012 | 0 | 0 |
| 6/18/2012 | 0 | 0 |
| 6/19/2012 | 0.01 | 0 |
| 6/20/2012 | 0 | 0 |
| 6/21/2012 | 0 | 0 |
| 6/22/2012 | 0 | 0 |
| 6/23/2012 | 0.25 | 0 |
| 6/24/2012 | 0 | 0 |

| Date | Avg Precip in | Runoff From Open Space (in.) |
|---|---|---|
| 4/5/2011 | 0.14 | 0 |
| 4/6/2011 | 0.13 | 0 |
| 4/7/2011 | 0 | 0 |
| 4/8/2011 | 0.01 | 0 |
| 4/9/2011 | 0.76 | 0.000943 |
| 4/10/2011 | 0 | 0 |
| 4/11/2011 | 0 | 0 |
| 4/12/2011 | 0 | 0 |
| 4/13/2011 | 0.98 | 0.020402 |
| 4/14/2011 | 0.1 | 0 |
| 4/15/2011 | 0 | 0 |
| 4/16/2011 | 0 | 0 |
| 4/17/2011 | 1.81 | 0.265843 |
| 4/18/2011 | 0 | 0 |
| 4/19/2011 | 0 | 0 |
| 4/20/2011 | 0.12 | 0 |
| 4/21/2011 | 0 | 0 |
| 4/22/2011 | 0 | 0 |
| 4/23/2011 | 0.24 | 0 |
| 4/24/2011 | 0.2 | 0 |
| 4/25/2011 | 0.02 | 0 |
| 4/26/2011 | 0 | 0 |
| 4/27/2011 | 0 | 0 |
| 4/28/2011 | 0.02 | 0 |
| 4/29/2011 | 0.15 | 0 |
| 4/30/2011 | 0.01 | 0 |
| 5/1/2011 | 0 | 0 |
| 5/2/2011 | 0 | 0 |
| 5/3/2011 | 0 | 0 |
| 5/4/2011 | 0.38 | 0 |
| 5/5/2011 | 0.31 | 0 |
| 5/6/2011 | 0 | 0 |
| 5/7/2011 | 0.1 | 0 |
| 5/8/2011 | 0.05 | 0 |
| 5/9/2011 | 0 | 0 |
| 5/10/2011 | 0 | 0 |
| 5/11/2011 | 0 | 0 |
| 5/12/2011 | 0 | 0 |
| 5/13/2011 | 0 | 0 |
| 5/14/2011 | 0.05 | 0 |
| 5/15/2011 | 0.38 | 0 |
| 5/16/2011 | 0.66 | 0 |
| 5/17/2011 | 0.47 | 0 |
| 5/18/2011 | 0.35 | 0 |
| 5/19/2011 | 0.05 | 0 |
| 5/20/2011 | 0.38 | 0 |
| 5/21/2011 | 0.26 | 0 |
| 5/22/2011 | 0 | 0 |
| 5/23/2011 | 0.06 | 0 |
| 5/24/2011 | 0.01 | 0 |
| 5/25/2011 | 0 | 0 |
| 5/26/2011 | 0 | 0 |
| 5/27/2011 | 0 | 0 |
| 5/28/2011 | 0 | 0 |
| 5/29/2011 | 0 | 0 |
| 5/30/2011 | 0 | 0 |
| 5/31/2011 | 0 | 0 |
| 6/1/2011 | 0 | 0 |
| 6/2/2011 | 0 | 0 |
| 6/3/2011 | 0 | 0 |
| 6/4/2011 | 0 | 0 |
| 6/5/2011 | 0.1 | 0 |
| 6/6/2011 | 0.06 | 0 |
| 6/7/2011 | 0 | 0 |
| 6/8/2011 | 0 | 0 |
| 6/9/2011 | 0 | 0 |
| 6/10/2011 | 0.1 | 0 |
| 6/11/2011 | 0.06 | 0 |
| 6/12/2011 | 0.71 | 1.82E-05 |
| 6/13/2011 | 0.03 | 0 |
| 6/14/2011 | 0 | 0 |
| 6/15/2011 | 0.05 | 0 |
| 6/16/2011 | 0 | 0 |
| 6/17/2011 | 0.46 | 0 |
| 6/18/2011 | 0.34 | 0 |
| 6/19/2011 | 0 | 0 |
| 6/20/2011 | 0 | 0 |
| 6/21/2011 | 0.23 | 0 |
| 6/22/2011 | 0.19 | 0 |
| 6/23/2011 | [illegible] | 0 |
| 6/24/2011 | 0.14 | 0 |

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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/25/2020 | 0 | 0 | 6/25/2019 | 0.05 | 0 | 6/25/2018 | 0.21 | 0 | 6/25/2017 | 0 | 0 | 6/25/2016 | 0.02 | 0 | 6/25/2015 | 0 | 0 | 6/25/2014 | 0 | 0 | 6/25/2013 | 0.44 | 0 | 6/25/2012 | 0.03 | 0 | 6/25/2011 | 0.07 | 0 |
| 6/26/2020 | 0.05 | 0 | 6/26/2019 | 0 | 0 | 6/26/2018 | 0 | 0 | 6/26/2017 | 0 | 0 | 6/26/2016 | 0 | 0 | 6/26/2015 | 0.19 | 0 | 6/26/2014 | 0.47 | 0 | 6/26/2013 | 0.11 | 0 | 6/26/2012 | 0.02 | 0 | 6/26/2011 | 0 | 0 |
| 6/27/2020 | 0.06 | 0 | 6/27/2019 | 0 | 0 | 6/27/2018 | 0 | 0 | 6/27/2017 | 0.16 | 0 | 6/27/2016 | 0 | 0 | 6/27/2015 | 0.29 | 0 | 6/27/2014 | 0 | 0 | 6/27/2013 | 0.14 | 0 | 6/27/2012 | 0 | 0 | 6/27/2011 | 0 | 0 |
| 6/28/2020 | 0.05 | 0 | 6/28/2019 | 0 | 0 | 6/28/2018 | 0.43 | 0 | 6/28/2017 | 0 | 0 | 6/28/2016 | 0.18 | 0 | 6/28/2015 | 1.97 | 0.336506 | 6/28/2014 | 0 | 0 | 6/28/2013 | 0.96 | 0.017666 | 6/28/2012 | 0 | 0 | 6/28/2011 | 0 | 0 |
| 6/29/2020 | 0.14 | 0 | 6/29/2019 | 0.08 | 0 | 6/29/2018 | 0.01 | 0 | 6/29/2017 | 0 | 0 | 6/29/2016 | 0.04 | 0 | 6/29/2015 | 0 | 0 | 6/29/2014 | 0 | 0 | 6/29/2013 | 1.32 | 0.09252 | 6/29/2012 | 0.17 | 0 | 6/29/2011 | 0.18 | 0 |
| 6/30/2020 | 0 | 0 | 6/30/2019 | 0.49 | 0 | 6/30/2018 | 0 | 0 | 6/30/2017 | 0 | 0 | 6/30/2016 | 0 | 0 | 6/30/2015 | 0 | 0 | 6/30/2014 | 0 | 0 | 6/30/2013 | 0 | 0 | 6/30/2012 | 0.11 | 0 | 6/30/2011 | 0 | 0 |
| 7/1/2020 | 0.02 | 0 | 7/1/2019 | 0 | 0 | 7/1/2018 | 0 | 0 | 7/1/2017 | 0 | 0 | 7/1/2016 | 0 | 0 | 7/1/2015 | 0.82 | 0.003838 | 7/1/2014 | 0 | 0 | 7/1/2013 | 1.13 | 0.046517 | 7/1/2012 | 0 | 0 | 7/1/2011 | 0 | 0 |
| 7/2/2020 | 0.02 | 0 | 7/2/2019 | 0 | 0 | 7/2/2018 | 0 | 0 | 7/2/2017 | 0.67 | 0 | 7/2/2016 | 0.19 | 0 | 7/2/2015 | 0 | 0 | 7/2/2014 | 0 | 0 | 7/2/2013 | 0.17 | 0 | 7/2/2012 | 0 | 0 | 7/2/2011 | 0 | 0 |
| 7/3/2020 | 0 | 0 | 7/3/2019 | 0.56 | 0 | 7/3/2018 | 0 | 0 | 7/3/2017 | 0 | 0 | 7/3/2016 | 0 | 0 | 7/3/2015 | 0.03 | 0 | 7/3/2014 | 0.3 | 0 | 7/3/2013 | 0.02 | 0 | 7/3/2012 | 0 | 0 | 7/3/2011 | 0.02 | 0 |
| 7/4/2020 | 0.02 | 0 | 7/4/2019 | 0 | 0 | 7/4/2018 | 0.92 | 0.012748 | 7/4/2017 | 0.01 | 0 | 7/4/2016 | 0 | 0 | 7/4/2015 | 0 | 0 | 7/4/2014 | 0.26 | 0 | 7/4/2013 | 0.27 | 0 | 7/4/2012 | 0.01 | 0 | 7/4/2011 | 0.03 | 0 |
| 7/5/2020 | 0 | 0 | 7/5/2019 | 0.22 | 0 | 7/5/2018 | 0.01 | 0 | 7/5/2017 | 0.21 | 0 | 7/5/2016 | 0.48 | 0 | 7/5/2015 | 0.08 | 0 | 7/5/2014 | 0 | 0 | 7/5/2013 | 0 | 0 | 7/5/2012 | 0 | 0 | 7/5/2011 | 0 | 0 |
| 7/6/2020 | 0 | 0 | 7/6/2019 | 0.11 | 0 | 7/6/2018 | 0.12 | 0 | 7/6/2017 | 0.01 | 0 | 7/6/2016 | 0 | 0 | 7/6/2015 | 0 | 0 | 7/6/2014 | 0 | 0 | 7/6/2013 | 0 | 0 | 7/6/2012 | 0 | 0 | 7/6/2011 | 0 | 0 |
| 7/7/2020 | 0.84 | 0.00522 | 7/7/2019 | 0.68 | 0 | 7/7/2018 | 0.17 | 0 | 7/7/2017 | 0.47 | 0 | 7/7/2016 | 0 | 0 | 7/7/2015 | 0.03 | 0 | 7/7/2014 | 0 | 0 | 7/7/2013 | 0 | 0 | 7/7/2012 | 0 | 0 | 7/7/2011 | 0.02 | 0 |
| 7/8/2020 | 0 | 0 | 7/8/2019 | 0.09 | 0 | 7/8/2018 | 0 | 0 | 7/8/2017 | 0.64 | 0 | 7/8/2016 | 0 | 0 | 7/8/2015 | 0 | 0 | 7/8/2014 | 0 | 0 | 7/8/2013 | 0.31 | 0 | 7/8/2012 | 0.06 | 0 | 7/8/2011 | 0.02 | 0 |
| 7/9/2020 | 0.03 | 0 | 7/9/2019 | 0.15 | 0 | 7/9/2018 | 0 | 0 | 7/9/2017 | 0.02 | 0 | 7/9/2016 | 0.03 | 0 | 7/9/2015 | 0.39 | 0 | 7/9/2014 | 0.18 | 0 | 7/9/2013 | 0.42 | 0 | 7/9/2012 | 0 | 0 | 7/9/2011 | 0.78 | 0.001696 |
| 7/10/2020 | 0.1 | 0 | 7/10/2019 | 0 | 0 | 7/10/2018 | 0 | 0 | 7/10/2017 | 0 | 0 | 7/10/2016 | 0.63 | 0 | 7/10/2015 | 0.5 | 0 | 7/10/2014 | 0 | 0 | 7/10/2013 | 0.01 | 0 | 7/10/2012 | 0.04 | 0 | 7/10/2011 | 0.01 | 0 |
| 7/11/2020 | 2.56 | 0.643101 | 7/11/2019 | 0.24 | 0 | 7/11/2018 | 0 | 0 | 7/11/2017 | 0 | 0 | 7/11/2016 | 0 | 0 | 7/11/2015 | 0 | 0 | 7/11/2014 | 0.61 | 0 | 7/11/2013 | 0.06 | 0 | 7/11/2012 | 0 | 0 | 7/11/2011 | 0 | 0 |
| 7/12/2020 | 0 | 0 | 7/12/2019 | 1.84 | 0.278624 | 7/12/2018 | 0 | 0 | 7/12/2017 | 0 | 0 | 7/12/2016 | 0 | 0 | 7/12/2015 | 0 | 0 | 7/12/2014 | 0 | 0 | 7/12/2013 | 0.05 | 0 | 7/12/2012 | 0 | 0 | 7/12/2011 | 0.1 | 0 |
| 7/13/2020 | 0.09 | 0 | 7/13/2019 | 0 | 0 | 7/13/2018 | 0 | 0 | 7/13/2017 | 0.01 | 0 | 7/13/2016 | 0 | 0 | 7/13/2015 | 0 | 0 | 7/13/2014 | 0.02 | 0 | 7/13/2013 | 2.49 | 0.603425 | 7/13/2012 | 0 | 0 | 7/13/2011 | 0 | 0 |
| 7/14/2020 | 0 | 0 | 7/14/2019 | 0 | 0 | 7/14/2018 | 0 | 0 | 7/14/2017 | 0.4 | 0 | 7/14/2016 | 0.46 | 0 | 7/14/2015 | 0.31 | 0 | 7/14/2014 | 0.29 | 0 | 7/14/2013 | 0.03 | 0 | 7/14/2012 | 0.36 | 0 | 7/14/2011 | 0 | 0 |
| 7/15/2020 | 0 | 0 | 7/15/2019 | 0 | 0 | 7/15/2018 | 0 | 0 | 7/15/2017 | 1.21 | 0.064227 | 7/15/2016 | 0 | 0 | 7/15/2015 | 0.82 | 0.003838 | 7/15/2014 | 0.25 | 0 | 7/15/2013 | 0 | 0 | 7/15/2012 | 0.37 | 0 | 7/15/2011 | 0 | 0 |
| 7/16/2020 | 0 | 0 | 7/16/2019 | 0 | 0 | 7/16/2018 | 0.5 | 0 | 7/16/2017 | 0 | 0 | 7/16/2016 | 0 | 0 | 7/16/2015 | 0.3 | 0 | 7/16/2014 | 0.33 | 0 | 7/16/2013 | 0 | 0 | 7/16/2012 | 0.62 | 0 | 7/16/2011 | 0 | 0 |
| 7/17/2020 | 0.02 | 0 | 7/17/2019 | 0.05 | 0 | 7/17/2018 | 0 | 0 | 7/17/2017 | 0 | 0 | 7/17/2016 | 0.11 | 0 | 7/17/2015 | 0 | 0 | 7/17/2014 | 0 | 0 | 7/17/2013 | 0 | 0 | 7/17/2012 | 0 | 0 | 7/17/2011 | 0 | 0 |
| 7/18/2020 | 0 | 0 | 7/18/2019 | 0.54 | 0 | 7/18/2018 | 1.19 | 0.059566 | 7/18/2017 | 0.18 | 0 | 7/18/2016 | 0 | 0 | 7/18/2015 | 0 | 0 | 7/18/2014 | 0 | 0 | 7/18/2013 | 0 | 0 | 7/18/2012 | 0 | 0 | 7/18/2011 | 0 | 0 |
| 7/19/2020 | 0 | 0 | 7/19/2019 | 0.7 | 0 | 7/19/2018 | 0 | 0 | 7/19/2017 | 0 | 0 | 7/19/2016 | 0.5 | 0 | 7/19/2015 | 0 | 0 | 7/19/2014 | 0 | 0 | 7/19/2013 | 0.01 | 0 | 7/19/2012 | 0.03 | 0 | 7/19/2011 | 0 | 0 |
| 7/20/2020 | 0.02 | 0 | 7/20/2019 | 0 | 0 | 7/20/2018 | 0 | 0 | 7/20/2017 | 0 | 0 | 7/20/2016 | 0 | 0 | 7/20/2015 | 0 | 0 | 7/20/2014 | 0.01 | 0 | 7/20/2013 | 0 | 0 | 7/20/2012 | 0.51 | 0 | 7/20/2011 | 0.14 | 0 |
| 7/21/2020 | 0 | 0 | 7/21/2019 | 0 | 0 | 7/21/2018 | 0 | 0 | 7/21/2017 | 0 | 0 | 7/21/2016 | 0 | 0 | 7/21/2015 | 0 | 0 | 7/21/2014 | 0 | 0 | 7/21/2013 | 0.07 | 0 | 7/21/2012 | 0.09 | 0 | 7/21/2011 | 0 | 0 |
| 7/22/2020 | 0.06 | 0 | 7/22/2019 | 0.04 | 0 | 7/22/2018 | 1.78 | 0.253288 | 7/22/2017 | 0 | 0 | 7/22/2016 | 0 | 0 | 7/22/2015 | 0.03 | 0 | 7/22/2014 | 0 | 0 | 7/22/2013 | 0.05 | 0 | 7/22/2012 | 0 | 0 | 7/22/2011 | 0 | 0 |
| 7/23/2020 | 0.35 | 0 | 7/23/2019 | 1.71 | 0.224892 | 7/23/2018 | 1.43 | 0.125055 | 7/23/2017 | 0.24 | 0 | 7/23/2016 | 0 | 0 | 7/23/2015 | 0 | 0 | 7/23/2014 | 0 | 0 | 7/23/2013 | 1.39 | 0.112755 | 7/23/2012 | 0 | 0 | 7/23/2011 | 0 | 0 |
| 7/24/2020 | 0.66 | 0 | 7/24/2019 | 0.02 | 0 | 7/24/2018 | 1.09 | 0.038621 | 7/24/2017 | 1.88 | 0.296008 | 7/24/2016 | 0.1 | 0 | 7/24/2015 | 0 | 0 | 7/24/2014 | 0.55 | 0 | 7/24/2013 | 0.07 | 0 | 7/24/2012 | 0.02 | 0 | 7/24/2011 | 0.01 | 0 |
| 7/25/2020 | 0.05 | 0 | 7/25/2019 | 0 | 0 | 7/25/2018 | 0.75 | 0.000648 | 7/25/2017 | 0.69 | 0 | 7/25/2016 | 0.47 | 0 | 7/25/2015 | 0 | 0 | 7/25/2014 | 0 | 0 | 7/25/2013 | 0 | 0 | 7/25/2012 | 0 | 0 | 7/25/2011 | 0.02 | 0 |
| 7/26/2020 | 0 | 0 | 7/26/2019 | 0 | 0 | 7/26/2018 | 0.54 | 0 | 7/26/2017 | 0.01 | 0 | 7/26/2016 | 0.48 | 0 | 7/26/2015 | 0 | 0 | 7/26/2014 | 0 | 0 | 7/26/2013 | 0 | 0 | 7/26/2012 | 0 | 0 | 7/26/2011 | 1.14 | 0.048593 |
| 7/27/2020 | 0 | 0 | 7/27/2019 | 0 | 0 | 7/27/2018 | 0.01 | 0 | 7/27/2017 | 0 | 0 | 7/27/2016 | 0 | 0 | 7/27/2015 | 0.4 | 0 | 7/27/2014 | 0.05 | 0 | 7/27/2013 | 0 | 0 | 7/27/2012 | 0.54 | 0 | 7/27/2011 | 0.03 | 0 |
| 7/28/2020 | 0 | 0 | 7/28/2019 | 0 | 0 | 7/28/2018 | 0.18 | 0 | 7/28/2017 | 0 | 0 | 7/28/2016 | 0 | 0 | 7/28/2015 | 0 | 0 | 7/28/2014 | 1.26 | 0.07654 | 7/28/2013 | 0.12 | 0 | 7/28/2012 | 0 | 0 | 7/28/2011 | 0 | 0 |
| 7/29/2020 | 0 | 0 | 7/29/2019 | 0 | 0 | 7/29/2018 | 0 | 0 | 7/29/2017 | 0.32 | 0 | 7/29/2016 | 1.07 | 0.034921 | 7/29/2015 | 0 | 0 | 7/29/2014 | 0.01 | 0 | 7/29/2013 | 0.82 | 0.003838 | 7/29/2012 | 0.16 | 0 | 7/29/2011 | 0.28 | 0 |
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| 7/31/2020 | 0.17 | 0 | 7/31/2019 | 0 | 0 | 7/31/2018 | 0.01 | 0 | 7/31/2017 | 0 | 0 | 7/31/2016 | 1.25 | 0.074003 | 7/31/2015 | 0.67 | 0 | 7/31/2014 | 0 | 0 | 7/31/2013 | 0 | 0 | 7/31/2012 | 0.02 | 0 | 7/31/2011 | 0 | 0 |
| 8/1/2020 | 0.06 | 0 | 8/1/2019 | 0.09 | 0 | 8/1/2018 | 0.05 | 0 | 8/1/2017 | 0 | 0 | 8/1/2016 | 0 | 0 | 8/1/2015 | 0 | 0 | 8/1/2014 | 0 | 0 | 8/1/2013 | 0.31 | 0 | 8/1/2012 | 0.01 | 0 | 8/1/2011 | 0.01 | 0 |
| 8/2/2020 | 0.02 | 0 | 8/2/2019 | 0.17 | 0 | 8/2/2018 | 0.22 | 0 | 8/2/2017 | 0 | 0 | 8/2/2016 | 0.11 | 0 | 8/2/2015 | 0 | 0 | 8/2/2014 | 0.45 | 0 | 8/2/2013 | 1.3 | 0.087051 | 8/2/2012 | 0.11 | 0 | 8/2/2011 | 0.13 | 0 |
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| 8/4/2020 | 1.21 | 0.064227 | 8/4/2019 | 0.01 | 0 | 8/4/2018 | 1.12 | 0.044482 | 8/4/2017 | 0.03 | 0 | 8/4/2016 | 0 | 0 | 8/4/2015 | 0.2 | 0 | 8/4/2014 | 0.02 | 0 | 8/4/2013 | 0.03 | 0 | 8/4/2012 | 0.03 | 0 | 8/4/2011 | 0.43 | 0 |
| 8/5/2020 | 4.76 | 2.17592 | 8/5/2019 | 0 | 0 | 8/5/2018 | 0.03 | 0 | 8/5/2017 | 0.63 | 0 | 8/5/2016 | 0 | 0 | 8/5/2015 | 0 | 0 | 8/5/2014 | 0 | 0 | 8/5/2013 | 0 | 0 | 8/5/2012 | 0.14 | 0 | 8/5/2011 | 0.02 | 0 |
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| 8/8/2020 | 1.57 | 0.172093 | 8/8/2019 | 0.19 | 0 | 8/8/2018 | 0.08 | 0 | 8/8/2017 | 0.5 | 0 | 8/8/2016 | 0 | 0 | 8/8/2015 | 0 | 0 | 8/8/2014 | 0 | 0 | 8/8/2013 | 0.25 | 0 | 8/8/2012 | 0 | 0 | 8/8/2011 | 0.01 | 0 |
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| 8/12/2020 | 0 | 0 | 8/12/2019 | 0 | 0 | 8/12/2018 | 0.87 | 0.007674 | 8/12/2017 | 0.03 | 0 | 8/12/2016 | 0.01 | 0 | 8/12/2015 | 0.1 | 0 | 8/12/2014 | 0.11 | 0 | 8/12/2013 | 0 | 0 | 8/12/2012 | 0.05 | 0 | 8/12/2011 | 0 | 0 |
| 8/13/2020 | 0.82 | 0.003838 | 8/13/2019 | 0 | 0 | 8/13/2018 | 1.27 | 0.079113 | 8/13/2017 | 0.06 | 0 | 8/13/2016 | 0.15 | 0 | 8/13/2015 | 0 | 0 | 8/13/2014 | 1.49 | 0.144473 | 8/13/2013 | 1.56 | 0.168536 | 8/13/2012 | 0 | 0 | 8/13/2011 | 0 | 0 |
| 8/14/2020 | 0.17 | 0 | 8/14/2019 | 0.15 | 0 | 8/14/2018 | 1.26 | 0.07654 | 8/14/2017 | 0 | 0 | 8/14/2016 | 0 | 0 | 8/14/2015 | 0 | 0 | 8/14/2014 | 0 | 0 | 8/14/2013 | 0.48 | 0 | 8/14/2012 | 0 | 0 | 8/14/2011 | 1.16 | 0.052864 |
| 8/15/2020 | 0 | 0 | 8/15/2019 | 0.81 | 0.003224 | 8/15/2018 | 0.16 | 0 | 8/15/2017 | 0.07 | 0 | 8/15/2016 | 0.04 | 0 | 8/15/2015 | 0 | 0 | 8/15/2014 | 0.01 | 0 | 8/15/2013 | 0 | 0 | 8/15/2012 | 0.92 | 0.012748 | 8/15/2011 | 1.27 | 0.079113 |
| 8/16/2020 | 0.35 | 0 | 8/16/2019 | 0 | 0 | 8/16/2018 | 0 | 0 | 8/16/2017 | 0.4 | 0 | 8/16/2016 | 0.08 | 0 | 8/16/2015 | 0 | 0 | 8/16/2014 | 0 | 0 | 8/16/2013 | 0 | 0 | 8/16/2012 | 0.01 | 0 | 8/16/2011 | 0.23 | 0 |
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| 8/18/2020 | 0.33 | 0 | 8/18/2019 | 0 | 0 | 8/18/2018 | 0.26 | 0 | 8/18/2017 | 0 | 0 | 8/18/2016 | 0.25 | 0 | 8/18/2015 | 0 | 0 | 8/18/2014 | 0.01 | 0 | 8/18/2013 | 0.04 | 0 | 8/18/2012 | 1.29 | 0.084369 | 8/18/2011 | 0.6 | 0 |
| 8/19/2020 | 0.01 | 0 | 8/19/2019 | 0.05 | 0 | 8/19/2018 | 0.27 | 0 | 8/19/2017 | 0.87 | 0.007674 | 8/19/2016 | 0.24 | 0 | 8/19/2015 | 0.05 | 0 | 8/19/2014 | 0 | 0 | 8/19/2013 | 0.01 | 0 | 8/19/2012 | 0 | 0 | 8/19/2011 | 0.95 | 0.016366 |
| 8/20/2020 | 0.03 | 0 | 8/20/2019 | 0 | 0 | 8/20/2018 | 1.15 | 0.050708 | 8/20/2017 | 0 | 0 | 8/20/2016 | 0 | 0 | 8/20/2015 | 0.11 | 0 | 8/20/2014 | 0 | 0 | 8/20/2013 | 0 | 0 | 8/20/2012 | 0 | 0 | 8/20/2011 | 0.6 | 0 |
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| 8/22/2020 | 0 | 0 | 8/22/2019 | 0.35 | 0 | 8/22/2018 | 0.89 | 0.009558 | 8/22/2017 | 0.01 | 0 | 8/22/2016 | 0.8 | 0.002662 | 8/22/2015 | 0 | 0 | 8/22/2014 | 0.11 | 0 | 8/22/2013 | 0.01 | 0 | 8/22/2012 | 0 | 0 | 8/22/2011 | 0.54 | 0 |
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| 8/24/2020 | 0.54 | 0 | 8/24/2019 | 0.21 | 0 | 8/24/2018 | 0 | 0 | 8/24/2017 | 0 | 0 | 8/24/2016 | 0 | 0 | 8/24/2015 | 0 | 0 | 8/24/2014 | 0.11 | 0 | 8/24/2013 | 0 | 0 | 8/24/2012 | 0 | 0 | 8/24/2011 | 0 | 0 |
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| 8/26/2020 | 0.01 | 0 | 8/26/2019 | 0 | 0 | 8/26/2018 | 0 | 0 | 8/26/2017 | 0 | 0 | 8/26/2016 | 0 | 0 | 8/26/2015 | 0 | 0 | 8/26/2014 | 0 | 0 | 8/26/2013 | 0 | 0 | 8/26/2012 | 0 | 0 | 8/26/2011 | 0.87 | 0.007674 |
| 8/27/2020 | 0 | 0 | 8/27/2019 | 0 | 0 | 8/27/2018 | 0 | 0 | 8/27/2017 | 0 | 0 | 8/27/2016 | 0 | 0 | 8/27/2015 | 0 | 0 | 8/27/2014 | 0 | 0 | 8/27/2013 | 0 | 0 | 8/27/2012 | 0.63 | 0 | 8/27/2011 | 0 | 0 |
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| 9/1/2020 | 0.08 | 0 | 9/1/2019 | 0 | 0 | 9/1/2018 | 1.22 | 0.066615 | 9/1/2017 | 0.07 | 0 | 9/1/2016 | 0.34 | 0 | 9/1/2015 | 0.02 | 0 | 9/1/2014 | 1.08 | 0.03675 | 9/1/2013 | 0 | 0 | 9/1/2012 | 0 | 0 | 9/1/2011 | 0 | 0 |
| 9/2/2020 | 0.03 | 0 | 9/2/2019 | 0 | 0 | 9/2/2018 | 0.04 | 0 | 9/2/2017 | 0 | 0 | 9/2/2016 | 0.04 | 0 | 9/2/2015 | 0 | 0 | 9/2/2014 | 0.13 | 0 | 9/2/2013 | 0 | 0 | 9/2/2012 | 0.03 | 0 | 9/2/2011 | 0 | 0 |
| 9/3/2020 | 0.17 | 0 | 9/3/2019 | 0.25 | 0 | 9/3/2018 | 0 | 0 | 9/3/2017 | 1.06 | 0.033134 | 9/3/2016 | 0 | 0 | 9/3/2015 | 0 | 0 | 9/3/2014 | 0.34 | 0 | 9/3/2013 | 0.33 | 0 | 9/3/2012 | 1.19 | 0.059566 | 9/3/2011 | 0 | 0 |
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| 9/8/2020 | 0 | 0 | 9/8/2019 | 0 | 0 | 9/8/2018 | 1.11 | 0.042487 | 9/8/2017 | 0 | 0 | 9/8/2016 | 0 | 0 | 9/8/2015 | 0 | 0 | 9/8/2014 | 0 | 0 | 9/8/2013 | 0.01 | 0 | 9/8/2012 | 0 | 0 | 9/8/2011 | 0.84 | 0.00522 |
| 9/9/2020 | 0 | 0 | 9/9/2019 | 0 | 0 | 9/9/2018 | 1.11 | 0.042487 | 9/9/2017 | 0 | 0 | 9/9/2016 | 0 | 0 | 9/9/2015 | 0 | 0 | 9/9/2014 | 0 | 0 | 9/9/2013 | 0 | 0 | 9/9/2012 | 0.52 | 0 | 9/9/2011 | 0.22 | 0 |
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| 9/11/2020 | 0.49 | 0 | 9/11/2019 | 0 | 0 | 9/11/2018 | 0.14 | 0 | 9/11/2017 | 0 | 0 | 9/11/2016 | 0 | 0 | 9/11/2015 | 1.16 | 0.052864 | 9/11/2014 | 0 | 0 | 9/11/2013 | 0 | 0 | 9/11/2012 | 0 | 0 | 9/11/2011 | 0 | 0 |
| 9/12/2020 | 0.01 | 0 | 9/12/2019 | 0.15 | 0 | 9/12/2018 | 0.03 | 0 | 9/12/2017 | 0 | 0 | 9/12/2016 | 0 | 0 | 9/12/2015 | 0 | 0 | 9/12/2014 | 0 | 0 | 9/12/2013 | 0 | 0 | 9/12/2012 | 0 | 0 | 9/12/2011 | 0.17 | 0 |
| 9/13/2020 | 0 | 0 | 9/13/2019 | 0.17 | 0 | 9/13/2018 | 0.18 | 0 | 9/13/2017 | 0 | 0 | 9/13/2016 | 0 | 0 | 9/13/2015 | 0.49 | 0 | 9/13/2014 | 0 | 0 | 9/13/2013 | 0.43 | 0 | 9/13/2012 | 0 | 0 | 9/13/2011 | 0 | 0 |
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| 9/16/2020 | 0 | 0 | 9/16/2019 | 0 | 0 | 9/16/2018 | 0 | 0 | 9/16/2017 | 0 | 0 | 9/16/2016 | 0 | 0 | 9/16/2015 | 0 | 0 | 9/16/2014 | 0.1 | 0 | 9/16/2013 | 0 | 0 | 9/16/2012 | 0 | 0 | 9/16/2011 | [illegible] | 0 |
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| | | | | | |
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| 9/18/2020 | 0 | 0 | 9/18/2019 | 0 | 0 |
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| 9/22/2020 | 0 | 0 | 9/22/2019 | 0 | 0 |
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| 10/6/2020 | 0.03 | 0 | 10/6/2019 | 0 | 0 |
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| 10/21/2020 | 0.01 | 0 | 10/21/2019 | 0.58 | 0 |
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| 10/27/2020 | 0.08 | 0 | 10/27/2019 | 0.37 | 0 |
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| 11/9/2020 | 0 | 0 | 11/9/2019 | 0 | 0 |
| 11/10/2020 | 0 | 0 | 11/10/2019 | 0 | 0 |
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| 11/19/2020 | 0 | 0 | 11/19/2019 | 0 | 0 |
| 11/20/2020 | 0 | 0 | 11/20/2019 | 0 | 0 |
| 11/21/2020 | 0 | 0 | 11/21/2019 | 0 | 0 |
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| 11/24/2020 | 0 | 0 | 11/24/2019 | 1.07 | 0.034921 |
| 11/25/2020 | 0 | 0 | 11/25/2019 | 0.08 | 0 |
| 11/26/2020 | 0.33 | 0 | 11/26/2019 | 0 | 0 |
| 11/27/2020 | 0 | 0 | 11/27/2019 | 0 | 0 |
| 11/28/2020 | 0 | 0 | 11/28/2019 | 0 | 0 |
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| 12/8/2020 | 0 | 0 | 12/8/2019 | 0 | 0 |
| 12/9/2020 | 0 | 0 | 12/9/2019 | 0.14 | 0 |
| 12/10/2020 | 0 | 0 | 12/10/2019 | 0.87 | 0.007674 |
| 12/11/2020 | 0 | 0 | 12/11/2019 | 0.38 | 0 |

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|---|---|---|---|---|---|
| 9/18/2018 | 1.02 | 0.026417 | 9/18/2017 | 0 | 0 |
| 9/19/2018 | 0.47 | 0 | 9/19/2017 | 0 | 0 |
| 9/20/2018 | 0 | 0 | 9/20/2017 | 0.05 | 0 |
| 9/21/2018 | 0 | 0 | 9/21/2017 | 0 | 0 |
| 9/22/2018 | 0.02 | 0 | 9/22/2017 | 0 | 0 |
| 9/23/2018 | 0.02 | 0 | 9/23/2017 | 0 | 0 |
| 9/24/2018 | 0.58 | 0 | 9/24/2017 | 0 | 0 |
| 9/25/2018 | 0.19 | 0 | 9/25/2017 | 0 | 0 |
| 9/26/2018 | 0.72 | 9.18E-05 | 9/26/2017 | 0 | 0 |
| 9/27/2018 | 0.35 | 0 | 9/27/2017 | 0 | 0 |
| 9/28/2018 | 1.23 | 0.06904 | 9/28/2017 | 0 | 0 |
| 9/29/2018 | 0.01 | 0 | 9/29/2017 | 0 | 0 |
| 9/30/2018 | 0 | 0 | 9/30/2017 | 0 | 0 |
| 10/1/2018 | 0 | 0 | 10/1/2017 | 0 | 0 |
| 10/2/2018 | 0 | 0 | 10/2/2017 | 0 | 0 |
| 10/3/2018 | 0.27 | 0 | 10/3/2017 | 0 | 0 |
| 10/4/2018 | 0.01 | 0 | 10/4/2017 | 0 | 0 |
| 10/5/2018 | 0.08 | 0 | 10/5/2017 | 0 | 0 |
| 10/6/2018 | 0.02 | 0 | 10/6/2017 | 0.01 | 0 |
| 10/7/2018 | 0 | 0 | 10/7/2017 | 0 | 0 |
| 10/8/2018 | 0 | 0 | 10/8/2017 | 0.06 | 0 |
| 10/9/2018 | 0.02 | 0 | 10/9/2017 | 0.16 | 0 |
| 10/10/201 | 0.01 | 0 | 10/10/2017 | 0.83 | 0.004504 |
| 10/11/201 | 0.01 | 0 | 10/11/2017 | 0 | 0 |
| 10/12/201 | 0.71 | 1.82E-05 | 10/12/2017 | 0.4 | 0 |
| 10/13/201 | 0.07 | 0 | 10/13/2017 | 0.02 | 0 |
| 10/14/201 | 0.05 | 0 | 10/14/2017 | 0.07 | 0 |
| 10/15/201 | 0.06 | 0 | 10/15/2017 | 0.02 | 0 |
| 10/16/201 | 0.17 | 0 | 10/16/2017 | 0.08 | 0 |
| 10/17/201 | 0 | 0 | 10/17/2017 | 0 | 0 |
| 10/18/201 | 0 | 0 | 10/18/2017 | 0 | 0 |
| 10/19/201 | 0.01 | 0 | 10/19/2017 | 0 | 0 |
| 10/20/201 | 0.11 | 0 | 10/20/2017 | 0 | 0 |
| 10/21/201 | 0.05 | 0 | 10/21/2017 | 0 | 0 |
| 10/22/201 | 0 | 0 | 10/22/2017 | 0 | 0 |
| 10/23/201 | 0 | 0 | 10/23/2017 | 0 | 0 |
| 10/24/201 | 0 | 0 | 10/24/2017 | 0.11 | 0 |
| 10/25/201 | 0 | 0 | 10/25/2017 | 0.4 | 0 |
| 10/26/201 | 0 | 0 | 10/26/2017 | 0 | 0 |
| 10/27/201 | 0.9 | 0.010573 | 10/27/2017 | 0 | 0 |
| 10/28/201 | 0.16 | 0 | 10/28/2017 | 0 | 0 |
| 10/29/201 | 0.06 | 0 | 10/29/2017 | 0.12 | 0 |
| 10/30/201 | 0.01 | 0 | 10/30/2017 | 2.33 | 0.51584 |
| 10/31/201 | 0 | 0 | 10/31/2017 | 0.01 | 0 |
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| 11/2/2018 | 0.01 | 0 | 11/2/2017 | 0 | 0 |
| 11/3/2018 | 1.32 | 0.09252 | 11/3/2017 | 0 | 0 |
| 11/4/2018 | 0.01 | 0 | 11/4/2017 | 0 | 0 |
| 11/5/2018 | 0.06 | 0 | 11/5/2017 | 0.3 | 0 |
| 11/6/2018 | 0.46 | 0 | 11/6/2017 | 0 | 0 |
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| 11/8/2018 | 0 | 0 | 11/8/2017 | 0.41 | 0 |
| 11/9/2018 | 0 | 0 | 11/9/2017 | 0 | 0 |
| 11/10/201 | 0.82 | 0.003838 | 11/10/2017 | 0.02 | 0 |
| 11/11/201 | 0 | 0 | 11/11/2017 | 0 | 0 |
| 11/12/201 | 0 | 0 | 11/12/2017 | 0 | 0 |
| 11/13/201 | 0.87 | 0.007674 | 11/13/2017 | 0.16 | 0 |
| 11/14/201 | 0.05 | 0 | 11/14/2017 | 0.02 | 0 |
| 11/15/201 | 0.07 | 0 | 11/15/2017 | 0 | 0 |
| 11/16/201 | 1.3 | 0.087051 | 11/16/2017 | 0.01 | 0 |
| 11/17/201 | 0.02 | 0 | 11/17/2017 | 0 | 0 |
| 11/18/201 | 0 | 0 | 11/18/2017 | 0 | 0 |
| 11/19/201 | 0 | 0 | 11/19/2017 | 0.43 | 0 |
| 11/20/201 | 0 | 0 | 11/20/2017 | 0 | 0 |
| 11/21/201 | 0 | 0 | 11/21/2017 | 0 | 0 |
| 11/22/201 | 0 | 0 | 11/22/2017 | 0.03 | 0 |
| 11/23/201 | 0 | 0 | 11/23/2017 | 0 | 0 |
| 11/24/201 | 0 | 0 | 11/24/2017 | 0 | 0 |
| 11/25/201 | 2.02 | 0.359802 | 11/25/2017 | 0 | 0 |
| 11/26/201 | 0 | 0 | 11/26/2017 | 0 | 0 |
| 11/27/201 | 0.58 | 0 | 11/27/2017 | 0 | 0 |
| 11/28/201 | 0 | 0 | 11/28/2017 | 0 | 0 |
| 11/29/201 | 0 | 0 | 11/29/2017 | 0 | 0 |
| 11/30/201 | 0 | 0 | 11/30/2017 | 0 | 0 |
| 12/1/2018 | 0.01 | 0 | 12/1/2017 | 0.03 | 0 |
| 12/2/2018 | 0.53 | 0 | 12/2/2017 | 0 | 0 |
| 12/3/2018 | 0.07 | 0 | 12/3/2017 | 0 | 0 |
| 12/4/2018 | 0 | 0 | 12/4/2017 | 0 | 0 |
| 12/5/2018 | 0 | 0 | 12/5/2017 | 0 | 0 |
| 12/6/2018 | 0 | 0 | 12/6/2017 | 0.24 | 0 |
| 12/7/2018 | 0 | 0 | 12/7/2017 | 0 | 0 |
| 12/8/2018 | 0 | 0 | 12/8/2017 | 0 | 0 |
| 12/9/2018 | 0 | 0 | 12/9/2017 | 0.03 | 0 |
| 12/10/201 | 0 | 0 | 12/10/2017 | 0.31 | 0 |
| 12/11/201 | 0 | 0 | 12/11/2017 | 0 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| 9/18/2016 | 0 | 0 | 9/18/2015 | 0 | 0 |
| 9/19/2016 | 0.9 | 0.010573 | 9/19/2015 | 0 | 0 |
| 9/20/2016 | 0.89 | 0.009558 | 9/20/2015 | 0 | 0 |
| 9/21/2016 | 0 | 0 | 9/21/2015 | 0 | 0 |
| 9/22/2016 | 0 | 0 | 9/22/2015 | 0.01 | 0 |
| 9/23/2016 | 0 | 0 | 9/23/2015 | 0 | 0 |
| 9/24/2016 | 0 | 0 | 9/24/2015 | 0 | 0 |
| 9/25/2016 | 0 | 0 | 9/25/2015 | 0 | 0 |
| 9/26/2016 | 0 | 0 | 9/26/2015 | 0 | 0 |
| 9/27/2016 | 0.05 | 0 | 9/27/2015 | 0 | 0 |
| 9/28/2016 | 0 | 0 | 9/28/2015 | 0 | 0 |
| 9/29/2016 | 0.58 | 0 | 9/29/2015 | 0 | 0 |
| 9/30/2016 | 2.43 | 0.570062 | 9/30/2015 | 1.61 | 0.186615 |
| 10/1/2016 | 0.13 | 0 | 10/1/2015 | 0.07 | 0 |
| 10/2/2016 | 0.07 | 0 | 10/2/2015 | 0.66 | 0 |
| 10/3/2016 | 0.02 | 0 | 10/3/2015 | 1.39 | 0.112755 |
| 10/4/2016 | 0 | 0 | 10/4/2015 | 0.04 | 0 |
| 10/5/2016 | 0 | 0 | 10/5/2015 | 0 | 0 |
| 10/6/2016 | 0 | 0 | 10/6/2015 | 0 | 0 |
| 10/7/2016 | 0 | 0 | 10/7/2015 | 0 | 0 |
| 10/8/2016 | 0 | 0 | 10/8/2015 | 0 | 0 |
| 10/9/2016 | 0.08 | 0 | 10/9/2015 | 0 | 0 |
| 10/10/201 | 0.06 | 0 | 10/10/201 | 0.51 | 0 |
| 10/11/201 | 0 | 0 | 10/11/201 | 0.04 | 0 |
| 10/12/201 | 0 | 0 | 10/12/201 | 0 | 0 |
| 10/13/201 | 0 | 0 | 10/13/201 | 0 | 0 |
| 10/14/201 | 0.01 | 0 | 10/14/201 | 0 | 0 |
| 10/15/201 | 0 | 0 | 10/15/201 | 0 | 0 |
| 10/16/201 | 0 | 0 | 10/16/201 | 0 | 0 |
| 10/17/201 | 0 | 0 | 10/17/201 | 0 | 0 |
| 10/18/201 | 0 | 0 | 10/18/201 | 0 | 0 |
| 10/19/201 | 0 | 0 | 10/19/201 | 0.01 | 0 |
| 10/20/201 | 0 | 0 | 10/20/201 | 0 | 0 |
| 10/21/201 | 0 | 0 | 10/21/201 | 0 | 0 |
| 10/22/201 | 0.13 | 0 | 10/22/201 | 0 | 0 |
| 10/23/201 | 0.02 | 0 | 10/23/201 | 0 | 0 |
| 10/24/201 | 0.01 | 0 | 10/24/201 | 0 | 0 |
| 10/25/201 | 0 | 0 | 10/25/201 | 0.01 | 0 |
| 10/26/201 | 0 | 0 | 10/26/201 | 0 | 0 |
| 10/27/201 | 0 | 0 | 10/27/201 | 0 | 0 |
| 10/28/201 | 0.43 | 0 | 10/28/201 | 0.04 | 0 |
| 10/29/201 | 0 | 0 | 10/29/201 | 2.08 | 0.388479 |
| 10/30/201 | 0 | 0 | 10/30/201 | 0 | 0 |
| 10/31/201 | 0.28 | 0 | 10/31/201 | 0 | 0 |
| 11/1/2016 | 0 | 0 | 11/1/2015 | 0 | 0 |
| 11/2/2016 | 0 | 0 | 11/2/2015 | 0 | 0 |
| 11/3/2016 | 0 | 0 | 11/3/2015 | 0 | 0 |
| 11/4/2016 | 0.03 | 0 | 11/4/2015 | 0 | 0 |
| 11/5/2016 | 0 | 0 | 11/5/2015 | 0.03 | 0 |
| 11/6/2016 | 0 | 0 | 11/6/2015 | 0.01 | 0 |
| 11/7/2016 | 0 | 0 | 11/7/2015 | 0 | 0 |
| 11/8/2016 | 0 | 0 | 11/8/2015 | 0 | 0 |
| 11/9/2016 | 0.03 | 0 | 11/9/2015 | 0 | 0 |
| 11/10/201 | 0.37 | 0 | 11/10/201 | 0.3 | 0 |
| 11/11/201 | 0 | 0 | 11/11/201 | 0.33 | 0 |
| 11/12/201 | 0 | 0 | 11/12/201 | 0 | 0 |
| 11/13/201 | 0 | 0 | 11/13/201 | 0.15 | 0 |
| 11/14/201 | 0 | 0 | 11/14/201 | 0 | 0 |
| 11/15/201 | 0 | 0 | 11/15/201 | 0 | 0 |
| 11/16/201 | 0 | 0 | 11/16/201 | 0 | 0 |
| 11/17/201 | 0 | 0 | 11/17/201 | 0 | 0 |
| 11/18/201 | 0 | 0 | 11/18/201 | 0 | 0 |
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| 11/22/201 | 0 | 0 | 11/22/201 | 0 | 0 |
| 11/23/201 | 0 | 0 | 11/23/201 | 0 | 0 |
| 11/24/201 | 0 | 0 | 11/24/201 | 0 | 0 |
| 11/25/201 | 0 | 0 | 11/25/201 | 0 | 0 |
| 11/26/201 | 0 | 0 | 11/26/201 | 0 | 0 |
| 11/27/201 | 0 | 0 | 11/27/201 | 0 | 0 |
| 11/28/201 | 0 | 0 | 11/28/201 | 0 | 0 |
| 11/29/201 | 0.08 | 0 | 11/29/201 | 0.11 | 0 |
| 11/30/201 | 1.07 | 0.034921 | 11/30/201 | 0.02 | 0 |
| 12/1/2016 | 1.36 | 0.103878 | 12/1/2015 | 0.25 | 0 |
| 12/2/2016 | 0 | 0 | 12/2/2015 | 0.73 | 0.000222 |
| 12/3/2016 | 0 | 0 | 12/3/2015 | 0.2 | 0 |
| 12/4/2016 | 0 | 0 | 12/4/2015 | 0 | 0 |
| 12/5/2016 | 0.15 | 0 | 12/5/2015 | 0 | 0 |
| 12/6/2016 | 0.01 | 0 | 12/6/2015 | 0 | 0 |
| 12/7/2016 | 0.77 | 0.001292 | 12/7/2015 | 0 | 0 |
| 12/8/2016 | 0.01 | 0 | 12/8/2015 | 0 | 0 |
| 12/9/2016 | 0 | 0 | 12/9/2015 | 0 | 0 |
| 12/10/201 | 0 | 0 | 12/10/201 | 0.03 | 0 |
| 12/11/201 | 0 | 0 | 12/11/201 | 0 | 0 |

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|---|---|---|---|---|---|
| 9/18/2014 | 0 | 0 | 9/18/2013 | 0 | 0 |
| 9/19/2014 | 0.02 | 0 | 9/19/2013 | 0 | 0 |
| 9/20/2014 | 0 | 0 | 9/20/2013 | 0 | 0 |
| 9/21/2014 | 0 | 0 | 9/21/2013 | 0 | 0 |
| 9/22/2014 | 0.08 | 0 | 9/22/2013 | 1.34 | 0.09813 |
| 9/23/2014 | 0 | 0 | 9/23/2013 | 0 | 0 |
| 9/24/2014 | 0 | 0 | 9/24/2013 | 0 | 0 |
| 9/25/2014 | 0.49 | 0 | 9/25/2013 | 0 | 0 |
| 9/26/2014 | 0.35 | 0 | 9/26/2013 | 0 | 0 |
| 9/27/2014 | 0 | 0 | 9/27/2013 | 0 | 0 |
| 9/28/2014 | 0 | 0 | 9/28/2013 | 0 | 0 |
| 9/29/2014 | 0 | 0 | 9/29/2013 | 0 | 0 |
| 9/30/2014 | 0.03 | 0 | 9/30/2013 | 0 | 0 |
| 10/1/2014 | 0 | 0 | 10/1/2013 | 0 | 0 |
| 10/2/2014 | 0 | 0 | 10/2/2013 | 0 | 0 |
| 10/3/2014 | 0 | 0 | 10/3/2013 | 0 | 0 |
| 10/4/2014 | 0.36 | 0 | 10/4/2013 | 0 | 0 |
| 10/5/2014 | 0.07 | 0 | 10/5/2013 | 0 | 0 |
| 10/6/2014 | 0 | 0 | 10/6/2013 | 0 | 0 |
| 10/7/2014 | 0.01 | 0 | 10/7/2013 | 0.01 | 0 |
| 10/8/2014 | 0.61 | 0 | 10/8/2013 | 0.58 | 0 |
| 10/9/2014 | 0 | 0 | 10/9/2013 | 0 | 0 |
| 10/10/201 | 0 | 0 | 10/10/201 | 0.19 | 0 |
| 10/11/201 | 0.35 | 0 | 10/11/201 | 2.86 | 0.821624 |
| 10/12/201 | 0.14 | 0 | 10/12/201 | 0.69 | 0 |
| 10/13/201 | 0.01 | 0 | 10/13/201 | 0.01 | 0 |
| 10/14/201 | 0.06 | 0 | 10/14/201 | 0 | 0 |
| 10/15/201 | 0 | 0 | 10/15/201 | 0 | 0 |
| 10/16/201 | 1.2 | 0.061877 | 10/16/201 | 0 | 0 |
| 10/17/201 | 0 | 0 | 10/17/201 | 0 | 0 |
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| 10/19/201 | 0 | 0 | 10/19/201 | 0 | 0 |
| 10/20/201 | 0 | 0 | 10/20/201 | 0.11 | 0 |
| 10/21/201 | 0.02 | 0 | 10/21/201 | 0 | 0 |
| 10/22/201 | 0.31 | 0 | 10/22/201 | 0 | 0 |
| 10/23/201 | 0.33 | 0 | 10/23/201 | 0.01 | 0 |
| 10/24/201 | 0.03 | 0 | 10/24/201 | 0 | 0 |
| 10/25/201 | 0 | 0 | 10/25/201 | 0 | 0 |
| 10/26/201 | 0 | 0 | 10/26/201 | 0 | 0 |
| 10/27/201 | 0 | 0 | 10/27/201 | 0 | 0 |
| 10/28/201 | 0 | 0 | 10/28/201 | 0 | 0 |
| 10/29/201 | 0 | 0 | 10/29/201 | 0 | 0 |
| 10/30/201 | 0.06 | 0 | 10/30/201 | 0 | 0 |
| 10/31/201 | 0 | 0 | 10/31/201 | 0.06 | 0 |
| 11/1/2014 | 0.18 | 0 | 11/1/2013 | 0.06 | 0 |
| 11/2/2014 | 0.35 | 0 | 11/2/2013 | 0.22 | 0 |
| 11/3/2014 | 0 | 0 | 11/3/2013 | 0 | 0 |
| 11/4/2014 | 0 | 0 | 11/4/2013 | 0 | 0 |
| 11/5/2014 | 0 | 0 | 11/5/2013 | 0 | 0 |
| 11/6/2014 | 0.49 | 0 | 11/6/2013 | 0 | 0 |
| 11/7/2014 | 0.22 | 0 | 11/7/2013 | 0 | 0 |
| 11/8/2014 | 0.01 | 0 | 11/8/2013 | 0.1 | 0 |
| 11/9/2014 | 0 | 0 | 11/9/2013 | 0 | 0 |
| 11/10/201 | 0 | 0 | 11/10/201 | 0 | 0 |
| 11/11/201 | 0 | 0 | 11/11/201 | 0 | 0 |
| 11/12/201 | 0 | 0 | 11/12/201 | 0 | 0 |
| 11/13/201 | 0 | 0 | 11/13/201 | 0 | 0 |
| 11/14/201 | 0.18 | 0 | 11/14/201 | 0 | 0 |
| 11/15/201 | 0 | 0 | 11/15/201 | 0 | 0 |
| 11/16/201 | 0 | 0 | 11/16/201 | 0.05 | 0 |
| 11/17/201 | 0.37 | 0 | 11/17/201 | 0.01 | 0 |
| 11/18/201 | 0.75 | 0.000648 | 11/18/201 | 0.09 | 0 |
| 11/19/201 | 0 | 0 | 11/19/201 | 0 | 0 |
| 11/20/201 | 0 | 0 | 11/20/201 | 0 | 0 |
| 11/21/201 | 0 | 0 | 11/21/201 | 0 | 0 |
| 11/22/201 | 0 | 0 | 11/22/201 | 0 | 0 |
| 11/23/201 | 0 | 0 | 11/23/201 | 0.04 | 0 |
| 11/24/201 | 0.74 | 0.000407 | 11/24/201 | 0 | 0 |
| 11/25/201 | 0 | 0 | 11/25/201 | 0 | 0 |
| 11/26/201 | 0.24 | 0 | 11/26/201 | 0 | 0 |
| 11/27/201 | 1.07 | 0.034921 | 11/27/201 | 2.48 | 0.597822 |
| 11/28/201 | 0 | 0 | 11/28/201 | 0.16 | 0 |
| 11/29/201 | 0 | 0 | 11/29/201 | 0 | 0 |
| 11/30/201 | 0 | 0 | 11/30/201 | 0 | 0 |
| 12/1/2014 | 0 | 0 | 12/1/2013 | 0 | 0 |
| 12/2/2014 | 0.08 | 0 | 12/2/2013 | 0 | 0 |
| 12/3/2014 | 0.25 | 0 | 12/3/2013 | 0 | 0 |
| 12/4/2014 | 0.14 | 0 | 12/4/2013 | 0 | 0 |
| 12/5/2014 | 0 | 0 | 12/5/2013 | 0 | 0 |
| 12/6/2014 | 0.22 | 0 | 12/6/2013 | 0.2 | 0 |
| 12/7/2014 | 0.6 | 0 | 12/7/2013 | 0.84 | 0.00522 |
| 12/8/2014 | 0 | 0 | 12/8/2013 | 0 | 0 |
| 12/9/2014 | 0.2 | 0 | 12/9/2013 | 0.82 | 0.003838 |
| 12/10/201 | 0.08 | 0 | 12/10/201 | 0.09 | 0 |
| 12/11/201 | 0.05 | 0 | 12/11/201 | 0.2 | 0 |

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|---|---|---|---|---|---|
| 9/18/2012 | 0.57 | 0 | 9/18/2011 | 0.02 | 0 |
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| 9/21/2012 | 0 | 0 | 9/21/2011 | 0.07 | 0 |
| 9/22/2012 | 0 | 0 | 9/22/2011 | 0.06 | 0 |
| 9/23/2012 | 0.19 | 0 | 9/23/2011 | 0.02 | 0 |
| 9/24/2012 | 0 | 0 | 9/24/2011 | 2.97 | 0.890243 |
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| 9/26/2012 | 0 | 0 | 9/26/2011 | 0 | 0 |
| 9/27/2012 | 0.32 | 0 | 9/27/2011 | 0 | 0 |
| 9/28/2012 | 0.08 | 0 | 9/28/2011 | 0.61 | 0 |
| 9/29/2012 | 0.02 | 0 | 9/29/2011 | 0.37 | 0 |
| 9/30/2012 | 0 | 0 | 9/30/2011 | 0.28 | 0 |
| 10/1/2012 | 0.01 | 0 | 10/1/2011 | 0.03 | 0 |
| 10/2/2012 | 0.01 | 0 | 10/2/2011 | 0.47 | 0 |
| 10/3/2012 | 0.85 | 0.005988 | 10/3/2011 | 0.26 | 0 |
| 10/4/2012 | 0.02 | 0 | 10/4/2011 | 0.01 | 0 |
| 10/5/2012 | 0.02 | 0 | 10/5/2011 | 0 | 0 |
| 10/6/2012 | 0 | 0 | 10/6/2011 | 0 | 0 |
| 10/7/2012 | 0.02 | 0 | 10/7/2011 | 0 | 0 |
| 10/8/2012 | 0.11 | 0 | 10/8/2011 | 0 | 0 |
| 10/9/2012 | 0.04 | 0 | 10/9/2011 | 0 | 0 |
| 10/10/201 | 0.05 | 0 | 10/10/2011 | 0 | 0 |
| 10/11/201 | 0 | 0 | 10/11/2011 | 0 | 0 |
| 10/12/201 | 0 | 0 | 10/12/2011 | 0.09 | 0 |
| 10/13/201 | 0 | 0 | 10/13/2011 | 0.31 | 0 |
| 10/14/201 | 0 | 0 | 10/14/2011 | 0.16 | 0 |
| 10/15/201 | 0 | 0 | 10/15/2011 | 0.4 | 0 |
| 10/16/201 | 0.76 | 0.000943 | 10/16/2011 | 0.08 | 0 |
| 10/17/201 | 0 | 0 | 10/17/2011 | 0 | 0 |
| 10/18/201 | 0 | 0 | 10/18/2011 | 0 | 0 |
| 10/19/201 | 0.65 | 0 | 10/19/2011 | 0.23 | 0 |
| 10/20/201 | 0.41 | 0 | 10/20/2011 | 0.36 | 0 |
| 10/21/201 | 0 | 0 | 10/21/2011 | 0 | 0 |
| 10/22/201 | 0 | 0 | 10/22/2011 | 0 | 0 |
| 10/23/201 | 0 | 0 | 10/23/2011 | 0 | 0 |
| 10/24/201 | 0.01 | 0 | 10/24/2011 | 0 | 0 |
| 10/25/201 | 0 | 0 | 10/25/2011 | 0.03 | 0 |
| 10/26/201 | 0 | 0 | 10/26/2011 | 0 | 0 |
| 10/27/201 | 0 | 0 | 10/27/2011 | 0.06 | 0 |
| 10/28/201 | 0.05 | 0 | 10/28/2011 | 0.15 | 0 |
| 10/29/201 | 1 | 0.02332 | 10/29/2011 | 0.18 | 0 |
| 10/30/201 | 4.35 | 1.859165 | 10/30/2011 | 0.84 | 0.00522 |
| 10/31/201 | 0.45 | 0 | 10/31/2011 | 0 | 0 |
| 11/1/2012 | 0.01 | 0 | 11/1/2011 | 0 | 0 |
| 11/2/2012 | 0 | 0 | 11/2/2011 | 0 | 0 |
| 11/3/2012 | 0 | 0 | 11/3/2011 | 0 | 0 |
| 11/4/2012 | 0 | 0 | 11/4/2011 | 0 | 0 |
| 11/5/2012 | 0 | 0 | 11/5/2011 | 0 | 0 |
| 11/6/2012 | 0 | 0 | 11/6/2011 | 0 | 0 |
| 11/7/2012 | 0 | 0 | 11/7/2011 | 0 | 0 |
| 11/8/2012 | 0.15 | 0 | 11/8/2011 | 0 | 0 |
| 11/9/2012 | 0 | 0 | 11/9/2011 | 0 | 0 |
| 11/10/201 | 0 | 0 | 11/10/2011 | 0 | 0 |
| 11/11/201 | 0 | 0 | 11/11/2011 | 0.1 | 0 |
| 11/12/201 | 0 | 0 | 11/12/2011 | 0 | 0 |
| 11/13/201 | 0.38 | 0 | 11/13/2011 | 0 | 0 |
| 11/14/201 | 0.08 | 0 | 11/14/2011 | 0 | 0 |
| 11/15/201 | 0 | 0 | 11/15/2011 | 0 | 0 |
| 11/16/201 | 0 | 0 | 11/16/2011 | 0.27 | 0 |
| 11/17/201 | 0 | 0 | 11/17/2011 | 0.36 | 0 |
| 11/18/201 | 0 | 0 | 11/18/2011 | 0 | 0 |
| 11/19/201 | 0 | 0 | 11/19/2011 | 0 | 0 |
| 11/20/201 | 0 | 0 | 11/20/2011 | 0 | 0 |
| 11/21/201 | 0 | 0 | 11/21/2011 | 0.31 | 0 |
| 11/22/201 | 0 | 0 | 11/22/2011 | 0.2 | 0 |
| 11/23/201 | 0 | 0 | 11/23/2011 | 1.69 | 0.217017 |
| 11/24/201 | 0 | 0 | 11/24/2011 | 0.05 | 0 |
| 11/25/201 | 0 | 0 | 11/25/2011 | 0 | 0 |
| 11/26/201 | 0 | 0 | 11/26/2011 | 0 | 0 |
| 11/27/201 | 0.3 | 0 | 11/27/2011 | 0 | 0 |
| 11/28/201 | 0.39 | 0 | 11/28/2011 | 0 | 0 |
| 11/29/201 | 0 | 0 | 11/29/2011 | 0.04 | 0 |
| 11/30/201 | 0 | 0 | 11/30/2011 | 0.89 | 0.009558 |
| 12/1/2012 | 0 | 0 | 12/1/2011 | 0 | 0 |
| 12/2/2012 | 0 | 0 | 12/2/2011 | 0 | 0 |
| 12/3/2012 | 0.02 | 0 | 12/3/2011 | 0 | 0 |
| 12/4/2012 | 0 | 0 | 12/4/2011 | 0 | 0 |
| 12/5/2012 | 0 | 0 | 12/5/2011 | 0 | 0 |
| 12/6/2012 | 0 | 0 | 12/6/2011 | 0.04 | 0 |
| 12/7/2012 | 0 | 0 | 12/7/2011 | 0.22 | 0 |
| 12/8/2012 | 0.43 | 0 | 12/8/2011 | 2.16 | 0.427891 |
| 12/9/2012 | 0.03 | 0.003838 | 12/9/2011 | 0 | 0 |
| 12/10/201 | 0.35 | 0 | 12/10/2011 | 0 | 0 |
| 12/11/201 | 0.2 | 0 | 12/11/2011 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/12/2020 | 0 | 0 | 12/12/2019 | 0.03 | 0 | 12/12/201 | 0 | 0 | 12/12/2017 | 0 | 0 | 12/12/201 | 0.45 | 0 | 12/12/201 | 0 | 0 | 12/12/201 | 0.02 | 0 | 12/12/201 | 0 | 0 | 12/12/201 | 0 | 0 | 12/12/2011 | 0 | 0 |
| 12/13/2020 | 0 | 0 | 12/13/2019 | 0 | 0 | 12/13/201 | 0 | 0 | 12/13/2017 | 0 | 0 | 12/13/201 | 0 | 0 | 12/13/201 | 0 | 0 | 12/13/201 | 0 | 0 | 12/13/201 | 0 | 0 | 12/13/201 | 0 | 0 | 12/13/2011 | 0 | 0 |
| 12/14/2020 | 0.07 | 0 | 12/14/2019 | 0.42 | 0 | 12/14/201 | 0 | 0 | 12/14/2017 | 0 08 | 0 | 12/14/201 | 0 | 0 | 12/14/201 | 0 | 0 | 12/14/201 | 0 | 0 | 12/14/201 | 0 | 0 | 12/14/201 | 0 | 0 | 12/14/2011 | 0 | 0 |
| 12/15/2020 | 0.84 | 0.00522 | 12/15/2019 | 0.08 | 0 | 12/15/201 | 0.26 | 0 | 12/15/2017 | 0 | 0 | 12/15/201 | 0 | 0 | 12/15/201 | 0.27 | 0 | 12/15/201 | 0 | 0 | 12/15/201 | 1.1 | 0.040533 | 12/15/201 | 0 | 0 | 12/15/2011 | 0 | 0 |
| 12/16/2020 | 0 | 0 | 12/16/2019 | 0 | 0 | 12/16/201 | 1.04 | 0.029689 | 12/16/2017 | 0.16 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/2011 | 0.07 | 0 |
| 12/17/2020 | 0.99 | 0.021839 | 12/17/2019 | 1.01 | 0.024847 | 12/17/201 | 0.4 | 0 | 12/17/2017 | 0 | 0 | 12/17/201 | 0.26 | 0 | 12/17/201 | 0 | 0 | 12/17/201 | 0.16 | 0 | 12/17/201 | 0.02 | 0 | 12/17/201 | 0.13 | 0 | 12/17/2011 | 0 | 0 |
| 12/18/2020 | 0 | 0 | 12/18/2019 | 0.15 | 0 | 12/18/201 | 0 | 0 | 12/18/2017 | 0 | 0 | 12/18/201 | 0.39 | 0 | 12/18/201 | 0 88 | 0.008591 | 12/18/201 | 0 | 0 | 12/18/201 | 0.03 | 0 | 12/18/201 | 0.17 | 0 | 12/18/2011 | 0 | 0 |
| 12/19/2020 | 0 | 0 | 12/19/2019 | 0 | 0 | 12/19/201 | 0 | 0 | 12/19/2017 | 0 | 0 | 12/19/201 | 0.05 | 0 | 12/19/201 | 0 | 0 | 12/19/201 | 0 | 0 | 12/19/201 | 0 | 0 | 12/19/201 | 0.03 | 0 | 12/19/2011 | 0 | 0 |
| 12/20/2020 | 0 | 0 | 12/20/2019 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/2017 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/2011 | 0 | 0 |
| 12/21/2020 | 0 | 0 | 12/21/2019 | 0 | 0 | 12/21/201 | 1.81 | 0.265843 | 12/21/2017 | 0 | 0 | 12/21/201 | 0 | 0 | 12/21/201 | 0 | 0 | 12/21/201 | 0 | 0 | 12/21/201 | 0 | 0 | 12/21/201 | 2.09 | 0.393333 | 12/21/2011 | 0.05 | 0 |
| 12/22/2020 | 0.07 | 0 | 12/22/2019 | 0 | 0 | 12/22/201 | 0.13 | 0 | 12/22/2017 | 0 | 0 | 12/22/201 | 0 | 0 | 12/22/201 | 0.03 | 0 | 12/22/201 | 0 | 0 | 12/22/201 | 0.01 | 0 | 12/22/201 | 0.03 | 0 | 12/22/2011 | 0.11 | 0 |
| 12/23/2020 | 0 | 0 | 12/23/2019 | 0 | 0 | 12/23/201 | 0 | 0 | 12/23/2017 | 0.21 | 0 | 12/23/201 | 0 | 0 | 12/23/201 | 0.05 | 0 | 12/23/201 | 0.15 | 0 | 12/23/201 | 0.42 | 0 | 12/23/201 | 0 | 0 | 12/23/2011 | 1.24 | 0.071503 |
| 12/24/2020 | 0 | 0 | 12/24/2019 | 0 | 0 | 12/24/201 | 0.07 | 0 | 12/24/2017 | 0.5 | 0 | 12/24/201 | 0 24 | 0 | 12/24/201 | 1.39 | 0.112755 | 12/24/201 | 0.42 | 0 | 12/24/201 | 0.44 | 0 | 12/24/201 | 0 | 0 | 12/24/2011 | 0 | 0 |
| 12/25/2020 | 2.08 | 0.388479 | 12/25/2019 | 0 | 0 | 12/25/201 | 0 | 0 | 12/25/2017 | 0.16 | 0 | 12/25/201 | 0.16 | 0 | 12/25/201 | 0.04 | 0 | 12/25/201 | 0.5 | 0 | 12/25/201 | 0 | 0 | 12/25/201 | 0.2 | 0 | 12/25/2011 | 0 | 0 |
| 12/26/2020 | 0 04 | 0 | 12/26/2019 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/2017 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/201 | 0.3 | 0 | 12/26/201 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/2011 | 0 | 0 |
| 12/27/2020 | 0 | 0 | 12/27/2019 | 0 | 0 | 12/27/201 | 0 | 0 | 12/27/2017 | 0 | 0 | 12/27/201 | 0.01 | 0 | 12/27/201 | 0.04 | 0 | 12/27/201 | 0 | 0 | 12/27/201 | 0 | 0 | 12/27/201 | 1.12 | 0.044482 | 12/27/2011 | 0 | 0 |
| 12/28/2020 | 0 | 0 | 12/28/2019 | 0 | 0 | 12/28/201 | 0.68 | 0 | 12/28/2017 | 0 | 0 | 12/28/201 | 0 | 0 | 12/28/201 | 0.11 | 0 | 12/28/201 | 0 | 0 | 12/28/201 | 0 | 0 | 12/28/201 | 0 | 0 | 12/28/2011 | 1.23 | 0.06904 |
| 12/29/2020 | 0 | 0 | 12/29/2019 | 0 | 0 | 12/29/201 | 0.66 | 0 | 12/29/2017 | 0 | 0 | 12/29/201 | 0.1 | 0 | 12/29/201 | 0.81 | 0.003224 | 12/29/201 | 0.01 | 0 | 12/29/201 | 0.02 | 0 | 12/29/201 | 0 | 0 | 12/29/2011 | 0 | 0 |
| 12/30/2020 | 0 | 0 | 12/30/2019 | 0.69 | 0 | 12/30/201 | 0 | 0 | 12/30/2017 | 0.04 | 0 | 12/30/201 | 0 15 | 0 | 12/30/201 | 0.07 | 0 | 12/30/201 | 0 | 0 | 12/30/201 | 1.15 | 0.050708 | 12/30/201 | 0.27 | 0 | 12/30/2011 | 0 | 0 |
| 12/31/2020 | 0.06 | 0 | 12/31/2019 | 0 23 | 0 | 12/31/201 | 0 | 0 | 12/31/2017 | 0.03 | 0 | 12/31/201 | 0 | 0 | 12/31/201 | 0.18 | 0 | 12/31/201 | 0 | 0 | 12/31/201 | 0 | 0 | 12/31/201 | 0 | 0 | 12/31/2011 | 0.01 | 0 |
| 1/1/2021 | 0.05 | 0 | 1/1/2020 | 0 | 0 | 1/1/2019 | 0 79 | 0.002152 | 1/1/2018 | 0 | 0 | 1/1/2017 | 0 | 0 | 1/1/2016 | 0 | 0 | 1/1/2015 | 0 | 0 | 1/1/2014 | 0 | 0 | 1/1/2013 | 0 | 0 | 1/1/2012 | 0 | 0 |
| 1/2/2021 | 0.98 | 0.020402 | 1/2/2020 | 0 | 0 | 1/2/2019 | 0 | 0 | 1/2/2018 | 0 | 0 | 1/2/2017 | 0.18 | 0 | 1/2/2016 | 0 | 0 | 1/2/2015 | 0 | 0 | 1/2/2014 | 0 | 0 | 1/2/2013 | 0 | 0 | 1/2/2012 | 0.05 | 0 |
| 1/3/2021 | 0.06 | 0 | 1/3/2020 | 0 11 | 0 | 1/3/2019 | 0 | 0 | 1/3/2018 | 0 | 0 | 1/3/2017 | 0.18 | 0 | 1/3/2016 | 0 | 0 | 1/3/2015 | 0 | 0 | 1/3/2014 | 0.51 | 0 | 1/3/2013 | 0 | 0 | 1/3/2012 | 0 | 0 |
| 1/4/2021 | 0.29 | 0 | 1/4/2020 | 0.2 | 0 | 1/4/2019 | 0 | 0 | 1/4/2018 | 0.09 | 0 | 1/4/2017 | 0.56 | 0 | 1/4/2016 | 0 | 0 | 1/4/2015 | 0.95 | 0.016366 | 1/4/2014 | 0 | 0 | 1/4/2013 | 0 | 0 | 1/4/2012 | 0 | 0 |
| 1/5/2021 | 0 01 | 0 | 1/5/2020 | 0.04 | 0 | 1/5/2019 | 0.27 | 0 | 1/5/2018 | 0.12 | 0 | 1/5/2017 | 0 | 0 | 1/5/2016 | 0 | 0 | 1/5/2015 | 0.06 | 0 | 1/5/2014 | 0 | 0 | 1/5/2013 | 0 | 0 | 1/5/2012 | 0 | 0 |
| 1/6/2021 | 0 | 0 | 1/6/2020 | 0 | 0 | 1/6/2019 | 0.12 | 0 | 1/6/2018 | 0 | 0 | 1/6/2017 | 0.14 | 0 | 1/6/2016 | 0 | 0 | 1/6/2015 | 0.05 | 0 | 1/6/2014 | 0.56 | 0 | 1/6/2013 | 0.02 | 0 | 1/6/2012 | 0 | 0 |
| 1/7/2021 | 0 | 0 | 1/7/2020 | 0 03 | 0 | 1/7/2019 | 0 | 0 | 1/7/2018 | 0 | 0 | 1/7/2017 | 0 | 0 | 1/7/2016 | 0 | 0 | 1/7/2015 | 0.11 | 0 | 1/7/2014 | 0.06 | 0 | 1/7/2013 | 0 | 0 | 1/7/2012 | 0 | 0 |
| 1/8/2021 | 0 | 0 | 1/8/2020 | 0.11 | 0 | 1/8/2019 | 0.14 | 0 | 1/8/2018 | 0 | 0 | 1/8/2017 | 0.04 | 0 | 1/8/2016 | 0 | 0 | 1/8/2015 | 0 | 0 | 1/8/2014 | 0 | 0 | 1/8/2013 | 0 | 0 | 1/8/2012 | 0 | 0 |
| 1/9/2021 | 0 | 0 | 1/9/2020 | 0.03 | 0 | 1/9/2019 | 0.2 | 0 | 1/9/2018 | 0.06 | 0 | 1/9/2017 | 0 | 0 | 1/9/2016 | 0.02 | 0 | 1/9/2015 | 0.03 | 0 | 1/9/2014 | 0 | 0 | 1/9/2013 | 0 | 0 | 1/9/2012 | 0 | 0 |
| 1/10/2021 | 0 | 0 | 1/10/2020 | 0 | 0 | 1/10/2019 | 0 | 0 | 1/10/2018 | 0 | 0 | 1/10/2017 | 0 | 0 | 1/10/2016 | 1.15 | 0.050708 | 1/10/2015 | 0 | 0 | 1/10/2014 | 0.01 | 0 | 1/10/2013 | 0 | 0 | 1/10/2012 | 0 | 0 |
| 1/11/2021 | 0 | 0 | 1/11/2020 | 0 | 0 | 1/11/2019 | 0 | 0 | 1/11/2018 | 0 | 0 | 1/11/2017 | 0.28 | 0 | 1/11/2016 | 0 1 | 0 | 1/11/2015 | 0 | 0 | 1/11/2014 | 0.67 | 0 | 1/11/2013 | 0 | 0 | 1/11/2012 | 0 | 0 |
| 1/12/2021 | 0 | 0 | 1/12/2020 | 0.2 | 0 | 1/12/2019 | 0 | 0 | 1/12/2018 | 0.12 | 0 | 1/12/2017 | 0.23 | 0 | 1/12/2016 | 0 | 0 | 1/12/2015 | 0.11 | 0 | 1/12/2014 | 0.68 | 0 | 1/12/2013 | 0.45 | 0 | 1/12/2012 | 1.33 | 0.095308 |
| 1/13/2021 | 0 | 0 | 1/13/2020 | 0 | 0 | 1/13/2019 | 0 15 | 0 | 1/13/2018 | 0 92 | 0.012748 | 1/13/2017 | 0 | 0 | 1/13/2016 | 0 | 0 | 1/13/2015 | 0.56 | 0 | 1/13/2014 | 0 | 0 | 1/13/2013 | 0.01 | 0 | 1/13/2012 | 0.11 | 0 |
| 1/14/2021 | 0.03 | 0 | 1/14/2020 | 0 | 0 | 1/14/2019 | 0 | 0 | 1/14/2018 | 0 | 0 | 1/14/2017 | 0 | 0 | 1/14/2016 | 0 | 0 | 1/14/2015 | 0 | 0 | 1/14/2014 | 0.03 | 0 | 1/14/2013 | 0.03 | 0 | 1/14/2012 | 0 | 0 |
| 1/15/2021 | 0 | 0 | 1/15/2020 | 0.04 | 0 | 1/15/2019 | 0 | 0 | 1/15/2018 | 0 | 0 | 1/15/2017 | 0.04 | 0 | 1/15/2016 | 0 | 0 | 1/15/2015 | 0 | 0 | 1/15/2014 | 0.29 | 0 | 1/15/2013 | 0.4 | 0 | 1/15/2012 | 0.01 | 0 |
| 1/16/2021 | 0.35 | 0 | 1/16/2020 | 0.03 | 0 | 1/16/2019 | 0 | 0 | 1/16/2018 | 0 | 0 | 1/16/2017 | 0 | 0 | 1/16/2016 | 0.25 | 0 | 1/16/2015 | 0 | 0 | 1/16/2014 | 0.04 | 0 | 1/16/2013 | 1.02 | 0.026417 | 1/16/2012 | 0 | 0 |
| 1/17/2021 | 0 | 0 | 1/17/2020 | 0 | 0 | 1/17/2019 | 0 | 0 | 1/17/2018 | 0.11 | 0 | 1/17/2017 | 0 | 0 | 1/17/2016 | 0 | 0 | 1/17/2015 | 0 | 0 | 1/17/2014 | 0 | 0 | 1/17/2013 | 0.08 | 0 | 1/17/2012 | 0.08 | 0 |
| 1/18/2021 | 0 | 0 | 1/18/2020 | 0 | 0 | 1/18/2019 | 0.07 | 0 | 1/18/2018 | 0.04 | 0 | 1/18/2017 | 0.45 | 0 | 1/18/2016 | 0.03 | 0 | 1/18/2015 | 0 | 0 | 1/18/2014 | 0.01 | 0 | 1/18/2013 | 0 | 0 | 1/18/2012 | 0.22 | 0 |
| 1/19/2021 | 0 | 0 | 1/19/2020 | 0 37 | 0 | 1/19/2019 | 0 01 | 0 | 1/19/2018 | 0 | 0 | 1/19/2017 | 0 | 0 | 1/19/2016 | 0 | 0 | 1/19/2015 | 0.99 | 0.021839 | 1/19/2014 | 0 | 0 | 1/19/2013 | 0 | 0 | 1/19/2012 | 0 | 0 |
| 1/20/2021 | 0 | 0 | 1/20/2020 | 0 | 0 | 1/20/2019 | 1.32 | 0.09252 | 1/20/2018 | 0 | 0 | 1/20/2017 | 0 | 0 | 1/20/2016 | 0 | 0 | 1/20/2015 | 0 | 0 | 1/20/2014 | 0 | 0 | 1/20/2013 | 0 | 0 | 1/20/2012 | 0 | 0 |
| 1/21/2021 | 0 | 0 | 1/21/2020 | 0 | 0 | 1/21/2019 | 0.07 | 0 | 1/21/2018 | 0 | 0 | 1/21/2017 | 0.19 | 0 | 1/21/2016 | 0 | 0 | 1/21/2015 | 0 | 0 | 1/21/2014 | 0 | 0 | 1/21/2013 | 0 | 0 | 1/21/2012 | 0.35 | 0 |
| 1/22/2021 | 0 | 0 | 1/22/2020 | 0 | 0 | 1/22/2019 | 0 | 0 | 1/22/2018 | 0 | 0 | 1/22/2017 | 0 01 | 0 | 1/22/2016 | 0 | 0 | 1/22/2015 | 0.05 | 0 | 1/22/2014 | 0.41 | 0 | 1/22/2013 | 0.02 | 0 | 1/22/2012 | 0.08 | 0 |
| 1/23/2021 | 0 | 0 | 1/23/2020 | 0 | 0 | 1/23/2019 | 0 | 0 | 1/23/2018 | 0.25 | 0 | 1/23/2017 | 0.11 | 0 | 1/23/2016 | 1.09 | 0.038621 | 1/23/2015 | 0 | 0 | 1/23/2014 | 0 | 0 | 1/23/2013 | 0 | 0 | 1/23/2012 | 0.01 | 0 |
| 1/24/2021 | 0 | 0 | 1/24/2020 | 0 | 0 | 1/24/2019 | 0.59 | 0 | 1/24/2018 | 0.16 | 0 | 1/24/2017 | 0.64 | 0 | 1/24/2016 | 1.41 | 0.118839 | 1/24/2015 | 0.72 | 9.18E-05 | 1/24/2014 | 0 | 0 | 1/24/2013 | 0 | 0 | 1/24/2012 | 0.22 | 0 |
| 1/25/2021 | 0 | 0 | 1/25/2020 | 0 99 | 0.021839 | 1/25/2019 | 0 9 | 0.010573 | 1/25/2018 | 0 | 0 | 1/25/2017 | 0 | 0 | 1/25/2016 | 0 | 0 | 1/25/2015 | 0 | 0 | 1/25/2014 | 0 | 0 | 1/25/2013 | 0 | 0 | 1/25/2012 | 0 | 0 |
| 1/26/2021 | 0 | 0 | 1/26/2020 | 1.11 | 0.042487 | 1/26/2019 | 0 | 0 | 1/26/2018 | 0 | 0 | 1/26/2017 | 0 | 0 | 1/26/2016 | 0 | 0 | 1/26/2015 | 0.08 | 0 | 1/26/2014 | 0.08 | 0 | 1/26/2013 | 0.04 | 0 | 1/26/2012 | 0 | 0 |
| 1/27/2021 | 0.15 | 0 | 1/27/2020 | 0 | 0 | 1/27/2019 | 0 | 0 | 1/27/2018 | 0 | 0 | 1/27/2017 | 0 | 0 | 1/27/2016 | 0 | 0 | 1/27/2015 | 0 1 | 0 | 1/27/2014 | 0 | 0 | 1/27/2013 | 0 | 0 | 1/27/2012 | 0.14 | 0 |
| 1/28/2021 | 0 | 0 | 1/28/2020 | 0 | 0 | 1/28/2019 | 0 | 0 | 1/28/2018 | 0.11 | 0 | 1/28/2017 | 0 | 0 | 1/28/2016 | 0 | 0 | 1/28/2015 | 0 | 0 | 1/28/2014 | 0 | 0 | 1/28/2013 | 0.01 | 0 | 1/28/2012 | 0.15 | 0 |
| 1/29/2021 | 0 | 0 | 1/29/2020 | 0 | 0 | 1/29/2019 | 0 | 0 | 1/29/2018 | 0.15 | 0 | 1/29/2017 | 0 | 0 | 1/29/2016 | 0 | 0 | 1/29/2015 | 0 | 0 | 1/29/2014 | 0.03 | 0 | 1/29/2013 | 0.12 | 0 | 1/29/2012 | 0 | 0 |
| 1/30/2021 | 0 | 0 | 1/30/2020 | 0 | 0 | 1/30/2019 | 0.29 | 0 | 1/30/2018 | 0.01 | 0 | 1/30/2017 | 0.01 | 0 | 1/30/2016 | 0 | 0 | 1/30/2015 | 0.01 | 0 | 1/30/2014 | 0 | 0 | 1/30/2013 | 0 | 0 | 1/30/2012 | 0 | 0 |
| 1/31/2021 | 0 02 | 0 | 1/31/2020 | 0 | 0 | 1/31/2019 | 0 01 | 0 | 1/31/2018 | 0 07 | 0 | 1/31/2017 | 0.01 | 0 | 1/31/2016 | 0 | 0 | 1/31/2015 | 0.01 | 0 | 1/31/2014 | 0 | 0 | 1/31/2013 | 1.59 | 0.179296 | 1/31/2012 | 0 | 0 |
| 2/1/2021 | 0.41 | 0 | 2/1/2020 | 0.07 | 0 | 2/1/2019 | 0 | 0 | 2/1/2018 | 0 | 0 | 2/1/2017 | 0 | 0 | 2/1/2016 | 0 | 0 | 2/1/2015 | 0 | 0 | 2/1/2014 | 0 | 0 | 2/1/2013 | 0 | 0 | 2/1/2012 | 0.02 | 0 |
| 2/2/2021 | 0.58 | 0 | 2/2/2020 | 0.07 | 0 | 2/2/2019 | 0.08 | 0 | 2/2/2018 | 0.17 | 0 | 2/2/2017 | 0 | 0 | 2/2/2016 | 0.11 | 0 | 2/2/2015 | 0.59 | 0 | 2/2/2014 | 0 | 0 | 2/2/2013 | 0 | 0 | 2/2/2012 | 0 | 0 |
| 2/3/2021 | 0.05 | 0 | 2/3/2020 | 0.01 | 0 | 2/3/2019 | 0 | 0 | 2/3/2018 | 0 | 0 | 2/3/2017 | 0 | 0 | 2/3/2016 | 0.04 | 0 | 2/3/2015 | 0.28 | 0 | 2/3/2014 | 0.7 | 0 | 2/3/2013 | 0.08 | 0 | 2/3/2012 | 0 | 0 |
| 2/4/2021 | 0 | 0 | 2/4/2020 | 0.02 | 0 | 2/4/2019 | 0 | 0 | 2/4/2018 | 0 | 0 | 2/4/2017 | 0 | 0 | 2/4/2016 | 0.77 | 0.001292 | 2/4/2015 | 0 | 0 | 2/4/2014 | 0.59 | 0 | 2/4/2013 | 0.01 | 0 | 2/4/2012 | 0 | 0 |
| 2/5/2021 | 0.05 | 0 | 2/5/2020 | 0.1 | 0 | 2/5/2019 | 0 | 0 | 2/5/2018 | 1.12 | 0.044482 | 2/5/2017 | 0 | 0 | 2/5/2016 | 0.16 | 0 | 2/5/2015 | 0 | 0 | 2/5/2014 | 1.4 | 0.11578 | 2/5/2013 | 0 | 0 | 2/5/2012 | 0.03 | 0 |
| 2/6/2021 | 0 01 | 0 | 2/6/2020 | 0 49 | 0 | 2/6/2019 | 0 | 0 | 2/6/2018 | 0 | 0 | 2/6/2017 | 0 | 0 | 2/6/2016 | 0.01 | 0 | 2/6/2015 | 0 | 0 | 2/6/2014 | 0.18 | 0 | 2/6/2013 | 0.02 | 0 | 2/6/2012 | 0 | 0 |
| 2/7/2021 | 0.16 | 0 | 2/7/2020 | 0.34 | 0 | 2/7/2019 | 0.31 | 0 | 2/7/2018 | 0.04 | 0 | 2/7/2017 | 0 | 0 | 2/7/2016 | 0 | 0 | 2/7/2015 | 0 | 0 | 2/7/2014 | 0 | 0 | 2/7/2013 | 0 | 0 | 2/7/2012 | 0 | 0 |
| 2/8/2021 | 0.37 | 0 | 2/8/2020 | 0.28 | 0 | 2/8/2019 | 0 04 | 0 | 2/8/2018 | 0.76 | 0.000943 | 2/8/2017 | 0 16 | 0 | 2/8/2016 | 0 | 0 | 2/8/2015 | 0 | 0 | 2/8/2014 | 0 | 0 | 2/8/2013 | 0.07 | 0 | 2/8/2012 | 0 | 0 |
| 2/9/2021 | 0 | 0 | 2/9/2020 | 0 | 0 | 2/9/2019 | 0.01 | 0 | 2/9/2018 | 0 | 0 | 2/9/2017 | 0.56 | 0 | 2/9/2016 | 0.16 | 0 | 2/9/2015 | 0 | 0 | 2/9/2014 | 0 | 0 | 2/9/2013 | 0.27 | 0 | 2/9/2012 | 0.15 | 0 |
| 2/10/2021 | 0 | 0 | 2/10/2020 | 0.08 | 0 | 2/10/2019 | 0 | 0 | 2/10/2018 | 0 | 0 | 2/10/2017 | 0.03 | 0 | 2/10/2016 | 0.32 | 0 | 2/10/2015 | 0.02 | 0 | 2/10/2014 | 0.13 | 0 | 2/10/2013 | 0 | 0 | 2/10/2012 | 0 | 0 |
| 2/11/2021 | 0.25 | 0 | 2/11/2020 | 0.61 | 0 | 2/11/2019 | 0.19 | 0 | 2/11/2018 | 1 | 0.02332 | 2/11/2017 | 0 | 0 | 2/11/2016 | 0 | 0 | 2/11/2015 | 0 | 0 | 2/11/2014 | 0 | 0 | 2/11/2013 | 0.34 | 0 | 2/11/2012 | 0.17 | 0 |
| 2/12/2021 | 0 | 0 | 2/12/2020 | 0 06 | 0 | 2/12/2019 | 0 2 | 0 | 2/12/2018 | 0 7 | 0 | 2/12/2017 | 0 | 0 | 2/12/2016 | 0 | 0 | 2/12/2015 | 0 | 0 | 2/12/2014 | 0 | 0 | 2/12/2013 | 0.08 | 0 | 2/12/2012 | 0.09 | 0 |
| 2/13/2021 | 0 | 0 | 2/13/2020 | 0.22 | 0 | 2/13/2019 | 0.84 | 0.00522 | 2/13/2018 | 0 | 0 | 2/13/2017 | 0.22 | 0 | 2/13/2016 | 0.01 | 0 | 2/13/2015 | 0 | 0 | 2/13/2014 | 0.91 | 0.011636 | 2/13/2013 | 0 | 0 | 2/13/2012 | 0 | 0 |
| 2/14/2021 | 0.03 | 0 | 2/14/2020 | 0.09 | 0 | 2/14/2019 | 0 | 0 | 2/14/2018 | 0 | 0 | 2/14/2017 | 0 | 0 | 2/14/2016 | 0 | 0 | 2/14/2015 | 0 | 0 | 2/14/2014 | 1.17 | 0.055059 | 2/14/2013 | 0.23 | 0 | 2/14/2012 | 0 | 0 |
| 2/15/2021 | 0 | 0 | 2/15/2020 | 0 | 0 | 2/15/2019 | 0 | 0 | 2/15/2018 | 0.17 | 0 | 2/15/2017 | 0 | 0 | 2/15/2016 | 0 | 0 | 2/15/2015 | 0.1 | 0 | 2/15/2014 | 0 | 0 | 2/15/2013 | 0 | 0 | 2/15/2012 | 0.01 | 0 |
| 2/16/2021 | 0.78 | 0.001696 | 2/16/2020 | 0 | 0 | 2/16/2019 | 0 | 0 | 2/16/2018 | 0.56 | 0 | 2/16/2017 | 0 | 0 | 2/16/2016 | 0.36 | 0 | 2/16/2015 | 0 | 0 | 2/16/2014 | 0.08 | 0 | 2/16/2013 | 0.15 | 0 | 2/16/2012 | 0 | 0 |
| 2/17/2021 | 0 | 0 | 2/17/2020 | 0 | 0 | 2/17/2019 | 0 | 0 | 2/17/2018 | 0.06 | 0 | 2/17/2017 | 0 | 0 | 2/17/2016 | 0.95 | 0.016366 | 2/17/2015 | 0.2 | 0 | 2/17/2014 | 0 | 0 | 2/17/2013 | 0 | 0 | 2/17/2012 | 0.09 | 0 |
| 2/18/2021 | 0.24 | 0 | 2/18/2020 | 0 | 0 | 2/18/2019 | 0 22 | 0 | 2/18/2018 | 0.38 | 0 | 2/18/2017 | 0 | 0 | 2/18/2016 | 0 | 0 | 2/18/2015 | 0 | 0 | 2/18/2014 | 0.14 | 0 | 2/18/2013 | 0 | 0 | 2/18/2012 | 0 | 0 |
| 2/19/2021 | 0.49 | 0 | 2/19/2020 | 0 | 0 | 2/19/2019 | 0 | 0 | 2/19/2018 | 0 | 0 | 2/19/2017 | 0 | 0 | 2/19/2016 | 0 | 0 | 2/19/2015 | 0 | 0 | 2/19/2014 | 0.03 | 0 | 2/19/2013 | 0 | 0 | 2/19/2012 | 0 | 0 |
| 2/20/2021 | 0.06 | 0 | 2/20/2020 | 0 | 0 | 2/20/2019 | 0 | 0 | 2/20/2018 | 0.03 | 0 | 2/20/2017 | 0 | 0 | 2/20/2016 | 0 | 0 | 2/20/2015 | 0 | 0 | 2/20/2014 | 0.17 | 0 | 2/20/2013 | 0 2 | 0 | 2/20/2012 | 0 | 0 |
| 2/21/2021 | 0 | 0 | 2/21/2020 | 0 | 0 | 2/21/2019 | 0.68 | 0 | 2/21/2018 | 0 | 0 | 2/21/2017 | 0 | 0 | 2/21/2016 | 0 | 0 | 2/21/2015 | 0 | 0 | 2/21/2014 | 0 | 0 | 2/21/2013 | 0 | 0 | 2/21/2012 | 0 | 0 |
| 2/22/2021 | 0.03 | 0 | 2/22/2020 | 0 | 0 | 2/22/2019 | 0 | 0 | 2/22/2018 | 0.03 | 0 | 2/22/2017 | 0 | 0 | 2/22/2016 | 0.06 | 0 | 2/22/2015 | 0.7 | 0 | 2/22/2014 | 0.21 | 0 | 2/22/2013 | 0 | 0 | 2/22/2012 | 0 | 0 |
| 2/23/2021 | 0.35 | 0 | 2/23/2020 | 0 | 0 | 2/23/2019 | 0 | 0 | 2/23/2018 | 0.27 | 0 | 2/23/2017 | 0 | 0 | 2/23/2016 | 0 | 0 | 2/23/2015 | 0 | 0 | 2/23/2014 | 0 | 0 | 2/23/2013 | 0.07 | 0 | 2/23/2012 | 0 | 0 |
| 2/24/2021 | 0 | 0 | 2/24/2020 | 0 | 0 | 2/24/2019 | 0 39 | 0 | 2/24/2018 | 0 15 | 0 | 2/24/2017 | 0 | 0 | 2/24/2016 | 0.53 | 0 | 2/24/2015 | 0 | 0 | 2/24/2014 | 0.01 | 0 | 2/24/2013 | 0.1 | 0 | 2/24/2012 | 0.26 | 0 |
| 2/25/2021 | 0 | 0 | 2/25/2020 | 0.02 | 0 | 2/25/2019 | 0.05 | 0 | 2/25/2018 | 0.54 | 0 | 2/25/2017 | 0 | 0 | 2/25/2016 | 1.6 | 0.182941 | 2/25/2015 | 0 | 0 | 2/25/2014 | 0 | 0 | 2/25/2013 | 0 | 0 | 2/25/2012 | 0.09 | 0 |
| 2/26/2021 | 0 | 0 | 2/26/2020 | 0 2 | 0 | 2/26/2019 | 0 | 0 | 2/26/2018 | 0.18 | 0 | 2/26/2017 | 0 62 | 0 | 2/26/2016 | 0.01 | 0 | 2/26/2015 | 0 | 0 | 2/26/2014 | 0.01 | 0 | 2/26/2013 | 0 | 0 | 2/26/2012 | 0 | 0 |
| 2/27/2021 | 0.35 | 0 | 2/27/2020 | 0.59 | 0 | 2/27/2019 | 0 | 0 | 2/27/2018 | 0 | 0 | 2/27/2017 | 0 | 0 | 2/27/2016 | 0 | 0 | 2/27/2015 | 0.01 | 0 | 2/27/2014 | 0.06 | 0 | 2/27/2013 | 0.58 | 0 | 2/27/2012 | 0 | 0 |
| 2/28/2021 | 0.07 | 0 | 2/28/2020 | 0 | 0 | 2/28/2019 | 0 | 0 | 2/28/2018 | 0 | 0 | 2/28/2017 | 0 | 0 | 2/28/2016 | 0 | 0 | 2/28/2015 | 0 | 0 | 2/28/2014 | 0 | 0 | 2/28/2013 | 0.04 | 0 | 2/28/2012 | 0 | 0 |
| 3/1/2021 | 1.17 | 0.055059 | 2/29/2020 | 0 | 0 | 3/1/2019 | 0.31 | 0 | 3/1/2018 | 0 | 0 | 3/1/2017 | 0.15 | 0 | 2/29/2016 | 0 | 0 | 3/1/2015 | 0 | 0 | 3/1/2014 | 0 | 0 | 3/1/2013 | 0.01 | 0 | 2/29/2012 | 0 | 0 |
| 3/2/2021 | 0.01 | 0 | 3/1/2020 | 0 | 0 | 3/2/2019 | 0.58 | 0 | 3/2/2018 | 1 08 | 0.03675 | 3/2/2017 | 0 01 | 0 | 3/1/2016 | 0 | 0 | 3/2/2015 | 0.52 | 0 | 3/2/2014 | 0 | 0 | 3/2/2013 | 0 | 0 | 3/1/2012 | 0.98 | 0.020402 |
| 3/3/2021 | 0 | 0 | 3/2/2020 | 0 | 0 | 3/3/2019 | 0 | 0 | 3/3/2018 | 0.29 | 0 | 3/3/2017 | 0 | 0 | 3/2/2016 | 0.16 | 0 | 3/3/2015 | 0 | 0 | 3/3/2014 | 0.21 | 0 | 3/3/2013 | 0 | 0 | 3/2/2012 | 0.01 | 0 |
| 3/4/2021 | 0 | 0 | 3/3/2020 | 0 1 | 0 | 3/4/2019 | 0.82 | 0.003838 | 3/4/2018 | 0 | 0 | 3/4/2017 | 0 | 0 | 3/3/2016 | 0 | 0 | 3/4/2015 | 0.55 | 0 | 3/4/2014 | 0.04 | 0 | 3/4/2013 | 0 | 0 | 3/3/2012 | 0.22 | 0 |
| 3/5/2021 | 0 | 0 | 3/4/2020 | 0.23 | 0 | 3/5/2019 | 0 | 0 | 3/5/2018 | 0 | 0 | 3/5/2017 | 0 | 0 | 3/4/2016 | 0.08 | 0 | 3/5/2015 | 0.67 | 0 | 3/5/2014 | 0 | 0 | 3/5/2013 | 0 | 0 | 3/4/2012 | 0.04 | 0 |
| 3/6/2021 | 0 | 0 | 3/5/2020 | 0 | 0 | 3/6/2019 | 0 | 0 | 3/6/2018 | 0 | 0 | 3/6/2017 | 0 | 0 | 3/5/2016 | 0.01 | 0 | 3/6/2015 | 0.63 | 0 | 3/6/2014 | 0 | 0 | 3/6/2013 | 0.1 | 0 | 3/5/2012 | 0 | 0 |

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| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/7/2021 | 0 | 0 | 3/6/2020 | 0 | 0 | 3/7/2019 | 0 | 0 | 3/7/2018 | 0.49 | 0 | 3/7/2017 | 0.02 | 0 |
| 3/8/2021 | 0 | 0 | 3/7/2020 | 0.37 | 0 | 3/8/2019 | 0 | 0 | 3/8/2018 | 0.63 | 0 | 3/8/2017 | 0.04 | 0 |
| 3/9/2021 | 0 | 0 | 3/8/2020 | 0 | 0 | 3/9/2019 | 0.01 | 0 | 3/9/2018 | 0 | 0 | 3/9/2017 | 0 | 0 |
| 3/10/2021 | 0 | 0 | 3/9/2020 | 0.01 | 0 | 3/10/2019 | 0.69 | 0 | 3/10/2018 | 0 | 0 | 3/10/2017 | 0.06 | 0 |
| 3/11/2021 | 0 | 0 | 3/10/2020 | 0 | 0 | 3/11/2019 | 0.08 | 0 | 3/11/2018 | 0 | 0 | 3/11/2017 | 0.28 | 0 |
| 3/12/2021 | 0 | 0 | 3/11/2020 | 0.04 | 0 | 3/12/2019 | 0 | 0 | 3/12/2018 | 0 | 0 | 3/12/2017 | 0 | 0 |
| 3/13/2021 | 0 | 0 | 3/12/2020 | 0.01 | 0 | 3/13/2019 | 0 | 0 | 3/13/2018 | 0.11 | 0 | 3/13/2017 | 0 | 0 |
| 3/14/2021 | 0 | 0 | 3/13/2020 | 0.33 | 0 | 3/14/2019 | 0 | 0 | 3/14/2018 | 0 | 0 | 3/14/2017 | 1.27 | 0.079113 |
| 3/15/2021 | 0 | 0 | 3/14/2020 | 0.01 | 0 | 3/15/2019 | 0 | 0 | 3/15/2018 | 0 | 0 | 3/15/2017 | 0.7 | 0 |
| 3/16/2021 | 0.01 | 0 | 3/15/2020 | 0.06 | 0 | 3/16/2019 | 0.22 | 0 | 3/16/2018 | 0 | 0 | 3/16/2017 | 0.01 | 0 |
| 3/17/2021 | 0.01 | 0 | 3/16/2020 | 0 | 0 | 3/17/2019 | 0 | 0 | 3/17/2018 | 0 | 0 | 3/17/2017 | 0 | 0 |
| 3/18/2021 | 0.13 | 0 | 3/17/2020 | 0.06 | 0 | 3/18/2019 | 0 | 0 | 3/18/2018 | 0 | 0 | 3/18/2017 | 0 | 0 |
| 3/19/2021 | 0.87 | 0.007674 | 3/18/2020 | 0.01 | 0 | 3/19/2019 | 0 | 0 | 3/19/2018 | 0 | 0 | 3/19/2017 | 0.01 | 0 |
| 3/20/2021 | 0 | 0 | 3/19/2020 | 0.82 | 0.003838 | 3/20/2019 | 0 | 0 | 3/20/2018 | 0 | 0 | 3/20/2017 | 0 | 0 |
| 3/21/2021 | 0 | 0 | 3/20/2020 | 0.02 | 0 | 3/21/2019 | 0.05 | 0 | 3/21/2018 | 0.41 | 0 | 3/21/2017 | 0.01 | 0 |
| 3/22/2021 | 0 | 0 | 3/21/2020 | 0.02 | 0 | 3/22/2019 | 2.01 | 0.355098 | 3/22/2018 | 0.63 | 0 | 3/22/2017 | 0 | 0 |
| 3/23/2021 | 0 | 0 | 3/22/2020 | 0 | 0 | 3/23/2019 | 0.04 | 0 | 3/23/2018 | 0 | 0 | 3/23/2017 | 0 | 0 |
| 3/24/2021 | 0.02 | 0 | 3/23/2020 | 0.06 | 0 | 3/24/2019 | 0 | 0 | 3/24/2018 | 0 | 0 | 3/24/2017 | 0 | 0 |
| 3/25/2021 | 1.8 | 0.261633 | 3/24/2020 | 0.71 | 1.82E-05 | 3/25/2019 | 0 | 0 | 3/25/2018 | 0 | 0 | 3/25/2017 | 0 | 0 |
| 3/26/2021 | 0.03 | 0 | 3/25/2020 | 0.01 | 0 | 3/26/2019 | 0.28 | 0 | 3/26/2018 | 0.01 | 0 | 3/26/2017 | 0 | 0 |
| 3/27/2021 | 0 | 0 | 3/26/2020 | 0.05 | 0 | 3/27/2019 | 0 | 0 | 3/27/2018 | 0 | 0 | 3/27/2017 | 0.07 | 0 |
| 3/28/2021 | 0.06 | 0 | 3/27/2020 | 0.02 | 0 | 3/28/2019 | 0 | 0 | 3/28/2018 | 0.02 | 0 | 3/28/2017 | 0.16 | 0 |
| 3/29/2021 | 0.62 | 0 | 3/28/2020 | 0.09 | 0 | 3/29/2019 | 0 | 0 | 3/29/2018 | 0.09 | 0 | 3/29/2017 | 0.48 | 0 |
| 3/30/2021 | 0 | 0 | 3/29/2020 | 1.07 | 0.034921 | 3/30/2019 | 0 | 0 | 3/30/2018 | 0.01 | 0 | 3/30/2017 | 0 | 0 |
| 3/31/2021 | 0 | 0 | 3/30/2020 | 0.02 | 0 | 3/31/2019 | 0 | 0 | 3/31/2018 | 0.12 | 0 | 3/31/2017 | 0.31 | 0 |
| 4/1/2021 | 0.46 | 0 | 3/31/2020 | 0.1 | 0 | 4/1/2019 | 0.08 | 0 | 4/1/2018 | 0 | 0 | 4/1/2017 | 1.41 | 0.118839 |
| 4/2/2021 | 0.01 | 0 | 4/1/2020 | 0.03 | 0 | 4/2/2019 | 0 | 0 | 4/2/2018 | 0.23 | 0 | 4/2/2017 | 0 | 0 |
| 4/3/2021 | 0 | 0 | 4/2/2020 | 0 | 0 | 4/3/2019 | 0 | 0 | 4/3/2018 | 0.04 | 0 | 4/3/2017 | 0 | 0 |
| 4/4/2021 | 0 | 0 | 4/3/2020 | 0 | 0 | 4/4/2019 | 0 | 0 | 4/4/2018 | 0.15 | 0 | 4/4/2017 | 0.25 | 0 |
| 4/5/2021 | 0 | 0 | 4/4/2020 | 0.01 | 0 | 4/5/2019 | 0 | 0 | 4/5/2018 | 0.06 | 0 | 4/5/2017 | 0.01 | 0 |
| Cumulative Runoff (Q) For 1 Year of Daily Rain Events (Inches) | | 4.973833 | | | 1.422009 | | | 2.935977 | | | 1.313634 | | | 1.095486 |
| Average Yearly Runoff (inches) | | 3.122313 | | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/6/2016 | 0 | 0 | 3/7/2015 | 0 | 0 | 3/7/2014 | 0 | 0 | 3/7/2013 | 0.17 | 0 | 3/6/2012 | 0 | 0 |
| 3/7/2016 | 0 | 0 | 3/8/2015 | 0 | 0 | 3/8/2014 | 0 | 0 | 3/8/2013 | 0.01 | 0 | 3/7/2012 | 0 | 0 |
| 3/8/2016 | 0 | 0 | 3/9/2015 | 0 | 0 | 3/9/2014 | 0 | 0 | 3/9/2013 | 0.01 | 0 | 3/8/2012 | 0 | 0 |
| 3/9/2016 | 0 | 0 | 3/10/2015 | 0 | 0 | 3/10/2014 | 0 | 0 | 3/10/2013 | 0 | 0 | 3/9/2012 | 0.05 | 0 |
| 3/10/2016 | 0 | 0 | 3/11/2015 | 0.64 | 0 | 3/11/2014 | 0 | 0 | 3/11/2013 | 0.01 | 0 | 3/10/2012 | 0 | 0 |
| 3/11/2016 | 0 | 0 | 3/12/2015 | 0 | 0 | 3/12/2014 | 0 | 0 | 3/12/2013 | 0.16 | 0 | 3/11/2012 | 0 | 0 |
| 3/12/2016 | 0 | 0 | 3/13/2015 | 0 | 0 | 3/13/2014 | 0.33 | 0 | 3/13/2013 | 0.96 | 0.017666 | 3/12/2012 | 0 | 0 |
| 3/13/2016 | 0 | 0 | 3/14/2015 | 0.71 | 1.82E-05 | 3/14/2014 | 0 | 0 | 3/14/2013 | 0 | 0 | 3/13/2012 | 0.07 | 0 |
| 3/14/2016 | 0.89 | 0.009558 | 3/15/2015 | 0.46 | 0 | 3/15/2014 | 0 | 0 | 3/15/2013 | 0 | 0 | 3/14/2012 | 0 | 0 |
| 3/15/2016 | 0.26 | 0 | 3/16/2015 | 0 | 0 | 3/16/2014 | 0.04 | 0 | 3/16/2013 | 0 | 0 | 3/15/2012 | 0 | 0 |
| 3/16/2016 | 0.04 | 0 | 3/17/2015 | 0 | 0 | 3/17/2014 | 0.16 | 0 | 3/17/2013 | 0.08 | 0 | 3/16/2012 | 0.04 | 0 |
| 3/17/2016 | 0 | 0 | 3/18/2015 | 0 | 0 | 3/18/2014 | 0.01 | 0 | 3/18/2013 | 0 | 0 | 3/17/2012 | 0 | 0 |
| 3/18/2016 | 0.01 | 0 | 3/19/2015 | 0 | 0 | 3/19/2014 | 0 | 0 | 3/19/2013 | 0.75 | 0.000648 | 3/18/2012 | 0 | 0 |
| 3/19/2016 | 0 | 0 | 3/20/2015 | 0.01 | 0 | 3/20/2014 | 0.65 | 0 | 3/20/2013 | 0.02 | 0 | 3/19/2012 | 0 | 0 |
| 3/20/2016 | 0.02 | 0 | 3/21/2015 | 0.53 | 0 | 3/21/2014 | 0 | 0 | 3/21/2013 | 0 | 0 | 3/20/2012 | 0 | 0 |
| 3/21/2016 | 0.02 | 0 | 3/22/2015 | 0 | 0 | 3/22/2014 | 0 | 0 | 3/22/2013 | 0 | 0 | 3/21/2012 | 0 | 0 |
| 3/22/2016 | 0 | 0 | 3/23/2015 | 0 | 0 | 3/23/2014 | 0 | 0 | 3/23/2013 | 0 | 0 | 3/22/2012 | 0 | 0 |
| 3/23/2016 | 0 | 0 | 3/24/2015 | 0 | 0 | 3/24/2014 | 0 | 0 | 3/24/2013 | 0 | 0 | 3/23/2012 | 0 | 0 |
| 3/24/2016 | 0 | 0 | 3/25/2015 | 0 | 0 | 3/25/2014 | 0 | 0 | 3/25/2013 | 0.13 | 0 | 3/24/2012 | 0 | 0 |
| 3/25/2016 | 0 | 0 | 3/26/2015 | 0.04 | 0 | 3/26/2014 | 0.07 | 0 | 3/26/2013 | 0.38 | 0 | 3/25/2012 | 0.17 | 0 |
| 3/26/2016 | 0.01 | 0 | 3/27/2015 | 0.88 | 0.008591 | 3/27/2014 | 0 | 0 | 3/27/2013 | 0.01 | 0 | 3/26/2012 | 0 | 0 |
| 3/27/2016 | 0 | 0 | 3/28/2015 | 0 | 0 | 3/28/2014 | 0 | 0 | 3/28/2013 | 0 | 0 | 3/27/2012 | 0 | 0 |
| 3/28/2016 | 0.47 | 0 | 3/29/2015 | 0.01 | 0 | 3/29/2014 | 0.07 | 0 | 3/29/2013 | 0 | 0 | 3/28/2012 | 0 | 0 |
| 3/29/2016 | 0.09 | 0 | 3/30/2015 | 0 | 0 | 3/30/2014 | 1.07 | 0.034921 | 3/30/2013 | 0 | 0 | 3/29/2012 | 0.01 | 0 |
| 3/30/2016 | 0 | 0 | 3/31/2015 | 0 | 0 | 3/31/2014 | 0.83 | 0.004504 | 3/31/2013 | 0 | 0 | 3/30/2012 | 0 | 0 |
| 3/31/2016 | 0 | 0 | 4/1/2015 | 0.05 | 0 | 4/1/2014 | 0 | 0 | 4/1/2013 | 0.06 | 0 | 3/31/2012 | 0.2 | 0 |
| 4/1/2016 | 0.01 | 0 | 4/2/2015 | 0 | 0 | 4/2/2014 | 0 | 0 | 4/2/2013 | 0 | 0 | 4/1/2012 | 0.01 | 0 |
| 4/2/2016 | 0.25 | 0 | 4/3/2015 | 0 | 0 | 4/3/2014 | 0.04 | 0 | 4/3/2013 | 0 | 0 | 4/2/2012 | 0.23 | 0 |
| 4/3/2016 | 0.12 | 0 | 4/4/2015 | 0.12 | 0 | 4/4/2014 | 0.12 | 0 | 4/4/2013 | 0 | 0 | 4/3/2012 | 0 | 0 |
| 4/4/2016 | 0 | 0 | 4/5/2015 | 0 | 0 | 4/5/2014 | 0.05 | 0 | 4/5/2013 | 0.01 | 0 | 4/4/2012 | 0 | 0 |
| | | 1.794757 | | | 3.150675 | | | 4.007924 | | | 3.736672 | | | 6.79216 |

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| Date | Avg Precip in. | Runoff From Impervious (in.) | Date | Avg Precip in. | Runoff From Impervious (in.) | Date | Avg Precip in. | Runoff From Impervious (in.) | Date | Avg Precip in. | Runoff From Impervious (in.) | Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/5/2020 | 0 | 0 | 4/5/2019 | 0 | 0 | 4/5/2018 | 0.06 | 0.001818 | 4/5/2017 | 0.01 | 0 | 4/5/2016 | 0.14 | 0.033333 |
| 4/6/2020 | 0 | 0 | 4/6/2019 | 0.16 | 0.045 | 4/6/2018 | 0.02 | 0 | 4/6/2017 | 0.04 | 2.41E-34 | 4/6/2016 | 0 | 0 |
| 4/7/2020 | 0 | 0 | 4/7/2019 | 0 | 0 | 4/7/2018 | 0 | 0 | 4/7/2017 | 0.99 | 0.784783 | 4/7/2016 | 0 | 0 |
| 4/8/2020 | 0.39 | 0.222727 | 4/8/2019 | 0.16 | 0.045 | 4/8/2018 | 0 | 0 | 4/8/2017 | 0.01 | 0 | 4/8/2016 | 0.46 | 0.284516 |
| 4/9/2020 | 0.03 | 0 | 4/9/2019 | 0 | 0 | 4/9/2018 | 0 | 0 | 4/9/2017 | 0 | 0 | 4/9/2016 | 0.02 | 0 |
| 4/10/2020 | 0.06 | 0.001818 | 4/10/2019 | 0 | 0 | 4/10/2018 | 0.04 | 2.41E-34 | 4/10/2017 | 0 | 0 | 4/10/2016 | 0.35 | 0.188431 |
| 4/11/2020 | 0 | 0 | 4/11/2019 | 0 | 0 | 4/11/2018 | 0 | 0 | 4/11/2017 | 0 | 0 | 4/11/2016 | 0 | 0 |
| 4/12/2020 | 0 | 0 | 4/12/2019 | 0 | 0 | 4/12/2018 | 0 | 0 | 4/12/2017 | 0 | 0 | 4/12/2016 | 0.06 | 0.001818 |
| 4/13/2020 | 1.4 | 1.185641 | 4/13/2019 | 0.43 | 0.257797 | 4/13/2018 | 0 | 0 | 4/13/2017 | 0 | 0 | 4/13/2016 | 0.23 | 0.092564 |
| 4/14/2020 | 1.12 | 0.91125 | 4/14/2019 | 0.01 | 0 | 4/14/2018 | 0 | 0 | 4/14/2017 | 0 | 0 | 4/14/2016 | 0 | 0 |
| 4/15/2020 | 0.06 | 0.001818 | 4/15/2019 | 0.44 | 0.266667 | 4/15/2018 | 0 | 0 | 4/15/2017 | 0 | 0 | 4/15/2016 | 0 | 0 |
| 4/16/2020 | 0 | 0 | 4/16/2019 | 0.01 | 0 | 4/16/2018 | 1.41 | 1.195478 | 4/16/2017 | 0 | 0 | 4/16/2016 | 0 | 0 |
| 4/17/2020 | 0 | 0 | 4/17/2019 | 0 | 0 | 4/17/2018 | 0.24 | 0.1 | 4/17/2017 | 0.01 | 0 | 4/17/2016 | 0 | 0 |
| 4/18/2020 | 0.07 | 0.003913 | 4/18/2019 | 0 | 0 | 4/18/2018 | 0.01 | 0 | 4/18/2017 | 0.09 | 0.01 | 4/18/2016 | 0 | 0 |
| 4/19/2020 | 0.02 | 0 | 4/19/2019 | 0 | 0 | 4/19/2018 | 0.02 | 0 | 4/19/2017 | 0 | 0 | 4/19/2016 | 0 | 0 |
| 4/20/2020 | 0 | 0 | 4/20/2019 | 1 | 0.794483 | 4/20/2018 | 0.03 | 0 | 4/20/2017 | 0 | 0 | 4/20/2016 | 0 | 0 |
| 4/21/2020 | 0 | 0 | 4/21/2019 | 0.36 | 0.196923 | 4/21/2018 | 0 | 0 | 4/21/2017 | 0.29 | 0.138889 | 4/21/2016 | 0 | 0 |
| 4/22/2020 | 0.15 | 0.039032 | 4/22/2019 | 0 | 0 | 4/22/2018 | 0 | 0 | 4/22/2017 | 0.2 | 0.071111 | 4/22/2016 | 0 | 0 |
| 4/23/2020 | 0.01 | 0 | 4/23/2019 | 0 | 0 | 4/23/2018 | 0 | 0 | 4/23/2017 | 0.16 | 0.045 | 4/23/2016 | 0.03 | 0 |
| 4/24/2020 | 0.83 | 0.630404 | 4/24/2019 | 0.01 | 0 | 4/24/2018 | 0 | 0 | 4/24/2017 | 0 | 0 | 4/24/2016 | 0.19 | 0.064286 |
| 4/25/2020 | 0.27 | 0.123023 | 4/25/2019 | 0 | 0 | 4/25/2018 | 0.62 | 0.431282 | 4/25/2017 | 0.18 | 0.057647 | 4/25/2016 | 0 | 0 |
| 4/26/2020 | 0.18 | 0.057647 | 4/26/2019 | 0.25 | 0.107561 | 4/26/2018 | 0.04 | 2.41E-34 | 4/26/2017 | 0.73 | 0.534944 | 4/26/2016 | 0.02 | 0 |
| 4/27/2020 | 0.23 | 0.092564 | 4/27/2019 | 0.82 | 0.620816 | 4/27/2018 | 0.21 | 0.078108 | 4/27/2017 | 0.01 | 0 | 4/27/2016 | 0.12 | 0.022857 |
| 4/28/2020 | 0.01 | 0 | 4/28/2019 | 0.01 | 0 | 4/28/2018 | 0.04 | 2.41E-34 | 4/28/2017 | 0 | 0 | 4/28/2016 | 0 | 0 |
| 4/29/2020 | 0 | 0 | 4/29/2019 | 0.03 | 0 | 4/29/2018 | 0.2 | 0.071111 | 4/29/2017 | 0.27 | 0.123023 | 4/29/2016 | 0.18 | 0.057647 |
| 4/30/2020 | 0 | 0 | 4/30/2019 | 0.03 | 0 | 4/30/2018 | 0 | 0 | 4/30/2017 | 0 | 0 | 4/30/2016 | 0.04 | 2.41E-34 |
| 5/1/2020 | 1.01 | 0.804188 | 5/1/2019 | 0 | 0 | 5/1/2018 | 0 | 0 | 5/1/2017 | 0 | 0 | 5/1/2016 | 0.21 | 0.078108 |
| 5/2/2020 | 0.01 | 0 | 5/2/2019 | 0 | 0 | 5/2/2018 | 0 | 0 | 5/2/2017 | 0.05 | 0.000476 | 5/2/2016 | 0.27 | 0.123023 |
| 5/3/2020 | 0.12 | 0.022857 | 5/3/2019 | 0 | 0 | 5/3/2018 | 0 | 0 | 5/3/2017 | 0 | 0 | 5/3/2016 | 0.57 | 0.384795 |
| 5/4/2020 | 0.02 | 0 | 5/4/2019 | 0.08 | 0.006667 | 5/4/2018 | 0 | 0 | 5/4/2017 | 0 | 0 | 5/4/2016 | 0.25 | 0.107561 |
| 5/5/2020 | 0 | 0 | 5/5/2019 | 0.38 | 0.214074 | 5/5/2018 | 0 | 0 | 5/5/2017 | 0.1 | 0.013846 | 5/5/2016 | 0.02 | 0 |
| 5/6/2020 | 0 | 0 | 5/6/2019 | 1.13 | 0.921008 | 5/6/2018 | 0.06 | 0.001818 | 5/6/2017 | 0.92 | 0.717037 | 5/6/2016 | 0.33 | 0.171633 |
| 5/7/2020 | 0.15 | 0.039032 | 5/7/2019 | 0.01 | 0 | 5/7/2018 | 0.08 | 0.006667 | 5/7/2017 | 0.08 | 0.006667 | 5/7/2016 | 1.16 | 0.950303 |
| 5/8/2020 | 0 | 0 | 5/8/2019 | 0.54 | 0.357143 | 5/8/2018 | 0 | 0 | 5/8/2017 | 0.04 | 2.41E-34 | 5/8/2016 | 0.15 | 0.039032 |
| 5/9/2020 | 0.51 | 0.329701 | 5/9/2019 | 0.01 | 0 | 5/9/2018 | 0 | 0 | 5/9/2017 | 0 | 0 | 5/9/2016 | 0 | 0 |
| 5/10/2020 | 0 | 0 | 5/10/2019 | 0.01 | 0 | 5/10/2018 | 0 | 0 | 5/10/2017 | 0 | 0 | 5/10/2016 | 0.02 | 0 |
| 5/11/2020 | 0.03 | 0 | 5/11/2019 | 0.21 | 0.078108 | 5/11/2018 | 0.18 | 0.057647 | 5/11/2017 | 0 | 0 | 5/11/2016 | 0.02 | 0 |
| 5/12/2020 | 0.06 | 0.001818 | 5/12/2019 | 0.43 | 0.257797 | 5/12/2018 | 0.63 | 0.440633 | 5/12/2017 | 0.1 | 0.013846 | 5/12/2016 | 0.01 | 0 |
| 5/13/2020 | 0 | 0 | 5/13/2019 | 0.96 | 0.755714 | 5/13/2018 | 0.51 | 0.329701 | 5/13/2017 | 0.79 | 0.592105 | 5/13/2016 | 0 | 0 |
| 5/14/2020 | 0 | 0 | 5/14/2019 | 0.69 | 0.497059 | 5/14/2018 | 0.89 | 0.688095 | 5/14/2017 | 0.85 | 0.649604 | 5/14/2016 | 0.11 | 0.018148 |
| 5/15/2020 | 0.09 | 0.01 | 5/15/2019 | 0.02 | 0 | 5/15/2018 | 0.01 | 0 | 5/15/2017 | 0.01 | 0 | 5/15/2016 | 0.11 | 0.018148 |
| 5/16/2020 | 0 | 0 | 5/16/2019 | 0.02 | 0 | 5/16/2018 | 0.6 | 0.412632 | 5/16/2017 | 0 | 0 | 5/16/2016 | 0 | 0 |
| 5/17/2020 | 0 | 0 | 5/17/2019 | 0.01 | 0 | 5/17/2018 | 1.38 | 1.165974 | 5/17/2017 | 0 | 0 | 5/17/2016 | 0 | 0 |
| 5/18/2020 | 0 | 0 | 5/18/2019 | 0.05 | 0.000476 | 5/18/2018 | 0.15 | 0.039032 | 5/18/2017 | 0 | 0 | 5/18/2016 | 0.14 | 0.033333 |
| 5/19/2020 | 0 | 0 | 5/19/2019 | 0 | 0 | 5/19/2018 | 0.58 | 0.394054 | 5/19/2017 | 0 | 0 | 5/19/2016 | 0.02 | 0 |
| 5/20/2020 | 0 | 0 | 5/20/2019 | 0.01 | 0 | 5/20/2018 | 0.39 | 0.222727 | 5/20/2017 | 0.03 | 0 | 5/20/2016 | 0 | 0 |
| 5/21/2020 | 0 | 0 | 5/21/2019 | 0 | 0 | 5/21/2018 | 0.02 | 0 | 5/21/2017 | 0.02 | 0 | 5/21/2016 | 0.01 | 0 |
| 5/22/2020 | 0 | 0 | 5/22/2019 | 0 | 0 | 5/22/2018 | 0 | 0 | 5/22/2017 | 0.07 | 0.003913 | 5/22/2016 | 0.79 | 0.592105 |
| 5/23/2020 | 1.23 | 1.018777 | 5/23/2019 | 0 | 0 | 5/23/2018 | 0.48 | 0.3025 | 5/23/2017 | 0.19 | 0.064286 | 5/23/2016 | 0.06 | 0.001818 |
| 5/24/2020 | 0.1 | 0.013846 | 5/24/2019 | 0.24 | 0.1 | 5/24/2018 | 0 | 0 | 5/24/2017 | 0.08 | 0.006667 | 5/24/2016 | 0.19 | 0.064286 |
| 5/25/2020 | 0 | 0 | 5/25/2019 | 0 | 0 | 5/25/2018 | 0 | 0 | 5/25/2017 | 0.39 | 0.222727 | 5/25/2016 | 0 | 0 |
| 5/26/2020 | 0.04 | 2.41E-34 | 5/26/2019 | 0.05 | 0.000476 | 5/26/2018 | 0 | 0 | 5/26/2017 | 1.21 | 0.999197 | 5/26/2016 | 0 | 0 |
| 5/27/2020 | 0 | 0 | 5/27/2019 | 0.05 | 0.000476 | 5/27/2018 | 0.14 | 0.033333 | 5/27/2017 | 0 | 0 | 5/27/2016 | 0 | 0 |
| 5/28/2020 | 0.04 | 2.41E-34 | 5/28/2019 | 0 | 0 | 5/28/2018 | 0.16 | 0.045 | 5/28/2017 | 0.01 | 0 | 5/28/2016 | 0 | 0 |
| 5/29/2020 | 0.04 | 2.41E-34 | 5/29/2019 | 0.66 | 0.46878 | 5/29/2018 | 0.01 | 0 | 5/29/2017 | 0.21 | 0.078108 | 5/29/2016 | 0.01 | 0 |
| 5/30/2020 | 0.19 | 0.064286 | 5/30/2019 | 0.51 | 0.329701 | 5/30/2018 | 0 | 0 | 5/30/2017 | 0.02 | 0 | 5/30/2016 | 0.68 | 0.487619 |
| 5/31/2020 | 0 | 0 | 5/31/2019 | 0.28 | 0.130909 | 5/31/2018 | 0.07 | 0.003913 | 5/31/2017 | 0.05 | 0.000476 | 5/31/2016 | 0 | 0 |
| 6/1/2020 | 0 | 0 | 6/1/2019 | 0 | 0 | 6/1/2018 | 0.03 | 0 | 6/1/2017 | 0 | 0 | 6/1/2016 | 0 | 0 |
| 6/2/2020 | 0 | 0 | 6/2/2019 | 0.16 | 0.045 | 6/2/2018 | 0.2 | 0.071111 | 6/2/2017 | 0 | 0 | 6/2/2016 | 0 | 0 |
| 6/3/2020 | 0.03 | 0 | 6/3/2019 | 0.23 | 0.092564 | 6/3/2018 | 1.06 | 0.852787 | 6/3/2017 | 0 | 0 | 6/3/2016 | 0.27 | 0.123023 |
| 6/4/2020 | 0.63 | 0.440633 | 6/4/2019 | 0 | 0 | 6/4/2018 | 0.47 | 0.293492 | 6/4/2017 | 0 | 0 | 6/4/2016 | 0.3 | 0.146957 |
| 6/5/2020 | 0.54 | 0.357143 | 6/5/2019 | 0 | 0 | 6/5/2018 | 0 | 0 | 6/5/2017 | 0 | 0 | 6/5/2016 | 0.03 | 0 |
| 6/6/2020 | 0.46 | 0.284516 | 6/6/2019 | 0.34 | 0.18 | 6/6/2018 | 0.08 | 0.006667 | 6/6/2017 | 0.36 | 0.196923 | 6/6/2016 | 0.53 | 0.347971 |
| 6/7/2020 | 0 | 0 | 6/7/2019 | 0.01 | 0 | 6/7/2018 | 0 | 0 | 6/7/2017 | 0.16 | 0.045 | 6/7/2016 | 0 | 0 |
| 6/8/2020 | 0 | 0 | 6/8/2019 | 0 | 0 | 6/8/2018 | 0 | 0 | 6/8/2017 | 0 | 0 | 6/8/2016 | 0.05 | 0.000476 |
| 6/9/2020 | 0 | 0 | 6/9/2019 | 0 | 0 | 6/9/2018 | 0 | 0 | 6/9/2017 | 0 | 0 | 6/9/2016 | 0.22 | 0.085263 |
| 6/10/2020 | 0 | 0 | 6/10/2019 | 0.26 | 0.115238 | 6/10/2018 | 0 | 0 | 6/10/2017 | 0 | 0 | 6/10/2016 | 0 | 0 |
| 6/11/2020 | 0.3 | 0.146957 | 6/11/2019 | 1.44 | 1.225 | 6/11/2018 | 1.8 | 1.580408 | 6/11/2017 | 0 | 0 | 6/11/2016 | 0 | 0 |
| 6/12/2020 | 0.33 | 0.171633 | 6/12/2019 | 0 | 0 | 6/12/2018 | 0.03 | 0 | 6/12/2017 | 0 | 0 | 6/12/2016 | 0 | 0 |
| 6/13/2020 | 0 | 0 | 6/13/2019 | 0.62 | 0.431282 | 6/13/2018 | 0 | 0 | 6/13/2017 | 0 | 0 | 6/13/2016 | 0 | 0 |
| 6/14/2020 | 0 | 0 | 6/14/2019 | 0.43 | 0.257797 | 6/14/2018 | 0 | 0 | 6/14/2017 | 0 | 0 | 6/14/2016 | 0 | 0 |
| 6/15/2020 | 0 | 0 | 6/15/2019 | 0 | 0 | 6/15/2018 | 0 | 0 | 6/15/2017 | 0 | 0 | 6/15/2016 | 0 | 0 |
| 6/16/2020 | 0 | 0 | 6/16/2019 | 0 | 0 | 6/16/2018 | 0 | 0 | 6/16/2017 | 0 | 0 | 6/16/2016 | 0.28 | 0.130909 |
| 6/17/2020 | 0 | 0 | 6/17/2019 | 0.29 | 0.138889 | 6/17/2018 | 0 | 0 | 6/17/2017 | 0.03 | 0 | 6/17/2016 | 0.36 | 0.196923 |
| 6/18/2020 | 0.04 | 2.41E-34 | 6/18/2019 | 0.08 | 0.006667 | 6/18/2018 | 0 | 0 | 6/18/2017 | 0.32 | 0.163333 | 6/18/2016 | 0 | 0 |
| 6/19/2020 | 0 | 0 | 6/19/2019 | 0.08 | 0.006667 | 6/19/2018 | 0.01 | 0 | 6/19/2017 | 0 | 0 | 6/19/2016 | 0 | 0 |
| 6/20/2020 | 0.15 | 0.039032 | 6/20/2019 | 1.68 | 1.461739 | 6/20/2018 | 0 | 0 | 6/20/2017 | 0.68 | 0.487619 | 6/20/2016 | 0 | 0 |
| 6/21/2020 | 0.03 | 0 | 6/21/2019 | 0.67 | 0.478193 | 6/21/2018 | 0.07 | 0.003913 | 6/21/2017 | 0 | 0 | 6/21/2016 | 0.01 | 0 |
| 6/22/2020 | 0 | 0 | 6/22/2019 | 0.14 | 0.033333 | 6/22/2018 | 0.02 | 0 | 6/22/2017 | 0.11 | 0.018148 | 6/22/2016 | 0.01 | 0 |

| Date | Avg Precip in. | Runoff From Impervious (in.) | Date | Avg Precip in. | Runoff From Impervious (in.) | Date | Avg Precip in. | Runoff From Impervious (in.) | Date | Avg Precip in. | Runoff From Impervious (in.) | Date | Avg Precip in. | Runoff From Impervious (in.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/5/2015 | 0 | 0 | 4/5/2014 | 0.05 | 0.000476 | 4/5/2013 | 0.01 | 0 | 4/5/2012 | 0 | 0 | 4/5/2011 | 0.14 | 0.033333 |
| 4/6/2015 | 0 | 0 | 4/6/2014 | 0 | 0 | 4/6/2013 | 0 | 0 | 4/6/2012 | 0 | 0 | 4/6/2011 | 0.13 | 0.027931 |
| 4/7/2015 | 0 | 0 | 4/7/2014 | 0 | 0 | 4/7/2013 | 0 | 0 | 4/7/2012 | 0 | 0 | 4/7/2011 | 0 | 0 |
| 4/8/2015 | 0.07 | 0.003913 | 4/8/2014 | 0.51 | 0.329701 | 4/8/2013 | 0 | 0 | 4/8/2012 | 0 | 0 | 4/8/2011 | 0.01 | 0 |
| 4/9/2015 | 0.05 | 0.000476 | 4/9/2014 | 0.01 | 0 | 4/9/2013 | 0 | 0 | 4/9/2012 | 0 | 0 | 4/9/2011 | 0.76 | 0.563478 |
| 4/10/2015 | 0.06 | 0.001818 | 4/10/2014 | 0 | 0 | 4/10/2013 | 0 | 0 | 4/10/2012 | 0 | 0 | 4/10/2011 | 0 | 0 |
| 4/11/2015 | 0.01 | 0 | 4/11/2014 | 0 | 0 | 4/11/2013 | 0.29 | 0.138889 | 4/11/2012 | 0 | 0 | 4/11/2011 | 0 | 0 |
| 4/12/2015 | 0 | 0 | 4/12/2014 | 0.01 | 0 | 4/12/2013 | 0.13 | 0.027931 | 4/12/2012 | 0.01 | 0 | 4/12/2011 | 0 | 0 |
| 4/13/2015 | 0 | 0 | 4/13/2014 | 0 | 0 | 4/13/2013 | 0.73 | 0.534944 | 4/13/2012 | 0.01 | 0 | 4/13/2011 | 0.98 | 0.775088 |
| 4/14/2015 | 0.04 | 2.41E-34 | 4/14/2014 | 0 | 0 | 4/14/2013 | 0 | 0 | 4/14/2012 | 0.01 | 0 | 4/14/2011 | 0.1 | 0.013846 |
| 4/15/2015 | 0.11 | 0.018148 | 4/15/2014 | 0.06 | 0.001818 | 4/15/2013 | 0 | 0 | 4/15/2012 | 0.02 | 0 | 4/15/2011 | 0 | 0 |
| 4/16/2015 | 0 | 0 | 4/16/2014 | 2.1 | 1.877699 | 4/16/2013 | 0 | 0 | 4/16/2012 | 0.01 | 0 | 4/16/2011 | 0 | 0 |
| 4/17/2015 | 0.12 | 0.022857 | 4/17/2014 | 0 | 0 | 4/17/2013 | 0.01 | 0 | 4/17/2012 | 0 | 0 | 4/17/2011 | 1.81 | 1.590305 |
| 4/18/2015 | 0 | 0 | 4/18/2014 | 0 | 0 | 4/18/2013 | 0 | 0 | 4/18/2012 | 0.02 | 0 | 4/18/2011 | 0 | 0 |
| 4/19/2015 | 0 | 0 | 4/19/2014 | 0 | 0 | 4/19/2013 | 0.1 | 0.013846 | 4/19/2012 | 0.09 | 0.01 | 4/19/2011 | 0 | 0 |
| 4/20/2015 | 1.19 | 0.97963 | 4/20/2014 | 0 | 0 | 4/20/2013 | 1.01 | 0.804188 | 4/20/2012 | 0 | 0 | 4/20/2011 | 0.12 | 0.022857 |
| 4/21/2015 | 0.57 | 0.384795 | 4/21/2014 | 0 | 0 | 4/21/2013 | 0 | 0 | 4/21/2012 | 0 | 0 | 4/21/2011 | 0 | 0 |
| 4/22/2015 | 0 | 0 | 4/22/2014 | 0 | 0 | 4/22/2013 | 0 | 0 | 4/22/2012 | 0.33 | 0.171633 | 4/22/2011 | 0 | 0 |
| 4/23/2015 | 0.14 | 0.033333 | 4/23/2014 | 0.08 | 0.006667 | 4/23/2013 | 0 | 0 | 4/23/2012 | 2.49 | 2.265094 | 4/23/2011 | 0.24 | 0.1 |
| 4/24/2015 | 0 | 0 | 4/24/2014 | 0 | 0 | 4/24/2013 | 0 | 0 | 4/24/2012 | 0.03 | 0 | 4/24/2011 | 0.2 | 0.071111 |
| 4/25/2015 | 0 | 0 | 4/25/2014 | 0 | 0 | 4/25/2013 | 0 | 0 | 4/25/2012 | 0 | 0 | 4/25/2011 | 0.02 | 0 |
| 4/26/2015 | 0 | 0 | 4/26/2014 | 0.42 | 0.248966 | 4/26/2013 | 0 | 0 | 4/26/2012 | 0.01 | 0 | 4/26/2011 | 0 | 0 |
| 4/27/2015 | 0 | 0 | 4/27/2014 | 0.01 | 0 | 4/27/2013 | 0 | 0 | 4/27/2012 | 0.12 | 0.022857 | 4/27/2011 | 0 | 0 |
| 4/28/2015 | 0 | 0 | 4/28/2014 | 0 | 0 | 4/28/2013 | 0 | 0 | 4/28/2012 | 0 | 0 | 4/28/2011 | 0.02 | 0 |
| 4/29/2015 | 0 | 0 | 4/29/2014 | 0.05 | 0.000476 | 4/29/2013 | 0.13 | 0.027931 | 4/29/2012 | 0.01 | 0 | 4/29/2011 | 0.15 | 0.039032 |
| 4/30/2015 | 0 | 0 | 4/30/2014 | 1.23 | 1.018777 | 4/30/2013 | 0.38 | 0.214074 | 4/30/2012 | 0 | 0 | 4/30/2011 | 0.01 | 0 |
| 5/1/2015 | 0 | 0 | 5/1/2014 | 4.53 | 4.298529 | 5/1/2013 | 0 | 0 | 5/1/2012 | 0.21 | 0.078108 | 5/1/2011 | 0 | 0 |
| 5/2/2015 | 0 | 0 | 5/2/2014 | 0.2 | 0.071111 | 5/2/2013 | 0 | 0 | 5/2/2012 | 0.1 | 0.013846 | 5/2/2011 | 0 | 0 |
| 5/3/2015 | 0 | 0 | 5/3/2014 | 0 | 0 | 5/3/2013 | 0 | 0 | 5/3/2012 | 0.28 | 0.130909 | 5/3/2011 | 0 | 0 |
| 5/4/2015 | 0 | 0 | 5/4/2014 | 0.04 | 2.41E-34 | 5/4/2013 | 0 | 0 | 5/4/2012 | 0.01 | 0 | 5/4/2011 | 0.38 | 0.214074 |
| 5/5/2015 | 0 | 0 | 5/5/2014 | 0 | 0 | 5/5/2013 | 0 | 0 | 5/5/2012 | 0.57 | 0.384795 | 5/5/2011 | 0.31 | 0.155106 |
| 5/6/2015 | 0.18 | 0.057647 | 5/6/2014 | 0 | 0 | 5/6/2013 | 0 | 0 | 5/6/2012 | 0.01 | 0 | 5/6/2011 | 0 | 0 |
| 5/7/2015 | 0.02 | 0 | 5/7/2014 | 0 | 0 | 5/7/2013 | 0 | 0 | 5/7/2012 | 0 | 0 | 5/7/2011 | 0.1 | 0.013846 |
| 5/8/2015 | 0 | 0 | 5/8/2014 | 0.02 | 0 | 5/8/2013 | 0.41 | 0.240175 | 5/8/2012 | 0.06 | 0.001818 | 5/8/2011 | 0.05 | 0.000476 |
| 5/9/2015 | 0 | 0 | 5/9/2014 | 0 | 0 | 5/9/2013 | 0.44 | 0.266667 | 5/9/2012 | 0.45 | 0.275574 | 5/9/2011 | 0 | 0 |
| 5/10/2015 | 0 | 0 | 5/10/2014 | 0 | 0 | 5/10/2013 | 0.01 | 0 | 5/10/2012 | 0.24 | 0.1 | 5/10/2011 | 0 | 0 |
| 5/11/2015 | 0 | 0 | 5/11/2014 | 0.37 | 0.205472 | 5/11/2013 | 1.3 | 1.087397 | 5/11/2012 | 0 | 0 | 5/11/2011 | 0 | 0 |
| 5/12/2015 | 0.17 | 0.051212 | 5/12/2014 | 0 | 0 | 5/12/2013 | 0.31 | 0.155106 | 5/12/2012 | 0 | 0 | 5/12/2011 | 0 | 0 |
| 5/13/2015 | 0 | 0 | 5/13/2014 | 0.09 | 0.01 | 5/13/2013 | 0 | 0 | 5/13/2012 | 0 | 0 | 5/13/2011 | 0 | 0 |
| 5/14/2015 | 0 | 0 | 5/14/2014 | 0.12 | 0.022857 | 5/14/2013 | 0 | 0 | 5/14/2012 | 0 | 0 | 5/14/2011 | 0.05 | 0.000476 |
| 5/15/2015 | 0 | 0 | 5/15/2014 | 0.02 | 0 | 5/15/2013 | 0.04 | 2.41E-34 | 5/15/2012 | 0.43 | 0.257797 | 5/15/2011 | 0.38 | 0.214074 |
| 5/16/2015 | 0 | 0 | 5/16/2014 | 0.11 | 0.018148 | 5/16/2013 | 0.05 | 0.000476 | 5/16/2012 | 1.06 | 0.852787 | 5/16/2011 | 0.66 | 0.46878 |
| 5/17/2015 | 0.27 | 0.123023 | 5/17/2014 | 1.72 | 1.501277 | 5/17/2013 | 0.02 | 0 | 5/17/2012 | 0 | 0 | 5/17/2011 | 0.47 | 0.293492 |
| 5/18/2015 | 0.02 | 0 | 5/18/2014 | 0 | 0 | 5/18/2013 | 0 | 0 | 5/18/2012 | 0 | 0 | 5/18/2011 | 0.35 | 0.188431 |
| 5/19/2015 | 0.9 | 0.697736 | 5/19/2014 | 0 | 0 | 5/19/2013 | 0.13 | 0.027931 | 5/19/2012 | 0 | 0 | 5/19/2011 | 0.05 | 0.000476 |
| 5/20/2015 | 0.1 | 0.013846 | 5/20/2014 | 0 | 0 | 5/20/2013 | 0.03 | 0 | 5/20/2012 | 0 | 0 | 5/20/2011 | 0.38 | 0.214074 |
| 5/21/2015 | 0 | 0 | 5/21/2014 | 0.03 | 0 | 5/21/2013 | 0.03 | 0 | 5/21/2012 | 0.16 | 0.045 | 5/21/2011 | 0.26 | 0.115238 |
| 5/22/2015 | 0.04 | 2.41E-34 | 5/22/2014 | 0.16 | 0.045 | 5/22/2013 | 0 | 0 | 5/22/2012 | 0.02 | 0 | 5/22/2011 | 0 | 0 |
| 5/23/2015 | 0 | 0 | 5/23/2014 | 0.2 | 0.071111 | 5/23/2013 | 0.03 | 0 | 5/23/2012 | 0.01 | 0 | 5/23/2011 | 0.06 | 0.001818 |
| 5/24/2015 | 0 | 0 | 5/24/2014 | 0 | 0 | 5/24/2013 | 0.66 | 0.46878 | 5/24/2012 | 0.02 | 0 | 5/24/2011 | 0.01 | 0 |
| 5/25/2015 | 0 | 0 | 5/25/2014 | 0 | 0 | 5/25/2013 | 0.09 | 0.01 | 5/25/2012 | 0.09 | 0.01 | 5/25/2011 | 0 | 0 |
| 5/26/2015 | 0 | 0 | 5/26/2014 | 0 | 0 | 5/26/2013 | 0 | 0 | 5/26/2012 | 0 | 0 | 5/26/2011 | 0 | 0 |
| 5/27/2015 | 0.04 | 2.41E-34 | 5/27/2014 | 0 | 0 | 5/27/2013 | 0 | 0 | 5/27/2012 | 0.06 | 0.001818 | 5/27/2011 | 0 | 0 |
| 5/28/2015 | 0.37 | 0.205472 | 5/28/2014 | 0.44 | 0.266667 | 5/28/2013 | 0.02 | 0 | 5/28/2012 | 0 | 0 | 5/28/2011 | 0 | 0 |
| 5/29/2015 | 0 | 0 | 5/29/2014 | 0.16 | 0.045 | 5/29/2013 | 0.21 | 0.078108 | 5/29/2012 | 0 | 0 | 5/29/2011 | 0 | 0 |
| 5/30/2015 | 0 | 0 | 5/30/2014 | 0.1 | 0.013846 | 5/30/2013 | 0 | 0 | 5/30/2012 | 0.52 | 0.338824 | 5/30/2011 | 0 | 0 |
| 5/31/2015 | 0 | 0 | 5/31/2014 | 0 | 0 | 5/31/2013 | 0 | 0 | 5/31/2012 | 0.01 | 0 | 5/31/2011 | 0 | 0 |
| 6/1/2015 | 0.67 | 0.478193 | 6/1/2014 | 0 | 0 | 6/1/2013 | 0 | 0 | 6/1/2012 | 0 | 0 | 6/1/2011 | 0 | 0 |
| 6/2/2015 | 1.02 | 0.813898 | 6/2/2014 | 0 | 0 | 6/2/2013 | 0 | 0 | 6/2/2012 | 0.92 | 0.717037 | 6/2/2011 | 0 | 0 |
| 6/3/2015 | 0.13 | 0.027931 | 6/3/2014 | 0 | 0 | 6/3/2013 | 0.49 | 0.311538 | 6/3/2012 | 0 | 0 | 6/3/2011 | 0 | 0 |
| 6/4/2015 | 0.02 | 0 | 6/4/2014 | 0.17 | 0.051212 | 6/4/2013 | 0.12 | 0.022857 | 6/4/2012 | 0.22 | 0.085263 | 6/4/2011 | 0 | 0 |
| 6/5/2015 | 0.26 | 0.115238 | 6/5/2014 | 0.16 | 0.045 | 6/5/2013 | 0 | 0 | 6/5/2012 | 0.2 | 0.071111 | 6/5/2011 | 0.1 | 0.013846 |
| 6/6/2015 | 0.01 | 0 | 6/6/2014 | 0.01 | 0 | 6/6/2013 | 0 | 0 | 6/6/2012 | 0 | 0 | 6/6/2011 | 0.06 | 0.001818 |
| 6/7/2015 | 0 | 0 | 6/7/2014 | 0 | 0 | 6/7/2013 | 1.47 | 1.25454 | 6/7/2012 | 0 | 0 | 6/7/2011 | 0 | 0 |
| 6/8/2015 | 0 | 0 | 6/8/2014 | 0 | 0 | 6/8/2013 | 2.5 | 2.275038 | 6/8/2012 | 0.02 | 0 | 6/8/2011 | 0 | 0 |
| 6/9/2015 | 0.89 | 0.688095 | 6/9/2014 | 0.07 | 0.003913 | 6/9/2013 | 0 | 0 | 6/9/2012 | 0 | 0 | 6/9/2011 | 0 | 0 |
| 6/10/2015 | 0 | 0 | 6/10/2014 | 0.39 | 0.222727 | 6/10/2013 | 0.47 | 0.293492 | 6/10/2012 | 0 | 0 | 6/10/2011 | 0.1 | 0.013846 |
| 6/11/2015 | 0 | 0 | 6/11/2014 | 0.25 | 0.107561 | 6/11/2013 | 1.44 | 1.225 | 6/11/2012 | 0 | 0 | 6/11/2011 | 0.06 | 0.001818 |
| 6/12/2015 | 0 | 0 | 6/12/2014 | 0.18 | 0.057647 | 6/12/2013 | 0.01 | 0 | 6/12/2012 | 0.01 | 0 | 6/12/2011 | 0.71 | 0.515977 |
| 6/13/2015 | 0.04 | 2.41E-34 | 6/13/2014 | 0.99 | 0.784783 | 6/13/2013 | 0 | 0 | 6/13/2012 | 1.61 | 1.392599 | 6/13/2011 | 0.03 | 0 |
| 6/14/2015 | 0.03 | 0 | 6/14/2014 | 0.15 | 0.039032 | 6/14/2013 | 0.58 | 0.394054 | 6/14/2012 | 0 | 0 | 6/14/2011 | 0 | 0 |
| 6/15/2015 | 0.53 | 0.347971 | 6/15/2014 | 0 | 0 | 6/15/2013 | 0.02 | 0 | 6/15/2012 | 0 | 0 | 6/15/2011 | 0.05 | 0.000476 |
| 6/16/2015 | 0 | 0 | 6/16/2014 | 0 | 0 | 6/16/2013 | 0 | 0 | 6/16/2012 | 0 | 0 | 6/16/2011 | 0 | 0 |
| 6/17/2015 | 0.05 | 0.000476 | 6/17/2014 | 0 | 0 | 6/17/2013 | 0.11 | 0.018148 | 6/17/2012 | 0 | 0 | 6/17/2011 | 0.46 | 0.284516 |
| 6/18/2015 | 0.91 | 0.707383 | 6/18/2014 | 0 | 0 | 6/18/2013 | 0.55 | 0.366338 | 6/18/2012 | 0 | 0 | 6/18/2011 | 0.34 | 0.18 |
| 6/19/2015 | 0.38 | 0.214074 | 6/19/2014 | 0.84 | 0.64 | 6/19/2013 | 0.5 | 0.320606 | 6/19/2012 | 0.01 | 0 | 6/19/2011 | 0 | 0 |
| 6/20/2015 | 0.04 | 2.41E-34 | 6/20/2014 | 0.07 | 0.003913 | 6/20/2013 | 0 | 0 | 6/20/2012 | 0 | 0 | 6/20/2011 | 0 | 0 |
| 6/21/2015 | 0.55 | 0.366338 | 6/21/2014 | 0 | 0 | 6/21/2013 | 0 | 0 | 6/21/2012 | 0 | 0 | 6/21/2011 | 0.23 | 0.092564 |
| 6/22/2015 | 0.01 | 0 | 6/22/2014 | 0.02 | 0 | 6/22/2013 | 0 | 0 | 6/22/2012 | 0 | 0 | 6/22/2011 | 0.19 | 0.064286 |

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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/23/2020 | 0.07 | 0.003913 | 6/23/2019 | 0 | 0 | 6/23/2018 | 0.07 | 0.003913 | 6/23/2017 | 0.01 | 0 | 6/23/2016 | 0.07 | 0.003913 | 6/23/2015 | 0 | 0 | 6/23/2014 | 0 | 0 | 6/23/2013 | 0 | 0 | 6/23/2012 | 0.25 | 0.107561 | 6/23/2011 | 0 | 0 |
| 6/24/2020 | 0.03 | 0 | 6/24/2019 | 0 | 0 | 6/24/2018 | 0.09 | 0.01 | 6/24/2017 | 1.5 | 1.284096 | 6/24/2016 | 0.75 | 0.553956 | 6/24/2015 | 0.82 | 0.620816 | 6/24/2014 | 0 | 0 | 6/24/2013 | 0.03 | 0 | 6/24/2012 | 0 | 0 | 6/24/2011 | 0.14 | 0.033333 |
| 6/25/2020 | 0 | 0 | 6/25/2019 | 0.05 | 0.000476 | 6/25/2018 | 0.21 | 0.078108 | 6/25/2017 | 0 | 0 | 6/25/2016 | 0.02 | 0 | 6/25/2015 | 0 | 0 | 6/25/2014 | 0 | 0 | 6/25/2013 | 0.44 | 0.266667 | 6/25/2012 | 0.03 | 0 | 6/25/2011 | 0.07 | 0.003913 |
| 6/26/2020 | 0.05 | 0.000476 | 6/26/2019 | 0 | 0 | 6/26/2018 | 0 | 0 | 6/26/2017 | 0 | 0 | 6/26/2016 | 0 | 0 | 6/26/2015 | 0.19 | 0.064286 | 6/26/2014 | 0.47 | 0.293492 | 6/26/2013 | 0.11 | 0.018148 | 6/26/2012 | 0.02 | 0 | 6/26/2011 | 0 | 0 |
| 6/27/2020 | 0.06 | 0.001818 | 6/27/2019 | 0 | 0 | 6/27/2018 | 0 | 0 | 6/27/2017 | 0.16 | 0.045 | 6/27/2016 | 0 | 0 | 6/27/2015 | 0.29 | 0.138889 | 6/27/2014 | 0 | 0 | 6/27/2013 | 0.14 | 0.033333 | 6/27/2012 | 0 | 0 | 6/27/2011 | 0 | 0 |
| 6/28/2020 | 0.05 | 0.000476 | 6/28/2019 | 0 | 0 | 6/28/2018 | 0.43 | 0.257797 | 6/28/2017 | 0 | 0 | 6/28/2016 | 0.18 | 0.057647 | 6/28/2015 | 1.97 | 1.748779 | 6/28/2014 | 0 | 0 | 6/28/2013 | 0.96 | 0.755714 | 6/28/2012 | 0 | 0 | 6/28/2011 | 0 | 0 |
| 6/29/2020 | 0.14 | 0.033333 | 6/29/2019 | 0.08 | 0.006667 | 6/29/2018 | 0.01 | 0 | 6/29/2017 | 0 | 0 | 6/29/2016 | 0.04 | 2.41E-34 | 6/29/2015 | 0 | 0 | 6/29/2014 | 0 | 0 | 6/29/2013 | 1.32 | 1.107027 | 6/29/2012 | 0.17 | 0.051212 | 6/29/2011 | 0.18 | 0.057647 |
| 6/30/2020 | 0 | 0 | 6/30/2019 | 0.49 | 0.311538 | 6/30/2018 | 0 | 0 | 6/30/2017 | 0 | 0 | 6/30/2016 | 0 | 0 | 6/30/2015 | 0 | 0 | 6/30/2014 | 0 | 0 | 6/30/2013 | 0 | 0 | 6/30/2012 | 0.11 | 0.018148 | 6/30/2011 | 0 | 0 |
| 7/1/2020 | 0.02 | 0 | 7/1/2019 | 0 | 0 | 7/1/2018 | 0 | 0 | 7/1/2017 | 0 | 0 | 7/1/2016 | 0 | 0 | 7/1/2015 | 0.82 | 0.620816 | 7/1/2014 | 0 | 0 | 7/1/2013 | 1.13 | 0.921008 | 7/1/2012 | 0 | 0 | 7/1/2011 | 0 | 0 |
| 7/2/2020 | 0.02 | 0 | 7/2/2019 | 0 | 0 | 7/2/2018 | 0 | 0 | 7/2/2017 | 0.67 | 0.478193 | 7/2/2016 | 0.19 | 0.064286 | 7/2/2015 | 0 | 0 | 7/2/2014 | 0 | 0 | 7/2/2013 | 0.17 | 0.051212 | 7/2/2012 | 0 | 0 | 7/2/2011 | 0 | 0 |
| 7/3/2020 | 0 | 0 | 7/3/2019 | 0.56 | 0.375556 | 7/3/2018 | 0 | 0 | 7/3/2017 | 0 | 0 | 7/3/2016 | 0 | 0 | 7/3/2015 | 0.03 | 0 | 7/3/2014 | 0.3 | 0.146957 | 7/3/2013 | 0.02 | 0 | 7/3/2012 | 0 | 0 | 7/3/2011 | 0.02 | 0 |
| 7/4/2020 | 0.02 | 0 | 7/4/2019 | 0 | 0 | 7/4/2018 | 0.92 | 0.717037 | 7/4/2017 | 0.01 | 0 | 7/4/2016 | 0 | 0 | 7/4/2015 | 0 | 0 | 7/4/2014 | 0.26 | 0.115238 | 7/4/2013 | 0.27 | 0.123023 | 7/4/2012 | 0.01 | 0 | 7/4/2011 | 0.03 | 0 |
| 7/5/2020 | 0 | 0 | 7/5/2019 | 0.22 | 0.085263 | 7/5/2018 | 0.01 | 0 | 7/5/2017 | 0.21 | 0.078108 | 7/5/2016 | 0.48 | 0.3025 | 7/5/2015 | 0.08 | 0.006667 | 7/5/2014 | 0 | 0 | 7/5/2013 | 0 | 0 | 7/5/2012 | 0 | 0 | 7/5/2011 | 0 | 0 |
| 7/6/2020 | 0 | 0 | 7/6/2019 | 0.11 | 0.018148 | 7/6/2018 | 0.12 | 0.022857 | 7/6/2017 | 0.01 | 0 | 7/6/2016 | 0 | 0 | 7/6/2015 | 0 | 0 | 7/6/2014 | 0 | 0 | 7/6/2013 | 0 | 0 | 7/6/2012 | 0 | 0 | 7/6/2011 | 0 | 0 |
| 7/7/2020 | 0.84 | 0.64 | 7/7/2019 | 0.68 | 0.487619 | 7/7/2018 | 0.17 | 0.051212 | 7/7/2017 | 0.47 | 0.293492 | 7/7/2016 | 0 | 0 | 7/7/2015 | 0.03 | 0 | 7/7/2014 | 0 | 0 | 7/7/2013 | 0 | 0 | 7/7/2012 | 0 | 0 | 7/7/2011 | 0.02 | 0 |
| 7/8/2020 | 0 | 0 | 7/8/2019 | 0.09 | 0.01 | 7/8/2018 | 0 | 0 | 7/8/2017 | 0.64 | 0.45 | 7/8/2016 | 0 | 0 | 7/8/2015 | 0 | 0 | 7/8/2014 | 0 | 0 | 7/8/2013 | 0.31 | 0.155106 | 7/8/2012 | 0.06 | 0.001818 | 7/8/2011 | 0.02 | 0 |
| 7/9/2020 | 0.03 | 0 | 7/9/2019 | 0.15 | 0.039032 | 7/9/2018 | 0 | 0 | 7/9/2017 | 0.02 | 0 | 7/9/2016 | 0.03 | 0 | 7/9/2015 | 0.39 | 0.222727 | 7/9/2014 | 0.18 | 0.057647 | 7/9/2013 | 0.42 | 0.248966 | 7/9/2012 | 0 | 0 | 7/9/2011 | 0.78 | 0.582553 |
| 7/10/2020 | 0.1 | 0.013846 | 7/10/2019 | 0 | 0 | 7/10/2018 | 0 | 0 | 7/10/2017 | 0 | 0 | 7/10/2016 | 0.63 | 0.440633 | 7/10/2015 | 0.5 | 0.320606 | 7/10/2014 | 0 | 0 | 7/10/2013 | 0.01 | 0 | 7/10/2012 | 0.04 | 2.41E-34 | 7/10/2011 | 0.01 | 0 |
| 7/11/2020 | 2.56 | 2.334706 | 7/11/2019 | 0.24 | 0.1 | 7/11/2018 | 0 | 0 | 7/11/2017 | 0 | 0 | 7/11/2016 | 0 | 0 | 7/11/2015 | 0 | 0 | 7/11/2014 | 0.61 | 0.421948 | 7/11/2013 | 0.06 | 0.001818 | 7/11/2012 | 0 | 0 | 7/11/2011 | 0 | 0 |
| 7/12/2020 | 0 | 0 | 7/12/2019 | 1.84 | 1.62 | 7/12/2018 | 0 | 0 | 7/12/2017 | 0 | 0 | 7/12/2016 | 0 | 0 | 7/12/2015 | 0 | 0 | 7/12/2014 | 0 | 0 | 7/12/2013 | 0.05 | 0.000476 | 7/12/2012 | 0 | 0 | 7/12/2011 | 0.1 | 0.013846 |
| 7/13/2020 | 0.09 | 0.01 | 7/13/2019 | 0 | 0 | 7/13/2018 | 0 | 0 | 7/13/2017 | 0.01 | 0 | 7/13/2016 | 0 | 0 | 7/13/2015 | 0 | 0 | 7/13/2014 | 0.02 | 0 | 7/13/2013 | 2.49 | 2.265094 | 7/13/2012 | 0 | 0 | 7/13/2011 | 0 | 0 |
| 7/14/2020 | 0 | 0 | 7/14/2019 | 0 | 0 | 7/14/2018 | 0 | 0 | 7/14/2017 | 0.4 | 0.231429 | 7/14/2016 | 0.46 | 0.284516 | 7/14/2015 | 0.31 | 0.155106 | 7/14/2014 | 0.29 | 0.138889 | 7/14/2013 | 0.03 | 0 | 7/14/2012 | 0.36 | 0.196923 | 7/14/2011 | 0 | 0 |
| 7/15/2020 | 0 | 0 | 7/15/2019 | 0 | 0 | 7/15/2018 | 0 | 0 | 7/15/2017 | 1.21 | 0.999197 | 7/15/2016 | 0 | 0 | 7/15/2015 | 0.82 | 0.620816 | 7/15/2014 | 0.25 | 0.107561 | 7/15/2013 | 0 | 0 | 7/15/2012 | 0.37 | 0.205472 | 7/15/2011 | 0 | 0 |
| 7/16/2020 | 0 | 0 | 7/16/2019 | 0 | 0 | 7/16/2018 | 0.5 | 0.320606 | 7/16/2017 | 0 | 0 | 7/16/2016 | 0 | 0 | 7/16/2015 | 0.3 | 0.146957 | 7/16/2014 | 0.33 | 0.171633 | 7/16/2013 | 0 | 0 | 7/16/2012 | 0.62 | 0.431282 | 7/16/2011 | 0 | 0 |
| 7/17/2020 | 0.02 | 0 | 7/17/2019 | 0.05 | 0.000476 | 7/17/2018 | 0 | 0 | 7/17/2017 | 0 | 0 | 7/17/2016 | 0.11 | 0.018148 | 7/17/2015 | 0 | 0 | 7/17/2014 | 0 | 0 | 7/17/2013 | 0 | 0 | 7/17/2012 | 0 | 0 | 7/17/2011 | 0 | 0 |
| 7/18/2020 | 0 | 0 | 7/18/2019 | 0.54 | 0.357143 | 7/18/2018 | 1.19 | 0.97963 | 7/18/2017 | 0.18 | 0.057647 | 7/18/2016 | 0 | 0 | 7/18/2015 | 0 | 0 | 7/18/2014 | 0 | 0 | 7/18/2013 | 0 | 0 | 7/18/2012 | 0 | 0 | 7/18/2011 | 0 | 0 |
| 7/19/2020 | 0 | 0 | 7/19/2019 | 0.7 | 0.506512 | 7/19/2018 | 0 | 0 | 7/19/2017 | 0 | 0 | 7/19/2016 | 0.5 | 0.320606 | 7/19/2015 | 0 | 0 | 7/19/2014 | 0 | 0 | 7/19/2013 | 0.01 | 0 | 7/19/2012 | 0.03 | 0 | 7/19/2011 | 0 | 0 |
| 7/20/2020 | 0.02 | 0 | 7/20/2019 | 0 | 0 | 7/20/2018 | 0 | 0 | 7/20/2017 | 0 | 0 | 7/20/2016 | 0 | 0 | 7/20/2015 | 0 | 0 | 7/20/2014 | 0.01 | 0 | 7/20/2013 | 0 | 0 | 7/20/2012 | 0.51 | 0.329701 | 7/20/2011 | 0.14 | 0.033333 |
| 7/21/2020 | 0 | 0 | 7/21/2019 | 0 | 0 | 7/21/2018 | 0 | 0 | 7/21/2017 | 0 | 0 | 7/21/2016 | 0 | 0 | 7/21/2015 | 0 | 0 | 7/21/2014 | 0 | 0 | 7/21/2013 | 0.07 | 0.003913 | 7/21/2012 | 0.09 | 0.01 | 7/21/2011 | 0 | 0 |
| 7/22/2020 | 0.06 | 0.001818 | 7/22/2019 | 0.04 | 2.41E-34 | 7/22/2018 | 1.78 | 1.560619 | 7/22/2017 | 0 | 0 | 7/22/2016 | 0 | 0 | 7/22/2015 | 0.03 | 0 | 7/22/2014 | 0 | 0 | 7/22/2013 | 0.05 | 0.000476 | 7/22/2012 | 0 | 0 | 7/22/2011 | 0 | 0 |
| 7/23/2020 | 0.35 | 0.188431 | 7/23/2019 | 1.71 | 1.49139 | 7/23/2018 | 1.43 | 1.215157 | 7/23/2017 | 0.24 | 0.1 | 7/23/2016 | 0 | 0 | 7/23/2015 | 0 | 0 | 7/23/2014 | 0 | 0 | 7/23/2013 | 1.39 | 1.175806 | 7/23/2012 | 0 | 0 | 7/23/2011 | 0 | 0 |
| 7/24/2020 | 0.66 | 0.46878 | 7/24/2019 | 0.02 | 0 | 7/24/2018 | 1.09 | 0.882 | 7/24/2017 | 1.88 | 1.659608 | 7/24/2016 | 0.1 | 0.013846 | 7/24/2015 | 0 | 0 | 7/24/2014 | 0.55 | 0.366338 | 7/24/2013 | 0.07 | 0.003913 | 7/24/2012 | 0.02 | 0 | 7/24/2011 | 0.01 | 0 |
| 7/25/2020 | 0.05 | 0.000476 | 7/25/2019 | 0 | 0 | 7/25/2018 | 0.75 | 0.553956 | 7/25/2017 | 0.69 | 0.497059 | 7/25/2016 | 0.47 | 0.293492 | 7/25/2015 | 0 | 0 | 7/25/2014 | 0 | 0 | 7/25/2013 | 0 | 0 | 7/25/2012 | 0 | 0 | 7/25/2011 | 0.02 | 0 |
| 7/26/2020 | 0 | 0 | 7/26/2019 | 0 | 0 | 7/26/2018 | 0.54 | 0.357143 | 7/26/2017 | 0.01 | 0 | 7/26/2016 | 0.48 | 0.3025 | 7/26/2015 | 0 | 0 | 7/26/2014 | 0 | 0 | 7/26/2013 | 0 | 0 | 7/26/2012 | 0 | 0 | 7/26/2011 | 1.14 | 0.930769 |
| 7/27/2020 | 0 | 0 | 7/27/2019 | 0 | 0 | 7/27/2018 | 0.01 | 0 | 7/27/2017 | 0 | 0 | 7/27/2016 | 0 | 0 | 7/27/2015 | 0.4 | 0.231429 | 7/27/2014 | 0.05 | 0.000476 | 7/27/2013 | 0 | 0 | 7/27/2012 | 0.54 | 0.357143 | 7/27/2011 | 0.03 | 0 |
| 7/28/2020 | 0 | 0 | 7/28/2019 | 0 | 0 | 7/28/2018 | 0.18 | 0.057647 | 7/28/2017 | 0 | 0 | 7/28/2016 | 0 | 0 | 7/28/2015 | 0 | 0 | 7/28/2014 | 1.26 | 1.048169 | 7/28/2013 | 0.12 | 0.022857 | 7/28/2012 | 0 | 0 | 7/28/2011 | 0 | 0 |
| 7/29/2020 | 0 | 0 | 7/29/2019 | 0 | 0 | 7/29/2018 | 0 | 0 | 7/29/2017 | 0.32 | 0.163333 | 7/29/2016 | 1.07 | 0.86252 | 7/29/2015 | 0 | 0 | 7/29/2014 | 0.01 | 0 | 7/29/2013 | 0.82 | 0.620816 | 7/29/2012 | 0.16 | 0.045 | 7/29/2011 | 0.28 | 0.130909 |
| 7/30/2020 | 0 | 0 | 7/30/2019 | 0 | 0 | 7/30/2018 | 0 | 0 | 7/30/2017 | 0 | 0 | 7/30/2016 | 0 | 0 | 7/30/2015 | 0 | 0 | 7/30/2014 | 0 | 0 | 7/30/2013 | 0 | 0 | 7/30/2012 | 0.11 | 0.018148 | 7/30/2011 | 0.1 | 0.013846 |
| 7/31/2020 | 0.17 | 0.051212 | 7/31/2019 | 0 | 0 | 7/31/2018 | 0.01 | 0 | 7/31/2017 | 0 | 0 | 7/31/2016 | 1.25 | 1.038369 | 7/31/2015 | 0.67 | 0.478193 | 7/31/2014 | 0 | 0 | 7/31/2013 | 0 | 0 | 7/31/2012 | 0.02 | 0 | 7/31/2011 | 0 | 0 |
| 8/1/2020 | 0.06 | 0.001818 | 8/1/2019 | 0.09 | 0.01 | 8/1/2018 | 0.05 | 0.000476 | 8/1/2017 | 0 | 0 | 8/1/2016 | 0 | 0 | 8/1/2015 | 0 | 0 | 8/1/2014 | 0 | 0 | 8/1/2013 | 0.31 | 0.155106 | 8/1/2012 | 0.01 | 0 | 8/1/2011 | 0.01 | 0 |
| 8/2/2020 | 0.02 | 0 | 8/2/2019 | 0.17 | 0.051212 | 8/2/2018 | 0.22 | 0.085263 | 8/2/2017 | 0 | 0 | 8/2/2016 | 0.11 | 0.018148 | 8/2/2015 | 0 | 0 | 8/2/2014 | 0.45 | 0.275574 | 8/2/2013 | 1.3 | 1.087397 | 8/2/2012 | 0.11 | 0.018148 | 8/2/2011 | 0.13 | 0.027931 |
| 8/3/2020 | 0 | 0 | 8/3/2019 | 0.07 | 0.003913 | 8/3/2018 | 0.06 | 0.001818 | 8/3/2017 | 0.31 | 0.155106 | 8/3/2016 | 0 | 0 | 8/3/2015 | 0 | 0 | 8/3/2014 | 0.11 | 0.018148 | 8/3/2013 | 0 | 0 | 8/3/2012 | 0 | 0 | 8/3/2011 | 0.03 | 0 |
| 8/4/2020 | 1.21 | 0.999197 | 8/4/2019 | 0.01 | 0 | 8/4/2018 | 1.12 | 0.91125 | 8/4/2017 | 0.03 | 0 | 8/4/2016 | 0 | 0 | 8/4/2015 | 0.2 | 0.071111 | 8/4/2014 | 0.02 | 0 | 8/4/2013 | 0.03 | 0 | 8/4/2012 | 0.03 | 0 | 8/4/2011 | 0.43 | 0.257797 |
| 8/5/2020 | 4.76 | 4.52813 | 8/5/2019 | 0 | 0 | 8/5/2018 | 0.03 | 0 | 8/5/2017 | 0.63 | 0.440633 | 8/5/2016 | 0 | 0 | 8/5/2015 | 0 | 0 | 8/5/2014 | 0 | 0 | 8/5/2013 | 0 | 0 | 8/5/2012 | 0.14 | 0.033333 | 8/5/2011 | 0.02 | 0 |
| 8/6/2020 | 0.05 | 0.000476 | 8/6/2019 | 0 | 0 | 8/6/2018 | 0 | 0 | 8/6/2017 | 0 | 0 | 8/6/2016 | 0 | 0 | 8/6/2015 | 0 | 0 | 8/6/2014 | 0 | 0 | 8/6/2013 | 0 | 0 | 8/6/2012 | 0.31 | 0.155106 | 8/6/2011 | 0 | 0 |
| 8/7/2020 | 0.09 | 0.01 | 8/7/2019 | 0 | 0 | 8/7/2018 | 0 | 0 | 8/7/2017 | 0.18 | 0.057647 | 8/7/2016 | 0.01 | 0 | 8/7/2015 | 0.06 | 0.001818 | 8/7/2014 | 0.01 | 0 | 8/7/2013 | 0.06 | 0.001818 | 8/7/2012 | 0 | 0 | 8/7/2011 | 0.15 | 0.039032 |
| 8/8/2020 | 1.57 | 1.353121 | 8/8/2019 | 0.19 | 0.064286 | 8/8/2018 | 0.08 | 0.006667 | 8/8/2017 | 0.5 | 0.320606 | 8/8/2016 | 0 | 0 | 8/8/2015 | 0 | 0 | 8/8/2014 | 0 | 0 | 8/8/2013 | 0.25 | 0.107561 | 8/8/2012 | 0 | 0 | 8/8/2011 | 0.01 | 0 |
| 8/9/2020 | 0 | 0 | 8/9/2019 | 0.14 | 0.033333 | 8/9/2018 | 0.14 | 0.033333 | 8/9/2017 | 0 | 0 | 8/9/2016 | 0 | 0 | 8/9/2015 | 0 | 0 | 8/9/2014 | 0 | 0 | 8/9/2013 | 0.04 | 2.41E-34 | 8/9/2012 | 0 | 0 | 8/9/2011 | 0 | 0 |
| 8/10/2020 | 0.22 | 0.085263 | 8/10/2019 | 0 | 0 | 8/10/2018 | 0 | 0 | 8/10/2017 | 0 | 0 | 8/10/2016 | 0 | 0 | 8/10/2015 | 0.01 | 0 | 8/10/2014 | 0 | 0 | 8/10/2013 | 0.1 | 0.013846 | 8/10/2012 | 0.2 | 0.071111 | 8/10/2011 | 0.98 | 0.775088 |
| 8/11/2020 | 0 | 0 | 8/11/2019 | 0 | 0 | 8/11/2018 | 0.09 | 0.01 | 8/11/2017 | 0 | 0 | 8/11/2016 | 0 | 0 | 8/11/2015 | 0.58 | 0.394054 | 8/11/2014 | 0 | 0 | 8/11/2013 | 0 | 0 | 8/11/2012 | 0.93 | 0.726697 | 8/11/2011 | 0 | 0 |
| 8/12/2020 | 0 | 0 | 8/12/2019 | 0 | 0 | 8/12/2018 | 0.87 | 0.668835 | 8/12/2017 | 0.03 | 0 | 8/12/2016 | 0.01 | 0 | 8/12/2015 | 0.1 | 0.013846 | 8/12/2014 | 0.11 | 0.018148 | 8/12/2013 | 0 | 0 | 8/12/2012 | 0.05 | 0.000476 | 8/12/2011 | 0 | 0 |
| 8/13/2020 | 0.82 | 0.620816 | 8/13/2019 | 0 | 0 | 8/13/2018 | 1.27 | 1.057972 | 8/13/2017 | 0.06 | 0.001818 | 8/13/2016 | 0.15 | 0.039032 | 8/13/2015 | 0 | 0 | 8/13/2014 | 1.49 | 1.274242 | 8/13/2013 | 1.56 | 1.343256 | 8/13/2012 | 0 | 0 | 8/13/2011 | 0 | 0 |
| 8/14/2020 | 0.17 | 0.051212 | 8/14/2019 | 0.15 | 0.039032 | 8/14/2018 | 1.26 | 1.048169 | 8/14/2017 | 0 | 0 | 8/14/2016 | 0 | 0 | 8/14/2015 | 0 | 0 | 8/14/2014 | 0 | 0 | 8/14/2013 | 0.48 | 0.3025 | 8/14/2012 | 0 | 0 | 8/14/2011 | 1.16 | 0.950303 |
| 8/15/2020 | 0 | 0 | 8/15/2019 | 0.81 | 0.611237 | 8/15/2018 | 0.16 | 0.045 | 8/15/2017 | 0.07 | 0.003913 | 8/15/2016 | 0.04 | 2.41E-34 | 8/15/2015 | 0 | 0 | 8/15/2014 | 0.01 | 0 | 8/15/2013 | 0 | 0 | 8/15/2012 | 0.92 | 0.717037 | 8/15/2011 | 1.27 | 1.057972 |
| 8/16/2020 | 0.35 | 0.188431 | 8/16/2019 | 0 | 0 | 8/16/2018 | 0 | 0 | 8/16/2017 | 0.4 | 0.231429 | 8/16/2016 | 0.08 | 0.006667 | 8/16/2015 | 0 | 0 | 8/16/2014 | 0 | 0 | 8/16/2013 | 0 | 0 | 8/16/2012 | 0.01 | 0 | 8/16/2011 | 0.23 | 0.092564 |
| 8/17/2020 | 0.13 | 0.027931 | 8/17/2019 | 0 | 0 | 8/17/2018 | 0 | 0 | 8/17/2017 | 0 | 0 | 8/17/2016 | 0.09 | 0.01 | 8/17/2015 | 0 | 0 | 8/17/2014 | 0 | 0 | 8/17/2013 | 0 | 0 | 8/17/2012 | 0 | 0 | 8/17/2011 | 0 | 0 |
| 8/18/2020 | 0.33 | 0.171633 | 8/18/2019 | 0 | 0 | 8/18/2018 | 0.26 | 0.115238 | 8/18/2017 | 0 | 0 | 8/18/2016 | 0.25 | 0.107561 | 8/18/2015 | 0 | 0 | 8/18/2014 | 0.01 | 0 | 8/18/2013 | 0.04 | 2.41E-34 | 8/18/2012 | 1.29 | 1.077586 | 8/18/2011 | 0.6 | 0.412632 |
| 8/19/2020 | 0.01 | 0 | 8/19/2019 | 0.05 | 0.000476 | 8/19/2018 | 0.27 | 0.123023 | 8/19/2017 | 0.87 | 0.668835 | 8/19/2016 | 0.24 | 0.1 | 8/19/2015 | 0.05 | 0.000476 | 8/19/2014 | 0 | 0 | 8/19/2013 | 0.01 | 0 | 8/19/2012 | 0 | 0 | 8/19/2011 | 0.95 | 0.746036 |
| 8/20/2020 | 0.03 | 0 | 8/20/2019 | 0 | 0 | 8/20/2018 | 1.15 | 0.940534 | 8/20/2017 | 0 | 0 | 8/20/2016 | 0 | 0 | 8/20/2015 | 0.11 | 0.018148 | 8/20/2014 | 0 | 0 | 8/20/2013 | 0 | 0 | 8/20/2012 | 0 | 0 | 8/20/2011 | 0.6 | 0.412632 |
| 8/21/2020 | 0 | 0 | 8/21/2019 | 0 | 0 | 8/21/2018 | 0 | 0 | 8/21/2017 | 0 | 0 | 8/21/2016 | 0 | 0 | 8/21/2015 | 0.99 | 0.784783 | 8/21/2014 | 0 | 0 | 8/21/2013 | 0 | 0 | 8/21/2012 | 0.06 | 0.001818 | 8/21/2011 | 0 | 0 |
| 8/22/2020 | 0 | 0 | 8/22/2019 | 0.35 | 0.188431 | 8/22/2018 | 0.89 | 0.688095 | 8/22/2017 | 0.01 | 0 | 8/22/2016 | 0.8 | 0.601667 | 8/22/2015 | 0 | 0 | 8/22/2014 | 0.11 | 0.018148 | 8/22/2013 | 0.01 | 0 | 8/22/2012 | 0 | 0 | 8/22/2011 | 0.54 | 0.357143 |
| 8/23/2020 | 0 | 0 | 8/23/2019 | 0.14 | 0.033333 | 8/23/2018 | 0 | 0 | 8/23/2017 | 0.97 | 0.765398 | 8/23/2016 | 0 | 0 | 8/23/2015 | 0.07 | 0.003913 | 8/23/2014 | 0 | 0 | 8/23/2013 | 0.13 | 0.027931 | 8/23/2012 | 0 | 0 | 8/23/2011 | 0 | 0 |
| 8/24/2020 | 0.54 | 0.357143 | 8/24/2019 | 0.21 | 0.078108 | 8/24/2018 | 0 | 0 | 8/24/2017 | 0 | 0 | 8/24/2016 | 0 | 0 | 8/24/2015 | 0 | 0 | 8/24/2014 | 0.11 | 0.018148 | 8/24/2013 | 0 | 0 | 8/24/2012 | 0 | 0 | 8/24/2011 | 0 | 0 |
| 8/25/2020 | 0 | 0 | 8/25/2019 | 0 | 0 | 8/25/2018 | 0 | 0 | 8/25/2017 | 0.01 | 0 | 8/25/2016 | 0 | 0 | 8/25/2015 | 0 | 0 | 8/25/2014 | 0 | 0 | 8/25/2013 | 0 | 0 | 8/25/2012 | 0 | 0 | 8/25/2011 | 0 | 0 |
| 8/26/2020 | 0.01 | 0 | 8/26/2019 | 0 | 0 | 8/26/2018 | 0 | 0 | 8/26/2017 | 0 | 0 | 8/26/2016 | 0 | 0 | 8/26/2015 | 0 | 0 | 8/26/2014 | 0 | 0 | 8/26/2013 | 0 | 0 | 8/26/2012 | 0 | 0 | 8/26/2011 | 0.87 | 0.668835 |
| 8/27/2020 | 0 | 0 | 8/27/2019 | 0 | 0 | 8/27/2018 | 0 | 0 | 8/27/2017 | 0 | 0 | 8/27/2016 | 0 | 0 | 8/27/2015 | 0 | 0 | 8/27/2014 | 0 | 0 | 8/27/2013 | 0 | 0 | 8/27/2012 | 0.63 | 0.440633 | 8/27/2011 | 0 | 0 |
| 8/28/2020 | 0 | 0 | 8/28/2019 | 0 | 0 | 8/28/2018 | 0 | 0 | 8/28/2017 | 0 | 0 | 8/28/2016 | 0 | 0 | 8/28/2015 | 0 | 0 | 8/28/2014 | 0 | 0 | 8/28/2013 | 0 | 0 | 8/28/2012 | 0.44 | 0.266667 | 8/28/2011 | 6.37 | 6.136126 |
| 8/29/2020 | 0.48 | 0.3025 | 8/29/2019 | 0.02 | 0 | 8/29/2018 | 0 | 0 | 8/29/2017 | 0 | 0 | 8/29/2016 | 0 | 0 | 8/29/2015 | 0 | 0 | 8/29/2014 | 0 | 0 | 8/29/2013 | 1.14 | 0.930769 | 8/29/2012 | 0.03 | 0 | 8/29/2011 | 0.15 | 0.039032 |
| 8/30/2020 | 0.17 | 0.051212 | 8/30/2019 | 0 | 0 | 8/30/2018 | 0 | 0 | 8/30/2017 | 0.6 | 0.412632 | 8/30/2016 | 0 | 0 | 8/30/2015 | 0 | 0 | 8/30/2014 | 0 | 0 | 8/30/2013 | 0.48 | 0.3025 | 8/30/2012 | 0 | 0 | 8/30/2011 | 0 | 0 |
| 8/31/2020 | 0 | 0 | 8/31/2019 | 0 | 0 | 8/31/2018 | 0 | 0 | 8/31/2017 | 0 | 0 | 8/31/2016 | 0 | 0 | 8/31/2015 | 0 | 0 | 8/31/2014 | 0 | 0 | 8/31/2013 | 0 | 0 | 8/31/2012 | 0 | 0 | 8/31/2011 | 0 | 0 |
| 9/1/2020 | 0.08 | 0.006667 | 9/1/2019 | 0 | 0 | 9/1/2018 | 1.22 | 1.008986 | 9/1/2017 | 0.07 | 0.003913 | 9/1/2016 | 0.34 | 0.18 | 9/1/2015 | 0.02 | 0 | 9/1/2014 | 1.08 | 0.872258 | 9/1/2013 | 0 | 0 | 9/1/2012 | 0 | 0 | 9/1/2011 | 0 | 0 |
| 9/2/2020 | 0.03 | 0 | 9/2/2019 | 0 | 0 | 9/2/2018 | 0.04 | 2.41E-34 | 9/2/2017 | 0 | 0 | 9/2/2016 | 0.04 | 2.41E-34 | 9/2/2015 | 0 | 0 | 9/2/2014 | 0.13 | 0.027931 | 9/2/2013 | 0 | 0 | 9/2/2012 | 0.03 | 0 | 9/2/2011 | 0 | 0 |
| 9/3/2020 | 0.17 | 0.051212 | 9/3/2019 | 0.25 | 0.107561 | 9/3/2018 | 0 | 0 | 9/3/2017 | 1.06 | 0.852787 | 9/3/2016 | 0 | 0 | 9/3/2015 | 0 | 0 | 9/3/2014 | 0.34 | 0.18 | 9/3/2013 | 0.33 | 0.171633 | 9/3/2012 | 1.19 | 0.97963 | 9/3/2011 | 0 | 0 |
| 9/4/2020 | 0.25 | 0.107561 | 9/4/2019 | 0 | 0 | 9/4/2018 | 0.13 | 0.027931 | 9/4/2017 | 0.01 | 0 | 9/4/2016 | 0 | 0 | 9/4/2015 | 0.14 | 0.033333 | 9/4/2014 | 0 | 0 | 9/4/2013 | 0 | 0 | 9/4/2012 | 1.58 | 1.362989 | 9/4/2011 | 0 | 0 |
| 9/5/2020 | 0 | 0 | 9/5/2019 | 0.06 | 0.001818 | 9/5/2018 | 0 | 0 | 9/5/2017 | 0 | 0 | 9/5/2016 | 0 | 0 | 9/5/2015 | 0.01 | 0 | 9/5/2014 | 0 | 0 | 9/5/2013 | 0 | 0 | 9/5/2012 | 0.24 | 0.1 | 9/5/2011 | 0.07 | 0.003913 |
| 9/6/2020 | 0 | 0 | 9/6/2019 | 0 | 0 | 9/6/2018 | 0 | 0 | 9/6/2017 | 0.53 | 0.347971 | 9/6/2016 | 0 | 0 | 9/6/2015 | 0 | 0 | 9/6/2014 | 0 | 0 | 9/6/2013 | 0 | 0 | 9/6/2012 | 0.01 | 0 | 9/6/2011 | 1.85 | 1.6299 |
| 9/7/2020 | 0 | 0 | 9/7/2019 | 0.01 | 0 | 9/7/2018 | 0.3 | 0.146957 | 9/7/2017 | 0.39 | 0.222727 | 9/7/2016 | 0 | 0 | 9/7/2015 | 0 | 0 | 9/7/2014 | 1.03 | 0.823613 | 9/7/2013 | 0 | 0 | 9/7/2012 | 0 | 0 | 9/7/2011 | 2.63 | 2.404337 |
| 9/8/2020 | 0 | 0 | 9/8/2019 | 0 | 0 | 9/8/2018 | 1.11 | 0.901496 | 9/8/2017 | 0 | 0 | 9/8/2016 | 0 | 0 | 9/8/2015 | 0 | 0 | 9/8/2014 | 0 | 0 | 9/8/2013 | 0.01 | 0 | 9/8/2012 | 0 | 0 | 9/8/2011 | 0.84 | 0.64 |
| 9/9/2020 | 0 | 0 | 9/9/2019 | 0 | 0 | 9/9/2018 | 1.11 | 0.901496 | 9/9/2017 | 0 | 0 | 9/9/2016 | 0 | 0 | 9/9/2015 | 0 | 0 | 9/9/2014 | 0 | 0 | 9/9/2013 | 0 | 0 | 9/9/2012 | 0.52 | 0.338824 | 9/9/2011 | 0.22 | 0.085263 |
| 9/10/2020 | 0.19 | 0.064286 | 9/10/2019 | 0 | 0 | 9/10/2018 | 1.24 | 1.028571 | 9/10/2017 | 0 | 0 | 9/10/2016 | 0.01 | 0 | 9/10/2015 | 0.2 | 0.071111 | 9/10/2014 | 0 | 0 | 9/10/2013 | 0 | 0 | 9/10/2012 | 0 | 0 | 9/10/2011 | 0.01 | 0 |
| 9/11/2020 | 0.49 | 0.311538 | 9/11/2019 | 0 | 0 | 9/11/2018 | 0.14 | 0.033333 | 9/11/2017 | 0 | 0 | 9/11/2016 | 0 | 0 | 9/11/2015 | 1.16 | 0.950303 | 9/11/2014 | 0 | 0 | 9/11/2013 | 0 | 0 | 9/11/2012 | 0 | 0 | 9/11/2011 | 0 | 0 |
| 9/12/2020 | 0.01 | 0 | 9/12/2019 | 0.15 | 0.039032 | 9/12/2018 | 0.03 | 0 | 9/12/2017 | 0 | 0 | 9/12/2016 | 0 | 0 | 9/12/2015 | 0 | 0 | 9/12/2014 | 0 | 0 | 9/12/2013 | 0 | 0 | 9/12/2012 | 0 | 0 | 9/12/2011 | 0.17 | 0.051212 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/13/2020 | 0 | 0 | 9/13/2019 | 0.17 | 0.051212 | 9/13/2018 | 0.18 | 0.057647 | 9/13/2017 | 0 | 0 | 9/13/2016 | 0 | 0 | 9/13/2015 | 0.49 | 0.311538 | 9/13/2014 | 0 | 0 | 9/13/2013 | 0.43 | 0.257797 | 9/13/2012 | 0 | 0 | 9/13/2011 | 0 | 0 |
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| 9/16/2020 | 0 | 0 | 9/16/2019 | 0 | 0 | 9/16/2018 | 0 | 0 | 9/16/2017 | 0 | 0 | 9/16/2016 | 0 | 0 | 9/16/2015 | 0 | 0 | 9/16/2014 | 0.1 | 0.013846 | 9/16/2013 | 0 | 0 | 9/16/2012 | 0 | 0 | 9/16/2011 | 0.13 | 0.027931 |
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| 9/18/2020 | 0 | 0 | 9/18/2019 | 0 | 0 | 9/18/2018 | 1.02 | 0.813898 | 9/18/2017 | 0 | 0 | 9/18/2016 | 0 | 0 | 9/18/2015 | 0 | 0 | 9/18/2014 | 0 | 0 | 9/18/2013 | 0 | 0 | 9/18/2012 | 0.57 | 0.384795 | 9/18/2011 | 0.02 | 0 |
| 9/19/2020 | 0 | 0 | 9/19/2019 | 0 | 0 | 9/19/2018 | 0.47 | 0.293492 | 9/19/2017 | 0 | 0 | 9/19/2016 | 0.9 | 0.697736 | 9/19/2015 | 0 | 0 | 9/19/2014 | 0.02 | 0 | 9/19/2013 | 0 | 0 | 9/19/2012 | 0.81 | 0.611237 | 9/19/2011 | 0 | 0 |
| 9/20/2020 | 0 | 0 | 9/20/2019 | 0 | 0 | 9/20/2018 | 0 | 0 | 9/20/2017 | 0.05 | 0.000476 | 9/20/2016 | 0.89 | 0.688095 | 9/20/2015 | 0 | 0 | 9/20/2014 | 0 | 0 | 9/20/2013 | 0 | 0 | 9/20/2012 | 0 | 0 | 9/20/2011 | 0 | 0 |
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| 9/24/2020 | 0 | 0 | 9/24/2019 | 0.02 | 0 | 9/24/2018 | 0.58 | 0.394054 | 9/24/2017 | 0 | 0 | 9/24/2016 | 0 | 0 | 9/24/2015 | 0 | 0 | 9/24/2014 | 0 | 0 | 9/24/2013 | 0 | 0 | 9/24/2012 | 0 | 0 | 9/24/2011 | 2.97 | 2.74278 |
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| 9/26/2020 | 0.43 | 0.257797 | 9/26/2019 | 0 | 0 | 9/26/2018 | 0.72 | 0.525455 | 9/26/2017 | 0 | 0 | 9/26/2016 | 0 | 0 | 9/26/2015 | 0 | 0 | 9/26/2014 | 0.35 | 0.188431 | 9/26/2013 | 0 | 0 | 9/26/2012 | 0 | 0 | 9/26/2011 | 0 | 0 |
| 9/27/2020 | 0.4 | 0.231429 | 9/27/2019 | 0.04 | 2.41E-34 | 9/27/2018 | 0.35 | 0.188431 | 9/27/2017 | 0 | 0 | 9/27/2016 | 0.05 | 0.000476 | 9/27/2015 | 0 | 0 | 9/27/2014 | 0 | 0 | 9/27/2013 | 0 | 0 | 9/27/2012 | 0.32 | 0.163333 | 9/27/2011 | 0 | 0 |
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| 9/29/2020 | 0 | 0 | 9/29/2019 | 0.16 | 0.045 | 9/29/2018 | 0.01 | 0 | 9/29/2017 | 0 | 0 | 9/29/2016 | 0.58 | 0.394054 | 9/29/2015 | 0 | 0 | 9/29/2014 | 0 | 0 | 9/29/2013 | 0 | 0 | 9/29/2012 | 0.02 | 0 | 9/29/2011 | 0.37 | 0.205472 |
| 9/30/2020 | 1.21 | 0.999197 | 9/30/2019 | 0 | 0 | 9/30/2018 | 0 | 0 | 9/30/2017 | 0 | 0 | 9/30/2016 | 2.43 | 2.205444 | 9/30/2015 | 1.61 | 1.392599 | 9/30/2014 | 0.03 | 0 | 9/30/2013 | 0 | 0 | 9/30/2012 | 0 | 0 | 9/30/2011 | 0.28 | 0.130909 |
| 10/1/2020 | 0 | 0 | 10/1/2019 | 0 | 0 | 10/1/2018 | 0 | 0 | 10/1/2017 | 0 | 0 | 10/1/2016 | 0.13 | 0.027931 | 10/1/2015 | 0.07 | 0.003913 | 10/1/2014 | 0 | 0 | 10/1/2013 | 0 | 0 | 10/1/2012 | 0.01 | 0 | 10/1/2011 | 0.03 | 0 |
| 10/2/2020 | 0.16 | 0.045 | 10/2/2019 | 0 | 0 | 10/2/2018 | 0 | 0 | 10/2/2017 | 0 | 0 | 10/2/2016 | 0.07 | 0.003913 | 10/2/2015 | 0.66 | 0.46878 | 10/2/2014 | 0 | 0 | 10/2/2013 | 0 | 0 | 10/2/2012 | 0.01 | 0 | 10/2/2011 | 0.47 | 0.293492 |
| 10/3/2020 | 0.01 | 0 | 10/3/2019 | 0.06 | 0.001818 | 10/3/2018 | 0.27 | 0.123023 | 10/3/2017 | 0 | 0 | 10/3/2016 | 0.02 | 0 | 10/3/2015 | 1.39 | 1.175806 | 10/3/2014 | 0 | 0 | 10/3/2013 | 0 | 0 | 10/3/2012 | 0.85 | 0.649604 | 10/3/2011 | 0.26 | 0.115238 |
| 10/4/2020 | 0 | 0 | 10/4/2019 | 0.09 | 0.01 | 10/4/2018 | 0.01 | 0 | 10/4/2017 | 0 | 0 | 10/4/2016 | 0 | 0 | 10/4/2015 | 0.04 | 2.41E-34 | 10/4/2014 | 0.36 | 0.196923 | 10/4/2013 | 0 | 0 | 10/4/2012 | 0.02 | 0 | 10/4/2011 | 0.01 | 0 |
| 10/5/2020 | 0.04 | 2.41E-34 | 10/5/2019 | 0 | 0 | 10/5/2018 | 0.08 | 0.006667 | 10/5/2017 | 0 | 0 | 10/5/2016 | 0 | 0 | 10/5/2015 | 0 | 0 | 10/5/2014 | 0.07 | 0.003913 | 10/5/2013 | 0 | 0 | 10/5/2012 | 0.02 | 0 | 10/5/2011 | 0 | 0 |
| 10/6/2020 | 0.03 | 0 | 10/6/2019 | 0 | 0 | 10/6/2018 | 0.02 | 0 | 10/6/2017 | 0.01 | 0 | 10/6/2016 | 0 | 0 | 10/6/2015 | 0 | 0 | 10/6/2014 | 0 | 0 | 10/6/2013 | 0 | 0 | 10/6/2012 | 0 | 0 | 10/6/2011 | 0 | 0 |
| 10/7/2020 | 0 | 0 | 10/7/2019 | 0.09 | 0.01 | 10/7/2018 | 0 | 0 | 10/7/2017 | 0 | 0 | 10/7/2016 | 0 | 0 | 10/7/2015 | 0 | 0 | 10/7/2014 | 0.01 | 0 | 10/7/2013 | 0.01 | 0 | 10/7/2012 | 0.02 | 0 | 10/7/2011 | 0 | 0 |
| 10/8/2020 | 0 | 0 | 10/8/2019 | 0.38 | 0.214074 | 10/8/2018 | 0 | 0 | 10/8/2017 | 0.06 | 0.001818 | 10/8/2016 | 0 | 0 | 10/8/2015 | 0 | 0 | 10/8/2014 | 0.61 | 0.421948 | 10/8/2013 | 0.58 | 0.394054 | 10/8/2012 | 0.11 | 0.018148 | 10/8/2011 | 0 | 0 |
| 10/9/2020 | 0 | 0 | 10/9/2019 | 0.08 | 0.006667 | 10/9/2018 | 0.02 | 0 | 10/9/2017 | 0.16 | 0.045 | 10/9/2016 | 0.08 | 0.006667 | 10/9/2015 | 0 | 0 | 10/9/2014 | 0 | 0 | 10/9/2013 | 0 | 0 | 10/9/2012 | 0.04 | 2.41E-34 | 10/9/2011 | 0 | 0 |
| 10/10/2020 | 0 | 0 | 10/10/2019 | 0.08 | 0.006667 | 10/10/201 | 0.01 | 0 | 10/10/2017 | 0.83 | 0.630404 | 10/10/201 | 0.06 | 0.001818 | 10/10/201 | 0.51 | 0.329701 | 10/10/201 | 0 | 0 | 10/10/2013 | 0.19 | 0.064286 | 10/10/2012 | 0.05 | 0.000476 | 10/10/2011 | 0 | 0 |
| 10/11/2020 | 0 | 0 | 10/11/2019 | 0 | 0 | 10/11/201 | 0.01 | 0 | 10/11/2017 | 0 | 0 | 10/11/201 | 0 | 0 | 10/11/201 | 0.04 | 2.41E-34 | 10/11/201 | 0.35 | 0.188431 | 10/11/2013 | 2.86 | 2.633245 | 10/11/2012 | 0 | 0 | 10/11/2011 | 0 | 0 |
| 10/12/2020 | 0.91 | 0.707383 | 10/12/2019 | 0 | 0 | 10/12/201 | 0.71 | 0.515977 | 10/12/2017 | 0.4 | 0.231429 | 10/12/201 | 0 | 0 | 10/12/201 | 0 | 0 | 10/12/201 | 0.14 | 0.033333 | 10/12/2013 | 0.69 | 0.497059 | 10/12/2012 | 0 | 0 | 10/12/2011 | 0.09 | 0.01 |
| 10/13/2020 | 0.19 | 0.064286 | 10/13/2019 | 0 | 0 | 10/13/201 | 0.07 | 0.003913 | 10/13/2017 | 0.02 | 0 | 10/13/201 | 0 | 0 | 10/13/201 | 0 | 0 | 10/13/201 | 0.01 | 0 | 10/13/2013 | 0.01 | 0 | 10/13/2012 | 0 | 0 | 10/13/2011 | 0.31 | 0.155106 |
| 10/14/2020 | 0.01 | 0 | 10/14/2019 | 0 | 0 | 10/14/201 | 0.05 | 0.000476 | 10/14/2017 | 0.07 | 0.003913 | 10/14/201 | 0.01 | 0 | 10/14/201 | 0 | 0 | 10/14/201 | 0.06 | 0.001818 | 10/14/2013 | 0 | 0 | 10/14/2012 | 0 | 0 | 10/14/2011 | 0.16 | 0.045 |
| 10/15/2020 | 0 | 0 | 10/15/2019 | 0 | 0 | 10/15/201 | 0.06 | 0.001818 | 10/15/2017 | 0.02 | 0 | 10/15/201 | 0 | 0 | 10/15/201 | 0 | 0 | 10/15/201 | 0 | 0 | 10/15/2013 | 0 | 0 | 10/15/2012 | 0 | 0 | 10/15/2011 | 0.4 | 0.231429 |
| 10/16/2020 | 0 | 0 | 10/16/2019 | 0 | 0 | 10/16/201 | 0.17 | 0.051212 | 10/16/2017 | 0.08 | 0.006667 | 10/16/201 | 0 | 0 | 10/16/201 | 0 | 0 | 10/16/201 | 1.2 | 0.989412 | 10/16/2013 | 0 | 0 | 10/16/2012 | 0.76 | 0.563478 | 10/16/2011 | 0.08 | 0.006667 |
| 10/17/2020 | 0.27 | 0.123023 | 10/17/2019 | 1.6 | 1.382727 | 10/17/201 | 0 | 0 | 10/17/2017 | 0 | 0 | 10/17/201 | 0 | 0 | 10/17/201 | 0 | 0 | 10/17/201 | 0 | 0 | 10/17/2013 | 0 | 0 | 10/17/2012 | 0 | 0 | 10/17/2011 | 0 | 0 |
| 10/18/2020 | 0 | 0 | 10/18/2019 | 0 | 0 | 10/18/201 | 0 | 0 | 10/18/2017 | 0 | 0 | 10/18/201 | 0 | 0 | 10/18/201 | 0 | 0 | 10/18/201 | 0 | 0 | 10/18/2013 | 0.08 | 0.006667 | 10/18/2012 | 0 | 0 | 10/18/2011 | 0 | 0 |
| 10/19/2020 | 0 | 0 | 10/19/2019 | 0 | 0 | 10/19/201 | 0.01 | 0 | 10/19/2017 | 0 | 0 | 10/19/201 | 0 | 0 | 10/19/201 | 0.01 | 0 | 10/19/201 | 0 | 0 | 10/19/2013 | 0 | 0 | 10/19/2012 | 0.65 | 0.459383 | 10/19/2011 | 0.23 | 0.092564 |
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| 10/21/2020 | 0.01 | 0 | 10/21/2019 | 0.58 | 0.394054 | 10/21/201 | 0.05 | 0.000476 | 10/21/2017 | 0 | 0 | 10/21/201 | 0 | 0 | 10/21/201 | 0 | 0 | 10/21/201 | 0.02 | 0 | 10/21/2013 | 0 | 0 | 10/21/2012 | 0 | 0 | 10/21/2011 | 0 | 0 |
| 10/22/2020 | 0.02 | 0 | 10/22/2019 | 0.02 | 0 | 10/22/201 | 0 | 0 | 10/22/2017 | 0 | 0 | 10/22/201 | 0.13 | 0.027931 | 10/22/201 | 0 | 0 | 10/22/201 | 0.31 | 0.155106 | 10/22/2013 | 0 | 0 | 10/22/2012 | 0 | 0 | 10/22/2011 | 0 | 0 |
| 10/23/2020 | 0.01 | 0 | 10/23/2019 | 0.65 | 0.459383 | 10/23/201 | 0 | 0 | 10/23/2017 | 0 | 0 | 10/23/201 | 0.02 | 0 | 10/23/201 | 0 | 0 | 10/23/201 | 0.33 | 0.171633 | 10/23/2013 | 0.01 | 0 | 10/23/2012 | 0 | 0 | 10/23/2011 | 0 | 0 |
| 10/24/2020 | 0 | 0 | 10/24/2019 | 0 | 0 | 10/24/201 | 0 | 0 | 10/24/2017 | 0.11 | 0.018148 | 10/24/201 | 0.01 | 0 | 10/24/201 | 0 | 0 | 10/24/201 | 0.03 | 0 | 10/24/2013 | 0 | 0 | 10/24/2012 | 0.01 | 0 | 10/24/2011 | 0 | 0 |
| 10/25/2020 | 0 | 0 | 10/25/2019 | 0 | 0 | 10/25/201 | 0 | 0 | 10/25/2017 | 0.4 | 0.231429 | 10/25/201 | 0 | 0 | 10/25/201 | 0.01 | 0 | 10/25/201 | 0 | 0 | 10/25/2013 | 0 | 0 | 10/25/2012 | 0 | 0 | 10/25/2011 | 0.03 | 0 |
| 10/26/2020 | 0.11 | 0.018148 | 10/26/2019 | 0 | 0 | 10/26/201 | 0 | 0 | 10/26/2017 | 0 | 0 | 10/26/201 | 0 | 0 | 10/26/201 | 0 | 0 | 10/26/201 | 0 | 0 | 10/26/2013 | 0 | 0 | 10/26/2012 | 0 | 0 | 10/26/2011 | 0 | 0 |
| 10/27/2020 | 0.08 | 0.006667 | 10/27/2019 | 0.37 | 0.205472 | 10/27/201 | 0.9 | 0.697736 | 10/27/2017 | 0 | 0 | 10/27/201 | 0 | 0 | 10/27/201 | 0 | 0 | 10/27/201 | 0 | 0 | 10/27/2013 | 0 | 0 | 10/27/2012 | 0 | 0 | 10/27/2011 | 0.06 | 0.001818 |
| 10/28/2020 | 0.01 | 0 | 10/28/2019 | 1.35 | 1.13649 | 10/28/201 | 0.16 | 0.045 | 10/28/2017 | 0 | 0 | 10/28/201 | 0.43 | 0.257797 | 10/28/201 | 0.04 | 2.41E-34 | 10/28/201 | 0 | 0 | 10/28/2013 | 0 | 0 | 10/28/2012 | 0.05 | 0.000476 | 10/28/2011 | 0.15 | 0.039032 |
| 10/29/2020 | 0.38 | 0.214074 | 10/29/2019 | 0.01 | 0 | 10/29/201 | 0.06 | 0.001818 | 10/29/2017 | 0.12 | 0.022857 | 10/29/201 | 0 | 0 | 10/29/201 | 2.08 | 1.857857 | 10/29/201 | 0 | 0 | 10/29/2013 | 0 | 0 | 10/29/2012 | 1 | 0.794483 | 10/29/2011 | 0.18 | 0.057647 |
| 10/30/2020 | 1.71 | 1.49139 | 10/30/2019 | 0.01 | 0 | 10/30/201 | 0.01 | 0 | 10/30/2017 | 2.33 | 2.106064 | 10/30/201 | 0 | 0 | 10/30/201 | 0 | 0 | 10/30/201 | 0.06 | 0.001818 | 10/30/2013 | 0 | 0 | 10/30/2012 | 4.35 | 4.118869 | 10/30/2011 | 0.84 | 0.64 |
| 10/31/2020 | 0.04 | 2.41E-34 | 10/31/2019 | 0.55 | 0.366338 | 10/31/201 | 0 | 0 | 10/31/2017 | 0.01 | 0 | 10/31/201 | 0.28 | 0.130909 | 10/31/201 | 0 | 0 | 10/31/201 | 0 | 0 | 10/31/2013 | 0.06 | 0.001818 | 10/31/2012 | 0.45 | 0.275574 | 10/31/2011 | 0 | 0 |
| 11/1/2020 | 0.01 | 0 | 11/1/2019 | 1.03 | 0.823613 | 11/1/2018 | 0 | 0 | 11/1/2017 | 0 | 0 | 11/1/2016 | 0 | 0 | 11/1/2015 | 0 | 0 | 11/1/2014 | 0.18 | 0.057647 | 11/1/2013 | 0.06 | 0.001818 | 11/1/2012 | 0.01 | 0 | 11/1/2011 | 0 | 0 |
| 11/2/2020 | 0.43 | 0.257797 | 11/2/2019 | 0 | 0 | 11/2/2018 | 0.01 | 0 | 11/2/2017 | 0 | 0 | 11/2/2016 | 0 | 0 | 11/2/2015 | 0 | 0 | 11/2/2014 | 0.35 | 0.188431 | 11/2/2013 | 0.22 | 0.085263 | 11/2/2012 | 0 | 0 | 11/2/2011 | 0 | 0 |
| 11/3/2020 | 0 | 0 | 11/3/2019 | 0 | 0 | 11/3/2018 | 1.32 | 1.107027 | 11/3/2017 | 0 | 0 | 11/3/2016 | 0 | 0 | 11/3/2015 | 0 | 0 | 11/3/2014 | 0 | 0 | 11/3/2013 | 0 | 0 | 11/3/2012 | 0 | 0 | 11/3/2011 | 0 | 0 |
| 11/4/2020 | 0 | 0 | 11/4/2019 | 0 | 0 | 11/4/2018 | 0.01 | 0 | 11/4/2017 | 0 | 0 | 11/4/2016 | 0.03 | 0 | 11/4/2015 | 0 | 0 | 11/4/2014 | 0 | 0 | 11/4/2013 | 0 | 0 | 11/4/2012 | 0 | 0 | 11/4/2011 | 0 | 0 |
| 11/5/2020 | 0 | 0 | 11/5/2019 | 0 | 0 | 11/5/2018 | 0.06 | 0.001818 | 11/5/2017 | 0.3 | 0.146957 | 11/5/2016 | 0 | 0 | 11/5/2015 | 0.03 | 0 | 11/5/2014 | 0 | 0 | 11/5/2013 | 0 | 0 | 11/5/2012 | 0 | 0 | 11/5/2011 | 0 | 0 |
| 11/6/2020 | 0 | 0 | 11/6/2019 | 0 | 0 | 11/6/2018 | 0.46 | 0.284516 | 11/6/2017 | 0 | 0 | 11/6/2016 | 0 | 0 | 11/6/2015 | 0.01 | 0 | 11/6/2014 | 0.49 | 0.311538 | 11/6/2013 | 0 | 0 | 11/6/2012 | 0 | 0 | 11/6/2011 | 0 | 0 |
| 11/7/2020 | 0 | 0 | 11/7/2019 | 0 | 0 | 11/7/2018 | 0.65 | 0.459383 | 11/7/2017 | 0.01 | 0 | 11/7/2016 | 0 | 0 | 11/7/2015 | 0 | 0 | 11/7/2014 | 0.22 | 0.085263 | 11/7/2013 | 0 | 0 | 11/7/2012 | 0 | 0 | 11/7/2011 | 0 | 0 |
| 11/8/2020 | 0 | 0 | 11/8/2019 | 0.14 | 0.033333 | 11/8/2018 | 0 | 0 | 11/8/2017 | 0.41 | 0.240175 | 11/8/2016 | 0 | 0 | 11/8/2015 | 0 | 0 | 11/8/2014 | 0.01 | 0 | 11/8/2013 | 0.1 | 0.013846 | 11/8/2012 | 0.15 | 0.039032 | 11/8/2011 | 0 | 0 |
| 11/9/2020 | 0 | 0 | 11/9/2019 | 0 | 0 | 11/9/2018 | 0 | 0 | 11/9/2017 | 0 | 0 | 11/9/2016 | 0.03 | 0 | 11/9/2015 | 0 | 0 | 11/9/2014 | 0 | 0 | 11/9/2013 | 0 | 0 | 11/9/2012 | 0 | 0 | 11/9/2011 | 0 | 0 |
| 11/10/2020 | 0 | 0 | 11/10/2019 | 0 | 0 | 11/10/201 | 0.82 | 0.620816 | 11/10/2017 | 0.02 | 0 | 11/10/201 | 0.37 | 0.205472 | 11/10/201 | 0.3 | 0.146957 | 11/10/201 | 0 | 0 | 11/10/2013 | 0 | 0 | 11/10/2012 | 0 | 0 | 11/10/2011 | 0 | 0 |
| 11/11/2020 | 0 | 0 | 11/11/2019 | 0 | 0 | 11/11/201 | 0 | 0 | 11/11/2017 | 0 | 0 | 11/11/201 | 0 | 0 | 11/11/201 | 0.33 | 0.171633 | 11/11/201 | 0 | 0 | 11/11/2013 | 0 | 0 | 11/11/2012 | 0 | 0 | 11/11/2011 | 0.1 | 0.013846 |
| 11/12/2020 | 1.51 | 1.293952 | 11/12/2019 | 0.14 | 0.033333 | 11/12/201 | 0 | 0 | 11/12/2017 | 0 | 0 | 11/12/201 | 0 | 0 | 11/12/201 | 0 | 0 | 11/12/201 | 0 | 0 | 11/12/2013 | 0 | 0 | 11/12/2012 | 0 | 0 | 11/12/2011 | 0 | 0 |
| 11/13/2020 | 0.19 | 0.064286 | 11/13/2019 | 0.03 | 0 | 11/13/201 | 0.87 | 0.668835 | 11/13/2017 | 0.16 | 0.045 | 11/13/201 | 0 | 0 | 11/13/201 | 0.15 | 0.039032 | 11/13/201 | 0 | 0 | 11/13/2013 | 0 | 0 | 11/13/2012 | 0.38 | 0.214074 | 11/13/2011 | 0 | 0 |
| 11/14/2020 | 0.04 | 2.41E-34 | 11/14/2019 | 0 | 0 | 11/14/201 | 0.05 | 0.000476 | 11/14/2017 | 0.02 | 0 | 11/14/201 | 0 | 0 | 11/14/201 | 0 | 0 | 11/14/201 | 0.18 | 0.057647 | 11/14/2013 | 0 | 0 | 11/14/2012 | 0.08 | 0.006667 | 11/14/2011 | 0 | 0 |
| 11/15/2020 | 0 | 0 | 11/15/2019 | 0 | 0 | 11/15/201 | 0.07 | 0.003913 | 11/15/2017 | 0 | 0 | 11/15/201 | 0 | 0 | 11/15/201 | 0 | 0 | 11/15/201 | 0 | 0 | 11/15/2013 | 0 | 0 | 11/15/2012 | 0 | 0 | 11/15/2011 | 0 | 0 |
| 11/16/2020 | 0.28 | 0.130909 | 11/16/2019 | 0 | 0 | 11/16/201 | 1.3 | 1.087397 | 11/16/2017 | 0.01 | 0 | 11/16/201 | 0 | 0 | 11/16/201 | 0 | 0 | 11/16/201 | 0 | 0 | 11/16/2013 | 0.05 | 0.000476 | 11/16/2012 | 0 | 0 | 11/16/2011 | 0.27 | 0.123023 |
| 11/17/2020 | 0 | 0 | 11/17/2019 | 0 | 0 | 11/17/201 | 0.02 | 0 | 11/17/2017 | 0 | 0 | 11/17/201 | 0 | 0 | 11/17/201 | 0 | 0 | 11/17/201 | 0.37 | 0.205472 | 11/17/2013 | 0.01 | 0 | 11/17/2012 | 0 | 0 | 11/17/2011 | 0.36 | 0.196923 |
| 11/18/2020 | 0.01 | 0 | 11/18/2019 | 0 | 0 | 11/18/201 | 0 | 0 | 11/18/2017 | 0 | 0 | 11/18/201 | 0 | 0 | 11/18/201 | 0 | 0 | 11/18/201 | 0.75 | 0.553956 | 11/18/2013 | 0.09 | 0.01 | 11/18/2012 | 0 | 0 | 11/18/2011 | 0 | 0 |
| 11/19/2020 | 0 | 0 | 11/19/2019 | 0 | 0 | 11/19/201 | 0 | 0 | 11/19/2017 | 0.43 | 0.257797 | 11/19/201 | 0 | 0 | 11/19/201 | 0 | 0 | 11/19/201 | 0 | 0 | 11/19/2013 | 0 | 0 | 11/19/2012 | 0 | 0 | 11/19/2011 | 0 | 0 |
| 11/20/2020 | 0 | 0 | 11/20/2019 | 0 | 0 | 11/20/201 | 0 | 0 | 11/20/2017 | 0 | 0 | 11/20/201 | 0.1 | 0.013846 | 11/20/201 | 1 | 0.794483 | 11/20/201 | 0 | 0 | 11/20/2013 | 0 | 0 | 11/20/2012 | 0 | 0 | 11/20/2011 | 0 | 0 |
| 11/21/2020 | 0 | 0 | 11/21/2019 | 0 | 0 | 11/21/201 | 0 | 0 | 11/21/2017 | 0 | 0 | 11/21/201 | 0 | 0 | 11/21/201 | 0 | 0 | 11/21/201 | 0 | 0 | 11/21/2013 | 0 | 0 | 11/21/2012 | 0 | 0 | 11/21/2011 | 0.31 | 0.155106 |
| 11/22/2020 | 0 | 0 | 11/22/2019 | 0 | 0 | 11/22/201 | 0 | 0 | 11/22/2017 | 0.03 | 0 | 11/22/201 | 0 | 0 | 11/22/201 | 0 | 0 | 11/22/201 | 0 | 0 | 11/22/2013 | 0 | 0 | 11/22/2012 | 0 | 0 | 11/22/2011 | 0.2 | 0.071111 |
| 11/23/2020 | 0.41 | 0.240175 | 11/23/2019 | 0.08 | 0.006667 | 11/23/201 | 0 | 0 | 11/23/2017 | 0 | 0 | 11/23/201 | 0 | 0 | 11/23/201 | 0 | 0 | 11/23/201 | 0 | 0 | 11/23/2013 | 0.04 | 2.41E-34 | 11/23/2012 | 0 | 0 | 11/23/2011 | 1.69 | 1.471622 |
| 11/24/2020 | 0 | 0 | 11/24/2019 | 1.07 | 0.86252 | 11/24/201 | 0 | 0 | 11/24/2017 | 0 | 0 | 11/24/201 | 0 | 0 | 11/24/201 | 0 | 0 | 11/24/201 | 0.74 | 0.544444 | 11/24/2013 | 0 | 0 | 11/24/2012 | 0 | 0 | 11/24/2011 | 0.05 | 0.000476 |
| 11/25/2020 | 0 | 0 | 11/25/2019 | 0.08 | 0.006667 | 11/25/201 | 2.02 | 1.798349 | 11/25/2017 | 0 | 0 | 11/25/201 | 0 | 0 | 11/25/201 | 0 | 0 | 11/25/201 | 0 | 0 | 11/25/2013 | 0 | 0 | 11/25/2012 | 0 | 0 | 11/25/2011 | 0 | 0 |
| 11/26/2020 | 0.33 | 0.171633 | 11/26/2019 | 0 | 0 | 11/26/201 | 0 | 0 | 11/26/2017 | 0 | 0 | 11/26/201 | 0 | 0 | 11/26/201 | 0 | 0 | 11/26/201 | 0.24 | 0.1 | 11/26/2013 | 0 | 0 | 11/26/2012 | 0 | 0 | 11/26/2011 | 0 | 0 |
| 11/27/2020 | 0 | 0 | 11/27/2019 | 0 | 0 | 11/27/201 | 0.58 | 0.394054 | 11/27/2017 | 0 | 0 | 11/27/201 | 0 | 0 | 11/27/201 | 0 | 0 | 11/27/201 | 1.07 | 0.86252 | 11/27/2013 | 2.48 | 2.255152 | 11/27/2012 | 0.3 | 0.146957 | 11/27/2011 | 0 | 0 |
| 11/28/2020 | 0 | 0 | 11/28/2019 | 0 | 0 | 11/28/201 | 0 | 0 | 11/28/2017 | 0 | 0 | 11/28/201 | 0 | 0 | 11/28/201 | 0 | 0 | 11/28/201 | 0 | 0 | 11/28/2013 | 0.16 | 0.045 | 11/28/2012 | 0.39 | 0.222727 | 11/28/2011 | 0 | 0 |
| 11/29/2020 | 0 | 0 | 11/29/2019 | 0 | 0 | 11/29/201 | 0 | 0 | 11/29/2017 | 0 | 0 | 11/29/201 | 0.08 | 0.006667 | 11/29/201 | 0.11 | 0.018148 | 11/29/201 | 0 | 0 | 11/29/2013 | 0 | 0 | 11/29/2012 | 0 | 0 | 11/29/2011 | 0.04 | 2.41E-34 |
| 11/30/2020 | 0.28 | 0.130909 | 11/30/2019 | 0 | 0 | 11/30/201 | 0 | 0 | 11/30/2017 | 0 | 0 | 11/30/201 | 1.07 | 0.86252 | 11/30/201 | 0.02 | 0 | 11/30/201 | 0 | 0 | 11/30/2013 | 0 | 0 | 11/30/2012 | 0 | 0 | 11/30/2011 | 0.89 | 0.688095 |
| 12/1/2020 | 2.1 | 1.877699 | 12/1/2019 | 0 | 0 | 12/1/2018 | 0.01 | 0 | 12/1/2017 | 0.03 | 0 | 12/1/2016 | 1.36 | 1.146316 | 12/1/2015 | 0.25 | 0.107561 | 12/1/2014 | 0 | 0 | 12/1/2013 | 0 | 0 | 12/1/2012 | 0 | 0 | 12/1/2011 | 0 | 0 |
| 12/2/2020 | 0 | 0 | 12/2/2019 | 0.72 | 0.525455 | 12/2/2018 | 0.53 | 0.347971 | 12/2/2017 | 0 | 0 | 12/2/2016 | 0 | 0 | 12/2/2015 | 0.73 | 0.534944 | 12/2/2014 | 0.08 | 0.006667 | 12/2/2013 | 0 | 0 | 12/2/2012 | 0 | 0 | 12/2/2011 | 0 | 0 |
| 12/3/2020 | 0 | 0 | 12/3/2019 | 0.02 | 0 | 12/3/2018 | 0.07 | 0.003913 | 12/3/2017 | 0 | 0 | 12/3/2016 | 0 | 0 | 12/3/2015 | 0.2 | 0.071111 | 12/3/2014 | 0.25 | 0.107561 | 12/3/2013 | 0 | 0 | 12/3/2012 | 0.02 | 0 | 12/3/2011 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/4/2020 | 0 | 0 | 12/4/2019 | 0 | 0 | 12/4/2018 | 0 | 0 | 12/4/2017 | 0 | 0 | 12/4/2016 | 0 | 0 | 12/4/2015 | 0 | 0 | 12/4/2014 | 0.14 | 0.033333 | 12/4/2013 | 0 | 0 | 12/4/2012 | 0 | 0 | 12/4/2011 | 0 | 0 |
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| 12/6/2020 | 0.03 | 0 | 12/6/2019 | 0 | 0 | 12/6/2018 | 0 | 0 | 12/6/2017 | 0.24 | 0.1 | 12/6/2016 | 0.01 | 0 | 12/6/2015 | 0 | 0 | 12/6/2014 | 0.22 | 0.085263 | 12/6/2013 | 0.2 | 0.071111 | 12/6/2012 | 0 | | 12/6/2011 | 0.04 | 2.41E-34 |
| 12/7/2020 | 0 | 0 | 12/7/2019 | 0.03 | 0 | 12/7/2018 | 0 | 0 | 12/7/2017 | 0 | 0 | 12/7/2016 | 0.77 | 0.573011 | 12/7/2015 | 0 | 0 | 12/7/2014 | 0.6 | 0.412632 | 12/7/2013 | 0.84 | 0.64 | 12/7/2012 | 0 | | 12/7/2011 | 0.22 | 0.085263 |
| 12/8/2020 | 0 | 0 | 12/8/2019 | 0 | 0 | 12/8/2018 | 0 | 0 | 12/8/2017 | 0 | 0 | 12/8/2016 | 0.01 | 0 | 12/8/2015 | 0 | 0 | 12/8/2014 | 0 | 0 | 12/8/2013 | 0 | 0 | 12/8/2012 | 0.43 | 0.257797 | 12/8/2011 | 2.16 | 1.937241 |
| 12/9/2020 | 0 | 0 | 12/9/2019 | 0.14 | 0.033333 | 12/9/2018 | 0 | 0 | 12/9/2017 | 0.03 | 0 | 12/9/2016 | 0 | 0 | 12/9/2015 | 0 | 0 | 12/9/2014 | 0.2 | 0.071111 | 12/9/2013 | 0.82 | 0.620816 | 12/9/2012 | 0.03 | 0 | 12/9/2011 | 0 | 0 |
| 12/10/2020 | 0 | 0 | 12/10/2019 | 0.87 | 0.668835 | 12/10/201 | 0 | 0 | 12/10/2017 | 0.31 | 0.155106 | 12/10/201 | 0 | 0 | 12/10/201 | 0.03 | 0 | 12/10/201 | 0.08 | 0.006667 | 12/10/201 | 0.09 | 0.01 | 12/10/201 | 0.35 | 0.188431 | 12/10/2011 | 0 | 0 |
| 12/11/2020 | 0 | 0 | 12/11/2019 | 0.38 | 0.214074 | 12/11/201 | 0 | 0 | 12/11/2017 | 0 | 0 | 12/11/201 | 0 | 0 | 12/11/201 | 0 | 0 | 12/11/201 | 0.05 | 0.000476 | 12/11/201 | 0.2 | 0.071111 | 12/11/201 | 0.2 | 0.071111 | 12/11/2011 | 0 | 0 |
| 12/12/2020 | 0 | 0 | 12/12/2019 | 0.03 | 0 | 12/12/201 | 0 | 0 | 12/12/2017 | 0 | 0 | 12/12/201 | 0.45 | 0.275574 | 12/12/201 | 0 | 0 | 12/12/201 | 0.02 | 0 | 12/12/201 | 0 | 0 | 12/12/201 | 0 | 0 | 12/12/2011 | 0 | 0 |
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| 12/14/2020 | 0.07 | 0.003913 | 12/14/2019 | 0.42 | 0.248966 | 12/14/201 | 0 | 0 | 12/14/2017 | 0.08 | 0.006667 | 12/14/201 | 0 | 0 | 12/14/201 | 0 | 0 | 12/14/201 | 0 | 0 | 12/14/201 | 0 | 0 | 12/14/201 | 0 | 0 | 12/14/2011 | 0 | 0 |
| 12/15/2020 | 0.84 | 0.64 | 12/15/2019 | 0.08 | 0.006667 | 12/15/201 | 0.26 | 0.115238 | 12/15/2017 | 0 | 0 | 12/15/201 | 0 | 0 | 12/15/201 | 0.27 | 0.123023 | 12/15/201 | 0 | 0 | 12/15/201 | 1.1 | 0.891746 | 12/15/201 | 0 | 0 | 12/15/2011 | 0 | 0 |
| 12/16/2020 | 0 | 0 | 12/16/2019 | 0 | 0 | 12/16/201 | 1.04 | 0.833333 | 12/16/2017 | 0.16 | 0.045 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/201 | 0 | 0 | 12/16/2011 | 0.07 | 0.003913 |
| 12/17/2020 | 0.99 | 0.784783 | 12/17/2019 | 1.01 | 0.804188 | 12/17/201 | 0.4 | 0.231429 | 12/17/2017 | 0 | 0 | 12/17/201 | 0.26 | 0.115238 | 12/17/201 | 0 | 0 | 12/17/201 | 0.16 | 0.045 | 12/17/201 | 0.02 | 0 | 12/17/201 | 0.13 | 0.027931 | 12/17/2011 | 0 | 0 |
| 12/18/2020 | 0 | 0 | 12/18/2019 | 0.15 | 0.039032 | 12/18/201 | 0 | 0 | 12/18/2017 | 0 | 0 | 12/18/201 | 0.39 | 0.222727 | 12/18/201 | 0.88 | 0.678462 | 12/18/201 | 0 | 0 | 12/18/201 | 0.03 | 0 | 12/18/201 | 0.17 | 0.051212 | 12/18/2011 | 0 | 0 |
| 12/19/2020 | 0 | 0 | 12/19/2019 | 0 | 0 | 12/19/201 | 0 | 0 | 12/19/2017 | 0 | 0 | 12/19/201 | 0.05 | 0.000476 | 12/19/201 | 0 | 0 | 12/19/201 | 0 | 0 | 12/19/201 | 0 | 0 | 12/19/201 | 0.03 | 0 | 12/19/2011 | 0 | 0 |
| 12/20/2020 | 0 | 0 | 12/20/2019 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/2017 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/201 | 0 | 0 | 12/20/2011 | 0 | 0 |
| 12/21/2020 | 0 | 0 | 12/21/2019 | 0 | 0 | 12/21/201 | 1.81 | 1.590305 | 12/21/2017 | 0 | 0 | 12/21/201 | 0 | 0 | 12/21/201 | 0 | 0 | 12/21/201 | 0 | 0 | 12/21/201 | 0 | 0 | 12/21/201 | 2.09 | 1.867778 | 12/21/2011 | 0.05 | 0.000476 |
| 12/22/2020 | 0.07 | 0.003913 | 12/22/2019 | 0 | 0 | 12/22/201 | 0.13 | 0.027931 | 12/22/2017 | 0 | 0 | 12/22/201 | 0 | 0 | 12/22/201 | 0.03 | 0 | 12/22/201 | 0 | 0 | 12/22/201 | 0.01 | 0 | 12/22/201 | 0.03 | 0 | 12/22/2011 | 0.11 | 0.018148 |
| 12/23/2020 | 0 | 0 | 12/23/2019 | 0 | 0 | 12/23/201 | 0 | 0 | 12/23/2017 | 0.21 | 0.078108 | 12/23/201 | 0 | 0 | 12/23/201 | 0.05 | 0.000476 | 12/23/201 | 0.15 | 0.039032 | 12/23/201 | 0.42 | 0.248966 | 12/23/201 | 0 | 0 | 12/23/2011 | 1.24 | 1.028571 |
| 12/24/2020 | 0 | 0 | 12/24/2019 | 0 | 0 | 12/24/201 | 0.07 | 0.003913 | 12/24/2017 | 0.5 | 0.320606 | 12/24/201 | 0.24 | 0.1 | 12/24/201 | 1.39 | 1.175806 | 12/24/201 | 0.42 | 0.248966 | 12/24/201 | 0.44 | 0.266667 | 12/24/201 | 0 | 0 | 12/24/2011 | 0 | 0 |
| 12/25/2020 | 2.08 | 1.857857 | 12/25/2019 | 0 | 0 | 12/25/201 | 0 | 0 | 12/25/2017 | 0.16 | 0.045 | 12/25/201 | 0.16 | 0.045 | 12/25/201 | 0.04 | 2.41E-34 | 12/25/201 | 0.5 | 0.320606 | 12/25/201 | 0 | 0 | 12/25/201 | 0.2 | 0.071111 | 12/25/2011 | 0 | 0 |
| 12/26/2020 | 0.04 | 2.41E-34 | 12/26/2019 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/2017 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/201 | 0.3 | 0.146957 | 12/26/201 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/201 | 0 | 0 | 12/26/2011 | 0 | 0 |
| 12/27/2020 | 0 | 0 | 12/27/2019 | 0 | 0 | 12/27/201 | 0 | 0 | 12/27/2017 | 0 | 0 | 12/27/201 | 0.01 | 0 | 12/27/201 | 0.04 | 2.41E-34 | 12/27/201 | 0 | 0 | 12/27/201 | 0 | 0 | 12/27/201 | 1.12 | 0.91125 | 12/27/2011 | 0 | 0 |
| 12/28/2020 | 0 | 0 | 12/28/2019 | 0 | 0 | 12/28/201 | 0.68 | 0.487619 | 12/28/2017 | 0 | 0 | 12/28/201 | 0 | 0 | 12/28/201 | 0.11 | 0.018148 | 12/28/201 | 0 | 0 | 12/28/201 | 0 | 0 | 12/28/201 | 0 | 0 | 12/28/2011 | 1.23 | 1.018777 |
| 12/29/2020 | 0 | 0 | 12/29/2019 | 0 | 0 | 12/29/201 | 0.66 | 0.46878 | 12/29/2017 | 0 | 0 | 12/29/201 | 0.1 | 0.013846 | 12/29/201 | 0.81 | 0.611237 | 12/29/201 | 0.01 | 0 | 12/29/201 | 0.02 | 0 | 12/29/201 | 0 | 0 | 12/29/2011 | 0 | 0 |
| 12/30/2020 | 0 | 0 | 12/30/2019 | 0.69 | 0.497059 | 12/30/201 | 0 | 0 | 12/30/2017 | 0.04 | 2.41E-34 | 12/30/201 | 0.15 | 0.039032 | 12/30/201 | 0.07 | 0.003913 | 12/30/201 | 0 | 0 | 12/30/201 | 1.15 | 0.940534 | 12/30/201 | 0.27 | 0.123023 | 12/30/2011 | 0 | 0 |
| 12/31/2020 | 0.06 | 0.001818 | 12/31/2019 | 0.23 | 0.092564 | 12/31/201 | 0 | 0 | 12/31/2017 | 0.03 | 0 | 12/31/201 | 0 | 0 | 12/31/201 | 0.18 | 0.057647 | 12/31/201 | 0 | 0 | 12/31/201 | 0 | 0 | 12/31/201 | 0 | 0 | 12/31/2011 | 0.01 | 0 |
| 1/1/2021 | 0.05 | 0.000476 | 1/1/2020 | 0 | 0 | 1/1/2019 | 0.79 | 0.592105 | 1/1/2018 | 0 | 0 | 1/1/2017 | 0 | 0 | 1/1/2016 | 0 | 0 | 1/1/2015 | 0 | 0 | 1/1/2014 | 0 | 0 | 1/1/2013 | 0 | 0 | 1/1/2012 | 0 | 0 |
| 1/2/2021 | 0.98 | 0.775088 | 1/2/2020 | 0 | 0 | 1/2/2019 | 0 | 0 | 1/2/2018 | 0 | 0 | 1/2/2017 | 0.18 | 0.057647 | 1/2/2016 | 0 | 0 | 1/2/2015 | 0 | 0 | 1/2/2014 | 0 | 0 | 1/2/2013 | 0 | 0 | 1/2/2012 | 0.05 | 0.000476 |
| 1/3/2021 | 0.06 | 0.001818 | 1/3/2020 | 0.11 | 0.018148 | 1/3/2019 | 0 | 0 | 1/3/2018 | 0 | 0 | 1/3/2017 | 0.18 | 0.057647 | 1/3/2016 | 0 | 0 | 1/3/2015 | 0 | 0 | 1/3/2014 | 0.51 | 0.329701 | 1/3/2013 | 0 | 0 | 1/3/2012 | 0 | 0 |
| 1/4/2021 | 0.29 | 0.138889 | 1/4/2020 | 0.2 | 0.071111 | 1/4/2019 | 0 | 0 | 1/4/2018 | 0.09 | 0.01 | 1/4/2017 | 0.56 | 0.375556 | 1/4/2016 | 0 | 0 | 1/4/2015 | 0.95 | 0.746036 | 1/4/2014 | 0 | 0 | 1/4/2013 | 0 | 0 | 1/4/2012 | 0 | 0 |
| 1/5/2021 | 0.01 | 0 | 1/5/2020 | 0.04 | 2.41E-34 | 1/5/2019 | 0.27 | 0.123023 | 1/5/2018 | 0.12 | 0.022857 | 1/5/2017 | 0 | 0 | 1/5/2016 | 0 | 0 | 1/5/2015 | 0.06 | 0.001818 | 1/5/2014 | 0 | 0 | 1/5/2013 | 0 | 0 | 1/5/2012 | 0 | 0 |
| 1/6/2021 | 0 | 0 | 1/6/2020 | 0 | 0 | 1/6/2019 | 0.12 | 0.022857 | 1/6/2018 | 0 | 0 | 1/6/2017 | 0.14 | 0.033333 | 1/6/2016 | 0 | 0 | 1/6/2015 | 0.05 | 0.000476 | 1/6/2014 | 0.56 | 0.375556 | 1/6/2013 | 0.02 | 0 | 1/6/2012 | 0 | 0 |
| 1/7/2021 | 0 | 0 | 1/7/2020 | 0.03 | 0 | 1/7/2019 | 0 | 0 | 1/7/2018 | 0 | 0 | 1/7/2017 | 0 | 0 | 1/7/2016 | 0 | 0 | 1/7/2015 | 0.11 | 0.018148 | 1/7/2014 | 0.06 | 0.001818 | 1/7/2013 | 0 | 0 | 1/7/2012 | 0 | 0 |
| 1/8/2021 | 0 | 0 | 1/8/2020 | 0.11 | 0.018148 | 1/8/2019 | 0.14 | 0.033333 | 1/8/2018 | 0 | 0 | 1/8/2017 | 0.04 | 2.41E-34 | 1/8/2016 | 0 | 0 | 1/8/2015 | 0 | 0 | 1/8/2014 | 0 | 0 | 1/8/2013 | 0 | 0 | 1/8/2012 | 0 | 0 |
| 1/9/2021 | 0 | 0 | 1/9/2020 | 0.03 | 0 | 1/9/2019 | 0.2 | 0.071111 | 1/9/2018 | 0.06 | 0.001818 | 1/9/2017 | 0 | 0 | 1/9/2016 | 0.02 | 0 | 1/9/2015 | 0.03 | 0 | 1/9/2014 | 0 | 0 | 1/9/2013 | 0 | 0 | 1/9/2012 | 0 | 0 |
| 1/10/2021 | 0 | 0 | 1/10/2020 | 0 | 0 | 1/10/2019 | 0 | 0 | 1/10/2018 | 0 | 0 | 1/10/2017 | 0 | 0 | 1/10/2016 | 1.15 | 0.940534 | 1/10/2015 | 0 | 0 | 1/10/2014 | 0.01 | 0 | 1/10/2013 | 0 | 0 | 1/10/2012 | 0 | 0 |
| 1/11/2021 | 0 | 0 | 1/11/2020 | 0 | 0 | 1/11/2019 | 0 | 0 | 1/11/2018 | 0 | 0 | 1/11/2017 | 0.28 | 0.130909 | 1/11/2016 | 0.1 | 0.013846 | 1/11/2015 | 0 | 0 | 1/11/2014 | 0.67 | 0.478193 | 1/11/2013 | 0 | 0 | 1/11/2012 | 0 | 0 |
| 1/12/2021 | 0 | 0 | 1/12/2020 | 0.2 | 0.071111 | 1/12/2019 | 0 | 0 | 1/12/2018 | 0.12 | 0.022857 | 1/12/2017 | 0.23 | 0.092564 | 1/12/2016 | 0 | 0 | 1/12/2015 | 0.11 | 0.018148 | 1/12/2014 | 0.68 | 0.487619 | 1/12/2013 | 0.45 | 0.275574 | 1/12/2012 | 1.33 | 1.116846 |
| 1/13/2021 | 0 | 0 | 1/13/2020 | 0 | 0 | 1/13/2019 | 0.15 | 0.039032 | 1/13/2018 | 0.92 | 0.717037 | 1/13/2017 | 0 | 0 | 1/13/2016 | 0 | 0 | 1/13/2015 | 0.56 | 0.375556 | 1/13/2014 | 0 | 0 | 1/13/2013 | 0.01 | 0 | 1/13/2012 | 0.11 | 0.018148 |
| 1/14/2021 | 0.03 | 0 | 1/14/2020 | 0 | 0 | 1/14/2019 | 0 | 0 | 1/14/2018 | 0 | 0 | 1/14/2017 | 0 | 0 | 1/14/2016 | 0 | 0 | 1/14/2015 | 0 | 0 | 1/14/2014 | 0.03 | 0 | 1/14/2013 | 0.03 | 0 | 1/14/2012 | 0 | 0 |
| 1/15/2021 | 0 | 0 | 1/15/2020 | 0.04 | 2.41E-34 | 1/15/2019 | 0 | 0 | 1/15/2018 | 0 | 0 | 1/15/2017 | 0.04 | 2.41E-34 | 1/15/2016 | 0 | 0 | 1/15/2015 | 0 | 0 | 1/15/2014 | 0.29 | 0.138889 | 1/15/2013 | 0.4 | 0.231429 | 1/15/2012 | 0.01 | 0 |
| 1/16/2021 | 0.35 | 0.188431 | 1/16/2020 | 0.03 | 0 | 1/16/2019 | 0 | 0 | 1/16/2018 | 0 | 0 | 1/16/2017 | 0 | 0 | 1/16/2016 | 0.25 | 0.107561 | 1/16/2015 | 0 | 0 | 1/16/2014 | 0.04 | 2.41E-34 | 1/16/2013 | 1.02 | 0.813898 | 1/16/2012 | 0 | 0 |
| 1/17/2021 | 0 | 0 | 1/17/2020 | 0 | 0 | 1/17/2019 | 0 | 0 | 1/17/2018 | 0.11 | 0.018148 | 1/17/2017 | 0 | 0 | 1/17/2016 | 0 | 0 | 1/17/2015 | 0 | 0 | 1/17/2014 | 0 | 0 | 1/17/2013 | 0.08 | 0.006667 | 1/17/2012 | 0.08 | 0.006667 |
| 1/18/2021 | 0 | 0 | 1/18/2020 | 0 | 0 | 1/18/2019 | 0.07 | 0.003913 | 1/18/2018 | 0.04 | 2.41E-34 | 1/18/2017 | 0.45 | 0.275574 | 1/18/2016 | 0.03 | 0 | 1/18/2015 | 0 | 0 | 1/18/2014 | 0.01 | 0 | 1/18/2013 | 0 | 0 | 1/18/2012 | 0.22 | 0.085263 |
| 1/19/2021 | 0 | 0 | 1/19/2020 | 0.37 | 0.205472 | 1/19/2019 | 0.01 | 0 | 1/19/2018 | 0 | 0 | 1/19/2017 | 0 | 0 | 1/19/2016 | 0 | 0 | 1/19/2015 | 0.99 | 0.784783 | 1/19/2014 | 0 | 0 | 1/19/2013 | 0 | 0 | 1/19/2012 | 0 | 0 |
| 1/20/2021 | 0 | 0 | 1/20/2020 | 0 | 0 | 1/20/2019 | 1.32 | 1.107027 | 1/20/2018 | 0 | 0 | 1/20/2017 | 0 | 0 | 1/20/2016 | 0 | 0 | 1/20/2015 | 0 | 0 | 1/20/2014 | 0 | 0 | 1/20/2013 | 0 | 0 | 1/20/2012 | 0 | 0 |
| 1/21/2021 | 0 | 0 | 1/21/2020 | 0 | 0 | 1/21/2019 | 0.07 | 0.003913 | 1/21/2018 | 0 | 0 | 1/21/2017 | 0.19 | 0.064286 | 1/21/2016 | 0 | 0 | 1/21/2015 | 0 | 0 | 1/21/2014 | 0 | 0 | 1/21/2013 | 0 | 0 | 1/21/2012 | 0.35 | 0.188431 |
| 1/22/2021 | 0 | 0 | 1/22/2020 | 0 | 0 | 1/22/2019 | 0 | 0 | 1/22/2018 | 0 | 0 | 1/22/2017 | 0.01 | 0 | 1/22/2016 | 0 | 0 | 1/22/2015 | 0.05 | 0.000476 | 1/22/2014 | 0.41 | 0.240175 | 1/22/2013 | 0.02 | 0 | 1/22/2012 | 0.08 | 0.006667 |
| 1/23/2021 | 0 | 0 | 1/23/2020 | 0 | 0 | 1/23/2019 | 0 | 0 | 1/23/2018 | 0.25 | 0.107561 | 1/23/2017 | 0.11 | 0.018148 | 1/23/2016 | 1.09 | 0.882 | 1/23/2015 | 0 | 0 | 1/23/2014 | 0 | 0 | 1/23/2013 | 0 | 0 | 1/23/2012 | 0.01 | 0 |
| 1/24/2021 | 0 | 0 | 1/24/2020 | 0 | 0 | 1/24/2019 | 0.59 | 0.403333 | 1/24/2018 | 0.16 | 0.045 | 1/24/2017 | 0.64 | 0.45 | 1/24/2016 | 1.41 | 1.195478 | 1/24/2015 | 0.72 | 0.525455 | 1/24/2014 | 0 | 0 | 1/24/2013 | 0 | 0 | 1/24/2012 | 0.22 | 0.085263 |
| 1/25/2021 | 0 | 0 | 1/25/2020 | 0.99 | 0.784783 | 1/25/2019 | 0.9 | 0.697736 | 1/25/2018 | 0 | 0 | 1/25/2017 | 0 | 0 | 1/25/2016 | 0 | 0 | 1/25/2015 | 0 | 0 | 1/25/2014 | 0 | 0 | 1/25/2013 | 0 | 0 | 1/25/2012 | 0 | 0 |
| 1/26/2021 | 0 | 0 | 1/26/2020 | 1.11 | 0.901496 | 1/26/2019 | 0 | 0 | 1/26/2018 | 0 | 0 | 1/26/2017 | 0 | 0 | 1/26/2016 | 0 | 0 | 1/26/2015 | 0.08 | 0.006667 | 1/26/2014 | 0.08 | 0.006667 | 1/26/2013 | 0.04 | 2.41E-34 | 1/26/2012 | 0 | 0 |
| 1/27/2021 | 0.15 | 0.039032 | 1/27/2020 | 0 | 0 | 1/27/2019 | 0 | 0 | 1/27/2018 | 0 | 0 | 1/27/2017 | 0 | 0 | 1/27/2016 | 0 | 0 | 1/27/2015 | 0.1 | 0.013846 | 1/27/2014 | 0 | 0 | 1/27/2013 | 0 | 0 | 1/27/2012 | 0.14 | 0.033333 |
| 1/28/2021 | 0 | 0 | 1/28/2020 | 0 | 0 | 1/28/2019 | 0 | 0 | 1/28/2018 | 0.11 | 0.018148 | 1/28/2017 | 0 | 0 | 1/28/2016 | 0 | 0 | 1/28/2015 | 0 | 0 | 1/28/2014 | 0 | 0 | 1/28/2013 | 0.01 | 0 | 1/28/2012 | 0.15 | 0.039032 |
| 1/29/2021 | 0 | 0 | 1/29/2020 | 0 | 0 | 1/29/2019 | 0 | 0 | 1/29/2018 | 0.15 | 0.039032 | 1/29/2017 | 0 | 0 | 1/29/2016 | 0 | 0 | 1/29/2015 | 0 | 0 | 1/29/2014 | 0.03 | 0 | 1/29/2013 | 0.12 | 0.022857 | 1/29/2012 | 0 | 0 |
| 1/30/2021 | 0 | 0 | 1/30/2020 | 0 | 0 | 1/30/2019 | 0.29 | 0.138889 | 1/30/2018 | 0.01 | 0 | 1/30/2017 | 0.01 | 0 | 1/30/2016 | 0 | 0 | 1/30/2015 | 0.01 | 0 | 1/30/2014 | 0 | 0 | 1/30/2013 | 0 | 0 | 1/30/2012 | 0 | 0 |
| 1/31/2021 | 0.02 | 0 | 1/31/2020 | 0 | 0 | 1/31/2019 | 0.01 | 0 | 1/31/2018 | 0.07 | 0.003913 | 1/31/2017 | 0.01 | 0 | 1/31/2016 | 0 | 0 | 1/31/2015 | 0.01 | 0 | 1/31/2014 | 0 | 0 | 1/31/2013 | 1.59 | 1.372857 | 1/31/2012 | 0 | 0 |
| 2/1/2021 | 0.41 | 0.240175 | 2/1/2020 | 0.07 | 0.003913 | 2/1/2019 | 0 | 0 | 2/1/2018 | 0 | 0 | 2/1/2017 | 0 | 0 | 2/1/2016 | 0 | 0 | 2/1/2015 | 0 | 0 | 2/1/2014 | 0 | 0 | 2/1/2013 | 0 | 0 | 2/1/2012 | 0.02 | 0 |
| 2/2/2021 | 0.58 | 0.394054 | 2/2/2020 | 0.07 | 0.003913 | 2/2/2019 | 0.08 | 0.006667 | 2/2/2018 | 0.17 | 0.051212 | 2/2/2017 | 0 | 0 | 2/2/2016 | 0.11 | 0.018148 | 2/2/2015 | 0.59 | 0.403333 | 2/2/2014 | 0 | 0 | 2/2/2013 | 0 | 0 | 2/2/2012 | 0 | 0 |
| 2/3/2021 | 0.05 | 0.000476 | 2/3/2020 | 0.01 | 0 | 2/3/2019 | 0 | 0 | 2/3/2018 | 0 | 0 | 2/3/2017 | 0 | 0 | 2/3/2016 | 0.04 | 2.41E-34 | 2/3/2015 | 0.28 | 0.130909 | 2/3/2014 | 0.7 | 0.506512 | 2/3/2013 | 0.08 | 0.006667 | 2/3/2012 | 0 | 0 |
| 2/4/2021 | 0 | 0 | 2/4/2020 | 0.02 | 0 | 2/4/2019 | 0 | 0 | 2/4/2018 | 0 | 0 | 2/4/2017 | 0 | 0 | 2/4/2016 | 0.77 | 0.573011 | 2/4/2015 | 0 | 0 | 2/4/2014 | 0.59 | 0.403333 | 2/4/2013 | 0.01 | 0 | 2/4/2012 | 0 | 0 |
| 2/5/2021 | 0.05 | 0.000476 | 2/5/2020 | 0.1 | 0.013846 | 2/5/2019 | 0 | 0 | 2/5/2018 | 1.12 | 0.91125 | 2/5/2017 | 0 | 0 | 2/5/2016 | 0.16 | 0.045 | 2/5/2015 | 0 | 0 | 2/5/2014 | 1.4 | 1.185641 | 2/5/2013 | 0 | 0 | 2/5/2012 | 0.03 | 0 |
| 2/6/2021 | 0.01 | 0 | 2/6/2020 | 0.49 | 0.311538 | 2/6/2019 | 0 | 0 | 2/6/2018 | 0 | 0 | 2/6/2017 | 0 | 0 | 2/6/2016 | 0.01 | 0 | 2/6/2015 | 0 | 0 | 2/6/2014 | 0.18 | 0.057647 | 2/6/2013 | 0.02 | 0 | 2/6/2012 | 0 | 0 |
| 2/7/2021 | 0.16 | 0.045 | 2/7/2020 | 0.34 | 0.18 | 2/7/2019 | 0.31 | 0.155106 | 2/7/2018 | 0.04 | 2.41E-34 | 2/7/2017 | 0 | 0 | 2/7/2016 | 0 | 0 | 2/7/2015 | 0 | 0 | 2/7/2014 | 0 | 0 | 2/7/2013 | 0 | 0 | 2/7/2012 | 0 | 0 |
| 2/8/2021 | 0.37 | 0.205472 | 2/8/2020 | 0.28 | 0.130909 | 2/8/2019 | 0.04 | 2.41E-34 | 2/8/2018 | 0.76 | 0.563478 | 2/8/2017 | 0.16 | 0.045 | 2/8/2016 | 0 | 0 | 2/8/2015 | 0 | 0 | 2/8/2014 | 0 | 0 | 2/8/2013 | 0.07 | 0.003913 | 2/8/2012 | 0 | 0 |
| 2/9/2021 | 0 | 0 | 2/9/2020 | 0 | 0 | 2/9/2019 | 0.01 | 0 | 2/9/2018 | 0 | 0 | 2/9/2017 | 0.56 | 0.375556 | 2/9/2016 | 0.16 | 0.045 | 2/9/2015 | 0 | 0 | 2/9/2014 | 0 | 0 | 2/9/2013 | 0.27 | 0.123023 | 2/9/2012 | 0.15 | 0.039032 |
| 2/10/2021 | 0 | 0 | 2/10/2020 | 0.08 | 0.006667 | 2/10/2019 | 0 | 0 | 2/10/2018 | 0 | 0 | 2/10/2017 | 0.03 | 0 | 2/10/2016 | 0.32 | 0.163333 | 2/10/2015 | 0.02 | 0 | 2/10/2014 | 0.13 | 0.027931 | 2/10/2013 | 0 | 0 | 2/10/2012 | 0 | 0 |
| 2/11/2021 | 0.25 | 0.107561 | 2/11/2020 | 0.61 | 0.421948 | 2/11/2019 | 0.19 | 0.064286 | 2/11/2018 | 1 | 0.794483 | 2/11/2017 | 0 | 0 | 2/11/2016 | 0 | 0 | 2/11/2015 | 0 | 0 | 2/11/2014 | 0 | 0 | 2/11/2013 | 0.34 | 0.18 | 2/11/2012 | 0.17 | 0.051212 |
| 2/12/2021 | 0 | 0 | 2/12/2020 | 0.06 | 0.001818 | 2/12/2019 | 0.2 | 0.071111 | 2/12/2018 | 0.7 | 0.506512 | 2/12/2017 | 0 | 0 | 2/12/2016 | 0 | 0 | 2/12/2015 | 0 | 0 | 2/12/2014 | 0 | 0 | 2/12/2013 | 0.08 | 0.006667 | 2/12/2012 | 0.09 | 0.01 |
| 2/13/2021 | 0 | 0 | 2/13/2020 | 0.22 | 0.085263 | 2/13/2019 | 0.84 | 0.64 | 2/13/2018 | 0 | 0 | 2/13/2017 | 0.22 | 0.085263 | 2/13/2016 | 0.01 | 0 | 2/13/2015 | 0 | 0 | 2/13/2014 | 0.91 | 0.707383 | 2/13/2013 | 0 | 0 | 2/13/2012 | 0 | 0 |
| 2/14/2021 | 0.03 | 0 | 2/14/2020 | 0.09 | 0.01 | 2/14/2019 | 0 | 0 | 2/14/2018 | 0 | 0 | 2/14/2017 | 0 | 0 | 2/14/2016 | 0 | 0 | 2/14/2015 | 0 | 0 | 2/14/2014 | 1.17 | 0.960075 | 2/14/2013 | 0.23 | 0.092564 | 2/14/2012 | 0 | 0 |
| 2/15/2021 | 0 | 0 | 2/15/2020 | 0 | 0 | 2/15/2019 | 0 | 0 | 2/15/2018 | 0.17 | 0.051212 | 2/15/2017 | 0 | 0 | 2/15/2016 | 0 | 0 | 2/15/2015 | 0.1 | 0.013846 | 2/15/2014 | 0 | 0 | 2/15/2013 | 0 | 0 | 2/15/2012 | 0.01 | 0 |
| 2/16/2021 | 0.78 | 0.582553 | 2/16/2020 | 0 | 0 | 2/16/2019 | 0 | 0 | 2/16/2018 | 0.56 | 0.375556 | 2/16/2017 | 0 | 0 | 2/16/2016 | 0.36 | 0.196923 | 2/16/2015 | 0 | 0 | 2/16/2014 | 0.08 | 0.006667 | 2/16/2013 | 0.15 | 0.039032 | 2/16/2012 | 0 | 0 |
| 2/17/2021 | 0 | 0 | 2/17/2020 | 0 | 0 | 2/17/2019 | 0 | 0 | 2/17/2018 | 0.06 | 0.001818 | 2/17/2017 | 0 | 0 | 2/17/2016 | 0.95 | 0.746036 | 2/17/2015 | 0.2 | 0.071111 | 2/17/2014 | 0 | 0 | 2/17/2013 | 0 | 0 | 2/17/2012 | 0.09 | 0.01 |
| 2/18/2021 | 0.24 | 0.1 | 2/18/2020 | 0 | 0 | 2/18/2019 | 0.22 | 0.085263 | 2/18/2018 | 0.38 | 0.214074 | 2/18/2017 | 0 | 0 | 2/18/2016 | 0 | 0 | 2/18/2015 | 0 | 0 | 2/18/2014 | 0.14 | 0.033333 | 2/18/2013 | 0 | 0 | 2/18/2012 | 0 | 0 |
| 2/19/2021 | 0.49 | 0.311538 | 2/19/2020 | 0 | 0 | 2/19/2019 | 0 | 0 | 2/19/2018 | 0 | 0 | 2/19/2017 | 0 | 0 | 2/19/2016 | 0 | 0 | 2/19/2015 | 0 | 0 | 2/19/2014 | 0.03 | 0 | 2/19/2013 | 0 | 0 | 2/19/2012 | 0 | 0 |
| 2/20/2021 | 0.06 | 0.001818 | 2/20/2020 | 0 | 0 | 2/20/2019 | 0 | 0 | 2/20/2018 | 0.03 | 0 | 2/20/2017 | 0 | 0 | 2/20/2016 | 0 | 0 | 2/20/2015 | 0 | 0 | 2/20/2014 | 0.17 | 0.051212 | 2/20/2013 | 0.2 | 0.071111 | 2/20/2012 | 0 | 0 |
| 2/21/2021 | 0 | 0 | 2/21/2020 | 0 | 0 | 2/21/2019 | 0.68 | 0.487619 | 2/21/2018 | 0 | 0 | 2/21/2017 | 0 | 0 | 2/21/2016 | 0 | 0 | 2/21/2015 | 0 | 0 | 2/21/2014 | 0 | 0 | 2/21/2013 | 0 | 0 | 2/21/2012 | 0 | 0 |
| 2/22/2021 | 0.03 | 0 | 2/22/2020 | 0 | 0 | 2/22/2019 | 0 | 0 | 2/22/2018 | 0.03 | 0 | 2/22/2017 | 0 | 0 | 2/22/2016 | 0.06 | 0.001818 | 2/22/2015 | 0.7 | 0.506512 | 2/22/2014 | 0.21 | 0.078108 | 2/22/2013 | 0 | 0 | 2/22/2012 | 0 | 0 |
| 2/23/2021 | 0.35 | 0.188431 | 2/23/2020 | 0 | 0 | 2/23/2019 | 0 | 0 | 2/23/2018 | 0.27 | 0.123023 | 2/23/2017 | 0 | 0 | 2/23/2016 | 0 | 0 | 2/23/2015 | 0 | 0 | 2/23/2014 | 0 | 0 | 2/23/2013 | 0.07 | 0.003913 | 2/23/2012 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2/24/2021 | 0 | 0 | 2/24/2020 | 0 | 0 | 2/24/2019 | 0.39 | 0.222727 | 2/24/2018 | 0.15 | 0.039032 | 2/24/2017 | 0 | 0 |
| 2/25/2021 | 0 | 0 | 2/25/2020 | 0.02 | 0 | 2/25/2019 | 0.05 | 0.000476 | 2/25/2018 | 0.54 | 0.357143 | 2/25/2017 | 0 | 0 |
| 2/26/2021 | 0 | 0 | 2/26/2020 | 0.2 | 0.071111 | 2/26/2019 | 0 | 0 | 2/26/2018 | 0.18 | 0.057647 | 2/26/2017 | 0.62 | 0.431282 |
| 2/27/2021 | 0.35 | 0.188431 | 2/27/2020 | 0.59 | 0.403333 | 2/27/2019 | 0 | 0 | 2/27/2018 | 0 | 0 | 2/27/2017 | 0 | 0 |
| 2/28/2021 | 0.07 | 0.003913 | 2/28/2020 | 0 | 0 | 2/28/2019 | 0 | 0 | 2/28/2018 | 0 | 0 | 2/28/2017 | 0 | 0 |
| 3/1/2021 | 1.17 | 0.960075 | 2/29/2020 | 0 | 0 | 3/1/2019 | 0.31 | 0.155106 | 3/1/2018 | 0 | 0 | 3/1/2017 | 0.15 | 0.039032 |
| 3/2/2021 | 0.01 | 0 | 3/1/2020 | 0 | 0 | 3/2/2019 | 0.58 | 0.394054 | 3/2/2018 | 1.08 | 0.872258 | 3/2/2017 | 0.01 | 0 |
| 3/3/2021 | 0 | 0 | 3/2/2020 | 0 | 0 | 3/3/2019 | 0 | 0 | 3/3/2018 | 0.29 | 0.138889 | 3/3/2017 | 0 | 0 |
| 3/4/2021 | 0 | 0 | 3/3/2020 | 0.1 | 0.013846 | 3/4/2019 | 0.82 | 0.620816 | 3/4/2018 | 0 | 0 | 3/4/2017 | 0 | 0 |
| 3/5/2021 | 0 | 0 | 3/4/2020 | 0.23 | 0.092564 | 3/5/2019 | 0 | 0 | 3/5/2018 | 0 | 0 | 3/5/2017 | 0 | 0 |
| 3/6/2021 | 0 | 0 | 3/5/2020 | 0 | 0 | 3/6/2019 | 0 | 0 | 3/6/2018 | 0 | 0 | 3/6/2017 | 0 | 0 |
| 3/7/2021 | 0 | 0 | 3/6/2020 | 0 | 0 | 3/7/2019 | 0 | 0 | 3/7/2018 | 0.49 | 0.311538 | 3/7/2017 | 0.02 | 0 |
| 3/8/2021 | 0 | 0 | 3/7/2020 | 0.37 | 0.205472 | 3/8/2019 | 0 | 0 | 3/8/2018 | 0.63 | 0.440633 | 3/8/2017 | 0.04 | 2.41E-34 |
| 3/9/2021 | 0 | 0 | 3/8/2020 | 0 | 0 | 3/9/2019 | 0.01 | 0 | 3/9/2018 | 0 | 0 | 3/9/2017 | 0 | 0 |
| 3/10/2021 | 0 | 0 | 3/9/2020 | 0.01 | 0 | 3/10/2019 | 0.69 | 0.497059 | 3/10/2018 | 0 | 0 | 3/10/2017 | 0.06 | 0.001818 |
| 3/11/2021 | 0 | 0 | 3/10/2020 | 0 | 0 | 3/11/2019 | 0.08 | 0.006667 | 3/11/2018 | 0 | 0 | 3/11/2017 | 0.28 | 0.130909 |
| 3/12/2021 | 0 | 0 | 3/11/2020 | 0.04 | 2.41E-34 | 3/12/2019 | 0 | 0 | 3/12/2018 | 0 | 0 | 3/12/2017 | 0 | 0 |
| 3/13/2021 | 0 | 0 | 3/12/2020 | 0.01 | 0 | 3/13/2019 | 0 | 0 | 3/13/2018 | 0.11 | 0.018148 | 3/13/2017 | 0 | 0 |
| 3/14/2021 | 0 | 0 | 3/13/2020 | 0.33 | 0.171633 | 3/14/2019 | 0 | 0 | 3/14/2018 | 0 | 0 | 3/14/2017 | 1.27 | 1.057972 |
| 3/15/2021 | 0 | 0 | 3/14/2020 | 0.01 | 0 | 3/15/2019 | 0 | 0 | 3/15/2018 | 0 | 0 | 3/15/2017 | 0.7 | 0.506512 |
| 3/16/2021 | 0.01 | 0 | 3/15/2020 | 0.06 | 0.001818 | 3/16/2019 | 0.22 | 0.085263 | 3/16/2018 | 0 | 0 | 3/16/2017 | 0.01 | 0 |
| 3/17/2021 | 0.01 | 0 | 3/16/2020 | 0 | 0 | 3/17/2019 | 0 | 0 | 3/17/2018 | 0 | 0 | 3/17/2017 | 0 | 0 |
| 3/18/2021 | 0.13 | 0.027931 | 3/17/2020 | 0.06 | 0.001818 | 3/18/2019 | 0 | 0 | 3/18/2018 | 0 | 0 | 3/18/2017 | 0 | 0 |
| 3/19/2021 | 0.87 | 0.668835 | 3/18/2020 | 0.01 | 0 | 3/19/2019 | 0 | 0 | 3/19/2018 | 0 | 0 | 3/19/2017 | 0.01 | 0 |
| 3/20/2021 | 0 | 0 | 3/19/2020 | 0.82 | 0.620816 | 3/20/2019 | 0 | 0 | 3/20/2018 | 0 | 0 | 3/20/2017 | 0 | 0 |
| 3/21/2021 | 0 | 0 | 3/20/2020 | 0.02 | 0 | 3/21/2019 | 0.05 | 0.000476 | 3/21/2018 | 0.41 | 0.240175 | 3/21/2017 | 0.01 | 0 |
| 3/22/2021 | 0 | 0 | 3/21/2020 | 0.02 | 0 | 3/22/2019 | 2.01 | 1.788433 | 3/22/2018 | 0.63 | 0.440633 | 3/22/2017 | 0 | 0 |
| 3/23/2021 | 0 | 0 | 3/22/2020 | 0 | 0 | 3/23/2019 | 0.04 | 2.41E-34 | 3/23/2018 | 0 | 0 | 3/23/2017 | 0 | 0 |
| 3/24/2021 | 0.02 | 0 | 3/23/2020 | 0.06 | 0.001818 | 3/24/2019 | 0 | 0 | 3/24/2018 | 0 | 0 | 3/24/2017 | 0 | 0 |
| 3/25/2021 | 1.8 | 1.580408 | 3/24/2020 | 0.71 | 0.515977 | 3/25/2019 | 0 | 0 | 3/25/2018 | 0 | 0 | 3/25/2017 | 0 | 0 |
| 3/26/2021 | 0.03 | 0 | 3/25/2020 | 0.01 | 0 | 3/26/2019 | 0.28 | 0.130909 | 3/26/2018 | 0.01 | 0 | 3/26/2017 | 0 | 0 |
| 3/27/2021 | 0 | 0 | 3/26/2020 | 0.05 | 0.000476 | 3/27/2019 | 0 | 0 | 3/27/2018 | 0 | 0 | 3/27/2017 | 0.07 | 0.003913 |
| 3/28/2021 | 0.06 | 0.001818 | 3/27/2020 | 0.02 | 0 | 3/28/2019 | 0 | 0 | 3/28/2018 | 0.02 | 0 | 3/28/2017 | 0.16 | 0.045 |
| 3/29/2021 | 0.62 | 0.431282 | 3/28/2020 | 0.09 | 0.01 | 3/29/2019 | 0 | 0 | 3/29/2018 | 0.09 | 0.01 | 3/29/2017 | 0.48 | 0.3025 |
| 3/30/2021 | 0 | 0 | 3/29/2020 | 1.07 | 0.86252 | 3/30/2019 | 0 | 0 | 3/30/2018 | 0.01 | 0 | 3/30/2017 | 0 | 0 |
| 3/31/2021 | 0 | 0 | 3/30/2020 | 0.02 | 0 | 3/31/2019 | 0 | 0 | 3/31/2018 | 0.12 | 0.022857 | 3/31/2017 | 0.31 | 0.155106 |
| 4/1/2021 | 0.46 | 0.284516 | 3/31/2020 | 0.1 | 0.013846 | 4/1/2019 | 0.08 | 0.006667 | 4/1/2018 | 0 | 0 | 4/1/2017 | 1.41 | 1.195478 |
| 4/2/2021 | 0.01 | 0 | 4/1/2020 | 0.03 | 0 | 4/2/2019 | 0 | 0 | 4/2/2018 | 0.23 | 0.092564 | 4/2/2017 | 0 | 0 |
| 4/3/2021 | 0 | 0 | 4/2/2020 | 0 | 0 | 4/3/2019 | 0 | 0 | 4/3/2018 | 0.04 | 2.41E-34 | 4/3/2017 | 0 | 0 |
| 4/4/2021 | 0 | 0 | 4/3/2020 | 0 | 0 | 4/4/2019 | 0 | 0 | 4/4/2018 | 0.15 | 0.039032 | 4/4/2017 | 0.25 | 0.107561 |
| 4/5/2021 | 0 | 0 | 4/4/2020 | 0.01 | 0 | 4/5/2019 | 0 | 0 | 4/5/2018 | 0.06 | 0.001818 | 4/5/2017 | 0.01 | 0 |
| Cumulative Runoff (Q) For 1 Year of Daily Rain Events (Inches) | | 40.12979 | | | 33.03327 | | | 49.69633 | | | 29.31586 | | | 24.60699 |
| Average Yearly Runoff (inches) | | 35.76508 | | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2/24/2016 | 0.53 | 0.347971 | 2/24/2015 | 0 | 0 | 2/24/2014 | 0.01 | 0 | 2/24/2013 | 0.1 | 0.013846 | 2/24/2012 | 0.26 | 0.115238 |
| 2/25/2016 | 1.6 | 1.382727 | 2/25/2015 | 0 | 0 | 2/25/2014 | 0 | 0 | 2/25/2013 | 0 | 0 | 2/25/2012 | 0.09 | 0.01 |
| 2/26/2016 | 0.01 | 0 | 2/26/2015 | 0 | 0 | 2/26/2014 | 0.01 | 0 | 2/26/2013 | 0 | 0 | 2/26/2012 | 0 | 0 |
| 2/27/2016 | 0 | 0 | 2/27/2015 | 0.01 | 0 | 2/27/2014 | 0.06 | 0.001818 | 2/27/2013 | 0.58 | 0.394054 | 2/27/2012 | 0 | 0 |
| 2/28/2016 | 0 | 0 | 2/28/2015 | 0 | 0 | 2/28/2014 | 0 | 0 | 2/28/2013 | 0.04 | 2.41E-34 | 2/28/2012 | 0 | 0 |
| 2/29/2016 | 0 | 0 | 3/1/2015 | 0 | 0 | 3/1/2014 | 0 | 0 | 3/1/2013 | 0.01 | 0 | 2/29/2012 | 0 | 0 |
| 3/1/2016 | 0 | 0 | 3/2/2015 | 0.52 | 0.338824 | 3/2/2014 | 0 | 0 | 3/2/2013 | 0 | 0 | 3/1/2012 | 0.98 | 0.775088 |
| 3/2/2016 | 0.16 | 0.045 | 3/3/2015 | 0 | 0 | 3/3/2014 | 0.21 | 0.078108 | 3/3/2013 | 0 | 0 | 3/2/2012 | 0.01 | 0 |
| 3/3/2016 | 0 | 0 | 3/4/2015 | 0.55 | 0.366338 | 3/4/2014 | 0.04 | 2.41E-34 | 3/4/2013 | 0 | 0 | 3/3/2012 | 0.22 | 0.085263 |
| 3/4/2016 | 0.08 | 0.006667 | 3/5/2015 | 0.67 | 0.478193 | 3/5/2014 | 0 | 0 | 3/5/2013 | 0 | 0 | 3/4/2012 | 0.04 | 2.41E-34 |
| 3/5/2016 | 0.01 | 0 | 3/6/2015 | 0.63 | 0.440633 | 3/6/2014 | 0 | 0 | 3/6/2013 | 0.1 | 0.013846 | 3/5/2012 | 0 | 0 |
| 3/6/2016 | 0 | 0 | 3/7/2015 | 0 | 0 | 3/7/2014 | 0 | 0 | 3/7/2013 | 0.17 | 0.051212 | 3/6/2012 | 0 | 0 |
| 3/7/2016 | 0 | 0 | 3/8/2015 | 0 | 0 | 3/8/2014 | 0 | 0 | 3/8/2013 | 0.01 | 0 | 3/7/2012 | 0 | 0 |
| 3/8/2016 | 0 | 0 | 3/9/2015 | 0 | 0 | 3/9/2014 | 0 | 0 | 3/9/2013 | 0.01 | 0 | 3/8/2012 | 0 | 0 |
| 3/9/2016 | 0 | 0 | 3/10/2015 | 0 | 0 | 3/10/2014 | 0 | 0 | 3/10/2013 | 0 | 0 | 3/9/2012 | 0.05 | 0.000476 |
| 3/10/2016 | 0 | 0 | 3/11/2015 | 0.64 | 0.45 | 3/11/2014 | 0 | 0 | 3/11/2013 | 0.01 | 0 | 3/10/2012 | 0 | 0 |
| 3/11/2016 | 0 | 0 | 3/12/2015 | 0 | 0 | 3/12/2014 | 0 | 0 | 3/12/2013 | 0.16 | 0.045 | 3/11/2012 | 0 | 0 |
| 3/12/2016 | 0 | 0 | 3/13/2015 | 0 | 0 | 3/13/2014 | 0.33 | 0.171633 | 3/13/2013 | 0.96 | 0.755714 | 3/12/2012 | 0 | 0 |
| 3/13/2016 | 0 | 0 | 3/14/2015 | 0.71 | 0.515977 | 3/14/2014 | 0 | 0 | 3/14/2013 | 0 | 0 | 3/13/2012 | 0.07 | 0.003913 |
| 3/14/2016 | 0.89 | 0.688095 | 3/15/2015 | 0.46 | 0.284516 | 3/15/2014 | 0 | 0 | 3/15/2013 | 0 | 0 | 3/14/2012 | 0 | 0 |
| 3/15/2016 | 0.26 | 0.115238 | 3/16/2015 | 0 | 0 | 3/16/2014 | 0.04 | 2.41E-34 | 3/16/2013 | 0 | 0 | 3/15/2012 | 0 | 0 |
| 3/16/2016 | 0.04 | 2.41E-34 | 3/17/2015 | 0 | 0 | 3/17/2014 | 0.16 | 0.045 | 3/17/2013 | 0.08 | 0.006667 | 3/16/2012 | 0.04 | 2.41E-34 |
| 3/17/2016 | 0 | 0 | 3/18/2015 | 0 | 0 | 3/18/2014 | 0.01 | 0 | 3/18/2013 | 0 | 0 | 3/17/2012 | 0 | 0 |
| 3/18/2016 | 0.01 | 0 | 3/19/2015 | 0 | 0 | 3/19/2014 | 0 | 0 | 3/19/2013 | 0.75 | 0.553956 | 3/18/2012 | 0 | 0 |
| 3/19/2016 | 0 | 0 | 3/20/2015 | 0.01 | 0 | 3/20/2014 | 0.65 | 0.459383 | 3/20/2013 | 0.02 | 0 | 3/19/2012 | 0 | 0 |
| 3/20/2016 | 0.02 | 0 | 3/21/2015 | 0.53 | 0.347971 | 3/21/2014 | 0 | 0 | 3/21/2013 | 0 | 0 | 3/20/2012 | 0 | 0 |
| 3/21/2016 | 0.02 | 0 | 3/22/2015 | 0 | 0 | 3/22/2014 | 0 | 0 | 3/22/2013 | 0 | 0 | 3/21/2012 | 0 | 0 |
| 3/22/2016 | 0 | 0 | 3/23/2015 | 0 | 0 | 3/23/2014 | 0 | 0 | 3/23/2013 | 0 | 0 | 3/22/2012 | 0 | 0 |
| 3/23/2016 | 0 | 0 | 3/24/2015 | 0 | 0 | 3/24/2014 | 0 | 0 | 3/24/2013 | 0 | 0 | 3/23/2012 | 0 | 0 |
| 3/24/2016 | 0 | 0 | 3/25/2015 | 0 | 0 | 3/25/2014 | 0 | 0 | 3/25/2013 | 0.13 | 0.027931 | 3/24/2012 | 0 | 0 |
| 3/25/2016 | 0 | 0 | 3/26/2015 | 0.04 | 2.41E-34 | 3/26/2014 | 0.07 | 0.003913 | 3/26/2013 | 0.38 | 0.214074 | 3/25/2012 | 0.17 | 0.051212 |
| 3/26/2016 | 0.01 | 0 | 3/27/2015 | 0.88 | 0.678462 | 3/27/2014 | 0 | 0 | 3/27/2013 | 0.01 | 0 | 3/26/2012 | 0 | 0 |
| 3/27/2016 | 0 | 0 | 3/28/2015 | 0 | 0 | 3/28/2014 | 0 | 0 | 3/28/2013 | 0 | 0 | 3/27/2012 | 0 | 0 |
| 3/28/2016 | 0.47 | 0.293492 | 3/29/2015 | 0.01 | 0 | 3/29/2014 | 0.07 | 0.003913 | 3/29/2013 | 0 | 0 | 3/28/2012 | 0 | 0 |
| 3/29/2016 | 0.09 | 0.01 | 3/30/2015 | 0 | 0 | 3/30/2014 | 1.07 | 0.86252 | 3/30/2013 | 0 | 0 | 3/29/2012 | 0.01 | 0 |
| 3/30/2016 | 0 | 0 | 3/31/2015 | 0 | 0 | 3/31/2014 | 0.83 | 0.630404 | 3/31/2013 | 0 | 0 | 3/30/2012 | 0 | 0 |
| 3/31/2016 | 0 | 0 | 4/1/2015 | 0.05 | 0.000476 | 4/1/2014 | 0 | 0 | 4/1/2013 | 0.06 | 0.001818 | 3/31/2012 | 0.2 | 0.071111 |
| 4/1/2016 | 0.01 | 0 | 4/2/2015 | 0 | 0 | 4/2/2014 | 0 | 0 | 4/2/2013 | 0 | 0 | 4/1/2012 | 0.01 | 0 |
| 4/2/2016 | 0.25 | 0.107561 | 4/3/2015 | 0 | 0 | 4/3/2014 | 0.04 | 2.41E-34 | 4/3/2013 | 0 | 0 | 4/2/2012 | 0.23 | 0.092564 |
| 4/3/2016 | 0.12 | 0.022857 | 4/4/2015 | 0.12 | 0.022857 | 4/4/2014 | 0.12 | 0.022857 | 4/4/2013 | 0 | 0 | 4/3/2012 | 0 | 0 |
| 4/4/2016 | 0 | 0 | 4/5/2015 | 0 | 0 | 4/5/2014 | 0.05 | 0.000476 | 4/5/2013 | 0.01 | 0 | 4/4/2012 | 0 | 0 |
| | | 32.26052 | | | 33.10527 | | | 42.33315 | | | 33.16771 | | | 40.00191 |

2072a

# Appendix B

## WCU000819 through WCU000820

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2073a

**West Chester University Campus**

*Pervious vs. Impervious Coverage*

*Storm Water Run-off Calculation*

| | SF | Acres |
|---|---|---|
| Campus **Pervious Area** Feeding West Chester Borugh Plum Run Outfall: | 983,671 | 22.6 |
| Campus **Impervious Area** Feeding West Chester Borugh Plum Run Outfall: | 1,371,897 | 31.5 |
| Campus **TOTAL Area** Feeding West Chester Borough Plum Run Outfall: | 2,355,568 | 54.1 |

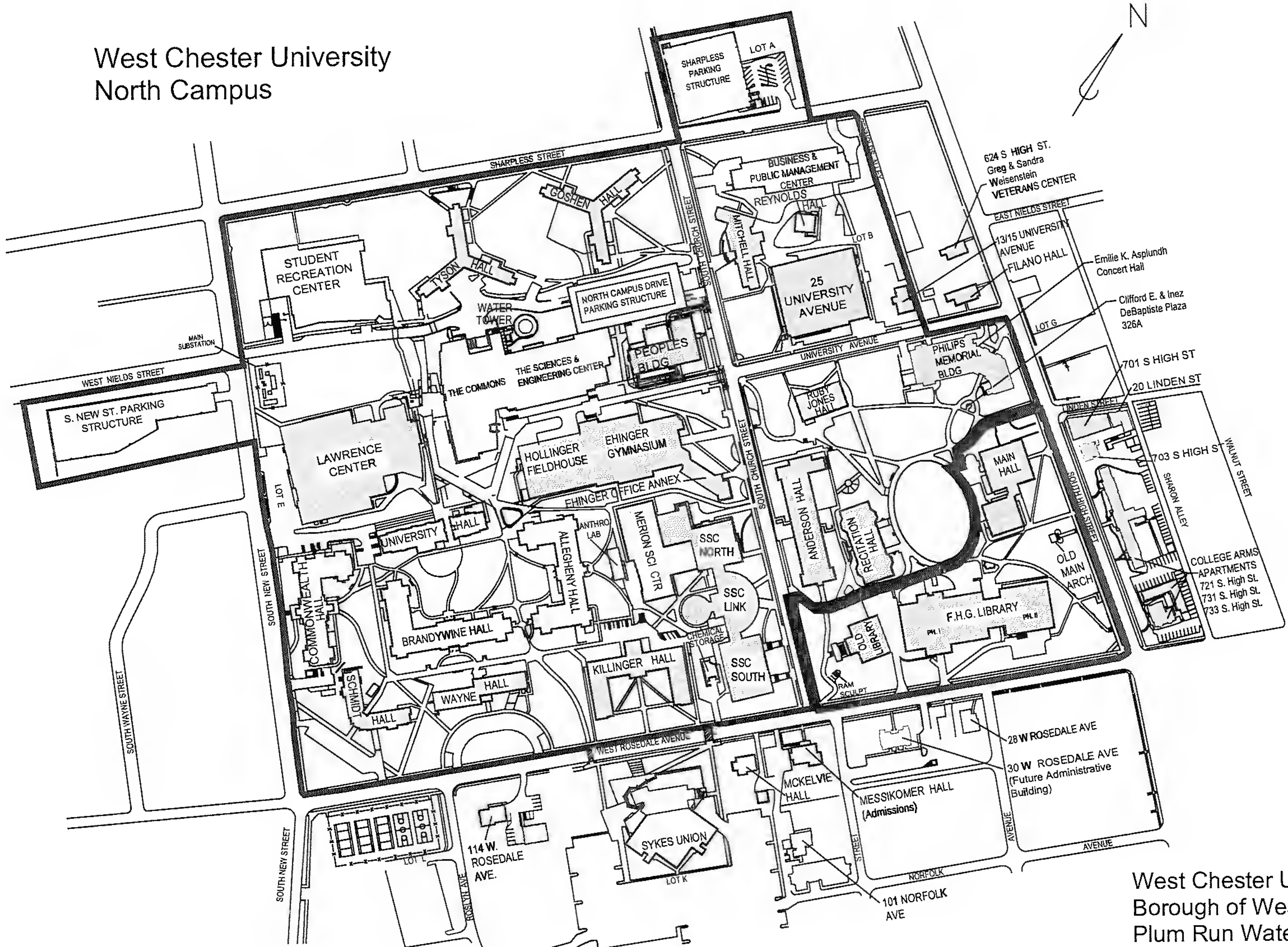
| **Run-off Volume Calculation** | **Volume = SF impervious x rainfall depth/ 12** | | |
|---|---|---|---|
| 2 year: 3.26 in / 24 hr | 1,371,897 sf x 3.26/12 = | 372,699 | CF |
| 5 year: 4.10 in/ 24 hr | 1,371,897 sf x 4.10/12 = | 468,731 | CF |

- explain calculations -
- relate to often $H_2O$ which doesn't enter Plum Run.

WCU000819

2074a

# West Chester University North Campus




West Chester University
Borough of West Chester
Plum Run Watershed
February 10, 2020

Borough of West Chester - WCU Plum Run Watershed - 2,355,568 sq ft - 54.1 acres
Borough of West Chester - Not Located in Plum Run Watershed - 272,343 sq ft - 6.2 acres
Buildings with No Structural Storm Water Management Systems

WCU000820

% of campus at what SW has managed vs % where its not managed.

2075a

# Appendix C

## Option 3 Analysis

West Chester Borough
Chester County

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# Appendix C

## Data and Information Review



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## Data and Information Review

NTM Engineering, Inc. reviewed the following information for development of the analysis:

- West Chester Borough's current and past stormwater ordinances https://ecode360.com/6469923
- Superblock Survey Sheets - The survey sheets date back to 2007 and include the area bounded by West Rosedale Avenue, South New Street, South Church Street, and Sharpless Avenue. While 2007 may seem recent, the University completed substantial development on North Campus after the survey, including development of the Student Recreation Center, the Commons, the Parking Facility, Commonwealth Hall, Brandywine Hall, and Allegheny Hall. WCU000871-875
- Civil Site and PCSM Plans for The Commons and Parking Facility- (new utility routings and site layout/buildings.) WCU000878-880
- Development Plans for President's Walk (It is our understanding this development project is not advancing). We reviewed the existing conditions plan and grading plan and used those resources for drainage modeling assumptions on the eastern half of North Campus-east of South Church Street). WCU000848
- Civil Site Layout Plan and Grading Plan for West Chester University Student Housing Building "C" (provided by the Borough via counsel)
- Site Layout Plan and Grading Plan for West Chester University Business and Public Affairs Center (provided by the Borough via counsel)
- PASDA Aerial photographs (to review a history of development on campus)

  PASDA (n.d.-a). [chester 091837 Statewide 1937-1942 B&W (not georeferenced)]. Retrieved from: ftp://ftp.pasda.psu.edu/pub/pennpilotr/era1940/chester_1938_photos_jpg_800/chester_091837_ahk4491

  PASDA (n.d.-b). [24002570PAS PEMA Orthoimagery Color (1/2 ft)]. Retrieved from: ftp://ftp.pasda.psu.edu/pub/pasda/pema_imagery/cycle1/TIF/South/2018/Survey_Feet/20000000/24002570PAS_PEMA_2018.zip

- Campus Base Plan (dated 7/19/2020- this map appears to have been made with GIS or AutoCAD and has the most recent sidewalks and drive configurations. This layout shows all new buildings (even if not fully constructed) and apparent storm drain information. An attempt was made to obtain the GIS or CAD file; however it was not available.) Based on existing topography and field review, there appears to be clear discrepancies with connectivity for storm drains in several areas. For instance, Brandywine Hall shows a connection to a stormwater facility in front (south) of Wayne Hall. For this connectivity to occur, the infiltration facility would need to be 18-20 feet deep. Based on downstream connectivity to the inlet, the configuration shown is not possible. WCU000001
- West Chester Borough Stormwater BMP list w/ dates (from the MS4 Permit) 001304-00136
- West Chester Campus Map and Data WCU000817-WCU000824

- West Chester Campus Maps

  1. West Chester University (n.d.-a). [West Chester University Map of North Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUNorthCampusMap.pdf
  2. West Chester University (n.d.-b) [West Chester University Map of South Campus]. Retrieved from: https://www.wcupa.edu/campusmap/documents/WCUSouthCampusMap.pdf
- West Chester Stream Protection Ordinance https://www.west-chester.com/DocumentCenter/View/13320/2016-Ordinance
- West Chester Borough MS4 Permit PRP https://west-chester.com/DocumentCenter/View/4288/WC-BrandywineBlackhorsePlumTaylor-PRP_Combined-1
- West Chester University MS4 Permit and PRP WCU000002-WCU000816
- NOAA Atlas 14 https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html
- PA StreamStats https://streamstats.usgs.gov/ss/
- Google. (n.d.). [Google Map of West Chester University]. Retrieved May 12, 2021 from https://www.google.com/maps/search/West+Chester+University/@39.946548,-75.6031328,2283m/data=!3m1!1e3
- ChescoViews https://arcweb.chesco.org/cv3/Default_CV.html
- We conducted a field visit on Wednesday May 5, 2021, to confirm general surface drainage area patterns. Existing roof drain tie-ins from buildings to on-campus storm drain conveyance networks could not be reviewed/confirmed in the field. The field visit was conducted during a rain event; therefore, surface drainage patterns were very clearly visible. The area of the Commons was not accessible due to construction, however muddy runoff was visible from the perimeter fence and the outfall to Plum Run was discharging sediment laden runoff, which we thought to originate from the construction site. Subsurface drainage facilities were not reviewable in the field. The University did not provide a representative familiar with the system, to answer questions about the existing system connectivity, or review the condition of inlets, manholes and other subsurface utilities.

**Other information reviewed but not used because of age or utility includes:**

- PASDA 2' Contours (2006-2008)
- Chester County GIS Buildings Layer (2015) (already partially outdated because of recent development on campus)
- West Chester County GIS (Various Layers - sidewalks were not available on campus)
- West Chester Borough GIS Maps (e.g. storm drain)

- Various maps provided with some level of conflicting information (*e.g.* the drainage area map showing the Plum Run drainage divided on North Campus or within the Superblock is not correct based on the plans and storm drain conveyance maps reviewed.)

**Information not available for review (which would have helped with analysis) includes:**

- Approved stormwater management analysis/reports, as-built plans, and drainage area maps for development on campus (since 2004)
- Design information on existing stormwater management facilities not installed as part of a land development project
- University GIS or CAD land use information

# Appendix C

## Modeling Approach and Assumptions

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## Modeling Approach and Assumptions

NTM Engineering, Inc. used the following methodology and general modeling assumptions for development of the H&H models and design.

- We superimposed/aggregated relevant available plan and topographic information provided as PDFs to generate an overall up-to-date layout of West Chester University Campus (See Exhibit A-6).
- Using available topography and existing storm drain maps, we delineated campus subdrainage areas.
- We conducted a field visit on Wednesday May 5, 2021, to confirm general surface drainage area patterns. Existing roof drain tie-ins from buildings to on-campus storm drain conveyance networks could not be reviewed/confirmed in the field. The field visit was conducted during a rain event; therefore, surface drainage patterns were very clearly visible. The area of the Commons was not accessible due to construction, however muddy runoff was visible from the perimeter fence and the outfall to Plum Run was discharging sediment laden runoff, which we thought to originate from the construction site. Subsurface drainage facilities were not reviewable in the field. The University did not provide a representative familiar with the system to answer questions about the existing system connectivity or review the condition of inlets, manholes, and other subsurface utilities.
- The modeling and design consider the area of North Campus which drains to the unnamed tributary of Plum Run located in the Borough (See **Appendix A**, Exhibit A-6). There are additional North Campus drainage areas which flow to the south and to the east, respectively, to Borough ROW and conveyance facilities (which, again, are part of the Borough Stormwater Management System) and ultimately to a different branch of Plum Run or Goose Creek. Modeling of these areas and analysis of the subsequent benefits which the University derives from draining to the Borough Stormwater Management System was not completed as part of this study; however, as more fully discussed in the Conclusion, the University would incur additional costs to provide a similar approach and replication of the existing benefits which the Borough Stormwater Management System provides to the University.
- Because full reports and documentation for existing stormwater facilities were not available, we did not complete detailed modeling for existing stormwater management facilities or storage areas on North Campus. To consider the benefits of the existing University-owned stormwater facilities and resulting potential flow reduction to separate University-owned storm drain conveyance facilities which would replicate the current benefits which arise from connection to the Borough Stormwater Management System, we reviewed the current and previous West Chester Borough stormwater ordinances for stormwater design standards. Stormwater management is designed to reduce a post development peak rate flow resulting from changes in land use, back to an existing or theoretical land use state.

The modeling completed considers that development on North Campus, where stormwater facilities are present, would reduce the peak rates as follows:

- Buildings completed after 2013 are assumed to have, as a result of stormwater regulations in affect at the time, reduced post development runoff back to existing condition rates, characterized by a drainage area land use of meadow in good condition (hydrologic soil group C soils).
- Buildings completed between 2004 and 2013 are assumed to have, as a result of stormwater regulations in affect at the time, reduced post development runoff back to existing condition rates, characterized by a drainage area land use of open space in good condition (hydrologic soil group C soils).
- We modeled portions of North Campus which the University developed prior to implementation of a stormwater management ordinance based on actual land use conditions (hydrologic soil group C soils).

- The conceptual design considers, to the extent possible, the layout and depth of existing storm drain and other utilities where/when known.
- The model does not include a pre/post analysis which would consider potential rate increases due to increased capacity conveyance. This would typically be completed as part of final design and permitting.
- AutoDesk Storm and Sanitary Sewer Analysis were utilized for modeling and design. Basin Modeling was considered as follows:
  - SCS TR-20 methodology was used for hydrologic modeling to consider full capture volumes created by typical design events.
  - Time of Concentration values were calculated using sheet flow calculations based on available topographic data and considering a manning's value of 0.240 for dense grass, shallow concentrated flow considering grass channel and open channel flow- pipe flowing full, where applicable impervious area was not separated out for consideration of flash flows which occur in high impervious environment. The approach may underestimate peak flows in some cases. This approach is conservative from the perspective of the case and benefits WCU.
  - Soils Hydrologic Soil Group (HSG) C Many urban areas have experienced significant soil compaction and are better represented as HSG D. HSG D represents less well drained soils and creates more runoff. This approach may underestimate peak flows. However, as it relates to case context, this approach reduces resulting costs benefiting WCU.
  - Land Use CN-Value
    - Open Space Meadow: 71
    - Open Space: 74
    - Impervious: 98

- Drainage area sub-watershed sizes are based on best available information or an estimated project area.
- Storm Drain Modeling Routing Conditions: Steady State.
- 100-year Design Storm- 7.55 Inches

# Appendix C

## Autodesk Storm and Sanitary Analysis

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## Project Description

File Name .................................................. 2021 05 12 WCU Concept SCS.SPF

## Project Options

Flow Units .................................................. CFS
Elevation Type ........................................... Elevation
Hydrology Method ...................................... SCS TR-20
Time of Concentration (TOC) Method ........ SCS TR-55
Link Routing Method .................................. Steady Flow
Enable Overflow Ponding at Nodes ........... YES
Skip Steady State Analysis Time Periods ... NO

## Analysis Options

| | | |
|---|---|---|
| Start Analysis On ....................................... | Feb 23, 2021 | 00:00:00 |
| End Analysis On ......................................... | Feb 23, 2021 | 23:00:00 |
| Start Reporting On ..................................... | Feb 23, 2021 | 00:00:00 |
| Antecedent Dry Days ................................. | 0 | days |
| Runoff (Dry Weather) Time Step ............... | 0 01:00:00 | days hh:mm:ss |
| Runoff (Wet Weather) Time Step .............. | 0 00:05:00 | days hh:mm:ss |
| Reporting Time Step .................................. | 0 00:05:00 | days hh:mm:ss |
| Routing Time Step ...................................... | 300 | seconds |

## Number of Elements

| | Qty |
|---|---|
| Rain Gages ................................................ | 1 |
| Subbasins................................................... | 19 |
| Nodes.......................................................... | 34 |
| *Junctions* ........................................... | 32 |
| *Outfalls* .............................................. | 2 |
| *Flow Diversions* ................................. | 0 |
| *Inlets* .................................................. | 0 |
| *Storage Nodes* .................................. | 0 |
| Links............................................................ | 32 |
| *Channels* ........................................... | 0 |
| *Pipes* ................................................. | 32 |
| *Pumps* ............................................... | 0 |
| *Orifices* ............................................. | 0 |
| *Weirs* ................................................. | 0 |
| *Outlets* ............................................... | 0 |
| Pollutants ................................................... | 0 |
| Land Uses .................................................. | 0 |

## Rainfall Details

| SN | Rain Gage ID | Data Source | Data Source ID | Rainfall Type | Rain Units | State | County | Return Period (years) | Rainfall Depth (inches) | Rainfall Distribution |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | Time Series | NOAA C | Cumulative | inches | | | | | User Defined |



2086a

## Subbasin Summary

| SN | Subbasin ID | Area (ac) | Peak Rate Factor | Weighted Curve Number | Total Rainfall (in) | Total Runoff (in) | Total Runoff Volume (ac-in) | Peak Runoff (cfs) | Time of Concentration (days hh:mm:ss) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | DA A1 | 2.08 | 484.00 | 78.04 | 7.47 | 4.91 | 10.20 | 11.94 | 0 00:09:43 |
| 2 | DA A1.5 | 0.12 | 484.00 | 94.00 | 7.47 | 6.75 | 0.81 | 0.98 | 0 00:06:00 |
| 3 | DA A2 | 2.22 | 484.00 | 82.89 | 7.47 | 5.46 | 12.12 | 13.77 | 0 00:09:58 |
| 4 | DA A3 | 2.24 | 484.00 | 82.84 | 7.47 | 5.45 | 12.21 | 13.31 | 0 00:11:14 |
| 5 | DA B1 | 1.14 | 484.00 | 77.58 | 7.47 | 4.85 | 5.53 | 5.50 | 0 00:14:52 |
| 6 | DA B1.5 | 0.45 | 484.00 | 78.60 | 7.47 | 4.97 | 2.24 | 2.69 | 0 00:08:43 |
| 7 | DA B10 | 2.26 | 484.00 | 83.88 | 7.47 | 5.57 | 12.59 | 12.09 | 0 00:15:21 |
| 8 | DA B11 | 0.77 | 484.00 | 80.16 | 7.47 | 5.15 | 3.96 | 4.55 | 0 00:09:55 |
| 9 | DA B12 | 2.69 | 484.00 | 81.58 | 7.47 | 5.31 | 14.28 | 15.63 | 0 00:11:12 |
| 10 | DA B13 | 2.38 | 484.00 | 89.73 | 7.47 | 6.25 | 14.88 | 14.25 | 0 00:14:08 |
| 11 | DA B14 | 5.71 | 484.00 | 83.54 | 7.47 | 5.53 | 31.59 | 31.95 | 0 00:13:34 |
| 12 | DA B2 | 1.55 | 484.00 | 93.51 | 7.47 | 6.70 | 10.38 | 12.41 | 0 00:06:00 |
| 13 | DA B3 | 14.51 | 484.00 | 83.63 | 7.47 | 5.54 | 80.43 | 77.97 | 0 00:15:00 |
| 14 | DA B4 | 2.60 | 484.00 | 83.07 | 7.47 | 5.48 | 14.24 | 13.86 | 0 00:14:58 |
| 15 | DA B5 | 0.33 | 484.00 | 84.73 | 7.47 | 5.67 | 1.87 | 2.43 | 0 00:06:00 |
| 16 | DA B6 | 0.39 | 484.00 | 73.79 | 7.47 | 4.43 | 1.73 | 2.31 | 0 00:06:18 |
| 17 | DA B7 | 0.70 | 484.00 | 74.00 | 7.47 | 4.45 | 3.12 | 4.19 | 0 00:06:00 |
| 18 | DA B8 | 0.24 | 484.00 | 79.50 | 7.47 | 5.07 | 1.22 | 1.63 | 0 00:06:00 |
| 19 | DA B9 | 1.74 | 484.00 | 88.86 | 7.47 | 6.15 | 10.70 | 10.07 | 0 00:15:00 |

## Node Summary

| SN | Element ID | Element Type | Invert Elevation (ft) | Ground/Rim (Max) Elevation (ft) | Initial Water Elevation (ft) | Surcharge Elevation (ft) | Ponded Area (ft²) | Peak Inflow (cfs) | Max HGL Elevation Attained (ft) | Max Surcharge Depth Attained (ft) | Min Freeboard Attained (ft) | Time of Peak Flooding Occurrence (days hh:mm) | Total Flooded Volume (ac-in) | Total Time Flooded (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S1.01 | Junction | 374.00 | 386.00 | 374.00 | 386.00 | 0.00 | 201.55 | 377.15 | 0.00 | 8.85 | 0 00:00 | 0.00 | 0.00 |
| 2 | S1.02 | Junction | 376.56 | 382.56 | 376.56 | 382.56 | 0.00 | 180.75 | 379.54 | 0.00 | 3.02 | 0 00:00 | 0.00 | 0.00 |
| 3 | S1.03 | Junction | 378.95 | 384.95 | 378.95 | 385.00 | 0.00 | 175.42 | 381.87 | 0.00 | 3.08 | 0 00:00 | 0.00 | 0.00 |
| 4 | S1.04 | Junction | 379.74 | 389.00 | 379.74 | 385.74 | 0.00 | 172.89 | 382.62 | 0.00 | 6.38 | 0 00:00 | 0.00 | 0.00 |
| 5 | S1.05 | Junction | 380.40 | 386.40 | 380.40 | 386.40 | 0.00 | 97.08 | 382.88 | 0.00 | 3.52 | 0 00:00 | 0.00 | 0.00 |
| 6 | S1.06 | Junction | 381.29 | 392.00 | 381.29 | 387.29 | 0.00 | 97.08 | 384.09 | 0.00 | 7.91 | 0 00:00 | 0.00 | 0.00 |
| 7 | S1.07 | Junction | 381.74 | 392.00 | 381.74 | 387.74 | 0.00 | 95.28 | 384.54 | 0.00 | 7.46 | 0 00:00 | 0.00 | 0.00 |
| 8 | S1.08 | Junction | 382.94 | 388.94 | 382.94 | 388.94 | 0.00 | 81.80 | 385.13 | 0.00 | 3.81 | 0 00:00 | 0.00 | 0.00 |
| 9 | S1.09 | Junction | 383.30 | 389.30 | 383.30 | 389.30 | 0.00 | 79.93 | 385.49 | 0.00 | 3.81 | 0 00:00 | 0.00 | 0.00 |
| 10 | S1.10 | Junction | 384.30 | 390.30 | 384.30 | 390.30 | 0.00 | 79.93 | 386.40 | 0.00 | 3.90 | 0 00:00 | 0.00 | 0.00 |
| 11 | S1.11 | Junction | 385.03 | 391.00 | 385.03 | 391.00 | 0.00 | 79.93 | 387.13 | 0.00 | 3.87 | 0 00:00 | 0.00 | 0.00 |
| 12 | S1.12 | Junction | 389.90 | 395.90 | 389.90 | 395.90 | 0.00 | 76.78 | 391.92 | 0.00 | 3.98 | 0 00:00 | 0.00 | 0.00 |
| 13 | S1.13 | Junction | 392.00 | 398.00 | 392.00 | 398.00 | 0.00 | 75.56 | 394.01 | 0.00 | 3.99 | 0 00:00 | 0.00 | 0.00 |
| 14 | S1.14 | Junction | 392.77 | 398.77 | 392.77 | 398.77 | 0.00 | 55.51 | 394.68 | 0.00 | 4.09 | 0 00:00 | 0.00 | 0.00 |
| 15 | S1.15 | Junction | 395.30 | 401.30 | 395.30 | 401.30 | 0.00 | 45.70 | 396.95 | 0.00 | 4.35 | 0 00:00 | 0.00 | 0.00 |
| 16 | S1.16 | Junction | 397.35 | 403.35 | 397.35 | 403.35 | 0.00 | 45.70 | 399.00 | 0.00 | 4.35 | 0 00:00 | 0.00 | 0.00 |
| 17 | S1.17 | Junction | 400.40 | 406.40 | 400.40 | 406.40 | 0.00 | 31.65 | 401.99 | 0.00 | 4.41 | 0 00:00 | 0.00 | 0.00 |
| 18 | S1.18 | Junction | 402.00 | 413.00 | 402.00 | 413.00 | 0.00 | 31.65 | 403.57 | 0.00 | 9.43 | 0 00:00 | 0.00 | 0.00 |
| 19 | S1.19 | Junction | 394.42 | 400.42 | 394.42 | 400.42 | 0.00 | 20.05 | 395.60 | 0.00 | 4.82 | 0 00:00 | 0.00 | 0.00 |
| 20 | S1.20 | Junction | 396.30 | 402.30 | 396.30 | 402.30 | 0.00 | 15.61 | 397.48 | 0.00 | 4.82 | 0 00:00 | 0.00 | 0.00 |
| 21 | S1.21 | Junction | 398.00 | 402.00 | 398.00 | 402.00 | 0.00 | 15.61 | 399.18 | 0.00 | 2.82 | 0 00:00 | 0.00 | 0.00 |
| 22 | S1.22 | Junction | 384.00 | 394.00 | 384.00 | 394.00 | 0.00 | 11.73 | 384.85 | 0.00 | 9.15 | 0 00:00 | 0.00 | 0.00 |
| 23 | S2.01 | Junction | 377.25 | 384.60 | 377.25 | 384.60 | 0.00 | 39.18 | 379.21 | 0.00 | 5.39 | 0 00:00 | 0.00 | 0.00 |
| 24 | S2.02 | Junction | 378.42 | 390.20 | 378.42 | 390.20 | 0.00 | 39.18 | 380.38 | 0.00 | 9.82 | 0 00:00 | 0.00 | 0.00 |
| 25 | S2.03 | Junction | 378.85 | 393.00 | 378.85 | 393.00 | 0.00 | 39.18 | 380.81 | 0.00 | 12.19 | 0 00:00 | 0.00 | 0.00 |
| 26 | S2.05 | Junction | 380.13 | 396.00 | 380.13 | 396.00 | 0.00 | 27.55 | 381.63 | 0.00 | 14.37 | 0 00:00 | 0.00 | 0.00 |
| 27 | S2.06 | Junction | 371.74 | 394.00 | 381.74 | 394.00 | 0.00 | 27.55 | 383.24 | 0.00 | 10.76 | 0 00:00 | 0.00 | 0.00 |
| 28 | S2.07 | Junction | 382.38 | 392.00 | 382.38 | 392.00 | 0.00 | 26.82 | 383.86 | 0.00 | 8.14 | 0 00:00 | 0.00 | 0.00 |
| 29 | S2.08 | Junction | 382.87 | 390.00 | 382.87 | 390.00 | 0.00 | 26.82 | 384.35 | 0.00 | 5.65 | 0 00:00 | 0.00 | 0.00 |
| 30 | S2.09 | Junction | 383.85 | 389.50 | 383.85 | 389.50 | 0.00 | 26.82 | 385.32 | 0.00 | 4.18 | 0 00:00 | 0.00 | 0.00 |
| 31 | S2.10 | Junction | 385.35 | 392.00 | 385.35 | 392.00 | 0.00 | 13.27 | 386.73 | 0.00 | 5.27 | 0 00:00 | 0.00 | 0.00 |
| 32 | S2.11 | Junction | 382.90 | 388.90 | 382.90 | 388.90 | 0.00 | 13.27 | 386.93 | 0.00 | 1.97 | 0 00:00 | 0.00 | 0.00 |
| 33 | Outfall 1 | Outfall | 373.00 | | | | | 201.55 | 376.15 | | | | | |
| 34 | Outfall 2 | Outfall | 373.00 | | | | | 39.18 | 374.00 | | | | | |

## Link Summary

| SN | Element ID | Element Type | From (Inlet) Node | To (Outlet) Node | Length (ft) | Inlet Invert Elevation (ft) | Outlet Invert Elevation (ft) | Average Slope (%) | Diameter or Height (in) | Manning's Roughness | Peak Flow (cfs) | Design Flow Capacity (cfs) | Peak Flow/ Design Flow Ratio | Peak Flow Velocity (ft/sec) | Peak Flow Depth (ft) | Peak Flow Depth/ Total Depth Ratio | Total Time Surcharged (min) | Reported Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | P1.01 | Pipe | S1.01 | Outfall 1 | 66.76 | 374.00 | 373.00 | 1.5000 | 54.000 | 0.0130 | 201.55 | 240.68 | 0.84 | 16.94 | 3.15 | 0.70 | 0.00 | Calculated |
| 2 | P1.02 | Pipe | S1.02 | S1.01 | 183.09 | 376.56 | 374.00 | 1.4000 | 54.000 | 0.0130 | 180.75 | 232.53 | 0.78 | 16.16 | 2.98 | 0.66 | 0.00 | Calculated |
| 3 | P1.03 | Pipe | S1.03 | S1.02 | 170.47 | 378.95 | 376.56 | 1.4000 | 54.000 | 0.0130 | 175.42 | 232.85 | 0.75 | 16.08 | 2.92 | 0.65 | 0.00 | Calculated |
| 4 | P1.04 | Pipe | S1.04 | S1.03 | 56.03 | 379.74 | 378.95 | 1.4100 | 54.000 | 0.0130 | 172.89 | 233.50 | 0.74 | 16.07 | 2.88 | 0.64 | 0.00 | Calculated |
| 5 | P1.05 | Pipe | S1.05 | S1.04 | 64.98 | 380.40 | 379.74 | 1.0200 | 48.000 | 0.0130 | 97.08 | 144.77 | 0.67 | 12.34 | 2.40 | 0.60 | 0.00 | Calculated |
| 6 | P1.06 | Pipe | S1.06 | S1.05 | 97.20 | 381.29 | 380.40 | 0.9200 | 48.000 | 0.0130 | 97.08 | 137.45 | 0.71 | 11.85 | 2.48 | 0.62 | 0.00 | Calculated |
| 7 | P1.07 | Pipe | S1.07 | S1.06 | 47.82 | 381.74 | 381.29 | 0.9400 | 42.000 | 0.0130 | 95.28 | 97.60 | 0.98 | 11.55 | 2.80 | 0.80 | 0.00 | Calculated |
| 8 | P1.08 | Pipe | S1.08 | S1.07 | 86.34 | 382.94 | 381.74 | 1.3900 | 42.000 | 0.0130 | 81.80 | 118.61 | 0.69 | 13.29 | 2.14 | 0.61 | 0.00 | Calculated |
| 9 | P1.09 | Pipe | S1.09 | S1.08 | 29.24 | 383.30 | 382.94 | 1.2300 | 42.000 | 0.0130 | 79.93 | 111.64 | 0.72 | 12.61 | 2.19 | 0.63 | 0.00 | Calculated |
| 10 | P1.10 | Pipe | S1.10 | S1.09 | 68.28 | 384.30 | 383.30 | 1.4600 | 42.000 | 0.0130 | 79.93 | 121.76 | 0.66 | 13.49 | 2.07 | 0.59 | 0.00 | Calculated |
| 11 | P1.11 | Pipe | S1.11 | S1.10 | 52.03 | 385.03 | 384.30 | 1.4000 | 42.000 | 0.0130 | 79.93 | 119.17 | 0.67 | 13.27 | 2.10 | 0.60 | 0.00 | Calculated |
| 12 | P1.12 | Pipe | S1.12 | S1.11 | 135.23 | 389.90 | 385.03 | 3.6000 | 30.000 | 0.0130 | 76.78 | 77.84 | 0.99 | 18.07 | 2.02 | 0.81 | 0.00 | Calculated |
| 13 | P1.13 | Pipe | S1.13 | S1.12 | 59.72 | 392.00 | 389.90 | 3.5200 | 30.000 | 0.0130 | 75.56 | 76.92 | 0.98 | 17.85 | 2.01 | 0.80 | 0.00 | Calculated |
| 14 | P1.14 | Pipe | S1.14 | S1.13 | 36.49 | 392.77 | 392.00 | 2.1100 | 30.000 | 0.0130 | 55.51 | 59.58 | 0.93 | 13.78 | 1.91 | 0.76 | 0.00 | Calculated |
| 15 | P1.15 | Pipe | S1.15 | S1.14 | 119.79 | 395.30 | 392.77 | 2.1100 | 30.000 | 0.0130 | 45.70 | 59.61 | 0.77 | 13.38 | 1.64 | 0.66 | 0.00 | Calculated |
| 16 | P1.16 | Pipe | S1.16 | S1.15 | 98.60 | 397.35 | 395.30 | 2.0800 | 30.000 | 0.0130 | 45.70 | 59.14 | 0.77 | 13.30 | 1.65 | 0.66 | 0.00 | Calculated |
| 17 | P1.17 | Pipe | S1.17 | S1.16 | 146.13 | 400.40 | 397.35 | 2.0900 | 24.000 | 0.0130 | 31.65 | 32.68 | 0.97 | 11.84 | 1.59 | 0.79 | 0.00 | Calculated |
| 18 | P1.18 | Pipe | S1.18 | S1.17 | 74.66 | 402.00 | 400.40 | 2.1400 | 24.000 | 0.0130 | 31.65 | 33.12 | 0.96 | 11.99 | 1.57 | 0.78 | 0.00 | Calculated |
| 19 | P1.19 | Pipe | S1.19 | S1.13 | 98.76 | 394.42 | 392.00 | 2.4500 | 24.000 | 0.0130 | 20.05 | 35.41 | 0.57 | 11.62 | 1.08 | 0.54 | 0.00 | Calculated |
| 20 | P1.20 | Pipe | S1.20 | S1.19 | 78.24 | 396.30 | 394.42 | 2.4000 | 18.000 | 0.0130 | 15.61 | 16.28 | 0.96 | 10.49 | 1.18 | 0.79 | 0.00 | Calculated |
| 21 | P1.21 | Pipe | S1.21 | S1.20 | 71.46 | 398.00 | 396.30 | 2.3800 | 18.000 | 0.0130 | 15.61 | 16.20 | 0.96 | 10.44 | 1.18 | 0.79 | 0.00 | Calculated |
| 22 | P1.22 | Pipe | S1.22 | S1.01 | 299.67 | 384.00 | 374.00 | 3.3400 | 18.000 | 0.0130 | 11.73 | 19.19 | 0.61 | 11.39 | 0.85 | 0.57 | 0.00 | Calculated |
| 23 | P2.01 | Pipe | S2.01 | Outfall 2 | 70.50 | 373.71 | 373.00 | 1.0100 | 36.000 | 0.0130 | 39.18 | 163.76 | 0.24 | 19.00 | 1.00 | 0.33 | 0.00 | Calculated |
| 24 | P2.02 | Pipe | S2.02 | S2.01 | 117.10 | 378.42 | 377.25 | 1.0000 | 30.000 | 0.0130 | 39.18 | 41.00 | 0.96 | 9.50 | 1.96 | 0.78 | 0.00 | Calculated |
| 25 | P2.03 | Pipe | S2.03 | S2.02 | 43.21 | 378.85 | 378.42 | 1.0000 | 30.000 | 0.0130 | 39.18 | 40.92 | 0.96 | 9.49 | 1.96 | 0.78 | 0.00 | Calculated |
| 26 | P2.04 | Pipe | S2.05 | S2.03 | 127.13 | 380.13 | 378.85 | 1.0100 | 30.000 | 0.0130 | 27.55 | 41.16 | 0.67 | 8.98 | 1.50 | 0.60 | 0.00 | Calculated |
| 27 | P2.06 | Pipe | S2.06 | S2.05 | 161.78 | 381.74 | 380.13 | 1.0000 | 30.000 | 0.0130 | 27.55 | 40.92 | 0.67 | 8.94 | 1.50 | 0.60 | 0.00 | Calculated |
| 28 | P2.07 | Pipe | S2.07 | S2.06 | 63.62 | 382.38 | 381.74 | 1.0100 | 30.000 | 0.0130 | 26.82 | 41.14 | 0.65 | 8.92 | 1.47 | 0.59 | 0.00 | Calculated |
| 29 | P2.08 | Pipe | S2.08 | S2.07 | 49.15 | 382.87 | 382.38 | 1.0000 | 30.000 | 0.0130 | 26.82 | 40.95 | 0.65 | 8.89 | 1.48 | 0.59 | 0.00 | Calculated |
| 30 | P2.09 | Pipe | S2.09 | S2.08 | 97.65 | 383.85 | 382.87 | 1.0000 | 30.000 | 0.0130 | 26.82 | 41.09 | 0.65 | 8.91 | 1.47 | 0.59 | 0.00 | Calculated |
| 31 | P2.10 | Pipe | S2.10 | S2.09 | 149.69 | 385.35 | 383.53 | 1.2200 | 24.000 | 0.0130 | 13.27 | 22.65 | 0.59 | 7.49 | 1.10 | 0.55 | 0.00 | Calculated |
| 32 | P2.11 | Pipe | S2.11 | S2.10 | 39.49 | 385.55 | 385.35 | 0.5100 | 24.000 | 0.0130 | 13.27 | 16.10 | 0.82 | 5.72 | 1.38 | 0.69 | 0.00 | Calculated |

# Subbasin Hydrology

## Subbasin : DA A1

### Input Data

Area (ac) ........................................................................ 2.08
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 78.04
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| Paved parking & roofs | 0.35 | C | 98.00 |
| > 75% grass cover, Good | 1.73 | C | 74.00 |
| Composite Area & Weighted CN | 2.08 | | 78.04 |

### Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | .240 | 0.00 |
| Flow Length (ft) : | 100 | 100 | 0.00 |
| Slope (%) : | 6.67 | 6.67 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 3.26 | 0.00 |
| Velocity (ft/sec) : | 0.19 | 0.19 | 0.00 |
| Computed Flow Time (min) : | 8.73 | 8.73 | 0.00 |

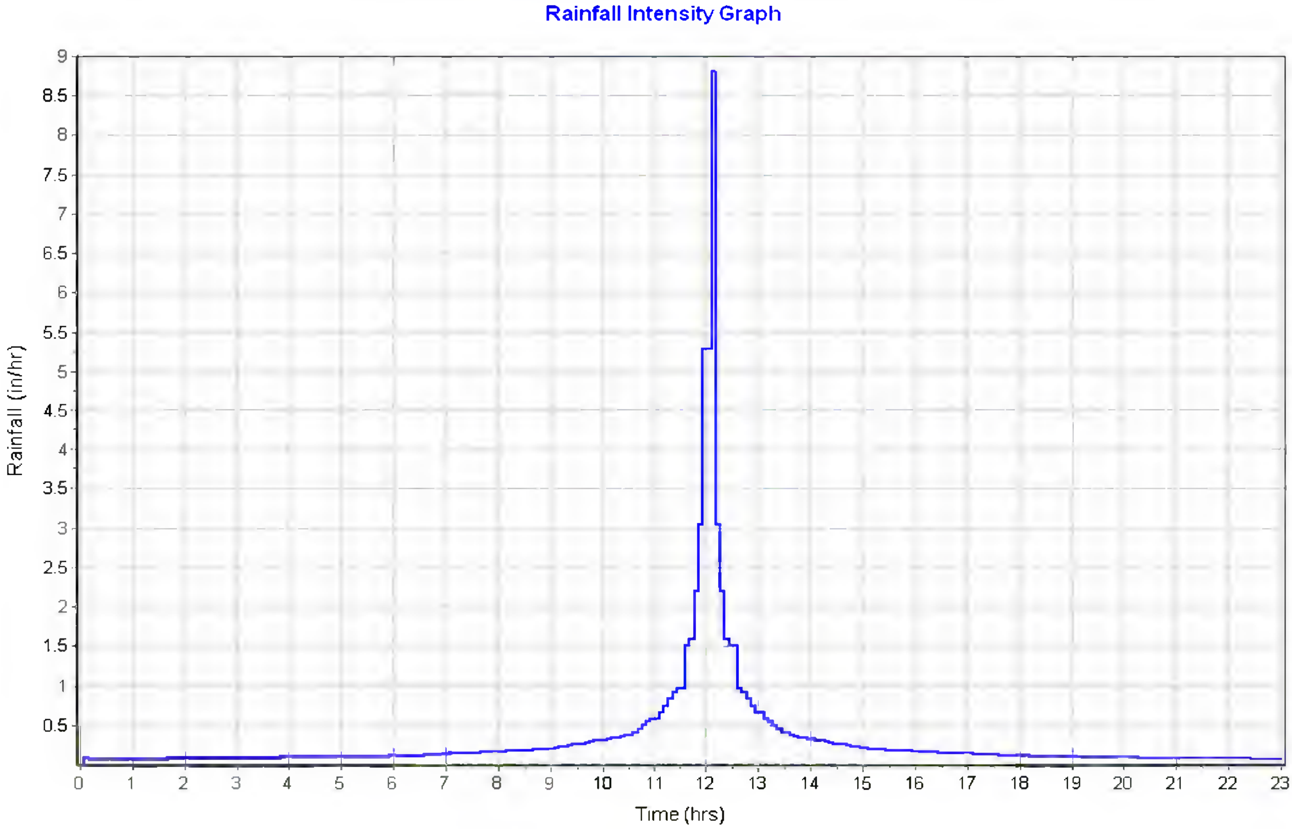
| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 230 | 230 | 0.00 |
| Slope (%) : | 6.67 | 6.67 | 0.00 |
| Surface Type : | Grassed waterway | Grassed waterway | Unpaved |
| Velocity (ft/sec) : | 3.87 | 3.87 | 0.00 |
| Computed Flow Time (min) : | 0.99 | 0.99 | 0.00 |

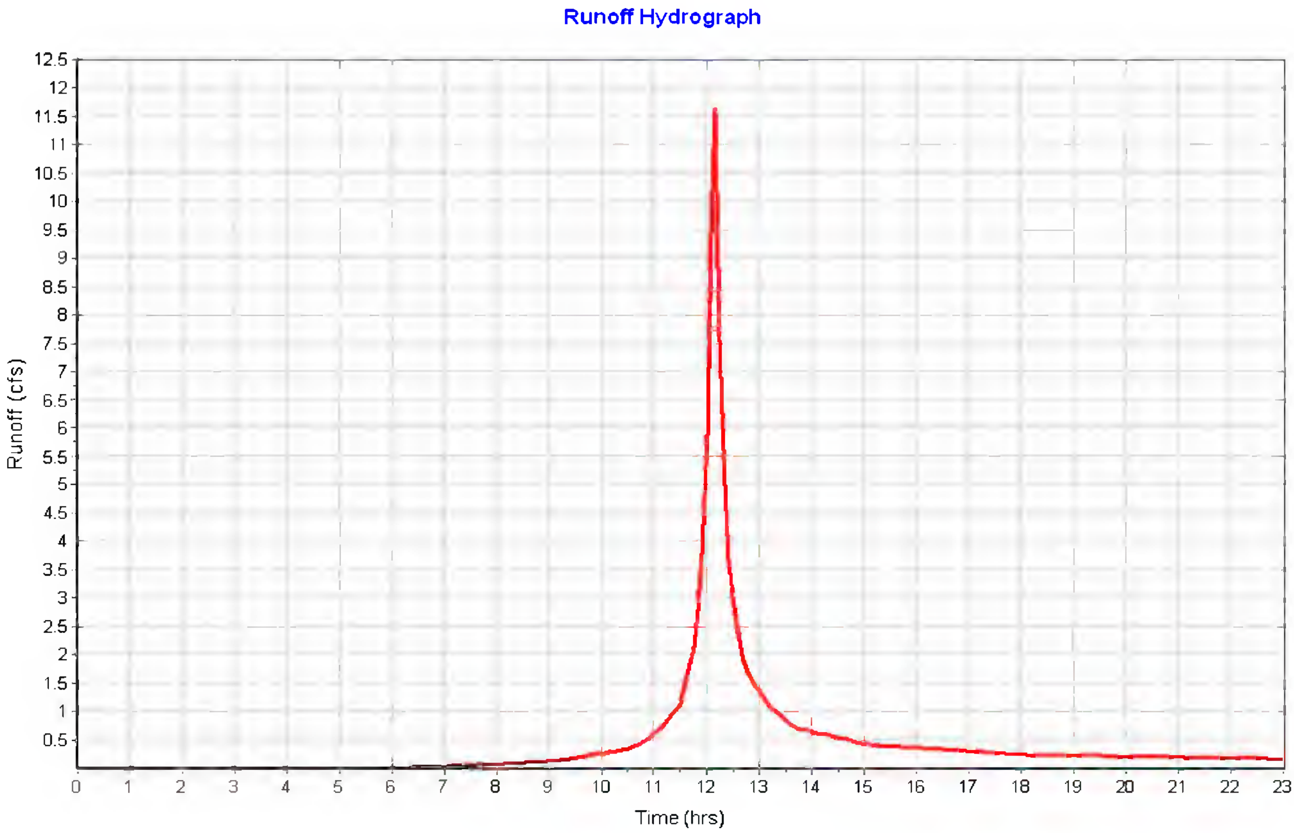
Total TOC (min) ..................9.72

### Subbasin Runoff Results

Total Rainfall (in) ........................................................... 7.47
Total Runoff (in) ............................................................. 4.91
Peak Runoff (cfs) ........................................................... 11.94
Weighted Curve Number ............................................... 78.04
Time of Concentration (days hh:mm:ss) ........................ 0 00:09:43

Subbasin : DA A1



## Subbasin : DA A1.5

### Input Data

Area (ac) ........................................................................ 0.12
Peak Rate Factor ............................................................ 484.00
Weighted Curve Number ................................................ 94.00
Rain Gage ID .................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.02 | C | 74.00 |
| Paved parking & roofs | 0.10 | C | 98.00 |
| Composite Area & Weighted CN | 0.12 | | 94.00 |

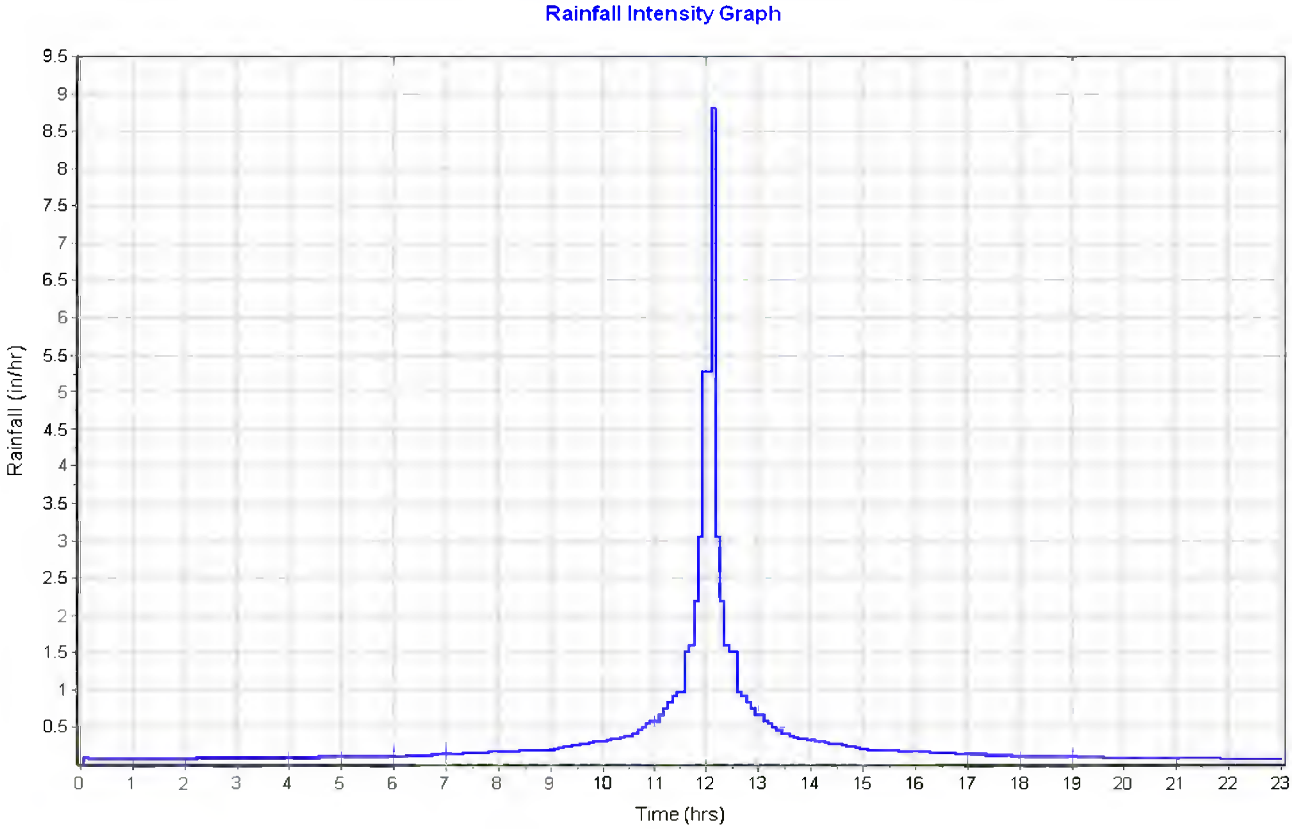
### Time of Concentration

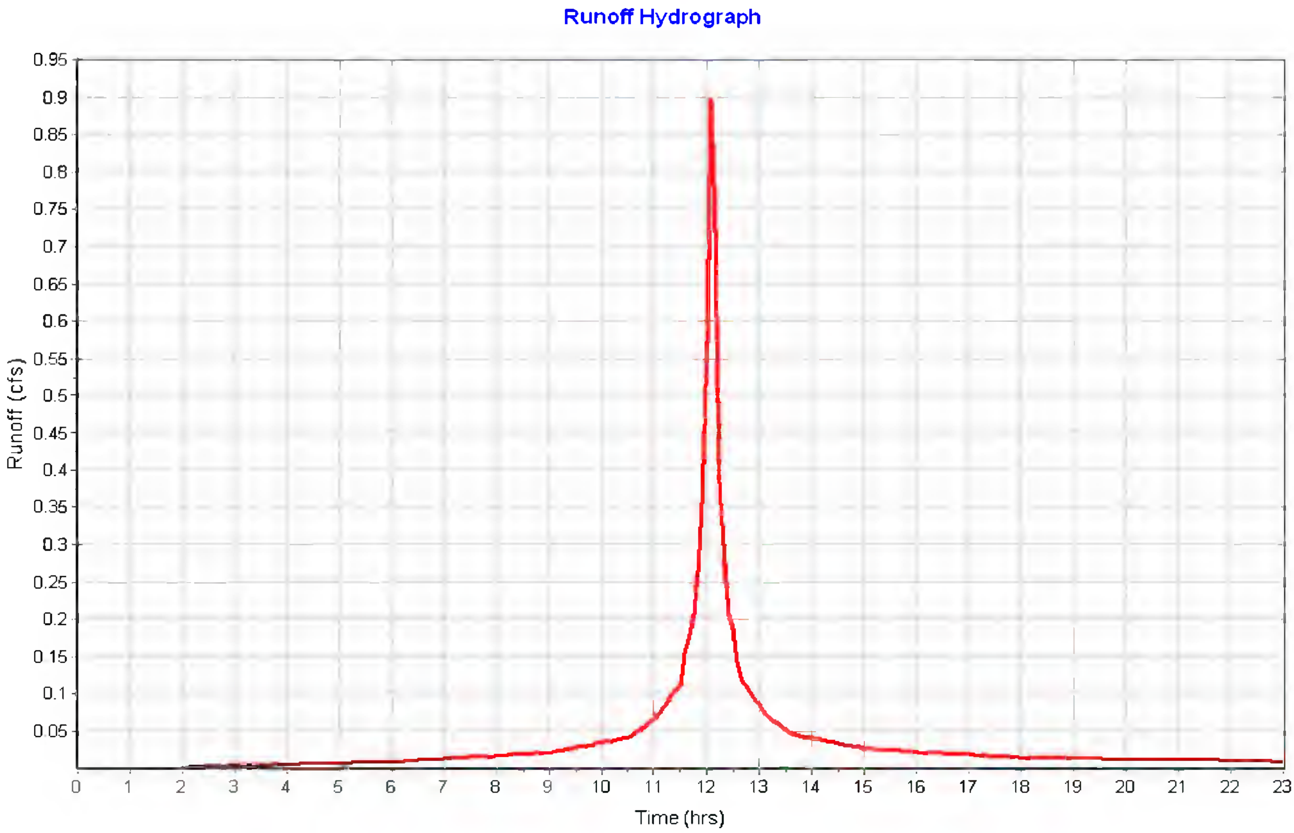
User-Defined TOC override (minutes): 6

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) .............................................................. 6.75
Peak Runoff (cfs) ............................................................ 0.98
Weighted Curve Number ................................................ 94.00
Time of Concentration (days hh:mm:ss) ......................... 0 00:06:00

**Subbasin : DA A1.5**



## Subbasin : DA A2

### Input Data

Area (ac) .......................................................................... 2.22
Peak Rate Factor ............................................................. 484.00
Weighted Curve Number ................................................. 82.89
Rain Gage ID .................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 1.33 | C | 74.00 |
| Paved parking & roofs | 0.83 | C | 98.00 |
| Meadow, non-grazed | 0.06 | C | 71.00 |
| Composite Area & Weighted CN | 2.22 | | 82.89 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 7 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.19 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 8.57 | 0.00 | 0.00 |

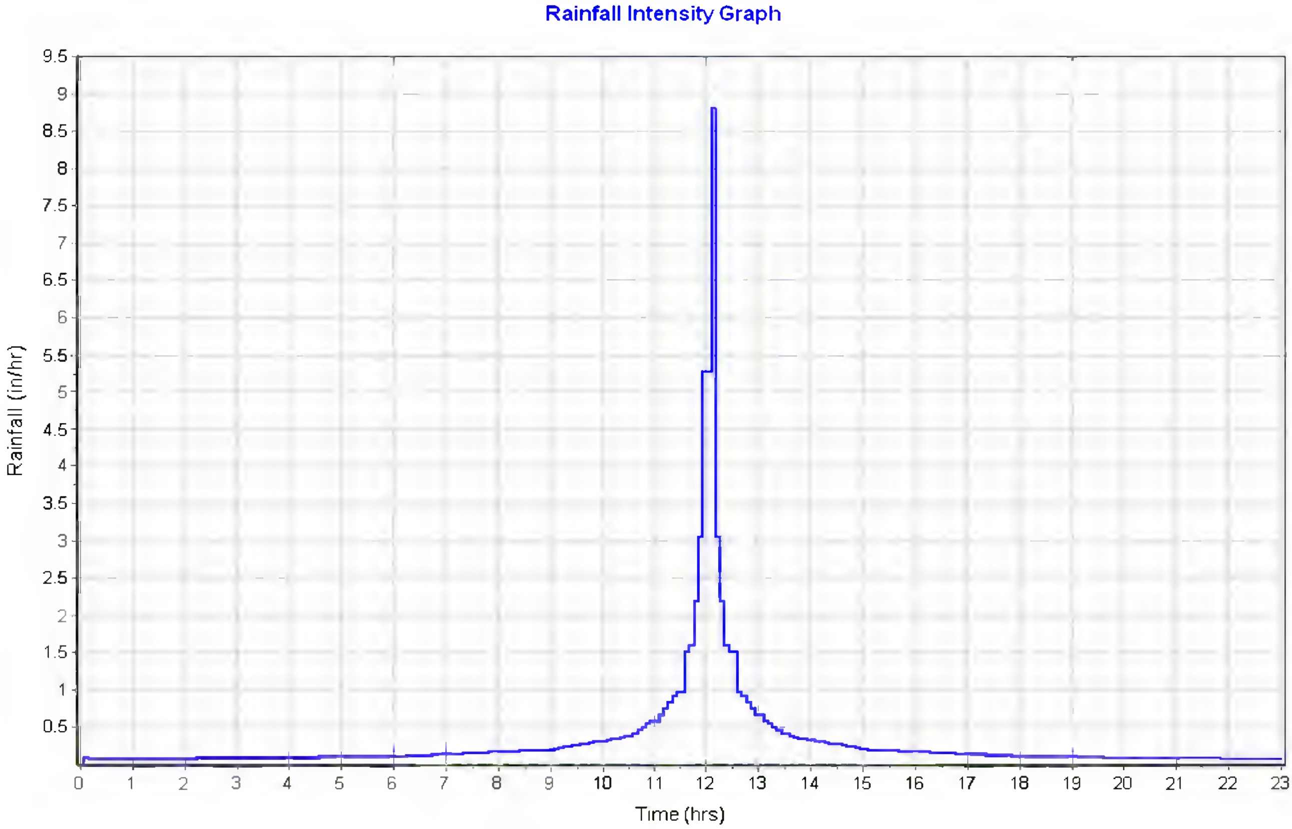
| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 235 | 0.00 | 0.00 |
| Slope (%) : | 3.4 | 0.00 | 0.00 |
| Surface Type : | Grassed waterway | Unpaved | Unpaved |
| Velocity (ft/sec) : | 2.77 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 1.41 | 0.00 | 0.00 |

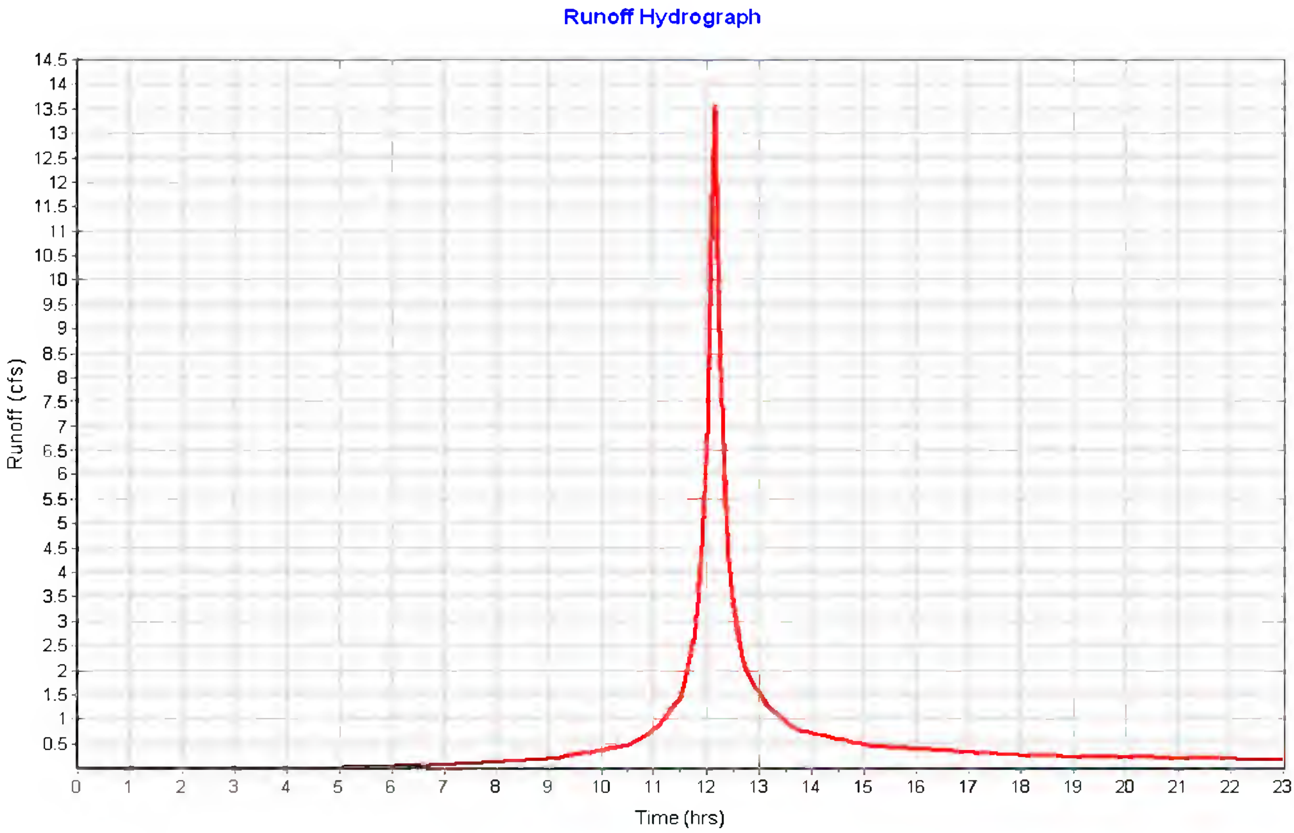
Total TOC (min) ..................9.98

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.46
Peak Runoff (cfs) ............................................................ 13.77
Weighted Curve Number ................................................ 82.89
Time of Concentration (days hh:mm:ss) ........................ 0 00:09:59

**Subbasin : DA A2**






2096a

## Subbasin : DA A3

### Input Data

Area (ac) .......................................................................... 2.24
Peak Rate Factor .............................................................. 484.00
Weighted Curve Number ................................................ 82.84
Rain Gage ID .................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 1.37 | C | 74.00 |
| Paved parking & roofs | 0.83 | C | 98.00 |
| Meadow, non-grazed | 0.04 | C | 71.00 |
| Composite Area & Weighted CN | 2.24 | | 82.84 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 4.5 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.16 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 10.22 | 0.00 | 0.00 |

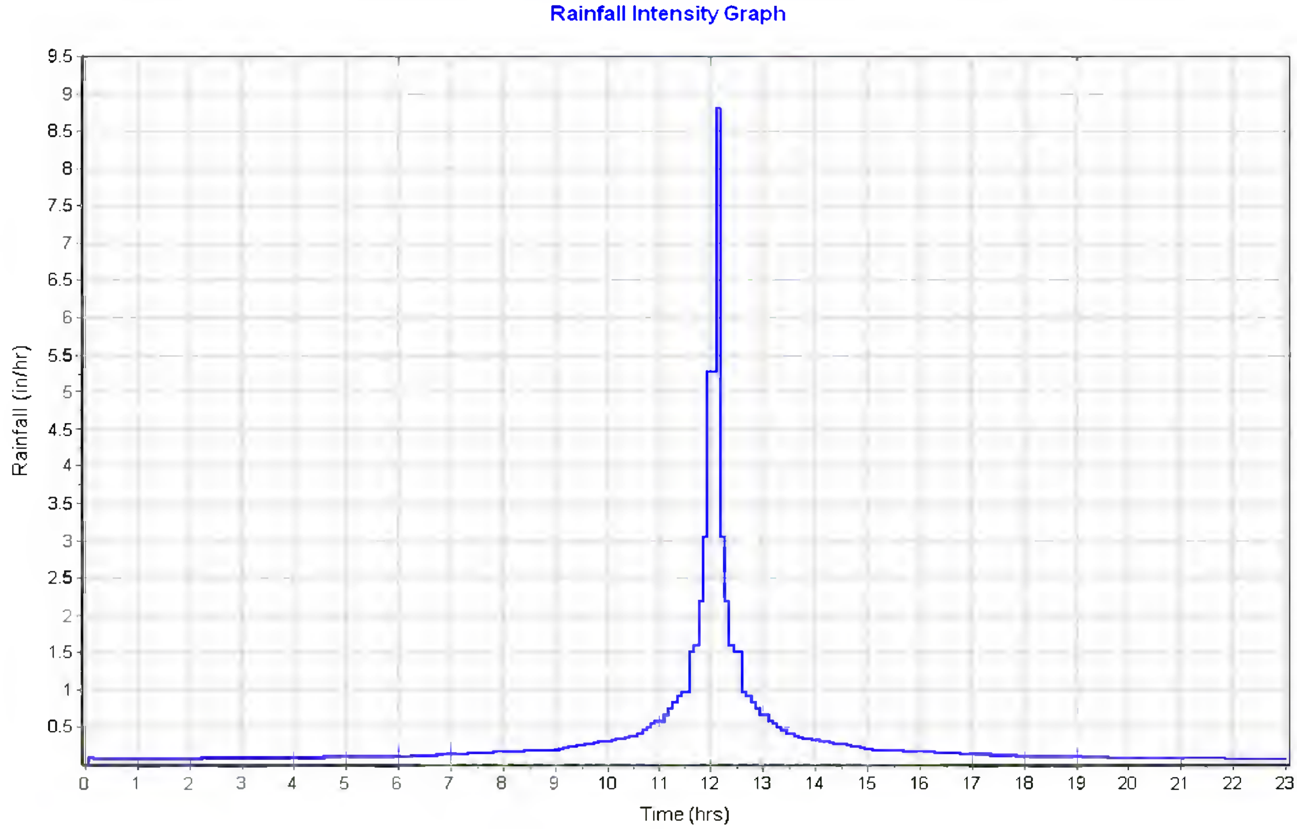
| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 209 | 0.00 | 0.00 |
| Slope (%) : | 5.2 | 0.00 | 0.00 |
| Surface Type : | Grassed waterway | Unpaved | Unpaved |
| Velocity (ft/sec) : | 3.42 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 1.02 | 0.00 | 0.00 |

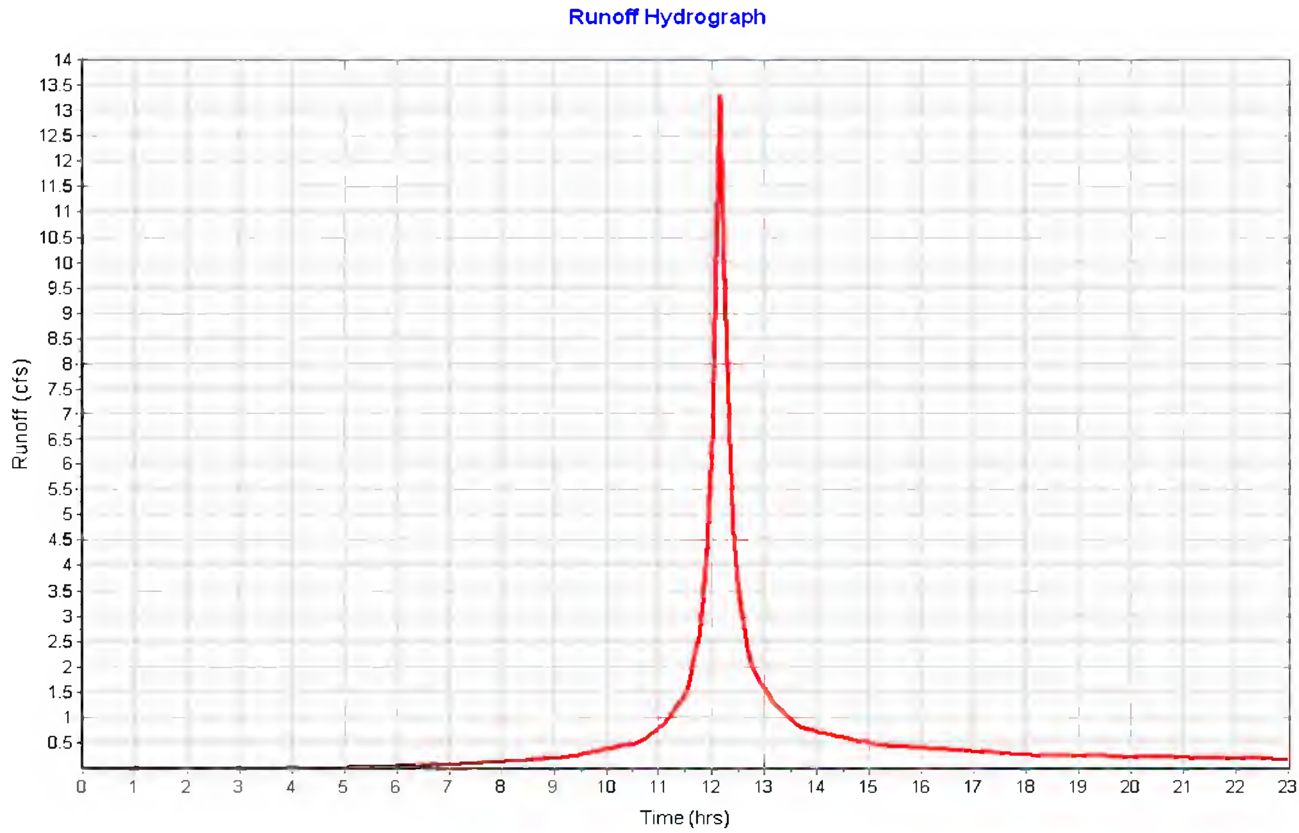
Total TOC (min) ..................11.24

### Subbasin Runoff Results

Total Rainfall (in) ........................................................... 7.47
Total Runoff (in) ............................................................. 5.45
Peak Runoff (cfs) ............................................................ 13.31
Weighted Curve Number ................................................ 82.84
Time of Concentration (days hh:mm:ss) ......................... 0 00:11:14

Subbasin : DA A3



## Subbasin : DA B1

### Input Data

Area (ac) ........................................................................ 1.14
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 77.58
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.97 | C | 74.00 |
| Paved roads with curbs & sewers | 0.17 | C | 98.00 |
| Composite Area & Weighted CN | 1.14 | | 77.58 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 2 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.12 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 14.14 | 0.00 | 0.00 |

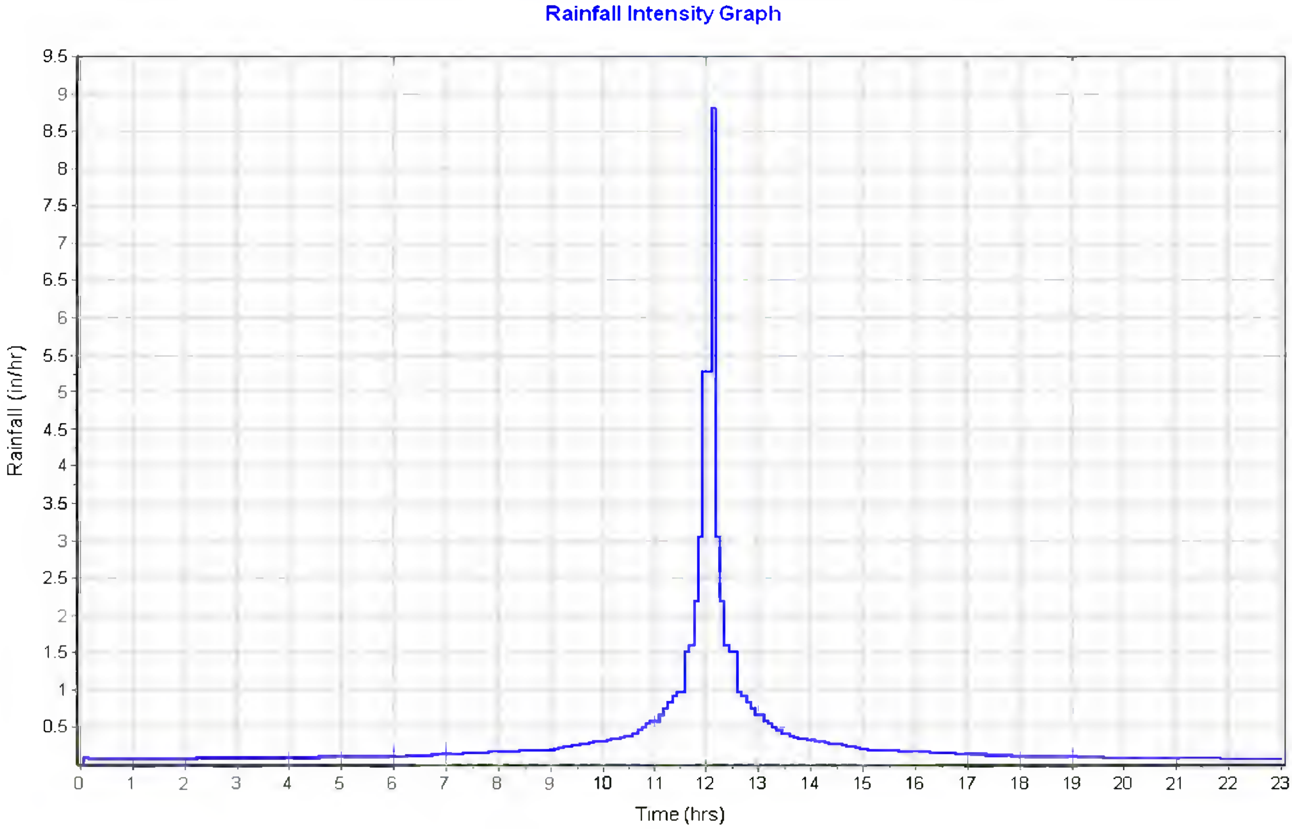
| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 120 | 0.00 | 0.00 |
| Slope (%) : | 3.33 | 0.00 | 0.00 |
| Surface Type : | Grassed waterway | Unpaved | Unpaved |
| Velocity (ft/sec) : | 2.74 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 0.73 | 0.00 | 0.00 |

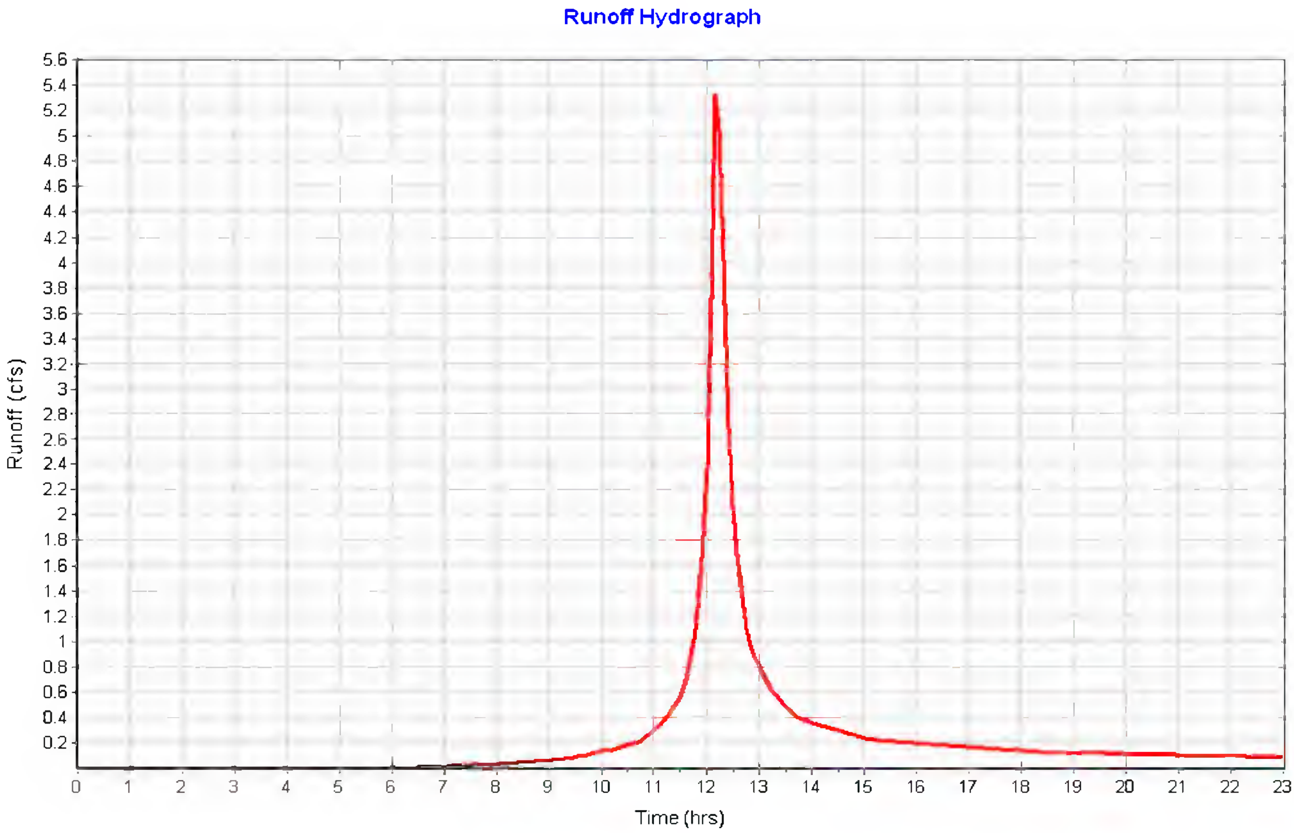
Total TOC (min) ..................14.87

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 4.85
Peak Runoff (cfs) ........................................................... 5.50
Weighted Curve Number ............................................... 77.58
Time of Concentration (days hh:mm:ss) ........................ 0 00:14:52

**Subbasin : DA B1**






2100a

## Subbasin : DA B1.5

### Input Data

Area (ac) ........................................................................ 0.45
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 78.60
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.33 | C | 74.00 |
| Paved roads with curbs & sewers | 0.09 | C | 98.00 |
| Meadow, non-grazed | 0.03 | C | 71.00 |
| Composite Area & Weighted CN | 0.45 | | 78.60 |

### Time of Concentration

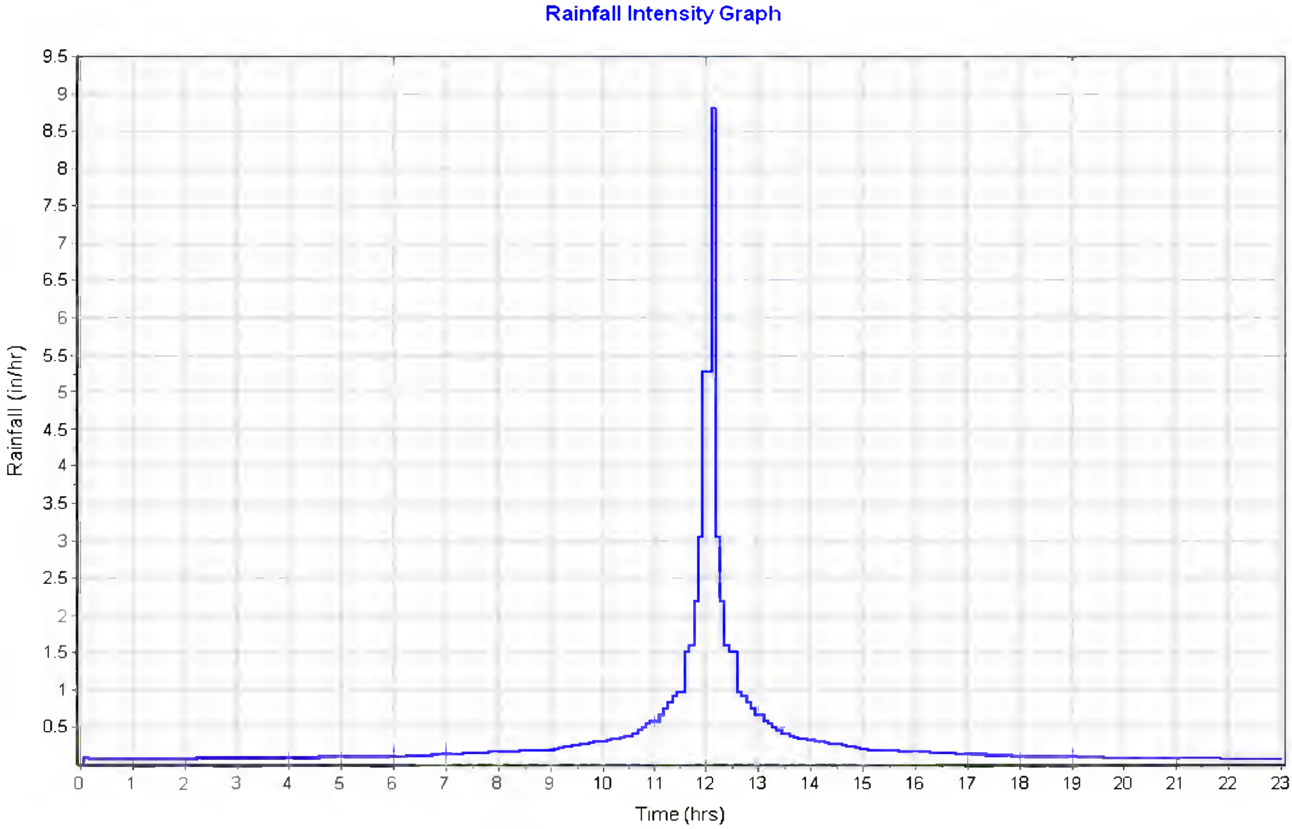
| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 67 | 0.00 | 0.00 |
| Slope (%) : | 3 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.13 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 8.73 | 0.00 | 0.00 |

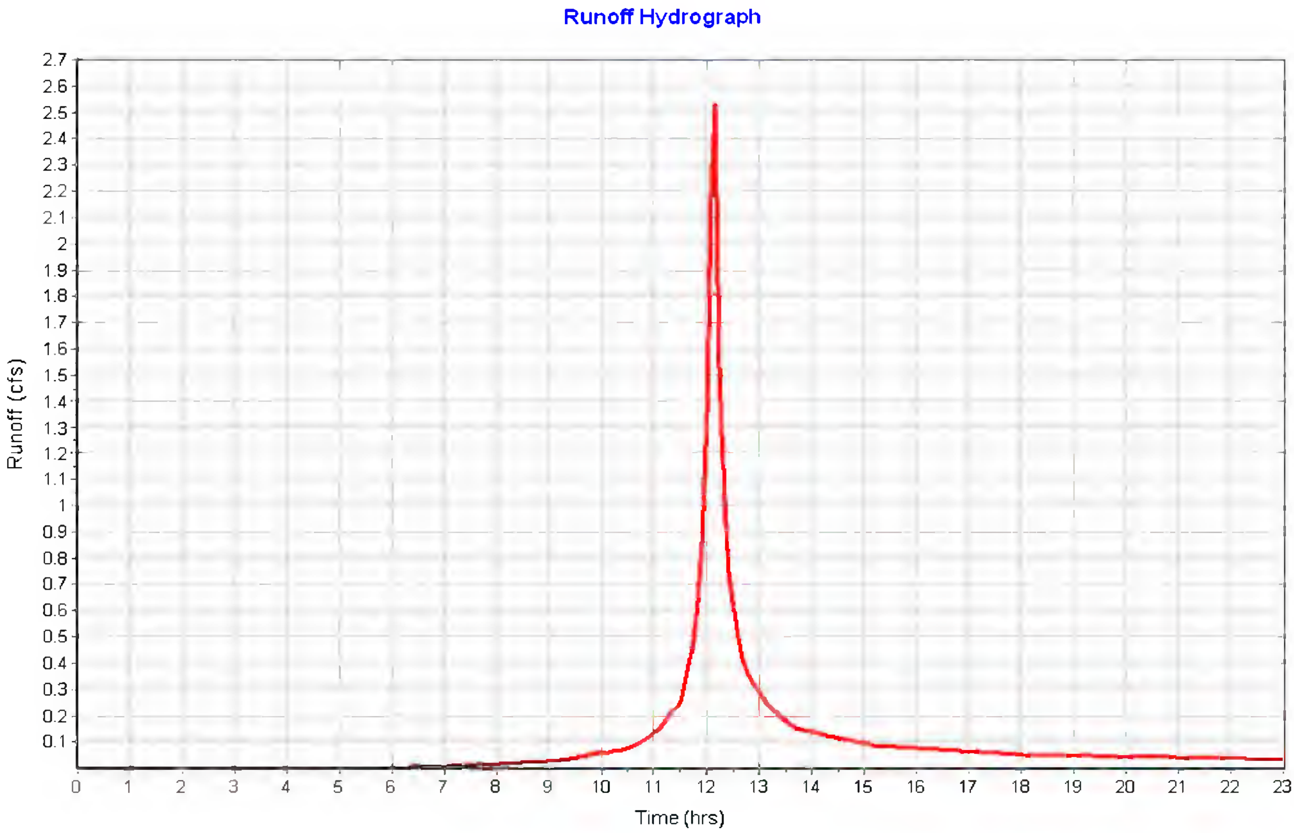
Total TOC (min) ..................8.73

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 4.97
Peak Runoff (cfs) ........................................................... 2.69
Weighted Curve Number ............................................... 78.60
Time of Concentration (days hh:mm:ss) ........................ 0 00:08:44

**Subbasin : DA B1.5**






2102a

## Subbasin : DA B10

### Input Data

Area (ac) ........................................................................ 2.26
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 83.88
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 1.33 | C | 74.00 |
| Paved roads with curbs & sewers | 0.93 | C | 98.00 |
| Composite Area & Weighted CN | 2.26 | | 83.88 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 2.5 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.13 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 12.93 | 0.00 | 0.00 |

| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 96 | 0.00 | 0.00 |
| Slope (%) : | 2.5 | 0.00 | 0.00 |
| Surface Type : | Grassed waterway | Unpaved | Unpaved |
| Velocity (ft/sec) : | 2.37 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 0.68 | 0.00 | 0.00 |

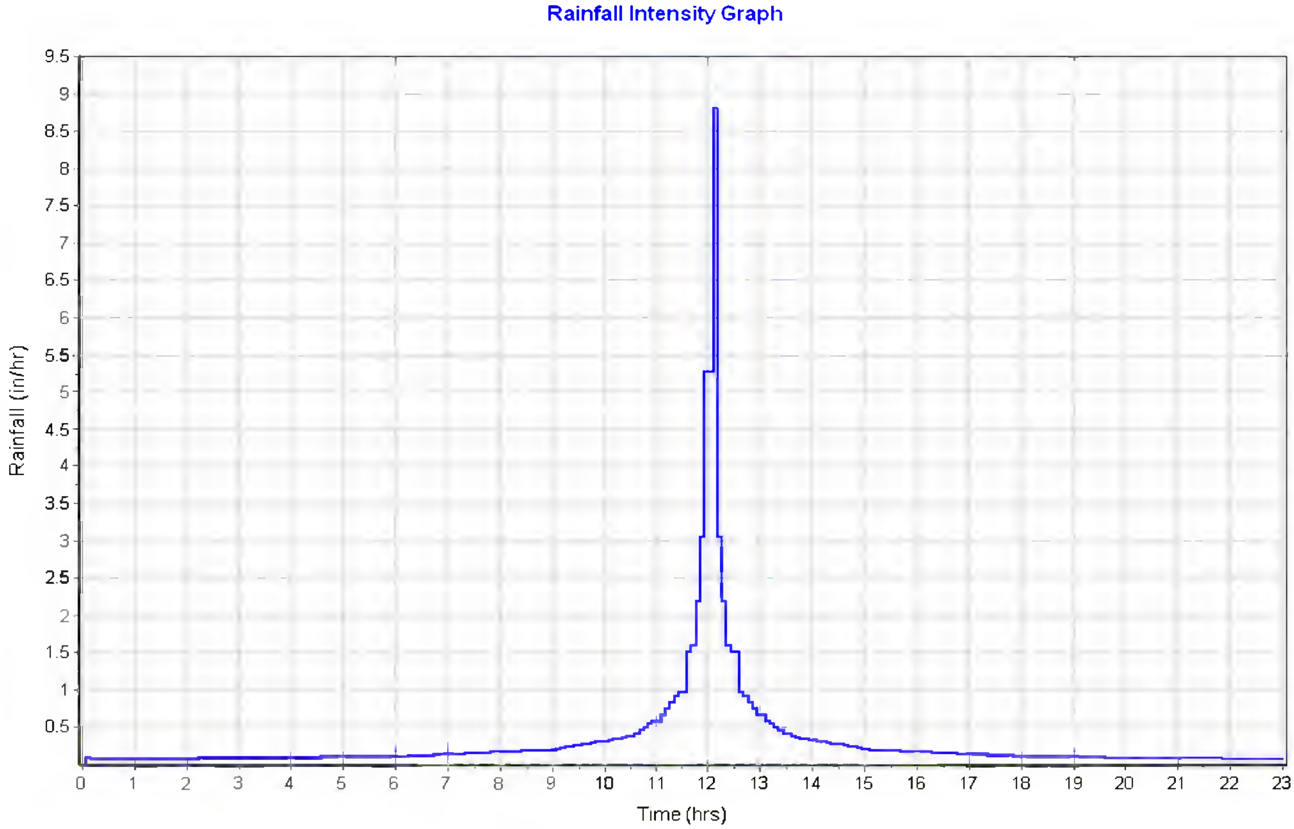
| Channel Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .013 | 0.00 | 0.00 |
| Flow Length (ft) : | 954 | 0.00 | 0.00 |
| Channel Slope (%) : | 4 | 0.00 | 0.00 |
| Cross Section Area ($ft^2$) : | .785 | 0.00 | 0.00 |
| Wetted Perimeter (ft) : | 3.14 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 9.10 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 1.75 | 0.00 | 0.00 |

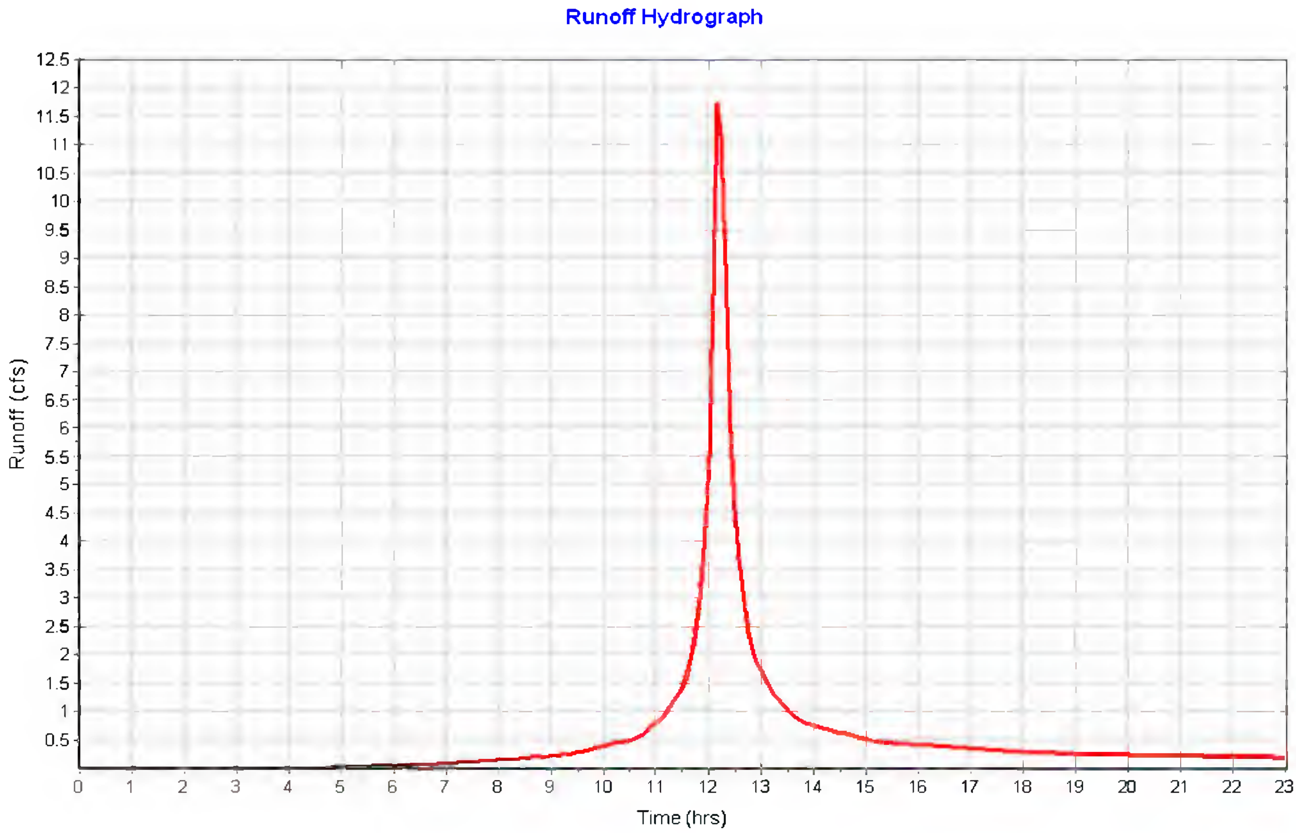
Total TOC (min) ..................15.35

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.57
Peak Runoff (cfs) ........................................................... 12.09
Weighted Curve Number ............................................... 83.88
Time of Concentration (days hh:mm:ss) ........................ 0 00:15:21

**Subbasin : DA B10**



## Subbasin : DA B11

### Input Data

Area (ac) ........................................................................ 0.77
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 80.16
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.55 | C | 74.00 |
| Paved roads with curbs & sewers | 0.20 | C | 98.00 |
| Meadow, non-grazed | 0.02 | C | 71.00 |
| Composite Area & Weighted CN | 0.77 | | 80.16 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 85 | 0.00 | 0.00 |
| Slope (%) : | 3.5 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.14 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 9.92 | 0.00 | 0.00 |

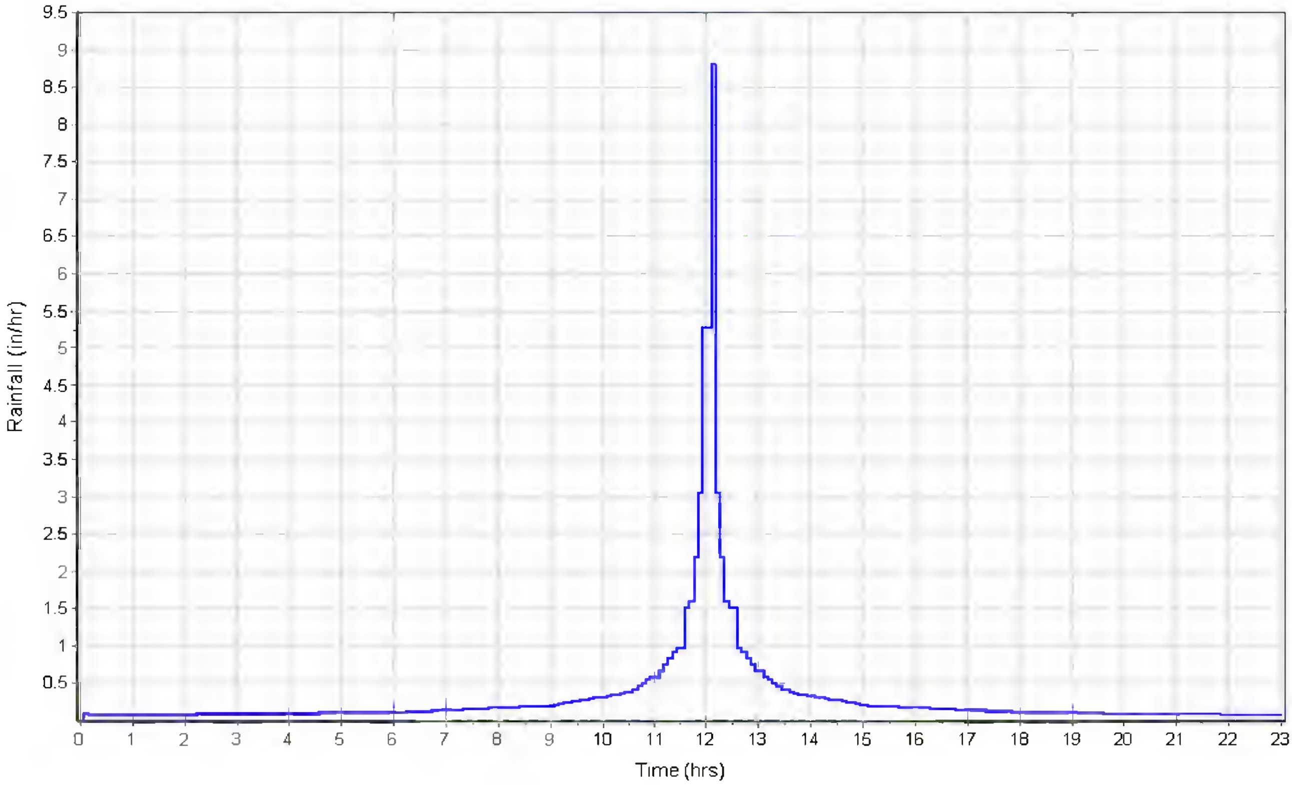
Total TOC (min) ..................9.92

### Subbasin Runoff Results

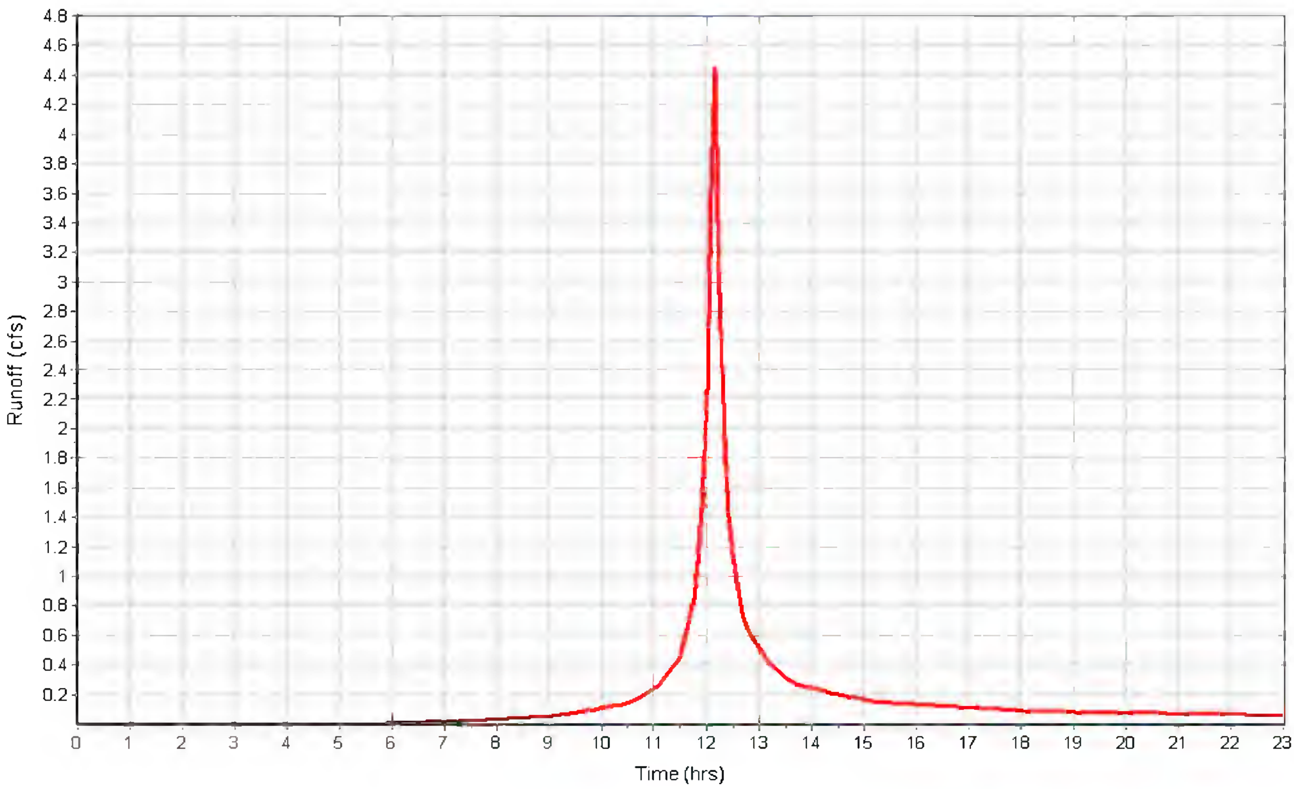
Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.15
Peak Runoff (cfs) ............................................................ 4.55
Weighted Curve Number ............................................... 80.16
Time of Concentration (days hh:mm:ss) ........................ 0 00:09:55

**Subbasin : DA B11**

Rainfall Intensity Graph




Runoff Hydrograph



## Subbasin : DA B12

### Input Data

Area (ac) ........................................................................ 2.69
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 81.58
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 1.84 | C | 74.00 |
| Paved roads with curbs & sewers | 0.85 | C | 98.00 |
| Composite Area & Weighted CN | 2.69 | | 81.58 |

### Time of Concentration

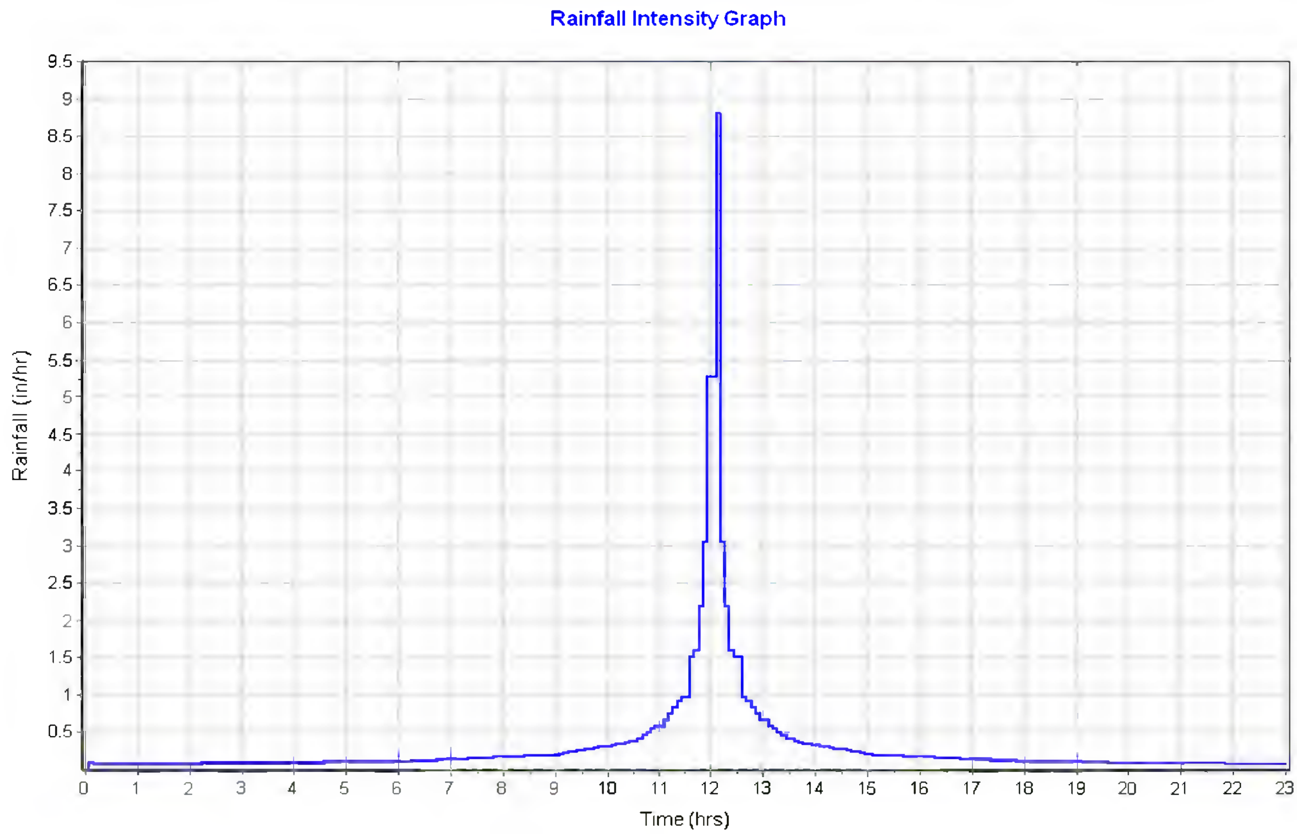
| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 82 | 0.00 | 0.00 |
| Slope (%) : | 2.4 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.12 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 11.21 | 0.00 | 0.00 |

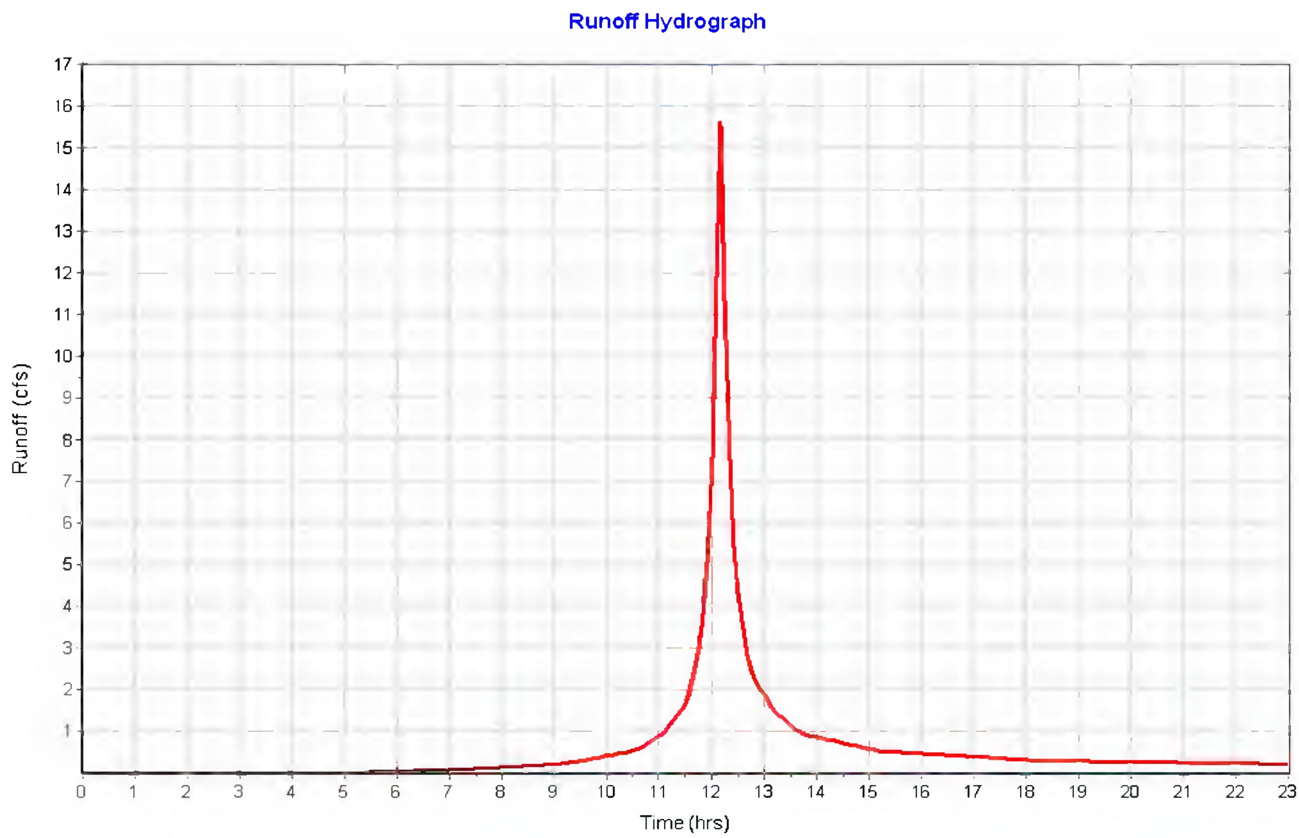
Total TOC (min) ..................11.21

### Subbasin Runoff Results

Total Rainfall (in) ........................................................... 7.47
Total Runoff (in) ............................................................. 5.31
Peak Runoff (cfs) ........................................................... 15.63
Weighted Curve Number ............................................... 81.58
Time of Concentration (days hh:mm:ss) ........................ 0 00:11:13

**Subbasin : DA B12**



## Subbasin : DA B13

### Input Data

Area (ac) ........................................................................ 2.38
Peak Rate Factor ............................................................ 484.00
Weighted Curve Number ................................................ 89.73
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.82 | C | 74.00 |
| Paved roads with curbs & sewers | 1.56 | C | 98.00 |
| Composite Area & Weighted CN | 2.38 | | 89.73 |

### Time of Concentration

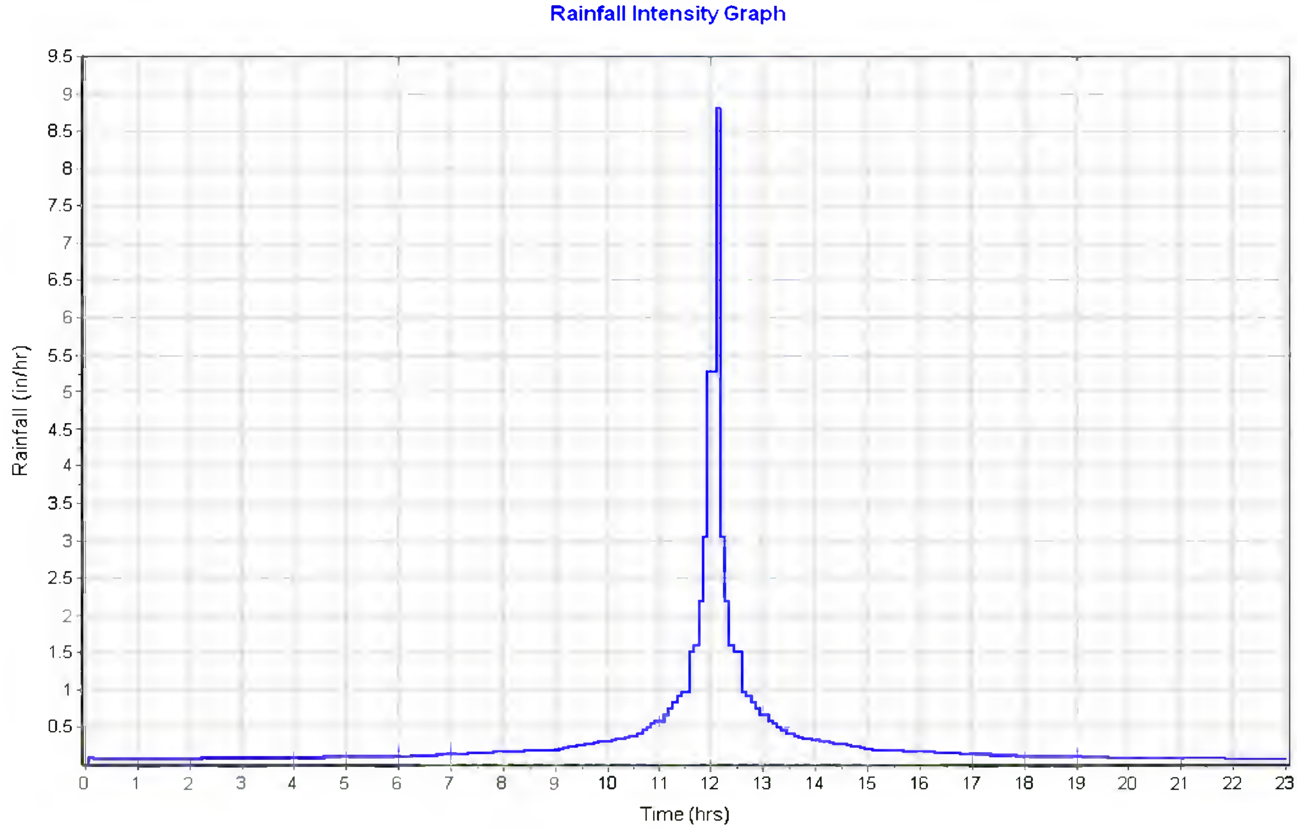
| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 2 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.12 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 14.14 | 0.00 | 0.00 |

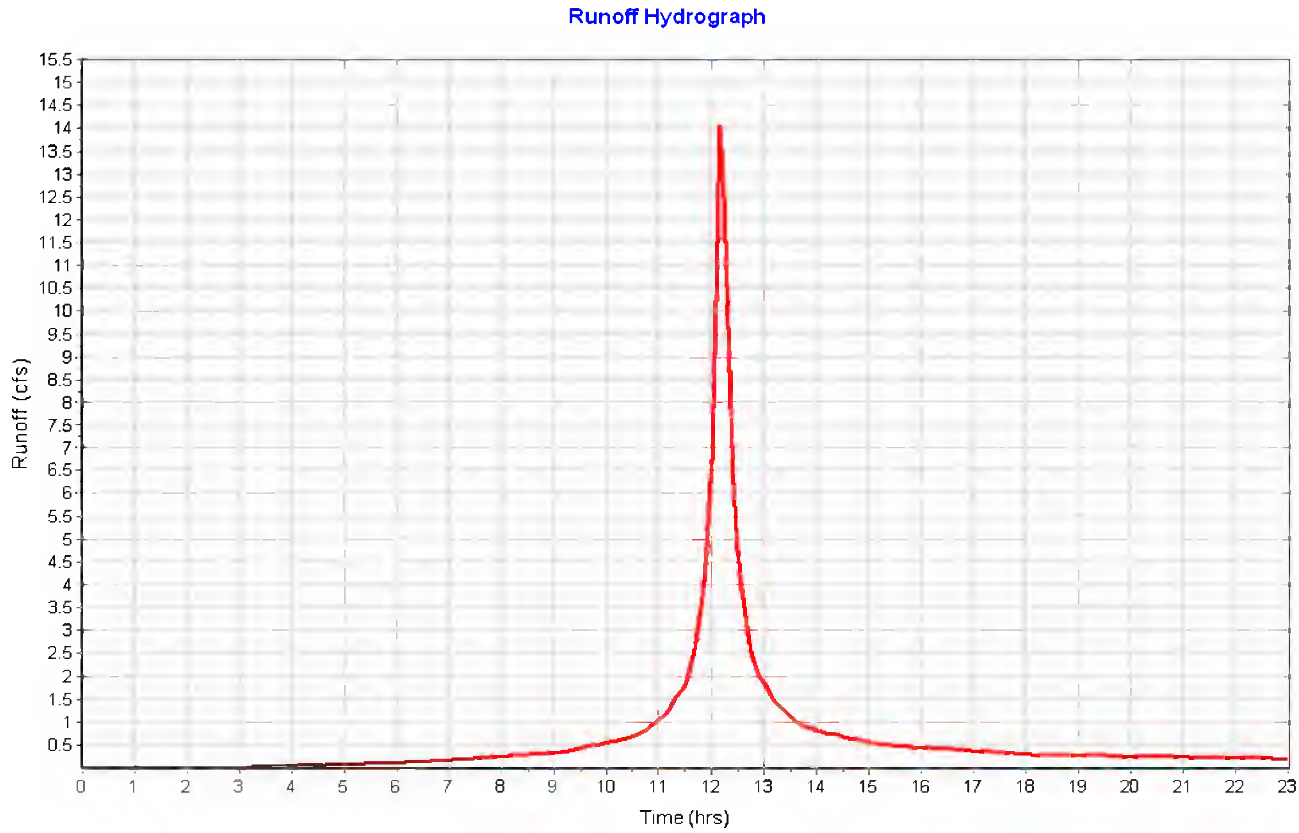
Total TOC (min) ..................14.14

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 6.25
Peak Runoff (cfs) ............................................................ 14.25
Weighted Curve Number ................................................ 89.73
Time of Concentration (days hh:mm:ss) ........................ 0 00:14:08

Subbasin : DA B13



## Subbasin : DA B14

### Input Data

Area (ac) ........................................................................ 5.71
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 83.54
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 3.44 | C | 74.00 |
| Paved roads with curbs & sewers | 2.27 | C | 98.00 |
| Composite Area & Weighted CN | 5.71 | | 83.54 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 3 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.14 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 12.02 | 0.00 | 0.00 |

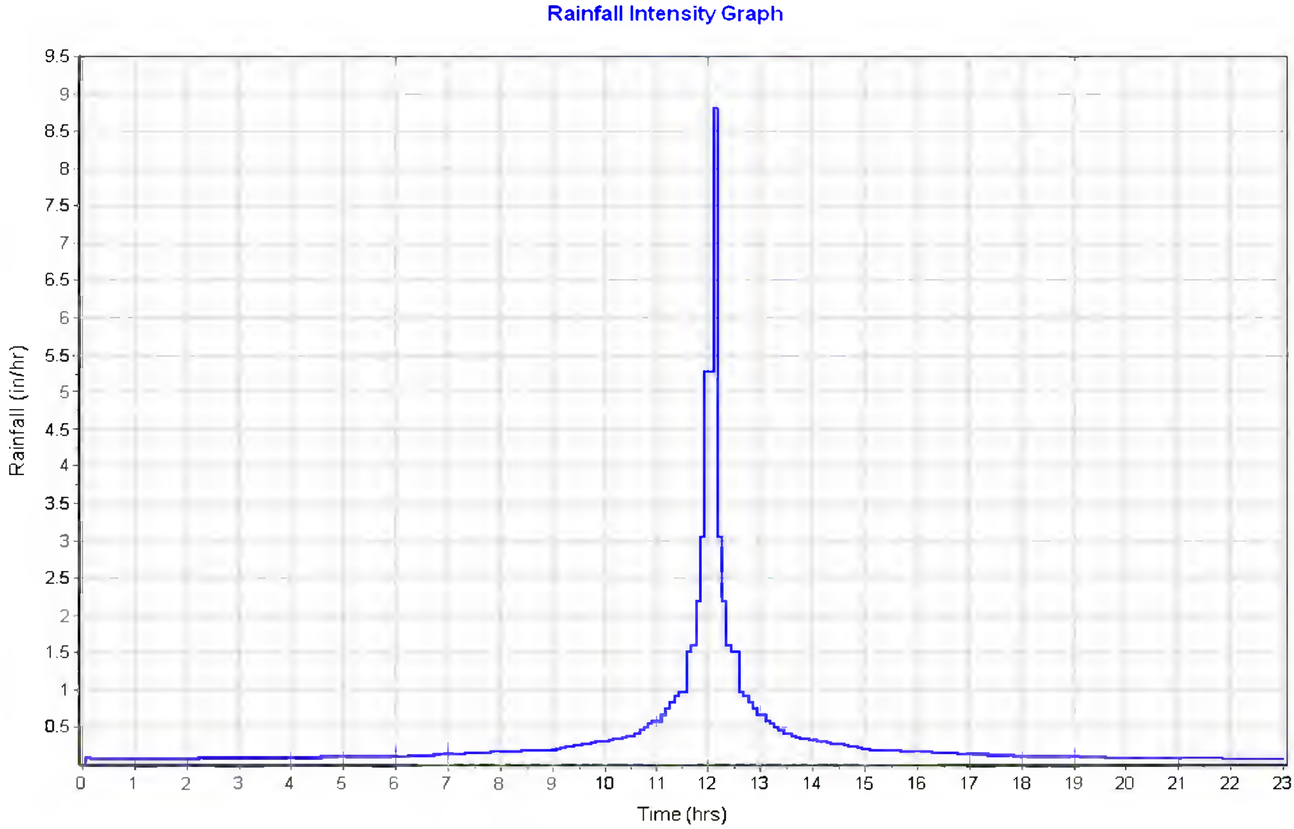
| Shallow Concentrated Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Flow Length (ft) : | 300 | 0.00 | 0.00 |
| Slope (%) : | 4.6 | 0.00 | 0.00 |
| Surface Type : | Grassed waterway | Unpaved | Unpaved |
| Velocity (ft/sec) : | 3.22 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 1.55 | 0.00 | 0.00 |

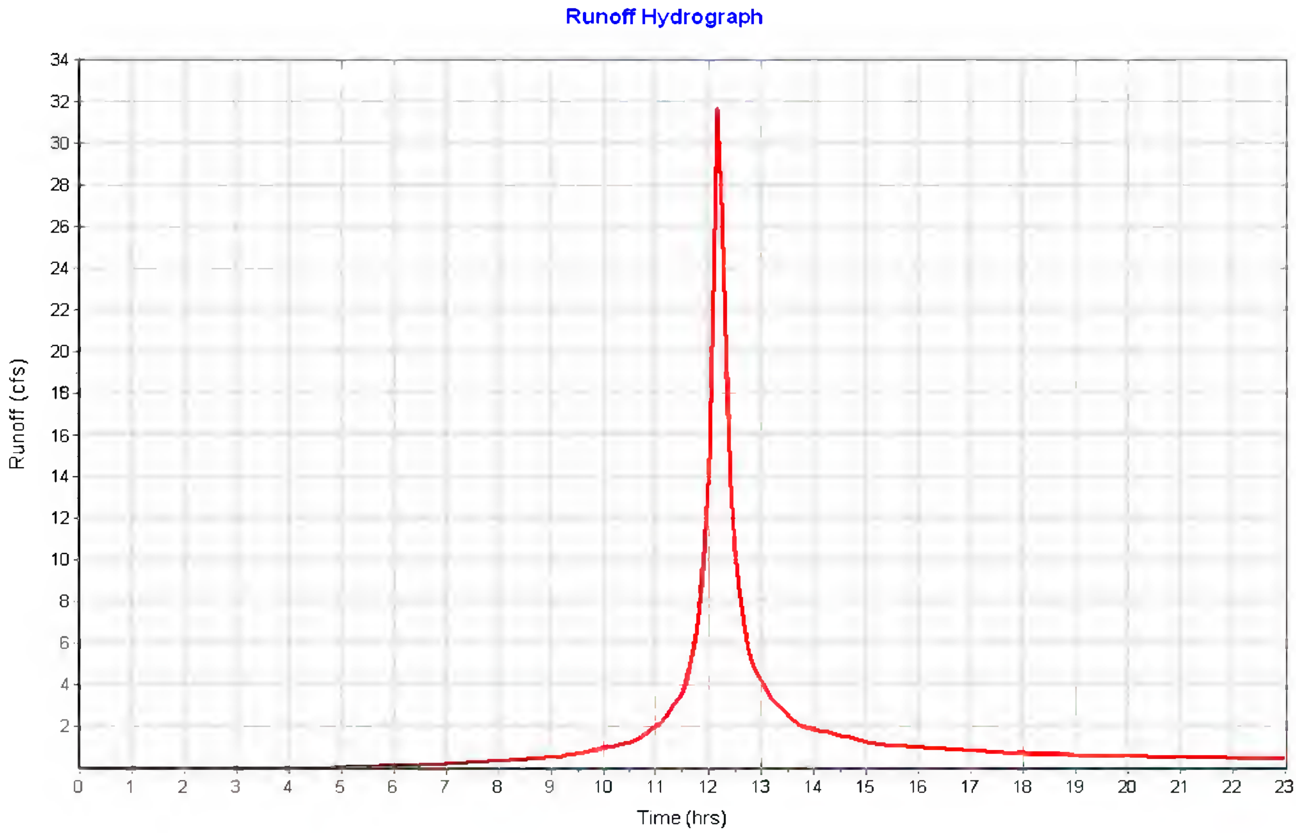
Total TOC (min) ..................13.57

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.53
Peak Runoff (cfs) ............................................................ 31.95
Weighted Curve Number ............................................... 83.54
Time of Concentration (days hh:mm:ss) ........................ 0 00:13:34

**Subbasin : DA B14**



## Subbasin : DA B2

### Input Data

Area (ac) ........................................................................ 1.55
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 93.51
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.29 | C | 74.00 |
| Paved parking & roofs | 1.26 | C | 98.00 |
| Composite Area & Weighted CN | 1.55 | | 93.51 |

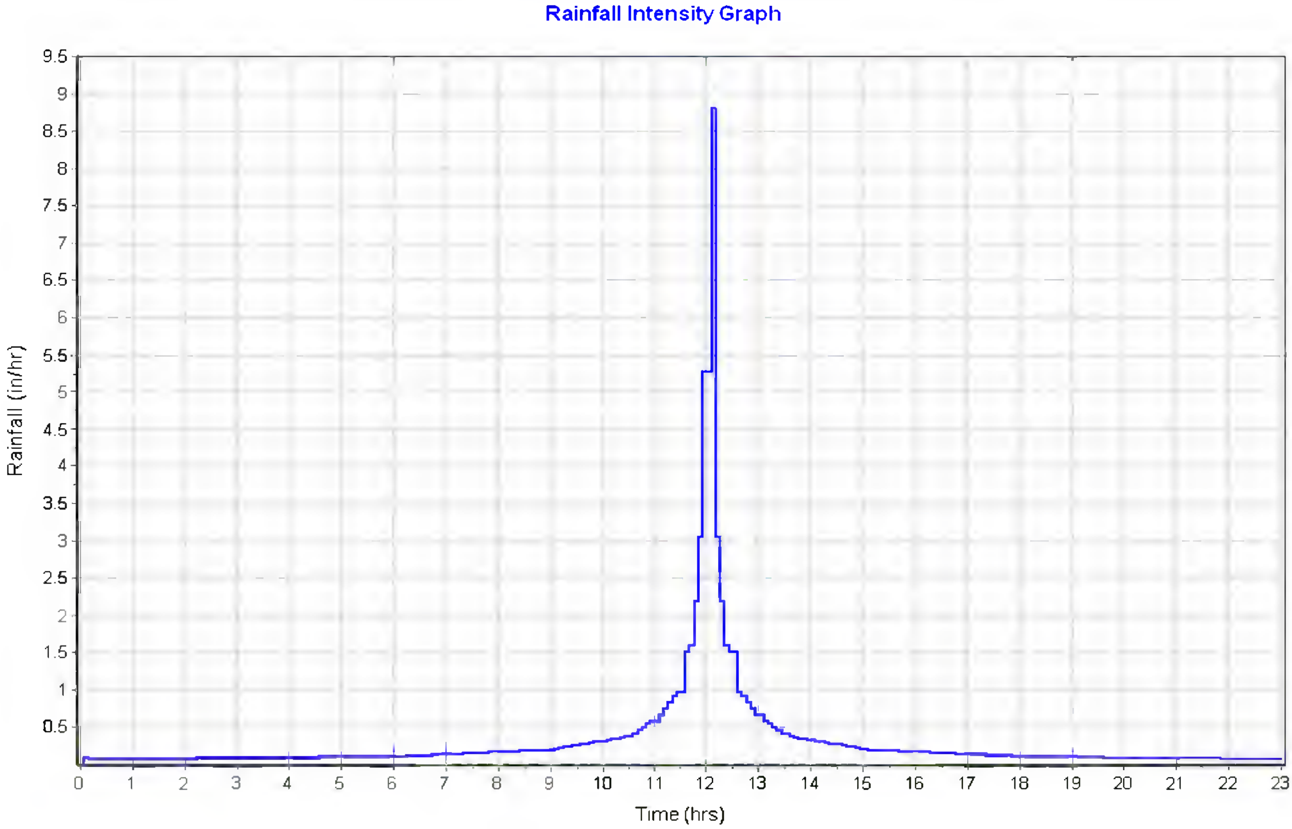
### Time of Concentration

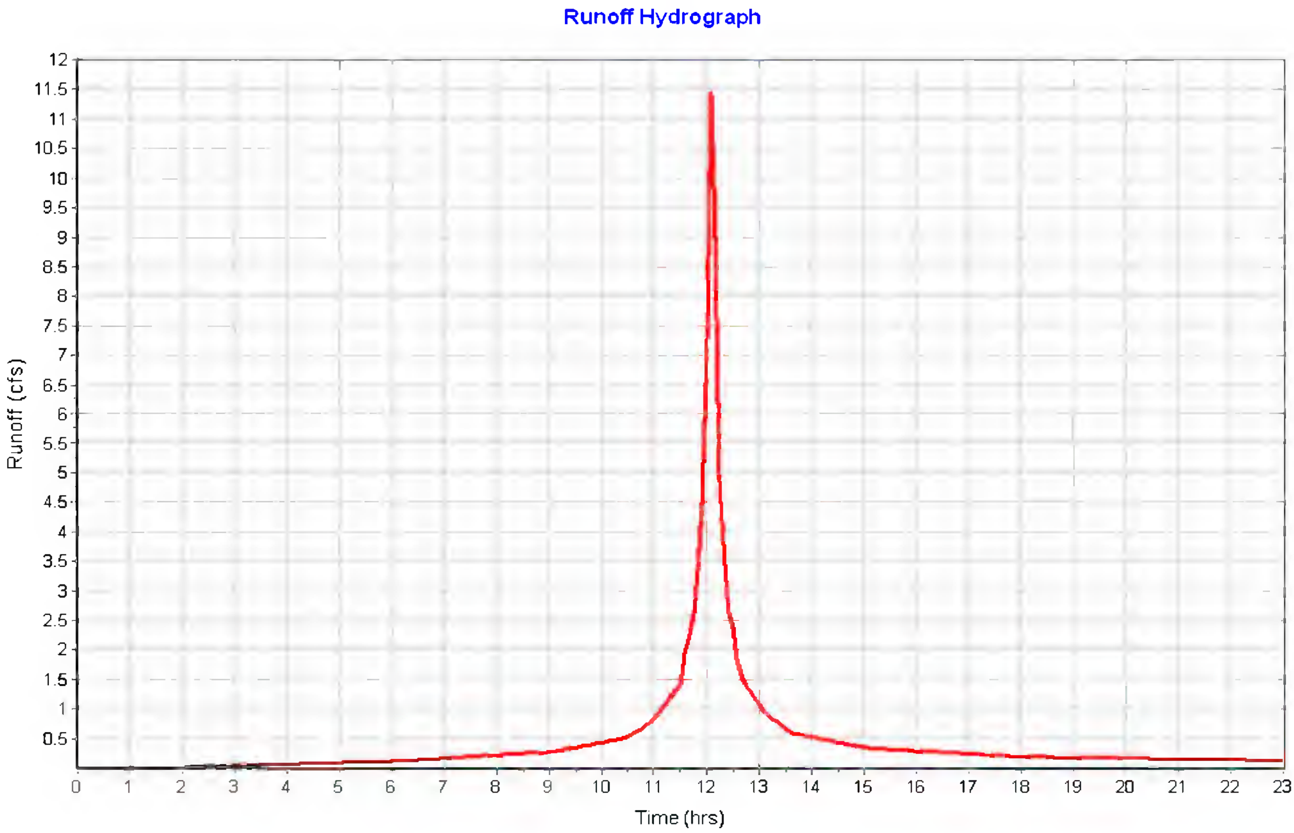
User-Defined TOC override (minutes): 6

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 6.70
Peak Runoff (cfs) ........................................................... 12.41
Weighted Curve Number ............................................... 93.51
Time of Concentration (days hh:mm:ss) ........................ 0 00:06:00

Subbasin : DA B2






2114a

## Subbasin : DA B3

### Input Data

Area (ac) ........................................................................ 14.51
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 83.63
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 7.26 | C | 74.00 |
| Paved parking & roofs | 5.98 | C | 98.00 |
| Meadow, non-grazed | 1.27 | C | 71.00 |
| Composite Area & Weighted CN | 14.51 | | 83.63 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 2 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.12 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 14.14 | 0.00 | 0.00 |

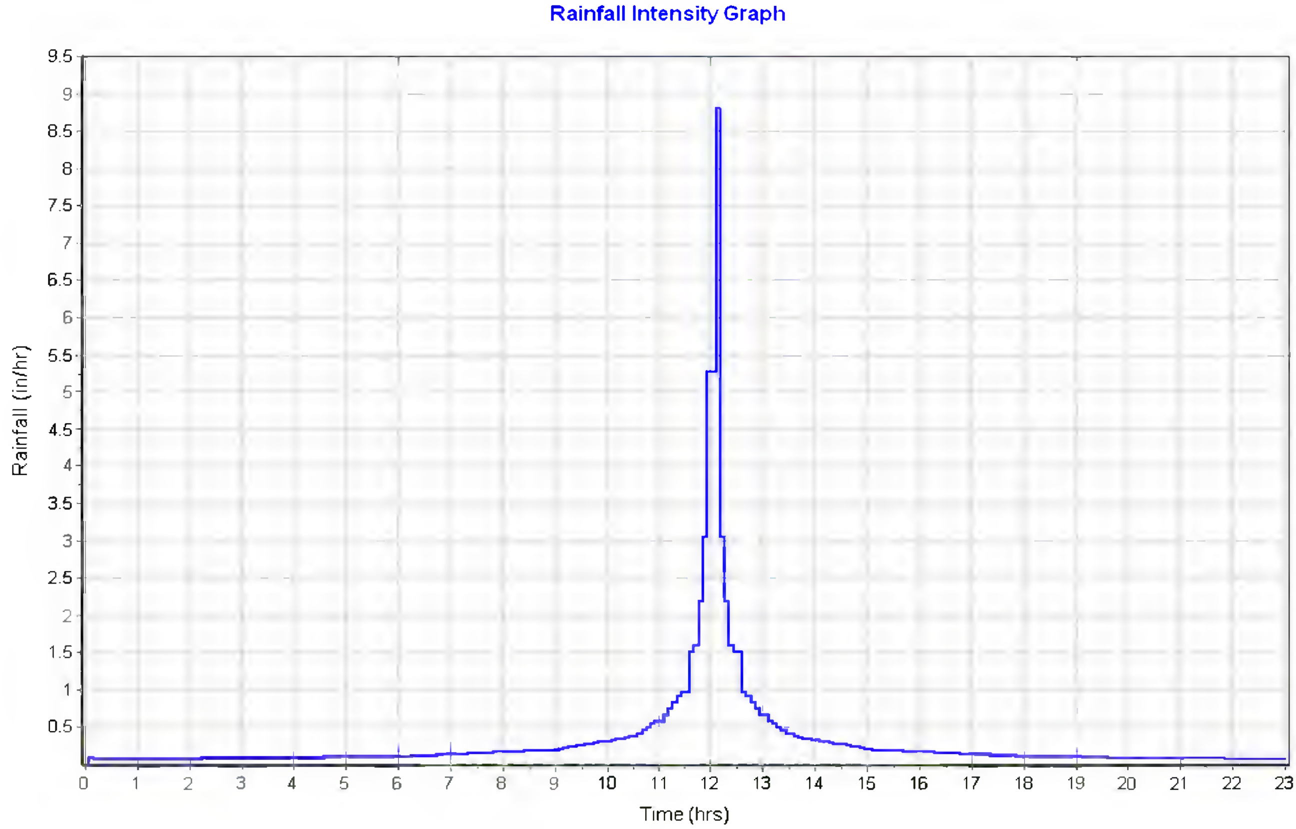
| Channel Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .013 | 0.00 | 0.00 |
| Flow Length (ft) : | 657 | 0.00 | 0.00 |
| Channel Slope (%) : | 3 | 0.00 | 0.00 |
| Cross Section Area (ft²) : | 3.14 | 0.00 | 0.00 |
| Wetted Perimeter (ft) : | 6.28 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 12.51 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 0.88 | 0.00 | 0.00 |

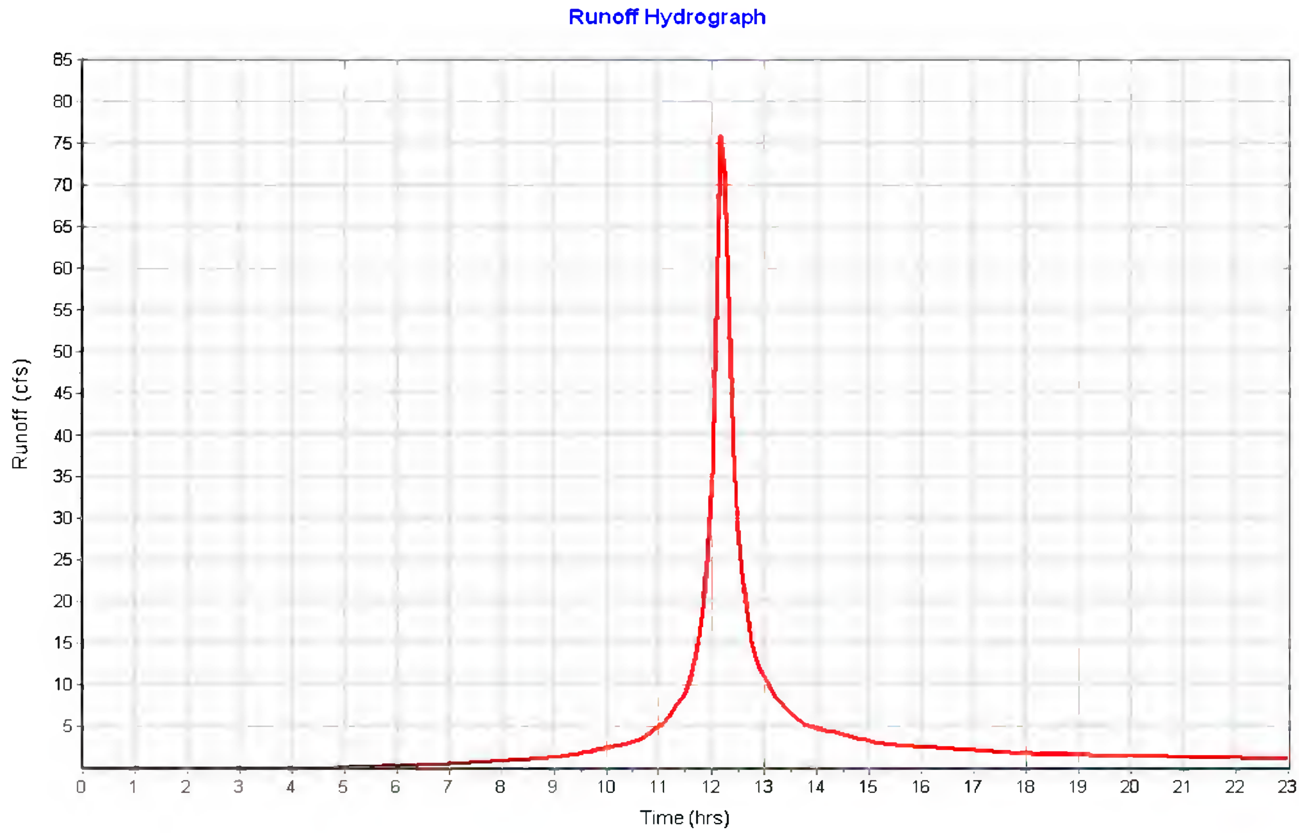
Total TOC (min) ..................15.01

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.54
Peak Runoff (cfs) ........................................................... 77.97
Weighted Curve Number ............................................... 83.63
Time of Concentration (days hh:mm:ss) ........................ 0 00:15:01

**Subbasin : DA B3**



## Subbasin : DA B4

### Input Data

Area (ac) .......................................................................... 2.60
Peak Rate Factor .......................................................... 484.00
Weighted Curve Number ............................................... 83.07
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.47 | C | 74.00 |
| Paved parking & roofs | 1.11 | C | 98.00 |
| Meadow, non-grazed | 1.02 | C | 71.00 |
| Composite Area & Weighted CN | 2.60 | | 83.07 |

### Time of Concentration

| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 2 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.12 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 14.14 | 0.00 | 0.00 |

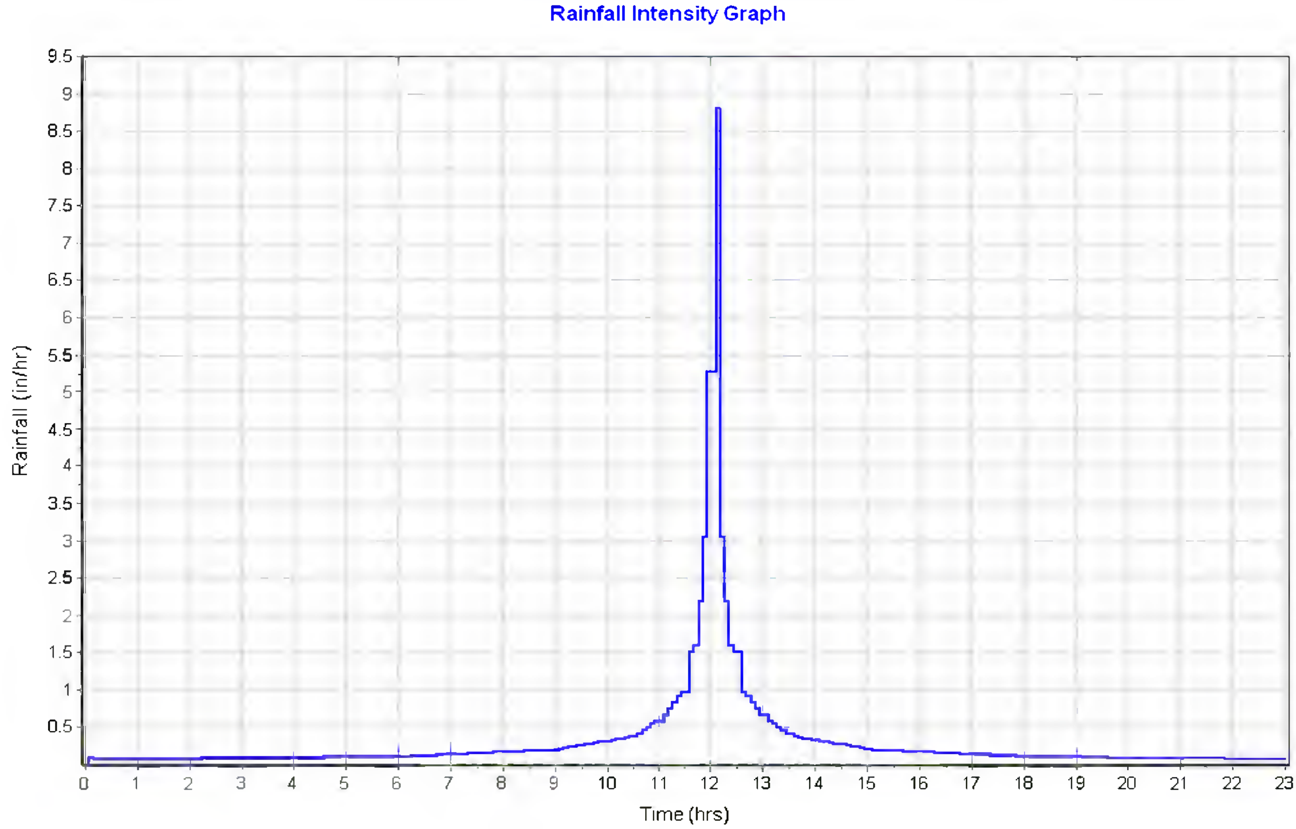
| Channel Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .013 | 0.00 | 0.00 |
| Flow Length (ft) : | 590 | 0.00 | 0.00 |
| Channel Slope (%) : | 4 | 0.00 | 0.00 |
| Cross Section Area (ft²) : | 1.76 | 0.00 | 0.00 |
| Wetted Perimeter (ft) : | 4.71 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 11.89 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 0.83 | 0.00 | 0.00 |

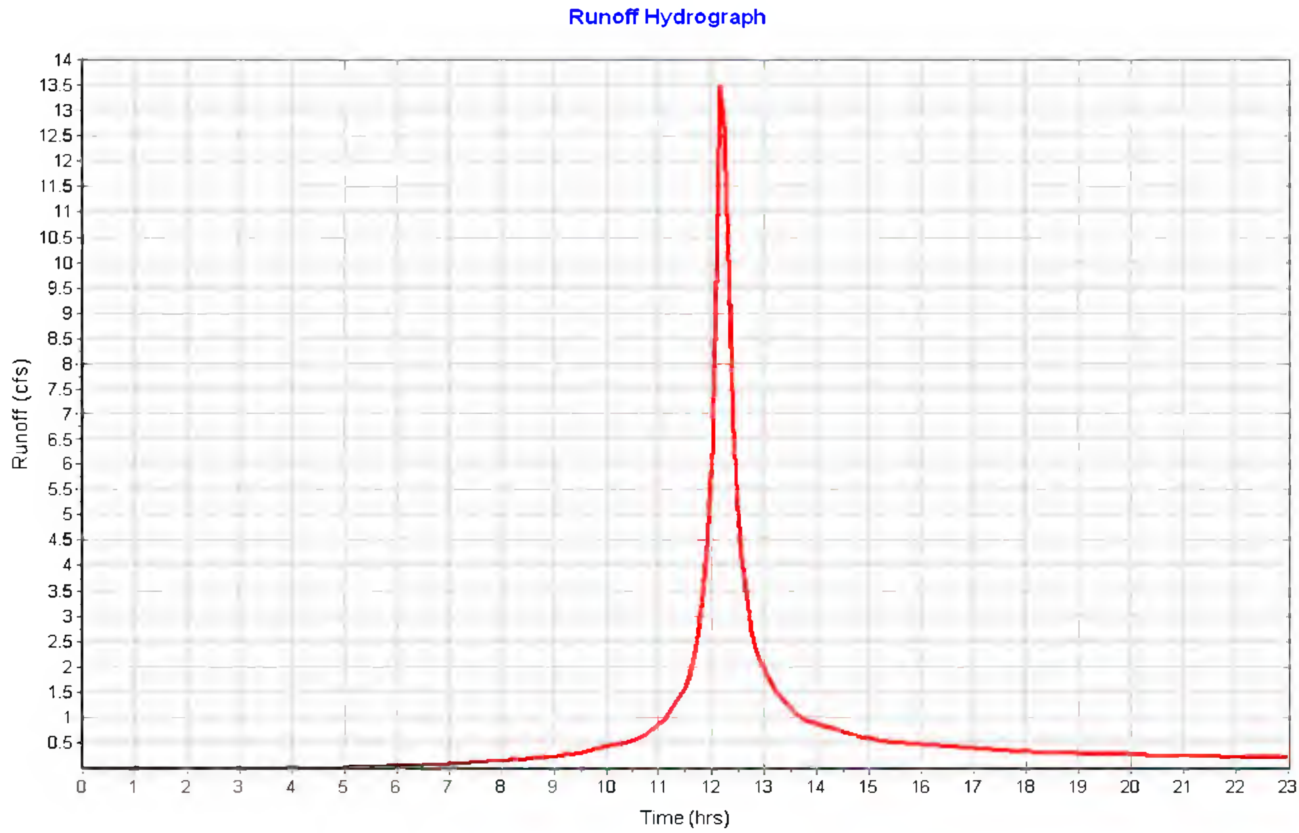
Total TOC (min) ..................14.97

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.48
Peak Runoff (cfs) ........................................................... 13.86
Weighted Curve Number ............................................... 83.07
Time of Concentration (days hh:mm:ss) ........................ 0 00:14:58

**Subbasin : DA B4**



## Subbasin : DA B5

### Input Data

Area (ac) ........................................................................ 0.33
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 84.73
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.16 | C | 74.00 |
| Paved roads with curbs & sewers | 0.15 | C | 98.00 |
| Meadow, non-grazed | 0.02 | C | 71.00 |
| Composite Area & Weighted CN | 0.33 | | 84.73 |

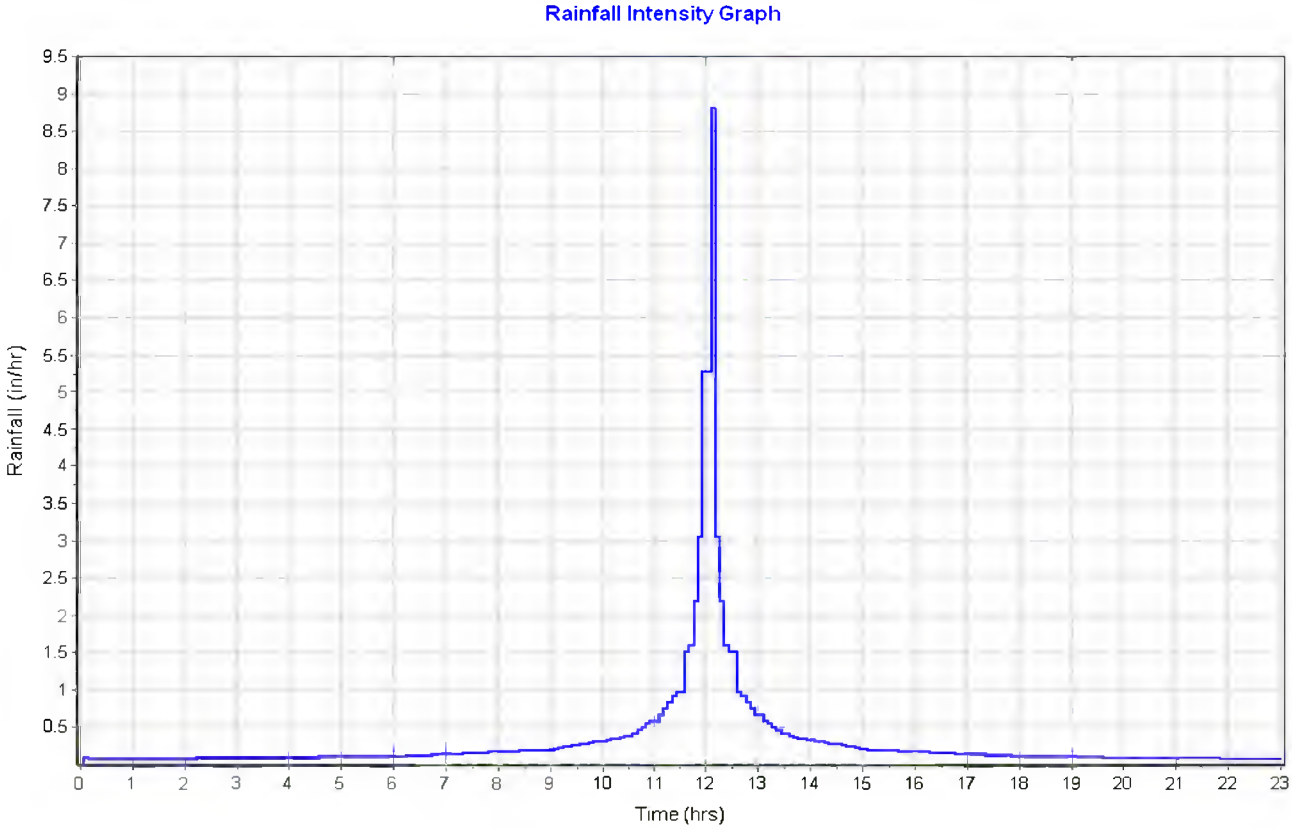
### Time of Concentration

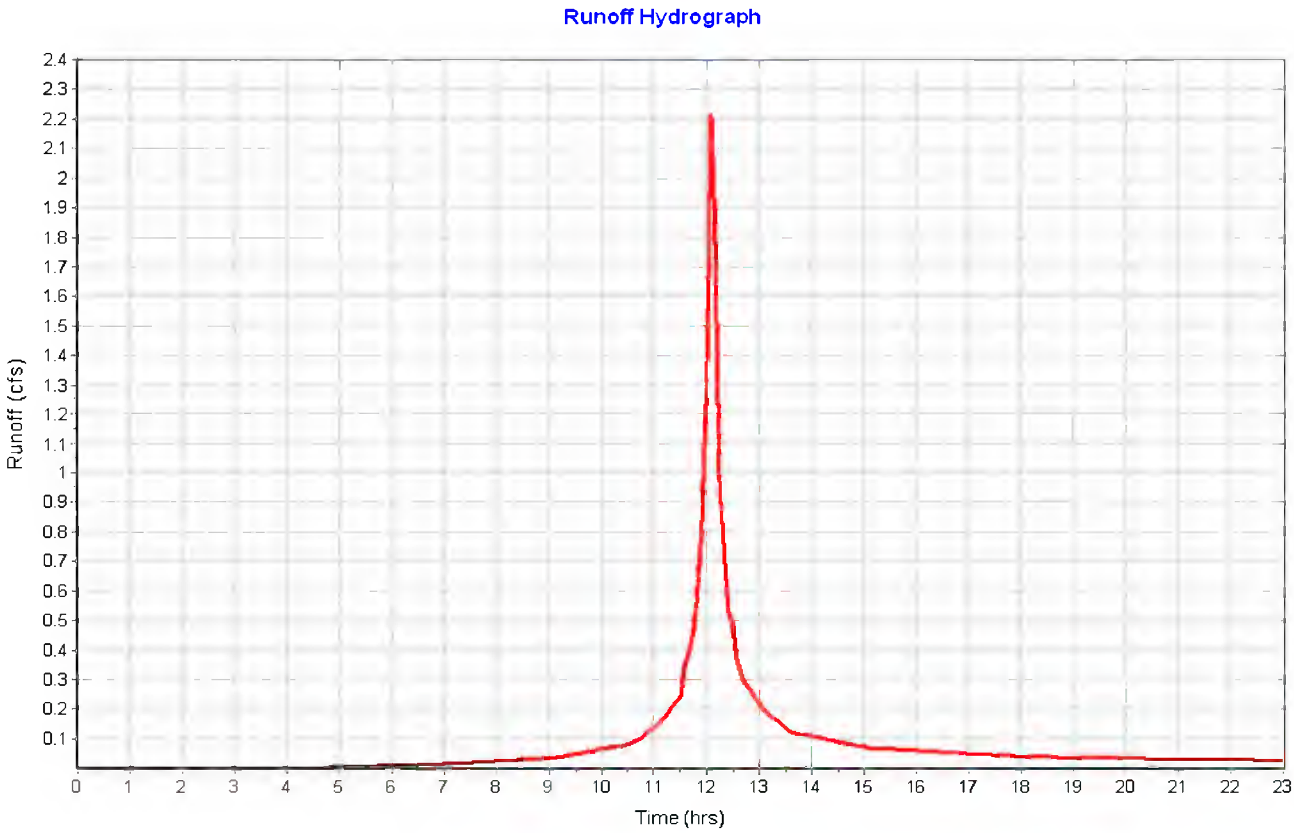
User-Defined TOC override (minutes): 6

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 5.67
Peak Runoff (cfs) ........................................................... 2.43
Weighted Curve Number ............................................... 84.73
Time of Concentration (days hh:mm:ss) ........................ 0 00:06:00

**Subbasin : DA B5**



## Subbasin : DA B6

### Input Data

Area (ac) ........................................................................ 0.39
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 73.79
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.23 | C | 74.00 |
| Paved parking & roofs | 0.12 | C | 98.00 |
| - | 0.04 | - | 0.00 |
| Composite Area & Weighted CN | 0.39 | | 73.79 |

### Time of Concentration

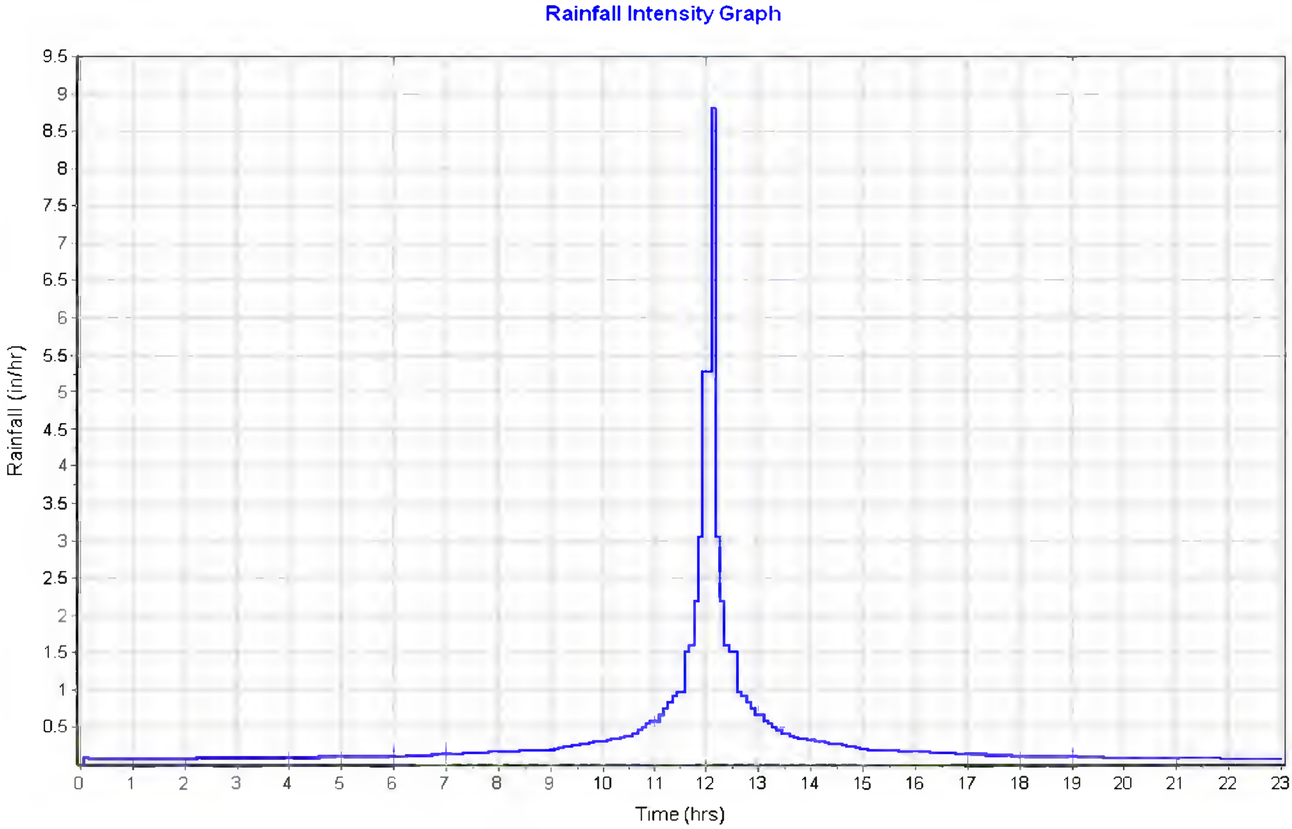
| Sheet Flow Computations | Flowpath A | Flowpath B | Flowpath C |
|---|---|---|---|
| Manning's Roughness : | .240 | 0.00 | 0.00 |
| Flow Length (ft) : | 100 | 0.00 | 0.00 |
| Slope (%) : | 15 | 0.00 | 0.00 |
| 2 yr, 24 hr Rainfall (in) : | 3.26 | 0.00 | 0.00 |
| Velocity (ft/sec) : | 0.26 | 0.00 | 0.00 |
| Computed Flow Time (min) : | 6.31 | 0.00 | 0.00 |

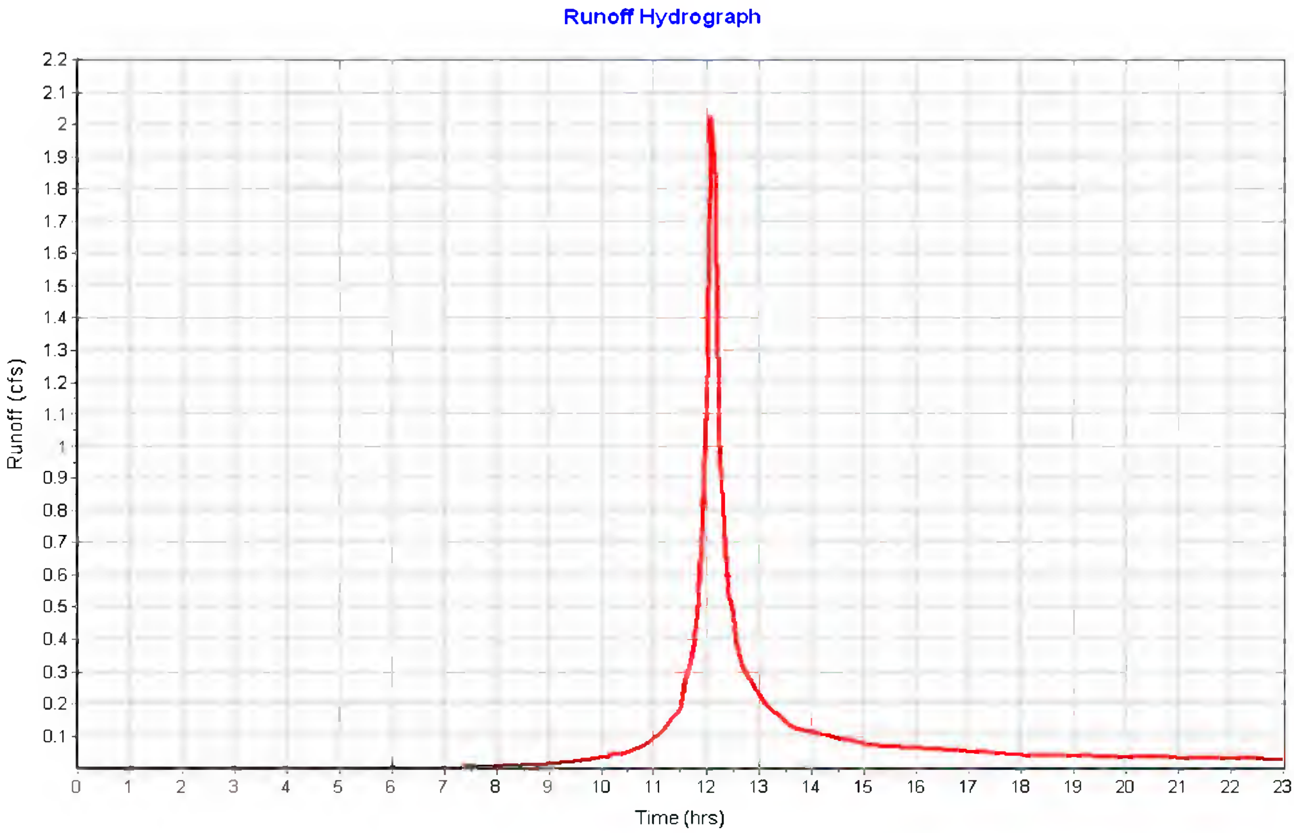
Total TOC (min) ..................6.31

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 4.43
Peak Runoff (cfs) ............................................................ 2.31
Weighted Curve Number ............................................... 73.79
Time of Concentration (days hh:mm:ss) ........................ 0 00:06:19

**Subbasin : DA B6**






2122a

## Subbasin : DA B7

### Input Data

Area (ac) ........................................................................ 0.70
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 74.00
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.70 | C | 74.00 |
| Composite Area & Weighted CN | 0.70 | | 74.00 |

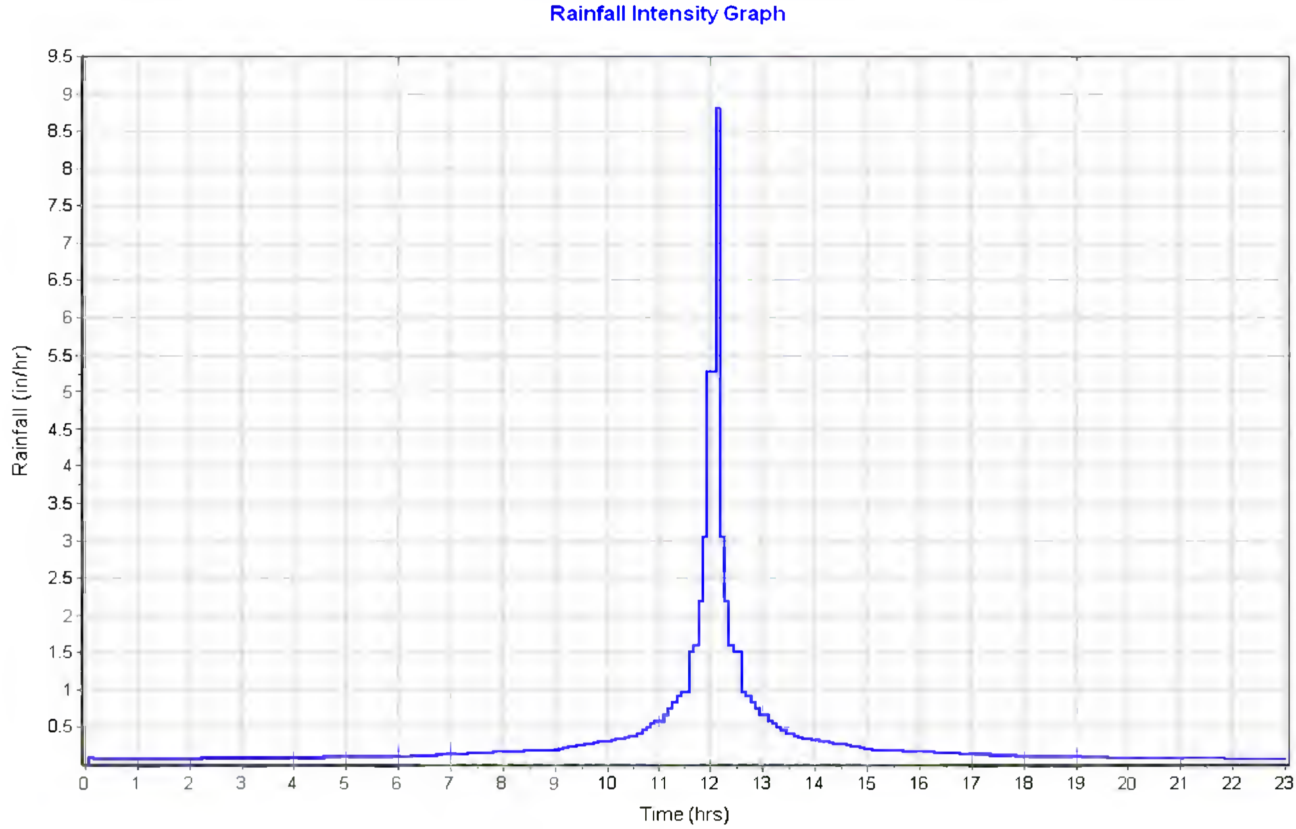
### Time of Concentration

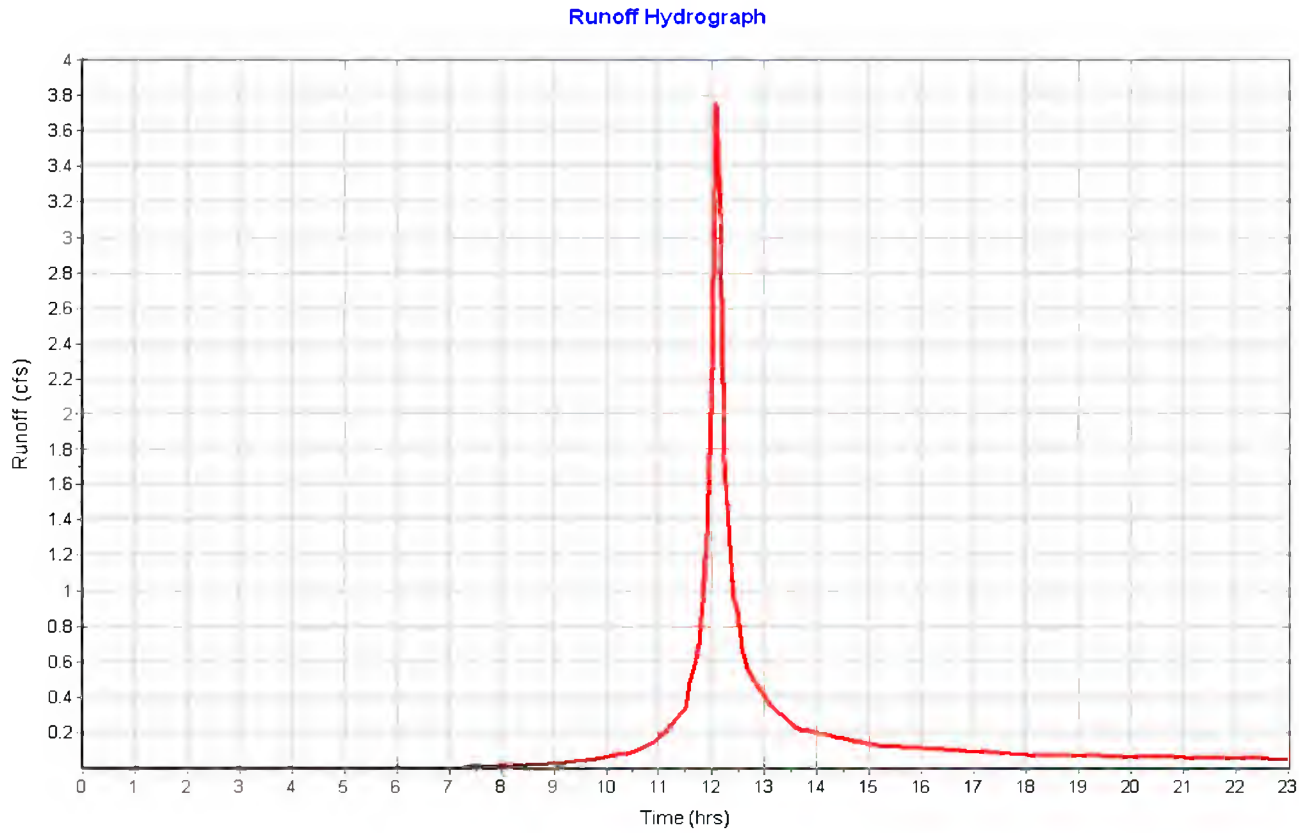
User-Defined TOC override (minutes): 6

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 4.45
Peak Runoff (cfs) ........................................................... 4.19
Weighted Curve Number ............................................... 74.00
Time of Concentration (days hh:mm:ss) ........................ 0 00:06:00

**Subbasin : DA B7**



## Subbasin : DA B8

### Input Data

Area (ac) ........................................................................ 0.24
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 79.50
Rain Gage ID .................................................................

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.05 | C | 74.00 |
| Paved parking & roofs | 0.07 | C | 98.00 |
| Meadow, non-grazed | 0.12 | C | 71.00 |
| Composite Area & Weighted CN | 0.24 | | 79.50 |

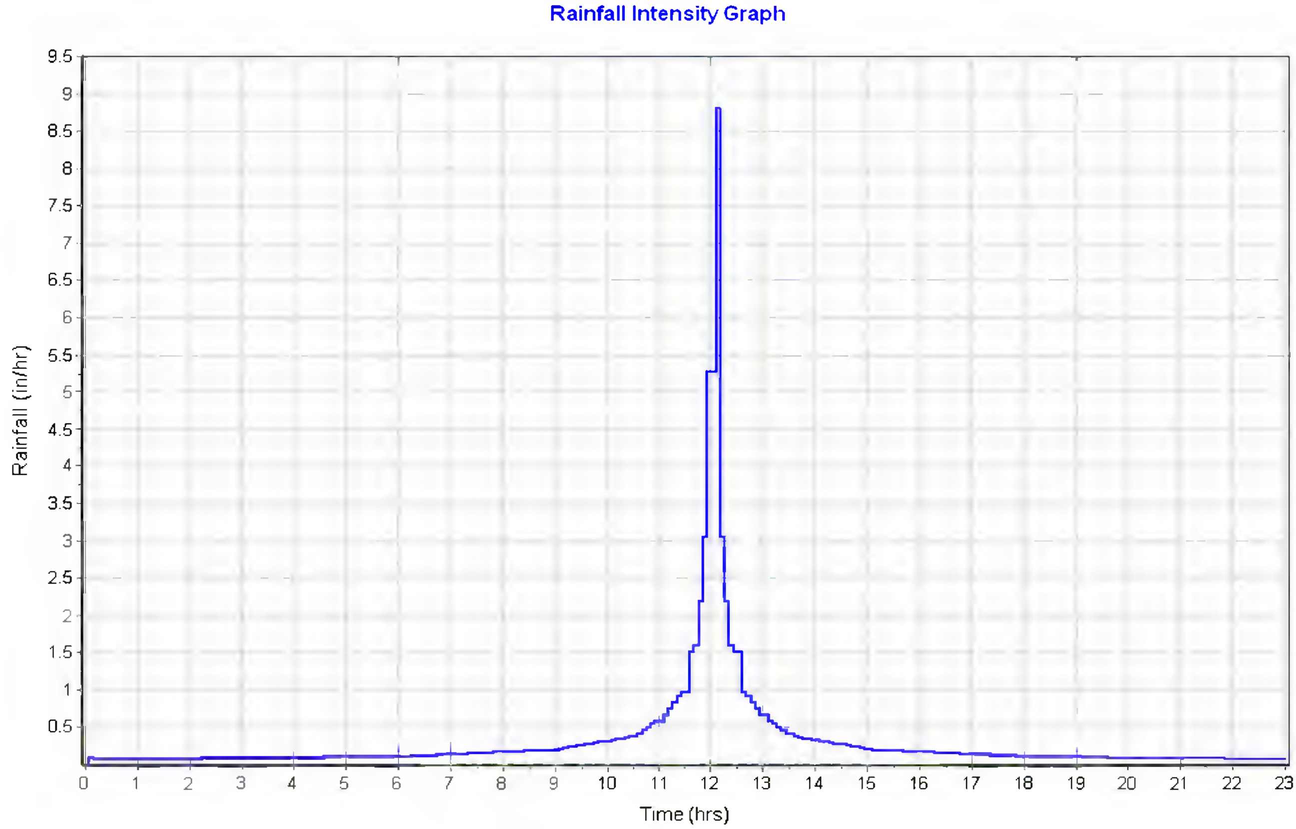
### Time of Concentration

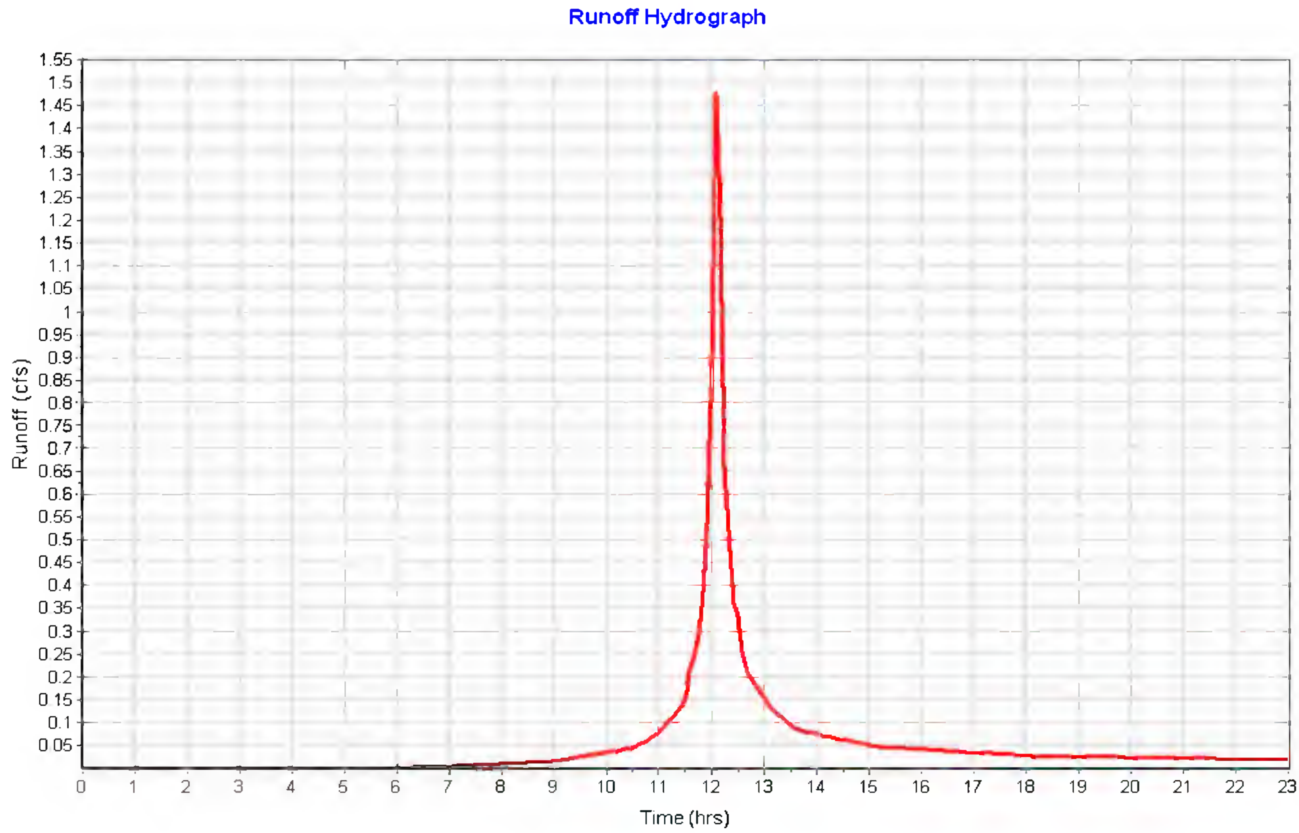
User-Defined TOC override (minutes): 6

### Subbasin Runoff Results

Total Rainfall (in) ........................................................... 7.47
Total Runoff (in) ............................................................ 5.07
Peak Runoff (cfs) ........................................................... 1.63
Weighted Curve Number ............................................... 79.50
Time of Concentration (days hh:mm:ss) ........................ 0 00:06:00

**Subbasin : DA B8**



## Subbasin : DA B9

### Input Data

Area (ac) ........................................................................ 1.74
Peak Rate Factor ........................................................... 484.00
Weighted Curve Number ............................................... 88.86
Rain Gage ID ................................................................. *

### Composite Curve Number

| Soil/Surface Description | Area (acres) | Soil Group | Curve Number |
|---|---|---|---|
| > 75% grass cover, Good | 0.64 | C | 74.00 |
| Paved roads with curbs & sewers | 1.08 | C | 98.00 |
| Meadow, non-grazed | 0.02 | C | 71.00 |
| Composite Area & Weighted CN | 1.74 | | 88.86 |

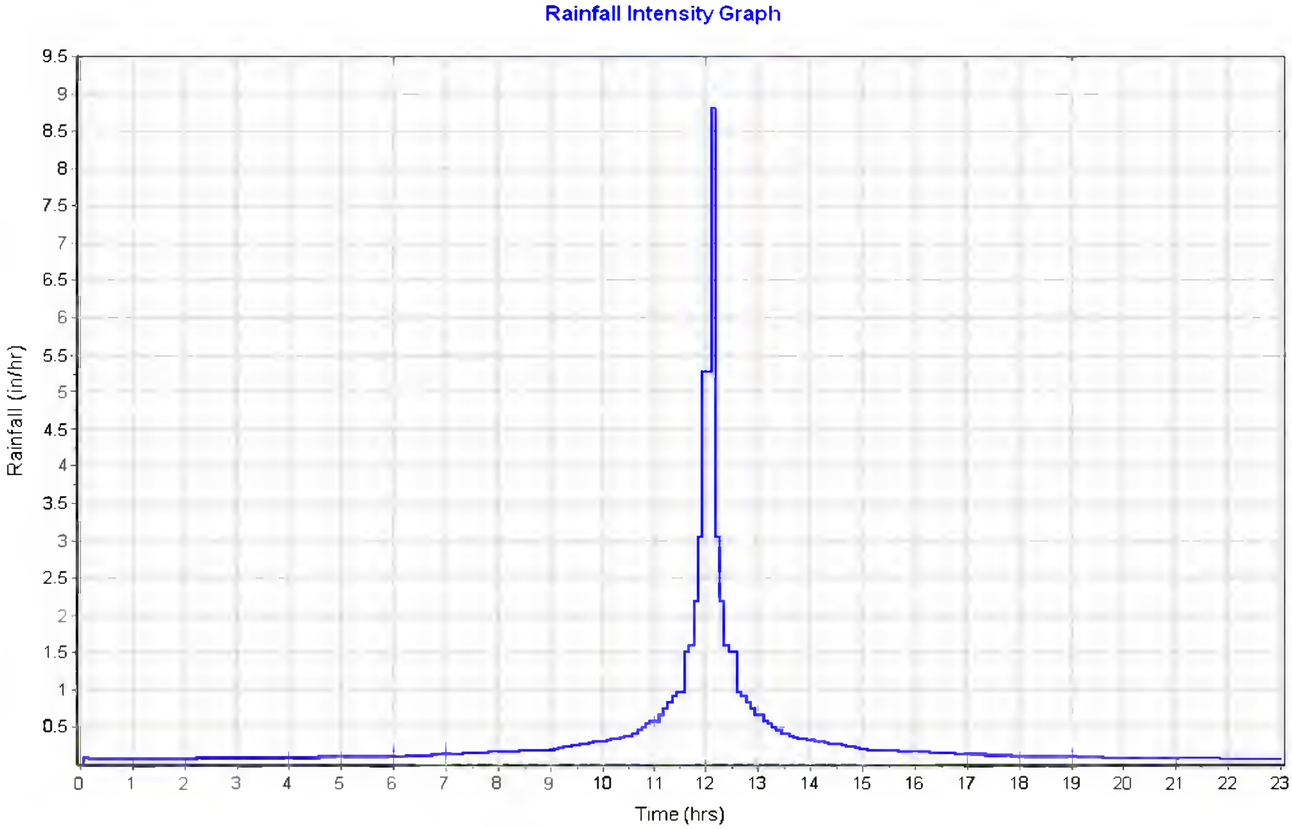
### Time of Concentration

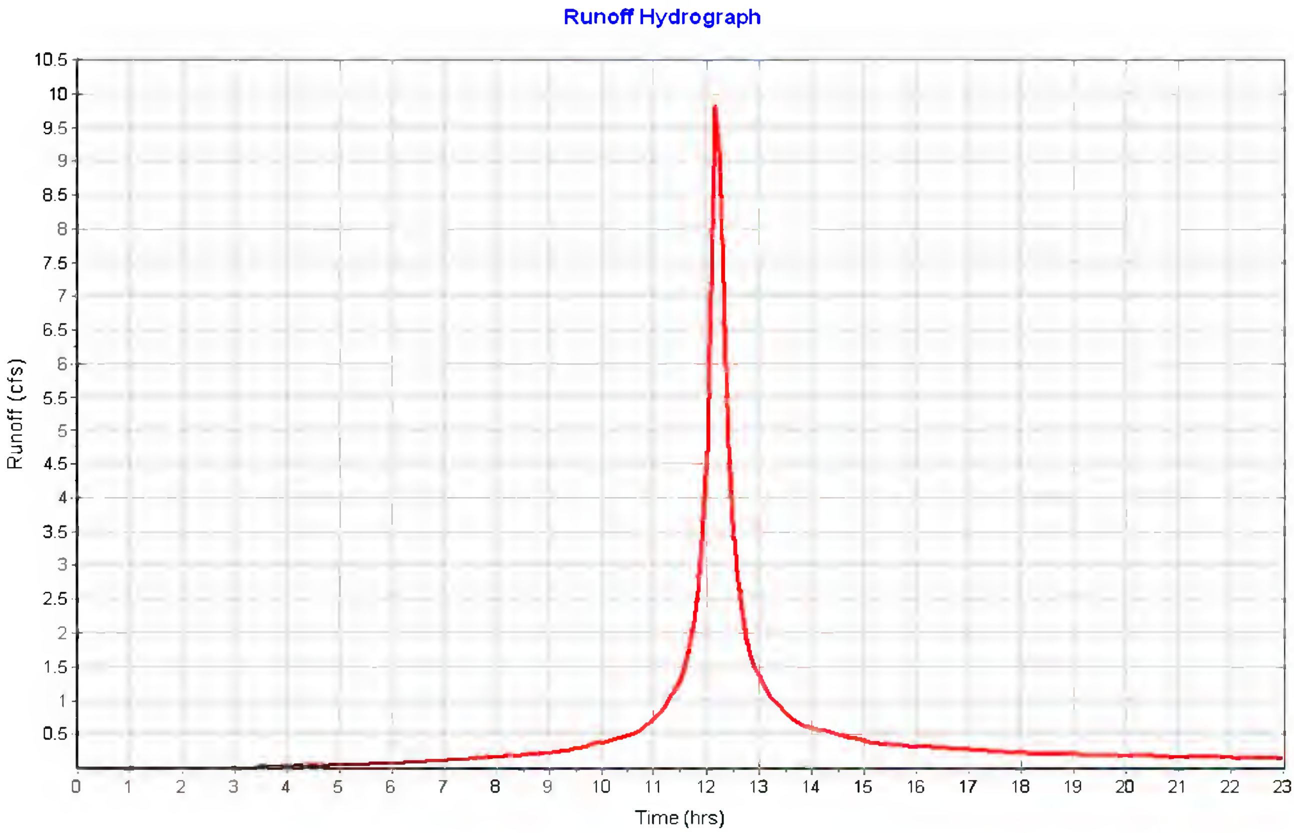
User-Defined TOC override (minutes): 15

### Subbasin Runoff Results

Total Rainfall (in) ............................................................ 7.47
Total Runoff (in) ............................................................. 6.15
Peak Runoff (cfs) ............................................................ 10.07
Weighted Curve Number ............................................... 88.86
Time of Concentration (days hh:mm:ss) ........................ 0 00:15:00

Subbasin : DA B9



## Junction Input

| SN | Element ID | Invert Elevation (ft) | Ground/Rim (Max) Elevation (ft) | Ground/Rim (Max) Offset (ft) | Initial Water Elevation (ft) | Initial Water Depth (ft) | Surcharge Elevation (ft) | Surcharge Depth (ft) | Ponded Area (ft²) | Minimum Pipe Cover (in) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S1.01 | 374.00 | 386.00 | 12.00 | 374.00 | 0.00 | 386.00 | 0.00 | 0.00 | 0.00 |
| 2 | S1.02 | 376.56 | 382.56 | 6.00 | 376.56 | 0.00 | 382.56 | 0.00 | 0.00 | 0.00 |
| 3 | S1.03 | 378.95 | 384.95 | 6.00 | 378.95 | 0.00 | 385.00 | 0.05 | 0.00 | 0.00 |
| 4 | S1.04 | 379.74 | 389.00 | 9.26 | 379.74 | 0.00 | 385.74 | -3.26 | 0.00 | 0.00 |
| 5 | S1.05 | 380.40 | 386.40 | 6.00 | 380.40 | 0.00 | 386.40 | 0.00 | 0.00 | 0.00 |
| 6 | S1.06 | 381.29 | 392.00 | 10.71 | 381.29 | 0.00 | 387.29 | -4.71 | 0.00 | 0.00 |
| 7 | S1.07 | 381.74 | 392.00 | 10.26 | 381.74 | 0.00 | 387.74 | -4.26 | 0.00 | 0.00 |
| 8 | S1.08 | 382.94 | 388.94 | 6.00 | 382.94 | 0.00 | 388.94 | 0.00 | 0.00 | 0.00 |
| 9 | S1.09 | 383.30 | 389.30 | 6.00 | 383.30 | 0.00 | 389.30 | 0.00 | 0.00 | 0.00 |
| 10 | S1.10 | 384.30 | 390.30 | 6.00 | 384.30 | 0.00 | 390.30 | 0.00 | 0.00 | 0.00 |
| 11 | S1.11 | 385.03 | 391.00 | 5.97 | 385.03 | 0.00 | 391.00 | 0.00 | 0.00 | 0.00 |
| 12 | S1.12 | 389.90 | 395.90 | 6.00 | 389.90 | 0.00 | 395.90 | 0.00 | 0.00 | 0.00 |
| 13 | S1.13 | 392.00 | 398.00 | 6.00 | 392.00 | 0.00 | 398.00 | 0.00 | 0.00 | 0.00 |
| 14 | S1.14 | 392.77 | 398.77 | 6.00 | 392.77 | 0.00 | 398.77 | 0.00 | 0.00 | 0.00 |
| 15 | S1.15 | 395.30 | 401.30 | 6.00 | 395.30 | 0.00 | 401.30 | 0.00 | 0.00 | 0.00 |
| 16 | S1.16 | 397.35 | 403.35 | 6.00 | 397.35 | 0.00 | 403.35 | 0.00 | 0.00 | 0.00 |
| 17 | S1.17 | 400.40 | 406.40 | 6.00 | 400.40 | 0.00 | 406.40 | 0.00 | 0.00 | 0.00 |
| 18 | S1.18 | 402.00 | 413.00 | 11.00 | 402.00 | 0.00 | 413.00 | 0.00 | 0.00 | 0.00 |
| 19 | S1.19 | 394.42 | 400.42 | 6.00 | 394.42 | 0.00 | 400.42 | 0.00 | 0.00 | 0.00 |
| 20 | S1.20 | 396.30 | 402.30 | 6.00 | 396.30 | 0.00 | 402.30 | 0.00 | 0.00 | 0.00 |
| 21 | S1.21 | 398.00 | 402.00 | 4.00 | 398.00 | 0.00 | 402.00 | 0.00 | 0.00 | 0.00 |
| 22 | S1.22 | 384.00 | 394.00 | 10.00 | 384.00 | 0.00 | 394.00 | 0.00 | 0.00 | 0.00 |
| 23 | S2.01 | 377.25 | 384.60 | 7.35 | 377.25 | 0.00 | 384.60 | 0.00 | 0.00 | 0.00 |
| 24 | S2.02 | 378.42 | 390.20 | 11.78 | 378.42 | 0.00 | 390.20 | 0.00 | 0.00 | 0.00 |
| 25 | S2.03 | 378.85 | 393.00 | 14.15 | 378.85 | 0.00 | 393.00 | 0.00 | 0.00 | 0.00 |
| 26 | S2.05 | 380.13 | 396.00 | 15.87 | 380.13 | 0.00 | 396.00 | 0.00 | 0.00 | 0.00 |
| 27 | S2.06 | 371.74 | 394.00 | 22.26 | 381.74 | 10.00 | 394.00 | 0.00 | 0.00 | 0.00 |
| 28 | S2.07 | 382.38 | 392.00 | 9.62 | 382.38 | 0.00 | 392.00 | 0.00 | 0.00 | 0.00 |
| 29 | S2.08 | 382.87 | 390.00 | 7.13 | 382.87 | 0.00 | 390.00 | 0.00 | 0.00 | 0.00 |
| 30 | S2.09 | 383.85 | 389.50 | 5.65 | 383.85 | 0.00 | 389.50 | 0.00 | 0.00 | 0.00 |
| 31 | S2.10 | 385.35 | 392.00 | 6.65 | 385.35 | 0.00 | 392.00 | 0.00 | 0.00 | 0.00 |
| 32 | S2.11 | 382.90 | 388.90 | 6.00 | 382.90 | 0.00 | 388.90 | 0.00 | 0.00 | 0.00 |

## Junction Results

| SN | Element ID | Peak Inflow (cfs) | Peak Lateral Inflow (cfs) | Max HGL Elevation Attained (ft) | Max HGL Depth Attained (ft) | Max Surcharge Depth Attained (ft) | Min Freeboard Attained (ft) | Average HGL Elevation Attained (ft) | Average HGL Depth Attained (ft) | Time of Max HGL Occurrence (days hh:mm) | Time of Peak Flooding Occurrence (days hh:mm) | Total Flooded Volume (ac-in) | Total Time Flooded (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S1.01 | 201.55 | 11.42 | 377.15 | 3.15 | 0.00 | 8.85 | 374.44 | 0.44 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 2 | S1.02 | 180.75 | 5.33 | 379.54 | 2.98 | 0.00 | 3.02 | 376.98 | 0.42 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 3 | S1.03 | 175.42 | 2.53 | 381.87 | 2.92 | 0.00 | 3.08 | 379.36 | 0.41 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 4 | S1.04 | 172.89 | 75.82 | 382.62 | 2.88 | 0.00 | 6.38 | 380.15 | 0.41 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 5 | S1.05 | 97.08 | 0.00 | 382.88 | 2.48 | 0.00 | 3.52 | 380.75 | 0.35 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 6 | S1.06 | 97.08 | 2.21 | 384.09 | 2.80 | 0.00 | 7.91 | 381.66 | 0.37 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 7 | S1.07 | 95.28 | 13.48 | 384.54 | 2.80 | 0.00 | 7.46 | 382.10 | 0.36 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 8 | S1.08 | 81.80 | 2.02 | 385.13 | 2.19 | 0.00 | 3.81 | 383.25 | 0.31 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 9 | S1.09 | 79.93 | 0.00 | 385.49 | 2.19 | 0.00 | 3.81 | 383.61 | 0.31 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 10 | S1.10 | 79.93 | 0.00 | 386.40 | 2.10 | 0.00 | 3.90 | 384.60 | 0.30 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 11 | S1.11 | 79.93 | 3.75 | 387.13 | 2.10 | 0.00 | 3.87 | 385.33 | 0.30 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 12 | S1.12 | 76.78 | 1.48 | 391.92 | 2.02 | 0.00 | 3.98 | 390.16 | 0.26 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 13 | S1.13 | 75.56 | 0.00 | 394.01 | 2.01 | 0.00 | 3.99 | 392.26 | 0.26 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 14 | S1.14 | 55.51 | 9.80 | 394.68 | 1.91 | 0.00 | 4.09 | 393.03 | 0.26 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 15 | S1.15 | 45.70 | 0.00 | 396.95 | 1.65 | 0.00 | 4.35 | 395.53 | 0.23 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 16 | S1.16 | 45.70 | 14.05 | 399.00 | 1.65 | 0.00 | 4.35 | 397.58 | 0.23 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 17 | S1.17 | 31.65 | 0.00 | 401.99 | 1.59 | 0.00 | 4.41 | 400.60 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 18 | S1.18 | 31.65 | 31.65 | 403.57 | 1.57 | 0.00 | 9.43 | 402.20 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 19 | S1.19 | 20.05 | 4.44 | 395.60 | 1.18 | 0.00 | 4.82 | 394.57 | 0.15 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 20 | S1.20 | 15.61 | 0.00 | 397.48 | 1.18 | 0.00 | 4.82 | 396.44 | 0.14 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 21 | S1.21 | 15.61 | 15.61 | 399.18 | 1.18 | 0.00 | 2.82 | 398.14 | 0.14 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 22 | S1.22 | 11.73 | 11.73 | 384.85 | 0.85 | 0.00 | 9.15 | 384.13 | 0.13 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 23 | S2.01 | 39.18 | 0.00 | 379.21 | 1.96 | 0.00 | 5.39 | 377.49 | 0.24 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 24 | S2.02 | 39.18 | 0.00 | 380.38 | 1.96 | 0.00 | 9.82 | 378.66 | 0.24 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 25 | S2.03 | 39.18 | 11.63 | 380.81 | 1.96 | 0.00 | 12.19 | 379.09 | 0.24 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 26 | S2.05 | 27.55 | 0.00 | 381.63 | 1.50 | 0.00 | 14.37 | 380.33 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 27 | S2.06 | 27.55 | 0.90 | 383.24 | 11.50 | 0.00 | 10.76 | 381.94 | 10.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 28 | S2.07 | 26.82 | 0.00 | 383.86 | 1.48 | 0.00 | 8.14 | 382.58 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 29 | S2.08 | 26.82 | 0.00 | 384.35 | 1.48 | 0.00 | 5.65 | 383.07 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 30 | S2.09 | 26.82 | 13.55 | 385.32 | 1.47 | 0.00 | 4.18 | 384.05 | 0.20 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 31 | S2.10 | 13.27 | 0.00 | 386.73 | 1.38 | 0.00 | 5.27 | 385.53 | 0.18 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |
| 32 | S2.11 | 13.27 | 13.27 | 386.93 | 4.03 | 0.00 | 1.97 | 385.73 | 2.83 | 0 12:15 | 0 00:00 | 0.00 | 0.00 |

## Pipe Input

| SN | Element ID | Length (ft) | Inlet Invert Elevation (ft) | Inlet Invert Offset (ft) | Outlet Invert Elevation (ft) | Outlet Invert Offset (ft) | Total Drop (ft) | Average Slope (%) | Pipe Shape | Pipe Diameter or Height (in) | Pipe Width (in) | Manning's Roughness | Entrance Losses | Exit/Bend Losses | Additional Losses | Initial Flow (cfs) | Flap Gate | No. of Barrels |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | P1.01 | 66.76 | 374.00 | 0.00 | 373.00 | 0.00 | 1.00 | 1.5000 | CIRCULAR | 54.000 | 54.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 2 | P1.02 | 183.09 | 376.56 | 0.00 | 374.00 | 0.00 | 2.56 | 1.4000 | CIRCULAR | 54.000 | 54.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 3 | P1.03 | 170.47 | 378.95 | 0.00 | 376.56 | 0.00 | 2.39 | 1.4000 | CIRCULAR | 54.000 | 54.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 4 | P1.04 | 56.03 | 379.74 | 0.00 | 378.95 | 0.00 | 0.79 | 1.4100 | CIRCULAR | 54.000 | 54.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 5 | P1.05 | 64.98 | 380.40 | 0.00 | 379.74 | 0.00 | 0.66 | 1.0200 | CIRCULAR | 48.000 | 48.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 6 | P1.06 | 97.20 | 381.29 | 0.00 | 380.40 | 0.00 | 0.89 | 0.9200 | CIRCULAR | 48.000 | 48.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 7 | P1.07 | 47.82 | 381.74 | 0.00 | 381.29 | 0.00 | 0.45 | 0.9400 | CIRCULAR | 42.000 | 42.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 8 | P1.08 | 86.34 | 382.94 | 0.00 | 381.74 | 0.00 | 1.20 | 1.3900 | CIRCULAR | 42.000 | 42.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 9 | P1.09 | 29.24 | 383.30 | 0.00 | 382.94 | 0.00 | 0.36 | 1.2300 | CIRCULAR | 42.000 | 42.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 10 | P1.10 | 68.28 | 384.30 | 0.00 | 383.30 | 0.00 | 1.00 | 1.4600 | CIRCULAR | 42.000 | 42.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 11 | P1.11 | 52.03 | 385.03 | 0.00 | 384.30 | 0.00 | 0.73 | 1.4000 | CIRCULAR | 42.000 | 42.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 12 | P1.12 | 135.23 | 389.90 | 0.00 | 385.03 | 0.00 | 4.87 | 3.6000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 13 | P1.13 | 59.72 | 392.00 | 0.00 | 389.90 | 0.00 | 2.10 | 3.5200 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 14 | P1.14 | 36.49 | 392.77 | 0.00 | 392.00 | 0.00 | 0.77 | 2.1100 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 15 | P1.15 | 119.79 | 395.30 | 0.00 | 392.77 | 0.00 | 2.53 | 2.1100 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.8000 | 0.0000 | 0.00 | No | 1 |
| 16 | P1.16 | 98.60 | 397.35 | 0.00 | 395.30 | 0.00 | 2.05 | 2.0800 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.8000 | 0.0000 | 0.00 | No | 1 |
| 17 | P1.17 | 146.13 | 400.40 | 0.00 | 397.35 | 0.00 | 3.05 | 2.0900 | CIRCULAR | 24.000 | 24.000 | 0.0130 | 0.2000 | 0.8000 | 0.0000 | 0.00 | No | 1 |
| 18 | P1.18 | 74.66 | 402.00 | 0.00 | 400.40 | 0.00 | 1.60 | 2.1400 | CIRCULAR | 24.000 | 24.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 19 | P1.19 | 98.76 | 394.42 | 0.00 | 392.00 | 0.00 | 2.42 | 2.4500 | CIRCULAR | 24.000 | 24.000 | 0.0130 | 0.2000 | 0.8000 | 0.0000 | 0.00 | No | 1 |
| 20 | P1.20 | 78.24 | 396.30 | 0.00 | 394.42 | 0.00 | 1.88 | 2.4000 | CIRCULAR | 18.000 | 18.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 21 | P1.21 | 71.46 | 398.00 | 0.00 | 396.30 | 0.00 | 1.70 | 2.3800 | CIRCULAR | 18.000 | 18.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 22 | P1.22 | 299.67 | 384.00 | 0.00 | 374.00 | 0.00 | 10.00 | 3.3400 | CIRCULAR | 18.000 | 18.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 23 | P2.01 | 70.50 | 373.71 | -3.54 | 373.00 | 0.00 | 0.71 | 1.0100 | CIRCULAR | 36.000 | 36.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 24 | P2.02 | 117.10 | 378.42 | 0.00 | 377.25 | 0.00 | 1.17 | 1.0000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 25 | P2.03 | 43.21 | 378.85 | 0.00 | 378.42 | 0.00 | 0.43 | 1.0000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 26 | P2.04 | 127.13 | 380.13 | 0.00 | 378.85 | 0.00 | 1.28 | 1.0100 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 27 | P2.06 | 161.78 | 381.74 | 10.00 | 380.13 | 0.00 | 1.61 | 1.0000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 28 | P2.07 | 63.62 | 382.38 | 0.00 | 381.74 | 10.00 | 0.64 | 1.0100 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.5000 | 0.0000 | 0.00 | No | 1 |
| 29 | P2.08 | 49.15 | 382.87 | 0.00 | 382.38 | 0.00 | 0.49 | 1.0000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 30 | P2.09 | 97.65 | 383.85 | 0.00 | 382.87 | 0.00 | 0.98 | 1.0000 | CIRCULAR | 30.000 | 30.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 31 | P2.10 | 149.69 | 385.35 | 0.00 | 383.53 | -0.32 | 1.82 | 1.2200 | CIRCULAR | 24.000 | 24.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |
| 32 | P2.11 | 39.49 | 385.55 | 2.65 | 385.35 | 0.00 | 0.20 | 0.5100 | CIRCULAR | 24.000 | 24.000 | 0.0130 | 0.2000 | 0.6000 | 0.0000 | 0.00 | No | 1 |

## Pipe Results

| SN | Element ID | Peak Flow (cfs) | Time of Peak Flow Occurrence (days hh:mm) | Design Flow Capacity (cfs) | Peak Flow/ Design Flow Ratio | Peak Flow Velocity (ft/sec) | Travel Time (min) | Peak Flow Depth (ft) | Peak Flow Depth/ Total Depth Ratio | Total Time Surcharged (min) | Froude Number | Reported Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | P1.01 | 201.55 | 0 12:15 | 240.68 | 0.84 | 16.94 | 0.07 | 3.15 | 0.70 | 0.00 | | Calculated |
| 2 | P1.02 | 180.75 | 0 12:15 | 232.53 | 0.78 | 16.16 | 0.19 | 2.98 | 0.66 | 0.00 | | Calculated |
| 3 | P1.03 | 175.42 | 0 12:15 | 232.85 | 0.75 | 16.08 | 0.18 | 2.92 | 0.65 | 0.00 | | Calculated |
| 4 | P1.04 | 172.89 | 0 12:15 | 233.50 | 0.74 | 16.07 | 0.06 | 2.88 | 0.64 | 0.00 | | Calculated |
| 5 | P1.05 | 97.08 | 0 12:15 | 144.77 | 0.67 | 12.34 | 0.09 | 2.40 | 0.60 | 0.00 | | Calculated |
| 6 | P1.06 | 97.08 | 0 12:15 | 137.45 | 0.71 | 11.85 | 0.14 | 2.48 | 0.62 | 0.00 | | Calculated |
| 7 | P1.07 | 95.28 | 0 12:15 | 97.60 | 0.98 | 11.55 | 0.07 | 2.80 | 0.80 | 0.00 | | Calculated |
| 8 | P1.08 | 81.80 | 0 12:15 | 118.61 | 0.69 | 13.29 | 0.11 | 2.14 | 0.61 | 0.00 | | Calculated |
| 9 | P1.09 | 79.93 | 0 12:15 | 111.64 | 0.72 | 12.61 | 0.04 | 2.19 | 0.63 | 0.00 | | Calculated |
| 10 | P1.10 | 79.93 | 0 12:15 | 121.76 | 0.66 | 13.49 | 0.08 | 2.07 | 0.59 | 0.00 | | Calculated |
| 11 | P1.11 | 79.93 | 0 12:15 | 119.17 | 0.67 | 13.27 | 0.07 | 2.10 | 0.60 | 0.00 | | Calculated |
| 12 | P1.12 | 76.78 | 0 12:15 | 77.84 | 0.99 | 18.07 | 0.12 | 2.02 | 0.81 | 0.00 | | Calculated |
| 13 | P1.13 | 75.56 | 0 12:15 | 76.92 | 0.98 | 17.85 | 0.06 | 2.01 | 0.80 | 0.00 | | Calculated |
| 14 | P1.14 | 55.51 | 0 12:15 | 59.58 | 0.93 | 13.78 | 0.04 | 1.91 | 0.76 | 0.00 | | Calculated |
| 15 | P1.15 | 45.70 | 0 12:15 | 59.61 | 0.77 | 13.38 | 0.15 | 1.64 | 0.66 | 0.00 | | Calculated |
| 16 | P1.16 | 45.70 | 0 12:15 | 59.14 | 0.77 | 13.30 | 0.12 | 1.65 | 0.66 | 0.00 | | Calculated |
| 17 | P1.17 | 31.65 | 0 12:15 | 32.68 | 0.97 | 11.84 | 0.21 | 1.59 | 0.79 | 0.00 | | Calculated |
| 18 | P1.18 | 31.65 | 0 12:15 | 33.12 | 0.96 | 11.99 | 0.10 | 1.57 | 0.78 | 0.00 | | Calculated |
| 19 | P1.19 | 20.05 | 0 12:15 | 35.41 | 0.57 | 11.62 | 0.14 | 1.08 | 0.54 | 0.00 | | Calculated |
| 20 | P1.20 | 15.61 | 0 12:15 | 16.28 | 0.96 | 10.49 | 0.12 | 1.18 | 0.79 | 0.00 | | Calculated |
| 21 | P1.21 | 15.61 | 0 12:15 | 16.20 | 0.96 | 10.44 | 0.11 | 1.18 | 0.79 | 0.00 | | Calculated |
| 22 | P1.22 | 11.73 | 0 12:15 | 19.19 | 0.61 | 11.39 | 0.44 | 0.85 | 0.57 | 0.00 | | Calculated |
| 23 | P2.01 | 39.18 | 0 12:15 | 163.76 | 0.24 | 19.00 | 0.06 | 1.00 | 0.33 | 0.00 | | Calculated |
| 24 | P2.02 | 39.18 | 0 12:15 | 41.00 | 0.96 | 9.50 | 0.21 | 1.96 | 0.78 | 0.00 | | Calculated |
| 25 | P2.03 | 39.18 | 0 12:15 | 40.92 | 0.96 | 9.49 | 0.08 | 1.96 | 0.78 | 0.00 | | Calculated |
| 26 | P2.04 | 27.55 | 0 12:15 | 41.16 | 0.67 | 8.98 | 0.24 | 1.50 | 0.60 | 0.00 | | Calculated |
| 27 | P2.06 | 27.55 | 0 12:15 | 40.92 | 0.67 | 8.94 | 0.30 | 1.50 | 0.60 | 0.00 | | Calculated |
| 28 | P2.07 | 26.82 | 0 12:15 | 41.14 | 0.65 | 8.92 | 0.12 | 1.47 | 0.59 | 0.00 | | Calculated |
| 29 | P2.08 | 26.82 | 0 12:15 | 40.95 | 0.65 | 8.89 | 0.09 | 1.48 | 0.59 | 0.00 | | Calculated |
| 30 | P2.09 | 26.82 | 0 12:15 | 41.09 | 0.65 | 8.91 | 0.18 | 1.47 | 0.59 | 0.00 | | Calculated |
| 31 | P2.10 | 13.27 | 0 12:15 | 22.65 | 0.59 | 7.49 | 0.33 | 1.10 | 0.55 | 0.00 | | Calculated |
| 32 | P2.11 | 13.27 | 0 12:15 | 16.10 | 0.82 | 5.72 | 0.12 | 1.38 | 0.69 | 0.00 | | Calculated |

# Appendix D

## Opinion of Probable Cost

### West Chester Borough
### Chester County

NEWELL TERESKA & MACKAY ENGINEERING



2133a

| | | | | | | |
|---|---|---|---|---|---|---|
| CONTRACT NUMBER: | | 21000 | | | | |
| COST ESTIMATE: | | Concept | | | | |
| TYPE OF CONTRACT: | | Expert Witness | | | | |
| LOCATION: | | WCU | | | | |
| ESTIMATE BY: | | Aaron Jolin, PE | | | | |
| DATE OF ESTIMATE | | 5/20/2021 | | | | |
| **WORK SCOPE:** | | | | | | |
| | | WCU Concept Storm Drain System | | | | |
| | | And Associated Work | | | | |
| **COST BASIS:** | | PennDOT ECMS District 6 | | | | |
| **TOTAL COST:** | | Design/Permitting/General/Construction | | | $ 4,201,969.59 | |
| **CONTINGENCY:** | | Contingency: 5% | | | | |
| **ASSUMPTIONS:** | | Borrow fill material not required for pipe installation | | | | |
| | | Pipe cost includes installation | | | | |
| **ESTIMATE:** | | | | | | |
| Item | **PennDOT Item Number** | Qty | Units | Unit Cost | Total | Division Totals |
| STORM DRAIN TRUNK SYSTEM CONSTRUCTION | | | | | | |
| TYPE A 18" REINFORCED CONCRETE PIPE (7'-3' FILL 100-YR LIFE S/T.B.) | 0601-7509 | 150 | LF | $ 149.00 | $ 22,350.00 | |
| TYPE A 24" REINFORCED CONCRETE PIPE (7'-3' FILL 100-YR LIFE S/T.B.) | 0601-7517 | 510 | LF | $ 175.00 | $ 89,250.00 | |
| TYPE A 30" REINFORCED CONCRETE PIPE (7'-3' FILL 100-YR LIFE S/T.B.) | 0601-7043 | 1111 | LF | $ 245.00 | $ 272,195.00 | |
| TYPE A 36" REINFORCED CONCRETE PIPE (15'-3' FILL 100-YR LIFE S/T.B.) | 0601-7536 | 71 | LF | $ 300.00 | $ 21,300.00 | |
| TYPE A 42" REINFORCED CONCRETE PIPE (10'-3' FILL 100-YR LIFE S/T.B.) | 0601-7541 | 284 | LF | $ 335.00 | $ 95,140.00 | |
| TYPE A 48" REINFORCED CONCRETE PIPE (7'-3' FILL TRENCH BOX) | 0601-7546 | 162 | LF | $ 345.00 | $ 55,890.00 | |
| TYPE A 54" REINFORCED CONCRETE PIPE (<15" DEPTH) | 0601-7551 | 476 | LF | $ 735.00 | $ 349,860.00 | |
| TYPE M INLET TOP UNIT AND BICYCLE SAFE GRATE | 0605-2731 | 16 | EA. | $ 1,100.00 | $ 17,600.00 | |
| TYPE 6 INLET BOX, HEIGHT </= 10' | 0605-2862 | 6 | EA. | $ 9,000.00 | $ 54,000.00 | |
| TYPE 5 INLET BOX, HEIGHT </=10' | 0605-2858 | 6 | EA. | $ 7,000.00 | $ 42,000.00 | |
| TYPE 4 INLET BOX, HEIGHT </= 10' | 0605-2854 | 19 | EA. | $ 4,500.00 | $ 85,500.00 | |
| SPECIAL ENDWALL- TEAR DOWN AND REBUILD | NO NUMBER | 1 | EA. | $ 100,000.00 | $ 100,000.00 | |
| ROCK APRON | 0851-0003 | 75 | SY | $ 150.00 | $ 11,250.00 | |
| FLOWABLE BACKFILL, TYPE D (INCLUDES PLUGGING PIPE) | 4220-0030 | 64 | CY | $ 220.00 | $ 14,080.00 | |
| PIPE REMOVAL/DEMOLITION (CLASS 2 EXCAVATION) | 0204-0001 | 358 | CY | $ 30.00 | $ 10,740.00 | |
| | **TOTAL - STORM DRAIN TRUNK SYSTEM CONSTRUCTION** | | | | | **$ 1,241,155.00** |
| PERIMETER CAPTURE/CONVEYANCE | | | | | | |
| NYLOPLAST DRAIN BASINS WITH GRATES | NO NUMBER | 83 | EA | $ 1,200.00 | $ 99,600.00 | |
| TRAFFIC RATED TRENCH DRAIN | NO NUMBER | 574 | LF | $ 350.00 | $ 200,900.00 | |

| Item | PennDOT Item Number | Qty | Units | Unit Cost | Total | Division Totals |
|---|---|---|---|---|---|---|
| 12" THERMOPLASTIC GROUP I (15'-1.5' FILL DEPTH) | 0601-0311 | 4009 | LF | $ 90.00 | $ 360,810.00 | |
| CURB-TRENCHDRAIN or KNEEWALL-SWALE | NO NUMBER | 1023 | LF | $ 240.00 | $ 245,520.00 | |
| CLASS 2 EXCAVATION (0.14 cy/lf OF PERIMETER WORK) | 0204-0001 | 358 | CY | $ 30.00 | $ 10,740.00 | |
| SEEDNG AND SOIL SUPPLEMENTS - FORMULA D | 0804-0011 | 580 | LB | $ 13.00 | $ 7,540.00 | |
| SEEDING - FORMULA E | 0804-0004 | 90 | LB | $ 20.00 | $ 1,800.00 | |
| TEMP SHORT TERM MATTING TYPE 2A | 0806-0110 | 7000 | SY | $ 2.00 | $ 14,000.00 | |
| TOPSOIL FURNISHED AND PLACED | 0802-0001 | 732 | CY | $ 93.50 | $ 68,442.00 | |
| | **TOTAL - PERIMTER CAPTURE/CONVEYANCE** | | | | | **$ 1,009,352.00** |
| | | | | | | |
| UTILITY RELOCATION (BASED ON KNOWN INFORMATION) | | | | | | |
| REPLACE BOROUGH INLETS WITH SOLID TOPS AND MANHOLE COVERS | NO NUMBER | 5 | EA. | $ 4,500.00 | $ 22,500.00 | |
| 10" PVC SEWER | NO NUMBER | 188 | LF | $ 150.00 | $ 28,200.00 | |
| SANITARY SEWER MANOLE - 4' DIAM, 4-8' DEEP | NO NUMBER | 3 | EA. | $ 4,000.00 | $ 12,000.00 | |
| TYPE A 48"x78" ELLIPTICAL CONCRETE PIPE (3-2' TYPE B TRENCH BOX) | 0601-6429 | 258 | LF | $ 900.00 | $ 232,200.00 | |
| TYPE 12 STORMWATER MANHOLE >10 <20' Height | 0605-3072 | 6 | EA. | $ 40,000.00 | $ 240,000.00 | |
| | **TOTAL - UTILITY RELOCATION** | | | | | **$ 534,900.00** |
| | | | | | | |
| PAVING AND SIDEWALK RESTORATION | | | | | | |
| 2" SUPERPAVE ASPHALT MIX 12.5 MM SRL-G | 0411-0353 | 3290 | SY | $ 23.27 | $ 76,558.30 | |
| 6" SUPERPAVE BASE 25MM | 0311-0026 | 1645 | SY | $ 38.00 | $ 62,510.00 | |
| SIDEWALK (EXCLUDES SIDEWALK REPLACEMENT REQUIRED FOR KNEE WALLS/TRENCH DRAINS) | 0676-0001 | 1254 | SY | $ 93.50 | $ 117,249.00 | |
| CURB AND GUTTER | 0641-0005 | 80 | LF | $ 85.00 | $ 6,800.00 | |
| SAW-CUTTING AND OVERLAY SEALING | 0515-0001 | 3215 | LF | $ 7.00 | $ 22,505.00 | |
| TACK COAT | 0460-0001 | 4800 | SY | $ 0.50 | $ 2,400.00 | |
| MILLING 2" | 0491-0013 | 2400 | SY | $ 3.58 | $ 8,592.00 | |
| CRUSHED AGGREGATE BASE COURSE (6") | 0310-0003 | 2400 | SY | $ 8.42 | $ 20,208.00 | |
| | **TOTAL- PAVING AND SIDEWALK** | | | | | **$ 316,822.30** |
| | | | | | | |
| | **TOTAL - NET CONSTRUCTION COSTS** | | | | | **$ 3,102,229.30** |
| OTHER PROJECTED COSTS | | | | | | |
| OTHER DEMOLITION AND HAUL OFF (1%) | NA | 1 | LS | $ 31,022.29 | $ 31,022.29 | |
| PERMITTING COSTS (2%) | NA | 1 | LS | $ 62,044.59 | $ 62,044.59 | |
| ENGINEERING, SURVEY, SUE, EASEMENT, CONSTRUCTION ADMIN (15%) | NA | 1 | LS | $ 465,334.40 | $ 465,334.40 | |
| STAGED MOBILIZATION (8%) | NA | 1 | LS | $ 248,178.34 | $ 248,178.34 | |
| E&S COSTS (3%) | NA | 1 | LS | $ 93,066.88 | $ 93,066.88 | |
| | | | | **TOTAL - OTHER COSTS** | | **$ 899,646.50** |
| | | | | | | |
| | | | | ***GRAND TOTAL:*** | | |
| | | | | *Net Costs* | | $ 4,001,875.80 |
| | | | | *5% Estimated Contingency* | | $ 200,093.79 |
| | | | | ***Total Estimated Cost:*** | **==============** | **$ 4,201,969.59** |

D-3 2135a

# Appendix E

## Operation and Costs Calculations

West Chester Borough
Chester County

NEWELL
TERESKA &
MACKAY
ENGINEERING

## Operations and Costs Calculations Methodology

To determine the additional annual operations and costs associated with Option 3, NTM Engineering reviewed the Borough of West Chester Stream Protect Fee Report's projected budgets to determine an annual cost per linear mile of storm drain. West Chester's fee schedule is based on an annual budget of 1.3 million dollars with the breakdown as shown below (taken from the 2017 West Chester Stream Protection Fee Report).

Table 1 below "Medium revised" shows the breakdown of cost estimates for program elements which the current impervious coverage fee (SPF) was projected to support annually, with the projected 6.70/1000 SF/month to fee based rate to generate the estimated $1.3m shown in the "Medium Revised" column.

Level of Service Cost Estimate Summary

| | Estimated Average Annual Costs | | | |
|---|---|---|---|---|
| | Low | Medium (revised) | Medium (original) | High |
| **Operating Costs** | | | | |
| Operations and Maintenance | $324,660 | $357,000 | $357,000 | $387,540 |
| NPDES Permit Activities | $10,880 | $33,100 | $33,100 | $59,580 |
| Administrative | $33,600 | $51,660 | $51,660 | $82,940 |
| Urban Forestry/Parks | $0 | $89,080 | $89,080 | $178,520 |
| Professional Services | $42,300 | $77,300 | $77,300 | $112,300 |
| **Total Operating** | **$411,440** | **$608,140** | **$608,140** | **$820,880** |
| **Capital Costs** | | | | |
| Equipment | $49,200 | $49,200 | $49,200 | $49,200 |
| Pipes | $250,750 | $250,750 | $250,750 | $250,750 |
| Stream Improvements | $320,500 | $320,500 | $320,500 | $320,500 |
| Additional Candidate Project | $0 | $61,000 | $285,600 | $571,000 |
| **Total Capital** | **$620,450** | **$681,450** | **$906,050** | **$1,191,450** |
| **Total Operating and Capital** | **$1,031,890** | **$1,289,590** | **$1,514,190** | **$2,012,330** |

Items not considered relative to West Chester University Costs were removed for consideration of calculating West Chester University's average annual costs as shown below.

**Calculation for Average Annual Operating and Capital Costs (per mile of storm drain)**

| | | |
|---|---|---|
| West Chester Borough Annual Budget for Operating and Capital Costs | $ | 1,289,590.00 |
| West Chester Borough Storm Drain Length (miles) | | 23 |
| West Chester Borough Cost Per Mile | $ | 56,069.13 |
| West Chester Borough Annual Budget Removing Items Not Considered Relative to West Chester University Costs (Removes Costs for Urban Forestry/Parks, Stream and Additional Candidate Projects Additional) | $ | 819,010.00 |
| West Chester University's Cost Per Mile | $ | 35,609.13 |
| Total Additional Miles to Be Maintained by West Chester University for Option 3 | | 1.2827 |
| West Chester University's Additional Annual Operations and Capital Costs | $ | 45,675.83 |

West Chester University's additional annual costs associated with Option 3 would be $45,675.83.

# Appendix F

## Expert Witness CVs

### West Chester Borough
### Chester County

NEWELL TERESKA & MACKAY ENGINEERING

# Scott A. Brown, MS, PE, D.WRE

## Senior Project Manager

NEWELL TERESKA & MACKAY ENGINEERING

### Professional Experience

Mr. Brown offers over 42 years of professional civil engineering experience specializing in urban drainage design, stormwater management, erosion and sedimentation control, hydrologic and hydraulic (H&H) analysis of river and watershed systems including floodplain analysis, and environmental agency coordination. His background also incudes experience in sustainable site design, utility design, and enviromental permitting including construction period and municipal stormwater NPDES permitting and waterway encroachment permitting. Mr. Brown has been involved with municipal land development plan reviews for code compliance and is actively involved in the development and delivery of stormwater management and drainage design professional training courses and seminars. He was a member of the PA DEP Best Management Practices Manual Technical Oversight Committee and is a Certified PennDOT Instructor, who teaches PennDOT's Highway Drainage Design, Stormwater Design & NPDES Permits, and Introduction to Highway Hydraulics courses. Mr. Brown's unique expertise and achievements in water resource engineering were acknowledged by the American Academy of Water Resource Engineers in 2013 through award of the credential Diplomat, Water Resource Engineer. His specific project experience is outlined below.

**Total Years of Experience: 42**

**Education:**

MS, Civil Engineering – Hydrology and Hydraulics, The Pennsylvania State University, 1979

BS, Civil Engineering, The Pennsylvania State University, 1977

**Licenses/Certifications:**

Professional Engineer:
PA No. PE042215R, 1991
NJ No. 24GE04685100, 2007
OH No. PE58163, 2014
VA No. 0402013334, 1982
WV No. 018145, 2009

National Council of Examiners for Engineering and Surveying (NCEES) Record No. 39398, 2010

ASCE Diplomat, Water Resources Engineer, 00632, 2013

Certified PennDOT Instructor, 2007

*Key Qualifications:*

- *Principal Author, Federal Highway Administration Publication HEC-22, Urban Drainage Design*
- *Co-author, Residential Site Development Standards for the Pennsylvania Housing Research Center*
- *Develops and teaches multiple stormwater management and drainage design courses and seminars*
- *Served as PA DEP Pennsylvania Stormwater Technical Work Group Design Standards Subcommittee Member*
- *Specializes in urban drainage design, stormwater management, and erosion and sediment control*
- *Expertise in H&H analysis of river and watershed systems, including floodplain analysis*
- *Diplomat, Water Resources Engineer*

### Forensic Engineering

**PTC Southern Beltway Section 55B, Peitragallo Gordon Alfano Bosick & Raspanti, LLP, Washington County, PA—*Principal Investigator and Expert*** in a dispute between a property owner and the Pennsylvania Turnpike Commission and their design and construction contractors. The question before the court is whether the Pennsylvania Turnpike Commission and it's contractors are responsible for damages resulting from storm runoff during the construction period. Responsibilities included review of case history and related background information including design reports, plans, specifications, correspondence, construction schedules, communications, and other relevant documentation. Responsibilities also included analysis of regional and local rainfall data and development of an expert report of findings.

**APEX at Kutztown Apartment Complex Infiltration Facility Failure, Kutztown University, Kutztown, PA—*Project Manager and Expert*** for investigation of Infiltration Area 2 failure including the basin overflow spillway at the APEX Student Apartment Complex. The investigation included design drawing and engineering calculations review and assessment, construction contractor interviews, field permeability data analysis, and field observations. The investigation revealed clear errors and omissions by the project's design engineer.

**Barger versus Dalesford Estates Community, Tredyffrin Township, Chester County, PA—*Project Manager and Technical Expert*** for stormwater management evaluations and basin operation and maintenance issues related to sinkhole development in and adjacent to a stormwater basin located on the Barger property.

**Galen Oaks Townhouse Basement Flooding Investigation, State College, PA—*Project Manager and Expert*** for the defense in litigation of basement flooding issues in the Galen Oaks townhouse community. The investigation included site drainage issue field investigation including consideration of the subsurface movement of moisture through soils, potential impacts from site stormwater infiltration practices, and the impact of connecting roof drains to subsurface foundation drains. The outcome was a settlement with the builder/developer to make necessary site improvement to rectify problems.

**Mill Creek Square Sink Hole Investigation, Lancaster County, PA—*Project Manager and Technical Expert*** for the cause evaluation of a sinkhole collapse in a stormwater infiltration/detention facility at a commercial facility along the Route 30 corridor just outside Lancaster City. The failure caused significant damage to adjacent residential properties.

**Pittston Aqueduct Failure, Pittston, PA—*Project Manager and Expert*** for hydraulics and stormwater for plaintiff in litigation related to building damage from the collapse of an over 100-year-old stone arch aqueduct in the City of Pittston. The investigation included hydrologic and hydraulic analysis and modeling to recreate the storm event that caused the failure to assist in determination of the aqueduct collapse cause. The analysis supported the conclusion that pressure and turbulence in the pipe at the failure location were sufficient to cause dislodging of individual arch stones resulting in failure.

**Borough of Sunbury Water Treatment Plant Holding Lagoon Failure, Borough Sunbury, PA—*Project Manager and Expert*** for the defense in litigation against the Borough of Sunbury claiming flood losses caused in part by a holding pond embankment failure at the Borough's water treatment facility during Shamokin Creek flooding. The investigation involved stream system modeling (HEC-RAS), stream stability evaluation, and investigation of embankment failure mode. The outcome was a settlement in favor of the Borough of Sunbury based on the technical report's findings.

## Stormwater Management/Drainage/Stormwater NPDES Permitting

**Pennsylvania Stormwater Technical Work Group, Department of Environmental Protection, Harrisburg, PA—*Subcommittee Member*** who participated on the Design Standards and Special Management Area Subcommittees providing recommendations to the PA DEP relative to needed revisions to the Pennsylvania Stormwater BMP Manual. Provided leadership and input for development of alternative design standard recommendations and assisted in drafting revisions to multiple sections of the "Special Management Areas" chapter.

**Luzerne County Transportation Authority Transit Maintenance and Operations Facility, PennDOT Bureau of Public Transportation, City of Wilkes-Barre, Luzurne County, PA – Project Manager and Technical Lead** for NTM's resopnsibilities as part of the design team. This project involves development of construction documents for all site improvements including roadway, parking, utility, and transit and maintenance facility design. NTM's resonsibilities include storm conveyance system and stormwater management analysis and design, erosion and sedimentation control design, and NPDES permitting.

**PTC I95 Sections A2 and A3 Roadway and Interchange Reconstruction and Widening, The Pennsylvania Turnpike Commission, Bucks County, PA— Project Manager and Technical Lead** for NTM's responsibilities on the project. The project involves development of construction and permit documents for reconstruction and widening of 1.3 miles of the Pennsylvania Turnpike mainline and major interchange ramp modifications at the Bensalem Interchange. NTM's responsibilities include stormwater management, drainage design, and preparation of NPDES permit documents. Challenges included restrictive township stormwater requirements, limited right-of-way, and NPDES permit requirement changes mid-project.

**PTC Milepost 320 – 326 Roadway Reconstruction Stormwatrer, E&S, and NPDES Permit Third Party Review, The Pennsylvania Turnpike Commission, Chester County and Montgomery County, PA—Project Manager and Technical Lead** for NTM's responsibilities on the project. NTM was brought in to the projects Final Design phase as a "third-party reviewer." The project extends from PA 29 in Phoenixville/Malvern Chester County to the Falley Forge exit in Montgomery Copunty. NTM's responsibilities include independently reviewing the previous stormwater design and NPDES permit submissions, evaluating the proposed design and providing improvement recommendations, and in-depth quality review of the fiinal NPDES permit package. The work included providing recommendations for achieving regulatory compliance within 12 separate sub watersheds all tributaries to special protection and impaired waters. Challenges included the carbonate nature of the watersheds, limited right-of-way, and significant public interest.

**PTC Milepost 320 – 326 Roadway Reconstruction NPDES Permit Envionrmental Hearing Board (EHB) Litigation, Buckley Brion McGuire & Morris L.L.P, Chester and Montgomery Counties, PA—Technical Expert** providing consultation and expert witness services to the Pennsylvania Turnpike Commission and Pennsylvania Department of Environmental Protection defense team. Mr. Brown was a key participant in negotiations with the Appellant's technical team. Mr. Brown's knowledge and expertise in stormwater management analysis/design and NPDES permitting were key factors in achieving a negotiated settlement to the EHB litigation brought by Valley Forge Chapter of Trout Unlimited and the National Parks Conservation Association.

**4-091 Transportation Improvement Study Milepost 333 to Milepost 351, Pennsylvania Turnpike Commission, Bucks and Montgomery Counties, PA—*/Project Manager*** and technical lead for NTM's services under a prime's agreement for a Transportation Improvement Study anticipating mainline widening from the Mid-County Interchange to the Bensalem Interchange. NTM's responsibilities included identify stormwater control facility land area needs to achieve regulatory compliance considering applicable 25 Pa Code §102.8 and PADEP stormwater requirements, municipal stormwater ordinances, and Pennsylvania Stormwater Management Act 167 Plans. Work also involved consideration of interchange improvements and overhead bridge replacements.

**SR 0080 Woodland Interchange Reconstruction, Clearfield County, PA—*Project Manager.*** This project involves reconstruction of the SR 80 bridges over SR 970 and ramp improvements at the Woodland Interchange. NTM is providing preliminary drainage system design including facility video inspection, condition assessment, and capacity analysis, final design, and construction period services. Mr. Brown is providing design oversight, QA/QC, and project management for NTM's project responsibilities.

**SR 0183 Bridge Over Norfolk Southern Raliway Replacement, City of Reading, PA – *Project Manager*.** This project involves the replacement of the SR 0183 bridge over the Norfolk Southern Railroad on a new vertical alignment. NTM's responsiblities include final drainge design and stormwater management evaluations. Final drainage design included evaluation of conveyance capacity for diverted flows through a portion of the City Storm conveyance system to the Schuylkill River. Mr. Brown's role includes design oversight, QA/QC, and project management for NTM's project responsibilities.

**Stormwater Reuse Study, The Pennsylvania State University, University Park Campus, Centre County, PA — *Project Manager.*** This project involved the development of a guidance document to assist project design professionals in the evaluation of stormwater reuse options for University Building projects. A key element of this study was development of a stormwater harvesting calculator based on local rainfall records for the the University Park Campus. Consideration was given to existing campus stromwater polanning and karst geology issues, as well as to maintaining uniformity in guidelines for harvesting and use facilities and equipment. Mr. Brown was responsible for project management and technical review and oversight.

**Project Management and Review Assistance for Projects in Berks County, PA, PennDOT District 5-0. — Review Engineer.** This project involved project management and review assistance for highway and bridge projects in Berks County. NTM responsibilities include Project Management, Erosion and Sedimentation Control Plan reviews, Hydraulic and Hydrologic Study reviews, Stormwater Management reviews, and permit document reviews. Mr. Brown provided senior technical review services on this project.

**Centre Region MS4 Partners Pollutant Reduction Plan (PRP) Development, Centre County, PA—*Project Manager*** for development of a joint municipal PRP for Penn State University, State College Borough, and College, Ferguson, Patton, and Harris Townships. The project includes development of a multi-municipal sewershed map, pollutant load modeling using the process based MapShed model, pollutant load evaluation, selection of BMPs, development of an implementation plan for mitigation of the regulatory pollutant load reduction, and assistance with the public participation elements of the plan.

**Pennsylvania Turnpike Commission MS4 Compliance Support, Statewide, PA – *Project Manager,*** for this project providing MS4 permit compliance support to the Pennsylvania Turnpike Commisson. NTM's responsibilities incude developing internal compliance documentaton, training program develoment, training program delivery, standards review, internal document updates, and develoment of new standards and maintenance documents associated with the following minimum control measures: public education and outreach; construction site stormwater runoff control; post-construction stormwater management; pollution prevention and good housekeepoing practices; and pollutant reduction plans. Mr. Brown's role also includes technical oversight and QA/QC responsibilities.

**Egypt Hollow Road Bridge (T-468) Replacement, Grove Township, Warren County, PA – *Project Manager*.** This project involved the replacement of the Egypt Hollow Road Bridge over Akeley Run. NTM provided H&H and waterway permitting, and Erosion & Sediment Pollution Control Plan development and permitting services. Mr. Brown's role included design oversight, QA/QC, and project Management for NTM's project responsibilities.

**McClelland Avenue Bridge (T-405) Replacement, Polk Borough, Venango County, PA – *Project Manager*.** This project involved the replacement of the McClelland Avneue Bridge over Sandy Run. NTM provided H&H and waterway permitting services, wetland delineation, and Erosion & Sediment Pollution Control Plan development and permitting services. Mr. Brown's role included design oversight, QA/QC, and project Management for NTM's project responsibilities.

**Permit and Policy Assistance, PennDOT BOMO, Harrisburg, PA—*Senior Technical Support*** providing review and technical input for development a Combined Pollution Reduction Plan (PRP)/Total Maximum Daily Load (TMDL) Plan for PennDOT's 2016-2021 MS4 Permit renewal application. The effort included developing a technical approach, methodology, and cost estimates for implementing the proposed Chesapeake Bay PRP.

**Suburban Avenue Drainage Improvements, Centre County, PA— *Project Manager and Design Engineer*** for the design of an improved drainage system to alleviate flooding along Suburban Avenue. The project included design of 375 linear feet of enlarged storm drain piping. An inovative drop inlet structure was designed at the upstream end of the conveyance pipe to maximize pipe capacity while meeting restrictive depth and cover condition requirements. Mr. Brown was the project manager technical design lead for this project. (2014 – 2015)

**Stormwater Basin Failure/Sinkhole Remediation Retrofit Plan, Pine Hall Development/Old Gatesburg Road, Ferguson Township, Centre County, PA—*Principle Investigator*** for development of stormwater quantity and quality control alternatives for retrofitting several stormwater infiltration basins that failed through lack of infiltration followed by sinkhole formation. In conjunction with a geotechnical engineer, retrofit alternatives were developed to enhance infiltration while controlling sinkhole development within these basins. (2012-2013)

**3-214 General Consulting Engineer (GCE) Services, Pennsylvania Turnpike Commission, Systemwide, PA—*Project Manager*.** This project involves conducting condition assessments of all Pennsylvania Turnpike Commission Infrastructure including roads, bridges, buildings, etc. NTM's role includes review and assessment of all drainage and stormwater infrastructure. The work involves field evaluations, conducting interviews with maintenance staff, and review of existing records to assess drainage and stormwater infrastructure condition and make recommendations for maintenance or other infrastructure upgrades. Under the same contract, NTM is assisting with developing internal PTC training for its Design Operations Manual. Mr. Brown provides senior oversight and QA/QC for the drainage and stormwater infrastructure condition assessments.

**3-241 Roadway Reconstruction Mileposts 320-326, Pennsylvania Turnpike Commission, Chester and Montgomery Counties, PA—*Project Manager/Quality Assurance Reviewer*** providing stormwater and permitting support services for the PTC's Roadway Reconstruction from PA 29 at Milepost 320 in Phoenixville/Malvern, Chester County, to the Valley Forge exit at Milepost 326, Montgomery County. This section of the Turnpike runs through Valley Creek Watershed, a high-quality karst waterway. Responsible for evaluating the proposed stormwater management design and providing improvement recommendations to meet NPDES permit requirements while respecting the Karst nature of the watershed. Also responsible for providing an in-depth quality review of the final NPDES permit package.

**SR 3014 Atherton Street Corridor Highway Improvement Projects, PennDOT, District 2-0, Centre County, PA—*Project Manager.*** This project includes Preliminary Design, Final Design, and Construction Consultation for various betterment improvement projects along SR 3014 in Patton, College, and Ferguson Townships and the Borough of State College. The improvements include pavement rehabilitation, drainage upgrades, signal upgrades, curb and sidewalk replacement, and the replacement of the cross draiange structure at Big Hollow Run. Critical design elements include draiange issues, utility coordination, public involvement, and maintenance and protection of traffic. NTM's responsibilities include drainage design, stormwater management design, erosion and sedimentation (E&S) control design, waterway hydrologic and hydraulic analysis (H&H), NPDES and waterway permitting, and box culvert design. Mr. Brown's responsibilities included project management for NTM's portions of the project. He also provided senior design guidance and QA/QC for drainage and E&S design.

**Fritz Island Wastewater Treatment Plant Upgrade, City of Reading Wastewater Treatment Plan, Berks County, PA—*Project Manager*** for assisting with the design of the Fritz Island Wastewater Treatment Plant upgrade. NTM developed the Erosion and Sediment Pollution Control (E&SPC) Plan and Post-Construction Stormwater Management (PCSM) Plan and provided a flood Impact assessment and NPDES and waterway permitting documents for this $100 million sewer treatment plant upgrade for the City of Reading. The Fritz Island Wastewater Treatment Plant is located on approximately 118 acres of Fritz Island, which is bounded by the Schuylkill River main channel and a flood relief channel. NTM developed a multi-stage E&SCP Plan to accommodate the need to keep the existing treatment plant in services during an anticipated three-year construction period. NTM selected stormwater best practices to avoid mobilization of contaminants, minimize maintenance, and meet regulatory requirements. The final management practices included seven bioretention basins, several land-scape restoration areas, and multiple grass-lined swales. Critical waterway permit elements included developing wetland and waterway impact mitigation plans, coordinating a Red Belly Turtle mitigation plan, and conducting a waterway H&H analysis to assess floodplain impacts. The hydraulic analysis involved developing a split flow model of the Schuylkill River to accurately assess the island's flood conditions. In addition to demonstrating that the proposed development activities would not impact flood levels in the Schuylkill River, the H&H model would be used to ensure that future plant flooding was minimized.

**Ferguson Township Stormwater Management Engineer, Ferguson Township, Centre County, PA—*Stormwater Management Engineer*** for Ferguson Township, providing review of land development plans and zoning requests to ensure compliance with the Township Stormwater Management Ordinances. Provided primary authorship of multiple revisions to the Township Stormwater Ordinance to address MS4 compliance and potential impacts to local groundwater and the environment resulting from accelerated sinkhole formation in the karst Spring Creek Watershed. Also provides surface drainage recommendations related to sinkhole repair in the Township, and advises the Board of Supervisors on stormwater management and drainage issues. (2007 – Current)

**Selders Lane Drainage Improvements, Ferguson Township, Centre County, PA— *Project Manager and Design Engineer*** for the design of an improved drainage system to alleviate flooding along Selders Lane. The project included design of 375 linear feet of enlarged storm drain piping, enlarged box culvert under Rosemont Drive, and 350 inear feet of conveyance channel. An inovative drop inlet structure was designed at the upstream end of the conveyance pipe to maximize pipe capacity while meeting restrictive depth and cover condition requirements. Mr. Brown was the project manager technical design lead for this project.

**Hydraulics Laboratory Support, Federal Highway Administration, Washington, DC—Manager and Principle Investigator** for highway drainage design investigations at the Federal Highway Administration Turner Fairbank Highway Research Center. Resposible for design and implementation of laboratory experiments related to highway drianage design.

**Spring Creek Stormwater Management Plan, Centre County Planning Office, Centre County, PA—*Project Manager*** for stormwater management planning for the Spring Creek Watershed in accordance with Pennsylvania Act 167. The project included developing an innovative technical standards and criteria to control stormwater runoff from a new development in this predominantly limestone underlain watershed.

**Spring Creek Watershed Water Quality Investigation, Centre County Planning Office, Centre County, PA—*Project Manager*** to select BMPs for treatment and control of urban runoff within this high quality watershed with significant karst influences.

**Clearfield County Stormwater Management Plan, Clearfield County Planning Office, Clearfield County, PA—*Project Manager*** for a stormwater management planning project covering 12 watersheds in Clearfield County. All planning and analysis was in compliance with Pennsylvania Act 167 requirements.

**Houserville Storm Drainage Improvements, College Township Department of Public Works, Centre County, PA—*Project Manager*** for the design of storm sewer conveyance improvements to alleviate nuisance flooding and general drainage problems within this 50-year-old neighborhood. Services included a significant public involvement initiative as well as design of and preparing construction documents for over 3000 linear feet of storm sewer piping and other conveyance components.

**Stormwater Runoff Remediation, Friends Hospital, Philadelphia, PA—*Project Manager*** for technical and conceptual design support for this storm runoff remediation project in the City of Philadelphia. The project goal was to reduce runoff to facilitate stormwater utility fee reductions for the owner.

**Municipal Stormwater Discharge Permit Compliance Activities, Narberth Borough and Lower Merion Township, Montgomery County, PA—*Project Manager*** responsible for the permit document development, annual reporting, and compliance issues associated with stormwater discharge (MS4) permits for both Narberth Borough and Lower Merion Township from 2006 through 2013. Services included illicit discharge detection monitoring and developing a Polychlorinated Biphenyl (PCB) Total Maximum Daily Loads (TMDL) Plan for municipal stormwater discharges to the Schuylkill River. Was responsible for completing the 20013-2018 MS4 permit renewal application.

**TMDL Plan, Lower Merion Township, Montgomery County, PA—*Project Manager*** for development of a Polychlorinated Biphenyl (PCB) Total Maximum Daily Loads (TMDL) Plan for discharges to the Schuylkill River. The plan included a strategy for detecting and mitigating possible pollutant loads in the municipal stormwater system. The TMDL Plan was submitted as part of the Township's 2013-2018 MS4 Permit renewal application.

**TMDL Strategy, Lower Merion Township, Montgomery County, PA— *Project Manager*** for development of a Schuylkill River Polychlorinated Biphenyl (PCB) Total Maximum Daily Loads (TMDL) strategy to address how Lower Merion Township will identify possible sources of PCBs within the Township and, if identified, how to mitigate those PCBs. The TMDL Strategy was submitted as part of the Township's 2013-2018 MS4 Permit renewal application.

**Resort and Water Park, Kalahari, Monroe County, PA—*Project Manager*** for stormwater design and NPDES permitting for this 158-acre resort and waterpark located in Toby Township in the Swiftwater Creek watershed (classified as exceptional value) and immediately adjacent to several exceptional value wetlands. The project included design of 18 surface and subsurface infiltration and stormwater management BMPs to ensure that the hydrologic character of the sensitive exceptional wetlands and stream would not be impacted.

**Stormwater Management Master Plan and Drainage Study, Mercer Borough, Mercer County, PA—*Project Manager*** for a Stormwater Management Master Plan and drainage improvements study for the Borough of Mercer.

**American Revolution Center Stormwater Management Plan, Montgomery County, Montgomery County, PA—*Engineer*** for the stormwater management design and analysis for a proposed museum and educational conference center development on 78 acres of fallow farmland and woodland along the Schuylkill River in Lower Providence Township. The stormwater management practices included use of pervious pavers, rain gardens, green roofs, and woodland and meadow landscape restoration.

**Pennsylvania Fish and Boat Commission Stream Dredging & Maintenance, Pennsylvania Department of General Services for, Erie County, PA—*Project Manager*** for preparing PA DEP and U.S. Army Corps of Engineers permit applications for stream dredging and other maintenance operations covering five Pennsylvania Fish and Boat facilities located at the mouth of tributaries to Lake Erie.

**SCI German Township Site Design and NPDES Permitting, Pennsylvania Department of General Services, Fayette County, PA—*Project Manager*** and design lead for drainage, stormwater management, and erosion and sediment control design and permitting for a 158-acre prison.

**SCI German Township Texas Eastern Gas Transmission Line Relocation Permitting, Pennsylvania Department of General Services, Fayette County, PA—*Project Manager*** for erosion and sediment control permitting (ESCGP-1) to relocate a 2,450-linear-foot gas transmission line.

**SCI Graterford East and West Prison Expansion NPDES Permit Documents, Pennsylvania Department of General Services, Montgomery County, PA—*Quality Assurance Reviewer*** for permit compliance and the design of all stormwater infrastructure. Stormwater elements included multiple stormwater management practices designed to mimic, to the maximum extent practicable, existing site hydrology particularly as it related to maintaining groundwater sources feeding wetlands and stream corridor buffer areas. The site's storm runoff feeds headwater areas to the Perkiomen and Skippack Creek Watersheds in Skippack Township.

**Bigler Sports Complex Stormwater Management Study, The Pennsylvania State University, University Park, PA—*Project Manager*** for this stormwater management study to investigate and define stormwater alternatives for planned development in and surrounding a 15-acre sports complex. Services included complex modeling to define runoff characteristics from both under-drained and non-under-drained fields.

**Fox Hollow/Park Avenue Drainage Improvements, The Pennsylvania State University, University Park, PA—*Project Manager*** for the design of comprehensive stormwater management improvements project for the Fox Hollow/Park Avenue watershed on the University Park campus. The project included developing a watershed hydrologic response model, assessing infrastructure needs within the watershed, developing a stormwater management plan and technical standards manual, and final design of several infrastructure improvement projects. This watershed's karst nature posed unique challenges for developing the plan's water quality and infiltration components.

**Pine Hall Drainage Improvements Study, The Pennsylvania State University, University Park, PA—*Project Manager*** for developing a Stormwater Master Plan and an Infrastructure Improvements Plan for drainage improvements within the Pine Hall drainage basin in Ferguson Township. The project included geotechnical investigations and design for a regional infiltration BMP.

**Convenience Store & Daycare, Trapasso, Monroe County, PA—*Quality Assurance Reviewer*** for the site design and NPDES permitting for a two-lot land development on a steeply sloping site with multiple point of discharge study locations in Pocono Township. Critical elements included non-surface water discharges and meeting conflicting agency regulatory requirements.

**Hotel, Trapasso, Monroe County, PA—*Quality Assurance Reviewer*** for the site design and NPDES permitting for an infill project to develop a hotel on an existing restaurant site in Pocono Township. The development required coordination of existing and proposed features to create a relatively seamless transition between old and new. The stormwater controls designs had to work around the infrastructure that was to remain while maintaining access to the existing building.

**Institutional Stormwater Discharge Permit Compliance Activities, Veterans Administration Medical Center, Martinsburg, WV—*Project Manager*** for developing municipal separate storm sewer (MS4) NPDES permit documents for this 175-acre campus. The effort included developing a stormwater management program to address public education and participation, erosion and sediment control for new construction standards, stormwater management standards, illicit discharge monitoring, and good housekeeping operation and maintenance practices. The program was designed to ensure compliance with local, state, and federal regulations.

## H&H and Waterway Studies

**Texas Creek Road Bridge Replacement, Anadarko Petroleum Corporation, Lycoming County, PA—*Project Manager*** for waterway analysis and permitting to reconstruct bridges over Texas Creek and Hugh's Run and a connecting township road in Pine Township. Services included H&H and scour analyses as well as preparing plans and reports in support of a joint permit application for waterway encroachments related to the project. Services also included preparing a NPDES construction and post-construction stormwater management permit plans and reports.

**Lincoln Woods Floodplain Impact Study, BETN Investment Company, Montgomery County, PA—*Project Manager*** in charge of a Wissahickon Creek floodplain encroachment study associated with permitting for restoring a 50-foot-high by 500-foot-long retaining wall, supporting ground around the Lincoln Woods Apartment complex in Springfield Township. The work involved developing a hydraulic model to assess floodplain and floodway impacts. The study's results were submitted in support of a waterway encroachment permit for the retaining wall restoration.

**River Meander Migration Analysis, Bureau of Indian Affairs, Washington, DC—*Engineer*** for a study to establish the meander migration patterns and migration history for a section of the Missouri River.

**100-200 Berwyn Place Pond Dredging, Brandywine Realty Group, Chester County, PA—*Project Manager*** for design and permit maintenance dredging for a 2-acre in-line pond/stormwater management basin on a 29-acre office complex on Cassett Road in Tredyffrin Township.

**100-200 Berwyn Place Stream Restoration, Brandywine Realty Group, Chester County, PA—*Project Manager*** for the design and permitting of stream restoration improvements to control erosion and reduce sediment discharged to an in-line pond in Tredyffrin Township. Services included H&H analysis, permitting, and preparing construction documents for waterway improvements, including cross-vanes and vegetative plantings to stabilize the waterway.

**Mountain Run, City of Culpepper, Culpepper, VA—*Engineer*** for a detailed floodplain alteration study. Services included applying to FEMA for processing of a flood boundary map amendment.

**Design of Riprap Revetments, Federal Highway Administration, Washington, DC—*Engineer*** for developing revised design guidelines for the design of riprap revetments.

**Stream Channel Degradation and Aggradation, Federal Highway Administration, Washington, DC—*Engineer*** for evaluating highway and bridge stability problems related to stream channel instabilities at over 100 sites nationwide.

**Streambank Stabilization Measures, Federal Highway Administration, Washington, DC—*Engineer*** for investigating the effectiveness of streambank stabilization methods and evaluating flow control structures used at highway bridges.

**Allegheny River Floodplain Encroachment Study for Route 6 Bridge Rehabilitation, Hawbaker Engineering, LLC, Port Allegany, PA—*Project Manager*** for a river floodplain study to identify flood levels for a 2.33-year event. This study was used to define areas outside these flood limits for use as contractor stockpile areas. (2008)

**Buck Run Floodway Determination and Encroachment Study, Hawbaker Engineering LLC, Mifflin County, PA—*Project Manager*** for a floodway determination study for Buck Run in Derry Heights, Brown Township. The study's goal was to establish the Buck Run floodway adjacent to a proposed roadway embankment. This study was submitted to and approved by the PA DEP as part of the waterway permit for the proposed roadway embankment construction.

**Burnham Interchange Floodway Encroachment Study, Hawbaker Engineering LLC, Mifflin County, PA—*Project Manager*** for this floodway encroachment study to establish floodway impacts associated with interchange improvements at the Route 322 interchange at Burnham in Brown Township. The resulting report was submitted to the PA DEP and approved as part of the waterway permit for the interchange improvements.

**Millers Run Floodplain Encroachment Study, Hawbaker Engineering, LLC, Williamsport, PA—*Project Manager*** for a river floodplain study to identify development activities impacts n project flood levels for adjacent levees. The resulting report was submitted to the PA DEP as part of the waterway permit for land development activities proposed adjacent to Millers Run.

**Sandy Lick Creek Floodplain Study, Hawbaker Enginering, LLC, Clearfield County, PA— *Project Manager*** for a study to assess flood level impacts resulting from the construction of a sand unloading and storage facility to be located partially in the Sandy Lick Creek floodplain. The results indicated that construction would have no impact on the 100-year floodplain in Sandy Township. The report was submitted to the PA DEP as part of the project's waterway permit application and approved.

**Turkey Run Floodplain Encroachment Study, Hawbaker Engineering, LLC, Lycoming County, PA—*Project Manager*** for a floodplain encroachment study to evaluate impacts associated with installation of a new culvert at SR 2014. Services involved H&H analysis of the existing and replacement culverts to assess impacts to flood levels along Turkey Run. The study was submitted to and approved by the PA DEP as part of the waterway permit for the proposed improvements.

**Kalahari Resort and Water Park Water Balance Assessment, Kalahari, Monroe County, PA— *Project Manager*** to assess the watershed water balance in support of a groundwater withdrawal permit for an 150-acre waterpark in Toby Township.

**Town Branch Flood Plain Study, Town of Leesburg, Leesburg, VA—*Engineer*** for a detailed floodplain alteration study for Town Branch in the vicinity of Dry Mill Road. Services included applying to FEMA for processing of a flood boundary map amendment.

**Unnamed Tributary to the Potomac River, Loudoun County, VA—*Engineer*** for a detailed floodplain alteration study. Services included applying to FEMA for processing of a flood boundary map amendment.

**Parks' Stormwater Impact Mitigation and Stream Restoration Feasibility Study, Lower Merion Township, Montgomery County, PA—*Project Manager*** for developing conceptual stream and park restoration projects to mitigate impacts caused by uncontrolled urban runoff in 11 Township-owned neighborhood and community parks. The study's goals were to provied preliminary identication of projects to address stream impairments as part of anticipated requirements under the township municipal separate storm sewer (MS4) permit and to also enhance park aesthetic values and environmental education opportunities for residents.

**Soapstone Watershed Assessment, Lower Merion Township, Montgomery County, PA— *Project Manager*** for a watershed assessment to evaluate stream stability and resolve erosion and debris transport issues in this suburban watershed near Philadelphia. Services included field evaluation of erosion and sediment/debris transport characteristics within the watershed and development of alternatives and recommendations for stream stabilization and reduction of debris transport. Developed preliminary cost estimates for each alternative.

**Hydraulic Vulnerability Assessments, NYDOT, Region 6, NY—*Quality Assurance Reviewer*** for hydraulic vulnerability assessments on 1,200 state and local bridges in NYDOT's Region 6.

**Scour Assessments for I-90 over the Buffalo River and Cazenovia Creeks, New York State Thruway Authority, Buffalo, NY—*Engineer*** for the design of scour retrofits to the Cazenovia Creek and Buffalo River Bridges.

**Warren County Bridge No. 04050 over Pullins Kill, Warren County, Warren County, NJ— *Project Manager*** for waterway related impact analysis and preparing permit documents to replace Warren County Bridge No. 04050 in Blairstown Township. Services included H&H modeling to determine flood hazard area impacts, design of stream scour countermeasures, and assessment of net waterway fill. The work also included analysis of construction period impacts resulting from temporary causeways required during construction.

**Consumptive Use Remediation Project, Confidential Client, Centre County, PA—*Project Manager*** for developing the preliminary design concepts and cost estimates for a major water withdrawal and consumptive use remediation project. This project involved providing 30-MGD of make-up water to a major Pennsylvania river basin to offset consumptive use within the watershed by a significant energy provider. Services included the conceptual design of the water withdraw pumping facilities, several miles of conveyance pipe, access roads, and associated infrastructure and support facilities.

**Surface Water Supply Assessment, Confidential Client, Schuylkill County, PA—*Project Manager*** for assessing surface water supply availability to meet a 1.1-MGD consumptive use demand for an energy development project in Reilly Township. Sources of supply evaluated included surface runoff capture, creek/stream withdrawals, mine water withdrawals, and re-use of nearby sewage treatment plant discharges.

**Adler Gymnasium Addition Floodplain Impact Study, The Pennsylvania State University, Altoona, PA—*Project Manager*** in charge of a floodplain encroachment study for Spring Run through the Altoona Campus. The analysis involved developing a hydraulic model for Spring Run to evaluate potential flood level impacts resulting from the anticipated building addition footprint. The study's goal was to define, if applicable, whether local and state regulatory standards for developing within floodplains could be reasonably met given the proposed additions.

## Environmental Studies

**Outfall Dispersion Analysis, GPU Nuclear, Middletown, PA—*Engineer*** for this study to establish dispersion characteristics in the Susquehanna River downstream of the Three Mile Island power plant. Field data was used to calibrate a dispersion model of the study reach for use in future planning studies.

**Outfall Dispersion Analysis, Pennsylvania Power and Light, Berwick, PA—*Engineer*** for this study to establish dispersion characteristics in the North Branch of the Susquehanna River downstream of the Susquehanna Steam Electric Station located near Berwick. Field data was used to calibrate a dispersion model of the study reach for use in future planning studies.

**Dispersion Analysis, U.S. Army Corps of Engineers, Omaha, NE—*Engineer*** on this study to establish dispersion characteristics in several reaches of the Missouri River. Field data was collected and used to calibrate a dispersion model of the study reaches for use in future planning studies.

## Dams

**Wayne Glen Dam, Arcadia Land Company, Narberth, PA—*Project Manager*** for the H&H analysis of this regional flood control dam proposed as part of the Wayne Glen Development located in Tredyffrin Township, Chester County. The project included an H&H analysis in support of the design of the dam structure, reservoir, and spillways to meet established peak flood rate reduction criteria established by Tredyffrin Township. Also performed a dam breach analysis in accordance with PA DEP dam safety regulations.

**Beech Mountain Lakes Dam, Beech Mountain Lakes Association, Luzerne County, PA—*Project Manager*** for the H&H analysis for a new emergency spillway at this recreational dam. Services included modeling numerous spillway configurations in compliance with PA DEP dam safety requirements. The work also involved hydraulic river system modeling of downstream waterways to assess floodplain impacts.

**Echo Lake Dam Restoration and Permitting, Echo Lake Development Owners Association Northampton County, PA—*Project Manager*** for the dam permit and construction documents to restore the Echo Lake Dam in Upper Mt. Bethel Township. Services included redesigning the spillway to meet current regulatory requirements, dam breach analysis, an Emergency Action Plan, wetland impact assessment, and habitat impact assessments. Design work also included developing an Erosion and Sedimentation Pollution Control Plan as well as the necessary dam permit documents.

**Rosegarden Dam Inspection, Removal, and Stream Restoration, LINLO Development Corporation, Cumberland County, PA—*Project Manager*** for a dam inspection and repair investigation for this 100+-year-old dam and two nearby raceway dam/spillways on the Yellow Breaches Creek just south of Mechanicsburg in Lower Allentown Township. The study recommended complete removal of the dam. Services also included assisting the owner with securing funding for the dam removal and developing the dam removal and stream restoration plans and permit documents.

**Knox and Remington Dam Breach Analysis and Emergency Action Plan, Lower Merion Township, Montgomery County, PA—*Project Manager*** for a dam breach analysis and developing an *Emergency Action Plan* for the Knox and Remington Basin Dams owned by Lower Merion Township. All services were completed in accordance with PA DEP requirements.

**Knox, Remington, and Rolling Hill Dam Inspections, Lower Merion Township, Montgomery County, PA—** Performed dam inspections and prepared annual dam inspection reports for submission to PA DEP for Knox, Remington, and Rolling Hill Dam's all owned by Lower Merion Township.

**Carbaugh Run Dam Breach Analysis and *Emergency Action Plan*, Pennsylvania Department of Public Welfare, Adams and Franklin Counties, PA—*Project Manager*** for a dam breach analysis and developing an Emergency Action Plan for the Carbaugh Run Dam in South Mountain. The dam breach analysis and Emergency Action Plan were developed in accordance with PA DEP dam safety regulations.

**Mill Dam Inspection, Breach Analysis, and *Emergency Action Plan*, Pennsylvania Department of Public Welfare, Berks County, PA—*Project Manager*** for multiple dam inspections and developing an Emergency Action Plan in accordance with PA DEP requirements for the Mill Dam on Hospital Run on the property of the Wernersville State Hospital. The Emergency Action Plan included developing a dam breach model to establish the extent of flooding under a specified design dam breach flood event. Also aided the client with determining funding sources for the dam's removal.

## Site Design/Planning/Permitting (Facilities)

**Residential Site Develoment Standandards, Pennsylvania Housing Research Center at Penn State** – Project Manager and Principal Investigator for developent of policies and standards for more sustainable residential site design in Pennsylvania. The project developed model standards and policies that were science based and could be used by municipalities to promote resopnsible and affordable development.

**Fox Hollow Subdivision, Allegheny Township, Blair County, PA—*Project Manager*** for the civil design of a 187-acre, 134-lot subdivision including all site geometry, road design, sanitary sewer collection system design, potable water distribution system design, stormwater management design, erosion and sediment control design, and land development permit processing.

**Christian Missionary Alliance Church, Ferguson Township, Centre County, PA—*Project Manager*** for the site engineering including site geometry, pavement detailing, drainage design, stormwater management design, and sedimentation and erosion control design. Services also included preparing all necessary permit plans and reports.

**North Atherton Shoppes Strip Mall, Ferguson Township, Centre County, PA—*Project Manager*** for the site design for a 60,000-square-foot strip mall. Services included site geometry, pavement design, sanitary sewer and potable water connection design and detailing, stormwater management design, erosion and sediment control design, and land development permit processing.

**Tudek Park Expansion, Ferguson Township, Centre County, PA—*Quality Assurance*** for the site work design and permit document preparation to expand a community park. Services included adding soccer fields, pedestrian trails, and associated infrastructure.

**Pleasant Gap Quarries Surface Facility Expansion, Graymont, Centre County, PA—*Project Manager*** for the site layout, drainage design, and grading for a significant expansion of surface limestone handling facilities for this 150-acre industrial site. The design included relocation of subsurface mine dewatering lines and relocation of material stockpiles and access roadways to accommodate the addition of major new conveyor systems and rock handling facilities.

**Gas Pipeline Highway Occupancy Permits, NiSource, Centre County, PA—*Project Manager*** for developing municipal and PennDOT highway occupancy permit documents for residential gas service line replacements in the State College and Bellefonte.

**Moshannon Valley Correction Facility, Pennsylvania Department of Corrections, Clearfield County, PA—*Project Manager*** for site and infrastructure improvements for a 3,500-bed prison complex in Morris and Decatur Townships. The site design included site layout and grading for a 28-building facility, 2.5 miles of road improvements, approximately 10,000 feet of sanitary sewer main extension, and a 7600-foot water main extension. Services also included preparing applications and support materials for all necessary land development approvals and permits.

**Agricultural Products Storage Facilities Improvements, The Pennsylvania State University, University Park, PA—*Project Manager*** to review and compile state and local land development regulations for improvements to four agricultural product storage areas and a proposed agricultural products digester. These planned projects were located in Benner and College Townships.

**Beaver Stadium Expansion, The Pennsylvania State University, University Park, PA—*Project Manager*** for the land development approvals and utility design to expand Beaver Stadium. Responsible for designing all exterior utility modifications including the water, sewer, and storm sewer systems. Coordinated the land development and erosion control plan approvals through College Township and the Centre County Conservation District.

**Centre County Visitors' Center, The Pennsylvania State University, University Park, PA—*Project Manager*** for the infrastructure design for the Centre County Visitors' Center located adjacent to Beaver Stadium. Coordinated the land development and erosion control plan approvals through College Township and the Centre County Conservation District.

**Coal and Ash Handling Area Improvements, The Pennsylvania State University, University Park, PA—*Project Manager*** for preparing construction plans and specifications to improve the coal and ash handling area at the University's power plant. Services included design of a concrete back-wall for the storage area, concrete pavement for the storage area surface, and installation of a vortex stormwater quality unit to minimize pollutant discharges to the borough storm sewer system. Coordinated the land development and erosion control permitting through the State College Borough and the Centre County Conservation District, respectively. This project was undertaken to improve the quality of storm runoff from the coal and ash handling area.

**Intercollegiate Athletics Hoop Storage Structure, The Pennsylvania State University, University Park, PA—*Project Manager*** for site work design and land development permitting to construct a 7,200-square-foot enclosed hoop storage structure. The design included demolition of an existing site garage, provisions for utility service to the new structure, an access drive, and stormwater management design to meet state NPDES and local municipal ordinance requirements.

**Misciagna Family Arts Center Addition, The Pennsylvania State University, Altoona, PA—*Project Manager*** for the site geometric design, utility modifications, stormwater management design, erosion and sediment control design, and land development permit processing for additions to the Misciagna Family Arts Center on the Altoona Campus.

**Nittany Parking Deck and Landscape Depot, The Pennsylvania State University, University Park, PA—*Project Manager*** for the site geometric design, utility modifications, stormwater management design, erosion and sediment control design, and land development permit processing to expand the Nittany Parking Deck. Services also included the geometric design to expand a surface parking lot for the Nittany Lion Inn adjacent to the Parking Deck. Coordinated the land development and erosion control plan approval through the State College Borough and the Centre County Conservation District.

**Pattee Library – Knowledge Commons Renovation Projects Phase III, The Pennsylvania State University, University Park, PA—*Project Manager*** for the site design and land development permitting to renovate the Pattee Library. The land development approvals were coordinated through the Borough of State College.

**Pollock Commons Renovations, The Pennsylvania State University, University Park, PA—*Project Manager*** for the design and permitting for new a new electric ductbank system to connect multiple buildings within the Pollock student housing area and parking/access area improvements. Services also involved preparation of erosion and sediment control permit documents.

**Steidle Building Renovations, The Pennsylvania State University, University Park, PA—*Project Manager*** for the site work, utility design, and land development permitting for a n118,500-square-foot renovation and expansion of the Steidle Building on the University Park Campus. The design included demolition and reconstruction of approximately 35% of the building's footprint and the addition of a new rear entrance area. Critical site design considerations included development of construction staging areas in a congested area of the campus, as well as meeting municipal water quality requirements for storm runoff.

**Retail Building, OS6-Tricon Development, City of Vineland, NJ—*Engineer*** responsible for the site design and permitting for a commercial development center that included floodplain analysis and surface water resource protection area documentation for NJDEP permitting. The project consisted of a 39,500-square-foot retail building, a 4,580-square-foot restaurant, and associated parking facilities.

**Uranium Mine Surface Facilities, Roca Honda, San Mateo, NM—*Project Manager*** responsible for developing site design elements and permit documents for surface facilities associated with the Roca Honda uranium mine in Cibola County. Services included siting surface ore handling and loading facilities, employee and security support buildings, parking areas, and all associated infrastructure needed to support a major underground uranium mine.

**Williamsburg Square Phases I, II, and III, Shaner Hotel Group, Centre County, PA—*Project Manager*** for site engineering for the three-phase development of a 15-acre hotel and restaurant complex in Patton Township. The site included three hotels, two restaurants, and the national headquarters building for the Shaner Hotel Group. Services included site geometry, pavement design, sanitary sewer and potable water system design, stormwater management design, erosion and sediment control design, and land development permit processing.

**YMCA Natatorium Addition, State College Area YMCA, Centre County, PA—*Project Manager*** for the site design of an 18,000-square-foot natatorium addition to the State College Area YMCA in the Borough of State College. Services included site geometry, pavement design, sanitary sewer and potable water connection design and detailing, stormwater management design, erosion and sediment control design, and land development permit processing.

**Voorhees Corporate Center, Voorhees Township, Camden County, NJ—*Project Manager*** for designing stormwater quality treatment and stormwater quantity control improvements for a commercial development, including a bank, a hotel, and retail sites. Responsibilities included NJPDES stormwater permitting.

**Little League Field Reconfiguration, Walker Township, Centre County, PA—*Project Manager*** for the revised layouts and plans to reconfigure the Walker Township Little League Fields to bring the fields into compliance for tournament play.

**Park Expansion, Walker Township, Centre County, PA—*Project Manager*** for civil engineering input for master planning and developing a conceptual design for a 30-acre expansion to the Walker Township Community Park. The master plan included new facilities for baseball, softball, and multi-use sports (soccer, football, lacrosse); parking; picnic pavilions; playgrounds; horseshoe pits; volleyball; a gazebo; informal play areas; a natural turf amphitheater; a loop pathway system connecting park facilities and the surrounding community; a BMX track; a concession/restroom/ Lowerstorage building; stormwater management; and a future long-term indoor recreation center.

**Water Bottling Plant Feasibility Study, Confidential Client, Blair and Huntington Counties, PA—*Project Manager*** for a plant site feasibility study for a major water bottling company. Services involved potential plan site evaluation based on available site size, zoning, site location relative to spring location, spring water piping versus tanker truck logistical considerations, utility availability, and truck to market accessibility. Considered properties in a two-county area in the general vicinity of an existing spring source.

**The Oaks at Pleasant Gap, Confidential Land Development Client, Centre County, PA—*Project Manager*** for the grading and drainage design for this planned retirement and assisted living community in Spring Township.

## Technical Training & Manual Projects

**Highway Drainage Design Training, NTM and PennDOT, Harrisburg, PA—*Course Developer/Instructor*** for a three and a half day Highway Drainage course. Also assisted with the development of a four-day Stormwater Management and NPDES Permitting course and served as a lead instructor for 12 deliveries of these courses, as a part of PennDOT's Drainage Professional Development Series.

**Stormwater Management Facilities Operation and Maintenance, PennDOT Local Transportation Assistance Program (LTAP) and Pennsylvania State Association of Township Supervisors—*Course Developer/Lead Instructor*** for a four-hour Stormwater Management Facilities Operation and Maintenance course to supplement existing LTAP roadway drainage courses. During the contract, delivered this course over 30 times to local municipal staff and elected officials. Also served as stormwater and drainage technical expert providing support to local municipalities in response to technical assist requests under the LTAP program.

***Best Management Practices Manual* Technical Oversight Committee, Department of Environmental Protection, Pennsylvania—*Committee Member*** providing peer review and oversight during development of Pennsylvania's Stormwater *Best Management Practices Manual.*

**Urban Drainage Design Manual, Federal Highway Administration, Washington, DC—*Project Manager/Principal Investigator*** for development of a comprehensive drainage design manual providing state-of-the-art storm drain design methods and techniques to assist highway engineers in the design of pavement drainage, conveyance, and stormwater management systems. Served as the principal author for the original publication in 1996 and provided input for updates and revisions to more recent editions of the document. This publication is available as FHWA Hydraulic Engineering Circular 22 (HEC-22). The analysis methods in HEC-22 are referenced in DM2-10.

## Professional Organizations

American Society of Civil Engineers (ASCE)
American Public Works Association
American Academy of Water Resources Engineers

## Technical Training & Course Development Experience

Adjunct Professor, The Pennsylvania State University, 1998-2005
- CE 360 – Fluid Mechanics Course
- CE 361 – Hydrology Course
- CE 410W – Sustainable Residential Development Design Senior Capstone Project Course

Developer/Instructor, PennDOT Technical Training and Development Section, 2007-current
- Highway Drainage Design – Developer & Lead Instructor
- Stormwater Design & NPDES Permits – Contributing Developer & Instructor
- Introduction to Highway Hydraulics – Instructor

Developer/Instructor, PennDOT Local Transportation Assistance Program, Various Pennsylvania Municipalities, 2007-current
- Stormwater Management Facilities Operation and Maintenance – Developer & Instructor
- Stormwater Management and NPDES Permitting for Municipal Officials – Developer & Instructor

Developer/Insructor, PennDOT Technical Training 2006
- Stormwater Management in a New Age – Developer and Lead Instructor.

Developer/Instructor, Lorman Educational Series
- Current Issues in Stromwater Management (Harrisburg, 2006)
- Understanding Hydrologic Processes for Better Stormwater Management (Philadelphia, 2007)

Instructor, The Pennsylvania State University Pennsylvania Housing Research Center, 2005
- Stormwater Management in a New Age

Understanding Infiltration Practices

Instructor, ASCE Lehigh Valley Chapter, 1998
- Urban Drainage Design

Instructor, 2012
- Basic Highway Hydraulics

## Modeling Experience

HEC-1, HEC-HMS, HEC-2, and HEC-RAS; HMR 51/52; TR-20 and TR-55; WMS; HY-8; and NWS DAMBRK

## Continuing Education

SWMM Applications, NTM Engineering, Inc., August 2019
Strategic Business Planning, Professional Services Management Journal, February 2018
Supervisor Safety Review Training, Safety Works, Inc., March 2016
Field Safety Review Training, Safety Works, Inc., March 2016
ASHE-PennDOT 2-0 Workshop, ASHE/PennDOT, June 2015

## Employment

NTM Engineering, Inc., Dillsburg, PA, January 2014-Present

Pennoni Associates Inc., State College, PA, September 2007-January 2014
Pennoni Associates Inc., Vineland, NJ, October 2006-September 2007
The Pennsylvania Housing Research Center, The Pennsylvania State University, July 2002-September 2006
Sweetland Engineering & Associates, State College, PA, July 1998-June 2002
TVGA Engineering Surveying, PC, Elma, NY, July 1991-June 1998
Scott A. Brown & Associates, Culpepper, VA, September 1988-June 1991
Kamber Engineering, Leesburg, VA, October 1987-September 1988
Sutron Corporation, Sterling, VA, June 1979-September 1987

## Publications/Presentations

*Residential Site Development Standards*, The Pennsylvania State University Pennsylvania Housing Research Center, Brown, S.A.; K. Foster, M. Rios, April 2007.

"Are Pennsylvania's New Stormwater Regulations a Catch-22 for Townships?," *Pennsylvania Township News*, Pennsylvania State Association of Township Supervisors, Brown, S.A., Vol. 61, No. 5, May, 2008.

"Urban Drainage Design Manual," *Hydraulic Engineering Circular No. 22*, Federal Highway Administration, Washington, DC, Brown S.A.; Schall, J.D.; Morris, J.L.; Doherty, C.L.; Stein, S.M.; and Warner, J.C., September 2009.

"Design of Riprap Revetments," *Hydraulic Engineering Circular No. 11*, Pub. No. FHWA IP-89-016, Federal Highway Administration, Washington, DC, Brown, S.A. and Clyde, E.S., March 1989.

"Application of Natural Stream Characteristics to Riprap Design," *Proceedings 66th Annual Meeting*, Transportation Research Board, National Academy of Sciences, Washington, DC, Brown, S.A. and Blodgett, J.C., January 1987.

"Streambank Stabilization Measures for Highway Engineers," *Report No. FHWA/RD-84/10*, Federal Highway Administration, Washington, DC Brown, S.A., July 1985.

"Design Guidelines for Spur-Type Flow Control Structures," *Report No. FHWA/RD-84/101*, Federal Highway Administration, Washington, DC, Brown, S.A. and McQuivey, R.S., July 1985.

"Prediction of Channel Bed Grade Changes at Highway Stream Crossings," *Proceedings, 61st Annual Meeting*, Transportation Research Board, National Academy of Sciences, Washington, DC, Brown, S.A., December 1982.

"Stream Channel Degradation and Aggradation: Analysis of Impacts to Highway Crossings Final Report," *Report No. FHWA/RD-80/159*, Federal Highway Administration, Washington, DC, Brown, S.A.; McQuivey, R.S.; and Keefer, T.N.; March 1981.

"Loyalsock Creek Model Study Verification of Mathematical and Physical Models in Hydraulic Engineering," *Proceedings of 26th Annual Hydraulics Division Specialty Conference*, University of Maryland, Miller, A.C.; Chadderton, R.A.; and Brown, S.A., August 1978.

# Aaron J. Jolin, PE

## Senior Engineer

Newell Tereska & Mackay Engineering

### Professional Experience

Mr. Jolin is an engineer who specializes in design and regulatory permitting of drainage, stormwater management and erosion and sedimentation control systems. His experience also includes hydrologic and hydraulic modeling for riverine systems, stream restoration, and dam breach analysis. His background also includes design and permitting for municipal, institutional, commercial, and residential site development projects. He has experience with site layout, grading, stormwater management, storm drainage systems, hydrology and hydraulics, roadways, parking, public right-of-way, floodplains, water, sewer, zoning, environmental, conservation, ADA, and other federal, state, and local code related design and permitting. His related project experience includes:

**Total Years of Experience: 14.5**

**Education:**

BS, Agricultural and Biological Engineering, The Pennsylvania State University, 2009

**Licenses/Certifications:**

Professional Engineer:
PA No. PE090935, 2020
MD No. PE0042435, 2012

*Key Qualifications:*

*Expertise in design and regulatory permitting of urban drainage, stormwater management, and erosion and sediment control*

*Expertise in hydrology and hydraulics modeling and regulatory permitting including riverine systems analysis, stream restoration, bridge/culvert modeling and dam breach analysis*

*Expertise in multi-disciplinary project design development and implementation*

*Expertise in stormwater management assessment and maintenance*

*Expertise in municpal engineering*

*Expertise in design of MS4 water quality facilities and retrofits*

### Forensic Engineering

**PTC Southern Beltway Section 55B, Peitragallo Gordon Alfano Bosick & Raspanti, LLP, Washington County, PA—*Engineer*** responsible for reviewing the case history and background (E&S and PCSM plans, reports, calculations, permits, specifications, violations, rainfall history) and preparation of expert witness report of findings for PTC.

### Stormwater Management, Erosion and Sediment Control, Hydrology and Hydraulics, Drainage and NPDES Permitting

**County of Lackawanna Transportation System (COLTS) Transit Facility, PennDOT Bureau of Public Transportation, Lackawanna County, PA—*Engineer*** responsible for PCSM, E&S and NPDES design and permitting for expansion of Colts Transit Facility.

**Burkittsville Green Streets and Stormwater Master Plan, Burkittsville, MD**, ***Project Manager/Engineer*** responsible for coordinating public meetings for community concerns and feedback, investigation of historic problems in the town relative to stormwater/sewer/potable water, providing preliminary H&H analysis and watershed studies, identifying and providing preliminary stream and drainage restoration options and opportunities, developing preliminary street design options with bike paths/traffic calming/landscaping/lighting/water quality treatment devices-while maintaining historic nature of town, developing cost estimates and assembling a final document to be used for applying for grants.

**Howard County Stormwater Retrofits, Howard County, MD-*Engineer*** responsible for water quality retro-fit design, erosion and sedimentation control and permitting of existing MD-378 registered dams in accordance with Howard County Public Private Partnership for meeting MS-4 pollution reduction goals.

**Montgomery County Stormwater Facility Inspection, Montgomery County, MD- *Engineer*,** working on a team of engineers and with County officials, responsible for reviewing field reports, providing QA/QC and providing direction for required maintenance of County-owned facilities.

**H&H Modeling for Bridge Design, York and Franklin Counties, PA—*Project Designer*** responsible for hydraulic/hydrologic modeling and waterways permitting for bridges in York and Franklin Counties, PA.

Responsible for various aspects of hydrology and hydraulic modeling for PennDOT reviewed County Bridges, plan and report preparation; focus on various methods of hydrology modeling including regression analysis, gauge weighting, and HEC-HMS TR-20 using GIS-based software Watershed Modeling System (Aquaveo), environmental permitting.

**Parkdale High School Green Infrastructure Pilot Study, Riverdale, MD-** ***Engineer*** responsible for developing a small pilot design for comparative analysis of different SWM treatment facilities, including treatment train sampling techniques for Prince George's County School's students at Parkdale High School.

**Manheim Township Detention Basin II Permitting and Design, Manheim Township, Lancaster County, PA—** ***Project Engineer*** for the analysis and design for improvements to a reclassified Chapter 105 Class C hazard dry impoundment in Manheim Township, Lancaster County, PA. Responsible for preparing technical analysis including HEC-HMS hydrologic study for determination of flow rate for probable maximum flood (PMF) event and incremental dam break simulation, unsteady state hydraulic analysis using HEC-RAS for determination of impacts of a dam failure per PA procedural guidelines, interface with PA Dam Safety personnel and project/client manager(s) to develop a cost estimate for required upgrades based on development of multiple mitigation options, design and calculation preparation for spillway, inlet, barrel and energy dissipater using FHWA Circular 14 and HDS 5 Publications, diaphragm filter design, construction plans, permitting and assistance with bidding.

**Gettysburg Borough Stratton Street Storm Drain Feasibility Study, Gettysburg, PA—*Project Designer*** responsible for preliminary design/improvement options for fixing drainage problems in the Gettysburg Borough, including H&H analysis and design, providing exhibits and written narrative for use in budgetary planning.

**Adams County Stormwater Management Ordinance Preparation, Adams County, PA—*Project Designer*** responsible for preparing new stormwater management ordinances in accordance with County Act 167 Plan for Gettysburg/Abbottstown/Fairfield Boroughs, Mount Pleasant, Hamiltonban, Hamilton and Oxford Townships.

**Gettysburg Inner Loop Greenway Master Plan, Gettysburg, PA—*Project Designer*** responsible for coordinating with local trail agency/Borough Engineer/Borough Planner to research and develop layout options, determine engineering design requirements, provide cost estimating, attend steering committee meetings, provide preliminary permitting agency (FEMA/PennDOT/Soil Conservation District) feedback, produce visuals/plan inserts/technical descriptions and preparation of final document for use in applying for grants.

**Municipal Culvert Replacement Projects, York and Franklin-*Project Designer*** responsible for H&H analysis, design, construction drawings and permitting of culverts for various municipalities in York and Adams County

**Mount Pleasant Twp Storm Store Road Stormwater Analysis, Mount Pleasant, PA-*Project Designer*** responsible for hydrologic and hydraulic modeling, analysis of existing problems, development of three alternatives solutions, preparation of exhibits for use by the Township in speaking with local residents about potential solutions requiring work outside of the right-of-way.

**Yokwood NPDES Permit Renewal and Stormwater Management Facilities, Greensburg, PA - *Project Designer*** responsible for (individual) NPDES Permitting renewal within exceptional value watershed, development of a standard BMP sizing sheet that allowed the developer to choose from several options including infiltration berms and drywells along with a combination of non-structural practices within individual lots. (The project had been designed under old design regulations where central stormwater facilities were considered inadequate and NPDES renewal required individual lots implore additional stormwater management BMPs.)

**East Vandergrift Storm Sewer Design, East Vandergrift, PA *Project Designer*** responsible for designing a financially feasible solution for a collapsed storm sewer (combination sewer), preparation of hydraulic/hydrologic analysis, culvert design options for the Borough of East Vandergrift

**Fairfax County Stormwater Facility Inspection, Fairfax, VA- *Inspector*** responsible for field condition assessment for various County-owned stormwater facilities around the County.

**HOA Assessments and Reserve Study Preparation, Fairfax County, VA-** ***Project Designer*** responsible for preparing infrastructure assessment of storm drain systems, stormwater management facilities, parking lots, sidewalks, retaining walls and other infrastructure in preparation for reserve study updates for various home-owner associations.

**Terre Arch Support Development, Terre Hill, PA-** ***Project Designer*** responsible for developing support and user spreadsheets for the Terre Arch Stormwater System for use by industry consultants as well as working with HydroCAD to develop stormwater chambers module.

**Hendrick House Expansion-LEED Gold Certified, University of Illinois-Urbana-Champaign,** ***Project Designer*** responsible for grading, porous pavement design, geometric layout of 30-well closed loop geothermal system, sanitary sewer pump station, erosion and sedimentation pollution control, local permitting (within a detailed FEMA study area on the Boneyard Creek), stormwater pump station, planning and details for green roof, sizing of cisterns for water reuse and civil-related LEED documentation.

**Village of Philo Storm Sewer/Stormwater Management Study, Philo, IL.** ***Project Designer*** responsible for development of feasibility study with design options for mitigating substantial flooding issues-retrofitting portions of the village with storm conveyance, storm sewer and stormwater management infrastructure.

**Clearview Stormwater Modeling, Champaign, IL-*Project Designer*** responsible for H&H modeling of as-built ponds

## Land Development and Site Design

**Tilden Middle School, Rockville, MD-** ***Project Manager/Engineer*** responsible for technical design including site layout and grading for buildings, parking lots, bus and parent drop-off loops, athletic fields/courts, utility connections and relocations layout, stormwater design, downstream H&H analysis and mitigation, erosion and sediment control, forest review coordination, site grading for ADA, ROW circulation improvements as well as coordinating development requirements with State, County, design team professionals and construction management team.

**Potomac Elementary School, Potomac, MD-** ***Project Manager/Engineer*** responsible for concept and final technical design including site layout and grading, utilities, stormwater management, storm drain-including downstream H&H analysis and mitigation, erosion and sediment control, forest review coordination, site grading-including ADA, ROW circulation and drainage improvements, pre/post floodplain modeling/permitting and hydraulic design for 400 l.f. of stream restoration as well as coordinating development requirements with client, State, County, design team professionals and construction management team.

**Fairmont Heights H.S., Landover, Maryland-** ***Project Manager/Engineer*** responsible for final technical design and permitting of site layout, phased erosion and sediment control-required for qualified brownfield site mitigation, forestation review coordination, site grading including ADA compliance, ROW traffic circulation improvements and signaling upgrades (in coordination with traffic engineer), floodplain mitigation and modeling, SWM as-built documentation as well as coordinating development requirements client, State, County and design team professionals.

**Julius West Middle School, Rockville, MD,** ***Project Manager/Engineer*** responsible for concept development and final technical design and permitting of site layout and grading, utilities, site grading including for ADA compliance, storm drain design, stormwater management design, ROW improvements, bidding and construction administration for school expansion.

**Laurel Library, Laurel MD,** ***Project Manager/Engineer*** responsible for final site civil technical design and permitting of utilities, grading-including for ADA compliance, storm drain design, stormwater management design, ROW improvements and bidding as well as construction administration and certification of stormwater as-builts for school expansion.

**Hyattsville Library, Hyattsville, MD-** ***Project Manager/Engineer*** responsible for concept site civil layout and grading design-including for ADA compliance, storm drain design, stormwater management design, ROW improvements, H&H analysis and floodplain permitting for reconstruction of a new library in Hyattsville MD.

**DC Water Fleet Maintenance Facility, Capitol Heights, MD** ***Project Manager/Engineer*** responsible for concept site layout, grading, stormwater management, H&H analysis and floodplain permitting for reconstruction of a new fleet maintenance facility as well as coordinating development requirements with client, State, County and design team professionals.

**Ten Mile Creek Trail Bridge, Headwaters at Little Seneca Lake, Boyds MD**, ***Project Manager/Engineer*** responsible for site design required for access and staging of an 80-ton truck crane, H&H floodplain/environmental/sediment control permitting, construction administration, ADA bridge approach design required to raise vehicular/walking steel truss bridge for local trail, high enough to avoid creation of debris dams during smaller frequent storm events.

**Seneca Creek Boat House, Boyds, MD**, ***Project Manager/Engineer*** responsible for site layout and grading, civil design, floodplain analysis/permitting and construction administration of an ADA accessible boat launch facility on Little Seneca Lake at Black Hills Regional Park.

**Carroll County Public School Pavement Assessments and Site Parking Designs for Five Schools, Carroll County, MD,** ***Project Manager/Engineer*** responsible for coordinating survey/geotechnical testing, identifying and designing ADA improvement requirements, researching utilities, completing pavement assessment, providing stormwater management design/permitting (as required), site layout and grading, developing plans/specs/bid packages for maintenance and improvement of parking lots/loading areas/bus loops as well as construction administration.

**Prince George's County P3 Program, Prince George's County, MD-** ***Engineer*** responsible for working with a team of professionals to develop standards for desktop analysis, field research requirements, design, implementation and costs of urban outfall and stream bank erosion stabilization for water quality credits associated with P3-MS4 program.

**Red Lion Municipal Authority Water Treatment Site Plan, Windsor Township, York County, PA-*****Project Designer*** responsible for grading, erosion and sedimentation pollution control design, storm drain design, and hydrologic/hydraulic modeling/technical report, NPDES/GP-4 permitting, development of specifications and sequencing plan for mitigating and monitoring the potentially acidic bed rock being excavated for construction for the plant.

**New Enterprise Stone and Lime Turnpike NPDES Fill Somerset County, PA-** ***Project Designer*** responsible for site plan grading, surface modeling, erosion and sedimentation pollution control, stormwater management facility design, NPDES and local permitting, H&H modeling and permitting for fill site.

**Corporate Park Development, Champaign, IL,** ***Project Designer*** responsible for site layout, grading and design of new corporate park, including H&H analysis for 1000 l.f. of channel improvements, a new bridge, incorporated stormwater management design, erosions and sediment control design, local road layout, grading, floodplain and environmental permitting as well as developing plans for permitting and construction.

**Tripi Subdivision Access Road, Gettysburg, PA** ***Project Manager and Designer*** responsible for topographic survey, site design/layout, site grading, utility layout (water and electric), stormwater management design, E&SC Design, NPDES permitting, PA DEP sewer module, municipal meetings/approvals, environmental permitting, wetlands mitigation design, bridge/culvert options analysis, H&H modeling and permitting, technical plan drawing, and attendance of client, State, Township and permitting agency meetings.

**Rice Fruit Company CA Storage Building/Site Reconfiguration, Menallen Township, PA -*****Project Manager and Designer*** responsible for topographic survey, site design/layout, site grading, utility layout, stormwater management design, wetlands mitigation plan and permitting, erosion and sediment control design, NPDES permitting, PennDOT HOP permitting and construction document preparation.

**Aesthetic Pond in Adams County, Hamiltonban Township, PA-** ***Project Manager and Designer*** responsible for H&H analysis, erosions and sediment control design, regulatory permitting through Dam Safety, wetlands mitigation plan, survey, stakeout and technical plan drawing

**Site's Property Access, Hamiltonban Township, Adams County, PA -** ***Project Manager and Designer*** responsible for developing multiple bridge/culvert options, H&H modeling, permitting, E&SC design, historic flood research on neighboring properties and technical plan drawing preparation.

## Municipal Engineering

**Borough ROW Management, State College Borough—*Borough Engineer*** responsible for management of the Borough ROW excavation and occupancy permitting-including sidewalk replacement, utility work, closures, plan review, inspections, traffic control, council approvals and general safety.

**Borough CIP and Fiscal Budgets, State College Borough—*Borough Engineer*** responsible for development of sanitary, storm, street, park, MS4 and other capital improvement projects and budgets.

**Borough MS4, State College Borough—*Borough Engineer*** responsible for managing annual Borough MS4 permitting.

**Borough Development Review, State College Borough—*Borough Engineer*** responsible for managing and completing engineering related development reviews, issuing regulatory approvals and post construction signoff required for occupancy.

**Atherton Street Section 153 Project, State College Borough—*Borough Engineer*** responsible for providing review and coordination of project design development including, reviewing traffic signal replacement, sanitary sewer improvements, pedestrian safety, sidewalk, landscaping and storm drain designs, coordinating approvals of cost additions through Borough Council, coordinating Act 537 special study design and permitting with Borough's planning staff, County and environmental design firm as required for permitting and planning upgrades to the sanitary collection system, associated with the 153 project improvements.

## Continuing Education

OSHA Ten Certification
Leadership Training for Non-Profits through PSU Outreach
HEC-RAS Short Course through PSU
Watershed Modeling System Short Course through PENNDOT

## Employment

NTM Engineering, Inc., Dillsburg, PA, January 2021-Present
State College Borough Engineer, State College, PA, March 2020-January 2021
ADTEK Engineers, Inc. Frederick, MD, April 2014- April 2016, January 2017-March 2020
Stormwater Maintenance and Consulting - Hunt Valley, MD April 2016-January 2017
C.S. Davidson, Inc. Gettysburg, PA, May 2011-April 2014
Tri-County Engineering, LLC., Greensburg, PA, April 2010-April 2011
HDC Engineering, LLC, Champaign, IL, April 2007-September 2008
Wm. F. Hill & Assoc., Inc Gettysburg, PA, August 2005-June 2007

# Exhibit D.1

To Brief

# West Chester Borough Stream Protection Fee Program

# Appeal Policies and Procedures Manual

## Contents



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# Introduction

The Borough has established a Stream Protection Fee (SPF) which will provide a dedicated funding source for the ongoing expenses associated with the Borough's stormwater management system and compliance with Pennsylvania Department of Environmental Protection Municipal Separate Stormwater System (MS4) permit requirements. All developed parcels in the Borough will be required to pay the fee, which is based on the impervious coverage of the parcel. Property owners are entitled to appeal the user fee in accordance with the procedures in this manual and the Stream Protection Fee Ordinance ("SPF Ordinance").

## Overview

Property owners are entitled to appeal the user fee, per Section 11 – "Appeals" of the SPF Ordinance. This manual has been prepared to detail the policies and application procedures by which a property owner can appeal the SPF.

# Appeal of Stream Protection Fee

## Objective

The appeal process is established to provide relief if a property owner believes the provisions of the SPF Ordinance have been applied in error. A property owner may appeal in accordance with the provisions described in greater detail in this manual.

## Appeals Policies

The basis for an appeal may include, but is not limited to the following:

1. Incorrect parcel information;
2. Inaccurate impervious area calculation;
3. Inaccurate Tier category assignment;
4. Mathematical error.

A Special Conditions Appeal (SCA) which addresses a circumstance where the property owner can demonstrate that the stormwater runoff from their parcel is not placing the same demand on the Borough system or services provided under the stormwater program as other impervious area. A property owner may appeal their SPF as a Special Conditions Appeal (SCA), provided the owner can demonstrate that:

5. Their parcel(s)'s stormwater runoff impact on the stormwater system or services is significantly less than suggested by its amount of impervious area; and
6. Their parcel or a portion thereof drains completely outside of the Borough.

All applicants must be current with their stormwater fees to be eligible for a SCA.

### Application

For all appeals, the property owner must submit an application using the Appeal Application form provided by the Borough and include supporting documentation as further described herein.

## Appeals Application Procedures

### Application Forms

Application Forms are available in Appendix A as well as in electronic format (Word file) on the Borough's website.

Application Deadline

The appeal application must be filed by March 31st.

Application Fee

There is no fee to file an appeal which alleges an error or inaccuracy within the billing system. The application fee for an appeal alleging an improper Tier classification or for a Stormwater Special Conditions Appeal is listed in accordance with the Borough's current fee schedule. All fees are non-refundable regardless of the outcome of the appeal. Application fees may be paid by check or money order made out to The Borough of West Chester Stormwater Program.

Documentation Requirements

The property owner must provide the following documentation with the appeal

1. A completed and signed application form.
2. A plot plan, map, aerial image or similar information detailing actual impervious surfaces currently on-site.
3. A requested value for the correct impervious area/ associated with the property for which an appeal is being requested.
4. Application Fee (check or money order)

For SCAs, the applicant must provide all the above, and the following additional item:

5. A plot plan, map, aerial image or similar information delineating the drainage areas or patterns on-site.

The Borough may request additional documentation to aid in review of the appeal.

Submission of Appeals Application

The completed application, supporting documentation, and any applicable non-refundable application fee may be submitted via email to spf-program@west-chester.com or by mail to:

Borough of West Chester Stormwater Program

401 E. Gay Street

West Chester, PA 19380

Determination

The Borough will review the required documentation and a written approval or denial of the appeal application will be issued by the Director of Public Works.

Appeal of Determination

In accordance with the SPF Ordinance, any person aggrieved by any decision of the Borough Manager may appeal to the Court of Common Peas of Chester County, Pennsylvania.

Billing Error Corrections

If an appeal alleging a billing error is successful, the Borough staff will correct the associated billing information

Special Condition Appeal Reduction of Stormwater Fee

If a SCA is approved the reduction in fee will only be applied to the portion of the impervious area that the that the property owner has demonstrated has less or no impact on the system or program of services and

drains outside of the Borough. The following calculation will be applied:

Any property which drains completely outside of the Borough is not a developed property and is not responsible for the Stream Protection Fee.

As for those properties which drain partially outside of the Borough & partially inside the Borough, the percentage of impervious area of such property which drains outside of the Borough will be excluded from the calculation made for the purposes of Section 94A-6. B. of this Ordinance.

If an appeal results in the reduction or elimination of the property's SPF, the Borough will provide a refund to the Property Owner, as applicable.

# Appendix A
# Appeal Application

BOROUGH OF WEST CHESTER
CHESTER COUNTY PENNSYLVANIA

# STREAM PROTECTION FEE APPEAL APPLICATION

The Borough has established a Stream Protection Fee (SPF) and all developed parcels in the Borough are required to pay the fee, which is based on the impervious coverage of the parcel. Property owners are entitled to appeal the user fee in accordance with the procedures in the Appeals Manual and the Stream Protection Fee Ordinance 2015-##

*Submit completed form: spf-program@west-chester.com*
*or mail to:*
*Borough of West Chester Stormwater Program*
*401 E. Gay Street, West*
*Chester, PA 19380*

Application Date: ______________________ SPF Account No.: ______________________

Owner Name: ______________________ Mailing Address: ______________________

Property Address: ______________________

Phone Number: ______________________ Email Address: ______________________

## Reason for Appeal (Check all that apply):

Incorrect parcel information

Inaccurate impervious area calculation

Inaccurate Tier category assignment

Mathematical error

## Special Condition Appeal

If the applicant is choosing this appeal, both reasons below must be true:

The stormwater runoff impact on the stormwater system or services is significantly less than suggested by its amount of impervious area; and

Applicant's parcel or a portion thereof drains completely outside of the Borough.

## Supporting Documentation Checklist (provide all items listed below)

Copy of SPF Bill

Plot plan, map, aerial image or similar information detailing actual impervious surfaces currently on-site

Requested value for the correct impervious area/ associated with the property for which an appeal is being requested (provide in Description, page 2)

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## Appeal Description

Provide detailed description of the billing error and your interpretation of corrected information. Attach additional sheets as necessary. Photographs are not required, but helpful.

*I attest that the information provided in this Appeal Application is complete and accurate:*

Applicant Signature: ______________________________

## Borough Use Only

Date Received: ______________________________

Reviewed By: ______________________________

Status:
- ☐ Approved
- ☐ Approved with Modifications
- ☐ Additional Information Needed
- ☐ Denied

Notes: ______________________________

______________________________

______________________________

Date Responded: ______________________________

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# Exhibit D.2

To Brief

# West Chester Borough
# Stream Protection Fee Program
# Non-Residential Credit Policies and Procedures Manual

NOVEMBER 2017

# Table of Contents

# Introduction

In 2016, the Borough enacted Ordinance No. 10-2016, titled the "Stream Protection Fee Ordinance" which establishes a Stream Protection Fee (SPF) to provide a dedicated funding source for ongoing expenses associated with the Borough's stormwater management system and compliance with its regulatory permit requirements. All developed parcels (properties), including both residential and non-residential properties, in the Borough are required to pay the stream protection fee, with the fee amount directly proportional to the total impervious surface area of the parcel.

## Overview

The Borough has developed an incentive program ("credit program") for property owners who undertake specific stormwater management activities. The credit program has been developed per Section 10 – "Stormwater Credits" of Ordinance No. 10-2016 to allow owners to apply for credits and/or rebates for implementing and maintaining eligible stormwater management practices (SMPs) on their parcel(s) that mitigate the volume, peak discharge rate or runoff pollution that leaves their parcel. By implementing such measures, property owners are helping to reduce the demand on the existing stormwater management system and related Borough services, and helping to achieve permit compliance. This manual, called the "Stream Protection Fee Program Non-Residential Credit Policies and Procedures Manual ("Credit Manual"), is called for in Section 10 of the SPF Ordinance along with its residential companion, "Residential Credit and Rebate Policies and Procedures Manual."

The primary goals of the Borough's credit program are to:

- Encourage private investment in installing and maintaining private SMPs,
- Ensure the SPF is equitable and fair by recognizing that stormwater management activities on private property can result in cost savings for the Borough which should translate into a reduced fee for the property owner.

## Applicability

The Credit program has two components, a Residential Rebate and Credit Program, and a Non-Residential Credit Program. **This document provides detail on the policy and procedures for the Non-Residential Credit Program only.** Property owners of Residential Properties are permitted to apply for a rebate and/or credit listed under the Residential Rebate/Credit Program or the Non-Residential Credit Program. Property owners of Non-Residential and Multi-Family Residential Properties are permitted to apply for a credit listed under the Non-Residential Credit Program only. For more information about the Residential Credit Program, property owners should view the Stream Protection Fee Page of the West Chester Borough website.

## Definitions

Words used herein shall be defined in accordance with their definition in the SPF Ordinance. If a word used in this manual is not defined in the SPF Ordinance, it shall be defined as follows:

**Apartment** - a building on a separate lot containing three or more dwelling units.

**Credit** - a recurring discount on the SPF which is applied to the property owner's bill to reduce the SPF on a recurring basis. The credit is valid for a set period (currently three years), after which time the property owner must reapply.

**Dwelling Unit** - One or more rooms in a building, designed for occupancy by one family for living purposes and having its own permanently installed cooking and sanitary facilities, with no enclosed space (other than vestibules. entrances or other hallways or porches) in common with any other dwelling unit. No dwelling unit shall have more than 50% of its exterior below the level of the exterior grade. A dwelling unit may be contained in any of the following structures:

A. **SINGLE-FAMILY DETACHED** - A building designed for and occupied exclusively as a residence for only one family and having no party wall in common with an adjacent building.

B. **SINGLE-FAMILY DETACHED, MOBILE HOME** - A transportable single-family detached dwelling unit intended for permanent occupancy, contained in one unit or in two units designed to be joined into one integral unit capable of again being separated for repeated towing, which arrives at a site complete and ready for occupancy except for minor and incidental unpacking and assembly operations and is constructed as permitted in Article VI, with the same, or equivalent, electrical, plumbing and sanitary facilities as for a conventional single-family detached dwelling. A mobile home shall include any addition or accessory structure, such as porches, sheds, decks or additional rooms, which is attached to it. A mobile home does not include recreational vehicles or travel trailers.

C. **SINGLE-FAMILY SEMIDETACHED** - A building designed for and occupied exclusively as a residence for only one family and having one party wall in common with an adjacent building.

D. **SINGLE-FAMILY ATTACHED** - A building designed for and occupied exclusively as a residence for only one family and having two party walls in common with an adjacent building, except for end units.

E. **TWO-FAMILY DETACHED** - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having no party wall in common with an adjacent building.

F. **TWO-FAMILY SEMIDETACHED** - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having one party wall in common with an adjacent building.

G. **TWO-FAMILY ATTACHED** - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having two party walls in common with adjacent buildings.

H. **MULTIFAMILY** - See "apartment."

**Impervious Drainage Area (IA)** – the impervious surfaces within the land contributing runoff to a single point (including but not limited to the point/line of interest used for hydrologic and hydraulic calculations) and that is enclosed by a natural or man-made ridge line.

**Multi-Family Residential Property**- a property which is improved with a building that is used as an apartment of multi family dwelling. Multi-Family Residential Properties are only eligible to apply for a credit under the Non-Residential Credit Program. Apartment units are considered Multi-Family Residential under the SPF Credit Program.

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**Non-Residential Property** - a property which is improved with a building that is used in any manner other than as a Residential Property or a Multi-Family Residential Property as defined herein. This term shall include but not be limited to buildings used for commercial, industrial and institutional uses.

**Non-Structural Stormwater Management Practices** or measures – operational and/or behavior-related practices that attempt to minimize the contact of pollutants with stormwater runoff whereas structural SMPs or measures are those that consist of a physical device or practice that is installed to capture and treat stormwater runoff.

**Rebate** - a one-time refund per Residential Property that is issued for installing a stormwater practice. The amount of the refund is based on the drainage area managed and the constructed stormwater management practice. One Residential Property can have multiple rebates.

**Residential Property** - a property which is improved with a building that is used as any form of Dwelling other than a Multi-Family Residential Property.

**Stormwater Management Practice (SMP)** – Activities, facilities, designs, measures, or procedures used to manage stormwater impacts from regulated activities, to provide water quality treatment, infiltration, volume reduction, and/or peak rate control, to promote groundwater recharge, and to otherwise meet the purposes of the Stream Protection Fee Program and associated ordinance. SMPs are commonly grouped into one (1) of two (2) broad categories or measures: "structural" or "non-structural."

**Structural Stormwater Management Practices** or measures - include, but are not limited to, a wide variety of practices and devices from large-scale retention ponds and constructed wetlands to small-scale underground treatment systems, infiltration facilities, filter strips, low impact design, bioretention, wet ponds, permeable paving, grassed swales, riparian or forested buffers, sand filters, detention basins, and manufactured devices. Structural SMPs are permanent appurtenances to the Site.

## Objectives

The objective of the credit program is to provide a way for property owners who install qualifying stormwater management practices (SMPs) on their property to reduce their SPF payment amount. SMPs are measures or facilities that prevent or reduce the transport of pollutants and/or control stormwater runoff volume or rate. Implementing such measures reduces the impact a developed property has on the downstream storm drainage system, which includes both natural features such as streams and man-made features such as pipes.

## Additional Resources

Non-Residential property owners are encouraged to research and utilize the following free resources found online:

- Technical resources for green infrastructure are available in Chapter 6 of the Pennsylvania Stormwater Best Management Practices Manual or Chapter 4 of the City of Philadelphia Water Department Stormwater Management Guidance Manual.
- Further information on peak rate control practices is available in Chapter 6.5 the Pennsylvania Stormwater Best Management Practices Manual.

In addition to the above, the following resources relating primarily to residential based green infrastructure are available online and apply to both Residential and Non-Residential properties:

- Homeowner's Guide to Stormwater Management prepared by the Philadelphia Water Department in 2006
- Homeowner's Guide to Stormwater produced by the Lancaster County Conservation District in 2013

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- The Alliance for the Chesapeake Bay has developed a website, Reduce Your Stormwater, which provides do-it-yourself guidance for SMPs.
- The Chesapeake Stormwater Network has developed a Homeowner Guide that provides excellent step-by-step guidance on designing, constructing and maintaining rain gardens, rain barrels, pervious pavers, and planting trees.

# General Credit Program Policies

The property owner must own and maintain a qualifying stormwater facility or approved non-structural control. Property owners are required to submit an application and documentation of construction or installation, as well as documentation regarding operation and maintenance (O & M) of the stormwater management facility. The property owner must pay their fee in full, and not be past due on their SPF payments. General policies for the Non-Residential credit program are provided below.

## Types of Projects Eligible for Credit

To be eligible for a SPF credit, a property owner must treat impervious area (IA) with a qualifying SMP that is owned and maintained by the property owner. The property owner must have an approved non-structural control, NPDES permit, or other eligible stormwater management feature, as listed in Table 1.

If residential property owners are interested in obtaining credit under the Non-Residential Program, they should reach out to the Public Works Department to discuss their application with staff early in the process.

Table 1.

*Eligible types of SMPs for the Residential and Non-Residential Credit Programs*

| Credit Category | Stormwater Management Practice (SMP) | Residential * | Non-Residential and Multi-Family Residential ** |
|---|---|---|---|
| Green Infrastructure / Runoff Volume Controls | Pervious pavement with infiltration bed | X | X |
| | Infiltration basin | | X |
| | Rain garden/bioretention | X | X |
| | Subsurface infiltration bed | | X |
| | Green Roof | | X |
| | Infiltration trench/ Tree Infiltration Trench | | X |
| | Runoff Capture & Reuse – Cistern or Rain Barrel | X | X |
| | Dry Well/ Seepage Pit | X | X |
| Peak Runoff Rate (Flood) Controls | Constructed wetland | | X |
| | Wet pond/ retention basin | | X |
| | Dry extended detention basin | | X |
| | Special Detention areas (parking lots/roof) | | X |
| Water Quality Treatment | Constructed wetland | | X |
| | Constructed Filter | | X |
| | Proprietary Water Quality Filters & Hydrodynamic Devices | | X |
| | Vegetated Swale | | X |
| | Vegetated Filter Strip | | X |
| Non-Structural Controls | Tree Canopy Cover | X | X |
| | Downspout Disconnection | X | X |
| | Approved Adopt-a-Stream volunteer program | | X |
| | Approved environmental education/outreach program | | X |
| National Pollutant Discharge Elimination System (NPDES) Stormwater Permit | Facilities with an active, fully-compliant NPDES Permit from PADEP | | X |

*Notes:*

** Single family residential property owners are eligible for SMPs listed in the non-residential categories.*

*** Non-residential and multi-family residential are excluded from obtaining the Rain Barrel rebate, but can obtain a cistern credit*

## Maximum Credit Amount

The maximum credit that any one property can receive is 60% percent of their fee. No property will receive 100% credit or reduction of the fee, and the maximum is set at 60% because the Borough needs to fund programmatic elements, public stormwater facilities, and perform standard maintenance, repair and rehabilitation of publicly owned stormwater facilities. Even if a property manages 100% of the stormwater runoff on their site, the Borough still has obligations under its MS4 permit and needs to maintain the public drainage system to protect the health and safety of the public.

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# Non-Residential Credit Types

The Non-Residential Credit Program incentivizes owners of any non-residential property (commercial, institutional, industrial, etc.) and multi-family residential property to manage their stormwater on site and reduce IA on their property. This program includes credits which can be applied to the property owner's bill to reduce the SPF on a recurring basis. The credit is valid for a set period (currently three years), after which time the property owner must reapply. The maximum credit is 60% of the SPF if the facility is maintained by the property owner and provides both quantity and/or quality controls. The maximum can be achieved by applying for a credit associated with one or more SMP types.

A non-residential property owner may apply for an eligible SMP type that is listed in Table 3. The amount of financial credit(s) earned for any given property is based on the type of SMP installed. Intensive practices such as green infrastructure are a primary strategy in the Borough's stormwater program due in large part to the multiple benefits they provide above and beyond management of stormwater volume. Therefore, green infrastructure is eligible for a larger credit than less intensive practices such as the non-structural controls category. Table 3 lists the eligible practices for credits under the non-residential program, and includes the specific credit amounts. Requirements for each type of SMP category and example calculations are provided in the following sections.

TABLE 3.
*Credits for Non-Residential Property Credit Types*

| Type of Stormwater Management Practice | Credit (%) | Possible Example Practices |
|---|---|---|
| Green Infrastructure / Runoff Volume Controls | 60% | Rain gardens, bioretention, infiltration trenches, permeable pavements, green roofs |
| Peak Runoff Rate (Flood) Controls | 30% | Constructed wetland, dry extended detention pond, wet/retention pond, underground detention system |
| Water Quality Treatment | 30% | Constructed wetland, constructed filters, vegetated swale/filter strip, proprietary treatment devices |
| Non-Structural Controls | 15% | Tree canopy, downspout disconnection, approved environmental education/outreach program |
| National Pollutant Discharge Elimination System (NPDES) Stormwater Permit | 15% | Facilities with an active and fully-compliant NPDES stormwater permit |

## Calculation of Non-Residential Credits

The Non-Residential Credit is calculated based on the amount of IA treated by stormwater management facilities (also called the *impervious drainage area*) that are owned and maintained by a property owner. For each type of credit summarized in Table 3, the fee associated with the amount of IA treated by a stormwater management facility is reduced by the percent credit for the type of credit. The following equation illustrates the credit calculation:

$$SPF\ Credit = \left(\frac{Treated\ IA}{1{,}000}\right) \times Credit\ \%\ by\ Type \times SPF$$

Where:

- Treated IA: amount of impervious area treated by an eligible stormwater facility, $ft^2$
- Credit% by Type: the percent credit allowed for by type of facility (see Table 3)
- SPF: Stream Protection Fee for current levy year, expressed as \$ per 1,000 $ft^2$

Requirements and examples of the credit calculation for each SMP type are detailed below.

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## Stormwater Feature Drainage Area Percentage

To determine the amount of IA treated by a stormwater facility, the drainage area specific to the facility must be determined. Note that if the facility drains IA either on or off the property, the total impervious treated for the purposes of credit calculations typically cannot exceed the amount of IA on the property. This information is generally included in the original design documents (drawings and/or stormwater report) for a facility. If the owner cannot find this information, they may attempt to estimate it through an online mapping package such as the (free) Google Earth or Google Maps program, or hire a registered professional engineer or registered land surveyor.

## Green Infrastructure / Runoff Volume Control Credit

Runoff volume control practices reduce the volume of stormwater runoff entering the public drainage system. Green infrastructure practices can reduce volume and restore the natural hydrologic cycle, in addition to providing several community-related benefits. Green infrastructure employs the following processes to mimic predevelopment conditions:

- Infiltration (allowing water to slowly soak into the soil)
- Evaporation/transpiration using native vegetation
- Rainwater capture and re-use (storing runoff to water plants, flush toilets, etc.)

**Green Infrastructure Credit Requirements**

- Any green infrastructure or volume control practice must capture 1 inch of runoff for full credit. The 1 inch of captured runoff is translated into a volume of water by multiplying it by the captured drainage area. Table 4 provides brief guidance on various green infrastructure technologies, including consideration of design, construction, operation and maintenance. In all cases, retention and detention facilities should be designed to completely drain water within 48 hours.

TABLE 4.
*Green infrastructure types with brief overview of design and construction requirements, as well as operational and maintenance needs.*

| Green Infrastructure Type | Design / Construction Guidance | Operation and Maintenance |
|---|---|---|
| Cisterns/Rain Barrels | Provide overflow to discharge water during large storm events<br>Discharge water before next storm event<br>Consider site topography, placing structure up-gradient of plantings (if applicable) will allow watering to work with gravity and eliminate pumping needs<br>All rain barrel openings must have screens to prevent the growth of mosquitoes (or other vector-control must be provided). | Discharge before next storm event<br>Clean annually and check for loose valves, etc.<br>Winterize the system: may require flow bypass valves during the winter |
| Bioretention/Rain Gardens | Ponding depths of no more than 12 inches and drawdown within 48 hours<br>Native vegetation that is tolerant of hydrologic variability, salts etc.<br>Water Table/ Bedrock Separation: 2-foot minimum, 4-foot recommended<br>Soils: HSG A and B preferred; C & D may require an underdrain | May require watering during establishment<br>Spot weeding, pruning, erosion repair, trash removal, mulch reapplication required 2-3x/growing season<br>Maintenance tasks and costs are generally similar to traditional landscaping but less frequently performed |

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TABLE 4.
*Green infrastructure types with brief overview of design and construction requirements, as well as operational and maintenance needs.*

| Green Infrastructure Type | Design / Construction Guidance | Operation and Maintenance |
|---|---|---|
| | Overflow required to release water during extreme events<br>Maximum loading ratio: 20:1; not more than 1 acre to one rain garden | |
| Green Roofs | 2-6 inches of non-soil engineered media; assemblies that are 4 inches and deeper may include more than one type of engineered media.<br>The roof structure must be evaluated for compatibility with the maximum predicted dead and live loads.<br>Waterproofing must be resistant to biological and root attack.<br>Typically installed on flat or gently-sloping rooftops | Once vegetation is established, spot weeding, replanting, and fertilization as required<br>Maintenance cost is similar to traditional landscaping, \$0.30-\$1.00 per square foot |
| Permeable Pavements | Level storage bed bottoms, uncompacted permeable subgrade soils<br>Water Table/ Bedrock Separation: 2-foot minimum, 4-foot recommended<br>Provide positive stormwater overflow from bed<br>Surface permeability >20"/hour and drawdown within 48 hours<br>Pretreatment for sediment-laden runoff | Clean inlets/outlets<br>Vacuum twice per year (typically), usually with a street cleaning unit<br>Maintain adjacent landscaping/planting beds to prevent wash-on<br>Periodic replacement of paver blocks<br>During winter, no sand/grit/abrasives and only clean salt or other deicers |
| Tree Trenches | Flexible in size and configuration<br>Native, appropriate tree species selection and spacing and soil volumes<br>Quick drawdown<br>Linear infiltration/storage trench<br>New inlets, curb cuts, or other means to introduce runoff into the trench | Water, mulch, treat diseased trees, and remove litter as needed<br>Annual inspection for erosion, sediment buildup, vegetative conditions<br>Biannual inspection of cleanouts, inlets, outlets, etc. |
| Subsurface Infiltration Practices | Water Table/ Bedrock Separation: 2-foot minimum, 4-foot recommended<br>Level or terraced infiltration surfaces preferred<br>Avoid proximity to buildings, drinking water supplies, karst features, and other sensitive areas<br>Appropriate soil types (permeability, limiting layer, etc.)<br>Drawdown within 48 hours<br>Provide pretreatment and positive overflow in most cases | All pretreatment devices, catch basins, and inlets should be inspected and cleaned at least twice per year<br>If vegetated, the overlying vegetation of subsurface infiltration feature should be maintained in good condition and any bare spots re-vegetated as soon as possible.<br>Vehicular access on vegetated subsurface infiltration areas should be prohibited. |

Further information on green infrastructure is available in Chapter 6 of the Pennsylvania Stormwater Best Management Practices Manual or Chapter 4 of the City of Philadelphia Water Department Stormwater Management Guidance Manual.

### Green Infrastructure Credit Calculation

The following example calculation shows the methodology for the green infrastructure credit. A property has one green infrastructure facility that treats 5,500 sf of IA. Assuming the SPF is $6.70 per 1,000 sf per month, the SPF Credit for that facility would be as follows:

$$SPF\ Credit\ = \left(\frac{5{,}500}{1{,}000}\right) \times 60\% \times \$6.70 = \$22.11$$

## Peak Runoff Rate (Flood) Control Credit

Peak runoff rate control protects against immediate downstream erosion and flooding by detaining runoff to reduce the peak flow. Most designs achieve peak rate control using detention structures. Peak rate control can also be integrated into volume control practices to become "at source" measures for reducing the rate and volume of runoff released during rainfall events.

### Peak Runoff Rate Credit Requirements

Peak rate control practices should aim to maintain the peak rate of runoff from pre-development conditions for the 1-year through 100-year design storm events. Constructed wetlands, dry extended detention ponds, and wet/retention ponds are excellent examples of peak rate control practices. Constructed Wetlands are shallow marsh systems planted with emergent vegetation that are designed to treat stormwater runoff to improve water quality. A dry extended detention basin is an earthen structure constructed either by impoundment of a natural depression or excavation of existing soils, that provides temporary storage of runoff and functions hydraulically to attenuate stormwater runoff peaks. Wet Ponds/Retention Basins are stormwater basins that include a substantial permanent pool for water quality treatment and additional capacity above the permanent pool for temporary runoff storage.

Table 5 has guidance on design, construction, operation and maintenance for these peak rate control practices. In all cases, retention and detention facilities should be designed to completely drain water within 72 hours.

TABLE 5.
*Peak rate control practices with design and construction requirements, as well as operational and maintenance needs.*

| Peak Runoff Rate practice | Design / Construction Guidance | Operation and Maintenance |
|---|---|---|
| Constructed Wetland | Adequate drainage area (usually 5 to 10 acres minimum) or proof of sustained base flow | Periodic sediment removal from the forebay and vegetation maintenance |
| | May require investigation of water supply to ensure a sustained baseflow to maintain the wetland | Inspect and maintain inlet and outlet structures as needed |
| | Maintenance of permanent water surface | |
| | Multiple vegetative growth zones through varying depths | |
| | Robust and diverse vegetation | |
| | Relatively impermeable soils or engineered liner | |
| | Provide for a way to collect and remove sediment | |

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TABLE 5.
*Peak rate control practices with design and construction requirements, as well as operational and maintenance needs.*

| Peak Runoff Rate practice | Design / Construction Guidance | Operation and Maintenance |
|---|---|---|
| | Adjustable permanent pool and dewatering mechanism | |
| Dry Extended Detention Pond | Hydraulic capacity controls effectiveness<br>Ideal in combination with other BMPS<br>Highly structural design features (rip-rap for erosion control, etc.) can be more costly than naturalized basins. | Regular maintenance is necessary including periodic sediment removal and vegetation maintenance |
| Wet/Retention Pond | Adequate drainage area (usually 5 to 10 acres minimum) or proof of sustained baseflow<br>Natural high groundwater table<br>Maintenance of permanent water surface<br>Should have at least 2 to 1 length to width ratio<br>Robust and diverse vegetation surrounding wet pond<br>Relatively impermeable soils<br>Forebay for sediment collection and removal<br>Dewatering mechanism | Outlet control devices should draw from open water areas 5 to 7 feet deep to prevent clogging and allow the WP to be drained for maintenance<br>A pond drain should also be included which allows the permanent pool to be completely drained for maintenance within 24 hours<br>Permanent access must be provided to the forebay, outlet, and embankment areas. It should be at least 9 feet wide, have a maximum slope of 15%, and be stabilized for vehicles. |

Further information on peak rate control practices is available in Chapter 6.5 the Pennsylvania Stormwater Best Management Practices Manual.

### Peak Runoff Rate Credit Calculation

A property with 15,000 square feet (sf) of total IA had retention pond that treats 8,000 sf of IA. The SPF is $6.70 per 1,000 sf per month, the SPF Credit would be as follows:

$$SPF\ Credit = \left(\frac{8{,}000}{1{,}000}\right) \times 30\% \times \$6.70 = \$16.08$$

The SPF before the credit is $100.50 per month and the net SPF including the credit is $84.42

## Water Quality Treatment Credit

During precipitation events, stormwater is carried over impervious surfaces like roads and rooftops, picking up pollutants including gasoline residue, motor oil, heavy metals, fertilizers, pesticides and more. Practices that provide water quality treatment serve to reduce pollutant loads in runoff.

### Water Quality Treatment Credit Requirements

Water quality functions include reducing suspended solids (TSS), phosphorus (TP), nitrogen (TN) and temperature of runoff. Water quality treatment practices must provide treatment for 1 inch of runoff for full credit. The 1 inch of captured runoff is translated into a volume of water by multiplying it by the captured drainage area and to a flow rate by performing routing calculations.

### Water Quality Treatment Credit Calculation

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A property with 12,000 square feet (sf) of total IA had vegetated swale that treats 10,000 sf of IA. The SPF is $6.70 per 1,000 sf per month, the SPF Credit would be as follows:

$$SPF\ Credit\ = \left(\frac{10,000}{1,000}\right) \times 30\% \times \$6.70 = \$20.10$$

The SPF before the credit is $80.40 per month and the net SPF including the credit is $60.30.

## Non-Structural Control Credit

Non-structural SMPs can be applied over an entire site and are not necessarily fixed and designed at one location. Non-structural SMPs can be designed to mitigate any number of stormwater impacts: peak rates, total runoff volumes, infiltration and recharge volumes, non-point source water quality loadings and temperature increases. Many of these practices can prevent stormwater generation and not just mitigate stormwater-related impacts once these problems have been generated. Prevention can be achieved by developing land in ways other than through use of standard or conventional development practices.

### Non-Structural Control Credit Requirements

Examples of non-structural controls include tree canopy, downspout disconnection, or an environmental education/outreach program. Design and operation/maintenance requirements vary greatly based on the type of practice and will be evaluated on an individual program/practice basis by the Borough. Several major "areas" of preventive Non-Structural BMPs have been identified in this manual:

### Downspout Disconnection and Tree Planting

Specific non-structural control practices eligible for credit include Downspout Disconnection and Tree Planting. Applicants should refer to the guidance found under the Residential Credit program to determine these requirements.

### Environmental Education/Outreach

A third non-structural control practice eligible for credit includes the Environmental Education/Outreach program category. Education credits are available to all public and private schools or school systems (K-12) and any church or non-profit facility. To receive the education credit, the applicant must implement an educational program that educates and informs the students on the importance of preserving and restoring the source and integrity of water resources (stormwater, ground water and/or surface waters). The educational program may include educational posters, take-home materials, classroom lessons, field trips, etc. Programs may be developed by the PA DEP, the Pennsylvania Department of Conservation and Natural Resources (DCNR), the United States Environmental Protection Agency (EPA), the United States Geological Survey (USGS), or a school official. Programs developed by other organizations may be considered eligible for credit. Some resources and example materials can be found at:

- EPA NPDES Stormwater Outreach Materials and Reference Documents http://cfpub.epa.gov/npdes/stormwatermonth.cfm#materials
- EPA Teacher Resources and Lesson Plans http://www.epa.gov/students/teachers.html
- EPA Water Science and Technology for Students and Educators http://water.epa.gov/learn/resources/
- USGS Education Resources http://education.usgs.gov/

### Non-Structural Control Credit Calculation Example #1

A property with 18,000 square feet (sf) of total IA disconnects downspouts that drain 12,000 sf of IA. The SPF is $6.70 per 1,000 sf per month, the SPF Credit would be as follows:

$$SPF\ Credit\ = \left(\frac{12,000}{1,000}\right) \times 15\% \times \$6.70 = \$12.06$$

The SPF before the credit is $120.60 per month and the net SPF including the credit is $108.54 per month.

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### Non-Structural Control Credit Calculation Example #2

A property with 18,000 square feet (sf) of total IA undertakes an educational campaign to provide stormwater outreach to the congregants. The SPF is $6.70 per 1,000 sf per month, the SPF Credit would be as follows:

$$SPF\ Credit\ = \left(\frac{18{,}000}{1{,}000}\right) \times 15\% \times \$6.70 = \$18.09$$

The SPF before the credit is $120.60 per month and the net SPF including the credit is $102.51 per month.

## National Pollutant Discharge Elimination System (NPDES) Stormwater Permit Credit

The NPDES Stormwater Permit credit applies to any entity who has an existing current NPDES permit approved by PADEP. The credit applies a 15% reduction to the SPF bill.

### NPDES Stormwater Permit Credit Requirements

This credit applies to any property that has an active, fully-compliant NPDES Permit from PA DEP.

### NPDES Stormwater Permit Credit Calculation

A property with an active, fully compliant NPDES Permit from PADEP has 10,000 square feet (sf) of total IA. The SPF is $6.70 per 1,000 sf per month, the SPF Credit would be as follows:

$$SPF\ Credit\ = 15\% \times \$6.70 \times \frac{10{,}000}{1{,}000} = \$10.05$$

The SPF before the credit is $67.00 per month and the net SPF including the credit is $56.95 per month.

# Credit Program Procedures

The following procedures are common to both the Residential Credit Program and the Non-Residential Credit Program.

## Application Forms

Residential and non-residential application forms are available on the Borough's website www.west-chester.com, searching Stream Protection Fee.

## Application Deadline

The Borough has determined that all approved credits will be applied retroactively based on the year the application was submitted using a deadline of July 31. All rebate/credit applications will be accepted year-round on a rolling basis. If the application is received by July 31, approved credits/rebates will be applied retroactively based on the year of the application submittal date. If the application is received after July 31, then the property owner must wait one year before the credit appears.

## Application Fee

Payment of a Credit Application Fee may be required for Borough review of the credit application. The fee is listed in the Borough's current fee schedule, which is available on the Borough's website. SPF credit application fees are non-refundable regardless of the outcome of the credit application. Borough Council may choose at their discretion to waive the application fee, and **as of November 2017, Council has waived the application fee.**

## Operations and Maintenance (O&M) Agreement

A signed maintenance agreement between the Borough and the property owner is required for credit approval. Under the Operations and Maintenance (O&M) agreement, the owner must allow the Borough access to the site to view and inspect the SMP per the Borough's inspection cycle. The Agreement can be found on the Borough website.

To receive the residential or non-residential SPF credit, a property owner must be able to demonstrate the stormwater facility is being properly maintained. A property owner can demonstrate maintenance of a stormwater facility by including with the SPF Credit Application available maintenance records showing the maintenance activities and date, or the most recent invoice from a qualified maintenance vendor. If the applicant does not maintain the facility as required, the Department of Public Works will notify the property owner in writing that they have 30 days to take corrective action otherwise the credit will be discontinued.

## Application Documentation Requirements

The property owner must provide the following documentation:

- Completed and signed application form.
- Photograph(s) of SMP
- A sketch (site plan, plot plan, map, aerial image or similar illustration) showing parcel lot lines, built features including all impervious areas, and location of the existing/proposed SMPs, and drainage areas to the SMP.
    - Refer to Appendix A: "How to Create a Site Plan" for instructions
    - The property owner should utilize the Borough's online mapping program which allows users to search for their property address and view their mapped parcel and impervious area. The website also allows for the user to print on a page size sheet suitable for inclusion in the application.

- Documentation of purchase and/or installation of the SMP including receipts, invoices, packing slips, or other records if available.
- Calculations or other documentation of impervious drainage area and SMP capacity estimates
- Maintenance logs noting the past inspection and maintenance records (or receipts from vendors hired to perform maintenance), or for newly constructed SMPs, a description of the proposed seasonal maintenance activities that the property owner will undertake.

In the event the credit application is missing information, Borough staff will request additional documentation to aid in review of the credit application.

## Submission of Credit Application

Electronic submissions can be made to spf-program@west-chester.com. Submit a copy of the completed credit application, the checklist, all supporting documentation and the non-refundable application fee (if applicable) to:

Borough of West Chester

Attention: Stream Protection Fee Program – Credit

205 Lacey Street

West Chester, PA 19382

## Determination

Borough staff will review the credit application and issue a determination no later than November 1. The applicant will be notified by letter and/or email of the decision.

## Appeal of Determination

Appeal of the credit determination can be made in accordance with Section 11 – "Appeals" of the Borough's Stream Protection Ordinance. Typically, a credit application will be primarily denied due to technical inadequacies. Should those inadequacies be addressed, the property owner may resubmit their application to the Borough.

## Issuance of Credits

Credits will be applied in the form of a credit and will be applied to subsequent bills.

## Credit Renewal

Non-Residential SPF credits will be valid for three years, after which they will require renewal by the property owner. To continue to receive the SPF credit, property owners are required to reapply before the credit period expires within 3 years. Should the owner fail to submit a renewal application, the credit(s) will expire. When reapplying, the property owner must update their demonstration of stormwater facility maintenance by including sufficient documentation in the application package.

## Site Inspections

Upon receipt of a credit application, the Borough or its designated appointee, may inspect the parcel to verify all information and supporting documentation. Efforts will be made to notify the property owner in advance. If the Borough's site inspection determines that the SMP is not being maintained appropriately, the credit could be denied. The Borough may choose to withhold the credit until the property owner demonstrates that the SMP is being appropriately maintained.

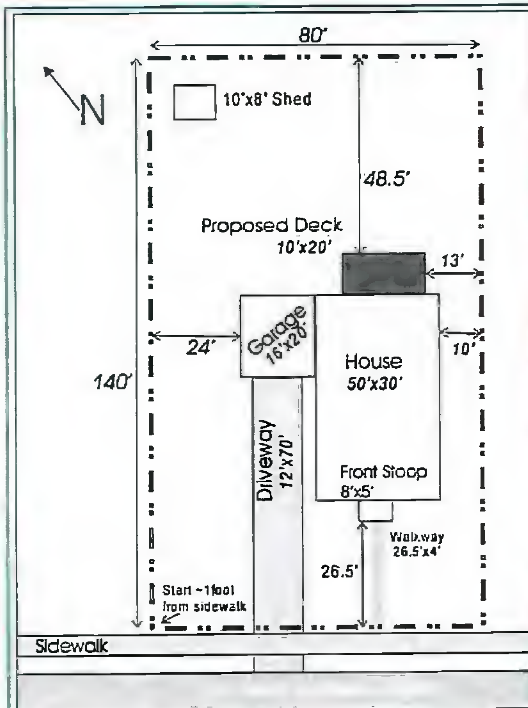
## Termination of Credits

Approved credits may be terminated at any time if the SMPs are found to be not functional, improperly maintained, or if the owner fails to restore the SMPs per Borough notification.

## Change in Property Ownership

If a property is sold and there is a change in ownership, the credit (residential or non-residential) will remain in place until the three-year credit term is completed. The new property owner will be required to resubmit the credit application in accordance with the Credit Renewal policy described in this Manual.

# Appendix A: How to Create a Site Plan




Sample Site Plan
Scale: 1"=30'

Proposed Rear Deck addition.

A site plan is a scaled map/diagram that graphically depicts a property's existing and/or proposed physical structures and landscape features. Site plans are drawn showing a bird's eye view of your property as if you were looking down at it from above. A site plan shows significant things that are on your property currently, such as the footprint of any buildings (home, garage, storage shed, or decks) and any other features such as driveways, patios, walkways, fences, swimming pools, etc. on the property.

Dimensions should be included for significant items and be used to show distances between existing items. The drawing should be done to a scale (e.g., 1 inch on the plan is equal to 30 feet on the ground). Site plans also should indicate the orientation of the plan using a North Arrow symbol that indicates which direction North is.

The following steps will help you in preparing your site plan.

**Step 1: Determine your property boundaries and lot dimensions (choose from one listed below).**

***Option 1 – Use Online Tax Assessor's Map***

Using an address or property owner name, you can look up your property on the Chester County Tax Assessor's Map website (accessible through "ChescoViews" application). Assessor's maps are regularly updated maps drawn to scale and based on the latest recorded surveys and plats of the area. The maps have an aerial photography background and they offer a measuring tool so you can measure the dimensions for all sides of your property.

***Option 2 – Use Subdivision Plat Information or Deed Records***

Like the Tax Assessor's map, you may also look up your lot on the recorded plat that your property is within. The legal description of your property, which should be included on the deed, usually contains your property's lot or parcel number and the subdivision name in which your lot is located. In cases where the property is not within a subdivision plat, the legal description will likely be a 'metes and bounds' description that describes the perimeter of the property in greater detail, without reference to a plat. To find a copy of your deed, you can contact the Chester County Historical Society, which has inventories of deeds dating back to 1688. Note – this option is not likely to be the most efficient option, however, it is included here in the even that applicants choose to use it.

***Option 3 – Use Recent Building Records***

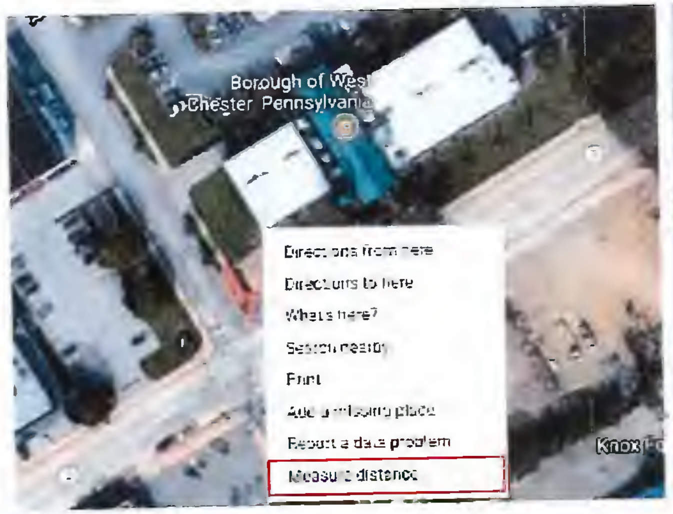
For newer constructed properties, using a previously approved site plan can save time when preparing your documentation. If there is a new structure on the property which required building permits, there is a possibility that the Borough may have an archived copy of the original building plans on file, including a site plan. You should make a request through the Borough's Department of Building, Housing, and Code Enforcement to obtain record site plans.

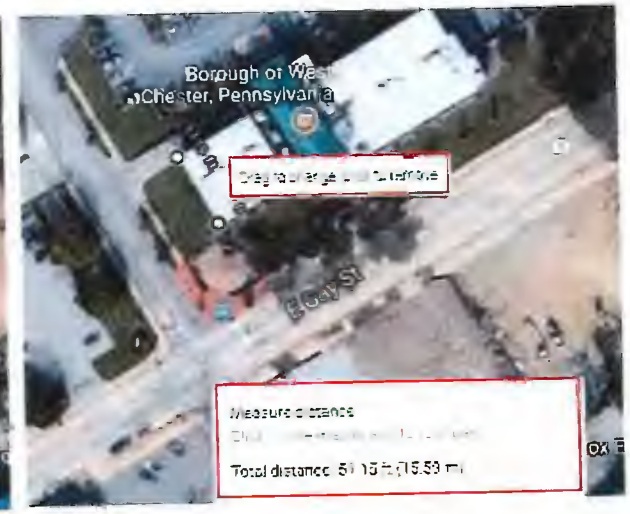
***Option 4 – Measure Your Property Yourself***

You can do this either by going outside with a tape measure and taking down measurements, or you can use an online program such as Google Maps' Measuring Tool on your computer.

*Directions to Use Measuring Tool in Google Maps*:

1. Open Google Maps in your internet browser.
2. Enter your address to zoom into your property.
3. Make sure you are in Satellite (aerial photography) mode so you can see your property's features.
4. Right-click on your starting point.
5. Choose Measure distance.
6. Click anywhere on the map to create and point and measure the distances between the two points. To add another point, click anywhere on the map. Drag the points to change/adjust your measurement or click any of the points to remove.
7. At the bottom of the Measure Distance dialogue box, you'll see the total distance in feet (ft) and/or total area in square feet (sf).
8. Right-click to find the Measuring Tool Menu and select Print. Print to a printer or Print to Save to a PDF if your computer has that option.





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**Step 2: Determine the location of structures and other site features in relation to the property boundaries.**

Using the property boundary location and dimension information gathered in Step 1, you must next determine the location of applicable existing buildings, streets, driveways, sidewalks, trees, and other site features in relation to the property boundaries. Measure the distance from these site features to the surrounding property lines. You can do this either with a tape measure or you can use an online program such as Google Maps' Measuring Tool on your computer.

**Step 3: Draw the plan.**

Use the information gathered in Steps 1 and 2 to prepare your site plan. You may draw your site plan by hand or use a computer graphics or drafting program. An example site plan template is provided in this Appendix for you to print and use if desired.

1. Determine Your Site Plan Scale and Orientation
    a. Using graph paper, choose a scale of measurement for the plan drawing so that one square = X feet. To ensure all information will fit on the page and be easy to read, a good example would be to have each block of the graph paper equal five (5) feet (or 1 inch = 25 feet). After choosing your scale of measurement, draw lines to show the house, driveway and any sidewalks on the plan. Write in the closest distances in feet of the lot lines to the house (i.e. building setbacks), and draw an arrow pointing north.
2. Add other Items that must be on the Plan such as the Property Owner Name and Address.
3. Draw Property Lines and Label all dimensions in feet.
4. Draw all Existing Buildings and Structures on the Plan (i.e., House, Garages, Sheds, etc.). These are your property's impervious areas (IA). Show distances between buildings and property lines. Label all dimensions in feet.
5. Draw Driveways, Parking Areas, Patios, Decks, and Sidewalks on the Plan. These are your property's additional impervious areas. Label all dimensions in feet.
6. Locate Existing Trees and Significant Landscape Elements
    a. Use a dot to indicate the approximate location of the tree and a circle to indicate the canopy coverage
    b. Landscape areas and planting beds can be drawn as solitary masses rather than individual plants/shrubs
7. Identify and draw the area of the site that will contain the existing or proposed SMP (i.e., rain garden, downspout disconnection, permeable pavement/drywell).
8. Then draw arrows depicting the flow direction of water as it runs off the property. The arrows should point downhill in the direction of the storm water flow.

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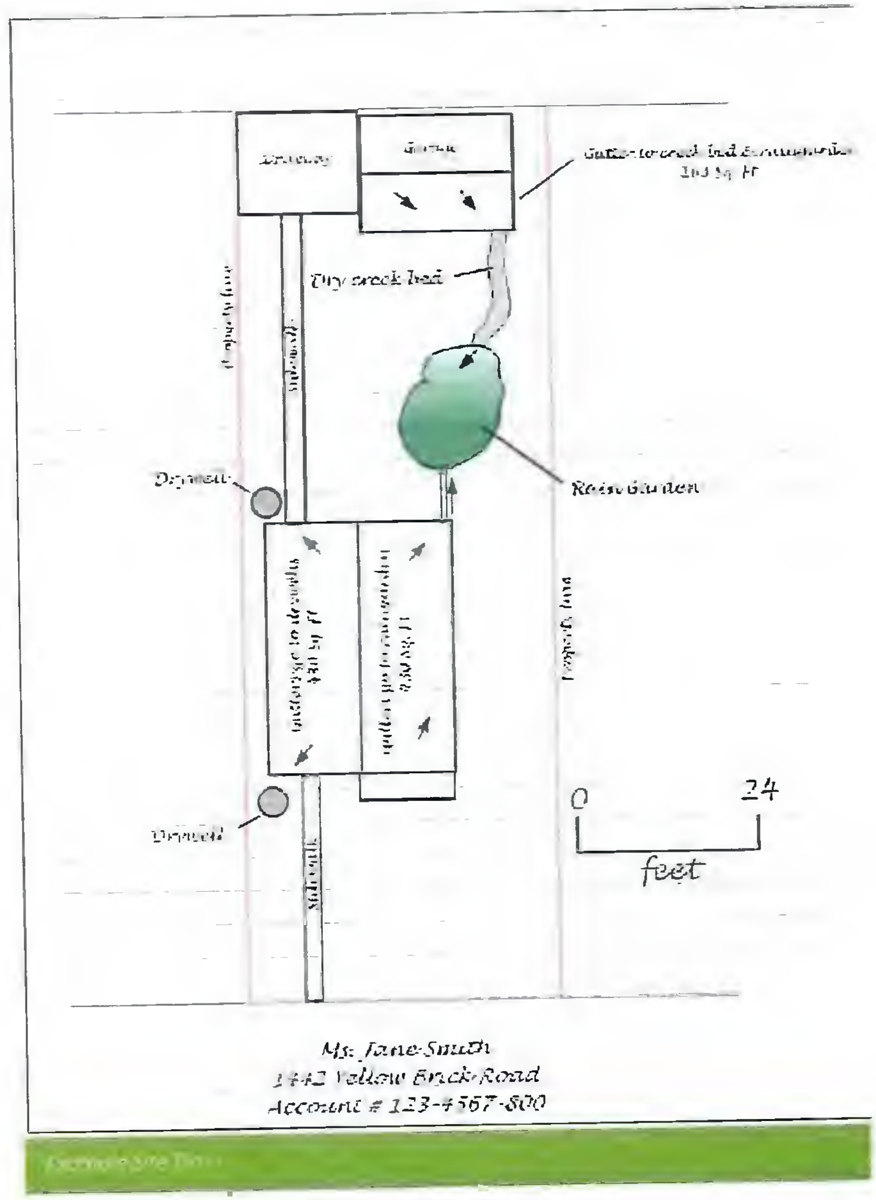

## Aerial Site Sketch

Draw a bird's-eye-view of your property including all impervious surfaces and existing structures. Draw arrows depicting the flow of water on the property and the proposed site of the rain garden.

Scale: 1 square = ______ feet

**KEY**

**Flow of Runoff**

**Structures/Surfaces**

**Rain Garden**

# Appendix B: How to Perform a Drainage Test

1. Know the exact location(s) on your property where you are planning to install your potential SMP(s) such as a rain garden. This potential SMP location will be where you conduct your drainage test. Drainage tests are done to test how fast your soil drains and determine suitability for stormwater SMPs.

2. **Do a PA One-Call at least three (3) business days prior to conducting your drainage test** so they can mark out all buried underground utilities, to reduce the risk of striking a utility line when digging.

   For more information: http://www.pa1call.org/pa811/Public/POCS_Content/About_Us/FAQS/FAQ.aspx or Dial 8-1-1 (or 1-800-242-1776).

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3. Gather the following tools near the test location:
   a. Shovel or post-hole digger
   b. Hose and/or bucket (and water source)
   c. Yardstick, tape measure, or ruler
   d. Notepad and pen

Drainage Testing Process

*Note: More elaborate testing procedures per the Pennsylvania Stormwater Manual or other approved guidance documents are also acceptable):*

1. Use the shovel or post-hole digger to dig a hole and remove soil from the hole. Place the excavated soil nearby so the hole can be refilled after the test. Block off or otherwise prominently mark the hole location to prevent people from tripping/falling.

2. Dig a hole that is at least 12 inches deep and at least 4 inches in diameter. If desired, place 2 inches of clean sand or gravel in the bottom of the hole to prevent scour in the bottom when being filled.

3. Using your water source, gently fill the hole with water and let it sit overnight. This saturates the soil and helps give a more accurate test reading.

4. The next day, gently refill the hole to the top with water. Measure the water level by laying a stick, pipe, or other straight edge across the top of the hole, then use a tape measure or yardstick to determine the starting water level. Check what time it is.

5. After an hour has passed, return to your test location to measure and record the depth of the water in the hole. Ideally, continue taking measurements at hourly increments for a few more hours or until all they water has drained.

6. Check the hole to watch how long it takes to become empty. When it is empty, record the time.
   - If the hole took <u>more than 48 hours</u> to drain completely, this typically indicates the site is <u>not suitable</u> for a stormwater SMP that relies on infiltration. Another site will need to be chosen (and another drainage test conducted).

7. When the testing process is complete, the hole should be immediately backfilled with the excavated soil.

# Exhibit D.3

To Brief

# West Chester Borough Stream Protection Fee Program
# Residential Credit and Rebate
# Policies and Procedures Manual

NOVEMBER 2017

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# Table of Contents



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# Introduction

In 2016, the Borough enacted Ordinance No. 10-2016, titled the "Stream Protection Fee Ordinance" which establishes a Stream Protection Fee (SPF) to provide a dedicated funding source for ongoing expenses associated with the Borough's stormwater management system and compliance with its regulatory permit requirements. All developed parcels (properties), including both residential and non-residential properties, in the Borough are required to pay the stream protection fee, with the fee amount directly proportional to the total impervious surface area of the parcel.

## Overview

The Borough has developed an incentive program ("credit program") for property owners who undertake specific stormwater management activities. The credit program has been developed per Section 10 – "Stormwater Credits" of Ordinance No. 10-2016 to allow owners to apply for credits and/or rebates for implementing and maintaining eligible stormwater management practices (SMPs) on their parcel(s) that mitigate the volume, peak discharge rate or runoff pollution that leaves their parcel. By implementing such measures, property owners are helping to reduce the demand on the existing stormwater management system and related Borough services, and helping to achieve permit compliance. This manual, called the "Stream Protection Fee Program Non-Residential Credit Policies and Procedures Manual ("Credit Manual"), is called for in Section 10 of the SPF Ordinance along with its residential companion, "Residential Credit and Rebate Policies and Procedures Manual."

The primary goals of the Borough's credit program are to:

- Encourage private investment in installing and maintaining private SMPs.
- Ensure the SPF is equitable and fair by recognizing that stormwater management activities on private property can result in cost savings for the Borough which should translate into a reduced fee for the property owner.

## Applicability

The Credit program has two components, a Residential Rebate and Credit Program, and a Non-Residential Credit Program. **This document provides detail on the policy and procedures for the Residential Program.** Property owners of Residential Properties are permitted to apply for a rebate and/or credit listed under the Residential Rebate/Credit Program or the Non-Residential Credit Program. Property owners of Non-Residential and Multi-Family Residential Properties are permitted to apply for a credit listed under the Non-Residential Credit Program only. For more information about the Residential Credit Program, property owners should view the Stream Protection Fee Page of the West Chester Borough website.

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## Definitions

Words used herein shall be defined in accordance with their definition in the SPF Ordinance. If a word used in this manual is not defined in the SPF Ordinance, it shall be defined as follows:

**Apartment** - a building on a separate lot containing three or more dwelling units.

**Credit** - a recurring discount on the SPF which is applied to the property owner's bill to reduce the SPF on a recurring basis. The credit is valid for a set period of time (currently three years), after which time the property owner must reapply.

**Dwelling Unit** - One or more rooms in a building, designed for occupancy by one family for living purposes and having its own permanently installed cooking and sanitary facilities, with no enclosed space (other than vestibules. entrances or other hallways or porches) in common with any other dwelling unit. No dwelling unit shall have more than 50% of its exterior below the level of the exterior grade. A dwelling unit may be contained in any of the following structures:

A. **SINGLE-FAMILY DETACHED** - A building designed for and occupied exclusively as a residence for only one family and having no party wall in common with an adjacent building.

B. **SINGLE-FAMILY DETACHED, MOBILE HOME** - A transportable single-family detached dwelling unit intended for permanent occupancy, contained in one unit or in two units designed to be joined into one integral unit capable of again being separated for repeated towing, which arrives at a site complete and ready for occupancy except for minor and incidental unpacking and assembly operations and is constructed as permitted in Article VI, with the same, or equivalent, electrical, plumbing and sanitary facilities as for a conventional single-family detached dwelling. A mobile home shall include any addition or accessory structure, such as porches, sheds, decks or additional rooms, which is attached to it. A mobile home does not include recreational vehicles or travel trailers. 001643

C. **SINGLE-FAMILY SEMIDETACHED** - A building designed for and occupied exclusively as a residence for only one family and having one party wall in common with an adjacent building.

D. **SINGLE-FAMILY ATTACHED** - A building designed for and occupied exclusively as a residence for only one family and having two party walls in common with an adjacent building, except for end units.

E. **TWO-FAMILY DETACHED** - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having no party wall in common with an adjacent building.

F. **TWO-FAMILY SEMIDETACHED** - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having one party wall in common with an adjacent building.

G. **TWO-FAMILY ATTACHED** - A building designed for and occupied exclusively as a residence for two families, with one family living wholly or partly over the other, and having two party walls in common with adjacent buildings.

H. **MULTIFAMILY** - See "apartment."

**Impervious Drainage Area (IA)** – the impervious surfaces within the land contributing runoff to a single point (including but not limited to the point/line of interest used for hydrologic and hydraulic calculations) and that is enclosed by a natural or man-made ridge line.

**Multi-Family Residential Property**- a property which is improved with a building that is used as an apartment of multi family dwelling. Multi-Family Residential Properties are only eligible to apply for a credit under the Non-Residential Credit Program. Apartment units are considered Multi-Family Residential under the SPF Credit Program.

**Non-Residential Property** - a property which is improved with a building that is used in any manner other than as a Residential Property or a Multi-Family Residential Property as defined herein. This term shall include but not be limited to buildings used for commercial, industrial and institutional uses.

**Non-Structural Stormwater Management Practices** or measures – operational and/or behavior-related practices that attempt to minimize the contact of pollutants with stormwater runoff whereas structural SMPs or measures are those that consist of a physical device or practice that is installed to capture and treat stormwater runoff.

**Rebate** - a one-time refund per Residential Property that is issued for installing a stormwater practice. The amount of the refund is based on the drainage area managed and the constructed stormwater management practice. One Residential Property can have multiple rebates.

**Residential Property** - a property which is improved with a building that is used as any form of Dwelling other than a Multi-Family Dwelling or Apartment.

**Stormwater Management Practice (SMP)** – Activities, facilities, designs, measures, or procedures used to manage stormwater impacts from regulated activities, to provide water quality treatment, infiltration, volume reduction, and/or peak rate control, to promote groundwater recharge, and to otherwise meet the purposes of the Stream Protection Fee Program and associated ordinance. SMPs are commonly grouped into one (1) of two (2) broad categories or measures: "structural" or "non-structural." 001644

**Structural Stormwater Management Practices** or measures - include, but are not limited to, a wide variety of practices and devices from large-scale retention ponds and constructed wetlands to small-scale underground treatment systems, infiltration facilities, filter strips, low impact design, bioretention, wet ponds, permeable paving, grassed swales, riparian or forested buffers, sand filters, detention basins, and manufactured devices. Structural SMPs are permanent appurtenances to the Site.

## Objectives

The objective of the credit program is to provide a way for property owners who install qualifying stormwater management practices (SMPs) on their property to reduce their SPF payment amount. SMPs are measures or facilities that prevent or reduce the transport of pollutants and/or control stormwater runoff volume or rate. Implementing such measures reduces the impact a developed property has on the downstream storm drainage system, which includes both natural features such as streams and man-made features such as pipes.

## Additional Resources

Property owners are encouraged to research and utilize the following free resources found online:

- Homeowner's Guide to Stormwater Management prepared by the Philadelphia Water Department in 2006

- Homeowner's Guide to Stormwater produced by the Lancaster County Conservation District in 2013
- The Alliance for the Chesapeake Bay has developed a website, Reduce Your Stormwater, which provides do-it-yourself guidance for SMPs.
- The Chesapeake Stormwater Network has developed a Homeowner Guide that provides excellent step-by-step guidance on designing, constructing and maintaining rain gardens, rain barrels, pervious pavers, and planting trees.

# General Credit Program Policies

The property owner must own and maintain a qualifying stormwater facility or approved non-structural control. Property owners are required to submit an application and documentation of construction or installation, as well as documentation regarding operation and maintenance (O & M) of the stormwater management facility. The property owner must pay their fee in full, and not be past due on their SPF payments. General policies for the Residential credit and rebate program are provided below.

## Types of Projects Eligible for Credit/Rebate

To be eligible for a SPF credit or rebate, a property owner must treat impervious area (IA) with a qualifying stormwater management practice (SMP) that is owned and maintained by the property owner. The property owner must have an approved eligible stormwater management feature, as listed in Table 1. Residential property owners are more likely to have installed one or more of the six SMPs listed in Table 1 due to cost and ease of installation and maintenance, therefore, only those SMPs are described in detail in this Manual. Residential property owners who have or plan to invest in more extensive SMPs, such as those noted for non-residential/multi-family in Table 1, are not excluded from obtaining that credit however, may have to demonstrate a higher degree of engineering feasibility. In the event that residential property owners are interested in obtaining credit under the Non-Residential Program, they should reach out to the Public Works Department to discuss their application with staff early in the process.

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Table 1: Eligible types of SMPs for the Residential and Non-Residential Credit Programs

| Credit Category | Stormwater Management Practice (SMP) | Residential * | Non-Residential and Multi-Family Residential ** |
|---|---|---|---|
| Green Infrastructure / Runoff Volume Controls | Pervious pavement with infiltration bed | X | X |
| | Infiltration basin | | X |
| | Rain garden/bioretention | X | X |
| | Subsurface infiltration bed | | X |
| | Green Roof | | X |
| | Infiltration trench/ Tree Infiltration Trench | | X |
| | Runoff Capture & Reuse – Cistern or Rain Barrel | X | X |
| | Dry Well/ Seepage Pit | X | X |
| Peak Runoff Rate (Flood) Controls | Constructed wetland | | X |
| | Wet pond/ retention basin | | X |
| | Dry extended detention basin | | X |
| | Special Detention areas (parking lots/roof) | | X |
| Water Quality Treatment | Constructed wetland | | X |
| | Constructed Filter | | X |
| | Proprietary Water Quality Filters & Hydrodynamic Devices | | X |
| | Vegetated Swale | | X |
| | Vegetated Filter Strip | | X |
| Non-Structural Controls | Tree Canopy Cover | X | X |
| | Downspout Disconnection | X | X |
| | Approved Adopt-a-Stream volunteer program | | X |
| | Approved environmental education/outreach program | | X |
| National Pollutant Discharge Elimination System (NPDES) Stormwater Permit | Facilities with an active, fully-compliant NPDES Permit from PADEP (this is not the same as a NPDES Construction Permit) | | X |

*Notes:*

** Single family residential property owners are eligible for SMPs listed in the non-residential categories.*

*** Non-residential and multi-family residential are excluded from obtaining the Rain Barrel rebate, but can obtain a cistern credit*

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## Maximum Credit Amount

The maximum credit that any one property can receive is 60% percent of their fee. No property will receive 100% credit or reduction of the fee, and the maximum is set at 60% because the Borough needs to fund programmatic elements, public stormwater facilities, and perform standard maintenance, repair and rehabilitation of publicly owned stormwater facilities. Even if a property manages 100% of the stormwater runoff on their site, the Borough still has obligations under its MS4 permit and needs to maintain the public drainage system to protect the health and safety of the public.

## Maximum Rebate Amount

There is no maximum SPF rebate for residential property owners, except within each SMP category as described below. The rebate can only be applied to one SMP for a given area of IA. For example, if a downspout is disconnected to a rain garden, the homeowner is only eligible for one rebate associated with that specific rooftop drainage area (i.e., the homeowner could receive the higher rain garden rebate, but not the disconnection rebate as well). The rebate is a one-time refund, per property. If the property is sold, the new owner is not eligible for an additional rebate.

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# Residential Credit Types

The residential rebate/credit program incentivizes residential property owners to manage their stormwater on site and/or reduce the amount of impervious area (IA) on their property. This program includes two types of incentives which can be applied to reduce a residential property owner's SPF:

**Residential Rebate** - A rebate provides a one-time refund per property per impervious area for installing a stormwater practice. The rebate is applicable to the impervious drainage area managed, and one property can have multiple rebates. The rebate can only be applied to one SMP for a given area of IA. For example, if a downspout is disconnected to a rain garden, the homeowner only receives the rain garden rebate ($100 per 500 SF) for that IA managed, not both a rain garden rebate and a downspout disconnect rebate ($25 per 500 SF). However, if a second downspout that manages a different IA is disconnected to a vegetated area, the homeowner would receive the downspout disconnect rebate ($25 per 500 SF) in addition to the rain garden rebate. In general, Rebates cannot be applied for SMPs built or constructed prior to the enactment of the SPF Ordinance in 2016.

**Residential Credit** - A credit is a recurring discount on the stream protection fee, and is applied to the property owner's bill to reduce the SPF payment amount on a recurring basis. The credit is valid for three years, after which time the property owner must reapply. Using the example above, the homeowner could apply for the rain garden credit ($20 per 500 SF) and the downspout disconnection credit ($5 per 500 SF). Credits can be applied for SMPs built or constructed prior to the enactment of the SPF Ordinance in 2016.

The amount of rebates or credits earned by each SMP is based on the type and capacity of SMP(s) installed. More intensive practices such as rain gardens typically treat a larger amount of stormwater, and therefore give property owners a larger credit. Less intensive practices such as rain barrels are eligible for a smaller incentive proportional to their stormwater management treatment potential. Table 2 lists the eligible practices for rebates/credits under the residential program, and includes the specific rebate and credit amounts per unit area managed. Further detail is provided below for each specific SMP. 001648

**Table 2. Rebates & Credits for Residential Properties**

| Stormwater Management Practice (SMP) | One-Time Rebate Amount | Annual Recurring Credit Amount | Credit Description |
|---|---|---|---|
| Rain Barrel | $30 | Not Applicable | Rebate is calculated based on per eligible rain barrel and/or tree installed |
| Tree Planting | $50 | Not Applicable | |
| Downspout Disconnection | $25 | $5 | Rebate/Credit is calculated based on per 500 square feet (SF) of IA disconnected or per 500 SF of IA captured |
| Rain Garden | $100 | $20 | |
| Permeable Pavement / Dry Well | $100 | $20 | |

## Calculation of Residential Credits

The Residential Credit is calculated based on the amount of IA treated by one or more SMPs that are owned and maintained by a property owner. For each SMP selected, the fee associated with the amount of IA treated is reduced by the credit applicable to that type of SMP. A description of each SMP type and example calculations for each follow.

## Rain Barrel Rebate

Rain barrels are containers that provide temporary storage of rain water typically for landscape irrigation or other non-potable water needs. Rainwater flows into rain barrels via gutters or downspouts. Collecting rainwater in a rain barrel reduces runoff volumes and can allow for greater infiltration and evaporation of stormwater runoff. For smaller structures, such as shed/garage roofs, rain barrels are typically able to fully manage the stormwater runoff generated during small storm events.

When installing a rain barrel, a property owner must abide by the specific requirements outlined in the table below to qualify for a rebate.

### Rain Barrel Rebate Requirements

| # | Requirement | Summary of Requirement |
|---|---|---|
| 1 | Maximum # of Rain Barrels Eligible for Credit | A maximum of 2 barrels per property will be eligible for rebates. |
| 2 | Rain Barrel Size and Storage Capacity | The rain barrel must have a minimum storage capacity (storage volume) of 45 gallons. This is a typical size among rain barrels that are available for purchase. |
| 3 | Rain Barrel Capture Volume | To qualify for a rebate, each rain barrel must capture runoff from an adjacent roof area of at least 100 square feet (e.g., 10 x 10 feet). |
| 4 | Rain Barrel Overflow | The barrel must provide an overflow outlet near the top of the barrel to discharge excess water during large storm events. |
| 5 | Plan for How to Use Stored Water | There must be a use for the stored water so that the rain barrel's storage capacity is replenished over time. Note that the water collected in rain barrels is <u>not</u> suitable for human consumption. |
| 6 | Rain Barrel Location | When locating the rain barrel, consider site topography. For example, placing a rain barrel up-gradient of a garden will allow watering to work with gravity and enable easy use of stored water. |
| 7 | Mosquito Control | All rain barrel openings must have screens to prevent the growth of mosquitoes (or other vector-control must be provided). |

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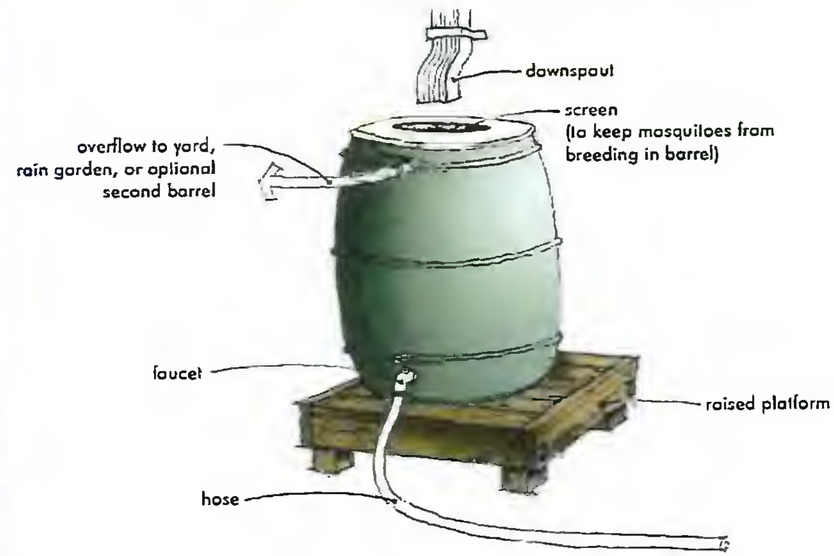

## Rain Barrel Rebate Calculation Example

A property owner installs two (2) eligible rain barrels to manage runoff from their house roof and garage roof. The following example calculation shows the methodology used to determine this property owner's one-time Rain Barrel rebate.

Total Rain Barrel Rebate = Rain Barrel Rebate Amount ($/barrel) x # of Rain Barrels (Up to 2)

Total Rain Barrel Rebate = $30 × 2

Total Rain Barrel One-Time Rebate = $60

## Application Example

**Rain Barrel Rebate**

Credit limit: Maximum of 2 barrels per property

Number of eligible barrels installed: 2 (2 Max)

Rain Barrel Rebate: $30 per barrel

*Total Rebate = (Rebate, $) x (Number of Barrels)*

Total Rebate: $60

001650

# Tree Planting Rebate

For the purposes of the Borough's SPF, tree planting refers to the practice of planting trees in areas where trees are likely to thrive and create a tree canopy that intercepts rainfall and reduces stormwater runoff. This means that trees planted in a grassed lawn, not near any impervious area, will not be covered under this Rebate program. Native tree species are preferred and species should be selected that will grow best given the specific site conditions, such as soil conditions and the amount of sun exposure at the planting site. Trees can be planted by either a property owner or a hired landscape contractor. Interested applicants are encouraged, but not required, to work with the Borough Arborist and the Sustainability Advisory Committee to review the Borough's list of preferred trees and consult them regarding species selection prior to planting. Trees purchased and/or installed through the Borough's tree planting program may qualify for the Tree Planting Rebate. Trees planted prior to the enactment of the Stream Protection Fee Ordinance (2016) are not eligible for the tree planting rebate to incentivize additional plantings. A photo must be submitted to verify its location.

When planting trees as part of the Borough's SPF program, a property owner must abide by the specific requirements outlined in the table below to qualify for a rebate.


## Tree Planting Rebate Requirements

| # | Requirement | Summary of Requirement |
|---|---|---|
| 1 | Maximum # of Trees Eligible for Rebate | A maximum of 4 trees per property are eligible for rebates. Only trees planted since 2016 are eligible for a rebate. |
| 2 | Minimum Tree Size at Time of Planting | Trees must have a minimum of a 2-inch caliper at time of planting. Caliper is the diameter of the tree trunk measured at six inches above the ground. (Refer to example image to right.) |
| 3 | Tree Planting Location – Setbacks, Clearances, and Soil Volume | Trees should be planted with adequate overhead clearance (setback from overhead wires) and appropriate root zone area. If the planting site is surrounded by pavement (e.g., between the street and sidewalk), the recommended minimum tree pit size is 4 x 4 feet or 3 x 6 feet. Ideally, tree pits should be larger (e.g., 6 x 6 feet) or trees roots should have access to adjacent landscaped areas to provide more soil volume for root growth. |
| 4 | Tree Canopy Location | A planting location should be selected that will enable the tree canopy to eventually grow and cover an impervious area (IA) such as a sidewalk, driveway, or roof. The maximum distance between the tree trunk and IA should be 25 feet. |
| 5 | Avoiding Underground Utility Conflicts | It is critical that the property owner minimizes any conflict with existing underground utility infrastructure, therefore, owners are required to utilize the Call Before You Dig Pennsylvania One-Call service for utility mark-outs prior to installing a new tree. For more information: http://www.pa1call.org/pa811/Default.aspx. |


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## Tree Planting Rebate Calculation Example

A property owner plants two (2) eligible trees. The following example calculation shows the methodology used to determine the one-time Tree Planting rebate.

Total Tree Planting Rebate = Tree Planting Rebate Amount ($/tree) x # of Trees (Up to 4)

Total Tree Planting Rebate = $50 × 2

Total Tree Planting One-Time Rebate = $100

## Application Example

**Tree Planting Rebate**

Credit limit: Maximum of 4 trees per property

| | | |
|---|---|---|
| Number of eligible trees planted: | 2 | (4 Max) |
| Tree Planting Rebate: | $50 | per tree |

*Total Rebate = (Rebate, $) x (Number of Trees)*

Total Rebate: $100

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# Downspout Disconnection Rebate/Credit

In West Chester, roof runoff typically is collected in gutters and then flows off the roof via downspouts. Many downspouts are directly connected to the storm sewer system or discharge stormwater onto an impervious surface (i.e., a driveway, sidewalk, or street) that conveys the runoff to a Borough storm inlet. Disconnecting downspouts is the process of physically separating roof downspouts from the sewer system and redirecting roof runoff to discharge onto pervious, landscaped surfaces where the water can naturally infiltrate into the ground. This reduces the amount of directly connected impervious area (IA) on a property. If done correctly, downspout disconnections can reduce peak flow rates, runoff volume, and pollution.

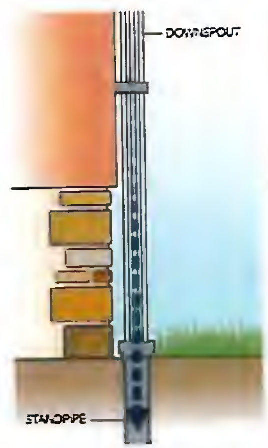
For disconnection to be safe and effective, each downspout must discharge into a suitable receiving area. Roof runoff can be redirected to a garden, yard, planter, or a rain barrel or cistern for eventual reuse. Runoff must <u>not</u> flow toward building foundations or adversely impact adjacent properties.

Note that downspouts that were already adequately disconnected prior to enactment of the Stream Protection Fee Ordinance (2016) are eligible for the credit but not for the rebate. A photo must be submitted to verify the condition of the downspout in question.

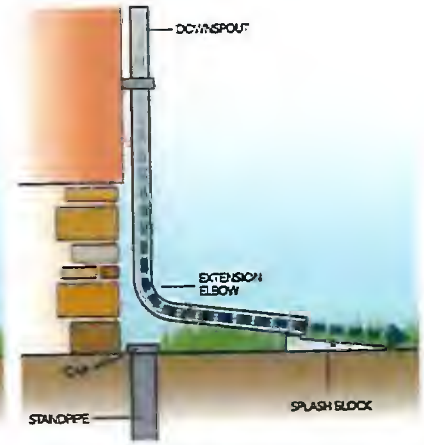
When considering a downspout disconnection, a property owner must follow specific design requirements. The Key Design Requirements for downspout disconnections are summarized in the table below.

## Downspout Disconnection Rebate/Credit Requirements

| # | Requirement | Summary of Requirement |
|---|---|---|
| 1 | Existing Downspout Characteristics | To qualify for a downspout disconnection rebate, the existing downspout must be currently directly draining into a storm sewer, either flowing via pipe or over impervious surfaces to a storm inlet. Downspouts that are already adequately disconnected are eligible for a credit but not a rebate. |
| 2 | Contributing Rooftop Area | Limit the contributing rooftop area to a maximum of 500 square feet (e.g., 20 x 25 feet) per downspout disconnection. |
| 3 | Required Distance from Structures | After disconnection, the extension, splash block and ground should all discharge water a minimum of 3 feet away from structures (i.e. basements, porch steps, or garages) or discharge directly into a rain barrel, cistern, or other structure. |
| 4 | Splash Block | It is recommended to use a splash block to absorb the energy of falling water, spread the water out, and prevent erosion. (See image for an example of a typical splash block). |




DOWNSPOUT CONNECTED TO SEWER SYSTEM




DOWNSPOUT DISCONNECTED FROM SEWER SYSTEM

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| | | |
|---|---|---|
| 5 | Disconnecting to Stable Slopes | Do not disconnect downspouts to steep slopes over 10% (i.e., areas with a vertical drop of more than 1 foot every 10 feet horizontally) unless the slopes are adequately stabilized. |
| 6 | Disconnecting to Pervious, Landscape Area | Make sure there is enough pervious area for the roof runoff to be absorbed into the ground. The pervious/landscaped area must be at least 20% of the roof area that drains to the disconnected downspout. |

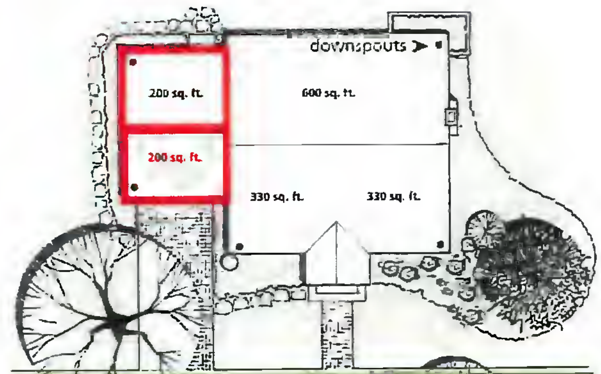


Figure 1- Example site plan noting locations of existing downspouts and their associated roof areas.

## Downspout Disconnection Rebate/Credit Calculation Example

The calculation of the downspout rebate/credit is based on the amount of rooftop area that is disconnected. To estimate the rooftop area draining to a downspout, the property owner should sketch a site plan of the property (refer to Appendix A: How to Create a Site Plan). Sources for an aerial site map include a view from Google or Bing maps or any other online mapping program. The locations of downspouts and the roof line should be marked as shown in the example graphic. The area of the rooftop can be estimated by measuring the area of the roof (length x width). Calculate or estimate the area of rooftop that drains to the downspout that has been selected for disconnection. If there is only one downspout, the property owner can utilize the entire roof area. If there are gutters with downspouts on both ends, assume that half of the roof area drains to each downspout.

001654

Example: A property owner installs two (2) downspout disconnections draining a total of 400 square feet (SF) of rooftop (e.g., the 2 garage downspouts shown on Figure 1, with their rooftop IA outlined in red). The following example calculation shows the methodology used to determine the downspout disconnection one-time rebate and recurring annual credit.

### Downspout Disconnection Rebate Calculation

Total Rebate = Downspout Disconnection Rebate Amount ($/500 SF) x (Rooftop Area Disconnected ÷ 500 SF)

Total Disconnection Rebate = $25 x (400 square feet ÷ 500 square feet)

Total Disconnection One-Time Rebate = $25 x 0.8 = $20



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Downspout Disconnection Annual Credit Calculation

Total Annual Disconnection Credit = Annual Credit Amount ($/500 SF) x (Impervious Area Disconnected ÷ 500 square feet)

Total Annual Credit = $5 x (400 square feet ÷ 500 square feet)

Total Annual Credit = $5 x 0.8

**Total Annual Disconnection Credit = $4**

Application Example

**Downspout Disconnection**

Provide sketch of roof area being disconnected, downspout locations, and the vegetated area that will receive the stormwater runoff. Note that only 1 residential credit/rebate can be applied to a given impervious area. For example, if a downspout is disconnected to a rain garden, apply for the higher rain garden credit/rebate below.

Total Rooftop area disconnected: 400 square feet

| | | |
|---|---|---|
| Downspout Disconnection Rebate: | $25 | per 500 SF disconnected |
| Downspout Disconnection Annual Credit: | $5 | per 500 SF disconnected |

*Total Rebate = (Rebate, $) x (Rooftop Area Disconnected / 500 SF)*

Total Rebate: $20.00

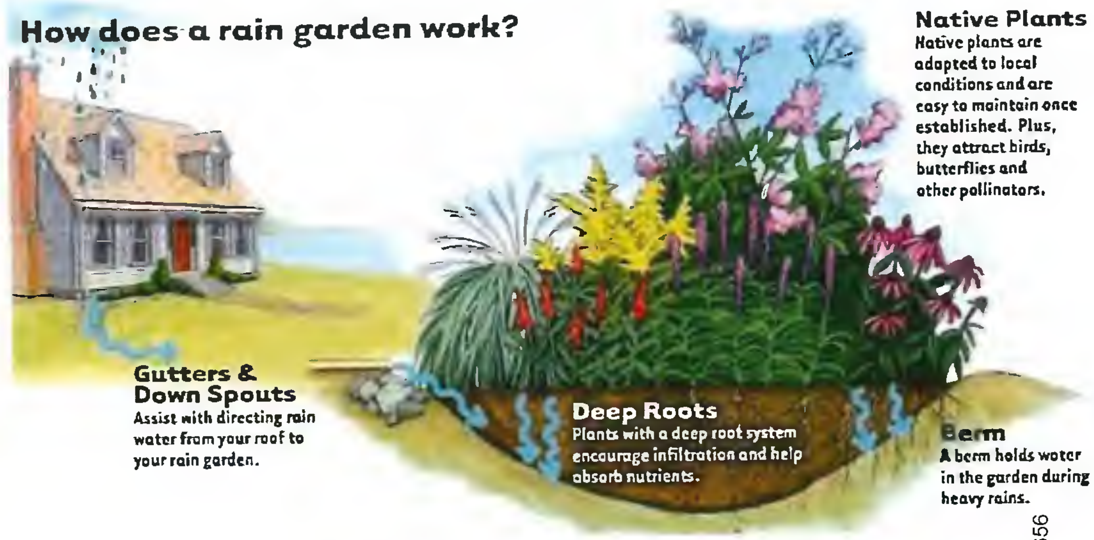
*Total Annual Credit = (Credit, $) x (Impervious Area Disconnected / 500 SF)*

Total Annual Credit: $4.00

001655

## Rain Garden Rebate/Credit

A rain garden (or "bioretention area") is a depressed landscaped area designed to capture and filter stormwater runoff. In addition to managing stormwater runoff volume and mitigating peak discharge rates, a rain garden can improve water quality by removing pollutants as the water percolates through the soil. Rain gardens can be designed with a range of shapes and sizes, allowing for easy integration into many yards/landscapes. Rain gardens typically require relatively little maintenance once established and often replace areas that were previously intensively landscaped. Vegetation for rain gardens should include hardy native plants that are tolerant of varying hydrologic conditions (i.e., both wet and dry conditions) and environmental stressors such as salts (i.e. if there is potential for exposure to deicing salts). Plants should be chosen for the appropriate sun/shade conditions as well.

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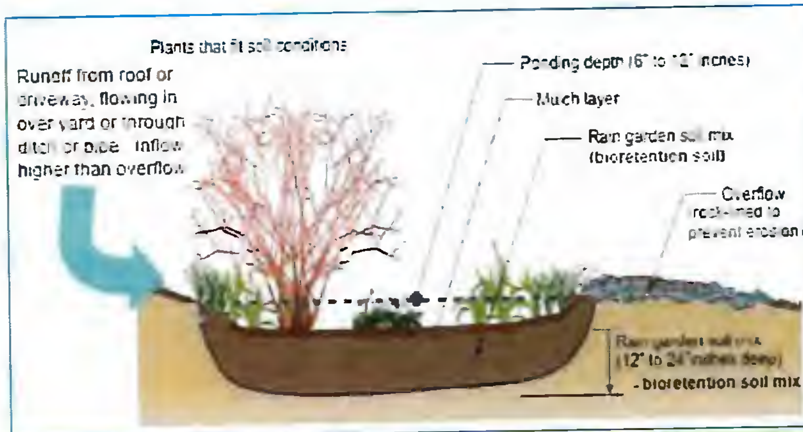
A variety of helpful resources for designing residential rain gardens are available online, including the following:

- Creating Your Rain Garden prepared by Pennsylvania Environmental Council
- Philadelphia Water Department's "How to Build a Rain Garden" online guide
- "Start to Finish Rain Garden Design: A Workbook for Homeowners" from Faribault County, MN

When designing a residential rain garden, a property owner must follow specific design requirements to qualify for a rebate or credit. The Key Design Requirements for a residential rain garden are summarized in the following table and explained in further detail on the following pages.

## Rain Garden Rebate/Credit Requirements

| # | Requirement | Summary of Requirement |
|---|---|---|
| 1 | Rain Garden Size (Square Feet) | Rain garden must be sized appropriately relative to contributing impervious area. *Refer to the Additional Design Information section on the next page.* |
| 2 | Rain Garden Volume (Cubic Feet) | Rain garden must be sized to capture 1" of runoff from contributing IA. *Refer to the Additional Design Information section on the next page.* |
| 3 | Rain Garden Depth (Inches) | Rain garden must have a ponding area depth of no more than 12 inches. |
| 4 | Soil Drainage Testing | Soil drainage tests must be conducted prior to constructing a rain garden to confirm that the rain garden will be able to handle the amount of water draining to it and that the rain garden will empty (drain down) within 48 hours. This is important for public health and safety reasons. *Refer to Appendix B: How to Perform a Drainage Test.* |
| 5 | Rain Garden Overflow | The rain garden should be designed to have a way to release excess water during extreme storm events through a secondary pathway (e.g., a rock channel, an overflow drain, or swale). |
| 6 | Avoiding Underground Utility Conflicts | It is critical that the property owner minimizes any conflict with existing underground utility infrastructure, therefore, owners are **required to utilize the Call Before You Dig Pennsylvania One-Call service** for utility mark-outs prior to digging a rain garden. For more information: http://www.pa1call.org/pa811/Default.aspx. |




*Rain gardens must have a ponding depth of no more than 12 inches and must have an overflow to enable water to exit during heavy storms.*

001657

### Typical Native Plants for Rain Gardens in Eastern Pennsylvania

**Perennials**

Bee-balm—*Monarda didyma*
Black-eyed Susan—*Rudbeckia hirta*
Blazing star—*Liatris spicata*
Blue flag iris—*Iris versicolor*
Boneset—*Eupatorium perfoliatum*
Butterfly weed—*Asclepias tuberosa*
Cardinal flower—*Lobelia cardinalis*
Early goldenrod—*Solidago bicolor*
Golden alexander—*Zizia aurea*
Joe-pye weed—*Eupatorium purpureum*
New England aster—*Aster novae-angliae*
New York ironweed—*Veronia novaboresensis*
Obedient plant—*Physostegia virginiana*
Ox-eye—Heliopsis helianthoides
Solomon's seal—*Polygonatum biflorum*
White snakeroot—*Eupatorium rugosum*

**Grasses and Grass-like plants**

Big bluestem—*Andropogon gerardii*
Bottle brush grass—*Elymus hystrix*
Canada wild rye—*Elymus canadensis*
Path rush—*Juncus tenuis*
Purple-top—*Tridens flavus*
Soft rush—*Juncus effusus*
Switch-grass—*Panicum virgatum*
Virginia wild rye—*Elymus virginicus*

**Ferns**

Christmas fern—*Polystichum acrostichoides*
Hay-scented fern—*Dennstaedtia punctilobula*
Rattlesnake fern—*Botrychium virginianum*
Sensitive fern—*Onoclea sensibilis*

**Shrubs**

Gray dogwood—*Cornus racemosa*
Highbush blueberry—*Vaccinium corymbosm*
Mountain laurel—*Kalmia latifolia**
Ninebark—*Physocarpus opulifolius*
Pasture rose—*Rosa carolina*
Red osier dogwood—*Cornus sericea*
Spicebush—*Lindera benzoin*
Sweet pepperbush—*Clethra alnifolia*

*Pennsylvania's state flower

*When purchasing plants, pay close attention to the scientific names to ensure the correct species are selected.*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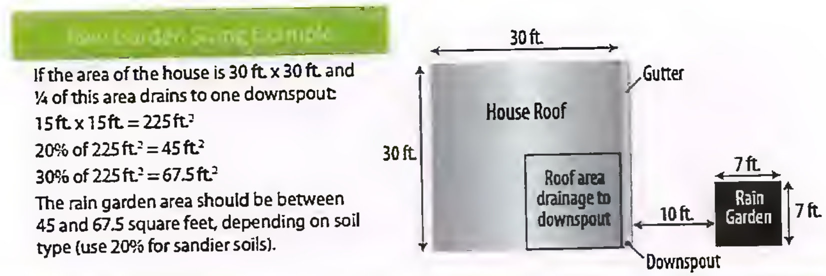
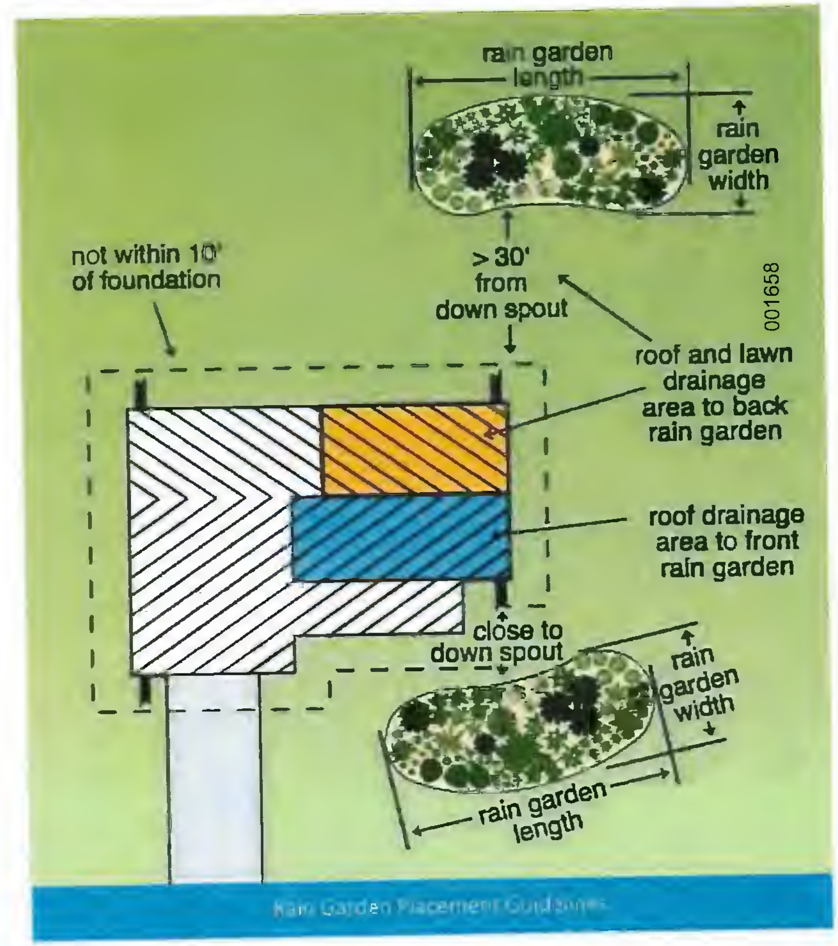
## **Rain Garden** Requirements - Additional Design Information

1. <u>Rain Garden Area</u>: The size of the rain garden shall be directly based on the amount of contributing impervious area (IA).
   - The maximum ratio of impervious drainage area (IA) to rain garden area should be 15:1 (e.g., a 50 SF rain garden can manage up to 750 SF of IA).
2. <u>Rain Garden Volume</u>: For full rebate/credit, the rain garden must capture 1 inch of runoff from the impervious area draining to it (a minimum of 0.25 inches must be captured for any credit).
   - One (1) inch of runoff from 500 SF is equivalent to 41.7 cubic feet (312 gallons) of water
     - 500 SF x 1 inch x 1 foot/12 inches = 41.7 cubic feet (CF)

   A simple way to estimate the capacity of the surface rain garden is to take the ponding area and multiply it by ½ of the ponding depth (multiplying by ½ accounts for the fact that there is shallower ponding around the perimeter as the sides slope up from the bottom of the rain garden). The ponding depth should be no more than 12 inches.
   - For example, an 8-foot diameter (50 SF) rain garden with 12 inches (1 foot) of ponding can store approximately 25 CF of runoff on the surface
     - 50 SF x ½ x 1 foot = 25 CF
   - Rain garden soils (12 inches thick) can typically store another 0.25 CF per square foot.
   - Therefore, 50 SF of soil can hold approximately 12.5 CF
     - 50 SF x 0.25 CF per SF = 12.5 CF
   - The total capacity of this example 50 SF rain garden would be 37.5 CF, enough to capture 1 inch of runoff from 450 square feet or 0.9 inches from 500 SF.
     - 25 CF surface storage + 12.5 CF soil storage = 37.5 CF total storage
   - If additional storage is provided through deeper rain garden soils or a gravel storage layer, that storage should be accounted for as well.



## Rain Garden Rebate/Credit Calculation Example

A property owner installs a 50 square foot rain garden draining a total of 750 square feet of IA, capable of capturing 1 inch of runoff from their contributing IA. The following example calculation shows the methodology used to determine the rain garden one-time rebate and recurring credit.

### Rain Garden Rebate Calculation

Total Rebate = Rain Garden Rebate Amount ($/500 SF) x (Impervious Area Captured in square feet ÷ 500 square feet)

Total Rebate = $100 x (750 square feet ÷ 500 square feet)

Total Rebate = $100 x 1.5

**Total One-Time Rebate = $150**



### Rain Garden Annual Credit Calculation

Total Annual Credit = Annual Credit Amount ($/500 SF) x (Impervious Area Captured in square feet ÷ 500 SF)

Total Annual Credit = $20 x (750 square feet ÷ 500 square feet)

Total Annual Credit = $20 x 1.5

**Total Annual Credit = $30**

Application Example

**Rain Garden Rebate/Credit**

On a separate sheet, provide sketch of the rain garden location and the impervious area being managed by each rain garden. Note that only 1 residential credit/rebate can be applied to a given impervious area.

Contributing impervious area to rain garden(s): 750 square feet

| | | |
|---|---|---|
| Rain Garden Rebate: | $100 | per 500 SF IA captured |
| Rain Garden Annual Credit: | $20 | per 500 SF IA captured |

*Total Rebate = (Rebate, $) x (Impervious Area Captured / 500 SF)*

Total Rebate: $150.00

*Total Annual Credit = (Credit, $) x (Impervious Area Captured / 500 SF)*

Total Annual Credit: $30.00

001660

# Permeable Pavement (Drywell) Rebate/Credit

<u>NOTE:</u> *It is recommended that residential owners who are considering this rebate/credit contact the Public Works Department, as engineering review is strongly encouraged. Due to the likely amount of land disturbance involved for these types of practices, an owner may need to consult with the Building and Housing Department to determine if a permit is required.*

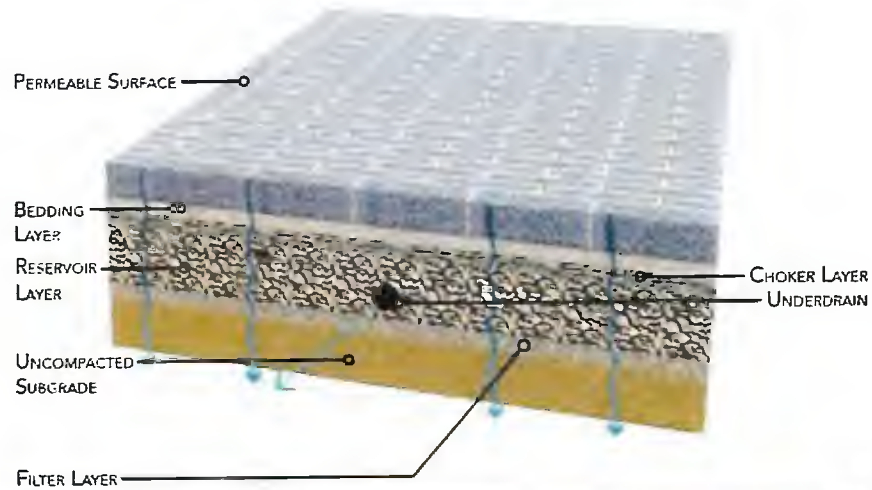
In general, permeable pavements (also called porous or pervious pavements) are designed to allow stormwater to infiltrate through the pavement surface, into an underground gravel/crushed stone storage bed or reservoir, and finally down into the underlying soil.

Dry wells are underground structures or gravel pits that collect rainwater and let it absorb into the soil.

Types of permeable pavements may include paving blocks, grid pavers, pervious concrete, porous asphalt, and a variety of proprietary materials. Installing crushed gravel alone as a surface is not considered permeable pavement and is not eligible for a credit, unless it is designed as part of an engineered system specifically intended for stormwater storage and infiltration. Permeable pavement can potentially be used for driveways, patios, parking lots, walking paths, sidewalks, playgrounds, basketball courts, and other similar uses.

The storage bed should generally be placed on an <u>uncompacted</u> base to facilitate stormwater infiltration. The subsurface storage bed may consist of uniformly graded, clean and washed coarse aggregate (stone or large gravel) with a void space of approximately 40%, or manufactured structural storage units. It is recommended that a qualified engineer and/or installer with knowledge of hydrology and hydraulics be consulted for applications using permeable hardscapes for driveways to ensure desired results and to ensure proper support for vehicles.

When installing a permeable pavement or dry well system on a residential property, the property owner must follow specific design requirements. The Key Design Requirements for a residential permeable pavement system are summarized in the following table and explained in further detail on the following pages.

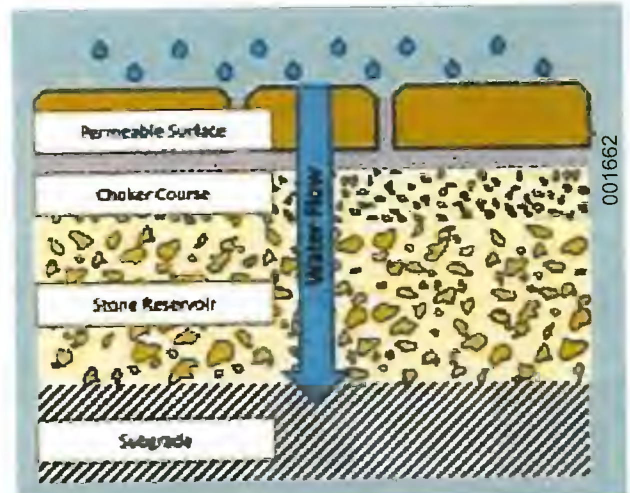




## Permeable Pavement Rebate/Credit Requirements

| # | Requirement | Summary of Requirement |
|---|---|---|
| 1 | Permeable Pavement Area (Square Feet) | Permeable pavement system must be sized appropriately relative to contributing impervious area (IA). *Refer to the Additional Design Information section on the next page.* |
| 2 | System Storage Capacity/Volume (Cubic Feet) | System must be sized to capture 1" of runoff from contributing IA. |
| 3 | Storage Bed Depth (Inches) | Bottom of storage bed must be a minimum of 2 feet above existing water table/bedrock. |
| 4 | Soil Drainage Testing | Rainwater must drain down (percolate) out of the permeable pavement system within 48 hours or less. *Refer to Appendix B: How to Perform a Drainage Test.* |
| 5 | Existing Site Characteristics | Site should have a fairly level or gently sloping surface with uncompacted soils. Provide level or slightly sloping storage beds. |
| 6 | Permeable Pavement System Overflow | Permeable pavement system should have an overflow mechanism to release excess water during extreme storm events. |
| 7 | Permeable Pavement Secondary inflow | A secondary mechanism for introducing water into the system is recommended. |
| 8 | Preventing Surface Clogging | Prevent sources of sediment and debris from clogging the permeable pavement system both during and after construction. |
| 9 | Surface Permeability | Pavement surface material should have a permeability of at least 20 inches per hour. The manufacturer of proprietary materials can provide this information. |
| 10 | Avoiding Underground Utility Conflicts | It is critical that the property owner minimizes any conflict with existing underground utility infrastructure, therefore, owners are required to utilize the **Call Before You Dig Pennsylvania One-Call** service for utility mark-outs prior to digging a rain garden. For more information: http://www.pa1call.org/pa811/Default.aspx. |

Permeable pavers come in a variety of colors and sizes




Typical cross-section of a permeable pavement system

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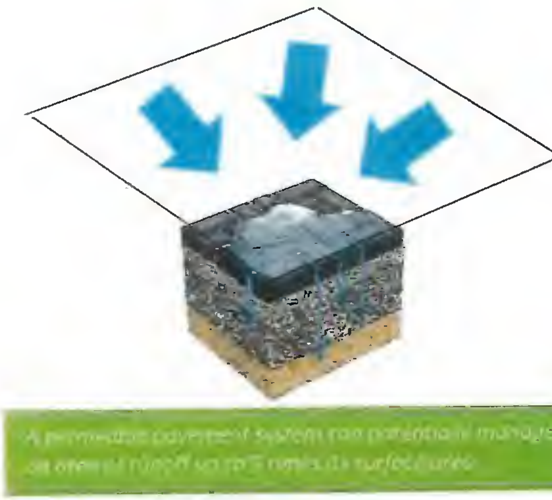
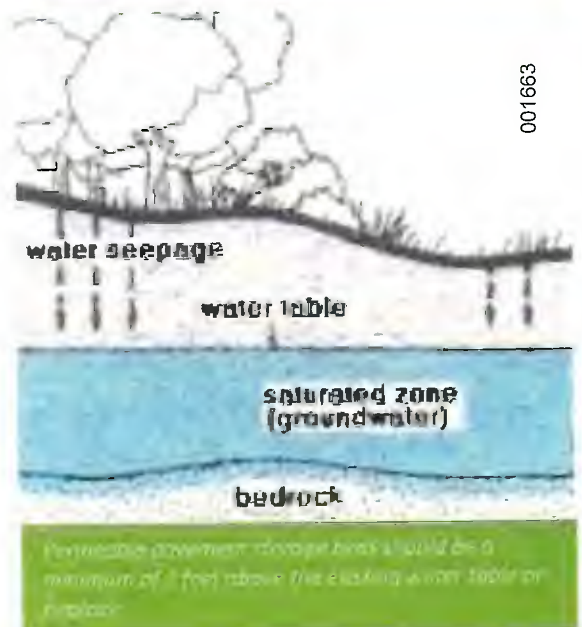
## Permeable Pavement and Drywell Rebate/Credit Requirements – Additional Design Information

1. Permeable Pavement Area: The surface area of the proposed permeable pavement system must be directly based on the amount of contributing impervious area (IA).
    - The maximum ratio of drainage area to permeable pavement should typically be 5:1 (e.g,. a 100 SF permeable pavement surface can manage up to 500 SF of IA).
    - Figure A-3 in Appendix A to the Ch.94 Stormwater Management Ordinance includes a standard seepage bed detail that can be used for drywell sizing.
2. System Storage Capacity/Volume: Permeable pavement systems must have the storage capacity to capture a 1-inch storm event for a full rebate/credit.
    - A good rule of thumb is to consider that 10 inches of clean, uniformly-sized gravel with 40% void space can store 4 inches of water, enough to store 1 inch of stormwater from the pavement area itself plus runoff from an area 3 times as large (for example, an adjacent rooftop).
3. Storage Bed Depth: The bottom of the storage bed and/or dry well should be located at a minimum of 2 feet above the existing water table or bedrock.
    - To check out your property's general soil characteristics (depth to groundwater and depth to bedrock), visit the online USDA NRCS Web Soil Survey
    - If signs of a shallow water table or bedrock are encountered when digging on your property or when conducting a drainage test, consult a professional.
4. Soil Drainage Testing: Soil conditions are variable in an urban environment such as the Borough, and as such, it is required that a soil drainage test be undertaken to confirm that the permeable pavement system can empty within 48 hours. A simple drainage test can be performed per the instructions in Appendix B: How to Perform a Drainage Test.
5. Existing Site Characteristics: Permeable pavement systems should be constructed only on fairly level or gently sloping surfaces. They are not practical on steep slopes.

   During installation, construction equipment should be kept off the soil and other measures taken to prevent compaction of the soil and the accompanying reduction in permeability.

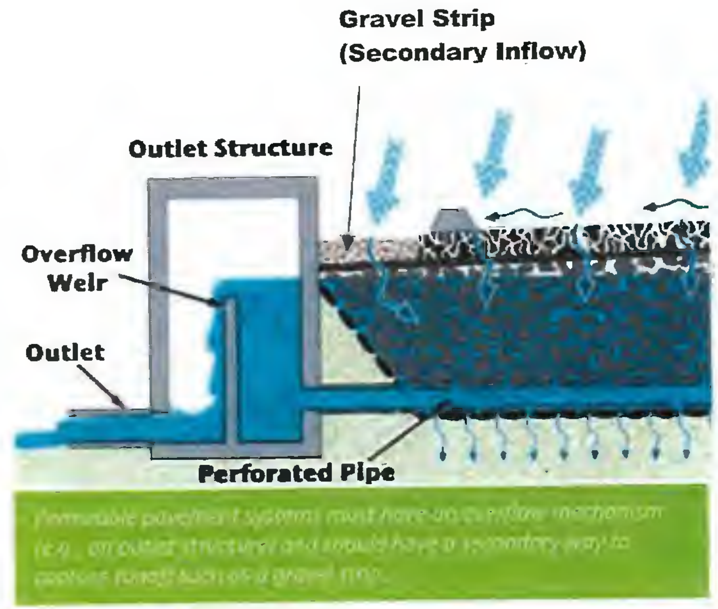
   Provide level or gently sloping storage bed bottoms to maximize storage and infiltration.
6. Permeable Pavement System Overflow: Provide a positive stormwater overflow structure/device from the system to release excess water during extreme storm events.





7. Permeable Pavement Secondary Inflow: It is recommended that the permeable pavement system be designed with a secondary inflow mechanism such as a gravel strip along the lower edge or a small area drain that connects to the storage bed under the pavement.

8. Preventing Surface Clogging: Prevent sediment-laden runoff (i.e., from un-stabilized pervious areas) from flowing towards the permeable pavement surface and consider how to prevent and/or remove other sources of debris (leaves, seeds, flowers, pollen, etc.) that may clog the permeable pavement. Avoid locating permeable pavements where they are likely to receive excessive sediment and/or debris.

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Permeable Pavement and Drywell Rebate/Credit Calculation Example

A property owner installs a permeable pavement driveway that is 10 feet wide by 25 feet long (250 square feet [SF]). It also manages the runoff flowing out of a garage downspout that collects runoff from 250 SF of the garage rooftop. Therefore, the total IA to be managed is 500 SF (permeable pavement driveway area plus garage rooftop area managed). The following example calculation shows the methodology used to determine the permeable pavement one-time rebate and credit.

Rebate Calculation

Total Rebate = Permeable Pavement Rebate Amount ($/500 SF) x (Impervious Area Replaced or Captured in square feet ÷ 500 square feet)

Total Rebate = $100 x (500 square feet ÷ 500 square feet)

Total Rebate = $100 x 1

Total One-Time Rebate = $100

Annual Credit Calculation

Total Annual Credit = Annual Credit Amount ($/500 SF) x (Impervious Area Replaced or Captured in square feet ÷ 500 square feet)

Total Annual Credit = $20 x (500 square feet ÷ 500 square feet)

Total Annual Credit = $20 x 1

Total Annual Credit = $20

Application Example

**Permeable Pavement / Dry Well**

Provide sketch of the permeable pavement area or dry well and the impervious area being replaced/captured by the permeable pavement or dry well. Note that only 1 residential credit rebate can be applied to a given impervious area.

| | | |
|---|---|---|
| Replaced / captured impervious area: | 500 | square feet |
| Permeable Pavement / Dry Well Rebate: | $100 | per 500 SF replaced / captured |
| Permeable Pavement / Dry Well Annual Credit: | $20 | per 500 SF replaced / captured |

*Total Rebate = (Rebate, $) x (Impervious Area Replaced / 500 SF)*

Total Rebate: $100.00

*Total Annual Credit = (Credit, $) x (Impervious Area Captured / 500 SF)*

Total Annual Credit: $20.00

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# Credit Program Procedures

The following procedures are common to both the Residential Credit Program and the Non-Residential Credit Program.

## Application Forms

Residential and non-residential application forms are available on the Borough's website www.west-chester.com, searching Stream Protection Fee.

## Application Deadline

The Borough has determined that all approved credits will be applied retroactively based on the year the application was submitted using a deadline of July 31. All rebate/credit applications will be accepted year-round on a rolling basis. If the application is received by July 31, approved credits/rebates will be applied retroactively based on the year of the application submittal date. If the application is received after July 31, then the property owner must wait one year before the credit appears.

## Application Fee

Payment of a Rebate/Credit Application Fee may be required for Borough review of the credit application. The fee is listed in the Borough's current fee schedule, which is available on the Borough's website. SPF credit application fees are non-refundable regardless of the outcome of the credit application. Borough council may choose at their discretion to waive the application fee, and as of November 2017, Council has waived the application fee.

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## Operations and Maintenance (O&M) Agreement

A signed maintenance agreement between the Borough and the property owner is required for credit approval. Under the Operations and Maintenance (O&M) agreement, the owner must allow the Borough access to the site to view and inspect the SMP according to the Borough's inspection cycle. The Agreement can be found on the Borough website.

To receive the residential or non-residential SPF credit, a property owner must be able to demonstrate the stormwater facility is being properly maintained. A property owner can demonstrate maintenance of a stormwater facility by including with the SPF Credit Application available maintenance records showing the maintenance activities and date, or the most recent invoice from a qualified maintenance vendor. If the applicant does not maintain the facility as required, the Department of Public Works will notify the property owner in writing that they have 30 days to take corrective action otherwise the credit will be discontinued.

## Application Documentation Requirements

The property owner must provide the following documentation:

- Completed and signed application form.
- Photograph(s) of SMP
- A sketch (site plan, plot plan, map, aerial image or similar illustration) showing parcel lot lines, built features including all impervious areas, and location of the existing/proposed SMPs, and drainage areas to the SMP.

   - Refer to Appendix A: "How to Create a Site Plan" for instructions
   - The property owner should utilize the Borough's online mapping program which allows users to search for their property address and view their mapped parcel and impervious area. The website also allows for the user to print on a page size sheet suitable for inclusion in the application.
- Documentation of purchase and/or installation of the SMP including receipts, invoices, packing slips, or other records if available.
- Calculations or other documentation of impervious drainage area and SMP capacity estimates
- Maintenance logs noting the past inspection and maintenance records (or receipts from vendors hired to perform maintenance), or for newly constructed SMPs, a description of the proposed seasonal maintenance activities that the property owner will undertake.

In the event the credit application is missing information; Borough staff will request additional documentation to aid in review of the credit application.

## Submission of Credit Application

Electronic submissions can be made to spf-program@west-chester.com. Submit a copy of the completed credit application. the checklist. all supporting documentation and the non-refundable application fee (if applicable) to:

Borough of West Chester Department of Public Works

Attention: Stream Protection Fee Program – Credit Program

205 Lacey Street

West Chester, PA 19382

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## Determination

Borough staff will review the credit application and issue a determination no later than November 1. The applicant will be notified by letter and/or email of the decision.

## Appeal of Determination

Appeal of the credit determination can be made in accordance with Section 11 – "Appeals" of the Borough's Stream Protection Ordinance. Typically, a credit application will be primarily denied due to technical inadequacies. Should those inadequacies be addressed, the property owner may resubmit their application to the Borough.

## Issuance of Credits

Rebates and/or Credits will be applied in the form of a credit and will be applied to subsequent bills.

## Credit Renewal

Residential SPF credits will be valid for three years, after which they will require renewal by the property owner. This renewal policy does not apply to the SPF Rebate which is a one-time refund per property. To continue to receive the SPF credit, property owners are required to reapply before the credit period expires within 3 years. Should the owner fail to submit a renewal application, the credit(s) will expire. When reapplying, the property owner must update their demonstration of stormwater facility maintenance by including sufficient documentation in the application package.

## Site Inspections

Upon receipt of a credit application, the Borough or its designated appointee, may inspect the parcel to verify all information and supporting documentation. Efforts will be made to notify the property owner in advance. If the Borough's site inspection determines that the SMP is not being maintained appropriately, the credit could be denied. The Borough may choose to withhold the credit until the property owner demonstrates that the SMP is being appropriately maintained.

## Termination of Credits

Approved credits may be terminated at any time if the SMPs are found to be not functional, improperly maintained, or if the owner fails to restore the SMPs per Borough notification.

## Change in Property Ownership

If a property is sold and there is a change in ownership, the credit (residential or non-residential) will remain in place until the three-year credit term is completed. The new property owner will be required to resubmit the credit application in accordance with the Credit Renewal policy described in this Manual. As the residential rebate is a one-time refund amount provided per property per eligible SMP, a new owner is not eligible for previously awarded rebates once a property changes hands.

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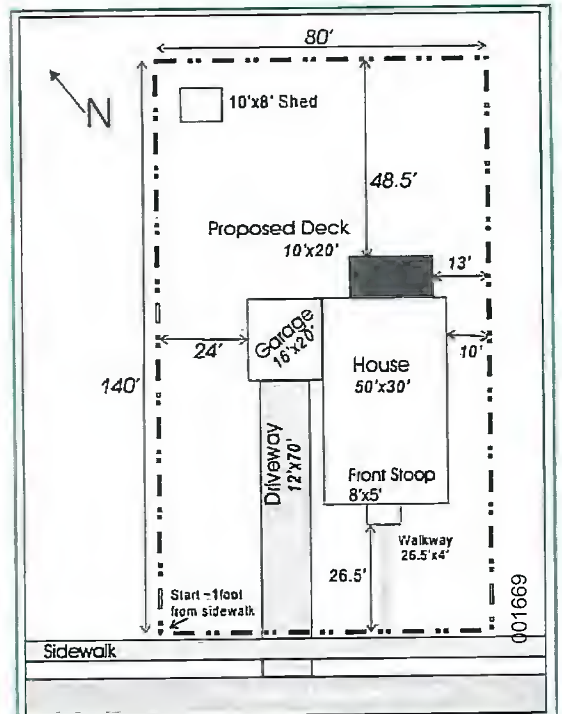
# Appendix A: How to Create a Site Plan

A site plan is a scaled map/diagram that graphically depicts a property's existing and/or proposed physical structures and landscape features. Site plans are drawn showing a bird's eye view of your property as if you were looking down at it from above. A site plan shows significant things that are on your property currently, such as the footprint of any buildings (home, garage, storage shed, or decks) and any other features such as driveways, patios, walkways, fences, swimming pools, etc. on the property.

Dimensions should be included for significant items and be used to show distances between existing items. The drawing should be done to a scale (e.g., 1 inch on the plan is equal to 30 feet on the ground). Site plans also should indicate the orientation of the plan using a North Arrow symbol that indicates which direction North is.

The following steps will help you in preparing your site plan.




*Sample Site Plan*
*Scale: 1"=30'*

*Proposed Rear Deck addition.*

**Step 1: Determine your property boundaries and lot dimensions (choose from one listed below).**

*Option 1 – Use Online Tax Assessor's Map*

Using an address or property owner name, you can look up your property on the Chester County Tax Assessor's Map website (accessible through "ChescoViews" application). Assessor's maps are regularly updated maps drawn to scale and based on the latest recorded surveys and plats of the area. The maps have an aerial photography background and they offer a measuring tool so you can measure the dimensions for all sides of your property.

*Option 2 – Use Subdivision Plat Information or Deed Records*

Like the Tax Assessor's map, you may also look up your lot on the recorded plat that your property is within. The legal description of your property, which should be included on the deed, usually contains your property's lot or parcel number and the subdivision name in which your lot is located. In cases where the property is not within a subdivision plat, the legal description will likely be a 'metes and bounds' description that describes the perimeter of the property in greater detail, without reference to a plat. To find a copy of your deed, you can contact the Chester County Historical Society, which has inventories of deeds dating back to 1688. Note – this option is not likely to be the most efficient option, however, it is included here in the even that applicants choose to use it.

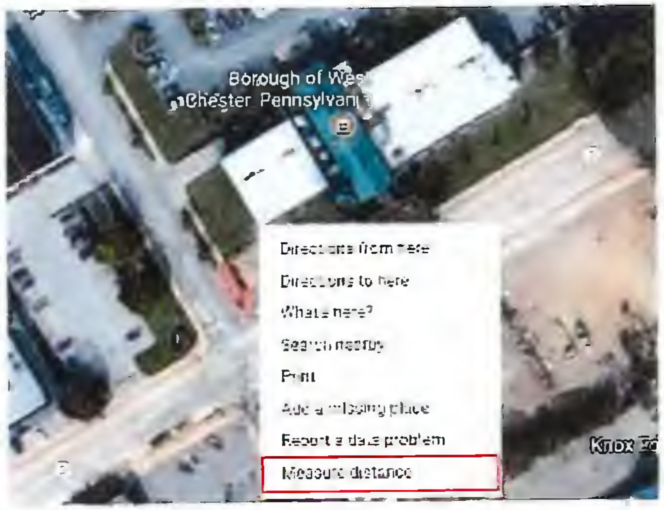
*Option 3 – Use Recent Building Records*

For newer constructed properties, using a previously approved site plan can save time when preparing your documentation. If there is a new structure on the property which required building permits, there is a possibility that the Borough may have an archived copy of the original building plans on file, including a site plan. You should make a request through the Borough's Department of Building, Housing, and Code Enforcement to obtain record site plans.

*Option 4 – Measure Your Property Yourself*

You can do this either by going outside with a tape measure and taking down measurements, or you can use an online program such as Google Maps' Measuring Tool on your computer.

*Directions to Use Measuring Tool in Google Maps*:





1. Open Google Maps in your internet browser.
2. Enter your address to zoom into your property.
3. Make sure you are in Satellite (aerial photography) mode so you can see your property's features.
4. Right-click on your starting point.
5. Choose **Measure distance.**
6. Click anywhere on the map to create and point and measure the distances between the two points. To add another point, click anywhere on the map. Drag the points to change/adjust your measurement or click any of the points to remove.
7. At the bottom of the Measure Distance dialogue box, you'll see the total distance in feet (ft) and/or total area in square feet (sf).
8. Right-click to find the Measuring Tool Menu and select Print. Print to a printer or Print to Save to a PDF if your computer has that option.

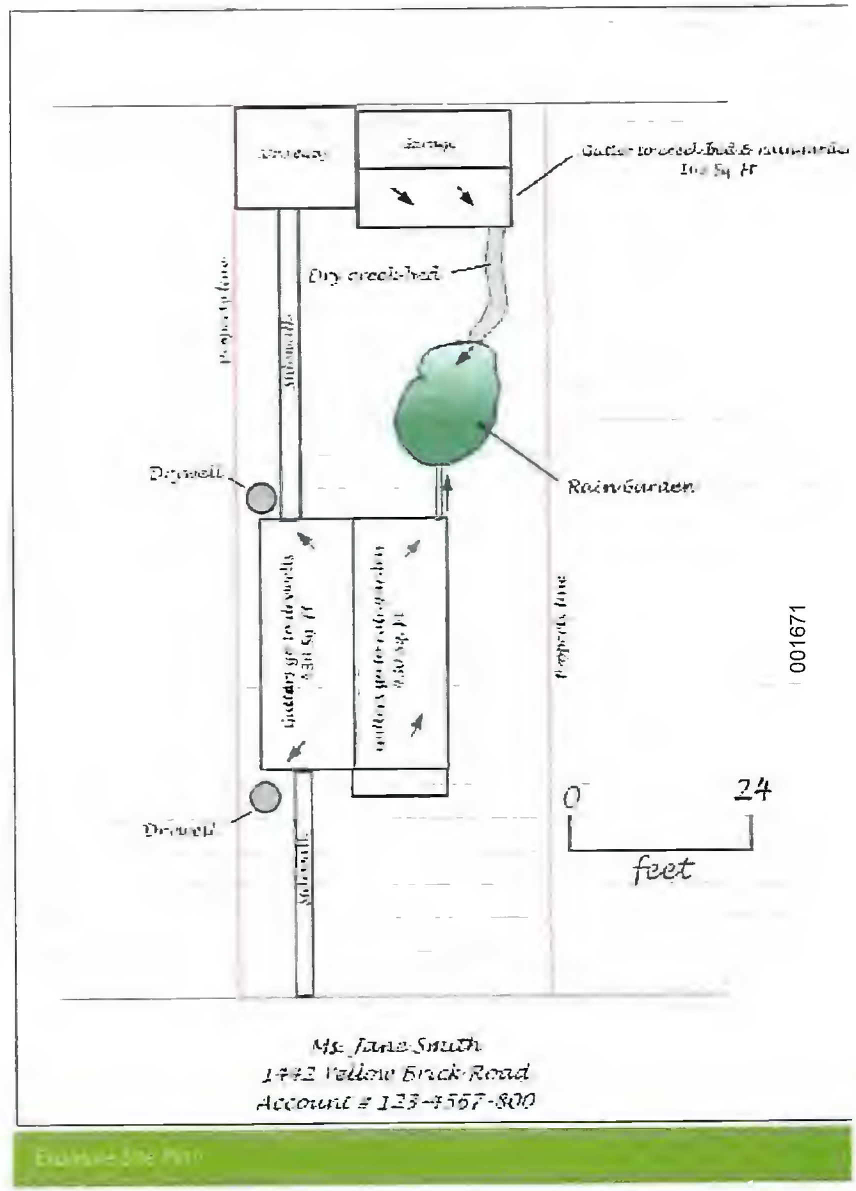

**Step 2: Determine the location of structures and other site features in relation to the property boundaries.**

Using the property boundary location and dimension information gathered in Step 1, you must next determine the location of applicable existing buildings, streets, driveways, sidewalks, trees, and other site features in relation to the property boundaries. Measure the distance from these site features to the surrounding property lines. You can do this either with a tape measure or you can use an online program such as Google Maps' Measuring Tool on your computer.

**Step 3: Draw the plan.**

Use the information gathered in Steps 1 and 2 to prepare your site plan. You may draw your site plan by hand or use a computer graphics or drafting program. An example site plan template is provided in this Appendix for you to print and use if desired.

1. Determine Your Site Plan Scale and Orientation
   a. Using graph paper, choose a scale of measurement for the plan drawing so that one square = X feet. To ensure all information will fit on the page and be easy to read, a good example would be to have each block of the graph paper equal five (5) feet (or 1 inch = 25 feet). After choosing your scale of measurement, draw lines to show the house, driveway and any sidewalks on the plan. Write in the closest distances in feet of the lot lines to the house (i.e. building setbacks), and draw an arrow pointing north.
2. Add other Items that must be on the Plan such as the Property Owner Name and Address.
3. Draw Property Lines and Label all dimensions in feet.
4. Draw all Existing Buildings and Structures on the Plan (i.e., House, Garages, Sheds, etc.). These are your property's impervious areas (IA). Show distances between buildings and property lines. Label all dimensions in feet.
5. Draw Driveways, Parking Areas, Patios, Decks, and Sidewalks on the Plan. These are your property's additional impervious areas. Label all dimensions in feet.
6. Locate Existing Trees and Significant Landscape Elements
   a. Use a dot to indicate the approximate location of the tree and a circle to indicate the canopy coverage
   b. Landscape areas and planting beds can be drawn as solitary masses rather than individual plants/shrubs
7. Identify and draw the area of the site that will contain the existing or proposed SMP (i.e., rain garden, downspout disconnection, permeable pavement/drywell).
8. Then draw arrows depicting the flow direction of water as it runs off the property. The arrows should point downhill in the direction of the storm water flow.



## Aerial Site Sketch

Draw a bird's-eye-view of your property including all impervious surfaces and existing structures. Draw arrows depicting the flow of water on the property and the proposed site of the rain garden.

Scale: 1 square = _______ feet

**KEY**

**Flow of Runoff**

**Structures/Surfaces**

**Rain Garden**

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# Appendix B: How to Perform a Drainage Test

1. Know the exact location(s) on your property where you are planning to install your potential SMP(s) such as a rain garden. This potential SMP location will be where you conduct your drainage test. Drainage tests are done to test how fast your soil drains and determine suitability for stormwater SMPs.

2. **Do a PA One-Call at least three (3) business days prior to conducting your drainage test** so they can mark out all buried underground utilities, to reduce the risk of striking a utility line when digging.

   For more information: http://www.pa1call.org/pa811/Public/POCS_Content/About_Us/FAQS/FAQ.aspx or Dial 8-1-1 (or 1-800-242-1776).

3. Gather the following tools near the test location:
   a. Shovel or post-hole digger
   b. Hose and/or bucket (and water source)
   c. Yardstick, tape measure, or ruler
   d. Notepad and pen

Drainage Testing Process

*Note: More elaborate testing procedures per the Pennsylvania Stormwater Manual or other approved guidance documents are also acceptable):*

1. Use the shovel or post-hole digger to dig a hole and remove soil from the hole. Place the excavated soil nearby so the hole can be refilled after the test. Block off or otherwise prominently mark the hole location to prevent people from tripping/falling.

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2. Dig a hole that is at least 12 inches deep and at least 4 inches in diameter. If desired, place 2 inches of clean sand or gravel in the bottom of the hole to prevent scour in the bottom when being filled.

3. Using your water source, gently fill the hole with water and let it sit overnight. This saturates the soil and helps give a more accurate test reading.

4. The next day, gently refill the hole to the top with water. Measure the water level by laying a stick, pipe, or other straight edge across the top of the hole, then use a tape measure or yardstick to determine the starting water level. Check what time it is.

5. After an hour has passed, return to your test location to measure and record the depth of the water in the hole. Ideally, continue taking measurements at hourly increments for a few more hours or until all they water has drained.



6. Check the hole to watch how long it takes to become empty. When it is empty, record the time.
    - **If the hole took <u>more than 48 hours</u> to drain completely, this typically indicates the site is <u>not suitable</u> for a stormwater SMP that relies on infiltration.** Another site will need to be chosen (and another drainage test conducted).
7. When the testing process is complete, the hole should be immediately backfilled with the excavated soil

Received 8/20/2021 8:53:02 PM Commonwealth Court of Pennsylvania

Filed 8/20/2021 8:53:00 PM Commonwealth Court of Pennsylvania
260 MD 2018

**IN THE COMMONWEALTH COURT OF PENNSYLVANIA**

| | | |
|---|---|---|
| THE BOROUGH OF WEST CHESTER, | : | |
| | : | Original Jurisdiction |
| Petitioner, | : | |
| v. | : | No. 260 MD 2018 |
| | : | |
| PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION and | : | |
| | : | |
| WEST CHESTER UNIVERSITY OF PENNSYLVANIA OF THE STATE SYSTEM OF HIGHER EDUCATION, | : | |
| | : | |
| Respondents. | : | |

**ORDER**

AND NOW, this ___ day of ______________, 2021, upon consideration of Petitioner's Motion for Summary Relief, and any response thereto, it is ORDERED that the motion is DENIED.

__________________________________
, J.

**IN THE COMMONWEALTH COURT OF PENNSYLVANIA**

| | | |
|---|---|---|
| THE BOROUGH OF WEST CHESTER,<br><br>Petitioner,<br>v.<br><br>PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION and<br><br>WEST CHESTER UNIVERSITY OF PENNSYLVANIA OF THE STATE SYSTEM OF HIGHER EDUCATION,<br><br>Respondents. | : | Original Jurisdiction<br><br>No. 260 MD 2018 |

**RESPONDENTS' ANSWER TO PETITIONER'S**
**<u>MOTION FOR SUMMARY RELIEF</u>**

Respondents Pennsylvania State System of Higher Education ("State System") and West Chester University of Pennsylvania of the State System of Higher Education ("University" or, collectively with the State System, "Respondents"), by counsel, answer Petitioner's Motion for Summary Relief pursuant to Pennsylvania Rule of Civil Procedure 1035.3 as follows.

## <u>INTRODUCTION</u>

This section contains no factual assertions supported by citations to the record, and therefore it requires no response.

## JURISDICTION

1. Admitted.[1]

2. Admitted in part, denied in part. It is admitted that counsel for State System sent to the Borough of West Chester ("Borough") the letter attached as Exhibit A. It is denied that University property is subject to or specifically benefitted by the projects funded by the Borough's assessment for stormwater management (the "Stormwater Tax"). *See* Borough's Brief in Support of Its Motion for Summary Judgment ("Borough Br.") at 24-30.

3. Admitted.

## THE PARTIES

4. Admitted.

5. Admitted.

6. Admitted.

7. Admitted.

8. Denied. This paragraph states a legal conclusion, and no response is required. The State System and University are arms of the Commonwealth subject to tax immunity. *See* Borough Br. at 22-24.

9. Admitted.

---

[1] A matter is admitted here only for the purposes of summary judgment, based upon the current record. The University reserves the right to dispute facts as appropriate at trial.

## THE PARTIES

10. This paragraph states a legal conclusion, and no response is required.

11. This paragraph states a legal conclusion, and no response is required.

12. This paragraph states a legal conclusion, and no response is required.

13. Denied. In a case involving tax immunity, like this one, "property owned by the Commonwealth is presumed to be immune from taxation and that the taxing authority bears the burden of proving the property's taxability." *Norwegian Twp. v. Schuylkill Cty. Bd. of Assessment Appeals*, 74 A.3d 1124, 1131 (Pa. Cmwlth. 2013).

## THE UNCONTESTED FACTS

14. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

15. Denied. Only a portion of North Campus is located in the Borough. Deposition of Gary Bixby, dated October 13, 2020 ("Bixby Dep."), 6:22-9:18.[2]

16. Denied. North Campus as a *whole* is approximately 61.7 acres.

17. Admitted in part, denied in part. It is admitted that the parcels identified in Exhibit B are owned by the State System and/or the University, which is a member institution of the State System.

---

[2] This depositions cited are already in the record, filed as exhibits to Respondents' Motion for Summary Judgment.

18. Admitted in part, denied in part. It is admitted that the parcels identified in Exhibit B are owned by the State System and/or the University, which is a member institution of the State System.

19. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

20. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

21. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

22. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

23. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

24. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

25. Denied. All structures are situated on North Campus, and the University has built and maintains stormwater management systems on North Campus to handle stormwater before it leaves campus. *See* Bixby Dep. 42:11-44:6.

26. Denied. All structures are situated on North Campus, and the University has built and maintains stormwater management systems on North Campus to handle stormwater before it leaves campus. *See* Bixby Dep. 42:11-44:6.

27. Denied. All structures are situated on North Campus, and the University has built and maintains stormwater management systems on North Campus to handle stormwater before it leaves campus. *See* Bixby Dep. 42:11-44:6.

28. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

29. Denied. A substantial amount of stormwater flows from North Campus into West Goshen Township. Bixby Dep. 107:18-108:6.

30. Admitted.

31. Denied. The University maintains its own stormwater collection and conveyance system on North Campus, which the Borough does not manage. Bixby Dep. 186:16-191:14. The University also largely does not use the Borough's stormwater system for its own benefit or purposes; to the extent it does, the Borough has no plans to use funds from the Stormwater Tax on that part of the system. Deposition of Michael A. Perrone ("Perrone Dep.") 126:3-22 (admitting that there are no plans to address the Borough stormwater pipe under North Campus).

32. Denied. The University maintains its own stormwater collection and conveyance system on North Campus, which the Borough does not manage. Bixby Dep. 186:16-191:14. The University also largely does not use the Borough's stormwater system for its own benefit or purposes; to the extent it does, the Borough has no plans to use funds from the Stormwater Tax on that part of the system. Deposition of Michael A. Perrone ("Perrone Dep.") 126:3-22 (admitting that there are no plans to address the Borough stormwater pipe under North Campus).

33. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

34. Admitted. Respondents admit that this fact is subject to judicial notice.

35. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

36. Admitted.

37. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

38. Denied. Circumstances surrounding this incident were not alleged in any pleading, have no relevance to the issues in this case, and were not subject to discovery.

39. Denied. The cited allegation states that the Stormwater Tax does not fund any projects that would improve real property owned by the University or State System.

40. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2. This paragraph further contains no citation to legal authority establishing obligations that are relieved by the Borough.

41. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

42. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

43. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

44. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

45. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2. It is further denied that the Stormwater Tax is "rent."

46. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

47. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

48. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

49. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2. By contrast, the record does contain evidence that Respondents operate their own MS4. Bixby Dep. 186:16-191:14.

50. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2. By contrast, the record does contain evidence that Respondents operate their own MS4. Bixby Dep. 186:16-191:14.

51. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2. By contrast, the record does contain evidence that Respondents' MS4 is covered under their own NPDES permit. Bixby Dep. 52:24-53:19.

52. This paragraph states a legal conclusion, and no response is required.

53. Admitted.

54. Admitted.

55. Admitted.

56. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

57. Admitted.

58. This paragraph states a legal conclusion, and no response is required. Further, the cited authority does not support the stated proposition; it instead stands for the proposition that "property which belongs to a municipal subdivision and used for governmental purposes is exempt from taxation and assessment for local improvements can only be overcome by express statutory authority to the contrary and such statutory authority must demonstrate *clearly* and *unequivocally* the legislative intent to remove such exemption." *Southwest Delaware Cty. Mun. Auth. v. Aston Twp.*, 413 Pa. 526, 198 A.2d 867, 872 (1964) (emphasis in original).

59. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2. Preliminary objections are not part of the factual record on summary judgment. Pa. R. Civ. P. 1035.1.

60. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2. Preliminary objections are not part of the factual record on summary judgment. Pa. R. Civ. P. 1035.1.

61. Admitted.

62. Admitted.

63. Admitted.

64. Admitted.

65. Admitted.

66. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

67. Admitted.

68. Admitted.

69. Admitted in part, denied in part. It is admitted that the Borough resolution provides that this ***should*** happen. Whether it ***does*** happen is denied because this paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

70. Admitted in part, denied in part. It is admitted that the Borough resolution provides that this ***should*** happen. Whether it ***does*** happen is denied because this paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

71. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

72. Denied as alleged. This paragraph contains no citation to the factual record. *See* Pa. R. Civ. P. 1035.2.

73. Admitted.

## **CONCLUSION**

This section contains no factual assertions supported by citations to the record, and therefore it requires no response. The Borough has failed to establish that there is no genuine issue of any material fact as to a necessary element of its cause of action and that it is entitled to judgment as a matter of law.

Dated: August 20, 2021

Respectfully submitted,

JOSH SHAPIRO
Attorney General

BY: /s/ Stephen R. Kovatis

STEPHEN R. KOVATIS
Pa. ID No. 209495
Senior Deputy Attorney General
Attorney-in-Charge

KAREN M. ROMANO
Chief Deputy Attorney General
Civil Litigation Section

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF ATTORNEY GENERAL
1600 Arch Street
Philadelphia, PA 19103
Telephone: (215) 560-2940
Fax: (717) 772-4526
skovatis@attorneygeneral.gov

## IN THE COMMONWEALTH COURT OF PENNSYLVANIA

| | | |
|---|---|---|
| THE BOROUGH OF WEST CHESTER,<br><br>Petitioner,<br>v.<br><br>PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION and<br><br>WEST CHESTER UNIVERSITY OF PENNSYLVANIA OF THE STATE SYSTEM OF HIGHER EDUCATION,<br><br>Respondents. | : | Original Jurisdiction<br><br>No. 260 MD 2018 |

**CERTIFICATE OF SERVICE**

I hereby certify that on this day the foregoing Motion for Summary Judgment is being served upon the persons and in the manner indicated below, which service satisfies the requirements of Pa. R.A.P. 121:

Electronic Service via PACFile and/or email

Kristin S. Camp, Esq.
Michael S. Gill, Esq.
BUCKLEY, BRION, MCGUIRE, & MORRIS LLP
118 West Market Street
West Chester, PA 19382
kcamp@buckleyllp.com; gillm@bluckleyllp.com

*Counsel for Petitioner Borough of West Chester*

Dated: August 20, 2021

Respectfully submitted,

JOSH SHAPIRO
Attorney General

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF ATTORNEY GENERAL
1600 Arch Street
Philadelphia, PA 19103
Telephone: (215) 560-2940
Fax: (717) 772-4526
skovatis@attorneygeneral.gov

BY: /s/ Stephen R. Kovatis
STEPHEN R. KOVATIS
Pa. ID No. 209495
Senior Deputy Attorney General
Attorney-in-Charge

KAREN M. ROMANO
Chief Deputy Attorney General
Civil Litigation Section

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260 MD 2018

**IN THE COMMONWEALTH COURT OF PENNSYLVANIA**

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| THE BOROUGH OF WEST CHESTER,<br><br>Petitioner,<br>v.<br><br>PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION and<br><br>WEST CHESTER UNIVERSITY OF PENNSYLVANIA OF THE STATE SYSTEM OF HIGHER EDUCATION,<br><br>Respondents. | : | Original Jurisdiction<br><br>No. 260 MD 2018 |

# RESPONDENTS' BRIEF IN OPPOSITION TO PETITIONER'S MOTION FOR SUMMARY ADJUDICATION

Dated: August 20, 2021

Respectfully submitted,

JOSH SHAPIRO
Attorney General

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF ATTORNEY GENERAL
1600 Arch Street
Philadelphia, PA 19103
Telephone: (215) 560-2940
Fax: (717) 772-4526
skovatis@attorneygeneral.gov

BY: STEPHEN R. KOVATIS
Pa. ID No. 209495
Senior Deputy Attorney General
Attorney-in-Charge

KAREN M. ROMANO
Chief Deputy Attorney General
Civil Litigation Section

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## STATEMENT OF THE CASE

This is an action for declaratory judgment, seeking an order that West Chester University (the "University") and the Pennsylvania State System of Higher Education ("State System") do not have tax immunity with respect an assessment for stormwater management (the "Stormwater Tax") levied by the Borough of West Chester ("Borough").

The material facts of this case were summarized in Respondents' Brief in Support of their Motion for Summary Judgment, which was filed in this Court on July 16, 2021 ("Respondents' MSJ Br."). Respondents incorporate the statement of the case from that brief into this response, including the defined terms.

## SUMMARY OF ARGUMENT

The Borough has failed to establish that it is entitled to declaratory judgment as a matter of law based on the undisputed material facts in this case.

***First***, on this issue of tax immunity, it is the Borough that carries the burden to show the taxability of the properties owned by the University. It is not, as the Borough contends, the University's burden to prove the taxes are unreasonable.

***Second***, the Borough has failed its burden as the movant to show that it is entitled to judgment as a matter of law based on facts in the record developed during discovery. The Borough's motion contains numerous factual assertions and conclusions with no record support whatsoever.

***Third***, largely for the reasons previously briefed, the Borough cannot establish that the Stormwater Tax is a fee-for-service. It is, at best, an assessment, which under Pennsylvania law is a species of tax subject to immunity.

***Fourth***, the Stormwater Tax is not a regulatory fee that can be imposed on the University. Unlike a fee-for-service—where there is at least arguable authority that it can overcome immunity—there is no authority supporting the contention that a municipality can use its police power to impose a regulatory fee on an arm of the Commonwealth. And even if there were, the Borough does not show that it has the authority to license or regulate the University.

For these reasons, the Borough's motion should be denied.

## ARGUMENT

### I. The Borough Bears the Initial Burden to Establish That the Stormwater Tax Is a Fee

The Borough contends that the University bears the burden of proving that the Stormwater Tax is "not in fact used to reimburse the Borough for its administrative or regulatory costs in providing a service." Borough's Brief in Support of Its Motion for Summary Judgment ("Borough Br.") at 4 (quoting *Rizzo v. City of Philadelphia*, 668 A.2d 236, 237 (Pa. Cmwlth. 1995)). This statement in *Rizzo*, however, provides the burden of a ***private*** taxpayer challenging the reasonableness of a fee, where there is a presumption of taxability. It does not provide the burden of proof for a party asserting tax immunity, like here.

This Court directly addressed the relevant burden in a case like this in *Norwegian Township v. Schuylkill County Board of Assessment Appeals*, holding that "property owned by the Commonwealth is presumed to be immune from taxation and that ***the taxing authority bears the burden of proving the property's taxability***." 74 A.3d 1124, 1131 (Pa. Cmwlth. 2013) (emphasis added). Thus, here it is the Borough's burden to show that University property is not immune from the Stormwater Tax.

### II. The Borough Has Failed to Show That It Is Entitled To Judgment as a Matter of Law Based on Undisputed Facts in the Record

A party carrying the burden of proof can be successful at summary judgment on when "the record clearly demonstrates that there is no genuine issue of material fact and that the moving party is entitled to judgment as a matter of law." *Bowser v. Clarion Cty.*, 206 A.3d 68, 72 n.2 (Pa. Cmwlth. 2019). "For courts to enter summary judgment, the record must demonstrate that no genuine issue of material fact exists after an examination of the record in a light most favorable to the non-moving party." *Bacon v. City of Chester*, 564 A.2d 276, 277 (Pa. Cmwlth. 1989). "A material fact is one that directly affects the outcome of the case." *Logans' Reserve Homeowners' Association v. McCabe*, 152 A.3d 1094, 1099 n.8 (Pa. Cmwlth. 2017). "The moving party bears the burden of proving that there exists no genuine issue as to any material fact and that the moving party is entitled to judgment as a matter of law." *Allen v. Colautti*, 417 A.2d 1303, 1307 (Pa. Cmwlth. 1980).

Here, the Borough's motion for summary adjudication is replete with factual averments and conclusions without any citation to the record developed in discovery. This results in factual statements that are, at times, vague and imprecise, *see, e.g.*, Borough's Motion for Summary Relief ¶ 48 (averring that Respondents somehow "use" the Borough system and that they avoid unspecified "Commonwealth-mandated" costs); highly technical, *see, e.g.*, *id.* ¶ 28 (stating as fact the environmental impact of stormwater on acquatic habitat and pollutant concentration); and even completely wrong, *see, e.g.*, *id.* ¶ 43 (contending, falsely, that the University does not currently build and manage its own comprehensive stormwater management system on North Campus). This significant number of bald factual assertions evinces a moving party without adequate factual support in the record for judgment.

Because their motion relies on so many unsupported assertions, the Borough has failed its burden as the movant to establish that it is entitled to judgment as a matter of law based on the factual record taken in the light most favorable to Respondents. *See* Pa. R. Civ. P. 1035.2. Its motion should be denied.

## III. The Specific, Undisputed Facts of this Case Show That the Stormwater Tax Is Not a Fee-For-Service

In its brief in support of its Motion for Summary Judgment, the University set out the standard for determining whether the Stormwater Tax could be considered a fee-for-service, and it described the reasons why it is not a fee-for-service. *See* Respondents' MSJ Br. at 24-36. That analysis, which need not be repeated here, is incorporated by reference.

The Borough contends that the Stormwater Tax can be considered a fee-for-service because it satisfied three criteria: (1) it is "not applicable to all properties" and its funds must be used only for stormwater-related purposes; (2) the University received a discrete benefit from the stormwater services; and (3) the charge is proportional to the benefit. *See* Borough's Brief in Support of Its Motion for Summary Judgment ("Borough Br.") at 27-33. None of these criteria support the outcome that the Stormwater Tax is not a tax.

First, even if it matters that the Stormwater Tax is not levied on all properties and only used for a limited purpose, this only makes it an assessment, which is still a species of tax subject to immunity. *See* Respondents' MSJ Br. at 25-26 (citing *Southwest Del. Cty. Mun. Auth. v. Aston Twp.*, 413 Pa. 526, 531, 198 A.2d 867, 870 (1964)). The Borough cites no law to the contrary.[1] Moreover, unlike assessments which are limited to a single defined infrastructure project, the Stormwater Tax funds a limited but not specifically defined range of potential projects. *See* Respondents' MSJ Br. at 37. In other words, it is more like a tax than it is like an assessment—even though both are barred by tax immunity.

Second, the Borough's contention that the University derives a discrete benefit from the Stormwater Tax is at odds with the enabling ordinance's stated purpose of promoting "public health, safety, and general welfare," *see* Ordinance at 1, § 2.D.; with the Borough's own witness's testimony, including his specific admission that the projects are designed to provide "a general benefit to the Community," *see* Perrone Dep. 60:21-22; and with the reality that both developed

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[1] The Borough points out that *Southwest Delaware County* also held that a municipality can levy connection charges and rental fees. *See* Borough Br. at 17-18. However, the Stormwater Tax is not a connection charge or rental fee for use of underground stormwater pipes. If it were, the charge would be based on physical connections, but instead it is based on above-ground total impervious surface. And if it were, it would not be used to fund thigs like rain gardens and curb extensions, which have nothing to do with the maintenance cost of the underground piping system.

and undeveloped properties receive the same benefits from the projects funded by the Stormwater Tax. *See generally* Respondents' MSJ Br. at 26-30.

The Borough asserts that it provides a service because it "enters into operation and maintenance agreements with the owners of stormwater management systems on individual properties and, on a regular basis, conducts inspections of those and similar systems." Borough Br. at 29. It further maintains that it "regularly inspects the stormwater management facilities" at the University's campus. *Id.* But there is no citation to the factual record supporting these averments, likely because the factual record does not support them. There is no "operation and maintenance" agreement between the Borough and the University concerning stormwater management. The Borough does not conduct "inspections" of stormwater facilities on the University's campus—in fact, the University maintains ***its own*** separate MS4 permit. *See* Bixby Dep. 186:16-191:14. And not only does the Borough not "inspect[ ] the stormwater management facilities" on campus, but the record shows that the ***University*** actually inspects an outfall that contains ***Borough*** stormwater. *See* Bixby Dep. 212:23-214:3. Despite the Borough's bald contentions, there is nothing in the factual record showing that it uses the Stormwater Tax to provide any direct service to the University.[2]

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[2] Later in its brief, the Borough appears to acknowledge as much. It admits that none of the projects funded by the Stormwater Tax touch University property, but it points out that there is no requirement "that a governing authority which

In its brief, just as its expert did, the Borough mistakenly assumes that the University receives a benefit because, without the Borough's Stormwater Conveyance System, the University would have to keep and manage all of its own stormwater. *See* Respondents' MSJ Br. at 44. There is no reason the University could not simply convey stormwater to its property edge and discharge it there, just as it does now. The Borough mentions (without legal citation) to "the common law requirement that owners of real property manage the outflow of water from their property," *see* Borough Br. at 14, but the University has sovereign immunity from this (and most) common law liability. *See* 1 Pa. C.S. § 2310; *accord Swift v. Dep't of Transp. of Com.*, 937 A.2d 1162, 1168-69 (Pa. Cmwlth. 2007) (holding that Commonwealth agency was immune from nuisance suit related to water flow).

The Borough analogizes the Stormwater Tax to a hypothetical Borough-created "cable or Wi-Fi system," arguing that "it is simply common sense that the University should have to pay a fair rental to use those services." Borough Br. at 31. But here, the Borough provides an example that perfectly illustrates the University's argument. Unlike the projects funded by the Stormwater Tax, if the

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imposes a validly imposed fee must perform work on the fee-payer's property." Borough Br. at 30. This argument misses the point. Even if it is not dispositive, the fact that the Borough does not do anything to or on North Campus using Stormwater Tax funds is relevant and revealing as to whether there is any discrete benefit to the University. The Borough simply cannot explain how installing curb extensions, for example, provides any kind of discrete benefit to any particular property owner.

University decided to use the Borough's cable or Wi-Fi system it would fit closely with Dr. Shoag's economic definition of a fee-for-service. *See* Respondents' MSJ Br. at 30. Most glaringly, ***there exists a robust private market*** for cable and Wi-Fi services. By contrast, there is no private demand for the type of projects funded by the Stormwater Tax. *See* Respondents' MSJ Br. at 34. Further, the University could ***voluntarily*** choose whether or not to use the Borough's cable or Wi-Fi system instead of its own private system, which it would likely do after weighing the costs of using the Borough's system against the costs of a private provider. The Stormwater Tax, by contrast, is being assessed against development that can be years or decades old. *See* Respondents' MSJ Br. at 31-32 (noting that the option of undoing development from years or decades ago does not make the Stormwater Tax voluntary). And the Borough can ***exclude*** some people from a cable or Wi-Fi system, the same way that Comcast or Verizon excludes non-customers from using its cable or Wi-Fi service, but it cannot exclude property owners from receiving the benefit of things like tree planting or inlet box cleaning. *See* Respondents' MSJ Br. at 32-33. In short, using Dr. Shoag's framework, a cable or Wi-Fi system is clearly a fee-for-service while the Stormwater Tax is not.[3]

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[3] Twice, the Borough uses the term "freeloading" to describe the idea that the University receives a general benefit without having to pay for it. *See* Borough Br. at 31-32. But this term is misplaced here. Tax immunity exists because "the public paying the public" is an absurd proposition. *See Southwest Del. Cty.*, 413 Pa. at 530, 198 A.2d at 870. Plaintiff is essentially arguing that state taxpayers in the

Third, in arguing that the Stormwater Tax is reasonable, the Borough states that it has annual expenditures on stormwater projects of more than $1 million, with one year approaching $2.5 million. *See* Borough Br. at 32. But conspicuously absent from the Borough's discussion is a description of what this money was used for. *But see* Opinion, dated July 15, 2019, at 11 (directing the parties to answer "how exactly does the Borough utilize the funds generated by the Stormwater Charge"). In 2020, over $900,000 was spent on renovations (like installing pervious pavers, planting trees, and improving parking) at the John O. Green Memorial Park in the Borough. *See* Cline Dep. 41:22-42:21. Nearly $750,000 was spent on the first phase of a streambank restoration project along Plum Run, downstream from the University and thus providing no direct benefit to the University. *See id.* 26:15-29:12. As these large projects demonstrate, the bottom line numbers presented by the Borough do not represent a reasonable value of the University's alleged "use" of the Stormwater Conveyance System—which is what the Borough claims it is charging for. In fact, the Borough has admitted that it has ***no plans at all*** to use any stormwater funds on its underground pipe that carries

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Borough are freeloading on local taxpayers in the Borough, which similarly makes no sense. In short, ***the government by definition cannot be a freeloader***.

Moreover, claiming that imposing the Stormwater Tax is necessary to prevent freeloading undermines the Borough's argument. The textbook solution to freeloading in government theory is making payment mandatory on all citizens using the enforcement power of the state. In other words, taxes.

Borough and University stormwater underneath North Campus. *See* Perrone Dep. 126:3-22.[4]

The Borough does not cite any authority supporting its assumption that the Stormwater Tax can be imposed on an entity that has tax immunity. Although its brief cites a series of cases—all nonbinding on this Court—these involve ***private taxpayers*** where the taxes-versus-fee analysis matters to tax ***exemptions*** rather than tax immunity. *See Norfolk S. Ry. Co. v. City of Roanoke*, 916 F.3d 315, 318 (4th Cir. 2019) (in suit brought by railway company, determining whether a stormwater charge "is a discriminatory tax in violation of the Railroad Revitalization and Regulatory Reform Act of 1976"); *Mcleod v. Columbia Cty.*, 278 Ga. 242, 243, 599 S.E.2d 152, 154 (2004) (in suit brought by landowners, determining whether a stormwater charge must meet a state constitutional requirement that taxes be imposed uniformly); *Church of Peace v. City of Rock Island*, 357 Ill.App.3d 471, 828 N.E.2d 1282 (Ill. App. Ct. 2005) (in suit brought by churches, determining whether charitable and religious tax exemption applies). As noted above, in these cases the burden is flipped. *See supra*, Section I. These cases did not involve a case like this one, where "the taxing authority bears the burden of establishing why taxation is permissible." *See City of Philadelphia v.*

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[4] The Borough's final argument, that the NTM Report shows the Stormwater Tax to be a "bargain," *see* Borough Br. at 32-33, is flawed as a proper measure of reasonable cost. *See* Respondents' MSJ Br. at 43-44.

*Cumberland Cty. Bd. of Assessment Appeals*, 622 Pa. 581, 584 n.1, 81 A.3d 24, 25 n.1 (2013).

Even on the general question as to whether stormwater charges are taxes or fees in non-immunity contexts, courts in other jurisdictions reach different conclusions. In *Lewiston Independent School District No. 1 v. City of Lewiston*, the Idaho Supreme Court held that a stormwater charge was an unauthorized tax. 151 Idaho 800, 804, 264 P.3d 907, 911 (2011). The court noted that the implementing ordinance was "purely concerned with revenue generation" for "on-going maintenance, operation, regulation, water quality management and improvement of the [stormwater] system." *Id.* at 805, 264 P.3d at 912 (alteration in original). Like the Stormwater Tax here, the Idaho stormwater charge funded projects that did not directly address the "flow or removal of stormwater on private property," and instead it was for the public benefit of "having a pollutant free stormwater system and clean streets . . . much like the public's use of city streets or police and firefighter services." *Id.* at 806, 264 P.3d at 913.

In *Zweig v. Metro. St. Louis Sewer District*, the Missouri Supreme Court echoed the conclusion of Idaho. 412 S.W.3d 223 (Mo. 2013). The court applied a thorough analysis under state law for whether a charge was an unconstitutional tax or a fee, holding that a stormwater charge was the former. *Id.* at 244. Notably, the court found that the stormwater charge could not be a fee-for-service because a property owner "pays the same stormwater charge every month regardless of the amount of rainfall or the amount of stormwater it discharges." *Id.* at 234. And it could not be a charge simply for the availability of the drainage system because a municipality's purpose of a stormwater management system is "to ensure that its stormwater services would be available for the entire district when needed." *Id.* at 236.

In *Shaarei Tfiloh Congregation v. Mayor & City Council of Baltimore*, 237 Md. App. 102, 183 A.3d 845 (2018), the Court of Special Appeals of Maryland also held that a stormwater charge was a tax and not a fee. The court noted that the objective of the stormwater charge in that case was "to raise revenue" for projects like the "operation and maintenance of the City stormwater management system and facilities," which "are indisputably utilized for the benefit of the general public." *Id.* at 139, 183 A.3d at 866-67. The fact that the stormwater charge went to "specialized funds" rather than the "general treasury" did not preclude the conclusion that it was a tax. *Id.* The court also found that the stormwater charge was not "a user fee or service charge because it is not based on a commodity or service consumed." *Id.* at 139-40, 183 A.3d at 867. The stormwater charge was not "akin to a user fee, such as for water or sewer service," but rather was "a charge that is applied, among other things, toward the operation and maintenance of the City stormwater management system and facilities." *Id.* at 140, 183 A.3d at 867.

At bottom, although *Lewiston Independent School District* and *Zweig* are particularly persuasive in their reasoning, these cases cited above come down to particular issues of the municipality's authority vis-à-vis the payer, the payer's asserted defense, and the specifics of each state's law. This case should be no different. Under ***Pennsylvania*** law and for the purpose of the University's ***tax immunity***, the Stormwater Tax is a tax that cannot be imposed.

## IV. The Stormwater Tax Cannot Be Imposed on Respondents as a Regulatory or License Fee

Rather than simply address the question posed by this Court following preliminary objections—whether the Stormwater Tax is a tax or a "fee for service," *see* Opinion, dated July 15, 2019, at 9—the Borough presents a third option. Now, the Borough contends that the Stormwater Tax may be a ***regulatory*** fee (otherwise known as a license fee), which it defines as a "regulatory measure[ ] intended to cover the cost of administering a regulatory scheme authorized under the police power of government[ ... ]." *See* Borough Br. at 19-20 (quoting *Rizzo*, 668 A.2d at 238. But this argument fails, because the Borough cites no law establishing that it can impose a regulatory fee on the University and, regardless, the Stormwater Tax is not a regulatory fee.

### A. Even if the Stormwater Tax Is a Regulatory Fee, Respondents Are Immune

While Petitioner spends considerable space arguing that the Stormwater Tax is a regulatory fee—which, as outlined below, it is not—its brief fails to address a threshold question: whether a municipality can impose a regulatory fee on state entities. Simply, it cannot. The Court need not even address most of the Borough's arguments because, even if the Borough is correct, there is no legal basis to conclude that it can overcome the Commonwealth's immunity by framing the Stormwater Tax as a regulatory fee.

Any analysis of this case has to begin with the principle that Respondents have tax immunity, which means they are presumptively "beyond the taxing power of [the Borough]." Respondents' MSJ Br. at 22 (quoting *Delaware Cty. Solid Waste Auth. v. Berks Cty. Bd. of Assessment Appeals*, 534 Pa. 81, 85, 626 A.2d 528, 530-31 (1993)). Previously, the Borough argued that the Stormwater Tax is a fee-for-service, relying on dicta in *Supervisors of Manheim Township. v. Workman* which implies that a municipality can overcome tax immunity by imposing a charge for "a function performed by [the municipality] in its proprietary or quasiprivate capacity." *See* 350 Pa. 168, 173, 38 A.2d 273, 276 (1944). The Court reasoned that immunity does not precluding paying a fee-for-service because it rests on a theory of "contract rather than taxation" and that "those who consume the product or receive the service act in so doing voluntarily . . . and thereby impliedly agree to pay the price of the product furnished or service rendered." *Id.*

A regulatory or license fee is not what the Supreme Court describes in *Supervisors of Manheim Township*. A regulatory fee is not imposed using a theory of contract, *i.e.* a bargained-for exchange. It does not rely on an implied agreement to pay between the two parties.

Instead, a regulatory fee is imposed using the sovereign power of government. *See National Biscuit Co. v. City of Phila.*, 374 Pa. 604, 615, 98 A.2d 182, 187 (1953) (regulatory or license fees are "imposed by the sovereign, in the exercise of its police power, upon a person within its jurisdiction for the privilege of performing certain acts"). Indeed, the Borough's own brief admits as much. *See* Borough Br. at 19-20 (justifying the Stormwater Tax as an exercise of the "police power of government"). Unlike the quasi-contract relationship when a charge is truly a fee-for-service, imposing the Stormwater Tax as a regulatory fee does not involve any type of "concession" that would be necessary to overcome the Commonwealth's tax immunity. *See City of Philadelphia*, 622 Pa. at 624, 81 A.3d at 50. That kind of quasiprivate agreement is critical to overcome tax immunity.

### B. <u>The Stormwater Tax Is Not a Regulatory Fee</u>

"A license fee is a charge which is imposed by the sovereign, in the exercise of its police power, upon a person within its jurisdiction for the privilege of performing certain acts and which has for its purpose the defraying of the expense of the regulation of such acts for the benefit of the general public." *Pa. Liquor Control Bd. v. Publicker Commercial Alcohol Co.*, 347 Pa. 555, 560, 32 A.2d 914, 917 (1943). A regulatory authority can only impose a fee on a person or entity that is "a type of business or occupation which is subject to supervision and regulation" by the regulatory authority. *National Biscuit Co.*, 98 A.2d at 188.

Here, the Stormwater Tax cannot be a regulatory fee because it is not imposed "for the privilege of performing certain acts" and it is not limited to people or entities generally subject to regulation by the Borough. Indeed, there is no particular act or class or people that appears to be being regulated here, unless the group is defined as *properties that experiences rainfall*. Further, the Borough has provided no legal basis for its right to regulate the University. The University does not have, and does not need, a license from the Borough to operate North Campus, and no state law provides the Borough with the power to impose a regulatory fee on the University simply for building a campus.

The Borough's analogy to regulatory fees for attorneys illustrates the distinction. *See* Borough Br. at 30-31. State law provides the courts with the ability to license and regulate lawyers, and lawyers make up only a small group of people who have voluntarily elected to enter the profession. The Stormwater Tax is not a regulatory fee because it is not imposed the same way that bar dues are imposed.

## CONCLUSION

Wherefore, Respondents Pennsylvania State System of Higher Education and West Chester University of Pennsylvania of the State System of Higher Education respectfully request that this Court deny Petitioner's Application for Summary Relief.

Dated: August 20, 2021

Respectfully submitted,

JOSH SHAPIRO
Attorney General

BY: /s/ Stephen R. Kovatis
STEPHEN R. KOVATIS
Pa. ID No. 209495
Senior Deputy Attorney General
Attorney-in-Charge

KAREN M. ROMANO
Chief Deputy Attorney General
Civil Litigation Section

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF ATTORNEY GENERAL
1600 Arch Street
Philadelphia, PA 19103
Telephone: (215) 560-2940
Fax: (717) 772-4526
skovatis@attorneygeneral.gov

**IN THE COMMONWEALTH COURT OF PENNSYLVANIA**

| | | |
|---|---|---|
| THE BOROUGH OF WEST CHESTER,<br><br>Petitioner,<br>v.<br><br>PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION and<br><br>WEST CHESTER UNIVERSITY OF PENNSYLVANIA OF THE STATE SYSTEM OF HIGHER EDUCATION,<br><br>Respondents. | : | Original Jurisdiction<br><br>No. 260 MD 2018 |

**CERTIFICATION PURSUANT TO Pa. R.A.P. 127**

I certify that this filing complies with the provisions of the *Public Access Policy of the Unified Judicial System of Pennsylvania: Case Records of the Appellate and Trial Courts* that require filing confidential information and documents differently than non-confidential information and documents.

Dated: August 20, 2021

Respectfully submitted,

JOSH SHAPIRO
Attorney General

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF ATTORNEY GENERAL
1600 Arch Street
Philadelphia, PA 19103
Telephone: (215) 560-2940
Fax: (717) 772-4526
skovatis@attorneygeneral.gov

BY: /s/ Stephen R. Kovatis
STEPHEN R. KOVATIS
Pa. ID No. 209495
Senior Deputy Attorney General
Attorney-in-Charge

KAREN M. ROMANO
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## CERTIFICATE OF SERVICE

I hereby certify that on this day the foregoing Brief in Support of Respondents' Motion for Summary Judgment is being served upon the persons and in the manner indicated below, which service satisfies the requirements of Pa. R.A.P. 121:

Electronic Service via PACFile and/or email

Kristin S. Camp, Esq.
Michael S. Gill, Esq.
BUCKLEY, BRION, MCGUIRE, & MORRIS LLP
118 West Market Street
West Chester, PA 19382
kcamp@buckleyllp.com; gillm@bluckleyllp.com

*Counsel for Petitioner Borough of West Chester*

Dated: August 20, 2021

Respectfully submitted,

JOSH SHAPIRO
Attorney General

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF ATTORNEY GENERAL
1600 Arch Street
Philadelphia, PA 19103
Telephone: (215) 560-2940
Fax: (717) 772-4526
skovatis@attorneygeneral.gov

BY: /s/ Stephen R. Kovatis
STEPHEN R. KOVATIS
Pa. ID No. 209495
Senior Deputy Attorney General
Attorney-in-Charge

KAREN M. ROMANO
Chief Deputy Attorney General
Civil Litigation Section

Received 8/23/2021 10:26:43 PM Commonwealth Court of Pennsylvania

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260 MD 2018

**IN THE COMMONWEALTH COURT OF PENNSYLVANIA**

**NO. 260 MD 2018**

**THE BOROUGH OF WEST CHESTER**
***Petitioner,***

***v.***

**PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION and WEST CHESTER UNIVERSITY OF PENNSYLVANIA OF THE STATE SYSTEM OF HIGHER EDUCATION**
***Respondents.***

# ANSWER OF PETITIONER THE BOROUGH OF WEST CHESTER IN OPPOSITION TO RESPONDENTS' MOTION FOR SUMMARY JUDGMENT

*Petition for Review Challenging the Determination by*
*Pennsylvania State System of Higher Education*
*(on behalf of itself and its constituent institution,*
*West Chester University of Pennsylvania of the State System of Higher Education)*
*Regarding the Borough of West Chester's Stream Protection Fee*

**BUCKLEY, BRION, MCGUIRE & MORRIS LLP**

Michael S. Gill, Esquire
gillm@buckleyllp.com

Aristidis W. Christakis, Esquire
achristakis@buckleyllp.com

Roger Cameron, Esquire
rcameron@buckleyllp.com

118 West Market Street, Suite 300
West Chester, Pennsylvania 19382
(610) 436-4400
*Attorneys for Petitioner*
*The Borough of West Chester*

Petitioner The Borough of West Chester ("Borough") hereby answers the Motion of Respondents Pennsylvania State System of Higher Education ("State System") and West Chester University of Pennsylvania of the State System of Higher Education (collectively with the State System, the "Respondents") for Summary Judgment (the "Respondents' Motion") as follows.

1. Admitted in part, denied in part. Borough admits that it seeks declaratory relief as formulated by this Court in its Opinion on Respondents' Preliminary Objections. As the term "green infrastructure projects" is not defined with any certainty, Borough is unable to admit or deny this averment. By way of further response, Borough filed its Action for Declaratory Judgment in response to the Refusal to Pay Letter (as that term is defined in the Brief in Support of Motion for Summary Judgment which the Borough filed with this Court on July 19, 2021). The Action for Declaratory Judgment is a document which speaks for itself and any characterization thereof by Respondents is denied. Borough demands strict proof of Respondents' averments.

2. Admitted in part, denied in part. It is admitted only that "[t]he issue in this case is whether the Stream Protection Fee is a fee or a tax. By way of further answer, the Action for Declaratory Judgment is a document which speaks for itself and any characterization thereof by Respondents is denied. By way of further response, the averments at Paragraph 2. of the Respondents' Motion are conclusions

or statements of law to which no response is here required. Borough demands strict proof of Respondents' averments.

3. Admitted in part, denied in part. It is admitted only that Respondents quoted a section of this Court's Order dated July 15, 2019. Otherwise, such Order is a writing which speaks for itself and any characterization thereof by Respondents is denied. Borough demands strict proof of Respondents' averments.

4. Denied. The averments at Paragraph 4. of the Respondents' Motion are conclusions or statements of law to which no response is here required. Borough demands strict proof of Respondents' averments.

5. Admitted.

6. Admitted in part, denied in part. It is admitted that the Borough maintains the Borough Stormwater Collection and Conveyance System. It is denied that Respondents' description of the Borough Stormwater Collection and Conveyance System is exhaustive. Borough demands strict proof of Respondents' averments.

7. Admitted in part, denied in part. The Borough admits that the Borough Stormwater Collection and Conveyance System includes such physical structures. It is further admitted that the Borough maintains the Borough Stormwater Collection and Conveyance System. It is denied that Respondents' description of the Borough

Stormwater Collection and Conveyance System is exhaustive. Borough demands strict proof of Respondents' averments

8. Admitted in part, denied in part. The Borough admits that the Borough Stormwater Collection and Conveyance System includes physical structures which "were first constructed about 100 years ago." It is denied that the entirety of the Borough Stormwater Collection and Conveyance System was so constructed. Borough demands strict proof of Respondents' averments.

9. Admitted.

10. Admitted in part, denied in part. It is admitted only that the Borough maintains a regulatory program regarding the management of stormwater related to or originating from the development or real property and/or other earth disturbance activities. By way of further response, the ordinances, rules, and regulations regarding such regulatory program (and the Federal and Commonwealth statutes upon which they are based) are writings which speak for themselves and any characterization thereof by Respondents is denied. By way of further response, and upon information and belief it is averred, that the University did not construct all of the dormitories at North Campus but, rather, some were constructed by a private entity. By way of further response, it is denied that Respondents manage, control, or maintain on-site all stormwater runoff from the sites of such dormitories and/or other improvements at North Campus but, rather, that stormwater runoff associated with

improvements at North Campus drains to, enters, and is conveyed away from North Campus by and through the Borough Stormwater Collection and Conveyance System. Borough demands strict proof of Respondents' averments.

11. Denied. The ordinances to which Respondents refer at Paragraph 11. of the Respondents' Motion are writings which speak for themselves and any characterization thereof by Respondents is denied. Borough demands strict proof of Respondents' averments.

12. Admitted, upon information and belief.

13. Admitted in part, denied in part. It is admitted only that the map and yellow shading which Respondents include at Paragraph 13. of the Respondents' Motion generally shows the location of North Campus. Because Borough did not perform a parcel-by-parcel analysis of such map, however, it is unable to admit that such map exhaustively includes all parcels, lots, tracts, or other units of real property which comprise North Campus. Borough demands strict proof of Respondents' averments.

14. Admitted.

15. Admitted in part, denied in part. It is admitted only that the map and red encirclement which Respondents include at Paragraph 15. of the Respondents' Motion generally shows the location of Plum Run. It is denied that such map includes a depiction of the entirety of Plum Run. It is further denied that all stormwater which

flows from North Campus ultimately enters Plum Run. Rather, some of that stormwater flow ultimately enters other watercourses both within and without the jurisdictional limits of Borough. Borough demands strict proof of Respondents' averments.

16. Admitted.

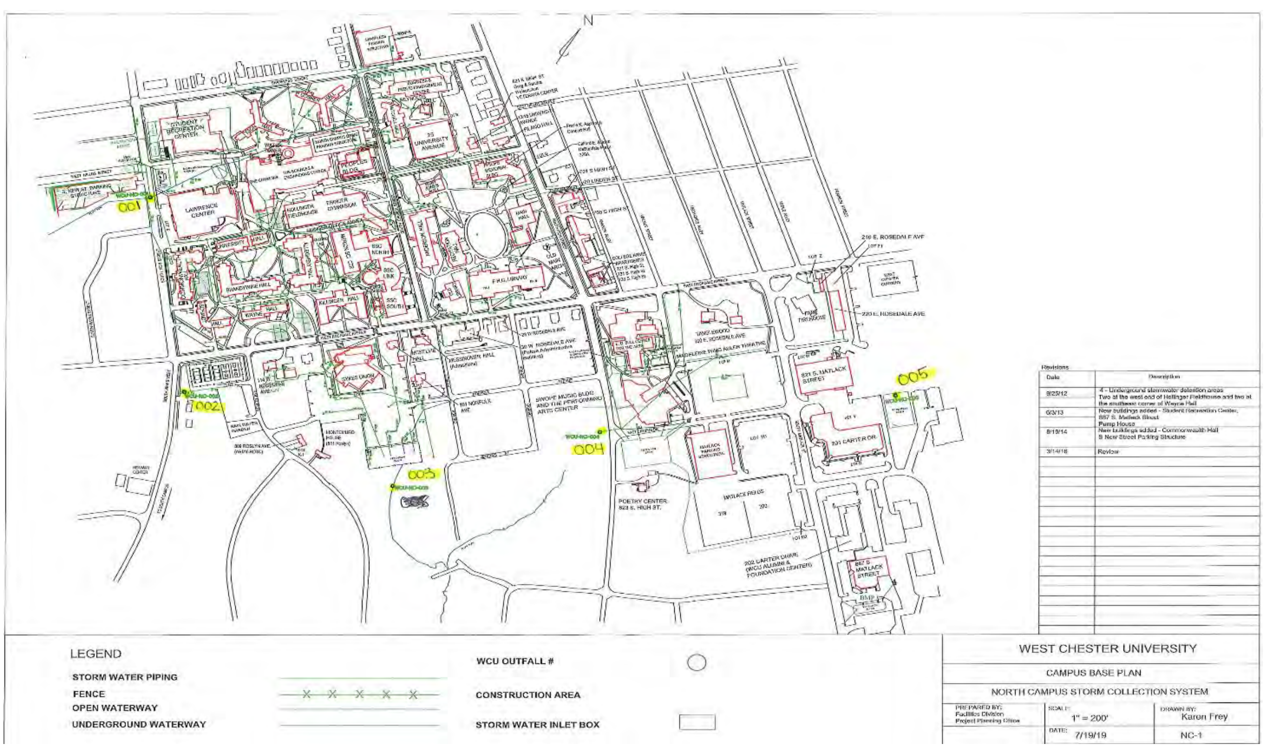
17. Admitted in part, denied in part. It is admitted only that the map and red encirclement which Respondents include at Paragraph 15. of the Respondents' Motion generally shows the location of Plum Run. Borough is without sufficient information and knowledge to admit or deny with certainty that the location to which Respondents refer at Paragraph 17. of the Respondents' Motion is the "first time" that water in Plum Run "begins flowing above ground . . . ." Borough demands strict proof of Respondents' averments.

18. Admitted.

19. Admitted in part, denied in part. It is admitted that, generally, "Plum Run flows west/southwest through the Borough and then continues into neighboring municipalities . . . ." Upon information and belief, is denied that Plum Run flows directly into the Brandywine River. Borough demands strict proof of Respondents' averments.

20. Admitted in part, denied in part. Borough admits all of these averments. By way of further response, some of that stormwater enters inlets and pipes

proximate to North Campus are owned by the Borough. By way of further response, some stormwater flow from North Campus flows in an uncontrolled manner into the Borough Stormwater Collection and Conveyance System and is conveyed away from North Campus by and through such system. By way of further response, some stormwater flow from North Campus flows through University-owned pipes and other infrastructure into the Borough Stormwater Collection and Conveyance System and is conveyed away from North Campus by and through such system. The map below (produced by Respondents in discovery and on which the aforementioned Plum Run Outfall is identified as No. 001) includes, *inter alia*, a depiction of stormwater conveyance pipes through and in the vicinity of North Campus. Borough demands strict proof of Respondents' averments.



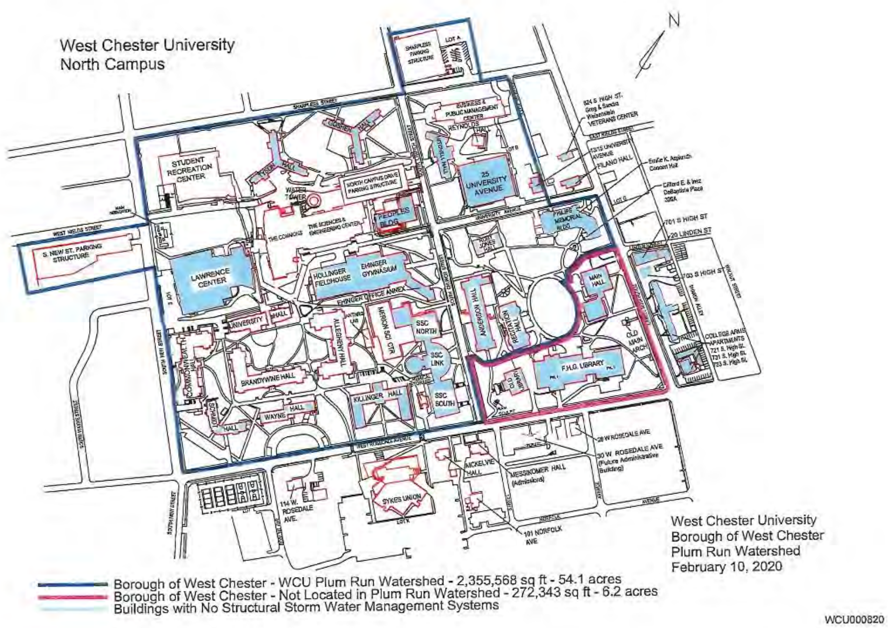
21. Admitted in part, denied in part. It is admitted, upon information and belief, that neither Borough nor Respondents maintains a precise calculation of the aggregate volume of stormwater runoff which flows from North Campus into the Borough Stormwater Collection and Conveyance System. It is denied that Respondents do not maintain any such calculation. By way of further response, Borough incorporates here the documents attached as **Exhibit B** to the Brief in Opposition to Motion for Summary Judgment which Borough filed with the Court on even date herewith. Borough demands strict proof of Respondents' averments.

22. Admitted in part, denied in part. It is admitted only that, being liquid in form, stormwater runoff which falls in the jurisdictional limits of Borough outside of North Campus may flow onto North Campus. By way of further response, Borough is without sufficient information or knowledge to admit or deny with certainty the averments at Paragraph 22. of the Respondents' Motion. Borough demands strict proof of Respondents' averments

23. Admitted in part, denied in part. It is admitted only that, being liquid in form, there is some possibility that stormwater runoff which ultimately is discharged from part of the Borough Stormwater Collection and Conveyance System to Plum Run contains constituent runoff from North Campus and constituent runoff from other properties within the jurisdictional limits of Borough. By way of further response, Borough is without sufficient information or knowledge to admit or deny

with certainty the averments at Paragraph 23. of the Respondents' Motion. Borough demands strict proof of Respondents' averments.

24. Admitted in part, denied in part. As more fully set forth in the map below (produced by Respondents in discovery) some buildings on North Campus have structural stormwater management facilities associated with them while others do not. By way of further response, stormwater runoff from all portions of North Campus (and especially (but not only) those buildings with no stormwater controls) enters into, and is conveyed away from North Campus by, the Borough Stormwater Collection and Conveyance System. Borough demands strict proof of Respondents' averments.



25. Denied. The LEED documents to which Respondents refer at Paragraph 25. of the Respondents' Motion are documents which speak for themselves and any characterization thereof by Respondents is denied. By way of further response, it is expressly denied that Respondents "manage . . . within the boundaries of [any] project" at North Campus "all of the storm water" [*sic*] associated with that project. By way of further response, stormwater runoff from all portions of North Campus enters into, and is conveyed away from North Campus by, the Borough Stormwater Collection and Conveyance System. Borough demands strict proof of Respondents' averments.

26. Admitted. By way of further response, the "strategies" to which Respondents refer at Paragraph 26. of the Respondents' Motion as described to include, "trees and open, grassy areas, to infiltrate stormwater . . ." are actually part of the University "System" of stormwater management, just as much as they are part of the Borough Stormwater Collection and Conveyance System.

27. Admitted in part; denied in part. Borough admits that the University has its own MS4. By way of further response, Borough is without sufficient information or knowledge to admit or deny with certainty whether the University is "unlike most private property owners" as that phrase is too vague and ambiguous for the Borough to answer. By way of further response, the averments at Paragraph 27. of the

Respondents' Motion are conclusions or statements of law to which no response is here required. Borough demands strict proof of Respondents' averments.

28. Admitted in part; denied in part. Borough admits that the University has its own MS4. By way of further response, University's MS4 Permit is a writing which speaks for itself and any characterization thereof by Respondents is denied. By way of further response, the averments at Paragraph 28. of the Respondents' Motion are conclusions or statements of law to which no response is here required. Borough demands strict proof of Respondents' averments.

29. Admitted in part; denied in part. Borough admits that the University has its own MS4. By way of further response, University's MS4 Permit is a writing which speaks for itself and any characterization thereof by Respondents is denied. By way of further response, the averments at Paragraph 29. of the Respondents' Motion are conclusions or statements of law to which no response is here required. Borough demands strict proof of Respondents' averments.

30. Admitted in part; denied in part. Borough admits that the University has its own MS4. By way of further response, University's MS4 Permit is a writing which speaks for itself and any characterization thereof by Respondents is denied. By way of further response, the averments at Paragraph 30. of the Respondents' Motion are conclusions or statements of law to which no response is here required. Borough demands strict proof of Respondents' averments.

31. Denied. It is denied that University "assumes the duty of mitigating the pollutants in the Borough's stormwater" or that University actually undertakes any such work. By way of further response, the averments at Paragraph 31. of the Respondents' Motion are conclusions or statements of law to which no response is here required. Borough demands strict proof of Respondents' averments.

32. Denied. The Stream Protection Ordinance is a writing which speaks for itself and any characterization thereof by Respondents (including, without limitation, the pejorative "Stormwater Tax") is denied. Borough demands strict proof of Respondents' averments.

33. Denied. The Stream Protection Ordinance is a writing which speaks for itself and any characterization thereof by Respondents (including, without limitation, the pejorative "Stormwater Tax") is denied. Borough demands strict proof of Respondents' averments.

34. Denied. The Stream Protection Ordinance is a writing which speaks for itself and any characterization thereof by Respondents is denied. Borough demands strict proof of Respondents' averments.

35. Denied. The Stream Protection Ordinance is a writing which speaks for itself and any characterization thereof by Respondents is denied. Borough demands strict proof of Respondents' averments.

36. Denied. The Stream Protection Ordinance is a writing which speaks for itself and any characterization thereof by Respondents is denied. By way of further response, and as set forth in the Brief accompanying this Answer, Mr. Perrone is legally incompetent to testify regarding the "purpose of the [Stream Protection] Ordinance." Borough demands strict proof of Respondents' averments.

37. Denied. The Stream Protection Ordinance is a writing which speaks for itself and any characterization thereof by Respondents (including, without limitation, the pejorative "Stormwater Tax") is denied. By way of further response, and as set forth in the Brief accompanying this Answer, Mr. Perrone is legally incompetent to testify regarding the reasons for which Borough Council enacted the Stream Protection Ordinance. Borough demands strict proof of Respondents' averments.

38. Admitted in part, denied in part. It is admitted that Borough is engaged in the restoration of streambank along Plum Run. By way of further response, the restoration of the Plum Run streambank is but one aspect of stormwater-related work for which Borough uses revenue from the Stormwater Management Fund. By way of further response, restoration of the Plum Run streambank is needed to maintain Plum Run as a viable stormwater conduit and integral part of the discharge of stormwater runoff including, as noted, stormwater runoff from North Campus.

39. Admitted in part, denied in part. Borough admits that one goal of the Plum Run streambank restoration is as Mr. Cline testified. By way of further response, Borough produced to Respondents during discovery plans regarding the Plum Run streambank restoration, which such plans are writings which speak for themselves. Any characterization thereof by Respondents is denied. Borough demands strict proof of Respondents' averments.

40. Admitted.

41. Admitted in part, denied in part. Borough admits that one project for which Borough utilized funds from the Stormwater Management Fun is as Mr. Cline testified. By way of further response, Borough produced to Respondents during discovery plans regarding the John O. Green Memorial Park project, which such plans are writings which speak for themselves. Any characterization thereof by Respondents is denied. Borough demands strict proof of Respondents' averments.

42. Denied as stated. The averment set forth at Paragraph 42. of the Respondents' Motion is too vague and ambiguous for Borough to answer with any certainty. By way of further response, Borough denies that use of the pejorative "Stormwater Tax" is at all appropriate. Borough demands strict proof of Respondents' averments.

43. Denied as stated. It is expressly denied that projects or other work which Borough funds with the Stormwater Management Fund do not provide a

specific benefit to University. By way of further response, and as set forth in the Brief accompanying this Answer and more fully in the transcript of his testimony, Mr. Perrone testified regarding such specific benefits. By way of further response, Borough denies that Respondents do not enjoy a specific benefit from their connection to, and use of, the Borough Stormwater Collection and Conveyance System. By way of further response, the averments at Paragraph 43. of the Respondents' Motion are conclusions or statements of law to which no response is here required. Borough demands strict proof of Respondents' averments.

44. Admitted in part, denied in part. Borough admits that it presently has no immediate plan regarding repair or replacement of the pipe to which Respondents refer at Paragraph 44. of the Respondents' Motion. By way of further response, Borough denies that use of the pejorative "Stormwater Tax" is at all appropriate. By way of further response, Borough denies that Respondents do not enjoy a specific benefit from their connection to, and use of, the Borough Stormwater Collection and Conveyance System. Borough demands strict proof of Respondents' averments.

45. Denied. The Stream Protection Ordinance is a writing which speaks for itself and any characterization thereof by Respondents (including, without limitation, the pejorative "Stormwater Tax") is denied. By way of further response, and as set forth in the Brief accompanying this Answer, Mr. Perrone is legally

incompetent to testify regarding the "purpose of the" Stream Protection Fee. Borough demands strict proof of Respondents' averments.

46. Admitted in part, denied in part. Borough admits that it issues invoices for the Stream Protection Fee in a manner consistent with the Stream Protection Ordinance. By way of further response, the Stream Protection Ordinance is a writing which speaks for itself and any characterization thereof by Respondents (including, without limitation, the pejorative "Stormwater Tax") is denied.

47. Admitted in part, denied in part. Borough admits that it issues invoices for the Stream Protection Fee in a manner consistent with the Stream Protection Ordinance. By way of further response, those invoices are writings which speak for themselves and any characterization thereof by Respondents is denied. Borough demands strict proof of Respondents' averments.

48. Admitted in part, denied in part. Borough admits that Respondents refuse to pay the Stream Protection Fee for the reasons as set forth in the Refusal to Pay Letter. By way of further response, the Refusal to Pay Letter is a writing which speaks for itself and any characterization thereof by Respondents is denied. By way of further response, it is denied that the Stream Protection Fee is a tax from which Respondents are immune. Borough demands strict proof of Respondents' averments.

49. Paragraph 49. of the Respondents' Motion is an incorporation Paragraph to which no response is required.

50. Denied. Paragraph 50. of the Respondents' Motion is a conclusion or statement of law to which no response is here required.

51. Denied. Paragraph 51. of the Respondents' Motion is a conclusion or statement of law to which no response is here required.

52. Denied. Paragraph 52. of the Respondents' Motion is a conclusion or statement of law to which no response is here required. By way of further response, it is denied that Respondents do not derive a specific benefit from their connection to, and use of, the Borough Stormwater Collection and Conveyance System. Borough demands strict proof of Respondents' averments.

53. Denied. The averment at Paragraph 53. of the Respondents' Motion is a conclusion or statement of law to which no response is here required. By way of further response, it is expressly denied that the Stream Protection Fee "funds only a discrete set of infrastructure projects . . . ." Borough demands strict proof of Respondents' averments.

54. Denied as stated. By way of further response, it is denied that so-called "general benefits" and so-called "specific benefits" are mutually exclusive; that is, the Borough Stormwater Collection and Conveyance System can and does provide specific benefits to the owners of Developed Properties which are connected to and use the Borough Stormwater Collection and Conveyance System. There can also, and simultaneously, exist general benefits which accrue from the Borough

Stormwater Collection and Conveyance System. By way of further response, Respondents do not (and cannot) establish that the presence of a general benefit negates or otherwise renders inapplicable the existence of a specific benefit. Borough demands strict proof of Respondents' averments.

55. Denied as stated. By way of further response, the averment at Paragraph 55. of the Respondents' Motion is a conclusion or statement of law to which no response is here required. By way of further response, it is expressly denied that the Stream Protection Fee "is not proportional to [] Borough's cost to maintain the" Borough Stormwater Collection and Conveyance System. Borough demands strict proof of Respondents' averments.

56. Denied as stated. By way of further response, the averment at Paragraph 56. of the Respondents' Motion is a conclusion or statement of law to which no response is here required. By way of further response, it is expressly denied that the Stream Protection Fee "funds projects other than the general operation, maintenance, or repair of the" Borough Stormwater Collection and Conveyance System. Borough demands strict proof of Respondents' averments.

57. Denied. The averment at Paragraph 57. of the Respondents' Motion is a conclusion or statement of law to which no response is here required.

**WHEREFORE**, Petitioner The Borough of West Chester respectfully requests that this Court enter an Order denying Respondents' Motion.

**Dated: August 23, 2021** **Respectfully submitted,**

**BUCKLEY, BRION,**
**MCGUIRE & MORRIS LLP**

By: /s/ Michael S. Gill

Michael S. Gill, Esquire
Attorney ID No. 86140
gillm@buckleyllp.com

118 West Market Street
West Chester, Pennsylvania 19382

## CERTIFICATION OF COMPLIANCE

I hereby certify that this filing complies with the provisions of the *Public Access Policy of the Unified Judicial System of Pennsylvania: Case Records of the Appellate and Trial Courts* that require filing confidential information and documents differently than non-confidential information and documents.

**Dated: August 23, 2021**

**Respectfully submitted,**

**BUCKLEY, BRION,**
**MCGUIRE & MORRIS LLP**

By: /s/ Michael S. Gill

Michael S. Gill, Esquire
Attorney ID No. 86140
gillm@buckleyllp.com

118 West Market Street
West Chester, Pennsylvania 19382

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260 MD 2018

**IN THE COMMONWEALTH COURT OF PENNSYLVANIA**

**NO. 260 MD 2018**

**THE BOROUGH OF WEST CHESTER**
***Petitioner,***

***v.***

**PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION and WEST CHESTER UNIVERSITY OF PENNSYLANIA OF THE STATE SYSTEM OF HIGHER EDUCATION**
***Respondents.***

# BRIEF OF PETITIONER THE BOROUGH OF WEST CHESTER IN OPPOSITION TO RESPONDENTS' MOTION FOR SUMMARY JUDGMENT

*Petition for Review Challenging the Determination by Pennsylvania State System of Higher Education (on behalf of itself and its constituent institution, West Chester University of Pennsylvania of the State System of Higher Education) Regarding the Borough of West Chester's Stream Protection Fee*

**BUCKLEY, BRION, MCGUIRE & MORRIS LLP**

Michael S. Gill, Esquire
gillm@buckleyllp.com

Aristidis W. Christakis, Esquire
achristakis@buckleyllp.com

Roger Cameron, Esquire
rcameron@buckleyllp.com

118 West Market Street, Suite 300
West Chester, Pennsylvania 19382
(610) 436-4400
*Attorneys for Petitioner*
*The Borough of West Chester*

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## RULES

## STATEMENT OF JURISDICTION

Pursuant to Section 761(a)(1) of the Pennsylvania Judicial Code, 42 Pa. C.S. § 761(a)(1), the Commonwealth Court has jurisdiction over the Action for Declaratory Judgment which Petitioner the Borough of West Chester (the "Borough") filed with this Court on April 13, 2018.[1]

[1] Unless otherwise noted, capitalized terms used, but not defined, in this Brief have the meanings ascribed thereto in the Action for Declaratory Judgment and/or the Brief in Support of Motion for Summary Judgment which the Borough filed with this Court on July 19, 2021 (the "Borough's Summary Judgment Brief").

## DETERMINATION IN QUESTION

The determination by the Pennsylvania State System of Higher Education (the "State System") (on behalf of itself and its constituent institution, West Chester University of Pennsylvania of the State System of Higher Education the "University" and, sometimes together with the State System, the "Respondents") dated January 18, 2018, pursuant to which the State System informed the Borough that neither the State System nor the University intends to pay the Stream Protection Fee (the "Refusal to Pay Letter"). A copy of the Refusal to Pay Letter is attached as **Exhibit A** to the Borough's Summary Judgment Brief and is incorporated here by reference.

## STATEMENT OF THE SCOPE AND STANDARD OF REVIEW

The Borough set forth in the Borough's Summary Judgment Brief the Scope of Review and the Standard of Review which are applicable at this stage of this litigation.

## QUESTIONS PRESENTED

**A. ASSUMING, *ARGUENDO*, THAT THE BOROUGH IS NOT ENTITLED TO SUMMARY RELIEF PURSUANT TO THE BOROUGH'S MOTION, MAY THIS COURT GRANT SUMMARY RELIEF TO RESPONDENTS?**

*Suggested Answer: No.*

**B. CAN THIS COURT CONCLUDE AT THIS STAGE OF THIS LITIGATION, AND AS A MATTER OF LAW, AN ABSENCE OF PROPORIONALITY IN THE AMOUNT OF THE STREAM PROTECTION FEE?**

*Suggested Answer: No.*

## STATEMENT OF THE CASE[2]

On July 16, 2021, Respondents filed with this Court their Motion for Summary Judgment (the "Respondents' Motion") and their Brief in support of that motion. On July 19, 2021, the Borough filed with this Court the Borough's Application and Motion for Summary Relief (the "Borough's Motion") and the Borough's Summary Judgment Brief. The Borough now files this Brief together with the Borough's concomitant Response to the Respondents' Motion.

[2] The Borough incorporates here by reference the Statement of Case as set forth in the Borough's Summary Judgment Brief.

## SUMMARY OF ARGUMENT

For the reasons set forth in the Borough's Motion and the Borough's Summary Judgment Brief, the Borough rests comfortably in its entitlement to summary relief that the Stream Protection Fee is just that . . . a fee, and not a tax. There are no material facts in dispute for which this Court must conduct an evidentiary hearing before it should reject as a matter of law Respondents' position as set forth in the Refusal to Pay Letter.

The corollary to that position, of course, is the Borough's opposition to the Respondents' Motion. Obviously, this Court cannot grant the Borough's Motion while simultaneously granting the relief which Respondents seek pursuant to the Respondents' Motion. If, though, the Court determines that the Borough is not entitled to summary relief, it should also deny the Respondents' Motion.

Respondents use more than two and one-half pages of the Brief which they filed in support of the Respondents' Motion (the "Respondent's Summary Judgment Brief") to argue that which requires no argument. **No party here disputes the proposition that the Borough cannot impose taxes upon the Commonwealth of Pennsylvania**. Though interesting, Respondents' exposition on the law governing the relationship between the state and its constituent municipalities is wholly irrelevant. The Borough does not seek to impose here any tax of any kind!

Otherwise, the Respondents' Motion is predicated almost entirely on the deposition testimony of Borough Manager Michael Perrone, the Shoag Report (as hereinafter defined), and a smattering of references to testimony by Respondents' own witnesses.

The many references to Mr. Perrone's testimony which litter the Respondent's Summary Judgment Brief are mostly incomplete and cherry-picked from Mr. Perrone's broader testimony. Moreover, and as he readily acknowledged during his deposition, Mr. Perrone lacked specific knowledge about the creation and enactment of the Stream Protection Ordinance.[3] Furthermore, of course, Mr. Perrone's statements regarding that purpose and intent are not determinative. Rather, the only controlling statements in that regard are those which Borough Council included in the Stream Protection Ordinance itself.

Moreover, the Shoag Report cannot serve as a basis for this Court to grant summary relief in favor of Respondents.

Finally, and in any event, the testimony of its own witnesses which Respondents bear in support of the Respondents' Motion is both factually incorrect and legally inadequate to establish that there is no dispute of material fact regarding

[3] Despite the availability of other Borough witnesses, including those who participated in creation and enactment of the Stream Protection Ordinance, Respondents elected to take the depositions of just two individuals . . . Mr. Perrone and Borough Engineer Nate Cline.

the all-important question of whether the Stream Protection Fee is a lawfully imposed fee or a tax by another name.

Respondents also ask this Court to "strike or disregard" the Expert Report by Dr. Harry Fishkind (the "Fishkind Report"). The Borough, of course, produced the Fishkind Report as a rebuttal to the Expert Report by Dr. Daniel Shoag which the Respondents produced (the "Shoag Report"). As a naked example of "the pot calling the kettle black," Respondents suggest that the Fishkind Report "simply mirrors the arguments of the Borough's counsel . . . ." Respondents make that suggestion mere paragraphs below their own regurgitation of the contents of the Shoag Report as a primary basis for their claim of entitlement to summary relief.[4]

Regardless of their inconsistent treatment of the Shoag Report and the Fishkind Report, Respondents' request that this Court strike the latter fails for another reason . . . there is nothing improper about Dr. Fishkind offering an opinion on the ultimate question in this case.

Respondents finally claim that the Stream Protection Fee "is not reasonably proportional to the Borough's Cost to Maintain the Stormwater Conveyance System." Here, Respondents suggest that, upon finding the Stream Protection Fee to

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[4] The Borough notes the Fishkind Report here only to observe the existence of a clear dispute between Dr. Fishkind and Dr. Shoag which precludes the grant of the Respondents' Motion. The Borough does not rely upon the Fishkind Report as an independent basis for the Borough's Motion. In other words, this Court may grant the Borough's Motion without reference to the Fishkind Report but, given Respondents' use of the Shoag Report as support for the Respondents' Motion, cannot grant the Respondents' Motion.

be a permissible fee, this Court should nevertheless excuse Respondents' payment obligations. Initially, the Borough notes that Respondents' claim regarding proportionality is not set forth in the Refusal to Pay Letter and, therefore, is not properly before this Court. Secondarily, to support that suggestion, Respondents make factual claims which are very much in dispute. If for no other reason than that, therefore, this Court must reject the Respondents' Motion.

## ARGUMENT

**A. ASSUMING, *ARGUENDO*, THAT THE BOROUGH IS NOT ENTITLED TO SUMMARY RELIEF PURSUANT TO THE BOROUGH'S MOTION, RESPONDENTS ARE LIKEWISE NOT ENTITELD TO SUCH RELIEF PURSUANT TO THE RESPONDENTS' MOTION.**

1. The "material facts" upon which Respondents base the Respondents' Motion are the subject of disputes and, therefore, cannot serve as grounds for the grant of summary relief.

The Stream Protection Ordinance "may be declared invalid only [if this Court determines that the ordinance] violates fundamental law clearly, palpably, plainly and in such manner as to leave no doubt or hesitation in [this Court's] mind" See Trigona v. Lender, 926 A.2d 1226 (Pa. Cmwlth. Ct. 2006) (citing Adams Outdoor Adver. Ltd. v. Hanover Twp., 633 A.2d 240 (Pa. Cmwlth. Ct. 1993)). Respondents cannot meet that burden generally. They certainly cannot meet the burden as a matter of law at this stage of this litigation.

Throughout their argument, Respondents repeat in conclusory terms their position that the Stream Protection Fee is a tax. In that regard, Respondents make much of their **(wholly) incorrect belief** that the only benefits which accrue from the Borough Stormwater Collection and Conveyance System are general in nature. As support for that claim, Respondents (A) make inaccurate factual claims, (B) cite only in part deposition testimony by Borough Manager Michael Perrone, (C) rely upon deposition testimony by their own witnesses, and (D) rely extensively upon the Shoag Report itself. Each of those bases is problematic in one form or another.

***Firstly***, Respondents state as fact that the Stream Protection Fee "is assessed to all properties in the Borough based on certain physical characteristics of the properties." Respondents also state as fact that the Stream Protection Fee is not used to maintain the Borough Stormwater Collection and Conveyance System but, rather, "was implemented recently to promote new projects that make waterways cleaner and reduce the environmental impact of stormwater runoff." Those statements are wholly inaccurate.

The Stream Protection Ordinance is a writing which speaks for itself and the best evidence of what Borough Council intended when it enacted that ordinance. See In re Nomination of Paulmier, 937 A.2d 364, 372 (Pa. 2007). Pursuant to the express terms of the Stream Protection Ordinance, the Stream Protection Fee is **not** charged to all properties within the Borough. BOROUGH OF WEST CHESTER, PA., STREAM PROTECTION ORDINANCE § 94A-6A (2016).

Rather, at Section 94A-6 of the Stream Protection Ordinance, Borough Council ordained that the Stream Protection Fee is "imposed on each and every [D]eveloped [P]roperty in the Borough that is connected with, uses, is serviced by or is benefitted by the [Borough Stormwater Collection and Conveyance System], either directly or indirectly, and upon the owners of such [D]eveloped [P]roperty . .

. .” BOROUGH OF WEST CHESTER, PA., STREAM PROTECTION ORDINANCE § 94A-6 (2016). In that same enactment, Borough Council defined the term “Developed” in relevant part to mean “[p]roperty where manmade changes have been made which add impervious surfaces to the property . . . .” BOROUGH OF WEST CHESTER, PA., STREAM PROTECTION ORDINANCE § 94A-4 (2016). Conversely, Borough Council defined “Undeveloped Land” in relevant part as “[a]ny land which has not been altered from its natural state and which contains no impervious surfaces . . . .” BOROUGH OF WEST CHESTER, PA., STREAM PROTECTION ORDINANCE § 94A-4 (2016)

As set forth in the Affidavit by the Borough Finance Director attached to the Borough’s Summary Judgment Brief as **Exhibit B** thereto (the “Lionti Affidavit”), “the Borough established an account for each Developed Property . . . within the Borough[]” and “there are 4,343 such accounts established for the purpose of billing and collection of the Stream Protection Fee.” Moreover, and as also set forth in the Stream Protection Ordinance, the Lionti Affidavit, and the Appeal Manual which the Borough promulgated pursuant to the Stream Protection Ordinance and which is attached as **Exhibit A** hereto, property owners may obtain credits against and rebates of the Stream Protection Fee.

The Stream Protection Fee is, even in the first instance, applicable only to Developed Properties which are “connected with, use[], [are] serviced by[,] or [are] benefitted by” the Borough Stormwater Collection and Conveyance System.

Furthermore, once presented with an invoice for the Stream Protection Fee, the owner of a Developed Property may lodge an appeal to demonstrate that the fee should be reduced or even eliminated. Those opportunities are available when the owner of a Developed Property takes steps to reduce the flow of stormwater runoff from the Developed Property or shows that the runoff has no impact on the Borough Stormwater Collection and Conveyance System and is draining outside of the Borough. Those are not the hallmarks of a tax.

Unlike a fee, a tax is "'an enforced contribution to provide for the support of the government.'" City of Philadelphia v. Pennsylvania PUC, 676 A.2d 1298, 1307 (Pa. Cmwlth. Ct. 1996) (quoting United States v. LaFranca, 282 U.S. 568 (1931)). "A tax is 'imposed by a legislature upon many, or all citizens . . . raises money, contributed to a general fund, and spent for the benefit of the entire community.'" Id. (quoting CNW v. San Juan Cellular Telephone Co. v. Public Service Commission of Puerto Rico, 967 F.2d 683 (1st Cir. 1992)).

In sum, the Stream Protection Fee is characterized by the absence of universal charge, opportunities to reduce (or eliminate) the amount due, and (as noted in the Borough's Motion, the Borough's Summary Judgment Brief, and the Stream Protection Ordinance itself) the dedication of all revenue generated from the fee to the Stormwater Management Fund (together with an ordinance-based requirement that those funds may be used only for stormwater-related purposes).

Likewise, Respondents cannot here prevail on their claim that the Borough does not use revenue from the Stream Protection Fee to maintain the Borough Stormwater Collection and Conveyance System. Respondents offer no evidence in support of that claim. The Stream Protection Ordinance itself, however, is instructive. As **expressly** set forth in the Stream Protection Ordinance, that revenue

> shall be used by the Borough for:
>
> (1) Implementation and management of a program to manage stormwater within the Borough.
>
> (2) Constructing, ***operating, and maintaining*** the [Borough Stormwater Collection and Conveyance System].
>
> . . .
>
> (4) Payment for other project costs and performance of other functions or duties authorized by law in conjunction with the ***maintenance, operation, repair***, construction, design, planning and management of stormwater facilities, programs and operations.

BOROUGH OF WEST CHESTER, PA., STREAM PROTECTION ORDINANCE § 94A-9 (2016) (emphasis added).

The Lionti Affidavit confirms that expenditures from the Stormwater Management Fund include, by way of example and not limitation, stormwater facilities maintenance, emergency stormwater facility repairs, inlet replacements, and storm drain materials." Furthermore, the Vennettilli Affidavit attached to the Borough's Motion (the "Vennettilli Affidavit ") confirms that the

> Borough's operation of the [Borough Stormwater Collection and Conveyance System] includes . . . the repair and maintenance of collection and conveyance pipes, clearing and unblocking of stormwater inlets, headwalls, and outflows, street sweeping, leaf collection, and snow removal.

Affidavit of Alberto Vennettilli at ¶18.

Mr. Vennettilli also confirms, *inter alia*, that

> Borough employees within the Public Works Department regularly perform work at and upon components of the [Borough Stormwater Collection and Conveyance System] which the University uses including, without limitation, maintenance and/or repair of such components, street sweeping, and inlet cleaning.

Affidavit of Alberto Vennettilli at ¶31.

Respondent's asserted claims that the Stream Protection Fee "is assessed to all properties in the Borough . . ." and that revenue from the Stream Protection Fee is not used to maintain the Borough Stormwater Collection and Conveyance System are, quite simply, just wrong. At the very least, those claims are the subject of a dispute of material fact which precludes this Court from granting the summary relief which Respondents seek.

***Secondly***, Respondents' citations to Mr. Perrone's testimony are incomplete and inaccurate. Respondents claim that Mr. Perrone "admitted throughout his deposition that the primary, if not exclusive purpose of the [Stream Protection Fee] is to provide a general benefit for all rather than a specific benefit to service property owners." Respondents also claim that Mr. Perrone "acknowledged that the [Stream Protection Fee] funds projects that provide 'a general benefit to the Community[.]'"

Here, Respondents wholly ignore a fundamental legal precept. In the presence of an unambiguous legislative enactment such as the Stream Protection Ordinance, the testimony of a single member of the legislative body or another governmental official regarding the purpose of that enactment is not relevant.[5] See Trigona, 926 A.2d at 1233.

In Trigona, the Court noted that preamble to a municipal ordinance "evince[d] the City's intent . . . ." Id. Presumably during the litigation, the City Solicitor executed an affidavit in which that attorney "set forth the City's purported intentions for adopting the" challenged ordinance." Id. at 1231. Given the unambiguous statement of municipal intent as set forth in the ordinance, the Court refused to rely upon that affidavit. See id. at 1233. Such is the case here where the Stream Protection Ordinance is clear and unambiguous.

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[5] Even if the person occupying the position of Borough Manager was legally competent to testify regarding the formation of the Stream Protection Ordinance, Mr. Perrone plainly and clearly testified that he was not "part of the storm water assessment advisory committee" and that he does not "have any first-hand knowledge from participating in the development of the [S]tream [P]rotection [O]rdinance . . . of the factors which went into the calculation of" the Stream Protection Fee. N.T., 10/15/20 at 155.

Notwithstanding the clear rule of law regarding the inadequacy of Mr. Perrone's testimony regarding municipal intent and purpose, Respondents base large parts of their argument upon that testimony.

Even in that, however, Respondents selectively mischaracterize Mr. Perrone's testimony. Respondents also ignore the axiom that the fact that Stream Protection Ordinance contemplates <u>general</u> community benefits does not negate or otherwise diminish the <u>specific</u> benefits which they enjoy from their connection with, use of, and service by the Borough Stormwater Collection and Conveyance System.

Regarding the true nature of Mr. Perrone's testimony, the Borough acknowledges that witness did, indeed, articulate both general and specific benefits which accrue from the Stream Protection Ordinance. By way of example only, and not limitation, the Borough notes one of Mr. Perrone's statements about "how [the Stream Protection Ordinance] benefits . . . specific properties." N.T., 10/15/20 at 62. Testifying in response to Respondents' counsel's question regarding a hypothetical property developer, Mr. Perrone stated

> A. Um, so let's say Ms. Smith is going to build a house and she has to, you know, put in a storm management system on her property and manage 100 percent of her water for every type of storm, you know, manageable, and not connect to the Borough's system She would be impacted by how much land she would develop on her particular home. So the house would get smaller, and the storm sewage management system may get larger. So in that

> case, there is a benefit to, you know, each individual property owner as you develop or we develop.

N.T., 10/15/20 at 63.

Mr. Perrone also testified that, by connecting their properties to the Borough Stormwater Collection and Conveyance System, owners avoid "flooding on their property[.]" N.T., 10/15/20 at 152. He testified that, without the benefit of their connection to the Borough Stormwater Collection and Conveyance System, property owners would either need to manage all of their stormwater runoff on-site, experience flooding, or simply allow stormwater runoff to discharge in an uncontrolled manner.[6] [7] N.T. 10/15/20 at 154.

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[6] Indeed, Respondents acknowledge as much at Page 33 of their Brief in support of the Respondents' Motion. There, Respondents themselves confirmed that

> excluding the University from directly connecting to the Stormwater Conveyance System would not exclude the University from being able to use it ***or benefit from it*** . . . if the University simply conveyed all of the excess stormwater to the edge of its property, that water would still make its way into [the Borough Stormwater Collection and Conveyance System] via the Borough's streets and inlets.

Citation to Respondents' Brief at p. 33. (emphasis added)

[7] Respondents also appear to ignore their duty to prevent adverse downstream impacts from their improvements at North Campus. See Ridgeway Court, Inc. v. Landon Courts, Inc., 442 A.2d 246, 247-48 (Pa. Super. 1981). As the Superior Court held, however,

> [a] landowner may not alter the natural flow of surface water on his property by concentrating it in an artificial channel and discharging it upon the lower land of his neighbor even though no more water is thereby collected than would naturally have flowed upon the neighbor's land in a diffused condition.

The Borough Manager is not competent to testify regarding the purpose and intent of the Stream Protection Ordinance. Notwithstanding that legal incompetence, Respondents base nearly their entire request for summary relief upon Mr. Perrone's deposition testimony. Even in that regard, however, Respondents ignore those portions of Mr. Perrone's testimony in which he articulated the specific benefits which accrue to Developed Properties which are connected to the Borough Stormwater Collection and Conveyance System.

Respondents' reliance upon Mr. Perrone's testimony cannot serve as the basis for the summary relief which Respondents' seek. At the very least, the substance of that testimony is such that there remains a dispute of material fact which precludes this Court from granting that relief. See DeArmitti v. New York Life Ins. Co., 73 A.3d 578 (Pa. Super. 2010) (holding, in the context of summary judgment, that "[t]o carry the weight of a binding judicial admission . . . the opposing party's acknowledgment must ***conclusively*** establish a material fact and not be subject to rebuttal. (emphasis added)).

***Thirdly***, when relaying to this Court the conclusions set forth in the Shoag Report, Respondents cite testimony from their own witness, Gary Bixby.[8]

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Id.

[8] Respondents' reliance upon the Shoag Report as a basis for summary relief is inappropriate. See DeArmitti 73 A.3d at 596 (citing, e.g., Glaab v. Honeywell Intern., Inc., 56 A.3d 693, 6998 (Pa. Super. 2012)) (observing that "[i]t has long been Pennsylvania law that, while

Indeed, however, Respondents' own documents produced in discovery and attached as **<u>Exhibit B</u>** hereto demonstrate that Respondents discharge to the Borough Stormwater Collection and Conveyance System some volume of stormwater runoff from certain storm events. That statement remains true even regarding those portions of North Campus which recently underwent (or are now undergoing) redevelopment.

In short, there is no portion of North Campus which is not hydrologically or otherwise connected in one form or another to the Borough Stormwater Collection and Conveyance System and which is not benefitted by those connections. There is (or should not be) any dispute of material fact in that regard. To the extent any such dispute remains, however, the same precludes this Court from granting the summary relief which Respondents seek pursuant to the Respondents' Motion.

<u>2.</u> <u>This Court should reject Respondents' invitation to exclude the Fishkind Report.</u>

Posturing their request like a Motion *in Limine* buried unusually within a motion for summary judgment, Respondents invite this Court to strike the Fishkind Report. The premise for that invitation is Respondents' argument that the Fishkind Report improperly states a legal opinion. The Court should reject that invitation for not less than two reasons.

conclusions recorded by experts may be disputed, the credibility and weight attributed to those conclusions are not proper considerations at summary judgment . . .").

Firstly, Respondents' invitation is premature. Respondents' Motion is not made on the eve of trial but, instead, at the stage for considering motions for summary judgment. Indeed, the purported motion to strike the Fishkind Report is entirely devoid of any request to strike *specific* portions of the Fishkind Report (let alone a proposed order doing the same), even though Respondents acknowledge that Dr. Fishkind does cite to *economic* authority in addition to his applied analysis of legal authority. Respondents' Brief at 38.

It is also premature in that the Borough does not now rely upon the Fishkind Report in support of the Borough's Motion. Therefore, the issue is not before the Court and Respondents have no need to raise it now. Moreover, the Fishkind Report is no more undisputed evidence than is the Shoag Report (upon which Respondents so heavily rely in their own right). Instead, only the testimony of Dr. Fishkind should be subject objection. The prematurity of Respondents' motion to strike suggests that Respondents' request is made merely so that their own expert's report, which they discuss for seven pages, would appear to control the matter. For the reasons set forth at Footnote No. 8 above, however, neither the Shoag Report nor the Fishkind Report may serve as a basis for summary relief.

Secondly, considered on its substance, Respondents' motion to strike is supported by outdated, superseded, and non-binding legal authority. Respondents cite to several authorities that pre-date the Pennsylvania Supreme Court's 2013 promulgation of the substantively revised version of Pa.R.E. 704. See Respondents' Brief at 38. That rule now provides that "[a]n opinion is not objectionable just because it embraces an ultimate issue." Respondents seem to have ignored this fundamental change in the law concerning the admissibility of expert opinions on ultimate issues, such as, in this matter, whether the Stream Protection Fee is a fee or a tax. Ironically, the Shoag Report offers up a contrary opinion on the same ultimate issue as Dr. Fishkind arguably does. Furthermore, when read as a whole, the Fishkind Report does analyze the opinions of other courts that have addressed the fee versus tax issue as applied to stormwater fees. However, he does so in the context of applying the facts and factors considered in those opinions as they measure up against the facts to be found and considered by this Court. This is no different than the introduction into evidence of expert opinions on ultimate issues that have been offered every day for many years in courts throughout this Commonwealth. See, e.g., Swartz v. General Elec. Co., 474 A.2d 1172 (Pa. 1984) (whether appliance was defective in products liability case); Christiansen v. Silfies, 667 A.2d 396 (Pa. Super. 1995) (expert may offer opinion as to ultimate issue in automobile accident case as to whether defendant complied with applicable standard of care but cannot do so where it requires credibility assessment by expert).

In sum, Respondents' request to strike the Fishkind Report is specious at best, ill-timed, and spuriously supported. The Court should ignore or deny it.

### B. THIS COURT CANNOT NOW CONCLUDE AS A MATTER OF LAW THE LACK OF PROPORTIONALITY IN THE AMOUNT OF THE STREAM PROTECTION FEE.

Respondents tack onto Respondents' Motion an assertion that the Stream Protection Fee lacks proportionality to the benefits which Respondents derive from their connection to the Borough Stormwater Collection and Conveyance System. They baldly assert "[e]ven if it could be considered a fee, the [Stream Protection Fee] is not reasonable because it is not proportional to the Borough's cost to maintain the" Borough Stormwater Collection and Conveyance System. Respondents continue addressing this strawman by averring that "[e]ven if it could be considered a fee, the [Stream Protection Fee]is not reasonable because it funds projects other than the general operation, maintain, or repair of the" Borough Stormwater Collection and Conveyance System.[9]

The Court should reject these arguments with little consideration because Respondents fail utterly to support those assertions with facts, let alone undisputed facts. Put simply, Respondents cite to no costs in specific dollar amounts that the

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[9] Curiously, these arguments assume that the proportionality of the Stream Protection Fee is (A) an issue which Respondents set forth in the Refusal to Pay Letter (upon which the issues in this case are framed) and (B) within the parameters of the issues that this Court requested the parties to litigate. Neither of those assumptions is correct. Having not included proportionality within the scope of the Refusal to Pay Letter, Respondents should not now be permitted to raise that issue. Nevertheless, to the extent that this Court indulges Respondents' efforts to litigate the issue (and as set forth, *inter alia*, in the Lionti Affidavit), there remains a dispute over the material issue of proportionality.

Borough spends to maintain the Borough Stormwater Collection and Conveyance System. Likewise, they cite to no specific dollar amounts that the Borough raises through the Stream Protection Fee. Without any such numbers, there can be no examination of the proportionality which Respondents nonetheless claim does not exist.[10]

Similarly, the Respondents do not cite to any projects which they assert are not used by the Borough for anything other than the general operation, maintenance or repair of the Borough Stormwater Collection and Conveyance System. This may stem in part from the Respondents' unwillingness to grasp that the "system" is comprised of more than hard infrastructure, such as pipes, inlets, and the like. Rather, the Borough Stormwater Collection and Conveyance System is the totality of the stormwater controls which the Borough maintains and on which the Borough works.

Furthermore, it is beyond belief to suggest that the Borough does not (and will not) use the Stormwater Management Fund to maintain the Borough Stormwater Collection and Conveyance System, including the hard infrastructure which forms a part of that system. Respondents appear to take a very narrow view of the word "maintain." Black's Law Dictionary, though, defines the word as

[10] Mr. Perrone confirmed at his deposition that he was not involved in the formulation of the manner in which the Stream Protection Fee is calculated. N.T., 10/15/20 at 58. Respondents had ample opportunity to depose the Borough Finance Director (to whom Mr. Perrone there referred) and/or individuals with knowledge of that issue. Respondents declined to do so. Respondents also received in discovery documents reciting the manner in which the Borough calculates the Stream Protection Fee but do not now make any arguments in that regard.

> acts of repairs and other acts to prevent a decline, lapse or cessation from existing state or condition…; keep in existence or continuance…; keep in proper condition . . . ; keep in repair . . . ; preserve from lapse, decline, failure or cessation; rebuild; repair; replace . . . ."

BLACK'S LAW DICTIONARY 953 (6th ed. 1990).

The restoration of Plum Run, into which so much of Respondents' stormwater runoff flows, is in fact hard infrastructure maintenance. Respondents set up their own antiquated definition of the word "maintain" which does not account for the modern use of that term as it relates to stormwater control. This Court need not follow suit.

As demonstrated throughout, and based upon the unchallenged facts, the Borough unquestionably uses the Stormwater Management Fund for the very purpose it was intended . . . to maintain the Borough Stormwater Collection and Conveyance System including, of course, all of its component parts not just the limited universe of hard infrastructure that Respondents would have this Court consider.

**WHEREFORE**, Petitioner The Borough of West Chester respectfully requests that this Court enter an Order denying Respondents' Motion.

**Dated: August 23, 2021**

**Respectfully submitted,**


**BUCKLEY, BRION,
MCGUIRE & MORRIS LLP**

By: /s/ Michael S. Gill
Michael S. Gill, Esquire
Attorney ID No. 86140
gillm@buckleyllp.com

By: /s/ Roger Cameron
Roger Cameron, Esquire
Attorney ID No. 53251
rcameron@buckleyllp.com

By: /s/ Aristidis W. Christakis
Aristidis W. Christakis, Esquire
Attorney ID No. 207815
achristakis@buckleyllp.com

118 West Market Street
West Chester, Pennsylvania 19382

## CERTIFICATION OF COMPLIANCE

I hereby certify that this filing complies with the provisions of the *Public Access Policy of the Unified Judicial System of Pennsylvania: Case Records of the Appellate and Trial Courts* that require filing confidential information and documents differently than non-confidential information and documents.

Dated: August 23, 2021 Respectfully submitted,

**BUCKLEY, BRION, MCGUIRE, & MORRIS LLP**

By: /s/ Aristidis W. Christakis
________________________
Aristidis W. Christakis, Esquire
Attorney ID No. 207815
achristakis@buckleyllp.com

# EXHIBIT A

# West Chester Borough Stream Protection Fee Program

# Appeal Policies and Procedures Manual

## Contents

# Introduction

The Borough has established a Stream Protection Fee (SPF) which will provide a dedicated funding source for the ongoing expenses associated with the Borough's stormwater management system and compliance with Pennsylvania Department of Environmental Protection Municipal Separate Stormwater System (MS4) permit requirements. All developed parcels in the Borough will be required to pay the fee, which is based on the impervious coverage of the parcel. Property owners are entitled to appeal the user fee in accordance with the procedures in this manual and the Stream Protection Fee Ordinance ("SPF Ordinance").

## Overview

Property owners are entitled to appeal the user fee, per Section 11 – "Appeals" of the SPF Ordinance. This manual has been prepared to detail the policies and application procedures by which a property owner can appeal the SPF.

# Appeal of Stream Protection Fee

## Objective

The appeal process is established to provide relief if a property owner believes the provisions of the SPF Ordinance have been applied in error. A property owner may appeal in accordance with the provisions described in greater detail in this manual.

## Appeals Policies

The basis for an appeal may include, but is not limited to the following:

1. Incorrect parcel information;
2. Inaccurate impervious area calculation;
3. Inaccurate Tier category assignment;
4. Mathematical error.

A Special Conditions Appeal (SCA) which addresses a circumstance where the property owner can demonstrate that the stormwater runoff from their parcel is not placing the same demand on the Borough system or services provided under the stormwater program as other impervious area. A property owner may appeal their SPF as a Special Conditions Appeal (SCA), provided the owner can demonstrate that:

5. Their parcel(s)'s stormwater runoff impact on the stormwater system or services is significantly less than suggested by its amount of impervious area; and
6. Their parcel or a portion thereof drains completely outside of the Borough.

All applicants must be current with their stormwater fees to be eligible for a SCA.

### Application

For all appeals, the property owner must submit an application using the Appeal Application form provided by the Borough and include supporting documentation as further described herein.

## Appeals Application Procedures

### Application Forms

Application Forms are available in Appendix A as well as in electronic format (Word file) on the Borough's website.

WEST CHESTER BOROUGH STREAM PROTECTION FEE – APPEAL POLICY
AND PROCEDURE MANUAL

Application Deadline

The appeal application must be filed by March 31st.

Application Fee

There is no fee to file an appeal which alleges an error or inaccuracy within the billing system. The application fee for an appeal alleging an improper Tier classification or for a Stormwater Special Conditions Appeal is listed in accordance with the Borough's current fee schedule. All fees are non-refundable regardless of the outcome of the appeal. Application fees may be paid by check or money order made out to The Borough of West Chester Stormwater Program.

Documentation Requirements

The property owner must provide the following documentation with the appeal

1. A completed and signed application form.
2. A plot plan, map, aerial image or similar information detailing actual impervious surfaces currently on-site.
3. A requested value for the correct impervious area/ associated with the property for which an appeal is being requested.
4. Application Fee (check or money order)

For SCAs, the applicant must provide all the above, and the following additional item:

5. A plot plan, map, aerial image or similar information delineating the drainage areas or patterns on-site.

The Borough may request additional documentation to aid in review of the appeal.

Submission of Appeals Application

The completed application, supporting documentation, and any applicable non-refundable application fee may be submitted via email to spf-program@west-chester.com or by mail to:

Borough of West Chester Stormwater Program

401 E. Gay Street

West Chester, PA 19380

Determination

The Borough will review the required documentation and a written approval or denial of the appeal application will be issued by the Director of Public Works.

Appeal of Determination

In accordance with the SPF Ordinance, any person aggrieved by any decision of the Borough Manager may appeal to the Court of Common Peas of Chester County, Pennsylvania.

Billing Error Corrections

If an appeal alleging a billing error is successful, the Borough staff will correct the associated billing information

Special Condition Appeal Reduction of Stormwater Fee

If a SCA is approved the reduction in fee will only be applied to the portion of the impervious area that the that the property owner has demonstrated has less or no impact on the system or program of services and

drains outside of the Borough. The following calculation will be applied:

Any property which drains completely outside of the Borough is not a developed property and is not responsible for the Stream Protection Fee.

As for those properties which drain partially outside of the Borough & partially inside the Borough, the percentage of impervious area of such property which drains outside of the Borough will be excluded from the calculation made for the purposes of Section 94A-6. B. of this Ordinance.

If an appeal results in the reduction or elimination of the property's SPF, the Borough will provide a refund to the Property Owner, as applicable.

# Appendix A
# Appeal Application

**BOROUGH OF WEST CHESTER**
CHESTER COUNTY PENNSYLVANIA

# STREAM PROTECTION FEE APPEAL APPLICATION

The Borough has established a Stream Protection Fee (SPF) and all developed parcels in the Borough are required to pay the fee, which is based on the impervious coverage of the parcel. Property owners are entitled to appeal the user fee in accordance with the procedures in the Appeals Manual and the Stream Protection Fee Ordinance 2015-##

*Submit completed form: spf-program@west-chester.com*
*or mail to:*
*Borough of West Chester Stormwater Program*
*401 E. Gay Street, West*
*Chester, PA 19380*

Application Date: ____________ SPF Account No.: ____________

Owner Name: ____________ Mailing Address: ____________

Property Address: ____________

Phone Number: ____________ Email Address: ____________

## Reason for Appeal (Check all that apply):

Incorrect parcel information

Inaccurate impervious area calculation

Inaccurate Tier category assignment

Mathematical error

## Special Condition Appeal

If the applicant is choosing this appeal, both reasons below must be true:

The stormwater runoff impact on the stormwater system or services is significantly less than suggested by its amount of impervious area; and

Applicant's parcel or a portion thereof drains completely outside of the Borough.

## Supporting Documentation Checklist (provide all items listed below)

Copy of SPF Bill

Plot plan, map, aerial image or similar information detailing actual impervious surfaces currently on-site

Requested value for the correct impervious area/ associated with the property for which an appeal is being requested (provide in Description, page 2)

2325a

## Appeal Description

Provide detailed description of the billing error and your interpretation of corrected information. Attach additional sheets as necessary. Photographs are not required, but helpful.

*I attest that the information provided in this Appeal Application is complete and accurate:*

Applicant Signature: ______________________________

## Borough Use Only

Date Received: ______________________________

Reviewed By: ______________________________

Status:
- ☐ Approved
- ☐ Approved with Modifications
- ☐ Additional Information Needed
- ☐ Denied

Notes: ______________________________

______________________________

______________________________

Date Responded: ______________________________

# EXHIBIT B

**West Chester University Campus**

*Pervious vs. Impervious Coverage*

*Storm Water Run-off Calculation*

| | SF | Acres |
|---|---|---|
| Campus **Pervious Area** Feeding West Chester Borugh Plum Run Outfall: | 983,671 | 22.6 |
| Campus **Impervious Area** Feeding West Chester Borugh Plum Run Outfall: | 1,371,897 | 31.5 |
| Campus **TOTAL Area** Feeding West Chester Borough Plum Run Outfall: | 2,355,568 | 54.1 |

| **Run-off Volume Calculation** | **Volume = SF impervious x rainfall depth/ 12** | | |
|---|---|---|---|
| 2 year: 3.26 in / 24 hr | 1,371,897 sf x 3.26/12 = | 372,699 | CF |
| 5 year: 4.10 in/ 24 hr | 1,371,897 sf x 4.10/12 = | 468,731 | CF |

**Storm Water Improvements by Campus Site**
**West Chester University- *Plum Run Outfall***

| | Existing Building w/ No Stormwater Management Installed | Foot print SF |
|---|---|---|
| 1 | Lawrence Center | 61,839 |
| 2 | Schmidt Hall | 8,080 |
| 3 | Killinger Hall | 20,396 |
| 4 | Schmucker Science Center | 47,744 |
| 5 | Ehinger Gymnasium/ Annex | 31,186 |
| 6 | Hollinger Fieldhouse | 28,893 |
| 7 | Peoples Building | 16,840 |
| 8 | Goshen Hall | 10,909 |
| 9 | Tyson Hall | 10,909 |
| 10 | Anderson Hall | 24,088 |
| 11 | Philips Memorial | 19,812 |
| 12 | 25 University Ave | 36,552 |
| 13 | Mitchell Hall | 11,539 |
| 14 | Ruby Jones Hall | 6,738 |
| 15 | Recitation Hall | 13,539 |
| 16 | 13/15 Univ Ave | 2,240 |
| 17 | Wayne Hall | 10,081 |
| | **TOTALS** | **361,385** |

| | Removed Building or Site w/ No Storm Water Management Originally Installed | Footprint SF |
|---|---|---|
| 1 | McCarthy Hall | 16,297 |
| 2 | Ramsey Hall | 10,909 |
| 3 | Sanderson Hall | 10,108 |
| 4 | Boiler Plant | 7,939 |
| 5 | Speakman Building | 4,197 |
| 6 | D Parking Lot | 69,533 |
| 7 | Campus Garage | 3,793 |
| | **TOTALS** | **122,776** |

| | New Building or Site with Code Required Storm Water Management Installed | Footprint SF |
|---|---|---|
| 1 | Student Recreation Center | 44,526 |
| 2 | S. New St Parking Structure | 38,815 |
| 3 | Commonwealth Hall | 20,668 |
| 4 | Brandywine Hall | 23,081 |
| 5 | University Hall | 14,471 |
| 6 | Merion Science Center | 23,834 |
| 7 | The Commons/ Sciences and Engineering Center | 69,724 |
| 8 | North Campus Parking Structure | 17,217 |
| 9 | Allegheny Hall | 24,551 |
| 10 | Business and Public Management Center | 20,276 |
| 11 | Sharpless Parking Structure | 18,343 |
| | **TOTALS** | **315,506** |

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260 MD 2018

**IN THE COMMONWEALTH COURT OF PENNSYLVANIA**

| | | |
|---|---|---|
| THE BOROUGH OF WEST CHESTER,<br><br>Petitioner,<br>v.<br><br>PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION and<br><br>WEST CHESTER UNIVERSITY OF PENNSYLVANIA OF THE STATE SYSTEM OF HIGHER EDUCATION,<br><br>Respondents. | : | Original Jurisdiction<br><br>No. 260 MD 2018 |

**RESPONDENTS' REPLY BRIEF IN FURTHER SUPPORT OF THEIR MOTION FOR SUMMARY JUDGMENT**

Dated: September 7, 2021

Respectfully submitted,

JOSH SHAPIRO
Attorney General

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF ATTORNEY GENERAL
1600 Arch Street
Philadelphia, PA 19103
Telephone: (215) 560-2940
Fax: (717) 772-4526
skovatis@attorneygeneral.gov

BY: STEPHEN R. KOVATIS
Pa. ID No. 209495
Senior Deputy Attorney General
Attorney-in-Charge

KAREN M. ROMANO
Chief Deputy Attorney General
Civil Litigation Section

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**TABLE OF AUTHORITIES**

## Cases



## Rules

## SUMMARY OF ARGUMENT

The core question in this case is whether the Stormwater Tax is a tax, or whether it is a fee for services provided by the Borough to specific individual property owners, like the University.[1] More precisely, in order to survive summary judgment, the Borough bears the burden to point to evidence that, if proven at trial, would overcome the University's tax immunity by establishing that the Stormwater Tax is a fee-for-service and that would show the fact-finder that it is a reasonable charge for that service. To do so, as this Court previously set out, the Borough has to point to evidence showing: (1) that the Stormwater Tax provides a "discrete benefit" to the University rather than "generally aiding the environment and the public at large"; (2) that the Stormwater Tax funds are being used in a way that provides this discrete, private benefit; and (3) that the Stormwater Tax is reasonably proportional to that benefit. Opinion, dated July 15, 2019, at 11.

The Borough has not, and cannot, point to any such evidence. Thus, it cannot overcome the University's tax immunity, and summary judgment should be granted in the University's favor.

Looking at the first two points together, the undisputed factual record in this case shows that the Stormwater Tax is being used to fund a series of infrastructure projects designed to render an environmental benefit to society at large rather than

[1] The University incorporates the terms defined in their previous brief.

a specific and discrete benefit to individual property owners. The Borough's Ordinance, the testimony of its witnesses, and the list of projects funded by the tax demonstrate that the goal of the Stormwater Tax is to improve the environment and benefit the health and well being of all citizens, whether or not they pay the tax. The Borough is spending millions of dollars on infrastructure improvements to decrease pollution, remediate erosion, and generally provide for cleaner waters. These are important and praiseworthy efforts, which the University has joined by undertaking similar project on its campus. These are not, however, discrete services that specifically benefit private landowners.

To the third point, even assuming there is some private benefit, the Stormwater Tax is not a reasonable fee for those services because it is not actually funding those services. The Stormwater Tax pays for things like rain gardens, pervious pavers, and curb extensions; there are currently no plans whatsoever to use it to build or maintain the underground pipe that runs under North Campus. As a matter of law, when a fee is used to pay for something other than the service provided, it cannot be reasonable.

Because the Borough cannot point to a dispute of material fact that might lead a fact finder to conclude that the Stormwater Tax is a reasonable fee for a private service, the University is entitled to summary judgment on the Borough's claim for declaratory relief.

## ARGUMENT

### I. The Borough Has Failed to Point to Any Evidence in the Record That Might Establish That the Stormwater Tax Is a Fee-For-Service

The Borough concedes, as it must, that University property is subject to tax immunity. *See* Brief of Petitioner in Opposition to Respondents' Motion for Summary Judgment, dated Aug. 23, 2021 ("Pet. Br. in Opp. to Resp. MSJ"), at 6. To overcome this immunity, the Borough must point to evidence that, if believed by a fact finder, would show that the Stormwater Tax is a fee-for-service. *See* Pa. R. Civ. P. 1035.2(2) (describing that summary judgment is appropriate where the opposing party "failed to produce evidence of facts essential to the cause of action").[2] If the Stormwater Tax is anything other than a reasonable fee-for-service, the University is immune. Importantly, the Borough does not dispute—or even mention—that under Pennsylvania law an assessment is considered a tax. *See* Respondents' Brief in Support of their Motion for Summary Judgment, dated July 16, 2021 ("Resp. MSJ Br."), at 25. So even if the Stormwater Tax is a charge

[2] This motion should be considered under Rule 1035.2(2), and not Rule 1035.2(1). As it has before, the Borough cites inapplicable law to attempt to flip the burden. The Borough cites *Trigona v. Lender*, 926 A.2d 1226 (Pa. Cmwlth. 2006), but the standard articulated in that case dictates when an ordinance "may be declared invalid." Pet. Br. in Opp. to Resp. MSJ at 10. Here, the University does not seek to declare the Ordinance or Stormwater Tax "invalid"; this is a suit brought ***by the Borough*** seeking a declaration with respect to the ***tax immunity*** of the University. In this context, the Borough carries the burden. *See* Resp. MSJ Br. at 3 (citing *Norwegian Township*).

imposed on certain property owners to pay for a discrete infrastructure project, it is tax. At bottom, nothing in the Borough's brief is sufficient to overcome tax immunity, and thus summary judgment is appropriate.

Instead of pointing to evidence that would meet its legal burden, the Borough attempts to overcome summary judgment by rhetorically questioning evidence in the record, including the testimony of its own witness, without actually pointing to other contrary evidence in the record. This is insufficient as a matter of law given the Borough's burden in this case and the requirements of the rules of civil procedure. Because there is no evidence in the record tending to show that the Stormwater Tax might be a reasonable fee-for-service, summary judgment in favor of Respondents is appropriate.

### A. That the Stormwater Tax Is Not Levied on All Properties Has No Bearing on Whether It Is a Tax

The Borough points out that undeveloped properties do not pay the Stormwater Tax and that some developed properties may be able to "demonstrate that the fee should be reduced or even eliminated." *See* Pet. Br. in Opp. to Resp. MSJ at 11-13. But, for both legal and factual reasons, this fails to demonstrate that the Stormwater Tax is a fee-for-service.

Legally, it fails because the Borough cites no case law or analytical principle supporting the idea that a charge must be paid by everyone in order to be a tax. Assessments are taxes, even though not everyone pays it. *See Southwest Del. Cty.*

*Mun. Auth. v. Aston Twp.*, 413 Pa. 526, 528, 198 A.2d 867, 869 (1964) (assessment made only "against properties benefited by the sewer construction" was a tax). Federal income taxes are taxes, even though not everyone pays it—like people with no income or income below a certain threshold. *See* Turbo Tax, "Does Everyone Need to File an Income Tax Return?," May 3, 2021 (available at https://turbotax.intuit.com/tax-tips/irs-tax-return/does-everyone-need-to-file-an-income-tax-return/L7pluHkoW). And property taxes are taxes, even though not everyone pays it—like renters. Even the authority cited by the Borough allows that a tax need only be imposed on "many" citizens, *see City of Philadelphia v. Pa. Pub. Util. Comm'n*, 676 A.2d 1298, 1307 (Pa. Cmwlth. 1996), and there is no dispute that the Stormwater Tax is imposed on ***many*** (even if not all) properties in the Borough.

Factually, this argument fails because the Borough relies on an immaterial contention that properties assessed the Stormwater Tax could, via administrative appeals, reduce their tax due to zero. *See* Pet. Br. in Opp. to Resp. MSJ at 12. As the Borough implicitly concedes, these properties ***are*** assessed the Stormwater Tax, even if they are able to, using an indeterminate standard, eliminate their tax liability. *See* Perrone Dep. 84:22-88:1; *accord id.* at 83:11-18 (Borough would "consider" reducing the tax if a property was not "putting any water into the system," but "it may require a change to the ordinance to get to that point."). Even taking this fact in the light most favorable to the Borough, the Borough admitted that this deduction system is not designed to ensure that the Stormwater Tax is only assessed on properties who ***use*** a service, but rather it is designed to reduce environmental harm. *See id.* 89:1-23 (admitting that properties that receive deductions get the same benefit from the Stormwater Tax as similar properties that do not receive the deduction). In other words, the purpose of the Borough's deduction system only further shows why the Stormwater Tax is a tax.[3]

### B. The Borough Is Bound By the Admissions of Its Self-Designated Representative Witness Under the Rules of Civil Procedure

The Borough attempts to distance itself from the testimony of the Borough Manager, Michael Perrone, contending that "the testimony of a single member of the legislative body or another governmental official regarding the purpose of that enactment is not relevant." Pet. Br. in Opp. to Resp. MSJ at 16. It further chides that "Respondents elected to take the depositions of just two individuals" in this matter. *Id.* at 7 n.3. The Borough's position fundamentally misstates the rules of civil procedure and the relevant notice of deposition in this case.

The University did not take the deposition of two "individuals," but rather it noticed and took the deposition of the Borough itself. Pursuant to Rule 4007.1(e),

[3] The Borough also notes that undeveloped properties are not assessed at all. But the Borough does not state why this fact matters—owners of open fields may not pay the tax but they certainly benefit from it. *See* Resp. MSJ Br. at 28.

the University noticed the ***Borough's*** deposition, and (as the rule requires) sent a list of topics. It was the ***Borough*** who elected to designate its representative, Perrone, to "testify as to matters known or reasonably available to the organization." *See* Pa. R. Civ. P. 4007.1(e). Thus, Perrone testified not simply in his individual capacity, but as the ***Borough's designated representative***. *See* Perrone Dep. 15:9-17:3 & Ex. University-1. If Perrone was personally "not competent" to testify about the Ordinance as the Borough argues, *see* Pet. Br. in Opp. to Resp. MSJ at 19, the Borough could have (and should have) educated him or designated someone else. Thus, Perrone's testimony in this case was the ***Borough's testimony*** and not merely that of a single official, and it can be used as such for any purpose. *See* Pa. R. Civ. P. 4020(a)(2).[4] The Borough cites no legal principle or admissible evidence—no testimony or document—that offers any basis for the Court to disregard a party's own sworn testimony.

The Borough cites *Trigona* to argue that Perrone's testimony about the purpose and operation of the Ordinance should be ignored, but that case dealt with the converse of what the Borough tries to do here. *See* Pet. Br. in Opp. to Resp. MSJ at 16. In *Trigona*, the Court would not consider an affidavit submitted by the City to contradict the stated purpose in ***its own*** ordinance. *Trigona*, 926 A.2d at

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[4] Additionally, Perrone's status as the Borough Manager provides an independent basis for his testimony to be admissible against the Borough. *See id.*

1233 & n.10. Here, it is the Borough (like the City in *Trigona*) attempting to escape judgment by contradicting its own evidence. As *Trigona* itself points out, the Borough cannot create a dispute of material of fact by arguing against itself. *See* 926 A.2d at 1233 & n.10; *accord Stephens v. Paris Cleaners, Inc.*, 885 A.2d 59, 65 (Pa. Super. 2005) (court may disregard argument or evidence that is submitted to contradict its own deposition testimony). Further, unlike *Trigona,* Perrone's testimony is not inconsistent with the Ordinance but simply explained and clarified what terms in the Ordinance means and how the principles stated in the Ordinance have played out in reality. The Borough cannot simply disregard Perrone's testimony and graft its own factually unsupported interpretation onto the Ordinance. Perrone's admissions are the Borough's admissions.[5]

### C. The Borough and Its Expert Concede the Analytical Framework of the Shoag Report

To the extent that this case presents a disagreement of properly considered expert opinions, the Borough is correct that it would present a dispute for trial. *See* Pet. Br. in Opp. to Resp. MSJ at 20-22. However, that is not what the Court has been presented, for two reasons. First, both the University's expert and the

[5] The Borough also points to portions of Perrone's testimony that the Stormwater Tax allows private owners like the University to avoid costs of handling all its own stormwater on-site. *See* Pet. Br. in Opp. to Resp. MSJ at 17-18. But Perrone's testimony is based on the same faulty assumption as the NTM Report. *See* Resp. MSJ Br. at 44. There is no private demand for avoiding discharging stormwater to public streets.

Borough's expert agree that the ***framework*** set out by Dr. Shoag for analyzing whether a charge is a tax or fee-for-service is a proper economic analysis. And second, although the Borough's expert disagrees with Dr. Shoag's ***conclusions***, he does so not as a matter of economics but rather as a matter of law, which is exclusively the province of the Court. Thus at summary judgment, the Court can consider Dr. Shoag's undisputed economic framework and his undisputed economic conclusions, although it remains up to the Court to determine what those mean as a matter of law. *See* Resp. MSJ Br. at 30 (acknowledging that, although it cannot be conclusive as a matter of law, Dr. Shoag's undisputed economic analysis provides the Court with "useful tools" in analyzing the Stormwater Tax).

There is no dispute in this case that Dr. Shoag properly laid out five factors to describe how the field of economics distinguishes between a tax and a fee-for-service. *See* Fishkind Report at 7 ("For the most part I agree with Dr. Shoag that what I label as 'Table 1' is a comprehensive and exhaustive list of those criteria which distinguish a tax from a fee."). The only dispute on this point between the experts—whether "purpose" should be a sixth category—is immaterial. *See* Resp. MSJ Br. at 38 & n.16. There is thus no dispute about the economic framework requiring a trier of fact. The Court could thus use these five or six factors without accepting either party's conclusion about what it means in this case.

But as to how these factors can be applied, the Borough has failed to present any potential dispute of ***fact***, only a dispute of ***law***. In its brief, the Borough misses the point that Dr. Shoag explicitly limited his opinion to economics, while Dr. Fishkind improperly reaches a conclusion of law. *See* Resp. MSJ Br. at 39-40. Thus, the Borough has not presented any potential evidence or opinion that might tend to show that Dr. Shoag might be wrong as a matter of economics.

The Borough argues that Rule 704 means that Dr. Fishkind's legal conclusions are properly considered. But again, this argument confuses factual opinions and legal opinions. As this Court recently observed, it has been and remains true that an expert witness cannot opine on the law. *Commonwealth v. Laskovich*, 1556 C.D. 2018, 2019 WL 5856006, at *3 (Pa. Cmwlth. Nov. 8, 2019) ("The law is settled that a witness may not testify to a conclusion of law."). By contrast, Rule 704 provides that an expert opinion is not objectionable merely because it "embraces an ultimate issue to be decided by the ***trier of fact***." Pa. R. Evid. 704 (emphasis added). In other words, what Rule 704 means is that an expert can opine on the ***factual*** issue to be decided by a judge or jury; what is does not mean is that a witness can tell the Court what the ***law*** says. *See, e.g.*, *Commonwealth v. Rivera*, 248 A.3d 458, 2021 WL 22058, *11 (Pa. Super. Ct. 2021) (in a drug possession criminal case, a witness was permitted to testify under this rule "whether [the defendant] possessed the narcotics"). Thus, under Rule 704, Dr. Shoag's economic conclusion is proper even though it reaches the ultimate factual issue, but Dr. Fishkind's opinion is not proper because it purports to state what the law of tax immunity is.

## II. The Stormwater Tax Is Unreasonable Based On Undisputed Facts In the Record

In its Opinion following preliminary objections, this Court directed the parties to consider, among other things, "whether the value of the Stormwater System to Respondents is reasonably proportional to the amount of the Stormwater Charge." Opinion, dated July 15, 2019, at 11. As the cases cited by the University illustrate, *see* Resp. MSJ Br. at 40-41, reasonableness in this context is about the relationship between the fee charged to a property owner and the actual cost to the municipality of delivering the service to that property owner.

Despite the Borough's attempt to characterize this argument as quantitative, the argument at this stage of the case is qualitative. That is, it is not simply that the Borough is attempting to collect more money than it spends, but rather that the Borough is using a bait-and-switch—it charges the University a fee for services allegedly provided to the University, but in reality it uses the money on completely different services that are unrelated to the alleged service provided.

The Borough argues that the projects funded by the Stormwater Tax benefit the University because it relieves the school (and all developed property owners) from having to deal with flooding or manage its stormwater on site. *See, e.g.*, Pet.

Br. in Opp. to Resp. MSJ at 18. But it is actually using the bulk of the Stormwater Tax money to remediate the effects of erosion along Plum Run downstream from the University, to rebuild a park on the other side of the Borough by installing pervious pavers and planting trees, and to install rain gardens and curb extensions throughout the Borough. *See* Resp. MSJ Br. at 14-16. To be sure, the University receives a general, environmental benefit from such services, but the charge is not reasonably related to the cost of services allegedly provided to the University.

The Borough's own undisputed testimony admits that it has no plans to spend the Stormwater Tax money on the underground pipe to which the University's MS4 physically connects. The Borough cites no evidence in the record to contradict Perrone's testimony that there is no plan for at least a decade to spend any money on that pipe. *See* Resp. MSJ Br. at 42. Instead, the Borough asserts that evidence is not necessary, calling it "beyond belief" that the Borough will not use the money to benefit the University. But if such a concept were so unbelievable, it should be easy to point to at least some evidence. Notably, the Borough fails to do so.

## CONCLUSION

Wherefore, Respondents Pennsylvania State System of Higher Education and West Chester University of Pennsylvania of the State System of Higher Education respectfully request that this Court find that the Stormwater Tax is a tax, grant them summary judgment, and dismiss the Borough's Action for Declaratory Judgment.

Dated: September 7, 2021

Respectfully submitted,

JOSH SHAPIRO
Attorney General

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF ATTORNEY GENERAL
1600 Arch Street
Philadelphia, PA 19103
Telephone: (215) 560-2940
Fax: (717) 772-4526
skovatis@attorneygeneral.gov

BY: /s/ Stephen R. Kovatis
STEPHEN R. KOVATIS
Pa. ID No. 209495
Senior Deputy Attorney General
Attorney-in-Charge

KAREN M. ROMANO
Chief Deputy Attorney General
Civil Litigation Section

**IN THE COMMONWEALTH COURT OF PENNSYLVANIA**

| | | |
|---|---|---|
| THE BOROUGH OF WEST CHESTER,<br><br>Petitioner,<br>v.<br><br>PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION and<br><br>WEST CHESTER UNIVERSITY OF PENNSYLVANIA OF THE STATE SYSTEM OF HIGHER EDUCATION,<br><br>Respondents. | : | Original Jurisdiction<br><br>No. 260 MD 2018 |

**CERTIFICATION PURSUANT TO Pa. R.A.P. 127**

I certify that this filing complies with the provisions of the *Public Access Policy of the Unified Judicial System of Pennsylvania: Case Records of the Appellate and Trial Courts* that require filing confidential information and documents differently than non-confidential information and documents.

Dated: September 7, 2021

Respectfully submitted,

JOSH SHAPIRO
Attorney General

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF ATTORNEY GENERAL
1600 Arch Street
Philadelphia, PA 19103
Telephone: (215) 560-2940
Fax: (717) 772-4526
skovatis@attorneygeneral.gov

BY: /s/ Stephen R. Kovatis
STEPHEN R. KOVATIS
Pa. ID No. 209495
Senior Deputy Attorney General
Attorney-in-Charge

KAREN M. ROMANO
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**CERTIFICATE OF SERVICE**

I hereby certify that on this day the foregoing Reply Brief in Support of Respondents' Motion for Summary Judgment is being served upon the persons and in the manner indicated below, which service satisfies the requirements of Pa. R.A.P. 121:

Electronic Service via PACFile and/or email

Michael S. Gill, Esq.
BUCKLEY, BRION, MCGUIRE, & MORRIS LLP
118 West Market Street
West Chester, PA 19382
gillm@bluckleyllp.com

*Counsel for Petitioner Borough of West Chester*

Dated: September 7, 2021

Respectfully submitted,

JOSH SHAPIRO
Attorney General

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF ATTORNEY GENERAL
1600 Arch Street
Philadelphia, PA 19103
Telephone: (215) 560-2940
Fax: (717) 772-4526
skovatis@attorneygeneral.gov

BY: /s/ Stephen R. Kovatis
STEPHEN R. KOVATIS
Pa. ID No. 209495
Senior Deputy Attorney General
Attorney-in-Charge

KAREN M. ROMANO
Chief Deputy Attorney General
Civil Litigation Section

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260 MD 2018

**IN THE COMMONWEALTH COURT OF PENNSYLVANIA**

**NO. 260 MD 2018**

**THE BOROUGH OF WEST CHESTER**
***Petitioner,***

***v.***

**PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION and WEST CHESTER UNIVERSITY OF PENNSYLANIA OF THE STATE SYSTEM OF HIGHER EDUCATION**
***Respondents.***

# REPLY BRIEF OF PETITIONER THE BOROUGH OF WEST CHESTER FOLLOWING BRIEF OF RESPONDENTS PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION AND WEST CHESTER UNIVERISTY OF PENNSYLVANIA OF THE STATE SYSTEM OF HIGHER EDUCATION

*Petition for Review Challenging the Determination by Pennsylvania State System of Higher Education (on behalf of itself and its constituent institution, West Chester University of Pennsylvania of the State System of Higher Education) Regarding the Borough of West Chester's Stream Protection Fee*

**BUCKLEY, BRION, MCGUIRE & MORRIS LLP**

Michael S. Gill, Esquire
gillm@buckleyllp.com

Roger Cameron, Esquire
rcameron@buckleyllp.com

Aristidis W. Christakis, Esquire
achristakis@buckleyllp.com

118 West Market Street, Suite 300
West Chester, Pennsylvania 19382
(610) 436-4400

*Attorneys for Petitioner*
*The Borough of West Chester*

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## SUMMARY OF ARGUMENT

In the Brief in Opposition which they filed on August 20, 2021 (the "Respondents' Brief in Opposition"), the State System and the University raise four arguments in opposition to the Application and Motion for Summary Relief which the Borough filed on July 19, 2021 (the "Borough Motion"). The Borough files this Reply Brief to the Respondents' Brief in Opposition. In particular, the Borough here (A) refutes the claim that it is the Borough which bears the burden of proof in this case, (B) corrects the State System's and the University's inaccurate characterization of the benefit which they must enjoy from their connection to the Borough Owned Stormwater Collection and Conveyance System, and (C) addresses the nature of the State System's and the University's duty to manage the stormwater runoff which is a product of their development and improvement of North Campus.

***Firstly***, in their argument regarding the burden of proof in this case, the State System and the University continue their habit of putting the proverbial rabbit in the hat. They argue, perhaps correctly, but ultimately irrelevantly, that the Borough bears the burden of proving the existence of some statutory or other legal authority to overcome the State System's and the University's presumed immunity from taxation. In doing so, however, they assume that the very legal issue which is in dispute in this case is already resolved in their favor. In short, they start with the (incorrect) position that the Stream Protection Fee is a tax and, from there, argue that the Borough has the burden to prove that it can impose that (wrongfully characterized) tax upon the State System and the University. Because the real question at issue in this case is whether the Stream Protection Fee is a fee, and because there is a strong presumption of the validity of the Stream Protection Ordinance itself, the State System and the University bear the burden of proving that the Stream Protection Fee is something other than a lawful fee.

***Secondly***, in the Respondents' Brief in Opposition the State System and the University suggest that the Stream Protection Fee cannot be a fee. They base that suggestion upon their (incorrect) view that, in order for the University to derive a specific benefit from the Borough Stormwater Collection and Conveyance System, the Borough must perform some work which physically touches North Campus. That view is not supported by law.

***Thirdly***, the State System and the University claim that they derive no specific benefit from the Borough Stormwater Collection and Conveyance System because, in their (quite incorrect) view, "[t]here is no reason the University could not simply convey stormwater to its property edge and discharge it there, just as it does now." That view is, likewise, not supported by law.

## ARGUMENT

### A. THIS CASE IS NOT ABOUT THE BOROUGH'S POWER TO IMPOSE A TAX UPON THE STATE SYSTEM AND THE UNIVERSITY AND THE STATE SYSTEM AND THE UNIVERSITY BEAR THE BURDEN OF PROVING THAT THE STREAM PROTECTION ORDINANCE IS INVALID.

In the Respondents' Brief in Opposition, the State System and the University claim that the Borough misstated the burden of proof which is applicable in this case. In their misstatement of that burden of proof, it is the Borough which must disprove the assertion which the State System and the University made in the Refusal to Pay Letter. That position, however, assumes that this Court already resolved the ultimate issue in this case; *to wit*, the proper characterization of the Stream Protection Fee. In that regard, the State System and the University jump over the question which is truly before this Court and set up a strawman argument against a position with which no one in this case disagrees. Indeed, as the Borough has stated repeatedly and as it seemingly must acknowledge again here, the Borough has no power to impose upon the State System and/or the University any tax on real property which they use in furtherance of their statutory mission. See Lehigh-Northampton Airport Auth. v. Lehigh Cty. Bd. of Assessment Appeals, 889 A.2d 1168 (Pa. 2005); SEPTA v. Bd. of Revision of Taxes, 833 A.2d 710, 715-16 (Pa. 2003).

Commonwealth entities, however, **are not** immune from charges for fees. See Sw. Del. Cty. Mun. Auth. v. Aston, 198 A.2d 867 (Pa. 1964). As to the real question in this case, the governmental statement which is now under review is the Refusal to Pay Letter. In that letter, the State System (for itself and the University) determined and announced that the Stream Protection Fee is a tax and that the Stream Protection Ordinance is unlawful. The Borough initiated this case to obtain judicial review of that determination and announcement and not some conjured claim that the Borough can impose a tax upon the State System and the University.

In that regard, this Court is well aware of the oft stated, and long-standing, rule that legislative actions by municipal governments enjoy a strong presumption of constitutionality under Pennsylvania law. See Rufo v. Board of License & Inspection Review, 192 A.3d 1113 (Pa. 2018). A court

> will not declare a statute unconstitutional 'unless it clearly, palpably, and plainly violates the Constitution. If there is any doubt that a challenger has failed to reach this high burden, then that doubt must be resolved in favor of finding the statute constitutional.

Zauflik v. Pennsbury Sch. Dist., 104 A.3d 1096, 1103 (Pa. 2014) (quoting Pa. State Ass'n. of Jury Comm'rs. v. Commonwealth, 64 A.3d 611, 618 (Pa. 2013).

That rule applies as much to local ordinances as it does to statutes which the General Assembly enacts. See, e.g., Messina v. E. Penn Twp., 62 A.3d 363 (Pa. 2012); Johnston v. Twp. of Plumcreek, 859 A.2d 7 (Pa. Commw. Ct. 2004) (holding that "[t]he burden of proving any ordinance unconstitutional is a heavy one inasmuch as the ordinance enjoys a strong presumption of validity[]") (citing Shubach v. Silver, 336 A.2d 328 (Pa. 1975)).

This case is not about whether the Borough can or cannot impose a tax upon real property which the State System and the University use in furtherance of their statutory purpose. The Borough does not here seek to impose any such tax.

Rather, this case is about whether the Stream Protection Ordinance is valid and whether the Stream Protection Fee is a fee which the Borough has all necessary authority to charge and collect. In that regard, it is the State System and the University which bear the burden of overcoming the presumption of validity which the Stream Protection Ordinance enjoys. The Borough bears no such burden.

### B. THE BOROUGH IS NOT REQUIRED TO PERFORM PHYSICAL WORK AT NORTH CAMPUS AND THE STATE SYSTEM IN ORDER FOR THE STREAM PROTECTION FEE TO MAINTAIN ITS PRESUMPTION OF VALIDITY.

In the Respondents' Brief in Opposition, the State System and the University claim, generally, that the Stream Protection Fee cannot be a fee because, in their view, the Borough has no immediate plans to use the Stormwater Management Fund to perform physical work at North Campus. That argument (for which the State System and the University supply no legal support) inappropriately ignores a fact to which Borough Manager Michael Perrone testified . . . the Borough Stormwater Collection and Conveyance System is a unified one without separate service districts. N.T., 10/15/20 at 156-57.

The Borough Stormwater Collection and Conveyance System is a "single and comprehensive system . . . ." Vennettilli Affidavit at ¶ 21. That system is one in which each component of the system is connected to every other component of the system. That unified system collects stormwater runoff **at**, and conveys stormwater runoff **away from**, Developed Properties. The Borough provides that service, and the owners of those Developed Properties are commensurately benefitted by their ability to operate otherwise free of regular flooding and the burden of disposing of that stormwater runoff.

More than thirty years ago, the Supreme Court concluded that a municipality may establish a monopoly to provide essential services and "require[e] all persons to use its facilities for essential services in the interest of uniformity and of assuring their availability to everyone." Council of Middletown Twp. v. Benham, 523 A.2d 311, 317 (Pa. 1987) (citing Ridley Arms, Inc. v. Township of Ridley, 531 A.2d 414 (Pa. 1987). The Court further held that

> [t]hrough the imposition and collection of reasonable users fees, [a municipality] can obtain the financing necessary to provide services to those who are not in an economic position to provide the required level of services for themselves.

Id.

The Borough provides **just that type of service** by making the Borough Owned Stormwater Collection and Conveyance System available to the owners of Developed Properties.

As the Borough noted in the Brief in Opposition to Respondents' Motion for Summary Judgment which it filed on August 23, 2021, there is **no factual dispute** that the Borough uses funds in the Stormwater Management Fund to perform maintenance and other work on the Borough Stormwater Collection and Conveyance System. There is also **no factual dispute** that stormwater runoff from North Campus is collected into, and conveyed away through, the Borough Stormwater Collection and Conveyance System. Finally, there is **no legal requirement** of which the Borough is aware (or which the State System or the University cite) that, in order for the Stream Protection Fee to be a fee, the Borough must perform some physical work on or adjacent to North Campus.

### C. NOTWITHSTANDING THEIR ASTOUNDING CLAIM TO THE CONTRARY, THE STATE SYSTEM AND UNIVERISTY MAY NOT SIMPLY OPERATE WITHOUT SOME MECHANISM FOR THE COLLECTION OF STORMWATER RUNOFF AT NORTH CAMPUS AND THE SAFE CONVYENACE OF THAT RUNOFF AWAY FROM NORTH CAMPUS.

Not for the first time, but certainly within the Respondents' Brief in Opposition, the State System and the University claim that they do not benefit from their use of the Borough Owned Stormwater Collection and Conveyance System because (they incorrectly claim) "[t]here is no reason the University could not simply convey stormwater to its property edge and discharge it there, just as it does now." That claim is as contrary to law as it is astounding that instrumentalities of the

Commonwealth would suggest some power to simply develop their properties without consideration for the impacts upon downstream properties.

Contrary to the State System's and the University's claims,

> [a] landowner may not alter the natural flow of surface water on his property by concentrating it in an artificial channel and discharging it upon the lower land of his neighbor even though no more water is thereby collected than would naturally have flowed upon the neighbor's land in a diffused condition. One may make improvements upon his own land, especially in the development of urban property, grade it and built upon it, without liability for any incidental effect upon adjoining property even though there may result some additional flow of surface water thereon through a natural watercourse, **but he may not, by artificial means, gather the water into a body and precipitate it upon his neighbor's property**.

Ridgeway Court, Inc. v. Landon Courts, Inc., 442 A.2d 246, 247-48 (Pa. Super. Ct. 1981) (quoting Rau v. Wilden Acres, Inc. 103 A.2d 422 (Pa. 1954)) (*emphasis added*).

No one here is attempting to recover damages from the State System or the University. That the State System and the University **might be** immune from **damages** arising out of a breach of their common law duty to prevent downstream impacts from stormwater runoff, however, does not legally equate with the proposition that they may willfully disregard that duty.[1] Indeed, it would be a strange position for the State System and the University to suggest that they can flout their

[1] The Borough takes no position here on the question of whether such immunity does or does not exist . . . that question is irrelevant to this Court's disposition of this case.

common law duty just because a hypothetical plaintiff might not be able to judicially compel compliance with that duty.

Moreover, even if sovereign immunity does allow for such willful disregard, that immunity does not undermine a framework on which the Stream Protection Ordinance may be constructed . . . that, as a matter of law, property owners must properly dispose of stormwater runoff from their Developed Properties.

That the State System or the University could be immune from damages arising out of their failure to do so does not mean that the Stream Protection Ordinance is improperly predicated on a need for **all other** Developed Property owners to properly dispose of their stormwater runoff. In that regard, the State System and the University must concede that the Stream Protection Ordinance is well-founded.

Then, having made the affirmative choice to continue to use the Borough Stormwater Collection and Conveyance System (as they indisputably do), the State System and the University may be charged for such use in the same manner as all other users. Of course, the State System and the University may avoid that charge by disconnecting North Campus from the Borough Stormwater Collection and Conveyance System and finding other ways to convey stormwater runoff to a receiving watercourse . . . that they do not do so speaks volumes to the benefit which they enjoy from the existing connections. Theoretically, if it is truly the State

System's and the University's position that they can simply discharge uncontrolled stormwater runoff from North Campus, they may attempt to do so and test whether sovereign immunity truly applies.

Regardless of the applicability of sovereign immunity and the common law duty regarding the discharge of stormwater runoff, the State System and the University also have an ongoing duty to comply with the Pennsylvania Storm Water Management Act, 32 P.S. § 680.1 *et seq*. (the "SWMA"). Pursuant to the SWMA,

> [a]ny landowner and any person engaged in the alteration or development of land which may affect storm water runoff characteristics shall implement such measures consistent with the provisions of the applicable watershed storm water plan as are reasonably necessary to prevent injury to health, safety or other property.

32 P.S. § 680.13

The SWMA's affirmative mandate that all landowners shall (i) comply with applicable watershed storm water plans, (ii) assure that development activities do not increase the maximum rate of runoff, and (iii) manage the quantity, velocity, and direction of storm water so as to protect health and property are binding upon Commonwealth instrumentalities when they act in their capacity as landowners. See Montgomery Cty. Conservation Dist. v. Bydalek, 2021 Pa. Commw. Unpub. LEXIS 348 (Pa. Commw. Ct. 2021); Kee v. Pennsylvania Turnpike Commission, 685 A.2d 1054, 1059 (Pa. Commw. Ct. 1996); Milestone Materials, Inc. v. Dep't. of Conservation & Nat. Res., 730 A.2d 1034, 1039 (Pa. Commw. Ct. 1999) (holding that, in cases where there is a non-discretionary duty involved, "the law is well settled that the doctrine of sovereign immunity does not bar suits that seek to compel state officials to carry out their duties in a lawful manner[]"). T

The issue of sovereign immunity which the State System and the University raise in opposition to the Borough Motion is a classic red herring. The true issue in this case is whether the Stream Protection Fee is a fee. Certain aspects of determining the answer to that question include whether the State System and the University are using and benefitting from the Borough Stormwater Collection and Conveyance System. There is no dispute of any genuine issue of material fact in that regard and, accordingly, this Court should grant the Borough Motion.

## CONCLUSION

For each of the foregoing reasons, as well as those set forth in the Borough's prior filings in this matter, the Borough respectfully requests that this Court grant the Borough Motion.

**WHEREFORE**, Petitioner The Borough of West Chester respectfully requests that this Court enter an Order granting Petitioner's Motion.

**Dated: September 7, 2021**

**Respectfully submitted,**

**BUCKLEY, BRION,**
**MCGUIRE & MORRIS LLP**

By: /s/ Michael S. Gill
Michael S. Gill, Esquire
Attorney ID No. 86140
gillm@buckleyllp.com

By: /s/ Roger Cameron
Roger Cameron, Esquire
Attorney ID No. 53251
rcameron@buckleyllp.com

By: /s/ Aristidis W. Christakis
Aristidis W. Christakis, Esquire
Attorney ID No. 207815
achristakis@buckleyllp.com

118 West Market Street
West Chester, Pennsylvania 19382

## CERTIFICATION OF COMPLIANCE

I hereby certify that this filing complies with the provisions of the *Public Access Policy of the Unified Judicial System of Pennsylvania: Case Records of the Appellate and Trial Courts* that require filing confidential information and documents differently than non-confidential information and documents.

**Dated: September 7, 2021** **Respectfully submitted,**

**BUCKLEY, BRION,**
**MCGUIRE, & MORRIS LLP**

/s/ Michael S. Gill

By: ________________________

Michael S. Gill, Esquire
Attorney ID No. 86140
gillm@buckleyllp.com