# PRELIMINARY
# DRAINAGE STUDY
# &
# HYDRAULIC CALCULATIONS

**DRNTY-2022-00005**

PREPARED FOR:

## MOUNTAIN AVENUE BEES
## LYTLE CREEK ROAD
## FONTANA, CA 92335
## APN 0239-311-03

PREPARED BY:

**LAND ENGINEERING CONSULTANTS, INC.**
**P.O. BOX 541, 650 AVENUE K**
**CALIMESA, CA. 92320**
**PH: (909) 795-8882**


STEVEN H. RITCHEY R.C.E. 51129 *November 29, 2022* DATE

# DISCUSSION

## INTRODUCTION

This proposed site is located on the west side of Lytle Creek Road approximately 6,300 feet north of Interstate 15 in the unincorporated area of Fontana within San Bernardino County. The proposed development area sheet flows to the southeast at an approximate average gradient of five percent.

The purpose of this study is to determine the rate of storm water runoff for the design of related drainage facilities for this project, to mitigate increased runoff generated from the proposed development and to address water quality conditions of concern.

The project site encompasses an area of 5.17 acres, and there is a total of 11.01 acres of tributary area that currently drains through this project site. In the proposed condition, the offsite flows will be conveyed around the project through an adequately sized drainage swale.

The project site is located within a studied FEMA Zone X designation area, moderate to low risk, as indicated on Panel 7905 of 9400. The area was studied in Case No. 08-09-0702P, effective October 30, 2008 and has been restudied in Case No. 20-09-1006P, effective December 12, 2022. The project area lies nearby the perimeter of the study area and the offsite flows from the west are in FEMA Zone D designation area, which is an undetermined flood hazard area.

The project site does lie within a Department of Water Resources (DWR) Awareness area from the upstream Grapevine Canyon watershed. This watershed crosses Lytle Creek Road at a culvert bridge crossing just north of the project site then confluences with the Lytle Creek watershed. The DWR Awareness studies are no longer being updated; therefore, at the County's request, the Grapevine Canyon watershed has been analyzed as relates to potential flooding of the project site. The analysis of this watershed shows that the entire flow is easily carried within the existing earthen channel and the existing culvert is adequately sized to carry the flow without the headwater overtopping the bank.

## EXISTING WATERSHED DESCRIPTION

The project site currently contains a house, storage building, asphalt drive lane, and a water-well structure and the remaining area is vacant. The entire site sheet flows across the project area to the southeast where it exits the project area and continues in this direction until it joins the drainage swales along Lytle Creek Road. The total runoff generated from the project site during a 100-year 24-hour storm using 25-year rainfall data was determined to be 29.18 cfs in its existing condition.

## METHODOLOGY

### Rational Method Hydrology

The following scenarios were modeled:

Existing Condition: 100-year for the 1-hour storm
Developed Condition: 100-year for the 1-hour storm

Rainfall depth was derived from precipitation frequency Atlas, NOAA Atlas 14.

Rational method computations were performed using Civilcadd/Civildesign Engineering Software, ver. 7.1, based on the Hydrology Manual. Intensity, runoff coefficients, and discharge were calculated

at each node by the software, based on user input of rainfall, soil type, acreage, and land use parameters.

Printouts of the rational method calculations, as well as, applicable plates from the Manual are included in this report.

**Synthetic Hydrograph for Detention Facilities Routing**

The following scenario was modeled for peak flows and volume routed through proposed detention facilities:

Existing Condition: 100-year, 25-year, 10-year & 2-year for the 24-hour storms
Development Condition: 100-year, 25-year, 10-year & 2-year for the 24-hour storms
Basin Outflow: 100-year, 25-year, 10-year & 2-year for the 24-hour storms

Rainfall depth was derived from the precipitation frequency Atlas, NOAA Atlas 14.

Synthetic Unit Hydrograph computations were performed using Hydrology Studio 2022 v 3.0.0.26, with data from the San Bernardino County Hydrology Manual methodology.

## PROPOSED WATERSHED DESCRIPTION

The project proposes to develop two concrete tilt-up single-story industrial buildings with concrete driveways and parking areas. The offsite flows entering the project area from the north and west will be collected by a drainage swale and conveyed around the project area to bypass the proposed development.

The flows within the project area and generated by the development will be directed around the proposed buildings through swales in the drive lane areas toward a catch basin located in the southeast portion of the drive lane area. The catch basin will then carry the flow to the proposed detention basin (southeast of this location) through an 18-inch PVC pipe. The basin and outlet are designed to detain the increased run-off and outlet it at a rate that is appropriate to mitigate the increase caused by the development of this site. Once the detention basin has completely filled, water may exit through a proposed outlet riser and continue to downstream in its historical course. The total runoff generated from the project during a 100-year 24-hour storm was determined to be 44.65 cfs in its proposed condition.

## RESULTS

The detention facilities routing analysis was utilized to design the detention basin and outlet structure facilities to adequately reduce the developed condition peak flow rates to be less than the target peak flow rates as required in accordance with Detention Basin Design Criteria for San Bernardino County and San Bernardino County Detention Basin Design Criteria Memo File 1(FC)-53. The proposed design provides a 4-foot-deep detention basin sized to a total volume of 60,594 cubic feet and an additional 1 foot of freeboard. From full capacity the basin will drawdown in approximately 10 hours. The maximum water surface elevation during a 100-year 24-hour storm is 2183.29 (4.29 feet of depth). During a 100-year 24-hour storm event 44.65 cfs will flow into the basin and 9.49 cfs will outflow, which is less than the target outlet peak flow rate of 26.26 cfs. Tables 1 and 2 below are included as a comparison of the studied flow events target peak flow rates versus the post-basin routed peak flow rates. For each storm event the target flow rates have been met.

*Table 1 - Existing Condition and Target Discharge Rates*

| 24-hour Storm Event | Existing Condition Peak Flow Rates | Target Peak Flow Rates (90%) |
|---|---|---|
| **2-year** | 11.88 | 10.69 |
| **10-year (using 5-year rainfall)** | 17.75 | 15.98 |
| **25-year (using 10-year rainfall)** | 22.59 | 20.33 |
| **100-year (using 25-year rainfall)** | 29.18 | 26.26 |

*Table 2 - Developed Condition and Mitigated Discharge Rates*

| 24-hour Storm Event | Developed Condition Peak Flow Rates | Developed Condition Mitigated Peak Flow Rates |
|---|---|---|
| **2-year** | 15.21 | 0.00 |
| **10-year** | 26.84 | 2.06 |
| **25-year** | 33.86 | 3.96 |
| **100-year** | 44.65 | 9.49 |

Below in Table 3 is a comparison of the rational method 100-year 1-hr results, the peak developed condition 1-hour flow rates were utilized for the hydraulic analysis and design of pipes, swales, catch basins, and culverts.

*Table 3 - Rational Method Comparison*

| **Rational Method Results** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Existing Condition** | | | | **Developed Condition** | | | |
| **Drainage Area** | **Area (ac)** | **$T_c$ (min)** | **Q 100-yr 1-hr (cfs)** | **Drainage Area** | **Area (ac)** | **$T_c$ (min)** | **Q 100-yr 1-hr (cfs)** |
| 100 (offsite) | 7.38 | 13.37 | 42.76 | 100 (offsite) | 7.38 | 13.42 | 42.66 |
| 200 (offsite) | 3.63 | 12.45 | 22.13 | 200 (offsite) | 3.63 | 12.45 | 22.13 |
| 300 (onsite) | 5.12 | 13.84 | 28.99 | 300 & 400 (onsite) | 5.12 | 7.95 | 42.02 |
| **Total** | **16.13** | | **93.88** | | **16.13** | | **106.81** |

## CONCLUSIONS

This drainage study and the calculations presented herein demonstrate that the onsite flows are collected and carried through the project in a controlled manner within drainage structures adequately sized. All on-site flows are directed toward the detention basin located southeast of the project area to detain the increase run-off generated by the development of this site. This increase has been mitigated by the use of the detention basin and is also sized to retain and mitigate the water quality concerns as outlined in the Water Quality Management Plan.

# DRAINAGE AREA MAPS

# MOUNTAIN AVENUE BEES - LYTLE CREEK

## EXISTING CONDITION DRAINAGE MAP

SCALE: 1"=50'

50 0 50 100

## LEGEND:

DRAINAGE AREA (AC)

NODE # (100)

10.00 / 500'

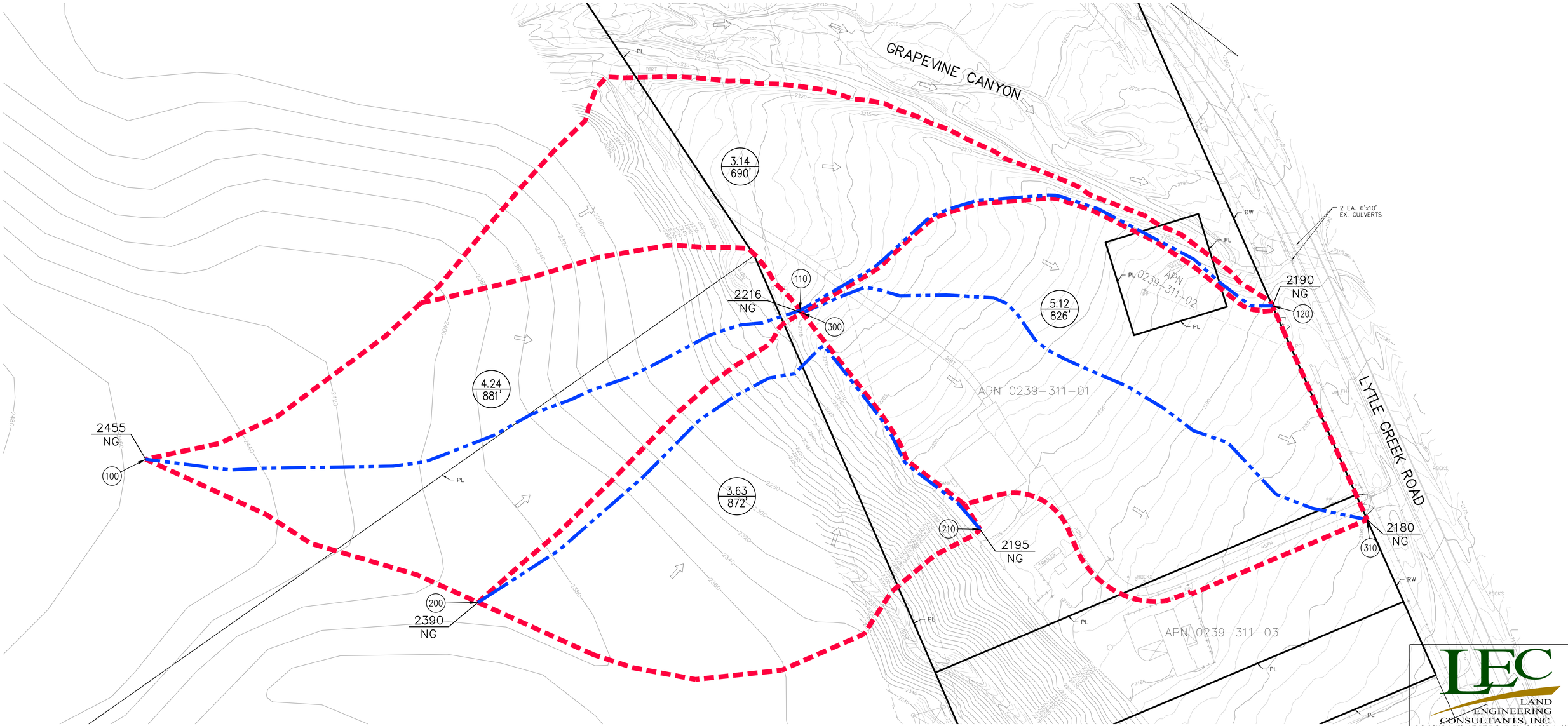
FLOW PATH LENGTH

FLOW LINE

WATERSHED BOUNDARY

FLOW PROCESS CHART:

| FROM NODE | TO NODE | FROM ELEV | TO ELEV | Q (CFS) 100-YR |
|---|---|---|---|---|
| 100 | 110 | 2216 | 2187 | 26.50 |
| 110 | 120 | 2216 | 2187 | 42.76 |
| 200 | 210 | 2216 | 2187 | 22.13 |
| 300 | 310 | 2216 | 2180 | 28.99 |





LEC
LAND ENGINEERING CONSULTANTS, INC.
P.O. BOX 541, 650 AVENUE K, CALIMESA, CALIFORNIA 92320
PH: (909) 795 - 8882

# MOUNTAIN AVENUE BEES - LYTLE CREEK

## DEVELOPED CONDITION DRAINAGE MAP

SCALE: 1"=50'

50 0 50 100

## LEGEND:

DRAINAGE AREA (AC)

NODE # (100)

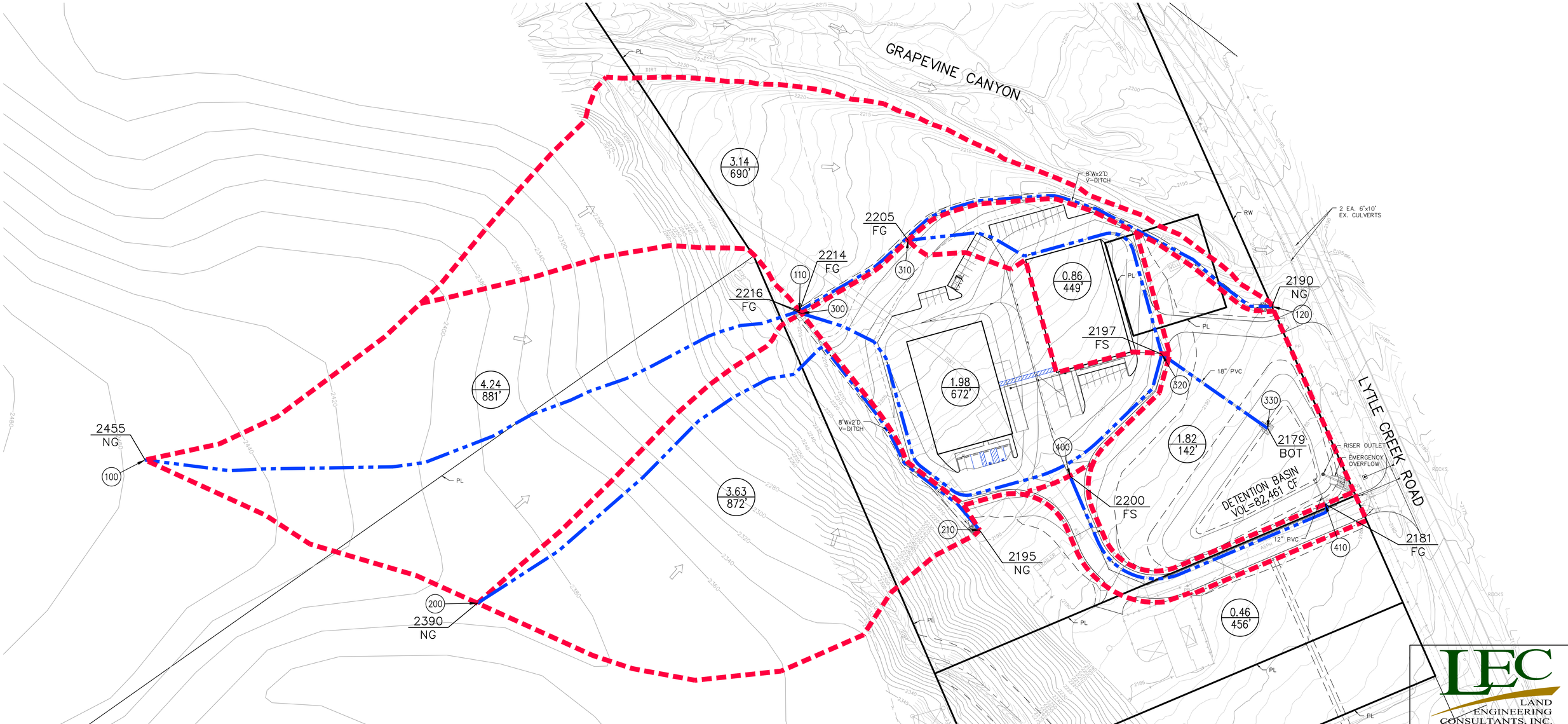
10.00 / 500' — FLOW PATH LENGTH

FLOW LINE

WATERSHED BOUNDARY

FLOW PROCESS CHART:

| FROM NODE | TO NODE | FROM ELEV | TO ELEV | Q (CFS) 100-YR |
|---|---|---|---|---|
| 100 | 110 | 2455 | 2216 | 26.50 |
| 110 | 120 | 2214 | 2190 | 42.66 |
| 200 | 210 | 2390 | 2195 | 22.13 |
| 300 | 320 | 2216 | 2197 | 16.11 |
| 310 | 320 | 2205 | 2197 | 7.35 |
| 320 | 320 | 2197 | 2197 | 23.13 |
| 320 | 330 | 2190 | 2179 | 23.13 |
| 330 | 330 | 2179 | 2179 | 38.17 |
| 400 | 410 | 2200 | 2179 | 4.11 |
| 330 | 410 | 2179 | 2179 | 42.02 |





LEC
LAND ENGINEERING CONSULTANTS, INC.
P.O. BOX 541, 650 AVENUE K, CALIMESA, CALIFORNIA 92320
PH: (909) 795 - 8882

# RATIONAL METHOD HYDROLOGY
# DEVELOPED CONDITION

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 11/18/22

---

MOUNTAIN AVENUE BEES
100 YEAR 1 HOUR STORM
DEVELOPED CONDITION

---

Program License Serial Number 6165

---

********* Hydrology Study Control Information **********

---

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 2.300 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Process from Point/Station 100.000 to Point/Station 110.000
**** INITIAL AREA EVALUATION ****

---

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.140(In/Hr)
Initial subarea data:
Initial area flow distance = 881.000(Ft.)
Top (of initial area) elevation = 2455.000(Ft.)
Bottom (of initial area) elevation = 2216.000(Ft.)
Difference in elevation = 239.000(Ft.)
Slope = 0.27128 s(%)= 27.13
TC = k(0.615)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.028 min.
Rainfall intensity = 7.084(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff = 26.500(CFS)
Total initial stream area = 4.240(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.140(In/Hr)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Process from Point/Station 110.000 to Point/Station 120.000
**** IMPROVED CHANNEL TRAVEL TIME ****

---

```
Upstream point elevation =  2214.000(Ft.)
Downstream point elevation =  2190.000(Ft.)
Channel length thru subarea  =   690.000(Ft.)
Channel base width     =    0.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     34.609(CFS)
Manning's 'N'    = 0.025
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     34.609(CFS)
Depth of flow =   1.445(Ft.), Average velocity =   8.286(Ft/s)
Channel flow top width =    5.780(Ft.)
Flow Velocity =    8.29(Ft/s)
Travel time  =    1.39 min.
Time of concentration =   13.42 min.
Critical depth =      1.797(Ft.)
 Adding area flow to channel
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      6.563(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.881
Subarea runoff =     16.162(CFS) for    3.140(Ac.)
Total runoff =     42.662(CFS)
Effective area this stream =        7.38(Ac.)
Total Study Area (Main Stream No. 1) =        7.38(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   1.563(Ft.), Average velocity =   8.731(Ft/s)
Critical depth =      1.953(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      210.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Initial subarea data:
Initial area flow distance =   872.000(Ft.)
Top (of initial area) elevation =  2390.000(Ft.)
Bottom (of initial area) elevation =  2195.000(Ft.)
Difference in elevation =   195.000(Ft.)
Slope =    0.22362  s(%)=      22.36
TC = k(0.615)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.451 min.
Rainfall intensity =      6.915(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff =     22.134(CFS)
Total initial stream area =        3.630(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.140(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      320.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   672.000(Ft.)
Top (of initial area) elevation =  2216.000(Ft.)
Bottom (of initial area) elevation =  2197.000(Ft.)
Difference in elevation =    19.000(Ft.)
Slope =    0.02827  s(%)=       2.83
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.386 min.
Rainfall intensity =      9.119(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.892
Subarea runoff =     16.110(CFS)
Total initial stream area =        1.980(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      320.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.980(Ac.)
Runoff from this stream =     16.110(CFS)
Time of concentration =    8.39 min.
Rainfall intensity =     9.119(In/Hr)
Area averaged loss rate (Fm) =    0.0785(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      310.000 to Point/Station      320.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
```

```
Initial subarea data:
Initial area flow distance =   449.000(Ft.)
Top (of initial area) elevation =  2205.000(Ft.)
Bottom (of initial area) elevation =  2197.000(Ft.)
Difference in elevation =     8.000(Ft.)
Slope =    0.01782  s(%)=       1.78
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.827 min.
Rainfall intensity =      9.570(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.893
Subarea runoff =      7.346(CFS)
Total initial stream area =        0.860(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      310.000 to Point/Station      320.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.860(Ac.)
Runoff from this stream =      7.346(CFS)
Time of concentration =    7.83 min.
Rainfall intensity =     9.570(In/Hr)
Area averaged loss rate (Fm) =    0.0785(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     16.11     1.980      8.39    0.079      9.119
2      7.35     0.860      7.83    0.079      9.570
Qmax(1) =
         1.000 *    1.000 *    16.110) +
         0.952 *    1.000 *     7.346) + =      23.108
Qmax(2) =
         1.050 *    0.933 *    16.110) +
         1.000 *    1.000 *     7.346) + =      23.133

Total of 2 main streams to confluence:
Flow rates before confluence point:
      17.110       8.346
Maximum flow rates at confluence using above data:
       23.108       23.133
Area of streams before confluence:
        1.980        0.860
Effective area values after confluence:
        2.840        2.708


Results of confluence:
Total flow rate =     23.133(CFS)
Time of concentration =     7.827 min.
```

```
Effective stream area after confluence  =      2.708(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.079(In/Hr)
Study area total =       2.84(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      320.000 to Point/Station      330.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =  2190.000(Ft.)
Downstream point/station elevation =  2179.000(Ft.)
Pipe length  =   142.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    23.133(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =    23.133(CFS)
Normal flow depth in pipe =   11.41(In.)
Flow top width inside pipe =   17.34(In.)
Critical depth could not be calculated.
Pipe flow velocity =     19.56(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =     7.95 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      320.000 to Point/Station      330.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 0.9600     Max loss rate(Fm)=     0.134(In/Hr)
Time of concentration =     7.95 min.
Rainfall intensity =      9.468(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.890
Subarea runoff =     15.039(CFS) for    1.820(Ac.)
Total runoff =     38.172(CFS)
Effective area this stream =        4.53(Ac.)
Total Study Area (Main Stream No. 1) =       15.67(Ac.)
Area averaged Fm value =    0.101(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      320.000 to Point/Station      330.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      4.528(Ac.)
Runoff from this stream =     38.172(CFS)
Time of concentration =    7.95 min.
Rainfall intensity =     9.468(In/Hr)
Area averaged loss rate (Fm) =    0.1010(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4457
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      400.000 to Point/Station      410.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.2300     Max loss rate(Fm)=     0.181(In/Hr)
Initial subarea data:
Initial area flow distance =   456.000(Ft.)
Top (of initial area) elevation =  2200.000(Ft.)
Bottom (of initial area) elevation =  2181.000(Ft.)
Difference in elevation =    19.000(Ft.)
Slope =    0.04167  s(%)=       4.17
TC = k(0.331)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.240 min.
Rainfall intensity =     10.107(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
Subarea runoff =      4.109(CFS)
Total initial stream area =        0.460(Ac.)
Pervious area fraction = 0.230
Initial area Fm value =    0.181(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      400.000 to Point/Station      410.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.460(Ac.)
Runoff from this stream =      4.109(CFS)
Time of concentration =    7.24 min.
Rainfall intensity =    10.107(In/Hr)
Area averaged loss rate (Fm) =    0.1806(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2300
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     38.17     4.528      7.95    0.101      9.468
2      4.11     0.460      7.24    0.181     10.107
Qmax(1) =
        1.000 *    1.000 *    38.172) +
        0.936 *    1.000 *     4.109) + =      42.017
Qmax(2) =
        1.068 *    0.911 *    38.172) +
        1.000 *    1.000 *     4.109) + =      41.253

Total of 2 main streams to confluence:
Flow rates before confluence point:
      39.172       5.109
```

```
Maximum flow rates at confluence using above data:
       42.017       41.253
Area of streams before confluence:
        4.528        0.460
Effective area values after confluence:
        4.988        4.585


Results of confluence:
Total flow rate =     42.017(CFS)
Time of concentration =     7.948 min.
Effective stream area after confluence  =      4.988(Ac.)
Study area average Pervious fraction(Ap) =  0.426
Study area average soil loss rate(Fm) =    0.108(In/Hr)
Study area total =       4.99(Ac.)
End of computations, Total Study Area =           16.13 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.815
Area averaged SCS curve number =  68.6
```

# RATIONAL METHOD HYDROLOGY
# EXISTING CONDITION

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 11/18/22

---

MOUNTAIN AVENUE BEES
100 YEAR 1 HOUR STORM
EXISTING CONDITION

---

Program License Serial Number 6165

---

********* Hydrology Study Control Information **********

---

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 2.300 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Process from Point/Station 100.000 to Point/Station 110.000
**** INITIAL AREA EVALUATION ****

---

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.140(In/Hr)
Initial subarea data:
Initial area flow distance = 881.000(Ft.)
Top (of initial area) elevation = 2455.000(Ft.)
Bottom (of initial area) elevation = 2216.000(Ft.)
Difference in elevation = 239.000(Ft.)
Slope = 0.27128 s(%)= 27.13
TC = k(0.615)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.028 min.
Rainfall intensity = 7.084(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff = 26.500(CFS)
Total initial stream area = 4.240(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.140(In/Hr)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Process from Point/Station 110.000 to Point/Station 120.000
**** IMPROVED CHANNEL TRAVEL TIME ****

---

```
Upstream point elevation =  2216.000(Ft.)
Downstream point elevation =  2190.000(Ft.)
Channel length thru subarea  =   690.000(Ft.)
Channel base width     =    0.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     34.656(CFS)
Manning's 'N'    = 0.025
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     34.656(CFS)
Depth of flow =   1.424(Ft.), Average velocity =   8.542(Ft/s)
Channel flow top width =    5.697(Ft.)
Flow Velocity =    8.54(Ft/s)
Travel time  =    1.35 min.
Time of concentration =   13.37 min.
Critical depth =      1.797(Ft.)
 Adding area flow to channel
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      6.577(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.881
Subarea runoff =     16.257(CFS) for    3.140(Ac.)
Total runoff =     42.756(CFS)
Effective area this stream =        7.38(Ac.)
Total Study Area (Main Stream No. 1) =        7.38(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   1.541(Ft.), Average velocity =   9.002(Ft/s)
Critical depth =      1.953(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      210.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Initial subarea data:
Initial area flow distance =   872.000(Ft.)
Top (of initial area) elevation =  2390.000(Ft.)
Bottom (of initial area) elevation =  2195.000(Ft.)
Difference in elevation =   195.000(Ft.)
Slope =    0.22362  s(%)=      22.36
TC = k(0.615)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.451 min.
Rainfall intensity =      6.915(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff =     22.134(CFS)
Total initial stream area =        3.630(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.140(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      310.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 0.9300     Max loss rate(Fm)=     0.130(In/Hr)
Initial subarea data:
Initial area flow distance =   826.000(Ft.)
Top (of initial area) elevation =  2216.000(Ft.)
Bottom (of initial area) elevation =  2180.000(Ft.)
Difference in elevation =    36.000(Ft.)
Slope =    0.04358  s(%)=       4.36
TC = k(0.504)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.843 min.
Rainfall intensity =      6.421(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff =     28.986(CFS)
Total initial stream area =        5.120(Ac.)
Pervious area fraction = 0.930
Initial area Fm value =    0.130(In/Hr)
End of computations, Total Study Area =           16.13 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.978
Area averaged SCS curve number =  78.0
```

INFILTRATION BASIN
HYDROGRAPH ROUTING

# Table of Contents

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

# Contents continued...

# Basin Model

Hydrology Studio v 3.0.0.26

Project Name:

11-29-2022

# Hydrograph by Return Period

Project Name:

11-29-2022

Hydrology Studio v 3.0.0.26

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Outflow (cfs) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 1 | NRCS Runoff | EX CONDITION DA 1 | | 11.88 | | 17.75 | 22.59 | 29.18 | | 39.37 |
| 2 | NRCS Runoff | DEV CONDITION DA 1 | | 15.21 | | 21.64 | 26.84 | 33.86 | | 44.65 |
| 3 | Pond Route | BASIN 1 | | 0.000 | | 0.818 | 2.060 | 3.955 | | 9.490 |

# Hydrograph 2-yr Summary

Project Name:

11-29-2022

Hydrology Studio v 3.0.0.26

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Flow (cfs) | Time to Peak (hrs) | Hydrograph Volume (cuft) | Inflow Hyd(s) | Maximum Elevation (ft) | Maximum Storage (cuft) |
|---|---|---|---|---|---|---|---|---|
| 1 | NRCS Runoff | EX CONDITION DA 1 | 11.88 | 10.00 | 61,947 | ---- | | |
| 2 | NRCS Runoff | DEV CONDITION DA 1 | 15.21 | 9.97 | 70,369 | ---- | | |
| 3 | Pond Route | BASIN 1 | 0.000 | 8.80 | 0.000 | 2 | 2180.89 | 23,711 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

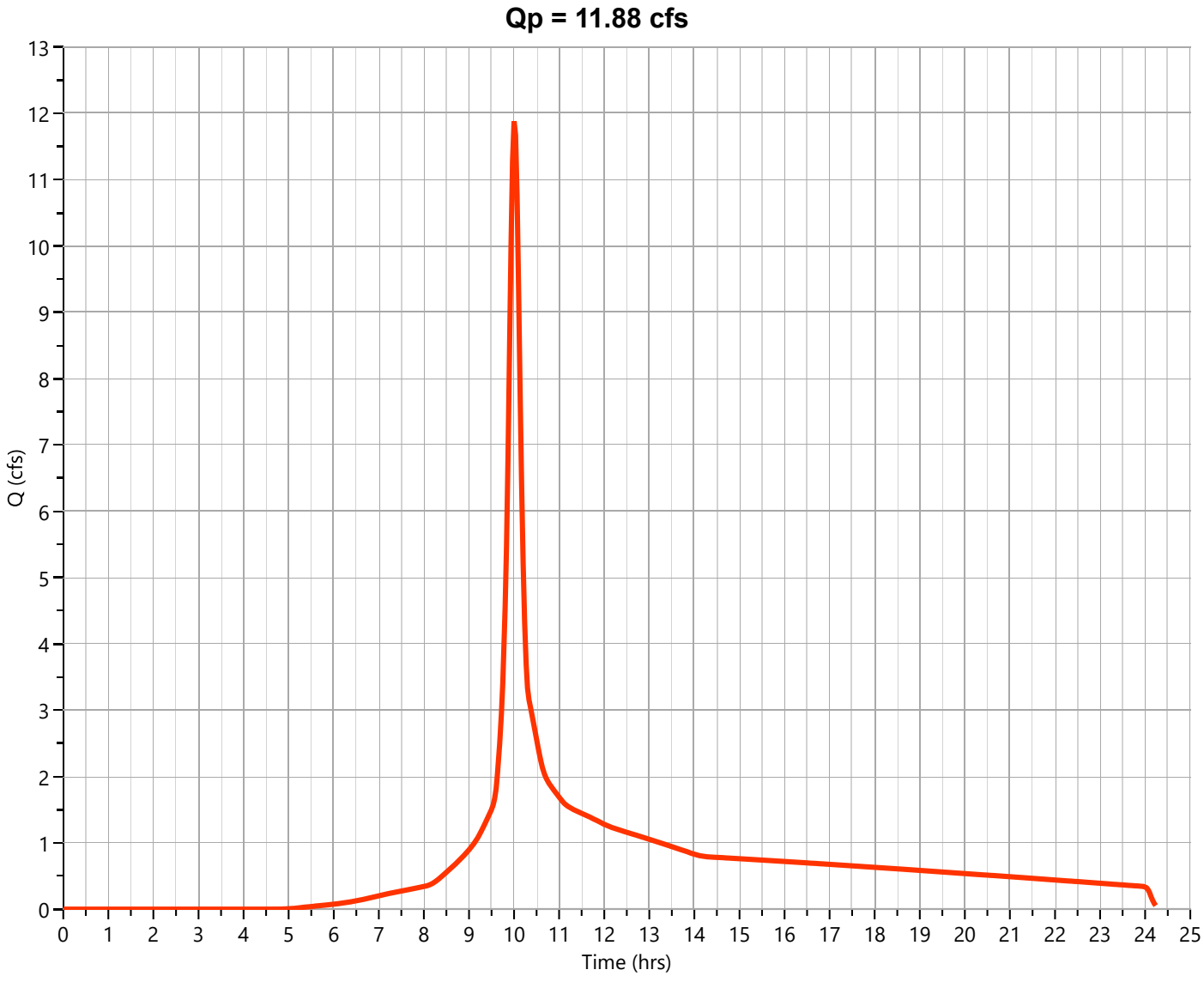
## EX CONDITION DA 1

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 11.88 cfs |
| Storm Frequency | = 2-yr | Time to Peak | = 10.00 hrs |
| Time Interval | = 2 min | Runoff Volume | = 61,947 cuft |
| Drainage Area | = 5.12 ac | Curve Number | = 79.41* |
| Tc Method | = User | Time of Conc. (Tc) | = 12.45 min |
| Total Rainfall | = 5.45 in | Design Storm | = Type I |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.76 | 78 | BARREN |
| 0.36 | 98 | IMPERVIOUS |
| **5.12** | **79** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

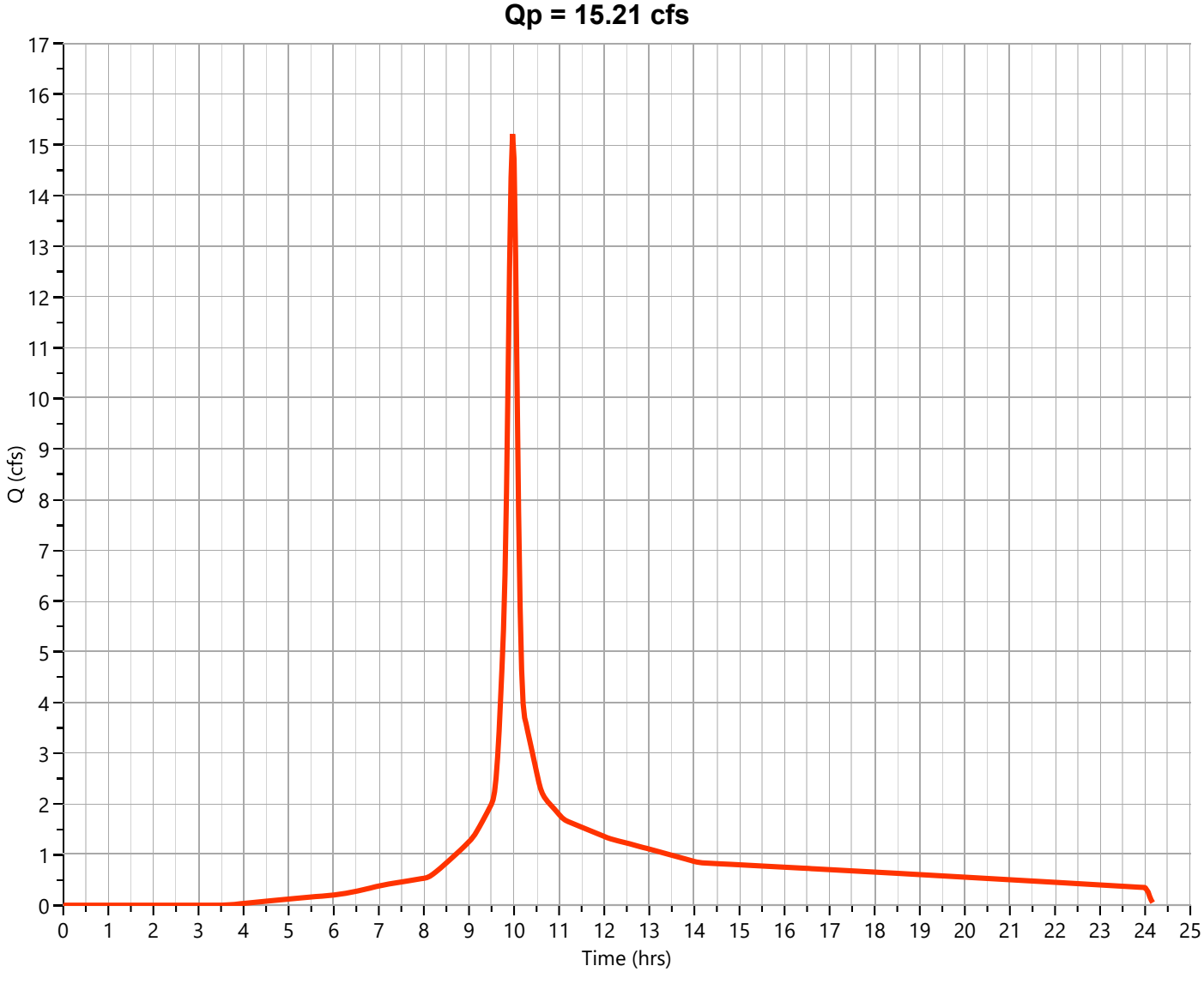
## DEV CONDITION DA 1

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 15.21 cfs |
| Storm Frequency | = 2-yr | Time to Peak | = 9.97 hrs |
| Time Interval | = 2 min | Runoff Volume | = 70,369 cuft |
| Drainage Area | = 5.12 ac | Curve Number | = 85* |
| Tc Method | = User | Time of Conc. (Tc) | = 7.95 min |
| Total Rainfall | = 5.45 in | Design Storm | = Type I |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 2.61 | 98 | CONC/BLDG |
| 2.15 | 78 | NATURAL |
| 0.36 | 32 | LANDSCAPE |
| **5.12** | **85** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

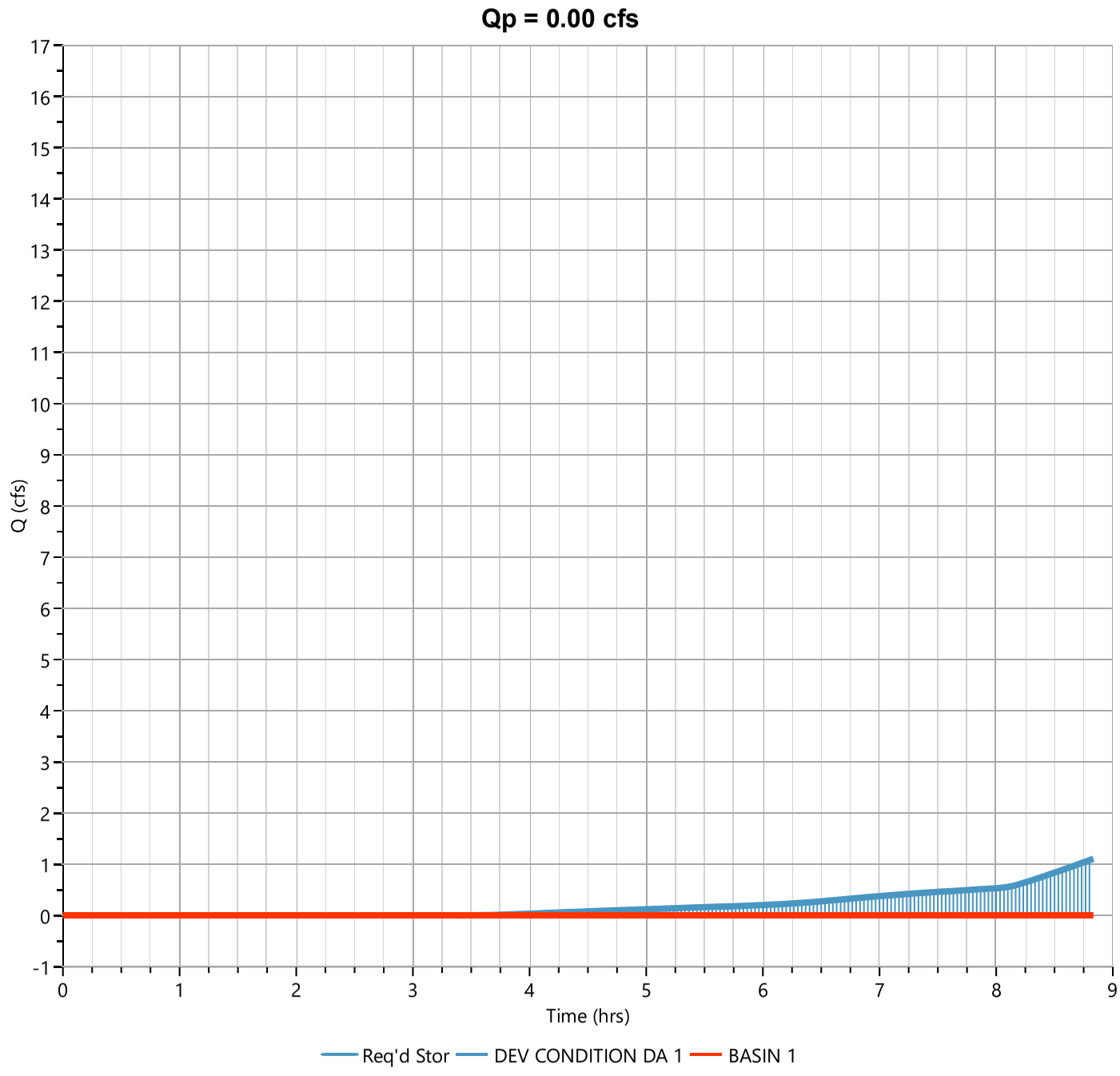
11-29-2022

## BASIN 1

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 0.000 cfs |
| Storm Frequency | = 2-yr | Time to Peak | = 8.80 hrs |
| Time Interval | = 2 min | Hydrograph Volume | = 0.000 cuft |
| Inflow Hydrograph | = 2 - DEV CONDITION DA 1 | Max. Elevation | = 2180.89 ft |
| Pond Name | = BASIN | Max. Storage | = 23,711 cuft |

*Pond Routing by Storage Indication Method*



# Pond Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

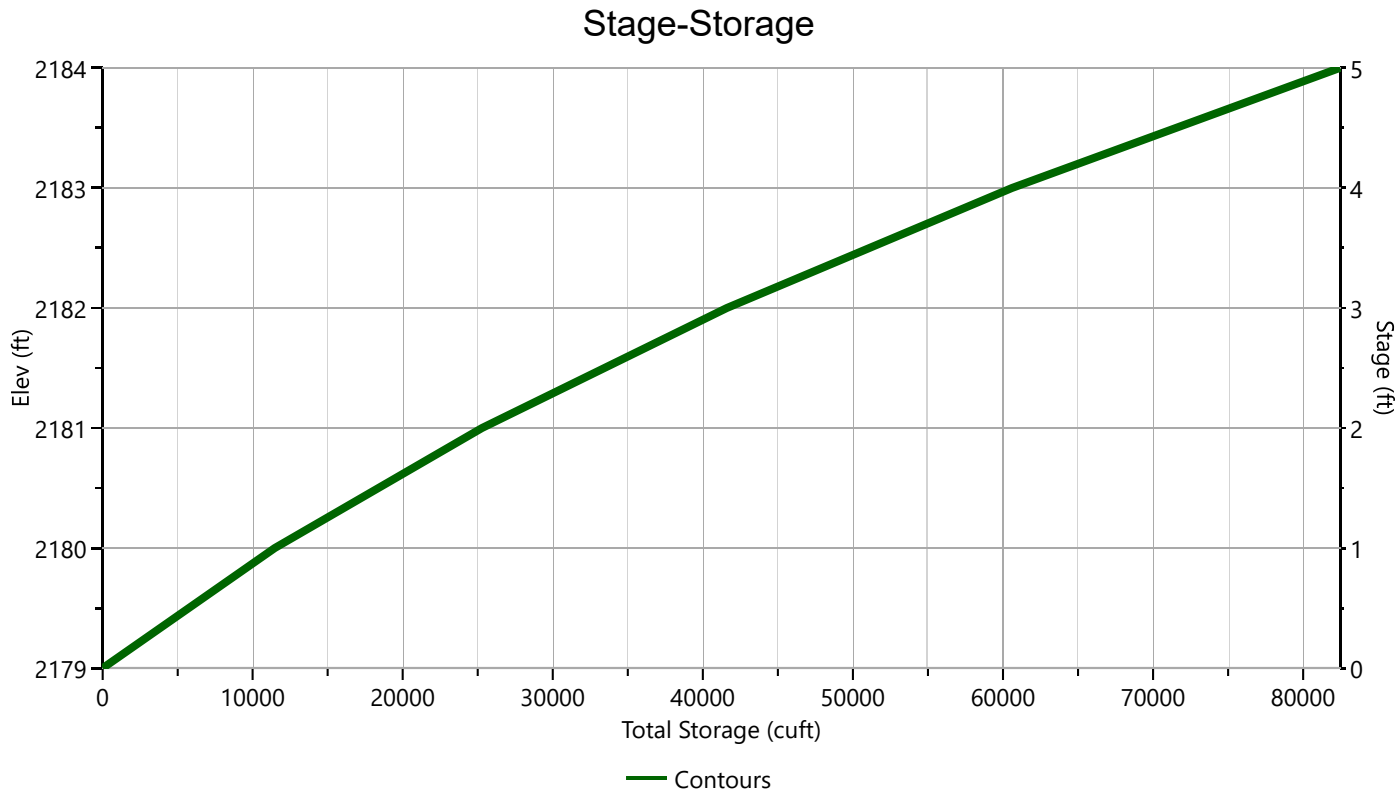
## BASIN

## Stage-Storage

| User Defined Contours | |
|---|---|
| **Description** | **Input** |
| Bottom Elevation, ft | 2179.00 |
| Voids (%) | 100.00 |
| Volume Calc | None |

**Stage / Storage Table**

| Stage (ft) | Elevation (ft) | Contour Area (sqft) | Incr. Storage (cuft) | Total Storage (cuft) |
|---|---|---|---|---|
| 0.00 | 2179.00 | 10,356 | 0.000 | 0.000 |
| 1.00 | 2180.00 | 12,597 | 11,477 | 11,477 |
| 2.00 | 2181.00 | 15,014 | 13,806 | 25,282 |
| 3.00 | 2182.00 | 17,611 | 16,313 | 41,595 |
| 4.00 | 2183.00 | 20,388 | 19,000 | 60,594 |
| 5.00 | 2184.00 | 23,345 | 21,867 | 82,461 |



# Pond Report

Project Name:

Hydrology Studio v 3.0.0.26

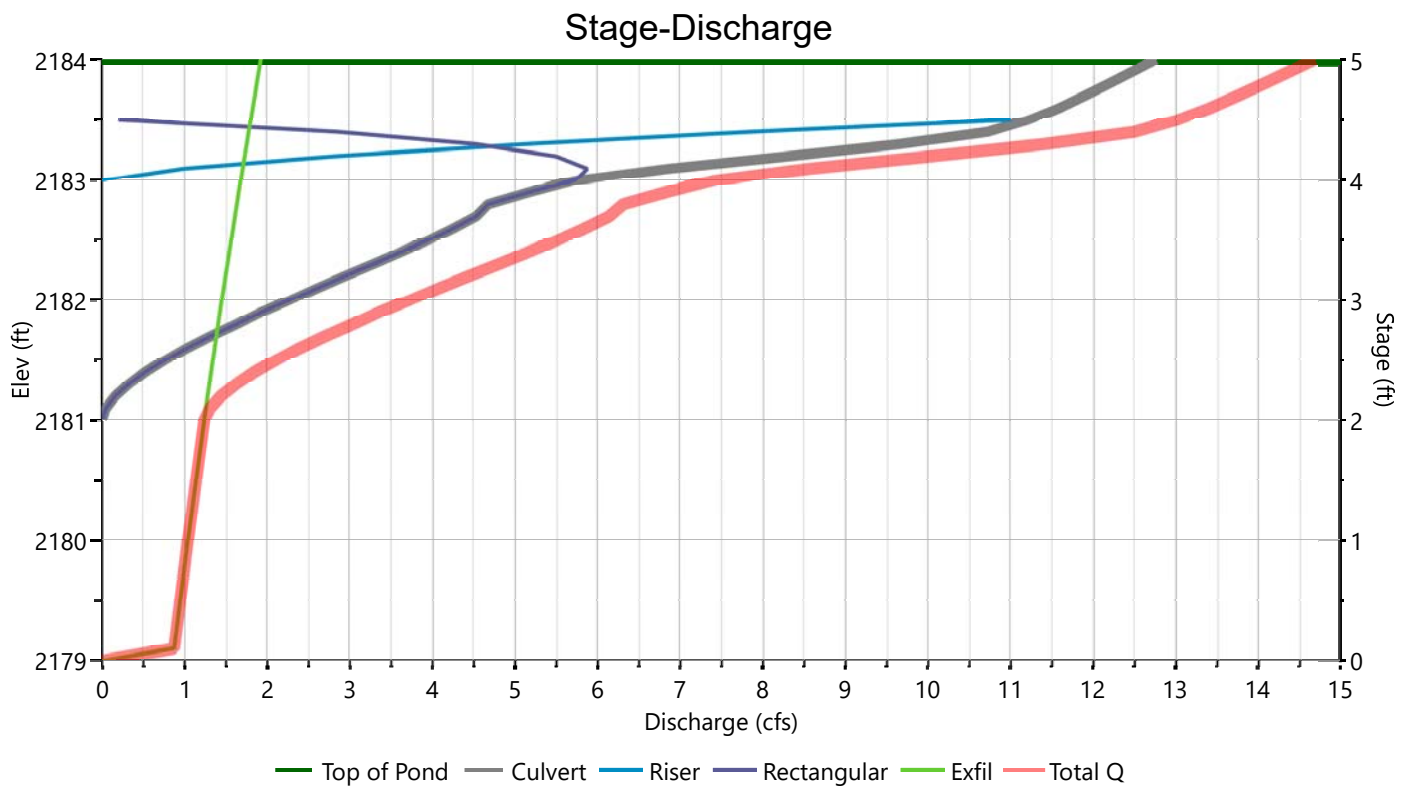
11-29-2022

## BASIN

## Stage-Discharge

| Culvert / Orifices | Culvert | Orifices | | | Orifice Plate | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | | |
| Rise, in | 18 | | | | Orifice Dia, in | |
| Span, in | 18 | | | | No. Orifices | |
| No. Barrels | 1 | | | | Invert Elevation, ft | |
| Invert Elevation, ft | 2181.00 | | | | Height, ft | |
| Orifice Coefficient, Co | 0.60 | | | | Orifice Coefficient, Co | |
| Length, ft | 20 | | | | | |
| Barrel Slope, % | 1 | | | | | |
| N-Value, n | 0.013 | | | | | |
| **Weirs** | **Riser*** | **Weirs** | | | **Ancillary** | |
| | | 1* | 2 | 3 | | |
| Shape / Type | Circular | Rectangular | Rectangular | | Exfiltration, in/hr | 3.56** |
| Crest Elevation, ft | 2183 | 2181 | 2183.5 | | | |
| Crest Length, ft | 9.42 | 1 | 10 | | | |
| Angle, deg | | | | | | |
| Weir Coefficient, Cw | 3.3 | 3.3 | 2.6 | | | |

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



## BASIN

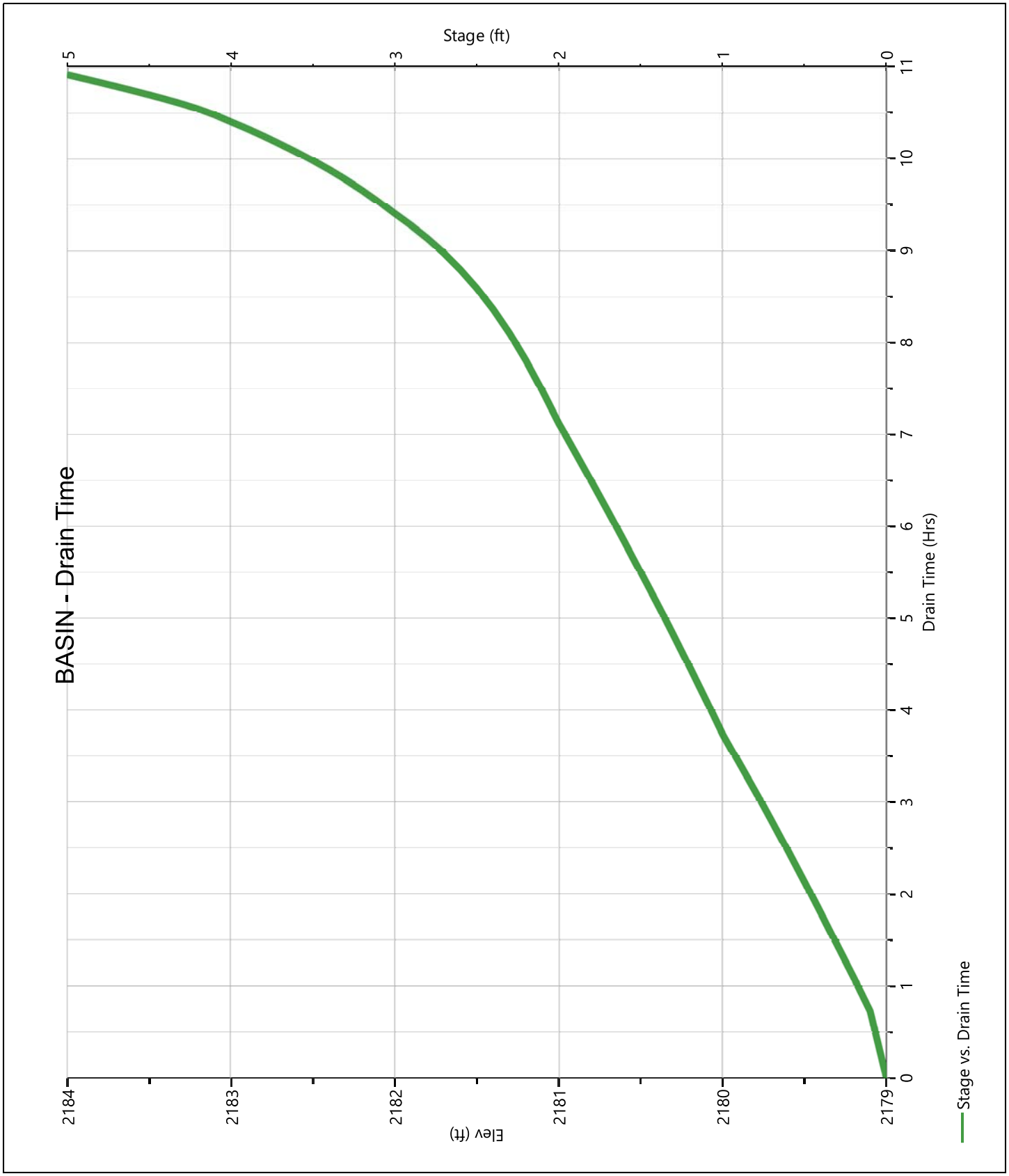
## Stage-Storage-Discharge Summary

| Stage (ft) | Elev. (ft) | Storage (cuft) | Culvert (cfs) | Orifices, cfs | | | Riser (cfs) | Weirs, cfs | | | Pf Riser (cfs) | Exfil (cfs) | User (cfs) | Total (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | | 1 | 2 | 3 | | | | |
| 0.00 | 2179.00 | 0.000 | 0.000 | | | | 0.000 | 0.000 | 0.000 | | | 0.000 | | 0.000 |
| 1.00 | 2180.00 | 11,477 | 0.000 | | | | 0.000 | 0.000 | 0.000 | | | 1.038 | | 1.038 |
| 2.00 | 2181.00 | 25,282 | 0.000 | | | | 0.000 | 0.000 | 0.000 | | | 1.237 | | 1.237 |
| 3.00 | 2182.00 | 41,595 | 2.274 oc | | | | 0.000 | 2.274 s | 0.000 | | | 1.451 | | 3.726 |
| 4.00 | 2183.00 | 60,594 | 5.730 oc | | | | 0.000 | 5.730 s | 0.000 | | | 1.680 | | 7.411 |
| 5.00 | 2184.00 | 82,461 | 12.76 ic | | | | 0.000 | 0.000 | 0.000 | | | 1.924 | | 14.69 |

*Suffix key: ic = inlet control, oc = outlet control, s = submerged weir*

## BASIN

## Pond Drawdown



# Design Storm Report

Custom Storm filename: TR32850.cds

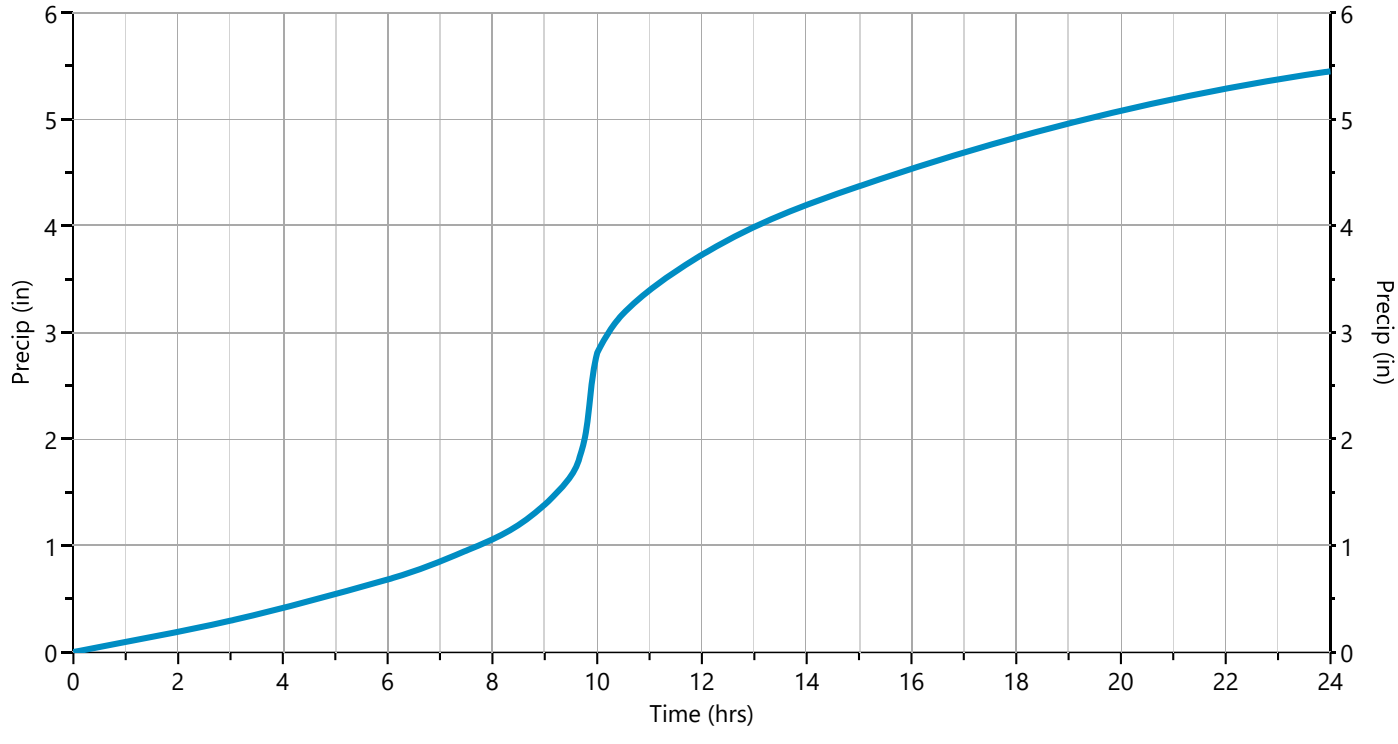
Hydrology Studio v 3.0.0.26

11-29-2022

## Storm Distribution: NRCS/SCS - Type I, 24-hr

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | ✔ 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | |
| 24 hrs | 0.00 | 5.45 | 0.00 | 7.15 | 8.53 | 10.40 | 0.00 | 13.30 | |

| Incremental Rainfall Distribution, 2-yr | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) |
| 8.87 | 0.013414 | 9.23 | 0.017358 | 9.60 | 0.035631 | 9.97 | 0.098613 | 10.33 | 0.022527 |
| 8.90 | 0.013647 | 9.27 | 0.017803 | 9.63 | 0.041425 | 10.00 | 0.057753 | 10.37 | 0.021437 |
| 8.93 | 0.013879 | 9.30 | 0.018249 | 9.67 | 0.047219 | 10.03 | 0.030672 | 10.40 | 0.020347 |
| 8.97 | 0.014112 | 9.33 | 0.018695 | 9.70 | 0.053013 | 10.07 | 0.031247 | 10.43 | 0.019257 |
| 9.00 | 0.014344 | 9.37 | 0.019140 | 9.73 | 0.058807 | 10.10 | 0.030157 | 10.47 | 0.018167 |
| 9.03 | 0.014685 | 9.40 | 0.019586 | 9.77 | 0.070967 | 10.13 | 0.029067 | 10.50 | 0.017077 |
| 9.07 | 0.015129 | 9.43 | 0.020032 | 9.80 | 0.103109 | 10.17 | 0.027977 | 10.53 | 0.016402 |
| 9.10 | 0.015575 | 9.47 | 0.020478 | 9.83 | 0.128850 | 10.20 | 0.026887 | 10.57 | 0.016132 |
| 9.13 | 0.016021 | 9.50 | 0.020923 | **9.87** | **0.141271** | 10.23 | 0.025797 | 10.60 | 0.015865 |
| 9.17 | 0.016466 | 9.53 | 0.024040 | 9.90 | 0.140372 | 10.27 | 0.024707 | 10.63 | 0.015599 |
| 9.20 | 0.016912 | 9.57 | 0.029837 | 9.93 | 0.126153 | 10.30 | 0.023617 | 10.67 | 0.015333 |



# Hydrograph 5-yr Summary

Project Name:

11-29-2022

Hydrology Studio v 3.0.0.26

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Flow (cfs) | Time to Peak (hrs) | Hydrograph Volume (cuft) | Inflow Hyd(s) | Maximum Elevation (ft) | Maximum Storage (cuft) |
|---|---|---|---|---|---|---|---|---|
| 1 | NRCS Runoff | EX CONDITION DA 1 | 17.75 | 10.00 | 91,374 | ---- | | |
| 2 | NRCS Runoff | DEV CONDITION DA 1 | 21.64 | 9.97 | 100,290 | ---- | | |
| 3 | Pond Route | BASIN 1 | 0.818 | 11.40 | 10,615 | 2 | 2181.52 | 33,771 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

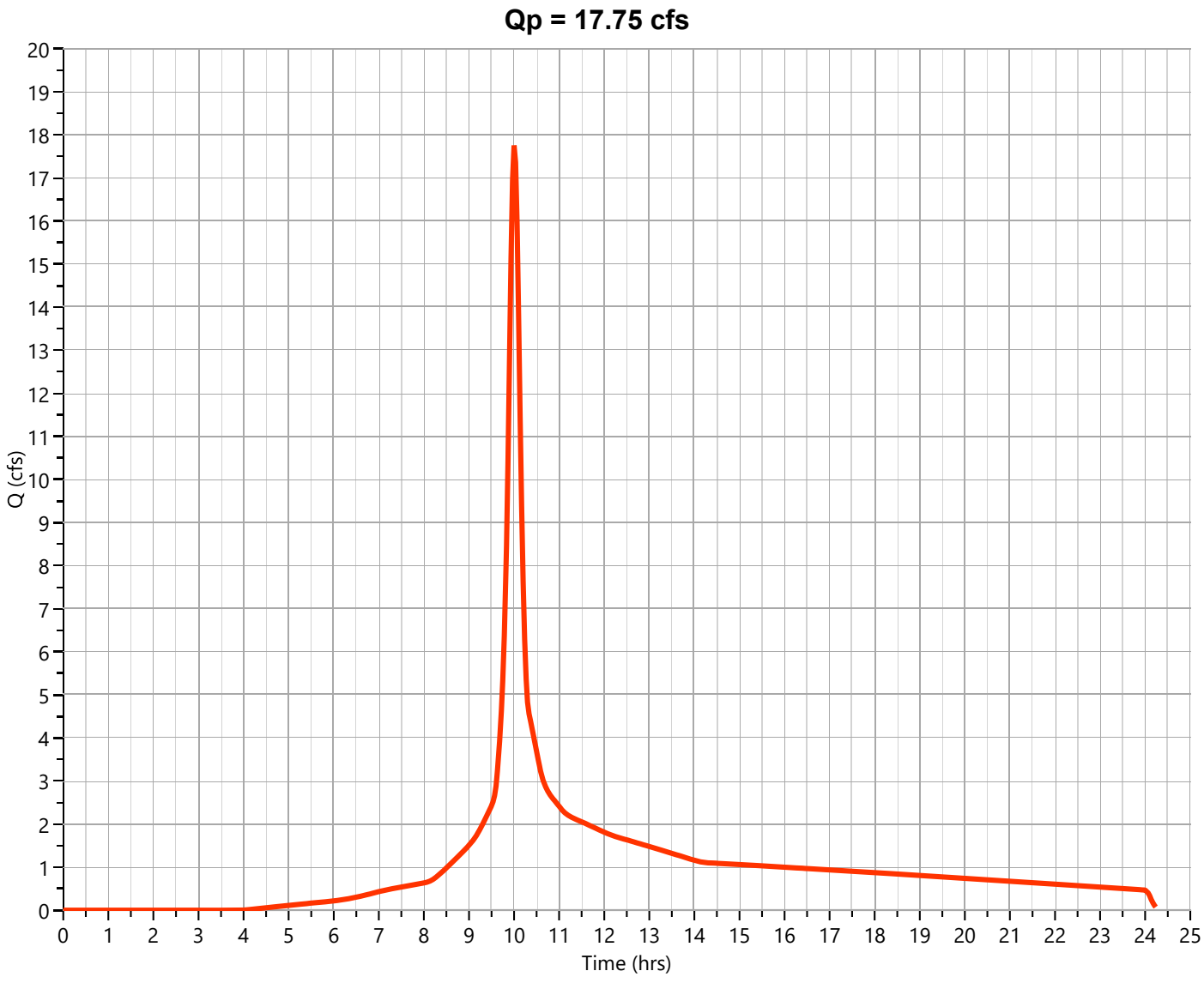
## EX CONDITION DA 1

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 17.75 cfs |
| Storm Frequency | = 5-yr | Time to Peak | = 10.00 hrs |
| Time Interval | = 2 min | Runoff Volume | = 91,374 cuft |
| Drainage Area | = 5.12 ac | Curve Number | = 79.41* |
| Tc Method | = User | Time of Conc. (Tc) | = 12.45 min |
| Total Rainfall | = 7.15 in | Design Storm | = Type I |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.76 | 78 | BARREN |
| 0.36 | 98 | IMPERVIOUS |
| **5.12** | **79** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

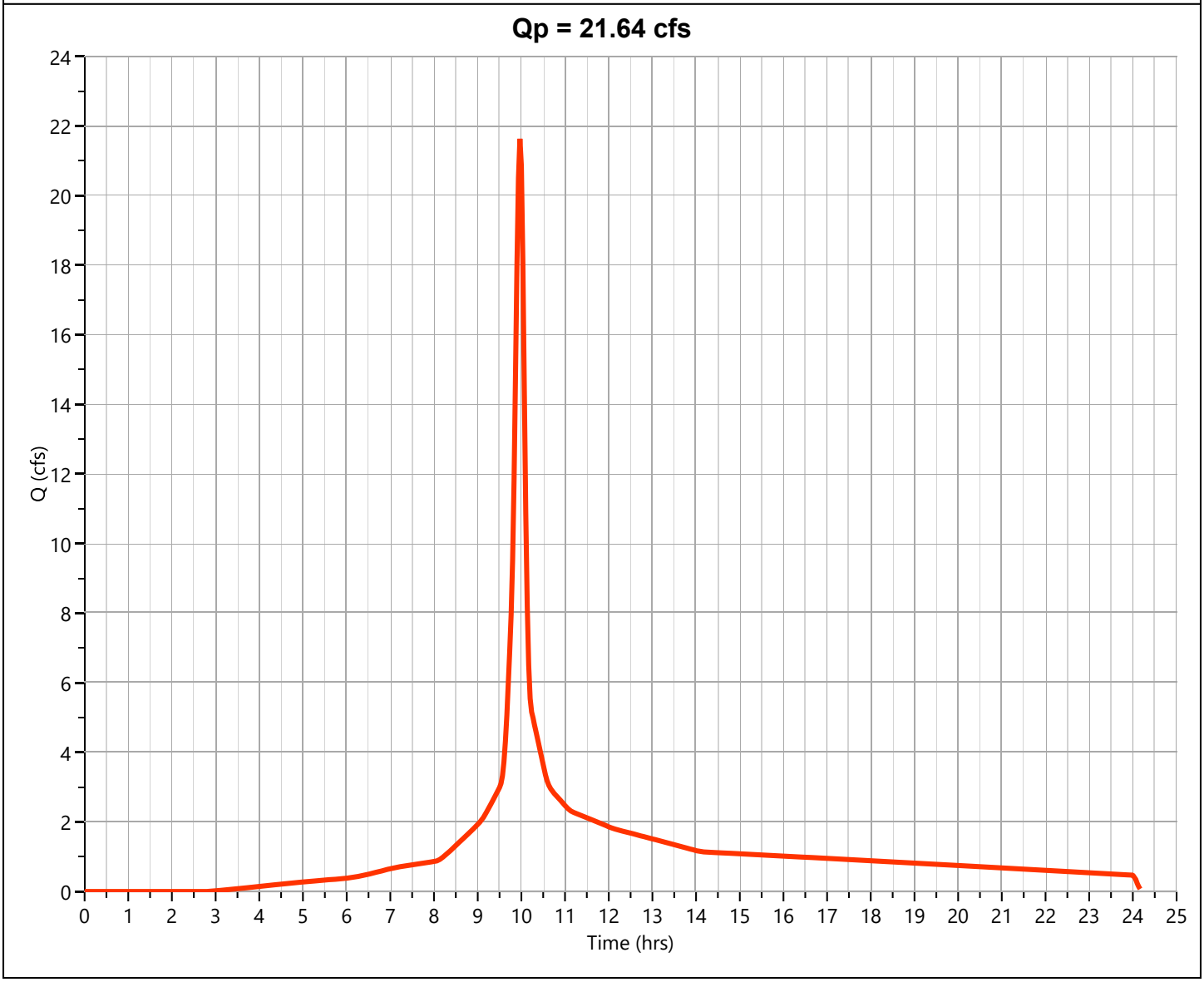
## DEV CONDITION DA 1

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 21.64 cfs |
| Storm Frequency | = 5-yr | Time to Peak | = 9.97 hrs |
| Time Interval | = 2 min | Runoff Volume | = 100,290 cuft |
| Drainage Area | = 5.12 ac | Curve Number | = 85* |
| Tc Method | = User | Time of Conc. (Tc) | = 7.95 min |
| Total Rainfall | = 7.15 in | Design Storm | = Type I |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 2.61 | 98 | CONC/BLDG |
| 2.15 | 78 | NATURAL |
| 0.36 | 32 | LANDSCAPE |
| **5.12** | **85** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

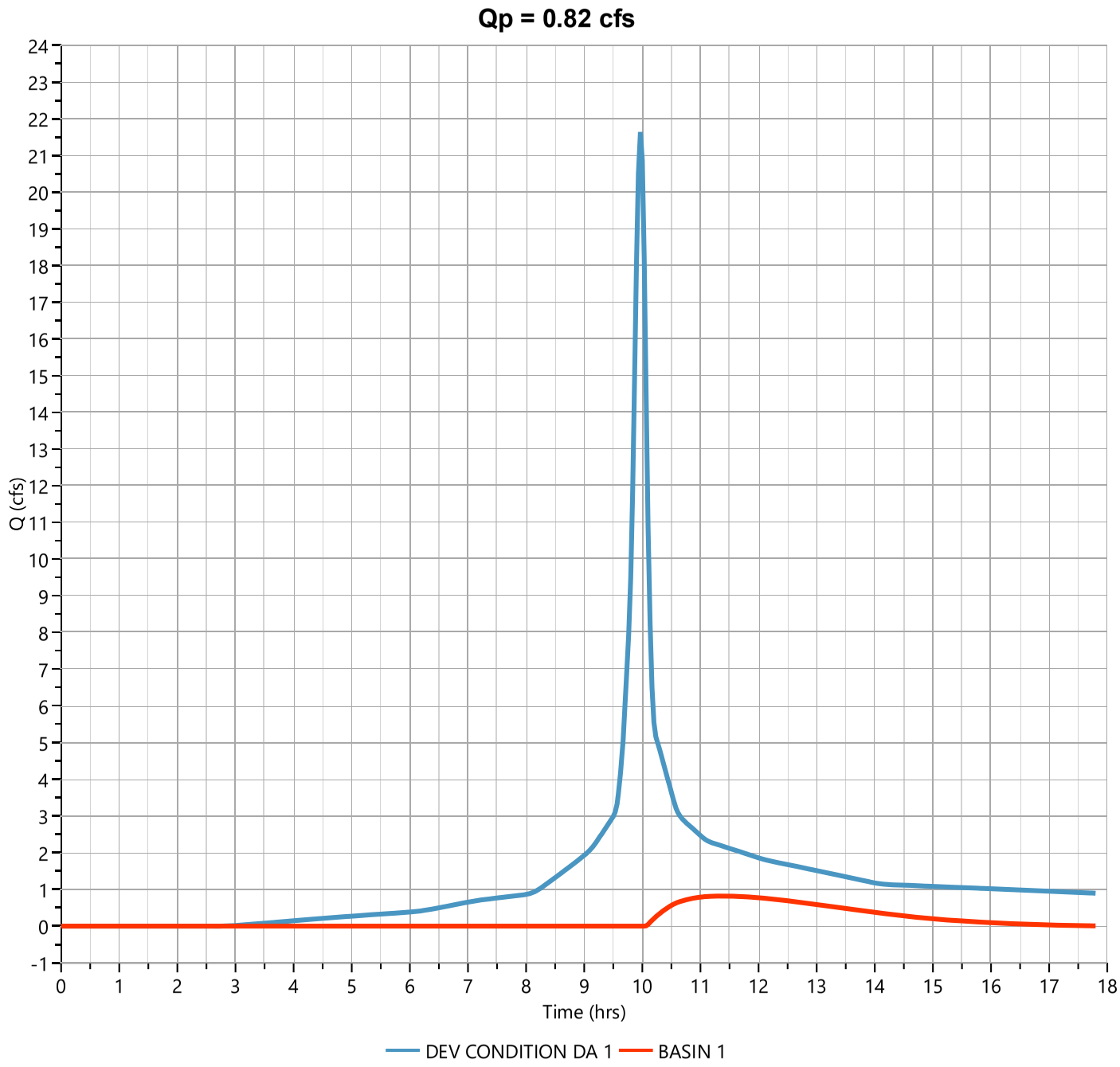
11-29-2022

## BASIN 1

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 0.818 cfs |
| Storm Frequency | = 5-yr | Time to Peak | = 11.40 hrs |
| Time Interval | = 2 min | Hydrograph Volume | = 10,615 cuft |
| Inflow Hydrograph | = 2 - DEV CONDITION DA 1 | Max. Elevation | = 2181.52 ft |
| Pond Name | = BASIN | Max. Storage | = 33,771 cuft |

*Pond Routing by Storage Indication Method*



# Design Storm Report

Custom Storm filename: TR32850.cds

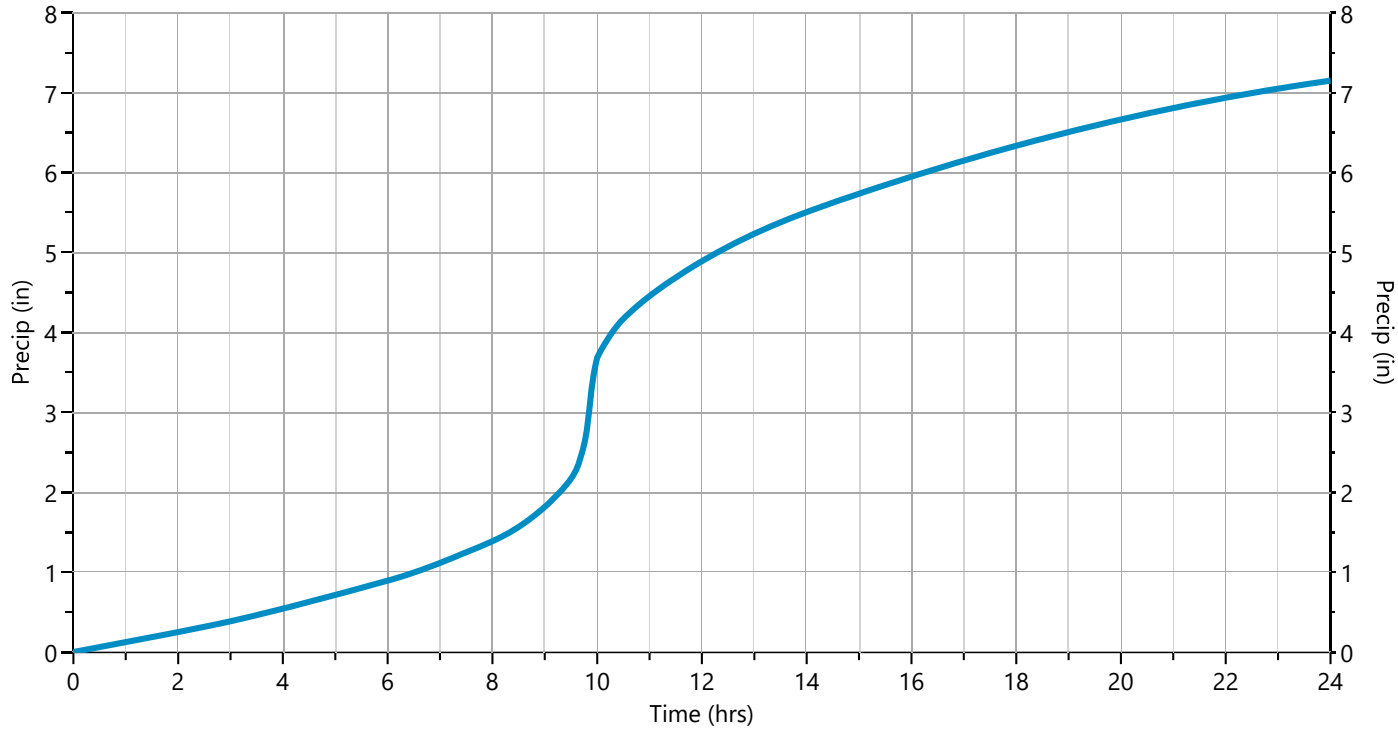
Hydrology Studio v 3.0.0.26

11-29-2022

## Storm Distribution: NRCS/SCS - Type I, 24-hr

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | ✔ 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | |
| 24 hrs | 0.00 | 5.45 | 0.00 | 7.15 | 8.53 | 10.40 | 0.00 | 13.30 | |

| Incremental Rainfall Distribution, 5-yr | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) |
| 8.87 | 0.017599 | 9.23 | 0.022772 | 9.60 | 0.046745 | 9.97 | 0.129373 | 10.33 | 0.029553 |
| 8.90 | 0.017904 | 9.27 | 0.023357 | 9.63 | 0.054346 | 10.00 | 0.075768 | 10.37 | 0.028123 |
| 8.93 | 0.018209 | 9.30 | 0.023941 | 9.67 | 0.061948 | 10.03 | 0.040239 | 10.40 | 0.026693 |
| 8.97 | 0.018514 | 9.33 | 0.024526 | 9.70 | 0.069549 | 10.07 | 0.040993 | 10.43 | 0.025263 |
| 9.00 | 0.018819 | 9.37 | 0.025111 | 9.73 | 0.077150 | 10.10 | 0.039563 | 10.47 | 0.023833 |
| 9.03 | 0.019265 | 9.40 | 0.025696 | 9.77 | 0.093103 | 10.13 | 0.038133 | 10.50 | 0.022403 |
| 9.07 | 0.019848 | 9.43 | 0.026280 | 9.80 | 0.135271 | 10.17 | 0.036703 | 10.53 | 0.021518 |
| 9.10 | 0.020433 | 9.47 | 0.026865 | 9.83 | 0.169042 | 10.20 | 0.035273 | 10.57 | 0.021164 |
| 9.13 | 0.021018 | 9.50 | 0.027450 | **9.87** | **0.185338** | 10.23 | 0.033843 | 10.60 | 0.020814 |
| 9.17 | 0.021603 | 9.53 | 0.031538 | 9.90 | 0.184158 | 10.27 | 0.032413 | 10.63 | 0.020465 |
| 9.20 | 0.022187 | 9.57 | 0.039144 | 9.93 | 0.165503 | 10.30 | 0.030983 | 10.67 | 0.020115 |



# Hydrograph 10-yr Summary

Project Name:

11-29-2022

Hydrology Studio v 3.0.0.26

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Flow (cfs) | Time to Peak (hrs) | Hydrograph Volume (cuft) | Inflow Hyd(s) | Maximum Elevation (ft) | Maximum Storage (cuft) |
|---|---|---|---|---|---|---|---|---|
| 1 | NRCS Runoff | EX CONDITION DA 1 | 22.59 | 10.00 | 116,005 | ---- | | |
| 2 | NRCS Runoff | DEV CONDITION DA 1 | 26.84 | 9.97 | 124,999 | ---- | | |
| 3 | Pond Route | BASIN 1 | 2.060 | 10.73 | 25,944 | 2 | 2181.94 | 40,545 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

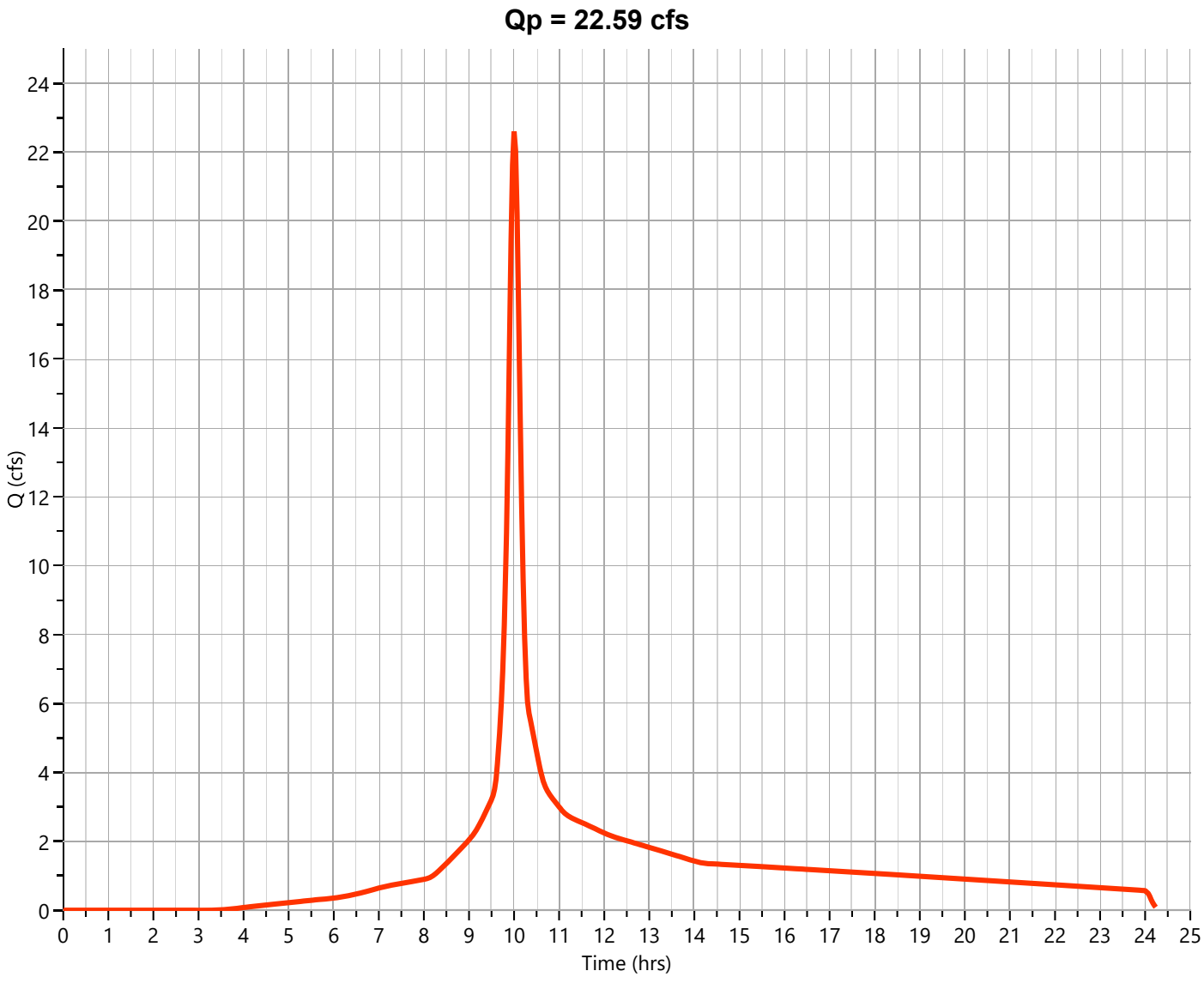
## EX CONDITION DA 1

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 22.59 cfs |
| Storm Frequency | = 10-yr | Time to Peak | = 10.00 hrs |
| Time Interval | = 2 min | Runoff Volume | = 116,005 cuft |
| Drainage Area | = 5.12 ac | Curve Number | = 79.41* |
| Tc Method | = User | Time of Conc. (Tc) | = 12.45 min |
| Total Rainfall | = 8.53 in | Design Storm | = Type I |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.76 | 78 | BARREN |
| 0.36 | 98 | IMPERVIOUS |
| **5.12** | **79** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

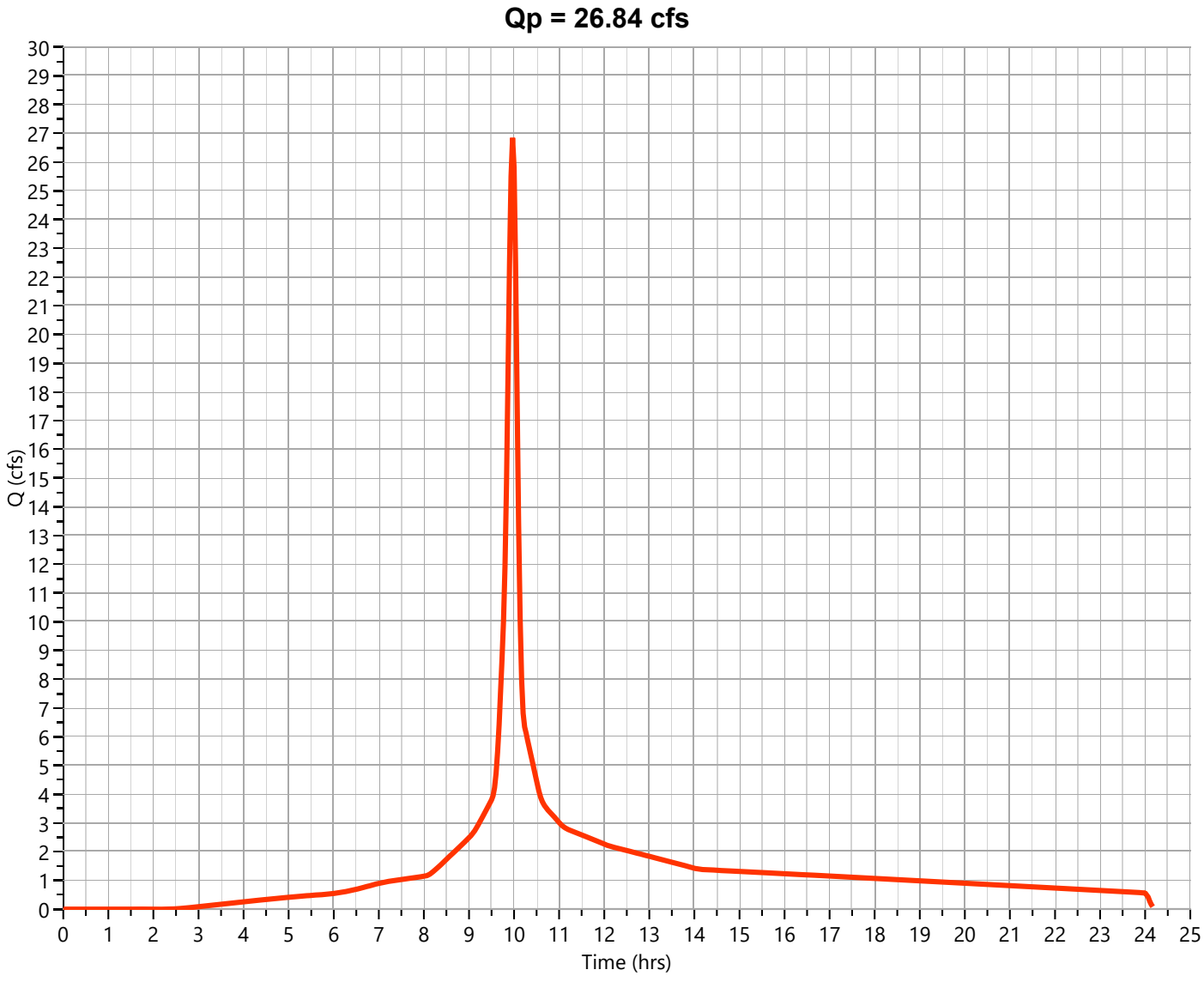
## DEV CONDITION DA 1

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 26.84 cfs |
| Storm Frequency | = 10-yr | Time to Peak | = 9.97 hrs |
| Time Interval | = 2 min | Runoff Volume | = 124,999 cuft |
| Drainage Area | = 5.12 ac | Curve Number | = 85* |
| Tc Method | = User | Time of Conc. (Tc) | = 7.95 min |
| Total Rainfall | = 8.53 in | Design Storm | = Type I |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 2.61 | 98 | CONC/BLDG |
| 2.15 | 78 | NATURAL |
| 0.36 | 32 | LANDSCAPE |
| **5.12** | **85** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

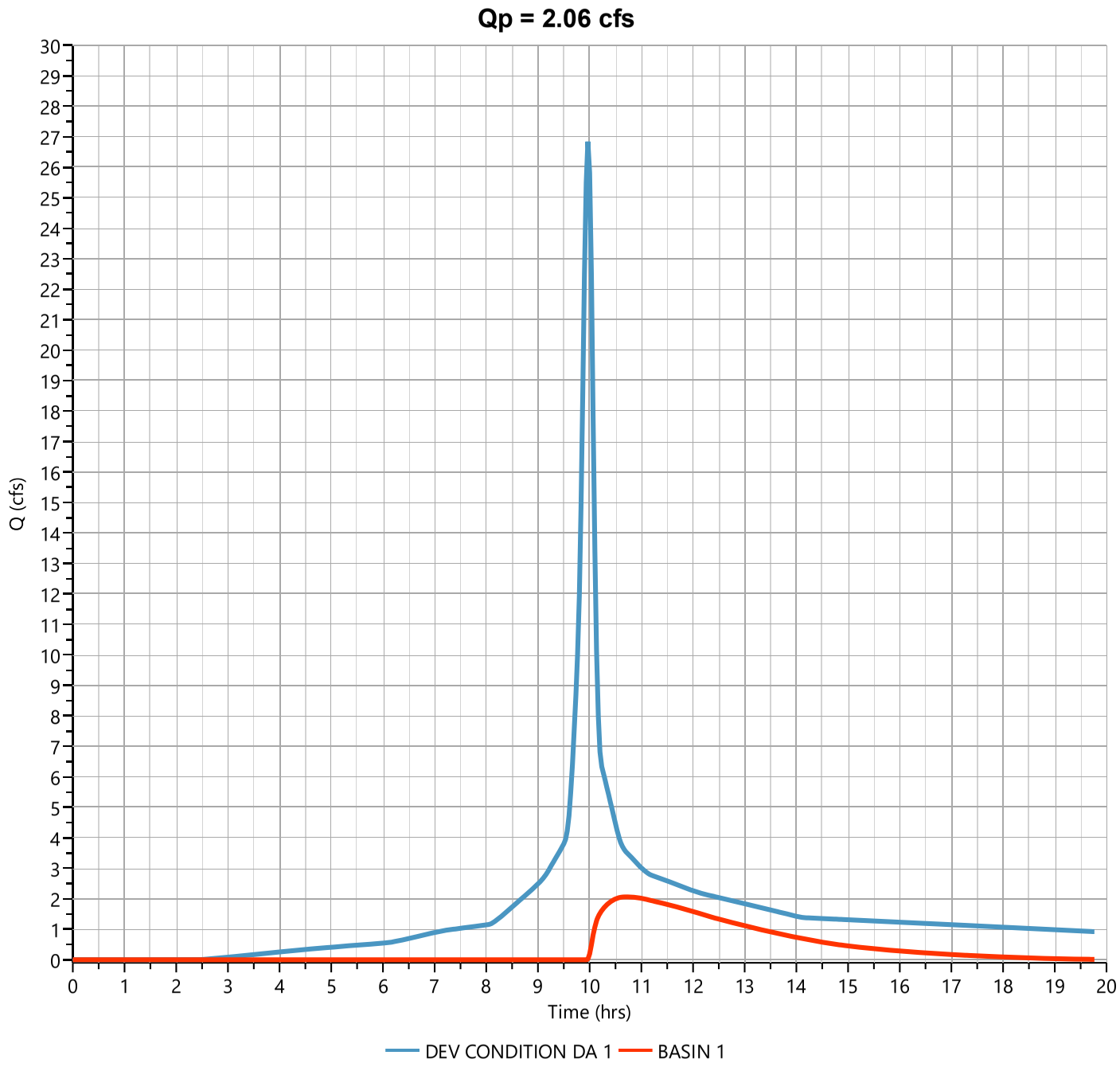
## BASIN 1

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 2.060 cfs |
| Storm Frequency | = 10-yr | Time to Peak | = 10.73 hrs |
| Time Interval | = 2 min | Hydrograph Volume | = 25,944 cuft |
| Inflow Hydrograph | = 2 - DEV CONDITION DA 1 | Max. Elevation | = 2181.94 ft |
| Pond Name | = BASIN | Max. Storage | = 40,545 cuft |

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 3 min*



# Design Storm Report

Custom Storm filename: TR32850.cds

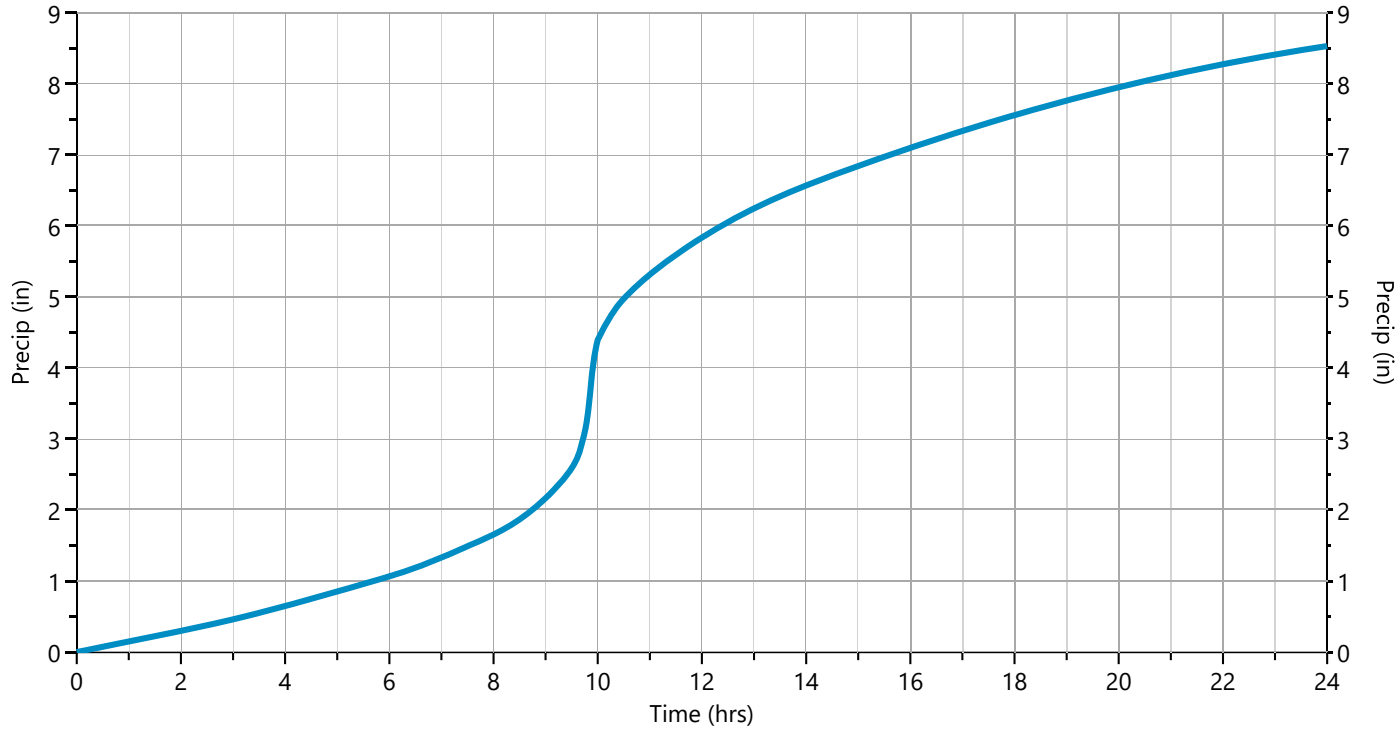
Hydrology Studio v 3.0.0.26

11-29-2022

## Storm Distribution: NRCS/SCS - Type I, 24-hr

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | 5-yr | ✔ 10-yr | 25-yr | 50-yr | 100-yr | |
| 24 hrs | 0.00 | 5.45 | 0.00 | 7.15 | 8.53 | 10.40 | 0.00 | 13.30 | |

| Incremental Rainfall Distribution, 10-yr | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) |
| 8.87 | 0.020995 | 9.23 | 0.027167 | 9.60 | 0.055767 | 9.97 | 0.154343 | 10.33 | 0.035257 |
| 8.90 | 0.021359 | 9.27 | 0.027865 | 9.63 | 0.064836 | 10.00 | 0.090392 | 10.37 | 0.033551 |
| 8.93 | 0.021723 | 9.30 | 0.028562 | 9.67 | 0.073904 | 10.03 | 0.048005 | 10.40 | 0.031845 |
| 8.97 | 0.022087 | 9.33 | 0.029260 | 9.70 | 0.082972 | 10.07 | 0.048905 | 10.43 | 0.030139 |
| 9.00 | 0.022451 | 9.37 | 0.029957 | 9.73 | 0.092041 | 10.10 | 0.047199 | 10.47 | 0.028433 |
| 9.03 | 0.022984 | 9.40 | 0.030655 | 9.77 | 0.111073 | 10.13 | 0.045493 | 10.50 | 0.026727 |
| 9.07 | 0.023679 | 9.43 | 0.031353 | 9.80 | 0.161379 | 10.17 | 0.043787 | 10.53 | 0.025671 |
| 9.10 | 0.024377 | 9.47 | 0.032050 | 9.83 | 0.201668 | 10.20 | 0.042081 | 10.57 | 0.025249 |
| 9.13 | 0.025074 | 9.50 | 0.032748 | **9.87** | **0.221109** | 10.23 | 0.040375 | 10.60 | 0.024832 |
| 9.17 | 0.025772 | 9.53 | 0.037625 | 9.90 | 0.219702 | 10.27 | 0.038669 | 10.63 | 0.024415 |
| 9.20 | 0.026470 | 9.57 | 0.046699 | 9.93 | 0.197446 | 10.30 | 0.036963 | 10.67 | 0.023998 |



# Hydrograph 25-yr Summary

Project Name:

11-29-2022

Hydrology Studio v 3.0.0.26

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Flow (cfs) | Time to Peak (hrs) | Hydrograph Volume (cuft) | Inflow Hyd(s) | Maximum Elevation (ft) | Maximum Storage (cuft) |
|---|---|---|---|---|---|---|---|---|
| 1 | NRCS Runoff | EX CONDITION DA 1 | 29.18 | 10.00 | 150,025 | ---- | | |
| 2 | NRCS Runoff | DEV CONDITION DA 1 | 33.86 | 9.97 | 158,833 | ---- | | |
| 3 | Pond Route | BASIN 1 | 3.955 | 10.50 | 49,905 | 2 | 2182.50 | 51,153 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

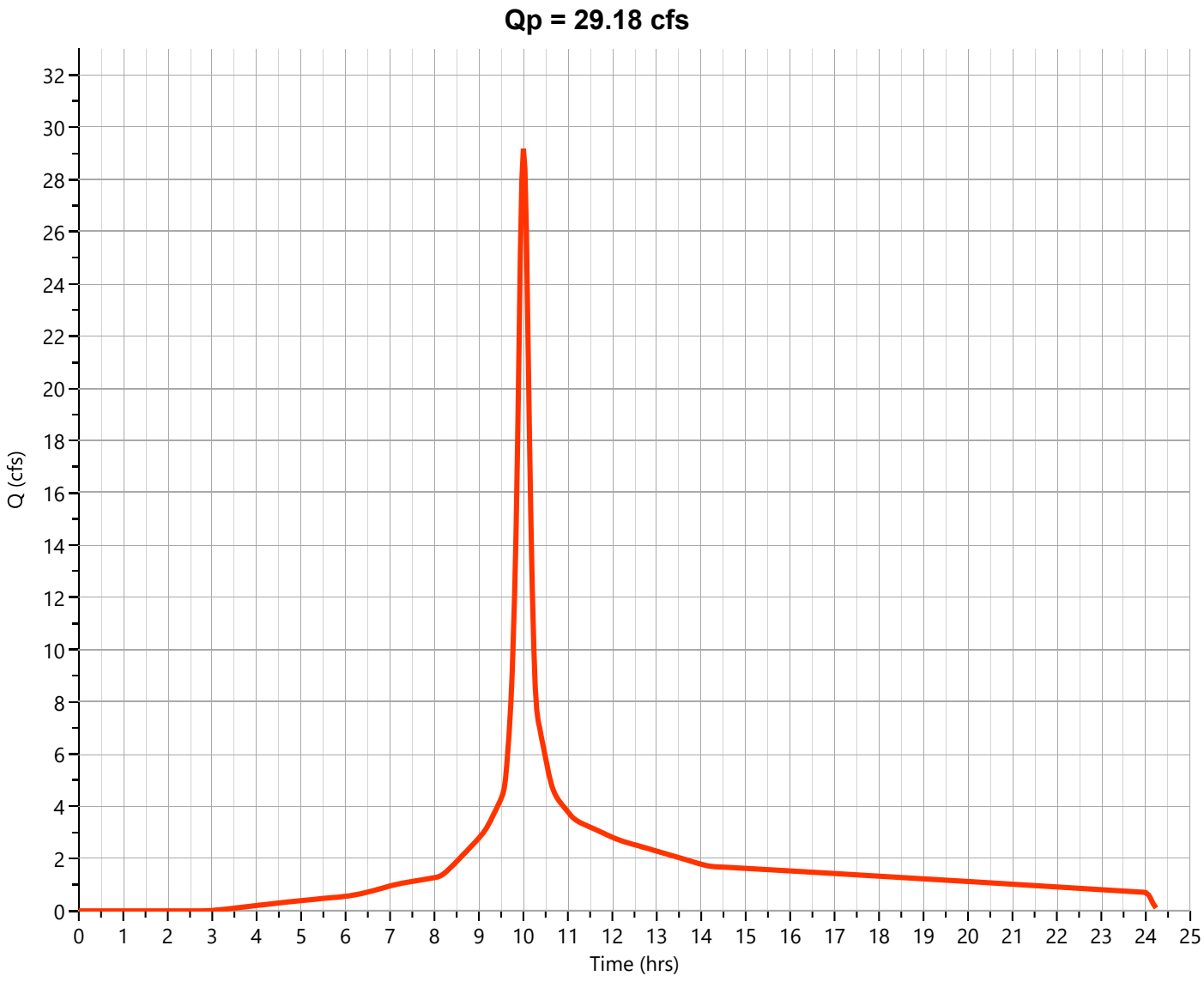
## EX CONDITION DA 1

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 29.18 cfs |
| Storm Frequency | = 25-yr | Time to Peak | = 10.00 hrs |
| Time Interval | = 2 min | Runoff Volume | = 150,025 cuft |
| Drainage Area | = 5.12 ac | Curve Number | = 79.41* |
| Tc Method | = User | Time of Conc. (Tc) | = 12.45 min |
| Total Rainfall | = 10.40 in | Design Storm | = Type I |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.76 | 78 | BARREN |
| 0.36 | 98 | IMPERVIOUS |
| **5.12** | **79** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

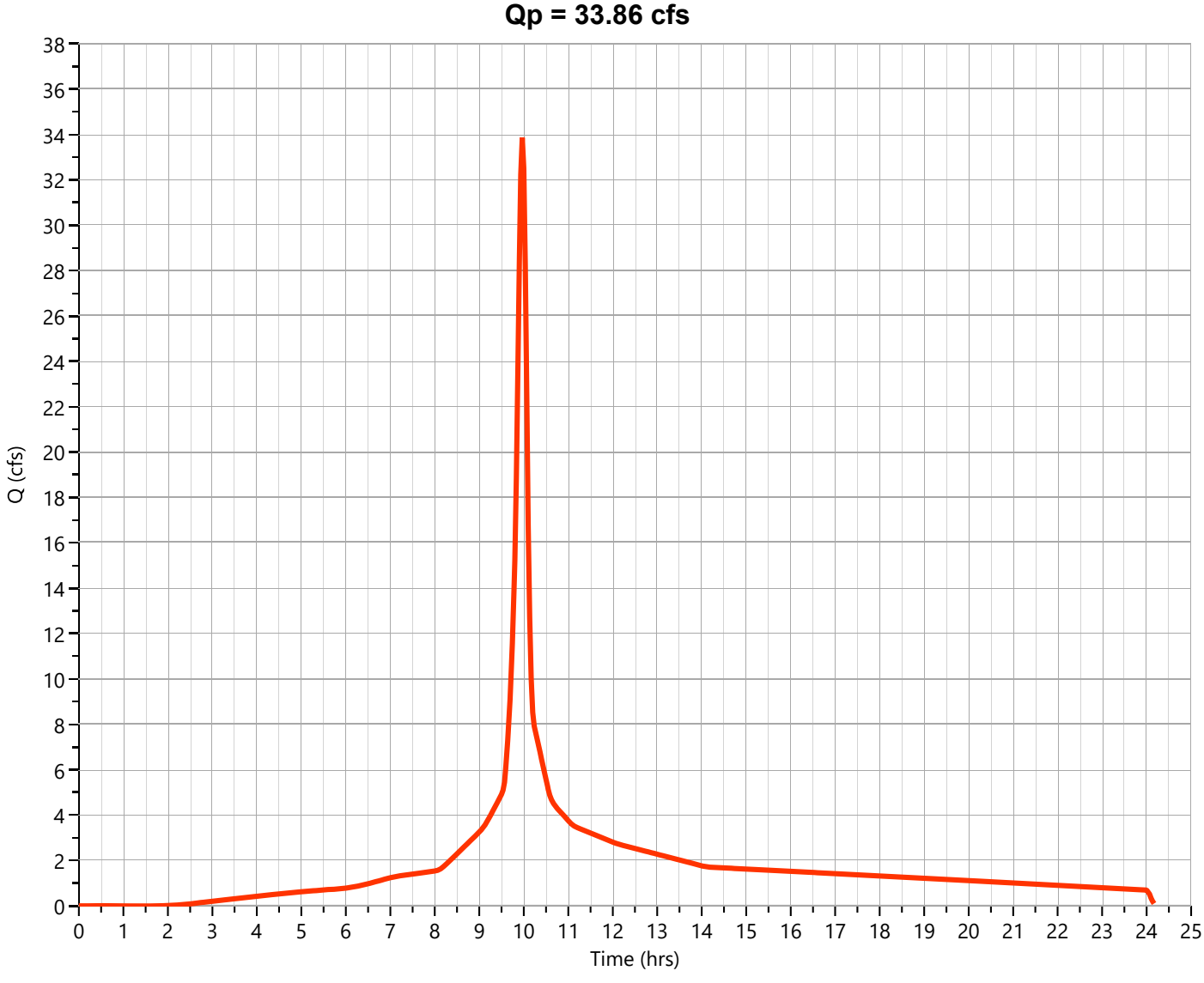
## DEV CONDITION DA 1

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 33.86 cfs |
| Storm Frequency | = 25-yr | Time to Peak | = 9.97 hrs |
| Time Interval | = 2 min | Runoff Volume | = 158,833 cuft |
| Drainage Area | = 5.12 ac | Curve Number | = 85* |
| Tc Method | = User | Time of Conc. (Tc) | = 7.95 min |
| Total Rainfall | = 10.40 in | Design Storm | = Type I |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 2.61 | 98 | CONC/BLDG |
| 2.15 | 78 | NATURAL |
| 0.36 | 32 | LANDSCAPE |
| **5.12** | **85** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

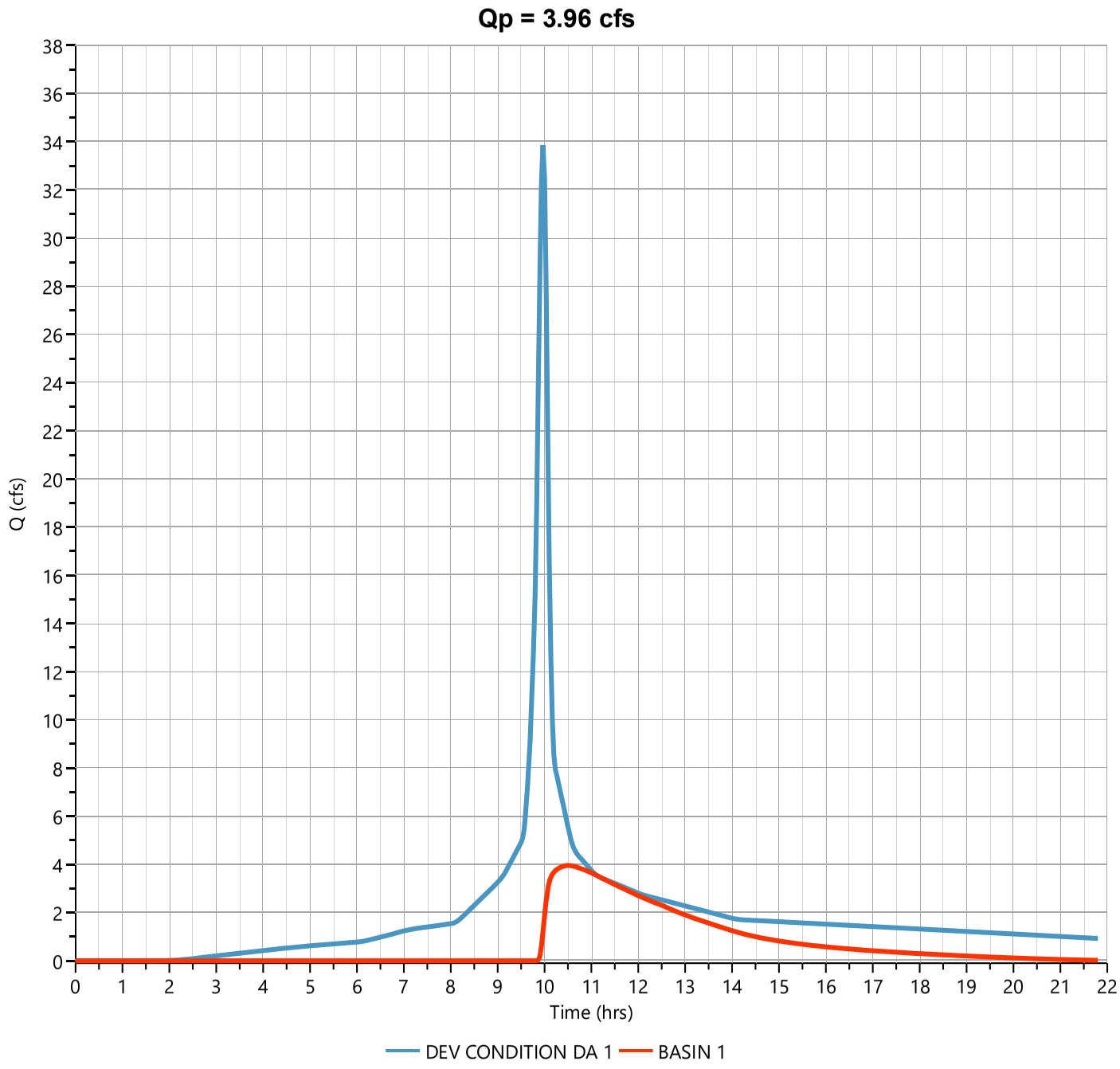
## BASIN 1

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 3.955 cfs |
| Storm Frequency | = 25-yr | Time to Peak | = 10.50 hrs |
| Time Interval | = 2 min | Hydrograph Volume | = 49,905 cuft |
| Inflow Hydrograph | = 2 - DEV CONDITION DA 1 | Max. Elevation | = 2182.50 ft |
| Pond Name | = BASIN | Max. Storage | = 51,153 cuft |

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 20 min*



# Design Storm Report

Custom Storm filename: TR32850.cds

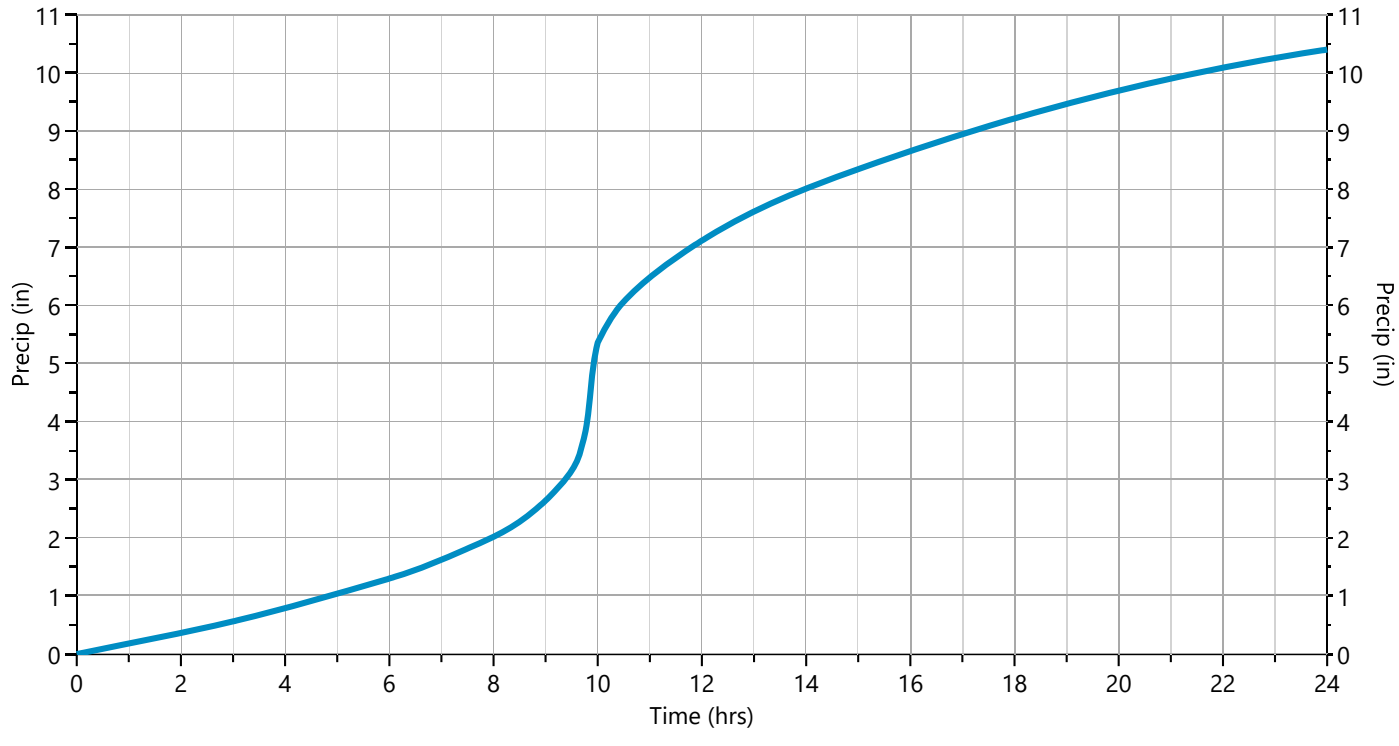
Hydrology Studio v 3.0.0.26

11-29-2022

## Storm Distribution: NRCS/SCS - Type I, 24-hr

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | ✔ 25-yr | 50-yr | 100-yr | |
| 24 hrs | 0.00 | 5.45 | 0.00 | 7.15 | 8.53 | 10.40 | 0.00 | 13.30 | |

| Incremental Rainfall Distribution, 25-yr | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) |
| 8.87 | 0.025598 | 9.23 | 0.033123 | 9.60 | 0.067993 | 9.97 | 0.188179 | 10.33 | 0.042987 |
| 8.90 | 0.026042 | 9.27 | 0.033973 | 9.63 | 0.079049 | 10.00 | 0.110208 | 10.37 | 0.040906 |
| 8.93 | 0.026485 | 9.30 | 0.034824 | 9.67 | 0.090106 | 10.03 | 0.058529 | 10.40 | 0.038827 |
| 8.97 | 0.026929 | 9.33 | 0.035674 | 9.70 | 0.101162 | 10.07 | 0.059627 | 10.43 | 0.036747 |
| 9.00 | 0.027373 | 9.37 | 0.036525 | 9.73 | 0.112218 | 10.10 | 0.057547 | 10.47 | 0.034667 |
| 9.03 | 0.028022 | 9.40 | 0.037375 | 9.77 | 0.135423 | 10.13 | 0.055467 | 10.50 | 0.032587 |
| 9.07 | 0.028871 | 9.43 | 0.038226 | 9.80 | 0.196758 | 10.17 | 0.053387 | 10.53 | 0.031300 |
| 9.10 | 0.029721 | 9.47 | 0.039076 | 9.83 | 0.245879 | 10.20 | 0.051306 | 10.57 | 0.030784 |
| 9.13 | 0.030571 | 9.50 | 0.039927 | **9.87** | **0.269582** | 10.23 | 0.049227 | 10.60 | 0.030276 |
| 9.17 | 0.031422 | 9.53 | 0.045874 | 9.90 | 0.267866 | 10.27 | 0.047147 | 10.63 | 0.029767 |
| 9.20 | 0.032272 | 9.57 | 0.056937 | 9.93 | 0.240732 | 10.30 | 0.045066 | 10.67 | 0.029259 |



# Hydrograph 100-yr Summary

Project Name:

11-29-2022

Hydrology Studio v 3.0.0.26

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Flow (cfs) | Time to Peak (hrs) | Hydrograph Volume (cuft) | Inflow Hyd(s) | Maximum Elevation (ft) | Maximum Storage (cuft) |
|---|---|---|---|---|---|---|---|---|
| 1 | NRCS Runoff | EX CONDITION DA 1 | 39.37 | 10.00 | 203,659 | ---- | | |
| 2 | NRCS Runoff | DEV CONDITION DA 1 | 44.65 | 9.97 | 211,765 | ---- | | |
| 3 | Pond Route | BASIN 1 | 9.490 | 10.20 | 91,619 | 2 | 2183.29 | 66,900 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

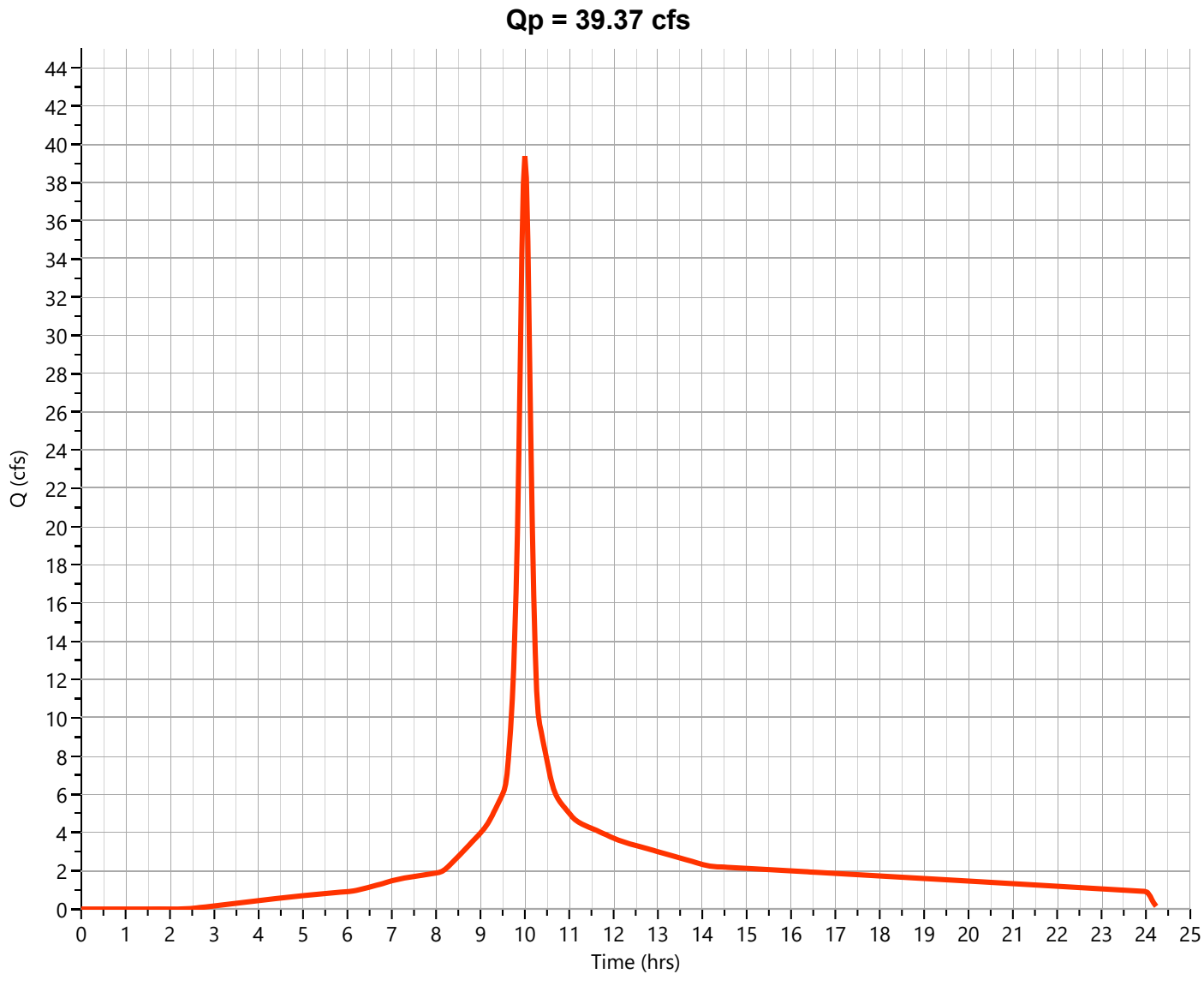
## EX CONDITION DA 1

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 39.37 cfs |
| Storm Frequency | = 100-yr | Time to Peak | = 10.00 hrs |
| Time Interval | = 2 min | Runoff Volume | = 203,659 cuft |
| Drainage Area | = 5.12 ac | Curve Number | = 79.41* |
| Tc Method | = User | Time of Conc. (Tc) | = 12.45 min |
| Total Rainfall | = 13.30 in | Design Storm | = Type I |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.76 | 78 | BARREN |
| 0.36 | 98 | IMPERVIOUS |
| **5.12** | **79** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

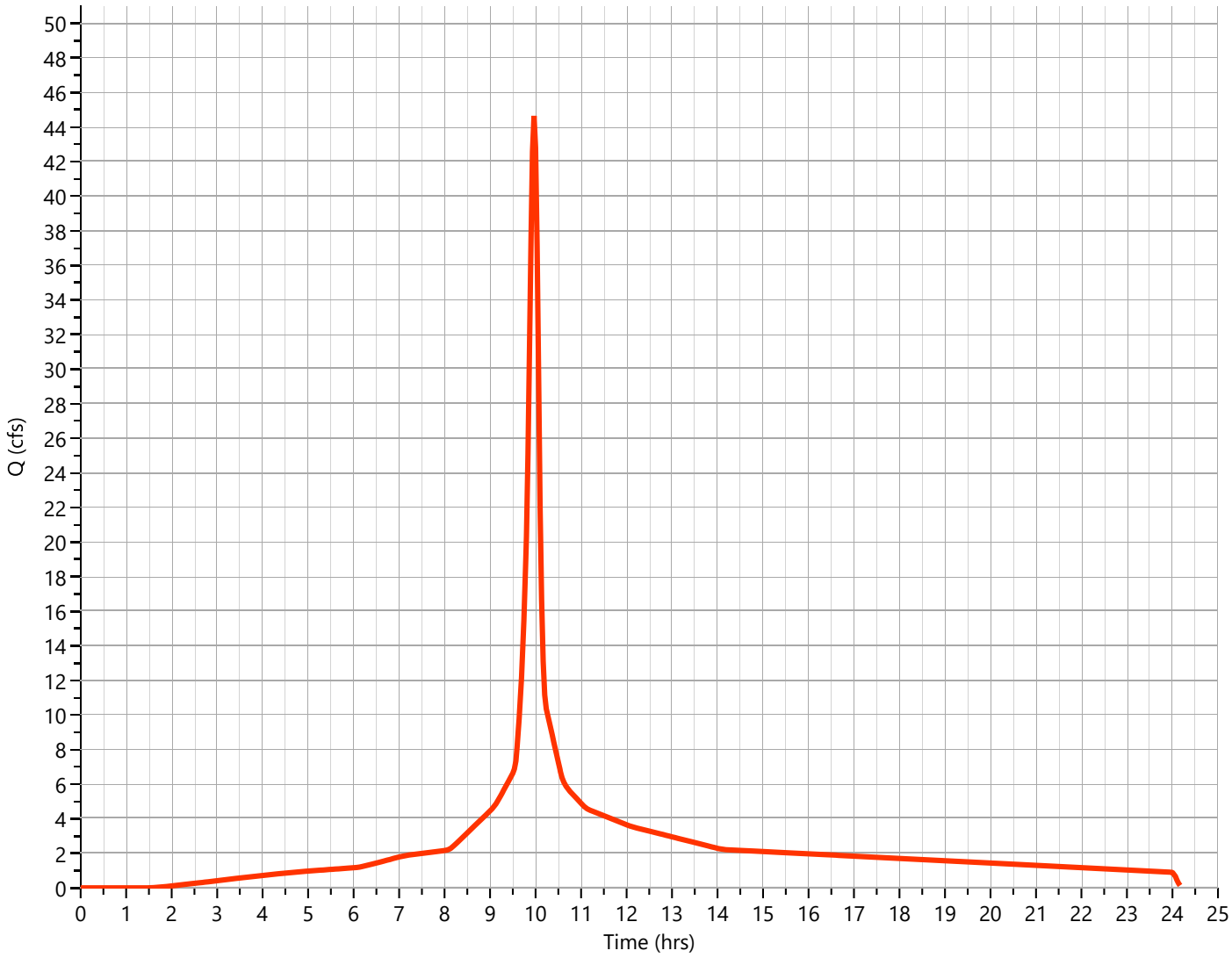
## DEV CONDITION DA 1

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 44.65 cfs |
| Storm Frequency | = 100-yr | Time to Peak | = 9.97 hrs |
| Time Interval | = 2 min | Runoff Volume | = 211,765 cuft |
| Drainage Area | = 5.12 ac | Curve Number | = 85* |
| Tc Method | = User | Time of Conc. (Tc) | = 7.95 min |
| Total Rainfall | = 13.30 in | Design Storm | = Type I |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 2.61 | 98 | CONC/BLDG |
| 2.15 | 78 | NATURAL |
| 0.36 | 32 | LANDSCAPE |
| **5.12** | **85** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

11-29-2022

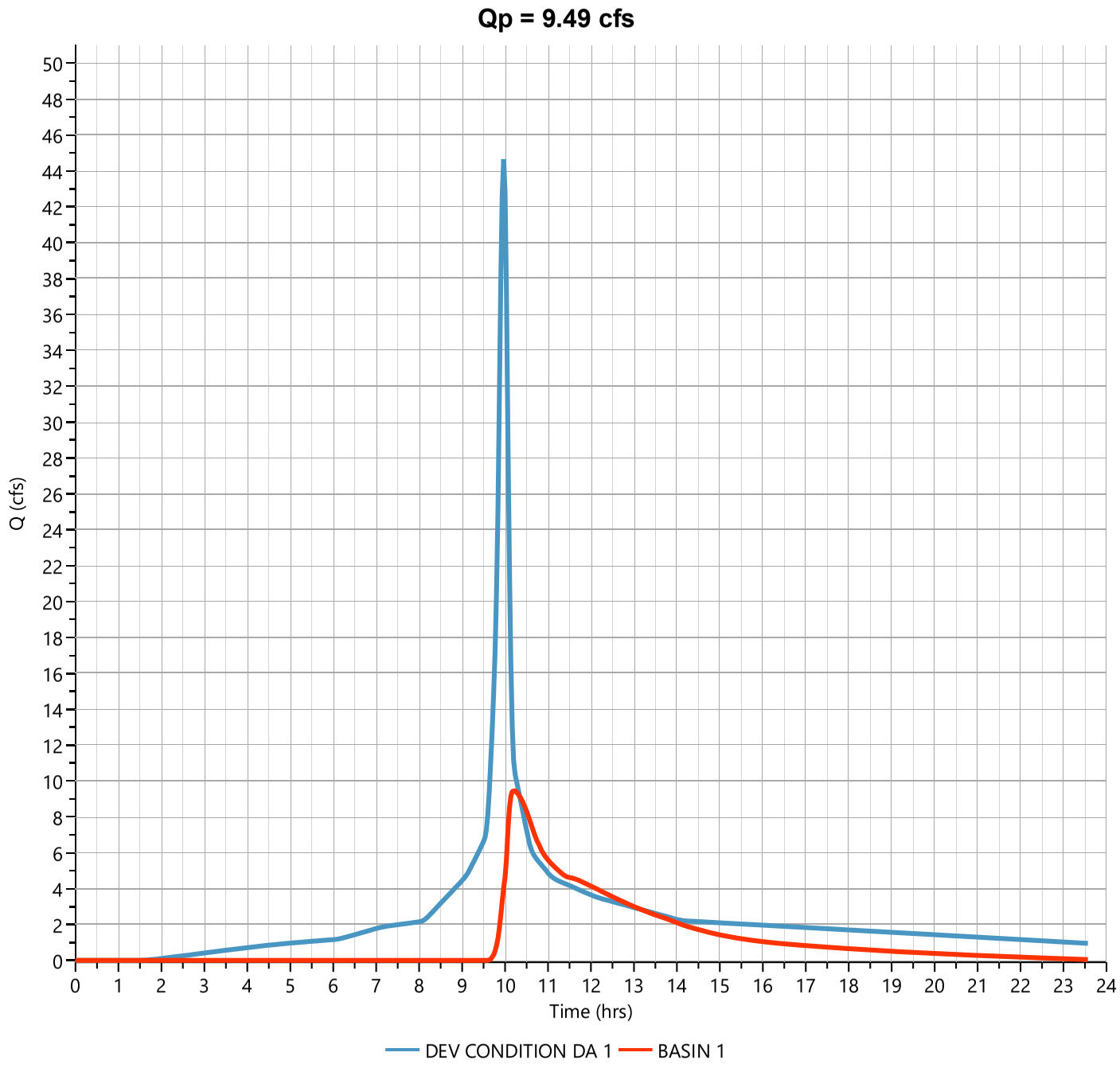
## BASIN 1

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 9.490 cfs |
| Storm Frequency | = 100-yr | Time to Peak | = 10.20 hrs |
| Time Interval | = 2 min | Hydrograph Volume | = 91,619 cuft |
| Inflow Hydrograph | = 2 - DEV CONDITION DA 1 | Max. Elevation | = 2183.29 ft |
| Pond Name | = BASIN | Max. Storage | = 66,900 cuft |

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 41 min*



# Design Storm Report

Custom Storm filename: TR32850.cds

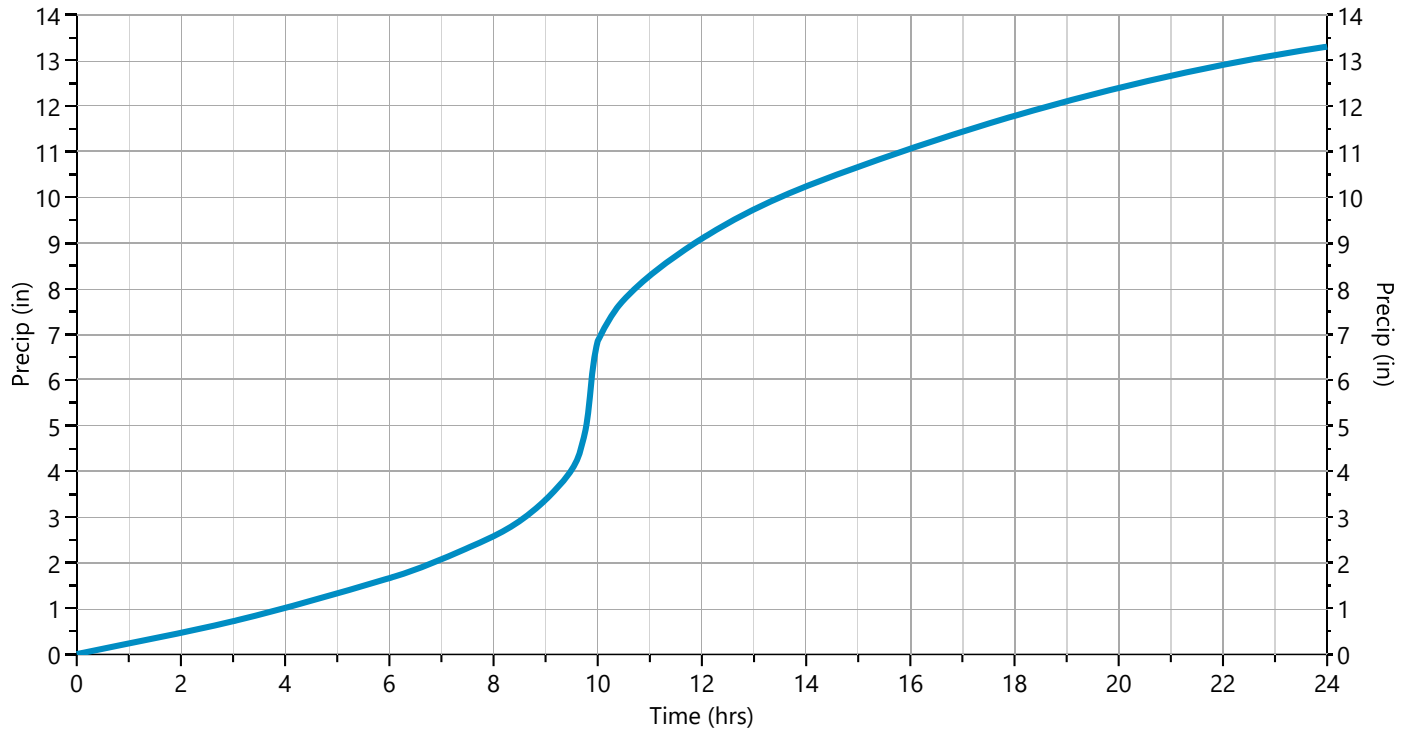
Hydrology Studio v 3.0.0.26

11-29-2022

## Storm Distribution: NRCS/SCS - Type I, 24-hr

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | ✔ 100-yr | |
| 24 hrs | 0.00 | 5.45 | 0.00 | 7.15 | 8.53 | 10.40 | 0.00 | 13.30 | |

| Incremental Rainfall Distribution, 100-yr | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) |
| 8.87 | 0.032736 | 9.23 | 0.042359 | 9.60 | 0.086952 | 9.97 | 0.240652 | 10.33 | 0.054973 |
| 8.90 | 0.033303 | 9.27 | 0.043447 | 9.63 | 0.101092 | 10.00 | 0.140939 | 10.37 | 0.052313 |
| 8.93 | 0.033871 | 9.30 | 0.044534 | 9.67 | 0.115231 | 10.03 | 0.074850 | 10.40 | 0.049653 |
| 8.97 | 0.034438 | 9.33 | 0.045622 | 9.70 | 0.129371 | 10.07 | 0.076253 | 10.43 | 0.046994 |
| 9.00 | 0.035006 | 9.37 | 0.046710 | 9.73 | 0.143510 | 10.10 | 0.073593 | 10.47 | 0.044333 |
| 9.03 | 0.035836 | 9.40 | 0.047797 | 9.77 | 0.173185 | 10.13 | 0.070933 | 10.50 | 0.041673 |
| 9.07 | 0.036921 | 9.43 | 0.048885 | 9.80 | 0.251623 | 10.17 | 0.068273 | 10.53 | 0.040027 |
| 9.10 | 0.038008 | 9.47 | 0.049973 | 9.83 | 0.314442 | 10.20 | 0.065613 | 10.57 | 0.039368 |
| 9.13 | 0.039096 | 9.50 | 0.051060 | **9.87** | **0.344754** | 10.23 | 0.062953 | 10.60 | 0.038718 |
| 9.17 | 0.040184 | 9.53 | 0.058666 | 9.90 | 0.342559 | 10.27 | 0.060293 | 10.63 | 0.038067 |
| 9.20 | 0.041271 | 9.57 | 0.072813 | 9.93 | 0.307859 | 10.30 | 0.057633 | 10.67 | 0.037417 |



# IDF Report

IDF filename: SampleIDF.idf

Hydrology Studio v 3.0.0.26

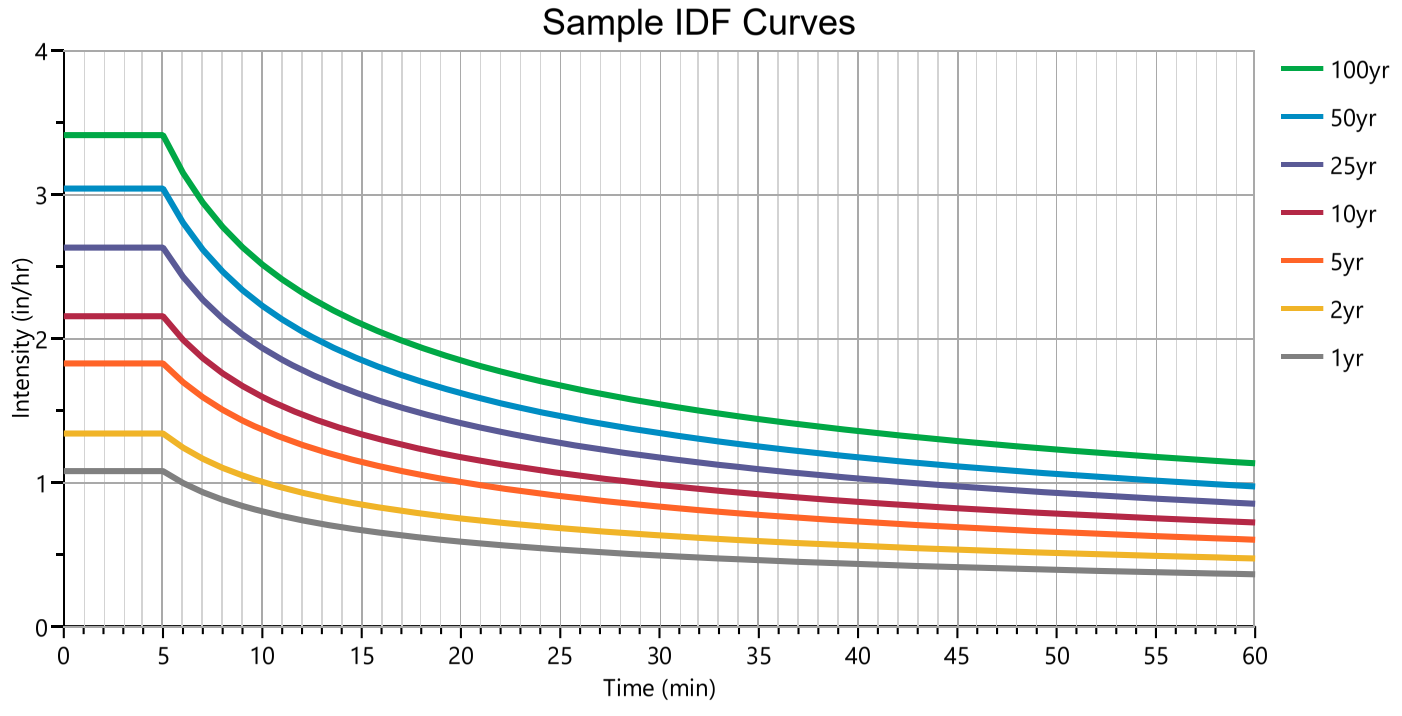
11-29-2022

| Equation Coefficients | Intensity = B / (Tc + D)^E (in/hr) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | |
| B | 2.2472 | 2.6658 | 0.0000 | 4.3056 | 4.4944 | 5.7019 | 6.6481 | 7.0705 | |
| D | 0.2000 | 0.1000 | 0.0000 | 1.0000 | 0.2000 | 0.3000 | 0.3000 | 0.1000 | |
| E | 0.4469 | 0.4237 | 0.0000 | 0.4794 | 0.4469 | 0.4643 | 0.4695 | 0.4477 | |

*Minimum Tc = 5 minutes*

| Tc (min) | Intensity Values (in/hr) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | |
| Cf | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| 5 | 1.08 | 1.34 | 0 | 1.82 | 2.15 | 2.63 | 3.04 | 3.41 | |
| 10 | 0.80 | 1.00 | 0 | 1.36 | 1.59 | 1.93 | 2.22 | 2.51 | |
| 15 | 0.67 | 0.84 | 0 | 1.14 | 1.33 | 1.61 | 1.85 | 2.10 | |
| 20 | 0.59 | 0.75 | 0 | 1.00 | 1.17 | 1.41 | 1.62 | 1.85 | |
| 25 | 0.53 | 0.68 | 0 | 0.90 | 1.06 | 1.27 | 1.46 | 1.67 | |
| 30 | 0.49 | 0.63 | 0 | 0.83 | 0.98 | 1.17 | 1.34 | 1.54 | |
| 35 | 0.46 | 0.59 | 0 | 0.77 | 0.92 | 1.09 | 1.25 | 1.44 | |
| 40 | 0.43 | 0.56 | 0 | 0.73 | 0.86 | 1.02 | 1.17 | 1.35 | |
| 45 | 0.41 | 0.53 | 0 | 0.69 | 0.82 | 0.97 | 1.11 | 1.29 | |
| 50 | 0.39 | 0.51 | 0 | 0.65 | 0.78 | 0.92 | 1.06 | 1.23 | |
| 55 | 0.37 | 0.49 | 0 | 0.63 | 0.75 | 0.88 | 1.01 | 1.17 | |
| 60 | 0.36 | 0.47 | 0 | 0.60 | 0.72 | 0.85 | 0.97 | 1.13 | |

*Cf = Correction Factor applied to Rational Method runoff coefficient.*



# Precipitation Report

Precipitation filename: MTN AVE BEES.pcp

Hydrology Studio v 3.0.0.26 (Rainfall totals in Inches)

11-29-2022

| | Active | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
|---|---|---|---|---|---|---|---|---|---|
| **Active** | | | ✔ | | ✔ | ✔ | ✔ | | ✔ |
| **SCS Storms** | **> SCS Dimensionless Storms** | | | | | | | | |
| SCS 6hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Type I, 24-hr | ✔ | 0 | 5.45 | 0 | 7.15 | 8.53 | 10.40 | 0 | 13.30 |
| Type IA, 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Type II, 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Type II FL, 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Type III, 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Synthetic Storms** | **> IDF-Based Synthetic Storms** | | | | | | | | |
| 1-hr | | 0.36 | 0.47 | 0 | 0.60 | 0.72 | 0.85 | 0.97 | 1.13 |
| 2-hr | | 0.53 | 0.70 | 0 | 0.86 | 1.06 | 1.23 | 1.40 | 1.66 |
| 3-hr | | 0.66 | 0.89 | 0 | 1.07 | 1.32 | 1.53 | 1.74 | 2.07 |
| 6-hr | | 0.97 | 1.32 | 0 | 1.54 | 1.94 | 2.22 | 2.51 | 3.04 |
| 12-hr | | 1.42 | 1.97 | 0 | 2.20 | 2.85 | 3.22 | 3.63 | 4.46 |
| 24-hr | | 2.09 | 2.94 | 0 | 3.16 | 4.18 | 4.67 | 5.25 | 6.54 |
| **Huff Distribution** | **> 1st Quartile (0 to 6 hrs)** | | | | | | | | |
| 1-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Huff Distribution** | **> 2nd Quartile (>6 to 12 hrs)** | | | | | | | | |
| 8-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Huff Distribution** | **> 3rd Quartile (>12 to 24 hrs)** | | | | | | | | |
| 18-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Custom Storms** | **> Custom Storm Distributions** | | | | | | | | |
| Custom Storm | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| My Custom Storm 2 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| My Custom Storm 3 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| My Custom Storm 4 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| My Custom Storm 5 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| My Custom Storm 6 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| My Custom Storm 7 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| My Custom Storm 8 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| My Custom Storm 9 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| My Custom Storm 10 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Precipitation Report Cont'd

Precipitation filename: MTN AVE BEES.pcp

Rainfall totals in Inches

11-29-2022

| | Active | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
|---|---|---|---|---|---|---|---|---|---|
| **Active** | | | ✔ | | ✔ | ✔ | ✔ | | ✔ |
| **Huff Indiana** | **> Indianapolis** | | | | | | | | |
| 30-min | | 0.99 | 1.19 | 0 | 1.44 | 1.63 | 1.89 | 2.08 | 2.28 |
| 1-hr | | 1.21 | 1.46 | 0 | 1.81 | 2.08 | 2.45 | 2.75 | 3.06 |
| 2-hr | | 1.46 | 1.77 | 0 | 2.22 | 2.57 | 3.05 | 3.44 | 3.85 |
| 3-hr | | 1.57 | 1.90 | 0 | 2.38 | 2.76 | 3.30 | 3.75 | 4.21 |
| 6-hr | | 1.92 | 2.31 | 0 | 2.88 | 3.36 | 4.01 | 4.56 | 5.13 |
| 12-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Huff Indiana** | **> Evansville** | | | | | | | | |
| 30-min | | 0.99 | 1.19 | 0 | 1.44 | 1.63 | 1.89 | 2.08 | 2.28 |
| 1-hr | | 1.21 | 1.46 | 0 | 1.81 | 2.08 | 2.45 | 2.75 | 3.06 |
| 2-hr | | 1.46 | 1.77 | 0 | 2.22 | 2.57 | 3.05 | 3.44 | 3.85 |
| 3-hr | | 1.57 | 1.90 | 0 | 2.38 | 2.76 | 3.30 | 3.75 | 4.21 |
| 6-hr | | 1.92 | 2.31 | 0 | 2.88 | 3.36 | 4.01 | 4.56 | 5.13 |
| 12-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Huff Indiana** | **> Fort Wayne** | | | | | | | | |
| 30-min | | 0.99 | 1.19 | 0 | 1.44 | 1.63 | 1.89 | 2.08 | 2.28 |
| 1-hr | | 1.21 | 1.46 | 0 | 1.81 | 2.08 | 2.45 | 2.75 | 3.06 |
| 2-hr | | 1.46 | 1.77 | 0 | 2.22 | 2.57 | 3.05 | 3.44 | 3.85 |
| 3-hr | | 1.57 | 1.90 | 0 | 2.38 | 2.76 | 3.30 | 3.75 | 4.21 |
| 6-hr | | 1.92 | 2.31 | 0 | 2.88 | 3.36 | 4.01 | 4.56 | 5.13 |
| 12-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Huff Indiana** | **> South Bend** | | | | | | | | |
| 30-min | | 0.99 | 1.19 | 0 | 1.44 | 1.63 | 1.89 | 2.08 | 2.28 |
| 1-hr | | 1.21 | 1.46 | 0 | 1.81 | 2.08 | 2.45 | 2.75 | 3.06 |
| 2-hr | | 1.46 | 1.77 | 0 | 2.22 | 2.57 | 3.05 | 3.44 | 3.85 |
| 3-hr | | 1.57 | 1.90 | 0 | 2.38 | 2.76 | 3.30 | 3.75 | 4.21 |
| 6-hr | | 1.92 | 2.31 | 0 | 2.88 | 3.36 | 4.01 | 4.56 | 5.13 |
| 12-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

# Precipitation Report Cont'd

Precipitation filename: MTN AVE BEES.pcp

Rainfall totals in Inches

11-29-2022

| | Active | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
|---|---|---|---|---|---|---|---|---|---|
| **Active** | | | ✔ | | ✔ | ✔ | ✔ | | ✔ |
| **NRCS Storms** | **> NRCS Dimensionless Storms** | | | | | | | | |
| NRCS MSE1, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NRCS MSE2, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NRCS MSE3, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NRCS MSE4, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NRCS MSE5, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NRCS MSE6, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NOAA-A, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NOAA-B, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NOAA-C, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NOAA-D, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NRCC-A, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NRCC-B, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NRCC-C, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| NRCC-D, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| CA-1, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| CA-2, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| CA-3, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| CA-4, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| CA-5, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| CA-6, 24-hr | | 2.72 | 3.27 | 0 | 4.07 | 4.72 | 5.63 | 6.37 | 7.15 |
| **FDOT Storms** | **> Florida DOT Storms** | | | | | | | | |
| FDOT, 1-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FDOT, 2-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FDOT, 4-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FDOT, 8-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FDOT, 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FDOT, 72-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SFWMD, 72-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Austin Storms** | **> Austin Frequency Storms** | | | | | | | | |
| Austin Zone 1, 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Austin Zone 2, 24-hr | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

HYDRAULIC CALCULATIONS

# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Feb 18 2022

## NODE 200 TO 210: DETERMINE CAPACITY 8' WIDE x 2' DEEP V-DITCH @ 0.7% MIN.

**Triangular**

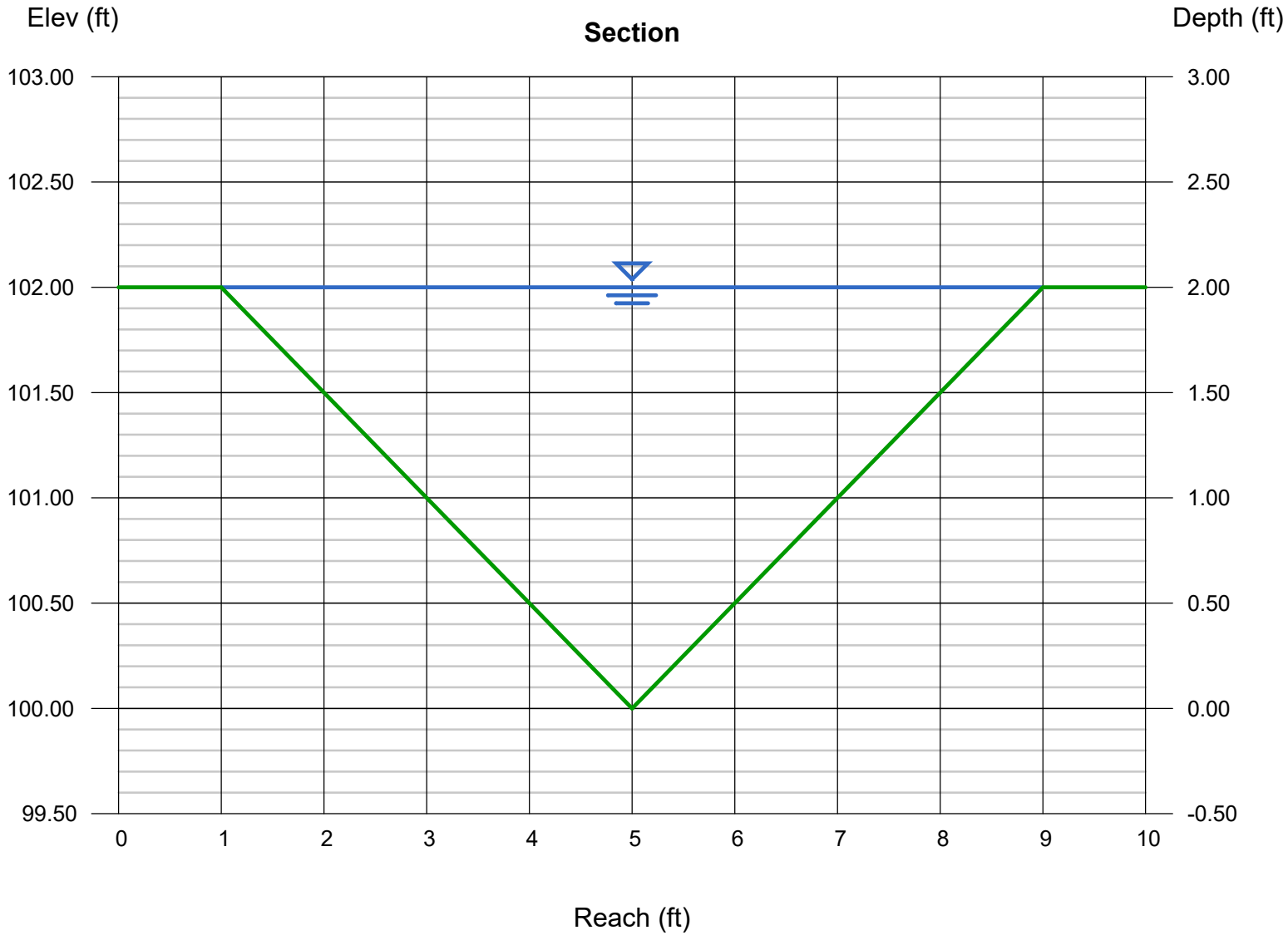
| | |
|---|---|
| Side Slopes (z:1) | = 2.00, 2.00 |
| Total Depth (ft) | = 2.00 |
| Invert Elev (ft) | = 100.00 |
| Slope (%) | = 0.70 |
| N-Value | = 0.025 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Depth |
| Known Depth (ft) | = 2.00 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 2.00 |
| Q (cfs) | = 36.93 |
| Area (sqft) | = 8.00 |
| Velocity (ft/s) | = 4.62 |
| Wetted Perim (ft) | = 8.94 |
| Crit Depth, Yc (ft) | = 1.85 |
| Top Width (ft) | = 8.00 |
| EGL (ft) | = 2.33 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Sep 12 2022

## NODE 110 TO 120: DETERMINE CAPACITY OF 8' WIDE x 2' DEEP V-DITCH @ 1.0% MIN.

**Triangular**

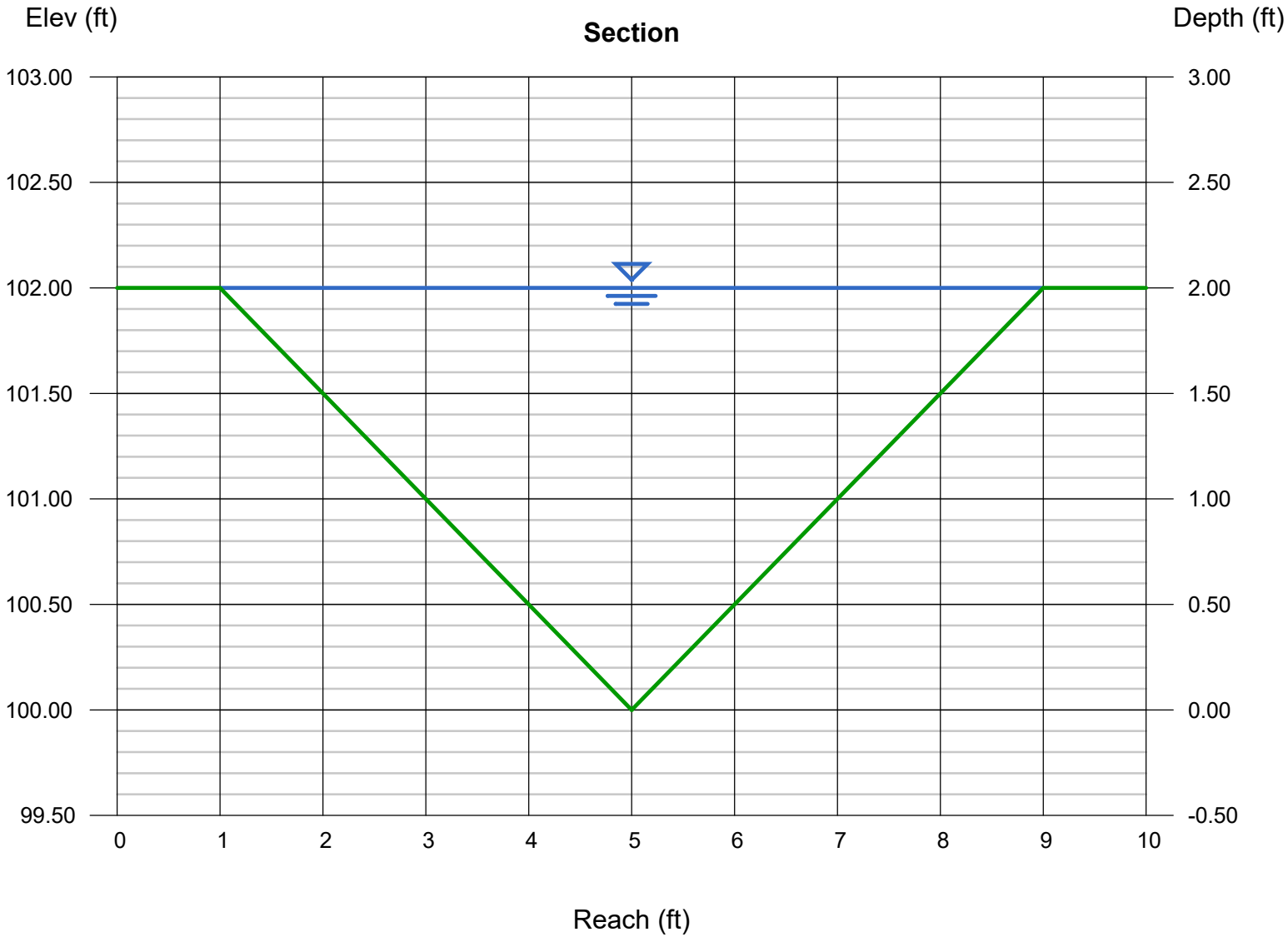
| | |
|---|---|
| Side Slopes (z:1) | = 2.00, 2.00 |
| Total Depth (ft) | = 2.00 |
| Invert Elev (ft) | = 100.00 |
| Slope (%) | = 1.00 |
| N-Value | = 0.025 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Depth |
| Known Depth (ft) | = 2.00 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 2.00 |
| Q (cfs) | = 44.14 |
| Area (sqft) | = 8.00 |
| Velocity (ft/s) | = 5.52 |
| Wetted Perim (ft) | = 8.94 |
| Crit Depth, Yc (ft) | = 1.98 |
| Top Width (ft) | = 8.00 |
| EGL (ft) | = 2.47 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 29 2022

## NODE 410 TO 330:DETERMINE CAPACITY 12" PVC @ 5.33%

### Circular

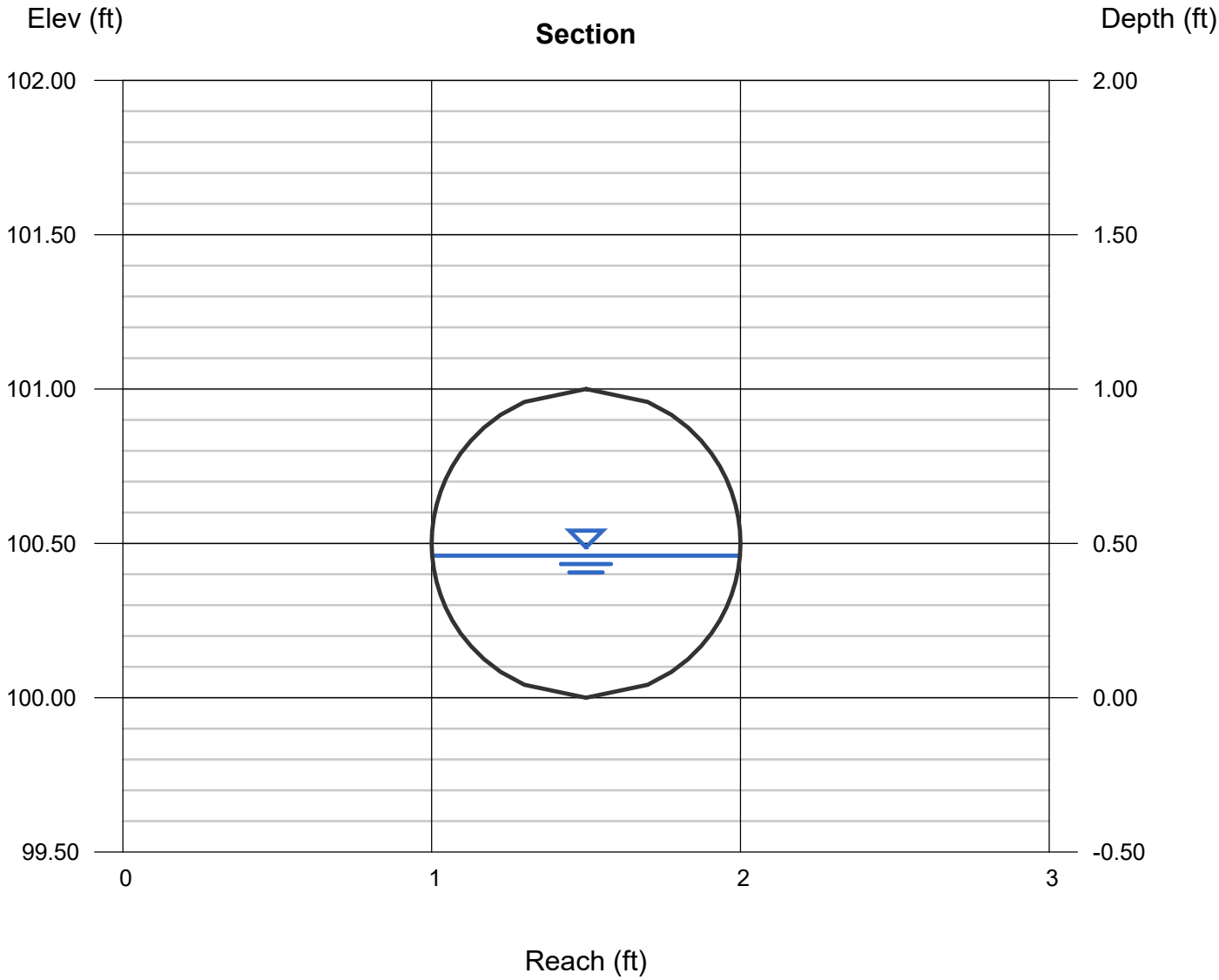
| | |
|---|---|
| Diameter (ft) | = 1.00 |
| Invert Elev (ft) | = 100.00 |
| Slope (%) | = 5.33 |
| N-Value | = 0.011 |

### Calculations

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 4.11 |

### Highlighted

| | |
|---|---|
| Depth (ft) | = 0.46 |
| Q (cfs) | = 4.110 |
| Area (sqft) | = 0.35 |
| Velocity (ft/s) | = 11.58 |
| Wetted Perim (ft) | = 1.49 |
| Crit Depth, Yc (ft) | = 0.86 |
| Top Width (ft) | = 1.00 |
| EGL (ft) | = 2.55 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Feb 18 2022

## NODE 320 TO 330: DETERMINE CAPACITY 18" PVC @ 10.0%

### Circular

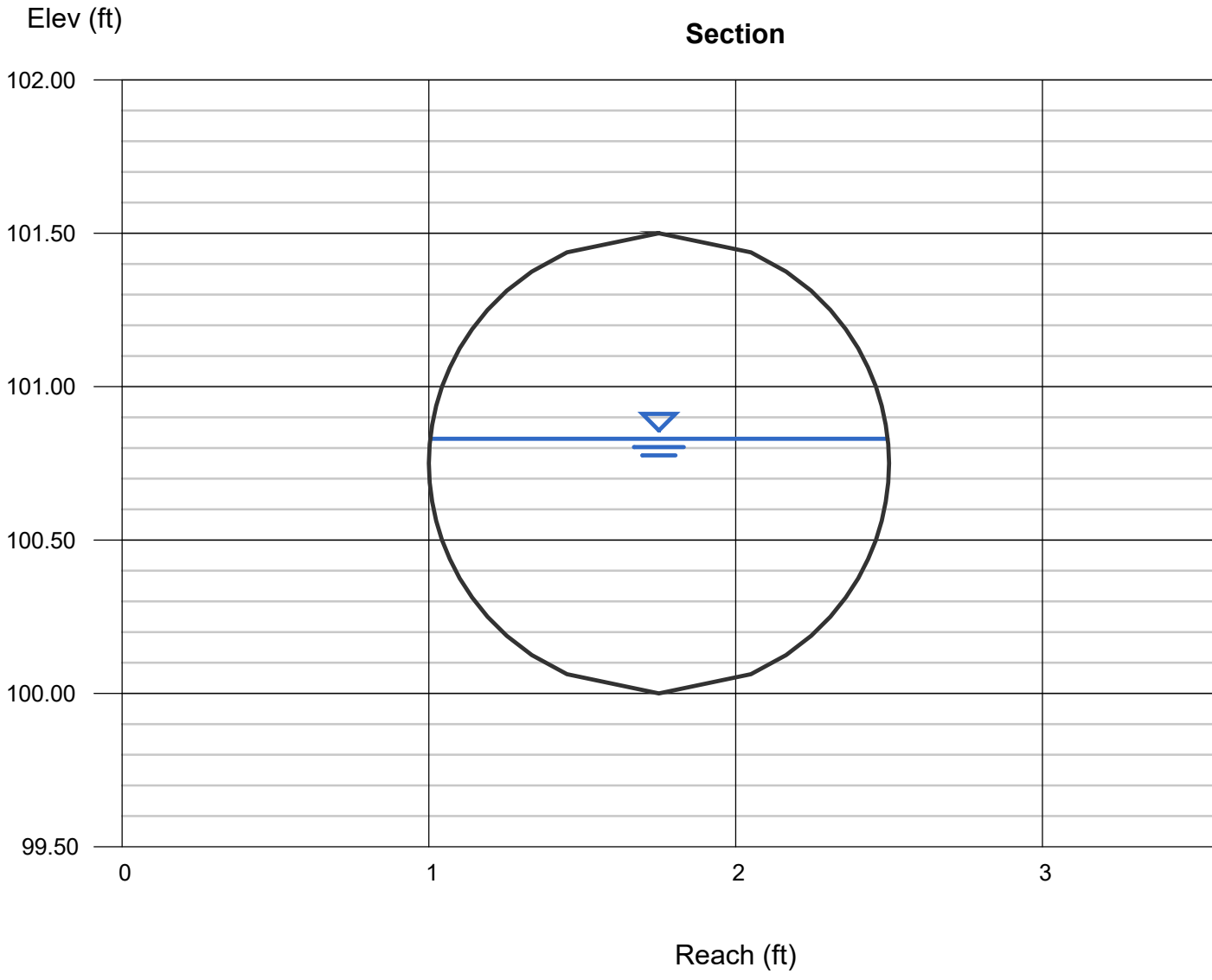
| | |
|---|---|
| Diameter (ft) | = 1.50 |
| Invert Elev (ft) | = 100.00 |
| Slope (%) | = 10.00 |
| N-Value | = 0.011 |

### Calculations

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 23.13 |

### Highlighted

| | |
|---|---|
| Depth (ft) | = 0.83 |
| Q (cfs) | = 23.13 |
| Area (sqft) | = 1.01 |
| Velocity (ft/s) | = 23.15 |
| Wetted Perim (ft) | = 2.52 |
| Crit Depth, Yc (ft) | = 1.49 |
| Top Width (ft) | = 1.49 |
| EGL (ft) | = 9.16 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 28 2022

## DETERMINE CAPACITY OF 18 INCH RCP AT BASIN OUTLET

**Circular**

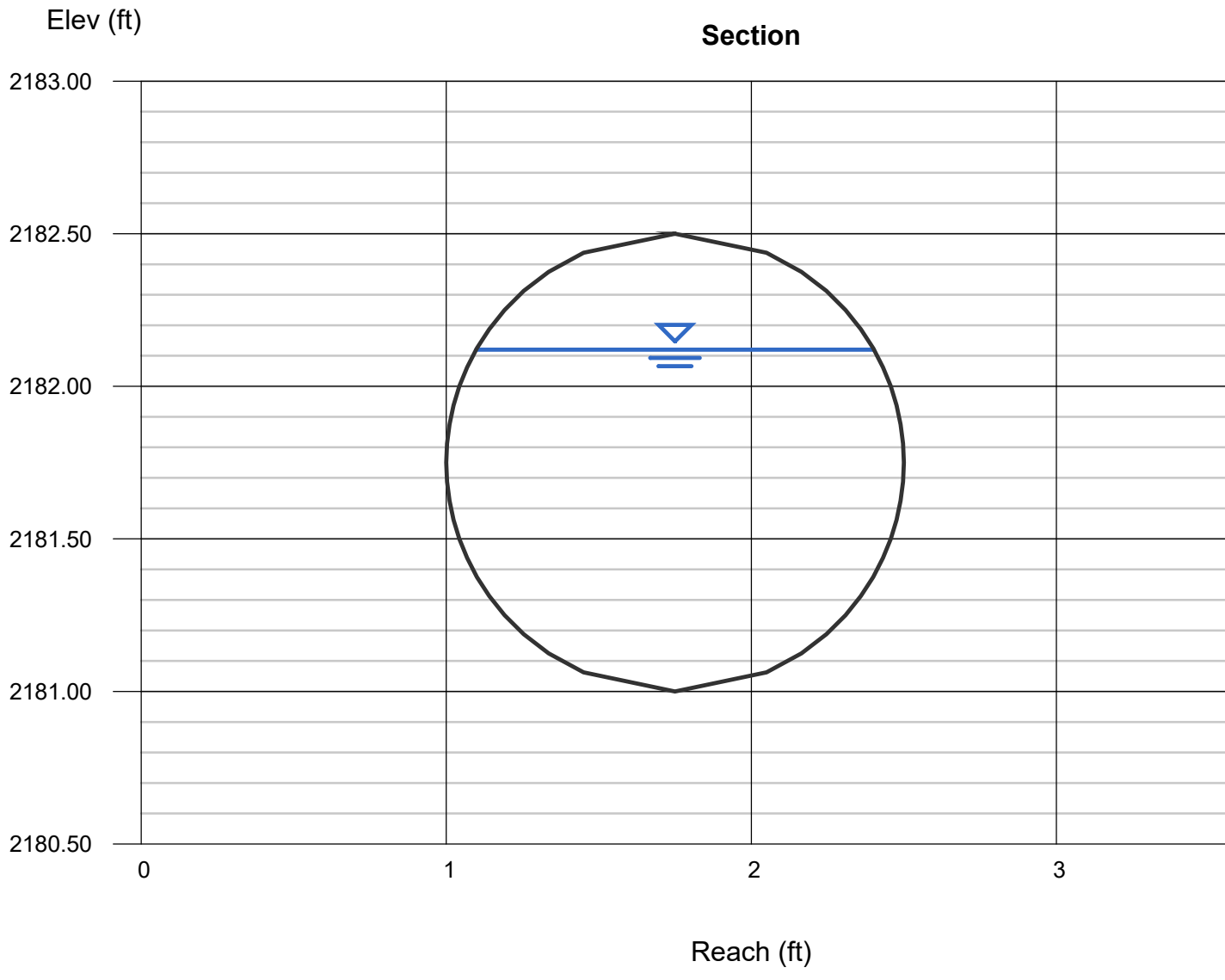
| | |
|---|---|
| Diameter (ft) | = 1.50 |
| Invert Elev (ft) | = 2181.00 |
| Slope (%) | = 1.00 |
| N-Value | = 0.013 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 9.49 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.12 |
| Q (cfs) | = 9.490 |
| Area (sqft) | = 1.42 |
| Velocity (ft/s) | = 6.69 |
| Wetted Perim (ft) | = 3.14 |
| Crit Depth, Yc (ft) | = 1.19 |
| Top Width (ft) | = 1.30 |
| EGL (ft) | = 1.82 |



# GRAPEVINE CANYON ANALYSIS

# LYTLE CREEK - GRAPEVINE CANYON
# FOR MOUNTAIN AVENUE BEES, INC.
## EXISTING CONDITION DRAINAGE MAP TO CULVERT AT LYTLE CREEK ROAD

SCALE: 1"=300'

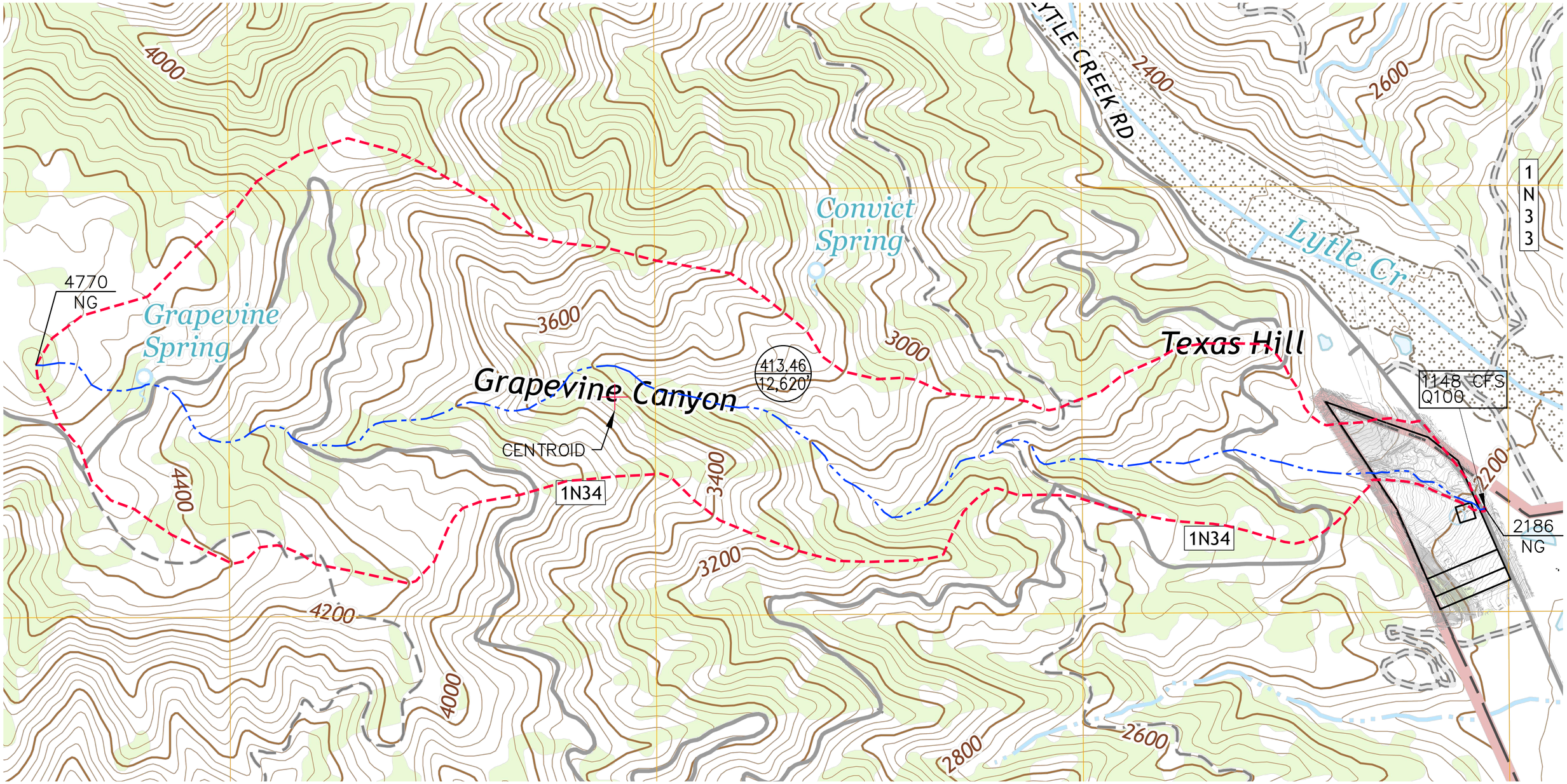
300 0 300 600

LEGEND:

DRAINAGE AREA (AC)
10.00
500'
FLOW PATH LENGTH

FLOW LINE

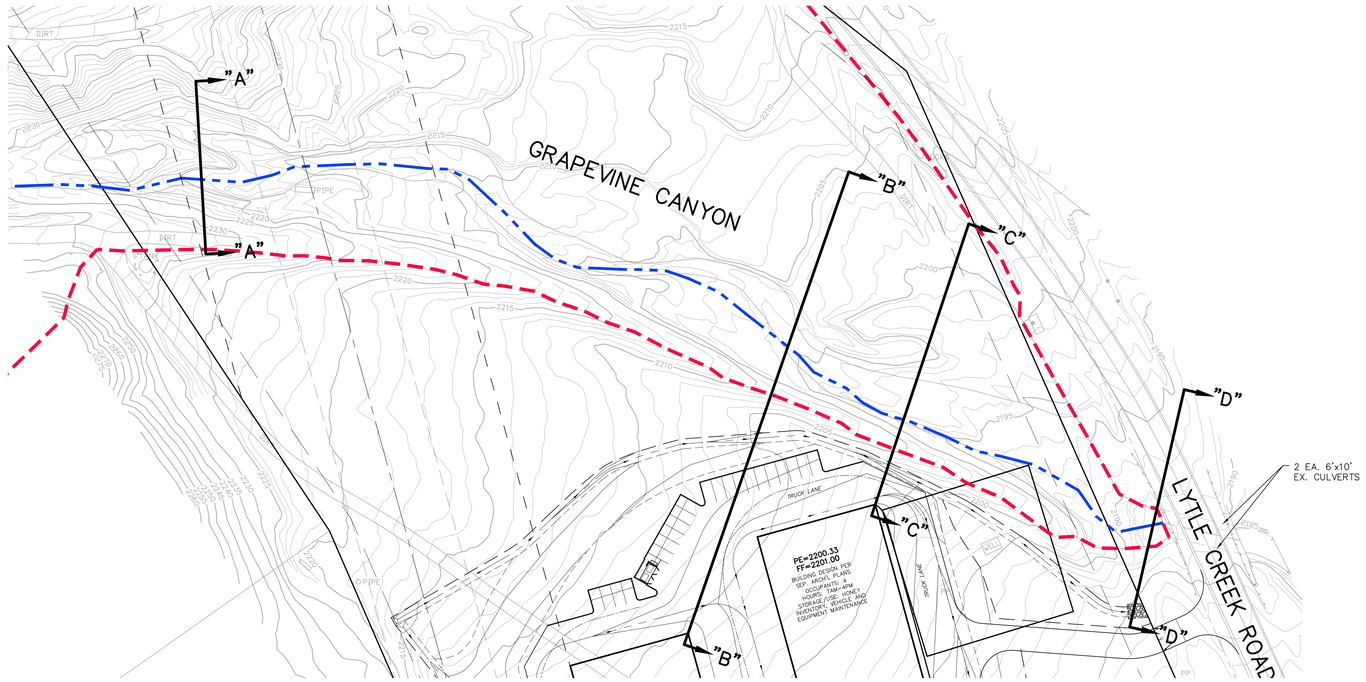
WATERSHED BOUNDARY

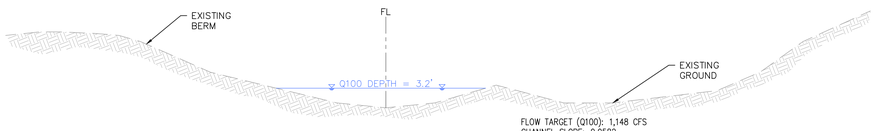


# LYTLE CREEK - GRAPEVINE CANYON
# FOR MOUNTAIN AVENUE BEES, INC.
## FLOW DEPTH SECTIONS UPSTREAM OF LYTLE CREEK ROAD

SCALE: 1"=50'

50 0 50 100




SECTION A–A
SCALE: 1"=10'

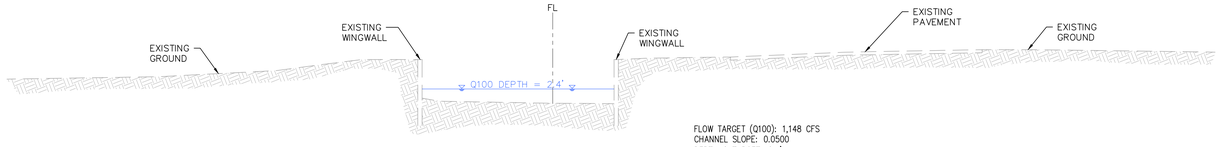
FLOW TARGET (Q100): 1,148 CFS
CHANNEL SLOPE: 0.0582
DEPTH @ TARGET: 3.2'
REMAINING FREE BOARD: 9.2'


SECTION B–B
SCALE: 1"=10'

FLOW TARGET (Q100): 1,148 CFS
CHANNEL SLOPE: 0.0252
DEPTH @ TARGET: 3.0'
REMAINING FREE BOARD: 5.6'


SECTION C–C
SCALE: 1"=10'

FLOW TARGET (Q100): 1,148 CFS
CHANNEL SLOPE: 0.0287
DEPTH @ TARGET: 3.4'
REMAINING FREE BOARD: 5.4'




SECTION D–D
SCALE: 1"=10'

FLOW TARGET (Q100): 1,148 CFS
CHANNEL SLOPE: 0.0500
DEPTH @ TARGET: 2.4'
REMAINING FREE BOARD: 4.8'

U n i t  H y d r o g r a p h  A n a l y s i s



Study date 09/02/22

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
----------

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6165

---

MTN AVES BEES - GRAPEVINE CHANNEL
100-YR 24-HR STORM
EXISTING CONDITION

---

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

| Sub-Area (Ac.) | Duration (hours) | Isohyetal (In) |
|---|---|---|
| Rainfall data for year 100 | | |
| 413.50 | 1 | 2.30 |
| Rainfall data for year 100 | | |
| 413.50 | 6 | 6.84 |
| Rainfall data for year 100 | | |
| 413.50 | 24 | 13.30 |

---
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********

| SCS curve No.(AMCII) | SCS curve NO.(AMC 3) | Area (Ac.) | Area Fraction | Fp(Fig C6) (In/Hr) | Ap (dec.) | Fm (In/Hr) |
|---|---|---|---|---|---|---|
| 78.0 | 92.8 | 413.50 | 1.000 | 0.140 | 1.000 | 0.140 |

Area-averaged adjusted loss rate Fm (In/Hr) = 0.140

********* Area-Averaged low loss rate fraction, Yb **********

| Area (Ac.) | Area Fract | SCS CN (AMC2) | SCS CN (AMC3) | S | Pervious Yield Fr |
|---|---|---|---|---|---|
| 413.50 | 1.000 | 78.0 | 92.8 | 0.78 | 0.933 |

Area-averaged catchment yield fraction, Y = 0.933
Area-averaged low loss fraction, Yb = 0.067
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watercourse length = 12620.00(Ft.)
Length from concentration point to centroid = 7478.00(Ft.)
Elevation difference along watercourse = 2584.00(Ft.)
Mannings friction factor along watercourse = 0.040
Watershed area = 413.50(Ac.)
Catchment Lag time = 0.405 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 20.5941
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.140(In/Hr)
Average low loss rate fraction (Yb) = 0.067 (decimal)
FOOTHILL S-Graph Selected
Computed peak 5-minute rainfall = 0.550(In)
Computed peak 30-minute rainfall = 1.480(In)
Specified peak 1-hour rainfall = 2.300(In)
Computed peak 3-hour rainfall = 4.530(In)
Specified peak 6-hour rainfall = 6.840(In)
Specified peak 24-hour rainfall = 13.300(In)

Note: user specified rainfall values used.
Rainfall depth area reduction factors:
Using a total area of 413.50(Ac.) (Ref: fig. E-4)

5-minute factor = 0.981 Adjusted rainfall = 0.539(In)
30-minute factor = 0.981 Adjusted rainfall = 1.451(In)
1-hour factor = 0.981 Adjusted rainfall = 2.255(In)
3-hour factor = 0.998 Adjusted rainfall = 4.519(In)
6-hour factor = 0.999 Adjusted rainfall = 6.831(In)
24-hour factor = 0.999 Adjusted rainfall = 13.293(In)
---

U n i t H y d r o g r a p h
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

| Interval Number | 'S' Graph Mean values | Unit Hydrograph ((CFS)) |
|---|---|---|
| (K = 5000.77 (CFS)) | | |
| 1 | 1.352 | 67.631 |
| 2 | 5.172 | 191.017 |
| 3 | 11.018 | 292.321 |
| 4 | 20.487 | 473.536 |
| 5 | 39.339 | 942.724 |
| 6 | 58.127 | 939.574 |

| | | |
|---|---|---|
| 7 | 66.843 | 435.838 |
| 8 | 72.907 | 303.259 |
| 9 | 77.677 | 238.526 |
| 10 | 81.564 | 194.410 |
| 11 | 84.737 | 158.659 |
| 12 | 87.420 | 134.168 |
| 13 | 89.708 | 114.430 |
| 14 | 91.621 | 95.662 |
| 15 | 93.258 | 81.875 |
| 16 | 94.621 | 68.168 |
| 17 | 95.711 | 54.461 |
| 18 | 96.616 | 45.274 |
| 19 | 97.362 | 37.329 |
| 20 | 97.890 | 26.364 |
| 21 | 98.166 | 13.833 |
| 22 | 98.413 | 12.335 |
| 23 | 98.634 | 11.044 |
| 24 | 98.840 | 10.299 |
| 25 | 99.024 | 9.227 |
| 26 | 99.151 | 6.339 |
| 27 | 99.276 | 6.268 |
| 28 | 99.431 | 7.725 |
| 29 | 99.595 | 8.239 |
| 30 | 99.729 | 6.696 |
| 31 | 99.812 | 4.157 |
| 32 | 99.891 | 3.922 |
| 33 | 99.939 | 2.385 |
| 34 | 100.000 | 1.193 |

---

| Peak Unit Number | Adjusted mass rainfall (In) | Unit rainfall (In) |
|---|---|---|
| 1 | 0.5393 | 0.5393 |
| 2 | 0.7910 | 0.2516 |
| 3 | 0.9896 | 0.1986 |
| 4 | 1.1601 | 0.1705 |
| 5 | 1.3123 | 0.1522 |
| 6 | 1.4513 | 0.1391 |
| 7 | 1.6008 | 0.1495 |
| 8 | 1.7427 | 0.1419 |
| 9 | 1.8783 | 0.1356 |
| 10 | 2.0085 | 0.1302 |
| 11 | 2.1340 | 0.1255 |
| 12 | 2.2554 | 0.1214 |
| 13 | 2.3726 | 0.1171 |
| 14 | 2.4864 | 0.1139 |
| 15 | 2.5973 | 0.1109 |
| 16 | 2.7056 | 0.1082 |
| 17 | 2.8113 | 0.1058 |
| 18 | 2.9148 | 0.1035 |
| 19 | 3.0162 | 0.1014 |
| 20 | 3.1157 | 0.0995 |
| 21 | 3.2134 | 0.0977 |
| 22 | 3.3093 | 0.0960 |
| 23 | 3.4037 | 0.0944 |
| 24 | 3.4966 | 0.0929 |
| 25 | 3.5880 | 0.0915 |
| 26 | 3.6782 | 0.0901 |

| | | |
|---|---|---|
| 27 | 3.7670 | 0.0889 |
| 28 | 3.8547 | 0.0877 |
| 29 | 3.9412 | 0.0865 |
| 30 | 4.0267 | 0.0854 |
| 31 | 4.1110 | 0.0844 |
| 32 | 4.1944 | 0.0834 |
| 33 | 4.2769 | 0.0824 |
| 34 | 4.3584 | 0.0815 |
| 35 | 4.4391 | 0.0807 |
| 36 | 4.5189 | 0.0798 |
| 37 | 4.5933 | 0.0744 |
| 38 | 4.6669 | 0.0736 |
| 39 | 4.7397 | 0.0728 |
| 40 | 4.8118 | 0.0721 |
| 41 | 4.8832 | 0.0714 |
| 42 | 4.9538 | 0.0707 |
| 43 | 5.0238 | 0.0700 |
| 44 | 5.0932 | 0.0693 |
| 45 | 5.1618 | 0.0687 |
| 46 | 5.2299 | 0.0681 |
| 47 | 5.2974 | 0.0675 |
| 48 | 5.3643 | 0.0669 |
| 49 | 5.4307 | 0.0663 |
| 50 | 5.4965 | 0.0658 |
| 51 | 5.5617 | 0.0653 |
| 52 | 5.6265 | 0.0648 |
| 53 | 5.6908 | 0.0643 |
| 54 | 5.7545 | 0.0638 |
| 55 | 5.8178 | 0.0633 |
| 56 | 5.8807 | 0.0628 |
| 57 | 5.9430 | 0.0624 |
| 58 | 6.0050 | 0.0619 |
| 59 | 6.0665 | 0.0615 |
| 60 | 6.1276 | 0.0611 |
| 61 | 6.1883 | 0.0607 |
| 62 | 6.2485 | 0.0603 |
| 63 | 6.3084 | 0.0599 |
| 64 | 6.3679 | 0.0595 |
| 65 | 6.4271 | 0.0591 |
| 66 | 6.4858 | 0.0588 |
| 67 | 6.5442 | 0.0584 |
| 68 | 6.6023 | 0.0581 |
| 69 | 6.6600 | 0.0577 |
| 70 | 6.7174 | 0.0574 |
| 71 | 6.7744 | 0.0570 |
| 72 | 6.8312 | 0.0567 |
| 73 | 6.8766 | 0.0454 |
| 74 | 6.9216 | 0.0451 |
| 75 | 6.9664 | 0.0448 |
| 76 | 7.0109 | 0.0445 |
| 77 | 7.0550 | 0.0442 |
| 78 | 7.0989 | 0.0439 |
| 79 | 7.1424 | 0.0436 |
| 80 | 7.1857 | 0.0433 |
| 81 | 7.2287 | 0.0430 |
| 82 | 7.2714 | 0.0427 |
| 83 | 7.3139 | 0.0425 |

| | | |
|---|---|---|
| 84 | 7.3561 | 0.0422 |
| 85 | 7.3980 | 0.0419 |
| 86 | 7.4397 | 0.0417 |
| 87 | 7.4811 | 0.0414 |
| 88 | 7.5222 | 0.0412 |
| 89 | 7.5632 | 0.0409 |
| 90 | 7.6039 | 0.0407 |
| 91 | 7.6443 | 0.0405 |
| 92 | 7.6846 | 0.0402 |
| 93 | 7.7246 | 0.0400 |
| 94 | 7.7643 | 0.0398 |
| 95 | 7.8039 | 0.0396 |
| 96 | 7.8432 | 0.0393 |
| 97 | 7.8824 | 0.0391 |
| 98 | 7.9213 | 0.0389 |
| 99 | 7.9600 | 0.0387 |
| 100 | 7.9985 | 0.0385 |
| 101 | 8.0368 | 0.0383 |
| 102 | 8.0749 | 0.0381 |
| 103 | 8.1129 | 0.0379 |
| 104 | 8.1506 | 0.0377 |
| 105 | 8.1881 | 0.0375 |
| 106 | 8.2255 | 0.0374 |
| 107 | 8.2627 | 0.0372 |
| 108 | 8.2997 | 0.0370 |
| 109 | 8.3365 | 0.0368 |
| 110 | 8.3731 | 0.0366 |
| 111 | 8.4096 | 0.0365 |
| 112 | 8.4459 | 0.0363 |
| 113 | 8.4820 | 0.0361 |
| 114 | 8.5180 | 0.0360 |
| 115 | 8.5538 | 0.0358 |
| 116 | 8.5894 | 0.0356 |
| 117 | 8.6249 | 0.0355 |
| 118 | 8.6602 | 0.0353 |
| 119 | 8.6954 | 0.0352 |
| 120 | 8.7304 | 0.0350 |
| 121 | 8.7653 | 0.0349 |
| 122 | 8.8000 | 0.0347 |
| 123 | 8.8346 | 0.0346 |
| 124 | 8.8690 | 0.0344 |
| 125 | 8.9033 | 0.0343 |
| 126 | 8.9374 | 0.0341 |
| 127 | 8.9714 | 0.0340 |
| 128 | 9.0052 | 0.0339 |
| 129 | 9.0390 | 0.0337 |
| 130 | 9.0725 | 0.0336 |
| 131 | 9.1060 | 0.0334 |
| 132 | 9.1393 | 0.0333 |
| 133 | 9.1725 | 0.0332 |
| 134 | 9.2055 | 0.0331 |
| 135 | 9.2385 | 0.0329 |
| 136 | 9.2713 | 0.0328 |
| 137 | 9.3040 | 0.0327 |
| 138 | 9.3365 | 0.0326 |
| 139 | 9.3689 | 0.0324 |
| 140 | 9.4012 | 0.0323 |

| | | |
|---|---|---|
| 141 | 9.4334 | 0.0322 |
| 142 | 9.4655 | 0.0321 |
| 143 | 9.4975 | 0.0320 |
| 144 | 9.5293 | 0.0318 |
| 145 | 9.5610 | 0.0317 |
| 146 | 9.5926 | 0.0316 |
| 147 | 9.6241 | 0.0315 |
| 148 | 9.6555 | 0.0314 |
| 149 | 9.6868 | 0.0313 |
| 150 | 9.7180 | 0.0312 |
| 151 | 9.7490 | 0.0311 |
| 152 | 9.7800 | 0.0310 |
| 153 | 9.8108 | 0.0308 |
| 154 | 9.8416 | 0.0307 |
| 155 | 9.8722 | 0.0306 |
| 156 | 9.9027 | 0.0305 |
| 157 | 9.9332 | 0.0304 |
| 158 | 9.9635 | 0.0303 |
| 159 | 9.9937 | 0.0302 |
| 160 | 10.0239 | 0.0301 |
| 161 | 10.0539 | 0.0300 |
| 162 | 10.0838 | 0.0299 |
| 163 | 10.1137 | 0.0298 |
| 164 | 10.1434 | 0.0298 |
| 165 | 10.1731 | 0.0297 |
| 166 | 10.2027 | 0.0296 |
| 167 | 10.2321 | 0.0295 |
| 168 | 10.2615 | 0.0294 |
| 169 | 10.2908 | 0.0293 |
| 170 | 10.3200 | 0.0292 |
| 171 | 10.3491 | 0.0291 |
| 172 | 10.3781 | 0.0290 |
| 173 | 10.4071 | 0.0289 |
| 174 | 10.4359 | 0.0288 |
| 175 | 10.4647 | 0.0288 |
| 176 | 10.4933 | 0.0287 |
| 177 | 10.5219 | 0.0286 |
| 178 | 10.5504 | 0.0285 |
| 179 | 10.5789 | 0.0284 |
| 180 | 10.6072 | 0.0283 |
| 181 | 10.6355 | 0.0283 |
| 182 | 10.6636 | 0.0282 |
| 183 | 10.6917 | 0.0281 |
| 184 | 10.7198 | 0.0280 |
| 185 | 10.7477 | 0.0279 |
| 186 | 10.7756 | 0.0279 |
| 187 | 10.8033 | 0.0278 |
| 188 | 10.8310 | 0.0277 |
| 189 | 10.8587 | 0.0276 |
| 190 | 10.8862 | 0.0276 |
| 191 | 10.9137 | 0.0275 |
| 192 | 10.9411 | 0.0274 |
| 193 | 10.9684 | 0.0273 |
| 194 | 10.9957 | 0.0273 |
| 195 | 11.0229 | 0.0272 |
| 196 | 11.0500 | 0.0271 |
| 197 | 11.0770 | 0.0270 |

| | | |
|---|---|---|
| 198 | 11.1040 | 0.0270 |
| 199 | 11.1309 | 0.0269 |
| 200 | 11.1577 | 0.0268 |
| 201 | 11.1845 | 0.0268 |
| 202 | 11.2112 | 0.0267 |
| 203 | 11.2378 | 0.0266 |
| 204 | 11.2643 | 0.0266 |
| 205 | 11.2908 | 0.0265 |
| 206 | 11.3172 | 0.0264 |
| 207 | 11.3436 | 0.0264 |
| 208 | 11.3699 | 0.0263 |
| 209 | 11.3961 | 0.0262 |
| 210 | 11.4222 | 0.0262 |
| 211 | 11.4483 | 0.0261 |
| 212 | 11.4744 | 0.0260 |
| 213 | 11.5003 | 0.0260 |
| 214 | 11.5262 | 0.0259 |
| 215 | 11.5520 | 0.0258 |
| 216 | 11.5778 | 0.0258 |
| 217 | 11.6035 | 0.0257 |
| 218 | 11.6292 | 0.0256 |
| 219 | 11.6548 | 0.0256 |
| 220 | 11.6803 | 0.0255 |
| 221 | 11.7058 | 0.0255 |
| 222 | 11.7312 | 0.0254 |
| 223 | 11.7565 | 0.0253 |
| 224 | 11.7818 | 0.0253 |
| 225 | 11.8070 | 0.0252 |
| 226 | 11.8322 | 0.0252 |
| 227 | 11.8573 | 0.0251 |
| 228 | 11.8824 | 0.0251 |
| 229 | 11.9074 | 0.0250 |
| 230 | 11.9323 | 0.0249 |
| 231 | 11.9572 | 0.0249 |
| 232 | 11.9820 | 0.0248 |
| 233 | 12.0068 | 0.0248 |
| 234 | 12.0315 | 0.0247 |
| 235 | 12.0562 | 0.0247 |
| 236 | 12.0808 | 0.0246 |
| 237 | 12.1054 | 0.0246 |
| 238 | 12.1299 | 0.0245 |
| 239 | 12.1543 | 0.0244 |
| 240 | 12.1787 | 0.0244 |
| 241 | 12.2031 | 0.0243 |
| 242 | 12.2273 | 0.0243 |
| 243 | 12.2516 | 0.0242 |
| 244 | 12.2758 | 0.0242 |
| 245 | 12.2999 | 0.0241 |
| 246 | 12.3240 | 0.0241 |
| 247 | 12.3480 | 0.0240 |
| 248 | 12.3720 | 0.0240 |
| 249 | 12.3959 | 0.0239 |
| 250 | 12.4198 | 0.0239 |
| 251 | 12.4437 | 0.0238 |
| 252 | 12.4674 | 0.0238 |
| 253 | 12.4912 | 0.0237 |
| 254 | 12.5149 | 0.0237 |

| | | |
|---|---|---|
| 255 | 12.5385 | 0.0236 |
| 256 | 12.5621 | 0.0236 |
| 257 | 12.5856 | 0.0235 |
| 258 | 12.6091 | 0.0235 |
| 259 | 12.6326 | 0.0234 |
| 260 | 12.6560 | 0.0234 |
| 261 | 12.6793 | 0.0234 |
| 262 | 12.7026 | 0.0233 |
| 263 | 12.7259 | 0.0233 |
| 264 | 12.7491 | 0.0232 |
| 265 | 12.7723 | 0.0232 |
| 266 | 12.7954 | 0.0231 |
| 267 | 12.8185 | 0.0231 |
| 268 | 12.8415 | 0.0230 |
| 269 | 12.8645 | 0.0230 |
| 270 | 12.8874 | 0.0229 |
| 271 | 12.9103 | 0.0229 |
| 272 | 12.9332 | 0.0229 |
| 273 | 12.9560 | 0.0228 |
| 274 | 12.9788 | 0.0228 |
| 275 | 13.0015 | 0.0227 |
| 276 | 13.0242 | 0.0227 |
| 277 | 13.0468 | 0.0226 |
| 278 | 13.0694 | 0.0226 |
| 279 | 13.0920 | 0.0226 |
| 280 | 13.1145 | 0.0225 |
| 281 | 13.1370 | 0.0225 |
| 282 | 13.1594 | 0.0224 |
| 283 | 13.1818 | 0.0224 |
| 284 | 13.2041 | 0.0223 |
| 285 | 13.2264 | 0.0223 |
| 286 | 13.2487 | 0.0223 |
| 287 | 13.2709 | 0.0222 |
| 288 | 13.2931 | 0.0222 |

| Unit Period (number) | Unit Rainfall (In) | Unit Soil-Loss (In) | Effective Rainfall (In) |
|---|---|---|---|
| 1 | 0.0222 | 0.0015 | 0.0207 |
| 2 | 0.0222 | 0.0015 | 0.0207 |
| 3 | 0.0223 | 0.0015 | 0.0208 |
| 4 | 0.0223 | 0.0015 | 0.0209 |
| 5 | 0.0224 | 0.0015 | 0.0209 |
| 6 | 0.0225 | 0.0015 | 0.0210 |
| 7 | 0.0226 | 0.0015 | 0.0211 |
| 8 | 0.0226 | 0.0015 | 0.0211 |
| 9 | 0.0227 | 0.0015 | 0.0212 |
| 10 | 0.0227 | 0.0015 | 0.0212 |
| 11 | 0.0228 | 0.0015 | 0.0213 |
| 12 | 0.0229 | 0.0015 | 0.0213 |
| 13 | 0.0229 | 0.0015 | 0.0214 |
| 14 | 0.0230 | 0.0015 | 0.0215 |
| 15 | 0.0231 | 0.0015 | 0.0215 |
| 16 | 0.0231 | 0.0015 | 0.0216 |
| 17 | 0.0232 | 0.0015 | 0.0217 |
| 18 | 0.0233 | 0.0016 | 0.0217 |

| | | | |
|---|---|---|---|
| 19 | 0.0234 | 0.0016 | 0.0218 |
| 20 | 0.0234 | 0.0016 | 0.0218 |
| 21 | 0.0235 | 0.0016 | 0.0219 |
| 22 | 0.0235 | 0.0016 | 0.0220 |
| 23 | 0.0236 | 0.0016 | 0.0221 |
| 24 | 0.0237 | 0.0016 | 0.0221 |
| 25 | 0.0238 | 0.0016 | 0.0222 |
| 26 | 0.0238 | 0.0016 | 0.0222 |
| 27 | 0.0239 | 0.0016 | 0.0223 |
| 28 | 0.0240 | 0.0016 | 0.0224 |
| 29 | 0.0241 | 0.0016 | 0.0225 |
| 30 | 0.0241 | 0.0016 | 0.0225 |
| 31 | 0.0242 | 0.0016 | 0.0226 |
| 32 | 0.0243 | 0.0016 | 0.0227 |
| 33 | 0.0244 | 0.0016 | 0.0228 |
| 34 | 0.0244 | 0.0016 | 0.0228 |
| 35 | 0.0246 | 0.0016 | 0.0229 |
| 36 | 0.0246 | 0.0016 | 0.0230 |
| 37 | 0.0247 | 0.0017 | 0.0231 |
| 38 | 0.0248 | 0.0017 | 0.0231 |
| 39 | 0.0249 | 0.0017 | 0.0232 |
| 40 | 0.0249 | 0.0017 | 0.0233 |
| 41 | 0.0251 | 0.0017 | 0.0234 |
| 42 | 0.0251 | 0.0017 | 0.0234 |
| 43 | 0.0252 | 0.0017 | 0.0235 |
| 44 | 0.0253 | 0.0017 | 0.0236 |
| 45 | 0.0254 | 0.0017 | 0.0237 |
| 46 | 0.0255 | 0.0017 | 0.0238 |
| 47 | 0.0256 | 0.0017 | 0.0239 |
| 48 | 0.0256 | 0.0017 | 0.0239 |
| 49 | 0.0258 | 0.0017 | 0.0241 |
| 50 | 0.0258 | 0.0017 | 0.0241 |
| 51 | 0.0260 | 0.0017 | 0.0242 |
| 52 | 0.0260 | 0.0017 | 0.0243 |
| 53 | 0.0262 | 0.0017 | 0.0244 |
| 54 | 0.0262 | 0.0018 | 0.0245 |
| 55 | 0.0264 | 0.0018 | 0.0246 |
| 56 | 0.0264 | 0.0018 | 0.0247 |
| 57 | 0.0266 | 0.0018 | 0.0248 |
| 58 | 0.0266 | 0.0018 | 0.0248 |
| 59 | 0.0268 | 0.0018 | 0.0250 |
| 60 | 0.0268 | 0.0018 | 0.0250 |
| 61 | 0.0270 | 0.0018 | 0.0252 |
| 62 | 0.0270 | 0.0018 | 0.0252 |
| 63 | 0.0272 | 0.0018 | 0.0254 |
| 64 | 0.0273 | 0.0018 | 0.0254 |
| 65 | 0.0274 | 0.0018 | 0.0256 |
| 66 | 0.0275 | 0.0018 | 0.0256 |
| 67 | 0.0276 | 0.0018 | 0.0258 |
| 68 | 0.0277 | 0.0018 | 0.0259 |
| 69 | 0.0279 | 0.0019 | 0.0260 |
| 70 | 0.0279 | 0.0019 | 0.0261 |
| 71 | 0.0281 | 0.0019 | 0.0262 |
| 72 | 0.0282 | 0.0019 | 0.0263 |
| 73 | 0.0283 | 0.0019 | 0.0264 |
| 74 | 0.0284 | 0.0019 | 0.0265 |
| 75 | 0.0286 | 0.0019 | 0.0267 |

| | | | |
|---|---|---|---|
| 76 | 0.0287 | 0.0019 | 0.0268 |
| 77 | 0.0288 | 0.0019 | 0.0269 |
| 78 | 0.0289 | 0.0019 | 0.0270 |
| 79 | 0.0291 | 0.0019 | 0.0272 |
| 80 | 0.0292 | 0.0019 | 0.0272 |
| 81 | 0.0294 | 0.0020 | 0.0274 |
| 82 | 0.0295 | 0.0020 | 0.0275 |
| 83 | 0.0297 | 0.0020 | 0.0277 |
| 84 | 0.0298 | 0.0020 | 0.0278 |
| 85 | 0.0299 | 0.0020 | 0.0279 |
| 86 | 0.0300 | 0.0020 | 0.0280 |
| 87 | 0.0302 | 0.0020 | 0.0282 |
| 88 | 0.0303 | 0.0020 | 0.0283 |
| 89 | 0.0305 | 0.0020 | 0.0285 |
| 90 | 0.0306 | 0.0020 | 0.0286 |
| 91 | 0.0308 | 0.0021 | 0.0288 |
| 92 | 0.0310 | 0.0021 | 0.0289 |
| 93 | 0.0312 | 0.0021 | 0.0291 |
| 94 | 0.0313 | 0.0021 | 0.0292 |
| 95 | 0.0315 | 0.0021 | 0.0294 |
| 96 | 0.0316 | 0.0021 | 0.0295 |
| 97 | 0.0318 | 0.0021 | 0.0297 |
| 98 | 0.0320 | 0.0021 | 0.0298 |
| 99 | 0.0322 | 0.0021 | 0.0300 |
| 100 | 0.0323 | 0.0022 | 0.0302 |
| 101 | 0.0326 | 0.0022 | 0.0304 |
| 102 | 0.0327 | 0.0022 | 0.0305 |
| 103 | 0.0329 | 0.0022 | 0.0307 |
| 104 | 0.0331 | 0.0022 | 0.0308 |
| 105 | 0.0333 | 0.0022 | 0.0311 |
| 106 | 0.0334 | 0.0022 | 0.0312 |
| 107 | 0.0337 | 0.0023 | 0.0315 |
| 108 | 0.0339 | 0.0023 | 0.0316 |
| 109 | 0.0341 | 0.0023 | 0.0319 |
| 110 | 0.0343 | 0.0023 | 0.0320 |
| 111 | 0.0346 | 0.0023 | 0.0323 |
| 112 | 0.0347 | 0.0023 | 0.0324 |
| 113 | 0.0350 | 0.0023 | 0.0327 |
| 114 | 0.0352 | 0.0023 | 0.0328 |
| 115 | 0.0355 | 0.0024 | 0.0331 |
| 116 | 0.0356 | 0.0024 | 0.0333 |
| 117 | 0.0360 | 0.0024 | 0.0336 |
| 118 | 0.0361 | 0.0024 | 0.0337 |
| 119 | 0.0365 | 0.0024 | 0.0340 |
| 120 | 0.0366 | 0.0024 | 0.0342 |
| 121 | 0.0370 | 0.0025 | 0.0345 |
| 122 | 0.0372 | 0.0025 | 0.0347 |
| 123 | 0.0375 | 0.0025 | 0.0350 |
| 124 | 0.0377 | 0.0025 | 0.0352 |
| 125 | 0.0381 | 0.0025 | 0.0356 |
| 126 | 0.0383 | 0.0026 | 0.0358 |
| 127 | 0.0387 | 0.0026 | 0.0361 |
| 128 | 0.0389 | 0.0026 | 0.0363 |
| 129 | 0.0393 | 0.0026 | 0.0367 |
| 130 | 0.0396 | 0.0026 | 0.0369 |
| 131 | 0.0400 | 0.0027 | 0.0373 |
| 132 | 0.0402 | 0.0027 | 0.0375 |

| | | | |
|---|---|---|---|
| 133 | 0.0407 | 0.0027 | 0.0380 |
| 134 | 0.0409 | 0.0027 | 0.0382 |
| 135 | 0.0414 | 0.0028 | 0.0387 |
| 136 | 0.0417 | 0.0028 | 0.0389 |
| 137 | 0.0422 | 0.0028 | 0.0394 |
| 138 | 0.0425 | 0.0028 | 0.0396 |
| 139 | 0.0430 | 0.0029 | 0.0401 |
| 140 | 0.0433 | 0.0029 | 0.0404 |
| 141 | 0.0439 | 0.0029 | 0.0409 |
| 142 | 0.0442 | 0.0029 | 0.0412 |
| 143 | 0.0448 | 0.0030 | 0.0418 |
| 144 | 0.0451 | 0.0030 | 0.0421 |
| 145 | 0.0567 | 0.0038 | 0.0529 |
| 146 | 0.0570 | 0.0038 | 0.0532 |
| 147 | 0.0577 | 0.0039 | 0.0539 |
| 148 | 0.0581 | 0.0039 | 0.0542 |
| 149 | 0.0588 | 0.0039 | 0.0548 |
| 150 | 0.0591 | 0.0039 | 0.0552 |
| 151 | 0.0599 | 0.0040 | 0.0559 |
| 152 | 0.0603 | 0.0040 | 0.0563 |
| 153 | 0.0611 | 0.0041 | 0.0570 |
| 154 | 0.0615 | 0.0041 | 0.0574 |
| 155 | 0.0624 | 0.0042 | 0.0582 |
| 156 | 0.0628 | 0.0042 | 0.0586 |
| 157 | 0.0638 | 0.0043 | 0.0595 |
| 158 | 0.0643 | 0.0043 | 0.0600 |
| 159 | 0.0653 | 0.0044 | 0.0609 |
| 160 | 0.0658 | 0.0044 | 0.0614 |
| 161 | 0.0669 | 0.0045 | 0.0624 |
| 162 | 0.0675 | 0.0045 | 0.0630 |
| 163 | 0.0687 | 0.0046 | 0.0641 |
| 164 | 0.0693 | 0.0046 | 0.0647 |
| 165 | 0.0707 | 0.0047 | 0.0659 |
| 166 | 0.0714 | 0.0048 | 0.0666 |
| 167 | 0.0728 | 0.0049 | 0.0680 |
| 168 | 0.0736 | 0.0049 | 0.0687 |
| 169 | 0.0798 | 0.0053 | 0.0745 |
| 170 | 0.0807 | 0.0054 | 0.0753 |
| 171 | 0.0824 | 0.0055 | 0.0769 |
| 172 | 0.0834 | 0.0056 | 0.0778 |
| 173 | 0.0854 | 0.0057 | 0.0797 |
| 174 | 0.0865 | 0.0058 | 0.0807 |
| 175 | 0.0889 | 0.0059 | 0.0829 |
| 176 | 0.0901 | 0.0060 | 0.0841 |
| 177 | 0.0929 | 0.0062 | 0.0867 |
| 178 | 0.0944 | 0.0063 | 0.0881 |
| 179 | 0.0977 | 0.0065 | 0.0911 |
| 180 | 0.0995 | 0.0066 | 0.0928 |
| 181 | 0.1035 | 0.0069 | 0.0966 |
| 182 | 0.1058 | 0.0071 | 0.0987 |
| 183 | 0.1109 | 0.0074 | 0.1035 |
| 184 | 0.1139 | 0.0076 | 0.1063 |
| 185 | 0.1214 | 0.0081 | 0.1133 |
| 186 | 0.1255 | 0.0084 | 0.1171 |
| 187 | 0.1356 | 0.0090 | 0.1265 |
| 188 | 0.1419 | 0.0095 | 0.1324 |
| 189 | 0.1391 | 0.0093 | 0.1298 |

| | | | |
|---|---|---|---|
| 190 | 0.1522 | 0.0102 | 0.1420 |
| 191 | 0.1986 | 0.0117 | 0.1869 |
| 192 | 0.2516 | 0.0117 | 0.2400 |
| 193 | 0.5393 | 0.0117 | 0.5277 |
| 194 | 0.1705 | 0.0114 | 0.1591 |
| 195 | 0.1495 | 0.0100 | 0.1395 |
| 196 | 0.1302 | 0.0087 | 0.1215 |
| 197 | 0.1171 | 0.0078 | 0.1093 |
| 198 | 0.1082 | 0.0072 | 0.1010 |
| 199 | 0.1014 | 0.0068 | 0.0946 |
| 200 | 0.0960 | 0.0064 | 0.0896 |
| 201 | 0.0915 | 0.0061 | 0.0854 |
| 202 | 0.0877 | 0.0059 | 0.0818 |
| 203 | 0.0844 | 0.0056 | 0.0788 |
| 204 | 0.0815 | 0.0054 | 0.0761 |
| 205 | 0.0744 | 0.0050 | 0.0695 |
| 206 | 0.0721 | 0.0048 | 0.0673 |
| 207 | 0.0700 | 0.0047 | 0.0653 |
| 208 | 0.0681 | 0.0045 | 0.0635 |
| 209 | 0.0663 | 0.0044 | 0.0619 |
| 210 | 0.0648 | 0.0043 | 0.0604 |
| 211 | 0.0633 | 0.0042 | 0.0591 |
| 212 | 0.0619 | 0.0041 | 0.0578 |
| 213 | 0.0607 | 0.0041 | 0.0566 |
| 214 | 0.0595 | 0.0040 | 0.0555 |
| 215 | 0.0584 | 0.0039 | 0.0545 |
| 216 | 0.0574 | 0.0038 | 0.0535 |
| 217 | 0.0454 | 0.0030 | 0.0424 |
| 218 | 0.0445 | 0.0030 | 0.0415 |
| 219 | 0.0436 | 0.0029 | 0.0407 |
| 220 | 0.0427 | 0.0029 | 0.0399 |
| 221 | 0.0419 | 0.0028 | 0.0391 |
| 222 | 0.0412 | 0.0027 | 0.0384 |
| 223 | 0.0405 | 0.0027 | 0.0378 |
| 224 | 0.0398 | 0.0027 | 0.0371 |
| 225 | 0.0391 | 0.0026 | 0.0365 |
| 226 | 0.0385 | 0.0026 | 0.0359 |
| 227 | 0.0379 | 0.0025 | 0.0354 |
| 228 | 0.0374 | 0.0025 | 0.0349 |
| 229 | 0.0368 | 0.0025 | 0.0344 |
| 230 | 0.0363 | 0.0024 | 0.0339 |
| 231 | 0.0358 | 0.0024 | 0.0334 |
| 232 | 0.0353 | 0.0024 | 0.0330 |
| 233 | 0.0349 | 0.0023 | 0.0325 |
| 234 | 0.0344 | 0.0023 | 0.0321 |
| 235 | 0.0340 | 0.0023 | 0.0317 |
| 236 | 0.0336 | 0.0022 | 0.0313 |
| 237 | 0.0332 | 0.0022 | 0.0310 |
| 238 | 0.0328 | 0.0022 | 0.0306 |
| 239 | 0.0324 | 0.0022 | 0.0303 |
| 240 | 0.0321 | 0.0021 | 0.0299 |
| 241 | 0.0317 | 0.0021 | 0.0296 |
| 242 | 0.0314 | 0.0021 | 0.0293 |
| 243 | 0.0311 | 0.0021 | 0.0290 |
| 244 | 0.0307 | 0.0021 | 0.0287 |
| 245 | 0.0304 | 0.0020 | 0.0284 |
| 246 | 0.0301 | 0.0020 | 0.0281 |

| | | | |
|---|---|---|---|
| 247 | 0.0298 | 0.0020 | 0.0279 |
| 248 | 0.0296 | 0.0020 | 0.0276 |
| 249 | 0.0293 | 0.0020 | 0.0273 |
| 250 | 0.0290 | 0.0019 | 0.0271 |
| 251 | 0.0288 | 0.0019 | 0.0268 |
| 252 | 0.0285 | 0.0019 | 0.0266 |
| 253 | 0.0283 | 0.0019 | 0.0264 |
| 254 | 0.0280 | 0.0019 | 0.0261 |
| 255 | 0.0278 | 0.0019 | 0.0259 |
| 256 | 0.0276 | 0.0018 | 0.0257 |
| 257 | 0.0273 | 0.0018 | 0.0255 |
| 258 | 0.0271 | 0.0018 | 0.0253 |
| 259 | 0.0269 | 0.0018 | 0.0251 |
| 260 | 0.0267 | 0.0018 | 0.0249 |
| 261 | 0.0265 | 0.0018 | 0.0247 |
| 262 | 0.0263 | 0.0018 | 0.0245 |
| 263 | 0.0261 | 0.0017 | 0.0243 |
| 264 | 0.0259 | 0.0017 | 0.0242 |
| 265 | 0.0257 | 0.0017 | 0.0240 |
| 266 | 0.0255 | 0.0017 | 0.0238 |
| 267 | 0.0253 | 0.0017 | 0.0237 |
| 268 | 0.0252 | 0.0017 | 0.0235 |
| 269 | 0.0250 | 0.0017 | 0.0233 |
| 270 | 0.0248 | 0.0017 | 0.0232 |
| 271 | 0.0247 | 0.0016 | 0.0230 |
| 272 | 0.0245 | 0.0016 | 0.0229 |
| 273 | 0.0243 | 0.0016 | 0.0227 |
| 274 | 0.0242 | 0.0016 | 0.0226 |
| 275 | 0.0240 | 0.0016 | 0.0224 |
| 276 | 0.0239 | 0.0016 | 0.0223 |
| 277 | 0.0237 | 0.0016 | 0.0222 |
| 278 | 0.0236 | 0.0016 | 0.0220 |
| 279 | 0.0234 | 0.0016 | 0.0219 |
| 280 | 0.0233 | 0.0016 | 0.0218 |
| 281 | 0.0232 | 0.0015 | 0.0216 |
| 282 | 0.0230 | 0.0015 | 0.0215 |
| 283 | 0.0229 | 0.0015 | 0.0214 |
| 284 | 0.0228 | 0.0015 | 0.0212 |
| 285 | 0.0226 | 0.0015 | 0.0211 |
| 286 | 0.0225 | 0.0015 | 0.0210 |
| 287 | 0.0224 | 0.0015 | 0.0209 |
| 288 | 0.0223 | 0.0015 | 0.0208 |

---

---

Total soil rain loss = 0.86(In)
Total effective rainfall = 12.44(In)
Peak flow rate in flood hydrograph = 1148.34(CFS)

---

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

---

Hydrograph in 5 Minute intervals ((CFS))

---

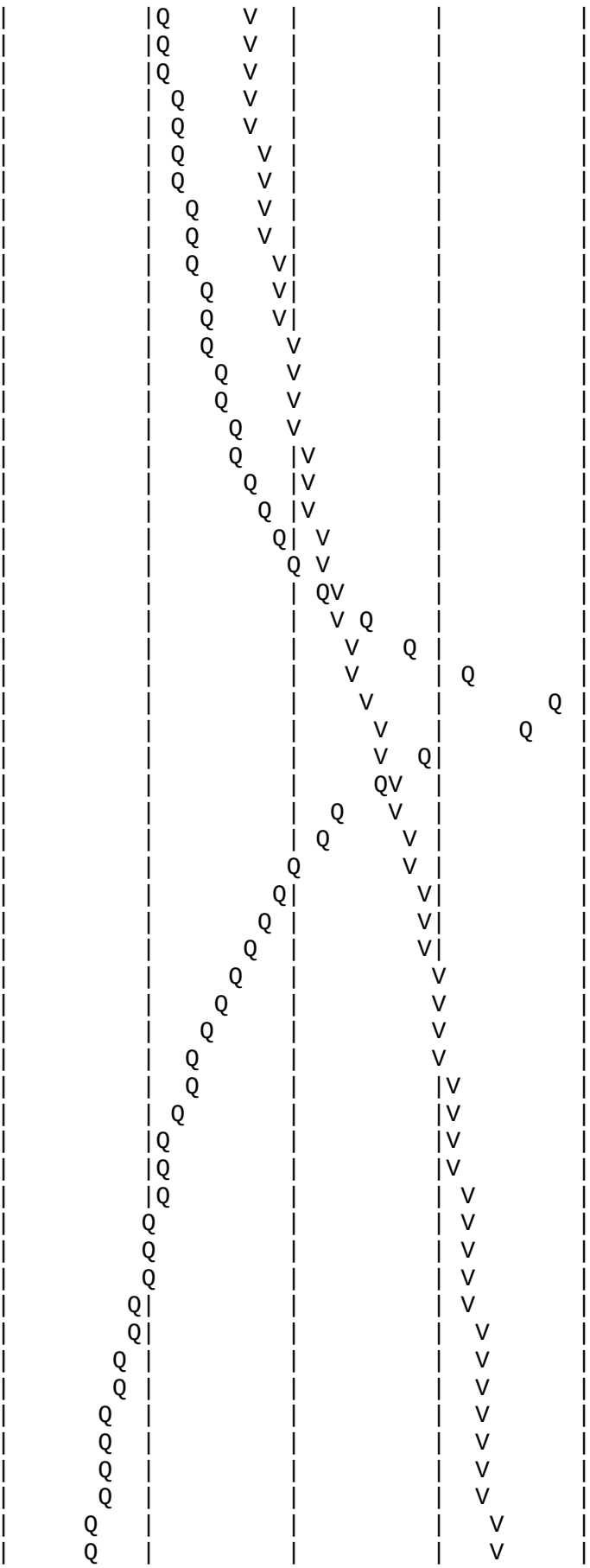
Time(h+m) Volume Ac.Ft Q(CFS) 0 300.0 600.0 900.0 1200.0

---

```
0+ 5       0.0096      1.40  Q          |          |          |          |
0+10       0.0465      5.36  Q          |          |          |          |
0+15       0.1252     11.42  Q          |          |          |          |
0+20       0.2716     21.26  Q          |          |          |          |
0+25       0.5528     40.83  VQ         |          |          |          |
0+30       0.9686     60.38  V Q        |          |          |          |
0+35       1.4477     69.57  V Q        |          |          |          |
0+40       1.9714     76.03  V Q        |          |          |          |
0+45       2.5305     81.18  V Q        |          |          |          |
0+50       3.1188     85.43  V Q        |          |          |          |
0+55       3.7314     88.95  V Q        |          |          |          |
1+ 0       4.3648     91.97  V  Q       |          |          |          |
1+ 5       5.0163     94.60  V  Q       |          |          |          |
1+10       5.6833     96.85  V  Q       |          |          |          |
1+15       6.3639     98.82  V  Q       |          |          |          |
1+20       7.0561    100.51  V  Q       |          |          |          |
1+25       7.7580    101.92  V  Q       |          |          |          |
1+30       8.4684    103.15  V  Q       |          |          |          |
1+35       9.1862    104.22  V  Q       |          |          |          |
1+40       9.9098    105.07  V  Q       |          |          |          |
1+45      10.6376    105.66  V  Q       |          |          |          |
1+50      11.3692    106.23  |V Q       |          |          |          |
1+55      12.1045    106.77  |V Q       |          |          |          |
2+ 0      12.8435    107.30  |V Q       |          |          |          |
2+ 5      13.5860    107.81  |V Q       |          |          |          |
2+10      14.3317    108.27  |V Q       |          |          |          |
2+15      15.0804    108.72  |V Q       |          |          |          |
2+20      15.8326    109.21  |V Q       |          |          |          |
2+25      16.5882    109.72  |V Q       |          |          |          |
2+30      17.3472    110.19  |V Q       |          |          |          |
2+35      18.1090    110.62  |V Q       |          |          |          |
2+40      18.8738    111.05  |V Q       |          |          |          |
2+45      19.6413    111.44  |V Q       |          |          |          |
2+50      20.4114    111.82  |V Q       |          |          |          |
2+55      21.1839    112.17  |V Q       |          |          |          |
3+ 0      21.9589    112.53  | VQ       |          |          |          |
3+ 5      22.7363    112.89  | VQ       |          |          |          |
3+10      23.5163    113.25  | VQ       |          |          |          |
3+15      24.2988    113.62  | VQ       |          |          |          |
3+20      25.0838    113.99  | VQ       |          |          |          |
3+25      25.8714    114.36  | VQ       |          |          |          |
3+30      26.6616    114.74  | VQ       |          |          |          |
3+35      27.4545    115.12  | VQ       |          |          |          |
3+40      28.2500    115.51  | VQ       |          |          |          |
3+45      29.0482    115.90  | VQ       |          |          |          |
3+50      29.8491    116.29  | VQ       |          |          |          |
3+55      30.6527    116.69  | VQ       |          |          |          |
4+ 0      31.4591    117.09  | VQ       |          |          |          |
4+ 5      32.2682    117.49  |  Q       |          |          |          |
4+10      33.0802    117.90  |  Q       |          |          |          |
4+15      33.8950    118.31  |  Q       |          |          |          |
4+20      34.7127    118.73  |  Q       |          |          |          |
4+25      35.5334    119.15  |  Q       |          |          |          |
4+30      36.3569    119.58  |  Q       |          |          |          |
4+35      37.1834    120.01  |  VQ      |          |          |          |
4+40      38.0129    120.44  |  VQ      |          |          |          |
4+45      38.8455    120.88  |  VQ      |          |          |          |
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4+50 | 39.6811 | 121.33 | VQ | | | | |
| 4+55 | 40.5197 | 121.78 | VQ | | | | |
| 5+ 0 | 41.3616 | 122.23 | VQ | | | | |
| 5+ 5 | 42.2066 | 122.69 | VQ | | | | |
| 5+10 | 43.0547 | 123.16 | Q | | | | |
| 5+15 | 43.9062 | 123.63 | Q | | | | |
| 5+20 | 44.7609 | 124.10 | Q | | | | |
| 5+25 | 45.6188 | 124.58 | Q | | | | |
| 5+30 | 46.4802 | 125.07 | Q | | | | |
| 5+35 | 47.3449 | 125.56 | Q | | | | |
| 5+40 | 48.2131 | 126.06 | Q | | | | |
| 5+45 | 49.0847 | 126.56 | Q | | | | |
| 5+50 | 49.9598 | 127.07 | Q | | | | |
| 5+55 | 50.8385 | 127.58 | Q | | | | |
| 6+ 0 | 51.7207 | 128.10 | Q | | | | |
| 6+ 5 | 52.6066 | 128.63 | Q | | | | |
| 6+10 | 53.4961 | 129.16 | Q | | | | |
| 6+15 | 54.3894 | 129.70 | QV | | | | |
| 6+20 | 55.2865 | 130.25 | QV | | | | |
| 6+25 | 56.1873 | 130.80 | QV | | | | |
| 6+30 | 57.0920 | 131.37 | QV | | | | |
| 6+35 | 58.0006 | 131.93 | QV | | | | |
| 6+40 | 58.9132 | 132.51 | QV | | | | |
| 6+45 | 59.8298 | 133.09 | QV | | | | |
| 6+50 | 60.7505 | 133.68 | QV | | | | |
| 6+55 | 61.6752 | 134.28 | QV | | | | |
| 7+ 0 | 62.6042 | 134.88 | QV | | | | |
| 7+ 5 | 63.5374 | 135.49 | QV | | | | |
| 7+10 | 64.4748 | 136.12 | Q V | | | | |
| 7+15 | 65.4166 | 136.75 | Q V | | | | |
| 7+20 | 66.3628 | 137.39 | Q V | | | | |
| 7+25 | 67.3134 | 138.03 | Q V | | | | |
| 7+30 | 68.2686 | 138.69 | Q V | | | | |
| 7+35 | 69.2283 | 139.36 | Q V | | | | |
| 7+40 | 70.1928 | 140.03 | Q V | | | | |
| 7+45 | 71.1619 | 140.72 | Q V | | | | |
| 7+50 | 72.1358 | 141.41 | Q V | | | | |
| 7+55 | 73.1146 | 142.12 | Q V | | | | |
| 8+ 0 | 74.0983 | 142.83 | Q V | | | | |
| 8+ 5 | 75.0869 | 143.56 | Q V | | | | |
| 8+10 | 76.0807 | 144.30 | Q V | | | | |
| 8+15 | 77.0796 | 145.04 | Q V | | | | |
| 8+20 | 78.0838 | 145.80 | Q V | | | | |
| 8+25 | 79.0933 | 146.57 | Q V | | | | |
| 8+30 | 80.1081 | 147.36 | Q V | | | | |
| 8+35 | 81.1285 | 148.15 | Q V | | | | |
| 8+40 | 82.1544 | 148.96 | Q V | | | | |
| 8+45 | 83.1860 | 149.78 | Q V | | | | |
| 8+50 | 84.2233 | 150.62 | Q V | | | | |
| 8+55 | 85.2665 | 151.47 | Q V | | | | |
| 9+ 0 | 86.3156 | 152.33 | Q V | | | | |
| 9+ 5 | 87.3707 | 153.21 | Q V | | | | |
| 9+10 | 88.4321 | 154.10 | Q V | | | | |
| 9+15 | 89.4996 | 155.01 | Q V | | | | |
| 9+20 | 90.5736 | 155.94 | Q V | | | | |
| 9+25 | 91.6540 | 156.87 | Q V | | | | |
| 9+30 | 92.7410 | 157.83 | Q V | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9+35 | 93.8347 | 158.81 | Q V | | | | |
| 9+40 | 94.9352 | 159.80 | Q V | | | | |
| 9+45 | 96.0427 | 160.81 | Q V | | | | |
| 9+50 | 97.1573 | 161.84 | Q V | | | | |
| 9+55 | 98.2791 | 162.89 | Q V | | | | |
| 10+ 0 | 99.4083 | 163.96 | Q V | | | | |
| 10+ 5 | 100.5450 | 165.05 | Q V | | | | |
| 10+10 | 101.6893 | 166.16 | Q V | | | | |
| 10+15 | 102.8415 | 167.29 | Q V | | | | |
| 10+20 | 104.0016 | 168.45 | Q V | | | | |
| 10+25 | 105.1699 | 169.63 | Q V | | | | |
| 10+30 | 106.3464 | 170.84 | Q V | | | | |
| 10+35 | 107.5315 | 172.07 | Q V | | | | |
| 10+40 | 108.7252 | 173.33 | Q V | | | | |
| 10+45 | 109.9277 | 174.61 | Q V | | | | |
| 10+50 | 111.1393 | 175.92 | Q V | | | | |
| 10+55 | 112.3601 | 177.26 | Q V | | | | |
| 11+ 0 | 113.5904 | 178.64 | Q V | | | | |
| 11+ 5 | 114.8304 | 180.04 | Q V | | | | |
| 11+10 | 116.0803 | 181.48 | Q V | | | | |
| 11+15 | 117.3402 | 182.95 | Q V | | | | |
| 11+20 | 118.6106 | 184.46 | Q V | | | | |
| 11+25 | 119.8916 | 186.00 | Q V | | | | |
| 11+30 | 121.1835 | 187.59 | Q V | | | | |
| 11+35 | 122.4866 | 189.21 | Q V | | | | |
| 11+40 | 123.8012 | 190.88 | Q V | | | | |
| 11+45 | 125.1275 | 192.58 | Q V | | | | |
| 11+50 | 126.4659 | 194.34 | Q V | | | | |
| 11+55 | 127.8167 | 196.14 | Q V | | | | |
| 12+ 0 | 129.1803 | 197.99 | Q V | | | | |
| 12+ 5 | 130.5618 | 200.59 | Q V | | | | |
| 12+10 | 131.9703 | 204.51 | Q V | | | | |
| 12+15 | 133.4132 | 209.52 | Q V | | | | |
| 12+20 | 134.9039 | 216.45 | Q V | | | | |
| 12+25 | 136.4758 | 228.24 | Q V | | | | |
| 12+30 | 138.1291 | 240.06 | Q V | | | | |
| 12+35 | 139.8285 | 246.75 | Q V | | | | |
| 12+40 | 141.5650 | 252.15 | Q V | | | | |
| 12+45 | 143.3346 | 256.94 | Q V | | | | |
| 12+50 | 145.1345 | 261.35 | Q V | | | | |
| 12+55 | 146.9629 | 265.47 | Q V | | | | |
| 13+ 0 | 148.8184 | 269.43 | Q V | | | | |
| 13+ 5 | 150.7003 | 273.26 | Q V | | | | |
| 13+10 | 152.6080 | 276.99 | Q V | | | | |
| 13+15 | 154.5410 | 280.67 | Q V | | | | |
| 13+20 | 156.4992 | 284.33 | Q V | | | | |
| 13+25 | 158.4822 | 287.94 | Q V | | | | |
| 13+30 | 160.4903 | 291.58 | Q V | | | | |
| 13+35 | 162.5238 | 295.26 | Q V | | | | |
| 13+40 | 164.5828 | 298.96 | Q V | | | | |
| 13+45 | 166.6673 | 302.68 | Q V | | | | |
| 13+50 | 168.7785 | 306.54 | Q V | | | | |
| 13+55 | 170.9172 | 310.54 | Q V | | | | |
| 14+ 0 | 173.0847 | 314.73 | Q V | | | | |
| 14+ 5 | 175.2843 | 319.37 | Q V | | | | |
| 14+10 | 177.5207 | 324.74 | Q V | | | | |
| 14+15 | 179.7985 | 330.74 | Q V | | | | |

| | | | |
|---|---|---|---|
| 14+20 | 182.1248 | 337.77 |  |
| 14+25 | 184.5150 | 347.05 | |
| 14+30 | 186.9707 | 356.57 | |
| 14+35 | 189.4789 | 364.19 | |
| 14+40 | 192.0381 | 371.59 | |
| 14+45 | 194.6488 | 379.07 | |
| 14+50 | 197.3126 | 386.80 | |
| 14+55 | 200.0318 | 394.82 | |
| 15+ 0 | 202.8095 | 403.32 | |
| 15+ 5 | 205.6493 | 412.35 | |
| 15+10 | 208.5560 | 422.04 | |
| 15+15 | 211.5348 | 432.52 | |
| 15+20 | 214.5923 | 443.96 | |
| 15+25 | 217.7369 | 456.58 | |
| 15+30 | 220.9787 | 470.71 | |
| 15+35 | 224.3306 | 486.69 | |
| 15+40 | 227.8087 | 505.03 | |
| 15+45 | 231.4275 | 525.45 | |
| 15+50 | 235.2000 | 547.76 | |
| 15+55 | 239.1605 | 575.07 | |
| 16+ 0 | 243.3710 | 611.36 | |
| 16+ 5 | 248.0049 | 672.84 | |
| 16+10 | 253.2313 | 758.88 | |
| 16+15 | 259.1336 | 857.00 | |
| 16+20 | 265.9089 | 983.77 | |
| 16+25 | 273.8175 | 1148.34 | |
| 16+30 | 281.3751 | 1097.37 | |
| 16+35 | 287.4108 | 876.38 | |
| 16+40 | 292.8097 | 783.92 | |
| 16+45 | 297.7553 | 718.10 | |
| 16+50 | 302.3366 | 665.20 | |
| 16+55 | 306.6086 | 620.31 | |
| 17+ 0 | 310.6236 | 582.97 | |
| 17+ 5 | 314.4105 | 549.86 | |
| 17+10 | 317.9852 | 519.05 | |
| 17+15 | 321.3695 | 491.39 | |
| 17+20 | 324.5705 | 464.79 | |
| 17+25 | 327.5873 | 438.05 | |
| 17+30 | 330.4398 | 414.18 | |
| 17+35 | 333.1521 | 393.82 | |
| 17+40 | 335.7304 | 374.38 | |
| 17+45 | 338.1868 | 356.67 | |
| 17+50 | 340.5588 | 344.40 | |
| 17+55 | 342.8556 | 333.51 | |
| 18+ 0 | 345.0853 | 323.75 | |
| 18+ 5 | 347.2475 | 313.95 | |
| 18+10 | 349.3357 | 303.21 | |
| 18+15 | 351.3547 | 293.17 | |
| 18+20 | 353.2982 | 282.19 | |
| 18+25 | 355.1322 | 266.30 | |
| 18+30 | 356.8541 | 250.02 | |
| 18+35 | 358.4999 | 238.97 | |
| 18+40 | 360.0863 | 230.34 | |
| 18+45 | 361.6172 | 222.29 | |
| 18+50 | 363.0989 | 215.14 | |
| 18+55 | 364.5366 | 208.76 | |
| 19+ 0 | 365.9370 | 203.33 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 19+ 5 | 367.3032 | 198.38 | | Q | | | V |
| 19+10 | 368.6384 | 193.87 | | Q | | | V |
| 19+15 | 369.9448 | 189.69 | | Q | | | V |
| 19+20 | 371.2245 | 185.82 | | Q | | | V |
| 19+25 | 372.4797 | 182.25 | | Q | | | V |
| 19+30 | 373.7119 | 178.92 | | Q | | | V |
| 19+35 | 374.9227 | 175.81 | | Q | | | V |
| 19+40 | 376.1138 | 172.94 | | Q | | | V |
| 19+45 | 377.2868 | 170.32 | | Q | | | V |
| 19+50 | 378.4426 | 167.82 | | Q | | | V |
| 19+55 | 379.5820 | 165.44 | | Q | | | V |
| 20+ 0 | 380.7057 | 163.16 | | Q | | | V |
| 20+ 5 | 381.8143 | 160.97 | | Q | | | V |
| 20+10 | 382.9085 | 158.89 | | Q | | | V |
| 20+15 | 383.9889 | 156.88 | | Q | | | V |
| 20+20 | 385.0559 | 154.93 | | Q | | | V |
| 20+25 | 386.1099 | 153.03 | | Q | | | V |
| 20+30 | 387.1513 | 151.22 | | Q | | | V |
| 20+35 | 388.1809 | 149.49 | | Q | | | V |
| 20+40 | 389.1989 | 147.81 | | Q | | | V |
| 20+45 | 390.2058 | 146.21 | | Q | | | V |
| 20+50 | 391.2021 | 144.66 | | Q | | | V |
| 20+55 | 392.1882 | 143.18 | | Q | | | V |
| 21+ 0 | 393.1644 | 141.74 | | Q | | | V |
| 21+ 5 | 394.1309 | 140.34 | | Q | | | V |
| 21+10 | 395.0880 | 138.98 | | Q | | | V |
| 21+15 | 396.0361 | 137.66 | | Q | | | V |
| 21+20 | 396.9753 | 136.37 | | Q | | | V |
| 21+25 | 397.9059 | 135.12 | | Q | | | V |
| 21+30 | 398.8282 | 133.91 | | Q | | | V |
| 21+35 | 399.7422 | 132.72 | | Q | | | V |
| 21+40 | 400.6484 | 131.57 | | Q | | | V |
| 21+45 | 401.5468 | 130.45 | | Q | | | V |
| 21+50 | 402.4376 | 129.35 | | Q | | | V |
| 21+55 | 403.3211 | 128.28 | | Q | | | V |
| 22+ 0 | 404.1973 | 127.23 | | Q | | | V |
| 22+ 5 | 405.0666 | 126.21 | | Q | | | V |
| 22+10 | 405.9290 | 125.22 | | Q | | | V |
| 22+15 | 406.7846 | 124.25 | | Q | | | V |
| 22+20 | 407.6338 | 123.29 | | Q | | | V |
| 22+25 | 408.4765 | 122.36 | | Q | | | V |
| 22+30 | 409.3130 | 121.45 | | Q | | | V |
| 22+35 | 410.1433 | 120.56 | | Q | | | V |
| 22+40 | 410.9676 | 119.69 | | Q | | | V |
| 22+45 | 411.7861 | 118.84 | | Q | | | V |
| 22+50 | 412.5988 | 118.00 | | Q | | | V |
| 22+55 | 413.4059 | 117.19 | | Q | | | V |
| 23+ 0 | 414.2074 | 116.38 | | Q | | | V |
| 23+ 5 | 415.0035 | 115.60 | | Q | | | V |
| 23+10 | 415.7944 | 114.83 | | Q | | | V |
| 23+15 | 416.5800 | 114.07 | | Q | | | V |
| 23+20 | 417.3605 | 113.33 | | Q | | | V |
| 23+25 | 418.1360 | 112.60 | | Q | | | V |
| 23+30 | 418.9066 | 111.89 | | Q | | | V |
| 23+35 | 419.6724 | 111.19 | | Q | | | V |
| 23+40 | 420.4334 | 110.50 | | Q | | | V |
| 23+45 | 421.1898 | 109.83 | | Q | | | V |

```
  23+50     421.9416    109.16  |  Q      |         |         |        V|
  23+55     422.6889    108.51  |  Q      |         |         |        V|
  24+ 0     423.4318    107.87  |  Q      |         |         |        V|
  24+ 5     424.1608    105.84  |  Q      |         |         |        V|
  24+10     424.8583    101.28  |  Q      |         |         |        V|
  24+15     425.5103     94.66  |  Q      |         |         |        V|
  24+20     426.0911     84.34  | Q       |         |         |        V|
  24+25     426.5344     64.38  | Q       |         |         |        V|
  24+30     426.8416     44.59  |Q        |         |         |        V|
  24+35     427.0849     35.33  |Q        |         |         |        V|
  24+40     427.2836     28.86  Q         |         |         |        V|
  24+45     427.4473     23.77  Q         |         |         |        V|
  24+50     427.5824     19.61  Q         |         |         |        V|
  24+55     427.6941     16.22  Q         |         |         |        V|
  25+ 0     427.7861     13.36  Q         |         |         |        V|
  25+ 5     427.8613     10.92  Q         |         |         |        V|
  25+10     427.9224      8.88  Q         |         |         |        V|
  25+15     427.9715      7.13  Q         |         |         |        V|
  25+20     428.0107      5.68  Q         |         |         |        V|
  25+25     428.0419      4.53  Q         |         |         |        V|
  25+30     428.0664      3.56  Q         |         |         |        V|
  25+35     428.0855      2.77  Q         |         |         |        V|
  25+40     428.1007      2.21  Q         |         |         |        V|
  25+45     428.1139      1.91  Q         |         |         |        V|
  25+50     428.1253      1.65  Q         |         |         |        V|
  25+55     428.1350      1.41  Q         |         |         |        V|
  26+ 0     428.1432      1.19  Q         |         |         |        V|
  26+ 5     428.1500      0.99  Q         |         |         |        V|
  26+10     428.1559      0.86  Q         |         |         |        V|
  26+15     428.1609      0.72  Q         |         |         |        V|
  26+20     428.1647      0.56  Q         |         |         |        V|
  26+25     428.1673      0.38  Q         |         |         |        V|
  26+30     428.1690      0.24  Q         |         |         |        V|
  26+35     428.1701      0.16  Q         |         |         |        V|
  26+40     428.1706      0.07  Q         |         |         |        V|
  26+45     428.1708      0.02  Q         |         |         |         V
-------------------------------------------------------------------------
```

# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Sep 7 2022

## HEADWATER DEPTH OF 2 EA. 6'x10' CULVERT @ GRAPEVINE CANYON / LYTLE CREE

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 2182.00 |
| Pipe Length (ft) | = | 60.00 |
| Slope (%) | = | 5.00 |
| Invert Elev Up (ft) | = | 2185.00 |
| Rise (in) | = | 72.0 |
| Shape | = | Box |
| Span (in) | = | 120.0 |
| No. Barrels | = | 2 |
| n-Value | = | 0.014 |
| Culvert Type | = | Flared Wingwalls, Top Edge Bevel |
| Culvert Entrance | = | 18D to 33.7D wingwall flare, d=0.083D |
| Coeff. K,M,c,Y,k | = | 0.486, 0.667, 0.0249, 0.83, 0.2 |

**Embankment**

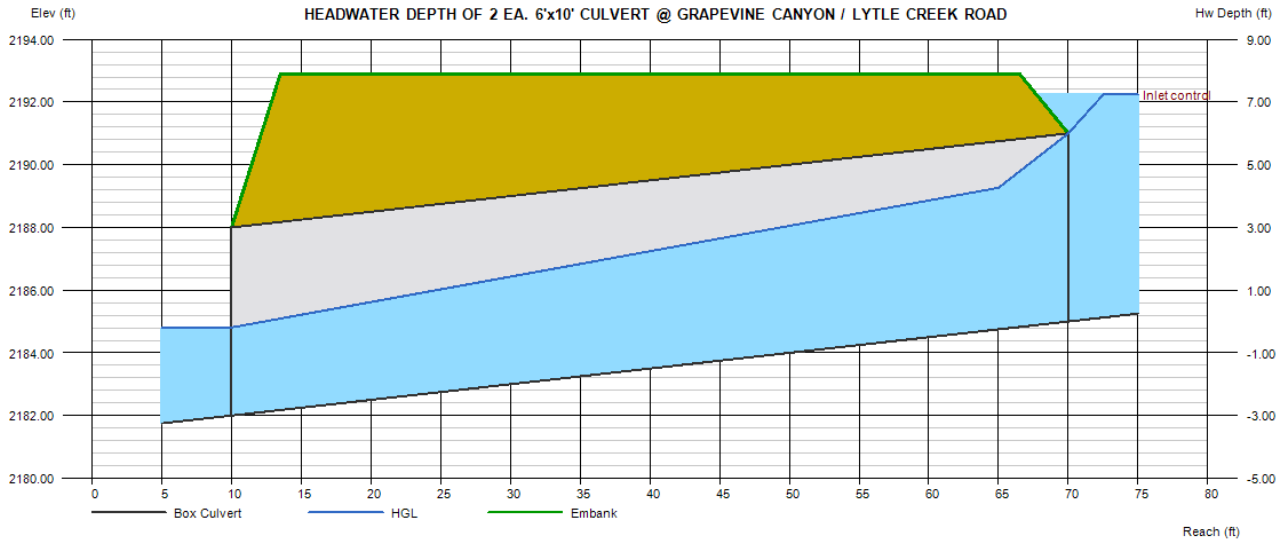
| | | |
|---|---|---|
| Top Elevation (ft) | = | 2192.90 |
| Top Width (ft) | = | 53.00 |
| Crest Width (ft) | = | 20.00 |

**Calculations**

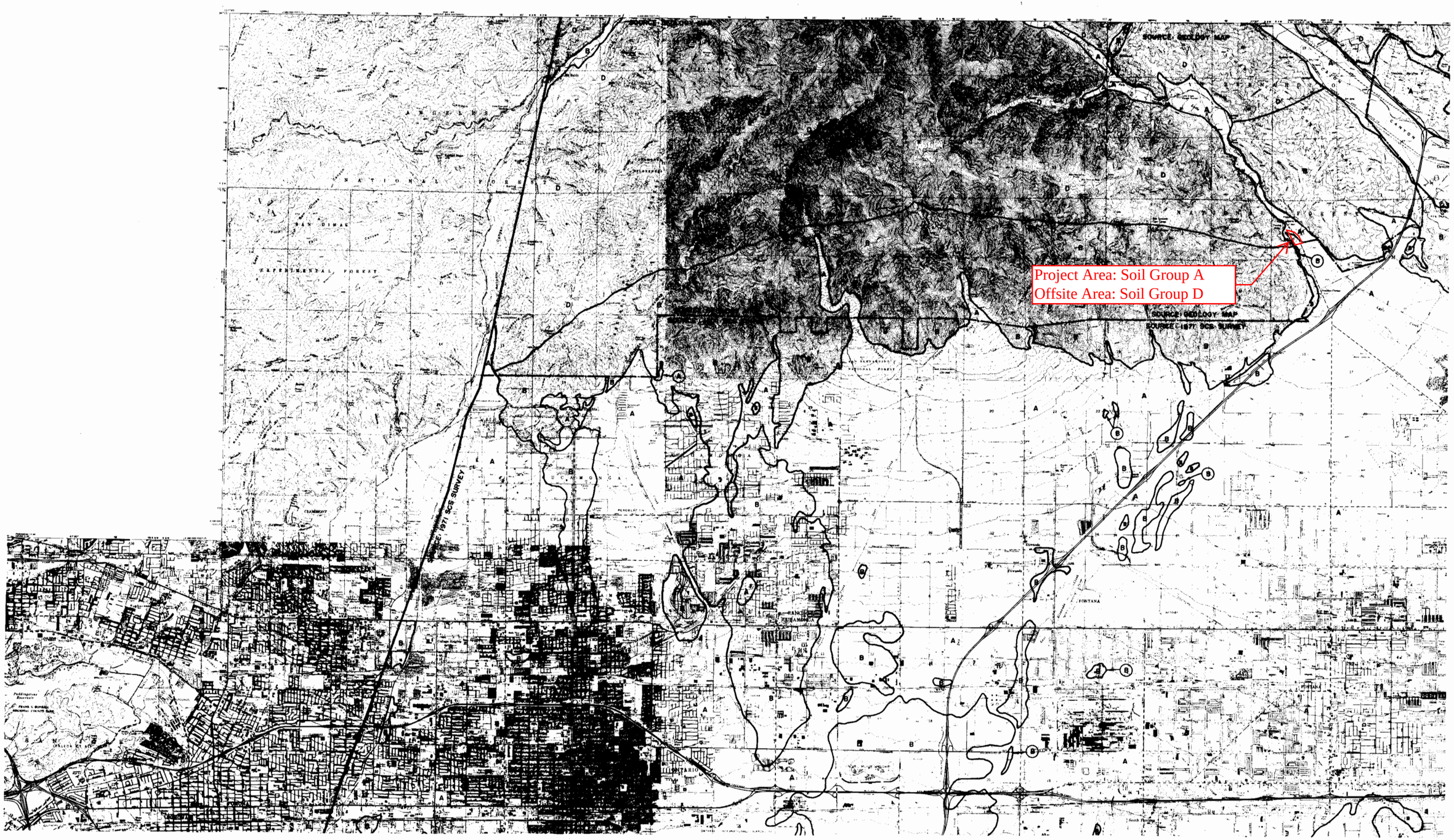
| | | |
|---|---|---|
| Qmin (cfs) | = | 1148.00 |
| Qmax (cfs) | = | 1148.00 |
| Tailwater Elev (ft) | = | Normal |

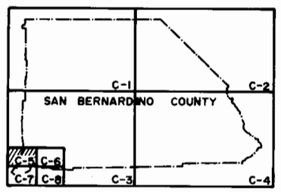
**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 1148.00 |
| Qpipe (cfs) | = | 1148.00 |
| Qovertop (cfs) | = | 0.00 |
| Veloc Dn (ft/s) | = | 20.43 |
| Veloc Up (ft/s) | = | 12.29 |
| HGL Dn (ft) | = | 2184.81 |
| HGL Up (ft) | = | 2189.67 |
| Hw Elev (ft) | = | 2192.24 |
| Hw/D (ft) | = | 1.21 |
| Flow Regime | = | Inlet Control |



# REFERENCE MAPS & CHARTS




INDEX MAP

LEGEND

SOIL GROUP BOUNDARY

A SOIL GROUP DESIGNATION

BOUNDARY OF INDICATED SOURCE

SCALE 1:48,000

**SCALE REDUCED BY 1/2**

**SAN BERNARDINO COUNTY**

HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-A AREA



FIGURE C-13

**NOAA Atlas 14, Volume 6, Version 2**
**Location name: Fontana, California, USA***
**Latitude: 34.1978°, Longitude: -117.4467°**
**Elevation: 2200.14 ft****
* source: ESRI Maps
** source: USGS

**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

## PF tabular

**PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]**

| Duration | Average recurrence interval (years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | **0.170** (0.142-0.207) | **0.222** (0.185-0.271) | **0.292** (0.241-0.356) | **0.348** (0.286-0.429) | **0.427** (0.339-0.543) | **0.488** (0.379-0.634) | **0.550** (0.417-0.734) | **0.616** (0.453-0.845) | **0.705** (0.497-1.01) | **0.776** (0.528-1.15) |
| 10-min | **0.244** (0.203-0.297) | **0.319** (0.265-0.388) | **0.418** (0.346-0.510) | **0.499** (0.410-0.614) | **0.612** (0.485-0.779) | **0.699** (0.543-0.909) | **0.789** (0.597-1.05) | **0.882** (0.649-1.21) | **1.01** (0.713-1.45) | **1.11** (0.757-1.65) |
| 15-min | **0.295** (0.245-0.359) | **0.386** (0.320-0.469) | **0.505** (0.418-0.616) | **0.604** (0.496-0.743) | **0.740** (0.587-0.942) | **0.845** (0.656-1.10) | **0.954** (0.722-1.27) | **1.07** (0.785-1.46) | **1.22** (0.862-1.75) | **1.35** (0.916-2.00) |
| 30-min | **0.459** (0.382-0.558) | **0.600** (0.498-0.730) | **0.786** (0.651-0.959) | **0.940** (0.771-1.16) | **1.15** (0.913-1.47) | **1.32** (1.02-1.71) | **1.48** (1.12-1.98) | **1.66** (1.22-2.28) | **1.90** (1.34-2.72) | **2.09** (1.43-3.10) |
| 60-min | **0.712** (0.592-0.865) | **0.930** (0.773-1.13) | **1.22** (1.01-1.49) | **1.46** (1.20-1.79) | **1.79** (1.42-2.27) | **2.04** (1.58-2.65) | **2.30** (1.74-3.07) | **2.58** (1.90-3.53) | **2.95** (2.08-4.22) | **3.25** (2.21-4.82) |
| 2-hr | **1.09** (0.908-1.33) | **1.43** (1.18-1.73) | **1.87** (1.54-2.28) | **2.23** (1.83-2.74) | **2.73** (2.16-3.47) | **3.12** (2.42-4.05) | **3.52** (2.66-4.69) | **3.93** (2.89-5.40) | **4.50** (3.18-6.45) | **4.96** (3.37-7.35) |
| 3-hr | **1.41** (1.17-1.71) | **1.84** (1.53-2.24) | **2.41** (1.99-2.94) | **2.88** (2.36-3.54) | **3.52** (2.79-4.48) | **4.02** (3.12-5.23) | **4.53** (3.43-6.04) | **5.07** (3.73-6.95) | **5.80** (4.09-8.31) | **6.38** (4.35-9.47) |
| 6-hr | **2.13** (1.77-2.59) | **2.78** (2.31-3.39) | **3.64** (3.02-4.45) | **4.35** (3.57-5.35) | **5.32** (4.22-6.77) | **6.07** (4.71-7.89) | **6.84** (5.18-9.12) | **7.63** (5.62-10.5) | **8.73** (6.15-12.5) | **9.58** (6.53-14.2) |
| 12-hr | **2.97** (2.47-3.61) | **3.88** (3.22-4.72) | **5.07** (4.20-6.19) | **6.04** (4.96-7.43) | **7.35** (5.84-9.36) | **8.36** (6.50-10.9) | **9.39** (7.11-12.5) | **10.4** (7.69-14.3) | **11.9** (8.38-17.0) | **13.0** (8.84-19.3) |
| 24-hr | **4.14** (3.67-4.77) | **5.45** (4.82-6.28) | **7.15** (6.31-8.27) | **8.53** (7.47-9.95) | **10.4** (8.82-12.5) | **11.8** (9.83-14.6) | **13.3** (10.8-16.8) | **14.8** (11.7-19.2) | **16.8** (12.7-22.7) | **18.4** (13.5-25.7) |
| 2-day | **5.22** (4.62-6.01) | **7.02** (6.21-8.10) | **9.46** (8.34-10.9) | **11.5** (10.1-13.4) | **14.4** (12.2-17.3) | **16.7** (13.8-20.5) | **19.0** (15.4-24.0) | **21.6** (17.0-27.9) | **25.1** (19.0-33.9) | **28.0** (20.5-39.1) |
| 3-day | **5.72** (5.07-6.59) | **7.81** (6.91-9.01) | **10.7** (9.45-12.4) | **13.2** (11.6-15.4) | **16.8** (14.3-20.3) | **19.8** (16.4-24.4) | **23.0** (18.6-28.9) | **26.4** (20.8-34.2) | **31.4** (23.8-42.4) | **35.5** (26.0-49.6) |
| 4-day | **6.13** (5.43-7.06) | **8.41** (7.44-9.70) | **11.6** (10.3-13.5) | **14.4** (12.6-16.8) | **18.6** (15.7-22.3) | **22.0** (18.2-27.0) | **25.6** (20.8-32.3) | **29.7** (23.4-38.4) | **35.6** (26.9-48.0) | **40.5** (29.6-56.5) |
| 7-day | **7.00** (6.20-8.07) | **9.64** (8.52-11.1) | **13.4** (11.8-15.5) | **16.6** (14.5-19.4) | **21.4** (18.1-25.8) | **25.3** (21.0-31.2) | **29.6** (24.0-37.3) | **34.4** (27.1-44.5) | **41.3** (31.2-55.7) | **47.0** (34.4-65.6) |
| 10-day | **7.64** (6.77-8.80) | **10.5** (9.31-12.1) | **14.6** (12.9-16.9) | **18.1** (15.9-21.2) | **23.4** (19.8-28.1) | **27.7** (23.0-34.1) | **32.4** (26.2-40.8) | **37.5** (29.6-48.6) | **45.1** (34.1-60.8) | **51.4** (37.6-71.7) |
| 20-day | **9.15** (8.10-10.5) | **12.6** (11.2-14.6) | **17.5** (15.5-20.3) | **21.8** (19.1-25.5) | **28.2** (23.8-33.9) | **33.4** (27.7-41.1) | **39.1** (31.6-49.2) | **45.3** (35.7-58.7) | **54.5** (41.2-73.5) | **62.1** (45.4-86.7) |
| 30-day | **10.5** (9.31-12.1) | **14.5** (12.9-16.8) | **20.2** (17.8-23.4) | **25.2** (22.0-29.3) | **32.5** (27.5-39.1) | **38.5** (31.9-47.3) | **45.1** (36.5-56.8) | **52.3** (41.2-67.7) | **62.8** (47.5-84.7) | **71.7** (52.4-100) |
| 45-day | **12.2** (10.8-14.0) | **16.9** (14.9-19.4) | **23.5** (20.7-27.1) | **29.2** (25.6-34.1) | **37.7** (31.9-45.4) | **44.7** (37.1-55.0) | **52.3** (42.4-65.9) | **60.7** (47.8-78.5) | **72.9** (55.1-98.3) | **83.1** (60.7-116) |
| 60-day | **14.2** (12.6-16.3) | **19.6** (17.3-22.6) | **27.3** (24.1-31.5) | **34.0** (29.7-39.6) | **43.7** (37.1-52.7) | **51.9** (43.0-63.8) | **60.6** (49.1-76.4) | **70.3** (55.4-91.0) | **84.4** (63.8-114) | **96.2** (70.3-134) |

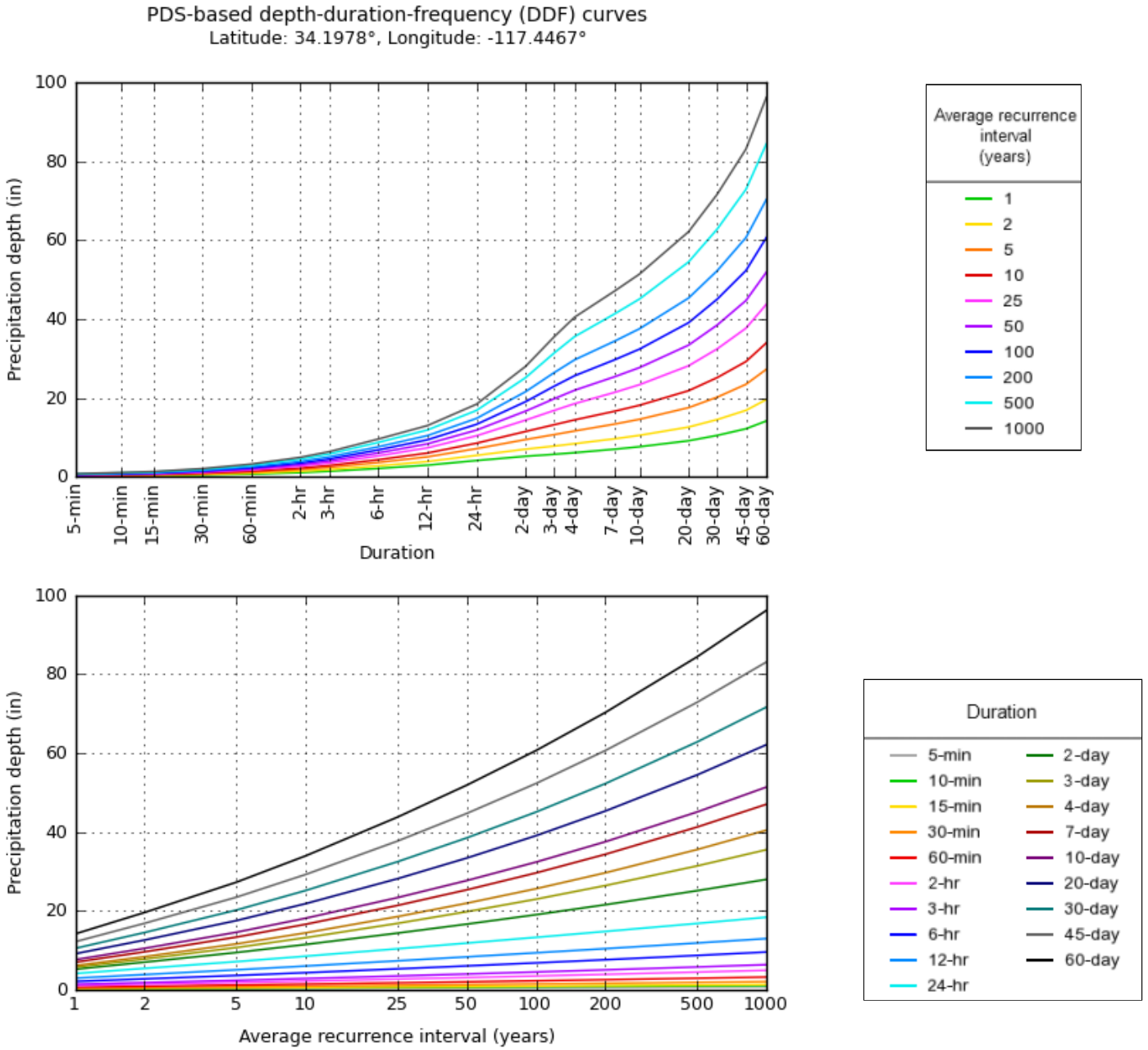
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

## PF graphical



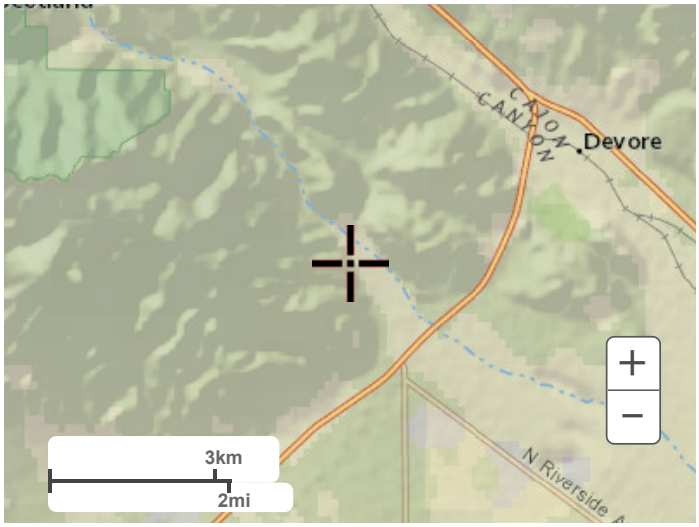

NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Mon Jan 10 16:34:32 2022

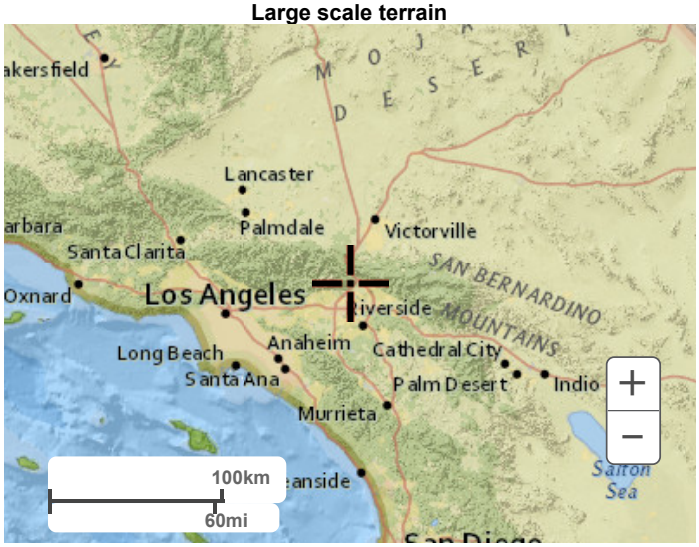
Back to Top

## Maps & aerials

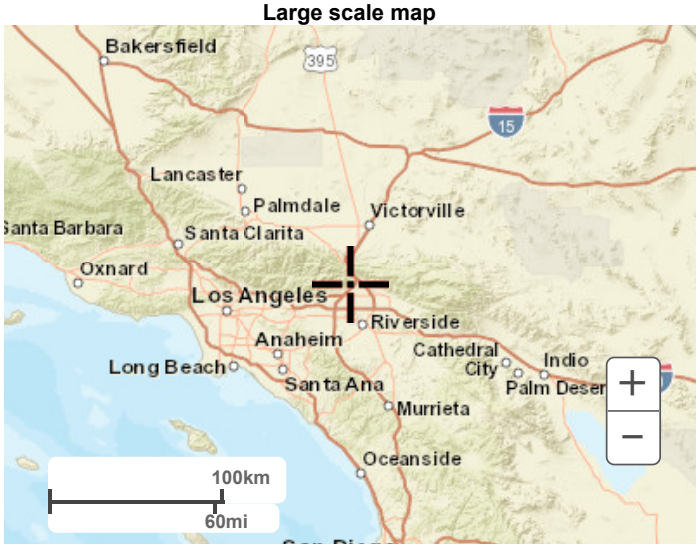
**Small scale terrain**




**Large scale terrain**




**Large scale map**




**Large scale aerial**


Back to Top

---

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer