DECEMBER 18, 2020

Detention Calculations for

# BRIDGEWATER CHURCH DEVELOPMENT

BUTLER COUNTY, FAIRFIELD TOWNSHIP, OHIO

*prepared by:*

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# Table of Contents

## INTRODUCTION

The proposed project includes the construction of a detention basin for the proposed Casey's gas station, future improvements to the existing Bridgewater church and developments on the two remaining lots. Drainage swales are proposed to be constructed on the west and north ends of the site to convey storm water to the proposed basin.

## STRATEGY

Butler County Stormwater Rules and Regulations follow a modified critical year storm method. The critical year storm event is determined by calculating the percent increase in runoff from a 24-hour storm frequency for a 1-year storm event under post-developed conditions compared with the runoff for a 1-year under pre-developed conditions. The post-developed runoff must be controlled for storms of a frequency between one year and the critical storm so that the rate of runoff does not exceed the peak rate of runoff for a pre-developed, 24-hour, 1-year frequency storm. All storm events greater than the critical year must be controlled such the post-developed runoff rate is reduced by one pre-developed storm event (i.e. Post-100 to Pre-50, Post-50 to Pre-25 etc...) The current site is close to 20 acres therefore the SCS (Urban Hydrology for Small Watersheds) TR55 method was used for the hydrologic analysis.

## DRAINAGE OVERVIEW

*Pre-developed Conditions*

The existing site is currently undeveloped open space in good condition. The watershed generally sheet flows with some shallow concentrated flow north west across the site to an unnamed tributary to the Great Miami River.

A summary of the current conditions on the school site are as follows:

TABLE 1 – Pre-Developed Conditions Summary

| PRE-DEVELOPED | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Tributary Area** | **Area (ac)** | **CN** | **Tc (min)** | **$Q_1$ (cfs)** | **$Q_2$ (cfs)** | **$Q_5$ (cfs)** | **$Q_{10}$ (cfs)** | **$Q_{25}$ (cfs)** | **$Q_{50}$ (cfs)** | **$Q_{100}$ (cfs)** |
| Onsite | 19.74 | 80 | 23 | 16.68 | 22.72 | 34.11 | 42.69 | 53.29 | 62.30 | 69.59 |

Refer to Appendix A for the Pre-Developed drainage map for the site.

*Post-developed Conditions*

The existing drainage pattern is maintained under the post-developed conditions. Drainage Swales are proposed on the West and North end of the site to convey storm water to the proposed basin. The critical year storm event was calculated, and those values were determined as follows:

- Pre-developed, 1-year, stormwater runoff volume = 1.42 Ac-ft
- Post-developed, 1-year, stormwater runoff volume = 2.20 Ac-ft
- Percent increase = 55%
- Critical Year storm event = **10-year**

Therefore, the peak flows for the 1-, 2-, 5- and 10-year storm events under post-developed conditions must not exceed the peak flow from this watershed under pre-developed conditions for the 1-year storm event.

Post-developed conditions are as follows.

TABLE 2 – Post-Developed Conditions Summary

| **POST-DEVELOPED** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Tributary Area** | **Area (ac)** | **CN** | **Tc (min)** | **$Q_1$ (cfs)** | **$Q_2$ (cfs)** | **$Q_5$ (cfs)** | **$Q_{10}$ (cfs)** | **$Q_{25}$ (cfs)** | **$Q_{50}$ (cfs)** | **$Q_{100}$ (cfs)** |
| Onsite Total to Pond | 19.74 | 87 | 10 | 41.48 | 52.06 | 70.91 | 84.51 | 100.9 | 114.5 | 125.4 |
| Pond Outflow | | | | 2.25 | 4.20 | 8.91 | 16.51 | 29.67 | 38.90 | 44.10 |

Refer to Appendix A for the Post-Developed drainage map for the site.

*Water Quality*

The proposed site will disturb more than 1 acre and therefore is subject to the post-construction stormwater management requirements set forth in the Construction Site Storm Water General Permit from the Ohio EPA. The permit requires projects to capture and treat stormwater for a storm event of 0.90 inches. The orifice size listed below are designed per EPA Permit No. OH000005 to release the water quality volume over 48 hours as required for dry basins. Appendix C shows the calculations for the water quality volume.

| **Tributary Area (Ac)** | **i** | **WQv (Required) (cu-ft)** | **Orifice size (in)** | **Elevation @ Volume Provided (ft)** |
|---|---|---|---|---|
| 19.74 | 0.53 | 34,098 | 2.5 | 727.46 |

Refer to Appendix B for water quality calculations for the site.

*Post-Developed Release*

Proposed Outlet structure is as follows:

- 6" perforated riser with a 2.5" water quality orifice @ 724.97
- (1)-13" W s 42"H weir @ 727.56 on south side of structure
- (2)-30" W x 12"H windows @ 729.50 on west / east side of structure
- (4)-30" W x 6"H windows (N, S, W, E)
- 30" (class IV RCP) culvert @ 724.95
- Spillway @ 731.50
- Top of berm at 732.50

The post-developed flows for the basin are summarized as follows:

| | Pre-Developed Allowable Peak Flow (cfs) | Post-Developed Peak Flow from Proposed Basin (cfs) | Peak Basin Water Surface Elevation (ft) (Post Developed Condition) |
|---|---|---|---|
| **1-yr** | 16.68 | 2.25 | 728.24 |
| **2-yr** | 16.68 | 4.20 | 728.63 |
| **5-yr** | 16.68 | 8.91 | 729.37 |
| **10-yr** | 16.68 | 16.51 | 729.87 |
| **25-yr** | 42.69 | 29.67 | 730.37 |
| **50-yr** | 53.29 | 38.90 | 730.76 |
| **100-yr** | 62.30 | 44.10 | 731.07 |

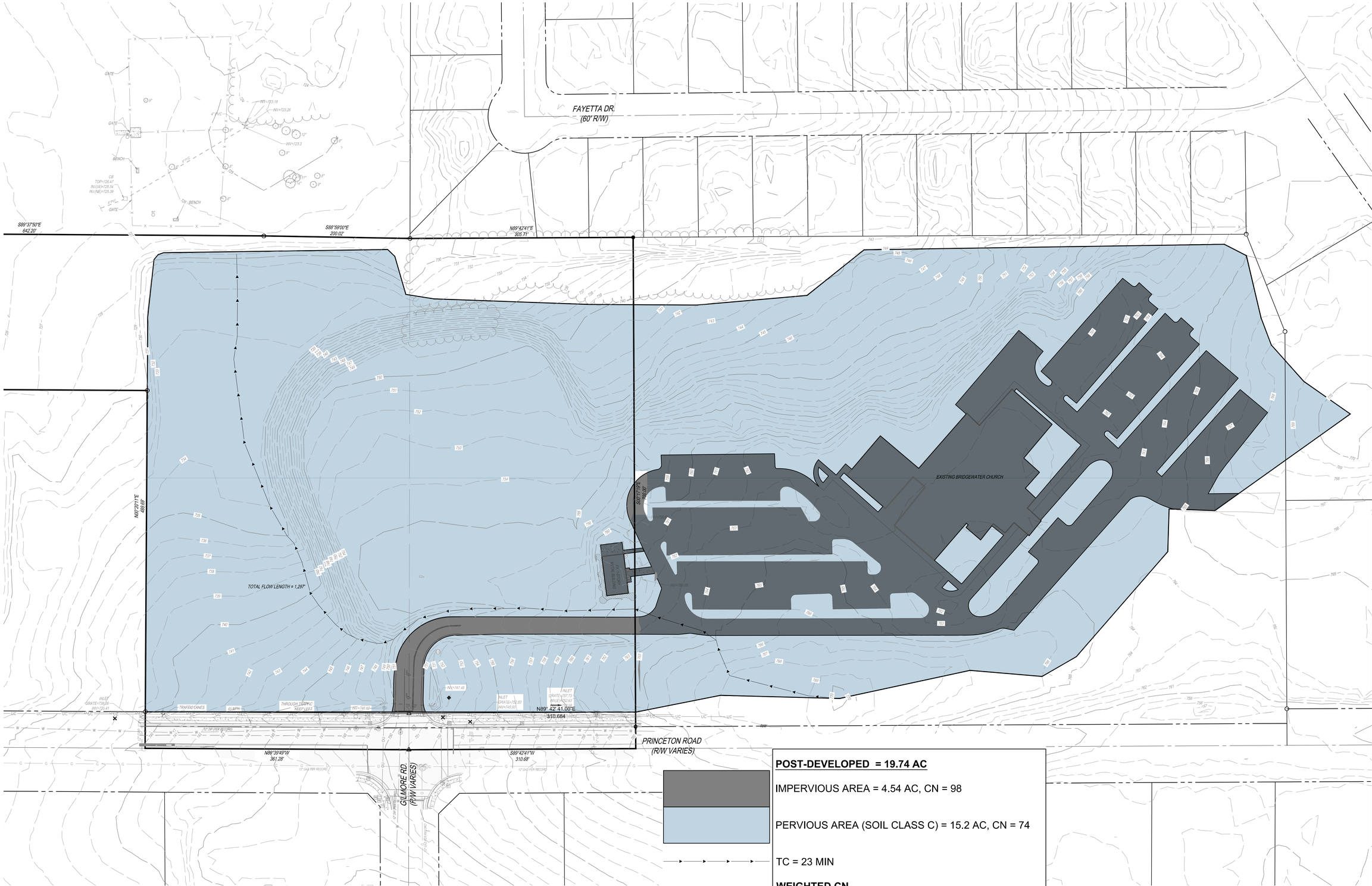
## CONCLUSION

In conclusion, the stormwater management system on site has been designed to meet the requirements set forth by the Butler County Stormwater Regulations. Post developed flows up to the critical 10-year event have been held back to the 1-year predeveloped condition and the following storm events have been held back to roughly 70% of the Predeveloped Storm events for the year prior. Therefore, we conclude that the proposed system is conservative and has capacity to meet the needs of future developments to come.

# Appendix A

Pre-Post Drainage Maps

INSPIRED PEOPLE ▲ CREATIVE DESIGN ▲ TRANSFORMING COMMUNITIES




**POST-DEVELOPED = 19.74 AC**

IMPERVIOUS AREA = 4.54 AC, CN = 98

PERVIOUS AREA (SOIL CLASS C) = 15.2 AC, CN = 74

TC = 23 MIN

**WEIGHTED CN**

(4.54*98+15.2*74) = 80
19.74

*NOTE:*
*UNDERGROUND UTILITIES ARE PLOTTED FROM A COMPILATION OF AVAILABLE RECORD INFORMATION, GIS AND SURFACE INDICATIONS OF UNDERGROUND STRUCTURES AND MAY NOT BE INCLUSIVE. PRECISE LOCATIONS AND THE EXISTENCE OR NON EXISTENCE OF UNDERGROUND UTILITIES CANNOT BE VERIFIED. PLEASE NOTIFY THE OHIO UTILITY PROTECTION SERVICE AT 1-800-362-2764 BEFORE ANY PERIOD OF EXCAVATION OR CONSTRUCTION ACTIVITY.*

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6305 Centre Park Dr.
West Chester, OH 45069
513.779.7851


SEAL:

| NO. | DATE | DESCRIPTION |
|---|---|---|
| 1 | 12/18/2020 | STORM WATER REPORT |

# BRIDGEWATER CHURCH MASTER PLAN

FAIRFIELD TOWNSHIP
BUTLER COUNTY, OHIO

PROJECT NO: 180075.000
DATE: 12/18/2020
SCALE: 0 20 40 80
SHEET NAME: PRE-DEVELOPED
SHEET NO. 1 OF 2

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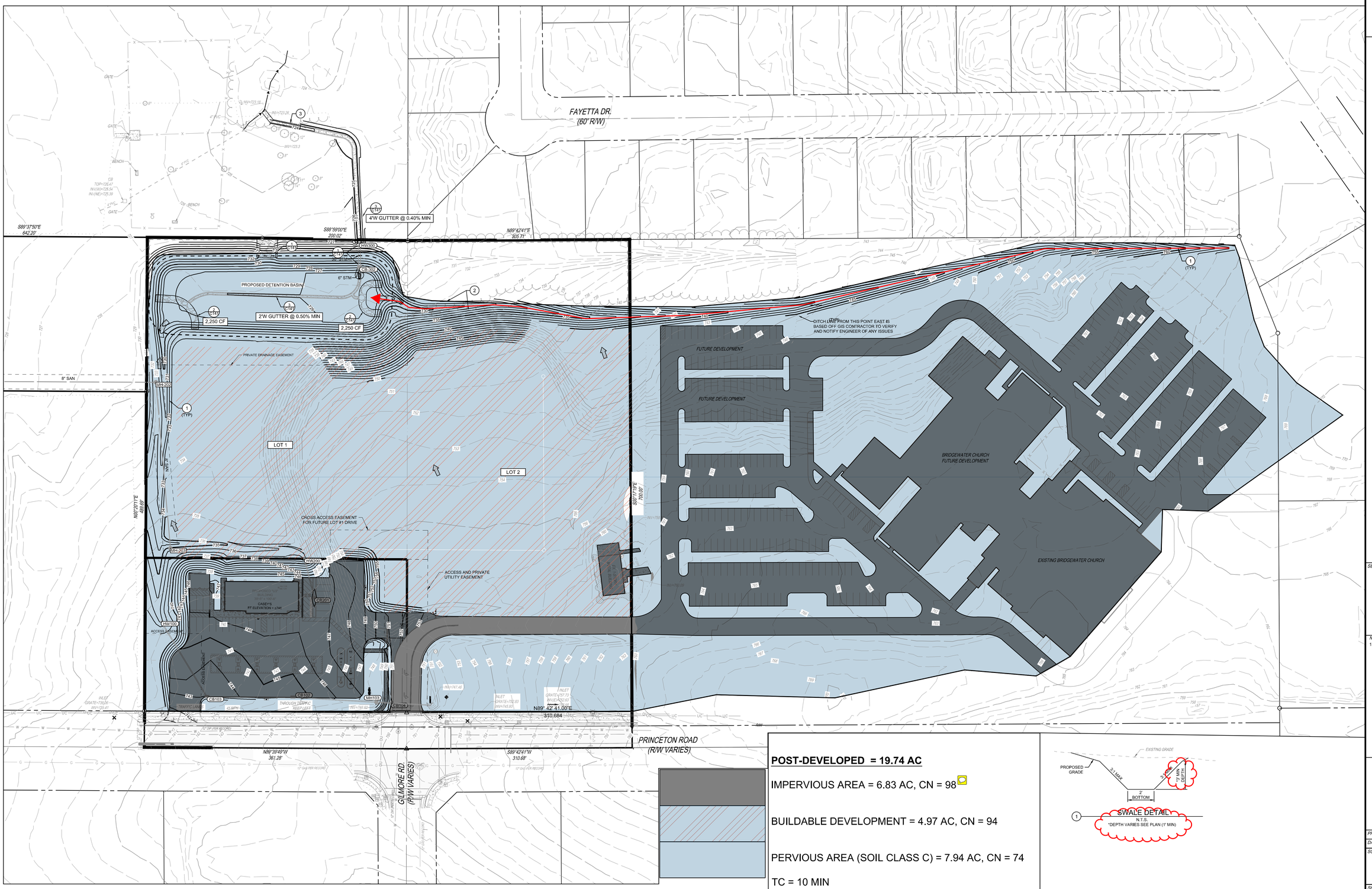
INSPIRED PEOPLE ▲ CREATIVE DESIGN ▲ TRANSFORMING COMMUNITIES




**POST-DEVELOPED = 19.74 AC**

IMPERVIOUS AREA = 6.83 AC, CN = 98

BUILDABLE DEVELOPMENT = 4.97 AC, CN = 94

PERVIOUS AREA (SOIL CLASS C) = 7.94 AC, CN = 74

TC = 10 MIN

**WEIGHTED CN**

$$\frac{(6.83*98+4.97*94+7.94*74)}{19.74} = 87$$




*NOTE:*
*UNDERGROUND UTILITIES ARE PLOTTED FROM A COMPILATION OF AVAILABLE RECORD INFORMATION, GIS AND SURFACE INDICATIONS OF UNDERGROUND STRUCTURES AND MAY NOT BE INCLUSIVE. PRECISE LOCATIONS AND THE EXISTENCE OR NON EXISTENCE OF UNDERGROUND UTILITIES CANNOT BE VERIFIED. PLEASE NOTIFY THE OHIO UTILITY PROTECTION SERVICE AT 1-800-362-2764 BEFORE ANY PERIOD OF EXCAVATION OR CONSTRUCTION ACTIVITY.*

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SEAL:

| NO. | DATE | DESCRIPTION |
|---|---|---|
| 1 | 12/18/2020 | STORM WATER REPORT |

# BRIDGEWATER CHURCH MASTER PLAN

FAIRFIELD TOWNSHIP
BUTLER COUNTY, OHIO

PROJECT NO: 180075.000
DATE: 12/18/2020
SCALE: 0 20 40 80

SHEET NAME:

## POST-DEVELOPED

SHEET NO.

# 2 OF 2

H:\2018\180075\DWG\000\Sheets\180075CDRN000.dwg, 12/21/2020 9:13:09 PM, mkramer

# Appendix B

Water Quality Volume Calculations

# Dry Extended Detention Basin WQv Compliance Tool

version 3.1 2018-10-25

## Project Summary

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Bridge Water Church Development | | | | |
| Subwatershed ID/Label: | TRIBUTARY ONSITE | | | | |
| Submitted by: | MEK | | | | |
| Date: | 12/18/2020 | | | | |
| Subwatershed Drainage Area, $A_{total}$ = | 19.74 | acres | = | 859,874 | ft2 |
| Subwatershed Impervious Area, $A_{imp}$ = | 10.50 | acres | = | 457,380 | ft2 |
| Imperviousness fraction, i = | 0.53 | | | 53 | % |
| Water Quality Volume, WQv = | 34,098 | $ft^3$ | = | 0.78 | ac-ft |

## Step 1 - Soil Suitability

Soil Series

HSG

## Step 2 - Dry ED Basin Volume Requirements

| | | |
|---|---|---|
| Extended Detention Volume, EDv = | 34098 | $ft^3$ |
| Minimum Sediment Storage Volume, $V_{sediment}$ = | 6820 | $ft^3$ |
| Minimum Forebay Volume, $V_{forebay}$ = | 3410 | $ft^3$ |
| Minimum Permanent Micropool Volume, $V_{micropool}$ = | 3410 | $ft^3$ |

## Step 3 - Basin Stage-Storage Relationship

| | Elevation ft | Area $ft^2$ | | Incremental Volume $ft^3$ | Cumulative Volume $ft^3$ |
|---|---|---|---|---|---|
| **Bottom of Permanent Micropool =** | 725.00 | 45 | | | |
| (include forebay area if below EDv) | 726.00 | 12,115 | | 4,299 | 4,299 |
| | 727.00 | 22,311 | | 16,956 | 21,255 |
| | 728.00 | 24,847 | | 23,568 | 44,823 |
| | 729.00 | 27,408 | | 26,117 | 70,940 |
| | 730.00 | 30,487 | | 28,934 | 99,874 |
| | 731.00 | 34,288 | | 32,369 | 132,242 |
| | 732.00 | 39,227 | | 36,730 | 168,972 |
| | | | | | |
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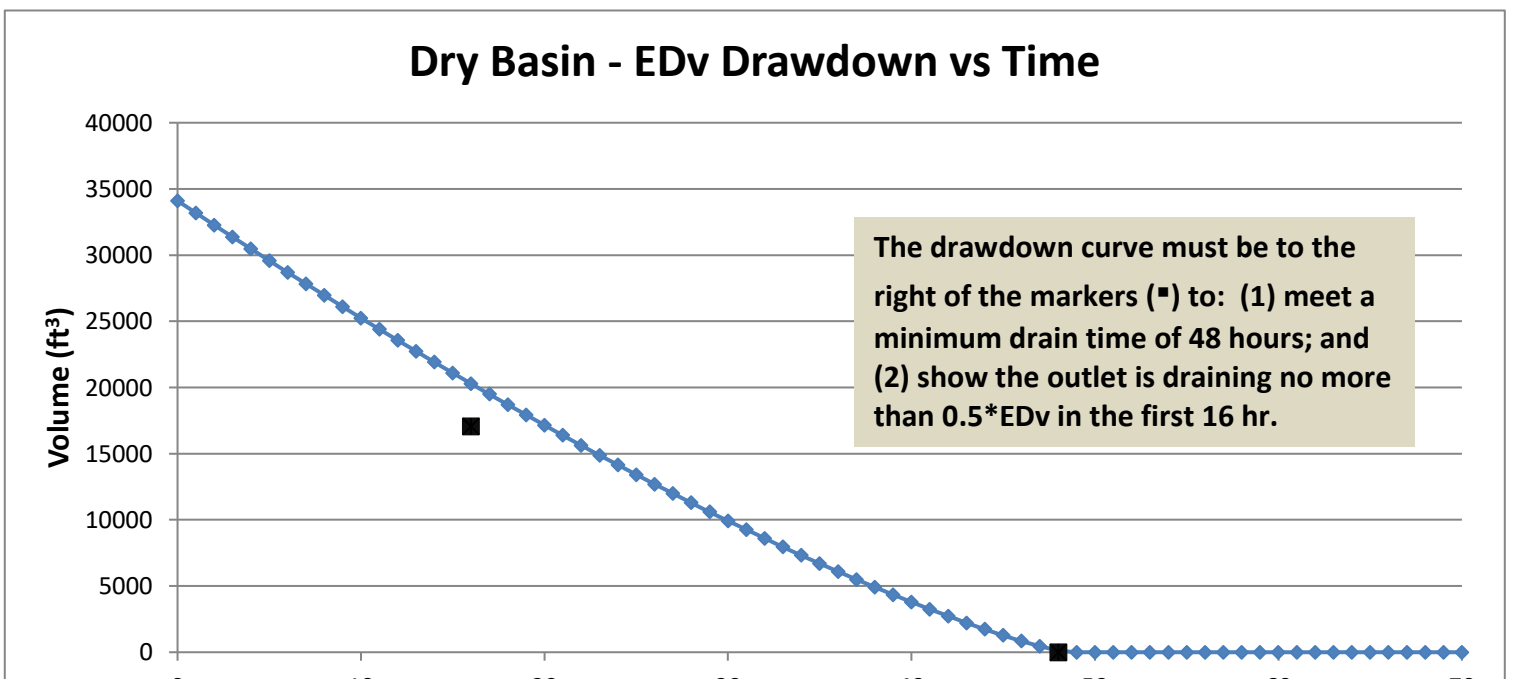
## Step 4 - Outlet Elevations and Storage Volumes

| | | | | | |
|---|---|---|---|---|---|
| WQ Orifice Invert Elevation = | 725.00 | | | | |
| Elevation of Top of EDv = | 727.56 | | | | |
| Secondary Outlet Invert Elevation = | 727.56 | | | | OKAY |
| WQ Treatment Volume Provided, $V_{treatment}$ = | 34,140 | $ft^3$ | | | |
| Treatment Vol Provided Relative to EDv, $V_{treatment}/EDv$ = | 1.00 | | = | 100% | OKAY |
| Permanent Pool Volume Provided, PPv = | 0 | $ft^3$ | | | |
| Forebay Volume Provided, $V_{forebay}$ = | 3,410 | $ft^3$ | = | 1.00 | |
| Is forebay volume below WQ outlet? (Yes or No) | No | | = | 100% | OKAY |
| Permanent Micropool Volume Provided, $V_{micropool}$ = | 0 | $ft^3$ | | | |
| Ratio $V_{micropool}$ Provided to $V_{micropool}$ Required = | 0.00 | | = | 0% | NOT MET |
| Sediment Storage Volume Provided, $V_{sediment}$ = | 3,410 | $ft^3$ | | | |
| Ratio $V_{sediment}$ Provided to $V_{sediment}$ Required = | 0.50 | | = | 50% | NOT MET |

## Step 5 - Outlet (Orifice) Sizing

| | | | | | |
|---|---|---|---|---|---|
| Maximum Hydraulic Head, Hmax = | 2.56 | ft | | | |
| Orifice Coefficient, C = | 0.6 | | | | |
| Target (Minimum) Draw-down Time, $T_d$ = | 48 | hr | | | |
| Target Average Discharge, $Q_{avg}$ = | 0.20 | cfs | | | |
| Average Hydraulic Head, $H_{avg}$ = | 1.28 | ft | | | |
| Estimated Orifice Area, $A_{orifice}$ = | 5.22 | $in^2$ | = | 0.036 | $ft^2$ |
| Estimated Orifice Diameter, $D_{orifice}$ = | 2.58 | in | = | 0.21 | ft |
| Design Orifice Diameter, $D_{orifice}$ = | 2.50 | in | = | 0.21 | ft |
| Design Orifice Area, $A_{orifice}$ = | 4.88 | $in^2$ | = | 0.034 | $ft^2$ |
| Time to Completely Drain EDv, $T_d$ = | 49 | hr | must be ≥ 48 hr | | OKAY |
| Volume Drained in First 16 hr = | 13,803 | $ft^3$ | | | |
| % of EDv = | 40.5 | % | must be ≤ 50% | | OKAY |




0
10
20
30
40
50
60
70
Time (hr)

# Appendix C

Soils Maps

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for Butler County, Ohio

## BridgeWater Church


September 29, 2020

# Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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# Contents

# How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Custom Soil Resource Report
## Soil Map


Map Scale: 1:3,440 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

## MAP LEGEND

**Area of Interest (AOI)**
- Area of Interest (AOI)

**Soils**
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

**Special Point Features**
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

**Water Features**
- Streams and Canals

**Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**
- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Butler County, Ohio
Survey Area Data: Version 20, Jun 10, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 28, 2019—Dec 5, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| DaB | Dana silt loam, 2 to 6 percent slopes | 9.3 | 39.3% |
| RdA | Raub silt loam, 0 to 2 percent slopes | 1.7 | 7.1% |
| WyB2 | Wynn silt loam, 2 to 6 percent slopes, eroded | 7.3 | 30.8% |
| WyC2 | Wynn silt loam, 6 to 12 percent slopes, eroded | 4.4 | 18.6% |
| XeB | Xenia silt loam, Southern Ohio Till Plain, 2 to 6 percent slopes | 1.0 | 4.3% |
| XfB | Xenia silt loam, bedrock substratum, 2 to 6 percent slopes | 0.0 | 0.0% |
| **Totals for Area of Interest** | | **23.6** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor

components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

# Butler County, Ohio

## DaB—Dana silt loam, 2 to 6 percent slopes

### Map Unit Setting

*National map unit symbol:* 2w0v8
*Elevation:* 590 to 1,180 feet
*Mean annual precipitation:* 37 to 45 inches
*Mean annual air temperature:* 50 to 55 degrees F
*Frost-free period:* 145 to 180 days
*Farmland classification:* All areas are prime farmland

### Map Unit Composition

*Dana and similar soils:* 90 percent
*Minor components:* 10 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Dana

#### Setting

*Landform:* Till plains, ground moraines
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve, crest
*Down-slope shape:* Convex, linear
*Across-slope shape:* Linear, convex
*Parent material:* Loess over loamy till derived from sedimentary rock

#### Typical profile

*Ap - 0 to 14 inches:* silt loam
*Bt - 14 to 37 inches:* silty clay loam
*2BC - 37 to 48 inches:* clay loam
*2Cd - 48 to 79 inches:* loam

#### Properties and qualities

*Slope:* 2 to 6 percent
*Depth to restrictive feature:* 37 to 55 inches to densic material
*Drainage class:* Moderately well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.60 in/hr)
*Depth to water table:* About 24 to 36 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 25 percent
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* High (about 9.3 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2e
*Hydrologic Soil Group:* C
*Ecological site:* R111DY012IN - Till Ridge Prairie
*Hydric soil rating:* No

**Minor Components**

**Raub**

*Percent of map unit:* 5 percent
*Landform:* Hillslopes, till plains
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Ecological site:* R111DY012IN - Till Ridge Prairie
*Hydric soil rating:* No

**Brookston**

*Percent of map unit:* 5 percent
*Landform:* — error in exists on —
*Landform position (two-dimensional):* Toeslope, footslope
*Landform position (three-dimensional):* Base slope
*Down-slope shape:* Linear, concave
*Across-slope shape:* Concave
*Ecological site:* F111DY008IN - Till Depression Flatwood
*Hydric soil rating:* Yes

## RdA—Raub silt loam, 0 to 2 percent slopes

**Map Unit Setting**

*National map unit symbol:* 5pp0
*Elevation:* 360 to 1,000 feet
*Mean annual precipitation:* 30 to 45 inches
*Mean annual air temperature:* 48 to 57 degrees F
*Frost-free period:* 150 to 210 days
*Farmland classification:* Prime farmland if drained

**Map Unit Composition**

*Raub and similar soils:* 90 percent
*Minor components:* 10 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Raub**

**Setting**

*Landform:* Rises on till plains
*Landform position (three-dimensional):* Rise
*Parent material:* Silty loess over loamy till

**Typical profile**

*H1 - 0 to 15 inches:* silt loam
*H2 - 15 to 37 inches:* silty clay loam
*H3 - 37 to 43 inches:* clay loam
*H4 - 43 to 60 inches:* loam

**Properties and qualities**

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat poorly drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* About 12 to 36 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 35 percent
*Available water capacity:* High (about 10.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2w
*Hydrologic Soil Group:* D
*Ecological site:* R111DY012IN - Till Ridge Prairie
*Hydric soil rating:* No

**Minor Components**

**Ragsdale**

*Percent of map unit:* 5 percent
*Landform:* Depressions
*Ecological site:* F111DY015IN - Wet Loess Upland
*Hydric soil rating:* Yes

**Dana**

*Percent of map unit:* 5 percent
*Landform:* Till plains
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Ecological site:* R111DY012IN - Till Ridge Prairie
*Hydric soil rating:* No

## WyB2—Wynn silt loam, 2 to 6 percent slopes, eroded

**Map Unit Setting**

*National map unit symbol:* 2xqyg
*Elevation:* 880 to 1,040 feet
*Mean annual precipitation:* 37 to 45 inches
*Mean annual air temperature:* 50 to 55 degrees F
*Frost-free period:* 145 to 180 days
*Farmland classification:* All areas are prime farmland

**Map Unit Composition**

*Wynn, eroded, and similar soils:* 90 percent

*Minor components:* 10 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Wynn, Eroded

#### Setting

*Landform:* Till plains
*Landform position (two-dimensional):* Shoulder, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Parent material:* Loess over loamy till over residuum weathered from limestone and shale

#### Typical profile

*Ap - 0 to 5 inches:* silt loam
*Bt - 5 to 15 inches:* silty clay loam
*2Bt2 - 15 to 25 inches:* clay loam
*2BC - 25 to 29 inches:* clay
*3Cr - 29 to 39 inches:* bedrock

#### Properties and qualities

*Slope:* 2 to 6 percent
*Depth to restrictive feature:* 28 to 33 inches to paralithic bedrock
*Drainage class:* Well drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 25 percent
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Low (about 4.6 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2e
*Hydrologic Soil Group:* C
*Ecological site:* F111DY010IN - Till Ridge
*Hydric soil rating:* No

### Minor Components

#### Millsdale

*Percent of map unit:* 7 percent
*Landform:* Stream terraces, drainageways
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Base slope, tread
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Ecological site:* F111DY008IN - Till Depression Flatwood
*Hydric soil rating:* Yes

#### Miamian, eroded

*Percent of map unit:* 3 percent
*Landform:* Recessionial moraines, till plains

*Landform position (two-dimensional):* Shoulder, backslope, summit
*Landform position (three-dimensional):* Nose slope, interfluve
*Down-slope shape:* Linear, convex
*Across-slope shape:* Convex, linear
*Ecological site:* F111DY010IN - Till Ridge
*Hydric soil rating:* No

## WyC2—Wynn silt loam, 6 to 12 percent slopes, eroded

### Map Unit Setting

*National map unit symbol:* 2xqyh
*Elevation:* 880 to 1,040 feet
*Mean annual precipitation:* 37 to 45 inches
*Mean annual air temperature:* 50 to 55 degrees F
*Frost-free period:* 145 to 180 days
*Farmland classification:* Farmland of local importance

### Map Unit Composition

*Wynn, eroded, and similar soils:* 90 percent
*Minor components:* 10 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Wynn, Eroded

#### Setting

*Landform:* Till plains
*Landform position (two-dimensional):* Backslope, shoulder
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Parent material:* Loess over loamy till over residuum weathered from limestone and shale

#### Typical profile

*Ap - 0 to 8 inches:* silt loam
*Bt1 - 8 to 12 inches:* silty clay loam
*2Bt2 - 12 to 16 inches:* silty clay loam
*2Bt3 - 16 to 26 inches:* clay
*2BC - 26 to 33 inches:* clay
*3Cr - 33 to 43 inches:* bedrock

#### Properties and qualities

*Slope:* 6 to 12 percent
*Depth to restrictive feature:* 32 to 34 inches to paralithic bedrock
*Drainage class:* Well drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.03 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None

*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 45 percent
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Low (about 5.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2e
*Hydrologic Soil Group:* C
*Ecological site:* F111DY010IN - Till Ridge
*Hydric soil rating:* No

**Minor Components**

**Miamian**

*Percent of map unit:* 5 percent
*Landform:* Till plains
*Landform position (two-dimensional):* Shoulder, summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Ecological site:* F111DY010IN - Till Ridge
*Hydric soil rating:* No

**Eden, eroded**

*Percent of map unit:* 5 percent
*Landform:* Till plains
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Nose slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Ecological site:* F111DY023IN - Moderately Deep Restricted
*Hydric soil rating:* No

## XeB—Xenia silt loam, Southern Ohio Till Plain, 2 to 6 percent slopes

**Map Unit Setting**

*National map unit symbol:* 2t98y
*Elevation:* 400 to 1,020 feet
*Mean annual precipitation:* 37 to 45 inches
*Mean annual air temperature:* 50 to 55 degrees F
*Frost-free period:* 145 to 180 days
*Farmland classification:* All areas are prime farmland

**Map Unit Composition**

*Xenia and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

## Description of Xenia

### Setting

*Landform:* Till plains
*Landform position (two-dimensional):* Shoulder, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Loess over loamy till

### Typical profile

*Ap - 0 to 9 inches:* silt loam
*Bt1 - 9 to 29 inches:* silty clay loam
*2Bt2 - 29 to 40 inches:* clay loam
*2BCt - 40 to 58 inches:* loam
*2Cd - 58 to 79 inches:* loam

### Properties and qualities

*Slope:* 2 to 6 percent
*Depth to restrictive feature:* 40 to 60 inches to densic material
*Drainage class:* Moderately well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Low to moderately high (0.01 to 0.20 in/hr)
*Depth to water table:* About 18 to 30 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 40 percent
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* High (about 9.9 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2e
*Hydrologic Soil Group:* C
*Ecological site:* F111DY010IN - Till Ridge
*Hydric soil rating:* No

## Minor Components

### Fincastle

*Percent of map unit:* 5 percent
*Landform:* Till plains
*Landform position (two-dimensional):* Summit, footslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Ecological site:* F111DY009IN - Wet Till Ridge
*Hydric soil rating:* No

### Russell

*Percent of map unit:* 5 percent
*Landform:* Till plains
*Landform position (two-dimensional):* Backslope, shoulder
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex

*Across-slope shape:* Linear
*Ecological site:* F111DY010IN - Till Ridge
*Hydric soil rating:* No

**Cyclone**

*Percent of map unit:* 5 percent
*Landform:* Flats, depressions, till plains
*Landform position (two-dimensional):* Summit, toeslope
*Landform position (three-dimensional):* Dip
*Down-slope shape:* Concave
*Across-slope shape:* Linear, concave
*Ecological site:* F111DY008IN - Till Depression Flatwood
*Hydric soil rating:* Yes

## XfB—Xenia silt loam, bedrock substratum, 2 to 6 percent slopes

**Map Unit Setting**

*National map unit symbol:* 5pq5
*Elevation:* 680 to 1,020 feet
*Mean annual precipitation:* 35 to 45 inches
*Mean annual air temperature:* 50 to 55 degrees F
*Frost-free period:* 150 to 180 days
*Farmland classification:* All areas are prime farmland

**Map Unit Composition**

*Xenia and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Xenia**

**Setting**

*Landform:* Rises on till plains
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Parent material:* Silty loess over till over

**Typical profile**

*H1 - 0 to 7 inches:* silt loam
*H2 - 7 to 33 inches:* silty clay loam
*H3 - 33 to 40 inches:* clay loam
*H4 - 40 to 55 inches:* flaggy clay loam
*H5 - 55 to 65 inches:* weathered bedrock

**Properties and qualities**

*Slope:* 2 to 6 percent
*Depth to restrictive feature:* 48 to 72 inches to paralithic bedrock
*Drainage class:* Moderately well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)

*Depth to water table:* About 24 to 42 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 50 percent
*Available water capacity:* Moderate (about 8.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2e
*Hydrologic Soil Group:* C
*Ecological site:* F111DY010IN - Till Ridge
*Forage suitability group:* Unnamed (G111DYA-6OH)
*Other vegetative classification:* Unnamed (G111DYA-6OH)
*Hydric soil rating:* No

**Minor Components**

**Soils greater than 60 inches to rock**

*Percent of map unit:* 5 percent

**Fincastle, bedrock substratum, bedrock substratum**

*Percent of map unit:* 5 percent
*Landform:* Till plains
*Hydric soil rating:* No

**Russell, bedrock substratum, bedrock substratum**

*Percent of map unit:* 3 percent
*Landform:* Till plains

**Ragsdale**

*Percent of map unit:* 1 percent
*Landform:* Drainageways
*Ecological site:* F111DY015IN - Wet Loess Upland
*Hydric soil rating:* Yes

**Miamian, bedrock substratum, bedrock substratum**

*Percent of map unit:* 1 percent
*Landform:* Till plains

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# Appendix D

Hydrology Studio Data

# Table of Contents

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

# Contents continued...

# Basin Model

Hydrology Studio v 3.0.0.16

Project Name:

12-14-2020

# Hydrograph by Return Period

Project Name:

12-14-2020

Hydrology Studio v 3.0.0.16

| 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 | Pre DEVELOPED | 16.68 | 22.72 | | 34.11 | 42.69 | 53.29 | 62.30 | 69.59 |
| 2 | NRCS Runoff | Post DEVELOPED | 41.48 | 52.06 | | 70.91 | 84.51 | 100.9 | 114.5 | 125.4 |
| 3 | Pond Route | Post DETENTION BASIN | 2.250 | 4.202 | | 8.911 | 16.51 | 29.67 | 38.90 | 44.10 |

# Hydrograph 1-yr Summary

Project Name:

12-14-2020

Hydrology Studio v 3.0.0.16

| 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 | Pre DEVELOPED | 16.68 | 12.13 | 59,531 | ---- | | |
| 2 | NRCS Runoff | Post DEVELOPED | 41.48 | 11.98 | 93,949 | ---- | | |
| 3 | Pond Route | Post DETENTION BASIN | 2.250 | 13.20 | 74,409 | 2 | 728.24 | 53,145 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

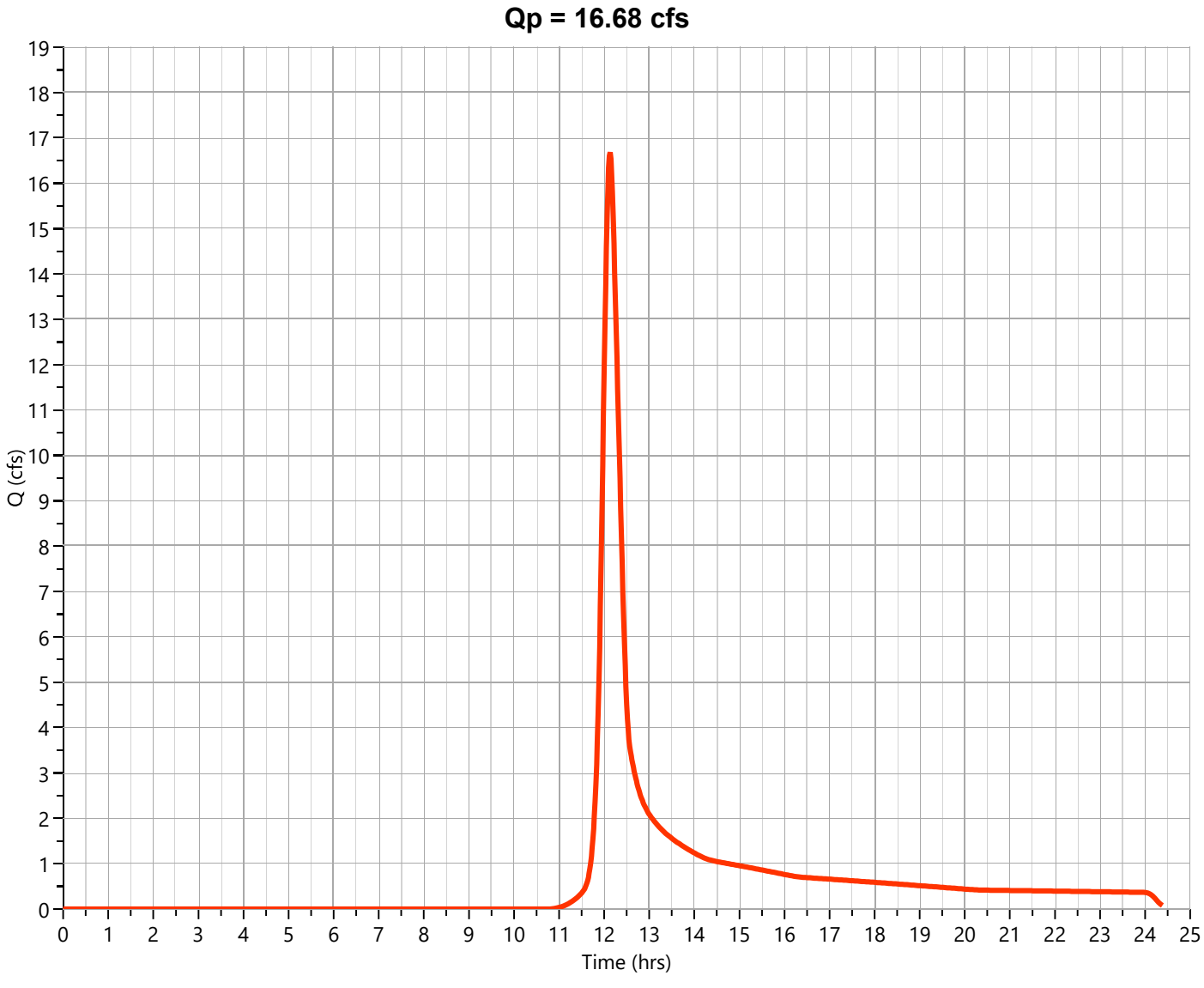
## Pre DEVELOPED

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 16.68 cfs |
| Storm Frequency | = 1-yr | Time to Peak | = 12.13 hrs |
| Time Interval | = 1 min | Runoff Volume | = 59,531 cuft |
| Drainage Area | = 19.76 ac | Curve Number | = 79* |
| Tc Method | = TR55 (See Worksheet) | Time of Conc. (Tc) | = 23.44 min |
| Total Rainfall | = 2.50 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.54 | 98 | IMPERVIOUS |
| 15.2 | 74 | PERVIOUS, CLASS C |
| **19.76** | **79** | Weighted CN Method Employed |



# Tc by TR55 Worksheet

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

## DEVELOPED
## NRCS Runoff

**Hyd. No. 1**

| Description | Segments | | | |
|---|---|---|---|---|
| | A | B | C | Tc (min) |
| | | | | |
| **Sheet Flow** | | | | |
| Description | | | | |
| Manning's n | 0.150 | 0.013 | 0.013 | |
| Flow Length (ft) | 100 | | | |
| 2-yr, 24-hr Precip. (in) | 2.900000 | 2.900000 | 2.900000 | |
| Land Slope (%) | 4 | | | |
| | | | | |
| **Travel Time (min)** | **7.80** | **0.00** | **0.00** | **7.80** |
| | | | | |
| **Shallow Concentrated Flow** | | | | |
| Flow Length (ft) | 300 | | | |
| Watercourse Slope (%) | 3 | | | |
| Surface Description | Unpaved | Paved | Paved | |
| Average Velocity (ft/s) | 2.79 | | | |
| | | | | |
| **Travel Time (min)** | **1.79** | **0.00** | **0.00** | **1.79** |
| | | | | |
| **Channel Flow** | | | | |
| X-sectional Flow Area (sqft) | 2 | | | |
| Wetted Perimiter (ft) | 4 | | | |
| Channel Slope (%) | 3 | | | |
| Manning's n | 0.150 | 0.013 | 0.013 | |
| Velocity (ft/s) | 1.08 | | | |
| Flow Length (ft) | 896 | | | |
| | | | | |
| **Travel Time (min)** | **13.81** | **0.00** | **0.00** | **13.81** |
| | | | | |
| **Total Travel Time** | | | | **23.44 min** |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

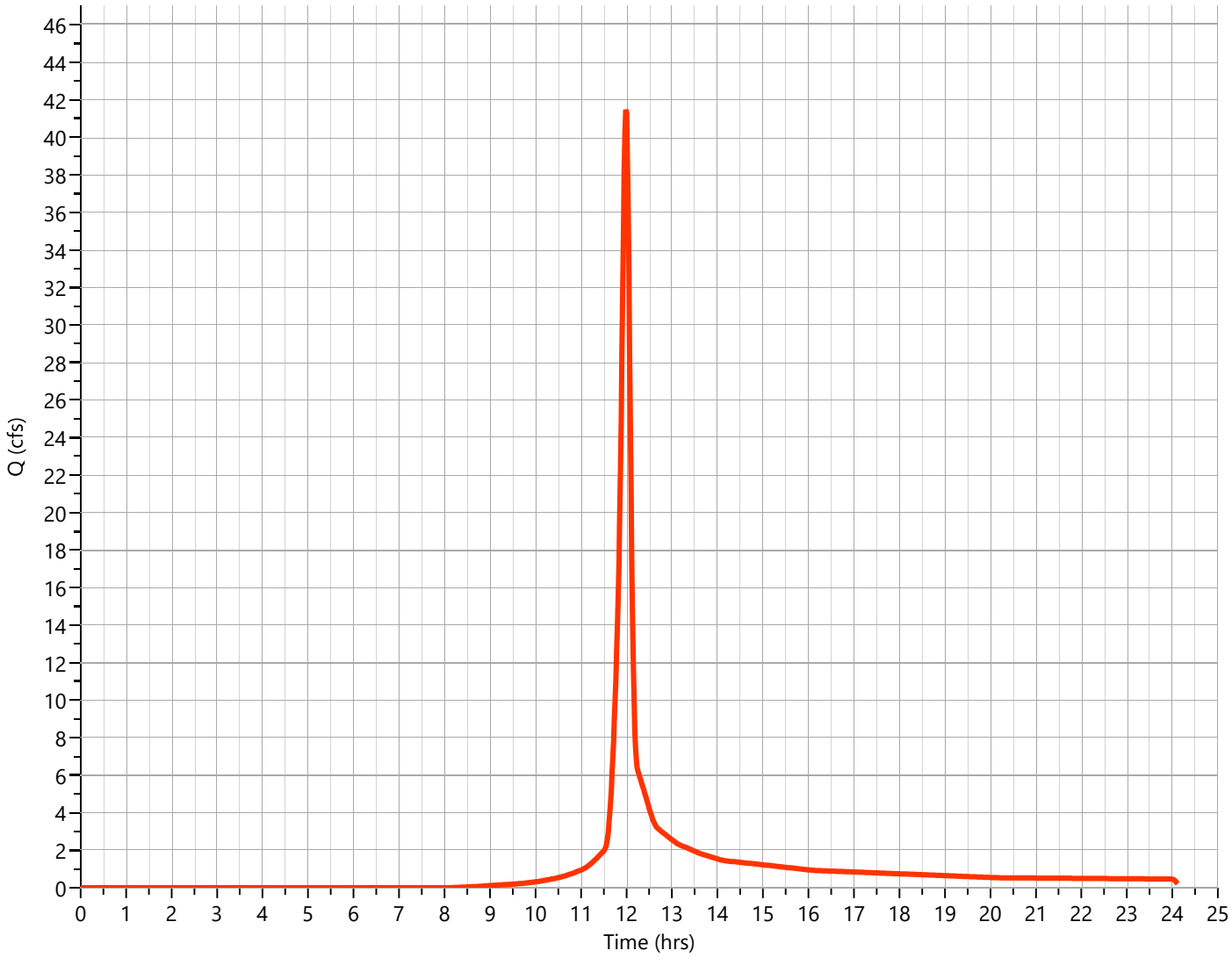
## Post DEVELOPED

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 41.48 cfs |
| Storm Frequency | = 1-yr | Time to Peak | = 11.98 hrs |
| Time Interval | = 1 min | Runoff Volume | = 93,949 cuft |
| Drainage Area | = 19.74 ac | Curve Number | = 87* |
| Tc Method | = User | Time of Conc. (Tc) | = 10.0 min |
| Total Rainfall | = 2.50 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 6.83 | 98 | IMPERVIOUS |
| 4.97 | 94 | BUILDABLE DEVELOPMENT |
| 7.94 | 74 | PERVIOUS, CLASS C |
| **19.74** | **87** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

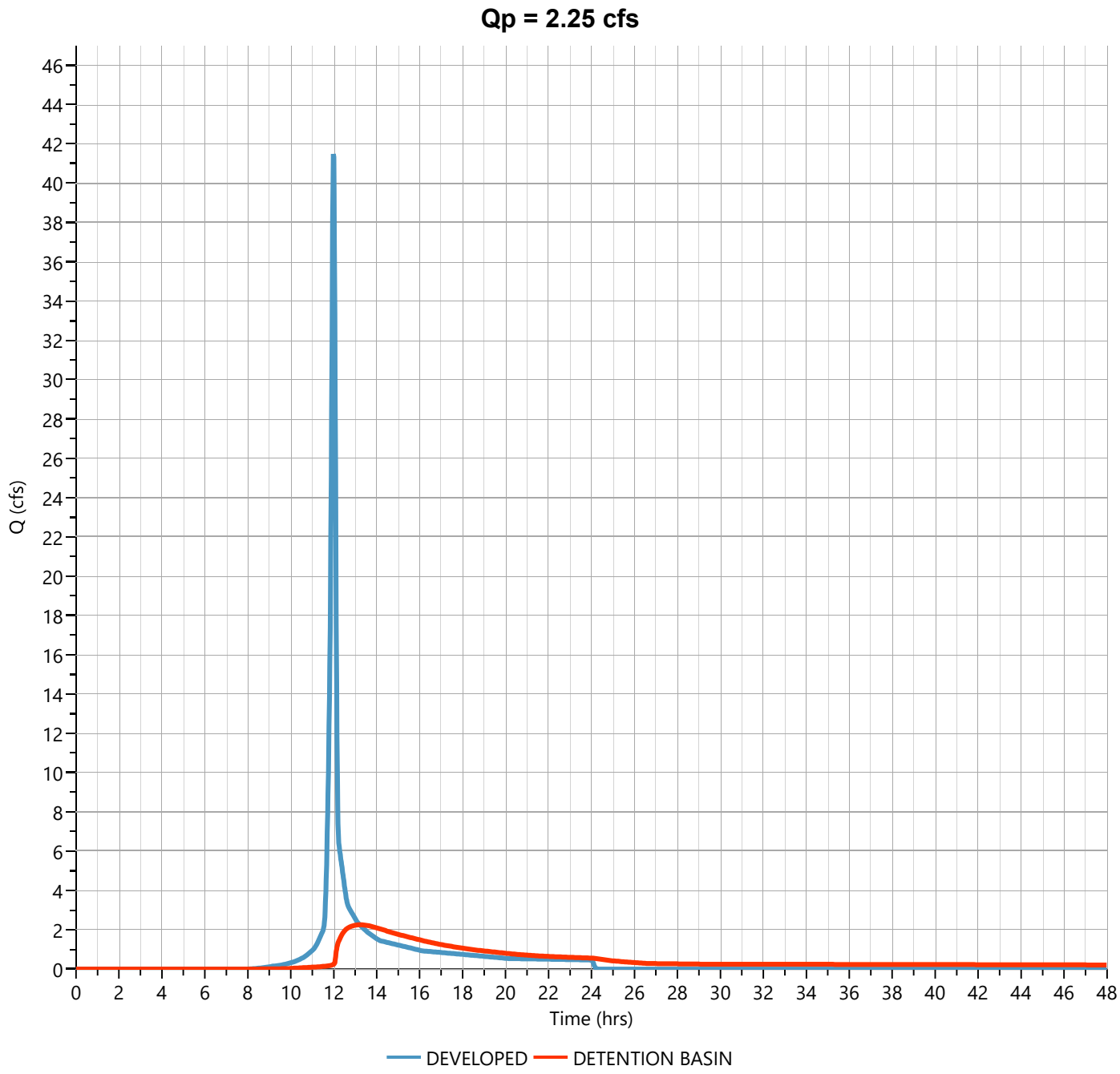
## Post DETENTION BASIN

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 2.250 cfs |
| Storm Frequency | = 1-yr | Time to Peak | = 13.20 hrs |
| Time Interval | = 1 min | Hydrograph Volume | = 74,409 cuft |
| Inflow Hydrograph | = 2 - DEVELOPED | Max. Elevation | = 728.24 ft |
| Pond Name | = DETENTION BASIN | Max. Storage | = 53,145 cuft |

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 8.05 hrs*



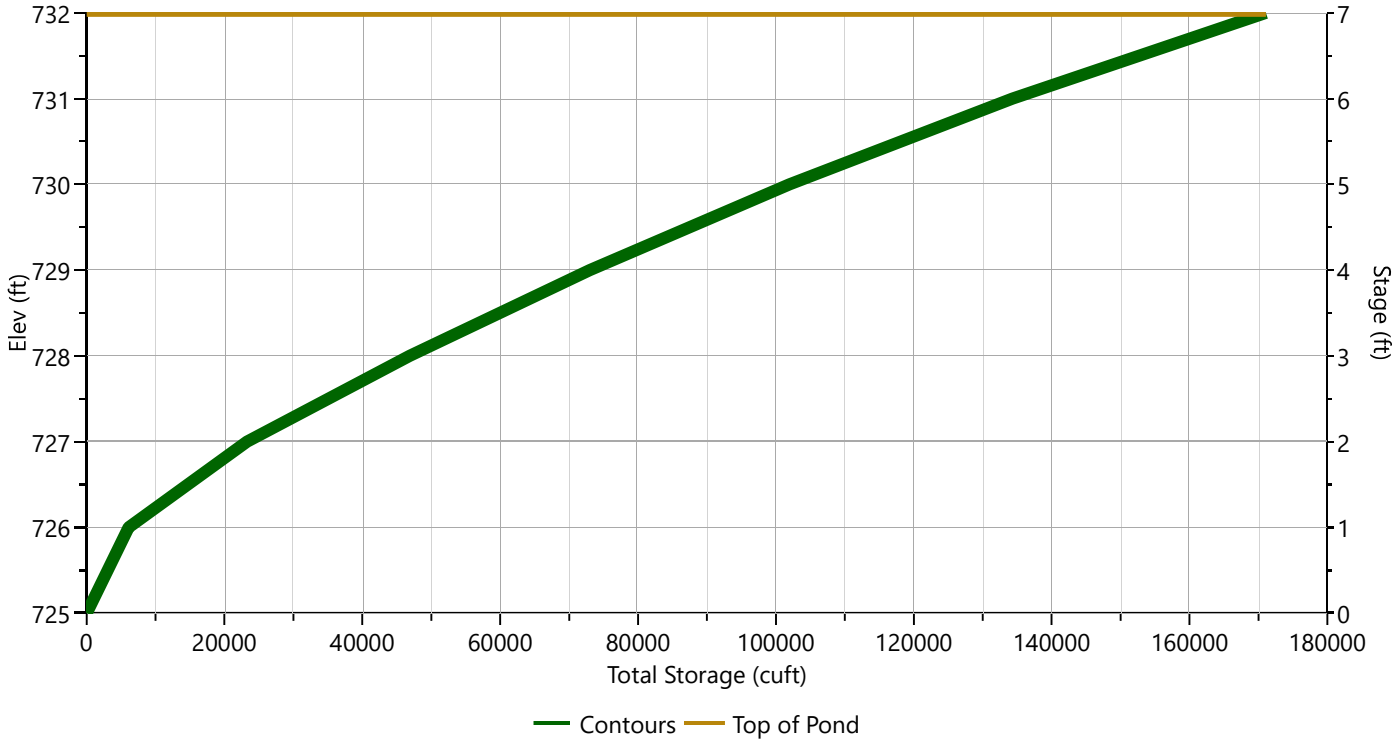
## DETENTION BASIN

## Stage-Storage

| User Defined Contours | |
|---|---|
| **Description** | **Input** |
| Bottom Elevation, ft | 725.00 |
| Voids (%) | 100.00 |
| Volume Calc | None |

**Stage / Storage Table**

| Stage (ft) | Elevation (ft) | Contour Area (sqft) | Incr. Storage (cuft) | Total Storage (cuft) |
|---|---|---|---|---|
| 0.00 | 725.00 | 45 | 0.000 | 0.000 |
| 1.00 | 726.00 | 12,115 | 6,080 | 6,080 |
| 2.00 | 727.00 | 22,311 | 17,213 | 23,293 |
| 3.00 | 728.00 | 24,847 | 23,579 | 46,872 |
| 4.00 | 729.00 | 27,408 | 26,128 | 73,000 |
| 5.00 | 730.00 | 30,487 | 28,948 | 101,947 |
| 6.00 | 731.00 | 34,288 | 32,388 | 134,335 |
| 7.00 | 732.00 | 39,227 | 36,758 | 171,092 |



# Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

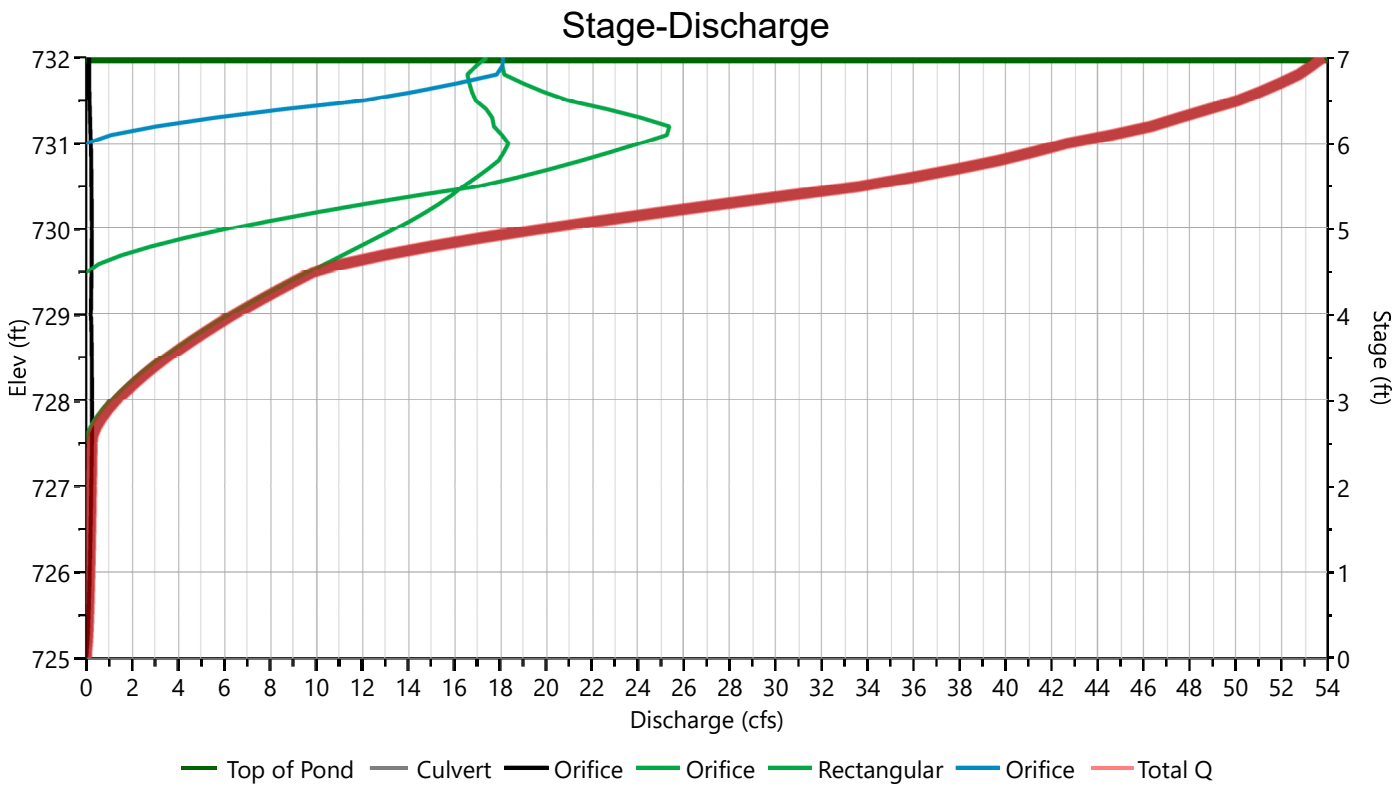
## DETENTION BASIN

## Stage-Discharge

| Culvert / Orifices | Culvert | Orifices | | | Orifice Plate | |
|---|---|---|---|---|---|---|
| | | 1* | 2* | 3* | | |
| Rise, in | 30 | 2.5 | 12 | 6 | Orifice Dia, in | |
| Span, in | 30 | 2.5 | 30 | 30 | No. Orifices | |
| No. Barrels | 1 | 1 | 2 | 4 | Invert Elevation, ft | |
| Invert Elevation, ft | 725.00 | 725.00 | 729.50 | 731.00 | Height, ft | |
| Orifice Coefficient, Co | 0.60 | 0.60 | 0.60 | 0.60 | Orifice Coefficient, Co | |
| Length, ft | 8 | | | | | |
| Barrel Slope, % | .5 | | | | | |
| N-Value, n | 0.013 | | | | | |

| Weirs | Riser* | Weirs | | | Ancillary | |
|---|---|---|---|---|---|---|
| | | 1 | 2* | 3 | | |
| Shape / Type | Box | Rectangular | Rectangular | | Exfiltration, in/hr | |
| Crest Elevation, ft | 732 | 731.5 | 727.56 | | | |
| Crest Length, ft | 12 | 10 | 1.08 | | | |
| Angle, deg | | | | | | |
| Weir Coefficient, Cw | 3.3 | | 3.3 | | | |

*Routes through Culvert.



## DETENTION BASIN

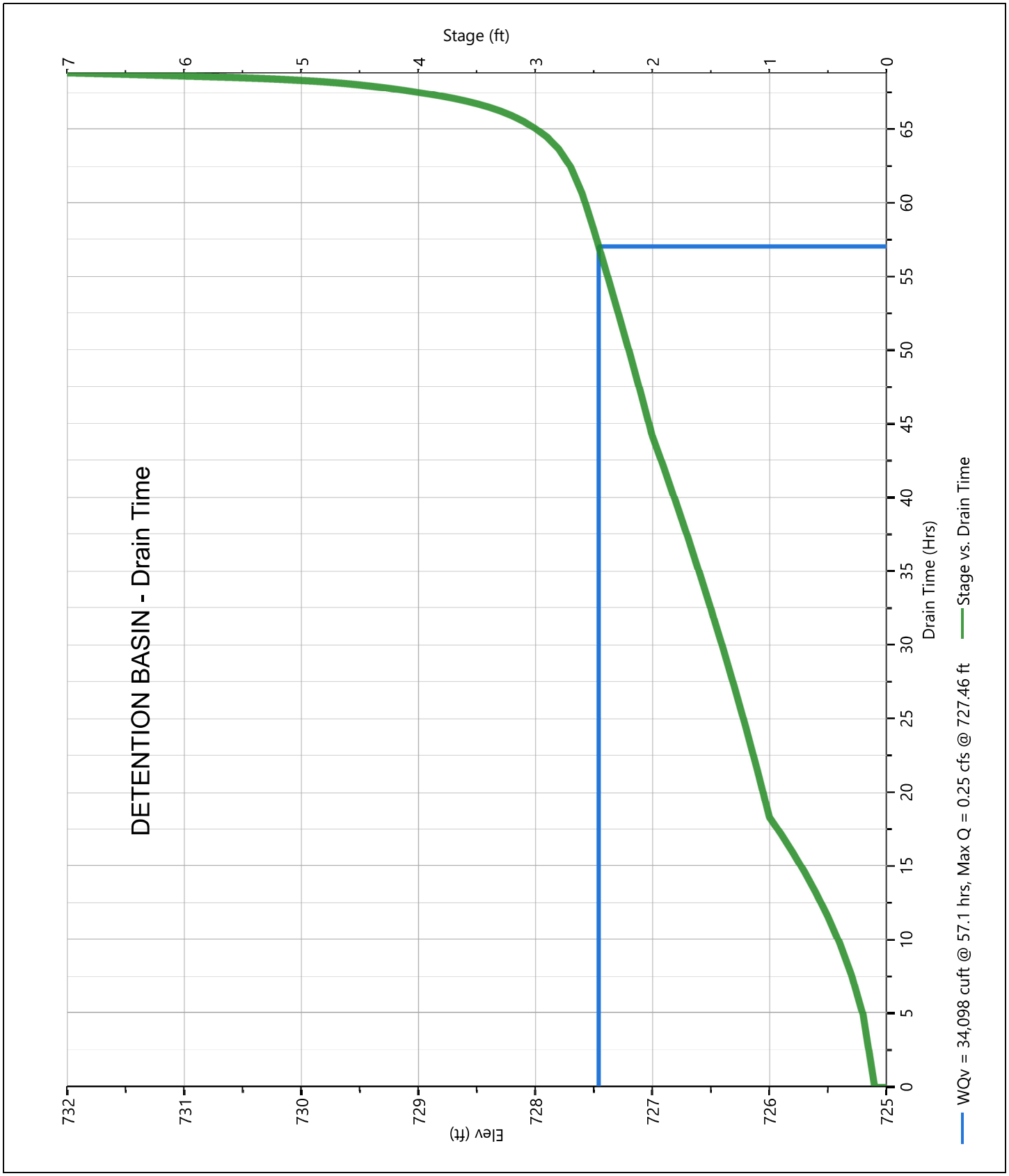
## Stage-Storage-Discharge Summary

| 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 | 725.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | | | 0.000 |
| 1.00 | 726.00 | 6,080 | 0.150 oc | 0.150 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | | | 0.150 |
| 2.00 | 727.00 | 23,293 | 0.220 oc | 0.220 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | | | 0.220 |
| 3.00 | 728.00 | 46,872 | 1.292 oc | 0.252 | 0.000 | 0.000 | 0.000 | 0.000 | 1.040 | | | | | 1.292 |
| 4.00 | 729.00 | 73,000 | 6.360 oc | 0.201 | 0.000 | 0.000 | 0.000 | 0.000 | 6.159 | | | | | 6.360 |
| 5.00 | 730.00 | 101,947 | 19.63 oc | 0.241 | 6.019 | 0.000 | 0.000 | 0.000 | 13.37 s | | | | | 19.63 |
| 6.00 | 731.00 | 134,335 | 42.64 ic | 0.201 | 24.07 | 0.000 | 0.000 | 0.000 | 18.37 s | | | | | 42.64 |
| 7.00 | 732.00 | 171,092 | 53.80 ic | 0.124 | 18.13 | 18.13 | 0.000 | 0.000 | 17.42 s | | | | | 53.80 |

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

## DETENTION BASIN

## Extended Detention



# Design Storm Report

Custom Storm filename:

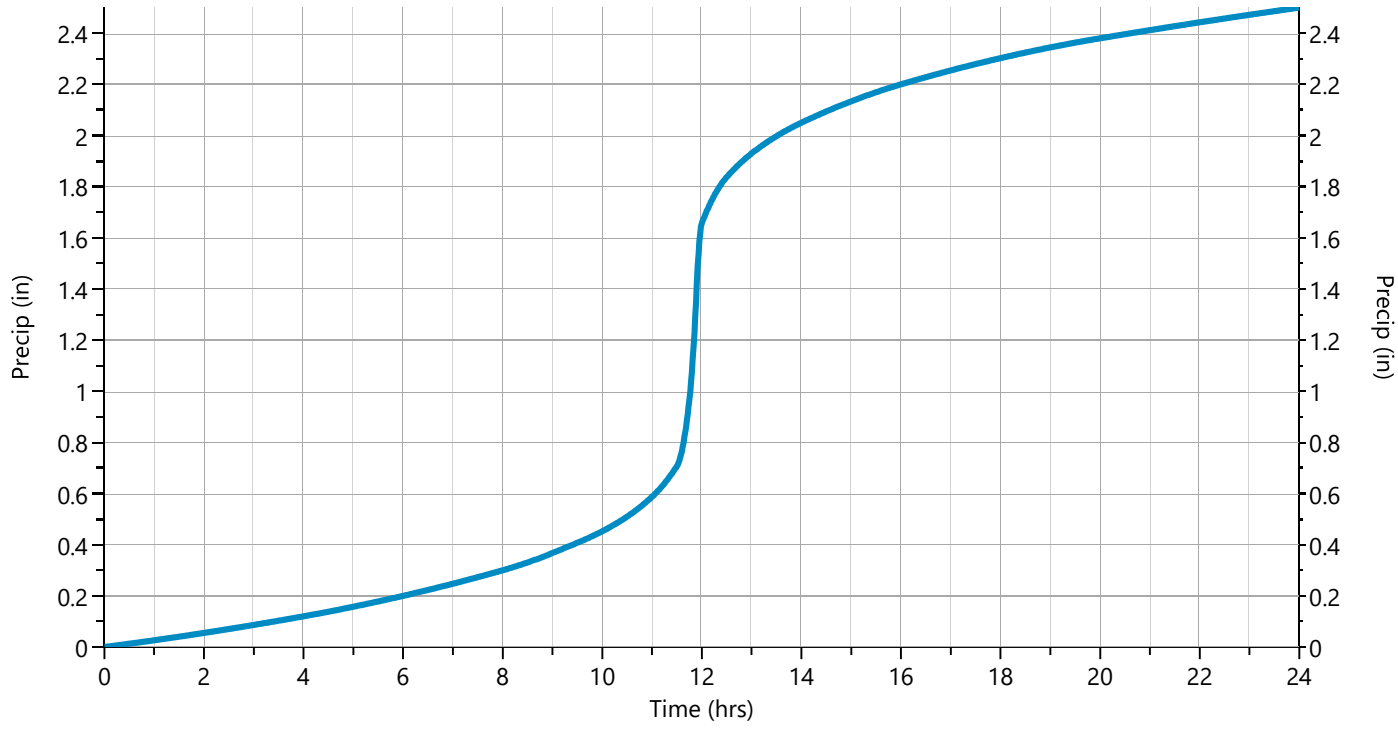
Hydrology Studio v 3.0.0.16

12-14-2020

## Storm Distribution: NRCS/SCS - Type II

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ✔ 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | |
| **24 hrs** | 2.50 | 2.90 | 0.00 | 3.60 | 4.10 | 4.70 | 5.20 | 5.60 | |

| Incremental Rainfall Distribution, 1-yr | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Time (hrs)** | **Precip (in)** | **Time (hrs)** | **Precip (in)** | **Time (hrs)** | **Precip (in)** | **Time (hrs)** | **Precip (in)** | **Time (hrs)** | **Precip (in)** |
| 11.42 | 0.004633 | 11.60 | 0.014045 | 11.78 | 0.036526 | 11.97 | 0.034399 | 12.15 | 0.007029 |
| 11.43 | 0.004700 | 11.62 | 0.015689 | 11.80 | 0.041100 | 11.98 | 0.023989 | 12.17 | 0.006871 |
| 11.45 | 0.004767 | 11.63 | 0.017333 | 11.82 | 0.045674 | 12.00 | 0.013580 | 12.18 | 0.006712 |
| 11.47 | 0.004833 | 11.65 | 0.018978 | 11.83 | 0.050248 | 12.02 | 0.008576 | 12.20 | 0.006554 |
| 11.48 | 0.004900 | 11.67 | 0.020622 | 11.85 | 0.054822 | 12.03 | 0.008137 | 12.22 | 0.006396 |
| 11.50 | 0.004967 | 11.68 | 0.022267 | 11.87 | 0.059396 | 12.05 | 0.007979 | 12.23 | 0.006238 |
| 11.52 | 0.005841 | 11.70 | 0.023911 | 11.88 | 0.063970 | 12.07 | 0.007821 | 12.25 | 0.006079 |
| 11.53 | 0.007467 | 11.72 | 0.025556 | 11.90 | 0.068544 | 12.08 | 0.007663 | 12.27 | 0.005921 |
| 11.55 | 0.009111 | 11.73 | 0.027200 | **11.92** | **0.073119** | 12.10 | 0.007504 | 12.28 | 0.005762 |
| 11.57 | 0.010756 | 11.75 | 0.028844 | 11.93 | 0.047813 | 12.12 | 0.007346 | 12.30 | 0.005604 |
| 11.58 | 0.012400 | 11.77 | 0.031710 | 11.95 | 0.044809 | 12.13 | 0.007187 | 12.32 | 0.005446 |



# Hydrograph 2-yr Summary

Project Name:

12-14-2020

Hydrology Studio v 3.0.0.16

| 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 | Pre DEVELOPED | 22.72 | 12.13 | 79,327 | ---- | | |
| 2 | NRCS Runoff | Post DEVELOPED | 52.06 | 11.98 | 118,383 | ---- | | |
| 3 | Pond Route | Post DETENTION BASIN | 4.202 | 12.62 | 98,502 | 2 | 728.63 | 63,424 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

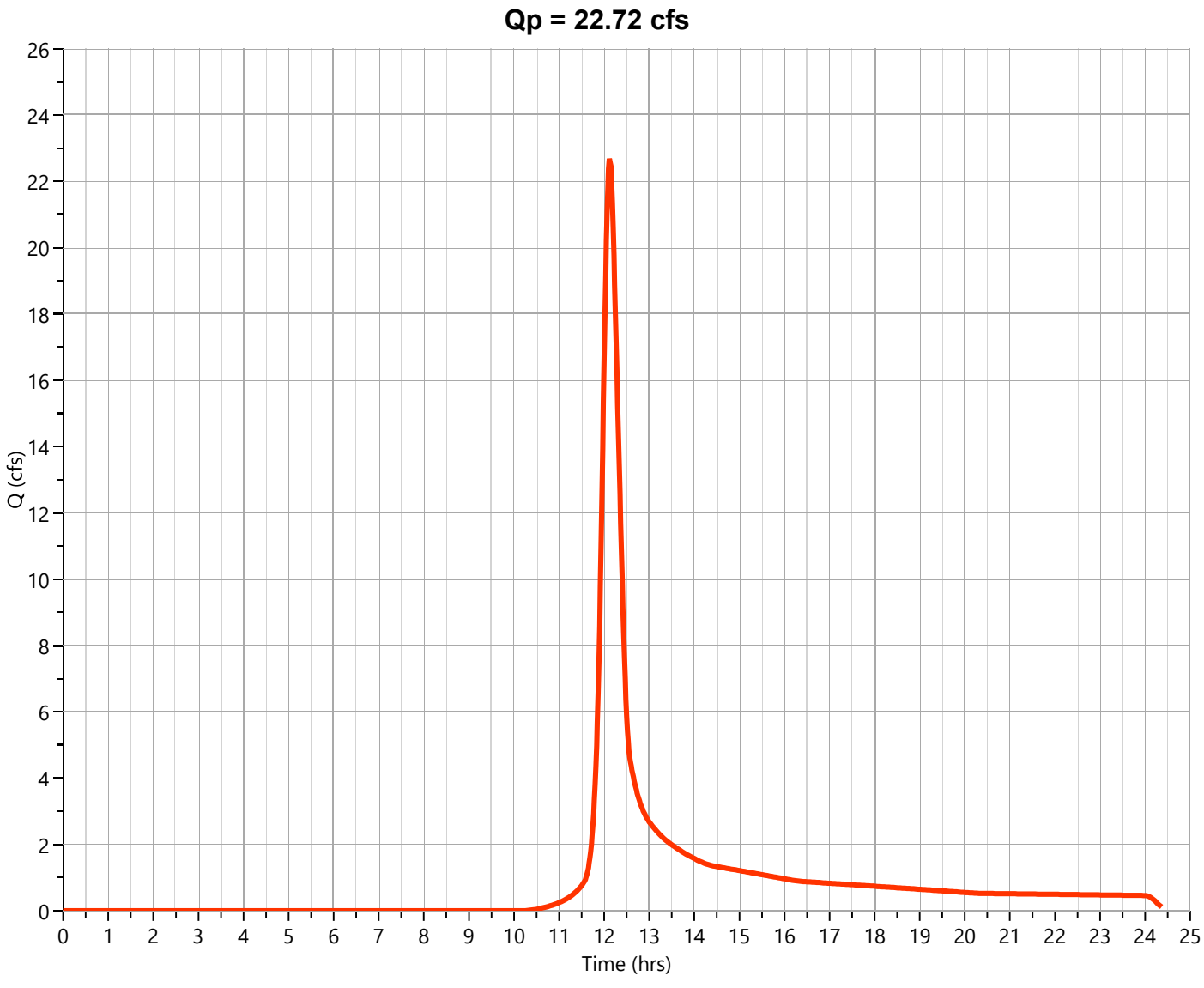
## Pre DEVELOPED

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 22.72 cfs |
| Storm Frequency | = 2-yr | Time to Peak | = 12.13 hrs |
| Time Interval | = 1 min | Runoff Volume | = 79,327 cuft |
| Drainage Area | = 19.76 ac | Curve Number | = 79* |
| Tc Method | = TR55 (See Worksheet) | Time of Conc. (Tc) | = 23.44 min |
| Total Rainfall | = 2.90 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.54 | 98 | IMPERVIOUS |
| 15.2 | 74 | PERVIOUS, CLASS C |
| **19.76** | **79** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

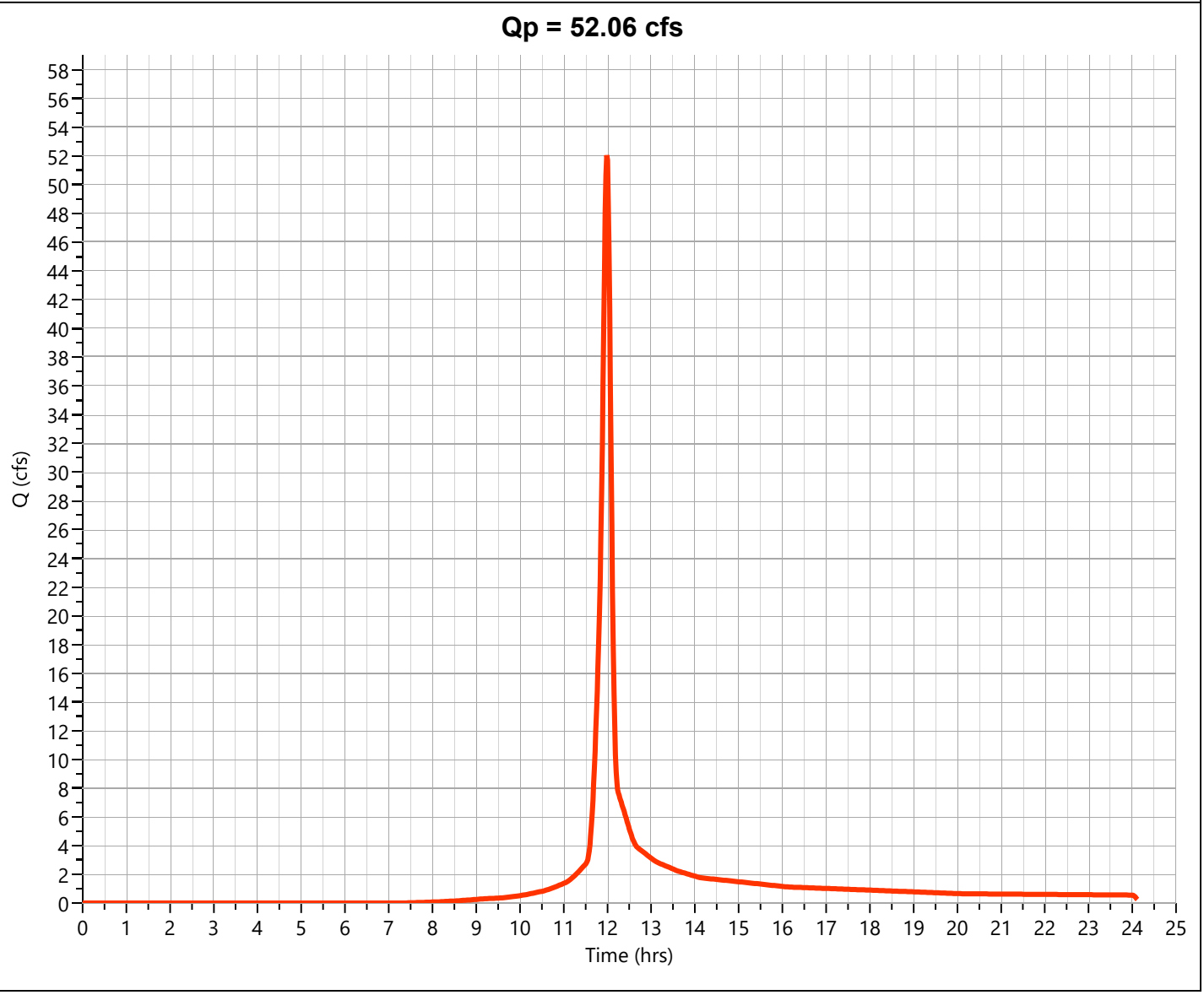
## Post DEVELOPED

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 52.06 cfs |
| Storm Frequency | = 2-yr | Time to Peak | = 11.98 hrs |
| Time Interval | = 1 min | Runoff Volume | = 118,383 cuft |
| Drainage Area | = 19.74 ac | Curve Number | = 87* |
| Tc Method | = User | Time of Conc. (Tc) | = 10.0 min |
| Total Rainfall | = 2.90 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 6.83 | 98 | IMPERVIOUS |
| 4.97 | 94 | BUILDABLE DEVELOPMENT |
| 7.94 | 74 | PERVIOUS, CLASS C |
| **19.74** | **87** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

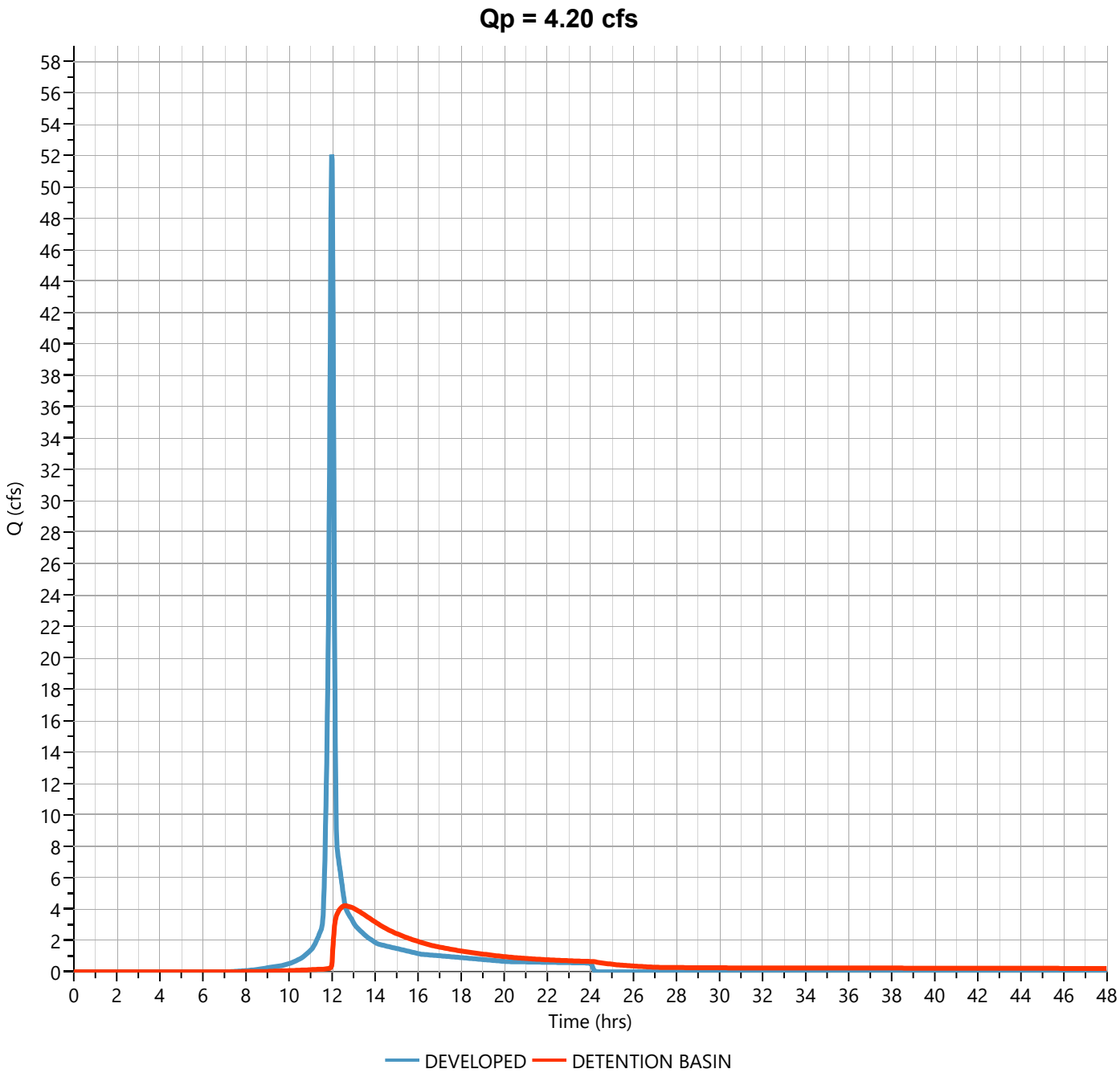
## Post DETENTION BASIN

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 4.202 cfs |
| Storm Frequency | = 2-yr | Time to Peak | = 12.62 hrs |
| Time Interval | = 1 min | Hydrograph Volume | = 98,502 cuft |
| Inflow Hydrograph | = 2 - DEVELOPED | Max. Elevation | = 728.63 ft |
| Pond Name | = DETENTION BASIN | Max. Storage | = 63,424 cuft |

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 6.51 hrs*



# Design Storm Report

Custom Storm filename:

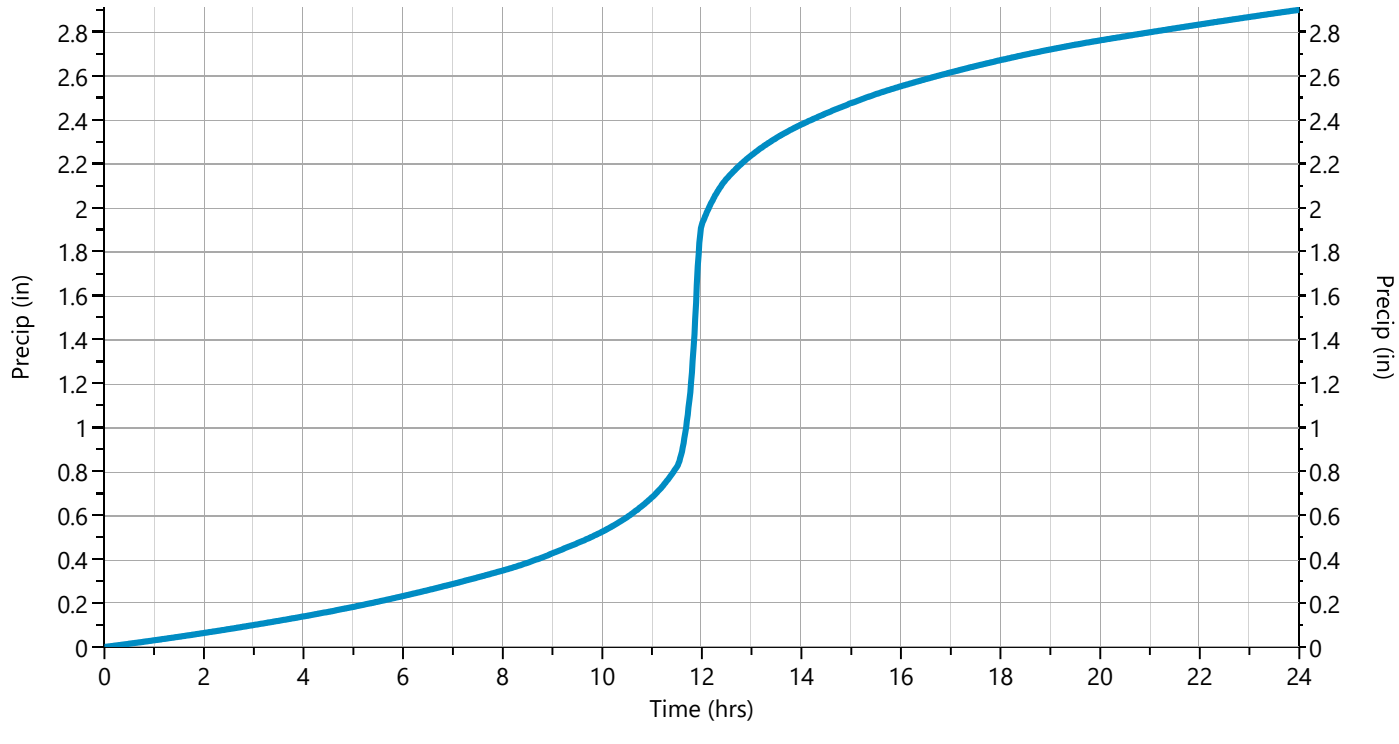
Hydrology Studio v 3.0.0.16

12-14-2020

## Storm Distribution: NRCS/SCS - Type II

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | ✔ 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | |
| **24 hrs** | 2.50 | 2.90 | 0.00 | 3.60 | 4.10 | 4.70 | 5.20 | 5.60 | |

| 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) |
| 11.42 | 0.005375 | 11.60 | 0.016292 | 11.78 | 0.042370 | 11.97 | 0.039903 | 12.15 | 0.008154 |
| 11.43 | 0.005452 | 11.62 | 0.018199 | 11.80 | 0.047676 | 11.98 | 0.027828 | 12.17 | 0.007970 |
| 11.45 | 0.005529 | 11.63 | 0.020107 | 11.82 | 0.052982 | 12.00 | 0.015752 | 12.18 | 0.007787 |
| 11.47 | 0.005607 | 11.65 | 0.022014 | 11.83 | 0.058288 | 12.02 | 0.009948 | 12.20 | 0.007603 |
| 11.48 | 0.005684 | 11.67 | 0.023922 | 11.85 | 0.063594 | 12.03 | 0.009440 | 12.22 | 0.007419 |
| 11.50 | 0.005761 | 11.68 | 0.025829 | 11.87 | 0.068900 | 12.05 | 0.009256 | 12.23 | 0.007236 |
| 11.52 | 0.006775 | 11.70 | 0.027737 | 11.88 | 0.074206 | 12.07 | 0.009072 | 12.25 | 0.007052 |
| 11.53 | 0.008661 | 11.72 | 0.029644 | 11.90 | 0.079512 | 12.08 | 0.008888 | 12.27 | 0.006868 |
| 11.55 | 0.010569 | 11.73 | 0.031552 | **11.92** | **0.084818** | 12.10 | 0.008705 | 12.28 | 0.006685 |
| 11.57 | 0.012477 | 11.75 | 0.033460 | 11.93 | 0.055463 | 12.12 | 0.008521 | 12.30 | 0.006501 |
| 11.58 | 0.014384 | 11.77 | 0.036784 | 11.95 | 0.051978 | 12.13 | 0.008337 | 12.32 | 0.006317 |



# Hydrograph 5-yr Summary

Project Name:

12-14-2020

Hydrology Studio v 3.0.0.16

| 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 | Pre DEVELOPED | 34.11 | 12.12 | 116,873 | ---- | | |
| 2 | NRCS Runoff | Post DEVELOPED | 70.91 | 11.98 | 162,839 | ---- | | |
| 3 | Pond Route | Post DETENTION BASIN | 8.911 | 12.35 | 142,537 | 2 | 729.37 | 83,744 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

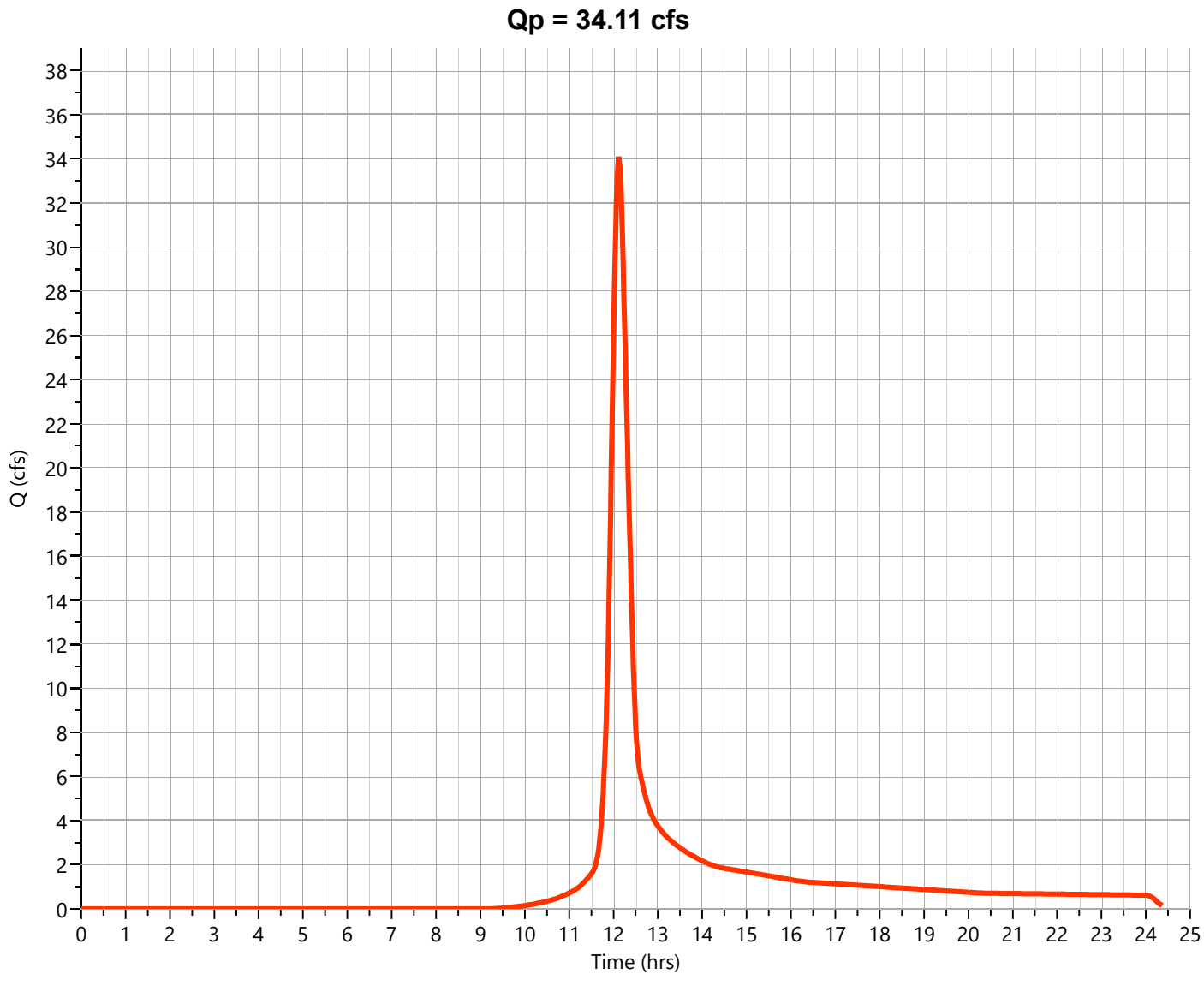
## Pre DEVELOPED

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 34.11 cfs |
| Storm Frequency | = 5-yr | Time to Peak | = 12.12 hrs |
| Time Interval | = 1 min | Runoff Volume | = 116,873 cuft |
| Drainage Area | = 19.76 ac | Curve Number | = 79* |
| Tc Method | = TR55 (See Worksheet) | Time of Conc. (Tc) | = 23.44 min |
| Total Rainfall | = 3.60 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.54 | 98 | IMPERVIOUS |
| 15.2 | 74 | PERVIOUS, CLASS C |
| **19.76** | **79** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

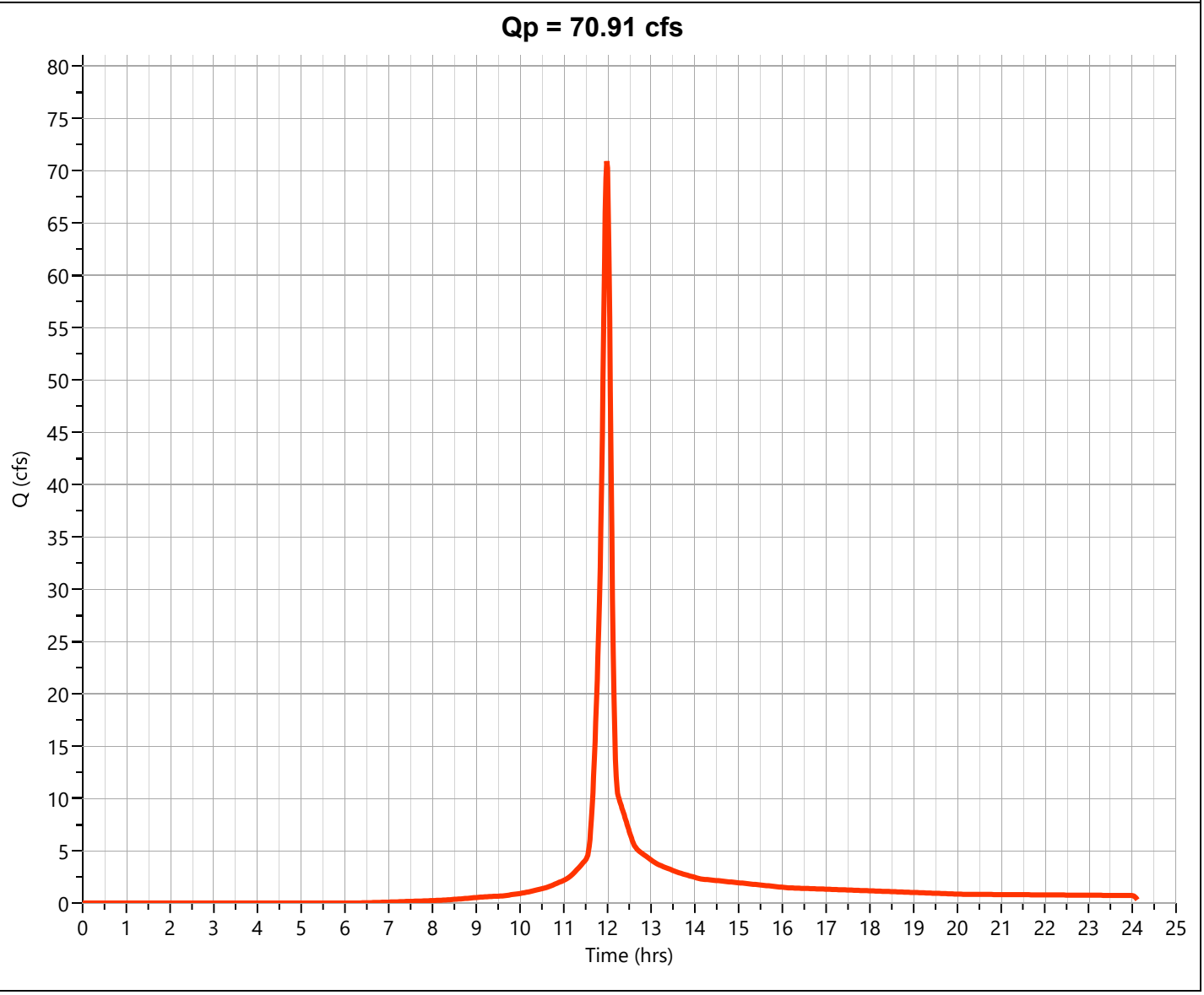
## Post DEVELOPED

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 70.91 cfs |
| Storm Frequency | = 5-yr | Time to Peak | = 11.98 hrs |
| Time Interval | = 1 min | Runoff Volume | = 162,839 cuft |
| Drainage Area | = 19.74 ac | Curve Number | = 87* |
| Tc Method | = User | Time of Conc. (Tc) | = 10.0 min |
| Total Rainfall | = 3.60 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 6.83 | 98 | IMPERVIOUS |
| 4.97 | 94 | BUILDABLE DEVELOPMENT |
| 7.94 | 74 | PERVIOUS, CLASS C |
| **19.74** | **87** | Weighted CN Method Employed |



# Hydrograph Report

Hydrology Studio v 3.0.0.16

12-14-2020

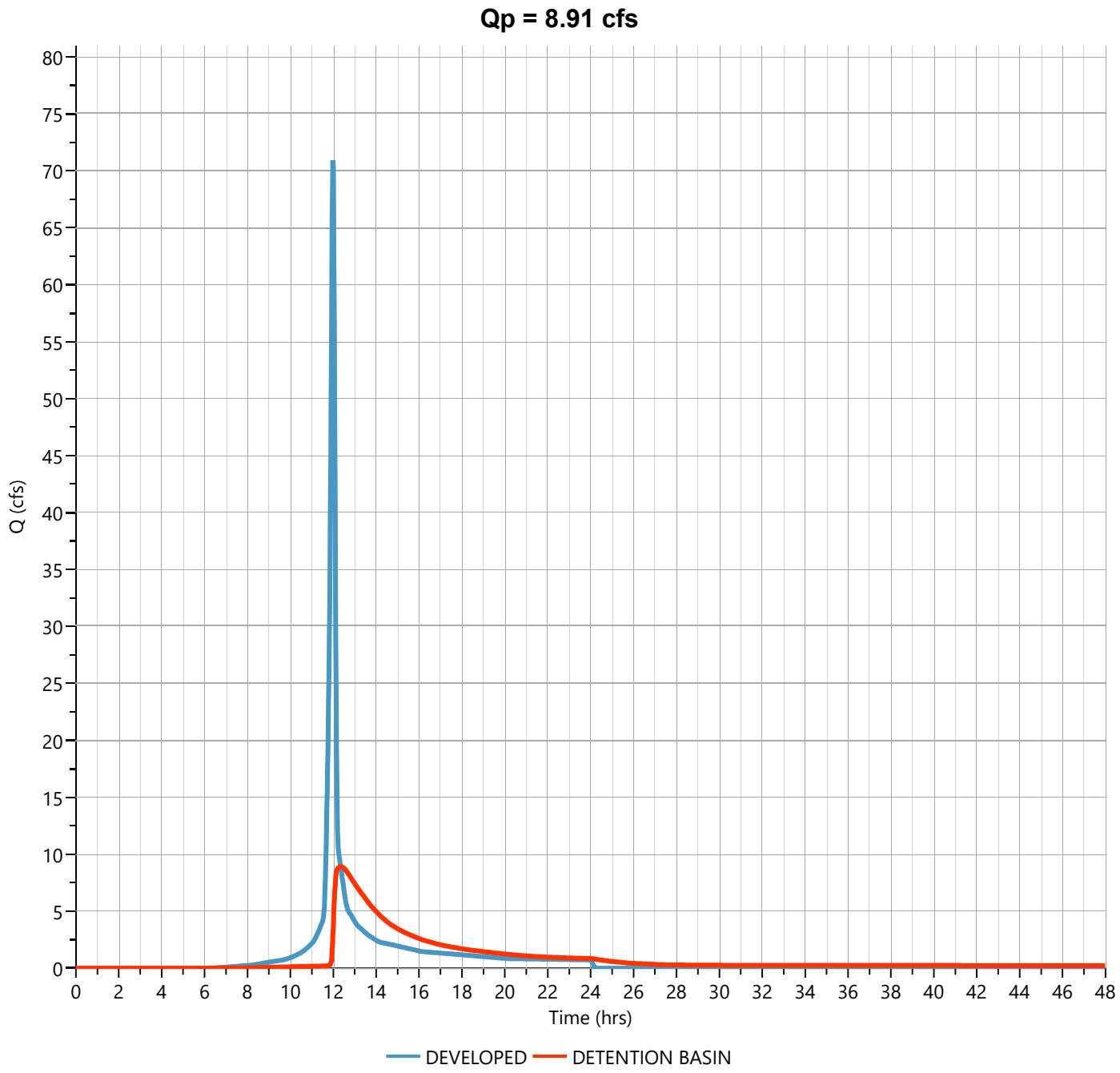
## Post DETENTION BASIN

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 8.911 cfs |
| Storm Frequency | = 5-yr | Time to Peak | = 12.35 hrs |
| Time Interval | = 1 min | Hydrograph Volume | = 142,537 cuft |
| Inflow Hydrograph | = 2 - DEVELOPED | Max. Elevation | = 729.37 ft |
| Pond Name | = DETENTION BASIN | Max. Storage | = 83,744 cuft |

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 4.99 hrs*



# Design Storm Report

Custom Storm filename:

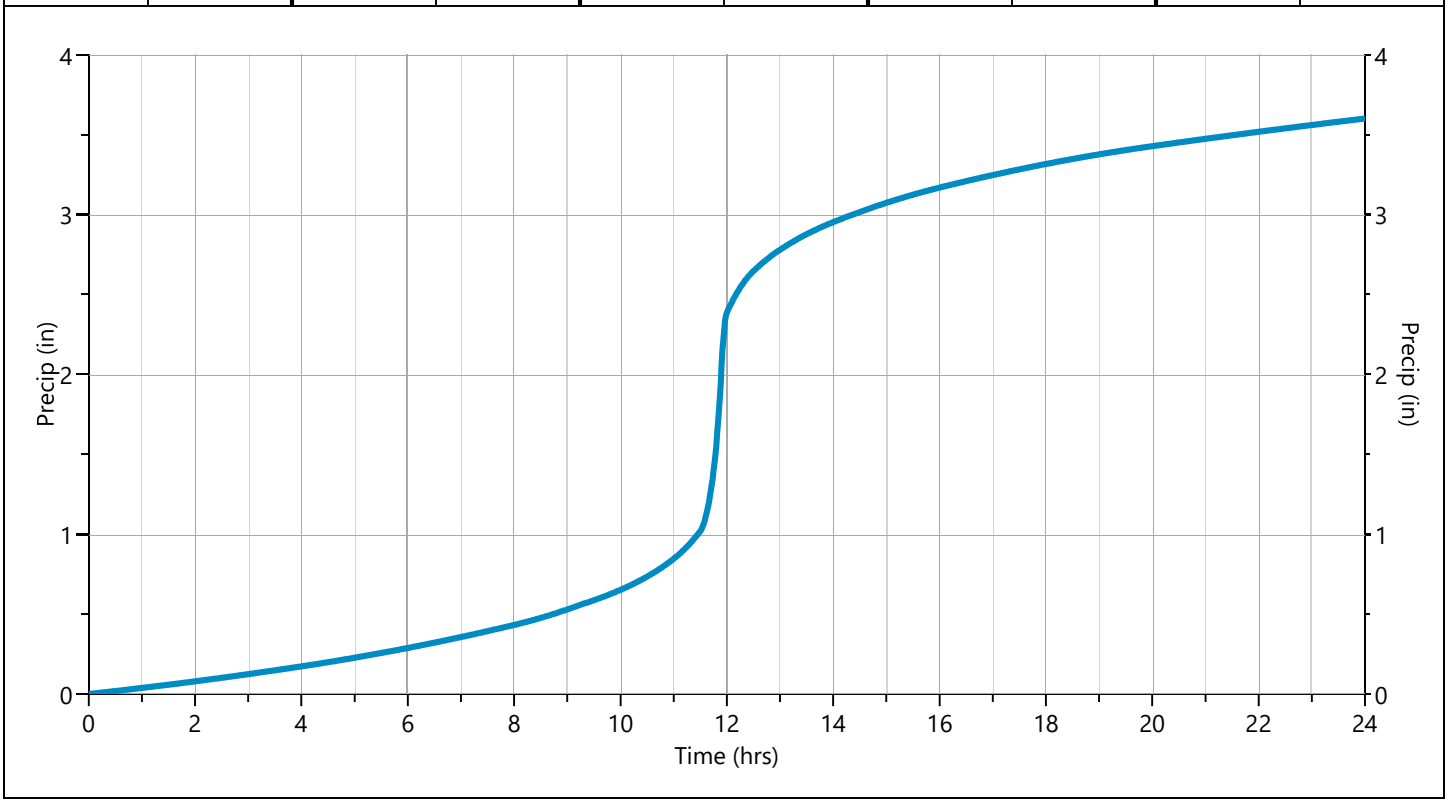
Hydrology Studio v 3.0.0.16

12-14-2020

## Storm Distribution: NRCS/SCS - Type II

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | ✔ 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | |
| 24 hrs | 2.50 | 2.90 | 0.00 | 3.60 | 4.10 | 4.70 | 5.20 | 5.60 | |

| 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) |
| 11.42 | 0.006672 | 11.60 | 0.020224 | 11.78 | 0.052597 | 11.97 | 0.049535 | 12.15 | 0.010122 |
| 11.43 | 0.006768 | 11.62 | 0.022592 | 11.80 | 0.059184 | 11.98 | 0.034545 | 12.17 | 0.009894 |
| 11.45 | 0.006864 | 11.63 | 0.024960 | 11.82 | 0.065771 | 12.00 | 0.019555 | 12.18 | 0.009666 |
| 11.47 | 0.006960 | 11.65 | 0.027328 | 11.83 | 0.072357 | 12.02 | 0.012349 | 12.20 | 0.009438 |
| 11.48 | 0.007056 | 11.67 | 0.029696 | 11.85 | 0.078944 | 12.03 | 0.011718 | 12.22 | 0.009210 |
| 11.50 | 0.007152 | 11.68 | 0.032064 | 11.87 | 0.085531 | 12.05 | 0.011490 | 12.23 | 0.008982 |
| 11.52 | 0.008411 | 11.70 | 0.034432 | 11.88 | 0.092117 | 12.07 | 0.011262 | 12.25 | 0.008754 |
| 11.53 | 0.010752 | 11.72 | 0.036800 | 11.90 | 0.098704 | 12.08 | 0.011034 | 12.27 | 0.008526 |
| 11.55 | 0.013120 | 11.73 | 0.039168 | **11.92** | **0.105291** | 12.10 | 0.010806 | 12.28 | 0.008298 |
| 11.57 | 0.015488 | 11.75 | 0.041536 | 11.93 | 0.068851 | 12.12 | 0.010578 | 12.30 | 0.008070 |
| 11.58 | 0.017856 | 11.77 | 0.045663 | 11.95 | 0.064525 | 12.13 | 0.010350 | 12.32 | 0.007842 |



# Hydrograph 10-yr Summary

Project Name:

12-14-2020

Hydrology Studio v 3.0.0.16

| 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 | Pre DEVELOPED | 42.69 | 12.12 | 145,373 | ---- | | |
| 2 | NRCS Runoff | Post DEVELOPED | 84.51 | 11.98 | 195,517 | ---- | | |
| 3 | Pond Route | Post DETENTION BASIN | 16.51 | 12.18 | 174,984 | 2 | 729.87 | 98,201 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

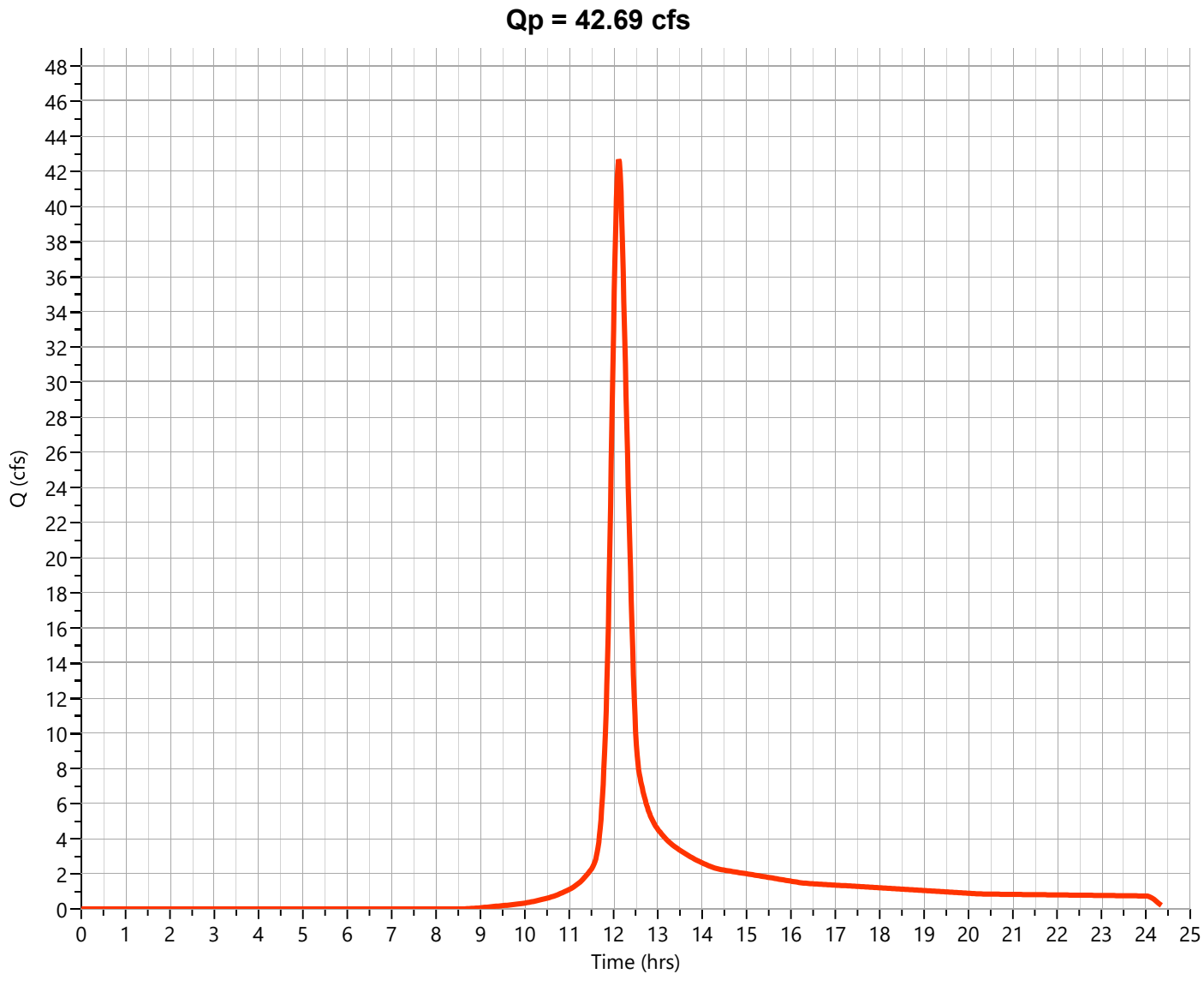
## Pre DEVELOPED

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 42.69 cfs |
| Storm Frequency | = 10-yr | Time to Peak | = 12.12 hrs |
| Time Interval | = 1 min | Runoff Volume | = 145,373 cuft |
| Drainage Area | = 19.76 ac | Curve Number | = 79* |
| Tc Method | = TR55 (See Worksheet) | Time of Conc. (Tc) | = 23.44 min |
| Total Rainfall | = 4.10 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.54 | 98 | IMPERVIOUS |
| 15.2 | 74 | PERVIOUS, CLASS C |
| **19.76** | **79** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

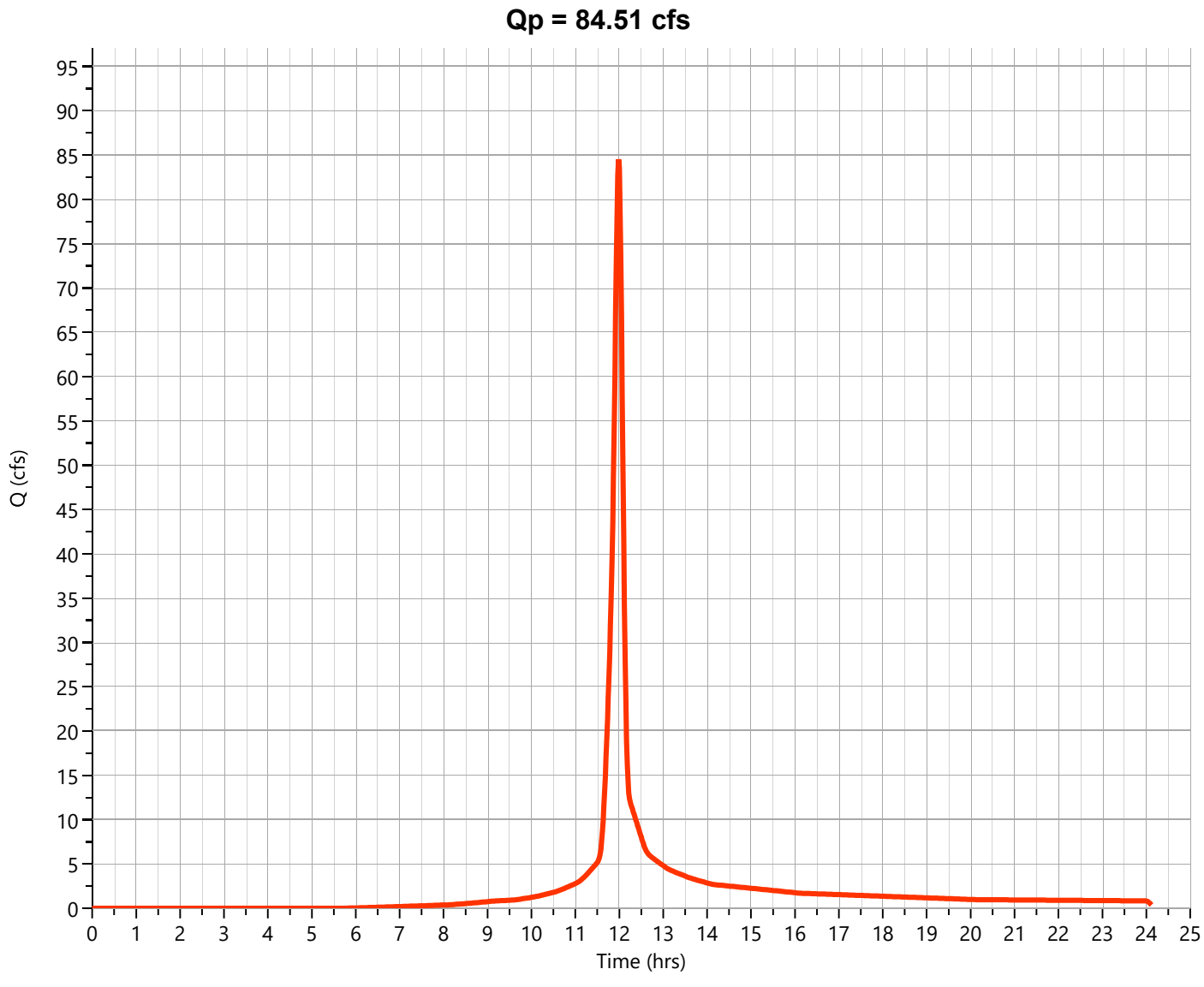
## Post DEVELOPED

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 84.51 cfs |
| Storm Frequency | = 10-yr | Time to Peak | = 11.98 hrs |
| Time Interval | = 1 min | Runoff Volume | = 195,517 cuft |
| Drainage Area | = 19.74 ac | Curve Number | = 87* |
| Tc Method | = User | Time of Conc. (Tc) | = 10.0 min |
| Total Rainfall | = 4.10 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 6.83 | 98 | IMPERVIOUS |
| 4.97 | 94 | BUILDABLE DEVELOPMENT |
| 7.94 | 74 | PERVIOUS, CLASS C |
| **19.74** | **87** | Weighted CN Method Employed |



# Hydrograph Report

Hydrology Studio v 3.0.0.16

12-14-2020

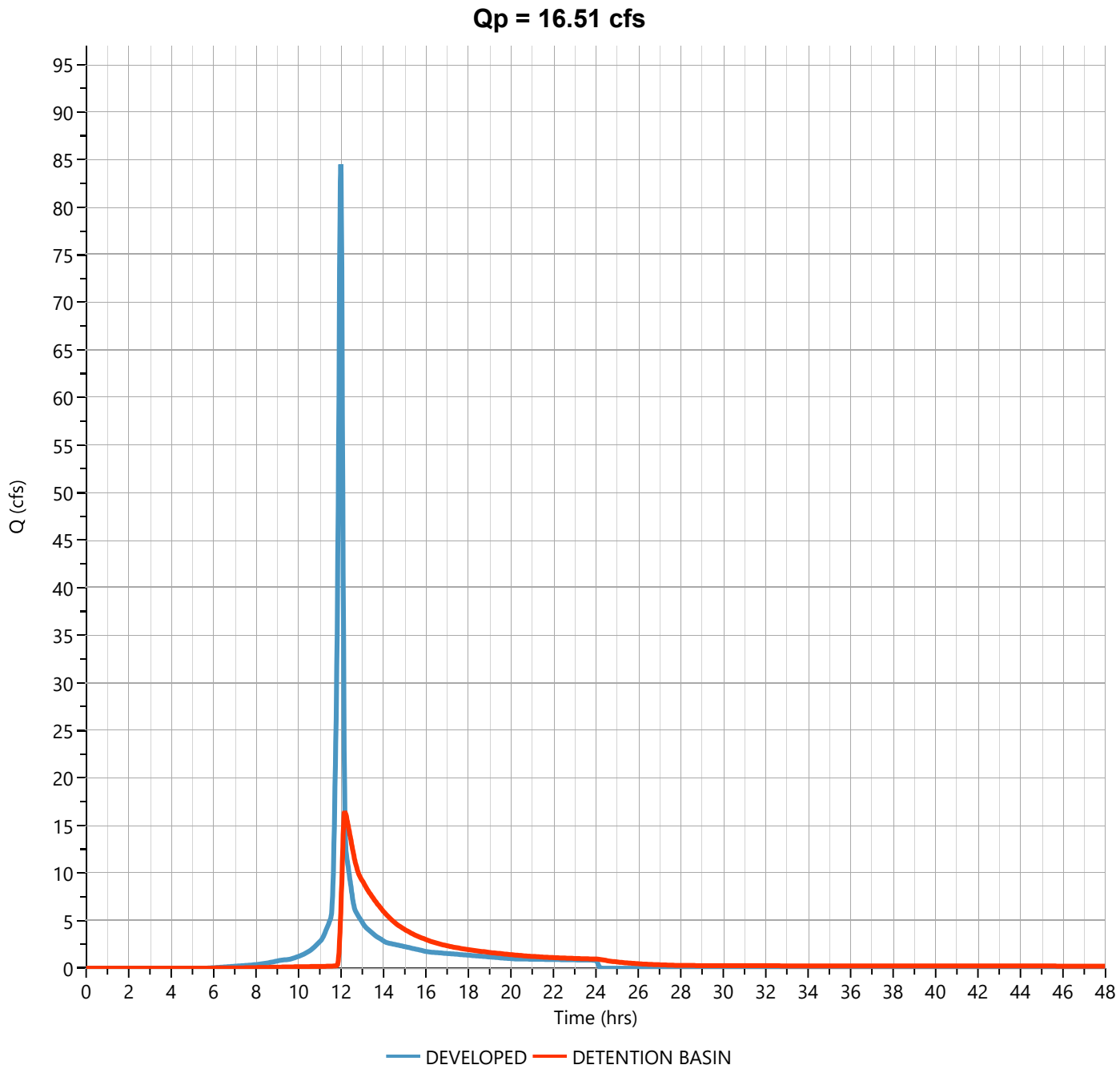
## Post DETENTION BASIN

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 16.51 cfs |
| Storm Frequency | = 10-yr | Time to Peak | = 12.18 hrs |
| Time Interval | = 1 min | Hydrograph Volume | = 174,984 cuft |
| Inflow Hydrograph | = 2 - DEVELOPED | Max. Elevation | = 729.87 ft |
| Pond Name | = DETENTION BASIN | Max. Storage | = 98,201 cuft |

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 4.38 hrs*



# Design Storm Report

Custom Storm filename:

Hydrology Studio v 3.0.0.16

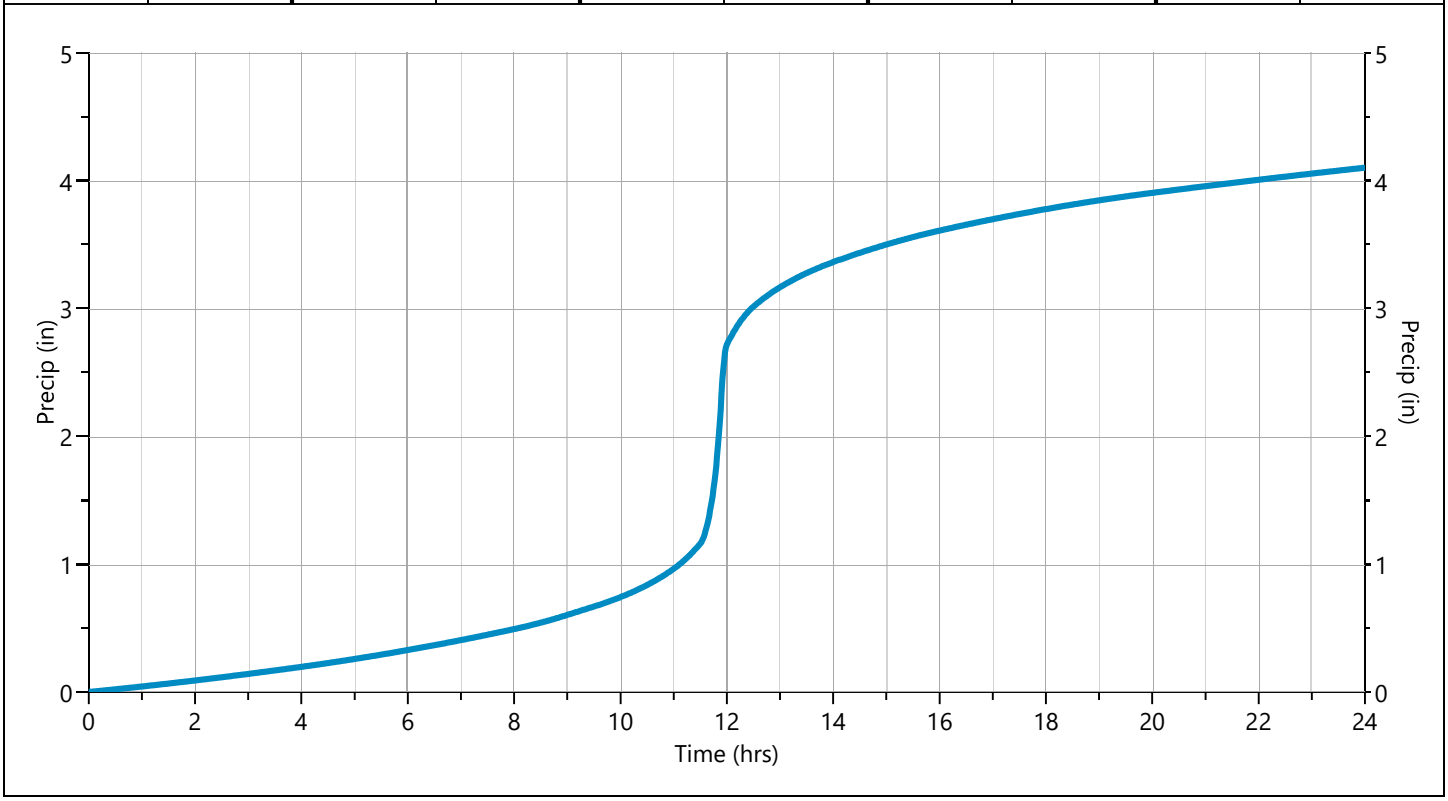
12-14-2020

## Storm Distribution: NRCS/SCS - Type II

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | 5-yr | ✔ 10-yr | 25-yr | 50-yr | 100-yr | |
| 24 hrs | 2.50 | 2.90 | 0.00 | 3.60 | 4.10 | 4.70 | 5.20 | 5.60 | |

**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) |
|---|---|---|---|---|---|---|---|---|---|
| 11.42 | 0.007599 | 11.60 | 0.023033 | 11.78 | 0.059903 | 11.97 | 0.056415 | 12.15 | 0.011528 |
| 11.43 | 0.007708 | 11.62 | 0.025730 | 11.80 | 0.067404 | 11.98 | 0.039343 | 12.17 | 0.011268 |
| 11.45 | 0.007817 | 11.63 | 0.028427 | 11.82 | 0.074906 | 12.00 | 0.022271 | 12.18 | 0.011009 |
| 11.47 | 0.007927 | 11.65 | 0.031124 | 11.83 | 0.082407 | 12.02 | 0.014064 | 12.20 | 0.010749 |
| 11.48 | 0.008036 | 11.67 | 0.033821 | 11.85 | 0.089909 | 12.03 | 0.013345 | 12.22 | 0.010489 |
| 11.50 | 0.008145 | 11.68 | 0.036517 | 11.87 | 0.097410 | 12.05 | 0.013086 | 12.23 | 0.010230 |
| 11.52 | 0.009579 | 11.70 | 0.039214 | 11.88 | 0.104912 | 12.07 | 0.012826 | 12.25 | 0.009970 |
| 11.53 | 0.012245 | 11.72 | 0.041911 | 11.90 | 0.112413 | 12.08 | 0.012567 | 12.27 | 0.009710 |
| 11.55 | 0.014942 | 11.73 | 0.044608 | **11.92** | **0.119914** | 12.10 | 0.012307 | 12.28 | 0.009450 |
| 11.57 | 0.017639 | 11.75 | 0.047305 | 11.93 | 0.078414 | 12.12 | 0.012047 | 12.30 | 0.009191 |
| 11.58 | 0.020336 | 11.77 | 0.052004 | 11.95 | 0.073487 | 12.13 | 0.011787 | 12.32 | 0.008931 |



# Hydrograph 25-yr Summary

Project Name:

12-14-2020

Hydrology Studio v 3.0.0.16

| 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 | Pre DEVELOPED | 53.29 | 12.12 | 180,936 | ---- | | |
| 2 | NRCS Runoff | Post DEVELOPED | 100.9 | 11.98 | 235,436 | ---- | | |
| 3 | Pond Route | Post DETENTION BASIN | 29.67 | 12.15 | 214,681 | 2 | 730.37 | 113,784 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

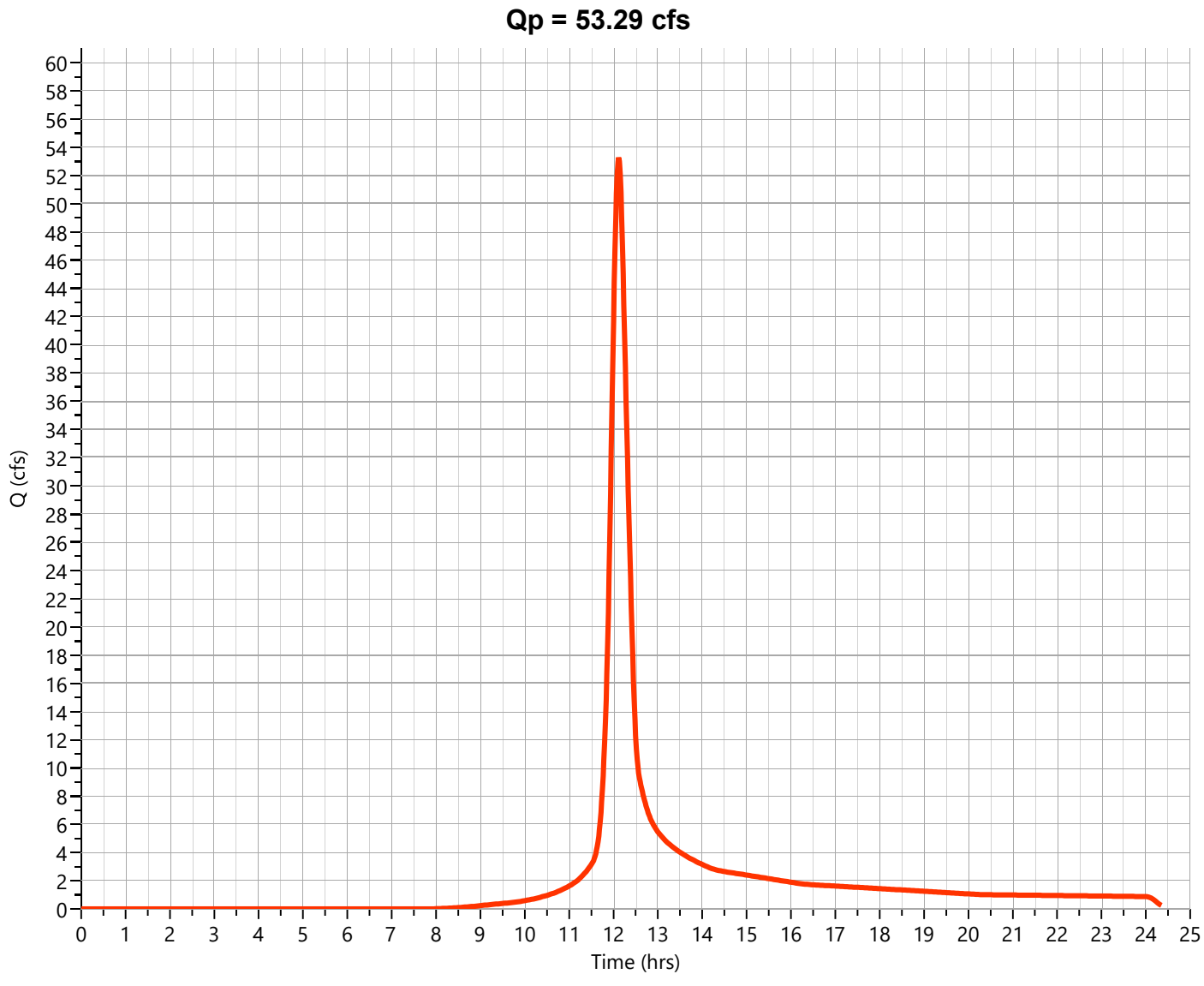
## Pre DEVELOPED

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 53.29 cfs |
| Storm Frequency | = 25-yr | Time to Peak | = 12.12 hrs |
| Time Interval | = 1 min | Runoff Volume | = 180,936 cuft |
| Drainage Area | = 19.76 ac | Curve Number | = 79* |
| Tc Method | = TR55 (See Worksheet) | Time of Conc. (Tc) | = 23.44 min |
| Total Rainfall | = 4.70 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.54 | 98 | IMPERVIOUS |
| 15.2 | 74 | PERVIOUS, CLASS C |
| **19.76** | **79** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

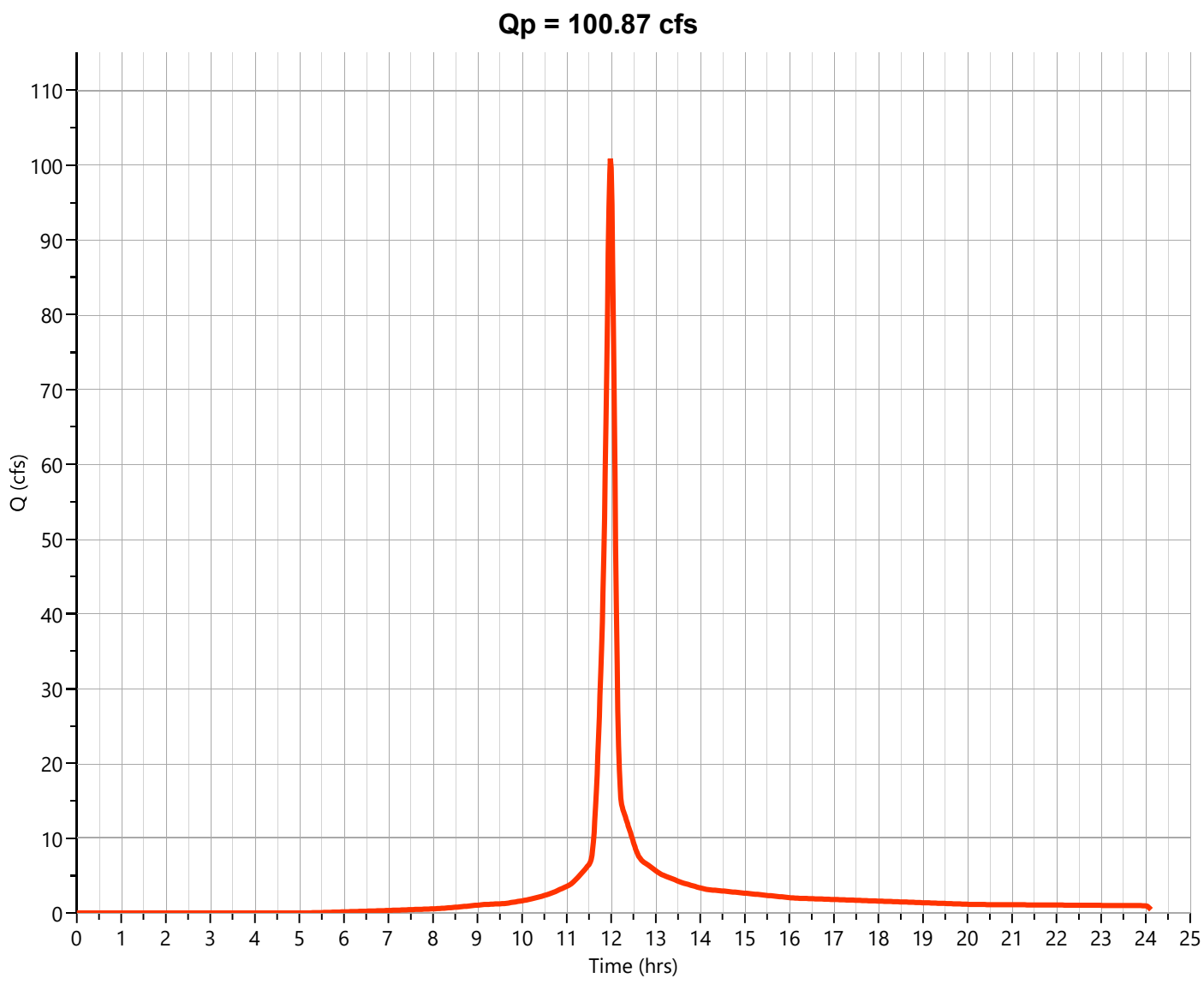
## Post DEVELOPED

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 100.9 cfs |
| Storm Frequency | = 25-yr | Time to Peak | = 11.98 hrs |
| Time Interval | = 1 min | Runoff Volume | = 235,436 cuft |
| Drainage Area | = 19.74 ac | Curve Number | = 87* |
| Tc Method | = User | Time of Conc. (Tc) | = 10.0 min |
| Total Rainfall | = 4.70 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 6.83 | 98 | IMPERVIOUS |
| 4.97 | 94 | BUILDABLE DEVELOPMENT |
| 7.94 | 74 | PERVIOUS, CLASS C |
| **19.74** | **87** | Weighted CN Method Employed |



# Hydrograph Report

Hydrology Studio v 3.0.0.16

12-14-2020

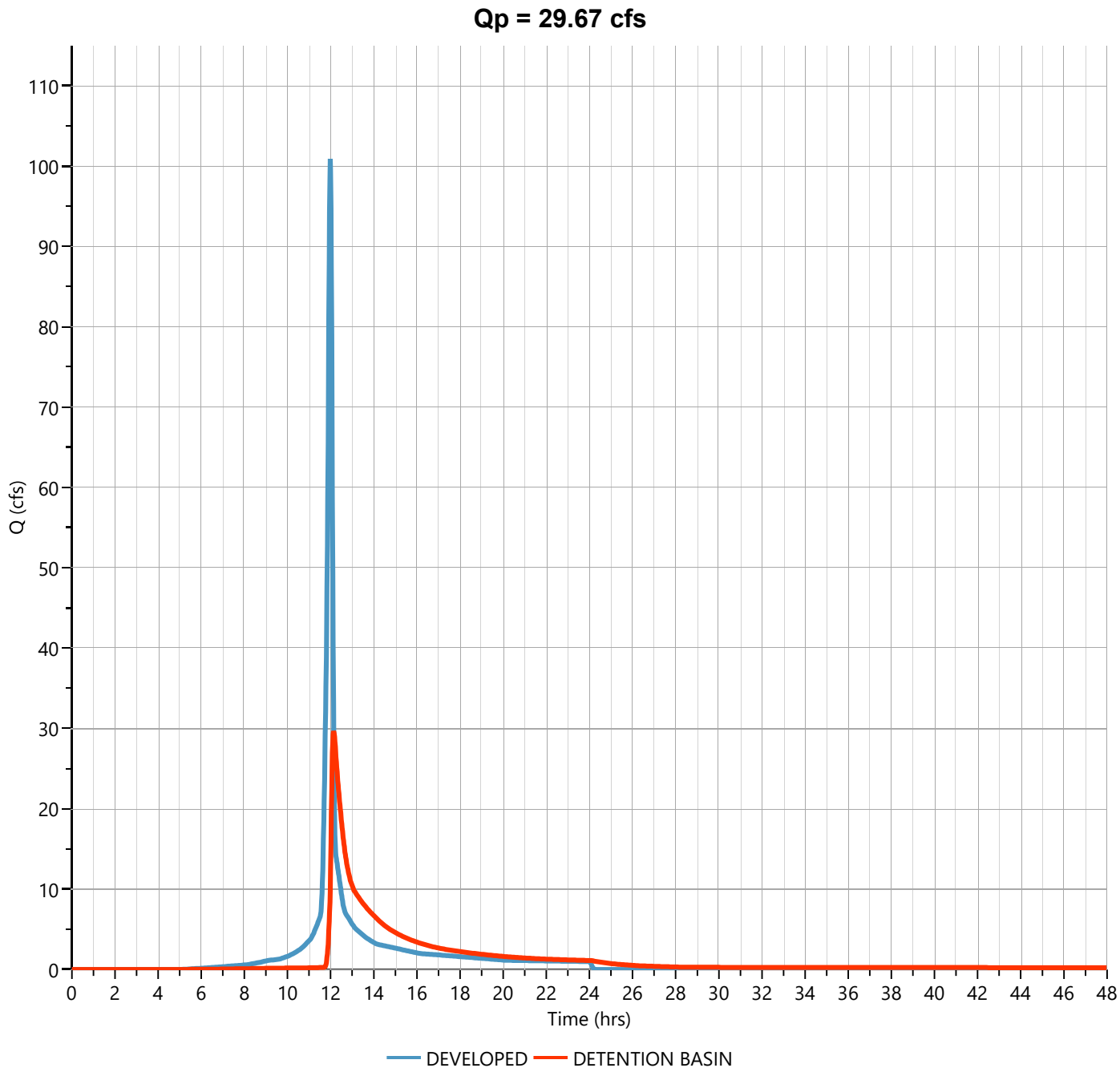
## Post DETENTION BASIN

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 29.67 cfs |
| Storm Frequency | = 25-yr | Time to Peak | = 12.15 hrs |
| Time Interval | = 1 min | Hydrograph Volume | = 214,681 cuft |
| Inflow Hydrograph | = 2 - DEVELOPED | Max. Elevation | = 730.37 ft |
| Pond Name | = DETENTION BASIN | Max. Storage | = 113,784 cuft |

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 2.11 hrs*



# Design Storm Report

Custom Storm filename:

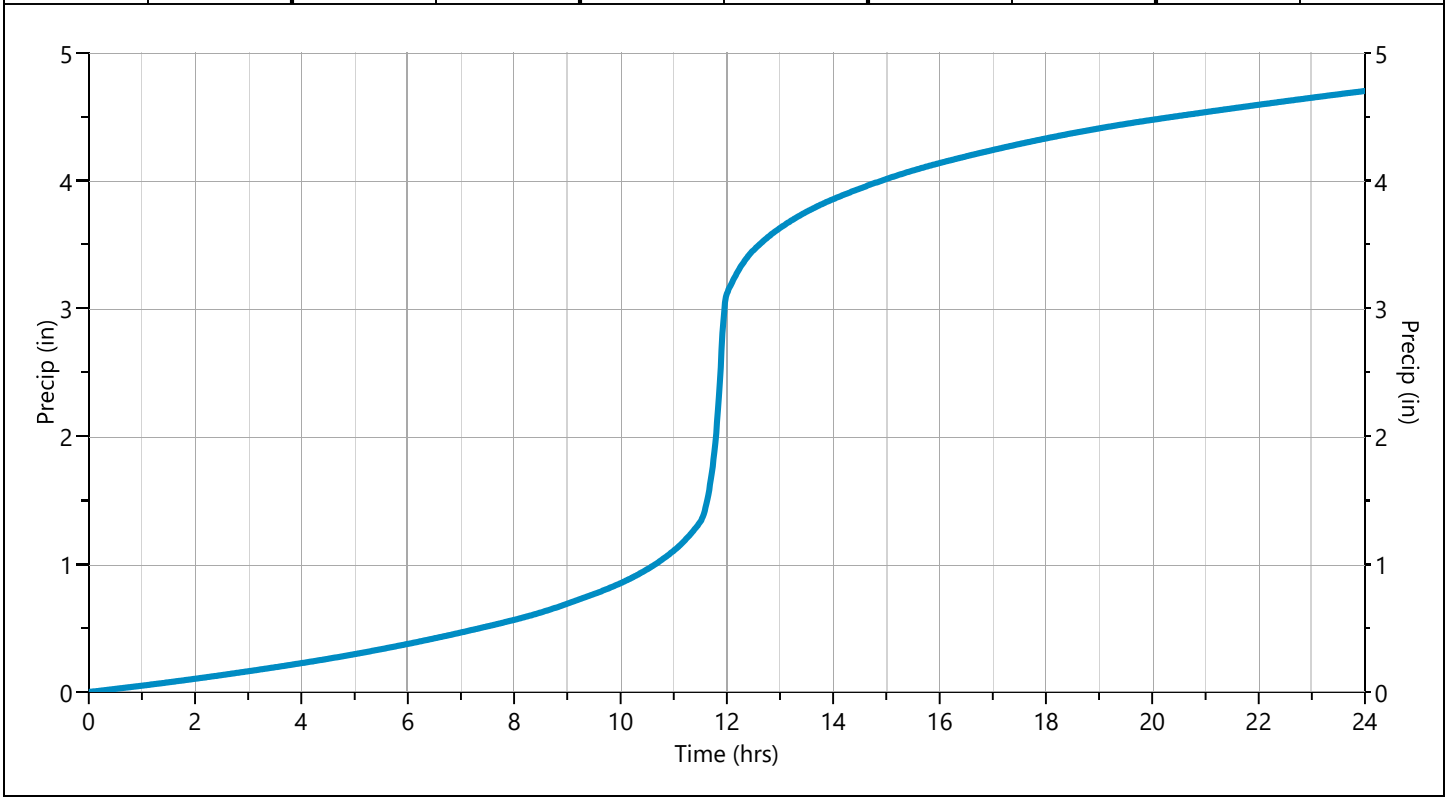
Hydrology Studio v 3.0.0.16

12-14-2020

## Storm Distribution: NRCS/SCS - Type II

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | ✔ 25-yr | 50-yr | 100-yr | |
| 24 hrs | 2.50 | 2.90 | 0.00 | 3.60 | 4.10 | 4.70 | 5.20 | 5.60 | |

| 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) |
| 11.42 | 0.008711 | 11.60 | 0.026404 | 11.78 | 0.068669 | 11.97 | 0.064670 | 12.15 | 0.013215 |
| 11.43 | 0.008836 | 11.62 | 0.029495 | 11.80 | 0.077268 | 11.98 | 0.045100 | 12.17 | 0.012917 |
| 11.45 | 0.008961 | 11.63 | 0.032587 | 11.82 | 0.085867 | 12.00 | 0.025530 | 12.18 | 0.012620 |
| 11.47 | 0.009087 | 11.65 | 0.035678 | 11.83 | 0.094467 | 12.02 | 0.016122 | 12.20 | 0.012322 |
| 11.48 | 0.009212 | 11.67 | 0.038770 | 11.85 | 0.103066 | 12.03 | 0.015298 | 12.22 | 0.012024 |
| 11.50 | 0.009337 | 11.68 | 0.041861 | 11.87 | 0.111665 | 12.05 | 0.015001 | 12.23 | 0.011727 |
| 11.52 | 0.010981 | 11.70 | 0.044953 | 11.88 | 0.120264 | 12.07 | 0.014703 | 12.25 | 0.011429 |
| 11.53 | 0.014037 | 11.72 | 0.048045 | 11.90 | 0.128864 | 12.08 | 0.014405 | 12.27 | 0.011131 |
| 11.55 | 0.017129 | 11.73 | 0.051136 | **11.92** | **0.137463** | 12.10 | 0.014108 | 12.28 | 0.010834 |
| 11.57 | 0.020221 | 11.75 | 0.054228 | 11.93 | 0.089889 | 12.12 | 0.013810 | 12.30 | 0.010536 |
| 11.58 | 0.023312 | 11.77 | 0.059615 | 11.95 | 0.084241 | 12.13 | 0.013513 | 12.32 | 0.010238 |



# Hydrograph 50-yr Summary

Project Name:

12-14-2020

Hydrology Studio v 3.0.0.16

| 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 | Pre DEVELOPED | 62.30 | 12.12 | 211,458 | ---- | | |
| 2 | NRCS Runoff | Post DEVELOPED | 114.5 | 11.98 | 269,142 | ---- | | |
| 3 | Pond Route | Post DETENTION BASIN | 38.90 | 12.13 | 248,226 | 2 | 730.76 | 126,496 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

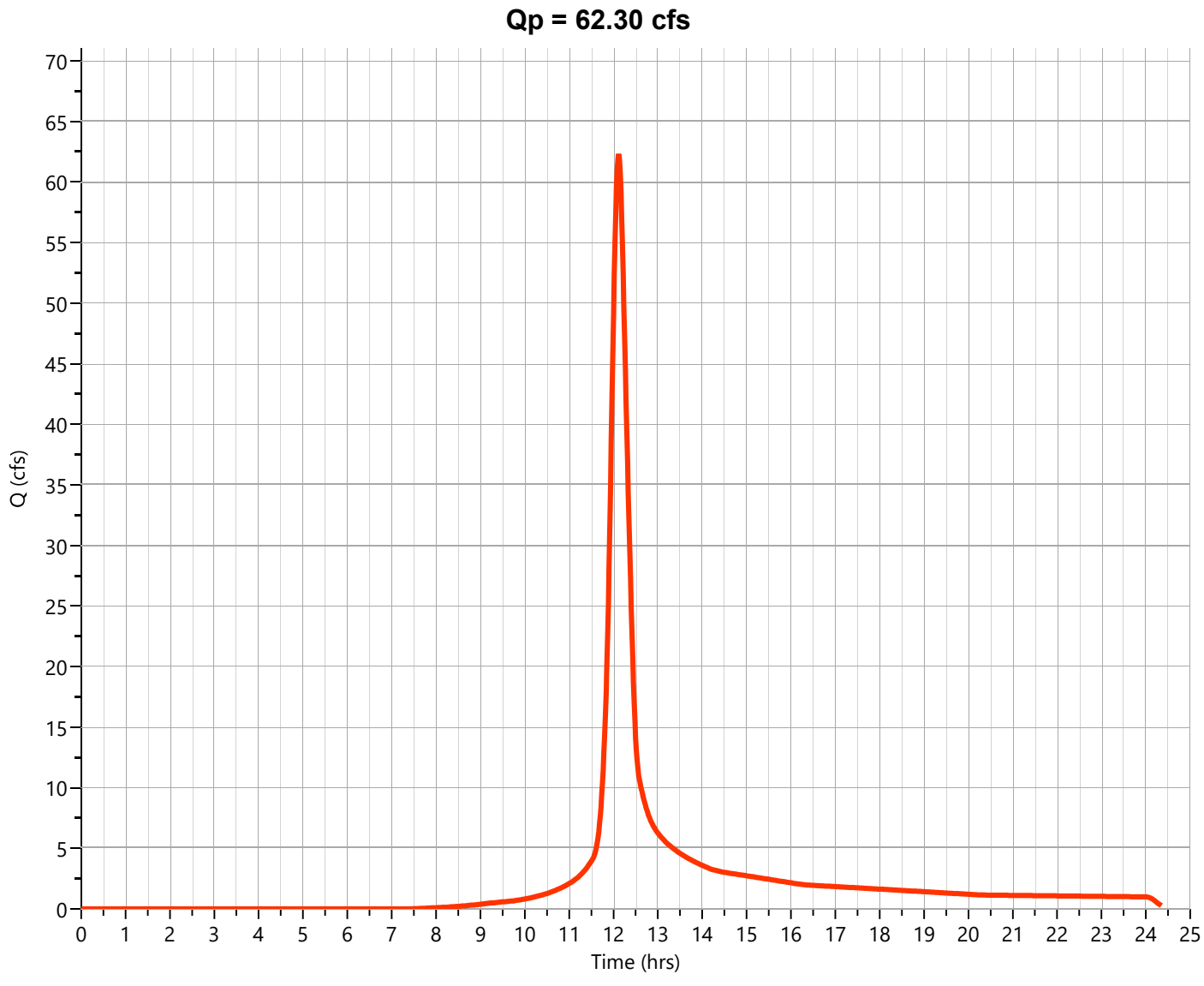
## Pre DEVELOPED

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 62.30 cfs |
| Storm Frequency | = 50-yr | Time to Peak | = 12.12 hrs |
| Time Interval | = 1 min | Runoff Volume | = 211,458 cuft |
| Drainage Area | = 19.76 ac | Curve Number | = 79* |
| Tc Method | = TR55 (See Worksheet) | Time of Conc. (Tc) | = 23.44 min |
| Total Rainfall | = 5.20 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.54 | 98 | IMPERVIOUS |
| 15.2 | 74 | PERVIOUS, CLASS C |
| **19.76** | **79** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

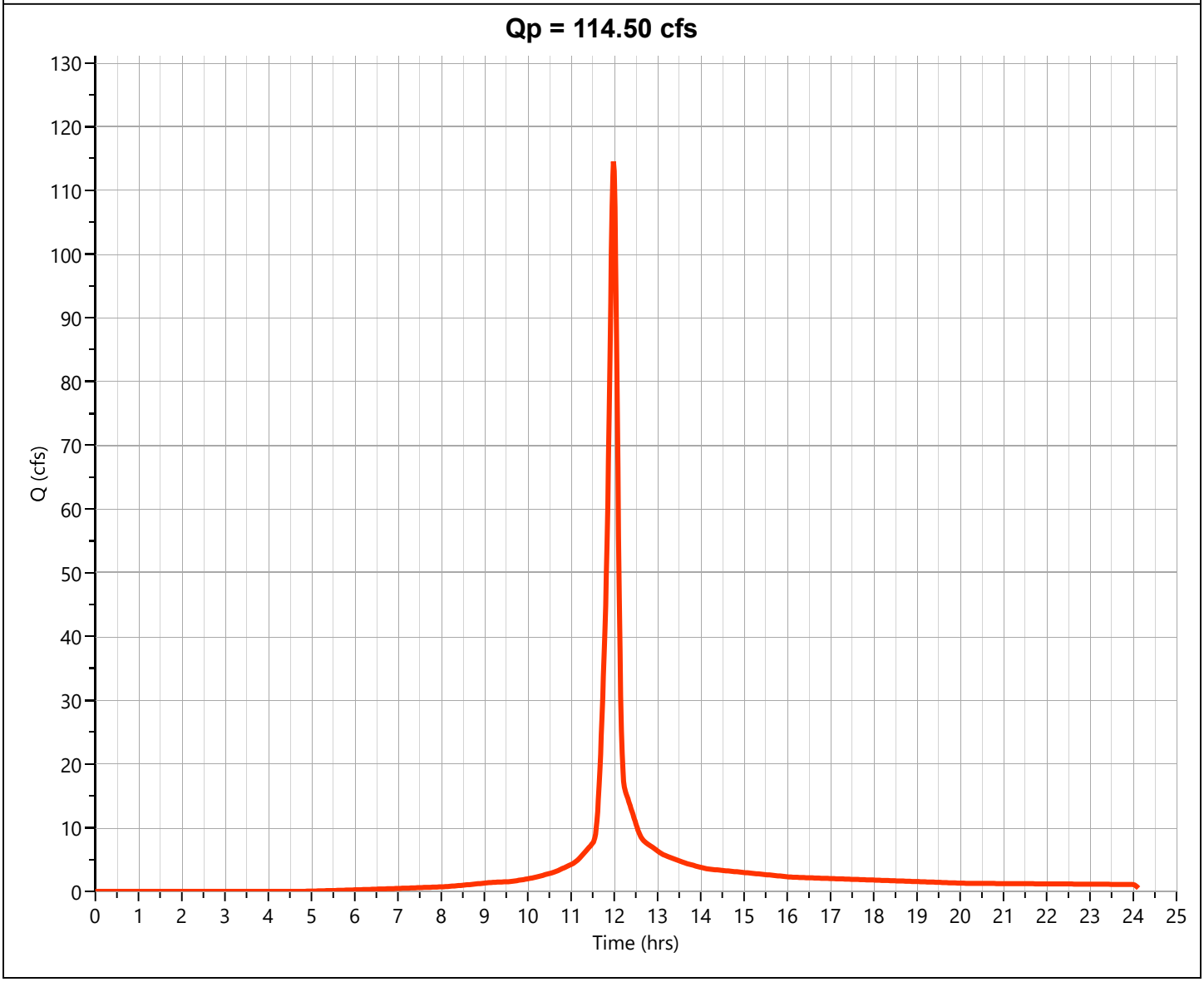
## Post DEVELOPED

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 114.5 cfs |
| Storm Frequency | = 50-yr | Time to Peak | = 11.98 hrs |
| Time Interval | = 1 min | Runoff Volume | = 269,142 cuft |
| Drainage Area | = 19.74 ac | Curve Number | = 87* |
| Tc Method | = User | Time of Conc. (Tc) | = 10.0 min |
| Total Rainfall | = 5.20 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 6.83 | 98 | IMPERVIOUS |
| 4.97 | 94 | BUILDABLE DEVELOPMENT |
| 7.94 | 74 | PERVIOUS, CLASS C |
| **19.74** | **87** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

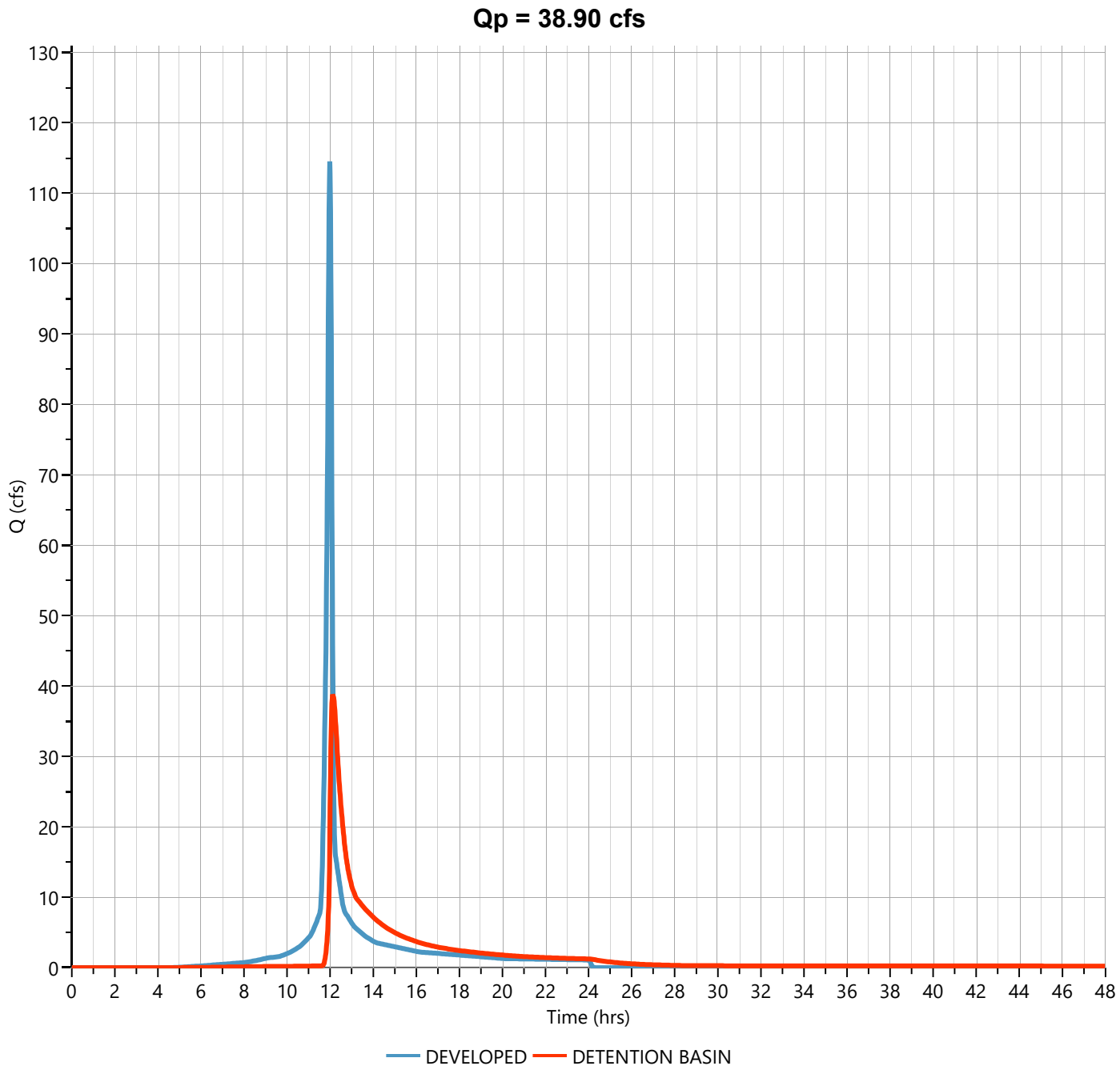
## Post DETENTION BASIN

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 38.90 cfs |
| Storm Frequency | = 50-yr | Time to Peak | = 12.13 hrs |
| Time Interval | = 1 min | Hydrograph Volume | = 248,226 cuft |
| Inflow Hydrograph | = 2 - DEVELOPED | Max. Elevation | = 730.76 ft |
| Pond Name | = DETENTION BASIN | Max. Storage | = 126,496 cuft |

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 1.96 hrs*



# Design Storm Report

Custom Storm filename:

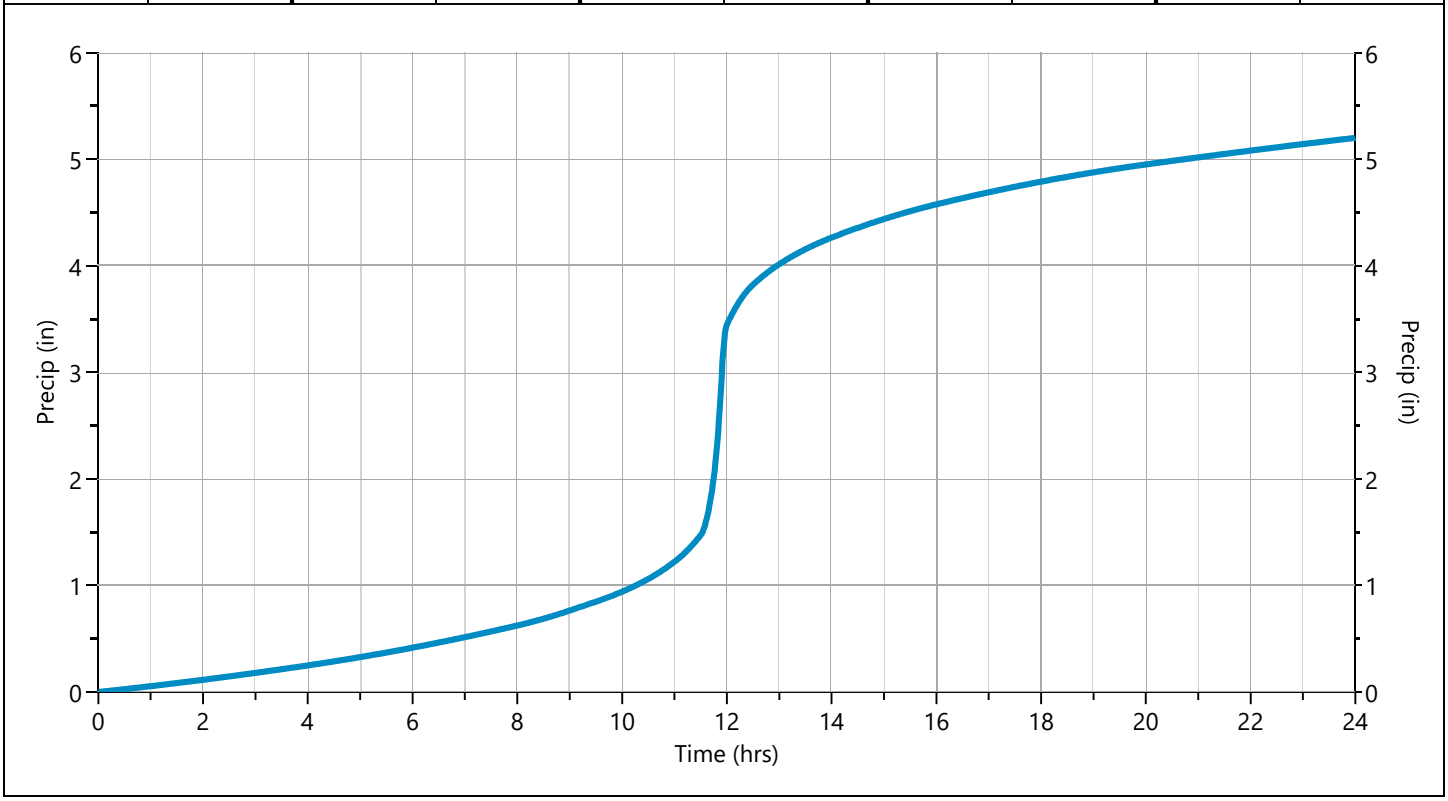
Hydrology Studio v 3.0.0.16

12-14-2020

## Storm Distribution: NRCS/SCS - Type II

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | ✔ 50-yr | 100-yr | |
| 24 hrs | 2.50 | 2.90 | 0.00 | 3.60 | 4.10 | 4.70 | 5.20 | 5.60 | |

| Incremental Rainfall Distribution, 50-yr | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) |
| 11.42 | 0.009637 | 11.60 | 0.029212 | 11.78 | 0.075974 | 11.97 | 0.071550 | 12.15 | 0.014621 |
| 11.43 | 0.009776 | 11.62 | 0.032633 | 11.80 | 0.085488 | 11.98 | 0.049898 | 12.17 | 0.014291 |
| 11.45 | 0.009915 | 11.63 | 0.036053 | 11.82 | 0.095002 | 12.00 | 0.028246 | 12.18 | 0.013962 |
| 11.47 | 0.010053 | 11.65 | 0.039474 | 11.83 | 0.104516 | 12.02 | 0.017837 | 12.20 | 0.013633 |
| 11.48 | 0.010192 | 11.67 | 0.042894 | 11.85 | 0.114030 | 12.03 | 0.016926 | 12.22 | 0.013304 |
| 11.50 | 0.010331 | 11.68 | 0.046315 | 11.87 | 0.123545 | 12.05 | 0.016597 | 12.23 | 0.012974 |
| 11.52 | 0.012149 | 11.70 | 0.049735 | 11.88 | 0.133058 | 12.07 | 0.016267 | 12.25 | 0.012645 |
| 11.53 | 0.015531 | 11.72 | 0.053156 | 11.90 | 0.142572 | 12.08 | 0.015938 | 12.27 | 0.012315 |
| 11.55 | 0.018951 | 11.73 | 0.056576 | **11.92** | **0.152087** | 12.10 | 0.015609 | 12.28 | 0.011986 |
| 11.57 | 0.022372 | 11.75 | 0.059996 | 11.93 | 0.099452 | 12.12 | 0.015279 | 12.30 | 0.011657 |
| 11.58 | 0.025792 | 11.77 | 0.065957 | 11.95 | 0.093202 | 12.13 | 0.014950 | 12.32 | 0.011327 |



# Hydrograph 100-yr Summary

Project Name:

12-14-2020

Hydrology Studio v 3.0.0.16

| 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 | Pre DEVELOPED | 69.59 | 12.12 | 236,344 | ---- | | |
| 2 | NRCS Runoff | Post DEVELOPED | 125.4 | 11.98 | 296,332 | ---- | | |
| 3 | Pond Route | Post DETENTION BASIN | 44.10 | 12.13 | 275,301 | 2 | 731.08 | 137,074 |

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

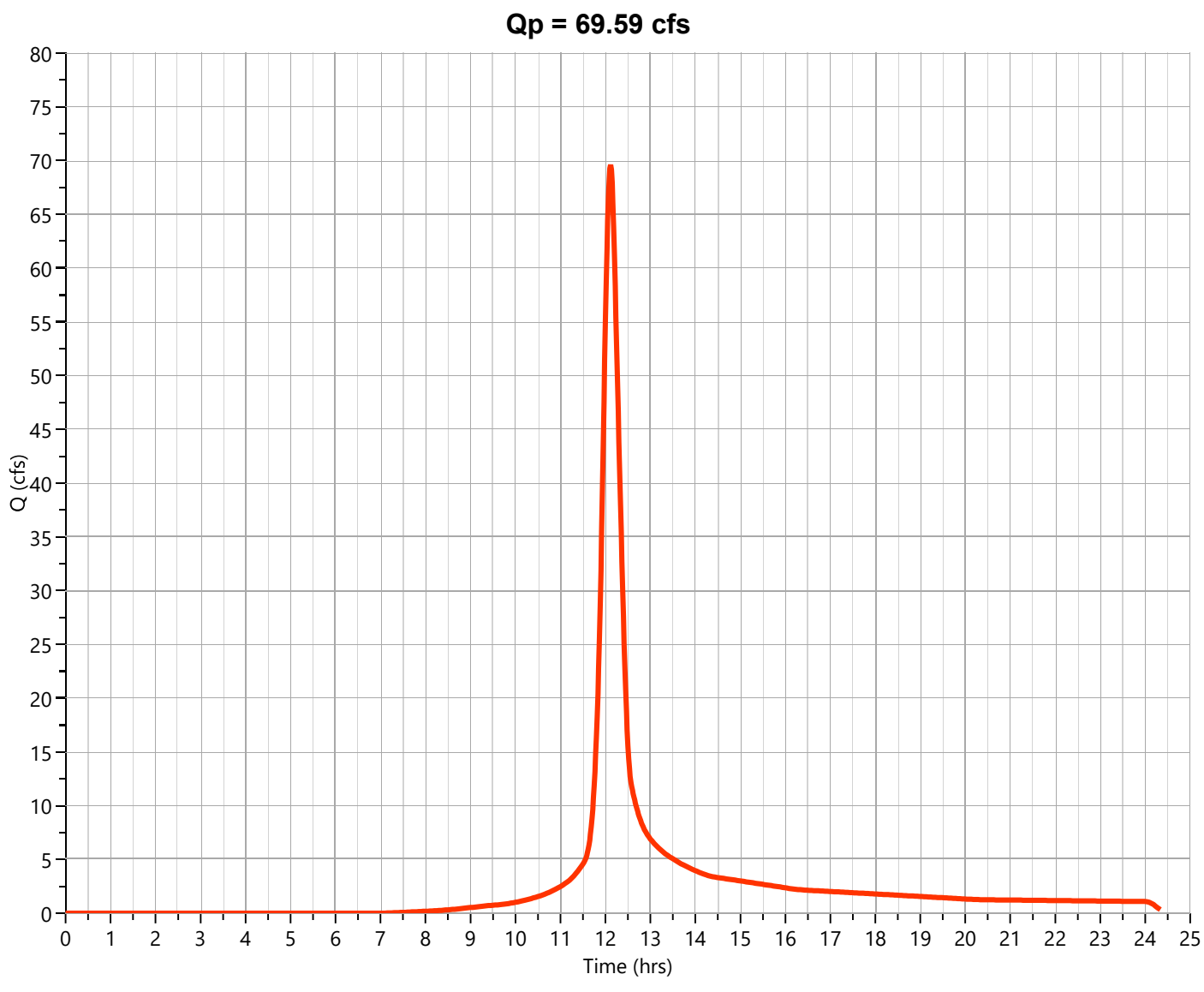
## Pre DEVELOPED

## Hyd. No. 1

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 69.59 cfs |
| Storm Frequency | = 100-yr | Time to Peak | = 12.12 hrs |
| Time Interval | = 1 min | Runoff Volume | = 236,344 cuft |
| Drainage Area | = 19.76 ac | Curve Number | = 79* |
| Tc Method | = TR55 (See Worksheet) | Time of Conc. (Tc) | = 23.44 min |
| Total Rainfall | = 5.60 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 4.54 | 98 | IMPERVIOUS |
| 15.2 | 74 | PERVIOUS, CLASS C |
| **19.76** | **79** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

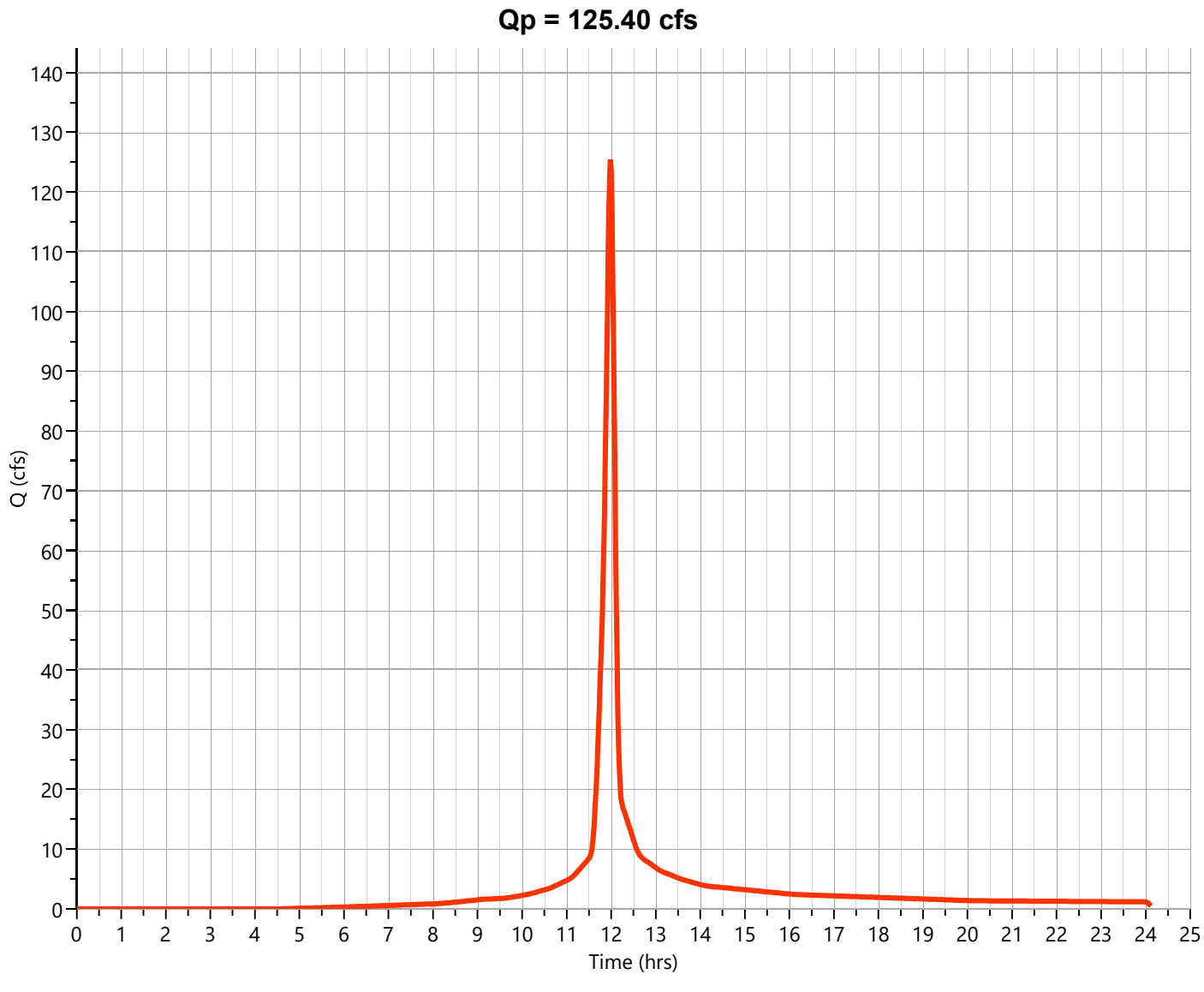
## Post DEVELOPED

## Hyd. No. 2

| | | | |
|---|---|---|---|
| Hydrograph Type | = NRCS Runoff | Peak Flow | = 125.4 cfs |
| Storm Frequency | = 100-yr | Time to Peak | = 11.98 hrs |
| Time Interval | = 1 min | Runoff Volume | = 296,332 cuft |
| Drainage Area | = 19.74 ac | Curve Number | = 87* |
| Tc Method | = User | Time of Conc. (Tc) | = 10.0 min |
| Total Rainfall | = 5.60 in | Design Storm | = Type II |
| Storm Duration | = 24 hrs | Shape Factor | = 484 |

*** Composite CN Worksheet**

| AREA (ac) | CN | DESCRIPTION |
|---|---|---|
| 6.83 | 98 | IMPERVIOUS |
| 4.97 | 94 | BUILDABLE DEVELOPMENT |
| 7.94 | 74 | PERVIOUS, CLASS C |
| **19.74** | **87** | Weighted CN Method Employed |



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-14-2020

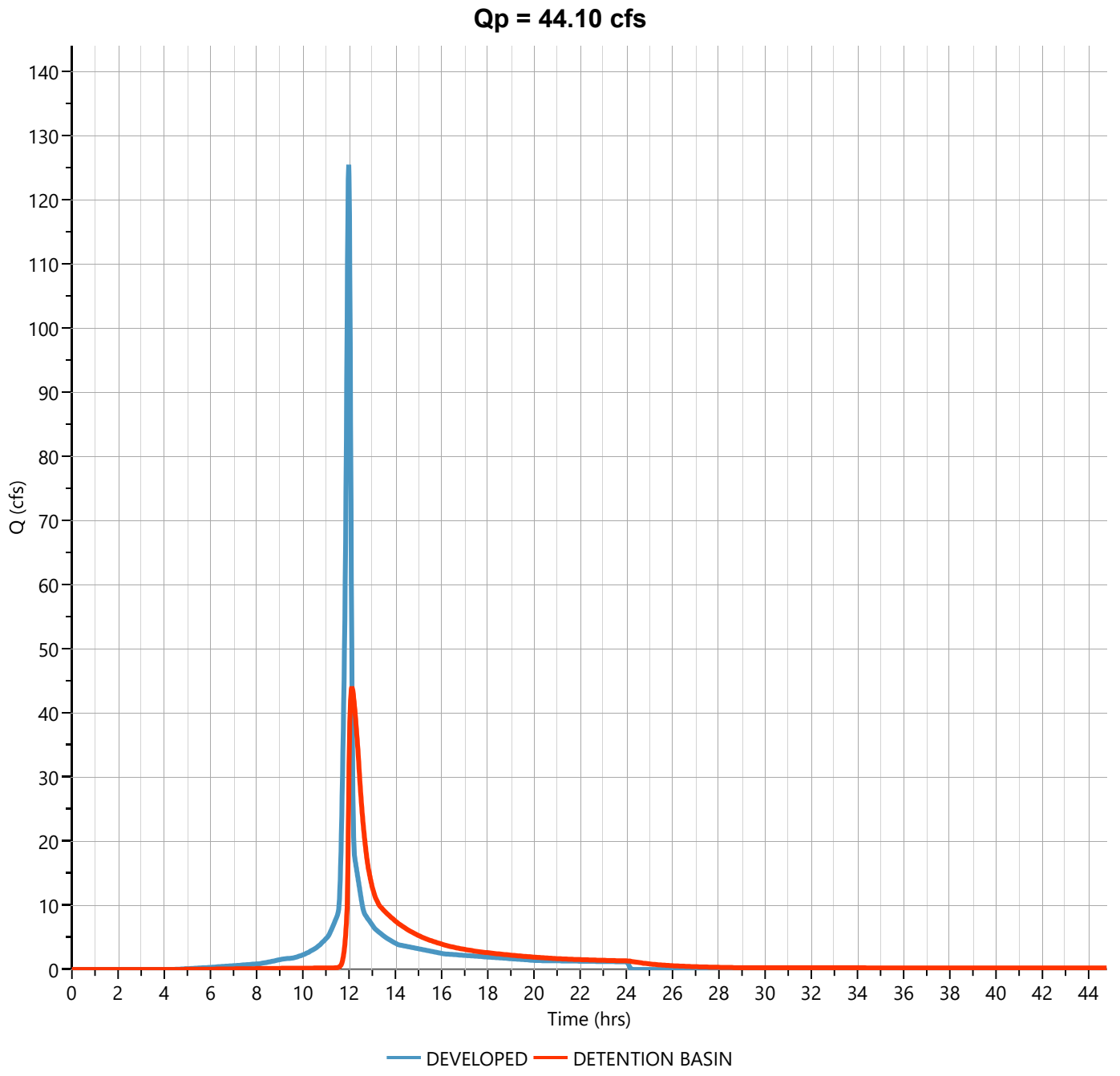
## Post DETENTION BASIN

## Hyd. No. 3

| | | | |
|---|---|---|---|
| Hydrograph Type | = Pond Route | Peak Flow | = 44.10 cfs |
| Storm Frequency | = 100-yr | Time to Peak | = 12.13 hrs |
| Time Interval | = 1 min | Hydrograph Volume | = 275,301 cuft |
| Inflow Hydrograph | = 2 - DEVELOPED | Max. Elevation | = 731.08 ft |
| Pond Name | = DETENTION BASIN | Max. Storage | = 137,074 cuft |

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 1.89 hrs*



# Design Storm Report

Custom Storm filename:

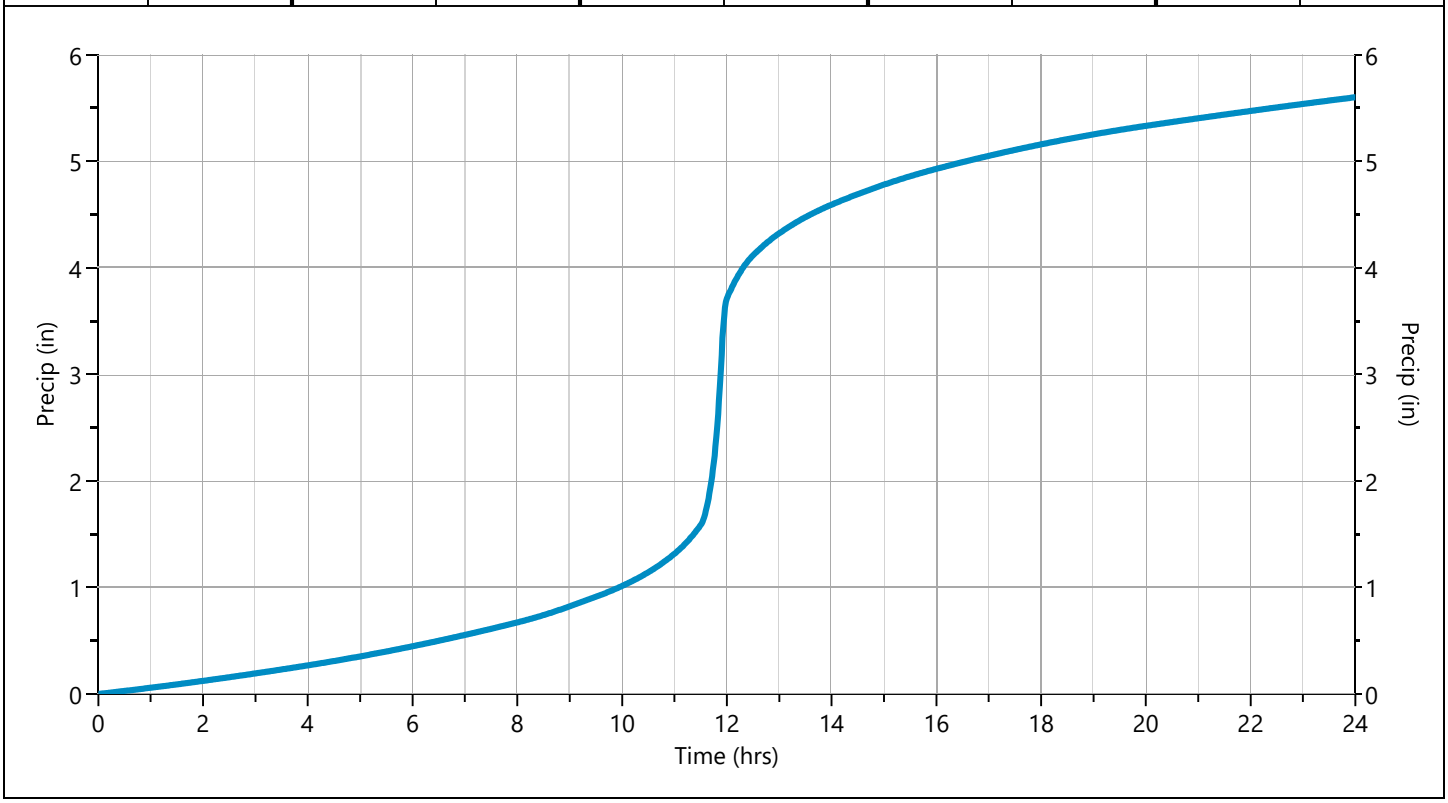
Hydrology Studio v 3.0.0.16

12-14-2020

## Storm Distribution: NRCS/SCS - Type II

| Storm Duration | Total Rainfall Volume (in) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | ✔ 100-yr | |
| 24 hrs | 2.50 | 2.90 | 0.00 | 3.60 | 4.10 | 4.70 | 5.20 | 5.60 | |

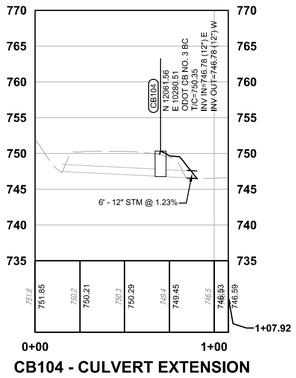
| Incremental Rainfall Distribution, 100-yr | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) | Time (hrs) | Precip (in) |
| 11.42 | 0.010379 | 11.60 | 0.031460 | 11.78 | 0.081818 | 11.97 | 0.077054 | 12.15 | 0.015745 |
| 11.43 | 0.010528 | 11.62 | 0.035143 | 11.80 | 0.092064 | 11.98 | 0.053736 | 12.17 | 0.015391 |
| 11.45 | 0.010677 | 11.63 | 0.038827 | 11.82 | 0.102310 | 12.00 | 0.030419 | 12.18 | 0.015036 |
| 11.47 | 0.010827 | 11.65 | 0.042510 | 11.83 | 0.112556 | 12.02 | 0.019210 | 12.20 | 0.014681 |
| 11.48 | 0.010976 | 11.67 | 0.046194 | 11.85 | 0.122802 | 12.03 | 0.018228 | 12.22 | 0.014327 |
| 11.50 | 0.011125 | 11.68 | 0.049877 | 11.87 | 0.133048 | 12.05 | 0.017873 | 12.23 | 0.013972 |
| 11.52 | 0.013084 | 11.70 | 0.053561 | 11.88 | 0.143294 | 12.07 | 0.017519 | 12.25 | 0.013618 |
| 11.53 | 0.016725 | 11.72 | 0.057245 | 11.90 | 0.153540 | 12.08 | 0.017164 | 12.27 | 0.013263 |
| 11.55 | 0.020409 | 11.73 | 0.060928 | **11.92** | **0.163786** | 12.10 | 0.016809 | 12.28 | 0.012908 |
| 11.57 | 0.024093 | 11.75 | 0.064612 | 11.93 | 0.107101 | 12.12 | 0.016455 | 12.30 | 0.012553 |
| 11.58 | 0.027776 | 11.77 | 0.071030 | 11.95 | 0.100372 | 12.13 | 0.016100 | 12.32 | 0.012199 |



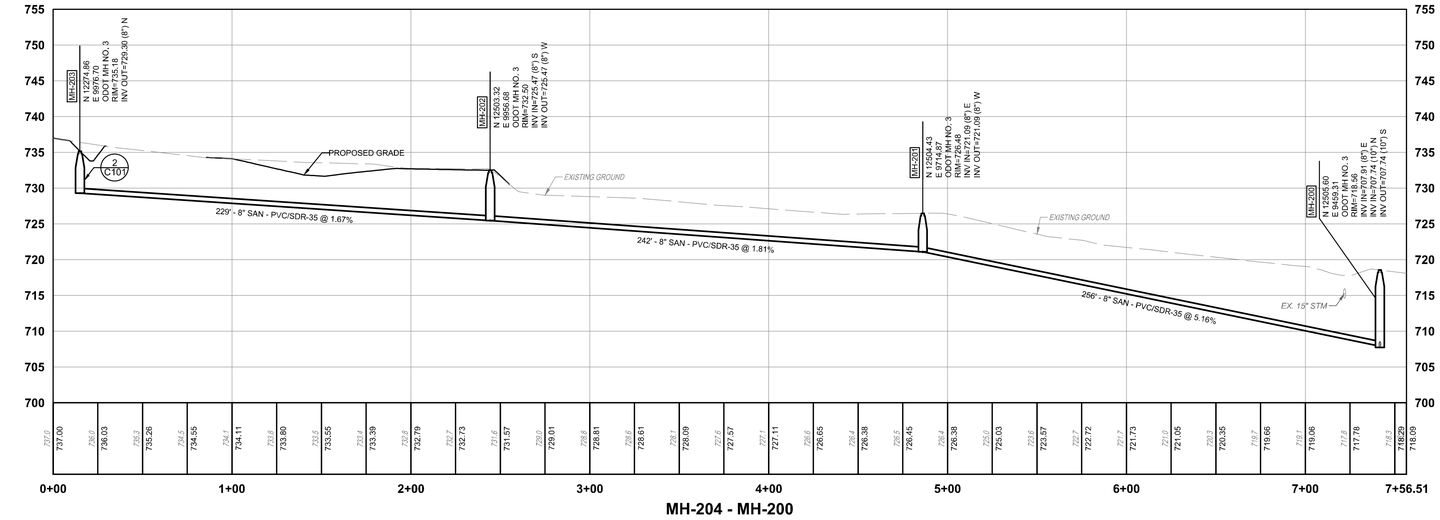
# Appendix E

Outlet Structures

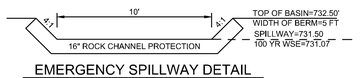
INSPIRED PEOPLE ▲ CREATIVE DESIGN ▲ TRANSFORMING COMMUNITIES



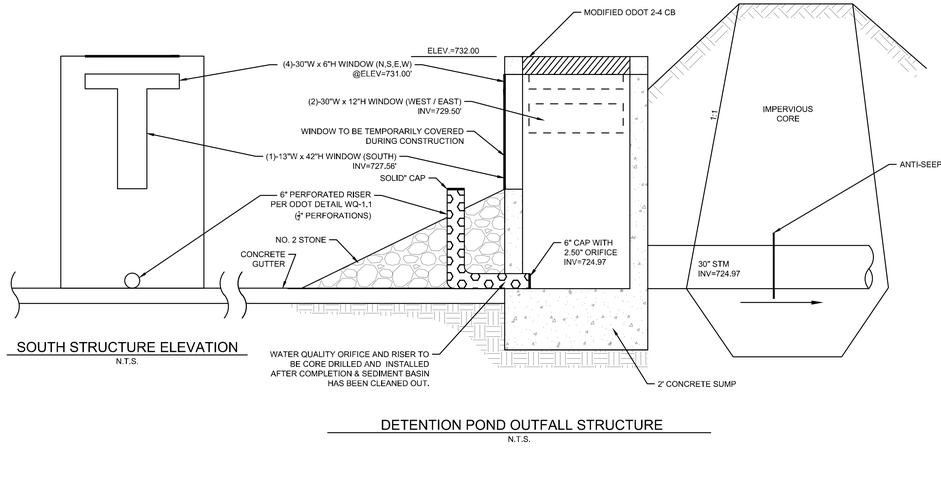

CB104 - CULVERT EXTENSION




MH-204 - MH-200

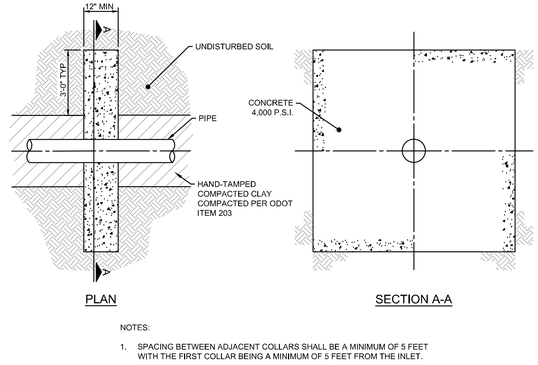



EMERGENCY SPILLWAY DETAIL
N.T.S.




SOUTH STRUCTURE ELEVATION
N.T.S.

DETENTION POND OUTFALL STRUCTURE
N.T.S.



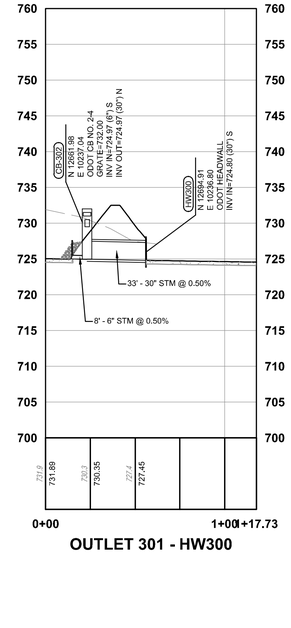

PLAN

SECTION A-A

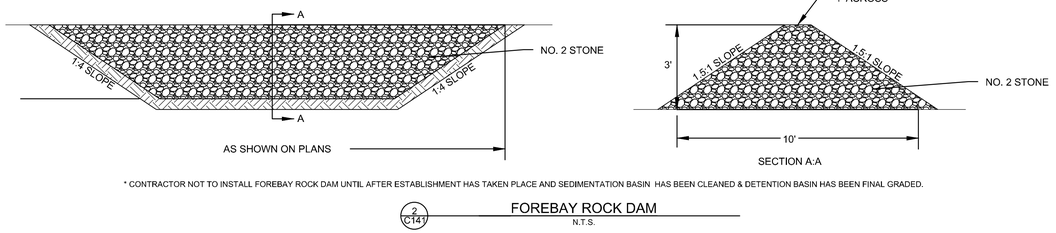
NOTES:

1. SPACING BETWEEN ADJACENT COLLARS SHALL BE A MINIMUM OF 5 FEET WITH THE FIRST COLLAR BEING A MINIMUM OF 5 FEET FROM THE INLET.
2. FURNISH A MINIMUM OF 2 COLLARS PER OUTLET CONDUIT.
3. ALL ANTI-SEEP COLLARS AND THEIR CONNECTIONS SHALL BE WATERTIGHT.

ANTI-SEEP COLLAR DETAIL
N.T.S.




OUTLET 301 - HW300




* CONTRACTOR NOT TO INSTALL FOREBAY ROCK DAM UNTIL AFTER ESTABLISHMENT HAS TAKEN PLACE AND SEDIMENTATION BASIN HAS BEEN CLEANED & DETENTION BASIN HAS BEEN FINAL GRADED.

FOREBAY ROCK DAM
N.T.S.

NORTH DETENTION POND OUTLET STRUCTURE AND EMERGENCY SPILLWAY
1 C141


NOTES:

1. CONCRETE GUTTER. SEE GRADING PLAN FOR MORE DETAIL

CONCRETE GUTTER SECTION DETAIL
3 C141
N.T.S.

*NOTE:*
*UNDERGROUND UTILITIES ARE PLOTTED FROM A COMPILATION OF AVAILABLE RECORD INFORMATION, GIS AND SURFACE INDICATIONS OF UNDERGROUND STRUCTURES AND MAY NOT BE INCLUSIVE. PRECISE LOCATIONS AND THE EXISTENCE OR NON EXISTENCE OF UNDERGROUND UTILITIES CANNOT BE VERIFIED. PLEASE NOTIFY THE KENTUCKY UTILITY PROTECTION SERVICE AT 1-800-752-6007 BEFORE ANY PERIOD OF EXCAVATION OR CONSTRUCTION ACTIVITY.*

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SEAL:

STATE OF OHIO
STEVEN R. KORTE
E-61033
REGISTERED PROFESSIONAL ENGINEER

| NO. | DATE | DESCRIPTION |
|---|---|---|
| 1 | 12/21/20 | CONSTRUCTION DOCUMENTS |

**BRIDGEWATER CHURCH**
**SUBDIVISION**
**FAIRFIELD TOWNSHIP**
**BUTLER COUNTY, OHIO**

PROJECT NO: **180075.000**
DATE: **12/18/2020**
SCALE: V 0 5 10 20 / H 0 20 40 80

SHEET NAME:
**UTILITY PROFILES & DETAILS**

SHEET NO.
**C141**

h:\2018\180075\DWG\000\Sheets\180075CUTL000.dwg, 12/21/2020 8:49:33 PM, mkramer