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STORMWATER MANAGEMENT REPORT

AMENDED PRELIMINARY & FINAL SITE PLAN

TENNENT ROAD WASH & LUBE, LLC

Block 122, Lot 33

Township of Marlboro, Monmouth County, New Jersey

FEBRUARY 16, 2021

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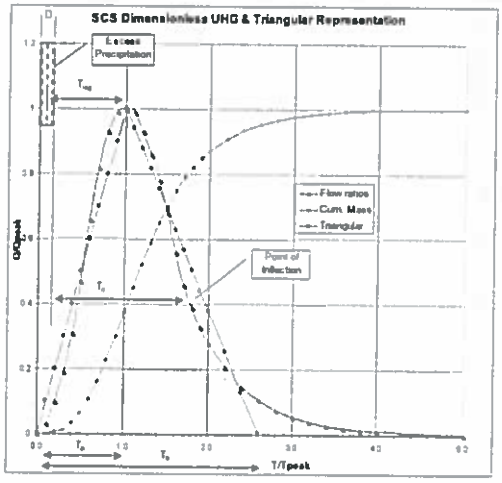
SCOPE & INTENT OF STUDY

The scope of this study is to present a comprehensive analysis of the anticipated hydrologic impacts upon surrounding lands and the environment as a result of the re-development of Block 122, Lot 33, Township of Marlboro, Monmouth County, New Jersey. The intended development consists of a semi- automated exterior car wash and ancillary site improvements where a single-family dwelling formerly existed in the C-2 commercial zone.

The engineering analyses presented have been carried out in accordance with the New Jersey Department of Environmental Protection (NJDEP) Stormwater Best Management Practices (BMP) Manual, as well as design standards of the Township of Marlboro. The hydrologic methodology and parameters utilized herein are based on sound design practice and regulatory guidelines.

The hydrologic study has been performed using the methodology described in *Technical Release 55* (TR-55) by the U.S. Department of Agriculture, Soil Conservation Service, entitled Urban Hydrology for Small Watersheds. Scientific parameters utilized in the calculations performed have been based upon those presented in TR-55, including Runoff Curve Numbers (CN), Time of Concentration (Tc), Manning's Roughness Coefficient (n), Initial Abstraction (Ia), and Unit Hydrograph shape factors.



The basis of the TR-55 methodology is the *Dimensionless Unit Hydrograph*, which is the hydrograph that results from 1-inch of excess precipitation spread uniformly in space and time over a watershed for a given duration.

A Type III storm distribution and hydrograph peaking factor of 484 is utilized pursuant to USDA Natural Resource Conservation Service and NJDEP BMP Manual requirements.

To adequately assess the project impacts, hydrologic analyses were carried out for the site under present, or 'pre-developed' conditions, then again in the 'post-development' scenario considering the improvements to be completed under the intended development. The site was divided into watershed sub-areas which drain to design points established at critical locations where impacts are individually assessed.

At each design point the peak rate and volume of runoff is modelled for the 2-, 10-, and 100-year return frequency 24-hour SCS design storms and a quantitative analysis undertaken to assess impacts.

The magnitude of development for which approval is being sought constitutes a 'Major Development' as it proposes greater than 10,000 square feet of new impervious cover, thus compliance with current & pending stormwater management regulations is required and has been considered in the design process.

The hydrologic computations presented later in this report in support of the conclusions drawn **(Appendix C)** include runoff hydrographs, detention basin routings and CN & Tc calculations. The computations were carried out using application software known as **Hydraflow Hydrographs, 2007** by Intellisolve. Detailed software information and limitations may be obtained at *www.intellisolve.com*.

PROJECT OVERVIEW

The intended development for which approval is sought includes a semi-automated car wash center on a previously developed 0.87 acre parcel, where a single family dwelling formerly existed. The physical improvements being proposed include a one (1) story car wash tunnel, an equipment room, bathroom, and office also included within the principal building, essential underground utilities, landscaping and buffering improvements, a paved parking area including thirteen (13) vacuums stalls, and a stormwater management system.

It is noted that the stormwater management strategy for this project consists of two (2) sand-bottom water-quality basins and one (1) row of twenty-four (24) SC-740 chambers, designed to attenuate the 2-, 10- and 100-year return frequency storm peak flow rates to 50%, 75% and 80% of pre-developed peak flow rates. Any outfall which may occur due to infiltration is not considered in any basin routings to yield conservative results, though a measurable element of recharge is expected to occur based on soil conditions.

The project site is identified as Block 122, Lot 33 of the official Tax Map of Township of Marlboro, Monmouth County, New Jersey and contains a total of 0.87 acres, located in the C-1 Village Commercial District. The development tract is adjacent to existing commercial development, with driveway access to Tennent Road.

The site presently is vacant as a result of the demolition of a former dwelling and contains open fields and limited wooded areas primarily along the lot perimeter where buffer plantings were placed as part of an earlier development. In the hydrologic analysis contained herein the lands were considered to be in 'good' hydrologic condition, consistent with BMP Manual guidelines.

The design strategies employed were intended to meet the intent and specific requirements of the Marlboro Township ordinance and NJDEP Stormwater BMP Manual, as well as sufficiently mitigate the impacts of this development upon surrounding and downstream lands.

The stormwater management basins designed for this project have been designed to infiltrate the water quality and subsequently alternate higher return frequency storm events. The proper function of the basin is demonstrated by hydrologic modelling and series routing calculations. Monitoring wells were established in the field in 2010 and have been periodically monitored to gauge an accurate reading of seasonal high groundwater levels, to ensure proper basin function and adequate separation to groundwater. Additional Soil borings in accordance with prevailing stormwater management regulations were also performed in July 2020 and seasonal high ground water depths encountered are shown on the plans.

PRE-DEVELOPED SITE CONDITIONS

The area studied consists of 0.874 acres of land area and is situated near the intersection of New Jersey State Highway 79 and Tennent Road, surrounded by developed commercial properties. The parcel was formerly developed as a single family residential use, with customary site amenities and maintained lawn areas. The residential structure was recently demolished in favor of commercial development and no credit for any former impervious surfaces has been considered in the analysis.

SOILS INFORMATION

The site is underlain by soils of the *Keyport and Klej* series as indicated on the USDA Soil Survey of Monmouth County, accompanying this report in **Appendix A**. The Keyport soils are described as moderately well drained soils, formed in acid, clayey coastal plain sediments, with depths to groundwater noted to range from 1.5 feet to 4 feet.

Klej soils are described as moderately well drained soils with depths to groundwater described to range from 1.5 feet to 2 feet, however actual soils investigations conducted on site indicate a significantly greater depth to groundwater. The klej soils are noted to be limited on-site along the property frontage at Tennent Road.

Site soils were further investigated by advancing soil borings and the placement of monitoring wells to record fluctuating ground water levels. The soils were sampled and subjected to tube permeameter testing to identify actual permeability rates. Actual permeability rates were recorded ranging from 6.1 inches per hour (K-4) to 24.3 inches per hour (K-5). Detailed soil logs and permeameter test results are also included in **Appendix A** of this report.

Subjacents soils were investigated again on July 1, 2020 in accordance with the NJDEP stormwater BMP manual to ensure accuracy of infiltration system design. The investigation consisted of six (6) soil profile pits and permeameter testing at each of the six locations as per NJDEP soil testing requirements. These findings are included in **Appendix A** of this report and were also used in the Groundwater recharge and mounding calculations as discussed below.

TOPOGRAPHY

The topography of the site is gently to moderately sloping at gradients typically in the 0-10 percent range. The existing configuration of the site includes a ridge line through the parcel in a north-south direction. Existing runoff patterns consist of overland flows tributary to off-site storm sewers and subsequent piped stormwater flow to an existing stormwater outfall situated on adjacent Lot 31 in Block 126. The Pre-Developed Drainage Area Map included in the plan set details the drainage area, and time of concentration path(s) considered.

There are no freshwater wetlands as verified by NJDEP, therefore no environmentally constrained lands exist on site.

For the purposes of hydrologic computations, a hydrologic soil group 'D' was utilized consistent with the soil type underlying the site, despite actual soils testing which indicates substantially more permeable soils. Time of concentrations were computed based on maximum sheet flow lengths of 150 feet in the presence of slopes in the 0-4 percent magnitude.

The hydrographs derived for each sub-area are based upon separating pervious and impervious elements of the watershed and algebraically combining the results to yield an overall hydrograph. This exercise was carried out utilizing the 24-hour rainfall amounts prescribed by the National Oceanic & Atmosphere Administration for this particular location which result from the 2-, 10- and 100-year return frequency storm events. NOAA Rainfall data is included herewith in **Appendix B**.

The intensity-duration-frequency (IDF) curve utilized in the computation is the Trenton, New Jersey curve, consistent with BMP Manual guidelines. The resultant hydrographs are contained herein, a summary of which is tabulated below.

Peak Rate Summary			
Hydrograph	2 year	10 year	100 year
Pre-Development	0.950 cfs	2.043 cfs	4.424 cfs
Attenuated	0.302 cfs	0.518 cfs	2.331 cfs

Hydrograph Volume Summary			
Hydrograph	2 year	10 year	100 year
Pre-Development	4,240 cf	8,858 cf	19,196 cf
Post-Development	4,414 cf	9,606 cf	20,695 cf

STORMWATER MANAGEMENT STRATEGY

The post-development drainage area map depicts the site being analyzed at the off-site storm sewer discharge point where all site runoff converges. The design point chosen is the same as in the pre-development conditions to facilitate an accurate assessment of impacts.

Each drainage area was analyzed using TR-55 methodology, with pervious and impervious areas modeled separately and algebraically combined. In similar fashion to the pre-development analysis, storm distributions utilized were Type III, with a shape factor of 484. Rainfall amounts utilized were 24 hour NOAA rainfall amounts. The IDF curves utilized are Trenton, New Jersey.

The requisite post-development peak rate reductions in runoff are achieved for the on-site areas being developed through the use of two (2) basins, which provide the requisite 80% TSS removal and bottom infiltration alternate peak flows through a series of discharge weir & orifice structures. For the purposes of hydrologic and routing computations no outflow attributable to infiltration was considered to yield a conservative design.

Additional storage volume is achieved through the use of a series of infiltrator chambers, where velocities are slowed, infiltration is promoted, and peak rate reductions are met. Please note that no outflow due to infiltration is considered to meet peak rate reductions.

The resultant hydrographs are included in the runoff computations contained herein, a summary of which is tabulated below.

Peak Rate Reduction Summary			
Hydrograph	2 year	10 year	100 year
Pre-Development	0.950 cfs	2.043 cfs	4.424 cfs
Peak Rate Reduction Requirements	(50%) or 0.475 cfs	(75%) or 1.532 cfs	(80%) or 3.539 cfs
Post-Development	0.302 cfs	0.518 cfs	2.331 cfs
In Compliance (Y/N)	YES	YES	YES

Given the nature of the intended use as a car wash, special design considerations were focused on ensuring water quality treatment for all runoff. The particular concern is the potential for higher than normal pollutant loading of runoff from detergents and surfactants, A cartridge type inlet filter was designed at the outlet point of the car wash tunnel to capture process-related pollutants. All stormwater then subsequently achieves 80% TS removal through infiltration BMP's associated with the intended use. The design data for a catch basin filter is contained in **Appendix H** and has been included in our design as a best management practice.

The special design considerations undertaken to mitigate the potential for pollutant loads include the following:

a. The car wash exit was designed to be grade-separated and direct runoff to the tunnel entrance, where it will be routed directly into the inlet that will filter out hydrocarbons and phosphates. This device will act as pre-treatment before being routed to the sand-bottom infiltration BMP.

b. The catch basin filter selected for this site is specifically intended to reduce pollutants through the use of media-filled filter cartridges. The "Stormexx Clean Catch Basin Filter' by Filtréxx has performance testing results indicating the following removal amounts for the below pollutants of concern:

Total Oil/Grease	99%
Total Suspended Solids	90%
Total Phosphorus	59%
Total Copper	75%
Total Zinc	58%
Ammonium-N	41%
TKN	22%

c. The use of porous pavement was specifically not included in this project given the potential for higher than normal non-point source pollutants associated with a carwash use.

SOIL EROSION & SEDIMENT CONTROL

The site was designed in conformance with Soil Erosion and Sediment Control Standards in the State of New Jersey. In addition to the requisite construction standards, point discharge and downstream stability was demonstrated through the requisite analyses.

Conduit outlets were designed with rip-rap scour holes to provide the requisite conduit outlet protection. The sizing computations for same are included in **Appendix E**.

Downstream stability was proven through the reduction in post-development peak runoff rates for the 2- 10- and 100- year return frequency storm events.

GROUNDWATER RECHARGE AND MOUNDING

As per NJDEP requirements, 100% of pre-development groundwater recharge must be maintained and calculations must be shown in the corresponding NJDEP spreadsheet. The completed NJDEP Groundwater Recharge spreadsheet is included in **Appendix F**. The soils information of Klej and Keyport as described above previously were used in calculation the pre- and post-development conditions. Based on these findings, a groundwater recharge deficit of 12,646 cubic feet annually was found. With the use of the sand-bottom infiltration basins, the post-deficit (recharge) volume is achieved.

The completed NJDEP Groundwater Mounding (Hantush) spreadsheets are included in **Appendix G**. Based on the findings from the Hantush spreadsheet, there is no adverse impact to groundwater due to mounding for Basin No. 1, Basin No. 2, and the drywell system. Adequate groundwater separation is achieved at each infiltration BMP.

SUMMARY & CONCLUSIONS

Based upon the foregoing, it may be concluded that the intended development shall not result in any negative impacts to downstream lands. The project has been designed in accordance with the NJDEP Stormwater Best Management Practices Manual to the highest extent possible to ensure the highest possible water quality of runoff, including the following:

1. The stormwater runoff from this site shall receive enhanced water-quality treatment through the use of infiltration BMP's Certified to 80% TSS removal.

2. Post-Development peak rate reductions are achieved through the use of sand-bottom basins and SC-740 chambers located on-site. Non-structural stormwater collection mean are included in this design to extend time of concentrator and promote Bio-filtration.

3. The overall stormwater management system design has been thoughtfully formulated to promote enhancement of water quality, and is highly protective of the environment.

4. A Post-Construction Long-Term Operations & Maintenance Manual shall be prepared as a condition of Site Plan Approval, and shall detail the necessary maintenance steps, routine and annual inspection/reporting requirements and all other operational standards to ensure proper long-term function of the stormwater system as designed.

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APPENDIX A

Soil Information & Permeability Testing Results

Monmouth County, New Jersey

KemB—Keyport sandy loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 4j83
Elevation: 0 to 200 feet
Mean annual precipitation: 28 to 59 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 161 to 231 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Keyport

Setting

Landform: Flats, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Silty and clayey eolian deposits and/or silty and clayey fluviomarine deposits

Typical profile

Ap - 0 to 12 inches: sandy loam
Bt1 - 12 to 18 inches: clay
Bt2 - 18 to 24 inches: clay
Bt3 - 24 to 32 inches: clay
Bt4 - 32 to 41 inches: clay
Cg1 - 41 to 55 inches: silty clay loam
Cg2 - 55 to 80 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very 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 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Lenni

Percent of map unit: 5 percent
Landform: Flats, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Hydric soil rating: Yes

Elkton

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Sassafras

Percent of map unit: 5 percent
Landform: Low hills, knolls
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Monmouth County, New Jersey
Survey Area Data: Version 13, Sep 16, 2019

Monmouth County, New Jersey

KkgkB—Klej loamy sand, clayey substratum, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 1js1n
Mean annual precipitation: 28 to 59 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 161 to 231 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Klej, Clay Substratum

Setting

Landform: Dunes
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Unconsolidated sandy marine deposits over clayey estuarine deposits

Typical profile

Oi - 0 to 3 inches: slightly decomposed plant material
Oe - 3 to 4 inches: moderately decomposed plant material
A - 4 to 14 inches: loamy sand
Bw - 14 to 40 inches: loamy sand
C - 40 to 46 inches: sand
2C - 46 to 60 inches: clay

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very 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 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Hydric soil rating: No

Minor Components

Shrewsbury

Percent of map unit: 5 percent
Landform: Flats
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Atsion

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Monmouth County, New Jersey
Survey Area Data: Version 13, Sep 16, 2019

Monmouth County, New Jersey

KemB—Keyport sandy loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 4j83
Elevation: 0 to 200 feet
Mean annual precipitation: 28 to 59 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 161 to 231 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Keyport

Setting

Landform: Flats, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Silty and clayey eolian deposits and/or silty and clayey fluviomarine deposits

Typical profile

Ap - 0 to 12 inches: sandy loam
Bt1 - 12 to 18 inches: clay
Bt2 - 18 to 24 inches: clay
Bt3 - 24 to 32 inches: clay
Bt4 - 32 to 41 inches: clay
Cg1 - 41 to 55 inches: silty clay loam
Cg2 - 55 to 80 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very 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 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Lenni

Percent of map unit: 5 percent
Landform: Flats, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Hydric soil rating: Yes

Elkton

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Sassafras

Percent of map unit: 5 percent
Landform: Low hills, knolls
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Monmouth County, New Jersey
Survey Area Data: Version 13, Sep 16, 2019

Block 122, Lot 33 Marlboro Township
LOGGED BY: VINCENT CREEVY

DEPTH	SOIL LOG #1--4/2/2010 SOIL DESCRIPTION
0-13"	10YR 4/3 , brown , sandy loam slightly dry,subangular blocky, friable, slightly plastic *****NO WATER OR MOTTLES OBSERVED
13"-40"	10YR 5/8 yellowish brown , loamy sand slightly dry,subangular blocky, friable to loose, non-plastic *****NO WATER OR MOTTLES OBSERVED
40"-92"	10YR 6/4 light yellowish brown , loamy sand slightly dry,subangular blocky, friable to loose, non-plastic *****NO WATER OR MOTTLES OBSERVED SAMPLE @ 42"
92"-145"	10YR 7/3 very pale brown , loamy sand slightly moist,subangular blocky, friable, non-plastic ***MOTTLES10YR 6/6 @ 95" (common, medium, distinct) WATER @ 108"

Block 122, Lot 33 Marlboro Township
LOGGED BY: VINCENT CREEVY

DEPTH	SOIL LOG #2--4/2/2010 SOIL DESCRIPTION
0-10"	10YR 4/3 , brown , sandy loam slightly dry,subangular blocky, friable, slightly plastic *****NO WATER OR MOTTLES OBSERVED
10"-42"	10YR 5/8 yellowish brown , loamy sand slightly dry,subangular blocky, friable to loose, non-plastic *****NO WATER OR MOTTLES OBSERVED
42"-85"	10YR 6/4 light yellowish brown , loamy sand slightly dry,subangular blocky, friable to loose, non-plastic *****NO WATER OR MOTTLES OBSERVED SAMPLE @ 43"

85"-146" 10YR 7/3 very pale brown , loamy sand
slightly moist,subangular blocky, friable, non-plastic
***MOTTLES10YR 6/6 @ 75" (common, medium, distinct) WATER @ 84"

Block 122, Lot 33 Marlboro Township
LOGGED BY: VINCENT CREEVY

DEPTH SOIL LOG #3--4/2/2010

SOIL DESCRIPTION

0-8" 10YR 4/3 , brown , sandy loam
slightly dry,subangular blocky, friable, slightly plastic
*****NO WATER OR MOTTLES OBSERVED

8"-39" 10YR 5/8 yellowish brown , loamy sand
slightly dry,subangular blocky, friable to loose, non-plastic
*****NO WATER OR MOTTLES OBSERVED

39"-74" 10YR 6/4 light yellowish brown , loamy sand
slightly dry,subangular blocky, friable to loose, non-plastic
*****NO WATER OR MOTTLES OBSERVED SAMPLE @ 40"

74"-144" 10YR 7/3 very pale brown , loamy sand
slightly moist,subangular blocky, friable, non-plastic
***MOTTLES10YR 6/6 @ 83" (common, medium, distinct) WATER @ 94"

Form 3b. Tube Permeameter Test Data: Block 122, Lot 33 Marlboro Twp.

1. Test Number Log-1 Replicate (letter) A Date Collected 4/2/2010

2. Material Tested: Test in Native Soil – Indicate Depth 42"

3. Type of Sample: X Undisturbed _____Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in inches 1.88"
Length of Sample, L, in inches 3.5"

5. Bulk Density Determination: N/A

6. Standpipe used: _____ No X Yes
Indicate Internal Radius, 0.44"

7. Height of Water Level Above Rim of Test Basin, in inches:
At the Beginning of Each Test Interval, H_1 7.0"
At the End of Each Test Interval, H_2 6.0"

8. Rate of Water Level Drop:

******STOPWATCH USED

Length of Test Interval, T in Minutes (decimal)

0.083min./inch
0.083min./inch
0.083 min./inch
0.083min./inch
0.083min./inch
0.083min./inch

9. Calculation of Permeability:

K, (in/hr) = 60 min/hr x r^2/R^2 x L(in)/T(min) x ln(H_1/H_2)
= (60 min/hr x 0.194/3.534) x 3.5" / 0.083
x ln (7.0/6.0) = 21.4 in/hr = K-5

10. Defects in the Sample: None

11. I hereby certify that the information furnished on Form 3C of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. : 7:14-8.

Signature of Soil Evaluator _____ Date 4/2/2010
Vincent Creevy

Signature of Professional Engineer _____ Date 4/2/2010
David A Cranmer, P.E., P.P., Lic. No.

Form 3b. Tube Permeameter Test Data: Block 122, Lot 33 Marlboro Twp.

1. Test Number Log-1 Replicate (letter) B Date Collected 4/2/2010

2. Material Tested: Test In Native Soil – Indicate Depth 42"

3. Type of Sample: X Undisturbed _____ Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in inches 1.88"
Length of Sample, L, in inches 3.25"

5. Bulk Density Determination: N/A

6. Standpipe used: _____ No X Yes
Indicate Internal Radius, 0.44"

7. Height of Water Level Above Rim of Test Basin, in inches:
At the Beginning of Each Test Interval, H_1 7.0"
At the End of Each Test Interval, H_2 6.0"

8. Rate of Water Level Drop:

******STOPWATCH USED

Length of Test Interval, T in Minutes (decimal)

0.07min./inch
0.07min./inch
0.07 min./inch
0.07min./inch
0.07min./inch
0.07min./inch

9. Calculation of Permeability:

K, (in/hr) = 60 min/hr x r^2/R^2 x L(in)/T(min) x $\ln(H_1/H_2)$
= (60 min/hr x 0.194/3.534) x 3.25" / 0.07
x ln (7.0/6.0) = 23.57 in/hr = K-5

10. Defects in the Sample: None

11. I hereby certify that the information furnished on Form 3C of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. : 7:14-8.

Signature of Soil Evaluator _____ Date 4/2/2010
Vincent Creevy

Signature of Professional Engineer _____ Date 4/2/2010
David A Cranmer, P.E., P.P., Lic. No.

Form 3b. Tube Permeameter Test Data: Block 122, Lot 33 Marlboro Twp.

1. Test Number Log-2 Replicate (letter) A Date Collected 4/2/2010

2. Material Tested: Test in Native Soil – Indicate Depth 43"

3. Type of Sample: X Undisturbed _____ Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in inches 1.88"
Length of Sample, L, in inches 3.25"

5. Bulk Density Determination: N/A

6. Standpipe used: _____ No X Yes
Indicate Internal Radius, 0.44"

7. Height of Water Level Above Rim of Test Basin, in inches:
At the Beginning of Each Test Interval, H_1 7.0"
At the End of Each Test Interval, H_2 6.0"

8. Rate of Water Level Drop:

******STOPWATCH USED

Length of Test Interval, T in Minutes (decimal)

0.05min./inch
0.05min./inch
0.068 min./inch
0.068min./inch
0.068min./inch
0.068min./inch

9. Calculation of Permeability:

K_s (in/hr) = 60 min/hr x r^2/R^2 x L(in)/T(min) x ln(H_1/H_2)
= (60 min/hr x 0.194/3.534) x 3.25" / 0.068
x ln (7.0/6.0) = 24.27 in/hr = K-5

10. Defects in the Sample: None

11. I hereby certify that the information furnished on Form 3C of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. : 7:14-8.

Signature of Soil Evaluator _____ Date 4/2/2010
Vincent Creevy

Signature of Professional Engineer _____ Date 4/2/2010
David A Cranmer, P.E., P.P., Lic. No.

Form 3b. Tube Permeameter Test Data: Block 122, Lot 33 Marlboro Twp.

1. Test Number Log-2 Replicate (letter) B Date Collected 4/2/2010

2. Material Tested: Test in Native Soil – Indicate Depth 43"

3. Type of Sample: X Undisturbed _____Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in inches 1.88"
Length of Sample, L, in inches 3.0"

5. Bulk Density Determination: N/A

6. Standpipe used: _____ No X Yes
Indicate Internal Radius, 0.44"

7. Height of Water Level Above Rim of Test Basin, in inches:
At the Beginning of Each Test Interval, H_1 7.0"
At the End of Each Test Interval, H_2 6.0"

8. Rate of Water Level Drop:

******STOPWATCH USED

Length of Test Interval, T in Minutes (decimal)

0.05min./inch
0.05min./inch
0.05 min./inch
0.05min./inch
0.068min./inch
0.068min./inch

9. Calculation of Permeability:

K, (in/hr) = 60 min/hr x r^2/R^2 x L(in)/T(min) x $\ln(H_1/H_2)$
= (60 min/hr x 0.194/3.534) x 3.0" / 0.068
x ln (7.0/6.0) = 22.40 in/hr = K-5

10. Defects in the Sample: None

11. I hereby certify that the information furnished on Form 3C of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. : 7:14-8.

Signature of Soil Evaluator _____ Date 4/2/2010
Vincent Creevy

Signature of Professional Engineer _____ Date 4/2/2010
David A Cranmer, P.E., P.P., Lic. No.

Form 3b. Tube Permeameter Test Data: Block 122, Lot 33 Marlboro Twp.

1. Test Number Log-3 Replicate (letter) A Date Collected 4/2/2010

2. Material Tested: Test in Native Soil – Indicate Depth 40"

3. Type of Sample: X Undisturbed _____ Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in inches 1.88"
Length of Sample, L, in inches 3.25"

5. Bulk Density Determination: N/A

6. Standpipe used: _____ No X Yes
Indicate Internal Radius, 0.44"

7. Height of Water Level Above Rim of Test Basin, in inches:
At the Beginning of Each Test Interval, H_1 7.0"
At the End of Each Test Interval, H_2 6.0"

8. Rate of Water Level Drop:

******STOPWATCH USED

Length of Test Interval, T in Minutes (decimal)

0.133min./inch
0.133min./inch
0.150 min./inch
0.167min./inch
0.167min./inch
0.167min./inch

9. Calculation of Permeability:

K, (in/hr) = 60 min/hr x r^2/R^2 x L(in)/T(min) x ln(H_1/H_2)
= (60 min/hr x 0.194/3.534) x 3.25" / 0.167
x ln (7.0/6.0) = 9.88 in/hr = K-4

10. Defects in the Sample: None

11. I hereby certify that the information furnished on Form 3C of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. : 7:14-8.

Signature of Soil Evaluator _____ Date 4/2/2010
Vincent Creevy

Signature of Professional Engineer _____ Date 4/2/2010
David A Cranmer, P.E., P.P., Lic. No.

Form 3b. Tube Permeameter Test Data: Block 122, Lot 33 Marlboro Twp.

1. Test Number Log-3 Replicate (letter) B Date Collected 4/2/2010

2. Material Tested: Test in Native Soil – Indicate Depth 40"

3. Type of Sample: X Undisturbed _____ Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in inches 1.88"
Length of Sample, L, in inches 3.0"

5. Bulk Density Determination: N/A

6. Standpipe used: _____ No X Yes
Indicate Internal Radius, 0.44"

7. Height of Water Level Above Rim of Test Basin, in inches:
At the Beginning of Each Test Interval, H_1 7.0"
At the End of Each Test Interval, H_2 6.0"

8. Rate of Water Level Drop:

******STOPWATCH USED

Length of Test Interval, T in Minutes (decimal)

0.217min./inch
0.217min./inch
0.25min./inch
0.25min./inch
0.25min./inch
0.25min./inch

9. Calculation of Permeability:

K, (in/hr) = 60 min/hr x r^2/R^2 x L(in)/T(min) x $\ln(H_1/H_2)$
= (60 min/hr x 0.194/3.534) x 3.0" / 0.25
x ln (7.0/6.0) = 6.1 in/hr = K-4

10. Defects in the Sample: None

11. I hereby certify that the information furnished on Form 3C of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. : 7:14-8.

Signature of Soil Evaluator _____ Date 4/2/2010
Vincent Creevy

Signature of Professional Engineer _____ Date 4/2/2010
David A Cranmer, P.E., P.P., Lic. No.

MONITORING WELL OBSERVATIONS

Posh Car Wash Lube Center
Block 122, Lot 33
Township of Marlboro, Monmouth County, New Jersey

Date of Observation	Well Identifier	Grade Elevation	Depth to Static Water Surface	Static Water Surface Elevation
12/14/2010	1-Front	99.8	>12.5	<87.3
12/14/2010	2-Rear	99.4	>12.3	<87.1
1/14/2011	1-Front	99.8	10.9	88.9
1/14/2011	2-Rear	99.4	10.3	89.1
2/17/2011	1-Front	99.8	11.1	88.7
2/17/2011	2-Rear	99.4	10.3	89.1
3/14/2011	1-Front	99.8	11.3	88.5
3/14/2011	2-Rear	99.4	10.4	89.0
4/15/2011	1-Front	99.8	11.2	88.6
4/15/2011	2-Rear	99.4	10.2	89.2

Two River Engineering
P.O. Box 155
Colts Neck, New Jersey 07722 *(732) 866-0111 Fax (732) 866-4348*

Location: 6 Tennent Road
Block 123, Lot 33
Marlboro, New Jersey
Date: July 1, 2020

Soil log 1

0"-8"	Organic layer/Topsoil
8" - 72"	Loamy sand, strong brown (7.5YR 4/6), single grain, loose, moist
72" - 114"	Loamy sand, very pale brown (10YR 7/3), single grain, loose, moist with light grey (10YR 7/1) mottles at 78"

No ground water encountered
Seaonsal high water table encountered at 78"

Soil log 2

0"-8"	Organic layer/Topsoil
8" - 60"	Loamy sand, strong brown (7.5YR 4/6), single grain, loose, moist
60" - 120"	Loamy sand, very pale brown (10YR 7/3), single grain, loose, moist with light grey (10YR 7/1) mottles at 84"

No ground water encountered
Seaonsal high water table encountered at 84"

Soil log 3

0"-12"	Organic layer/Topsoil
12" - 108"	Loamy sand, yellowish brown (10YR 7/6), single grain, loose, moist with light grey (10YR 7/1) mottles at 78"

No ground water encountered
Seaonsal high water table encountered at 78"

Soil log 4

0"-18"	Organic layer/Topsoil
12" - 114"	Loamy sand, yellowish brown (10YR 7/6), single grain, loose, moist with light grey (10YR 7/1) mottles at 84"

No ground water encountered
Seaonsal high water table encountered at 84"

Soil log 5

0"-14"	Organic layer/Topsoil
14" - 108"	Loamy sand, yellowish brown (10YR 7/6), single grain, loose, moist with light grey (10YR 7/1) mottles at 80"

No ground water encountered
Seaonsal high water table encountered at 80"

Soil log 6

0"-14"	Organic layer/Topsoil
14" - 108"	Loamy sand, yellowish brown (10YR 7/6), single grain, loose, moist with light grey (10YR 7/1) mottles at 78"

No ground water encountered
Seaonsal high water table encountered at 78"

Cara L. Smith, P.E. Lic. 37929

N.J.A.C. 7:9A – Appendix B Forms

Form 3b
Tube Permeameter Test Data

Lot: 33 Block: 123 Soil log #1

1. Test Number: 1 Replicate (letter): A+B Date collected: 7-1-20
2. Material Tested: Fill: ____ Tested in native soil: ✓ Indicate Depth: 72"
3. Type of Sample: Undisturbed: ✓ Disturbed: ____
4. Sample dimensions: Inside radius of sample tube, R, in cm 0.75" Length of sample, L, in inches 3"
5. Bulk density determination (disturbed samples only): N/A
   Sample weight (wt. tube containing sample-wt. of empty tube), grams
   Sample volume (L x 2.54cm./inch x 2.24²), cc ____
   Bulk density (sample Wt./Sample Volume), grams/cc
6. Standpipe used: No: ✓ Yes: ____ Indicate internal radius, cm: ____
7. Height of water level above rim of test basin, in inches:
   At the beginning of each test interval, H1 3"
   At the end of each test interval, H2 2.00 & 2.125"
8. Rate of water level drop (add additional lines if needed):

Time, start of test interval, t1	Time, end of test, interval t2	Length of test interval, t, minutes
		5 min
		↓

Drop in Inches: A 1.00" → 1.00; B 0.875" → 0.875"

9. Calculation of permeability:
   K, (in/hr) = 60 min/hr x r^2/R^2 x L(in)/t(min) x ln (H1/H2)
   = 60 min/hr x ____ / ____ x 3 / 5 x ln (3 / 2.125) = 12.41 in/hr
   (3 / 2.00) 14.60 in/hr
10. Defects in the Sample (Check appropriate items):
    ✓ None ____ Cracks ____ Worm Channels
    ____ Root Channels ____ Soil/Tube Contact
    ____ Large Gravel ____ Large Roots
    ____ Dry Soil ____ Smearing ____ Compaction
    Other (specify): ____
11. I hereby certify that the information furnished on Form 3b of this application (and the attachments thereto) is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Soil Evaluator: [signature] Date: 7-1-20
Signature of Professional Engineer: [signature] License #: 37929

County: ____ Municipality: ____

N.J.A.C. 7:9A – Appendix B Forms

Form 3b
Tube Permeameter Test Data

Lot: 33 Block: 123

1. Test Number: Soil by #2 Replicate (letter): A+B Date collected: 7-1-20
2. Material Tested: Fill: ____ Tested in native soil: ✓ Indicate Depth: 72"
3. Type of Sample: Undisturbed: ✓ Disturbed: ____
4. Sample dimensions: Inside radius of sample tube, R, in cm 0.75" Length of sample, L, in inches 3"
5. Bulk density determination (disturbed samples only):
   Sample weight (wt. tube containing sample-wt. of empty tube), grams
   Sample volume (L x 2.54cm./inch x 2.24²), cc ____
   Bulk density (sample Wt./Sample Volume), grams/cc
6. Standpipe used: No: ✓ Yes: ____ Indicate internal radius, cm: ____
7. Height of water level above rim of test basin, in inches:
   At the beginning of each test interval, H1 3"
   At the end of each test interval, H2 2.00 + 1.875"
8. Rate of water level drop (add additional lines if needed):

Time, start of test interval, t1	Time, end of test, interval t2	Length of test interval, t, minutes
		5 min
		↓

Drop in Inches
A: 1.125" → 1.125" ↓
B: 1.00" → 1.00" ↓

9. Calculation of permeability:
   K, (in/hr) = 60 min/hr x r²/R² x L(in)/t(min) x ln (H1/H2)
   = 60 min/hr x ____ / ____ x 3/5 x ln (3/2.0) = 14.60 in/hr
   3/5 x ln(3/1.875) = 16.92 in/hr
10. Defects in the Sample (Check appropriate items):
    ✓ None ____ Cracks ____ Worm Channels
    ____ Root Channels ____ Soil/Tube Contact
    ____ Large Gravel ____ Large Roots
    ____ Dry Soil ____ Smearing ____ Compaction
    Other (specify): ____
11. I hereby certify that the information furnished on Form 3b of this application (and the attachments thereto) is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Soil Evaluator: [signature] Date: 7-1-20
Signature of Professional Engineer: [signature] License #: 37989

County: ____ Municipality: ____

N.J.A.C. 7:9A – Appendix B Forms

Form 3b
Tube Permeameter Test Data

Lot: 3 Block: 123

1. Test Number: Soil log #3 Replicate (letter): A+B Date collected: 7-1-20
2. Material Tested: Fill: ____ Tested in native soil: ✓ Indicate Depth: 72"
3. Type of Sample: Undisturbed: ✓ Disturbed: ____
4. Sample dimensions: Inside radius of sample tube, R, in cm 0.75" Length of sample, L, in inches 3
5. Bulk density determination (disturbed samples only):
   Sample weight (wt. tube containing sample-wt. of empty tube), grams
   Sample volume (L x 2.54cm./inch x 2.24²), cc ____
   Bulk density (sample Wt./Sample Volume), grams/cc
6. Standpipe used: No: ✓ Yes: ____ Indicate internal radius, cm: ____
7. Height of water level above rim of test basin, in inches:
   At the beginning of each test interval, H1 3"
   At the end of each test interval, H2 1.75"
8. Rate of water level drop (add additional lines if needed):

Time, start of test interval, t1	Time, end of test, interval t2	Length of test interval, t, minutes
		5 min

Drop in Inches
A B
1.25 1.25
1.25 1.25

9. Calculation of permeability:
   K_s (in/hr) = 60 min/hr x r^2/R^2 x L(in)/t(min) x ln (H1/H2)
   = 60 min/hr x ____ / ____ x 3 / 5 x ln (3 / 1.75") = 19.40 in/hr
10. Defects in the Sample (Check appropriate items):
    ✓ None ____ Cracks ____ Worm Channels
    ____ Root Channels ____ Soil/Tube Contact
    ____ Large Gravel ____ Large Roots
    ____ Dry Soil ____ Smearing ____ Compaction
    Other (specify): ____

11. I hereby certify that the information furnished on Form 3b of this application (and the attachments thereto) is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Soil Evaluator: ____ Date: 7-1-20
Signature of Professional Engineer: ____ License #: 37929

County: ____ Municipality: ____

N.J.A.C. 7:9A – Appendix B Forms

Form 3b
Tube Permeameter Test Data

Lot: 33 Block: 123

1. Test Number: Soil Log #4 Replicate (letter): A+B Date collected: 7-1-20
2. Material Tested: Fill; ____ Tested in native soil: ✓ Indicate Depth: 72"
3. Type of Sample: Undisturbed: ✓ Disturbed: ____
4. Sample dimensions: Inside radius of sample tube, R, in cm 0.75" Length of sample, L, in inches 3"
5. Bulk density determination (disturbed samples only):
   Sample weight (wt. tube containing sample-wt. of empty tube), grams
   Sample volume (L x 2.54cm./inch x 2.24^2), cc ____
   Bulk density (sample Wt./Sample Volume), grams/cc
6. Standpipe used: No: ✓ Yes: ____ Indicate internal radius, cm: ____
7. Height of water level above rim of test basin, in inches:
   At the beginning of each test interval, H1 3"
   At the end of each test interval, H2 1.75 + 1.875"
8. Rate of water level drop (add additional lines if needed):

Time, start of test interval, t1	Time, end of test, interval t2	Length of test interval, t, minutes

Drop in Inches
A: 1.25" → 1.25"
B: 1.125" → 1.125"

9. Calculation of permeability:
   K, (in/hr) = 60 min/hr x r^2/R^2 x L(in)/t(min) x in (H1/H2)
   = 60 min/hr x ____ / ____ x 3 / 5 x in (3 / 1.75) = 19.40 in/hr
   3 / 5 x ln(3/1.875) = 16.92 in/hr
10. Defects in the Sample (Check appropriate items):
    ✓ None ____ Cracks ____ Worm Channels
    ____ Root Channels ____ Soil/Tube Contact
    ____ Large Gravel ____ Large Roots
    ____ Dry Soil ____ Smearing ____ Compaction
    Other (specify): ____
11. I hereby certify that the information furnished on Form 3b of this application (and the attachments thereto) is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Soil Evaluator: [signature] Date: 7-1-20
Signature of Professional Engineer: [signature] License #: 37981

County: ____ Municipality: ____

N.J.A.C. 7:9A – Appendix B Forms

Form 3b
Tube Permeameter Test Data

Lot: 33 Block: 123

1. Test Number: Soil log #5 Replicate (letter): A+B Date collected: 7-1-20
2. Material Tested: Fill: ____ Tested in native soil: ✓ Indicate Depth: 72"
3. Type of Sample: Undisturbed: ✓ Disturbed: ____
4. Sample dimensions: Inside radius of sample tube, R, in cm 3.75" Length of sample, L, in inches 3"
5. Bulk density determination (disturbed samples only): N/A
   Sample weight (wt. tube containing sample-wt. of empty tube), grams
   Sample volume (L x 2.54cm./inch x 2.24^2), cc ____
   Bulk density (sample Wt./Sample Volume), grams/cc
6. Standpipe used: No: ✓ Yes: ____ Indicate internal radius, cm: ____
7. Height of water level above rim of test basin, in inches:
   At the beginning of each test interval, H1 3"
   At the end of each test interval, H2 1.75" + 1.625
8. Rate of water level drop (add additional lines if needed):

Time, start of test interval, t1	Time, end of test, interval t2	Length of test interval, t, minutes
		5 min
		↓

Drop in Inches: A 1.375 → 1.375"; B 1.25 → 1.25"

9. Calculation of permeability:
   K, (in/hr) = 60 min/hr x r^2/R^2 x L(in)/t(min) x in (H1/H2)
   = 60 min/hr x ____ / ____ x 3/3 x 15/15 x ln(3/1.75) = 19.40 in/hr
   x ln(3/1.625) = 22.07 in/hr
10. Defects in the Sample (Check appropriate items):
    ✓ None ____ Cracks ____ Worm Channels
    ____ Root Channels ____ Soil/Tube Contact
    ____ Large Gravel ____ Large Roots
    ____ Dry Soil ____ Smearing ____ Compaction
    Other (specify): ____

11. I hereby certify that the information furnished on Form 3b of this application (and the attachments thereto) is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Soil Evaluator: [signature] Date: 7-1-20
Signature of Professional Engineer: [signature] License #: 37929

County: ____ Municipality: ____

N.J.A.C. 7:9A – Appendix B Forms

Form 3b
Tube Permeameter Test Data

Lot: 33 Block: 123

1. Test Number: Soil log #6 Replicate (letter): A+B Date collected: 7-1-20
2. Material Tested: Fill: ____ Tested in native soil: ✓ Indicate Depth: 72"
3. Type of Sample: Undisturbed: ✓ Disturbed: ____
4. Sample dimensions: Inside radius of sample tube, R, in cm 3.75" Length of sample, L, in inches 3"
5. Bulk density determination (disturbed samples only): w/ PA
   Sample weight (wt. tube containing sample-wt. of empty tube), grams
   Sample volume (L x 2.54cm./inch x 2.24²), cc ____
   Bulk density (sample Wt./Sample Volume), grams/cc
6. Standpipe used: No: ✓ Yes: ____ Indicate internal radius, cm: ____
7. Height of water level above rim of test basin, in inches:
   At the beginning of each test interval, H1 3
   At the end of each test interval, H2 2.0 + 2.0
8. Rate of water level drop (add additional lines if needed):

Time, start of test interval, t1	Time, end of test, interval t2	Length of test interval, t, minutes
		5 min
		↓

Drop in Inches
A: 1.0 ↓ 1.0
B: 1.0 ↓ 1.0

9. Calculation of permeability:
   K, (in/hr) = 60 min/hr x r²/R² x L(in)/t(min) x in (H1/H2)
   = 60 min/hr x ____ / ____ x 3 / 5 x in (3 2.0) = 14.60 in/hr
10. Defects in the Sample (Check appropriate items):
    ✓ None ____ Cracks ____ Worm Channels
    ____ Root Channels ____ Soil/Tube Contact
    ____ Large Gravel ____ Large Roots
    ____ Dry Soil ____ Smearing ____ Compaction
    Other (specify): ____
11. I hereby certify that the information furnished on Form 3b of this application (and the attachments thereto) is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Soil Evaluator: [signature] Date: 7-1-20
Signature of Professional Engineer: [signature] License #: 37909

County: ____ Municipality: ____

United States Department of Agriculture

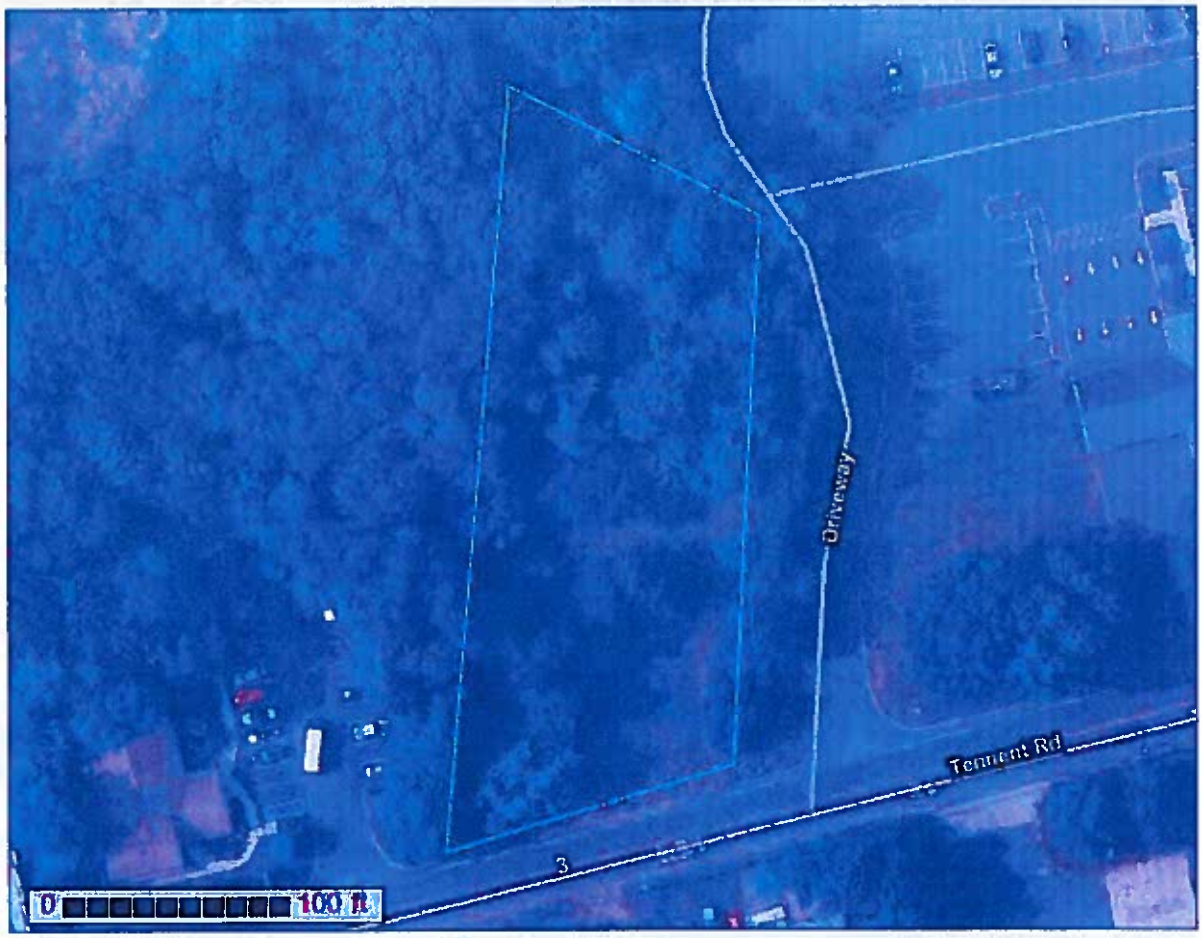
NRCS

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 Monmouth County, New Jersey

Posh Car Wash



February 12, 2021

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.

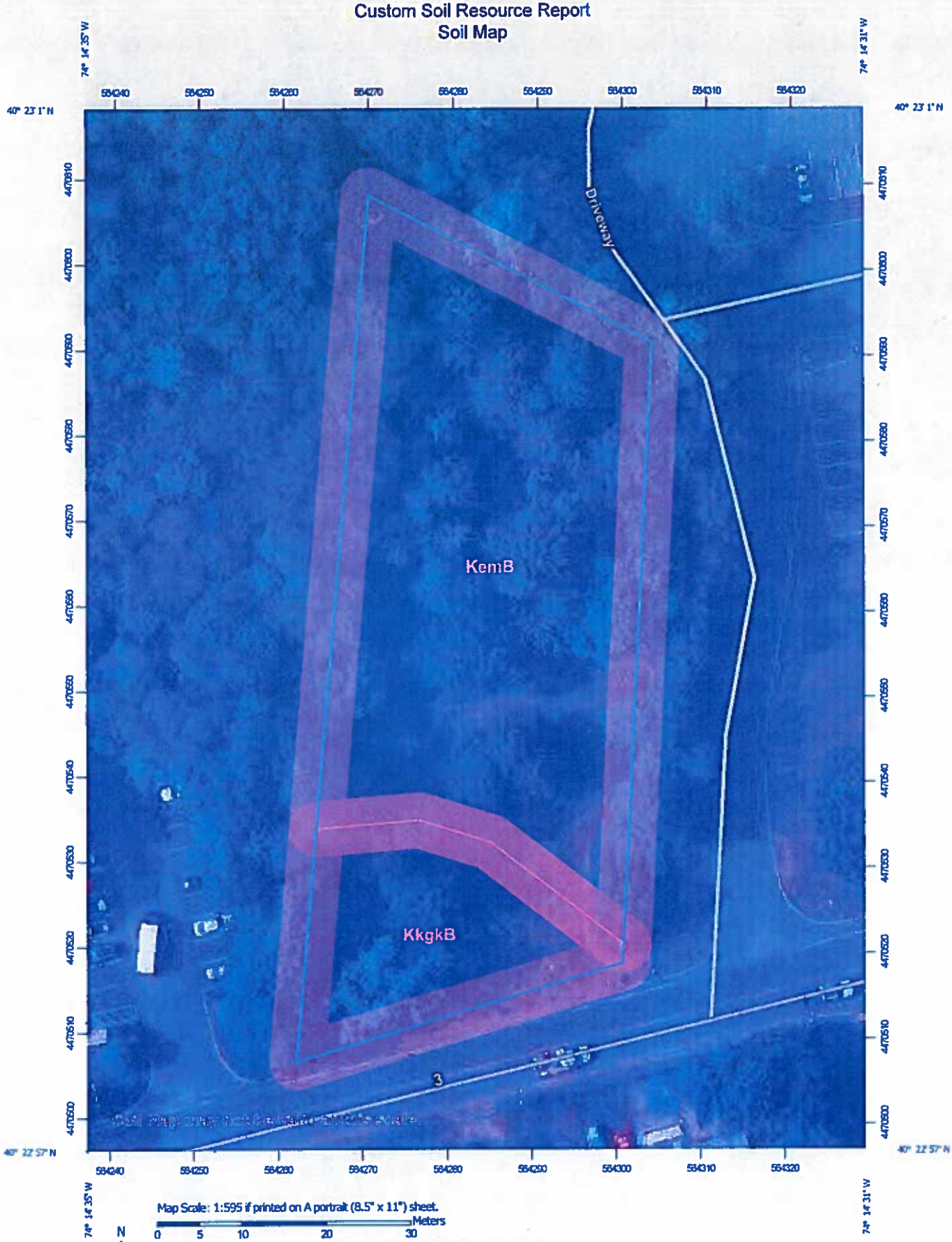
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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 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 1:24,000.

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: Monmouth County, New Jersey
Survey Area Data: Version 14, Jun 1, 2020

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

Date(s) aerial images were photographed: Jun 29, 2019—Jul 16, 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
KemB	Keyport sandy loam, 2 to 5 percent slopes	0.6	78.3%
KkgkB	Klej loamy sand, clayey substratum, 0 to 5 percent slopes	0.2	21.7%
Totals for Area of Interest		0.8	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.

Monmouth County, New Jersey

KemB—Keyport sandy loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 4j83
Elevation: 0 to 200 feet
Mean annual precipitation: 28 to 59 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 161 to 231 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Keyport

Setting

Landform: Depressions, flats
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Silty and clayey eolian deposits and/or silty and clayey fluviomarine deposits

Typical profile

Ap - 0 to 12 inches: sandy loam
Bt1 - 12 to 18 inches: clay
Bt2 - 18 to 24 inches: clay
Bt3 - 24 to 32 inches: clay
Bt4 - 32 to 41 inches: clay
Cg1 - 41 to 55 inches: silty clay loam
Cg2 - 55 to 80 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very 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 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Sassafras

Percent of map unit: 5 percent
Landform: Knolls, low hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Lenni

Percent of map unit: 5 percent
Landform: Flats, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Hydric soil rating: Yes

Elkton

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

KkgkB—Klej loamy sand, clayey substratum, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 1js1n
Elevation: 0 to 180 feet
Mean annual precipitation: 28 to 59 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 161 to 231 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Klej, Clay Substratum

Setting

Landform: Dunes
Down-slope shape: Convex
Across-slope shape: Linear

Parent material: Unconsolidated sandy marine deposits over clayey estuarine deposits

Typical profile

Oi - 0 to 3 inches: slightly decomposed plant material
Oe - 3 to 4 inches: moderately decomposed plant material
A - 4 to 14 inches: loamy sand
Bw - 14 to 40 inches: loamy sand
C - 40 to 46 inches: sand
2C - 46 to 60 inches: clay

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very 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 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Hydric soil rating: No

Minor Components

Shrewsbury

Percent of map unit: 5 percent
Landform: Flats
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Atsion

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

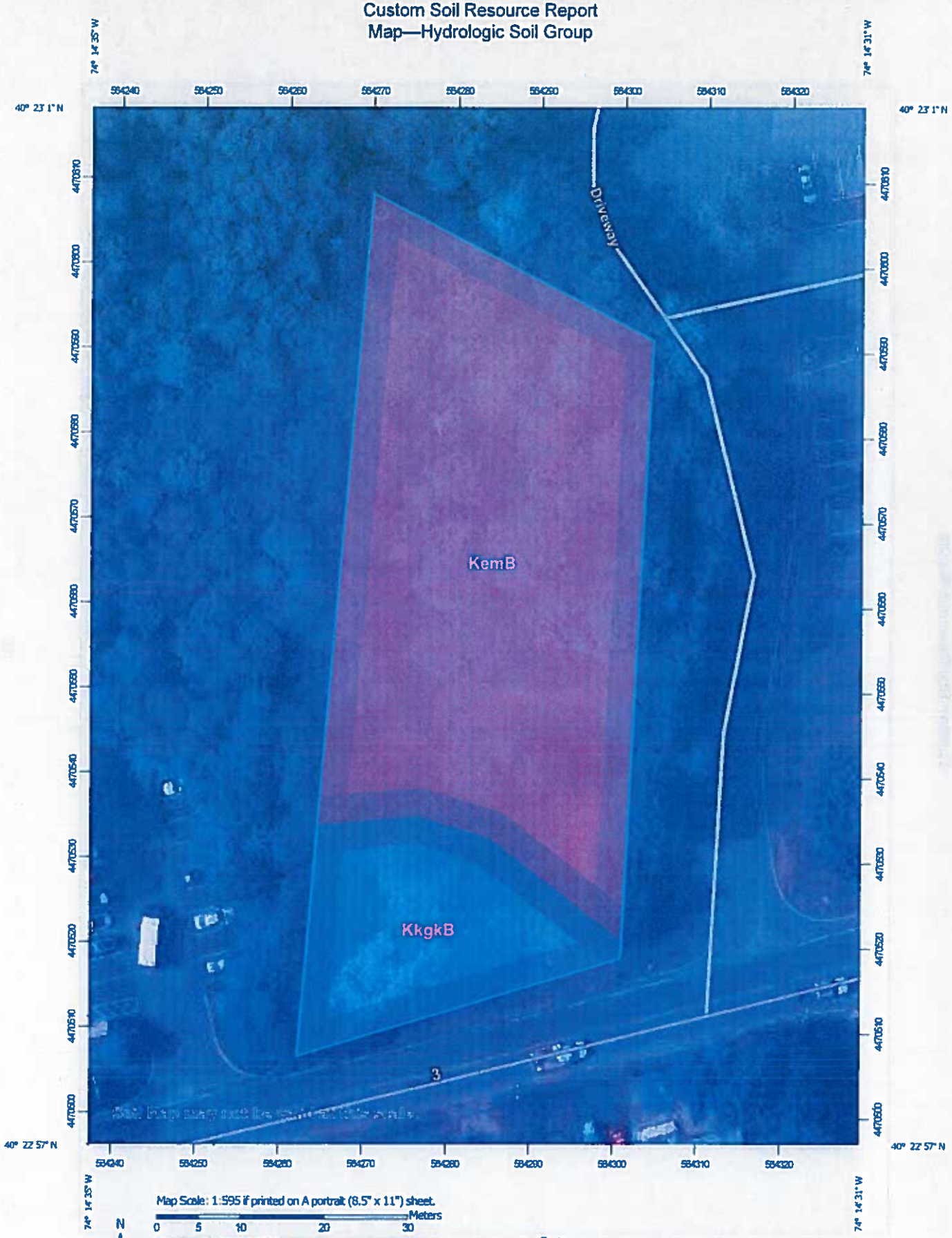
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group



MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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 1:24,000.

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.

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Soil Survey Area: Monmouth County, New Jersey
Survey Area Data: Version 14, Jun 1, 2020

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

Date(s) aerial images were photographed: Jun 29, 2019—Jul 16, 2019

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Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
KemB	Keyport sandy loam, 2 to 5 percent slopes	D	0.6	78.3%
KkgkB	Klej loamy sand, clayey substratum, 0 to 5 percent slopes	A/D	0.2	21.7%
Totals for Area of Interest			0.8	100.0%

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Depth to Any Soil Restrictive Layer

A "restrictive layer" is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers.

This theme presents the depth to any type of restrictive layer that is described for each map unit. If more than one type of restrictive layer is described for an individual soil type, the depth to the shallowest one is presented. If no restrictive layer is described in a map unit, it is represented by the "> 200" depth class.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Custom Soil Resource Report
Map—Depth to Any Soil Restrictive Layer

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Lines

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Points

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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Table—Depth to Any Soil Restrictive Layer

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
KemB	Keyport sandy loam, 2 to 5 percent slopes	>200	0.6	78.3%
KkgkB	Klej loamy sand, clayey substratum, 0 to 5 percent slopes	>200	0.2	21.7%
Totals for Area of Interest			0.8	100.0%

Rating Options—Depth to Any Soil Restrictive Layer

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Water Features

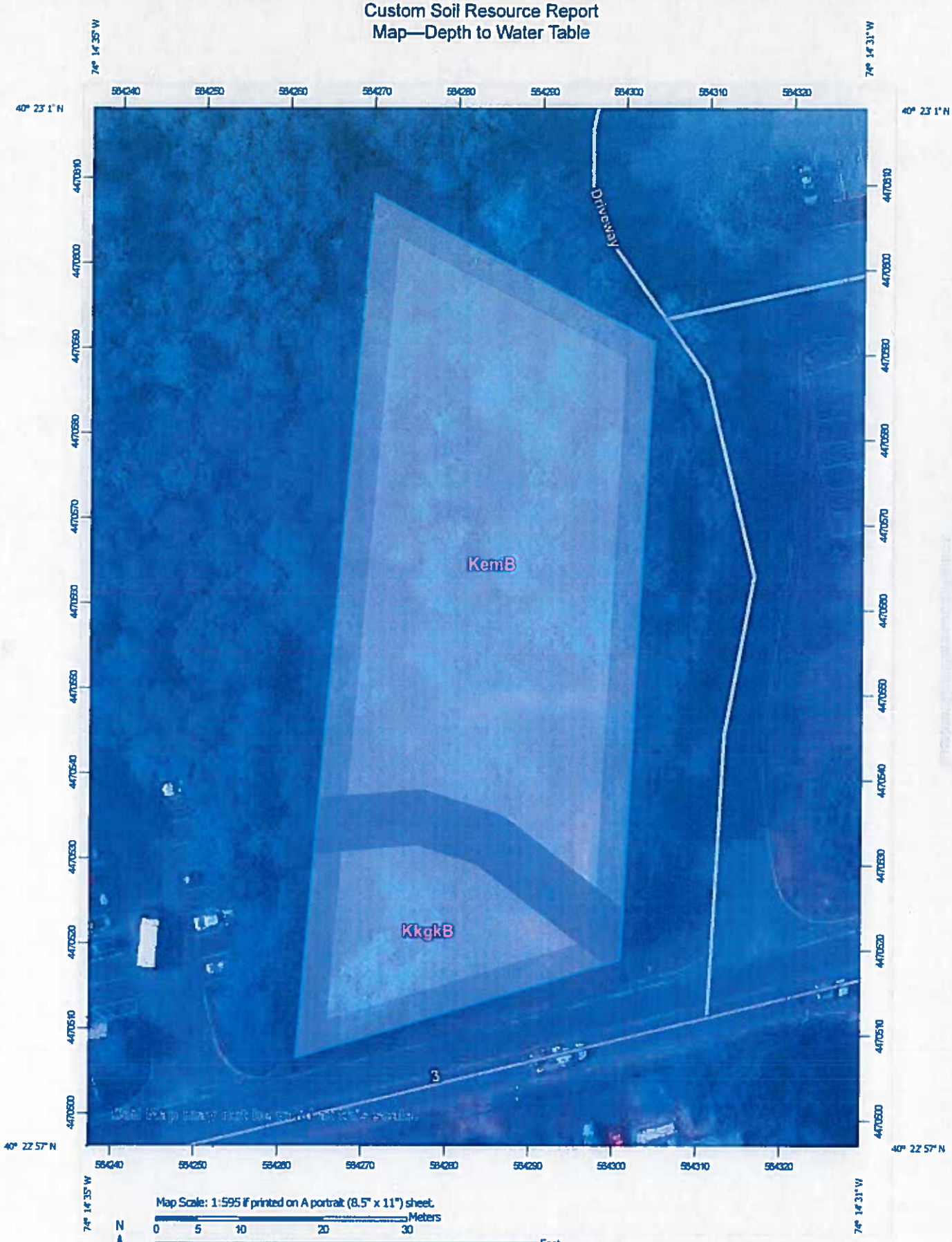
Water Features include ponding frequency, flooding frequency, and depth to water table.

Depth to Water Table

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Custom Soil Resource Report
Map—Depth to Water Table



MAP LEGEND

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

Soils

Soil Rating Polygons
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Lines
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Points
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

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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.

Table—Depth to Water Table

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
KemB	Keyport sandy loam, 2 to 5 percent slopes	76	0.6	78.3%
KkgkB	Klej loamy sand, clayey substratum, 0 to 5 percent slopes	54	0.2	21.7%
Totals for Area of Interest			**0.8**	**100.0%**

Rating Options—Depth to Water Table

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

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2018-015-125

APPENDIX B

Rainfall Data Report

Point precipitation frequency estimates (inches)
NOAA Atlas 14 Volume 2 Version 3
Data type: Precipitation depth
Time series type: Partial duration
Project area: Ohio River Basin
Location na New Jerse USA
Station Name: -
Latitude: 40.3831°
Longitude: -74.2415°
Elevation (USGS): 107.69 ft

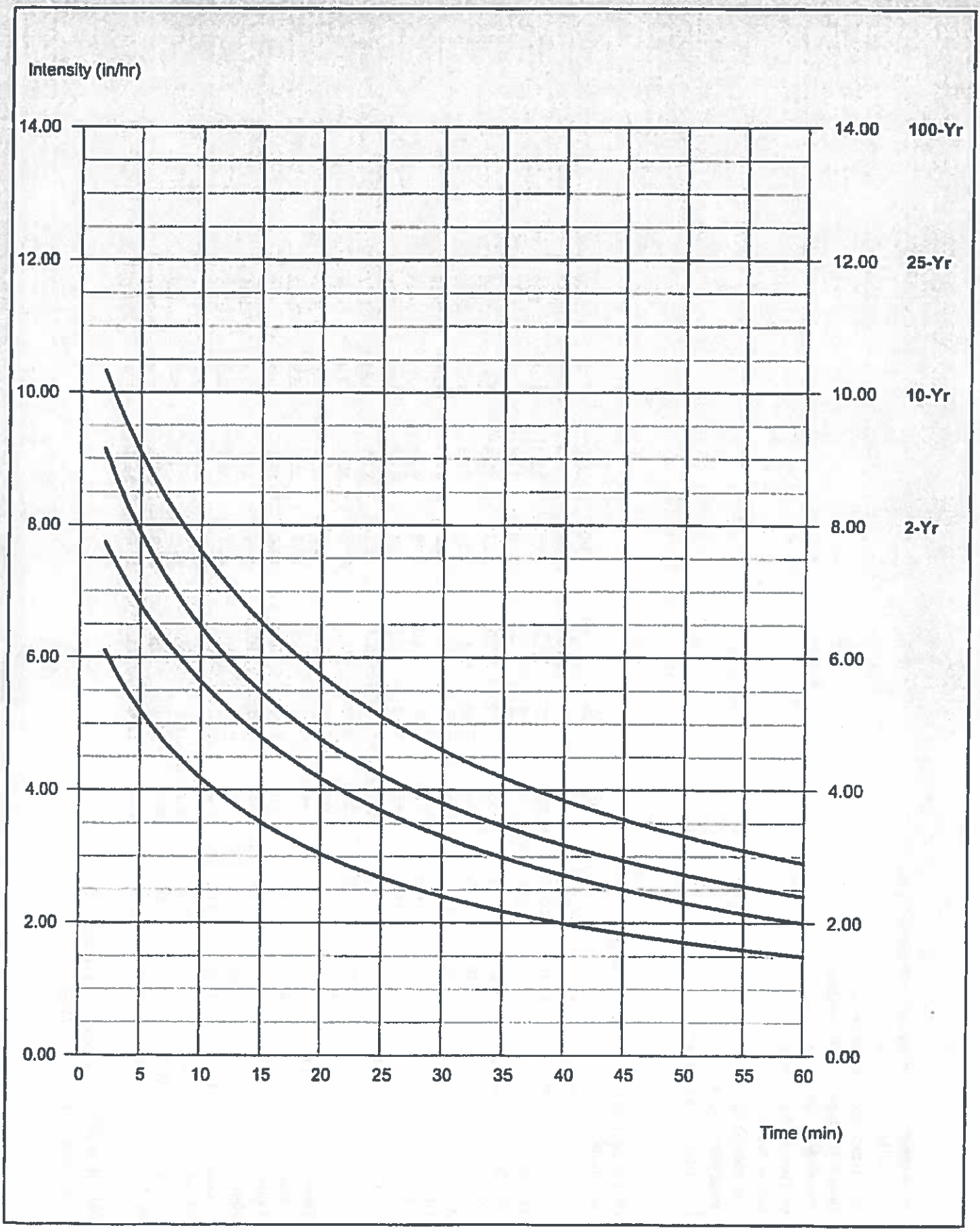
PRECIPITATION FREQUENCY ESTIMATES

by duratior	1	2	5	10	25	50	100	200	500	1000
5-min:	0.334	0.399	0.473	0.528	0.596	0.645	0.694	0.739	0.796	0.839
10-min:	0.534	0.638	0.758	0.845	0.95	1.03	1.1	1.17	1.26	1.32
15-min:	0.667	0.801	0.959	1.07	1.2	1.3	1.39	1.48	1.58	1.66
30-min:	0.915	1.11	1.36	1.55	1.78	1.96	2.13	2.3	2.52	2.69
60-min:	1.14	1.39	1.75	2.02	2.38	2.65	2.94	3.23	3.62	3.92
2-hr:	1.4	1.71	2.17	2.52	3.01	3.41	3.82	4.25	4.85	5.32
3-hr:	1.55	1.89	2.4	2.8	3.36	3.82	4.29	4.79	5.49	6.05
6-hr:	1.99	2.42	3.06	3.58	4.34	4.97	5.64	6.37	7.42	8.29
12-hr:	2.4	2.91	3.71	4.39	5.39	6.25	7.2	8.25	9.81	11.1
24-hr:	2.76	3.35	4.32	5.16	6.42	7.52	8.76	10.2	12.3	14.1
2-day:	3.2	3.89	5	5.95	7.35	8.56	9.9	11.4	13.6	15.5
3-day:	3.4	4.12	5.28	6.25	7.69	8.91	10.3	11.7	13.9	15.8
4-day:	3.6	4.36	5.56	6.56	8.02	9.26	10.6	12.1	14.2	16
7-day:	4.2	5.05	6.31	7.38	8.91	10.2	11.6	13.1	15.3	17.1
10-day:	4.75	5.69	7.01	8.09	9.64	10.9	12.3	13.7	15.8	17.5
20-day:	6.38	7.58	9.09	10.3	11.9	13.2	14.6	15.9	17.7	19.2
30-day:	7.94	9.39	11.1	12.3	14.1	15.4	16.7	18	19.6	20.9
45-day:	10.1	11.9	13.8	15.3	17.1	18.5	19.9	21.2	22.9	24.1
60-day:	12.1	14.2	16.3	17.8	19.8	21.2	22.6	23.9	25.4	26.5

Date/time (GMT): Thu Nov 28 16:46:57 2019
pyRunTime: 0.0140180587769

Hydraflow IDF Curves

IDF file: Trenton.IDF



Hydraflow Rainfall Report

Hydraflow Hydrographs by Intelisolve v9.22 — Wednesday, Feb 19, 2020

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	———
2	68.2833	13.1000	0.8896	———
3	0.0000	0.0000	0.0000	———
5	0.0000	0.0000	0.0000	———
10	249.7597	21.8001	1.0961	———
25	115.7547	14.9000	0.8980	———
50	0.0000	0.0000	0.0000	———
100	210.5742	19.8000	0.9784	———

File name: Trenton.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.19	4.18	3.51	3.04	2.68	2.40	2.18	1.99	1.84	1.71	1.60	1.50
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	6.80	5.63	4.80	4.17	3.69	3.30	2.98	2.72	2.50	2.31	2.14	2.00
25	7.89	6.45	5.47	4.76	4.23	3.80	3.46	3.17	2.93	2.73	2.55	2.40
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	9.10	7.60	6.53	5.73	5.10	4.60	4.19	3.85	3.56	3.31	3.09	2.90

Tc = time in minutes. Values may exceed 60.

Precip. file name: Monmouth Cty 24hr rainfall.pcp

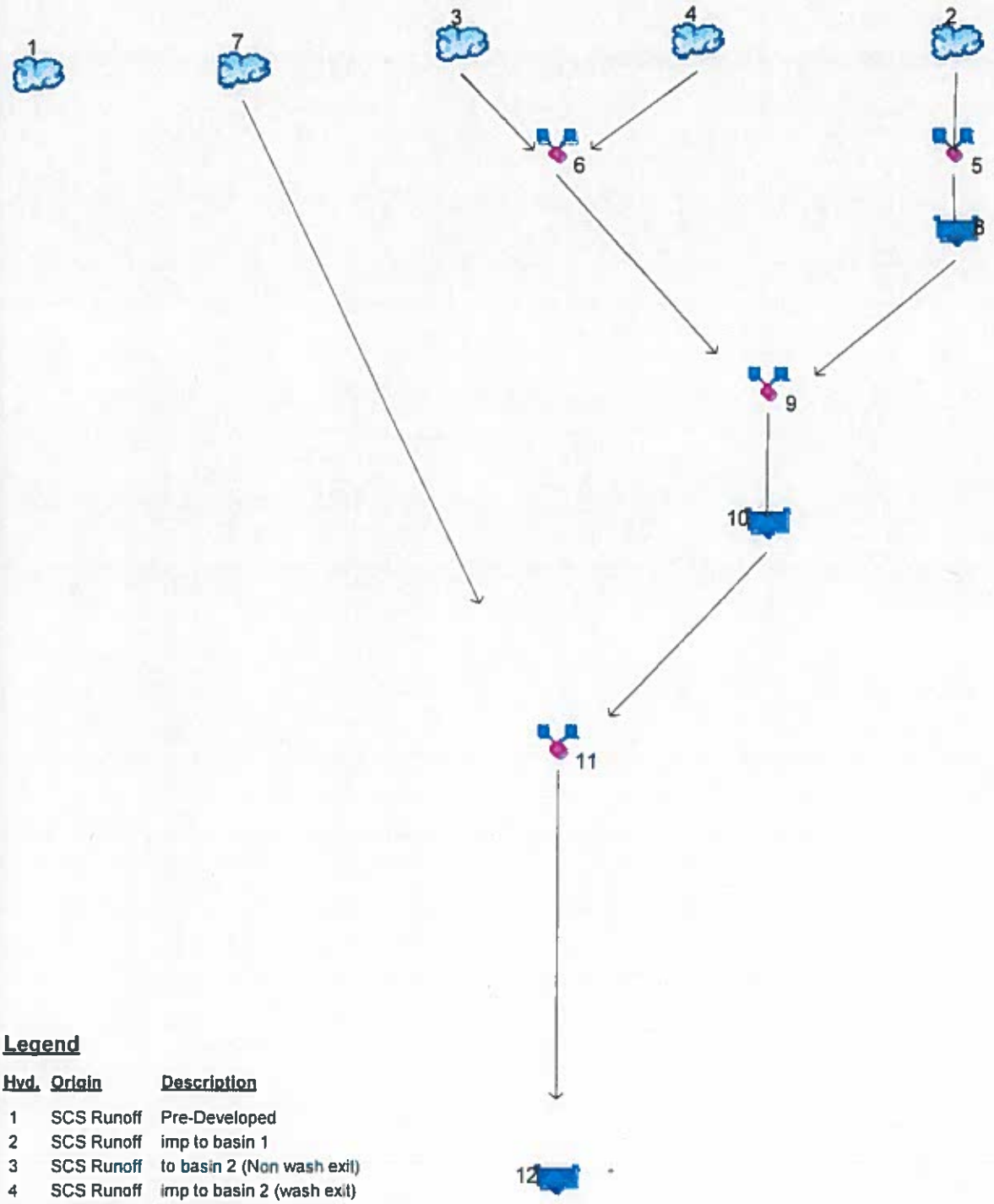
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.35	0.00	0.00	5.16	0.00	0.00	8.76
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.20
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2018-015-125

APPENDIX C
Hydrologic Models

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021



Legend

Hyd.	Origin	Description
1	SCS Runoff	Pre-Developed
2	SCS Runoff	imp to basin 1
3	SCS Runoff	to basin 2 (Non wash exit)
4	SCS Runoff	imp to basin 2 (wash exit)
5	Combine	To Basin 1
6	Combine	To Basin 2
7	SCS Runoff	Roofed Area
8	Reservoir	Inflow to Basin 1
9	Combine	Inflow to basin 2
10	Reservoir	Basin 2 Outflow
11	Combine	Inflow to Infiltrator Chambers
12	Reservoir	Site Outflow- Chambers

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	0.123	-------	------	-------	------	------	------	------	Pre-Developed
2	SCS Runoff	------	0.160	-------	------	-------	------	------	------	------	imp to basin 1
3	SCS Runoff	------	0.136	-------	------	-------	------	------	------	------	to basin 2 (Non wash exit)
4	SCS Runoff	------	0.025	-------	------	-------	------	------	------	------	imp to basin 2 (wash exit)
5	Combine	2,	0.160	-------	------	-------	------	------	------	------	To Basin 1
6	Combine	3, 4,	0.155	-------	------	-------	------	------	------	------	To Basin 2
7	SCS Runoff	------	0.211	-------	------	-------	------	------	------	------	Roofed Area
8	Reservoir	5	0.021	-------	------	-------	------	------	------	------	Inflow to Basin 1
9	Combine	6, 8	0.155	-------	------	-------	------	------	------	------	Inflow to basin 2
10	Reservoir	9	0.000	-------	------	-------	------	------	------	------	Basin 2 Outflow
11	Combine	7, 10	0.211	-------	------	-------	------	------	------	------	Inflow to Infiltrator Chambers
12	Reservoir	11	0.000	-------	------	-------	------	------	------	------	Site Outflow- Chambers

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.123	5	95	382	----	------	----	Pre-Developed
2	SCS Runoff	0.160	5	75	286	----	------	----	imp to basin 1
3	SCS Runoff	0.136	5	75	245	----	----	------	to basin 2 (Non wash exit)
4	SCS Runoff	0.025	5	70	40	----	----	------	imp to basin 2 (wash exit)
5	Combine	0.160	5	75	286	2,	------	----	To Basin 1
6	Combine	0.155	5	75	286	3, 4,	------	----	To Basin 2
7	SCS Runoff	0.211	5	70	334	----	----	------	Roofed Area
8	Reservoir	0.021	5	120	27	5	96.21	268	Inflow to Basin 1
9	Combine	0.155	5	75	312	6, 8	------	------	Inflow to basin 2
10	Reservoir	0.000	5	n/a	0	9	96.19	312	Basin 2 Outflow
11	Combine	0.211	5	70	334	7, 10	----	----	Inflow to Infiltrator Chambers
12	Reservoir	0.000	5	n/a	0	11	95.62	334	Site Outflow- Chambers

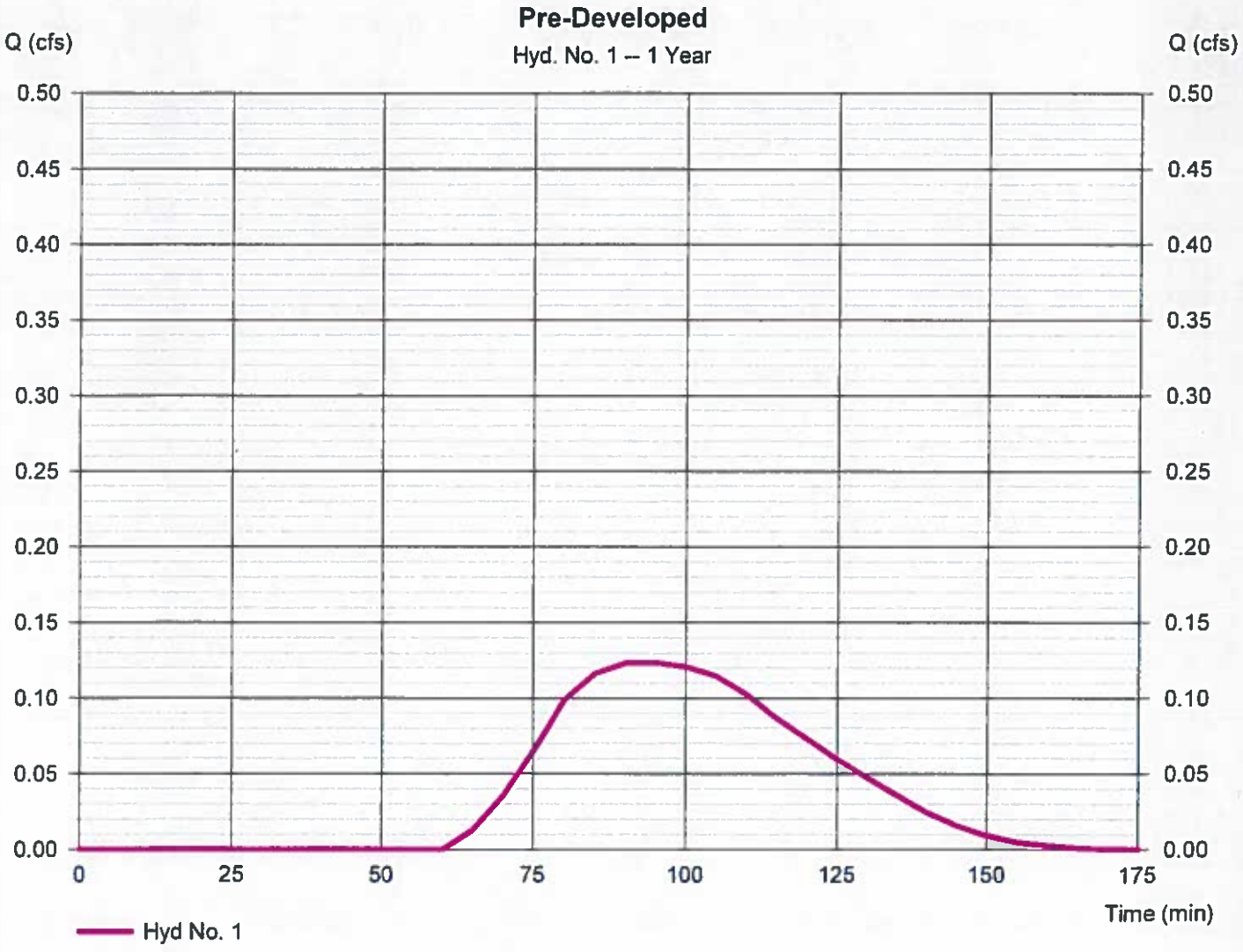
Hydrograph Report

Hyd. No. 1

Pre-Developed

Hydrograph type	= SCS Runoff	Peak discharge	= 0.123 cfs
Storm frequency	= 1 yrs	Time to peak	= 95 min
Time interval	= 5 min	Hyd. volume	= 382 cuft
Drainage area	= 0.874 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 30.90 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= J:\2018-015-125 Posh Carwash Bakersfield\DOCUMENTS & REPORTS\STORM\HY		= 24

* Composite (Area/CN) = [(0.117 x 39) + (0.100 x 30) + (0.247 x 80) + (0.410 x 77)] / 0.874



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 1

Pre-Developed

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.400		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.35		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 25.45**	**+**	**0.00**	**+**	**0.00**	**=**	**25.45**
Shallow Concentrated Flow							
Flow length (ft)	= 130.00		13.00		345.00		
Watercourse slope (%)	= 0.50		21.50		0.65		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.14		9.43		1.64		
Travel Time (min)	**= 1.90**	**+**	**0.02**	**+**	**3.51**	**=**	**5.43**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 30.90 min

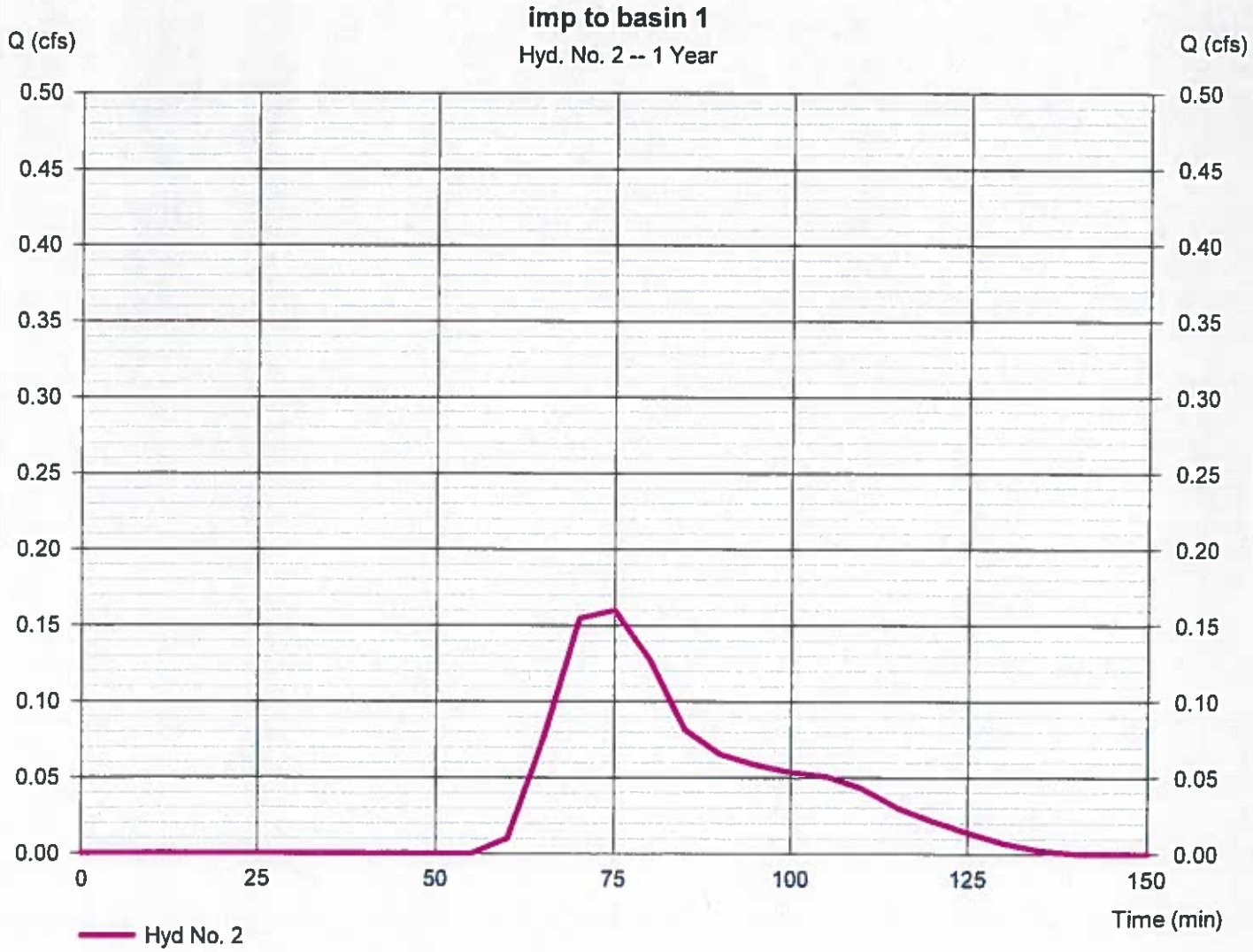
Hydrograph Report

Hyd. No. 2

imp to basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.160 cfs
Storm frequency	= 1 yrs	Time to peak	= 75 min
Time interval	= 5 min	Hyd. volume	= 286 cuft
Drainage area	= 0.390 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= J:\2018-015-125 Posh Carwash Shapefile\DOCUMENTS & REPORTS\STORM\HY	Storm Distribution	

* Composite (Area/CN) = [(0.212 x 98) + (0.175 x 62)] / 0.390



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 2

imp to basin 1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 118.0		32.0		0.0		
Two-year 24-hr precip. (in)	= 3.35		3.35		0.00		
Land slope (%)	= 1.60		1.60		0.00		
Travel Time (min)	**= 11.95**	**+**	**0.52**	**+**	**0.00**	**=**	**12.47**
Shallow Concentrated Flow							
Flow length (ft)	= 75.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 0.55**	**+**	**0.00**	**+**	**0.00**	**=**	**0.55**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 13.00 min

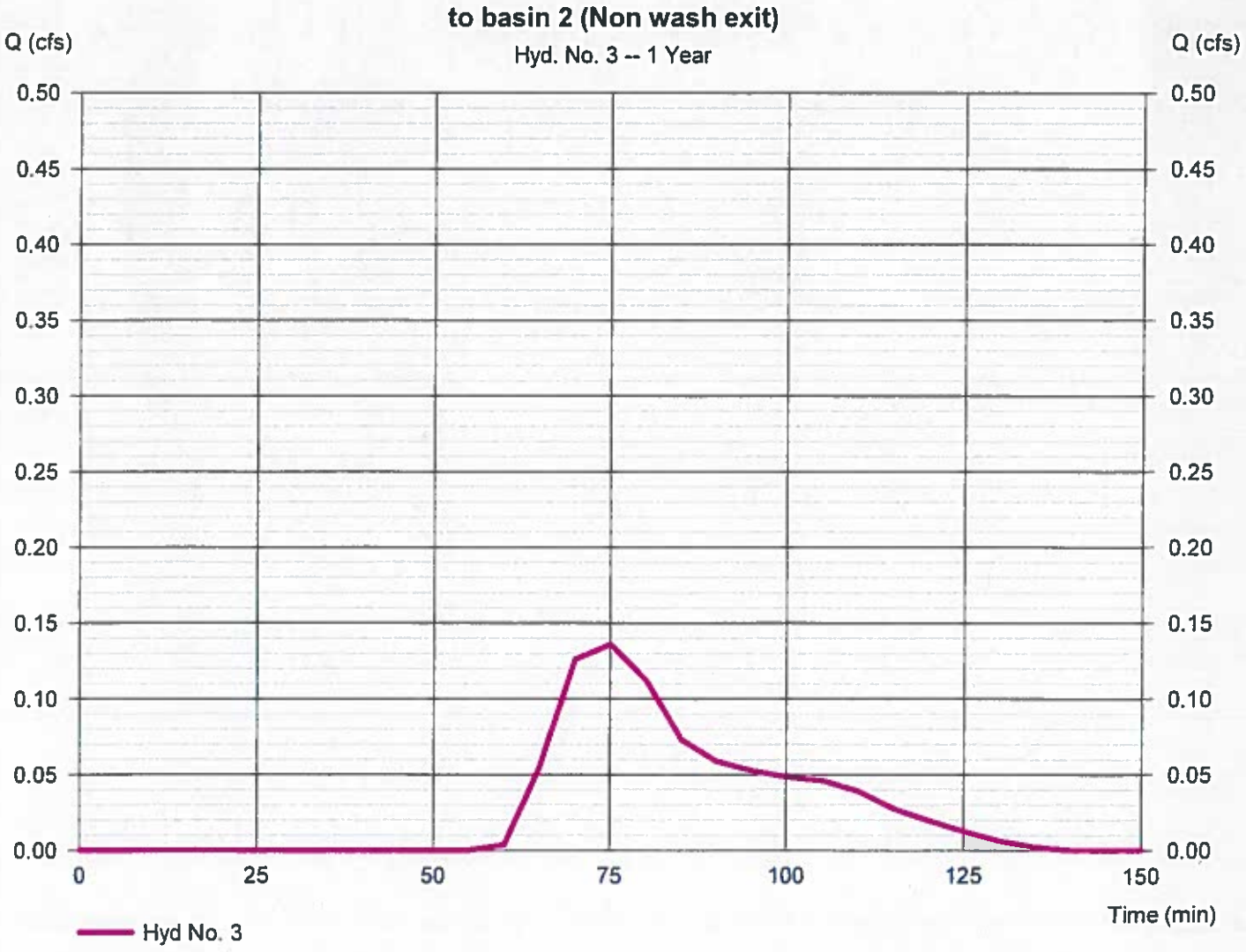
Hydrograph Report

Hyd. No. 3

to basin 2 (Non wash exit)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.136 cfs
Storm frequency	= 1 yrs	Time to peak	= 75 min
Time interval	= 5 min	Hyd. volume	= 245 cuft
Drainage area	= 0.380 ac	Curve number	= 81*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.70 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= J:\2018-015-125 Posh Carwash Shapefile\DOCUMENTS & REPORTS\STORM\HY		

* Composite (Area/CN) = [(0.201 x 98) + (0.175 x 62)] / 0.380



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 3

to basin 2 (Non wash exit)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 97.0		53.0		0.0		
Two-year 24-hr precip. (in)	= 3.35		3.35		0.00		
Land slope (%)	= 1.27		1.27		0.00		
Travel Time (min)	**= 11.21**	**+**	**0.85**	**+**	**0.00**	**=**	**12.06**
Shallow Concentrated Flow							
Flow length (ft)	= 88.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 0.64**	**+**	**0.00**	**+**	**0.00**	**=**	**0.64**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

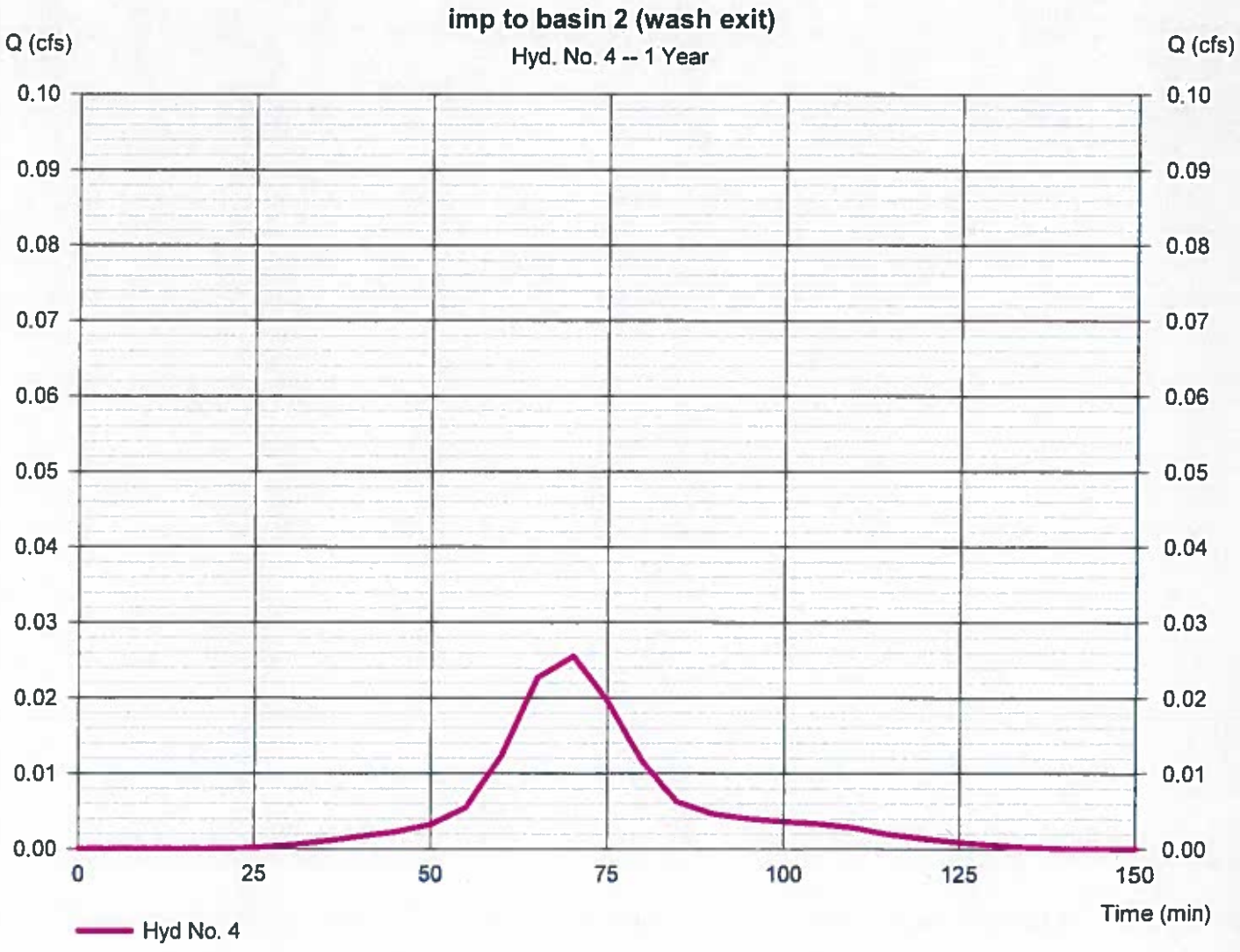
Total Travel Time, Tc ..... 12.70 min

Hydrograph Report

Hyd. No. 4

imp to basin 2 (wash exit)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.025 cfs
Storm frequency	= 1 yrs	Time to peak	= 70 min
Time interval	= 5 min	Hyd. volume	= 40 cuft
Drainage area	= 0.012 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= J:\2018-015-125 Posh Carwash Bakersfield\DOCUMENTS & REPORTS\STORM\HY	Storm Duration	= 24

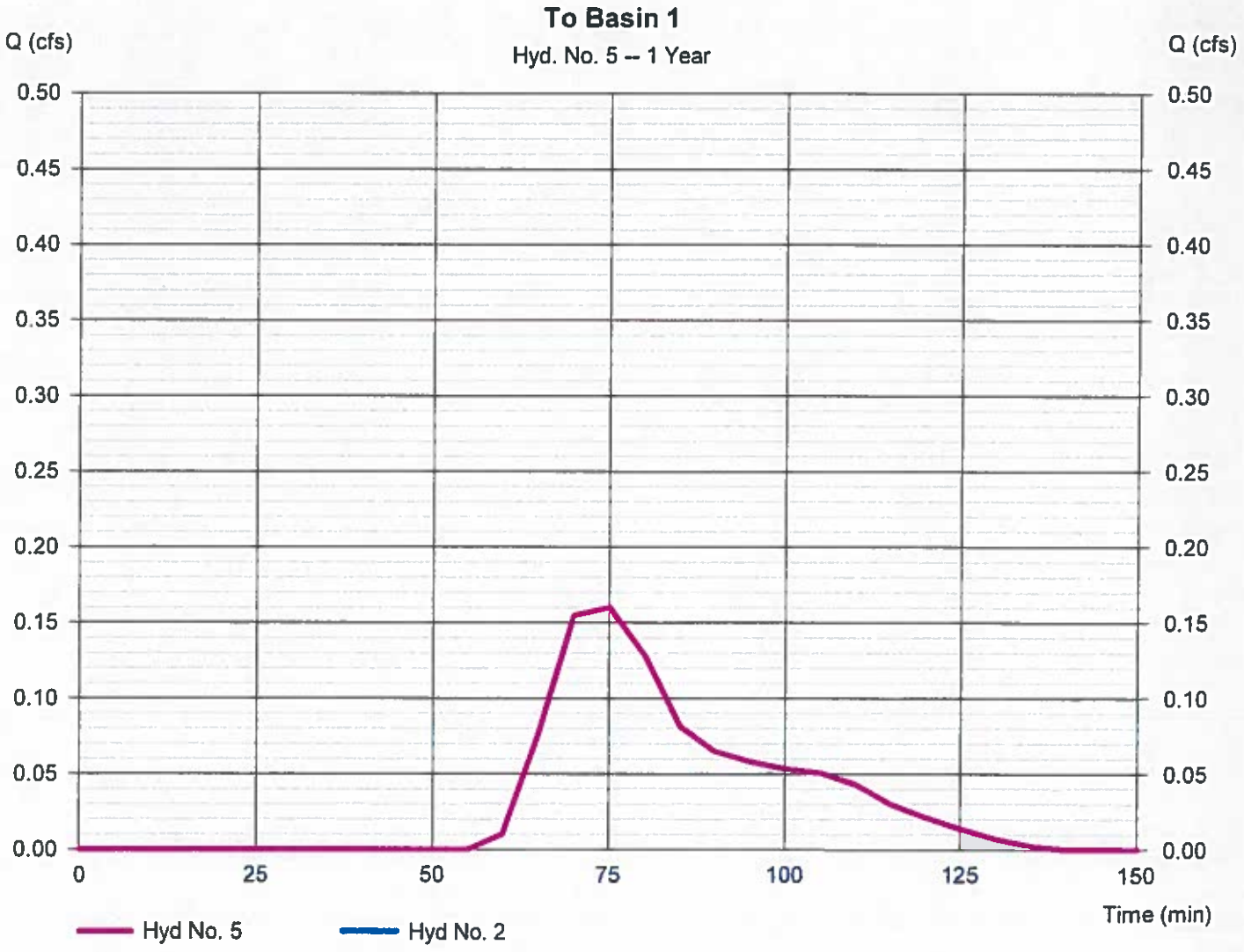


Hydrograph Report

Hyd. No. 5

To Basin 1

Hydrograph type	= Combine	Peak discharge	= 0.160 cfs
Storm frequency	= 1 yrs	Time to peak	= 75 min
Time interval	= 5 min	Hyd. volume	= 286 cuft
Inflow hyds.	= 2	Contrib. drain. area	= 0.390 ac

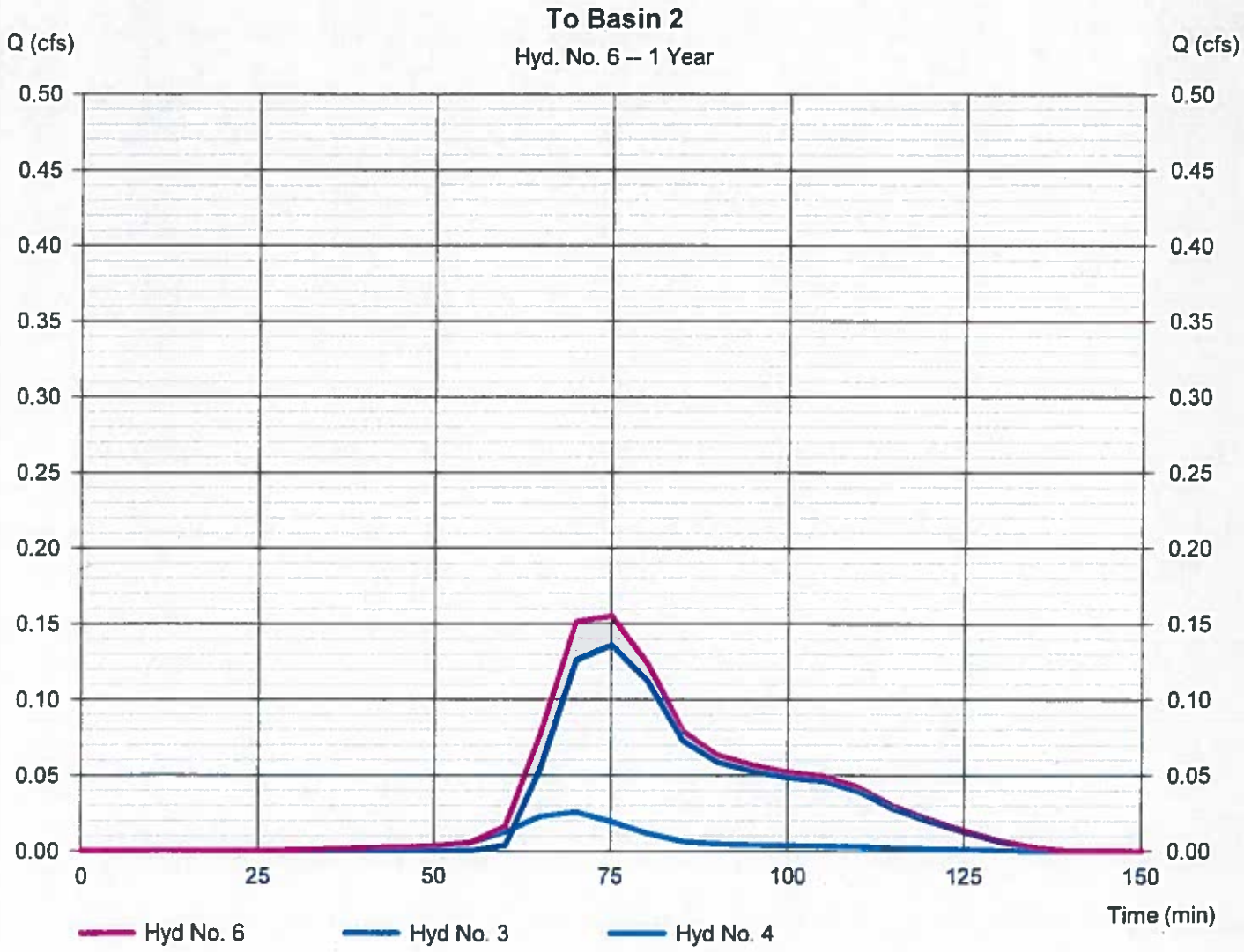


Hydrograph Report

Hyd. No. 6

To Basin 2

Hydrograph type	= Combine	Peak discharge	= 0.155 cfs
Storm frequency	= 1 yrs	Time to peak	= 75 min
Time interval	= 5 min	Hyd. volume	= 286 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 0.391 ac

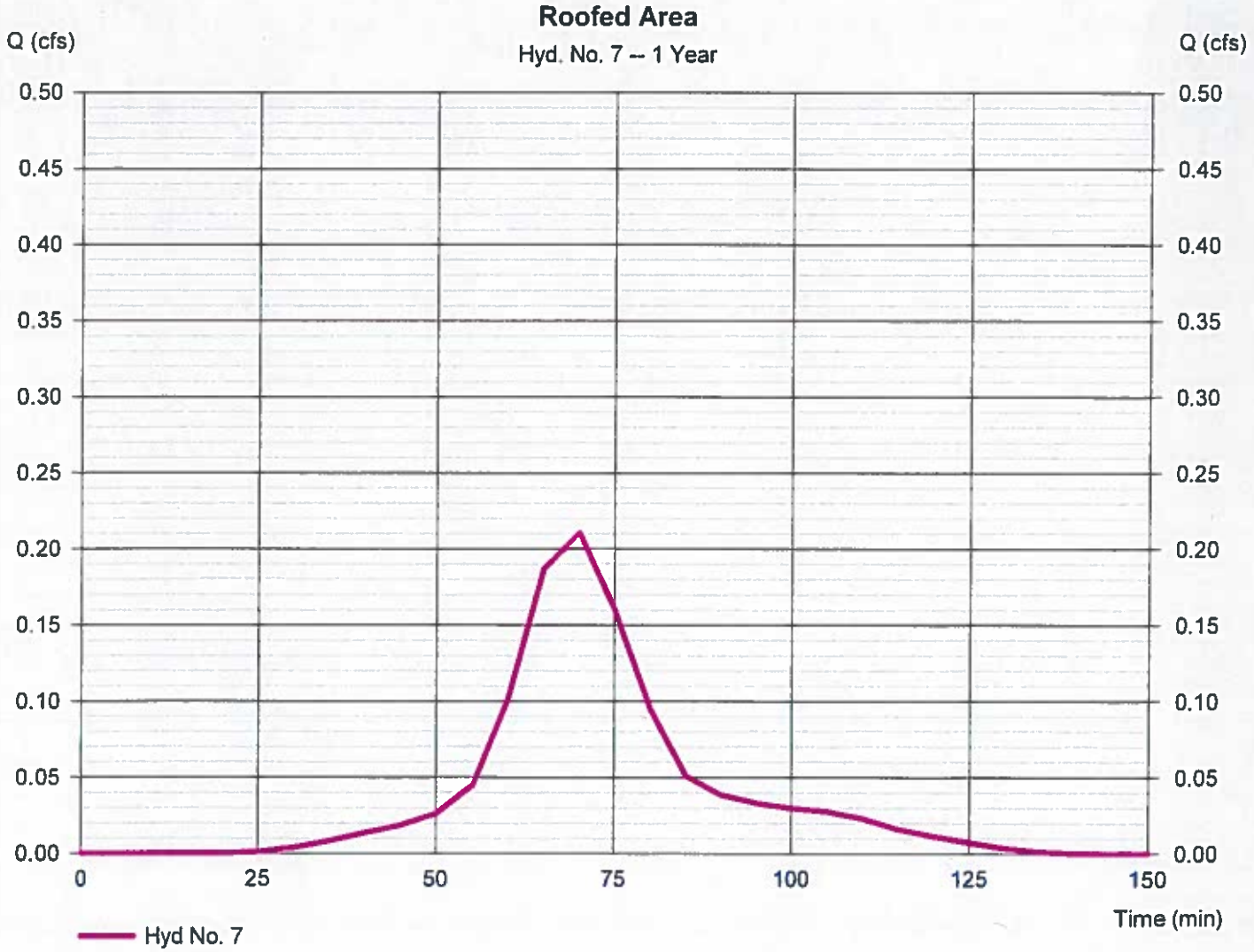


Hydrograph Report

Hyd. No. 7

Roofed Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.211 cfs
Storm frequency	= 1 yrs	Time to peak	= 70 min
Time interval	= 5 min	Hyd. volume	= 334 cuft
Drainage area	= 0.095 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= J:\2018-015-125 Posh Carwash Bakersfield\DOCUMENTS & REPORTS\STORM\HY	Storm Duration	= 24



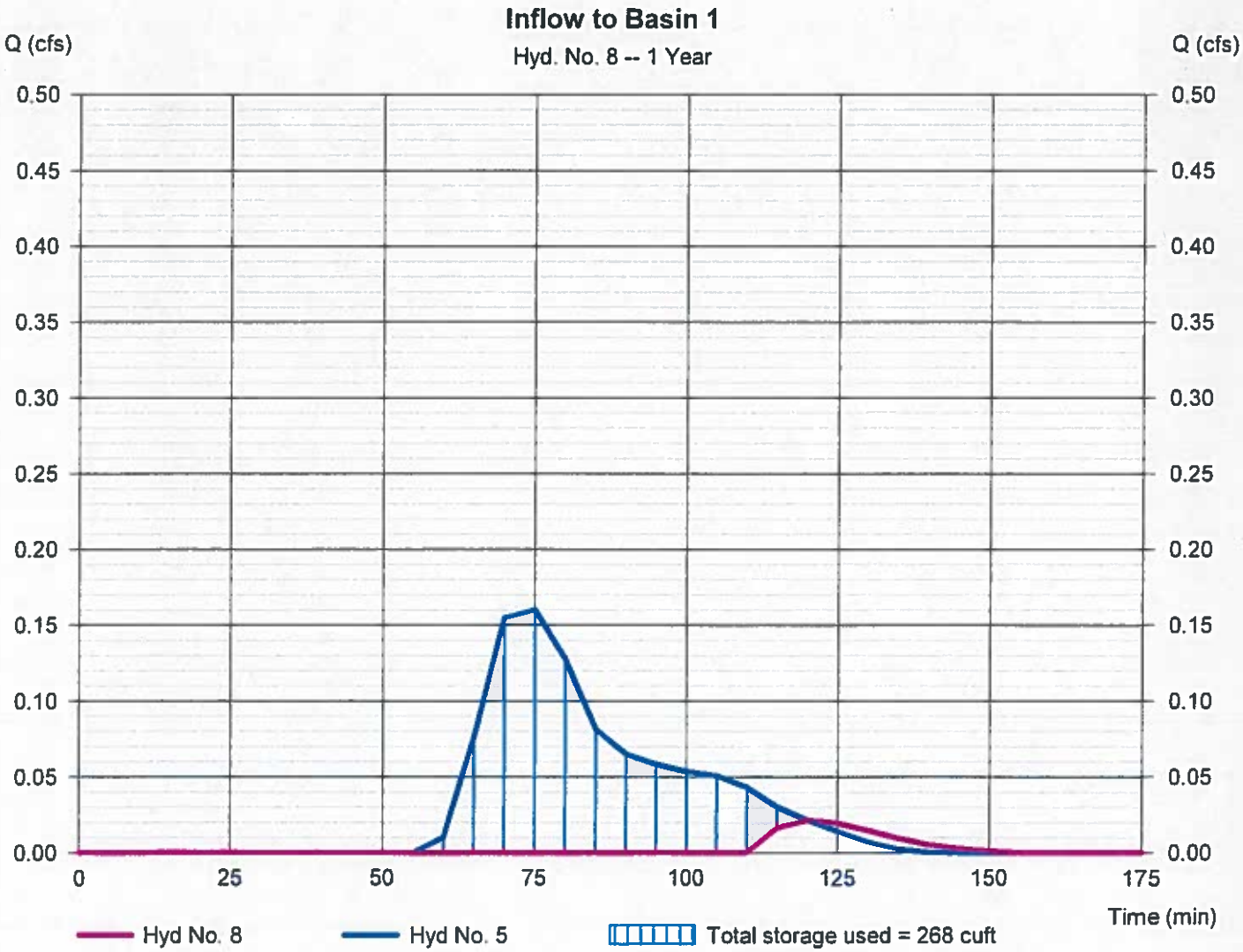
Hydrograph Report

Hyd. No. 8

Inflow to Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 0.021 cfs
Storm frequency	= 1 yrs	Time to peak	= 120 min
Time interval	= 5 min	Hyd. volume	= 27 cuft
Inflow hyd. No.	= 5 - To Basin 1	Max. Elevation	= 96.21 ft
Reservoir name	= Sand Basin #1	Max. Storage	= 268 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Sand Basin #1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 96.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	96.00	1,230	0	0
1.00	97.00	1,362	1,295	1,295
2.00	98.00	1,472	1,417	2,712
3.00	99.00	2,019	1,738	4,450
3.50	98.00	2,200	1,054	5,504

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	Inactive
Span (in)	= 24.00	24.00	15.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 96.80	96.80	96.80	0.00
Length (ft)	= 44.00	44.00	44.00	0.00
Slope (%)	= 0.50	5.00	0.50	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 25.00	4.00	Inactive	Inactive
Crest El. (ft)	= 98.98	96.22	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Rect	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

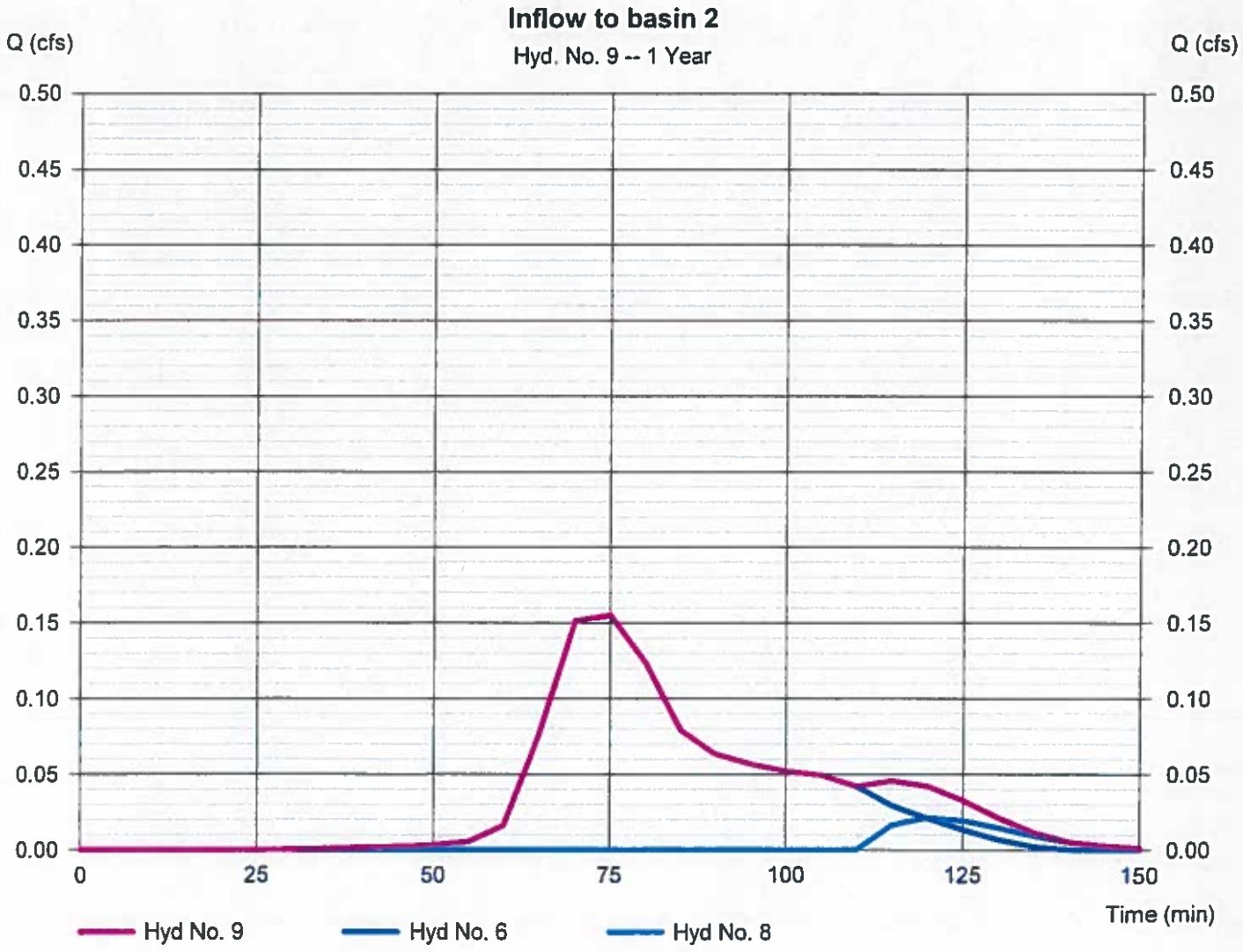
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	96.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.00	1,295	97.00	0.00	0.00	0.00	---	0.00	9.18	---	---	---	---	9.176
2.00	2,712	98.00	0.00	0.00	0.00	---	0.00	31.63	---	---	---	---	31.63
3.00	4,450	99.00	0.00	0.00	0.00	---	0.24	61.74	---	---	---	---	61.98
3.50	5,504	98.00	0.00	0.00	0.00	---	0.00	31.63	---	---	---	---	31.63

Hydrograph Report

Hyd. No. 9

Inflow to basin 2

Hydrograph type	= Combine	Peak discharge	= 0.155 cfs
Storm frequency	= 1 yrs	Time to peak	= 75 min
Time interval	= 5 min	Hyd. volume	= 312 cuft
Inflow hyds.	= 6, 8	Contrib. drain. area	= 0.000 ac



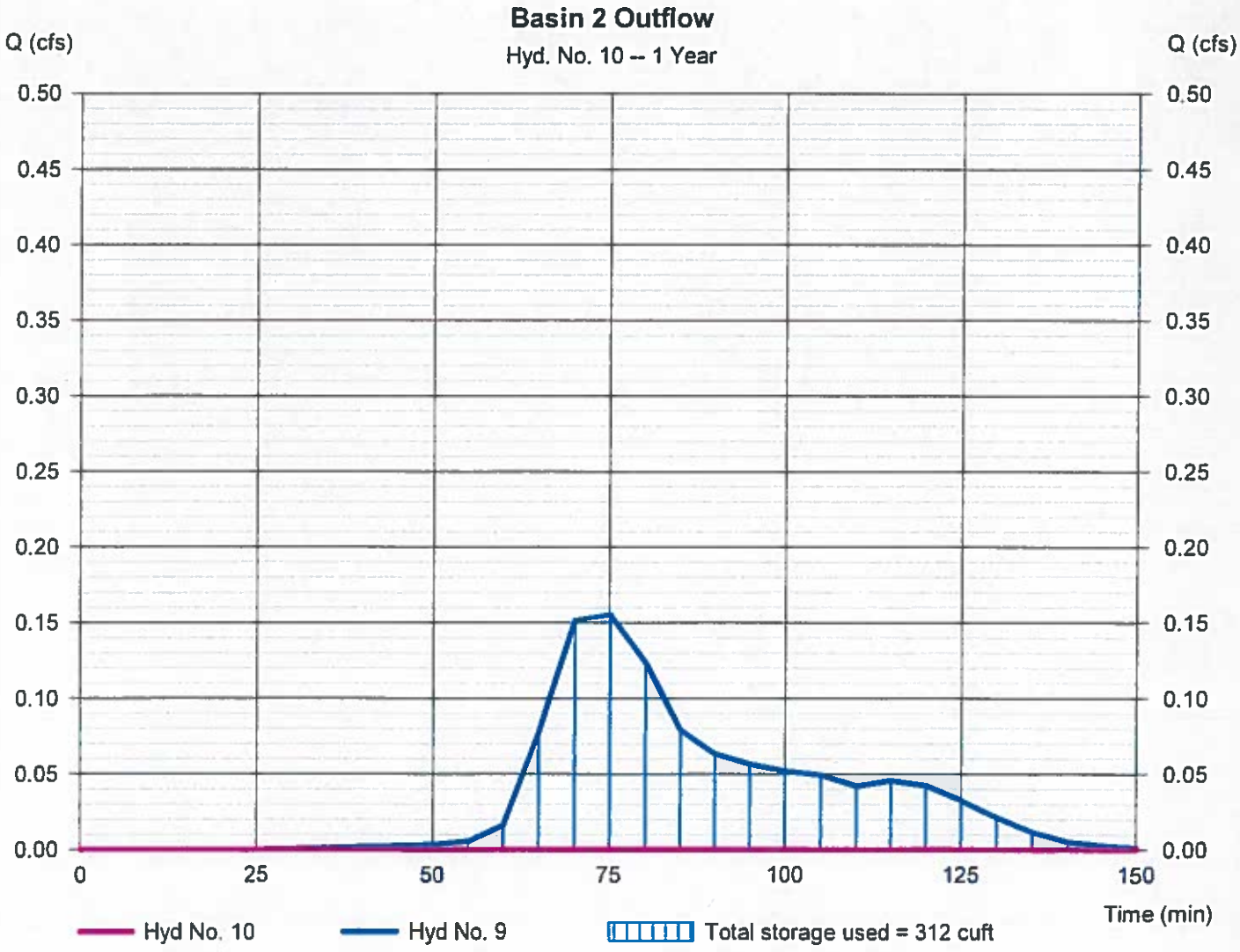
Hydrograph Report

Hyd. No. 10

Basin 2 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 9 - Inflow to basin 2	Max. Elevation	= 96.19 ft
Reservoir name	= SAND BASIN #2	Max. Storage	= 312 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - SAND BASIN #2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 96.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	96.00	1,495	0	0
1.00	97.00	1,864	1,676	1,676
2.00	98.00	2,235	2,046	3,722
3.00	99.00	2,948	2,583	6,305
3.50	99.50	3,200	1,536	7,842

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	0.00
Span (in)	= 15.00	2.50	6.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 96.00	96.24	97.60	0.00
Length (ft)	= 255.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	4.00	Inactive	0.00
Crest El. (ft)	= 98.42	96.20	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Rect	Rect	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

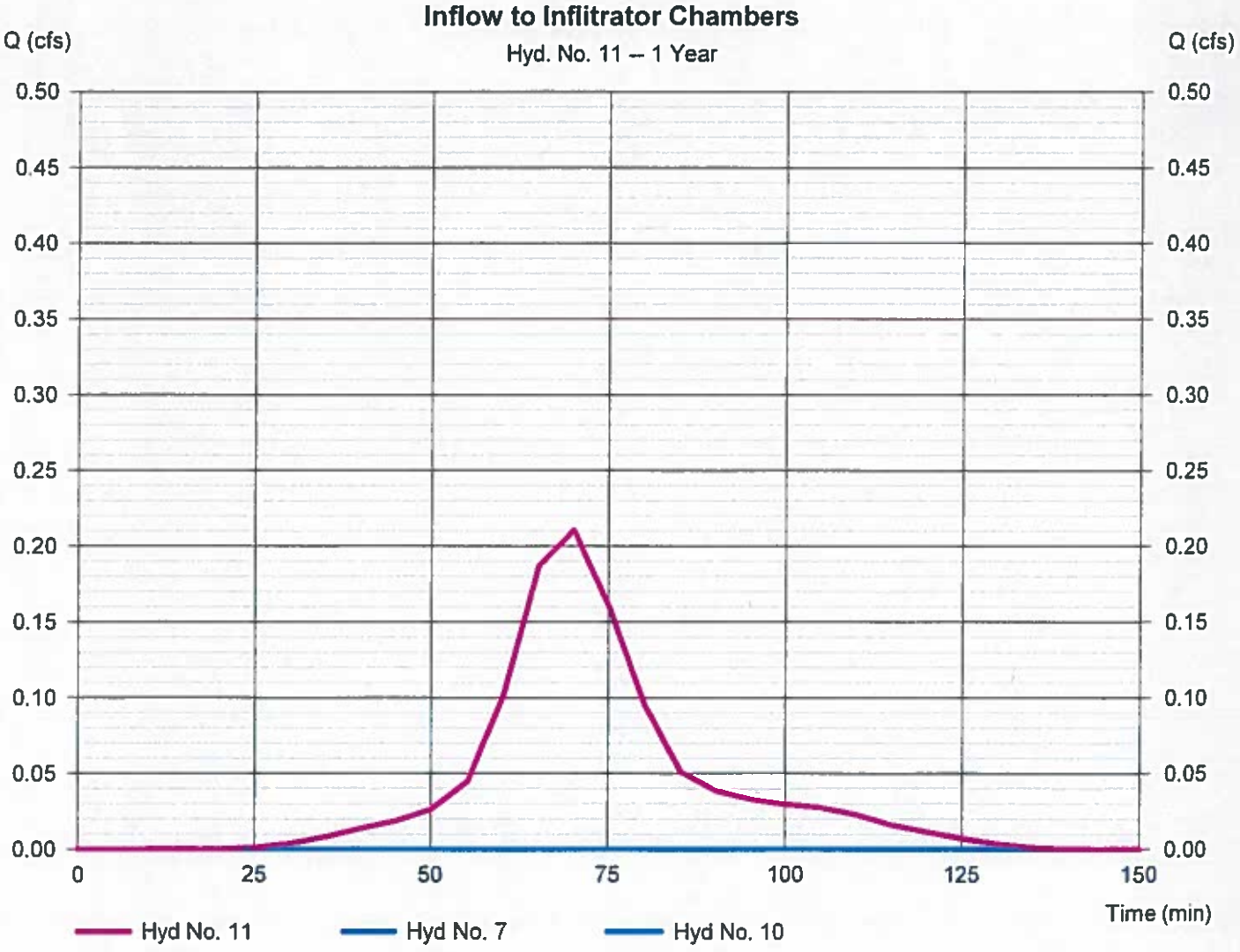
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	96.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.00	1,676	97.00	0.00	0.00	0.00	---	0.00	9.53	---	---	---	---	9.531
2.00	3,722	98.00	0.00	0.00	0.00	---	0.00	32.17	---	---	---	---	32.17
3.00	6,305	99.00	0.00	0.00	0.00	---	0.00	62.41	---	---	---	---	62.41
3.50	7,842	99.50	0.00	0.00	0.00	---	0.00	79.85	---	---	---	---	79.85

Hydrograph Report

Hyd. No. 11

Inflow to Inflitrator Chambers

Hydrograph type	= Combine	Peak discharge	= 0.211 cfs
Storm frequency	= 1 yrs	Time to peak	= 70 min
Time interval	= 5 min	Hyd. volume	= 334 cuft
Inflow hyds.	= 7, 10	Contrib. drain. area	= 0.095 ac



Hydrograph Report

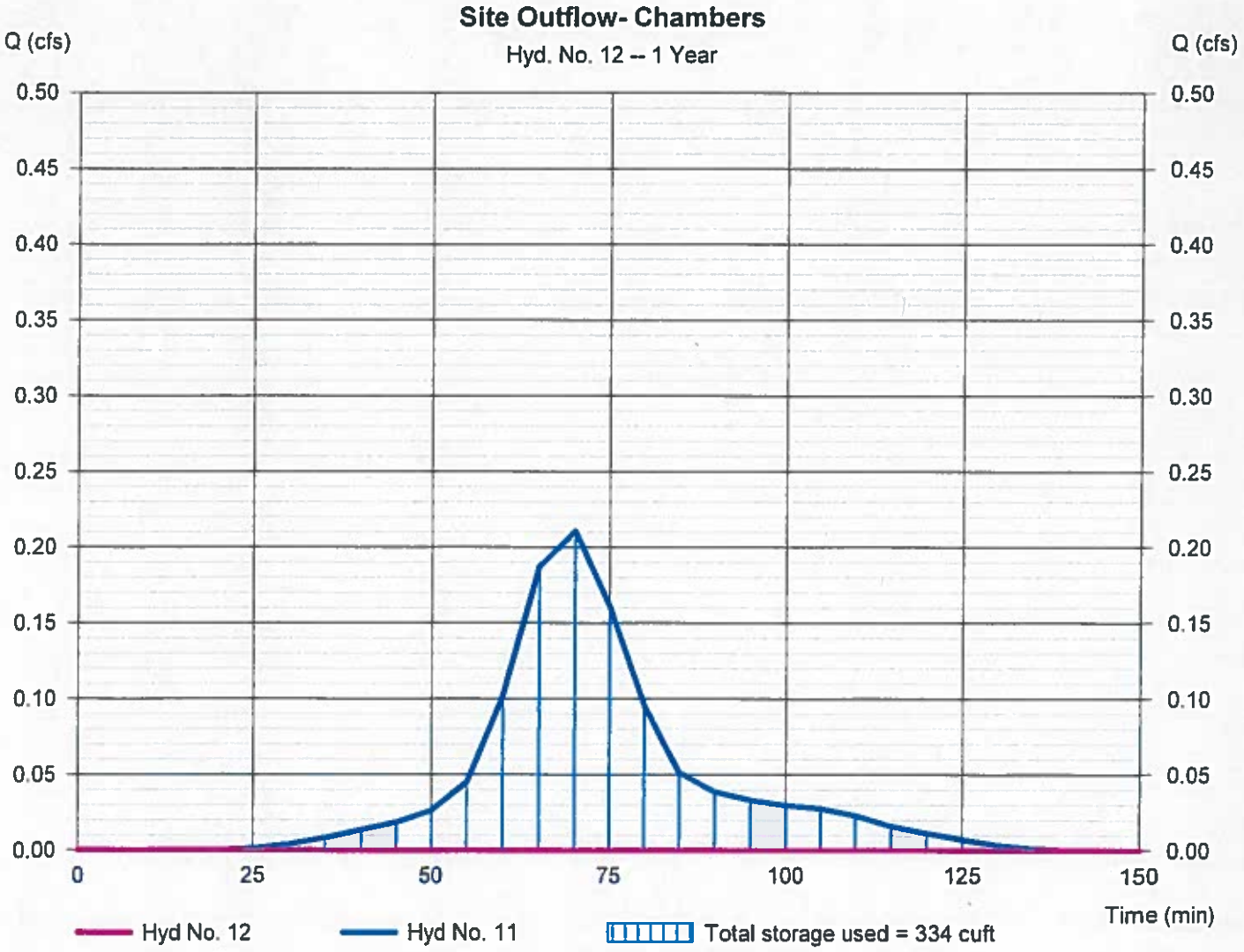
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Tuesday, 02 / 16 / 2021

Hyd. No. 12

Site Outflow- Chambers

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 11 - Inflow to Inflitrator Chambers	Max. Elevation	= 95.62 ft
Reservoir name	= Recharge Chambers	Max. Storage	= 334 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Recharge Chambers

Pond Data

UG Chambers -Invert elev. = 95.50 ft, Rise x Span = 2.50 x 4.25 ft, Barrel Len = 7.12 ft, No. Barrels = 24, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 95.00 ft, Width = 6.25 ft, Height = 3.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	95.00	n/a	0	0
0.35	95.35	n/a	150	150
0.70	95.70	n/a	237	386
1.05	96.05	n/a	300	686
1.40	96.40	n/a	295	982
1.75	96.75	n/a	287	1,269
2.10	97.10	n/a	275	1,544
2.45	97.45	n/a	257	1,800
2.80	97.80	n/a	229	2,029
3.15	98.15	n/a	173	2,202
3.50	98.50	n/a	150	2,351

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	95.00	---	---	---	---	---	---	---	---	---	---	0.000
0.35	150	95.35	---	---	---	---	---	---	---	---	---	---	0.000
0.70	386	95.70	---	---	---	---	---	---	---	---	---	---	0.000
1.05	686	96.05	---	---	---	---	---	---	---	---	---	---	0.000
1.40	982	96.40	---	---	---	---	---	---	---	---	---	---	0.000
1.75	1,269	96.75	---	---	---	---	---	---	---	---	---	---	0.000
2.10	1,544	97.10	---	---	---	---	---	---	---	---	---	---	0.000
2.45	1,800	97.45	---	---	---	---	---	---	---	---	---	---	0.000
2.80	2,029	97.80	---	---	---	---	---	---	---	---	---	---	0.000
3.15	2,202	98.15	---	---	---	---	---	---	---	---	---	---	0.000
3.50	2,351	98.50	---	---	---	---	---	---	---	---	---	---	0.000

Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	49.1011	12.2000	0.8732	———
2	57.2873	12.3000	0.8621	———
3	0.0000	0.0000	0.0000	———
5	0.0000	0.0000	0.0000	———
10	65.8347	12.6000	0.8085	———
25	57.5756	11.1000	0.7423	———
50	0.0000	0.0000	0.0000	———
100	48.4935	9.2000	0.6560	———

File name: Long Branch.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.09	3.28	2.74	2.37	2.09	1.87	1.70	1.55	1.43	1.33	1.25	1.17
2	4.91	3.94	3.31	2.86	2.53	2.27	2.06	1.89	1.75	1.63	1.52	1.43
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	6.48	5.29	4.50	3.94	3.51	3.17	2.90	2.67	2.48	2.32	2.18	2.06
25	7.32	5.99	5.11	4.49	4.02	3.65	3.35	3.11	2.90	2.72	2.57	2.43
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	8.51	6.98	6.00	5.30	4.78	4.37	4.04	3.76	3.53	3.33	3.16	3.01

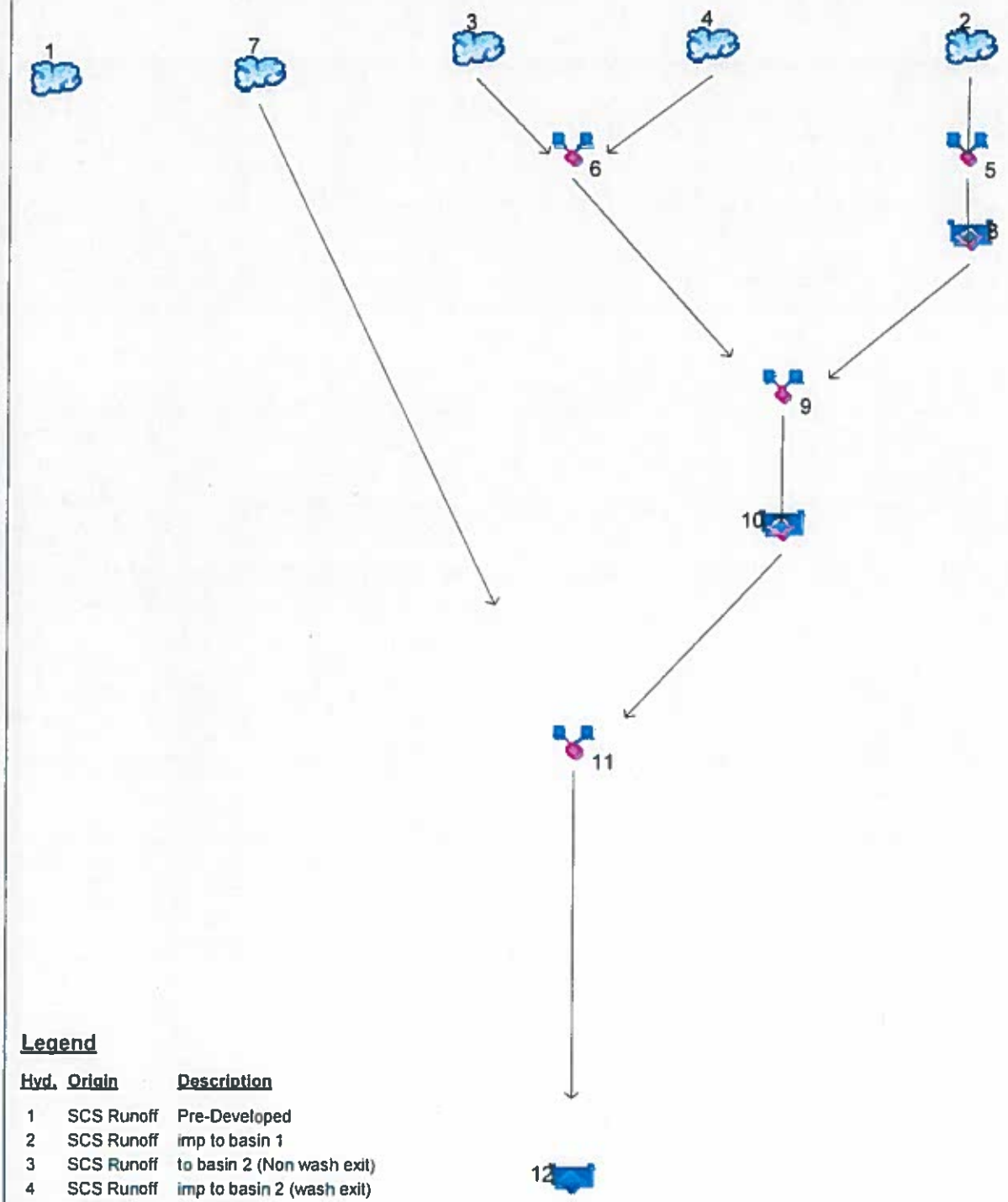
Tc = time in minutes. Values may exceed 60.

Precip. file name: Monmouth Cty 24hr rainfall.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.35	0.00	0.00	5.16	0.00	0.00	8.76
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.20
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021



Legend

Hyd.	Origin	Description
1	SCS Runoff	Pre-Developed
2	SCS Runoff	imp to basin 1
3	SCS Runoff	to basin 2 (Non wash exit)
4	SCS Runoff	imp to basin 2 (wash exit)
5	Combine	To Basin 1
6	Combine	To Basin 2
7	SCS Runoff	Roofed Area
8	Reservoir(i)	Inflow to Basin 1
9	Combine	Inflow to basin 2
10	Reservoir(i)	Basin 2 Outflow
11	Combine	Inflow to Infiltrator Chambers
12	Reservoir	Site Outflow- Chambers

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	0.950	-----	-----	2.043	-----	-----	4.424	Pre-Developed
2	SCS Runoff	-----	-----	0.934	-----	-----	1.804	-----	-----	3.586	imp to basin 1
3	SCS Runoff	-----	-----	0.869	-----	-----	1.710	-----	-----	3.444	to basin 2 (Non wash exit)
4	SCS Runoff	-----	-----	0.046	-----	-----	0.071	-----	-----	0.121	imp to basin 2 (wash exit)
5	Combine	2,	-----	0.934	-----	-----	1.804	-----	-----	3.586	To Basin 1
6	Combine	3, 4,	-----	0.915	-----	-----	1.781	-----	-----	3.565	To Basin 2
7	SCS Runoff	-----	-----	0.378	-----	-----	0.587	-----	-----	1.000	Roofed Area
8	Reservoir(i)	5	-----	0.052	-----	-----	0.118	-----	-----	0.501	Inflow to Basin 1
9	Combine	6, 8	-----	0.915	-----	-----	1.806	-----	-----	3.718	Inflow to basin 2
10	Reservoir(i)	9	-----	0.084	-----	-----	0.154	-----	-----	1.411	Basin 2 Outflow
11	Combine	7, 10	-----	0.378	-----	-----	0.616	-----	-----	2.635	Inflow to Infiltrator Chambers
12	Reservoir	11	-----	0.302	-----	-----	0.518	-----	-----	2.331	Site Outflow- Chambers

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.950	2	734	4,240	----	------	----	Pre-Developed
2	SCS Runoff	0.934	2	720	2,423	----	------	----	imp to basin 1
3	SCS Runoff	0.869	2	720	2,259	------	----	----	to basin 2 (Non wash exit)
4	SCS Runoff	0.046	2	720	134	----	----	------	imp to basin 2 (wash exit)
5	Combine	0.934	2	720	2,423	2,	------	----	To Basin 1
6	Combine	0.915	2	720	2,393	3, 4,	------	----	To Basin 2
7	SCS Runoff	0.378	2	720	1,108	------	----	------	Roofed Area
8	Reservoir(i)	0.052	2	826	1,644	5	96.57	1,512	Inflow to Basin 1
9	Combine	0.915	2	720	4,186	6, 8	------	------	Inflow to basin 2
10	Reservoir(i)	0.084	2	924	3,425	9	96.62	1,811	Basin 2 Outflow
11	Combine	0.378	2	720	4,665	7, 10	------	----	Inflow to Infiltrator Chambers
12	Reservoir	0.302	2	724	4,414	11	95.75	430	Site Outflow- Chambers

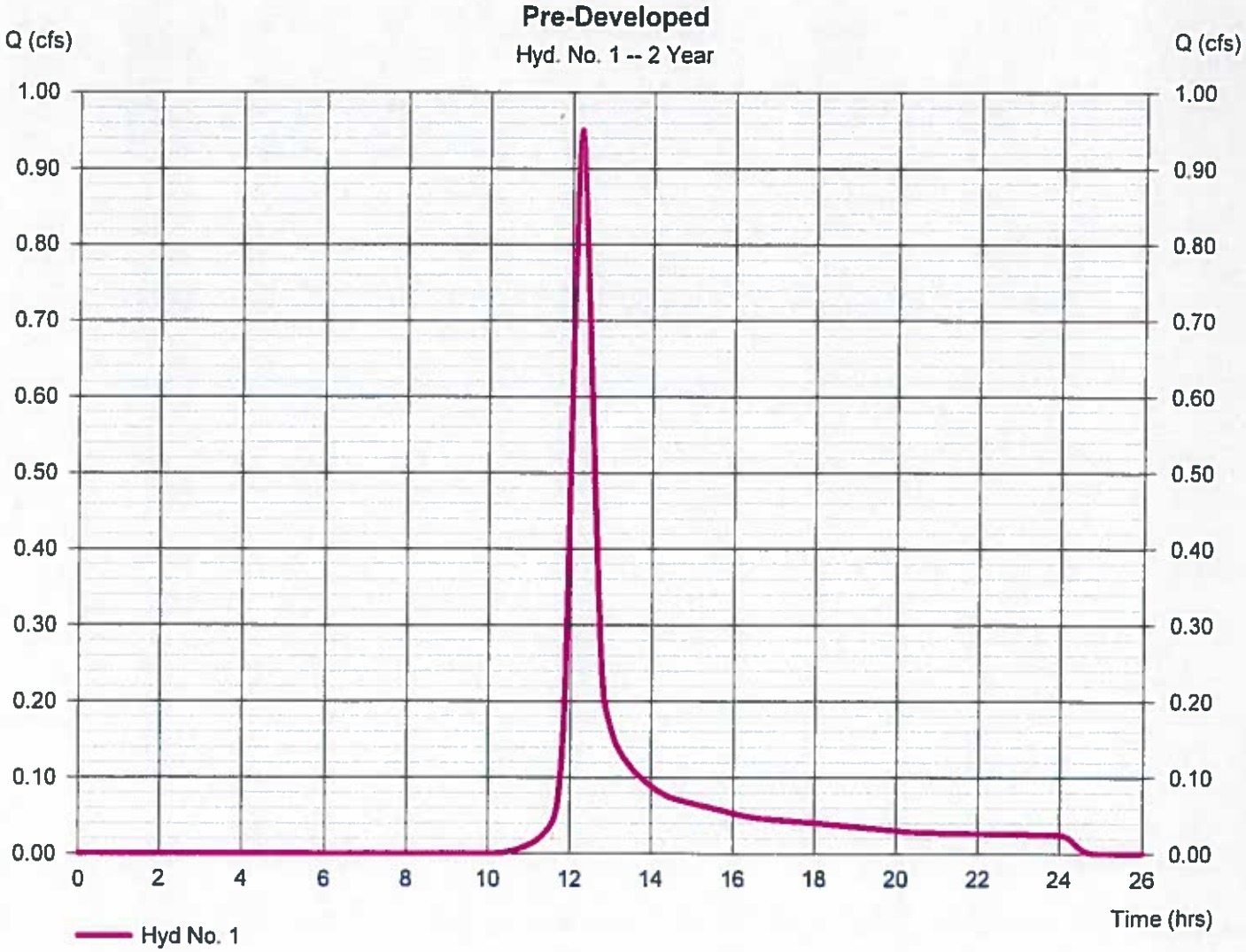
Hydrograph Report

Hyd. No. 1

Pre-Developed

Hydrograph type	= SCS Runoff	Peak discharge	= 0.950 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 4,240 cuft
Drainage area	= 0.874 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 30.90 min
Total precip.	= 3.35 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.117 x 39) + (0.100 x 30) + (0.247 x 80) + (0.410 x 77)] / 0.874



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 1

Pre-Developed

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.400		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.35		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 25.45**	**+**	**0.00**	**+**	**0.00**	**=**	**25.45**
Shallow Concentrated Flow							
Flow length (ft)	= 130.00		13.00		345.00		
Watercourse slope (%)	= 0.50		21.50		0.65		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.14		9.43		1.64		
Travel Time (min)	**= 1.90**	**+**	**0.02**	**+**	**3.51**	**=**	**5.43**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 30.90 min

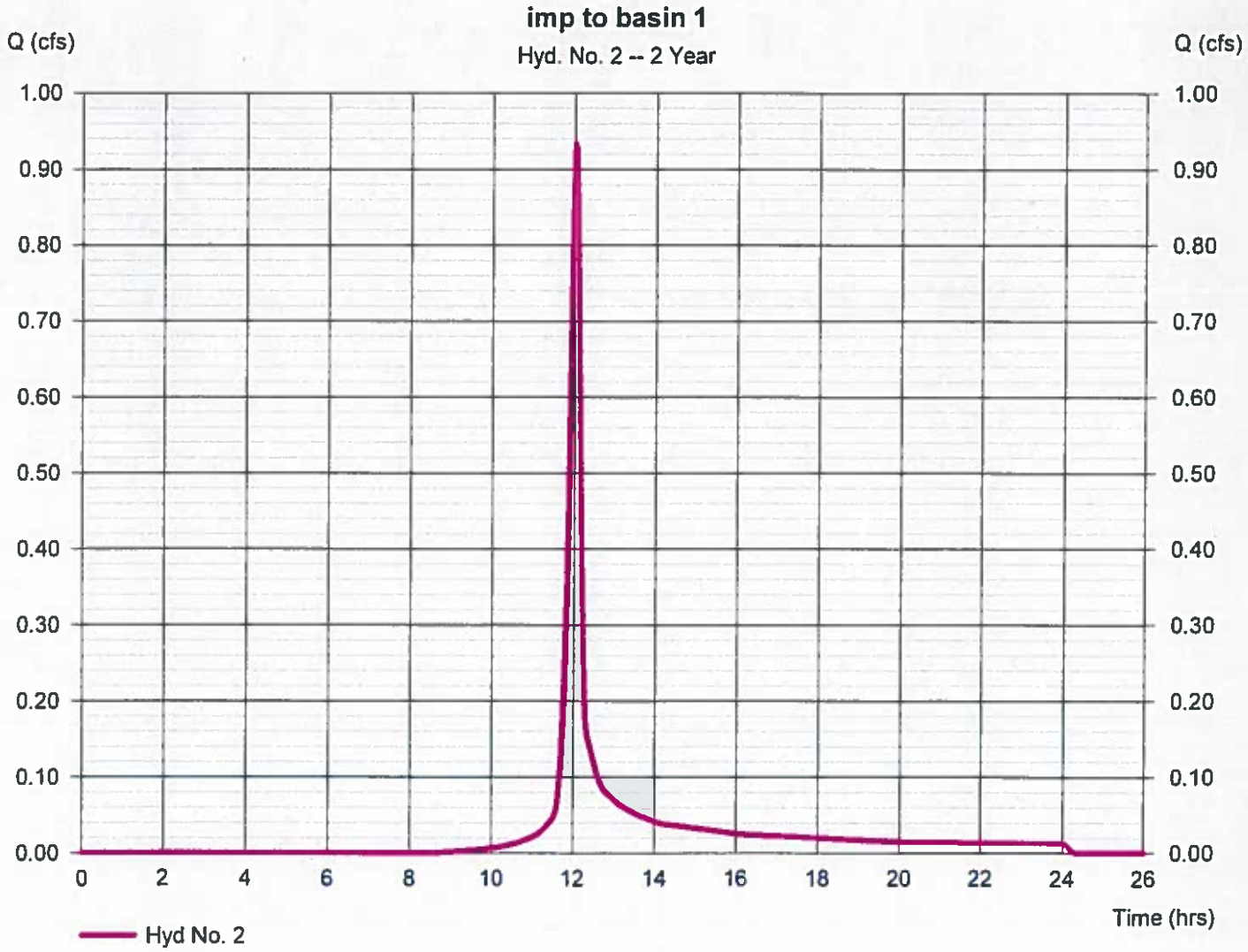
Hydrograph Report

Hyd. No. 2

imp to basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.934 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 2,423 cuft
Drainage area	= 0.390 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.00 min
Total precip.	= 3.35 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.212 x 98) + (0.175 x 62)] / 0.390



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 2

imp to basin 1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 118.0		32.0		0.0		
Two-year 24-hr precip. (in)	= 3.35		3.35		0.00		
Land slope (%)	= 1.60		1.60		0.00		
Travel Time (min)	**= 11.95**	**+**	**0.52**	**+**	**0.00**	**=**	**12.47**
Shallow Concentrated Flow							
Flow length (ft)	= 75.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 0.55**	**+**	**0.00**	**+**	**0.00**	**=**	**0.55**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 13.00 min

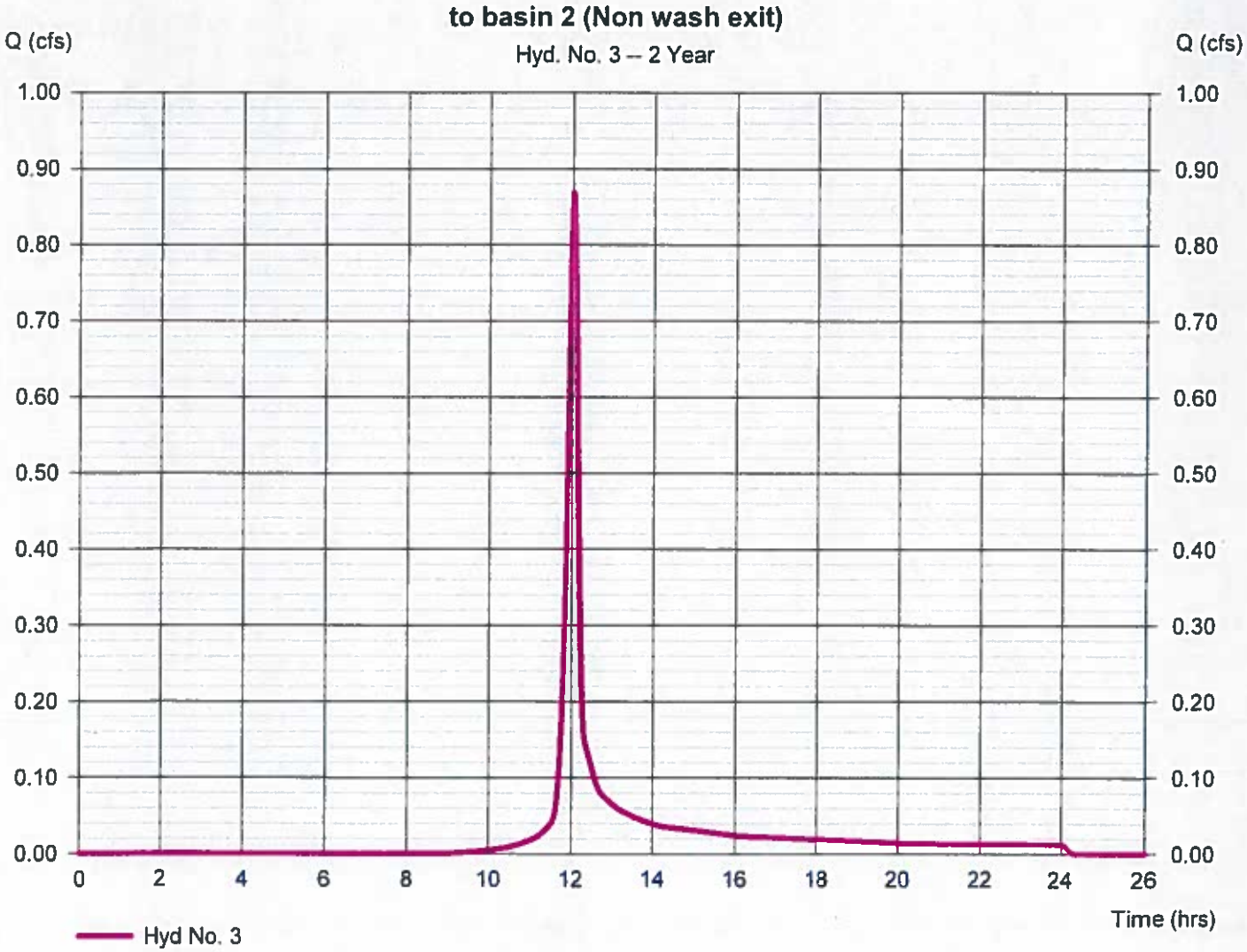
Hydrograph Report

Hyd. No. 3

to basin 2 (Non wash exit)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.869 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 2,259 cuft
Drainage area	= 0.380 ac	Curve number	= 81*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.70 min
Total precip.	= 3.35 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.201 x 98) + (0.175 x 62)] / 0.380



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 3

to basin 2 (Non wash exit)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 97.0		53.0		0.0		
Two-year 24-hr precip. (in)	= 3.35		3.35		0.00		
Land slope (%)	= 1.27		1.27		0.00		
Travel Time (min)	**= 11.21**	**+**	**0.85**	**+**	**0.00**	**=**	**12.06**
Shallow Concentrated Flow							
Flow length (ft)	= 88.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 0.64**	**+**	**0.00**	**+**	**0.00**	**=**	**0.64**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

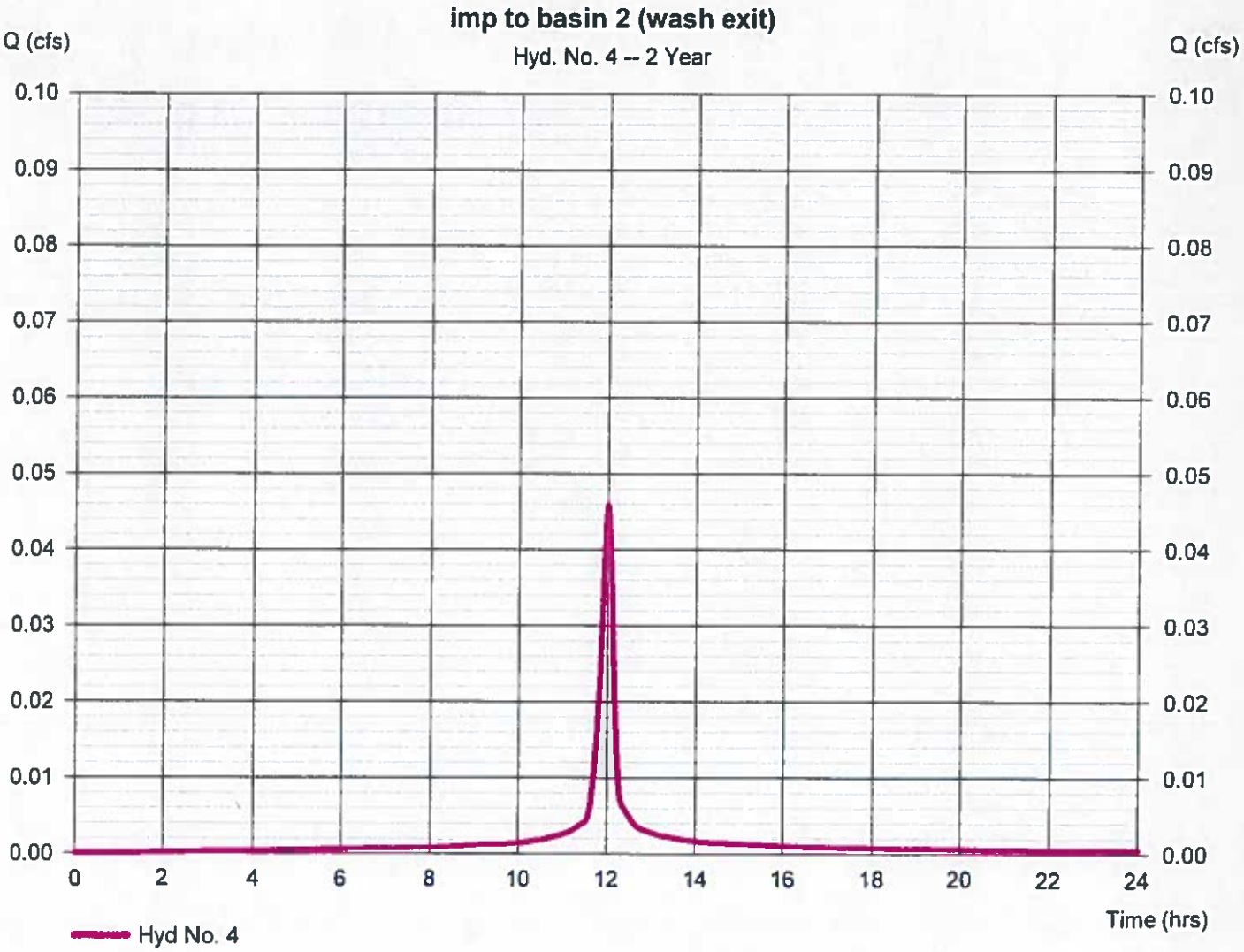
Total Travel Time, Tc ..... 12.70 min

Hydrograph Report

Hyd. No. 4

imp to basin 2 (wash exit)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.046 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 134 cuft
Drainage area	= 0.012 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.35 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

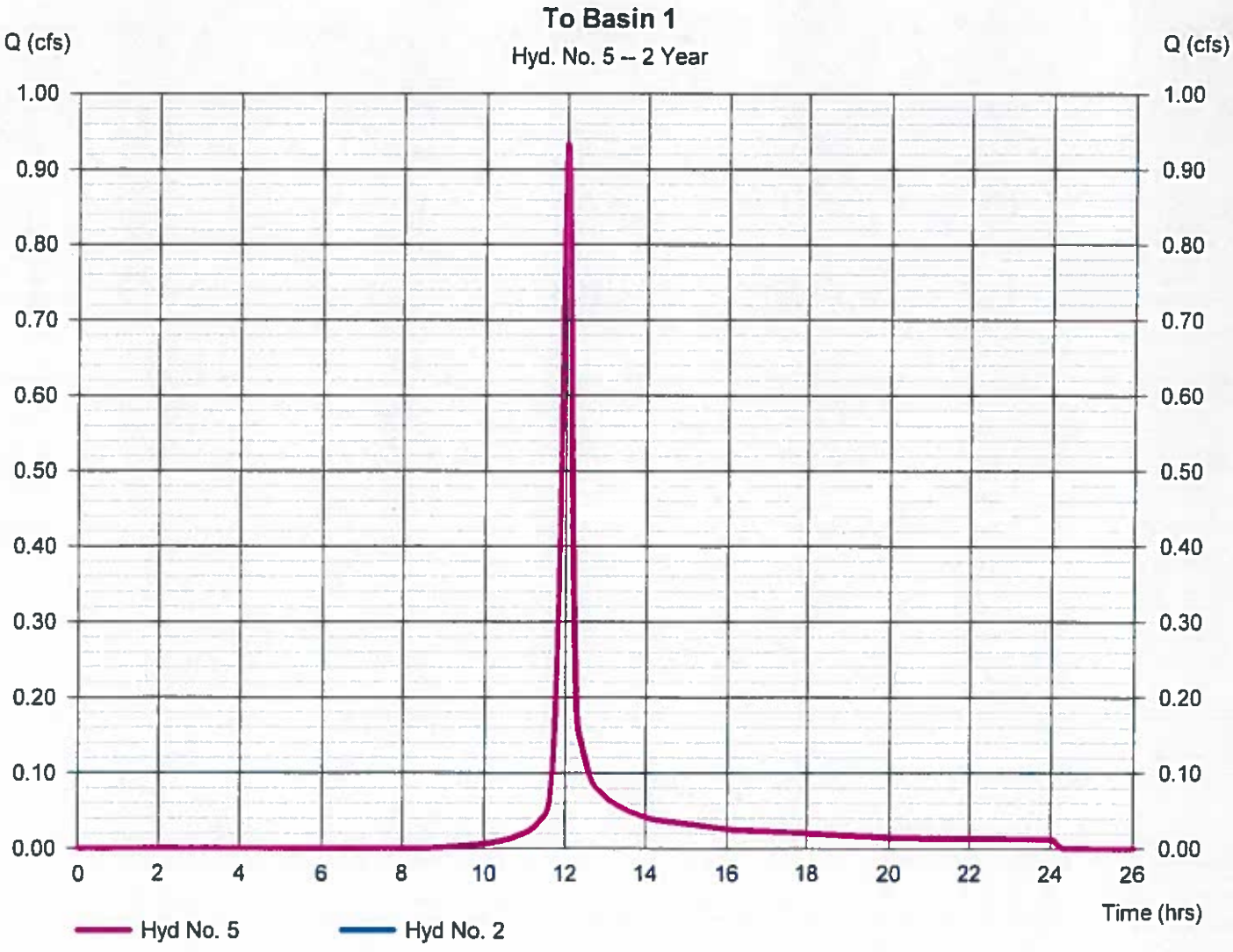


Hydrograph Report

Hyd. No. 5

To Basin 1

Hydrograph type	= Combine	Peak discharge	= 0.934 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 2,423 cuft
Inflow hyds.	= 2	Contrib. drain. area	= 0.390 ac

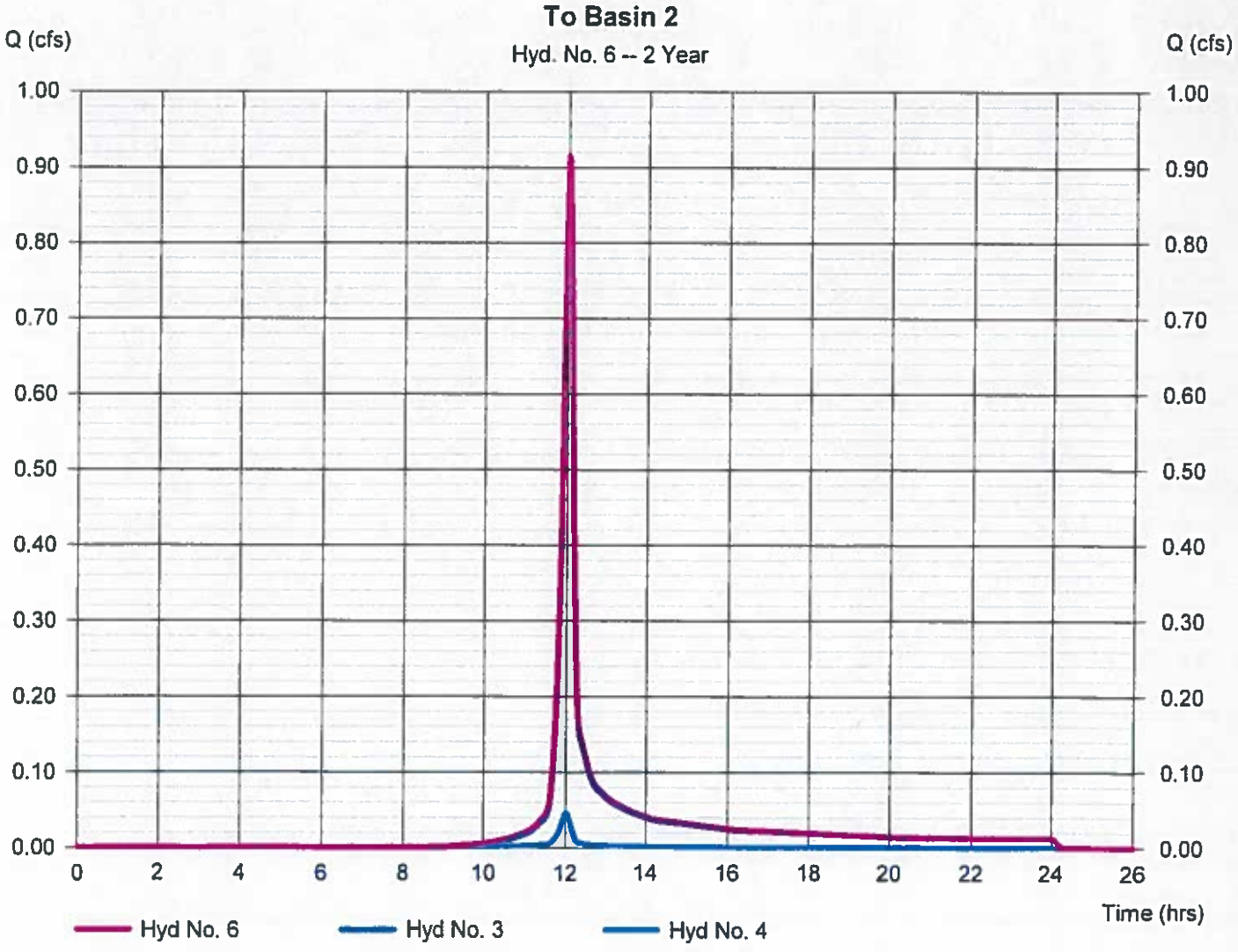


Hydrograph Report

Hyd. No. 6

To Basin 2

Hydrograph type	= Combine	Peak discharge	= 0.915 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 2,393 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 0.391 ac

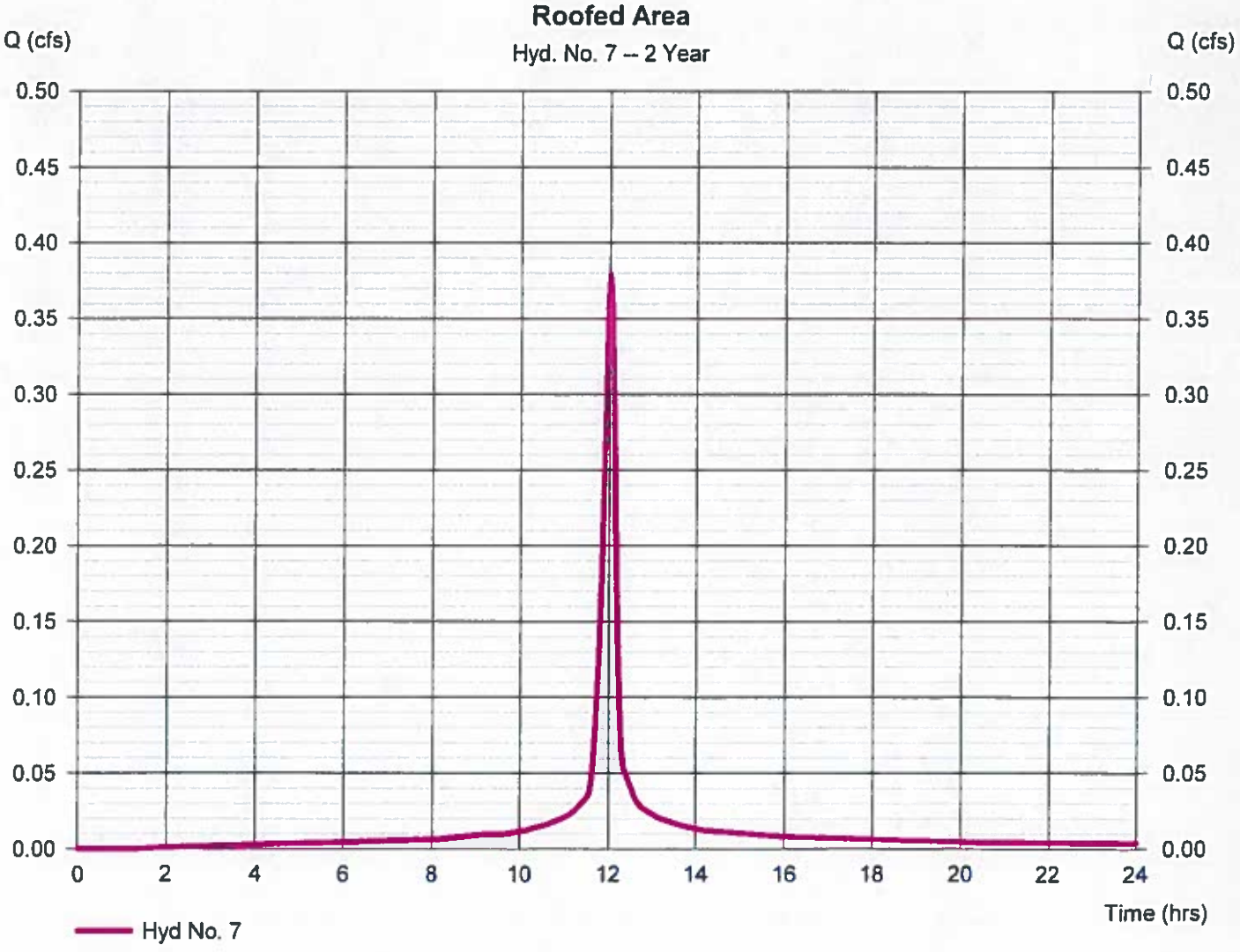


Hydrograph Report

Hyd. No. 7

Roofed Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.378 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,108 cuft
Drainage area	= 0.095 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.35 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



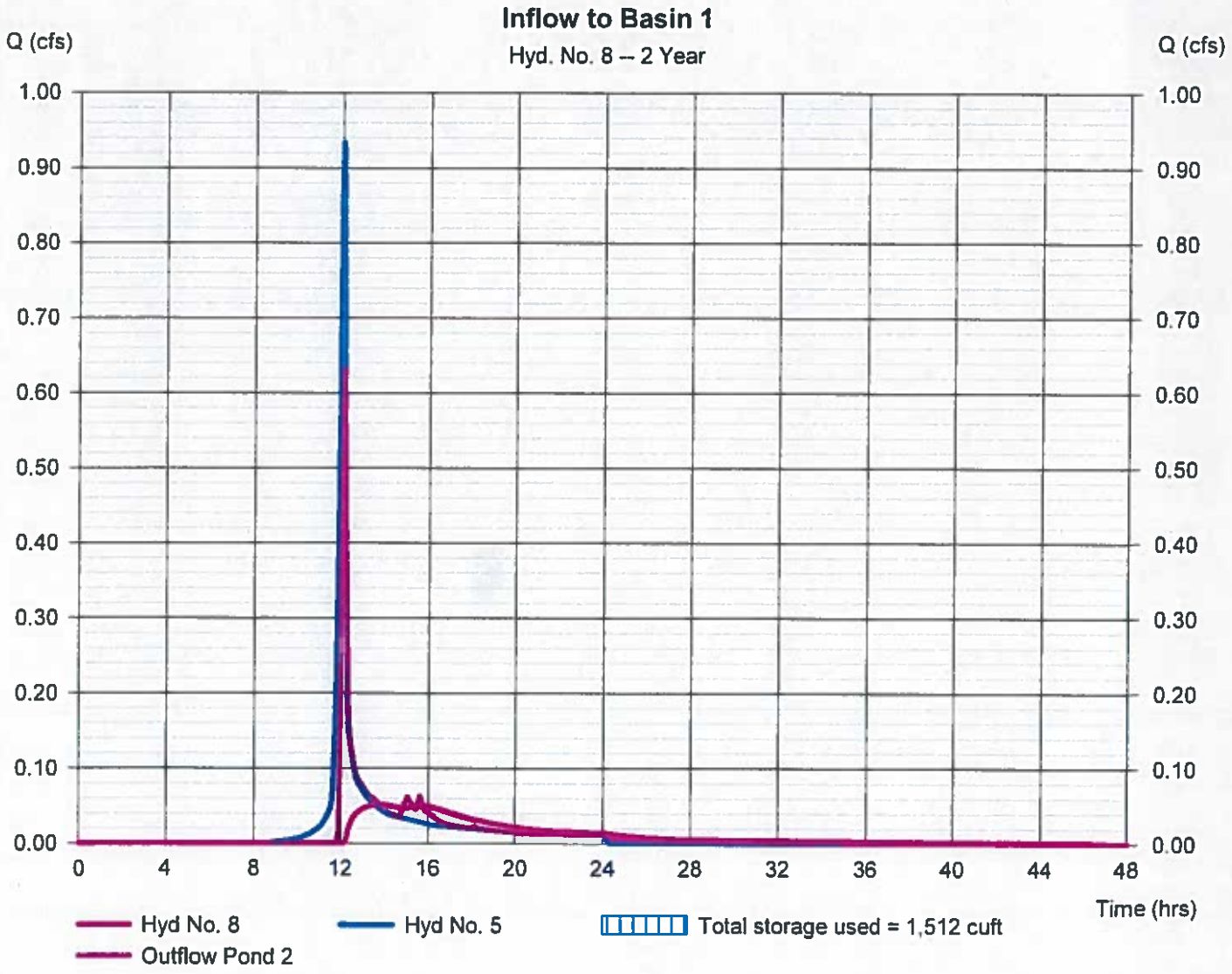
Hydrograph Report

Hyd. No. 8

Inflow to Basin 1

Hydrograph type	= Reservoir (Interconnected)	Peak discharge	= 0.052 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.77 hrs
Time interval	= 2 min	Hyd. volume	= 1,644 cuft
Upper Pond	= Sand Basin #1	Lower Pond	= SAND BASIN #2
Inflow hyd.	= 5 - To Basin 1	Other Inflow hyd.	= None
Max. Elevation	= 96.57 ft	Max. Elevation	= 96.46 ft
Max. Storage	= 739 cuft	Max. Storage	= 774 cuft

Interconnected Pond Routing. Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 — Tuesday, 02 / 16 / 2021

Pond No. 2 - Sand Basin #1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 96.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	96.00	1,230	0	0
1.00	97.00	1,362	1,295	1,295
2.00	98.00	1,472	1,417	2,712
3.00	99.00	2,019	1,738	4,450

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	Inactive	Inactive	Inactive
Span (in)	= 18.00	0.00	15.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 96.22	0.00	96.80	0.00
Length (ft)	= 44.00	0.00	44.00	0.00
Slope (%)	= 0.50	0.00	0.50	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	Inactive	Inactive	Inactive
Crest El. (ft)	= 98.98	98.70	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Rect	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	96.00	0.00	---	0.00	---	0.00	0.00	---	---	---	---	0.000
1.00	1,295	97.00	2.32 oc	---	0.00	---	0.00	0.00	---	---	---	---	2.323
2.00	2,712	98.00	6.62 oc	---	0.00	---	0.00	0.00	---	---	---	---	6.618
3.00	4,450	99.00	11.46 oc	---	0.00	---	0.00	0.00	---	---	---	---	11.46

Pond Report

Pond No. 1 - SAND BASIN #2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 96.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	96.00	1,495	0	0
1.00	97.00	1,864	1,676	1,676
2.00	98.00	2,235	2,046	3,722
3.00	99.00	2,948	2,583	6,305

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 2.50	Inactive	Inactive	0.00
Span (in)	= 2.50	2.50	6.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 96.25	96.24	97.60	0.00
Length (ft)	= 5.00	0.00	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 1.00	4.00	Inactive	0.00
Crest El. (ft)	= 97.50	98.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Rect	Rect	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

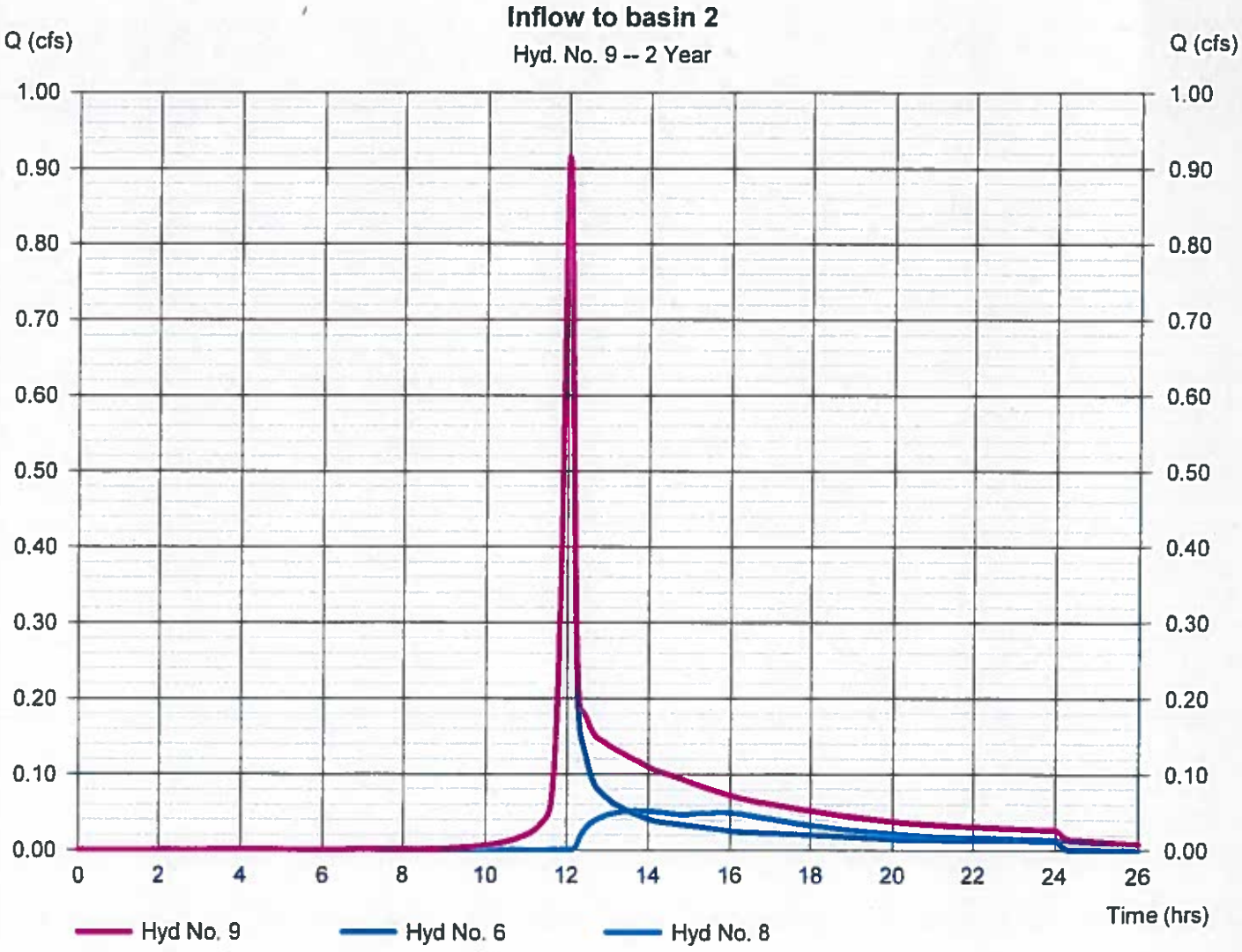
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	96.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.00	1,676	97.00	0.13 ic	0.00	0.00	---	0.00	0.00	---	---	---	---	0.132
2.00	3,722	98.00	0.21 ic	0.00	0.00	---	1.18	0.00	---	---	---	---	1.388
3.00	6,305	99.00	0.27 ic	0.00	0.00	---	6.12	13.32	---	---	---	---	19.70

Hydrograph Report

Hyd. No. 9

Inflow to basin 2

Hydrograph type	= Combine	Peak discharge	= 0.915 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 4,186 cuft
Inflow hyds.	= 6, 8	Contrib. drain. area	= 0.000 ac



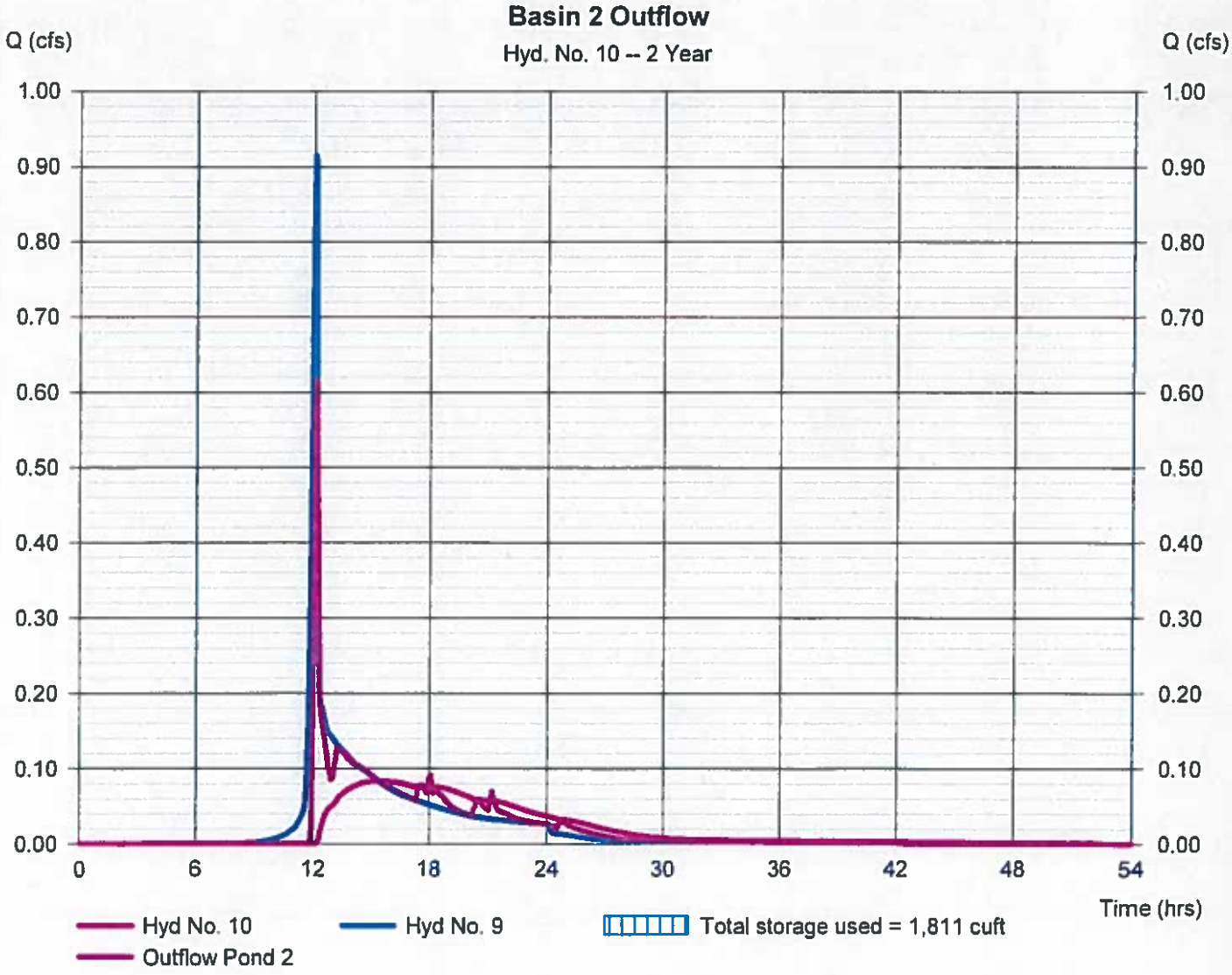
Hydrograph Report

Hyd. No. 10

Basin 2 Outflow

Hydrograph type	= Reservoir (Interconnected)	Peak discharge	= 0.084 cfs
Storm frequency	= 2 yrs	Time to peak	= 15.40 hrs
Time interval	= 2 min	Hyd. volume	= 3,425 cuft
Upper Pond	= Sand Basin #1	Lower Pond	= SAND BASIN #2
Inflow hyd.	= 9 - Inflow to basin 2	Other Inflow hyd.	= None
Max. Elevation	= 96.56 ft	Max. Elevation	= 96.62 ft
Max. Storage	= 778 cuft	Max. Storage	= 1,034 cuft

Interconnected Pond Routing. Storage Indication method used.



Pond Report

Pond No. 2 - Sand Basin #1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 96.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	96.00	1,230	0	0
1.00	97.00	1,362	1,295	1,295
2.00	98.00	1,472	1,417	2,712
3.00	99.00	2,019	1,738	4,450

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	Inactive	Inactive	Inactive
Span (in)	= 18.00	0.00	15.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 96.22	0.00	96.80	0.00
Length (ft)	= 44.00	0.00	44.00	0.00
Slope (%)	= 0.50	0.00	0.50	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	Inactive	Inactive	Inactive
Crest El. (ft)	= 98.98	98.70	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Rect	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	96.00	0.00	---	0.00	---	0.00	0.00	---	---	---	---	0.000
1.00	1,295	97.00	2.32 oc	---	0.00	---	0.00	0.00	---	---	---	---	2.323
2.00	2,712	98.00	6.62 oc	---	0.00	---	0.00	0.00	---	---	---	---	6.618
3.00	4,450	99.00	11.46 oc	---	0.00	---	0.00	0.00	---	---	---	---	11.46

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Tuesday, 02 / 16 / 2021

Pond No. 1 - SAND BASIN #2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 96.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	96.00	1,495	0	0
1.00	97.00	1,864	1,676	1,676
2.00	98.00	2,235	2,046	3,722
3.00	99.00	2,948	2,583	6,305

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 2.50	Inactive	Inactive	0.00
Span (in)	= 2.50	2.50	6.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 96.25	96.24	97.60	0.00
Length (ft)	= 5.00	0.00	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 1.00	4.00	Inactive	0.00
Crest El. (ft)	= 97.50	98.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Rect	Rect	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

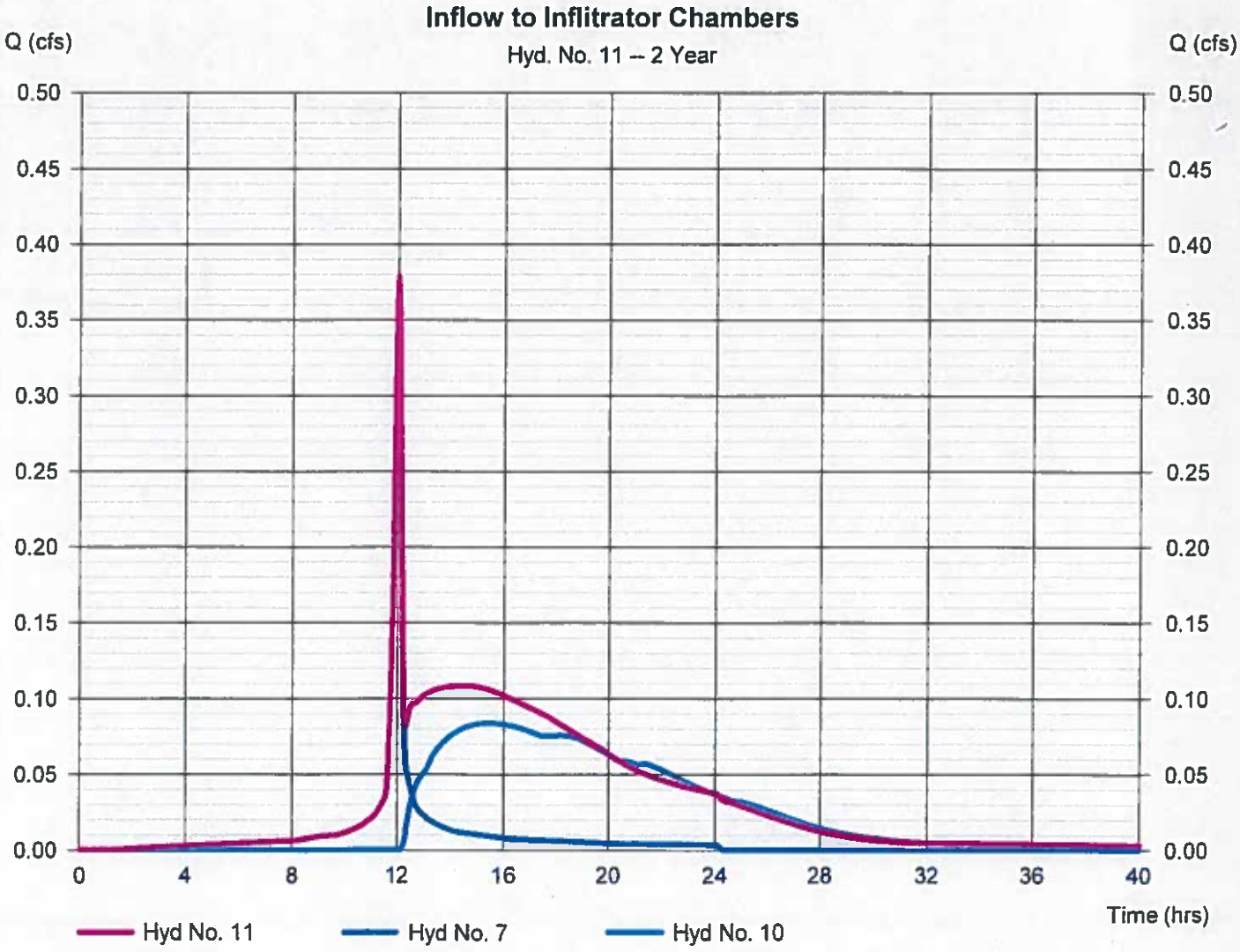
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	96.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.00	1,676	97.00	0.13 ic	0.00	0.00	---	0.00	0.00	---	---	---	---	0.132
2.00	3,722	98.00	0.21 ic	0.00	0.00	---	1.18	0.00	---	---	---	---	1.388
3.00	6,305	99.00	0.27 ic	0.00	0.00	---	6.12	13.32	---	---	---	---	19.70

Hydrograph Report

Hyd. No. 11

Inflow to Inflitrator Chambers

Hydrograph type	= Combine	Peak discharge	= 0.378 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 4,665 cuft
Inflow hyds.	= 7, 10	Contrib. drain. area	= 0.095 ac



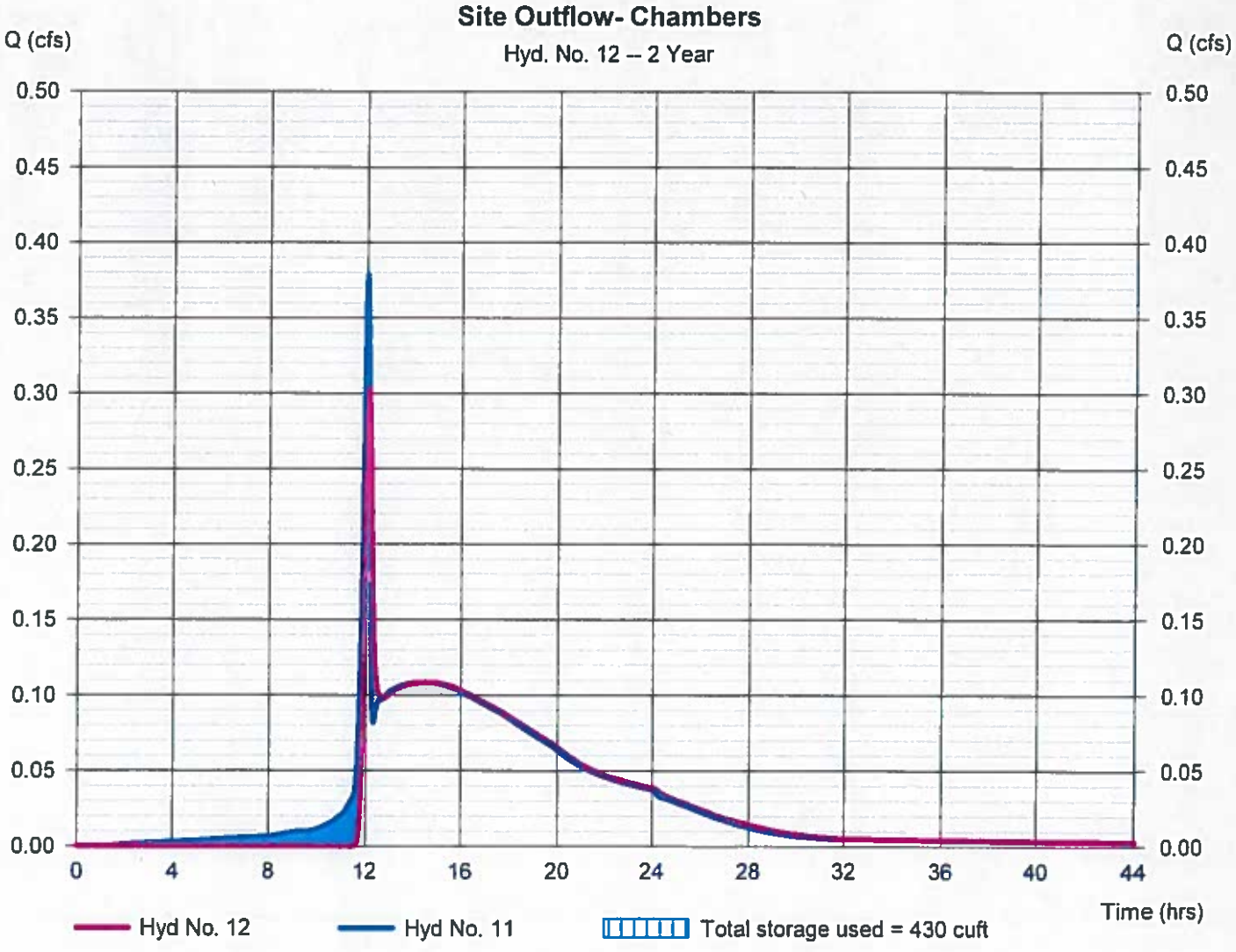
Hydrograph Report

Hyd. No. 12

Site Outflow- Chambers

Hydrograph type	= Reservoir	Peak discharge	= 0.302 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 4,414 cuft
Inflow hyd. No.	= 11 - Inflow to Inflitrator Chambers	Max. Elevation	= 95.75 ft
Reservoir name	= Recharge Chambers	Max. Storage	= 430 cuft

Storage Indication method used.



Pond No. 3 - Recharge Chambers

Pond Data

UG Chambers -Invert elev. = 95.50 ft, Rise x Span = 2.50 x 4.25 ft, Barrel Len = 7.12 ft, No. Barrels = 24, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 95.00 ft, Width = 6.25 ft, Height = 3.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	95.00	n/a	0	0
0.35	95.35	n/a	150	150
0.70	95.70	n/a	237	386
1.05	96.05	n/a	300	686
1.40	96.40	n/a	295	982
1.75	96.75	n/a	287	1,269
2.10	97.10	n/a	275	1,544
2.45	97.45	n/a	257	1,800
2.80	97.80	n/a	229	2,029
3.15	98.15	n/a	173	2,202
3.50	98.50	n/a	150	2,351

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 3.00	15.00	Inactive	Inactive
Span (in)	= 3.00	15.00	6.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 96.00	95.50	96.80	0.00
Length (ft)	= 4.00	10.00	5.00	0.00
Slope (%)	= 0.00	1.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	4.00	0.00	0.00
Crest El. (ft)	= 97.50	98.75	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Rect	---	---
Multi-Stage	= No	Yes	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	95.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.35	150	95.35	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.70	386	95.70	0.00	0.19 ic	0.00	---	0.00	0.00	---	---	---	---	0.193
1.05	686	96.05	0.00	1.00 oc	0.00	---	0.00	0.00	---	---	---	---	0.997
1.40	982	96.40	0.00	1.85 oc	0.00	---	0.00	0.00	---	---	---	---	1.853
1.75	1,269	96.75	0.00	2.37 oc	0.00	---	0.00	0.00	---	---	---	---	2.367
2.10	1,544	97.10	0.00	5.02 oc	0.00	---	0.00	0.00	---	---	---	---	5.022
2.45	1,800	97.45	0.00	6.70 oc	0.00	---	0.00	0.00	---	---	---	---	6.696
2.80	2,029	97.80	0.00	7.65 ic	0.00	---	0.00	0.00	---	---	---	---	7.646
3.15	2,202	98.15	0.00	8.41 ic	0.00	---	0.00	0.00	---	---	---	---	8.407
3.50	2,351	98.50	0.00	9.11 ic	0.00	---	0.00	0.00	---	---	---	---	9.105

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.043	2	732	8,858	-----	-----	-----	Pre-Developed
2	SCS Runoff	1.804	2	720	4,705	-----	-----	-----	imp to basin 1
3	SCS Runoff	1.710	2	720	4,448	-----	-----	-----	to basin 2 (Non wash exit)
4	SCS Runoff	0.071	2	720	212	-----	-----	-----	imp to basin 2 (wash exit)
5	Combine	1.804	2	720	4,705	2,	-----	-----	To Basin 1
6	Combine	1.781	2	720	4,660	3, 4,	-----	-----	To Basin 2
7	SCS Runoff	0.587	2	720	1,751	-----	-----	-----	Roofed Area
8	Reservoir(i)	0.118	2	836	3,954	5	96.87	2,699	Inflow to Basin 1
9	Combine	1.806	2	720	8,733	6, 8	-----	-----	Inflow to basin 2
10	Reservoir(i)	0.154	2	1046	7,974	9	97.23	3,811	Basin 2 Outflow
11	Combine	0.616	2	722	9,858	7, 10	-----	-----	Inflow to Infiltrator Chambers
12	Reservoir	0.518	2	726	9,606	11	95.85	515	Site Outflow- Chambers

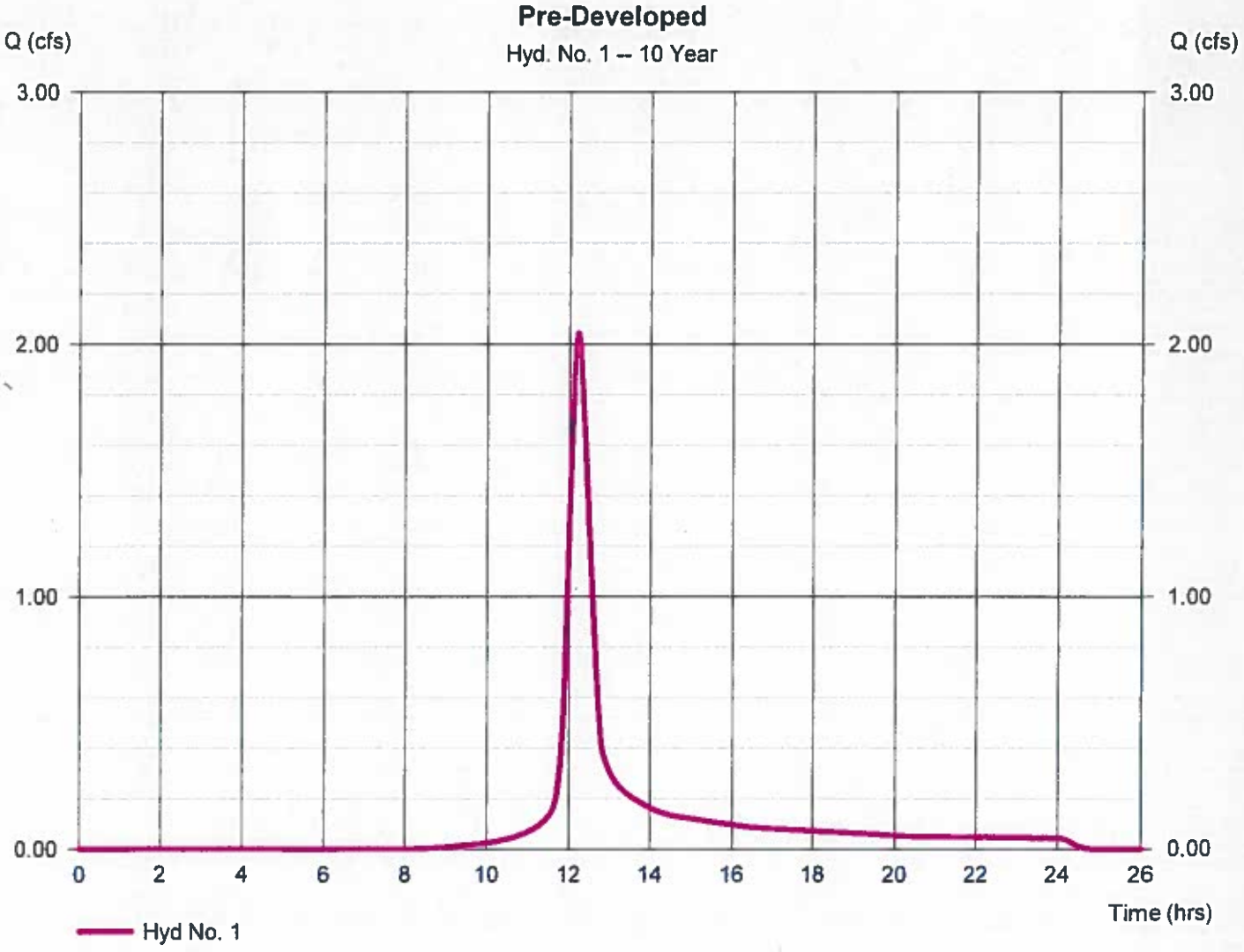
Hydrograph Report

Hyd. No. 1

Pre-Developed

Hydrograph type	= SCS Runoff	Peak discharge	= 2.043 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 8,858 cuft
Drainage area	= 0.874 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 30.90 min
Total precip.	= 5.16 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.117 x 39) + (0.100 x 30) + (0.247 x 80) + (0.410 x 77)] / 0.874



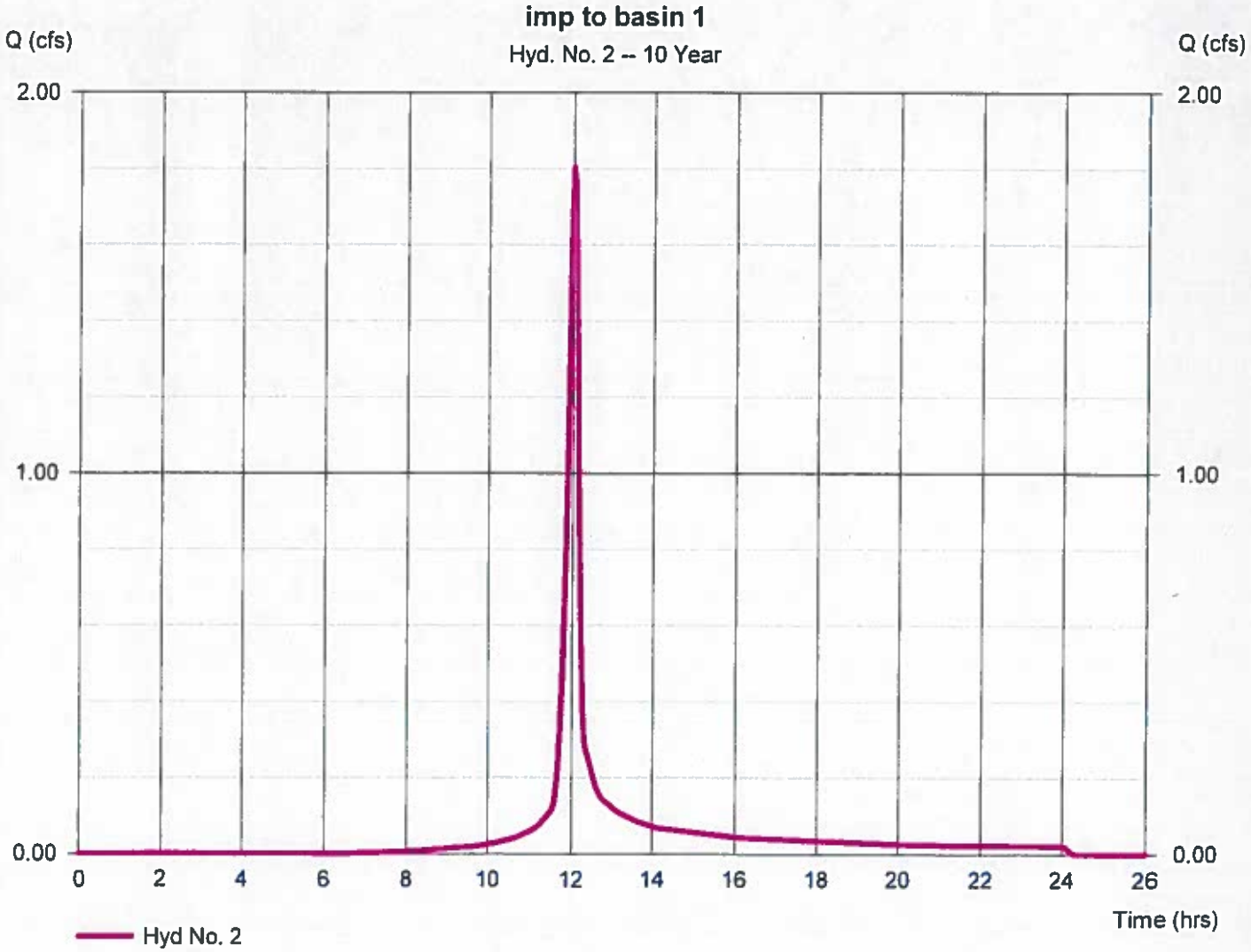
Hydrograph Report

Hyd. No. 2

imp to basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.804 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 4,705 cuft
Drainage area	= 0.390 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.00 min
Total precip.	= 5.16 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.212 x 98) + (0.175 x 62)] / 0.390



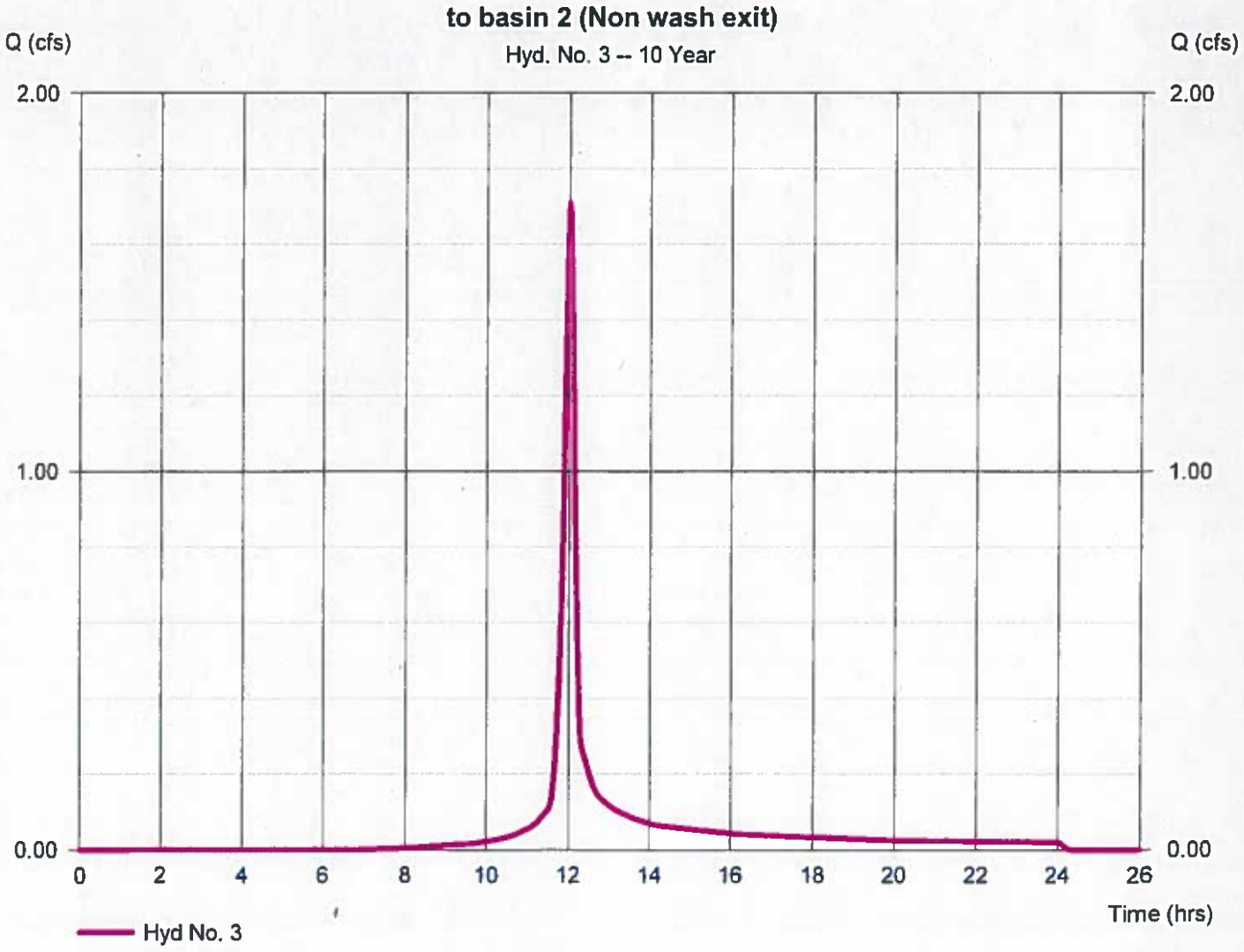
Hydrograph Report

Hyd. No. 3

to basin 2 (Non wash exit)

Hydrograph type	= SCS Runoff	Peak discharge	= 1.710 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 4,448 cuft
Drainage area	= 0.380 ac	Curve number	= 81*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.70 min
Total precip.	= 5.16 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.201 x 98) + (0.175 x 62)] / 0.380

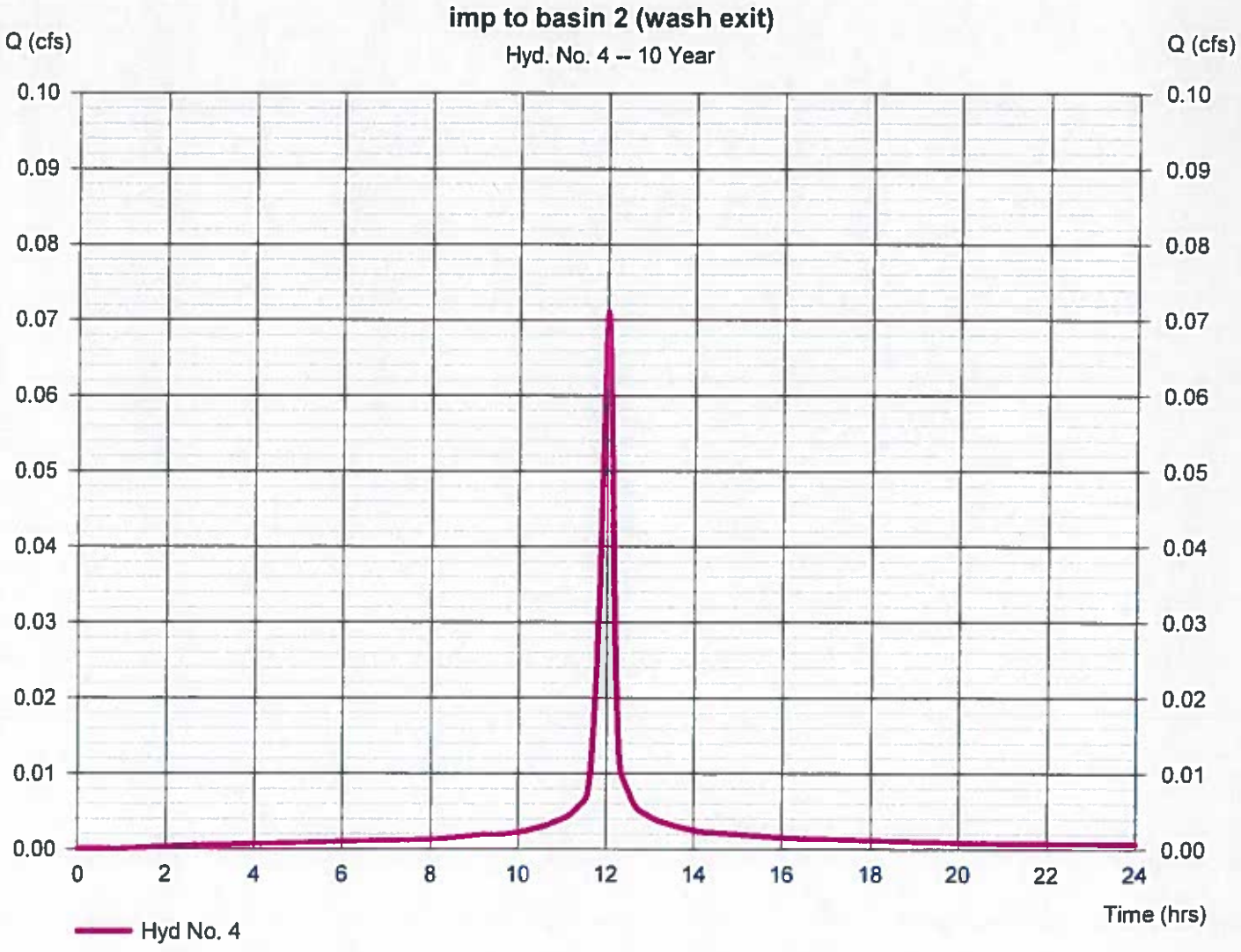


Hydrograph Report

Hyd. No. 4

imp to basin 2 (wash exit)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.071 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 212 cuft
Drainage area	= 0.012 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.16 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

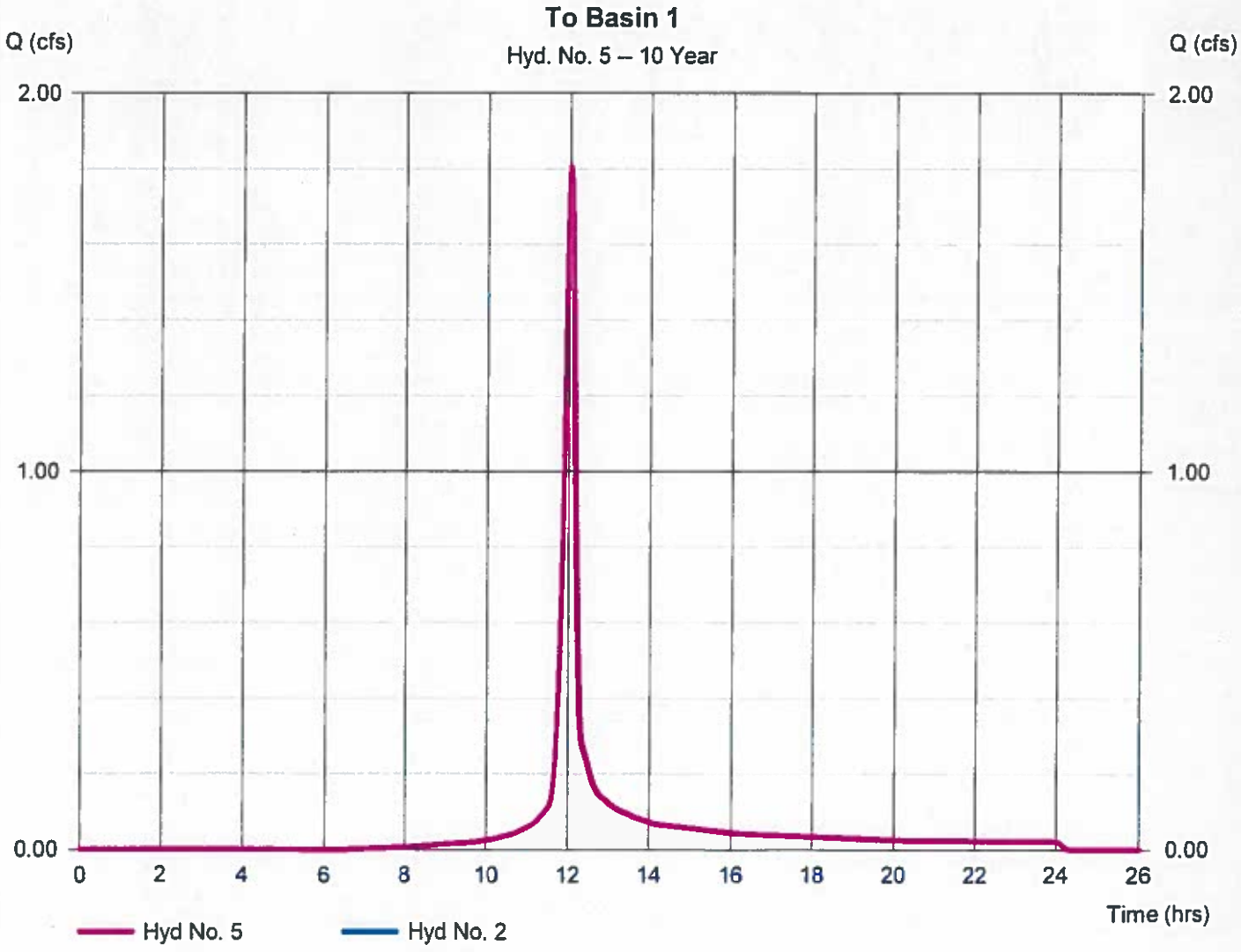


Hydrograph Report

Hyd. No. 5

To Basin 1

Hydrograph type	= Combine	Peak discharge	= 1.804 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 4,705 cuft
Inflow hyds.	= 2	Contrib. drain. area	= 0.390 ac

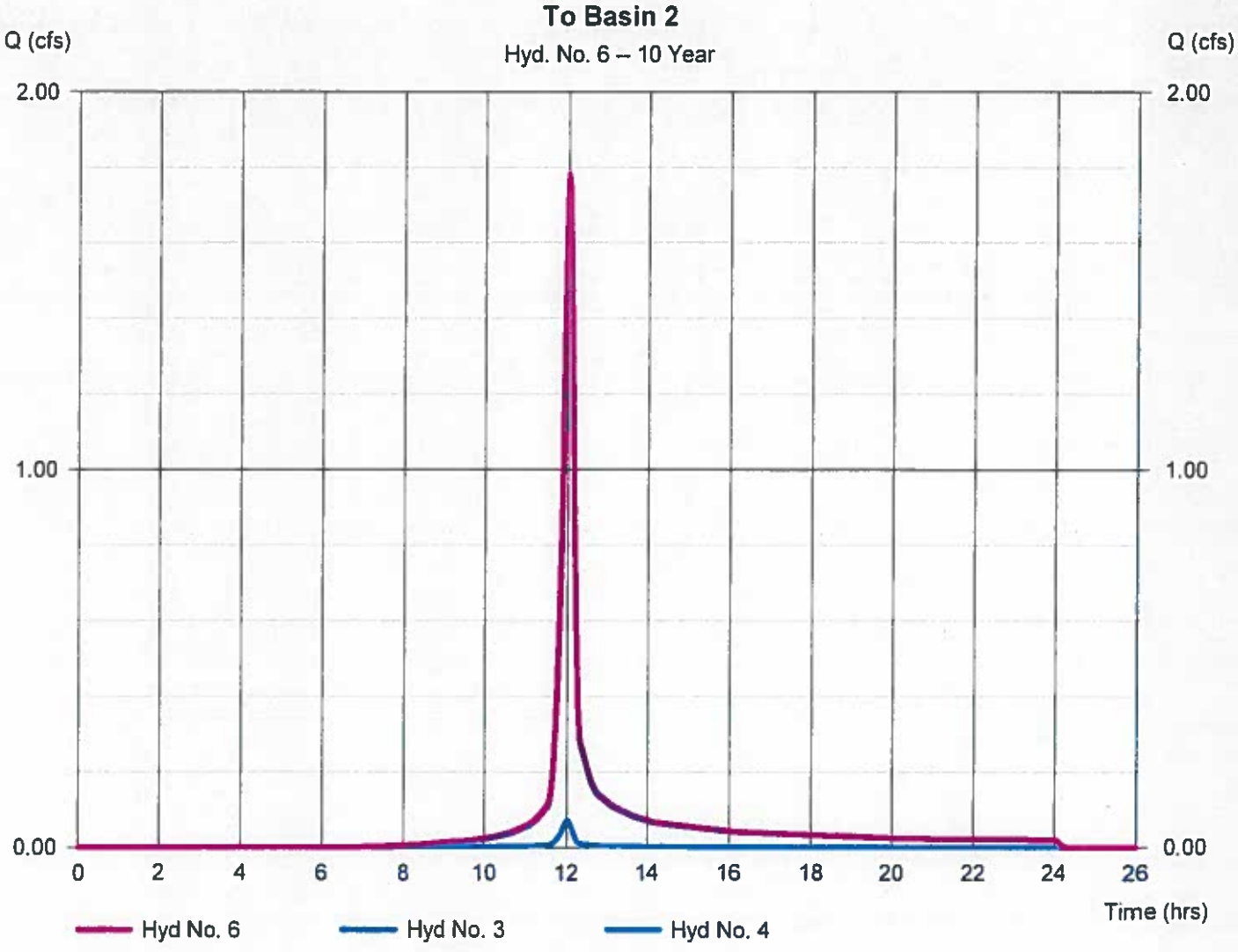


Hydrograph Report

Hyd. No. 6

To Basin 2

Hydrograph type	= Combine	Peak discharge	= 1.781 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 4,660 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 0.391 ac

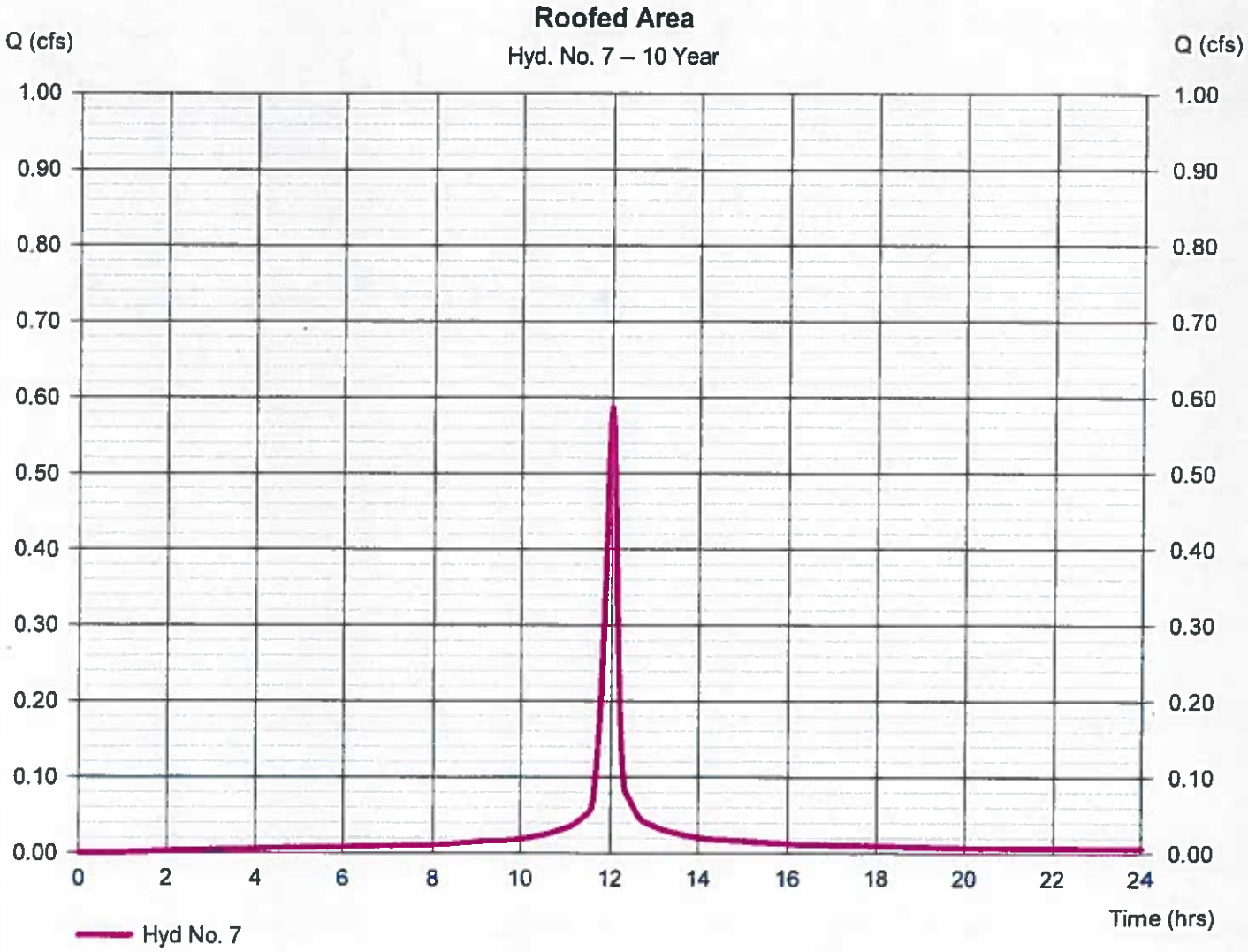


Hydrograph Report

Hyd. No. 7

Roofed Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.587 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,751 cuft
Drainage area	= 0.095 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.16 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



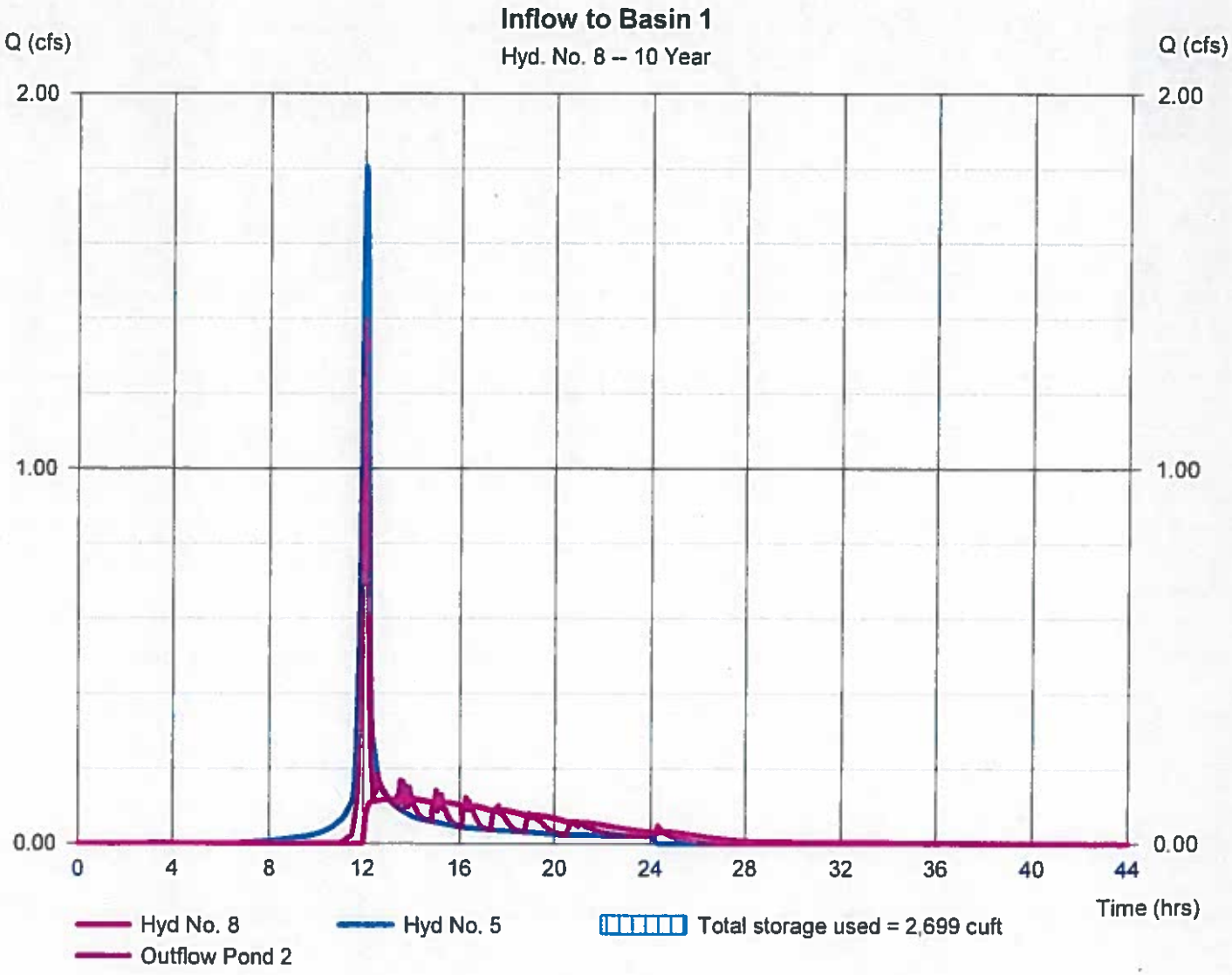
Hydrograph Report

Hyd. No. 8

Inflow to Basin 1

Hydrograph type	= Reservoir (Interconnected)	Peak discharge	= 0.118 cfs
Storm frequency	= 10 yrs	Time to peak	= 13.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,954 cuft
Upper Pond	= Sand Basin #1	Lower Pond	= SAND BASIN #2
Inflow hyd.	= 5 - To Basin 1	Other Inflow hyd.	= None
Max. Elevation	= 96.77 ft	Max. Elevation	= 96.87 ft
Max. Storage	= 1,239 cuft	Max. Storage	= 1,461 cuft

Interconnected Pond Routing. Storage Indication method used.

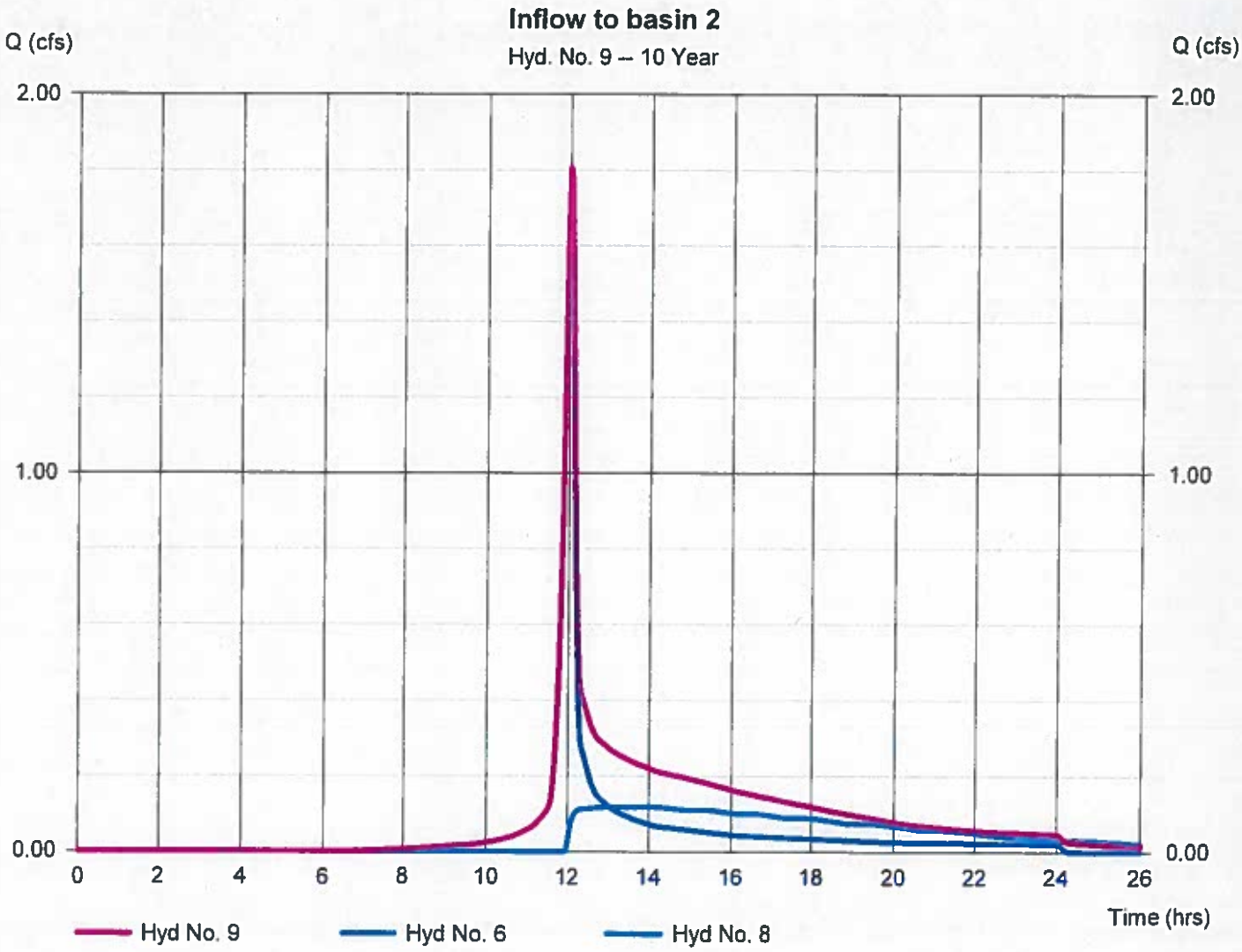


Hydrograph Report

Hyd. No. 9

Inflow to basin 2

Hydrograph type	= Combine	Peak discharge	= 1.806 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 8,733 cuft
Inflow hyds.	= 6, 8	Contrib. drain. area	= 0.000 ac



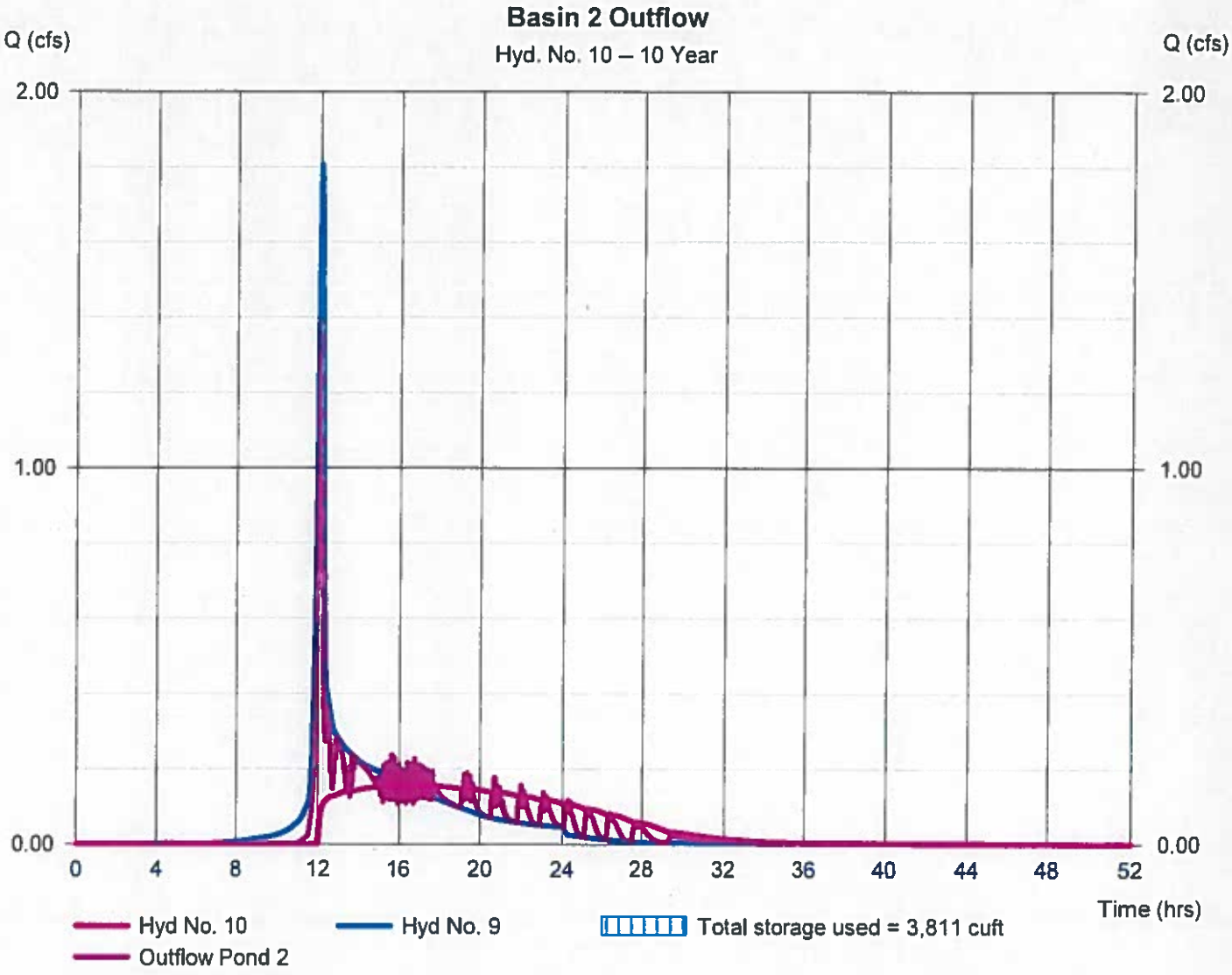
Hydrograph Report

Hyd. No. 10

Basin 2 Outflow

Hydrograph type	= Reservoir (Interconnected)	Peak discharge	= 0.154 cfs
Storm frequency	= 10 yrs	Time to peak	= 17.43 hrs
Time interval	= 2 min	Hyd. volume	= 7,974 cuft
Upstream Pond	= Sand Basin #1	Downstream Pond	= SAND BASIN #2
Inflow hyd.	= 9 - Inflow to basin 2	Other Inflow hyd.	= None
Max. Elevation	= 96.77 ft	Max. Elevation	= 97.23 ft
Max. Storage	= 1,658 cuft	Max. Storage	= 2,153 cuft

Interconnected Pond Routing. Storage Indication method used.

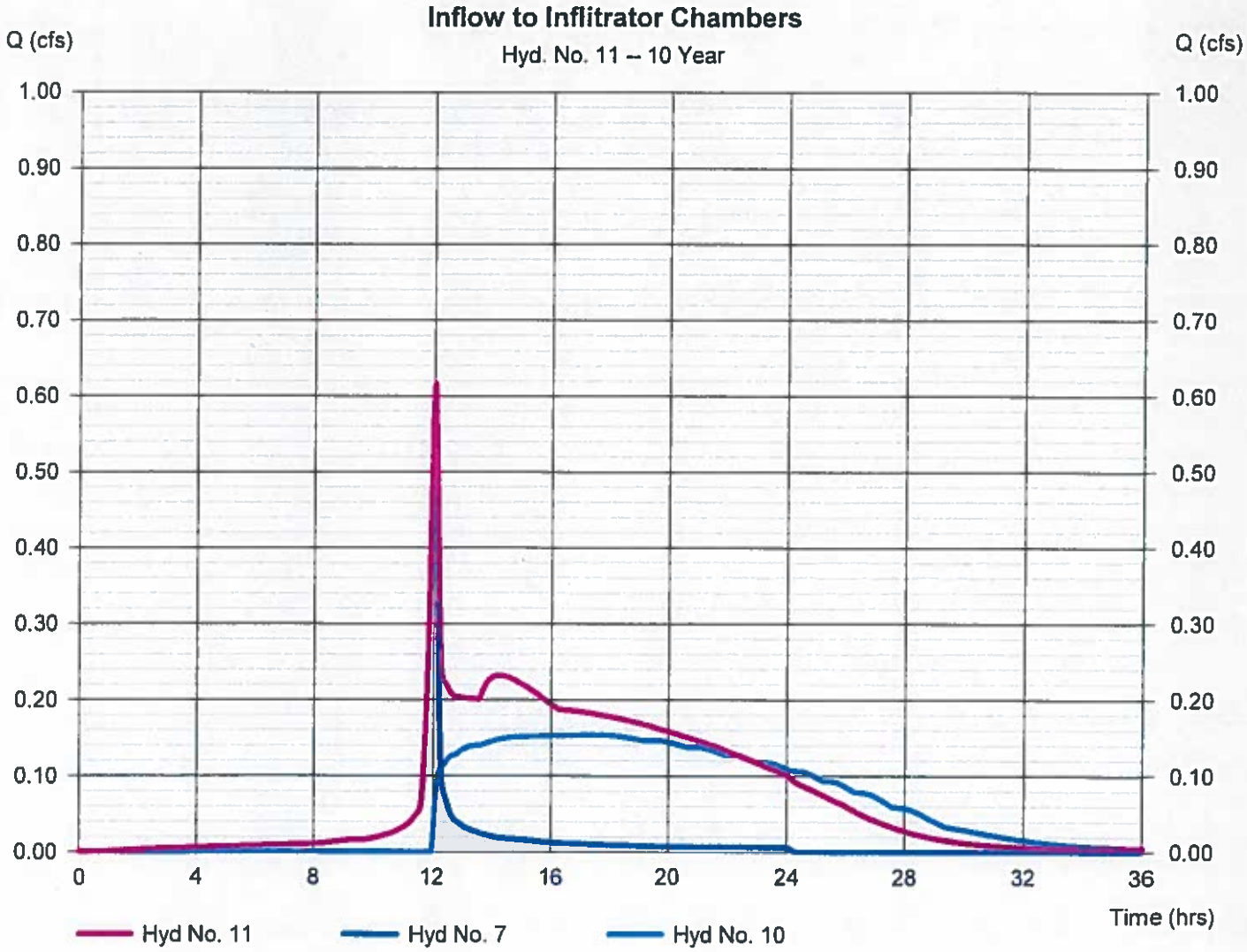


Hydrograph Report

Hyd. No. 11

Inflow to Inflitrator Chambers

Hydrograph type	= Combine	Peak discharge	= 0.616 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 9,858 cuft
Inflow hyds.	= 7, 10	Contrib. drain. area	= 0.095 ac



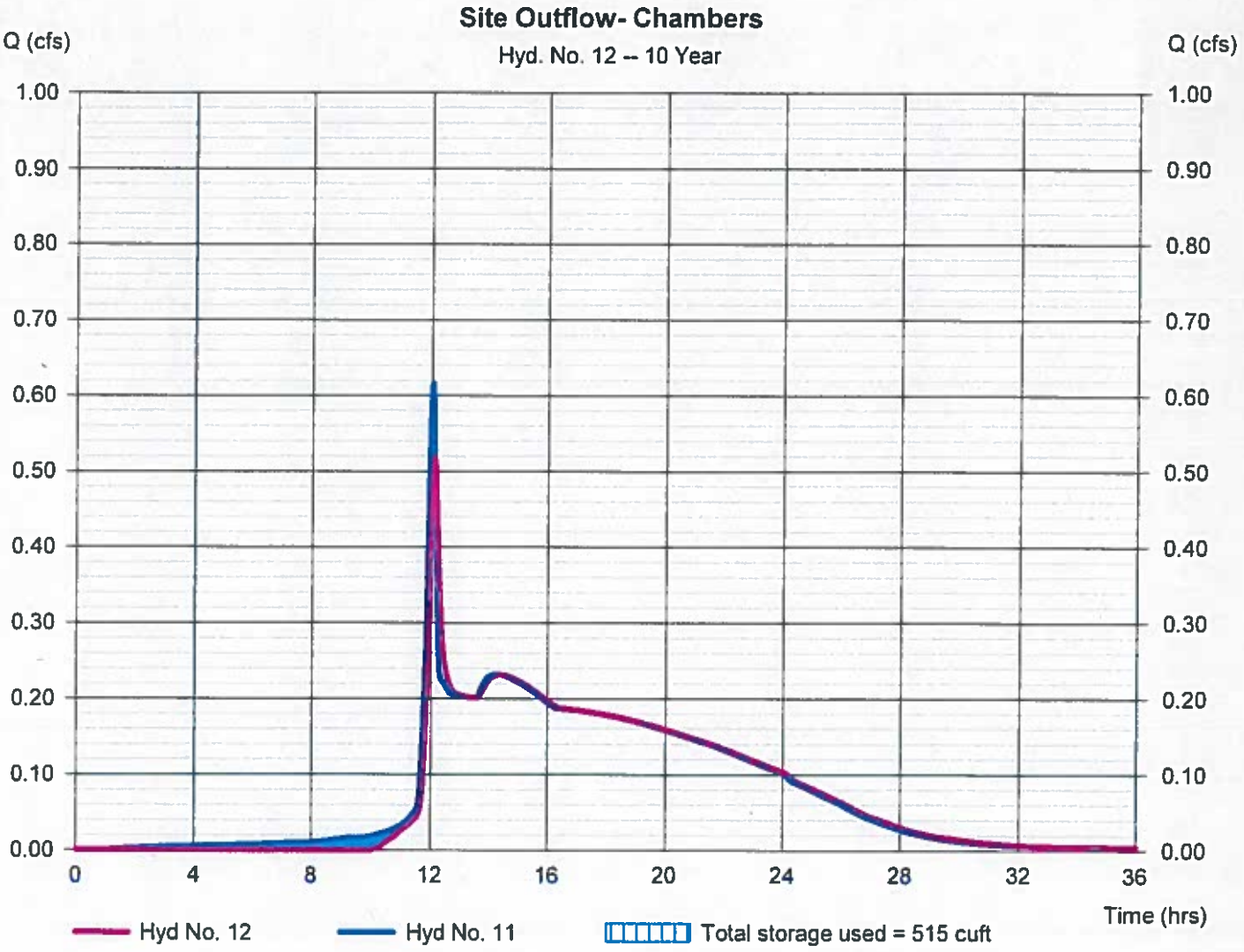
Hydrograph Report

Hyd. No. 12

Site Outflow- Chambers

Hydrograph type	= Reservoir	Peak discharge	= 0.518 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 9,606 cuft
Inflow hyd. No.	= 11 - Inflow to Inflitrator Chambers	Max. Elevation	= 95.85 ft
Reservoir name	= Recharge Chambers	Max. Storage	= 515 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.424	2	732	19,196	----	------	----	Pre-Developed
2	SCS Runoff	3.586	2	720	9,612	----	------	----	imp to basin 1
3	SCS Runoff	3.444	2	720	9,193	------	----	------	to basin 2 (Non wash exit)
4	SCS Runoff	0.121	2	720	367	------	----	------	imp to basin 2 (wash exit)
5	Combine	3.586	2	720	9,612	2,	------	----	To Basin 1
6	Combine	3.565	2	720	9,560	3, 4,	------	----	To Basin 2
7	SCS Runoff	1.000	2	720	3,030	----	----	------	Roofed Area
8	Reservoir(i)	0.501	2	744	8,852	5	97.70	5,355	Inflow to Basin 1
9	Combine	3.718	2	720	18,544	6, 8	------	------	Inflow to basin 2
10	Reservoir(i)	1.411	2	750	17,786	9	98.00	6,494	Basin 2 Outflow
11	Combine	2.635	2	738	20,947	7, 10	----	----	Inflow to Infiltrator Chambers
12	Reservoir	2.331	2	746	20,695	11	96.67	1,203	Site Outflow- Chambers

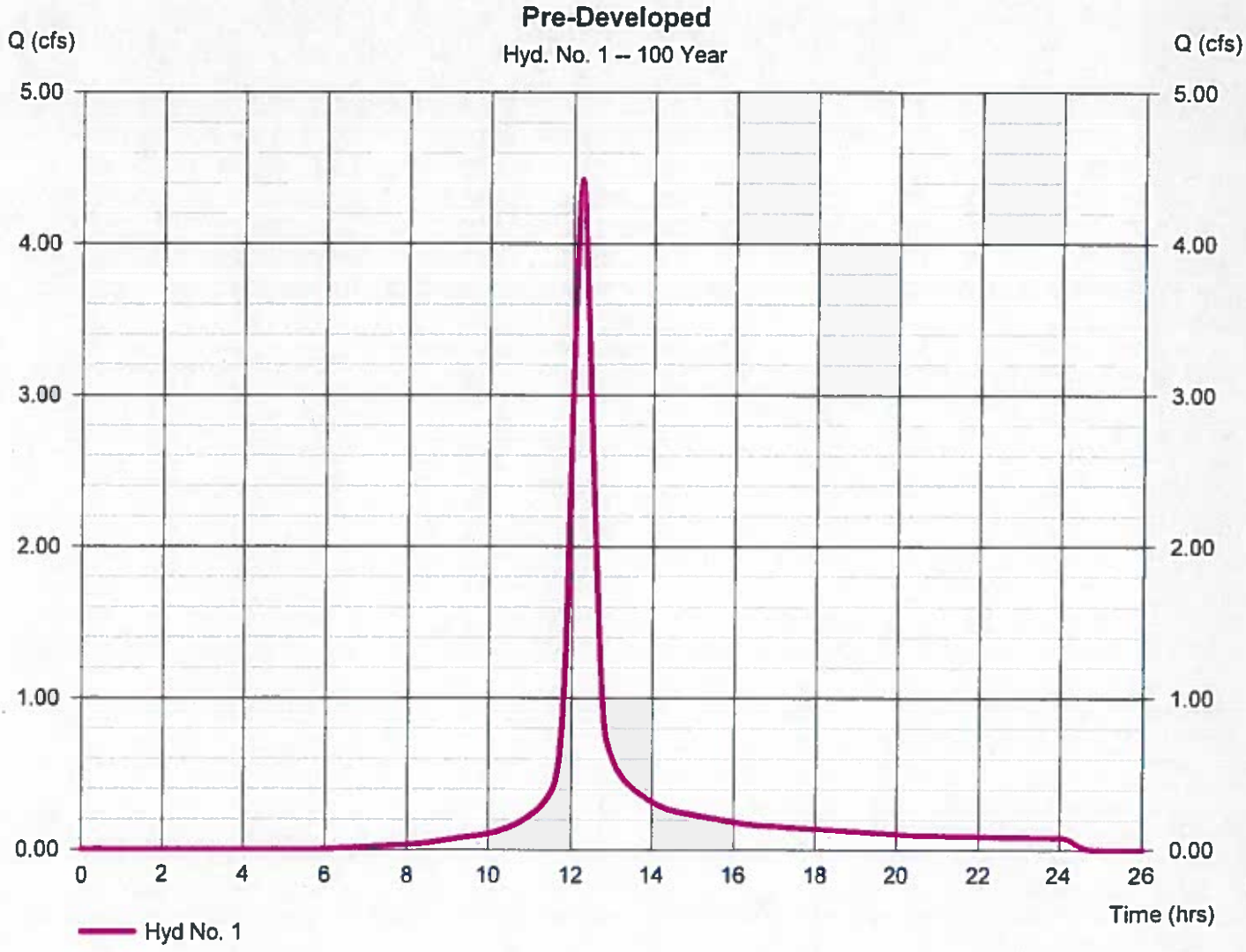
Hydrograph Report

Hyd. No. 1

Pre-Developed

Hydrograph type	= SCS Runoff	Peak discharge	= 4.424 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 19,196 cuft
Drainage area	= 0.874 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 30.90 min
Total precip.	= 8.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.117 x 39) + (0.100 x 30) + (0.247 x 80) + (0.410 x 77)] / 0.874



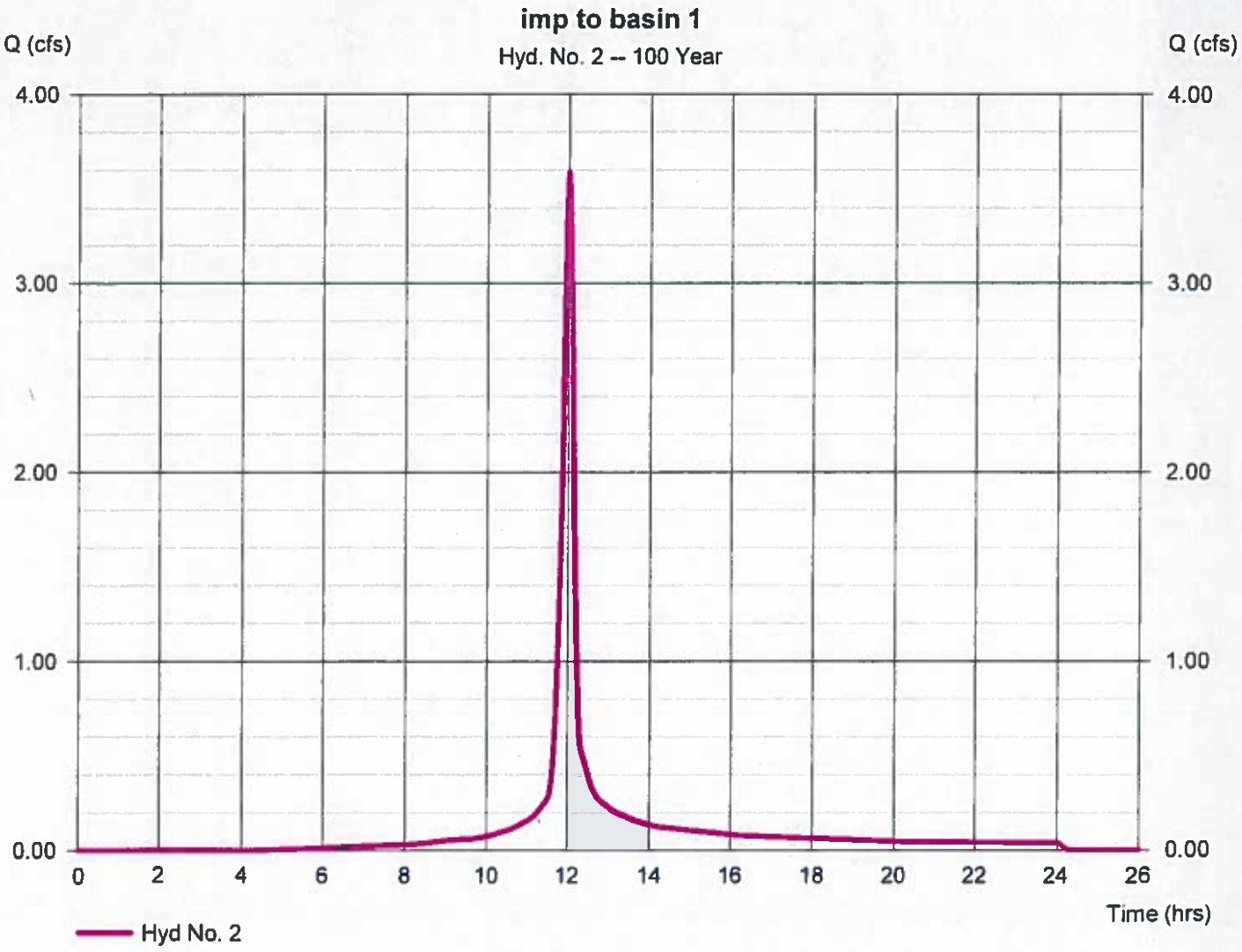
Hydrograph Report

Hyd. No. 2

imp to basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 3.586 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 9,612 cuft
Drainage area	= 0.390 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.00 min
Total precip.	= 8.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.212 x 98) + (0.175 x 62)] / 0.390



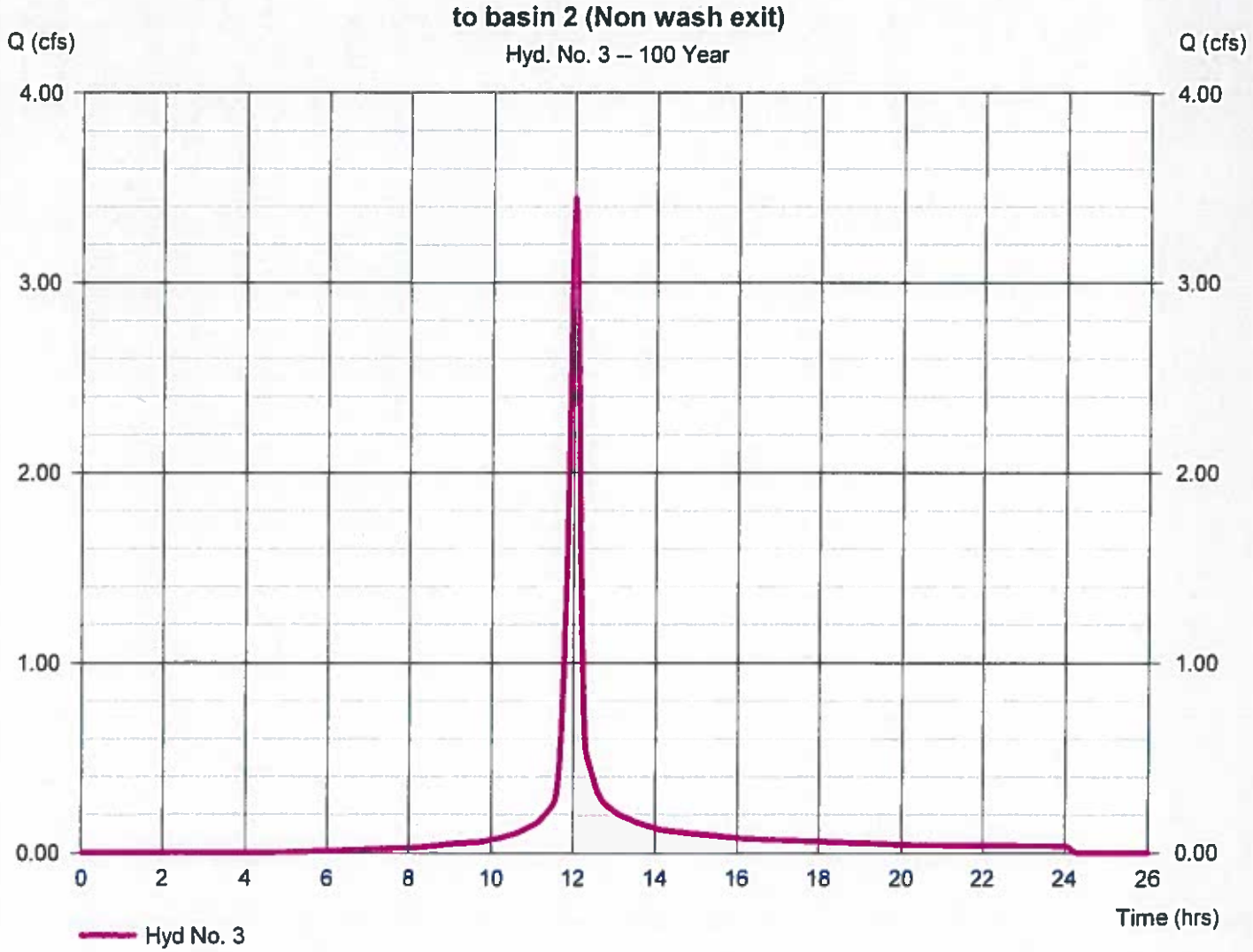
Hydrograph Report

Hyd. No. 3

to basin 2 (Non wash exit)

Hydrograph type	= SCS Runoff	Peak discharge	= 3.444 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 9,193 cuft
Drainage area	= 0.380 ac	Curve number	= 81*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.70 min
Total precip.	= 8.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.201 x 98) + (0.175 x 62)] / 0.380

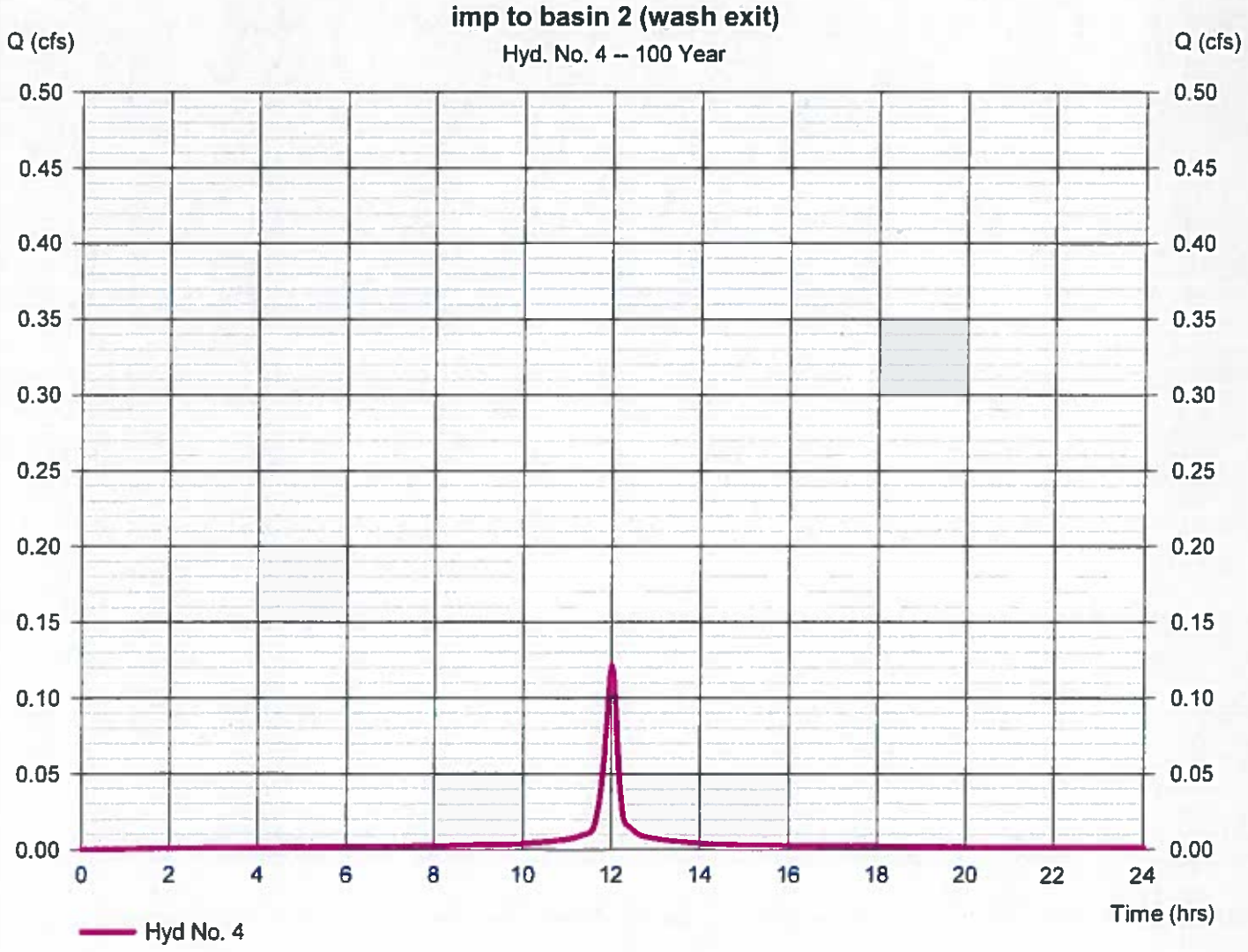


Hydrograph Report

Hyd. No. 4

imp to basin 2 (wash exit)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.121 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 367 cuft
Drainage area	= 0.012 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

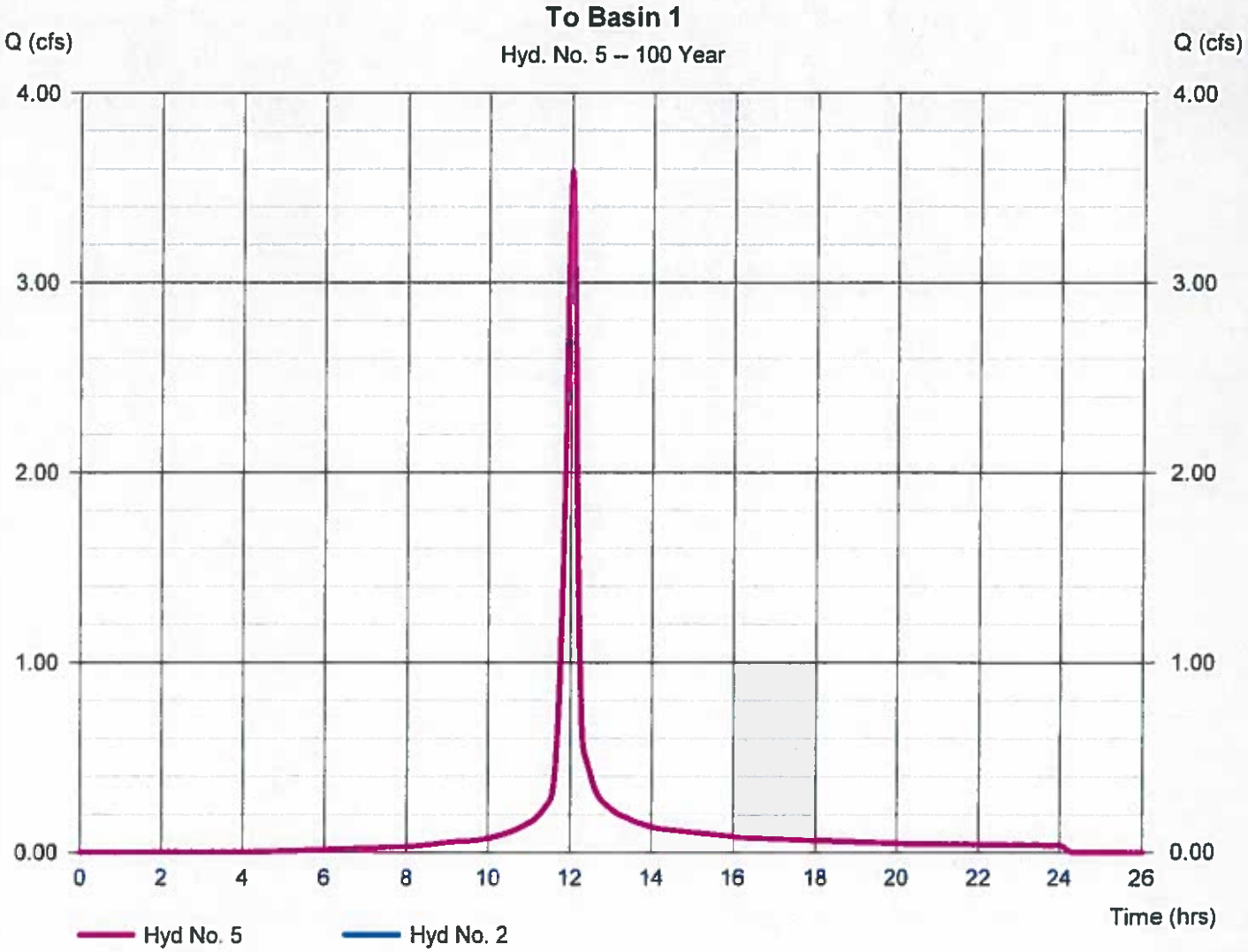


Hydrograph Report

Hyd. No. 5

To Basin 1

Hydrograph type	= Combine	Peak discharge	= 3.586 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 9,612 cuft
Inflow hyds.	= 2	Contrib. drain. area	= 0.390 ac

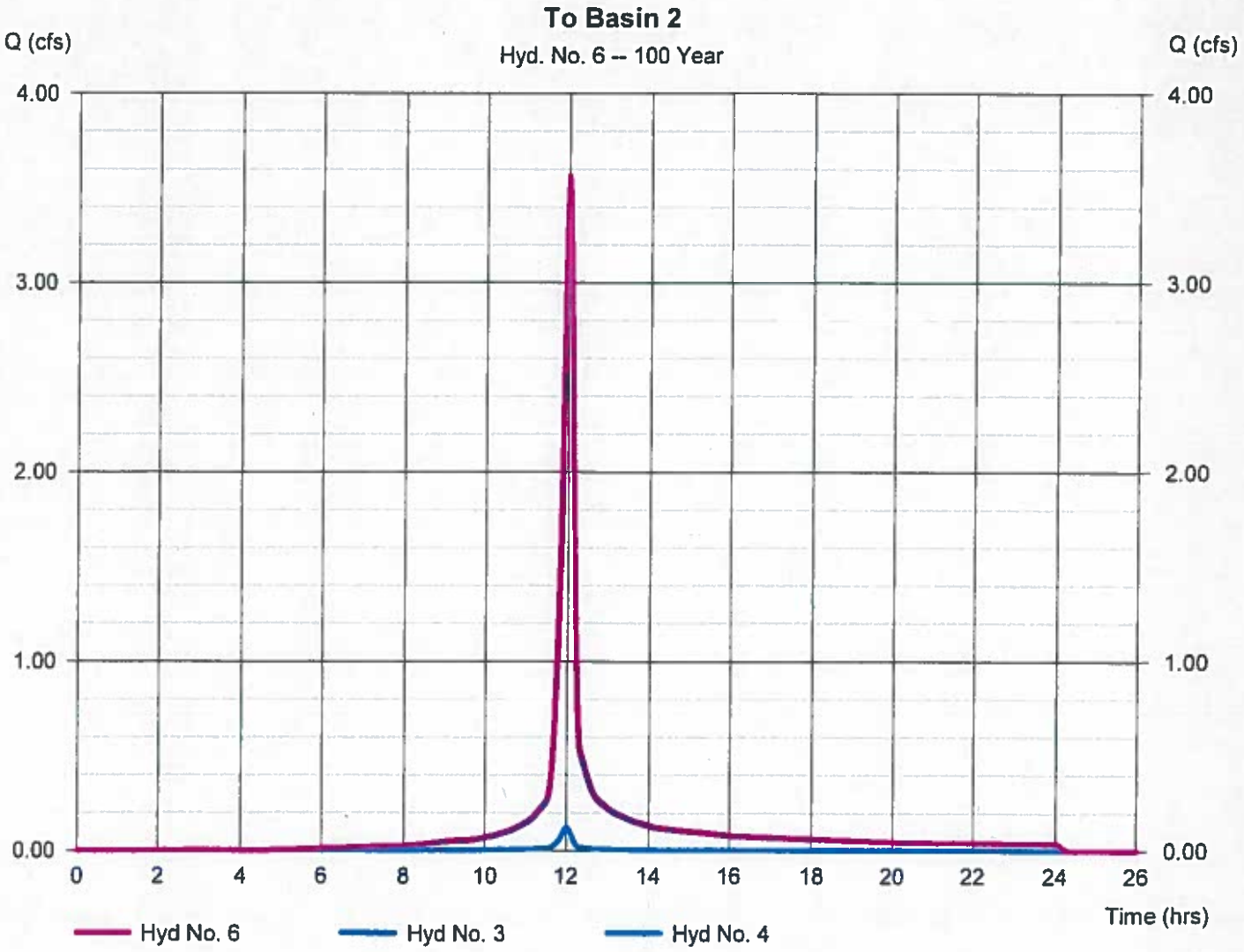


Hydrograph Report

Hyd. No. 6

To Basin 2

Hydrograph type	= Combine	Peak discharge	= 3.565 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 9,560 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 0.391 ac

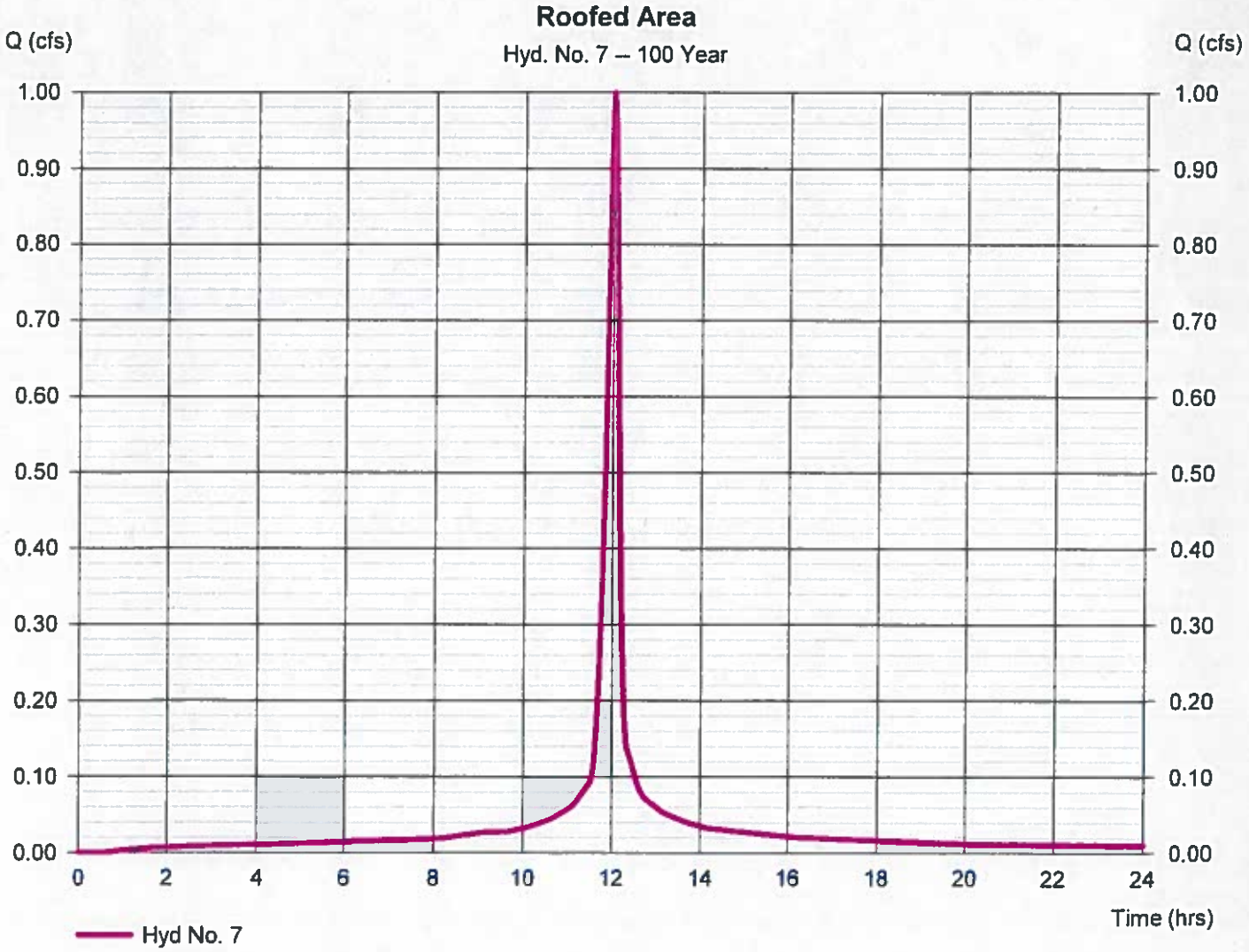


Hydrograph Report

Hyd. No. 7

Roofed Area

Hydrograph type	= SCS Runoff	Peak discharge	= 1.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 3,030 cuft
Drainage area	= 0.095 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



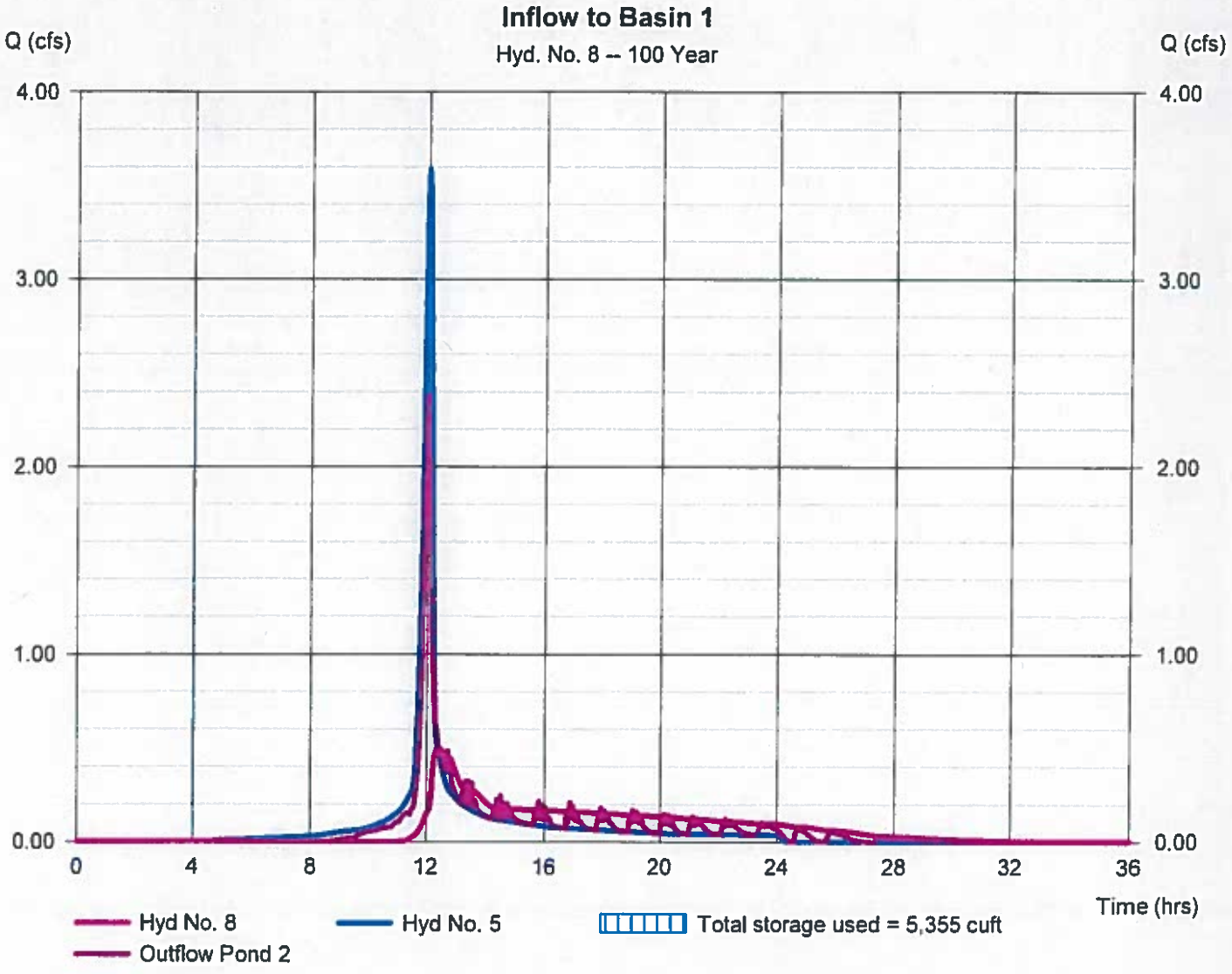
Hydrograph Report

Hyd. No. 8

Inflow to Basin 1

Hydrograph type	= Reservoir (Interconnected)	Peak discharge	= 0.501 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 8,852 cuft
Upper Pond	= Sand Basin #1	Lower Pond	= SAND BASIN #2
Inflow hyd.	= 5 - To Basin 1	Other Inflow hyd.	= None
Max. Elevation	= 97.01 ft	Max. Elevation	= 97.70 ft
Max. Storage	= 2,236 cuft	Max. Storage	= 3,118 cuft

Interconnected Pond Routing. Storage Indication method used.

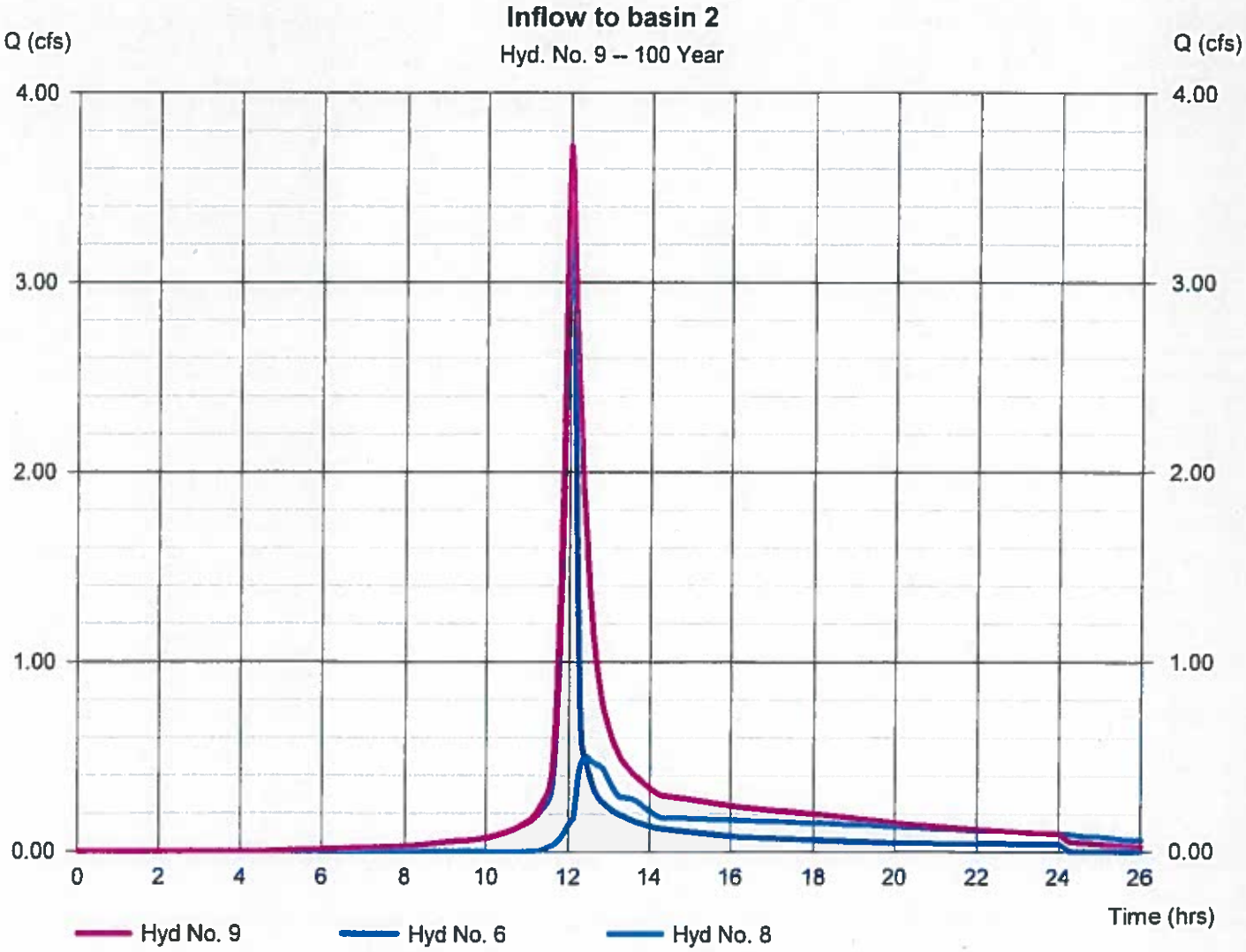


Hydrograph Report

Hyd. No. 9

Inflow to basin 2

Hydrograph type	= Combine	Peak discharge	= 3.718 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 18,544 cuft
Inflow hyds.	= 6, 8	Contrib. drain. area	= 0.000 ac



Hydrograph Report

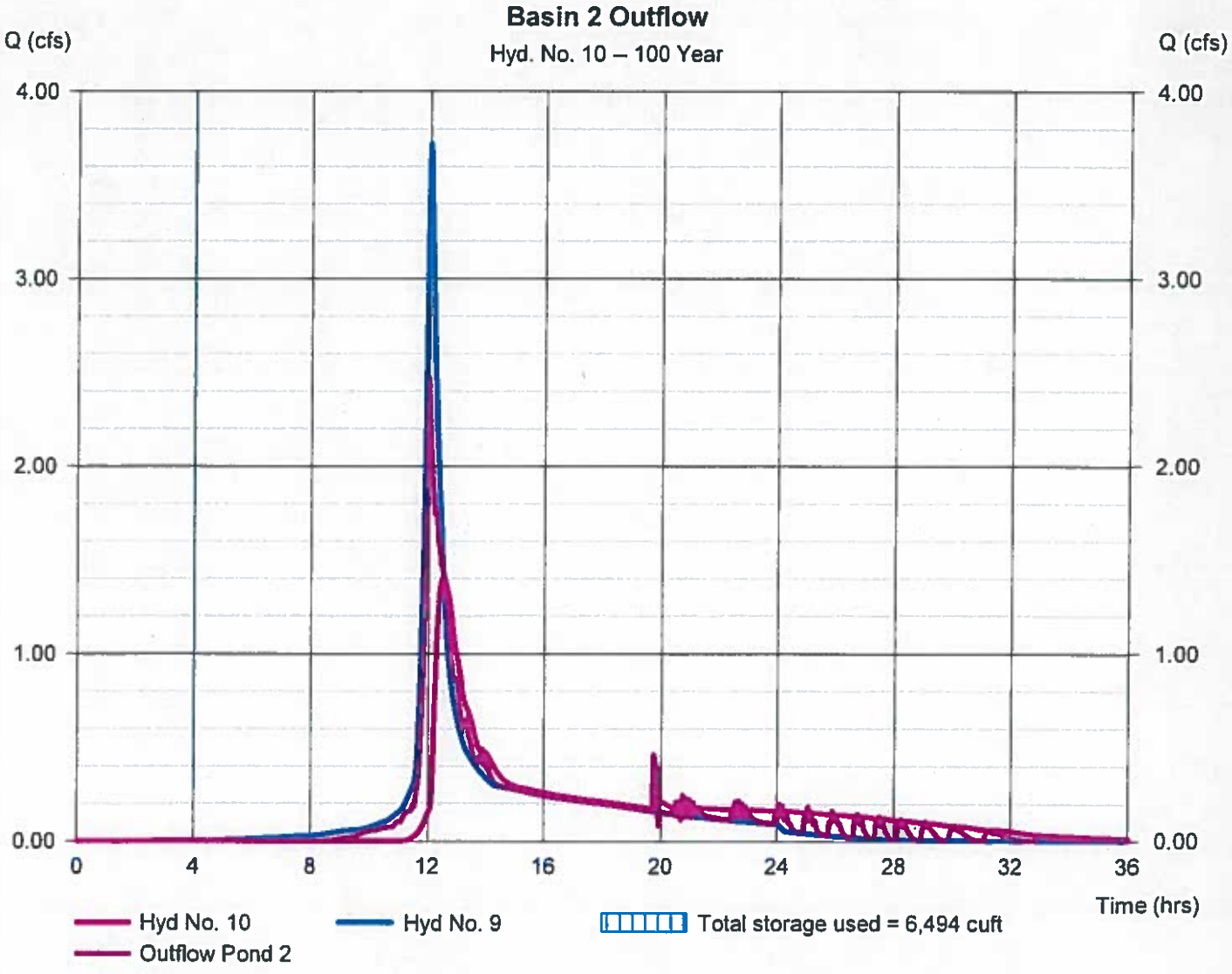
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 — Tuesday, 02 / 16 / 2021

Hyd. No. 10

Basin 2 Outflow

Hydrograph type	= Reservoir (Interconnected)	Peak discharge	= 1.411 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.50 hrs
Time interval	= 2 min	Hyd. volume	= 17,786 cuft
Upper Pond	= Sand Basin #1	Lower Pond	= SAND BASIN #2
Inflow hyd.	= 9 - Inflow to basin 2	Other Inflow hyd.	= None
Max. Elevation	= 97.04 ft	Max. Elevation	= 98.00 ft
Max. Storage	= 2,763 cuft	Max. Storage	= 3,730 cuft

Interconnected Pond Routing. Storage Indication method used.

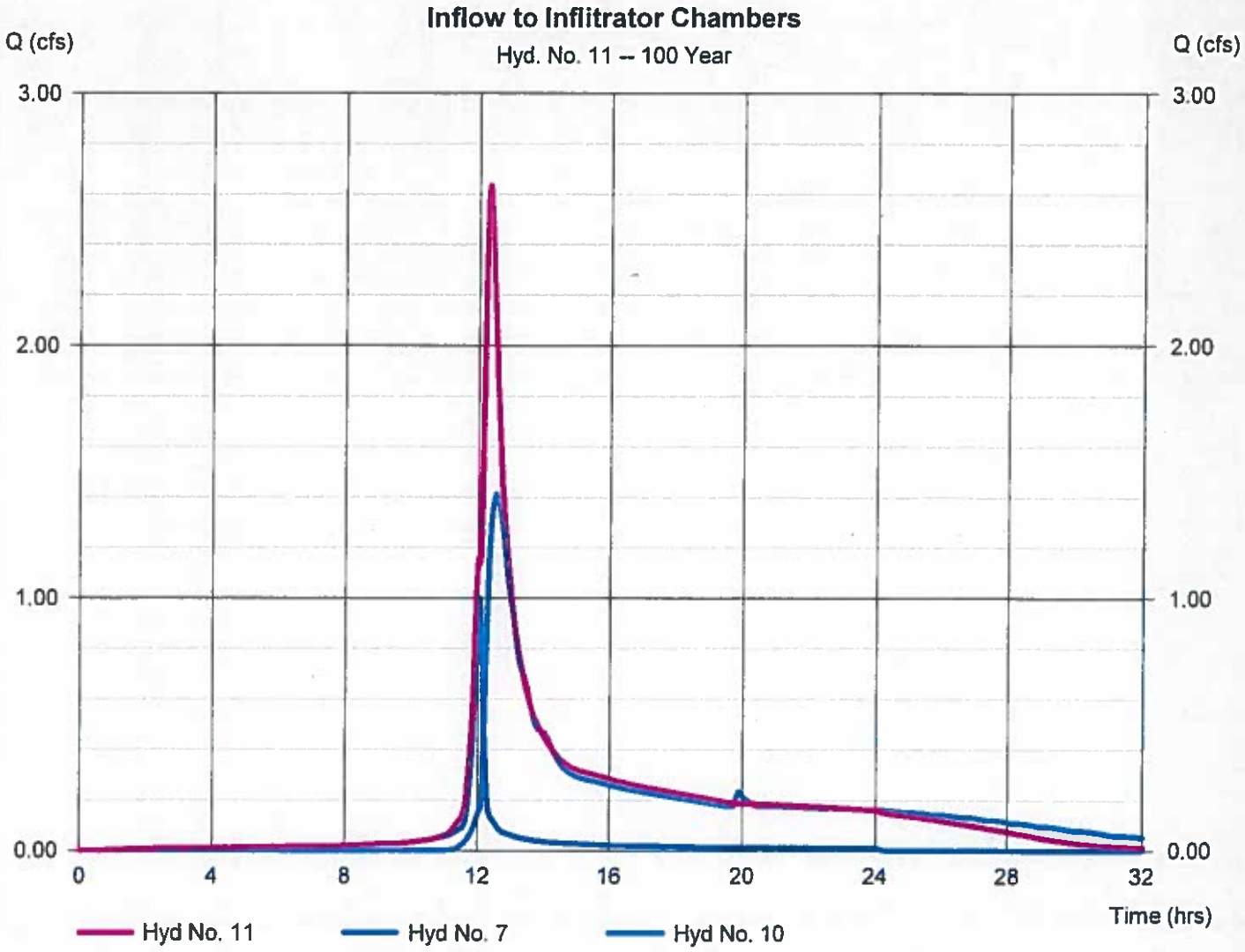


Hydrograph Report

Hyd. No. 11

Inflow to Inflitrator Chambers

Hydrograph type	= Combine	Peak discharge	= 2.635 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 20,947 cuft
Inflow hyds.	= 7, 10	Contrib. drain. area	= 0.095 ac



Hydrograph Report

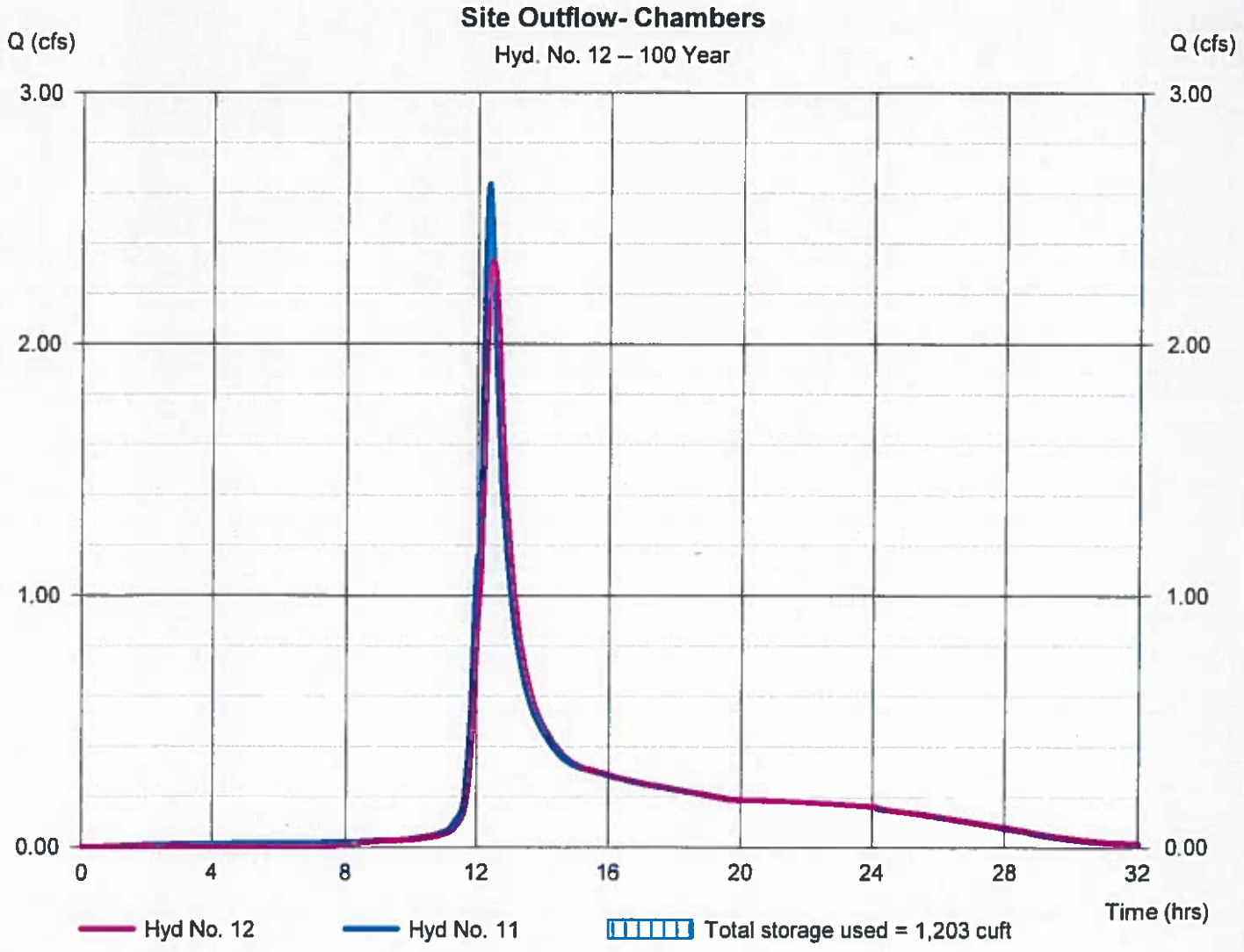
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Tuesday, 02 / 16 / 2021

Hyd. No. 12

Site Outflow- Chambers

Hydrograph type	= Reservoir	Peak discharge	= 2.331 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 20,695 cuft
Inflow hyd. No.	= 11 - Inflow to Inflitrator Chambers	Max. Elevation	= 96.67 ft
Reservoir name	= Recharge Chambers	Max. Storage	= 1,203 cuft

Storage Indication method used.



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	49.1011	12.2000	0.8732	------
2	57.2873	12.3000	0.8621	------
3	0.0000	0.0000	0.0000	------
5	0.0000	0.0000	0.0000	------
10	65.8347	12.6000	0.8085	------
25	57.5756	11.1000	0.7423	------
50	0.0000	0.0000	0.0000	------
100	48.4935	9.2000	0.6560	------

File name: Long Branch.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.09	3.28	2.74	2.37	2.09	1.87	1.70	1.55	1.43	1.33	1.25	1.17
2	4.91	3.94	3.31	2.86	2.53	2.27	2.06	1.89	1.75	1.63	1.52	1.43
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	6.48	5.29	4.50	3.94	3.51	3.17	2.90	2.67	2.48	2.32	2.18	2.06
25	7.32	5.99	5.11	4.49	4.02	3.65	3.35	3.11	2.90	2.72	2.57	2.43
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	8.51	6.98	6.00	5.30	4.78	4.37	4.04	3.76	3.53	3.33	3.16	3.01

Tc = time in minutes. Values may exceed 60.

Precip. file name: Monmouth Cty 24hr rainfall.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.35	0.00	0.00	5.16	0.00	0.00	8.76
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.20
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2018-015-125

APPENDIX D

Infiltrator System Design Data

RECHARGE TRENCH SIZING CALCULATIONS

6 Tennant Rd.
Block 122, Lot 33
Township of Marlboro, Monmouth County, New Jersey

By: MPS
Date: February 15, 2021
Project #: 2018-015-125

DRYWELL VOLUME

Trench Width: 6.5 ft
Trench Length: 180 ft
Trench Height: 5.0 ft

Void Ratio: 40%
Chambers: 24 Stormtech SC-740

(74.9 cf/Chamber) - SC-740
(See attached manufacturer's data)

Chamber Volume: 1797.60 ft^3

Total Storage Volume= 1797.60 Cubic Feet

TIME TO DRAIN

Stone Bottom Area: 1170 sf
1/2 Sides Area: 900 sf
Total Infiltration Area: 2070 sf (Bottom Area + 1/2 Sides)

Infiltration Rate: 14.60 in/hr (Most Restrictive Layer)
Factor of Safety: 2.00
Design Infiltration Rate: 7.30 in/hr (Min. Permissible, See Chapter 9.3 of BMP Manual)

$$\text{Time to Drain} = \frac{1797.60 \text{ cf} \times 12 \text{ in}}{2070.00 \text{ sf} \times 1 \text{ ft} \times 7.30 \text{ in/hr}}$$

Time to Drain = 1.43 hours (<72 hrs - Complies)

Posh Car Wash
Drywell
2/15/2021

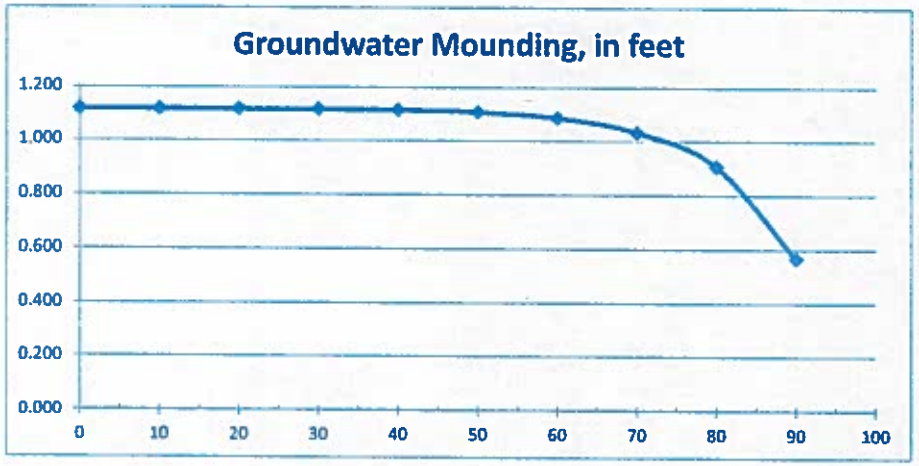
Input Values

7.30	R	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
36.50	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
90.000	x	1/2 length of basin (x direction, in feet)
3.250	y	1/2 width of basin (y direction, in feet)
1.43	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

11.119	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
1.119	Δh(max)	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.119	0
1.119	10
1.119	20
1.118	30
1.115	40
1.107	50
1.086	60
1.032	70
0.906	80
0.567	90

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

ADVANCED DRAINAGE SYSTEMS, INC.

SiteASSIST by StormTech
FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

Posh Car Wash

Marlboro, NJ

STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-740, SC-310, OR APPROVED EQUAL.
2. CHAMBERS SHALL BE MANUFACTURED FROM VIRGIN POLYPROPYLENE OR POLYETHYLENE RESINS.
3. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORT PANELS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
4. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
5. CHAMBERS SHALL MEET ASTM F2922 (POLYETHYLENE) OR ASTM F2418 (POLYPROPYLENE), "STANDARD SPECIFICATION FOR THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
6. CHAMBERS SHALL BE DESIGNED AND ALLOWABLE LOADS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
7. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. THE CHAMBER MANUFACTURER SHALL SUBMIT THE FOLLOWING UPON REQUEST TO THE SITE DESIGN ENGINEER FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE:
   a. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY AASHTO FOR THERMOPLASTIC PIPE.
   b. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET. THE 50 YEAR CREEP MODULUS DATA SPECIFIED IN ASTM F2418 OR ASTM F2922 MUST BE USED AS PART OF THE AASHTO STRUCTURAL EVALUATION TO VERIFY LONG-TERM PERFORMANCE.
   c. STRUCTURAL CROSS SECTION DETAIL ON WHICH THE STRUCTURAL EVALUATION IS BASED.
8. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-310/SC-740 SYSTEM

1. STORMTECH SC-310 & SC-740 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-310 & SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/SC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS.

   STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 3/4-2" (20-50 mm).
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-310 & SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-310 & SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

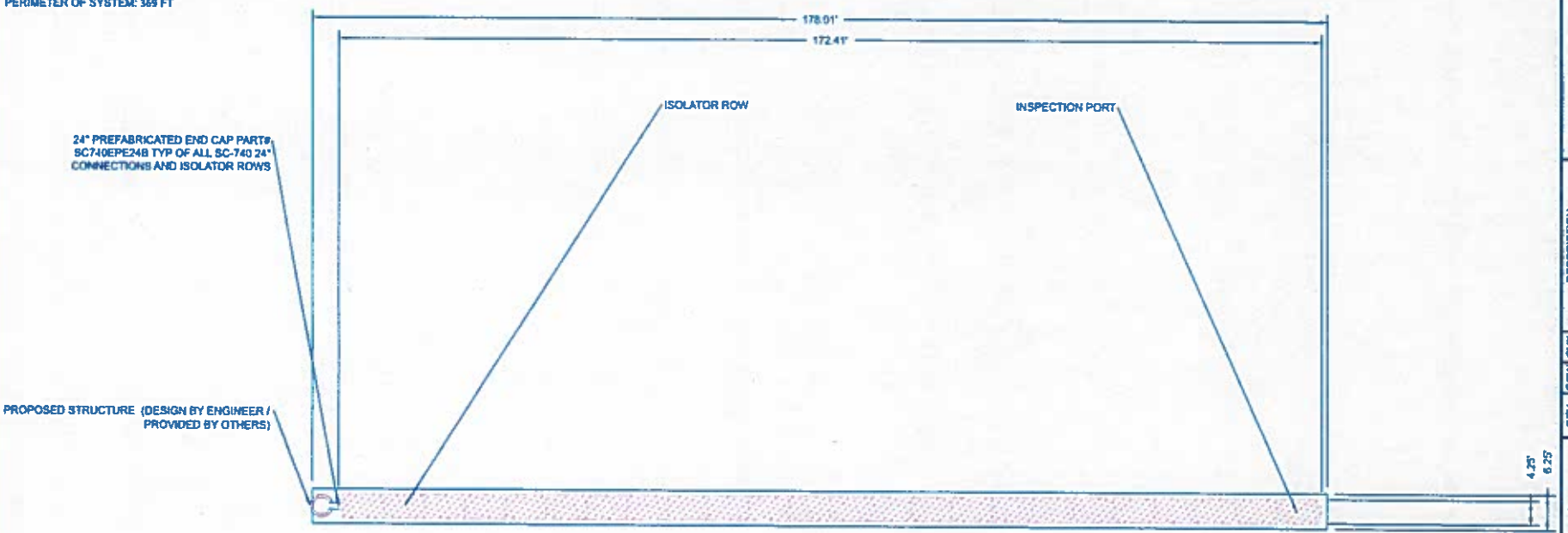
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

CONCEPTUAL LAYOUT

(24) STORMTECH SC-740 CHAMBERS
(2) STORMTECH SC-740 END CAPS
INSTALLED WITH 6 " COVER STONE, 6 " BASE STONE, 40% STONE VOID
INSTALLED SYSTEM VOLUME: 2219 CF
AREA OF SYSTEM: 1113 **FT²**
PERIMETER OF SYSTEM: 369 FT

COMPUTER GENERATED CONCEPTUAL LAYOUT - NOT FOR CONSTRUCTION



Posh Car Wash
Marlboro, NJ

DATE: 02/15/2021 DRAWN: MS
PROJECT #: Tool CHECKED: —

REV | DRW | CHK | DESCRIPTION

StormTech

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

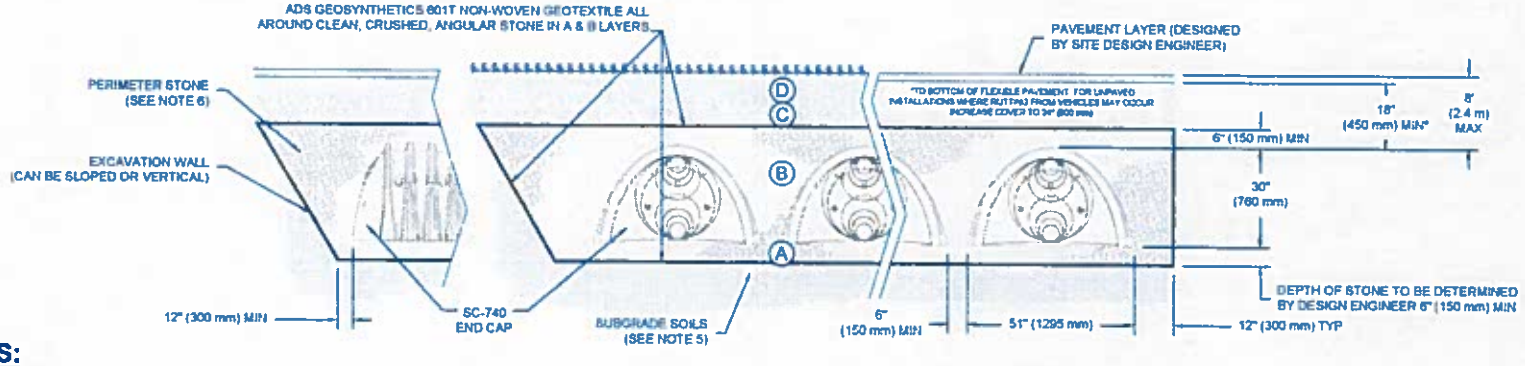
NOT TO SCALE

SHEET
2 OF 5

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 16" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN)
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE"
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION. FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.



NOTES:

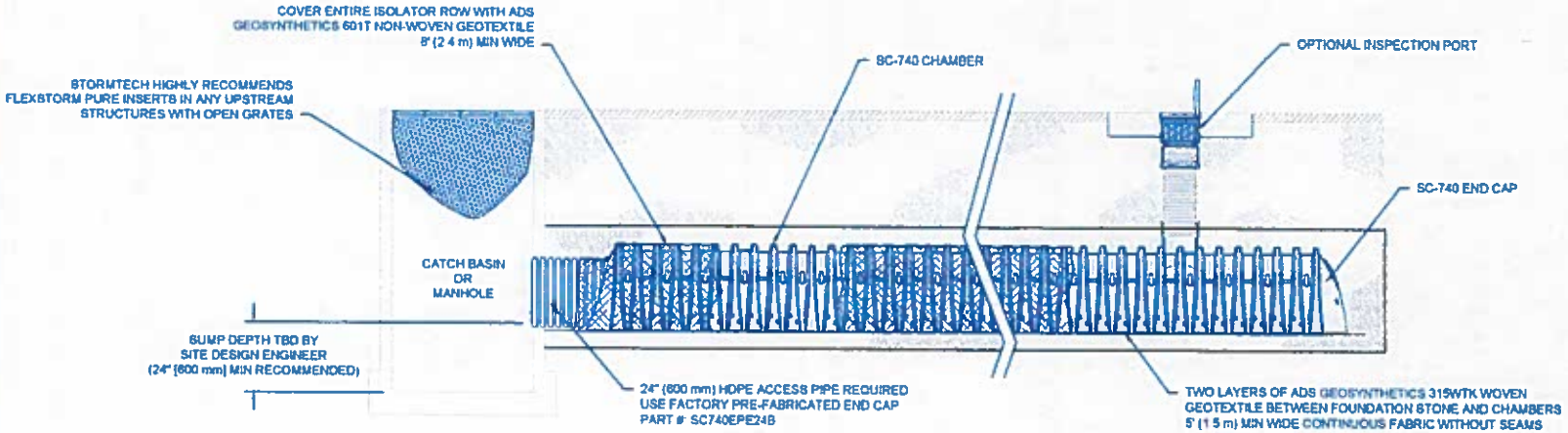
1. SC-740 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS", OR ASTM F2922 "STANDARD SPECIFICATION FOR POLYETHYLENE (PE) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
3. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS
4. THE "SITE DESIGN ENGINEER" REFERS TO THE ENGINEER RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE STORMTECH CHAMBERS FOR THIS PROJECT
5. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
6. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS
7. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION

Posh Car Wash
Marlboro, NJ

REV	DRW	CHK	DESCRIPTION	DATE
				02/15/2023

DRAWN: MS
CHECKED: --
PROJECT # Tod

4DS
4540 TRUEMAN BLVD
HILLIARD, OH 43026
t 800-733-7473



SC-740 ISOLATOR ROW DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3
- B. ALL ISOLATOR ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

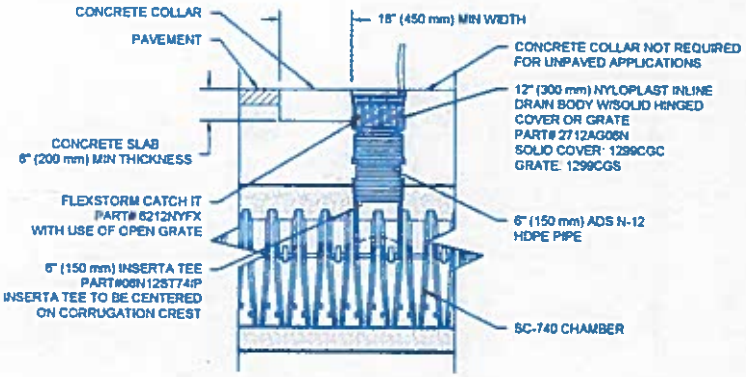
STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY



SC-740 6" INSPECTION PORT DETAIL
NTS

Posh Car Wash
Marlboro, NJ

DATE 02/15/2021 DRAWN MS
PROJECT # Tool CHECKED JT

REV | DRW | CHK | DESCRIPTION

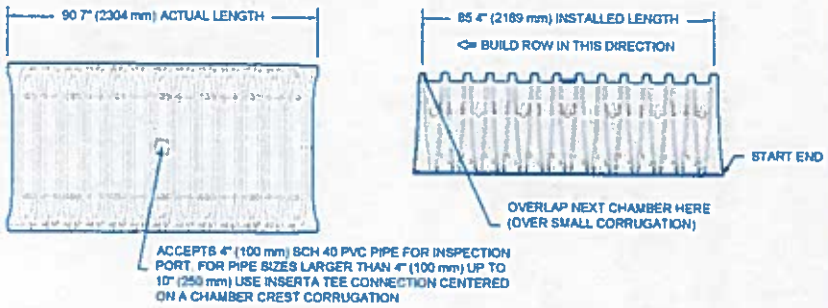
Stormtech

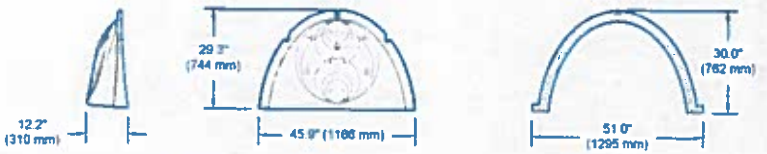
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1.800.733.7473

SHEET
4 OF 5

INTENTIONALLY
LEFT BLANK

SC-740 TECHNICAL SPECIFICATION
NTS



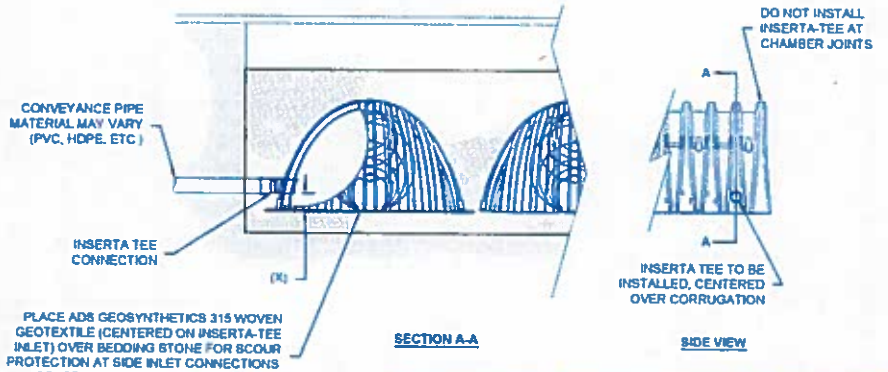


NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS

INSERTA TEE DETAIL
NTS

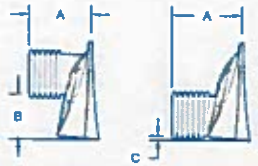


SECTION A-A

SIDE VIEW

CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS.
CONTACT STORMTECH FOR MORE INFORMATION



STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	19.5" (470 mm)	—
SC740EPE06B / SC740EPE06BPC			—	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	—
SC740EPE08B / SC740EPE08BPC			—	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	—
SC740EPE10B / SC740EPE10BPC			—	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	—
SC740EPE12B / SC740EPE12BPC			—	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	—
SC740EPE15B / SC740EPE15BPC			—	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	—
SC740EPE18B / SC740EPE18BPC			—	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	—	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694

* FOR THE SC740EPE24B THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

Posh Car Wash
Marlboro, NJ

DATE 02/15/2021 | DRAWN MS | CHECKED —
PROJECT # Tool

REV | DRW | CHK | DESCRIPTION

StormTech

ADS
4640 TRUEMAN BLVD
HILLIARD OH 43026
1-800-733-7473

SHEET
5 OF 5

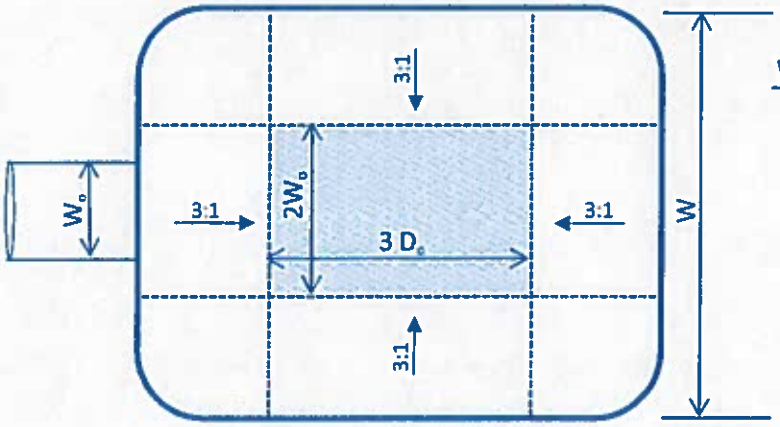
APPENDIX E

Conduit Outlet Protection Design

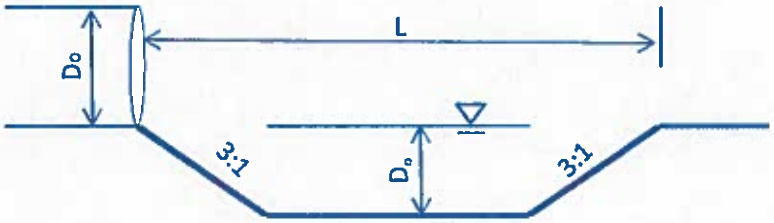
PREFORMED SCOUR HOLE 'A' DESIGN

Project: Posh Carwash
Block 122, Lot 33
Township of Marlboro, Monmouth County

2018-015-125
February 16, 2021



PLAN



SECTION

Where:

W_o = 1.25 Feet
D_o = 1.25 Feet

T_w = .2 D_o
or 0.25 Feet

q_{25} = 3.60 Ft^3/Sec

Design Calculations:

L = 11.3 Feet
W = 10.0 Feet

$$D_{50} = \frac{0.0125}{T_w} q_{25}^{1.33}$$

D_{50} = 0.27 Feet
or 3.3 Inches

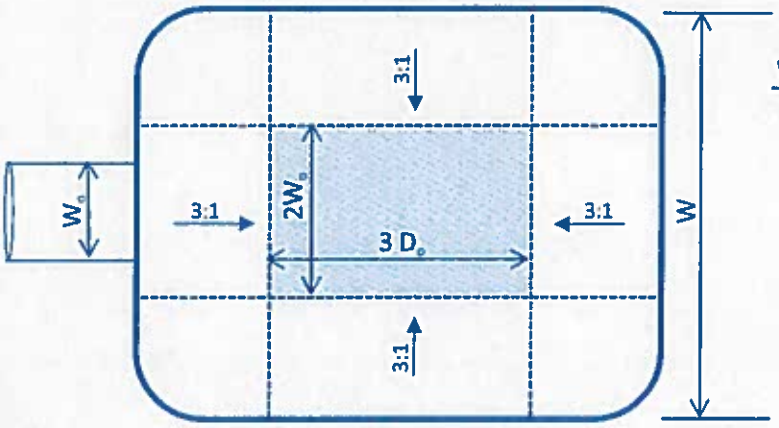
SCOUR HOLE DIMENSIONS		
Length	12	Feet
Width	10	Feet
D_{50}	4.0	Inches
Thickness	12	Inches

David A. Cranmer, PE
Professional Engineer License No. 41926

PREFORMED SCOUR HOLE 'B' DESIGN

Project: Posh Carwash
Block 122, Lot 33
Township of Marlboro, Monmouth County

2018-015-125
February 16, 2021



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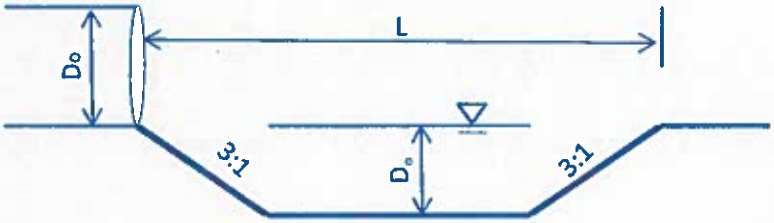


SECTION

Where:

W_o = 1.25 Feet
D_o = 1.25 Feet
T_w = .2 D_o
or 0.25 Feet

q_{25} = 2.30 Ft^3/Sec

Design Calculations:

L = 11.3 Feet
W = 10.0 Feet

$$D_{50} = \frac{0.0125}{T_w} q_{25}^{1.33}$$

D_{50} = 0.15 Feet
or 1.8 Inches

SCOUR HOLE DIMENSIONS		
Length	12	Feet
Width	10	Feet
D_{50}	4.0	Inches
Thickness	12	Inches

David A. Cranmer, PE
Professional Engineer License No. 41926

2018-015-125

APPENDIX F

NJDEP Groundwater Recharge Spreadsheet

New Jersey Groundwater Recharge Spreadsheet Version 2.0 November 2003

Annual Groundwater Recharge Analysis (based on GSR-32)

Project Name:	Posh Car Wash
Description:	B: 122, L: 33 ¦ Marlboro, NJ
Analysis Date:	02/16/21

Select Township ↓	Average Annual P (in)	Climatic Factor
MONMOUTH CO., MARLBORO TWP	44.9	1.44

Pre-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	0.21	Impervious areas	Klej	0.0	-
2	0.03	Woods	Klej	13.7	1,496
3	0.015	Gravel, dirt	Klej	10.0	544
4	0.27	Open space	Klej	14.5	14,208
5	0.015	Gravel, dirt	Keyport	6.9	378
6	0.04	Woods	Keyport	11.9	1,725
7	0.32	Open space	Keyport	12.2	14,132
8					
9					
10					
11					
12					
13					
14					
15					
Total =	0.9			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				9.9	32,482

Post-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	0.418	Impervious areas	Keyport	0.0	-
2	0.274	Open space	Keyport	12.2	12,101
3	0.147	Open space	Klej	14.5	7,735
4	0.061	Impervious areas	Klej	0.0	-
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
Total =	0.9			Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				6.1	19,836

Annual Recharge Requirements Calculation ↓

% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft)	20,865
Post-Development Annual Recharge Deficit=	*12,646*	(cubic feet)	

Recharge Efficiency Parameters Calculations (area averages)

RWC=	3.01	(in)	DRWC=	1.34	(in)
ERWC =	0.84	(in)	EDRWC=	0.38	(in)

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

Project Name	Description	Analysis Date	BMP or LID Type
Posh Car Wash	B: 122, L: 33 | Marlboro, NJ	02/16/21	

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	2500.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	1.2	in
Upper level of the BMP surface (negative if above ground)	dBMPu	-0.2	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	24.0	in
Post-development Land Segment Location of BMP, Input Zero if Location is distributed or undetermined	SegBMP	0	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.84	in
ERWC Modified to consider dEXC	EDRWC	0.38	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.29	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	0.15	in
Inches of Rainfall to capture	Pdesign	0.21	in
Recharge Provided Avg. over Imp. Area		7.3	in
Runoff Captured Avg. over Imp. Area		10.1	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.12	unitless
BMP Volume	VBMP	251	cu.ft

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	12,646	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	20,865	sq.ft
Root Zone Water Capacity	RWC	3.01	in
RWC Modified to consider dEXC	DRWC	1.34	in
Climatic Factor	C-factor	1.44	no units
Average Annual P	Pavg	44.9	in
Recharge Requirement over Imp. Area	dr	7.3	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		12,646	cu.ft
Avg BMP Recharge Efficiency		72.3%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.7%	%
%Runoff Infiltrated		28.8%	%
%Runoff Recharged		20.8%	%
%Rainfall Recharged		16.2%	%

CALCULATION CHECK MESSAGES

Volume Balance-> OK
dBMP Check—> OK
dEXC Check—> OK

BMP Location—> Location is selected as distributed or undetermined

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

2018-015-125

APPENDIX G

NJDEP Groundwater Mounding Spreadsheet (Hantush)

Basin #1 & Basin #2

BASIN TIME TO DRAIN CALCULATIONS

Posh Carwash - 6 Tennent Rd.
Block 122, Lot 33
Township of Marlboro, Monmouth County, New Jersey

By: MPS
Date: February 16, 2021
Project #: 2018-015-125

B-1 TIME TO DRAIN

Volume to be Infiltrated:	382	cf	
Total Infiltration Area:	1000	sf	
Infiltration Rate:	16.92	in/hr	(Most Restrictive Layer)
Factor of Safety:	2.00		
Design Infiltration Rate:	8.46	in/hr	(Minimum Permissible, See Chapter 9.3)

$$\text{Time to Drain} = \frac{382 \text{ cf} \times 12 \text{ in}}{1000 \text{ sf} \times 1 \text{ ft} \times 8.46 \text{ in/hr}}$$

Time to Drain = 0.54 hours (<72 hrs - Complies)

B-2 TIME TO DRAIN

Volume to be Infiltrated:	382	cf	
Total Infiltration Area:	1200	sf	
Infiltration Rate:	14.60	in/hr	(Most Restrictive Layer)
Factor of Safety:	2.00		
Design Infiltration Rate:	7.30	in/hr	(Minimum Permissible, See Chapter 9.3)

$$\text{Time to Drain} = \frac{382 \text{ cf} \times 12 \text{ in}}{1200 \text{ sf} \times 1 \text{ ft} \times 7.30 \text{ in/hr}}$$

Time to Drain = 0.52 hours (<72 hrs - Complies)

Posh Carwash
Basin #1
2/15/2021

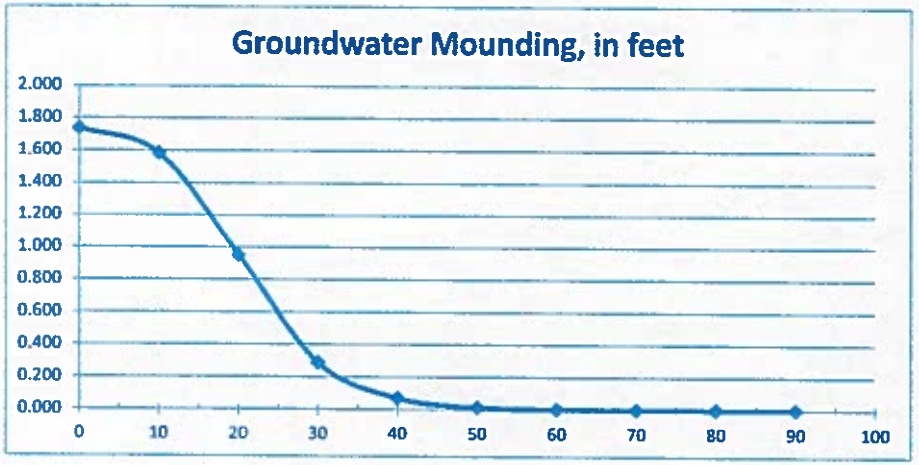
Input Values

8.46	R	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
42.30	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
20.000	x	1/2 length of basin (x direction, in feet)
12.500	y	1/2 width of basin (y direction, in feet)
0.54	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

11.739	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
1.739	Δh(max)	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.739	0
1.584	10
0.953	20
0.290	30
0.070	40
0.014	50
0.003	60
0.001	70
0.001	80
0.001	90

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Posh Carwash
Basin #2
2/15/2021

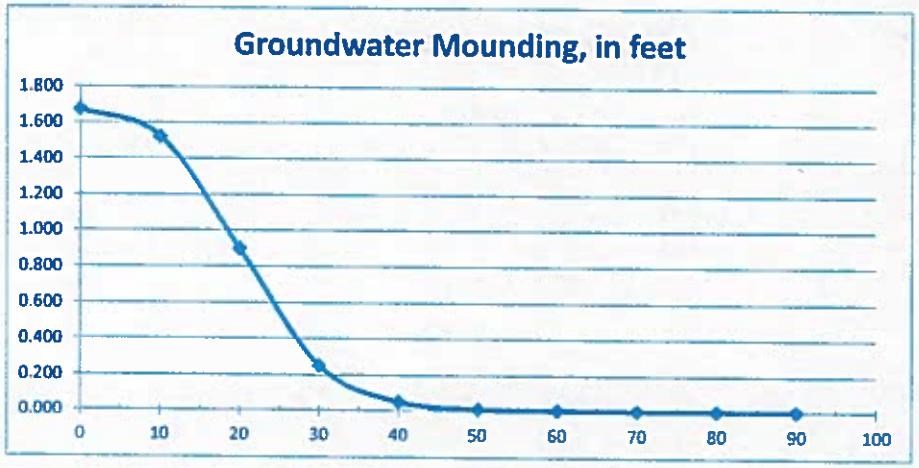
Input Values

7.30	R	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
36.50	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
20.000	x	1/2 length of basin (x direction, in feet)
15.000	y	1/2 width of basin (y direction, in feet)
0.52	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

11.672	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
1.672	Δh(max)	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.672	0
1.523	10
0.899	20
0.249	30
0.052	40
0.008	50
0.001	60
0.001	70
0.001	80
0.001	90

Re-Calculate Now



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APPENDIX H

Inlet Filter Data

FLEXSTORM INLET FILTERS

POWERED BY filtrexx TECHNOLOGY

ADS

STORMEXX® CLEAN CATCH BASIN FILTER

FlexStorm has partnered with Filtrexx to offer the latest in compost filter technology. The StormExx Clean Catch Basin Filter utilizes an enhanced cartridge filter for the capture and removal of sediment, hydrocarbons, heavy metals, nutrients and bacteria from stormwater runoff. The filter insert sits below the grate and will fit any round or rectangular storm drain using FlexStorm engineered framing systems.

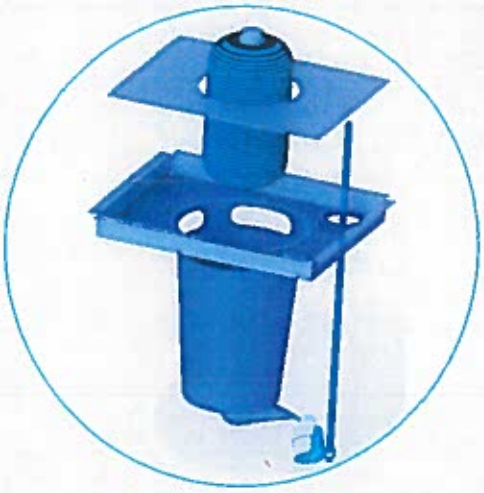
FEATURES & BENEFITS:

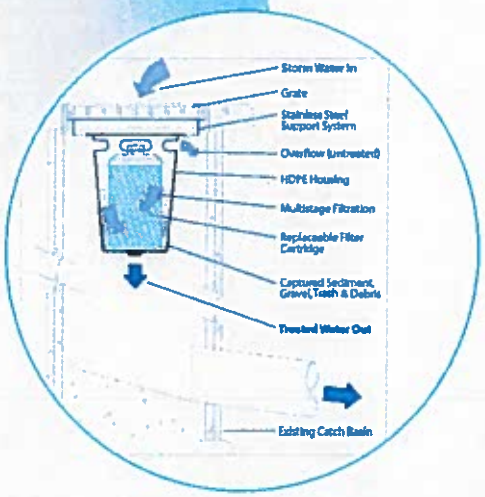
- Easy to install, maintain and replace
- Treats stormwater at the street/inlet level
- Patented multi-stage filtration system
- Option for double units
- Overflow bypass of 500+ gpm

TARGETS & EFFECTIVELY REMOVES THE FOLLOWING POLLUTANTS:

- TSS
- Total Phosphorous
- Soluble Phosphorous
- Ammonium Nitrate
- Chromium
- E. Coli
- pH (low) neutralized to 6.62
- Oil/Hydrocarbons
- Copper
- Zinc
- Cadmium
- Arsenic
- Total Coliform
- pH (high) neutralized to 8.31
- Turbidity
- Nickel
- TKN
- Lead
- Selenium
- Fecal Coliform

The above pollutants are common stormwater pollutants and part of industrial and municipal stormwater permit effluent limit guideline regulations. For total efficiency removal percentages and test methodology, reference Filtrexx TechLink Research Summary #3338 at www.filtrexx.com.





FLEXSTORM INLET FILTERS

POWERED BY filtrexx TECHNOLOGY

ADS

STORMEXX CLEAN CATCH BASIN FILTER

SUMMARY

StormExx inserts are for use at stormwater catch basins in roadways, parking lots and paved areas as indicated on the plans and specifications. The inserts remove sediment, hydrocarbons, heavy metals, nutrients and bacteria from stormwater run-off. Installer must provide size and type as required upon placing order. Inserts shall include all components required for a complete installation at each catch basin as indicated on drawings. Each insert shall include a stainless steel framing system and a replaceable filter/absorber cartridge with filter media having a combined total volume of approximately 1,200 cubic inches.

CATCH BASIN INSERT FEATURES AND CHARACTERISTICS

1. Filter Cartridge Size: Nominal 10" in diameter by 18" high with center perforated HDPE tube. Stormwater flows through media horizontally on a downward path through the filter/absorber cartridge before exiting the perforated tube. The cartridge shall slip over a perforated internal drain tube that exits through the bottom of the housing. The cartridge shall contain approximately 1,200 cubic inches of various absorbent material arranged primarily in layers. The outer surface of the cartridge shall be covered with a poly strainer fabric. Cartridge shall be easily removable for replacement. Drain tube with perforations may extend above filter/absorber portion to allow a minimum flow rate to deter standing water if unit becomes plugged or blinded.
2. Nominal Flow Rate: 15-40 gpm through clean filter/absorber cartridge. Unit features a large overflow opening area and space between housing, deflector and catch basin that allows for high overflow rates with minimum restriction during storm conditions. Overflow capable of passing several hundred gpm.
3. Nominal Flow Rate with Pre-Strainer: Where leaves and other surface material are anticipated, a pre-strainer can be used. Flow restriction can occur when pre-strainer is restricted or plugged.
4. Filter Housing: HDPE solid housing suitable for full height sediment containment and shall be nominal 15 gallons retention size. Smaller size capacity may be used on shallow catch basins. A perforated tube shall be incorporated within the housing to allow the filter/absorber cartridge to slip on for easy replacement. A locking screw-on-cap keeps cartridge in place during use. Use modified or shorter housing (with less storage, flow and filtration) where depth of catch basin is shallow or to suit basin.
5. Frame/Deflector: Each insert shall be fitted with a custom frame that directs incoming water from the grate inlet to the housing. Materials include HDPE or poly sheet and/or Type 304 SS sheet and frame.

OPERATION AND MAINTENANCE GUIDELINES

StormExx catch basin inserts are used to intercept stormwater as it passes through the grate. Heavy sediment items settle to the bottom of the housing and the collected water starts to rise and pass through the filter cartridge. As the rainfall rate increases, the water level may rise to the top of the cartridge. During high rainfall flow events excess untreated water will overflow the housing. **Note**: The most concentrated contaminants in stormwater generally occur at the beginning of each rain event. Stormwater treatment devices are frequently sized to treat this "first flush" event. Each site and installation may vary widely as to exposure to sediment, construction debris, landscaping and other pollutants.

With periodic site inspections, the proper care and maintenance frequency may be determined for a proper service schedule. The StormExx inserts should be inspected during each season before and after rain events to ensure that the insert filter assembly is ready to accept and treat stormwater run-off. Keep the grate and area within 6' of the grate clean and free of leaves, grass clippings, sediment and debris to minimize these contaminants from entering the unit housing. This is especially important during leaf fall season as decaying leaves on the filter cartridge can shorten filter life. Periodic visual inspections involve looking through the grate to see if any standing water exists. The collected water should drain through the filter cartridge that is designed for deep bed loading. As it becomes blinded or plugged with sediment, the flow rate capability will be reduced. Replace filter cartridge if standing water is in the housing. Maintenance schedules will vary with rainfall and pollutant concentration levels. Typical post-construction installations will require cartridge change-outs once or twice per year. If sediment reaches a height of 6" to 8" above bottom of the 24" housing, the sediment should be dumped and the filter cartridge inspected and replaced if necessary. Collected leaves, grass clippings, sediment, debris and spent filter cartridges that are not considered hazardous may be disposed of in on-site trash bins if approved by client. Cartridge disposal shall be in accordance with applicable rules and regulations.

Advanced Drainage Systems, Inc.
1-800-821-6710 www.ads-pipe.com

FLEXSTORM www.inletfilters.com

filtrexx®
SUSTAINABLE TECHNOLOGIES

TechLink Research Summary #3338

StormExx® Clean Filter Media Performance Evaluation

According to the U.S. Environmental Protection Agency's (US EPA) national water quality assessment, 35% of U.S. streams are severely impaired and 75% of the population lives within 10 miles of an impaired surface water (US EPA, 2007). In accordance with Section 303(d) of the Clean Water Act, the US EPA designates specific stream segments as impaired, triggering Total Maximum Daily Load (TMDL) development for particular pollutants in contributing watersheds - today there are approximately 50,000.

Storm water runoff is one of the leading sources of these pollutants. Typical concentrations in urban post-construction storm water runoff contributing to water quality impairment for total nitrogen (N) and nitrate-nitrogen range from from 0.14 mg/L to 29.0 mg/L, total phosphorus (P) from 0.24 mg/L to 3.6 mg/L (Flint and Davis 2007), oil/grease ranges from 10 mg/L to 35 mg/L (US EPA, 2002), and E. coli levels from 1,000 to 100,000 CFU/100 mL, with an average level near 30,000 CFU/100 mL (McLellan and Sauer, 2009).

Pollutants in urban storm water typically originate from non-point sources, and the majority of these pollutants are typically in soluble form. Berg and Carter (1980) reported that soluble pollutants may exceed 80% of the total storm water pollutant load where land surfaces have been stabilized. In many watersheds, soluble pollutants may be of greater concern due to an increased bioavailability to aquatic organisms, relative to sediment-bound pollutants. Storm water permit holders need adequate technology and best management practice (BMP) information to effectively reduce site storm water pollutants, protect the quality of receiving waters, and comply with industrial and municipal storm water permit effluent limit guidelines for storm water quality.

The US EPA National Pollutant Discharge Elimination System (NPDES) Phase II National Menu of Best Management Practices includes compost filter socks as a leading means to manage runoff (US EPA, 2006), while USDA ARS and university research shows these compost-based biofilters can target and filter a variety of storm water pollutants (Faucette et al., 2005; Faucette and Tyler, 2006; Faucette et al., 2006; Keener et al., 2007; Faucette, et al., 2008; Faucette et al., 2013). StormExx Clean is the latest technology to use compost biofiltration in a storm water application. StormExx Clean relies on a below the grate drop inlet filter cartridge to target specific pollutants commonly found in urban, municipal, and industrial storm water runoff.

The objective of this study was to evaluate the pollutant removal performance and longevity of StormExx Clean filtration media.

MATERIALS AND METHODS

Research was conducted at SWM laboratory, 2810 Weeks Ave SE, Minneapolis MN 55414. The laboratory study was designed to simulate and evaluate the storm water runoff pollutant removal performance of StormExx Clean compost-based filter media. Experiments were conducted to test the removal efficiency and capacity of the filter media for various pollutants from synthetic runoff. Pollutants evaluated included total suspended solids (TSS), turbidity, total kjeldahl nitrogen (TKN), ammonium-N (NH-4), total P (TP), soluble P (SP), oil/grease (OG), copper (Cu), nickel (Ni), lead (Pb), zinc (Zn), cadmium (Cd), chromium (Cr), arsenic (As), selenium (Se), low pH, high pH, total coliform bacteria, fecal coliform bacteria, and E. coli bacteria.

Each experiment evaluated a single pollutant, based on concentrations typical to urban, industrial, and municipal storm water runoff, with 10 sequential events spaced a minimum of 24 hours between events to simulate multiple runoff events. Each experiment was conducted in triplicate to obtain statistical means and standard deviations. The experiment used vertically mounted columns made from from 6 in (150 mm) nominal diameter, 48 in (1200 mm) high clear PVC tubes. Each column was filled with StormExx Clean filter media to a height of 36 in (900 mm). This is approximately the same volume of media that is used in a standard StormExx Clean catch basin filter cartridge. Filtration media was added to columns manually with no mechanical compaction.

Synthetic runoff was generated by adding soluble form pollutants to a stainless steel mixing pail with 12 L of municipal tap water. Flow velocity through the media was 15 in (375 mm)/min, and flow rate was 6 L/min. Concentrated soluble pollutants were

obtained from ERA Laboratory Supply Company (Golden, CO), sediment for TSS and turbidity used an AASHTO sandy loam soil, and all bacteria species used 3 oz (255 g) of field collected horse manure samples. Particle size distribution for the soil used for sediment was 10% < 0.002 mm, 7.5% < 0.06 mm, and 82.6% < 2.0 mm. One pail represented one storm water event. Prior to pouring the synthetic runoff into the column, a 16 L pail of municipal tap water was poured into each column and allowed to flow through the filter media. All runoff was metered into the top of the column and collected at the base of the column after each simulated runoff event. All collected water samples followed chain of custody protocols and were preserved in a cooler immediately after sampling and until delivery to the analytical laboratory. Water turbidity (NTU) was measured using a Hach 2100Q handheld turbidity meter and pH was measured using an Oakton pHTestr with Cole-Parmer Calibration Kit. All other water pollutants used US EPA sampling and analytical test methods described in the Methods for Chemical Analysis of Water and Wastes (US EPA, 1983) performed by Pace Analytical Laboratories.

Removal efficiency (%) was determined for each pollutant replicate and each event by dividing the effluent concentration by the influent concentration. Final removal efficiency was the mean for all replicates for the final storm event in the sequence, and total removal efficiency was the mean for all replicates for all storm events in the sequence. Means were determined using the three replicates for each event for each pollutant over the 10-event period for influent, effluent, and removal efficiency, while standard deviations were determined for influent concentrations for precision, bias, and quality control.

RESULTS

Table 1. Mean pollutant influent, effluent, final event removal efficiency, and total removal efficiency for all pollutants.

Pollutant	Influent (mg/L)	Effluent (mg/L)	Final Event Removal Efficiency (%)	Total Removal Efficiency (%)
TSS	483 ±41	49	83	90
Turbidity (NTU)	309 ±40	73	58	76
TKN	9.4 ±0.65	7.4	34	22
Ammonium-N	8.9 ±0.43	5.5	42	41
Total P	1.07 ±0.84	0.31	74	59
Soluble P	2.47 ±0.75	0.14	88	94
Oil/Grease	150 ±0.05	0.0	99	99
pH (low)	5.4 ±0.19	6.62	NA	NA
pH (high)	9.64 ±0.05	8.31	NA	NA
Copper	0.71 ±0.16	0.17	77	75
Cadmium	0.06 ±0.007	0.001	99	99
Chromium	0.93 ±1.4	0.75	50	24
Nickel	4.5 ±0.19	2.0	45	58
Lead	1.6 ±0.08	0.64	62	60
Zinc	1.8 ±0.12	0.78	59	58
Arsenic	1.2 ±0.046	1.0	19	18
Selenium	0.18 ±0.01	0.14	26	25
Total Coliform (MPN/100 mL)	938000 ± 5.0 x105	34000	2	79
Fecal Coliform (CFU/100 mL)	165000 ± 1.4 x105	40000	67	71
E. coli (MPN/100 mL)	2477000 ± 3.3 x106	3500	60	93

SUMMARY AND CONCLUSION

Based on this evaluation, StormExx Clean filtration media has the ability to target and remove a wide variety of sediment and soluble storm water pollutants, for both first flush and multi-event exposure conditions. Average pollutant removal efficiencies over 10 runoff events ranged from 18 to 99%, including removal for metals, nutrients, pH, hydrocarbons, sediment, and bacteria. These results give science-based evidence that this technology can be an effective best management practice and treatment system used in a comprehensive treatment train design approach to meet storm water permit requirements.

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