Living Word Church

South end of Donald Drive
City of Waukesha
Waukesha County, WI

Storm Water Management Plan

Prepared By:

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Introduction

Living Word Evangelical Lutheran Church is a proposing a new church development comprised of a single building and parking facilities. **The subject property is a 7.043 acre lot, of which roughly 3.319 acres is being proposed to be developed.**

The subject site is located of the west side of Saylesville Road, adjacent to Waukesha West High School. The property is currently being utilized as an agricultural farm field. The property drains north to south and discharges to an existing navigable drainage way, located at the southern tip of the property. Ultimately the storm water runoff from the site discharges to the Fox River.

The property to the west of the site is owned by Siepman Realty which is proposing to develop a subdivision, which will include a system of City roads and public utilities. The proposed Living Word Church project will propose to coordinate with the Siepmann development so future conditions mesh with the subject project. Storm water from the proposed site will continue to flow in the north to south direction, maintaining existing drainage patterns. A proposed storm water management facility will be located at the southernmost tip of the property and will discharge to the navigable drainage way maintaining the existing discharge point. Post development discharge rates from the facility will be maintained and/or reduce as compared to pre-existing conditions for the 2, 10, and 100 year storm events, meeting City requirements.

Owner

The owner and responsible entity for installation and maintenance of the storm water management practices is:

Living Word Evangelical Lutheran Church, Inc.
2712 Sussex Ln,
Waukesha, WI 53188
Contact: John Borgward
(262) 347-9673

Design Requirements

The following design standards have been used to develop the storm water management plan for the *Living Evangelical Lutheran Church*:

- City of Waukesha Stormwater Management Ordinance – Chapter 32
- Wisconsin Department of Natural Resources (WDNR) Technical Standards, NR 151 and NR 216.
- Summary of design requirements:
    - Peak Discharge: Peak flow rates from the post-development site shall be reduced to less than the corresponding event under existing conditions for the 1, 2, 10, and 100-year storm events.
    - Water Quality (Total Suspended Solids): Reduce, to the maximum extent practicable, the total suspended solids load by 80%, based on an average annual rainfall, as compared to no runoff management controls.

- Infiltration: Exempt for this property with clay and silt loam soils having less than a 0.6 in/hr infiltration rate above the field determined seasonal high groundwater elevations.

Analysis Overview

Existing and post development storm water runoff conditions for the Living Word Evangelical Lutheran Church Development project have been analyzed for: runoff volume, peak volume, discharge, detention area storage capacity required, outlet structures and storm sewer system requirements. The software package used for modeling and analysis was Hydraflow© 2015 Version 10.4 by Intelisolve. Hydraflow uses NRCS methods to generate runoff and pond routing hydrographs. Hydraflow's capabilities include: modeling simple or complex drainage basins, combining hydrographs to determine runoff and storage requirements, analyzing interconnected detention basins and detention basin and outlet structure sizing.

The computer model analyzed the one, two, ten, and one hundred-year storm events utilizing Waukesha Atlas 14 IDF curves. NOAA Waukesha MSE3 rainfall distribution is used. The necessary hydrographs were generated to determine the storm water runoff rates, depths and volumes for pre and post development conditions. This information is used to calculate detention basin size and outlet requirements.

Run-off curve numbers for the onsite and off-site areas were determined using the requirements outlined in the NRCS TR-55 Manual. The existing soils on the site are of hydrologic soil group type B. The central portion of the site is made up of predominantly Warsaw Loam (WhA). Curve numbers for proposed open space conditions have been based on hydrologic soil group type B within the development footprint.

The post development analysis runoff curve numbers are assigned based on TR-55 standards, and by calculating composite curve numbers per TR-55 standards, as applicable.

The rainfall depths for the 24-hour duration storm are:

Rainfall Depths for 24-Hour Storm Duration

(per City of Waukesha Atlas rain event data)

1-year	2-year	10-year	100-year
2.3	2.7	4.0	5.6

The following describes the curve numbers assigned for composite calculations:

Curve Numbers: Impervious Area (Pavement, Sidewalk, Etc.), CN = 98
Impervious Rooftop, CN = 98
Grass/Open Space in Good Condition: Type "B" Soil, CN = 61
Existing Site Cropland: CN = 70 (per current standards)

Existing Site Description & Drainage Summary

Description

The existing site is a vacant 7.043 acre property, located at the north side of Saylesville Road, adjacent to Waukesha West High School, in the City of Waukesha, Wisconsin. The parcel contains a navigable water way and wetland that straddles the southernmost property line with in the water way. The site is currently being farmed and has contained row crops during the growing season. The general drainage path for this site is in the north to south direction, and discharges to the water way.

The following is a summary of the existing conditions analysis:

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	------	1.105	1.658	-------	-------	4.143	-------	-------	10.64	E-1

Post-Development Site Description & Drainage Summary

Description

Living Word Evangelical Lutheran Church is a proposing a new church development comprised of a single building and parking facilities. **T**he subject property is a 7.043 acre lot, of which 3.087 acres is being proposed to be developed.

Storm water from the proposed site will flow in the north to south direction, maintaining existing drainage patterns. A proposed storm water management facility will be located at the southernmost tip of the property and will discharge to the navigable drainage way maintaining the existing discharge point. Post development discharge rates from the facility will be maintained and/or reduce as compared to pre-existing conditions for the 2, 10, and 100 year storm events, meeting City requirements.

Proposed Drainage Areas

- Area P-1 encompasses the majority for the developed site, which will contain the proposed building, parking lot and green space around building. This area will drain to the proposed storm water pond.
- Area P-2 encompasses open space, located between the developed site and the proposed storm water facility. This area has been intentionally left to be open space and has the potential to be developed into a future parking lot expansion, during future phases. This area will drain to the proposed storm water facility.
- Area UD-1 is an undetained drainage area, which includes the rear yard around the proposed building and will flow directly to the navigable water way, maintaining existing drainage patterns.

Future Phase Considerations

The proposed site has been design to meet the needs of the Living Word Church, with the knowledge that one of the hopes is spread their message and grow their congregation. Knowing

this is a possibility for the future there have been a few design considerations that have been proposed to meet potential future demand. First, with the high ground water in the areas of the proposed storm water management facility, the wet pool has been slightly over designed to allow for a future phase to be put online without disturbing the wet pool itself. The hope would be to expand the live storage area while maintaining the wet pool. Second, future expansion may likely include additions to the proposed building. With this in mind, the proposed storm sewer has been designed to handle additional flow generated by future roofs or developed area to the north of the proposed site. These design considerations have been included to ensure that the owner has the option to expand in the future with minimal disturbance to infrastructure proposed as part of this phase.

Proposed Drainage Summary

The following provides a summary of the peak discharge rates for the proposed drainage areas and rain gardens. Please refer to the attachments for additional information.

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	
3	SCS Runoff	------	2.785	3.460	-------	-------	6.012	-------	-------	11.69	P-1
4	SCS Runoff	------	0.080	0.159	-------	-------	0.665	-------	-------	2.359	P-2
5	SCS Runoff	------	0.023	0.064	-------	-------	0.280	-------	-------	0.924	UD-1
7	Combine	3, 4,	2.813	3.534	-------	-------	6.476	-------	-------	13.60	INFLOW TO POND P-1
8	Reservoir	7	0.107	0.121	-------	-------	1.428	-------	-------	9.611	POND P-1
9	SCS Runoff	------	0.740	0.840	-------	-------	1.196	-------	-------	1.953	UD-2
10	Combine	5, 8, 9	0.801	0.947	-------	-------	1.574	-------	-------	10.33	TOTAL DISCHARGE FROM SITE

Descriptions & Summaries of Storm Water Practices

Wet Pond P-1

Wet Pond P-1 receives water from drainage areas P-1 and P-2 through means of sheet flow and a system of inlets and storm sewer.

- Top of Berm = 61.25
- Overflow Weir = 60.25
- Top of Riser = 59.35
- 100-year = 59.93
- 10-year = 59.45
- 2-year = 58.96
- 2~12” culvert = 57.50
- Bottom of basin = 52.50
- NWL = 57.50
- 2” Orifice = 57.50

Infiltration Considerations

The geotechnical investigations and reporting indicate a predominance of soils with low infiltration rates (with infiltration rates less than 0.6 in/hr) below the topsoil. As such, the site is not ideal for storm water management through infiltration [NR 151.12(5)(c)6 and NR 151.124].

Total Site Release Rates

The table below summarizes the storm water release rates associated with the development. The Allowable Release Rate is defined as the pre-development release rate, which is the existing/pre-development drainage area. The Total Proposed Release Rate is calculated as the addition of the:

- Wet Pond P-1 release rate at the peak time
- Discharge from undetained area UD-1 at the peak time

The table verifies that the Storm Water Management Plan reduces the post-developed flow rates to equal to or less than the corresponding pre-developed (existing) flow rates. As a result, the actual design basin will be more conservative than the modelled basin.

Site Discharge*

Storm Event	**Total Proposed Release Rate**	**Allowable Release Rate**
(Year)	***(cfs)***	***(cfs)***
1	***0.801***	***1.105***
2	**0.947**	**1.658**
10	**1.574**	**4.143**
100	**10.330**	**10.640**

* Total Peak Runoff Rates are based on the addition of the peak discharge rates from the associated hydrographs at the peak time for the site; due to varying peak times, the total discharge rates are not a direct summation of the peak rates for each. Refer to the attached calculations for additional information.

Water Quality – TSS Reduction

WinSLAMM © version 10.0 was utilized to calculate the total suspended solids loadings for the rain garden drainage areas and reductions produced by the rain gardens. WinSLAMM version 10.2 allows the combining of areas and practices to produce a complete analysis in one design file. The following table provides a summary of the results of the WinSLAMM © analysis:

SLAMM Results – Living Word Church March 22, 2019			
Rain file: Milwaukee WI 1969.RAN Model Run Start Date: 03/28/69 Model Run End Date: 12/06/69	Runoff Volume (cu ft)	Particulate Solids Concentration (mg/L)	Particulate Solids yield (lbs)
Total Without Controls:			
P-1, P-2, UD-1, & UD-2	102,971	109.3	702.6
Total Site	**102,971**	**-**	**702.6**
Total After Outlet Controls:			
P-1, P-2, UD-1, & UD-2	103,064	20.20	130.0
Total Site	**103,064**	**-**	**130.0**
Percent Reduction: **Total Rear Yard/Rain Garden Site**	N/A	N/A	**81.50%**

Conclusion

The proposed Living Word Evangelical Lutheran Church development meets the storm water management requirements of the City of Waukesha Storm Water Management chapter 32 requirements and WDNR NR 151.

APPENDIX 1

Geotechnical Report

CGC, Inc.

Construction • Geotechnical
Consulting Engineering/Testing

February 17, 2017
CM16163

Mr. John Bartelson
Living Word Church
2712 Sussex Lane
Waukesha, WI 53188-1335

Re: Geotechnical Exploration
Proposed Living Word Church
CTH X and Future West High Drive
Waukesha, Wisconsin

Dear Mr. Bartelson:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the subsurface exploration for the above-referenced project. The purpose of this exploration was to determine the subsurface conditions across the site and to provide geotechnical-related recommendations regarding site preparation, foundation, floor slab and pavement design/construction. In addition, the site's soils were evaluated to provide an indication as to their infiltration properties. One copy of the report is provided for your use, with an additional copy being forwarded electronically to Mr. Matthew Bailey of Trio Engineering.

PROJECT DESCRIPTION

We understand that the project consists of the proposed construction of an approximate 12,000 sq ft church on a vacant parcel located at the northwest corner of CTH X and future West High Drive in Waukesha, Wisconsin. The basic construction will consist of a single-story, slab-on-grade building, supported on conventional spread footings. Building foundation loads are expected to be relatively light to moderate with estimated maximum column and wall loads on the order of 75 kips and 3 klf, respectively. Current plans indicate that the finished floor of the building will be established at Elevation 63.5 ft. Existing site grades within the planned building footprint vary between Elevations 61 and 63 ft; therefore, relatively minor fills are anticipated to establish the planned building subgrade.

The development will include at-grade surface parking for 78 vehicles and a related access drive southwest/west of the building. Other planned site improvements include the construction of stormwater management area south of the new pavement areas. Future expansion plans include a building addition to the northwest side of the church and an expansion of the parking lot to accommodate 160 total vehicles.

336 S. Curtis Road
West Allis, WI 53214
Telephone: 414/443-2000
FAX: 414/443-2099

EXPLORATION PROGRAM

The subsurface conditions were explored by drilling twelve (12) standard penetration test (SPT) borings across the site. Borings 1 through 6 were drilled within the footprints for the planned and future buildings to a depth of 15 ft below existing site grades. Borings 7 through 10 were drilled in the planned pavement areas and were extended to a depth of 7.5 ft. The remaining two borings, Nos. 11 and 12, were drilled within the stormwater management area and were extended to a depth of 15 ft. The number and location of the borings was selected by Trio Engineering. The boring locations were field staked by the driller as shown in plan on the Soil Boring Location Map presented in Appendix B. Ground surface elevations at the test locations were determined by interpolating between plan contours shown on the "Preliminary Site Utility and Grading Plan" (dated 1/13/17). Specific procedures used for drilling and sampling are described in Appendix A.

Water level observations were made at each boring location during and immediately upon completion of drilling. Representative samples of the subsoils were also collected during the field exploration for classification and laboratory testing. The soils were classified by a geotechnical engineer using the Unified Soil Classification System (USCS) and the samples collected from the stormwater management area borings (i.e., No. 11 and 12) were also classified in accordance with the descriptive procedures, terminology and interpretations presented by the USDA - NRCS Field Book for Describing and Sampling Soils (version 2.0, dated September 2002). Pocket penetrometer readings were also obtained on intact cohesive samples, where appropriate, to aid in the evaluation of their shear strength properties. The final logs and soil evaluation-storm form prepared by the engineer per the USCS and USDA procedures are presented in Appendices B and C, respectively.

SITE CONDITIONS

A. Surface Conditions

The proposed development area is depicted on the Soil Boring Location Map attached in Appendix B. The site is currently an agricultural field. The subject parcel has a fairly level to slightly rolling topography, with site grades typically varying from Elevations 57 to 66 ft. The site slopes gently downward to the south.

B. Regional Geology

Surficial soil deposits (i.e., upper 5 ft) within the planned development site are mapped in the *Soil Survey for Milwaukee and Waukesha Counties* as Warsaw loam (WeB) and Warsaw silt loam

(WhA). The Warsaw series is generally described as loamy glaciofluvial soils that have silt loam, loam, sandy clay loam and stratified sand to gravel underlain by sand and gravel outwash deposits. The Warsaw soil series is characterized as being well drained with a seasonal high ground table in the range of 60 to 80 in.

C. Subsurface Conditions

The subsurface exploration program revealed a fairly uniform soil profile across the site. The generalized subsurface profile consists of the following (in descending order): 12 to 18 in. of black to dark brown clayey topsoil; 0 to 3.5 ft of brown lean clay; underlain by fine to coarse sand and gravel or sand to the maximum depths explored (i.e., 15 ft). Pocket penetrometer readings ranged between 0.75 and 1.75 tsf within the natural surficial lean clays, indicating the cohesive soils are medium stiff to stiff. The underlying natural granular soils are typically medium dense to very dense, with SPT blow counts (i.e., N-values) generally ranging between 25 to greater than 100 blows/ft.

Exceptions to the above-described generalized profile were noted and include the following:

- Loose to medium dense silt soils were observed below the surficial lean clay and/or topsoil in Borings 1 and 12, respectively, between the depths of 3.5 to 6 ft and 1 to 2 ft.

- Medium dense to very dense sandy silt soils were observed below the prevailing underlying sand and gravel soils in Borings 2 through 6, 11 and 12.

D. Groundwater Conditions

Groundwater was encountered within all the borings at depths of 3.5 to 6 ft during and/or upon completion of drilling. Groundwater was typically observed within the underlying sand and gravel soils at fairly consistent levels during and following drilling and corresponding to an elevation in the range of 56 to 58.5± ft. Water levels can be expected to fluctuate, however, based on seasonal variations in precipitation, infiltration, surface runoff, etc.

More detailed information regarding the subsurface and groundwater conditions is presented on the boring logs contained in Appendix B. The completed Soil Evaluation-Storm form, with detailed soil profile descriptions prepared for the two stormwater borings following USDA classification procedures, is presented in Appendix C.

DISCUSSION AND RECOMMENDATIONS

Within the limitations described below, it is our opinion that the site is suitable for construction and that the planned structure can be supported by conventional spread footings. Specific recommendations for site preparation, as well as foundation, floor slab and pavement design/construction, are presented in the following subsections. Discussion regarding the infiltration characteristics of the subsoils within the designated stormwater basin is presented in Subsection E. Additional information regarding the conclusions and recommendations presented in this report is discussed in Appendix D.

A. Site Preparation

To prepare the site for construction, we recommend that surficial vegetation and topsoil be removed from within and to a point at least 5 ft beyond the proposed building and pavement limits, along with clearing and grubbing of the trees on the site. The observed topsoil thickness ranges between 12 and 18 in. Topsoil is generally not considered suitable for re-use as structural fill and should be stockpiled in designated areas beyond the construction limits, or removed from the site. However, these soils may be used in landscape areas.

Based on planned site grades, it is our understanding that relatively minor cutting and filling (i.e., generally 2 ft or less) will be required to establish the building pad and the majority of the surrounding parking/pavement area subgrades. Following the removal of surficial vegetation/topsoil, the exposed subgrades are generally expected to consist of the medium stiff to stiff brown lean clay or loose silt soils. *The clayey soils are mottled and/or exhibit relatively low unconfined compressive strengths (i.e., medium stiff to stiff) and display an average moisture content of around 23%. Therefore, some areas of instability following topsoil removal should be anticipated.* Furthermore, these soils are highly susceptible to disturbance and loss of bearing capacity if subjected to repeated trafficking by wheeled or tracked construction equipment, especially if wet. To assist in the evaluation of the subgrades across the site, we recommend that exposed subgrades be evaluated by proof-rolling with a loaded tri-axle dump truck, scraper or a similar piece of rubber-tired construction equipment. The purpose of proof-rolling is to check the overall stability of the exposed subgrade, as well as for identifying soft or yielding conditions that may require recompaction or undercutting prior to any fill placement. If unstable areas are detected, an initial attempt should be made to aerate and densify the subgrade by recompaction where natural moisture contents are at appropriate levels (i.e., on the dry side of optimum moisture content). If this procedure is ineffective, the disturbed soils should be undercut and replaced with compacted fill and/or stabilizing materials such as an imported 3-in. breaker rock. A relatively firm, non-yielding subgrade should be established prior to proceeding with fill placement.

After the subgrade is prepared as described above, the exposed subgrade should be thoroughly compacted with an appropriate piece of construction equipment. Fill placement should then proceed as necessary to establish planned subgrade elevations. Selection, placement and compaction of engineered fills should be in accordance with the guidelines presented in our "Recommended Compacted Fill Specifications" included in Appendix E. It is anticipated that the bulk of the fills used to develop building and pavement area subgrades will originate from completed site cuts and from the stormwater basin excavation. These materials are generally expected to consist of the prevailing lean clay, with possible silt and sand/gravel soils. These materials are generally deemed suitable for developing building and pavement area subgrades. The placement of the clayey and silt soils in structural areas will require close observation on a regular basis during fill placement including the monitoring of moisture contents, compaction levels and the overall stability of the prepared fill subgrade. Natural moisture contents of the clay soils ranged between 21 and 25%. *As such, some moisture conditioning of the clay and silt soils should be anticipated to achieve desired compaction levels noted in Appendix E.* Engineered fills placed below structures and pavement areas should be compacted to a minimum of 95% and 93 to 95%, respectively, of the modified Proctor (ASTM D1557). Regular field density testing should be conducted during fill placement to confirm that satisfactory compaction levels are being achieved.

B. Foundation Design

Based on the proposed finished floor elevation of 63.5 ft, bearing conditions are expected to be fairly uniform. It is anticipated that foundations for the planned building will bear within the natural soil strata described as either the stiff lean clay and/or the medium dense to very dense fine to coarse sand and gravel. However, loose silt soils may be encountered within the future expansion footprint (i.e., Boring 1).

Provided the building pad subgrade is developed per the recommendations outlined in the Site Preparation section of this report, the following parameters should be used for foundation design, assuming that all footings are bearing directly on the above mentioned suitable bearing subsoils:

- **Maximum Allowable Bearing Pressure:** 2,000 psf

- **Minimum Foundation Widths:**
  -- Continuous wall footings: 18 in.
  -- Individual column pads: 30 in.

- **Minimum Footing Depths:**
  -- Exterior footings: 4 ft
  -- Interior footings: No minimum required

- **Site Classification for Seismic Design**
  In our opinion, the average soil/rock properties in the upper 100 ft of the site (based on SPT blow count N-values exceeding 15 blows per foot, on average, in granular soils) can be conservatively characterized as a stiff soil profile. This characterization would place the site in Site Class D for seismic design according to the International Building Code, current edition (see Table 1613.5.2).

We recommend that footing subgrades be observed by a CGC representative during the excavation operation to check that bearing soils are consistent with the findings of the exploration. The evaluation would include checking for localized soft and/or loose zones within the near surface natural subsoils that may have gone undetected beyond the borings completed for the project, and confirming the adequacy of undercutting, if deemed necessary, should questionable weak clayey zones be encountered at and/or below planned footing grades. Should unsuitable conditions occur, footings can be either extended to bear on the underlying competent soils (i.e., sand and gravel) or established on engineered granular fill and/or crushed stone placed within the undercut excavation. If an undercut/refill scheme is deemed necessary, the width of the over-excavation should be equal to the footing width plus the depth of undercut below the base of the footing. *It should be recognized that observed groundwater levels were detected at depths of 0.5 to 1.5 ft below planned footing grades. Should undercutting be deemed necessary, measures may need to be implemented to control groundwater inflows.* Fill placement should proceed in accordance with the guidelines presented in Appendix E. Alternately, footing grades could be re-established with a lean-mixed concrete having a minimum strength of 500 psi. The main advantage with lean concrete is that over-sizing of the excavation can be reduced to a maximum width which equals the footing width plus approximately 6 in. each side. Footings can then be cast directly on the lean concrete base.

Providing the foundation design/construction recommendations discussed above are followed, we estimate that total and differential settlements should not exceed 1.0 and 0.5 in., respectively.

C. Floor Slabs

After preparing the building site as described in the Site Preparation section of this report, soils present at floor subgrade should generally be suitable for slab-on-grade construction. Based on the proposed floor slab grade, subgrade soils beneath the slab are expected to consist of engineered fills

placed to establish the planned floor subgrade and/or natural soils. Floor slabs supported on the prepared subgrade may be designed using a subgrade modulus of 100 pci. At a minimum, the slab should contain mesh for crack control. Prior to slab construction, the subgrades should be recompacted to densify soil that may become disturbed or loosened during construction activities. To serve as a capillary break, the final 4 to 6 in. of soils placed below the slab should consist of an imported well-graded sand or gravel with no more than 5 percent by weight passing the No. 200 U.S. Standard Sieve. To further minimize the potential for moisture migration, a plastic vapor barrier could also be utilized. Fill and drainage course materials required to prepare floor slab subgrades should be placed in accordance with the guidelines presented in Appendix E. If clean crushed stone is used as a drainage course material, these materials should be densified until no deflection or settlement is observed under compaction equipment.

Floor slabs should be isolated from the building walls and columns with a compressible filler, and the design should include an adequate number of isolation and contraction joints.

D. Pavement Design

We assume the pavements within the access drives and vehicle parking lots surrounding the building are expected to be exposed primarily to automobile traffic (i.e., Traffic Class I per the 2016 WAPA Design Guide), with limited truck traffic. The pavement subgrade will consist of a combination of the natural lean clay soils or newly-compacted fill. Prior to base course placement, the subgrade soils should be proof-rolled as discussed in the Site Preparation section of this report, and evaluated regarding the need for any undercutting. The clayey soils will control the pavement thickness design. Accordingly, the pavement section tabulated below was selected based on a CBR value in the range of 2 to 4 for the prepared subgrade, WAPA design guidelines and a design life of 15 to 20 years.

Table 1
Recommended Pavement Section

Material	Thickness (in.)	WisDOT Specification [1]
Bituminous upper layer	1.5	Section 460, Table 460-1, 9.5 mm and 12.5 mm
Bituminous lower layer	2.0	Section 460, Table 460-1, 12.5 mm and 19.0 mm
Dense graded base course (*fully-fractured crushed stone*)	8.0	Sections 301 and 305, 31.5 mm
TOTAL THICKNESS	**11.5**	

Notes:

1. Wisconsin DOT *Standard Specifications for Highway and Structure Construction*, latest edition, including supplementals but excluding limitations in Section 460.3.2 relating layer thickness to aggregate size.

2. Compaction requirements:
   -- Bituminous concrete: Refer to Section 460.3.3.
   -- Base course: 95% modified Proctor (ASTM D1557); also refer to Section 301.3.4.2, Standard Compaction.

3. Type LT or equivalent asphaltic pavement is recommended. Refer to Section 460, Table 460-2 of the *Standard Specifications*.

Pavement areas subjected to concentrated wheel loads, such as near the dumpster pad, etc., should be constructed of a Portland cement concrete. The slab should be at least 6 in. thick, contain mesh reinforcement for crack control, and be underlain by at least 4-inches of well-graded granular soils. It is recommended that the edges of these pads be thickened to 12 inches to minimize cracking. A subgrade modulus of 100 pci should be used for concrete pavement design founded on recompacted/stable soils.

The pavement design assumes a stable/non-yielding subgrade and a preventative maintenance program. If there is a period of delay between completion of subgrade preparation and the placement of base course and pavements, the subgrade could soften or become disturbed due to wet conditions or construction traffic. Unstable soils should be recompacted or replaced immediately prior to placement of base course and pavement. The subgrade should also be protected from frost during construction.

E. Stormwater Infiltration Potential

Based on the concept plan provided for our review, management of stormwater runoff is anticipated to be addressed by the utilization of a basin located in the southwest corner of the site. The proposed base elevation of the basin will be established near Elevation 57 ft. Current site grades within the basin footprint vary between Elevations 58 to 62 ft. Therefore, cuts on the order of 1 to 5 ft will be required to establish the bottom of the basin.

The subsoil conditions within the basin area were explored by the drilling of two borings (i.e., Nos. 11 and 12). The borings were extended to a depth of 15 ft below the existing ground surface. Based on the relatively shallow depth to groundwater (i.e., 3.5 to 5.5 ft, corresponding to Elevations 55.9 to 56.4 ft) as revealed by the pond borings and elsewhere across the site, it is our opinion that this site has a very limited capacity for infiltration of stormwater through the use of infiltration devices. Therefore, as there is only a 1 ft or less separation from the bottom of the basin and observed groundwater, the site is considered to be **excluded** from infiltration (except for roof runoff). The on-site lean clays appear to be suitable to construct a "Type A" clay liner according to guidelines outlined in Section A of Appendix D of the Wisconsin Department of Natural Resources (WDNR) *Technical Standard 1001* (Wet Detention Pond), however. Because groundwater was observed within 1 ft of the planned bottom of the pond, the need for dewatering measures to be implemented during pond construction should be expected.

In summary, based on the soil classifications, guidelines in the Wisconsin DNR *Technical Standard 1002,* and the lack of 5 ft of separation between the bottom of pond and the seasonal high groundwater, the site should be eligible for *exclusion* under Chapter NR 151 Wis. Adm. Code guidelines, in our opinion. Should infiltration be performed at the site, a design infiltration rate of 0.07 in. per hour is recommended based on the limiting lean clay and guidelines provided in the aforementioned *Standard.*

The soil evaluation-storm form prepared by the engineer per USDA procedures is presented in Appendix C.

CONSTRUCTION CONSIDERATIONS

Due to variations in weather, construction methods and other factors, specific construction problems are difficult to predict. Soil related difficulties which could be encountered on the site are discussed below:

1. Due to the sensitive nature of the silty and/or clayey soils at the site, we recommend that general site grading activities be completed during dry weather, if possible. Earthwork construction during the early spring or late fall could be complicated as a result of wet weather and freezing temperatures.

2. Trafficking of prepared/stabilized subgrades should be kept to a minimum to minimize disturbance of the subgrade.

3. During cold weather, exposed subgrades should be protected from freezing before and after footing construction. Fill should never be placed while frozen.

4. Excavations extending greater than 4 ft in depth below the existing ground surface should be sloped or braced in accordance with current OSHA standards.

5. Based on observations made during the field exploration, groundwater infiltration into footing excavations is not expected to be a problem. However, should isolated undercutting be deemed necessary and/or water accumulate at the base of the footing excavation as a result of precipitation or seepage from interspersed sand seams (if any), we believe that satisfactory removal of seeping water (short-term) could be accomplished by using pumps operating from filtered sump pits.

RECOMMENDED CONSTRUCTION MONITORING

The quality of the foundation and floor slab subgrades will be largely determined by the level of care exercised during site development. To check that earthwork and foundation construction proceeds in accordance with our recommendations, the following operations should be monitored by CGC:

1. Foundation, floor slab and pavement subgrade preparation;
2. Fill placement and compaction;
3. Foundation excavation; and
4. Concrete placement.

* * * * *

It has been a pleasure to serve you on this project. We look forward to continuing our project involvement by providing construction testing services during the construction phase of the project. If you have any questions or need additional consultation, please contact us.

Sincerely,
CGC, Inc.

Nathan I. Springstead, P.E., C.S.T.
Senior Staff Engineer

Jeff P. Simkowski, P.E.
Senior Consulting Professional

Encl: Appendix A - Field Exploration
Appendix B - Soil Boring Location Map
Logs of Test Borings (12)
Log of Test Boring - General Notes
Unified Soil Classification System
Appendix C - Soil Evaluation-Storm Form
Appendix D - Document Qualifications
Appendix E - Recommended Compacted Fill Specifications

cc (via email): Mr. Matthew Bailey / Trio Engineering

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

A series of twelve (12) 7.5 to 15 ft deep Standard Penetration Test (SPT) soil borings were drilled at the site between January 11 and 12, 2017 at the approximate locations shown on the Soil Boring Location Map presented in Appendix B. The soil borings were drilled by J&J Soil Testing, Ltd. (under subcontract to CGC, Inc.) using a truck-mounted, rotary drill rig equipped with hollow-stem augers. Ground surface elevations at the boring locations were determined by methods described in this report.

In each boring, soil samples were generally obtained at 2.5-ft intervals to a depth of 10 ft and at 5-ft intervals thereafter. The soil samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1586. The specific procedures used for drilling and sampling are described below.

1. Boring Procedures Between Samples

   The boring is extended downward, between samples, by a hollow-stem auger.

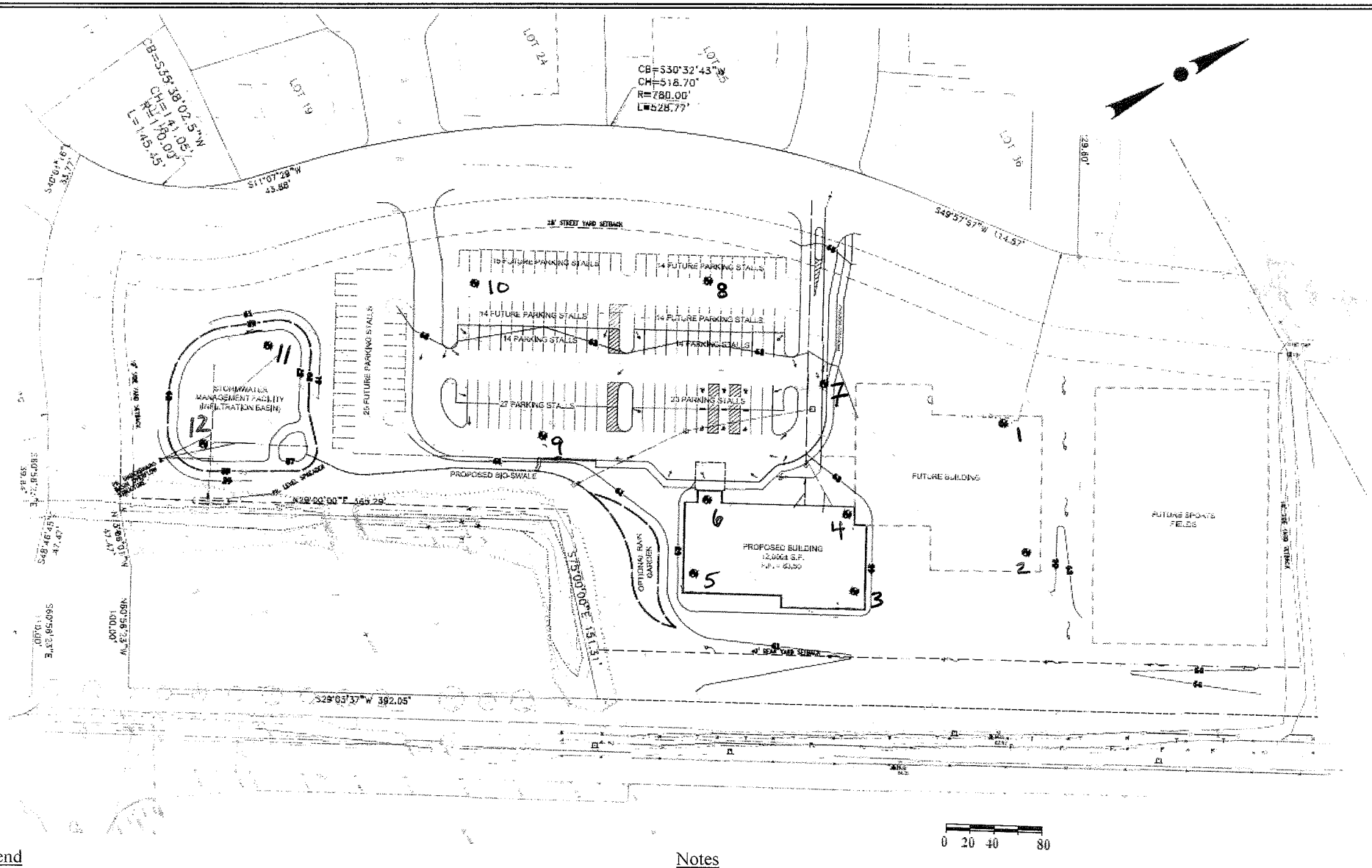
2. Standard Penetration Test and Split-Barrel Sampling of Soils
   (ASTM Designation: D 1586)

   This method consists of driving a 2-inch outside diameter split barrel sampler using a 140-pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance. Recovered samples are first classified as to texture by the driller.

During the field exploration, the driller visually classified the soil and prepared a field log. *Field screening of the samples for possible environmental contaminants was not conducted during the field exploration program, as environmental site assessment activities were not part of CGC's work scope.* Water level observations were made in the borehole during and after drilling and are shown at the bottom of each boring log. Upon completion of drilling, the boreholes were backfilled in accordance with WDNR regulations, and the soil samples were delivered to our laboratory for visual classification and laboratory testing. The soils were visually classified by a geotechnical engineer using the Unified Soil Classification System. The final logs prepared by the engineer and a description of the Unified Soil Classification System are presented in Appendix B. USDA classifications are presented in the Soil Evaluation - Storm Form attached in Appendix C.

APPENDIX B

SOIL BORING LOCATION MAP
LOGS OF TEST BORINGS (12)
LOG OF TEST BORING - GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM



Legend

Denotes Approximate Soil Boring Location and Number

Notes

1. Soil borings were conducted by J&J Soil Testing, Ltd. (under subcontract to CGC) on January 11 and 12, 2017.
2. Base map is an excerpt of the "Preliminary Site Utility and Grading Plan" provided by Trio Engineering.

Drwn: --	APP'D: NIS	Date: 2/13/17	CM16163	**CGC, Inc.**	**SOIL BORING LOCATION MAP** **Living Word Church** **CTH X & Future West High Drive** **Waukesha, Wisconsin**

CGC Inc.

LOG OF TEST BORING

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **1**
Surface Elevation (ft) **63.8**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LOI
						16" Black Clayey TOPSOIL (OL)					
1A/B		14	M	6		Stiff, Brown Mottled Lean CLAY; Little Fine Sand, Trace Gravel (CL)	(1.25)	23.5			
2		6	M	7	5	Loose, Brown Mottled SILT; Little Clay and Fine Sand, Trace Gravel (ML)		16.7			
3		15	W	40		Dense to Very Dense, Brown Fine to Coarse SAND and GRAVEL; Trace Silt, Few Scattered Cobbles and Boulders (SP/GP)					
4		14	W	41	10						
5		0	-	100/1"	15	End of Boring at 15 ft Backfilled with Bentonite Chips					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0' ±** Upon Completion of Drilling **5.5'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/11/17** End **1/11/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

CGC Inc.

LOG OF TEST BORING

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **2**
Surface Elevation (ft) **63.0**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LOI
						18" Black Clayey TOPSOIL (OL)					
1A/B		12	M	9		Stiff, Dark Brown Mottled Lean CLAY; Little Fine Sand, Trace Gravel (CL)	(1.5)	24.7			
						Medium Dense to Very Dense, Brown Fine to Coarse SAND and GRAVEL; Trace Silt, Some Scattered Cobbles and Boulders (SP/GP)					
2		14	M	53							
					5						
3		10	W	67							
4		18	W	27							
					10						
5		18	W	13		Medium Dense, Light Brown Sandy SILT; Some Clay, Little Fine to Coarse Gravel (ML)					
					15	End of Boring at 15 ft Backfilled with Bentonite Chips					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **5.0'** Upon Completion of Drilling **5.5'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/11/17** End **1/11/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

CGC Inc.

LOG OF TEST PIT

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **3**
Surface Elevation (ft) **62.3**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	H.P.'s (in.)
						13" Black Clayey TOPSOIL (OL)					
1		8	M	7		Stiff, Brown Mottled Lean CLAY; Little Fine Sand, Trace Gravel (CL)	(1.5)	23.2			
2		6	M/W	27/6"		Medium Dense to Dense, Brown Fine to Coarse SAND and GRAVEL; Trace Silt, Some Scattered Cobbles and Boulders, Few Wet Fine to Medium Sand Layers (SP/GP)					
3		18	W	29	5						
4		2	W	32							
5		18	W/M	20	10	Medium Dense, Light Brown Sandy SILT; Some Clay, Little Fine to Coarse Gravel (ML)					
					15	End of Boring at 15 ft Backfilled with Bentonite Chips					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **4.5'** Upon Completion of Drilling **4.0'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/11/17** End **1/11/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

CGC Inc.

LOG OF TEST BORING

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **4**
Surface Elevation (ft) **62.7**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LOI
						12" Black Clayey TOPSOIL (OL)					
1		13	M	6		Medium Stiff to Stiff, Dark Brown Mottled Lean CLAY; Little Fine Sand, Trace Gravel (CL)	(1.0)	20.8			
2		18	M/W	48	▽	Dense to Very Dense, Brown Fine to Coarse SAND and GRAVEL; Trace Silt, Some Scattered Cobbles and Boulders (SP/GP)					
					5						
3		18	W	51							
4		7	W	32							
					10						
5A/B		18	W	30							
					15	Medium Dense to Dense, Light Brown Sandy SILT; Some Clay, Little Fine to Coarse Gravel (ML)					
						End of Boring at 15 ft Backfilled with Bentonite Chips					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **4.0' ±** Upon Completion of Drilling **4.5'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/12/17** End **1/12/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

CGC Inc.

LOG OF TEST BORING

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **5**
Surface Elevation (ft) **61.2**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LOI
						14" Black Clayey TOPSOIL (OL)					
1		10	M	14		Medium Dense to Dense, Brown Fine to Coarse SAND and GRAVEL; Trace Silt, Some Scattered Cobbles and Boulders, Few Moist to Wet Fine to Medium Sand Layers (SP/GP)					
						▽					
2		18	W	38							
					5						
3		12	W	40							
4		18	W	39							
					10						
5		18	W	12		Medium Dense, Light Brown Sandy SILT; Some Clay, Little Fine to Coarse Gravel (ML)					
					15	End of Boring at 15 ft Backfilled with Bentonite Chips					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **3.5'** Upon Completion of Drilling **3.5'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/11/17** End **1/11/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

LOG OF TEST BORING

CGC Inc.

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **6**
Surface Elevation (ft) **61.7**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LOI
						14" Black Clayey TOPSOIL (OL)					
1		12	M	6		Stiff, Dark Brown Mottled Lean CLAY; Little Fine Sand, Trace Gravel (CL)	(1.25)	21.9			
						Dense, Brown SAND and GRAVEL; Trace Silt, Some Scattered Cobbles and Boulders (SP/GP)					
2		15	W	45							
					5						
3		1	W	100/16"							
4		12	W	40							
					10						
5		6	W	12		Medium Dense, Light Brown Sandy SILT; Some Clay, Little Fine to Coarse Gravel (ML)					
					15	End of Boring at 15 ft Backfilled with Bentonite Chips					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **3.5' ±** Upon Completion of Drilling **4.0'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/12/17** End **1/12/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

CGC Inc.

LOG OF TEST BORING

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **7**
Surface Elevation (ft) **63.0**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LOI
						12" Black Clayey TOPSOIL (OL)					
1		10	M	6		6" Dark Brown Clayey TOPSOIL (OL)					
						Stiff, Dark Brown to Brown Mottled Lean CLAY; Little Fine Sand, Trace Gravel (CL)	(1.25-1.5)	23.9			
2		12	M	33		Dense, Brown Fine to Coarse SAND and GRAVEL; Trace Silt, Few Scattered Cobbles and Boulders (SP/GP)					
					5						
3		16	W	44							
						End of Boring at 7.5 ft Backfilled with Bentonite Chips					
					10						
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **5.5' ±** Upon Completion of Drilling **5.5'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/11/17** End **1/11/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

CGC Inc.

LOG OF TEST PIT

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **8**
Surface Elevation (ft) **64.4**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	H.P.'s (in.)
						14" Black Clayey TOPSOIL (OL)					
1A/B		15	M	5		Medium Stiff to Stiff, Dark Brown to Brown Mottled Lean CLAY; Little Fine Sand, Trace Gravel (CL)	(1.0-1.25)	21.1			
2A/B		18	M	13			(0.75)				
					5	Dense, Brown Fine to Coarse SAND and GRAVEL; Trace Silt, Some Scattered Cobbles and Boulders (SP/GP)					
3		10	W	46	▽						
						End of Boring at 7.5 ft Backfilled with Bentonite Chips					
					10						
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling **6.0'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/12/17** End **1/12/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

CGC Inc.

LOG OF TEST BORING

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **9**
Surface Elevation (ft) **61.8**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LOI
						15" Black Clayey TOPSOIL (OL)					
1A/B		15	M	6		Stiff, Dark Brown to Brown Mottled Lean CLAY; Little Fine Sand, Trace Gravel (CL)	(1.25)	25.4			
						Medium Dense, Brown Silty Fine to Medium SAND; Little to Some Fine to Coarse Gravel (SM)					
2		9	M/W	11	▽						
					5	Dense, Brown Fine to Coarse SAND and GRAVEL; Trace Silt, Some Scattered Cobble and Boulders (SP/GP)					
3		12	W	41							
						End of Boring at 7.5 ft Backfilled with Bentonite Chips					
					10						
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **4.0'** Upon Completion of Drilling **4.5'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/12/17** End **1/12/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

LOG OF TEST BORING

CGC Inc.

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **10**
Surface Elevation (ft) **63.8**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LOI
						18" Black Clayey TOPSOIL (OL)					
1		8	M	6		Medium Stiff, Brown Mottled Lean CLAY; Little Fine Sand, Trace Gravel (CL)	(0.75)				
2		6	M	48	5	Dense, Brown Fine to Coarse SAND and GRAVEL; Trace Silt, Some Scattered Cobbles and Boulders (SP/GP)					
3		10	M/W	46							
					10	End of Boring at 7.5 ft Backfilled with Bentonite Chips					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.5'** Upon Completion of Drilling **6.5'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/12/17** End **1/12/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

CGC Inc.

LOG OF TEST PIT

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **11**
Surface Elevation (ft) **61.4**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	H.P.'s (in.)
						14" Black Clayey TOPSOIL (OL)					
1A/B		13	M	7		Medium Stiff to Stiff, Dark Brown to Brown Mottled Lean CLAY; Little Fine Sand, Trace Gravel (CL)	(1.0-1.75)	22.3	33	18	
2		6	M	100/15"	5	Dense to Very Dense, Brown Fine to Coarse SAND and GRAVEL; Trace Silt, Some Scattered Cobbles and Boulders (SP/GP)					
3		12	W	38							
4		7	W	58	10						
						Very Dense, Light Brown Sandy SILT; Some Clay, Little Fine to Coarse Gravel (ML)					
5		8	M	61	15						
						End of Boring at 15 ft Backfilled with Bentonite Chips					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **5.0'** Upon Completion of Drilling **5.5'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/11/17** End **1/11/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

CGC Inc.

LOG OF TEST PIT

Project **Living Word Church**
CTH X & Future West High Drive
Location **Waukesha, Wisconsin**

Boring No. **12**
Surface Elevation (ft) **59.4**
Job No. **CM16163**
Sheet **1** of **1**

336 S. Curtis Rd, West Allis, WI 53214 (414) 443-2000, FAX (414) 443-2099

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	H.P.'s (in.)
						13" Black Clayey TOPSOIL (OL)					
1		12	M	20		Medium Dense, Dark Brown to Brown Mottled SILT; Little Fine Sand and Gravel, Trace Topsoil Inclusions (ML)					
						Medium Dense to Dense, Brown Fine to Coarse SAND and GRAVEL; Trace Silt, Some Scattered Cobbles and Boulders (SP/GP)					
2		9	W	43							
					5						
3		1	W	25							
4		5	W	36							
					10						
						Very Dense, Light Brown Sandy SILT; Some Clay, Little Fine to Coarse Gravel (ML)					
5		9	M	100/9"							
					15	End of Boring at 15 ft Backfilled with Bentonite Chips					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **3.5'** Upon Completion of Drilling **3.5'**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **1/11/17** End **1/11/17**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **AS**
Drill Method **2.25" HSA**

CGC, Inc.

LOG OF TEST BORING
General Notes

DESCRIPTIVE SOIL CLASSIFICATION

Grain Size Terminology

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to 12"	3" to 12"
Gravel: Coarse	¾" to 3"	¾" to 3"
Fine	4.76 mm to ¾"	#4 to ¾"
Sand: Coarse	2.00 mm to 4.76 mm	#10 to #4
Medium	0.42 to mm to 2.00 mm	#40 to #10
Fine	0.074 mm to 0.42 mm	#200 to #40
Silt	0.005 mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

General Terminology

Physical Characteristics
Color, moisture, grain shape, fineness, etc.
Major Constituents
Clay, silt, sand, gravel
Structure
Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin
Glacial, alluvial, eolian, residual, etc.

Relative Density

Term	"N" Value
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

Relative Proportions Of Cohesionless Soils

Proportional Term	Defining Range by Percentage of Weight
Trace	0% - 5%
Little	5% - 12%
Some	12% - 35%
And	35% - 50%

Consistency

Term	q_u-tons/sq. ft
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Medium	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

Organic Content by Combustion Method

Soil Description	Loss on Ignition
Non Organic	Less than 4%
Organic Silt/Clay	4 – 12%
Sedimentary Peat	12% - 50%
Fibrous and Woody Peat	More than 50%

Plasticity

Term	Plastic Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6" penetrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test.

SYMBOLS

Drilling and Sampling

CS – Continuous Sampling
RC – Rock Coring: Size AW, BW, NW, 2"W
RQD – Rock Quality Designation
RB – Rock Bit/Roller Bit
FT – Fish Tail
DC – Drove Casing
C – Casing: Size 2 ½", NW, 4", HW
CW – Clear Water
DM – Drilling Mud
HSA – Hollow Stem Auger
FA – Flight Auger
HA – Hand Auger
COA – Clean-Out Auger
SS - 2" Dia. Split-Barrel Sample
2ST – 2" Dia. Thin-Walled Tube Sample
3ST – 3" Dia. Thin-Walled Tube Sample
PT – 3" Dia. Piston Tube Sample
AS – Auger Sample
WS – Wash Sample
PTS – Peat Sample
PS – Pitcher Sample
NR – No Recovery
S – Sounding
PMT – Borehole Pressuremeter Test
VS – Vane Shear Test
WPT – Water Pressure Test

Laboratory Tests

q_a – Penetrometer Reading, tons/sq ft
q_a – Unconfined Strength, tons/sq ft
W – Moisture Content, %
LL – Liquid Limit, %
PL – Plastic Limit, %
SL – Shrinkage Limit, %
LI – Loss on Ignition
D – Dry Unit Weight, lbs/cu ft
pH – Measure of Soil Alkalinity or Acidity
FS – Free Swell, %

Water Level Measurement

▽ - Water Level at Time Shown
NW – No Water Encountered
WD – While Drilling
BCR – Before Casing Removal
ACR – After Casing Removal
CW – Cave and Wet
CM – Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

CGC, Inc.

Madison - Milwaukee

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

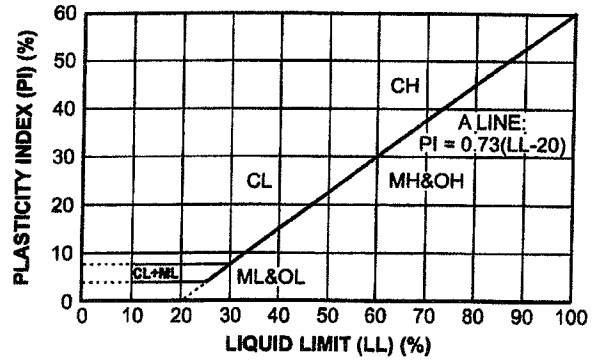
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



APPENDIX C

SOIL EVALUATION-STORM FORM

Wisconsin Department of Commerce
Division of Safety and Buildings

SOIL EVALUATION - STORM

in accordance with Comm 82.365 & 85, Wis. Adm. Code

Attach complete site plan on paper not less than 8 1/2 x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent slope, scale or dimensions, north arrow, and BM referenced to nearest road.

Please print all information.

Personal information you provide may be used for secondary purposes (Privacy Law, s.15.04 (1) (m)).

County	Waukesha
Parcel I.D.	
Review by	**Date**

Property Owner	**Property Location**
Living Word Evangelical Lutheran Church, Inc.	**Govt. Lot** NW 1/4 S 20 T 6 N R 17 E
Property Owner's Mailing Address	**Lot #** 1 **Block #** **CSM#** 10680
2712 Sussex Lane	
City Waukesha **State** WI **Zip Code** 53188 **Phone Number**	[X] City [ ] Village [ ] Town **Nearest Road** Waukesha CTH X

Drainage area: _____ [ ] sq. ft. [ ] acres

Optional:

Test Site Suitable for (check all that apply)

[ ] Irrigation [ ] Bioretention trench [ ] Trench(es)

[ ] Rain Garden [ ] Grassed Swale [ ] Reuse

[ ] Infiltration trench [X] SDS (>15' wide) [ ] Other _____

Hydraulic Application Test Method

[X] Morphological Evaluation

[ ] Double-Ring Infiltrometer

[ ] Other (Specify)_____

11 **Obs. #** [X] Boring [ ] Pit **Ground Surface Elev.** 61.4 ft **Depth to limiting factor** 60 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0-14	10YR2/2	None	SICL	1fsbk	mfr	as	<5	0.04
2	14-42	10YR3/3 & 4/4	c1d 10YR2/2 & 6/2	SIC	2fsbk	mfi	cw	<5	0.07
3	42-144	10YR6/6	None	GRVS	0sg	mlo	cw	35-<60	3.60
4	144-180	10YR7/3	None	SICL	0m	mefi	--	<15	0.04
		Groundwater encountered @ 60 in. while drilling.							

12 **Obs. #** [X] Boring [ ] Pit **Ground Surface Elev.** 59.4 ft **Depth to limiting factor** 42 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0-13	10YR2/2	None	SICL	1fsbk	mfr	as	<5	0.04
2	13-24	10YR3/3 & 6/6	c1d 10YR2/2 & 6/2	SIC	2fsbk	mfi	cw	<5	0.07
3	24-144	10YR6/4	None	GRVS	0sg	mlo	cw	35-<60	3.60
4	144-180	10YR7/3	None	SICL	0m	mefi	--	<15	0.04
		Groundwater encountered @ 42 in. while drilling.							

CST/PSS Name (Please Print)	**Signature**	**CST Number**
Nathan I. Springstead, CST	Nathan Springstead	1091739
Address	**Date Evaluation Conducted**	**Telephone Number**
336 S. Curtis Road, West Allis, WI 53214	1/24/17	(414) 443-2000

APPENDIX D

DOCUMENT QUALIFICATIONS

APPENDIX D
DOCUMENT QUALIFICATIONS

I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in compliance with the design concepts, specifications and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until construction.

II. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

READ THE FULL REPORT

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not informed.*

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most

effective method of managing the risks associated with unanticipated conditions.

A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the confirmation-dependent recommendations included in your report. *Those confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgement and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *CGC cannot assume responsibility or liability for the report's confirmation-dependent recommendations if we do not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical engineering report. Confront that risk by having CGC participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

GIVE CONSTRUCTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and constructors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

ENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in the Geotechnical Business Council (GBC) of Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of GBC, for more information.

Modified and reprinted with permission from:

Geotechnical Business Council
of the Geoprofessional Business Association
8811 Colesville Road, Suite G 106
Silver Spring, MD 20910

APPENDIX E

RECOMMENDED COMPACTED FILL SPECIFICATIONS

APPENDIX E

CGC, INC.

RECOMMENDED COMPACTED FILL SPECIFICATIONS

General Fill Materials

Proposed fill shall contain no vegetation, roots, topsoil, peat, ash, wood or any other non-soil material which by decomposition might cause settlement. Also, fill shall never be placed while frozen or on frozen surfaces. Rock, stone or broken concrete greater than 6 in. in the largest dimension shall not be placed within 10 ft of the building area. Fill used greater than 10 ft beyond the building limits shall not contain rock, boulders or concrete pieces greater than a 2 sq ft area and shall not be placed within the final 2 ft of finish subgrade or in designated utility construction areas. Fill containing rock, boulders or concrete pieces should include sufficient finer material to fill voids among the larger fragments.

Special Fill Materials

In certain cases, special fill materials may be required for specific purposes, such as stabilizing subgrades, backfilling undercut excavations or filling behind retaining walls. For reference, WisDOT gradation specifications for various types of granular fill are attached in Table 1.

Placement Method

The approved fill shall be placed, spread and leveled in layers generally not exceeding 10 in. in thickness before compaction. The fill shall be placed at a moisture content capable of achieving the desired compaction level. For clay soils or granular soils containing an appreciable amount of cohesive fines, moisture conditioning will likely be required.

It is the Contractor's responsibility to provide all necessary compaction equipment and other grading equipment that may be required to attain the specified compaction. Hand-guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns or in confined areas.

Compaction Specifications

Maximum dry density and optimum moisture content of the fill soil shall be determined in accordance with modified Proctor methods (ASTM D1557). The recommended field compaction as a percentage of the maximum dry density is shown in Table 2. Note that these compaction guidelines would generally not apply to coarse gravel/stone fill. Instead, a method specification would apply (e.g., compact in thin lifts with a vibratory compactor until no further consolidation is evident).

Testing Procedures

Representative samples of proposed fill shall be submitted to CGC, Inc. for optimum moisture-maximum density determination (ASTM D1557) prior to the start of fill placement. The sample size should be approximately 50 lb.

CGC, Inc. shall be retained to perform field density tests to determine the level of compaction being achieved in the fill. The tests shall generally be conducted on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.

Table 1
Gradation of Special Fill Materials

Material	WisDOT Section 311	WisDOT Section 312	WisDOT Section 305			WisDOT Section 209		WisDOT Section 210
	Breaker Run	Select Crushed Material	3-in. Dense Graded Base	1 1/4-in. Dense Graded Base	3/4-in. Dense Graded Base	Grade 1 Granular Backfill	Grade 2 Granular Backfill	Structure Backfill
Sieve Size	Percent Passing by Weight							
6 in.	100							
5 in.		90-100						
3 in.			90-100					100
1 1/2 in.		20-50	60-85					
1 1/4 in.				95-100				
1 in.					100			
3/4 in.			40-65	70-93	95-100			
3/8 in.				42-80	50-90			
No. 4			15-40	25-63	35-70	100 (2)	100 (2)	25-100
No. 10		0-10	10-30	16-48	15-55			
No. 40			5-20	8-28	10-35	75 (2)		
No. 100						15 (2)	30 (2)	
No. 200			2-12	2-12	5-15	8 (2)	15 (2)	15 (2)

Notes:

1. Reference: Wisconsin Department of Transportation *Standard Specifications for Highway and Structure Construction.*
2. Percentage applies to the material passing the No. 4 sieve, not the entire sample.
3. Per WisDOT specifications, both breaker run and select crushed material can include concrete that is 'substantially free of steel, building materials and other deleterious material'.

Table 2
Compaction Guidelines

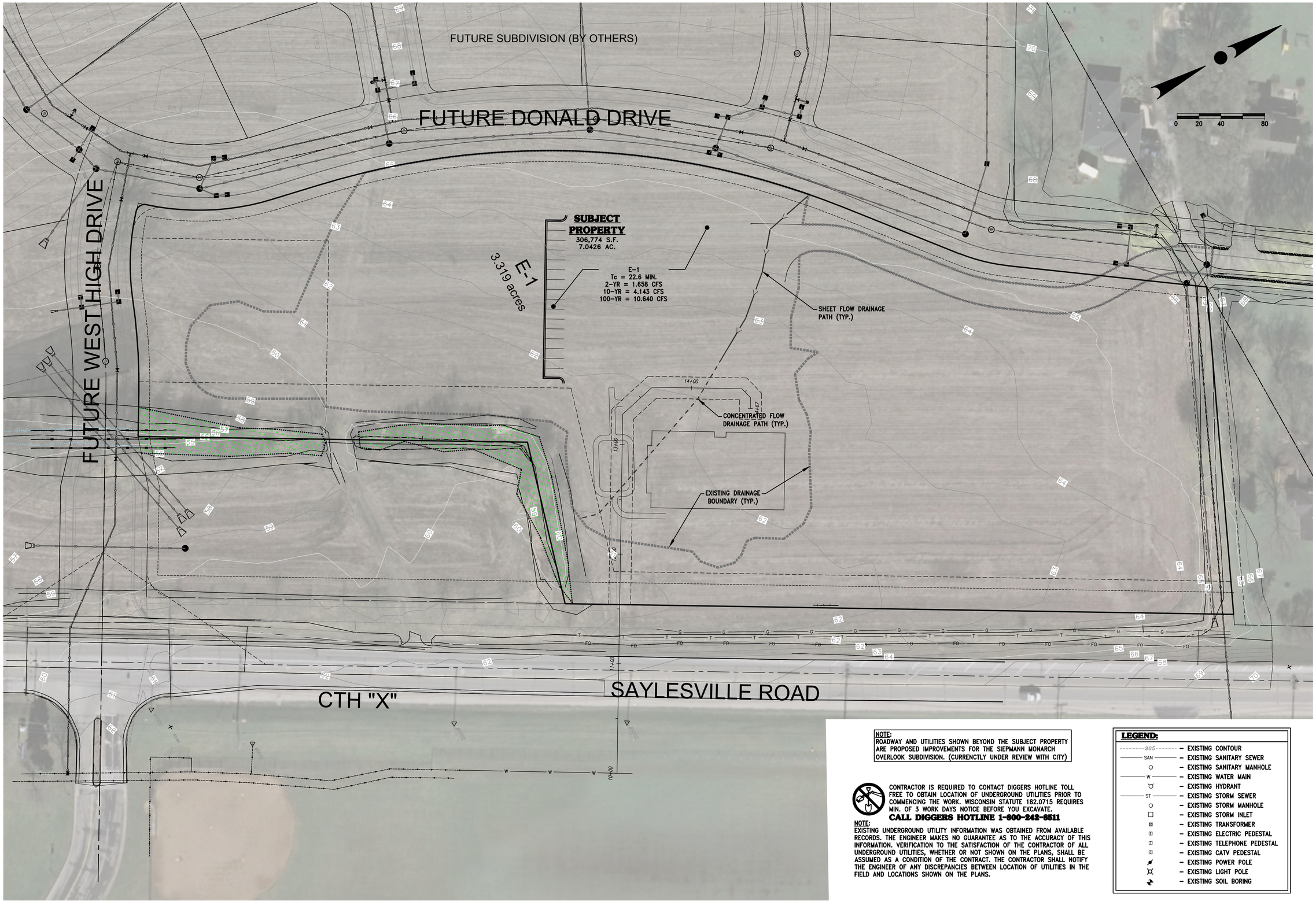
Area	Percent Compaction (1)	
	Clay/Silt	Sand/Gravel
Within 10 ft of building lines		
Footing bearing soils	93 - 95	95
Under floors, steps and walks		
- Lightly loaded floor slab	90	90
- Heavily loaded floor slab and thicker fill zones	92	95
Beyond 10 ft of building lines		
Under walks and pavements		
- Less than 2 ft below subgrade	92	95
- Greater than 2 ft below subgrade	90	90
Landscaping	85	90

Notes:

1. Based on Modified Proctor Dry Density (ASTM D 1557)

APPENDIX 2

Existing & Proposed Drainage Area Maps
Rain Garden Details



NOTE:
ROADWAY AND UTILITIES SHOWN BEYOND THE SUBJECT PROPERTY ARE PROPOSED IMPROVEMENTS FOR THE SIEPMANN MONARCH OVERLOOK SUBDIVISION. (CURRENCTLY UNDER REVIEW WITH CITY)

CONTRACTOR IS REQUIRED TO CONTACT DIGGERS HOTLINE TOLL FREE TO OBTAIN LOCATION OF UNDERGROUND UTILITIES PRIOR TO COMMENCING THE WORK. WISCONSIN STATUTE 182.0715 REQUIRES MIN. OF 3 WORK DAYS NOTICE BEFORE YOU EXCAVATE.
CALL DIGGERS HOTLINE 1-800-242-8511

NOTE:
EXISTING UNDERGROUND UTILITY INFORMATION WAS OBTAINED FROM AVAILABLE RECORDS. THE ENGINEER MAKES NO GUARANTEE AS TO THE ACCURACY OF THIS INFORMATION. VERIFICATION TO THE SATISFACTION OF THE CONTRACTOR OF ALL UNDERGROUND UTILITIES, WHETHER OR NOT SHOWN ON THE PLANS, SHALL BE ASSUMED AS A CONDITION OF THE CONTRACT. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES BETWEEN LOCATION OF UTILITIES IN THE FIELD AND LOCATIONS SHOWN ON THE PLANS.

LEGEND:

905	– EXISTING CONTOUR
SAN	– EXISTING SANITARY SEWER
	– EXISTING SANITARY MANHOLE
W	– EXISTING WATER MAIN
	– EXISTING HYDRANT
ST	– EXISTING STORM SEWER
	– EXISTING STORM MANHOLE
	– EXISTING STORM INLET
	– EXISTING TRANSFORMER
E	– EXISTING ELECTRIC PEDESTAL
T	– EXISTING TELEPHONE PEDESTAL
TV	– EXISTING CATV PEDESTAL
	– EXISTING POWER POLE
	– EXISTING LIGHT POLE
	– EXISTING SOIL BORING

WISCONSIN
Matthew BAILEY E-41533 NASHOTAH
PROFESSIONAL ENGINEER

TRIO
DESIGN • LAND SURVEYING
CIVIL ENGINEERING
12660 W. NORTH AVE, BLDG D
BROOKFIELD, WI 53005
PHONE: (262) 790-1480
FAX: (262) 790-1481
EMAIL: jpudelko@trioeng.com

PROJECT:
LIVING WORD LUTHERAN CHURCH

CITY OF WAUKESHA, WISCONSIN
BY: LIVING WORD LUTHERAN CHURCH
2712 SUSSEX LANE
WAUKESHA, WI 53188

REVISION HISTORY

DATE	DESCRIPTION
03/22/2019	SITE PLAN REV.
02/07/2019	SITE PLAN REV.
08/28/2018	DSPS SUBMITTAL
06/06/2018	INITIAL SUBMITTAL

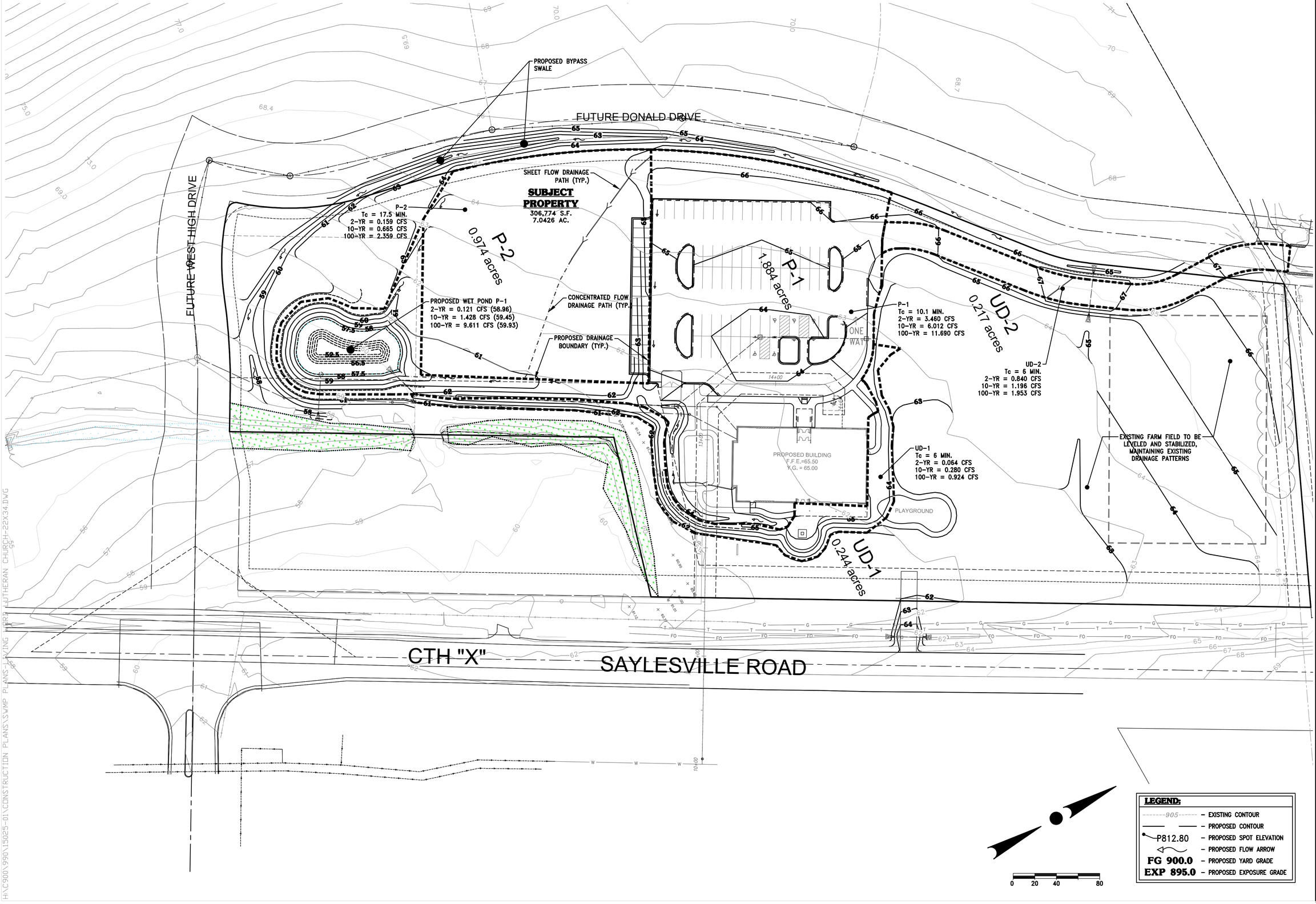
DATE:
MARCH 22, 2019

JOB NUMBER:
15025

DESCRIPTION:
EXISTING SITE PLAN

SHEET
C1.0

H:\C900\990\15025-01\CONSTRUCTION PLANS\SWMP PLANS-LIVING WORD LUTHERAN CHURCH-22X34.DWG



0 20 40 80

LEGEND:

- 905 – EXISTING CONTOUR
- ——— – PROPOSED CONTOUR
- P812.80 – PROPOSED SPOT ELEVATION
- ⇦ – PROPOSED FLOW ARROW
- **FG 900.0** – PROPOSED YARD GRADE
- **EXP 895.0** – PROPOSED EXPOSURE GRADE

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PROJECT:
LIVING WORD LUTHERAN CHURCH

CITY OF WAUKESHA, WISCONSIN
BY: LIVING WORD LUTHERAN CHURCH
2712 SUSSEX LANE
WAUKESHA, WI 53188

REVISION HISTORY

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08/28/2018	DSPS SUBMITTAL
06/06/2018	INITIAL SUBMITTAL

DATE:
MARCH 22, 2019

JOB NUMBER:
15025

DESCRIPTION:
PROPOSED DRAINAGE PLAN

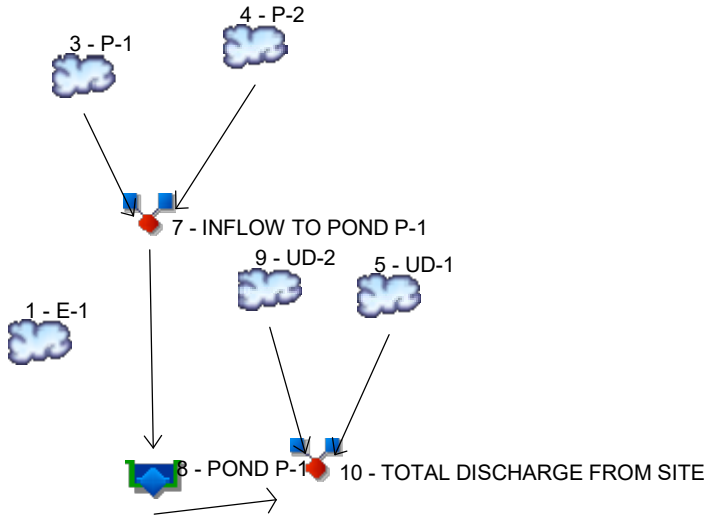
SHEET
D1.1

H:\C900\990\15025-01\CONSTRUCTION PLANS\SWMP PLANS\LIVING WORD LUTHERAN CHURCH-22X34.DWG

APPENDIX 3

Hydraflow Calculations

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	E-1
3	SCS Runoff	P-1
4	SCS Runoff	P-2
5	SCS Runoff	UD-1
7	Combine	INFLOW TO POND P-1
8	Reservoir	POND P-1
9	SCS Runoff	UD-2
10	Combine	TOTAL DISCHARGE FROM SITE

Hydrograph Return Period Recap

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	------	1.105	1.658	-------	-------	4.143	-------	-------	10.64	E-1
3	SCS Runoff	------	2.785	3.460	-------	-------	6.012	-------	-------	11.69	P-1
4	SCS Runoff	------	0.080	0.159	-------	-------	0.665	-------	-------	2.359	P-2
5	SCS Runoff	------	0.023	0.064	-------	-------	0.280	-------	-------	0.924	UD-1
7	Combine	3, 4,	2.813	3.534	-------	-------	6.476	-------	-------	13.60	INFLOW TO POND P-1
8	Reservoir	7	0.107	0.121	-------	-------	1.428	-------	-------	9.611	POND P-1
9	SCS Runoff	------	0.740	0.840	-------	-------	1.196	-------	-------	1.953	UD-2
10	Combine	5, 8, 9	0.801	0.947	-------	-------	1.574	-------	-------	10.33	TOTAL DISCHARGE FROM SITE

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

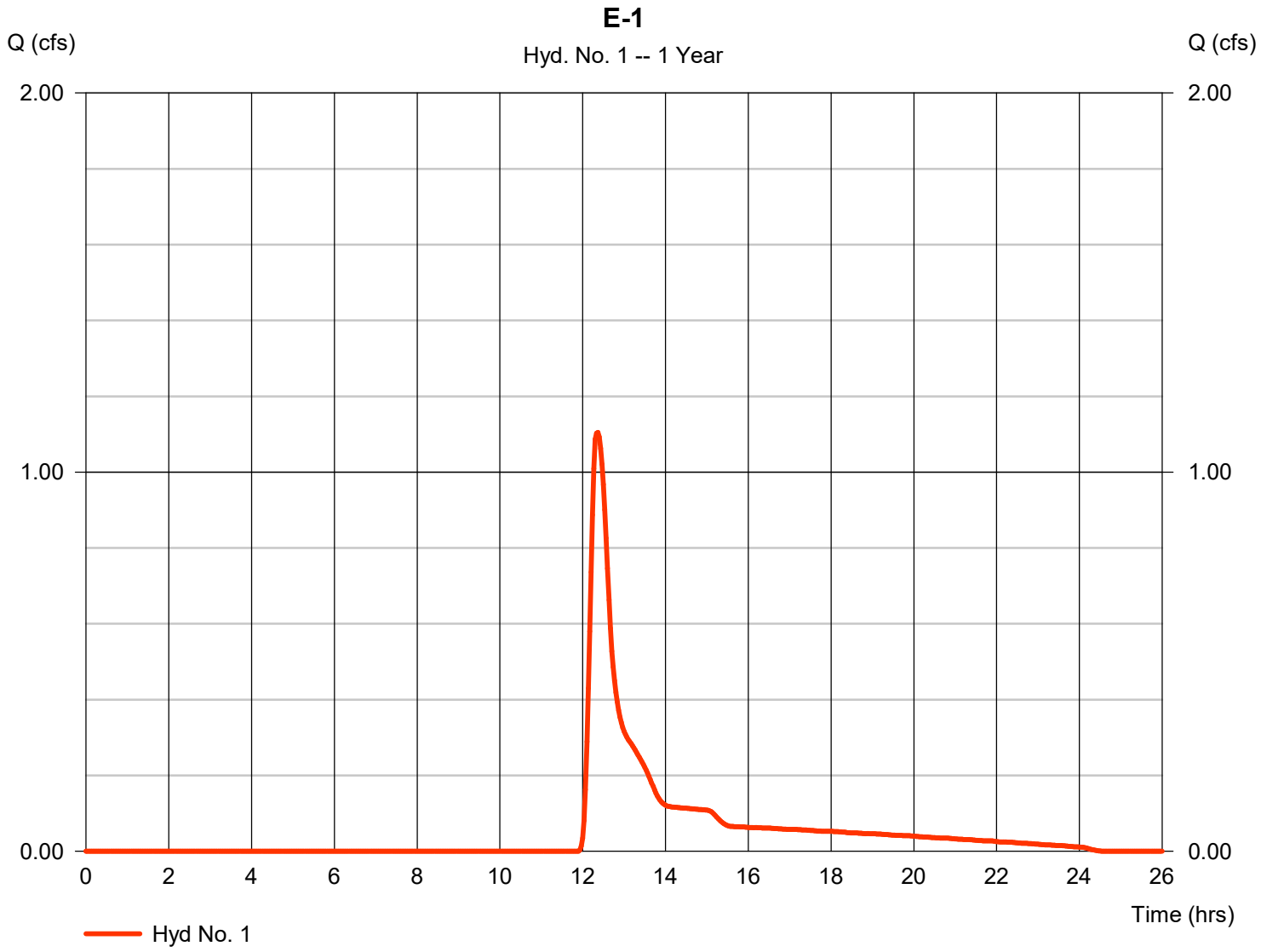
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	1.105	2	742	0.112	------	------	------	E-1
3	SCS Runoff	2.785	2	732	0.166	------	------	------	P-1
4	SCS Runoff	0.080	2	748	0.013	------	------	------	P-2
5	SCS Runoff	0.023	2	732	0.003	------	------	------	UD-1
7	Combine	2.813	2	732	0.179	3, 4,	------	------	INFLOW TO POND P-1
8	Reservoir	0.107	2	908	0.178	7	58.65	0.118	POND P-1
9	SCS Runoff	0.740	2	726	0.036	------	------	------	UD-2
10	Combine	0.801	2	726	0.217	5, 8, 9	------	------	TOTAL DISCHARGE FROM SITE

Hydrograph Report

Hyd. No. 1

E-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.105 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.37 hrs
Time interval	=	2 min	Hyd. volume	=	0.112 acft
Drainage area	=	3.319 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.60 min
Total precip.	=	2.38 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor Distribution\MSE3 DISTRIBUTION CU	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 1

E-1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.170		0.011		0.011		
Flow length (ft)	= 175.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.60		0.00		0.00		
Land slope (%)	= 1.60		0.00		0.00		
Travel Time (min)	**= 20.55**	**+**	**0.00**	**+**	**0.00**	**=**	**20.55**
Shallow Concentrated Flow							
Flow length (ft)	= 197.00		0.00		0.00		
Watercourse slope (%)	= 1.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.61		0.00		0.00		
Travel Time (min)	**= 2.03**	**+**	**0.00**	**+**	**0.00**	**=**	**2.03**
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**

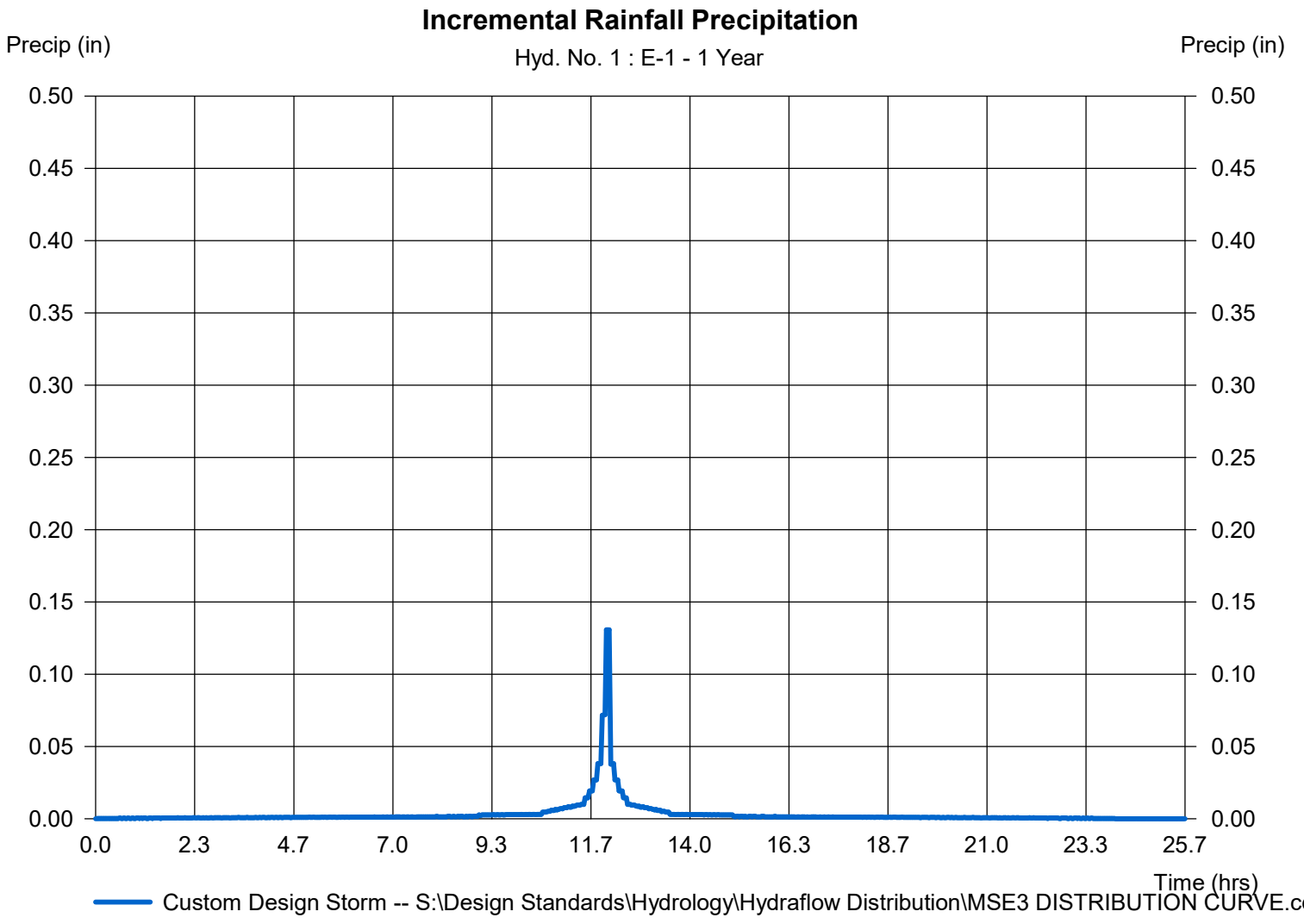
Total Travel Time, Tc ..... 22.60 min

Precipitation Report

Hyd. No. 1

E-1

Storm Frequency	= 1 yrs	Time interval	= 2 min
Total precip.	= 2.3800 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

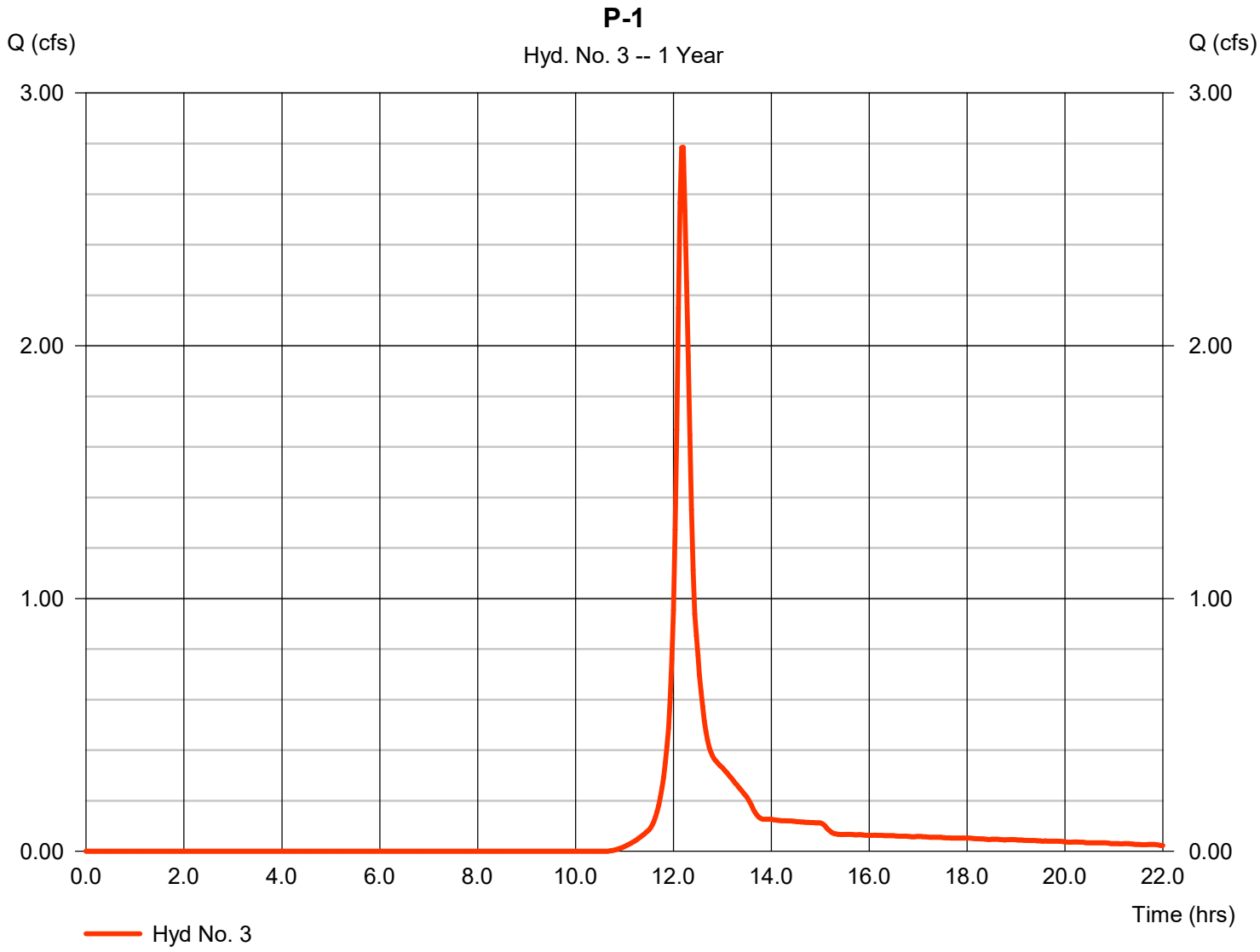


Hydrograph Report

Hyd. No. 3

P-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.785 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.20 hrs
Time interval	=	2 min	Hyd. volume	=	0.166 acft
Drainage area	=	1.884 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	10.10 min
Total precip.	=	2.38 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor Distribution = SE3 DISTRIBUTION CU	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 3

P-1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 58.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.60		2.60		0.00		
Land slope (%)	= 3.40		0.00		0.00		
Travel Time (min)	**= 8.28**	**+**	**0.00**	**+**	**0.00**	**=**	**8.28**
Shallow Concentrated Flow							
Flow length (ft)	= 66.00		0.00		0.00		
Watercourse slope (%)	= 1.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.61		0.00		0.00		
Travel Time (min)	**= 0.68**	**+**	**0.00**	**+**	**0.00**	**=**	**0.68**
Channel Flow							
X sectional flow area (sqft)	= 1.23		0.00		0.00		
Wetted perimeter (ft)	= 3.93		0.00		0.00		
Channel slope (%)	= 0.50		0.00		0.00		
Manning's n-value	= 0.013		0.015		0.015		
Velocity (ft/s)	=3.72						
			0.00				
					0.00		
Flow length (ft)	({0})261.0		0.0		0.0		
Travel Time (min)	**= 1.17**	**+**	**0.00**	**+**	**0.00**	**=**	**1.17**

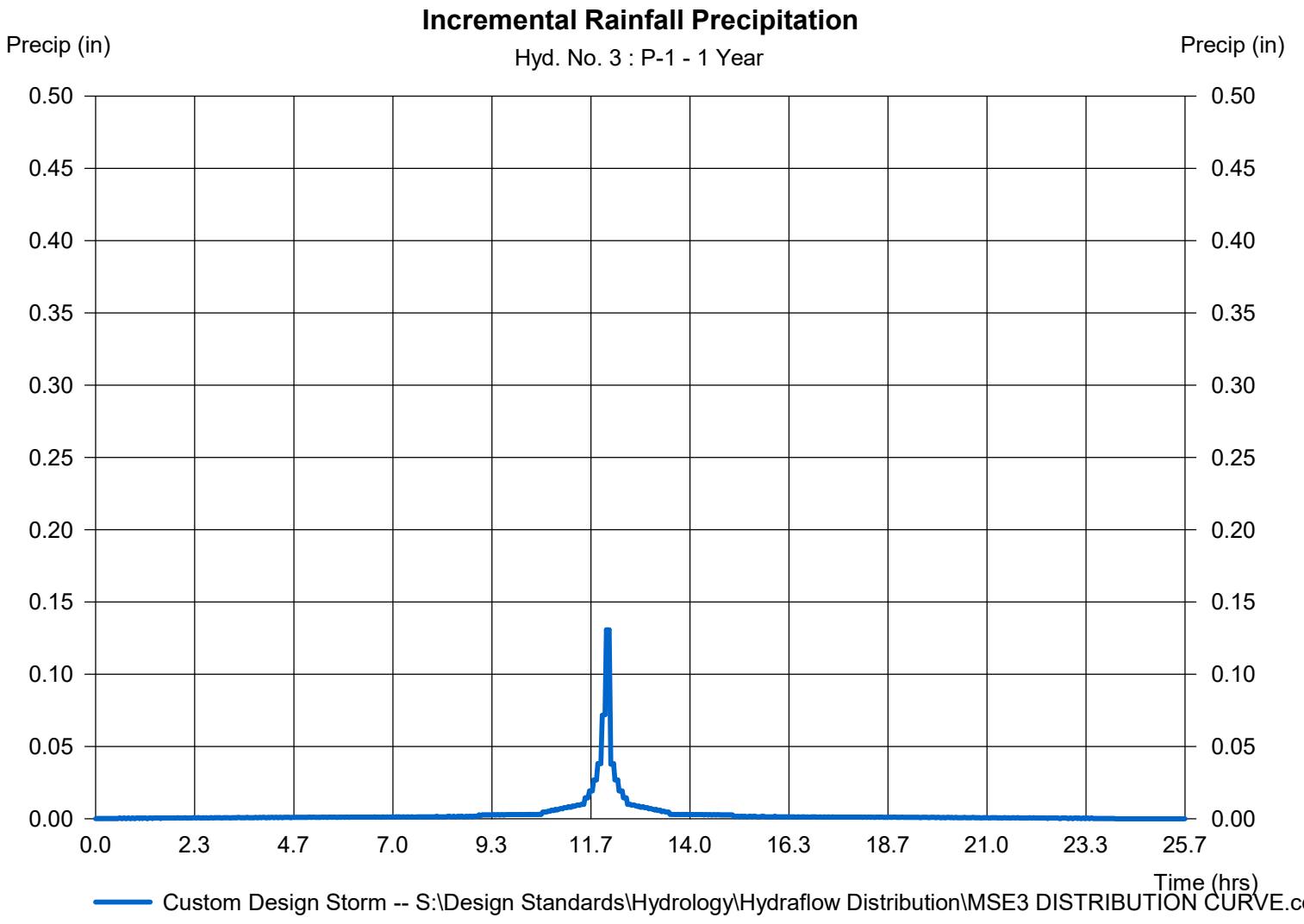
Total Travel Time, Tc ..... 10.10 min

Precipitation Report

Hyd. No. 3

P-1

Storm Frequency	= 1 yrs	Time interval	= 2 min
Total precip.	= 2.3800 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

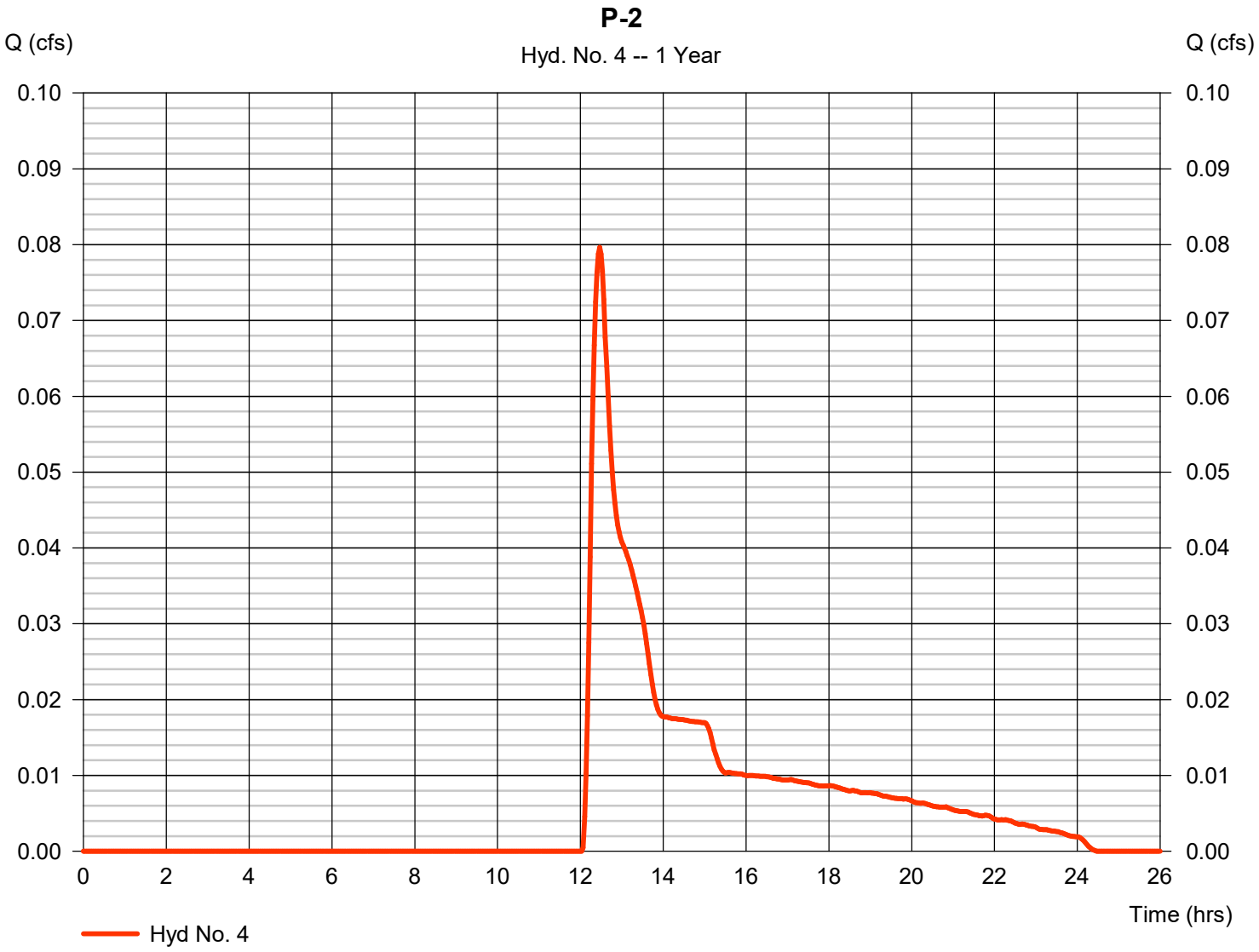


Hydrograph Report

Hyd. No. 4

P-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.080 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.47 hrs
Time interval	=	2 min	Hyd. volume	=	0.013 acft
Drainage area	=	0.974 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	17.50 min
Total precip.	=	2.38 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyd Factor Distribution\MSE3 DISTRIBUTION CU	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 4

P-2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 120.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.60		0.00		0.00		
Land slope (%)	= 2.70		0.00		0.00		
Travel Time (min)	**= 16.25**	**+**	**0.00**	**+**	**0.00**	**=**	**16.25**
Shallow Concentrated Flow							
Flow length (ft)	= 239.00		0.00		0.00		
Watercourse slope (%)	= 3.70		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.10		0.00		0.00		
Travel Time (min)	**= 1.28**	**+**	**0.00**	**+**	**0.00**	**=**	**1.28**
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**

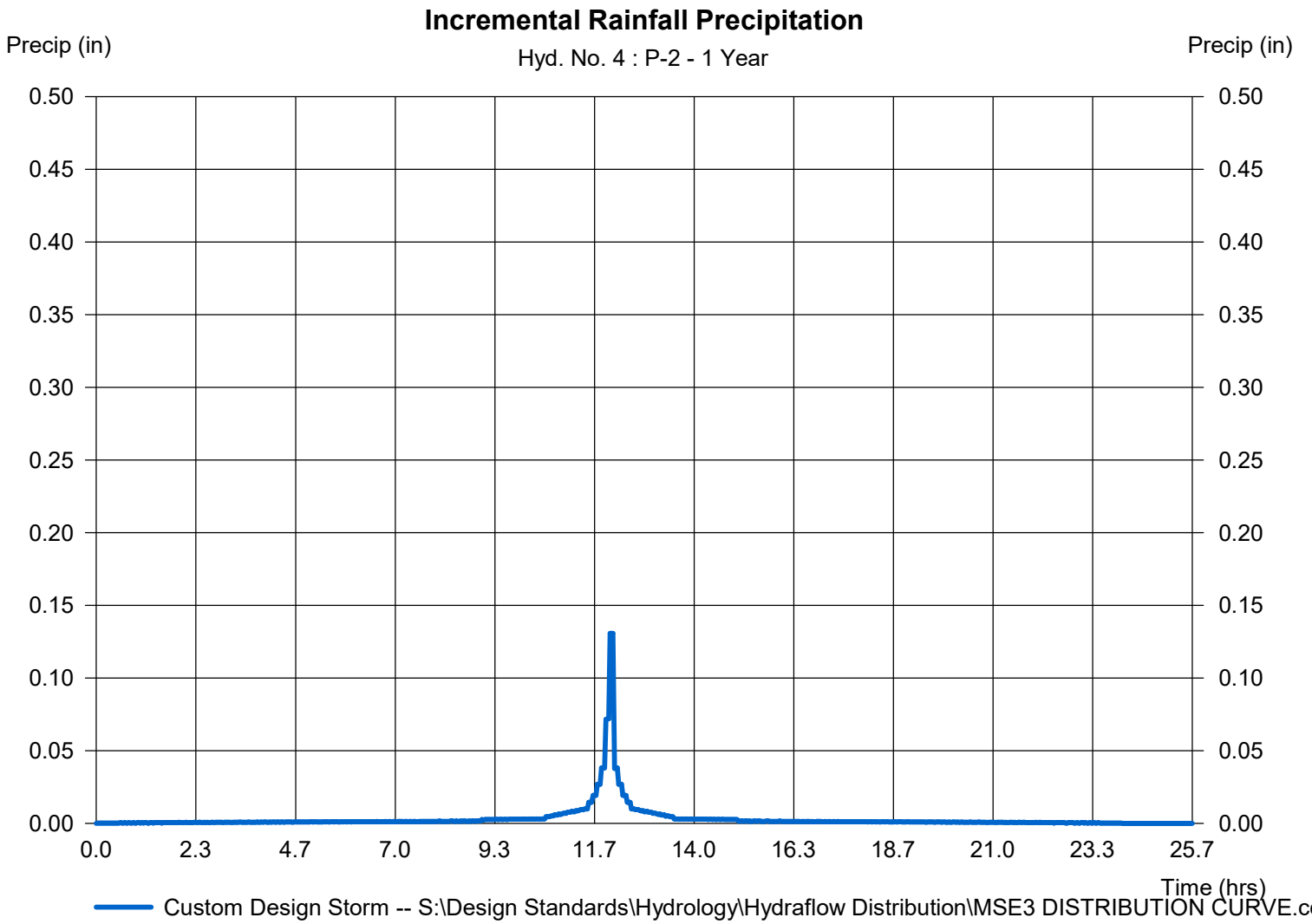
Total Travel Time, Tc ..... 17.50 min

Precipitation Report

Hyd. No. 4

P-2

Storm Frequency	= 1 yrs	Time interval	= 2 min
Total precip.	= 2.3800 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

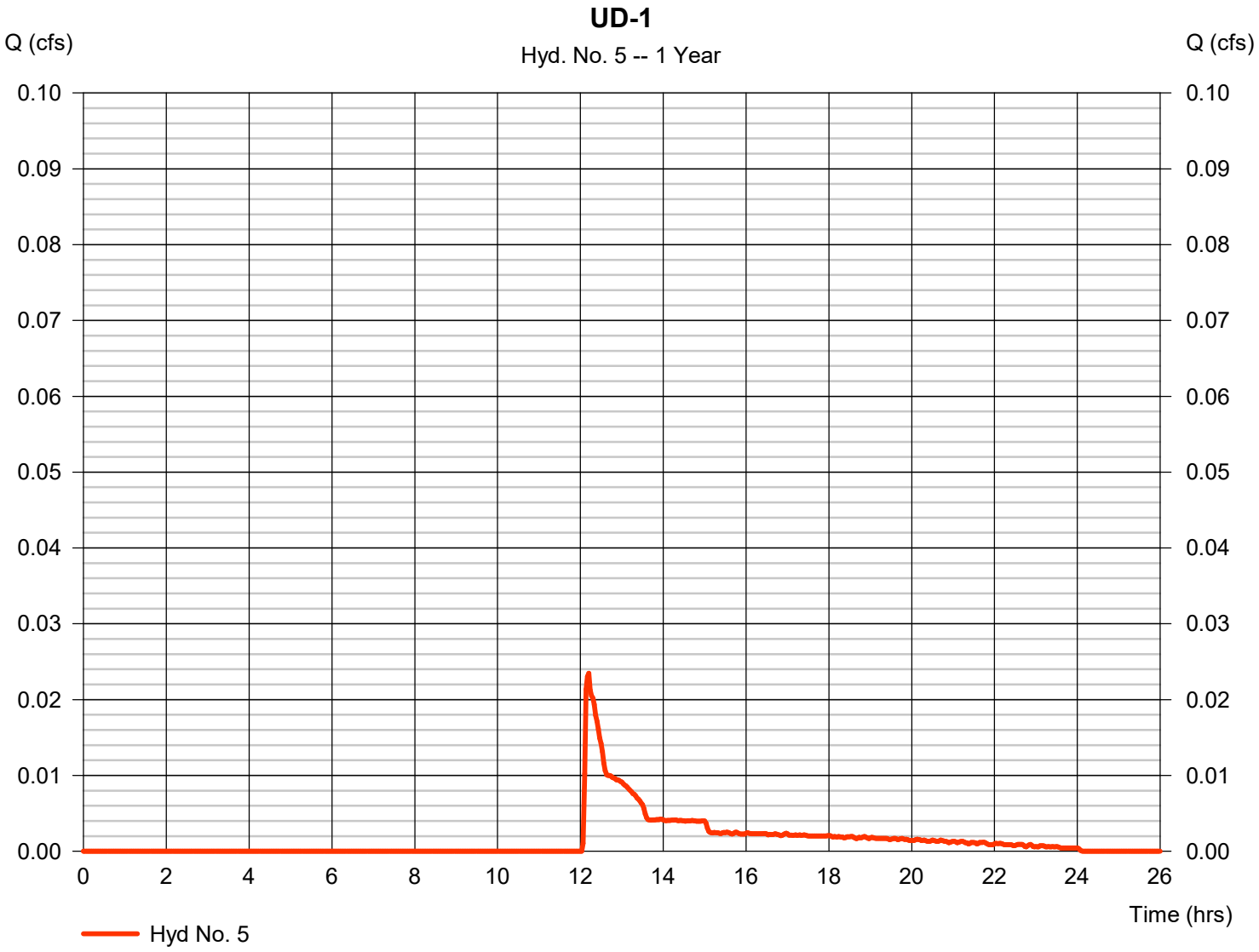


Hydrograph Report

Hyd. No. 5

UD-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.023 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.20 hrs
Time interval	=	2 min	Hyd. volume	=	0.003 acft
Drainage area	=	0.244 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	2.38 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION CU	Shape factor	=	484

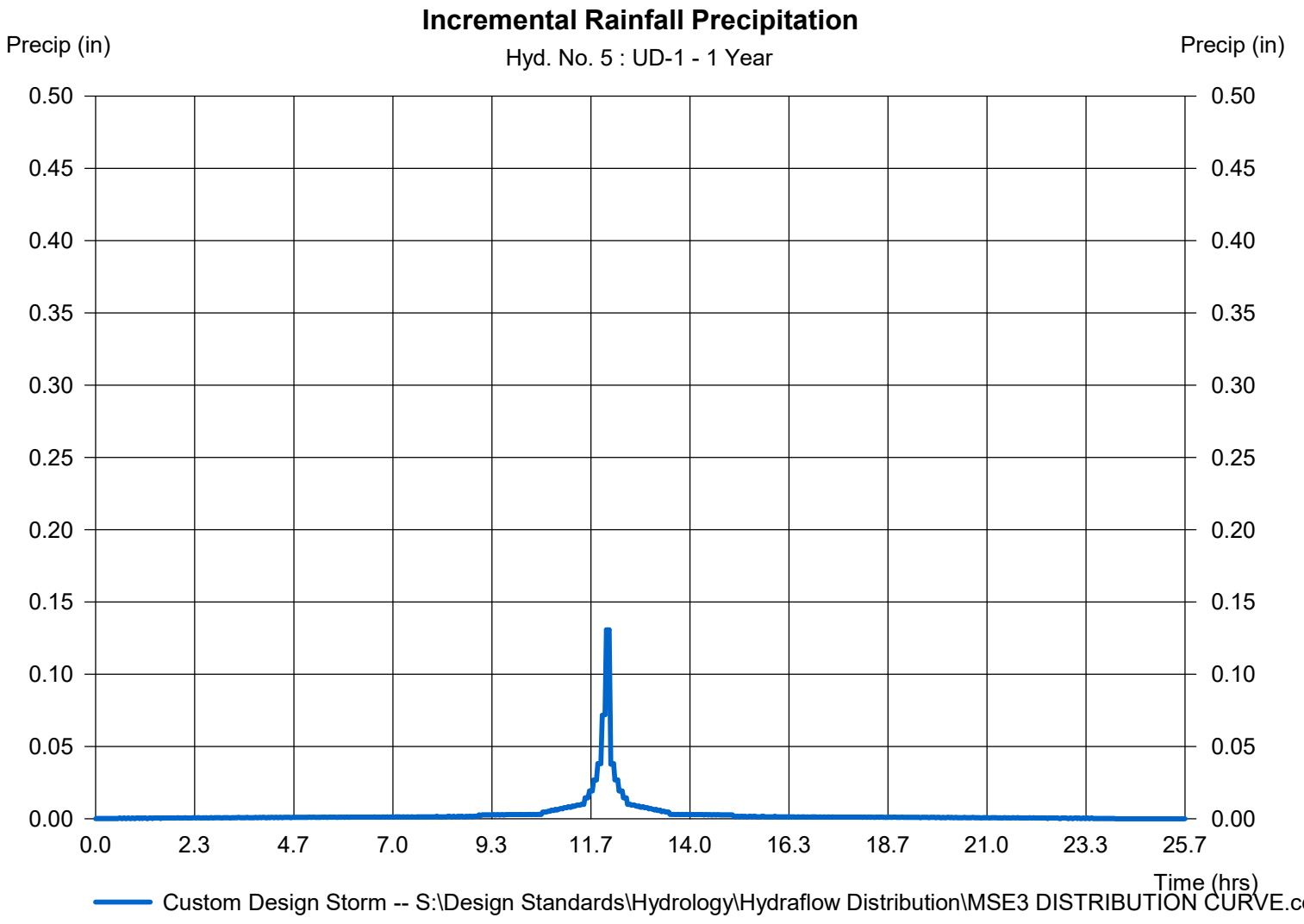


Precipitation Report

Hyd. No. 5

UD-1

Storm Frequency	= 1 yrs	Time interval	= 2 min
Total precip.	= 2.3800 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

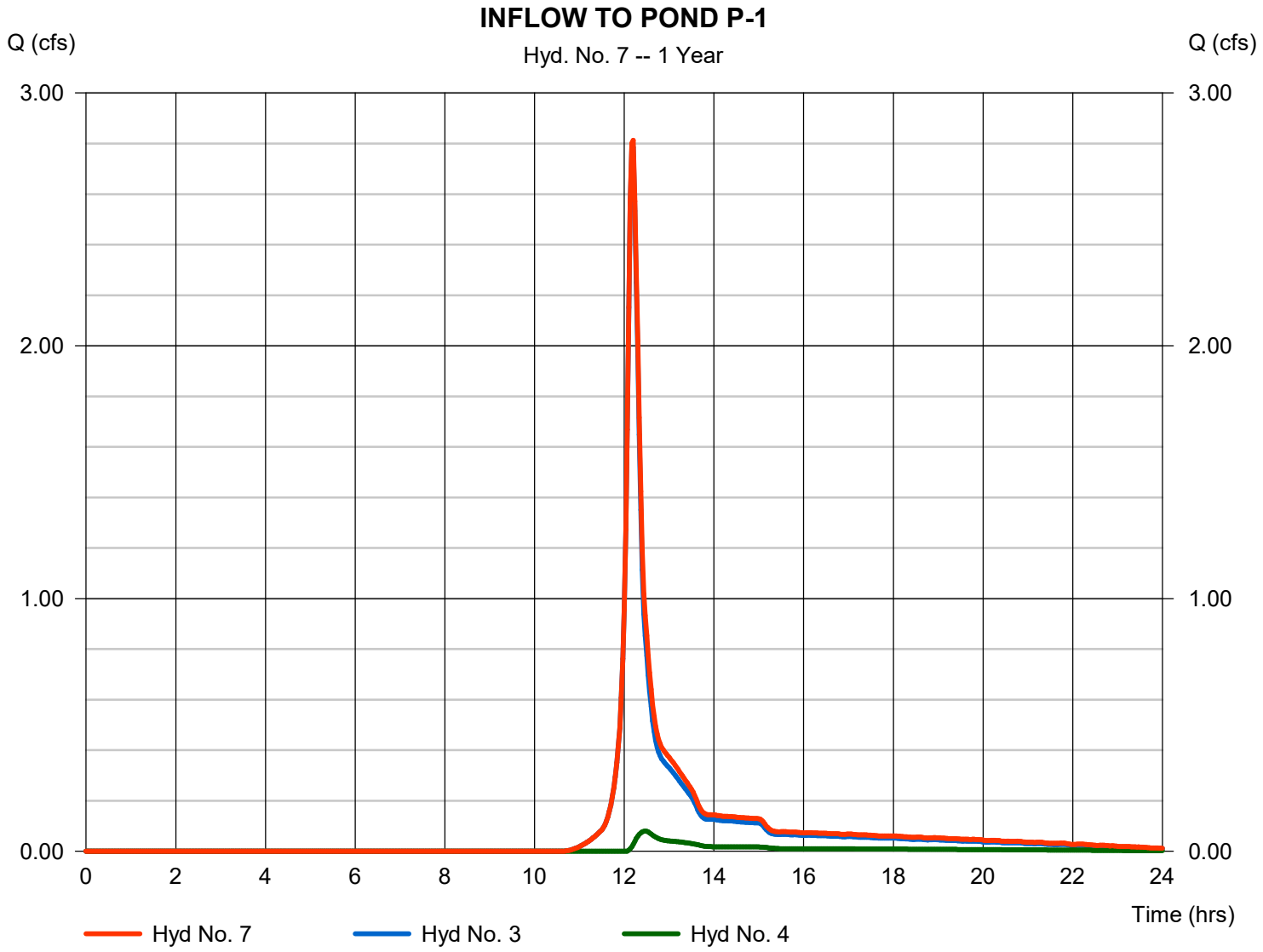


Hydrograph Report

Hyd. No. 7

INFLOW TO POND P-1

Hydrograph type	= Combine	Peak discharge	= 2.813 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 0.179 acft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 2.858 ac



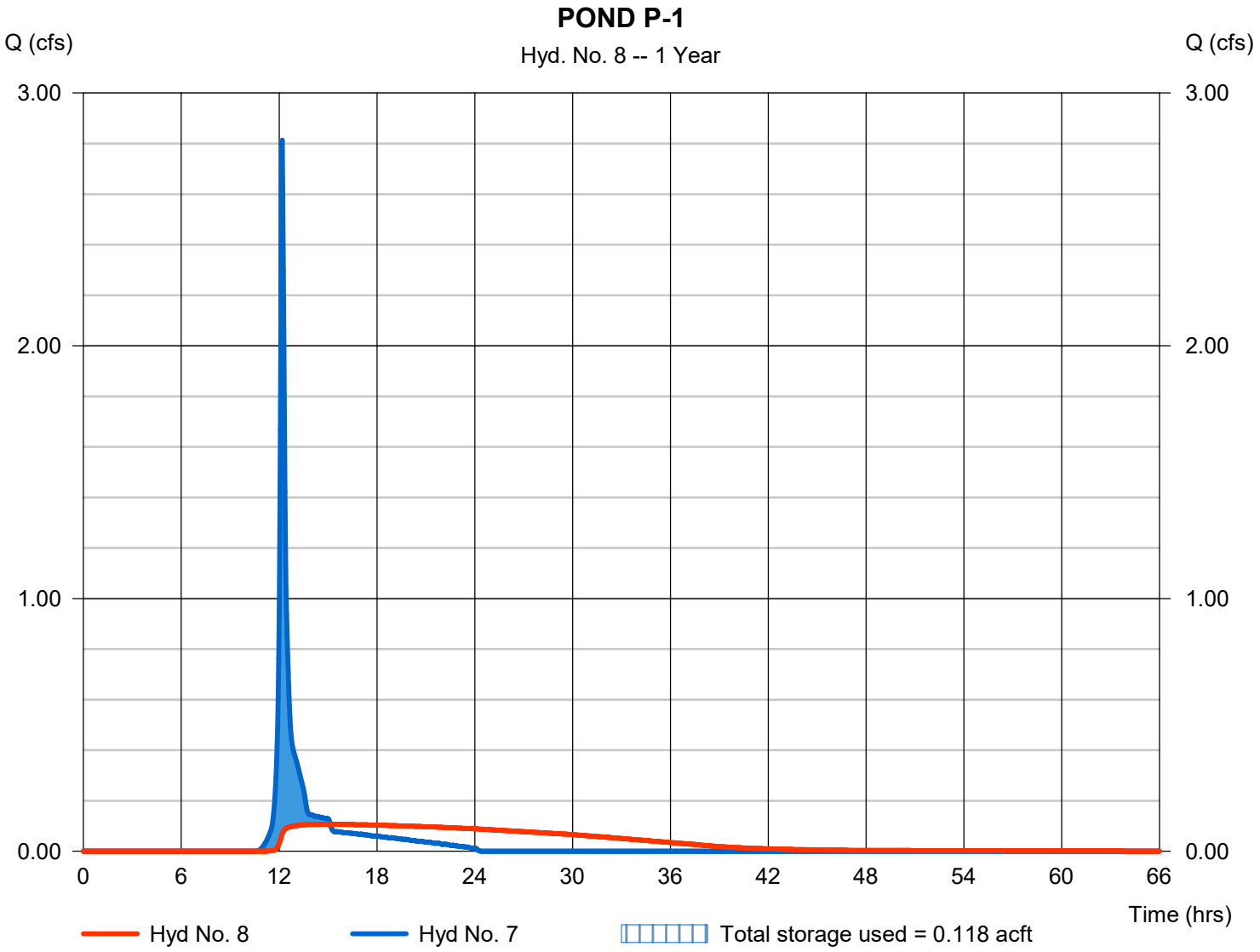
Hydrograph Report

Hyd. No. 8

POND P-1

Hydrograph type	= Reservoir	Peak discharge	= 0.107 cfs
Storm frequency	= 1 yrs	Time to peak	= 15.13 hrs
Time interval	= 2 min	Hyd. volume	= 0.178 acft
Inflow hyd. No.	= 7 - INFLOW TO POND P-1	Max. Elevation	= 58.65 ft
Reservoir name	= POND P-1	Max. Storage	= 0.118 acft

Storage Indication method used.



Pond No. 1 - POND P-1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 57.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	57.50	3,039	0.000	0.000
0.50	58.00	4,461	0.043	0.043
1.50	59.00	5,596	0.115	0.158
2.50	60.00	6,862	0.143	0.301
3.50	61.00	8,332	0.174	0.475
3.75	61.25	8,726	0.049	0.524

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	2.00	0.00	0.00
Span (in)	= 12.00	2.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 57.50	57.50	0.00	0.00
Length (ft)	= 37.00	0.50	0.00	0.00
Slope (%)	= 0.27	0.50	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.00	0.00	10.00
Crest El. (ft)	= 59.35	0.00	0.00	60.25
Weir Coeff.	= 3.33	3.33	3.33	2.60
Weir Type	= 1	---	---	Broad
Multi-Stage	= Yes	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 acft	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	0.000	57.50	0.00	0.00	---	---	0.00	---	---	0.00	---	---	0.000
0.05	0.004	57.55	0.01 oc	0.00 ic	---	---	0.00	---	---	0.00	---	---	0.004
0.10	0.009	57.60	0.02 oc	0.01 ic	---	---	0.00	---	---	0.00	---	---	0.015
0.15	0.013	57.65	0.03 oc	0.03 ic	---	---	0.00	---	---	0.00	---	---	0.027
0.20	0.017	57.70	0.04 oc	0.04 ic	---	---	0.00	---	---	0.00	---	---	0.036
0.25	0.021	57.75	0.05 oc	0.04 ic	---	---	0.00	---	---	0.00	---	---	0.043
0.30	0.026	57.80	0.05 oc	0.05 ic	---	---	0.00	---	---	0.00	---	---	0.049
0.35	0.030	57.85	0.06 oc	0.05 ic	---	---	0.00	---	---	0.00	---	---	0.054
0.40	0.034	57.90	0.06 oc	0.06 ic	---	---	0.00	---	---	0.00	---	---	0.059
0.45	0.039	57.95	0.07 oc	0.06 ic	---	---	0.00	---	---	0.00	---	---	0.063
0.50	0.043	58.00	0.07 oc	0.07 ic	---	---	0.00	---	---	0.00	---	---	0.067
0.60	0.054	58.10	0.08 oc	0.07 ic	---	---	0.00	---	---	0.00	---	---	0.075
0.70	0.066	58.20	0.08 oc	0.08 ic	---	---	0.00	---	---	0.00	---	---	0.081
0.80	0.077	58.30	0.09 oc	0.09 ic	---	---	0.00	---	---	0.00	---	---	0.088
0.90	0.089	58.40	0.10 oc	0.09 ic	---	---	0.00	---	---	0.00	---	---	0.093
1.00	0.100	58.50	0.10 oc	0.10 ic	---	---	0.00	---	---	0.00	---	---	0.099
1.10	0.112	58.60	0.11 oc	0.10 ic	---	---	0.00	---	---	0.00	---	---	0.104
1.20	0.123	58.70	0.12 oc	0.11 ic	---	---	0.00	---	---	0.00	---	---	0.109
1.30	0.135	58.80	0.12 oc	0.11 ic	---	---	0.00	---	---	0.00	---	---	0.114
1.40	0.146	58.90	0.13 oc	0.12 ic	---	---	0.00	---	---	0.00	---	---	0.119
1.50	0.158	59.00	0.13 oc	0.12 ic	---	---	0.00	---	---	0.00	---	---	0.123
1.60	0.172	59.10	0.14 oc	0.13 ic	---	---	0.00	---	---	0.00	---	---	0.127
1.70	0.187	59.20	0.14 oc	0.13 ic	---	---	0.00	---	---	0.00	---	---	0.132
1.80	0.201	59.30	0.14 oc	0.14 ic	---	---	0.00	---	---	0.00	---	---	0.136
1.90	0.215	59.40	0.60 oc	0.13 ic	---	---	0.45	---	---	0.00	---	---	0.579
2.00	0.229	59.50	2.44 oc	0.11 ic	---	---	2.32	---	---	0.00	---	---	2.433
2.10	0.244	59.60	5.09 oc	0.09 ic	---	---	4.99	---	---	0.00	---	---	5.088
2.20	0.258	59.70	8.07 oc	0.06 ic	---	---	8.01 s	---	---	0.00	---	---	8.068
2.30	0.272	59.80	8.95 oc	0.04 ic	---	---	8.91 s	---	---	0.00	---	---	8.953
2.40	0.286	59.90	9.50 oc	0.03 ic	---	---	9.47 s	---	---	0.00	---	---	9.498
2.50	0.301	60.00	9.93 oc	0.03 ic	---	---	9.90 s	---	---	0.00	---	---	9.927
2.60	0.318	60.10	10.30 oc	0.02 ic	---	---	10.28 s	---	---	0.00	---	---	10.30
2.70	0.336	60.20	10.64 oc	0.02 ic	---	---	10.62 s	---	---	0.00	---	---	10.64
2.80	0.353	60.30	10.96 oc	0.02 ic	---	---	10.93 s	---	---	0.29	---	---	11.24
2.90	0.370	60.40	11.26 oc	0.02 ic	---	---	11.24 s	---	---	1.51	---	---	12.77
3.00	0.388	60.50	11.56 oc	0.01 ic	---	---	11.53 s	---	---	3.25	---	---	14.79
3.10	0.405	60.60	11.84 oc	0.01 ic	---	---	11.81 s	---	---	5.38	---	---	17.21

Continues on next page...

POND P-1

Stage / Storage / Discharge Table

Stage ft	Storage acft	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
3.20	0.423	60.70	12.11 oc	0.01 ic	---	---	12.10 s	---	---	7.85	---	---	19.96
3.30	0.440	60.80	12.38 oc	0.01 ic	---	---	12.35 s	---	---	10.60	---	---	22.97
3.40	0.457	60.90	12.64 oc	0.01 ic	---	---	12.61 s	---	---	13.62	---	---	26.25
3.50	0.475	61.00	12.89 oc	0.01 ic	---	---	12.84 s	---	---	16.89	---	---	29.74
3.53	0.480	61.03	12.96 oc	0.01 ic	---	---	12.93 s	---	---	17.74	---	---	30.68
3.55	0.485	61.05	13.02 oc	0.01 ic	---	---	12.95 s	---	---	18.60	---	---	31.57
3.58	0.489	61.08	13.08 oc	0.01 ic	---	---	13.03 s	---	---	19.48	---	---	32.53
3.60	0.494	61.10	13.14 oc	0.01 ic	---	---	13.11 s	---	---	20.38	---	---	33.50
3.63	0.499	61.13	13.20 oc	0.01 ic	---	---	13.18 s	---	---	21.28	---	---	34.47
3.65	0.504	61.15	13.26 oc	0.01 ic	---	---	13.24 s	---	---	22.20	---	---	35.45
3.68	0.509	61.18	13.33 oc	0.01 ic	---	---	13.29 s	---	---	23.13	---	---	36.43
3.70	0.514	61.20	13.39 oc	0.01 ic	---	---	13.34 s	---	---	24.07	---	---	37.42
3.73	0.519	61.23	13.45 oc	0.01 ic	---	---	13.38 s	---	---	25.03	---	---	38.42
3.75	0.524	61.25	13.51 oc	0.01 ic	---	---	13.48 s	---	---	26.00	---	---	39.49

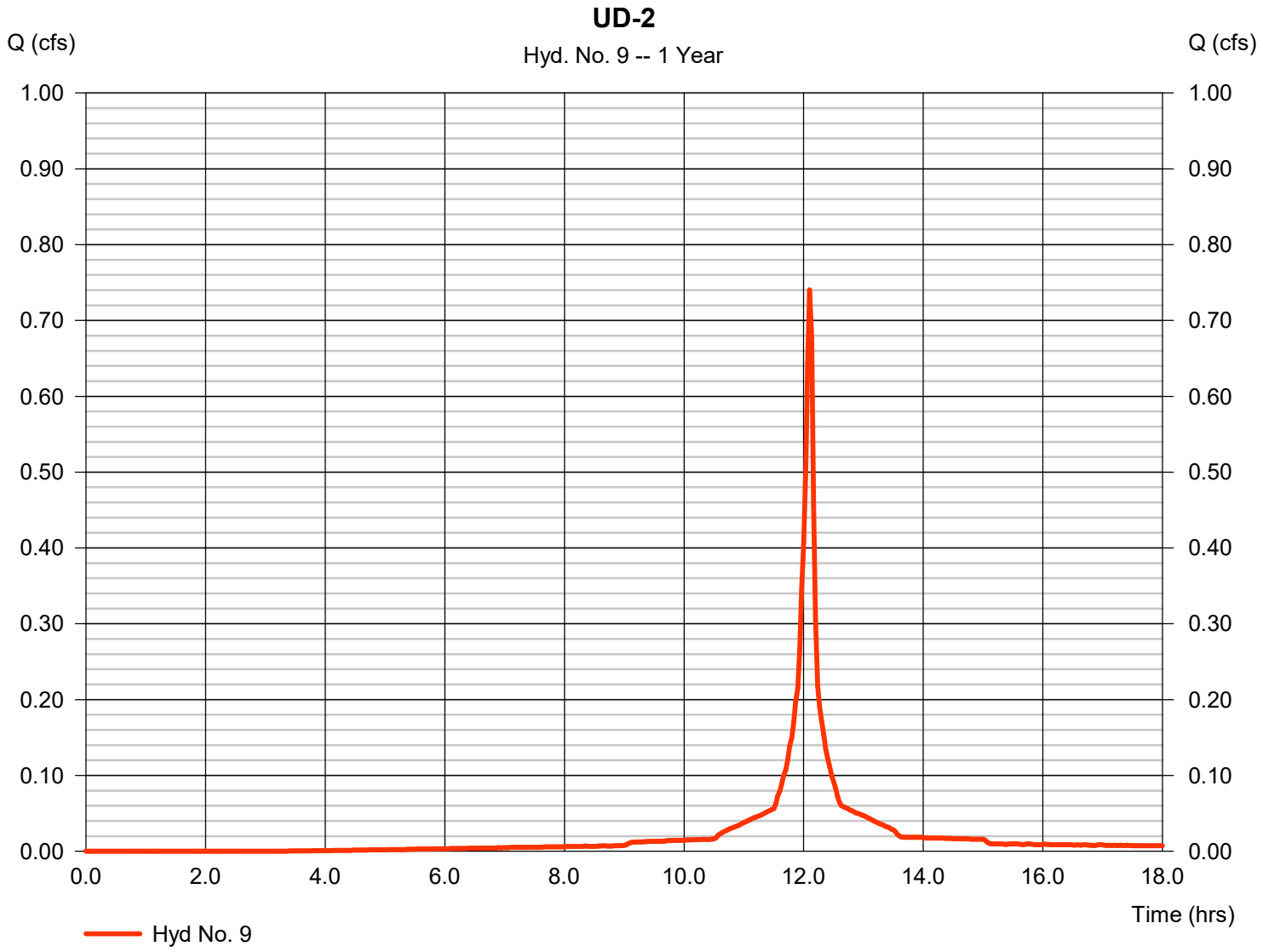
...End

Hydrograph Report

Hyd. No. 9

UD-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.740 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	0.036 acft
Drainage area	=	0.217 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	2.38 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor Distribution = SE3 DISTRIBUTION CU	Shape factor	=	484

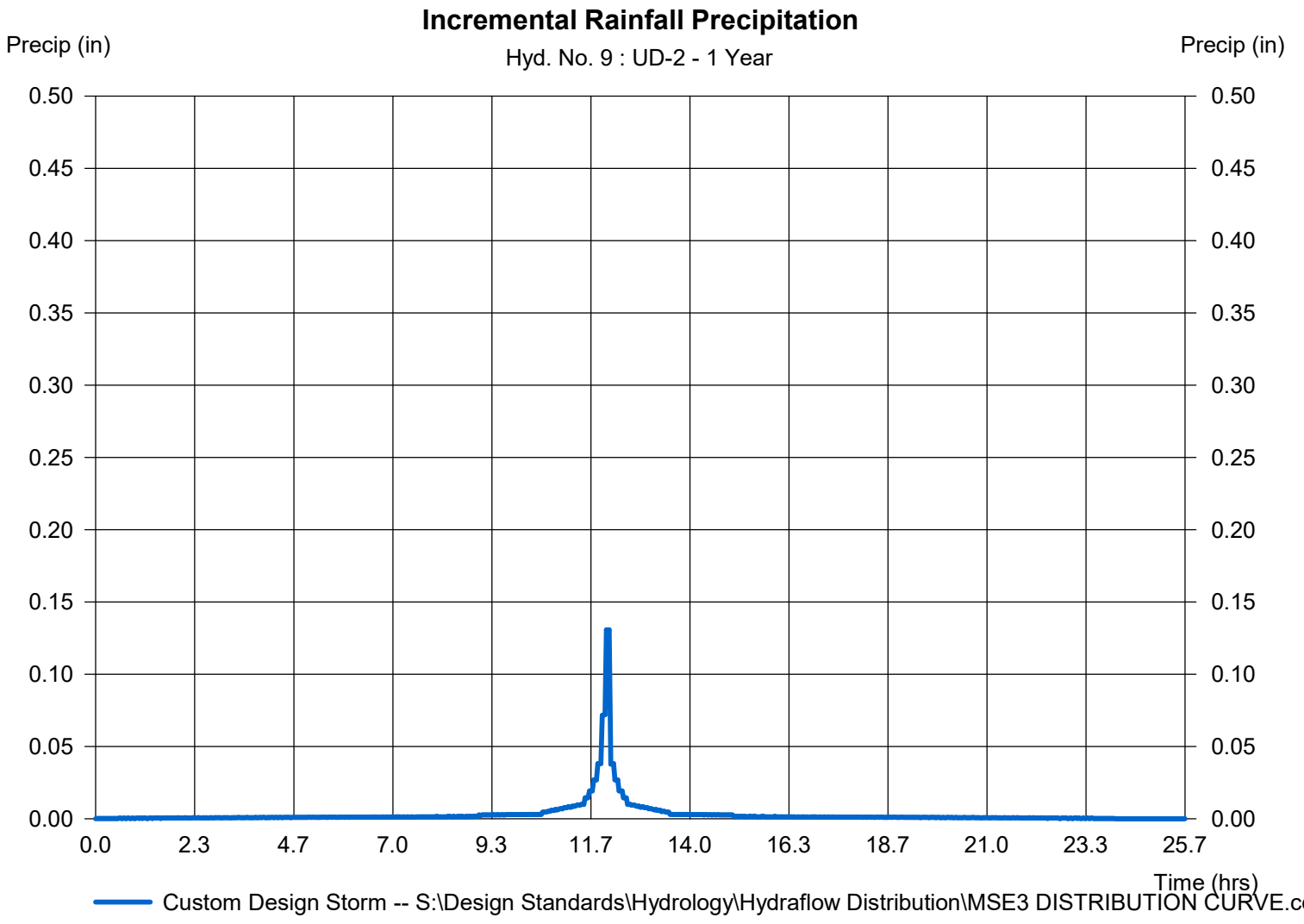


Precipitation Report

Hyd. No. 9

UD-2

Storm Frequency	= 1 yrs	Time interval	= 2 min
Total precip.	= 2.3800 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

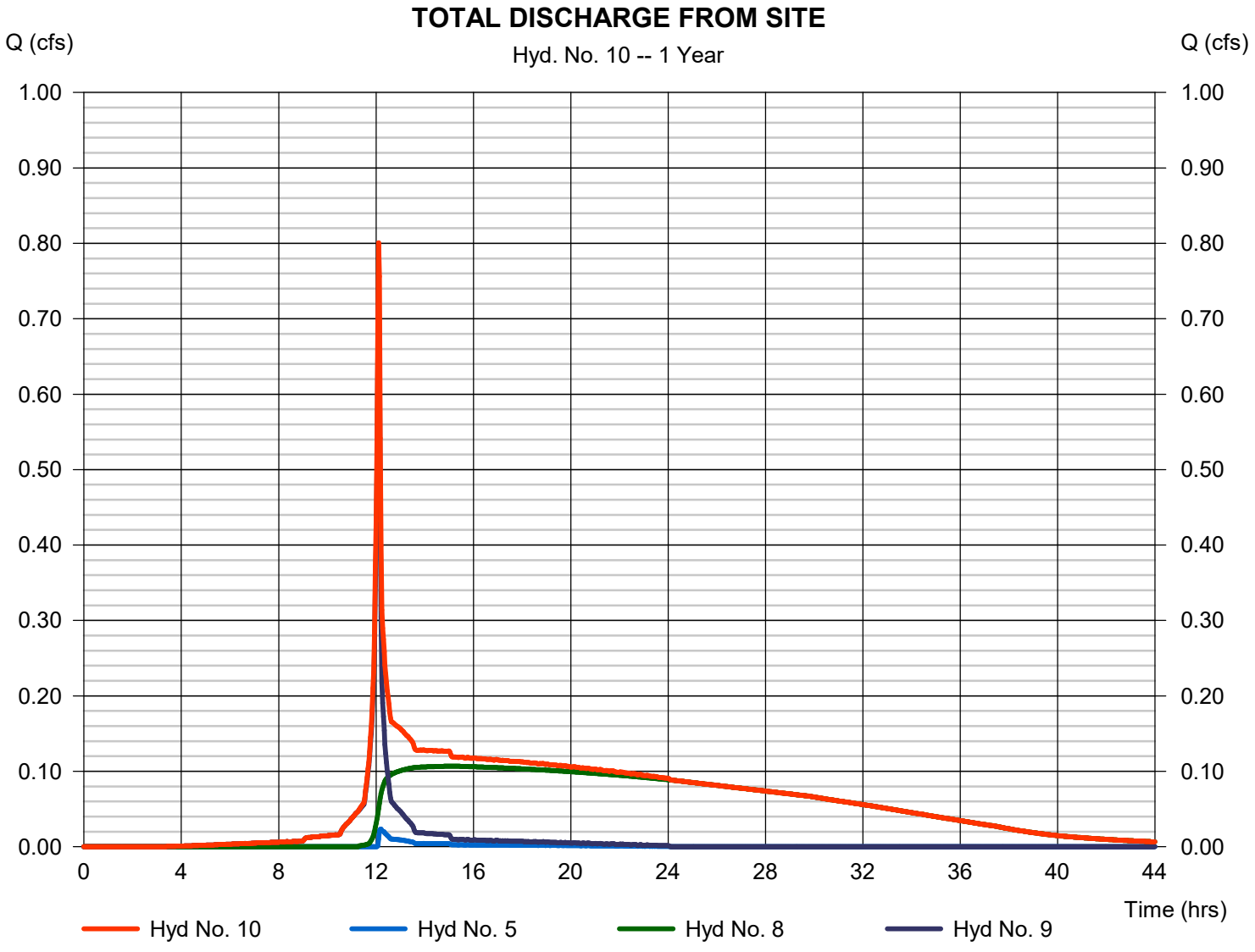


Hydrograph Report

Hyd. No. 10

TOTAL DISCHARGE FROM SITE

Hydrograph type	= Combine	Peak discharge	= 0.801 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 0.217 acft
Inflow hyds.	= 5, 8, 9	Contrib. drain. area	= 0.461 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

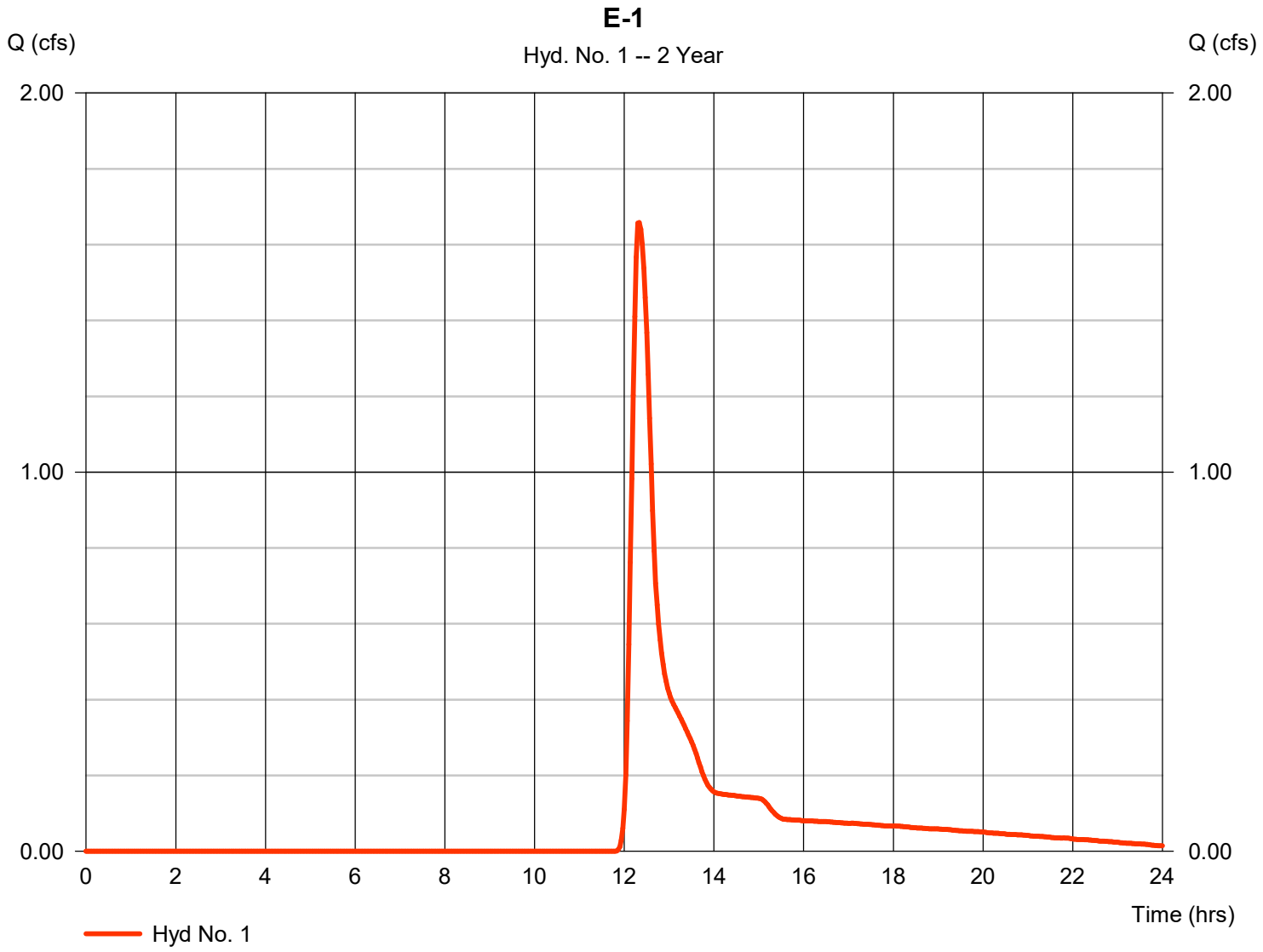
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	1.658	2	740	0.155	------	------	------	E-1
3	SCS Runoff	3.460	2	730	0.205	------	------	------	P-1
4	SCS Runoff	0.159	2	744	0.021	------	------	------	P-2
5	SCS Runoff	0.064	2	728	0.005	------	------	------	UD-1
7	Combine	3.534	2	732	0.226	3, 4,	------	------	INFLOW TO POND P-1
8	Reservoir	0.121	2	910	0.225	7	58.96	0.153	POND P-1
9	SCS Runoff	0.840	2	726	0.042	------	------	------	UD-2
10	Combine	0.947	2	726	0.271	5, 8, 9	------	------	TOTAL DISCHARGE FROM SITE

Hydrograph Report

Hyd. No. 1

E-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.658 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.33 hrs
Time interval	=	2 min	Hyd. volume	=	0.155 acft
Drainage area	=	3.319 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.60 min
Total precip.	=	2.69 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor Distribution\MSE3 DISTRIBUTION CU	Shape factor	=	484

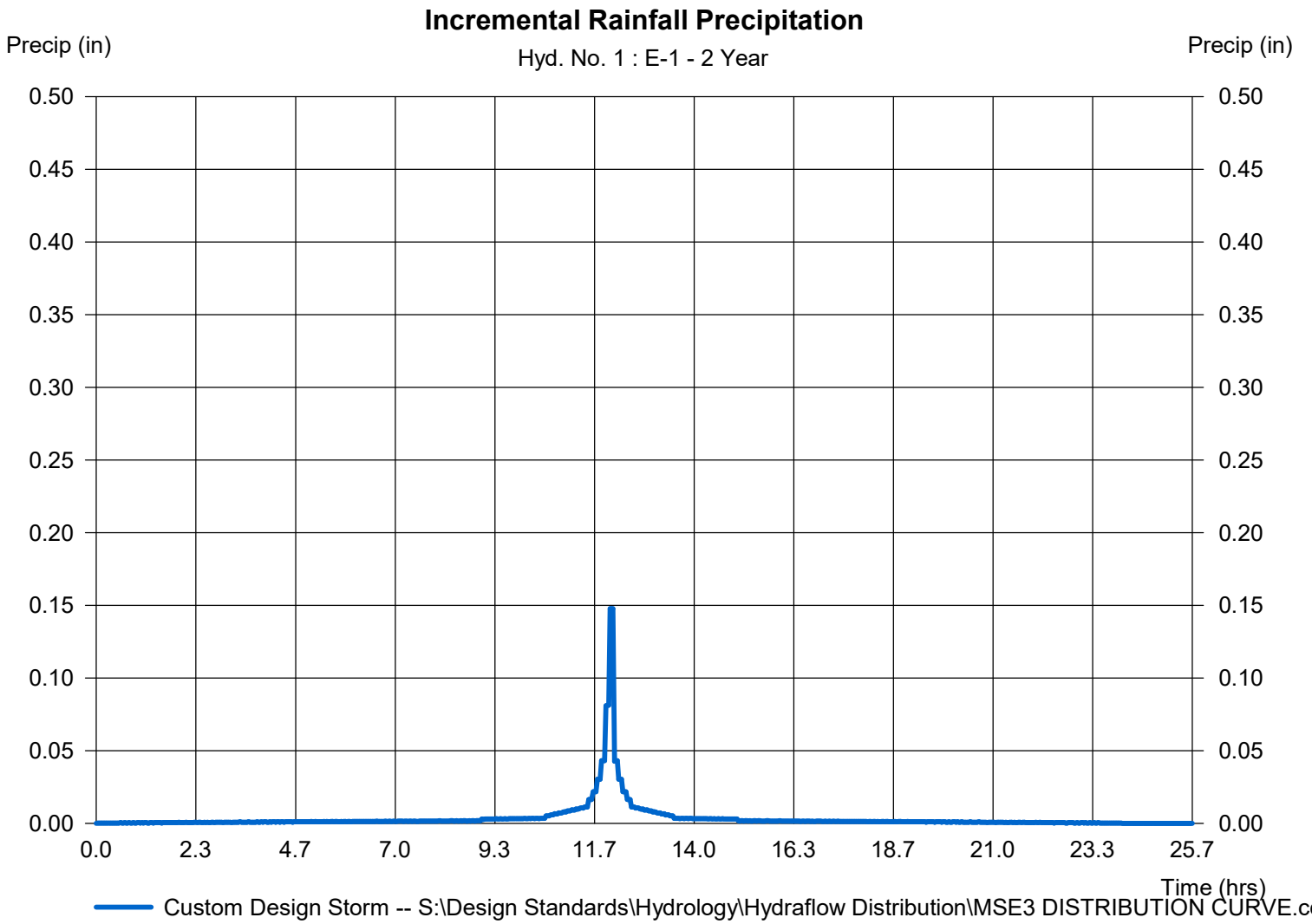


Precipitation Report

Hyd. No. 1

E-1

Storm Frequency	= 2 yrs	Time interval	= 2 min
Total precip.	= 2.6900 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

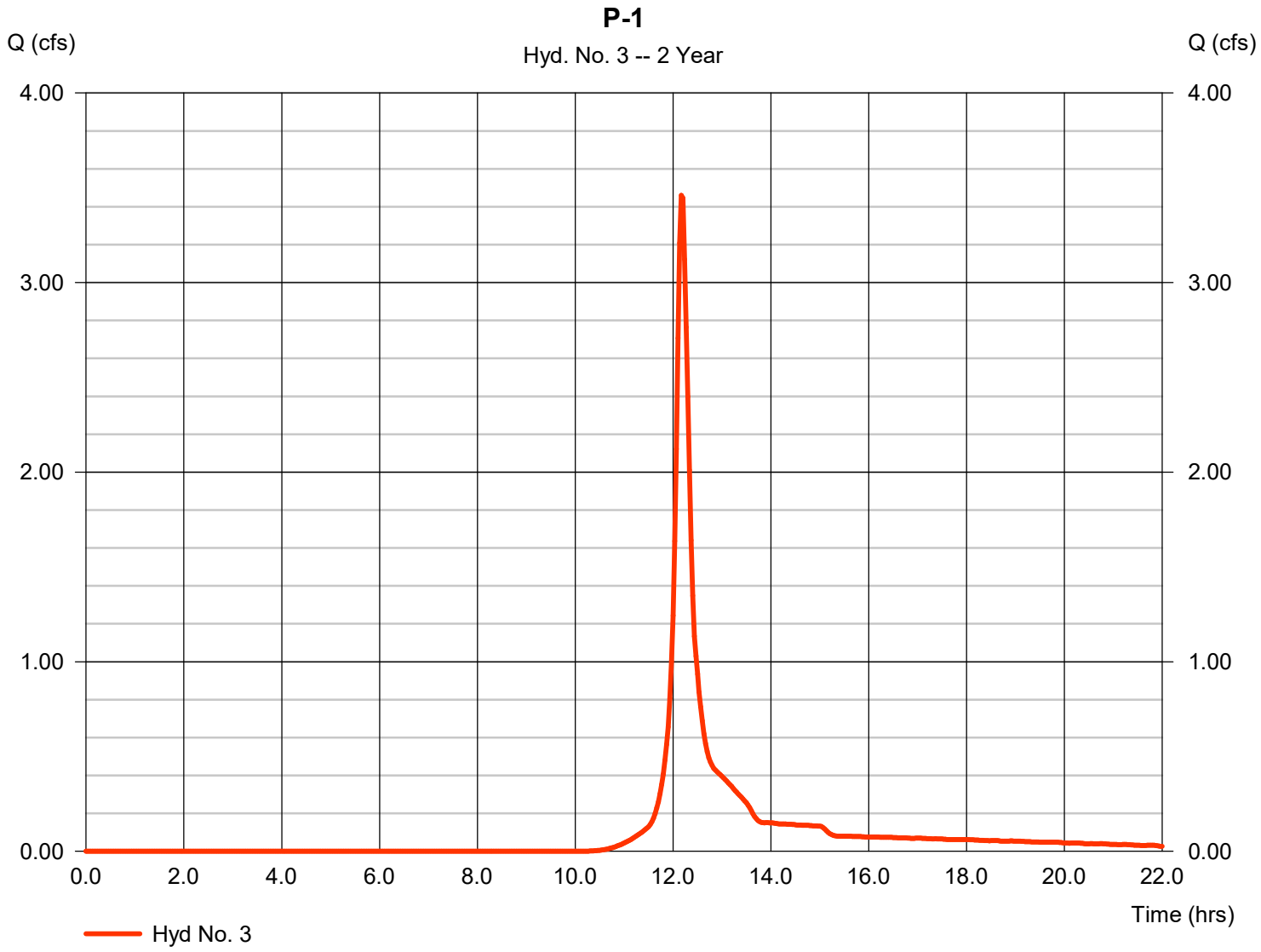


Hydrograph Report

Hyd. No. 3

P-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.460 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	0.205 acft
Drainage area	=	1.884 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	10.10 min
Total precip.	=	2.69 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor Distribution\MSE3 DISTRIBUTION CU	Shape factor	=	484

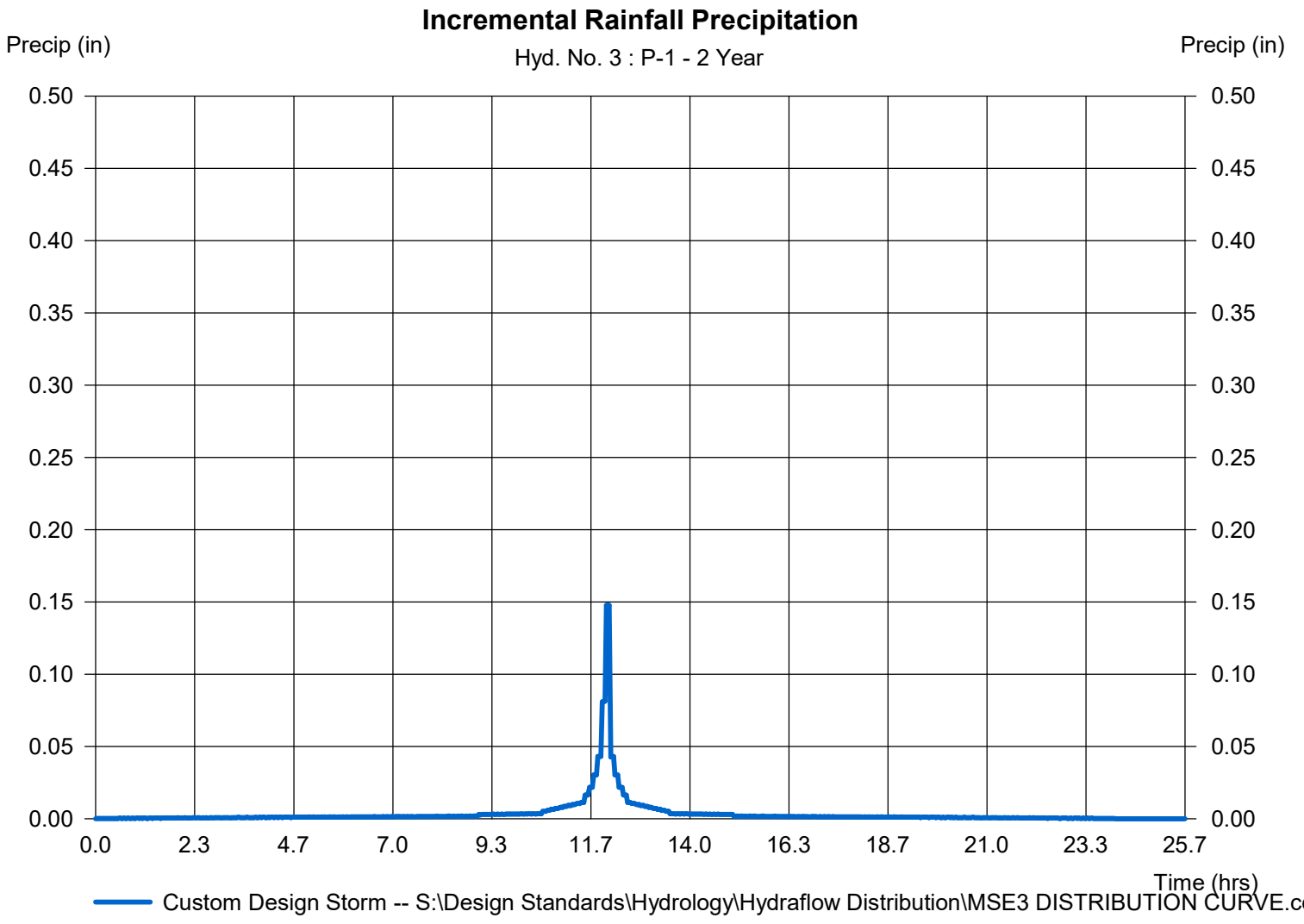


Precipitation Report

Hyd. No. 3

P-1

Storm Frequency	= 2 yrs	Time interval	= 2 min
Total precip.	= 2.6900 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

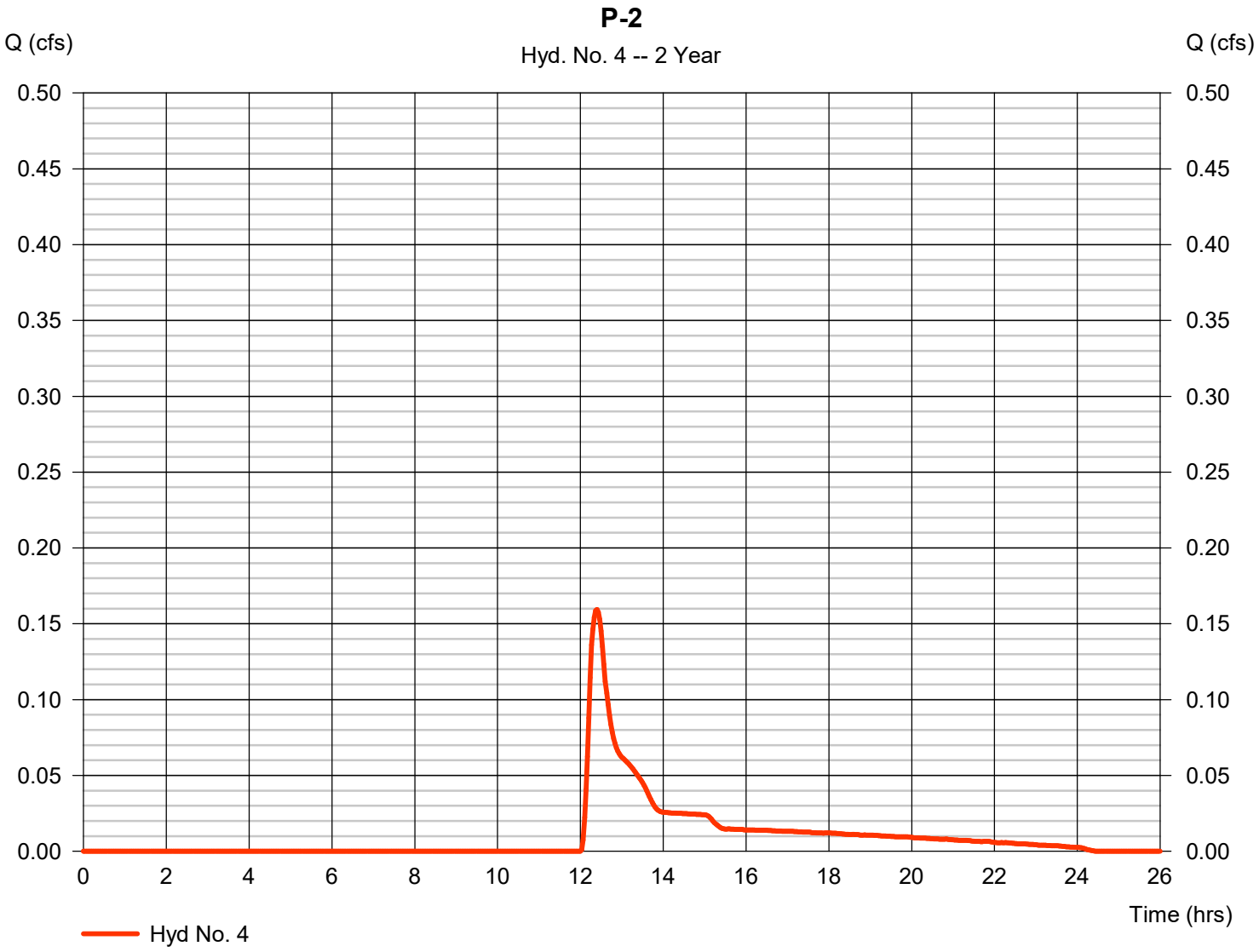


Hydrograph Report

Hyd. No. 4

P-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.159 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.40 hrs
Time interval	=	2 min	Hyd. volume	=	0.021 acft
Drainage area	=	0.974 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	17.50 min
Total precip.	=	2.69 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor Distribution = SE3 DISTRIBUTION CU	Shape factor	=	484

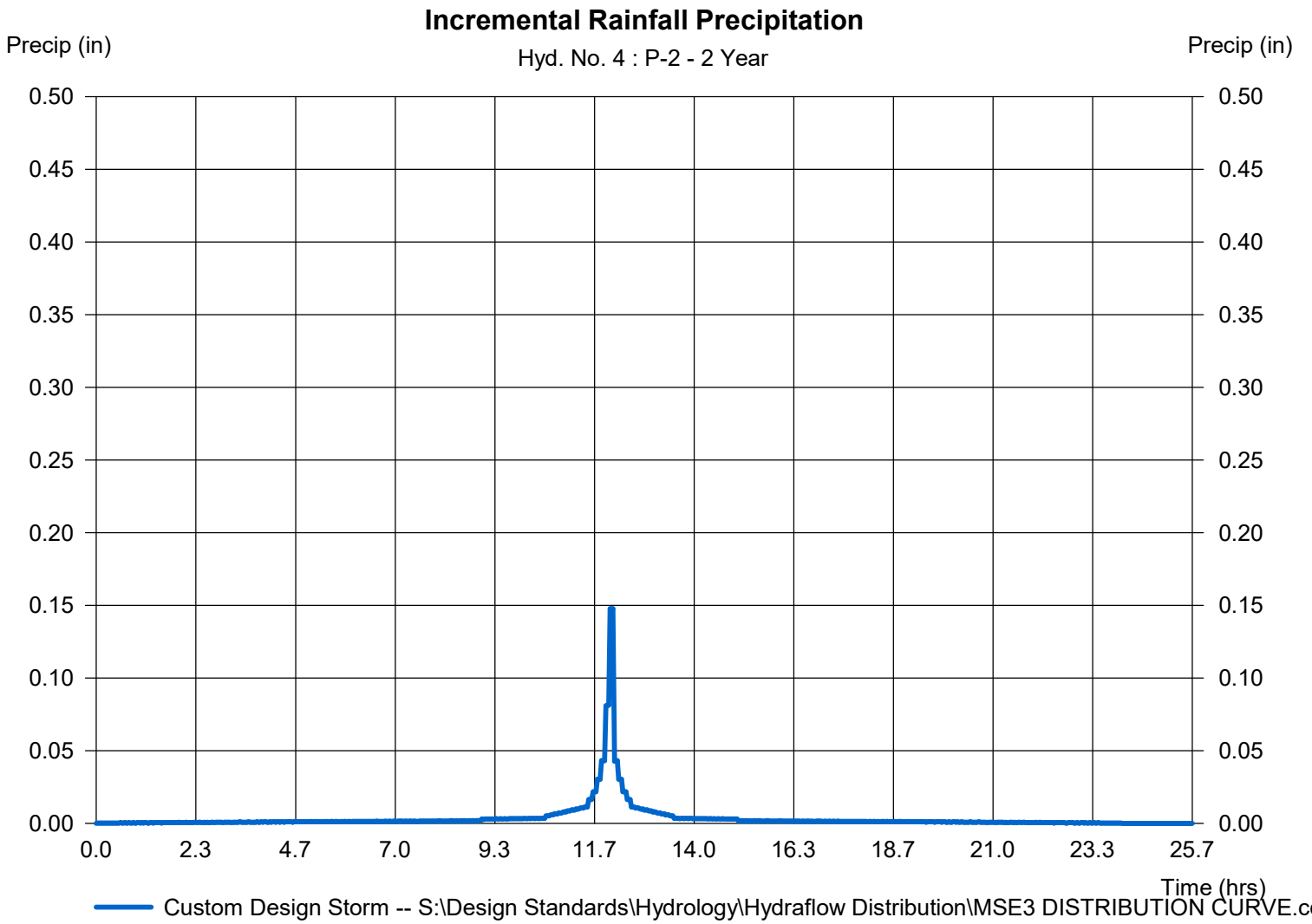


Precipitation Report

Hyd. No. 4

P-2

Storm Frequency	= 2 yrs	Time interval	= 2 min
Total precip.	= 2.6900 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

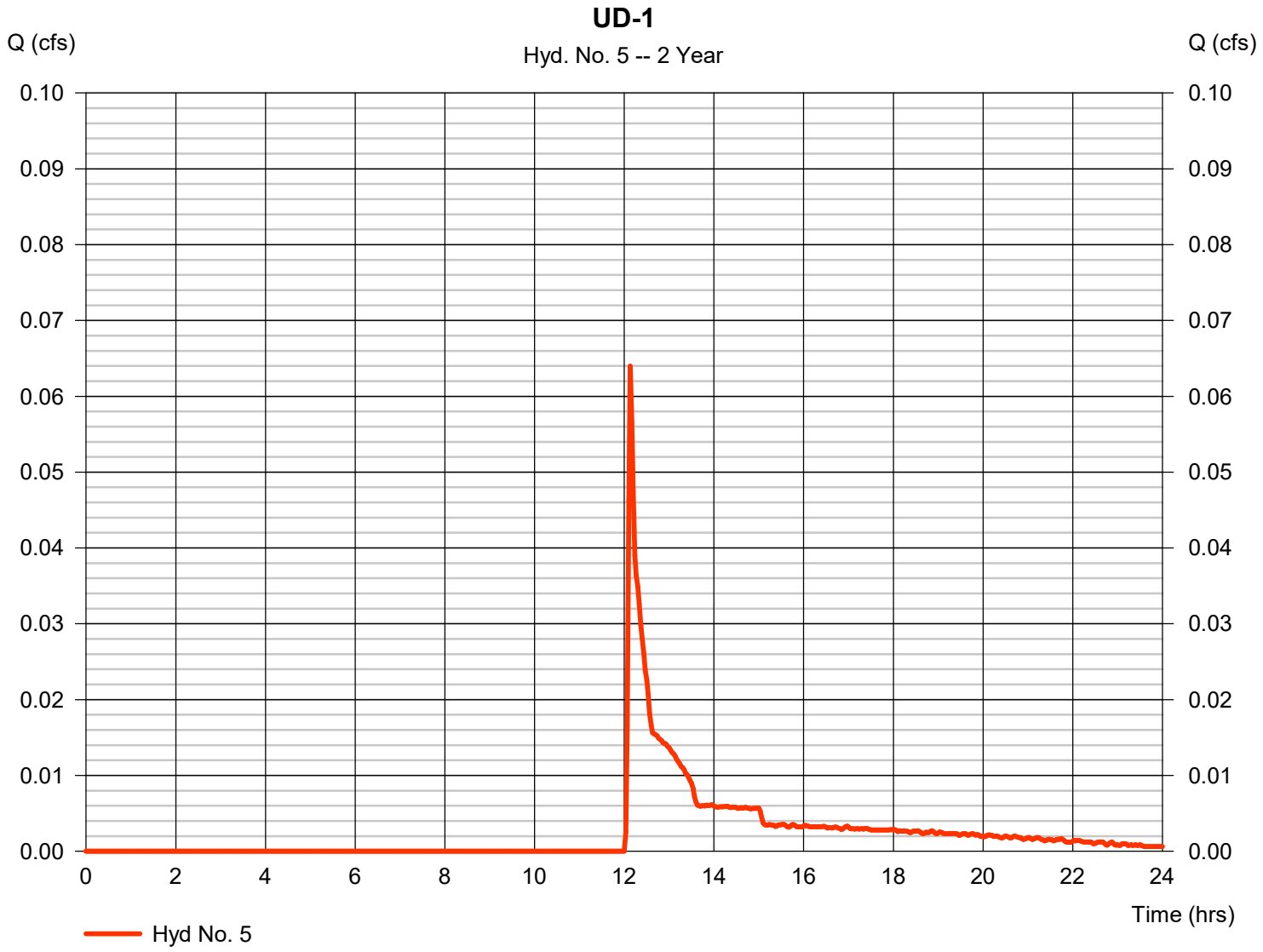


Hydrograph Report

Hyd. No. 5

UD-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.064 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	0.005 acft
Drainage area	=	0.244 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	2.69 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor	Shape factor Distribution = MSE3 DISTRIBUTION CU		

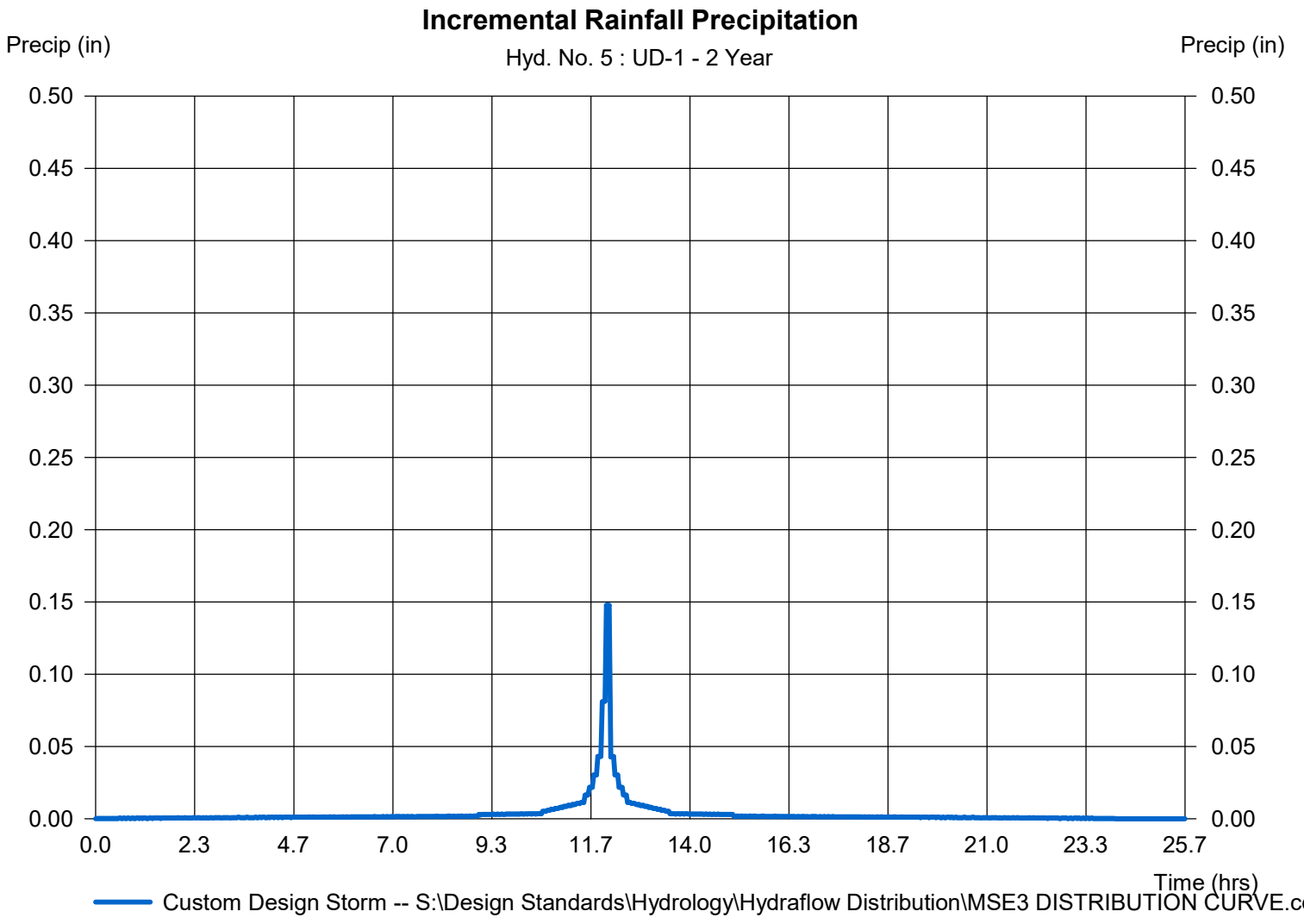


Precipitation Report

Hyd. No. 5

UD-1

Storm Frequency	= 2 yrs	Time interval	= 2 min
Total precip.	= 2.6900 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

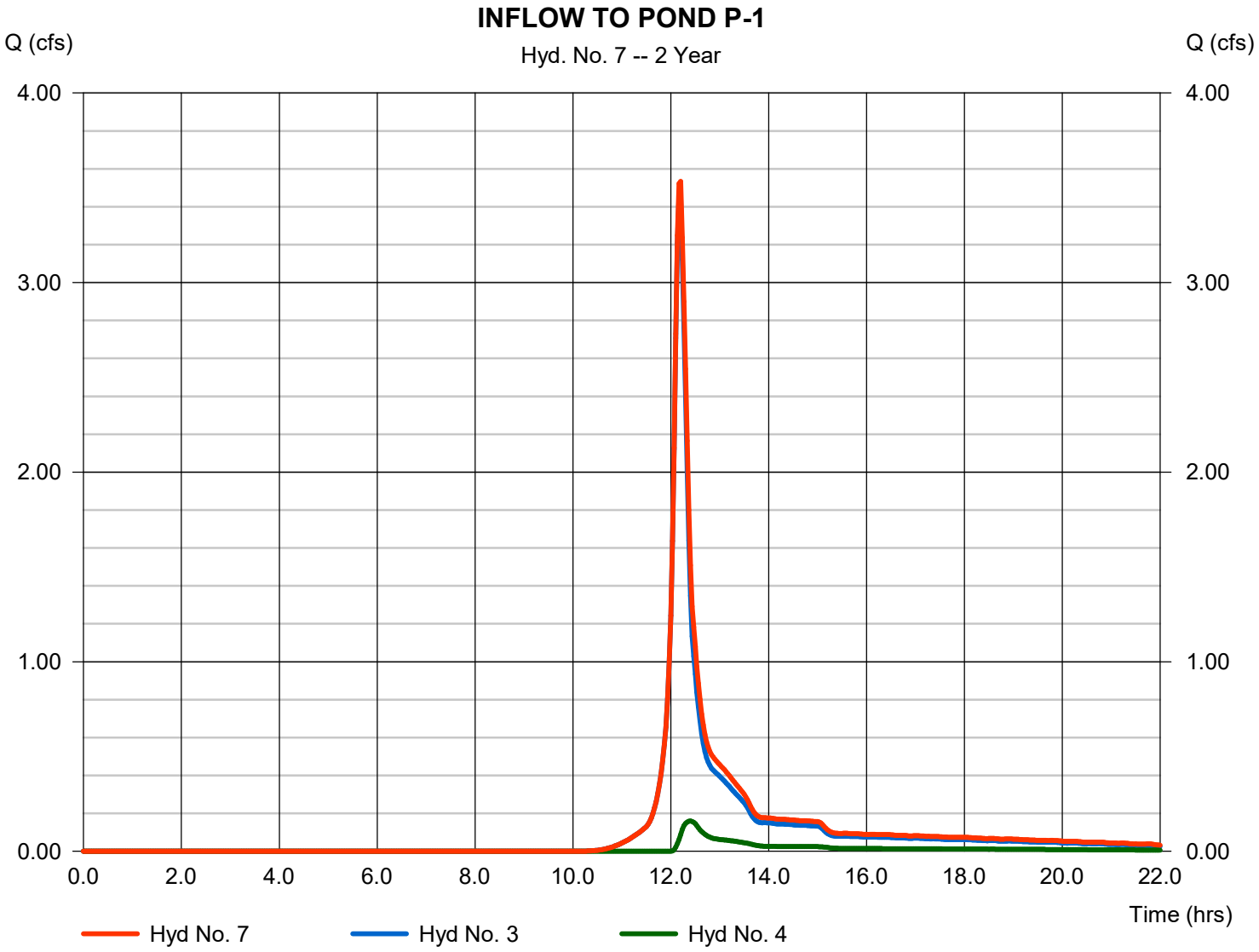


Hydrograph Report

Hyd. No. 7

INFLOW TO POND P-1

Hydrograph type	= Combine	Peak discharge	= 3.534 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 0.226 acft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 2.858 ac



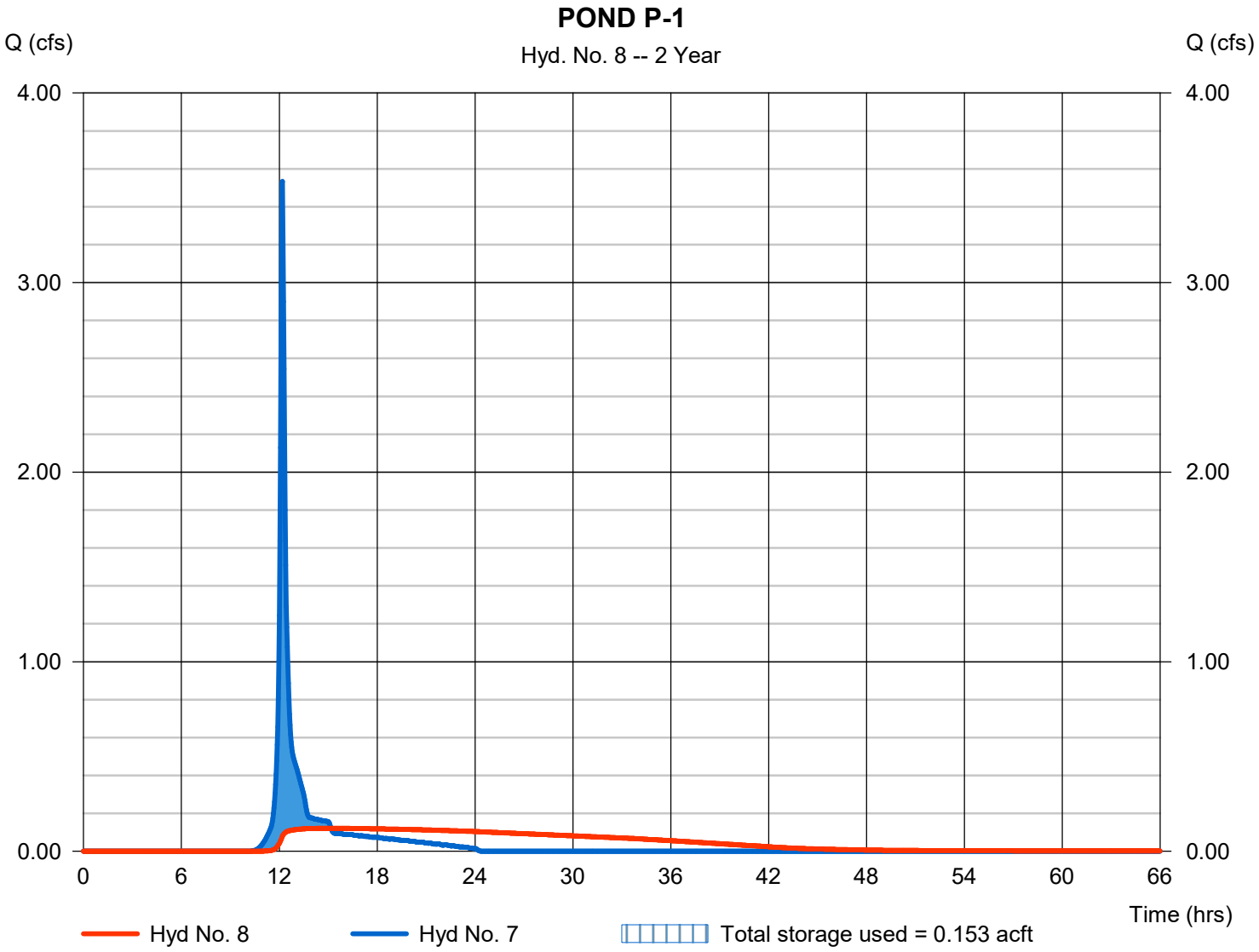
Hydrograph Report

Hyd. No. 8

POND P-1

Hydrograph type	=	Reservoir	Peak discharge	=	0.121 cfs
Storm frequency	=	2 yrs	Time to peak	=	15.17 hrs
Time interval	=	2 min	Hyd. volume	=	0.225 acft
Inflow hyd. No.	=	7 - INFLOW TO POND P-1	Max. Elevation	=	58.96 ft
Reservoir name	=	POND P-1	Max. Storage	=	0.153 acft

Storage Indication method used.

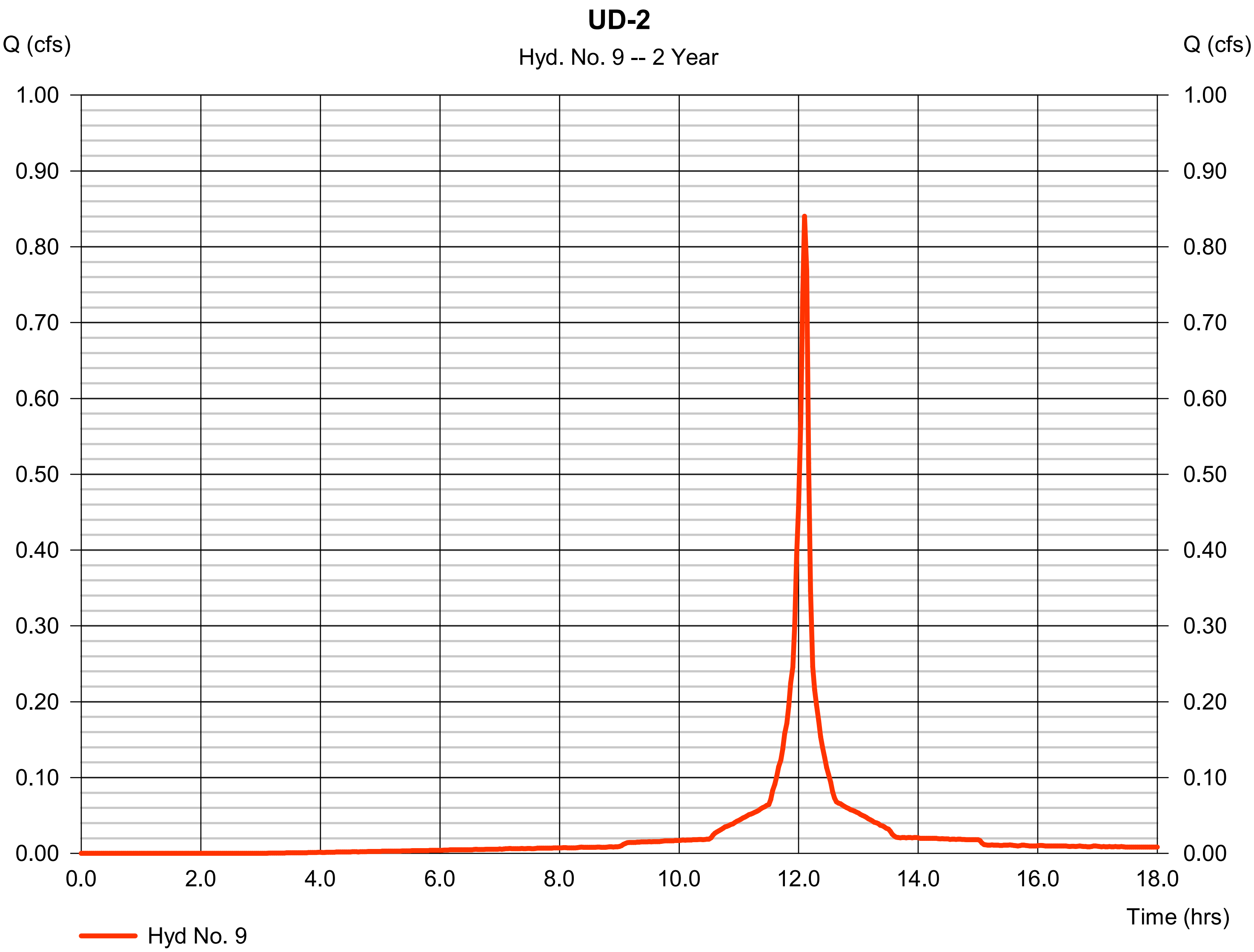


Hydrograph Report

Hyd. No. 9

UD-2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.840 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 0.042 acft
Drainage area	= 0.217 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 2.69 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION CU	Shape factor	= 484

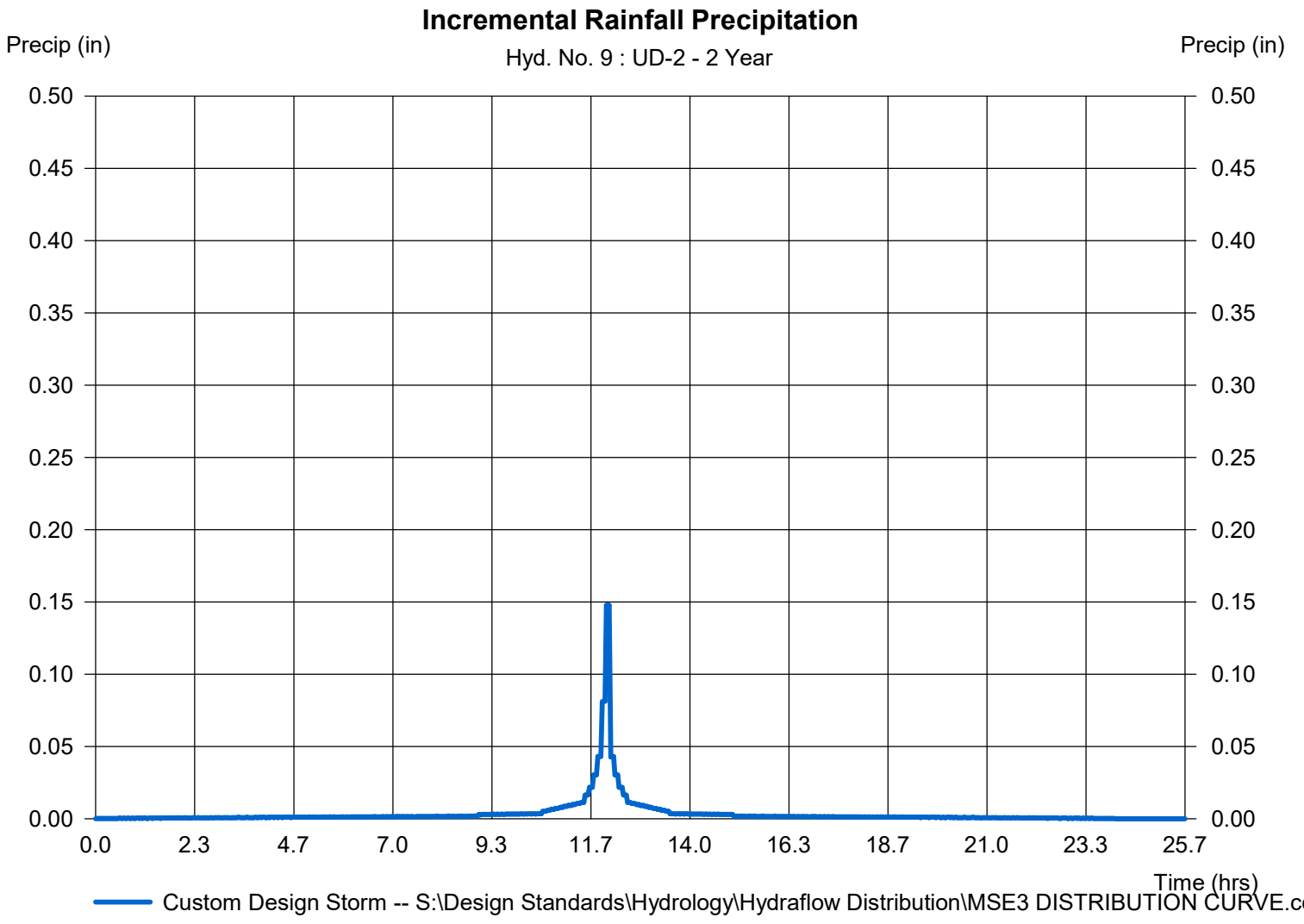


Precipitation Report

Hyd. No. 9

UD-2

Storm Frequency	= 2 yrs	Time interval	= 2 min
Total precip.	= 2.6900 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

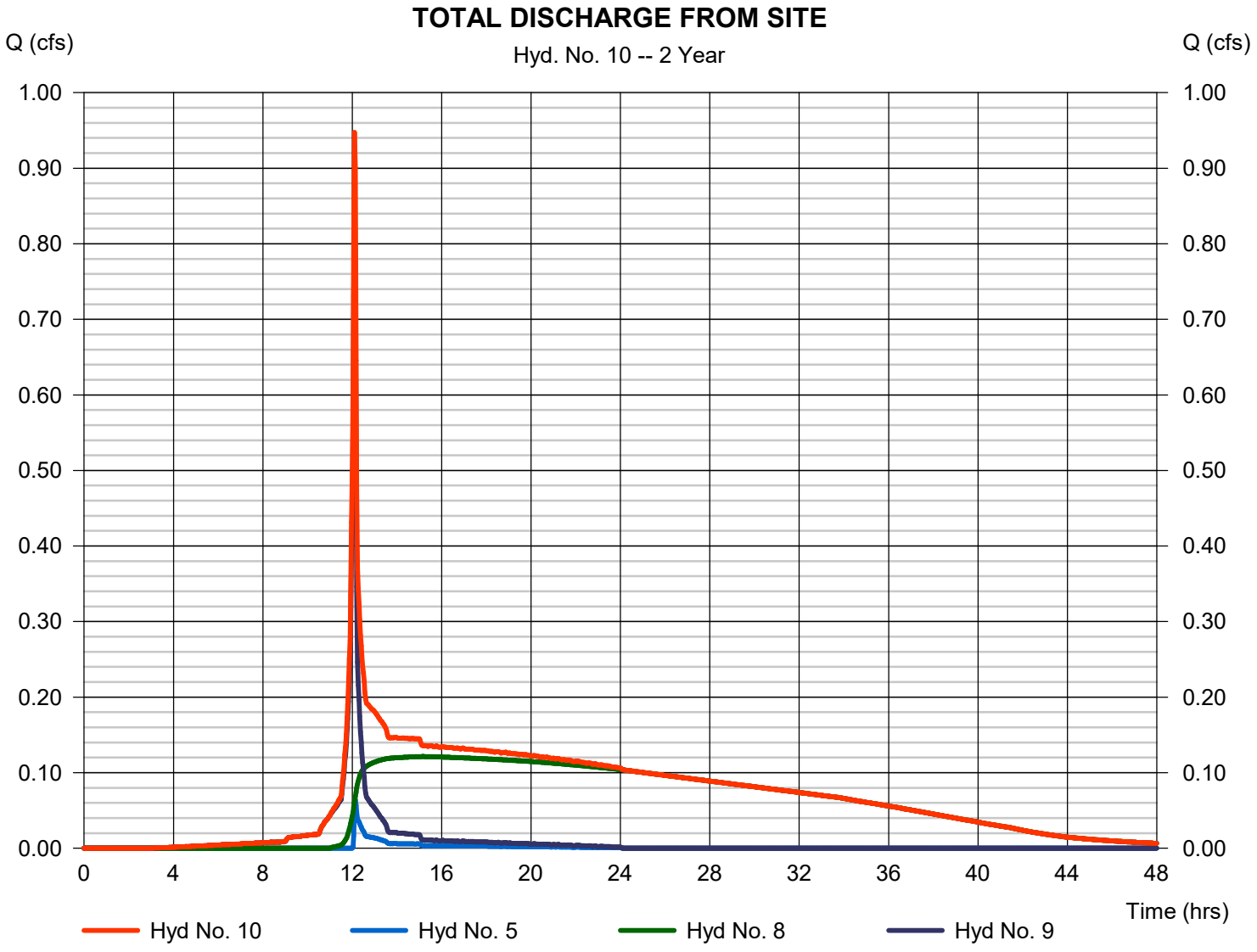


Hydrograph Report

Hyd. No. 10

TOTAL DISCHARGE FROM SITE

Hydrograph type	= Combine	Peak discharge	= 0.947 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 0.271 acft
Inflow hyds.	= 5, 8, 9	Contrib. drain. area	= 0.461 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

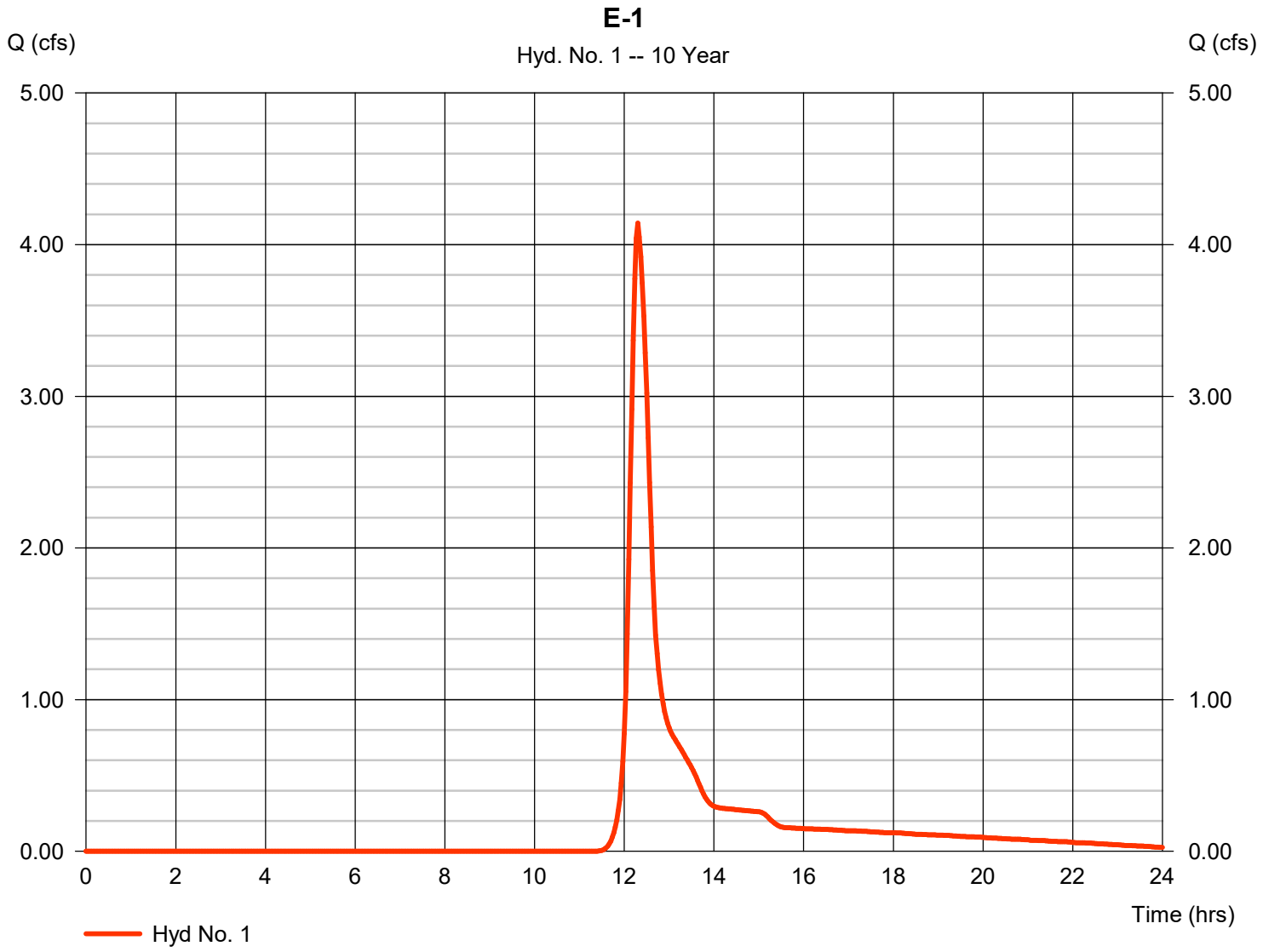
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	4.143	2	738	0.337	------	------	------	E-1
3	SCS Runoff	6.012	2	730	0.356	------	------	------	P-1
4	SCS Runoff	0.665	2	736	0.058	------	------	------	P-2
5	SCS Runoff	0.280	2	728	0.014	------	------	------	UD-1
7	Combine	6.476	2	732	0.413	3, 4,	------	------	INFLOW TO POND P-1
8	Reservoir	1.428	2	756	0.412	7	59.45	0.222	POND P-1
9	SCS Runoff	1.196	2	726	0.060	------	------	------	UD-2
10	Combine	1.574	2	756	0.486	5, 8, 9	------	------	TOTAL DISCHARGE FROM SITE

Hydrograph Report

Hyd. No. 1

E-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.143 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.30 hrs
Time interval	=	2 min	Hyd. volume	=	0.337 acft
Drainage area	=	3.319 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.60 min
Total precip.	=	3.80 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor Distribution = SE3 DISTRIBUTION CU			

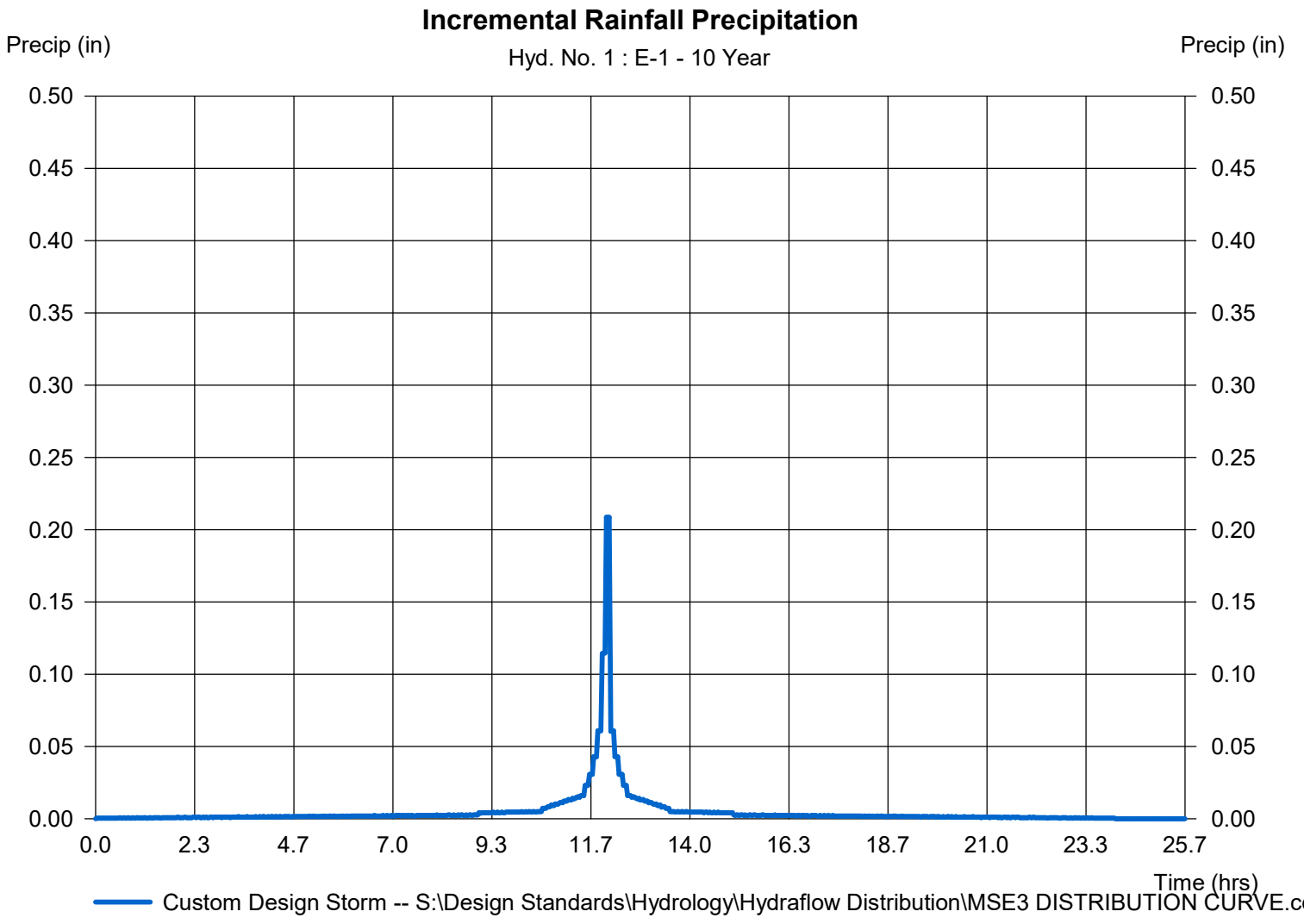


Precipitation Report

Hyd. No. 1

E-1

Storm Frequency	= 10 yrs	Time interval	= 2 min
Total precip.	= 3.8000 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

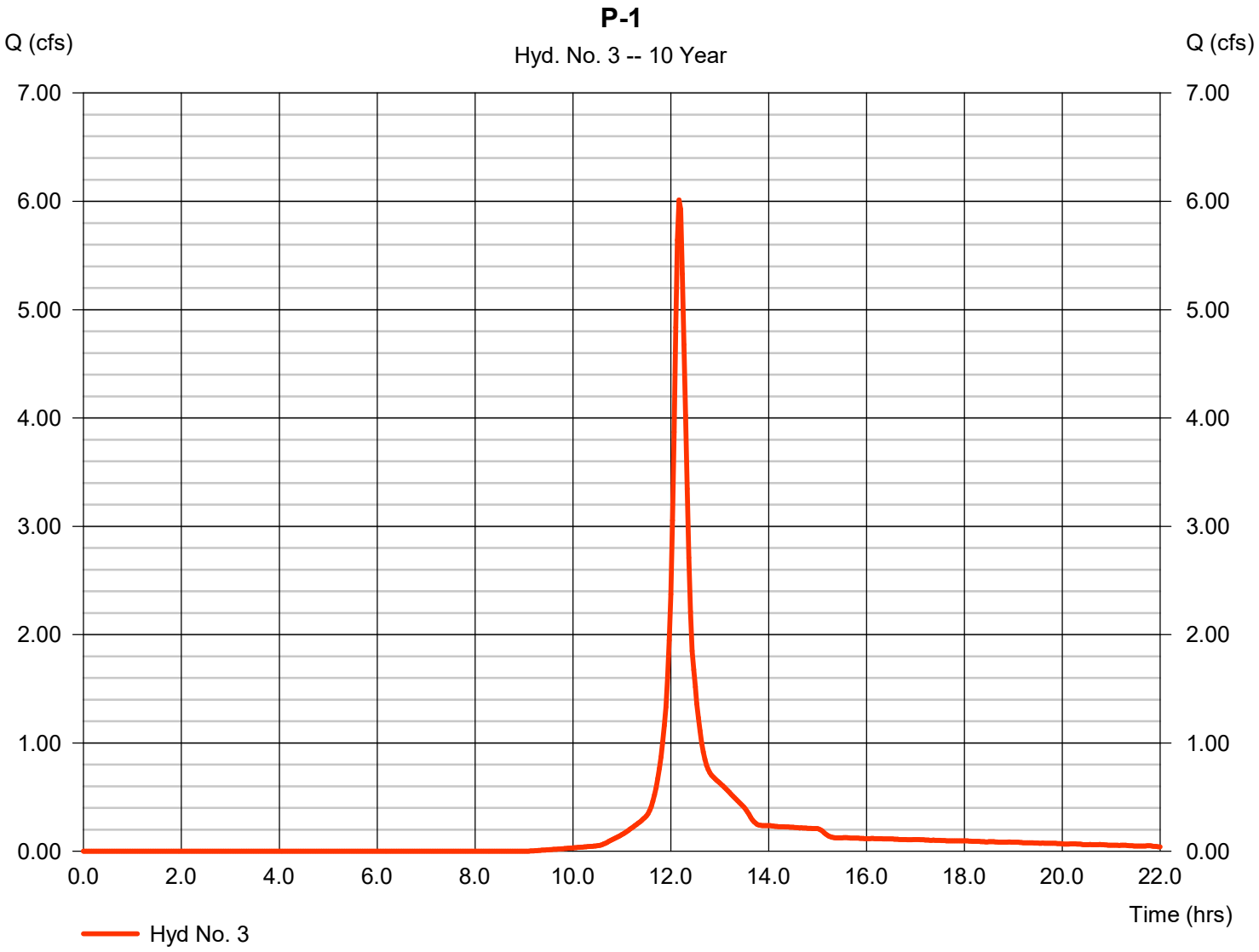


Hydrograph Report

Hyd. No. 3

P-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.012 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	0.356 acft
Drainage area	=	1.884 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	10.10 min
Total precip.	=	3.80 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor Distribution = SE3 DISTRIBUTION CU			

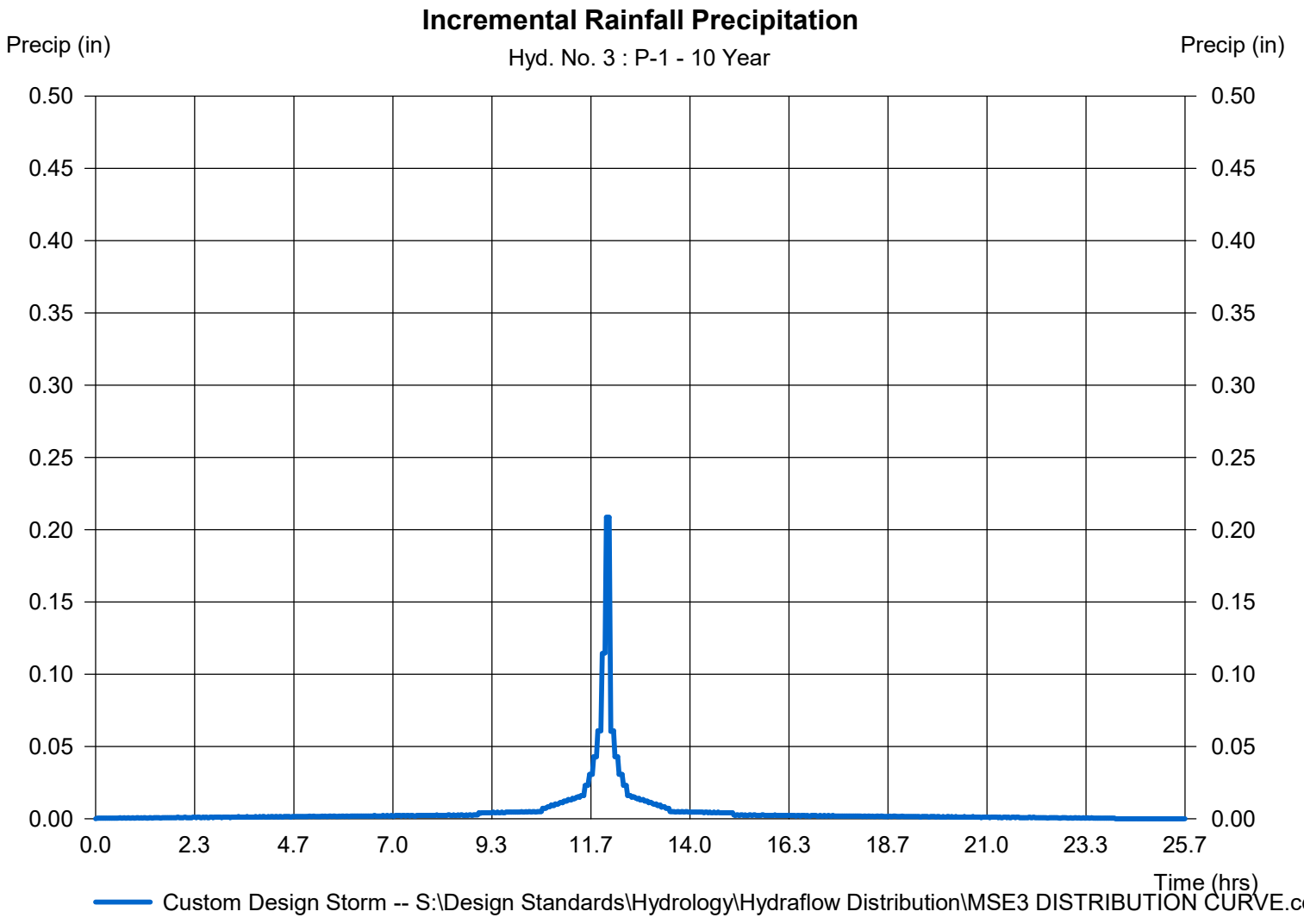


Precipitation Report

Hyd. No. 3

P-1

Storm Frequency	= 10 yrs	Time interval	= 2 min
Total precip.	= 3.8000 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

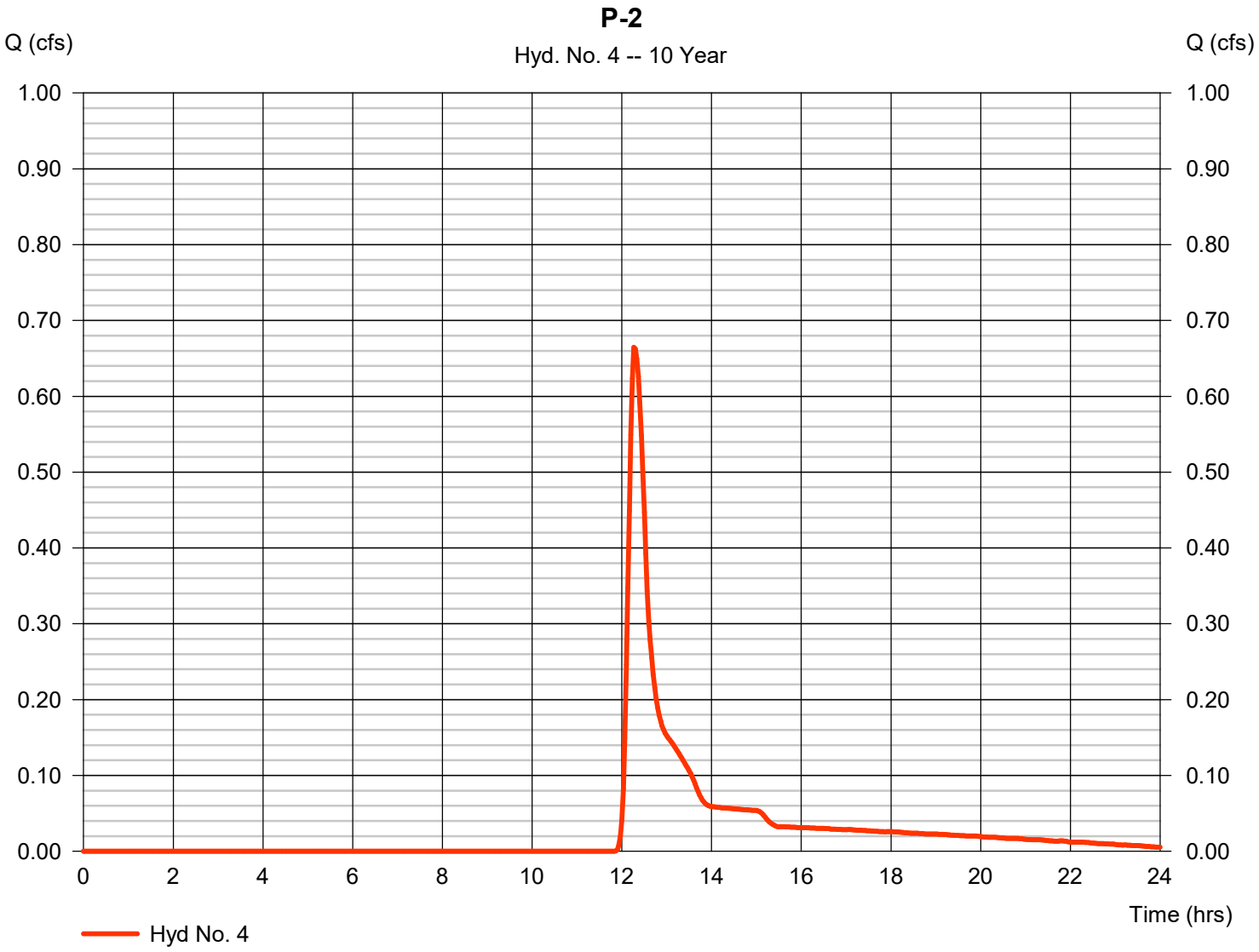


Hydrograph Report

Hyd. No. 4

P-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.665 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	0.058 acft
Drainage area	=	0.974 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	17.50 min
Total precip.	=	3.80 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde flow Distribution\MSE3 DISTRIBUTION CU	Shape factor	=	484

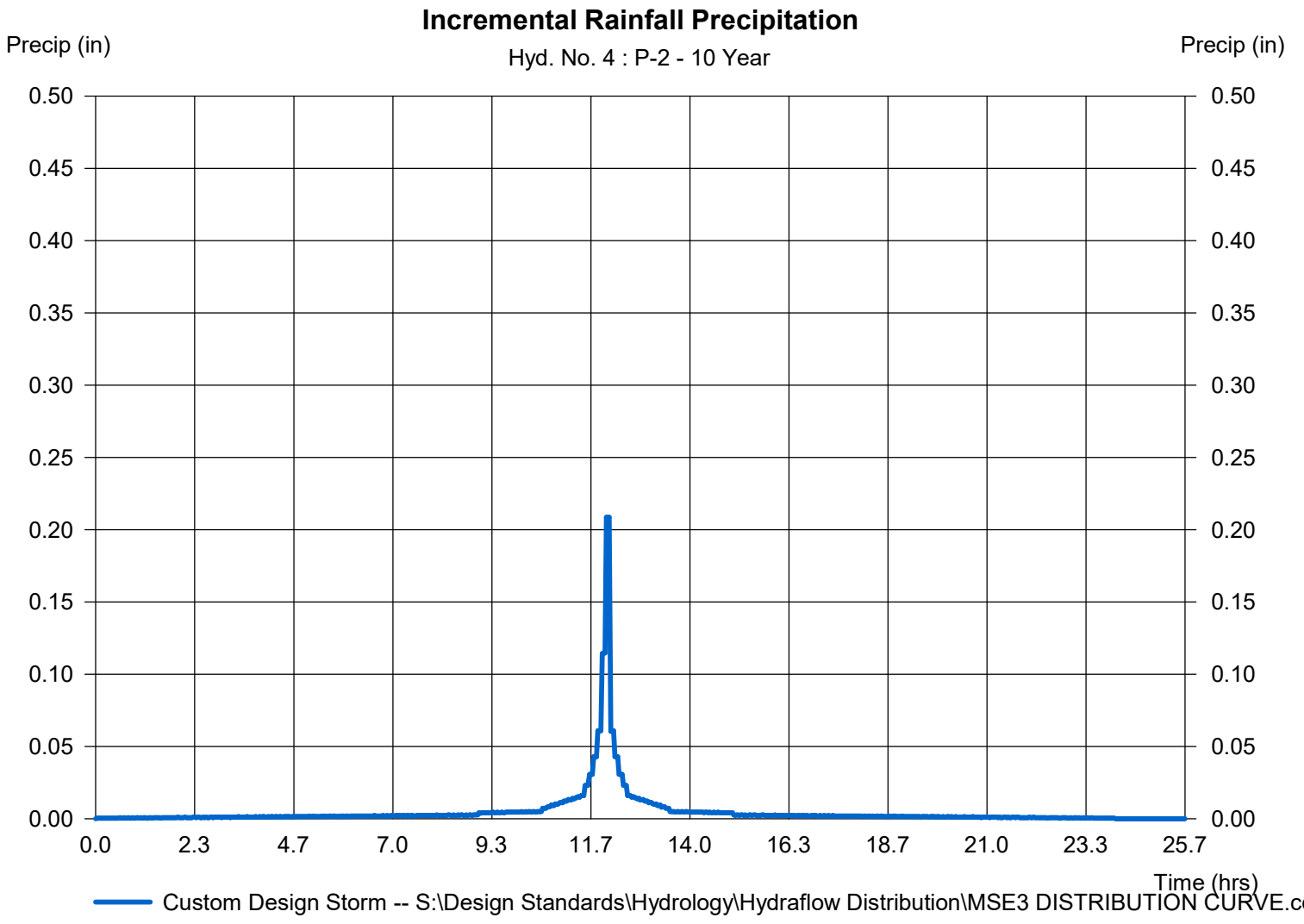


Precipitation Report

Hyd. No. 4

P-2

Storm Frequency	= 10 yrs	Time interval	= 2 min
Total precip.	= 3.8000 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

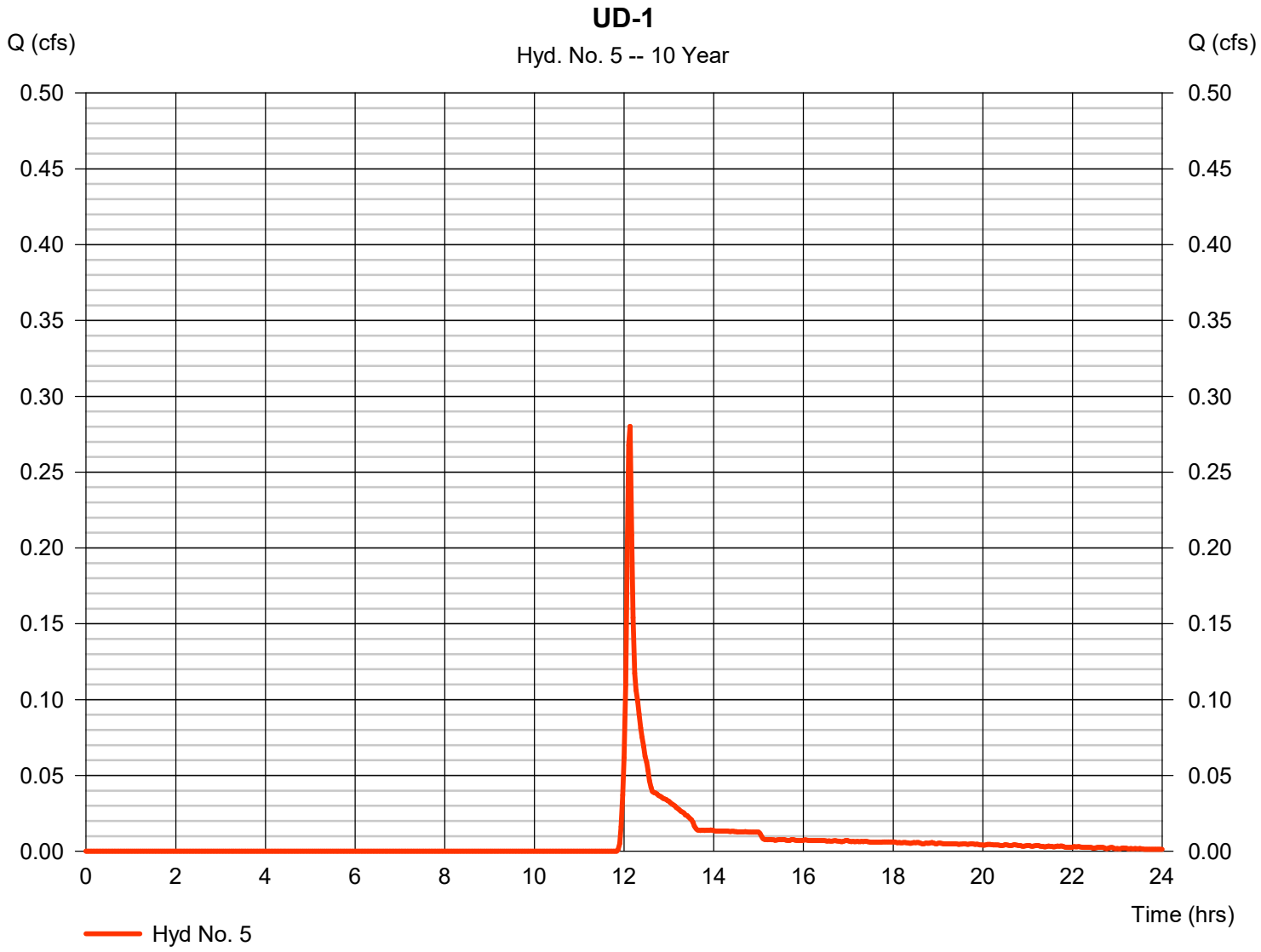


Hydrograph Report

Hyd. No. 5

UD-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.280 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	0.014 acft
Drainage area	=	0.244 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.80 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION CU	Shape factor	=	484

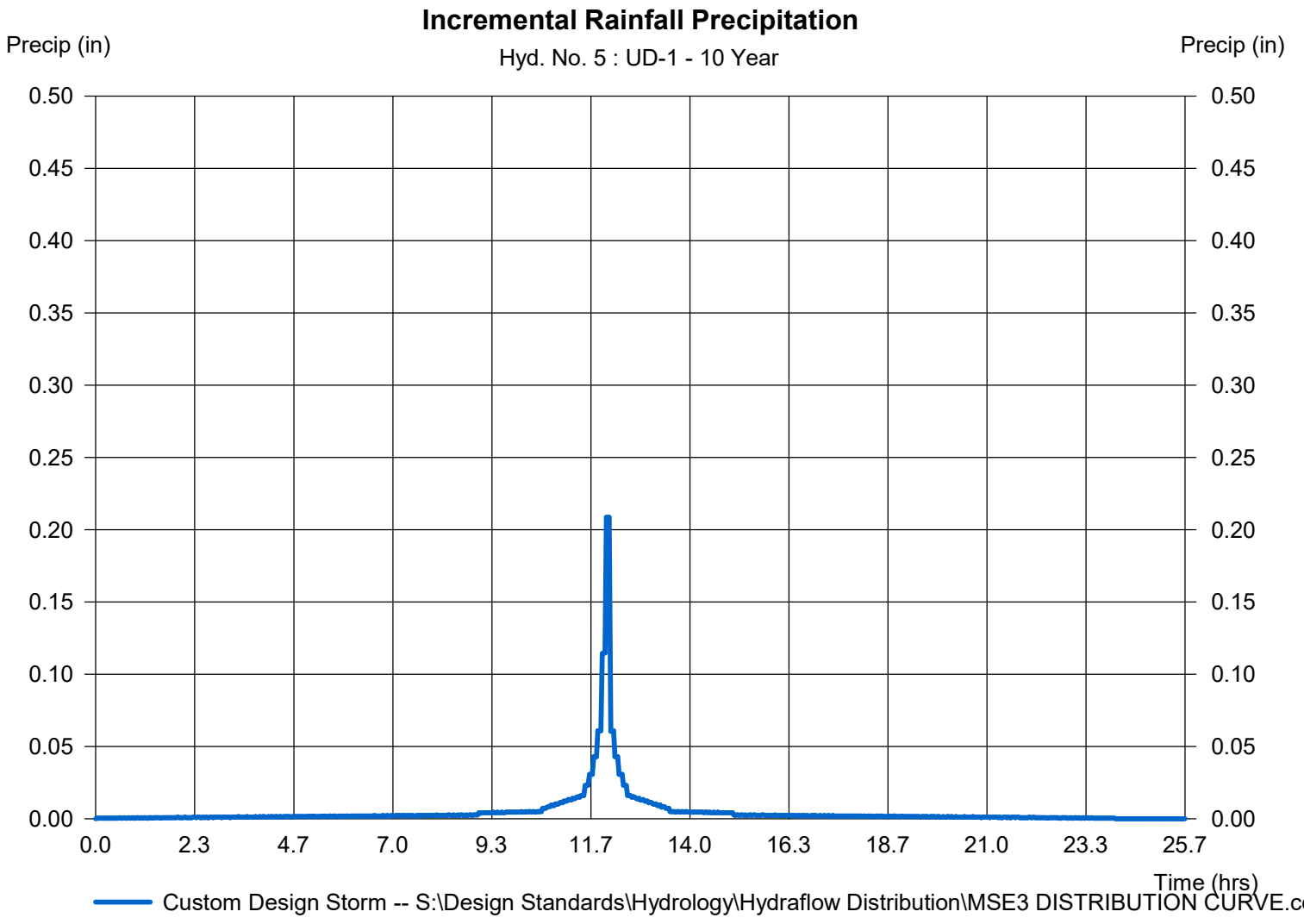


Precipitation Report

Hyd. No. 5

UD-1

Storm Frequency	= 10 yrs	Time interval	= 2 min
Total precip.	= 3.8000 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

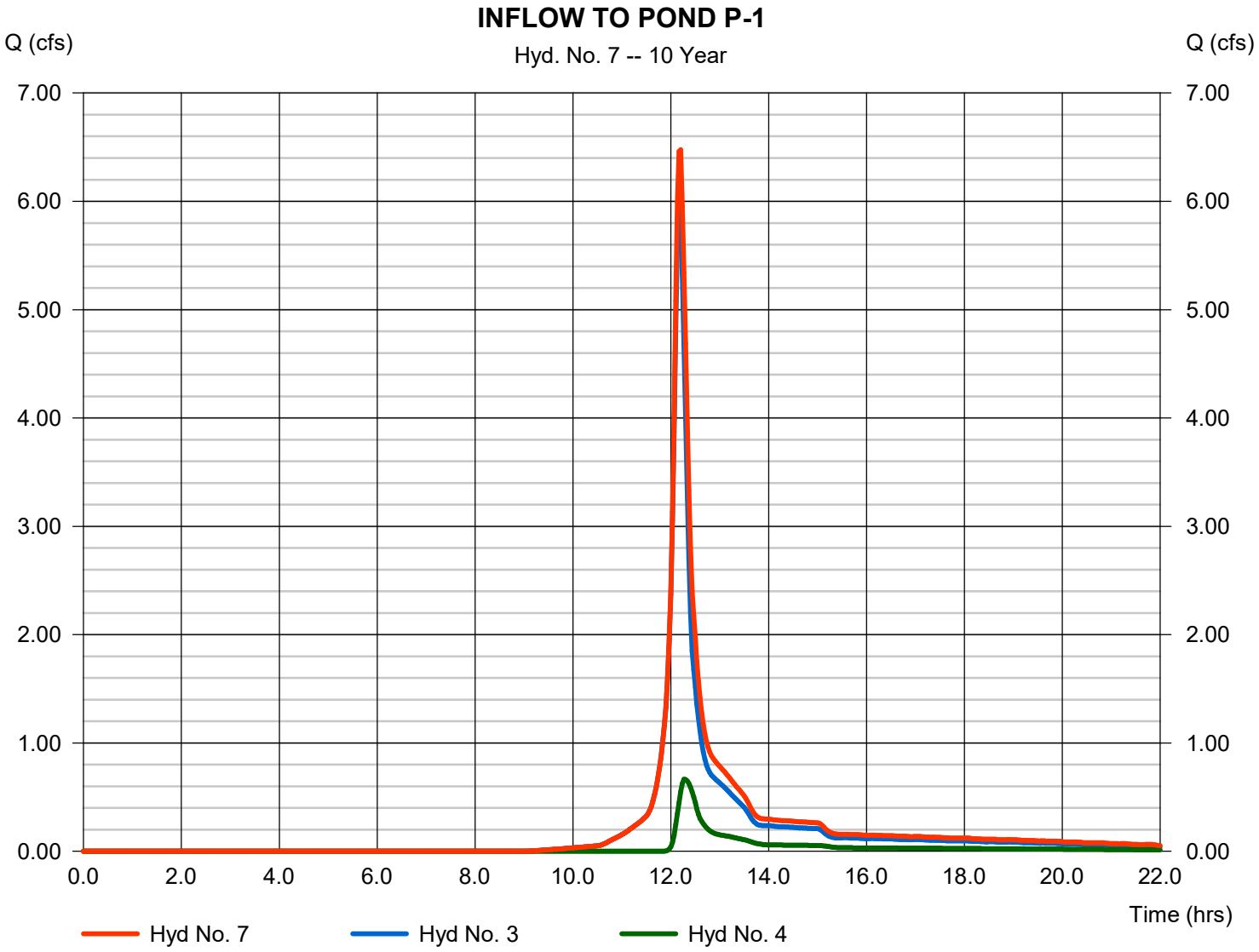


Hydrograph Report

Hyd. No. 7

INFLOW TO POND P-1

Hydrograph type	= Combine	Peak discharge	= 6.476 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 0.413 acft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 2.858 ac



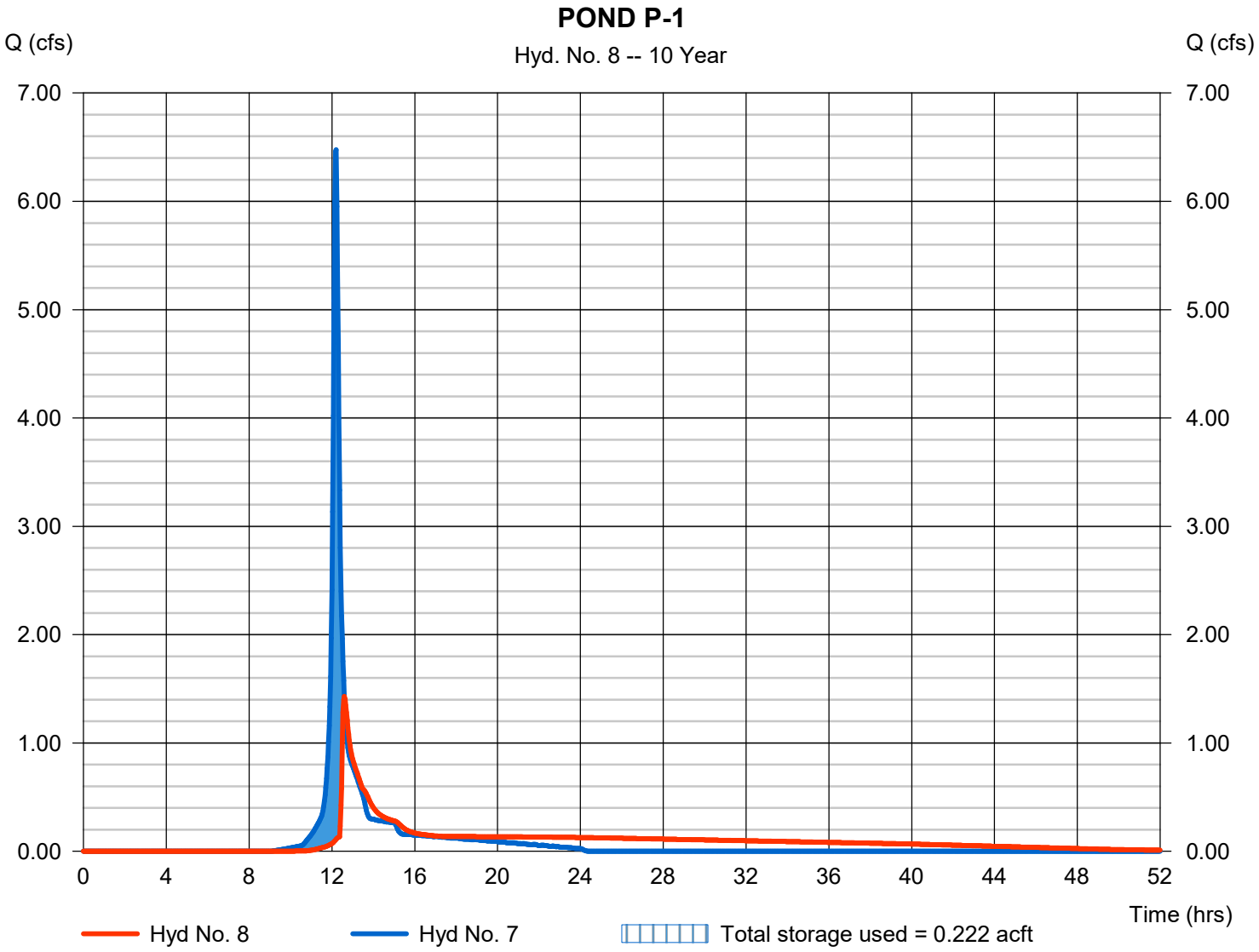
Hydrograph Report

Hyd. No. 8

POND P-1

Hydrograph type	=	Reservoir	Peak discharge	=	1.428 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.60 hrs
Time interval	=	2 min	Hyd. volume	=	0.412 acft
Inflow hyd. No.	=	7 - INFLOW TO POND P-1	Max. Elevation	=	59.45 ft
Reservoir name	=	POND P-1	Max. Storage	=	0.222 acft

Storage Indication method used.

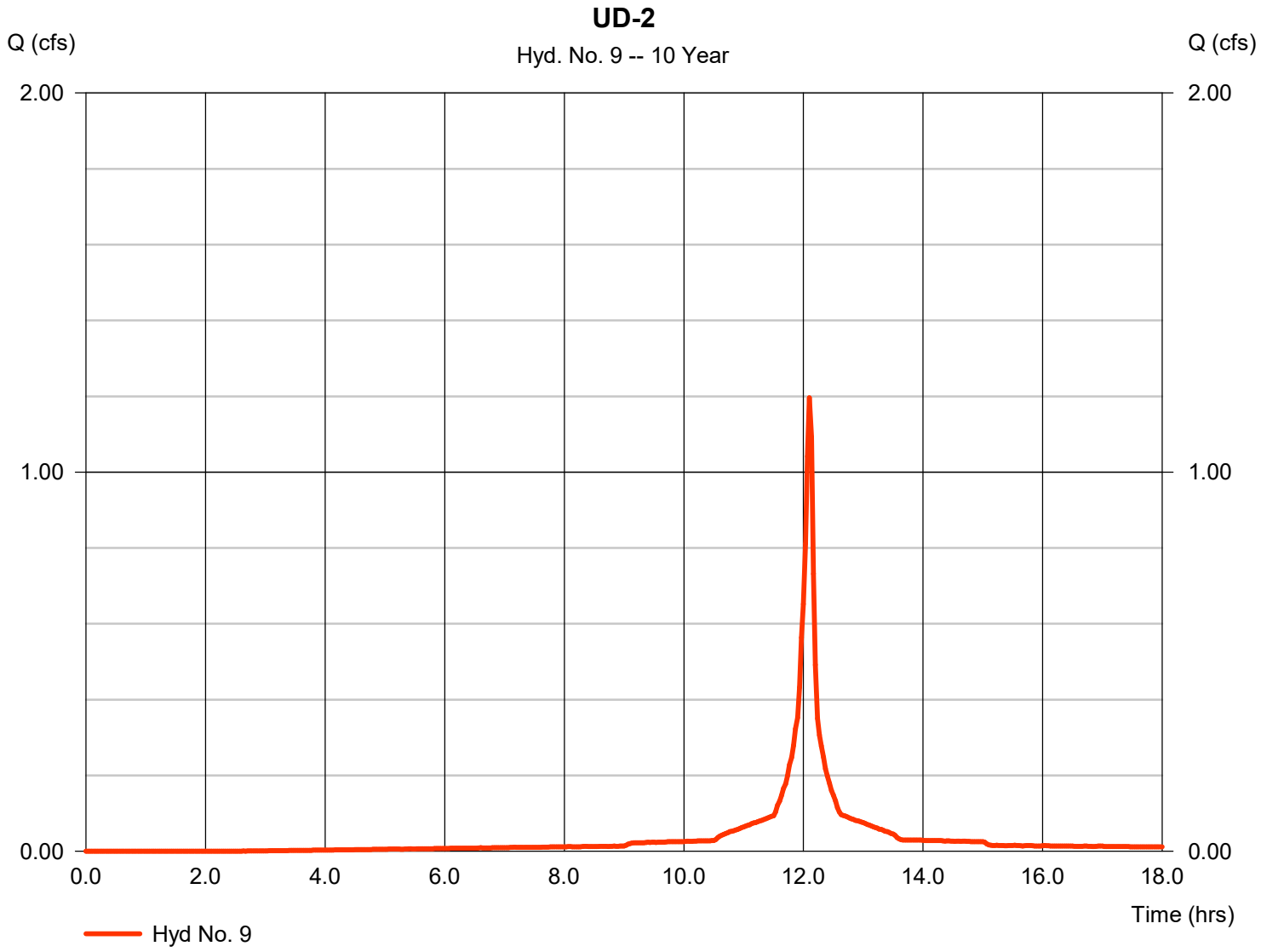


Hydrograph Report

Hyd. No. 9

UD-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.196 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	0.060 acft
Drainage area	=	0.217 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.80 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor Distribution - SE3 DISTRIBUTION CU	Shape factor	=	484

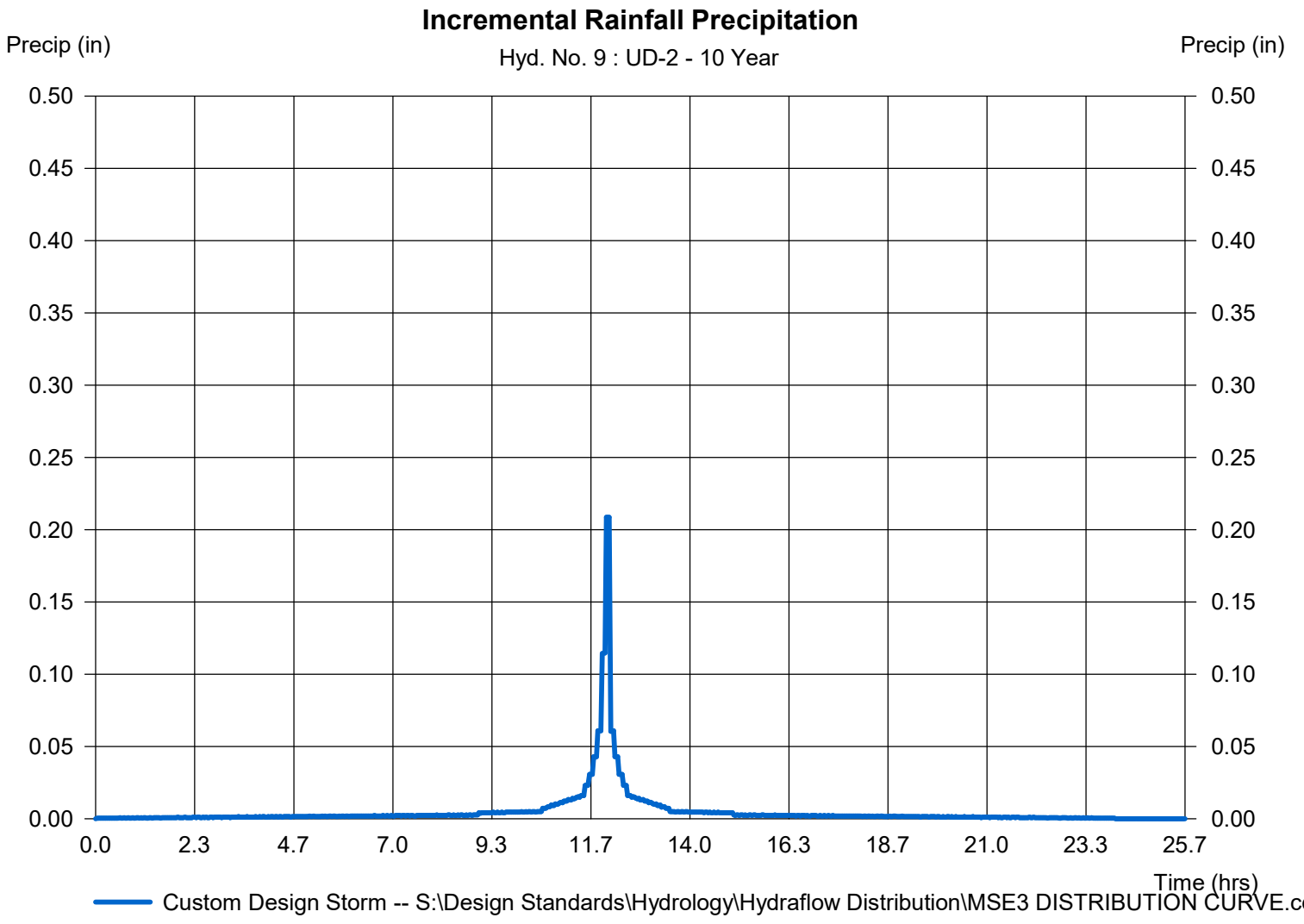


Precipitation Report

Hyd. No. 9

UD-2

Storm Frequency	= 10 yrs	Time interval	= 2 min
Total precip.	= 3.8000 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

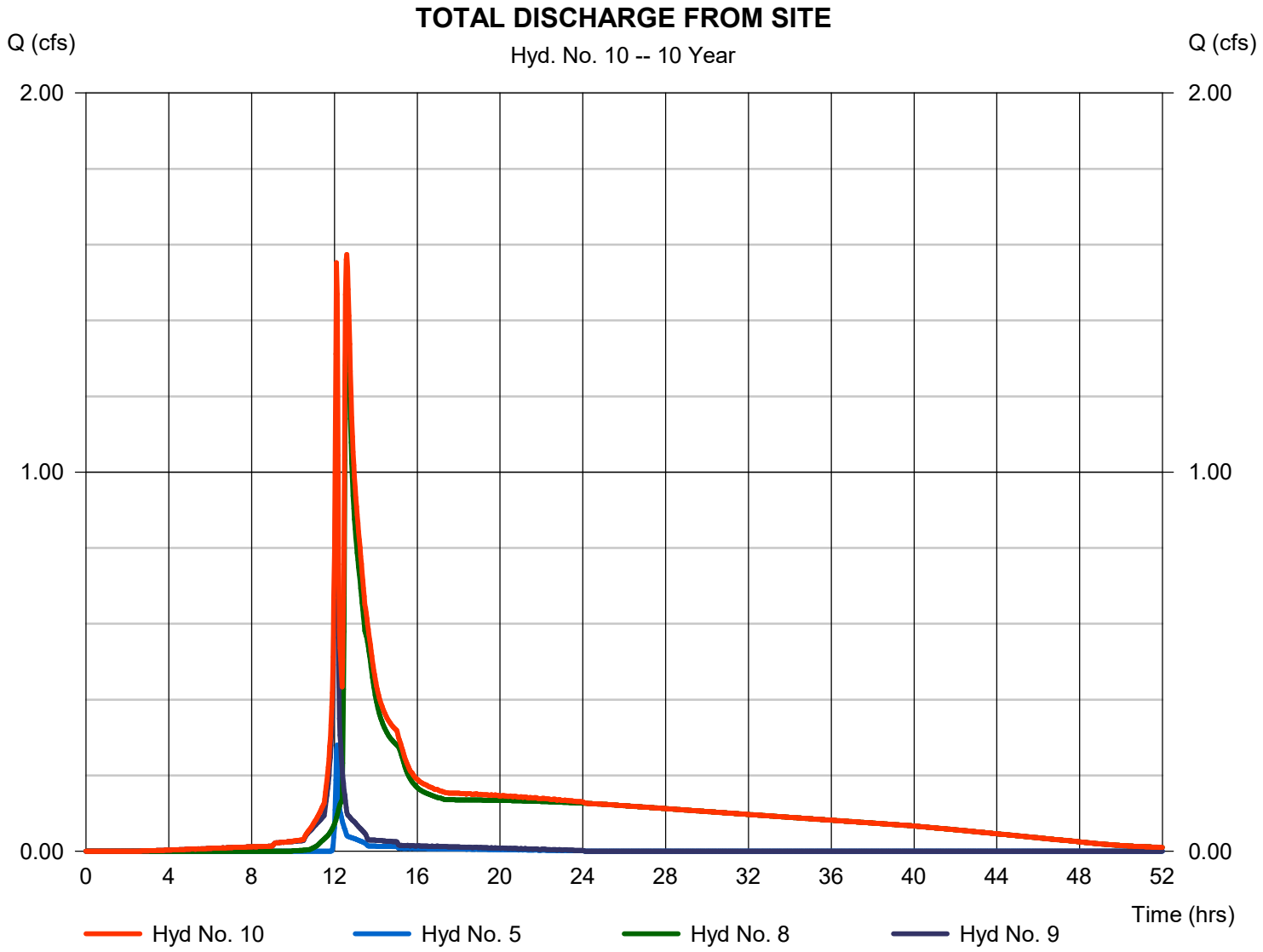


Hydrograph Report

Hyd. No. 10

TOTAL DISCHARGE FROM SITE

Hydrograph type	= Combine	Peak discharge	= 1.574 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 0.486 acft
Inflow hyds.	= 5, 8, 9	Contrib. drain. area	= 0.461 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

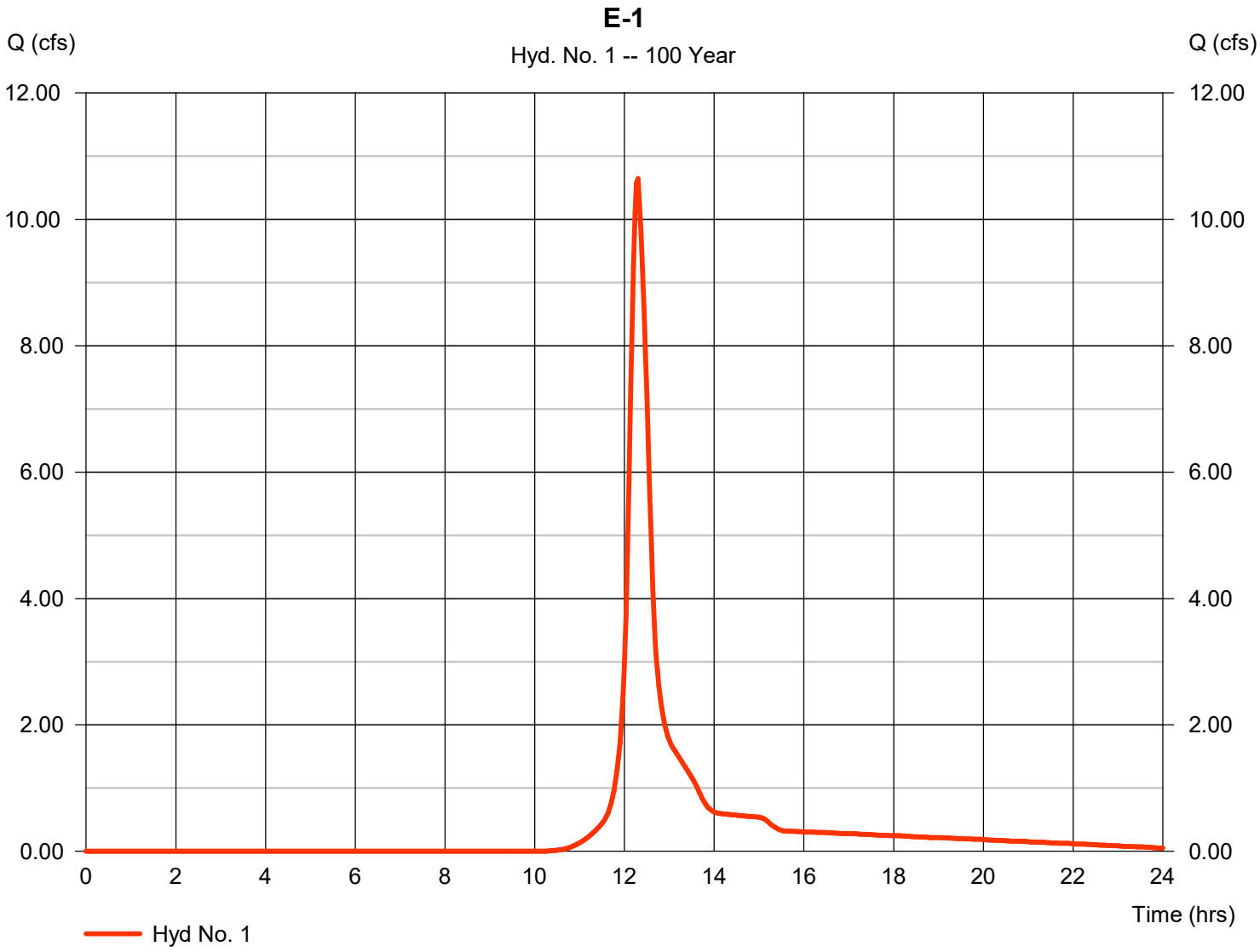
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	10.64	2	738	0.828	------	------	------	E-1
3	SCS Runoff	11.69	2	730	0.705	------	------	------	P-1
4	SCS Runoff	2.359	2	736	0.172	------	------	------	P-2
5	SCS Runoff	0.924	2	726	0.040	------	------	------	UD-1
7	Combine	13.60	2	730	0.877	3, 4,	------	------	INFLOW TO POND P-1
8	Reservoir	9.611	2	738	0.876	7	59.93	0.290	POND P-1
9	SCS Runoff	1.953	2	726	0.101	------	------	------	UD-2
10	Combine	10.33	2	738	1.017	5, 8, 9	------	------	TOTAL DISCHARGE FROM SITE

Hydrograph Report

Hyd. No. 1

E-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	10.64 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.30 hrs
Time interval	=	2 min	Hyd. volume	=	0.828 acft
Drainage area	=	3.319 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.60 min
Total precip.	=	6.17 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor Distribution - SE3 DISTRIBUTION CU	Shape factor	=	484

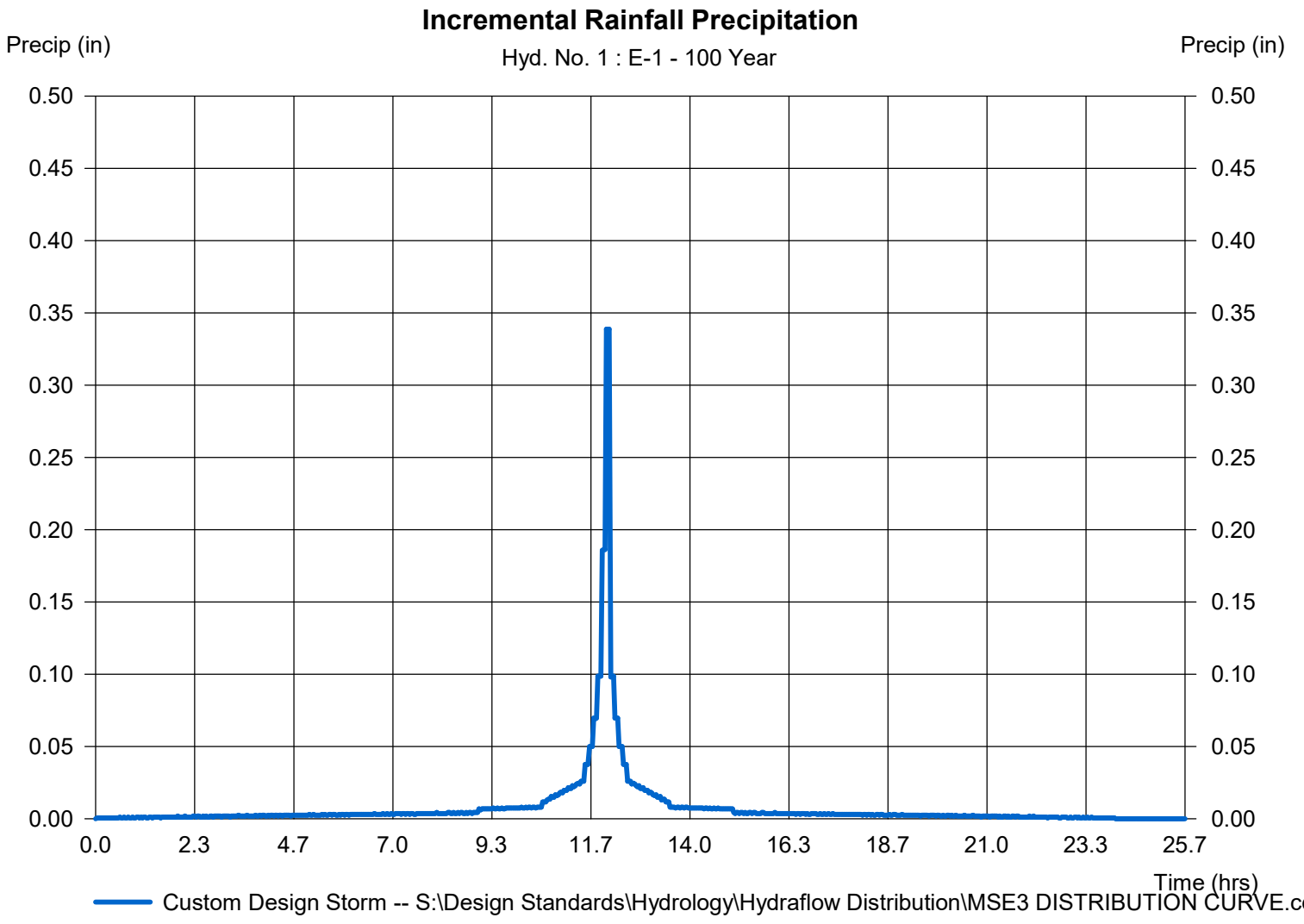


Precipitation Report

Hyd. No. 1

E-1

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 6.1700 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

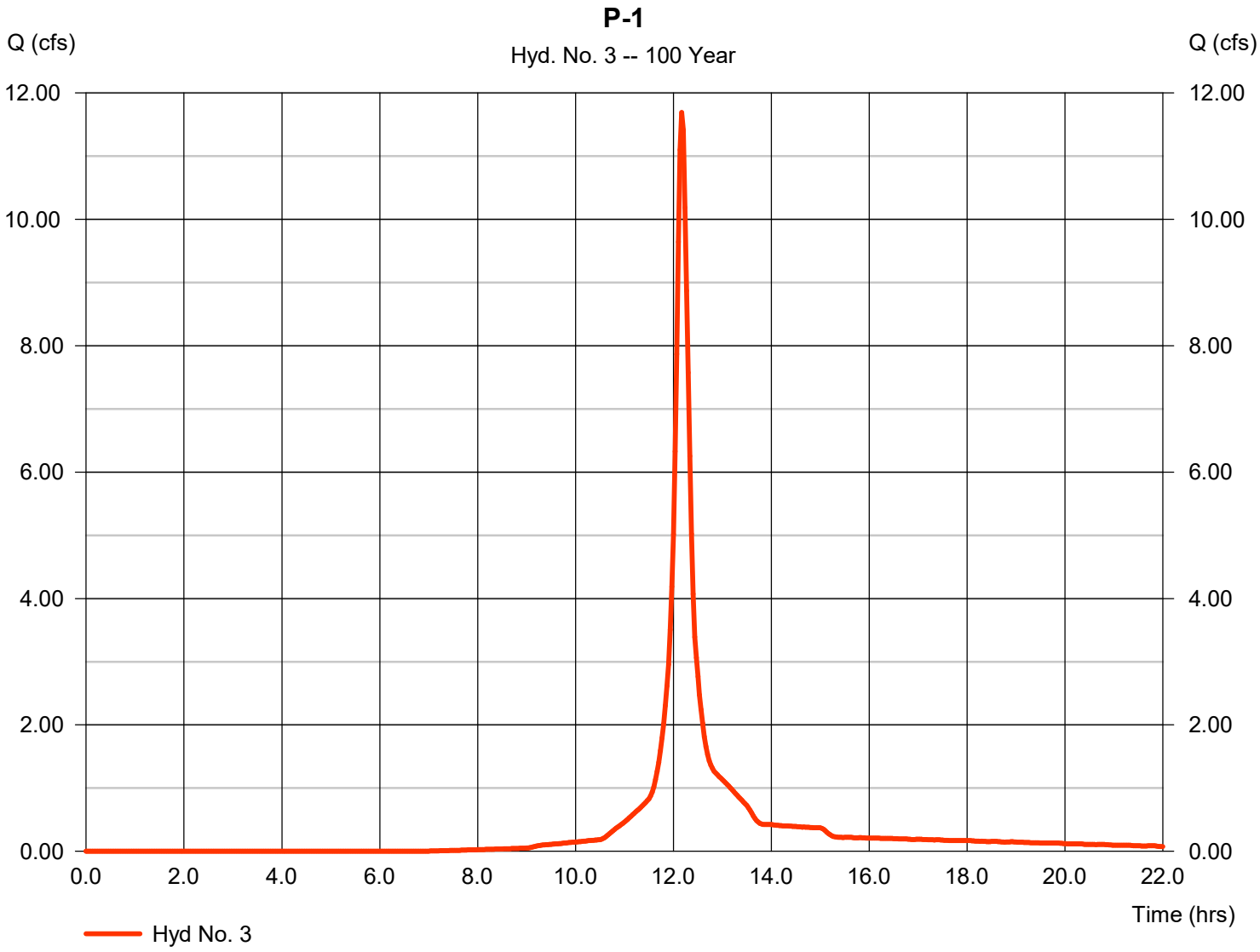


Hydrograph Report

Hyd. No. 3

P-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.69 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	0.705 acft
Drainage area	=	1.884 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	10.10 min
Total precip.	=	6.17 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyd Factor Distribution\MSE3 DISTRIBUTION CU	Shape factor	=	484

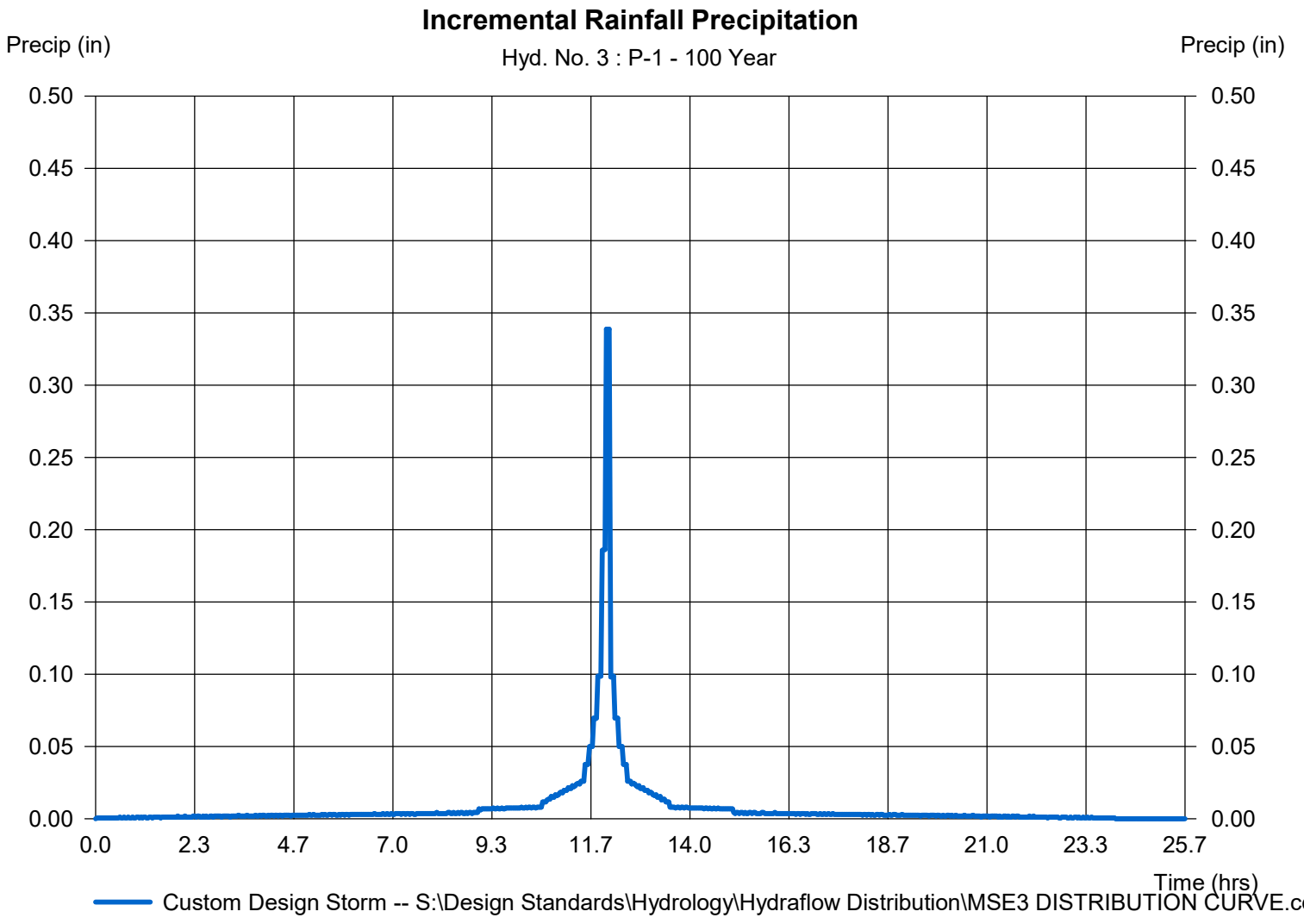


Precipitation Report

Hyd. No. 3

P-1

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 6.1700 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

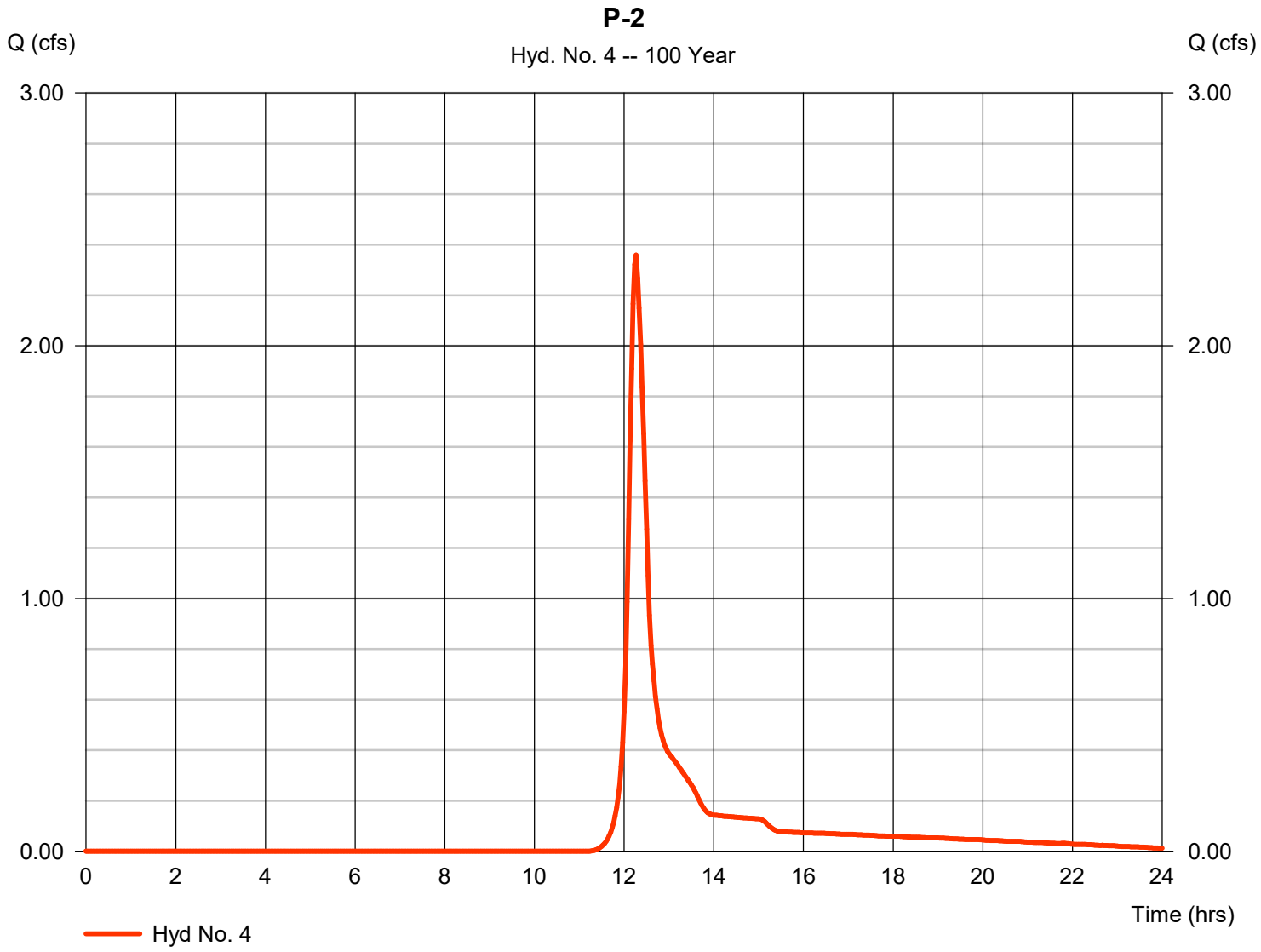


Hydrograph Report

Hyd. No. 4

P-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.359 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	0.172 acft
Drainage area	=	0.974 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	17.50 min
Total precip.	=	6.17 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyde factor Distribution\MSE3 DISTRIBUTION CU	Shape factor	=	484

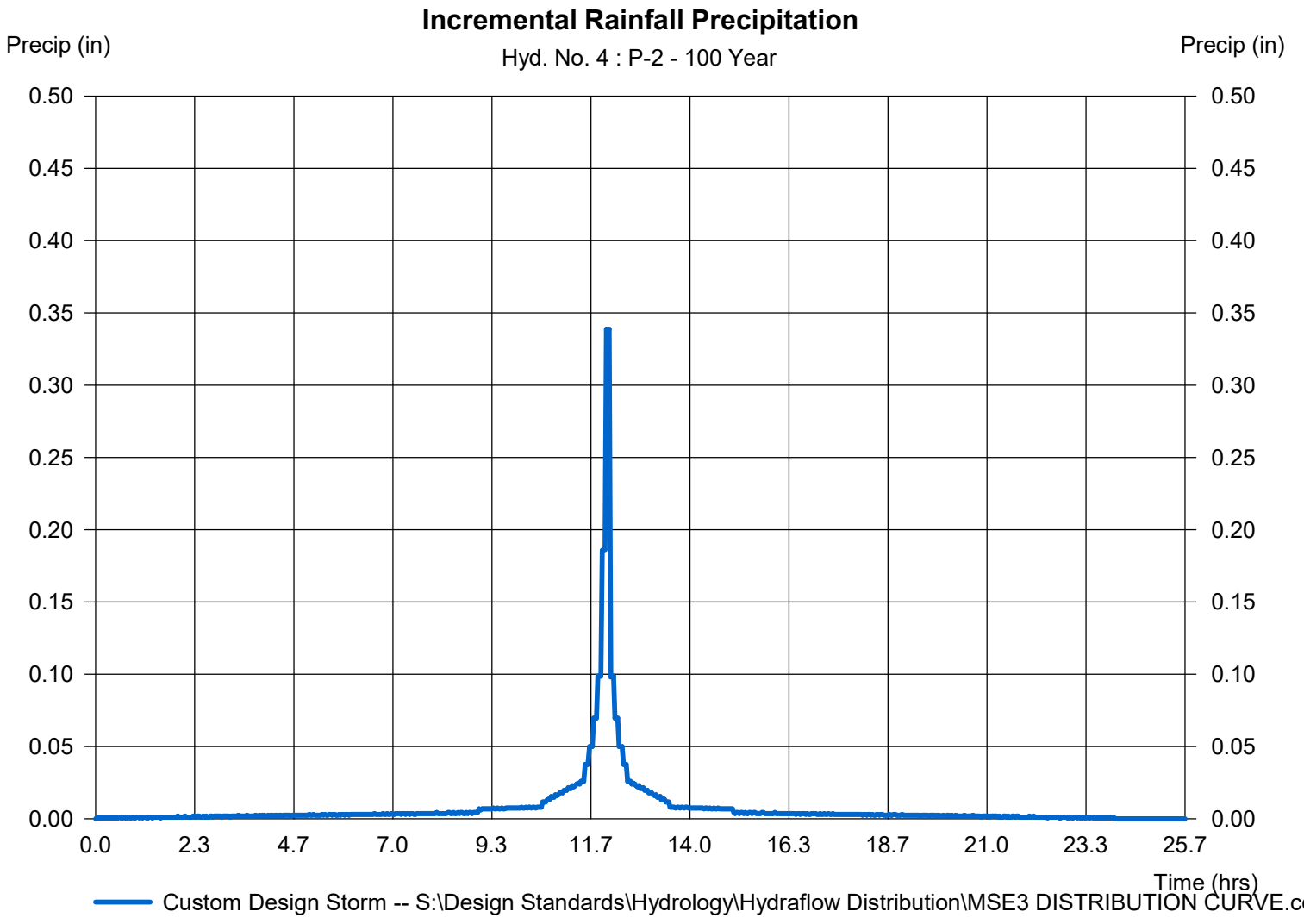


Precipitation Report

Hyd. No. 4

P-2

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 6.1700 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

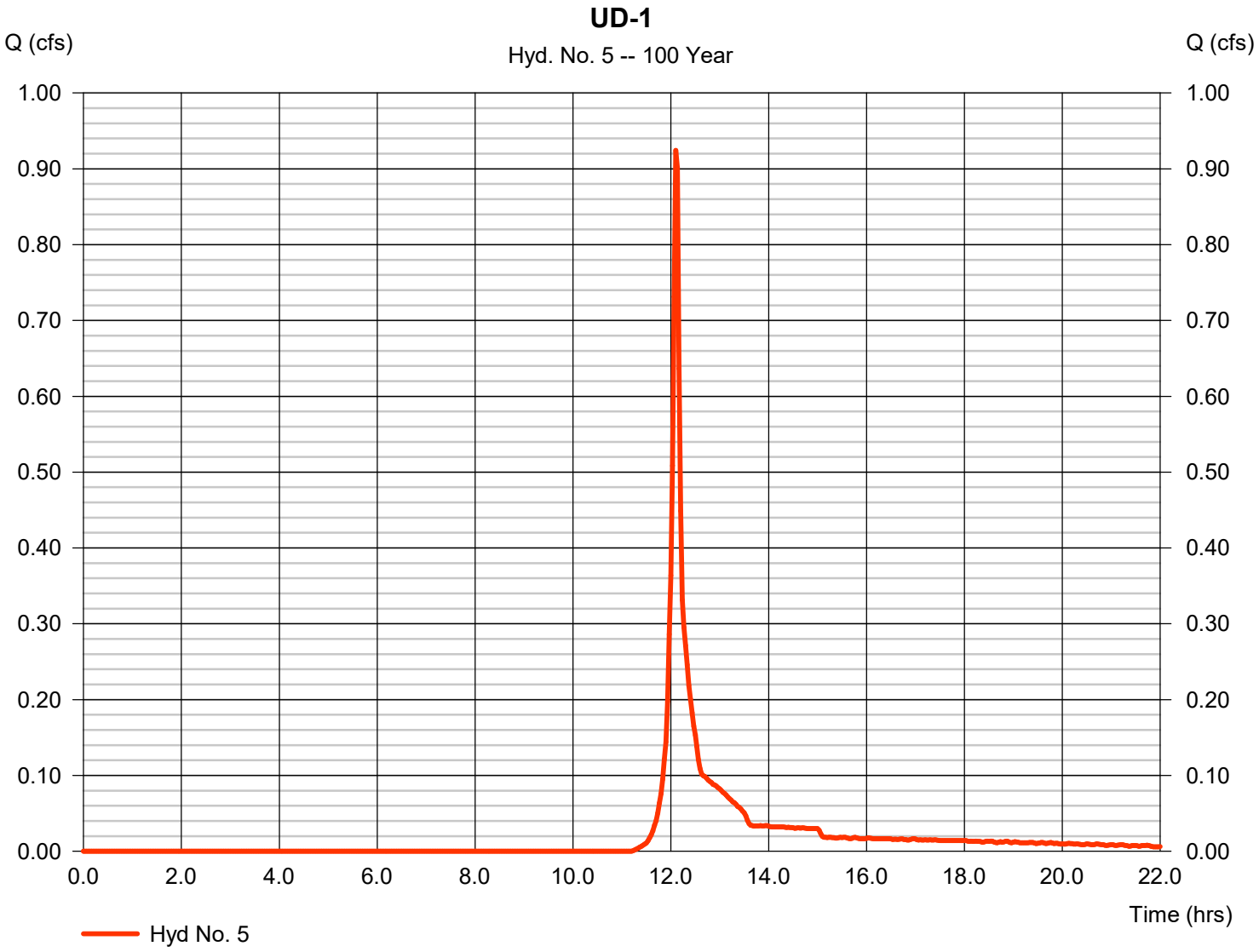


Hydrograph Report

Hyd. No. 5

UD-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.924 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	0.040 acft
Drainage area	=	0.244 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	6.17 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION CU	Shape factor	=	484

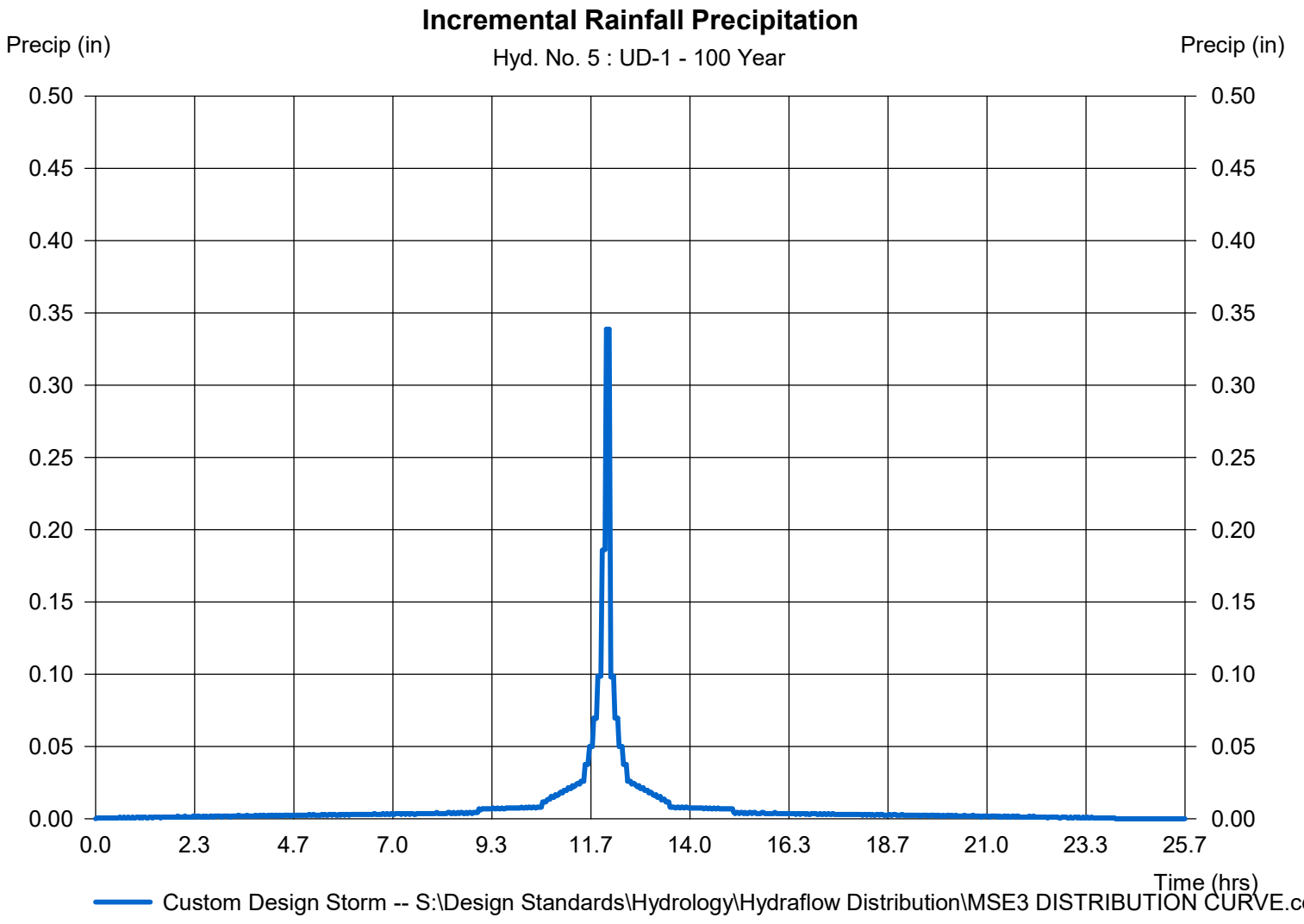


Precipitation Report

Hyd. No. 5

UD-1

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 6.1700 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

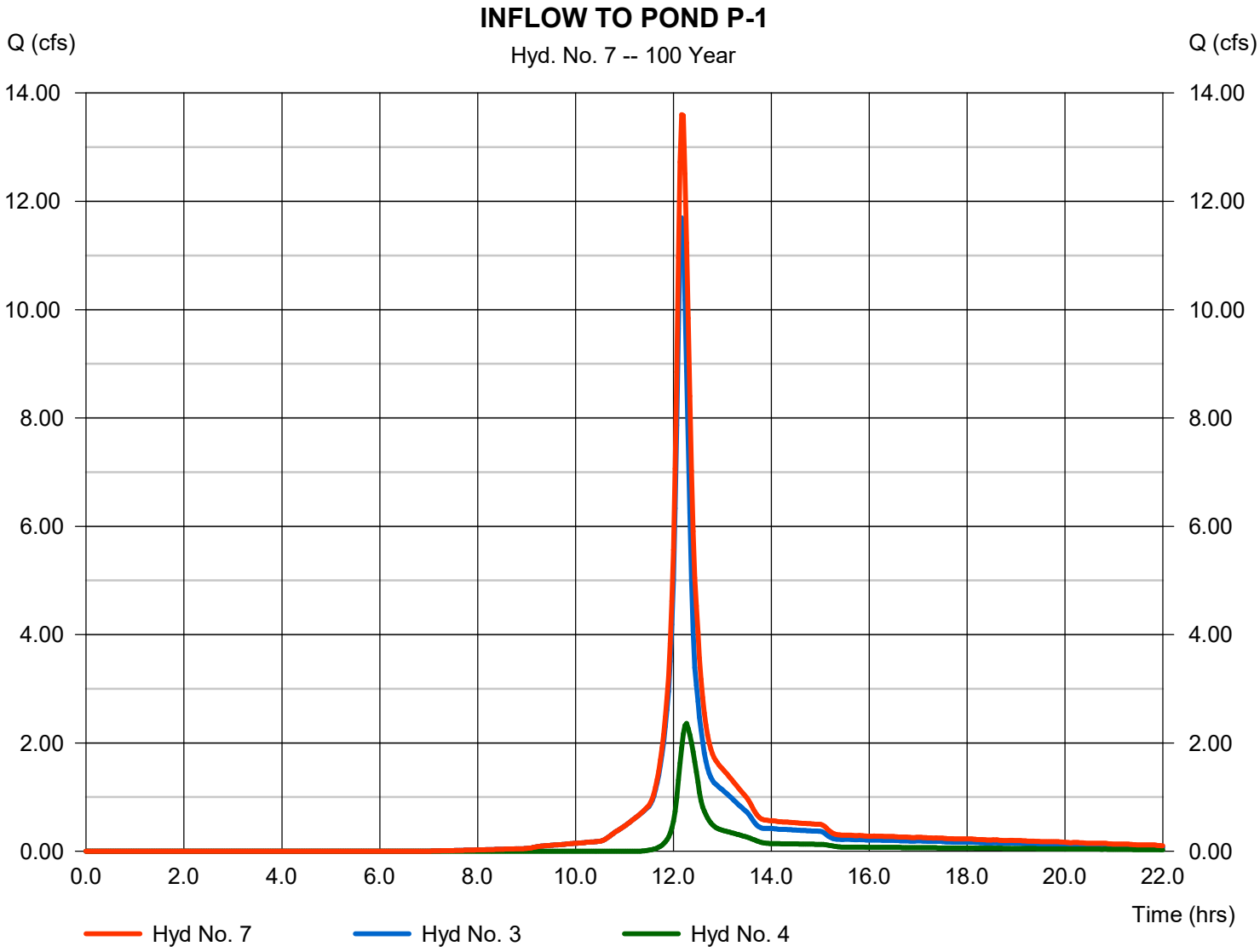


Hydrograph Report

Hyd. No. 7

INFLOW TO POND P-1

Hydrograph type	= Combine	Peak discharge	= 13.60 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 0.877 acft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 2.858 ac



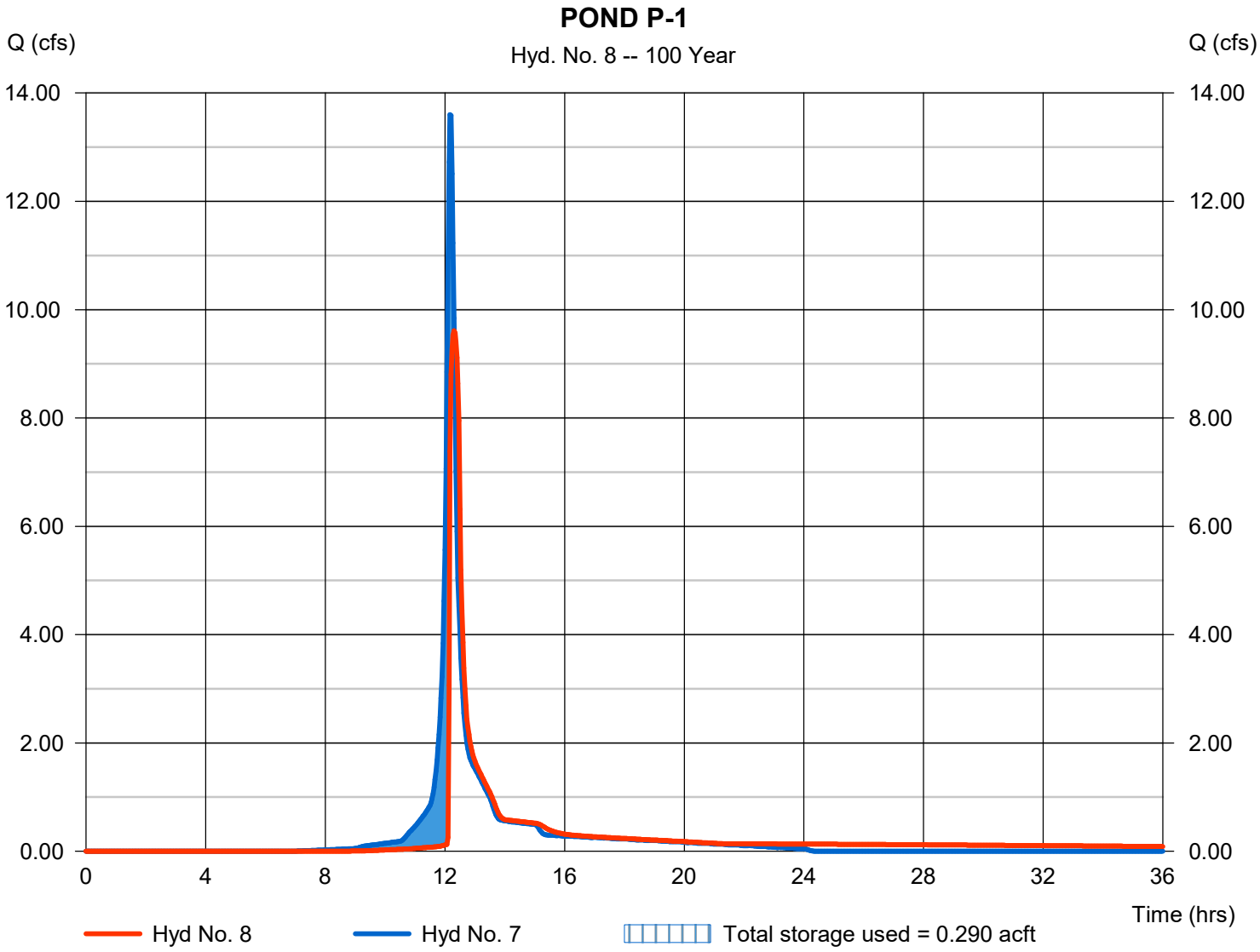
Hydrograph Report

Hyd. No. 8

POND P-1

Hydrograph type	=	Reservoir	Peak discharge	=	9.611 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.30 hrs
Time interval	=	2 min	Hyd. volume	=	0.876 acft
Inflow hyd. No.	=	7 - INFLOW TO POND P-1	Max. Elevation	=	59.93 ft
Reservoir name	=	POND P-1	Max. Storage	=	0.290 acft

Storage Indication method used.

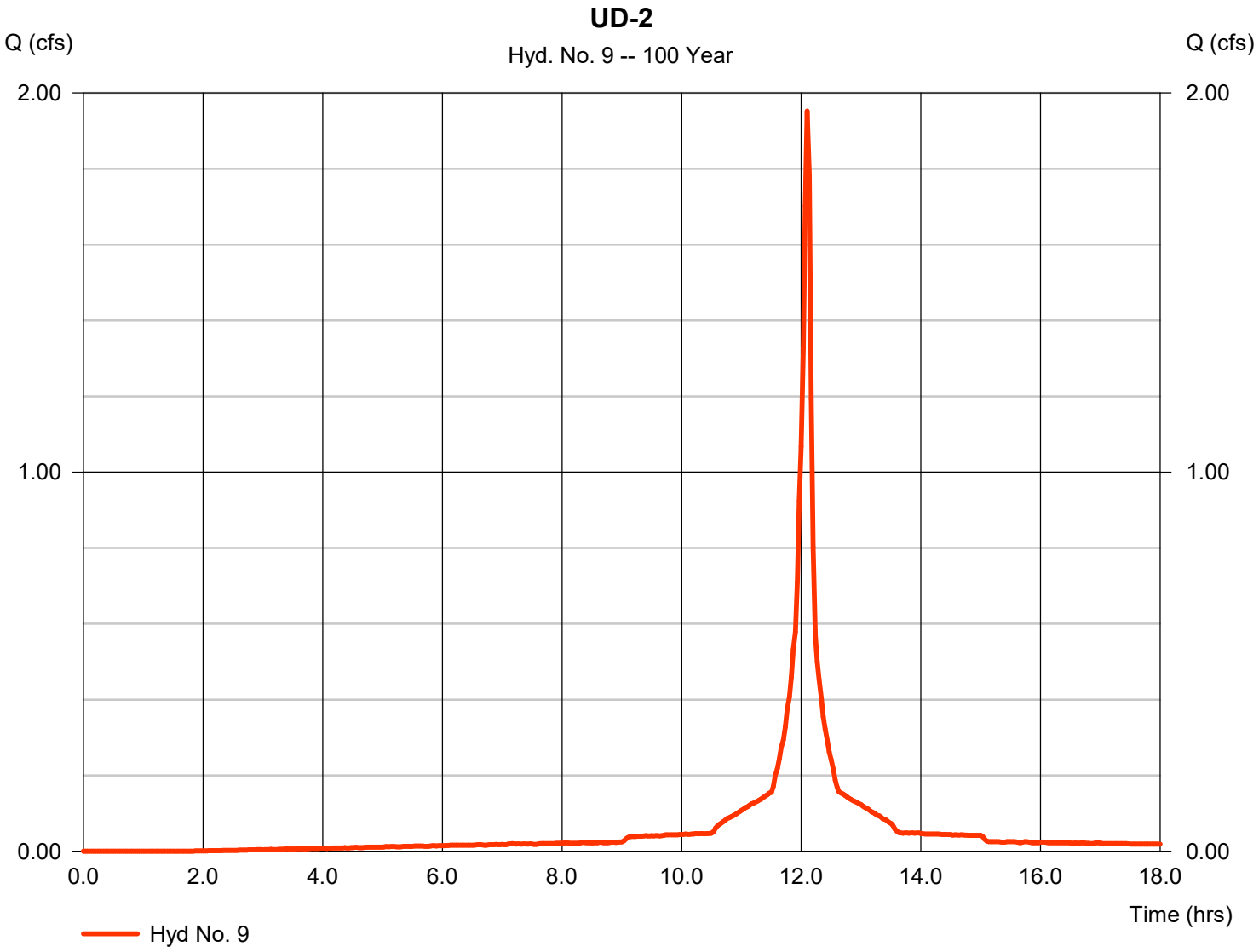


Hydrograph Report

Hyd. No. 9

UD-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.953 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	0.101 acft
Drainage area	=	0.217 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	6.17 in	Distribution	=	Custom
Storm duration	=	S:\Design Standards\Hydrology\Hyd Factor Distribution\484 DISTRIBUTION CU	Shape factor	=	484

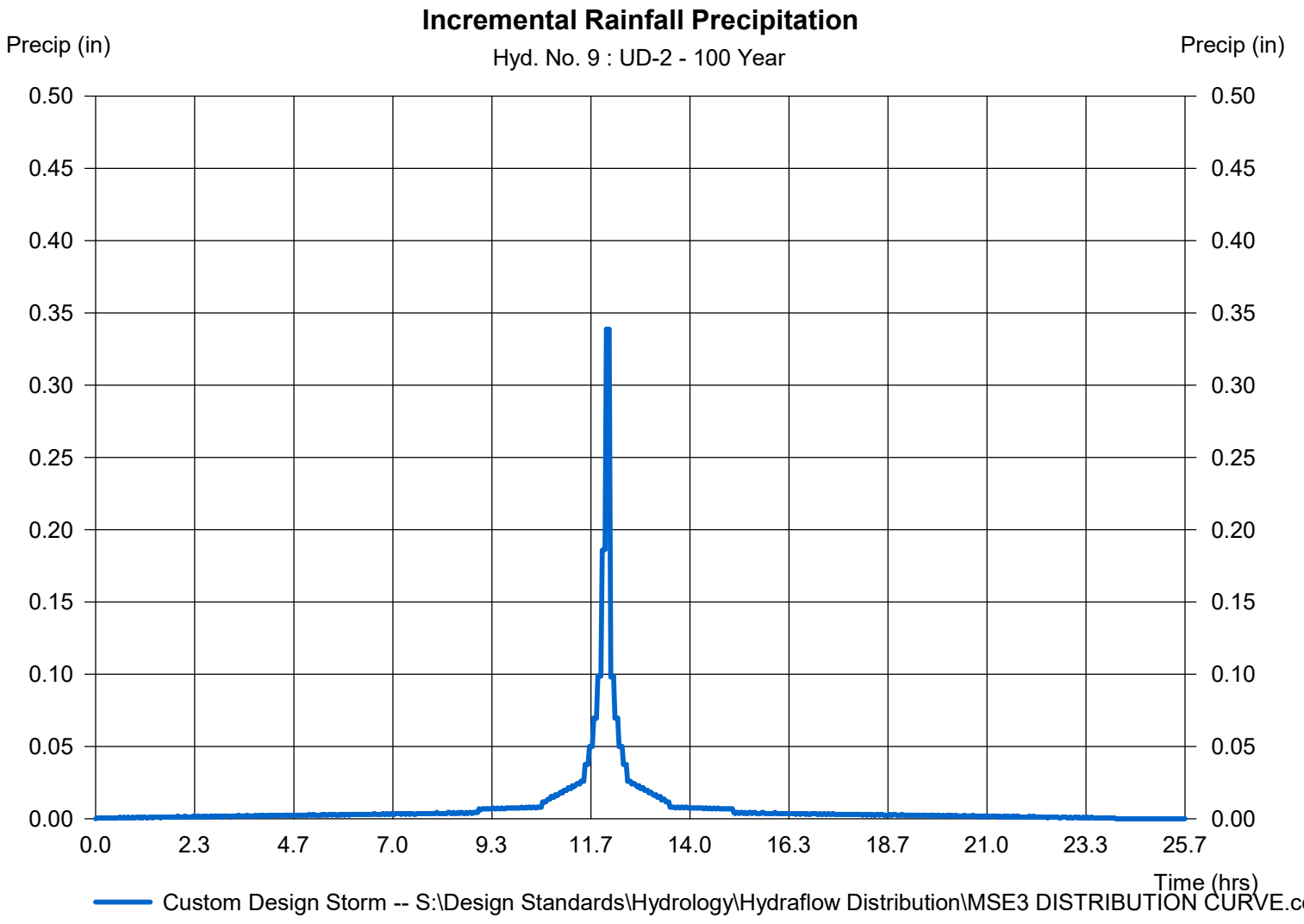


Precipitation Report

Hyd. No. 9

UD-2

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 6.1700 in	Distribution	= Custom
Storm duration	= S:\Design Standards\Hydrology\Hydraflow Distribution\MSE3 DISTRIBUTION C		

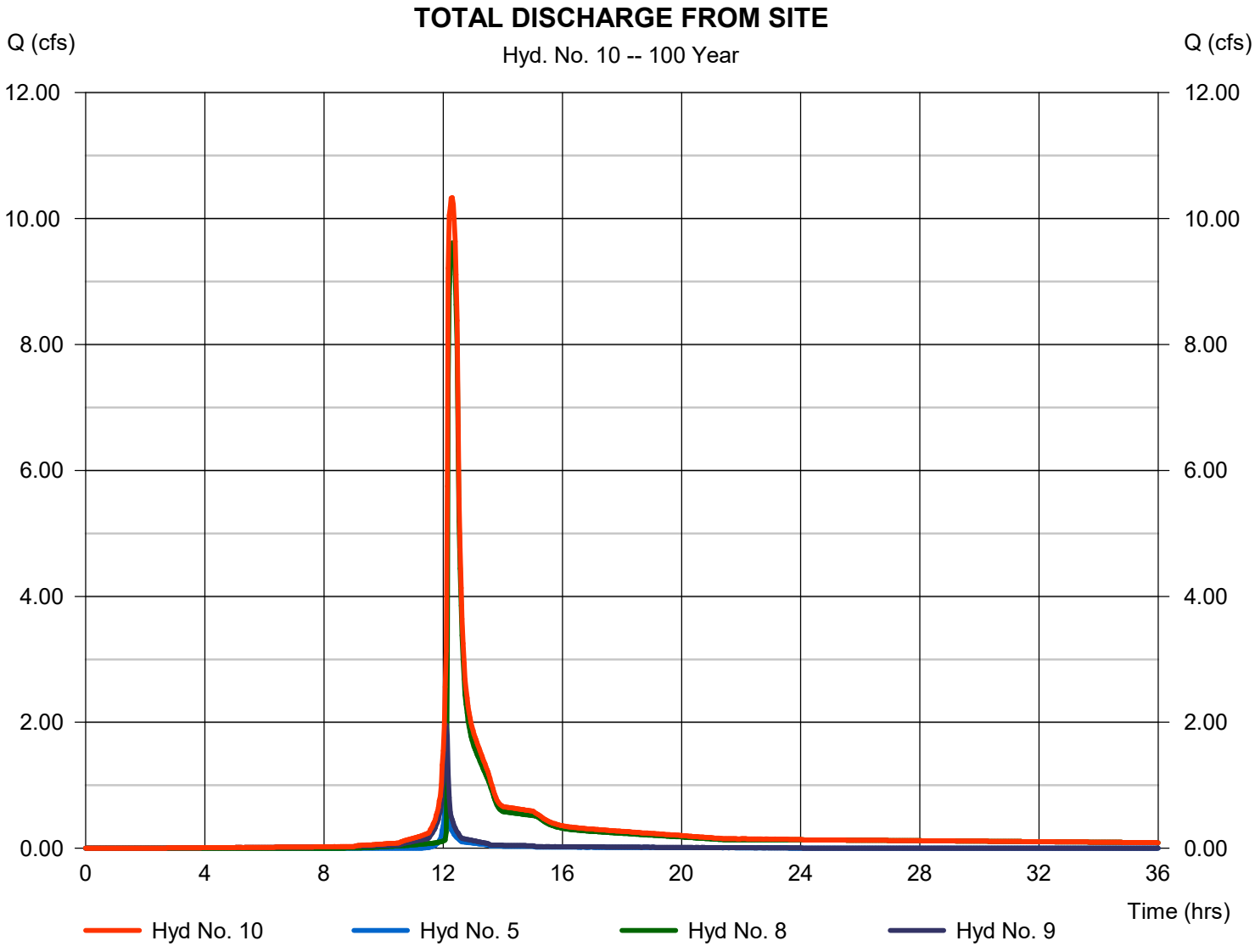


Hydrograph Report

Hyd. No. 10

TOTAL DISCHARGE FROM SITE

Hydrograph type	= Combine	Peak discharge	= 10.33 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 1.017 acft
Inflow hyds.	= 5, 8, 9	Contrib. drain. area	= 0.461 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	18.2870	4.3000	0.6909	--------
2	26.1396	5.4000	0.7292	--------
3	0.0000	0.0000	0.0000	--------
5	35.3749	5.9000	0.7422	--------
10	37.7243	5.3000	0.7189	--------
25	40.9232	4.8000	0.6943	--------
50	39.8053	3.9000	0.6600	--------
100	38.6889	3.1000	0.6284	--------

File name: PORT WASHINGTON ATLAS 14 IDF.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	3.92	2.91	2.37	2.02	1.77	1.59	1.45	1.33	1.24	1.16	1.09	1.03
2	4.74	3.56	2.90	2.47	2.17	1.94	1.76	1.62	1.50	1.40	1.31	1.24
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	6.01	4.54	3.71	3.16	2.77	2.48	2.25	2.07	1.91	1.79	1.68	1.58
10	7.05	5.31	4.33	3.70	3.25	2.91	2.65	2.43	2.26	2.11	1.98	1.87
25	8.39	6.30	5.15	4.40	3.88	3.48	3.17	2.92	2.71	2.54	2.39	2.26
50	9.40	7.01	5.72	4.90	4.32	3.89	3.55	3.28	3.05	2.86	2.70	2.56
100	10.39	7.68	6.27	5.38	4.76	4.29	3.93	3.63	3.39	3.19	3.01	2.86

Tc = time in minutes. Values may exceed 60.

ign Standards\Hydrology\Hydraflow UPDATED ATLAS 14\STATIONS\WAUKESHA\WAUKESHA ATLAS 14 Precip.pcp

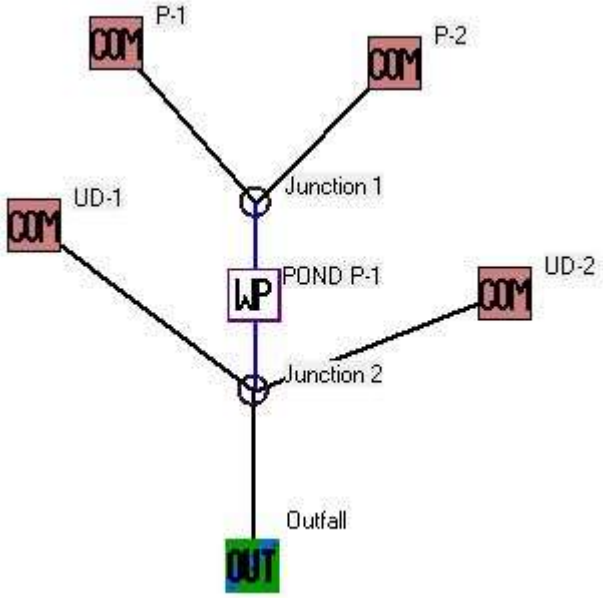
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.38	2.69	0.00	3.26	3.80	4.65	5.37	6.17
SCS 6-Hr	1.75	2.03	0.00	2.55	3.04	3.77	4.40	5.08
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	2.38	2.69	0.00	0.00	3.80	0.00	0.00	6.17

Hydraflow Table of Contents

APPENDIX 4

WinSLAMM Data

Modeling of Proposed Wet Ponds



INPUT DATA

Data file name: \\Trio-data1\lobbys\WPDOCS\DOCUMENT\990\15025-01\284-Storm Water Management Plan\2018-03-23_WinSlamm Calc_Phase 1.mdb
WinSLAMM Version 10.4.0
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Milwaukee WI 1969.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\Freeway Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
Seed for random number generator: -42
Study period starting date: 03/28/69 Study period ending date: 12/06/69
Date: 03-22-2019 Time: 08:22:50
Site information:

LU# 1 - Commercial: P-1 Total area (ac): 1.884
1 - Roofs 1: 0.224 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
13 - Paved Parking 1: 0.759 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
31 - Sidewalks 1: 0.100 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
45 - Large Landscaped Areas 1: 0.731 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

70 - Water Body Areas: 0.070 ac. Source Area PSD File: C:\WinSLAMM Files\\Commercial Land Use

LU# 2 - Commercial: P-2 Total area (ac): 0.974
45 - Large Landscaped Areas 1: 0.974 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 3 - Commercial: UD-1 Total area (ac): 0.244
45 - Large Landscaped Areas 1: 0.244 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 4 - Commercial: UD-2 Total area (ac): 0.217
25 - Driveways 1: 0.217 ac. Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

Control Practice 1: Wet Detention Pond CP# 1 (DS) - POND P-1
Particle Size Distribution file name: Not needed - calculated by program
Initial stage elevation (ft): 5
Peak to Average Flow Ratio: 3.8
Maximum flow allowed into pond (cfs): No maximum value entered
Outlet Characteristics:
Outlet type: Orifice 1
1. Orifice diameter (ft): 0.17
2. Number of orifices: 1
3. Invert elevation above datum (ft): 5
Outlet type: Broad Crested Weir
1. Weir crest length (ft): 10
2. Weir crest width (ft): 10
3. Height from datum to bottom of weir opening: 7.75
Outlet type: Vertical Stand Pipe
1. Stand pipe diameter (ft): 3.9
2. Stand pipe height above datum (ft): 6.85
Pond stage and surface area

Entry Number	Stage (ft)	Pond Area (acres)	Natural Seepage (in/hr)	Other Outflow (cfs)
0	0.00	0.0000	0.00	0.00
1	0.01	0.0100	0.00	0.00
2	1.00	0.0160	0.00	0.00
3	2.00	0.0230	0.00	0.00
4	3.00	0.0310	0.00	0.00
5	4.00	0.0400	0.00	0.00
6	5.00	0.0900	0.00	0.00
7	5.50	0.1020	0.00	0.00
8	6.50	0.1280	0.00	0.00
9	7.50	0.1580	0.00	0.00
10	8.50	0.1910	0.00	0.00
11	8.75	0.2000	0.00	0.00

OUTPUT SUMMARY

SLAMM for Windows Version 10.4.0

Data file name: \\Trio-data1\lobbys\WPDOCS\DOCUMENT\990\15025-01\284-Storm Water Management Plan\2018-03-23_WinSlamm Calc_Phase 1.mdb
Data file description:
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Milwaukee WI 1969.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\Freeway Dec06.std
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Model Run Start Date: 03/28/69 Model Run End Date: 12/06/69
Date of run: 03-22-2019 Time of run: 08:22:33
Total Area Modeled (acres): 3.319
Years in Model Run: 0.67

	Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of all Land Uses without Controls:	102971	-	109.3	702.6	-
Outfall Total with Controls:	103064	-0.09%	20.20	130.0	81.50%
Annualized Total After Outfall Controls:	154809			195.3	

APPENDIX 5

Storm Water Practice Maintenance Requirements

Document Number

Storm Water Management Practice Maintenance Agreement

Living Word Lutheran Church, as "Owner" of the property described below, in accordance with Chapter 32 City of Waukesha Storm Water Management and Erosion Control, agrees to install and maintain storm water management practice(s) on the subject property in accordance with approved plans and Storm Water Management Plan conditions. The owner further agrees to the terms stated in this document to ensure that the storm water management practice(s) continues serving the intended functions in perpetuity. This Agreement includes the following exhibits:

Exhibit A: Legal Description of the real estate for which this Agreement applies ("Property").
Exhibit B: Location Map(s) – shows an accurate location of each storm water management practice affected by this Agreement.
Exhibit C: Maintenance Plan – prescribes those activities that must be carried out to maintain compliance with this Agreement.

Note: After construction verification has been accepted by the City of Waukesha, for all planned storm water management practices, an addendum(s) to this agreement shall be recorded by the Owner showing design and construction details. The addendum(s) may contain several additional exhibits, including certification by City of Waukesha of Storm Water and Erosion Control Permit termination, as described below.

Name and Return Address

City of Waukesha
130 Delafield Street
Waukesha, WI 53188

WAKC1374002001
Parcel Identification Number(s) – (PIN)

Through this Agreement, the Owner hereby subjects the Property to the following covenants, conditions and restrictions:

1. The Owner shall be responsible for the routine and extraordinary maintenance and repair of the storm water management practice(s) and drainage easements identified in Exhibit B until Storm Water and Erosion Control Permit termination by the City of Waukesha in accordance with Chapter 32 of the City Code of Ordinances.
2. After Storm Water and Erosion Control Permit termination under 1., the current Owner(s) shall be solely responsible for maintenance and repair of the storm water management practices and drainage easements in accordance with the maintenance plan contained in Exhibit C.
3. The Owner(s) shall, at their own cost, complete inspections of the storm water management practices at the time intervals listed in Exhibit C, and conduct the inspections by a qualified professional, file the reports with the City of Waukesha after each inspection and complete any maintenance or repair work recommended in the report. The Owner(s) shall be liable for the failure to undertake any maintenance or repairs. After the work is completed by the Contractor, the qualified professional shall verify that the work was properly completed and submit the follow-up report to the City within 30 days.
4. In addition, and independent of the requirements under paragraph 3 above, the City of Waukesha, or its designee, is authorized to access the property as necessary to conduct inspections of the storm water management practices or drainage easements to ascertain compliance with the intent of this Agreement and the activities prescribed in Exhibit C. The City of Waukesha may require work to be done which differs from the report described in paragraph 3 above, if the City of Waukesha reasonably concludes that such work is necessary and consistent with the intent of this agreement. Upon notification by the City of Waukesha of required maintenance or repairs, the Owner(s) shall complete the specified maintenance or repairs within a reasonable time frame determined by the City of Waukesha.
5. If the Owner(s) do not complete an inspection under 3. above or required maintenance or repairs under 4. above within the specified time period, the City of Waukesha is authorized, but not required, to perform the specified inspections, maintenance or repairs. In the case of an emergency situation, as determined by the City of Waukesha, no notice shall be required prior to the City of Waukesha performing emergency maintenance or repairs. The City of Waukesha may levy the costs and expenses of such inspections, maintenance or repair related actions as a special charge against the Property and collected as such in accordance with the procedures under s. 66.0627 Wis. Stats. or subch. VII of ch. 66 Wis. Stats.

6. This Agreement shall run with the Property and be binding upon all heirs, successors and assigns. After the Owner records the addendum noted above, the City of Waukesha shall have the sole authority to modify this agreement upon a 30-day notice to the current Owner(s). (Collectively the "Successors") with the Successors being exclusively obligated to perform the covenants contained herein once the Owner has entirely transferred Owner's interest in the Property; provided that nothing herein shall relieve Owner of any obligations that Owner has previously agreed to undertake by separate written document.)

Dated this ___ day of _____, 201_.

Owner: Living Word Lutheran Church

_____
(Owners Signature)

_____
(Owners Typed Name)

Acknowledgements

State of Wisconsin:
County of Waukesha

Personally came before me this ____ day of _____, 2019, the above named _____to me known to be the person who executed the foregoing instrument and acknowledged the same.

_____.
[Name]
Notary Public, Waukesha County, WI
My commission expires:_____.

This document was drafted by:

Matthew Bailey, P.E.
Trio Engineering, LLC
4100 N. Calhoun Road, Suite 300
Brookfield, WI 53005

For Certification Stamp

Exhibit A – Legal Description

The following description and reduced copy map identifies the land parcels affected by this Agreement. For a larger scale view of the referenced document, contact the Waukesha County Register of Deeds office.

Project Identifier: **Living Word Lutheran Church** Acres**: 7.0428**
Date of Recording:
Map Produced By: **Trio Engineering, LLC**
4100 N. Calhoun Road, Suite 300
Brookfield, WI 53005

Legal Description:

All of Lot 1, of Certified Survey Map No. 10680, located in a part of the Northeast 1/4 and Northwest 1/4 of the Northwest 1/4 of Section 20, Town 6 North, Range 19 East, in the City of Waukesha, Waukesha County, Wisconsin, now being more particularly bounded and described as follows:

Commencing at the Northeast Corner of the Northwest 1/4 of said Section 20; thence South 88º49'20" West along the North line of said Northwest 1/4, 1103.87 feet to the Northwest corner of said Lot 1, which is on the Easterly Right-of-Way line of Donald Drive and the place of beginning of lands hereinafter described;

Thence South 66º32'02" East along the North line of said Lot 1, 299.90 feet to a point on the Northwesterly Right-of-Way line of Saylesville Road (C.T.H. "X"); thence South 29º03'37" West along said Northwesterly line, 610.18 feet to the Northeast corner of Lot 2 of said Certified Survey Map No. 10680; thence North 75º00'00" West along the North line of said Lot 2,151.31 feet the Northwest corner of said Lot 2; thence South 29º00'00" West along the Northwesterly line said Lot 2, 355.29 feet to the Southwest corner of said Lot 2 and the Northeasterly Right-of-Way line of West High Drive; thence North 60º56'23" West along said Northeasterly Right-of-Way Line, 39.84 feet to a point; thence Northwesterly, 85.43 feet along said Northeasterly Right-of-Way line and the arc of a curve whose center lies to the Southwest, whose radius is 530.00 feet and whose chord bears North 65°33'27" West, 85.34 feet to a point; thence Northwesterly, 80.98 feet along said Northeasterly Right-of-Way line and the arc of a curve whose center lies to the Northeast, whose radius is 220.00 feet and whose chord bears North 59°37'49" West, 80.52 feet to a point on the Easterly Right-of-Way line of Donald Drive; thence Northwesterly along said Easterly Right-of-Way line, 12.46 feet along the arc of a curve whose center lies to the Northeast, whose radius is 8.00 feet and whose chord bears North 04°28'11" West, 11.24 feet to a point; thence Northeasterly along said Easterly Right-of-Way line, 116.50 feet along the arc of a curve whose center lies to the Northwest, whose radius is 230.00 feet and whose chord bears North 25°38'06" East, 115.26 feet to a point; thence North 11º07'29" East along said Easterly Right-of-Way Line, 43.88 feet to a point; thence Northeasterly along said Easterly Right-of-Way line, 488.09 feet along the arc of a curve whose center lies to the Southeast, whose radius is 720.00 feet and whose chord bears North 30°32'43" East, 478.80 feet to a point; thence North 49º57'57" East along said Easterly Right-of-Way Line, 114.57 feet to a point; thence Northeasterly along said Easterly Right-of-Way line, 45.74 feet along the arc of a curve whose center lies to the Northwest, whose radius is 166.33 feet and whose chord bears North 42°05'17" East, 45.59 feet to a point; thence North 34º12'37" East along said Easterly Right-of-Way Line, 182.51 feet to the point of beginning of this description.

Said Parcel contains 306,774 Square Feet (or 7.0428 Acres) of land, more or less.

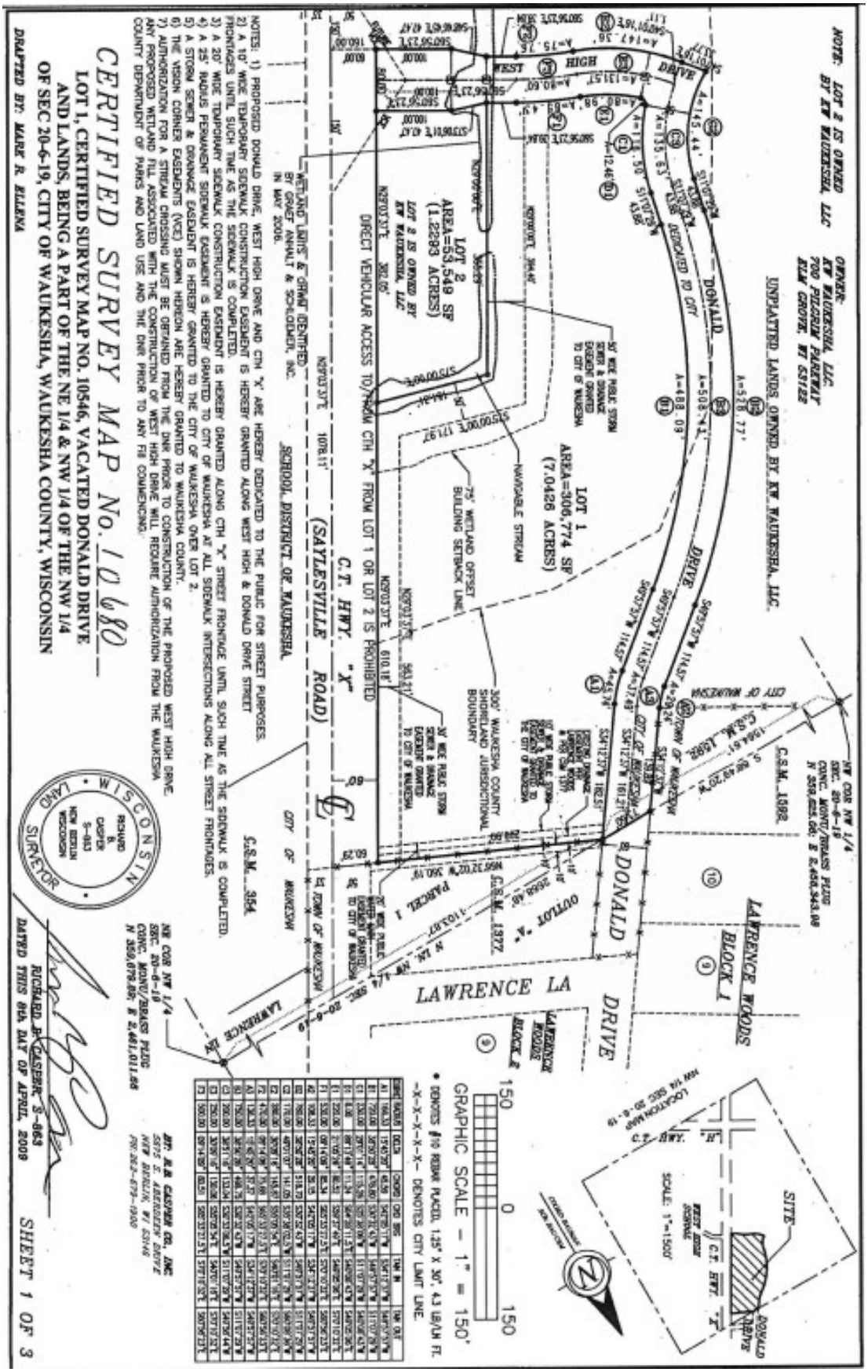

CERTIFIED SURVEY MAP No. 10,980
LOT 1, CERTIFIED SURVEY MAP NO. 10546, VACATED DONALD DRIVE
AND LANDS, BEING A PART OF THE NE 1/4 & NW 1/4 OF THE NW 1/4
OF SEC 20-6-19, CITY OF WAUKESHA, WAUKESHA COUNTY, WISCONSIN
NOTE: LOT 2 IS OWNED BY KW WAUKESHA, LLC
OWNER:
KW WAUKESHA, LLC
700 PILGRIM PARKWAY
ELM GROVE, WI 53122
UNPLATTED LANDS OWNED BY KW WAUKESHA, LLC
LOT 2
AREA=53,549 SF
(1.2293 ACRES)
LOT 2 IS OWNED BY
KW WAUKESHA, LLC
LOT 1
AREA=306,774 SF
(7.0426 ACRES)
DONALD DRIVE
WEST HIGH DRIVE
DIRECT VEHICULAR ACCESS TO/FROM CTH "X" FROM LOT 1 OR LOT 2 IS PROHIBITED
C.T. HWY. "X"
(SAYLESVILLE ROAD)
LAWRENCE LA
LAWRENCE DR
LAWRENCE WOODS
BLOCK 1
OUTLOT "A"
PARCEL 1
WETLAND LIMITS & GRADE CERTIFIED
BY GRAEF ANHALT & SCHLOEMER, INC.
IN MAY 2006.
SCHOOL DISTRICT OF WAUKESHA
CITY OF WAUKESHA
TOWN OF WAUKESHA
NAVIGABLE STREAM
75' WETLAND OFFSET
BUILDING SETBACK LINE
300' WAUKESHA COUNTY
SHORELAND JURISDICTIONAL
BOUNDARY
NW MKE PUBLIC STORM
SEWER & DRAINAGE
EASEMENT GRANTED
TO CITY OF WAUKESHA
C.S.M. 1582
C.S.M. 354
C.S.M. 1377
SITE
LOCATION MAP
NW 1/4 SEC 20-6-19
SCALE: 1"=1500'
GRAPHIC SCALE – 1" = 150'
• DENOTES #10 REBAR PLACED, 1.25" X 30", 4.3 LB/LIN FT.
-X-X-X-X- DENOTES CITY LIMIT LINE.
NW COR NW 1/4
SEC. 20-6-19
CONC. MONU/BRASS PLUG
N 359,655.06; E 2,458,343.09
NW COR NW 1/4
SEC. 20-6-19
CONC. MONU/BRASS PLUG
N 359,678.82; E 2,461,011.88
SURVEYED FOR:
KW WAUKESHA, LLC
700 PILGRIM PARKWAY
ELM GROVE, WI 53122
PREPARED BY:
R.A.K. CASPER CO., INC.
5975 S. ABERDEEN DRIVE
NEW BERLIN, WI 53146
PH: 262-679-1900
WISCONSIN
RICHARD A. CASPER
S-863
NEW BERLIN WISCONSIN
LAND SURVEYOR
RICHARD A. CASPER, S-863
DATED THIS 6th DAY OF APRIL, 2006
DRAFTED BY: MARK R. KLEINA
SHEET 1 OF 3

Exhibit B – Location Map

The storm water management practices covered by this Agreement are depicted in the reduced copy of a portion of the construction plans, as shown below. The practice associated with this development will be a wet pond and all associated pipes, earthen berms, rock chutes and other components of this practices. All of the noted storm water management practices are located within a drainage easement at the southern end of the property.

Development Name(s):	**Living Word Lutheran Church**
Storm water Practices:	**Wet Pond**
Location of Practices:	**Southeast corner of property.**
Owner:	**Living Word Lutheran Church**
	The Owner of the property, shall be responsible for the cost to repair, maintain or restore said Storm water Management Facilities and Storm water Infiltration Facilities. Said repairs, maintenance and restoration shall be performed by the Owner of this property.

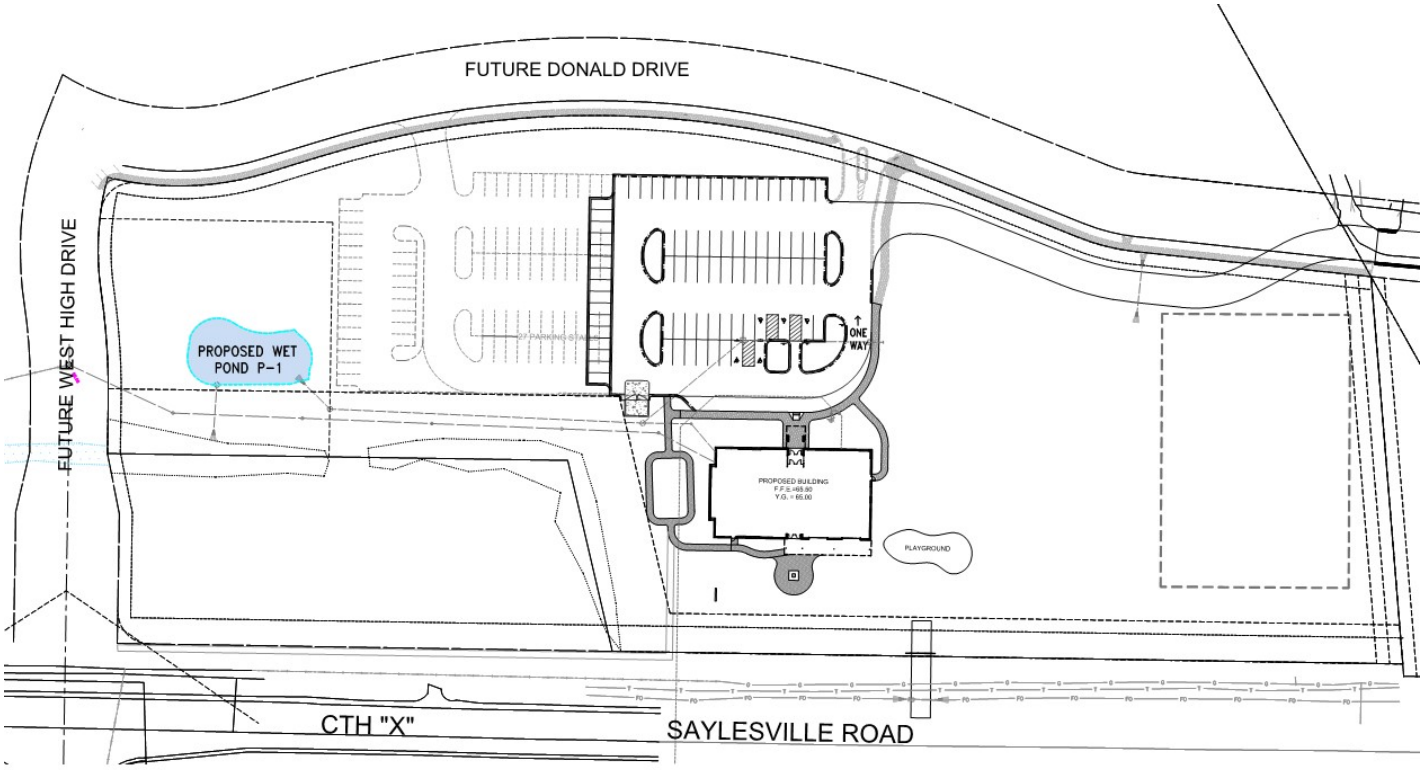


Exhibit C
Minimum Storm Water Practice Maintenance Requirements

This exhibit explains the basic function of each of the storm water practices listed in Exhibit B and prescribes the minimum maintenance requirements to remain compliant with this Agreement. The maintenance activities listed below are aimed to ensure these practices continue serving their intended functions in perpetuity. The list of activities is not all inclusive, but rather indicates the minimum type of maintenance that can be expected for this particular site. Access to the stormwater practices for maintenance vehicles is shown in Exhibit B. Any failure of a storm water practice that is caused by a lack of maintenance will subject the Owner(s) to enforcement of the provisions listed on page 1 of this Agreement by the City of Waukesha.

"As-built" construction drawings of the basin, showing actual dimensions, elevations, outlet structures, etc. will be recorded as an addendum(s) to this agreement within 60 days after the City of Waukesha accepts verification of construction from the project engineer.

Minimum Maintenance Requirements:

To ensure the proper long-term function of the storm water management practices described above, the following activities must be completed by 13050 Cleveland, LLC (or their heirs and assigns):

1. All outlet pipes must be checked annually or after significant rain events (greater than 3 inches/24-hours) to ensure there is no blockage from floating debris or ice, especially in front of the low flow pipes/orifices and the trash rack on the outlet structure risers. Any blockage must be removed immediately.
2. Grass swales shall be preserved to allow free flowing of surface runoff in accordance with approved grading plans. No buildings or other structures are allowed in these areas. No grading or filling is allowed that may interrupt flows in any way.
3. Grass swales, inlets and outlets must be checked after heavy rains (minimum of annually in May) for signs of erosion. Any eroding areas must be repaired immediately to prevent premature sediment build-up in the downstream forebays or basin. Erosion matting is recommended for repairing grassed areas.
4. If floating algae or weed growth becomes a nuisance (decay odors, etc.), it must be removed from the basin or the forebay and deposited where it cannot drain back into the basin. Removal of the vegetation from the water reduces regrowth the following season (by harvesting the nutrients). Wetland vegetation must be maintained along the waters edge for safety and pollutant removal purposes.
5. When sediment in the basin has accumulated to an elevation of three feet below the outlet elevation, it must be removed. All removed sediment must be placed in an appropriate upland disposal site and stabilized (grass cover) to prevent sediment from washing back into the basin.
6. No grading or filling of the basin or berm other than for sediment removal is allowed, unless otherwise approved by the City.
7. Periodic mowing of the grass swales will encourage rigorous grass cover and allow better inspections for erosion. Waiting until after August 1 will avoid disturbing nesting wildlife. Mowing around the basin or the forebays may attract nuisance populations of geese to the property and is not necessary or recommended.
8. Any other repair or maintenance needed to ensure the continued function of the storm water practices or as ordered by the City under the provisions listed on page 1 of this Agreement.

Wet Detention Pond

I. ROUTINE MAINTENANCE

A. Mowing

1. Side slopes, embankments, and emergency spillways that are not rock lined which have been planted with turf grasses should be mowed at least three (3) times a year to prevent woody growth and control noxious weeds. Recommended mowing times are April, July and October of each year.

2. The Owner may more frequently mow areas adjacent to the entry drive, typically once every week to two weeks during a normal growing season, for aesthetic and allergy control purposes.
3. Native grasses should be mowed to a height of 6" in mid to late summer or after they have achieved a height of 1-1/2 feet during the first growing season. Further mowing in subsequent growing seasons may not be required.
4. A 6" to 8" mowing every 3 to 4 years, may suffice as a substitute management technique. The mowed area should be raked and performed in the spring.

B. Inspections

1. Inspections of the ponds shall be completed on an annual basis or after significant rainfall events.
2. The inspections should be completed during wet weather conditions to determine if the ponds are functioning properly.
3. Inspection priorities shall be as follows:
   a. Inspect the embankments for subsidence, erosion, cracking and tree growth.
   b. Inspect the condition of the emergency spillway and overland flow path.
   c. Inspect the pond for accumulation of sediment.
   d. Inspect the outlet control structure for clogs, debris and material failures.
   e. Inspect upstream and downstream channels from an erosion perspective.
   f. Inspect any modifications that may have been done to the ponds following their initial construction.
   g. Inspect the side slopes of the pond for erosion, slumping, cracking or woody plant materials.
4. As-built plans shall accompany the person responsible for the pond inspections.
5. Documentation of the inspections should be completed and filed. Documentation should include as a minimum:
   a. Inspectors name, affiliation and professional credentials if applicable.
   b. Date, time and weather conditions.
   c. Approximate rainfall total over a 24 hour period if applicable.
   d. Existing embankment, outlet and inlet conveyance systems and vegetation condition.
   e. Sediment depth at the outlet control structure (in wet forebays) and at a minimum one other location.
   f. Identification of potential structural failures and repair needs.
   g. Other pond conditions such as vegetation growth, algae growth and emergency spillway conditions.
   h. Repair recommendations.

C. Debris and Litter Removal.

1. Debris and litter removal from the pond surface shall be completed at least once a month.
2. Particular attention should be paid to debris accumulating around the riser pipe to prevent potential clogging.

D. Erosion Control.

1. The pond side slopes, embankments and emergency spillways may suffer from periodic slumpage and erosion.
2. Corrective measures shall include regrading, filling and revegetation of the eroded or slumping areas.
3. Permanent geosynthetic erosion matting (or rip rap) at the pond outlet and emergency spillways should be inspected for displacement or undermining. Repairs shall be made upon discovery.

E. Nuisance Control.

1. Biological control of algae and mosquitoes is preferred over chemical control. Consultation with local WDNR officials is recommended prior to the introduction of any biological control.
2. Maintaining the native grass perimeter will aide in the control of geese.
3. Mechanical controls should be used when feasible.

II. NON-ROUTINE MAINTENANCE

A. Structural Repairs and Replacement.

1. The outlets of the pond have been constructed utilizing concrete or PVC pipe and concrete materials. The estimate life of these structures is 75 to 100 years. Annual inspection of the structures will disclose any potential structural problems. If structural problems appear, repair or replace the outlet.
2. Excessive or chronic drawdowns of the ponds may cause leaks or seepage through the embankments. Excessive drawdowns should be avoided and thus corrective measures for leakage and seepage can be avoided.

B. Sediment Removal.

1. A sediment clean out cycle of 10 to 15 years is recommended. Sediment removal may be necessary prior to 10 years if there is a substantial amount of land disturbance occurring within the contributory watershed. Annual inspections shall be made to insure that the design depth of the permanent water pool is maintained.
2. It is recommended that the sediment be tested to determine if land filling is necessary. Contact the local DNR prior to sediment sampling and testing to insure compliance with State standards and regulations.
3. Surveyed depths of the sediment storage area and permanent pool elevations shall be made immediately following the construction of the ponds and recorded on the as-built plans. Annual inspections shall include measure downs to determine sediment elevations in relation to the permanent pool elevation.

III. RESPONSIBLE PARTY & FINANCIAL FUNDING

A. The responsible party for the operation, inspection and maintenance of the wet ponds shall be 13050 Cleveland, LLC and their heirs and assigns.

B. It is recommended that the 13050 Cleveland, LLC and/or their heirs and assigns establish or set aside a perpetual maintenance fund to insure that the ponds are properly inspected, maintained and repaired.

IV. ADDITIONAL CONSIDERATIONS TO IMPROVE POND WATER QUALITY AND REDUCE MAINTENANCE COSTS.

A. General.

1. Improper disposal of yard wastes will affect the water quality of the wet ponds and may cause clogging of the outlet structure.
2. Improper fertilizer and pesticide application will affect the water quality of the wet ponds and add to algae growth.
3. Excess lawn watering will affect the water quality of the ponds due to increased water runoff that may contain fertilizers and pesticides.

B. Yard Care.

1. It is recommended to consider routine yard care maintenance that is practical and environmentally sound.
2. Refer to the U.W. Extension's "Rethinking Yard Care" for additional information.

C. Leaves and Yard Trimmings.

1. It is recommended that leaves and yard trimmings be properly disposed of.
2. Refer to the U.W. Extension's "Managing Leaves and Yard Trimmings" for further information.

D. Lawn and Garden Fertilizers.

1. It is recommended to control fertilizer applications on lawn and gardens so as not to be detrimental to the water quality of the ponds.

2. Refer to the U.W. Extension's "Lawn and Garden Fertilizers" for further information.

E. Lawn and Garden Pesticides.
   1. Lawn and garden pesticides may pollute surface and ground water.
   2. Refer to the U.W. Extension's "Lawn and Garden Pesticides" for further information.

F. Lawn Watering.
   1. Excess lawn watering will wash pollutants into the wet ponds.
   2. Refer to the U.W. Extension's "Lawn Watering" for further information.

G. Lawn Weed Control.
   1. Proper turf management will lower the amount of the chemicals that may runoff into the wet ponds during rain events.
   2. Refer to the U.W. Extension's "Lawn Weed Control" for further information.

STORM SEWER SYSTEM OPERATIONS AND MAINTENANCE

I. INSPECTION

A. Frequency

a. Inspect catch basins, inlets and manholes at least once per year.

b. Inspect storm sewer end sections at least twice per year and after major rainfall events.

B. Inspection

a. Catch Basins, Inlets and Manholes

i. Inspect for sediment deposition in the bottom of structures.

ii. Check frames and lids for cracks and wear such as rocking lids or lids moved by traffic and for shifted frames.

iii. Check chimneys for cracked mortar, cracked lift rings and spalling.

iv. Check for leaks at joints.

v. Check surrounding areas for pollutants such as leaks from dumpsters, minor spills and oil dumping.

b. Storm Sewer End sections

i. Observe for obstructions, accumulation of sediment and trash, undermining and joint separation.

ii. Inspect end treatment for settlement, scour and displaced armoring.

II. STANDARD MAINTENANCE

A. Catch Basins, Inlets and Manholes

a. Repair any deterioration threatening structural integrity immediately.

b. Replace worn or cracked frames and lids. Frames that have shifted should be re-centered and re-set on the structure.

c. Repair any spalled or cracked mortar. Cracked rings should be repaired or replaced.

d. Repair leaking joints.

e. Clean manhole and storm inlet inverts of deposited material. Catch basins should be cleaned before the sump is 40 percent full.

f. Remove potential sources of contamination away from catch basins, inlets and manholes.

B. Storm Sewer End sections

a. End sections should be free flowing; trash, debris and obstructions should be removed to prevent backups.

b. End sections which have separated from the storm sewer pipe shall be reset on firm bedding and reconnected to the existing storm sewer pipe. Restrain joints if necessary.

c. Scour areas shall be repaired immediately. Replace missing soil with clean fill and replace/install end treatment. Missing armoring will require additional stone, typically one class larger.

d. Excessive material deposited at the storm sewer outfall is indicative of: a disturbed area upstream draining to the system or a potential failure of a system component. Disturbed areas draining to the system should be stabilized immediately or diverted to drain to a BMP. Potential system failures require non-standard maintenance.

III. NON-STANDARD MAINTENANCE

A. Non-standard maintenance includes inspection, repair or replacement of buried structures.

a. Televising of buried structures (pipes) should occur when excessive material is found within the system or at an outfall with no apparent source area visible at the surface, or the system experiences frequent backups.

b. Follow the recommendations for the repair and/or replacement of system components televised by a firm specializing in this work.

CULVERTS
OPERATION AND MAINTENANCE

I. INSPECTION

A. Culverts should be inspected twice a year and after heavy rainfall.

B. Inspect for sediment deposition, scour at the ends of pipe, accumulations of trash and obstructions.

II. MAINTENANCE

A. Scour areas should be repaired with clean fill and replacement of end treatment (rip rap, TRM, etc.). Scour areas with no end treatment should be stabilized with topsoil, seed and erosion control mat at a minimum.

B. Sediment deposits, trash and obstructions should be removed from the pipe ends.

C. Material deposited within the pipe should be promptly removed to maintain the conveyance capacity of the pipe.

APPENDIX 6

Storm Water Sewer Calculations

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe 1-2	12.81	24	Cir	30.735	57.50	57.70	0.651	58.99	58.99	n/a	58.99 j	End	Manhole
2	Pipe 2-3	13.27	24	Cir	241.624	57.70	58.50	0.331	59.24	60.04	0.44	60.48	1	Combination
3	Pipe 3-4	10.75	24	Cir	100.456	58.50	59.16	0.657	60.48	60.33	0.51	60.33	2	Combination
4	Pipe 4-5	7.36	18	Cir	98.363	59.66	60.15	0.498	60.79	61.28	0.21	61.49	3	Combination
5	Pipe 5-FUT BLDG	6.01	18	Cir	10.000	60.15	60.20	0.500	61.49	61.50	0.21	61.71	4	None
6	Pipe 3-PR BLDG	1.38	8	Cir	37.493	60.00	61.35	3.592	60.48	61.90	0.31	61.90	2	None

Project File: 2018-05-23_STM SEWER CALC.stm

Number of lines: 6

Run Date: 5/29/2018

NOTES: Return period = 10 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	DRIVEWAY	5.66	15	Cir	43.500	64.50	64.75	0.575	65.46	65.86	0.38	66.23	End	None
2	FIRE LANE	1.71	15	Cir	33.000	61.30	61.65	1.061	61.82	62.17	0.20	62.17	End	None

Project File: 2018-05-24_STM CULVERT CALC.stm | Number of lines: 2 | Run Date: 5/29/2018

NOTES: Return period = 10 Yrs.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe 1-2	17.90	24	Cir	30.735	57.50	57.70	0.651	58.99	59.22	0.54	59.22	End	Manhole
2	Pipe 2-3	18.32	24	Cir	241.624	57.70	58.50	0.331	59.70*	61.05*	0.57	61.62	1	Combination
3	Pipe 3-4	14.75	24	Cir	100.456	58.50	59.16	0.657	61.62*	61.99*	0.36	62.35	2	Combination
4	Pipe 4-5	10.05	18	Cir	98.363	59.66	60.15	0.498	62.35*	63.11*	0.25	63.37	3	Combination
5	Pipe 5-FUT BLDG	8.20	18	Cir	10.000	60.15	60.20	0.500	63.37*	63.42*	0.33	63.75	4	None
6	Pipe 3-PR BLDG	1.88	8	Cir	37.493	60.00	61.35	3.592	61.62*	62.40*	0.45	62.85	2	None

Project File: 2018-05-23_STM SEWER CALC.stm | Number of lines: 6 | Run Date: 5/29/2018

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown).