STORMWATER MANAGEMENT FACILITIES REPORT FOR

CVS/pharmacy®

Store # 10134

Owner:

Missouri CVS Pharmacy, L.L.C.

A Limited Liability Company

Contact Person: Richard Smart

1165 North Clark Street

Chicago, IL 60610

Continuing Authority:

Missouri CVS Pharmacy, L.L.C.

A Missouri Limited Liability Company

Prepared By:

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Dated 1-17-2014

STORMWATER MANAGEMENT FACILITIES REPORT

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OVERVIEW

INTRODUCTION

CVS Pharmacy is proposing to construct a 13,225 sf building at the southwest corner of Veterans Memorial Parkway and Highway K in the city of O'Fallon, MO. The site is 1.88 acres and will consist of the building, parking and associated infrastructure improvements as required to make this a complete and useable site. The site currently has two buildings located on it. A now vacant Shell gas station and convenience store is located to the north of the property and a Goodwill store is located on the southern part of the site. Both existing buildings and their site improvements will be demolished for construction of the CVS Pharmacy.

FEATURES

With all new developments, stormwater volume issues are a concern. CVS is addressing these issues with an underground stormwater detention and filtering chamber system. The Post-Construction permanent underground detention system chosen for this site consists of an ADS MC-3500 underground detention arch chamber system. Silt fence will be used as a temporary BMP during construction to reduce silt leaving the site and inlet protection fabric drops will surround inlets to reduce off-site contamination due to erosion. As a private BMP, CVS will be responsible for regular maintenance and inspection. Proper maintenance will ensure that the stormwater from the site will have minimal impact on the surrounding properties as well as reduce downstream sediment issues while the site is under construction.

Also included in the design of the site are storm water quality devices to improve the quality of stormwater runoff from the site. The underground detention chamber system incorporates two isolator rows of chambers at the inlet point of upstream flows. The isolator rows serve to remove trash and debris and are constructed with filter fabric wrapped chambers to trap pollutants in the isolator row. Field testing has shown that the isolator rows are capable of removing 80% of the total suspended solids contained in stormwater runoff. Additional removal efficiency results are: Phosphorus – 49%, total petroleum Hydrocarbons – 90% and Zinc at 53% removal efficiency. Thermal impacts of runoff from developed sites are also reduced through the action of the underground detention chamber system.

To help increase public awareness of the City's stormwater efforts, CVS is also constructing two bioretention basins to filter, cool and slow the stormwater runoff from the paved areas of the site.

EVALUATION OF EXISTING AND PROPOSED SITE CONDITIONS

DEVELOPMENT USE

This development will construct a standalone CVS Pharmacy with a single drive thru window for prescription drop off and pickup. Construction of site components associated with a pharmacy such as parking lots, curb and gutter, landscaped areas, sidewalks, utilities, drainage facilities and sanitary sewers are also proposed.

DISTURBED AREA

The total on and offsite area disturbed by construction of this development is 2.02 acres and is depicted on the enclosed disturbed area exhibit.

EXISTING CONDITIONS

Per the direction of the City of O'Fallon, the pre-development condition that establishes flows for the 1.88 ac. CVS site; shall be the church that was constructed on a portion of the site prior to the construction of the Shell station and Goodwill building around 1988 and 1989 respectively.

After review of the construction documents and stormwater runoff calculations for the existing Shell Station and Goodwill; the existing underground corrugated metal pipe detention system located on the Goodwill lot provides detention for the 0.50 ac. vacant bank site to the south of the CVS development. The stormwater runoff calculation completed and approved in 1989 for Goodwill (formerly a pharmacy) indicates that a total of 2.43 acres (Shell Station, Goodwill, and Vacant Bank Site) was considered and detained for. Therefore, the CVS project stormwater runoff calculations have been based on providing detention for all three sites that totals 2.38 acres due to previous Right-of-Way dedications. This report depicts the differential runoff calculations for the pre developed condition as the former church site and the bank site in an undeveloped condition.

CALCULATION OF THE DIFFERENTIAL RUNOFF SCS 24-HR TR-55 TYPE II:

TOTAL ACREAGE OF AREA TO PROVIDE DETENTION FOR = 2.38 AC.

Existing Condition:

Grass and landscaped areas at 5% impervious = 0.76 ac.
Building and pavement areas at 100% impervious = 1.62 ac.

Post Developed Condition:

Post Developed conditions have been modeled using the proposed CVS improvements and the existing bank improvements as they exist today.

Grass and landscaped areas at 5% impervious = 0.58 ac.
Building and pavement areas at 100% impervious = 1.80 ac.

	Peak runoff in cfs		
	2 yr.	25 yr.	100 yr.
Post developed condition	9.444	19.31	24.51
Existing condition	7.043	15.09	19.36
Differential runoff	2.40	4.22	5.15

PEAK FLOW RATES TO UNDERGROUND CHAMBERS

	Peak flow rate in cfs		
	2 yr.	25 yr.	100 yr.
Peak Q to underground chambers	6.30	12.89	16.38

CALCULATION OF ALLOWABLE DISCHARGE

	Flow in cfs		
	2 yr.	25 yr.	100 yr.
Post developed peak Q to basin	6.30	12.89	16.38
Differential runoff	2.40	4.22	5.15
Allowable discharge	3.90	8.67	11.23

SUMMARY OF CALCULATED DISCHARGES AND STORAGE VOLUMES

	2 yr.	25 yr.	100 yr.
Post developed peak discharge	2.887 cfs	6.781 cfs	8.940 cfs
Runoff volume stored	3,395 c.f.	7,189 c.f.	8,944 c.f.

DESCRIPTION OF STORMWATER MANAGEMENT FACILITIES PROPOSED

This project will construct an ADS MC-3500 Stormtech underground detention arch chamber system with an isolator row. The system will consist of four rows of chambers. A total of fifty-eight chambers are symmetrical about a centerline with one row of 17 chambers adjacent to an outer row of 7 chambers to create a footprint that is complimentary to the layout of the site. The system has the capacity to detain 11,202 cu. ft. of stormwater runoff. The system has three pipes entering the chamber complex to maximize the capture of onsite runoff. The outfall structure will consist of an outfall structure with a weir and two orifices' to regulate the discharge rate of the chamber system.

The Isolator Row is a row of Stormtech chambers that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation. Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geo textile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. An Operation and Maintenance Manual with Checklist has been included in this report.

The project is also providing two bioretention basins to collect and treat stormwater runoff. Bioretention systems collect and filter stormwater through layers of mulch, soil and plant root systems, where pollutants such as bacteria, nitrogen, phosphorus, heavy metals, oil and grease are retained, degraded and absorbed. Treated stormwater is then infiltrated into the ground as groundwater or, if infiltration is not appropriate, discharged into a traditional stormwater drainage system. Bioretention Basins may look similar to traditional landscaped areas, but they differ in design and function. Bio-Retention Basins can be planted with a variety of perennials, grasses, shrubs and small trees. Native plants are typically preferred. Rain gardens are a valuable addition to both residential and commercial sites. Because this is a Private BMP, a Maintenance Log has been attached to this report.

Exhibits

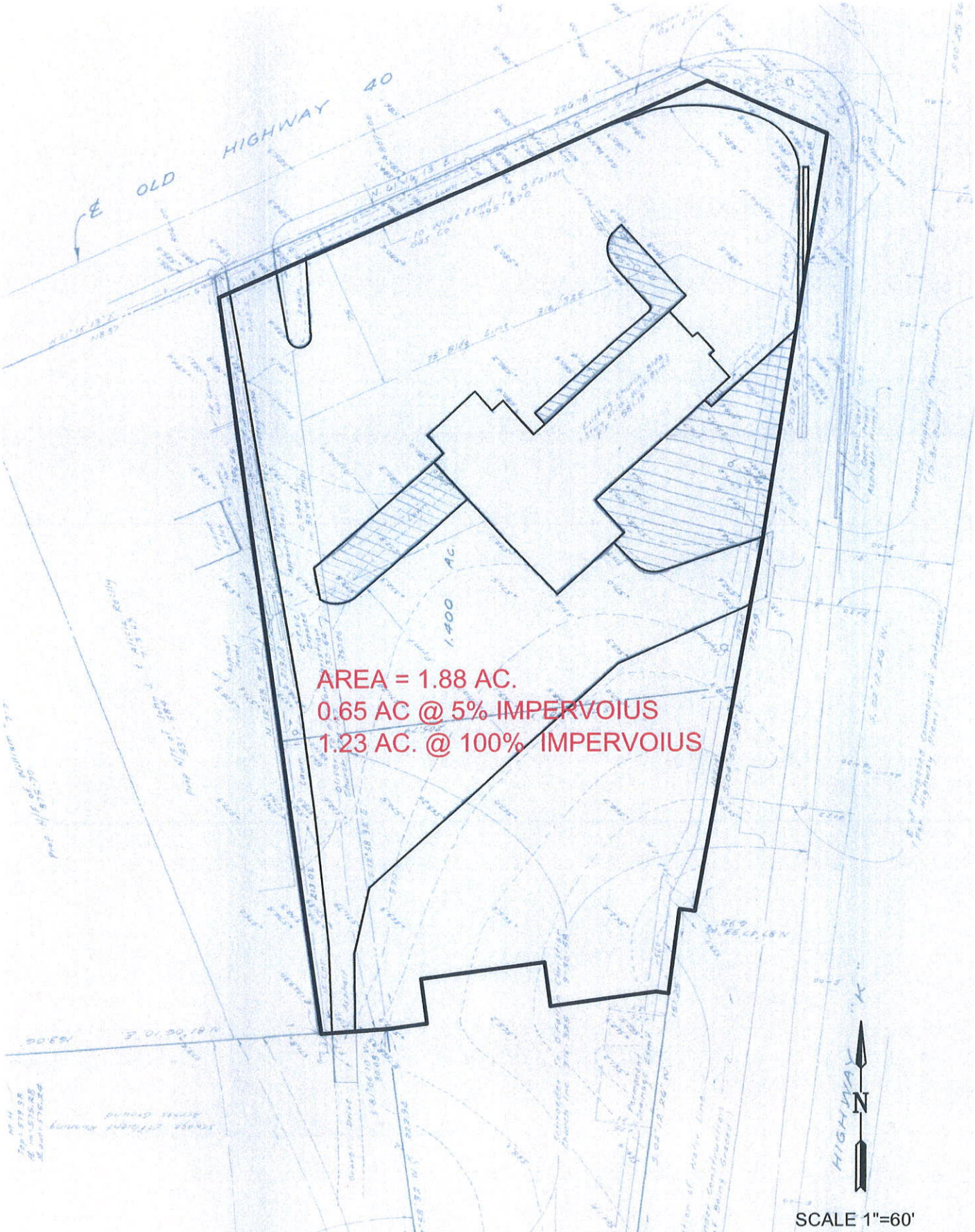

EXHIBIT SHOWING FORMER CHUCH PROPERTY PERVIOUS AND IMPERVOIUS AREAS.

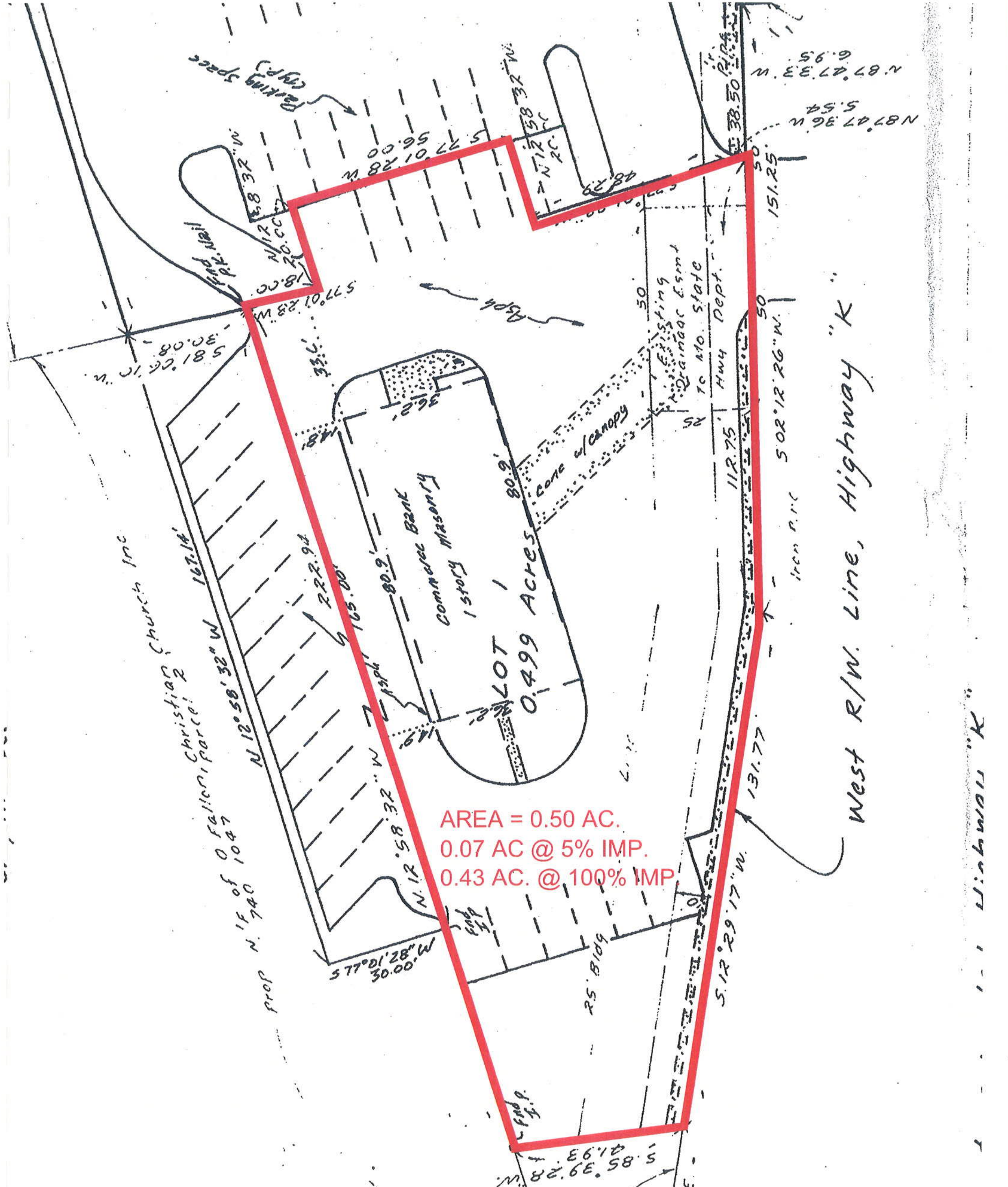

EXHIBIT SHOWING EXISTING BANK PROPERTY IMPERVIOUS
AND IMPERVIOUS AREAS

Map Scale: 1:761 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: St. Charles County, Missouri
Survey Area Data: Version 11, Sep 24, 2012

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

Date(s) aerial images were photographed: Oct 1, 2010—Mar 9, 2012

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — St. Charles County, Missouri (MO183)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
60124	Harvester-Urban land complex, 2 to 9 percent slopes	C	1.8	100.0%
Totals for Area of Interest			1.8	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

MAINTENANCE AND OPERATION PLAN

The owner has recorded a "Maintenance Agreement" between themselves and the City of O'Fallon. This agreement states that the owner agrees to maintain the stormwater management facilities located on this property and sets forth penalties that may occur if this maintenance is not performed. The contact information for the responsible party is as follows:

Richard Smart, Construction Project Manager
1165 North Clark St., Suite 305
Chicago, IL 60610
Ph: 312-953-6322

The responsible party will maintain all private stormwater facilities in good working order. Minimum maintenance of the private facilities shall include routine inspection, maintenance and removal of sediment, debris, oil and foreign material from the storm sewers, inlets and manholes; and routine inspection, maintenance and cleaning of the outlet structure. An Inspection Checklist is also attached and should be used for regular maintenance and record keeping for reporting purposes. The party responsible for maintenance must evaluate the plan for effectiveness at least annually, and revise as necessary.

Reporting Requirements

To ensure the maintenance of privately owned stormwater management facilities, the City of O'Fallon requires an Annual BMP Maintenance Report to be submitted to the City for these facilities. The Annual Report should provide documentation that maintenance was performed in accordance with the Stormwater Management Facilities Report submitted for your development and approved by the City of O'Fallon for the above referenced project. The Annual Report typically consists of a completed inspection checklist and/or maintenance log, narrative description of corrective action measures taken, photographs, and any other documentation appropriate for demonstrating compliance with the BMP Maintenance Agreement and your Facilities Report.

The annual BMP Maintenance Report should be submitted to the City of O'Fallon before December 31st of each year. A City of O'Fallon inspector will also periodically inspect the BMP to determine if it is being maintained properly.

Operation and Maintenance Procedures:

Bio-Retention Rain Garden Maintenance Notes

Filtering Maintenance Criteria

The mulch layer plays an important role in the performance of the bioretention system. It helps maintain soil moisture and avoids surface sealing that reduces permeability. Mulch helps prevent erosion and provides a microenvironment suitable for soil biota at the mulch/soil interface. It also serves as a pretreatment layer trapping the finer sediments.

The mulch layer should be a standard landscape style, single or double shredded hardwood mulch. The mulch layer should be free of other materials such as weeds, soil, roots, etc. The mulch should be applied to a maximum depth of three inches. Grass clippings should not be used as mulch. Alternatively, pea gravel or other similar natural gravel may be used. A "natural" (i.e. river-run) source of sand and gravel should be used. Materials must be washed to prevent fines from clogging the sand and gravel layers.

Plantings in the Bio-Retention area have been chosen from the MSD Landscape Guide for Stormwater Best Management Practices. The Landscaping Guide for Stormwater Design requires the use of native plants in stormwater management facilities. Native plants are defined as those species that evolved naturally to live n this region. Native species are those that lived in Missouri before Europeans explored and settled in America and brought many common, but, non-native species with them. Many introduced species were weeds brought in by accident; others were intentionally introduced and cultivated for use as medicinal herbs, spices, dyes, fiber plants and ornamentals.

Because they have evolved to live here naturally, native plants are best suited to our local conditions. This translates into greater survivorship when planted and less replacement or maintenance during the life of the stormwater management facility. Both of these attributes provide cost savings to the owner. The deep root systems help develop pore space in the soil to promote infiltration of rainfall and sustain them during dry periods.

Dead or diseased plants should be removed from the Bio-Retention Area and replaced with plant materials selected from the MSD Landscape Guide for Stormwater Best Management Design.

The 3" mulch layer shall be replenished at a minimum on yearly basis. Discolored or mulch clogged with sediment shall be removed, disposed of and replaced. The plantings should not be mowed or trimmed.

BIO-RETENTION AREA INSPECTION LOG

Location:					
Date	Mulch Condition and Thickness	Plant Conditions	Maintenance Performed	Maintenance Personnel	Comments

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Save Valuable Land and Protect Water Resources

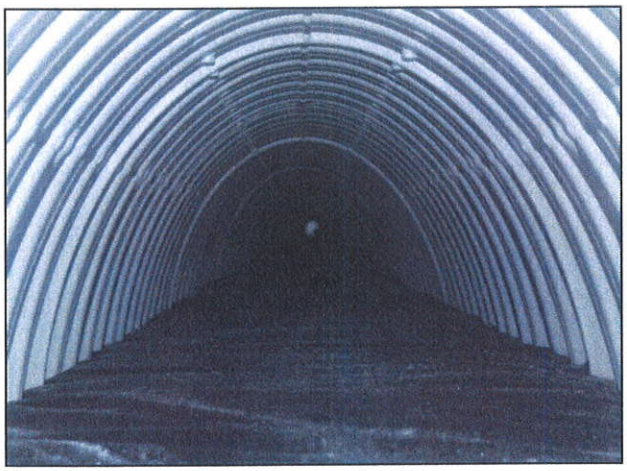
Isolator® Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator® Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patented technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.



Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

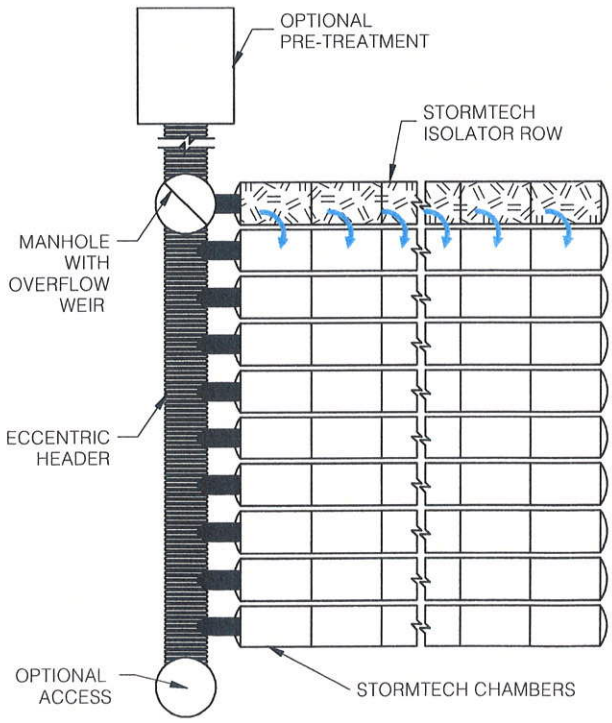
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

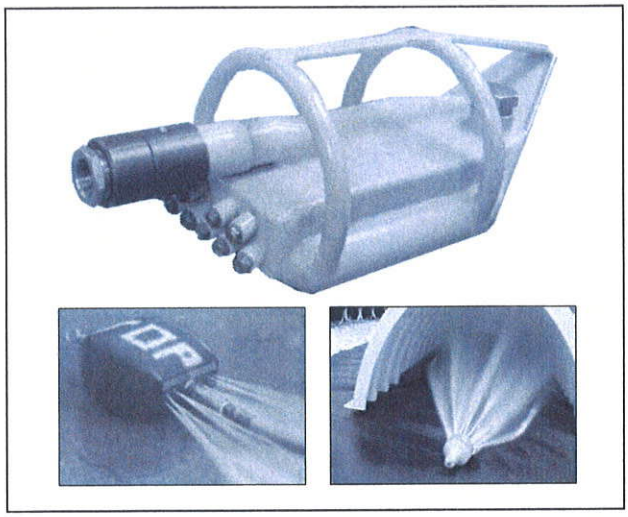
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

2.2 MAINTENANCE

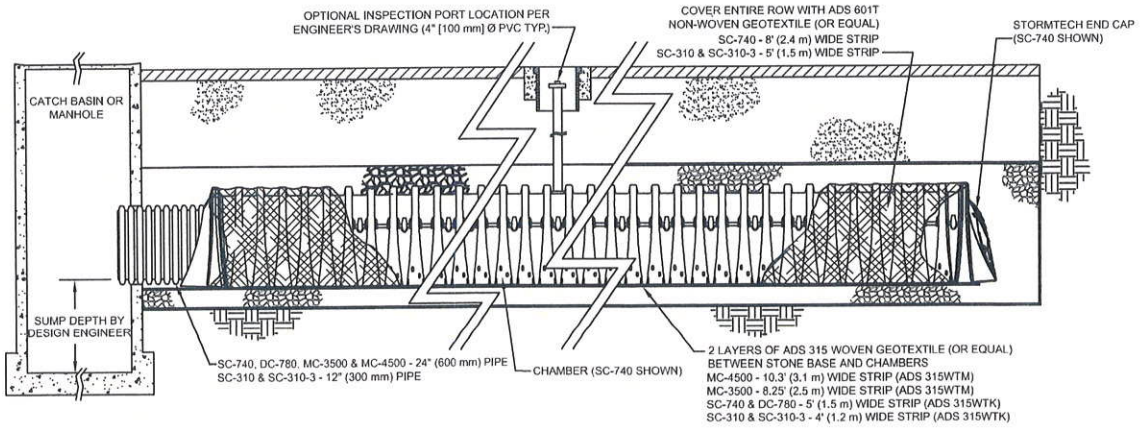
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

i. Remove cover from manhole at upstream end of Isolator Row

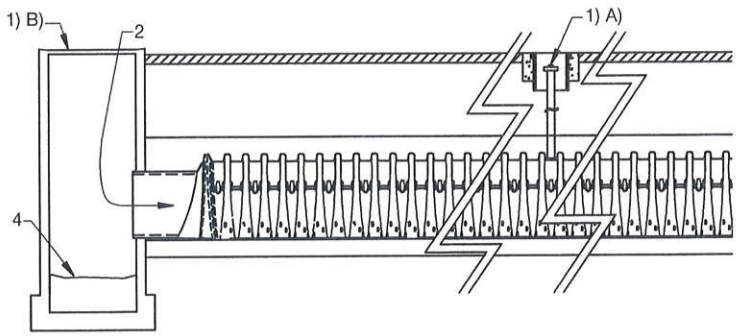
ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry

2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

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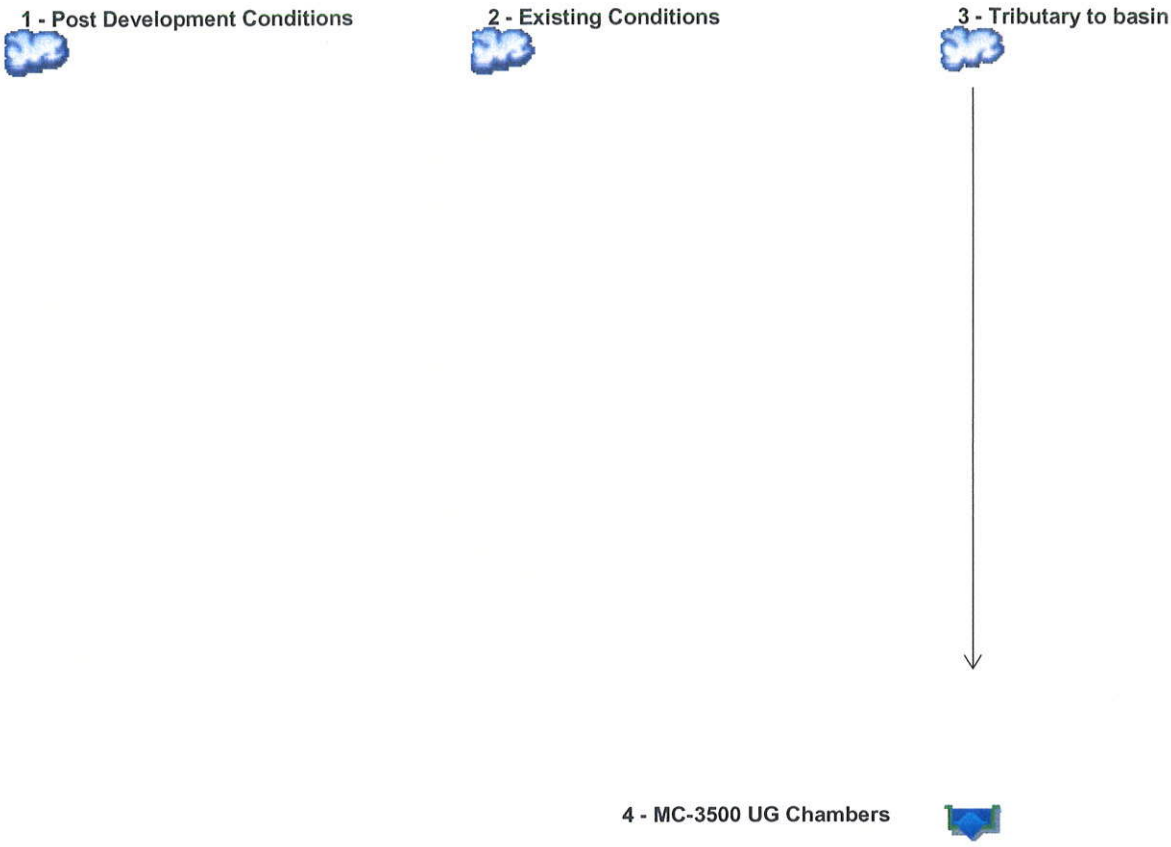
Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Post Development Conditions
2	SCS Runoff	Existing Conditions
3	SCS Runoff	Tributary to basin
4	Reservoir	MC-3500 UG Chambers

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	------	-------	9.444	-------	-------	-------	19.31	-------	24.51	Post Development Conditions
2	SCS Runoff	------	-------	7.043	-------	-------	-------	15.09	-------	19.36	Existing Conditions
3	SCS Runoff	------	-------	6.302	-------	-------	-------	12.89	-------	16.38	Tributary to basin
4	Reservoir	3	-------	2.887	-------	-------	-------	6.781	-------	8.940	MC-3500 UG Chambers

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	9.444	1	717	20,097	------	------	------	Post Development Conditions
2	SCS Runoff	7.043	2	720	18,497	------	------	------	Existing Conditions
3	SCS Runoff	6.302	2	716	13,280	------	------	------	Tributary to basin
4	Reservoir	2.887	2	722	13,277	3	566.83	3,395	MC-3500 UG Chambers

Hydrograph Report

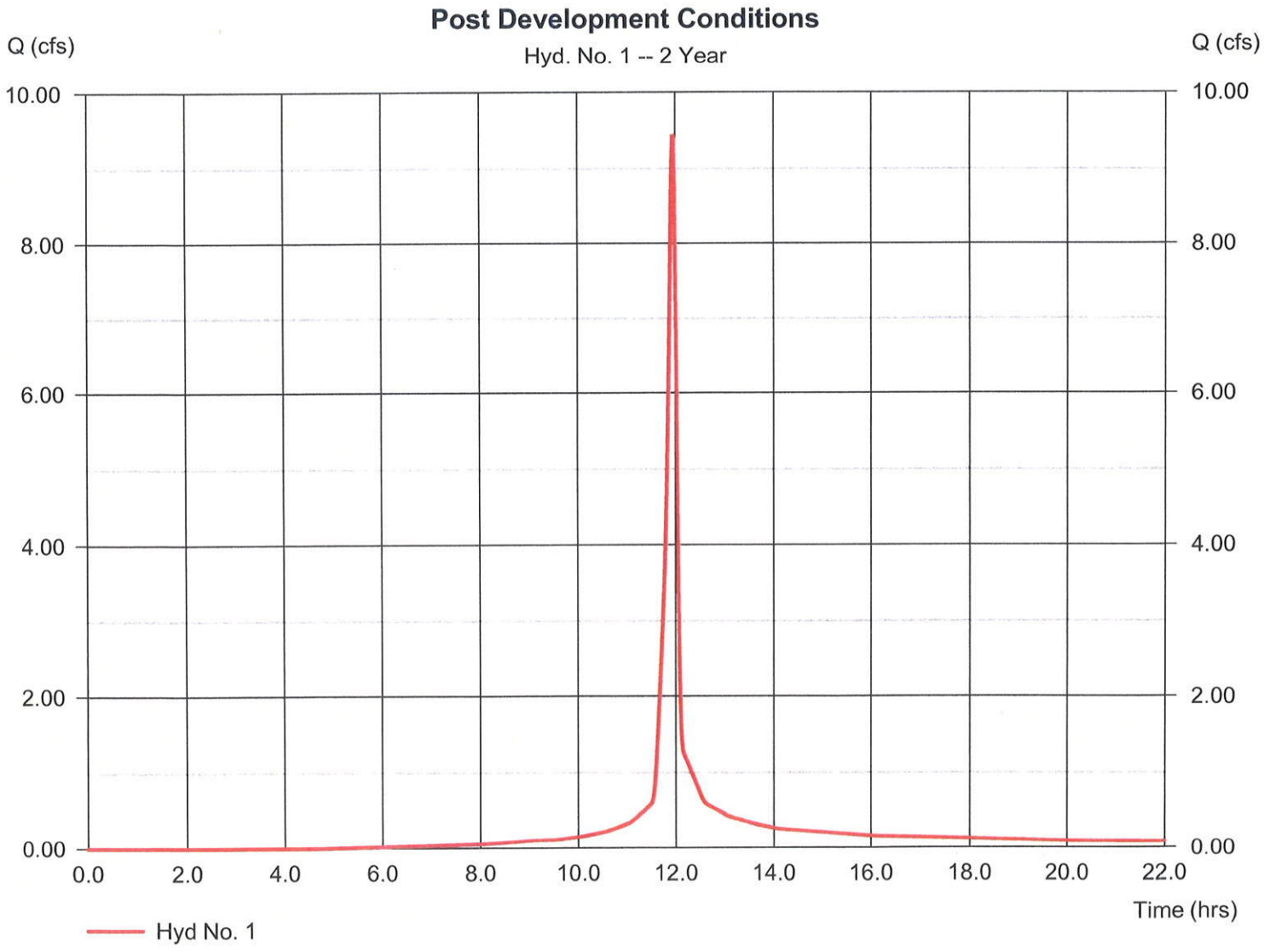
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Thursday, 01 / 16 / 2014

Hyd. No. 1

Post Development Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 9.444 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 20,097 cuft
Drainage area	= 2.380 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.800 x 98) + (0.580 x 74)] / 2.380



Hydrograph Report

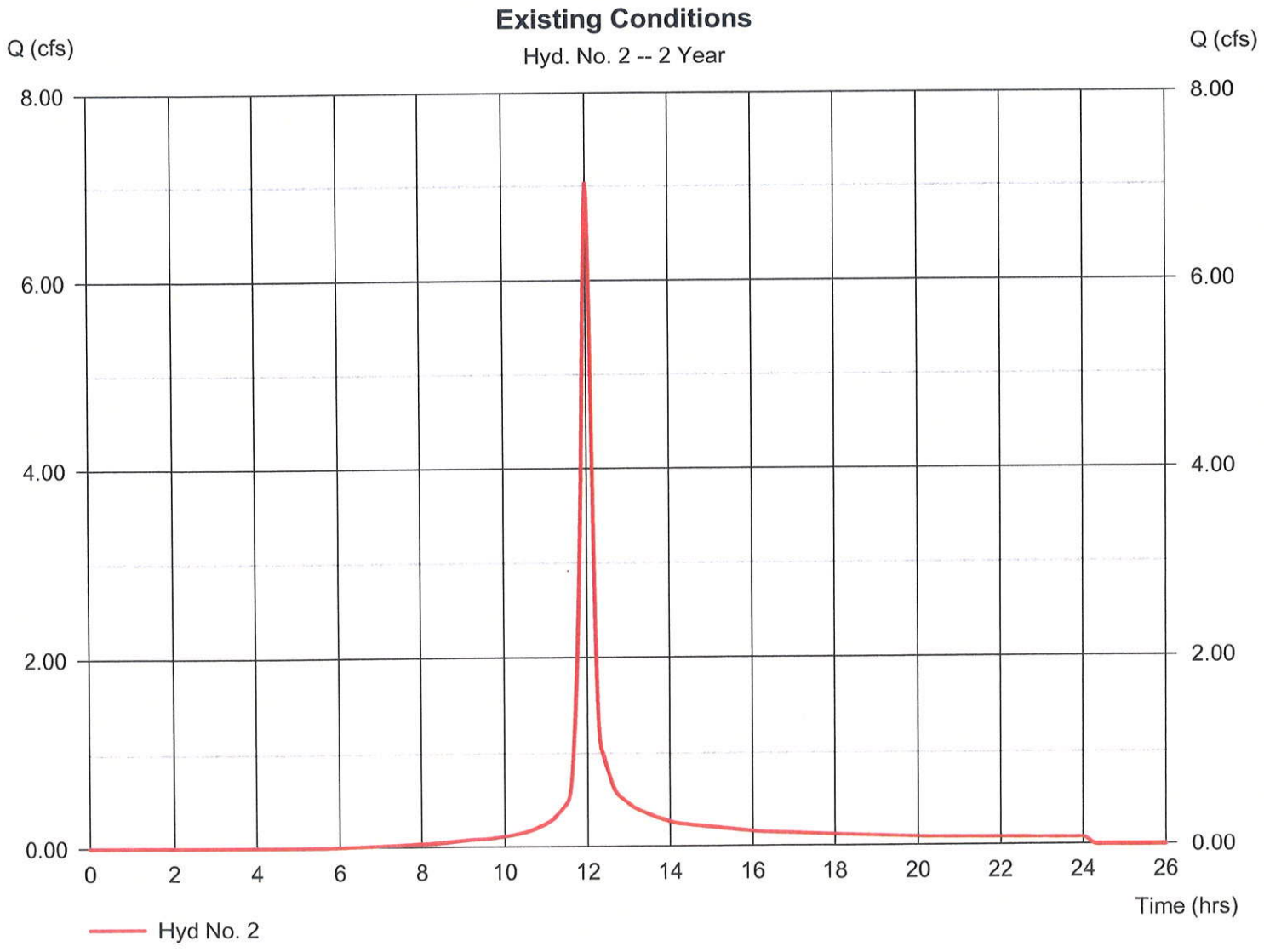
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Thursday, 01 / 16 / 2014

Hyd. No. 2

Existing Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 7.043 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 18,497 cuft
Drainage area	= 2.380 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.620 x 98) + (0.760 x 74)] / 2.380



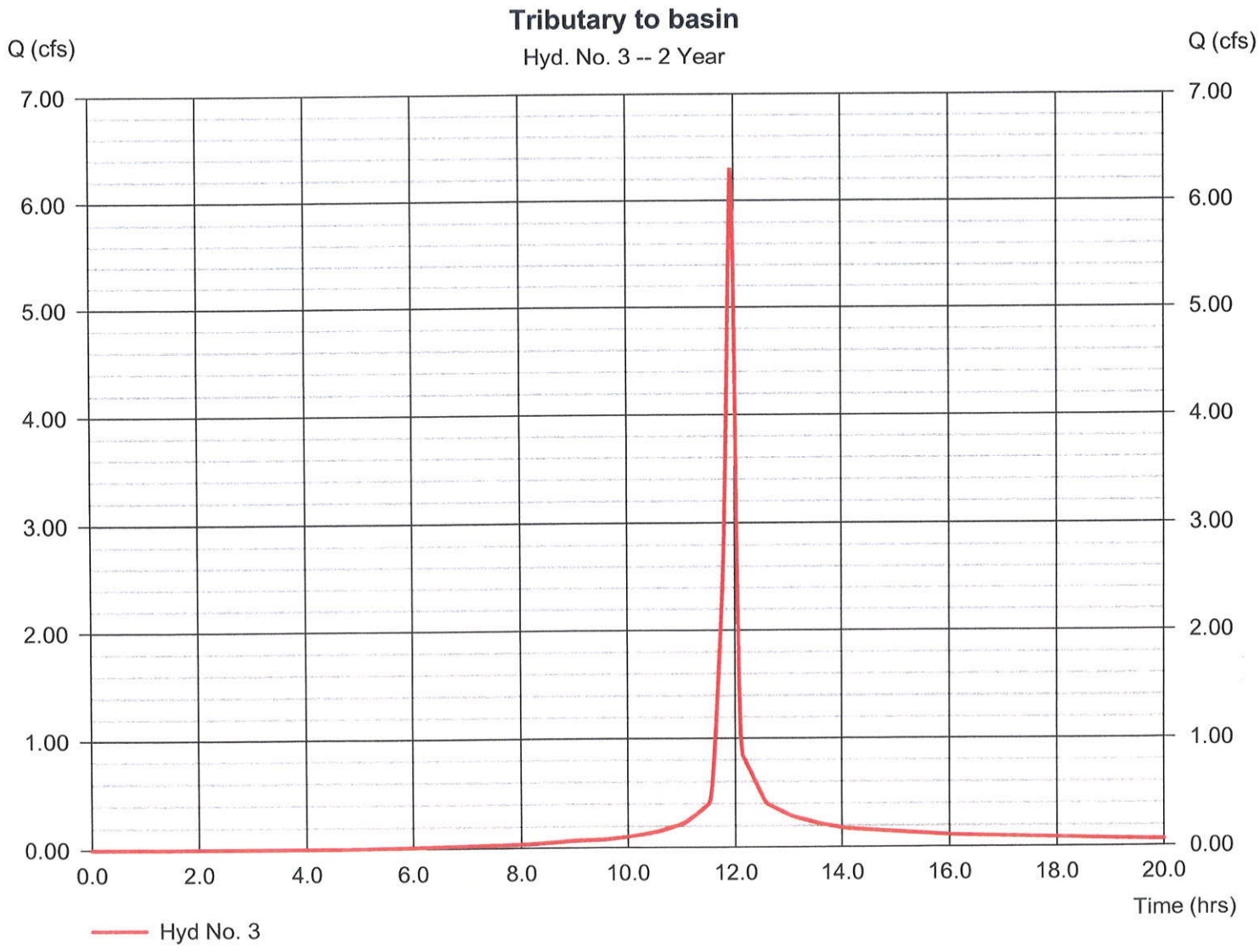
Hydrograph Report

Hyd. No. 3

Tributary to basin

Hydrograph type	= SCS Runoff	Peak discharge	= 6.302 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 13,280 cuft
Drainage area	= 1.730 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.310 x 98) + (0.420 x 74)] / 1.730



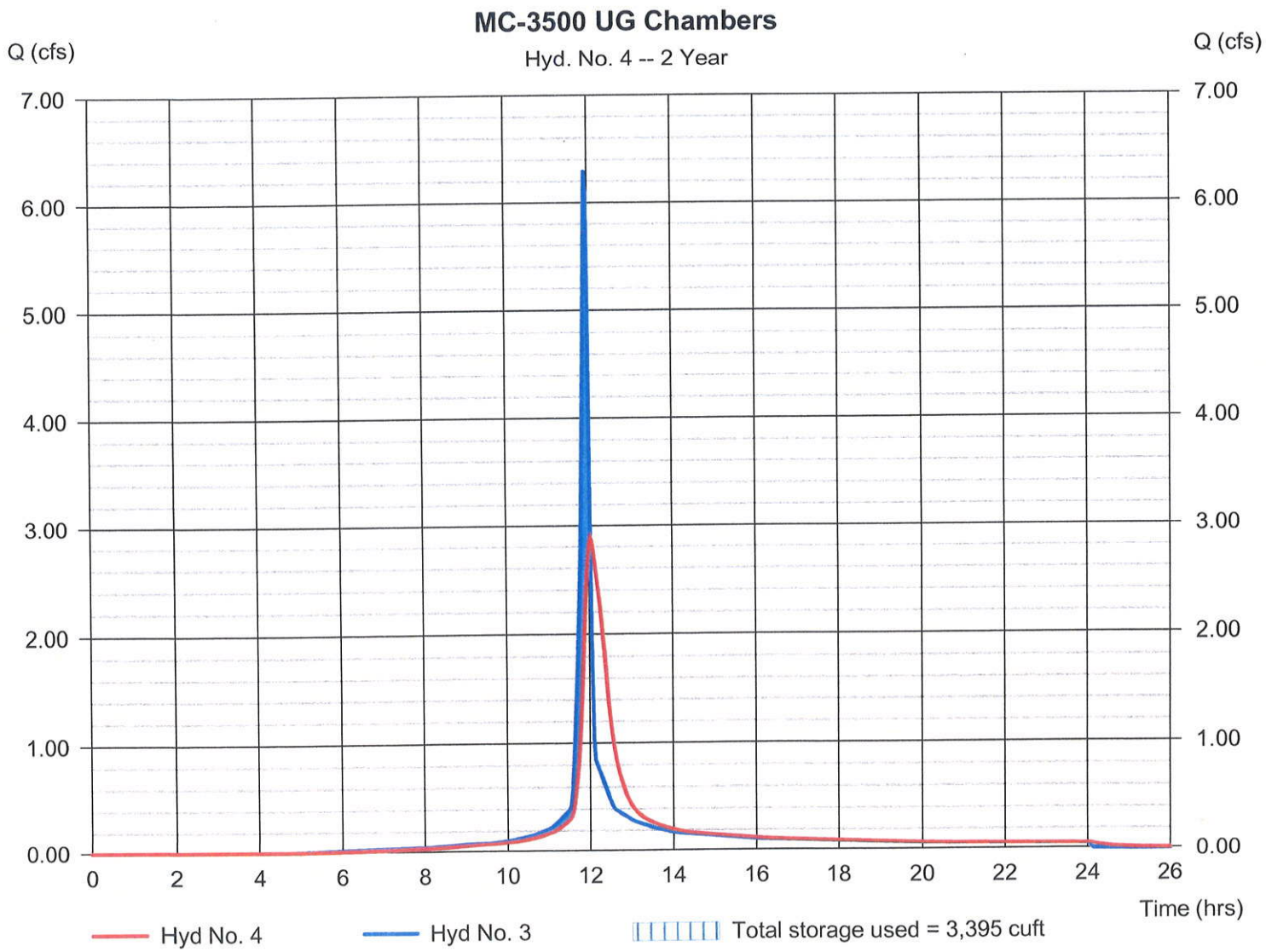
Hydrograph Report

Hyd. No. 4

MC-3500 UG Chambers

Hydrograph type	= Reservoir	Peak discharge	= 2.887 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 13,277 cuft
Inflow hyd. No.	= 3 - Tributary to basin	Max. Elevation	= 566.83 ft
Reservoir name	= MC-3500	Max. Storage	= 3,395 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Thursday, 01 / 16 / 2014

Pond No. 1 - MC-3500

Pond Data

UG Chambers -Invert elev. = 566.00 ft, Rise x Span = 3.75 x 6.42 ft, Barrel Len = 114.56 ft, No. Barrels = 3, Slope = 0.00%, Headers = Yes
Encasement -Invert elev. = 565.00 ft, Width = 7.58 ft, Height = 5.75 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	565.00	n/a	0	0
0.57	565.58	n/a	679	679
1.15	566.15	n/a	903	1,582
1.73	566.72	n/a	1,534	3,116
2.30	567.30	n/a	1,508	4,624
2.88	567.88	n/a	1,458	6,082
3.45	568.45	n/a	1,381	7,463
4.03	569.03	n/a	1,265	8,729
4.60	569.60	n/a	1,074	9,802
5.18	570.17	n/a	721	10,523
5.75	570.75	n/a	679	11,202

Culvert / Orifice Structures

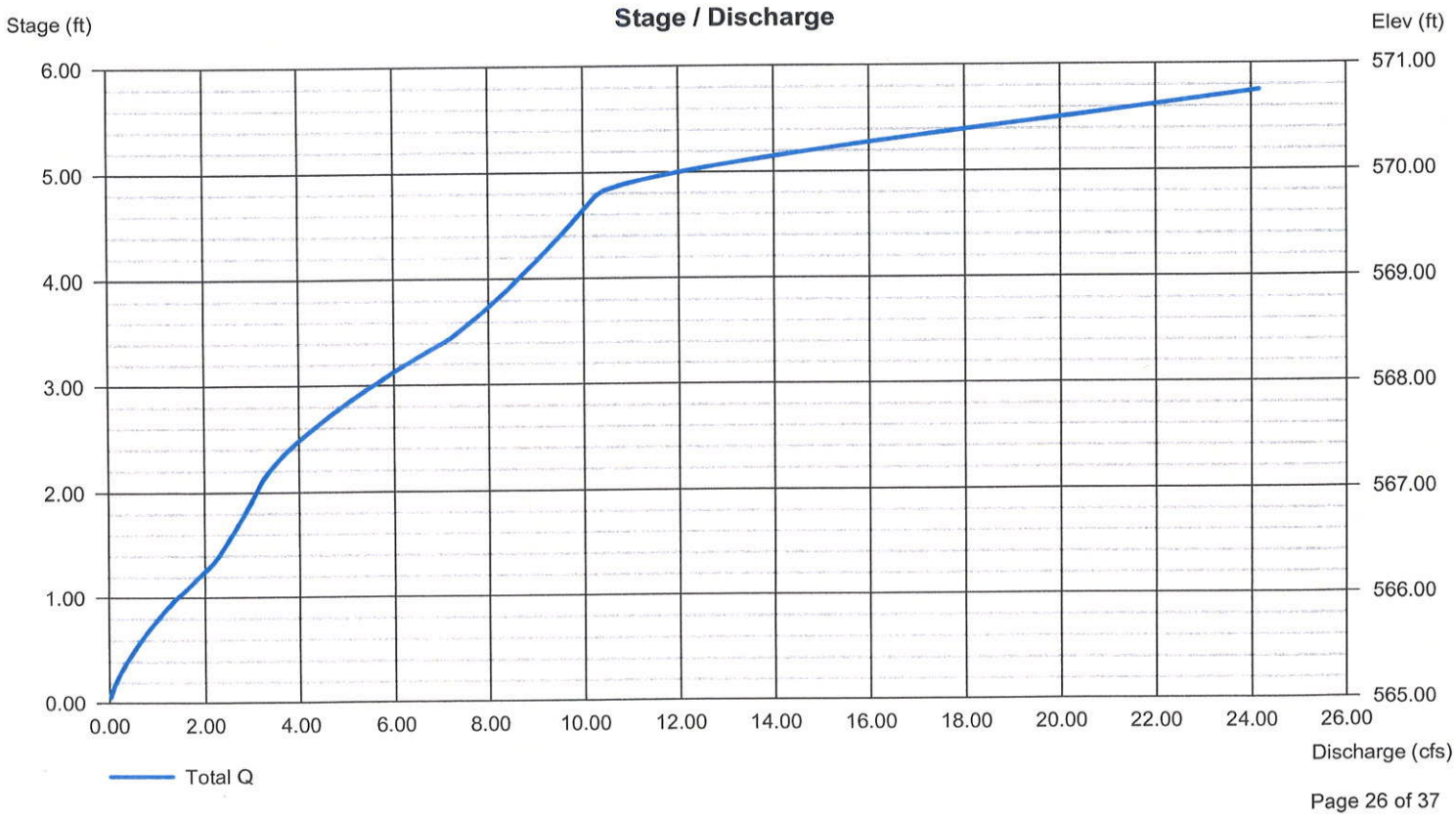
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	16.00	16.00	Inactive
Span (in)	= 24.00	5.00	7.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 564.90	565.00	567.10	0.00
Length (ft)	= 35.00	0.50	0.50	0.00
Slope (%)	= 9.07	0.01	0.01	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.00	Inactive	Inactive	0.00
Crest El. (ft)	= 569.80	570.00	0.00	0.00
Weir Coeff.	= 2.60	2.60	3.33	3.33
Weir Type	= Broad	Broad	Rect	---
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).



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	19.31	1	717	43,152	------	------	------	Post Development Conditions
2	SCS Runoff	15.09	2	720	41,180	------	------	------	Existing Conditions
3	SCS Runoff	12.89	2	716	28,515	------	------	------	Tributary to basin
4	Reservoir	6.781	2	722	28,512	3	568.35	7,189	MC-3500 UG Chambers

Hydrograph Report

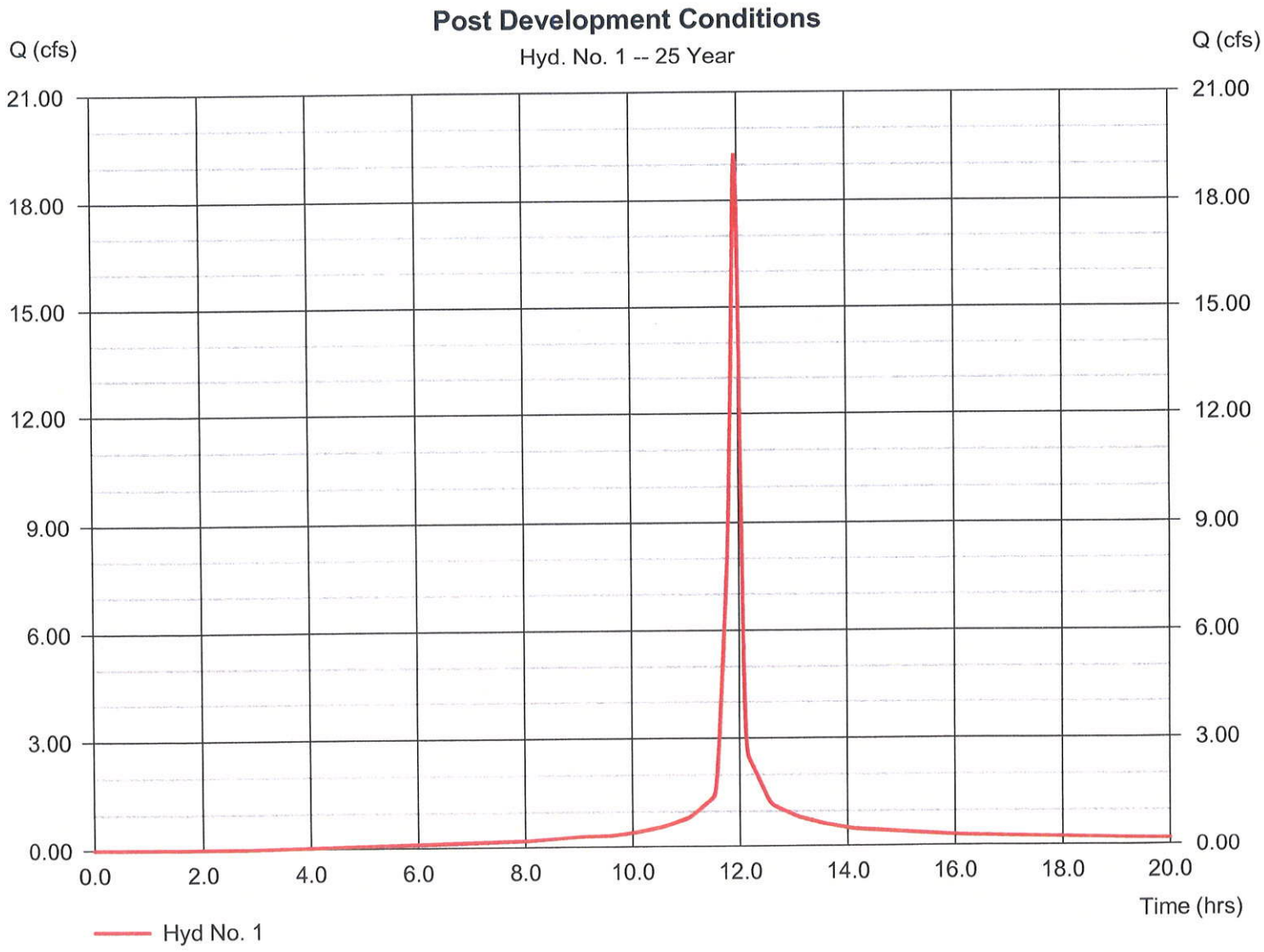
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Thursday, 01 / 16 / 2014

Hyd. No. 1

Post Development Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 19.31 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 43,152 cuft
Drainage area	= 2.380 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.800 x 98) + (0.580 x 74)] / 2.380



Hydrograph Report

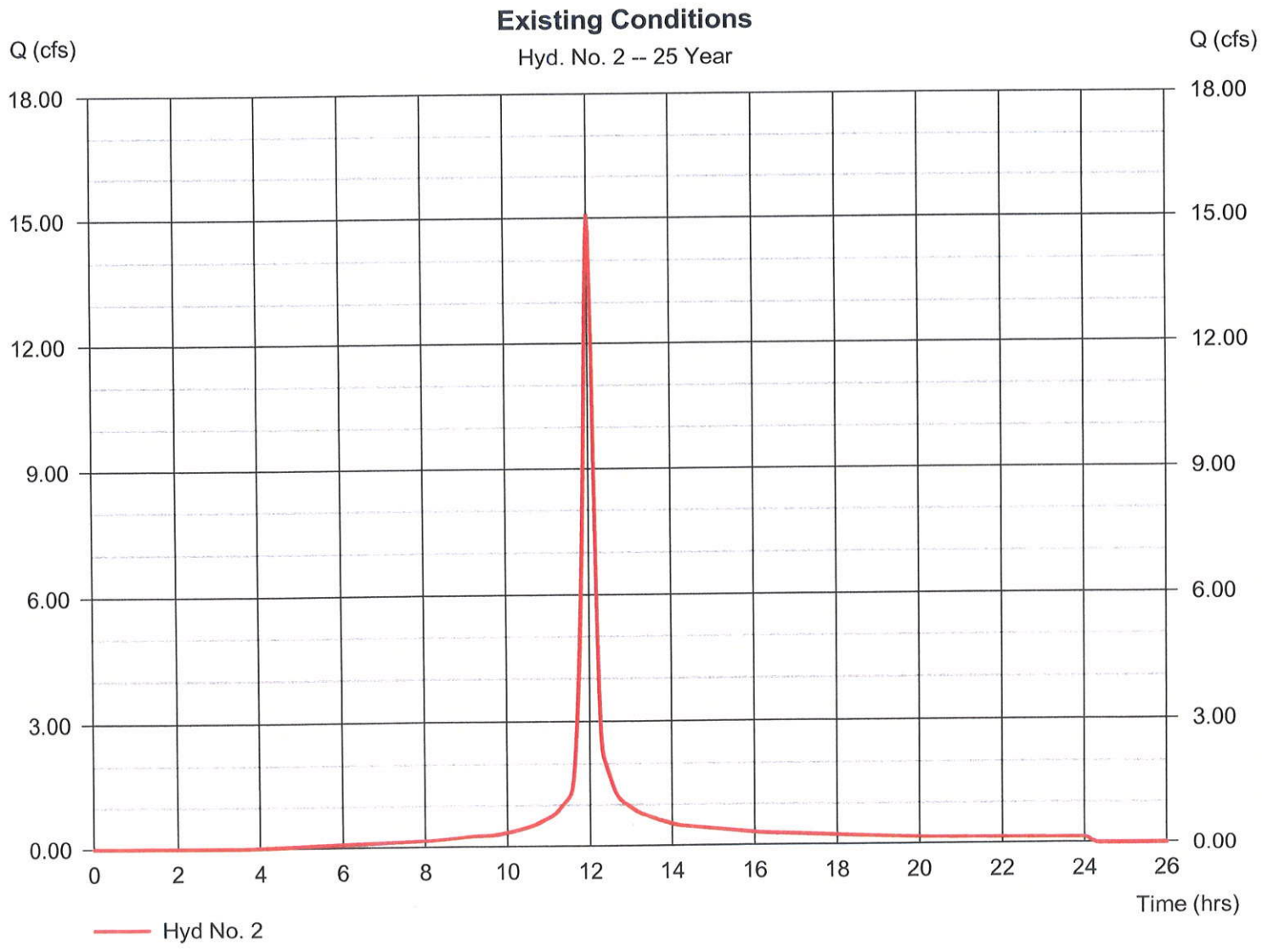
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Thursday, 01 / 16 / 2014

Hyd. No. 2

Existing Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 15.09 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 41,180 cuft
Drainage area	= 2.380 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.620 x 98) + (0.760 x 74)] / 2.380



Hydrograph Report

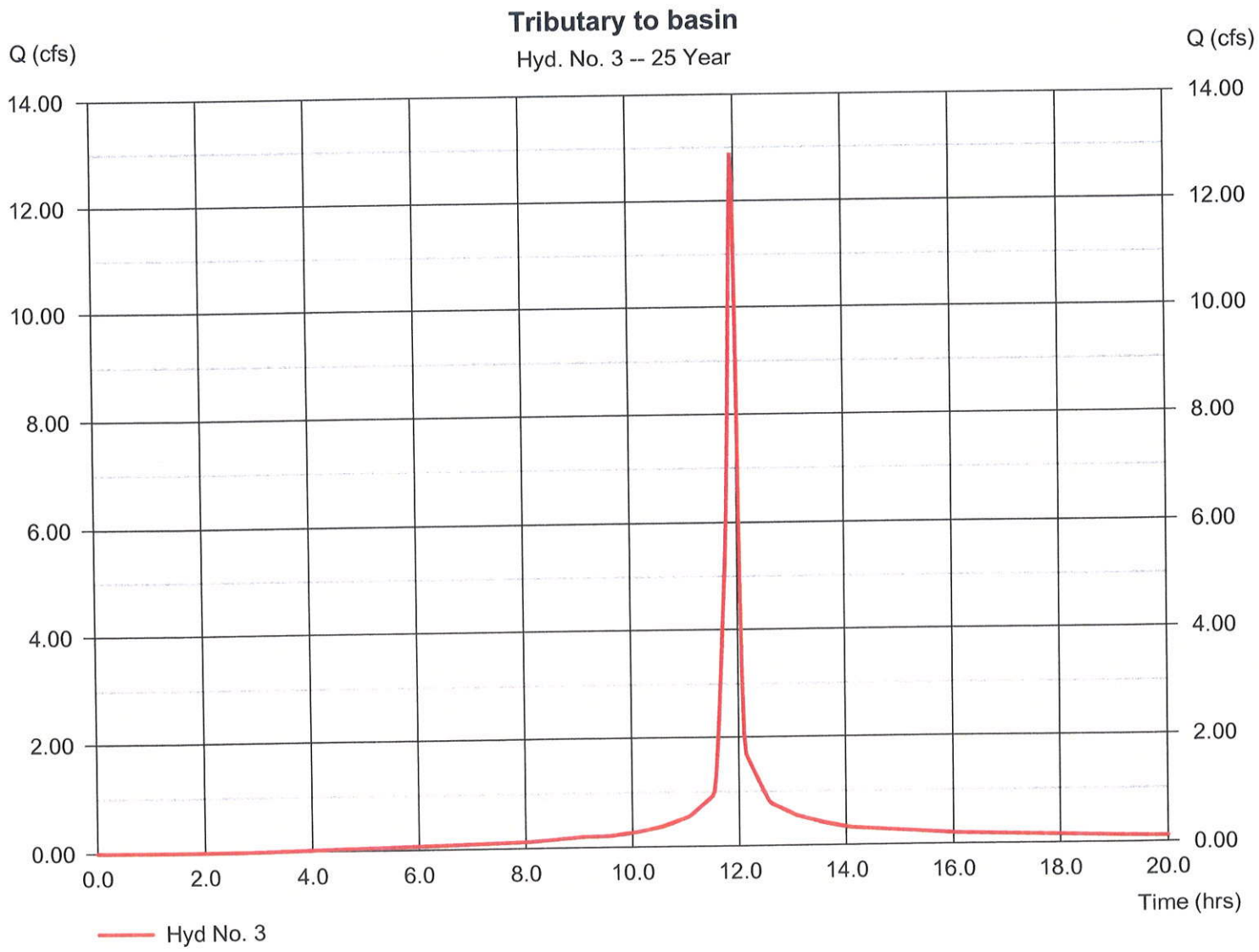
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Thursday, 01 / 16 / 2014

Hyd. No. 3

Tributary to basin

Hydrograph type	= SCS Runoff	Peak discharge	= 12.89 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 28,515 cuft
Drainage area	= 1.730 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.310 x 98) + (0.420 x 74)] / 1.730



Hydrograph Report

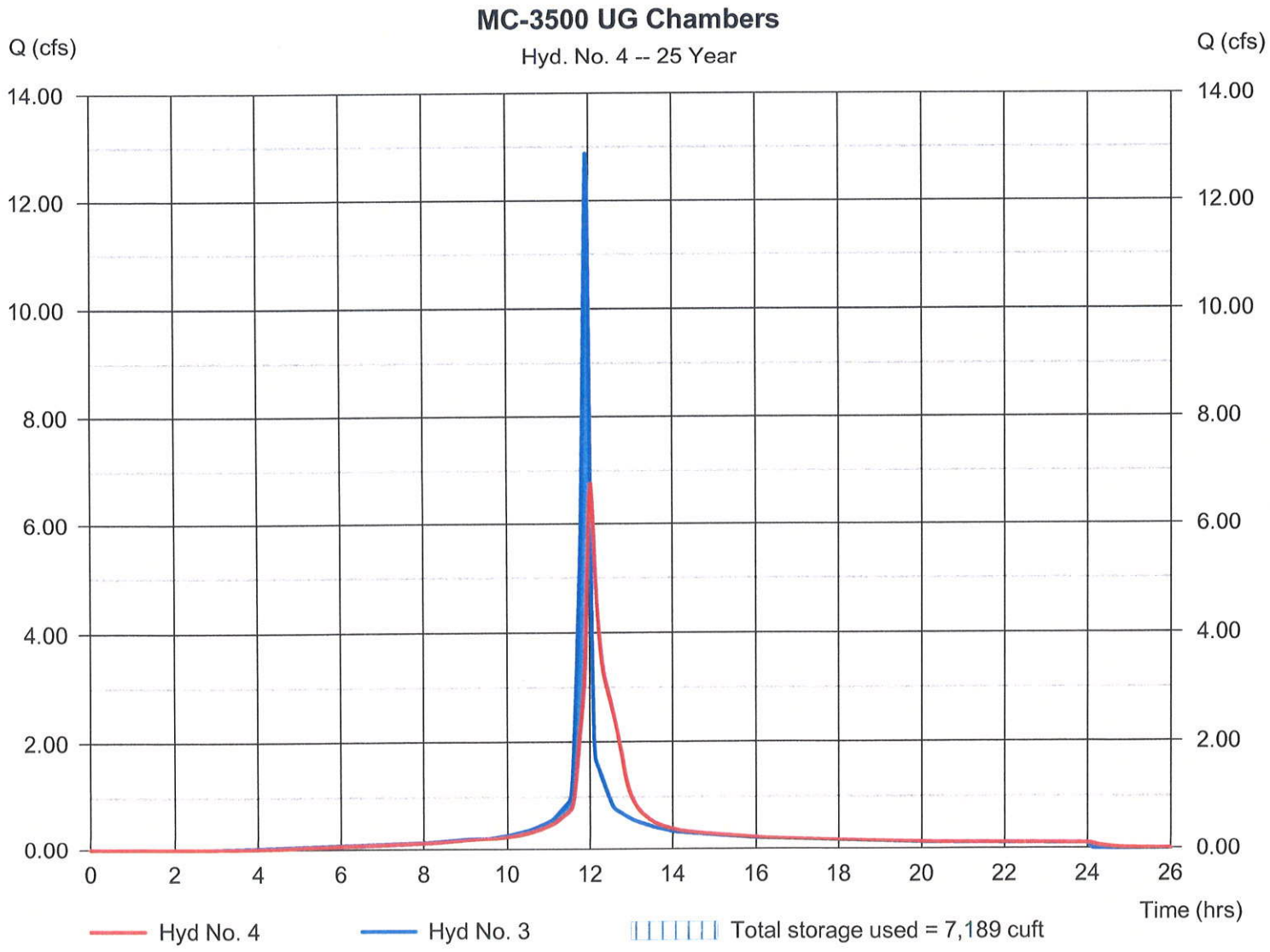
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Thursday, 01 / 16 / 2014

Hyd. No. 4

MC-3500 UG Chambers

Hydrograph type	= Reservoir	Peak discharge	= 6.781 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 28,512 cuft
Inflow hyd. No.	= 3 - Tributary to basin	Max. Elevation	= 568.35 ft
Reservoir name	= MC-3500	Max. Storage	= 7,189 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	24.51	1	717	55,704	------	------	------	Post Development Conditions
2	SCS Runoff	19.36	2	720	53,628	------	------	------	Existing Conditions
3	SCS Runoff	16.38	2	716	36,810	------	------	------	Tributary to basin
4	Reservoir	8.940	2	722	36,806	3	569.18	8,944	MC-3500 UG Chambers

Hydrograph Report

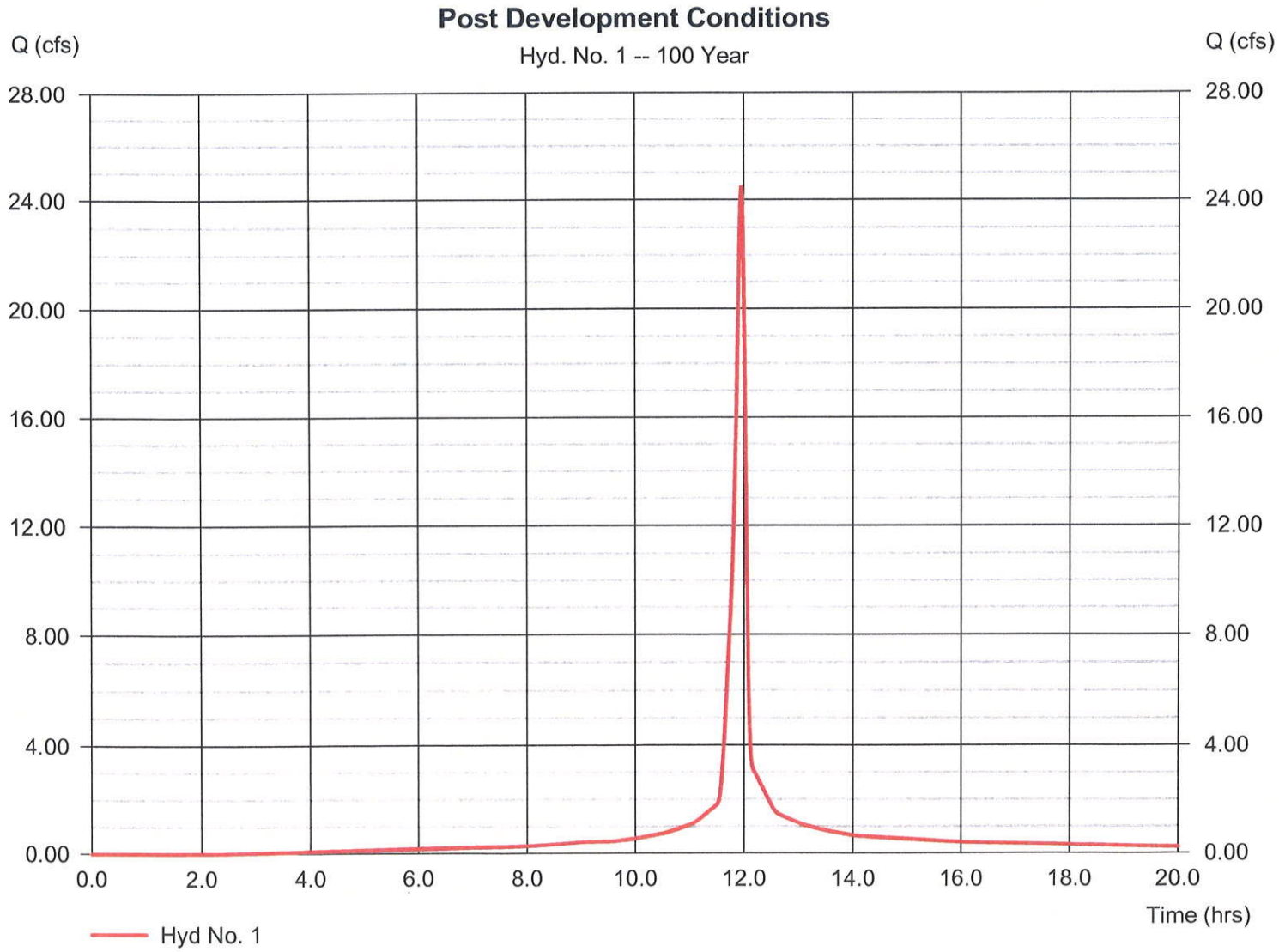
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Thursday, 01 / 16 / 2014

Hyd. No. 1

Post Development Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 24.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 55,704 cuft
Drainage area	= 2.380 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.800 x 98) + (0.580 x 74)] / 2.380



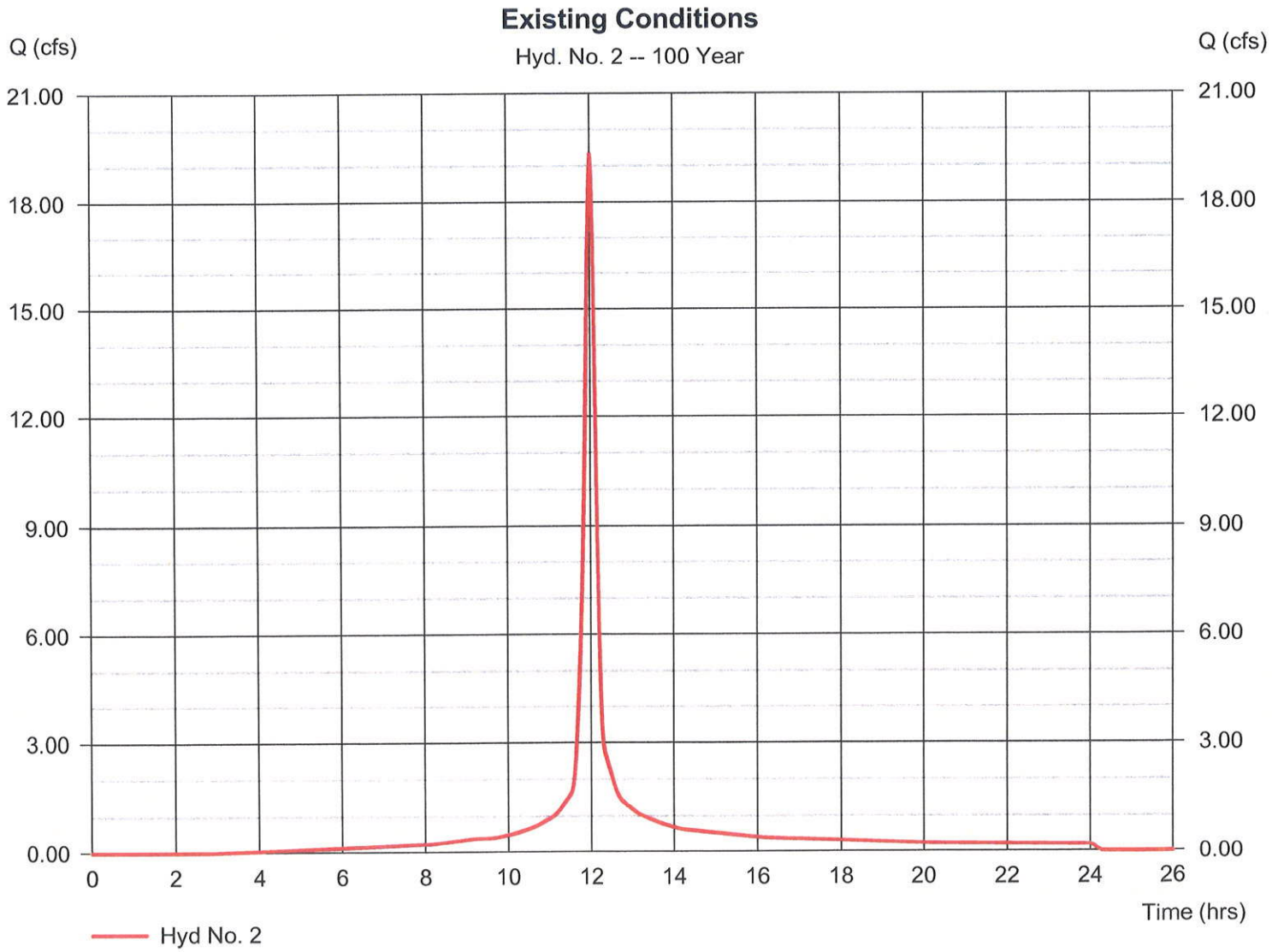
Hydrograph Report

Hyd. No. 2

Existing Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 19.36 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 53,628 cuft
Drainage area	= 2.380 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 7.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.620 x 98) + (0.760 x 74)] / 2.380



Hydrograph Report

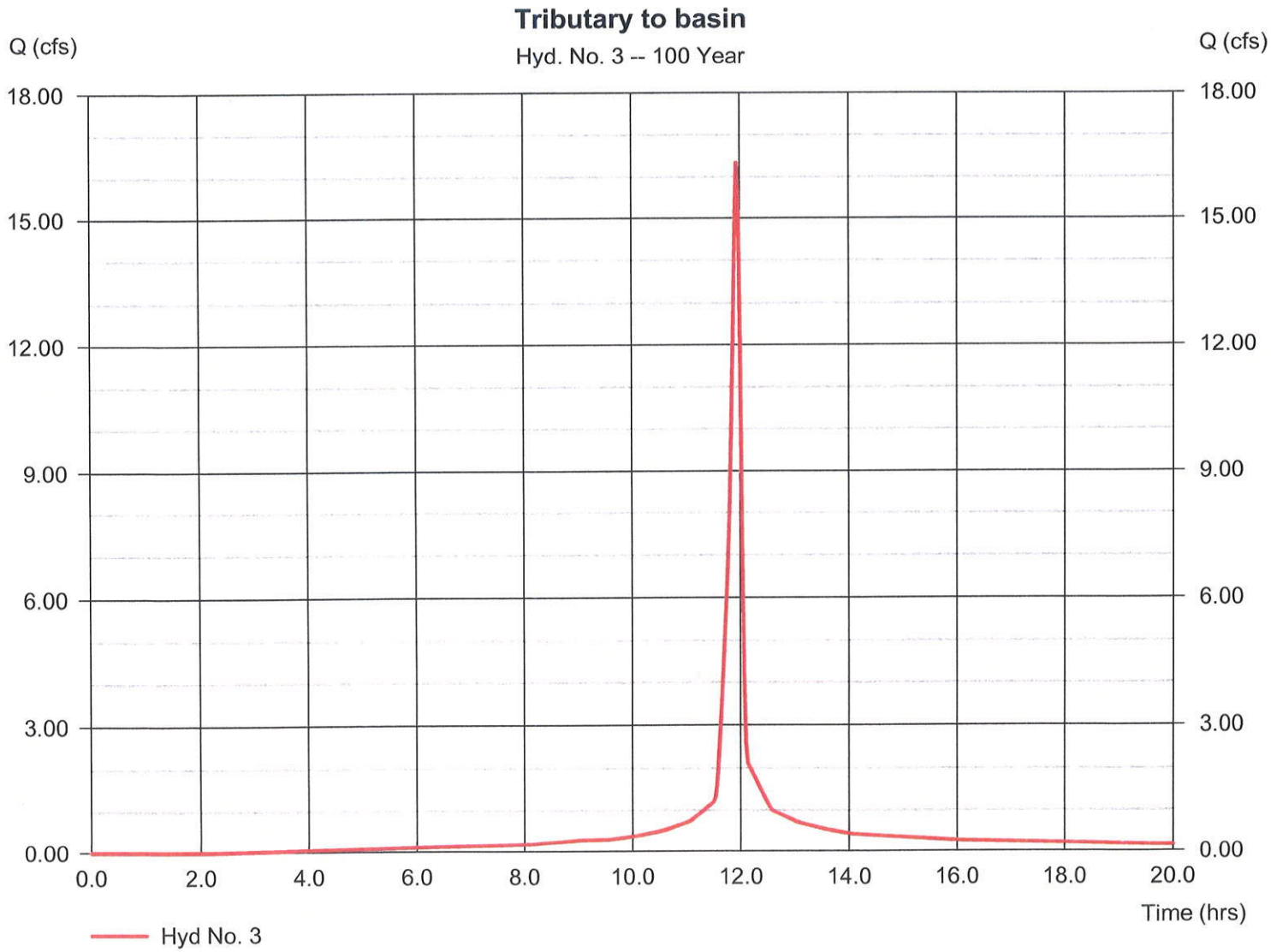
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Thursday, 01 / 16 / 2014

Hyd. No. 3

Tributary to basin

Hydrograph type	= SCS Runoff	Peak discharge	= 16.38 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 36,810 cuft
Drainage area	= 1.730 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.310 x 98) + (0.420 x 74)] / 1.730



Hydrograph Report

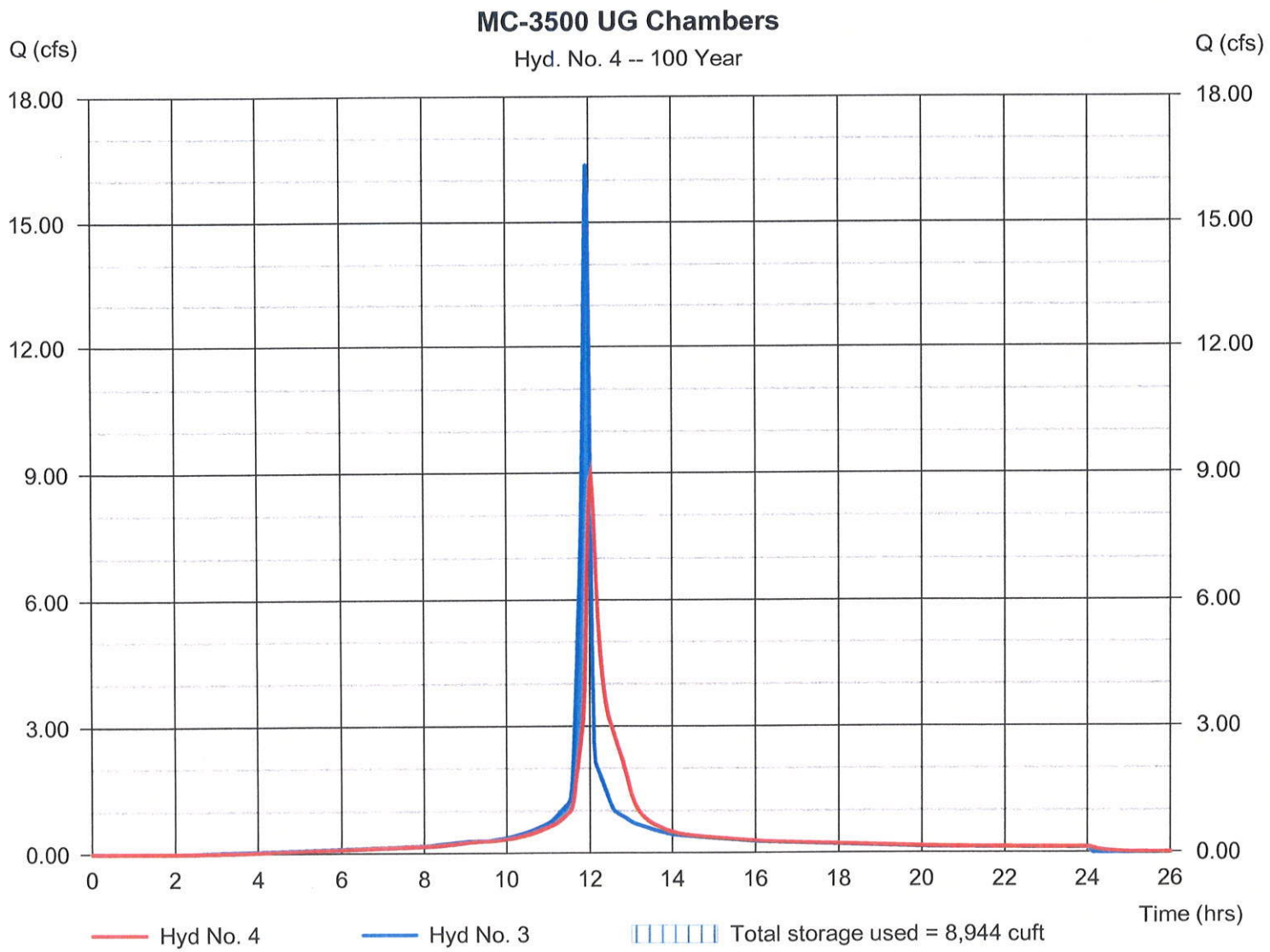
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Thursday, 01 / 16 / 2014

Hyd. No. 4

MC-3500 UG Chambers

Hydrograph type	= Reservoir	Peak discharge	= 8.940 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 36,806 cuft
Inflow hyd. No.	= 3 - Tributary to basin	Max. Elevation	= 569.18 ft
Reservoir name	= MC-3500	Max. Storage	= 8,944 cuft

Storage Indication method used.



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	50.8911	10.2000	0.8213	--------
3	0.0000	0.0000	0.0000	--------
5	54.4457	10.8000	0.7816	--------
10	72.1448	12.1000	0.8106	--------
25	126.4769	16.3000	0.9195	--------
50	191.2003	20.9000	0.9872	--------
100	51622.3203	89.9992	1.9305	--------

File name: SAINT LOUIS.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.45	4.31	3.60	3.10	2.73	2.45	2.23	2.04	1.89	1.76	1.65	1.55
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	6.30	5.08	4.29	3.74	3.32	3.00	2.74	2.53	2.35	2.20	2.06	1.95
10	7.22	5.87	4.97	4.34	3.86	3.48	3.18	2.93	2.72	2.54	2.38	2.25
25	7.60	6.26	5.33	4.65	4.13	3.72	3.39	3.11	2.87	2.67	2.50	2.35
50	7.70	6.47	5.58	4.90	4.37	3.95	3.60	3.31	3.06	2.85	2.66	2.50
100	7.85	7.11	6.47	5.91	5.43	5.00	4.62	4.28	3.98	3.71	3.47	3.25

Tc = time in minutes. Values may exceed 60.

AUL\7 CALC SPECS AND REPORTS\3 HYDRAULIC AND DETENTION CALCS\REPORT 4.19.2013\STL PCP.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	2.50	3.10	0.00	3.30	4.25	5.77	6.80	7.20
SCS 6-Hr	0.00	0.00	0.00	0.00	2.60	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	2.75	4.00	0.00	6.50	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	0.00	0.00	0.00	2.80	3.90	0.00	6.00	0.00