Stamski and McNary, Inc.
Engineering - Planning – Surveying
1000 Main Street Acton, MA 01720 (978) 263-8585

Site Plan Special Permit Application

for

429 Great Road
Map C-5, Parcel 67
Acton, MA 01720

Applicant: Country Properties, LLC
6 Proctor Street
Acton, MA 01720

Date: April 22, 2016

SM-5369

STAMSKI AND MCNARY, INC.
1000 Main Street
Acton, Massachusetts 01720
(978) 263-8585
FAX (978) 263-9883

JOSEPH MARCH, P.E., P.L.S.
GEORGE DIMAKARAKOS, P.E.

April 22, 2016

Acton Town Clerk
472 Main Street
Acton, MA 01720

Re: 429 Great Road

Dear Town Clerk,

On behalf of our client, Country Properties, LLC, we hereby submit the enclosed information for a *Site Plan Special Permit* pursuant to the Board of Selectmen's *Rules and Regulations for Site Plan Special Permits* and the *Town of Acton Zoning Bylaw* for the referenced site.

Very truly yours,

Stamski and McNary, Inc.

James Melvin, E.I.T.

George Dimakarakos, P.E.

STAMSKI AND MCNARY, INC.
1000 Main Street
Acton, Massachusetts 01720
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JOSEPH MARCH, P.E., P.L.S.
GEORGE DIMAKARAKOS, P.E.

April 22, 2016

Acton Board of Selectmen
472 Main Street
Acton, MA 01720

Re: 429 Great Road

Members of the Board,

On behalf of our client, Country Properties, LLC, we hereby submit the enclosed information for a *Site Plan Special Permit* pursuant to the Board of Selectmen's *Rules and Regulations for Site Plan Special Permits* and the *Town of Acton Zoning Bylaw* for the referenced site.

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3.1
APPLICATION
FOR A
SITE PLAN SPECIAL PERMIT

Appendix B

TOWN OF ACTON
APPLICATION FOR SITE PLAN SPECIAL PERMIT

For 429 Great Road

Under Zoning Bylaw Section 10.4

Refer to the "Rules and Regulations for Site Plan Special Permits" available from the Building Department or the Planning Department for details on the information and fees required for this application. Contact the Planning Department at 978-929-6631 or Building Department at 978-929-6633 with any questions concerning the Rules. Incomplete applications may be denied.

Please type or print your application.

1. Location and Street Address of Site 429 Great Road

2. Applicant's Name Country Properties, LLC
   Address 6 Proctor Street Acton, MA 01720
   Telephone (978) 430-4000 Email _____

3. Record Owner's Name Same as applicant
   Address _____
   Telephone _____ Email _____

4. Town Atlas Map(s)/Parcel Number(s) Map C-5, Parcel 67

5. Zoning District (s) of Parcel(s) Limited Business, Groundwater Protection Zone 3 & 4

If any site plans have been filed previously for this site give file numbers: _____

The undersigned hereby apply to the Board of Selectmen for a public hearing and a site plan special permit under Section 10.4 of the Zoning Bylaw approving the attached site plan.

The undersigned hereby certify that the information on this application and plans submitted herewith is correct, and that all applicable provisions of Statutes, Regulations, and Bylaws will be complied with. The above is subscribed to and executed by the undersigned under the penalties of perjury in accordance with Section 1-A of Chapter 268, General Laws of the Commonwealth of Massachusetts.

Date	Signature of Petitioner(s)	Signature of Petitioner(s)
4-22-16	L C Barkalow	

RECORD OWNER'S KNOWLEDGE AND CONSENT

I hereby assert that I have knowledge of and give my consent to the application presented above.

Date	Signature of Record Owner(s)	Signature of Record Owner(s)
4-22-16	L C Barkalow	

3.2
CERTIFIED ABUTTERS LIST

Town of Acton
472 Main Street
Acton, MA 01720
Telephone (978) 929-6621
Fax (978) 929-6340

Brian McMullen
Assistant Assessor

Locus: **429 Great Rd**
Parcel: **C5-67**

PropertyID	SiteAddress	OwnerName	OwnerName2	OwnerAddress	OwnerTownStateZip
C4-22-1	15 HARRIS ST	DEB ASHISH K	DEB ABHAYA	15 HARRIS ST	ACTON, MA 01720
C4-27	436 GREAT RD	KERAMARIS GEORGIOS		16 STRAWBERRY HILL ROAD	ACTON, MA 01720
C5-67-3	425 GREAT RD	TUDMAN ROBERT M ET AL	ACT-SUD REALTY TRUST	19 CRAIG RD	ACTON, MA 01720
C4-21-1	440 GREAT RD	ACTON 440 GREAT ROAD LLC	C/O SF PROPERTIES INC	837 WASHINGTON ST S-200	BROOKLINE, MA 02446
C4-21-2	444 GREAT RD	FFD LLC MASSACHUSETTS		PO BOX 1544	ARLINGTON, MA 02474
C4-21-3	448 GREAT RD	448 GREAT ROAD LLC		198 GREAT RD	ACTON, MA 01720
C5-54	25 HARRIS ST	SPRING HILL AT ACTON LLC	C/O UNIVERSAL MANAGEMENT	181 WELLS AVE	NEWTON, MA 02459
C4-22	457 GREAT RD	1 ON 1 SELF INDULGENCE INC		PO BOX 2646	ACTON, MA 01720
C4-424-10	424 GREAT RD #10	WU MIAO YUN	WAI KWAN	1 TOWN HOUSE LN APT 17	ACTON, MA 01720
C4-424-11	424 GREAT RD #11	SHEN LITAO	PU MIN	8 BIRCHWOOD DR	WESTBOROUGH, MA 01886
C4-424-12	424 GREAT RD #12	DOZOIS PAUL	DOZOIS LOUIS	11 JONATHAN LANE	BEDFORD, MA 01730
C4-424-13	424 GREAT RD #13	LIXIA QIN		424 GREAT RD #13	ACTON, MA 01720
C4-424-14	424 GREAT RD #14	SHI FUNAN	LIU MINHUA	12 GREYBIRCH LN	ACTON, MA 01720
C4-424-15	424 GREAT RD #15	TSANG CARA Y L		31 HILLSIDE RD	LINCOLN, MA 01773
C4-424-16	424 GREAT RD #16	MONAGHAN SHARON L/DAVID W TRSTEE	THE SHARON L MONAGHAN TRUST	46 STRICHEN LANE	BELLA VISTA, AR 72739
C4-424-17	424 GREAT RD #17	MOULTON JOHN		424 GREAT RD #17	ACTON, MA 01720
C4-424-18	424 GREAT RD #18	CHENERY ANDREW J		424 GREAT RD #18	ACTON, MA 01720
C4-424-1	424 GREAT RD #1	GALLIVAN JOHN E	WHEATON A PAGE	424 GREAT RD #1	ACTON, MA 01720
C4-424-2	424 GREAT RD #2	HAIGH ROBERT A TRUSTEE	GREAT ROAD REALTY TRUST	6 DURKEE LN	WESTFORD, MA 01886
C4-424-3	424 GREAT RD #3	FEELEY KEVIN	FEELEY CLAUDIA	424 GREAT RD #3	ACTON, MA 01720
C4-424-4	424 GREAT RD #4	DEROSA MICHAEL S TRUSTEE	ASORED REALTY TRUST	8 WAGON WHEEL ROAD	WINCHESTER, MA 01890
C4-424-5	424 GREAT RD #5	ATHYAL ANNIE ELIZABETH	MATHEW MANI T	46 JOHNSON RD	WINCHESTER, MA 01890
C4-424-6	424 GREAT RD #6	PENNEY SEAN R		424 GREAT RD #6	ACTON, MA 01720
C4-424-7	424 GREAT RD #7	HARNUM FRANCES M		17 KIRSI CIR	WESTFORD, MA 01886
C4-424-8	424 GREAT RD #8	GODFREY DANIEL		164 ASH STREET #1	WALTHAM, MA 02453
C4-424-9	424 GREAT RD #9	SCHAEJBE REALTY LLC		1337 MASS AVE #155	ARLINGTON, MA 02476
C4-426-10	426 GREAT RD #10	LEI HANSHI		426 GREAT RD #10	ACTON, MA 01720
C4-426-11	426 GREAT RD #11	GENG MAIKE		426 GREAT RD #11	ACTON, MA 01720
C4-426-12	426 GREAT RD #12	XZ LIMITED LC		426 GREAT RD #12	ACTON, MA 01720
C4-426-13	426 GREAT RD #13	HU CUIE		14 LOTHROP RD	ACTON, MA 01720
C4-426-14	426 GREAT RD #14	ZHANG XIAO FAN		124 MAIN ST	ACTON, MA 01720
C4-426-15	426 GREAT RD #15	RONG XIANHUI + ZHAO JUAN		426 GREAT RD #15	ACTON, MA 01720
C4-426-16	426 GREAT RD #16	GORHAM WILLIAM J	GORHAM PATRICIA	17 FOX LANE	FOXBORO, MA 02035
C4-426-17	426 GREAT RD #17	ACTON HOUSING AUTHORITY		PO BOX 681	ACTON, MA 01720
C4-426-18	426 GREAT RD #18	YEUNG PETER FUK-WAH	YEUNG MEI CHANG	426 GREAT RD #18	ACTON, MA 01720
C4-426-1	426 GREAT RD #1	DUNBAR MICHAEL ALLEN		426 GREAT RD #1	ACTON, MA 01720
C4-426-2	426 GREAT RD #2	ACTON HOUSING AUTHORITY		PO BOX 681	ACTON, MA 01720
C4-426-4	426 GREAT RD #4	SCHAEJBE REALTY ONE LLC		1337 MASS AVE #155	ARLINGTON, MA 02476
C4-426-5	426 GREAT RD #5	RAY JUSTIN W		8 DRUMMOND RD	STONEHAM, MA 02180
C4-426-6	426 GREAT RD #6	DEROSA MICHAEL S TRUSTEE	ASORED REALTY TRUST	8 WAGON WHEEL ROAD	WINCHESTER, MA 01890
C4-426-7	426 GREAT RD #7	JONAS ALFRED G		426 GREAT RD #7	ACTON, MA 01720
C4-426-8	426 GREAT RD #8	TSANG KWAN WAI		1 TOWN HOUSE LANE, APT 17	ACTON, MA 01720
C4-426-9	426 GREAT RD #9	SCHAEJBE THOMAS	C/O SCHAEJBE REALTY	1337 MASS AVE #155	ARLINGTON, MA 02476
C4-428-10	428 GREAT RD #10	HEDBERG KENNETH B TRUSTEE	HEDBERG RUTH R TRUSTEE	2185 FAULKNER RD	WHITINGHAM,VT 05361
C4-428-11	428 GREAT RD #11	VIMAL RAM LAKHAN PANDEY TRUSTEE	VIMAL-PANDEY RESEARCH FNDTN	25 RITA STREET	LOWELL, MA 01854
C4-428-12	428 GREAT RD #12	SCHAEJBE THOMAS ET UX TR	428-12 REALTY TRUST	1337 MASS AVE #155	ARLINGTON, MA 02476
C4-428-13	428 GREAT RD #13	PIPICH ROBERT B	KATHRYN L	1808 SHIRLEY ROAD	LANCASTER, MA 01523

Brian McMullen
Assistant Assessor

Locus: **429 Great Rd**
Parcel: **C5-67**

C4-428-14	428 GREAT RD #14	KELLY JOHN J		428 GREAT RD #14	ACTON, MA 01720
C4-428-15	428 GREAT RD #15	AZAR KRISTIN A AKA LYONS KRISTIN		17 BATTCOCK AV	HAMPTON, NH 03842
C4-428-16	428 GREAT RD #16	SPARKS RICHARD A SR TRUSTEE	SPARKS SPARKS DOROTHY C TRUSTE	428 GREAT RD #16	ACTON, MA 01720
C4-428-17	428 GREAT RD #17	SOKOLOVSKAYA YEKATERINA M		34 PERSHING RD	NEEDHAM, MA 02494
C4-428-18	428 GREAT RD #18	MCLEAN JANET		428 GREAT RD #18	ACTON, MA 01720
C4-428-1	428 GREAT RD #1	HAMWEY PAMELA		428 GREAT RD #1	ACTON, MA 01720
C4-428-2	428 GREAT RD #2	LU HUY V		428 GREAT RD #2	ACTON, MA 01720
C4-428-3	428 GREAT RD #3	DEROSA MICHAEL S TRUSTEE	ASORED REALTY TRUST	8 WAGON WHEEL ROAD	WINCHESTER, MA 01890
C4-428-4	428 GREAT RD #4	LEGGETT THOMAS		164 ASH STREET #1	WALTHAM, MA 02453
C4-428-5	428 GREAT RD #5	NISTAS HOUDA	RACHID HANKAOUI	428 GREAT RD #5	ACTON, MA 01720
C4-428-6	428 GREAT RD #6	CHEN FRANK H		428 GREAT RD #6	ACTON, MA 01720
C4-428-7	428 GREAT RD #7	MONAGHAN SHARON L/DAVID W TRSTEE	THE SHARON L MONAGHAN TRUST	46 STRICHEN LANE	BELLA VISTA, AR 72739
C4-428-8	428 GREAT RD #8	KEANE THOMAS M	TRUSTEE	20 OAKDALE RD	BRADFORD, MA 03221
C4-428-9	428 GREAT RD #9	ALLEN JOHN H		428 GREAT RD #9	ACTON, MA 01720
C5-10-16	2 CAPT HANDLEY RD	AYYAPILLAI MURALI		2 CAPT HANDLEY RD	ACTON, MA 01720
C5-10-18	1 CAPT HANDLEY RD	TOWN OF ACTON		472 MAIN STREET	ACTON, MA 01720
C4-21-4	452 GREAT RD	WORKERS CREDIT UNION	ATT: SHAWN LINEHAN	452 GREAT ROAD	ACTON, MA 01720
C5-44	32 HARRIS ST	ZHOU YI	XU RENJIA	32 HARRIS ST	ACTON, MA 01720
C5-501-11	28 HARRIS ST #A1	ROJANO TRACY L TRUSTEE		28 HARRIS ST #A1	ACTON, MA 01720
C5-501-12	28 HARRIS ST #A2	SONG VIVIAN YUANYUAN		28 HARRIS ST #A2	ACTON, MA 01720
C5-501-13	28 HARRIS ST #A3	KURIAKOSE THOMAS S	KURIAKOSE MERIA	28 HARRIS ST #A3	ACTON, MA 01720
C5-501-14	28 HARRIS ST #A4	KHAYKIN ROMAN Y	KHAYKINA SVETLANA	28 HARRIS ST #A4	ACTON, MA 01720
C5-502-25	30 HARRIS ST #B5	WU XIAOJUN		30 HARRIS ST #B5	ACTON, MA 01720
C5-502-26	30 HARRIS ST #B6	MAILLE SUSAN M		30 HARRIS ST #B6	ACTON, MA 01720
C5-502-27	30 HARRIS ST #B7	GERACE JOHN J	GERACE RITA M	30 HARRIS STREET #B7	ACTON, MA 01720
C5-502-28	30 HARRIS ST #B8	TESSIER PAULINE T		30 HARRIS ST #B8	ACTON, MA 01720

Abutters and owners of land directly opposite on any public or private street or way and abutters to the abutters within three hundred feet of the
s they appear on the most recent applicable tax list.

HEARING NOTICES FOR ALL SPECIAL PERMITS MUST BE SENT TO THE PLANNING BOARD, TOWN HALL IN THE FOLLOWING TOWNS:

Boxborough, MA 01729	Maynard, MA 01754	Concord, MA 01742	Littleton, MA 01460
Carlisle, MA 01741	Stow, MA 01775	Westford, MA 01886	Sudbury, MA 01776

Kelly Schorr 19-Apr-16

Acton Assessors Office

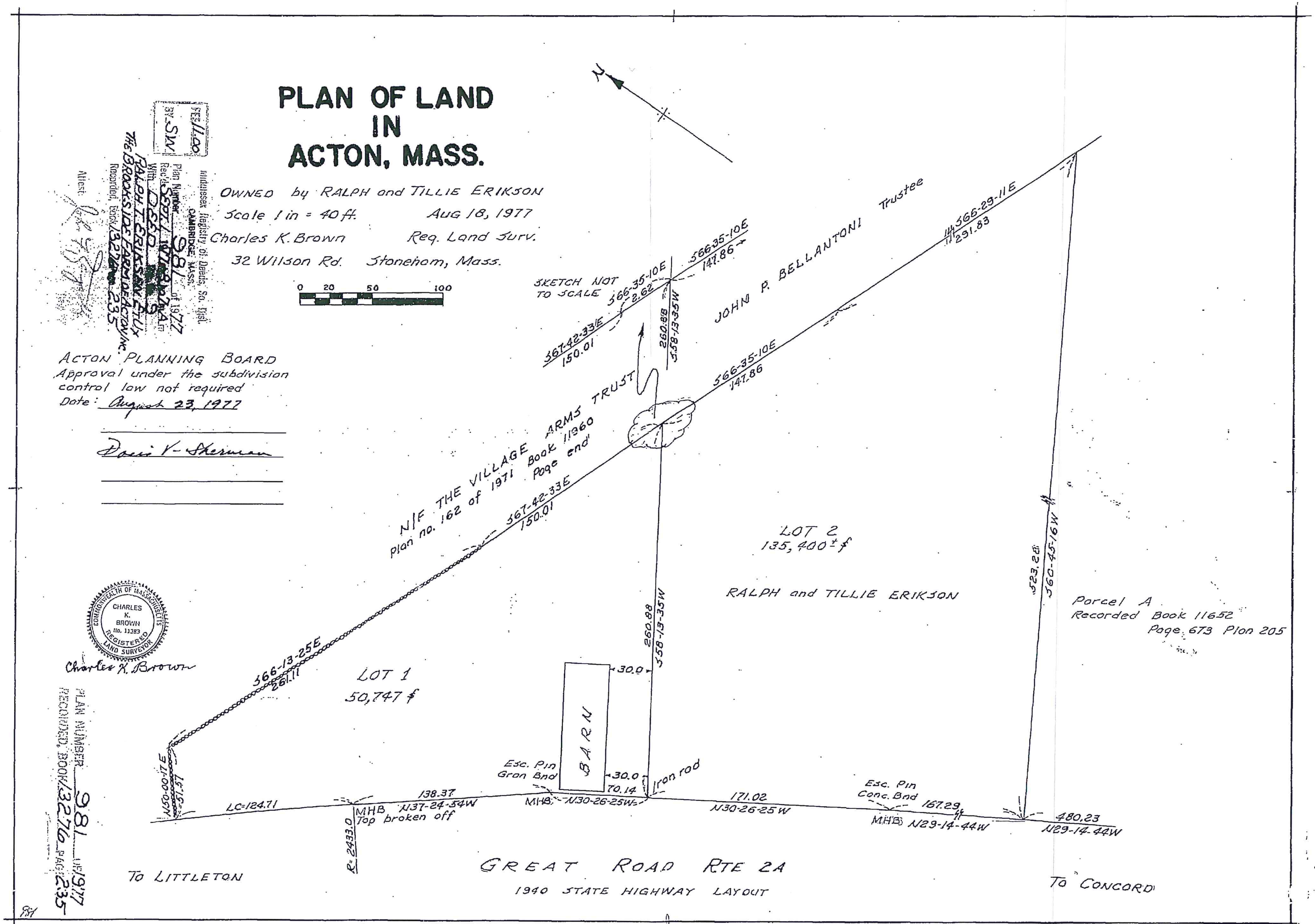
3.3 USE DESCRIPTION

The existing use of the site is RETAIL. The proposed use of the site is for VEHICLE SALES and VEHICLE SERVICE STATION.

3.4 OTHER PERMITS AND VARIANCES

PERMITTING BODY	REQUIRED
Acton Board of Appeals	Front Yard Variance (Obtained)
Acton Board of Health	Disposal Works Construction Permit Aquifer Permit
Acton Conservation Commission	Order of Conditions
Mass Highway	Curb Cut Permit
EPA	NPDES Construction General Permit

3.5
RECORDED PLANS


PLAN OF LAND
IN
ACTON, MASS.
OWNED by RALPH and TILLIE ERIKSON
Scale 1 in = 40 ft.
AUG 18, 1977
Charles K. Brown
Reg. Land Surv.
32 Wilson Rd.
Stoneham, Mass.
0 20 50 100
Middlesex Registry of Deeds, So. Dist.
CAMBRIDGE, MASS.
Plan Number 981 of 1977
Rec'd Sept 1 1977
With Deed
Ralph T. Erikson et ux
The Brookside Farm of Acton Inc.
Recorded, Book 13276 Page 235
Attest:
FEE 11.00
ACTON PLANNING BOARD
Approval under the subdivision control law not required
Date: August 23, 1977
CHARLES K. BROWN No. 11383
COMMONWEALTH OF MASSACHUSETTS
REGISTERED LAND SURVEYOR
Charles K. Brown
PLAN NUMBER 981 OF 1977
RECORDED, BOOK 13276 PAGE 235
N
SKETCH NOT TO SCALE
S66-35-10E 2.62
S66-35-10E 147.86
S67-42-33E 150.01
260.88
S58-13-35W
JOHN P. BELLANTONI Trustee
S66-29-11E 231.83
N/F THE VILLAGE ARMS TRUST
Plan no. 162 of 1971 Book 11360 Page end
S66-35-10E 147.86
S67-42-33E 150.01
S66-13-25E 261.11
LOT 1
50,747 ✓f
LOT 2
135,400± ✓f
RALPH and TILLIE ERIKSON
523.28
S60-45-16W
Parcel A
Recorded Book 11652 Page 673 Plan 205
30.0
BARN
30.0
70.14
Iron rod
Esc. Pin Gran Bnd
Esc. Pin Conc. Bnd
MHB
MHB Top broken off
LC=124.71
138.37 N37-24-54W
N30-26-25W
171.02 N30-26-25W
167.29 N29-14-44W
480.23 N29-14-44W
R=2433.0
N30-00-17E 51.51
GREAT ROAD RTE 2A
1940 STATE HIGHWAY LAYOUT
To LITTLETON
To CONCORD
981

14.6-27.0

RECORDING REQUESTED BY AND WHEN RECORDED RETURN TO:

SPACE ABOVE FOR REGISTRY USE ONLY

QUITCLAIM DEED

THE BROOKSIDE FARM OF ACTON, INC., A Massachusetts corporation with its principal place of business located at 11 Laws Brook Road, Acton, Middlesex County, Massachusetts, for good and valuable consideration paid in the amount of **Five Hundred Fifty Thousand and 00/100 Dollars ($550,000.00)**, grant to **COUNTRY PROPERTIES, LLC,** a Massachusetts limited liability company with its principal place of business located at 6 Proctor Street, Acton, Middlesex County, Massachusetts, with **QUITCLAIM COVENANTS,**

Property Address: 429 Great Road, Acton, MA

A certain parcel of land with the buildings thereon, located on the Northeasterly side of Great Road in Acton, Middlesex County, Massachusetts and being shown as Lot 1 on plan entitled: "Plan of Land in Acton, Mass., owned by Ralph and Tillie Eriksen, dated August 18, 1977, Charles K. Brown, Reg. Land Surv., 32 Wilson Road, Stoneham, Mass.", which plan is recorded with said Deeds as Plan No. 981 of 1977, and bounded and described as follows:

Beginning at the Southwesterly corner thereof at Great Road and at Lot 2, thence running N30-26-25W, 70.14 feet to Massachusetts Highway Boundary, thence turning and running N37-24-54W, 138.37 feet to Massachusetts Highway Boundary and 124.71 feet to a stone wall as shown on said plan, the last three (3) boundaries being by said Great Road, thence turning and running N50-00-17E, by said stone wall 51.57 feet thence S66-13-25E, 261.11 feet by said stone wall to a point, thence running S67-42-33E, 150.01 feet to a point and S66-35-10E, 2.62 feet to Lot 2 as shown on said plan. The last four (4) courses being by land now or formerly of the Village Arms Trust; thence turning and running S58-13-35W, 260.88 feet by said Lot 2 to the point of beginning.

Containing 50,747 square feet of land and being Lot 1 on said Plan however otherwise bounded, measured or described.

For Grantor's title see Deed of Ralph T. Eriksen and Tillie Eriksen, dated August 30, 1977 and recorded with Middlesex South District Registry of Deeds in Book 13276 Page 235.

Witness the execution hereof under seal this 8th day of November, 2012.

The Brookside Farm of Acton, Inc.

Helen Rotondo, President

Joseph M. Rotondo, Treasurer

STATE OF MAINE

Cumberland, ss.

On this 8 day of November, 2012, before me, the undersigned notary public, personally appeared Helen Rotondo and Joseph M. Rotondo, proved to me through satisfactory evidence of identification, which were valid drivers' licenses, to be the persons whose names are signed on the preceding document, and acknowledged that they executed the same voluntarily for its stated purpose, as President and Treasurer of The Brookside Farm of Acton, Inc., respectively.

Teresa A Thurlow

, Notary Public

My Commission Expires:

TERESA A. THURLOW
NOTARY PUBLIC, STATE OF MAINE
MY COMMISSION EXPIRES JAN. 25, 2015

3.6 DRAINAGE CALCULATIONS
for
429 Great Road
Acton, MA

PREPARED FOR:

Country Properties, LLC
6 ProctorStreet
Acton, MA 01720

PREPARED BY:

Stamski and McNary, Inc.
1000 Main Street
Acton, MA 01720

Engineering-Planning-Surveying

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Post-Development Hydrology

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Groundwater Recharge Calculations

Inlet Grate Capacity Calculations

Infiltration Trench Sizing Calculations

TSS Removal Calculations

Groundwater Mounding Calculations

Storm Sewer Design

Soil Evaluation

Operation and Maintenance Manual

Drainage Maps

Narrative

STORMWATER MANAGEMENT

The site is located at 429 Great Road in Acton, Massachusetts and is approximately 1.16 acres in size and has been previously developed. There is an existing building with a paved parking lot, and a detached barn located on the site. The Natural Resource Conservation Service (N.R.C.S.) soil survey report for Middlesex County and associated soil map for Acton indicates that soils located on the site are Merrimac-Urban Land Complex and Charlton-Urban land-Hollis Complex. Merrimac-Urban Land Complex and Charlton-Urban land-Hollis Complex. are in Hydrologic Group A.

Pre-Development

The site is comprised of one subcatchment. Subcatchment E1 contains the existing building, barn, and the paved parking lot. This subcatchment ultimately drains to the Wetland off-site to the east. The subcatchment can be seen on the attached drainage maps.

Post-Development

The fully developed site will consist of the proposed building, paved driveway, and a walkway. The post-development site has been divided into four subcatchments. Subcatchment P1A contains the lawn and landscaped areas surrounding the building and driveway. The subcatchment drains to the Wetland located off-site to the east. Subcatchment P1B contains a portion of the lawn and driveway. The runoff is collected through three catchbasins, directed into a manhole containing a Contech CDS 2015-4 unit, and infiltrated through a subsurface infiltration area. Subcatchment P1C contains a portion of the landscaped area around the building and a portion of the driveway. The runoff is collected through a catchbasin, directed into a manhole containing a Vortsentry HS36 unit, and infiltrated through a subsurface infiltration area. Subcatchment P1D contains the remaining portion of the driveway. The runoff is directed away from the building towards an 8" stone diaphragm, 3' filter strip and into an infiltration trench. All roof runoff from the building will be collected and infiltrated in a roof drywell.

This project would qualify as a "Redevelopment Project" as defined by the Stormwater Management Standards but all standards have been met. The following describes the drainage system and the project's compliance with the Stormwater Management Standards.

The proposed impervious surface within the Great Road right of way has been decreased by approximately 130 s.f. Therefore, the proposed runoff within the right of way has not been analyzed.

Standard #1 Untreated direct discharge of Stormwater:

The untreated Stormwater standard states that there will be no untreated stormwater point source discharge to resource areas. Point source runoff from all areas with impervious cover drains to either the Subsurface Infiltration Areas, Infiltration Trench or roof drywell. All Stormwater Management Areas retain and recharge the runoff. No discharge is proposed from any of the proposed Stormwater BMPs.

Standard #2 Post-Development Peak Discharge:

The Stormwater Management Policy requires that peak discharge rates for the 2-year and 10-year storm events not be increased from pre-development conditions. Furthermore, the 100-year storm event will not increase flooding impacts offsite.

Attenuation of peak discharge rates will be accomplished by using infiltration.

The following table summarizes the peak runoff rates to the overland flow discharge points.

Discharge Summary Table

Total Runoff

2-year Storm		10-year Storm		100-year Storm	
Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
0.009	0.000	0.179	0.007	0.877	0.118

Detailed Calculations are attached.

Standard #3 Recharge to Groundwater:

This standard prescribes the stormwater volume that must be recharged to groundwater based on the existing site soil conditions. The Natural Resources Conservation Service (N.R.C.S.) Middlesex Soil Survey map indicates that the site contains soils in hydrologic group A. The stormwater management Policy requires 0.6 inches of runoff over the total impervious area to be recharged in areas with the respective soil groups. Furthermore the town's regulations require that the annual water budget is balanced to preserve groundwater supply. Detailed "Water Balance Calculations" showing compliance with this standard are attached.

Standard #4 TSS Removal:

The required water quality volume for this project is 1" of runoff over the impervious area for the subsurface infiltration structures since the infiltration rate is greater than 2.4 inches per hour. This volume will be treated to meet the 80% TSS removal requirement of Standard 4. Also, 44% TSS removal will be provided prior to infiltration. Calculations showing treatment levels are attached.

Standard #5 Higher Potential Pollutant Loads:

The site is not considered to have a "Higher Potential Pollutant Load" as defined in the Stormwater Management Policy.

Standard #6 Protection of Critical Areas:

The site does not discharge runoff to critical areas.

Standard #7 Redevelopment Projects:

The proposed project qualifies as redevelopment but meets all the requirements for new development.

Standard #8 Erosion/Sediment Control:

Erosion and sediment controls are incorporated into the project design to prevent erosion, control sediment movement, and stabilize exposed and disturbed soils during construction. Temporary erosion and sedimentation controls during construction include minimizing areas of exposed soil, directing and controlling runoff, and rapidly stabilizing exposed areas. Soils left exposed for extended periods will be mulched and seeded for temporary vegetative cover. Following construction, exposed areas will be permanently vegetated with appropriate ground cover. Erosion and sedimentation control measures will be maintained throughout all phases of construction. Inspections will be made regularly and after rainfalls exceeding 0.5 inches in a 24-hour period during construction. The contractor will be required to inspect erosion and sedimentation control measures at the end of each workday, when precipitation is forecasted, and after each rainfall. All measures will be inspected prior to each weekend. The contractor will replace and repair any malfunctioning or damaged control measures including vegetative stabilization.

Long term erosion and sedimentation control will be realized using the Best Management Practices described previously. Areas where soils have been disturbed will be loamed and vegetated with lawn, trees, and shrubs.

Standard #9 Operation and Maintenance Plan:

An Operation and Maintenance plan has been prepared and is shown on the plan set.

Standard #10 Illicit Discharges to Drainage System:

No known illicit discharges exist and none are proposed.

Design Basis

1. The rational method (Q=CIA) was used as a basis for sizing pipes. Runoff Coefficients: C=0.15 for woods, 0.20 for grass/landscaped areas, 0.76 for gravel, and 0.90 for impervious surfaces.
2. The 100-year storm was used for sizing pipes. Rainfall intensity values were taken from the U.S. Weather Bureau Technical Paper 40.
3. The United States Department of Agriculture Natural Resource Conservation Service (N.R.C.S.) TR55 methodology was used to determine offsite rates of runoff.
4. The twenty-four hour rainfall, taken from N.R.C.S. publications, is 6.4 inches for the 100-year storm, 4.5 inches for the 10-year storm, and 3.1 inches for the 2-year storm event.
5. The hydrologic calculations were performed using the computer program: "Hydraflow Hydrographs 2007" by Intelisolve.
6. The soil types of the site were taken from the N.R.C.S. Soil Survey Map from nesoil.com.
7. Soil conditions and estimated seasonal high groundwater table were based on on-site soil evaluations.
8. The Hantoush Method was used for Mounding analysis.

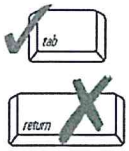
Checklist for Stormwater Report

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

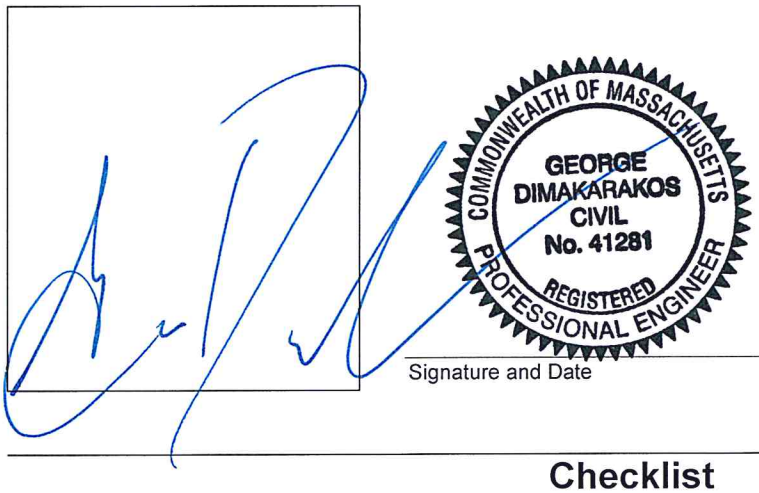
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Subsurface Drainage Structure

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

☐ is within the Zone II or Interim Wellhead Protection Area

☐ is near or to other critical areas

☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Pre-Development Hydrology

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.009	2	904	252	----	------	------	E1

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.179	2	744	1,573	----	------	------	E1

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.877	2	734	4,683	----	------	------	E1

Worksheet 2: Runoff curve number and runoff SM-5369

Project: 429 Great Rd By JTM Date 4/13/16

Location: Acton, MA Checked _____ Date _____

Circle one: [Present] Developed E1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
A	Woods	30			0.31	9.23
A	Open	39			0.66	25.74
	Impervious	98			0.21	20.45
Totals =					1.18	55.43

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{55.43}{1.18} = 47.11$; Use CN = 47.1

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.06	0.38	1.12
Runoff, Q.....	cf	258	1610	4793

(210-VI-TR-55, Second Ed., June 1986)

Project: 429 Great Rd By JTM Date 4/13/2016

Location: Acton, MA Checked _____ Date _____

Circle one: Present / Developed E1

Circle one: Tc / Tt through subarea _____

Sheet flow (Applicable to Tc only)		Segment ID	A-B	B-C			
1. Surface Description (table 3-1)			Woods	Grass			
2. Mannings roughness coeff., n (table 3-1)			0.4	0.24			
3. Flow length, L (total L <= 300 ft)		ft	42	8			
4. Two-yr 24-hr rainfall, P2		in	3.1	3.1			
5. Land Slope, s		ft/ft	0.0333	0.013			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.15	0.04			0.19
Shallow concentrated Flow		Segment ID	C-D	D-E	E-F	F-G	G-H
7. Surface Description (paved or unpaved)			unpaved	paved	unpaved	paved	unpaved
8. Flow Length, L		ft	185	25	86	20	182
9. Watercourse slope, s		ft/ft	0.02	0.02	0.02	0.013	0.015
10. Average Velocity, V (figure 3-1)		ft/s	2.28	2.87	2.28	2.32	1.98
11. Tt = L / 3600V	Compute Tt	hr	0.02	0.00	0.01	0.00	0.03	0.06
Channel flow		Segment ID					
12. Cross sectional flow area, a		sf					
13. Wetted perimeter, pw		ft					
14. Hydraulic radius, r=a/wp	Compute r	ft					
15. Channel Slope, s		ft/ft					
16. Manning's roughness coeff., n							
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s					
18. Flow length, L		ft					
19. Tt = L / 3600V	Compute Tt	hr					0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.25 min 15.0

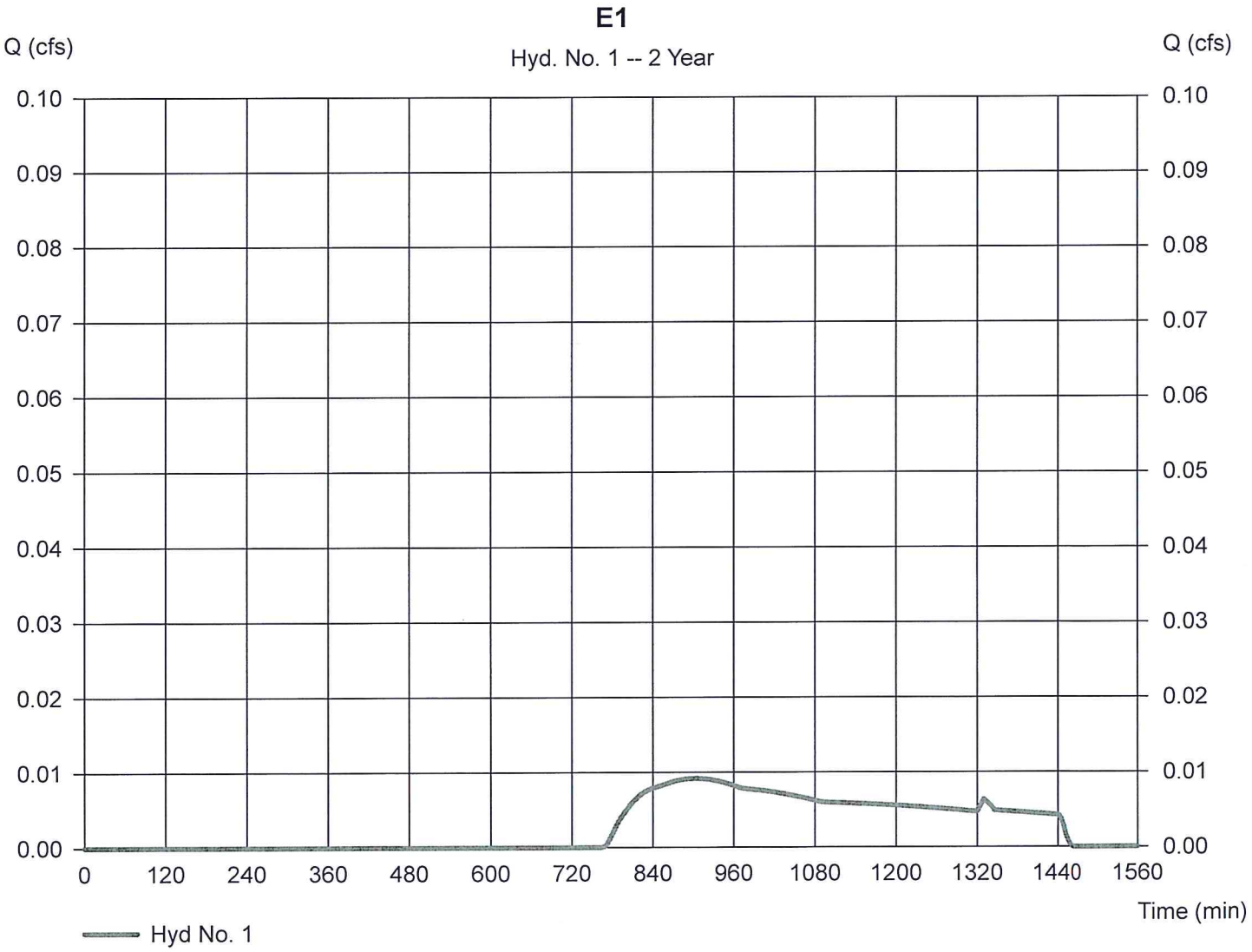
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 1

E1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.009 cfs
Storm frequency	= 2 yrs	Time to peak	= 904 min
Time interval	= 2 min	Hyd. volume	= 252 cuft
Drainage area	= 1.180 ac	Curve number	= 47.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 15.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



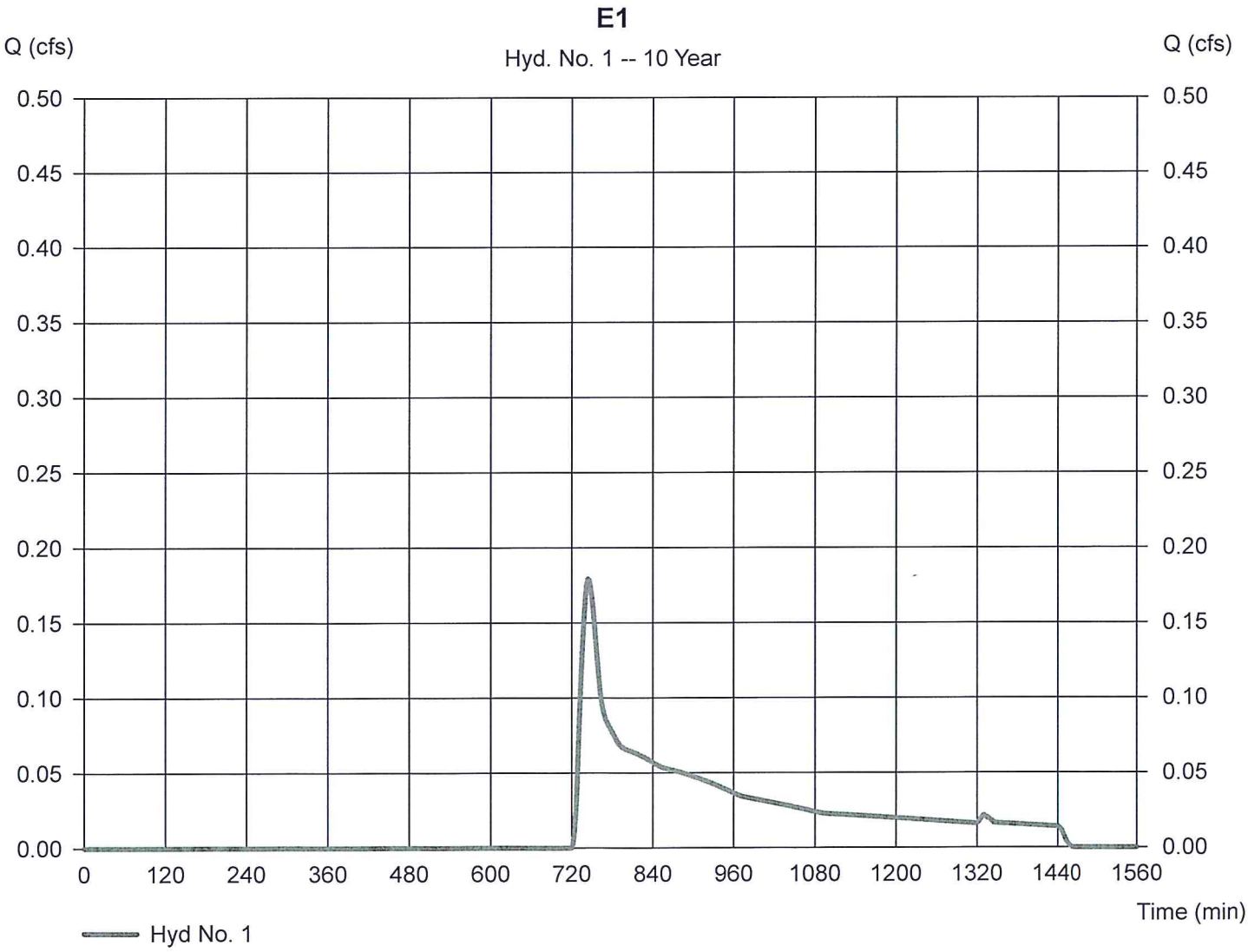
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 1

E1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.179 cfs
Storm frequency	= 10 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 1,573 cuft
Drainage area	= 1.180 ac	Curve number	= 47.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 15.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



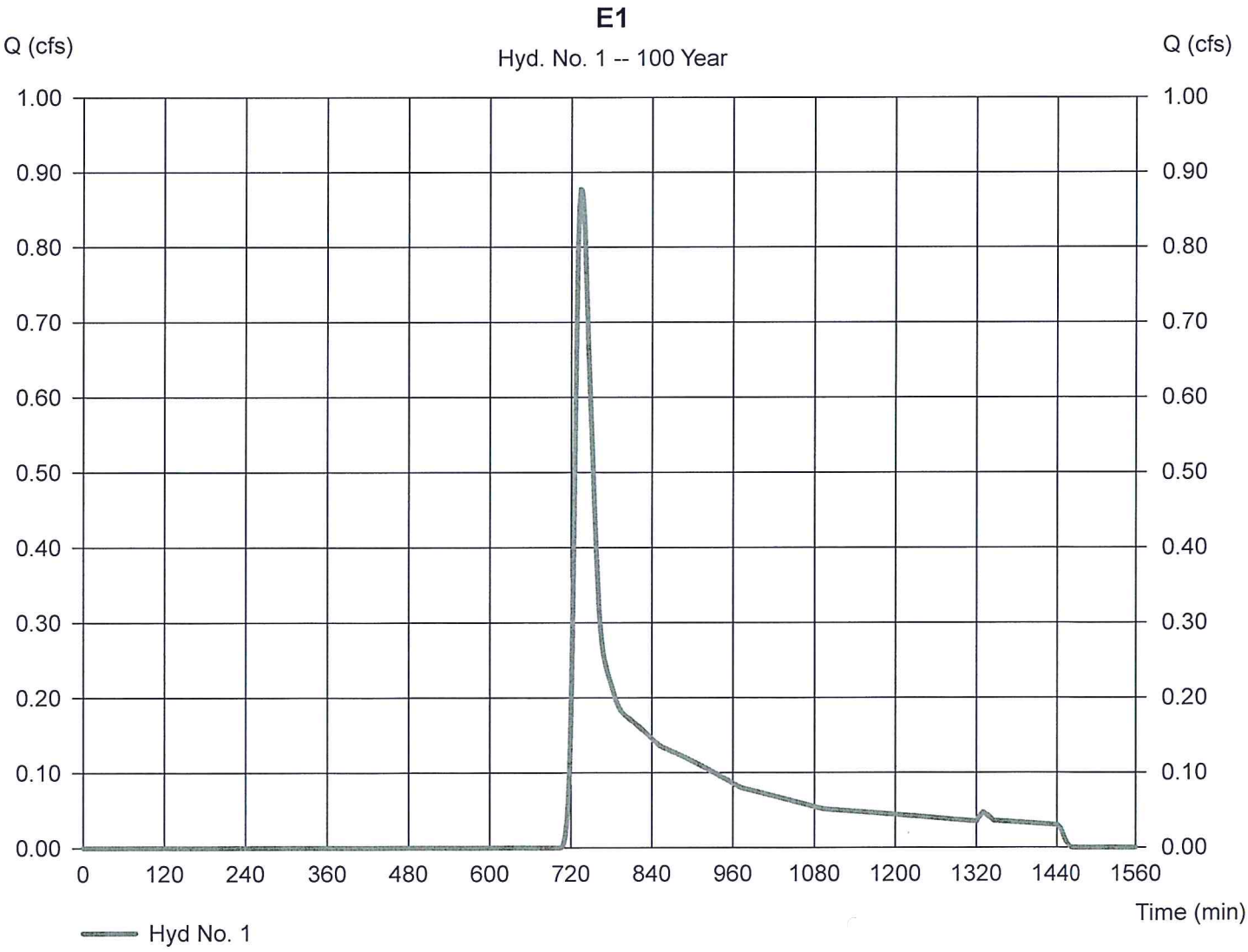
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 1

E1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.877 cfs
Storm frequency	= 100 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 4,683 cuft
Drainage area	= 1.180 ac	Curve number	= 47.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Post-Development Hydrology

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.000	2	n/a	0	----	------	------	P1A
2	SCS Runoff	0.357	2	724	1,084	----	------	------	P1B
3	Reservoir	0.166	2	734	1,084	2	200.90	113	Infiltration Area 1
4	SCS Runoff	0.290	2	724	976	----	------	------	P1C
5	Reservoir	0.102	2	738	976	4	198.69	142	Infiltration Area 2
6	SCS Runoff	0.696	2	724	2,342	----	------	------	Roof
7	Reservoir	0.239	2	738	2,342	6	201.98	356	Roof Drywell

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.007	2	886	182	----	------	------	P1A
2	SCS Runoff	0.681	2	724	2,036	----	------	------	P1B
3	Reservoir	0.205	2	744	2,036	2	201.42	400	Infiltration Area 1
4	SCS Runoff	0.424	2	724	1,451	----	------	------	P1C
5	Reservoir	0.120	2	742	1,451	4	199.11	280	Infiltration Area 2
6	SCS Runoff	1.017	2	724	3,483	----	------	------	Roof
7	Reservoir	0.281	2	742	3,483	6	202.43	690	Roof Drywell

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.118	2	738	977	----	------	------	P1A
2	SCS Runoff	1.148	2	724	3,454	----	------	------	P1B
3	Reservoir	0.281	2	746	3,454	2	202.41	892	Infiltration Area 1
4	SCS Runoff	0.605	2	724	2,097	----	------	------	P1C
5	Reservoir	0.150	2	744	2,097	4	199.86	476	Infiltration Area 2
6	SCS Runoff	1.452	2	724	5,032	----	------	------	Roof
7	Reservoir	0.363	2	744	5,032	6	203.29	1,160	Roof Drywell

Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Friday, Apr 22, 2016

Pond No. 1 - Infiltration Area 1

Pond Data

UG Chambers - Invert elev. = 201.00 ft, Rise x Span = 1.33 x 2.83 ft, Barrel Len = 28.48 ft, No. Barrels = 7, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 200.50 ft, Width = 3.54 ft, Height = 2.33 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	200.50	n/a	0	0
0.23	200.73	n/a	66	66
0.47	200.97	n/a	66	132
0.70	201.20	n/a	133	264
0.93	201.43	n/a	142	407
1.17	201.67	n/a	138	544
1.40	201.90	n/a	129	674
1.63	202.13	n/a	116	790
1.86	202.36	n/a	90	880
2.10	202.60	n/a	66	946
2.33	202.83	n/a	66	1,012

Culvert / Orifice Structures

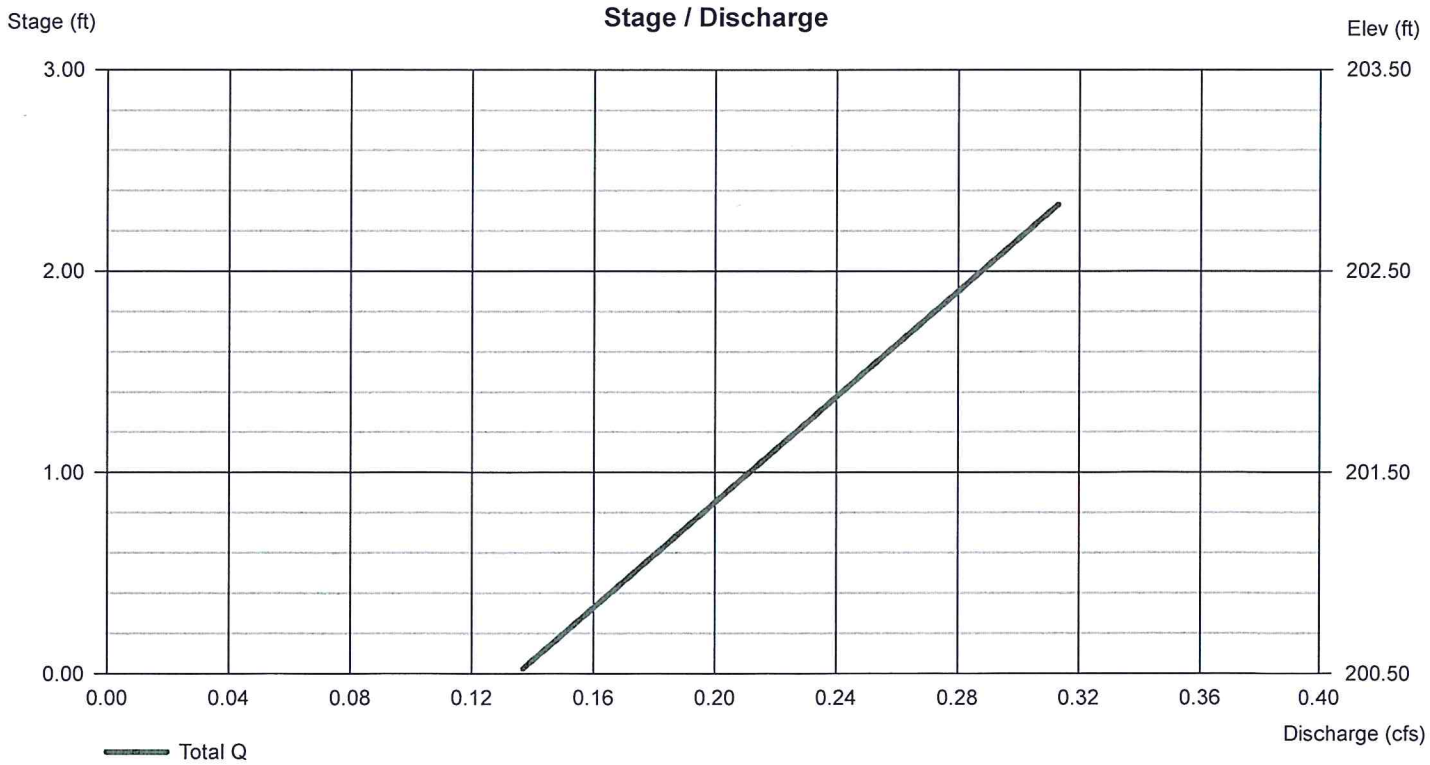
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

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

Exfil.(in/hr) = 8.270 (by Wet area)
TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Pond No. 2 - Infiltration Area 2

Pond Data

UG Chambers - Invert elev. = 198.50 ft, Rise x Span = 1.33 x 2.83 ft, Barrel Len = 21.36 ft, No. Barrels = 5, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 198.00 ft, Width = 3.63 ft, Height = 2.33 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	198.00	n/a	0	0
0.23	198.23	n/a	36	36
0.47	198.47	n/a	36	72
0.70	198.70	n/a	72	144
0.93	198.93	n/a	77	222
1.17	199.17	n/a	75	296
1.40	199.40	n/a	70	366
1.63	199.63	n/a	63	430
1.86	199.86	n/a	49	479
2.10	200.10	n/a	36	515
2.33	200.33	n/a	36	551

Culvert / Orifice Structures

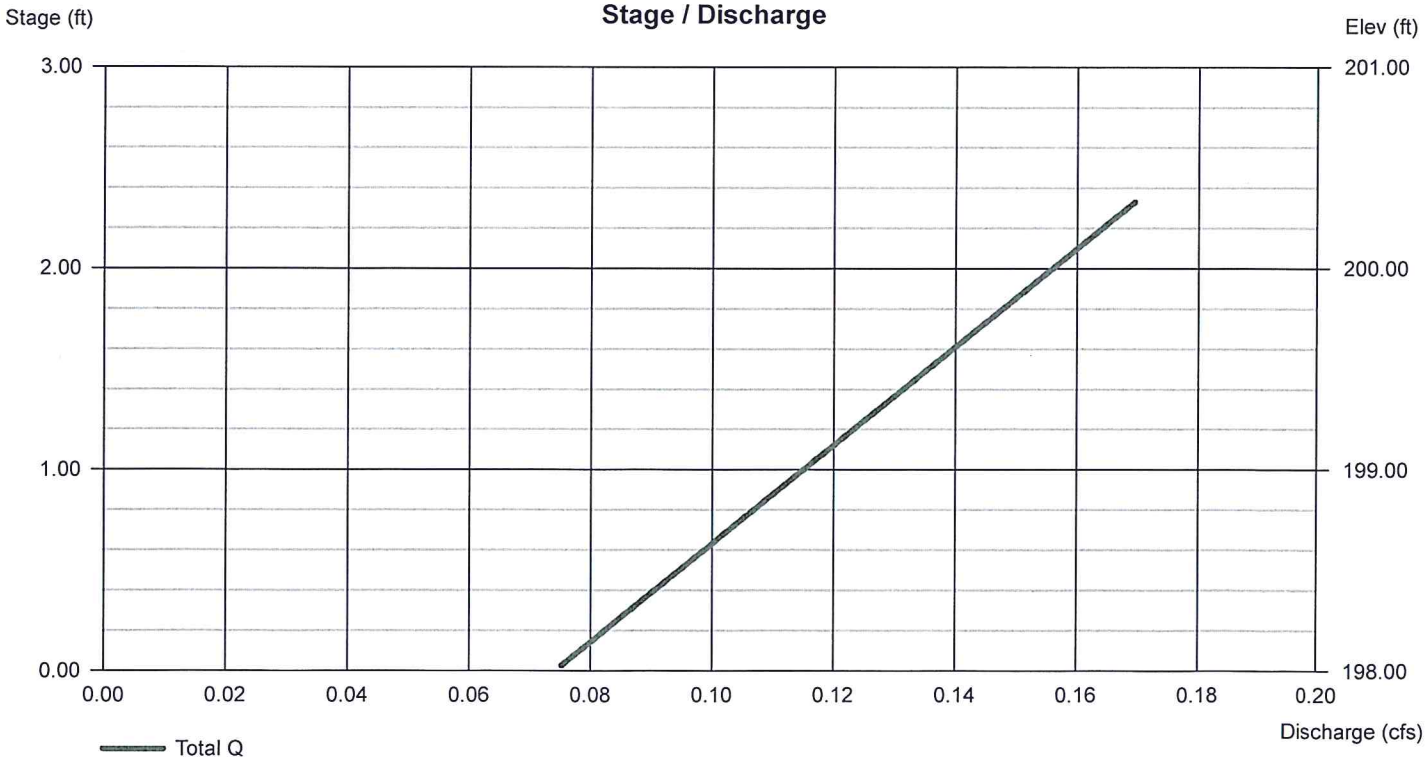
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

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

Exfil.(in/hr) = 8.270 (by Wet area)
TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Pond No. 4 - Roof Drywell

Pond Data

UG Chambers - Invert elev. = 201.75 ft, Rise x Span = 1.33 x 2.83 ft, Barrel Len = 35.60 ft, No. Barrels = 7, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 201.25 ft, Width = 3.54 ft, Height = 2.33 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	201.25	n/a	0	0
0.23	201.48	n/a	82	82
0.47	201.72	n/a	82	164
0.70	201.95	n/a	166	331
0.93	202.18	n/a	178	509
1.17	202.42	n/a	172	680
1.40	202.65	n/a	162	842
1.63	202.88	n/a	146	988
1.86	203.11	n/a	112	1,100
2.10	203.35	n/a	82	1,182
2.33	203.58	n/a	82	1,264

Culvert / Orifice Structures

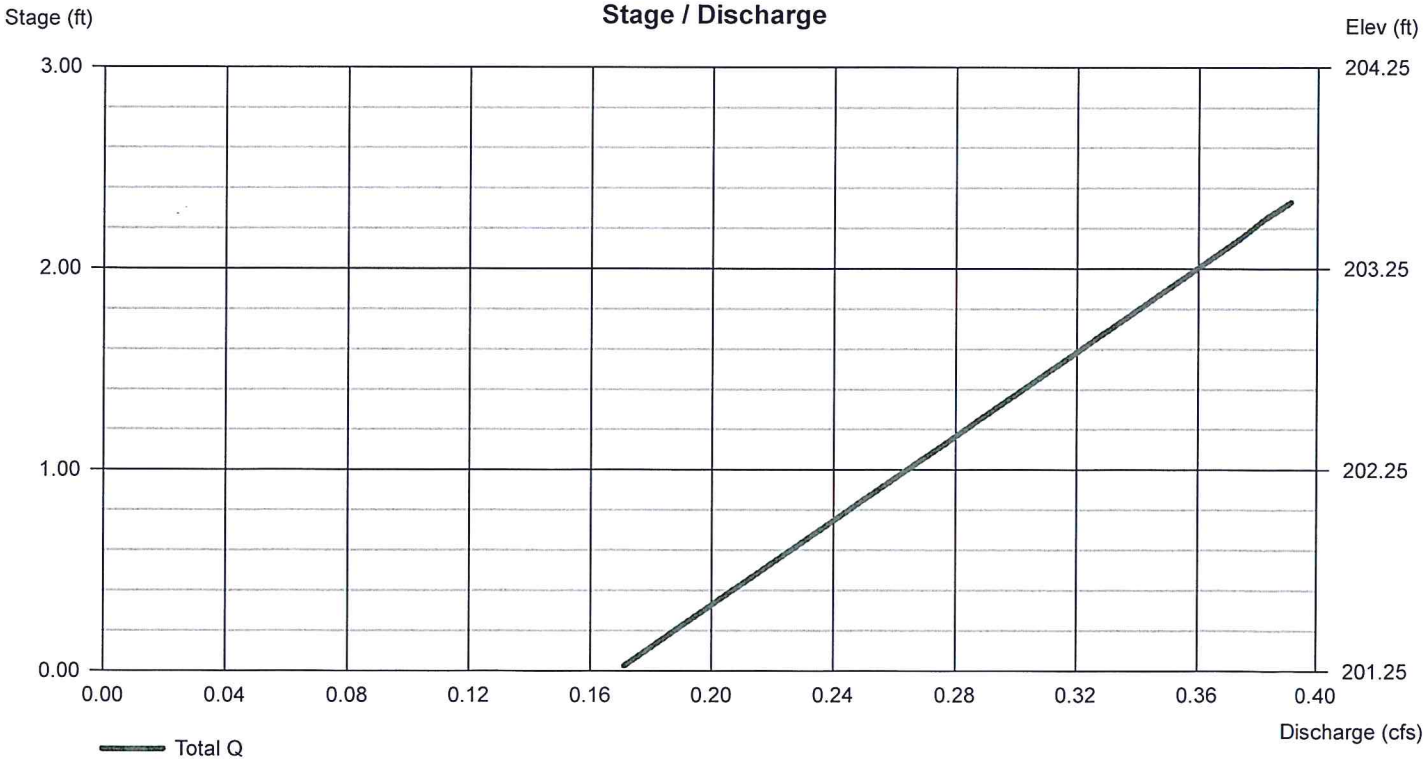
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

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

Exfil.(in/hr) = 8.270 (by Wet area)
TW Elev. (ft) = 0.00

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



Worksheet 2: Runoff curve number and runoff SM-5369

Project: 429 Great Rd By JTM Date 4/14/16

Location: Acton, MA Checked _____ Date _____

Circle one: Present [Developed] P1A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
A	Woods	30			0.02	0.70
A	Open	39			0.51	19.80
	Impervious	98			0.00	0.00
Totals =					0.53	20.50

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{20.50}{0.53} = 38.61$; Use CN = 38.6

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.00	0.10	0.54
Runoff, Q.....	cf	1	195	1045

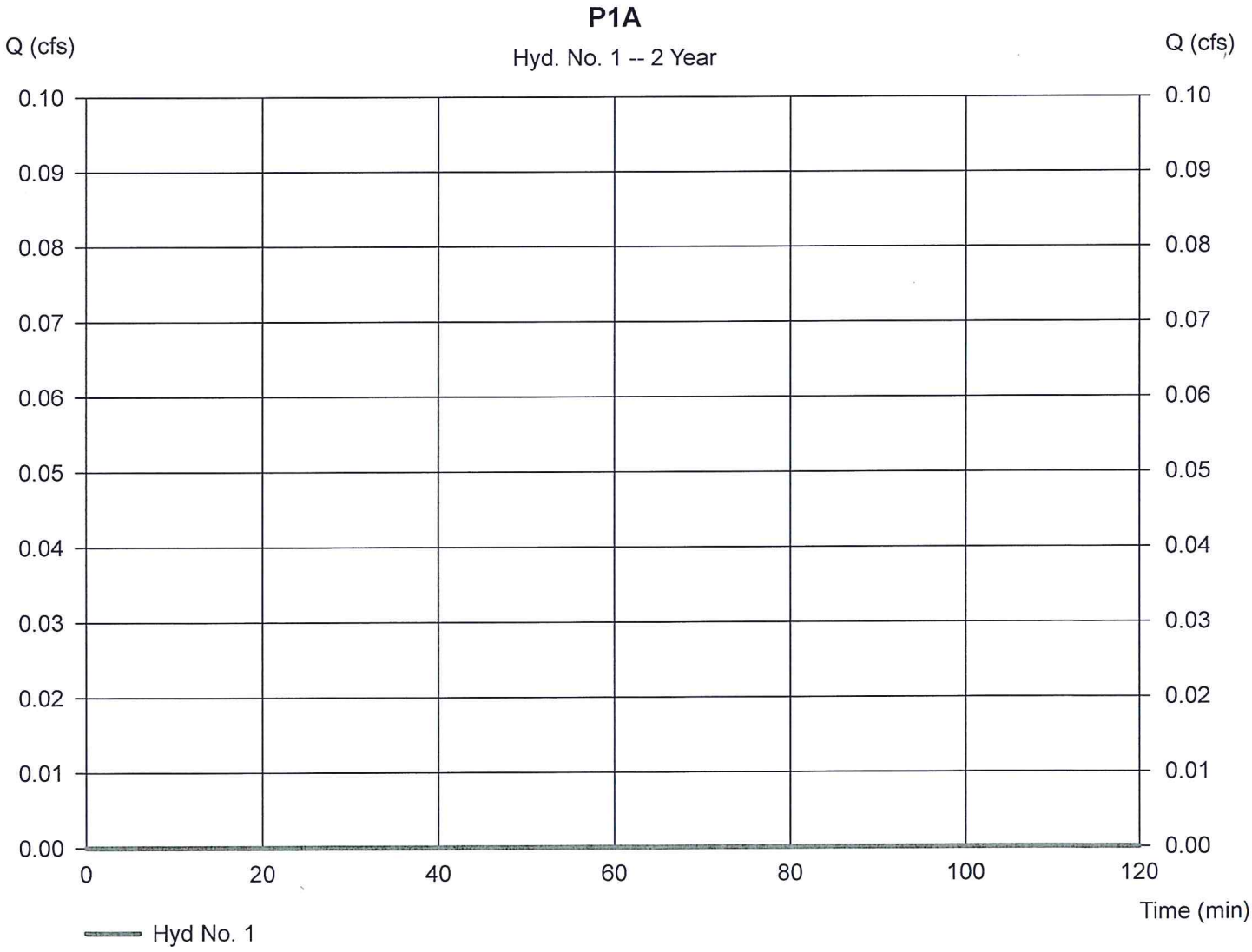
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 1

P1A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.530 ac	Curve number	= 38.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



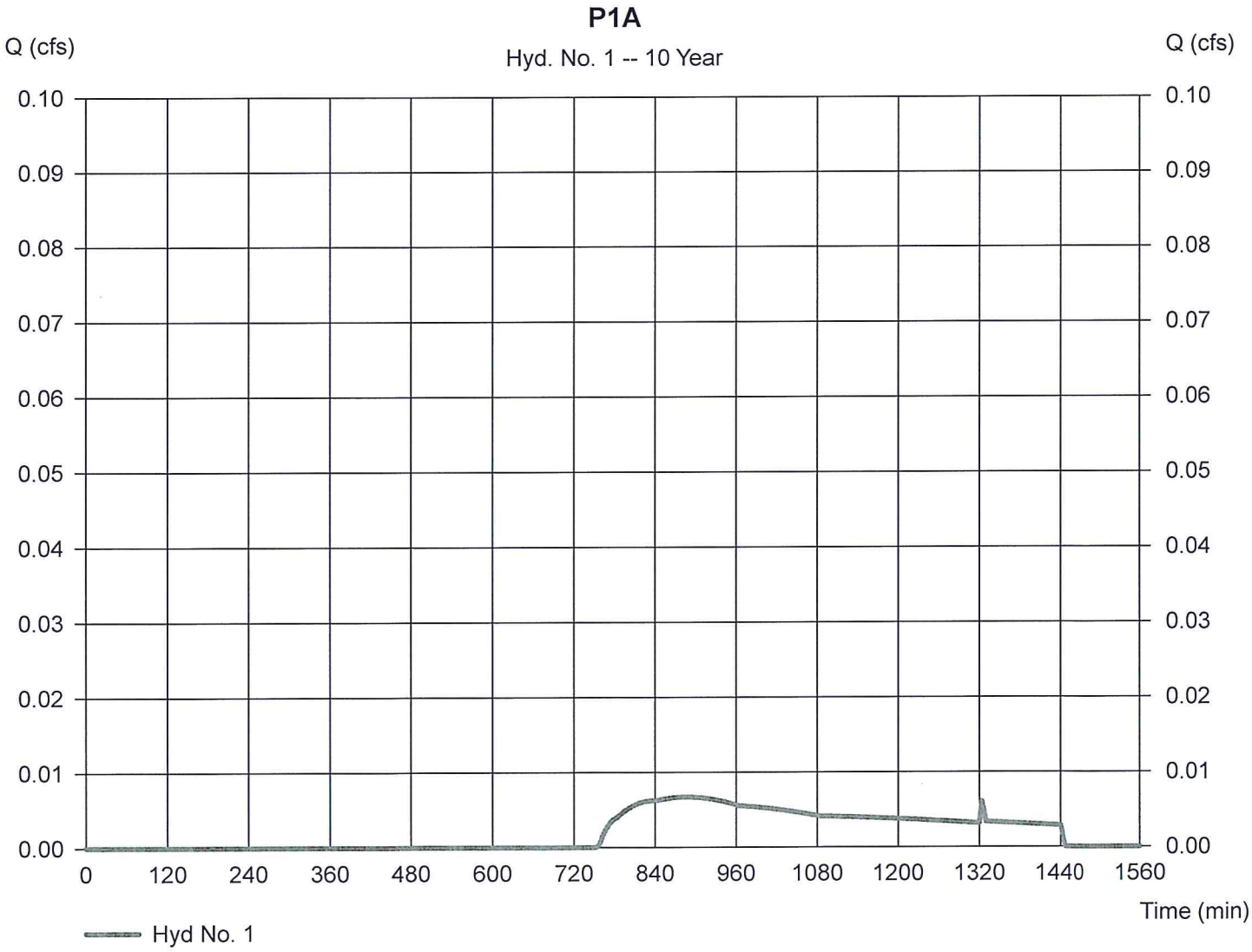
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 1

P1A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.007 cfs
Storm frequency	= 10 yrs	Time to peak	= 886 min
Time interval	= 2 min	Hyd. volume	= 182 cuft
Drainage area	= 0.530 ac	Curve number	= 38.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



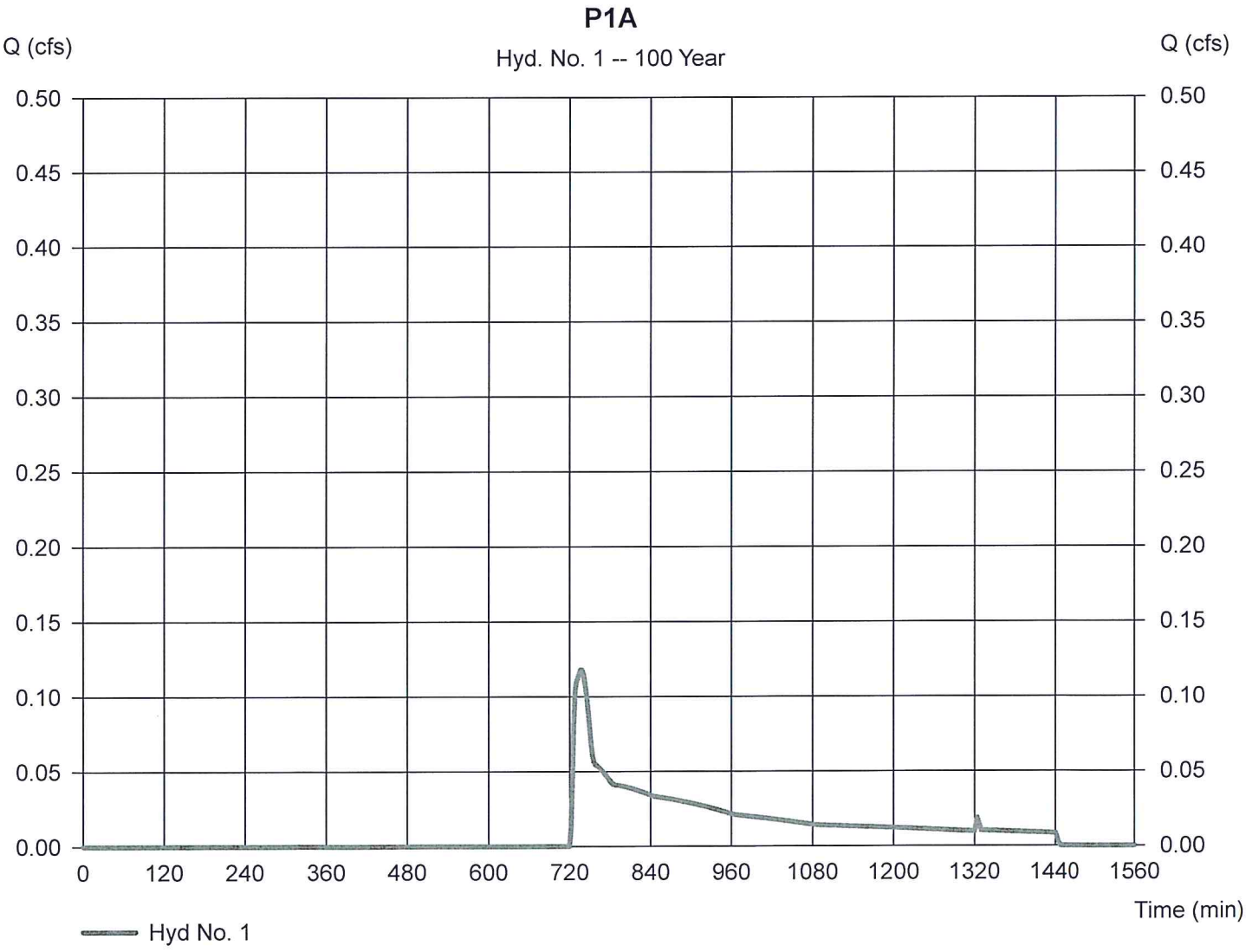
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 1

P1A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.118 cfs
Storm frequency	= 100 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 977 cuft
Drainage area	= 0.530 ac	Curve number	= 38.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-5369

Project: 429 Great Rd By JTM Date 4/14/16

Location: Acton, MA Checked _____ Date _____

Circle one: Present [Developed] P1B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
A	Woods	30			0.00	0.00
A	Open	39			0.08	3.14
	Impervious	98			0.17	16.86
Totals =					0.25	20.01

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{20.01}{0.25}$ = 79.19 ; Use CN = 79.2

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	1.27	2.39	4.06
Runoff, Q.....	cf	1168	2194	3722

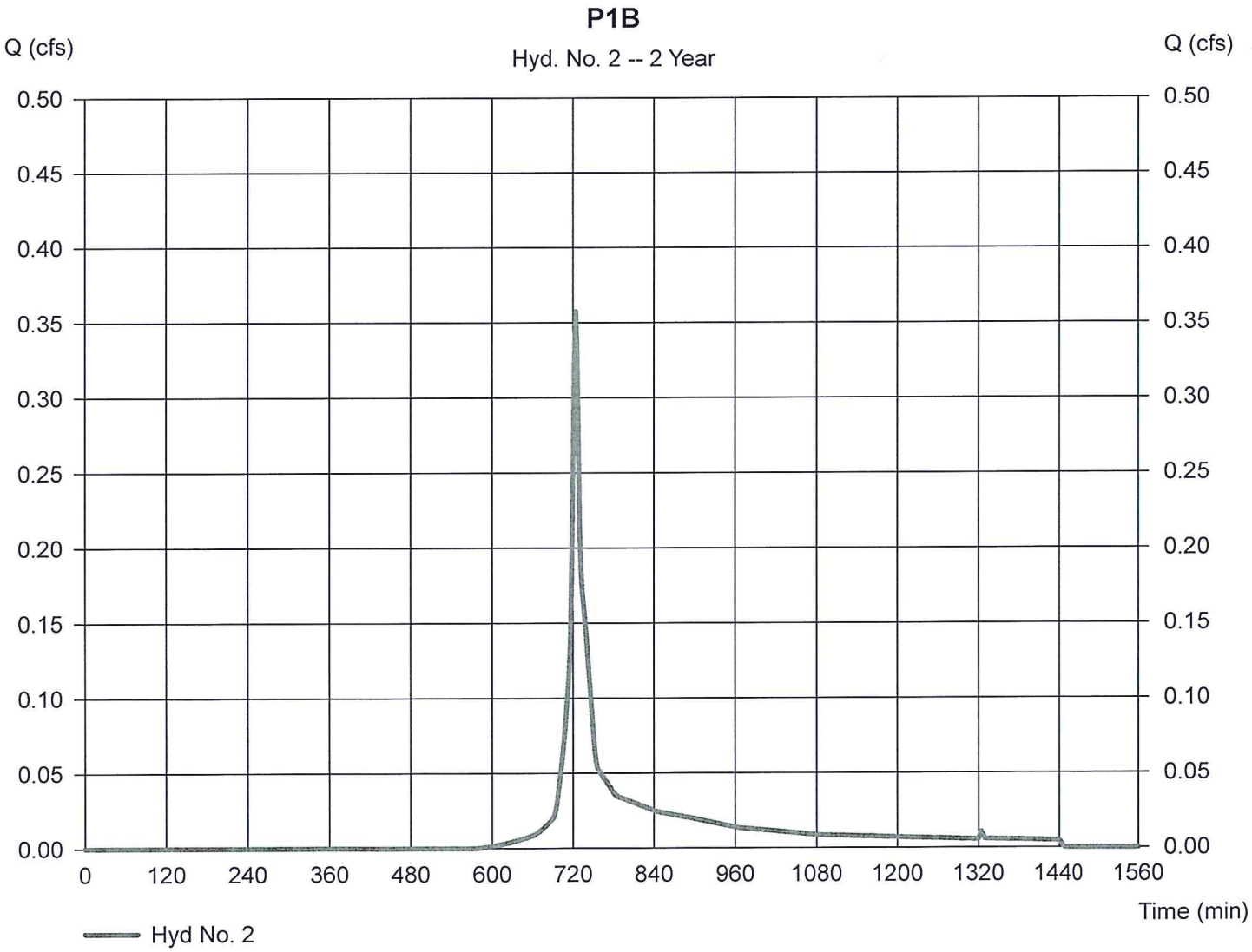
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 2

P1B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.357 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,084 cuft
Drainage area	= 0.250 ac	Curve number	= 79.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



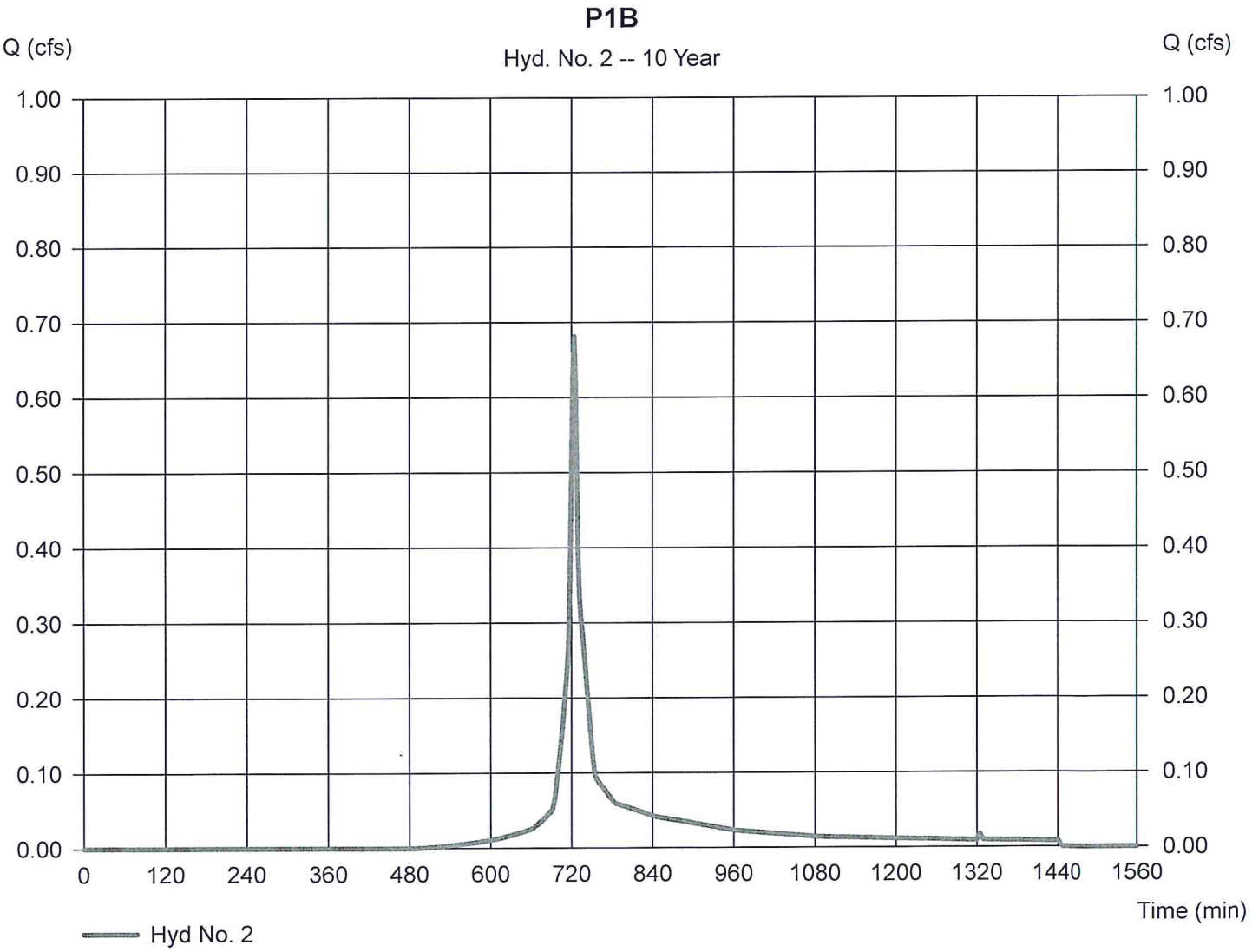
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 2

P1B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.681 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 2,036 cuft
Drainage area	= 0.250 ac	Curve number	= 79.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



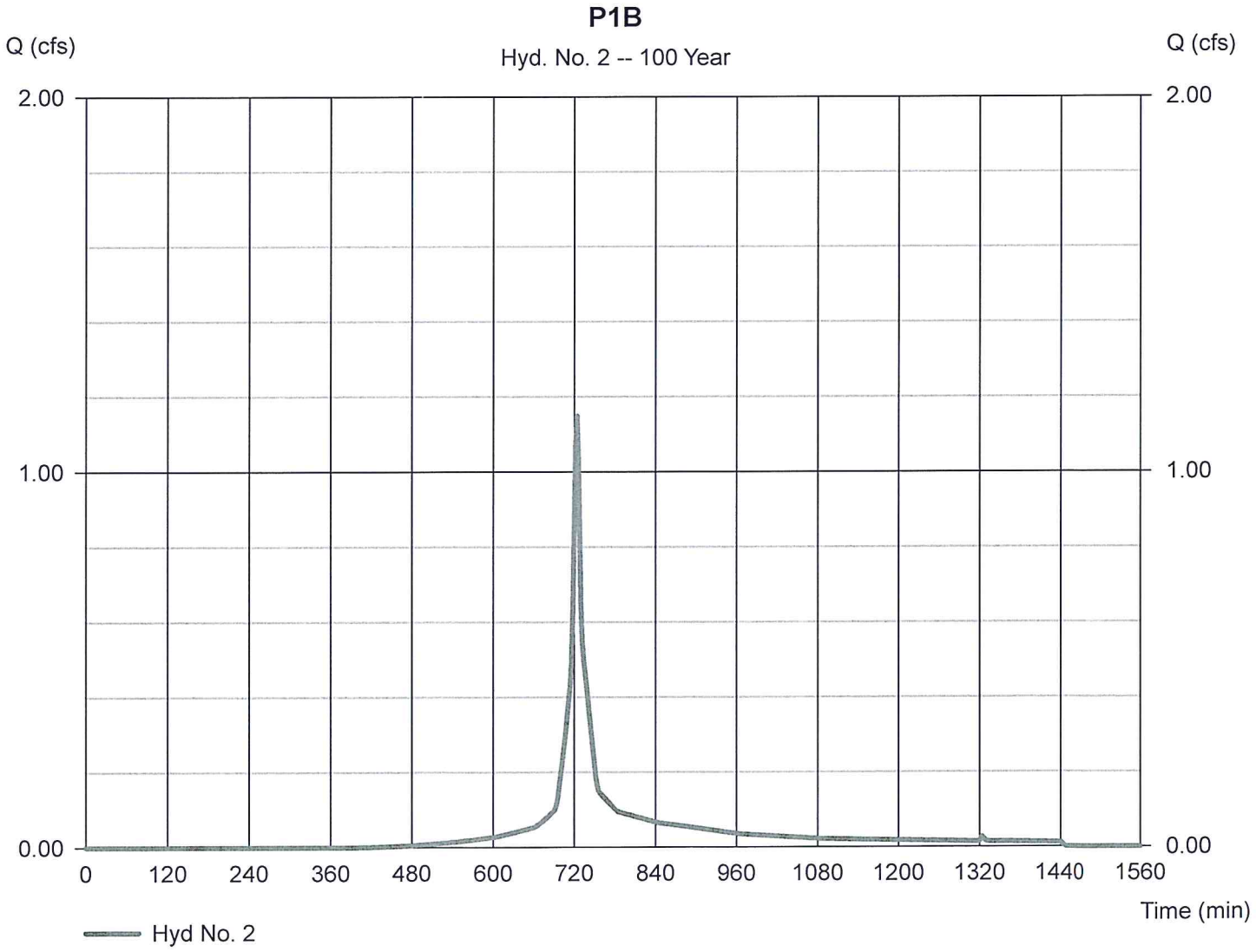
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 2

P1B

Hydrograph type	= SCS Runoff	Peak discharge	= 1.148 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 3,454 cuft
Drainage area	= 0.250 ac	Curve number	= 79.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

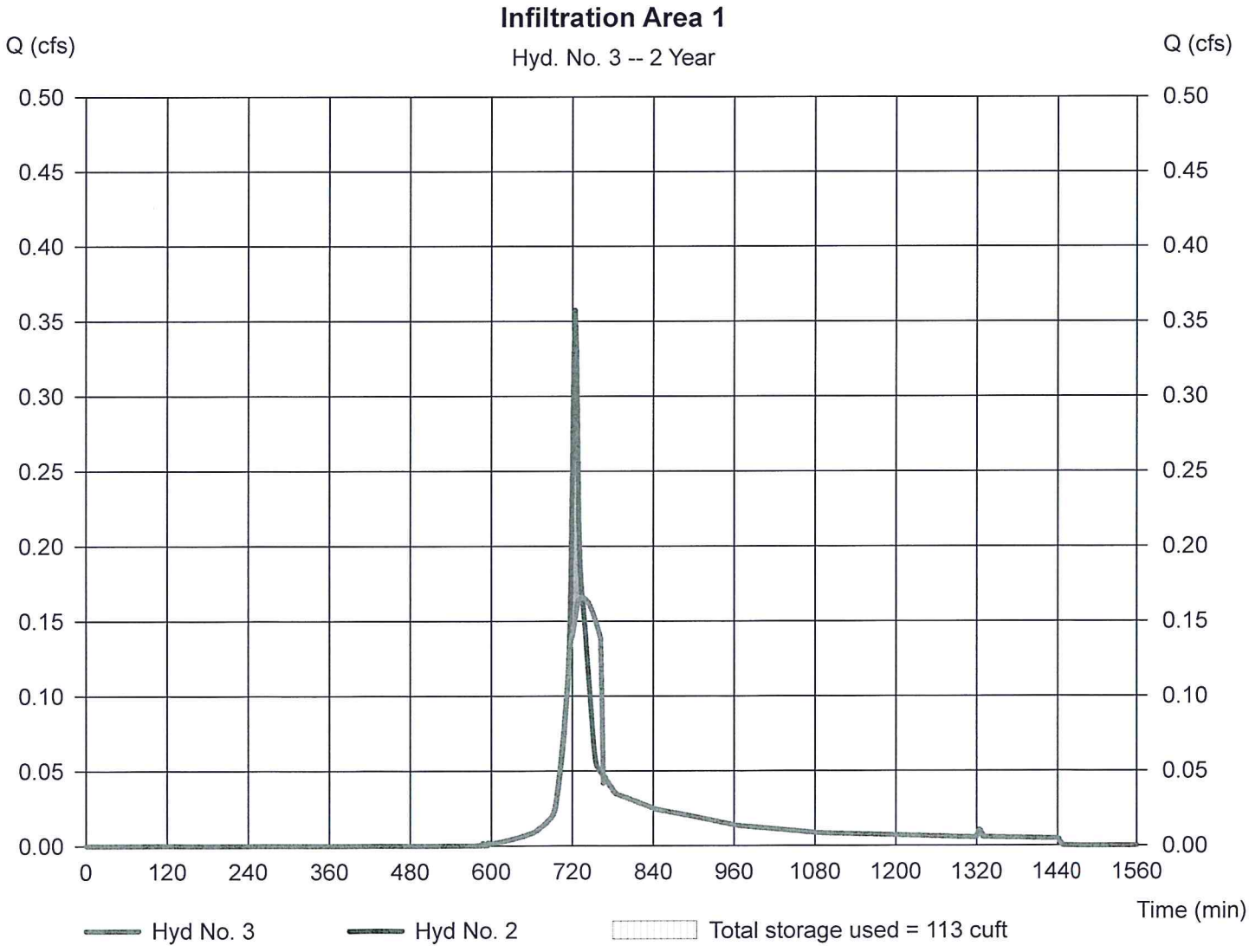
Hydraflow Hydrographs by Intelisolve v9.2 — Friday, Apr 22, 2016

Hyd. No. 3

Infiltration Area 1

Hydrograph type	= Reservoir	Peak discharge	= 0.166 cfs
Storm frequency	= 2 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 1,084 cuft
Inflow hyd. No.	= 2 - P1B	Max. Elevation	= 200.90 ft
Reservoir name	= Infiltration Area 1	Max. Storage	= 113 cuft

Storage Indication method used. Outflow includes exfiltration.



Hydrograph Report

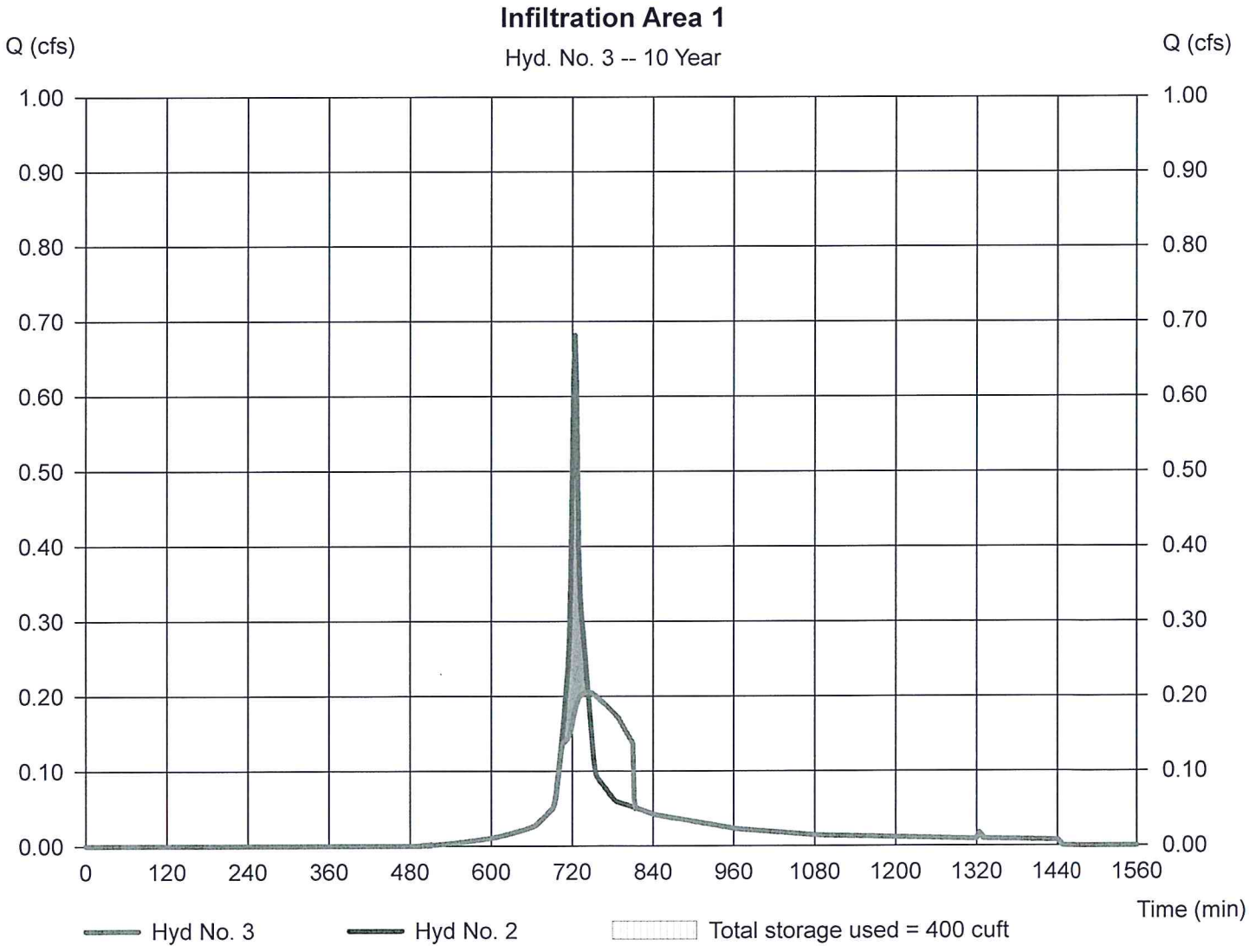
Hydraflow Hydrographs by Intelisolve v9.2 — Friday, Apr 22, 2016

Hyd. No. 3

Infiltration Area 1

Hydrograph type	= Reservoir	Peak discharge	= 0.205 cfs
Storm frequency	= 10 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 2,036 cuft
Inflow hyd. No.	= 2 - P1B	Max. Elevation	= 201.42 ft
Reservoir name	= Infiltration Area 1	Max. Storage	= 400 cuft

Storage Indication method used. Outflow includes exfiltration.



Hydrograph Report

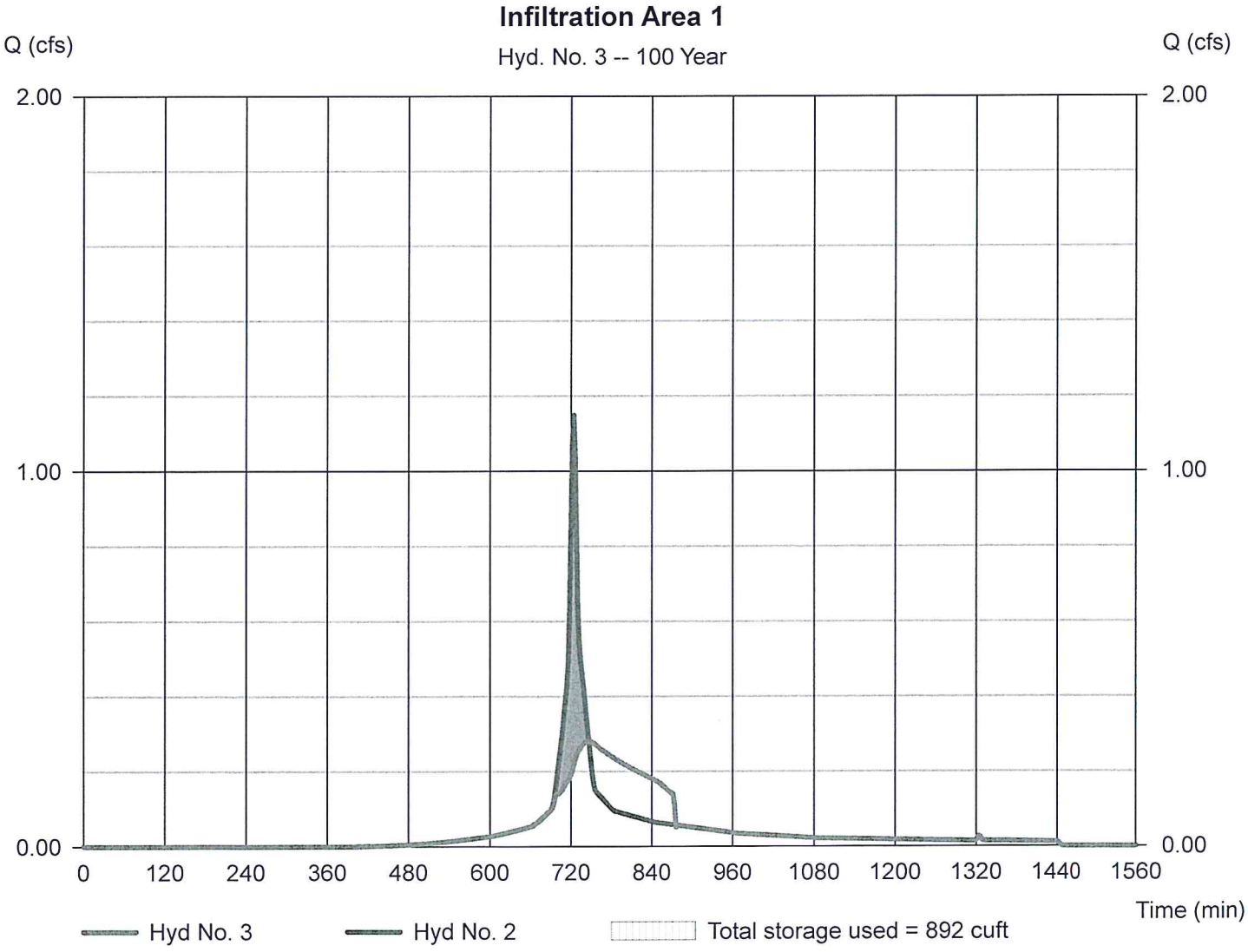
Hydraflow Hydrographs by Intelisolve v9.2 — Friday, Apr 22, 2016

Hyd. No. 3

Infiltration Area 1

Hydrograph type	= Reservoir	Peak discharge	= 0.281 cfs
Storm frequency	= 100 yrs	Time to peak	= 746 min
Time interval	= 2 min	Hyd. volume	= 3,454 cuft
Inflow hyd. No.	= 2 - P1B	Max. Elevation	= 202.41 ft
Reservoir name	= Infiltration Area 1	Max. Storage	= 892 cuft

Storage Indication method used. Outflow includes exfiltration.



Worksheet 2: Runoff curve number and runoff SM-5369

Project: 429 Great Rd By JTM Date 4/14/16

Location: Acton, MA Checked _____ Date _____

Circle one: Present [Developed] P1C

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
A	Woods	30			0.00	0.00
A	Open	39			0.00	0.13
	Impervious	98			0.10	9.87
	Totals =				0.10	10.00

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{10.00}{0.10} = 96.16$; Use CN = 96.2

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	2.67	4.05	5.94
Runoff, Q.....	cf	1007	1530	2244

(210-VI-TR-55, Second Ed., June 1986)

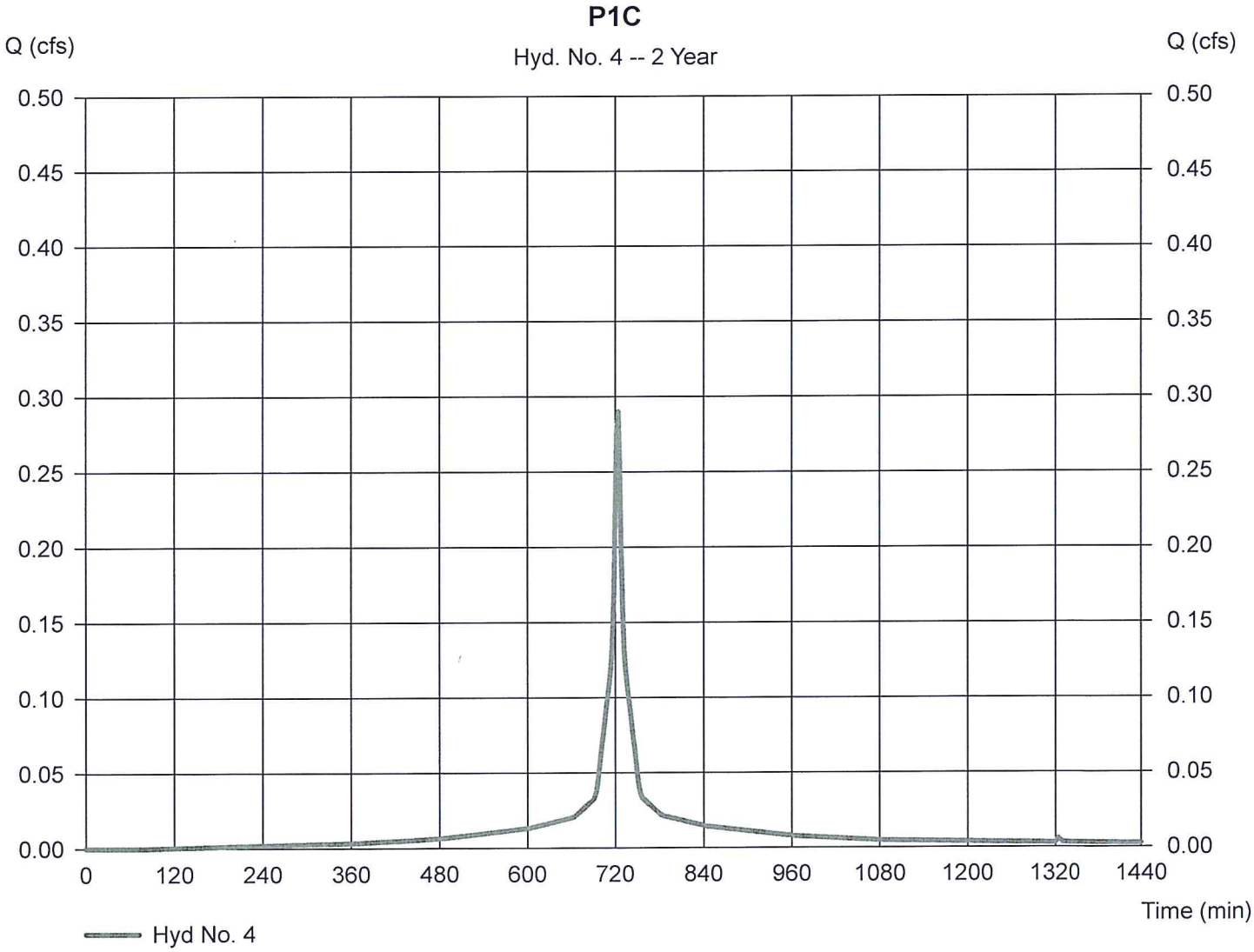
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 4

P1C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.290 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 976 cuft
Drainage area	= 0.100 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



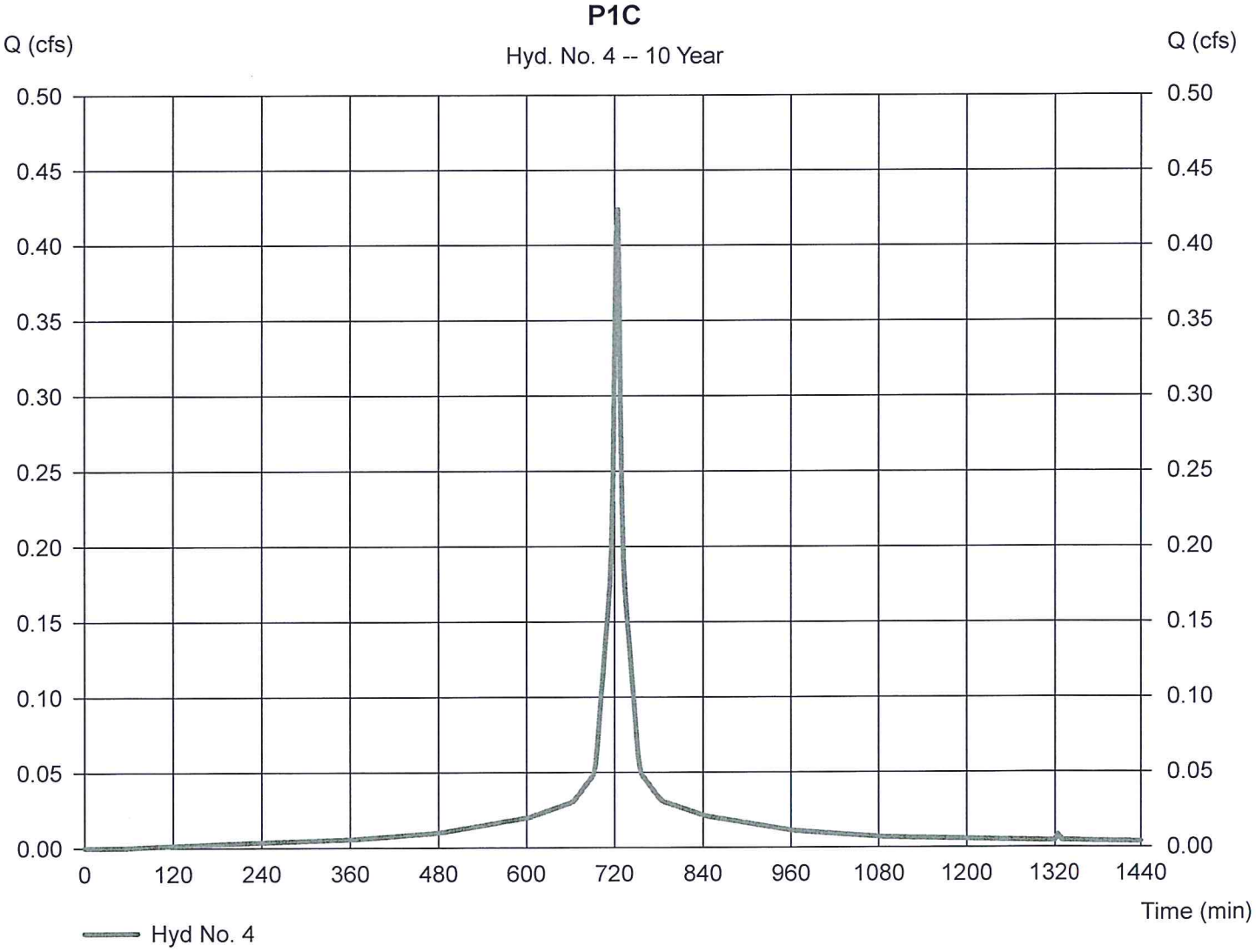
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 4

P1C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.424 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,451 cuft
Drainage area	= 0.100 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



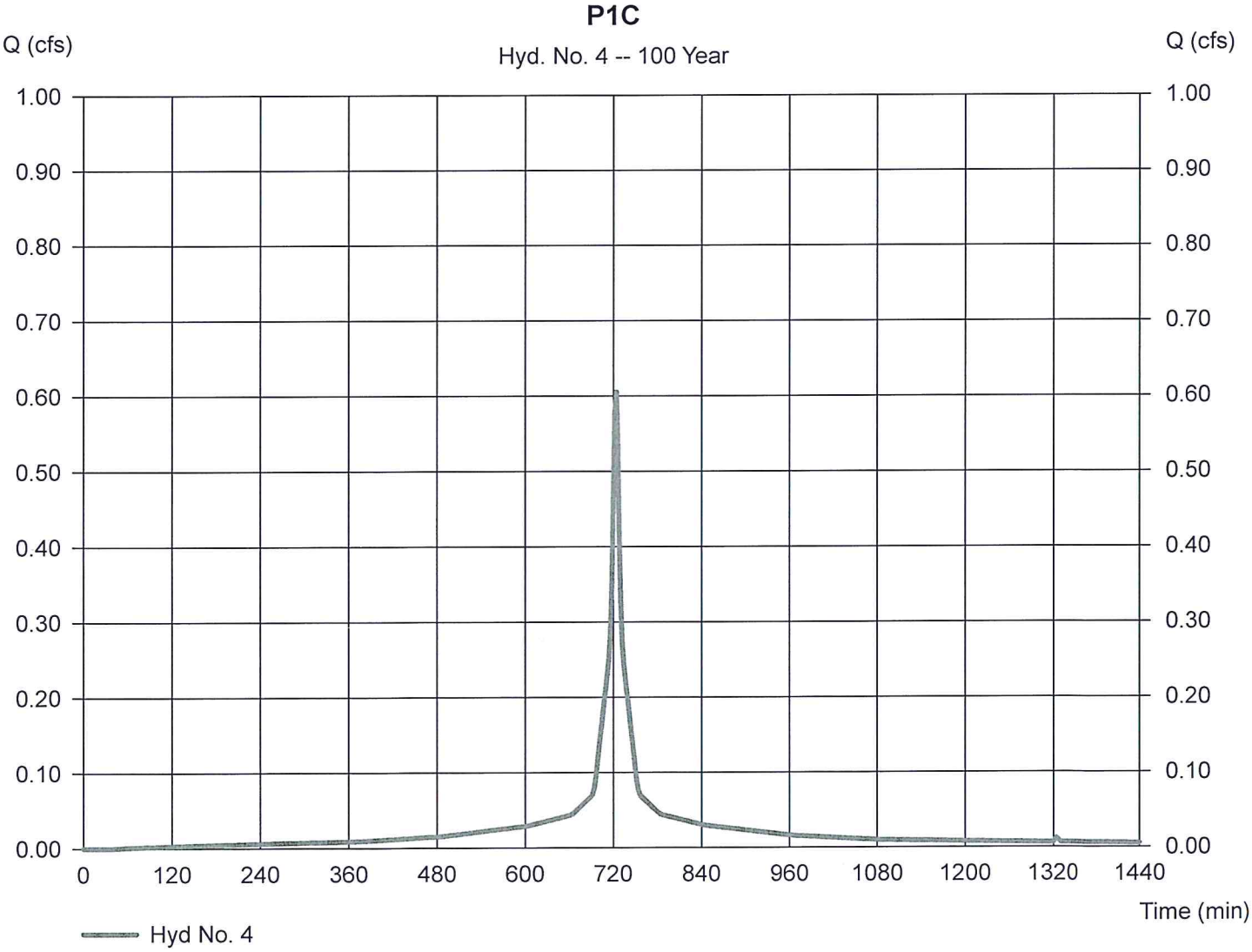
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 4

P1C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.605 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 2,097 cuft
Drainage area	= 0.100 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

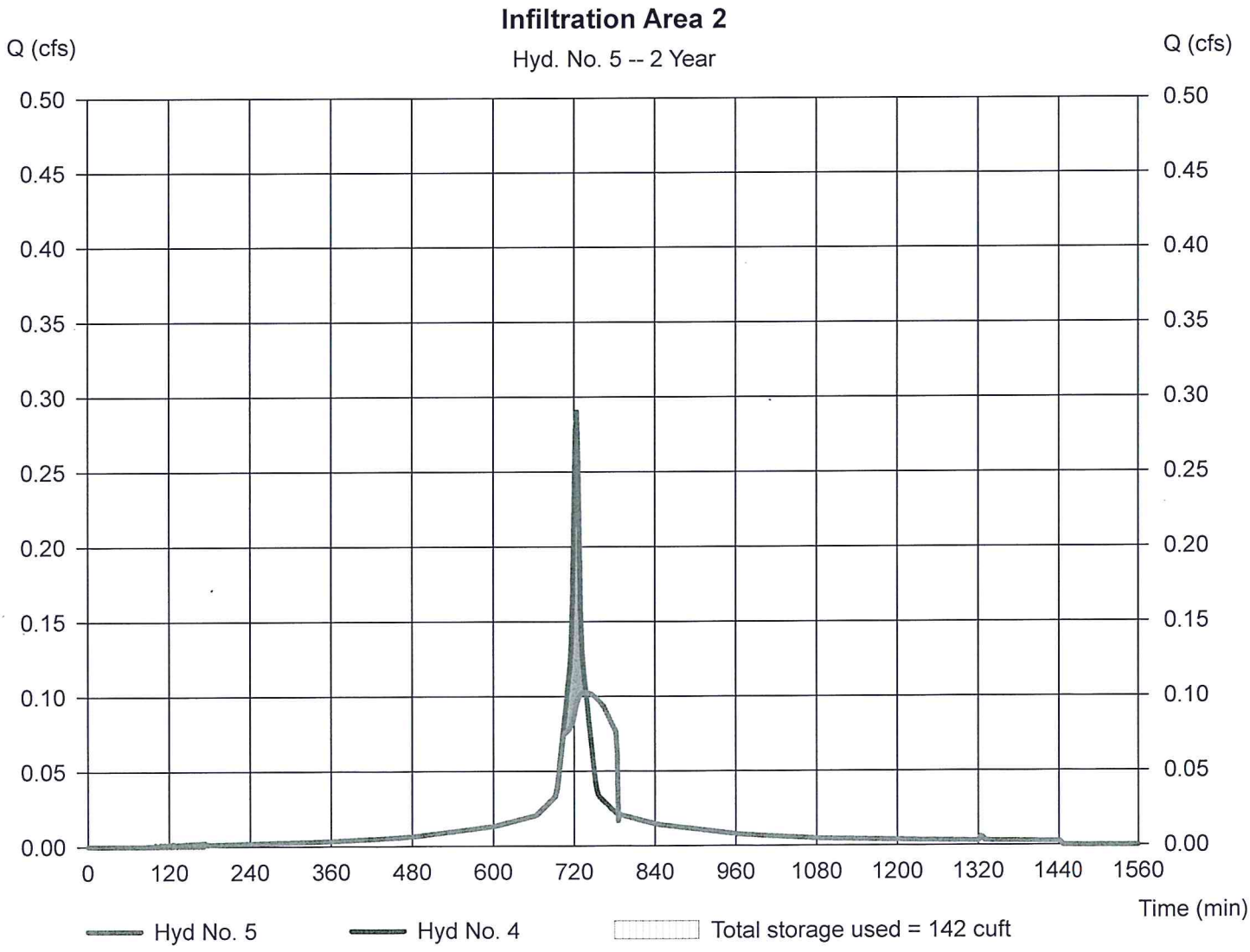
Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 5

Infiltration Area 2

Hydrograph type	= Reservoir	Peak discharge	= 0.102 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 976 cuft
Inflow hyd. No.	= 4 - P1C	Max. Elevation	= 198.69 ft
Reservoir name	= Infiltration Area 2	Max. Storage	= 142 cuft

Storage Indication method used. Outflow includes exfiltration.



Hydrograph Report

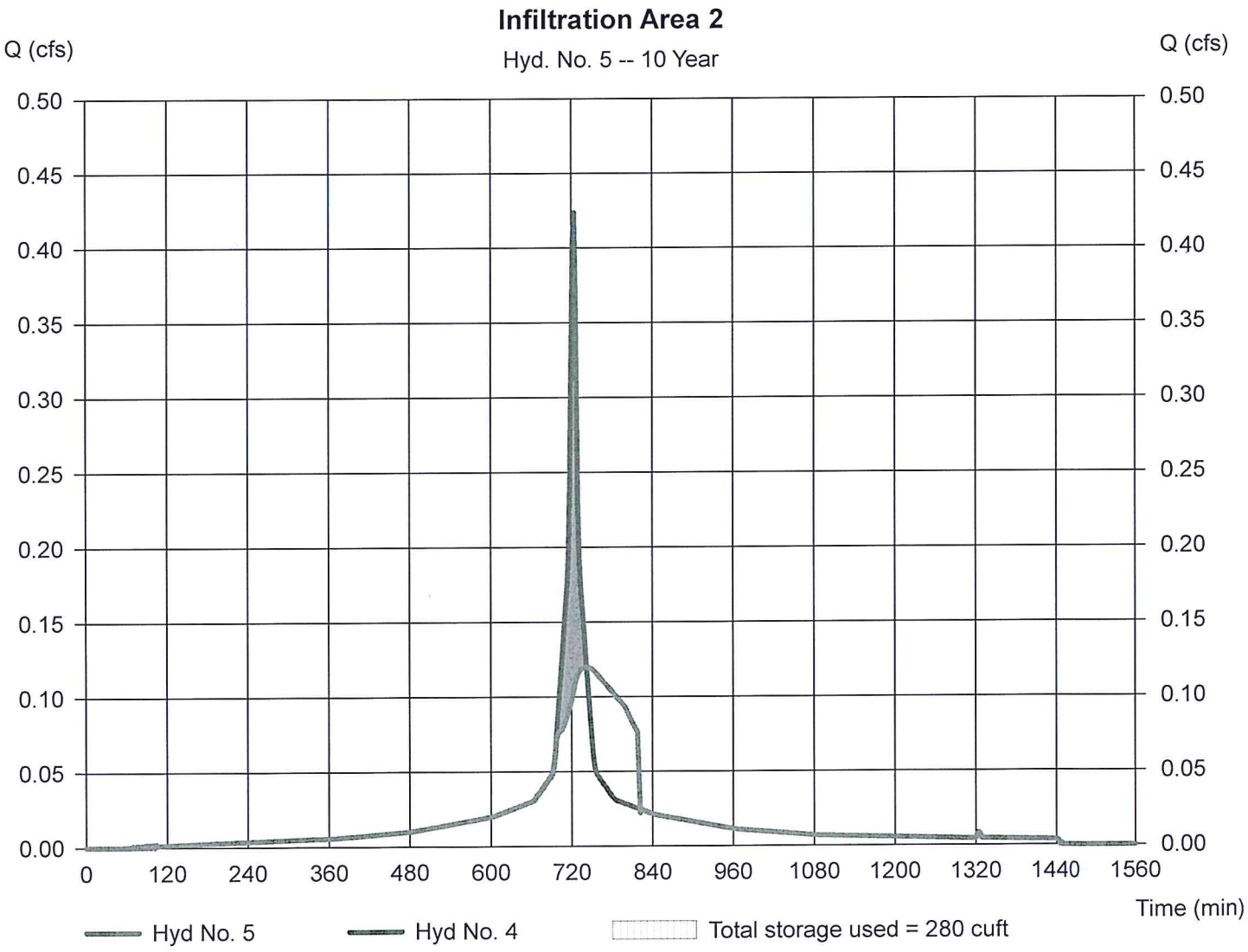
Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 5

Infiltration Area 2

Hydrograph type	= Reservoir	Peak discharge	= 0.120 cfs
Storm frequency	= 10 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 1,451 cuft
Inflow hyd. No.	= 4 - P1C	Max. Elevation	= 199.11 ft
Reservoir name	= Infiltration Area 2	Max. Storage	= 280 cuft

Storage Indication method used. Outflow includes exfiltration.



Hydrograph Report

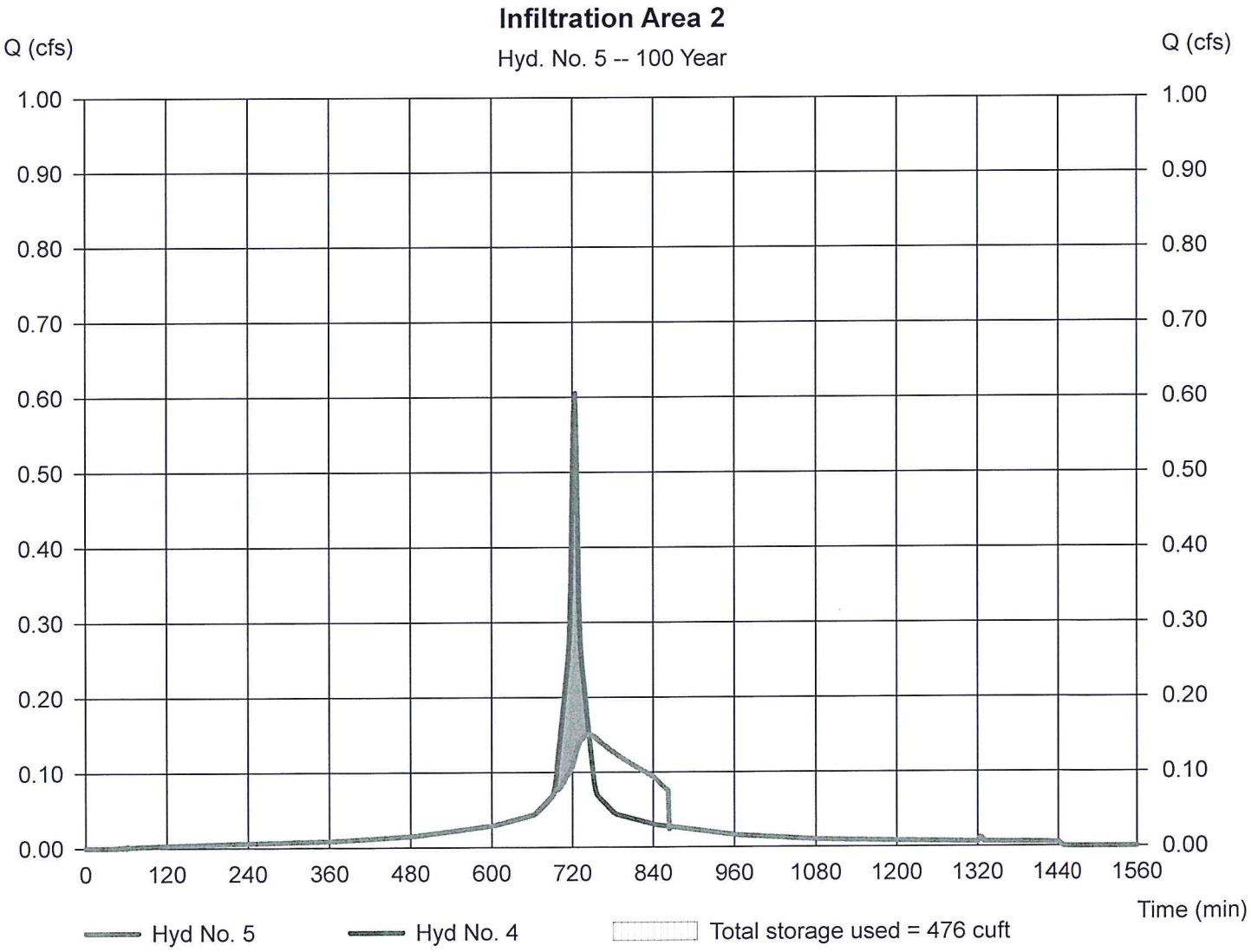
Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 5

Infiltration Area 2

Hydrograph type	= Reservoir	Peak discharge	= 0.150 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 2,097 cuft
Inflow hyd. No.	= 4 - P1C	Max. Elevation	= 199.86 ft
Reservoir name	= Infiltration Area 2	Max. Storage	= 476 cuft

Storage Indication method used. Outflow includes exfiltration.



Worksheet 2: Runoff curve number and runoff SM-5369

Project: 429 Great Rd By JTM Date 4/14/16

Location: Acton, MA Checked _____ Date _____

Circle one: Present [Developed] P1D

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
A	Woods	30			0.00	0.00
A	Open	39			0.00	0.00
	Impervious	98			0.04	3.75
					Totals =	0.04	3.75

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{3.75}{0.04}$ = 98.00 ; Use CN = [98.0]

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	2.87	4.26	6.16
Runoff, Q.....	cf	398	592	856

(210-VI-TR-55, Second Ed., June 1986)

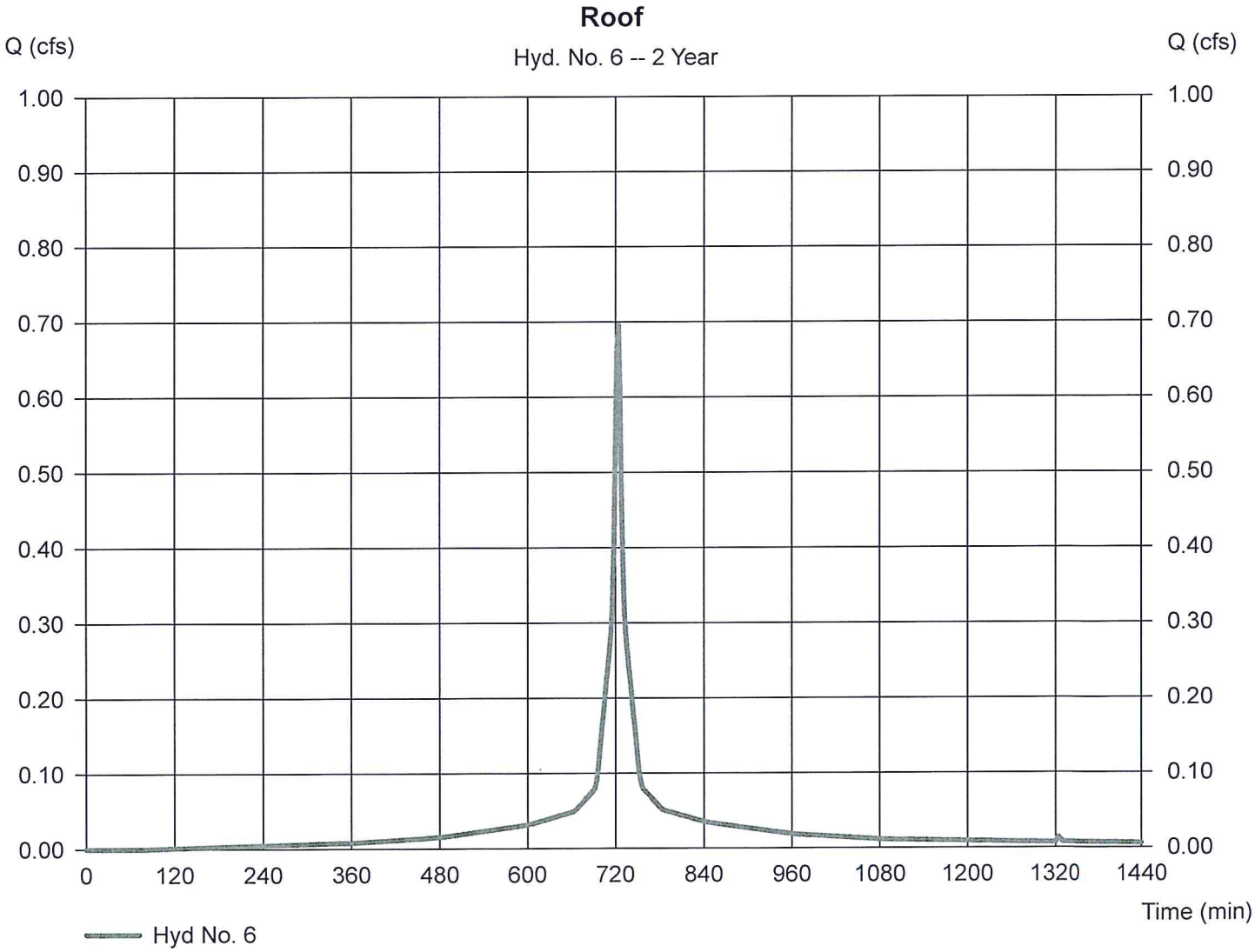
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 6

Roof

Hydrograph type	= SCS Runoff	Peak discharge	= 0.696 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 2,342 cuft
Drainage area	= 0.240 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



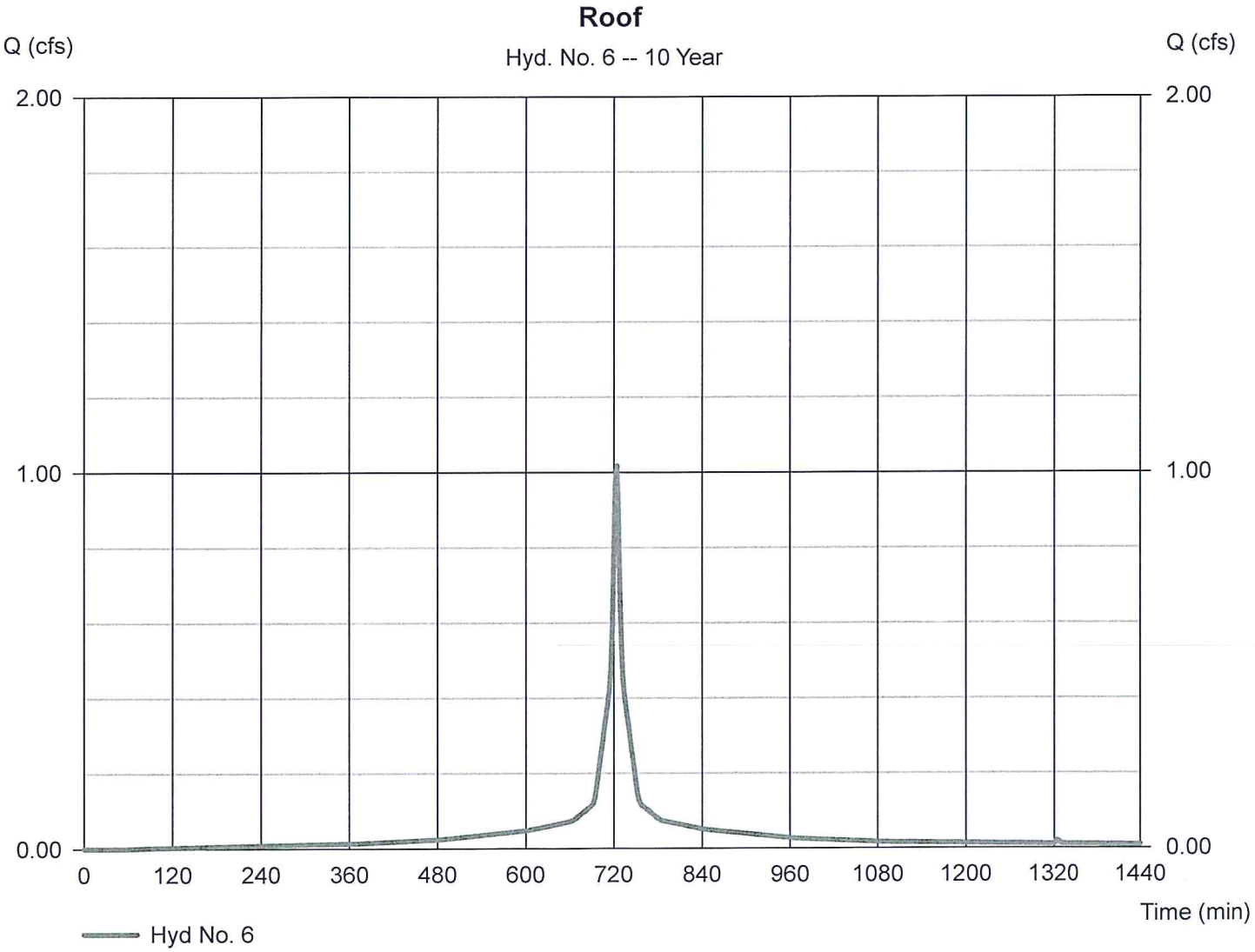
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 6

Roof

Hydrograph type	= SCS Runoff	Peak discharge	= 1.017 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 3,483 cuft
Drainage area	= 0.240 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



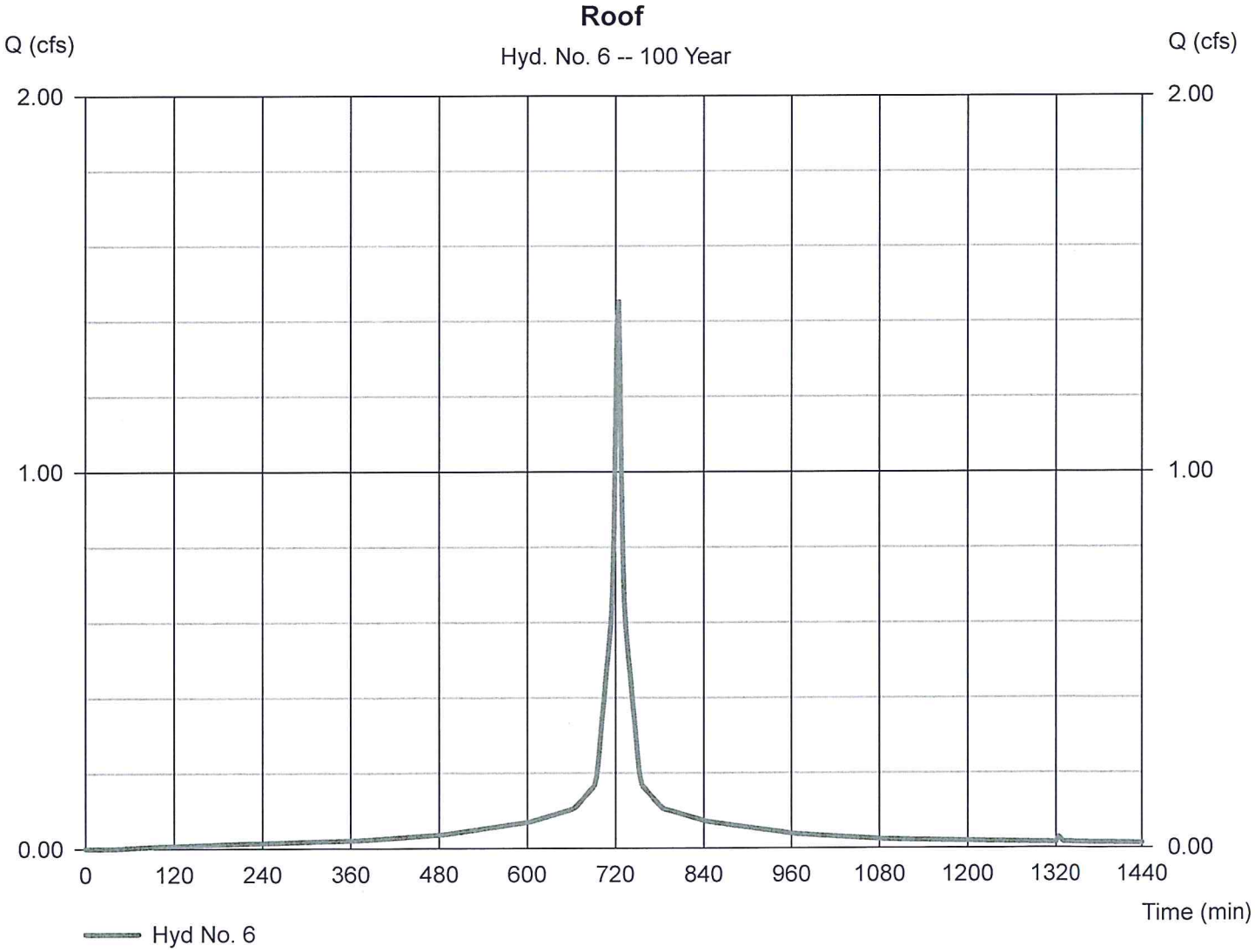
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 6

Roof

Hydrograph type	= SCS Runoff	Peak discharge	= 1.452 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 5,032 cuft
Drainage area	= 0.240 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

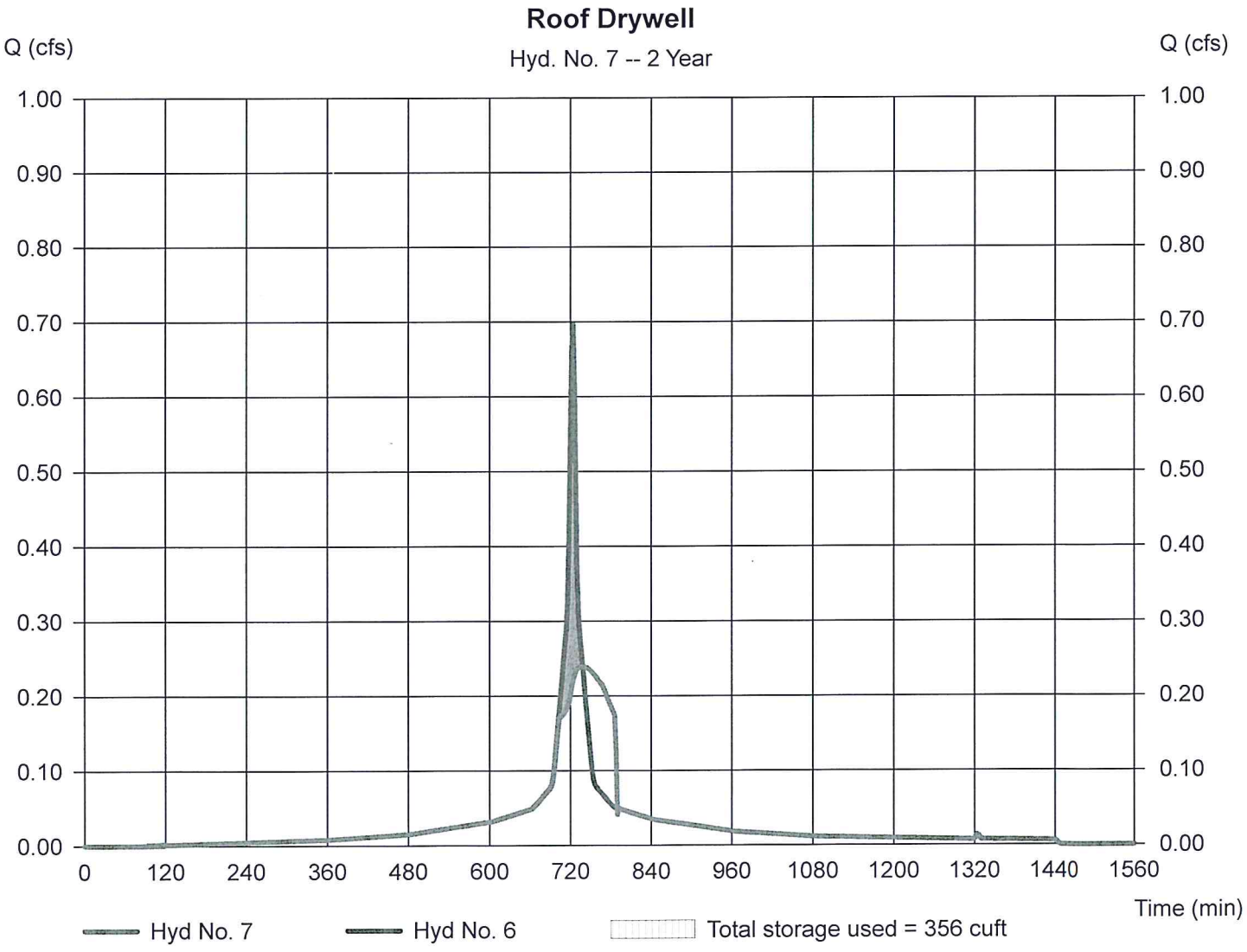
Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 7

Roof Drywell

Hydrograph type	= Reservoir	Peak discharge	= 0.239 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 2,342 cuft
Inflow hyd. No.	= 6 - Roof	Max. Elevation	= 201.98 ft
Reservoir name	= Roof Drywell	Max. Storage	= 356 cuft

Storage Indication method used. Outflow includes exfiltration.



Hydrograph Report

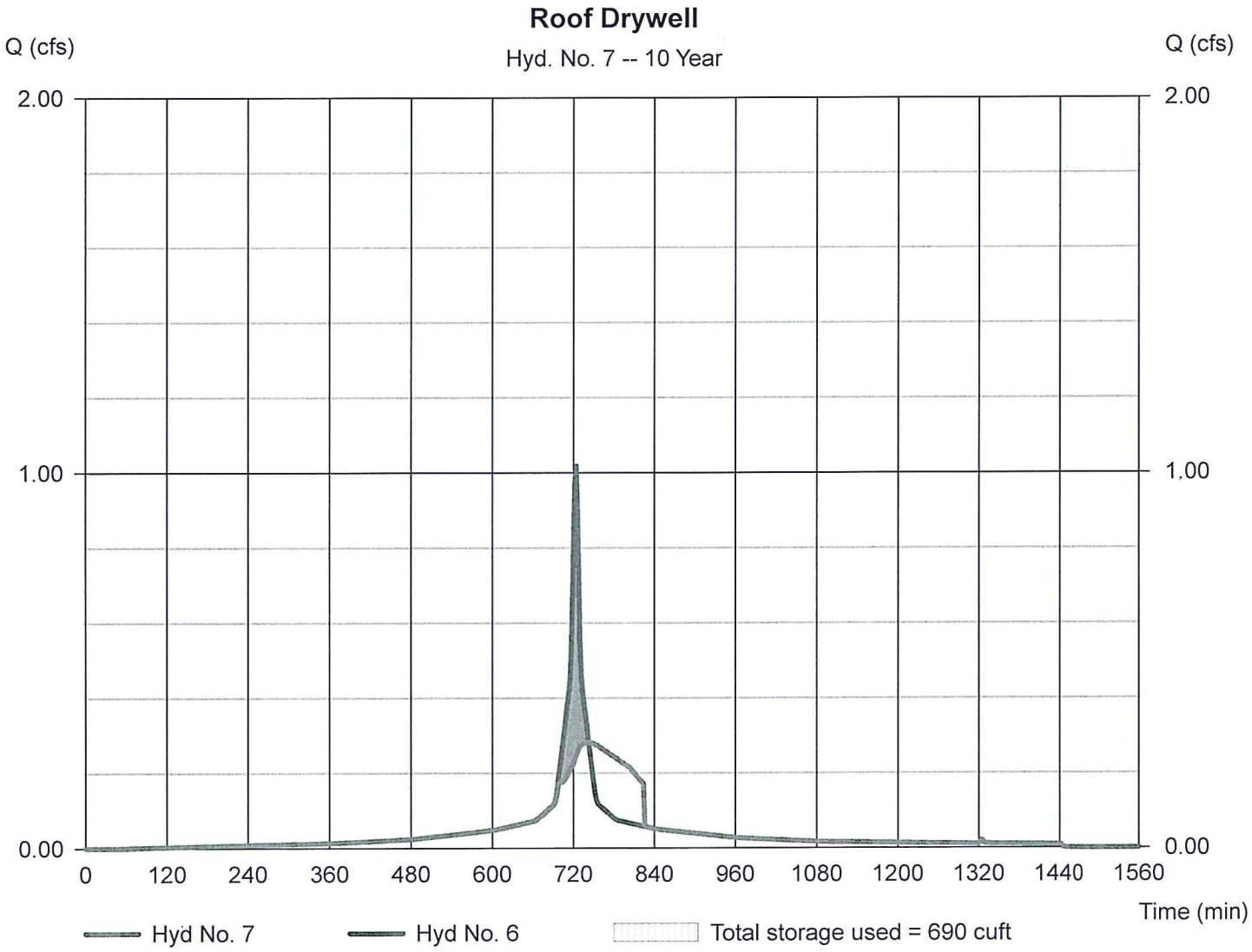
Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 7

Roof Drywell

Hydrograph type	= Reservoir	Peak discharge	= 0.281 cfs
Storm frequency	= 10 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 3,483 cuft
Inflow hyd. No.	= 6 - Roof	Max. Elevation	= 202.43 ft
Reservoir name	= Roof Drywell	Max. Storage	= 690 cuft

Storage Indication method used. Outflow includes exfiltration.



Hydrograph Report

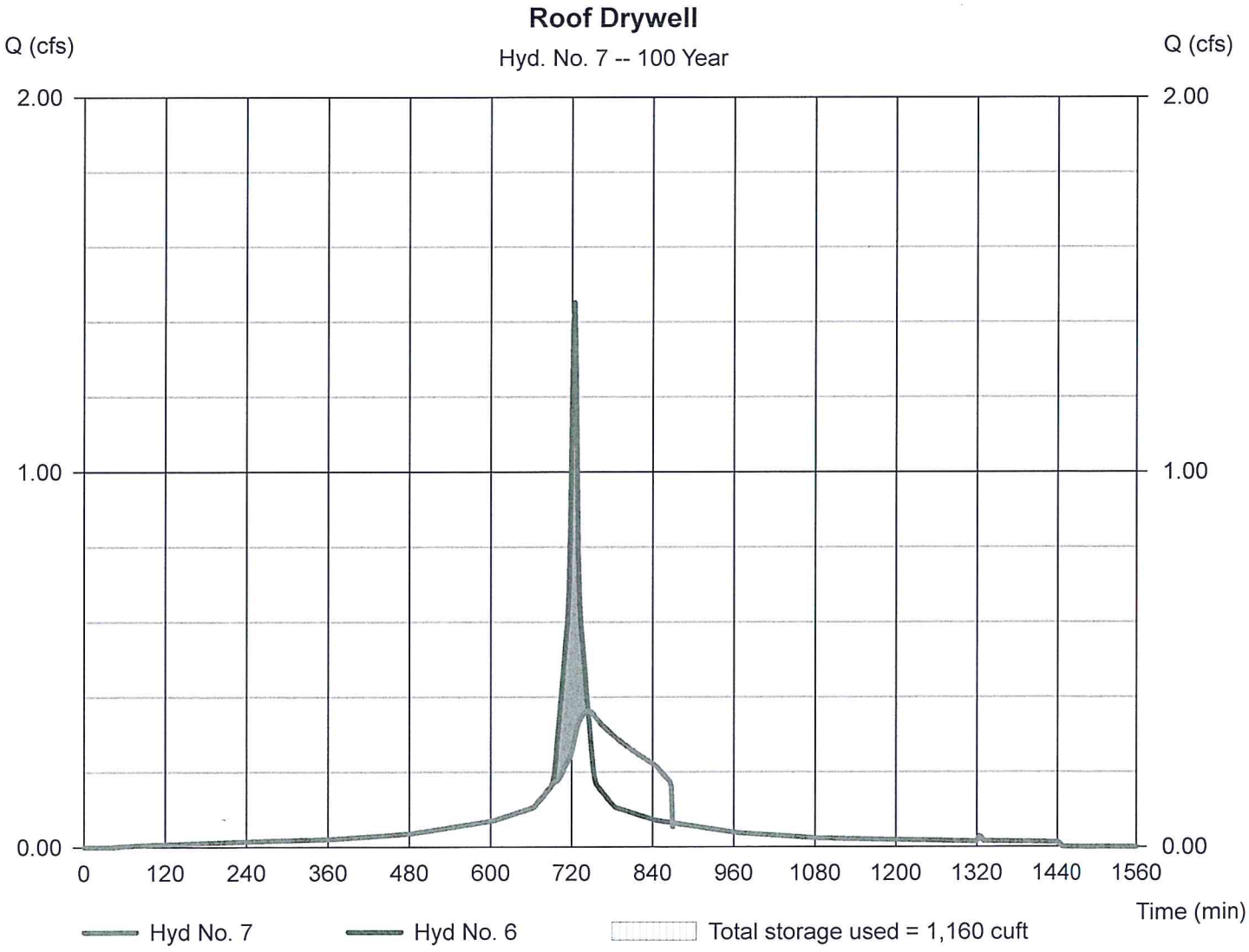
Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Apr 20, 2016

Hyd. No. 7

Roof Drywell

Hydrograph type	= Reservoir	Peak discharge	= 0.363 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 5,032 cuft
Inflow hyd. No.	= 6 - Roof	Max. Elevation	= 203.29 ft
Reservoir name	= Roof Drywell	Max. Storage	= 1,160 cuft

Storage Indication method used. Outflow includes exfiltration.



Water Quality Volume Calculations

Project: 429 Great Road
Location: Acton, MA
Prepared For: James Melvin - Stamski & McNary, Inc.

CONTECH ENGINEERED SOLUTIONS

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1.0" of runoff.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	Impv. (acres)	A ($miles^2$)	t_c (min)	t_c (hr)	WQV (in)
DMH4	0.17	0.0002689	6.0	0.100	1.00
DMH5	0.10	0.0001574	6.0	0.100	1.00

Procedure:

Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Structure Name	qu (csm/in.)
DMH4	774.00
DMH5	774.00

1. Compute Q Rate using the following equation:

$$Q_1 = (qu)\ (A)\ (WQV)$$

where:

Q_1 = flow fate associated with first 1.0" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1.0" in this case)

Structure Name	Q_1 (cfs)
DMH4	0.21
DMH5	0.12

Water Quality Volume Calculations

Job: SM-5369

Calculated by: JTM
Date: 4/19/2016

Subcatchment P1D

Soils: Merrimac-Urban Land Complaex
Hydrologic Group: A
Required Water Quality Volume
1 inches of runoff x impervious area

Impervious area: 0.04 acres
1,667 s.f.

Required Water Quality Volume

$$V = 1{,}667 \text{ s.f.} \times \frac{1}{12} = \mathbf{139} \text{ c.f.}$$

Volume Provided 172 c.f.

172	**c.f. >**	**139**	**c.f. O.K.**

Groundwater Recharge Calculations

Recharge Volume Calculations

Job: SM-5369

Calculated by: JTM
Date: 4/19/2016

P1B

Soils: Merrimac-Urban land complex
Hydrologic Group: A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 0.17 acres
7,496 s.f.

Required Recharge Volume (Rv)

$$Rv = 7{,}496 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{375\ c.f.}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility): 0.5 ft
K (saturated hydraulic conductivity): 8.27 inches/hour
0.6891667 feet/hour
T (time): 2 hours
A= 735 s.f.
Voids= 0.40
Volume of Chambers= 397
Rv= 1,557 c.f. > 375 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 0.35 Hours
0.35 < 72 hours O.K.

P1C

Soils: Merrimac-Urban land complex

Hydrologic Group: A

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.10 acres

4,388 s.f.

Required Recharge Volume (Rv)

$$Rv = 4{,}388 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{219\ c.f.}$$

Simple Dynamic Method

A=Rv / (D+KT)

Rv=A(D+kT)

D (depth of infiltration facility):	0.5	ft		
K (saturated hydraulic conductivity):	8.27	inches/hour		
	0.6891667	feet/hour		
T (time):	2	hours		
A=	424	s.f.		
Voids=	0.40			
Volume of Chambers=	220			
Rv=	889	c.f.	>	219 c.f.

72 Hour Drawdown

Rv/(K x Bottom Area)= 0.36 Hours

0.36 < 72 hours O.K.

P1D

Soils: Merrimac-Urban land complex

Hydrologic Group: A

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.04 acres

1,667 s.f.

Required Recharge Volume (Rv)

$$Rv = 1{,}667 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{83\ c.f.}$$

Simple Dynamic Method

A=Rv / (D+KT)

Rv=A(D+kT)

D (depth of infiltration facility): 1 ft

K (saturated hydraulic conductivity): 8.27 inches/hour

0.6891667 feet/hour

T (time): 2 hours

A= 360 s.f.

Voids= 0.40

Rv= 640 c.f. > 83 c.f.

72 Hour Drawdown

Rv/(K x Bottom Area)= 0.19 Hours

0.19 < 72 hours O.K.

Roof Drywell

Soils: Merrimac-Urban land complex

Hydrologic Group: A

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.24 acres

10,510 s.f.

Required Recharge Volume (Rv)

$$Rv = 10{,}510 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{526\ c.f.}$$

Simple Dynamic Method

A=Rv / (D+KT)

Rv=A(D+kT)

D (depth of infiltration facility):	0.5	ft
K (saturated hydraulic conductivity):	8.27	inches/hour
	0.6891667	feet/hour
T (time):	2	hours
A=	933	s.f.
Voids=	0.40	
Volume of Chambers=	514	
Rv=	1,987	c.f. > 526 c.f.

72 Hour Drawdown

Rv/(K x Bottom Area)= 0.38 Hours

0.38 < 72 hours O.K.

Inlet Grate Capacity Calculations