CERTIFICATE OF AUTHENTICITY

THIS IS TO CERTIFY THAT THE FOLLOWING ELECTRONIC RECORDS ARE TRUE AND ACCURATE REPRODUCTIONS OF THE ORIGINAL RECORDS OF JAMES CITY COUNTY GENERAL SERVICES DEPARTMENT- STORMW ATER DIVISION; WERE SCANNED IN THE REGULAR COURSE OF BUSINESS PURSUANT TO GUIDELINES ESTABLISHED BY THE LIBRARY OF VIRGINIA AND ARCHIVES; AND HAVE BEEN VERIFIED IN THE CUSTODY OF THE INDIVIDUAL LISTED BELOW.

BMP NUMBER: **88041**

DATE VERIFIED: **April 30, 2021**

QUALITY ASSURANCE TECHNICIAN: **Charles E. Lovett II**

Charles E. Lovett II

LOCATION: WILLIAMSBURG, VIRGINIA

NOTES: CERTIFY, BOOKMARKED & UPLOAD

1. Maintenance Agreement

Return to:
JCC Attorney's Office
101-C Mount's Bay Road
Williamsburg, VA 23185
(757) 253-6612

COUNTY OF JAMES CITY, VIRGINIA

COPY

DECLARATION OF COVENANTS
INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

Please type or print legibly in black ink. Covenantor(s) should submit this form to the JCC Environmental Division, 101-E Mounts Bay Road, Williamsburg, VA 23185.

THIS DECLARATION OF COVENANTS, made this 27 day of SEPTEMBER, 2010, between New Town Six, LLC, and all successors in interest, ("COVENANTOR(S)"), owner(s) of the following property:

Parcel Identification Number: 3840100036, 3840100004, 3840100004A, 3840100004B, 3840100003E, 3840100003F
Legal Description: SEE EXHIBIT A
Project or Subdivision Name: COURTHOUSE COMMONS
Document/Instrument No. 100001975/100013847 or Deed Book _____, Page No. _____, and the County of James City, Virginia ("COUNTY.")

WITNESSETH:

I (We), the COVENANTOR(S), with full authority to execute deeds, mortgages, other covenants, and all rights, titles and interests in the property described above, do hereby covenant with the COUNTY as follows:

1. The COVENANTOR(S) shall provide maintenance for the drainage system including any runoff control facilities, conveyance systems and associated easements, hereinafter referred to as the "SYSTEM," located on and serving the above-described property to ensure that the SYSTEM is and remains in proper working condition in accordance with approved design standards, and with the law and applicable executive regulations. The SYSTEM shall not include any elements located within any Virginia Department of Transportation rights-of-way.

2. If necessary, the COVENANTOR(S) shall levy regular or special assessments against all present or subsequent owners of property served by the SYSTEM to ensure that the SYSTEM is properly maintained.

3. The COVENANTOR(S) shall provide and maintain perpetual access from public right-of-ways to the SYSTEM for the COUNTY, its agent and its contractor.

4. The COVENANTOR(S) shall grant the COUNTY, its agent and its contractor a right of entry to the SYSTEM for the purpose of inspecting, monitoring, operating, installing, constructing, reconstructing, maintaining or repairing the SYSTEM.

5. If, after reasonable notice by the COUNTY, the COVENANTOR(S) shall fail to maintain the SYSTEM in accordance with the approved design standards and with the law and applicable executive regulations, the COUNTY may perform all necessary repair or maintenance work, and the COUNTY may assess the COVENANTOR(S) and/or all property served by the SYSTEM for the cost of the work and any applicable penalties.

6. The COVENANTOR(S) shall indemnify and save the COUNTY harmless from any and all claims for damages to persons or property arising from the installation, construction, maintenance, repair, operation or use of the SYSTEM.

Instrument # 100020866

Recorded on Sept. 30, 2010

7. The COVENANTOR(s) shall promptly notify the COUNTY when the COVENANTOR(S) legally transfers any of the COVENANTOR(S) responsibilities for the SYSTEM. The COVENANTOR(S) shall supply the COUNTY with a copy of any document of transfer, executed by both parties.

8. The covenants contained herein shall run with the land and shall bind the COVENANTOR(S) and the COVENANTOR(S)' heirs, executors, administrators, successors and assignees, and shall bind all present and subsequent owners of property served by the SYSTEM.

9. This COVENANT shall be recorded in the County Land Records.

IN WITNESS WHEREOF, the COVENANTOR(S) has executed this DECLARATION OF COVENANTS as of the date first above written.

COVENANTOR(S)

Signature

JOHN R. LAWSON II MEMBER
Print Name and Title

ACKNOWLEDGMENT

COMMONWEALTH OF VIRGINIA
CITY/COUNTY OF Newport News, to wit:

I hereby certify that on this 27th day of September, 2010, before the subscribed, a Notary Public for the Commonwealth of Virginia, personally appeared JOHN R. LAWSON II and did acknowledge the foregoing instrument to be his/her Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 27th day of September, 2010.

[SEAL]

DERRI J. BENNETT NOTARY PUBLIC REG. #7086633 MY COMMISSION EXPIRES 9/30/2011 COMMONWEALTH OF VIRGINIA

Notary Public

Notary Registration Number: 7086633
My Commission expires: 9/30/2011

Approved as to form:

Asst. County Attorney

This Declaration of Covenants prepared by:

Signature: T. C. Henderson Print Name and Title: T. C. Henderson, Member

Address: 12350 Jefferson Ave. Suite 160, Newport News, VA 23602

Phone Number: (757) 561-4452

Drainage1_pre_doc
(Revised 9-5-08)

EXHIBIT A

Tax Id: 3840100003F (4025 Ironbound Road)
Tax Id: 3840100003E (4023 Ironbound Road)
Tax Id: 3840100003G (5223 Monticello Avenue)
Tax Id: 3840100004B (Address: N/A)
Tax Id: 3840100004A (Address: N/A)

ALL THOSE certain parcels or tracts of land, with the improvements shown thereon, situate, lying and being in the Berkeley District of the County of James City, Virginia, set out and shown on a plat entitled, "ALTA/ACSM LAND TITLE SURVEY OF PROPERTY OWNED BY PHILIP O. RICHARDSON TRUSTEE OF THE PHILIP O. RICHARDSON REVOCABLE TRUST & PHILIP O. RICHARDSON LOCATED IN NEW QUARTER INDUSTRIAL PARK BERKELEY DISTRICT, JAMES CITY COUNTY, VIRGINIA", made by AES Consulting Engineers, and dated December 6, 2000, a copy of which plat is recorded with the deed from Mary N. Richardson to Philip O. Richardson, as Trustee of the Philip O. Richardson Revocable Trust Restated as of February 11, 2000, recorded in the Clerk's Office of the Circuit Court of the County of James City, Virginia, prior hereto, containing a total of 5.159 acres more or less and being more particularly described as follows:

Beginning at an iron rod found at the intersection of the southeasterly right of way line of Monticello Avenue Extension and the northeasterly right of way line of State Route 615 relocated. Thence along the southeasterly right of way line of Monticello Avenue Extension N46°23'51"E, 431.61' to a point; thence along a curve to the right having a radius of 723.51', an arc length of 42.32', a chord bearing of N48°04'24"E and a chord distance of 42.32'to an iron rod found; thence S77°26'22"E, 68.29' to an iron rod found; thence N57°33'24"E, 100.01' to an iron rod found; thence N12°33'10"E, 68.29' to an iron rod found, thence along a curve to the right having a radius of 723.51', an arc length of 305.60', a chord bearing of N77°27'53"E and a chord distance of 303.33' to a point; thence departing the southeasterly right of way line of Monticello Avenue Extension and being along the line of the United States Postal Service, S07°23'40"W, 303.75' to an iron pipe found, said pipe being on the westerly private right of way line of New Quarter Drive; thence along the westerly private right of way line of New Quarter Drive S13°47'52"W, 74.48' to an iron pipe found, thence departing the westerly private right of way line of New Quarter Drive and being along the line of Bell Atlantic-Virginia, Inc., N76°41'18"W, 500.00' to an iron rod found; thence S13°47'52"W, 340.00' to an iron rod found; thence S76°41'18"E, 500.00' to a point on the westerly private right of way line of New Quarter Drive; thence along the westerly private right of way line of New Quarter Drive S13°47'52"W, 10.17' to an iron rod found; thence departing the westerly private right of way line of New Quarter Drive and being along the line of Northwest Homes Assoc., N76°38'58"W, 215.00' to an iron rod found; thence S13°51'12"W, 259.93' to an iron rod found, said rod being on the northeasterly right of way line of State Route 615 relocated; thence along the northeasterly right of way line of State Route 615 relocated

N50°04'24"W, 237.71' to a point; thence N44°32'44"W, 303.87' to a point; thence N01°23'51"E, 50.01' to the point of beginning.

TOGETHER with all and singular the buildings and improvements thereon, the tenements, hereditaments an appurtenances thereunto belonging or in anywise appertaining and specifically including the non-exclusive right and easement to use jointly with other parties served thereby that certain 50-foot wide right of way, known as "New Quarter", for the purpose of ingress and egress to and from the property.

Tax Id: 3840100004 (113 New Quarter Drive)

ALL THAT certain lot, piece or parcel of land situate, lying and being in James City County, Virginia, containing an Area of 169,993 S.F. or 3.903 Acres, as shown on that certain plat entitled, "BOUNDARY SURVEY OF THE PROPERTY OF PHILIP O. RICHARDSON AND MARY N. RICHARDSON (LEASED TO BELL ATLANTIC-VIRGINIA, INC.) LOCATED IN NEW QUARTER INDUSTRIAL PARK, BERKELEY DISTRICT, JAMES CITY COUNTY, VIRGINIA", dated December 11, 1998, made by Sledd & Associates, P.C., Engineers, Planners, Surveyors, Newport News, Virginia, a copy of which said plat is attached to that certain Deed recorded as Instrument No. 990002420, to which plat reference is here made for a more particular description.

TOGETHER with all and singular the buildings and improvements thereon, the tenements, hereditaments and appurtenances thereunto belonging or in anywise appertaining.

2. Deeds/Easements/ Agreements/Property Records

3. Construction Certificate

James City County Engineering and Resource Protection Division
Stormwater Management/BMP Record Drawing and Construction Certification Review Tracking Form

Project Name: Courthouse Commons Parcels 2 and 3
County Plan No. (List any amendments): SP-49-10
Stormwater Management Facility Type: Bio-retention
BMP Phase #: ☐ I ☐ II ☐ III

- [x] Information Package Submittal Date: 6/5/12 Jason Grimes
- [x] Completeness Check:
  - [x] Record Drawing — Date/By: 5/23/12 Jason Grimes
  - [x] Construction Certification — Date/By: 5/23/12 E. Scott Gresham
  - [x] RD/CC Standard Forms (Ensure that all forms for the BMP type are included)
  - [x] Insp/Maint Agreement — # / Date: 1000208866 Sept 30, 2010
  - [x] BMP Maintenance Plan — Location: Sheet #9
  - [ ] Special Considerations:
- [x] Standard E&SC Notes on Approved Plan Requiring RD/CC or County comment in plan review
  Location (sheet #): Sheet 15 Item 20
- [x] **County BMP ID Code #**: PC-254
- [ ] Log into Division's "As-Built Tracking Log"
- [x] Obtain basic site information (GPIN, Owner, Address, etc.)
- [x] Log into Access Database (BMP ID #, Plan No., GPIN, Project Name, etc.)
- [x] Copy from Active Project File (correspondence, H&H, design computations, etc.).
- [x] Create As-Built File using Project File information (File label, folder, copy plan/details/design information, etc.).
- [x] Inspector Review of RD/CC (consult with Chief Engineer prior to completion of comments).
- [x] Record Drawing Review against Approved Plan prior to Field Inspection.
- [x] Final Site Inspection (FI) Performed — Date: 2/13/12
- [x] Record Drawing (RD) Review — Date: 6/6/12
- [x] Construction Certification (CC) Review — Date: 6/6/12
- [x] Actions:
  - [ ] No comments.
  - [x] Comments. Letter Forwarded. — Date:
  - [x] Record Drawing (RD)
  - [x] Construction Certification (CC)
  - [x] Construction-Related (CR)
  - [ ] Site Issues (SI)
  - [ ] Other :
- [x] Resubmittal (# and date): NA
- [x] Re-inspection (if necessary): NA
- [ ] Drainage System Information Acceptable (RD/CC/System Info). Ok for bond release.
- [ ] Complete "Surety Request Form".
- [ ] Final Inspection of active file copying any relevant information to "As-Built" file.
- [ ] On County BMP Inventory (Phase I, II or III).
- [ ] Copy Final Inspection Report into County BMP Inspection Program file.
- [ ] Provide Digital Photographs of BMP and save into County BMP Inventory.
- [ ] Request mylar/reproducible from As-Built plan preparer.
- [ ] Complete "As-built Tracking Log".
- [ ] Last check of BMP Access Database (County BMP Inventory).
- [ ] Add BMP to JCC Hydrology & Hydraulic database (optional).
- [ ] Add BMP to Municipal BMP list (if a County-owned facility)
- [ ] Add BMP to PRIDE BMP ratings database.

Final Sign-Off

Inspector: _____ Date: 6/15/12

Chief Engineer: _____ Date: _____

*** See separate checklist, if needed.

3843400002 556660 32614
5235 Marticello Ave

Section 2 - Stormwater Management / BMP Facility Construction Information:

PreConstruction Meeting Held for Construction of SWM/BMP Facility: ☐ Yes ☐ No ☑ Unknown
Approx. Construction Start Date for SWM/BMP Facility: October 30, 2010
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☑ Unknown
Name of Site Work Contractor Who Constructed Facility: C.A. Barrs
Name of Professional Firm Who Routinely Monitored Construction: ECS Mid-Atlantic, LLC
Date of Completion for SWM/BMP Facility: April 6, 2011
Date of Record Drawing/Construction Certification Submittal: _____

(Note: Record Drawing and Construction Certifications are required within thirty (30) days of the completion of Stormwater Management and/or BMP facility construction. Record Drawings and Construction Certifications must be reviewed and approved by the James City County Environmental Division prior to final inspection, acceptance and bond or surety release.)

Section 3 - Owner / Designer / Contractor Information:

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*

Name: Newtown Six, LLC
Mailing Address: P.O. box 6000
Williamsburg, VA 23188
Business Phone: (757) 259-3820 Fax: (757) 259-3800
Contact Person: Gregory Davis Title: _____

Design Professional: *(Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater Management / BMP facility.)*

Firm Name: AES Consulting Engineers
Mailing Address: 5248 olde Towne Rd
Williamsburg, VA 23188
Business Phone: 253-0040
Fax: _____
Responsible Plan Preparer: Jason Grimes
Title: Project Manager
Plan Name: Courthouse Commons, Phase 1
Firm's Project No. 8509-04
Plan Date: 10-4-10
Sheet No.'s Applicable to SWM/BMP Facility: 6 / 7 / 8 / 9 / _____

BMP Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater Management / BMP facility.)*

Name: C.A. Barrs Contractor
Mailing Address: P.O. Box 1489
Grafton , Virginia 23692
Business Phone: (757) 898-7282
Fax: (757) 898-1282
Contact Person: Scott St. Clair
Site Foreman/Supervisor: _____
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 - Professional Certifications:

Certifying Professionals: *(Note: A Registered Professional Engineer or Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the drainage system for the project including any Stormwater Management/BMP Facilities. A Registered Professional Engineer is responsible for the inspection, monitoring and certification of Stormwater Management / BMP facilities during its construction.)*

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Road, Suite 1
Williamsburg, Va. 23188
Business Phone: (757) 253-0040
Fax: (757) 869-2924

Name: Jason Grimes, P.E.
Title: Project Manager

Signature:
Date: 5/23/12

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

COMMONWEALTH OF VIRGINIA
JASON A. GRIMES
Lic. No. 40170
5/23/12
PROFESSIONAL ENGINEER

_____ (Seal)

Virginia Registered Professional Engineer or Certified Land Surveyor

Construction Certification

Firm Name: ECS Mid-Atlantic, LLC
Mailing Address: 108 Ingram Road, Suite 1
Williamsburg, Va. 23188
Business Phone: (757) 229-6677
Fax: (757) 229-9978

Name: B. Scott Gresham, P.E.
Title: Construction Services Manager

Signature:
Date: 5/23/12

I hereby certify to the best of my knowledge and belief that this Stormwater Management/BMP facility was monitored and constructed in accordance with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

COMMONWEALTH OF VIRGINIA
5/23/12
B. SCOTT GRESHAM
Lic. No. 037785
PROFESSIONAL ENGINEER

_____ (Seal)

Virginia Registered Professional Engineer

Section 5 - Record Drawing and Construction Certification Requirements and Instructions:

☑ PreConstruction Meeting - Provides an opportunity to review SWM / BMP facility construction, maintenance and operation plans and address any questions regarding construction and/or monitoring of the structure. The design engineer, certifying professionals (if different), Owner/Applicant, Contractor and County representative(s) are encouraged to attend the preconstruction meeting. Advanced notice to the Environmental Division is requested. Usually, this requirement can be met simultaneously with Erosion and Sediment Control preconstruction meetings held for the project.

☑ A fully completed ***STORMWATER MANAGEMENT / BMP FACILITIES, RECORD DRAWING and CONSTRUCTION CERTIFICATION FORM*** and ***RECORD DRAWING CHECKLIST***. All applicable sections shall be completed in their entirety and certification statements signed and sealed by the registered professional responsible for individual record drawing and/or construction certification.

☑ The Record Drawing shall be prepared by a Registered Professional Engineer or Certified Land Surveyor for the drainage system of the project including any Best Management Practices.

☑ Construction Certification. Construction of Stormwater Management / BMP facilities which contain impoundments, embankments and related engineered appurtenances including subgrade preparation, compacted soils, structural fills, liners, geosynthetics, filters, seepage controls, cutoffs, toe drains, hydraulic flow control structures, etc. shall be visually observed and monitored by a Registered Professional Engineer or his/her authorized representative. The Engineer must certify that the structure, embankment and associated appurtenances were built in accordance with the approved design plan, specifications and stormwater management plan and standard accepted construction practice and shall submit a written certification and/or drawings to the Environmental Division as required. Soil and compaction test reports, concrete test reports, inspection reports, logs and other required construction material or installation documentation may be required by the Environmental Division to substantiate the certification, if specifically requested. The Engineer shall have the authority and responsibility to make minor changes to the approved plan, in coordination with the assigned County inspector, in order to compensate for unsafe or unusual conditions encountered during construction such as those related to bedrock, soils, groundwater, topography, etc. as long as changes do not adversely affect the integrity of the structure(s). Major changes to the approved design plan or structure must be reviewed and approved by the original design professional and the James City County Environmental Division.

☑ Record Drawing and Construction Certifications are required within **thirty (30) days** of the completion of Stormwater Management / BMP facility construction. Submittals must be reviewed and accepted by James City County Environmental Division prior to final inspection, acceptance and bond/surety release.

Dual Purpose Facilities - Completion of construction also includes an interim stage for Stormwater Management / BMP facilities which serve dual purpose as temporary sediment basins during construction and as permanent stormwater management / BMP facilities following construction, once development and stabilization are substantially complete. For these dual purpose facilities, construction certification is required once the temporary sediment basin phase of construction is complete. Final record drawing and construction certification of additional permanent components is required once permanent facility construction is complete.

Interim Construction Certification is required for those dual purpose embankment-type facilities that are generally ten (10) feet or greater in dam height (*) and may not be converted, modified or begin function as a permanent SWM / BMP structure for a period generally ranging from six (6) to eighteen (18) months or more from issuance of a Land Disturbance permit for construction.

Interim or final record drawing and construction certifications are not required for temporary sediment basins which are designed and constructed in accordance with current minimum standards and specifications for temporary sediment basins per the Virginia Erosion and Sediment Control Handbook (VESCH); have a temporary service life of less than eighteen (18) months; and will be removed completely once associated disturbed areas are stabilized, unless a distinct hazard to the public's health, safety and welfare is determined by the Environmental Division due to the size or presence of the structure or due to evidence of improper construction.

(*Note: Dam Height as referenced above is generally defined as the vertical distance from the natural bed of the stream or waterway at the downstream toe of the embankment to the top of the embankment structure in accordance with 4VAC50-20-30, Virginia Impoundment Structure Regulations and the Virginia Dam Safety Program.)

☑ Record Drawings shall provide, at a minimum, all information as shown within these requirements and the attached **RECORD DRAWING CHECKLIST** specific to the type of SWM/BMP facility being constructed. Other additional record data may be formally requested by the James City County Environmental Division. *(Note: Refer to the current edition of the James City County Guidelines for Design and Construction of Stormwater Management BMP's manual for a complete list of acceptable BMP's. Currently there are over 20 acceptable water quality type BMP's accepted by the County.)*

☑ Record Drawings shall consist of blue/black line prints and a reproducible (mylar, sepia, diazo, etc.) set of the approved stormwater management plan including applicable plan views, profiles, sections, details, maintenance plans, etc. as related to the subject SWM / BMP facility. The set shall indicate **"RECORD DRAWING "** in large text in the lower right hand corner of each sheet with record elevations, dimensions and data drawn in a clearly annotated format and/or boxed beside design values. Approved design plan values, dimensions and data shall not be removed or erased. Drawing sheet revision blocks shall be modified as required to indicate record drawing status. Elevations to the nearest 0.1' are sufficiently accurate except where higher accuracy is needed to show positive drainage. Certification statements as shown in Section 4 of the Record Drawing and Construction Certification Form, ***or similar forms thereof***, and professional signatures and seals, with dates matching that of the record drawing status in the revision or title block, are also required on all associated record drawing plans, prints or reproducibles.

☑ Submission Requirements. Initial and subsequent submissions for review shall consist of a minimum of one (1) blue/black line set for record drawings and one copy of the construction certification documents with appropriate transmittal. Under certain circumstances, it is understood that the record drawing and construction certification submissions may be performed by different professional firms. Therefore, record drawing submission may be in advance of construction certification or vice versa. Upon approval and prior to release of bond/surety, final submission shall include one (1) reproducible set of the record drawings, one (1) blue/black line set of the record drawings and one (1) copy of the construction certification. Also for current and/or future incorporation into the County BMP database and GIS system, it is requested that the record drawings also be submitted to the Environmental Division on a diskette or CD-ROM in an acceptable electronic file format such as *.dxf, *.dwg, etc. or in a standard scanned and readable format. The electronic file requirement can be discussed and coordinated with Environmental Division staff at the time of final submission.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

I. Methods and Presentation: *(Required for all Stormwater Management / BMP facilities.)*

XX 1. All constructed facilities meet approved design plans, unless otherwise shown. Record information or deviations from approved design plan shown in clearly annotated format and/or boxed beside design values.

XX 2. Elevations to the nearest 0.1' unless higher accuracy is needed to show positive drainage.

XX 3. All plan sheets labeled with "RECORD DRAWING" in large text in lower right hand corner (Approved County Plan Number and BMP ID Code can be included if known).

XX 4. All plan sheet revision blocks modified to indicate date and record drawing status.

XX 5. All plan sheets have certification statements and certifying professional's signature and seal.

II. Minimum Standards: *(Required for all Stormwater Management / BMP facilities, as applicable.)*

XX 1. All requirements of Section I (Methods and Presentation) apply to this section.

XX 2. Plan Views: Show general location, arrangement and dimensions. Location and alignment shall generally match approved design plans.

XX 3. Profile or elevations along top or berm of the facility. At a minimum, elevations are required at each end, at intervals not to exceed 50 feet and where low spots may be present. Top of embankment or berm elevations must be no less than design elevation plus any settlement allowances.

____ 4. Top widths, berm widths and embankment side slopes.

____ 5. Show length, width and depth of facility or grading, contours or spot elevations as required to verify permanent pool and design storage volumes were met or were reasonably close to the approved design. Evaluation of as-built grading, contours, spot elevations, or cross-sections, may be necessary by the professional to ensure approved design configurations, depths and volumes were closely maintained. If grading or elevations are significantly different from the approved plan, the Environmental Division shall be contacted immediately to determine whether the variation is acceptable or whether further evidence will be required. Facilities which do not closely resemble approved plan grades, elevations or configurations may require regrading by the Contractor; check volumetric computations; and/or a check hydraulic routing to ensure approved design water surface elevations, discharges or freeboard were closely maintained.

XX 6. Cross-section of the embankment through the principal spillway or outlet barrel. Must extend at least 100 ft. downstream of the pipe outlet or to recorded site property line, whichever is closer. Proper correlation is required between principal spillway (control structure) crest, emergency spillway crest, orifice and weirs and the top of the dam or facility. All elevations and dimensions must reasonably match the design plan or be sequentially relative to each other and the facility must reflect the required design storage volume(s) and/or design depth.

N/A 7. Profile or elevations along the entire centerline of the emergency spillway. Emergency spillway may be steeper, but no flatter or narrower than design.

N/A 8. Elevation of the principal spillway crest or outlet crest of the structure.

XX	9.	Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc.
XX	10.	Dimensions, locations and elevations of outlet orifices, weirs, slots and drains.
N/A	11.	Type and size of anti-vortex and trash rack device. Height, diameter, dimensions, bar spacings (if applicable) and elevations relative to the principal spillway crest. Indicate if lockable hatch is present or not.
N/A	12.	Type, location, size and number of anti-seep collars or documentation of other methods utilized for seepage control. **May need to obtain this information during construction.**
N/A	13.	Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. **May need to obtain this information during construction.**
XX	14.	Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert.
XX	15.	Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall.
N/A	16.	Outfall protection dimension, type and depth of rock and if underlain filter fabric is present.
____	17.	BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan.
____	18.	Maintenance plan taken from approved design plan transposed onto record drawing set.
N/A	19.	Fencing location and type, if applicable to facility.
N/A	20.	BMP vicinity properly cleaned of stockpiles and construction debris.
XX	21.	No visual signs of erosion or channel degradation immediately downstream of facility.
XX	22.	Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility.

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

III. Group A - Wet Ponds *(Includes A-1 Small Wet Ponds; A-2 Wet Ponds; A-3 Wet Ext Det Ponds.)*

N/A A1. All requirements of Section II, Minimum Standards, apply to Group A facilities.

N/A A2. Principal spillway consists of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.

N/A A3. Sediment forebays or pretreatment devices provided at inlets to pond. Generally 4 to 6 ft. deep.

N/A A4. Access for maintenance and equipment is provided to the forebay(s). Access corridors are at least 12 ft. wide, have a maximum slope of 15 percent and are adequately stabilized to withstand heavy equipment or vehicle use.

N/A A5. Adequate fixed vertical sediment depth markers installed in the forebay(s) for future sediment monitoring purposes.

N/A A6. Pond liner (if required) provided. Either clay liners, polyliners, bentonite liners or use of chemical soil additives based on requirements of the approved plan.

N/A A7. Minimum 6 percent slope safety bench extending a minimum of 15 feet outward from normal pool edge and/or an aquatic bench extending a minimum of 10 feet inward from the normal shoreline with a maximum depth of 12 inches below the normal pool elevation, if applicable, per the approved design plans. (Note: Safety benches may be waived if pond side slopes are no steeper than 4H:1V).

N/A A8. No trees are present within a zone 15 feet around the embankment toe and 25 feet from the principal spillway structure.

N/A A9. Wet permanent pool, typically 3 to 6 feet deep, is provided and maintains level within facility.

N/A A10. Low flow orifice has a non-clogging mechanism.

N/A A11. A pond drain pipe with valve was provided.

N/A A12. Pond side slopes are not steeper than 3H:1V, unless approved plan allowed for steeper slope.

N/A A13. End walls above barrels (outlet pipe) greater than 48 inch in diameter are fenced to prevent a fall hazard.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

IV. Group B - Wetlands *(Includes B-1 Shallow Marsh; B-2 Ext Det Shallow Wetlands; B-3 Pond Wetland System and B-4 Pocket Wetland)*

N/A B1. Same requirements as Group A Wet Ponds.

N/A B2. Minimum 2:1 length to width flow path provided across the facility.

N/A B3. Micropool provided at or around outlet from BMP (generally 3 to 6 ft. deep).

N/A B4. Wetland type landscaping provided in accordance with approved plan. Includes correct pondscaping zones, plant species, planting arrangements, wetland beds, etc. Wetland plants include 5 to 7 emergent wetland species. Individual plants at 18 inches on center in clumps.

N/A B5. Adequate wetland buffer provided (Typically 25 ft. outward from maximum design water surface elevation and 15 ft. setback to structures).

N/A B6. No more than one-half (½) of the wetland surface area is planted.

N/A B7. Topsoil or wetland mulch provided to support vigorous growth of wetland plants.

N/A B8. Planting zones staked or flagged in field and locations subsequently established by appropriate field surveying methods for record drawing presentation.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

V. Group C - Infiltration Practices *(Includes C-1 Infiltration Trench; C-2 Infiltration Trench; C-3 Infiltration Basin; and C-4 Infiltration Basin)*

XX	C1.	All requirements of Section II, Minimum Standards, apply to Group C facilities as applicable.
XX	C2.	Facility is not located on fill slopes or on natural ground in excess of six (6) percent.
XX	C3.	Pretreatment devices provided prior to entry into the infiltration facility. Acceptable pretreatment devices include sediment forebays, sediment basins, sediment traps, sump pits or inlets, grass channels, plunge pools or other acceptable measures.
N/A	C4.	Three (3) or more of the following pretreatment devices provided to protect long term integrity of structure: grass channel; grass filter strip; bottom sand layer; upper filter fabric layer; use of washed bank run gravel aggregate.
N/A	C5.	Sides of infiltration practice lined with filter fabric.
XX	C6.	Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.
N/A	C7.	Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.
XX	C8.	Minimum one hundred (100) foot separation horizontally from any known water supply well and minimum one hundred (100) foot separation upslope from any building.
XX	C9.	Minimum twenty-five (25) foot separation down gradient from any structure.
XX	C10.	Stormwater outfalls provided for overflow associated with larger design storms.
XX	C11.	No visual signs of erosion or channel degradation immediately downstream of facility.
XX	C12.	Facility does not currently cause any apparent surface or subsurface water problems to downgrade properties.
XX	C13.	Observation well provided.
XX	C14.	Adequate, direct access provided to the facility for future maintenance, operation and inspection.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

VI. Group D - Filtering Systems *(Includes D-1 Bioretention Cells; D-2 Surface Sand Filters; D-3 Underground Sand Filters; D-4 Perimeter Sand Filters; D-5 Organic Filters; and D-6 Pocket Sand Filters)*

XX	D1.	All requirements of Section II, Minimum Standards, apply to Group D facilities.
XX	D2.	Sediment pretreatment devices provided.
XX	D3.	For D-1 BMPs (Bioretention Cells), pretreatment consisting of a grass filter strip below level spreader (deflector); a gravel diaphragm; and mulch and planting soil layers were provided.
XX	D4.	For D-1 BMPs (Bioretention Cells), plantings consist of native plant species; vegetation provided was based on zones of hydric tolerances; trees and understory of shrubs and herbaceous materials were provided; woody vegetation is absent from inflow locations; and trees are located around facility perimeter.
XX	D5.	Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.
XX	D6.	No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed .
____	D7.	Filtering system is off-line from storm drainage conveyance system.
XX	D8.	Overflow outlet has adequate erosion protection.
XX	D9.	Deflector, diversion, flow splitter or regulator structure provided to divert the water quality volume to the filtering structure.
XX	D10.	Minimum four (4) inch perforated underdrain provided in a clean aggregate envelope layer beneath the facility.
XX	D11.	Minimum fifty (50) foot separation from any slope fifteen (15) percent or greater. Minimum one hundred (100) foot separation horizontally from any known water supply well. Minimum one hundred (100) foot separation upslope and twenty-five (25) foot separation downslope from any building.
XX	D12.	Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.
XX	D13.	No visual signs of erosion or channel degradation immediately downstream of facility.
XX	D14.	Adequate, direct access provided to the pretreatment area and/or filter bed for future maintenance.

STORMWATER MANAGEMENT / BMP FACILITIES
AS-BUILT PLAN CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

VII. Group E - Open Channel Systems *(Includes E-1 Wet Swales (Check Dams); E-2 Dry Swales;and E-3 Biofilters)*

N/A	E1.	All requirements of Section II, Minimum Standards, apply to Group E facilities as applicable.
N/A	E2.	Open channel system has constructed longitudinal slope of less than four (4) percent.
N/A	E3.	No visual signs of erosion in the open channel system's soil and/or vegetative cover.
N/A	E4.	Open channel side slopes are no steeper than 2H:1V at any location. Preferred channel sideslope is 3H:1V or flatter.
N/A	E5.	No visual signs of ponding are present at any location in the open channel system, except at rock check dam locations for E-1 systems (Wet Swales).
N/A	E6.	For E-2 BMPs (Dry Swales), an underdrain system was provided.
N/A	E7.	Treated timber or rock check dams provided as pretreatment devices for the open channel system.
N/A	E8.	Gravel diaphragm provided in areas where lateral sheet flow from impervious surfaces are directly connected to the open channel system.
N/A	E9.	Grass cover/stabilization in the open channel system appears adaptable to the specific soils and hydric conditions for the site and along the channel system.
N/A	E10.	Open channel system areas with grass covers higher than four (4) to six (6) inches were properly mowed.
N/A	E11.	Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.
N/A	E12.	No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.
N/A	E13.	For E-3 BMPs (Biofilters), the bottom width is six (6) feet maximum at any location.
N/A	E14.	For E-3 BMPs (Biofilters), sideslopes are 3H:1V maximum at any location.
N/A	E15.	For E-3 BMPs (Biofilters), the constructed channel slope is less than or equal to three (3) percent at any location.
N/A	E16.	For E-3 BMPs (Biofilters), the constructed grass channel is approximately equivalent to the constructed roadway length.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

VIII. Group F - Extended Dry Detention *(Includes F-1 Timber Walls; and F-2 Dry Extended Detention with Forebay)*

N/A	F1.	All requirements of Section II, Minimum Standards, apply to Group F facilities.
N/A	F2.	Basin bottom has positive slope and drainage from all basin inflow points to the riser (or outflow) location.
N/A	F3.	Timber wall BMP used in intermittent stream only. (ie. Prohibited in perennial streams.)
N/A	F4.	Forebay provided approximately 20 ft. upstream of the facility. Forebays generally 4 to 6 feet in depth.
N/A	F5.	A reverse slope pipe, vertical stand pipe or mini-barrel and riser was provided to prevent clogging.
N/A	F6.	Principal spillway and outlet barrel provided consisting of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.
N/A	F7.	Mini-barrel and riser, if used, contains a removable trash rack to reduce clogging.
N/A	F8.	Low flow orifice, if used, has a minimum diameter of three (3) inches or two (2) inches if internal orifice control was utilized and a small, cage type external trash rack.
N/A	F9.	Timbers properly reinforced or concrete footing provided if soil conditions were prohibitive.
N/A	F10.	Timber wall cross members extended to a minimum depth of two (2) feet below ground elevation.
N/A	F11.	Protection against erosion and scour from the low flow orifice and weir-flow trajectory provided.
N/A	F12.	Stilling basin or standard outlet protection provided at principal spillway outlet.
N/A	F13.	Adequate, direct access provided to the facility. Access corridor to facility is at least ten (10) feet wide, slope is less than twenty (20) percent and appropriate stabilization provided for equipment and vehicle use. Access extends to forebay, standpipe and timber wall, as applicable.
N/A	F14.	No visual signs of undercutting of timber walls or clogging of the low orifice were present.
N/A	F15.	No visual signs of erosion or channel degradation immediately downstream of facility.
N/A	F16.	No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

IX. Group G - Open Spaces *(Includes All Open Space Types G-1; G-2; and G-3)*

N/A G1. All requirements of Section II, Minimum Standards, apply to Group G facilities as applicable.

N/A G2. Constructed impervious areas appear to conform with locations indicated on the approved plan and appear less than sixty (60) percent impervious in accordance with the requirements of the James City County Chesapeake Bay Preservation Ordinance.

N/A G3. Dedicated open space areas are in undisturbed common areas, conservation easements or are protected by other enforceable instruments that ensures perpetual protection.

N/A G4. Provisions included to clearly specify how the natural vegetated areas utilized as dedicated open space will be managed and field identified (marked).

N/A G5. Adequate protection measures were implemented during construction to protect the defined dedicated open space areas.

N/A G6. Dedicated open space areas were not disturbed during construction (ie. cleared, grubbed or graded).

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

X. Storm Drainage Systems (Associated with BMP's Only)

(Includes all incidental stormwater drainage conveyance systems associated with SWM/BMP facilities such as onsite or offsite storm drains, open channels, inlets, manholes, junctions, outlet protections, deflectors, etc. These facilities are external to the treatment function of, but are directly associated with drainage to and/or from a constructed SWM/BMP facility. The intent of this portion of the certification is to accurately identify the type and quantity of inflow or outflow points associated with the facility for future reference. The Professional may use his/her own discretion to determine inclusive facilities to meet the intent of this section. As a general rule, storm drainage systems would include incidental facilities to the nearest access structure upslope or downslope from the normal physical limits of the facility or 800 feet of storm drainage conveyance system length, whichever is less.)

N/A SD1. All requirements of Section II, Minimum Standards, apply to Storm Drainage Systems.

N/A SD2. Horizontal location of all pipe and structures relative to the SWM/BMP facility.

N/A SD3. Type, top elevation and invert elevation of all access type structures (inlets, manholes, etc.).

N/A SD4. Material type, size or diameter, class, invert elevations, lengths and slopes for all pipe segments.

N/A SD5. Class, length, width and depth of riprap and outlet protections or dimensions of special energy dissipation structures.

XII. Other Systems

(Includes any non-typical, specialty, manufactured or innovative stormwater management/BMP practices or systems generally accepted for use as or in conjunction with other acceptable stormwater management / BMP practices. Requires evidence of prior satisfactory industry use and prior Environmental Division approval, waiver or exception .)

N/A O1. All requirements of Section II, Minimum Standards, apply to this section.

N/A O2. Certification criteria to be determined on a case-by-case basis by the Environmental Division specific to the proposed SWM/BMP facility.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

XIII. References *(The James City County Record Drawing and Construction Certification Forms and Checklists for Stormwater Management / BMP facilities were developed using the following sources and references.)*

- ☐ Baltimore County, Maryland Soil Conservation District, As-Built Stormwater Management Pond Checklist.
- ☑ James City County, Virginia, Guidelines for Design and Construction of Stormwater Management BMP's (October 1999).
- ☑ James City County, Virginia, Stormwater Detention/Retention Basin Design Checklist and Erosion and Sediment Control and Stormwater Management Design Plan Checklists.
- ☐ James City County Stormwater Policy Framework, Final Report of the James City County BMP Policy Project, October 1998, The Center for Watershed Protection.
- ☐ Prince Georges County, Maryland, As-Built Requirements Retention or Detention Pond/Basin.
- ☐ Prince William County, Virginia, Stormwater Management Fact Sheet.
- ☐ Stafford County, Virginia, As-Built Plan Checklist.
- ☐ Stormwater Management Design Manual, NRCS Maryland Code No. 378, Pond Standards and Specifications.
- ☐ USEPA/Watershed Management Institute, Stormwater Management Inspection Forms.
- ☐ Virginia Impounding Structure Regulations (Dam Safety), Department of Conservation & Recreation, 1997.
- ☑ Virginia Erosion and Sediment Control Handbook, Third Edition 1992, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation.
- ☑ Virginia Stormwater Management Handbook, 1999 edition, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation.

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James City County
VIRGINIA
Jamestown 1607

Development Management
101-A Mounts Bay Road
P.O. Box 8784
Williamsburg, VA 23187-8784
P: 757-253-6671
F. 757-253-6822
devman@james-city.va.us

jamescitycountyva.gov

Building Safety and Permits 757-253-6620
Engineering and Resource Protection 757-253-6670
Planning 757-253-6685
Zoning Enforcement 757-253-6671

W. M. Jordon
ATTN: Dave Ancarrow
3951Western Parkway Suite 160
Newport News, Virginia 23

Re: Courthouse Commons Parcel 2 and 3
SP-049-10; SP-084-11; SP-092-10: SP-085-11; SP-015-11; SP-021-12
County BMP ID Code: MC-022, MC-068, MC-067, PC-254, PC 255

Dear Mr. Ancarrow:

The Engineering and Resource Protection Division has received a record drawing (as-built) for ***only*** the stormwater management conveyance system components associated with the above referenced projects. The record drawing provides as-built information for the stormwater system located throughout the site, encompassing various phases of the project and generally as shown on the respective site plans as listed above by James City County Site Plan Number.

Based on our review of the project, record drawing submittal, and concurrent field inspection as performed on February 28 and March 20, 2012, the following items are necessary for address prior to the release of posted bonds and surety, and in order for our division to proceed with the closing out of the project:

Record Drawing & Construction Certification:

1. A this time, our office has not received all of the information as related to record drawing and construction certifications and as is provided for in note 21 on plan sheet 18 of the approved plan set. In addition to record drawings (as-built) to assure the drainage system was installed in accordance with the approved plans and will function as designed, construction certifications are required for the whole of the drainage conveyance, attenuation, and water quality treatment system to ensure proper materials were used during the installation of the systems components , that the bedding and backfill was provided consistent with the specifications contained in the approved plan set, and that the Best Management Practices (BMP's) will operate as intended. We have not received construction certifications for the storm system and have not received either record drawings or certifications for the various BMP's as located throughout the project. While information has been provided for the majority of the pipe network, portions of this network are currently being revised in both plans and during construction. Once this work has been completed, be advised that revised information will be required for all revised components. Please be advised that our office cannot reduce or release the posted bonds or surety until this information has been provided, reviewed, and deemed consistent with the approved plans for both placement and operation.

Record Drawing:

2. Each of the underground storage facilities (B-1, B-2 and B-3) systems installed on the project are shown on the record drawing. The facilities are shaded indicating that information for the facilities was not to be provided in these record drawings. These facilities need to be indentified on the plan to include all information pertaining to each one (not shaded).

3. The following inventory numbers are being provided for the facilities which are currently in place. Please contact Engineering and Resource Protection for the inventory numbers for the future facilities. Please add the following County identifiers to the plans as follows:

    a. Identify the underground infiltration facility B-3 as PC254.
    b. Identify the underground infiltration facility B-2 as MC067.
    c. Identify the underground infiltration facility B-1 as MC069.
    d. Identify the Bioretention facility B-1 as MC068.
    e. Identify the Bioretention B-3 as PC255.

4. According to the information provided in the record drawings, the pipe runs at line 2, 3, 5, 6, 9 have a slope percent change. An updated computation needs to be submitted to confirm these changes will affect the stormwater system. Please provide this information with the next submittal of the record drawings.

Construction Related Items:

5. Site inspection appears to indicate that the recently installed underground infiltration facilities B-1 and B-3 are not providing any infiltration. This is based on a 7 day period of no rainfall and no apparent drawdown in the associated manholes. As these facilities are the main components which provide the attenuation necessary for proper system function and compliance with State Minimum Standard 19 for channel adequacy and water quality as required under local, State, and Federal Regulation, none of the associated bonds can be reduced or released until this item has been addressed in full.

6. Bioretention B-3. With the next submittal of the record drawings, in providing all of the required information for this facility, please include in it all relevant information for the portion of the underdrain leading in a southerly direction as the observation port could not be located in the filed.

7. Bioretention B-3. The Rip Rap inlet channels need to be revised in the field so that the top of the stone is even with the respective gutter pan inlet. This is causing ponding at the inlets during rain events and is preventing stormwater from entering the facility in the design location. For example, there is an area of wash-out within the northern end of the facility that is in need of repair and all inlet locations need to be cleared of debris.

8. Structure SSB-6.4. on the east side of the south-easternmost structure, there appears to be the formation of a sinkhole; however, in this area there also appears to have been an irrigation line installed. It may be a simple fix, however, the source of the sinkhole needs to be investigated and rectified prior to release of the bonds.

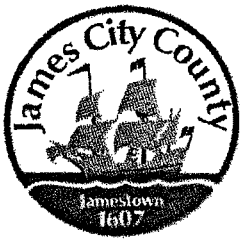
Be advised that once these comments have been addressed, and all of the required information has been provided, additional comments may be provided at that time.

Please contact me at 757-253-6702 or the assigned Engineering and Resource Protection Division inspector at 757-253-6683 should you have any comments or questions.

Sincerely,

William Cain, P.E.
Chief Civil Engineer
Engineering and Resource Protection

cc: AES – Jason Grimes - via email
W.M. Jordon – David Anacarrow/Bernie Taylor email
C.A. Barrs- Scott StClare-
JCC – Greg Johnson– via email



James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities
Record Drawing and Construction Certification Forms

(Note: In accordance with the requirements of the Chesapeake Bay Preservation Ordinance, Chapter 23, Section 23-10(4), BMP's shall be designed and constructed in accordance with the manual entitled James City County Guidelines for Design and Construction of Stormwater Management BMP's. Erosion and sediment control policy and approved plans generally require that at the completion of the project and prior to release of surety, an "as-built" plan prepared by a registered Professional Engineer or Certified Land Surveyor must be provided for the drainage system for the project, including any Best Management Practice (BMP) facilities. In addition, for BMP facilities involving the construction of an impounding structure or dam embankment, certification is required by a Professional Engineer who has inspected the structure during its construction. Currently there are over 20 water quality type BMP's accepted by the County.)

Section 1 - Site Information:

Project Name: Courthouse Commons Phase 1
Structure/BMP Name:
Project Location: 5223 Monticello Avenue, Williamsburg, Va.
BMP Location:
County Plan No.: SP - 0049 - 2010

Project Type: ☐ Residential ☑ Business
☐ Commercial ☐ Office
☐ Institutional ☐ Industrial
☐ Public ☐ Roadway
☐ Other

Tax Map/Parcel No.: 3840100003G
BMP ID Code (if known):
Zoning District::
Land Use: M1 (Limited Business/Industrial
Site Area (sf or acres): 9.06 acres

Brief Description of Stormwater Management/BMP Facility:
BMP ID: PC254, PC255, MC067, MC068, MC069

Nearest Visible Landmark to SWM/BMP Facility:

Nearest Vertical Ground Control (if known):
☐ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☐ Other
Station Number or Name:
Datum or Reference Elevation:
Control Description:
Control Location from Subject Facility:

Section 2 - Stormwater Management / BMP Facility Construction Information:

PreConstruction Meeting Held for Construction of SWM/BMP Facility: ☐ Yes ☐ No ☑ Unknown
Approx. Construction Start Date for SWM/BMP Facility: October 30, 2010
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☑ Unknown
Name of Site Work Contractor Who Constructed Facility: C.A. Barrs
Name of Professional Firm Who Routinely Monitored Construction: ECS Mid-Atlantic, LLC
Date of Completion for SWM/BMP Facility: April 6, 2011
Date of Record Drawing/Construction Certification Submittal: _____

(Note: Record Drawing and Construction Certifications are required within thirty (30) days of the completion of Stormwater Management and/or BMP facility construction. Record Drawings and Construction Certifications must be reviewed and approved by the James City County Environmental Division prior to final inspection, acceptance and bond or surety release.)

Section 3 - Owner / Designer / Contractor Information:

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*

Name: Newtown Six, LLC
Mailing Address: P.O. box 6000
Williamsburg, VA 23188
Business Phone: (757) 259-3820 Fax: (757) 259-3800
Contact Person: Gregory Davis Title: _____

Design Professional: *(Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater Management / BMP facility.)*

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Rd
Williamsburg, VA 23188
Business Phone: 253-0040
Fax: _____
Responsible Plan Preparer: Jason Grimes
Title: Project Manager
Plan Name: Courthouse Commons, Phase 1
Firm's Project No. 8509-04
Plan Date: 10-4-10
Sheet No.'s Applicable to SWM/BMP Facility: 6 / 7 / 8 / 9 / _____

BMP Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater Management / BMP facility.)*

Name: C.A. Barrs Contractor
Mailing Address: P.O. Box 1489
Grafton , Virginia 23692
Business Phone: (757) 898-7282
Fax: (757) 898-1282
Contact Person: Scott St. Clair
Site Foreman/Supervisor: _____
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 - Professional Certifications:

Certifying Professionals: *(Note: A Registered Professional Engineer or Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the drainage system for the project including any Stormwater Management/BMP Facilities. A Registered Professional Engineer is responsible for the inspection, monitoring and certification of Stormwater Management / BMP facilities during its construction.)*

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Road, Suite 1
Williamsburg, Va. 23188
Business Phone: (757) 253-0040
Fax: (757) 869-2924

Name: Jason Grimes, P.E.
Title: Project Manager
Signature:
Date: 5/23/12

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

COMMONWEALTH OF VIRGINIA
JASON A. GRIMES
Lic. No. 40170
5/23/12
PROFESSIONAL ENGINEER

_____ (Seal)

Virginia Registered Professional Engineer
or Certified Land Surveyor

Construction Certification

Firm Name: ECS Mid-Atlantic, LLC
Mailing Address: 108 Ingram Road, Suite 1
Williamsburg, Va. 23188
Business Phone: (757) 229-6677
Fax: (757) 229-9978

Name: B. Scott Gresham, P.E.
Title: Construction Services Manager
Signature:
Date: 5/23/12

I hereby certify to the best of my knowledge and belief that this Stormwater Management/BMP facility was monitored and constructed in accordance with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

COMMONWEALTH OF VIRGINIA
5/23/12
B. SCOTT GRESHAM
Lic. No. 037785
PROFESSIONAL ENGINEER

_____ (Seal)

Virginia Registered
Professional Engineer

Section 5 - Record Drawing and Construction Certification Requirements and Instructions:

☑ PreConstruction Meeting - Provides an opportunity to review SWM / BMP facility construction, maintenance and operation plans and address any questions regarding construction and/or monitoring of the structure. The design engineer, certifying professionals (if different), Owner/Applicant, Contractor and County representative(s) are encouraged to attend the preconstruction meeting. Advanced notice to the Environmental Division is requested. Usually, this requirement can be met simultaneously with Erosion and Sediment Control preconstruction meetings held for the project.

☑ A fully completed ***STORMWATER MANAGEMENT / BMP FACILITIES, RECORD DRAWING and CONSTRUCTION CERTIFICATION FORM*** and ***RECORD DRAWING CHECKLIST***. All applicable sections shall be completed in their entirety and certification statements signed and sealed by the registered professional responsible for individual record drawing and/or construction certification.

☑ The Record Drawing shall be prepared by a Registered Professional Engineer or Certified Land Surveyor for the drainage system of the project including any Best Management Practices.

☑ Construction Certification. Construction of Stormwater Management / BMP facilities which contain impoundments, embankments and related engineered appurtenances including subgrade preparation, compacted soils, structural fills, liners, geosynthetics, filters, seepage controls, cutoffs, toe drains, hydraulic flow control structures, etc. shall be visually observed and monitored by a Registered Professional Engineer or his/her authorized representative. The Engineer must certify that the structure, embankment and associated appurtenances were built in accordance with the approved design plan, specifications and stormwater management plan and standard accepted construction practice and shall submit a written certification and/or drawings to the Environmental Division as required. Soil and compaction test reports, concrete test reports, inspection reports, logs and other required construction material or installation documentation may be required by the Environmental Division to substantiate the certification, if specifically requested. The Engineer shall have the authority and responsibility to make minor changes to the approved plan, in coordination with the assigned County inspector, in order to compensate for unsafe or unusual conditions encountered during construction such as those related to bedrock, soils, groundwater, topography, etc. as long as changes do not adversely affect the integrity of the structure(s). Major changes to the approved design plan or structure must be reviewed and approved by the original design professional and the James City County Environmental Division.

☑ Record Drawing and Construction Certifications are required within **thirty (30) days** of the completion of Stormwater Management / BMP facility construction. Submittals must be reviewed and accepted by James City County Environmental Division prior to final inspection, acceptance and bond/surety release.

Dual Purpose Facilities - Completion of construction also includes an interim stage for Stormwater Management / BMP facilities which serve dual purpose as temporary sediment basins during construction and as permanent stormwater management / BMP facilities following construction, once development and stabilization are substantially complete. For these dual purpose facilities, construction certification is required once the temporary sediment basin phase of construction is complete. Final record drawing and construction certification of additional permanent components is required once permanent facility construction is complete.

Interim Construction Certification is required for those dual purpose embankment-type facilities that are generally ten (10) feet or greater in dam height (*) and may not be converted, modified or begin function as a permanent SWM / BMP structure for a period generally ranging from six (6) to eighteen (18) months or more from issuance of a Land Disturbance permit for construction.

Interim or final record drawing and construction certifications are not required for temporary sediment basins which are designed and constructed in accordance with current minimum standards and specifications for temporary sediment basins per the Virginia Erosion and Sediment Control Handbook (VESCH); have a temporary service life of less than eighteen (18) months; and will be removed completely once associated disturbed areas are stabilized, unless a distinct hazard to the public's health, safety and welfare is determined by the Environmental Division due to the size or presence of the structure or due to evidence of improper construction.

(*Note: Dam Height as referenced above is generally defined as the vertical distance from the natural bed of the stream or waterway at the downstream toe of the embankment to the top of the embankment structure in accordance with 4VAC50-20-30, Virginia Impoundment Structure Regulations and the Virginia Dam Safety Program.)

☑ Record Drawings shall provide, at a minimum, all information as shown within these requirements and the attached **RECORD DRAWING CHECKLIST** specific to the type of SWM/BMP facility being constructed. Other additional record data may be formally requested by the James City County Environmental Division. *(Note: Refer to the current edition of the James City County Guidelines for Design and Construction of Stormwater Management BMP's manual for a complete list of acceptable BMP's. Currently there are over 20 acceptable water quality type BMP's accepted by the County.)*

☑ Record Drawings shall consist of blue/black line prints and a reproducible (mylar, sepia, diazo, etc.) set of the approved stormwater management plan including applicable plan views, profiles, sections, details, maintenance plans, etc. as related to the subject SWM / BMP facility. The set shall indicate **"RECORD DRAWING "** in large text in the lower right hand corner of each sheet with record elevations, dimensions and data drawn in a clearly annotated format and/or boxed beside design values. Approved design plan values, dimensions and data shall not be removed or erased. Drawing sheet revision blocks shall be modified as required to indicate record drawing status. Elevations to the nearest 0.1' are sufficiently accurate except where higher accuracy is needed to show positive drainage. Certification statements as shown in Section 4 of the Record Drawing and Construction Certification Form, ***or similar forms thereof***, and professional signatures and seals, with dates matching that of the record drawing status in the revision or title block, are also required on all associated record drawing plans, prints or reproducibles.

☑ Submission Requirements. Initial and subsequent submissions for review shall consist of a minimum of one (1) blue/black line set for record drawings and one copy of the construction certification documents with appropriate transmittal. Under certain circumstances, it is understood that the record drawing and construction certification submissions may be performed by different professional firms. Therefore, record drawing submission may be in advance of construction certification or vice versa. Upon approval and prior to release of bond/surety, final submission shall include one (1) reproducible set of the record drawings, one (1) blue/black line set of the record drawings and one (1) copy of the construction certification. Also for current and/or future incorporation into the County BMP database and GIS system, it is requested that the record drawings also be submitted to the Environmental Division on a diskette or CD-ROM in an acceptable electronic file format such as *.dxf, *.dwg, etc. or in a standard scanned and readable format. The electronic file requirement can be discussed and coordinated with Environmental Division staff at the time of final submission.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

I. Methods and Presentation: *(Required for all Stormwater Management / BMP facilities.)*

XX 1. All constructed facilities meet approved design plans, unless otherwise shown. Record information or deviations from approved design plan shown in clearly annotated format and/or boxed beside design values.

XX 2. Elevations to the nearest 0.1' unless higher accuracy is needed to show positive drainage.

XX 3. All plan sheets labeled with "RECORD DRAWING" in large text in lower right hand corner (Approved County Plan Number and BMP ID Code can be included if known).

XX 4. All plan sheet revision blocks modified to indicate date and record drawing status.

XX 5. All plan sheets have certification statements and certifying professional's signature and seal.

II. Minimum Standards: *(Required for all Stormwater Management / BMP facilities, as applicable.)*

XX 1. All requirements of Section I (Methods and Presentation) apply to this section.

XX 2. Plan Views: Show general location, arrangement and dimensions. Location and alignment shall generally match approved design plans.

XX 3. Profile or elevations along top or berm of the facility. At a minimum, elevations are required at each end, at intervals not to exceed 50 feet and where low spots may be present. Top of embankment or berm elevations must be no less than design elevation plus any settlement allowances.

____ 4. Top widths, berm widths and embankment side slopes.

____ 5. Show length, width and depth of facility or grading, contours or spot elevations as required to verify permanent pool and design storage volumes were met or were reasonably close to the approved design. Evaluation of as-built grading, contours, spot elevations, or cross-sections, may be necessary by the professional to ensure approved design configurations, depths and volumes were closely maintained. If grading or elevations are significantly different from the approved plan, the Environmental Division shall be contacted immediately to determine whether the variation is acceptable or whether further evidence will be required. Facilities which do not closely resemble approved plan grades, elevations or configurations may require regrading by the Contractor; check volumetric computations; and/or a check hydraulic routing to ensure approved design water surface elevations, discharges or freeboard were closely maintained.

XX 6. Cross-section of the embankment through the principal spillway or outlet barrel. Must extend at least 100 ft. downstream of the pipe outlet or to recorded site property line, whichever is closer. Proper correlation is required between principal spillway (control structure) crest, emergency spillway crest, orifice and weirs and the top of the dam or facility. All elevations and dimensions must reasonably match the design plan or be sequentially relative to each other and the facility must reflect the required design storage volume(s) and/or design depth.

N/A 7. Profile or elevations along the entire centerline of the emergency spillway. Emergency spillway may be steeper, but no flatter or narrower than design.

N/A 8. Elevation of the principal spillway crest or outlet crest of the structure.

XX	9.	Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc.
XX	10.	Dimensions, locations and elevations of outlet orifices, weirs, slots and drains.
N/A	11.	Type and size of anti-vortex and trash rack device. Height, diameter, dimensions, bar spacings (if applicable) and elevations relative to the principal spillway crest. Indicate if lockable hatch is present or not.
N/A	12.	Type, location, size and number of anti-seep collars or documentation of other methods utilized for seepage control. **May need to obtain this information during construction.**
N/A	13.	Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. **May need to obtain this information during construction.**
XX	14.	Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert.
XX	15.	Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall.
N/A	16.	Outfall protection dimension, type and depth of rock and if underlain filter fabric is present.
____	17.	BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan.
____	18.	Maintenance plan taken from approved design plan transposed onto record drawing set.
N/A	19.	Fencing location and type, if applicable to facility.
N/A	20.	BMP vicinity properly cleaned of stockpiles and construction debris.
XX	21.	No visual signs of erosion or channel degradation immediately downstream of facility.
XX	22.	Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility.

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

III. Group A - Wet Ponds *(Includes A-1 Small Wet Ponds; A-2 Wet Ponds; A-3 Wet Ext Det Ponds.)*

N/A A1. All requirements of Section II, Minimum Standards, apply to Group A facilities.

N/A A2. Principal spillway consists of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.

N/A A3. Sediment forebays or pretreatment devices provided at inlets to pond. Generally 4 to 6 ft. deep.

N/A A4. Access for maintenance and equipment is provided to the forebay(s). Access corridors are at least 12 ft. wide, have a maximum slope of 15 percent and are adequately stabilized to withstand heavy equipment or vehicle use.

N/A A5. Adequate fixed vertical sediment depth markers installed in the forebay(s) for future sediment monitoring purposes.

N/A A6. Pond liner (if required) provided. Either clay liners, polyliners, bentonite liners or use of chemical soil additives based on requirements of the approved plan.

N/A A7. Minimum 6 percent slope safety bench extending a minimum of 15 feet outward from normal pool edge and/or an aquatic bench extending a minimum of 10 feet inward from the normal shoreline with a maximum depth of 12 inches below the normal pool elevation, if applicable, per the approved design plans. (Note: Safety benches may be waived if pond side slopes are no steeper than 4H:1V).

N/A A8. No trees are present within a zone 15 feet around the embankment toe and 25 feet from the principal spillway structure.

N/A A9. Wet permanent pool, typically 3 to 6 feet deep, is provided and maintains level within facility.

N/A A10. Low flow orifice has a non-clogging mechanism.

N/A A11. A pond drain pipe with valve was provided.

N/A A12. Pond side slopes are not steeper than 3H:1V, unless approved plan allowed for steeper slope.

N/A A13. End walls above barrels (outlet pipe) greater than 48 inch in diameter are fenced to prevent a fall hazard.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

IV. Group B - Wetlands *(Includes B-1 Shallow Marsh; B-2 Ext Det Shallow Wetlands; B-3 Pond Wetland System and B-4 Pocket Wetland)*

N/A B1. Same requirements as Group A Wet Ponds.

N/A B2. Minimum 2:1 length to width flow path provided across the facility.

N/A B3. Micropool provided at or around outlet from BMP (generally 3 to 6 ft. deep).

N/A B4. Wetland type landscaping provided in accordance with approved plan. Includes correct pondscaping zones, plant species, planting arrangements, wetland beds, etc. Wetland plants include 5 to 7 emergent wetland species. Individual plants at 18 inches on center in clumps.

N/A B5. Adequate wetland buffer provided (Typically 25 ft. outward from maximum design water surface elevation and 15 ft. setback to structures).

N/A B6. No more than one-half (½) of the wetland surface area is planted.

N/A B7. Topsoil or wetland mulch provided to support vigorous growth of wetland plants.

N/A B8. Planting zones staked or flagged in field and locations subsequently established by appropriate field surveying methods for record drawing presentation.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

V. Group C - Infiltration Practices *(Includes C-1 Infiltration Trench; C-2 Infiltration Trench; C-3 Infiltration Basin; and C-4 Infiltration Basin)*

XX	C1.	All requirements of Section II, Minimum Standards, apply to Group C facilities as applicable.
XX	C2.	Facility is not located on fill slopes or on natural ground in excess of six (6) percent.
XX	C3.	Pretreatment devices provided prior to entry into the infiltration facility. Acceptable pretreatment devices include sediment forebays, sediment basins, sediment traps, sump pits or inlets, grass channels, plunge pools or other acceptable measures.
N/A	C4.	Three (3) or more of the following pretreatment devices provided to protect long term integrity of structure: grass channel; grass filter strip; bottom sand layer; upper filter fabric layer; use of washed bank run gravel aggregate.
N/A	C5.	Sides of infiltration practice lined with filter fabric.
XX	C6.	Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.
N/A	C7.	Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.
XX	C8.	Minimum one hundred (100) foot separation horizontally from any known water supply well and minimum one hundred (100) foot separation upslope from any building.
XX	C9.	Minimum twenty-five (25) foot separation down gradient from any structure.
XX	C10.	Stormwater outfalls provided for overflow associated with larger design storms.
XX	C11.	No visual signs of erosion or channel degradation immediately downstream of facility.
XX	C12.	Facility does not currently cause any apparent surface or subsurface water problems to downgrade properties.
XX	C13.	Observation well provided.
XX	C14.	Adequate, direct access provided to the facility for future maintenance, operation and inspection.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

VI. Group D - Filtering Systems *(Includes D-1 Bioretention Cells; D-2 Surface Sand Filters; D-3 Underground Sand Filters; D-4 Perimeter Sand Filters; D-5 Organic Filters; and D-6 Pocket Sand Filters)*

XX	D1.	All requirements of Section II, Minimum Standards, apply to Group D facilities.
XX	D2.	Sediment pretreatment devices provided.
XX	D3.	For D-1 BMPs (Bioretention Cells), pretreatment consisting of a grass filter strip below level spreader (deflector); a gravel diaphragm; and mulch and planting soil layers were provided.
XX	D4.	For D-1 BMPs (Bioretention Cells), plantings consist of native plant species; vegetation provided was based on zones of hydric tolerances; trees and understory of shrubs and herbaceous materials were provided; woody vegetation is absent from inflow locations; and trees are located around facility perimeter.
XX	D5.	Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.
XX	D6.	No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed .
____	D7.	Filtering system is off-line from storm drainage conveyance system.
XX	D8.	Overflow outlet has adequate erosion protection.
XX	D9.	Deflector, diversion, flow splitter or regulator structure provided to divert the water quality volume to the filtering structure.
XX	D10.	Minimum four (4) inch perforated underdrain provided in a clean aggregate envelope layer beneath the facility.
XX	D11.	Minimum fifty (50) foot separation from any slope fifteen (15) percent or greater. Minimum one hundred (100) foot separation horizontally from any known water supply well. Minimum one hundred (100) foot separation upslope and twenty-five (25) foot separation downslope from any building.
XX	D12.	Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.
XX	D13.	No visual signs of erosion or channel degradation immediately downstream of facility.
XX	D14.	Adequate, direct access provided to the pretreatment area and/or filter bed for future maintenance.

STORMWATER MANAGEMENT / BMP FACILITIES
AS-BUILT PLAN CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

VII. Group E - Open Channel Systems *(Includes E-1 Wet Swales (Check Dams); E-2 Dry Swales;and E-3 Biofilters)*

N/A	E1.	All requirements of Section II, Minimum Standards, apply to Group E facilities as applicable.
N/A	E2.	Open channel system has constructed longitudinal slope of less than four (4) percent.
N/A	E3.	No visual signs of erosion in the open channel system's soil and/or vegetative cover.
N/A	E4.	Open channel side slopes are no steeper than 2H:1V at any location. Preferred channel sideslope is 3H:1V or flatter.
N/A	E5.	No visual signs of ponding are present at any location in the open channel system, except at rock check dam locations for E-1 systems (Wet Swales).
N/A	E6.	For E-2 BMPs (Dry Swales), an underdrain system was provided.
N/A	E7.	Treated timber or rock check dams provided as pretreatment devices for the open channel system.
N/A	E8.	Gravel diaphragm provided in areas where lateral sheet flow from impervious surfaces are directly connected to the open channel system.
N/A	E9.	Grass cover/stabilization in the open channel system appears adaptable to the specific soils and hydric conditions for the site and along the channel system.
N/A	E10.	Open channel system areas with grass covers higher than four (4) to six (6) inches were properly mowed.
N/A	E11.	Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.
N/A	E12.	No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.
N/A	E13.	For E-3 BMPs (Biofilters), the bottom width is six (6) feet maximum at any location.
N/A	E14.	For E-3 BMPs (Biofilters), sideslopes are 3H:1V maximum at any location.
N/A	E15.	For E-3 BMPs (Biofilters), the constructed channel slope is less than or equal to three (3) percent at any location.
N/A	E16.	For E-3 BMPs (Biofilters), the constructed grass channel is approximately equivalent to the constructed roadway length.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

VIII. Group F - Extended Dry Detention *(Includes F-1 Timber Walls; and F-2 Dry Extended Detention with Forebay)*

N/A	F1.	All requirements of Section II, Minimum Standards, apply to Group F facilities.
N/A	F2.	Basin bottom has positive slope and drainage from all basin inflow points to the riser (or outflow) location.
N/A	F3.	Timber wall BMP used in intermittent stream only. (ie. Prohibited in perennial streams.)
N/A	F4.	Forebay provided approximately 20 ft. upstream of the facility. Forebays generally 4 to 6 feet in depth.
N/A	F5.	A reverse slope pipe, vertical stand pipe or mini-barrel and riser was provided to prevent clogging.
N/A	F6.	Principal spillway and outlet barrel provided consisting of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.
N/A	F7.	Mini-barrel and riser, if used, contains a removable trash rack to reduce clogging.
N/A	F8.	Low flow orifice, if used, has a minimum diameter of three (3) inches or two (2) inches if internal orifice control was utilized and a small, cage type external trash rack.
N/A	F9.	Timbers properly reinforced or concrete footing provided if soil conditions were prohibitive.
N/A	F10.	Timber wall cross members extended to a minimum depth of two (2) feet below ground elevation.
N/A	F11.	Protection against erosion and scour from the low flow orifice and weir-flow trajectory provided.
N/A	F12.	Stilling basin or standard outlet protection provided at principal spillway outlet.
N/A	F13.	Adequate, direct access provided to the facility. Access corridor to facility is at least ten (10) feet wide, slope is less than twenty (20) percent and appropriate stabilization provided for equipment and vehicle use. Access extends to forebay, standpipe and timber wall, as applicable.
N/A	F14.	No visual signs of undercutting of timber walls or clogging of the low orifice were present.
N/A	F15.	No visual signs of erosion or channel degradation immediately downstream of facility.
N/A	F16.	No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

IX. Group G - Open Spaces *(Includes All Open Space Types G-1; G-2; and G-3)*

N/A G1. All requirements of Section II, Minimum Standards, apply to Group G facilities as applicable.

N/A G2. Constructed impervious areas appear to conform with locations indicated on the approved plan and appear less than sixty (60) percent impervious in accordance with the requirements of the James City County Chesapeake Bay Preservation Ordinance.

N/A G3. Dedicated open space areas are in undisturbed common areas, conservation easements or are protected by other enforceable instruments that ensures perpetual protection.

N/A G4. Provisions included to clearly specify how the natural vegetated areas utilized as dedicated open space will be managed and field identified (marked).

N/A G5. Adequate protection measures were implemented during construction to protect the defined dedicated open space areas.

N/A G6. Dedicated open space areas were not disturbed during construction (ie. cleared, grubbed or graded).

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

X. Storm Drainage Systems (Associated with BMP's Only)

(Includes all incidental stormwater drainage conveyance systems associated with SWM/BMP facilities such as onsite or offsite storm drains, open channels, inlets, manholes, junctions, outlet protections, deflectors, etc. These facilities are external to the treatment function of, but are directly associated with drainage to and/or from a constructed SWM/BMP facility. The intent of this portion of the certification is to accurately identify the type and quantity of inflow or outflow points associated with the facility for future reference. The Professional may use his/her own discretion to determine inclusive facilities to meet the intent of this section. As a general rule, storm drainage systems would include incidental facilities to the nearest access structure upslope or downslope from the normal physical limits of the facility or 800 feet of storm drainage conveyance system length, whichever is less.)

N/A SD1. All requirements of Section II, Minimum Standards, apply to Storm Drainage Systems.

N/A SD2. Horizontal location of all pipe and structures relative to the SWM/BMP facility.

N/A SD3. Type, top elevation and invert elevation of all access type structures (inlets, manholes, etc.).

N/A SD4. Material type, size or diameter, class, invert elevations, lengths and slopes for all pipe segments.

N/A SD5. Class, length, width and depth of riprap and outlet protections or dimensions of special energy dissipation structures.

XII. Other Systems

(Includes any non-typical, specialty, manufactured or innovative stormwater management/BMP practices or systems generally accepted for use as or in conjunction with other acceptable stormwater management / BMP practices. Requires evidence of prior satisfactory industry use and prior Environmental Division approval, waiver or exception .)

N/A O1. All requirements of Section II, Minimum Standards, apply to this section.

N/A O2. Certification criteria to be determined on a case-by-case basis by the Environmental Division specific to the proposed SWM/BMP facility.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

XIII. References *(The James City County Record Drawing and Construction Certification Forms and Checklists for Stormwater Management / BMP facilities were developed using the following sources and references.)*

- ☐ Baltimore County, Maryland Soil Conservation District, As-Built Stormwater Management Pond Checklist.
- ☑ James City County, Virginia, Guidelines for Design and Construction of Stormwater Management BMP's (October 1999).
- ☑ James City County, Virginia, Stormwater Detention/Retention Basin Design Checklist and Erosion and Sediment Control and Stormwater Management Design Plan Checklists.
- ☐ James City County Stormwater Policy Framework, Final Report of the James City County BMP Policy Project, October 1998, The Center for Watershed Protection.
- ☐ Prince Georges County, Maryland, As-Built Requirements Retention or Detention Pond/Basin.
- ☐ Prince William County, Virginia, Stormwater Management Fact Sheet.
- ☐ Stafford County, Virginia, As-Built Plan Checklist.
- ☐ Stormwater Management Design Manual, NRCS Maryland Code No. 378, Pond Standards and Specifications.
- ☐ USEPA/Watershed Management Institute, Stormwater Management Inspection Forms.
- ☐ Virginia Impounding Structure Regulations (Dam Safety), Department of Conservation & Recreation, 1997.
- ☑ Virginia Erosion and Sediment Control Handbook, Third Edition 1992, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation.
- ☑ Virginia Stormwater Management Handbook, 1999 edition, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation.

File: Shared\SWMProg\BMP\Certif\RDCC_fillable.wpd

4. Record Drawings (As Builts)

NOTES

SITE PLANIMETRIC INFORMATION IS A COMBINATION OF FIELD VERIFIED FEATURES AND PROPOSED ITEMS FROM THE APPROVED PLANS DATED 12/22/10.

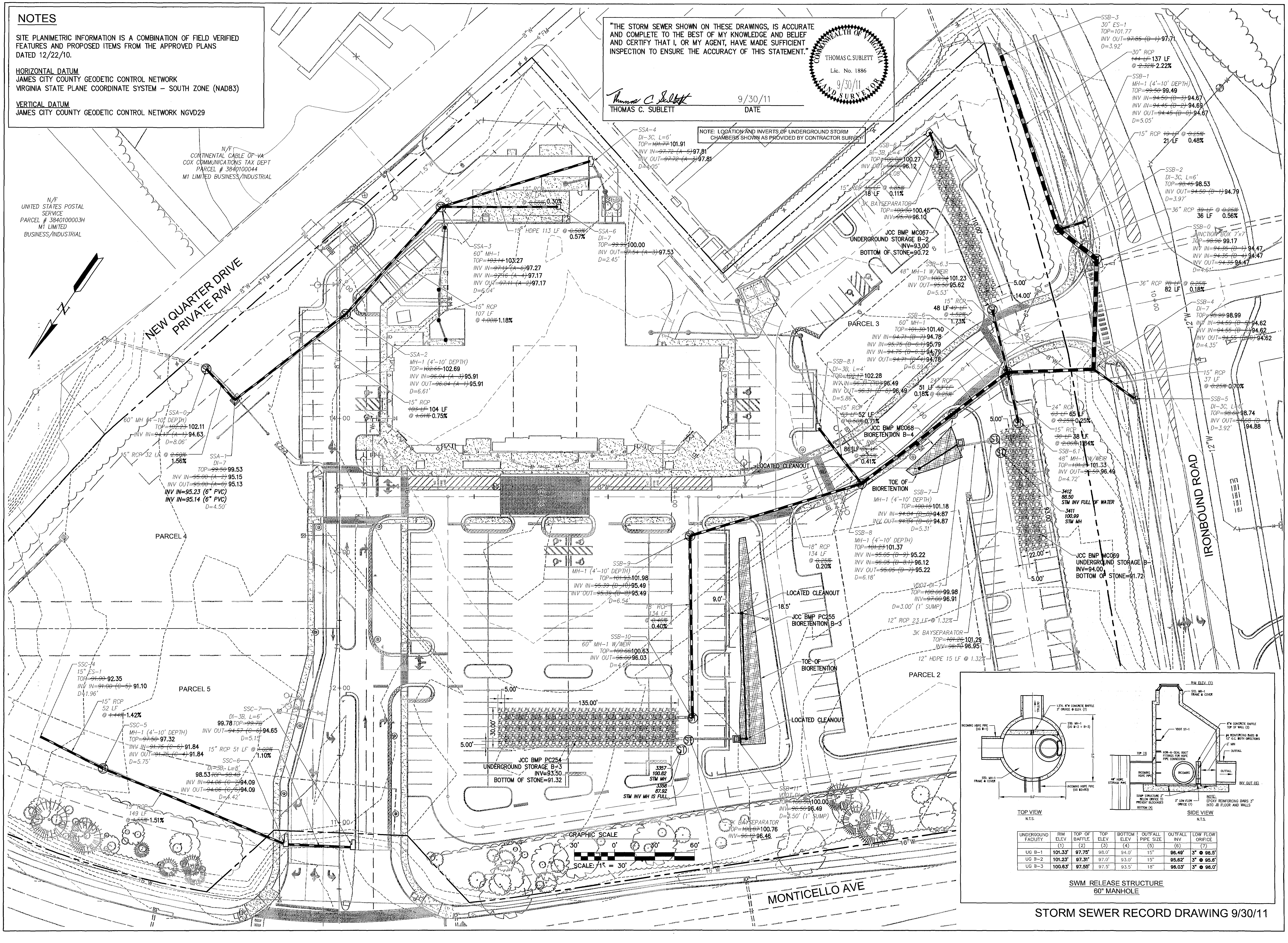
HORIZONTAL DATUM
JAMES CITY COUNTY GEODETIC CONTROL NETWORK
VIRGINIA STATE PLANE COORDINATE SYSTEM – SOUTH ZONE (NAD83)

VERTICAL DATUM
JAMES CITY COUNTY GEODETIC CONTROL NETWORK NGVD29

"THE STORM SEWER SHOWN ON THESE DRAWINGS, IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF AND CERTIFY THAT I, OR MY AGENT, HAVE MADE SUFFICIENT INSPECTION TO ENSURE THE ACCURACY OF THIS STATEMENT."

COMMONWEALTH OF VIRGINIA — THOMAS C. SUBLETT — Lic. No. 1886 — 9/30/11 — LAND SURVEYOR

THOMAS C. SUBLETT — 9/30/11
DATE



UNDERGOUND FACILITY	RIM ELEV	TOP OF BAFFLE	TOP ELEV	BOTTOM ELEV	OUTFALL PIPE SIZE	OUTFALL INV	LOW FLOW ORIFICE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
UG B-1	101.33'	97.75'	98.0'	94.0'	15"	96.49'	3" @ 96.5'
UG B-2	101.23'	97.31'	97.0'	93.0'	15"	95.62'	3" @ 95.6'
UG B-3	100.63'	97.55'	97.5'	93.5'	18"	96.03'	3" @ 96.0'

SWM RELEASE STRUCTURE
60" MANHOLE

STORM SEWER RECORD DRAWING 9/30/11

AES CONSULTING ENGINEERS
5248 Olde Towne Road, Suite 1 Williamsburg, Virginia 23188 — www.aesva.com
Hampton Roads | Central Virginia | Middle Peninsula

UTILITY RECORD DRAWING
COURTHOUSE COMMONS
PARCELS 2 & 3
BERKELEY DISTRICT — JAMES CITY COUNTY — VIRGINIA

Project Contacts: JAG, TCS
Project Number: 8509-04
Scale: 1"=30'
Date: 9/30/11
Sheet Title: STORM SEWER RECORD DRAWING
Sheet Number 1 OF 1

5. Construction Drawings

6. Design Calculations

DRAINAGE CALCULATIONS

FOR

Courthouse Commons

SITE:
James City County

SUBMITTED TO:

James City County Environmental Division

County Plan No.:

Prepared By:

AES Consulting Engineers
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188

October 4, 2010

SP-49-10
PH 1
FINAL COMPS.

AES Project No. 8509-04

AES
CONSULTING ENGINEERS

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    2. 100-Year
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5. 100-Year

r. P.O.C. B
1. 10-Year
2. 100-Year

s. Area C-2
1. 10-Year
2. 100-Year

t. Area C-6
1. 10-Year
2. 100-Year

u. Area C-7
1. 10-Year
2. 100-Year

v. Infiltration Basin C Routed
1. Water Quality Volume
2. Infiltration Calculations
3. Pond Report
4. 10-Year
5. 100-Year

w. Area C-3
1. 10-Year
2. 100-Year

x. P.O.C. C
1. 10-Year
2. 100-Year.

- **Erosion & Sediment Control**

a. Ditch Calculations
3. Diversion Ditch B1
4. Diversion Ditch C1
5. Diversion Ditch B2
6. Diversion Ditch C2

b. Sediment Basin B
7. Max. Drainage Area to Sediment Basin
8. Sediment Basin Design Worksheet
9. Pond Report

10. 25-Year Storm

c. Sediment Basin C
    11. Max. Drainage Area to Sediment Basin
    12. Sediment Basin Design Worksheet
    13. Pond Report
    14. 25-Year Storm

- **Offsite Evaluation (Ironbound Mini-Storage)**
    a. Pre-Development
        1. 10-Year Storm
        2. 100-Year Storm
    b. Post-Development
        1. 10-Year Storm
        2. 100-Year Storm
    c. Pre and Post-Development Drainage Maps

Stormwater Management and Drainage Design Report
Courthouse Commons

AES Project Number 8509-04
Revised August 2010

Project Description

New Town Six LLC, through the services of AES Consulting Engineers, has prepared a Site Plan for the development of a 9 acre tract of land in James City County, Virginia. This site is being designed per the approved SUP master plan and in accordance with the current James City County Zoning Ordinance under the M-1 designation. The site at the intersection of Monticello Avenue and Ironbound Road and is bounded along the southeastern side by the private New Quarter Drive.

Description of Site Drainage

The existing site is made up of 6 parcels, of which over 3 acres were developed as a Bell Atlantic/Verizon office with vehicle storage. The remainder of the site is wooded with the exception of the remnants of an old woods road running through the site near the Post Office Parcel. The developed portion of the site current drains into a storm system which drains through the Post Office property, into the Monticello Avenue storm system and discharges uncontrolled into a tributary of the Powhattan Creek. Another 1.5 acres of wooded area on the site drains directly to Monticello Avenue and ultimately into the roadway drainage system. The remainder of the wooded portion of the property drains into the roadside ditch along Ironbound road, and runs through a series of culverts and ultimately discharges through a design 42" by-pass storm pipe under the Ironbound Mini-Storage site to a tributary of Mill Creek.

Stormwater Management/Best Management Practices

The proposed development will be treated through a series of underground and surface infiltration measures to ensure the total runoff leaving the site meets the requirements of the Virginia Stormwater Handbook and James City County BMP Handbook and associated stormwater policies.

The runoff from the grocery/retail building will mainly be captured and directed to an on-site cistern for irrigation reuse. This system will be used for SSC compliance and the overflow will be discharged uncontrolled into the existing storm system through the Post Office site. Additionally the parking to the eastern side and rear of the building will sheet flow and be directed to a bioretention basin. This basin will provide water quality credit towards the JCC 10-point system. The basin is sized to handle additional surface/building runoff from the adjacent undeveloped parcel.

The runoff from the parking area in front of the grocery/retail building will sheet flow to a bioretention basin which will be used for SSC compliance and act as a potential flood control device. The piped overflow from the bioretention will pass through stormwater pretreatment device before entering the proposed underground infiltration basin. This basin is designed to handle the flows from the parking lot and portions of the adjacent future development parcel on the corner of the site. The underground infiltration basin will provide water quality credit towards JCC 10-pt system.

The remaining out-parcels on the site are planned to be cleared and brought to rough grade. These sites will be treated by Erosion and sediment control measures during construction. Upon stabilization of the site we are proposing to install or modify existing features to allow for infiltration trench/basins to be used to treat the site to obtain the required JCC 10-points for the entire development.

10-YEAR STORM		
	Pre-Development	Post-Development
Areas A & C (towards Post Office)	*18.8 CFS*	*0.61 CFS*
Area B (towards Mini-storage)	*16.22 CFS*	*14.41 CFS*

100-YEAR STORM		
	Pre-Development	Post-Development
Areas A & C (towards Post Office)	*25.1 CFS*	*4.55 CFS*
Area B (towards Mini-storage)	*22.15 CFS*	*21.33 CFS*

Special Stormwater Criteria (SSC)

The proposed site falls on the drainage divide of the Powhattan and Mill Creek Watersheds. The Powhattan Creek watershed requires by JCC policy adherence to the Special Stormwater Criteria and by SUP condition that requirement was extended to include all portions of the site. The SSC requirement is to provide 3 unit measures for the entire site. The following are the SSC measures that are being taken credit for:

- SSCP #8 – Limit the use of underground storm piping = 1 unit
  - Site wide we have tried to sheet flow everything to bioretention areas, eliminating underground pipe networks.

- SSCP #12 – Bioretention Basin (650 sq.ft.) = 1 unit
  - Bioretention Basin B-3 is 1,237 sqft and acts as an upstream treatment measure and flood control for the large parking field in front of the proposed grocery building.
- SSCP #14 – Sumped or Bottomless Inlets = 1/2 unit
  - All inlet structures have a 1-foot sump to collect debris.
- SSCP #15 – Manufactured BMP System = 1 unit
  - A Hanson Stromceptor is proposed upstream of underground Infiltration Basin B-3
- SSCP #29 – Rain barrels /cistern = 1 unit
  - A large 5,000 gallon cistern is proposed to capture runoff from the proposed building roof. Additional cisterns or rain barrels will be considered on future buildings as the site is restricted from using the JCSA water system for irrigation.

Offsite Mini-Storage By-Pass

The Ironbound Mini-storage site has an existing 42" pipe installed with a slope between 2-6% running from the Ironbound cul-de-sac through the site and discharging near the outfall of the mini-storage BMP. This pipe was designed to handle over 40 acres of off-site drainage and safely by-pass the flows during and over a 100-year storm event. These calculations assumed that the offsite parcels would be developed and the resulting flows would impact the site. A large portion of the offsite development (approx 20 acres) was assumed to be developed on what is now the Settler's Market and Walmart @ Settler's Market sites, on the opposite side of Monticello Avenue. With the proposed Settler's Market developments, the run-off from 17 of those 20 acres is being redirected towards on-site BMPs that flow to Powhattan Creek and away from the mini-storage site. Please see the attached displays showing the original design drainage areas and the current proposed and future drainage areas as part of our project and the development of Settler's Market.

The area draining towards the mini-storage located on Ironbound Road will increase with the development; however AES Consulting Engineers has reviewed the drainage areas and downstream conditions to show that they can handle the flows during large storm events (100-year storm event). The downstream system had a large portion of the drainage area removed with the development of Settler's Market (SP-74-06) and will have even more drainage offloaded with the future construction of the Wal-mart controlled parcel (in accordance with approved JCC SP-85-06). With the proposed site improvements the total runoff leaving the site will be reduced below pre-development.

10-YEAR STORM		
	Pre-Development	Post-Development
@ Mini-Storage	*81.53 CFS* (per original design)	*46.58 CFS* (w/o Walmart Improvements)

100-YEAR STORM		
	Pre-Development	Post-Development
@ Mini-Storage	*113.10 CFS* (per original design)	*64.39 CFS* (w/o Walmart Improvements)

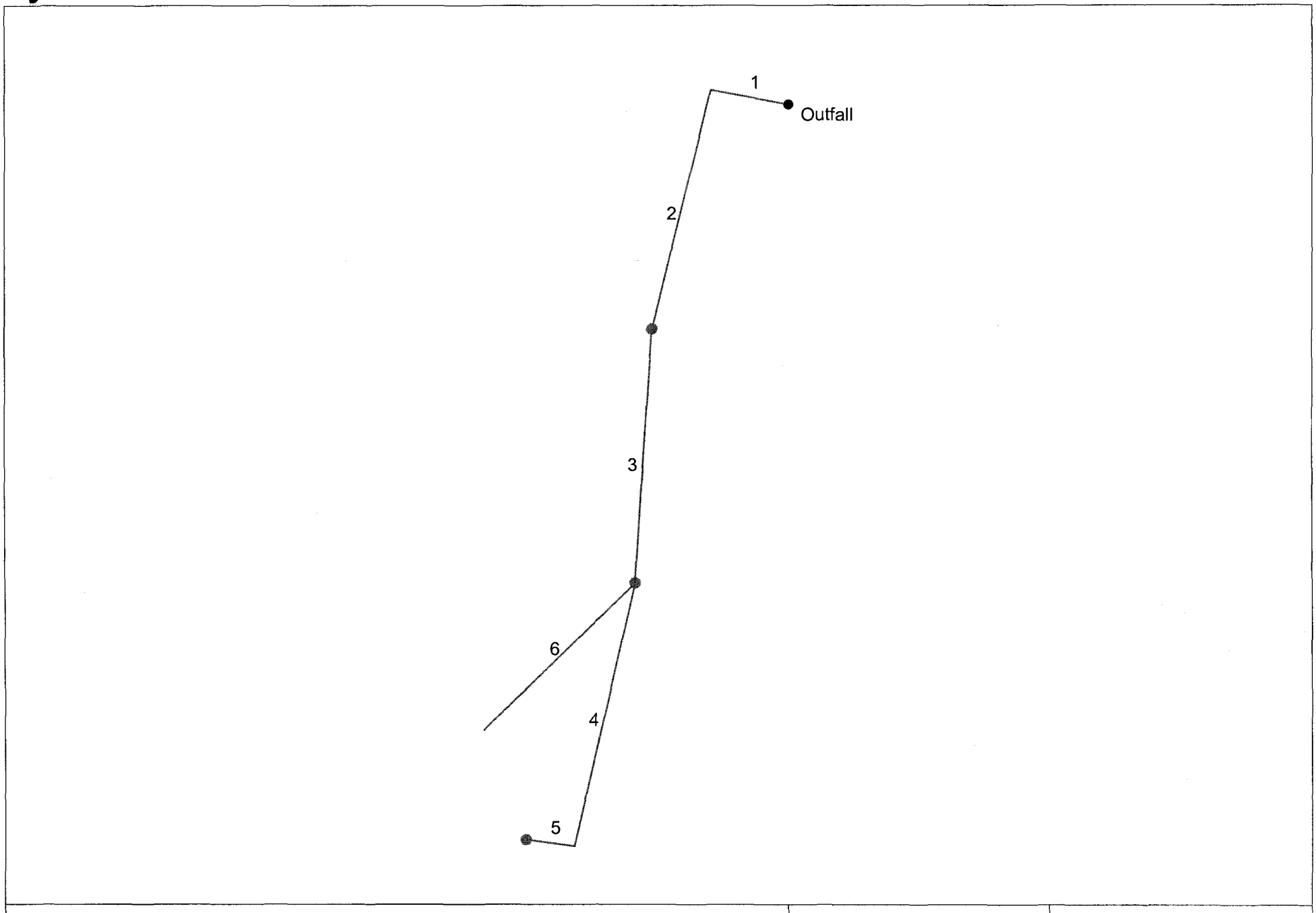
Conclusion

Our calculations are currently showing a significant decrease in the drainage area (and flow) towards the Post Office and New Town. The calculations also show a decrease in drainage to the offsite mini-storage area (with a significant reduction in the flow that was original anticipated with the construction of the by-pass pipe). It is our belief that the infiltration based stormwater management plan as presented works to not only meet the requirements of the state and local stormwater requirements but exceeds them in many ways.

S:\Jobs\8509\04-IronboundMonticello\Admin\Reports\Stormwater Management Report.doc

DRAINAGE CALCULATIONS

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2009 Plan



Project File: Storm System A 10YR.stm	Number of lines: 6	Date: 10-04-2010

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	32.000	0.00	0.79	0.00	0.00	0.67	5.0	6.9	6.9	4.60	10.40	4.57	15	2.59	94.17	95.00	95.27	95.86	102.41	99.50	A-1
2	1	103.000	0.57	0.79	0.90	0.51	0.67	0.0	6.3	7.0	4.71	6.49	5.21	15	1.01	95.00	96.04	95.86	96.91	99.50	102.92	A-2
3	2	107.000	0.00	0.22	0.00	0.00	0.16	5.0	5.7	7.2	1.13	6.46	2.16	15	1.00	96.04	97.11	96.91	97.54	102.92	103.14	A-3
4	3	113.000	0.04	0.09	0.85	0.03	0.05	5.0	5.1	7.5	0.38	4.55	1.73	15	0.50	97.16	97.72	97.54	97.97	103.14	101.77	A-4
5	4	20.000	0.05	0.05	0.35	0.02	0.02	5.0	5.0	7.5	0.13	5.80	1.29	12	2.65	97.72	98.25	97.97	98.40	101.77	100.00	A-5
6	3	87.000	0.13	0.13	0.81	0.11	0.11	5.0	5.0	7.5	0.79	2.50	2.68	12	0.49	97.11	97.54	97.54	97.92	103.14	99.99	A-6

Project File: Storm System A 10YR.stm

Number of lines: 6

Run Date: 10-04-2010

NOTES: Intensity = 55.52 / (Inlet time + 10.00) ^ 0.74; Return period = 10 Yrs. ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	32.000	0.00	0.79	0.00	0.00	0.67	5.0	6.9	9.1	6.08	10.40	5.58	15	2.59	94.17	95.00	95.27	95.99	102.41	99.50	A-1
2	1	103.000	0.57	0.79	0.90	0.51	0.67	0.0	6.3	9.3	6.25	6.49	5.96	15	1.01	95.00	96.04	95.99	97.04	99.50	102.92	A-2
3	2	107.000	0.00	0.22	0.00	0.00	0.16	5.0	5.7	9.6	1.51	6.46	2.32	15	1.00	96.04	97.11	97.18	97.60	102.92	103.14	A-3
4	3	113.000	0.04	0.09	0.85	0.03	0.05	5.0	5.1	9.9	0.51	4.55	1.87	15	0.50	97.16	97.72	97.60	98.01	103.14	101.77	A-4
5	4	20.000	0.05	0.05	0.35	0.02	0.02	5.0	5.0	10.0	0.17	5.80	1.40	12	2.65	97.72	98.25	98.01	98.43	101.77	100.00	A-5
6	3	87.000	0.13	0.13	0.81	0.11	0.11	5.0	5.0	10.0	1.05	2.50	2.96	12	0.49	97.11	97.54	97.60	97.98	103.14	99.99	A-6

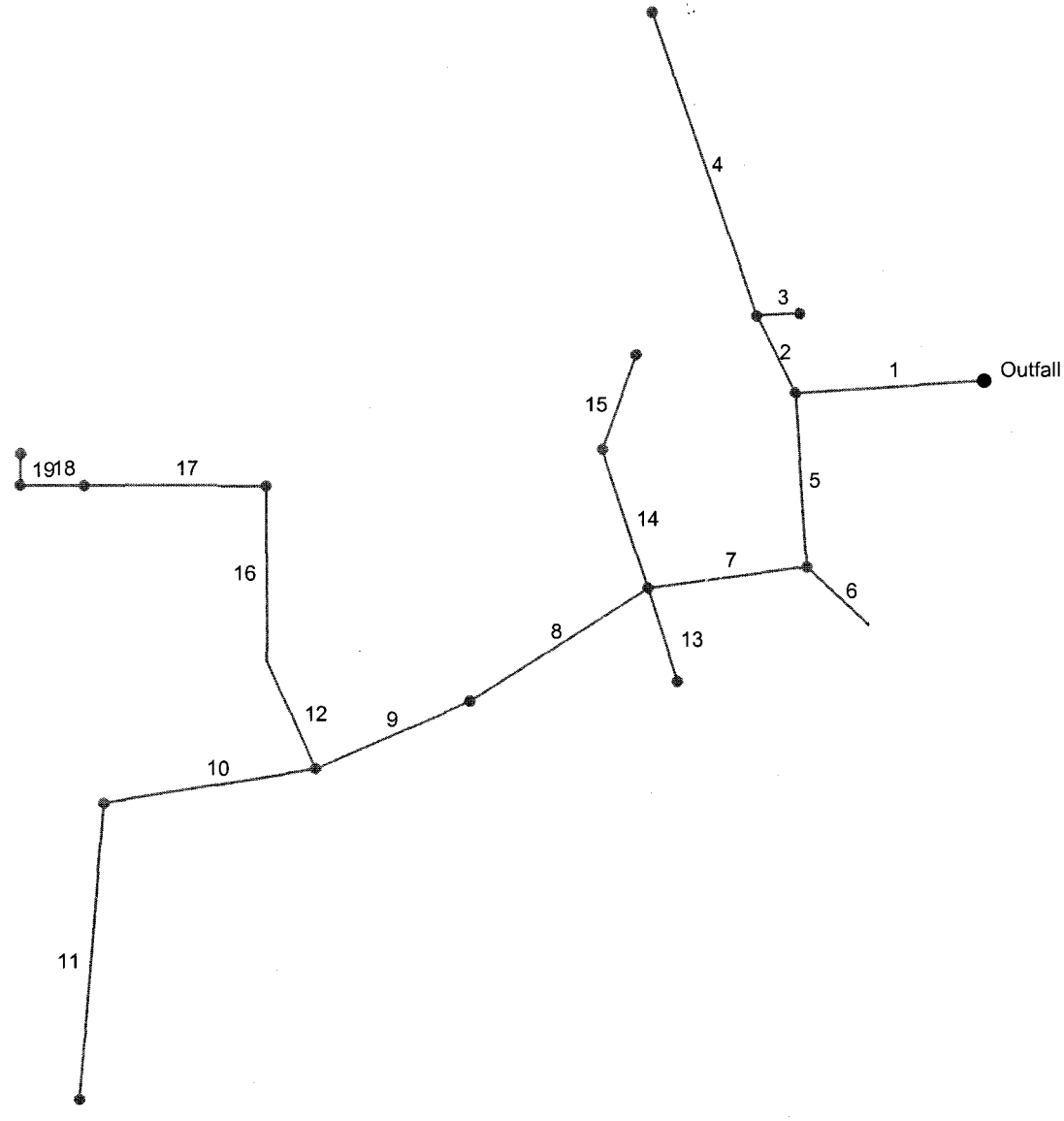
Project File: Storm System A 100YR.stm

Number of lines: 6

Run Date: 10-04-2010

NOTES: Intensity = 36.97 / (Inlet time + 5.30) ^ 0.56; Return period = 100 Yrs. ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2009 Plan



Project File: Storm System B100YR.stm	Number of lines: 19	Date: 10-04-2010

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	83.000	0.00	6.59	0.00	0.00	4.28	0.0	26.0	3.9	17.25	56.70	5.07	36	0.72	93.75	94.35	95.38	95.67	99.99	99.58	B-0
2	1	39.000	0.00	4.81	0.00	0.00	3.39	5.0	25.8	3.9	13.35	33.77	4.45	36	0.26	94.35	94.45	95.67	95.77	99.58	99.50	B-1
3	2	19.000	0.41	0.41	0.75	0.31	0.31	5.0	5.0	7.5	2.31	3.31	1.88	15	0.26	94.45	94.50	96.08	96.10	99.50	98.45	B-2
4	2	144.000	4.40	4.40	0.70	3.08	3.08	25.0	25.0	4.0	12.34	62.55	4.61	30	2.33	94.50	97.85	96.08	99.02	99.50	97.85	B-3
5	1	78.000	0.44	1.78	0.30	0.13	0.89	10.0	10.2	6.0	5.83	33.77	2.14	36	0.26	94.35	94.55	95.67	95.70	99.58	98.90	B-4
6	5	37.000	0.47	0.47	0.82	0.39	0.39	10.0	10.0	6.1	2.34	3.18	1.96	15	0.24	94.59	94.68	95.78	95.82	98.90	98.60	B-5
7	5	71.000	0.00	0.87	0.00	0.00	0.38	5.0	7.3	6.7	2.99	11.70	1.62	24	0.27	94.55	94.74	95.78	95.80	98.90	100.94	B-6
8	7	93.000	0.00	0.31	0.00	0.00	0.21	5.0	6.8	6.9	1.65	11.25	1.07	24	0.25	94.74	94.97	95.85	95.86	100.94	100.61	B-7
9	8	74.000	0.00	0.31	0.00	0.00	0.21	5.0	6.4	7.0	1.67	11.16	1.41	24	0.24	94.97	95.15	95.87	95.89	100.61	101.65	B-8
10	9	95.000	0.00	0.00	0.00	0.00	0.00	5.0	5.7	0.0	0.22	5.28	0.31	18	0.25	95.15	95.39	95.93	95.93	101.65	101.92	B-9
11	10	134.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.22	7.09	1.10	18	0.46	95.39	96.00	95.93	96.18	101.92	100.67	B-10
12	9	53.000	0.07	0.31	0.90	0.06	0.21	5.0	6.1	7.1	1.47	3.20	2.55	15	0.25	96.50	96.63	97.10	97.23	101.65	102.73	B-8.1
13	7	44.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.24	3.23	0.24	15	0.25	94.84	94.95	95.85	95.85	100.94	101.50	B-6.1
14	7	65.000	0.00	0.56	0.00	0.00	0.17	5.0	5.3	7.4	1.24	6.64	1.04	18	0.40	94.74	95.00	95.85	95.86	100.94	101.03	B-6.3
15	14	45.000	0.56	0.56	0.30	0.17	0.17	5.0	5.0	7.5	1.26	9.63	2.28	15	2.22	95.00	96.00	95.87	96.45	101.03	99.50	B-6.4
16	12	78.000	0.00	0.24	0.00	0.00	0.14	5.0	5.7	7.3	1.04	1.09	3.27	8	0.81	96.63	97.26	97.27	97.79	102.73	102.00	YD
17	16	80.000	0.00	0.24	0.00	0.00	0.14	5.0	5.2	7.4	1.07	1.08	3.07	8	0.80	97.26	97.90	97.98	98.55	102.00	102.00	YD
18	17	28.000	0.00	0.24	0.00	0.00	0.14	5.0	5.1	7.5	1.08	1.07	3.08	8	0.79	97.90	98.12	98.57	98.78	102.00	100.50	YD
19	18	14.000	0.24	0.24	0.60	0.14	0.14	5.0	5.0	7.5	1.08	1.07	3.09	8	0.79	98.12	98.23	98.93	99.04	100.50	100.00	YD

Project File: Storm System B 10YR.stm

Number of lines: 19

Run Date: 10-04-2010

NOTES: Intensity = 55.52 / (Inlet time + 10.00) ^ 0.74; Return period = 10 Yrs. ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	83.000	0.00	6.59	0.00	0.00	4.28	0.0	26.0	5.3	30.06	56.70	7.03	36	0.72	93.75	94.35	95.50	96.10	99.99	99.58	B-0
2	1	39.000	0.00	4.81	0.00	0.00	3.39	5.0	25.8	5.4	18.19	33.77	4.32	36	0.26	94.35	94.45	96.10	96.15	99.58	99.50	B-1
3	2	19.000	0.41	0.41	0.75	0.31	0.31	5.0	5.0	10.0	3.07	3.31	2.50	15	0.26	94.45	94.50	96.45	96.50	99.50	98.45	B-2
4	2	144.000	4.40	4.40	0.70	3.08	3.08	25.0	25.0	5.4	16.78	62.55	5.09	30	2.33	94.50	97.85	96.45	99.22	99.50	97.85	B-3
5	1	78.000	0.44	1.78	0.30	0.13	0.89	10.0	10.2	7.9	14.25	33.77	3.52	36	0.26	94.35	94.55	96.10	96.16	99.58	98.90	B-4
6	5	37.000	0.47	0.47	0.82	0.39	0.39	10.0	10.0	8.0	3.08	3.18	2.51	15	0.24	94.59	94.68	96.37	96.45	98.90	98.60	B-5
7	5	71.000	0.00	0.87	0.00	0.00	0.38	5.0	7.3	8.9	10.51	11.70	3.55	24	0.27	94.55	94.74	96.37	96.49	98.90	100.94	B-6
8	7	93.000	0.00	0.31	0.00	0.00	0.21	5.0	6.8	9.1	6.70	11.25	2.20	24	0.25	94.74	94.97	96.70	96.76	100.94	100.61	B-7
9	8	74.000	0.00	0.31	0.00	0.00	0.21	5.0	6.4	9.3	6.73	11.16	2.32	24	0.24	94.97	95.15	96.78	96.83	100.61	101.65	B-8
10	9	95.000	0.00	0.00	0.00	0.00	0.00	5.0	5.7	0.0	4.81	5.28	2.72	18	0.25	95.15	95.39	96.92	97.12	101.65	101.92	B-9
11	10	134.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	4.81	7.09	2.72	18	0.46	95.39	96.00	97.23	97.50	101.92	100.67	B-10
12	9	53.000	0.07	0.31	0.90	0.06	0.21	5.0	6.1	9.4	1.95	3.20	2.73	15	0.25	96.50	96.63	97.21	97.34	101.65	102.73	B-8.1
13	7	44.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	2.36	3.23	1.92	15	0.25	94.84	94.95	96.70	96.75	100.94	101.50	B-6.1
14	7	65.000	0.00	0.56	0.00	0.00	0.17	5.0	5.3	9.8	1.65	6.64	0.94	18	0.40	94.74	95.00	96.70	96.71	100.94	101.03	B-6.3
15	14	45.000	0.56	0.56	0.30	0.17	0.17	5.0	5.0	10.0	1.68	9.63	1.83	15	2.22	95.00	96.00	96.72	96.72	101.03	99.50	B-6.4
16	12	78.000	0.00	0.24	0.00	0.00	0.14	5.0	5.7	9.6	1.39	1.09	3.97	8	0.81	96.63	97.26	97.39	98.42	102.73	102.00	YD
17	16	80.000	0.00	0.24	0.00	0.00	0.14	5.0	5.2	9.9	1.42	1.08	4.07	8	0.80	97.26	97.90	98.66	99.77	102.00	102.00	YD
18	17	28.000	0.00	0.24	0.00	0.00	0.14	5.0	5.1	9.9	1.43	1.07	4.10	8	0.79	97.90	98.12	99.81	100.20	102.00	100.50	YD
19	18	14.000	0.24	0.24	0.60	0.14	0.14	5.0	5.0	10.0	1.44	1.07	4.12	8	0.79	98.12	98.23	100.46	100.66	100.50	100.00	YD

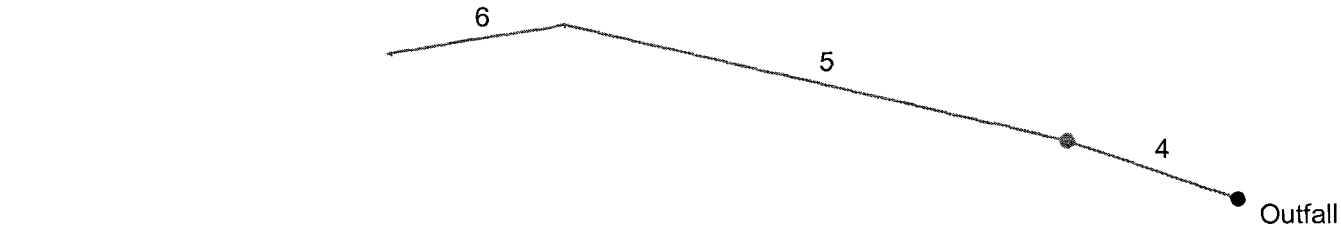
Project File: Storm System B100YR.stm

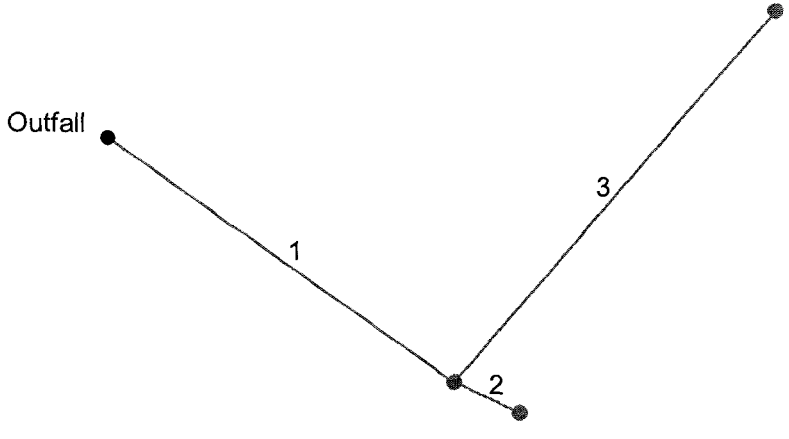
Number of lines: 19

Run Date: 10-04-2010

NOTES: Intensity = 36.97 / (Inlet time + 5.30) ^ 0.56; Return period = 100 Yrs. ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2009 Plan





Project File: Storm System C 10YR.stm	Number of lines: 6	Date: 10-04-2010

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	123.000	0.00	0.05	0.00	0.00	0.02	5.0	12.1	5.6	0.69	16.40	1.55	18	2.44	85.00	88.00	86.00	88.32	93.00	95.00	C-1
2	1	21.000	0.00	0.00	0.00	0.00	0.00	12.0	12.0	0.0	0.61	6.46	2.91	15	1.00	91.29	91.50	91.55	91.82	95.00	94.00	C-2
3	1	143.000	0.05	0.05	0.30	0.02	0.02	5.0	5.0	7.5	0.11	10.80	1.02	15	2.80	88.00	92.00	88.32	92.13	95.00	97.50	C-3
4	End	52.000	0.00	0.63	0.00	0.00	0.51	5.0	6.1	7.1	3.60	7.76	3.00	15	1.44	91.00	91.75	92.75	92.89	92.00	97.50	C-5
5	4	149.000	0.44	0.63	0.81	0.36	0.51	5.0	5.3	7.4	3.74	8.04	3.92	15	1.55	91.75	94.06	92.91	94.83	97.50	98.48	C-6
6	5	51.000	0.19	0.19	0.79	0.15	0.15	5.0	5.0	7.5	1.13	6.46	2.24	15	1.00	94.06	94.57	94.83	94.99	98.48	99.72	C-7

Project File: Storm System C 10YR.stm

Number of lines: 6

Run Date: 10-04-2010

NOTES: Intensity = 55.52 / (Inlet time + 10.00) ^ 0.74; Return period = 10 Yrs. ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	123.000	0.00	0.05	0.00	0.00	0.02	5.0	12.1	7.4	4.66	16.40	4.21	18	2.44	85.00	88.00	86.00	88.82	93.00	95.00	C-1
2	1	21.000	0.00	0.00	0.00	0.00	0.00	12.0	12.0	0.0	4.55	6.46	5.39	15	1.00	91.29	91.50	92.06	92.36	95.00	94.00	C-2
3	1	143.000	0.05	0.05	0.30	0.02	0.02	5.0	5.0	10.0	0.15	10.80	0.94	15	2.80	88.00	92.00	88.82	92.15	95.00	97.50	C-3
4	End	52.000	0.00	0.63	0.00	0.00	0.51	5.0	6.1	9.4	4.77	7.76	3.89	15	1.44	91.00	91.75	92.75	93.00	92.00	97.50	C-5
5	4	149.000	0.44	0.63	0.81	0.36	0.51	5.0	5.3	9.8	4.98	8.04	4.68	15	1.55	91.75	94.06	93.03	94.95	97.50	98.48	C-6
6	5	51.000	0.19	0.19	0.79	0.15	0.15	5.0	5.0	10.0	1.50	6.46	2.48	15	1.00	94.06	94.57	94.95	95.06	98.48	99.72	C-7

Project File: Storm System C 100YR.stm

Number of lines: 6

Run Date: 10-04-2010

NOTES: Intensity = 36.97 / (Inlet time + 5.30) ^ 0.56; Return period = 100 Yrs. ; c = cir e = ellip b = box

AES CONSULTING ENGINEERS
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax: (757) 220-8994

PROJECT	Courthouse Commons
PROJECT NO.	8509-04
SUBJECT	Curb Inlets
SHEET NO.	1
DATE	July 26, 2010
BY	AMR

STORM WATER INLET COMPUTATIONS

INLET																								Sag Inlets Only				
Number	Type	Length	Structure #	Drainage Area (Ac.)	C	CA	Σ CA	I in/hr	Q-Inter (CFS)	Q Carry-Over (CFS)	Qt Gutter Flow	S Gutter Slope (ft/ft)	Sx Cross Slope (ft/ft)	T(Spread)	W (ft)	W/T	Sw (ft/ft)	Sw/Sx	Eo(#10)	n	Local Dep.	a	Sw =a/(12W)	Se (ft/ft) =Sx+SwEo	P Lt (ft) 15 Effec L	d L/Lt (ft)	h E(#16) (ft)	Q Int CFS d/h	Q Carryover Spread	Remark
Monticello Entrance Road																													
Left Side																													
T allow = 12'/2 + 2' = 8'																													
GRADE	DI-3B	8	SSC-6	0.44	0.81	0.356	0.356	4	1.426	0	1.426	0.01	0.021	6.3	2	0.317	0.08	3.846	0.735	0.015	2	3.421	0.143	0.126	7.548	1	1	1.426	0	
GRADE	DI-3B	6	SSC-7	0.19	0.79	0.15	0.15	4	0.6	0	0.6	0.01	0.021	3.6	2	0.556	0.08	3.846	0.952	0.015	2	3.421	0.143	0.156	4.6	1	1	0.6	0	
Ironbound Road																													
Left Side																													
T allow = 26'/2 + 2' = 15'																													
				0.15	0.75	0.113	0.113	4	0.45	0	0.45	0.01	0.021	2.6	Flow Approaching From Down Station														
SUMP	DI-3C	6	SSB-2								1.23	0.00	0.02		2		0.08								9.6	0.132	0.42	0.314	6.346	
				0.26	0.75	0.195	0.195	4	0.78	0	0.78	0.03	0.021	2.4	Flow Approaching From Up Station														
				0.38	0.82	0.312	0.312	4	1.246	0	1.246	0.01	0.021	5.8	Flow Approaching From Down Station														
SUMP	DI-3C	6	SSB-5	0.09							2.165	0.00	0.02		2		0.08								9.6	0.196	0.42	0.467	9.423	
				0.28	0.82	0.23	0.23	4	0.918	0	0.918	0.03	0.021	2.9	Flow Approaching From Up Station														0.09 Ac. Actual

TABLE 3

WORKSHEET FOR BMP POINT SYSTEM
COURTHOUSE COMMON, AES PROJECT No. 8509-04
TOTAL AREA* = 6.12 ACRE(s)

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Drainage Area	BMP Points		Fraction of Site Served by BMP (BMP Drainage Area/Total Area)		Weighted BMP Points
Bioretention A	0.53	10	X	0.087	=	0.87
			X		=	
Infilt. Basin B ***	1.57	10	X	0.257	=	2.57
Infilt.Basin C ***	2.01	10	X	0.328	=	3.28
UG Infilt. B-3	1.61	10	X	0.263	=	2.63
			X		=	0.00
			X		=	
Future Infilt. UG B-2**	0.56	10	X	0.092	=	0.92
		TOTAL WEIGHTED STRUCTURAL BMP POINTS:				10.26

B. NATURAL OPEN SPACE CREDIT

Open Space Area	Fraction of Site (Open Space Area/Total Area)	Natural Open Space Credit		Points for Natural Open Space (Fraction of Site * Natural Open Space Credit %)
0.00	0.00	(0.1 per 1%)	=	
		(0.15 per 1%)	=	
		TOTAL OPEN SPACE POINTS:		0.00

C. TOTAL WEIGHTED POINTS

10.26	+	0.00	=	10.26
Structural BMP Points		Natural Open Space Points		TOTAL

Notes:
* The site area was reduced from 9.06 to 6.12 acres. The 6.12 acres excludes the 2.94 acres of existing impervious cover.

** Anticiapted Underground Infiltration to be installed on "restaurant" parcel adjacent to shopping center

*** Proposed Infiltration Basins are anticiapted to be adjusted into undergound facilities with future development. 10-pt calculations prepared to show ability of development to meet JCC minimum requirements going forward.

STORMWATER MANAGEMENT

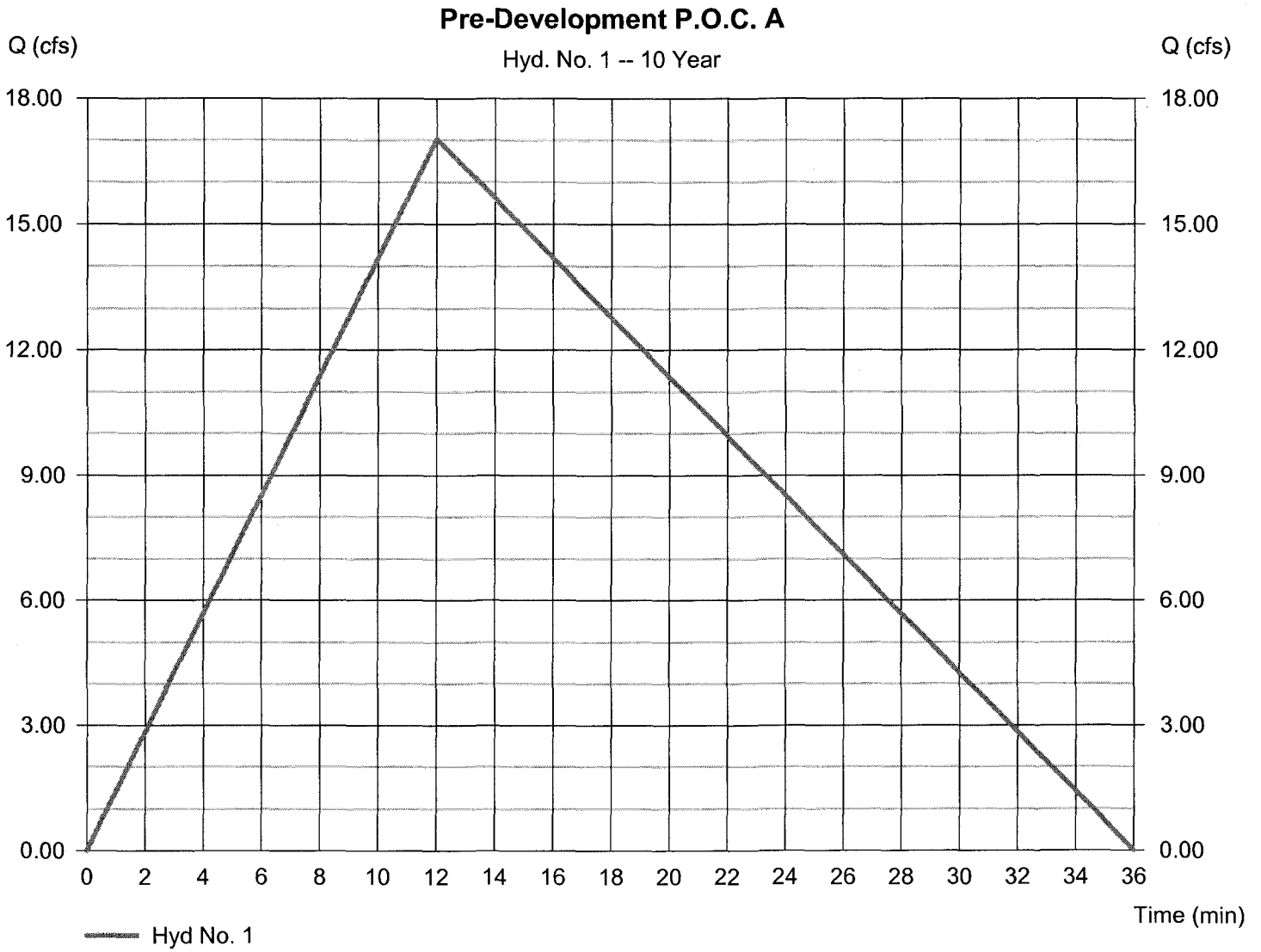
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Monday, Oct 4, 2010

Hyd. No. 1

Pre-Development P.O.C. A

Hydrograph type	= Rational	Peak discharge	= 17.03 cfs
Storm frequency	= 10 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 18,398 cuft
Drainage area	= 4.310 ac	Runoff coeff.	= 0.7
Intensity	= 5.646 in/hr	Tc by User	= 12.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/2



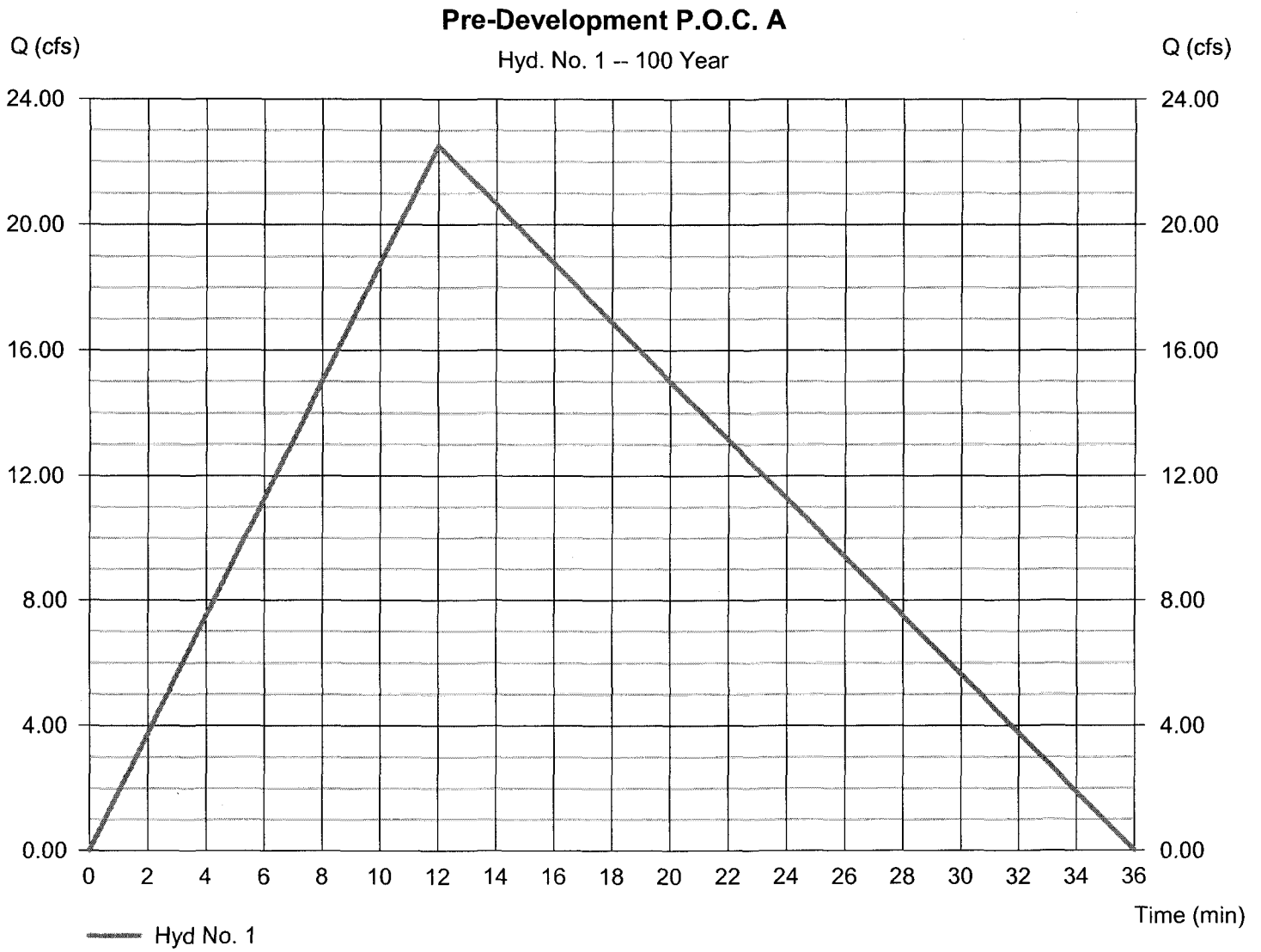
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 1

Pre-Development P.O.C. A

Hydrograph type	= Rational	Peak discharge	= 22.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 24,316 cuft
Drainage area	= 4.310 ac	Runoff coeff.	= 0.7
Intensity	= 7.463 in/hr	Tc by User	= 12.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/2



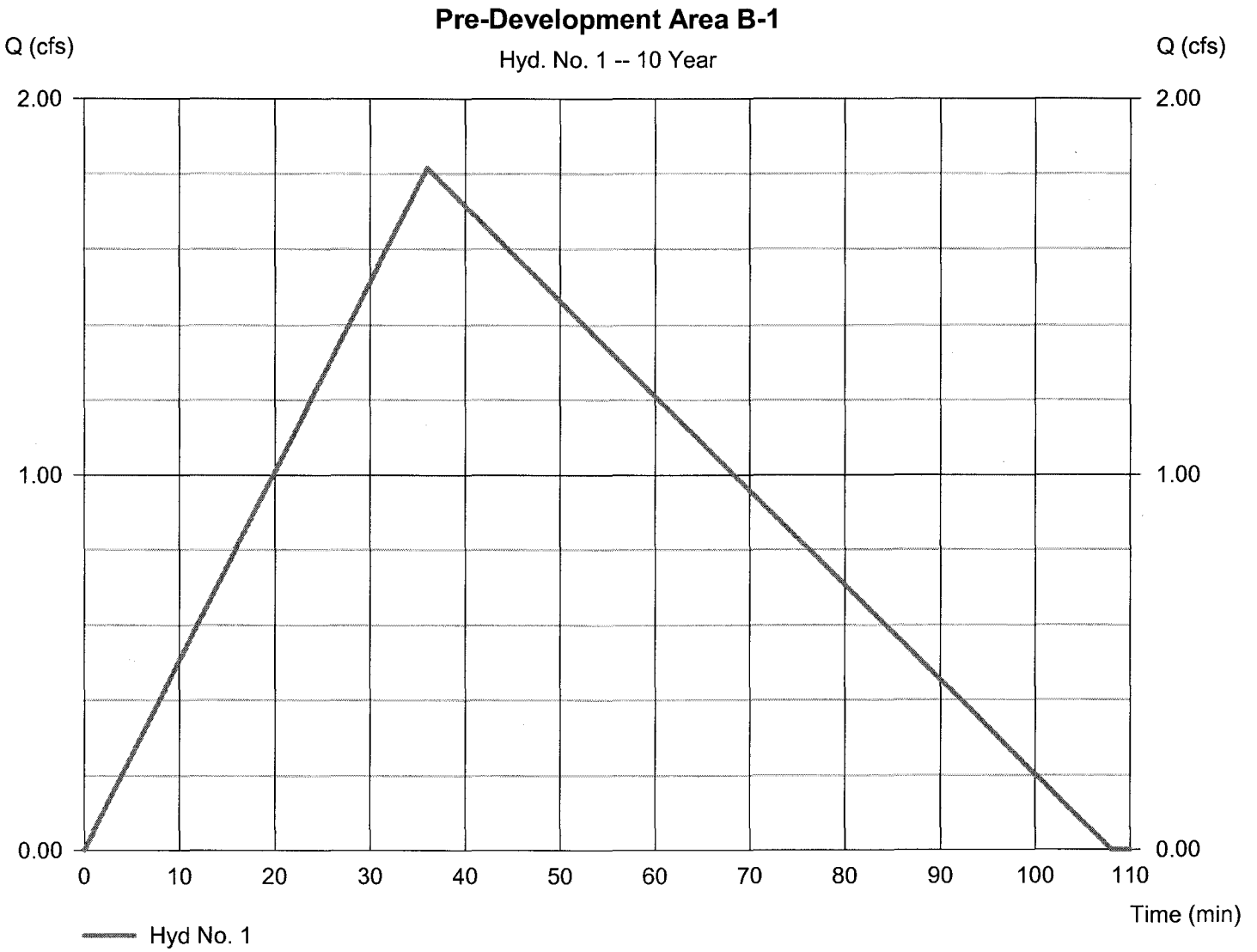
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 1

Pre-Development Area B-1

Hydrograph type	= Rational	Peak discharge	= 1.815 cfs
Storm frequency	= 10 yrs	Time to peak	= 36 min
Time interval	= 1 min	Hyd. volume	= 5,880 cuft
Drainage area	= 1.460 ac	Runoff coeff.	= 0.38
Intensity	= 3.271 in/hr	Tc by User	= 36.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/2



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 1

Pre-Development Area B-1

Hydrograph type	= Rational	Peak discharge	= 2.541 cfs
Storm frequency	= 100 yrs	Time to peak	= 36 min
Time interval	= 1 min	Hyd. volume	= 8,233 cuft
Drainage area	= 1.460 ac	Runoff coeff.	= 0.38
Intensity	= 4.580 in/hr	Tc by User	= 36.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/2

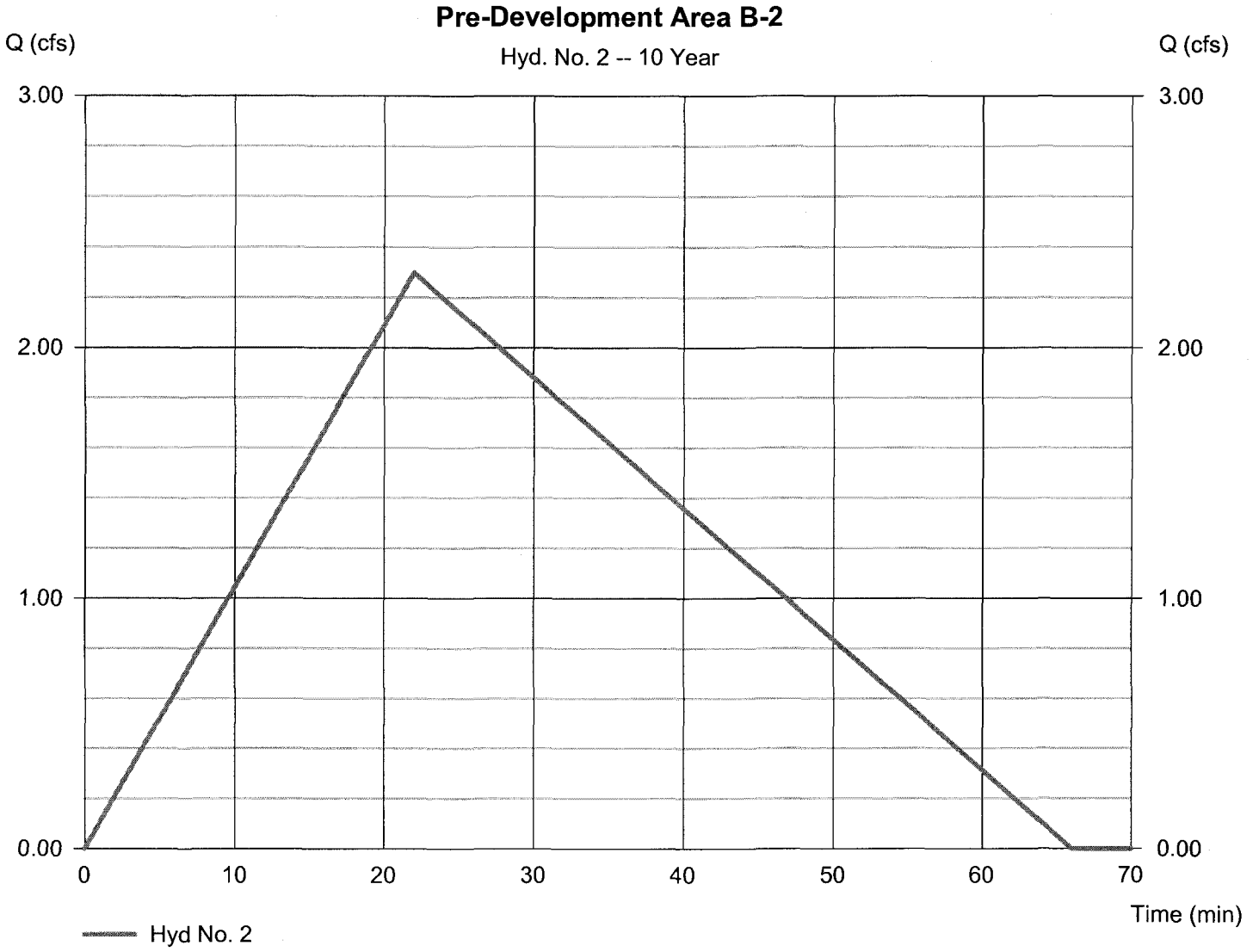
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 2

Pre-Development Area B-2

Hydrograph type	= Rational	Peak discharge	= 2.298 cfs
Storm frequency	= 10 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 4,551 cuft
Drainage area	= 1.310 ac	Runoff coeff.	= 0.41
Intensity	= 4.279 in/hr	Tc by User	= 22.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/2



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 2

Pre-Development Area B-2

Hydrograph type	= Rational	Peak discharge	= 3.103 cfs
Storm frequency	= 100 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 6,143 cuft
Drainage area	= 1.310 ac	Runoff coeff.	= 0.41
Intensity	= 5.777 in/hr	Tc by User	= 22.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/2

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 3

Pre-Development Area B-3

Hydrograph type	= Rational	Peak discharge	= 12.33 cfs
Storm frequency	= 10 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 27,751 cuft
Drainage area	= 4.400 ac	Runoff coeff.	= 0.7
Intensity	= 4.004 in/hr	Tc by User	= 25.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/2

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 3

Pre-Development Area B-3

Hydrograph type	= Rational	Peak discharge	= 16.78 cfs
Storm frequency	= 100 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 37,759 cuft
Drainage area	= 4.400 ac	Runoff coeff.	= 0.7
Intensity	= 5.449 in/hr	Tc by User	= 25.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/2

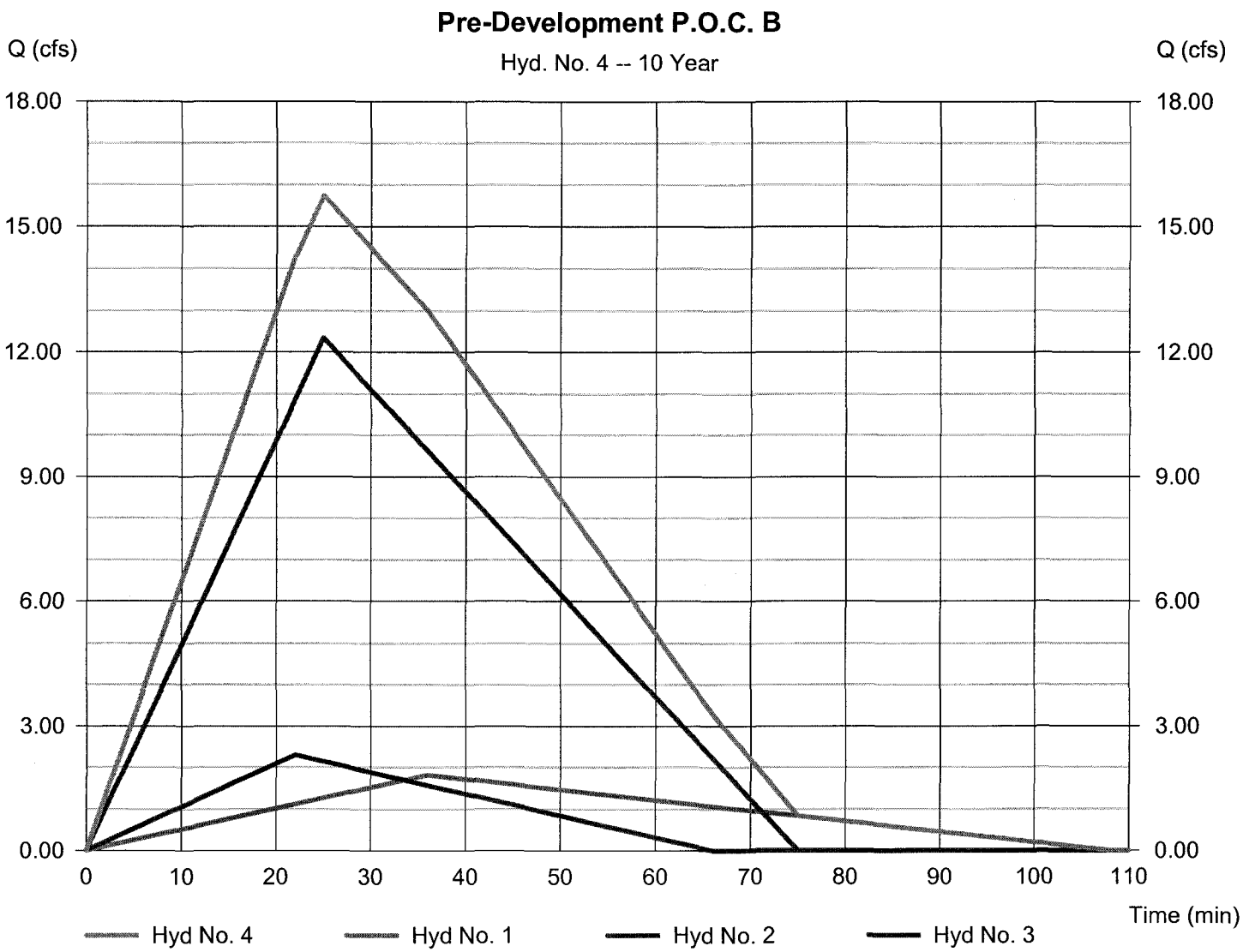
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 4

Pre-Development P.O.C. B

Hydrograph type	= Combine	Peak discharge	= 15.74 cfs
Storm frequency	= 10 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 38,182 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 7.170 ac



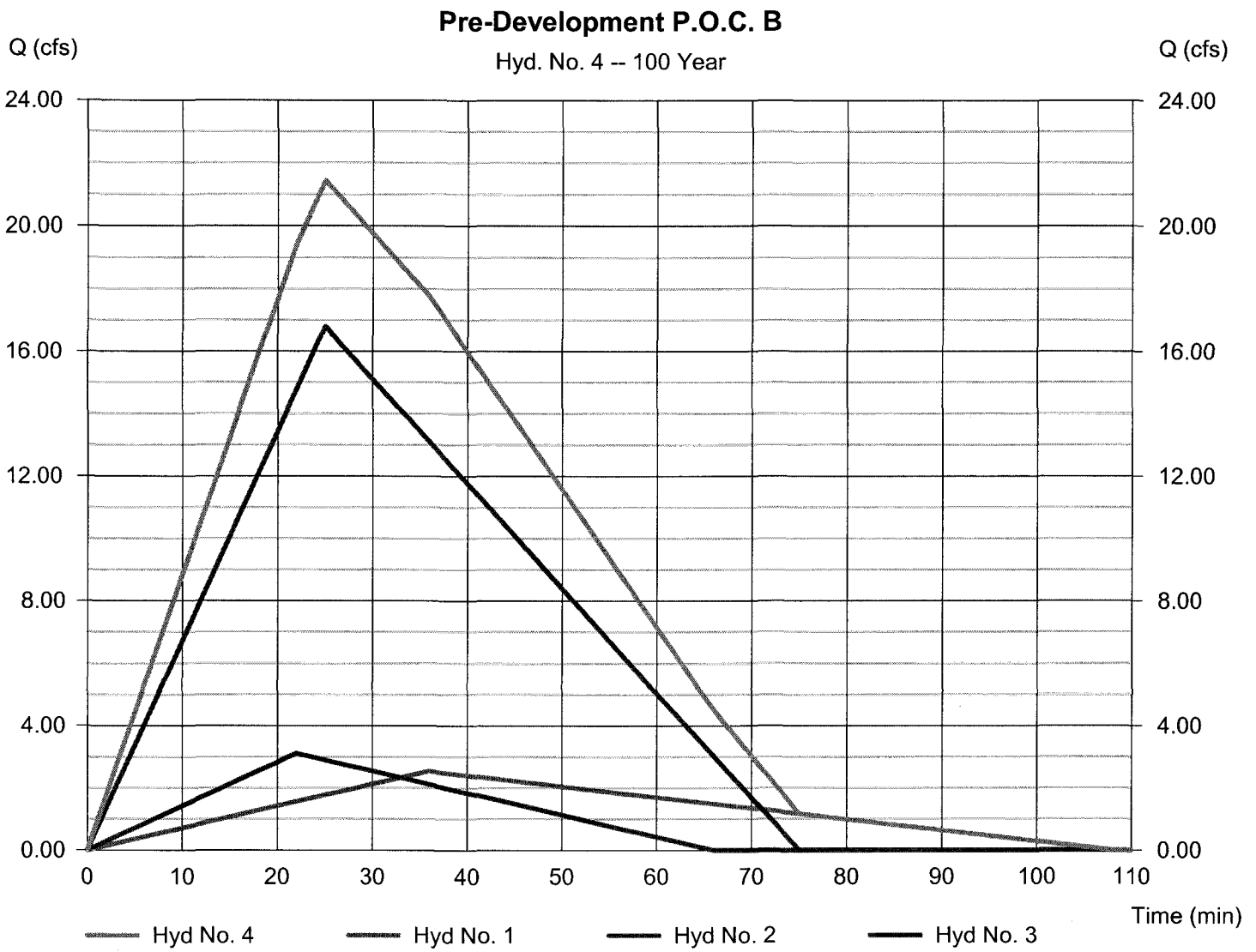
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 4

Pre-Development P.O.C. B

Hydrograph type	= Combine	Peak discharge	= 21.44 cfs
Storm frequency	= 100 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 52,135 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 7.170 ac



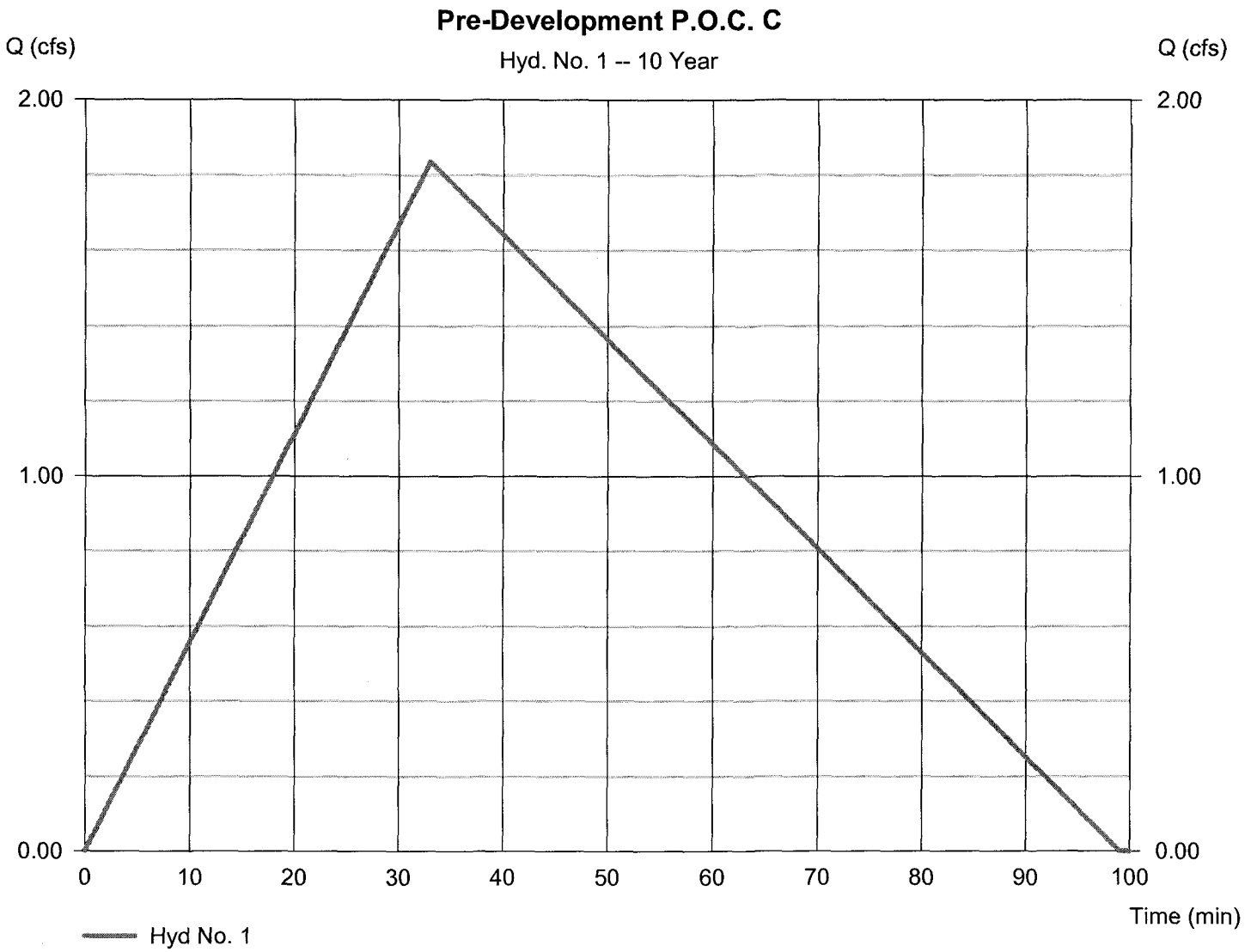
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Monday, Oct 4, 2010

Hyd. No. 1

Pre-Development P.O.C. C

Hydrograph type	= Rational	Peak discharge	= 1.836 cfs
Storm frequency	= 10 yrs	Time to peak	= 33 min
Time interval	= 1 min	Hyd. volume	= 5,454 cuft
Drainage area	= 1.780 ac	Runoff coeff.	= 0.3
Intensity	= 3.439 in/hr	Tc by User	= 33.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/2



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 1

Pre-Development P.O.C. C

Hydrograph type	= Rational	Peak discharge	= 2.551 cfs
Storm frequency	= 100 yrs	Time to peak	= 33 min
Time interval	= 1 min	Hyd. volume	= 7,577 cuft
Drainage area	= 1.780 ac	Runoff coeff.	= 0.3
Intensity	= 4.778 in/hr	Tc by User	= 33.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/2

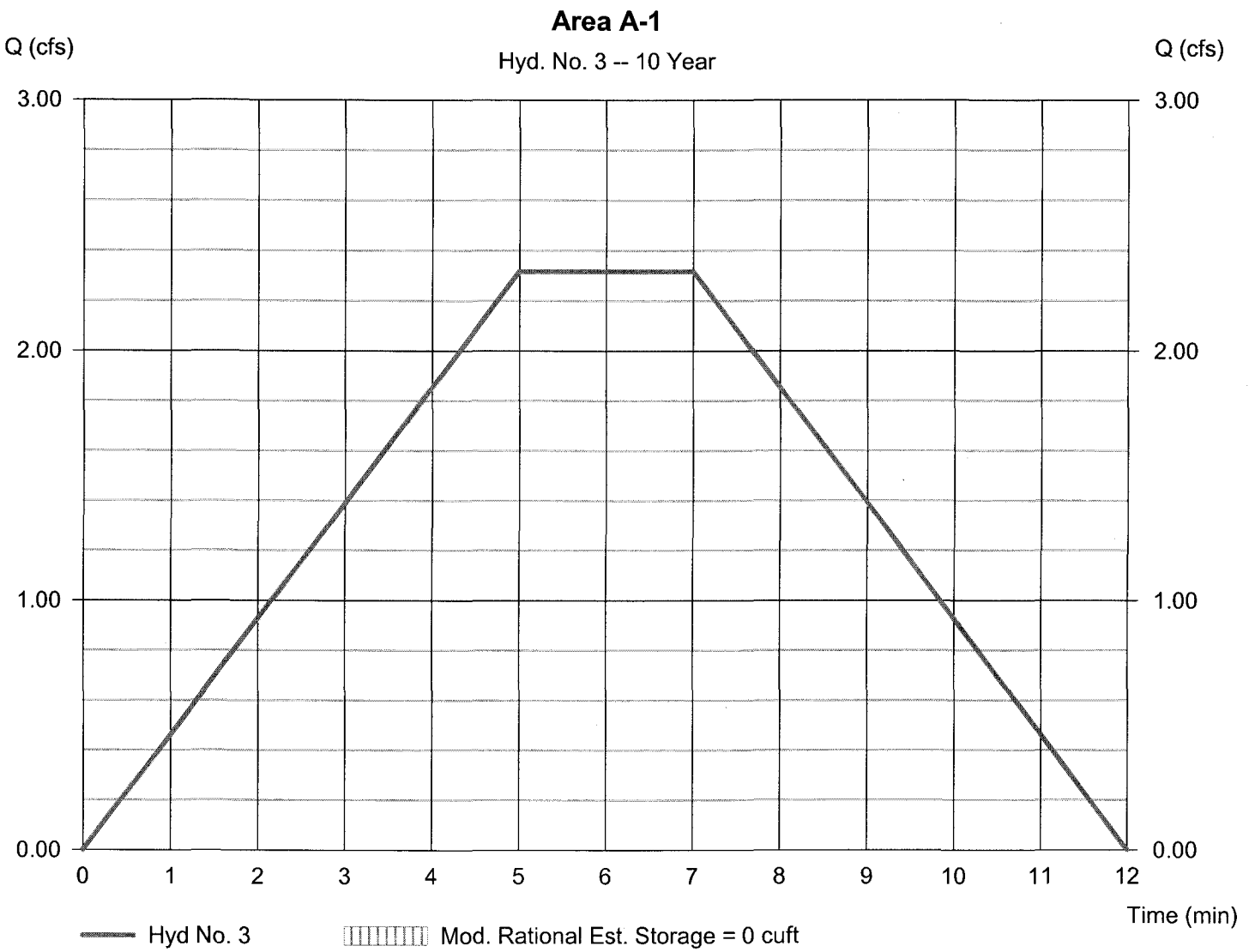
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Monday, Oct 4, 2010

Hyd. No. 3

Area A-1

Hydrograph type	= Mod. Rational	Peak discharge	= 2.318 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 973 cuft
Drainage area	= 0.530 ac	Runoff coeff.	= 0.64
Intensity	= 6.833 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 1.4 x Tc
Target Q	= 2.500 cfs	Est. Req'd Storage	= 0 cuft



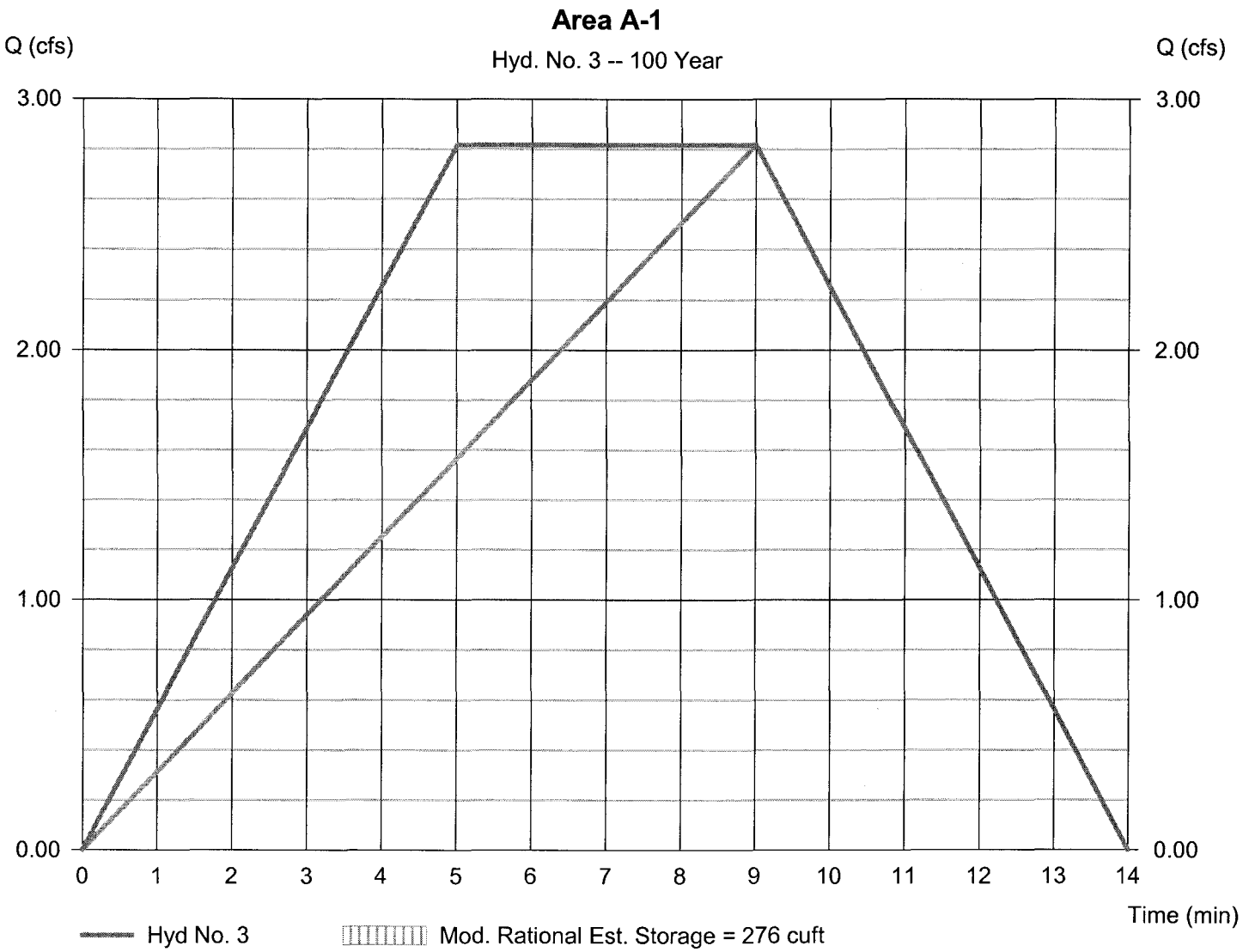
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 3

Area A-1

Hydrograph type	= Mod. Rational	Peak discharge	= 2.817 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 1,521 cuft
Drainage area	= 0.530 ac	Runoff coeff.	= 0.64
Intensity	= 8.305 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 1.8 x Tc
Target Q	= 2.800 cfs	Est. Req'd Storage	= 276 cuft



AES
CONSULTING ENGINEERS

Project:	**Courthouse Common**
Project No.:	**8509-04**
Subject:	**Water Quality Volume**
	Bioretention A
Date:	**7/22/2010**
Calculated By:	**AMR**

BMP Type = **Bioretention A**

Water Quality Volume = 0.5 in. x **0.3** acres of impervious coverage

= (0.5 / 12) x (43,560 x **0.3**)

= **545** CF

Total Storage Volume Required = **2** x Water Quality Volume

= **2** x **545**

= **1089** CF @ 99.5 = 1,766 CF Storage Provided

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Pond No. 1 - Bioretention A

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 99.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	99.00	3,115	0	0
1.00	100.00	3,967	3,532	3,532
2.00	101.00	4,879	4,415	7,947

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	0.00	0.00	0.00
Span (in)	= 15.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 95.00	0.00	0.00	0.00
Length (ft)	= 32.00	0.00	0.00	0.00
Slope (%)	= 2.60	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

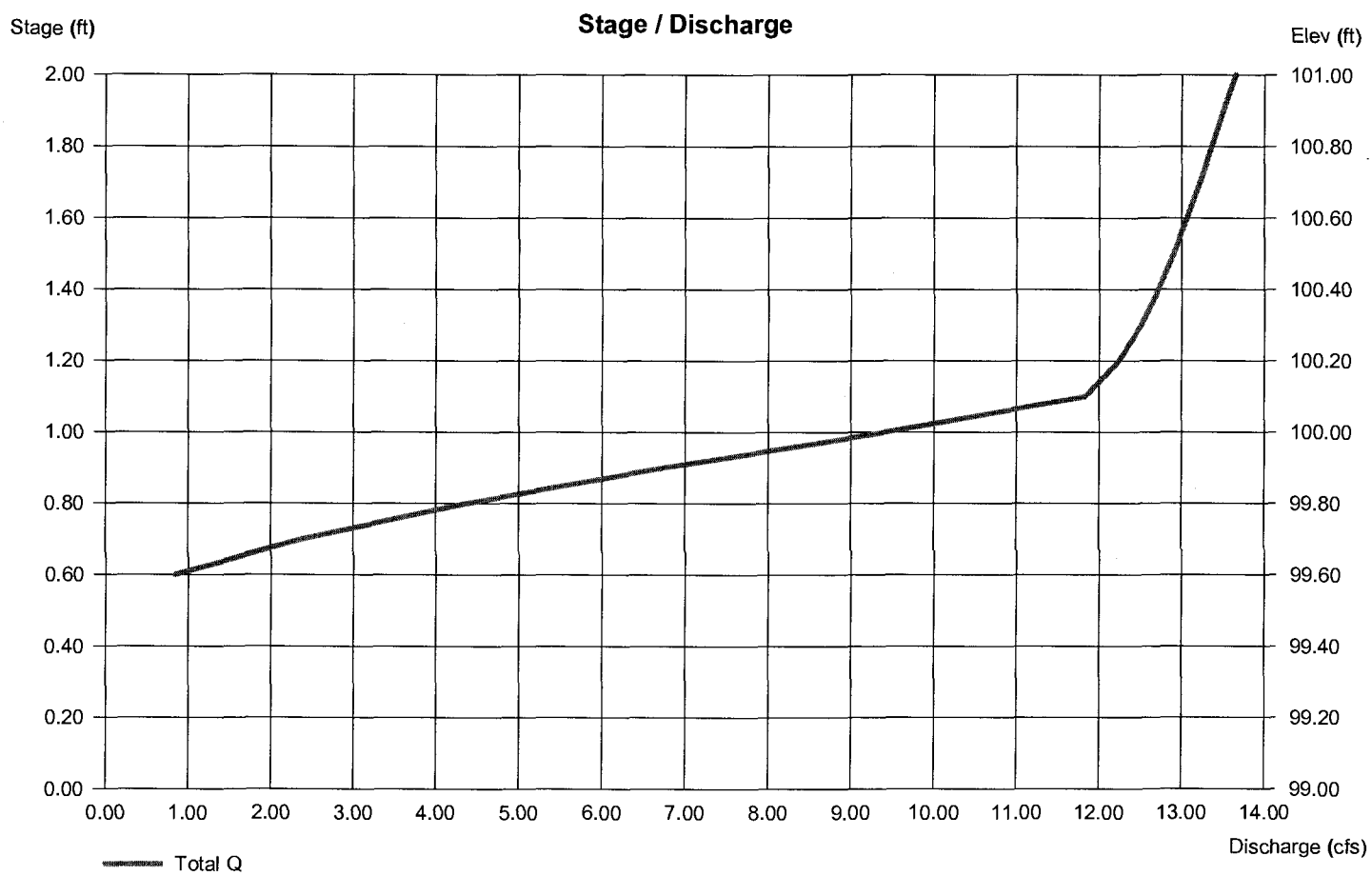
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 99.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Report

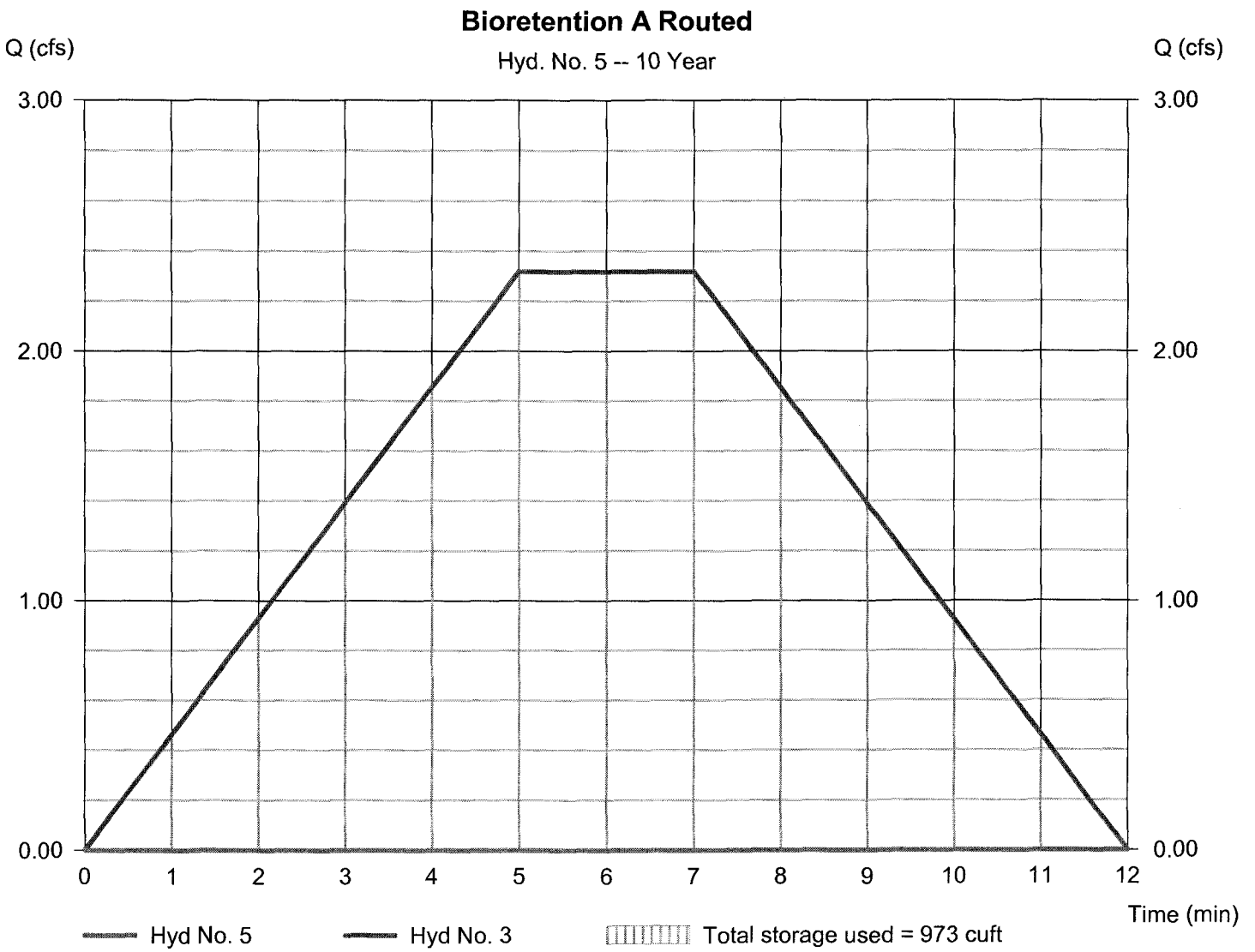
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 5

Bioretention A Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Area A-1	Max. Elevation	= 99.28 ft
Reservoir name	= Bioretention A	Max. Storage	= 973 cuft

Storage Indication method used.



Hydrograph Report

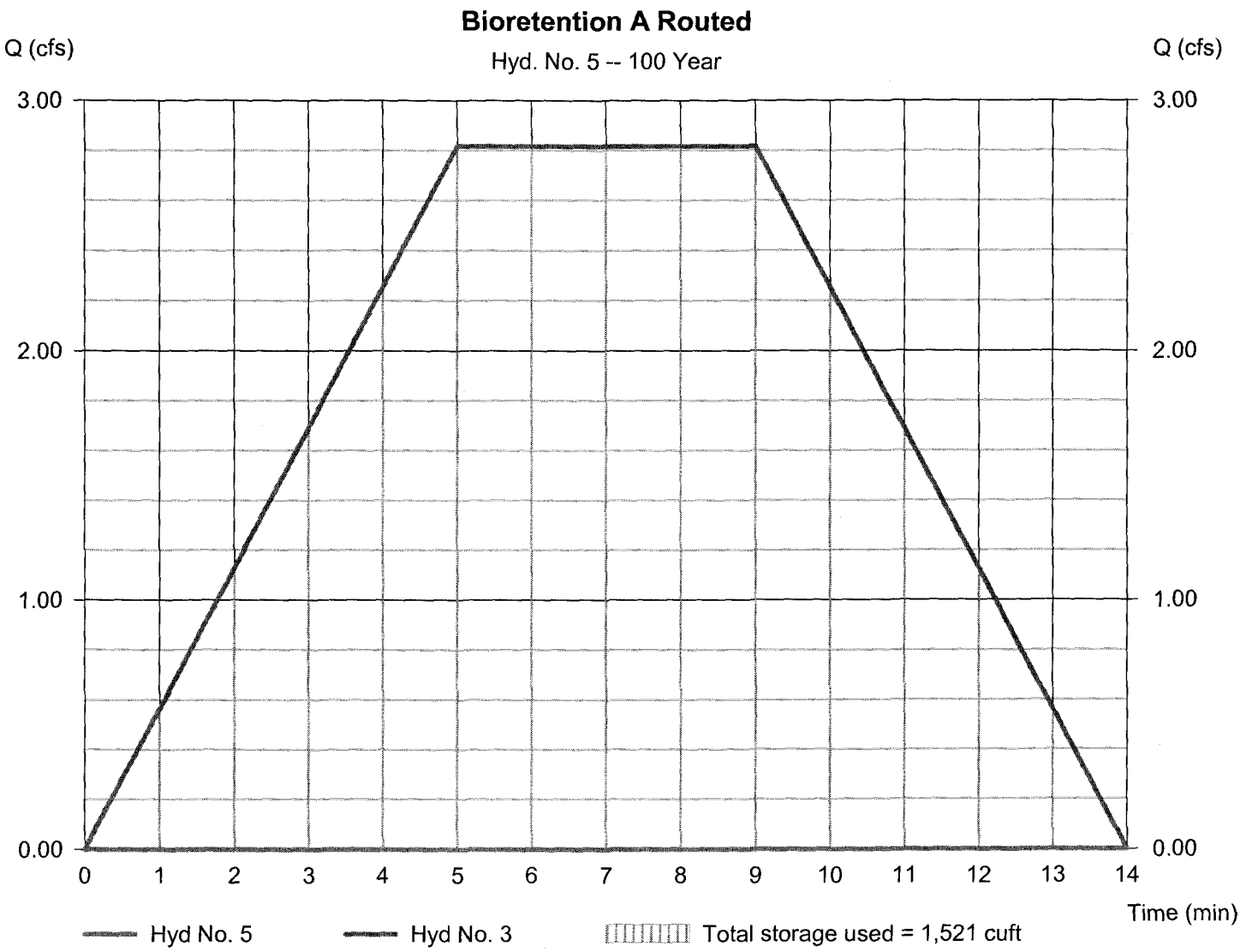
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 5

Bioretention A Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Area A-1	Max. Elevation	= 99.43 ft
Reservoir name	= Bioretention A	Max. Storage	= 1,521 cuft

Storage Indication method used.



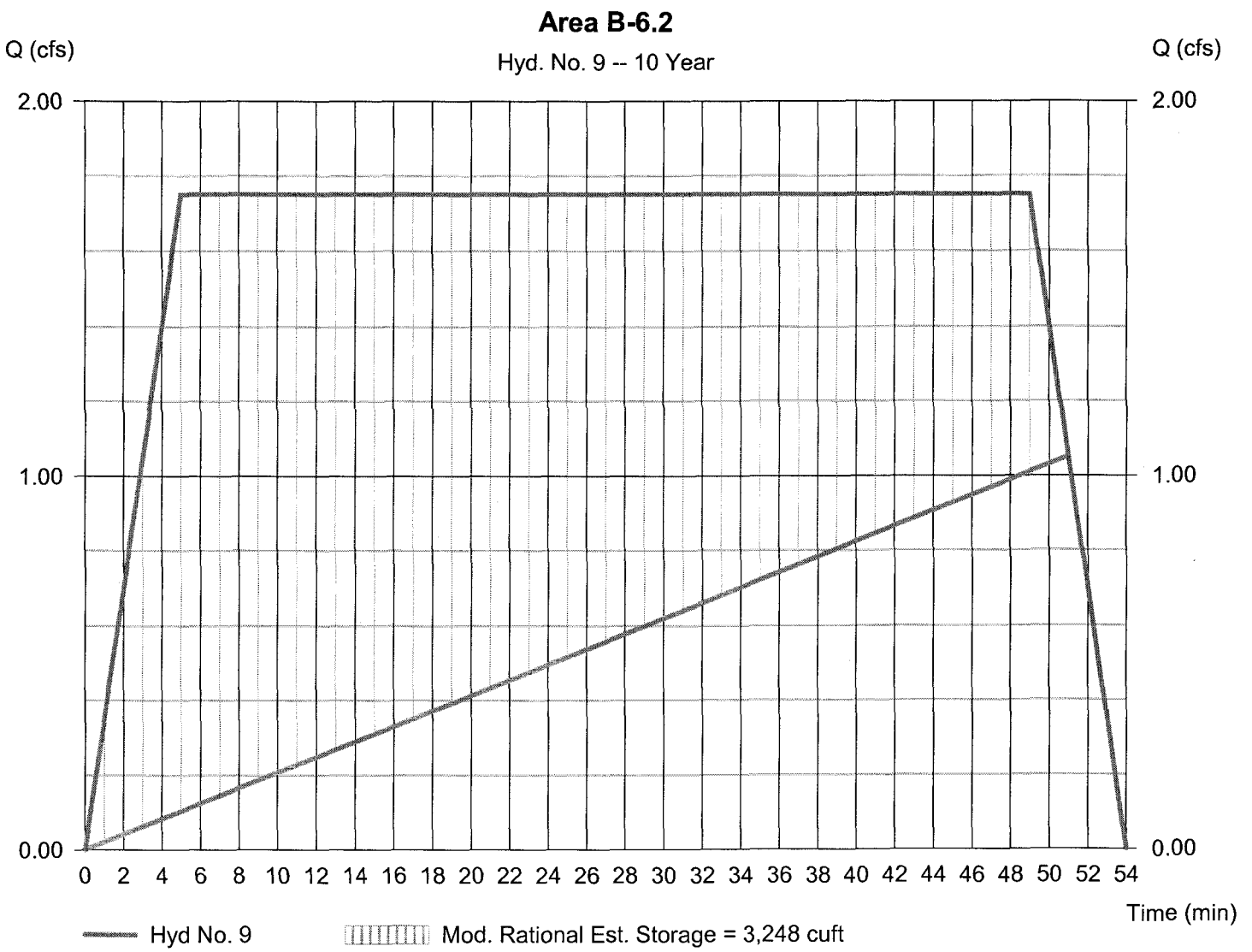
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 9

Area B-6.2

Hydrograph type	= Mod. Rational	Peak discharge	= 1.751 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 5,149 cuft
Drainage area	= 1.570 ac	Runoff coeff.	= 0.41
Intensity	= 2.721 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 9.8 x Tc
Target Q	= 1.160 cfs	Est. Req'd Storage	= 3,248 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 9

Area B-6.2

Hydrograph type	= Mod. Rational	Peak discharge	= 2.529 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 7,435 cuft
Drainage area	= 1.570 ac	Runoff coeff.	= 0.41
Intensity	= 3.929 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 9.8 x Tc
Target Q	= 1.600 cfs	Est. Req'd Storage	= 4,805 cuft

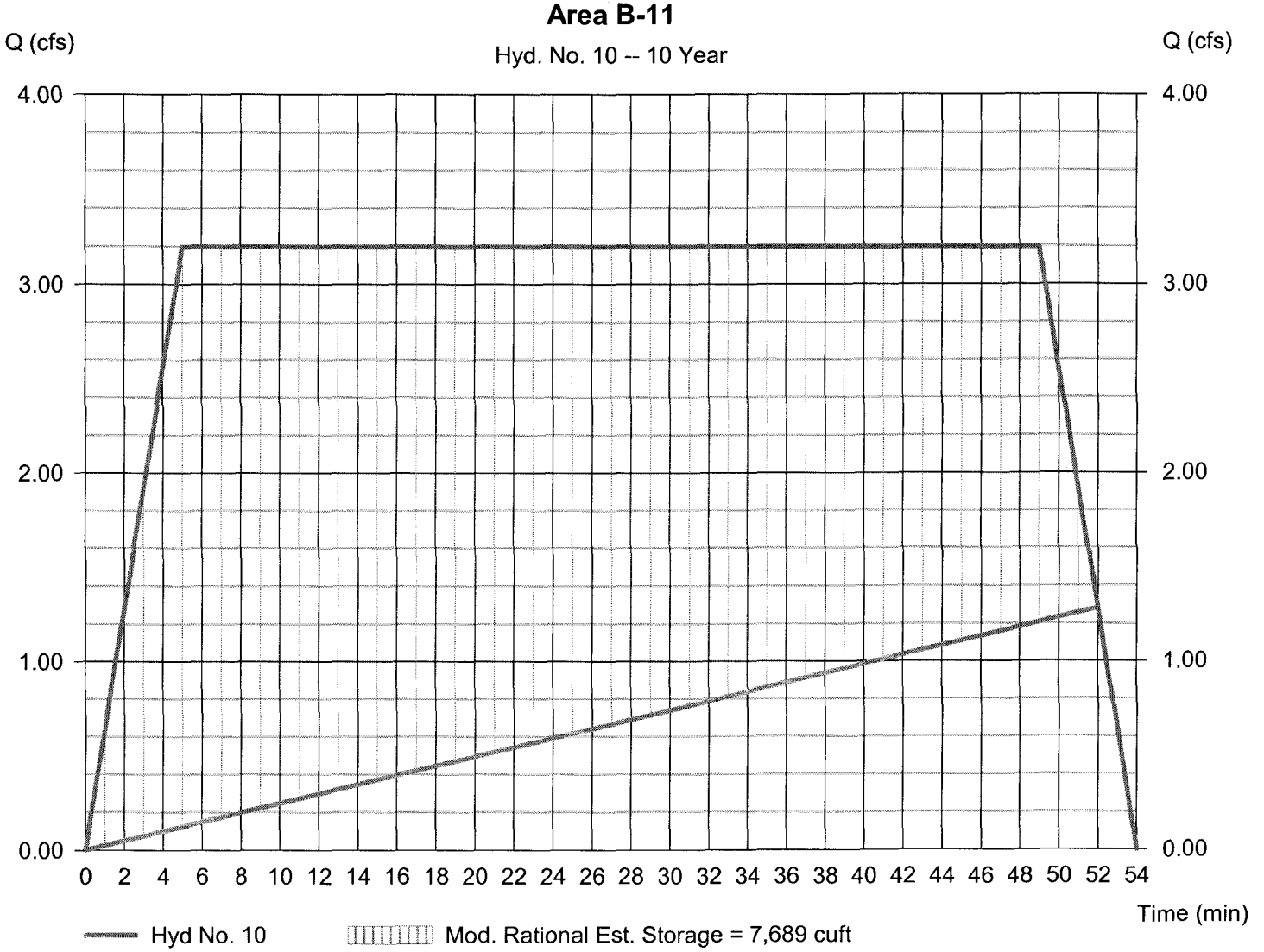
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 10

Area B-11

Hydrograph type	= Mod. Rational	Peak discharge	= 3.198 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 9,402 cuft
Drainage area	= 1.610 ac	Runoff coeff.	= 0.73
Intensity	= 2.721 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 9.8 x Tc
Target Q	= 1.030 cfs	Est. Req'd Storage	= 7,689 cuft



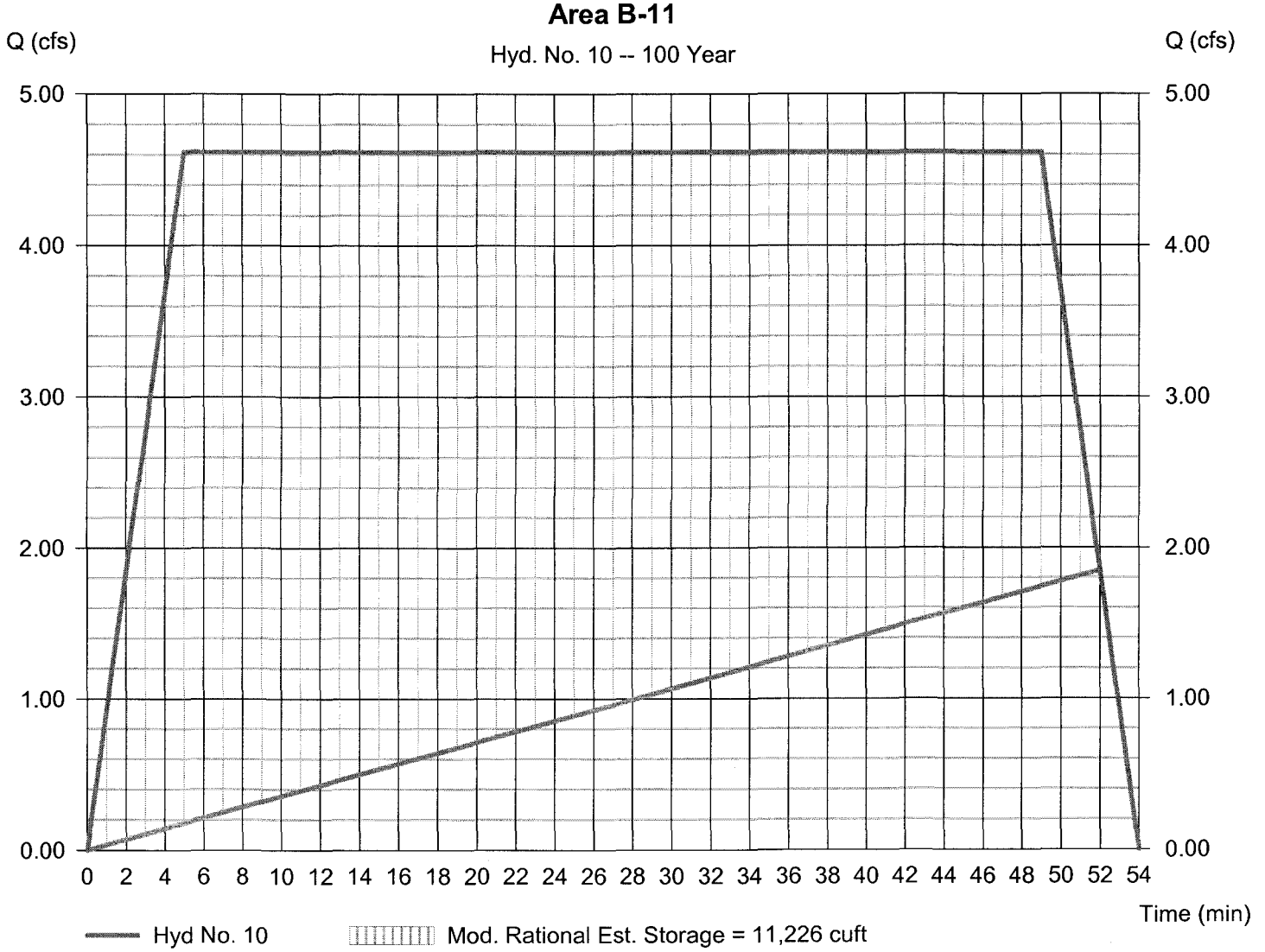
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Monday, Oct 4, 2010

Hyd. No. 10

Area B-11

Hydrograph type	= Mod. Rational	Peak discharge	= 4.617 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 13,575 cuft
Drainage area	= 1.610 ac	Runoff coeff.	= 0.73
Intensity	= 3.929 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 9.8 x Tc
Target Q	= 1.410 cfs	Est. Req'd Storage	= 11,226 cuft



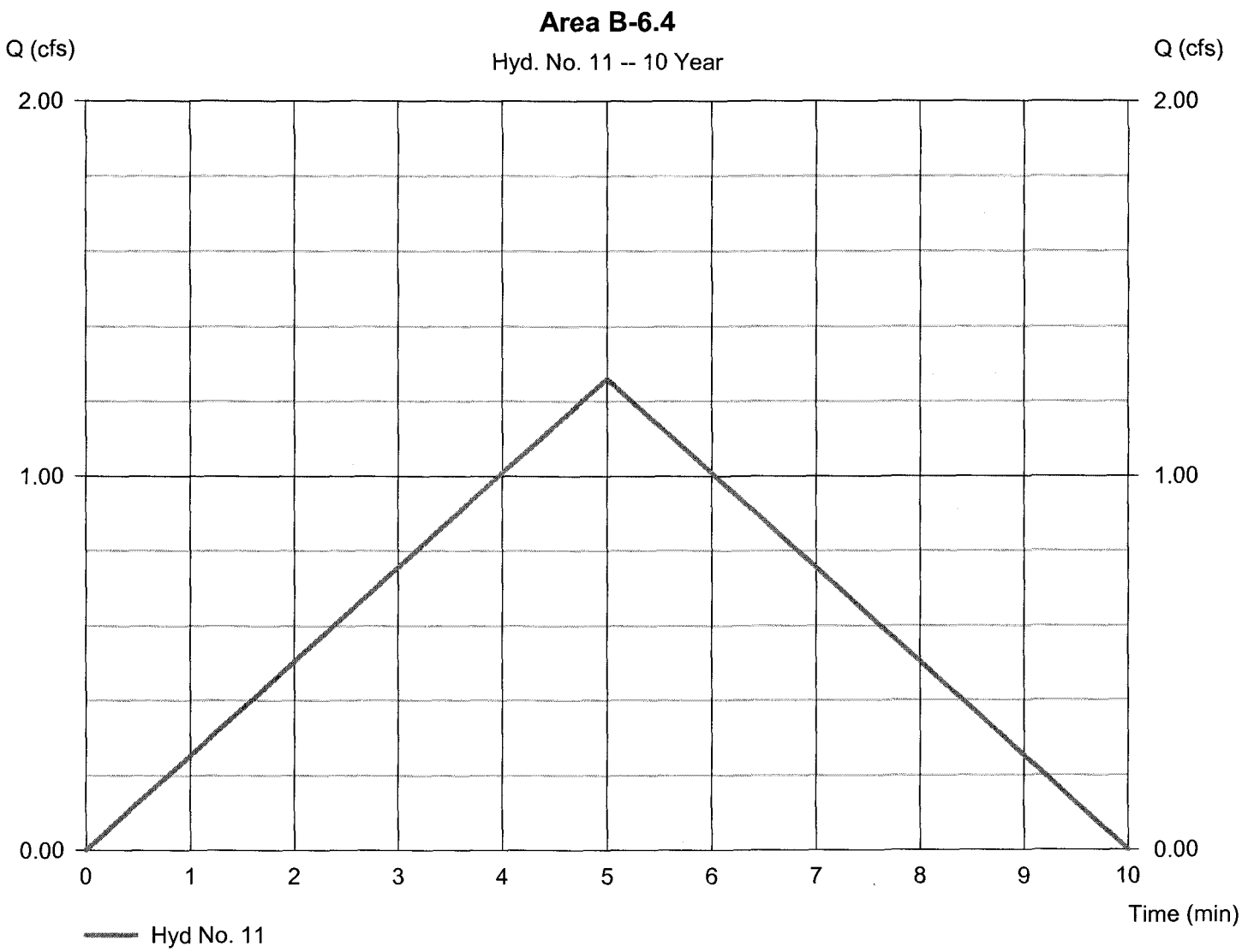
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 11

Area B-6.4

Hydrograph type	= Rational	Peak discharge	= 1.259 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 378 cuft
Drainage area	= 0.560 ac	Runoff coeff.	= 0.3
Intensity	= 7.496 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



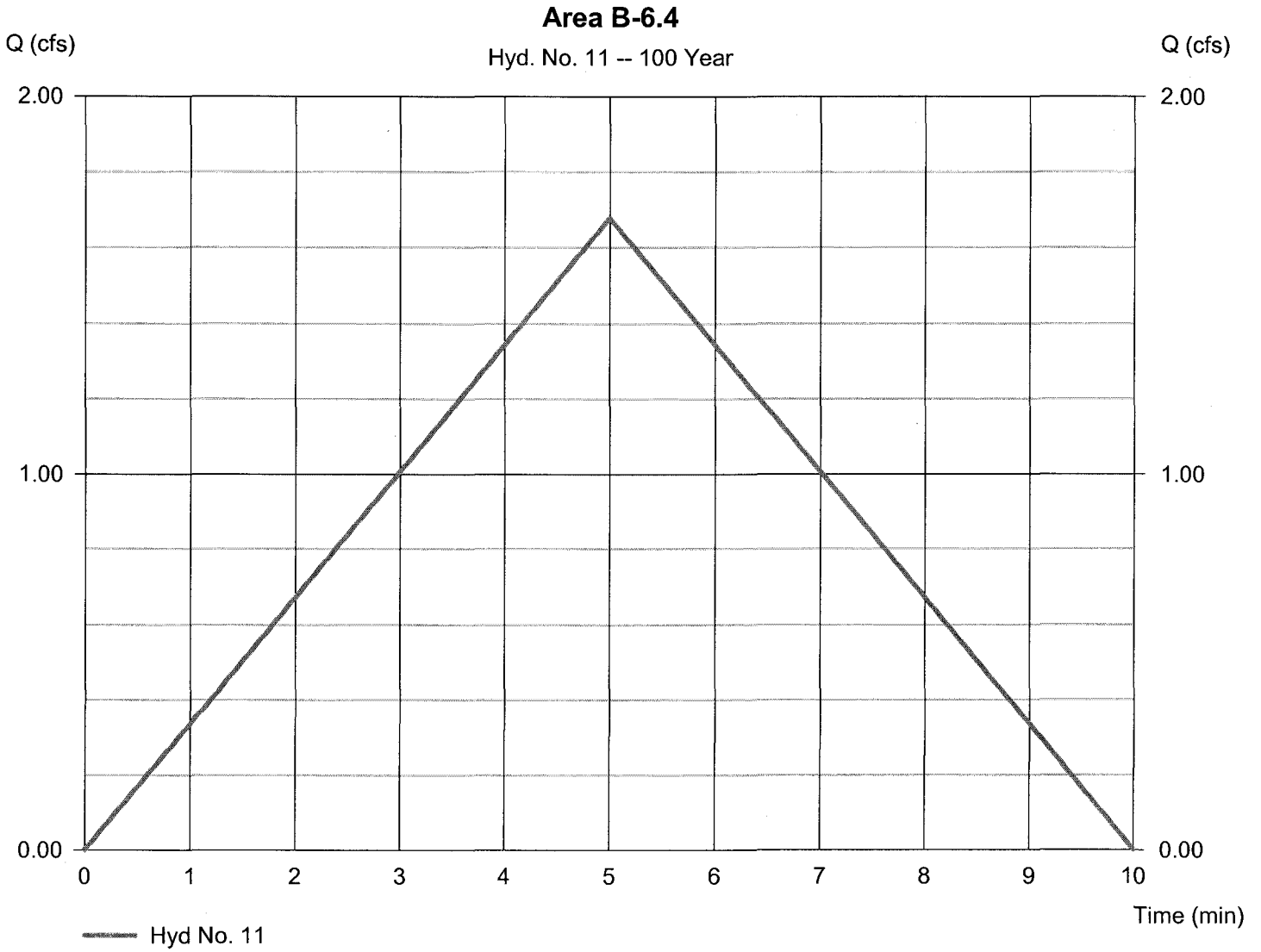
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 11

Area B-6.4

Hydrograph type	= Rational	Peak discharge	= 1.678 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 503 cuft
Drainage area	= 0.560 ac	Runoff coeff.	= 0.3
Intensity	= 9.988 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



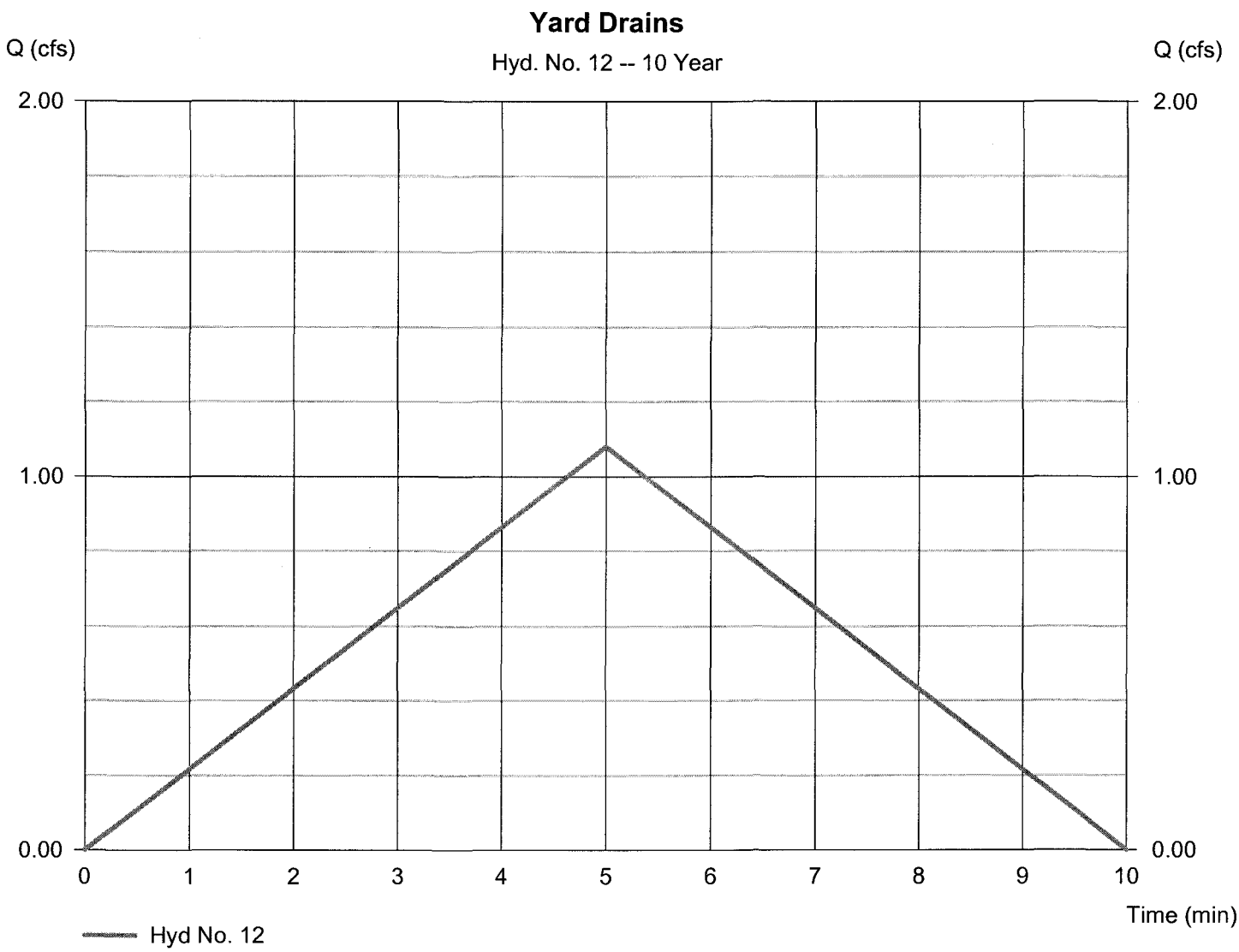
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 12

Yard Drains

Hydrograph type	= Rational	Peak discharge	= 1.079 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 324 cuft
Drainage area	= 0.240 ac	Runoff coeff.	= 0.6
Intensity	= 7.496 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



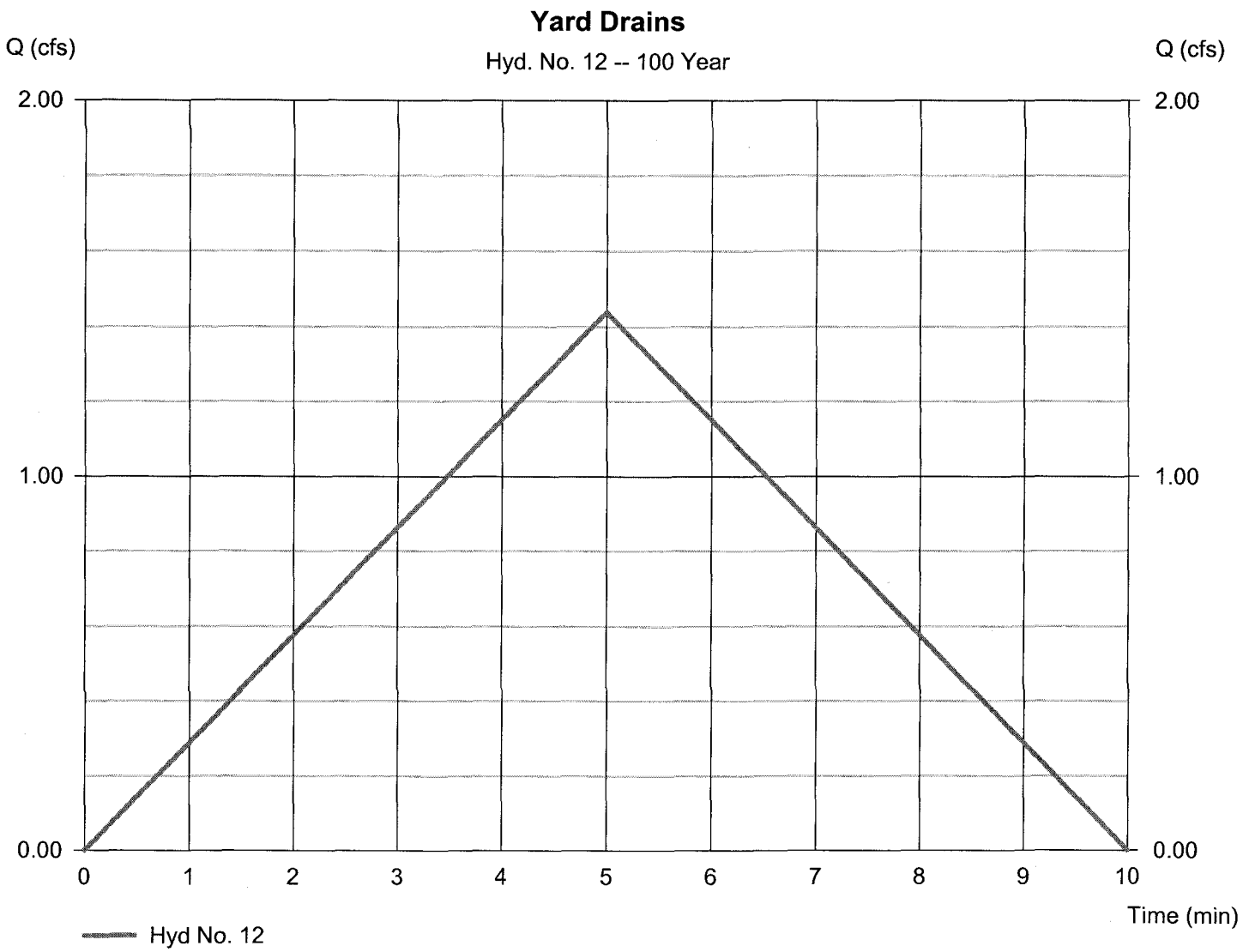
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 12

Yard Drains

Hydrograph type	= Rational	Peak discharge	= 1.438 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 431 cuft
Drainage area	= 0.240 ac	Runoff coeff.	= 0.6
Intensity	= 9.988 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



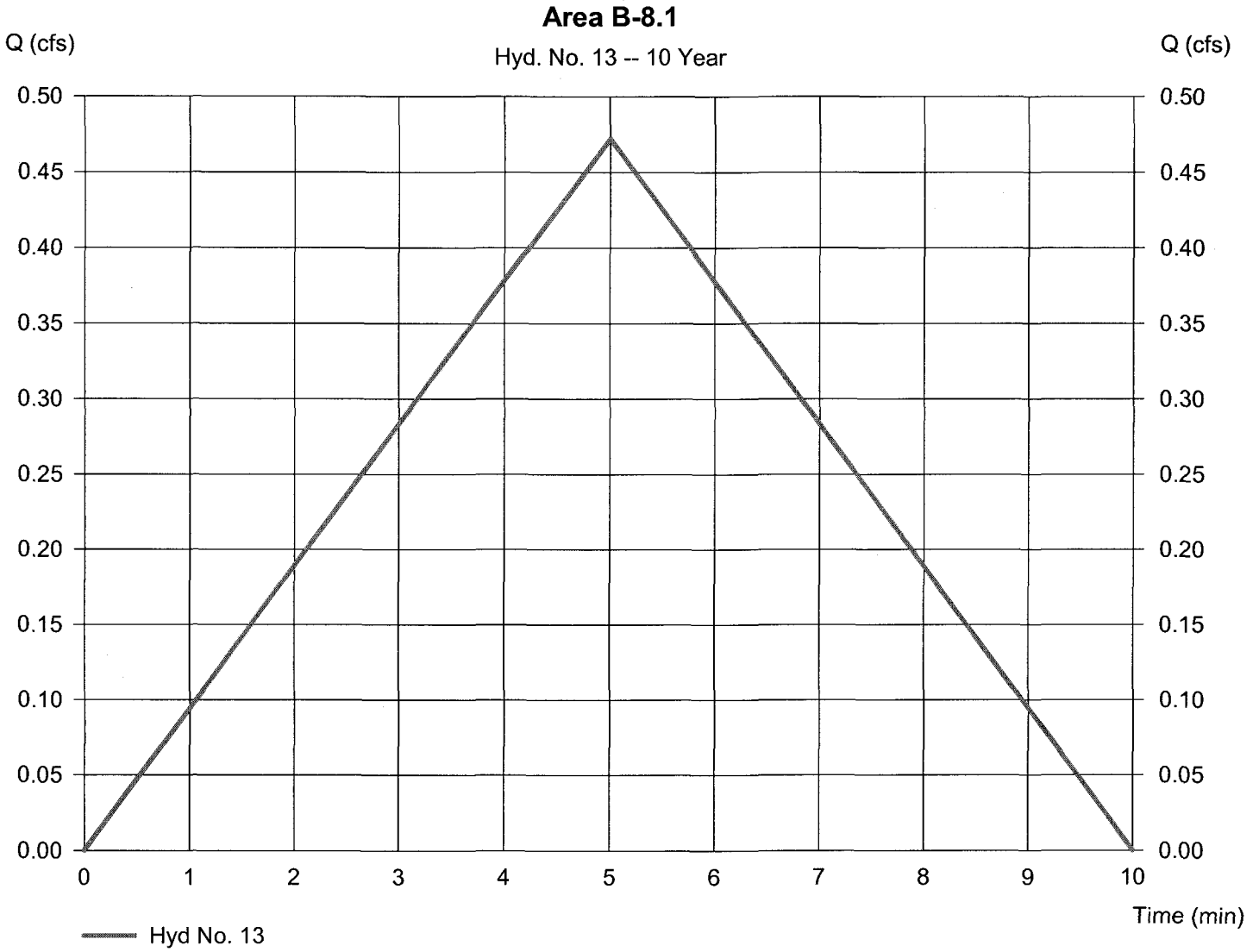
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 13

Area B-8.1

Hydrograph type	= Rational	Peak discharge	= 0.472 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 142 cuft
Drainage area	= 0.070 ac	Runoff coeff.	= 0.9
Intensity	= 7.496 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



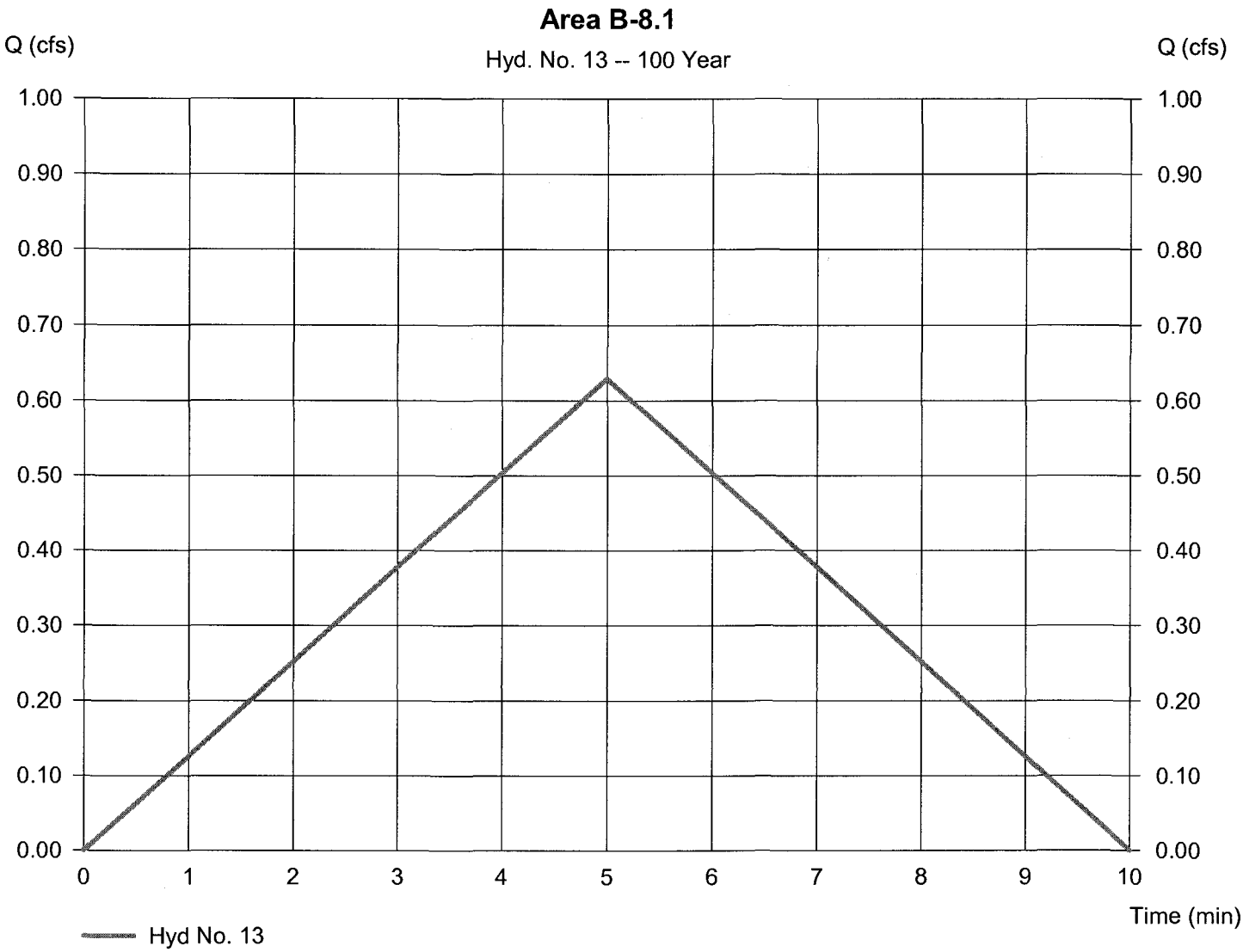
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 13

Area B-8.1

Hydrograph type	= Rational	Peak discharge	= 0.629 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 189 cuft
Drainage area	= 0.070 ac	Runoff coeff.	= 0.9
Intensity	= 9.988 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



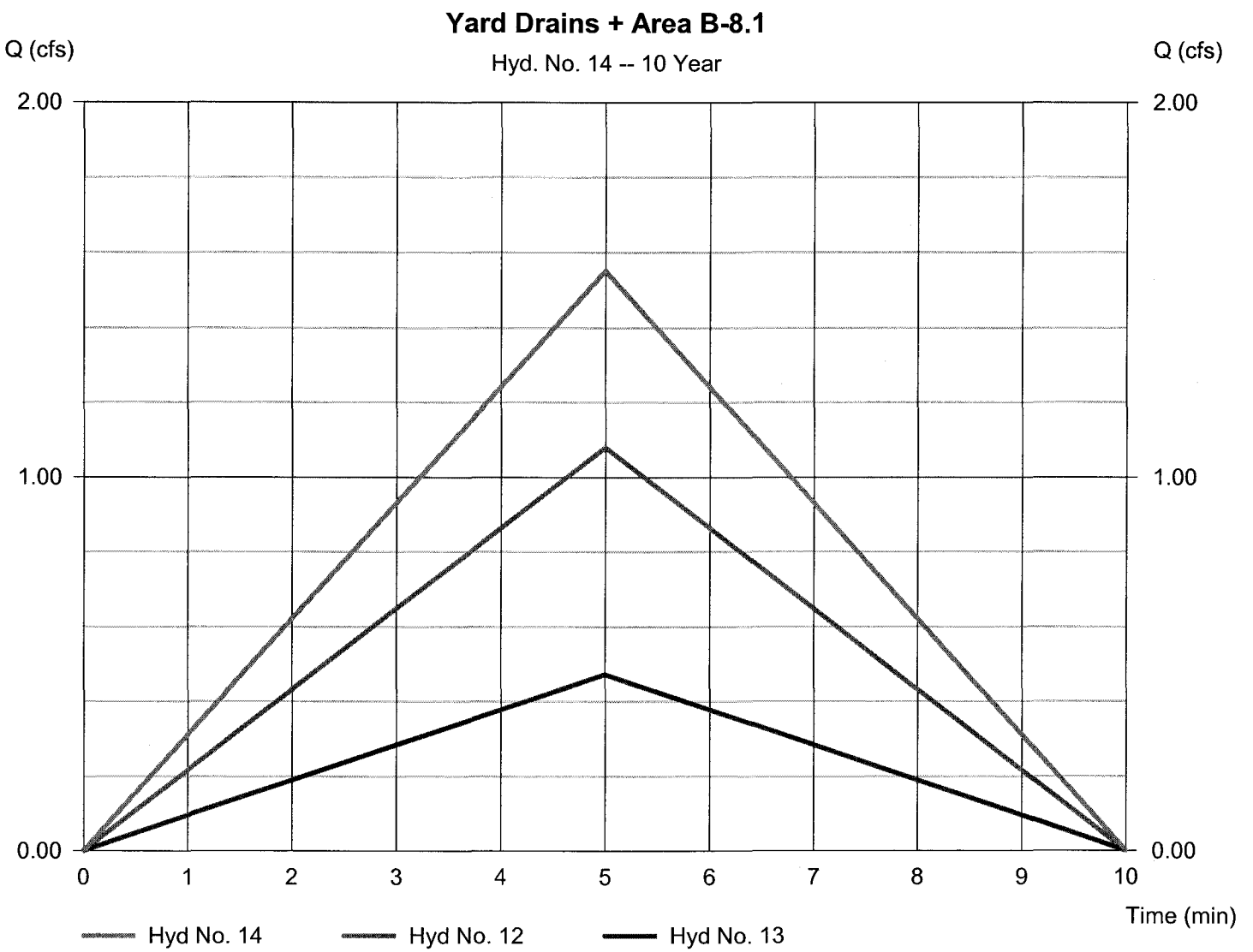
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 14

Yard Drains + Area B-8.1

Hydrograph type	= Combine	Peak discharge	= 1.552 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 466 cuft
Inflow hyds.	= 12, 13	Contrib. drain. area	= 0.310 ac



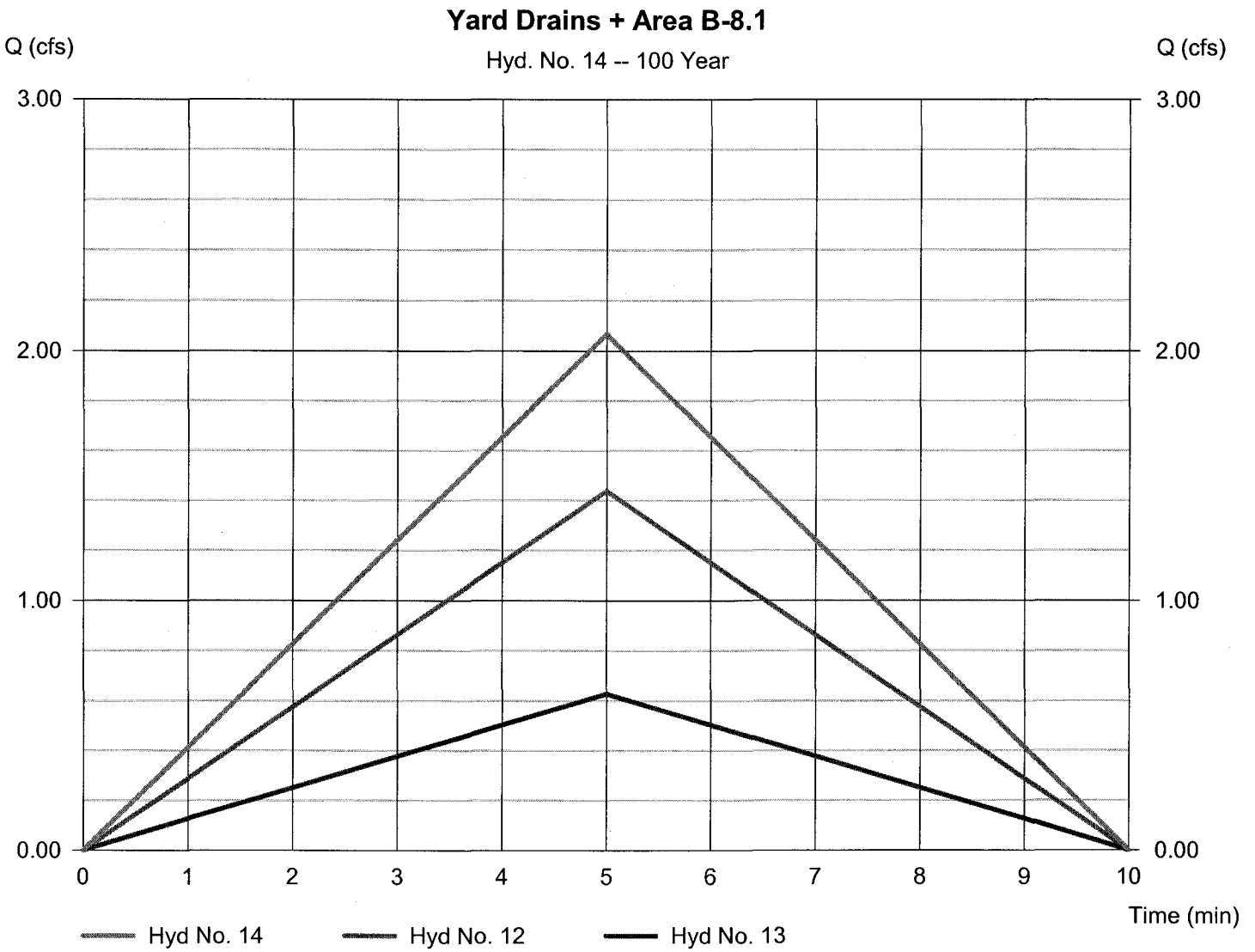
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 14

Yard Drains + Area B-8.1

Hydrograph type	= Combine	Peak discharge	= 2.068 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 620 cuft
Inflow hyds.	= 12, 13	Contrib. drain. area	= 0.310 ac



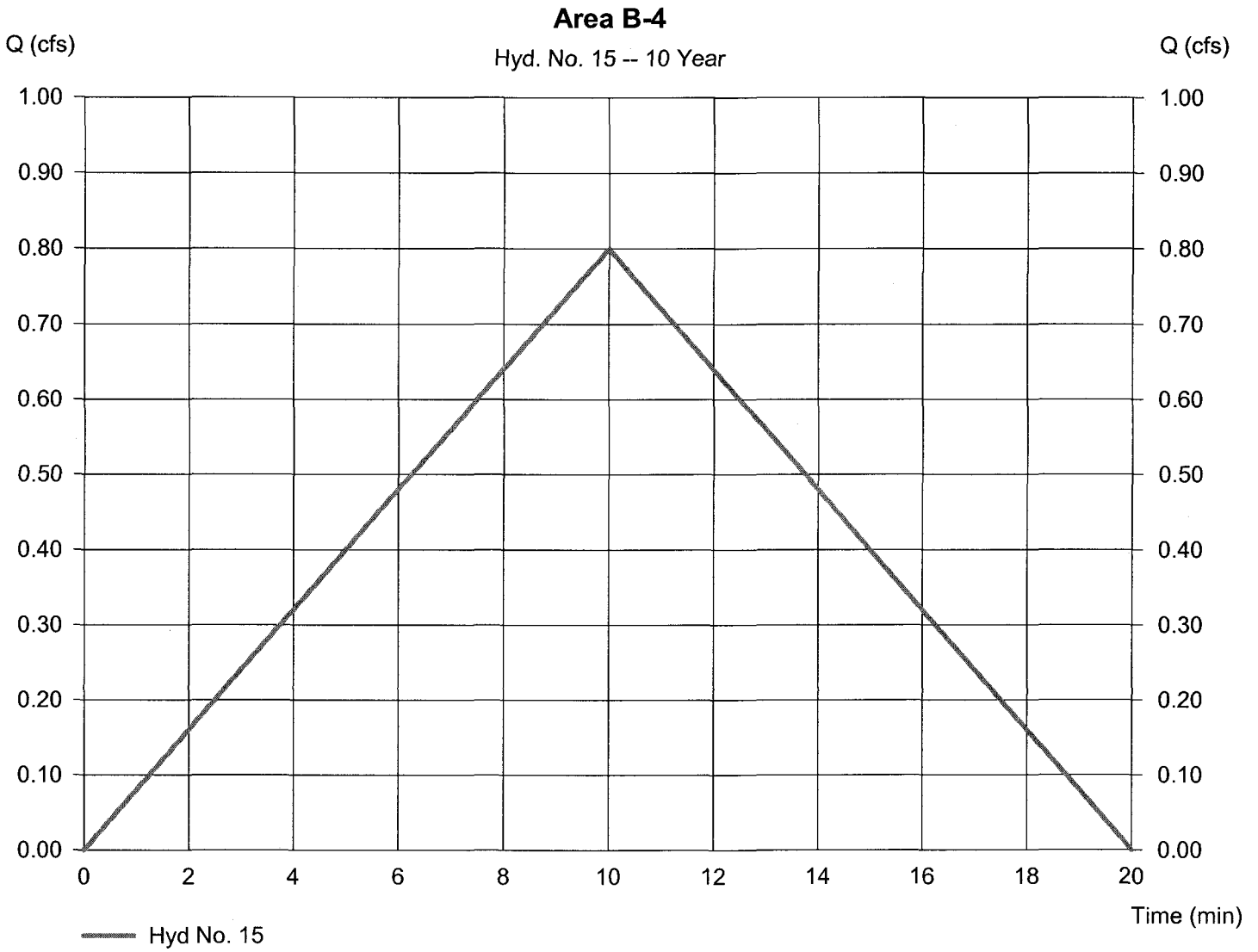
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 15

Area B-4

Hydrograph type	= Rational	Peak discharge	= 0.800 cfs
Storm frequency	= 10 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 480 cuft
Drainage area	= 0.440 ac	Runoff coeff.	= 0.3
Intensity	= 6.059 in/hr	Tc by User	= 10.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



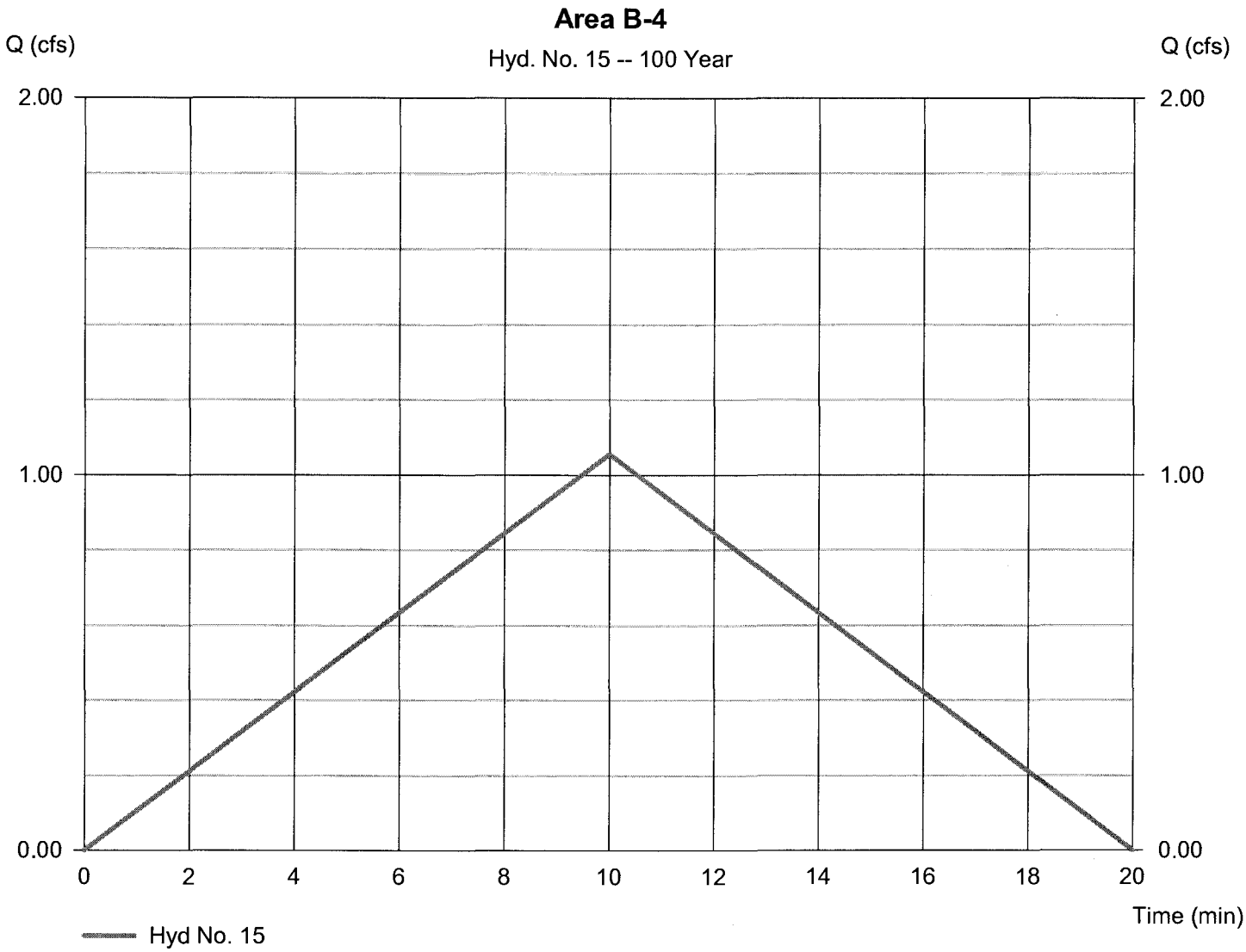
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 15

Area B-4

Hydrograph type	= Rational	Peak discharge	= 1.055 cfs
Storm frequency	= 100 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 633 cuft
Drainage area	= 0.440 ac	Runoff coeff.	= 0.3
Intensity	= 7.996 in/hr	Tc by User	= 10.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



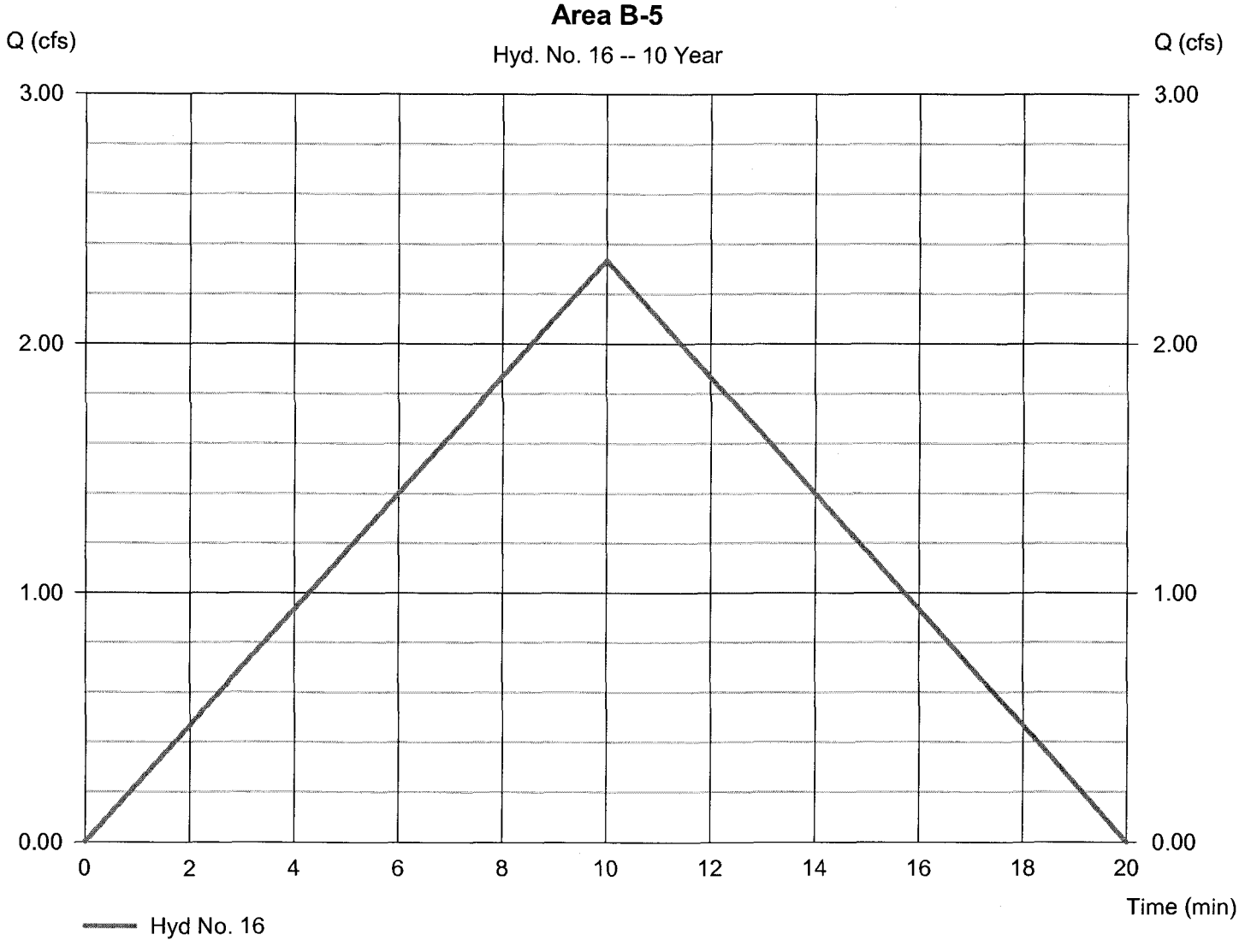
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 16

Area B-5

Hydrograph type	= Rational	Peak discharge	= 2.335 cfs
Storm frequency	= 10 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 1,401 cuft
Drainage area	= 0.470 ac	Runoff coeff.	= 0.82
Intensity	= 6.059 in/hr	Tc by User	= 10.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



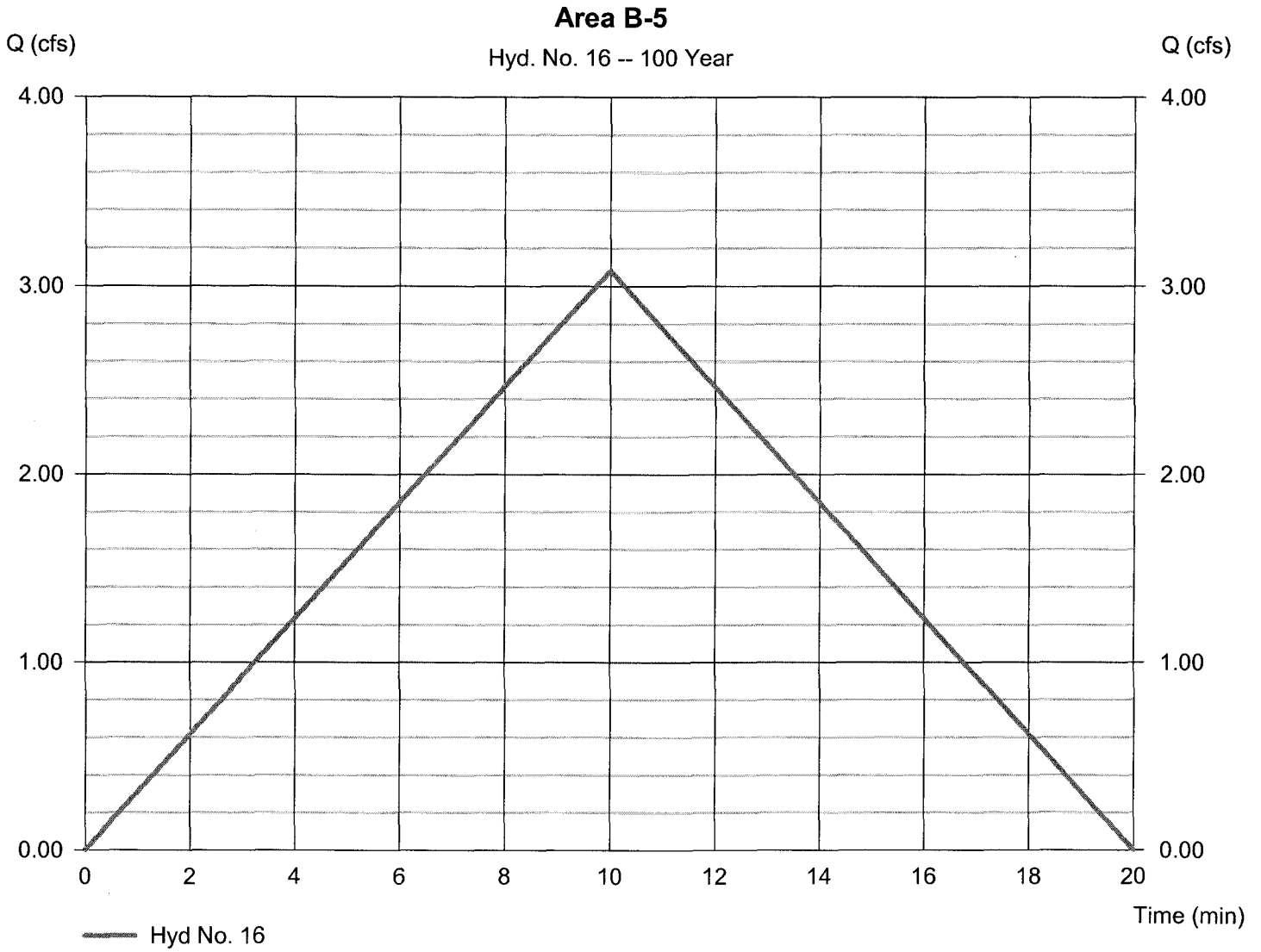
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 16

Area B-5

Hydrograph type	= Rational	Peak discharge	= 3.082 cfs
Storm frequency	= 100 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 1,849 cuft
Drainage area	= 0.470 ac	Runoff coeff.	= 0.82
Intensity	= 7.996 in/hr	Tc by User	= 10.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



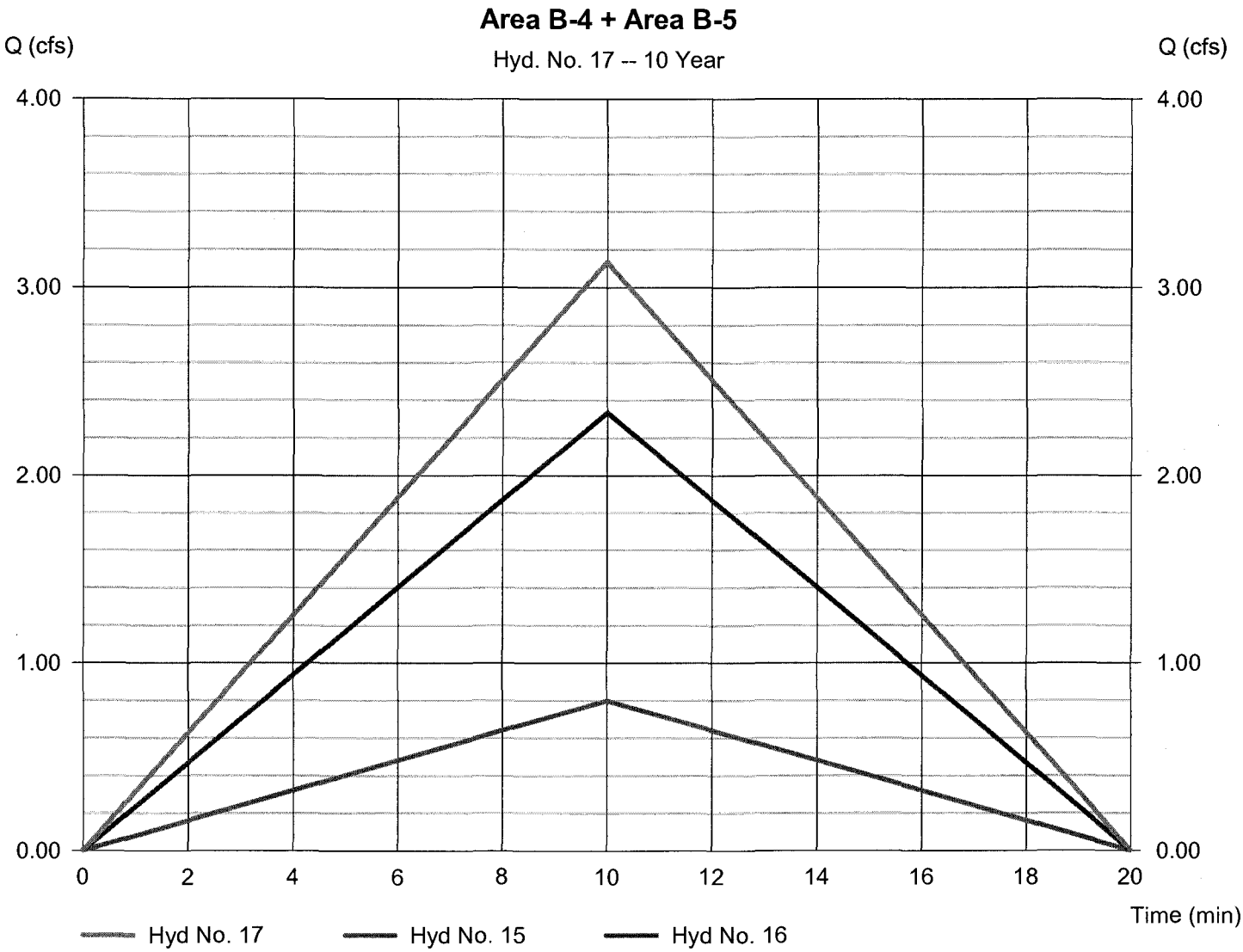
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 17

Area B-4 + Area B-5

Hydrograph type	= Combine	Peak discharge	= 3.135 cfs
Storm frequency	= 10 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 1,881 cuft
Inflow hyds.	= 15, 16	Contrib. drain. area	= 0.910 ac



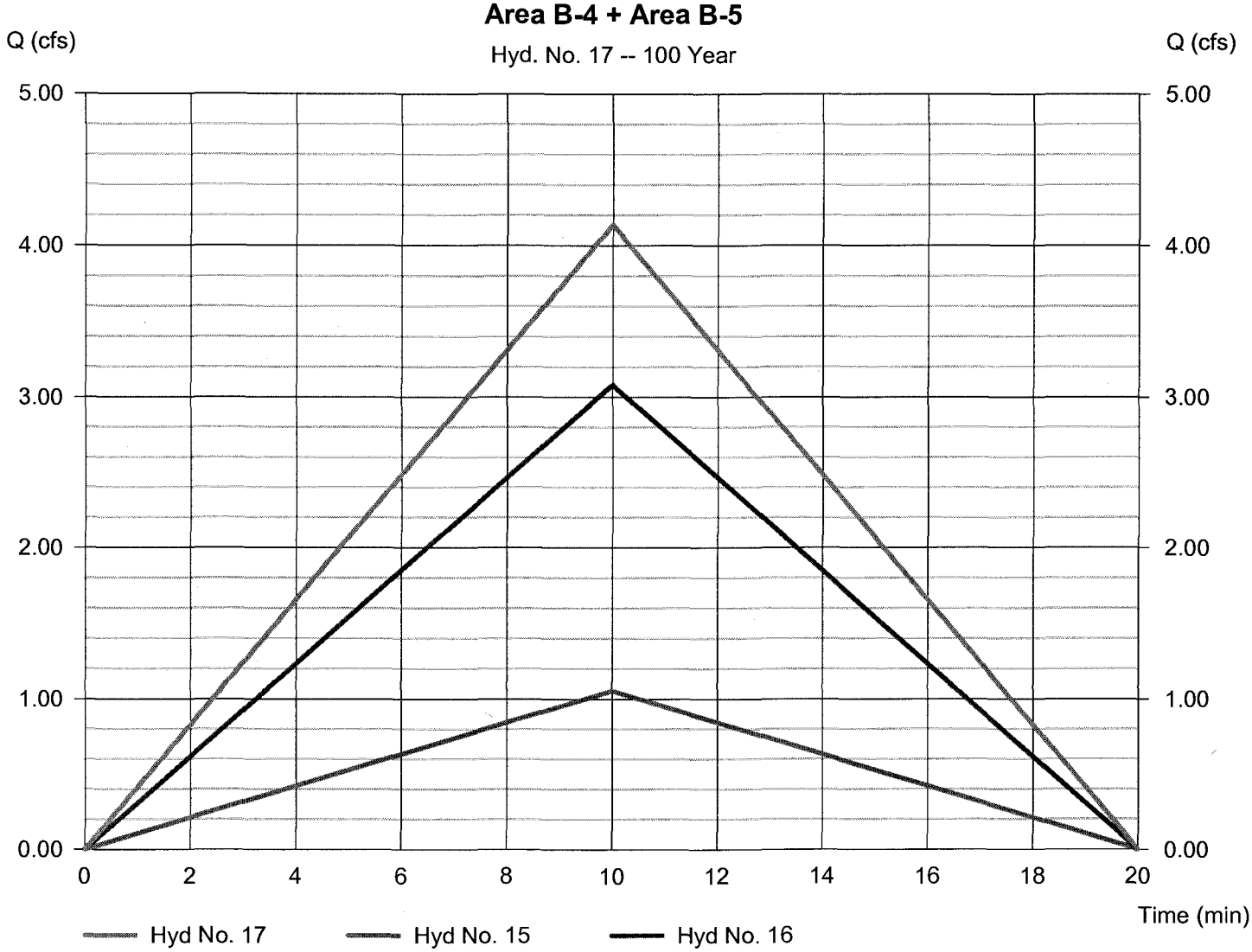
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 17

Area B-4 + Area B-5

Hydrograph type	= Combine	Peak discharge	= 4.137 cfs
Storm frequency	= 100 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 2,482 cuft
Inflow hyds.	= 15, 16	Contrib. drain. area	= 0.910 ac



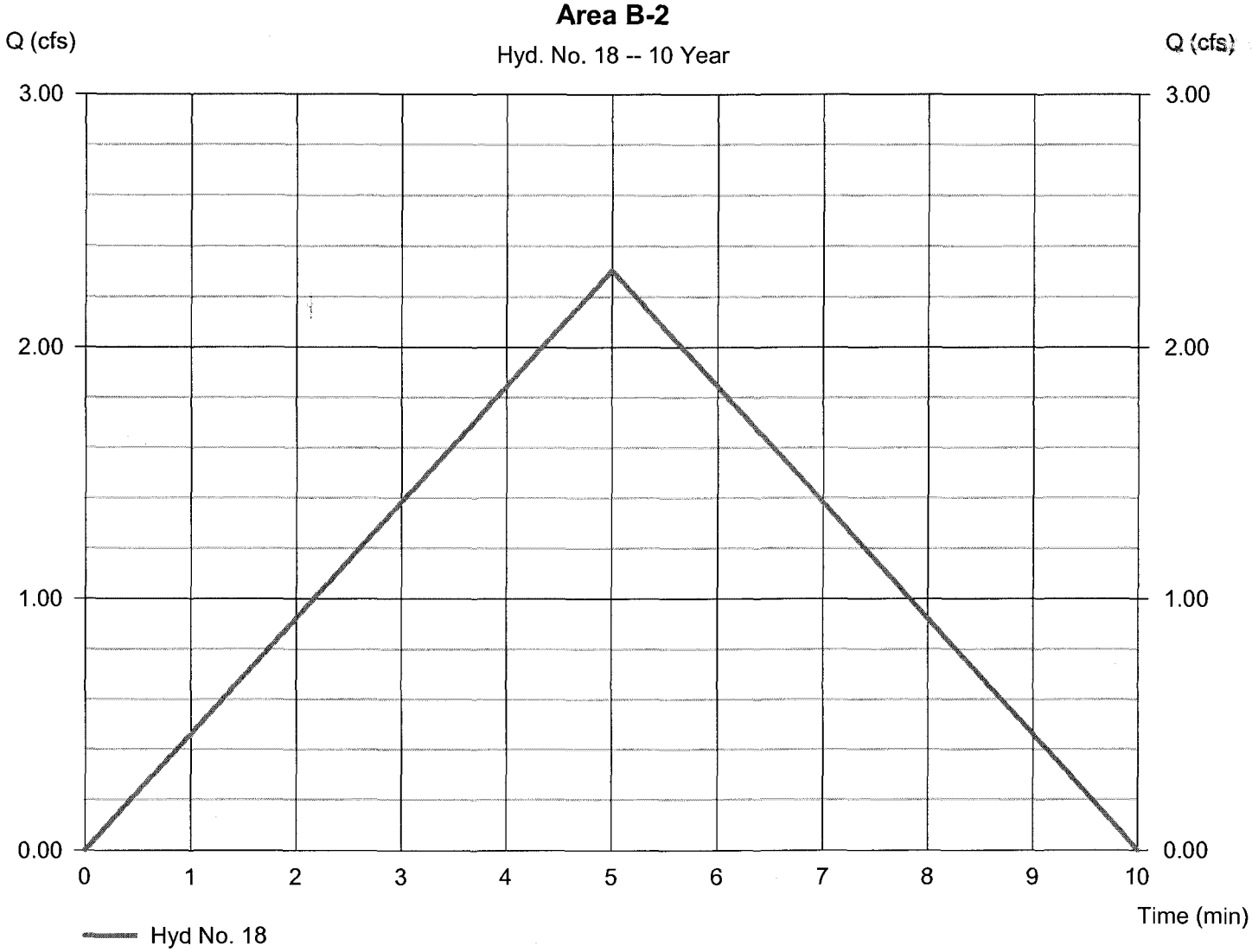
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 18

Area B-2

Hydrograph type	= Rational	Peak discharge	= 2.305 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 692 cuft
Drainage area	= 0.410 ac	Runoff coeff.	= 0.75
Intensity	= 7.496 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



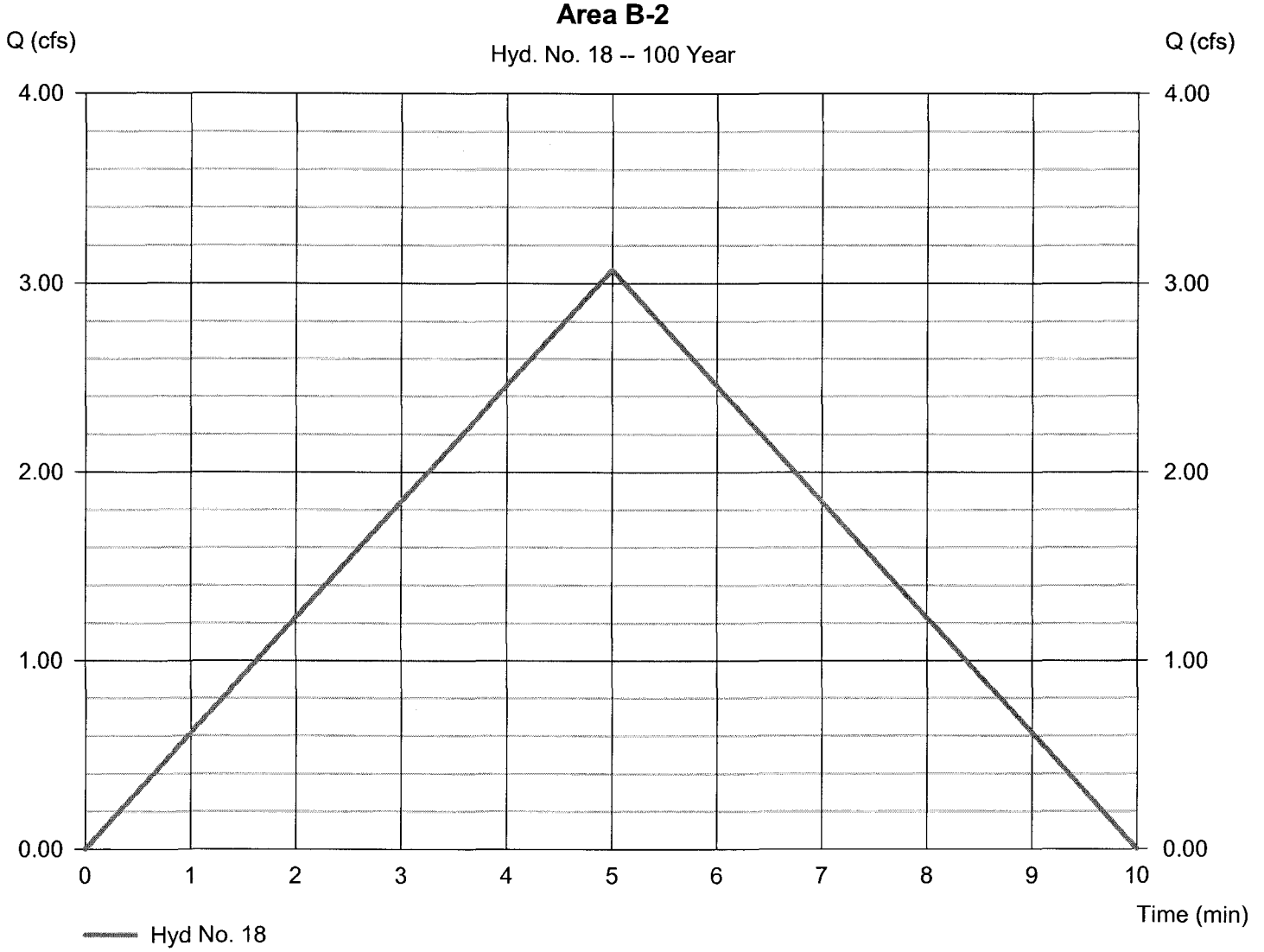
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 18

Area B-2

Hydrograph type	= Rational	Peak discharge	= 3.071 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 921 cuft
Drainage area	= 0.410 ac	Runoff coeff.	= 0.75
Intensity	= 9.988 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



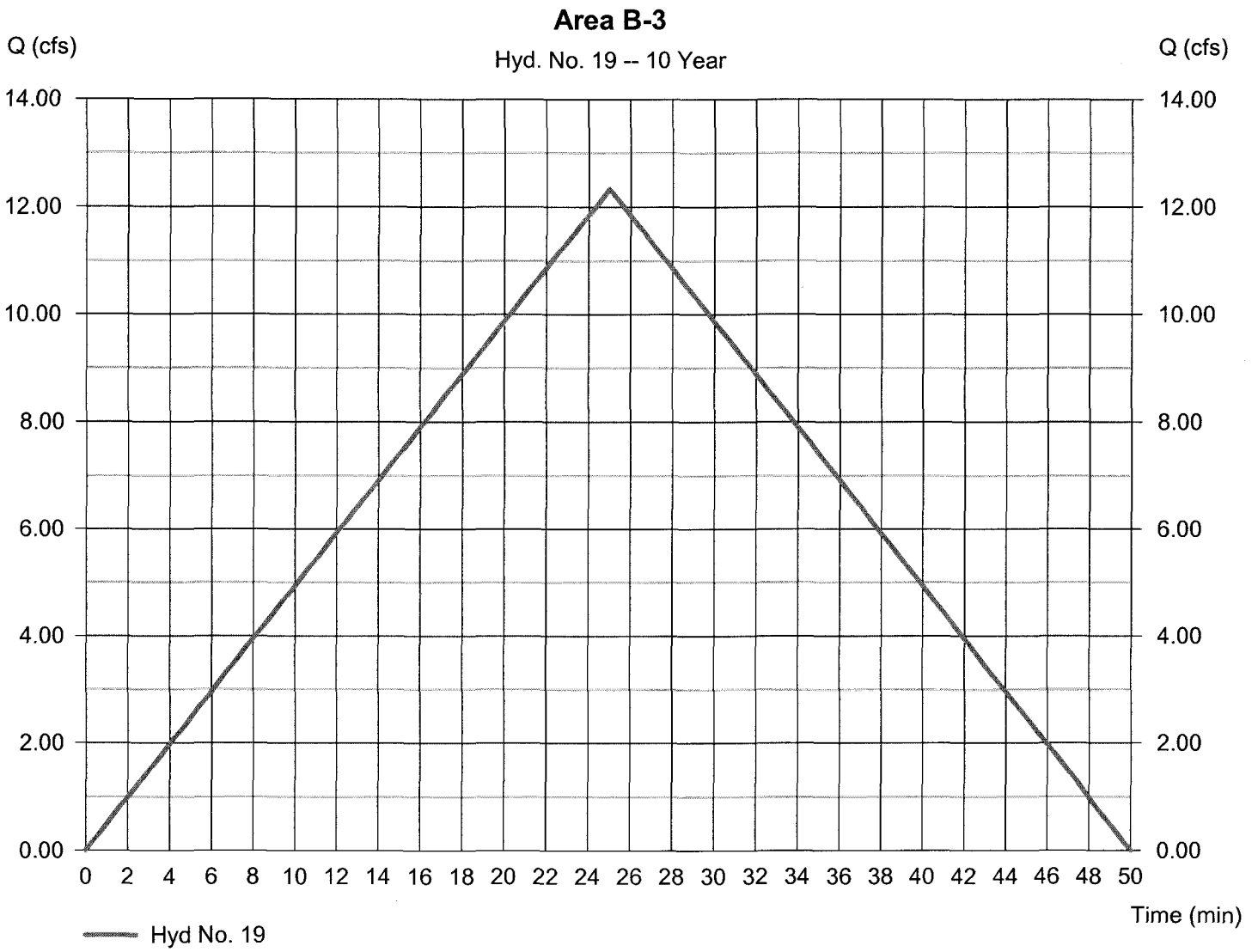
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Monday, Oct 4, 2010

Hyd. No. 19

Area B-3

Hydrograph type	= Rational	Peak discharge	= 12.33 cfs
Storm frequency	= 10 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 18,501 cuft
Drainage area	= 4.400 ac	Runoff coeff.	= 0.7
Intensity	= 4.004 in/hr	Tc by User	= 25.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



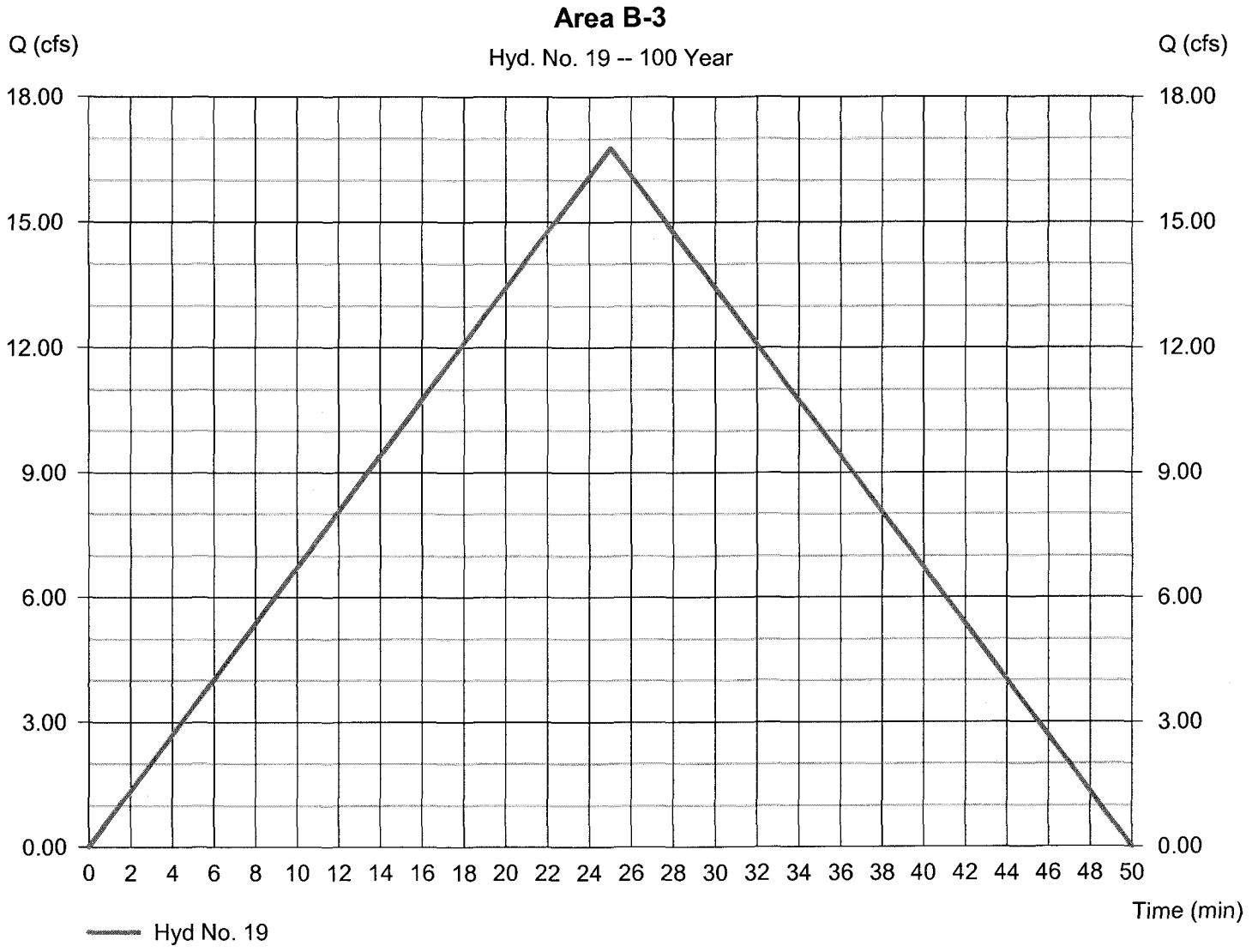
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Monday, Oct 4, 2010

Hyd. No. 19

Area B-3

Hydrograph type	= Rational	Peak discharge	= 16.78 cfs
Storm frequency	= 100 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 25,173 cuft
Drainage area	= 4.400 ac	Runoff coeff.	= 0.7
Intensity	= 5.449 in/hr	Tc by User	= 25.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



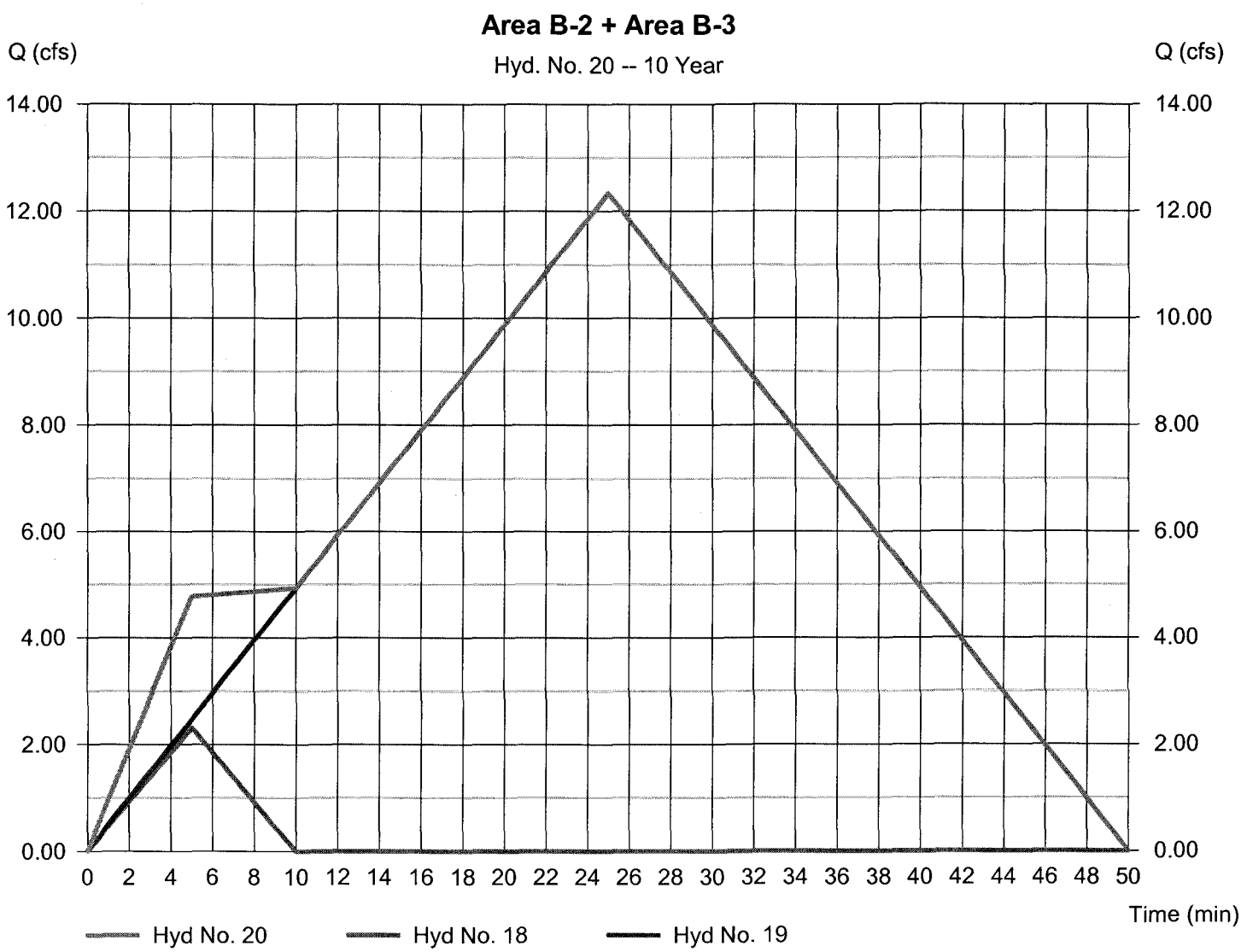
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 20

Area B-2 + Area B-3

Hydrograph type	= Combine	Peak discharge	= 12.33 cfs
Storm frequency	= 10 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 19,192 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 4.810 ac



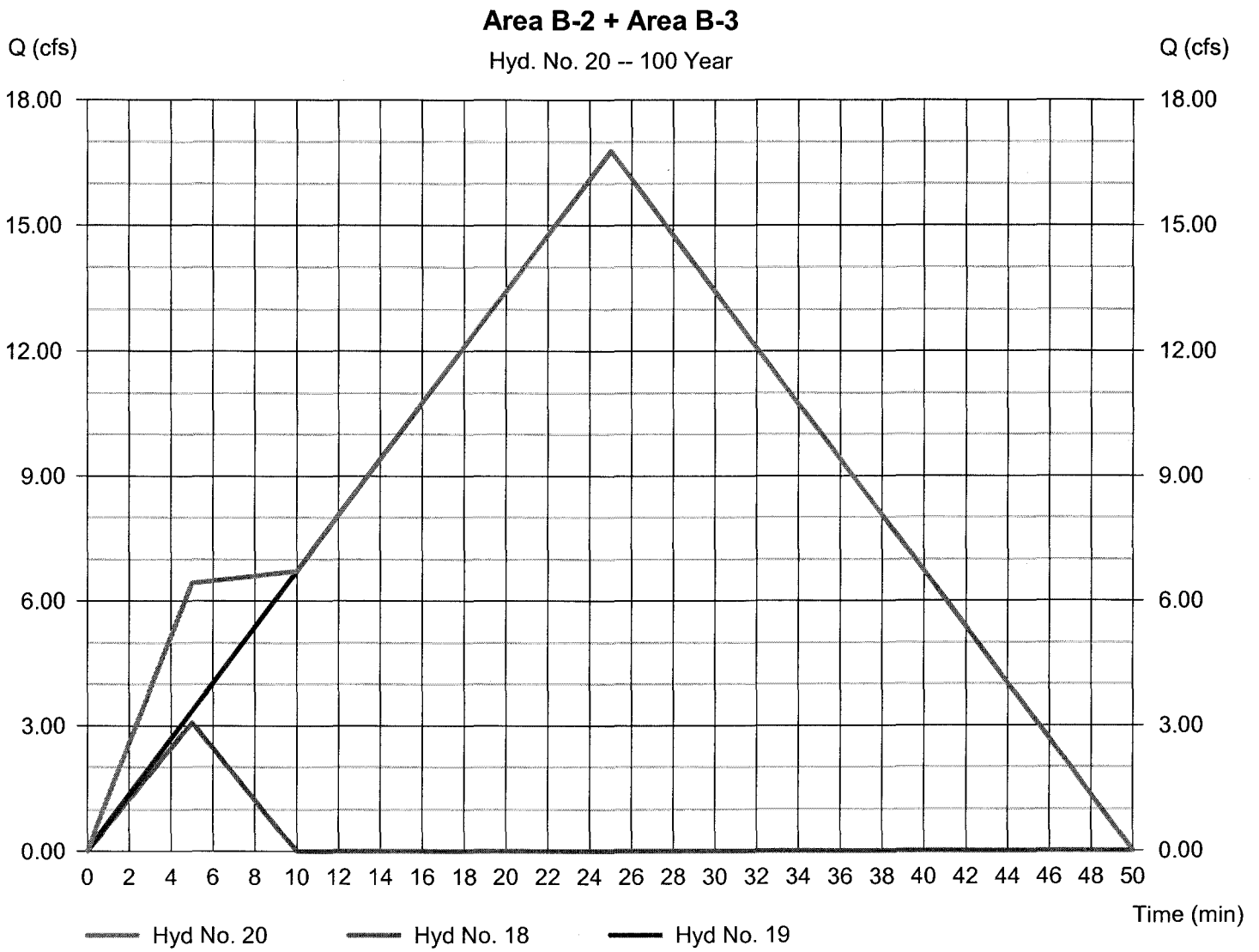
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 20

Area B-2 + Area B-3

Hydrograph type	= Combine	Peak discharge	= 16.78 cfs
Storm frequency	= 100 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 26,094 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 4.810 ac



AES
CONSULTING ENGINEERS

Project:	**Courthouse Common**
Project No.:	**8509-04**
Subject:	**Water Quality Volume**
	Bioretention B-3
Date:	**2/18/2010**
Calculated By:	**AMR**

BMP Type = **Bioretention B-3**

Water Quality Volume = 0.5 in. x **1.6** acres of impervious coverage (@ Future Conditions)

= (0.5 / 12) x (43,560 x **1.6**)

= **2904** CF

Total Storage Volume Required = **1** x Water Quality Volume

= **1** x **2904**

= **2904** CF @ 99.5 = 1,237 CF Storage Provided

** Bioretention used for SSC Complaince and not JCC 10-pt

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Pond No. 9 - Bioretention B-3

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 99.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	99.00	2,220	0	0
0.50	99.50	2,738	1,237	1,237
1.00	100.00	3,275	1,501	2,738
1.50	100.50	4,000	1,816	4,554
2.00	101.00	10,000	3,387	7,941

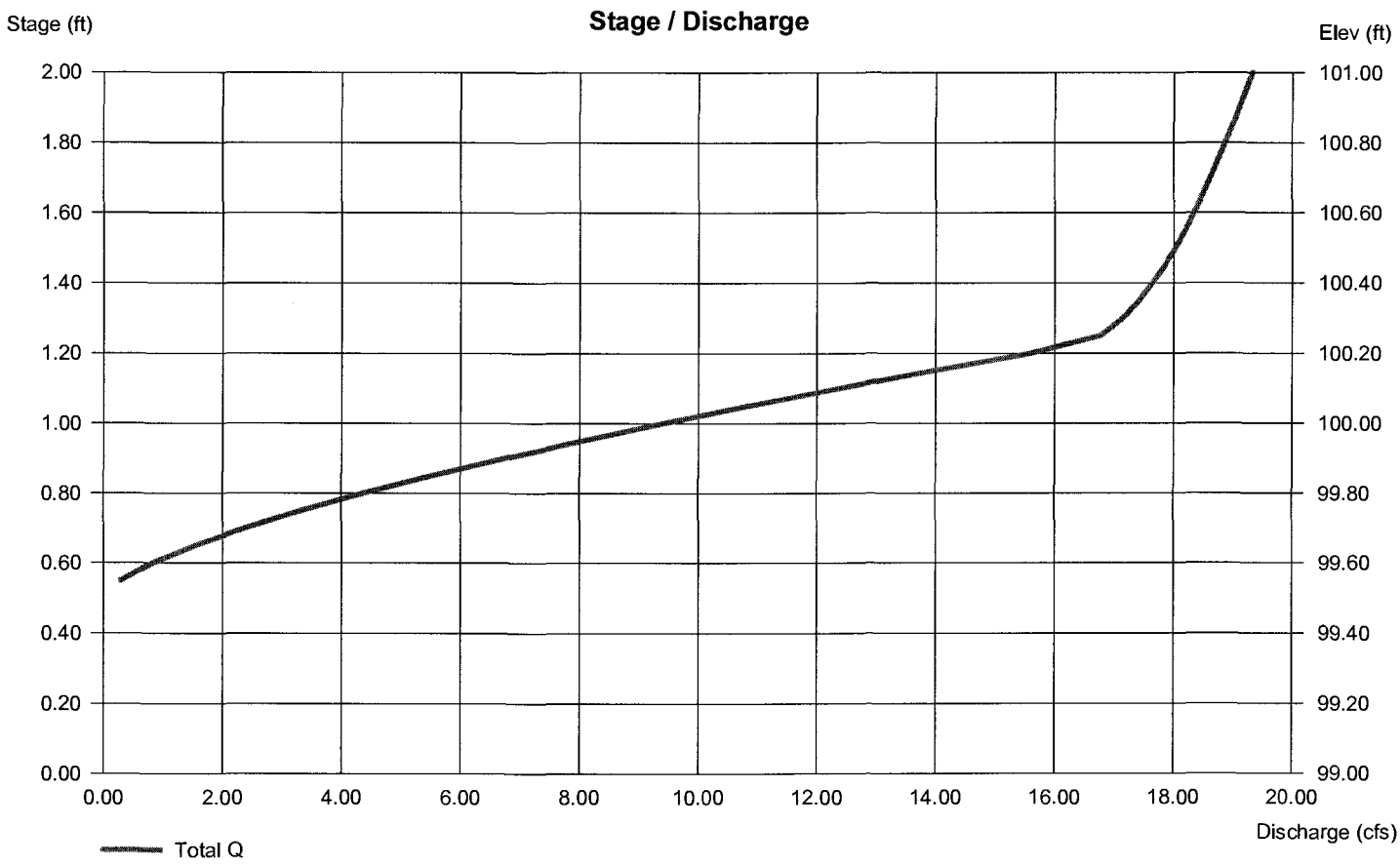
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 95.00	0.00	0.00	0.00
Length (ft)	= 30.00	0.00	0.00	0.00
Slope (%)	= 1.00	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)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 99.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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



Hydrograph Report

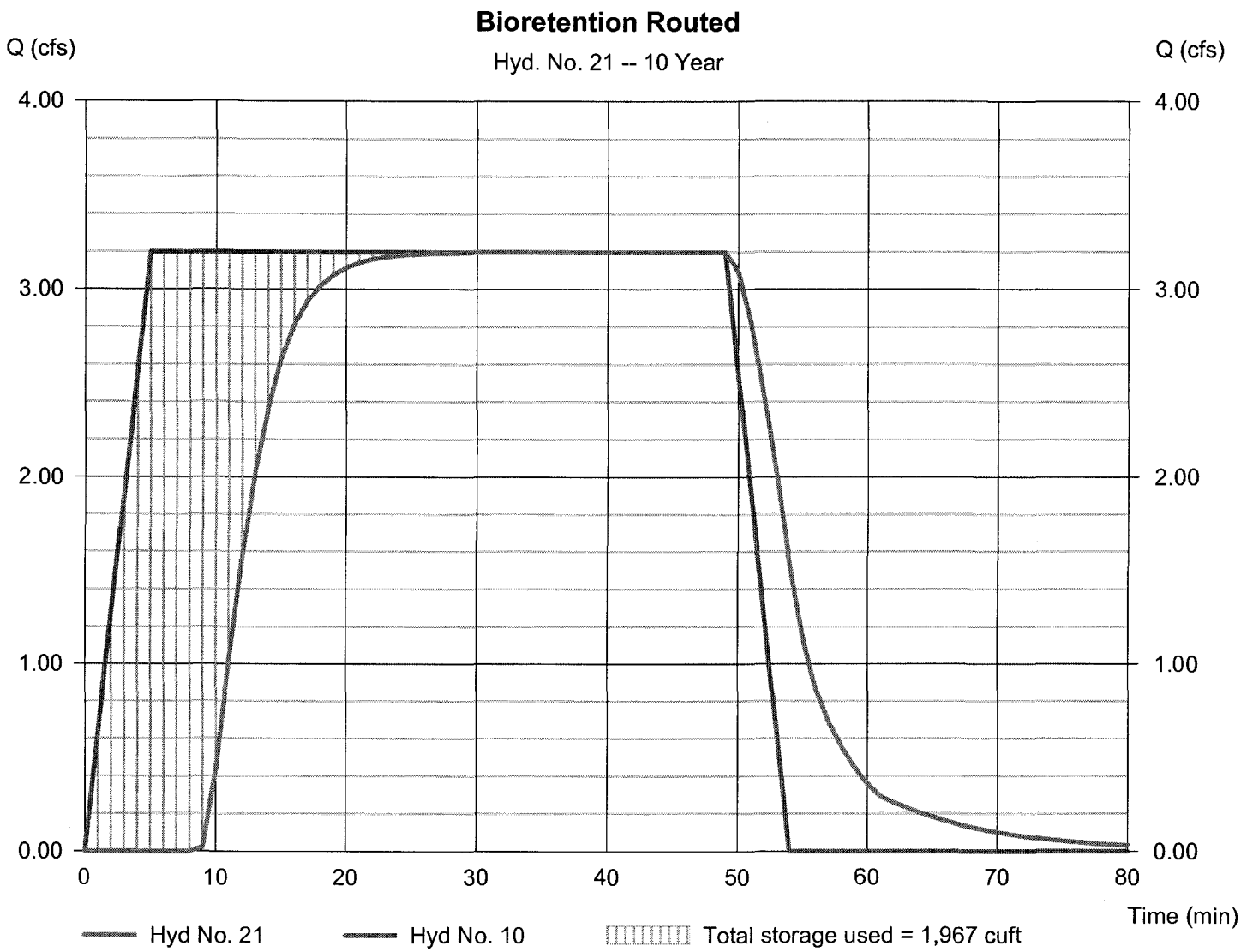
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 21

Bioretention Routed

Hydrograph type	= Reservoir	Peak discharge	= 3.198 cfs
Storm frequency	= 10 yrs	Time to peak	= 48 min
Time interval	= 1 min	Hyd. volume	= 8,164 cuft
Inflow hyd. No.	= 10 - Area B-11	Max. Elevation	= 99.74 ft
Reservoir name	= Bioretention B-3	Max. Storage	= 1,967 cuft

Storage Indication method used.



Hydrograph Report

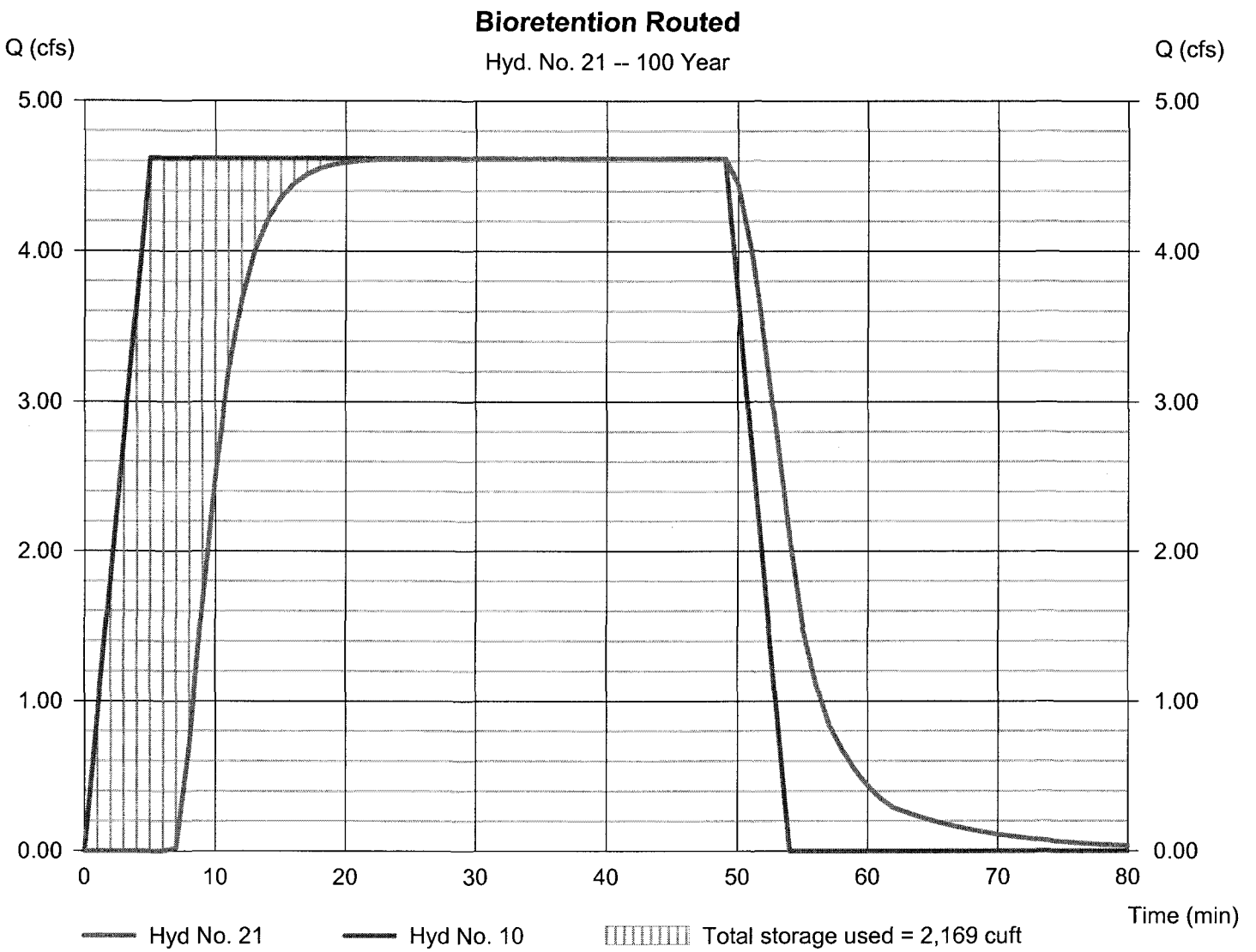
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 21

Bioretention Routed

Hydrograph type	= Reservoir	Peak discharge	= 4.617 cfs
Storm frequency	= 100 yrs	Time to peak	= 41 min
Time interval	= 1 min	Hyd. volume	= 12,337 cuft
Inflow hyd. No.	= 10 - Area B-11	Max. Elevation	= 99.81 ft
Reservoir name	= Bioretention B-3	Max. Storage	= 2,169 cuft

Storage Indication method used.



AES
CONSULTING ENGINEERS

Project:	**Courthouse Common**
Project No.:	**8509-04**
Subject:	**Water Quality Volume**
	Underground Infiltration B-3
Date:	**2/18/2010**
Calculated By:	**AMR**

BMP Type = **Underground Infiltration B-3**

Water Quality Volume = 0.5 in. x **1.6** acres of impervious coverage (@ Future Conditions)

= (0.5 / 12) x (43,560 x **1.6**)

= **2904** CF

Total Storage Volume Required = **2** x Water Quality Volume

= **2** x **2904**

= **5808** CF @ 96.0 = 9,000 CF Storage Provided

AES CONSULTING ENGINEERS
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax: (757) 220-8994

PROJECT [illegible]

PROJECT NO. 8509-04

SUBJECT UNDERGROUND INFIL. B-3

SHEET NO. _____ OF _____

CALCULATED BY AMR DATE 8/23/10

$f = 8.6\ ^{in}/_{hr} = 0.717\ ^{ft}/_{hr}$

$f_d = 0.5f$

$f_d = 0.5(0.717\ ^{ft}/_{hr})$

$f_d = 0.359\ ^{ft}/_{hr}$

MAXIMUM DEPTH

$$d_{MAX} = \frac{f_d T_{MAX}}{V_r} = \frac{0.359\ ^{ft}/_{hr}\ (48hr)}{0.4}$$

$d_{MAX} = 43.08$ ft

MINIMUM SURFACE AREA

$$SA_{MIN} = \frac{2V_{WQ}}{f_d T_{MAX}} = \frac{2(2,904\ ft^3)}{17.23\ ft}$$

$SA_{MIN} = 337\ ft^2$

$SA_{PROVIDED} = \boxed{4,050\ ft^2}$

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Monday, Oct 4, 2010

Pond No. 6 - Underground Storage B-3

Pond Data

UG Chambers - Invert elev. = 93.50 ft, Rise x Span = 4.00 x 4.00 ft, Barrel Len = 125.00 ft, No. Barrels = 3, Slope = 0.00%, Headers = Yes
Encasement - Invert elev. = 93.50 ft, Width = 15.00 ft, Height = 4.00 ft, Voids = 40.00%
Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 98.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	93.50	n/a	0	0
0.40	93.90	n/a	1,299	1,299
0.80	94.30	n/a	1,433	2,732
1.20	94.70	n/a	1,502	4,234
1.60	95.10	n/a	1,541	5,775
2.00	95.50	n/a	1,560	7,335
2.40	95.90	n/a	1,560	8,895
2.80	96.30	n/a	1,541	10,435
3.20	96.70	n/a	1,502	11,937
3.60	97.10	n/a	1,433	13,370
4.00	97.50	n/a	1,298	14,668
5.00	98.50	100	33	14,702
5.50	99.00	2,220	465	15,167
6.00	99.50	2,738	1,237	16,404
6.50	100.00	3,275	1,501	17,905

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	3.00	0.00	0.00
Span (in)	= 18.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 96.00	96.00	0.00	0.00
Length (ft)	= 134.00	0.00	0.00	0.00
Slope (%)	= 0.46	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	Yes	No	No

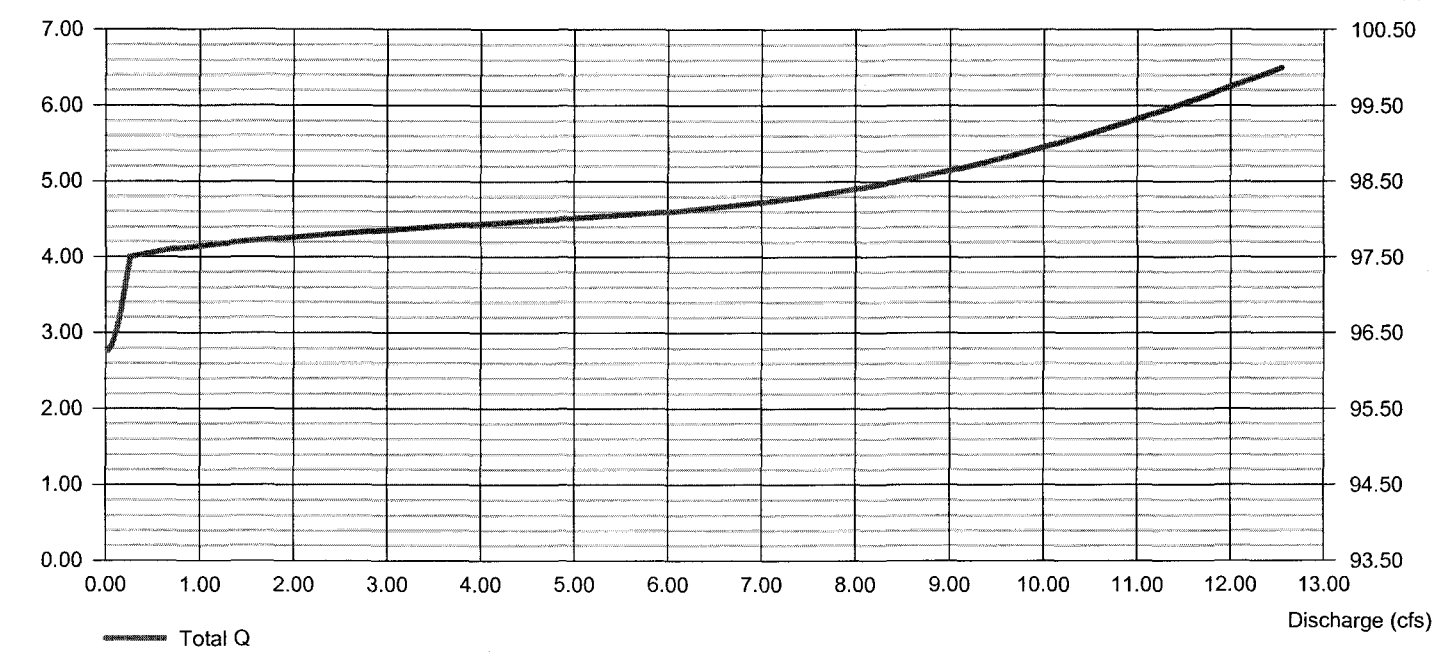
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	0.00	0.00	0.00
Crest El. (ft)	= 97.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)
TW Elev. (ft) = 96.25

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

Stage / Discharge



Hydrograph Report

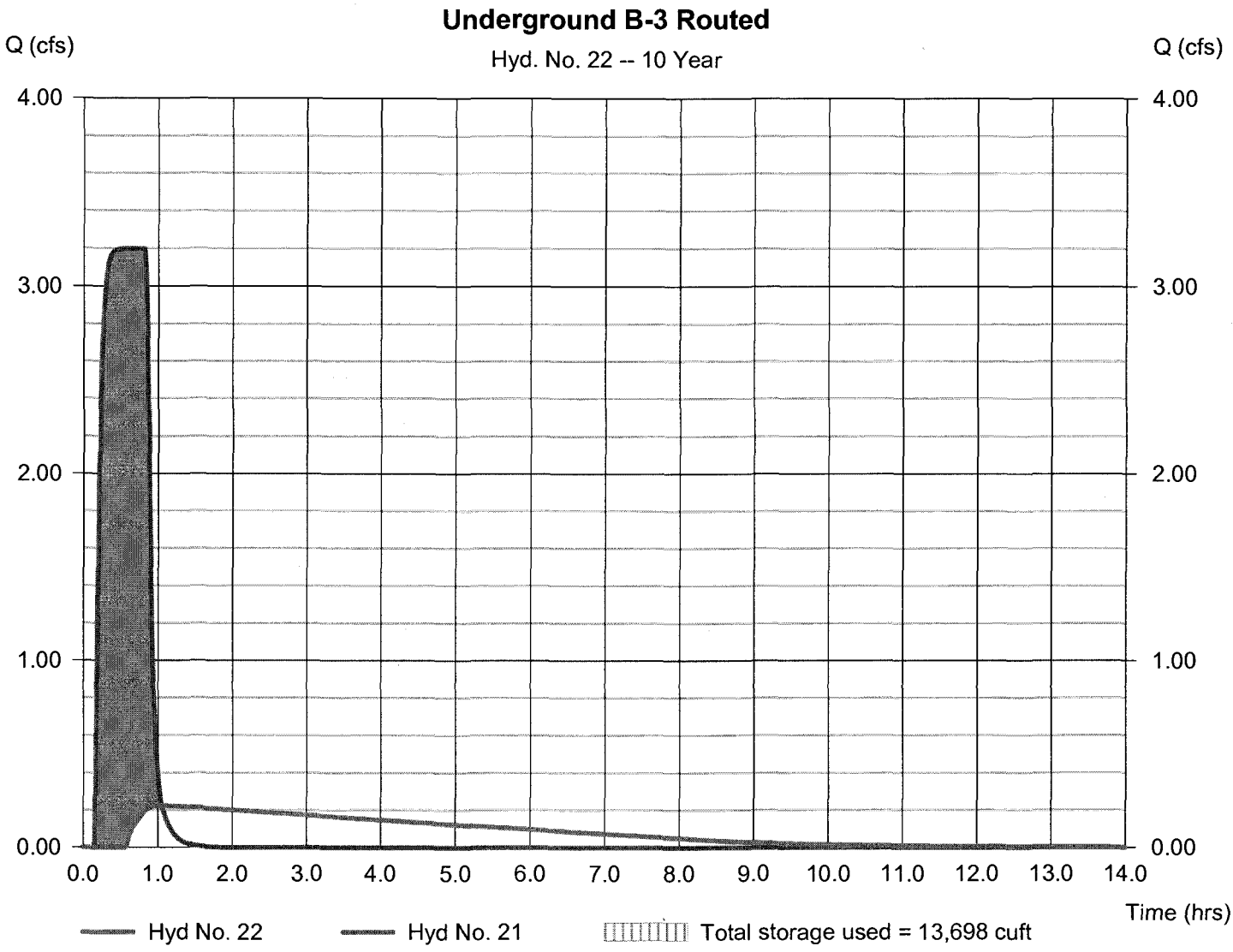
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 22

Underground B-3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.222 cfs
Storm frequency	= 10 yrs	Time to peak	= 63 min
Time interval	= 1 min	Hyd. volume	= 3,961 cuft
Inflow hyd. No.	= 21 - Bioretention Routed	Max. Elevation	= 97.20 ft
Reservoir name	= Underground Storage B-3	Max. Storage	= 13,698 cuft

Storage Indication method used. Wet pond routing start elevation = 95.14 ft.



Hydrograph Report

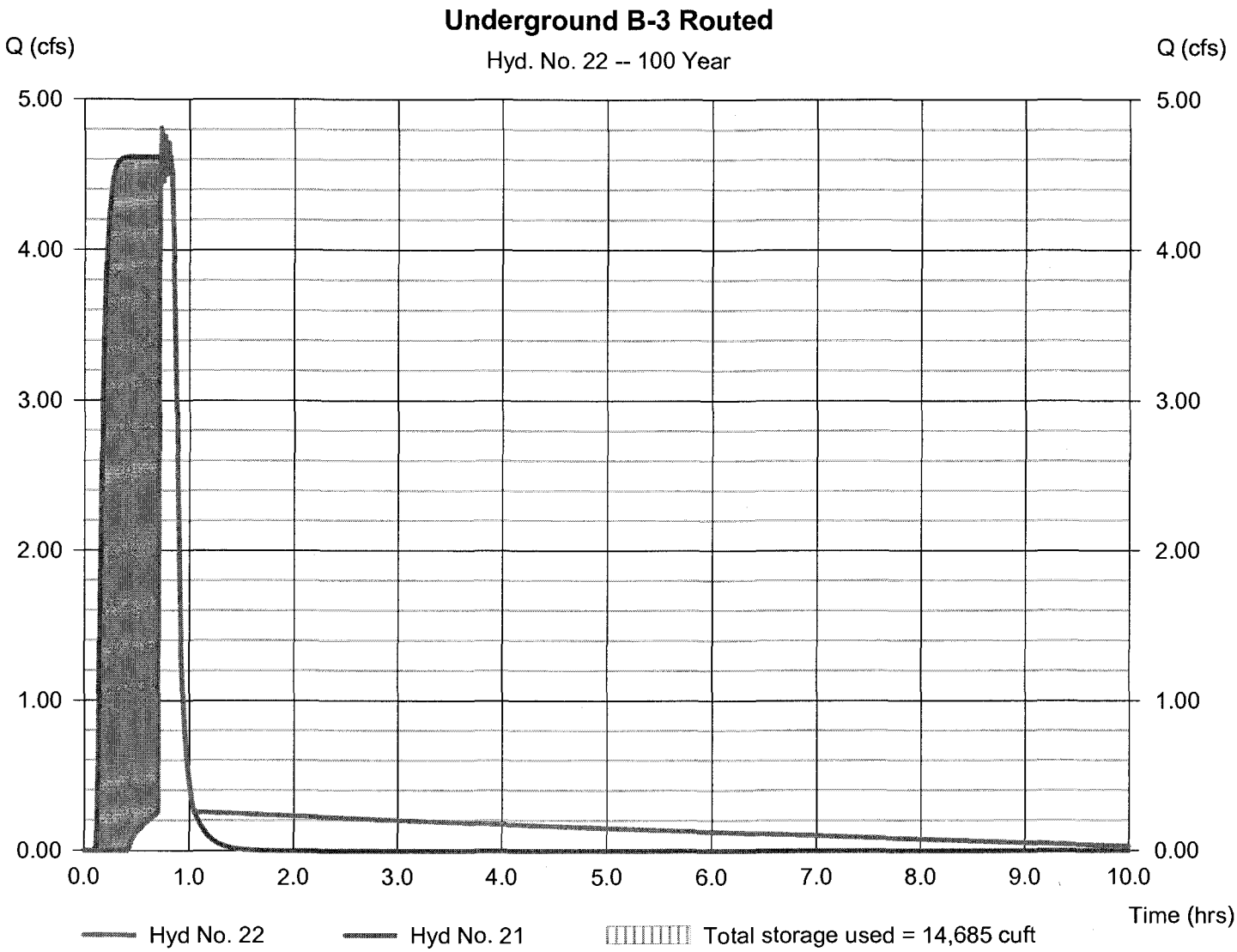
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 22

Underground B-3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 4.811 cfs
Storm frequency	= 100 yrs	Time to peak	= 44 min
Time interval	= 1 min	Hyd. volume	= 8,133 cuft
Inflow hyd. No.	= 21 - Bioretention Routed	Max. Elevation	= 98.17 ft
Reservoir name	= Underground Storage B-3	Max. Storage	= 14,685 cuft

Storage Indication method used. Wet pond routing start elevation = 95.14 ft.



AES
CONSULTING ENGINEERS

Project:	**Courthouse Common**
Project No.:	**8509-04**
Subject:	**Water Quality Volume**
	Infiltration Basin B
Date:	**2/18/2010**
Calculated By:	**AMR**

BMP Type = **Infiltration Basin**

Water Quality Volume = 0.5 in. x **0.94** acres of impervious coverage (60% assumed)

= (0.5 / 12) x (43,560 x **0.94**)

= **1706** CF

Total Storage Volume Required = **2** x Water Quality Volume

= **2** x **1706**

= **3412.2** CF @ 96.5 = 7,179 CF Storage Provided

AES CONSULTING ENGINEERS
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax: (757) 220-8994

PROJECT COURTHOUSE COMMONS
PROJECT NO. 8509-04
SUBJECT INFILTRATION BASIN B
SHEET NO. _____ OF _____
CALCULATED BY AMR DATE 8/23/10

$f = 0.8\ in/hr = 0.067\ ft/hr$

$f_d = 0.5f$

$f_d = 0.5\ (0.067\ ft/hr)$

$f_d = 0.034\ ft/hr$

MAXIMUM DEPTH

$d_{MAX} = f_d T_{MAX}$

$d_{MAX} = 0.034\ ft/hr\ (48\ hr)$

$d_{MAX} = 1.63\ ft$

MINIMUM SURFACE AREA

$SA_{MIN} = \frac{2 V_{WQ}}{f_d T_{MAX}} = \frac{2(1,706\ ft^3)}{1.63\ ft}$

$SA_{MIN} = 2,093\ ft^2$

$SA_{PROVIDED} = \boxed{2,094\ ft^2}$

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Monday, Oct 4, 2010

Pond No. 16 - Infiltration Basin B

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 94.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	94.00	2,094	0	0
1.00	95.00	2,671	2,376	2,376
2.00	96.00	3,304	2,982	5,358
3.00	97.00	3,994	3,643	9,001
4.00	98.00	4,741	4,362	13,363
5.00	99.00	5,545	5,137	18,500
6.00	100.00	6,403	5,968	24,468
7.00	101.00	7,320	6,856	31,324

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	3.00	0.00	0.00
Span (in)	= 15.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 95.00	96.50	0.00	0.00
Length (ft)	= 17.00	0.00	0.00	0.00
Slope (%)	= 0.25	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	Yes	No	No

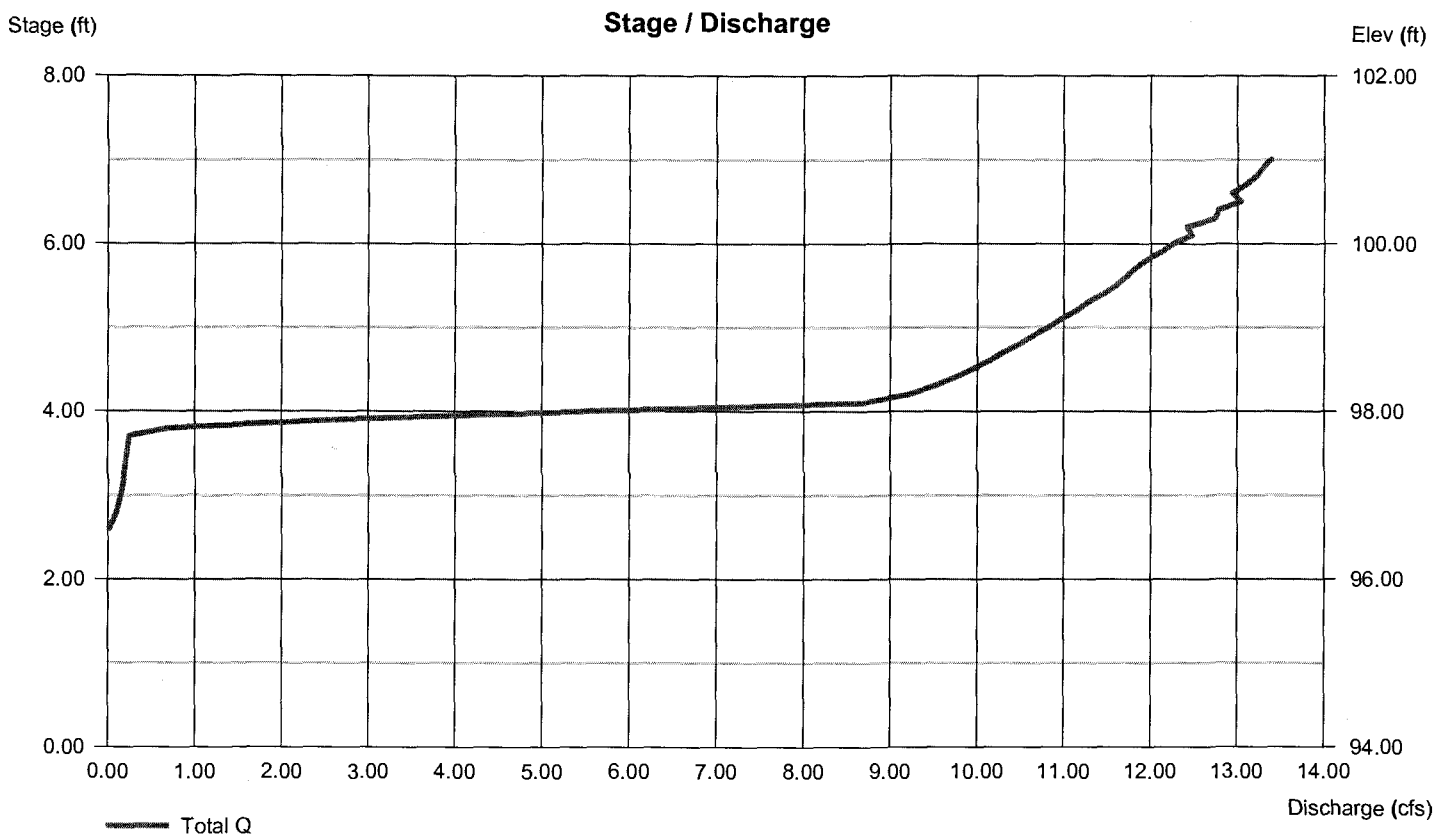
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.56	0.00	0.00	0.00
Crest El. (ft)	= 97.75	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Report

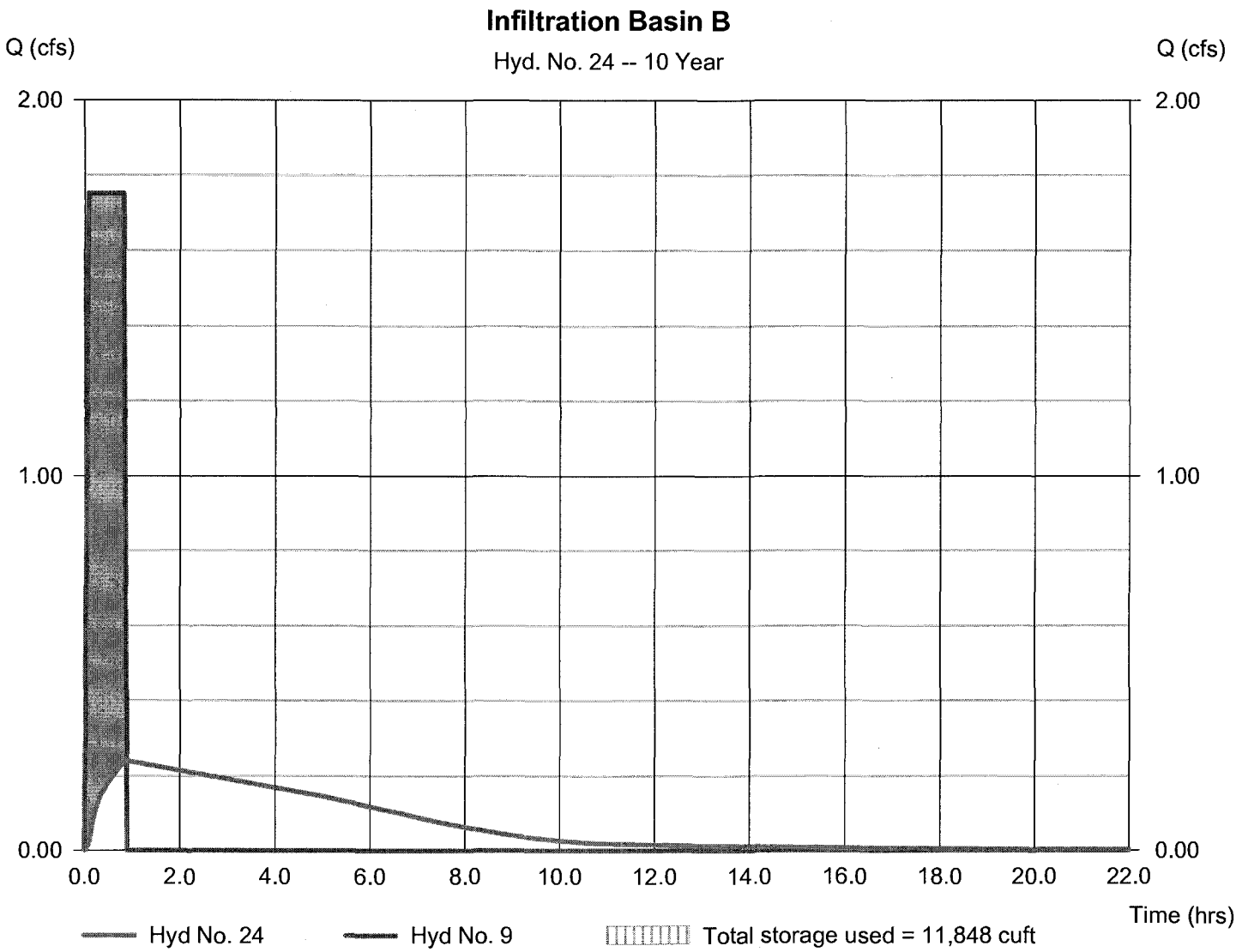
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 24

Infiltration Basin B

Hydrograph type	= Reservoir	Peak discharge	= 0.240 cfs
Storm frequency	= 10 yrs	Time to peak	= 53 min
Time interval	= 1 min	Hyd. volume	= 5,131 cuft
Inflow hyd. No.	= 9 - Area B-6.2	Max. Elevation	= 97.65 ft
Reservoir name	= Infiltration Basin B	Max. Storage	= 11,848 cuft

Storage Indication method used. Wet pond routing start elevation = 96.50 ft.



Hydrograph Report

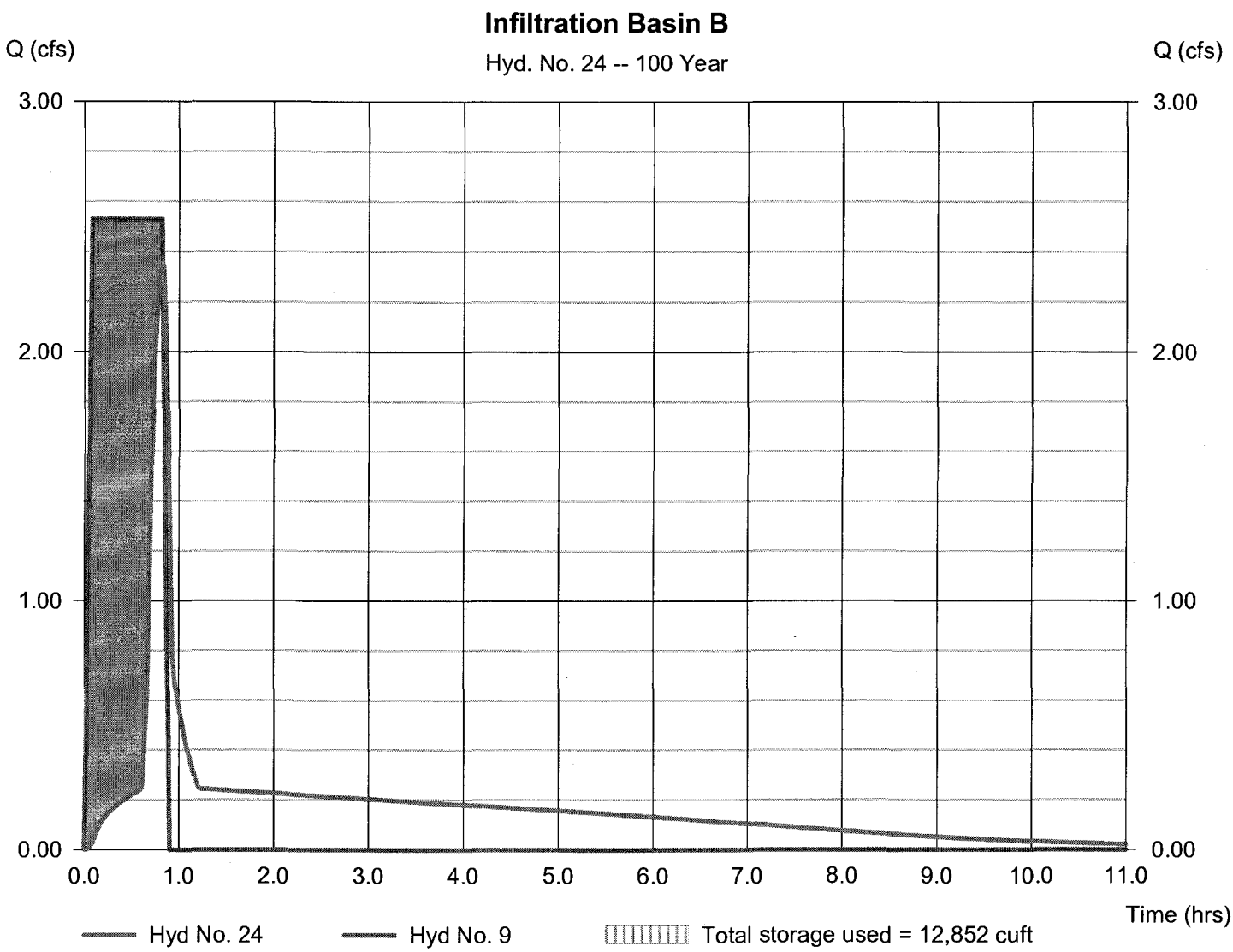
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 24

Infiltration Basin B

Hydrograph type	= Reservoir	Peak discharge	= 2.360 cfs
Storm frequency	= 100 yrs	Time to peak	= 49 min
Time interval	= 1 min	Hyd. volume	= 7,417 cuft
Inflow hyd. No.	= 9 - Area B-6.2	Max. Elevation	= 97.88 ft
Reservoir name	= Infiltration Basin B	Max. Storage	= 12,852 cuft

Storage Indication method used. Wet pond routing start elevation = 96.50 ft.



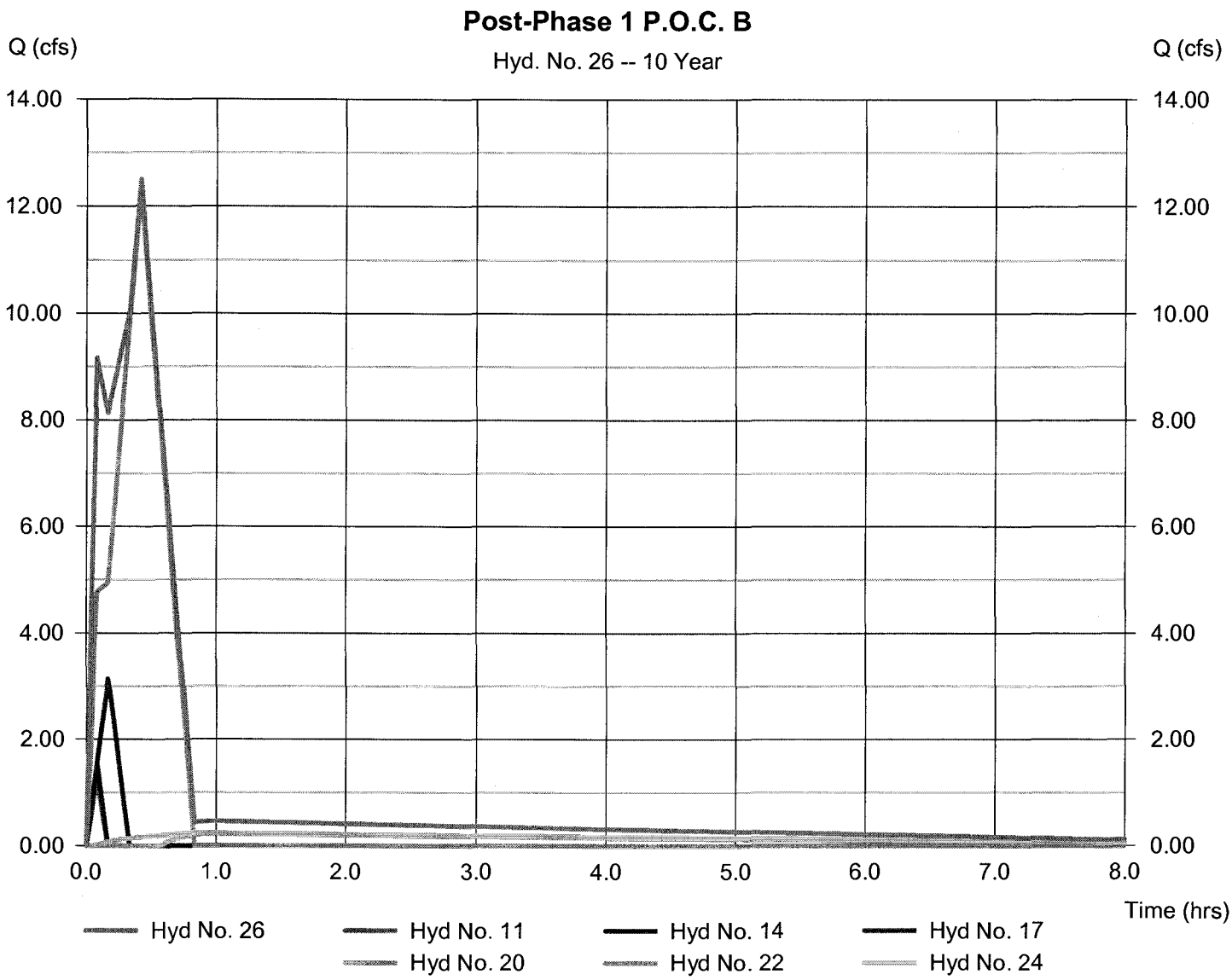
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 26

Post-Phase 1 P.O.C. B

Hydrograph type	= Combine	Peak discharge	= 12.50 cfs
Storm frequency	= 10 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 31,008 cuft
Inflow hyds.	= 11, 14, 17, 20, 22, 24	Contrib. drain. area	= 0.560 ac



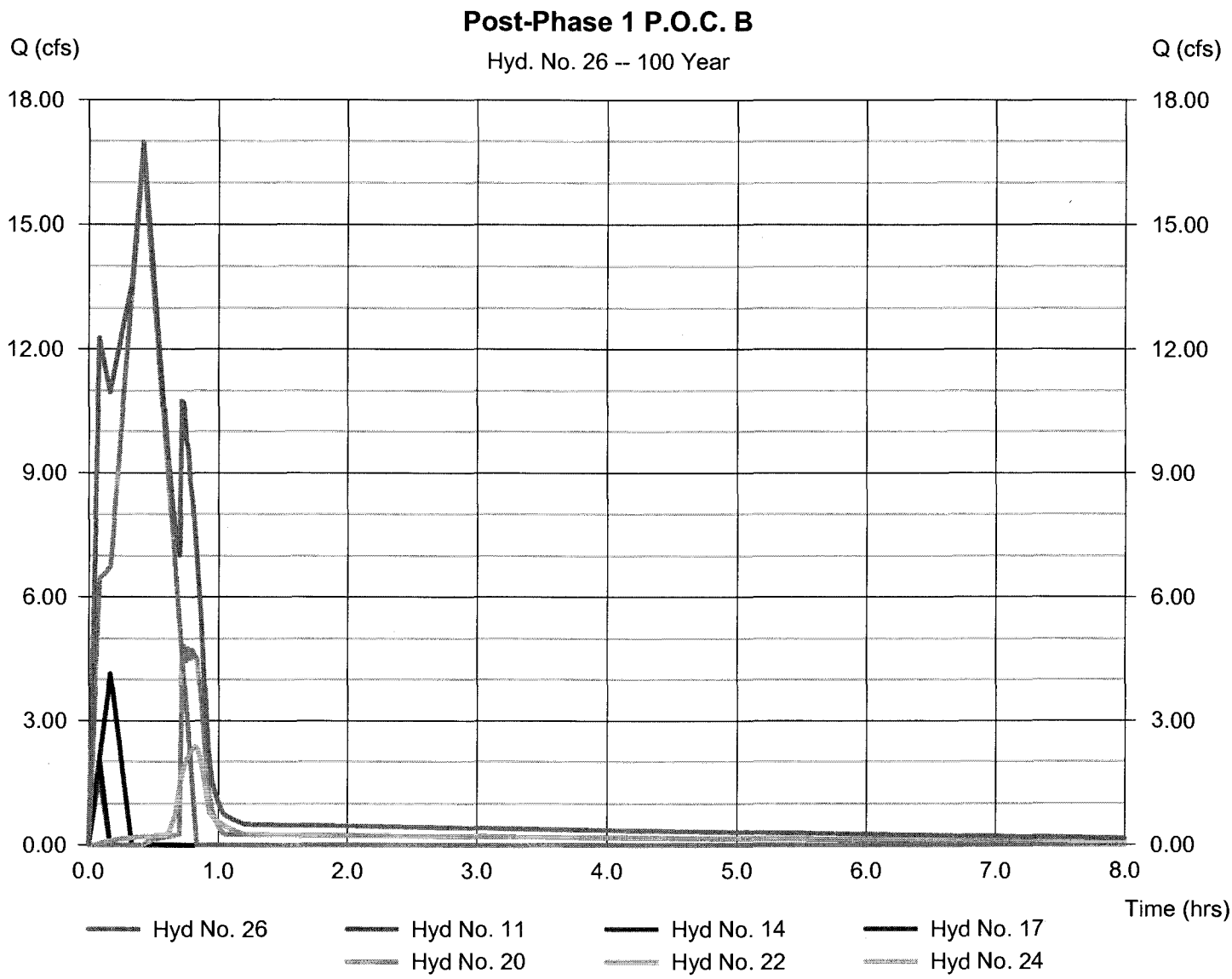
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 26

Post-Phase 1 P.O.C. B

Hydrograph type	= Combine	Peak discharge	= 16.98 cfs
Storm frequency	= 100 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 45,250 cuft
Inflow hyds.	= 11, 14, 17, 20, 22, 24	Contrib. drain. area	= 0.560 ac



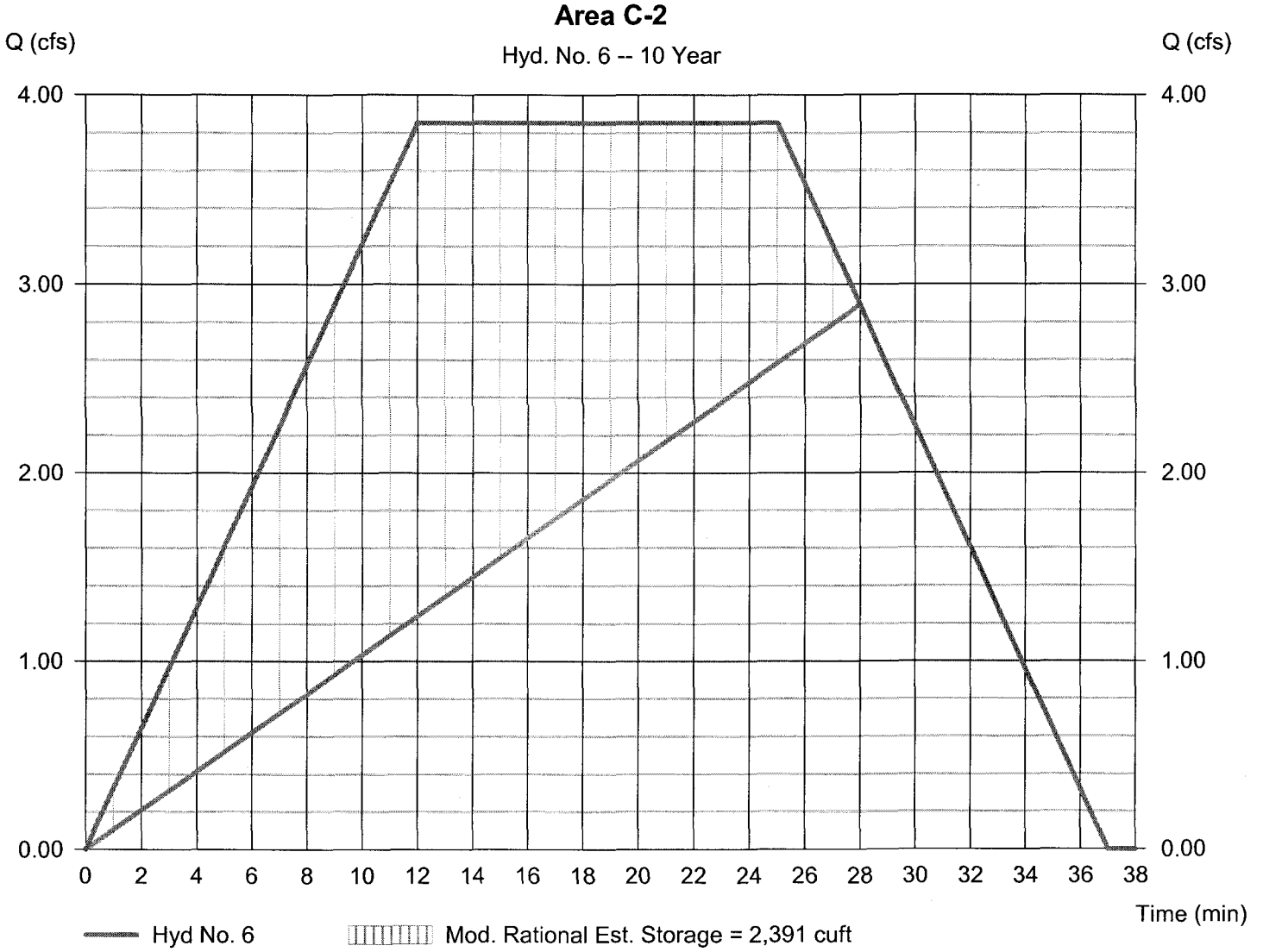
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Monday, Oct 4, 2010

Hyd. No. 6

Area C-2

Hydrograph type	= Mod. Rational	Peak discharge	= 3.852 cfs
Storm frequency	= 10 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 5,824 cuft
Drainage area	= 1.380 ac	Runoff coeff.	= 0.7
Intensity	= 3.988 in/hr	Tc by User	= 12.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 2.1 x Tc
Target Q	= 3.000 cfs	Est. Req'd Storage	= 2,391 cuft

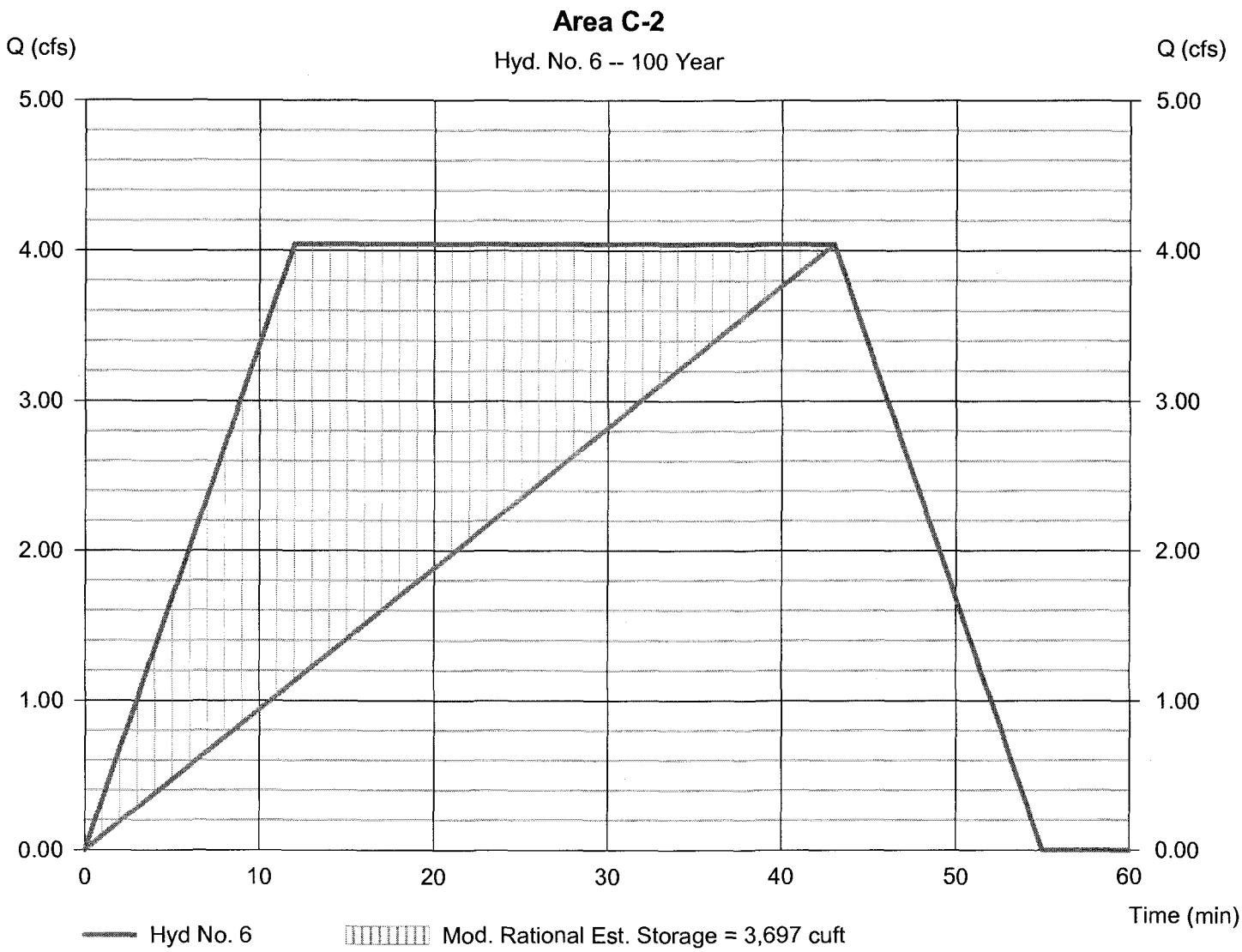


Hydrograph Report

Hyd. No. 6

Area C-2

Hydrograph type	= Mod. Rational	Peak discharge	= 4.043 cfs
Storm frequency	= 100 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 10,480 cuft
Drainage area	= 1.380 ac	Runoff coeff.	= 0.7
Intensity	= 4.185 in/hr	Tc by User	= 12.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 3.6 x Tc
Target Q	= 4.000 cfs	Est. Req'd Storage	= 3,697 cuft



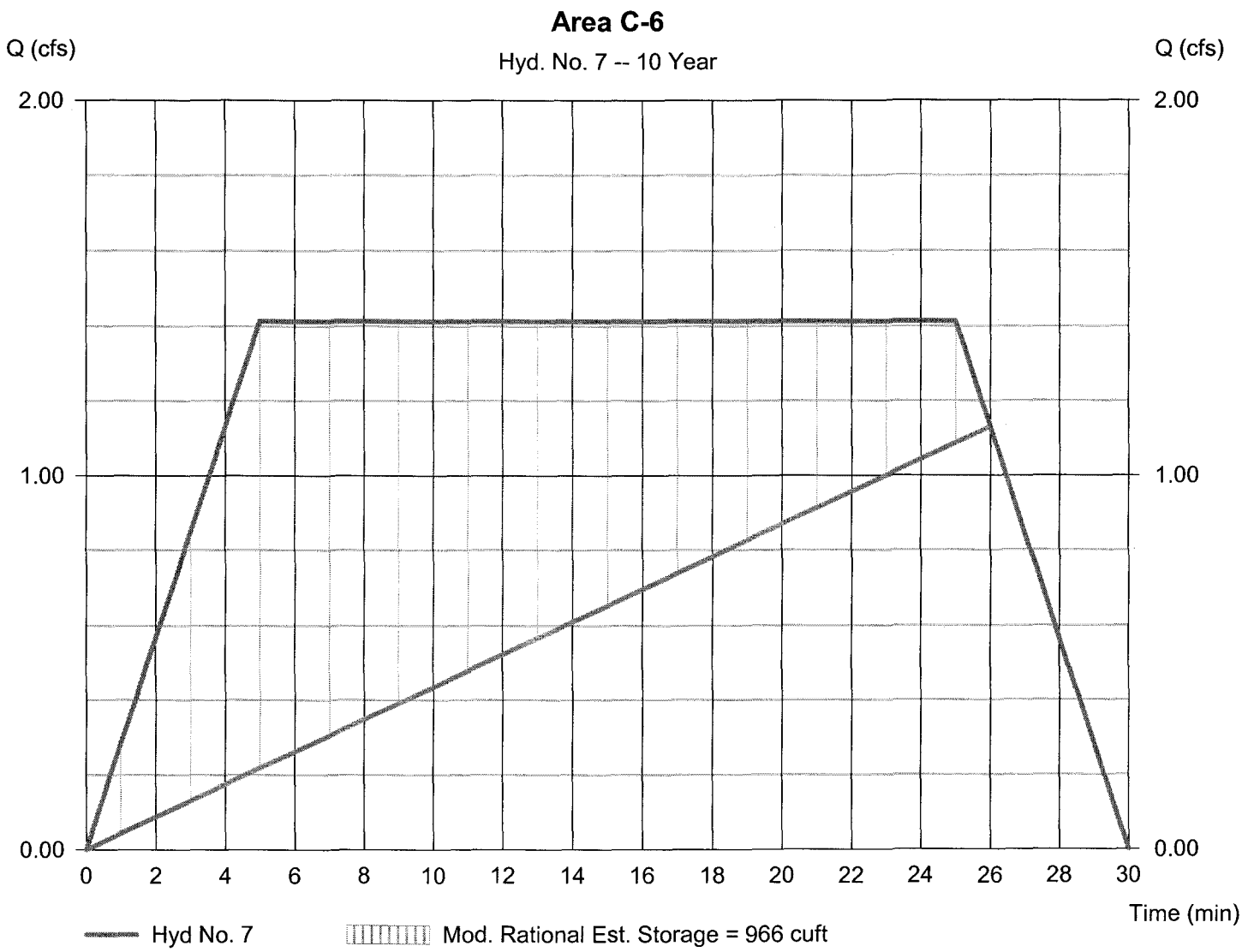
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 7

Area C-6

Hydrograph type	= Mod. Rational	Peak discharge	= 1.412 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 2,161 cuft
Drainage area	= 0.440 ac	Runoff coeff.	= 0.81
Intensity	= 3.963 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 5.1 x Tc
Target Q	= 1.270 cfs	Est. Req'd Storage	= 966 cuft



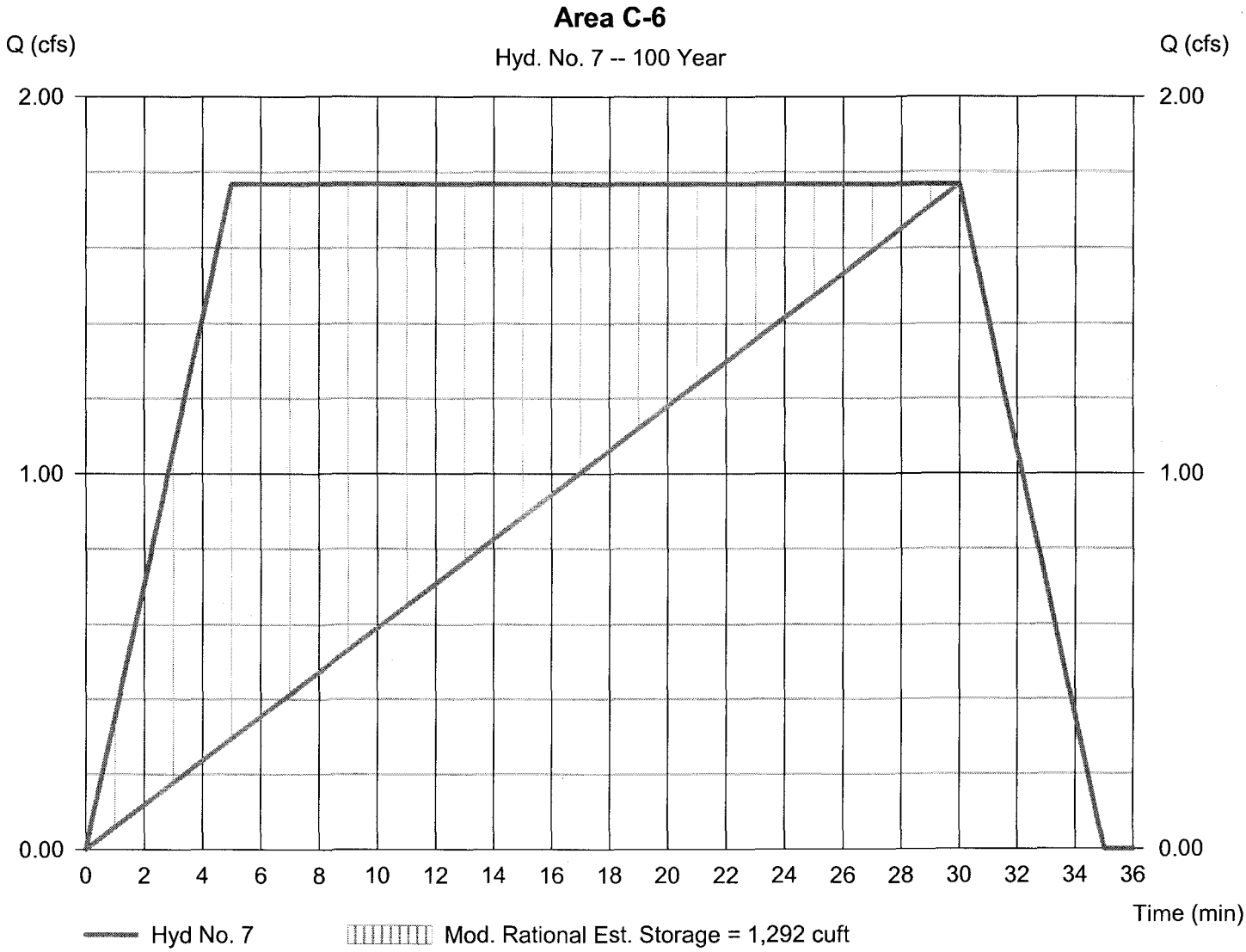
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 7

Area C-6

Hydrograph type	= Mod. Rational	Peak discharge	= 1.768 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 3,236 cuft
Drainage area	= 0.440 ac	Runoff coeff.	= 0.81
Intensity	= 4.962 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 6.1 x Tc
Target Q	= 1.760 cfs	Est. Req'd Storage	= 1,292 cuft



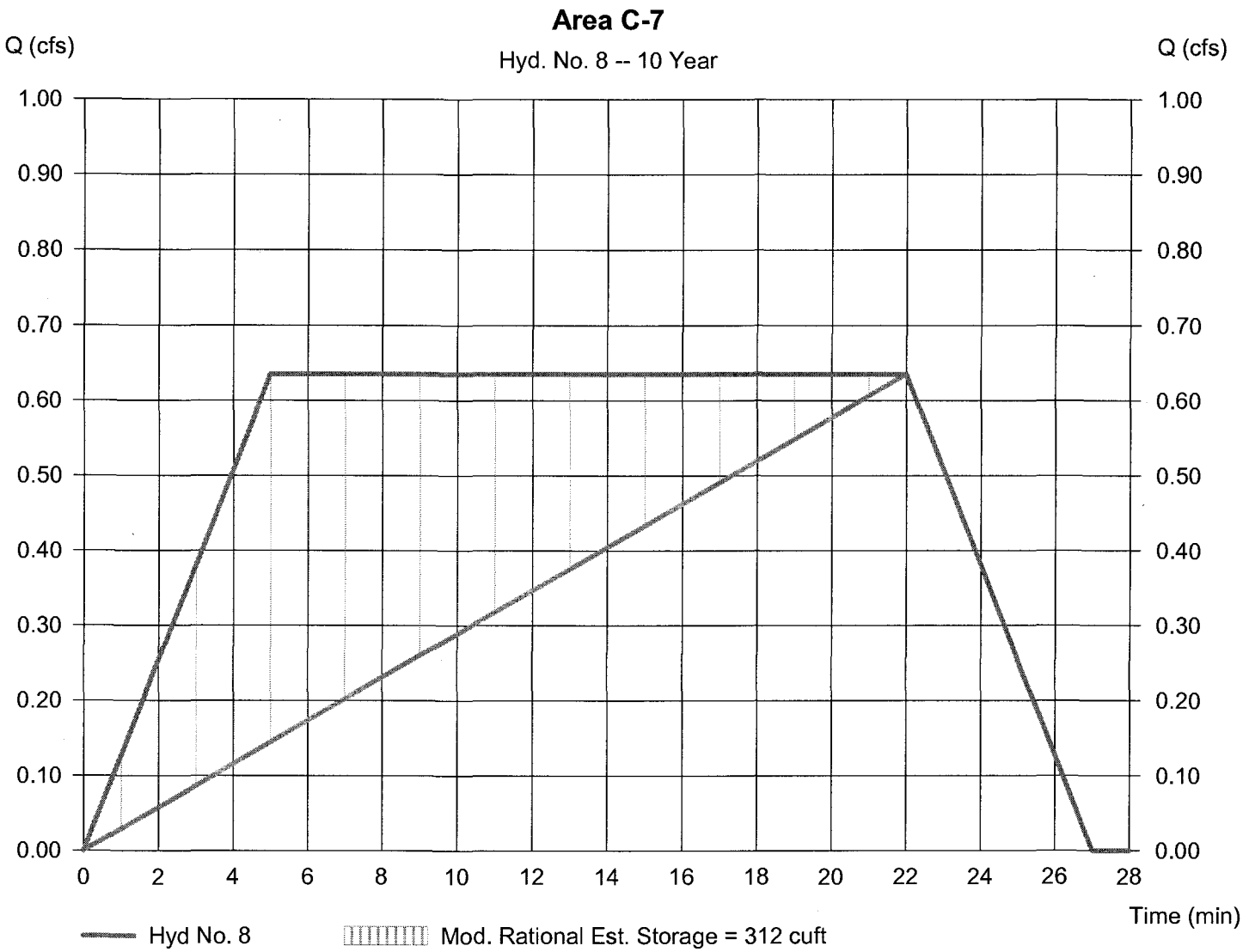
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 8

Area C-7

Hydrograph type	= Mod. Rational	Peak discharge	= 0.635 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 857 cuft
Drainage area	= 0.190 ac	Runoff coeff.	= 0.79
Intensity	= 4.230 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 4.5 x Tc
Target Q	= 0.630 cfs	Est. Req'd Storage	= 312 cuft



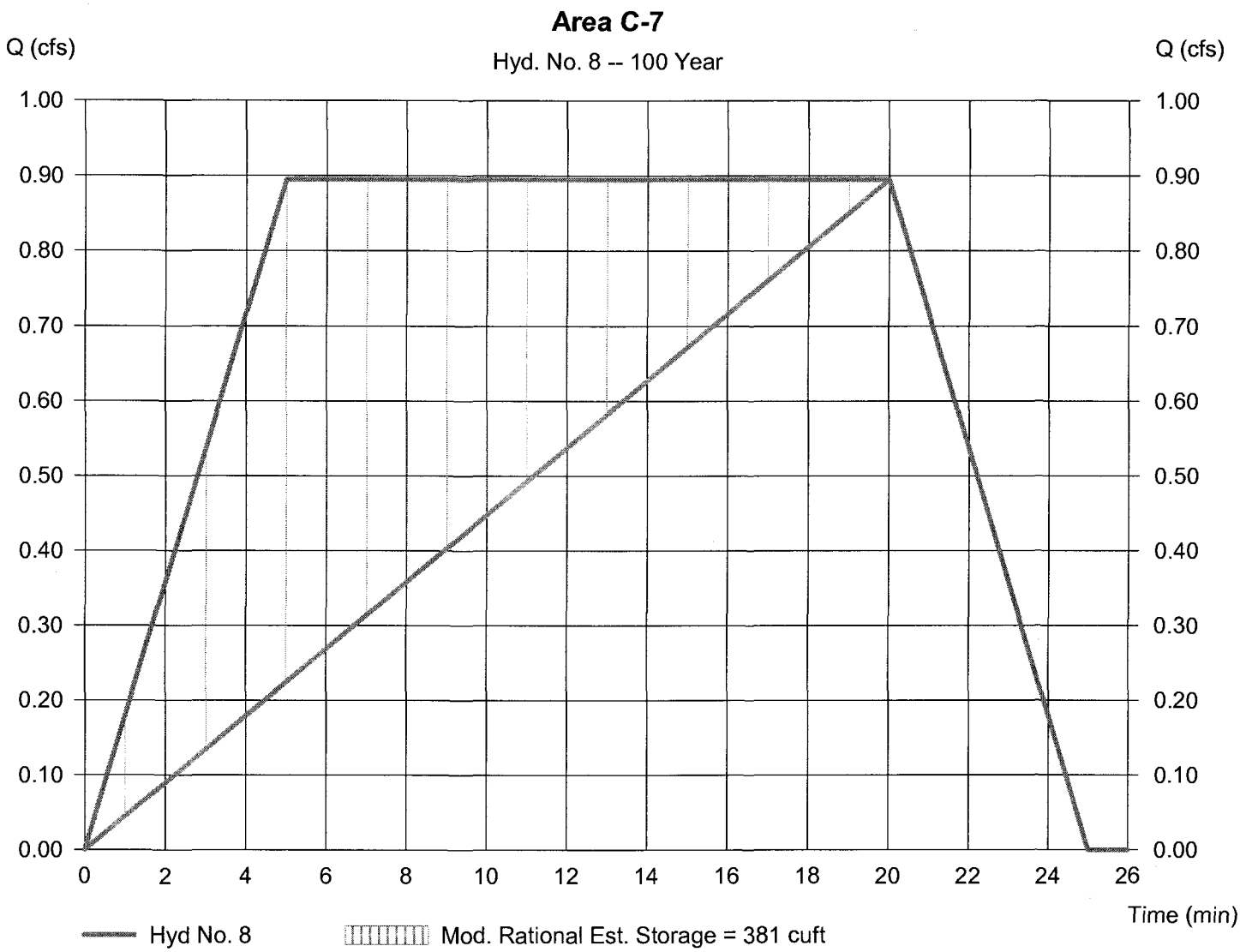
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 8

Area C-7

Hydrograph type	= Mod. Rational	Peak discharge	= 0.895 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 1,101 cuft
Drainage area	= 0.190 ac	Runoff coeff.	= 0.79
Intensity	= 5.963 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 4.1 x Tc
Target Q	= 0.880 cfs	Est. Req'd Storage	= 381 cuft



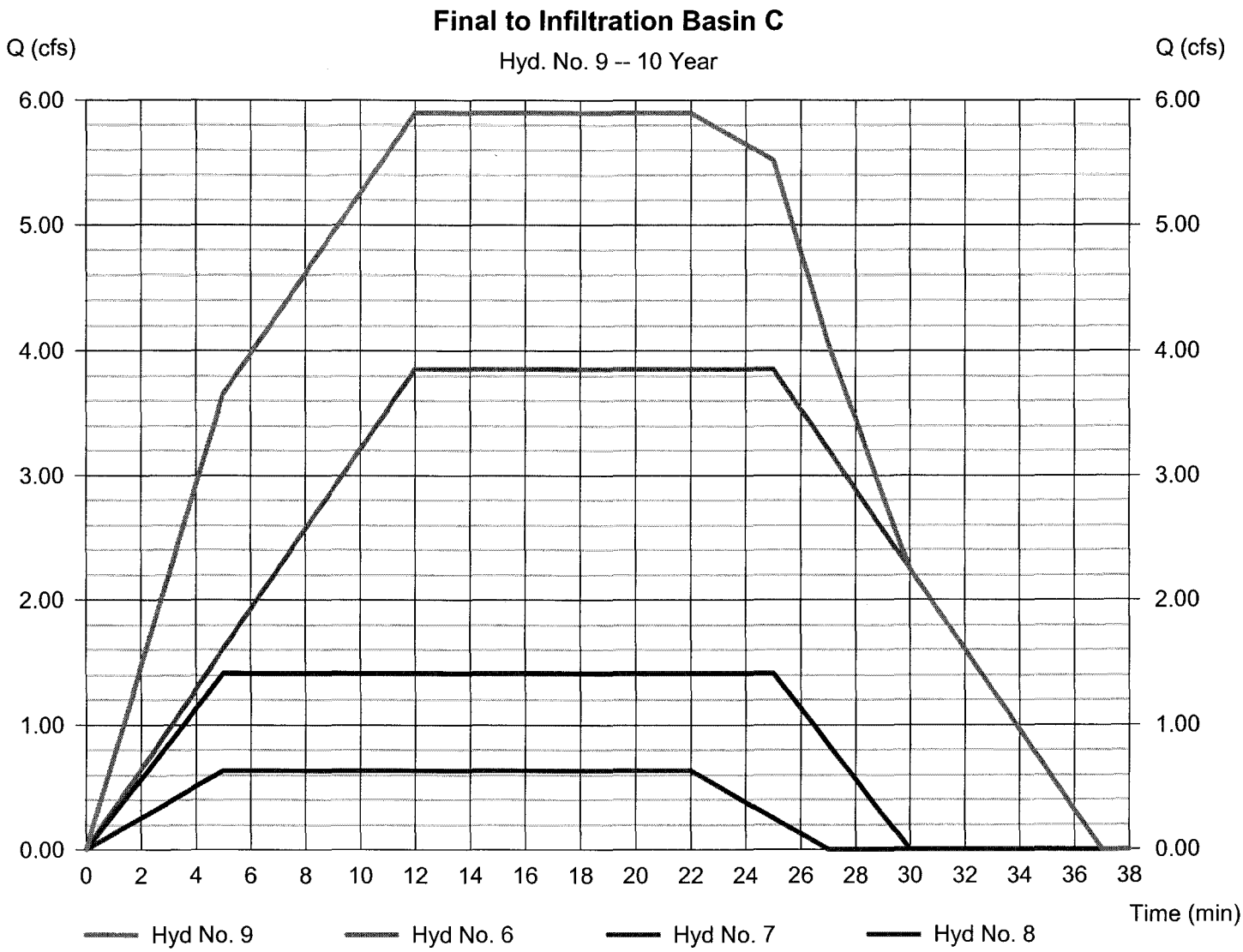
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 9

Final to Infiltration Basin C

Hydrograph type	= Combine	Peak discharge	= 5.899 cfs
Storm frequency	= 10 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 8,735 cuft
Inflow hyds.	= 6, 7, 8	Contrib. drain. area	= 2.010 ac



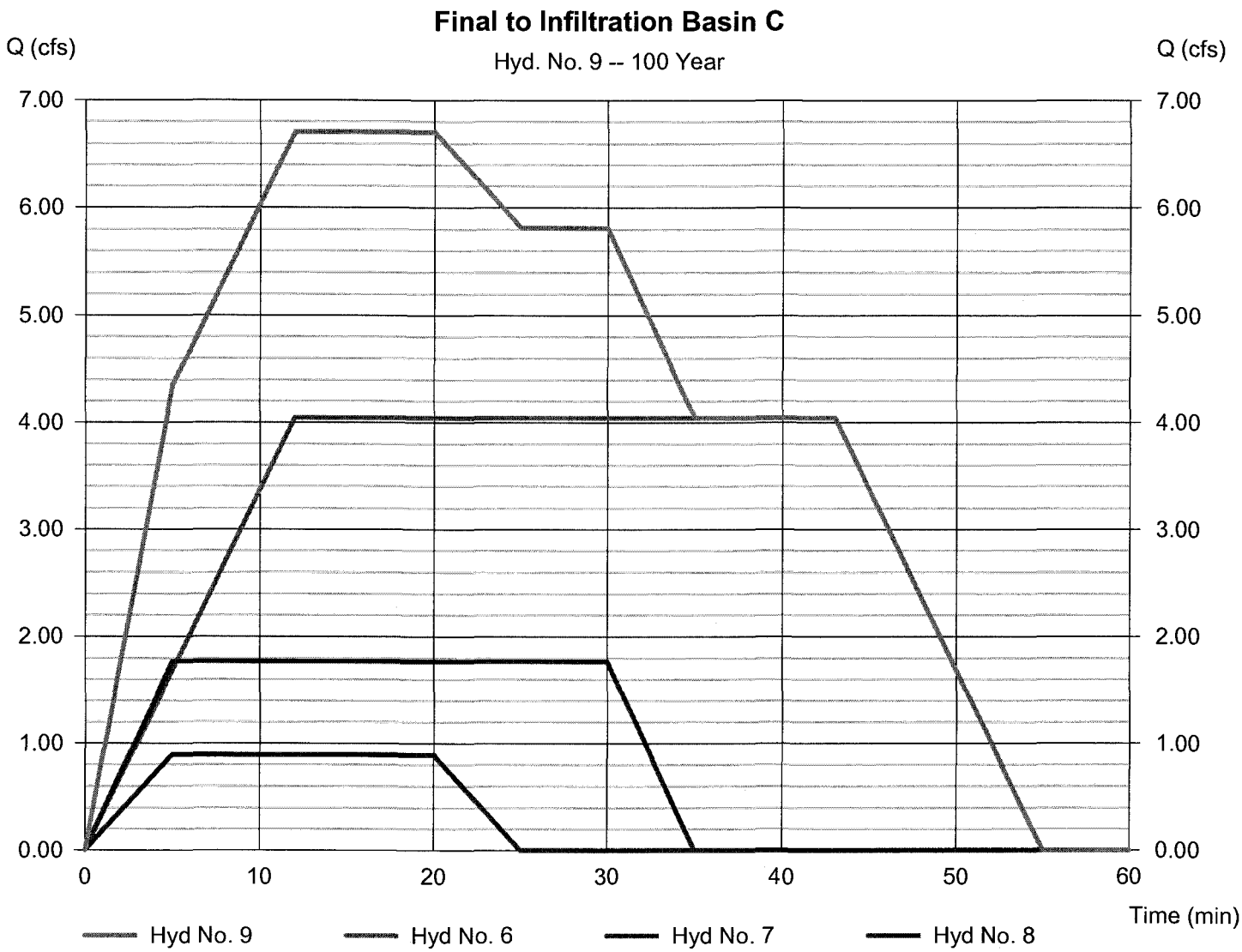
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 9

Final to Infiltration Basin C

Hydrograph type	= Combine	Peak discharge	= 6.707 cfs
Storm frequency	= 100 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 14,688 cuft
Inflow hyds.	= 6, 7, 8	Contrib. drain. area	= 2.010 ac



AES
CONSULTING ENGINEERS

Project:	**Courthouse Common**
Project No.:	**8509-04**
Subject:	**Water Quality Volume**
	Infiltration Basin C
Date:	**2/18/2010**
Calculated By:	**AMR**

BMP Type = **Infiltration Basin**

Water Quality Volume = 0.5 in. x **0.9** acres of impervious coverage

= (0.5 / 12) x (43,560 x **0.9**)

= **1634** CF

Total Storage Volume Required = **2** x Water Quality Volume

= **2** x **1634**

= **3267** CF @ 93.5 = 8,649 CF Storage Provided

AES CONSULTING ENGINEERS
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax: (757) 220-8994

PROJECT COURTHOUSE COMMONS

PROJECT NO. 8509-04

SUBJECT INFILTRATION BASIN C

SHEET NO. _____ OF _____

CALCULATED BY AMR DATE 8/23/10

$f = 0.6 \frac{in}{hr} = 0.05 \frac{ft}{hr}$

$f_d = 0.5 f$

$f_d = 0.5 (0.05 \frac{ft}{hr})$

$f_d = 0.025 \frac{ft}{hr}$

MAXIMUM DEPTH

$d_{MAX} = f_d T_{MAX}$

$d_{MAX} = 0.025 \frac{ft}{hr} (48 hr)$

$d_{MAX} = 1.20 ft$

MINIMUM SURFACE AREA

$SA_{MIN} = \frac{2 V_{WQ}}{f_d T_{MAX}} = \frac{2(1,634 ft^3)}{1.20 ft}$

$SA_{MIN} = 2,723 ft^2$

$SA_{PROVIDED} = \boxed{2,782 ft^2}$

Hydrograph Report

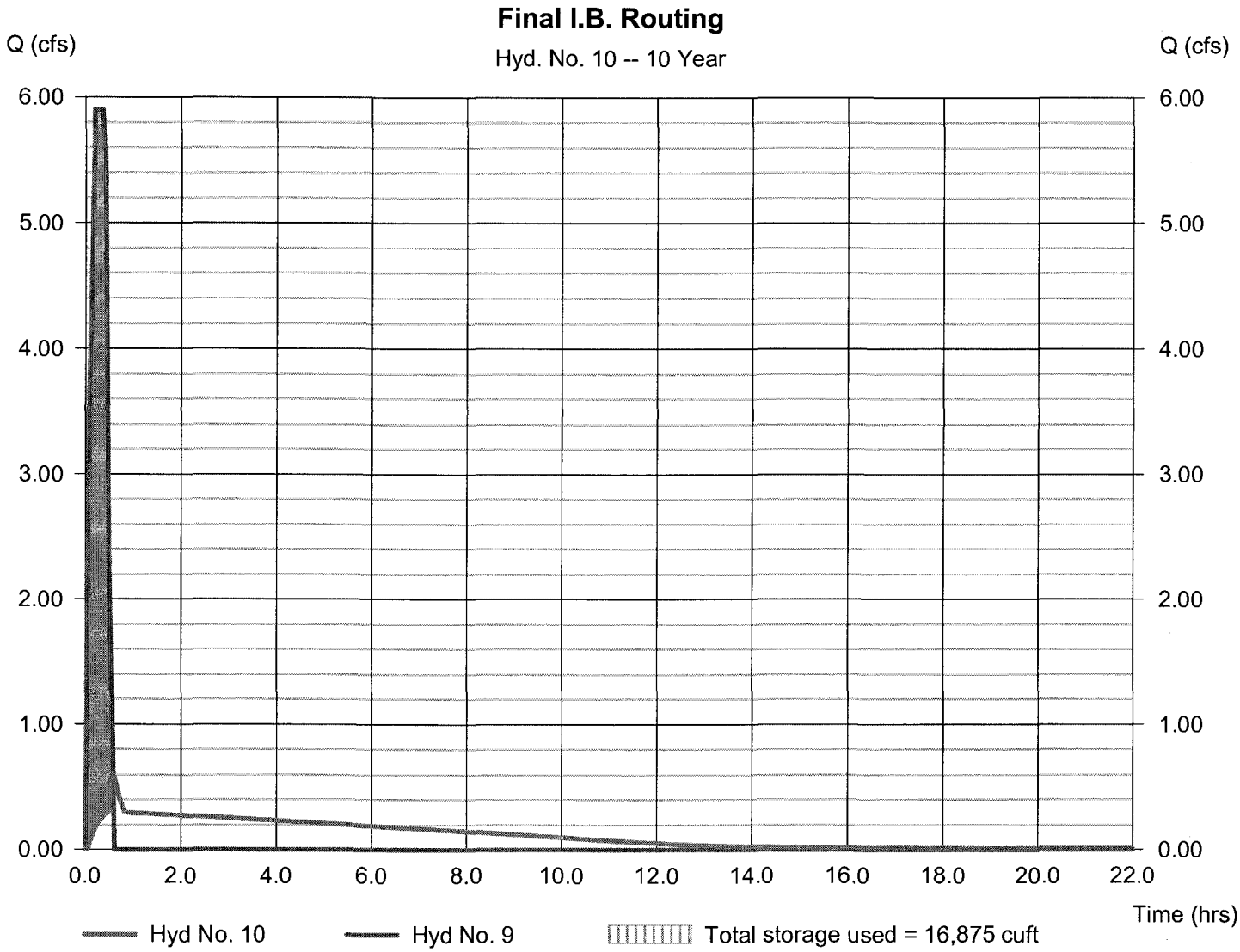
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 10

Final I.B. Routing

Hydrograph type	= Reservoir	Peak discharge	= 0.610 cfs
Storm frequency	= 10 yrs	Time to peak	= 35 min
Time interval	= 1 min	Hyd. volume	= 8,714 cuft
Inflow hyd. No.	= 9 - Final to Infiltration Basin C	Max. Elevation	= 95.27 ft
Reservoir name	= Sediment Basin C	Max. Storage	= 16,875 cuft

Storage Indication method used. Wet pond routing start elevation = 93.50 ft.



Hydrograph Report

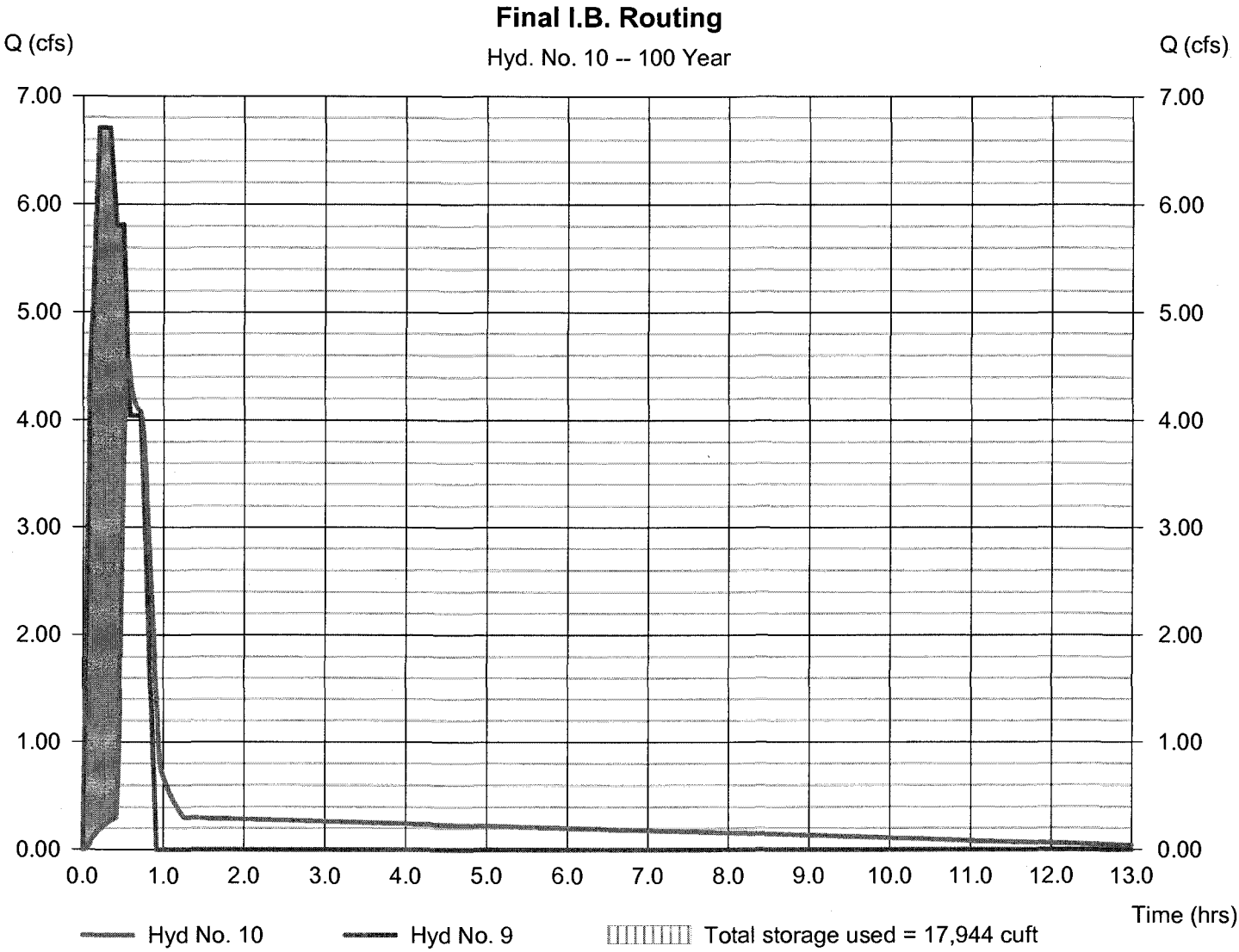
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 10

Final I.B. Routing

Hydrograph type	= Reservoir	Peak discharge	= 4.553 cfs
Storm frequency	= 100 yrs	Time to peak	= 34 min
Time interval	= 1 min	Hyd. volume	= 14,668 cuft
Inflow hyd. No.	= 9 - Final to Infiltration Basin C	Max. Elevation	= 95.47 ft
Reservoir name	= Sediment Basin C	Max. Storage	= 17,944 cuft

Storage Indication method used. Wet pond routing start elevation = 93.50 ft.



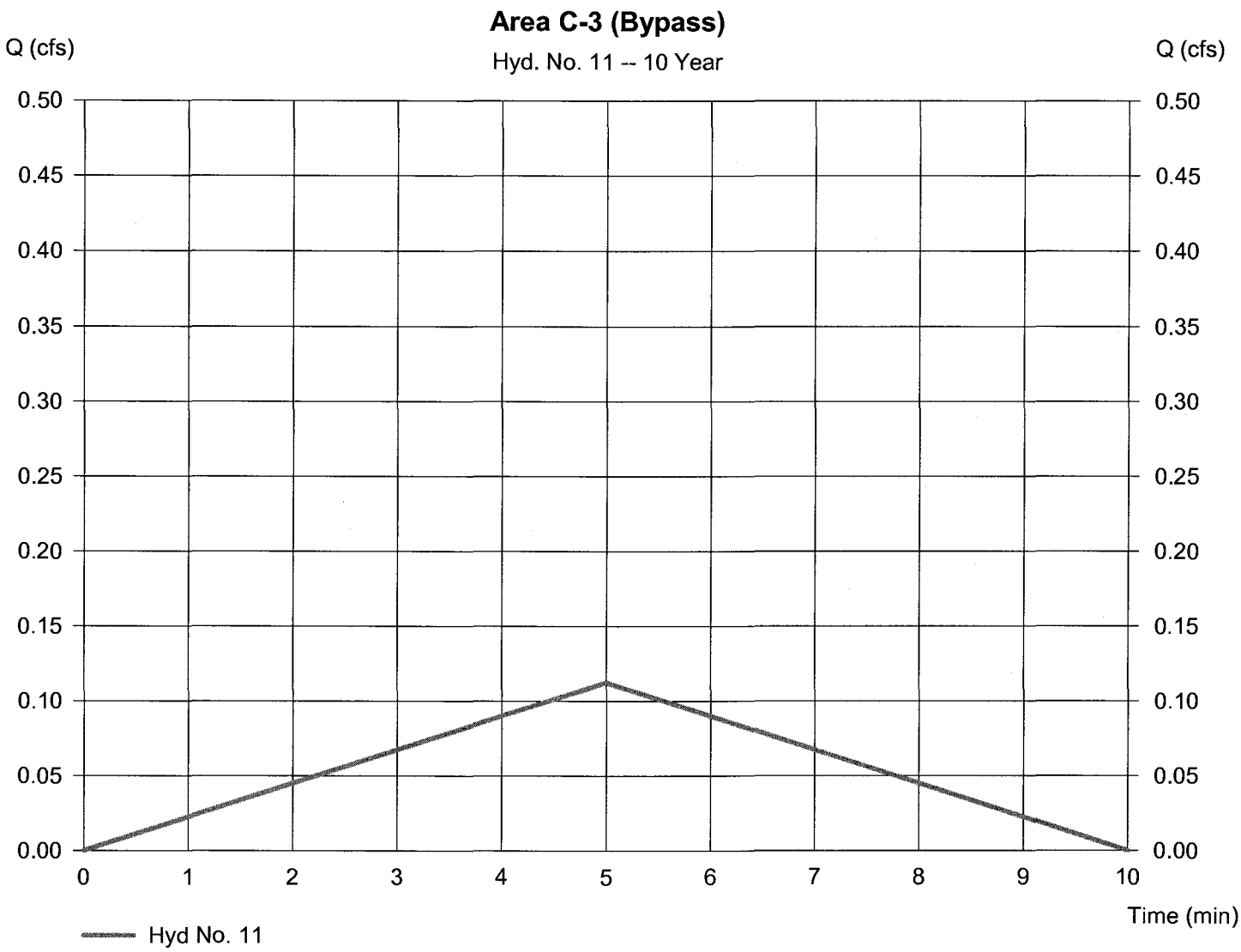
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 11

Area C-3 (Bypass)

Hydrograph type	= Rational	Peak discharge	= 0.112 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 34 cuft
Drainage area	= 0.050 ac	Runoff coeff.	= 0.3
Intensity	= 7.496 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



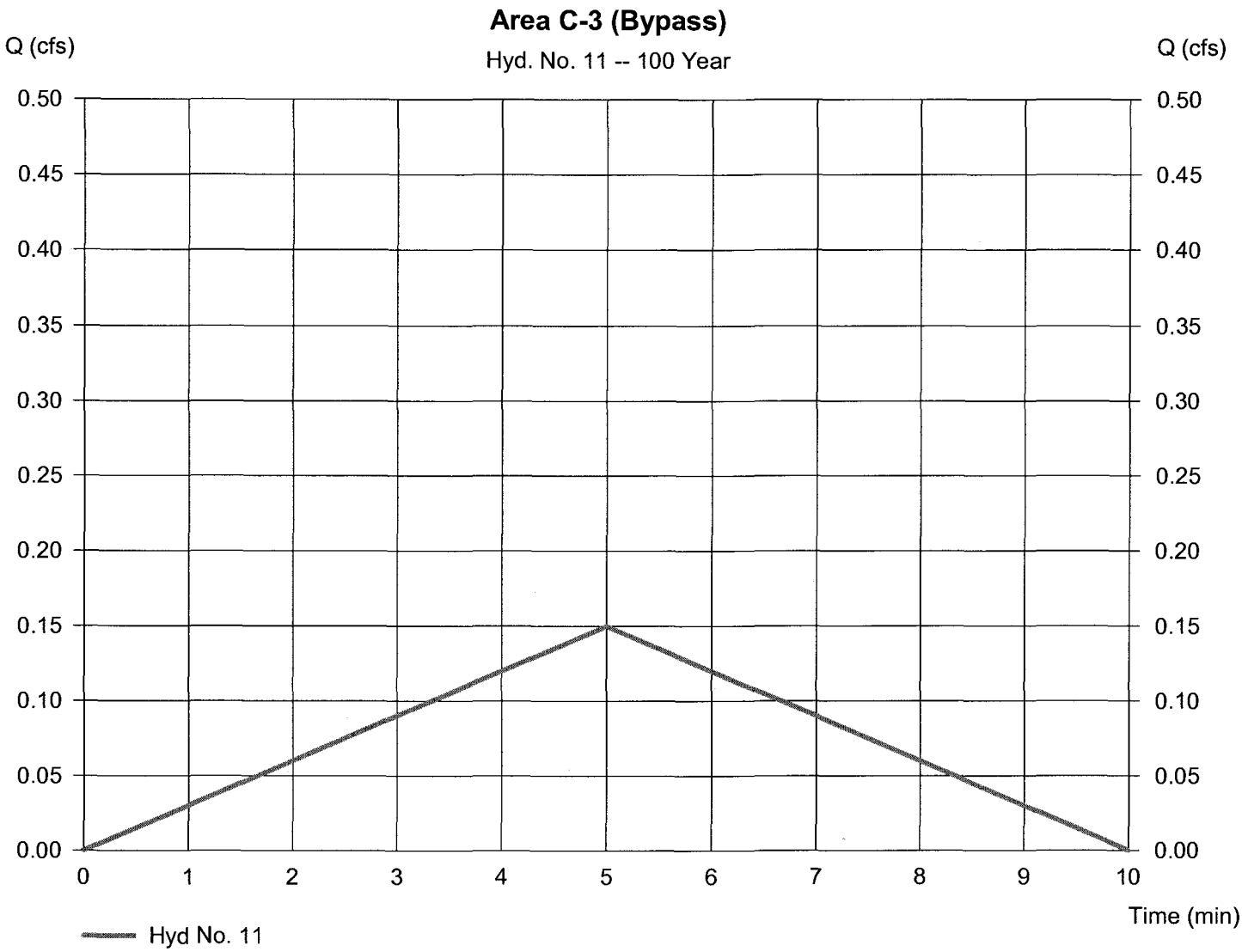
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 11

Area C-3 (Bypass)

Hydrograph type	= Rational	Peak discharge	= 0.150 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 45 cuft
Drainage area	= 0.050 ac	Runoff coeff.	= 0.3
Intensity	= 9.988 in/hr	Tc by User	= 5.00 min
IDF Curve	= JamesCity-NW-14.IDF	Asc/Rec limb fact	= 1/1



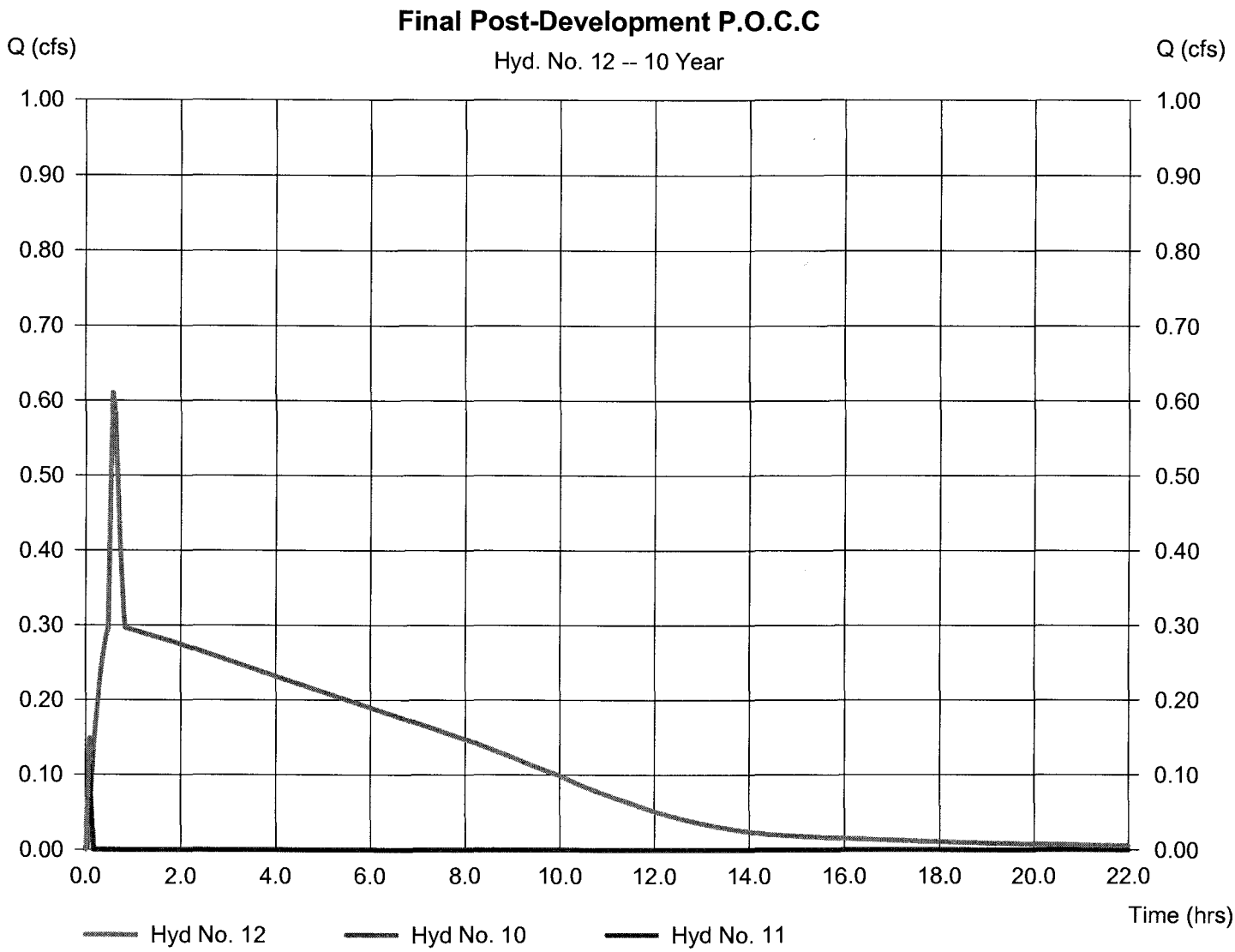
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 12

Final Post-Development P.O.C.C

Hydrograph type	= Combine	Peak discharge	= 0.610 cfs
Storm frequency	= 10 yrs	Time to peak	= 35 min
Time interval	= 1 min	Hyd. volume	= 8,748 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 0.050 ac



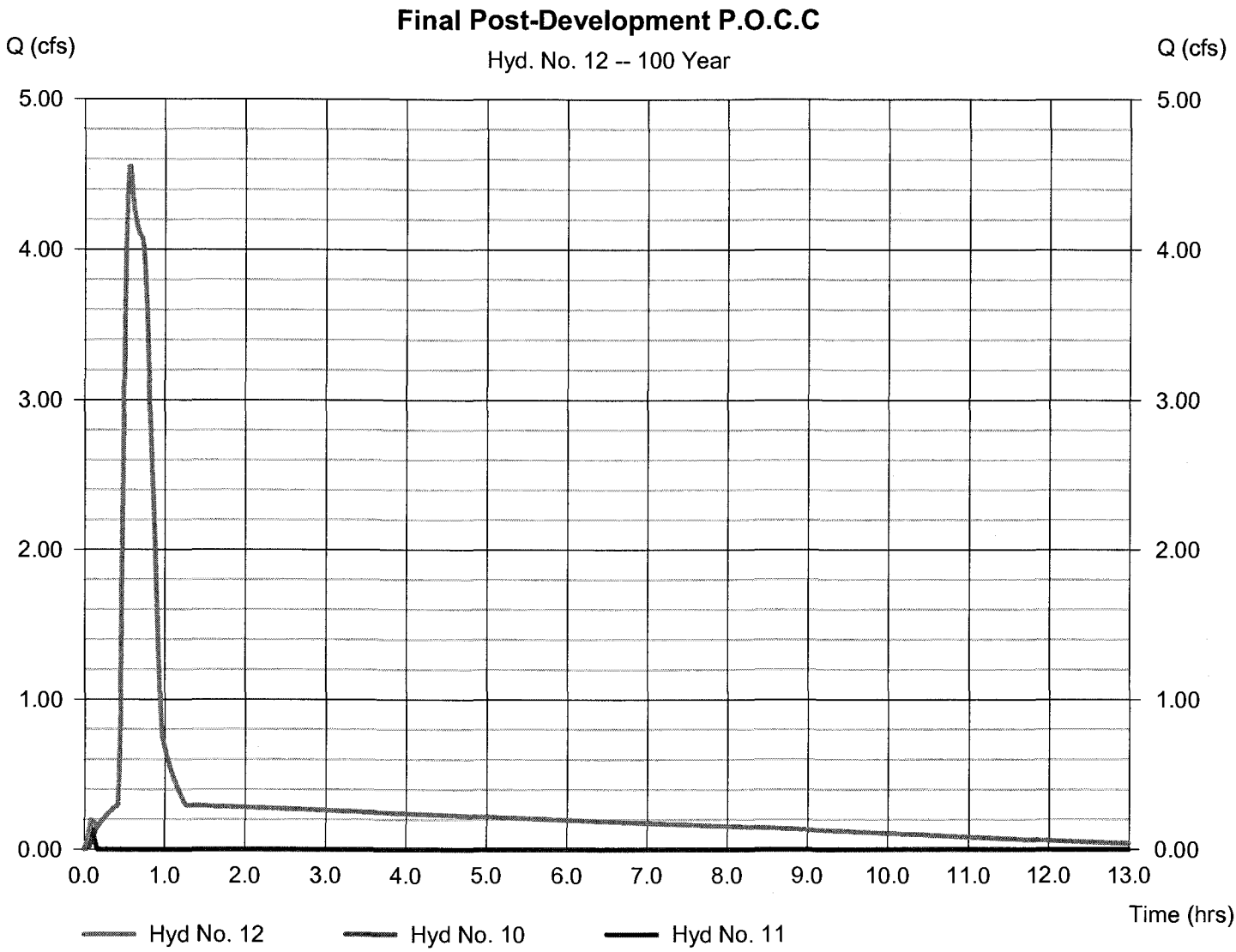
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 12

Final Post-Development P.O.C.C

Hydrograph type	= Combine	Peak discharge	= 4.553 cfs
Storm frequency	= 100 yrs	Time to peak	= 34 min
Time interval	= 1 min	Hyd. volume	= 14,713 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 0.050 ac



EROSION & SEDIMENT CONTROL

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Monday, Oct 4 2010

Diversion Ditch B1

Triangular

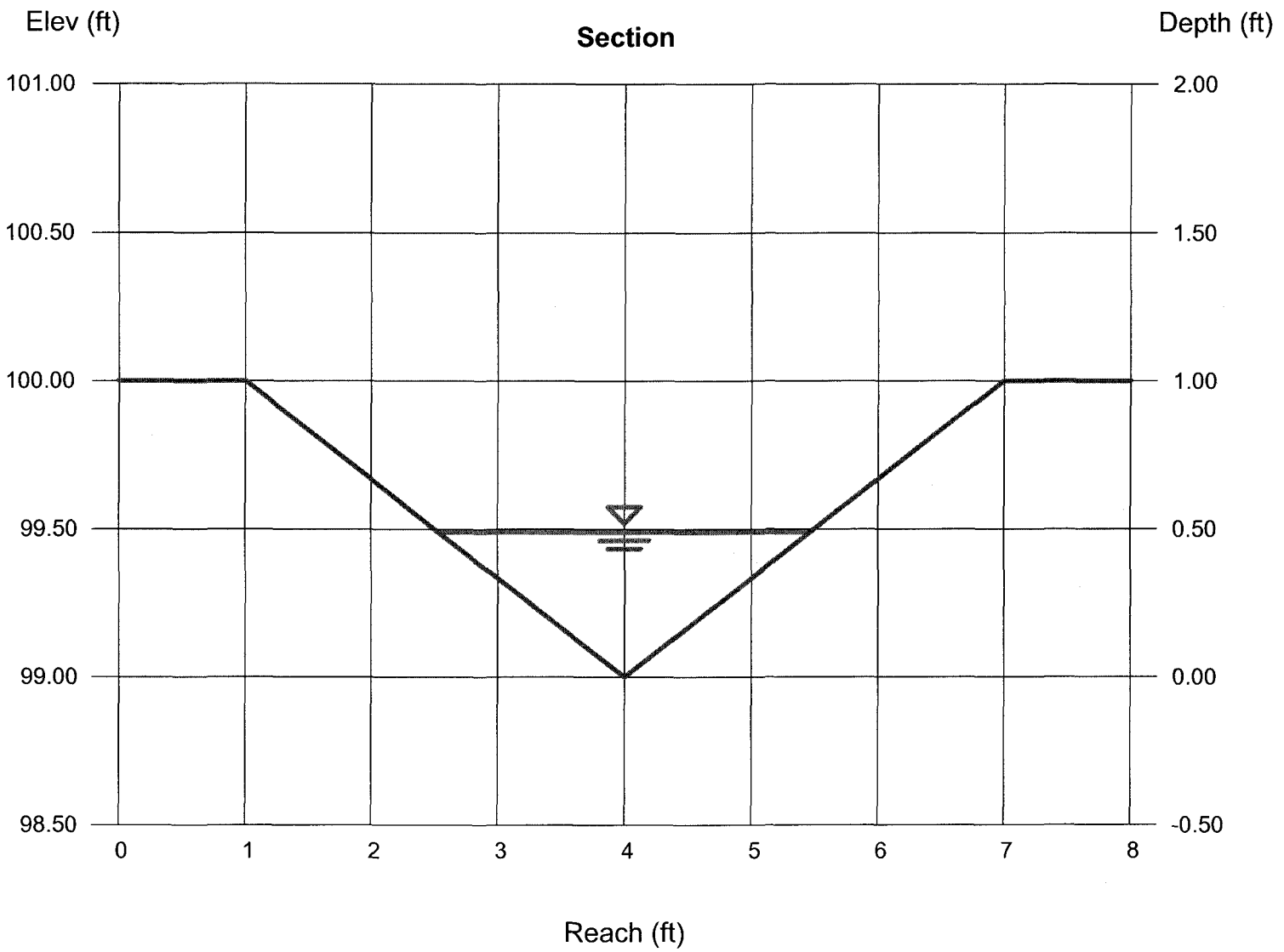
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 99.00
Slope (%)	= 1.00
N-Value	= 0.050

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.80

Highlighted

Depth (ft)	= 0.49
Q (cfs)	= 0.800
Area (sqft)	= 0.72
Velocity (ft/s)	= 1.11
Wetted Perim (ft)	= 3.10
Crit Depth, Yc (ft)	= 0.34
Top Width (ft)	= 2.94
EGL (ft)	= 0.51



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Monday, Oct 4 2010

Diversion Ditch C1

Triangular

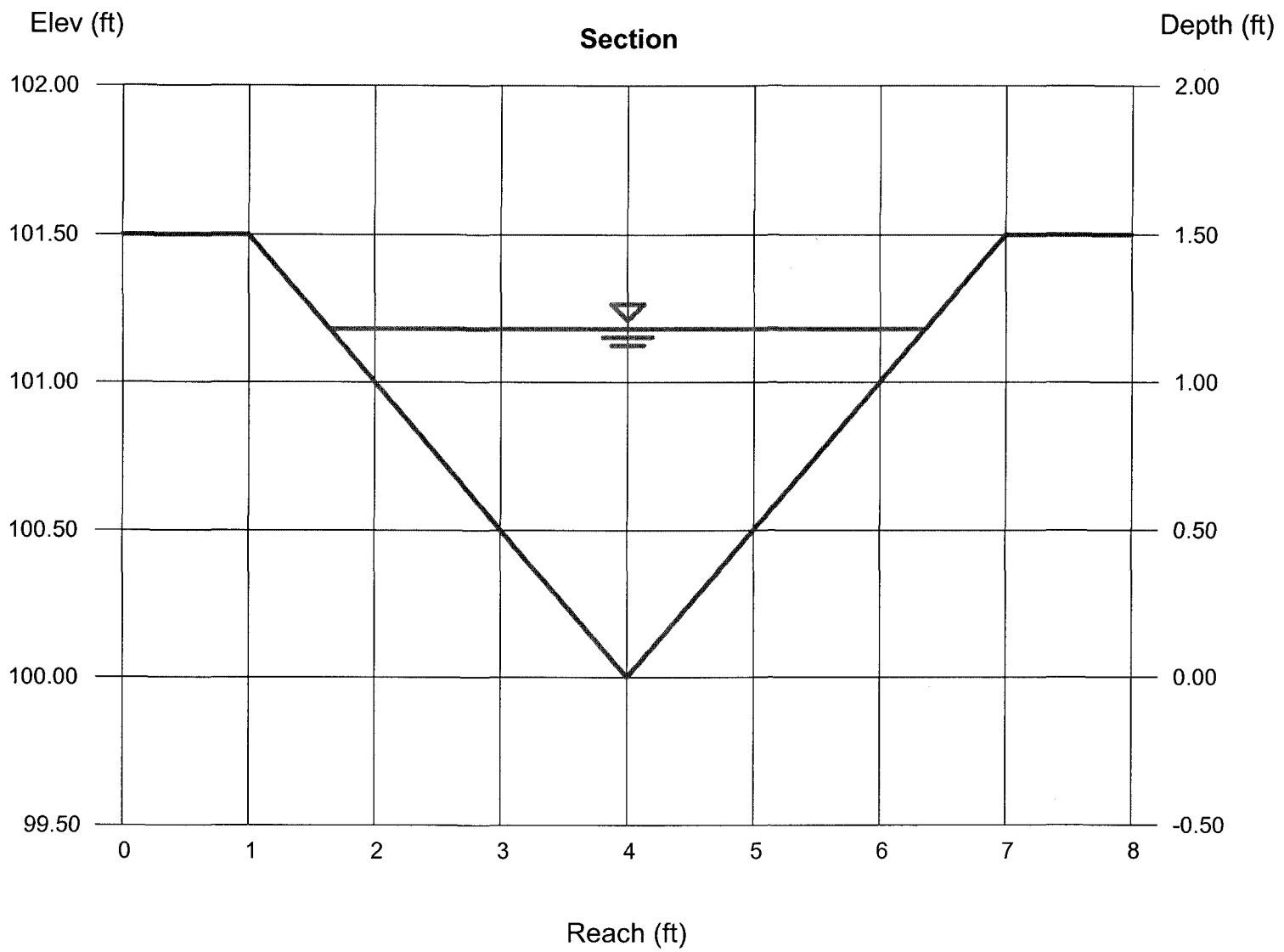
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 100.00
Slope (%)	= 1.10
N-Value	= 0.050

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.62

Highlighted

Depth (ft)	= 1.18
Q (cfs)	= 5.620
Area (sqft)	= 2.78
Velocity (ft/s)	= 2.02
Wetted Perim (ft)	= 5.28
Crit Depth, Yc (ft)	= 0.87
Top Width (ft)	= 4.72
EGL (ft)	= 1.24



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Monday, Oct 4 2010

Diversion Ditch B2

Triangular

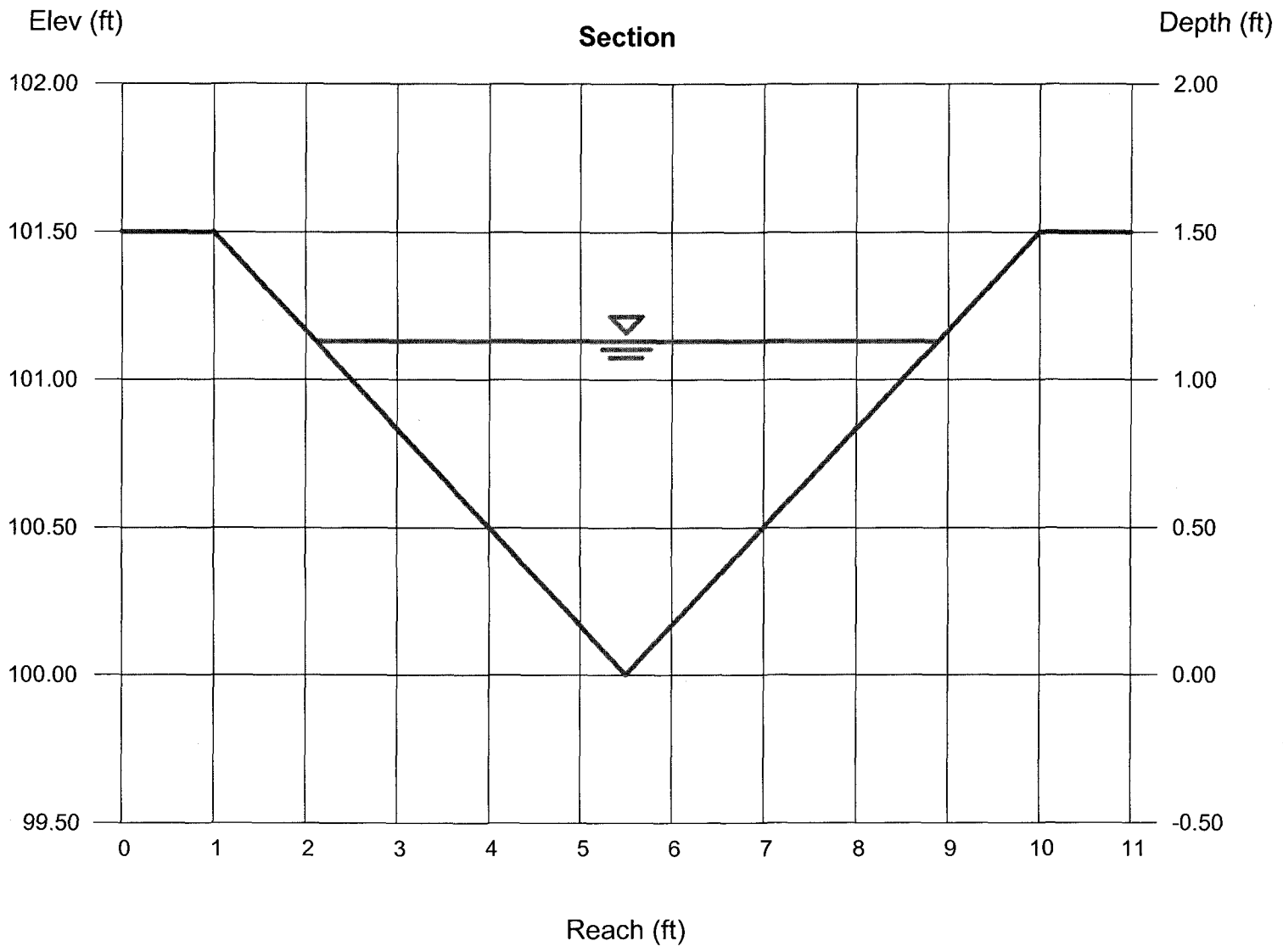
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.050

Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.43

Highlighted

Depth (ft)	= 1.13
Q (cfs)	= 7.430
Area (sqft)	= 3.83
Velocity (ft/s)	= 1.94
Wetted Perim (ft)	= 7.15
Crit Depth, Yc (ft)	= 0.83
Top Width (ft)	= 6.78
EGL (ft)	= 1.19



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Monday, Oct 4 2010

Diversion Ditch C2

Triangular

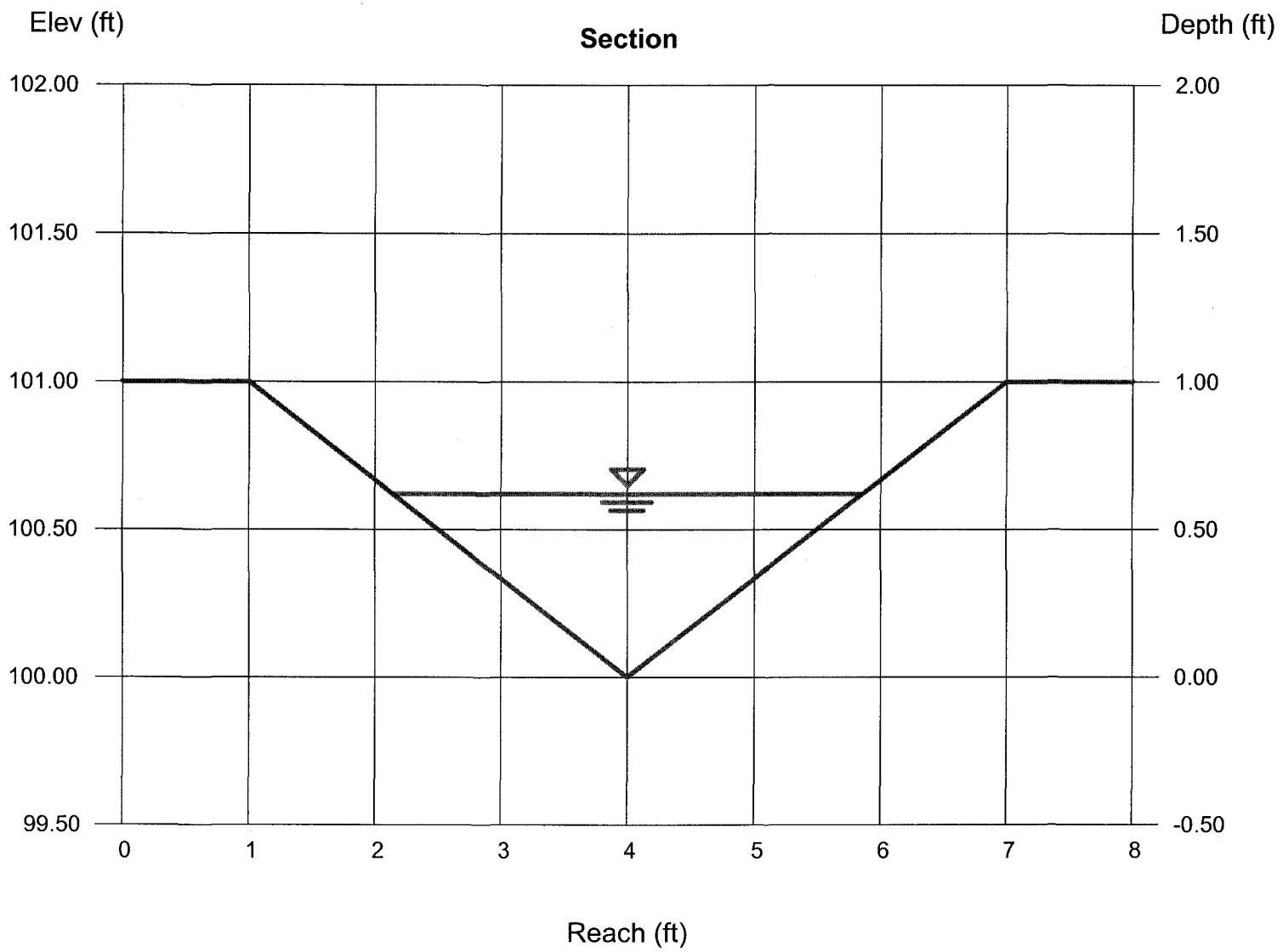
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 2.25
N-Value	= 0.050

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.27

Highlighted

Depth (ft)	= 0.62
Q (cfs)	= 2.270
Area (sqft)	= 1.15
Velocity (ft/s)	= 1.97
Wetted Perim (ft)	= 3.92
Crit Depth, Yc (ft)	= 0.52
Top Width (ft)	= 3.72
EGL (ft)	= 0.68



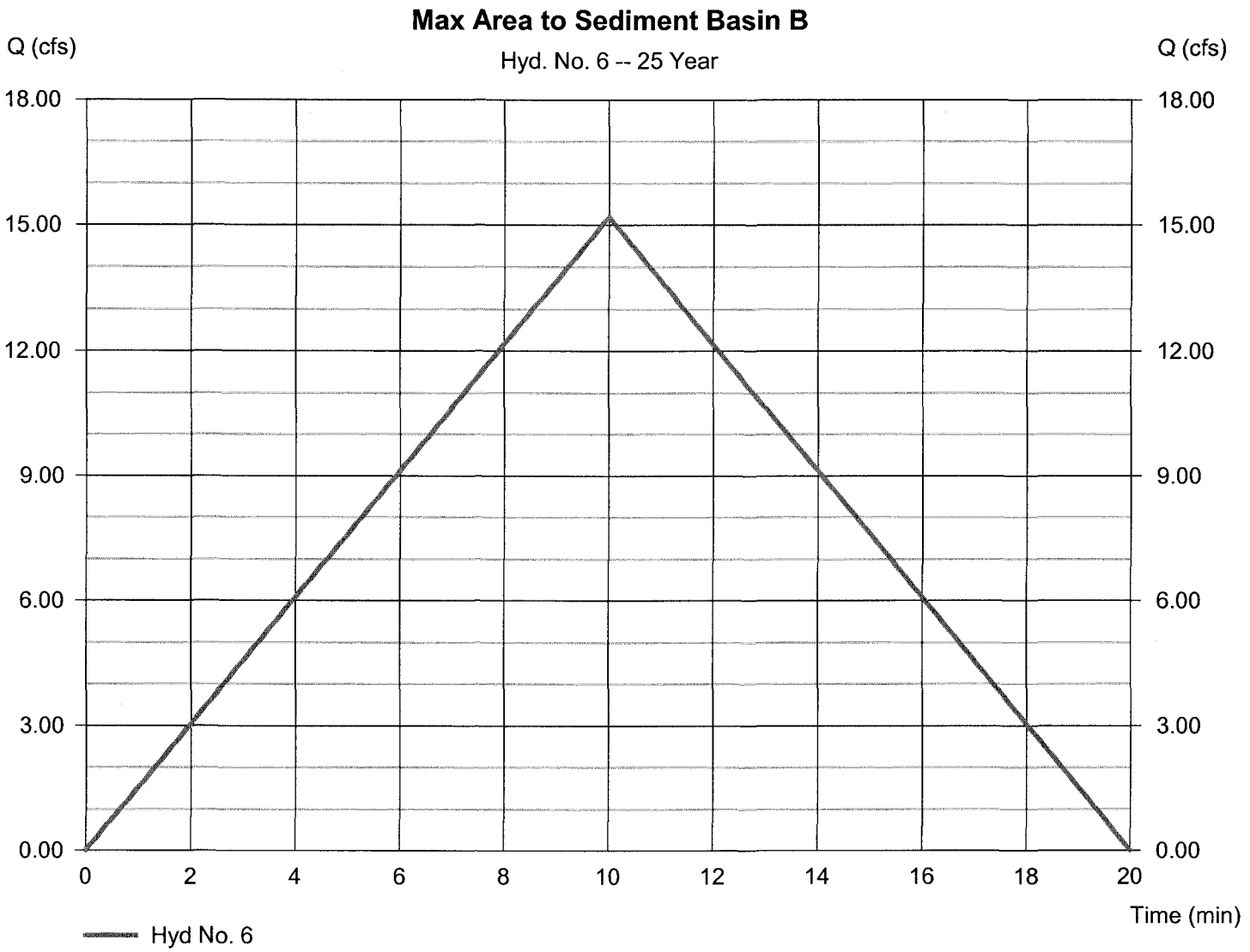
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 6

Max Area to Sediment Basin B

Hydrograph type	= Mod. Rational	Peak discharge	= 15.19 cfs
Storm frequency	= 25 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 9,117 cuft
Drainage area	= 3.300 ac	Runoff coeff.	= 0.67
Intensity	= 6.872 in/hr	Tc by User	= 10.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 1.0 x Tc
Target Q	= n/a	Est. Req'd Storage	= n/a



AES
CONSULTING ENGINEERS

Project:	**Courthouse Commons**
Project No.:	**8509-04**
Subject:	**Sediment Basin B Design**
Date:	**7/12/2010**
Calculated By:	**AMR**

1992 3.14

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET

(with or without an emergency spillway)

Total area draining to basin: **3.3** acres. (Maximum Area)

Basin Volume Design

Wet Storage:

1. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x **3.3** acres = **221.1** cu. yds.

2. Available basin volume = **265** cu. yds. at elevation **96.5** . (From storage - elevation curve)

3. Excavate **265** cu. yds. to obtain required volume*.

   * Elevation corresponding to required volume = invert of the dewatering orifice.

4. Available volume before cleanout required.

   33 cu. yds. x **3.3** acres = **108.9** cu. yds.

5. Elevation corresponding to cleanout level = **95.25** .

   (From Storage - Elevation Curve)

6. Distance from invert of the dewatering orifice to cleanout level = **1.25** ft. (Min. = 1.0 ft.)

Dry Storage:

7. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x **3.3** acres = **221.1** cu. yds.

8. Total available basin volume at crest of riser* = **454** cu. yds. at elevation **97.75** . (From Storage - Elevation Curve)

*Minimum = 134 cu. yds./acre of total drainage area.

9. Diameter of dewatering orifice = **3** in.

10. Diameter of flexible tubing = **5** in. (diameter of dewatering orifice plus 2 inches).

Preliminary Design Elevations

11. Crest of Riser = **97.75**

Top of Dam = **101**

Design High Water = **98**

Upstream Toe of Dam = **100**

Basin Shape

12. $\frac{\text{Length of Flow}}{\text{Effective Width}}$ $\frac{L}{We}$ = **-**

If > 2, baffles are not required ✓

If < 2, baffles are required _____

Runoff

13. Q_2 = **4.948** cfs (From Chapter 5)

14. Q_{25} = **7.988** cfs (From Chapter 5)

Principal Spillway Design

15. With emergency spillway, required spillway capacity $Q_p = Q_2$ = **4.948** cfs. (riser and barrel)

Without emergency spillway, required spillway capacity $Q_p = Q_{25}$ = **7.988** cfs. (riser and barrel)

16. With emergency spillway:

Assumed available head (h) = - ft. (Using Q_2)

h = Crest of Emergency Spillway Elevation - Crest of Riser Elevation

Without emergency spillway:

Assumed available head (h) = 0.25 ft. (Using Q_{25})

h = Design High Water Elevation - Crest of Riser Elevation

17. Riser diameter (D_r) = 48 in. Actual head (h) = 0.25 ft.

(From Plate 3.14-8.)

Note: Avoid orifice flow conditions.

18. Barrel length (l) = 17 ft.

Head (H) on barrel through embankment = - ft.

(From Plate 3.14-7).

19. Barrel diameter = 15 in.

(From Table 3.14-B [concrete pipe] or Table 3.14-A [corrugated pipe]).

20. Trash rack and anti-vortex device

Diameter = 72 inches.

Height = 21 inches.

(From Table 3.14-D).

Emergency Spillway Design

21. Required spillway capacity $Q_e = Q_{25} - Q_p$ = 3.04 cfs.

22. Bottom width (b) = - ft.; the slope of the exit channel (s) = - ft./foot; and the minimum length of the exit channel (x) = - ft.
(From Table 3.14-C)

Anti-Seep Collar Design

23. Depth of water at principal spillway crest (Y) = **3.75** ft.

Slope of upstream face of embankment (Z) = **3** :1.

Slope of principal spillway barrel (S_b) = **0.25** %

Length of barrel in saturated zone (L_s) = **29** ft.

24. Number of collars required = **2** dimensions = **3x3**

(From Plate 3.14-12).

Final Design Elevations

25. Top of Dam = **101**

Design High Water = **98.0**

Emergency Spillway Crest = **-**

Principal Spillway Crest = **97.75**

Dewatering Orifice Invert = **96.5**

Cleanout Elevation = **95.25**

Elevation of Upstream Toe of Dam or Excavated Bottom of "Wet Storage Area" (if excavation was performed) = **94.0**

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Monday, Oct 4, 2010

Pond No. 14 - Sediment Basin B

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 94.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	94.00	2,094	0	0
1.00	95.00	2,671	2,376	2,376
2.00	96.00	3,304	2,982	5,358
3.00	97.00	3,994	3,643	9,001
4.00	98.00	4,741	4,362	13,363
5.00	99.00	5,545	5,137	18,500
6.00	100.00	6,403	5,968	24,468
7.00	101.00	7,320	6,856	31,324

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	3.00	0.00	0.00
Span (in)	= 15.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 95.00	96.50	0.00	0.00
Length (ft)	= 17.00	0.00	0.00	0.00
Slope (%)	= 0.25	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	Yes	No	No

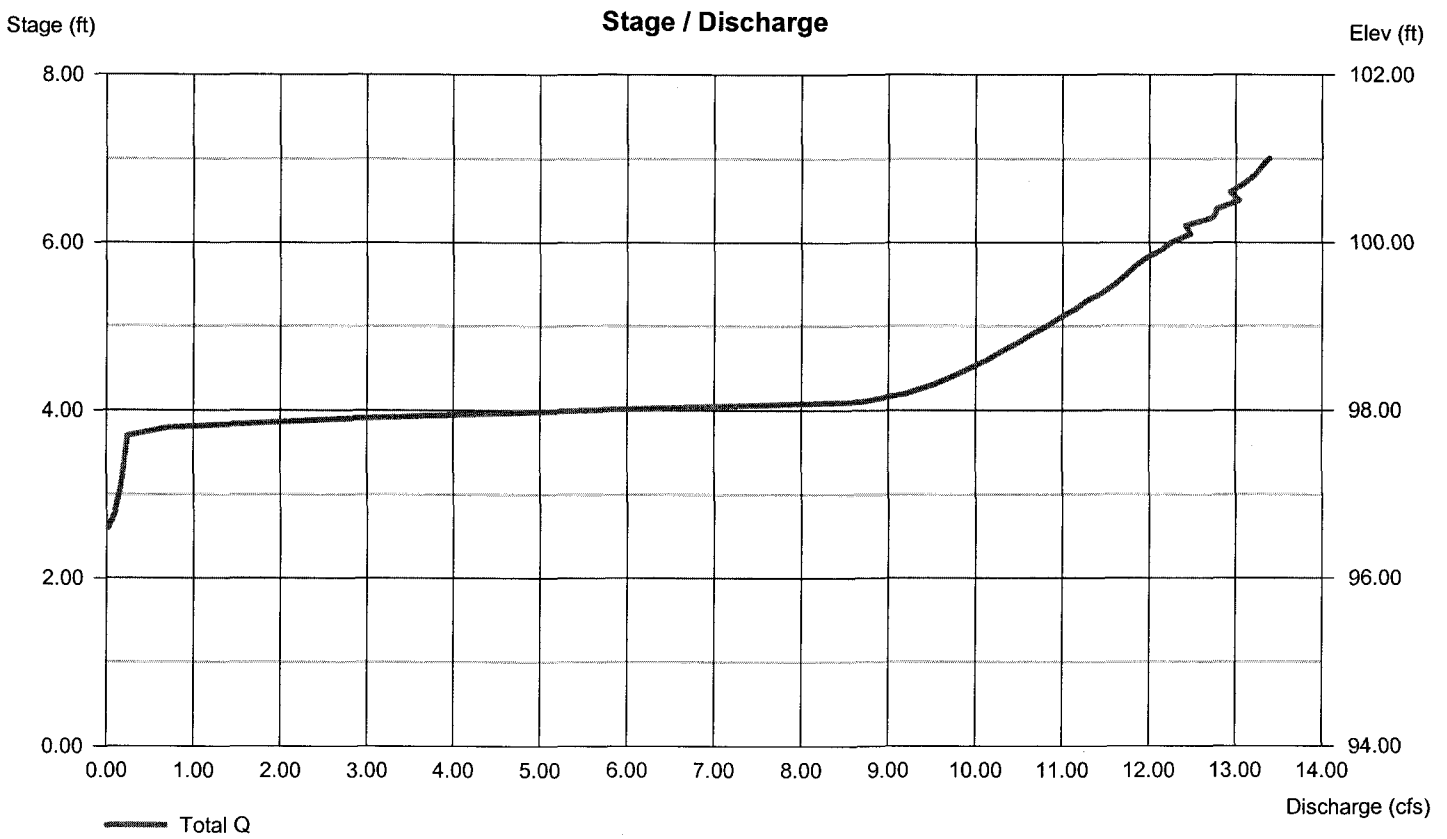
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.56	0.00	0.00	0.00
Crest El. (ft)	= 97.75	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Report

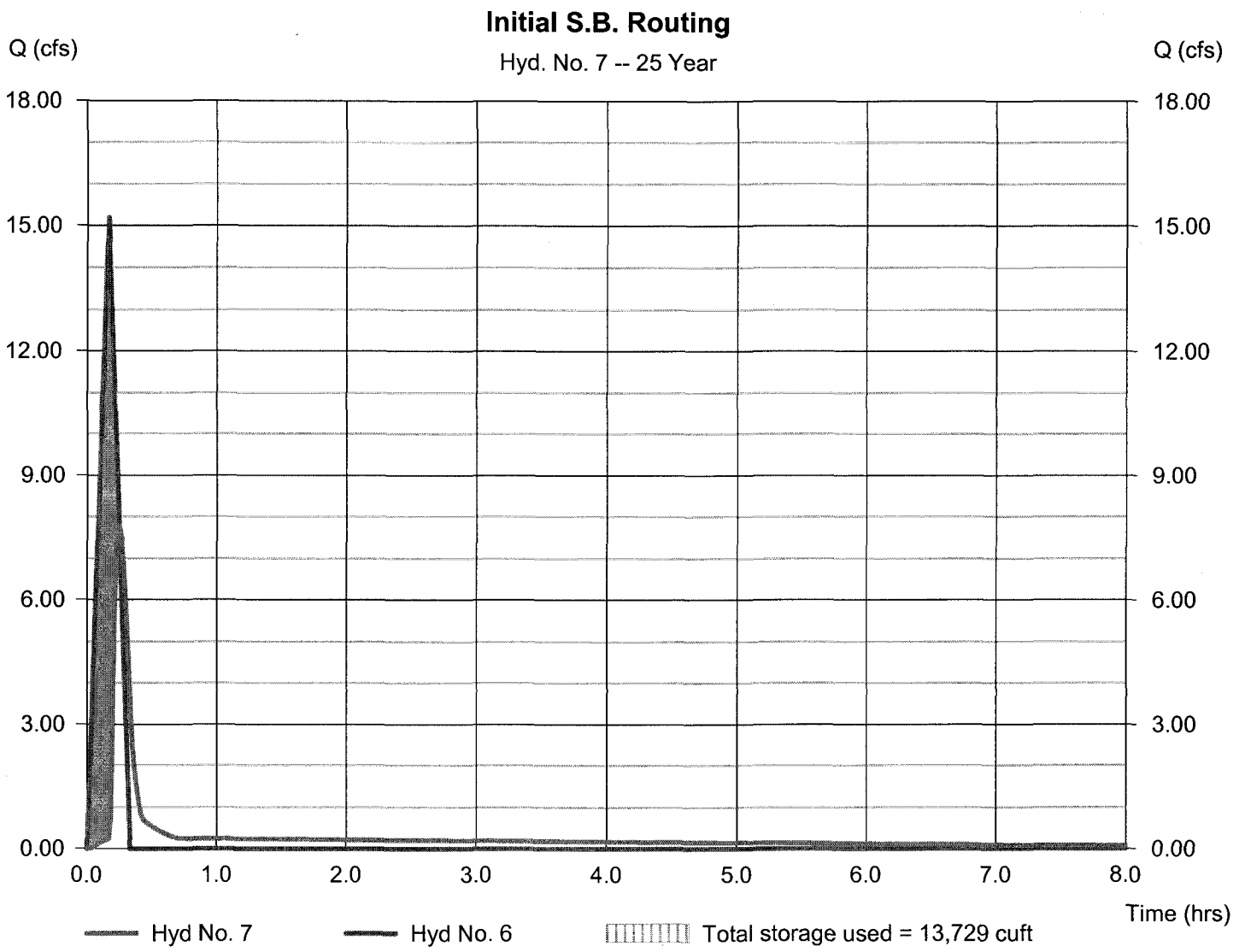
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 7

Initial S.B. Routing

Hydrograph type	= Reservoir	Peak discharge	= 7.766 cfs
Storm frequency	= 25 yrs	Time to peak	= 15 min
Time interval	= 1 min	Hyd. volume	= 9,099 cuft
Inflow hyd. No.	= 6 - Max Area to Sediment Basin B	Max. Elevation	= 98.07 ft
Reservoir name	= Sediment Basin B	Max. Storage	= 13,729 cuft

Storage Indication method used. Wet pond routing start elevation = 96.50 ft.



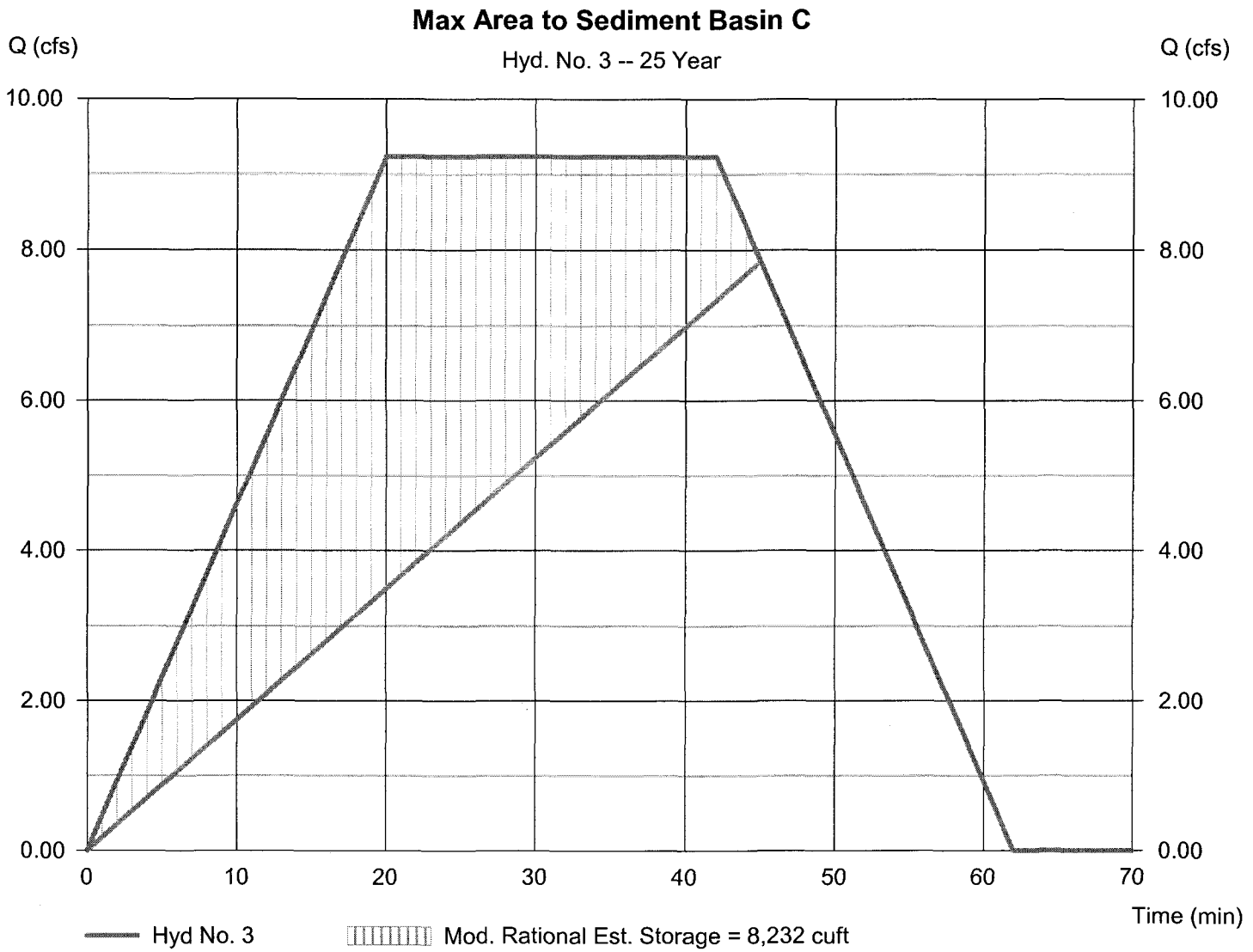
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 3

Max Area to Sediment Basin C

Hydrograph type	= Mod. Rational	Peak discharge	= 9.234 cfs
Storm frequency	= 25 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 23,271 cuft
Drainage area	= 4.620 ac	Runoff coeff.	= 0.57
Intensity	= 3.507 in/hr	Tc by User	= 20.00 min
IDF Curve	= JamesCity-NW-14.IDF	Storm duration	= 2.1 x Tc
Target Q	= 8.000 cfs	Est. Req'd Storage	= 8,232 cuft



AES
CONSULTING ENGINEERS

Project:	**Courthouse Commons**
Project No.:	**8509-04**
Subject:	**Sediment Basin C Design**
Date:	**7/12/2010**
Calculated By:	**AMR**

1992 3.14

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET

(with or without an emergency spillway)

Total area draining to basin: **4.62** acres.

Basin Volume Design

Wet Storage:

1. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x **4.62** acres = **309.54** cu. yds.

2. Available basin volume = **320** cu. yds. at elevation **93.5**. (From storage - elevation curve)

3. Excavate **320** cu. yds. to obtain required volume*.

   * Elevation corresponding to required volume = invert of the dewatering orifice.

4. Available volume before cleanout required.

   33 cu. yds. x **4.62** acres = **152.46** cu. yds.

5. Elevation corresponding to cleanout level = **92.3**.

   (From Storage - Elevation Curve)

6. Distance from invert of the dewatering orifice to cleanout level = **1.2** ft. (Min. = 1.0 ft.)

Dry Storage:

7. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x **4.62** acres = **309.54** cu. yds.

8. Total available basin volume at crest of riser* = **622** cu. yds. at elevation **95.25** . (From Storage - Elevation Curve)

*Minimum = 134 cu. yds./acre of total drainage area.

9. Diameter of dewatering orifice = **3** in.

10. Diameter of flexible tubing = 5 in. (diameter of dewatering orifice plus 2 inches).

Preliminary Design Elevations

11. Crest of Riser = **95.25**

Top of Dam = **97**

Design High Water = **95.6**

Upstream Toe of Dam = **95**

Basin Shape

12. $\frac{\text{Length of Flow}}{\text{Effective Width}}$ $\frac{L}{We}$ = **0.9**

If > 2, baffles are not required _____

If < 2, baffles are required ✓

Runoff

13. Q_2 = **5.14** cfs (From Chapter 5)

14. Q_{25} = **9.162** cfs (From Chapter 5)

Principal Spillway Design

15. With emergency spillway, required spillway capacity $Q_p = Q_2$ = **5.14** cfs. (riser and barrel)

Without emergency spillway, required spillway capacity $Q_p = Q_{25}$ = **9.162** cfs. (riser and barrel)

16. With emergency spillway:

Assumed available head (h) = **0.26** ft. (Using Q_2)

h = Crest of Emergency Spillway Elevation - Crest of Riser Elevation

Without emergency spillway:

Assumed available head (h) = **-** ft. (Using Q_{25})

h = Design High Water Elevation - Crest of Riser Elevation

17. Riser diameter (D_r) = **48** in. Actual head (h) = **3** ft.

(From Plate 3.14-8.)

Note: Avoid orifice flow conditions.

18. Barrel length (l) = **17** ft.

Head (H) on barrel through embankment = **5.2** ft.

(From Plate 3.14-7).

19. Barrel diameter = **15** in.

(From Table 3.14-B [concrete pipe] or Table 3.14-A [corrugated pipe]).

20. Trash rack and anti-vortex device

Diameter = **72** inches.

Height = **21** inches.

(From Table 3.14-D).

Emergency Spillway Design

21. Required spillway capacity $Q_e = Q_{25} - Q_p$ = **4.022** cfs.

22. Bottom width (b) = **8** ft.; the slope of the exit channel (s) = **3.9** ft./foot; and the minimum length of the exit channel (x) = **32** ft.
(From Table 3.14-C)

Anti-Seep Collar Design

23. Depth of water at principal spillway crest (Y) = **4.25** ft.

Slope of upstream face of embankment (Z) = **2** :1.

Slope of principal spillway barrel (S_b) = **1** %

Length of barrel in saturated zone (L_s) = **26** ft.

24. Number of collars required = **2** dimensions = **4x4**

(From Plate 3.14-12).

Final Design Elevations

25. Top of Dam = **97**

Design High Water = **95.6**

Emergency Spillway Crest = **96.5**

Principal Spillway Crest = **95.25**

Dewatering Orifice Invert = **93.5**

Cleanout Elevation = **92.3**

Elevation of Upstream Toe of Dam or Excavated Bottom of "Wet Storage Area" (if excavation was performed) = **91.0**

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Monday, Oct 4, 2010

Pond No. 4 - Sediment Basin C

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 91.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	91.00	2,782	0	0
1.00	92.00	3,287	3,031	3,031
2.00	93.00	3,834	3,557	6,587
3.00	94.00	4,422	4,124	10,711
4.00	95.00	5,052	4,733	15,444
5.00	96.00	5,723	5,383	20,828
6.00	97.00	6,427	6,071	26,899

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	3.00	0.00	0.00
Span (in)	= 15.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 91.50	93.50	0.00	0.00
Length (ft)	= 21.00	0.00	0.00	0.00
Slope (%)	= 1.00	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	Yes	No	No

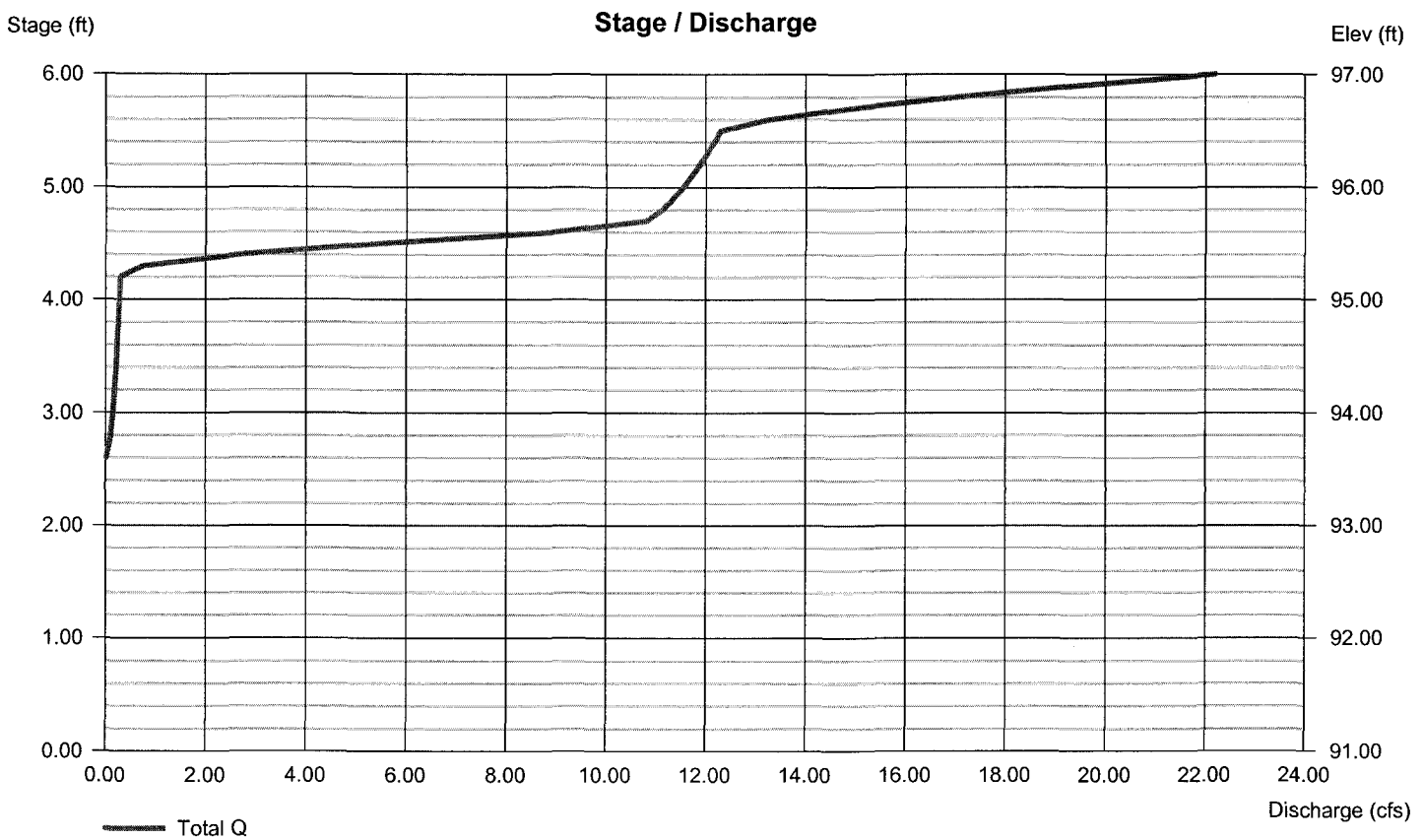
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.57	10.00	0.00	0.00
Crest El. (ft)	= 95.25	96.50	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Riser	Broad	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Report

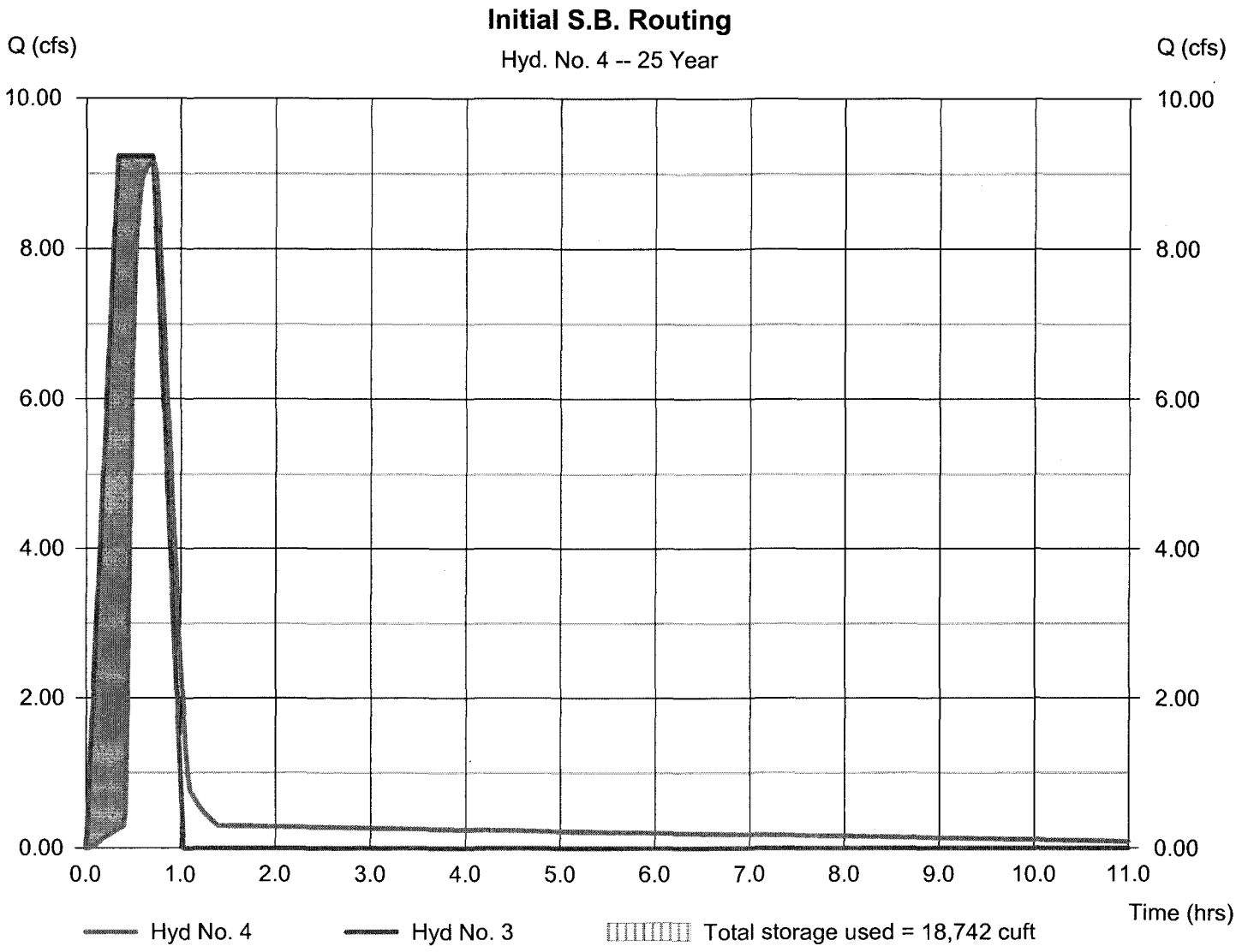
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Monday, Oct 4, 2010

Hyd. No. 4

Initial S.B. Routing

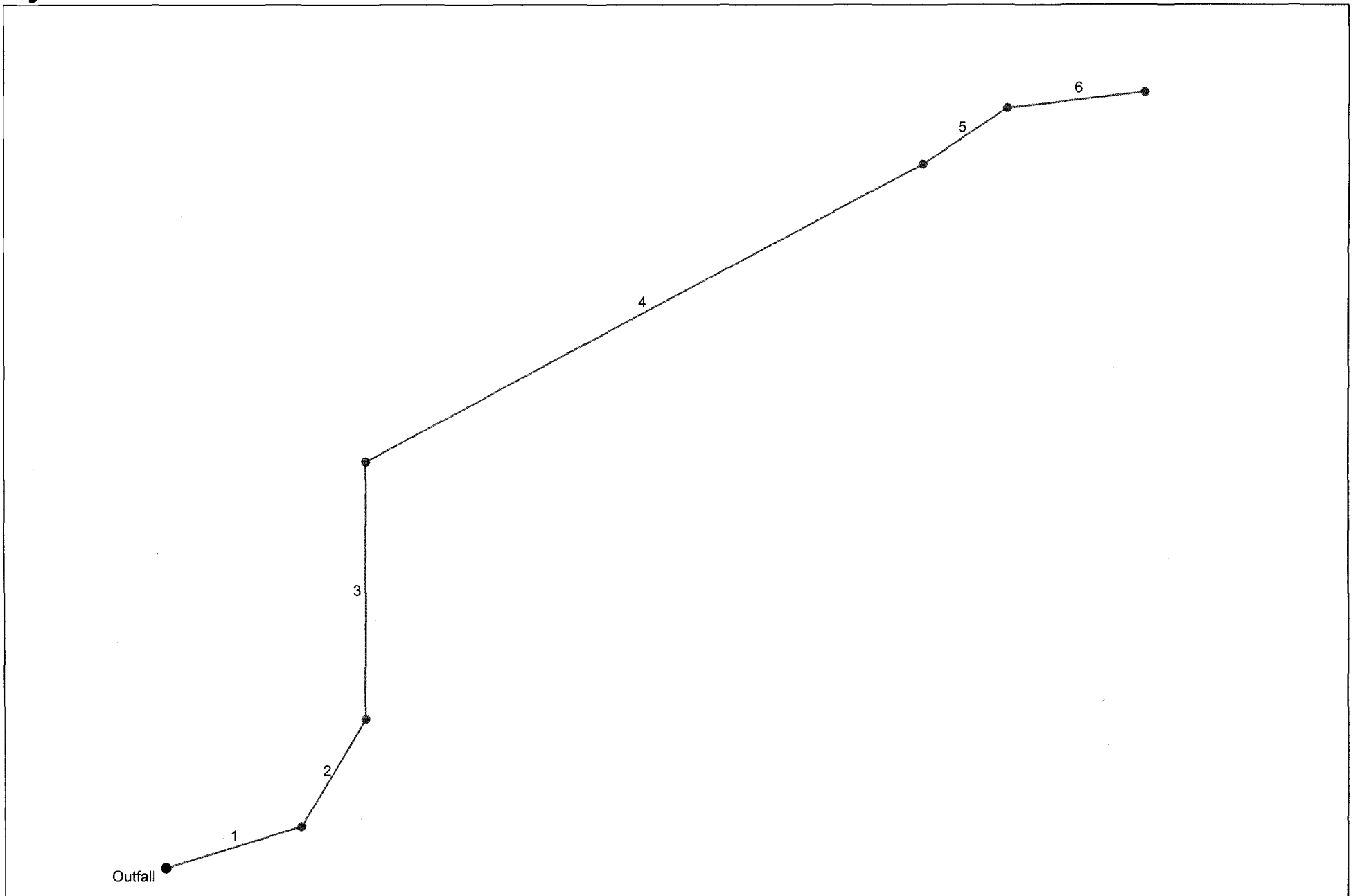
Hydrograph type	= Reservoir	Peak discharge	= 9.162 cfs
Storm frequency	= 25 yrs	Time to peak	= 42 min
Time interval	= 1 min	Hyd. volume	= 23,250 cuft
Inflow hyd. No.	= 3 - Max Area to Sediment Basin C	Max. Elevation	= 95.61 ft
Reservoir name	= Sediment Basin C	Max. Storage	= 18,742 cuft

Storage Indication method used. Wet pond routing start elevation = 93.50 ft.



OFFSITE EVALUTAION

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2009 Plan



Project File: Ironbound Mini Storage Storm Pre Development.stm	Number of lines: 6	Date: 10-04-2010

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	78.000	0.00	40.10	0.00	0.00	19.27	0.0	33.9	3.4	81.05	227.8	9.39	42	5.13	66.00	70.00	69.19	72.76	0.00	78.00	
2	1	70.000	0.00	40.10	0.00	0.00	19.27	0.0	33.5	3.4	81.48	255.1	10.01	42	6.43	70.00	74.50	72.76	77.26	78.00	81.00	
3	2	144.000	0.00	40.10	0.00	0.00	19.27	0.0	32.7	3.5	82.39	145.2	12.08	42	2.08	76.00	79.00	77.89	82.44	81.00	85.00	
4	3	348.000	0.00	40.10	0.00	0.00	19.27	0.0	30.7	3.6	84.72	100.9	9.04	42	1.01	79.00	82.50	83.47	85.66	85.00	87.20	
5	4	56.000	5.20	40.10	0.35	1.82	19.27	0.0	30.4	3.6	85.11	242.4	9.60	42	5.80	82.50	85.75	85.86	88.58	87.20	90.50	
6	5	75.000	34.90	34.90	0.50	17.45	17.45	30.0	30.0	3.6	63.30	100.6	9.43	42	1.00	90.50	91.25	92.51	94.00	90.50	91.25	

Project File: Ironbound Mini Storage Storm Pre Development.stm

Number of lines: 6

Run Date: 10-04-2010

NOTES: Intensity = 55.61 / (Inlet time + 10.00) ^ 0.74; Return period = 10 Yrs. ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	78.000	0.00	40.10	0.00	0.00	19.27	0.0	33.9	4.7	112.4	227.8	12.19	42	5.13	66.00	70.00	69.20	73.20	0.00	78.00	
2	1	70.000	0.00	40.10	0.00	0.00	19.27	0.0	33.5	4.7	112.9	255.1	12.24	42	6.43	70.00	74.50	73.20	77.70	78.00	81.00	
3	2	144.000	0.00	40.10	0.00	0.00	19.27	0.0	32.7	4.8	114.0	145.2	14.28	42	2.08	76.00	79.00	78.34	82.92	81.00	85.00	
4	3	348.000	0.00	40.10	0.00	0.00	19.27	0.0	30.7	4.9	116.7	100.9	12.13	42	1.01	79.00	82.50	84.88	89.57	85.00	87.20	
5	4	56.000	5.20	40.10	0.35	1.82	19.27	0.0	30.4	5.0	117.2	242.4	12.18	42	5.80	82.50	85.75	89.91	90.67	87.20	90.50	
6	5	75.000	34.90	34.90	0.50	17.45	17.45	30.0	30.0	5.0	87.27	100.6	10.75	42	1.00	90.50	91.25	93.02	94.33	90.50	91.25	

Project File: Ironbound Mini Storage Storm Pre Development.stm

Number of lines: 6

Run Date: 10-04-2010

NOTES: Intensity = 36.77 / (Inlet time + 5.25) ^ 0.56; Return period = 100 Yrs. ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	78.000	0.00	20.56	0.00	0.00	9.50	0.0	33.9	3.4	44.70	227.8	6.81	42	5.13	66.00	70.00	68.54	72.05	0.00	78.00	
2	1	70.000	0.00	20.56	0.00	0.00	9.50	0.0	33.5	3.4	44.91	255.1	7.67	42	6.43	70.00	74.50	72.05	76.55	78.00	81.00	
3	2	144.000	0.00	20.56	0.00	0.00	9.50	0.0	32.7	3.5	45.36	145.2	10.49	42	2.08	76.00	79.00	77.34	81.07	81.00	85.00	
4	3	348.000	0.00	20.56	0.00	0.00	9.50	0.0	30.7	3.6	46.51	100.9	6.62	42	1.01	79.00	82.50	81.89	84.59	85.00	87.20	
5	4	56.000	5.20	20.56	0.35	1.82	9.50	0.0	30.4	3.6	46.70	242.4	7.79	42	5.80	82.50	85.75	84.59	87.84	87.20	90.50	
6	5	75.000	15.36	15.36	0.50	7.68	7.68	30.0	30.0	3.6	27.86	100.6	7.52	42	1.00	90.50	91.25	91.76	92.93	90.50	91.25	

Project File: Ironbound Mini Storage Storm Post Development.stm | Number of lines: 6 | Run Date: 10-04-2010

NOTES: Intensity = 55.61 / (Inlet time + 10.00) ^ 0.74; Return period = 10 Yrs. ; c = cir e = ellip b = box

Storm Sewer Tabulation

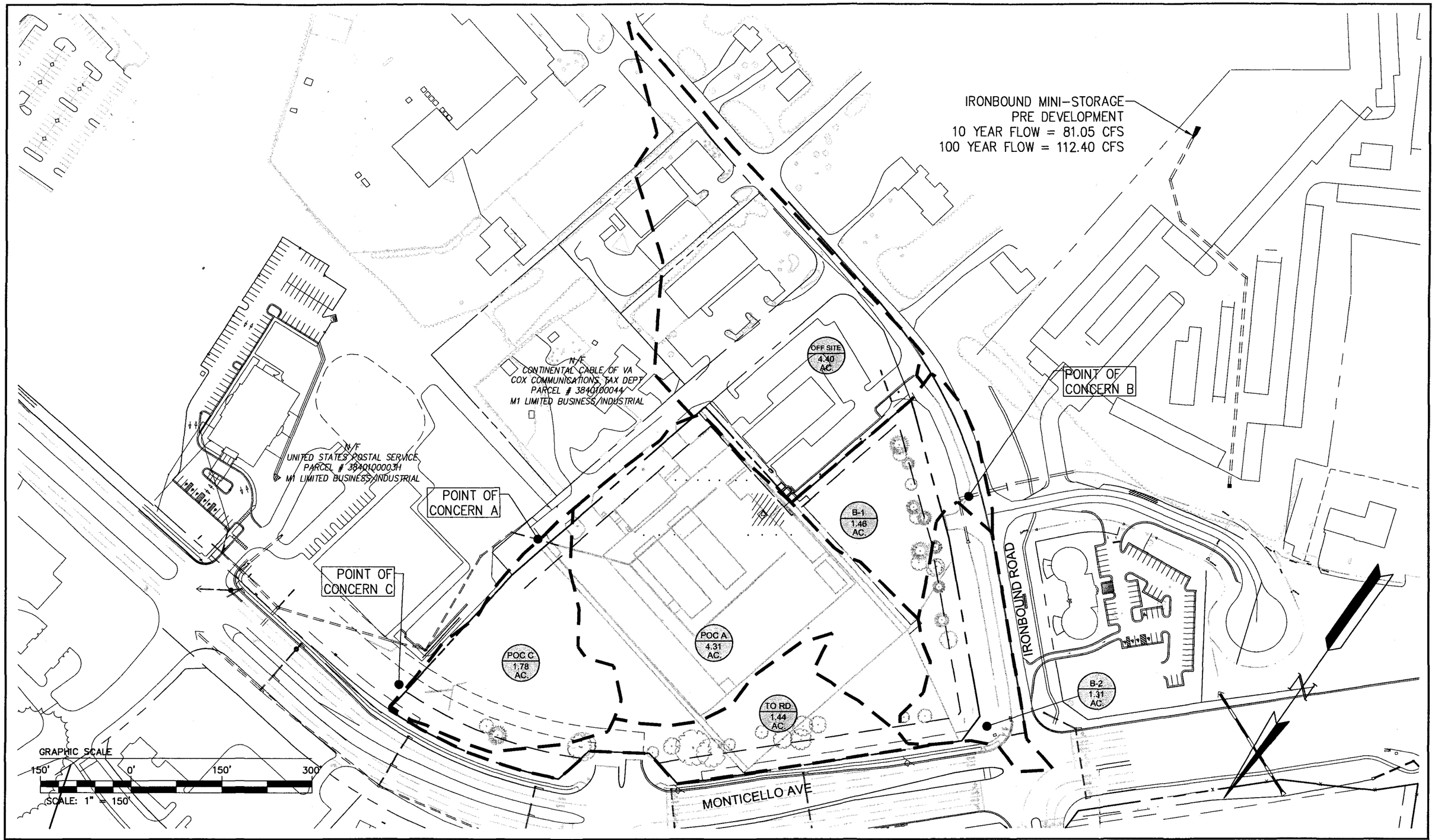
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	78.000	0.00	20.56	0.00	0.00	9.50	0.0	33.9	4.7	61.81	227.8	8.51	42	5.13	66.00	70.00	68.54	72.41	0.00	78.00	
2	1	70.000	0.00	20.56	0.00	0.00	9.50	0.0	33.5	4.7	62.06	255.1	8.79	42	6.43	70.00	74.50	72.41	76.91	78.00	81.00	
3	2	144.000	0.00	20.56	0.00	0.00	9.50	0.0	32.7	4.8	62.60	145.2	11.09	42	2.08	76.00	79.00	77.61	81.77	81.00	85.00	
4	3	348.000	0.00	20.56	0.00	0.00	9.50	0.0	30.7	4.9	63.95	100.9	7.77	42	1.01	79.00	82.50	82.59	84.95	85.00	87.20	
5	4	56.000	5.20	20.56	0.35	1.82	9.50	0.0	30.4	5.0	64.18	242.4	8.92	42	5.80	82.50	85.75	84.95	88.20	87.20	90.50	
6	5	75.000	15.36	15.36	0.50	7.68	7.68	30.0	30.0	5.0	38.41	100.6	8.08	42	1.00	90.50	91.25	92.00	93.34	90.50	91.25	

Project File: Ironbound Mini Storage Storm Post Development.stm

Number of lines: 6

Run Date: 10-04-2010

NOTES: Intensity = 36.77 / (Inlet time + 5.25) ^ 0.56; Return period = 100 Yrs. ; c = cir e = ellip b = box



Rev.	Date	Description	Revised By

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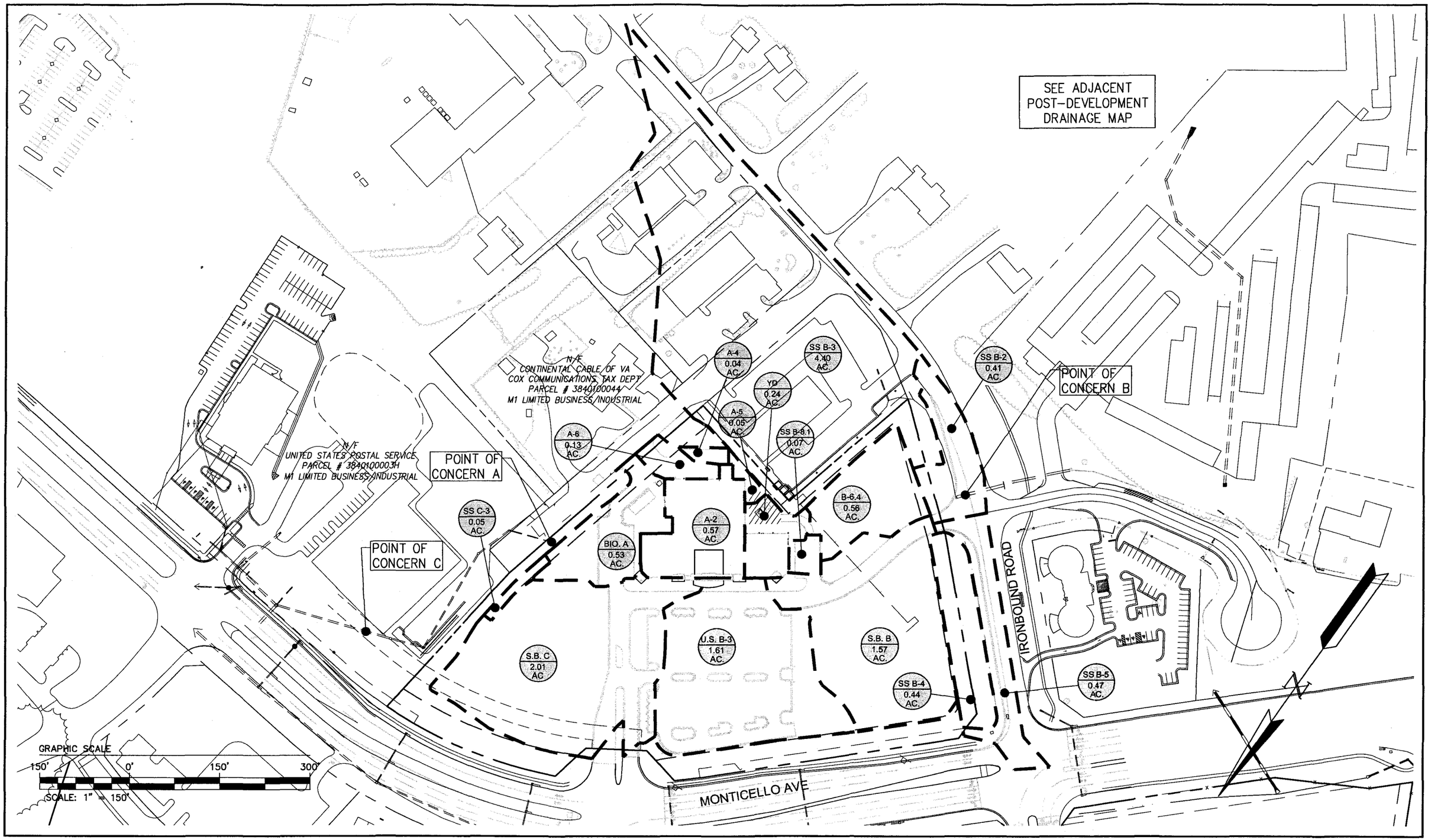
PRE-DEVELOPMENT DRAINAGE MAP

COURTHOUSE COMMONS

SHOPPING CENTER

BERKELEY DISTRICT JAMES CITY COUNTY VIRGINIA

Project Contacts:	JAG, AMR
Project Number:	8509-04
Scale: 1"=150'	Date: 6/2/10
Sheet Number	-



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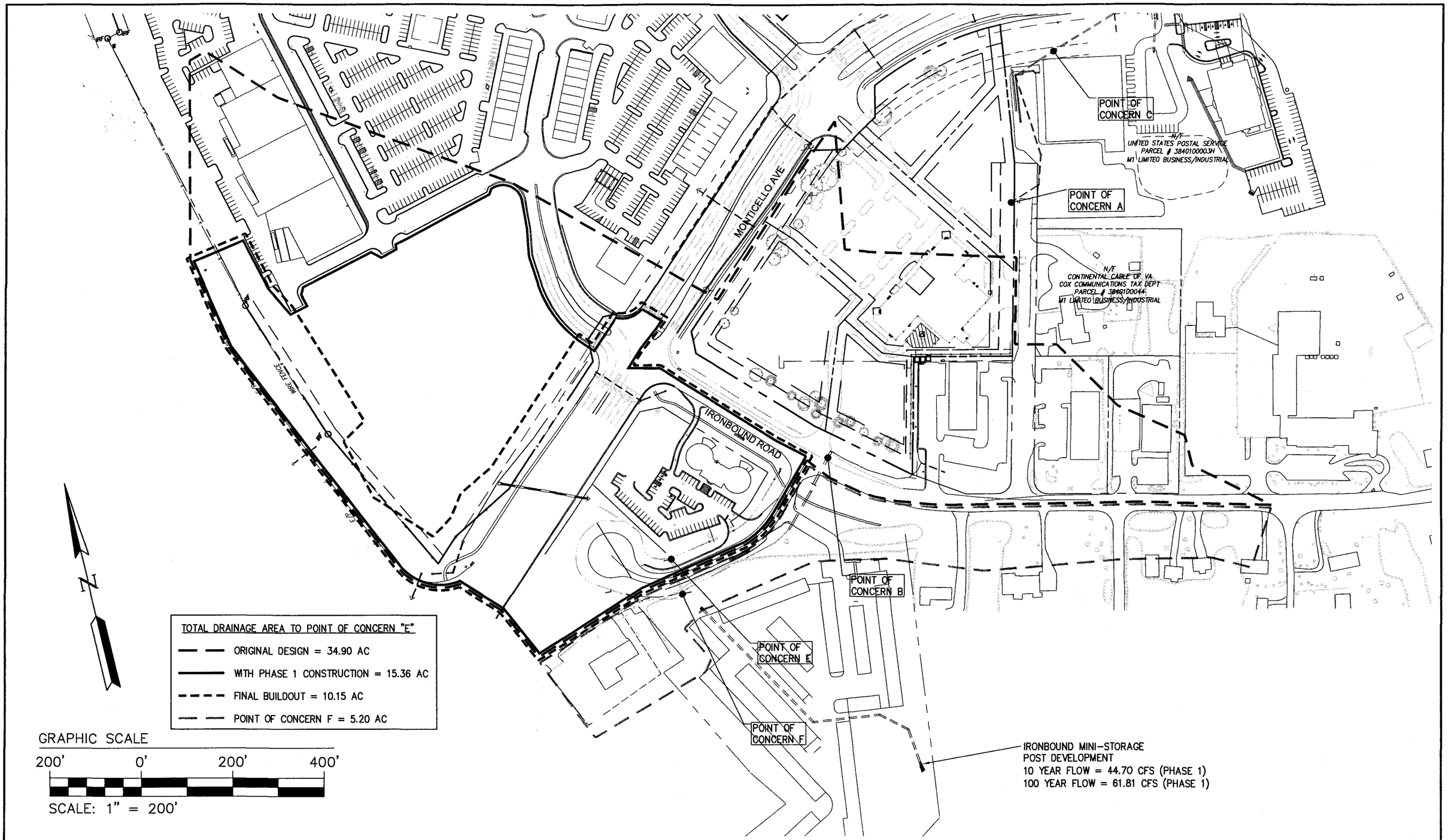
POST-DEVELOPMENT DRAINAGE MAP

COURTHOUSE COMMONS

SHOPPING CENTER

BERKELEY DISTRICT JAMES CITY COUNTY VIRGINIA

Project Contacts:	JAG, AMR
Project Number:	8509-04
Scale: 1"=150'	Date: 8/25/10
Sheet Number	-



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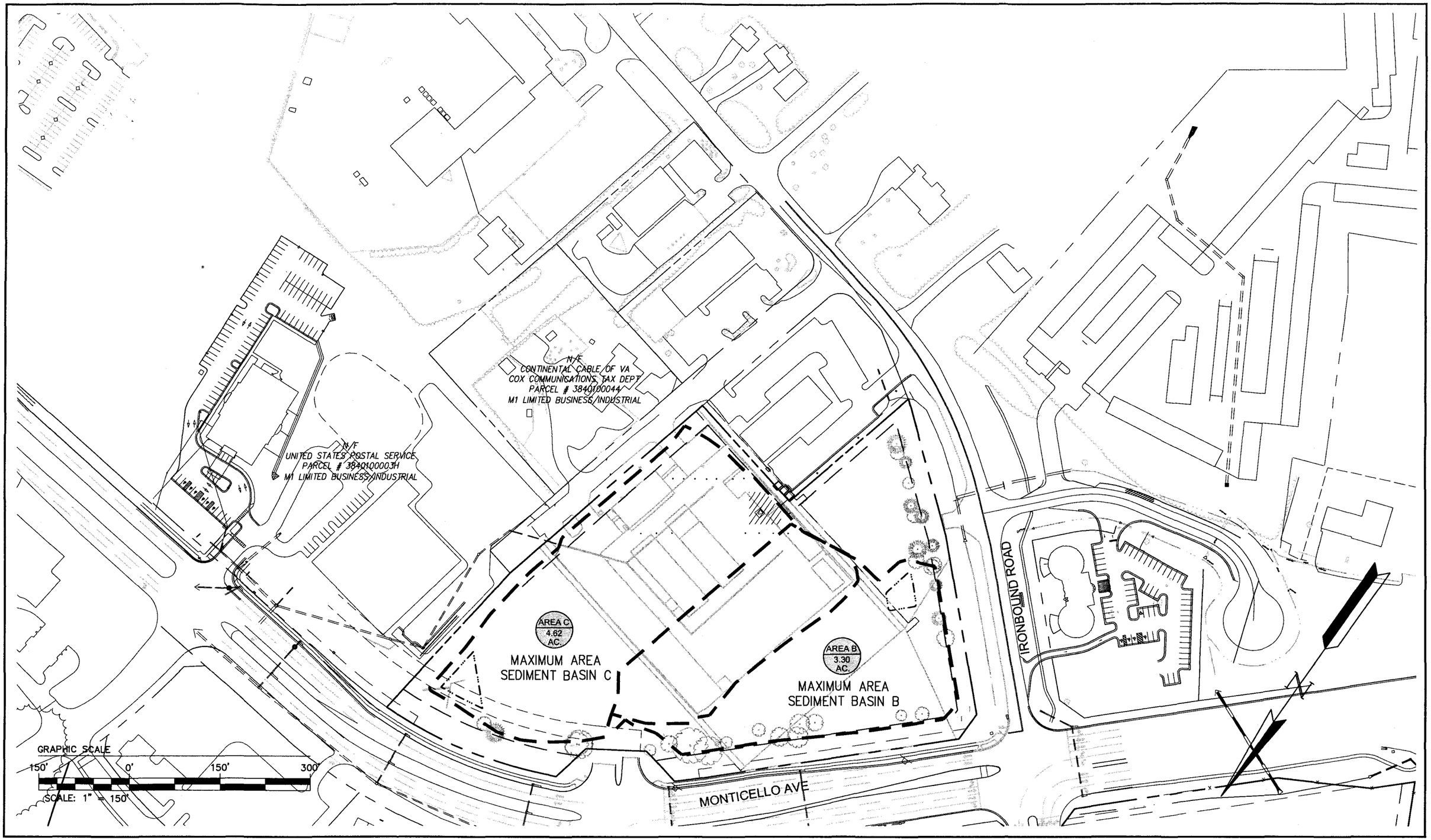
ADJACENT POST-DEVELOPMENT DRAINAGE MAP

COURTHOUSE COMMONS

BERKELEY DISTRICT JAMES CITY COUNTY VIRGINIA

Project Contacts:	JAG, AMR
Project Number:	8509-04
Scale: 1"=200'	Date: 7/13/10
Sheet Number	-



Rev.	Date	Description	Revised By

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SEDIMENT BASIN DRAINAGE MAP

COURHOUSE COMMONS

SHOPPING CENTER

BERKELEY DISTRICT JAMES CITY COUNTY VIRGINIA

Project Contacts:	JAG, AMR
Project Number:	8509-04
Scale: 1"=150'	Date: 8/25/10
Sheet Number	-

7. Reports

Stormwater Management and Drainage Design Report
Courthouse Commons

AES Project Number 8509-04
Revised October 2010

Project Description

New Town Six LLC, through the services of AES Consulting Engineers, has prepared a Site Plan for the development of a 9 acre tract of land in James City County, Virginia. This site is being designed per the approved SUP master plan and in accordance with the current James City County Zoning Ordinance under the M-1 designation. The site at the intersection of Monticello Avenue and Ironbound Road and is bounded along the southeastern side by the private New Quarter Drive.

Description of Site Drainage

The existing site is made up of 6 parcels, of which over 3 acres were developed as a Bell Atlantic/Verizon office with vehicle storage. The remainder of the site is wooded with the exception of the remnants of an old woods road running through the site near the Post Office Parcel. The developed portion of the site current drains into a storm system which drains through the Post Office property, into the Monticello Avenue storm system and discharges uncontrolled into a tributary of the Powhattan Creek. Another 1.5 acres of wooded area on the site drains directly to Monticello Avenue and ultimately into the roadway drainage system. The remainder of the wooded portion of the property drains into the roadside ditch along Ironbound road, and runs through a series of culverts and ultimately discharges through a design 42" by-pass storm pipe under the Ironbound Mini-Storage site to a tributary of Mill Creek.

Stormwater Management/Best Management Practices

The proposed development will be treated through a series of underground and surface infiltration measures to ensure the total runoff leaving the site meets the requirements of the Virginia Stormwater Handbook and James City County BMP Handbook and associated stormwater policies.

The runoff from the grocery/retail building will mainly be captured and directed to an on-site cistern for irrigation reuse. This system will be used for SSC compliance and the overflow will be discharged uncontrolled into the existing storm system through the Post Office site. Additionally the parking to the eastern side and rear of the building will sheet flow and be directed to a bioretention basin. This basin will provide water quality credit towards the JCC 10-point system. The basin is sized to handle additional surface/building runoff from the adjacent undeveloped parcel.

The runoff from the parking area in front of the grocery/retail building will sheet flow to a bioretention basin which will be used for SSC compliance and act as a potential flood control device. The piped overflow from the bioretention will pass through stormwater pretreatment device before entering the proposed underground infiltration basin. This basin is designed to handle the flows from the parking lot and portions of the adjacent **parcel 3** on the corner of the site. The underground infiltration basin will provide water quality credit towards JCC 10-pt system.

Outparcel 3 has been designed to be directed to a surface ponding area before entering a DI-7. The DI-7 will connect to an underground infiltration basin providing water quality credit towards the JCC 10-pt system. Outparcel 2 also will direct surface and building flows into an underground infiltration basin achieving the necessary 10-pt water quality credit.

The remaining 2 out-parcels on the site are planned to be cleared and brought to rough grade. These sites will be treated by erosion and sediment control measures during construction. Upon stabilization of the site we are proposing to install an infiltration basin which ultimately will be converted into a bioretention basin to obtain the required JCC 10-points for the entire development.

10-YEAR STORM		
	Pre-Development	Post-Development
Areas A & C (towards Post Office)	*18.8 CFS*	*0.61 CFS*
Area B (towards Mini-storage)	*15.82 CFS*	***14.49 CFS***

100-YEAR STORM		
	Pre-Development	Post-Development
Areas A & C (towards Post Office)	*25.1 CFS*	*4.55 CFS*
Area B (towards Mini-storage)	*21.55 CFS*	***21.53 CFS***

Special Stormwater Criteria (SSC)

The proposed site falls on the drainage divide of the Powhattan and Mill Creek Watersheds. The Powhattan Creek watershed requires by JCC policy adherence to the Special Stormwater Criteria and by SUP condition that requirement was extended to

include all portions of the site. The SSC requirement is to provide 3 unit measures for the entire site. The following are the SSC measures that are being taken credit for:

- SSCP #8 – Limit the use of underground storm piping = 1 unit
  - Site wide we have tried to sheet flow everything to bioretention areas, eliminating underground pipe networks.
- SSCP #12 – Bioretention Basin (650 sq.ft.) = 1 unit
  - Bioretention Basin B-3 is 1,237 sqft and acts as an upstream treatment measure and flood control for the large parking field in front of the proposed grocery building.
- SSCP #14 – Sumped or Bottomless Inlets = 1/2 unit
  - All inlet structures have a 1-foot sump to collect debris.
- SSCP #15 – Manufactured BMP System = 1 unit
  - A Hanson Stromceptor is proposed upstream of underground Infiltration Basin B-3
- SSCP #29 – Rain barrels /cistern = 1 unit
  - A large 5,000 gallon cistern is proposed to capture runoff from the proposed building roof. Additional cisterns or rain barrels will be considered on future buildings as the site is restricted from using the JCSA water system for irrigation.

Offsite Mini-Storage By-Pass

The Ironbound Mini-storage site has an existing 42" pipe installed with a slope between 2-6% running from the Ironbound cul-de-sac through the site and discharging near the outfall of the mini-storage BMP. This pipe was designed to handle over 40 acres of off-site drainage and safely by-pass the flows during and over a 100-year storm event. These calculations assumed that the offsite parcels would be developed and the resulting flows would impact the site. A large portion of the offsite development (approx 20 acres) was assumed to be developed on what is now the Settler's Market and Walmart @ Settler's Market sites, on the opposite side of Monticello Avenue. With the proposed Settler's Market developments, the run-off from 17 of those 20 acres is being redirected towards on-site BMPs that flow to Powhattan Creek and away from the mini-storage site. Please see the attached displays showing the original design drainage areas and the current proposed and future drainage areas as part of our project and the development of Settler's Market.

The area draining towards the mini-storage located on Ironbound Road will increase with the development; however AES Consulting Engineers has reviewed the drainage areas and downstream conditions to show that they can handle the flows during large storm events (100-year storm event). The downstream system had a large portion of the drainage area removed with the development of Settler's Market (SP-74-06) and will have even more drainage offloaded with the future construction of the Wal-mart controlled parcel (in accordance with approved JCC SP-85-06). With the proposed site improvements the total runoff leaving the site will be reduced below pre-development.

10-YEAR STORM		
	Pre-Development	Post-Development
@ Mini-Storage	*81.53 CFS* (per original design)	*46.58 CFS* (w/o Walmart Improvements)

100-YEAR STORM		
	Pre-Development	Post-Development
@ Mini-Storage	*113.10 CFS* (per original design)	*64.39 CFS* (w/o Walmart Improvements)

Conclusion

Our calculations are currently showing a significant decrease in the drainage area (and flow) towards the Post Office and New Town. The calculations also show a decrease in drainage to the offsite mini-storage area (with a significant reduction in the flow that was original anticipated with the construction of the by-pass pipe). It is our belief that the infiltration based stormwater management plan as presented works to not only meet the requirements of the state and local stormwater requirements but exceeds them in many ways.

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TABLE 3

WORKSHEET FOR BMP POINT SYSTEM
COURTHOUSE COMMON, AES PROJECT No. 8509-04
TOTAL AREA* = 6.12 ACRE(s)

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Drainage Area	BMP Points		Fraction of Site Served by BMP (BMP Drainage Area/Total Area)		Weighted BMP Points
Bioretention A	0.53	10	X	0.087	=	0.87
PC256 UG Infilt. B-1	1.25	10	X	0.204	=	2.04
UG Infilt. B-2	0.43	10	X	0.070	=	0.70
PC257 Infilt.Basin C ***	2.01	10	X	0.328	=	3.28
PC254 UG Infilt. B-3 PC255	1.91	10	X	0.312	=	3.12
			X		=	0.00
			X		=	
			X		=	
		TOTAL WEIGHTED STRUCTURAL BMP POINTS:				10.02

B. NATURAL OPEN SPACE CREDIT

Open Space Area	Fraction of Site (Open Space Area/Total Area)	Natural Open Space Credit		Points for Natural Open Space (Fraction of Site * Natural Open Space Credit %)
0.00	0.00	(0.1 per 1%)	=	
		(0.15 per 1%)	=	
		TOTAL OPEN SPACE POINTS:		0.00

C. TOTAL WEIGHTED POINTS

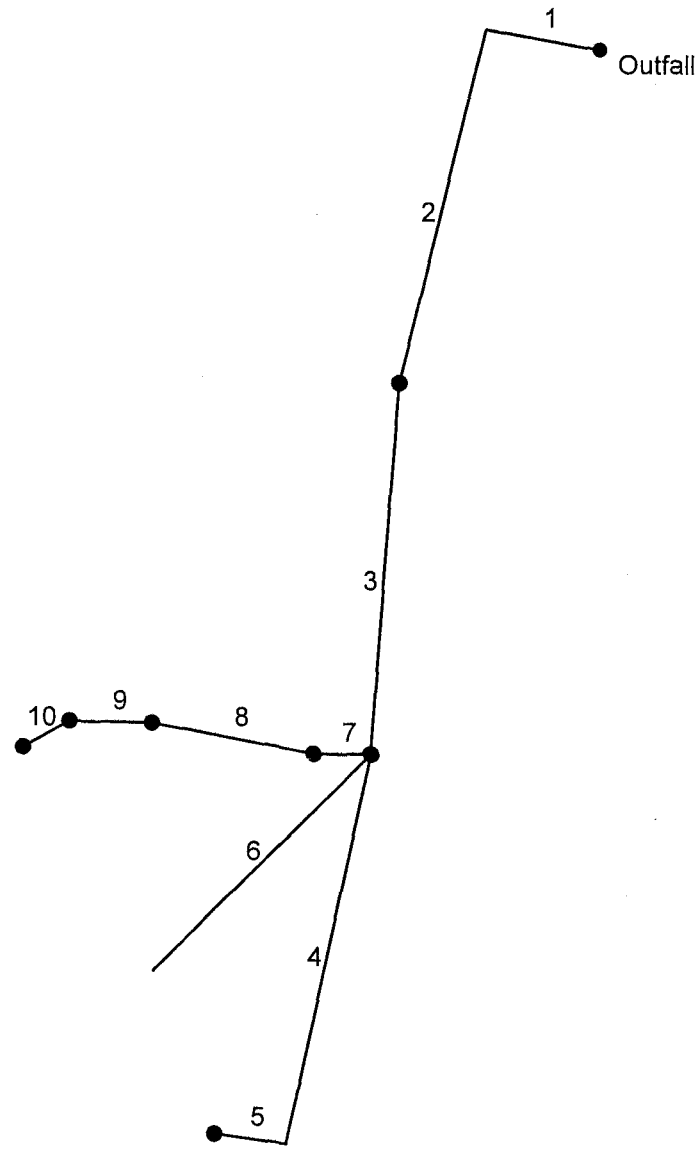
Structural BMP Points		Natural Open Space Points		TOTAL
10.02	+	0.00	=	10.02

Notes:
* The site area was reduced from 9.06 to 6.12 acres. The 6.12 acres excludes the 2.94 acres of existing impervious cover.

** Anticiapted Underground Infiltration to be installed on "restaurant" parcel adjacent to shopping center

*** Proposed Infiltration Basins are anticiapted to be adjusted into undergound facilities with future development. 10-pt calculations prepared to show ability of development to meet JCC minimum requirements going forward.

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Project File: Storm System A (as-built).stm	Number of lines: 10	Date: 4/6/2012

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	123.000	0.00	0.05	0.00	0.00	0.02	5.0	12.1	5.6	0.69	16.40	1.55	18	2.44	85.00	88.00	86.00	88.32	93.00	95.00	C-1
2	1	21.000	0.00	0.00	0.00	0.00	0.00	12.0	12.0	0.0	0.61	6.46	2.91	15	1.00	91.29	91.50	91.55	91.82	95.00	94.00	C-2
3	1	143.000	0.05	0.05	0.30	0.02	0.02	5.0	5.0	7.5	0.11	10.80	1.02	15	2.80	88.00	92.00	88.32	92.13	95.00	97.50	C-3
4	End	52.000	0.00	0.67	0.00	0.00	0.54	5.0	5.9	7.2	3.86	7.70	3.31	15	1.42	91.10	91.84	92.75	92.90	92.00	97.32	C-5
5	4	149.000	0.44	0.67	0.81	0.36	0.54	5.0	5.3	7.4	3.97	7.94	4.16	15	1.51	91.84	94.09	92.92	94.89	97.32	98.53	C-6
6	5	51.000	0.23	0.23	0.79	0.18	0.18	5.0	5.0	7.5	1.36	6.77	2.45	15	1.10	94.09	94.65	94.89	95.12	98.53	99.78	C-7

Project File: Storm System C (as-built).stm

Number of lines: 6

Run Date: 4/6/2012

NOTES:Intensity = 55.52 / (Inlet time + 10.00) ^ 0.74; *Return period* =Yrs. 10 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(In/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	32.000	0.00	0.85	0.00	0.00	0.67	5.0	6.9	6.9	4.58	8.07	5.10	15	1.56	94.63	95.13	95.49	95.99	102.41	99.53	A-1
2	1	104.000	0.00	0.85	0.00	0.00	0.67	0.0	6.5	7.0	4.65	5.59	5.09	15	0.75	95.13	95.91	96.00	96.78	99.53	102.69	A-2
3	2	107.000	0.00	0.85	0.00	0.00	0.67	5.0	6.2	7.1	4.73	7.01	4.94	15	1.18	95.91	97.17	96.87	98.04	102.69	103.27	A-3
4	3	113.000	0.50	0.55	0.86	0.43	0.45	5.0	5.7	7.3	3.25	4.86	3.98	15	0.57	97.17	97.81	98.04	98.53	103.27	101.91	A-4
5	4	20.000	0.05	0.05	0.35	0.02	0.02	5.0	5.0	7.5	0.13	5.80	0.22	12	2.65	97.72	98.25	98.84	98.83	101.91	100.00	A-5
6	3	87.000	0.13	0.13	0.81	0.11	0.11	5.0	5.0	7.5	0.79	1.95	1.47	12	0.30	97.27	97.53	98.04	98.10	103.27	100.00	A-6
7	3	16.000	0.00	0.17	0.00	0.00	0.11	5.0	5.4	7.4	0.84	5.08	2.95	8	17.69	97.17	100.00	98.04	100.43	103.27	103.40	YD
8	7	46.000	0.00	0.17	0.00	0.00	0.11	5.0	5.2	7.4	0.85	2.52	3.53	8	4.35	100.00	102.00	100.43	102.43	103.40	103.30	YD
9	8	23.000	0.00	0.17	0.00	0.00	0.11	5.0	5.1	7.5	0.85	1.38	3.53	8	1.30	102.00	102.30	102.43	102.73	103.30	103.30	YD
10	9	15.000	0.17	0.17	0.67	0.11	0.11	5.0	5.0	7.5	0.85	1.21	3.53	8	1.00	102.30	102.45	102.73	102.89	103.30	103.80	YD

Project File: Storm System A (as-built).stm

Number of lines: 10

Run Date: 4/6/2012

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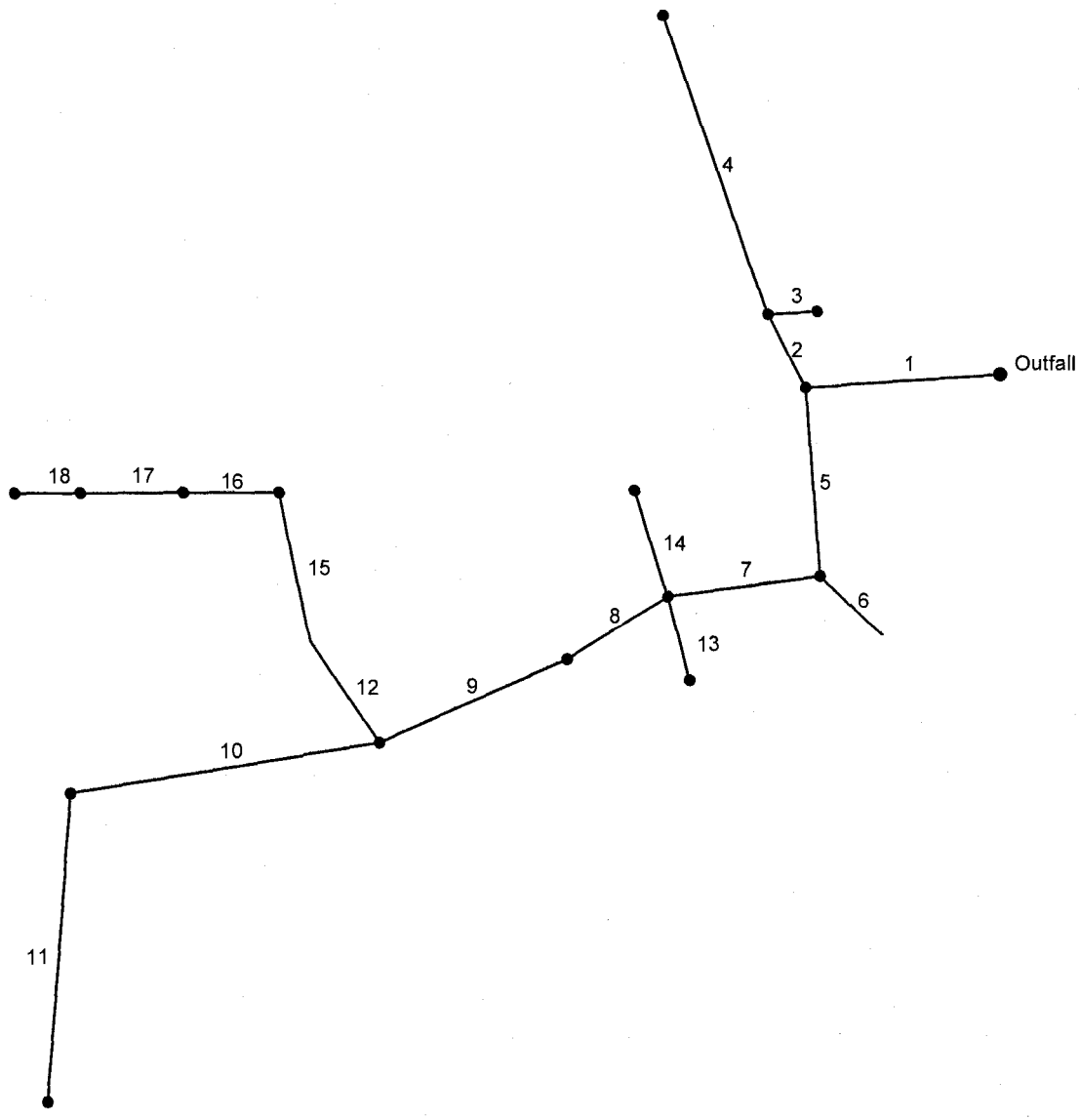
Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Project File: Storm System B (as-built).stm	Number of lines: 18	Date: 4/6/2012

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	83.000	0.00	6.13	0.00	0.00	4.20	0.0	25.5	4.0	20.30	56.70	5.62	36	0.72	93.75	94.35	95.38	95.79	99.99	99.58	B-0
2	1	36.000	0.00	4.87	0.00	0.00	3.43	5.0	25.4	4.0	13.63	49.71	4.93	36	0.56	94.47	94.67	95.79	95.85	99.58	99.49	B-1
3	2	21.000	0.44	0.44	0.75	0.33	0.33	5.0	5.0	7.5	2.47	4.46	2.14	15	0.48	94.69	94.79	95.85	95.87	99.49	98.53	B-2
4	2	137.000	4.43	4.43	0.70	3.10	3.10	25.0	25.0	4.0	12.42	61.09	5.47	30	2.22	94.67	97.71	95.85	98.89	99.49	97.85	B-3
5	1	82.000	0.41	1.26	0.30	0.12	0.77	10.0	18.1	4.7	7.29	28.53	2.58	36	0.18	94.47	94.62	95.79	95.84	99.58	98.99	B-4
6	5	37.000	0.50	0.50	0.82	0.41	0.41	10.0	10.0	6.1	2.48	5.41	2.09	15	0.70	94.62	94.88	95.95	95.99	98.99	98.74	B-5
7	5	65.000	0.00	0.35	0.00	0.00	0.24	5.0	17.6	4.8	4.79	11.22	2.29	24	0.25	94.62	94.78	95.95	95.99	98.99	101.40	B-6
8	7	51.000	0.00	0.35	0.00	0.00	0.24	5.0	16.4	4.9	1.44	9.50	0.70	24	0.18	94.78	94.87	96.08	96.08	101.40	101.18	B-7
9	8	88.000	0.00	0.35	0.00	0.00	0.24	5.0	14.8	5.2	1.50	14.26	0.95	24	0.40	94.87	95.22	96.08	96.09	101.18	101.37	B-8
10	9	134.000	0.00	0.00	0.00	0.00	0.00	5.0	7.3	0.0	0.25	4.71	0.30	18	0.20	95.22	95.49	96.11	96.11	101.37	101.98	B-9
11	10	134.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.25	6.67	0.95	18	0.40	95.49	96.03	96.11	96.25	101.98	100.63	B-10
12	9	52.000	0.11	0.35	0.88	0.10	0.24	5.0	5.9	7.2	1.73	5.45	3.72	15	0.71	96.12	96.49	96.60	97.02	101.37	102.28	B-8.1
13	7	38.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	2.45	8.76	5.05	15	1.84	95.79	96.49	96.24	97.12	101.40	101.33	B-6.1
14	7	48.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.94	8.49	1.56	15	1.73	94.79	95.62	96.08	96.07	101.40	101.23	B-6.3
15	12	67.000	0.00	0.24	0.00	0.00	0.14	5.0	5.6	7.3	1.05	1.21	3.13	8	1.00	96.31	96.98	97.10	97.56	102.28	102.40	YD
16	15	41.000	0.00	0.24	0.00	0.00	0.14	5.0	5.4	7.4	1.06	1.73	3.46	8	2.05	96.98	97.82	97.72	98.31	102.40	102.00	YD
17	16	44.000	0.00	0.24	0.00	0.00	0.14	5.0	5.2	7.4	1.07	0.96	3.07	8	0.64	97.82	98.10	98.49	98.83	102.00	102.30	YD
18	17	28.000	0.24	0.24	0.60	0.14	0.14	5.0	5.0	7.5	1.08	0.85	3.09	8	0.50	98.10	98.24	98.85	99.08	102.30	100.50	YD

Project File: Storm System B (as-built).stm

Number of lines: 18

Run Date: 4/6/2012

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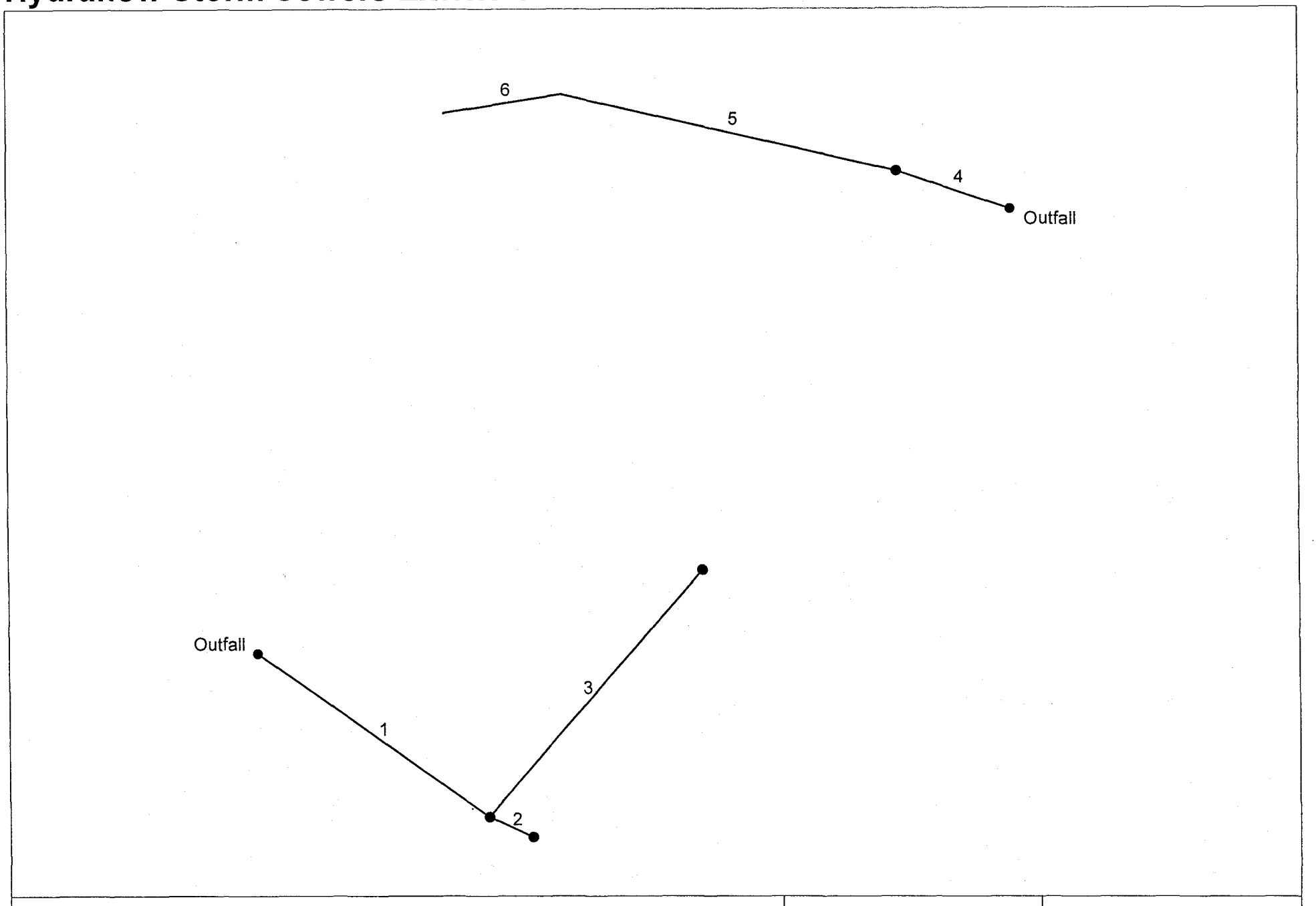

Project File: Storm System C (as-built).stm	Number of lines: 6	Date: 4/6/2012

Stormwater Management and Drainage Design Report
Courthouse Commons

AES Project Number 8509-04
Revised October 2010

Project Description

New Town Six LLC, through the services of AES Consulting Engineers, has prepared a Site Plan for the development of a 9 acre tract of land in James City County, Virginia. This site is being designed per the approved SUP master plan and in accordance with the current James City County Zoning Ordinance under the M-1 designation. The site at the intersection of Monticello Avenue and Ironbound Road and is bounded along the southeastern side by the private New Quarter Drive.

Description of Site Drainage

The existing site is made up of 6 parcels, of which over 3 acres were developed as a Bell Atlantic/Verizon office with vehicle storage. The remainder of the site is wooded with the exception of the remnants of an old woods road running through the site near the Post Office Parcel. The developed portion of the site current drains into a storm system which drains through the Post Office property, into the Monticello Avenue storm system and discharges uncontrolled into a tributary of the Powhattan Creek. Another 1.5 acres of wooded area on the site drains directly to Monticello Avenue and ultimately into the roadway drainage system. The remainder of the wooded portion of the property drains into the roadside ditch along Ironbound road, and runs through a series of culverts and ultimately discharges through a design 42" by-pass storm pipe under the Ironbound Mini-Storage site to a tributary of Mill Creek.

Stormwater Management/Best Management Practices

The proposed development will be treated through a series of underground and surface infiltration measures to ensure the total runoff leaving the site meets the requirements of the Virginia Stormwater Handbook and James City County BMP Handbook and associated stormwater policies.

The runoff from the grocery/retail building will mainly be captured and directed to an on-site cistern for irrigation reuse. This system will be used for SSC compliance and the overflow will be discharged uncontrolled into the existing storm system through the Post Office site. Additionally the parking to the eastern side and rear of the building will sheet flow and be directed to a bioretention basin. This basin will provide water quality credit towards the JCC 10-point system. The basin is sized to handle additional surface/building runoff from the adjacent undeveloped parcel.

The runoff from the parking area in front of the grocery/retail building will sheet flow to a bioretention basin which will be used for SSC compliance and act as a potential flood control device. The piped overflow from the bioretention will pass through stormwater pretreatment device before entering the proposed underground infiltration basin. This basin is designed to handle the flows from the parking lot and portions of the adjacent **parcel 3** on the corner of the site. The underground infiltration basin will provide water quality credit towards JCC 10-pt system.

Outparcel 3 has been designed to be directed to a surface ponding area before entering a DI-7. The DI-7 will connect to an underground infiltration basin providing water quality credit towards the JCC 10-pt system. Outparcel 2 also will direct surface and building flows into an underground infiltration basin achieving the necessary 10-pt water quality credit.

The remaining 2 out-parcels on the site are planned to be cleared and brought to rough grade. These sites will be treated by erosion and sediment control measures during construction. Upon stabilization of the site we are proposing to install an infiltration basin which ultimately will be converted into a bioretention basin to obtain the required JCC 10-points for the entire development.

10-YEAR STORM		
	Pre-Development	Post-Development
Areas A & C (towards Post Office)	*18.8 CFS*	*0.61 CFS*
Area B (towards Mini-storage)	*15.82 CFS*	***14.49 CFS***

100-YEAR STORM		
	Pre-Development	Post-Development
Areas A & C (towards Post Office)	*25.1 CFS*	*4.55 CFS*
Area B (towards Mini-storage)	*21.55 CFS*	***21.53 CFS***

Special Stormwater Criteria (SSC)

The proposed site falls on the drainage divide of the Powhattan and Mill Creek Watersheds. The Powhattan Creek watershed requires by JCC policy adherence to the Special Stormwater Criteria and by SUP condition that requirement was extended to

include all portions of the site. The SSC requirement is to provide 3 unit measures for the entire site. The following are the SSC measures that are being taken credit for:

- SSCP #8 – Limit the use of underground storm piping = 1 unit
  - Site wide we have tried to sheet flow everything to bioretention areas, eliminating underground pipe networks.
- SSCP #12 – Bioretention Basin (650 sq.ft.) = 1 unit
  - Bioretention Basin B-3 is 1,237 sqft and acts as an upstream treatment measure and flood control for the large parking field in front of the proposed grocery building.
- SSCP #14 – Sumped or Bottomless Inlets = 1/2 unit
  - All inlet structures have a 1-foot sump to collect debris.
- SSCP #15 – Manufactured BMP System = 1 unit
  - A Hanson Stromceptor is proposed upstream of underground Infiltration Basin B-3
- SSCP #29 – Rain barrels /cistern = 1 unit
  - A large 5,000 gallon cistern is proposed to capture runoff from the proposed building roof. Additional cisterns or rain barrels will be considered on future buildings as the site is restricted from using the JCSA water system for irrigation.

Offsite Mini-Storage By-Pass

The Ironbound Mini-storage site has an existing 42" pipe installed with a slope between 2-6% running from the Ironbound cul-de-sac through the site and discharging near the outfall of the mini-storage BMP. This pipe was designed to handle over 40 acres of off-site drainage and safely by-pass the flows during and over a 100-year storm event. These calculations assumed that the offsite parcels would be developed and the resulting flows would impact the site. A large portion of the offsite development (approx 20 acres) was assumed to be developed on what is now the Settler's Market and Walmart @ Settler's Market sites, on the opposite side of Monticello Avenue. With the proposed Settler's Market developments, the run-off from 17 of those 20 acres is being redirected towards on-site BMPs that flow to Powhattan Creek and away from the mini-storage site. Please see the attached displays showing the original design drainage areas and the current proposed and future drainage areas as part of our project and the development of Settler's Market.

The area draining towards the mini-storage located on Ironbound Road will increase with the development; however AES Consulting Engineers has reviewed the drainage areas and downstream conditions to show that they can handle the flows during large storm events (100-year storm event). The downstream system had a large portion of the drainage area removed with the development of Settler's Market (SP-74-06) and will have even more drainage offloaded with the future construction of the Wal-mart controlled parcel (in accordance with approved JCC SP-85-06). With the proposed site improvements the total runoff leaving the site will be reduced below pre-development.

10-YEAR STORM		
	Pre-Development	Post-Development
@ Mini-Storage	*81.53 CFS* (per original design)	*46.58 CFS* (w/o Walmart Improvements)

100-YEAR STORM		
	Pre-Development	Post-Development
@ Mini-Storage	*113.10 CFS* (per original design)	*64.39 CFS* (w/o Walmart Improvements)

Conclusion

Our calculations are currently showing a significant decrease in the drainage area (and flow) towards the Post Office and New Town. The calculations also show a decrease in drainage to the offsite mini-storage area (with a significant reduction in the flow that was original anticipated with the construction of the by-pass pipe). It is our belief that the infiltration based stormwater management plan as presented works to not only meet the requirements of the state and local stormwater requirements but exceeds them in many ways.

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COURTHOUSE COMMON, AES PROJECT No. 8509-04
TOTAL AREA* = 6.12 ACRE(s)

A. STRUCTURAL BMP POINT ALLOCATION

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PC256	UG Infilt. B-1	1.25	10	X	0.204	=	2.04
	UG Infilt. B-2	0.43	10	X	0.070	=	0.70
PC257	Infilt.Basin C ***	2.01	10	X	0.328	=	3.28
PC254	UG Infilt. B-3 PC255	1.91	10	X	0.312	=	3.12
				X		=	0.00
				X		=	
				X		=	
			TOTAL WEIGHTED STRUCTURAL BMP POINTS:				10.02

B. NATURAL OPEN SPACE CREDIT

Open Space Area	Fraction of Site (Open Space Area/Total Area)	Natural Open Space Credit		Points for Natural Open Space (Fraction of Site * Natural Open Space Credit %)
0.00	0.00	(0.1 per 1%)	=	
		(0.15 per 1%)	=	
		TOTAL OPEN SPACE POINTS:		0.00

C. TOTAL WEIGHTED POINTS

10.02	+	0.00	=	10.02
Structural BMP Points		Natural Open Space Points		TOTAL

Notes:
* The site area was reduced from 9.06 to 6.12 acres. The 6.12 acres excludes the 2.94 acres of existing impervious cover.

** Anticiapted Underground Infiltration to be installed on "restaurant" parcel adjacent to shopping center

*** Proposed Infiltration Basins are anticiapted to be adjusted into undergound facilities with future development. 10-pt calculations prepared to show ability of development to meet JCC minimum requirements going forward.

AES
CONSULTING ENGINEERS

Project:	**Courthouse Common**
Project No.:	**8509-04**
Subject:	**Water Quality Volume**
	Bioretention B-1
Date:	**2/18/2010**
Calculated By:	**AMR**

BMP Type = **Bioretention B-1**

Water Quality Volume = 0.5 in. x **0.92** acres of impervious coverage

= (0.5 / 12) x (43,560 x **0.92**)

= **1670** CF

Total Storage Volume Required = **1** x Water Quality Volume

= **1** x **1670**

= **1669.8** CF @ 100.50 = 2,090 CF Storage Provided

** Bioretention used for SSC Complaince and not JCC 10-pt

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Tuesday, Nov 23, 2010

Pond No. 8 - Bioretention B-1

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 99.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	99.00	1,003	0	0
0.50	99.50	1,243	560	560
1.00	100.00	1,482	680	1,241
1.50	100.50	1,738	804	2,045
2.00	101.00	1,994	932	2,977

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 97.00	0.00	0.00	0.00
Length (ft)	= 23.00	0.00	0.00	0.00
Slope (%)	= 1.32	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

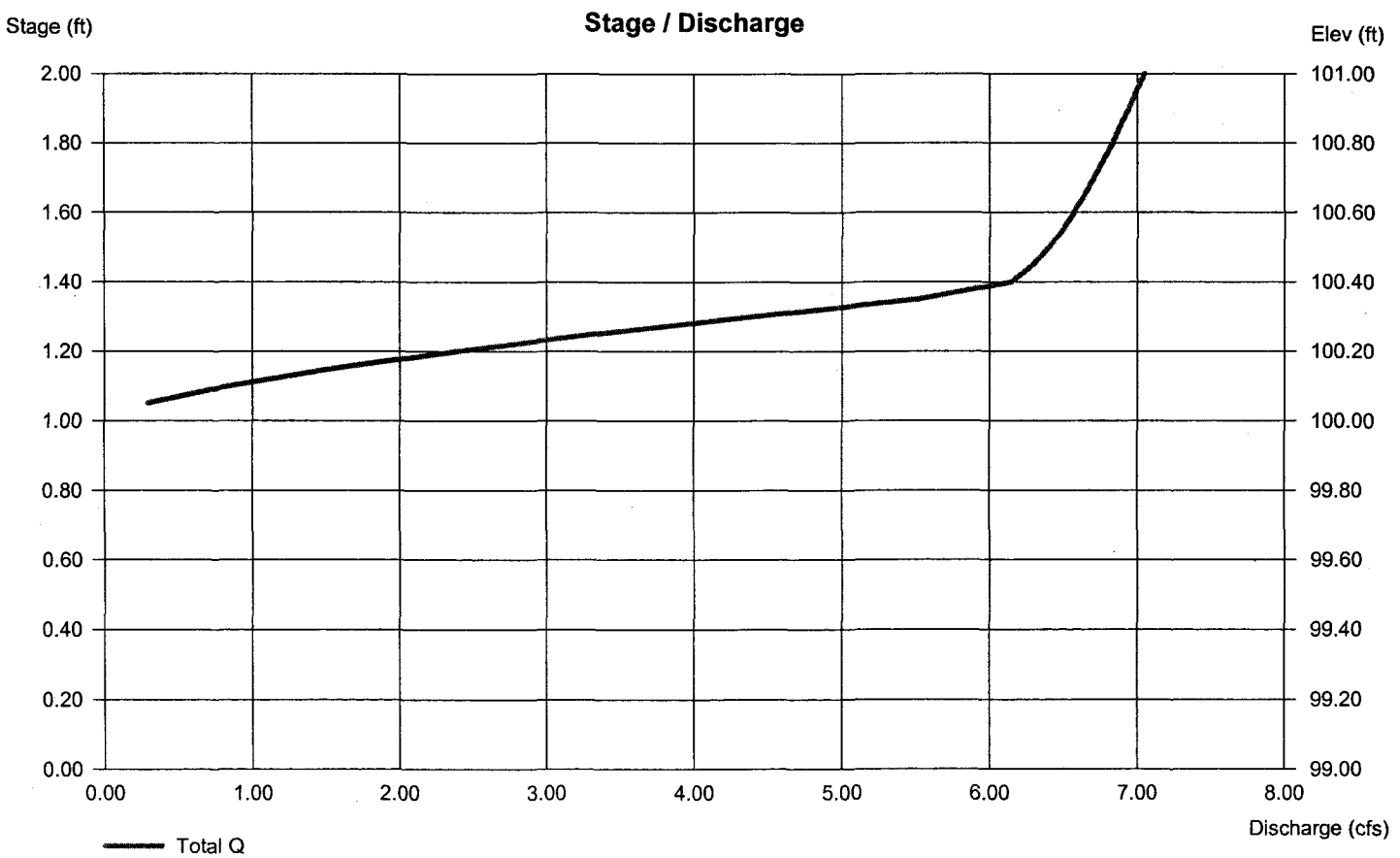
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 100.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Report

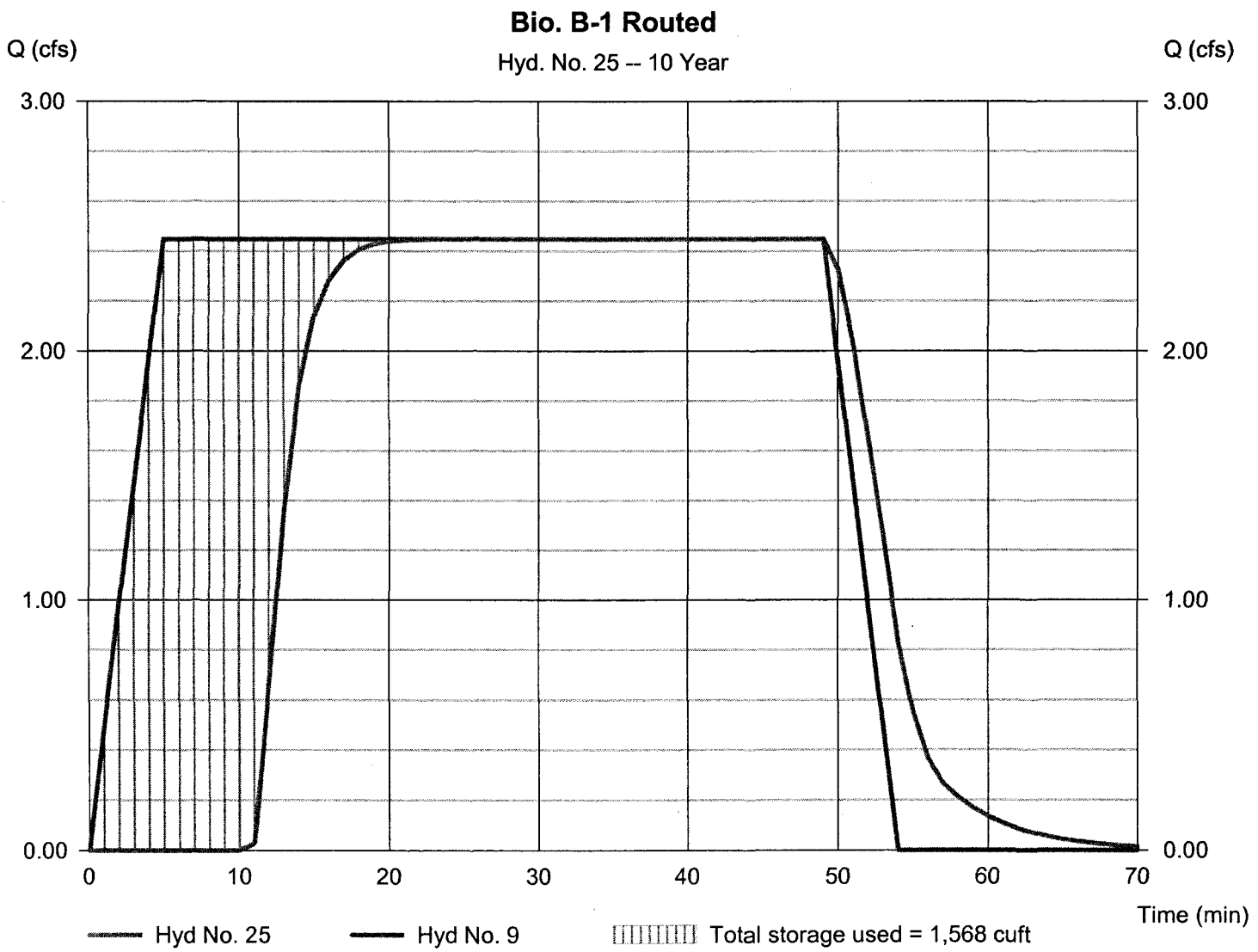
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Nov 23, 2010

Hyd. No. 25

Bio. B-1 Routed

Hydrograph type	= Reservoir	Peak discharge	= 2.449 cfs
Storm frequency	= 10 yrs	Time to peak	= 32 min
Time interval	= 1 min	Hyd. volume	= 5,959 cuft
Inflow hyd. No.	= 9 - Area B-6.2	Max. Elevation	= 100.20 ft
Reservoir name	= Bioretention B-1	Max. Storage	= 1,568 cuft

Storage Indication method used.



Hydrograph Report

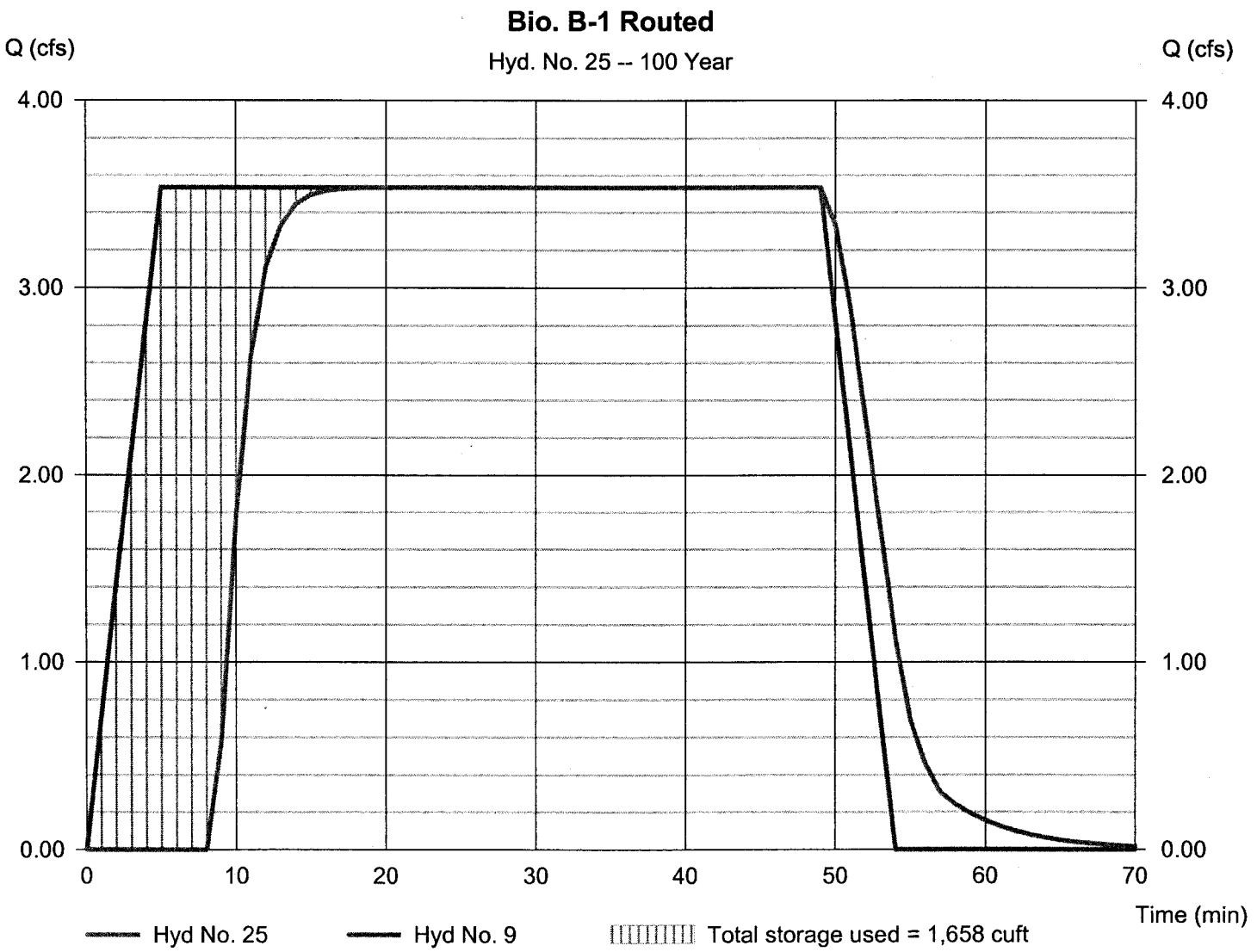
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Nov 23, 2010

Hyd. No. 25

Bio. B-1 Routed

Hydrograph type	= Reservoir	Peak discharge	= 3.536 cfs
Storm frequency	= 100 yrs	Time to peak	= 28 min
Time interval	= 1 min	Hyd. volume	= 9,154 cuft
Inflow hyd. No.	= 9 - Area B-6.2	Max. Elevation	= 100.26 ft
Reservoir name	= Bioretention B-1	Max. Storage	= 1,658 cuft

Storage Indication method used.



AES
CONSULTING ENGINEERS

Project:	**Courthouse Common**
Project No.:	**8509-04**
Subject:	**Water Quality Volume**
	Bioretention B-3
Date:	**2/18/2010**
Calculated By:	**AMR**

PC-255

BMP Type = **Bioretention B-3**

Water Quality Volume = 0.5 in. x **1.5** acres of impervious coverage

= (0.5 / 12) x (43,560 x **1.5**)

= **2723** CF

Total Storage Volume Required = **1** x Water Quality Volume

= **1** x **2723**

= **2722.5** CF @ 100.00 = 2,738 CF Storage Provided

** Bioretention used for SSC Complaince and not JCC 10-pt

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Tuesday, Nov 23, 2010

Pond No. 9 - Bioretention B-3

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 99.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	99.00	2,220	0	0
0.50	99.50	2,738	1,237	1,237
1.00	100.00	3,275	1,501	2,738
1.50	100.50	4,000	1,816	4,554
2.00	101.00	10,000	3,387	7,941

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 96.50	0.00	0.00	0.00
Length (ft)	= 38.00	0.00	0.00	0.00
Slope (%)	= 1.00	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

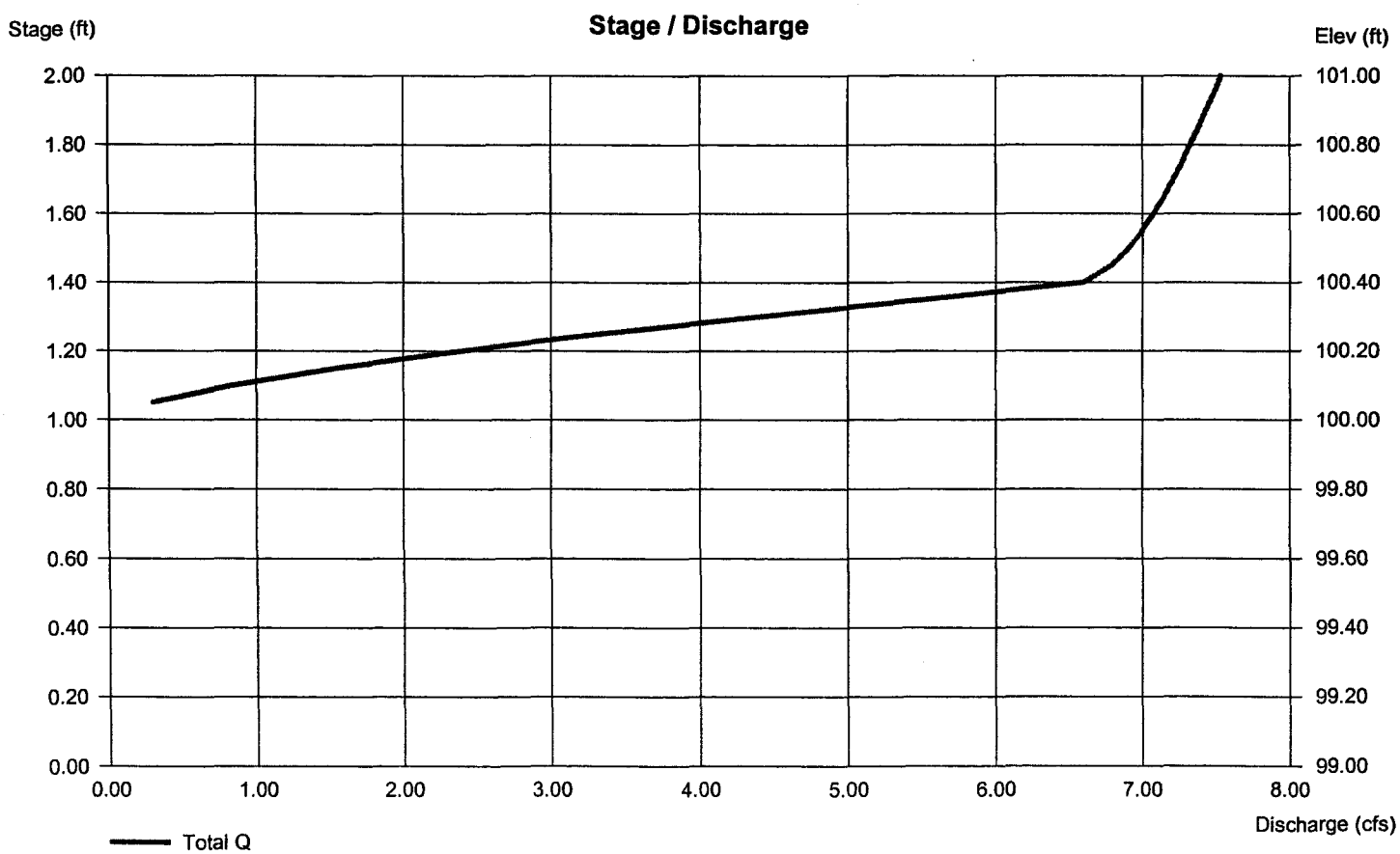
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 100.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Report

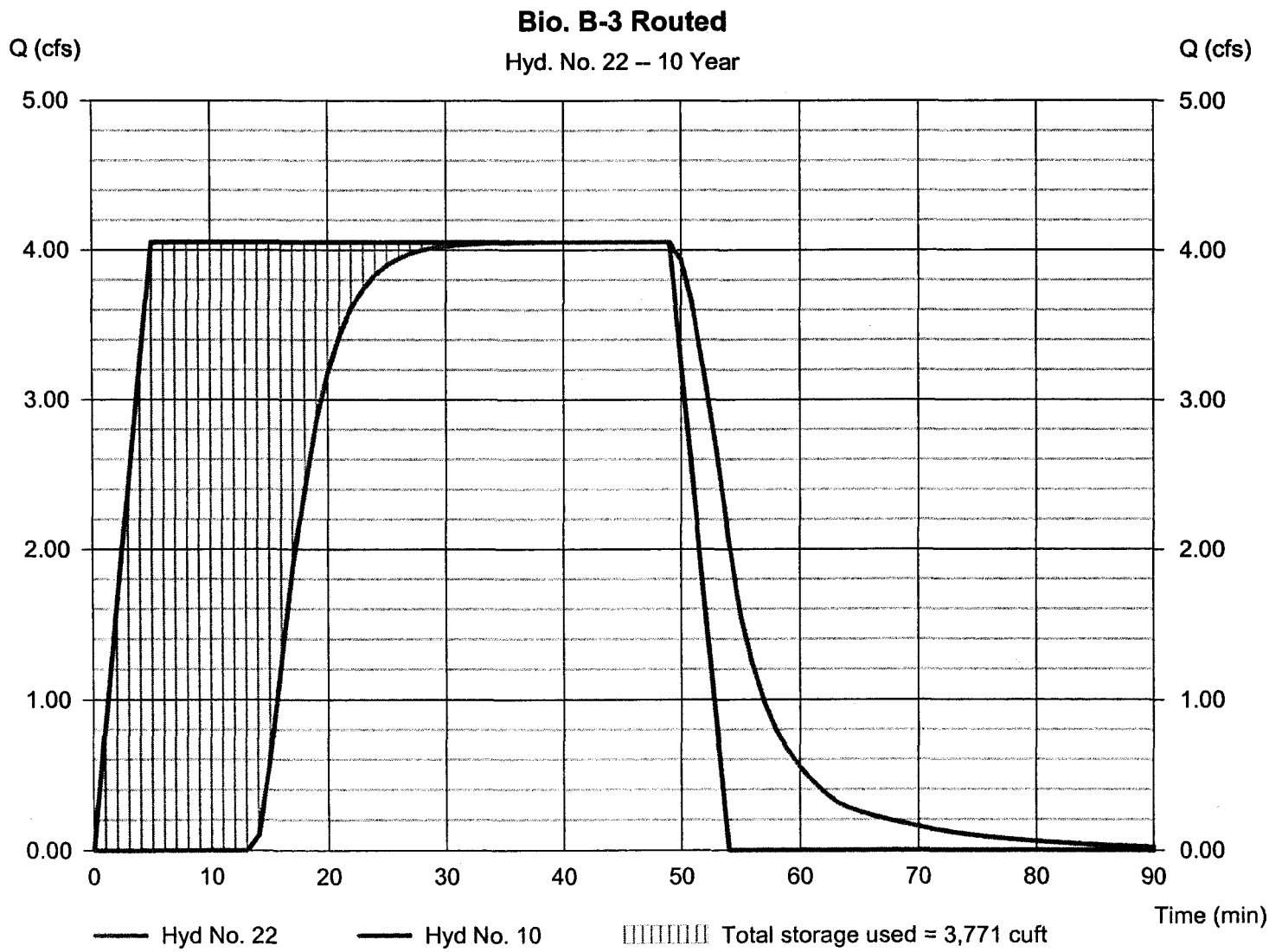
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 — Friday, Oct 15, 2010

Hyd. No. 22

Bio. B-3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 4.054 cfs
Storm frequency	= 10 yrs	Time to peak	= 49 min
Time interval	= 1 min	Hyd. volume	= 9,179 cuft
Inflow hyd. No.	= 10 - Area B-11	Max. Elevation	= 100.28 ft
Reservoir name	= Bioretention B-3	Max. Storage	= 3,771 cuft

Storage Indication method used.



Hydrograph Report

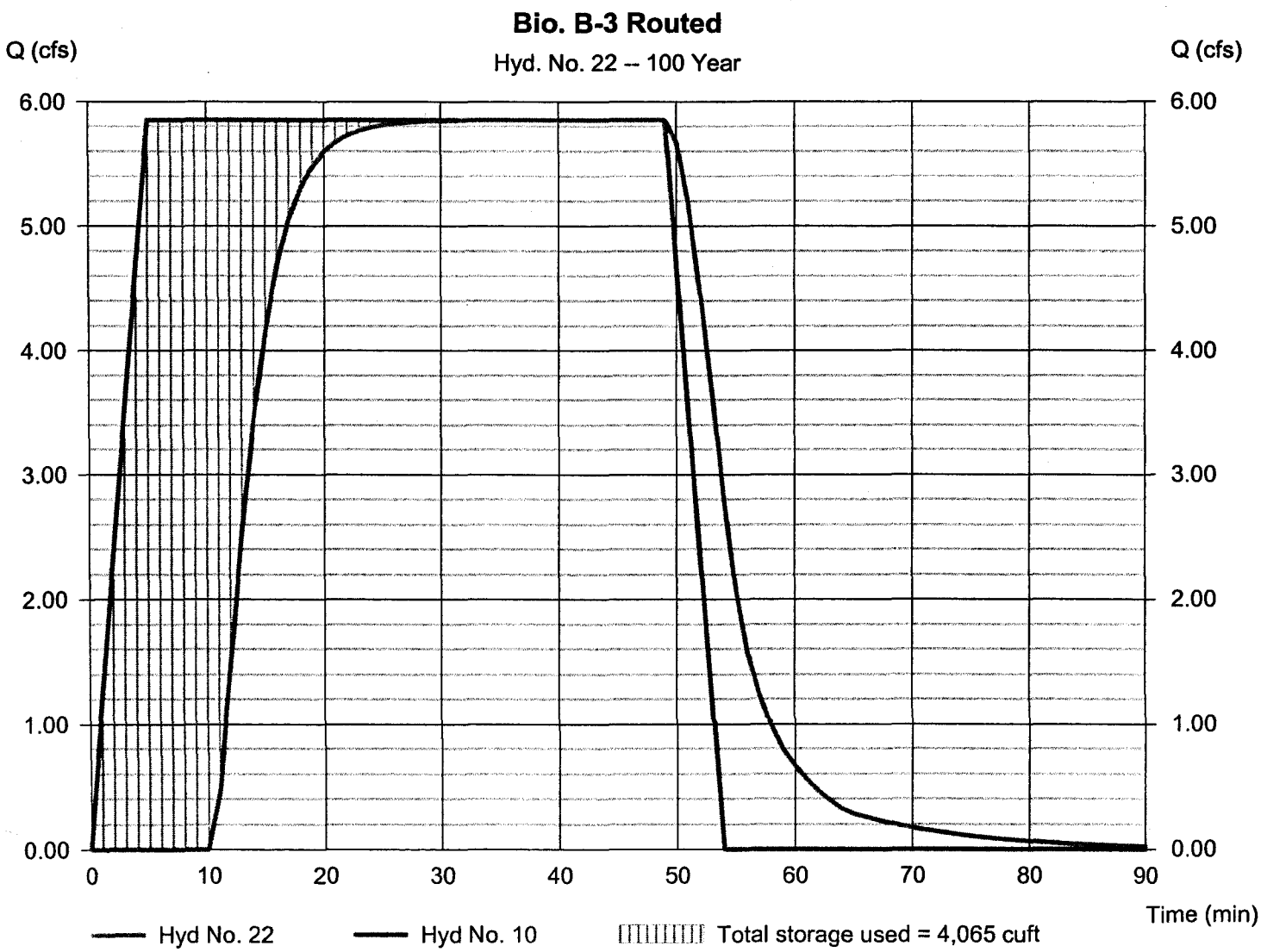
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Oct 15, 2010

Hyd. No. 22

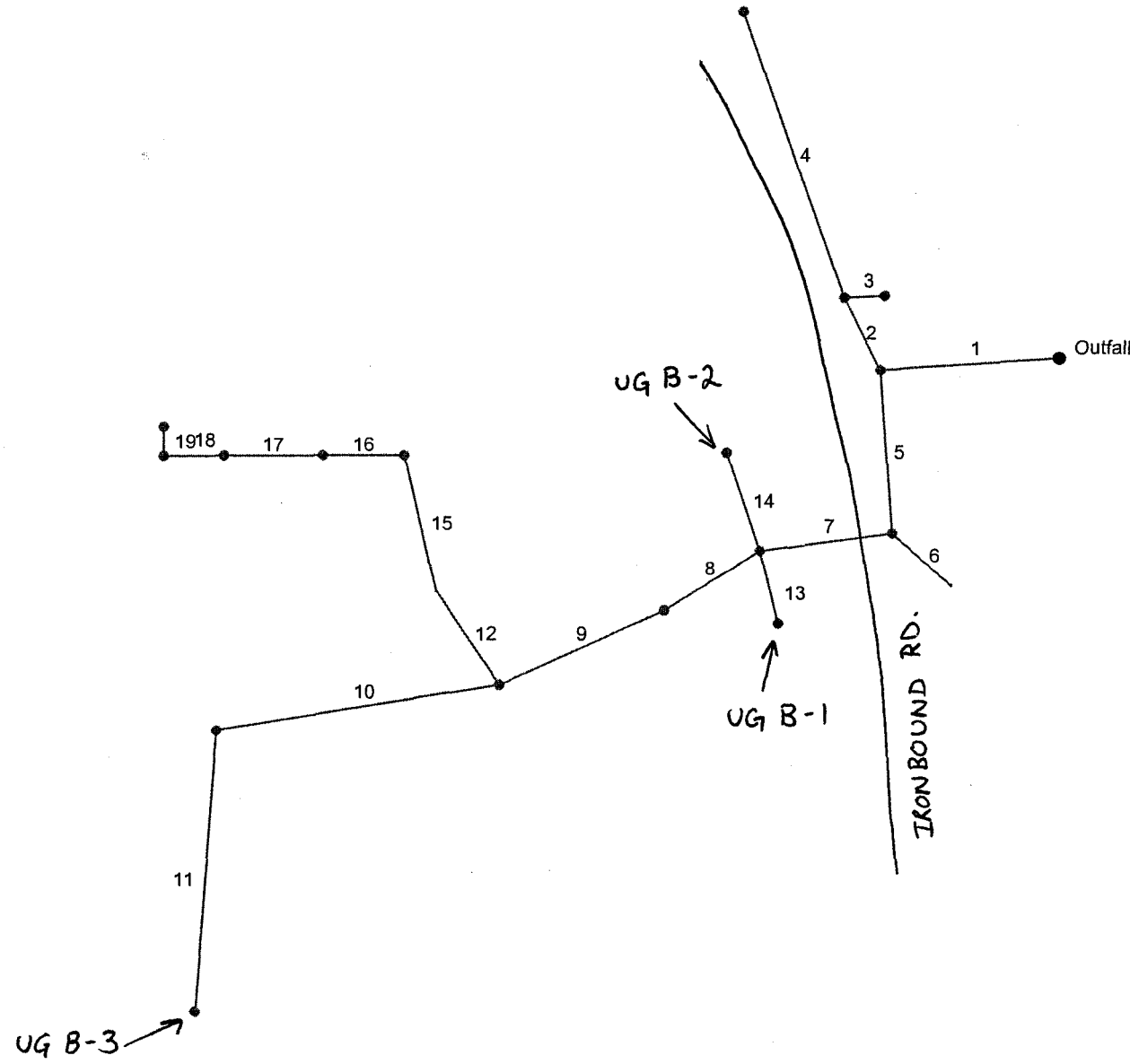
Bio. B-3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 5.853 cfs
Storm frequency	= 100 yrs	Time to peak	= 49 min
Time interval	= 1 min	Hyd. volume	= 14,468 cuft
Inflow hyd. No.	= 10 - Area B-11	Max. Elevation	= 100.37 ft
Reservoir name	= Bioretention B-3	Max. Storage	= 4,065 cuft

Storage Indication method used.



Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2009 Plan



Project File: Storm System B 10YR.stm	Number of lines: 19	Date: 11-23-2010

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	83.000	0.00	6.13	0.00	0.00	4.20	0.0	26.0	3.9	20.13	56.70	5.59	36	0.72	93.75	94.35	95.38	95.78	99.99	99.58	B-0
2	1	39.000	0.00	4.87	0.00	0.00	3.43	5.0	25.8	3.9	13.52	33.77	4.15	36	0.26	94.35	94.45	95.78	95.84	99.58	99.50	B-1
3	2	19.000	0.44	0.44	0.75	0.33	0.33	5.0	5.0	7.5	2.47	3.31	2.02	15	0.26	94.45	94.50	96.12	96.14	99.50	98.45	B-2
4	2	144.000	4.43	4.43	0.70	3.10	3.10	25.0	25.0	4.0	12.42	62.55	4.58	30	2.33	94.50	97.85	96.12	99.03	99.50	97.85	B-3
5	1	78.000	0.41	1.26	0.30	0.12	0.77	10.0	10.2	6.0	8.29	33.77	2.71	36	0.26	94.35	94.55	95.78	95.81	99.58	98.90	B-4
6	5	37.000	0.50	0.50	0.82	0.41	0.41	10.0	10.0	6.1	2.48	3.18	2.02	15	0.24	94.59	94.68	95.95	96.00	98.90	98.60	B-5
7	5	63.000	0.00	0.35	0.00	0.00	0.24	5.0	7.3	6.8	5.27	11.40	2.37	24	0.25	94.55	94.71	95.95	95.98	98.90	101.30	B-6
8	7	53.000	0.00	0.35	0.00	0.00	0.24	5.0	7.0	6.8	1.90	11.20	0.88	24	0.25	94.71	94.84	96.08	96.08	101.30	100.15	B-7
9	8	85.000	0.00	0.35	0.00	0.00	0.24	5.0	6.5	7.0	1.93	11.24	1.05	24	0.25	94.84	95.05	96.09	96.10	100.15	101.27	B-8
10	9	134.000	0.00	0.00	0.00	0.00	0.00	5.0	5.7	0.0	0.25	5.29	0.24	18	0.25	95.05	95.39	96.12	96.12	101.27	101.92	B-9
11	10	134.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.25	7.09	0.86	18	0.46	95.39	96.00	96.12	96.23	101.92	100.67	B-10
12	9	53.000	0.11	0.35	0.88	0.10	0.24	5.0	6.1	7.1	1.72	4.52	3.43	15	0.49	96.05	96.31	96.58	96.84	101.27	102.17	B-8.1
13	7	36.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	2.45	9.32	5.19	15	2.08	95.75	96.50	96.19	97.13	101.30	101.25	B-6.1
14	7	49.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.94	7.99	1.23	15	1.53	94.75	95.50	96.08	96.08	101.30	100.94	B-6.3
15	12	67.000	0.00	0.24	0.00	0.00	0.14	5.0	5.7	7.2	1.04	6.46	2.37	15	1.00	96.31	96.98	96.92	97.39	102.17	102.40	YD
16	15	38.000	0.00	0.24	0.00	0.00	0.14	0.0	5.5	7.3	1.05	3.56	3.35	12	1.00	96.98	97.36	97.39	97.80	102.40	102.20	YD
17	16	46.000	0.00	0.24	0.00	0.00	0.14	5.0	5.2	7.4	1.07	3.56	3.24	12	1.00	97.36	97.82	97.80	98.26	102.20	102.00	YD
18	17	28.000	0.00	0.24	0.00	0.00	0.14	5.0	5.1	7.5	1.08	3.56	3.24	12	1.00	97.82	98.10	98.26	98.54	102.00	100.50	YD
19	18	14.000	0.24	0.24	0.60	0.14	0.14	5.0	5.0	7.5	1.08	3.56	3.24	12	1.00	98.10	98.24	98.54	98.68	100.50	100.00	YD

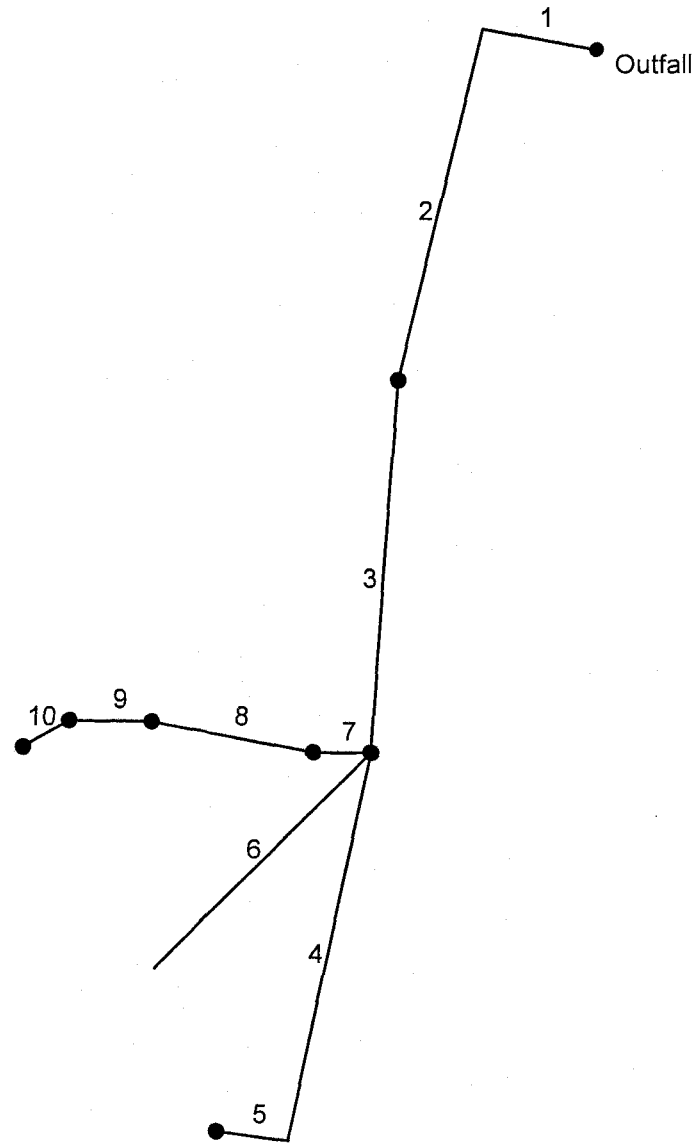
Project File: Storm System B 10YR.stm

Number of lines: 19

Run Date: 11-23-2010

NOTES: Intensity = 55.52 / (Inlet time + 10.00) ^ 0.74; Return period = 10 Yrs. ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Project File: Storm System A (as-built).stm	Number of lines: 10	Date: 4/6/2012

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	32.000	0.00	0.85	0.00	0.00	0.67	5.0	6.9	6.9	4.58	8.07	5.10	15	1.56	94.63	95.13	95.49	95.99	102.41	99.53	A-1
2	1	104.000	0.00	0.85	0.00	0.00	0.67	0.0	6.5	7.0	4.65	5.59	5.09	15	0.75	95.13	95.91	96.00	96.78	99.53	102.69	A-2
3	2	107.000	0.00	0.85	0.00	0.00	0.67	5.0	6.2	7.1	4.73	7.01	4.94	15	1.18	95.91	97.17	96.87	98.04	102.69	103.27	A-3
4	3	113.000	0.50	0.55	0.86	0.43	0.45	5.0	5.7	7.3	3.25	4.86	3.98	15	0.57	97.17	97.81	98.04	98.53	103.27	101.91	A-4
5	4	20.000	0.05	0.05	0.35	0.02	0.02	5.0	5.0	7.5	0.13	5.80	0.22	12	2.65	97.72	98.25	98.84	98.83	101.91	100.00	A-5
6	3	87.000	0.13	0.13	0.81	0.11	0.11	5.0	5.0	7.5	0.79	1.95	1.47	12	0.30	97.27	97.53	98.04	98.10	103.27	100.00	A-6
7	3	16.000	0.00	0.17	0.00	0.00	0.11	5.0	5.4	7.4	0.84	5.08	2.95	8	17.69	97.17	100.00	98.04	100.43	103.27	103.40	YD
8	7	46.000	0.00	0.17	0.00	0.00	0.11	5.0	5.2	7.4	0.85	2.52	3.53	8	4.35	100.00	102.00	100.43	102.43	103.40	103.30	YD
9	8	23.000	0.00	0.17	0.00	0.00	0.11	5.0	5.1	7.5	0.85	1.38	3.53	8	1.30	102.00	102.30	102.43	102.73	103.30	103.30	YD
10	9	15.000	0.17	0.17	0.67	0.11	0.11	5.0	5.0	7.5	0.85	1.21	3.53	8	1.00	102.30	102.45	102.73	102.89	103.30	103.80	YD

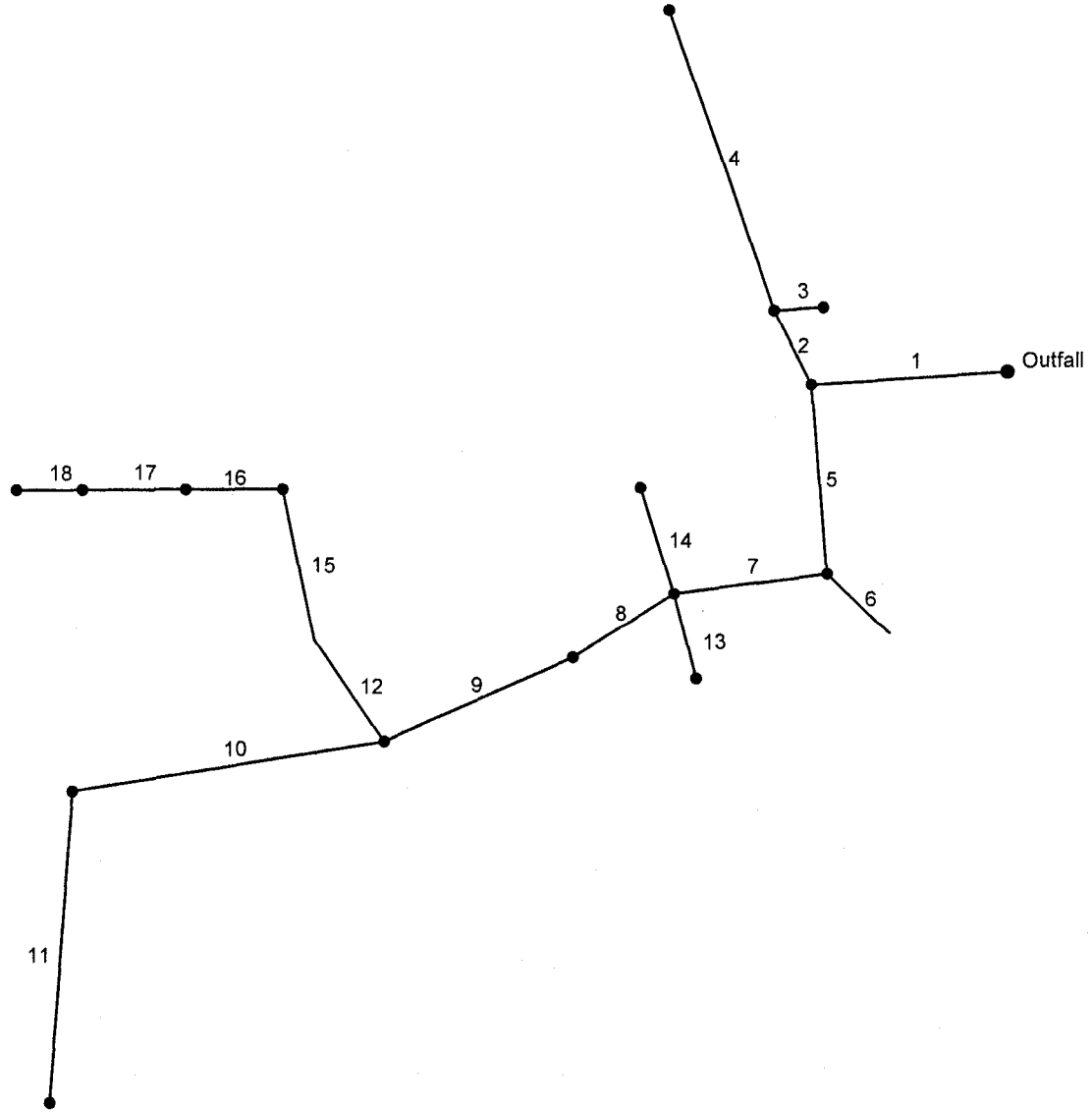
Project File: Storm System A (as-built).stm

Number of lines: 10

Run Date: 4/6/2012

NOTES:Intensity = 55.52 / (Inlet time + 10.00) ^ 0.74; Return period =Yrs. 10 ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Project File: Storm System B (as-built).stm	Number of lines: 18	Date: 4/6/2012

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	83.000	0.00	6.13	0.00	0.00	4.20	0.0	25.5	4.0	20.30	56.70	5.62	36	0.72	93.75	94.35	95.38	95.79	99.99	99.58	B-0
2	1	36.000	0.00	4.87	0.00	0.00	3.43	5.0	25.4	4.0	13.63	49.71	4.93	36	0.56	94.47	94.67	95.79	95.85	99.58	99.49	B-1
3	2	21.000	0.44	0.44	0.75	0.33	0.33	5.0	5.0	7.5	2.47	4.46	2.14	15	0.48	94.69	94.79	95.85	95.87	99.49	98.53	B-2
4	2	137.000	4.43	4.43	0.70	3.10	3.10	25.0	25.0	4.0	12.42	61.09	5.47	30	2.22	94.67	97.71	95.85	98.89	99.49	97.85	B-3
5	1	82.000	0.41	1.26	0.30	0.12	0.77	10.0	18.1	4.7	7.29	28.53	2.58	36	0.18	94.47	94.62	95.79	95.84	99.58	98.99	B-4
6	5	37.000	0.50	0.50	0.82	0.41	0.41	10.0	10.0	6.1	2.48	5.41	2.09	15	0.70	94.62	94.88	95.95	95.99	98.99	98.74	B-5
7	5	65.000	0.00	0.35	0.00	0.00	0.24	5.0	17.6	4.8	4.79	11.22	2.29	24	0.25	94.62	94.78	95.95	95.99	98.99	101.40	B-6
8	7	51.000	0.00	0.35	0.00	0.00	0.24	5.0	16.4	4.9	1.44	9.50	0.70	24	0.18	94.78	94.87	96.08	96.08	101.40	101.18	B-7
9	8	88.000	0.00	0.35	0.00	0.00	0.24	5.0	14.8	5.2	1.50	14.26	0.95	24	0.40	94.87	95.22	96.08	96.09	101.18	101.37	B-8
10	9	134.000	0.00	0.00	0.00	0.00	0.00	5.0	7.3	0.0	0.25	4.71	0.30	18	0.20	95.22	95.49	96.11	96.11	101.37	101.98	B-9
11	10	134.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.25	6.67	0.95	18	0.40	95.49	96.03	96.11	96.25	101.98	100.63	B-10
12	9	52.000	0.11	0.35	0.88	0.10	0.24	5.0	5.9	7.2	1.73	5.45	3.72	15	0.71	96.12	96.49	96.60	97.02	101.37	102.28	B-8.1
13	7	38.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	2.45	8.76	5.05	15	1.84	95.79	96.49	96.24	97.12	101.40	101.33	B-6.1
14	7	48.000	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.94	8.49	1.56	15	1.73	94.79	95.62	96.08	96.07	101.40	101.23	B-6.3
15	12	67.000	0.00	0.24	0.00	0.00	0.14	5.0	5.6	7.3	1.05	1.21	3.13	8	1.00	96.31	96.98	97.10	97.56	102.28	102.40	YD
16	15	41.000	0.00	0.24	0.00	0.00	0.14	5.0	5.4	7.4	1.06	1.73	3.46	8	2.05	96.98	97.82	97.72	98.31	102.40	102.00	YD
17	16	44.000	0.00	0.24	0.00	0.00	0.14	5.0	5.2	7.4	1.07	0.96	3.07	8	0.64	97.82	98.10	98.49	98.83	102.00	102.30	YD
18	17	28.000	0.24	0.24	0.60	0.14	0.14	5.0	5.0	7.5	1.08	0.85	3.09	8	0.50	98.10	98.24	98.85	99.08	102.30	100.50	YD

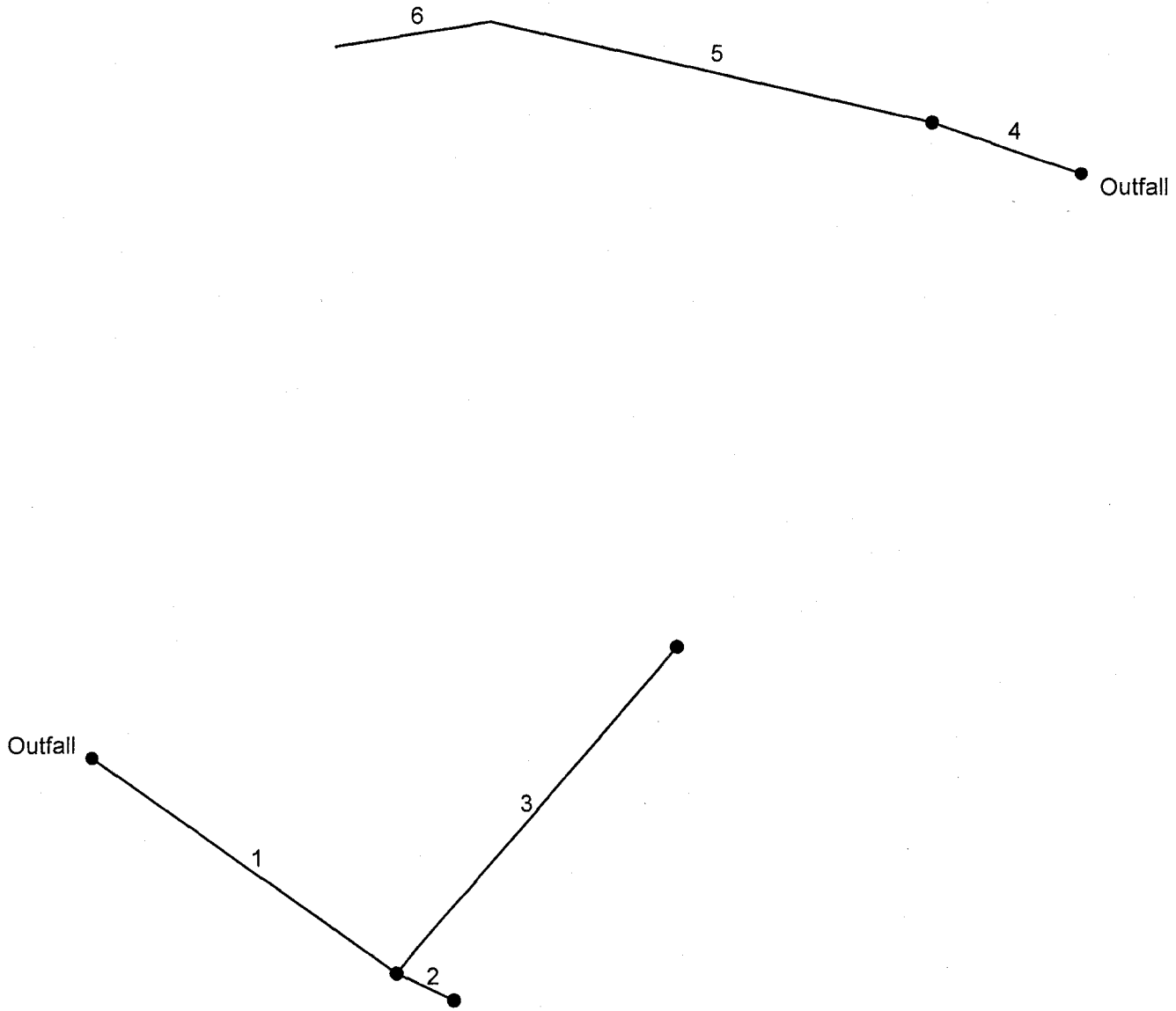
Project File: Storm System B (as-built).stm

Number of lines: 18

Run Date: 4/6/2012

NOTES:Intensity = 55.52 / (Inlet time + 10.00) ^ 0.74; Return period =Yrs. 10 ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Project File: Storm System C (as-built).stm	Number of lines: 6	Date: 4/6/2012

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	123.000	0.00	0.05	0.00	0.00	0.02	5.0	12.1	5.6	0.69	16.40	1.55	18	2.44	85.00	88.00	86.00	88.32	93.00	95.00	C-1
2	1	21.000	0.00	0.00	0.00	0.00	0.00	12.0	12.0	0.0	0.61	6.46	2.91	15	1.00	91.29	91.50	91.55	91.82	95.00	94.00	C-2
3	1	143.000	0.05	0.05	0.30	0.02	0.02	5.0	5.0	7.5	0.11	10.80	1.02	15	2.80	88.00	92.00	88.32	92.13	95.00	97.50	C-3
4	End	52.000	0.00	0.67	0.00	0.00	0.54	5.0	5.9	7.2	3.86	7.70	3.31	15	1.42	91.10	91.84	92.75	92.90	92.00	97.32	C-5
5	4	149.000	0.44	0.67	0.81	0.36	0.54	5.0	5.3	7.4	3.97	7.94	4.16	15	1.51	91.84	94.09	92.92	94.89	97.32	98.53	C-6
6	5	51.000	0.23	0.23	0.79	0.18	0.18	5.0	5.0	7.5	1.36	6.77	2.45	15	1.10	94.09	94.65	94.89	95.12	98.53	99.78	C-7

Project File: Storm System C (as-built).stm

Number of lines: 6

Run Date: 4/6/2012

NOTES:Intensity = 55.52 / (Inlet time + 10.00) ^ 0.74; Return period =Yrs. 10 ; c = cir e = ellip b = box

8. Correspondence

9. Inspections

James City County Environmental Division
Stormwater Management / BMP Inspection Report
Bioretention Facilities

County BMP ID Code (if known): _____

Name of Facility: Courthouse Commons BMP No.: PC-255 Date: 8/3/12

Location: 5230 Monticello Ave

Name of Owner: New Town Six LLC

Name of Inspector: G Johnson

Type of Facility: Bio Retention

Weather Conditions: Sunny Type: ☒ Final Inspection ☐ County BMP Inspection Program ☐ Owner Inspection

If an inspection item is not applicable, mark NA, otherwise mark the appropriate column.

O.K. - The item checked is in adequate condition and the maintenance program is currently satisfactory. No action required.
Routine - The item checked requires attention, but does not present an immediate threat to the function/integrity of the BMP.
Urgent - The item checked requires immediate attention to keep the BMP operational and prevent damage to the facility.

Provide an explanation and details in the comment column, if routine or urgent are marked.

Facility Item	O.K.	Routine	Urgent	Comments
Accessibility:				
Roads	✓			
Parking Areas	✓			
Gates	NA			
Locks	NA			
Safety Fencing	NA			
Observation Wells/Areas: 3 inch PVC w/cap				
Trap Doors	NA			
Manhole Covers				
Grates				
Steps				
Pretreatment Devices: ☐ Inlet ☐ Sump ☐ Forebay ☒ Other				
Sediment	✓			
Trash & Debris	✓			
Structure	✓			
Other	NA			
Inflow Structure (Describe Type/Location):				

Facility Item	O.K.	Routine	Urgent	Comments
Condition	X			
Erosion		X		
Trash and Debris		X		
Sediment		X		
Aesthetics	X			
Other	-			
Primary Infiltration (Bioretention Cell) Area:				
Specialty Landscaping	X			
Mulch Layer		X		
Planting Soil/Sand	X			
Subgrade Soil	X			
Aggregate	X			
Underdrain	X			
Sediment	X			
Aesthetics	X			
Overflow or Bypass Control Structure (Describe Type/Location): DI-7				
Condition	X			
Erosion	X			
Trash & Debris	X			
Sediment	X			
Other	NA			
Outlet Structure (Describe Type/Location): Bay Saver Device				
Condition	X			
Erosion	NA			
Trash & Debris				
Sediment				
Other				
Contributing Drainage Area/Perimeter Conditions:				
Land Use	X			Paving
Stabilization	X			
Trash & Debris	X			
Pollutant Hazard	X			
Other				

Facility Item	O.K.	Routine	Urgent	Comments

Sketch and/or Remarks:

Overall Environmental Division Internal Rating: _____

Signature: _____ **Date:** 8/3/12

Title: _____

SWMProg\BMP\CoInspProg\Bioret.wpd

James City County Environmental Division
Stormwater Management / BMP Inspection Report
Bioretention Facilities

SP-49-10

County BMP ID Code (if known): _____

Name of Facility: Courthouse Commons Parcel 2 and 3 BMP No.: PC-255 Date: 2/13/2012

Location: 5235 Monticello Ave

Name of Owner: Newtown Six, LLC

Name of Inspector: Gregory B Johnson

Type of Facility: Bio Retention

Weather Conditions: Sunny / Cold Type: ☒ Final Inspection ☐ County BMP Inspection Program ☐ Owner Inspection

If an inspection item is not applicable, mark NA, otherwise mark the appropriate column.

O.K. - The item checked is in adequate condition and the maintenance program is currently satisfactory. No action required.
Routine - The item checked requires attention, but does not present an immediate threat to the function/integrity of the BMP.
Urgent - The item checked requires immediate attention to keep the BMP operational and prevent damage to the facility.

Provide an explanation and details in the comment column, if routine or urgent are marked.

Facility Item	O.K.	Routine	Urgent	Comments
Accessibility:				
Roads	X			
Parking Areas	X			
Gates	–			
Locks	–			
Safety Fencing	–			
Observation Wells/Areas: 3 inch PVC w/cap				
Trap Doors	–			
Manhole Covers	–			
Grates	–			
Steps	–			
Pretreatment Devices: ☐ Inlet ☐ Sump ☐ Forebay ☒ Other				
Sediment		X		Mulch needed in bottom
Trash & Debris		X		Remove trash from inside basin.
Structure	X			
Other	–			
Inflow Structure (Describe Type/Location):				

Facility Item	O.K.	Routine	Urgent	Comments
Condition	x			
Erosion		x		Minor slope erosion
Trash and Debris		x		Remove trash
Sediment		x		Remove sediment before adding mulch
Aesthetics	x			
Other	—			
Primary Infiltration (Bioretention Cell) Area:				
Specialty Landscaping	x			
Mulch Layer		x		Add additional mulch
Planting Soil/Sand	x			
Subgrade Soil	x			
Aggregate	x			
Underdrain	x			
Sediment	x			
Aesthetics	x			
Overflow or Bypass Control Structure (Describe Type/Location): DI-7				
Condition	x			
Erosion	x			
Trash & Debris	x			
Sediment	x			
Other				
Outlet Structure (Describe Type/Location): Bay Saver Device				
Condition	x			Bay saver
Erosion	—			
Trash & Debris	—			
Sediment	—			
Other	—			
Contributing Drainage Area/Perimeter Conditions:				
Land Use	x			Parking / roadway / commercial
Stabilization	x			Some minor slope erosion
Trash & Debris	x			Trash on stone
Pollutant Hazard	x			Oil from parking
Other				

Facility Item	O.K.	Routine	Urgent	Comments

Sketch and/or Remarks:

1. Class I rip rap needs rearranged to fill in voids
2. Sides of swales need more stone and stabilization
3. Additional mulch needs added to bottom

Overall Environmental Division Internal Rating: _____

Signature: _____ **Date:** 2/13/2012

Title: Inspector

SWMProg\BMP\CoInspProg\Bioret.wpd

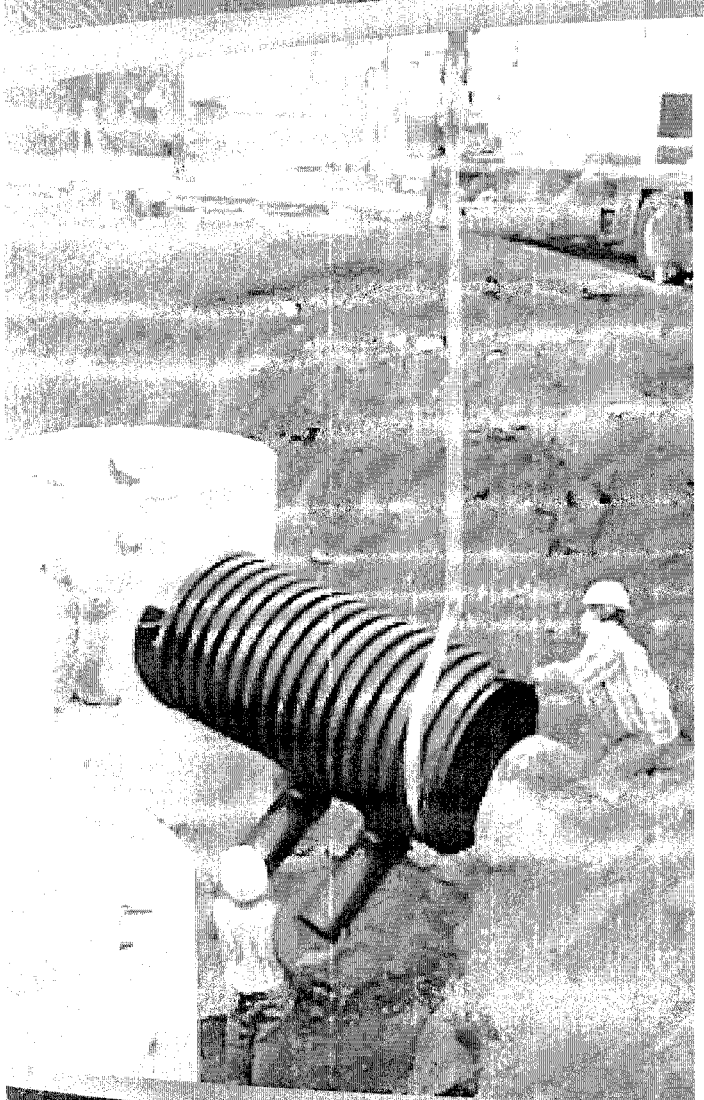
10. Permitting

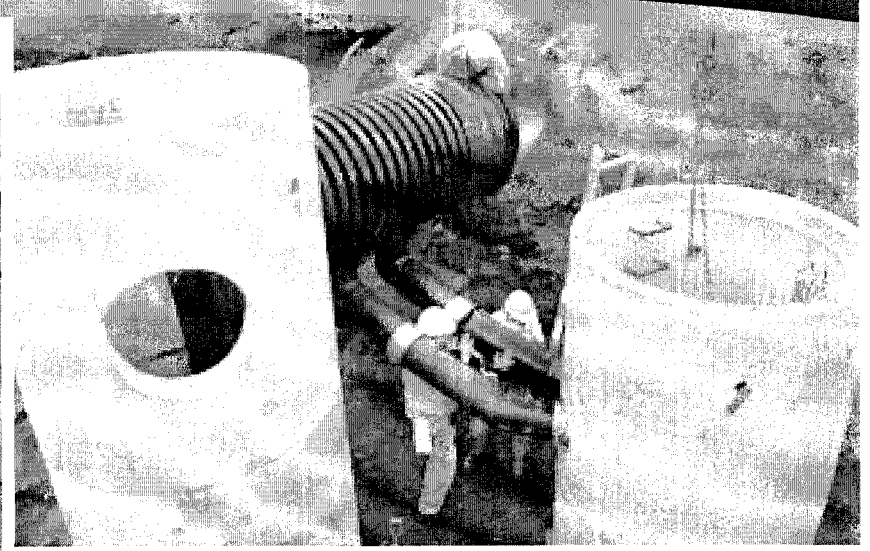
11. Misc. (ex. photos)

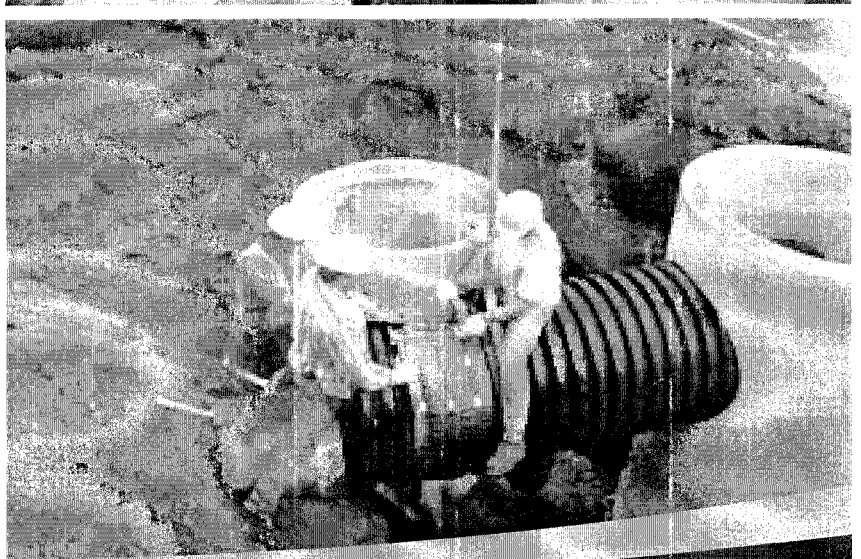
12. Project Development Documents

BaySeparator™

Fully Customizable for any Project



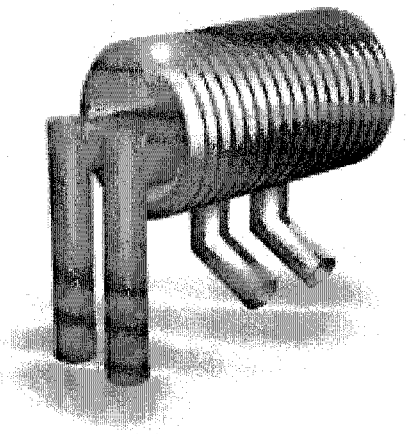




*The Most **Advanced** Name in Drainage Systems®*

ADS

ADS BAYSEPARATOR STORMWATER TREATMENT SYSTEM

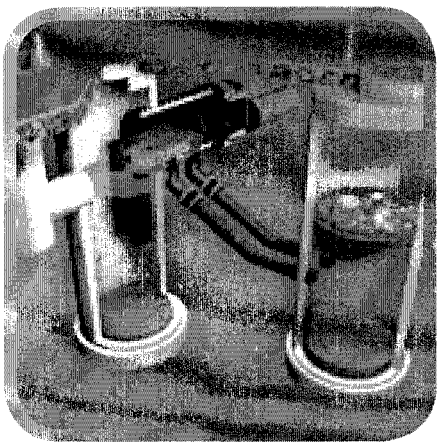


Through extensive testing and mathematical modeling, the BaySeparator was developed to deliver predictable, reliable, and scalable performance with efficiency, ease of maintenance, and cost effectiveness. Using fully customizable systems, BaySeparator removes over 80% of oils, suspended solids, and floatable debris as soon as runoff enters the system.

COMPONENTS:

The BaySeparator system utilizes a unique polyethylene structure to route stormwater and separate pollutants into two standard precast manholes. The entire system consist of three main components: the BaySeparator unit, the primary manhole, and the storage manhole. The BaySeparator is purchased from BaySaver through ADS. The manholes are purchased from the precast manufacturer of your choice.

THREE DISTINCT TREATMENT FLOWS:



During low flows, the BaySeparator treats all the runoff through both manholes. This occurs for small storms and the beginning of more intense storms. Coarse sediments immediately fall to the floor of the primary manhole. The remaining floatables and finer sediments flow through the separator and are conveyed to the storage manhole. Sediments fall to the floor of the storage manhole and floatables rise leaving clean water which is taken from the center of the water column to be discharged.

For larger storms the flow rate continues to increase. The BaySeparator continues to divert surface flows which contain the majority of the pollutants from the primary manhole to the storage manhole. The incremental flow associated with the large flows are treated by separation in the primary manhole. Treated water leaves the primary manhole through the center of the water column.

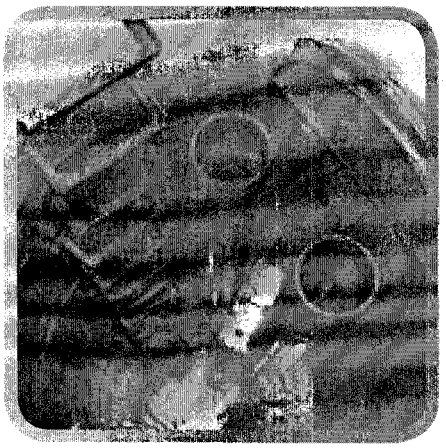
During large peak flow storms the BaySeparator bypasses the flow. The offline storage of contaminants prevents scour and resuspension of the material. The bypass function of the unit prevents upstream flooding and allows the peak design flow to be maintained.

DESIGN:

The BaySeparator is available in five (5) standard sizes and is also customizable for larger flows as shown below:

Model Number	Diameter (inches)	Maximum Treatment Rate (cfs)	Maximum Hydraulic Rate (cfs)	Manhole Diameter (inches)	Manhole Vault Depth (feet)	Sediment Storage (cf)	Storage Oil (cf)
1.5 K	24	1.1	8.5	48	6	38	19
2 K	24	2.4	10	48	8	50	37
3 K	36	7.8	30	60	8	78	58
5 K	48	11.1	50	72	8	113	84
10 K	60	21.8	100	120	8	314	235
XK	Custom	Custom	Custom	Custom	Custom	Custom	Custom

The sizes of both Primary and Storage Manholes in the BaySeparator may be varied to suit specific site conditions and treatment requirements as necessary. By selecting the appropriate separator unit size and the manhole diameters, the design engineer has the freedom to adapt the BaySeparator unit to the needs of a particular site. The XK unit can be specifically designed to handle larger flows on a site by site basis.



HYDRAULIC PERFORMANCE:

The BaySeparator has two flow rates, the maximum treatment rate and the maximum hydraulic rate. The maximum treatment rate is the maximum flow that can be fully treated by the BaySeparator unit without any bypass. The maximum hydraulic rate is the maximum flow rate that can be conveyed through the BaySeparator. The ability of the BaySeparator to bypass flows allows the system to be installed online without the need for a separate diversion structure.

The BaySeparator has been extensively tested in both laboratory and field conditions. The lab testing verified by field testing provides data establishing 80% annual aggregate removal efficiency for stand alone treatment applications. In addition the system can be designed for pretreatment applications in combination with other treatment technologies such as the BayFilter.

Sizing can be accomplished based on flow based, annual aggregate removal, or local design regulations. In pretreatment applications the unit is typically sized to remove 50% of the TSS on an annual aggregate removal basis. The pretreatment separator is usually part of a treatment train. The stand alone separator usually is designed to remove 80% of the TSS on an annual aggregate removal basis.

INSTALLATION:

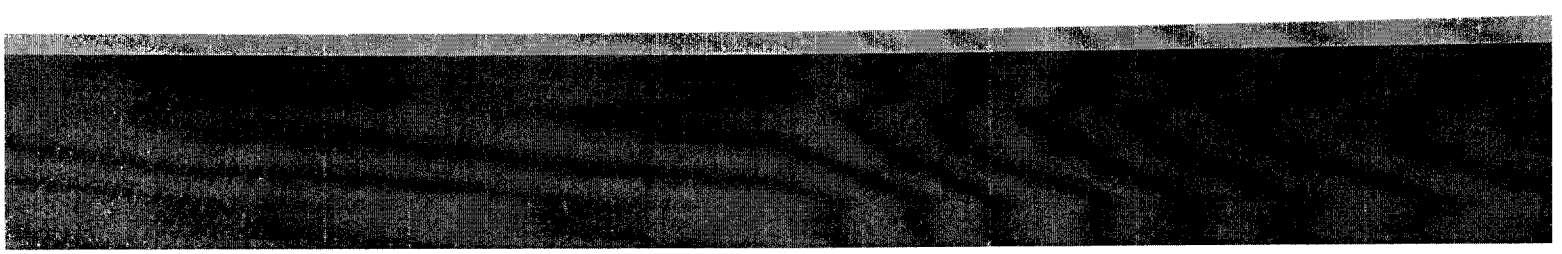
BaySeparators are installed as part of the stormwater treatment system. The BaySeparator unit and inlet pipe are grouted into the primary manhole. The connecting pipes to the storage manhole require watertight connections. Connections can be made using standard boots or other approved seals. The pipes extending down from the separator and the separator itself should be backfilled with a Class 1 material. Minimum burial depths for each separator are 12 inches for 24–48 inch units and 18 inches for 60-inch diameter units. For more detailed installation instructions contact your local ADS sales representative.

MAINTENANCE:

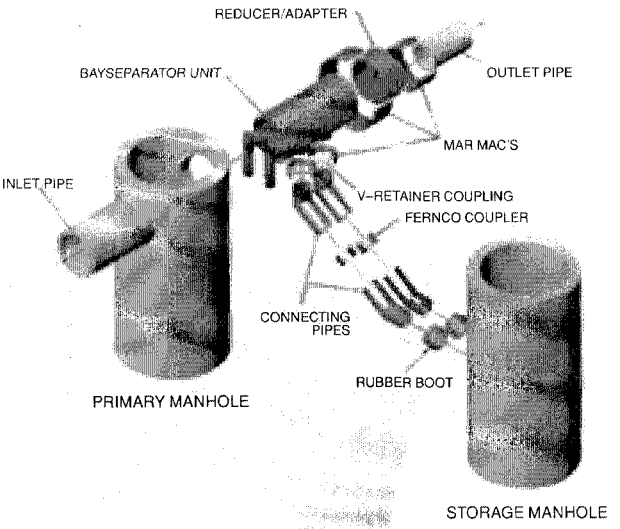
A big advantage of the BaySeparator system is the ease of maintenance. Like any system that collects pollutants, the system must be periodically maintained for continued effectiveness. Maintenance is a simple procedure performed using a vacuum truck or similar equipment. The system is designed to minimize the volume of water removed during routine maintenance which reduces disposal costs.

The pollutants stored in each manhole are accessed through a 30" manhole cover. This allows an unobstructed ability to reach the full depth of the system. No confined space entry is required for inspection or maintenance.

Periodic inspection is required to determine the need for maintenance. Inspection should be performed initially every six (6) months. Typically the system will require maintenance every 12 to 36 months depending on site conditions. The system requires cleaning when the sediment has accumulated to within one foot of the bottom of the connecting pipes.



SPECIFICATIONS



MATERIALS AND DESIGN

- Concrete structures shall be designed for H-20 loading traffic and applicable earth loads or as otherwise determined by a Licensed Professional Engineer. The materials and structural design of the devices shall be per ASTM C478.
- The separator structure shall be substantially constructed of HDPE or equivalent corrosion-resistant material meeting ASTM F2306.
- Smooth wall pipes within the unit, (i.e. tee pipes, connector pipes and down pipes) shall be constructed of SDR 32.5 HDPE pipe of standard ASTM F412.
- Pipe and fitting material shall be high-density polyethylene meeting ASTM F2306 minimum cell classification 435400C for 24-inch through 60-inch diameters.
- The reducer/adaptor shall be installed with an exterior joining coupler. The joint coupler shall be Mar-Mac® couplers and shall be installed according to the manufacturer's recommendations.
- The connector pipes shall be connected with the down pipes using flexible couplings that have been manufactured to conform to ASTM C425.

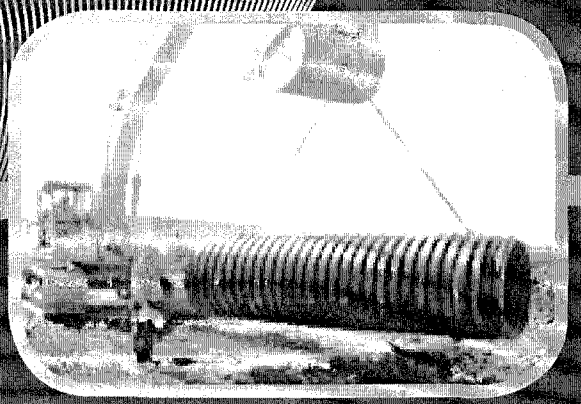
PERFORMANCE

- The stormwater treatment unit shall be an online unit capable of conveying 100% of the peak design flow.
- The stormwater treatment unit shall be designed to remove at least 80% of the suspended solids load on an annual aggregate removal basis. Said removal shall be based on full-scale third party testing using F-95 media gradation (manufactured by US Silica®) or equivalent. Said full scale testing shall have included sediment capture based on actual total mass collected by the Stormwater Treatment Unit(s).
- The stormwater treatment unit shall consist of one (1) prefabricated separator structure, one (1) on-line coarse sediment capture structure, and one (1) off-line sediment capture structure. The separator structure shall be substantially constructed of HDPE or equivalent corrosion resistant material. The offline sediment storage structure must provide for offline sediment storage of sediments and floatables that are isolated from high intensity storms. The said capture structures or manholes shall be of standard concrete construction.
- The Stormwater Treatment Unit(s) head loss at the Peak Design Flow Rate shall not exceed the head loss specified by the Engineer.
- The unit shall be designed to remove sediment particles as well as floating oils and debris.

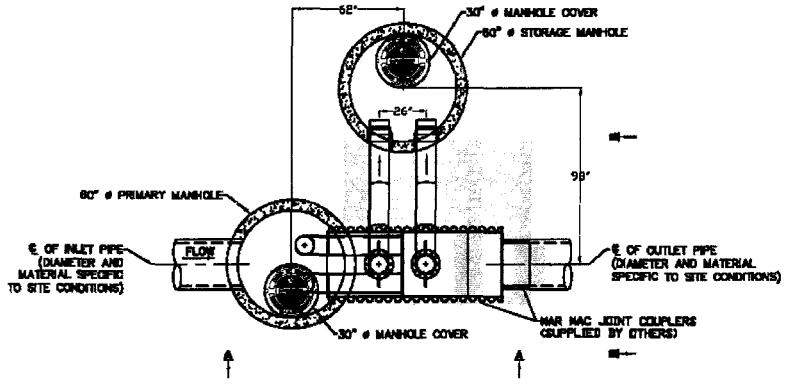
INSTALLATION

Installation of the Stormwater Treatment Unit(s) shall be performed per manufacturer's Installation Instructions.

For more information on BaySeparator Stormwater Filtration System and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710



Advanced Drainage Systems, Inc.
4640 Trueman Blvd. Hilliard, OH 43026
1-800-821-6710
www.ads-pipe.com

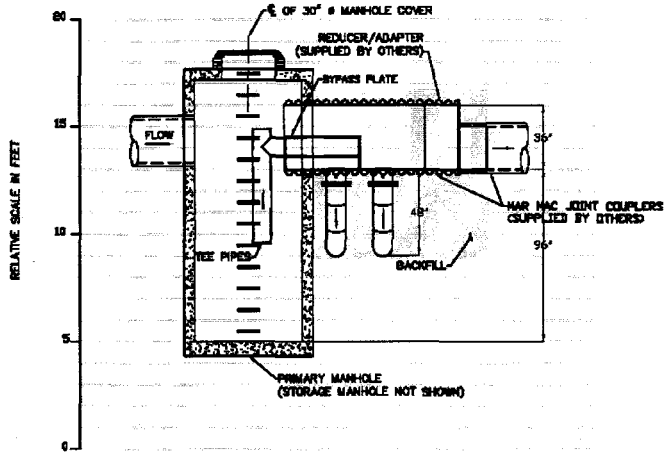


PLAN VIEW-BAYSAVER SEPARATION SYSTEM
(LEFT HAND ORIENTATION SHOWN)

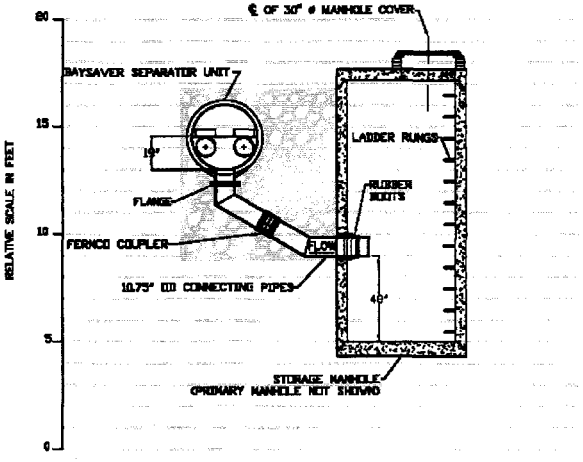
INLET PIPE INVERT:	XX.XX
INLET PIPE ID AND MATERIAL:	XX.XX
OUTLET PIPE INVERT:	XX.XX
OUTLET PIPE ID AND MATERIAL:	XX.XX
PRIMARY MANHOLE RIM ELEVATION:	XX.XX
STORAGE MANHOLE RIM ELEVATION:	XX.XX
ORIENTATION (RIGHT OR LEFT):	

GENERAL NOTES:

1. MANHOLES SHOWN REPRESENT STANDARD PRECAST STRUCTURES PROVIDED BY OTHERS.
2. SEAL THE CONNECTING PIPES INTO THE STORAGE MANHOLE USING RUBBER BOOTS/GASKETS.
3. THE BAYSAVER SEPARATION SYSTEM INCLUDES THE SEPARATOR UNIT, (2) CONNECTING PIPES AND (2) FERNCO COUPLERS.
4. LEFT HAND ORIENTATION SHOWN. FOR RIGHT HAND ORIENTATION ROTATE STORAGE MANHOLE AND CONNECTING PIPES 180°.
5. SEE BAYSAVER SPECIFICATIONS AND INSTALLATION INSTRUCTIONS FOR FURTHER DETAIL.
6. USE NON-SHRINK GROUT TO SEAL THE INLET PIPE AND BAYSEPARATOR IN TO THE PRIMARY MANHOLE.
7. BACKFILL: CLASS 1, II OR III BACKFILL SHOULD BE USED TO AN ELEVATION OF AT LEAST 6" OVER THE CROWN OF THE SEPARATOR UNIT.
8. 12" COVER REQUIRED FOR TRAFFIC RATED SURFACE.
9. BAYSEPARATOR IS PROTECTED BY US PATENT NO. 5,746,911



PROFILE VIEW A-A



PROFILE VIEW B-B

REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
Engineering Stormwater Solutions
www.BaySaver.com 800.229.7283

DESIGNED:	TEP	DATE:	11/04/08
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	EKH	DWG NO:	3K

3K BAYSEPARATOR™ GENERAL SYSTEM DETAILS