



## 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- STORMWATER 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.

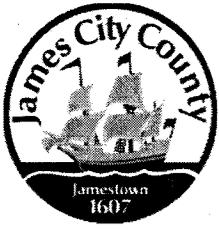
**BMP NUMBER:** CC-030

**DATE VERIFIED:** March 16, 2012

**QUALITY ASSURANCE TECHNICIAN:** Leah Hardenbergh

  
\_\_\_\_\_

**LOCATION:** WILLIAMSBURG, VIRGINIA



# Stormwater Division

## MEMORANDUM

**DATE:** March 11, 2010  
**TO:** Michael J. Gillis, Virginia Correctional Enterprises Document Management Services  
**FROM:** Jo Anna Ripley, Stormwater  
**PO:** 270712  
**RE:** Files Approved for Scanning

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**General File ID or BMP ID:** CC030

**PIN:** 3910100109

**Subdivision, Tract, Business or Owner**

**Name (if known):**

James City County

**Property Description:**

**Site Address:**

120 Watford Lane

*(For internal use only)*

**Box** 12

**Drawer:** 7

**Agreements:** (in file as of scan date)

N

**Book or Doc#:**

**Page:**

Comments

CC030

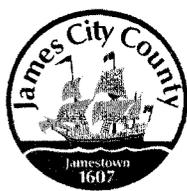
**Contents for Stormwater Management Facilities As-built Files**

Each file is to contain:

- ① As-built plan
- ② Completed construction certification
3. Construction Plan
- ④ Design Calculations
- ⑤ Watershed Map
6. Maintenance Agreement
7. Correspondence with owners
- ⑧ Inspection Records
9. Enforcement Actions

39/0100109

in future will serve as  
forebay for County  
Regional BMP



**James City County Environmental Division  
Stormwater Management/BMP Record Drawing and  
Construction Certification Review Tracking Form**

WATFORD  
LANE

Project Name: Ironbound Square Revitalization Road Improvement (BMP)

County Plan No.: SP-131-05

Stormwater Management Facility: Timber Comb Wall

BMP Phase #:  I  II  III

Information Package Received. Date/By: 1/7/08

Completeness Check:

Record Drawing Date/By: 1/9/08 Mathew H. Connolly

Construction Certification Date/By: 1/4/08 Aaron B. Small

RD/CC Standard Forms (Required for all BMPs after Feb 1<sup>st</sup> 2001 Only)

Insp/Maint Agreement # / Date: \_\_\_\_\_

BMP Maintenance Plan Location: Left side of record drawing

Other: \_\_\_\_\_

Standard E&S Note on Approved Plan Requiring RD/CC or County comment in plan review  
 Yes  No Location: Sheet 12 - RIGHT LOWER CORNER

Assign County BMP ID Code #: Code: CC 030

Preliminary Input/Log into Division's "As-Built Tracking Log"

Add location to GIS Map. Obtain basic site information (GPIN, Owner, Address, etc.) Done

Preliminary Log into Access Database (BMP ID #, Plan No., GPIN, Project Name, etc.)

Active Project File Review (correspondence, H&H, design computations, etc.)

Initial As-Built File setup (File label, folder, copy plan/details/design information, etc.)

Inspector Check of RD/CC (forward to Inspector using transmittal for cursory review).

Pre-Inspection Drawing Review of Approved Plan (Quick look prior to Field Inspection).

Final Inspection (FI) Performed Date: 12/22/2007

Record Drawing (RD) Review Date: 8/1/2007

Construction Certification (CC) Review Date: 2/1/2007

Actions:

No comments.

Comments. Letter Forwarded. Date: 8/1/2007

Record Drawing (RD)

Construction Certification (CC)

Construction-Related (CR)

Site Issues (SI)

Other: Letter dated 12/7/07 - Construction Comment. Addressed

Second Submission: 12/19/2007

Reinspection (if necessary): NA

Acceptable for SWM Purposes (RD/CC/CR/Other). Ok to proceed with bond release.

Complete "Surety Request Form".

Check/Clean active file of any remaining material and finish "As-Built" file.

Add to County BMP Inventory/Inspection schedule (Phase I, II or III).

Copy Final Inspection Report into County BMP Inspection Program file.

Obtain 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 ICC 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: [Signature]

Date: 1/10/2007

Chief Engineer: \_\_\_\_\_

Date: \_\_\_\_\_

\*\*\* See separate checklist, if needed.



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: WATFORD LANE IMPROVEMENTS  
Structure/BMP Name: DRY DETENTION BASIN COUNTY TYPE F-2 BMP  
Project Location: JUST SOUTH OF 122 WATFORD LANE  
BMP Location: " " " " " "  
County Plan No.: SP - 131 - 05

Project Type:  Residential  Business Tax Map/Parcel No.: 3910100109  
 Commercial  Office BMP ID Code (if known): CC 030  
 Institutional  Industrial Zoning District: R2  
 Public  Roadway Land Use: BMP LOT  
 Other Site Area (sf or acres): 0.439A (FROM G15)

Brief Description of Stormwater Management/BMP Facility: DRY DETENTION BASIN WITH RIPRAP FOREBAY & TIMBER SPILLWAY/WEIR

Nearest Visible Landmark to SWM/BMP Facility: JCSA PUMP STATION 122 WATFORD

Nearest Vertical Ground Control ( if known ):  
 JCC Geodetic Ground Control  USGS  Temporary  Arbitrary  Other  
Station Number or Name: 325  
Datum or Reference Elevation: NGVD 29 ELEVATION = 110.67'  
Control Description: 3/4" DISK IN CONCRETE - 2" BELOW GROUND  
Control Location from Subject Facility: MONUMENT AT SE SIDE OF INTER-SECTION OF RTE 615/616 AT BERKELEY ELEM. SCHOOL

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: \_\_\_\_\_

Facility Monitored by County Representative during Construction:  Yes  No  Unknown

Name of Site Work Contractor Who Constructed Facility: HENRY S. BRANSCOME, LLC

Name of Professional Firm Who Routinely Monitored Construction: AES CONSULTING ENGINEERS

Date of Completion for SWM/BMP Facility: 06-04-07 (SUBSTANTIAL COMPLETION)

Date of Record Drawing/Construction Certification Submittal: 01-04-2008

*( 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: JAMES CITY COUNTY  
Mailing Address: 5340 PALMER LANE, SUITE 1A  
WILLIAMSBURG, VIRGINIA 23188-2674  
Business Phone: 757-259-5347 Fax: 757-220-0640  
Contact Person: MARION O. PAINE 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  
Mailing Address: 5248 OLDE TOWNE ROAD, SUITE 1  
WILLIAMSBURG, VIRGINIA 23188  
Business Phone: 757-253-0040  
Fax: 757-220-8994  
Responsible Plan Preparer: AARON B. SMALL  
Title: PROFESSIONAL ENGINEER  
Plan Name: IRON BOUND SQUARE ROADWAY IMPROVEMENTS  
Firm's Project No. 9014-01  
Plan Date: 6-21-2006  
Sheet No.'s Applicable to SWM/BMP Facility: 6 / 12 / \_\_\_\_ / \_\_\_\_ / \_\_\_\_

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

Name: HENRY S. BRANSCOME, LLC  
Mailing Address: P.O. BOX 6478  
WILLIAMSBURG, VIRGINIA 23185  
Business Phone: 757-221-7221  
Fax: 757-221-7220  
Contact Person: EDWIN GILLEY  
Site Foreman/Supervisor: ED WARBURTON  
Specialty Subcontractors & Purpose (for BMP Construction Only):  
NONE

**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: LANDTECH RESOURCES, INC.  
Mailing Address: 201-A BULIFANTS BLVD.  
WILLIAMSBURG, VA. 23188  
Business Phone: 757-565-1077  
Fax: 757-565-0782

Name: MATTHEW H. CONNOLLY  
Title: LAND SURVEYOR

Signature: *Matthew H. Connolly*  
Date: 01-04-2008

**Construction Certification**

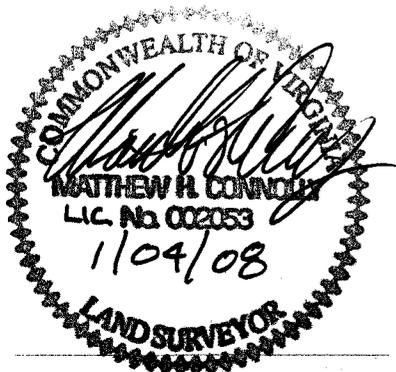
Firm Name: AES CONSULTING ENGINEERS  
Mailing Address: 5248 OLDETOWNE RD  
SUITE 1, WILLIAMSBURG, VA 23188  
Business Phone: 757-253-0040  
Fax: 757-220-8994

Name: AARON B. SMALL  
Title: PROJECT MANAGER

Signature: *Aaron B. Small*  
Date: 1-4-2008

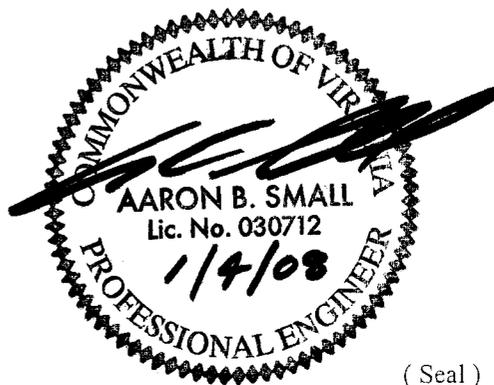
I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically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

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.



( Seal )

Virginia Registered Professional Engineer or Certified Land Surveyor



( Seal )

Virginia Registered Professional Engineer

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

X 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.

X 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.

X 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.

X 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.

X 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.)

X

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.)*

X

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.

X

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.
- XX 4. Top widths, berm widths and embankment side slopes.
- XX 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.
- NA 7. Profile or elevations along the entire centerline of the emergency spillway. Emergency spillway may be steeper, but no flatter or narrower than design.
- XX 8. Elevation of the principal spillway crest or outlet crest of the structure.

- NA 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.
- NA 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.
- NA 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.**
- NA 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.
- XX 16. Outfall protection dimension, type and depth of rock and if underlain filter fabric is present.
- NA 17. BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan.
- XX 18. Maintenance plan taken from approved design plan transposed onto record drawing set.
- NA 19. Fencing location and type, if applicable to facility.
- XX 20. BMP vicinity properly cleaned of stockpiles and construction debris.
- XX 21. No visual signs of erosion or channel degradation immediately downstream of facility.
- NA 22. Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility.

**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 )

- XX F1. All requirements of Section II, Minimum Standards, apply to Group F facilities.
- XX F2. Basin bottom has positive slope and drainage from all basin inflow points to the riser (or outflow) location.
- XX F3. Timber wall BMP used in intermittent stream only. (ie. Prohibited in perennial streams.)
- XX F4. Forebay provided approximately 20 ft. upstream of the facility. Forebays generally 4 to 6 feet in depth.
- NA F5. A reverse slope pipe, vertical stand pipe or mini-barrel and riser was provided to prevent clogging.
- NA F6. Principal spillway and outlet barrel provided consisting of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.
- NA F7. Mini-barrel and riser, if used, contains a removable trash rack to reduce clogging.
- XX 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.
- XX F9. Timbers properly reinforced or concrete footing provided if soil conditions were prohibitive.
- XX F10. Timber wall cross members extended to a minimum depth of two (2) feet below ground elevation.
- XX F11. Protection against erosion and scour from the low flow orifice and weir-flow trajectory provided.
- XX F12. Stilling basin or standard outlet protection provided at principal spillway outlet.
- XX 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.
- XX F14. No visual signs of undercutting of timber walls or clogging of the low orifice were present.
- XX F15. No visual signs of erosion or channel degradation immediately downstream of facility.
- XX 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.

# Transmittal

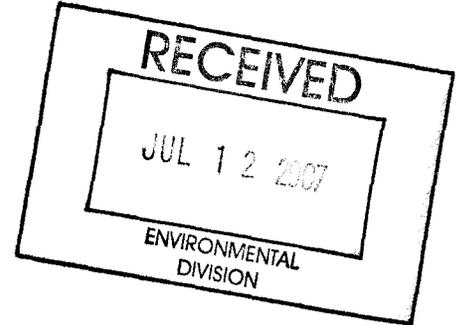
## LandTech Resources, Inc.

Surveying - Mapping - GPS

5810-F Mooretown Road, Williamsburg, VA 23188

Tel: 757-565-1677 Fax: 757-565-0782

To: James City County  
 Company: Environmental Division  
 From: Matthew Connolly  
 Date: 7/11/07  
 Job Name/Number: 06-490



The following have been sent:

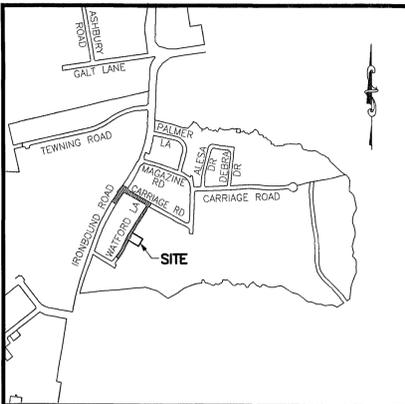
- as requested
- for review and comment
- please sign and return
- for temporary use, please return by \_\_\_\_\_

Quantity	Drawing Date	Description
2	7/10/07	"As-Built" Plan
1	7/10/07	Record Drawing Checklist
		<i>Ironbound Square Road Improvements Part 1</i>
		<i>Interim BMP / Forebay Future</i>
		<i>Ironbound Square Redevelopment Project</i>
		<i>(Watford Lane)</i>
		<i>No const cert</i>
		<i>SP-131-05</i>
		<i>CC 030</i>
		<i>This will be a future pretreatment</i>
		<i>sediment forebay for the County</i>
		<i>Regional Basin once it moves</i>
		<i>forward.</i>

Remarks:

cc: Henry S. Branscome

Signature: *Matthew Connolly*



VICINITY MAP -- NOT TO SCALE

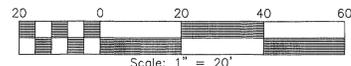
**STORMWATER MANAGEMENT / BMP FACILITY MAINTENANCE PLAN FOR BMP**

PROPER MAINTENANCE OF THIS FACILITY IS ENCOURAGED TO PREVENT THE INTRODUCTION OF DEBRIS AND SEDIMENT INTO THE FACILITY, SPILLWAY(S) AND DOWNSTREAM WATERWAYS. FOLLOWING INSTALLATION OF THE FACILITY AND ESTABLISHMENT OF VEGETATION IN DISTURBED AREAS, INSPECTIONS FOR SEDIMENT BUILDUPS WILL BE PERFORMED AT LEAST QUARTERLY. IT IS ANTICIPATED THAT UNDER NORMAL CONDITIONS, SEDIMENT REMOVAL FROM THE FACILITY WILL BE REQUIRED ONCE EVERY 10 YEARS. IF OTHER CONSTRUCTION OR RELATED ACTIVITIES ARE PERFORMED ON UPSLOPE PARCELS, ADEQUATE PROTECTION SHOULD BE PROVIDED AND INSPECTIONS PERFORMED AT LEAST ONCE WEEKLY.

A DESIGNATED REPRESENTATIVE OF THE OWNER WILL INSPECT THE SWM STRUCTURE AFTER EACH SIGNIFICANT RAINFALL EVENT OR THE FOLLOWING WORKING DAY IF A WEEKEND OR HOLIDAY OCCURS. A SIGNIFICANT RAINFALL FOR THIS STRUCTURE IS DEFINED AS ONE (1) INCH OR MORE OF GAUGED RAINFALL WITHIN A 24 HOUR PERIOD. ONCE PER YEAR, A REPRESENTATIVE OF THE COUNTY MAY JOINTLY INSPECT THE STRUCTURE. APPROPRIATE ACTION, PERFORMED AT THE COST OF THE OWNER, WILL BE TAKEN TO ENSURE APPROPRIATE MAINTENANCE. WHERE STRUCTURES ARE TO BE MAINTAINED JOINTLY, ALLOCATION OF MAINTENANCE COSTS WILL BE IN ACCORDANCE WITH THE TERMS ESTABLISHED IN MAINTENANCE AGREEMENTS. KEYS TO LOCKED ACCESS POINTS SHALL BE MADE AVAILABLE TO COUNTY INSPECTION PERSONNEL UPON REQUEST.

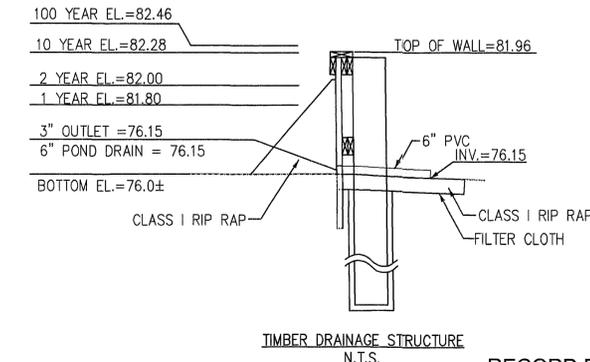
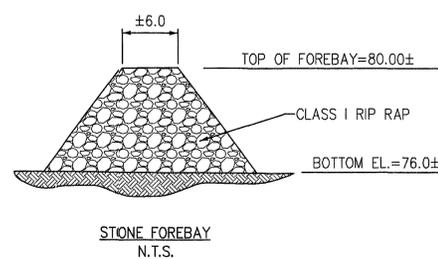
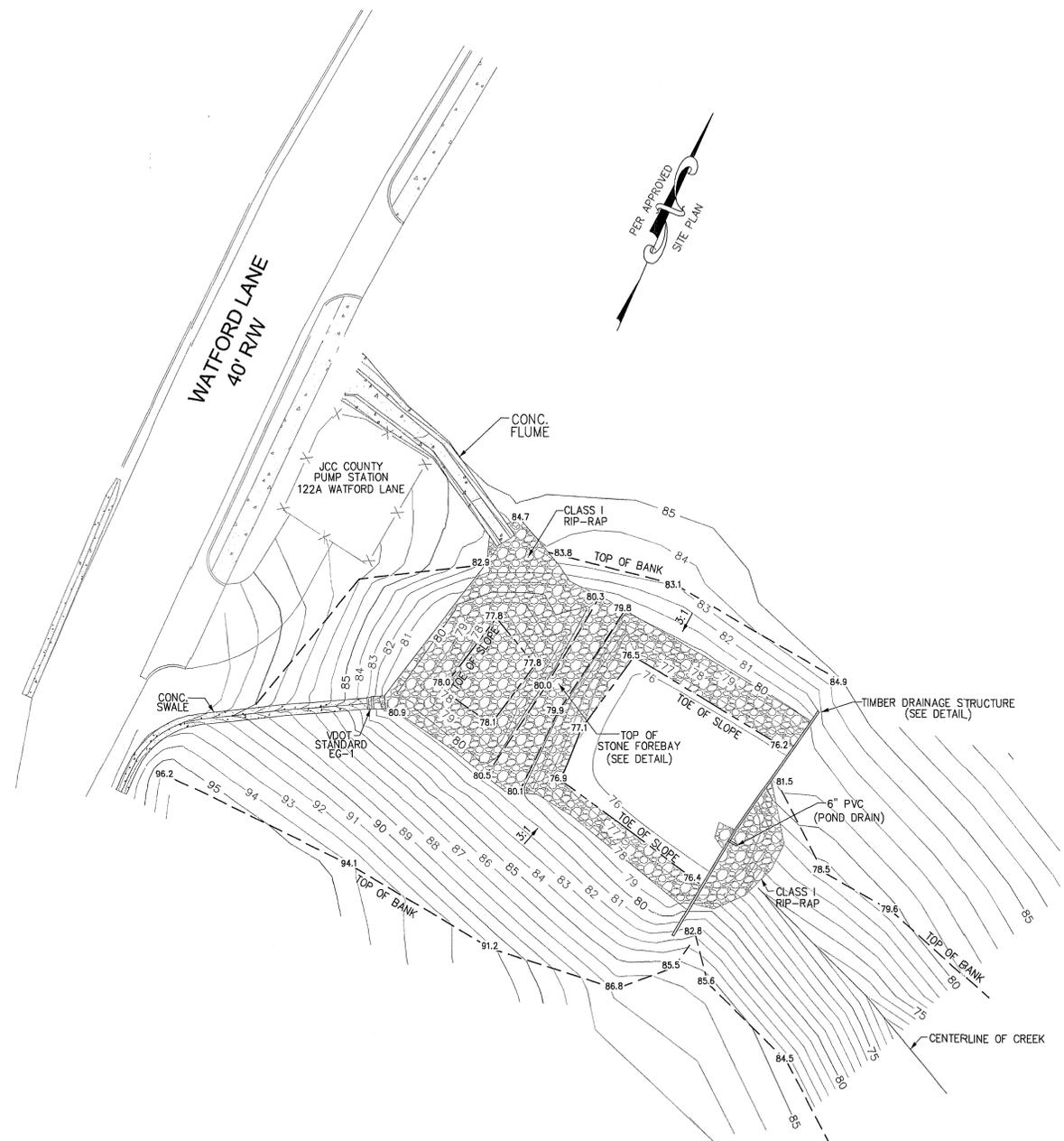
**INSPECTION AND MAINTENANCE OF THE FACILITY WILL CONSIST OF THE FOLLOWING ADDITIONAL MEASURES:**

- 1.) THE INSPECTION FOR SEDIMENT BUILDUP WILL BE PERFORMED BY VISUAL INSPECTION AND A PHYSICAL DETERMINATION OF SEDIMENT DEPTH WITHIN THE STORAGE AREA. IF THE DEPTH OF SEDIMENT REACHES THE DEPTH OF 1.0 FT. ABOVE THE BOTTOM OF THE LOW FLOW ORIFICE IN THE TIMBER WALL, REMOVAL IS REQUIRED USING A RUBBER-WHEELED BACKHOE. AT THIS TIME, THE SEDIMENT FOREBAY LOCATED AT THE OUTFALLS OF THE STORM SEWER PIPE SYSTEMS SHALL ALSO BE INSPECTED. IF THE DEPTH OF SEDIMENT WITHIN THE FOREBAY REACHES A DEPTH OF 18" ABOVE THE BOTTOM OF THE BASIN OR 6" ABOVE THE INVERT OF THE OUTFALL CHANNEL, REMOVAL OF THE MATERIAL IS REQUIRED. AT THE SAME TIME, OR AT LEAST ONCE PER YEAR, CLEAN THE ORIFICES WITHIN THE TIMBER WALL DETENTION BASINS OF ACCUMULATED SEDIMENTS. DISPOSE OF SEDIMENTS REMOVED FROM THE FACILITY AT AN ACCEPTABLE DISPOSAL AREA.
- 2.) PERFORM QUARTERLY INSPECTIONS OF THE TIMBER STRUCTURE AND SPILLWAY DEVICES FOR THE OBSERVANCE OF COLLECTED DEBRIS. IMMEDIATELY REMOVE ANY DEBRIS TO MAINTAIN THE INTEGRITY OF THE STRUCTURE AND PROVIDE AN ATTRACTIVE APPEARANCE.
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- 4.) PERFORM QUARTERLY INSPECTIONS OF THE GRADED SIDE SLOPES OF THE DETENTION FACILITY FOR SIGNS OF ANIMAL/RODENT BORROWS OR SLOPE EROSION. IMMEDIATELY PERFORM NECESSARY REPAIRS, REFILLING OR RESEEDING AS APPROPRIATE.
- 5.) RECORD KEEPING. THE OWNER OR DESIGNATED REPRESENTATIVE SHALL KEEP REASONABLE, ACCURATE WRITTEN RECORDS OR INSPECTIONS PERFORMED FOR THE STRUCTURE. RECORDS SHALL DOCUMENT OR REPAIRS PERFORMED. COPIES SHALL BE PROVIDED TO THE COUNTY UPON REQUEST.
- 6.) THE FACILITY SHALL NOT BE MODIFIED IN ANY WAY WITHOUT PRIOR CONSENT/APPROVAL OF THE COUNTY.



**RECORD DRAWING CERTIFICATION**

I HEREBY CERTIFY TO THE BEST OF MY KNOWLEDGE AND BELIEF THAT THIS RECORD DRAWING REPRESENTS THE ACTUAL CONDITION OF THE STORM WATER MANAGEMENT/BMP FACILITY. THE FACILITY APPEARS TO CONFORM WITH THE PROVISIONS OF THE APPROVED DESIGN PLAN, SPECIFICATIONS AND STORM WATER MANAGEMENT PLAN, EXCEPT AS SPECIFICALLY NOTED.



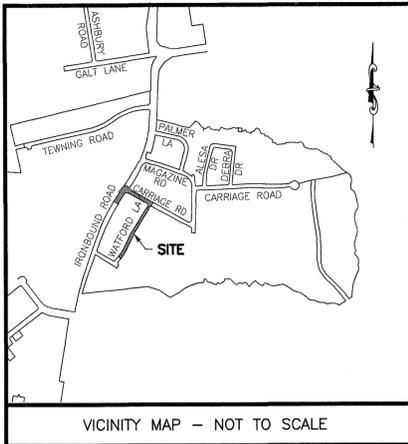
TIMBER DRAINAGE STRUCTURE N.T.S. RECORD DRAWING  
 BMP 10 CODE: CC030 COUNTY PLAN # JCC SP-131-05

**IRONBOUND SQUARE REVITALIZATION  
 PHASE I - BMP RECORD DRAWING**  
 120 WATFORD LANE  
 COUNTY PLAN # JCC SP-131-05  
 JAMES CITY COUNTY  
 BERKELY DISTRICT  
 VIRGINIA

NO.	DATE	REVISION / COMMENT / NOTE
1	1/3/08	REVISIONS PER COMMENT LETTER DATED DECEMBER 19, 2007.

**LandTech Resources, Inc.**  
 Surveying • GPS • Engineering  
 5810-F Mooretown Road, Williamsburg, VA 23188  
 Phone: (757) 565-1677 Fax: (757) 565-0782  
 web: landtechresources.com

SCALE: 1" = 20'  
 DATE: 07/10/07  
 JOB: 06-490  
 DRAWN BY: JC  
 SHEET: 1 OF 1



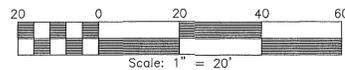
**STORMWATER MANAGEMENT / BMP FACILITY  
MAINTENANCE PLAN FOR BMP**

PROPER MAINTENANCE OF THIS FACILITY IS ENCOURAGED TO PREVENT THE INTRODUCTION OF DEBRIS AND SEDIMENT IN TO THE FACILITY, SPILLWAY(S) AND DOWNSTREAM WATERWAYS. FOLLOWING INSTALLATION OF THE FACILITY AND ESTABLISHMENT OF VEGETATION IN DISTURBED AREAS, INSPECTIONS FOR SEDIMENT BUILDUPS WILL BE PERFORMED AT LEAST QUARTERLY. IT IS ANTICIPATED THAT UNDER NORMAL CONDITIONS, SEDIMENT REMOVAL FROM THE FACILITY WILL BE REQUIRED ONCE EVERY 10 YEARS. IF OTHER CONSTRUCTION OR RELATED ACTIVITIES ARE PERFORMED ON UPSLOPE PARCELS, ADEQUATE PROTECTION SHOULD BE PROVIDED AND INSPECTIONS PERFORMED AT LEAST ONCE WEEKLY.

A DESIGNATED REPRESENTATIVE OF THE OWNER WILL INSPECT THE SWM STRUCTURE AFTER EACH SIGNIFICANT RAINFALL EVENT OR THE FOLLOWING WORKING DAY IF A WEEKEND OR HOLIDAY OCCURS. A SIGNIFICANT RAINFALL FOR THIS STRUCTURE IS DEFINED AS ONE (1) INCH OR MORE OF GAUGED RAINFALL WITHIN A 24 HOUR PERIOD. ONCE PER YEAR, A REPRESENTATIVE OF THE COUNTY MAY JOINTLY INSPECT THE STRUCTURE. APPROPRIATE ACTION, PERFORMED AT THE COST OF THE OWNER, WILL BE TAKEN TO ENSURE APPROPRIATE MAINTENANCE. WHERE STRUCTURES ARE TO BE MAINTAINED JOINTLY, ALLOCATION OF MAINTENANCE COSTS WILL BE IN ACCORDANCE WITH THE TERMS ESTABLISHED IN MAINTENANCE AGREEMENTS. KEYS TO LOCKED ACCESS POINTS SHALL BE MADE AVAILABLE TO COUNTY INSPECTION PERSONNEL UPON REQUEST.

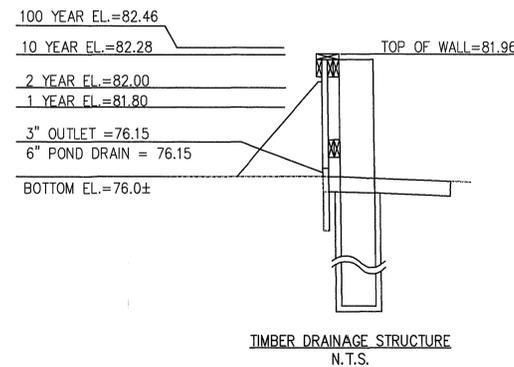
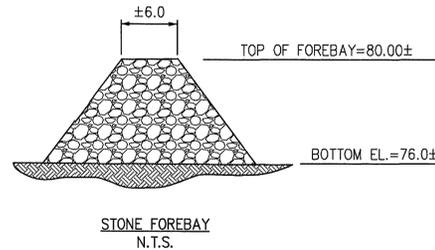
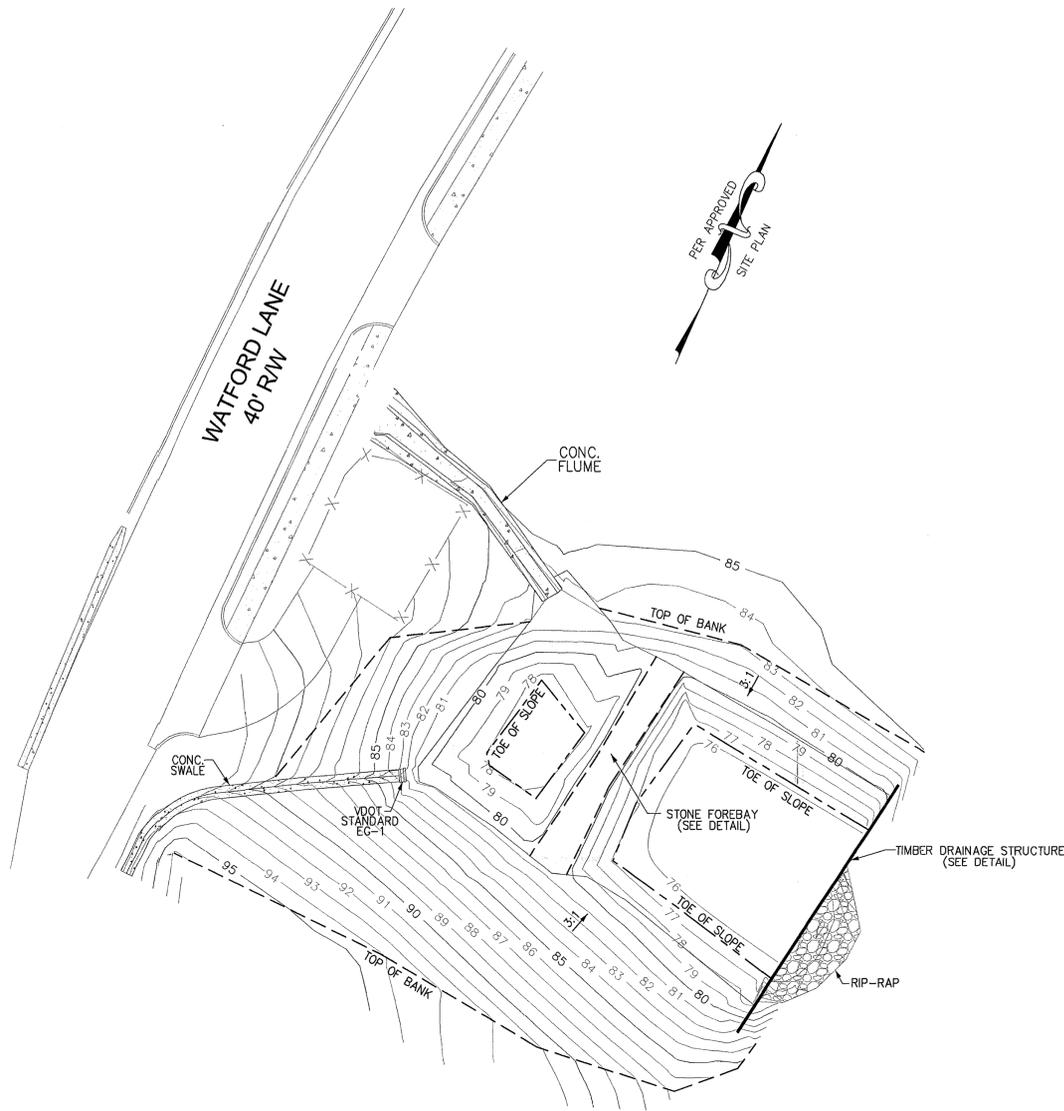
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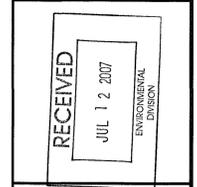
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RECORD DRAWING

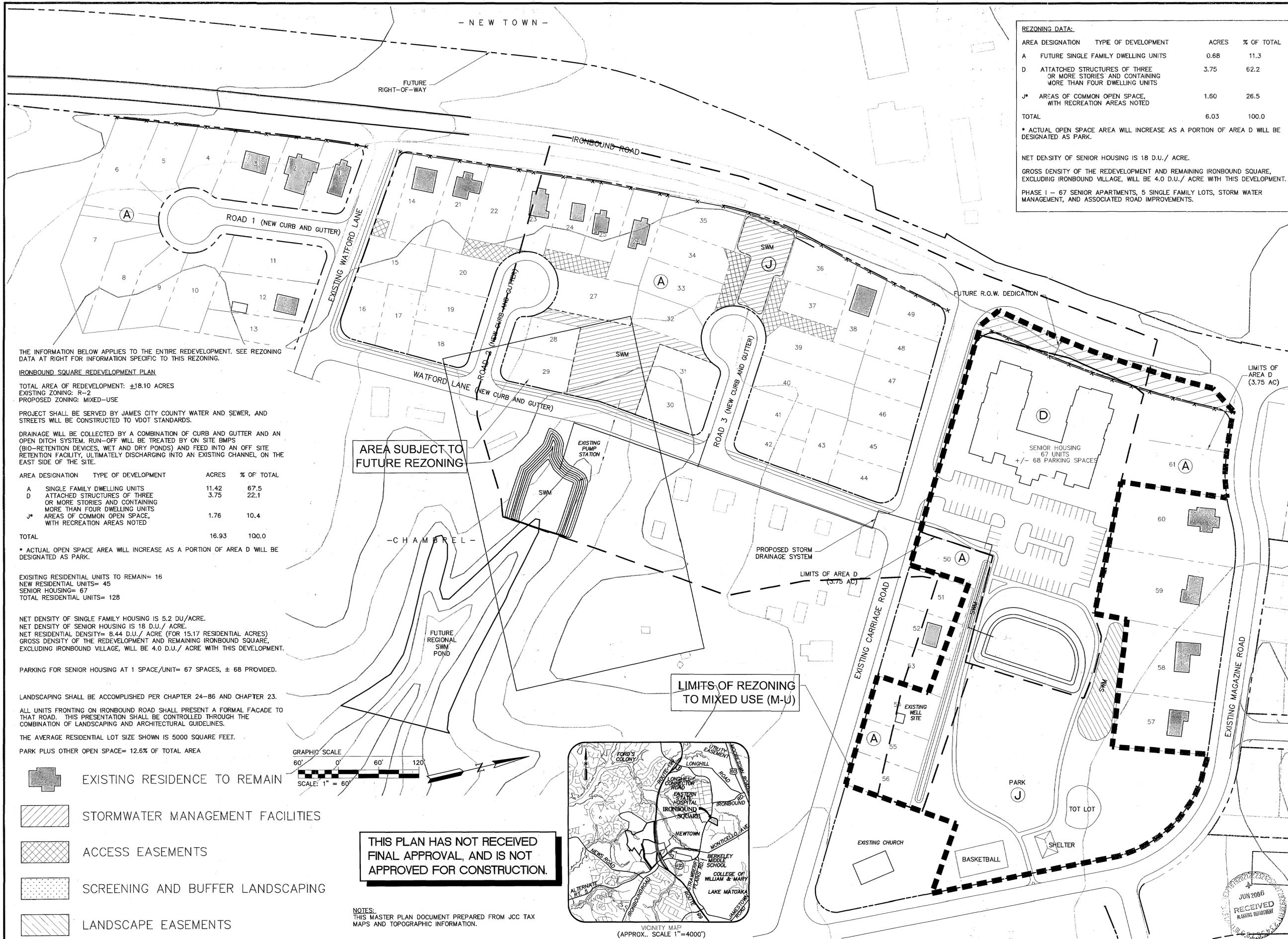
**IRONBOUND SQUARE REVITALIZATION  
PHASE I - BMP RECORD DRAWING**  
120 WATFORD LANE  
COUNTY PLAN # JCC SP-131-05  
BERKELY DISTRICT  
JAMES CITY COUNTY  
VIRGINIA

NO.	DATE	REVISION / COMMENT / NOTE



**LandTech Resources, Inc.**  
Surveying • GPS • Engineering  
5810-F Mooretown Road, Williamsburg, VA 23188  
Phone: (757) 565-4677 Fax: (757) 565-0782  
web: landtechresources.com

SCALE: 1" = 20'
DATE: 07/10/07
JOB: 07-133
DRAWN BY: JC
SHEET: 1 OF 1



**REZONING DATA:**

AREA DESIGNATION	TYPE OF DEVELOPMENT	ACRES	% OF TOTAL
A	FUTURE SINGLE FAMILY DWELLING UNITS	0.68	11.3
D	ATTACHED STRUCTURES OF THREE OR MORE STORIES AND CONTAINING MORE THAN FOUR DWELLING UNITS	3.75	62.2
J*	AREAS OF COMMON OPEN SPACE, WITH RECREATION AREAS NOTED	1.60	26.5
<b>TOTAL</b>		<b>6.03</b>	<b>100.0</b>

\* ACTUAL OPEN SPACE AREA WILL INCREASE AS A PORTION OF AREA D WILL BE DESIGNATED AS PARK.

NET DENSITY OF SENIOR HOUSING IS 18 D.U./ ACRE.

GROSS DENSITY OF THE REDEVELOPMENT AND REMAINING IRONBOUND SQUARE, EXCLUDING IRONBOUND VILLAGE, WILL BE 4.0 D.U./ ACRE WITH THIS DEVELOPMENT.

PHASE I - 67 SENIOR APARTMENTS, 5 SINGLE FAMILY LOTS, STORM WATER MANAGEMENT, AND ASSOCIATED ROAD IMPROVEMENTS.

THE INFORMATION BELOW APPLIES TO THE ENTIRE REDEVELOPMENT. SEE REZONING DATA AT RIGHT FOR INFORMATION SPECIFIC TO THIS REZONING.

**IRONBOUND SQUARE REDEVELOPMENT PLAN**

TOTAL AREA OF REDEVELOPMENT: ±18.10 ACRES  
 EXISTING ZONING: R-2  
 PROPOSED ZONING: MIXED-USE

PROJECT SHALL BE SERVED BY JAMES CITY COUNTY WATER AND SEWER, AND STREETS WILL BE CONSTRUCTED TO VDOT STANDARDS.

DRAINAGE WILL BE COLLECTED BY A COMBINATION OF CURB AND GUTTER AND AN OPEN DITCH SYSTEM. RUN-OFF WILL BE TREATED BY ON SITE BMPs (BIO-RETENTION DEVICES, WET AND DRY PONDS) AND FEED INTO AN OFF SITE RETENTION FACILITY, ULTIMATELY DISCHARGING INTO AN EXISTING CHANNEL ON THE EAST SIDE OF THE SITE.

AREA DESIGNATION	TYPE OF DEVELOPMENT	ACRES	% OF TOTAL
A	SINGLE FAMILY DWELLING UNITS	11.42	67.5
D	ATTACHED STRUCTURES OF THREE OR MORE STORIES AND CONTAINING MORE THAN FOUR DWELLING UNITS	3.75	22.1
J*	AREAS OF COMMON OPEN SPACE, WITH RECREATION AREAS NOTED	1.76	10.4
<b>TOTAL</b>		<b>16.93</b>	<b>100.0</b>

\* ACTUAL OPEN SPACE AREA WILL INCREASE AS A PORTION OF AREA D WILL BE DESIGNATED AS PARK.

EXISTING RESIDENTIAL UNITS TO REMAIN= 16  
 NEW RESIDENTIAL UNITS= 45  
 SENIOR HOUSING= 67  
 TOTAL RESIDENTIAL UNITS= 128

NET DENSITY OF SINGLE FAMILY HOUSING IS 5.2 DU/ACRE.  
 NET DENSITY OF SENIOR HOUSING IS 18 D.U./ ACRE.  
 NET RESIDENTIAL DENSITY= 8.44 D.U./ ACRE (FOR 15.17 RESIDENTIAL ACRES)  
 GROSS DENSITY OF THE REDEVELOPMENT AND REMAINING IRONBOUND SQUARE, EXCLUDING IRONBOUND VILLAGE, WILL BE 4.0 D.U./ ACRE WITH THIS DEVELOPMENT.

PARKING FOR SENIOR HOUSING AT 1 SPACE/UNIT= 67 SPACES, ± 68 PROVIDED.

LANDSCAPING SHALL BE ACCOMPLISHED PER CHAPTER 24-86 AND CHAPTER 23.

ALL UNITS FRONTING ON IRONBOUND ROAD SHALL PRESENT A FORMAL FACADE TO THAT ROAD. THIS PRESENTATION SHALL BE CONTROLLED THROUGH THE COMBINATION OF LANDSCAPING AND ARCHITECTURAL GUIDELINES.

THE AVERAGE RESIDENTIAL LOT SIZE SHOWN IS 5000 SQUARE FEET.

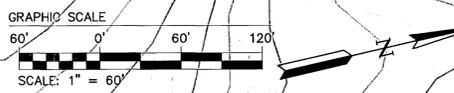
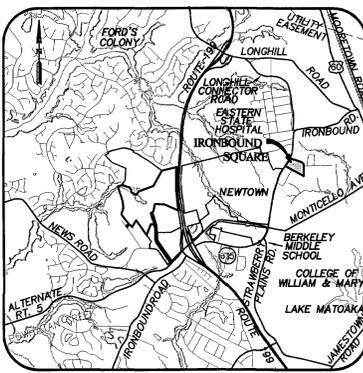
PARK PLUS OTHER OPEN SPACE= 12.6% OF TOTAL AREA

AREA SUBJECT TO FUTURE REZONING

LIMITS OF REZONING TO MIXED USE (M-U)

**THIS PLAN HAS NOT RECEIVED FINAL APPROVAL, AND IS NOT APPROVED FOR CONSTRUCTION.**

NOTES:  
 THIS MASTER PLAN DOCUMENT PREPARED FROM JCC TAX MAPS AND TOPOGRAPHIC INFORMATION.



- EXISTING RESIDENCE TO REMAIN
- STORMWATER MANAGEMENT FACILITIES
- ACCESS EASEMENTS
- SCREENING AND BUFFER LANDSCAPING
- LANDSCAPE EASEMENTS

NO.	DATE	REVISION / COMMENT / NOTE	BY

5248 Old Towne Road, Suite 1  
 Williamsburg, Virginia 23188  
 (757) 253-0040  
 Fax (757) 220-8894



MASTER PLAN FOR REZONING APARTMENTS FOR SENIOR HOUSING AT IRONBOUND SQUARE

BERKELEY DISTRICT JAMES CITY COUNTY VIRGINIA

Designed JSP	Drawn KSU
Scale 1"=60'	Date 2/22/05
Project No. 9014	
Drawing No. 1 OF 1	

JUN 2006 RECEIVED PLANNING DEPARTMENT

S:\Jobs\801400-IRONBOUND\_SQ\dwg\15-05 9014.bmc.dwg, 6/21/2006 9:50:37 AM, mmf

SP-131-05

**SUBMITTAL DOCUMENTS**

**FOR**

**IRONBOUND SQUARE REVITALIZATION  
ROADWAY IMPROVEMENTS - PHASE 1**

**SUBMITTED TO:**

**James City County  
Environmental Division**

*SP-131-05  
2ND SUB*  
*KEEP IN  
FILE*

*INTERIM  
DA = 17.35 AC*

*FUTURE (NEW TOWN BUILT)  
DA = 15.77 AC*

*Does not include size 0 AS  
Forest  
• Does not include  
improvements to  
Ironbound Road  
VADT  
• size 0 AS  
5.47 AC IMP*

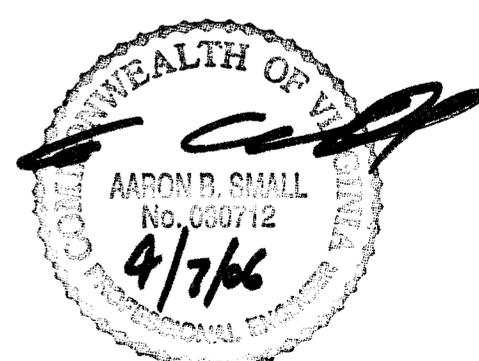


**Prepared By:**

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

**October 19, 2005  
Revised: April 7, 2006**

**AES Project No. 9014**



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- I. WORKSHEET FOR BMP POINT SYSTEM
- II. STORM SEWER DRAINAGE AREA MAPS
- III. STORM SEWER CALCULATIONS
- IV. INLET SPREAD AND CAPACITY CALCULATIONS
- V. EQUIVALENT PIPE CALCULATION
- VI. CHANNEL ANALYSIS
- VII. DRAINAGE AREA MAPS
- VIII. SCS CALCULATIONS
- IX. CHANNEL PROTECTION VOLUME *? where*
- X. FOREBAY SIZE
- XI. DRY DETENTION BASIN CALCULATIONS
- XII. TRAJECTORY CALCULATIONS
- XIII. CULVERT CALCULATIONS

TABLE 3

WORKSHEET FOR BMP POINT SYSTEM  
 Ironbound Square, AES PROJECT No. 9014-01  
 TOTAL AREA = 7.3\* 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 Filter	1.48	10	X	0.203	2.03
Bioretention Filter	0.30	10	X	0.041	0.41
Dry Pond*	13.99	4	X	1.916	7.67
Dry Pond	1.78	2	X	0.244	0.49
TOTAL WEIGHTED STRUCTURAL BMP POINTS:					10.59

*Handwritten notes:*  
 599 BASIS  
 1.060  
 0.210  
 4.000  
 0.254  
 5.524

B. NATURAL OPEN SPACE CREDIT

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

*Handwritten note:*  
 NEED 5 ACRES OF 10 PT BMP

C. TOTAL WEIGHTED POINTS

10.59	+	0.00	=	10.59
Structural BMP Points		Natural Open Space Points		TOTAL

\* Total site area includes 5 single family lots and the Bay Aging property (4.64 AC) plus the site area for Ironbound Square (2.66 AC)

13.99 AC is used for the Dry Pond Drainage Area instead of 17.35 AC, which currently drains to the Dry Pond, because when New Town is built out the difference, 3.36 AC, will not



STORM SEWER DRAINAGE AREAS  
 BAY AGING SENIOR HOUSING PROJECT  
 SITE DEVELOPMENT PLAN  
 IRONBOUND SQUARE

BERKELEY DISTRICT    JAMES CITY COUNTY    VIRGINIA

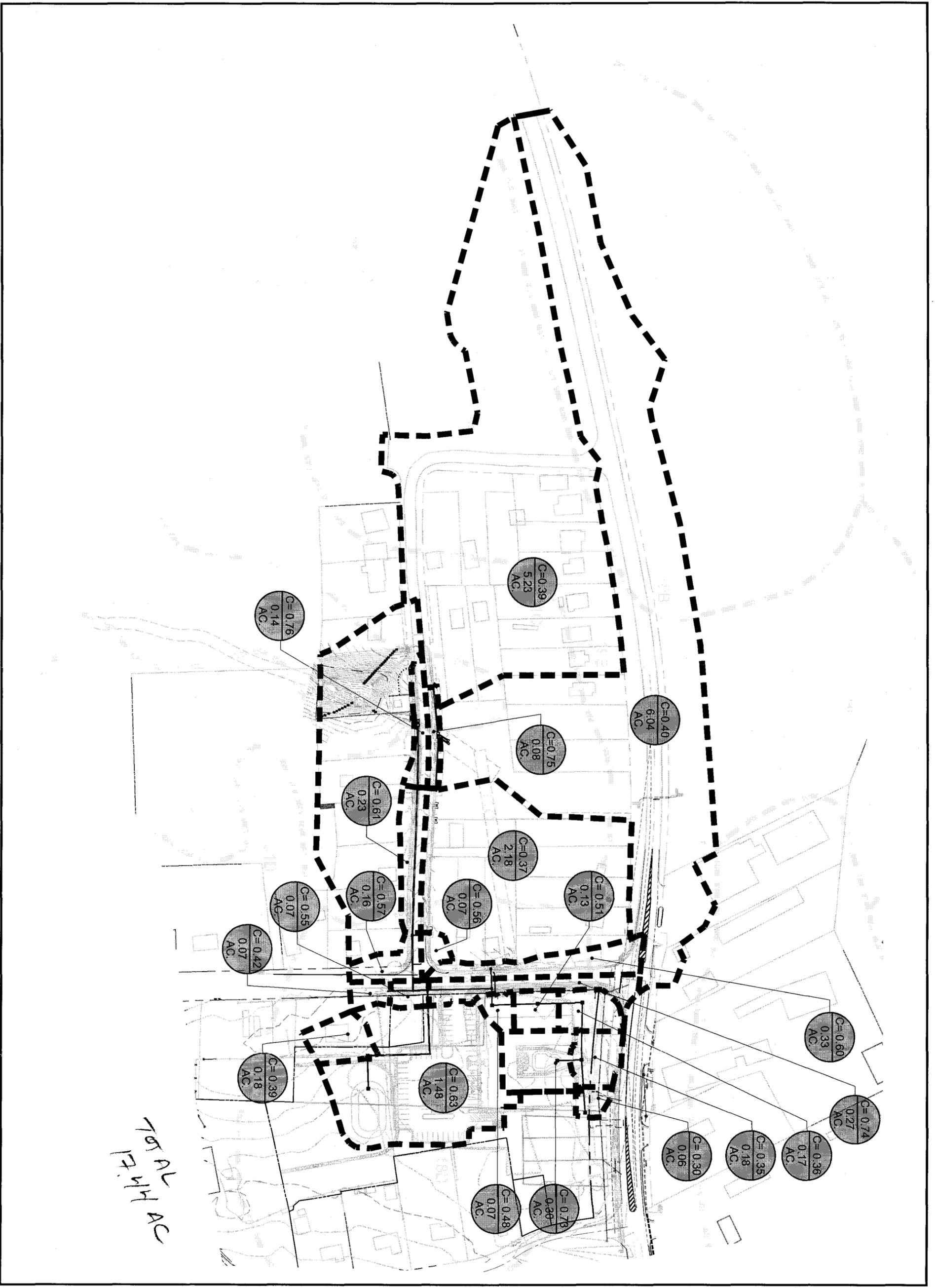


5248 Olde Towne Road, Suite 1  
 Williamsburg, Virginia 23188  
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 Fax (757) 220-8994



No.	DATE	REVISION / COMMENT / NOTE	REVISOR	REVIEWER
2	11/16/06	PER JCC COMMENTS DATED 11/16/05, 11/21/05, 12/19/05	ABS	ABS
1	10/19/05	PER JCC COMMENTS DATE 8/25/05 & 10/3/05	EMG	ABS

2



TOTAL  
75.14 AC

**FUTURE STORM SEWER DRAINAGE AREAS**  
**BAY AGING SENIOR HOUSING PROJECT**  
**SITE DEVELOPMENT PLAN**  
**IRONBOUND SQUARE**

BERKELEY DISTRICT      JAMES CITY COUNTY      VIRGINIA

Designated: ABS/BMC	Drawn: SJP
Scale: 1"=50'	Date: 8/03/05
Project No. 9551-00	Drawing No. 3

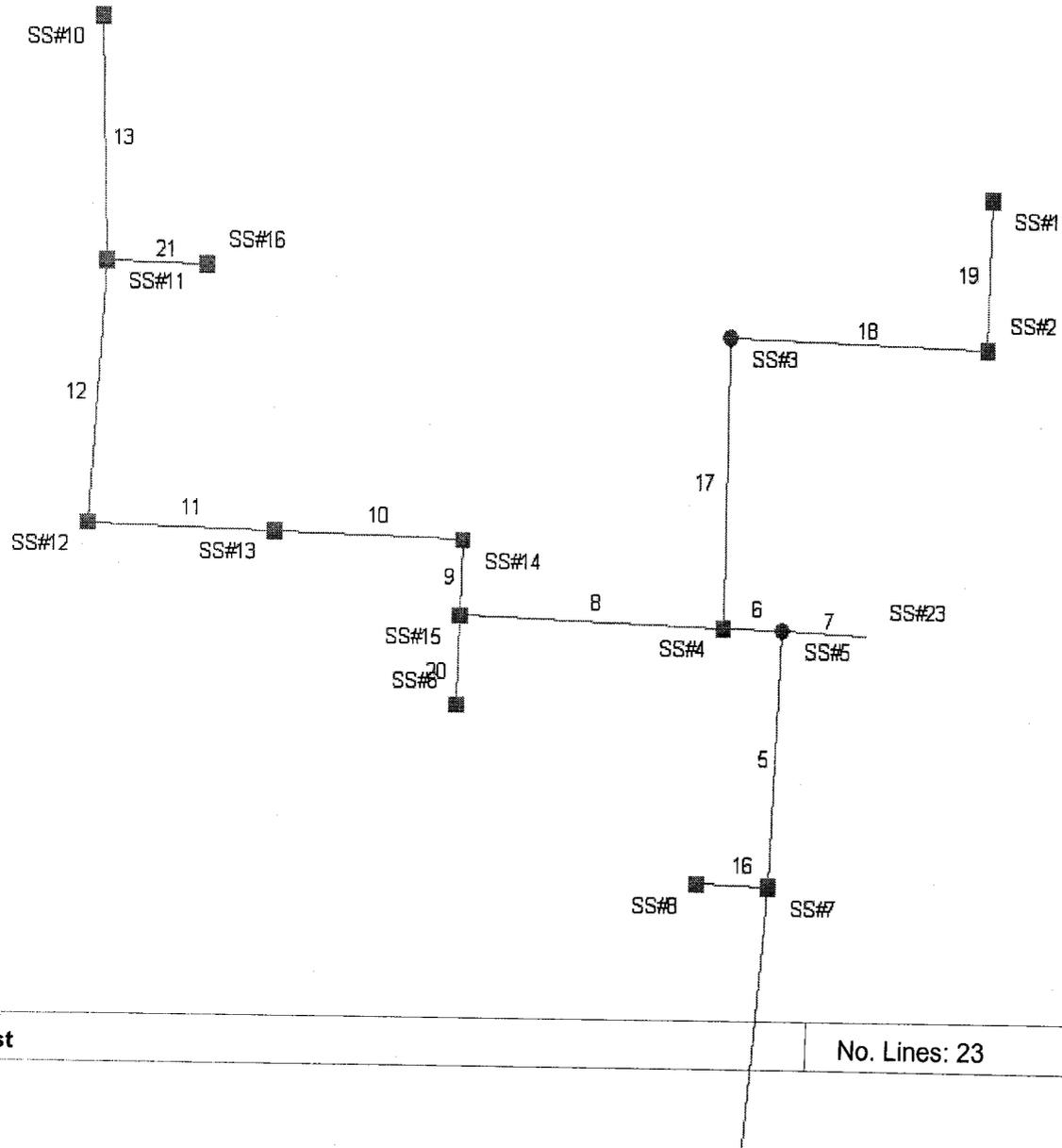
**ES**  
**CONSULTING ENGINEERS**  
 WILLIAMSBURG • RICHMOND

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

COMMONWEALTH OF VIRGINIA  
 AARON B. SMALL  
 No. 030712  
 1/16/06  
 PROFESSIONAL ENGINEER

No.	DATE	REVISION / COMMENT / NOTE	REVISOR	REVIEWED BY
2	1/16/06	PER JCC COMMENTS DATED 11/16/05, 11/21/05, 12/19/05	ABS	ABS
1	10/19/05	PER JCC COMMENTS DATE 8/25/05 & 10/3/05	BMC	ABS

# Hydraflow Plan View

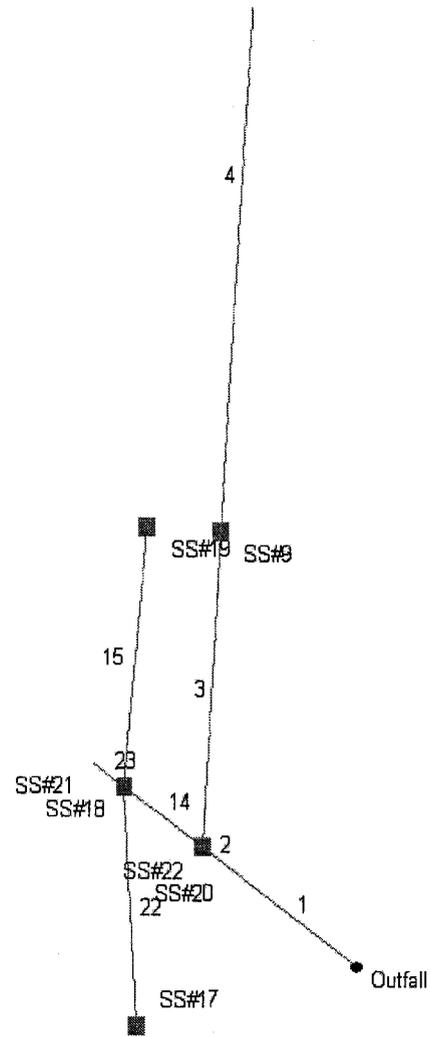


9014-Ironbound Square - Post

No. Lines: 23

04-05-2006

# Hydraflow Plan View



# Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	60.0	0.00	15.44	0.00	0.00	6.03	0.0	29.3	3.7	30.75	434.0	5.23	36 72 b	4.45	84.67	82.00	85.60	83.03	87.00	82.00	CHANNEL - Outf
2	1	15.0	0.14	15.44	0.76	0.11	6.03	5.0	29.3	3.7	30.78	85.27	6.85	39	1.07	84.83	84.67	86.56	86.40	90.74	87.00	SS#22 - CHANN
3	2	113.0	0.23	1.99	0.61	0.14	1.05	5.0	22.9	4.2	13.00	29.64	5.14	24	1.72	86.77	84.83	88.05	87.02	95.07	90.74	SS#9- SS#22
4	3	255.0	0.16	1.76	0.57	0.09	0.91	5.0	21.9	4.3	12.50	25.30	5.32	24	1.25	89.96	86.77	91.21	88.39	101.30	95.07	SS#7 - SS#9
5	4	97.0	0.00	1.53	0.00	0.00	0.78	0.0	21.5	4.3	11.97	25.26	5.20	24	1.25	91.17	89.96	92.40	91.55	103.60	101.30	SS#5 - SS#7
6	5	25.0	0.07	1.46	0.55	0.04	0.75	5.0	21.4	4.3	11.85	15.67	4.64	24	0.48	91.29	91.17	92.77	92.72	103.14	103.60	SS#4 - SS#5
7	5	36.0	0.07	0.07	0.42	0.03	0.03	5.0	5.0	7.5	0.22	21.52	1.90	15	11.11	103.00	99.00	103.19	99.19	103.00	103.60	SS#23 - SS#5
8	6	112.0	0.27	1.21	0.74	0.20	0.64	5.0	21.0	4.4	4.60	7.30	4.54	15	1.28	93.47	92.04	94.33	93.17	102.26	103.14	SS#15 - SS#4
9	8	29.0	0.07	0.61	0.48	0.03	0.24	5.0	20.9	4.4	2.86	5.09	4.21	15	0.62	96.73	96.55	97.41	97.23	101.30	102.26	SS#14 - SS#15
10	9	80.0	0.13	0.54	0.51	0.07	0.21	5.0	20.4	4.4	2.73	4.68	2.90	15	0.52	97.15	96.73	97.93	97.81	101.30	101.30	SS#13 - SS#14
11	10	78.0	0.17	0.41	0.36	0.06	0.14	5.0	19.8	4.5	2.44	4.57	3.02	15	0.50	97.54	97.15	98.22	98.09	102.00	101.30	SS#12 - SS#13
12	11	100.0	0.18	0.24	0.35	0.06	0.08	5.0	18.9	4.6	2.17	4.38	2.68	15	0.46	98.00	97.54	98.67	98.52	103.30	102.00	SS#11 - SS#12
13	12	92.0	0.06	0.06	0.30	0.02	0.02	5.0	5.0	7.5	0.13	10.05	0.90	15	2.42	100.23	98.00	100.38	98.96	103.00	103.30	SS#10 - SS#11
14	2	38.0	0.08	13.31	0.75	0.06	4.88	5.0	29.1	3.7	17.99	41.07	4.29	31	0.84	85.15	84.83	86.92	86.95	90.79	90.74	SS#18 - SS#22
15	14	93.0	0.11	0.11	0.77	0.08	0.08	5.0	5.0	7.5	0.63	14.59	1.54	15	5.11	90.65	85.90	90.97	87.35	94.57	90.79	SS#19 - SS#18
16	4	30.0	0.07	0.07	0.56	0.04	0.04	5.0	5.0	7.5	0.29	7.55	2.06	15	1.37	97.38	96.97	97.60	97.19	101.30	101.30	SS#8 - SS#7
17	6	111.0	0.00	0.18	0.00	0.00	0.07	0.0	11.0	5.8	7.21	16.07	2.65	24	0.50	91.85	91.29	93.29	93.22	101.86	103.14	SS#3 - SS#4
18	17	109.0	0.18	0.18	0.39	0.07	0.07	5.0	10.2	6.0	7.22	16.07	3.42	24	0.50	92.40	91.85	93.50	93.41	102.00	101.86	SS#2 - SS#3
19	18	57.0	0.00	0.00	0.00	0.00	0.00	10.0	10.0	0.0	6.80	7.23	4.22	18	0.47	92.67	92.40	93.92	93.72	98.50	102.00	SS#1 - SS#2
20	8	34.0	0.33	0.33	0.60	0.20	0.20	5.0	5.0	7.5	1.48	4.57	1.27	15	0.50	93.64	93.47	94.71	94.70	102.26	102.26	SS#6- SS#15
21	12	42.0	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	1.80	4.67	2.63	15	0.52	98.22	98.00	98.83	98.79	103.30	103.30	SS#16 - SS#11

9014-Ironbound Square - Post

Number of lines: 23

Run Date: 04-05-2006

NOTES: Intensity = 55.61 / (Inlet time + 10.00) ^ 0.74; Return period = 10 Yrs.

# Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
22	14	86.0	0.08	0.08	0.45	0.04	0.04	5.0	5.0	7.5	0.27	17.90	1.05	18	2.91	88.15	85.65	88.35	87.35	92.32	90.79	SS#17 - SS#18
23	14	15.0	13.04	13.04	0.36	4.69	4.69	29.0	29.0	3.7	17.35	47.65	4.64	31	1.13	85.32	85.15	86.95	87.01	85.32	90.79	SS#21 - SS#18

9014-Ironbound Square - Post

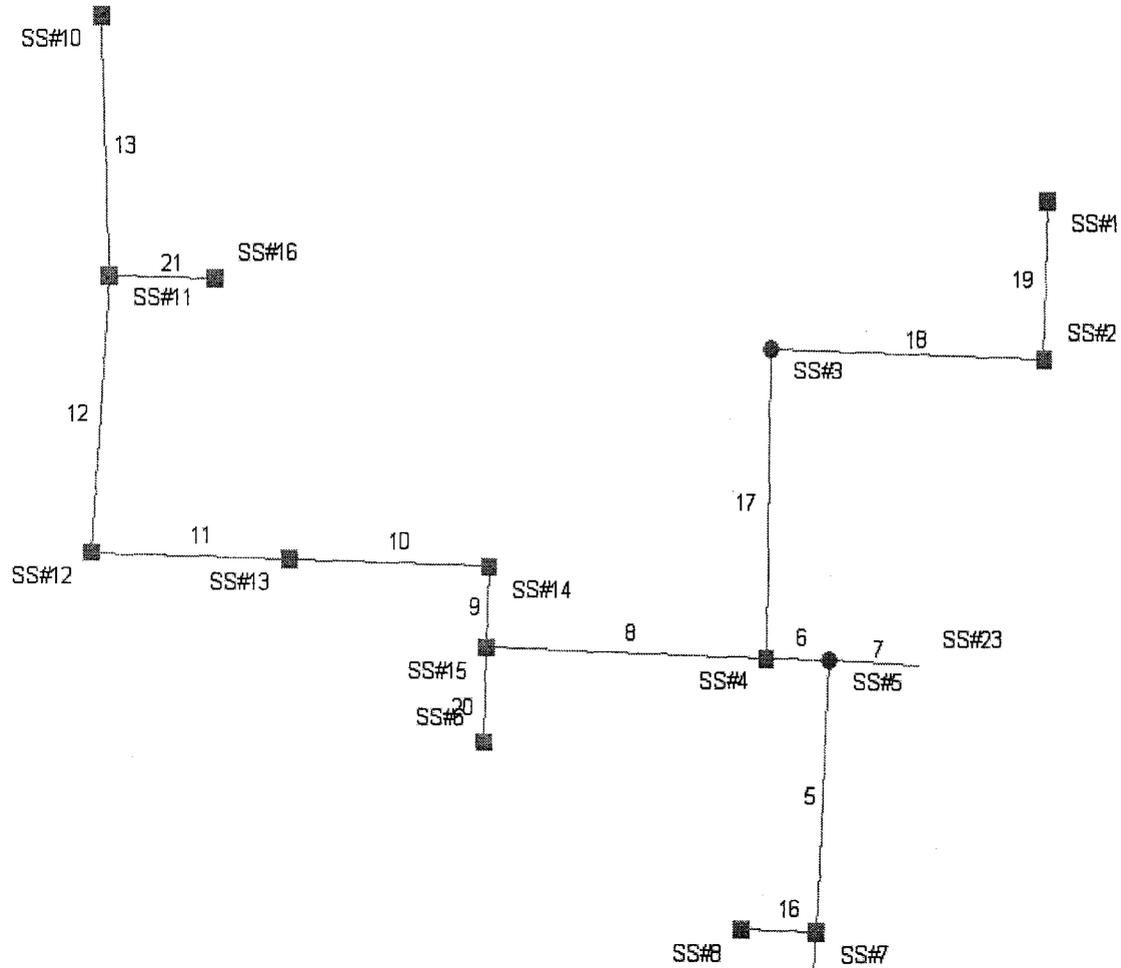
Number of lines: 23

Run Date: 04-05-2006

NOTES: Intensity = 55.61 / (Inlet time + 10.00) ^ 0.74; Return period = 10 Yrs.



# Hydraflow Plan View

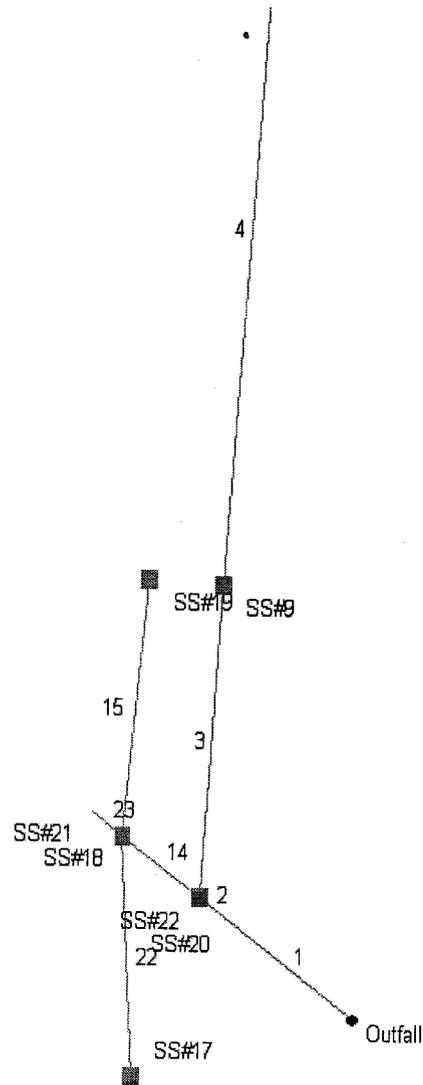


9014-Ironbound Square - Future

No. Lines: 23

04-05-2006

# Hydraflow Plan View



2014-Ironbound Square - Future

No. Lines: 23

04-05-2006

# Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	60.0	0.00	15.66	0.00	0.00	6.48	0.0	23.3	4.2	35.49	434.0	5.47	36 72 b	4.45	84.67	82.00	85.70	83.14	87.00	82.00	CHANNEL - Outf
2	1	15.0	0.14	15.66	0.76	0.11	6.48	5.0	23.3	4.2	35.51	85.27	7.23	39	1.07	84.83	84.67	86.69	86.53	90.74	87.00	SS#22 - CHANN
3	2	113.0	0.23	1.99	0.61	0.14	1.05	5.0	22.9	4.2	13.00	29.64	5.14	24	1.72	86.77	84.83	88.05	87.24	95.07	90.74	SS#9 - SS#22
4	3	255.0	0.16	1.76	0.57	0.09	0.91	5.0	21.9	4.3	12.50	25.30	5.32	24	1.25	89.96	86.77	91.21	88.39	101.30	95.07	SS#7 - SS#9
5	4	97.0	0.00	1.53	0.00	0.00	0.78	0.0	21.5	4.3	11.97	25.26	5.20	24	1.25	91.17	89.96	92.40	91.56	103.60	101.30	SS#5 - SS#7
6	5	25.0	0.07	1.46	0.55	0.04	0.75	5.0	21.4	4.3	11.85	15.67	4.64	24	0.48	91.29	91.17	92.77	92.72	103.14	103.60	SS#4 - SS#5
7	5	36.0	0.07	0.07	0.42	0.03	0.03	5.0	5.0	7.5	0.22	21.52	1.90	15	11.11	103.00	99.00	103.19	99.19	103.00	103.60	SS#23 - SS#5
8	6	112.0	0.27	1.21	0.74	0.20	0.64	5.0	21.0	4.4	4.60	7.30	4.54	15	1.28	93.47	92.04	94.33	93.17	102.26	103.14	SS#15 - SS#4
9	8	29.0	0.07	0.61	0.48	0.03	0.24	5.0	20.9	4.4	2.86	5.09	4.21	15	0.62	96.73	96.55	97.41	97.23	101.30	102.26	SS#14 - SS#15
10	9	80.0	0.13	0.54	0.51	0.07	0.21	5.0	20.4	4.4	2.73	4.68	2.90	15	0.52	97.15	96.73	97.93	97.81	101.30	101.30	SS#13 - SS#14
11	10	78.0	0.17	0.41	0.36	0.06	0.14	5.0	19.8	4.5	2.44	4.57	3.02	15	0.50	97.54	97.15	98.22	98.09	102.00	101.30	SS#12 - SS#13
12	11	100.0	0.18	0.24	0.35	0.06	0.08	5.0	18.9	4.6	2.17	4.38	2.68	15	0.46	98.00	97.54	98.67	98.52	103.30	102.00	SS#11 - SS#12
13	12	92.0	0.06	0.06	0.30	0.02	0.02	5.0	5.0	7.5	0.13	10.05	0.90	15	2.42	100.23	98.00	100.38	98.96	103.00	103.30	SS#10 - SS#11
14	2	38.0	0.08	13.53	0.75	0.06	5.32	5.0	10.4	6.0	31.79	41.07	7.40	31	0.84	85.15	84.83	87.02	86.93	90.79	90.74	SS#18 - SS#22
15	14	93.0	2.18	2.18	0.37	0.81	0.81	10.0	10.0	6.1	4.89	14.59	4.62	15	5.11	90.65	85.90	91.53	87.73	94.57	90.79	SS#19 - SS#18
16	4	30.0	0.07	0.07	0.56	0.04	0.04	5.0	5.0	7.5	0.29	7.55	2.06	15	1.37	97.38	96.97	97.60	97.19	101.30	101.30	SS#8 - SS#7
17	6	111.0	0.00	0.18	0.00	0.00	0.07	0.0	11.0	5.8	7.21	16.07	2.65	24	0.50	91.85	91.29	93.29	93.22	101.86	103.14	SS#3 - SS#4
18	17	109.0	0.18	0.18	0.39	0.07	0.07	5.0	10.2	6.0	7.22	16.07	3.42	24	0.50	92.40	91.85	93.50	93.41	102.00	101.86	SS#2 - SS#3
19	18	57.0	0.00	0.00	0.00	0.00	0.00	10.0	10.0	0.0	6.80	7.23	4.22	18	0.47	92.67	92.40	93.92	93.72	98.50	102.00	SS#1 - SS#2
20	8	34.0	0.33	0.33	0.60	0.20	0.20	5.0	5.0	7.5	1.48	4.57	1.27	15	0.50	93.64	93.47	94.71	94.70	102.26	102.26	SS#6 - SS#15
21	12	42.0	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	1.80	4.67	2.63	15	0.52	98.22	98.00	98.83	98.79	103.30	103.30	SS#16 - SS#11

9014-Ironbound Square - Future

Number of lines: 23

Run Date: 04-05-2006

NOTES: Intensity = 55.61 / (Inlet time + 10.00) ^ 0.74; Return period = 10 Yrs.

# Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
22	14	86.0	5.23	5.23	0.39	2.04	2.04	10.0	10.0	6.1	12.36	17.90	7.23	18	2.91	88.15 ✓	85.65	89.48	87.21	92.32	90.79	SS#17 - SS#18
23	14	15.0	6.04	6.04	0.40	2.42	2.42	10.0	10.0	6.1	14.64	47.65	2.80	31	1.13	85.32 ✓	85.15	87.86	87.84	85.32	90.79	SS#21 - SS#18

9014-Ironbound Square - Future

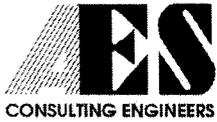
Number of lines: 23

Run Date: 04-05-2006

NOTES: Intensity = 55.61 / (Inlet time + 10.00) ^ 0.74; Return period = 10 Yrs.







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 Fax: (757) 220-8994  
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Project Title: Ironbound Square  
 Project No.: 9014-01  
 Prepared By: SJP  
 Date: 1/22/2006

Q=flow rate, cfs  
 A=cross-sectional area, ft<sup>2</sup>  
 n=roughness factor  
 R=hydraulic radius, ft  
 S=gradient, ft/ft  
 P=wetted perimeter, ft

Flow for Single Pipe				
Q (cfs)	n	s (ft/ft)	A	Diameter (in)
20.2	0.013	0.008	3.1	24

# of Pipes 2

Q (cfs)	n	s (ft/ft)	A	Eq. Pipe Diameter (in)
40.5	0.013	0.008	5.3	31.09

$$Q = A \frac{1.49 R^{2/3} s^{1/2}}{n} \quad R = \frac{A}{P} \quad A = \pi r^2 \quad P = 2\pi r$$

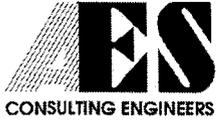
$$Q = A \frac{1.49 (A)^{2/3} s^{1/2}}{n (P)}$$

$$Q = (2)\pi r^2 \frac{1.49 (\pi r^2)^{2/3} s^{1/2}}{n (2\pi r)}$$

$$Q = \pi r^2 \frac{1.49 (r)^{2/3} s^{1/2}}{n (2)}$$

$$\frac{Qn}{\pi 1.49 s^{1/2}} = r^2 \frac{(r)^{2/3}}{(2)}$$

$$\left\{ \frac{2^{2/3} Qn}{\pi 1.49 s^{1/2}} \right\}^{3/8} = r$$



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Project Title: Ironbound Square  
 Project No.: 9014-01  
 Prepared By: SJP  
 Date: 1/22/2006

Flow for Single Pipe				
Q (cfs)	n	s (ft/ft)	A	Diameter (in)
36.7	0.013	0.008	4.9	30

# of Pipes 2

Q (cfs)	n	s (ft/ft)	A	Eq. Pipe Diameter (in)
73.4	0.013	0.008	8.2	38.87

Q=flow rate, cfs  
 A=cross-sectional area, ft<sup>2</sup>  
 n=roughness factor  
 R=hydraulic radius, ft  
 S=gradient, ft/ft  
 P=wetted perimeter, ft

$$Q = A \frac{1.49}{n} R^{2/3} s^{1/2} \quad R = \frac{A}{P} \quad A = \pi r^2 \quad P = 2\pi r$$

$$Q = A \frac{1.49}{n} \left(\frac{A}{P}\right)^{2/3} s^{1/2}$$

$$Q = (2\pi r)^2 \frac{1.49}{n} \left(\frac{\pi r^2}{2\pi r}\right)^{2/3} s^{1/2}$$

$$Q = \pi r^2 \frac{1.49}{n} \left(\frac{r}{2}\right)^{2/3} s^{1/2}$$

$$\frac{Qn}{\pi 1.49 s^{1/2}} = r^2 \left(\frac{r}{2}\right)^{2/3}$$

$$\left\{ \frac{2^{2/3} Qn}{\pi 1.49 s^{1/2}} \right\}^{3/8} = r$$

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name:

Comment: Concrete Channel on West side Watford Ln

Solve For Depth

Given Input Data:

Left Side Slope..	2.00:1 (H:V)
Right Side Slope.	2.00:1 (H:V)
Manning's n.....	0.015
Channel Slope....	0.0097 ft/ft
Discharge.....	0.27 cfs

Computed Results:

Depth.....	0.25 ft
Velocity.....	2.24 fps
Flow Area.....	0.12 sf
Flow Top Width...	0.98 ft
Wetted Perimeter.	1.10 ft
Critical Depth...	0.26 ft
Critical Slope...	0.0075 ft/ft
Froude Number....	1.13 (flow is Supercritical)



Drawing No. 1  
 Project No. 9551-00  
 Date 8/03/05  
 Designer ABS/BMC  
 Scale 1"=50'  
 Drawn SJP

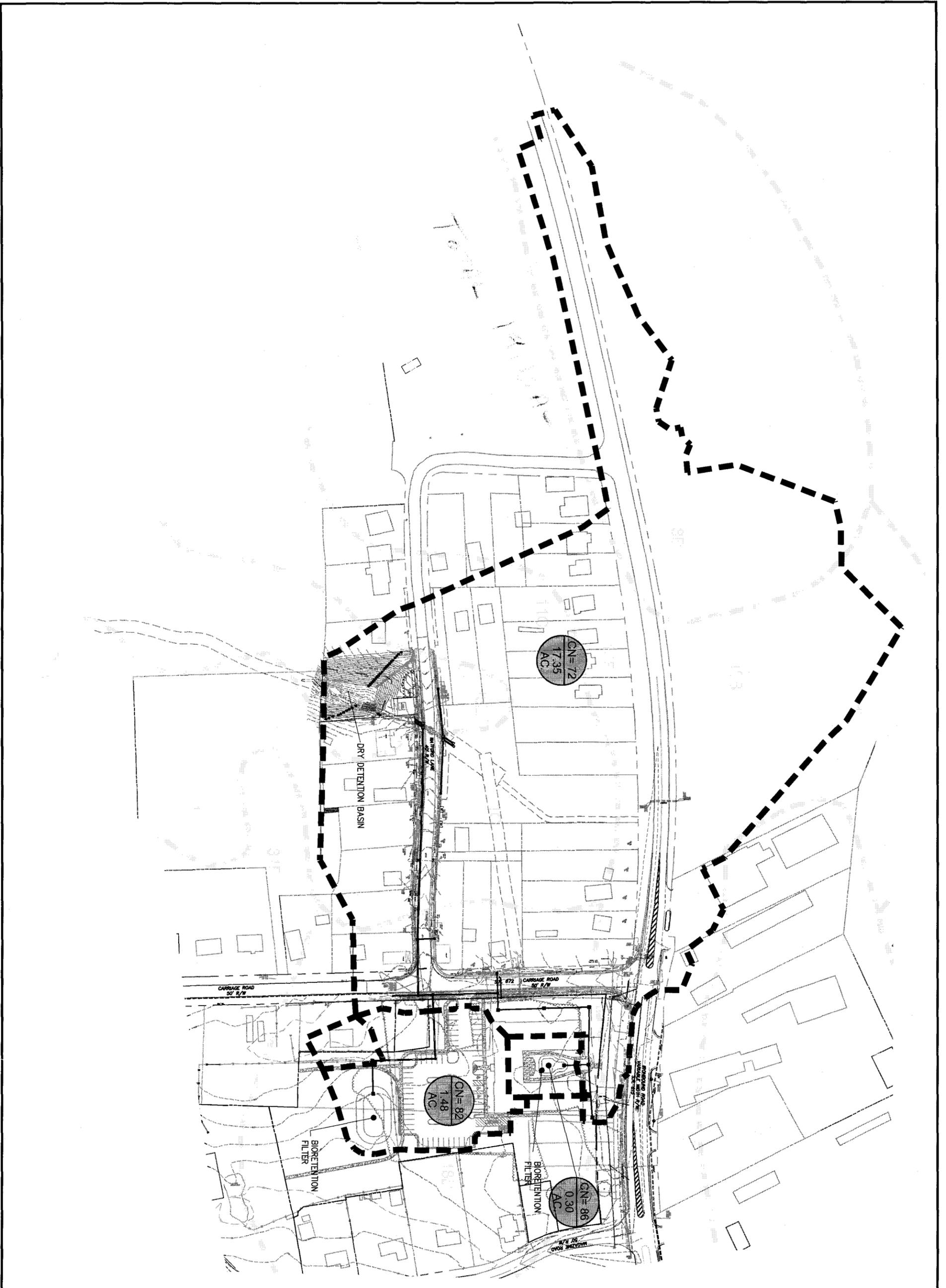
**PRE-DEVELOPMENT DRAINAGE AREAS**  
**BAY AGING SENIOR HOUSING PROJECT**  
**SITE DEVELOPMENT PLAN**  
**IRONBOUND SQUARE**  
 BERKELEY DISTRICT    JAMES CITY COUNTY    VIRGINIA



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No.	DATE	REVISION / COMMENT / NOTE	REVIEWED BY	REVIEWED BY
2	11/16/06	PER JCC COMMENTS DATED 11/16/05, 11/21/05, 12/19/05	ABS	ABS
1	10/19/05	PER JCC COMMENTS DATE 8/25/05 & 10/3/05	BMC	ABS



Drawing No. 9851-00  
 Date 8/03/05  
 Scale 1"=50'  
 Designer ABS/BMC  
 Checker SJP  
 Project No. 9851-00  
 4

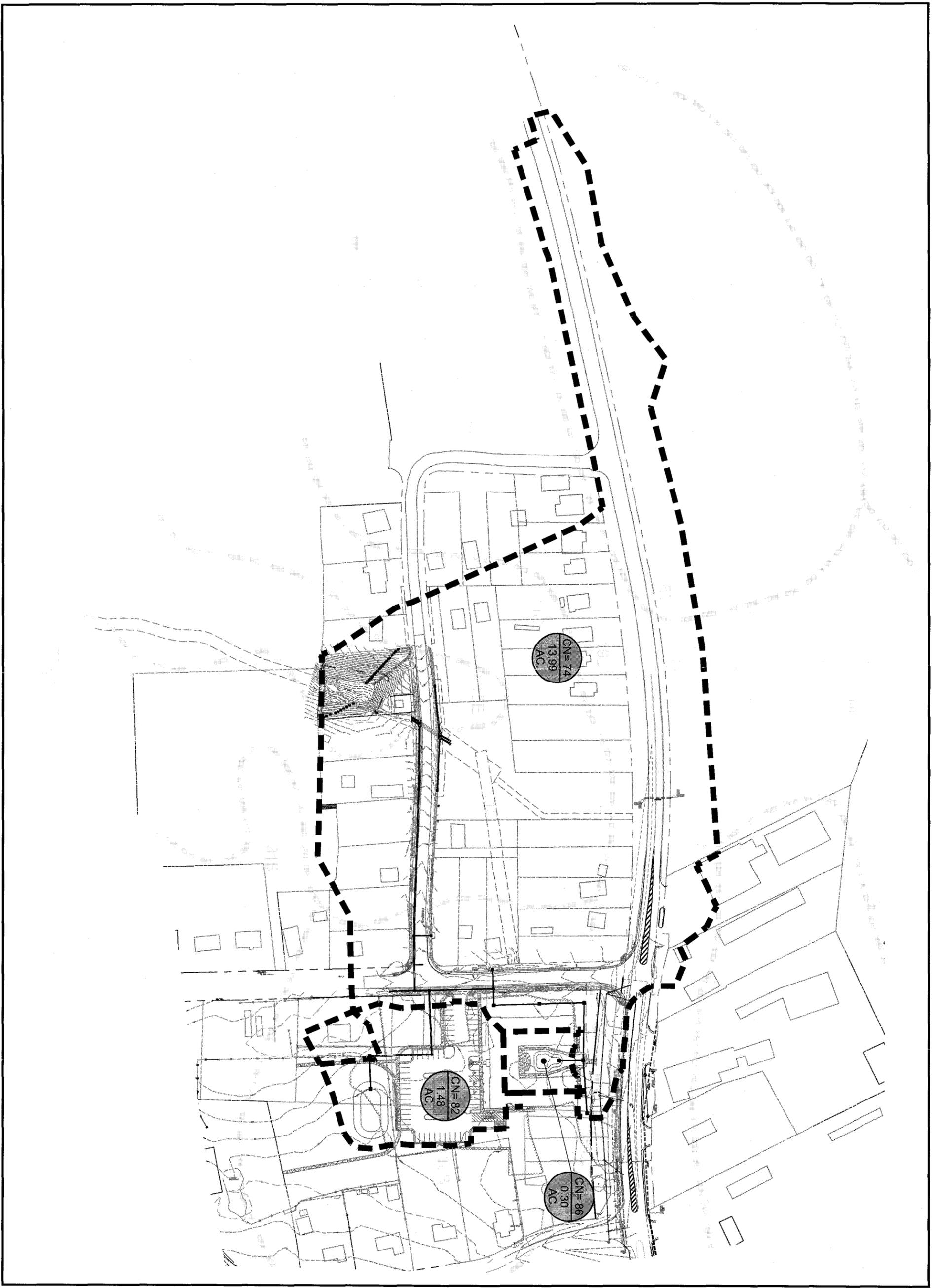
**BMP DRAINAGE AREAS**  
**BAY AGING SENIOR HOUSING PROJECT**  
**SITE DEVELOPMENT PLAN**  
**IRONBOUND SQUARE**  
 BERKELEY DISTRICT    JAMES CITY COUNTY    VIRGINIA



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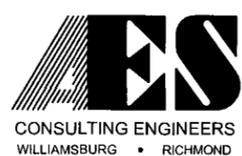


No.	DATE	REVISION / COMMENT / NOTE	REVIEWED BY	DESIGNED BY
2	1/16/06	PER JCC COMMENTS DATED 11/16/05, 11/21/05, 12/19/05	ABS	ABS
1	10/19/05	PER JCC COMMENTS DATE 8/25/05 & 10/3/05	BMC	ABS



Designed by  
 ABS/BMC  
 Scale  
 1"=50'  
 Date  
 8/03/05  
 Project No.  
 9551-00  
 Drawing No.  
 3

**FUTURE BMP DRAINAGE AREAS**  
**BAY AGING SENIOR HOUSING PROJECT**  
**SITE DEVELOPMENT PLAN**  
**IRONBOUND SQUARE**  
 BERKELEY DISTRICT    JAMES CITY COUNTY    VIRGINIA



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No.	DATE	REVISION / COMMENT / NOTE	REVISION BY	REVIEWED BY
2	1/16/06	PER JCC COMMENTS DATED 11/16/05, 11/21/05, 12/19/05	ABS	ABS
1	10/19/05	PER JCC COMMENTS DATE 8/23/05 & 10/3/05	BMC	ABS

**IRONBOUND SQUARE  
CALCULATION OF SCS CURVE NUMBER AND  
TIME OF CONCENTRATION USING SCS SEGMENTAL METHOD**

Job. No.: 9014-01  
Date: February 3, 2006  
Revised: April 6, 2006  
By: Steven J. Poe

**PRE-DEVELOPMENT CONDITIONS**

Outfall to Existing Wetlands

A. Pre-Development Drainage Area to Point of Concern = 17.68 Acres

B. Pre-development Land Use, Soil Classification and Calculation of Composite Curve Number

	Soil Type	Hydrologic Soil Group	Pre-Development Land Use	Area of Land Use (in Acres)	Curve Number for Land Use (CN)	Sum (CN*A)
1)	8B Caroline fine sandy loam, 2	C	23 Woods (fair - 50-75% Ground Cover)	0.70	73	51
2)	8B Caroline fine sandy loam, 2	C	32 Pasture or Range (good - >75% Ground Cover)	2.08	74	154
3)	8B Caroline fine sandy loam, 2	C	07 Roadways w/ Open Ditch (incl R/W)	0.91	92	84
4)	11C Craven-Uchee complex, 6	B	12 Residential District (1/3 acre) (30% Imp)	4.79	72	345
5)	15E Emporia complex, 15 to 25	C	12 Residential District (1/3 acre) (30% Imp)	0.75	81	61
6)	15E Emporia complex, 15 to 25	C	23 Woods (fair - 50-75% Ground Cover)	0.35	73	26
7)	18B Kempsville fine sandy loam	B	12 Residential District (1/3 acre) (30% Imp)	2.45	72	176
8)	18B Kempsville fine sandy loam	B	09 Gravel	0.05	85	4
9)	19B Kempsville-Emporia fine sa	B	24 Woods (good - >75% Ground Cover)	1.11	55	61
10)	19B Kempsville-Emporia fine sa	B	32 Pasture or Range (good - >75% Ground Cover)	1.79	61	109
11)	19B Kempsville-Emporia fine sa	B	16 Commercial and business (85% Imp)	0.31	92	29
12)	19B Kempsville-Emporia fine sa	B	12 Residential District (1/3 acre) (30% Imp)	1.74	72	125
13)	19B Kempsville-Emporia fine sa	B	07 Roadways w/ Open Ditch (incl R/W)	0.53	89	47
14)	19B Kempsville-Emporia fine sa	B	09 Gravel	0.12	85	10
Totals =				17.68		1,282

**Composite CN = 73**

C. Post-Development Time of Concentration Calculations

- 1) Overland Flow (maximum 300 feet)  
Surface description (table 5-7)  
Manning's roughness coefficient, n (table 5-7)  
Length of overland flow, L  
2-year 24-hour rainfall, P2  
Average slope of overland flow, s  
Travel time,  $Tt = (0.007 * (n * L)^{0.8}) / (P2^{0.5} * s^{0.4})$

09 Woods: Light underbrush  
0.4  
100 feet  
3.6 inches  
0.01 feet per foot  
26.7 minutes

- 2) Shallow concentrated flow  
Surface description, paved or unpaved  
Length of shallow concentrated flow, L  
Average slope of shallow concentrated flow, s  
Average velocity, v  
Travel time,  $Tt = L / (60 * v)$

Unpaved  
400 feet  
0.019 feet per foot  
2.27 feet per second  
2.9 minutes

- 3) Channel or Pipe Flow  
Length of channel flow, L  
Average velocity of channel flow, v  
Travel time,  $Tt = L / (3600 * v)$

732 Feet  
6 feet per second  
2.0 minutes

**Total Time of Concentration = 31.7 minutes**  
0.53 hours

**IRONBOUND SQUARE  
CALCULATION OF SCS CURVE NUMBER AND  
TIME OF CONCENTRATION USING SCS SEGMENTAL METHOD**

Job. No.: 9014-01  
Date: February 3, 2006  
Revised: April 6, 2006  
By: Steven J. Poe

**POST-DEVELOPMENT CONDITIONS**

**Total Drainage to BMP**

A. Post-Development Drainage Area to Point of Concern =

**19.13** Acres

B. Post-development Land Use, Soil Classification and Calculation of Composite Curve Number

	<u>Soil Type</u>	<u>Hydrologic Soil Group</u>	<u>Post-Development Land Use</u>	<u>Area of Land Use (in Acres)</u>	<u>Curve Number for Land Use (CN)</u>	<u>Sum (CN*A)</u>
1)	8B Caroline fine sandy loam, 21	C	24 Woods (good - >75% Ground Cover)	0.7	70	49
2)	8B Caroline fine sandy loam, 21	C	32 Pasture or Range (good ->75% Ground Cover)	2.08	74	154
3)	8B Caroline fine sandy loam, 21	C	07 Roadways w/ Open Ditch (incl R/W)	0.91	92	84
4)	11C Craven-Uchee complex, 6	B	12 Residential District (1/3 acre) (30% Imp)	4.79	72	345
5)	15E Emporia complex, 15 to 25	C	12 Residential District (1/3 acre) (30% Imp)	0.73	81	59
6)	15E Emporia complex, 15 to 25	C	04 Open space - Good (grass cover >75%)	0.38	74	28
7)	18B Kempsville fine sandy loam	B	12 Residential District (1/3 acre) (30% Imp)	2.31	72	166
8)	19B Kempsville-Emporia fine sa	B	24 Woods (good - >75% Ground Cover)	1.11	55	61
9)	19B Kempsville-Emporia fine sa	B	32 Pasture or Range (good ->75% Ground Cover)	1.79	61	109
10)	19B Kempsville-Emporia fine sa	B	16 Commercial and business (85% Imp)	0.31	92	29
11)	19B Kempsville-Emporia fine sa	B	07 Roadways w/ Open Ditch (incl R/W)	0.56	89	50
12)	19B Kempsville-Emporia fine sa	B	12 Residential District (1/3 acre) (30% Imp)	1.86	72	134
13)	18B Kempsville fine sandy loam	B	06 Buildings	0.29	98	28
14)	18B Kempsville fine sandy loam	B	05 Pavement & Sidewalks (100% Imp)	0.69	98	68
15)	18B Kempsville fine sandy loam	B	04 Open space - Good (grass cover >75%)	0.62	61	38
Totals =				19.13		1,401
<b>Composite CN =</b>						<b>73</b>

**IRONBOUND SQUARE  
CALCULATION OF SCS CURVE NUMBER AND  
TIME OF CONCENTRATION USING SCS SEGMENTAL METHOD**

Job. No.: 9014-01  
Date: February 3, 2006  
Revised: March 30, 2006  
By: Brendan Clisso

**POST-DEVELOPMENT CONDITIONS**

**Extended Detention Basin**

A. Post-Development Drainage Area to Point of Concern = **17.35 Acres**

B. Post-development Land Use, Soil Classification and Calculation of Composite Curve Number

	Soil Type	Hydrologic Soil Group	Post-Development Land Use	Area of Land Use (in Acres)	Curve Number for Land Use (CN)	Sum (CN*A)
1)	8B Caroline fine sandy loam, 2	C	24 Woods (good ->75% Ground Cover)	0.7	70	49
2)	8B Caroline fine sandy loam, 2	C	32 Pasture or Range (good ->75% Ground Cover)	2.08	74	154
3)	8B Caroline fine sandy loam, 2	C	07 Roadways w/ Open Ditch (incl R/W)	0.91	92	84
4)	11C Craven-Uchee complex, 6	B	12 Residential District (1/3 acre) (30% Imp)	4.79	72	345
5)	15E Emporia complex, 15 to 25	C	12 Residential District (1/3 acre) (30% Imp)	0.73	81	59
6)	15E Emporia complex, 15 to 25	C	04 Open space - Good (grass cover >75%)	0.38	74	28
7)	18B Kempsville fine sandy loam	B	12 Residential District (1/3 acre) (30% Imp)	2.13	72	153
8)	19B Kempsville-Emporia fine sa	B	24 Woods (good ->75% Ground Cover)	1.11	55	61
9)	19B Kempsville-Emporia fine sa	B	32 Pasture or Range (good ->75% Ground Cover)	1.79	61	109
10)	19B Kempsville-Emporia fine sa	B	16 Commercial and business (85% Imp)	0.31	92	29
11)	19B Kempsville-Emporia fine sa	B	07 Roadways w/ Open Ditch (incl R/W)	0.56	89	50
12)	19B Kempsville-Emporia fine sa	B	12 Residential District (1/3 acre) (30% Imp)	1.86	72	134
<b>Totals =</b>				<b>17.35</b>		<b>1,255</b>
<b>Composite CN =</b>						<b>72</b>

C. Post-Development Time of Concentration Calculations

1) Overland Flow (maximum 300 feet)	
Surface description (table 5-7)	<b>09 Woods: Light underbrush</b>
Manning's roughness coefficient, n (table 5-7)	0.4
Length of overland flow, L	100 feet
2-year 24-hour rainfall, P2	3.6 inches
Average slope of overland flow, s	0.01 feet per foot
Travel time, $Tt = (0.007 * (n * L)^{0.8}) / (P2^{0.5} * s^{0.4})$	26.7 minutes
2) Shallow concentrated flow	
Surface description, paved or unpaved	<b>Unpaved</b>
Length of shallow concentrated flow, L	400 feet
Average slope of shallow concentrated flow, s	0.019 feet per foot
Average velocity, v	2.27 feet per second
Travel time, $Tt = L / (60 * v)$	2.9 minutes
3) Channel or Pipe Flow	
Length of channel flow, L	732 Feet
Average velocity of channel flow, v	6 feet per second
Travel time, $Tt = L / (3600 * v)$	2.0 minutes

**Total Time of Concentration = 31.7 minutes**  
0.53 hours

**IRONBOUND SQUARE  
CALCULATION OF SCS CURVE NUMBER AND  
TIME OF CONCENTRATION USING SCS SEGMENTAL METHOD**

Job. No.: 9014-01  
Date: February 3, 2006  
Revised: April 6, 2006  
By: Steven J. Poe

**FUTURE-DEVELOPMENT CONDITIONS**

**Total Drainage to BMP**

A. Future-Development Drainage Area to Point of Concern =

**15.77 Acres**

B. Future-development Land Use, Soil Classification and Calculation of Composite Curve Number

	<u>Soil Type</u>	<u>Hydrologic Soil Group</u>	<u>Future-Development Land Use</u>	<u>Area of Land Use (in Acres)</u>	<u>Curve Number for Land Use (CN)</u>	<u>Sum (CN*A)</u>
1)	8B Caroline fine sandy loam, 2	C	07 Roadways w/ Open Ditch (incl R/W)	0.91	92	84
2)	8B Caroline fine sandy loam, 2	C	04 Open space - Good (grass cover >75%)	1.47	74	109
3)	11C Craven-Uchee complex, 6	B	12 Residential District (1/3 acre) (30% Imp)	4.79	72	345
4)	15E Emporia complex, 15 to 25	C	12 Residential District (1/3 acre) (30% Imp)	0.73	81	59
5)	15E Emporia complex, 15 to 25	C	04 Open space - Good (grass cover >75%)	0.38	74	28
6)	18B Kempsville fine sandy loam	B	12 Residential District (1/3 acre) (30% Imp)	2.31	72	166
7)	19B Kempsville-Emporia fine sa	B	16 Commercial and business (85% Imp)	0.31	92	29
8)	19B Kempsville-Emporia fine sa	B	07 Roadways w/ Open Ditch (incl R/W)	0.56	89	50
9)	19B Kempsville-Emporia fine sa	B	04 Open space - Good (grass cover >75%)	0.85	61	52
10)	19B Kempsville-Emporia fine sa	B	12 Residential District (1/3 acre) (30% Imp)	1.86	72	134
11)	18B Kempsville fine sandy loam	B	06 Buildings	0.29	98	28
12)	18B Kempsville fine sandy loam	B	05 Pavement & Sidewalks (100% Imp)	0.69	98	68
13)	18B Kempsville fine sandy loam	B	04 Open space - Good (grass cover >75%)	0.62	61	38

Totals =

15.77

1,189

**Composite CN =**

**75**

**IRONBOUND SQUARE  
CALCULATION OF SCS CURVE NUMBER AND  
TIME OF CONCENTRATION USING SCS SEGMENTAL METHOD**

Job. No.: 9014-01  
Date: February 3, 2006  
Revised: March 30, 2006  
By: Brendan Clisso

**FUTURE-DEVELOPMENT CONDITIONS**

**Extended Detention Basin**

A. Post-Development Drainage Area to Point of Concern =

**13.99 Acres**

B. Post-development Land Use, Soil Classification and Calculation of Composite Curve Number

	<u>Soil Type</u>	<u>Hydrologic Soil Group</u>	<u>Post-Development Land Use</u>	<u>Area of Land Use (in Acres)</u>	<u>Curve Number for Land Use (CN)</u>	<u>Sum (CN*A)</u>
1)	8B Caroline fine sandy loam, 2	C	07 Roadways w/ Open Ditch (incl R/W)	0.91	92	84
2)	8B Caroline fine sandy loam, 2	C	04 Open space - Good (grass cover >75%)	1.47	74	109
3)	11C Craven-Uchee complex, 6	B	12 Residential District (1/3 acre) (30% Imp)	4.79	72	345
4)	15E Emporia complex, 15 to 24	C	12 Residential District (1/3 acre) (30% Imp)	0.73	81	59
5)	15E Emporia complex, 15 to 24	C	04 Open space - Good (grass cover >75%)	0.38	74	28
6)	18B Kempsville fine sandy loam	B	12 Residential District (1/3 acre) (30% Imp)	2.13	72	153
7)	19B Kempsville-Emporia fine s	B	16 Commercial and business (85% Imp)	0.31	92	29
8)	19B Kempsville-Emporia fine s	B	07 Roadways w/ Open Ditch (incl R/W)	0.56	89	50
9)	19B Kempsville-Emporia fine s	B	04 Open space - Good (grass cover >75%)	0.85	61	52
10)	19B Kempsville-Emporia fine s	B	12 Residential District (1/3 acre) (30% Imp)	1.86	72	134
<b>Totals =</b>				13.99		1,042
<b>Composite CN =</b>						<b>74</b>

C. Future-Development Time of Concentration Calculations

1) Overland Flow (maximum 300 feet)

Surface description (table 5-7)  
Manning's roughness coefficient, n (table 5-7)  
Length of overland flow, L  
2-year 24-hour rainfall, P2  
Average slope of overland flow, s  
Travel time,  $T_t = (0.007 \cdot (n \cdot L)^{0.8}) / (P2^{0.5} \cdot s^{0.4})$

**09 Woods: Light underbrush**  
0.4  
**100** feet  
3.6 inches  
**0.010** feet per foot  
26.7 minutes

2) Shallow concentrated flow

Surface description, paved or unpaved  
Length of shallow concentrated flow, L  
Average slope of shallow concentrated flow, s  
Average velocity, v  
Travel time,  $T_t = L / (60 \cdot v)$

**Unpaved**  
**170** feet  
**0.025** feet per foot  
2.61 feet per second  
1.1 minutes

3) Channel or Pipe Flow

Length of channel flow, L  
Average velocity of channel flow, v  
Travel time,  $T_t = L / (3600 \cdot v)$

**350** Feet  
**5** feet per second  
1.2 minutes

**Total Time of Concentration =**

**29.0 minutes**  
0.48 hours

**IRONBOUND SQUARE  
CALCULATION OF SCS CURVE NUMBER AND  
TIME OF CONCENTRATION USING SCS SEGMENTAL METHOD**

Job. No.: 9014-01  
Date: February 3, 2006  
Revised: March 30, 2006  
By: Brendan Clisso

**POST-DEVELOPMENT CONDITIONS**

**Bioretention Basin 1**

A. Post-Development Drainage Area to Point of Concern = **1.48 Acres**

B. Post-development Land Use, Soil Classification and Calculation of Composite Curve Number

	<u>Soil Type</u>	<u>Hydrologic Soil Group</u>	<u>Post-Development Land Use</u>	<u>Area of Land Use (in Acres)</u>	<u>Curve Number for Land Use (CN)</u>	<u>Sum (CN*A)</u>
1)	18B Kempsville fine sandy loam	B	06 Buildings	0.12	98	12
2)	18B Kempsville fine sandy loam	B	05 Pavement & Sidewalks (100% Imp)	0.66	98	65
3)	18B Kempsville fine sandy loam	B	04 Open space - Good (grass cover >75%)	0.52	61	32
4)	18B Kempsville fine sandy loam	B	12 Residential District (1/3 acre) (30% Imp)	0.18	72	13
Totals =				1.48		121

**Composite CN = 82**

C. Future-Development Time of Concentration Calculations

- 1) Overland Flow (maximum 300 feet)
  - Surface description (table 5-7) **05 Short grass prairie**
  - Manning's roughness coefficient, n (table 5-7) 0.15
  - Length of overland flow, L 100 feet
  - 2-year 24-hour rainfall, P2 3.6 inches
  - Average slope of overland flow, s 0.025 feet per foot
  - Travel time,  $T_t = (0.007 \cdot (n \cdot L)^{0.8}) / (P_2^{0.5} \cdot s^{0.4})$  8.4 minutes
  
- 2) Shallow concentrated flow
  - Surface description, paved or unpaved Unpaved
  - Length of shallow concentrated flow, L 130 feet
  - Average slope of shallow concentrated flow, s 0.015 feet per foot
  - Average velocity, v 2.02 feet per second
  - Travel time,  $T_t = L / (60 \cdot v)$  1.1 minutes
  
- 3) Channel or Pipe Flow
  - Length of channel flow, L   Feet
  - Average velocity of channel flow, v   feet per second
  - Travel time,  $T_t = L / (3600 \cdot v)$  0.0 minutes

**Total Time of Concentration = 9.5 minutes**  
0.16 hours

**IRONBOUND SQUARE  
CALCULATION OF SCS CURVE NUMBER AND  
TIME OF CONCENTRATION USING SCS SEGMENTAL METHOD**

Job. No.: 9014-01  
Date: February 3, 2006  
Revised: March 30, 2006  
By: Brendan Clisso

**POST-DEVELOPMENT CONDITIONS**

**Bioretention Basin 2**

A. Post-Development Drainage Area to Point of Concern = **0.3 Acres**

B. Post-development Land Use, Soil Classification and Calculation of Composite Curve Number

Soil Type	Hydrologic Soil Group	Post-Development Land Use	Area of Land Use (in Acres)	Curve Number for Land Use (CN)	Sum (CN*A)
1) 18B Kempsville fine sandy loam	B	06 Buildings	0.17	98	17
2) 18B Kempsville fine sandy loam	B	05 Pavement & Sidewalks (100% Imp)	0.03	98	3
3) 18B Kempsville fine sandy loam	B	04 Open space - Good (grass cover >75%)	0.1	61	6
Totals =			0.30		26

**Composite CN = 86**

C. Future-Development Time of Concentration Calculations

1) Overland Flow (maximum 300 feet)

Surface description (table 5-7)

**05 Short grass prairie**

Manning's roughness coefficient, n (table 5-7)

0.15

Length of overland flow, L

10 feet

2-year 24-hour rainfall, P2

3.6 inches

Average slope of overland flow, s

0.010 feet per foot

Travel time,  $T_t = (0.007 * (n * L)^{0.8}) / (P2^{0.5} * s^{0.4})$

1.9 minutes

2) Shallow concentrated flow

Surface description, paved or unpaved

Unpaved

Length of shallow concentrated flow, L

feet

Average slope of shallow concentrated flow, s

0.015 feet per foot

Average velocity, v

2.02 feet per second

Travel time,  $T_t = L / (60 * v)$

0.0 minutes

3) Channel or Pipe Flow

Length of channel flow, L

feet

Average velocity of channel flow, v

feet per second

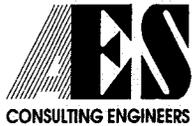
Travel time,  $T_t = L / (3600 * v)$

0.0 minutes

**Total Time of Concentration =**

**5.0 minutes**

0.08 hours



Williamsburg (757) 253-0040  
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*CURRENT TOTAL DRAINAGE AREA (INCL. NEWSPAWN)*

Project  
 Project No.  
 Subject  
 Sheet No.  
 Calculated By

Ironbound Sq - Ph1 Road		
9014-01		
Pond #		1
1	of	1
ABS	Date	4/5/06

**Channel Protection Volume:**

Drainage Area  
 Runoff Curve No.  
 1-Yr, 24-Hr Storm Volume

Direct Runoff (From TR55 Equations 2-3 & 2-4)  
 Q = 0.74 inches

Channel Protection Volume = DA \* Q \* 60% (Virginia Stormwater Management Handbook section 5-6.2 - Method 2)

Vcp = 14.10 Ac-in = **30,710** cubic feet

*Handwritten calculations:*

$$Q = \frac{(P - 0.25)^2}{(P + 0.85)}$$

$$= \frac{(2.8 - 0.25)^2}{(2.8 + 0.85)}$$

$$= \frac{(2.55)^2}{3.65}$$

$$= \frac{6.5025}{3.65}$$

$$= 1.78$$

*Another calculation:*

$$CS = \frac{1000}{CN} - 10 = \frac{1000}{73} - 10 = 3.7$$

**Determine Volume of Pond by Contour (starting at normal pool):**

Elevation	Incremental Depth	Area (sq. ft.)	Volume (cu. ft.)	Volume (cu. yd.)	Sum Volume (cu. ft.)	Sum Volume (cu. yd.)	Incremental Avg Head <sup>1</sup> (feet)	Incremental Avg Flow <sup>1</sup> (feet)	Incremental Drawdown Time <sup>1</sup> (hrs)
76.0	0.0	3,203	-	-	-	-	-	-	-
77.0	1.0	3,815	3,509	130	3,509	130	0.5	0.14	6.73
78.0	1.0	4,463	4,139	153	7,648	283	1.5	0.28	4.15
79.0	1.0	5,143	4,803	178	12,451	461	2.5	0.36	3.66
80.0	1.0	5,856	5,500	204	17,951	665	3.5	0.43	3.52
81.0	1.0	6,603	6,230	231	24,180	896	4.5	0.49	3.50
82.0	1.0	7,383	6,993	259	31,173	1,155	5.47	0.55	3.32
Total			31,173	1,155					24.88

<sup>1</sup> Incremental values computed from Channel Protection Volume Elevation

Elevation of Normal Pool = 76.00 feet  
 Elevation of 1-yr, 24-hr Storage Volume = 81.93 feet  
 Size of Orifice = 3.00 inches  
 Total Average Drawdown Time = **24.88** hrs

*Handwritten notes:*  
 CLOSE ENOUGH, MET w/ AES  
 4/05/06  
 DISCUSSED THIS.

*Handwritten calculations:*

$$t = \frac{V_{cp}}{a \cdot C \cdot \sqrt{2} \cdot g \cdot h} = \frac{30,710 \text{ FT}^3}{(0.049 \text{ FT}^2) \cdot 0.6 \cdot \left( \sqrt{2 \cdot 32.2 \frac{\text{FT}}{\text{SEC}^2} \cdot 2.965 \text{ FT}} \right)}$$

$$h = \frac{81.93' - 76.00'}{2} = 2.965'$$

$$= 75,592 \text{ SEC}$$

$$= 21 \text{ HRS}$$

*Handwritten calculation:*

$$a = \pi r^2 = \pi \left( \frac{1}{2} \cdot \frac{3}{12} \right)^2 = 0.049 \text{ FT}^2$$

### SCS runoff curve number method

The SCS Runoff Curve Number (CN) method is described in detail in NEH-4 (SCS 1985). The SCS runoff equation is

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \quad [\text{eq. 2-1}]$$

where

- Q = runoff (in)
- P = rainfall (in)
- S = potential maximum retention after runoff begins (in) and
- I<sub>a</sub> = initial abstraction (in)

Initial abstraction (I<sub>a</sub>) is all losses before runoff begins. It includes water retained in surface depressions, water intercepted by vegetation, evaporation, and infiltration. I<sub>a</sub> is highly variable but generally is correlated with soil and cover parameters. Through studies of many small agricultural watersheds, I<sub>a</sub> was found to be approximated by the following empirical equation:

$$I_a = 0.2S \quad [\text{eq. 2-2}]$$

By removing I<sub>a</sub> as an independent parameter, this approximation allows use of a combination of S and P to produce a unique runoff amount. Substituting equation 2-2 into equation 2-1 gives:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)} \quad [\text{eq. 2-3}]$$

S is related to the soil and cover conditions of the watershed through the CN. CN has a range of 0 to 100, and S is related to CN by:

$$S = \frac{1000}{CN} - 10 \quad [\text{eq. 2-4}]$$

Figure 2-1 and table 2-1 solve equations 2-3 and 2-4 for a range of CN's and rainfall.

### Factors considered in determining runoff curve numbers

The major factors that determine CN are the hydrologic soil group (HSG), cover type, treatment, hydrologic condition, and antecedent runoff condition (ARC). Another factor considered is whether impervious areas outlet directly to the drainage system (connected) or whether the flow spreads over pervious areas before entering the drainage system (unconnected). Figure 2-2 is provided to aid in selecting the appropriate figure or table for determining curve numbers.

CN's in table 2-2 (*a* to *d*) represent average antecedent runoff condition for urban, cultivated agricultural, other agricultural, and arid and semiarid rangeland uses. Table 2-2 assumes impervious areas are directly connected. The following sections explain how to determine CN's and how to modify them for urban conditions.

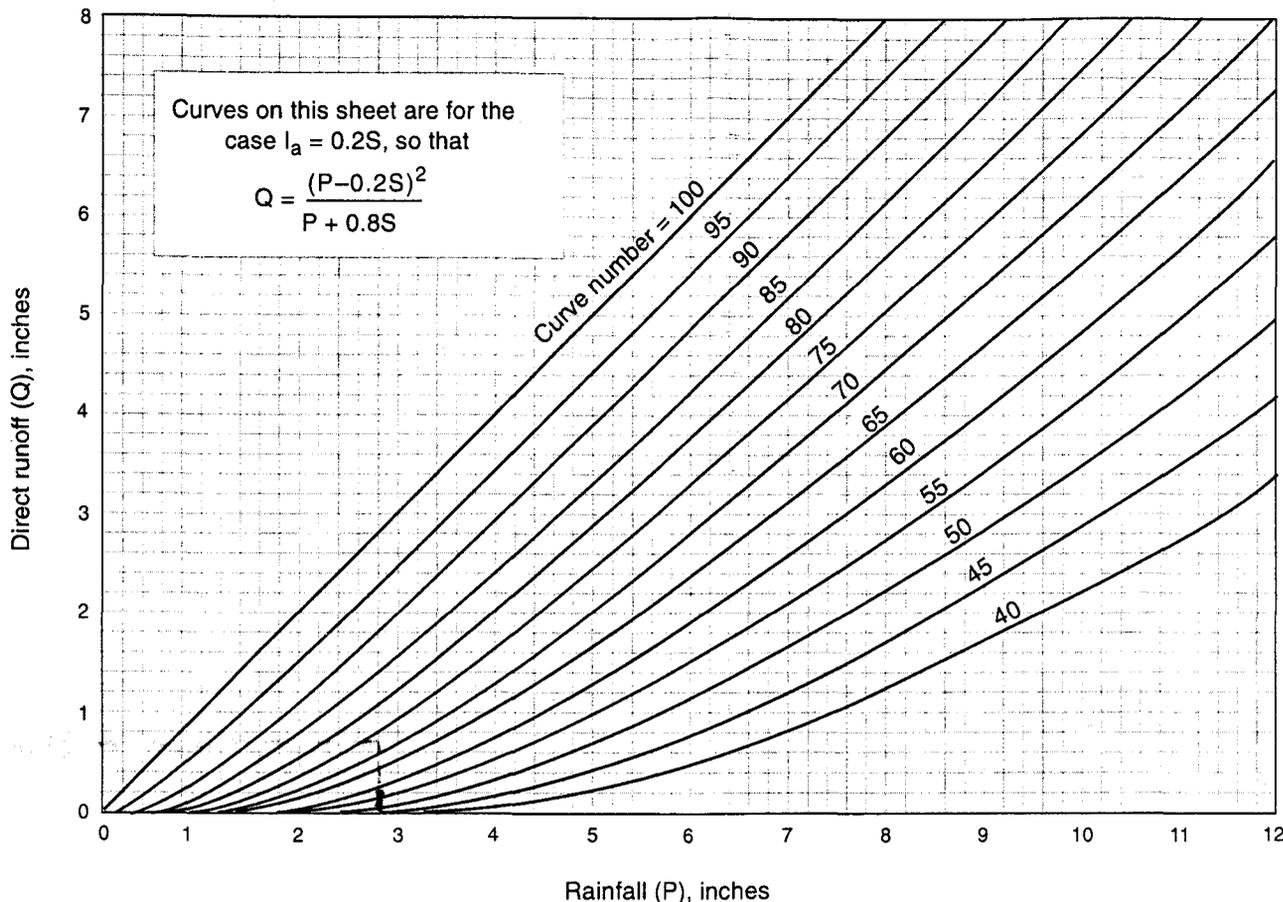
#### Hydrologic soil groups

Infiltration rates of soils vary widely and are affected by subsurface permeability as well as surface intake rates. Soils are classified into four HSG's (A, B, C, and D) according to their minimum infiltration rate, which is obtained for bare soil after prolonged wetting. Appendix A defines the four groups and provides a list of most of the soils in the United States and their group classification. The soils in the area of interest may be identified from a soil survey report, which can be obtained from local SCS offices or soil and water conservation district offices.

Most urban areas are only partially covered by impervious surfaces: the soil remains an important factor in runoff estimates. Urbanization has a greater effect on runoff in watersheds with soils having high infiltration rates (sands and gravels) than in watersheds predominantly of silts and clays, which generally have low infiltration rates.

Any disturbance of a soil profile can significantly change its infiltration characteristics. With urbanization, native soil profiles may be mixed or removed or fill material from other areas may be introduced. Therefore, a method based on soil texture is given in appendix A for determining the HSG classification for disturbed soils.

Figure 2-1 Solution of runoff equation.



**Cover type**

Table 2-2 addresses most cover types, such as vegetation, bare soil, and impervious surfaces. There are a number of methods for determining cover type. The most common are field reconnaissance, aerial photographs, and land use maps.

**Treatment**

*Treatment* is a cover type modifier (used only in table 2-2b) to describe the management of cultivated agricultural lands. It includes mechanical practices, such as contouring and terracing, and management practices, such as crop rotations and reduced or no tillage.

**Hydrologic condition**

*Hydrologic condition* indicates the effects of cover type and treatment on infiltration and runoff and is generally estimated from density of plant and residue cover on sample areas. *Good* hydrologic condition indicates that the soil usually has a low runoff potential for that specific hydrologic soil group, cover type, and treatment. Some factors to consider in estimating the effect of cover on infiltration and runoff are (a) canopy or density of lawns, crops, or other vegetative areas; (b) amount of year-round cover; (c) amount of grass or close-seeded legumes in rotations; (d) percent of residue cover; and (e) degree of surface roughness.



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PROJECT IRON BOUND SQUARE  
 PROJECT NO. 9014-01  
 SUBJECT FOREBAY SIZING  
 SHEET NO. 1 OF 1  
 CALCULATED BY BMC DATE 3/31/06

REQUIRED FOREBAY SIZE

RESIDENTIAL DISTRICT (30% IMP) + COMMERCIAL AND BUSINESS (85% IMP) +  
 ROADWAY W/ OPEN DITCH (90% IMP) + BUILDINGS/PAVEMENT/SIDEWALK (100%)

$$0.3 (4.79 + 0.73 + 2.13 + 1.86 + 0.18) + 0.85 (0.31) + 0.9 (0.91 + 0.56) + 1.0 (0.12 + 0.66 + 0.2)$$

$$0.3 (9.69) + 0.85 (0.31) + 0.9 (1.47) + 1.0 (0.98)$$

TOTAL IMP AC = 5.47 AC

REQUIRED FOREBAY STORAGE = 5.47 AC x 0.1" / 100' AC x 1 1/2" x 43560 SF/AC

REQUIRED FOREBAY STORAGE = 1,986 CF

PROVIDED FOREBAY STORAGE

<u>CONTOUR</u>	<u>SF</u>
76	218
77	439
78	719
79	1057
80	1453

FOREBAY IS 4' DEEP

PROVIDED FOREBAY STORAGE = 218 (0.5) + 439 + 719 + 1057 + 1453 (0.5)

PROVIDED FOREBAY STORAGE = 3,051 CF

# Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Apr 7 2006, 8:4 AM

## Pond No. 7 - Dry Pond

### Pond Data

Pond storage is based on known contour areas. Average end area method used.

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	76.00	3,203	0	0
1.00	77.00	3,815	3,509	3,509
2.00	78.00	4,463	4,139	7,648
3.00	79.00	5,143	4,803	12,451
4.00	80.00	5,856	5,500	17,951
5.00	81.00	6,603	6,230	24,180
6.00	82.00	7,383	6,993	31,173
7.00	83.00	8,263	7,823	38,996
8.00	84.00	10,636	9,450	48,446

### Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 3.00	0.00	0.00	0.00
Span (in)	= 3.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 76.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .013	.013	.013	.013
Orif. 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)	= 46.00	0.00	0.00	0.00
Crest El. (ft)	= 81.85	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

### Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	76.00	0.00	---	---	---	0.00	---	---	---	---	0.00
0.10	351	76.10	0.02	---	---	---	0.00	---	---	---	---	0.02
0.20	702	76.20	0.06	---	---	---	0.00	---	---	---	---	0.06
0.30	1,053	76.30	0.10	---	---	---	0.00	---	---	---	---	0.10
0.40	1,404	76.40	0.12	---	---	---	0.00	---	---	---	---	0.12
0.50	1,755	76.50	0.14	---	---	---	0.00	---	---	---	---	0.14
0.60	2,105	76.60	0.16	---	---	---	0.00	---	---	---	---	0.16
0.70	2,456	76.70	0.18	---	---	---	0.00	---	---	---	---	0.18
0.80	2,807	76.80	0.19	---	---	---	0.00	---	---	---	---	0.19
0.90	3,158	76.90	0.21	---	---	---	0.00	---	---	---	---	0.21
1.00	3,509	77.00	0.22	---	---	---	0.00	---	---	---	---	0.22
1.10	3,923	77.10	0.23	---	---	---	0.00	---	---	---	---	0.23
1.20	4,337	77.20	0.25	---	---	---	0.00	---	---	---	---	0.25
1.30	4,751	77.30	0.26	---	---	---	0.00	---	---	---	---	0.26
1.40	5,165	77.40	0.27	---	---	---	0.00	---	---	---	---	0.27
1.50	5,579	77.50	0.28	---	---	---	0.00	---	---	---	---	0.28
1.60	5,992	77.60	0.29	---	---	---	0.00	---	---	---	---	0.29
1.70	6,406	77.70	0.30	---	---	---	0.00	---	---	---	---	0.30
1.80	6,820	77.80	0.31	---	---	---	0.00	---	---	---	---	0.31
1.90	7,234	77.90	0.31	---	---	---	0.00	---	---	---	---	0.31
2.00	7,648	78.00	0.32	---	---	---	0.00	---	---	---	---	0.32
2.10	8,128	78.10	0.33	---	---	---	0.00	---	---	---	---	0.33
2.20	8,609	78.20	0.34	---	---	---	0.00	---	---	---	---	0.34
2.30	9,089	78.30	0.35	---	---	---	0.00	---	---	---	---	0.35
2.40	9,569	78.40	0.36	---	---	---	0.00	---	---	---	---	0.36
2.50	10,050	78.50	0.36	---	---	---	0.00	---	---	---	---	0.36
2.60	10,530	78.60	0.37	---	---	---	0.00	---	---	---	---	0.37
2.70	11,010	78.70	0.38	---	---	---	0.00	---	---	---	---	0.38
2.80	11,490	78.80	0.39	---	---	---	0.00	---	---	---	---	0.39

Continues on next page...

Dry Pond

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
2.90	11,971	78.90	0.39	---	---	---	0.00	---	---	---	---	0.39
3.00	12,451	79.00	0.40	---	---	---	0.00	---	---	---	---	0.40
3.10	13,001	79.10	0.41	---	---	---	0.00	---	---	---	---	0.41
3.20	13,551	79.20	0.41	---	---	---	0.00	---	---	---	---	0.41
3.30	14,101	79.30	0.42	---	---	---	0.00	---	---	---	---	0.42
3.40	14,651	79.40	0.43	---	---	---	0.00	---	---	---	---	0.43
3.50	15,201	79.50	0.43	---	---	---	0.00	---	---	---	---	0.43
3.60	15,751	79.60	0.44	---	---	---	0.00	---	---	---	---	0.44
3.70	16,301	79.70	0.45	---	---	---	0.00	---	---	---	---	0.45
3.80	16,851	79.80	0.45	---	---	---	0.00	---	---	---	---	0.45
3.90	17,401	79.90	0.46	---	---	---	0.00	---	---	---	---	0.46
4.00	17,951	80.00	0.47	---	---	---	0.00	---	---	---	---	0.47
4.10	18,573	80.10	0.47	---	---	---	0.00	---	---	---	---	0.47
4.20	19,196	80.20	0.48	---	---	---	0.00	---	---	---	---	0.48
4.30	19,819	80.30	0.48	---	---	---	0.00	---	---	---	---	0.48
4.40	20,442	80.40	0.49	---	---	---	0.00	---	---	---	---	0.49
4.50	21,065	80.50	0.49	---	---	---	0.00	---	---	---	---	0.49
4.60	21,688	80.60	0.50	---	---	---	0.00	---	---	---	---	0.50
4.70	22,311	80.70	0.51	---	---	---	0.00	---	---	---	---	0.51
4.80	22,934	80.80	0.51	---	---	---	0.00	---	---	---	---	0.51
4.90	23,557	80.90	0.52	---	---	---	0.00	---	---	---	---	0.52
5.00	24,180	81.00	0.52	---	---	---	0.00	---	---	---	---	0.52
5.10	24,879	81.10	0.53	---	---	---	0.00	---	---	---	---	0.53
5.20	25,579	81.20	0.53	---	---	---	0.00	---	---	---	---	0.53
5.30	26,278	81.30	0.54	---	---	---	0.00	---	---	---	---	0.54
5.40	26,977	81.40	0.54	---	---	---	0.00	---	---	---	---	0.54
5.50	27,677	81.50	0.55	---	---	---	0.00	---	---	---	---	0.55
5.60	28,376	81.60	0.55	---	---	---	0.00	---	---	---	---	0.55
5.70	29,075	81.70	0.56	---	---	---	0.00	---	---	---	---	0.56
5.80	29,774	81.80	0.56	---	---	---	0.00	---	---	---	---	0.56
5.90	30,474	81.90	0.57	---	---	---	1.71	---	---	---	---	2.28
6.00	31,173	82.00	0.57	---	---	---	8.90	---	---	---	---	9.47
6.10	31,955	82.10	0.58	---	---	---	19.15	---	---	---	---	19.73
6.20	32,738	82.20	0.58	---	---	---	31.72	---	---	---	---	32.30
6.30	33,520	82.30	0.59	---	---	---	46.24	---	---	---	---	46.83
6.40	34,302	82.40	0.59	---	---	---	62.48	---	---	---	---	63.07
6.50	35,085	82.50	0.60	---	---	---	80.27	---	---	---	---	80.87
6.60	35,867	82.60	0.60	---	---	---	99.49	---	---	---	---	100.09
6.70	36,649	82.70	0.61	---	---	---	120.04	---	---	---	---	120.65
6.80	37,431	82.80	0.61	---	---	---	141.83	---	---	---	---	142.44
6.90	38,214	82.90	0.62	---	---	---	164.81	---	---	---	---	165.42
7.00	38,996	83.00	0.62	---	---	---	188.91	---	---	---	---	189.53
7.10	39,941	83.10	0.62	---	---	---	214.08	---	---	---	---	214.70
7.20	40,886	83.20	0.63	---	---	---	240.27	---	---	---	---	240.90
7.30	41,831	83.30	0.63	---	---	---	267.46	---	---	---	---	268.09
7.40	42,776	83.40	0.64	---	---	---	295.60	---	---	---	---	296.23
7.50	43,721	83.50	0.64	---	---	---	324.66	---	---	---	---	325.30
7.60	44,666	83.60	0.65	---	---	---	354.61	---	---	---	---	355.26
7.70	45,611	83.70	0.65	---	---	---	385.44	---	---	---	---	386.09
7.80	46,556	83.80	0.65	---	---	---	417.11	---	---	---	---	417.76
7.90	47,501	83.90	0.66	---	---	---	449.60	---	---	---	---	450.26
8.00	48,446	84.00	0.66	---	---	---	482.90	---	---	---	---	483.57

...End

# Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Apr 7 2006, 8:6 AM

## Pond No. 1 - Small Bioretention

### Pond Data

Pond storage is based on known contour areas. Average end area method used.

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	103.00	736	0	0
1.00	104.00	1,372	1,054	1,054

### Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
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)	= 98.00	0.00	0.00	0.00
Length (ft)	= 44.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.00	0.00	0.00
Crest El. (ft)	= 103.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 3.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

### Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Civ A cfs	Civ B cfs	Civ C cfs	Civ D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	103.00	0.00	---	---	---	0.00	---	---	---	0.000	0.00
0.10	105	103.10	7.65	---	---	---	0.00	---	---	---	0.000	0.01
0.20	211	103.20	7.65	---	---	---	0.00	---	---	---	0.000	0.02
0.30	316	103.30	7.65	---	---	---	0.00	---	---	---	0.000	0.03
0.40	422	103.40	7.65	---	---	---	0.00	---	---	---	0.000	0.04
0.50	527	103.50	7.65	---	---	---	0.00	---	---	---	0.000	0.05
0.60	632	103.60	7.65	---	---	---	1.26	---	---	---	0.000	1.32
0.70	738	103.70	7.65	---	---	---	3.57	---	---	---	0.000	3.64
0.80	843	103.80	7.65	---	---	---	6.57	---	---	---	0.000	6.64
0.90	949	103.90	8.28	---	---	---	8.28	---	---	---	0.000	8.36
1.00	1,054	104.00	8.43	---	---	---	8.43	---	---	---	0.000	8.53

# Pond Report

Hydraflow Hydrographs by Intelisolve

Friday, Apr 7 2006, 8:6 AM

## Pond No. 3 - Bioretention

### Pond Data

Pond storage is based on known contour areas. Average end area method used.

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	98.00	2,432	0	0
1.25	99.25	5,351	4,864	4,864
2.00	100.00	8,334	5,132	9,996
3.00	101.00	16,244	12,289	22,285

### Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
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)	= 92.67	0.00	0.00	0.00
Length (ft)	= 57.00	0.00	0.00	0.00
Slope (%)	= 0.47	0.00	0.00	0.00
N-Value	= .013	.013	.013	.000
Orif. Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= n/a	No	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	0.00	5.00	0.00
Crest El. (ft)	= 98.50	98.50	100.61	0.00
Weir Coeff.	= 3.33	0.97	3.33	0.00
Weir Type	= Rect	70 degV	Rect	--
Multi-Stage	= Yes	Yes	Yes	No

Exfiltration = 3.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

### Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Civ A cfs	Civ B cfs	Civ C cfs	Civ D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	98.00	0.00	---	---	---	0.00	---	0.00	---	0.000	0.00
0.13	486	98.13	18.05	---	---	---	0.00	---	0.00	---	0.000	0.04
0.25	973	98.25	18.05	---	---	---	0.00	---	0.00	---	0.000	0.07
0.38	1,459	98.38	18.05	---	---	---	0.00	---	0.00	---	0.000	0.11
0.50	1,946	98.50	18.05	---	---	---	0.00	---	0.00	---	0.000	0.15
0.63	2,432	98.63	18.05	---	---	---	0.74	0.01	0.00	---	0.000	0.93
0.75	2,919	98.75	18.05	---	---	---	2.08	0.03	0.00	---	0.000	2.33
0.88	3,405	98.88	18.05	---	---	---	3.82	0.08	0.00	---	0.000	4.17
1.00	3,892	99.00	18.05	---	---	---	5.89	0.17	0.00	---	0.000	6.35
1.13	4,378	99.13	18.05	---	---	---	8.23	0.30	0.00	---	0.000	8.86
1.25	4,864	99.25	18.05	---	---	---	10.81	0.47	0.00	---	0.000	11.66
1.33	5,378	99.33	18.05	---	---	---	12.48	0.60	0.00	---	0.000	13.47
1.40	5,891	99.40	18.05	---	---	---	14.22	0.74	0.00	---	0.000	15.37
1.48	6,404	99.47	18.05	---	---	---	16.03	0.91	0.00	---	0.000	17.37
1.55	6,917	99.55	19.01	---	---	---	17.91	1.09	0.00	---	0.000	19.46
1.63	7,430	99.62	19.79	---	---	---	18.58	1.21	0.00	---	0.000	20.27
1.70	7,944	99.70	20.20	---	---	---	18.89	1.31	0.00	---	0.000	20.70
1.78	8,457	99.77	20.53	---	---	---	19.11	1.41	0.00	---	0.000	21.05
1.85	8,970	99.85	20.81	---	---	---	19.29	1.51	0.00	---	0.000	21.34
1.93	9,483	99.92	21.05	---	---	---	19.44	1.61	0.00	---	0.000	21.60
2.00	9,996	100.00	21.27	---	---	---	19.56	1.70	0.00	---	0.000	21.84
2.10	11,225	100.10	21.53	---	---	---	19.70	1.83	0.00	---	0.000	22.16
2.20	12,454	100.20	21.77	---	---	---	19.81	1.95	0.00	---	0.000	22.46
2.30	13,683	100.30	21.99	---	---	---	19.91	2.08	0.00	---	0.000	22.73
2.40	14,912	100.40	22.20	---	---	---	19.99	2.20	0.00	---	0.000	22.99
2.50	16,141	100.50	22.40	---	---	---	20.07	2.33	0.00	---	0.000	23.25
2.60	17,370	100.60	22.59	---	---	---	20.13	2.45	0.00	---	0.000	23.50
2.70	18,599	100.70	22.78	---	---	---	19.80	2.53	0.45	---	0.000	23.74
2.80	19,827	100.80	22.97	---	---	---	19.26	2.57	1.14	---	0.000	23.99
2.90	21,056	100.90	23.15	---	---	---	18.79	2.62	1.74	---	0.000	24.22
3.00	22,285	101.00	23.33	---	---	---	18.37	2.67	2.28	---	0.000	24.45

# Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	<del>3-Yr</del> <sup>500-Yr</sup>	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-----	9.42	16.16	104.02	-----	42.25	-----	-----	69.97	Predevelopment
3	SCS Runoff	-----	8.48	14.90	100.28	-----	40.06	-----	-----	66.98	Initial Post Area
5	SCS Runoff	-----	8.99	15.00	92.16	-----	38.07	-----	-----	62.47	Ultimate Post Condition
7	SCS Runoff	-----	2.40	3.53	15.91	-----	7.49	-----	-----	11.35	Bioretention Area
8	Reservoir	7	1.03	2.47	14.37	-----	6.80	-----	-----	10.64	Bioretention
10	SCS Runoff	-----	0.67	0.94	3.73	-----	1.85	-----	-----	2.71	Small Bioretention Area
11	Reservoir	10	0.58	0.94	3.60	-----	1.80	-----	-----	2.63	Small Bioretention
12	Combine	8, 11	1.15	2.90	17.07	-----	8.17	-----	-----	12.62	Combined Bioretentions
14	Combine	3, 12,	9.55	16.91	110.35	-----	44.78	-----	-----	74.03	Total Area
15	Reservoir	14	0.64	9.64	110.42	-----	44.47	-----	-----	73.93	Dry Pond
17	Combine	5, 12,	10.14	17.52	105.50	-----	44.32	-----	-----	71.69	Ultimate Condition
18	Reservoir	17	0.54	6.55	105.38	-----	47.29	-----	-----	71.59	Dry Pond

# Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	9.42	3	735	48,148	---	----	----	Predevelopment
3	SCS Runoff	8.48	3	735	44,349	---	----	----	Initial Post Area
5	SCS Runoff	8.99	3	732	39,812	---	----	----	Ultimate Post Condition
7	SCS Runoff	2.40	3	720	6,573	---	----	----	Bioretention Area
8	Reservoir	1.03	3	732	6,560	7	98.63	2,468	Bioretention
10	SCS Runoff	0.67	3	717	1,524	---	----	----	Small Bioretention Area
11	Reservoir	0.58	3	723	1,513	10	103.54	571	Small Bioretention
12	Combine	1.15	3	732	8,073	8, 11	----	----	Combined Bioretentions
14	Combine	9.55	3	735	52,421	3, 12,	----	----	Total Area
15	Reservoir	0.64	3	1065	52,403	14	81.80	29,807	Dry Pond
17	Combine	10.14	3	732	47,885	5, 12,	----	----	Ultimate Condition
18	Reservoir	0.54	3	1083	47,867	17	81.40	26,981	Dry Pond

# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:36 PM

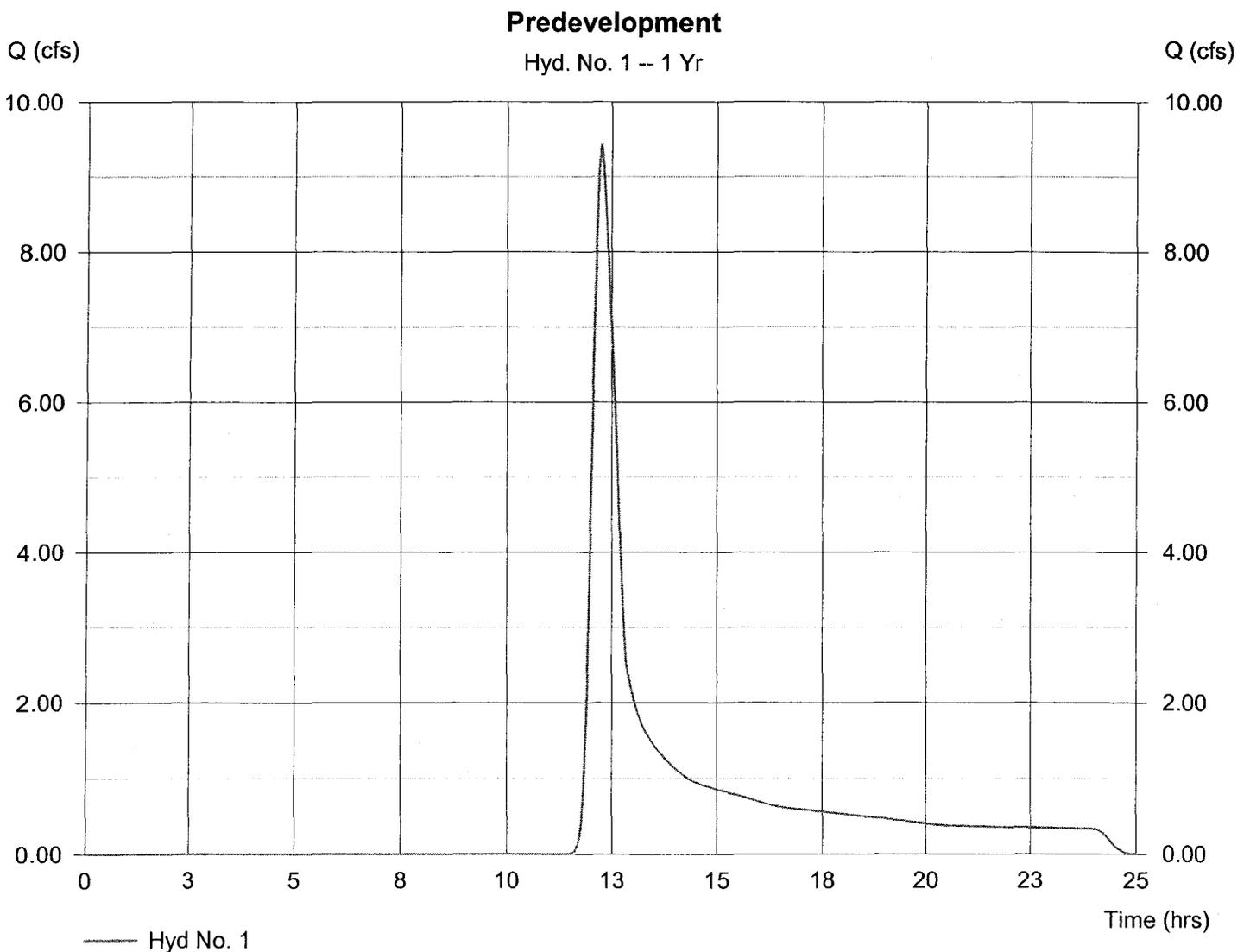
## Hyd. No. 1

Predevelopment

Hydrograph type = SCS Runoff  
Storm frequency = 1 yrs  
Drainage area = 17.68 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 2.80 in  
Storm duration = 24 hrs

Peak discharge = 9.42 cfs  
Time interval = 3 min  
Curve number = 73  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 31.7 min  
Distribution = Type II  
Shape factor = 484

Hydrograph Volume = 48,148 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 8

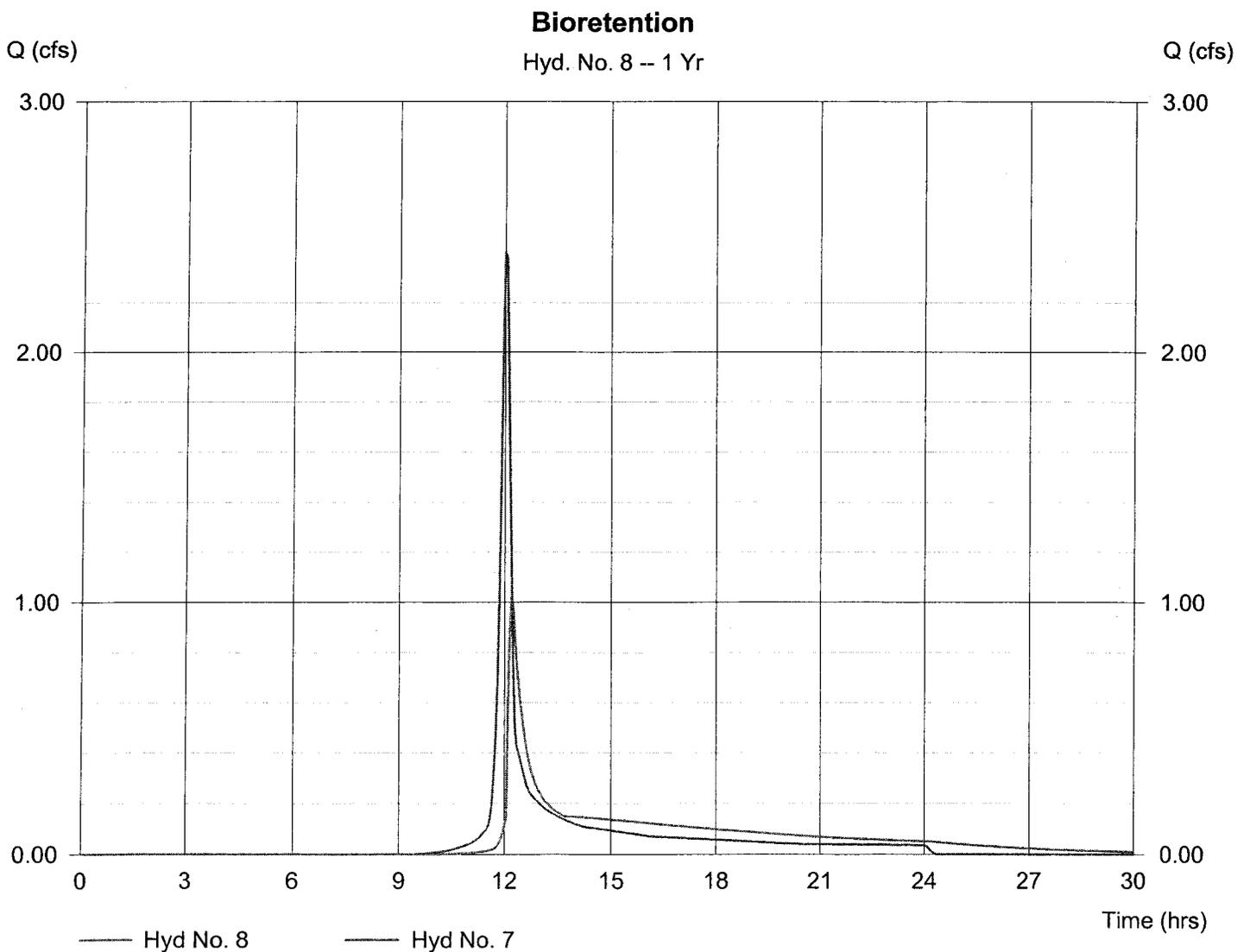
Bioretention

Hydrograph type = Reservoir  
Storm frequency = 1 yrs  
Inflow hyd. No. = 7  
Reservoir name = Bioretention

Peak discharge = 1.03 cfs  
Time interval = 3 min  
Max. Elevation = 98.63 ft  
Max. Storage = 2,468 cuft

Storage Indication method used.

Hydrograph Volume = 6,560 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 11

Small Bioretention

Hydrograph type = Reservoir  
Storm frequency = 1 yrs  
Inflow hyd. No. = 10  
Reservoir name = Small Bioretention

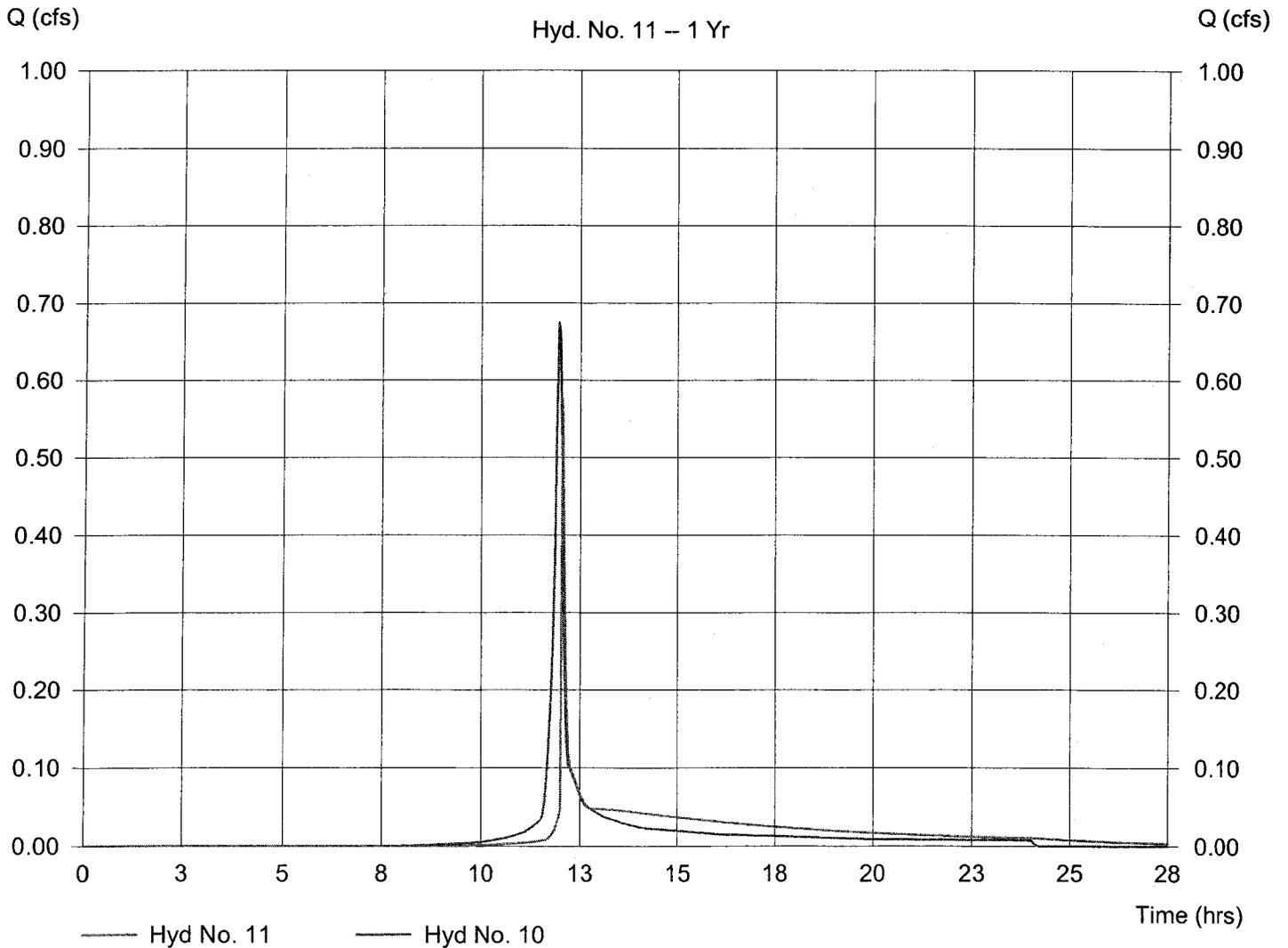
Peak discharge = 0.58 cfs  
Time interval = 3 min  
Max. Elevation = 103.54 ft  
Max. Storage = 571 cuft

Storage Indication method used.

Hydrograph Volume = 1,513 cuft

### Small Bioretention

Hyd. No. 11 - 1 Yr



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 15

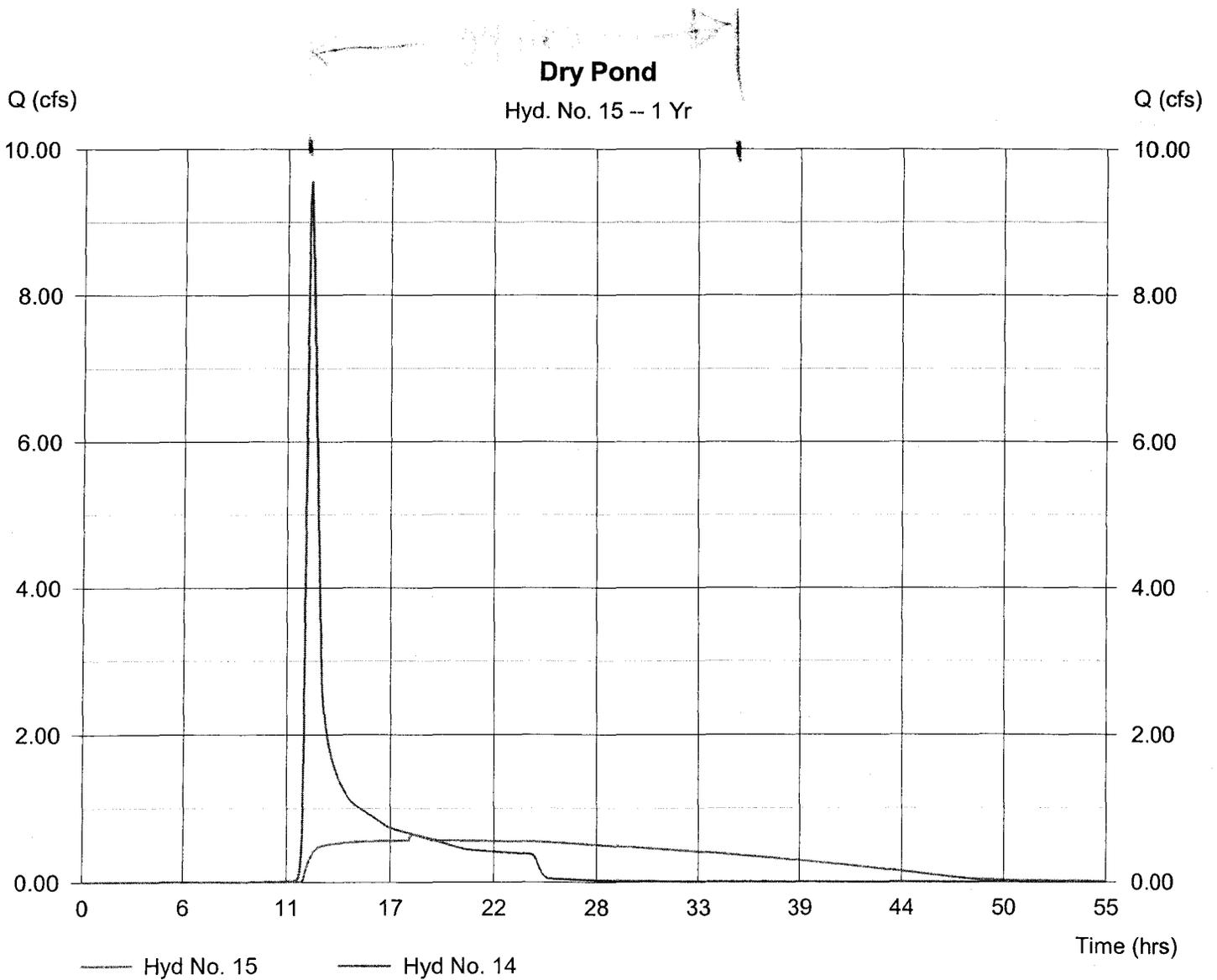
Dry Pond

Hydrograph type = Reservoir  
Storm frequency = 1 yrs  
Inflow hyd. No. = 14  
Reservoir name = Dry Pond

Peak discharge = 0.64 cfs  
Time interval = 3 min  
Max. Elevation = 81.80 ft  
Max. Storage = 29,807 cuft

Storage Indication method used.

Hydrograph Volume = 52,403 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:38 PM

## Hyd. No. 18

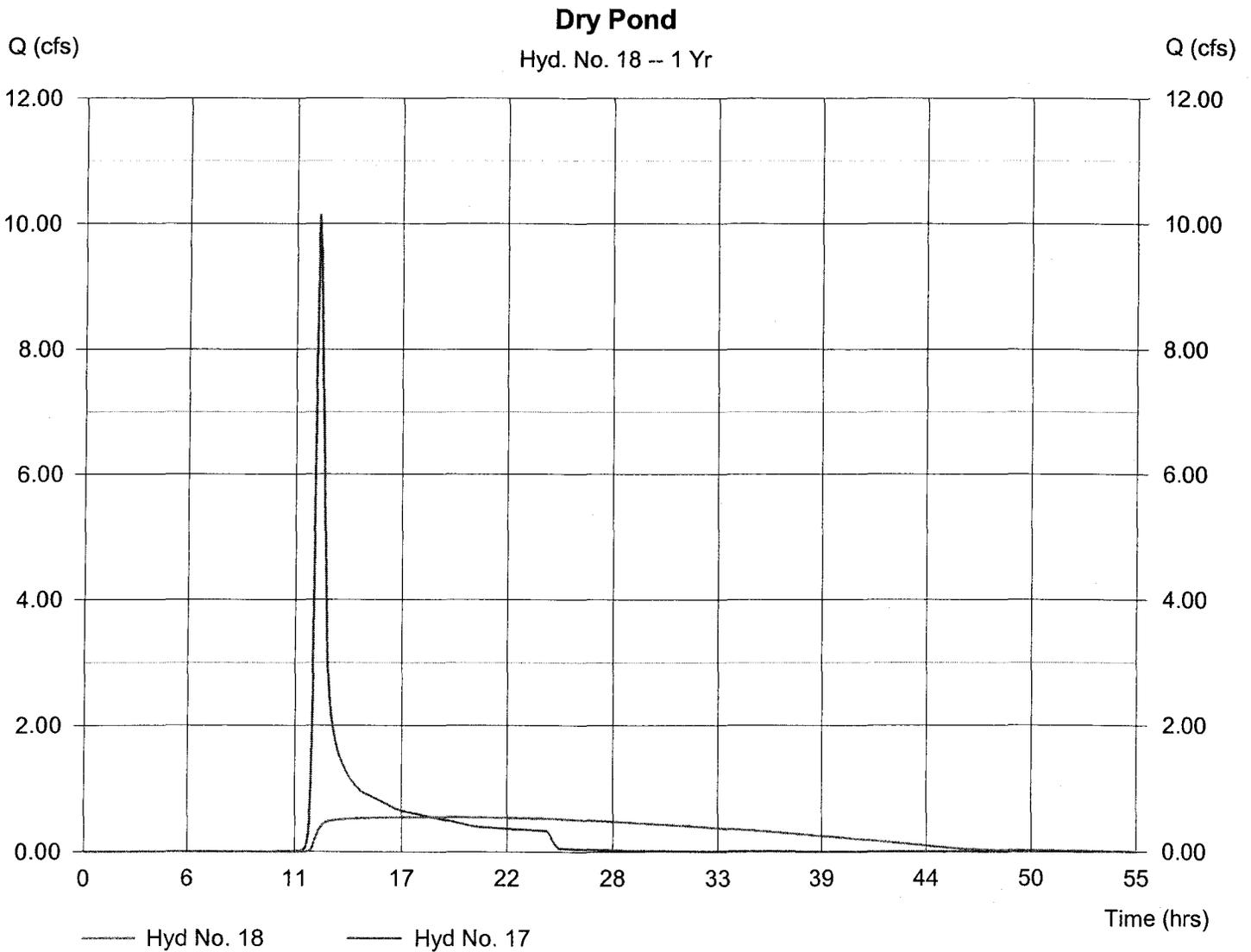
Dry Pond

Hydrograph type = Reservoir  
Storm frequency = 1 yrs  
Inflow hyd. No. = 17  
Reservoir name = Dry Pond

Peak discharge = 0.54 cfs  
Time interval = 3 min  
Max. Elevation = 81.40 ft  
Max. Storage = 26,981 cuft

Storage Indication method used.

Hydrograph Volume = 47,867 cuft



# Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	16.16	3	735	77,058	---	----	----	Predevelopment
3	SCS Runoff	14.90	3	735	71,856	---	----	----	Initial Post Area
5	SCS Runoff	15.00	3	732	62,967	---	----	----	Ultimate Post Condition
7	SCS Runoff	3.53	3	720	9,577	---	----	----	Bioretention Area
8	Reservoir	2.47	3	729	9,564	7	98.76	2,955	Bioretention
10	SCS Runoff	0.94	3	717	2,142	---	----	----	Small Bioretention Area
11	Reservoir	0.94	3	720	2,131	10	103.57	601	Small Bioretention
12	Combine	2.90	3	726	11,695	8, 11	----	----	Combined Bioretentions
14	Combine	16.91	3	732	83,551	3, 12,	----	----	Total Area
15	Reservoir	9.64	3	756	83,533	14	82.00	31,186	Dry Pond
17	Combine	17.52	3	729	74,662	5, 12,	----	----	Ultimate Condition
18	Reservoir	6.55	3	756	74,644	17	81.96	30,889	Dry Pond

# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:36 PM

## Hyd. No. 1

Predevelopment

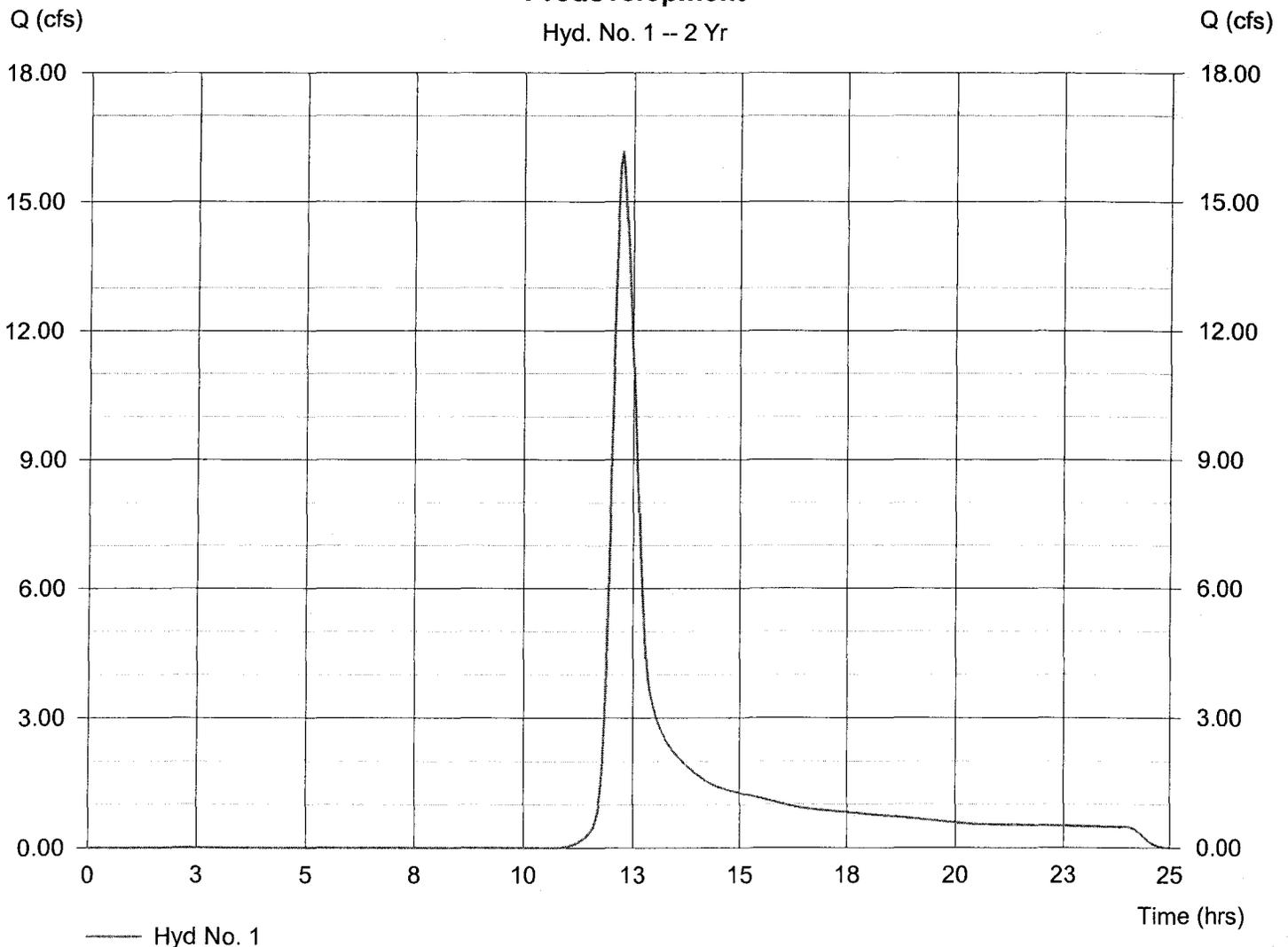
Hydrograph type = SCS Runoff  
Storm frequency = 2 yrs  
Drainage area = 17.68 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 3.50 in  
Storm duration = 24 hrs

Peak discharge = 16.16 cfs  
Time interval = 3 min  
Curve number = 73  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 31.7 min  
Distribution = Type II  
Shape factor = 484

Hydrograph Volume = 77,058 cuft

### Predevelopment

Hyd. No. 1 -- 2 Yr



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 8

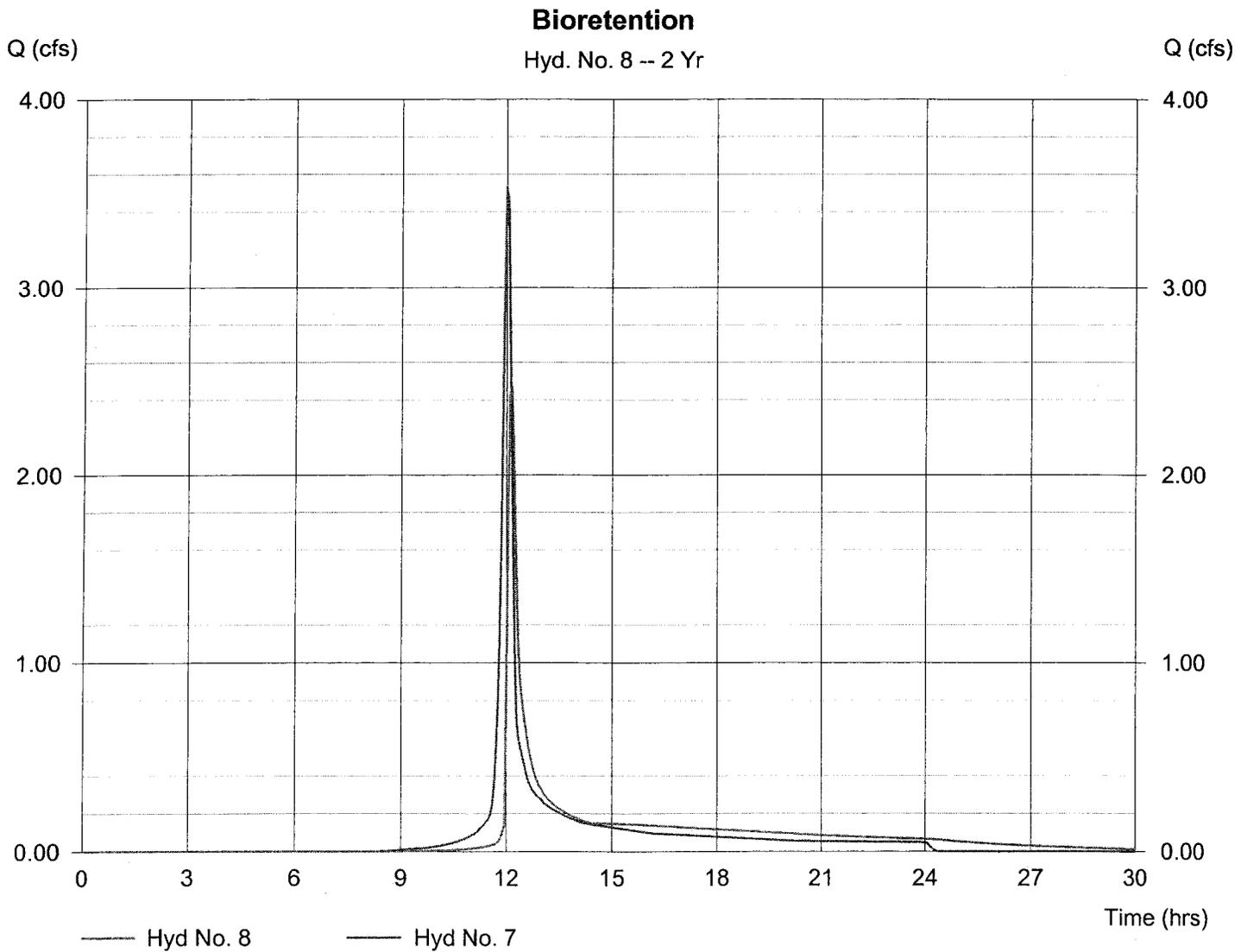
Bioretention

Hydrograph type = Reservoir  
Storm frequency = 2 yrs  
Inflow hyd. No. = 7  
Reservoir name = Bioretention

Peak discharge = 2.47 cfs  
Time interval = 3 min  
Max. Elevation = 98.76 ft  
Max. Storage = 2,955 cuft

Storage Indication method used.

Hydrograph Volume = 9,564 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 11

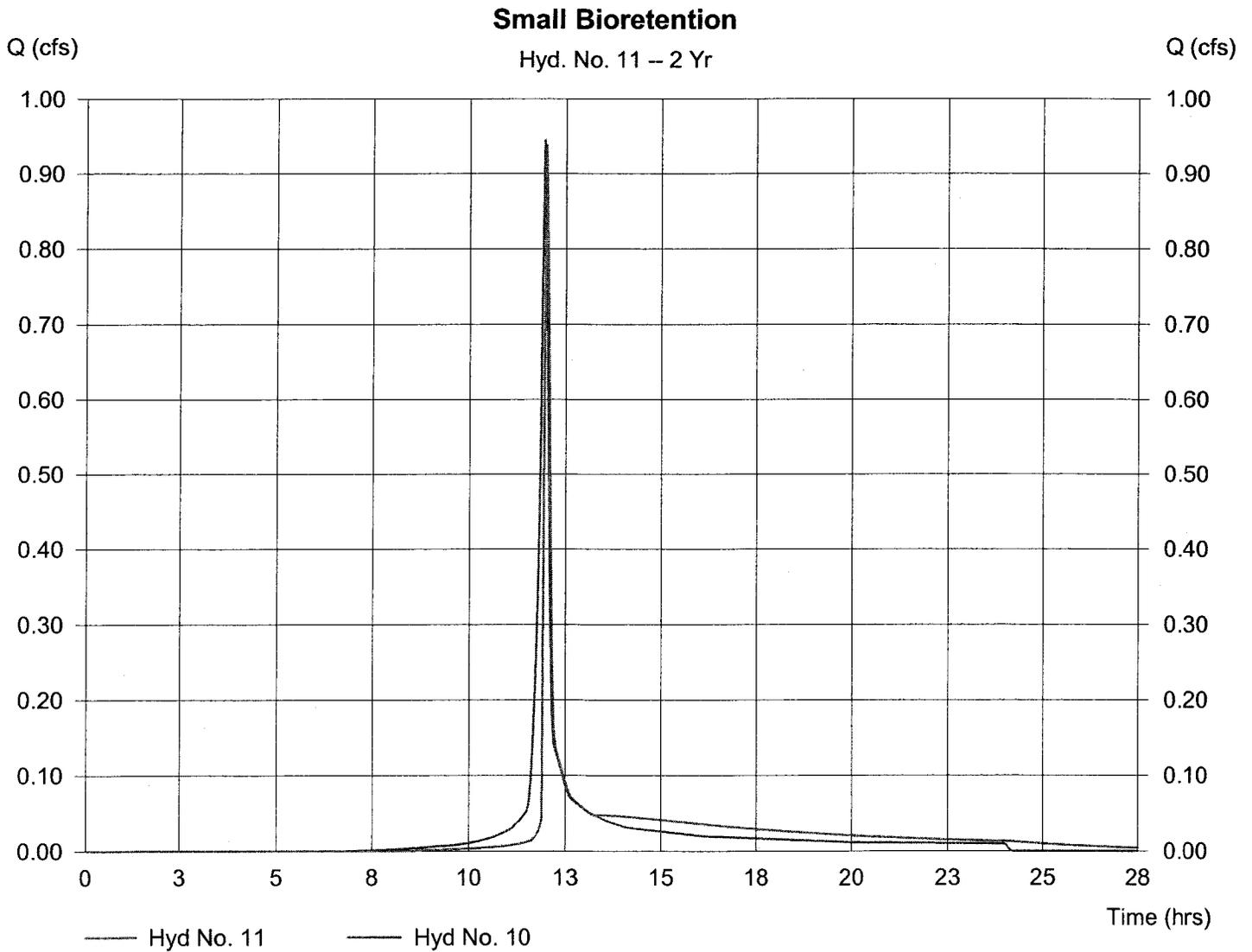
Small Bioretention

Hydrograph type = Reservoir  
Storm frequency = 2 yrs  
Inflow hyd. No. = 10  
Reservoir name = Small Bioretention

Peak discharge = 0.94 cfs  
Time interval = 3 min  
Max. Elevation = 103.57 ft  
Max. Storage = 601 cuft

Storage Indication method used.

Hydrograph Volume = 2,131 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 15

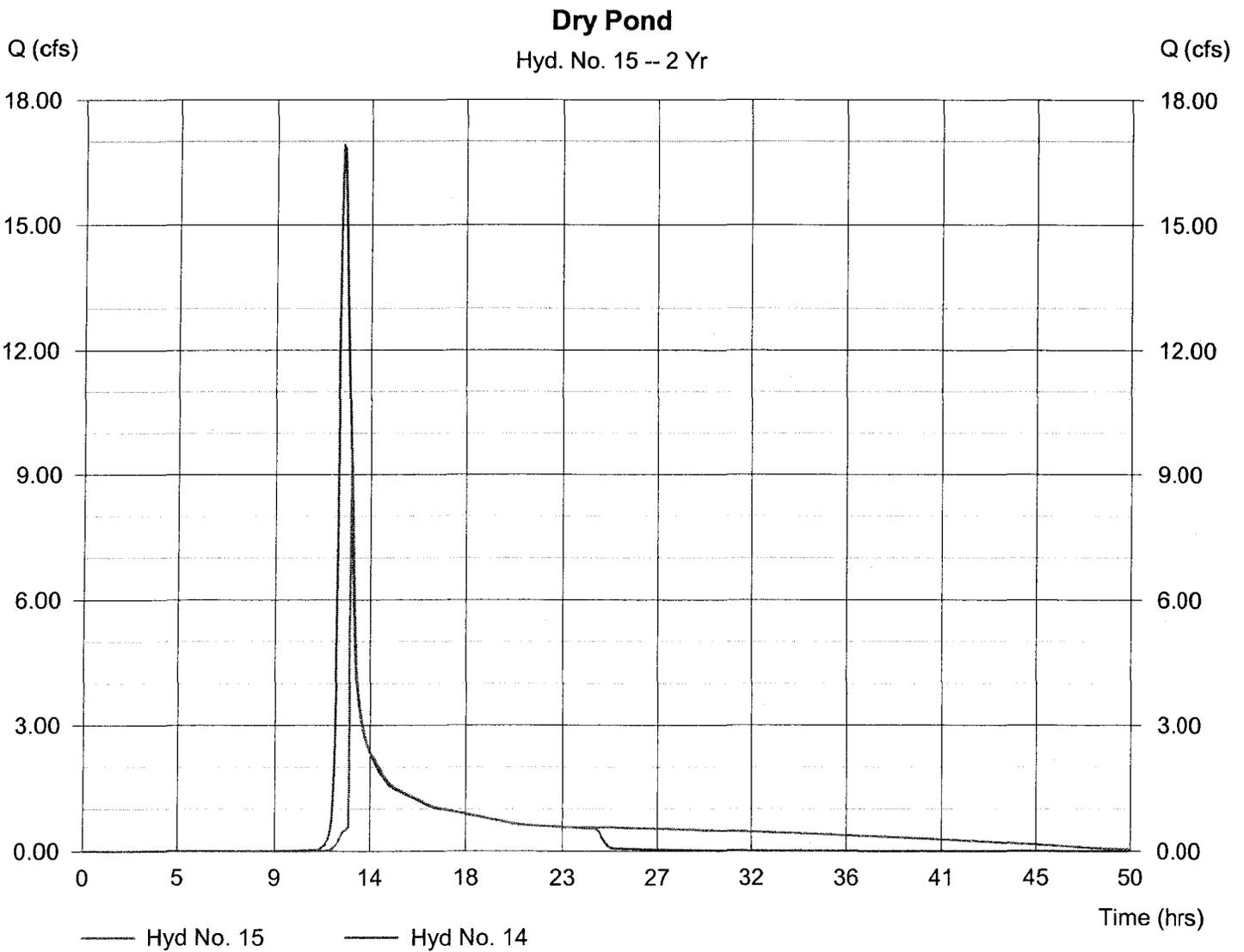
Dry Pond

Hydrograph type = Reservoir  
Storm frequency = 2 yrs  
Inflow hyd. No. = 14  
Reservoir name = Dry Pond

Peak discharge = 9.64 cfs  
Time interval = 3 min  
Max. Elevation = 82.00 ft  
Max. Storage = 31,186 cuft

Storage Indication method used.

Hydrograph Volume = 83,533 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:38 PM

## Hyd. No. 18

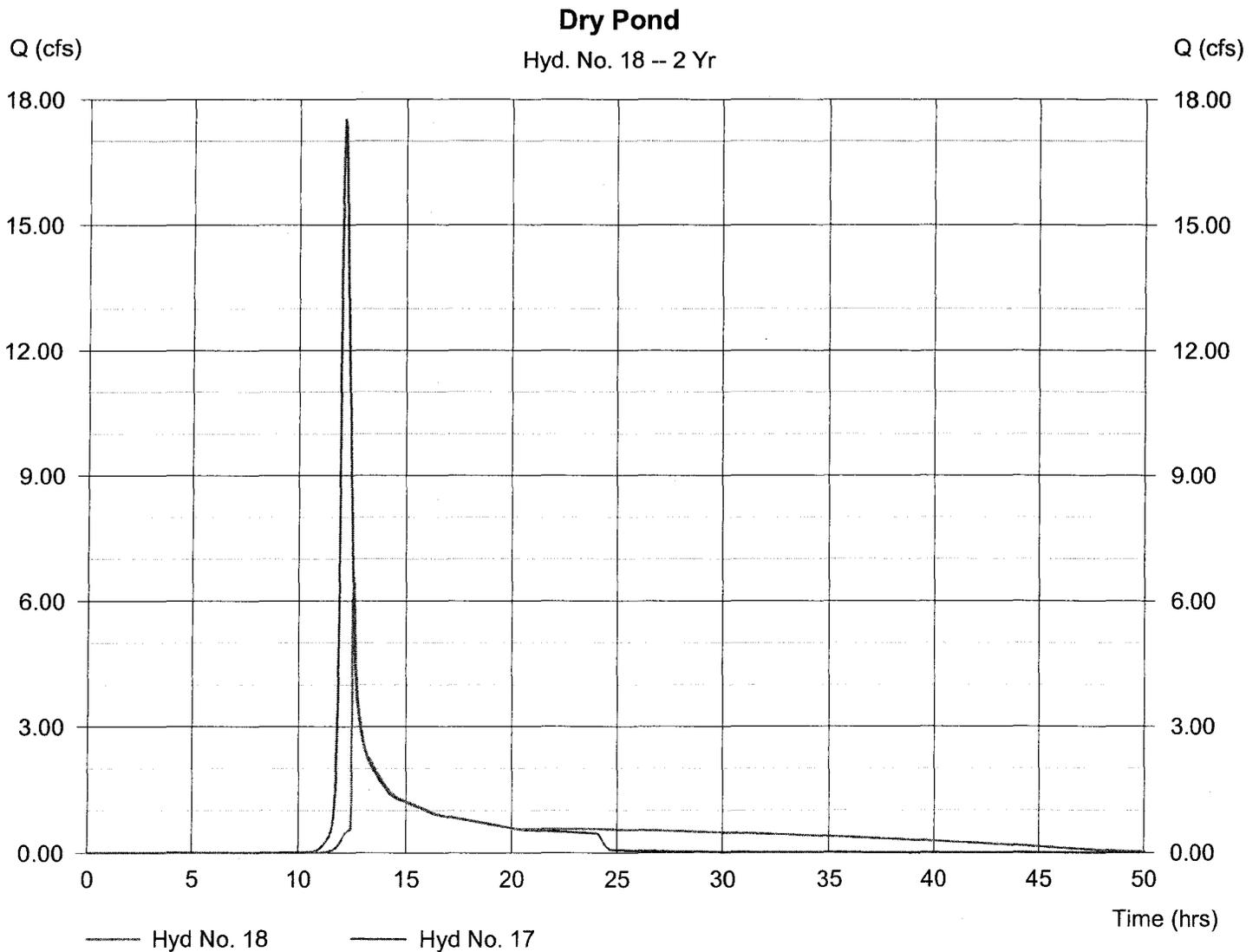
Dry Pond

Hydrograph type = Reservoir  
Storm frequency = 2 yrs  
Inflow hyd. No. = 17  
Reservoir name = Dry Pond

Peak discharge = 6.55 cfs  
Time interval = 3 min  
Max. Elevation = 81.96 ft  
Max. Storage = 30,889 cuft

Storage Indication method used.

Hydrograph Volume = 74,644 cuft



# Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	42.25	3	735	190,974	---	----	-----	Predevelopment
3	SCS Runoff	40.06	3	735	181,448	---	----	-----	Initial Post Area
5	SCS Runoff	38.07	3	729	153,236	---	----	-----	Ultimate Post Condition
7	SCS Runoff	7.49	3	720	20,434	---	----	-----	Bioretention Area
8	Reservoir	6.80	3	723	20,421	7	99.02	3,978	Bioretention
10	SCS Runoff	1.85	3	717	4,308	---	----	-----	Small Bioretention Area
11	Reservoir	1.80	3	717	4,297	10	103.62	654	Small Bioretention
12	Combine	8.17	3	723	24,718	8, 11	----	-----	Combined Bioretentions
14	Combine	44.78	3	732	206,166	3, 12,	----	-----	Total Area
15	Reservoir	44.47	3	732	206,148	14	82.28	33,393	Dry Pond
17	Combine	44.32	3	729	177,954	5, 12,	----	-----	Ultimate Condition
18	Reservoir	47.29	3	726	177,936	17	82.30	33,542	Dry Pond

# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 1

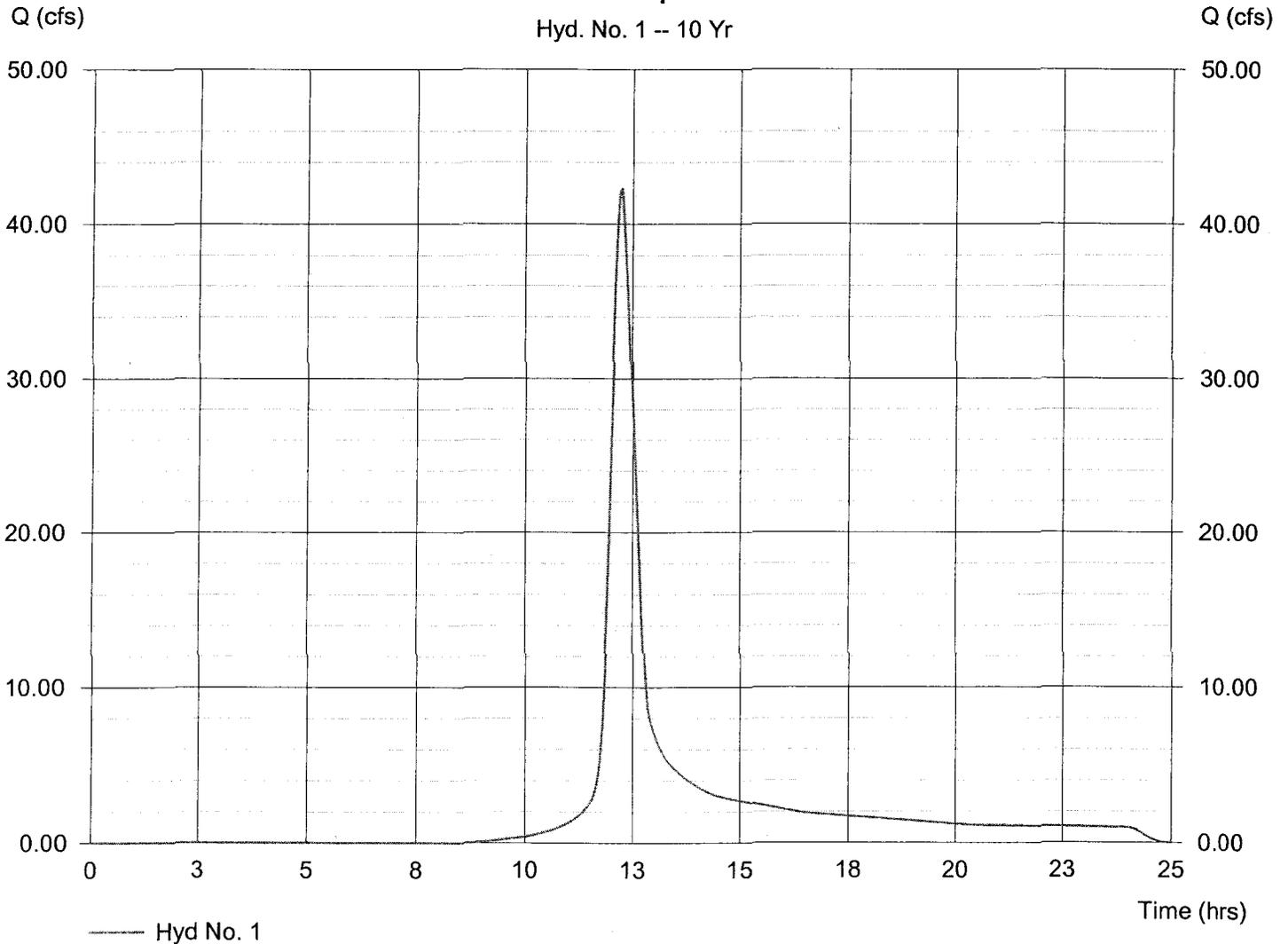
Predevelopment

Hydrograph type = SCS Runoff  
Storm frequency = 10 yrs  
Drainage area = 17.68 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 5.80 in  
Storm duration = 24 hrs

Peak discharge = 42.25 cfs  
Time interval = 3 min  
Curve number = 73  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 31.7 min  
Distribution = Type II  
Shape factor = 484

Hydrograph Volume = 190,974 cuft

**Predevelopment**  
Hyd. No. 1 -- 10 Yr



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 8

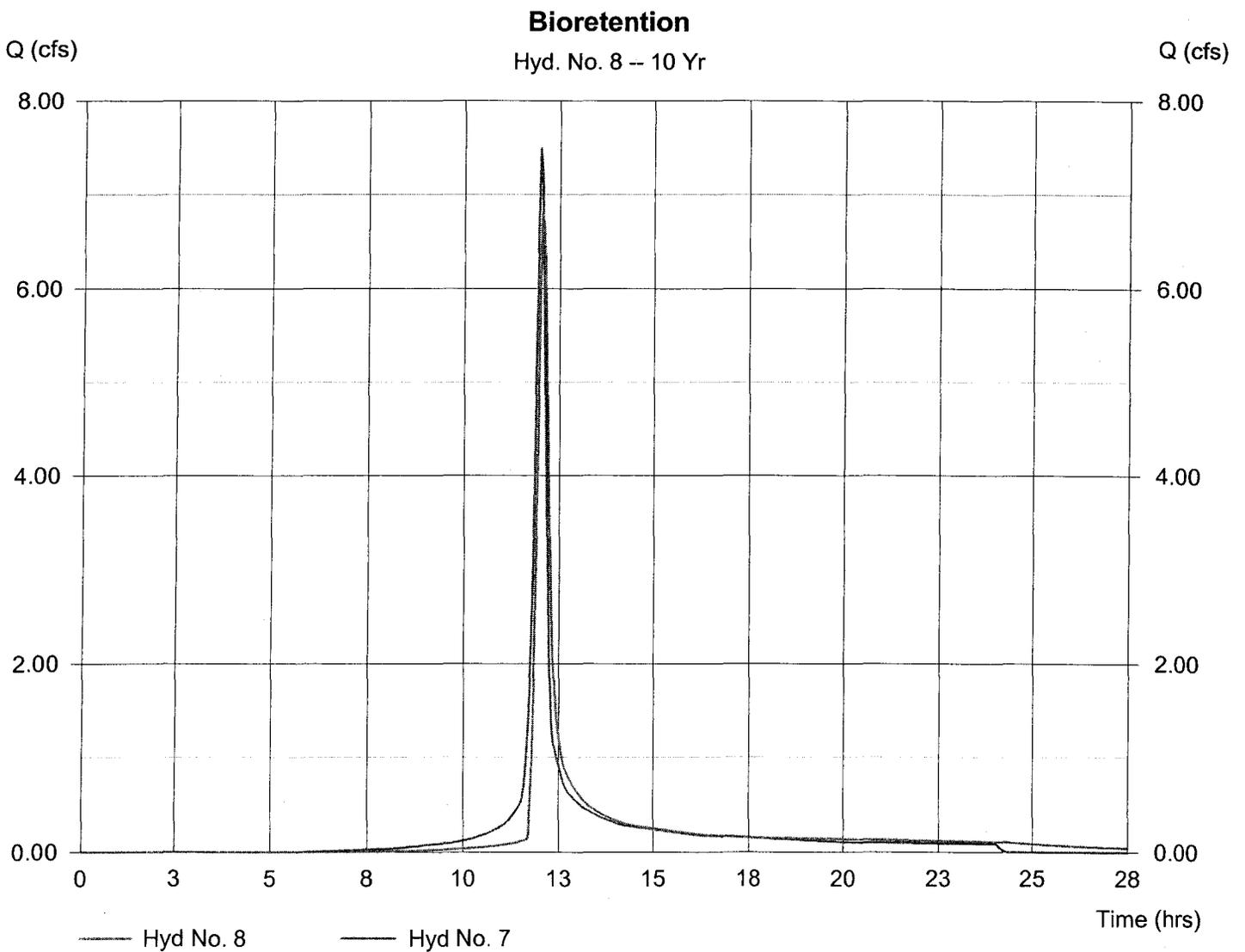
Bioretention

Hydrograph type = Reservoir  
Storm frequency = 10 yrs  
Inflow hyd. No. = 7  
Reservoir name = Bioretention

Peak discharge = 6.80 cfs  
Time interval = 3 min  
Max. Elevation = 99.02 ft  
Max. Storage = 3,978 cuft

Storage Indication method used.

Hydrograph Volume = 20,421 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 11

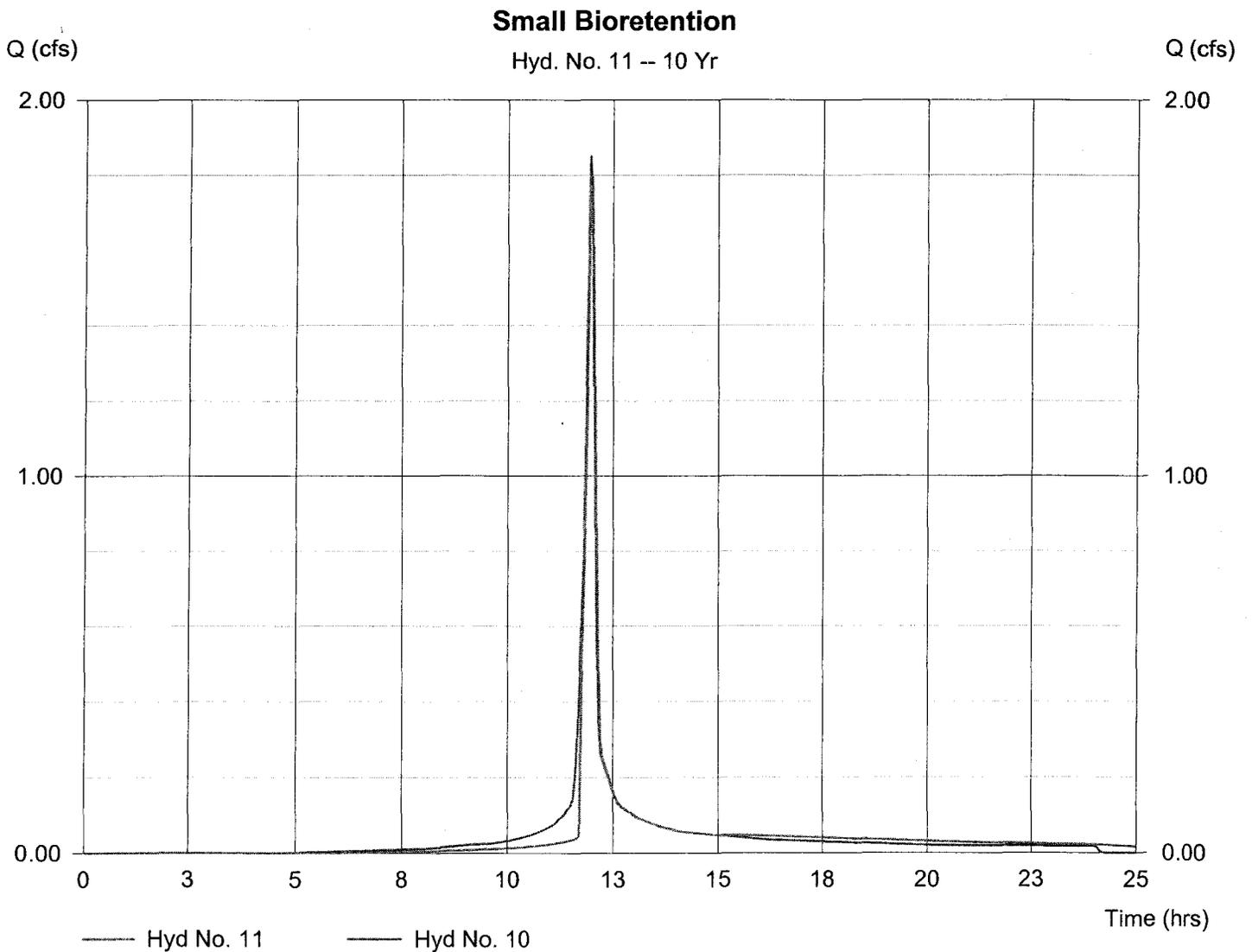
Small Bioretention

Hydrograph type = Reservoir  
Storm frequency = 10 yrs  
Inflow hyd. No. = 10  
Reservoir name = Small Bioretention

Peak discharge = 1.80 cfs  
Time interval = 3 min  
Max. Elevation = 103.62 ft  
Max. Storage = 654 cuft

Storage Indication method used.

Hydrograph Volume = 4,297 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 15

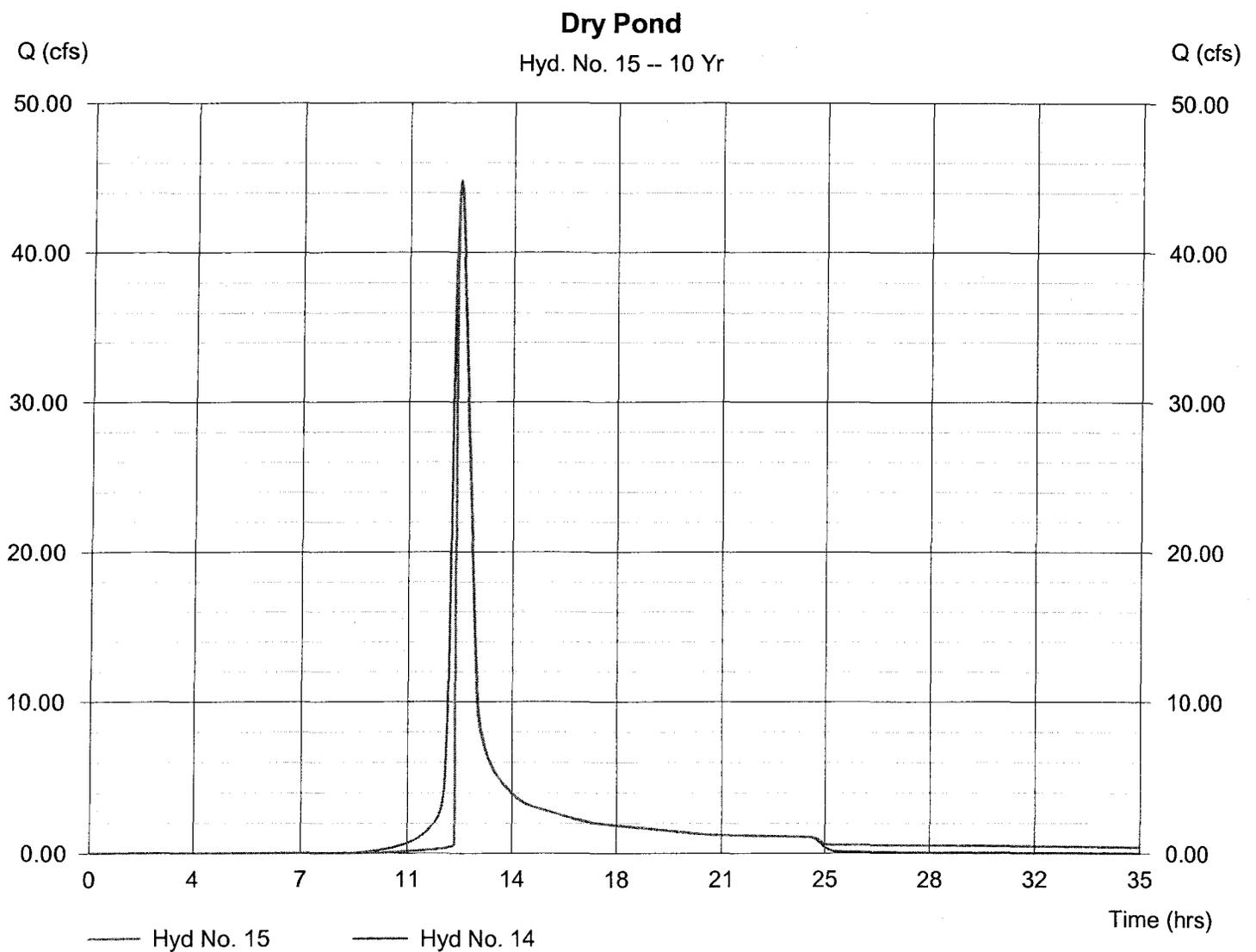
Dry Pond

Hydrograph type = Reservoir  
Storm frequency = 10 yrs  
Inflow hyd. No. = 14  
Reservoir name = Dry Pond

Peak discharge = 44.47 cfs  
Time interval = 3 min  
Max. Elevation = 82.28 ft  
Max. Storage = 33,393 cuft

Storage Indication method used.

Hydrograph Volume = 206,148 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:38 PM

## Hyd. No. 18

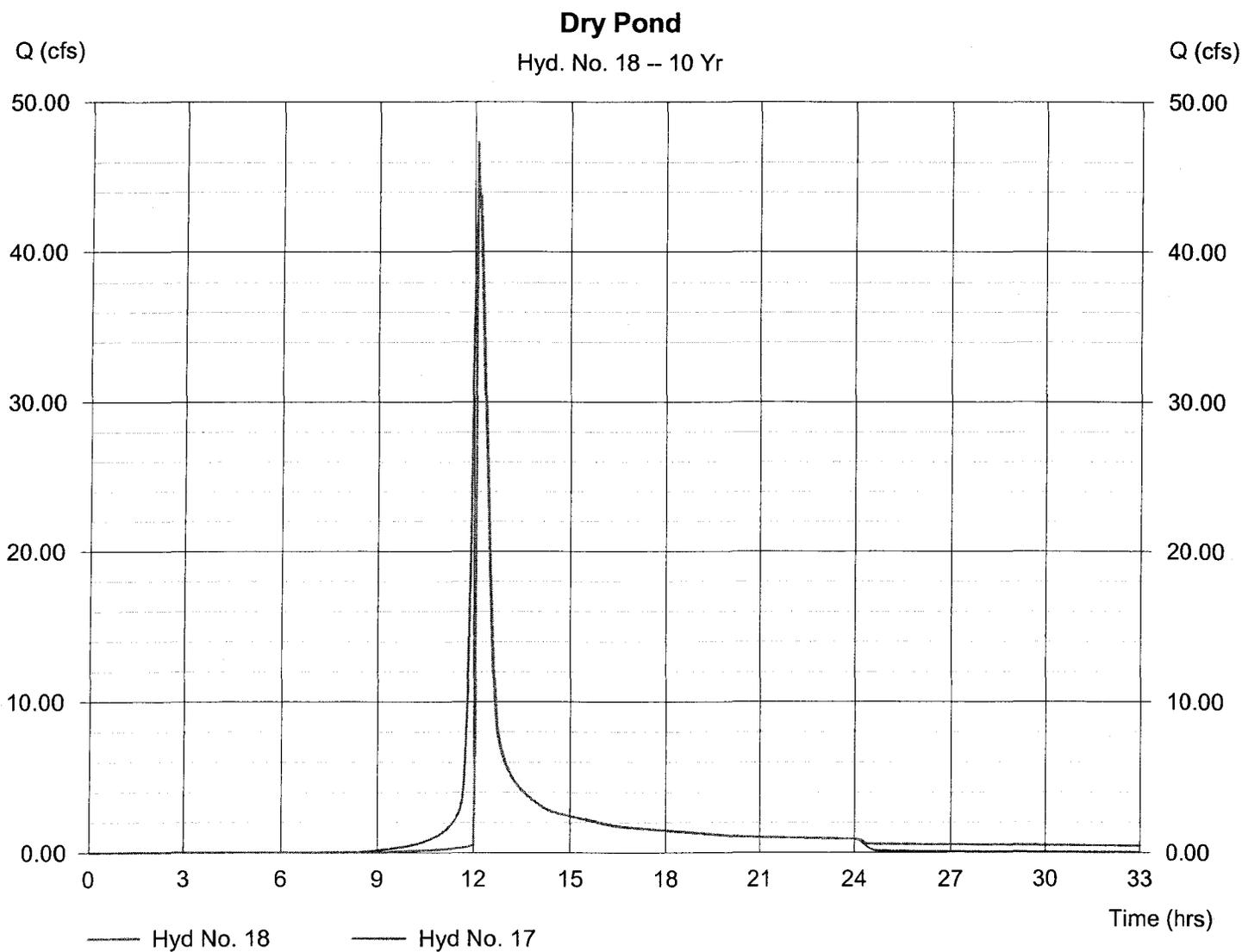
Dry Pond

Hydrograph type = Reservoir  
Storm frequency = 10 yrs  
Inflow hyd. No. = 17  
Reservoir name = Dry Pond

Peak discharge = 47.29 cfs  
Time interval = 3 min  
Max. Elevation = 82.30 ft  
Max. Storage = 33,542 cuft

Storage Indication method used.

Hydrograph Volume = 177,936 cuft



# Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	69.97	3	732	314,206	---	----	----	Predevelopment
3	SCS Runoff	66.98	3	732	300,938	---	----	----	Initial Post Area
5	SCS Runoff	62.47	3	729	250,144	---	----	----	Ultimate Post Condition
7	SCS Runoff	11.35	3	720	31,481	---	----	----	Bioretention Area
8	Reservoir	10.64	3	723	31,468	7	99.20	4,688	Bioretention
10	SCS Runoff	2.71	3	717	6,464	---	----	----	Small Bioretention Area
11	Reservoir	2.63	3	720	6,453	10	103.66	692	Small Bioretention
12	Combine	12.62	3	723	37,921	8, 11	----	----	Combined Bioretentions
14	Combine	74.03	3	732	338,859	3, 12,	----	----	Total Area
15	Reservoir	73.93	3	732	338,841	14	82.46	34,779	Dry Pond
17	Combine	71.69	3	729	288,065	5, 12,	----	----	Ultimate Condition
18	Reservoir	71.59	3	729	288,047	17	82.45	34,677	Dry Pond

# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

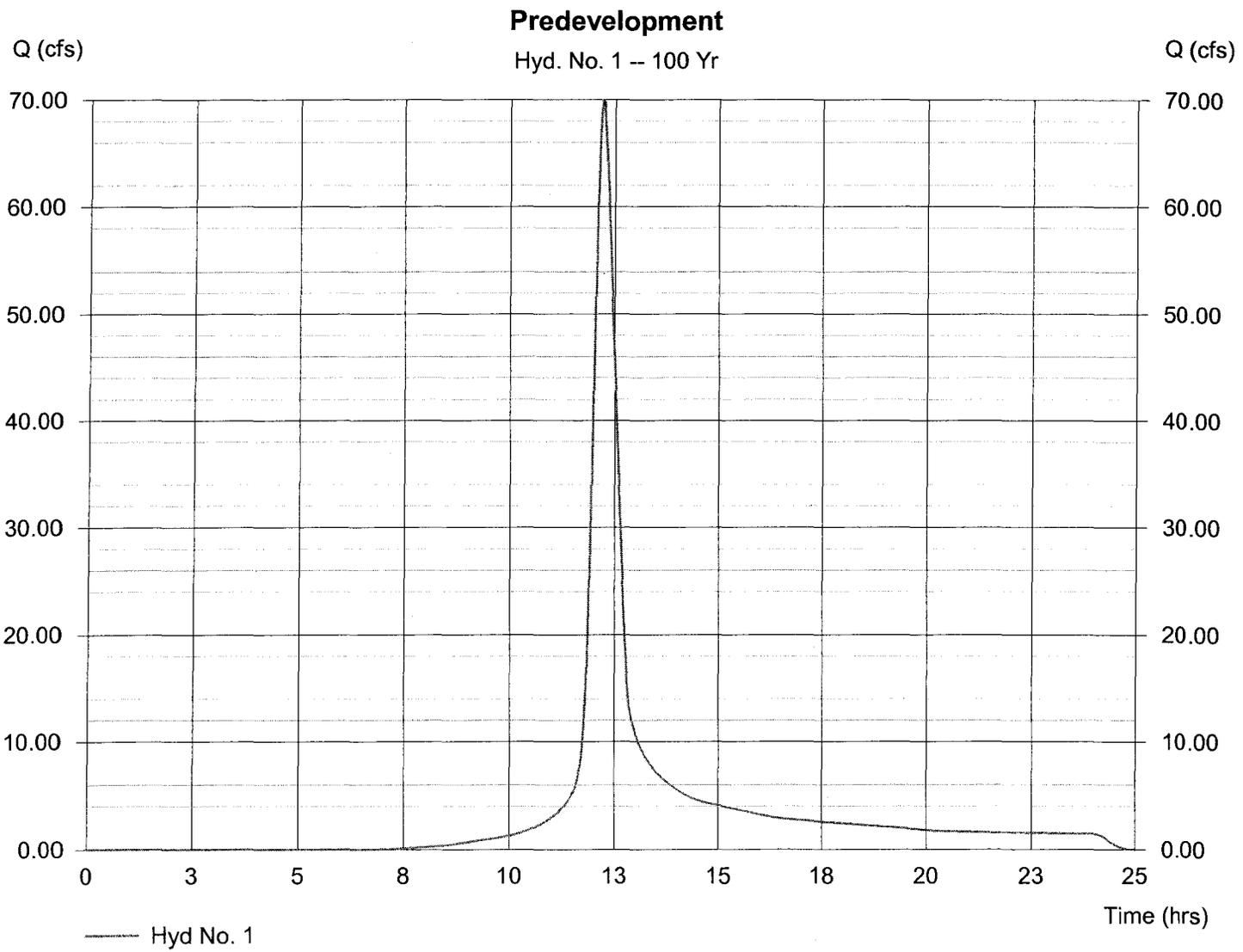
Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 1

### Predevelopment

Hydrograph type	= SCS Runoff	Peak discharge	= 69.97 cfs
Storm frequency	= 100 yrs	Time interval	= 3 min
Drainage area	= 17.68 ac	Curve number	= 73
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.7 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 314,206 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 8

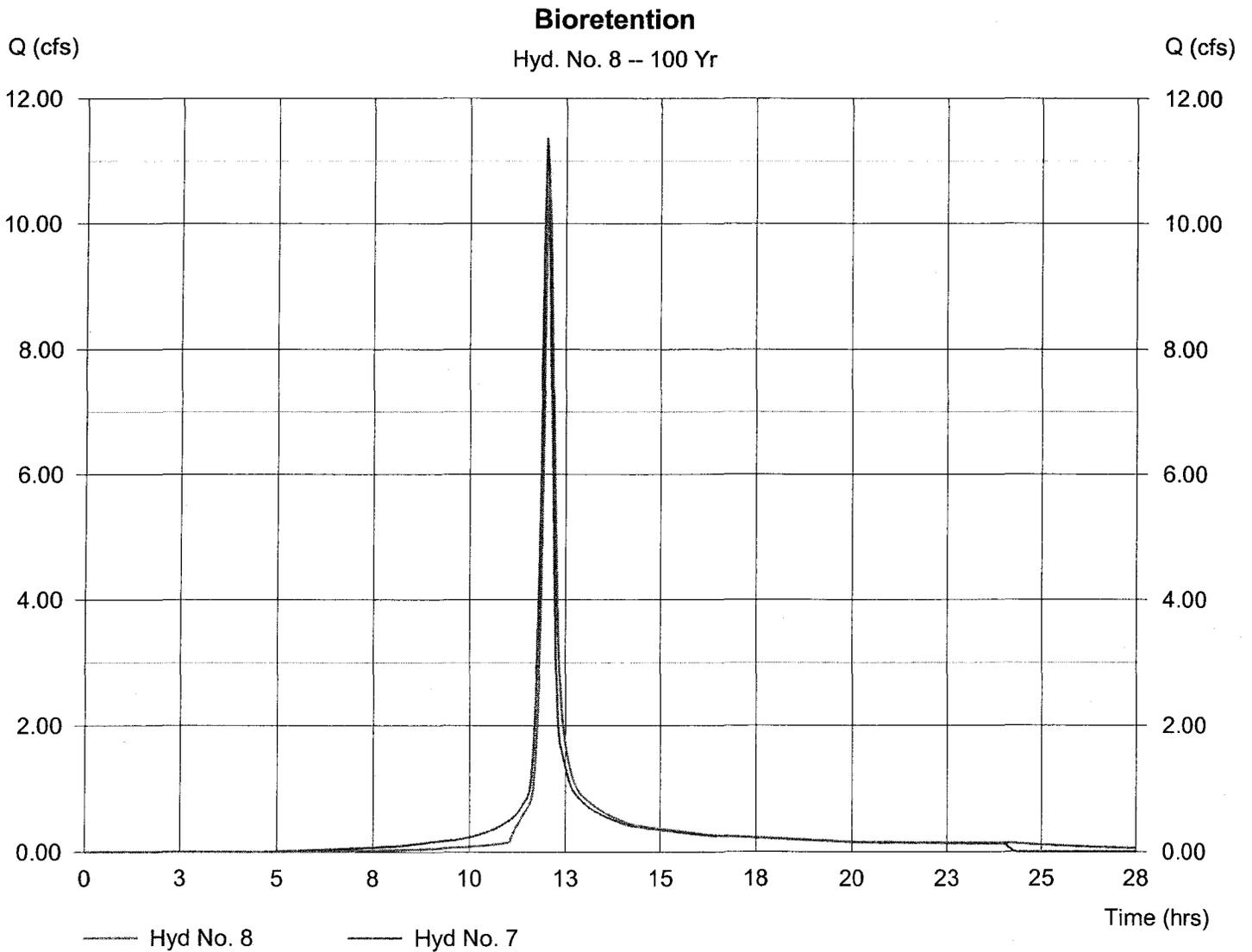
Bioretention

Hydrograph type = Reservoir  
Storm frequency = 100 yrs  
Inflow hyd. No. = 7  
Reservoir name = Bioretention

Peak discharge = 10.64 cfs  
Time interval = 3 min  
Max. Elevation = 99.20 ft  
Max. Storage = 4,688 cuft

Storage Indication method used.

Hydrograph Volume = 31,468 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 11

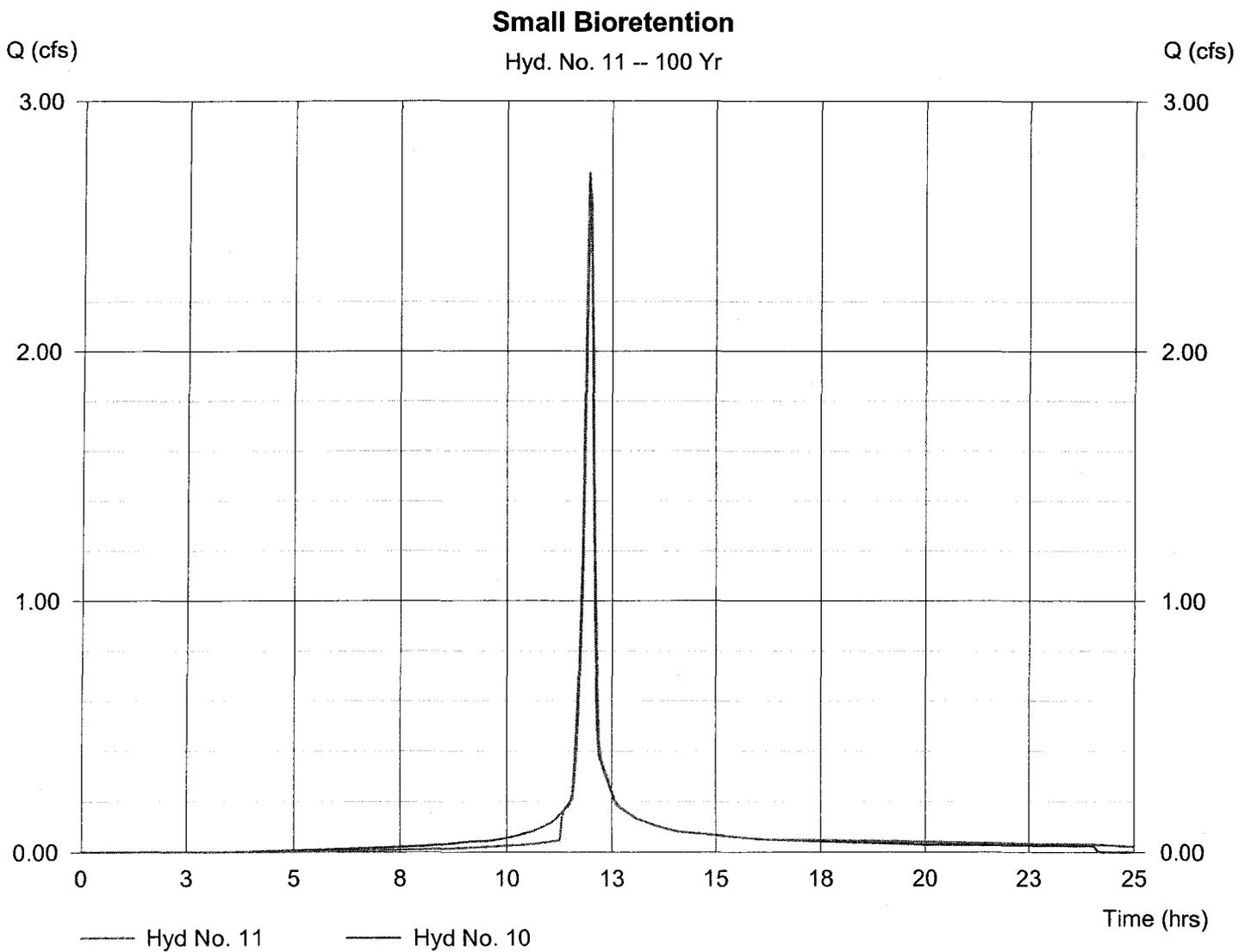
Small Bioretention

Hydrograph type = Reservoir  
Storm frequency = 100 yrs  
Inflow hyd. No. = 10  
Reservoir name = Small Bioretention

Peak discharge = 2.63 cfs  
Time interval = 3 min  
Max. Elevation = 103.66 ft  
Max. Storage = 692 cuft

Storage Indication method used.

Hydrograph Volume = 6,453 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 15

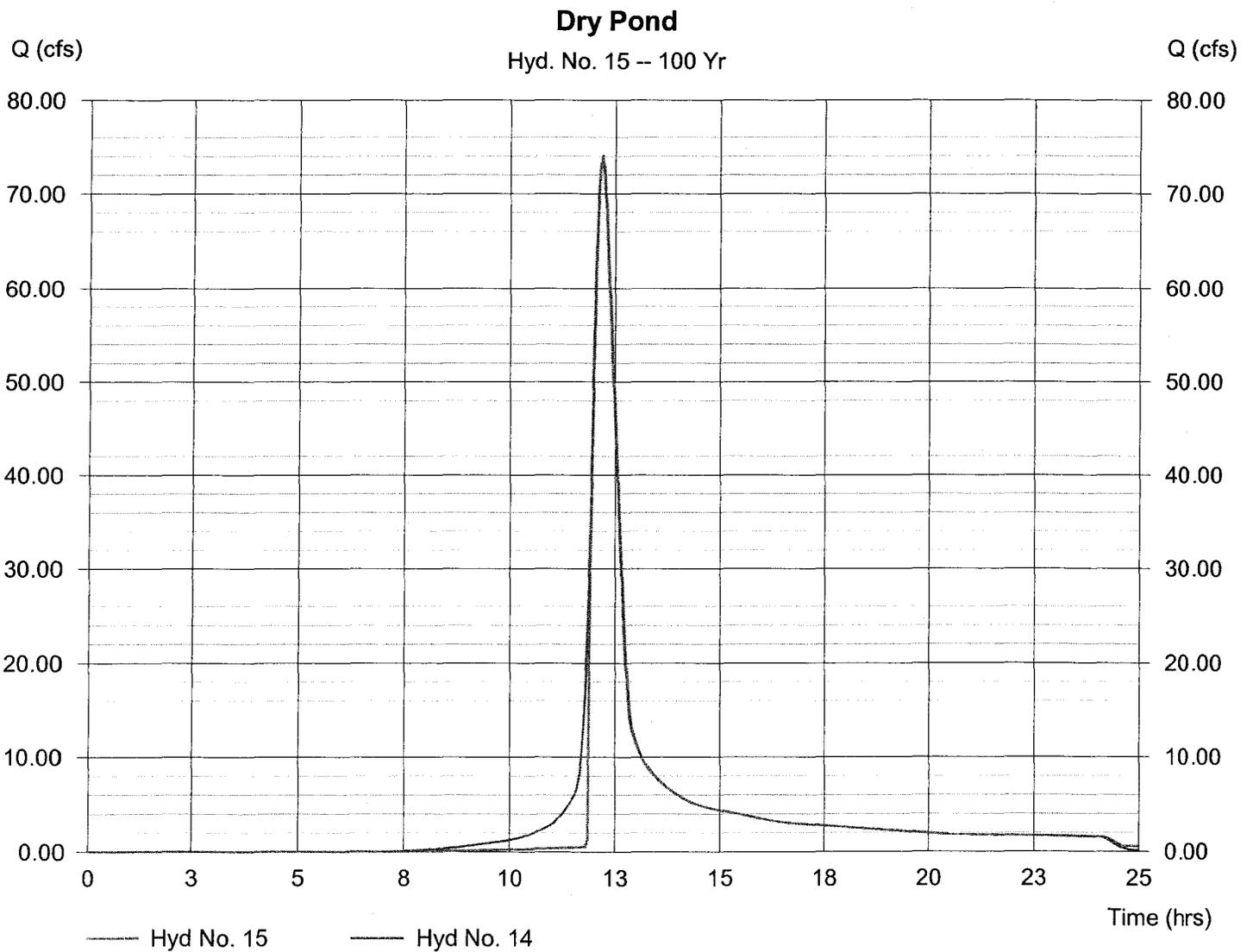
Dry Pond

Hydrograph type = Reservoir  
Storm frequency = 100 yrs  
Inflow hyd. No. = 14  
Reservoir name = Dry Pond

Peak discharge = 73.93 cfs  
Time interval = 3 min  
Max. Elevation = 82.46 ft  
Max. Storage = 34,779 cuft

Storage Indication method used.

Hydrograph Volume = 338,841 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:38 PM

## Hyd. No. 18

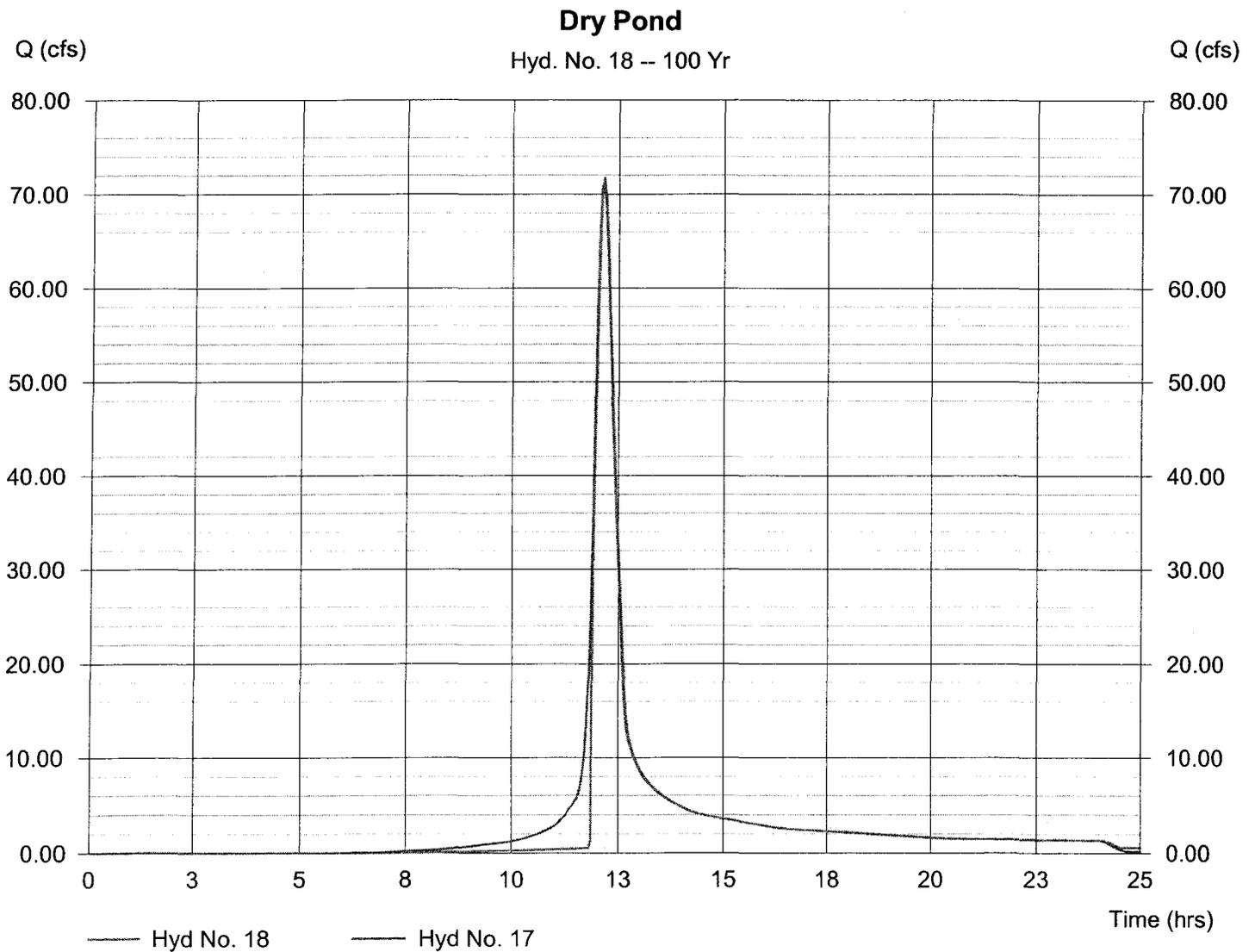
Dry Pond

Hydrograph type = Reservoir  
Storm frequency = 100 yrs  
Inflow hyd. No. = 17  
Reservoir name = Dry Pond

Peak discharge = 71.59 cfs  
Time interval = 3 min  
Max. Elevation = 82.45 ft  
Max. Storage = 34,677 cuft

Storage Indication method used.

Hydrograph Volume = 288,047 cuft



# Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	104.02	3	732	468,413	---	----	----	Predevelopment
3	SCS Runoff	100.28	3	732	451,065	---	----	----	Initial Post Area
5	SCS Runoff	92.16	3	729	370,939	---	----	----	Ultimate Post Condition
7	SCS Runoff	15.91	3	720	44,891	---	----	----	Bioretention Area
8	Reservoir	14.37	3	723	44,878	7	99.36	5,621	Bioretention
10	SCS Runoff	3.73	3	717	9,055	---	----	----	Small Bioretention Area
11	Reservoir	3.60	3	720	9,044	10	103.70	736	Small Bioretention
12	Combine	17.07	3	723	53,922	8, 11	----	----	Combined Bioretentions
14	Combine	110.35	3	732	504,987	3, 12,	----	----	Total Area
15	Reservoir	110.42	3	732	504,970	14	82.65	36,260	Dry Pond
17	Combine	105.50	3	729	424,860	5, 12,	----	----	Ultimate Condition
18	Reservoir	105.38	3	729	424,843	17	82.63	36,068	Dry Pond

*500-YEAR*

*500 YEAR*

# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:36 PM

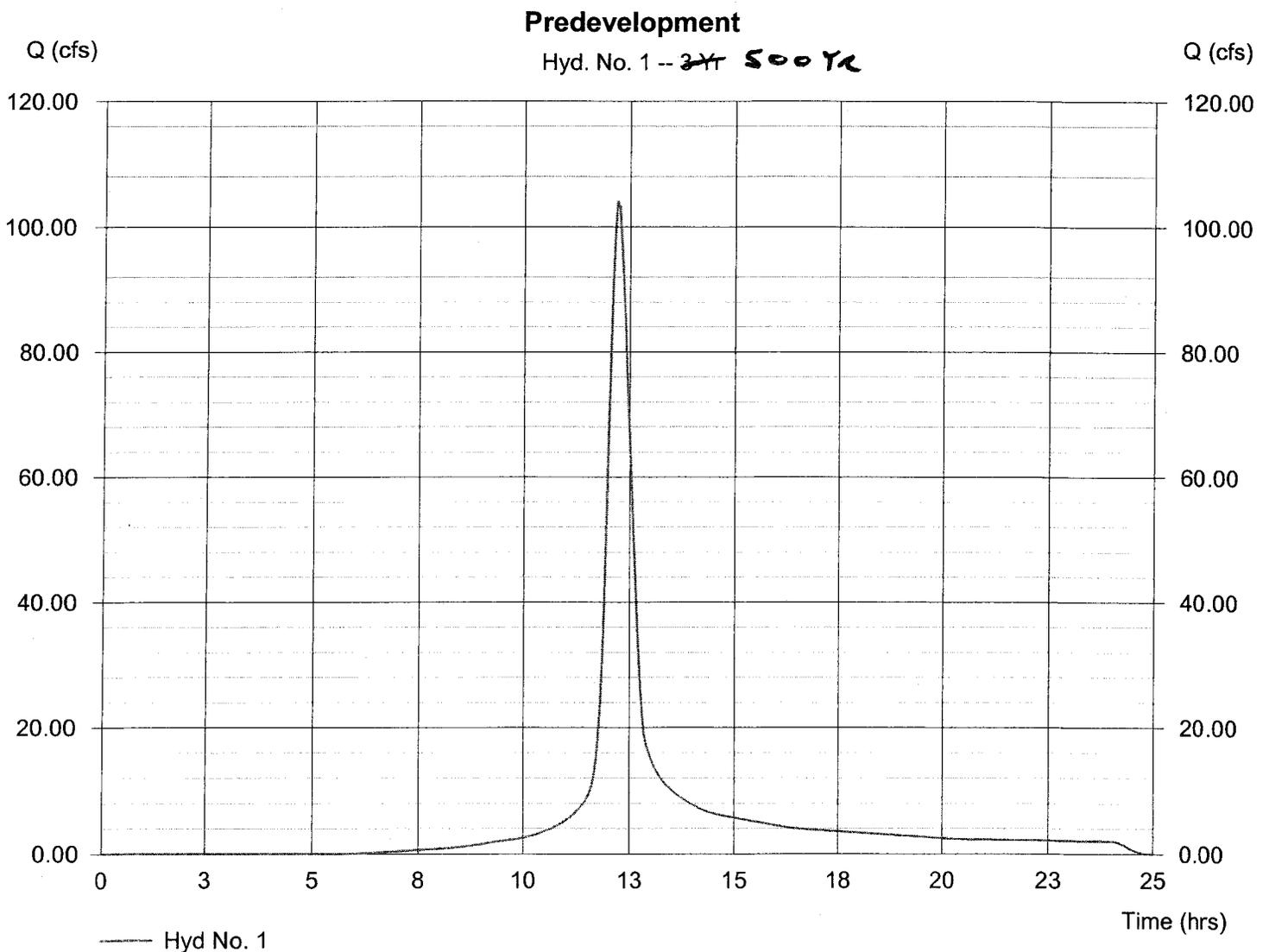
## Hyd. No. 1

Predevelopment

Hydrograph type = SCS Runoff  
Storm frequency = ~~3 yrs~~ 500 yrs  
Drainage area = 17.68 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 10.60 in  
Storm duration = 24 hrs

Peak discharge = 104.02 cfs  
Time interval = 3 min  
Curve number = 73  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 31.7 min  
Distribution = Type II  
Shape factor = 484

Hydrograph Volume = 468,413 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 8

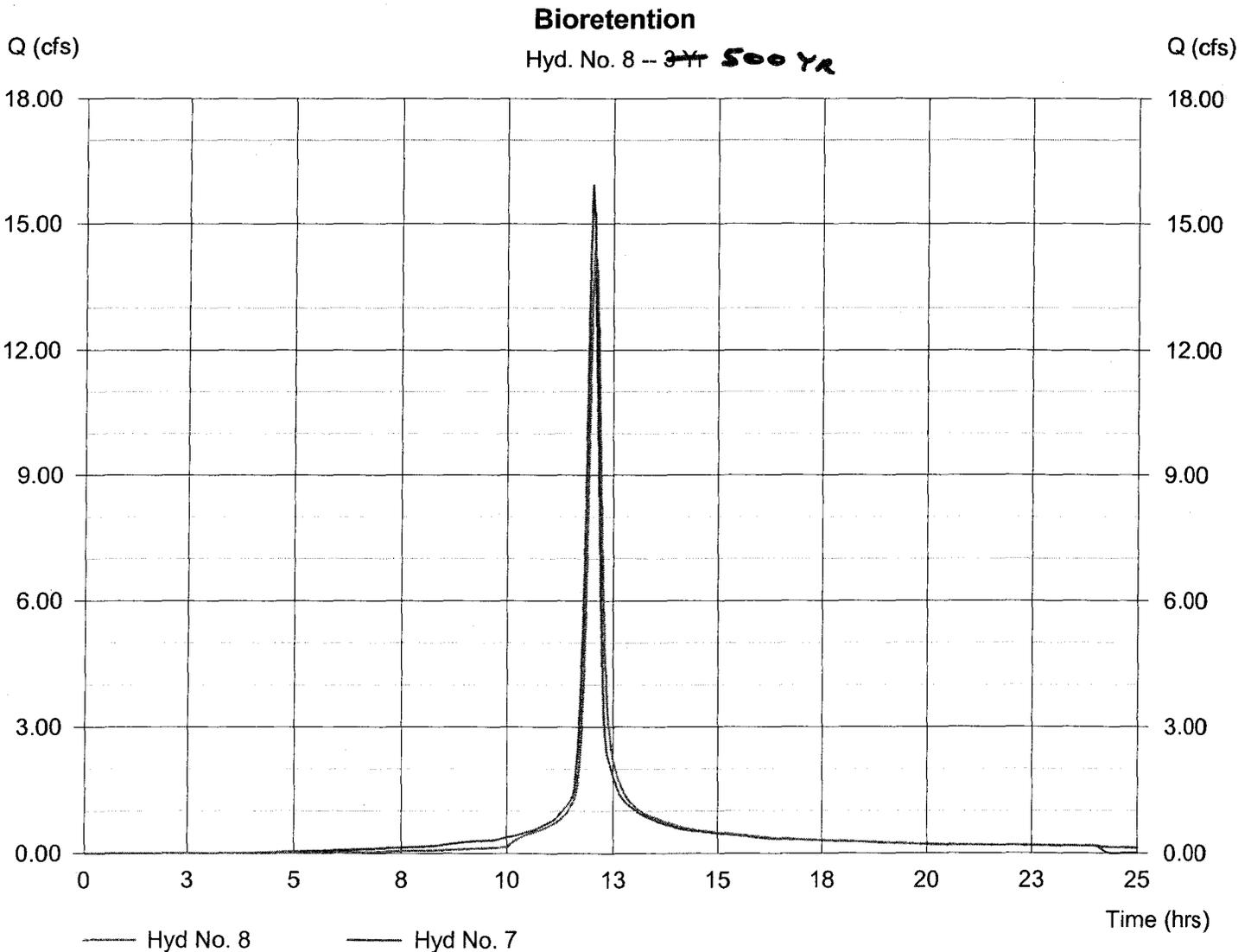
Bioretention

Hydrograph type = Reservoir  
Storm frequency = ~~3 yrs~~ 500 yrs  
Inflow hyd. No. = 7  
Reservoir name = Bioretention

Peak discharge = 14.37 cfs  
Time interval = 3 min  
Max. Elevation = 99.36 ft  
Max. Storage = 5,621 cuft

Storage Indication method used.

Hydrograph Volume = 44,878 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 11

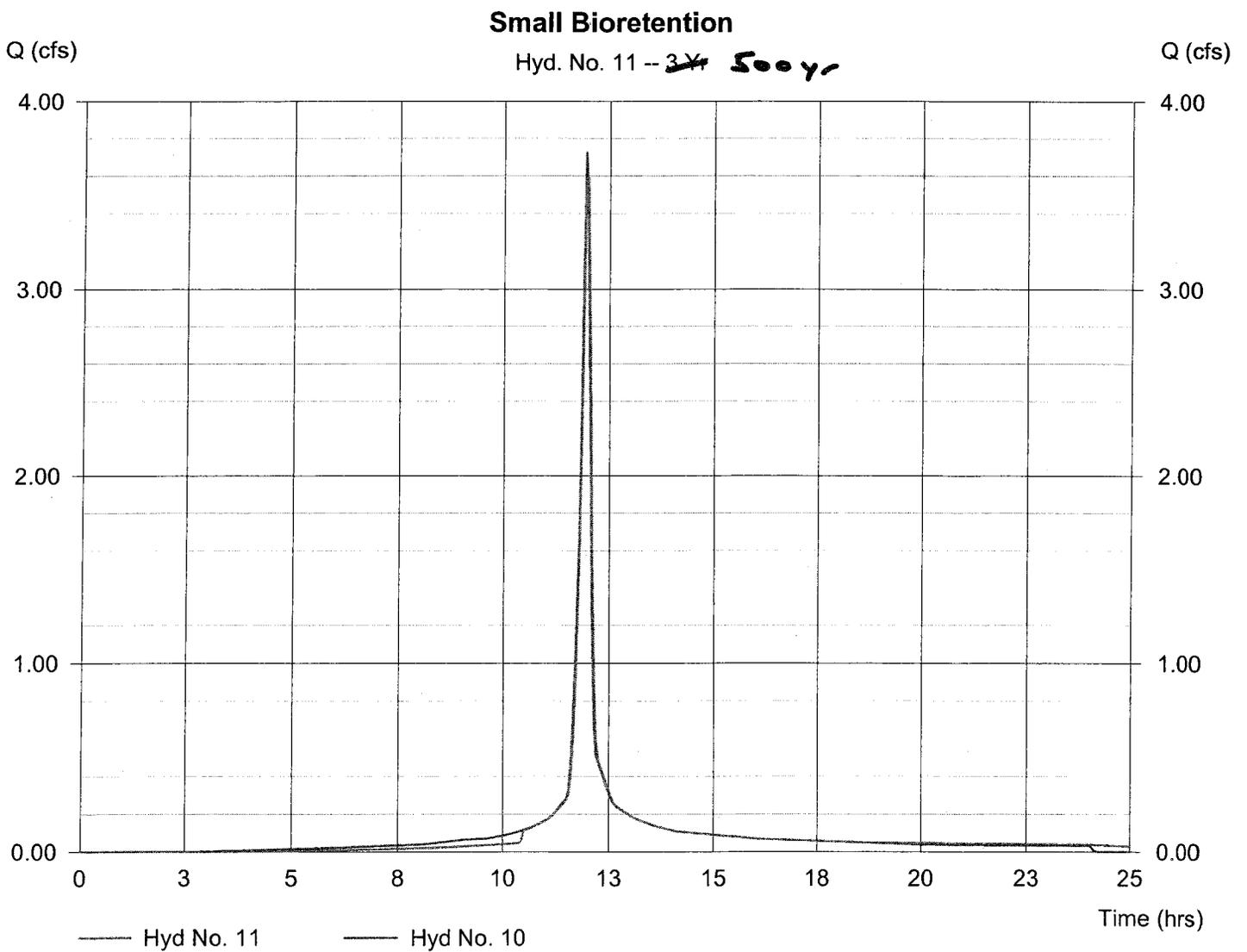
Small Bioretention

Hydrograph type = Reservoir  
Storm frequency = ~~3 yrs~~ 500 yrs  
Inflow hyd. No. = 10  
Reservoir name = Small Bioretention

Peak discharge = 3.60 cfs  
Time interval = 3 min  
Max. Elevation = 103.70 ft  
Max. Storage = 736 cuft

Storage Indication method used.

Hydrograph Volume = 9,044 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:37 PM

## Hyd. No. 15

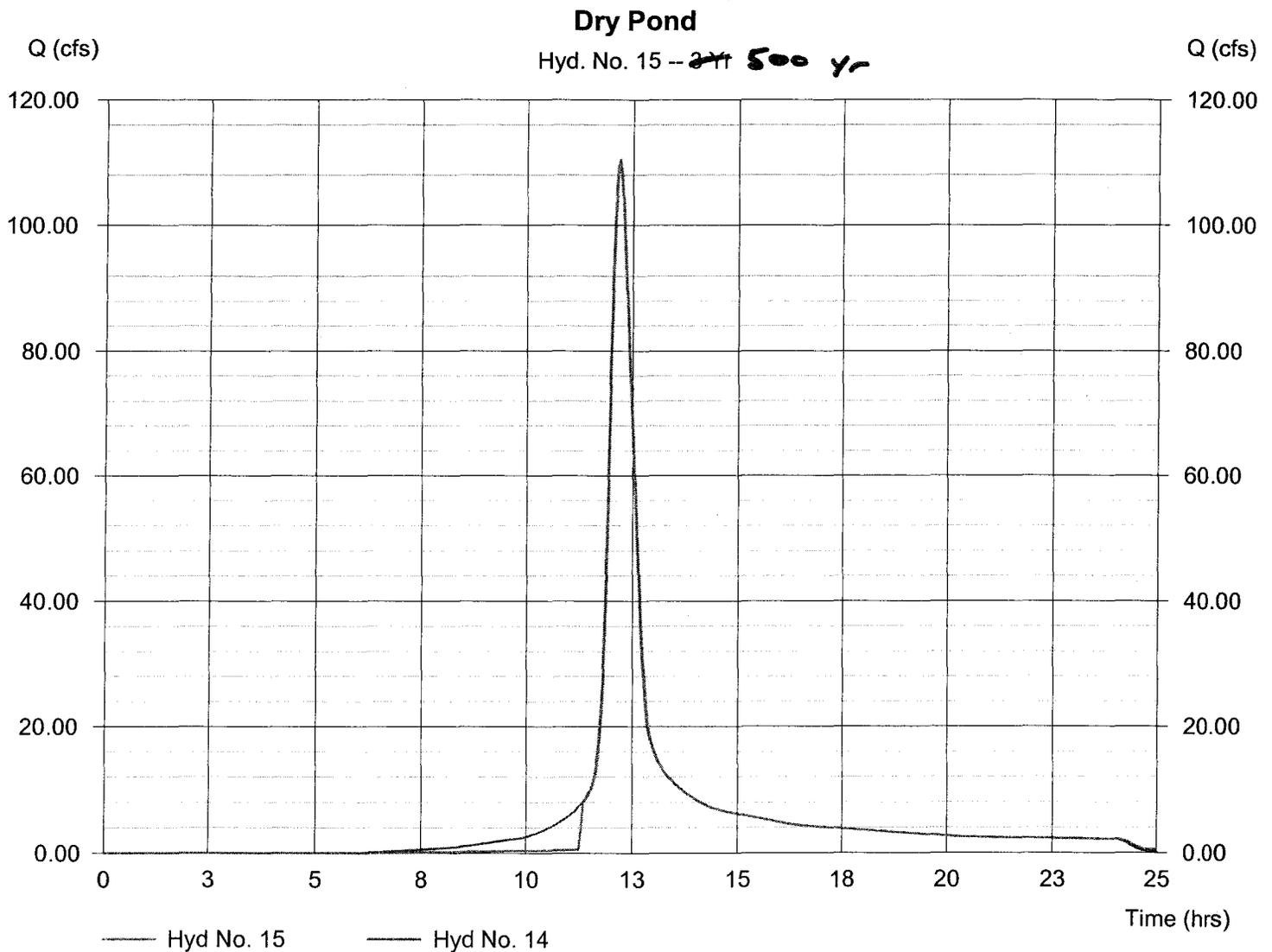
Dry Pond

Hydrograph type = Reservoir  
Storm frequency = ~~2 yrs~~ 500 yr  
Inflow hyd. No. = 14  
Reservoir name = Dry Pond

Peak discharge = 110.42 cfs  
Time interval = 3 min  
Max. Elevation = 82.65 ft  
Max. Storage = 36,260 cuft

Storage Indication method used.

Hydrograph Volume = 504,970 cuft



# Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Apr 6 2006, 5:38 PM

## Hyd. No. 18

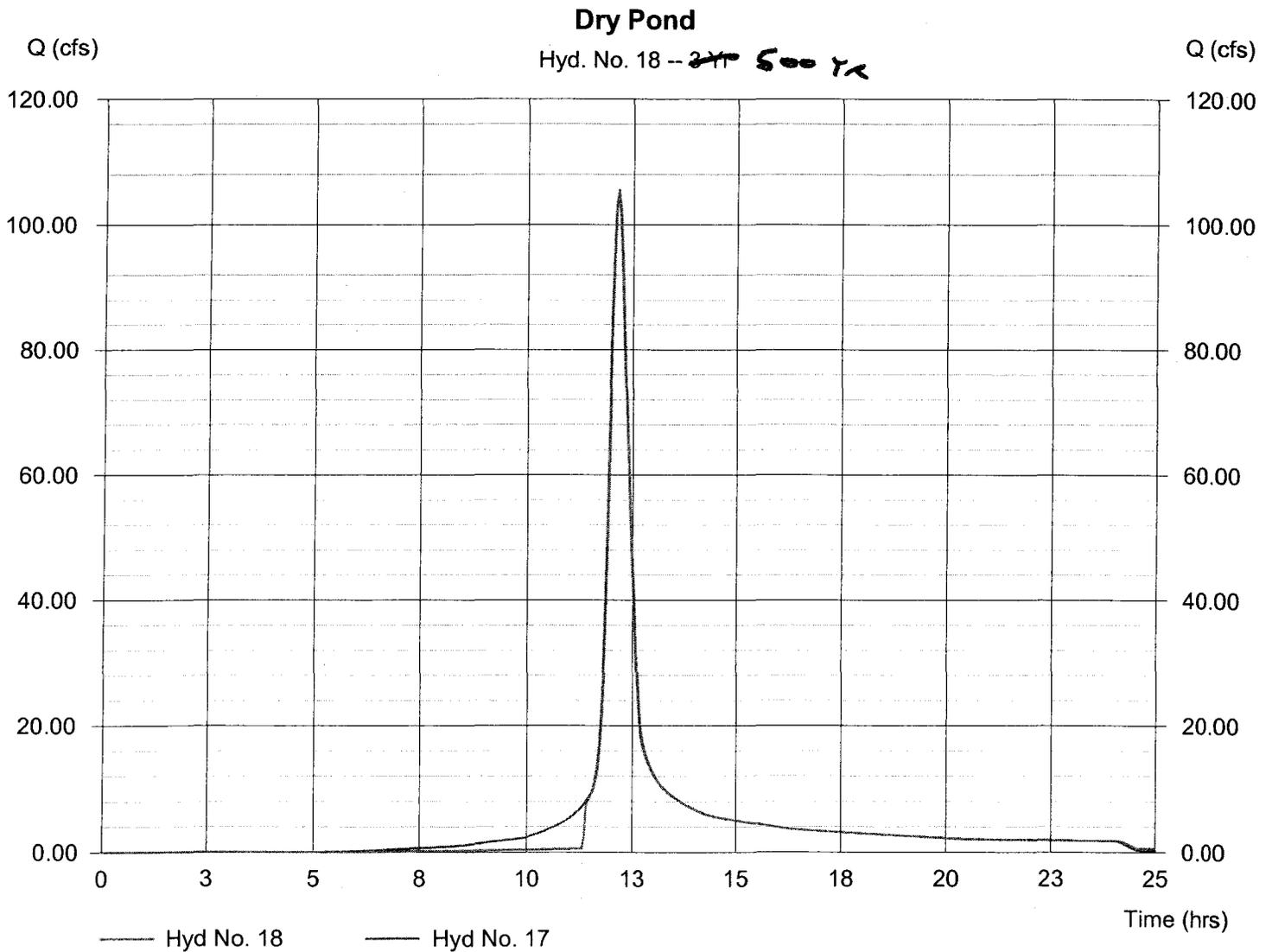
Dry Pond

Hydrograph type = Reservoir  
Storm frequency = ~~3 yrs~~ 500 YR  
Inflow hyd. No. = 17  
Reservoir name = Dry Pond

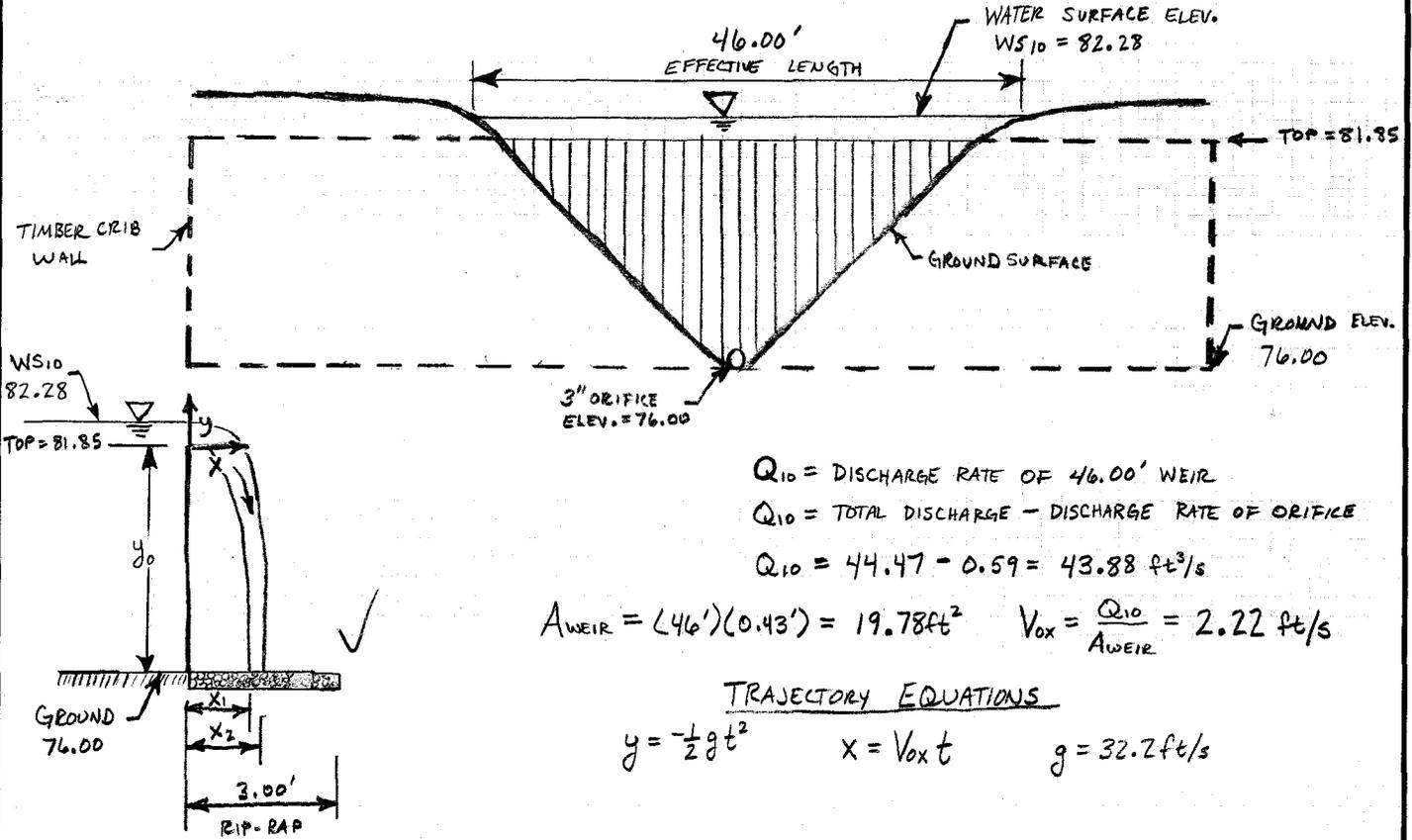
Peak discharge = 105.38 cfs  
Time interval = 3 min  
Max. Elevation = 82.63 ft  
Max. Storage = 36,068 cuft

Storage Indication method used.

Hydrograph Volume = 424,843 cuft



DRAWING NOT TO SCALE



$Q_{10}$  = DISCHARGE RATE OF 46.00' WEIR

$Q_{10}$  = TOTAL DISCHARGE - DISCHARGE RATE OF ORIFICE

$Q_{10} = 44.47 - 0.59 = 43.88 \text{ ft}^3/\text{s}$

$A_{WEIR} = (46') (0.43') = 19.78 \text{ ft}^2$       $V_{OX} = \frac{Q_{10}}{A_{WEIR}} = 2.22 \text{ ft/s}$

TRAJECTORY EQUATIONS

$y = -\frac{1}{2}gt^2$       $x = V_{OX}t$       $g = 32.2 \text{ ft/s}^2$

FOR  $y = y_0$

$-y_0 = -\frac{1}{2}gt^2$

$-5.85 = -\frac{1}{2}(32.2 \text{ ft/s}^2)t^2$

$t = 0.60 \text{ s}$

$x_1 = V_{OX}t$

$x_1 = (2.22 \text{ ft/s})(0.60 \text{ s})$

$x_1 = 1.33 \text{ ft}$

FOR  $y = WS_{10} - 76.00$

$-(WS_{10} - 76.00) = -\frac{1}{2}gt^2$

$-6.28 = -\frac{1}{2}(32.2 \text{ ft/s}^2)t^2$

$t = 0.62 \text{ s}$

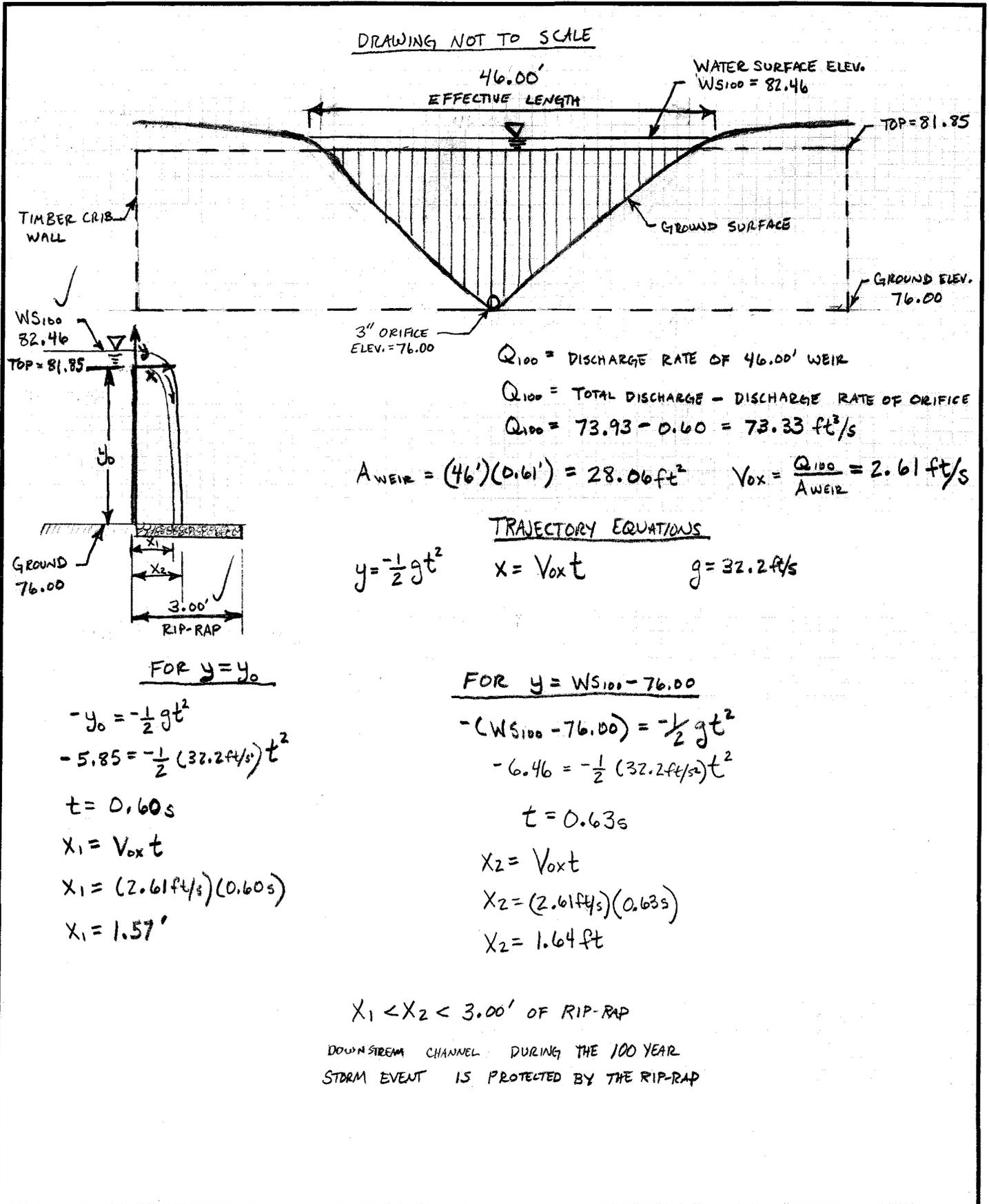
$x_2 = V_{OX}t$

$x_2 = (2.22 \text{ ft/s})(0.62 \text{ s})$

$x_2 = 1.38 \text{ ft}$

$x_1 < x_2 < 3.00'$  OF RIP-RAP

DOWNSTREAM CHANNEL DURING THE 10 YEAR STORM EVENT IS PROTECTED BY THE RIP-RAP



CURRENT DATE: 03-31-2006  
CURRENT TIME: 09:37:48

FILE DATE: 03-31-2006  
FILE NAME: 9014SS23

-----  
FHWA CULVERT ANALYSIS  
HY-8, VERSION 6.0  
-----

C U L V N O.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	103.00	102.50	36.00	1 RCP	1.25	1.25	.012	CONVENTIONAL
2								
3								
4								
5								
6								

-----  
SUMMARY OF CULVERT FLOWS (cfs)

FILE: 9014SS23

DATE: 03-31-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
103.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
103.14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
103.15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
103.16	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
103.18	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
103.18	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
103.19	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
103.20	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
103.20	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
103.21	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
103.21	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING

-----  
SUMMARY OF ITERATIVE SOLUTION ERRORS

FILE: 9014SS23

DATE: 03-31-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
103.00	0.000	0.00	0.00	0.00
103.14	0.000	0.02	0.00	0.00
103.15	0.000	0.04	0.00	0.00
103.16	0.000	0.07	0.00	0.00
103.18	0.000	0.09	0.00	0.00
103.18	0.000	0.10	0.00	0.00
103.19	0.000	0.13	0.00	0.00
103.20	0.000	0.15	0.00	0.00
103.20	0.000	0.18	0.00	0.00
103.21	0.000	0.20	0.00	0.00
103.21	0.000	0.22	0.00	0.00

<1> TOLERANCE (ft) = 0.010

<2> TOLERANCE (%) = 1.000  
-----

CURRENT DATE: 03-31-2006  
CURRENT TIME: 09:37:48

FILE DATE: 03-31-2006  
FILE NAME: 9014SS23

PERFORMANCE CURVE FOR CULVERT 1 - 1( 1.25 (ft) BY 1.25 (ft)) RCP

DIS- CHARGE FLOW (cfs)	HEAD- WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	103.00	0.00	-0.50	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.02	103.14	0.11	0.14	1-S2n	0.02	0.03	0.02	0.03	1.44	1.12
0.04	103.15	0.12	0.15	1-S2n	0.03	0.05	0.03	0.04	1.55	1.45
0.07	103.16	0.13	0.16	1-S2n	0.05	0.08	0.05	0.05	1.67	1.68
0.09	103.18	0.14	0.18	1-S2n	0.06	0.10	0.06	0.06	1.81	1.86
0.10	103.18	0.15	0.18	1-S2n	0.07	0.12	0.07	0.07	1.90	1.94
0.13	103.19	0.17	0.19	1-S2n	0.10	0.14	0.10	0.08	2.19	2.14
0.15	103.20	0.18	0.20	1-S2n	0.11	0.14	0.11	0.09	2.44	2.25
0.18	103.20	0.19	0.20	1-S2n	0.13	0.15	0.13	0.10	2.76	2.35
0.20	103.21	0.20	0.21	1-S2n	0.13	0.16	0.13	0.11	3.11	2.45
0.22	103.21	0.21	0.21	1-S2n	0.14	0.17	0.14	0.11	3.47	2.53

El. inlet face invert 103.00 ft El. outlet invert 102.50 ft  
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

\*\*\*\*\* SITE DATA \*\*\*\*\* CULVERT INVERT \*\*\*\*\*  
INLET STATION 0.00 ft  
INLET ELEVATION 103.00 ft  
OUTLET STATION 36.00 ft  
OUTLET ELEVATION 102.50 ft  
NUMBER OF BARRELS 1  
SLOPE (V/H) 0.0139  
CULVERT LENGTH ALONG SLOPE 36.00 ft

\*\*\*\*\* CULVERT DATA SUMMARY \*\*\*\*\*  
BARREL SHAPE CIRCULAR  
BARREL DIAMETER 1.25 ft  
BARREL MATERIAL CONCRETE  
BARREL MANNING'S n 0.012  
INLET TYPE CONVENTIONAL  
INLET EDGE AND WALL SQUARE EDGE WITH HEADWALL  
INLET DEPRESSION NONE

CURRENT DATE: 03-31-2006

FILE DATE: 03-31-2006

CURRENT TIME: 09:37:48

FILE NAME: 9014SS23

 -----  
 TAILWATER  
 -----

## \*\*\*\*\* REGULAR CHANNEL CROSS SECTION \*\*\*\*\*

BOTTOM WIDTH 0.67 ft  
 SIDE SLOPE H/V (X:1) 1.0  
 CHANNEL SLOPE V/H (ft/ft) 0.013  
 MANNING'S n (.01-0.1) 0.013  
 CHANNEL INVERT ELEVATION 102.50 ft  
 CULVERT NO.1 OUTLET INVERT ELEVATION 102.50 ft

## \*\*\*\*\* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	102.50	0.000	0.00	0.00	0.00
0.02	102.53	1.183	0.03	1.12	0.02
0.04	102.54	1.240	0.04	1.45	0.03
0.07	102.55	1.271	0.05	1.68	0.04
0.09	102.56	1.290	0.06	1.86	0.05
0.10	102.57	1.298	0.07	1.94	0.05
0.13	102.58	1.314	0.08	2.14	0.06
0.15	102.59	1.322	0.09	2.25	0.07
0.18	102.60	1.328	0.10	2.35	0.08
0.20	102.61	1.333	0.11	2.45	0.08
0.22	102.61	1.338	0.11	2.53	0.09

 -----  
 ROADWAY OVERTOPPING DATA  
 -----

ROADWAY SURFACE PAVED  
 EMBANKMENT TOP WIDTH 32.00 ft  
 CREST LENGTH 20.00 ft  
 OVERTOPPING CREST ELEVATION 105.00 ft

 -----

CURRENT DATE: 03-31-2006  
 CURRENT TIME: 09:13:01

FILE DATE: 03-31-2006  
 FILE NAME: 9014SS21

-----  
 FHWA CULVERT ANALYSIS  
 HY-8, VERSION 6.0  
 -----

C U L V N O.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	85.32	85.15	15.00	2 RCP	2.00	2.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

-----  
 SUMMARY OF CULVERT FLOWS (cfs)

FILE: 9014SS21

DATE: 03-31-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
86.94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
86.95	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
86.96	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
86.97	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
86.99	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
87.01	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
87.03	10.4	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
87.06	12.1	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
87.10	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
87.12	14.6	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
87.18	17.4	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING

-----  
 SUMMARY OF ITERATIVE SOLUTION ERRORS

FILE: 9014SS21

DATE: 03-31-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
86.94	0.000	0.00	0.00	0.00
86.95	0.000	1.74	0.00	0.00
86.96	0.000	3.47	0.00	0.00
86.97	0.000	5.20	0.00	0.00
86.99	0.000	6.94	0.00	0.00
87.01	0.000	8.68	0.00	0.00
87.03	0.000	10.41	0.00	0.00
87.06	0.000	12.15	0.00	0.00
87.10	0.000	13.88	0.00	0.00
87.12	0.000	14.64	0.00	0.00
87.18	0.000	17.35	0.00	0.00

<1> TOLERANCE (ft) = 0.010

<2> TOLERANCE (%) = 1.000



CURRENT DATE: 03-31-2006  
CURRENT TIME: 09:13:01

FILE DATE: 03-31-2006  
FILE NAME: 9014SS21

-----  
TAILWATER  
-----

CONSTANT WATER SURFACE ELEVATION  
86.94

-----  
ROADWAY OVERTOPPING DATA  
-----

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	1.00 ft
CREST LENGTH	50.00 ft
OVERTOPPING CREST ELEVATION	90.79 ft

-----

JCC Office of Housing and Community Development  
ATTN: Marion Paine  
5340 Palmer Lane Suite 1A  
Williamsburg, VA 23188-1776

Ironbound Square Revitalization Roadway Improvement  
JCC BMP  
County Plan No. SP-131-05  
County BMP ID Code: CC030

Dear Mrs. Paine:

The Environmental Divisions has received a record drawing (as-built) and construction certification for the stormwater management facility for the above referenced project. The record drawing provides as-built information for a timber crib wall retention BMP located on Watford Lane.

Based on our review of the project and a concurrent field inspection was performed on August 1, 2007, the following items must be addressed prior to release of the developer's surety instrument for the stormwater management/BMP facility at the site and to proceed with closing out the project:

**Construction Certification:**

1. In accordance with the Note # 5 on Sheet 12 of the approved plan, construction certification for the stormwater management/BMP facility is required. **There was no engineer construction certification submitted.** This is especially important since the facility has an engineered and compacted earthen embankment. The certification can be in letter format or by use of the certification statements in Section 4 of the JCC, Stormwater Management/BMP Facilities, Record Drawing and Construction Certification, Standard Forms & Instructions.
2. A professional engineer's seal and signature is required on construction certifications.
3. Add the following County identifiers to the construction certification documents: County Plan Number **SP-131-05**.
4. **Record Drawing:**
5. The record drawing set dated 7/10/2007 is **unsatisfactory**.
6. On original plan set dated **6/8/2007** rip rap is delineated on site plan as existing rip rap. On the record drawing this was omitted. During the field inspection it was noted that the stone is in place. In addition to this a detail of this area should be on the record drawing as well.
7. Show the following additional information on the record drawing: size of stone, area of coverage and any elevation changes.
8. Add the following County identifiers to the lower right hand corner of the record drawing: County Plan Number SP-131-05 and BMP ID Code: CC 030.

9. **Construction - Related Items:**

10. VDOT Standard EG-1 has a board wedge between the gate for the energy dissipater in the channel.
11. Along toe of slope approximately the 81 topo line center of the slope water is seeping and eroding on the embankment at the Watford Lane side of the pond. This appears to be ground water.
12. Timber wall structure has the following issues:
  - a. The center of the structure has water seeping underneath the structure
  - b. Slopes on the outside of the structure have eroded causing sediment to enter stream.
  - c. Excessive trash at the top of the slopes exterior side of the timber structure
13. Pond has excessive amount of sediment next to the timber structure that needs to be removed.
14. On embankments there are dead or dying bushes/trees. These are plants that were planted for the BMP.
15. Embankments need more stabilization: matting mulch or seed and straw.

Once this work is satisfactorily completed, contact our office appropriately for a re-inspection. We can then proceed with final release of the surety and/or closing out the project. One reproducible and one blue/black line set of the record drawings will be required once the above items are adequately addressed.

Please contact me at 757-253-6683 if you have any further comments or questions.

Sincerely,

Gregory B. Johnson  
Environmental Inspector  
James City County  
Environmental Division

cc: Mathew Connolly LandTech Resources, Inc.  
Henry S. Bransome , LLC  
Aron B. Small, AES

G:\AsBuilts\admin\final\PlanNo.bmpIDcode

JCC Office of Housing and Community Development  
ATTN: Marion Paine  
5340 Palmer Lane Suite 1A  
Williamsburg, VA 23188-1776

December 19, 2007

**Second comment submission**

Ironbound Square Revitalization Roadway Improvement  
JCC BMP  
County Plan No. SP-131-05  
County BMP ID Code: CC030

Dear Mrs. Paine:

The Environmental Divisions has received a record drawing (as-built) and construction certification for the stormwater management facility for the above referenced project. The record drawing provides as-built information for a timber crib wall retention BMP located on Watford Lane.

Based on our review of the project and a concurrent field inspection was performed on August 1, 2007, the following items must be addressed prior to release of the developer's surety instrument for the stormwater management/BMP facility at the site and to proceed with closing out the project:

**Construction Certification:**

1. In accordance with the Note # 5 on Sheet 12 of the approved plan, construction certification for the stormwater management/BMP facility is required. **There was no engineer construction certification submitted.** This is especially important since the facility has an engineered and compacted earthen embankment. The certification can be in letter format or by use of the certification statements in Section 4 of the JCC, Stormwater Management/BMP Facilities, Record Drawing and Construction Certification, Standard Forms & Instructions.
2. A professional engineer's seal and signature is required on construction certifications.
3. Add the following County identifiers to the construction certification documents: County Plan Number **SP-131-05**.
4. **Record Drawing:**
5. The record drawing set dated 7/10/2007 is **unsatisfactory**.
6. On original plan set dated 6/8/2007 rip rap is delineated on site plan as existing rip rap. On the record drawing this was omitted. During the field inspection it was noted that the stone is in place. In addition to this a detail of this area should be on the record drawing as well. ✓ @
7. Show the following additional information on the record drawing: size of stone, area of coverage and any elevation changes. ✓ @
8. Add the following County identifiers to the lower right hand corner of the record drawing: ✓ @

9. County Plan Number SP-131-05 and BMP ID Code: CC 030.

Once this work is satisfactorily completed, contact our office appropriately for a re-inspection. We can then proceed with final release of the surety and/or closing out the project. One reproducible and one blue/black line set of the record drawings will be required once the above items are adequately addressed.

Please contact me at 757-253-6683 if you have any further comments or questions.

Sincerely,

Gregory B. Johnson  
Environmental Inspector  
James City County  
Environmental Division

cc: Mathew Connolly LandTech Resources, Inc.  
Henry S. Bransome , LLC  
Aron B. Small, AES



# HOUSING AND COMMUNITY DEVELOPMENT

5320 PALMER LANE, SUITE 1A, WILLIAMSBURG, VIRGINIA 23188  
TELEPHONE: (757) 259-5340

E-Mail: ohcd@james-city.va.us  
FAX: (757) 220-0640 TELECOMMUNICATIONS RELAY SERVICE: 711

December 7, 2007

Mr. Scott Thomas  
Director, Environmental Division  
James City County  
101-E Mounts Bay Road  
Williamsburg, VA 23187

**RE: Watford Lane BMP**

Dear Scott:

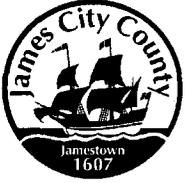
In consideration of your agreement to permit our contractor, Henry S. Branscome, LLC, to add topsoil and seed to the toe of the western slope of the BMP where some erosion has taken place, OHCD agrees that we will make further repairs, if needed, and agrees that the need for further repairs will be determined by the Environmental Division no later than the Fall of 2008. If further repairs are warranted, OHCD, upon Environmental's written request, will promptly have fabric and stone installed to correct the problem.

Sincerely,

Richard B. Hanson

MOP/RBH:pl

Post-it® Fax Note	7671	Date	12/7	# of pages	1
To	SCOTT THOMAS	From	RICK HANSON		
Co./Dept.		Co.			
Phone #		Phone #			
Fax #	259-4030	Fax #			



**James City County Environmental Division  
Stormwater Management / BMP Inspection Report  
Detention and Retention Pond Facilities**

County BMP ID Code (if known): CC030

Name of Facility: JCC Ironbound Square Road Improv BMP No.: 1 of 1 Date: 8/6/2007

Location: 120 Watford Lane

Name of Owner: JCC

Name of Inspector: Gregory B. Johnson

Type of Facility: Extended Dry Detention Pond with Timber Wall

Weather Conditions: Sunny/Hot 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 to 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
<b>Embankments and Side Slopes:</b>				
Grass Height	✓			
Vegetation Condition	✓			
Tree Growth	✓			
Erosion		✓		Upper slope behind timber wall is eroding under matting. lower slope same
Trash & Debris		✓		Moderate trash in and around pond
Seepage				Water seeping under timbers - Toe of slope
Fencing or Benches	NA			
<b>Interior Landscaping/Planted Areas:</b> <input type="checkbox"/> None <input type="checkbox"/> Constructed Wetland/Shallow Marsh <input type="checkbox"/> Naturally Established Vegetation				
Vegetated Conditions	✓			
Trash & Debris		✓		along rip rap lower side of upper ditch
Floating Material	✓			
Erosion				Toe of slope at approx 81' elevation. seepage occurring also
Sediment		✓		
Dead Plant	✓	✓		4-5 un healthy plants - 1 tree
Aesthetics		✓		
Other				
Notes: <u>2X10 wedged between slope and ditch?</u>				

Facility Item	O.K.	Routine	Urgent	Comments
<b>Water Pools:</b> <input type="checkbox"/> Permanent Pool (Retention Basin) <input checked="" type="checkbox"/> Shallow Marsh (Detention Basin) <input type="checkbox"/> None, Dry (Detention Basin)				
Shoreline Erosion	✓			
Algae	✓			
Trash & Debris	✓			
Sediment				
Aesthetics				
Other				
<b>Inflows (Describe Types/Locations):</b>				
Condition of Structure	✓			
Erosion	✓			
Trash and Debris		✓		Trash at outlet on RT ditch
Sediment	✓			
Outlet Protection		✓		Rip rap/stone needs to be secured
Other				
<b>Principal Flow Control Structure - Riser, Intake, etc. (Describe Type):</b>				
Condition of Structure				
Corrosion				
Trash and Debris				
Sediment				
Vegetation				
Other				
<b>Principal Outlet Structure - Barrel, Conduit, etc. :</b>				
Condition of Structure				
Settlement				
Trash & Debris				
Erosion/Sediment				
Outlet Protection				
Other				
<b>Emergency Spillway (Overflow):</b>				
Vegetation				
Lining				
Erosion				
Trash & Debris				
Other				
Notes:				

Facility Item	O.K.	Routine	Urgent	Comments
<b>Nuisance Type Conditions:</b>				
Mosquito Breeding	✓			
Animal Burrows	NA			
Graffiti	NA			
Other				
<b>Surrounding Perimeter Conditions:</b>				
Land Uses	OK			
Vegetation	OK			
Trash & Debris		X		Trash on slopes rear of skunk yard
Aesthetics	OK			Some plants dying
Access /Maintenance Roads or Paths	OK			
Other				
<b>Remarks:</b>				
Overall Environmental Division Internal Rating: _____				
Signature: _____ Date: _____				
Title: _____				

Date Record Created:

WS\_BMPNO:

Print Record

Created By:

CC030

PRINTED ON  
Thursday, March 11, 2010  
8:49:59 AM

**WATERSHED** CC  
**BMP ID NO** 030  
**PLAN NO** SP-131-05  
**TAX PARCEL** (39-1)(1-109)  
**PIN NO** 3910100109  
**CONSTRUCTION DATE** 5/1/2007  
**PROJECT NAME** JCC-Ironbound Square Road Improv  
**FACILITY LOCATION** 120 Watford Lane  
**CITY-STATE** Williamsburg, VA  
**CURRENT OWNER** James City County  
**OWNER ADDRESS** 5340 Palmer Lane Suite 1A  
**OWNER ADDRESS 2**  
**CITY-STATE-ZIP CODE** Williamsburg, VA 23188  
**OWNER PHONE** 757-259-5347  
**MAINT AGREEMENT** No  
**EMERG ACTION PLAN** No

**MAINTENANCE PLAN**

**SITE AREA acre**

**LAND USE**

**old BMP TYP**

**JCC BMP CODE**

**POINT VALUE**

**SVC DRAIN AREA acres**

**SERVICE AREA DESCRI**

**IMPERV AREA acres**

**RECV STREAM**

**EXT DET-WQ-CTRL**

**WTR QUAL VOL acre-ft**

**CHAN PROT CTRL**

**CHAN PROT VOL acre-ft**

**SW/FLOOD CONTROL**

**GEOTECH REPORT**

Yes

0.439

Residential

Timber Wall

F1 Timber Walls

11

7.3

SF, Roadways

1.40

College Creek

No

No

No

No

**CTRL STRUC DESC**

**CTRL STRUC SIZE inches**

**OTLT BARRL DESC**

**OTLT BARRL SIZE inch**

**EMERG SPILLWAY**

**DESIGN HW ELEV**

**PERM POOL ELEV**

**2-YR OUTFLOW cfs**

**10-YR OUTFLOW cfs**

**REC DRAWING**

**CONSTR CERTIF**

**LAST INSP DATE**

**INTERNAL RATING**

**MISC/COMMENTS**

Phase 1. Interim timb crib wall BMP for road & Bay Aging. Future sediment FB.

Timber Crib

No

82.46

76

0.00

0.00

Yes

Yes

Inspected by:

Get Last BMP No

Return to Menu

Additional Comments:

