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: **WC072**

DATE VERIFIED: **July 11, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

DATE: March 12, 2010

TO: Michael J. Gillis, Virginia Correctional Enterprises Document Management Services

FROM: Jo Anna Ripley, Stormwater

PO: 270712

RE: Files Approved for Scanning

General File ID or BMP ID: WC072

PIN: 0520400001A

Subdivision, Tract, Business or Owner Name (if known): Stonehouse

Property Description: Bent Tree Common Area Section 3

Site Address:

(For internal use only)	**Box**	20		**Drawer:**	8
Agreements: (in file as of scan date)	**Y**		**Book or Doc#:**	010018060 990026872	**Page:**

Comments

DECLARATION OF COVENANTS

DRAFT

INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

THIS DECLARATION, made this 25th day of SEPTEMBER, 2001, between STONEHOUSE, LLC, and all successors in interest, hereinafter referred to as the "COVENANTOR(S)," owner(s) of the following property: SECTION V-B ("BENT TREE" - SECTION 3), Deed Book _____, Page No. _____ or Instrument No. 99-0026872, and James City County, Virginia, hereinafter referred to as the "COUNTY."

WITNESSETH:

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

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

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

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

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

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

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

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

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

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

Instrument # 010018060
Recorded on Oct. 4, 2001

IN WITNESS WHEREOF, the COVENANTOR(S) have executed this DECLARATION OF COVENANTS as of this 25TH day of SEPTEMBER, ~~19~~ 2001

COVENANTOR(S)

Print Name/Title JAMES H. BENNETT
VICE PRESIDENT

ATTEST:

_____

COVENANTOR(S)

_____

Print Name/Title _____

ATTEST:

_____

COMMONWEALTH OF VIRGINIA
CITY/COUNTY OF James City

I hereby certify that on this 25th day of September, ~~19~~ 2001, before the subscribed, a Notary Public of the State of Virginia, and for the ~~City~~/County of James City, aforesaid personally appeared James H. Bennett and did acknowledge the aforegoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 25th day of September, ~~19~~ 2001.

Notary Public

My Commission expires: 4/25/04

Approved as to form:

Deputy County Attorney

This Declaration of Covenants prepared by:

JAMES H. BENNETT
(Print Name)

VICE PRESIDENT
(Title)

9701 MILL POND RUN
(Address)

TOANO VA 23168
(City) (State) (Zip)

drainage.pre
Revised 2/97

S-68-01
S-81-99

Bond Release

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

Project Name: Stonehouse Bent Tree Sec 5B Ph 3
County Plan No.: S-81-99; S-68-01
Stormwater Management Facility: BMP #5.4 Dry Pond
BMP Phase #: ☐ I ☐ II ☒ III
☐ Information Package Received. Date/By: 10/12/04 AES
☐ Completeness Check:
- ☒ Record Drawing Date/By: 2/13/06 AES
- ☒ Construction Certification Date/By: 2/17/06 GET
- ☒ RD/CC Standard Forms (Required for all BMPs after Feb 1st 2001Only)
- ☒ Insp/Maint Agreement # / Date: #0401 8060 Oct 04 2001
- ☐ BMP Maintenance Plan Location: Sheet 17
- ☐ Other: N

☐ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review
☒ Yes ☐ No Location: Note #19 on Sheet 18
☐ Assign **County BMP ID Code #**: Code: WC 072
☒ Preliminary Input/Log into Division's "As-Built Tracking Log"
☒ Add Location to GIS Map. Obtain basic site information (GPIN, Owner, Address, etc.)
☒ 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: 1/13/05 SJT
☒ Record Drawing (RD) Review Date: 02/12/06 SJT
☒ Construction Certification (CC) Review Date: 02/12/06 SJT
☐ Actions:
- ☐ No comments.
- ☐ Comments. Letter Forwarded. Date:
- ☐ Record Drawing (RD)
- ☐ Construction Certification (CC)
- ☒ Construction-Related (CR) Punch-list completed. Insp 1/13/05
- ☐ Site Issues (SI)
- ☐ Other :

☐ Second Submission:
☒ Reinspection (if necessary): 5/30/06 SJT
☒ 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).
☒ N/A Add BMP to JCC Hydrology & Hydraulic database (optional).
☒ NO Add BMP to Municipal BMP list (if a County-owned facility)
☐ Add BMP to PRIDE BMP ratings database.

Final Sign-Off

Plan Reviewer: [signature] Date: 02/13/07

*** See separate checklist, if needed.

James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities
Record Drawing and Construction Certification

Standard Forms & Instructions

Issue Date
February 1, 2001

WC072
BMP 5.4

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: Stonehouse - Section V-B (Bent Tree Phase 3)
Structure/BMP Name: BMP #5.4
Project Location: Stonehouse - Bent Tree
BMP Location: Off Private Drive at end of Sapling Drive
County Plan No.: JCC Case No. S - 81 - 99

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

Tax Map/Parcel No.: (6-4) (1-1)
BMP ID Code (if known): WC072
Zoning District: PUD-R
Land Use: Residential
Site Area (sf or acres): 20.86

Brief Description of Stormwater Management/BMP Facility: Dry Pond

Nearest Visible Landmark to SWM/BMP Facility: Private Drive at end of Sapling Drive

Nearest Vertical Ground Control (if known):
☒ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☒ Other
Station Number or Name: 303
Datum or Reference Elevation: NGVD 1929
Control Description: NAD 27
Control Location from Subject Facility: 3.5 miles south

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: September 2001
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☐ Unknown
Name of Site Work Contractor Who Constructed Facility: George Nice & Sons, Inc.
Name of Professional Firm Who Routinely Monitored Construction: _____
Date of Completion for SWM/BMP Facility: October 2002
Date of Record Drawing/Construction Certification Submittal: 11/07/02

(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: Stonehouse Development Company
Mailing Address: 9701 Mill Pond Run
Toano, VA 23168
Business Phone: 757-234-5000 Fax:757-234-5091
Contact Person: Jerry Moore Title:President

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

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188
Business Phone: 757-253-0040
Fax: 757-220.8994
Responsible Plan Preparer: Marc Bennett
Title: Senior Project Manager
Plan Name: Stonehouse - Development Area One, Phase 1- Section V-B, "Bent Tree" - Phase 3
Firm's Project No. 8878-00
Plan Date: March 2, 2001
Sheet No.'s Applicable to SWM/BMP Facility: 7 / 13 / 14 / 17 / _____

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

Name: George Nice & Sons, Inc.
Mailing Address: 143 Skimino Road
Williamsburg, VA 23188-2229
Business Phone: (757) 565-2885
Fax: (757) 565-1526
Contact Person: Ray Nice P. E.
Site Foreman/Supervisor: _____
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 – Professional Certifications:

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

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188
Business Phone: 757-253-0040
Fax: 757-220-8994

Name: Marc Bennett
Title: Senior Project manager

Signature: V. Marc Bennett
Date: 2/13/06

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

COMMONWEALTH OF VIRGINIA
VAN MARC BENNETT
2/13/06
No. 26628
PROFESSIONAL ENGINEER

V. Marc Bennett (Seal)

Virginia Registered Professional Engineer
Or Certified Land Surveyor

Construction Certification

Firm Name: _____
Mailing Address: _____

Business Phone: _____
Fax: _____

Name: _____
Title: _____

Signature: _____
Date: _____

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

Section 4 – Professional Certifications:

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

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188
Business Phone: 757-253-0040
Fax: 757-220-8994

Name: Marc Bennett
Title: Senior Project manager

Signature: V. Marc Bennett
Date: 2/13/06

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

COMMONWEALTH OF VIRGINIA
VAN MARC BENNETT
2/13/06
No. 26628
PROFESSIONAL ENGINEER

V. Marc Bennett (Seal)

Virginia Registered Professional Engineer
Or Certified Land Surveyor

Construction Certification

Firm Name:
Mailing Address:

Business Phone:
Fax:

Name:
Title:

Signature: Camille A. Kattan
Date: 2/17/06

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

COMMONWEALTH OF VIRGINIA
CAMILLE A. KATTAN
No. 018045
2/17/06
PROFESSIONAL ENGINEER

Camille A. Kattan (Seal)

Virginia Registered
Professional Engineer

James City County, Virginia
Environmental Division

Erosion and Sediment Control and Stormwater Management Design Plan Checklists

Table of Contents

GENERAL INFORMATION

Project Name: BENT TREE - PHASE 3 (STONEHOUSE)
Owner / Applicant: STONEHOUSE DEVELOPMENT COMPANY, LLC
Plan Preparer: AES CONSULTING ENG. Email:
Project Location: ADJACENT TO BENT TREE - PHASE 1 (NORTH OF MILL POND RD)
Tax Map / Parcel:
County Plan No. (if known):
County BMP Type: EXTENDED DETENTION DRY POND (F-2)
Other information submitted in addition to this checklist (Check all that apply):

- ☑ Design or Construction Drawings (Plans, Profiles, Details, etc.).
- ☑ Erosion & Sediment Control Plan (Plans, Details, etc.).
- ☐ Erosion & Sediment Control Plan Design Report.
- ☑ Stormwater Management Design Plan (Plans, Profiles, Details, etc.).
- ☑ Stormwater Management Design Report.
- ☐ Other, List:

S/T REVIEW 04-10-01

Issue Date
March 1, 2001

JAMES CITY COUNTY, VIRGINIA
ENVIRONMENTAL DIVISION

EROSION AND SEDIMENT CONTROL PLAN CHECKLIST

I. *GENERAL:*

Yes	No	N/A	
☑	☐	☐	*FAMILIARITY* with current versions of Chapter 8, Erosion and Sedimentation Control and Chapter 23, Chesapeake Bay Preservation ordinances of the Code of James City County, Virginia and the Virginia Erosion and Sediment Control Handbook (VESCH).
☑	☐	☐	*LAND DISTURBING PERMIT AND SILTATION AGREEMENT* with surety are required for the project.
☐	☐	☑	*VARIANCE* if necessary, requested in writing, for the plan approving authority to waive or modify any of the minimum standards and specifications of the VESCH deemed inappropriate based on site conditions specific to this review case only. Variances which are approved shall be properly documented in the plan and become part of the approved erosion and sediment control plan for the site. 25% SLOPE WAIVER REQUEST.

II. *SITE PLAN:*

Yes	No	N/A	
☑	☐	☐	*VICINITY MAP* locating the site in relation to the surrounding area. Include any major landmarks which might assist in physically locating the site.
☑	☐	☐	*INDICATE NORTH* direction in relation to the site.
☑	☐	☐	*LIMITS OF CLEARING AND GRADING* for the site including that required for implementation of erosion and sediment controls, stockpile areas and utilities.
☑	☐	☐	*DISTURBED AREA ESTIMATES* in acres or square feet for the project.
☑	☐	☐	*EXISTING TOPOGRAPHY* or contours for the site at no more than 5 foot contour interval.
☑	☐	☐	*FINAL TOPOGRAPHY*, contours or proposed site grading in accordance with the design plan which indicates changes to existing topography and drainage patterns at no more than 2 foot contour interval (or 1 foot contours where required).
☑	☐	☐	*EXISTING AND PROPOSED SPOT ELEVATIONS* to supplement existing and proposed contours, topography or site grading information. Spot elevations may replace final contours in some instances, especially if terrain is in a low lying area or relatively flat.
☑	☐	☐	*EXISTING VEGETATION* including existing tree lines, grassed or unique vegetation areas.

Yes	No	N/A	
☑	☐	☐	*EXISTING SITE FEATURES* including roads, buildings, homes, utilities, streams, fences, structures and other important surface features of the site.
☑	☐	☐	*SOILS MAP* with soil symbols, boundaries and legend in accordance with the current Soil Survey of James City and York Counties and the City of Williamsburg, Virginia.
☑	☐	☐	*ENVIRONMENTAL INVENTORY* in accordance with Section 23-10(2) of the Chesapeake Bay Preservation Ordinance of James City County. Inventory generally includes: tidal shores and wetlands, non-tidal wetlands, resource protection area, hydric soils and slopes steeper than 25 percent. For wetlands, provide a copy of issued permits or satisfactory evidence that appropriate permits are being pursued for the entire project.
☑	☐	☐	*100-YEAR FLOODPLAIN LIMITS* or any special flood hazard areas or flood zones based on appropriate Federal Management Agency Flood Insurance Rate Maps (FIRMs) or Flood Hazard Boundary Maps (FHBMs) of James City County, Virginia.
☑	☐	☐	*DRAINAGE AREAS* for offsite and onsite areas, existing or proposed as applicable. Include drainage divides and directional labels for all subareas at points of interest and size (in acres), weighted runoff coefficient or curve number and times of concentration for each subarea.
☑	☐	☐	*CRITICAL EROSION AREAS* which require special consideration or unique erosion and sediment control measures. Refer to the VESCH, Chapter 6 for criteria.
☑	☐	☐	*DEVELOPMENT PLAN* for the site showing all improvements such as buildings, structures, parking areas, access roadways, above and below ground utilities, stormwater management and drainage facilities, trails or sidewalks, proposed vegetation and landscaping, amenities, etc.
☑	☐	☐	*LOCATION OF PRACTICES* proposed for erosion and sediment control, tree protection and temporary stormwater management due to land disturbance activities at the site. Use standard abbreviations, labels and symbols consistent for plan views based on minimum standards and specifications in Chapter 3 of the VESCH.
☑	☐	☐	*TEMPORARY STOCKPILE AREAS* or staging and equipment storage areas as required for onsite or offsite construction activities or indicate that none are anticipated for this project.
☑	☐	☐	*OFFSITE LAND DISTURBING AREAS* including borrow sites, waste areas, utility extensions, etc. and required erosion and sediment controls. If none are anticipated for the project, then indicate on the plans by general or erosion and sediment control notes.
☑	☐	☐	*DETAILS* or alternately, appropriate reference to current minimum standards and specifications of the VESCH for each measure proposed for the project. Non-modified, standard duplicated details (silt fence, diversion dikes, etc.) may be referenced to the current version of the VESCH. Specific dimensional or modified standards (basins, traps, outlet protections, check dams, etc.) require presentation on detail sheets. Schedules or tables may be used for multiple site measures such as sediment traps, basins, channels, slope drains, etc. Any modification to standard details should be clearly defined, explained and illustrated.

WE HAVE REQUESTED COPY OF WETLANDS PERMIT FROM CORPS.

ZONE A NOT SHOWN.

NOT ADDRESSED

Yes No N/A

☑ ☐ ☐ *MAINTENANCE PLAN* or alternately, appropriate reference to current minimum standards and specifications of the VESCH, outlining the inspection frequency and maintenance requirements for all erosion and sediment control measures proposed for the project.

☑ ☐ ☐ *TRENCH DEWATERING* methods and erosion and sediment controls, if anticipated for the project.

☑ ☐ ☐ *CONSTRUCTION SEQUENCE* outlining the anticipated sequence for installation of erosion and sediment controls and site, grading and utility work to be performed for the project by the site contractor.

☑ ☐ ☐ *PHASING PLAN* if required for larger project sites that are to be developed in stages or phases.

☑ ☐ ☐ *STANDARD COUNTY NOTES* are required to be placed on the erosion and sediment control plan. Refer to the standard James City County Erosion and Sediment Control Notes dated May 5, 1999.

☑ ☐ ☐ *PROFESSIONAL SEAL AND SIGNATURE* required on final and complete approved plans, drawings, technical reports and specifications.

NOT on Design report for BMP & storm drainage.

III. ***NARRATIVE:*** WHERE?

Yes No N/A

☑ ☐ ☐ *PROJECT DESCRIPTION* briefly describing the nature and purpose of the land disturbing activity and the acreage to be disturbed.

☑ ☐ ☐ *EXISTING SITE CONDITIONS* description of existing topography, land use, cover and drainage patterns at the site.

☑ ☐ ☐ *ADJACENT AREA* descriptions of neighboring onsite or offsite areas such as streams, lakes, property, roads, etc. and potential impacts due to concentrated flow or runoff from the land disturbing activity.

☑ ☐ ☐ *OFFSITE DISTURBED AREA* descriptions of proposed borrow sites, waste or surplus areas, utility extensions and erosion and sediment controls to be implemented.

☑ ☐ ☐ *SOILS DESCRIPTION* briefly summarizing site, disturbed area and drainage basin soils including name, unit, hydrologic soil group (HSG) classification, surface runoffpotential, erodibility, permeability, depth, texture, structure, erosion hazards, shrink-swell potential, limitations for use and anticipated depths to bedrock and the seasonal water table, as applicable.

☑ ☐ ☐ ? *CRITICAL AREAS* on the site which many have potentially serious erosion and sediment control problems and special considerations required (ie. steep slopes, hydric soils, channels, springs, sinkholes, water supply reservoirs, groundwater recharge areas, etc.)

Yes No N/A

☑ ☐ ☐ *PROPOSED EROSION & SEDIMENT CONTROL MEASURES* inclusive to the specific erosion and sediment control plan as proposed for the land disturbing activity. Measures should be consistent with those proposed on the site drawings. Address general use, installation, limitations, sequencing and maintenance requirements for each control measure.

☑ ☐ ☐ *STABILIZATION MEASURES* required for the site, either temporary or permanent, and during and following construction including temporary and permanent seeding and mulching, paving, stone, soil stabilization blankets and matting, sodding, landscaping or special stabilization techniques to be utilized at the site.

☑ ☐ ☐ *STORMWATER MANAGEMENT CONSIDERATIONS* for the site, either of temporary or permanent nature, and strategies, sequences and measures required for control. May reference the stormwater management plan for the site, if prepared, for permanent stormwater management facilities and control of drainage once the site is stabilized.

IV. *CALCULATIONS:*

Yes No N/A

☑ ☐ ☐ *CALCULATIONS AND COMPUTATIONS* associated with hydrology, hydraulics and design of proposed temporary and permanent erosion and sediment control measures including: sediment traps and basins, diversions, stormwater conveyance channels, culverts, slope drains, outlet protections, etc. Computations are not required on the construction plan and may be attached in a supplemental erosion and sediment control plan design report, if presented in a clear and organized format.

☐ ☐ ☑ *TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET* submitted for each basin along with schematic or sketch cross-section showing applicable design and construction data, storage volumes (wet-dry), dimensions and elevations. Peak design runoff to be based on the 2- or 25-year design storm event based on maximum disturbed site conditions (existing, interim or proposed conditions) in accordance with Minimum Standard 3.14 of the VESCH.

Need for sed BASIN #1 & #2

LOT 28

LOT 26

LOT 29

LOT 23

LOT 22

LOT 21

LOT 20

LOT 18

LOT 17

LOT 16

LOT 15

LOT 14

LOT 8

RIP RAP BERM
(TOP ELEV.=71.5)
AROUND INLET

SS #1-4
DI-7 W/
CONC. FLUME
TOP=70.00
INV.=65.00

RIP RAP BERM
AROUND INLET
TOP ELEV.=52.00

SS #1-2A
STA. 11+65, 18' LT
DI-7 W/CONC. FLUME
TOP=51.00
INV.=45.50

INV. OUT=35.0

36 LF OF 15" RCP
@ 1.39%

36 LF OF 15"
RCP @ 1.39%

60 LF OF 15"
RCP @ 12.19%

128 LF OF 15"
RCP @ 7.03%

SS #1-1
ES-1
INV.=~~36.00~~(36.12)
STILLING BASIN
(10'x 10')

SS #1-2
DI-7 W/CONC. FLUME
TOP=51.00
INV.=45.00

RIP RAP BERM
(TOP ELEV.=71.5)
AROUND INLET

SS #1-3
DI-7 W/CONC. FLUME
TOP=70.00
INV.=64.50

BMP
ACCESS
ROAD

EMERGENCY SPILLWAY
TOP ELEV.= 44.50
8' BOTTOM WIDTH
160' TO BE LINED WITH EC-2
STABILIZATION MATTING
(SEE DETAIL SHEET 17)

EW-1
INV.=~~30.4~~(30.54)
STILLING BASIN
(10'x10')

BMP 5.4
2 YR WSE=42.00
10 YR WSE=43.67
100 YR WSE=44.15

70(72) LF OF 24"
CLASS III RCP
(O-RING) @ ~~3.00%~~ (2.78%)

48" PRECAST
CONCRETE RISER
TOP=~~43.00~~ (42.91)
(RISER STRUCTURE
TOP=44.55)

#5-1
WC072

EW-1A (MOD)
INV IN=~~34.50~~(34.60)

TOP OF DAM
WIDTH=12' (AVG)

SS #3-1A
STORM MH
TOP=58.50
INV. IN=52.50 (15")
INV. OUT=52.00 (15")

90 LF OF 15"
RCP @ 22.67%

SS #3-1
ES-1
INV.=~~40.00~~(39.90)
STILLING BASIN
(10'x 10')

80 LF OF 15"
RCP @ 15.0%

10 YR WSE=43.67

100 YR WSE=44.15

SS #3-2
DI-7 W/
CONC. FLUME
TOP=77.70
INV.=72.90

34 LF OF 15" RCP
@ 1.18%

SS #3-3
DI-5
TOP=77.80
INV.=73.30

SAPLING DRIVE
(50' R/W)

N

GRAPHIC SCALE
25' 0' 25' 50'
SCALE: 1" = 25'

I HEREBY CERTIFY TO THE BEST OF MY JUDGEMENT, KNOWLEDGE, AND BELIEF THAT THIS RECORD DRAWING REPRESENTS THE CONDITIONS OF THE SITE ON THE DATE IT WAS SURVEYED. THE SITE APPEARS TO CONFORM WITH THE PROVISIONS OF THE APPROVED DESIGN PLAN.

Bmp #5.4
WC 072

RECORD DRAWING—1/30/03

09.30.04-11:08 8878R13.dwg ADS

No.	DATE	REVISION / COMMENT / NOTE	BY
4	11/30/03	BMP 5.4 RECORD DRAWING	RED
3	9/25/01	REVISED PER JCSA AND JCC COMMENTS	RGW
2	8/24/01	REVISED PER JCC AND VDOT COMMENTS	RGW
1	6/22/01	REVISED PER JCC AND VDOT COMMENTS	RGW

COMMONWEALTH OF VIRGINIA
ROBERT G. WORKUM
No. 0281138
PROFESSIONAL ENGINEER
9/25/01

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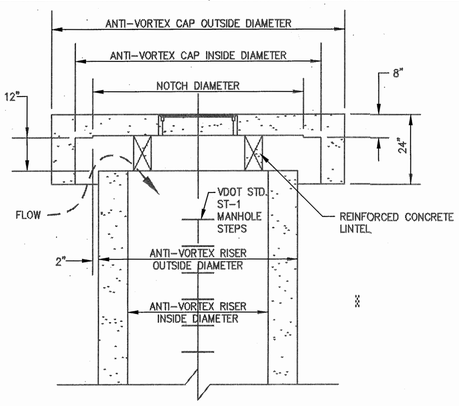
CONSULTING ENGINEERS

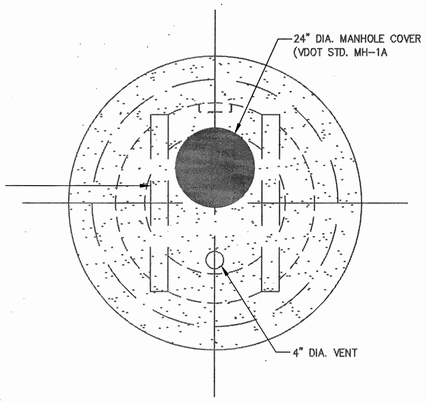
RECORD DRAWING
BMP 5.4
&
SECTION V-B "BENT TREE" - PHASE 3
AT STONEHOUSE
FOR
STONEHOUSE DEVELOPMENT COMPANY, L.L.C.
STONEHOUSE DISTRICT — JAMES CITY COUNTY — VIRGINIA

Designed	Drawn
RED	RED
Scale	Date
1"= 25'	1/29/03
Project No.	
8878-00	
Drawing No.	
R13(B)	

WC072_STONEHOUSE_PHASE_1_SEC_5B - 016



SECTION



PLAN - TOP SLAB

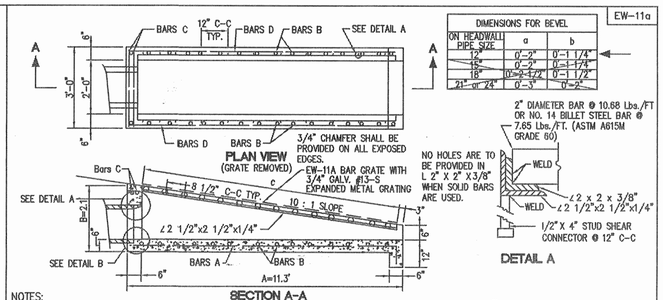
RISER		ANTI-VORTEX CAP		NOTCH DIAMETER	APPROXIMATE CAP WEIGHT
I.D.	O.D.	I.D.	O.D.		
48"	58"	84"	100"	62"	4.27 T

1. ANTI-VORTEX DEVICE (CAP AND RISER) MANUFACTURED IN ACCORDANCE WITH ASTM C478.
2. DIMENSIONS SUBJECT TO PERMISSIBLE VARIATIONS OF ASTM C478
3. INLET AREA (AREA BETWEEN DEVICE I.D. AND RISER O.D.) IS GREATER THAN OUTLET AREA (AREA OF RISER I.D.)
4. SLAB REINFORCEMENT TO BE ASTM A615 #4 BARS @ 8" E.W. CIRCUMFERENCIAL.

ANTI- VORTEX DETAIL

NOT TO SCALE

EW-11a



DIMENSIONS FOR BEVEL		
ON HEADWALL PIPE SIZE	a	b
12"	0'-2"	0'-1 1/4"
15"	0'-2"	0'-1 3/4"
18"	0'-2 1/2"	0'-1 1/2"
21" or 24"	0'-3"	0'-2"

NOTES:

IN NO CASE SHALL TOP OF END WALL (PROJECT ABOVE FIL. SLOPE, DITCH SLOPE, OR SHOULDER.

CLASS A3 CONCRETE TO BE USED IF CAST IN PLACE, 4000 PSI IF PRE-CAST.

REINFORCING STEEL TO HAVE A MINIMUM 1 1/2" CONCRETE COVER.

FOR SCHEDULE OF REINFORCING STEEL, DIMENSIONS, AND QUANTITIES SEE SHEET 2 OF 2.

THIS ITEM MAY BE PRE-CAST OR CAST IN PLACE.

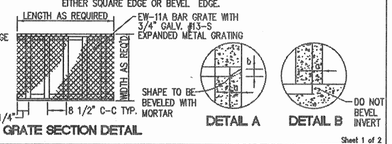
BOTTOM OF STRUCTURE TO BE ON THE SAME GRADE AS DRAINAGE DITCH.

HEADWALL TO BE BEVELED IN ALL AREAS EXCEPT WHERE A CONFLICT WITH INVERT OR WINGWALLS OCCUR.

BEVEL EDGE IS REQUIRED ON HEADWALL AT THE INLET END OF THE CULVERT (WHERE THE FLOW ENTERS THE CULVERT).

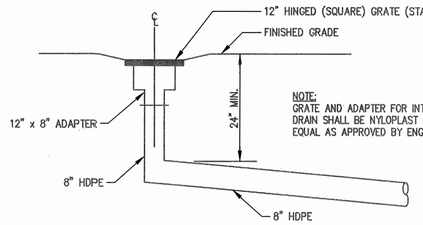
BEVEL EDGE IS REQUIRED ON HEADWALL AT THE INLET END OF THE CULVERT (WHERE THE FLOW ENTERS THE CULVERT).

HEADWALL AT THE OUTLET END OF THE CULVERT MAY BE EITHER SQUARE EDGE OR BEVEL EDGE.

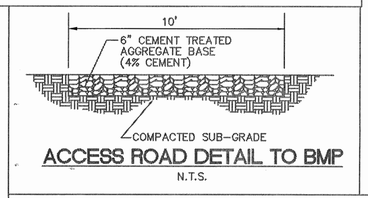


Sheet 1 of 2

PIPE ENDWALL WITH LOAD - CARRYING GRATE

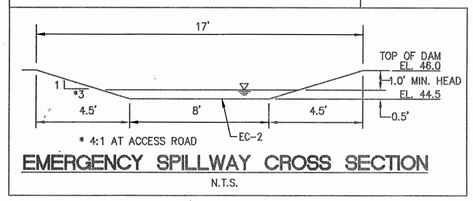


INLINE DRAIN AT COMMON DRIVES



ACCESS ROAD DETAIL TO BMP

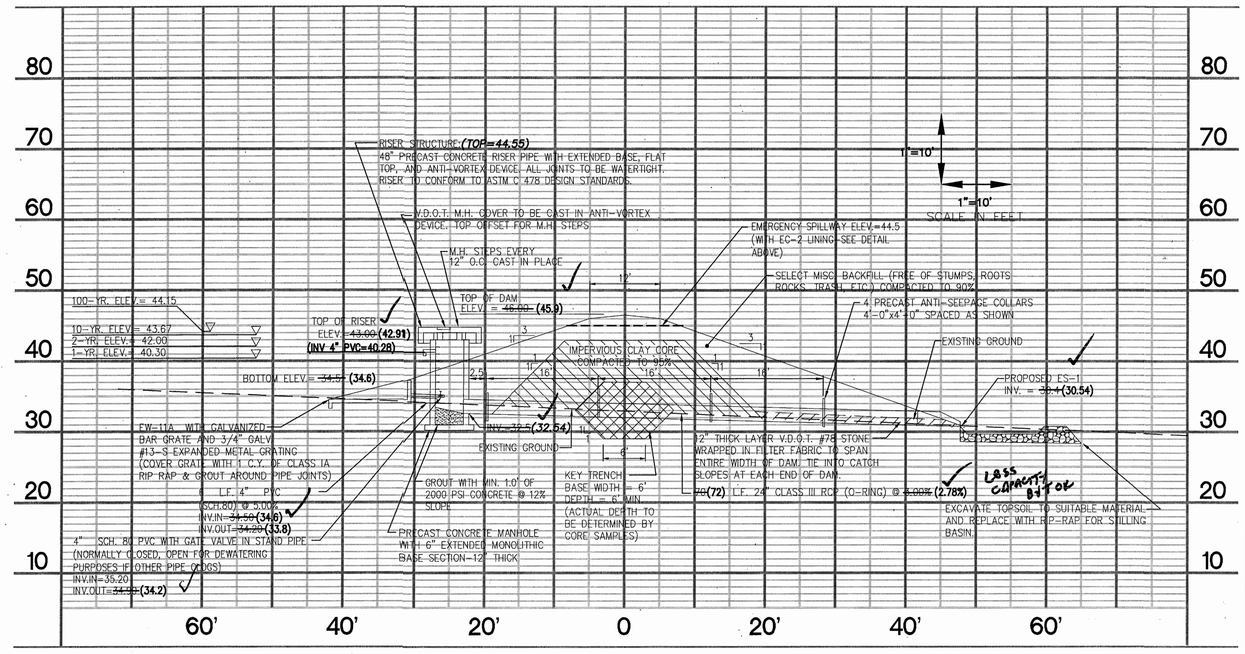
N.T.S.



EMERGENCY SPILLWAY CROSS SECTION

N.T.S.

WC072



SECTION A-A BMP 5.4

I HEREBY CERTIFY TO THE BEST OF MY JUDGEMENT, KNOWLEDGE, AND BELIEF THAT THIS RECORD DRAWING REPRESENTS THE CONDITIONS OF THE SITE ON THE DATE IT WAS SURVEYED. THE SITE APPEARS TO CONFORM WITH THE PROVISIONS OF THE APPROVED DESIGN PLAN.

GENERAL NOTES FOR CONSTRUCTION OF STORMWATER BASINS

1. THE CONTRACTOR SHALL PROVIDE ALL WORK AND MATERIALS NEEDED TO CONSTRUCT THE STORMWATER BASIN, STORMWATER MANAGEMENT PONDS, BEST MANAGEMENT PRACTICES, SEDIMENT BASINS AND SEDIMENT TRAPS. THE WORK SHALL INCLUDE ALL LABOR, MATERIALS, EQUIPMENT AND MATERIALS NEEDED FOR THE COMPLETION OF GRADING AND EARTHWORK ASSOCIATED WITH THE CONSTRUCTION.

2. THE CONTRACTOR SHALL CONSULT AND PROVIDE FOR THE SERVICES OF A GEOTECHNICAL ENGINEER. THE GEOTECHNICAL ENGINEER SHALL PROVIDE TEST RESULTS ON PLACED DAM MATERIALS, IDENTIFYING SOIL CLASSIFICATION, PERMEABILITY, PLASTICITY INDEX, AND COMPACTION. ALL TESTS SHALL BE IN CONFORMANCE WITH ASTM STANDARDS. THE COST OF THE SERVICES OF THE GEOTECHNICAL ENGINEER SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. SATISFACTORY GEOTECHNICAL REULTS ARE NEEDED PRIOR TO FINAL APPROVAL.

3. ALL INSPECTIONS REQUIRED FOR THE WORK SHALL BE PERFORMED BY A GEOTECHNICAL ENGINEER AT THE EXPENSE OF THE GENERAL CONTRACTOR.

4. ON-SITE EXCAVATED MATERIAL, IF DETERMINED SUITABLE FOR USE IN DAM CONSTRUCTION BY A GEOTECHNICAL ENGINEER, MAY BE USED FOR DAM CONSTRUCTION. SHOULD ADDITIONAL MATERIAL BE REQUIRED, THE CONTRACTOR SHALL IDENTIFY THE NEED FOR MATERIAL TO THE OWNER, AS ADDITIONAL BORROW MATERIAL MAY BE AVAILABLE ON THE STONEHOUSE PROPERTY. ALL EXCAVATED MATERIAL DETERMINED BY THE GEOTECHNICAL ENGINEER TO BE UNSUITABLE SHALL BE DISPOSED OF PROPERLY AT THE CONTRACTOR'S EXPENSE. ALL EXCAVATED MATERIAL NOT REQUIRED FOR BACKFILLING SHALL EITHER BE DEPOSITED ON SITE AND SPREAD BY THE CONTRACTOR, OR SHALL BE DEPOSITED IN AN AREA ON THE STONEHOUSE PROPERTY AS DIRECTED BY THE OWNER. THE CONTRACTOR SHALL PROVIDE PROPER STABILIZATION, AND EROSION AND SEDIMENT CONTROL MEASURES NEEDED TO CONTROL AS PER THE VESCH THIRD EDITION.

5. UNDERCUT FOR THE FOUNDATION OF THE DAM EMBANKMENT SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL ENGINEER'S RECOMMENDATION. THE FOUNDATION SHALL BE BACKFILLED WITH SOILS CLASSIFIED AS SM, SC, OR CL UNDER THE UNIFIED SOIL CLASSIFICATION SYSTEM. SOILS SHALL HAVE A MINIMUM OF 15% BY WEIGHT FINES, HAVING A PLASTICITY INDEX OF 30% AND A PERMEABILITY OF 0.0004 IN./SEC. OR LESS. FILL SHALL BE COMPACTED IN 12-INCH LIFTS, OR AS DIRECTED BY THE GEOTECHNICAL ENGINEER, TO A DRY DENSITY OF 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY (ASTM D-698). EXCAVATION FOR THE DAM KEY SHALL BE IN ACCORDANCE TO THE GEOTECHNICAL ENGINEER'S RECOMMENDATION. HEIGHT, DEPTH, AND WIDTH OF THE KEY SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL ENGINEER'S RECOMMENDATIONS. THE KEY SHALL BE FORMED USING SOILS CLASSIFIED AS SC OR CL, WITH A PERMEABILITY OF 0.0004 IN./SEC. OR LESS.

6. THE DAM CORE SHALL BE AS CONSTRUCTED WITH NON-EXPANSIVE SC OR CL CLAYEY MATERIAL WITH PERMEABILITY OF 0.0004 IN./SEC. OR LESS. THE FILL OF THE CORE SHALL BE MADE IN 12-INCH LIFTS, OR AS DIRECTED BY THE GEOTECHNICAL ENGINEER, TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY (ASTM D-698). SIZE, SHAPE, WIDTH, DEPTH, AND HEIGHT OF THE DAM CORE SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL ENGINEER'S RECOMMENDATIONS. TO COVER THE DAM CORE, A SILTY FINE SAND OR CLAYEY SOIL (SM, SC, OR CL) SHALL BE PLACED. A VEGETATIVE COVER USING VDOT EC-2 EROSION CONTROL BLANKETS SHALL BE PLACED ON DAM SLOPES AND CREST TO PREVENT EROSION.

7. UPON COMPLETION, THE CONSTRUCTION OF THE DAM WILL BE CERTIFIED BY A GEOTECHNICAL ENGINEER WHO HAS INSPECTED THE STRUCTURE DURING CONSTRUCTION.

STORMWATER MANAGEMENT/ BMP FACILITY MAINTENANCE PLAN

PROPER MAINTENANCE OF THIS FACILITY IS ENCOURAGED TO PREVENT THE INTRODUCTION OF DEBRIS AND SEDIMENT IN TO THE FACTILITY, 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 OF THESE NEWLY DISTRIBUTED AREAS AS WELL AS INSPECTIONS FOR ACCUMULATED SEDIMENTS AT TWO BMP FACILITY.

A DESIGNATED REPRESENTATIVE OF THE OWNER WILL INSPECT THE BMP 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. 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. SEDIMENT REMOVAL IS REQUIRED USING A RUBBER-WHEELED BACKHOE. AT THE SAME TIME, OR AT LEAST ONCE PER YEAR, THE RISER BOTTOM AND OUTLET PIPE SHALL BE CLEANED OF ACCUMULATED SEDIMENTS. DISPOSE OF SEDIMENTS REMOVED FROM THE FACILITY AT AN ACCEPTABLE DISPOSAL AREA. SEDIMENT SHALL NOT BE ALLOWED TO ACCUMULATE IN DEPTHS GREATER THAN 1-FOOT. NO SEDIMENT SHALL BE ALLOWED TO ACCUMULATE TO PREVENT THE PROPER FUNCTION OF ANY PIPE OR CULVERT.

2. PERFORM MAINTENANCE MOWING OF GRASSED AREAS AT LEAST TWICE EACH YEAR. GRASSES SUCH AS TALL FESCUE SHOULD BE MOWED IN EARLY SUMMER AFTER EMERGENCE OF THE HEADS ON COOL SEASON GRASSES AND IN LATE FALL TO PREVENT SEEDS OF ANNUAL WEEDS FROM MATURING. MOWING OF LEGUMES CAN BE LESS FREQUENT TREES AND SHRUBS SHOULD NOT BE PERMITTED TO GROW ON ANY PART OF THE GRADED EMBANKMENT.

3. PERFORM SOIL SAMPLING ON STABILIZED BMP SOIL AREAS ONCE EVERY FOUR (4) YEARS. SOIL SAMPLING AND TESTING SHOULD BE PERFORMED BY A QUALIFIED INDEPENDENT TESTING LABORATORY. APPLY ADDITIONAL LIME AND FERTILIZER IN ACCORDANCE WITH TEST RECOMMENDATIONS.

4. IN STABILIZED BMP AREAS, IF VEGETATION COVERS LESS THAN 40% OF SOIL SURFACES, LIME FERTILIZE AND SEED IN ACCORDANCE WITH RECOMMENDATIONS FOR NEW SEEDLINGS, AS LISTED IN DAM CONSTRUCTION NOTES. IF VEGETATION COVERS MORE THAN 40% BUT LESS THAN 70% OF SOIL SURFACES, LIME FERTILIZE AND OVERSEED IN ACCORDANCE WITH CURRENT SEEDLING RECOMMENDATIONS.

5. PERFORM QUARTERLY INSPECTIONS OF THE RELEASE STRUCTURES, RISER SECTION AND CREST OF SPILLWAY FOR THE OBSERVANCE OF COLLECTED DEBRIS. IMMEDIATELY REMOVE ANY DEBRIS TO MAINTAIN THE INTEGRITY OF THE STRUCTURE AND PROVIDE AN ATTRACTIVE APPEARANCE. DURING QUARTERLY INSPECTIONS, THE POND DRAIN VALVE, USUALLY LEFT IN THE VALVE "CLOSED" POSITION, SHALL BE INSPECTED AND OPERATED THROUGH TWO COMPLETE FULL-OPEN TO FULL-CLOSE TO FULL-OPEN CYCLES.

6. PERFORM YEARLY STRUCTURAL INSPECTIONS OF THE FACILITY FOR DAMAGE. STRUCTURAL INSPECTION SHALL BE PERFORMED ON THE CONCRETE RISER, ANTI-VORTEX DEVICE, TRASH RACK, ORIFICE/ WEIR(S), OUTLET BARREL AND POND EMBANKMENT. IF DAMAGE IS EVIDENT, FURTHER INVESTIGATION BY A PROFESSIONAL ENGINEER MAY BE REQUIRED TO ASSESS THE CONTINUED INTEGRITY OF THE STRUCTURE.

7. PERFORM QUARTERLY INSPECTIONS OF THE GRADED SIDE SLOPES OF THE FACILITY FOR SIGNS OF ANIMAL/ RODENT BORROWS OR SLOPE EROSION. IMMEDIATELY PERFORM NECESSARY REPAIRS, REFILLING OR RESEEDING AS APPROPRIATE.

8. RECORD KEEPING. THE LANDOWNER OR DESIGNATED REPRESENTATIVE SHALL KEEP REASONABLE, ACCURATE WRITTEN RECORDS OR INSPECTIONS PERFORMED FOR THE STRUCTURE. RECORDS SHALL DOCUMENT ROUTINE MAINTENANCE AND/ OR REPAIRS PERFORMED. COPIES SHALL BE PROVIDED TO THE COUNTY UPON REQUEST.

9. THE FACILITY SHALL NOT BE MODIFIED IN ANY WAY WITHOUT PRIOR CONSENT/ APPROVAL OF THE COUNTY.

No.	DATE	REVISION / COMMENT / NOTE	BY
4	1/30/03	BMP 5.4 RECORD DRAWING	RED
3	9/25/01	REVISED PER JCSA AND JCC COMMENTS	RGW
2	8/24/01	REVISED PER JCC AND VDOT COMMENTS	RGW
1	6/22/01	REVISED PER JCC AND VDOT COMMENTS	RGW

COMMONWEALTH OF VIRGINIA — ROBERT G. WORKMAN — No. 028138 — 4/25/01 — PROFESSIONAL ENGINEER

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(757) 253-0040
Fax (757) 220-8994
CONSULTING ENGINEERS

ASBUILT DAM SECTION AND DETAILS
SECTION V-B "BENT TREE" - PHASE 3
AT STONEHOUSE
FOR
STONEHOUSE DEVELOPMENT COMPANY, L.L.C.
STONEHOUSE DISTRICT — JAMES CITY COUNTY — VIRGINIA

Designed	Drawn
RGW	RED
Scale	Date
NOTED	3/2/01
Project No.	
8878-00	
Drawing No.	
R17	

RECORD DRAWING – 1/30/03

PLANT LIST FOR BMP SCREENING

KEY	QTY	BOTANICAL NAME	COMMON NAME	MIN. SIZE	ROOT	COMMENTS
WM	52	MYRICA CERIFERA	WAX MYRTLE	24" HT. OR SPR.	CONTAINER	DENSE, FULL PLANTED 6' O.C.

EROSION AND SEDIMENTATION CONTROL LEGEND

- (SF) SILT FENCE (SPEC. 3.05)
- (IP) INLET PROTECTION (SPEC. 3.07)
- (CE) CONSTRUCTION ENTRANCE (SPEC. 3.02)
- (CD) CHECK DAM (SPEC. 3.20)
- (DD) TEMPORARY DIVERSION DIKE (SPEC. 3.09)
- (OP) OUTLET PROTECTION (SPEC. 3.18)
- (CIP) CULVERT INLET PROTECTION (SPEC. 3.08-1 WITH STONE COMBIN. INSTEAD OF SILT FENCE)
- (ST) TEMPORARY SEDIMENT TRAP (SPEC. 3.13)
- (PS) PERMANENT SEEDING (SPEC. 3.32)
- (SB) TEMPORARY SEDIMENT BASIN (SPEC. 3.14)
- (TP) TREE PROTECTION (SPEC. 3.38)

NOTE:
SEE VIRGINIA EROSION & SEDIMENT CONTROL HANDBOOK FOR EROSION CONTROL SPECIFICATIONS (SPEC.) AND DETAILS.

C.A. 41

C.A. 40

FIELD CHANGE #1
INSTALLED A GRASS SWALE W/ OP IN PLACE OF 12" INLINE DRAIN AND 8" HDPE JCSA APPROVED

70' OF 8" HDPE PIPE @ 5.0%

LIMITS OF CLEARING

12" INLINE DRAIN
TOP=44.5
INV.IN=38.5
(SEE DETAIL SHEET 17)

(OP) RIP RAP, CL 1
8' W x 10' L x 1.5'
(5 C.Y.)

FIELD CHANGE #1

INV.OUT=35.0

4" X 8" SIGN 3' HIGH
"DRAIN FOR JCSA USE"

RIP RAP BERM
(TOP ELEV.=71.5)
AROUND INLET

SS #1-4
STA. 10+05(O/S=18' LT)
DI-7 W/
CONC. FLUME
TOP=70.00
INV.=65.00

BEGIN EC-2 DITCH
STA 11+05, 18' LT
STA 10+80, 18' RT

RIP RAP BERM
AROUND INLET
TOP ELEV.=52.00

SS #1-2A
STA. 11+65, 18' LT
DI-7 W/CONC. FLUME
TOP=51.00
INV.=45.50

36 LF OF 15"
RCP @ 1.39%

MATCH LINE
SEE SHEET 14

EMERGENCY SPILLWAY
TOP ELEV.= 44.50
8' BOTTOM WIDTH
160' TO BE LINED WITH EC-2
STABILIZATION MATTING
(SEE DETAIL SHEET 17)

BMP 5.4
2 YR WSE=42.00
10 YR WSE=43.67
100 YR WSE=44.15

NOTE:
ULTIMATE OWNERSHIP FOR BMP 5.4 IS THE STONEHOUSE HOMEOWNERS ASSOCIATION

BMP ACCESS ROAD

20-WM

12-WM

EW-1
INV.=30.4
STILLING BASIN
(10'x10')

70 LF OF 24"
CLASS III RCP
(O-RING) @
3.00%

AREA OF WETLAND
IMPACT=5051 SF/
0.12 AC

48" PRECAST
CONCRETE RISER

6 LF OF 4" PVC
(SCH 80) @ 5.00%

EW-11A (MOD)
INV.IN=34.50

STORM SYSTEM NO. 1

10' DRNG. ESMT.

LIMITS OF CLEARING

RIP RAP BERM
(TOP ELEV.=71.5)
AROUND INLET

SS #1-3
STA. 10+05, 18' RT
DI-7 W/CONC. FLUME
TOP=70.00
INV.=64.50

160 LF OF 15"
RCP @ 12.19%

SS #1-2
STA 11+65, 18'RT
DI-7 W/CONC. FLUME
TOP=51.00
INV.=45.00

125 LF OF 15"
RCP @ 7.03%

SS #1-1
ES-1
INV.=26.00
STILLING BASIN
(10'x 10')

BMP 5.4

100 YR WSE

144 LF OF 15"
RCP @ 22.85%

25' SETBACK
15' MAINT. ESMT.

STA. 13+00 BEGIN
6" DEEP EC-2
LINED DITCH
INV.=99.66
(BOTH SIDES)

LONG WOOD DR.

SAPLING DR.

WINDY BRANCH DR.

LOT 12 LOT 13 LOT 14 LOT 15 LOT 16 LOT 17 LOT 29 LOT 30 LOT 6

24 25 26 27 28 29 30 31 22 23 21 20 19 18 17 16 15 14 13 12 11 8 7 6

GRAPHIC SCALE
50' 0' 50' 100'
SCALE: 1" = 50'

No.	DATE	REVISION / COMMENT / NOTE	BY
3	9/25/01	REVISED PER JCSA AND JCC COMMENTS	RGW
2	8/24/01	REVISED PER JCC AND VDOT COMMENTS	RGW
1	6/22/01	REVISED PER JCC AND VDOT COMMENTS	RGW

COMMONWEALTH OF VIRGINIA
ROBERT G. WORNOM
No. 025710
PROFESSIONAL ENGINEER
9/25/01

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AES CONSULTING ENGINEERS

DRAINAGE, GRADING AND E&S CONTROL PLAN
SECTION V-B "BENT TREE" - PHASE 3
AT STONEHOUSE
FOR
STONEHOUSE DEVELOPMENT COMPANY, L.L.C.

STONEHOUSE DISTRICT — JAMES CITY COUNTY — VIRGINIA

Designed	Drawn
RGW	HBK
Scale	Date
1"= 50'	3/2/01
Project No.	
8878-00	
Drawing No.	
13	

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ARH 01.25.02 - 15:06 8878C13.dwg

WC072_STONEHOUSE_PHASE_1_SEC_5B - 018

SEQUENCE OF CONSTRUCTION

PHASE 1

1 – INSTALL STONE CONSTRUCTION ENTRANCES (SPLITWOOD ROAD, SAPLING DRIVE, AND WINDY BRANCH DRIVE).

2 – CLEAR PERIMETER EXCEPT FOR TEMPORARY STOCKPILE AREA.

3 – INSTALL CULVERT AND ROAD FILL BEFORE CLEARING AND USING TEMPORARY STOCKPILE AREA.

4 – CONSTRUCT SEDIMENT BASIN #1 AND SEDIMENT TRAP #2

5 – INSTALL TREE PROTECTION, SILT FENCE, CHECK DAMS, OUTLET PROTECTION, AND DIVERSION DIKES AS SHOWN ON THIS SHEET.

6 – CLEAR AND GRUB REMAINING AREAS.

7 – STRIP TOPSOIL FROM CLEARED AREAS FOR EARTHWORK OPERATIONS.

PHASE 2

1– INSTALL DITCHES, CULVERTS, & STORM SEWER WITH CHECK DAMS, INLET, & TEMP. OUTLET PROTECTION.

2 – SEED AND MULCH DISTURBED AREAS ONCE FINISHED GRADE IS ACHIEVED.

3 – OFF–SITE GRADING ACTIVITIES INCLUDE FILL SECTIONS FOR THE FUTURE EXTENSION OF SPLITWOOD ROAD. AND A TEMPORARY STOCKPILE. NO OTHER OFF–SITE GRADING ACTIVITIES ARE ANTICIPATED.

4 – BEGIN UNDERGROUND UTILITY CONSTRUCTION (WATER AND SEWER NETWORKS). CONNECT SYSTEMS TO EXISTING FACILITIES AT THE PRESENT END OF SPLITWOOD DRIVE AND AT INTERSECTIONS OF SAPLING AND WINDY BRANCH DRIVES WITH EXISTING LONGWOOD DRIVE.

5 – COMPLETE ROADWAY CONSTRUCTION WITH FINE GRADING, STONE AGGREGATE AND BASE COURSE.

6 – CONSTRUCT CONCRETE DITCHES.

7 – TOPSOIL DENUDED AREAS AND PERMANENTLY SEED.

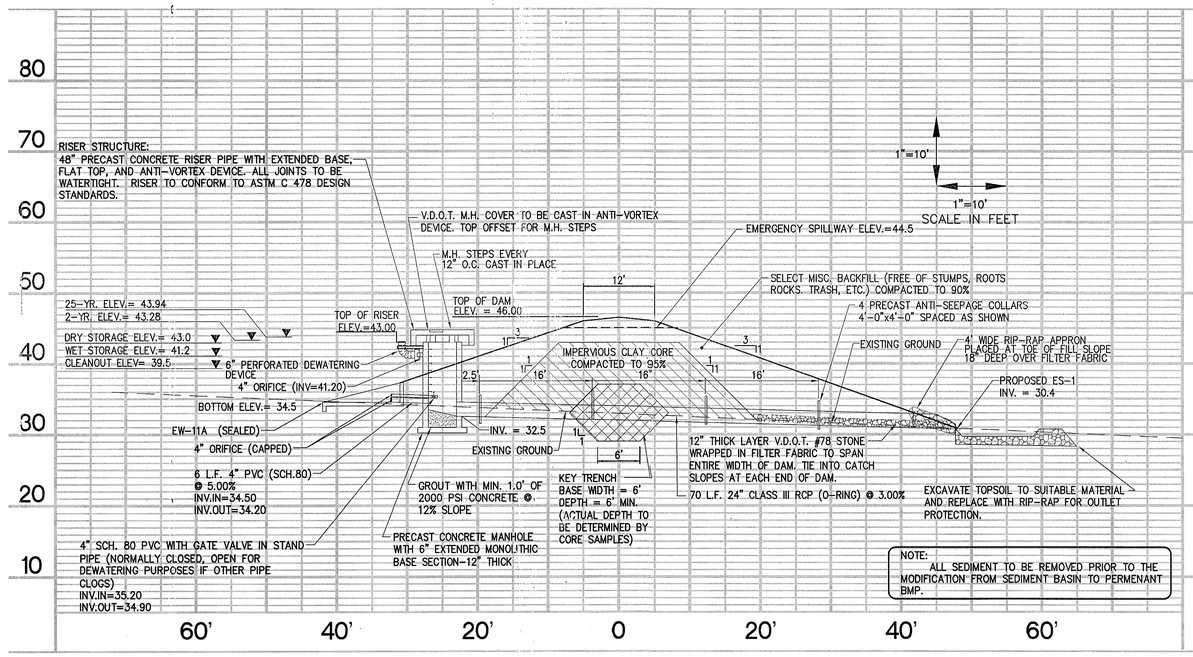
8 – REMOVE ALL ACCUMULATED SEDIMENT FROM SEDIMENT TRAP #2 AND TEMPORARY SEDIMENT BASIN #1. REMOVE SEDIMENT TRAP #2.

9 – MODIFY SEDIMENT BASIN #1 BY REMOVING DEWATERING DEVICE AND GROUTING OVER OPEN ORIFICE. UNCOVER PERMANENT ORIFICES AND REMOVE CAPS AND REPLACE SCREEN ON EW–11.

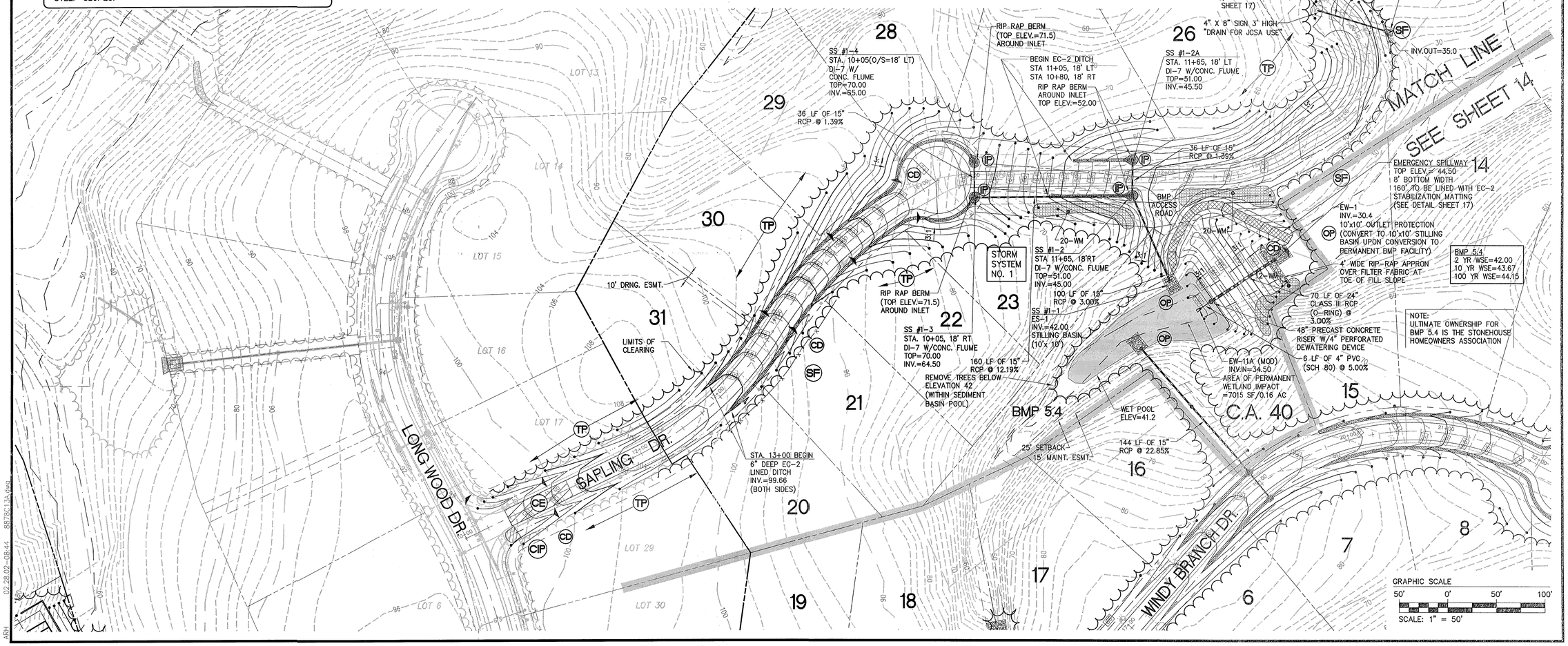
10 – REMOVE REMAINING EROSION CONTROL MEASURES UPON SITE STABILIZATION.

11 – INSTALL ALL PERMANENT STILLING BASINS, AFTER OBTAINING J.C.C. ENVIRONMENTAL DIVISION APPROVAL.

PURPOSE AND INTENT OF AMMENDED PLAN SHEET 13A IS TO SHOW THE REDESIGN OF BMP 5.4 INTO A SEDIMENT BASIN. THIS WILL ELIMINATE THE NEED FOR THE UPHILL SEDIMENT TRAP PREVENTING EXCESSIVE CLEARING AND GRADING ACTIVITIES ON STEEP SLOPES.



SECTION A–A SEDIMENT BASIN 1



No.	DATE	REVISION / COMMENT / NOTE	BY
4	3/5/02	MODIFIED FOR BMP CHANGES	VMB
3	9/25/01	REVISED PER JCSA AND JCC COMMENTS	ROW
2	8/24/01	REVISED PER JCC AND VDOT COMMENTS	ROW
1	6/22/01	REVISED PER JCC AND VDOT COMMENTS	ROW

COMMONWEALTH OF VIRGINIA — VAN MARC BENNETT — No. 25628 — 35102 — PROFESSIONAL ENGINEER

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

AMENDED DRAINAGE, GRADING AND E & S CONTROL PLAN
SECTION V–B "BENT TREE" – PHASE 3
AT STONEHOUSE
FOR
STONEHOUSE DEVELOPMENT COMPANY, L.L.C. — VIRGINIA
STONEHOUSE DISTRICT — JAMES CITY COUNTY

Designed VMB/JAG	Drawn JAG
Scale 1" = 50'	Date 3/5/02
Project No. 8878–00	
Drawing No. 13 A	

02.28.02–08:44 8878C13A.DWG
ARH

WC072_STONEHOUSE_PHASE_1_SEC_5B - 019

EROSION AND SEDIMENTATION CONTROL LEGEND

- (SF) SILT FENCE (SPEC. 3.05)
- (IP) INLET PROTECTION (SPEC. 3.07)
- (CE) CONSTRUCTION ENTRANCE (SPEC. 3.02)
- (CD) CHECK DAM (SPEC. 3.20)
- (DD) TEMPORARY DIVERSION DIKE (SPEC. 3.09)
- (OP) OUTLET PROTECTION (SPEC. 3.18)
- (CIP) CULVERT INLET PROTECTION (SPEC. 3.08–1 WITH STONE COMBIN. INSTEAD OF SILT FENCE)
- (ST) TEMPORARY SEDIMENT TRAP (SPEC. 3.13)
- (PS) PERMANENT SEEDING (SPEC. 3.32)
- (SB) TEMPORARY SEDIMENT BASIN (SPEC. 3.14)
- (TP) TREE PROTECTION (SPEC. 3.38)
- (TSD) TEMPORARY SLOPE DRAIN (SPEC. 3.15)

NOTE:
SEE VIRGINIA EROSION & SEDIMENT CONTROL HANDBOOK FOR EROSION CONTROL SPECIFICATIONS (SPEC.) AND DETAILS.

SOIL No.	SOIL NAME	TYPICAL SLOPES	EROSION FACTOR (K)	EROSION FACTOR (T)
11C	CRAVEN–UCHEE COMPLEX	6–10%	0.32–0.37	3
14B	EMPORIA	2–6%	0.20–0.28	4
15F	EMPORIA COMPLEX	25–60%	0.20–0.28	4
17	JOHNSTON COMPLEX	–	0.17–0.20	5
19B	KEMPSVILLE–EMPORIA FINE SANDY LOAM	2–6%	0.24–0.32	3
25B	NORFOLK FINE SANDY LOAM	2–6%	0.17–0.24	5

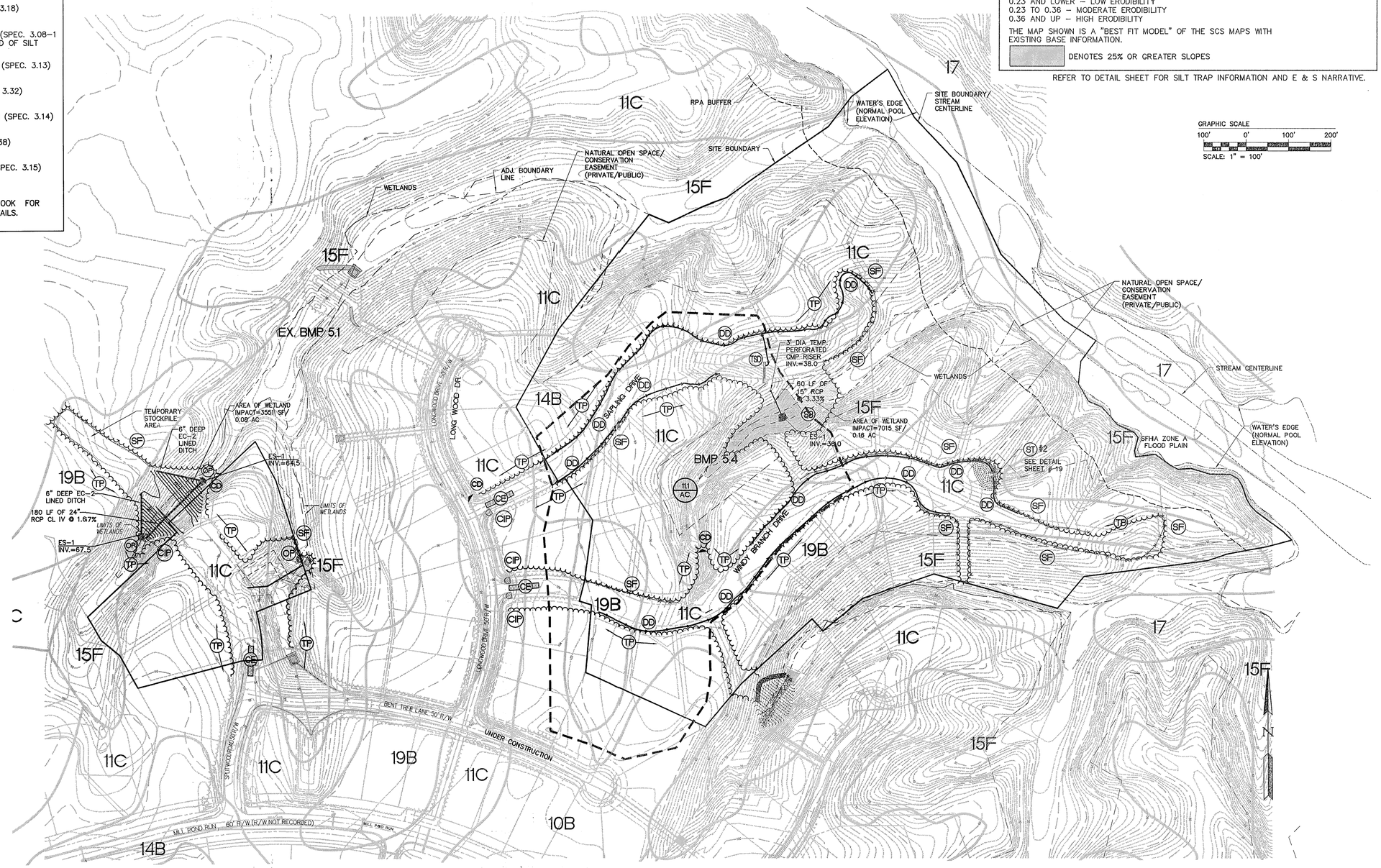
INFORMATION TAKEN FROM "SOIL SURVEY OF JAMES CITY AND YORK COUNTIES AND THE CITY OF WILLIAMSBURG, VIRGINIA" ISSUED IN APRIL, 1985, BY THE UNITED STATES DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE IN COOPERATION WITH VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY.

SOIL SUSCEPTIBILITY TO EROSION CLASSIFICATION (K)
0.23 AND LOWER – LOW ERODIBILITY
0.23 TO 0.36 – MODERATE ERODIBILITY
0.36 AND UP – HIGH ERODIBILITY

THE MAP SHOWN IS A "BEST FIT MODEL" OF THE SCS MAPS WITH EXISTING BASE INFORMATION.

DENOTES 25% OR GREATER SLOPES

REFER TO DETAIL SHEET FOR SILT TRAP INFORMATION AND E & S NARRATIVE.



No.	DATE	REVISION / COMMENT / NOTE	BY
4	3/5/02	BMP MODIFICATION	YMB
3	9/25/01	REVISED PER JCSA AND JCC COMMENTS	RGW
2	8/24/01	REVISED PER JCC AND VDOT COMMENTS	RGW
1	6/22/01	REVISED PER JCC AND VDOT COMMENTS	RGW

COMMONWEALTH OF VIRGINIA VAN MARC BENNETT No. 26828 PROFESSIONAL ENGINEER 35/02

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
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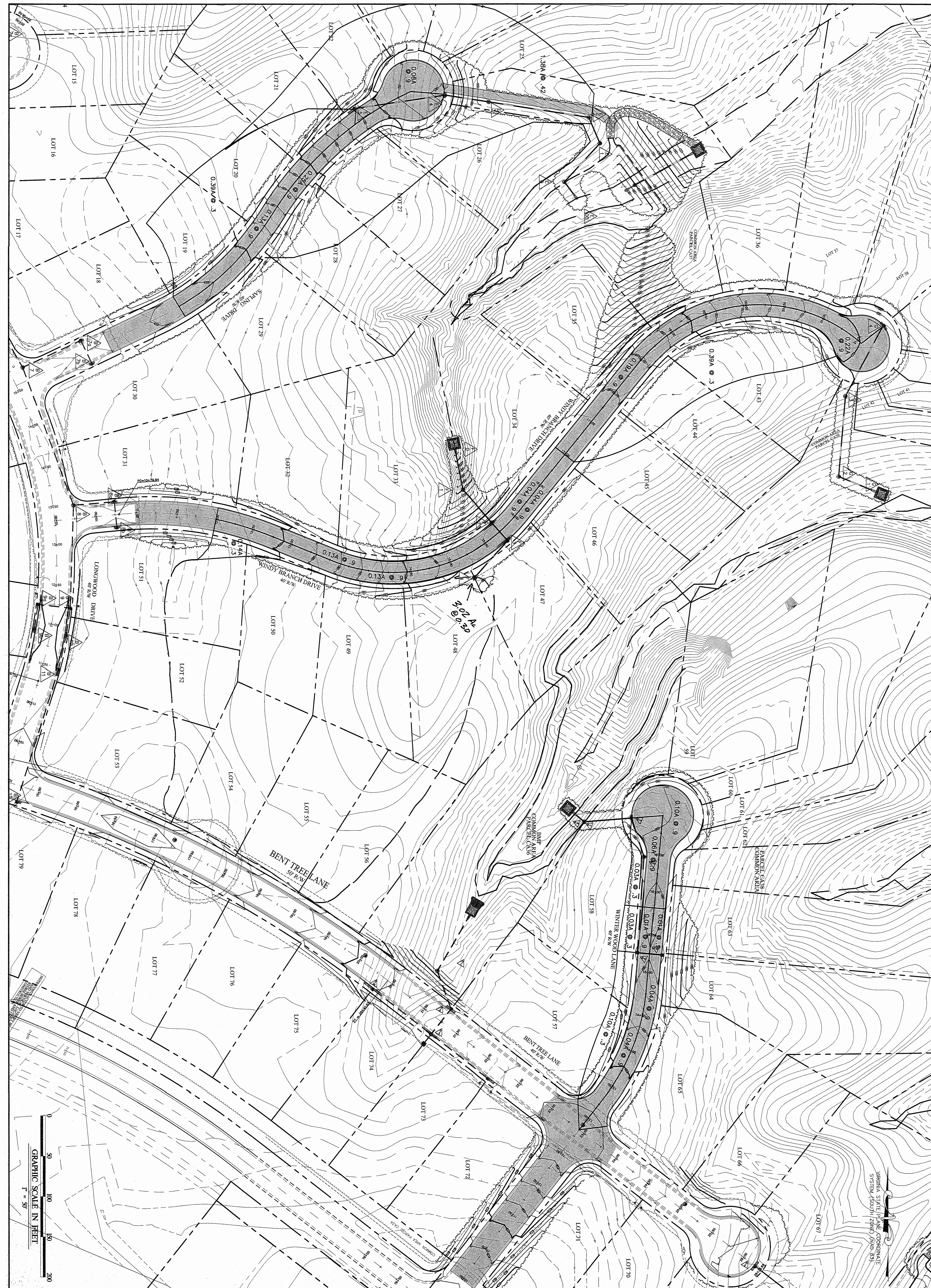
CONSULTING ENGINEERS

AMENDED ENVIRONMENTAL INVENTORY AND PH. 1 & E & S CONTROL
SECTION V-B "BENT TREE" - PHASE 3
AT STONEHOUSE
FOR
STONEHOUSE DEVELOPMENT COMPANY, L.L.C.
STONEHOUSE DISTRICT — JAMES CITY COUNTY — VIRGINIA

Designed	Drawn
RGW	ARH
Scale	Date
1"=100'	3/5/01
Project No.	
8878–00	
Drawing No.	
16A	

09.25.01–10:37 8878C16.dwg
HBK

WC072_STONEHOUSE_PHASE_1_SEC_5B - 020



Designed: SAG/RSP	Date: 7/30/1999
Checked: SAG/RSP	Scale: 1"=50'
Drawn: CMJ	CADD File name: DRAINAGE-AREA.DWG
Project Number: 1960038-111.73	Dwg. File No.: 10507W

Drawing Number

D-1

1 OF 1

STORM SEWER DRAINAGE AREA MAP

SECTION VB "BENT TREE" - PHASE 3
AT STONEHOUSE
FOR
STONEHOUSE L.L.C.

STONEHOUSE DISTRICT JAMES CITY COUNTY VIRGINIA

DRAWING STATUS
- Interoffice Review
- Client for Review
- Pre Approval Bidding
- NOTE

COUNTY APPROVAL
- 1st Submittal
- 2nd Submittal
- 3rd Submittal
- Approved

REVISIONS:

No.	Date	Comment	By
1	2/21/00	REVISED PER COUNTY COMMENTS	CMJ

Langley and McDonald, Inc.
Engineers · Surveyors · Planners
Landscape Architects · Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG
4029 Ironbound RD. Suite 100
Williamsburg, VA 23188
Tel. (757) 253-2975
Fax (757) 229-0049
Email: @ langleyeng.com
5544 Greenwich Road — Suite 200
Virginia Beach, VA 23464
Tel. (757) 473-2000
Fax (757) 497-7933
Email: @ langleyeng.com

COMMONWEALTH OF VIRGINIA
RICHARD S. PHILLIPS
No. 023631
PROFESSIONAL ENGINEER

E PLAN

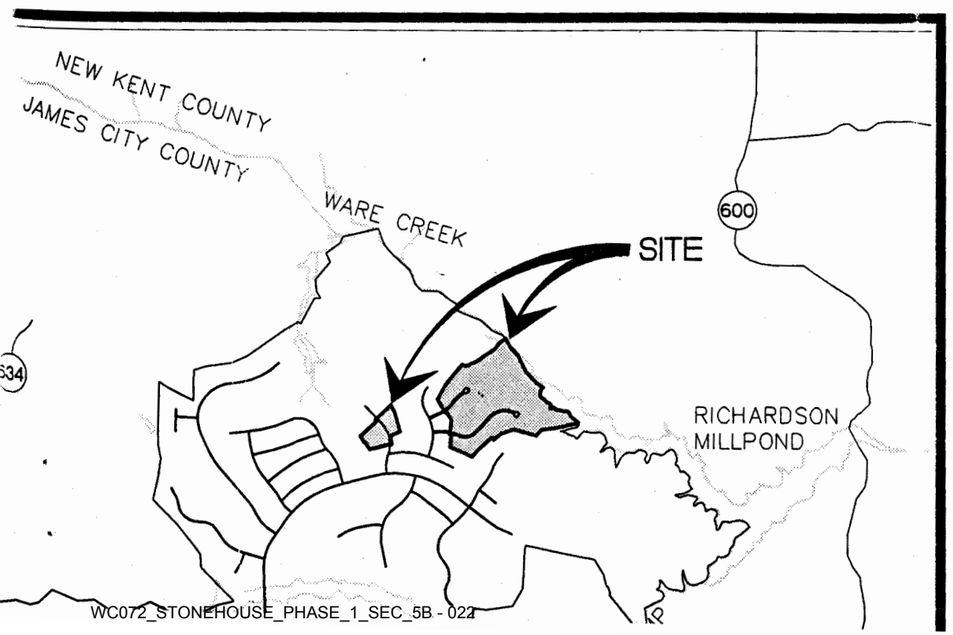
FOR

NEHOUSIE

DEVELOPMENT COMPANY, L.L.C.

T AREA ONE, PHASE I
BENT TREE" - PHASE 3
Y COUNTY, VIRGINIA

S-68-01



WC072_STONEHOUSE_PHASE_1_SEC_5B - 022

INDEX OF SHEETS

SITE DATA:

TAX MAP PARCEL No.	(6–4) (1–1)
ZONING:	PUD–R
PROJECT AREA:	35.07 ACRES / 1,527,769 SF
DISTURBED AREA:	8.81 ACRES / 383,774 SF
NUMBER OF LOTS (PHASE 3):	34
FLOOD HAZARD MAP:	FEMA PANEL NUMBER 510201 0010 B – SFHA ZONE A

OWNER INFORMATION:

STONEHOUSE DEVELOPMENT COMPANY, L.L.C.
ATTENTION: MR. JAMES H. BENNETT
P.O. BOX 759
9701 MILL POND RUN
TOANO, VIRGINIA. 23168

RESPONSIBLE LAND DISTURBER

MR. JAMES H. BENNETT, P.E.
(757) 234–5000

NOTES:

1. OWNERS OF LOTS WHICH REQUIRE A GRINDER PUMP FOR SANITARY SEWER SERVICE ARE REQUIRED TO K
GRINDER PUMP MAINTENANCE CONTRACT.

DEVELOPMENT AREA 1, PHASE 1

BILITY COMPANY
I–R
810
)–97

WATER'S EDGE
(NORMAL POOL
ELEVATION)

SITE BOUNDARY

ADJ. BOUNDARY
LINE

RPA BUFFER

SITE BOUNDARY/ STREAM CENTERLINE

NATURAL OPEN SPACE/
CONSERVATION
EASEMENT
(PRIVATE/PUBLIC)

COMMON AREA (C.A.)
41

WETLANDS

STONEHOUSE INC.
DB 149, PG 185
FORMERLY
DEAN TRACT
(TAX PARCEL 47–18)

NATURAL OPEN SPACE/
CONSERVATION
EASEMENT
(PRIVATE/PUBLIC)

25
24
28
27
26
29
30
23
13
14
31
22
C.A.
40
15
12
WETLANDS
21
20
16
11
10
7
8
9
17
19
18
6
C.A.
39
5
4
1
2
3

DRIVE
SAPLING DR.
WOOD
WINDY BRANCH DR.
LONG
BENT TREE LANE
POND
RUN
CROSS BRANCH
BRANCH
OAK
LANE
WALNUT CREEK
ROAD
TRAILWOOD LANE

ONSERV.
SMT.

ECTION V–B
NT TREE" PH 1

SECTION V–B
"BENT TREE" PH 2

BMP/SWM
POND

SECTION V–B
"WALNUT CREEK"

VI–A
AK" PH 1

SECTION VI–B
"HOLLOW OAK" PH 3

BMP/SWM
POND

SECTION VI–C
FUTURE
RESIDENTIAL

SECTION VII–A
FUTURE
RESIDENTIAL

1.
2.
3.

WC072_STONEHOUSE_PHASE_1_SEC_5B - 023

FT.

L= 214.38'

L= 61.30'

L= 17.57'

N44°26'31"E 9.62'

L=20.63' R=25.00'

L= 78.06'

N57°55'48"E 48.22'

50' R

R=405.00'

G DRIVE 50' R/W

L= 109.75'

L= 57.29'

L=21.53' R=25.00'

L= 30.01'

N59°52'46"E 29.79'

50' INGRESS-EGRESS EASEMENT FOR LOTS 24-26 & POND

S85°06'25"E 176.65'

L= 25.00'

N73°05'23"E 6.46'

L= 23.06'

S85°06'25"E 165.90'

L= 26.94'

S85°06'25"E 171.82'

S85°06'25"E 184.28'

15' DRAINAGE EASEMENT

23
19,722 SQ.FT.
0.45 AC.

50' INGRESS-EGRESS EASEMENT FOR LOTS 24-26

25' JCSA UTILITY EASEMENT

N79°42'21"E 118.43'

N79°42'21"E 126.65'

N79°42'21"E 134.88'

N08°07

N57°33'06"E 83.75'

N57°33'06"E 100.15'

128.37'

S57°33'06"W 445.

MATCH

SEE SHEET 4

WETLANDS

CONSERVATION EASEMENT

S35°22'12"E 80.98'

S54°37'48"W 71.18'

S21°24'52"E 127.37'

VARIABLE WIDTH POND ACCESS EASEMENT

22
22,408 SQ.FT.
0.51 AC.

S45°30'46"E 195.61'

15' MAINT. ESMT. FROM 100YR WSE TO BE DEDICATED TO STONEHOUSE HOA.

182.30'

C.A. 40
52,577 SQ.FT.
1.21 AC.

S45°30'46"E 212.15'

S39°45'29"W 371.19'

BMP 5.4

21
23,050 SQ.FT.
0.53 AC.

108.89'

S55°14'15"W 152.42'

N41°21'28"W 138.17'

20' DRAINAGE EASEMENT

CONSERVATION EASEMENT

25' POND BUFFER/ SETBACK FROM 100YR WSE.

L= 95.72'

R=275.00'

80.00'

S64°42'48"W 119.03'

43.18'

S74°45'44"W 183.18'

CONSERVATION EASEMENT

S74°47'E 181.25'

DY BRANCH DRIVE

0.32 AC.

0.42 AC.

0.17 AC.

0.17 AC.

0.09 AC.

0.09 AC.

0.26 AC.

STORM SYSTEM NO. 1

0.22 AC.

0.06 AC.

0.15 AC.

0.09 AC.

0.05 AC.

0.07 AC.

BMP 5.4

STORM SYSTEM NO. 3

0.07 AC.

0.06 AC.

0.06 AC.

0.19 AC.

0.12 AC.

0.16 AC.

5.33 AC.

0.06 AC.

0.14 AC.

0.05 AC.

0.05 AC.

0.20 AC.

STORM SYSTEM NO. 4

0.05 AC.

0.05 AC.

0.05 AC.

0.05 AC.

0.22 AC.

4.39 AC.

0.09 AC.

0.26 AC.

STORM SYSTEM NO. 2

0.75 AC.

0.68 AC.

1.25 AC.

STA. 10+05(O/S=18' LT)
DI-7 W/
CONC. FLUME
TOP=70.00
INV.=65.00

29

36 LF OF 15"
RCP @ 1.39%

BEGIN EC-2 DITCH
STA 11+05, 18' LT
STA 10+80, 18' RT

RIP RAP BERM
AROUND INLET
TOP ELEV.=52.00

STA. 11+65, 18' LT
DI-7 W/CONC. FLUME
TOP=51.00
INV.=45.50

36 LF OF 15"
RCP @ 1.39%

SEE SHEET

14

EMERGENCY SPILLWAY
TOP ELEV.= 44.50
8' BOTTOM WIDTH
160' TO BE LINED WITH EC-2
STABILIZATION MATTING
(SEE DETAIL SHEET 17)

BMP ACCESS ROAD

20-WM

EW-1
INV.=30.4
STILLING BASIN
(10'x10')

BMP 5.4
2 YR WSE=42.00
10 YR WSE=43.67
100 YR WSE=44.15

70 LF OF 24"
CLASS III RCP
(O-RING) @
3.00%

2-WM

AREA OF WETLAND
IMPACT=5051 SF/
0.12 AC

15

NOTE:
ULTIMATE OWNERSHIP FOR
BMP 5.4 IS THE STONEHOUSE
HOMEOWNERS ASSOCIATION

48" PRECAST
CONCRETE RISER

6 LF OF 4" PVC
(SCH 80) @ 5.00%

EW-11A (MOD)
INV.IN=34.50

STORM
SYSTEM
NO. 1

#1

RIP RAP BERM
(TOP ELEV.=71.5)
AROUND INLET

23

22

SS #1-2
STA 11+65, 18'RT
DI-7 W/CONC. FLUME
TOP=51.00
INV.=45.00

SS #1-3
STA. 10+05, 18' RT
DI-7 W/CONC. FLUME
TOP=70.00
INV.=64.50

160 LF OF 15"
RCP @ 12.19%

128 LF OF 15"
RCP @ 7.03%

SS #1-1
ES-1
INV.=36.00
STILLING BASIN
(10'x 10')

BMP 5.4

100 YR WSE

25' SETBACK
15' MAINT. ESMT.

144 LF OF 15"
RCP @ 22.85%

16

C.A. 40

21

20

. 13+00 BEGIN
DEEP EC-2
D DITCH
=99.66
TH SIDES)

17

7

8

BRANCH DR.

WC072_STONEHOUSE_PHASE_1_SEC_5B - 026

29

30

22

21

20

C.A. 40

ST #1

STORM SYSTEM NO. 3

BMP 5.4
(NOT A SEDIMENT TRAP)

16

SS #3-2
STA. 18+75
DI-7 W/
CONC. FLUME
TOP=77.70
INV.=72.90

SS #3-1
ES-1
INV.=40.00
STILLING BASIN
(10'x 10')
144 LF OF 15"
RCP @ 22.85%
3-CONCRETE
ANCHORS

15

SF

CD

TP

IP

STA. 19+75 BEGIN
6" DEEP EC-2
LINED DITCH
(BOTH SIDES)

34 LF OF 15"
RCP @ 1.18%

SS #3-3
STA. 18+75
DI-5
TOP=77.80
INV.=73.30

8

7

STA. 18+00 BEGIN
6" DEEP EC-2
LINED DITCH
INV.=81.54
(BOTH SIDES)

17

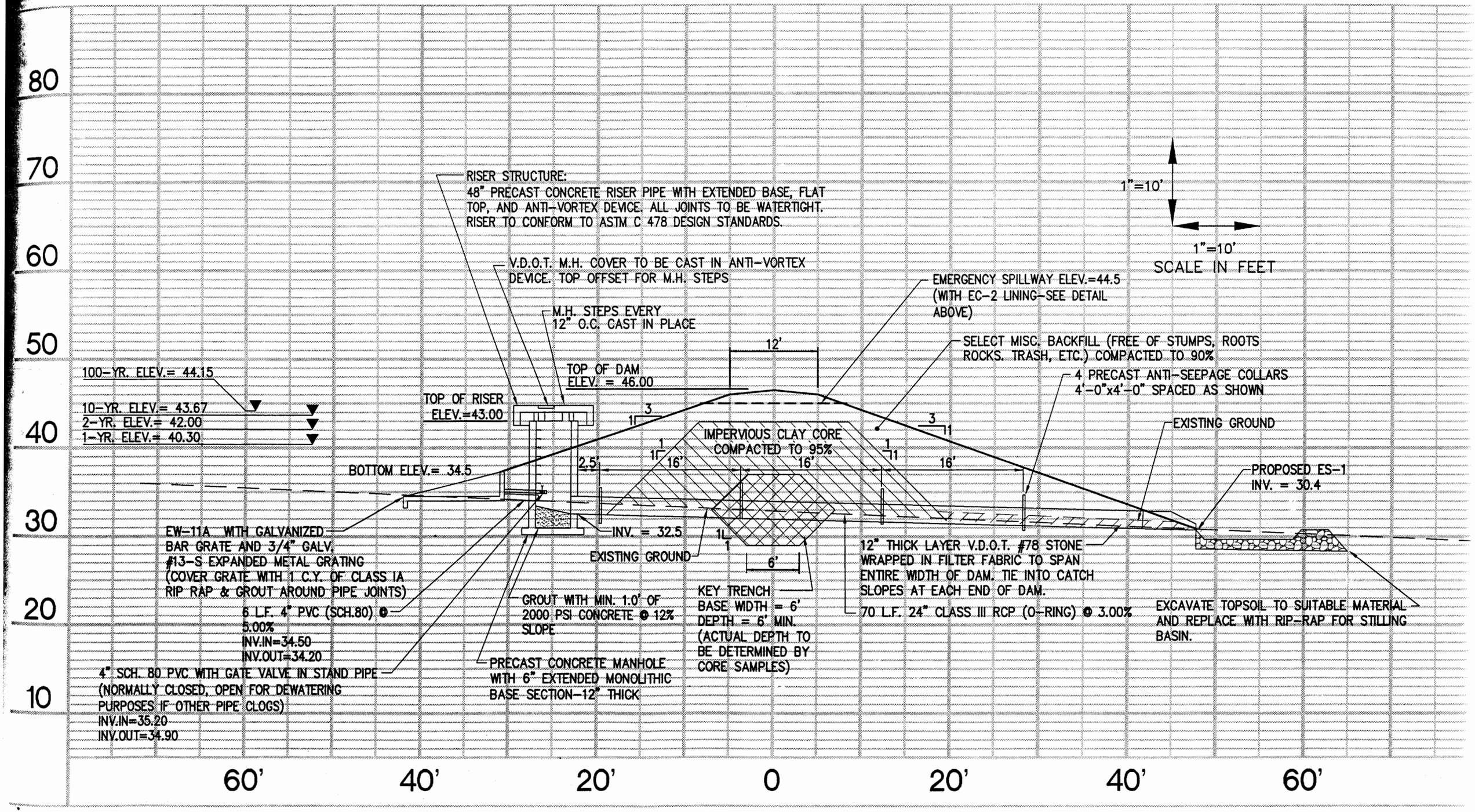
SS #2-1
ES-1
INV.=63.50
STILLING BASIN

EC-3A
LINED
DITCH

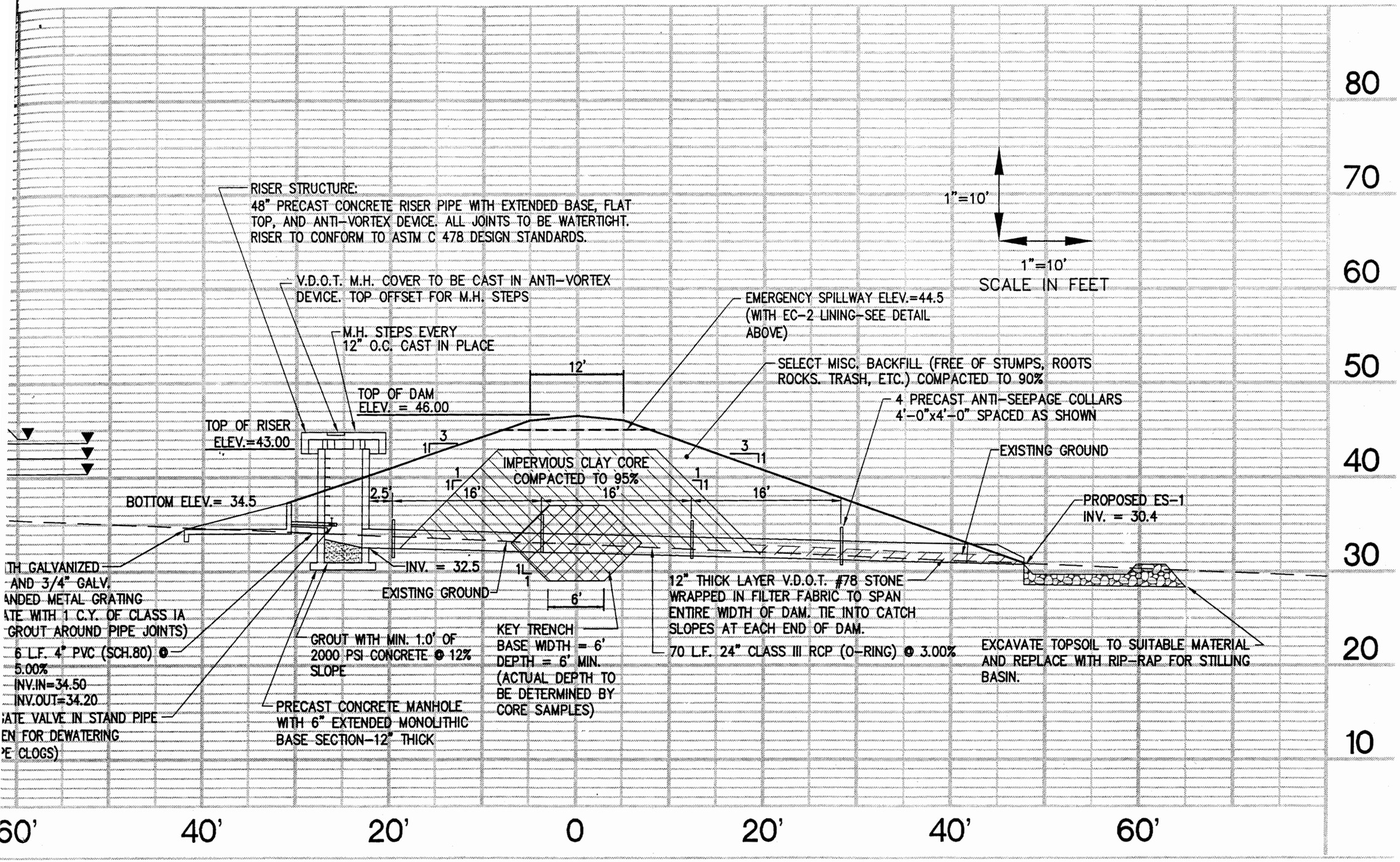
NCH DR.

Storehouse-Bent Tree

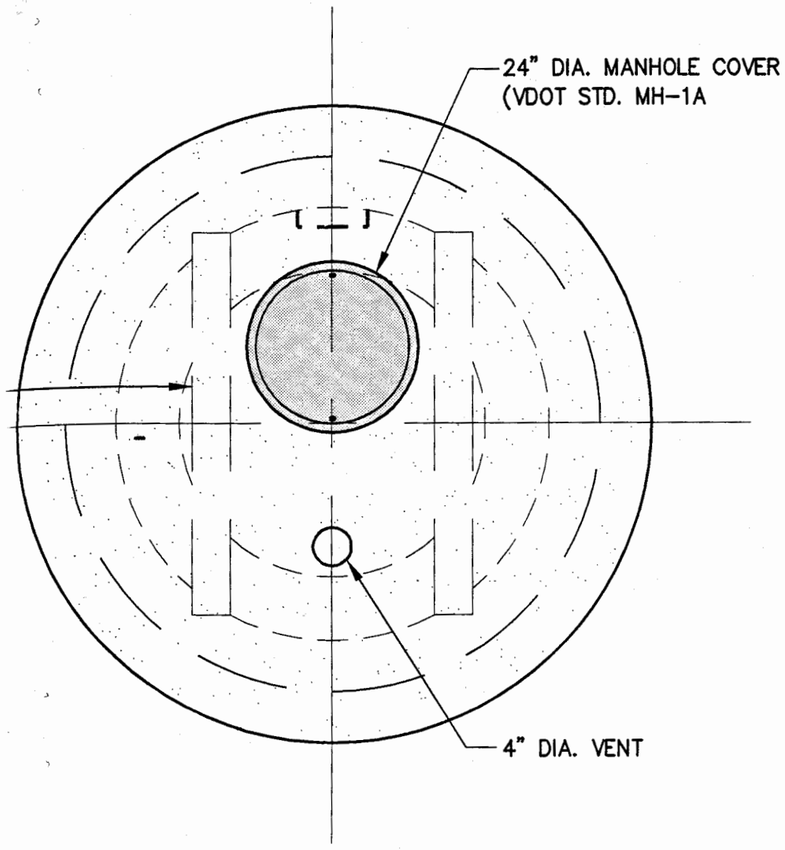
WC072_STONEHOUSE_PHASE_1_SEC_5B / 027



SECTION A-A BMP 5.4



SECTION A-A BMP 5.4



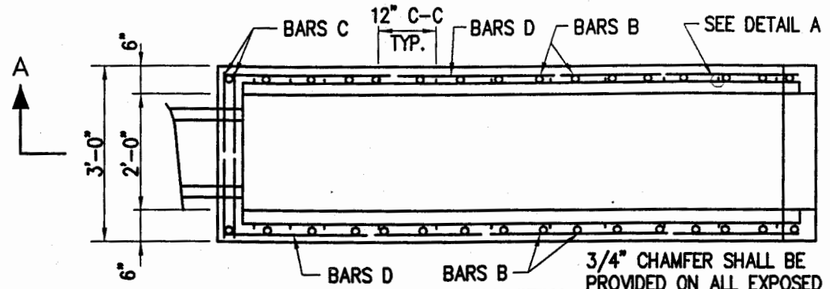
PLAN - TOP SLAB

1. ANTI-VORTEX DEVICE (CAP AND RISER) MANUFACTURED IN ACCORDANCE WITH ASTM C478.
2. DIMENSIONS SUBJECT TO PERMISSIBLE VARIATIONS OF ASTM C478
3. INLET AREA (AREA BETWEEN DEVICE I.D. AND RISER O.D.) IS GREATER THAN OUTLET AREA (AREA OF RISER I.D.)
4. SLAB REINFORCEMENT TO BE ASTM A615 #4 BARS @ 8" E.W. CIRCUMFERENCIAL.

ANTI- VORTEX DETAIL

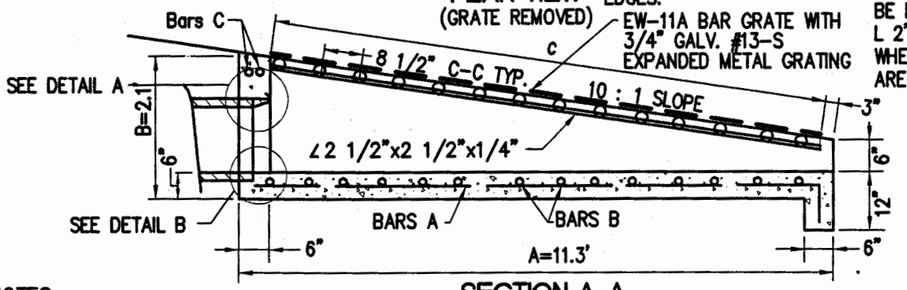
NOT TO SCALE

EW-11a

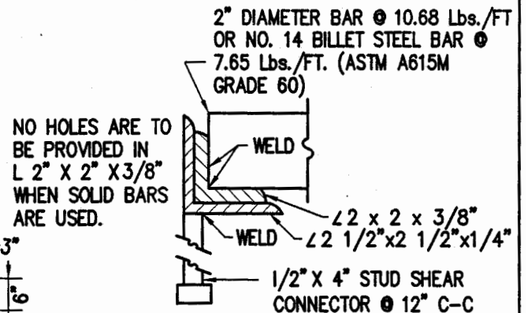


PLAN VIEW
(GRATE REMOVED)

DIMENSIONS FOR BEVEL		
ON HEADWALL PIPE SIZE	a	b
12"	0'-2"	0'-1 1/4"
15"	0'-2"	0'-1 1/4"
18"	0'-2 1/2"	0'-1 1/2"
21" or 24"	0'-3"	0'-2"



SECTION A-A



DETAIL A

NOTES:

IN NO CASE SHALL TOP OF END WALL PROJECT ABOVE FILL SLOPE, DITCH SLOPE, OR SHOULDER.

CLASS A3 CONCRETE TO BE USED IF CAST IN PLACE, 4000 PSI IF PRE-CAST.

REINFORCING STEEL TO HAVE A MINIMUM 1 1/2" CONCRETE COVER.

FOR SCHEDULE OF REINFORCING STEEL, DIMENSIONS, AND QUANTITIES SEE SHEET 2 OF 2.

THIS ITEM MAY BE PRE-CAST OR CAST IN PLACE.

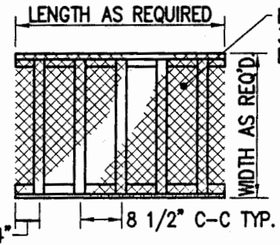
BOTTOM OF STRUCTURE TO BE ON THE SAME GRADE AS DRAINAGE DITCH.

HEADWALL TO BE BEVELED IN ALL AREAS EXCEPT WHERE A CONFLICT WITH INVERT OR WINGWALLS OCCUR.

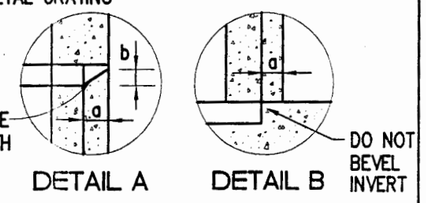
BEVEL EDGE IS REQUIRED ON HEADWALL AT THE INLET END OF THE CULVERT (WHERE THE FLOW ENTERS THE CULVERT).

BEVEL EDGE IS REQUIRED ON HEADWALL AT THE INLET END OF THE CULVERT (WHERE THE FLOW ENTERS THE CULVERT).

HEADWALL AT THE OUTLET END OF THE CULVERT MAY BE EITHER SQUARE EDGE OR BEVEL EDGE.

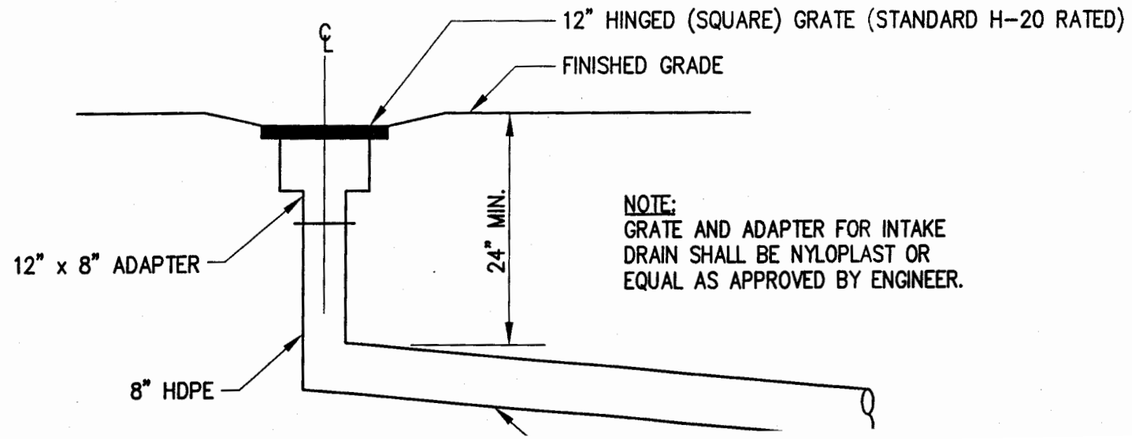


GRATE SECTION DETAIL



DETAIL A DETAIL B

PIPE ENDWALL WITH LOAD - CARRYING GRATE



NOTE:
GRATE AND ADAPTER FOR INTAKE DRAIN SHALL BE NYLOPLAST OR EQUAL AS APPROVED BY ENGINEER.

DO NOT BEVEL INVERT

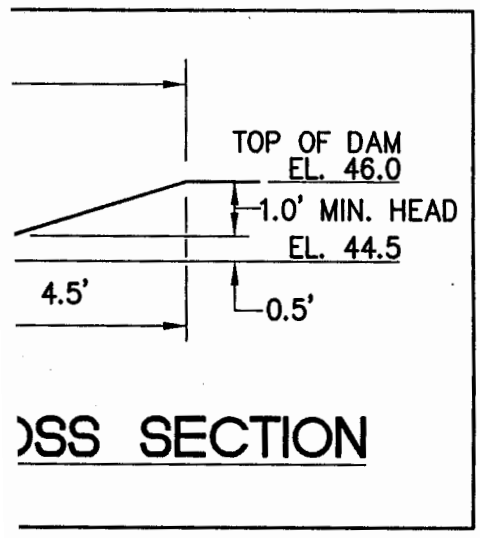
AIL B

Sheet 1 of 2

TED)

ADE

IL TO BMP



OSS SECTION

PROVIDE PROPER STABILIZATION, AND EROSION AND SEDIMENT CONTROL MEASURES NEEDED TO CONTROL AS PER THE VESCH THIRD EDITION.

5. UNDERCUT FOR THE FOUNDATION OF THE DAM EMBANKMENT SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL ENGINEER'S RECOMMENDATION. THE FOUNDATION SHALL BE BACKFILLED WITH SOILS CLASSIFIED AS SM, SC, OR CL UNDER THE UNIFIED SOIL CLASSIFICATION SYSTEM. SOILS SHALL HAVE A MINIMUM OF 15% BY WEIGHT FINES, HAVING A PLASTICITY INDEX OF 30% AND A PERMEABILITY OF 0.0004 IN./SEC. OR LESS. FILL SHALL BE COMPACTED IN 12-INCH LIFTS, OR AS DIRECTED BY THE GEOTECHNICAL ENGINEER, TO A DRY DENSITY OF 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY (ASTM D-698). EXCAVATION FOR THE DAM KEY SHALL BE IN ACCORDANCE TO THE GEOTECHNICAL ENGINEER'S RECOMMENDATION. HEIGHT, DEPTH, AND WIDTH OF THE KEY SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL ENGINEER'S RECOMMENDATIONS. THE KEY SHALL BE FORMED USING SOILS CLASSIFIED AS SC OR CL, WITH A PERMEABILITY OF 0.0004 IN./SEC. OR LESS.

6. THE DAM CORE SHALL BE AS CONSTRUCTED WITH NON-EXPANSIVE SC OR CL CLAYEY MATERIAL WITH PERMEABILITY OF 0.0004 IN./SEC. OR LESS. THE FILL OF THE CORE SHALL BE MADE IN 12-INCH LIFTS, OR AS DIRECTED BY THE GEOTECHNICAL ENGINEER, TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY (ASTM D-698). SIZE, SHAPE, WIDTH, DEPTH, AND HEIGHT OF THE DAM CORE SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL ENGINEER'S RECOMMENDATIONS. TO COVER THE DAM CORE, A SILTY FINE SAND OR CLAYEY SOIL (SM, SC, OR CL) SHALL BE PLACED. A VEGETATIVE COVER USING VDOT EC-2 EROSION CONTROL BLANKETS SHALL BE PLACED ON DAM SLOPES AND CREST TO PREVENT EROSION.

7. UPON COMPLETION, THE CONSTRUCTION OF THE DAM WILL BE CERTIFIED BY A GEOTECHNICAL ENGINEER WHO HAS INSPECTED THE STRUCTURE DURING CONSTRUCTION.

STORMWATER MANAGEMENT/ BMP FACILITY MAINTENANCE PLAN

PROPER MAINTENANCE OF THIS FACILITY IS ENCOURAGED TO PREVENT THE INTRODUCTION OF DEBRIS AND SEDIMENT IN TO THE FACTILITY, 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 OF THESE NEWLY DISTRIBUTED AREAS AS WELL AS INSPECTIONS FOR ACCUMULATED SEDIMENTS AT TWO BMP FACILITY.

A DESIGNATED REPRESENTATIVE OF THE OWNER WILL INSPECT THE BMP 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. 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. SEDIMENT REMOVAL IS REQUIRED USING A RUBBER-WHEELED BACKHOE. AT THE SAME TIME, OR AT LEAST ONCE PER YEAR, THE RISER BOTTOM AND OUTLET PIPE SHALL BE CLEANED OF ACCUMULATED SEDIMENTS. DISPOSE OF SEDIMENTS REMOVED FROM THE FACILITY AT AN ACCEPTABLE DISPOSAL AREA. SEDIMENT SHALL NOT BE ALLOWED TO ACCUMULATE IN DEPTHS GREATER THAN 1-FOOT. NO SEDIMENT SHALL BE ALLOWED TO ACCUMULATE TO PREVENT THE PROPER FUNCTION OF ANY PIPE OR CULVERT.

2. PERFORM MAINTENANCE MOWING OF GRASSED AREAS AT LEAST TWICE EACH YEAR. GRASSES SUCH AS TALL FESCUE SHOULD BE MOWED IN EARLY SUMMER AFTER EMERGENCE OF THE HEADS ON COOL SEASON GRASSES AND IN LATE FALL TO PREVENT SEEDS OF ANNUAL WEEDS FROM MATURING. MOWING OF LEGUMES CAN BE LESS FREQUENT TREES AND SHRUBS SHOULD NOT BE PERMITTED TO GROW ON ANY PART OF THE GRADED EMBANKMENT.

3. PERFORM SOIL SAMPLING ON STABILIZED BMP SOIL AREAS ONCE EVERY FOUR (4) YEARS. SOIL SAMPLING AND TESTING SHOULD BE PERFORMED BY A QUALIFIED INDEPENDENT TESTING LABORATORY. APPLY ADDITIONAL LIME AND FERTILIZER IN ACCORDANCE WITH TEST RECOMMENDATIONS.

4. IN STABILIZED BMP AREAS, IF VEGETATION COVERS LESS THAN 40% OF SOIL SURFACES, LIME FERTILIZE AND SEED IN ACCORDANCE WITH RECOMMENDATIONS FOR NEW SEEDLINGS, AS LISTED IN DAM CONSTRUCTION NOTES. IF VEGETATION COVERS MORE THAN 40% BUT LESS THAN 70% OF SOIL SURFACES, LIME FERTILIZE AND OVERSEED IN ACCORDANCE WITH CURRENT SEEDLING RECOMMENDATIONS.

5. PERFORM QUARTERLY INSPECTIONS OF THE RELEASE STRUCTURES, RISER SECTION AND CREST OF SPILLWAY FOR THE OBSERVANCE OF COLLECTED DEBRIS. IMMEDIATELY REMOVE ANY DEBRIS TO MAINTAIN THE INTEGRITY OF THE STRUCTURE AND PROVIDE AN ATTRACTIVE APPEARANCE. DURING QUARTERLY INSPECTIONS, THE POND DRAIN VALVE, USUALLY LEFT IN THE VALVE "CLOSED" POSITION, SHALL BE INSPECTED AND OPERATED THROUGH TWO COMPLETE FULL-OPEN TO FULL-CLOSE TO FULL-OPEN CYCLES.

6. PERFORM YEARLY STRUCTURAL INSPECTIONS OF THE FACILITY FOR DAMAGE. STRUCTURAL INSPECTION SHALL BE PERFORMED ON THE CONCRETE RISER, ANTI-VORTEX DEVICE, TRASH RACK, ORIFICE/ WEIR(S), OUTLET BARREL AND POND EMBANKMENT. IF DAMAGE IS EVIDENT, FURTHER INVESTIGATION BY A PROFESSIONAL ENGINEER MAY BE REQUIRED TO ASSESS THE CONTINUED INTEGRITY OF THE STRUCTURE.

7. PERFORM QUARTERLY INSPECTIONS OF THE GRADED SIDE SLOPES OF THE FACILITY FOR SIGNS OF ANIMAL/ RODENT BORROWS OR SLOPE EROSION. IMMEDIATELY PERFORM NECESSARY REPAIRS, REFILLING OR RESEEDING AS APPROPRIATE.

8. RECORD KEEPING. THE LANDOWNER OR DESIGNATED REPRESENTATIVE SHALL KEEP REASONABLE, ACCURATE WRITTEN RECORDS OR INSPECTIONS PERFORMED FOR THE STRUCTURE. RECORDS SHALL DOCUMENT ROUTINE MAINTENANCE AND/ OR REPAIRS PERFORMED. COPIES SHALL BE PROVIDED TO THE COUNTY UPON REQUEST

COMMONWEALTH OF VIRGINIA
ROBERT G. WORNOM
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DAM SECTION AND DETAILS
SECTION V-B "BENT TREE" - PHASE 3
AT STONEHOUSE
FOR

Designed	Draw
RGW	
Scale	Date
NOTED	3/

Project No
8878-00

JAMES CITY COUNTY, VIRGINIA
ENVIRONMENTAL DIVISION

STORMWATER MANAGEMENT DESIGN PLAN CHECKLIST

I. *GENERAL:*

Yes No N/A

☑ ☐ ☐ *FAMILIARITY* with current versions of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual; Chapter 8, Erosion and Sediment Control and Chapter 23, Chesapeake Bay Preservation ordinances of the Code of James City County, Virginia; the Virginia Erosion and Sediment Control Handbook (VESCH); and the Virginia Stormwater Management Handbook (VSMH).

☑ ☐ ☐ *WAIVER OR EXCEPTION* if necessary, requested in writing, for the plan approving authority to waive or except the requirements of Chapter 23, Chesapeake Bay Preservation ordinance in accordance with procedure established in Sections 23-14 through 23-17 of the ordinance. Applies to this review case only.

☑ ☐ ☐ *VARIANCE REQUEST* if necessary, requested in writing for the plan approving authority to waive or modify any of the minimum standards and specifications of the VESCH deemed inappropriate based on site conditions specific to this review case only. Variances which are approved shall be properly documented in the plan and become part of the approved erosion and sediment control plan for the site.

☑ ☑ ☐ *PROFESSIONAL SEAL AND SIGNATURE* required on final and complete approved stormwater management plans, drawings, technical reports and specifications. NOT ON REPORTS.

☑ ☐ ☐ *WORKSHEET FOR BMP POINT SYSTEM* to ensure the stormwater management plan for the project attains at least 10 BMP points (New Development) or traditional pollutant load reduction computations per the Chesapeake Bay Local Assistance Manual (Redevelopment Only). NOT PROVIDED.

☑ ☐ ☐ *PROPOSED CONSERVATION EASEMENT AREAS* for any natural open space points claimed in the BMP worksheet.

☑ ☐ ☐ *INSPECTION/MAINTENANCE AGREEMENT* is required to be prepared and executed with the County for the project.

☑ ☐ ☐ *FEMA FIRM PANEL* reference with designated special flood hazard areas or zone designations associated with the site, as applicable. MISSING REFER TO ZONE A

☑ ☐ ☐ *DRAINAGE AREA MAP* at a maximum scale of 1"=200' scale showing drainage area boundaries for pre- and postdevelopment conditions and associated time of concentration flow paths. Labels to include drainage area size, runoff coefficient or curve number and time of concentration for each subarea shown on the map.

Yes No N/A

☑ ☐ ☐ *SOILS MAP* with soil symbols, boundaries and legend in accordance with the current Soil Survey of James City and York Counties and the City of Williamsburg, Virginia with approximate locations of the project site, BMPs and applicable drainage basins.

☑ ☐ ☐ *STORMWATER MANAGEMENT NARRATIVE* in a brief and simple format which describes the project; location; site and drainage basin soil characteristics; receiving water or drainage facility; existing site and drainage basin conditions (topography, land use, cover, slopes, etc.); proposed site development; proposed stormwater management and drainage plan including County BMP type selected; summary of hydrology and hydraulics; maintenance program; and any special assumptions utilized for development of the stormwater management and drainage design plan or computations.

None provided

☑ ☐ ☐ *TEMPORARY STORMWATER MANAGEMENT* (if applicable) for control of stormwater runoff encountered during construction activities in addition to measures provided in the erosion and sediment control plan or stormwater management/drainage plan for the site. Adequate protection measures or sequencing provided.

☑ ☐ ☐ *MODIFICATION PLAN* clearly defined for temporary sediment control structures which will be converted to permanent SWM/BMP structures. Includes appropriate hydrologic and hydraulic computations, conversions, sequencing and cleanout information or details. Normally related to primary control structures associated with dry detention or wet retention ponds. Normally not permitted for Group C or D categories such as bioretention, infiltration and filtering system facilities.

None for BMP #54

☑ ☐ ☐ *STORMWATER MANAGEMENT and DRAINAGE DESIGN REPORT* in a bound 8-1/2 x 11 inch size format. Report shall generally include a title sheet, date, project identification, owner and preparer information, table of contents, narrative, summaries and computations as required. Computations may include: backwater, closed conduit, headwater, hydraulic, hydraulic grade line, hydrology, inlet, open channel, storm sewer, water quality, extended detention or stream channel protection and muti-stage storm routing calculations, as applicable, for the project. Computation data may include hand or computer generated computations, maps or schematics. All information should be presented in a clear, easy to follow format and should closely match construction plan information.

☑ ☐ ☐ *PLAN VIEW* at 1 inch = 50 ft. scale or less (1" = 40', 1" = 30', etc.)

- ☑ ☐ ☐ North arrow and plan legend.
- ☑ ☐ ☐ Property lines.
- ☑ ☐ ☐ Adjacent property information.
- ☑ ☐ ☐ Existing site features and existing impervious cover areas.
- ☑ ☐ ☐ Impervious cover tabulations.
- ☑ ☐ ☐ Existing drainage facilities (natural or manmade).
- ☑ ☐ ☐ Existing environmentally sensitive areas (RPA, wetlands, floodplain, steep slopes, critical soils, buffers, etc.).
- ☑ ☐ ☐ Existing and proposed contours (1' or 2' contour interval) and spot elevations as necessary to define high and low topography.
- ☑ ☐ ☐ Existing and proposed easement locations.

Yes	No	N/A	
☑	☐	☐	Proposed site improvements and proposed impervious cover areas.
☑	☐	☐	Proposed stormwater conveyance, drainage and management facilities with appropriate labeled construction data and information.
☑	☐	☐	Proposed landscaping and seeding plans (disturbed areas, pond interior, etc.).
☑	☐	☐	Proposed slope stabilization areas (riprap, blankets, mattings, walls, etc.).
☑	☐	☐	Delineation of permanent pools and the 1-, 2-, 10- and 100-year Design Water Surface Elevations.
☑	☐	☐	Delineation of ponding, headwater, surcharge or backwater areas which may affect adjacent existing or proposed buildings, structures or upstream adjacent properties.
☐	☑	☐	Test boring locations with reference surface elevations (if known).
☑	☐	☐	Risers, barrels, underdrains, overflows and outlet protections.
☑	☐	☐	Emergency spillway level section and outlet channel.
☑	☐	☐	Existing and proposed site utilities and protection measures.
☑	☐	☐	Erosion and sediment control measures (for site or BMP).
☑	☐	☐	Maintenance or access corridors to permanent stormwater management, BMP or drainage facilities.

II. *STORMWATER CONVEYANCE SYSTEMS:*

Yes	No	N/A	
☑	☐	☐	*PLAN VIEWS*
☑	☐	☐	Storm drain lengths, sizes, types, classes and slopes for all segments. Label directly on plan or use structure/pipe schedule.
☑	☐	☐	Access structure (inlets, manholes, junctions, etc.) rim elevations, inverts, type and required grate or top unit and lengths labeled.
☑	☐	☐	All structure numbers labeled.
☑	☐	☐	Adequate horizontal clearance from other site utilities or structures.
☑	☐	☐	*PROFILES* generally are not required but are encouraged to expedite review. If not provided, ensure all pipe segments have adequate minimum cover, do not exceed maximum depths of cover for the type/class of pipe specified and do not conflict with other site utilities or excavation areas.
☑	☐	☐	*DETAILS*
☑	☐	☐	Typical storm drain bedding details or reference note. VDOT.
☑	☐	☐	Standard details or reference note for all proposed access structure types (inlets, manholes, junctions, etc.).
☑	☐	☐	Inlet shaping detail or applicable reference note.
☑	☐	☐	Step detail or applicable reference note (if depth 4 ft. or more).
☑	☐	☐	Typical open channel details with designation, location, shape, type, bottom width, top width, lining, slope, length, side slope, and installation depth required for construction. Channel design data as necessary may also be included.
☑	☐	☐	Outlet protections at all pipe outfalls.

Yes No N/A

☑ ☐ ☐ *STORMWATER CONVEYANCE SYSTEM COMPUTATIONS*

- ☑ ☐ ☐ Storm Sewer Design computations based on 10-year design event.
- ☑ ☐ ☐ Hydraulic Grade Line computations based on 10-year design event.
- ☑ ☐ ☐ Inlet computations based on current VDOT procedure for spread, ponding depth and grate size required.
- ☑ ☐ ☐ Culvert Headwater computations. Design based on 10-year design storm event and check only for 100-year storm event.
- ☑ ☐ ☐ Open Channel computations based on 2-year design event for velocity and 10-year design event for capacity.
- ☑ ☐ ☐ Standard outlet protection or special energy dissipators.
- ☑ ☐ ☐ Pipe thickness design computations, as required, for selected pipe type (live load, minimum cover, maximum height of cover, etc.).
- ☑ ☐ ☐ Adequate channel computations for receiving channels (based on field measured channel section data).

III. *STORMWATER MANAGEMENT / BMP FACILITIES:*

Yes No N/A

☐ ☐ ☐ *HYDROLOGY* - An SCS based methodology is required for the design of stormwater management/BMP facilities with watersheds exceeding 20 acres. Under 20 acres, other generally accepted methodologies such as the modified rational, critical storm are allowable. Refer to Chapter 5 of the VESCH or Chapter 5 of the VSMH.

- ☑ ☐ ☐ Runoff Curve Number or Coefficient determinations: predeveloped and ultimate development land use scenarios.
- ☑ ☐ ☐ Time of concentration: predeveloped and ultimate development indicating overland, shallow concentrated, and channel flow components (200 ft. maximum length for overland flow).
- ☑ ☐ ☐ Hydrograph generation (tabular or graphical): pre- and postdevelopment conditions for the 1-, 2-, 10-, and 100-year design storm events.

☑ ☐ ☐ *FACILITY CONFIGURATION and MINIMUM SEPARATIONS*

- ☑ ☐ ☐ Screening and layout consistent with Section 24-98(d) of the Chapter 24 Zoning ordinance (landscaping, screening, visibility, etc.).
- ☑ ☐ ☐ Basic considerations for safety and unauthorized entry.
- ☑ ☐ ☐ Proper length to width ratio (Typically 2H:1V).
- ☐ ☐ ☒ Facilities with deep pools (4 feet or more in depth) provided with two benches. Fifteen (15) ft. safety bench outward from normal pool at maximum 6 percent slope and aquatic bench inward from normal shoreline below normal pool. Narrower widths may be considered on a case-by-case basis.

NOT PROVIDED 15' BUFFER SHOWN

- ☑ ☐ ☐ Pond buffer minimum 25 feet outward from maximum design WSEL. Additional setbacks may be required to permanent structures.
- ☑ ☐ ☐ No trees, shrubs or woody plants within 15 feet of embankment toe or 25 feet from principal spillway structure.

Yes	No	N/A	
☑	☐	☒	Infiltration and filtering system facilities generally located at least 100 feet horizontally from any water supply well; 100 feet from any downslope building; and 25 feet from any upslope buildings, unless site specific investigation allows for reduced separation.

Yes	No	N/A	
☑	☐	☐	*HYDRAULIC COMPUTATIONS*
☑	☐	☐	Elevation- or Stage- Storage curve and/or tabular data.
☑	☐	☐	Weir / Orifice Control - Extended Detention.
☑	☐	☐	Weir / Orifice Control - riser 1-year control for channel protection.
☑	☐	☐	Weir / Orifice Control - riser 2-year control for quantity (if required).
☑	☐	☐	Weir / Orifice Control - riser 10-year control for quantity (if required).
☑	☐	☐	Inlet / Outlet (barrel) control - (All Storms).
☑	☐	☐	Check for barrel control prior to riser orifice flow to prevent slug flow-water hammer conditions.
☑	☐	☐	Emergency spillway capacity and depth of flow.
☑	☐	☐	Elevation - Discharge (Outlet Rating) curve and/or table. Provide all supporting calculations and/or design assumptions.
☑	☐	☒	Adequate channel computations for receiving channel. May be waived if facility is designed based on current Stream Channel Protection criteria.

☑	☐	☐	*POND or RESERVOIR ROUTING*
☑	☐	☐	Storage-Indication Routing of postdeveloped inflow hydrographs for the 1-, 2-, 10-, and 100-year design storms. Preference is for structure to discharge up to the 10-year storm through the principal spillway and pass the 100-year storm with a minimum 1 foot of freeboard through a combination principal and emergency spillways. If no emergency spillway is provided, riser must be large enough to pass the design high water flow and trash without overtopping the facility, have 3 square feet or more of cross-sectional area, contain a hood type inlet and have a minimum freeboard of 2 feet. Token spillways with minimum 8 ft. width are also recommended at or above the design 100-year storm elevation.
☐	☐	☒	Downstream hydrographs at established study points, if conditions warrant (ie. facility discharge combined with uncontrolled bypass).

☑	☐	☐	*MISCELLANEOUS COMPUTATIONS*
☑	☐	☐	Water quality volume for permanent pool based on selected BMP treatment volume (WQv).
☑	☐	☐	Water quality volume for extended detention based on selected BMP treatment volume (WQv) with drawdown computations.
☑	☐	☐	Drawdown computations for the 1-year, 24 hour detention for stream channel protection criteria.
☑	☐	☐	Pond drain computations (within 24 hours). WHY DRY DET
☑	☐	☐	Anti-seep collar design (concrete preferred) or match material type.
☑	☐	☐	Filter diaphragm design (or alternative method of controlling seepage).

Yes No N/A

☐ ☐ ☐ Riser / base structure flotation analyses. FS = 1.25 minimum.

☐ ☐ ☑ Downstream danger reach study and/or emergency action plan (if conditions warrant).

☐ ☐ ☑ Upstream backwater analyses onto offsite adjacent property (if conditions warrant).

☐ ☐ ☑ 100 year floodplain impacts (if conditions warrant).

Yes No N/A

☑ ☐ ☐ *GEOTECHNICAL REQUIREMENTS*

☐ ☐ ☐ Geotechnical Report with recommendations specific to BMP facility type selected. Report prepared by a registered professional engineer. Requires submission, review and approval prior to issuance of Land Disturbance Permit.

☐ ☐ ☑ Initial Feasibility Testing requirements satisfied as per Appendix E of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual. (Infiltration, Bioretention and Filtering System BMP types only).

☐ ☐ ☑ Concept Design Testing requirements satisfied as per Appendix E of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual. (Infiltration, Bioretention and Filtering System BMP types only).

☐ ☐ ☐ Minimum Boring locations: borrow area, pool area, principal control structure, top of facility near one abutment and emergency spillway if provided.

☐ ☐ ☐ Boring logs with Unified Soil Classification (ASTM D2487), soils descriptions and depths to bedrock and the seasonal water table indicated.

☑ ☐ ☐ Standard County Record Drawing/Construction Certification note provided on plan. *Note: It is understood that preparation of record drawings and construction certifications as required for project facilities may not necessarily be performed by the plan preparer. These components may be performed by others.*

☑ ☐ ☐ *PRINCIPAL SPILLWAY PROFILE AND ASSOCIATED DETAILS*

☐ ☐ ☐ *EXISTING GROUND AND PROPOSED GRADE*

☑ ☐ ☐ Embankment or excavation side slopes labeled (3H:1V maximum).

☑ ☐ ☐ Minimum top width labeled (per VESCH or VSMH requirements).

☑ ☐ ☐ Removal of unsuitable material under proposed facility (per Geotechnical Report requirements).

Yes No N/A

☑ ☐ ☐ *CORE TRENCH*

- ☑ ☐ ☐ Material (per plan or Geotechnical Report).
- ☑ ☐ ☐ Bottom width (4' minimum or greater as dictated by Geotechnical Report recommendations).
- ☑ ☐ ☐ Side slopes (1:1 maximum steepness)
- ☑ ☐ ☐ Depth (4' minimum or greater as dictated by Geotechnical Report).

☑ ☐ ☐ *PRINCIPAL CONTROL STRUCTURE. RISER OR SIMILAR STRUCTURE (DETAILS REQUIRED FOR ALL ITEMS)*

ASTM C361 pipe or ASTM C478 MH

- ☑ ☐ ☐ Durable, watertight, resistant material (concrete preferred).
- ☑ ☐ ☐ Riser diameter is at least 1.25 times larger than barrel diameter.
- ☑ ☐ ☐ All pertinent dimensions and elevations shown.
- ☑ ☐ ☐ Control orifice or weir dimensions and elevations shown.
- ☐ ☐ ☐ Trash rack - removable - for each release.
- ☑ ☐ ☐ Anti-vortex device, baffle or plate.
- ☑ ☐ ☐ Riser base structure with dimensions and embedment specifications (concrete preferred).
- ☑ ☐ ☐ Interior access (steps, ladders, etc.) for maintenance for structures over 4 feet in height. Excessively high risers may need some form of exterior access on top portion.
- ☑ ☐ ☐ Low flow orifice with trash rack device.

☑ ☐ ☐ *PRINCIPAL CONTROL STRUCTURE OUTLET BARREL*

- ☑ ☐ ☐ Material (ASTM C-361 reinforced concrete pipe) with watertight joints. Prior approval required for all other pipe material (other RCP types, CMP, CPP, PVC, etc.).
- ☑ ☐ ☐ Support and bedding requirements for barrel - concrete cradles, etc. or as recommended by the Geotechnical Report.
- ☑ ☐ ☐ Pipe inverts, length, size, class and slope shown.
- ☑ ☐ ☐ Flared end section or endwall provided on barrel outlet.

☐ ☐ ☐ *SEEPAGE CONTROL*

where

- ☐ ☐ ☐ Phreatic line shown (4:1 slope measured from the intersection of the embankment and the principal spillway design high water).

☑ ☐ ☐ *ANTI-SEEP COLLARS*

- ☑ ☐ ☐ Anti-seep collar, concrete preferred.
- ☑ ☐ ☐ Size - 15 percent increase in length of saturation using outside pipe diameter.
- ☑ ☐ ☐ Spacing and location on barrel (located at least 2 feet from a pipe joint).

☐ ☐ ☐ *FILTER DIAPHRAGMS*

☐ ☐ ☐ Design based on latest NRCS design methods and certified by a professional engineer.

Yes No N/A

☐ ☐ ☐ *ELEVATION AND DIMENSIONAL DESIGN DATA*

☑ ☐ ☐ Top of facility - construction height and settled height (10 percent settlement).

☑ ☐ ☐ Crest of principal control structure spillway at least one (1) foot below crest of emergency spillway, if provided.

☑ ☐ ☐ Minimum freeboard of one (1) foot above the 100-year design high water elevation for facilities <u>with</u> an emergency spillway.

☑ ☐ ☐ Minimum freeboard of two (2) feet above the 100-year design high water elevation for facilities <u>without</u> an emergency spillway or in accordance with the SCS National Engineering Handbook (prior approval required).

New CO Elev BMP #54 @ 73B More.

☐ ☐ ☐ Basin Sediment Clean-Out elevation (permanent mode). Typically 10 to 25 percent of water quality volume.

☑ ☐ ☐ *CROSS SECTION THROUGH FACILITY*

☑ ☐ ☐ Existing Ground.

☑ ☐ ☐ Proposed grade.

☑ ☐ ☐ Top of facility - constructed and settled.

☑ ☐ ☐ Location of emergency spillway with side slopes labeled (emergency spillway in cut).

☑ ☐ ☐ Bottom of core trench (4' minimum).

☐ ☐ ☐ Location of each soil boring.

☑ ☐ ☐ Barrel location.

☑ ☐ ☐ Existing and proposed utility location/protection.

☑ ☐ ☐ *EMERGENCY SPILLWAY PROFILE*

☑ ☐ ☐ Existing ground.

☑ ☐ ☐ Inlet, level (control) and outlet sections per SCS.

☑ ☐ ☐ Spillway and crest elevations.

where?

☑ ☐ ☐ *PRETREATMENT DEVICES* of adequate depth and properly designed using required pretreatment volumes for the selected County BMP facility type. Including, but not limited to: sediment forebays, sediment basins, sumps, grass channels, gravel diaphragms, plunge pools, chamber separators, manufactured systems or other acceptable methods.

Yes	No	N/A	
☑	☐	☐	*CONSTRUCTION SPECIFICATIONS and NOTES*
☑	☐	☐	Anticipated sequence of construction for BMP (consistent with erosion and sediment control plan).
☑	☐	☐	Provisions to control base stream or storm flow conditions encountered during construction.
☑	☐	☐	Site and subgrade preparation requirements.
☑	☐	☐	Embankment, fill and backfill material soil and placement (lift) thickness requirements.
☑	☐	☐	Compaction and soil moisture content requirements.
☑	☐	☐	Geosynthetics for drainage, filtration, moisture barrier, separation, and reinforcement purposes.
☐	☐	☒	Clay or synthetic (PVC or HDPE) pond liners.
☑	☐	☐	Storm drain, underdrain and pipe conduit requirements.
☑	☐	☐	Minimum depth of pipe cover for temporary (construction) and final cover conditions.
☑	☐	☐	Permanent shutoff valve and pond drain.
☑	☐	☐	Concrete requirements for structural components.
☑	☐	☐	Riprap and slope protection.
☑	☐	☐	Access or maintenance road surface, base, subbase.
☑	☐	☐	Temporary and permanent stabilization measures.
☑	☐	☐	Temporary or permanent safety fencing.
☑	☐	☐	BMP Landscaping (deep, shallow, fringe, perimeter,etc.)
☐	☐	☐	Dust and traffic control (if warranted).
☐	☐	☐	Construction monitoring and certification by professional.
☐	☐	☐	Other: _____
☐	☐	☐	Other: _____.
☑	☐	☐	*MAINTENANCE PROVISIONS*
☑	☐	☐	Entity responsible for maintenance identified..
☑	☐	☐	Maintenance Plan which outlines the long-term schedule for inspection/maintenance of the facility and forebays
☑	☐	☐	Maintenance access from public right-of-way or publicly traveled road.
☑	☐	☐	Maintenance easement provided encompassing high water pool and buffer, principal and emergency spillways, outlet structures, forebays, embankment area and possible sediment-removal stockpile areas.
☐	☐	☐	Minimum 6 foot wide public safety shelf (landing) or alternative fencing.

IV. *OUTLET PROTECTIONS:*

Yes	No	N/A	
☐	☐	☐	Sized for maximum design release (generally 10-year storm).
☐	☐	☐	Flared end section or endwall.
☐	☐	☐	Dimensions. MISSING FOR SEV OP's STILLING BASINS.
☐	☐	☐	Rock or riprap size, quantity and placement thickness.
☐	☐	☐	Slope at 0 percent (Level Grade).
☐	☐	☐	Geotextiles (nonwoven).
☐	☐	☐	Special energy dissipators are required for design discharge velocities that exceed eighteen (18) feet per second; or if use of standard outlet protection would result in velocities exceeding permissible channel velocities; or if space restricts or limits their use.

V. *ADDITIONAL COMMENTS OR INFORMATION SPECIFIC TO THE PLAN:*

Plan Preparer: Robert Warren

Date: 3/12/01

SWMProg/BMP/Checklist/ChkList

James City County, Virginia
Environmental Division
Stormwater Management Program

Stormwater Management Design Plan
Staff "Quick" Review

Plan No. SP - 81 - 99 Date/Time: 04/05/01 2:00pm
Project Name: Stonehouse Bent Tree, Section 5B, Phase 3 (35 LOTS)
Rough Location: 9000' NE OF INTX. I64 & US 30
ADC Map: Sheet 1 Grid: J - 2 ☒ First Review
Flood Map / Zone: 510201- 00 10B Zone: A & X, ☐ Review
Description: A (SFHA) N/O BFE's determined; X outside 500-YEAR.
Drainage Area: ☐ Onsite Only ☐ Offsite Only ☐ Combination of Both
Submitted:

Y	N		
☐	☒	Demolition Plan (if applicable)	Sheets:
☒	☐	Site, Geometric or Layout Plan	Sheets: 2, 3, 4, 5, 6, 7, 8, 9
☒	☐	Grading Plan	Sheets: 13, 14, 15
☒	☐	Storm Drainage Plan	Sheets: 12, 13, 14, 15
☒	☐	E&SC Plan	Sheets: 13, 14, 15, 16
☒	☐	Profiles (~~Storm~~) ROAD	Sheets: 10, 11,
☒	☐	Environmental Inventory	Sheets: 16
☒	☐	Note & Detail Sheets	Sheets: 17, 18, 19, 20
☒	☐	Drainage Map(s)	12
☒	☐	Soils Map	16
☒	☐	E&SC and SWM Design Plan Checklists.	
☐	☒	E&SC and/or Stormwater Management / Drainage Narratives.	
☒	☐	E&SC and/or Stormwater Management Design Report with Calculations (Attachment).	DRY POND
☐	☒	Geotechnical Report (Attachment).	
☐	☐	Waivers, Variances, or Exceptions (Attachments in Writing).	
		☐ VESCH ☒ CBP Ord (RPA, Steep Slope Policy) ☐ JCC BMP Manual	
☐	☐	Other (List):	

JCC GIS Database: Zoning: PUD - R Tax Parcel/GPIN: (6-4)(1-1)
Receiving Water: UT of Ware Creek Site Acreage: 35.07 acres / s.f.
Other Approvals (SUP, etc.):
Site Plan Information: Owner: Stonehouse Development Company LLC.
Zoning: PUD - R Description: Res Planned Unit Dev
Site Area: 35.07 acres / s.f
Disturbed Area: 9.39 (acres) / s.f. (26.78 %)
☒ Disturbance > 5 acres, VPDES Notice of Intent required.
Impervious Cover: ? acres / s.f. (. %)
☐ Less than or equal to 60 percent. Meets CBPO requirements.
☐ More than 60 percent. Does Not Meet CBPO requirements.
Open / Green Space: ? acres / s.f. (. %)

Site Development Plan:

☒ Residential, Lots, etc.	☐ Commercial (B / O / R)	☐ Govern./Institutional	☐ Industrial
☒ Roadways or Entrances	☐ Parking or Loading	☒ Water	☐ Sanitary Sewer
☐ Landscaping	☒ SWM/BMP facilities	☒ Manmade Drainage	☐ Parks, Amenities
☐ Pump/Lift Station	☐ Dams (regulated)	☐ Other,	

Site Improvements: 35 LOTS; AVG SIZE 0.79AC; 1 LOT PER AC. DENSITY

Soils Information: Site: 11C, 14B, 15F, 17, 19B, 25B Hydric: ☑ Yes ☐ No 17
Soil Survey Sheet DA: SAME HSG: _____
_____ BMP: 15F Hydric: ☐ Yes ☐ No
Description of Soils at BMP: 15F

BMP Control: ☐ None ☐ Onsite ☐ Offsite ☐ Previously Approved ☐ Manufactured BMP
BMP Types: 1- Name: DRY EXT DET (JCC BMP Type F - 2), Points 4 BMP 5.4
2- Name: _____ (JCC BMP Type _____ - _____), Points _____
3- Name: _____ (JCC BMP Type _____ - _____), Points _____

Onsite Drainage: ☒ Reinforced Concrete Pipe ☐ Corrugated Metal Pipe ☐ Aluminum Type Pipe
☐ Corrugated Polyethylene Pipe ☐ PVC Type Pipe ☒ Open Channel Type
☐ Storm Drain ☐ Culverts Type: P6-2A, RCP
☐ Inlets ☐ Other (Specify): _____

1. VDOT Standards & Specifications Referenced for work **within** R/W: ☑ Yes ☐ No
2. VDOT Standards & Specifications Referenced for work **outside** R/W: ☑ Yes ☐ No

Site Limitations: ☑ RPA ☐ RMA ☑ Steep Slopes ☑ Delineated Wetlands
☑ Hydric Soils ☐ Critical Soils ☑ Vegetated ☐ Buffers: _____
☑ Defined Natural Drainage Features onsite ☐ Downstream Storm/Culv.
☐ Evidence of Downstream Channel Erosion (by Field Observation) _____
☑ Floodplain ☐ Problem Drainage Area ☐ Stormwater Hotspot
☐ Site Activities may warrant a General VPDES Permit for Discharge of Stormwater Associated with Industrial Activities (ie. process water, batch plants, etc.).
☐ Other (Specify): _____

Site Stormwater Management / BMP Control (Add sheets if necessary for Multiple Onsite Facilities): SCS METHOD

☐ Yes ☐ No	# BMP 5.4					
Predev (Present)	DA = 12.19 ac.	C/CN = 72	Tc = 37	min / hrs.		
2-year	10.06	cfs				41,037 CF
10-year	27.10	cfs				
100-year	45.38	cfs				
PostDev w/o Detention (Inflow)	DA = 11.05 ac.	C/CN = 75	Tc = 20	min / hrs.		
1-year	9.98					
2-year	16.19	cfs				
10-year	39.92	cfs				
100-year	~~46.52~~ 64.49	cfs				
PostDev with Detention (Routed)	DA = 11.05 ac.	C/CN = 75	Tc = 20	min / hrs.		
2-year	1.02	cfs	at El.	42.07		52,217 CF
10-year	27.47	cfs	at El.	43.68		
100-year (DHW)	59.86	cfs	at El.	44.16		

25-YR 31.95 CFS

25-YEAR 46.52 CFS

1-YR 0.90 CFS @ EL 40.38

Downstream Tailwater Assumption for Pond Routing: 34.50 (4.1' Depth)
Routed Peak Discharges (Outflows) from BMP meet Predevelopment Allowables: ☑ Yes ☐ No
Appears to Meet VESCH / E&SC Ordinance / CBP Ordinance Requirements: ☑ Yes ☐ No

1-YR, 24 CONTROL Provided.

Pond / BMP Design Data (Add Sheet If Necessary for Multiple Onsite Facilities): ☐ Check if None ☑ Provided: BMP # 5.4 Type: EXT DRY DET

Y N * See Below for Pertinent WQv /Stream CPv Design Information.

Y	N				
☑	☐	Top of Facility (Dam Crest)	El. 46.0		
☑	☐	Design High Water (100-year)	El. 44.16		
☑	☐	Emergency Spillway (ES) Crest	El. 44.5	BW:	SS:
☑	☐	FreeBoard	1.84	1 ft. or > with Emerg. Spillway.	
		☑ Acceptable ☐ Not Acceptable.		2 ft. or > w/o Emerg. Spillway.	
☑	☐	Principal Spillway (Riser) Crest	El. 43.0	Size/Type:	
☑	☐	Principal Spillway Crest 1 ft. below Crest of Emergency Spillway.		☑ Yes ☐ No ☐ N/A	
☑	☐	Stage-Storage Curve or Data			
☑	☐	Outlet Rating Curve or Table (Composite Structure)			
☑	☐	1-year design storm	El. 40.6	or Volume 33,394 CF	
☑	☐	1-year, 24 hour detention criteria for Stream Channel Protection.		☑ Yes ☐ No ☐ N/A	
☐	☑	Extended Detention for WQ Provided (Min. 24 hours)		☐ Yes ☑ No ☐ N/A	
☐	☑	Normal/Permanent Pool	El. ~~40.0~~ N/A	☐ N/A	
☑	☐	Orifice/Weir #1 (Highest El.)	El. 44.5	Type: ES 6' WIDE, GRASS; 3H:1V	
☑	☐	Orifice/Weir #2	El. 43.0	Type: TOP 60" RCP RISER	
☑	☐	Orifice/Weir #3	El. 34.5	Type: 4" BMP ORIF.	
☐	☐	Orifice/Weir #4	El.	Type:	
☐	☐	Orifice/Weir #5 (Lowest El.)	El.	Type:	
☑	☐	Low Flow Orifice (ExDet, CPv)	El. 34.5	Type: 4" BMP ORIF	
☑	☐	Pond Drain w/ Valve (24 hr.)	El.	Type: PVC GV Provided, not req'd.	
☑	☐	Pond Bottom (Positive Drain)	El. 34.5	Riser Height: 11'	
☑	☐	Steps or Access Provided (for over 4 ft. depth)		☐ N/A	
☑	☐	Riser Base EXT MH BASE	Bottom El. 32	Type: 43-32	
☑	☐	Core Trench	☐ N/A		
☑	☐	Anti-Seep Collars or other Acceptable Seepage Control Method.		☐ N/A ROYL Filter & ASC.	
☑	☐	Principal Spillway-AntiVortex/Trash Rack Device		Type: 72" CONC. CAP.	
☑	☐	Low Flow Orifice Trash Rack. EW-		Type: EW-11 TYPE, 4" ORIF	
☑	☐	Outlet Barrel: Type/Class: III		Size: 30"	
		Inv. U/S: 32.0		Inv D/S: 30.4	
		Slope: 2.00%		Length: 80 (ft.)	
☑	☐	Flared End Section/Wingwalls. Matches Outlet Barrel material type, over 48 inch with fence. EW-1			
☑	☐	Outlet Protection.			
		☐ Standard Riprap Outlet Protection (OP)		Type:	
		☑ Special Dissipator Structure (SDS)		Type: STILLING BASIN (L & W ?)	
☑	☐	BMP Sediment Cleanout Elevation		El. 355 or Depth 1'-0"	
☐	☐	Adequate Channel Downstream of BMP:		☑ 1-year, 24-hour; or ☐ MS # 19 criteria.	

Sketch or Notes, If Necessary:

TYPICAL RISER/BARREL CONFIG.

* WQv / Stream CPv Design Summary	
Imperv. Area	?
WQTV (Per JCC Man)	1.0 inch per imperv acre
WQ Vol. Required	?
WQ Vol. Provided	?
1-yr SCPv Required	33,394 CF
1-yr SCPv Provided	
Ext Det Orifice Size	4-inch

Sediment Trap & Basins

☐ Temporary Sediment Trap # 1 _____ DA = _____ < 3 acres

☐ Temporary Sediment Trap # 2 _____ DA = _____ < 3 acres

☐ Temporary Sediment Basin # 1 _____ DA = _____ ☐ BMP # ____ convert.

☐ Temporary Sediment Basin # 2 _____ DA = _____ ☐ BMP # ____ convert.

E&SC Plan Comments: _____

Plan Review Steps & Components:

Y	N	
☒	☐	First "Look-Thru". Quick look through plan for familiarity and completeness.
☐	☒	Miss Utility (1-800-552-7001) and/or standard utility protection notes.
☐	☒	Worksheet for BMP Point System. New Plan 10 point system or Redevelopment Pollutant Load method.
☐	☒	FEMA Special Flood Hazard Areas. Check against property, site and/or development.
☒	☐	Check JCC Tax Parcel Maps for RPA / RMA locations and parcel identification.
☒	☐	Stormwater hotspot, general layout or separation distances (if any) satisfactory.
☒	☐	Environmental Inventory for Chesapeake Bay Ordinance requirements satisfactory.
☒	☐	Highlight and check impact to environmental sensitive areas (wetlands, RPA, steep slope,etc.).
☐	☒	Demolition plan (if any) or offsite borrow, waste areas and onsite stockpiles.
☒	☐	Review existing topography to determine adequacy of E&SC plan (Phase I).
☒	☐	Standard JCC Erosion & Sediment Control Notes on plan.
☒	☐	Virginia E&SC Regulations. Minimum Standards # 1 thru # 19 appear satisfied.
☒	☐	Review grading plan for conflicts (offsite grading, excessive cut-fill slopes, etc.) & Phase II E&SC.
☒	☐	Review layout plan to check for conflicts (utilities, buildings, parking, buffers, etc.).
☒	☐	Highlight Culverts and Storm drains. Check pipe data, thickness and cover/utility conflicts.
☒	☐	Proper Culvert, Stormdrain and Channel specifications, notes and details or reference to VDOT.
☐	☒	Proper Outlet Protection details and computations.
☒	☐	Review Sequence of Construction (for E&SC and SWM/BMP applicability to site and utility work).
☒	☐	Review plan based on Chapter 19 Subdivision ordinance as it relates to SWM/BMP control.
☒	☐	Review plan based on Chapter 24 Zoning as it relates to SWM/BMP control.
☒	☐	Review plan based on Chapter 23 Chesapeake Bay ordinance requirements.
☒	☐	Review plan based on General Knowledge and Experience for Design/Construction.
☒	☐	Review plan based on JCC BMP manual for the BMP type selected for project.
☐	☒	Review plan based on JCC Stormwater Conveyance System D/C Guidelines.
☒	☐	Review plan based on Virginia Erosion and Sediment Control Handbook (VESCH).
☒	☐	Review plan based on Virginia Stormwater Management Handbook (VSMH) for BMP type.
☐	☒	Review plan based on Hampton Roads BMP Design Guidance manual (***Optional***).
☐	☒	Review plan based on MWCOG, Controlling Urban Runoff BMP manual (***Optional***).
☒	☐	Review plan based on standard JCC E&SC and SWM Design Plan Checklists.
☒	☐	Review for BMP Buffer, Setback, and Maintenance Access Requirements.
☐	☒	Review BMP Benching (aquatic, safety) & Landscaping (deep pool, shallow water, shoreline fringes, etc.). DRY POND.
☒	☐	Review Maintenance Plan for SWM / BMP facility. Detailed and specific guidance for long-term.
☐	☒	Review E&SC Plan Design Report and computations (Attached report). NONE ON TSB's
☒	☐	Review SWM Design Report and computations (Attached Report).
☐	☒	Adequate Channels downstream of both uncontrolled or SWM/BMP areas. (MS # 19 or 1-year criteria). NONE.
☐	☒	Adequate function, conversion of Temp Sed Basin to BMP mode. BMP #5.4
☐	☒	Geotechnical. Information per App. E JCC BMP manual or to substantiate use of other BMPs.
☒	☐	Provisions on plan requiring proper Record Drawing and Const. Cert of facility.
☒	☐	Drainage, Maintenance and Open Space Easements (if provided) appear satisfactory.
☐	☒	Wetland Permit required prior to Land Disturbance Permit issuance or Final Approval.
☐	☐	Inclusion of H&H and SWM / BMP data into any JCC databases.
☐	☐	Other: _____

Prepared Environmental Division comments for the following categories based on above review areas:

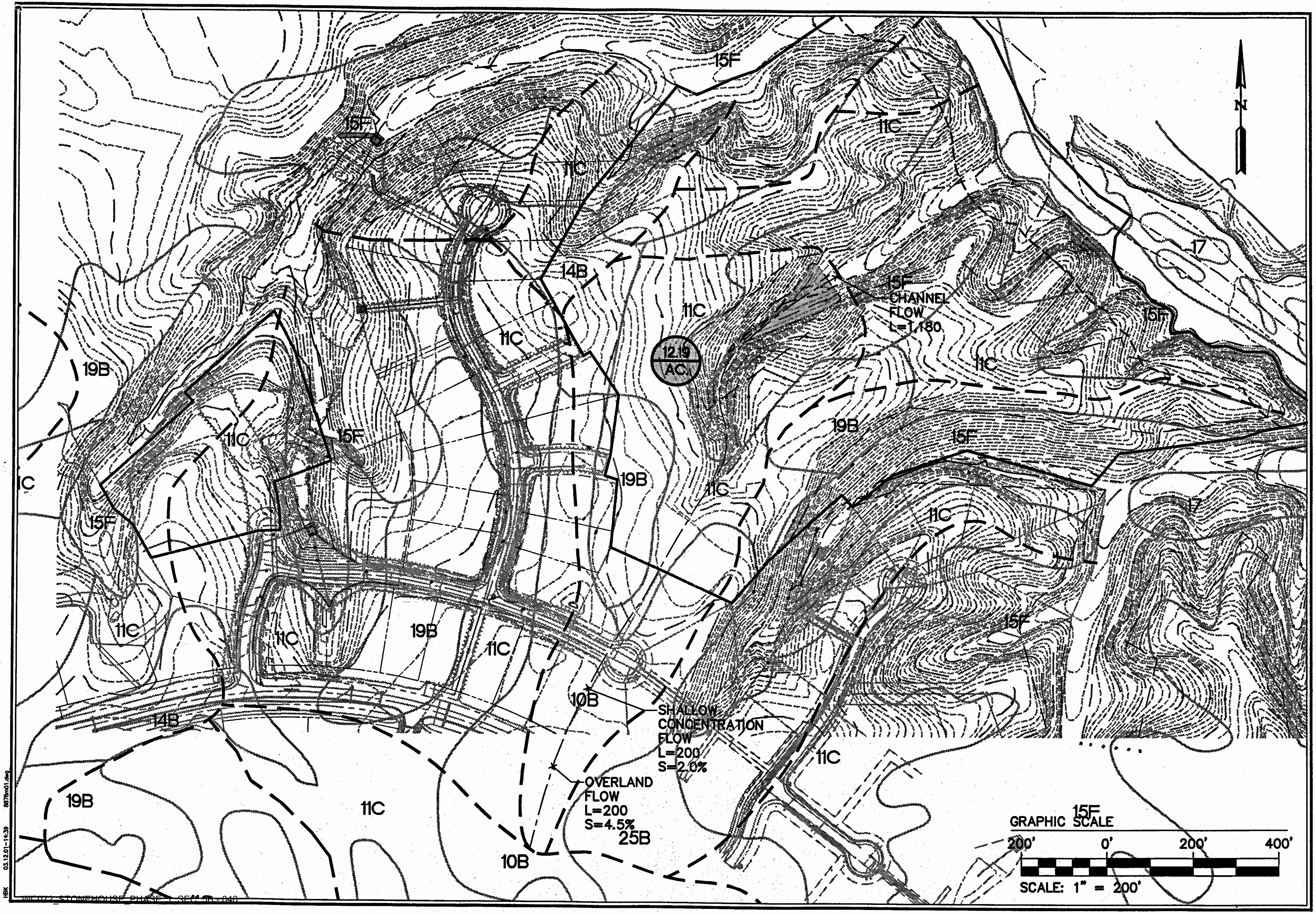
☒ ☐	***General Comments:***	☒ ☐	***Erosion & Sediment Control Plan:***
☒ ☐	***Floodplain:***	☒ ☐	***Chesapeake Bay Preservation:***
☒ ☐	***Stormwater Management / Drainage:***	☐ ☐	***Other:***

Additional Notes & Comments: _____

(Note: THIS FORM FOR COUNTY USE ONLY.)

☒ 1st Rev ☐ 2nd Rev ☐ 3rd Rev

Signature	Date: 04-10-01 10:00 AM
Signature	Date
Signature	Date



REVISION / COMMENT / NOTE | BY | No. | DATE

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

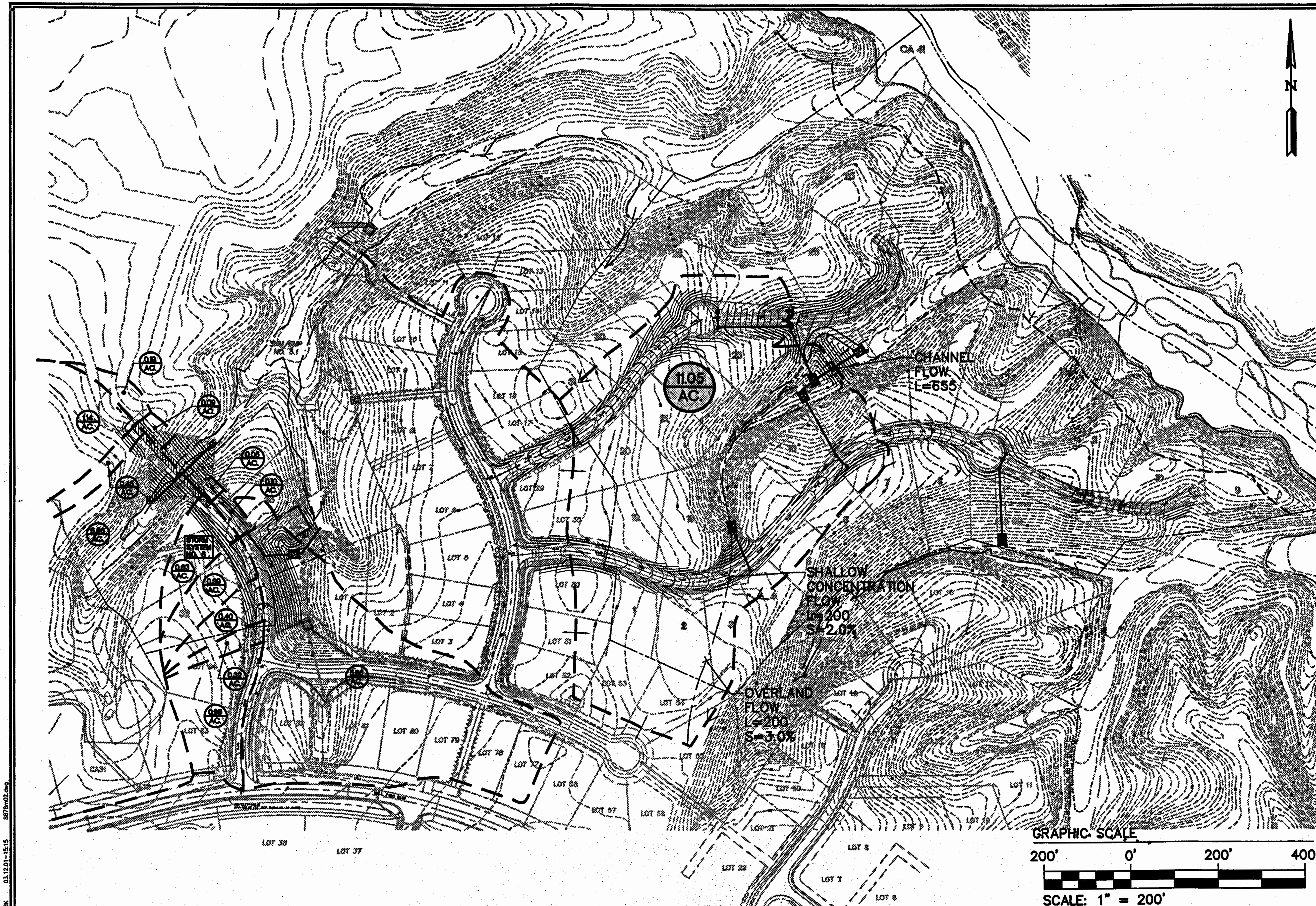
AES CONSULTING ENGINEERS

PRE DRAINAGE AREAS
SECTION V-B "BENT TREE" - PHASE 3 AT STONEHOUSE

STONEHOUSE DISTRICT JAMES CITY COUNTY VIRGINIA

Designed	Drawn
RGW	HBK
Scale	Date
1"=200'	3/2/01
Project No.	
8678-00	
Drawing No.	
1 OF 2	

HBK 03.12.01-14:39 8678m01.dwg



POST DRAINAGE AREAS
SECTION V-B "BENT TREE" - PHASE 3
AT STONEHOUSE

STONEHOUSE DISTRICT JAMES CITY COUNTY VIRGINIA

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

No.	DATE	REVISION / COMMENT / NOTE	BY

Designed	Drawn
RSW	HBK
Scale	Date
1"=200'	3/2/01
Project No.	
8878-00	
Drawing No.	
2 OF 2	

HBK 03.12.01-15:15 8878m02.dwg

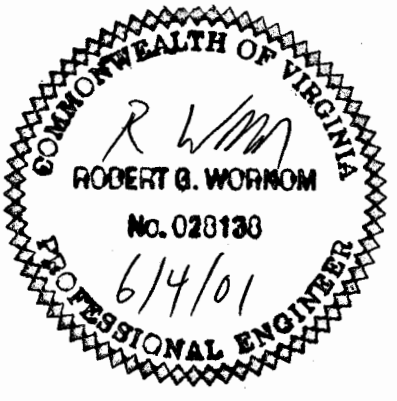
STONEHOUSE
AREA 1, PHASE 1
BENT TREE, SECT. V-B
PHASE 3

FOR
STONEHOUSE DEVELOPMENT COMPANY, LLC.

PROJECT NUMBER: 8878-00

STORMWATER MANAGEMENT/BMP #5.4

JUNE 4, 2001 (REVISED)



CONSULTING ENGINEERS

AES Consulting Engineers
5248 Olde Towne Road. Suite 1
Williamsburg, VA 23188
(757) 253-0040 Fax: (757) 220-8994
http://www.aesva.com

STREAM CHANNEL PROTECTION CALCULATIONS
for
STONEHOUSE Ph 1, Bent Tree (Sect. V-B) Ph3
AES Project No.: 8878-00

PROPOSED POND VOLUME

Eleva	Depth	Area (sq. ft.)	Incremental Volume (cu. ft.)	Sum Volume (cu. ft.)	Sum Volume (cu. yd.)	Volume Above NPE
34.5	0.0	0	0	0	0	
36.0	1.5	809	607	607	22	
38.0	2.0	2,568	3,377	3,984	148	
40.0	2.0	5,150	7,718	11,702	433	
42.0	2.0	8,390	13,540	25,242	935	
43.0	1.0	10,281	9,336	34,577	1,281	
44.0	1.0	12,172	11,227	45,804	1,696	
44.5	0.5	12,915	6,272	52,076	1,929	
45.0	0.5	13,659	6,644	58,719	2,175	
46.0	1.0	15,146	14,403	73,122	2,708	

RELEASE RATE REQUIRED TO DETAINED VOLUME FOR 24 HOURS

Required Volume based upon 1-Year, 24-Hour Storm Hydrograph = 33,394 cubic feet

SCS OR RAT STORM? SCP - SCS METHOD.

Elevation of water surface associated with required volume = 43.0

Elevation of Low Flow Orifice = 34.5 ✓

Average Head, in feet = 4.3

Average Release Rate Calculation $\frac{33{,}394 \text{ cubic feet}}{(24 \text{ hours} \times 60 \text{ minutes/hour} \times 60 \text{ seconds/ minute})} =$ 0.4 cfs

LOW FLOW ORIFICE DIAMETER REQUIRED TO MAINTAIN AVERAGE RELEASE RATE

Diameter of Low Flow Orifice = 2 * (Q / ((64.32 * (h / 2)) ^ (1/2) * 0.6 * 3.14))) ^ (1/2)

where, Q equals average release rate (cfs), h equals average head (feet)

Diameter of Low Flow Orifice = 0.30 feet, or 4 inches

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Return period (yrs)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	7.0	2	736	37,219	2	—	———	———	Pre 2-yr
2	SCS Runoff	22.4	2	736	104,210	10	—	———	———	Pre 10-yr
3	SCS Runoff	39.6	2	736	180,441	100	—	———	———	Pre 100-yr
5	SCS Runoff	7.7	2	732	33,545	1	—	———	———	Post 1-yr
6	SCS Runoff	12.6	2	732	52,453	2	—	———	———	Post 2-yr
7	SCS Runoff	31.3	2	730	125,405	10	—	———	———	Post 10-yr
8	SCS Runoff	50.8	2	730	203,144	100	—	———	———	Post 100-yr
10	Reservoir	1.0	2	804	33,545	1	5	40.30	13,705	1-yr Routed
11	Reservoir	1.1	2	834	52,453	2	6	41.99	25,183	2-yr Routed
12	Reservoir	21.9	2	744	125,405	10	7	43.67	42,103	10-yr Routed
13	Reservoir	46.9	2	736	203,144	100	8	44.15	47,689	100-yr Routed

Proj. file: 887854.gpw | IDF file: Jcc.IDF | Run date: 06-14-2001

Hydrograph Plot

English

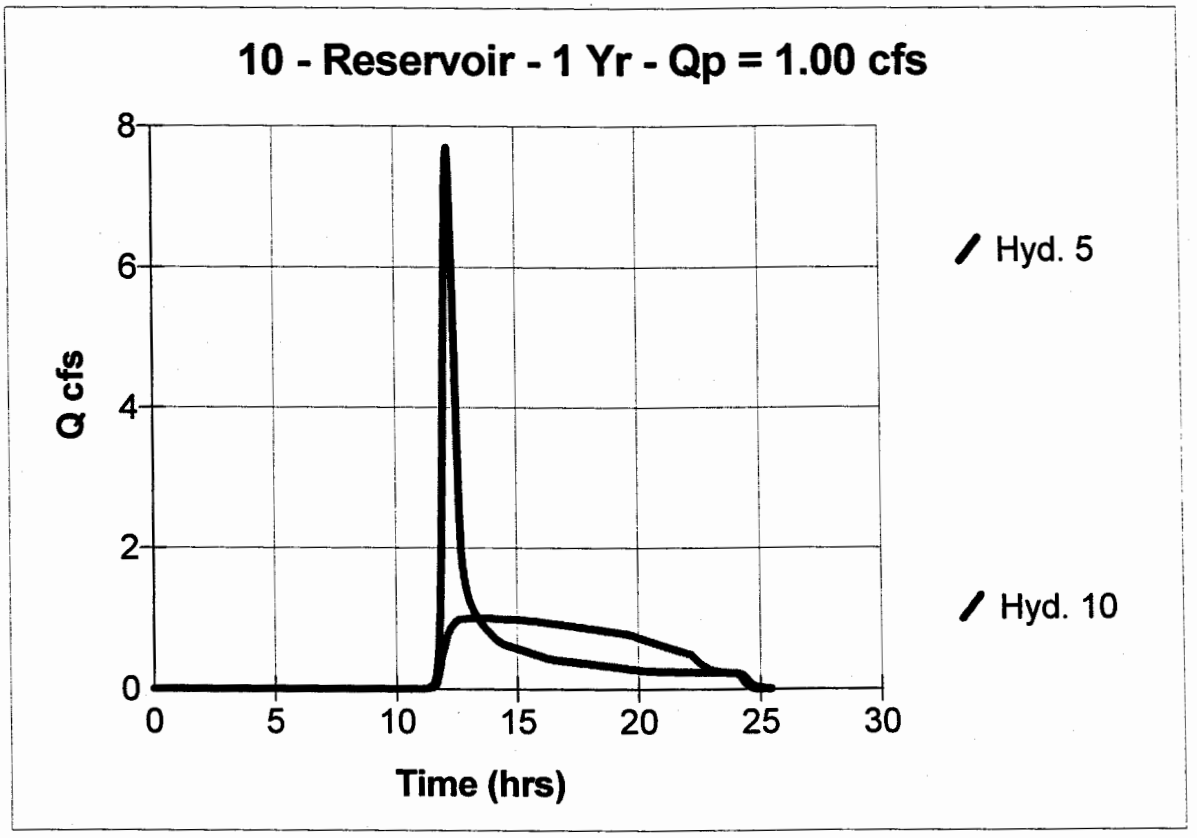
Hyd. No. 10

1-yr Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.00 cfs
Storm frequency	= 1 yrs	Time interval	= 2 min
Inflow hyd. No.	= 5	Reservoir name	= BMP 5.4
Max. Elevation	= 40.30 ft	Max. Storage	= 13,705 cuft

Storage Indication method used.

Total Volume = 33,545 cuft



1-yr Routed

Hydrograph Plot

English

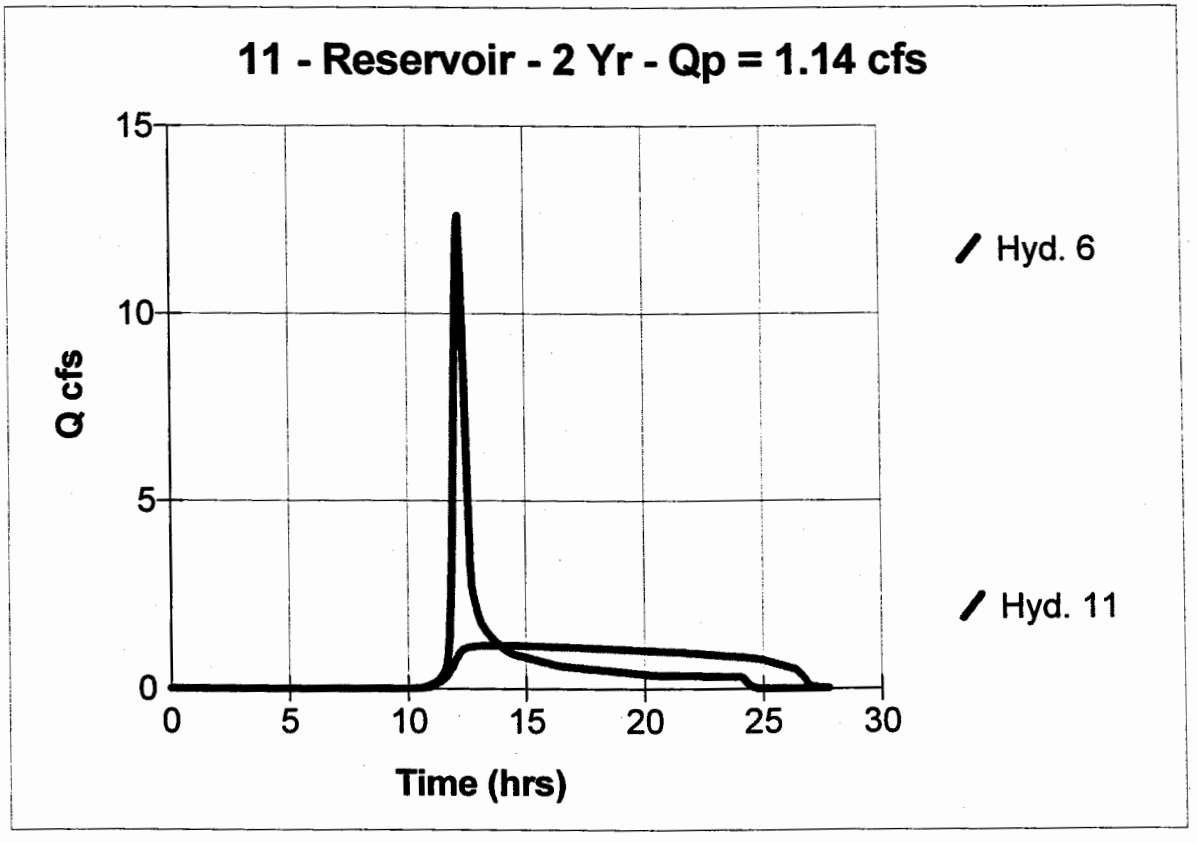
Hyd. No. 11

2-yr Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.14 cfs
Storm frequency	= 2 yrs	Time interval	= 2 min
Inflow hyd. No.	= 6	Reservoir name	= BMP 5.4
Max. Elevation	= 41.99 ft	Max. Storage	= 25,183 cuft

Storage Indication method used.

Total Volume = 52,453 cuft



2-yr Routed

Hydrograph Plot

English

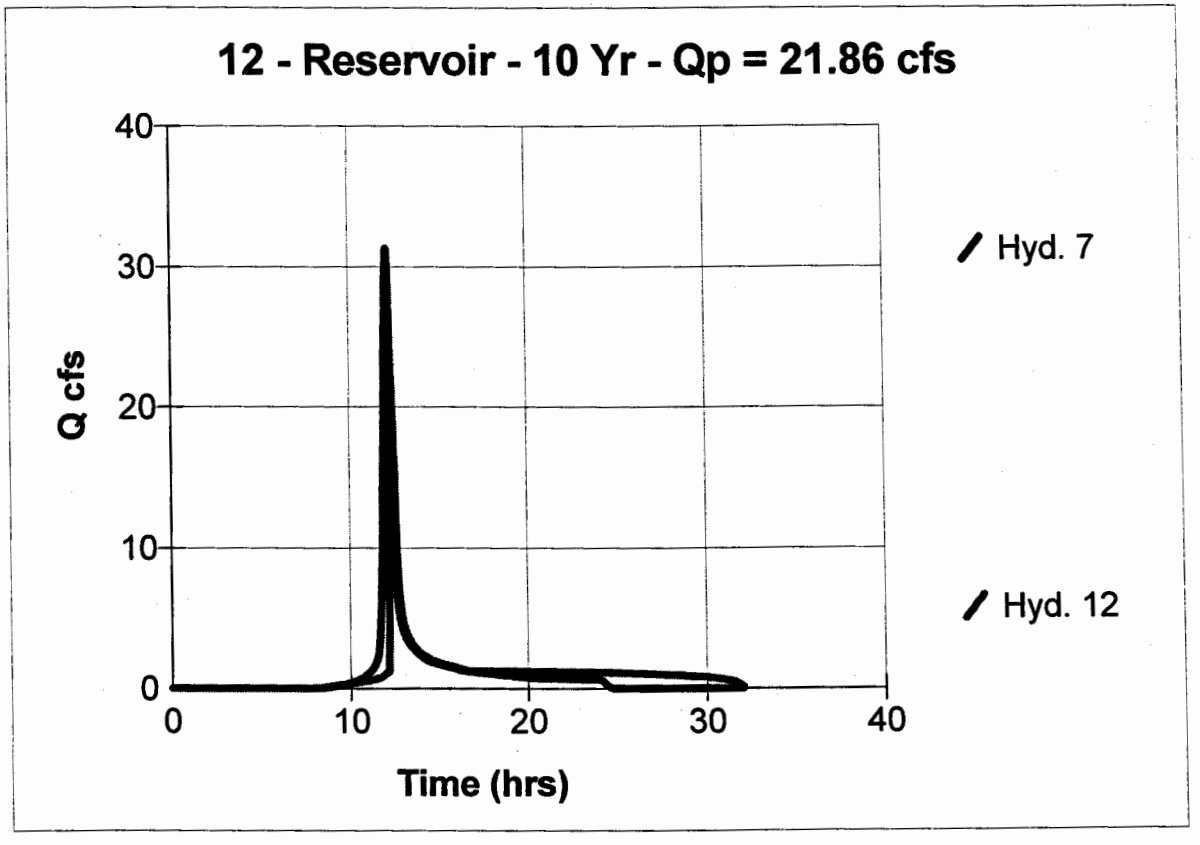
Hyd. No. 12

10-yr Routed

Hydrograph type	= Reservoir	Peak discharge	= 21.86 cfs
Storm frequency	= 10 yrs	Time interval	= 2 min
Inflow hyd. No.	= 7	Reservoir name	= BMP 5.4
Max. Elevation	= 43.67 ft	Max. Storage	= 42,103 cuft

Storage Indication method used.

Total Volume = 125,405 cuft



10-yr Routed

Hydrograph Plot

English

Hyd. No. 13

100-yr Routed

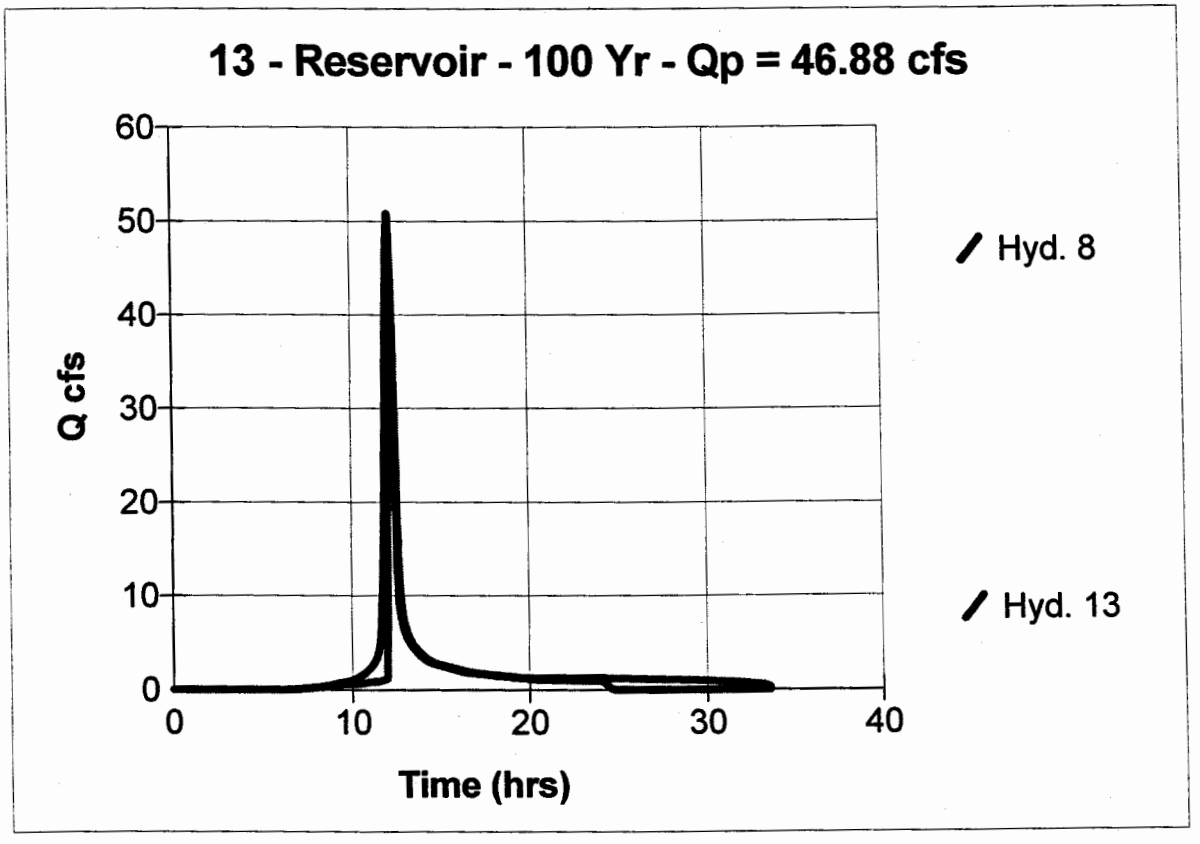
Hydrograph type	=	Reservoir	Peak discharge	=	46.88 cfs
Storm frequency	=	100 yrs	Time interval	=	2 min
Inflow hyd. No.	=	8	Reservoir name	=	BMP 5.4
Max. Elevation	=	44.15 ft	Max. Storage	=	47,689 cuft

DHW

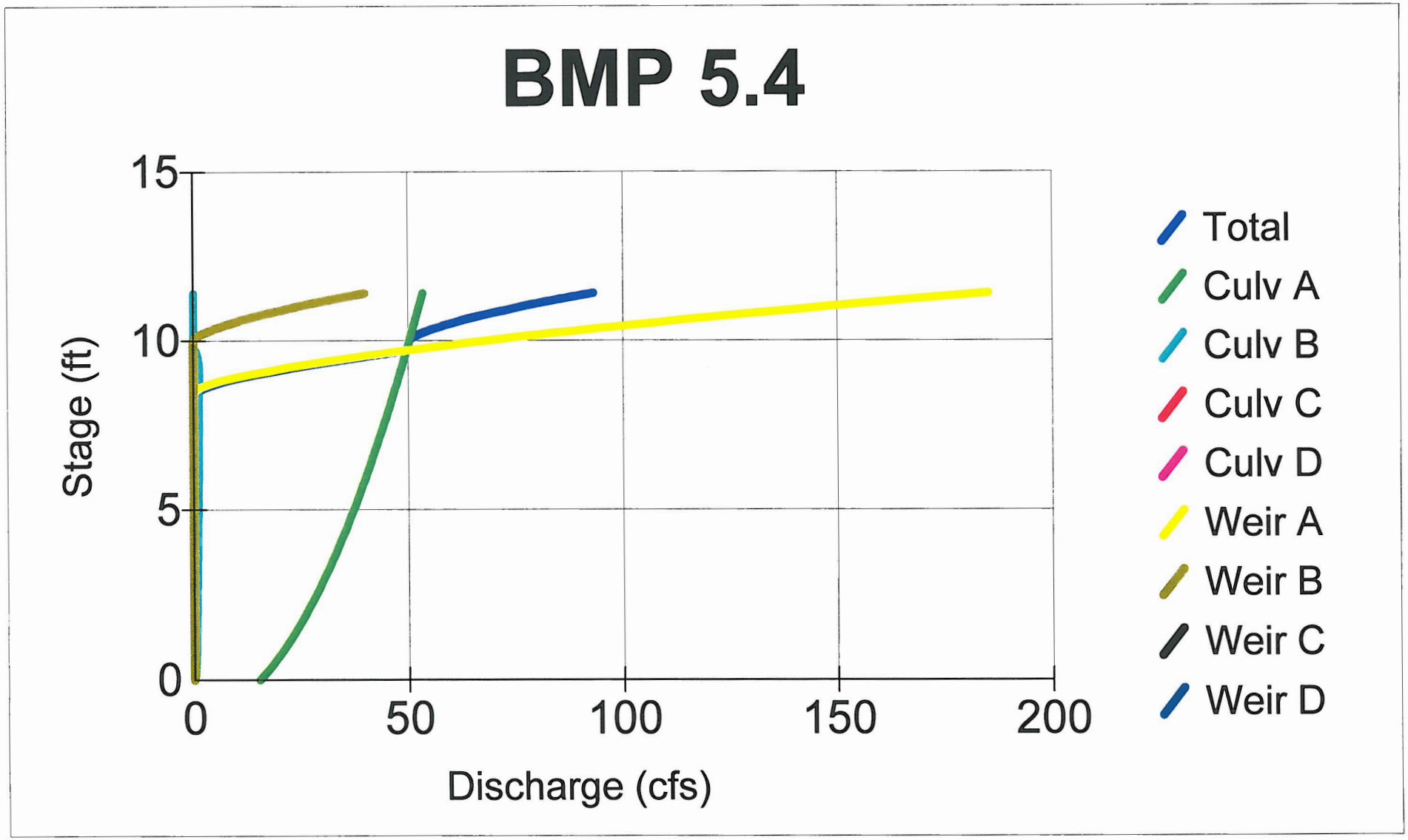
DHW

Storage Indication method used.

Total Volume = 203,144 cuft



100-YEAR ROUTED


BMP 5.4
15
10
5
0
Stage (ft)
0
50
100
150
200
Discharge (cfs)
Total
Culv A
Culv B
Culv C
Culv D
Weir A
Weir B
Weir C
Weir D

Reservoir Report

English

Reservoir No. 1 - BMP 5.4

Pond Data

Pond storage is based on known contour areas

Stage / Storage Table

Stage ft	Elevation ft	Contour area sqft	Incr. Storage cuft	Total storage cuft
0.00	34.50	00	0	0
1.50	36.00	809	607	607
3.50	38.00	2,568	3,377	3,984
5.50	40.00	5,150	7,718	11,702
7.50	42.00	8,390	13,540	25,242
8.50	43.00	10,281	9,336	34,578
9.50	44.00	12,172	11,227	45,805
10.00	44.50	12,915	6,272	52,077
10.50	45.00	13,659	6,644	58,721
11.50	46.00	15,146	14,403	73,124

Culvert / Orifice Structures

	[A] BARREL	[B] BMP ORIF	[C]	[D]
Rise in	= 24.0 ✓	4.0 ✓	0.0	0.0
Span in	= 24.0 ✓	4.0 ✓	0.0	0.0
No. Barrels	= 1	1 ✓	0	0
Invert El. ft	= 32.50 ✓	34.50	0.00	0.00
Length ft	= 70.0 ✓	6.0 ✓	0.0	0.0
Slope %	= 3.00 ✓	5.00	0.00	0.00
N-Value	= .013	.013 ✓	.000	.000
Orif. Coeff.	= 0.60 ✓	0.60	0.00	0.00
Multi-Stage	= -----	Yes	No	No

Weir Structures

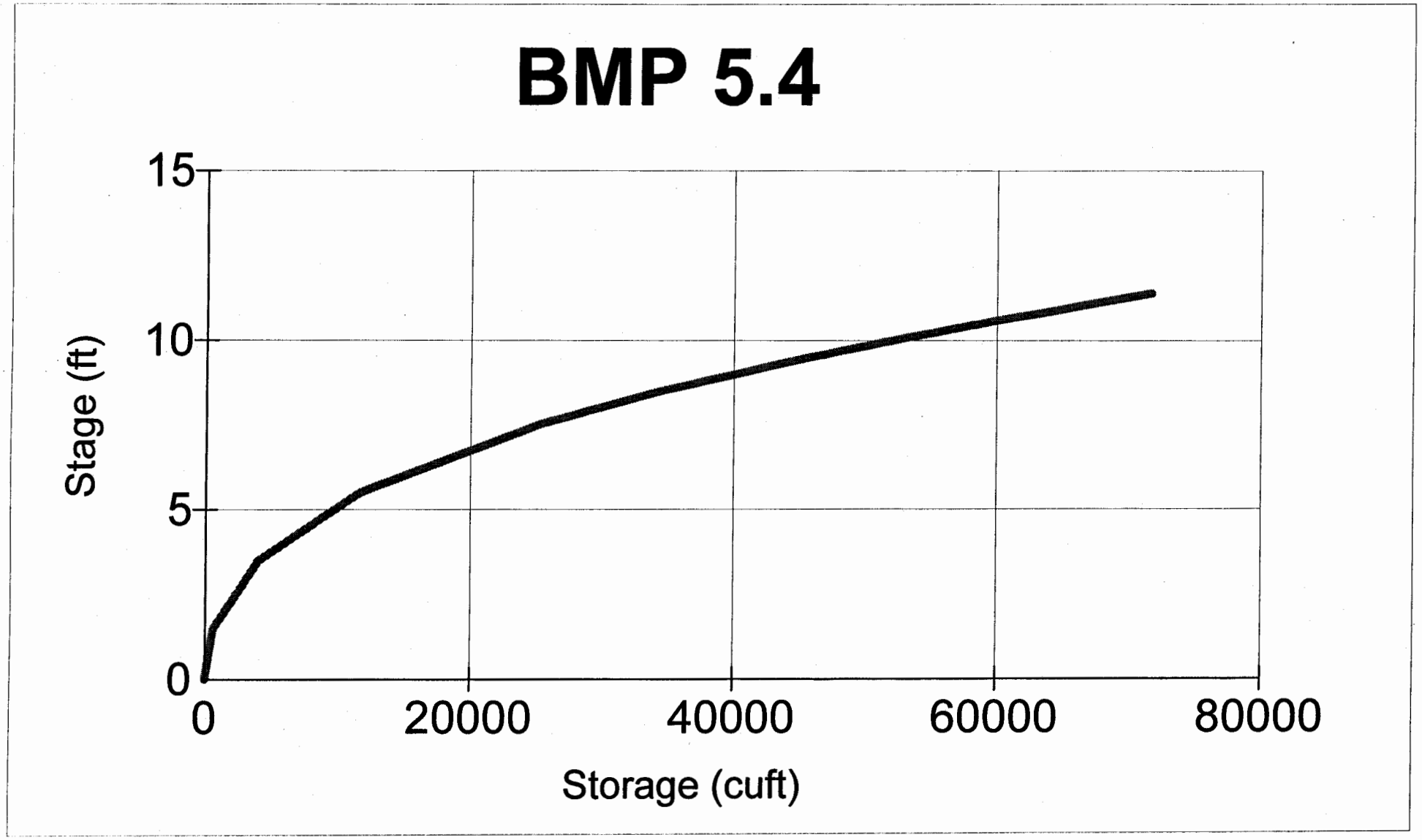
	[A] RISER	[B] EM. SPILL	[C]	[D]
Crest Len ft	= 12.5 ✓	8.0 ✓	0.0	0.0
Crest El. ft	= 43.00 ✓	44.50	0.00	0.00
Weir Coeff.	= 3.00 ✓	3.00	0.00	0.00
Eqn. Exp.	= 1.50	1.50	0.00	0.00
Multi-Stage	= Yes	No	No	No

Tailwater Elevation = 32.00 ft (1.6')

Note: All 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	Discharge cfs
0.00	0	34.50	15.12	0.00	---	---	0.00	0.00	---	---	0.00
1.50	607	36.00	23.91	0.49	---	---	0.00	0.00	---	---	0.49
3.50	3,984	38.00	32.08	0.77	---	---	0.00	0.00	---	---	0.77
5.50	11,702	40.00	38.56	0.97	---	---	0.00	0.00	---	---	0.97
7.50	25,242	42.00	44.10	1.14	---	---	0.00	0.00	---	---	1.14
8.50	34,578	43.00	46.62	1.21	---	---	0.00	0.00	---	---	1.21
9.50	45,805	44.00	49.01	1.00	---	---	37.50	0.00	---	---	38.50
10.00	52,077	44.50	50.16	0.00	---	---	68.89	0.00	---	---	50.16
10.50	58,721	45.00	51.29	0.00	---	---	106.07	8.49	---	---	59.78
11.50	73,124	46.00	53.47	0.00	---	---	194.86	44.09	---	---	97.57


BMP 5.4
15
10
5
0
Stage (ft)
0
20000
40000
60000
80000
Storage (cuft)

15F
11C
14B
19B
17
25B
10B

A CHANNEL FLOW L=1,180

12.19 AC.

B SHALLOW CONCENTRATION FLOW L=200 S=2.0%

C OVERLAND FLOW L=200 S=4.5%

D

GRAPHIC SCALE
200' 0' 200' 400'
SCALE 1" = 200'

N

No.	DATE	REVISION / COMMENT / NOTE	BY

5348 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994
CONSULTING ENGINEERS

PRE DRAINAGE AREAS
SECTION V-B "BENT TREE" - PHASE 3
AT STONEHOUSE
STONEHOUSE DISTRICT JAMES CITY COUNTY VIRGINIA

Designed	Drawn
RSW	HBK
Scale	Date
1"=200'	3/2/01
Project No.	
8678-00	
Drawing No.	

S/8878/00-B13/DESIGN/POND-E&S/PRE-DEV.DWG
HBK 06:14:01-11:17 pre-dev.dwg
WC072_STONEHOUSE_PHASE_4_SEC_5B_DEV

SCS HYDROGRAPH GENERATION
for
STONEHOUSE Ph1, Bent Tree (Sect. V-B) Ph 3
AES Project No.: 8878-00
June 14, 2001

PRE-DEVELOPMENT CONDITIONS TO POINT OF CONCERN

A. Pre-Development Drainage Area to Point of Concern = 12.2 Acres

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

	Soil Type	Hydrologic Group Appendix 4A*	Land Use	Area Acres	CN Table 4-6*	Adjusted CN
1)	10-B Craven Fine Sandy Loam	C	Wooded	3.6	70	253
2)	11-C Craven-Uchee	C	Wooded	3.1	70	214
3)	14-B Emporia Fine Sandy Loam	C	Wooded	0.8	70	54
3)	15-F Emporia Complex	C	Wooded	2.6	70	185
4)	19-B Kempsville-Emporia Fine Sandy Loam	B	Wooded	2.1	55	116
5)						
	Totals =			12.2		822
	Composite CN =					67

C. Pre-Development Time of Concentration Calculations

1)	Overland Flow	Segment C-D	
	Surface description		Woods - Light Underbrush
	Manning's roughness coefficient., n (Table 4-9a*)		0.40
	Length of overland flow, L		200 Feet
	2-year 24-hour rainfall, P2 (Appendix 4B*)		3.5 inches
	Average slope of overland flow , s		0.045 feet per foot
	Travel time, Tt = (0.007*(n*L)^0.8)/(P2^0.5*s^0.4)		0.43 hours
2)	Shallow concentrated flow	Segment B-C	
	Surface description, paved or unpaved		unpaved
	Length of shallow concentrated flow, L		200 Feet
	Average slope of shallow concentrated flow, s		0.02 feet per foot
	Average velocity, v		1.0 feet per second
	Travel time, Tt = L/(3600*v)		0.06 hours
3)	Channel or Pipe Flow	Segment A-B	
	Length of channel flow, L		1180 Feet
	Average velocity of channel flow, v		2.5 feet per second
	Travel time, Tt = L/(3600*v)		0.13 hours
	Total Time of Concentration =		0.62 hours
		or	37 minutes

*Va. SWM Handbook (DCR, DSWC)

Hydrograph Plot

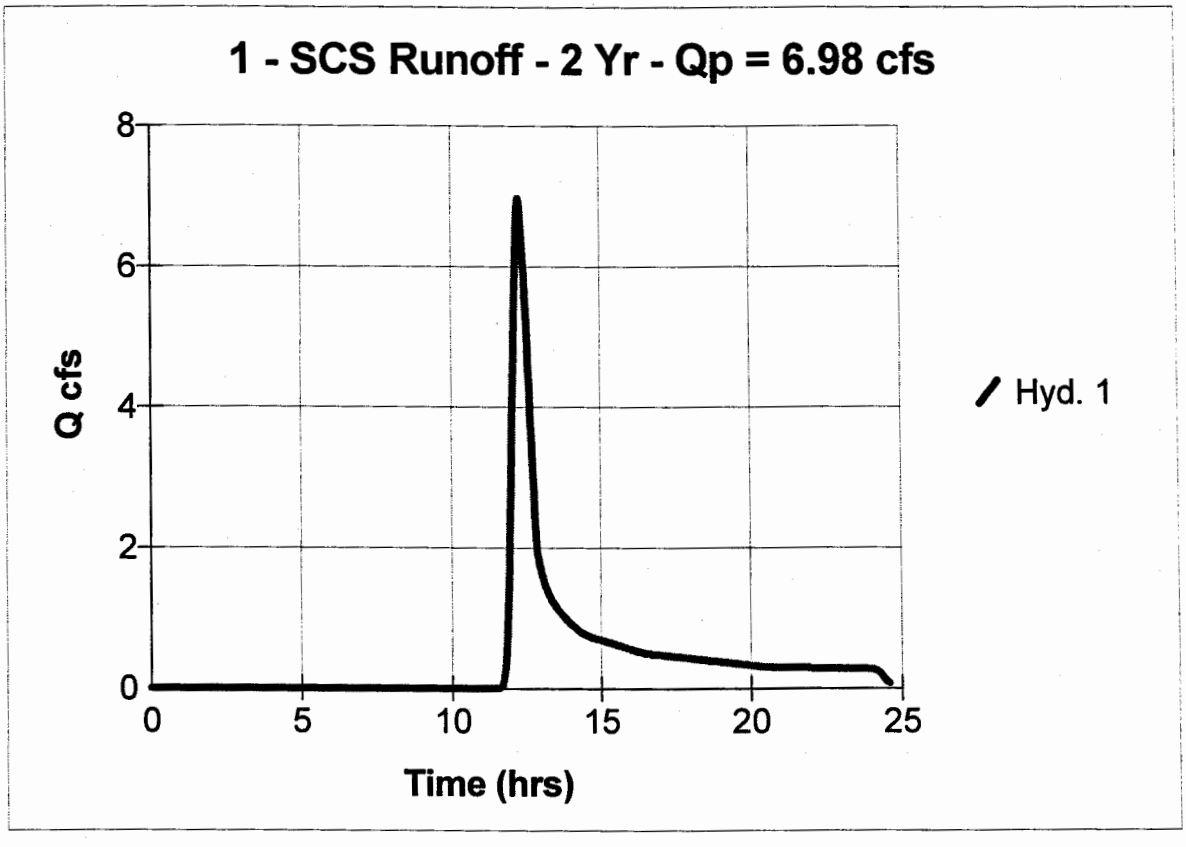
English

Hyd. No. 1

Pre-Development 2-yr

Hydrograph type	= SCS Runoff	Peak discharge	= 6.98 cfs
Storm frequency	= 2 yrs	Time interval	= 2 min
Drainage area	= 12.20 ac	Curve number	= 67
Basin Slope	= 5.0 %	Hydraulic length	= 1580 ft
Tc method	= USER	Time of conc. (Tc)	= 37 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 37,219 cuft



Hydrograph Plot

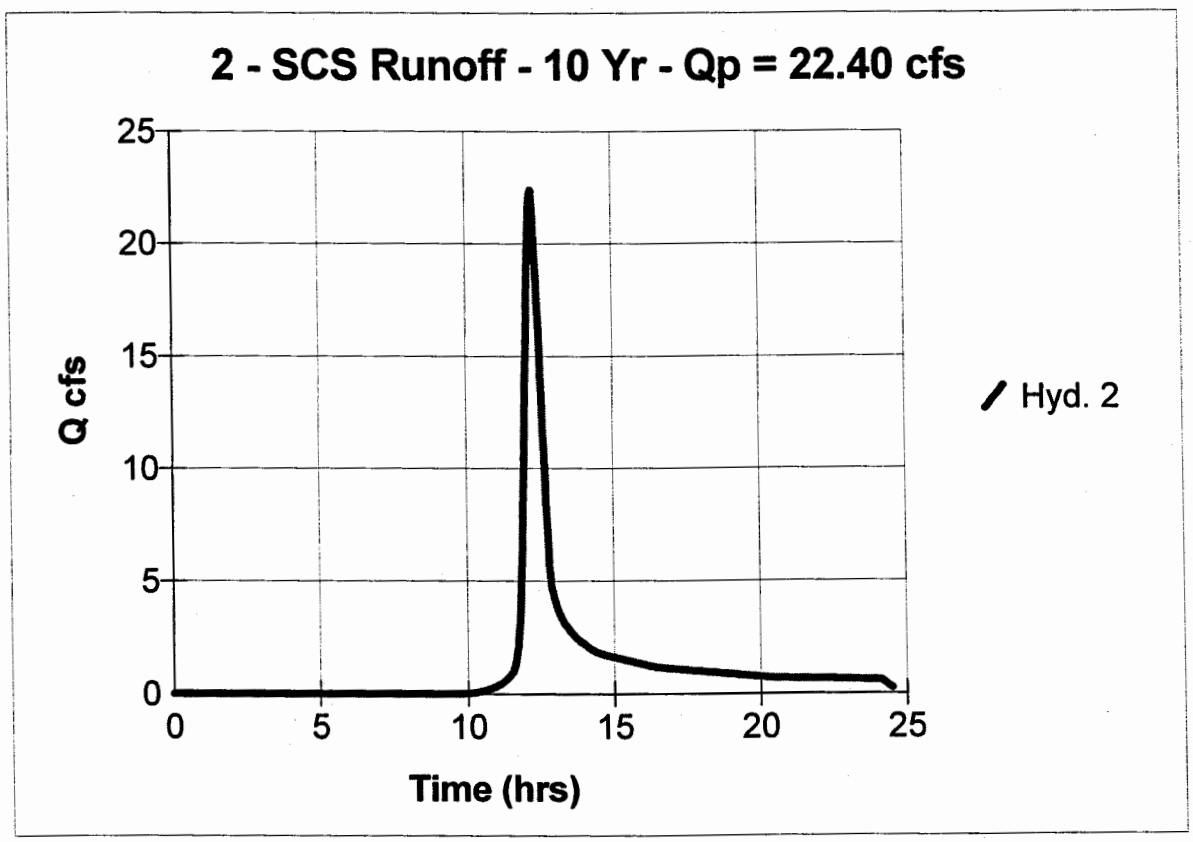
English

Hyd. No. 2

Pre-Development 10-yr

Hydrograph type	= SCS Runoff	Peak discharge	= 22.40 cfs
Storm frequency	= 10 yrs	Time interval	= 2 min
Drainage area	= 12.20 ac	Curve number	= 67
Basin Slope	= 5.0 %	Hydraulic length	= 1580 ft
Tc method	= USER	Time of conc. (Tc)	= 37 min
Total precip.	= 5.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 104,210 cuft



Hydrograph Plot

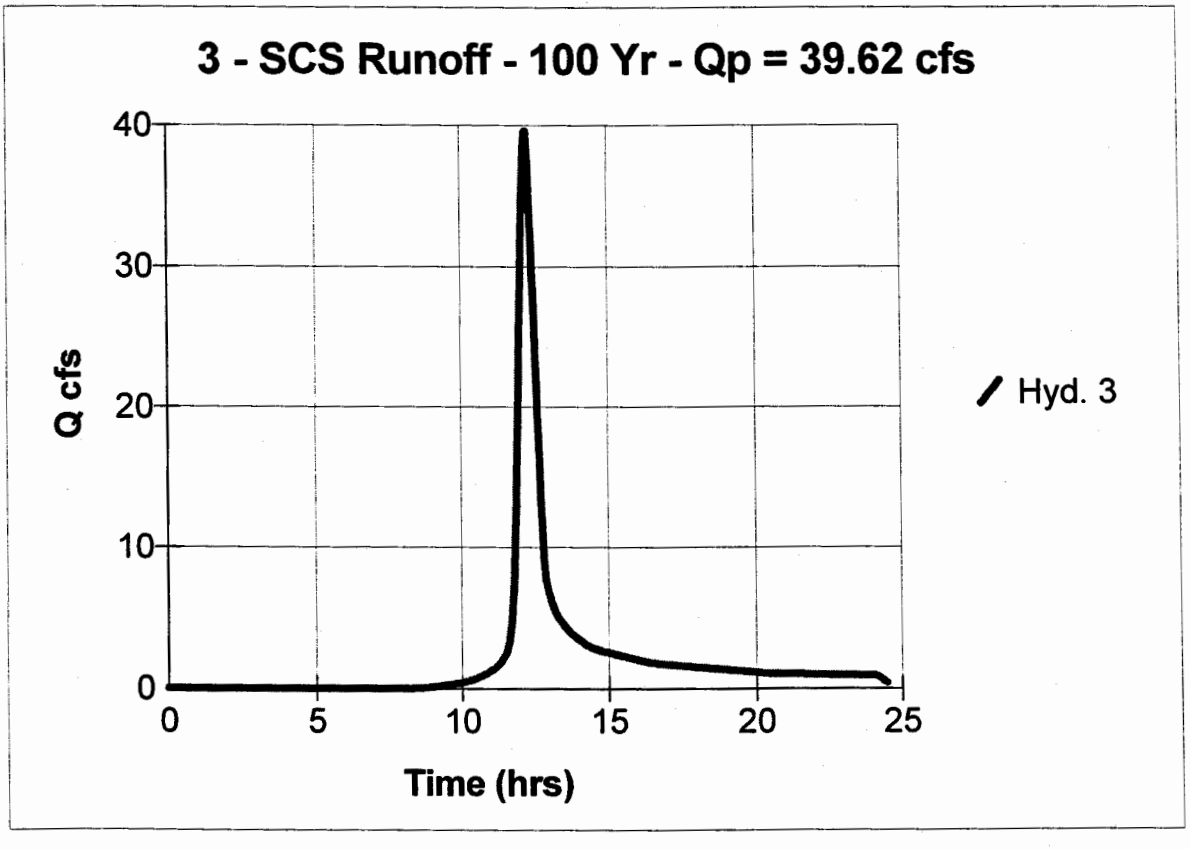
English

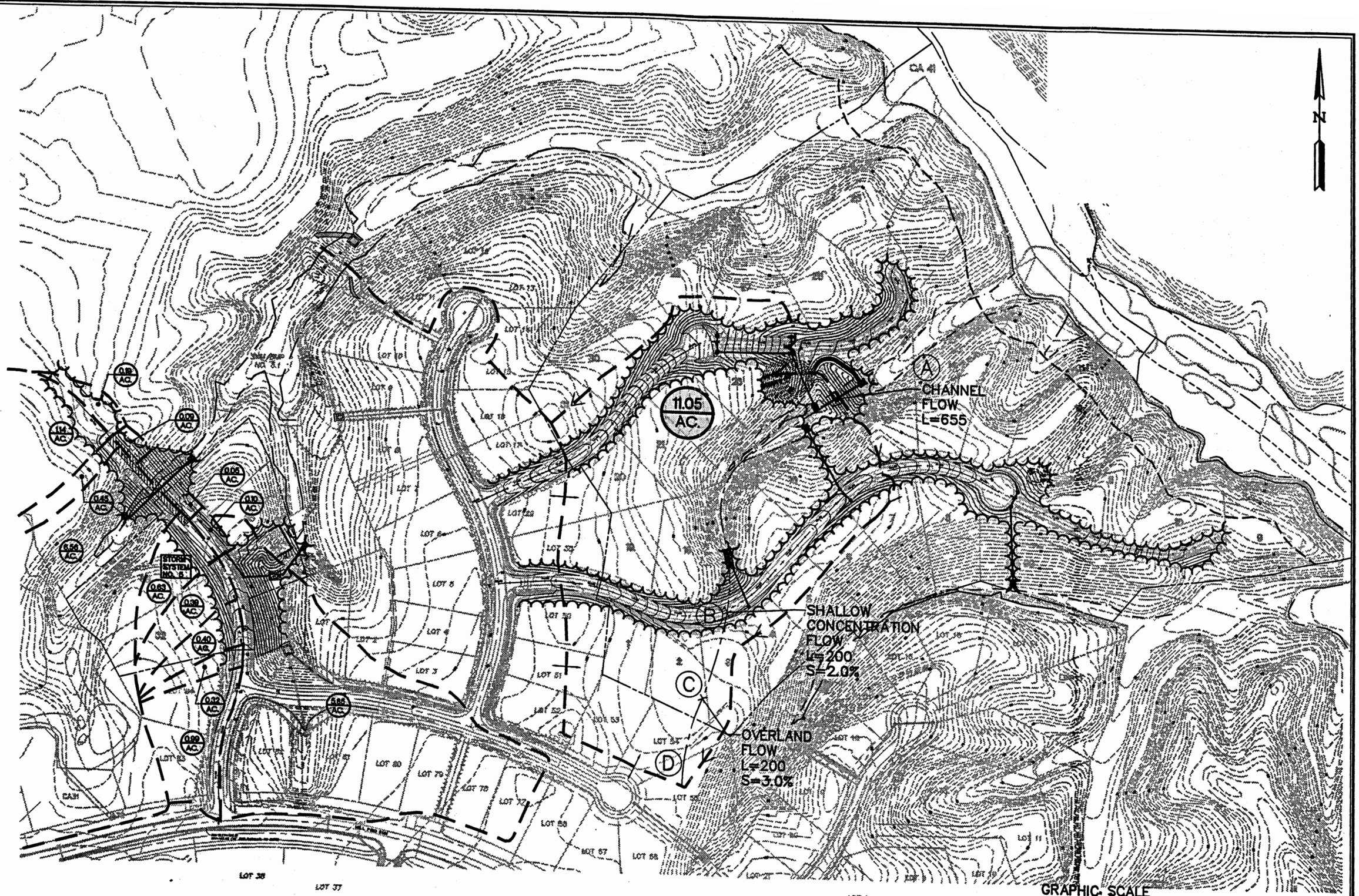
Hyd. No. 3

Pre-Development 100-yr

Hydrograph type	= SCS Runoff	Peak discharge	= 39.62 cfs
Storm frequency	= 100 yrs	Time interval	= 2 min
Drainage area	= 12.20 ac	Curve number	= 67
Basin Slope	= 5.0 %	Hydraulic length	= 1580 ft
Tc method	= USER	Time of conc. (Tc)	= 37 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 180,440 cuft





N

No.	DATE	REVISION / COMMENT / NOTE	BY

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

CONSULTING ENGINEERS

POST DRAINAGE AREAS
SECTION V-B "BENT TREE" - PHASE 3
AT STONEHOUSE
JAMES CITY COUNTY VIRGINIA
STONEHOUSE DISTRICT

Designed	Drawn
RGW	HBK
Scale	Date
1"=200'	3/2/01
Project No.	
9878-00	
Drawing No.	
2 OF 2	

HBK 06.14.01-11:06 post-dev.dwg S/9878/DD-BT3/DESIGN/POND-E&S/POST-DEV.DWG

SCS HYDROGRAPH GENERATION
for
STONEHOUSE Ph1, Bent Tree (Sect. V-B) Ph 3
AES Project No.: 8878-00
June 14, 2001

POST-DEVELOPMENT CONDITIONS TO POINT OF CONCERN (for total site)

A. Post-Development Drainage Area to Point of Concern = 11.1 Acres

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

	Soil Type	Hydrologic Group Appendix 4A*	Land Use	Area Acres	CN Table 4-6*	Adjusted CN
1)	10-B Craven Fine Sandy Loam	C	Residential - 1/2 acre lots	1.5	80	119
2)	10-B Craven Fine Sandy Loam	C	Open Space/Wooded	0.2	76	18
3)	10-B Craven Fine Sandy Loam	C	Right-of-Way	0.1	92	5
4)	11-C Craven-Uchee	C	Residential - 1/2 acre lots	2.8	80	223
5)	11-C Craven-Uchee	C	Right-of-Way	0.7	92	65
6)	14-B Emporia Fine Sandy Loam	C	Residential - 1/2 acre lots	0.5	80	39
7)	14-B Emporia Fine Sandy Loam	C	Right-of-Way	0.2	92	17
8)	15-F Emporia Complex	C	Residential - 1/2 acre lots	1.7	80	133
10)	15-F Emporia Complex	C	Open Space/Wooded	0.9	76	69
11)	15-F Emporia Complex	C	BMP Surface	0.4	100	36
12)	19-B Kempsville-Emporia Fine Sandy Loam	B	Residential - 1/2 acre lots	1.7	60	100
13)	19-B Kempsville-Emporia Fine Sandy Loam	B	Right-of-Way	0.5	89	45
	Total Adjusted CN =			11.1		824
	Composite CN =					75

C. Post-Development Time of Concentration Calculations

1) Overland Flow

Surface description		Dense Grass
Manning's roughness coefficient., n (Table 4-9a*)		0.24
Length of overland flow, L		200 Feet
2-year 24-hour rainfall, P2 (Appendix 4B*)		3.5 inches
Average slope of overland flow , s		0.030 feet per foot
Travel time, Tt = (0.007*(n*L)^0.8)/(P2^0.5*s^0.4)		0.34 hours

2) Shallow concentrated flow

Surface description, paved or unpaved		unpaved
Length of shallow concentrated flow, L		200 Feet
Average slope of shallow concentrated flow, s		0.02 feet per foot
Average velocity, v		1.00 feet per second
Travel time, Tt = L/(3600*v)		0.06 hours

3) Channel or Pipe Flow

Length of channel flow, L		655 Feet
Average velocity of channel flow, v		3 feet per second
Travel time, Tt = L/(3600*v)		0.06 hours
Total Time of Concentration =		0.45 hours
	or	27 minutes

*Va. SWM Handbook (DCR, DSWC)

Hydrograph Plot

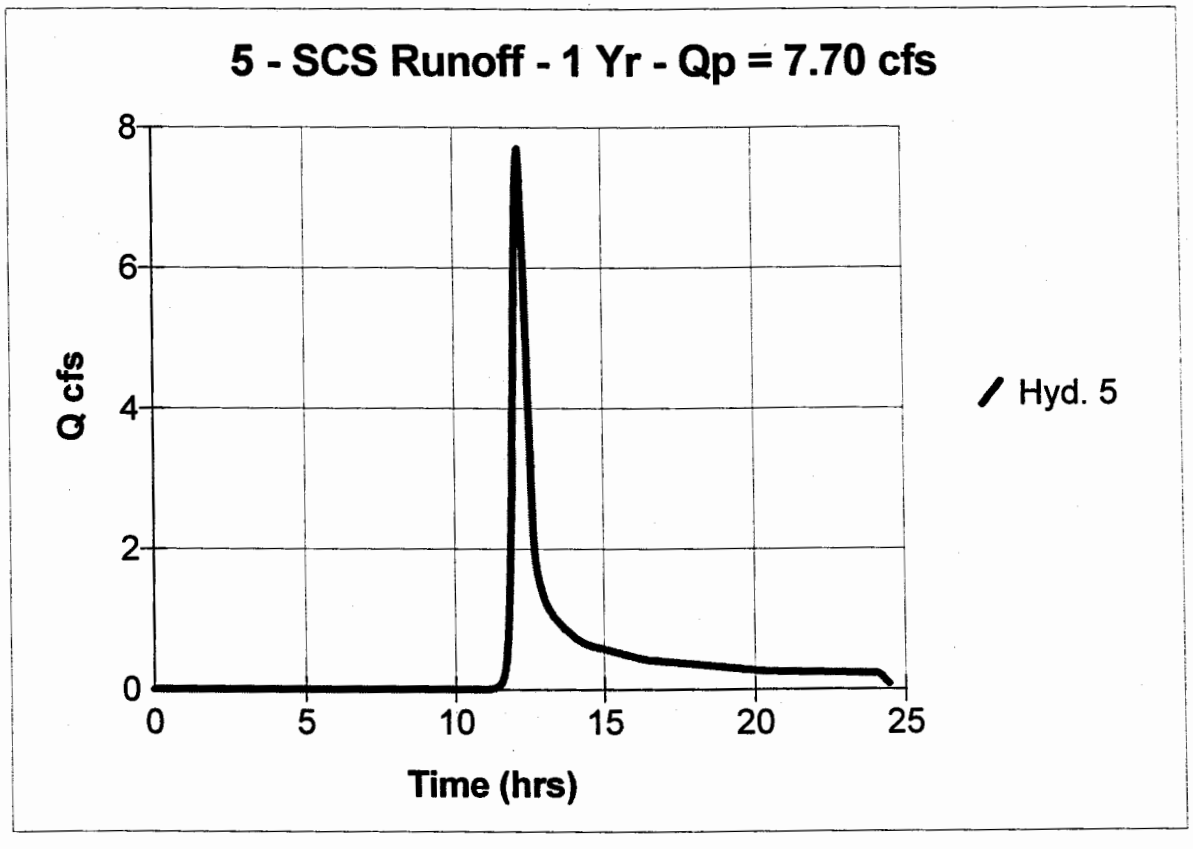
English

Hyd. No. 5

Post-Development 1-yr

Hydrograph type	= SCS Runoff	Peak discharge	= 7.70 cfs
Storm frequency	= 1 yrs	Time interval	= 2 min
Drainage area	= 11.10 ac	Curve number	= 75
Basin Slope	= 6.0 %	Hydraulic length	= 1055 ft
Tc method	= USER	Time of conc. (Tc)	= 27 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 33,545 cuft ✓



Hydrograph Plot

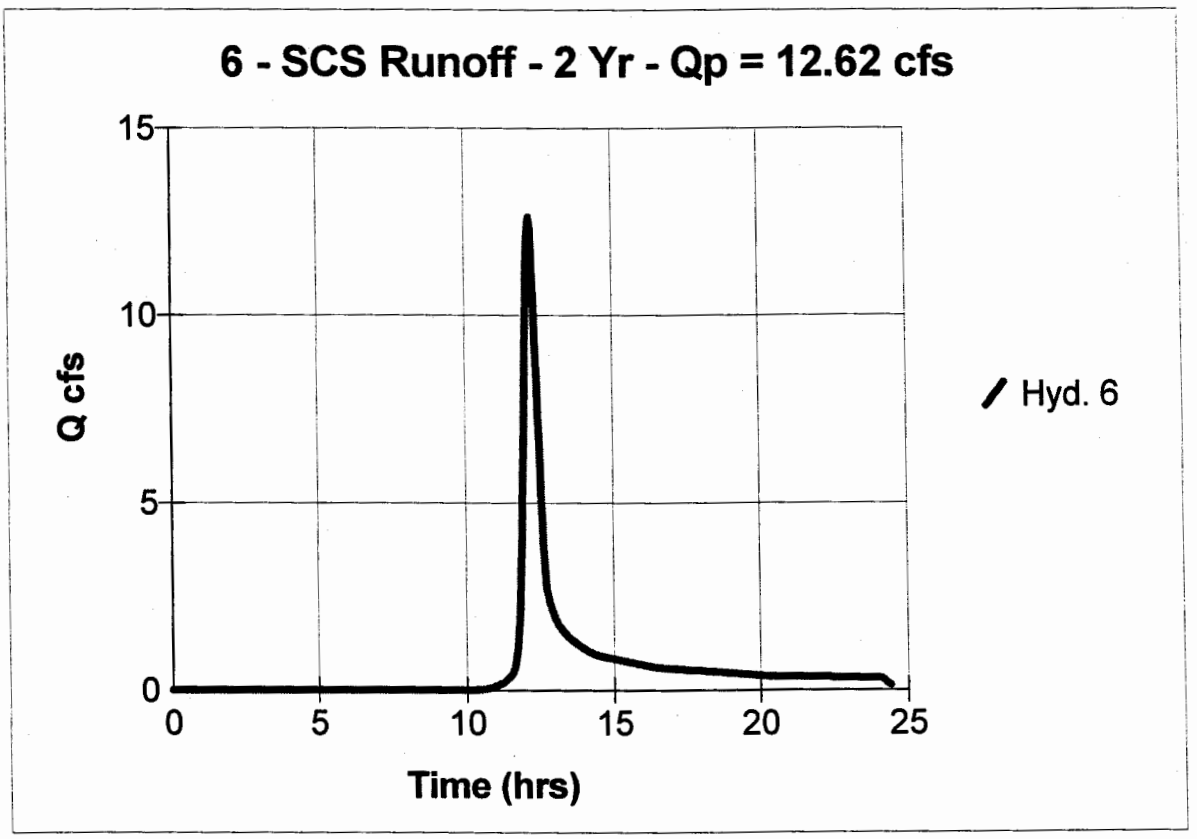
English

Hyd. No. 6

Post-Development 2-yr

Hydrograph type	= SCS Runoff	Peak discharge	= 12.62 cfs
Storm frequency	= 2 yrs	Time interval	= 2 min
Drainage area	= 11.10 ac	Curve number	= 75
Basin Slope	= 6.0 %	Hydraulic length	= 1055 ft
Tc method	= USER	Time of conc. (Tc)	= 27 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 52,453 cuft



Hydrograph Plot

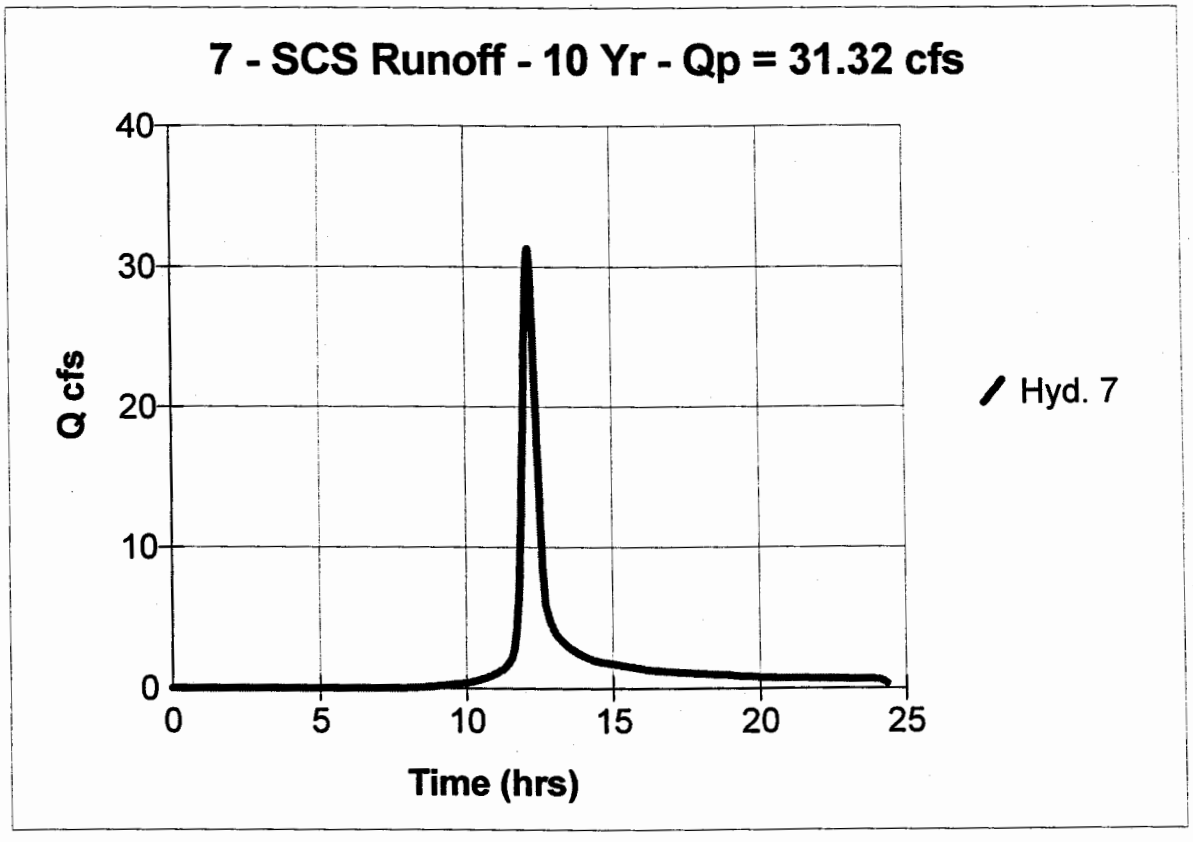
English

Hyd. No. 7

Post-Development 10-yr

Hydrograph type	= SCS Runoff	Peak discharge	= 31.32 cfs
Storm frequency	= 10 yrs	Time interval	= 2 min
Drainage area	= 11.10 ac	Curve number	= 75
Basin Slope	= 6.0 %	Hydraulic length	= 1055 ft
Tc method	= USER	Time of conc. (Tc)	= 27 min
Total precip.	= 5.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 125,405 cuft



Hydrograph Plot

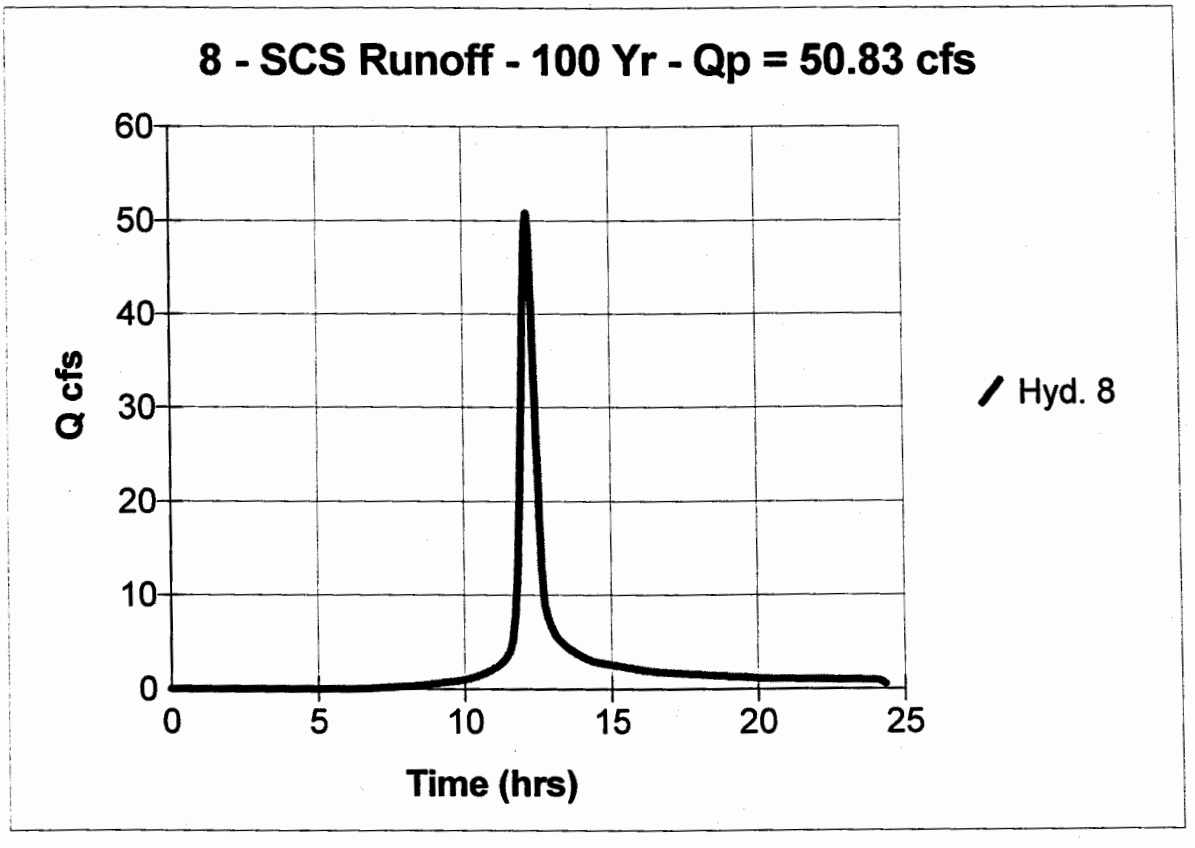
English

Hyd. No. 8

Post-Development 100-yr

Hydrograph type	= SCS Runoff	Peak discharge	= 50.83 cfs
Storm frequency	= 100 yrs	Time interval	= 2 min
Drainage area	= 11.10 ac	Curve number	= 75
Basin Slope	= 6.0 %	Hydraulic length	= 1055 ft
Tc method	= USER	Time of conc. (Tc)	= 27 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 203,144 cuft



BMP Calcs-8878-00 Stonehouse Bent Tree Phase III

Impervious items	Totals		Acres
Houses	18 Ea	2000 SF	0.83
Drveways	20 Ea	600 SF	0.28
Roads:			
Sapling	438.2 LF	22 Width	0.22
Windy Branch	845.3 LF	18 Width	0.35
Sapling common driveway	166.6 LF	16 Width	0.06
Pond Access Rd	50 LF	12 Width	0.01
Sidewalks:			
At Windy Branch	317.64 LF	6 Width	0.04
Wet Pond Surface @ N.P.	135 LF	100 Width	0.31
		Total Impervious Area (TIA)	**2.10**

~~Wet Pond's Required Volume = (1")(ft/12")(TIA Ac)(43560 sf/Ac) = 7,627 s.f.~~ N/A

Dry Pond's Required Volume = (1")(ft/12")(TIA Ac)(43560 sf/Ac) = 7,627 s.f. ✓

Sediment Forebay's Required Volume = (0.1")(ft/12")(TIA Ac)(43560 sf/Ac) = 763 s.f.

BMP VOLUME CALCULATIONS
for
STONEHOUSE Ph 1, Bent Tree (Sect. V-B) Ph3
AES Project No.: 8878-00

PROPOSED POND VOLUME

Eleva	Depth	Area (sq. ft.)	Incremental Volume (cu. ft.)	Sum Volume (cu. ft.)	Sum Volume (cu. yd.)	Volume Above NPE
34.5	0.0	0	0	0	0	
36.0	1.5	809	607	607	22	
38.0	2.0	2,568	3,377	3,984	148	
40.0	2.0	5,150	7,718	11,702	433	
42.0	2.0	8,390	13,540	25,242	935	
43.0	1.0	10,240	9,315	34,557	1,280	
44.0	1.0	12,172	11,206	45,763	1,695	
46.0	2.0	15,416	27,588	73,351	2,717	
46.0	0.0	15,146	0	73,351	2,717	
46.0	0.0	15,146	0	73,351	2,717	

RELEASE RATE REQUIRED TO DETAINED VOLUME FOR 24 HOURS

NRW

Required BMP Volume (based upon Impervious Area) = 7,627 cubic feet

Elevation of water surface associated with required volume = 39.5

Elevation of Low Flow Orifice = 34.5

Average Head, in feet = 2.5

Average Release Rate Calculation $\frac{\text{7,627 cubic feet}}{\text{(24 hours x 60 minutes/hour x 60 seconds/ minute)}}$ = 0.1 cfs

LOW FLOW ORIFICE DIAMETER REQUIRED TO MAINTAIN AVERAGE RELEASE RATE

Diameter of Low Flow Orifice = 2 * (Q / ((64.32 * (h / 2)) ^ (1/2) * 0.6 * 3.14))) ^ (1/2)

where, Q equals average release rate (cfs), h equals average head (feet)

Diameter of Low Flow Orifice = 0.10 feet, or 2 inches

4" used.

SEDIMENT FOREBAY
for
Stonehouse Ph1, Bent Tree (Sect. V-B) Ph3
AES Project No.: 8878-0

DRAINAGE AREA TO POINT OF CONCERN 11.10 Acres

IMPERVIOUS AREA TO POINT OF CONCERN 2.10 Acres

STORAGE REQUIRED

A. Volume = 0.1" per Impervious Area = 762 cf

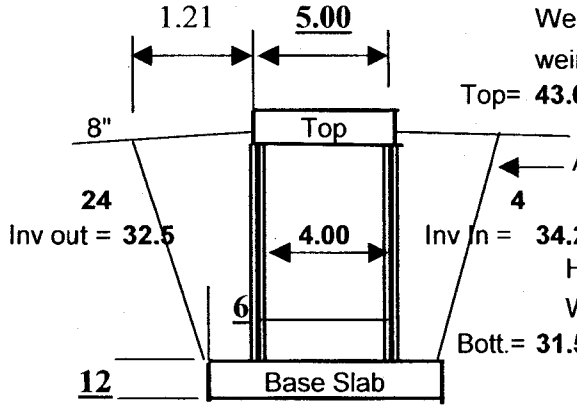
STORAGE PROVIDED

Eleva	Depth	Area (sq. ft.)	Incremental Volume (cu. ft.)	Wet Volume (cu. ft.)	Wet Volume (cu. yd.)		
35.0	0.0	200	0	0	0		
36.0	1.0	392	296	296	11		
37.0	1.0	648	520	816	30		

Stilling Basins Pretreatment

Buoyancy / Anti-Flotation Calculations

A. Sketch:



Weir Width = 0
weir height = 0
Top= 43.00
Area of the Effective Weight of Soil
4
10 Degrees Angle of Repose
Inv In = 34.2
Height of backfill = 4
Wetwell Height = 11.50
Bott.= 31.50

B. Buoyancy Calculations (Uplift)

Uplift = Wt. Water Displaced by the Wetwell

Vol. of the riser = $(O.D. / 2)^2$ x 3.14 x Height

226 CF

Vol. of slab = $(Dia. Slab / 2)^2$ x 3.14 x Slab Thickness

28 CF

Total Vol. of Displacement = 254 CF

Total Uplift 16354 LB ↑Up
Safety factor against uplift = 1.3 for any pond
Safety factor against uplift = 1.5 at normal pool elevation of wet ponds

Total Uplift with safety factor = 21260 LB ↑Up

C. Anti-Flotation Calculations

Down Force = Wt of riser + Wt. of Soil + Wt. of Anti-Vortex Cap

Wt. Riser = Wt. Walls + Wt. Slab + Wt. Grout - Openings - Weir

Wt. Walls = $((O.D./2)^2 - (I.D./2)^2) \times 3.14 \times (\text{Height}) \times 150$ LB/CF

Wt. of walls	**12187**	LB
Wt. Slab	Area Base Slab x Thickness x 150LB/CF	
Wt. of slab	**4239**	LB
Wt. Grout	**3485**	LB
Wt. outlet opening	**236**	LB
Wt. of weir	**0**	LB
Wt.of Riser =	**19676**	LB

Effective Wt. Of the Soil = Wt. Soil at the Angle of Repose - Wt. Water
= (Vol. Above Base Slab - Vol. Riser) x (110LB - 64.4 LB)

Slab Area =	**28.26**	SF	
			Avg. Area =
Surface Area =	**43.11**	SF	**35.69**
Vol. above Base =	**143**	CF	
Vol. Riser =	**64**	CF	
Wt. Soil =	**2929**	LB	

Wt. Anti-Vortex Cap **4270** LB

Total Down Force =	**26875**	LB	↓ (19676 + 2929 + 4270 = 26875#)
Total Uplift =	**21260**	LB	↑ ✓
Resultant Force =	**5615**	LB	↓

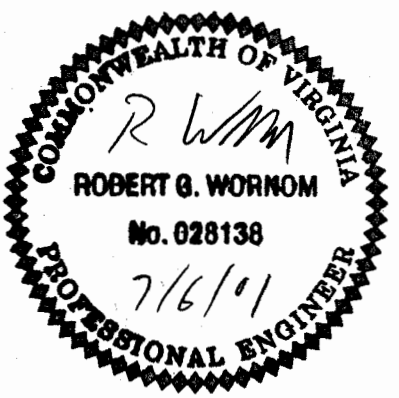
FS = 1.26

STONEHOUSE
AREA 1, PHASE 1
BENT TREE, SECT. V-B
PHASE 3

FOR
STONEHOUSE DEVELOPMENT COMPANY, LLC.

PROJECT NUMBER: 8878-00

DRAINAGE AND E&S CALCULATIONS



CONSULTING ENGINEERS

AES CONSULTING ENGINEERS
5248 OLDE TOWNE ROAD, SUITE #1
WILLIAMSBURG, VIRGINIA 23188

July 6, 2001

Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
4	1	36.0	0.42	0.42	0.70	0.29	0.29	5.0	5.0	7.1	2.09	7.61	1.71	15	1.39	45.50	45.00	47.24	47.20	51.00	51.00	ss1 2-2A
3	2	36.0	0.76	0.76	0.76	0.58	0.58	5.0	5.0	7.1	4.12	7.61	3.36	15	1.39	65.00	64.50	66.24	66.10	70.00	70.00	ss1 3-4
2	1	160.0	0.42	1.18	0.83	0.35	0.93	5.0	5.2	7.1	6.55	22.54	5.71	15	12.19	64.50	45.00	65.52	47.20	70.00	51.00	ss1 2-3
1	End	128.0	0.26	1.86	0.70	0.18	1.40	5.0	5.7	6.9	9.73	17.12	11.06	15	7.03	45.00	36.00	46.18	36.69	51.00	37.25	ss1 1-2

Project File: ss1.stm | IDF File: JCCstormsewer.IDF | Total number of lines: 4 | Run Date: 07-09-2001

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 36.69 (ft)

Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	100.0	3.16	3.16	0.66	2.09	2.09	5.0	5.0	7.1	14.86	24.27	16.20	15	14.13	77.63	63.50	78.87	64.22	83.63	63.25	ss2 2-1

Project File: ss2.stm | IDF File: JCCstormsewer.IDF | Total number of lines: 1 | Run Date: 07-09-2001

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 64.22 (ft)

Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
2	1	34.0	0.27	0.27	0.75	0.20	0.20	5.0	5.0	7.1	1.44	7.00	2.66	15	1.18	73.30	72.90	73.78	73.61	77.70	77.80	ss3 2-3
1	End	144.0	0.09	0.36	0.80	0.07	0.27	5.0	5.5	7.0	1.92	30.87	8.76	15	22.85	72.90	40.00	73.45	40.21	77.80	43.25	ss3 1-2

Project File: ss3.stm | IDF File: JCCstormsewer.IDF | Total number of lines: 2 | Run Date: 07-09-2001

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 40.21 (ft)

Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
2	1	36.0	0.20	0.20	0.82	0.16	0.16	5.0	5.0	7.1	1.17	6.81	1.50	15	1.11	56.00	55.60	56.62	56.63	60.59	61.10	ss4 2-3
1	End	169.0	0.70	0.90	0.69	0.48	0.65	5.0	5.6	7.0	4.50	26.10	10.23	15	16.33	55.60	28.00	56.45	28.36	61.10	33.25	ss4 1-2

Project File: ss4.stm | IDF File: JCCstormsewer.IDF | Total number of lines: 2 | Run Date: 07-09-2001

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 28.36 (ft)

SEDIMENT TRAP #1
for
STONEHOUSE, BENT TREE, Phase 3
AES Project No.: 8878-00

DRAINAGE AREA TO POINT OF CONCERN 1.34 Acres

STORAGE REQUIRED

A. Wet Pond Volume = Drainage Area x 67 cy/ac = 89.78 cy

B. Dry Pond Volume = Drainage Area x 67 cy/ac = 89.78 cy

STORAGE PROVIDED

Elev.	Depth	Area (sq. ft.)	Incremental Volume (cu. ft.)	Wet Volume (cu. ft.)	Wet Volume (cu. yd.)	Dry NPE=62.0 (cu. ft.)	Dry NPE=62.0 (cu. yd.)
38.0	0.0	850	0	0	0	0	0
40.0	2.0	1,541	2,391	2,391	89	0	0
42.0	2.0	2,524	4,065	6,456	239	4,065	151
43.5	1.5	3,506	4,523	10,979	407	8,588	318

SEDIMENT TRAP DATA

Type of Outlet (Aggregate & Rip Rap or Perforated CMP Riser): Riser

Pond Bottom Elevation = 38.0 feet ✓

Base of Aggregate & Rip Rap (Begin Perforations) = 40.0 feet 40.5 ON PLAN

Top of Aggregate & Rip Rap (Top of Riser Elevation) = 42.0 feet 42.5 ON PLAN

Top of Diversion Dike = 43.5 feet 44.0 ON PLAN

Length of Aggr. & Rip Rap (Diameter of Riser) = 6 x Drain. Area (6' min.) = ~~3.0~~ feet 8.04'

Height of Aggregate & Rip Rap (Riser Top - Orifice Invert) = 2.0 feet

Diversion Dike Height = Top of D.D. - Base of Aggregate (Begin Perforatio 3.5 feet

SEDIMENT TRAP #2
Aggregate & Rip Rap Type Outlet

STONEHOUSE, BENT TREE, Phase 3
AES Project No.: 8878-00

DRAINAGE AREA TO POINT OF CONCERN 0.98 Acres

STORAGE REQUIRED

A. Wet Pond Volume = Drainage Area x 67 cy/ac = 65.66 cy (not provided) WHY?

B. Dry Pond Volume = Drainage Area x 67 cy/ac = 65.66 cy

STORAGE PROVIDED

Eleva	Depth	Area (sq. ft.)	Incremental Volume (cu. ft.)	Wet Volume (cu. ft.)	Wet Volume (cu. yd.)	Dry NPE=51.6 (cu. ft.)	Dry NPE=51.6 (cu. yd.)
48.0	0.0	30	0	0	0	0	0
50.0	2.0	571	601	601	22	601	22
52.0	2.0	1,066	1,637	2,238	83	2,238	83

SEDIMENT TRAP DATA

Pond Bottom Elevation = 48.0 feet ✓

Base of Aggregate & Rip Rap = 48.0 feet ✓

Top of Aggregate & Rip Rap = 52.0 feet 53.0

Top of Diversion Dike = 53.0 feet ✓

Length of Aggr. & Rip Rap = 6 x Drain. Area = (6' min.) = 12.0 feet 6'

Height of Aggregate & Rip Rap = 4.0 feet ✓

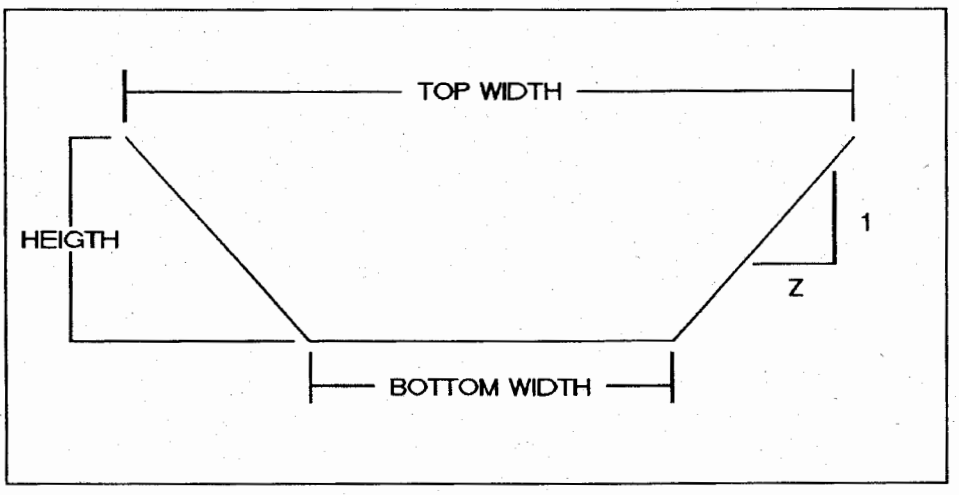
Top Width Aggregate & Rip Rap (Plate 3.13-1) = 4.5 feet ✓

Diversion Dike Height = Top of D.D. - Base of Aggregate = 5.0 feet ✓

outfall of SS # 4-1

Adequate Channel Analysis
Stonehouse - Bent Tree Phase 3
June 4, 2001
Project No. 8878-0

CHANNEL GEOMETRY



BOTTOM WIDTH =	15 FT
HEIGHT =	5 FT
Z =	1.5 FT
SLOPE (S)	0.05 FT/FT
MANNING'S N	0.18

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

WHERE:

N1 = CHANNEL IN EARTH	0.02
N2 = EROSION	0.01
N3 = SIZE/SHAPE OF CHANN	0.005
N4 = OBSTRUCTIONS	0.05
N5 = VEGETATION	0.075
N6 = MEANDER	0.15 SEE

N = 0.18

SOIL TYPE

SANDY LOAM

MAX. PERMISSIBLE VELOCITY = **2.5 FT /SEC**

2-YEAR STORM EVENT

TIME OF CONCENTRATION	5.6 MIN.	
RAINFALL INTENSITY =	1.8	
RUNOFF COEF. =	0.82	
DRAINAGE AREA =	(0.7 AC.)	0.90 AC PER SSCOMPS.
PEAK FLOW RATE =	**3.44 CFS**	(SEE HYDROGRAPH)
PEAK VELOCITY =	**0.76 CFS**	(SEE FOLLOWING PAGE)

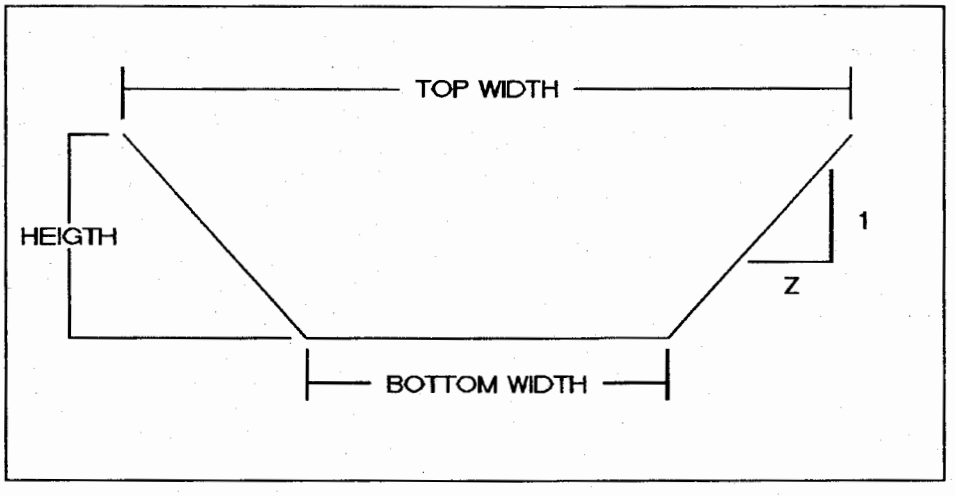
*** VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.37 CFS THEREFORE, CHANNEL IS ADEQUATE.**

Incremental Depth (FT)	Area (SQ FT)	WP (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)	
0.00	0.00	15.00	0.00	0.00	0.00	
0.10	0.02	15.36	0.00	0.02	0.00	
0.20	0.18	15.72	0.01	0.09	0.02	
0.30	0.61	16.08	0.04	0.21	0.13	
0.40	1.44	16.44	0.09	0.37	0.53	
0.50	2.81	16.80	0.17	0.56	1.58	
0.59	4.52	17.11	0.26	0.76	3.44	<-----
0.70	7.72	17.52	0.44	1.07	8.27	

Outfall of SS #2-1

Adequate Channel Analysis
Stonehouse - Bent Tree Phase 3
June 4, 2001
Project No. 8878-0

CHANNEL GEOMETRY



BOTTOM WIDTH =	5	FT
HEIGHT =	5	FT
Z =	1.8	FT
SLOPE (S)	0.1	FT/FT
MANNING'S N	0.18	

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

WHERE:

N1 = CHANNEL IN EARTH	0.02
N2 = EROSION	0.01
N3 = SIZE/SHAPE OF CHANN	0.005
N4 = OBSTRUCTIONS	0.05
N5 = VEGETATION	0.075
N6 = MEANDER	0.15 — mod.

N = 0.18

SOIL TYPE

SANDY LOAM

MAX. PERMISSIBLE VELOCITY = **2.5 FT /SEC**

2-YEAR STORM EVENT

TIME OF CONCENTRATION	5 MIN.	
RAINFALL INTENSITY =	1.8	
RUNOFF COEF. =	0.66 ✓	
DRAINAGE AREA =	3.16 AC. ✓	
PEAK FLOW RATE =	**11.53 CFS**	(SEE HYDROGRAPH)
PEAK VELOCITY =	**2.01 CFS**	(SEE FOLLOWING PAGE) ✓

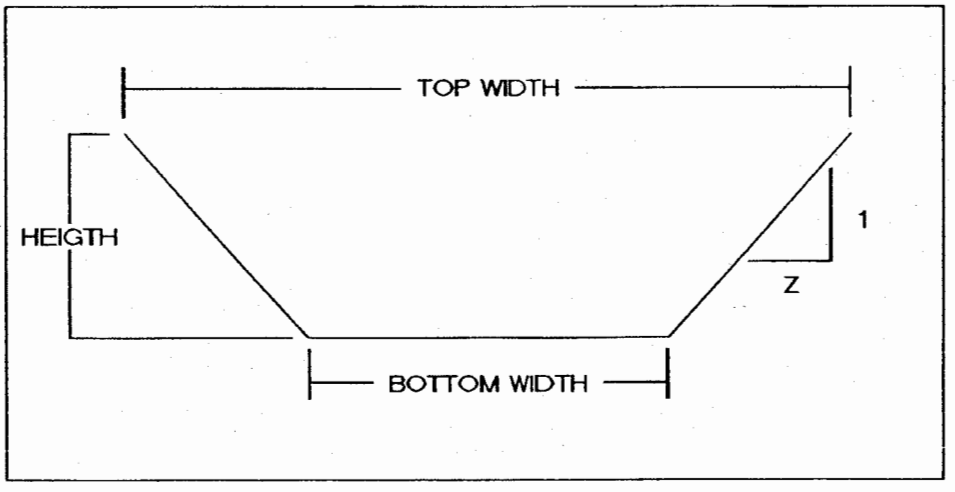
* **VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.37 CFS THEREFORE, CHANNEL IS ADEQUATE.**

Incremental Depth (FT)	Area (SQ FT)	WP (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)	
0.00	0.00	5.00	0.00	0.00	0.00	
0.10	0.01	5.41	0.00	0.04	0.00	
0.20	0.07	5.82	0.01	0.14	0.01	
0.30	0.24	6.24	0.04	0.30	0.07	
0.40	0.58	6.65	0.09	0.51	0.30	
0.50	1.13	7.06	0.16	0.77	0.87	
0.60	1.94	7.47	0.26	1.07	2.07	
0.70	3.09	7.88	0.39	1.40	4.33	
0.80	4.61	8.29	0.56	1.77	8.15	
0.86	5.74	8.55	0.67	2.01	11.53	<-----
1.00	9.00	9.12	0.99	2.59	23.35	
1.10	11.98	9.53	1.26	3.05	36.52	
1.20	15.55	9.94	1.56	3.53	54.86	

Outfall of 30" culvert by pump station on Splitwood Rd. to Downstream BMP

Adequate Channel Analysis
Stonehouse - Bent Tree Phase 3
June 4, 2001
Project No. 8878-0

CHANNEL GEOMETRY



BOTTOM WIDTH =	20 FT
HEIGHT =	8 FT
Z =	4.0 FT
SLOPE (S)	0.03 FT/FT
MANNING'S N	0.18

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

WHERE:

N1 = CHANNEL IN EARTH	0.02 ✓
N2 = EROSION	0.01 ✓
N3 = SIZE/SHAPE OF CHANN	0.005 ✓
N4 = OBSTRUCTIONS	0.05 ✓
N5 = VEGETATION	0.075
N6 = MEANDER	0.15

N = 0.18

SOIL TYPE

SANDY LOAM

MAX. PERMISSIBLE VELOCITY = **2.5 FT /SEC**

2-YEAR STORM EVENT

TIME OF CONCENTRATION	53 MIN.	
RAINFALL INTENSITY =	1.8	
RUNOFF COEF. =	0.37	
DRAINAGE AREA =	15.57 AC.	
PEAK FLOW RATE =	**8.04 CFS**	(SEE HYDROGRAPH)
PEAK VELOCITY =	**0.8 CFS**	(SEE FOLLOWING PAGE)

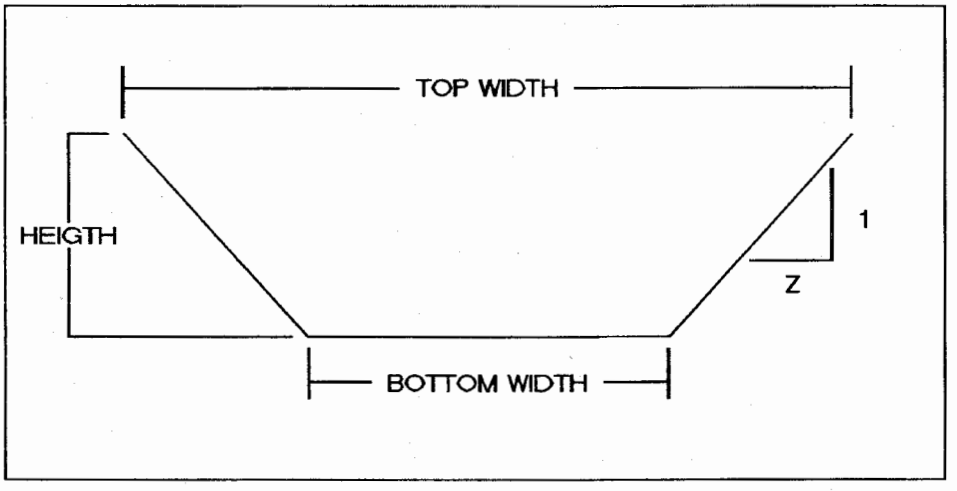
*** VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.37 CFS THEREFORE, CHANNEL IS ADEQUATE.**

Incremental Depth (FT)	Area (SQ FT)	WP (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)	
0.00	0.00	20.00	0.00	0.00	0.00	
0.10	0.08	20.82	0.00	0.04	0.00	
0.20	0.64	21.65	0.03	0.14	0.09	
0.30	2.16	22.47	0.10	0.30	0.65	
0.40	5.12	23.30	0.22	0.52	2.67	
0.50	10.00	24.12	0.41	0.80	7.97	
0.50	10.05	24.13	0.42	0.80	8.04	<-----
0.70	27.44	25.77	1.06	1.49	41.02	
0.80	40.96	26.60	1.54	1.91	78.32	
0.86	51.04	27.10	1.88	2.19	111.60	
1.00	80.00	28.25	2.83	2.87	229.61	
1.10	106.48	29.07	3.66	3.41	362.76	
1.20	138.24	29.90	4.62	3.98	550.12	

Outfall at Culvert of Splitwood Dr @ STA 18+0

Adequate Channel Analysis
Stonehouse - Bent Tree Phase 3
June 4, 2001
Project No. 8878-0

CHANNEL GEOMETRY



BOTTOM WIDTH =	25	FT
HEIGHT =	6	FT
Z =	5.0	FT
SLOPE (S)	0.036	FT/FT
MANNING'S N	0.18	

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

WHERE:

N1 = CHANNEL IN EARTH	0.02
N2 = EROSION	0.01
N3 = SIZE/SHAPE OF CHANN	0.005
N4 = OBSTRUCTIONS	0.05
N5 = VEGETATION	0.075
N6 = MEANDER	0.15

N = 0.18

SOIL TYPE

SANDY LOAM

MAX. PERMISSIBLE VELOCITY = **2.5 FT /SEC**

2-YEAR STORM EVENT

TIME OF CONCENTRATION	53 MIN.	
RAINFALL INTENSITY =	1.8	
RUNOFF COEF. =	0.37	
DRAINAGE AREA =	15.57 AC.	
PEAK FLOW RATE =	**13.9 CFS**	(SEE HYDROGRAPH)
PEAK VELOCITY =	**0.96 CFS**	(SEE FOLLOWING PAGE)

*** VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.37 CFS THEREFORE, CHANNEL IS ADEQUATE.**

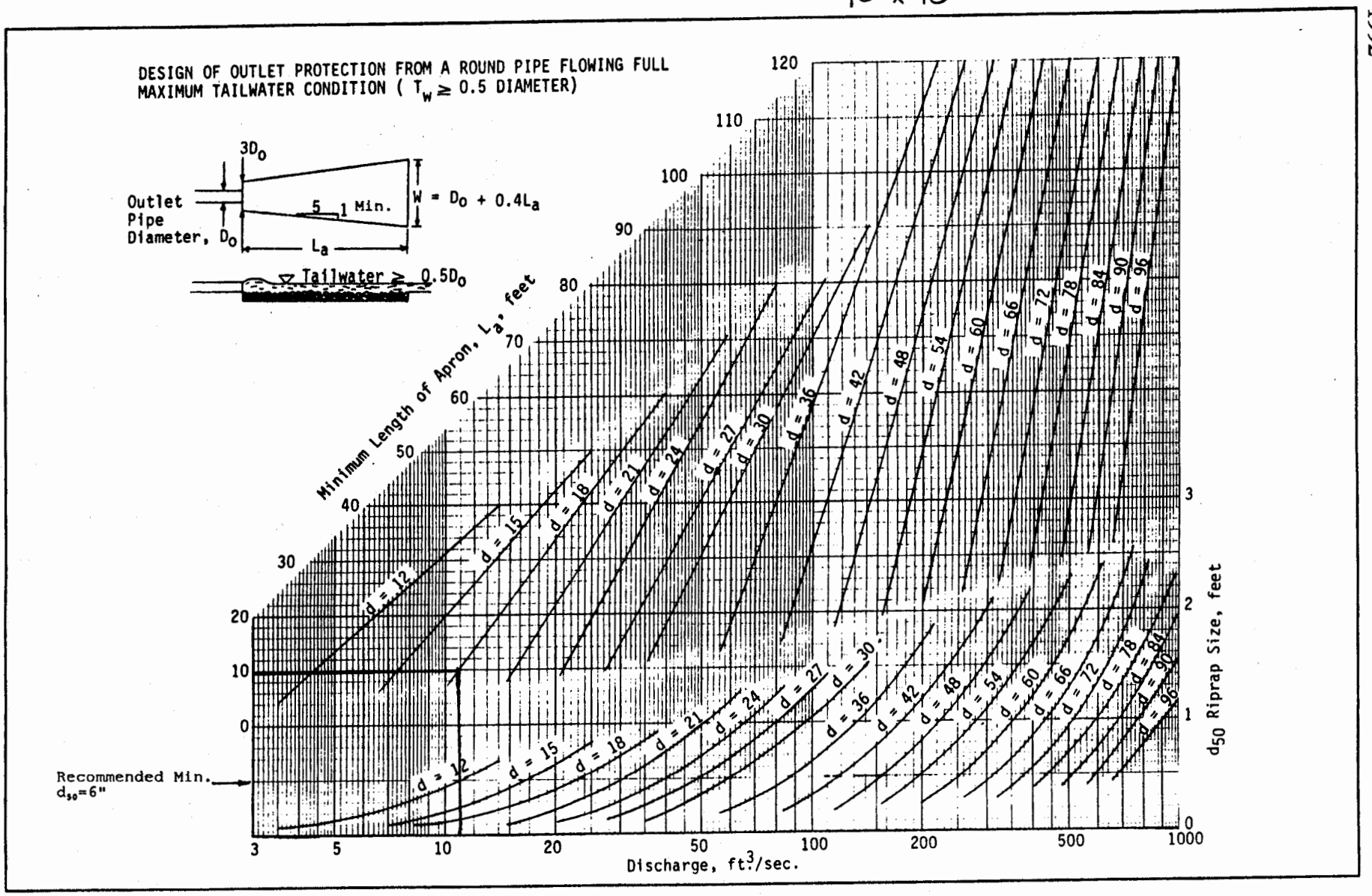
Incremental Depth (FT)	Area (SQ FT)	WP (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)	
0.00	0.00	25.00	0.00	0.00	0.00	
0.10	0.13	26.02	0.00	0.04	0.01	
0.20	1.00	27.04	0.04	0.17	0.17	
0.30	3.38	28.06	0.12	0.38	1.29	
0.40	8.00	29.08	0.28	0.66	5.31	
0.49	14.41	29.96	0.48	0.96	13.90	<-----
0.50	15.71	30.11	0.52	1.02	15.99	
0.70	42.88	32.14	1.33	1.90	81.61	
0.80	64.00	33.16	1.93	2.43	155.82	
0.86	79.75	33.78	2.36	2.78	222.06	
1.00	125.00	35.20	3.55	3.66	456.99	
1.10	166.38	36.22	4.59	4.34	722.10	
1.20	216.00	37.24	5.80	5.07	1095.22	

Outfall SS #5-1
FOR:

Q_{10} = 10.77 cfs
D = 18"

BENT TREE III
8878
5/29/01

10' x 10'



Source: USDA-SCS 1992

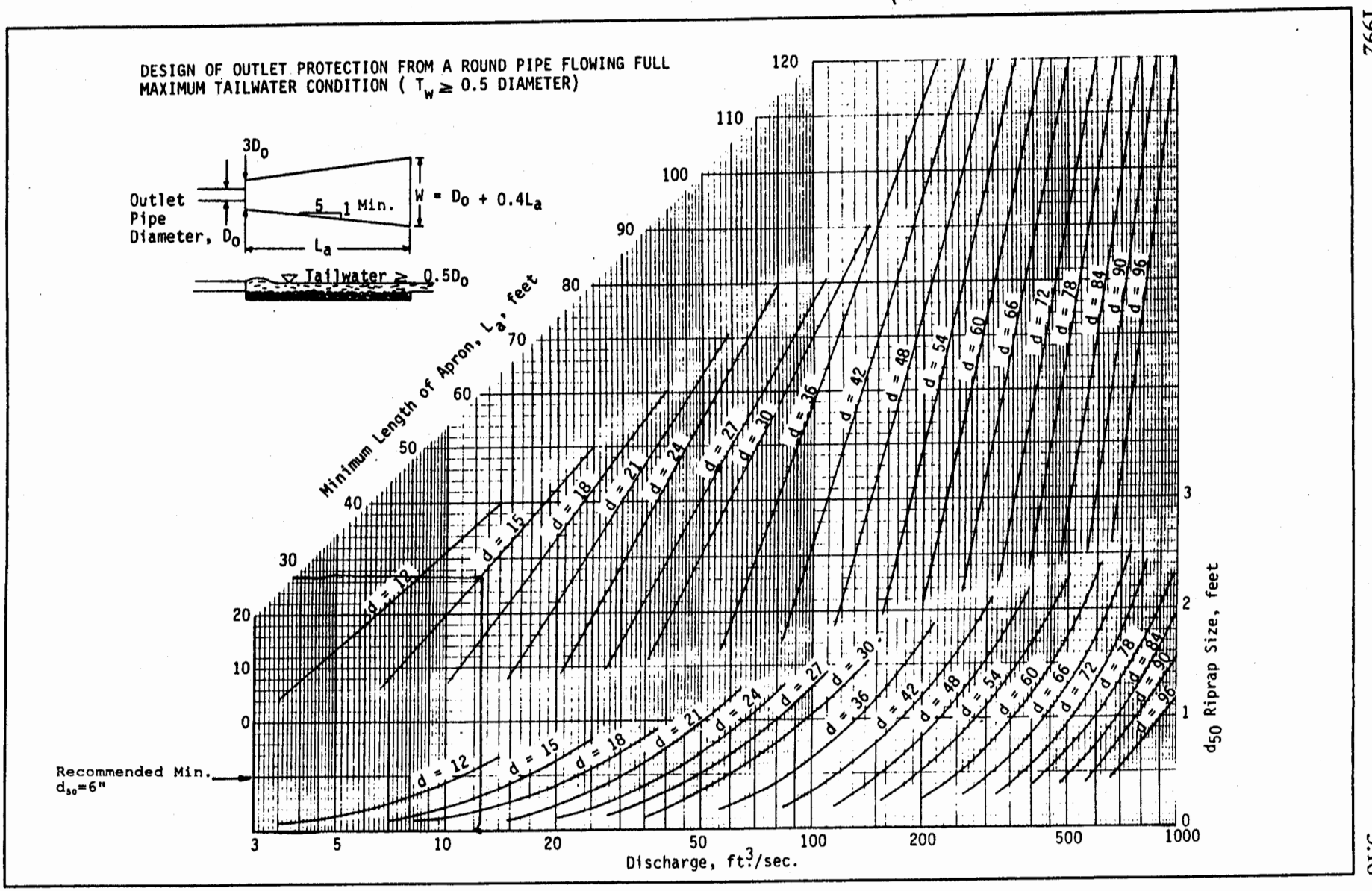
Plate 3.18-4

FOR SS#2-1

Q_{10} = 14.86 cfs
D = 15"

BENT TREE III
8878
5/29/01

L_a = 27' W = 12'



Source: USDA-SCS

1992

Plate 3.18-4

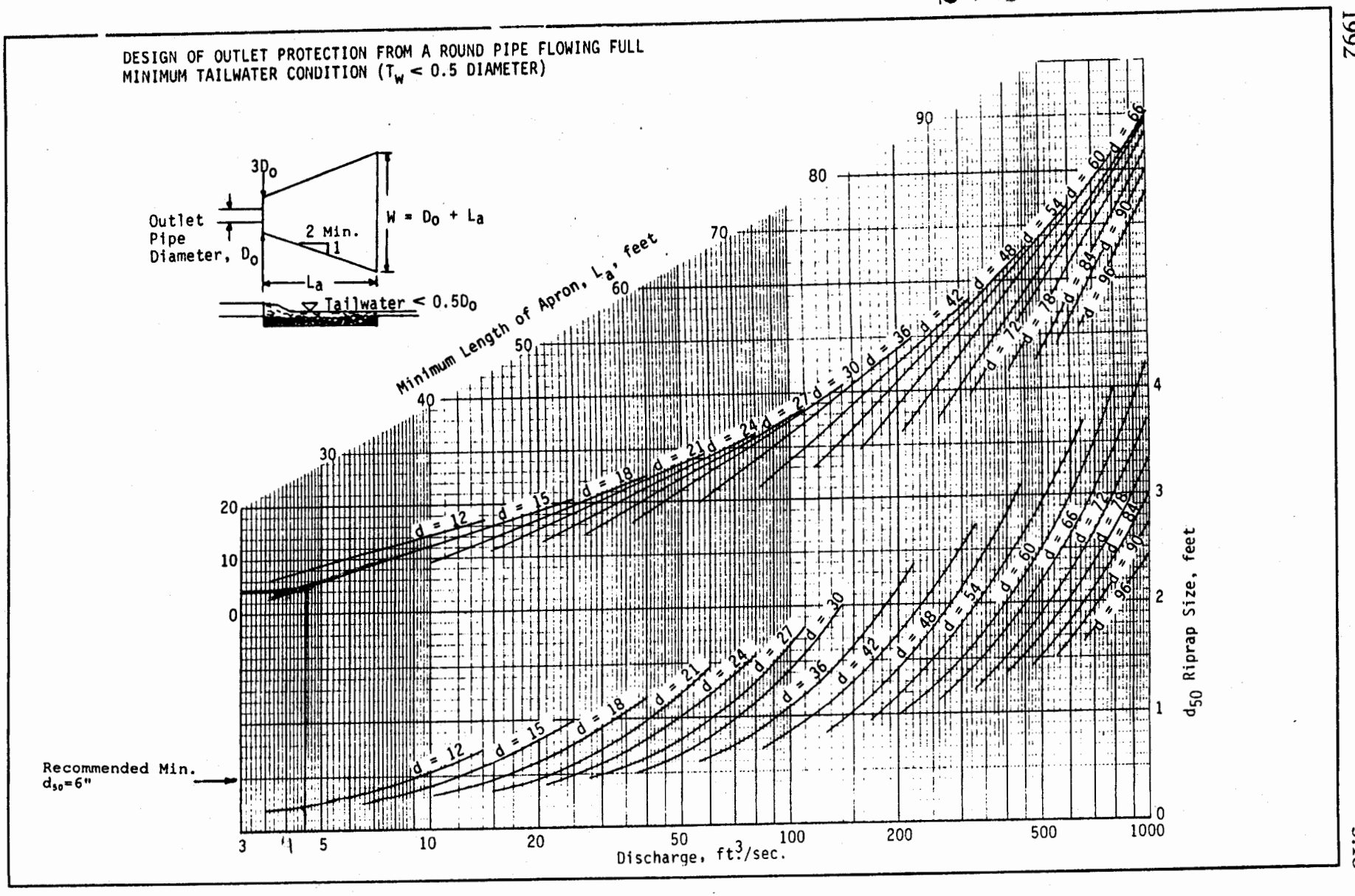
III - 165

3.18

SS# 4-1

$Q_{10} = 4.50$ cfs
D = 15"

10' x 10'



Source: USDA-SCS

1992

III - 164

Plate 3.18-3

3.18

STONEHOUSE L.L.C.

Section V-B "BENT TREE" Phase 3

Date: 7/30/99

STORMWATER ATTENUATION BASIN

PRE-DEVELOPMENT DRAINAGE AREA MAP

LEGEND

PHASE 3 ROADS

PRE-DEVELOPMENT DRAINAGE AREA

Langley and McDonald

A Professional Corporation

ENGINEERS - PLANNERS - SURVEYORS

LANDSCAPE ARCHITECTS - ENVIRONMENTAL CONSULTANTS

Virginia Beach and Williamsburg Virginia

GRAPHIC SCALE

0 100 200 400

DA=11.69 Ac.

11C

15F

19B

11C

15F

19B

11C

10B

14B

WINDY BRANCH DRIVE 40' R/W

SAPLING GROVE DRIVE

LONGWOOD DRIVE 40' R/W

BENT TREE LANE 50' R/W

BMP COMMON AREA PARCEL CA36

COMMON AREA PARCEL CA37

DRAINAGE, STORMWATER MANAGEMENT,

EROSION CONTROL AND PAVEMENT DESIGN CALCULATIONS

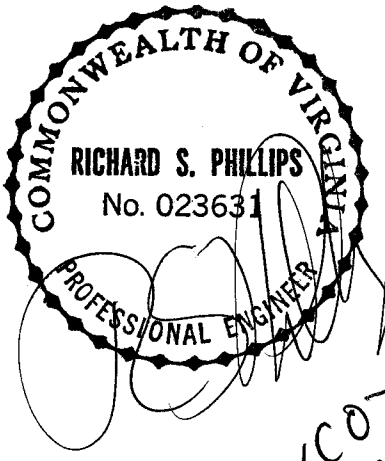
AND

ENVIRONMENTAL INVENTORY

STONEHOUSE L.L.C.

DEVELOPMENT AREA ONE, PHASE I SECTION VB

"BENT TREE" – PHASE 3



Revised February 21, 2000
July 30,1999

LMDG No. 1960038-111.73

WC072
BMP 5.4

LANDMARK DESIGN GROUP

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STORMWATER DESIGN PARAMETERS
STONEHOUSE DEVELOPMENT
JAMES CITY COUNTY

U.S.D.A. S.C.S	24 HOUR RAINFALL
1 YR.	2.80 INCHES
2 YR.	3.36 INCHES
10 YR.	5.04 INCHES
100 YR.	7.68 INCHES

ROADWAY INLETS BASED ON V.D.O.T.
INTENSITY 4 INCHES PER HOUR

CHANNEL PROTECTION VOLUME CALCULATION

Project Name : Stonehouse, Section V-B, BMP 5.4 — Project # : 1980036-111.73

One Year Precipitation : P= 2.8 Inches

TABLE F1 / TR-55
Coefficients for Rainfall Type II

I_a/P	C_0	C_1	C_2
0.10	2.55323	-0.61512	-0.16403
0.30	2.46532	-0.62257	-0.11657
0.35	2.41896	-0.61594	-0.08820
0.40	2.36409	-0.59857	-0.05621
0.45	2.29238	-0.57005	-0.02281
0.50	2.20282	-0.51599	-0.01259

PRE-DEVELOPMENT CONDITIONS :

Drainage Area : DA_{PRE} = 11.69 Acres
SCS Curve Number : CN_{PRE} = 70 Unitless
Time of Concentration : Tc_{PRE} = 0.25 Hours

Initial abstraction ; $I_a=0.2x(1000/CN - 10)$ = 0.857 Inches
I_a/P = 0.31

Accumulated direct runoff : $Q_U = (P-I_a)^2 / (P+4xI_a)$ = 0.61 Inches

Unit Peak Discharge : q_u = 628 cfs/sq.mile/in.
$\log(q_u)=C_0+C_1\log(T_c)+C_2[\log(T]^2$
C_0, C_1, C_2 Coefficients from TABLE F1 above

Pre-development peak discharge :
$q_p = q_u \times DA \times Q_U / 640$ = 6.95 c.f.s.

POST DEVELOPMENT CONDITIONS :

Drainage Area : DA_{POST} = 11.57 Acres
SCS Curve Number : CN_{POST} = 77 Unitless
Time of Concentration Tc_{POST} = 0.2 Hours

Initial abstraction ; I_a = 0.597 Inches
I_a/P = 0.21
Accumulated direct runoff : Q_U = 0.93 Inches
Unit Peak Discharge : q_u = 800 cfs/sq.mile/in.
Post development peak discharge rate : $q_i = q_p$ = 13.52 c.f.s.

Ration of outflow to inflow : * $q_o/q_i = 11.98 \times q_u^{0.937}$ = 0.0228
* Direct calculation using equation for T=24hr. developed by Stewart Comstock,P.E., MDE

Peak outflow discharge : q_o = 0.3085 c.f.s.

Ratio of storage volume to runoff volume : V_s/V_r = 0.65
$V_s/V_r = 0.683-1.43(qq_i)+1.64(_o/q_i)^2-8.04(q_o/q_i)^3$ =

Required Storage Volume :
$V_s = V_s/V_r \times Q_u \times A/12 \times 43560$ = **25568** cubic feet ✓

ESTIMATED POND FULL DRAWDOWN

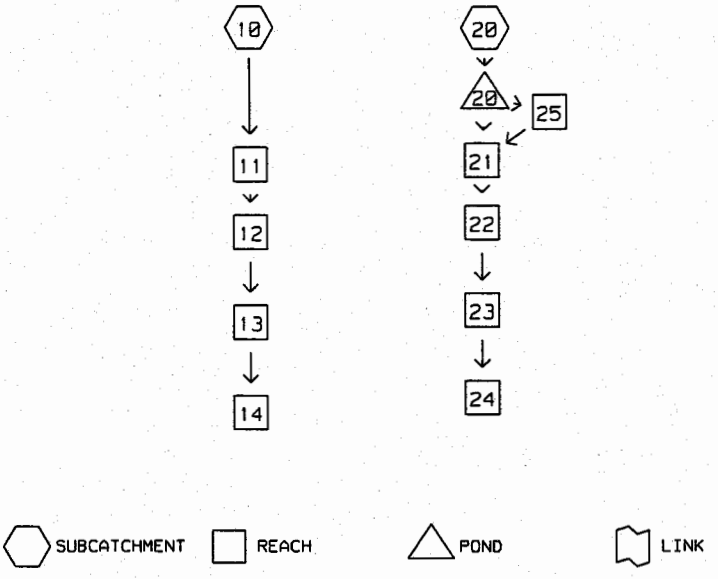
H_{TRIAL} = 6
A_o = 0.026183
d_o = 2.191011

BMP POND 5.4 — $D_{ORIFICE}$ = 2 inches

W.S.E. (feet)	AREA s.f.	INC. VOL c.f.	STORAGE c.f	H_{AVG} ft.	Q_{AVG} cfs	dT hours	
44.00	16056	28362	58915	8.00			
42.00	12306	17814	30553	6.00			
41.60	10946	13164	**25903**	5.80	**0.2512**	**14.6**	**WQVSE**
40.00	5508	8541	12739	4.00	0.2079	11.4	
38.00	3033	4198	4198	1.50	0.1250	9.3	
36.00	1165	691	691	0.50	0.0678	2.8	
35.00	217	0	0	0.00			

DRAW DOWN TIME = 35.3

WATERSHED ROUTING ==========



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SUBCATCHMENT 10 **PREDEVELOPMENT DRAINAGE AREA BMP 5.4**

PEAK= 6.38 CFS @ 12.11 HRS, VOLUME= .59 AF

ACRES	CN	
11.69	70	WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.80 IN
SPAN= 6-66 HRS, dt=.12 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**PRE DEVELOPMENT WOODLAND SWALE**	20.0

SUBCATCHMENT 20 **POST DEVELOPMENT / PHASE 3 BMP5.4**

PEAK= 12.85 CFS @ 12.02 HRS, VOLUME= .90 AF

ACRES	CN	
11.57	77	SUBDIVISION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.80 IN
SPAN= 6-66 HRS, dt=.12 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**DEVELOPED SITE**	15.0

REACH 11 **WOODLAND RAVINE SECTION #1**

Qin = 6.38 CFS @ 12.11 HRS, VOLUME= .59 AF
Qout= 6.28 CFS @ 12.13 HRS, VOLUME= .59 AF, ATTEN= 2%, LAG= 1.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
27.80	0.0	0.00
28.00	.4	4.00
30.00	50.0	46.44
32.00	154.0	58.65

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 871.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 28.08 FT
PEAK VELOCITY= 2.7 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 12 **WOODLAND RAVINE SECTION #2**

Qin = 6.28 CFS @ 12.13 HRS, VOLUME= .59 AF
Qout= 6.08 CFS @ 12.15 HRS, VOLUME= .59 AF, ATTEN= 3%, LAG= 1.4 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
24.00	0.0	0.00
26.00	46.0	43.20
28.00	145.0	56.60
30.00	227.0	72.50

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .02 FT/FT
CAPACITY= 1021 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 24.12 FT
PEAK VELOCITY= 2.2 FPS
TRAVEL TIME = .8 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 13 **WOODLAND RAVINE SECTION #3**

Qin = 6.08 CFS @ 12.15 HRS, VOLUME= .59 AF
Qout= 5.82 CFS @ 12.18 HRS, VOLUME= .59 AF, ATTEN= 4%, LAG= 1.5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
21.80	0.0	0.00
22.00	5.0	47.00
24.00	130.0	78.46
26.00	298.0	90.67

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 1957.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 22.01 FT
PEAK VELOCITY= 1.1 FPS
TRAVEL TIME = 1.5 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 14 **WOODLAND RAVINE SECTION #4**

Qin = 5.82 CFS @ 12.18 HRS, VOLUME= .59 AF
Qout= 5.61 CFS @ 12.22 HRS, VOLUME= .59 AF, ATTEN= 4%, LAG= 2.5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
20.00	0.0	0.00
22.00	54.0	54.20
24.00	177.0	69.58
26.00	328.0	82.69

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 2442.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 20.07 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 21 **WOODLAND RAVINE SECTION #1**

Qin = .29 CFS @ 19.86 HRS, VOLUME= .90 AF
Qout= .29 CFS @ 19.91 HRS, VOLUME= .90 AF, ATTEN= 0%, LAG= 2.9 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
27.80	0.0	0.00
28.00	.4	4.00
30.00	50.0	46.44
32.00	154.0	58.65

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 871.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 28.00 FT
PEAK VELOCITY= .7 FPS
TRAVEL TIME = 2.3 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 22 **WOODLAND RAVINE SECTION #2**

Qin = .29 CFS @ 19.91 HRS, VOLUME= .90 AF
Qout= .29 CFS @ 19.94 HRS, VOLUME= .90 AF, ATTEN= 0%, LAG= 1.5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
24.00	0.0	0.00
26.00	46.0	43.20
28.00	145.0	56.60
30.00	227.0	72.50

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .02 FT/FT
CAPACITY= 1021 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 24.01 FT
PEAK VELOCITY= 2.2 FPS
TRAVEL TIME = .8 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 23 **WOODLAND RAVINE SECTION #3**

Qin = .29 CFS @ 19.94 HRS, VOLUME= .90 AF
Qout= .29 CFS @ 20.02 HRS, VOLUME= .90 AF, ATTEN= 0%, LAG= 5.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
21.80	0.0	0.00
22.00	5.0	47.00
24.00	130.0	78.46
26.00	298.0	90.67

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 1957.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 21.82 FT
PEAK VELOCITY= .7 FPS
TRAVEL TIME = 2.5 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 24 **WOODLAND RAVINE SECTION #4**

Qin = .29 CFS @ 20.02 HRS, VOLUME= .90 AF
Qout= .29 CFS @ 20.04 HRS, VOLUME= .90 AF, ATTEN= 0%, LAG= 1.1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
20.00	0.0	0.00
22.00	54.0	54.20
24.00	177.0	69.58
26.00	328.0	82.69

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 2442.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 20.00 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 25 **EMERGENCY SPILLWAY**

Qin = 0.00 CFS @ 0.00 HRS, VOLUME= 0.00 AF
Qout= 0.00 CFS @ 0.00 HRS, VOLUME= 0.00 AF, ATTEN= 0%, LAG= 0.0 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.10	.80	3.45
.20	1.61	10.84
.30	2.43	21.11
.43	3.50	38.01
.60	4.92	65.25
.80	6.61	103.70
1.00	8.33	148.18

8' x 1' CHANNEL
SIDE SLOPE= 3 '/'
n= .03
LENGTH= 70 FT
SLOPE= .1667 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 0.00 FT
PEAK VELOCITY= 0.0 FPS
TRAVEL TIME = 0.0 MIN
SPAN= 6-66 HRS, dt=.12 HRS

POND 20 **STORMWATER MANAGEMENT POND 5.4**

Qin = 12.85 CFS @ 12.02 HRS, VOLUME= .90 AF
Qout= .29 CFS @ 19.86 HRS, VOLUME= .90 AF, ATTEN= 98%, LAG= 470.4 MIN
Qpri= .29 CFS @ 19.86 HRS, VOLUME= .90 AF
Qsec= 0.00 CFS @ 0.00 HRS, VOLUME= 0.00 AF

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
34.0	0	0	0
36.0	1165	1165	1165
38.0	3033	4198	5363
40.0	5508	8541	13904
42.0	8715	14223	28127
44.0	12306	21021	49148
46.0	16056	28362	77510

STOR-IND METHOD
PEAK STORAGE = 26874 CF
PEAK ELEVATION= 41.8 FT
FLOOD ELEVATION= 46.0 FT
START ELEVATION= 34.0 FT
SPAN= 6-66 HRS, dt=.12 HRS
Tdet= 1037.1 MIN (.9 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	3	34.0'	**2" ORIFICE/GRATE**
			Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
2	3	42.3'	**48" HORIZONTAL ORIFICE/GRATE**
			Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)
3	P	31.0'	**18" CULVERT**
			n=.013 L=100' S=.078'/' Ke=.6 Cc=.9 Cd=.56
4	S	44.0'	**6' BROAD-CRESTED RECTANGULAR WEIR X 1.81**
			Q=C L H^1.5 C=1.4, 1.45, 1.5, 0, 0, 0, 0, 0

Primary Discharge
└──3=Culvert
  ├──1=Orifice/Grate
  └──2=Orifice/Grate

Secondary Discharge
└──4=Broad-Crested Rectangular Weir

SUBCATCHMENT 10 PREDEVELOPMENT DRAINAGE AREA BMP 5.4

PEAK= 10.45 CFS @ 12.10 HRS, VOLUME= .90 AF

ACRES	CN	
11.69	70	WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 6-66 HRS, dt=.12 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**PRE DEVELOPMENT WOODLAND SWALE**	20.0

SUBCATCHMENT 20 POST DEVELOPMENT / PHASE 3 BMP5.4

PEAK= 18.68 CFS @ 12.02 HRS, VOLUME= 1.28 AF

ACRES	CN	
11.57	77	SUBDIVISION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 6-66 HRS, dt=.12 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**DEVELOPED SITE**	15.0

REACH 11 **WOODLAND RAVINE SECTION #1**

Qin = 10.45 CFS @ 12.10 HRS, VOLUME= .90 AF
Qout= 10.35 CFS @ 12.12 HRS, VOLUME= .90 AF, ATTEN= 1%, LAG= 1.1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
27.80	0.0	0.00
28.00	.4	4.00
30.00	50.0	46.44
32.00	154.0	58.65

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 871.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 28.13 FT
PEAK VELOCITY= 2.9 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 12 **WOODLAND RAVINE SECTION #2**

Qin = 10.35 CFS @ 12.12 HRS, VOLUME= .90 AF
Qout= 10.06 CFS @ 12.14 HRS, VOLUME= .90 AF, ATTEN= 3%, LAG= 1.3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
24.00	0.0	0.00
26.00	46.0	43.20
28.00	145.0	56.60
30.00	227.0	72.50

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .02 FT/FT
CAPACITY= 1021 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 24.20 FT
PEAK VELOCITY= 2.2 FPS
TRAVEL TIME = .8 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 13 **WOODLAND RAVINE SECTION #3**

Qin = 10.06 CFS @ 12.14 HRS, VOLUME= .90 AF
Qout= 9.84 CFS @ 12.16 HRS, VOLUME= .90 AF, ATTEN= 2%, LAG= 1.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
21.80	0.0	0.00
22.00	5.0	47.00
24.00	130.0	78.46
26.00	298.0	90.67

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 1957.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 22.03 FT
PEAK VELOCITY= 1.5 FPS
TRAVEL TIME = 1.1 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 14 **WOODLAND RAVINE SECTION #4**

Qin = 9.84 CFS @ 12.16 HRS, VOLUME= .90 AF
Qout= 9.33 CFS @ 12.18 HRS, VOLUME= .90 AF, ATTEN= 5%, LAG= 1.4 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
20.00	0.0	0.00
22.00	54.0	54.20
24.00	177.0	69.58
26.00	328.0	82.69

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 2442.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 20.12 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 21 **WOODLAND RAVINE SECTION #1**

Qin = 1.23 CFS @ 13.64 HRS, VOLUME= 1.28 AF
Qout= 1.23 CFS @ 13.67 HRS, VOLUME= 1.28 AF, ATTEN= 0%, LAG= 1.5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
27.80	0.0	0.00
28.00	.4	4.00
30.00	50.0	46.44
32.00	154.0	58.65

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 871.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 28.01 FT
PEAK VELOCITY= 1.7 FPS
TRAVEL TIME = 1.0 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 22 **WOODLAND RAVINE SECTION #2**

Qin = 1.23 CFS @ 13.67 HRS, VOLUME= 1.28 AF
Qout= 1.23 CFS @ 13.70 HRS, VOLUME= 1.28 AF, ATTEN= 0%, LAG= 1.8 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
24.00	0.0	0.00
26.00	46.0	43.20
28.00	145.0	56.60
30.00	227.0	72.50

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .02 FT/FT
CAPACITY= 1021 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 24.02 FT
PEAK VELOCITY= 2.2 FPS
TRAVEL TIME = .8 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 23 **WOODLAND RAVINE SECTION #3**

Qin = 1.23 CFS @ 13.70 HRS, VOLUME= 1.28 AF
Qout= 1.23 CFS @ 13.79 HRS, VOLUME= 1.28 AF, ATTEN= 0%, LAG= 5.6 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
21.80	0.0	0.00
22.00	5.0	47.00
24.00	130.0	78.46
26.00	298.0	90.67

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 1957.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 21.87 FT
PEAK VELOCITY= .7 FPS
TRAVEL TIME = 2.5 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 24 **WOODLAND RAVINE SECTION #4**

Qin = 1.23 CFS @ 13.79 HRS, VOLUME= 1.28 AF
Qout= 1.23 CFS @ 13.81 HRS, VOLUME= 1.28 AF, ATTEN= 0%, LAG= 1.2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
20.00	0.0	0.00
22.00	54.0	54.20
24.00	177.0	69.58
26.00	328.0	82.69

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 2442.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 20.02 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 25 **EMERGENCY SPILLWAY**

Qin = 0.00 CFS @ 0.00 HRS, VOLUME= 0.00 AF
Qout= 0.00 CFS @ 0.00 HRS, VOLUME= 0.00 AF, ATTEN= 0%, LAG= 0.0 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.10	.80	3.45
.20	1.61	10.84
.30	2.43	21.11
.43	3.50	38.01
.60	4.92	65.25
.80	6.61	103.70
1.00	8.33	148.18

8' x 1' CHANNEL
SIDE SLOPE= 3 '/'
n= .03
LENGTH= 70 FT
SLOPE= .1667 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 0.00 FT
PEAK VELOCITY= 0.0 FPS
TRAVEL TIME = 0.0 MIN
SPAN= 6-66 HRS, dt=.12 HRS

POND 20 **STORMWATER MANAGEMENT POND 5.4**

Qin = 18.68 CFS @ 12.02 HRS, VOLUME= 1.28 AF
Qout= 1.23 CFS @ 13.64 HRS, VOLUME= 1.28 AF, ATTEN= 93%, LAG= 97.6 MIN
Qpri= 1.23 CFS @ 13.64 HRS, VOLUME= 1.28 AF
Qsec= 0.00 CFS @ 0.00 HRS, VOLUME= 0.00 AF

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
34.0	0	0	0
36.0	1165	1165	1165
38.0	3033	4198	5363
40.0	5508	8541	13904
42.0	8715	14223	28127
44.0	12306	21021	49148
46.0	16056	28362	77510

STOR-IND METHOD
PEAK STORAGE = 31722 CF
PEAK ELEVATION= 42.3 FT
FLOOD ELEVATION= 46.0 FT
START ELEVATION= 34.0 FT
SPAN= 6-66 HRS, dt=.12 HRS
Tdet= 912.9 MIN (1.28 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	3	34.0'	**2" ORIFICE/GRATE**
			Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
2	3	42.3'	**48" HORIZONTAL ORIFICE/GRATE**
			Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)
3	P	31.0'	**18" CULVERT**
			n=.013 L=100' S=.078'/' Ke=.6 Cc=.9 Cd=.56
4	S	44.0'	**6' BROAD-CRESTED RECTANGULAR WEIR X 1.81**
			Q=C L H^1.5 C=1.4, 1.45, 1.5, 0, 0, 0, 0, 0

Primary Discharge
└──3=Culvert
  ├──1=Orifice/Grate
  └──2=Orifice/Grate

Secondary Discharge
└──4=Broad-Crested Rectangular Weir

SUBCATCHMENT 10 **PREDEVELOPMENT DRAINAGE AREA BMP 5.4**

PEAK= 25.06 CFS @ 12.09 HRS, VOLUME= 2.01 AF

ACRES	CN	
11.69	70	WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 6-66 HRS, dt=.12 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**PRE DEVELOPMENT WOODLAND SWALE**	20.0

SUBCATCHMENT 20 **POST DEVELOPMENT / PHASE 3 BMP5.4**

PEAK= 38.08 CFS @ 12.01 HRS, VOLUME= 2.56 AF

ACRES	CN	
11.57	77	SUBDIVISION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 6-66 HRS, dt=.12 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**DEVELOPED SITE**	15.0

REACH 11 **WOODLAND RAVINE SECTION #1**

Qin = 25.06 CFS @ 12.09 HRS, VOLUME= 2.01 AF
Qout= 24.88 CFS @ 12.11 HRS, VOLUME= 2.01 AF, ATTEN= 1%, LAG= 1.2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
27.80	0.0	0.00
28.00	.4	4.00
30.00	50.0	46.44
32.00	154.0	58.65

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 871.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 28.32 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 12 **WOODLAND RAVINE SECTION #2**

Qin = 24.88 CFS @ 12.11 HRS, VOLUME= 2.01 AF
Qout= 24.34 CFS @ 12.13 HRS, VOLUME= 2.01 AF, ATTEN= 2%, LAG= 1.4 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
24.00	0.0	0.00
26.00	46.0	43.20
28.00	145.0	56.60
30.00	227.0	72.50

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .02 FT/FT
CAPACITY= 1021 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 24.49 FT
PEAK VELOCITY= 2.2 FPS
TRAVEL TIME = .8 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 13 **WOODLAND RAVINE SECTION #3**

Qin = 24.34 CFS @ 12.13 HRS, VOLUME= 2.01 AF
Qout= 23.82 CFS @ 12.14 HRS, VOLUME= 2.01 AF, ATTEN= 2%, LAG= .9 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
21.80	0.0	0.00
22.00	5.0	47.00
24.00	130.0	78.46
26.00	298.0	90.67

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 1957.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 22.08 FT
PEAK VELOCITY= 2.5 FPS
TRAVEL TIME = .7 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 14 **WOODLAND RAVINE SECTION #4**

Qin = 23.82 CFS @ 12.14 HRS, VOLUME= 2.01 AF
Qout= 23.21 CFS @ 12.16 HRS, VOLUME= 2.01 AF, ATTEN= 3%, LAG= 1.2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
20.00	0.0	0.00
22.00	54.0	54.20
24.00	177.0	69.58
26.00	328.0	82.69

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 2442.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 20.29 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 21 **WOODLAND RAVINE SECTION #1**

Qin = 26.09 CFS @ 12.17 HRS, VOLUME= 2.56 AF
Qout= 23.89 CFS @ 12.21 HRS, VOLUME= 2.56 AF, ATTEN= 8%, LAG= 2.7 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
27.80	0.0	0.00
28.00	.4	4.00
30.00	50.0	46.44
32.00	154.0	58.65

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 871.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 28.30 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 22 **WOODLAND RAVINE SECTION #2**

Qin = 23.89 CFS @ 12.21 HRS, VOLUME= 2.56 AF
Qout= 24.00 CFS @ 12.24 HRS, VOLUME= 2.56 AF, ATTEN= 0%, LAG= 1.7 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
24.00	0.0	0.00
26.00	46.0	43.20
28.00	145.0	56.60
30.00	227.0	72.50

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .02 FT/FT
CAPACITY= 1021 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 24.49 FT
PEAK VELOCITY= 2.2 FPS
TRAVEL TIME = .8 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 23 **WOODLAND RAVINE SECTION #3**

Qin = 24.00 CFS @ 12.24 HRS, VOLUME= 2.56 AF
Qout= 24.30 CFS @ 12.25 HRS, VOLUME= 2.56 AF, ATTEN= 0%, LAG= .8 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
21.80	0.0	0.00
22.00	5.0	47.00
24.00	130.0	78.46
26.00	298.0	90.67

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 1957.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 22.08 FT
PEAK VELOCITY= 2.5 FPS
TRAVEL TIME = .7 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 24 **WOODLAND RAVINE SECTION #4**

Qin = 24.30 CFS @ 12.25 HRS, VOLUME= 2.56 AF
Qout= 22.77 CFS @ 12.27 HRS, VOLUME= 2.56 AF, ATTEN= 6%, LAG= 1.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
20.00	0.0	0.00
22.00	54.0	54.20
24.00	177.0	69.58
26.00	328.0	82.69

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 2442.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 20.29 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 25 **EMERGENCY SPILLWAY**

Qin = 0.00 CFS @ 0.00 HRS, VOLUME= 0.00 AF
Qout= 0.00 CFS @ 0.00 HRS, VOLUME= 0.00 AF, ATTEN= 0%, LAG= 0.0 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.10	.80	3.45
.20	1.61	10.84
.30	2.43	21.11
.43	3.50	38.01
.60	4.92	65.25
.80	6.61	103.70
1.00	8.33	148.18

8' x 1' CHANNEL
SIDE SLOPE= 3 '/'
n= .03
LENGTH= 70 FT
SLOPE= .1667 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 0.00 FT
PEAK VELOCITY= 0.0 FPS
TRAVEL TIME = 0.0 MIN
SPAN= 6-66 HRS, dt=.12 HRS

POND 20 **STORMWATER MANAGEMENT POND 5.4**

Qin = 38.08 CFS @ 12.01 HRS, VOLUME= 2.56 AF
Qout= 26.09 CFS @ 12.17 HRS, VOLUME= 2.56 AF, ATTEN= 31%, LAG= 9.3 MIN
Qpri= 26.09 CFS @ 12.17 HRS, VOLUME= 2.56 AF
Qsec= 0.00 CFS @ 0.00 HRS, VOLUME= 0.00 AF

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
34.0	0	0	0
36.0	1165	1165	1165
38.0	3033	4198	5363
40.0	5508	8541	13904
42.0	8715	14223	28127
44.0	12306	21021	49148
46.0	16056	28362	77510

STOR-IND METHOD
PEAK STORAGE = 38529 CF
PEAK ELEVATION= 43.0 FT
FLOOD ELEVATION= 46.0 FT
START ELEVATION= 34.0 FT
SPAN= 6-66 HRS, dt=.12 HRS
Tdet= 469.6 MIN (2.56 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	3	34.0'	**2" ORIFICE/GRATE**
			Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
2	3	42.3'	**48" HORIZONTAL ORIFICE/GRATE**
			Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)
3	P	31.0'	**18" CULVERT**
			n=.013 L=100' S=.078'/' Ke=.6 Cc=.9 Cd=.56
4	S	44.0'	**6' BROAD-CRESTED RECTANGULAR WEIR X 1.81**
			Q=C L H^1.5 C=1.4, 1.45, 1.5, 0, 0, 0, 0, 0

Primary Discharge
└──3=Culvert
  ├──1=Orifice/Grate
  └──2=Orifice/Grate

Secondary Discharge
└──4=Broad-Crested Rectangular Weir

SUBCATCHMENT 10 PREDEVELOPMENT DRAINAGE AREA BMP 5.4

PEAK= 51.60 CFS @ 12.08 HRS, VOLUME= 4.08 AF

ACRES	CN	
11.69	70	WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 6-66 HRS, dt=.12 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**PRE DEVELOPMENT WOODLAND SWALE**	20.0

SUBCATCHMENT 20 POST DEVELOPMENT / PHASE 3 BMP5.4

PEAK= 70.87 CFS @ 12.01 HRS, VOLUME= 4.80 AF

ACRES	CN	
11.57	77	SUBDIVISION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 6-66 HRS, dt=.12 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**DEVELOPED SITE**	15.0

REACH 11 **WOODLAND RAVINE SECTION #1**

Qin = 51.60 CFS @ 12.08 HRS, VOLUME= 4.08 AF
Qout= 51.27 CFS @ 12.10 HRS, VOLUME= 4.08 AF, ATTEN= 1%, LAG= 1.3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
27.80	0.0	0.00
28.00	.4	4.00
30.00	50.0	46.44
32.00	154.0	58.65

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 871.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 28.65 FT
PEAK VELOCITY= 3.1 FPS
TRAVEL TIME = .5 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 12 **WOODLAND RAVINE SECTION #2**

Qin = 51.27 CFS @ 12.10 HRS, VOLUME= 4.08 AF
Qout= 50.30 CFS @ 12.12 HRS, VOLUME= 4.08 AF, ATTEN= 2%, LAG= 1.4 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
24.00	0.0	0.00
26.00	46.0	43.20
28.00	145.0	56.60
30.00	227.0	72.50

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .02 FT/FT
CAPACITY= 1021 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 25.02 FT
PEAK VELOCITY= 2.2 FPS
TRAVEL TIME = .8 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 13 **WOODLAND RAVINE SECTION #3**

Qin = 50.30 CFS @ 12.12 HRS, VOLUME= 4.08 AF
Qout= 49.46 CFS @ 12.13 HRS, VOLUME= 4.08 AF, ATTEN= 2%, LAG= .8 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
21.80	0.0	0.00
22.00	5.0	47.00
24.00	130.0	78.46
26.00	298.0	90.67

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 1957.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 22.17 FT
PEAK VELOCITY= 3.2 FPS
TRAVEL TIME = .5 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 14 **WOODLAND RAVINE SECTION #4**

Qin = 49.46 CFS @ 12.13 HRS, VOLUME= 4.08 AF
Qout= 48.42 CFS @ 12.15 HRS, VOLUME= 4.08 AF, ATTEN= 2%, LAG= 1.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
20.00	0.0	0.00
22.00	54.0	54.20
24.00	177.0	69.58
26.00	328.0	82.69

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 2442.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 20.61 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 21 **WOODLAND RAVINE SECTION #1**

Qin = 43.72 CFS @ 12.17 HRS, VOLUME= 4.80 AF
Qout= 42.95 CFS @ 12.20 HRS, VOLUME= 4.80 AF, ATTEN= 2%, LAG= 2.3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
27.80	0.0	0.00
28.00	.4	4.00
30.00	50.0	46.44
32.00	154.0	58.65

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 871.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 28.54 FT
PEAK VELOCITY= 3.1 FPS
TRAVEL TIME = .5 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 22 **WOODLAND RAVINE SECTION #2**

Qin = 42.95 CFS @ 12.20 HRS, VOLUME= 4.80 AF
Qout= 42.48 CFS @ 12.23 HRS, VOLUME= 4.80 AF, ATTEN= 1%, LAG= 1.4 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
24.00	0.0	0.00
26.00	46.0	43.20
28.00	145.0	56.60
30.00	227.0	72.50

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .02 FT/FT
CAPACITY= 1021 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 24.85 FT
PEAK VELOCITY= 2.2 FPS
TRAVEL TIME = .8 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 23 **WOODLAND RAVINE SECTION #3**

Qin = 42.48 CFS @ 12.23 HRS, VOLUME= 4.80 AF
Qout= 42.64 CFS @ 12.24 HRS, VOLUME= 4.80 AF, ATTEN= 0%, LAG= .8 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
21.80	0.0	0.00
22.00	5.0	47.00
24.00	130.0	78.46
26.00	298.0	90.67

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 1957.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 22.15 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 24 **WOODLAND RAVINE SECTION #4**

Qin = 42.64 CFS @ 12.24 HRS, VOLUME= 4.80 AF
Qout= 41.28 CFS @ 12.26 HRS, VOLUME= 4.80 AF, ATTEN= 3%, LAG= 1.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
20.00	0.0	0.00
22.00	54.0	54.20
24.00	177.0	69.58
26.00	328.0	82.69

SPECIAL 100' CHANNEL
n= .1
LENGTH= 100 FT
SLOPE= .04 FT/FT
CAPACITY= 2442.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 20.52 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 6-66 HRS, dt=.12 HRS

REACH 25 **EMERGENCY SPILLWAY**

Qin = 15.28 CFS @ 12.16 HRS, VOLUME= .31 AF
Qout= 14.82 CFS @ 12.17 HRS, VOLUME= .31 AF, ATTEN= 3%, LAG= .4 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.10	.80	3.45
.20	1.61	10.84
.30	2.43	21.11
.43	3.50	38.01
.60	4.92	65.25
.80	6.61	103.70
1.00	8.33	148.18

8' x 1' CHANNEL
SIDE SLOPE= 3 '/'
n= .03
LENGTH= 70 FT
SLOPE= .1667 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .23 FT
PEAK VELOCITY= 7.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 6-66 HRS, dt=.12 HRS

POND 20 **STORMWATER MANAGEMENT POND 5.4**

Qin = 70.87 CFS @ 12.01 HRS, VOLUME= 4.80 AF
Qout= 44.18 CFS @ 12.16 HRS, VOLUME= 4.80 AF, ATTEN= 38%, LAG= 9.2 MIN
Qpri= 28.90 CFS @ 12.16 HRS, VOLUME= 4.50 AF
Qsec= 15.28 CFS @ 12.16 HRS, VOLUME= .31 AF

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
34.0	0	0	0
36.0	1165	1165	1165
38.0	3033	4198	5363
40.0	5508	8541	13904
42.0	8715	14223	28127
44.0	12306	21021	49148
46.0	16056	28362	77510

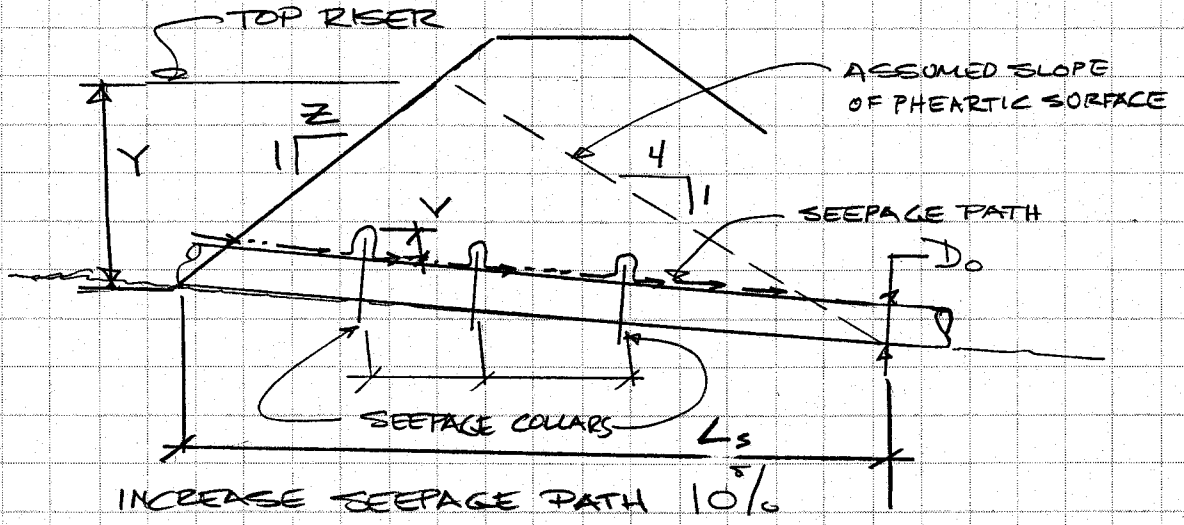
STOR-IND METHOD
PEAK STORAGE = 62533 CF
PEAK ELEVATION= 44.9 FT
FLOOD ELEVATION= 46.0 FT
START ELEVATION= 34.0 FT
SPAN= 6-66 HRS, dt=.12 HRS
Tdet= 262.9 MIN (4.79 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	3	34.0'	**2" ORIFICE/GRATE**
			Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
2	3	42.3'	**48" HORIZONTAL ORIFICE/GRATE**
			Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)
3	P	31.0'	**18" CULVERT**
			n=.013 L=100' S=.078'/' Ke=.6 Cc=.9 Cd=.56
4	S	44.0'	**6' BROAD-CRESTED RECTANGULAR WEIR X 1.81**
			Q=C L H^1.5 C=1.4, 1.45, 1.5, 0, 0, 0, 0, 0

Primary Discharge
└──3=Culvert
├──1=Orifice/Grate
└──2=Orifice/Grate

Secondary Discharge
└──4=Broad-Crested Rectangular Weir

BMP 5.4 SEEPAGE COLLAR DESIGN



INCREASE SEEPAGE PATH 10%

L_s: LENGTH IN SATURATED ZONE S: SLOPE OF PIPE ft/ft.

$$L_s = Y(z+4)\left(1+\frac{S}{.25-S}\right)$$

$Y = 4.23 - .35 = 7.3$

$S = .02$

4x4 collars $V = 4 - 1.7/2 = 1.15$

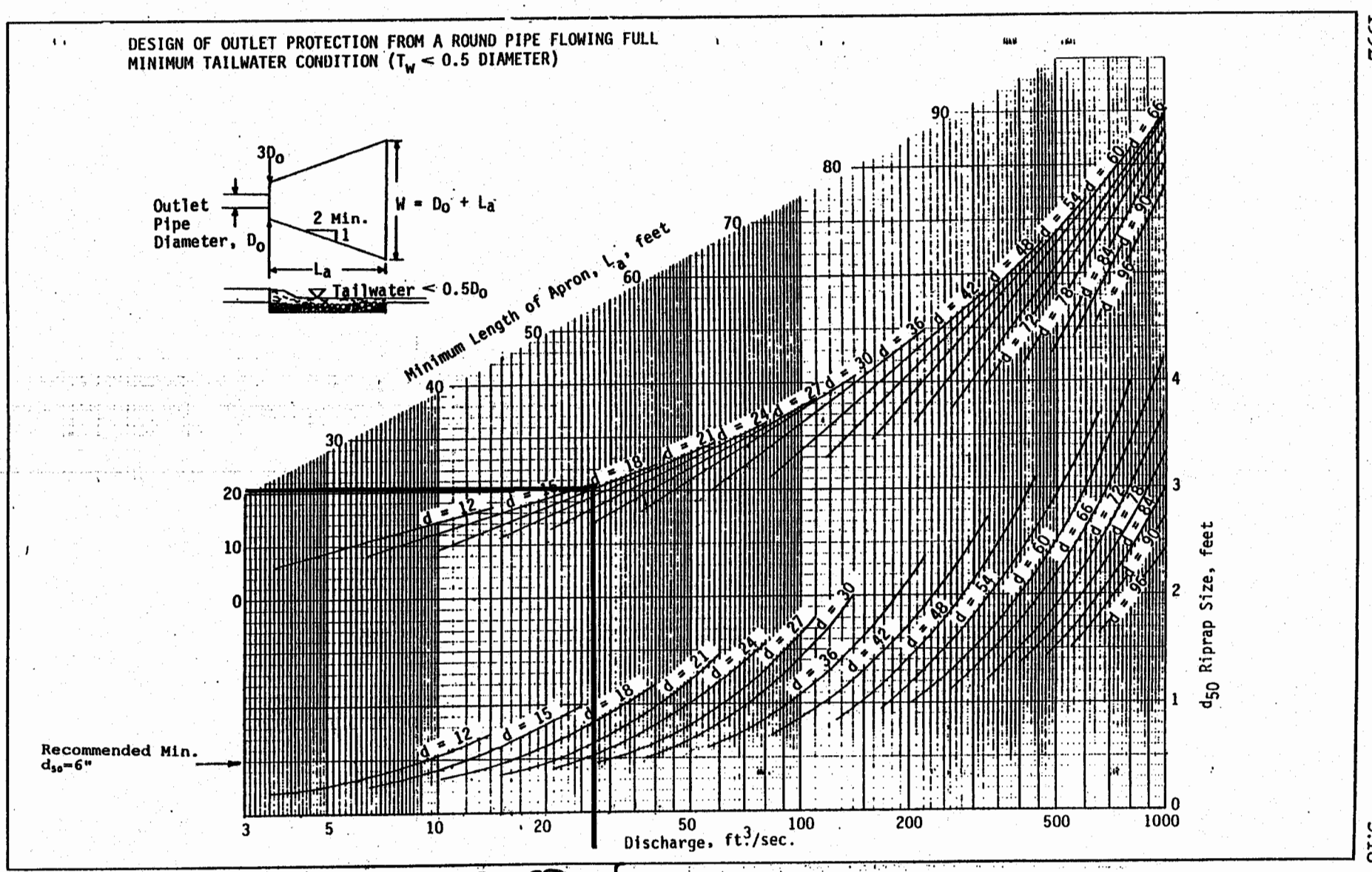
$$\therefore L_s = 7.3 \times 7 \times \left(1+\frac{.02}{.23}\right) = 55.54 \text{ ft.}$$

$L_s + 10\% = 61$ ft.

Reqd. Seepage Path: $L_{s\,reqd} = L_s \times 1.1$

$L_{s\,reqd} = L_{s1} + 2 \times V \times N = 55.5 + 2 \times 1.15\,N = 61$

$$N = \frac{61 - 55.5}{2.3} = \frac{5.55}{2.3} = 2.41 \xrightarrow{\text{USE}} 3$$



Source: USDA-SCS

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Plate 3.18-3

3.18

OUTLET BMP 5.4 Q_{10} = 26.09 cfs

D_o = 18" Q_{100} = 28.9 cfs

USE L_a = 20 ft.

PROJECT 1960038-111.72
HEC12 Version: V2.91 Run Date: 07-08-1999

==========

INLET NUMBER E-5 LENGTH 8.0 STATION 15+50L

DRAINAGE AREA = 0.130 ACRES C VALUE = .900 CA = 0.117
DRAINAGE AREA = 0.390 ACRES C VALUE = .300 CA = 0.117
SUM CA= 0.234 INT= 4.00 CFS= 0.936 CO= 0.000 GUTTER FLOW= 0.936

GUTTER SLOPE = 0.0267 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.31	2.0	0.60	0.0833	4.0	0.98	3.5	0.146	0.164

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 7.2 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.94 CFS CARRYOVER= 0.00

==========

INLET NUMBER E-4 LENGTH 8.0 STATION 16+60 END

DRAINAGE AREA = 0.080 ACRES C VALUE = .900 CA = 0.072
DRAINAGE AREA = 0.250 ACRES C VALUE = .900 CA = 0.225

FOR THE FIRST SIDE
SUM CA= 0.072 INT= 4.00 CFS= 0.288 CO= 0.000 GUTTER FLOW= 0.288
FOR THE OTHER SIDE
SUM CA= 0.225 INT= 4.00 CFS= 0.900 CO= 0.000 GUTTER FLOW= 0.900
AT THE INLET

SUM CA= 0.297 INT= 4.00 CFS= 1.188 CO= 0.000 GUTTER FLOW= 1.188

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.90 (cfs) IS 9.07 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 11.60 H (ft) = 0.458
DEPTH OF WATER (ft) = 0.13 SPREAD (ft) = 6.03

```
================================================================================
INLET NUMBER F-3            LENGTH   8.0        STATION  15+75 R

DRAINAGE AREA =  0.130 ACRES       C VALUE = .900       CA =  0.117
DRAINAGE AREA =  0.140 ACRES       C VALUE = .300       CA =  0.042
DRAINAGE AREA =  0.040 ACRES       C VALUE = .900       CA =  0.036

FOR THE FIRST SIDE
SUM CA=   0.159 INT=  4.00  CFS=   0.636  CO=  0.000 GUTTER FLOW=   0.636
FOR THE OTHER SIDE
SUM CA=   0.036 INT=  4.00  CFS=   0.144  CO=  0.000 GUTTER FLOW=   0.144
AT THE INLET

SUM CA=   0.195 INT=  4.00  CFS=   0.780  CO=  0.000 GUTTER FLOW=   0.780

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.64 (cfs) IS  7.66 (ft.)

      XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
   P EFFEC. LENGTH (ft) = 11.60                H (ft) = 0.458
   DEPTH OF WATER (ft) =   0.09          SPREAD (ft)  =  4.56


================================================================================
INLET NUMBER F-2            LENGTH   6.0        STATION  15+75 L

DRAINAGE AREA =  0.130 ACRES       C VALUE = .900       CA =  0.117
DRAINAGE AREA =  0.040 ACRES       C VALUE = .900       CA =  0.036

FOR THE FIRST SIDE
SUM CA=   0.117 INT=  4.00  CFS=   0.468  CO=  0.000 GUTTER FLOW=   0.468
FOR THE OTHER SIDE
SUM CA=   0.036 INT=  4.00  CFS=   0.144  CO=  0.000 GUTTER FLOW=   0.144
AT THE INLET

SUM CA=   0.153 INT=  4.00  CFS=   0.612  CO=  0.000 GUTTER FLOW=   0.612

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.47 (cfs) IS  6.50 (ft.)

      XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
   P EFFEC. LENGTH (ft) =  9.60                H (ft) = 0.458
   DEPTH OF WATER (ft) =   0.09          SPREAD (ft)  =  4.40
```

PROJECT 1960038-111.73
HEC12 Version: V2.91 Run Date: 07-28-1999

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INLET NUMBER G-4 LENGTH 10.0 STATION 21+63L

DRAINAGE AREA = 0.220 ACRES C VALUE = .900 CA = 0.198
DRAINAGE AREA = 0.180 ACRES C VALUE = .300 CA = 0.054
DRAINAGE AREA = 0.210 ACRES C VALUE = .300 CA = 0.063
DRAINAGE AREA = 0.190 ACRES C VALUE = .900 CA = 0.171

FOR THE FIRST SIDE
SUM CA= 0.252 INT= 4.00 CFS= 1.008 CO= 0.000 GUTTER FLOW= 1.008
FOR THE OTHER SIDE
SUM CA= 0.234 INT= 4.00 CFS= 0.936 CO= 0.000 GUTTER FLOW= 0.936
AT THE INLET

SUM CA= 0.486 INT= 4.00 CFS= 1.944 CO= 0.000 GUTTER FLOW= 1.944

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 1.01 (cfs) IS 8.95 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 13.60 H (ft) = 0.458
DEPTH OF WATER (ft) = 0.16 SPREAD (ft) = 7.54

```
================================================================================
INLET NUMBER H-4            LENGTH   2.5        STATION  15+25 L

DRAINAGE AREA =  0.040 ACRES       C VALUE = .900       CA =  0.036
DRAINAGE AREA =  0.100 ACRES       C VALUE = .300       CA =  0.030
DRAINAGE AREA =  0.010 ACRES       C VALUE = .900       CA =  0.009
DRAINAGE AREA =  0.030 ACRES       C VALUE = .300       CA =  0.009

FOR THE FIRST SIDE
SUM CA=   0.066 INT=  4.00  CFS=   0.264  CO=  0.000 GUTTER FLOW=   0.264
FOR THE OTHER SIDE
SUM CA=   0.018 INT=  4.00  CFS=   0.072  CO=  0.000 GUTTER FLOW=   0.072
AT THE INLET

SUM CA=   0.084 INT=  4.00  CFS=   0.336  CO=  0.000 GUTTER FLOW=   0.336

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.26 (cfs) IS  4.53 (ft.)

      XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
   P EFFEC. LENGTH (ft) =  6.10                H (ft) = 0.458
   DEPTH OF WATER (ft) =   0.08          SPREAD (ft)  =  3.99



================================================================================
INLET NUMBER H-3a           LENGTH   6.0        STATION  17+35 END

DRAINAGE AREA =  0.080 ACRES       C VALUE = .900       CA =  0.072
DRAINAGE AREA =  0.030 ACRES       C VALUE = .300       CA =  0.009
DRAINAGE AREA =  0.080 ACRES       C VALUE = .900       CA =  0.072

FOR THE FIRST SIDE
SUM CA=   0.081 INT=  4.00  CFS=   0.324  CO=  0.000 GUTTER FLOW=   0.324
FOR THE OTHER SIDE
SUM CA=   0.072 INT=  4.00  CFS=   0.288  CO=  0.000 GUTTER FLOW=   0.288
AT THE INLET

SUM CA=   0.153 INT=  4.00  CFS=   0.612  CO=  0.000 GUTTER FLOW=   0.612

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.32 (cfs) IS  5.22 (ft.)

      XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
   P EFFEC. LENGTH (ft) =  9.60                H (ft) = 0.458
   DEPTH OF WATER (ft) =   0.09          SPREAD (ft)  =  4.40
```

```
==========================================================================
INLET NUMBER H-5            LENGTH   2.5        STATION  15+25 R

DRAINAGE AREA =  0.040 ACRES       C VALUE = .900       CA =  0.036
DRAINAGE AREA =  0.010 ACRES       C VALUE = .900       CA =  0.009

FOR THE FIRST SIDE
SUM CA=   0.036 INT=  4.00  CFS=   0.144  CO=  0.000 GUTTER FLOW=   0.144
FOR THE OTHER SIDE
SUM CA=   0.009 INT=  4.00  CFS=   0.036  CO=  0.000 GUTTER FLOW=   0.036
AT THE INLET

SUM CA=   0.045 INT=  4.00  CFS=   0.180  CO=  0.000 GUTTER FLOW=   0.180

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.14 (cfs) IS  2.59 (ft.)

       XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
    P EFFEC. LENGTH (ft) =  6.10                H (ft) = 0.458
    DEPTH OF WATER (ft) =   0.05          SPREAD (ft)  =  2.63
```

PROJECT 1960038-111.73
HEC12 Version: V2.91 Run Date: 01-19-2000

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INLET NUMBER I-3 **LENGTH 0.0** **STATION 17+00 L**

DRAINAGE AREA = 1.340 ACRES C VALUE = .300 CA = 0.402
DRAINAGE AREA = 0.170 ACRES C VALUE = .900 CA = 0.153
DRAINAGE AREA = 0.270 ACRES C VALUE = .300 CA = 0.081
DRAINAGE AREA = 0.190 ACRES C VALUE = .900 CA = 0.171
TOTAL AREA = 1.97 **COMPOSITE C = .41** **CUM. CA = .81**
FOR THE FIRST SIDE
SUM CA= 0.555 INT= 4.00 CFS= 2.220 CO= 0.000 GUTTER FLOW= 2.220
FOR THE OTHER SIDE
SUM CA= 0.252 INT= 4.00 CFS= 1.008 CO= 0.000 GUTTER FLOW= 1.008
AT THE INLET

SUM CA= 0.807 INT= 4.00 CFS= 3.228 CO= 0.000 GUTTER FLOW= 3.228

GUTTER SLOPE = 0.0290 FT/FT PAVEMENT CROSS SLOPE = 0.0233 FT/FT

SPREAD AT A SLOPE OF .029 (ft./ft.) AND 2.22 (cfs) IS 16.06 (ft.)

XXXXXXXXXX GRATE INLET IN A SUMP XXXXXXXXXX
DEPTH OF WATER (ft) = 0.19 SPREAD (ft) = 8.24
Grate operates as A WEIR

STORM SEWER DESIGN / RATIONAL METHOD 10 YEAR RETURN PERIOD

STONEHOUSE SECTION VB, PHASE 3

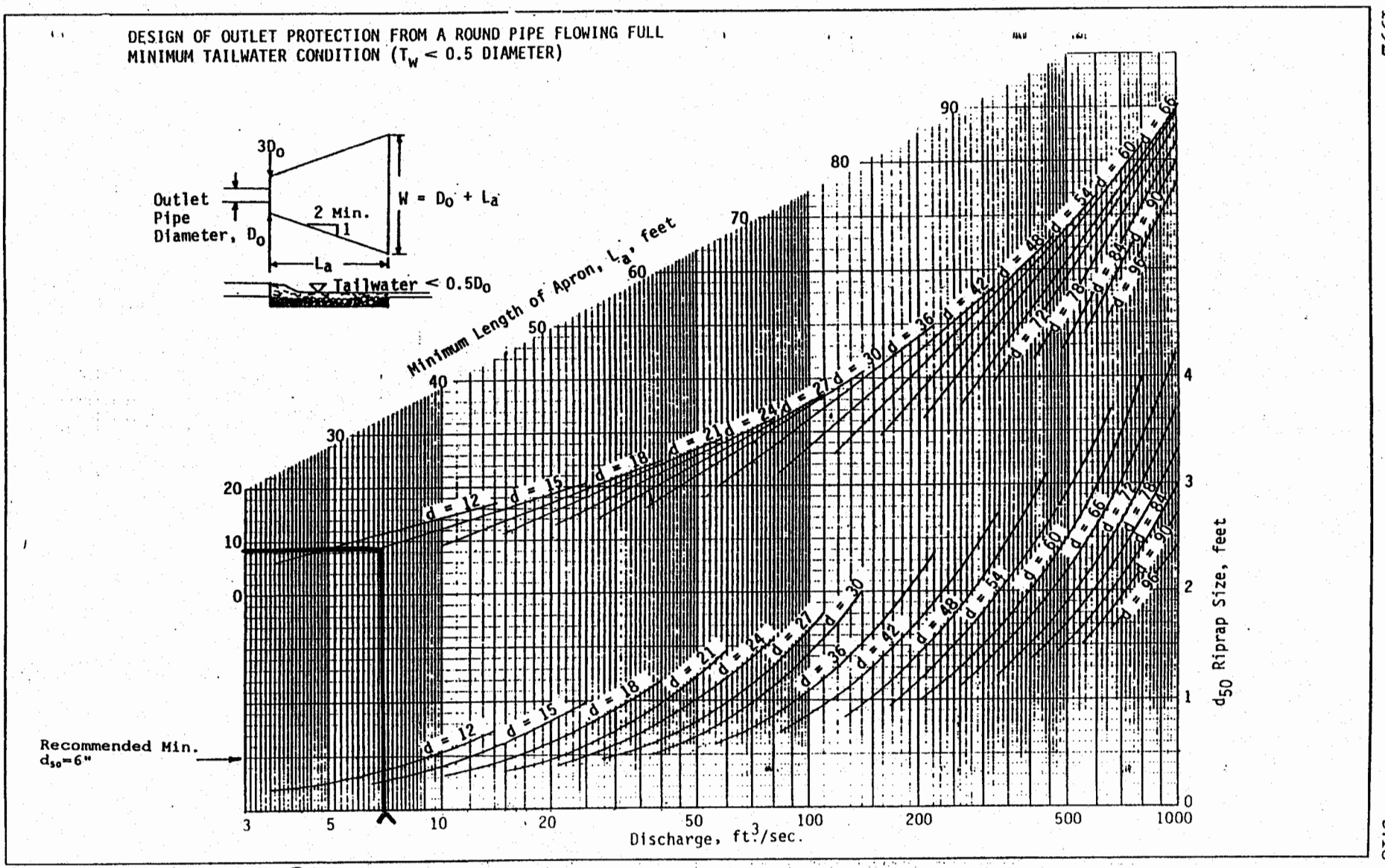
Concrete Pipe,"n" = 0.013 Capacity @ 80% Full Depth

VDOT L&D 229		Area Drained	Run-off Coeff.	"C x A		Inlet Time	Time of Conc.	Rainfall Intensity	RUNOFF	INVERT ELEVATIONS		LENGTH	SLOPE	DIAM	CAPACITY	VELOCITY	TRAVEL"t"	REMARKS
FROM PT.	TO PT.	"Acres"	"C"	INCR.	ACCUM	"t"	"tc"	"i"	"QRational"	UPPER END	LOWER END	ft.	ft/ft	inch	cfs	fps	min.	
(1)	(2)	(3)	(4)	(5)	(6)	*	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	
SYSTEM "E"	SAPLING DRIVE																	
PAVEMENT	E-5	0.13	0.90	0.12	0.12	1.26	5.00	7.2	0.84									
ROADSIDE AREA	E-5	0.39	0.30	0.12	0.23	7.90	7.90	6.4	1.50									
DI-3B @ E-5	E-4								1.50	77.00	70.40	110	0.0600	15	15.47	14.70	0.12	E-4 TOP = 82.19
PAVEMENT	E-4	0.08	0.90	0.07	0.31	2.54	8.02	6.4	1.96									
PAVEMENT	E-4	0.25	0.90	0.23	0.53	1.05	8.02	6.4	3.40									
DI-3C @ E-4	E-3								3.40	65.20	55.85	77	0.1214	15	22.00	20.91	0.06	E-4 TOP = 75.56
MH-1 @ E-3	E-2								3.40	55.75	45.10	103	0.1034	15	20.30	19.29	0.09	E-3 RIM = 65.50
LOT AREA	E-2	1.38	0.42	0.58	1.11	1.71	8.17	6.4	7.06									
MH-I @ E-2	E-1								7.06	45.00	43.90	56	0.0196	15	8.85	8.41	0.11	E-2 RIM = 50.50
MH-1 @ E-1	E-0								7.06	41.00	39.70	65	0.0200	15	8.93	8.48	0.13	E-1 RIM = 48.50
MH-1 @ E-0	E-00	2.23							7.06	39.54	39.00	27	0.0200	15	8.93	8.48	0.05	E-0@46.5/ E-00 WSE@43.0
SYSTEM "F"	WINDY BRANCH																	
WOODS AND LOT	F-4	3.02	0.30	0.91	0.91	24.40	24.40	4.0	3.65									
DI-1/DI-7 @ F-4	F-3								3.65	81.00	76.60	110	0.0400	15	12.63	12.00	0.15	F-4 TOP 86.00
PAVEMENT	F-3	0.13	0.90	0.12	0.12	2.21	24.55	4.0	0.47									
SHOULDER	F-3	0.14	0.30	0.04	0.16	0.84	24.55	4.0	0.64									
PAVEMENT	F-3	0.04	0.90	0.04	0.20	1.24	24.55	4.0	0.78									
DI-3C @ F-3	F-2								0.78	80.30	80.00	30	0.0100	15	6.31	6.00	0.08	F-3 TOP = 86.28
PAVEMENT	F-2	0.13	0.90	0.12	0.31	2.89	24.64	4.0	1.25									
PAVEMENT	F-2	0.04	0.90	0.04	0.35	1.24	24.64	4.0	1.40									
DI-3C @ F-2	F-1								5.05	76.28	66.00	54	0.1904	15	27.55	26.18	0.03	F-2 TOP = 86.28
DROP MH-I @ F-1	F-0	3.50							5.05	58.00	56.00	50	0.0400	15	12.63	12.00	0.07	F-1 RIM = 71.00
SYSTEM "G"	WINDY BRANCH																	
AVEMENT 17+00 - 21+50 L	G-4	0.22	0.90	0.20	0.20	3.48	5.00	7.2	1.43									
LOT / SHOULDER	G-4	0.18	0.30	0.05	0.25	5.64	5.64	7.0	1.77									
LOT / SHOULDER	G-4	0.21	0.30	0.06	0.32	3.65	5.64	7.0	2.21									
AVEMENT 17+00 - 21+50 L	G-4	0.19	0.90	0.17	0.49	3.48	5.64	7.0	3.41									
DI - 3C @ G-4	G-3								3.41	64.00	59.00	100	0.0500	15	14.12	13.42	0.12	G-4 TOP = 68.04
DROP MH-1 @ G-3	G-2								3.41	55.00	40.00	100	0.1500	15	24.45	23.24	0.07	G-3 RIM = 69.00
DROP MH-1 @ G-2	G-1	0.80							3.41	36.50	36.00	50	0.0100	15	6.31	6.00	0.14	G-2 RM = 44.00
SYSTEM "H"	WINTER WOOD																	
PAVEMENT	H-5	0.04	0.90	0.04	0.04	1.48	5.00	7.2	0.26									
PAVEMENT	H-5	0.01	0.90	0.01	0.05	0.72	5.00	7.2	0.32									
DI-3B @ H-5	H-4								0.32	91.00	90.70	30	0.0100	15	6.31	6.00	0.08	H-5 TOP = 96.93
PAVEMENT	H-4	0.04	0.90	0.04	0.08	0.25	5.00	7.2	0.58									
LOT / SHOULDER	H-4	0.10	0.30	0.03	0.11	0.38	5.00	7.2	0.80									
PAVEMENT	H-4	0.01	0.90	0.01	0.12	0.72	5.00	7.2	0.86									
SHOULDER	H-4	0.03	0.30	0.01	0.13	0.55	5.00	7.2	0.93									
DI-3C @ H-4	H-3								0.93	90.60	88.30	120	0.0192	15	8.74	8.31	0.24	H-4 TOP = 96.93
MH-1 @ H-3	H-2								0.93	83.00	82.00	50	0.0200	15	8.93	8.48	0.10	H-3 RIM = 95.50
PAVEMENT	H-2	0.06	0.90	0.05	0.18	2.72	5.00	7.2	1.32									
SHOULDER	H-2	0.03	0.30	0.01	0.19	2.72	5.00	7.2	1.38									
PAVEMENT	H-2	0.10	0.90	0.09	0.28	0.86	5.00	7.2	2.03									
DI-3C @ H-2	H-1								2.03	81.00	66.00	75	0.2000	15	28.24	26.83	0.05	H-2 TOP = 93.56
MH-1 @ H-I	H-0	0.42							2.03	62.50	62.00	19	0.0263	15	10.24	9.73	0.03	H-1 RIM = 81
SYSTEM "I"	SPLIT WOOD ROAD																	
LOT & PAVING	I-3	1.97	0.41	0.81	0.81	2.62	5.00	7.2	5.82									
DI - 3B/DI-7 @ I-3	I-2								5.82	73.00	72.60	40	0.0100	15	6.31	6.00	0.11	TEMP. DI-7 TOP
DMH-I @ I-2	I-1								5.82	72.50	70.52	125	0.0158	15	7.95	7.55	0.28	
MH-1 @I-1	A-1								5.82	70.42	66.22	84	0.0500	15	14.12	13.42	0.10	EXIST. TEMP. SB RISER
MH-1@S.B. RISER	ES-1								19.69	62.00	59.80	66	0.0333	24	40.37	14.98	0.07	EXISTING SB OUTFALL

VDOT L&D 229		INVERT ELEVATI		LENGTH	SLOPE	DIAM	RUNOFF	Yn	Vn	REMARKS
FROM PT.	TO PT.	UPPER	LOWER	ft.	ft/ft	inch	"QRational"	ft.	fps	
(1)	(2)	(10)	(11)	(12)	(13)	(14)	(9)			
SYSTEM "I"	SPLIT WOOD ROAD									
MH-1@S.B. RISER	ES-1	62.00	59.80	66	0.0333	24	19.69	0.47	9.51	A-1 MH RIM = 70.00
MH-1 @I-1	A-1	70.42	66.22	84	0.0500	15	5.82	0.55	11.13	I-1 MH RIM = 79.17
DMH-I @ I-2	I-1	72.50	70.52	125	0.0158	15	5.82	0.78	7.20	I-2 RIM = 77.22
DI - 3B/DI-7 @ I-3	I-2	73.00	72.60	40	0.0100	15	5.82	0.93	5.96	I-3 TEMP. DI-7 TOP = 77
SYSTEM "H"	WINTER WOOD									
MH-1 @ H-I	H-0	62.50	62.00	19	0.0263	15	2.03	0.37	6.61	H-1 RIM = 73.50
DI-3C @ H-2	H-1	81.00	66.00	75	0.2000	15	2.03	0.22	13.57	H-2 TOP = 93.56
MH-1 @ H-3	H-2	83.00	82.00	50	0.0200	15	0.93	0.32	3.74	H-3 RIM = 95.50
DI-3C @ H-4	H-3	90.60	88.30	120	0.0192	15	0.93	0.32	3.74	H-4 TOP = 96.93
DI-3B @ H-5	H-4	91.00	90.70	30	0.0100	15	0.32	0.19	2.74	H-5 TOP = 96.93
SYSTEM "G"	WINDY BRANCH									
DROP MH-1 @ G-2	G-1	36.50	36.00	50	0.0100	15	3.41	0.65	5.33	G-2 RM = 44.00
DROP MH-1 @ G-3	G-2	55.00	40.00	100	0.1500	15	3.41	0.31	14.27	G-3 RIM = 69.00
DI - 3C @ G-4	G-3	64.00	59.00	100	0.0500	15	3.41	0.41	9.63	G-4 TOP = 68.04
SYSTEM "F"	WINDY BRANCH									
DROP MH-I @ F-1	F-0	58.00	56.00	50	0.0400	15	5.05	0.27	7.17	F-1 RIM = 71.00
DI-3C @ F-2	F-1	76.28	66.00	54	0.1904	15	5.05	0.19	12.32	F-2 TOP = 86.28
DI-3C @ F-3	F-2	80.30	80.00	30	0.0100	15	0.78	0.15	2.50	F-3 TOP = 86.28
DI-1/DI-7 @ F-4	F-2	81.00	76.60	110	0.0400	15	3.65	0.23	6.49	F-4 TOP 86.00
SYSTEM "E"	SAPLING DRIVE									E-00 10YR WSE @ 43.00
MH-1 @ E-0	E-00	39.54	39.00	27	0.0200	15	7.06	0.36	6.25	E-0 RIM= 46.50
MH-1 @ E-1	E-0	41.00	39.70	65	0.0200	15	7.06	0.36	6.25	E-1 RIM = 48.50
MH-I @ E-2	E-1	45.00	43.90	56	0.0196	15	7.06	0.37	6.20	E-2 RIM = 50.50
MH-1 @ E-3	E-2	55.75	45.10	103	0.1034	15	3.40	0.18	8.83	E-3 RIM = 65.50
DI-3C @ E-4	E-3	65.20	57.50	55	0.1400	15	3.40	0.32	13.90	E-4 TOP = 75.56
DI-3B @ E-5	E-4	77.00	70.40	110	0.0600	15	1.50	0.26	8.12	E-4 TOP = 82.19

HYDRAULIC GRADELINE CALCULATION — **STONEHOUSE SECTION VB, PHASE 3**

INLET STATION	Outlet Water Surface	FRICTION LOSS IN PIPE						JUNCTION LOSS												H Adjusted	Inlet Water Surface Elevation	Rim Elevation
		Do	Qo	Lo	no	So / So	Hf	Vo	Ho	Qi	Vi	Qi x Vi	V²/ 2g	Hi	Δ	Hdelta	Ht	.3 x Ht	0.5 x Ht			
1	2	3	4	5	5A	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
SYSTEM "I"	SPLIT WOOD ROAD																					
DMH-1 @ RISER	60.80	24	19.69	66	0.013	0.0076	0.500	6.27	0.15	5.82	11.13	64.78	0.49	0.17	69	0.27	0.60	0.18	-0.30	0.98	61.78	A-1 MH RIM = 70.00
FROM SYS. "A"										13.87	5.63	78.09										
DMH-1 @ I-1	61.78	15	5.82	84	0.013	0.0081	0.682	4.74	0.09	5.82	7.2	41.90	0.80	0.28	28	0.18	0.55	0.16	-0.27	1.12	62.90	I-1 MH RIM = 79.17
DMH-I @ I-2	62.90	15	5.82	125	0.013	0.0081	1.015	4.74	0.09	5.82	5.96	34.69	0.55	0.19	90	0.39	0.67	0.20	-0.33	1.55	64.44	I-2 RIM = 77.22
DI - 3B/DI-7 @ I-3	64.44	15	5.82	40	0.013	0.0081	0.325	4.74	0.09			0.00	0.00	0.00	0	0.00	0.09	0.03	-0.04	0.39	64.84	TEMP. DI-7 TOP = 77
SYSTEM "H"	WINTER WOOD																					
MH-1 @ H-I	63.00	15	2.03	19	0.013	0.0010	0.019	1.65	0.01	2.03	13.57	27.55	2.86	1.00	43	1.09	2.10	0.63	-1.05	1.70	64.70	H-1 RIM = 73.50
DI-3C @ H-2	64.70	15	2.03	75	0.013	0.0010	0.074	1.65	0.01	0.93	3.74	3.48	0.22	0.08	77	0.00	0.09	0.03	-0.04	0.14	64.84	H-2 TOP = 93.56
MH-1 @ H-3	64.84	15	0.93	50	0.013	0.0002	0.010	0.76	0.00	0.93	3.74	3.48	0.22	0.08	14	0.00	0.08	0.02	-0.04	0.07	64.91	H-3 RIM = 95.50
DI-3C @ H-4	64.91	15	0.93	119	0.013	0.0002	0.025	0.76	0.00	0.32	2.74	0.88	0.12	0.04	90	0.08	0.12	0.04	-0.06	0.12	65.04	H-4 TOP = 96.93
DI-3B @ H-5	65.04	15	0.32	26	0.013	0.0000	0.001	0.26	0.00			0.00	0.00	0.00	0	0.00	0.00	0.00	-0.00	0.00	65.04	H-5 TOP = 96.93
SYSTEM "G"	WINDY BRANCH																					
DROP MH-1 @ G-2	37.00	15	3.41	50	0.013	0.0028	0.139	2.78	0.03	3.41	14.27	48.66	3.16	1.11	71	0.00	1.14	0.34	-0.57	1.05	38.05	G-2 RM = 44.00
DROP MH-1 @ G-3	38.05	15	3.41	100	0.013	0.0028	0.279	2.78	0.03	3.41	9.63	32.84	1.44	0.50	23	0.23	0.76	0.23	-0.38	0.89	38.94	G-3 RIM = 69.00
DI - 3C @ G-4	38.94	15	3.41	100	0.013	0.0028	0.279	2.78	0.03			0.00	0.00	0.00	0	0.00	0.03	0.01	-0.01	0.30	39.24	G-4 TOP = 68.04
SYSTEM "F"	WINDY BRANCH																					
DROP MH-I @ F-1	57.00	15	5.05	50	0.013	0.0061	0.306	4.12	0.07	5.05	12.32	62.22	2.36	0.82	32	0.66	1.55	0.47	-0.78	1.55	58.55	F-1 RIM = 71.00
DI-3C @ F-2	58.55	15	5.05	54	0.013	0.0061	0.330	4.12	0.07	0.78	2.5	1.95	0.10	0.03	0	0.00	0.10	0.03	-0.05	0.41	58.96	F-2 TOP = 86.28
DI-3C @ F-3	58.96	15	0.78	30	0.013	0.0001	0.004	0.64	0.00	3.65	6.49	23.69	0.65	0.23	80	0.43	0.66	0.20	-0.33	0.53	59.49	F-3 TOP = 86.28
DI-1/DI-7 @ F-4	59.49	15	3.65	60	0.013	0.0032	0.192	2.97	0.03			0.00	0.00	0.00	0	0.00	0.03	0.01	-0.02	0.22	59.71	F-4 TOP 86.00
SYSTEM "E"	SAPLING DRIVE																					E-00 10YR WSE @ 43.00
MH-1 @ E-0	43.00	15	7.06	30	0.013	0.0119	0.358	5.75	0.13	7.06	6.25	44.13	0.61	0.21	80	0.40	0.74	0.22	-0.37	0.95	43.95	E-0 RIM= 46.50
MH-1 @ E-1	43.95	15	7.06	65	0.013	0.0119	0.776	5.75	0.13	7.06	6.2	43.77	0.60	0.21	65	0.33	0.67	0.20	-0.33	1.31	45.26	E-1 RIM = 48.50
MH-I @ E-2	45.26	15	7.06	35	0.013	0.0119	0.418	5.75	0.13	3.4	8.83	30.02	1.21	0.42	60	0.67	1.22	0.37	-0.61	1.39	46.65	E-2 RIM = 50.50
MH-1 @ E-3	46.65	15	3.4	125	0.013	0.0028	0.346	2.77	0.03	3.4	13.9	47.26	3.00	1.05	0	0.00	1.08	0.32	-0.54	1.21	47.86	E-3 RIM = 65.50
DI-3C @ E-4	47.86	15	3.4	55	0.013	0.0028	0.152	2.77	0.03	1.5	8.12	12.18	1.02	0.36	18	0.10	0.49	0.15	-0.25	0.54	48.41	E-4 TOP = 75.56
DI-3B @ E-5	48.41	15	1.5	110	0.013	0.0005	0.059	1.22	0.01			0.00	0.00	0.00	0	0.00	0.01	0.00	-0.00	0.06	48.47	E-4 TOP = 82.19



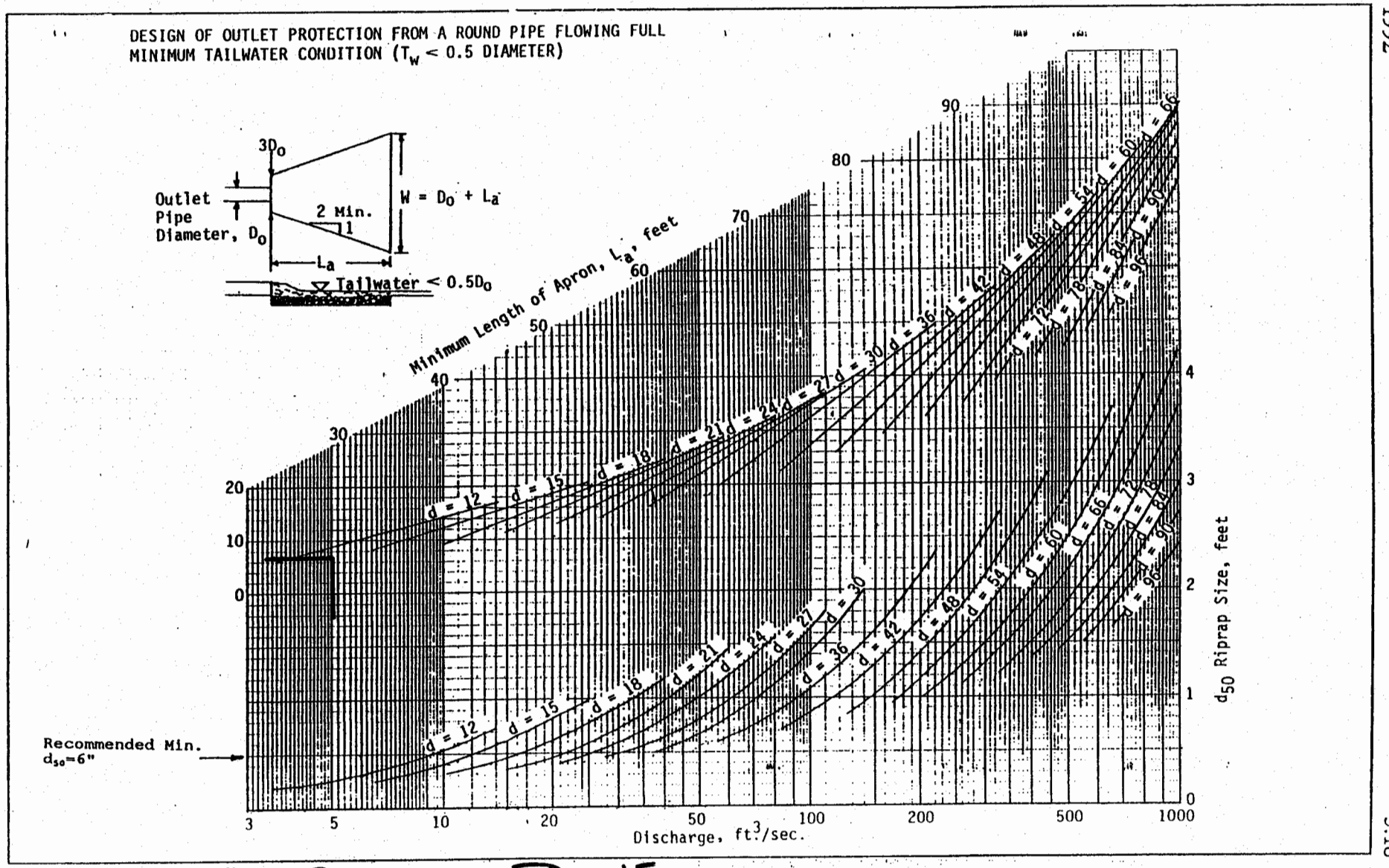
Source: USDA-SCS

Plate 3.18-3

SYS. "E"
D_o = 15"

Q_{10} = 7.06

USE L_a = 10'



Source: USDA-SCS

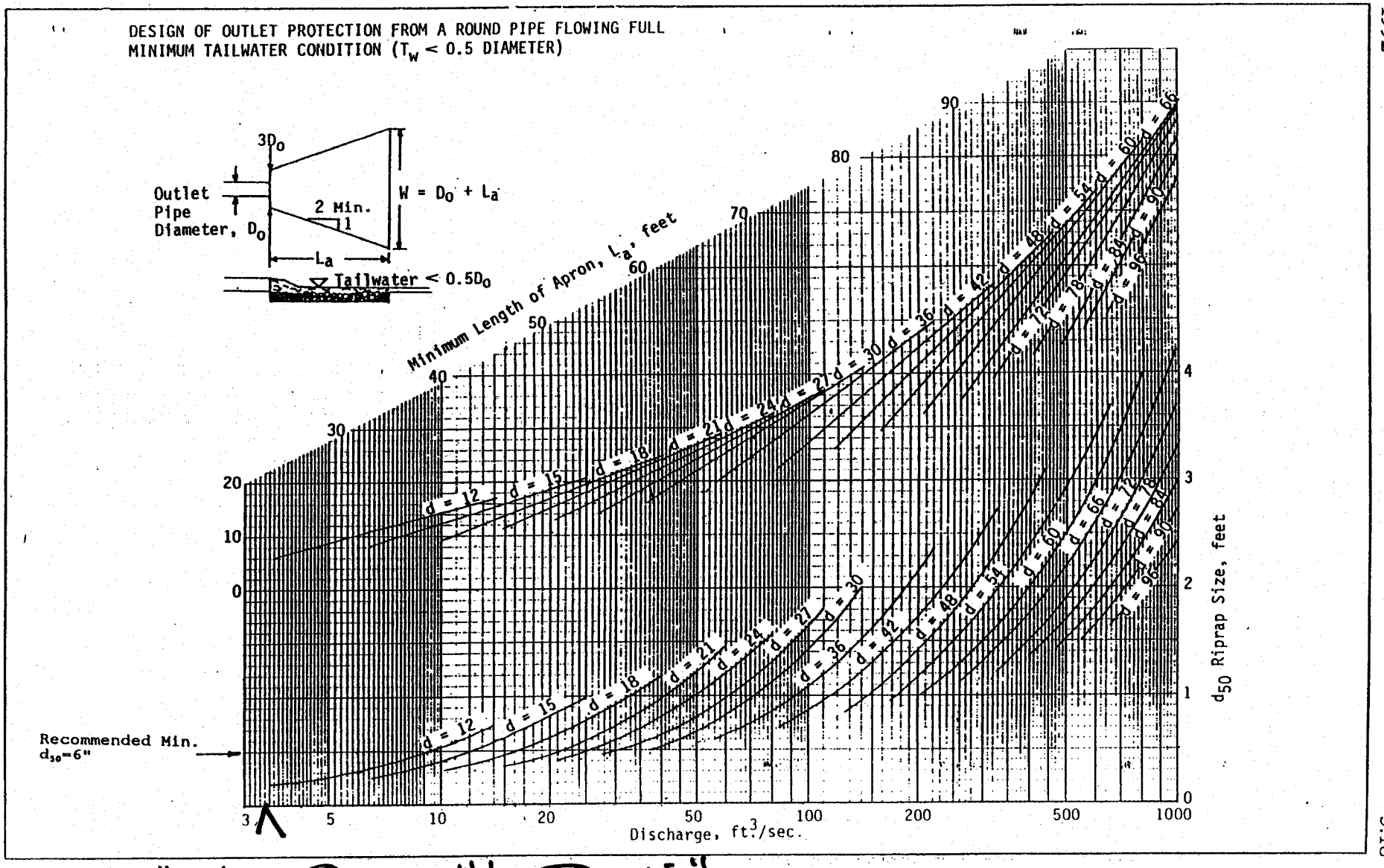
III - 164

Plate 3.18-3

3.18

SYS "F" $Q_{10} = 5.05$ $D_o = 15$

USE $L_a = 10'$

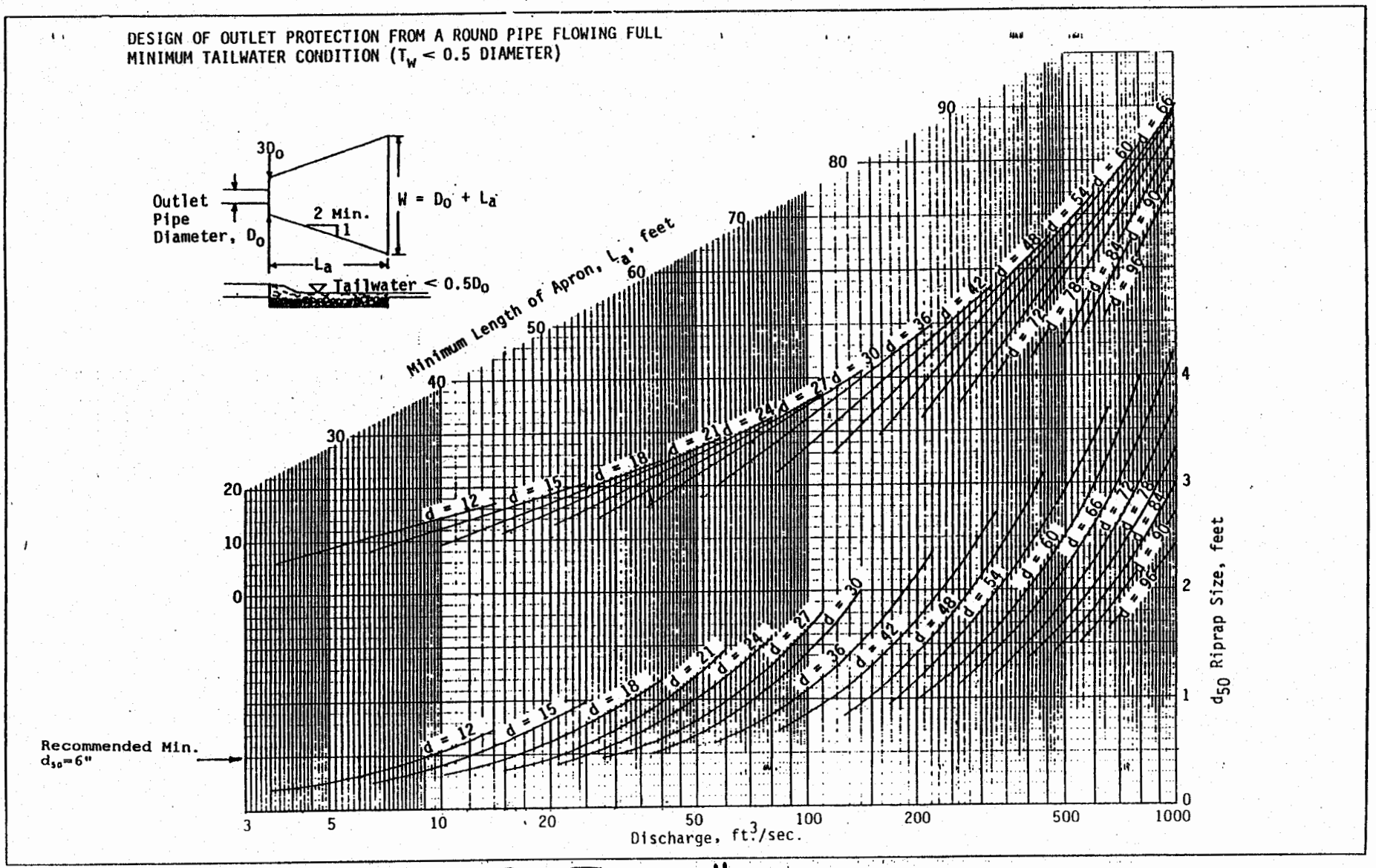


SYS. "G" Q_{10} = 3.41 D_o = 15"

Use L_a = 10'

Source: USDA-SCS

Plate 3.18-3

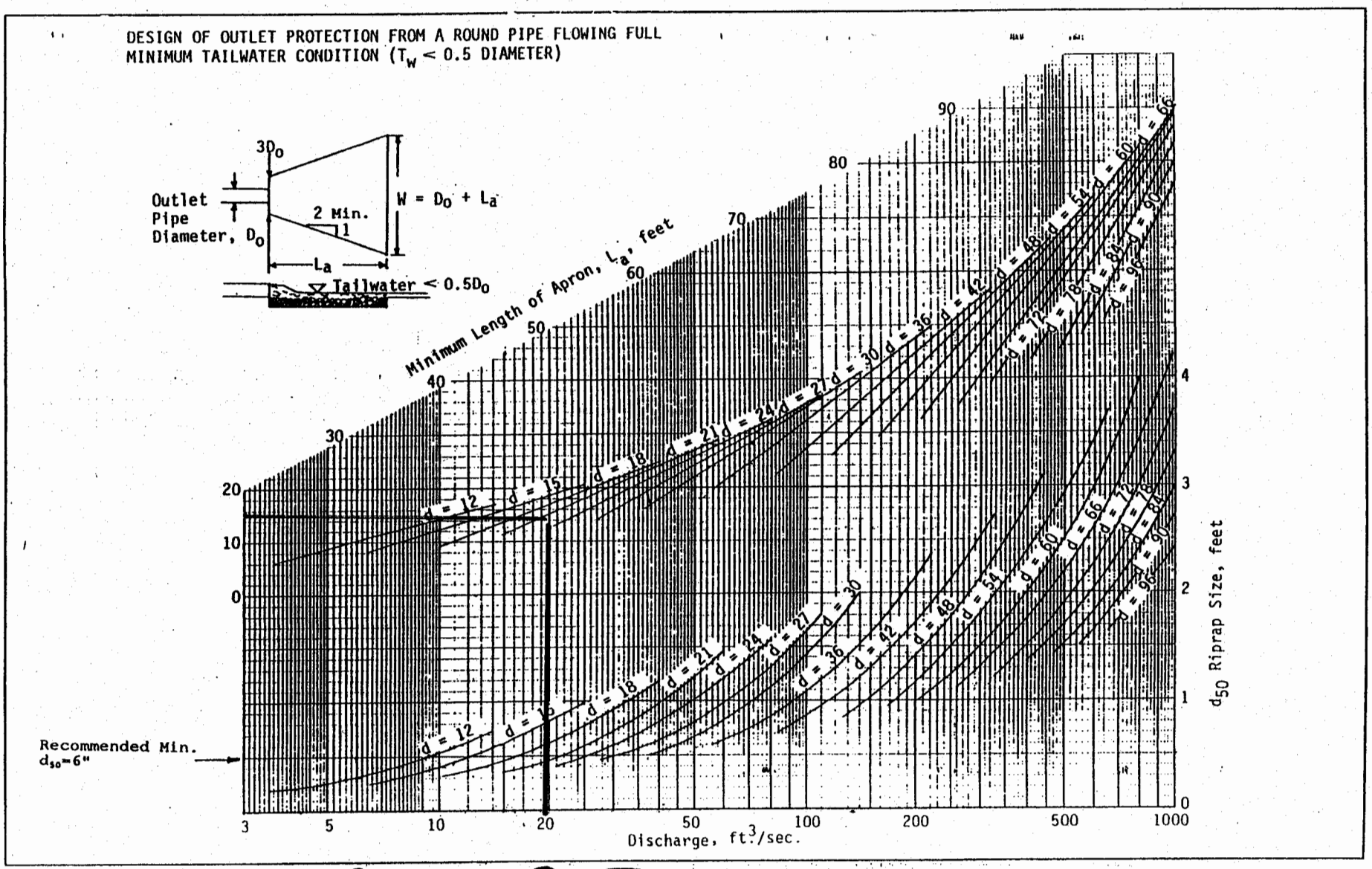


Source: USDA-SCS

Plate 3.18-3

SYS "H" Q_{10} = 2.03 D_o = 15"

USE L_a = 10'



Source: USDA-SCS

1992

III - 164

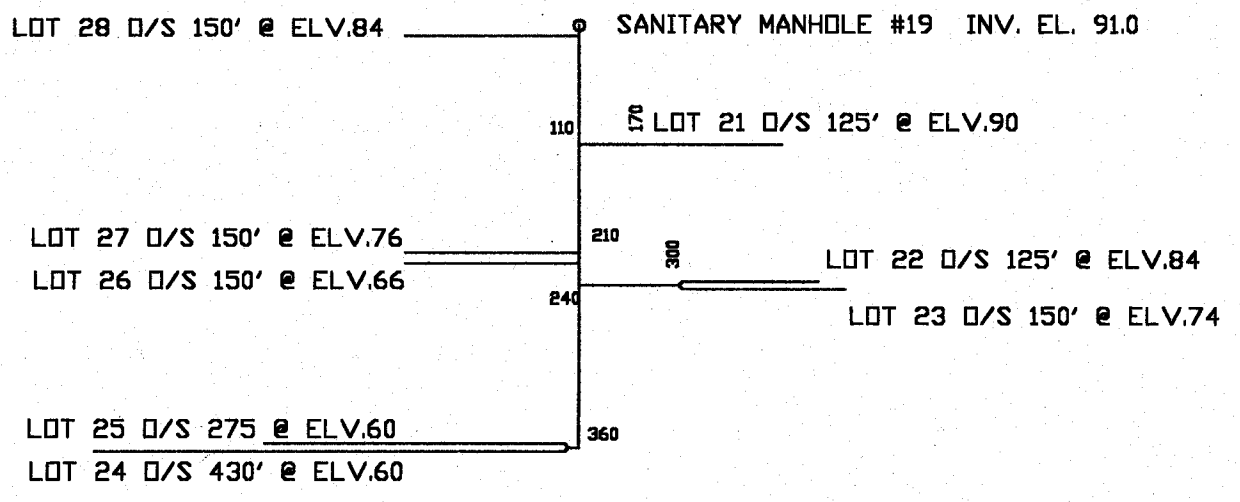
Plate 3.18-3

3.18

SYS "I" Q_{10} = 19.69 D_o = 24

USE L_a = 20'

LOW PRESSURE FORCE MAIN SCHEMATIC
SAPLING DRIVE, Stonehouse, L. L. C.
JAMES CITY COUNTY



SEWAGE PUMPING STATION DESIGN CALCULATIONS:

PROJECT:

STONEHOUSE, L. L. C.
SECTION VB, Phase 3
SAPLING DRIVE
JAMES CITY COUNTY, VA

DATE: 07/26/99
Prepared by: RS PHILLIPS
FILE NO.: 1960038-111.73

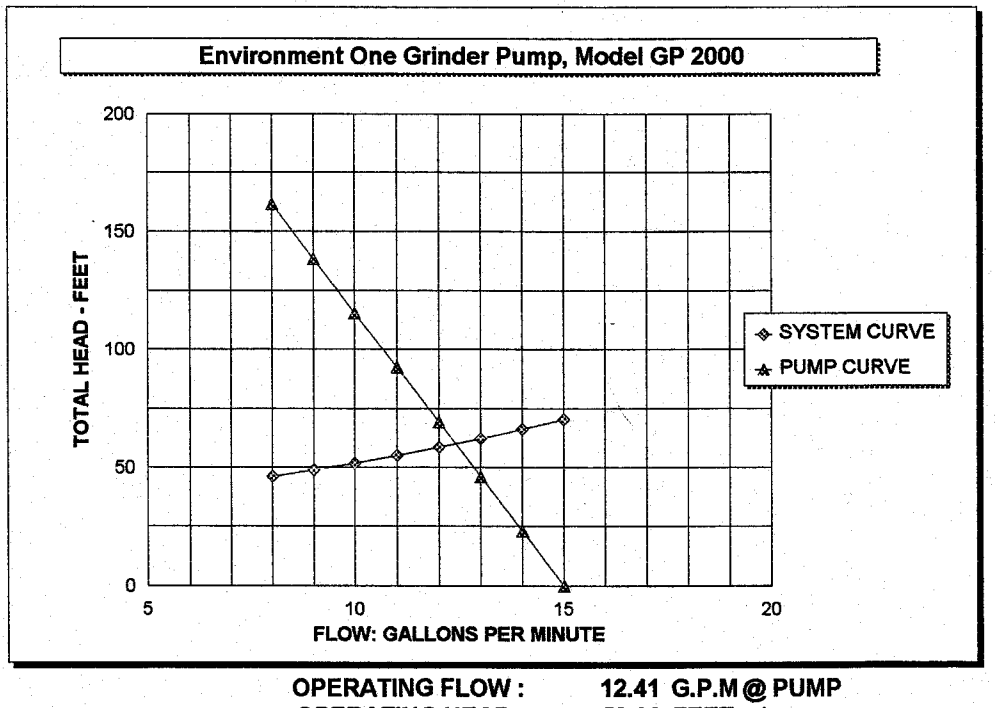
LOT 24 PUMP / NO OTHER PUMPS RUNNING

PUMP TOTAL DYNAMIC HEAD CALCULATION:

PUMP ON LIQUID ELEV.:	56	FEET		
PUMP OFF LIQUID ELEV.:	55.67	FEET		
HIGH POINT ELEVATION :	91	FEET		
CONNECTION ELEVATION :	91	FEET		
PRESSURE HEAD AT CONNECTION.:	0	FEET		
STATIC HEAD :	35.33	FEET		
	SEG.#1	SEG.#2	SEG.#3	
NUMBER OF PUMPS SIMULTANEOUSLY :	1	1	1	
LENGTH OF FORCE MAIN :	430	120	240	FEET
EQUIVALENT LENGTH OF FITTINGS :	29	12	12	FEET
PIPE DIAMETER :	1.25	1.5	1.5	INCHES
HAZEN-WILLIAMS CONSTANT :	140	140	140	
DESIGN DISCHARGE FLOW RATE :	10	10	10	GALLONS PER MINUTE
FLOW VELOCITY =	2.61	1.82	1.82	FEET PER SECOND
PIPE FRICTION HEAD =	11.47	1.32	2.64	FEET
TOTAL DYNAMIC HEAD =	50.75	FEET		

Environment One Grinder Pump, Model GP 2000

FLOW G.P.M. at PUMP	T.D.H. FEET at PUMP
8	46.22
9	48.88
10	51.79
11	54.96
12	58.39
13	62.07
14	66.00
15	70.18



OPERATING FLOW : 12.41 G.P.M @ PUMP
OPERATING HEAD : 58.32 FEET +/-
1 1/4" FORCE MAIN VELOCITY : 3.24 F.P.S.

1 1/2" FORCE MAIN VELOCITY : 2.25 F.P.S.

EONEVB3.WK4

SEWAGE PUMPING STATION DESIGN CALCULATIONS:

PROJECT:

STONEHOUSE, L. L. C.
SECTION VB, Phase 3
SAPLING DRIVE
JAMES CITY COUNTY, VA

DATE: 07/26/99
Prepared by: RS PHILLIPS
FILE NO.: 1960038-111.73

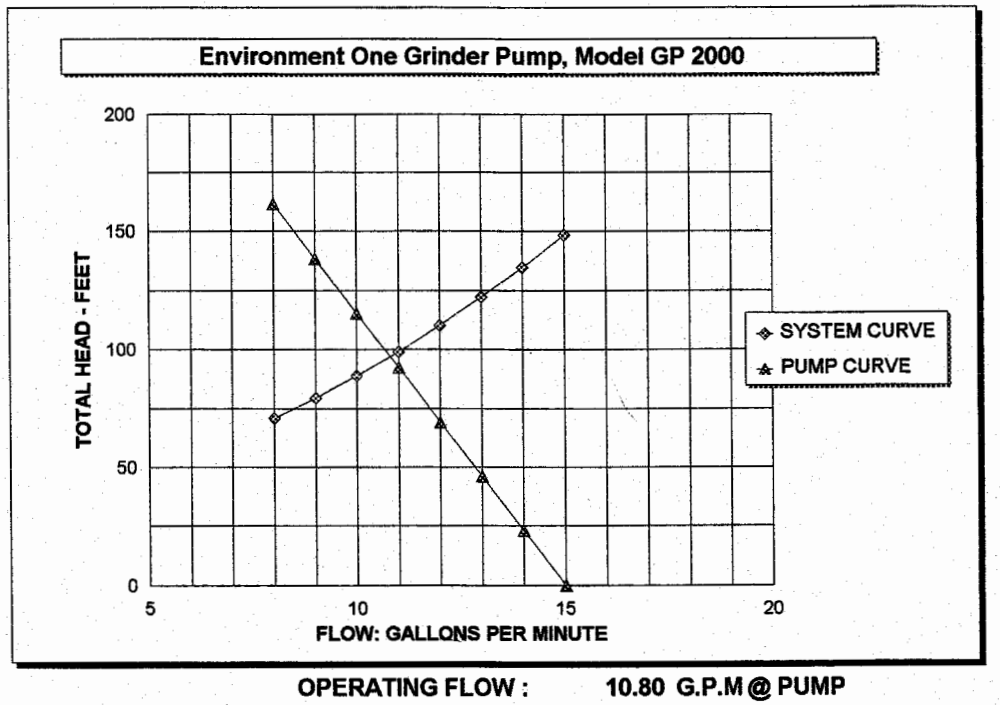
LOT 24 PUMP / PUMPS RUNNING : LOTS 25, 22 & 23

PUMP TOTAL DYNAMIC HEAD CALCULATION:

PUMP ON LIQUID ELEV.:	56	FEET		
PUMP OFF LIQUID ELEV.:	55.67	FEET		
HIGH POINT ELEVATION :	91	FEET		
CONNECTION ELEVATION :	91	FEET		
PRESSURE HEAD AT CONNECTION.:	0	FEET		
STATIC HEAD :	35.33	FEET		
	SEG.#1	SEG.#2	SEG.#3	
NUMBER OF PUMPS SIMULTANEOUSLY :	1	2	4	
LENGTH OF FORCE MAIN :	430	120	240	FEET
EQUIVALENT LENGTH OF FITTINGS :	29	12	12	FEET
PIPE DIAMETER :	1.25	1.5	1.5	INCHES
HAZEN-WILLIAMS CONSTANT :	140	140	140	
DESIGN DISCHARGE FLOW RATE :	10	20	40	GALLONS PER MINUTE
FLOW VELOCITY =	2.61	3.63	7.26	FEET PER SECOND
PIPE FRICTION HEAD =	11.47	4.75	34.26	FEET
TOTAL DYNAMIC HEAD =	85.82	FEET		

Environment One Grinder Pump, Model GP 2000

FLOW G.P.M. at PUMP	T.D.H. FEET at PUMP
8	70.67
9	79.28
10	88.74
11	99.03
12	110.16
13	122.10
14	134.85
15	148.40

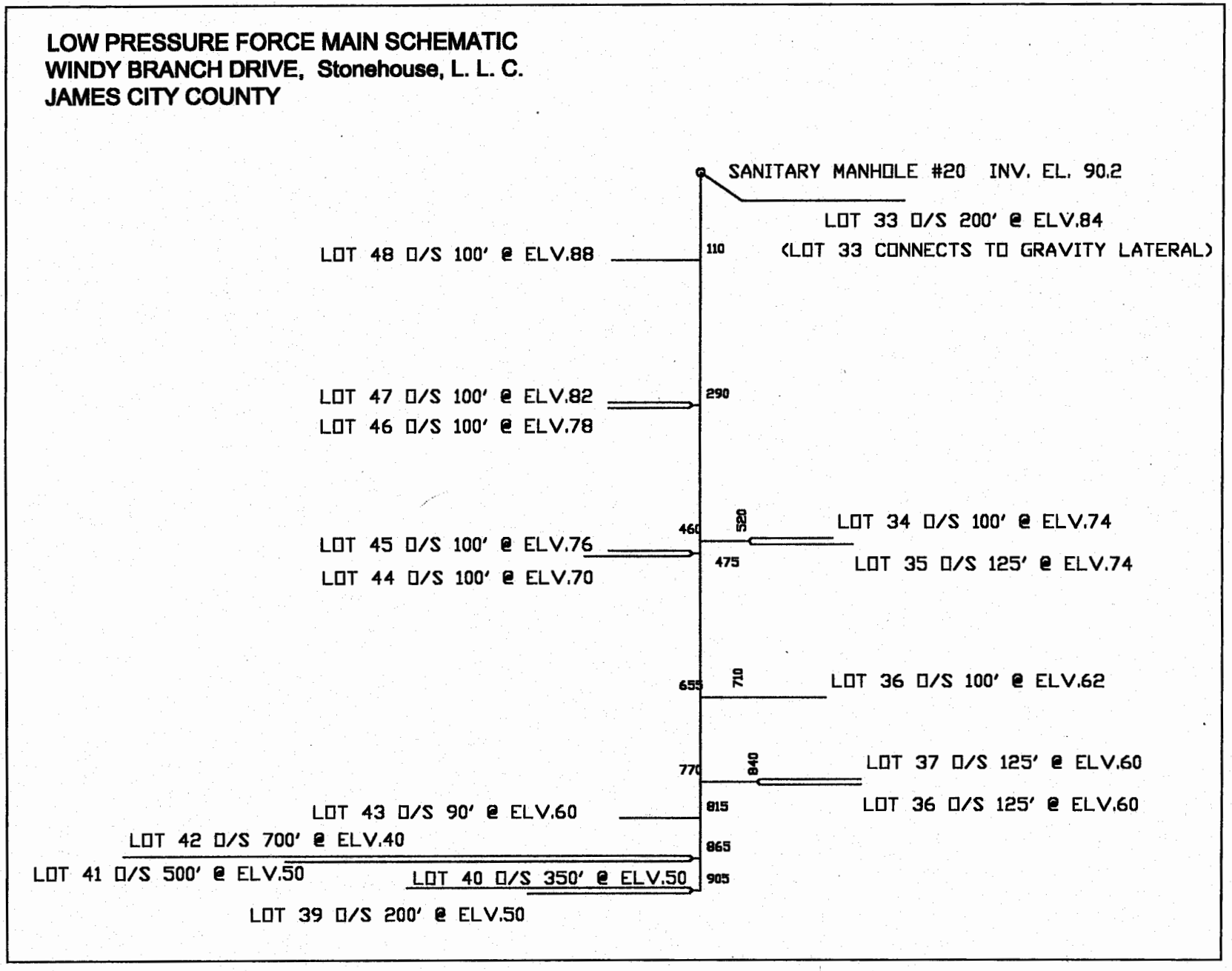


OPERATING FLOW : 10.80 G.P.M @ PUMP
OPERATING HEAD : 93.55 FEET +/-
1 1/4" FORCE MAIN VELOCITY : 2.82 F.P.S.

1 1/2" FORCE MAIN VELOCITY : 7.84 F.P.S.

EONEVB3.WK4

LOW PRESSURE FORCE MAIN SCHEMATIC
WINDY BRANCH DRIVE, Stonehouse, L. L. C.
JAMES CITY COUNTY



SEWAGE PUMPING STATION DESIGN CALCULATIONS:

PROJECT:

STONEHOUSE, L. L. C.
SECTION VB, Phase 3
WINDY BRANCH DRIVE
JAMES CITY COUNTY, VA

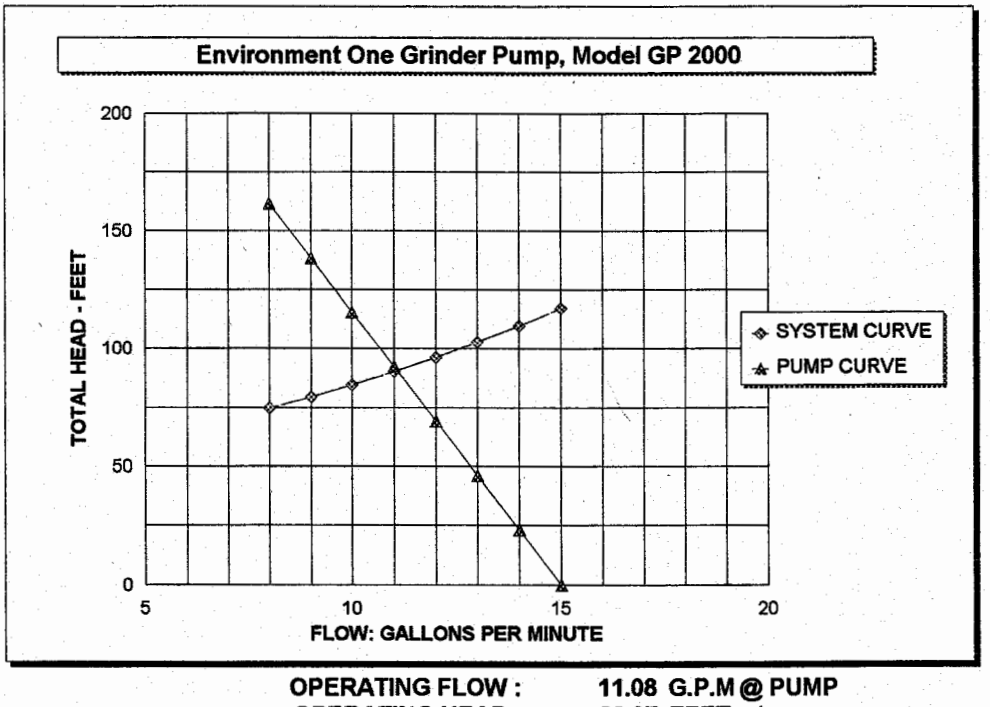
DATE: 07/26/99
Prepared by: RS PHILLIPS
FILE NO.: 1960038-111.73

LOT 42/ NO OTHER PUMPS RUNNING

PUMP TOTAL DYNAMIC HEAD CALCULATION:

PUMP ON LIQUID ELEV.:	36	FEET		
PUMP OFF LIQUID ELEV.:	35.67	FEET		
HIGH POINT ELEVATION :	91	FEET		
CONNECTION ELEVATION :	91	FEET		
PRESSURE HEAD AT CONNECTION.:	0	FEET		
STATIC HEAD :	55.33	FEET		
	SEG.#1	SEG.#2	SEG.#3	
NUMBER OF PUMPS SIMULTANEOUSLY :	1	1	1	
LENGTH OF FORCE MAIN :	700	405	460	FEET
EQUIVALENT LENGTH OF FITTINGS :	29	12	12	FEET
PIPE DIAMETER :	1.25	1.5	1.5	INCHES
HAZEN-WILLIAMS CONSTANT :	140	140	140	
DESIGN DISCHARGE FLOW RATE :	10	10	10	GALLONS PER MINUTE
FLOW VELOCITY =	2.61	1.82	1.82	FEET PER SECOND
PIPE FRICTION HEAD =	18.67	4.45	5.05	FEET
TOTAL DYNAMIC HEAD =	83.5	FEET		

FLOW G.P.M. at PUMP	T.D.H. FEET at PUMP	*Environment One Grinder Pump, Model GP 2000*
8	74.66	162
9	79.37	139
10	84.54	116
11	90.17	92
12	96.26	69
13	102.79	46
14	109.76	23
15	117.17	0



OPERATING FLOW : 11.08 G.P.M @ PUMP
OPERATING HEAD : 89.37 FEET +/-
1 1/4" FORCE MAIN VELOCITY : 2.90 F.P.S.

1 1/2" FORCE MAIN VELOCITY : 2.01 F.P.S.

EONEVB3.WK4

SEWAGE PUMPING STATION DESIGN CALCULATIONS:

PROJECT:

STONEHOUSE, L. L. C.
SECTION VB, Phase 3
WINDY BRANCH DRIVE
JAMES CITY COUNTY, VA

DATE: 07/26/99
Prepared by: RS PHILLIPS
FILE NO.: 1960038-111.73

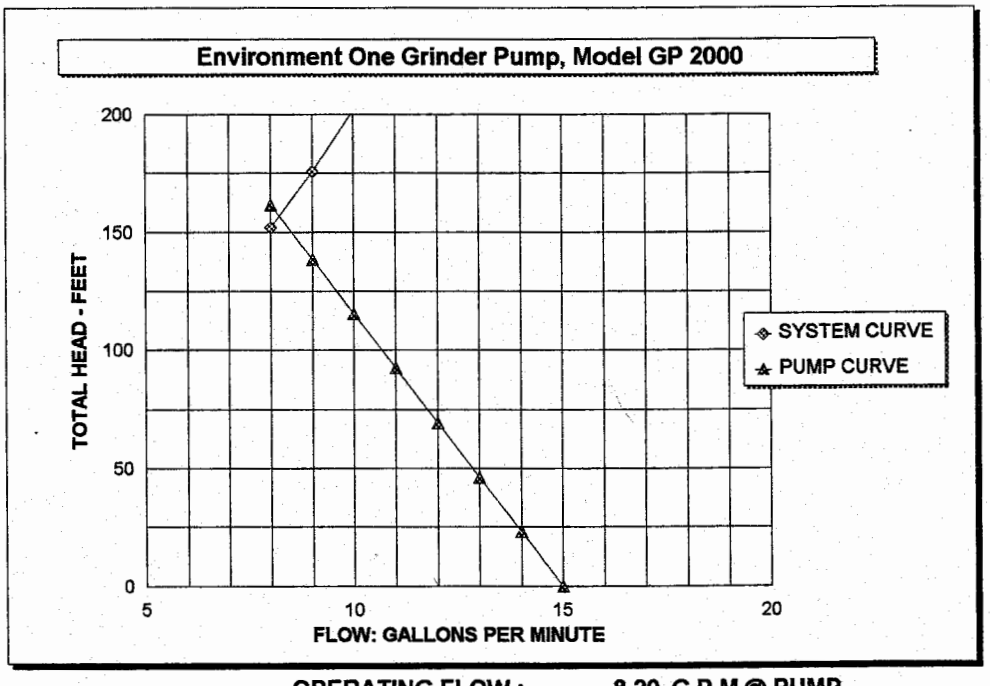
LOT 42/ PUMPS RUNNING: 39, 40, & 41

PUMP TOTAL DYNAMIC HEAD CALCULATION:

PUMP ON LIQUID ELEV.:	36	FEET		
PUMP OFF LIQUID ELEV.:	35.67	FEET		
HIGH POINT ELEVATION :	91	FEET		
CONNECTION ELEVATION :	91	FEET		
PRESSURE HEAD AT CONNECTION.:	0	FEET		
STATIC HEAD :	55.33	FEET		
	SEG.#1	SEG.#2	SEG.#3	
NUMBER OF PUMPS SIMULTANEOUSLY :	1	4	4	
LENGTH OF FORCE MAIN :	700	405	460	FEET
EQUIVALENT LENGTH OF FITTINGS :	29	12	12	FEET
PIPE DIAMETER :	1.25	1.5	1.5	INCHES
HAZEN-WILLIAMS CONSTANT :	140	140	140	
DESIGN DISCHARGE FLOW RATE :	10	40	40	GALLONS PER MINUTE
FLOW VELOCITY =	2.61	7.26	7.26	FEET PER SECOND
PIPE FRICTION HEAD =	18.67	57.82	65.67	FEET
TOTAL DYNAMIC HEAD =	197.5	FEET		

Environment One Grinder Pump, Model GP 2000

FLOW G.P.M. at PUMP	T.D.H. FEET at PUMP	
8	152.15	162
9	175.72	139
10	201.63	116
11	229.84	92
12	260.31	69
13	293.03	46
14	327.96	23
15	365.07	0

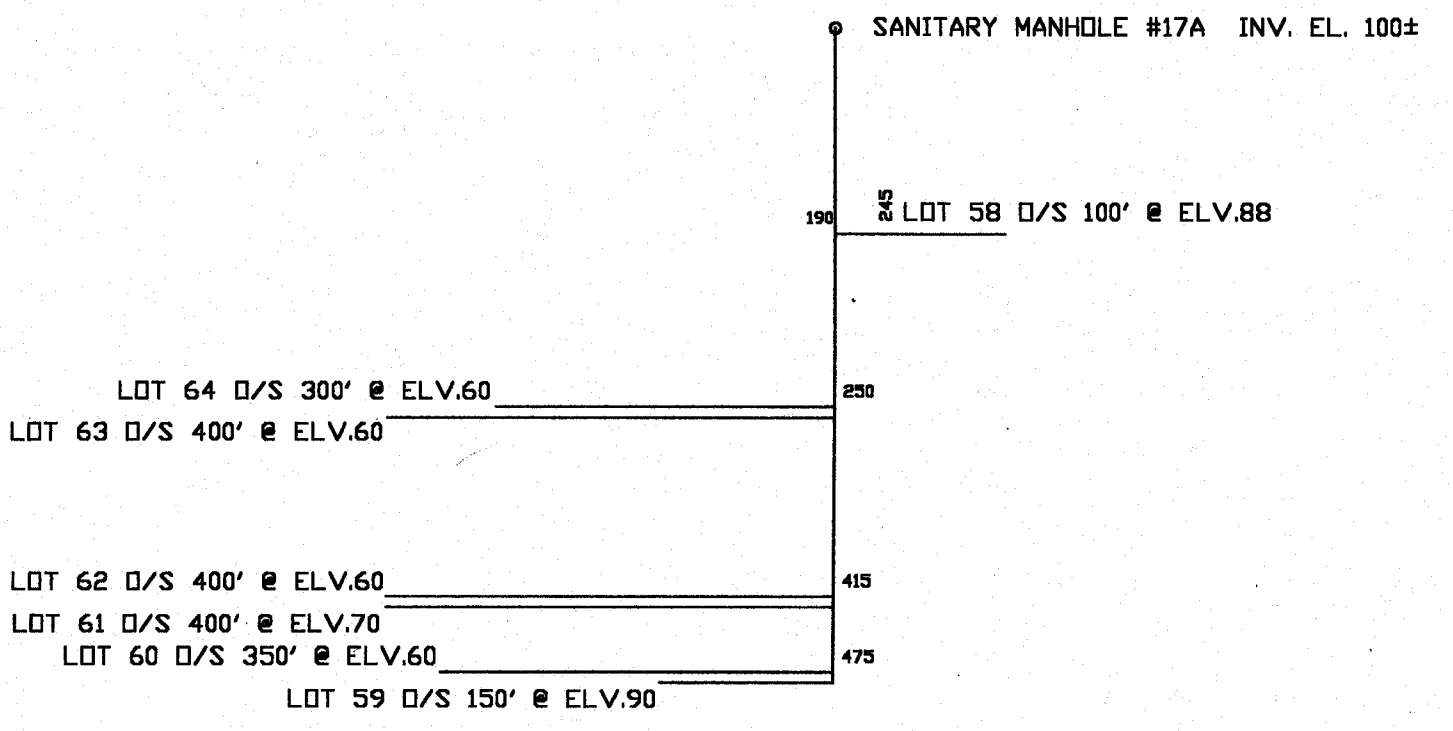


OPERATING FLOW : 8.20 G.P.M @ PUMP
OPERATING HEAD : 153.91 FEET +/-
1 1/4" FORCE MAIN VELOCITY : 2.15 F.P.S.

1 1/2" FORCE MAIN VELOCITY : 5.96 F.P.S.

EONEVB3.WK4

LOW PRESSURE FORCE MAIN SCHEMATIC
WINTER WOOD LANE, Stonehouse, L. L. C.
JAMES CITY COUNTY



SEWAGE PUMPING STATION DESIGN CALCULATIONS:

PROJECT:

STONEHOUSE, L. L. C.
SECTION VB, Phase 3
WINTER WOOD DRIVE
JAMES CITY COUNTY, VA

DATE: 07/26/99
Prepared by: RS PHILLIPS
FILE NO.: 1960038-111.73

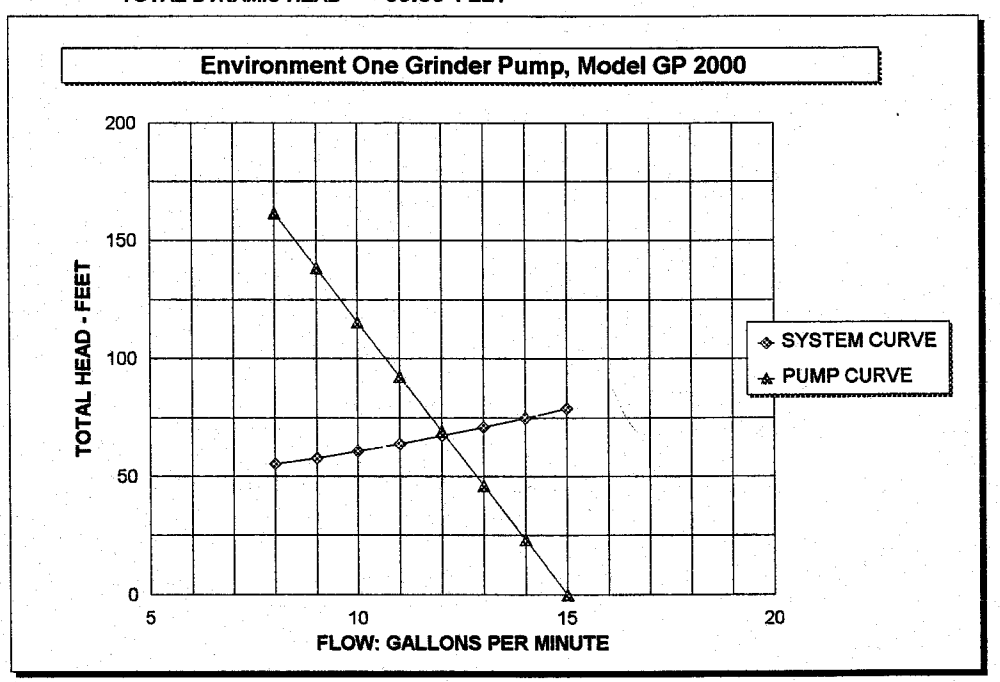
LOT 62 / NO OTHER PUMPS RUNNING

PUMP TOTAL DYNAMIC HEAD CALCULATION:

PUMP ON LIQUID ELEV.:	56	FEET		
PUMP OFF LIQUID ELEV.:	55.67	FEET		
HIGH POINT ELEVATION :	100	FEET		
CONNECTION ELEVATION :	100	FEET		
PRESSURE HEAD AT CONNECTION.:	0	FEET		
STATIC HEAD :	44.33	FEET		
	SEG.#1	SEG.#2	SEG.#3	
NUMBER OF PUMPS SIMULTANEOUSLY :	1	1	1	
LENGTH OF FORCE MAIN :	400	165	250	FEET
EQUIVALENT LENGTH OF FITTINGS :	29	12	12	FEET
PIPE DIAMETER :	1.25	1.5	1.5	INCHES
HAZEN-WILLIAMS CONSTANT :	140	140	140	
DESIGN DISCHARGE FLOW RATE :	10	10	10	GALLONS PER MINUTE
FLOW VELOCITY =	**2.61**	**1.82**	**1.82**	**FEET PER SECOND**
PIPE FRICTION HEAD =	**10.67**	**1.81**	**2.75**	**FEET**
TOTAL DYNAMIC HEAD =	**59.56**	**FEET**		

Environment One Grinder Pump, Model GP 2000

FLOW G.P.M. at PUMP	T.D.H. FEET at PUMP
8	55.09
9	57.71
10	60.59
11	63.73
12	67.12
13	70.76
14	74.64
15	78.77



OPERATING FLOW : 12.08 G.P.M @ PUMP
OPERATING HEAD : 65.94 FEET +/-
1 1/4" FORCE MAIN VELOCITY : 3.16 F.P.S.

1 1/2" FORCE MAIN VELOCITY : 2.19 F.P.S.

EONEVB3.WK4

SEWAGE PUMPING STATION DESIGN CALCULATIONS:

PROJECT:

STONEHOUSE, L. L. C.
SECTION VB, Phase 3
WINTER WOOD DRIVE
JAMES CITY COUNTY, VA

DATE: 07/26/99
Prepared by: RS PHILLIPS
FILE NO.: 1960038-111.73

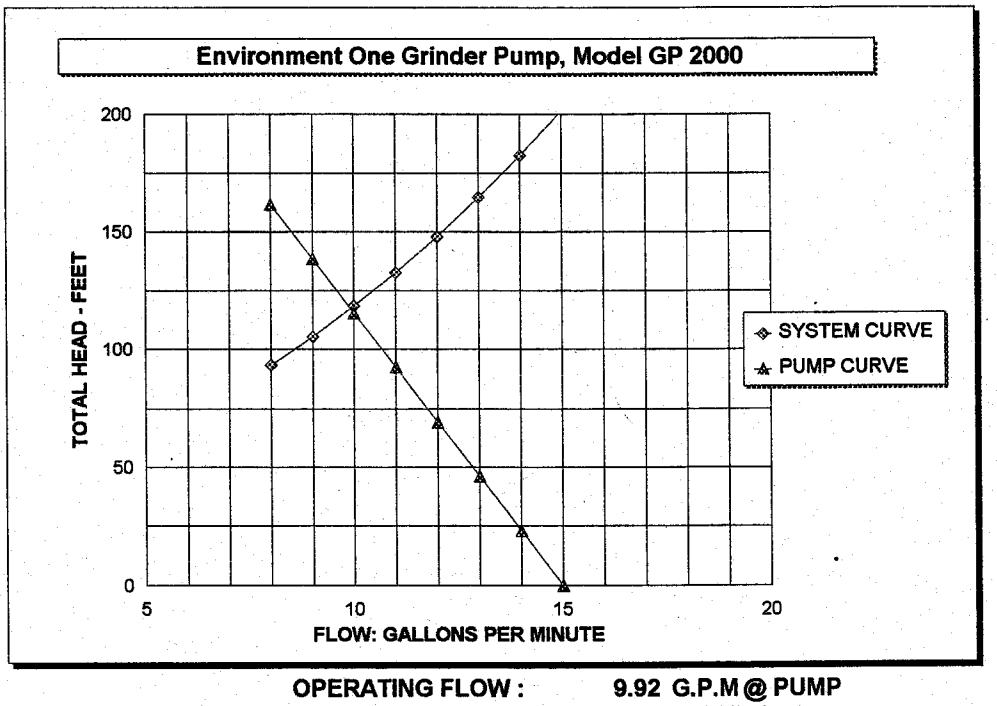
LOT 62 / PUMPS RUNNING: LOTS 59, 60 & 61

PUMP TOTAL DYNAMIC HEAD CALCULATION:

PUMP ON LIQUID ELEV.:	56	FEET		
PUMP OFF LIQUID ELEV.:	55.67	FEET		
HIGH POINT ELEVATION :	100	FEET		
CONNECTION ELEVATION :	100	FEET		
PRESSURE HEAD AT CONNECTION.:	0	FEET		
STATIC HEAD :	44.33	FEET		
	SEG.#1	SEG.#2	SEG.#3	
NUMBER OF PUMPS SIMULTANEOUSLY :	1	4	4	
LENGTH OF FORCE MAIN :	400	165	250	FEET
EQUIVALENT LENGTH OF FITTINGS :	29	12	12	FEET
PIPE DIAMETER :	1.25	1.5	1.5	INCHES
HAZEN-WILLIAMS CONSTANT :	140	140	140	
DESIGN DISCHARGE FLOW RATE :	10	40	40	GALLONS PER MINUTE
FLOW VELOCITY =	**2.61**	**7.26**	**7.26**	**FEET PER SECOND**
PIPE FRICTION HEAD =	**10.67**	**23.56**	**35.69**	**FEET**
TOTAL DYNAMIC HEAD =	**114.2**	**FEET**		

Environment One Grinder Pump, Model GP 2000

FLOW G.P.M. at PUMP	T.D.H. FEET at PUMP
8	93.34
9	105.27
10	118.38
11	132.66
12	148.09
13	164.65
14	182.32
15	201.11

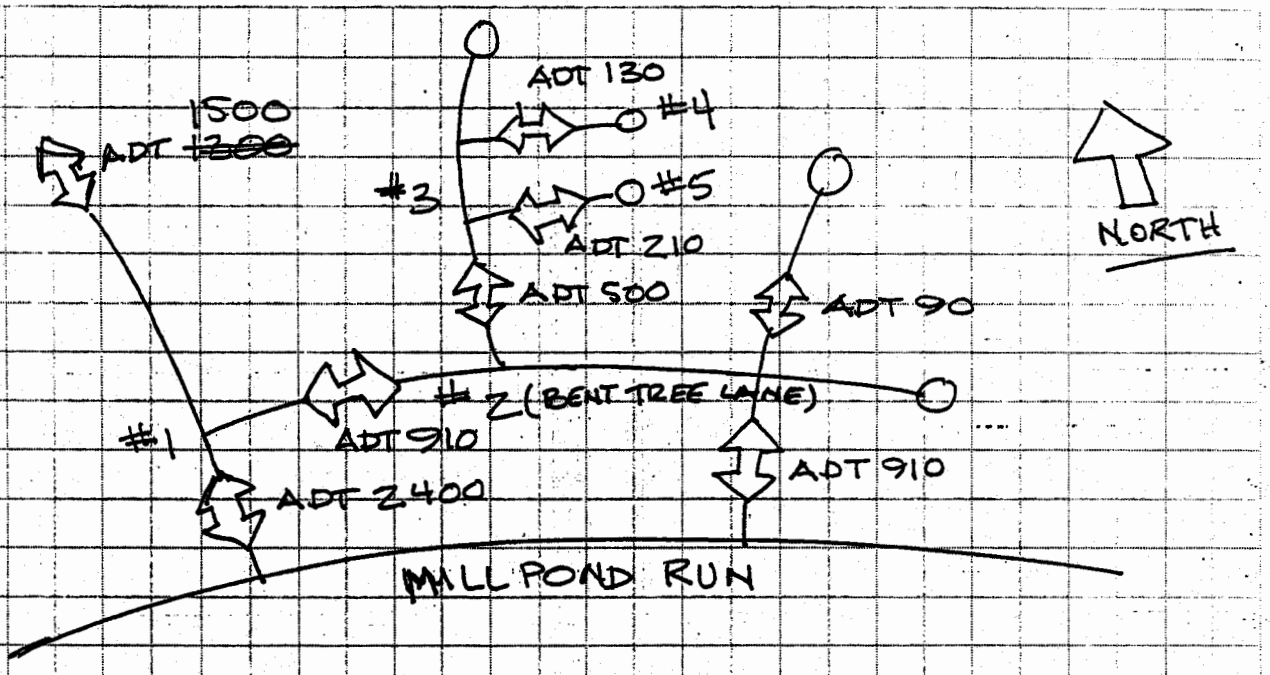


OPERATING FLOW : 9.92 G.P.M @ PUMP
OPERATING HEAD : 113.22 FEET +/-
1 1/4" FORCE MAIN VELOCITY : 2.59 F.P.S.

1 1/2" FORCE MAIN VELOCITY : 7.20 F.P.S.

Langley and McDonald, P.C.
ENGINEERS • SURVEYORS• PLANNERS
LANDSCAPE ARCHITECTS • ENVIRONMENTAL CONSULTANTS
VIRGINIA BEACH • WILLIAMSBURG, VIRGINIA

Subject SECTION 5B TRAFFIC SKETCH
Computed By _____ Checked by _____
Project No. _____
Client _____
Date _____ Sheet No. _____



ADT

ROAD #1 91 LOTS + 150 FUTURE → 2400

ROAD #2 91 LOTS → 910 ADT

ROAD #3 50 LOTS → 500 ADT

USE 400 ADT MIN.

@ 55V = 20

VDOT APPENDIX II

ROAD #1 ADT 2400 → D_R = 15.2 2+2.5+9.0

ROAD #3 ADT 910 → D_R = 12.8 2+2.5+6.0

ROAD #3 ADT 500 → D_R = 10.2 2+2+6.0

ADT 400 → D_R = 9.6

Appendix IV

Flexible Pavement Design Worksheet for New Subdivision Streets

This sheet is intended for use in conjunction with VDOT's Subdivision Street Requirements

County	JAMES CITY COUNTY	Date:	JAN 7, 1999
Subdivision	SECTION VB "POINT TREE"		
Street Name	SPLIT WOOD STA + 00 to 17+50		
Developer	STONEHOUSE L.L.C.	Phone:	234-5100

ADT	Projected traffic for the street segment considered, as defined in the Subdivision Street Requirements.
CBR_D	Design CBR = Average of CBR_T x 2/3 and modified only as discussed in the Pavement Design Guide.
CBR_T	CBR value of the subgrade sample, taken and tested as specified in the Pavement Design Guide
DME	VDOT District Materials Engineer
EPT	Equivalent projected traffic
HCV	Number of Heavy Commercial Vehicles (e.g. trucks, buses, etc., with 2 or more axles and 6 or more tires).
%HCV	Percentage of the total traffic volume composed of Heavy Commercial Vehicles.
RF	Resiliency Factor = Relative value of the subgrade soil's ability to withstand repeated loading.
SSV	Soil support value of subgrade (SSV = CBR_D x RF)
D_P	Thickness index of proposed pavement design computed by the Conventional Pavement Design Method
D_R	Thickness index required, based on Design ADT and SSV, determined by Appendix II.

Step 1: Determine Design ADT

ADT	1500
%HCV = 100 x HCV ÷ ADT	5%
EPT = 0.20(%HCV x ADT) or 20 x HCV Note: For %HCV ≤ 5%, use ADT	Note: For %HCV>5%, EPT>ADT
Design ADT = greater of ADT or EPT	1500

Step 2: Determine Design Values CBR, RF and SSV

Sample	CBR_T	Resiliency Factor	(RF)
# 1		Source	Value
# 2		Table 1	
# 3	6	Appendix I	3.0
#		DME approved RF	
#		For preliminary designs, use the lowest RF value in the equation	
#			

CBR_D	x	RF	=	SSV
(6.67)	x	(3)	=	20

Step 3: Pavement Design (Check appropriate box and show proposed pavement design below.)

☐ (A) Limited to Design ADT ≤ 400 - Show pavement material notations and thickness from Appendix IV Tables A and B.

☐ (B) Show pavement section as developed in the Pavement Design Guide. (See Appendix III for material notations and thickness equivalency values (a)).

D_R = 14.0 from Appendix II

Description of Proposed Pavement Section

	Material Notation	Thickness, h	a	(a x h)
Surface	SM-2A	2	2.25	4.50
Base	IM-1A	2.5	2.25	5.625
Subbase	TYPE 21B AGG BASE MATERIAL	8.0	0.6	4.8

D_P must equal or exceed the value of D_R. $D_P = \sum(a \times h)$ = 14.93

D_R 14.93 > D_R 14.0

Appendix IV

Flexible Pavement Design Worksheet for New Subdivision Streets

This sheet is intended for use in conjunction with VDOT's Subdivision Street Requirements

County	JAMES CITY COUNTY	Date:	JAN. 7, 1999
Subdivision	SECTION VB "BENT TREE"		
Street Name	ROAD #2 WINTERWOOD LANE 10+50 to 12+50		
Developer	STONEHOUSE, L.L.C.	Phone:	234-5100

ADT	Projected traffic for the street segment considered, as defined in the Subdivision Street Requirements.
CBR_D	Design CBR = Average of CBR_T x 2/3 and modified only as discussed in the Pavement Design Guide.
CBR_T	CBR value of the subgrade sample, taken and tested as specified in the Pavement Design Guide
DME	VDOT District Materials Engineer
EPT	Equivalent projected traffic
HCV	Number of Heavy Commercial Vehicles (e.g. trucks, buses, etc., with 2 or more axles and 6 or more tires).
%HCV	Percentage of the total traffic volume composed of Heavy Commercial Vehicles.
RF	Resiliency Factor = Relative value of the subgrade soil's ability to withstand repeated loading.
SSV	Soil support value of subgrade (SSV = CBR_D x RF)
D_P	Thickness index of proposed pavement design computed by the Conventional Pavement Design Method
D_R	Thickness index required, based on Design ADT and SSV, determined by Appendix II.

Step 1: Determine Design ADT

ADT	
%HCV = 100 x HCV ÷ ADT	910
EPT = 0.20(%HCV x ADT) or 20 x HCV Note: For %HCV ≤ 5%, use ADT	Note: For %HCV>5%, EPT>ADT
Design ADT = greater of ADT or EPT	910

Step 2: Determine Design Values CBR, RF and SSV

Sample	CBR_T	Resiliency Factor	(RF)
# 1		Source	Value
# 2		Table 1	
# 3	6	Appendix I	3.0
#		DME approved RF	
#		For preliminary designs, use the lowest RF value in the equation	
#			

CBR_D	x	RF	=	SSV
(6.67)	x	(3)	=	20

Step 3: Pavement Design (Check appropriate box and show proposed pavement design below.)

☐ (A) Limited to Design ADT ≤ 400 - Show pavement material notations and thickness from Appendix IV Tables A and B.

☐ (B) Show pavement section as developed in the Pavement Design Guide. (See Appendix III for material notations and thickness equivalency values (a)).

D_R = 12.8 from Appendix II

Description of Proposed Pavement Section

	Material Notation	Thickness, h	a	(a x h)
Surface	SM-2A	2.0	2.25	4.5
Base	IM-1A	2.5	2.25	5.625
Subbase	TYPE 21B AGG. BASE	6	.6	3.6

D_P must equal or exceed the value of D_R. $D_P = \sum(a \times h)$ = 13.7

13.7 > 12.8 ok

60

Appendix IV

Flexible Pavement Design Worksheet for New Subdivision Streets

This sheet is intended for use in conjunction with VDOT's Subdivision Street Requirements

County	JAMES CITY COUNTY	Date:	JAN. 7, 1999
Subdivision	SECTION VB "BENT TREE"		
Street Name	ROADS #3, 4 & 5 SAPLING DRIVE, WINDY BRANCH DRIVE, WINTERWOOD 13+00 to END		
Developer	STONEHOUSE, L.L.C.	Phone:	234-5100

ADT	Projected traffic for the street segment considered, as defined in the Subdivision Street Requirements.
CBR_D	Design CBR = Average of CBR_T x 2/3 and modified only as discussed in the Pavement Design Guide.
CBR_T	CBR value of the subgrade sample, taken and tested as specified in the Pavement Design Guide
DME	VDOT District Materials Engineer
EPT	Equivalent projected traffic
HCV	Number of Heavy Commercial Vehicles (e.g. trucks, buses, etc., with 2 or more axles and 6 or more tires).
%HCV	Percentage of the total traffic volume composed of Heavy Commercial Vehicles.
RF	Resiliency Factor = Relative value of the subgrade soil's ability to withstand repeated loading.
SSV	Soil support value of subgrade (SSV = CBR_D x RF)
D_P	Thickness index of proposed pavement design computed by the Conventional Pavement Design Method
D_R	Thickness index required, based on Design ADT and SSV, determined by Appendix II.

Step 1: Determine Design ADT

ADT	500
%HCV = 100 x HCV ÷ ADT	
EPT = 0.20(%HCV x ADT) or 20 x HCV Note: For %HCV ≤ 5%, use ADT	Note: For %HCV>5%, EPT>ADT
Design ADT = greater of ADT or EPT	500

Step 2: Determine Design Values CBR, RF and SSV

Sample	CBR_T	Resiliency Factor	(RF)
# 1		Source	Value
# 2		Table 1	
# 3	6	Appendix I	3.0
#		DME approved RF	
#		For preliminary designs, use the lowest RF value in the equation	
#			

CBR_D	x	RF	=	SSV
(6.67)	x	(3.0)	=	20

Step 3: Pavement Design (Check appropriate box and show proposed pavement design below.)

☐ (A) Limited to Design ADT ≤ 400 - Show pavement material notations and thickness from Appendix IV Tables A and B.

☐ (B) Show pavement section as developed in the Pavement Design Guide. (See Appendix III for material notations and thickness equivalency values (a)).

D_R = 10.2 from Appendix II

Description of Proposed Pavement Section

	Material Notation	Thickness, h	a	(a x h)
Surface	SM-2A	2	1.67	3.34
Base	IM-1A	2	1.67	3.34
Subbase	TYPE 21B AGG. BASE	6	0.6	3.6

D_P must equal or exceed the value of D_R. $D_P = \sum(a \times h)$ = 10.28

10.28 > 10.2 ok

Environmental Inventory Section V

Development Section V is divided into Section VA and VB. Section VA is bordered by Section VIC, Ware Creek, and Coates Pond to the east and north east, Ware Creek to the North, Section VB to the west and Golf Hole 13 to the south.

Section VB is bordered by Section VA to the west, Ware Creek to the north, Mill Pond Run Sections II and III and Section VI to the south, and Section VII to the east.

The canopy vegetation of Section VB is comprised of beech (*Fagus grandifolia*) white oak,(*Quercus alba*), sweet gum (*Liquidambar styraciflua*), loblolly pine (*Pinus taeda*) and red maple (*Acer rubrum*). Section VA canopy vegetation is predominantly pine The sappling/shrub stratum is comprised of very dense mountain laurel, (*Kalmia latifolia*) holly (*Ilex opaca*), and flowering *dogwood (Cornus florida*); and the herbaceous layer includes wild ginger (*Hexistylis* sp.), strawberry bush *(Euonymus americanus*), pine, beech, white oak and red maple seedlings.

The habitat along Ware Creek is considered scrub-shrub and emergent wetlands. The canopy is comprised of alders (*Alnus serrulata*) and black willow (*Salix nigra*) with lizards tail *(Saururus cernuus*), golden ragwort (*Senacio aures),* pickerel weed (*Pontedaria cordata*) and saw grass (*Cladium jamaicense)* in the herbaceous layer. The were a few floating aquatic plants present in ponded areas comprised of duckweed (*Lemna minor* and *Spirodela sp.*)

The wildlife usage of the area would include species typical of mature woods including mammals such as white tailed deer, raccoons, gray squirrel, beaver, Virginia opossum, red fox and birds including robins, cardinals, sparrows, black birds, blue jays, doves, meadowlarks and turkey vultures. Reptiles and amphibians usage would include toads, bull frogs, black snake, copperhead, cottonmouth water moccasin, and eastern garter snake

STONEHOUSE L.L.C.

Section V-B "BENT TREE" Phase 3

Date: 7/30/99 Revised: 1/21/00

STORMWATER ATTENUATION BASIN

POST-DEVELOPMENT DRAINAGE AREA MAP

LEGEND

PHASE 3 ROADS

POST-DEVELOPMENT DRAINAGE AREA

Langley and McDonald

A Professional Corporation

ENGINEERS - PLANNERS - SURVEYORS

LANDSCAPE ARCHITECTS - ENVIRONMENTAL CONSULTANTS

Virginia Beach and Williamsburg Virginia

GRAPHIC SCALE

0 100 200 400

DA=11.57 Ac.

11C

15F

19B

15F

11C

11C

19B

14B

10B

WINDY BRANCH DRIVE 40' R/W

SAPLING DRIVE 40' R/W

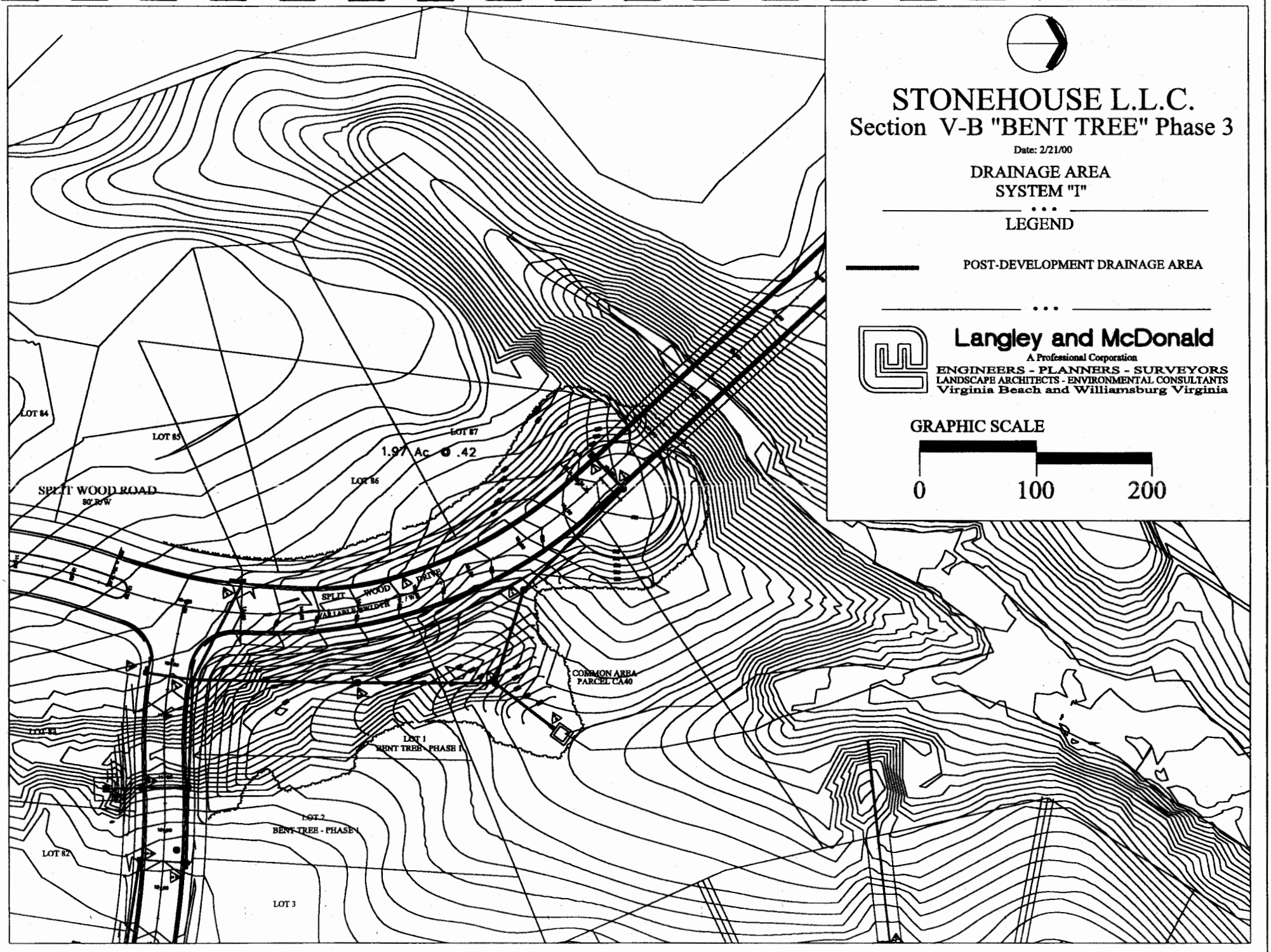
LONGWOOD DRIVE 40' R/W

BENT TREE LANE 50' R/W

LOT 14 LOT 15 LOT 16 LOT 18 LOT 19 LOT 20 LOT 21 LOT 23 LOT 25 LOT 26 LOT 27 LOT 28 LOT 29 LOT 30 LOT 31 LOT 32 LOT 33 LOT 34 LOT 35 LOT 36 LOT 43 LOT 44 LOT 45 LOT 46 LOT 47 LOT 48 LOT 49 LOT 50 LOT 51 LOT 52 LOT 53 LOT 54 LOT 55 LOT 56 LOT 59 LOT 60 LOT 61 LOT 62 LOT 74 LOT 75 LOT 76 LOT 77 LOT 78

COMMON AREA PARCEL CA37

BMP COMMON AREA PARCEL CA36



STONEHOUSE L.L.C.

Section V-B "BENT TREE" Phase 3

Date: 2/21/00

DRAINAGE AREA
SYSTEM "I"

LEGEND

POST-DEVELOPMENT DRAINAGE AREA

Langley and McDonald
A Professional Corporation
ENGINEERS - PLANNERS - SURVEYORS
LANDSCAPE ARCHITECTS - ENVIRONMENTAL CONSULTANTS
Virginia Beach and Williamsburg Virginia

GRAPHIC SCALE

0 100 200

Scott Thomas

From: Bains, Victoria A. [vbains@aesva.com]
Sent: Tuesday, May 23, 2006 4:30 PM
To: Scott Thomas
Cc: ggoder@kaufcanconsulting.com
Subject: Stonehouse - BMP Inspection List

Scott,

Here is the list of BMP's that need to be inspected.

Bent Tree:

	AES No.	JCC No.	
5-3-99	BMP 5.1	WC071	✓ REINSPECT 5/30/06. OK. WALL CLEAN LFO.
5-12-99	BMP 5.4	WC072	✓ REINSPECT 5/30/06. OK. " "
5-12-99	BMP 5.2	WC073	✓ REINSPECT 5/30/06. OK " "
5-21-99	BMP 5.3	WC074	✓ REINSPECT 5/30/06. OK " " + MOW DAM.

Richardson's Mill:

AES No.	JCC No.	
BMP 7.3	WC075	✓ REINSPECT 5/30/06. OK. NO PROBLEMS. Deep Valley. PP
BMP 7.4	WC076	✓ Reinspect 5/30/06. OK. NO " . PP
BMP 7.2	WC077	✓ Reinspect 5/30/06. OK. " " "
BMP 7.1	WC078	Reinspect 5/30/06. BMP ok, Inflow pipe undercut. Process Letter.

Let me know if you cannot find any of the certifications or calculations and I can have copies sent to you before we meet. See you at the Sales Center next Tuesday May 30 at 1:00pm.

Thank you,

Tory

Victoria (Tory) A. Bains
Project Engineer

AES Consulting Engineers
Williamsburg | Richmond | Gloucester
(757) 253-0040
www.aesva.com

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

Reinspect 5/30/06. Items ok.

County BMP ID Code (if known): WC072

Name of Facility: Stonehouse Bentree BMP-5-4 BMP No.: ____ of ____ Date: 1/13/05

Location: Sapling

Name of Owner: ____

Name of Inspector: SJThomas, Tom Bains AES

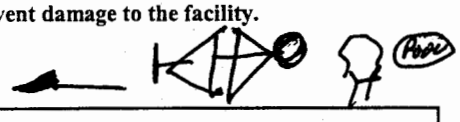
Type of Facility: Dry Pond

Weather Conditions: ____ 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
Embankments and Side Slopes:				Earth 10' wide; 3H:1V SS; Dam 15-20' High
Grass Height	✓			OK.
Vegetation Condition	✓			5' High
Tree Growth	✓			None. Some bayberries on
Erosion	✓			o/s toe & around riser. Will
Trash & Debris	✓			allow if maintained.
Seepage	✓			No signs.
Fencing or Benches				(About 20 bayberries)
Interior Landscaping/Planted Areas:	☐ None	☐ Constructed Wetland/Shallow Marsh		☒ Naturally Established Vegetation
Vegetated Conditions	✓			Natural ravine.
Trash & Debris	✓			
Floating Material	✓			Some dead wood.
Erosion	✓			
Sediment		✓		Outfall pipe from subdiv.
Dead Plant	✓			Sediment.
Aesthetics	✓			
Other				
Notes: Serves SF & Roads				

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools: ☐ Permanent Pool (Retention Basin) ☐ Shallow Marsh (Detention Basin) ☑ None, Dry (Detention Basin)				
Shoreline Erosion	✓			None
Algae	✓			
Trash & Debris	✓			
Sediment		✓		Sed. @ inflow pipe outfall 2' deep.
Aesthetics				
Other				Small pool 1.6" deep
Inflows (Describe Types/Locations):	15-18" RCP from West, within 50' of riser.			
Condition of Structure	✓			
Erosion	✓			
Trash and Debris	✓			
Sediment		✓		Sediment 1-2' deep, clean
Outlet Protection		✓		10'x10' Class I
Other				
Principal Flow Control Structure - Riser, Intake, etc. (Describe Type):	48" RCP Riser w/ CAP			
Condition of Structure	✓			Low Flow Orif w/ screen
Corrosion	✓			Higher 6" NC Turndown
Trash and Debris	✓			
Sediment	✓			Inside riser is a backup
Vegetation	✓			4-6" orfice w/ PE valve (closed)
Other	✓			Why?
Principal Outlet Structure - Barrel, Conduit, etc. :	24" RCP w/ endwall, Large offstall basin			
Condition of Structure	✓			Class I RR 30'x30'
Settlement	✓			Class I RR along toe of dam
Trash & Debris	✓			
Erosion/Sediment	✓			Sediment in RR. Minor
Outlet Protection	✓			
Other				
Emergency Spillway (Overflow):	10' w GRASS ES; Trap. 2-2.5' deep.			
Vegetation	✓			
Lining	✓			Grass
Erosion	✓			
Trash & Debris	✓			
Other				
Notes:	Upland active SF discharging Sediment into BMP.			

...ity Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	✓			
Animal Burrows	✓			
Graffiti	✓			
Other	✓			
Surrounding Perimeter Conditions:	N, W – SF; East/South Woods (ravine)			
Land Uses	✓			
Vegetation	✓			
Trash & Debris	✓			
Aesthetics	✓			Sediment from SF Construction
Access /Maintenance Roads or Paths				easy off sapling
Other				

Remarks: BMP great condition, except for sediments from SF.

▷ clean screen on LF orif mesh screen
▷ clean sediment from int/ow pipe.

Overall Environmental Division Internal Rating: 3

Signature: [signature] P.E. **Date:** 1/13/05

Title: Senior Engineer ENV DIV

SWMProg\BMP\CoInspProg\InspForms\DetRet.wpd

Date Record Created: [redacted]

Created By: [redacted]

WS_BMPNO: WC072

Print Form

PRINTED ON:
Friday, March 12, 2010
1:25:53 PM

WATERSHED	WC
BMP ID NO	072
PLAN NO	S-81-99
TAX PARCEL	
PIN NO	
CONSTRUCTION DATE	10/1/2002
PROJECT NAME	Stonehouse Bent Tree Sec 5B PH 3
FACILITY LOCATION	North of Windy Branch Drive
CITY-STATE	Toano, Va. 23168
CURRENT OWNER	Stonehouse LLC
OWNER ADDRESS	P.O. Box 759
OWNER ADDRESS 2	
CITY-STATE-ZIP CODE	Toano, VA 23168
OWNER PHONE	7572345000
MAINT AGREEMENT	Yes
EMERG ACTION PLAN	No

Get Last BMP No | Return to Menu

MAINTENANCE PLAN	Yes
SITE AREA acre	35.07
LAND USE	Planned Unit Dev
old BMP TYP	Dry Pond
JCC BMP CODE	F2 Dry ED with forebay
POINT VALUE	0
SVC DRAIN AREA acres	11.1
SERVICE AREA DESCRI	SF Lots & Roadways
IMPERV AREA acres	2.10
RECV STREAM	UT of Ware Creek RMP
EXT DET-WQ-CTRL	Yes
WTR QUAL VOL acre-ft	0.175
CHAN PROT CTRL	Yes
CHAN PROT VOL acre-ft	0.76
SW/FLOOD CONTROL	Yes
GEOTECH REPORT	No

CTRL STRUC DESC	RCP Riser
CTRL STRUC SIZE inches	48
OTLT BARRL DESC	RCP Barrel
OTLT BARRL SIZE inch	24
EMERG SPILLWAY	Yes
DESIGN HW ELEV	44.15
PERM POOL ELEV	n/a
2-YR OUTFLOW cfs	1.14
10-YR OUTFLOW cfs	21.86
REC DRAWING	Yes
CONSTR CERTIF	Yes

LAST INSP DATE 5/30/2006 Inspected by: [redacted]

INTERNAL RATING 3

MISC/COMMENTS

BMP # 5.4, amend S-68-0. Not a WQ BMP, attenuation only.

Additional Comments: [redacted]

ENVIRONMENTAL DIVISION REVIEW COMMENTS
STONEHOUSE BENT TREE, SECTION 5, PHASE 3
COUNTY PLAN NO. S - 81 - 99
April 10, 2001

MDW/SJT

General Comments:

1. A Land Disturbing Permit and Siltation Agreement, with surety, are required for this project.

2. A Subdivision Agreement, with surety, shall be executed with the County prior to recordation of lots.

3. Water and sewer inspection fees must be paid prior to the issuance of a Land Disturbing Permit.

4. An Inspection/Maintenance Agreement shall be executed with the County for the BMP facility for this project.

5. As-built drawings must be provided for the detention basin upon completion.

6. Wetlands. Provide evidence that any necessary wetlands permits have been obtained or have not expired for this portion of the project.

7. Offsite Work. In accordance with the Step 10 of the construction sequence as provided on Sheet 16, provide evidence of permission to occupy or disturb the offsite adjacent tract from the parcel owner (Fernandez Tract).

8. Streetlights. A streetlight rental fee for 5 lights must be paid prior to the recordation of the subdivision plat. Add one additional streetlight between Lots 34 and 35.

9. VPDES. It appears land disturbance for the project will exceed five (5) acres. Therefore, it is the owners responsibility to register for a General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Construction Activities, in accordance with current requirements of the Virginia Department of Environmental Quality and 9 VAC 25-180-10 et seq. Contact the Tidewater Regional Office of the DEQ at (757) 518-2000 or the Central Office at (804) 698-4000 for further information.

10. Professional seal and signature is required on final and complete approved stormwater management plans, drawings, technical reports and specifications.

Floodplain:

11. FEMA Data. Based on FEMA FIRM data, it appears Special Flood Hazard Area, Zone A is present along the northeast portion of the site. Designate SFHA Zone A on the note provided on the cover sheet and correctly label the floodplain as Zone A on all applicable plan sheets, especially the Environmental Inventory.

Chesapeake Bay Preservation:

12. Waiver Request. Waiver request to disturb approximately 1.86 acres of 25 percent slopes dated March 9th 2001 is acknowledged.

Erosion & Sediment Control Plan:

13. Temporary Stockpile Areas. Show any temporary soil stockpile, staging and equipment storage areas (with required erosion and sediment controls) or indicate on the plans that none are anticipated for this portion of the project.

14. Offsite Land Disturbing Areas. Profile sheets 10 & 11 indicate a large amount of areas to be cut to meet proposed road grades. Identify any offsite land disturbing areas including waste or disposal sites (with required erosion and sediment controls) or indicate on the plans that none are anticipated for this project.

15. Grading Plan. Label intended cut/fill slopes on plan Sheets 13, 14 and 15 to the greatest extent possible (3H:1V, 2H:1V, etc.). Use standard VESCH Chapter 3 symbols to indicate areas where matting is required.

16. Limits of Clearing. Check and adjust clearing limits as necessary on the plan to account for any extremely deep utility installations, some of which are well in excess of 15 ft. depth (ie. sanitary sewer).

17. Temporary Sediment Basins. Submit Sediment Basin Design Data Sheets and associated computations to ensure Temporary Sediment Basins # 1 and # 2 are in compliance with Minimum Standard 3.14 of the VESCH. Include hydrology computations, hydraulic and basin routings as necessary. Sheet 16 should reflect use of sediment basins, not traps for Phase 1 temporary basins # 1 and # 2. Step 15 of the construction sequence on Sheet 16 indicates that BMP # 5.4 is to be cleaned of sediment. If this facility is to be utilized as a sediment trapping facility during construction, show the cleanout elevation for BMP # 5.4 during the construction phase and include any special provisions that are required to be provided to this facility (ie. riser/orifice modifications) during the construction phase.

18. Sediment Trapping Facilities. Transpose the locations of Sediment Basins # 1 and # 2 on the 1"=50' grading and drainage plans.

19. Site Stabilization. Include provisions in the sequence of construction, Step 9 or 10, to perform early stabilization (seed & mulch) of disturbed areas associated with road grading, storm drainage systems and installation of BMP # 5.4. In order to minimize erosion, stabilization of certain areas which are at finished grade, especially road cut/fill slopes, outfall areas and the BMP, do not need to wait until remaining sitework such as road ditch grading, road stabilization (with stone) and other incidental utility installations are complete.

20. Culvert Inlet Protection. It appears the culvert inlet protection at the inlet to the 24-inch RCP culvert at Splitwood Road Sta. 18+00 will require a sediment-trap type (CIP) device per VESCH Minimum Standard 3.08, since drainage area to this measure appears to exceed 1 acre. Ensure this is properly specified on the plans and adequate details are provided.

21. Channel Adequacy. Submit adequacy analyses for all receiving natural drainage facilities. Adequacy computations are required to verify that natural channels are adequate for velocity and capacity using the 2-year design storm event. In specific, provide computations for the following four (4) areas: downstream of SS # 2-1 (System 2) prior to BMP # 5.4; downstream of SS # 4-1 (System 4); downstream of the 24-inch culvert at Splitwood Sta. 18+00 before existing BMP # 5.1; and at outfall SS # 5-2 near the Splitwood Pump Sta.(System 5).

22. Rock Check Dams. Add rock check dam structures for secondary control at the following proposed stilling basin locations: at the outfall of the 24-inch RCP culvert at Splitwood Road Sta. 18+00; at the outfall of the 15-inch RCP culvert across Windy Branch Sta. 15+50; and downstream of the 30-inch outlet barrel for BMP # 5.4. These measures will help provide control during first clearing and grading activities until associated storm drainage structures are in place. Stone from the check dams can then be utilized in the stilling basins once tributary site areas are substantially stabilized.

23. Stilling Basins. No dimensions were found on Sheets 13 & 14 for stilling basins proposed at SS # 1-1, SS # 2-1, SS # 3-1, SS # 4-1 and at BMP # 5.4. Also, some side walls of the basins are shown at 1H:1V (ie. slope down areas). The detail on Sheet 19 should reflect slopes for the basins at 2H:1V maximum per Minimum Standard 3.18 of the VESCH. Also indicate slope required (3H:1V, etc.) above the upper limit of riprap, if additional cut is required to tie/meet original ground.

Stormwater Management / Drainage:

24. BMP/Water Quality Points. Provide a County standard Worksheet for BMP Point System to ensure the stormwater management plan for this portion of the project attains at least 10 BMP points or is consistent with the overall stormwater management master plan for the project.

25. BMP Water Quality. Computations were provided in the design report to show 24-hour detention of the 1-year, 24-hour storm to meet County stream channel protection criteria. Provide similar computations as necessary to show water quality treatment volume and detention time through the 4-inch low flow orifice. Design shall be consistent with a County type F-2 facility design (extended dry detention) for a treatment volume of 1.0 inch per impervious acre.

26. Stream Channel Protection. In the design report, the elevation of the release inlet (El. 36.0) does not match the elevation of the 4-inch low-flow orifice on the construction plan (El. 34.5). Determine if this difference will have any impact on the orifice size provided for extended detention for water quality and/or stream channel protection.

27. Hydrology. Provide the basis for the CN selection of 74 as used in the predevelopment conditions analyses for HSG C, wooded subareas associated with subareas tributary to BMP 5.4. Normally "good" hydrologic conditions are used in predevelopment analyses, which in this case would reflect a CN value of around 70. These subareas make up for approximately 82 percent of area tributary to the pond.

28. BMP Design. Explain the purpose of the 4-inch PVC gate valve at the end of the low-flow orifice if basin design is intended as dry extended detention. If the valve is necessary, indicate "normally open" on the detail on Sheet 17.

29. BMP Tailwater. Provide the basis for the 4.1 ft. tailwater depth assumption (El. 34.5) as used in the basin routings for BMP # 5.4. This is the water surface elevation in the natural channel below the pond outlet barrel.

30. Emergency Spillway. Minimum bottom widths for token emergency spillways are 8 feet.

31. Concrete Riser. Specify if the riser barrel is to meet the requirements of ASTM C361 for reinforced concrete pipe or ASTM C 478 for precast reinforced concrete manholes.

32. Flotation Computations. Provide flotation (buoyancy) computations for the riser and base structure.

33. BMP Pretreatment. No provisions were shown on the plan to address BMP pretreatment requirements per the JCC BMP manual.

34. BMP Labels. Properly label BMP # 5.4 on plan Sheets 3, 12, 13, 14, and 16.

35. Pond Buffer. Sheet 3 shows a 15 ft. maintenance easement to be provided from the 100-year floodplain. In addition to the maintenance easement, a pond buffer/setback is required 25 feet outward (landward) from the design high water surface elevation of the pond (currently at El. 44.16). The preferred arrangement is for the design high water plus the 25 ft. buffer to be located in common area rather than having a maintenance easement or buffer/setback situated on proposed lots.

36. Storm Drain System 3. The storm drain computation (table) in the design report for System 3 is missing design drainage area, time of concentration, intensity, flow/capacity and velocity data.

37. Roadside Channels. Based on the roadside channel computations in the design report, Windy Branch Drive, right side, Sta. 14+50 to 15+50 requires a deeper paved channel section due to a 7-inch 10-year design storm channel depth. The construction plan does not reflect transition from a 6-inch paved channel to a deeper paved channel section at this location.

38. Stormwater Conveyance. Describe whether an onsite designed stormwater conveyance channel is necessary just downstream of outfall SS # 5-2 to convey drainage to the natural downstream channel once the site is stabilized and the temporary sediment trap is removed.