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: **DC018**

DATE VERIFIED: **November 20, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

Date: March 28, 2012

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

From: Leah Hardenbergh

PO: 110426

Re: Files Approved for Scanning

General File ID or BMP ID: **DC018**

PIN: **1240100063**

Owner Name (if known): **ACAH LLC**

Legal Property Description: **6.237 AC ACAH LLC**

Site Address: **8391 RICHMOND ROAD**

(For internal use only):

Box # 2

Agreements (in file as of scan date): Y Book or Doc #: 060018437/080000692

Contents for Stormwater Management Facilities As-built Files

Each file is to contain:

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

SP-21-07; DC 018

COPY

COUNTY OF JAMES CITY, VIRGINIA

DECLARATION OF COVENANTS
INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

THIS DECLARATION, made this 12th day of December, 2007, between ACAH, LLC, and all successors in interest, ("COVENANTOR(S)"), owner(s) of the following property:

Parcel Identification Number: 1240100001
Legal Description: Hickory Neck Springs
Project or Subdivision Name: Anderson Corner Animal Care and Surgical Center
Document No. 060018437
OR Deed Book _____, Page No. _____,
and the County of James City, Virginia ("COUNTY.")

WITNESSETH:

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

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

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

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

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

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

Instrument # 080000692
Recorded on 1-7-08

DC018_ANDERSONS_CORNER_ANIMAL_HOSPITAL - 004

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.

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

COVENANTOR(S)

R. Andrew Murphie Owner

Print Name

Title

ACKNOWLEDGMENT

COMMONWEALTH OF VIRGINIA
CITY/COUNTY OF James City, to wit:

I hereby certify that on this 12 day of December, 20 07, before the subscribed, a Notary Public for the Commonwealth of Virginia, personally appeared R. Andrew Murphie and did acknowledge the foregoing instrument to be his/her Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 12 day of December, 20 07.

[SEAL]

Notary Public

Notary Registration Number:

My Commission expires:

AMY M. KESSLER
Notary Public
Commonwealth of Virginia
216363
My Commission Expires Nov 30, 2009

COVENANTOR(S)

_____
Print Name

_____
Title

ACKNOWLEDGMENT

COMMONWEALTH OF VIRGINIA
CITY/COUNTY OF _____, to wit:

I hereby certify that on this _____ day of _____, 20____, before the subscribed, a Notary Public for the Commonwealth of Virginia, personally appeared _____ and did acknowledge the foregoing instrument to be his/her Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this _____ day of _____, 20____.

[SEAL] _____
Notary Public

Notary Registration Number:_____

My Commission expires: _____

Approved as to form:

_____
County Attorney

This Declaration of Covenants prepared by:

Name: _____

Print Name: Amy M Kessler

Title: Project Engineer

Address: 4571 Ware Creek Rd
Williamsburg, VA 23188

Phone Number: 757 5663032

(drainage1.pre)

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

Project Name: ANDERSON'S CORNER ANIMAL HOSPITAL
County Plan No.: SP-21-07
Stormwater Management Facility: INFILTRATION TRENCH
BMP Phase #: ☑ I ☐ II ☐ III
☑ Information Package Received. Date/By: 6/1/10 MHAJDESKI
☑ Completeness Check:
- ☑ Record Drawing Date/By: 3/25/10 A. SEBERT
- ☑ Construction Certification Date/By: 4/21/10 D. DEYOUNG
- ☑ RD/CC Standard Forms (Required for all BMPs after Feb 1st 2001Only)
- ☑ Insp/Maint Agreement # / Date: 0200000692 / 1-7-08
- ☑ BMP Maintenance Plan Location: ON ASBUILT DRAWINGS ; COPY OF MAINT. PLAN IN FILE
- ☐ Other:

☑ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review
- ☑ Yes ☐ No Location: JCC GEN NOTES PAGE C6

☑ Assign **County BMP ID Code #**: Code: DC-018
☑ 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: 7/20/2010
☑ Record Drawing (RD) Review Date: 7/19/10 - WAC
☑ Construction Certification (CC) Review Date: 7/19/10 - WAC
☐ Actions:
- ☐ No comments.
- ☑ Comments. Letter Forwarded. Date: 7/20/10
- ☑ Record Drawing (RD)
- ☑ Construction Certification (CC) OK
- ☑ Construction-Related (CR)
- ☐ Site Issues (SI)
- ☐ Other :

☑ Second Submission: January 4, 2011
☐ Reinspection (if necessary): NA
☑ Acceptable for SWM Purposes (RD/CC/CR/Other). Ok to proceed with bond release.
☐ Complete "Surety Request Form".
☑ Check/Clean active file of any remaining material and finish "As-Built" file.
☑ Add to County BMP Inventory/Inspection schedule (Phase I, II or III).
☐ Copy Final Inspection Report into County BMP Inspection Program file.
☐ Obtain Digital Photographs of BMP and save into County BMP Inventory.
☑ Request mylar/reproducible from As-Built plan preparer.
☑ Complete "As-built Tracking Log".
☐ Last check of BMP Access Database (County BMP Inventory).
☐ Add BMP to JCC Hydrology & Hydraulic database (optional).
NA Add BMP to Municipal BMP list (if a County-owned facility)
☐ Add BMP to PRIDE BMP ratings database.

Final Sign-Off

Inspector: Date: 1/21/11
Chief Engineer: Date: 1/21/11

*** See separate checklist, if needed.

James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities
Record Drawing and Construction Certification Forms

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

Section 1 - Site Information:

Project Name: Anderson Corner Animal Hospital
Structure/BMP Name: Infiltration Basin
Project Location: 8391 Richmond Road, Toano, VA 23168
BMP Location: N 3,671,608.0 E 11,974,847.8
County Plan No.: 12-1 - 12-2 -SP-21-07

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

Tax Map/Parcel No.: 1240100001
BMP ID Code (if known): ~~DC~~ DC-018
Zoning District:: A1
Land Use: Animal Hospital
Site Area (sf or acres): 6.19 a

Brief Description of Stormwater Management/BMP Facility:

_____

Nearest Visible Landmark to SWM/BMP Facility: _____

Nearest Vertical Ground Control (if known):
- ☑ JCC Geodetic Ground Control
- ☐ USGS
- ☐ Temporary
- ☐ Arbitrary
- ☐ Other

Station Number or Name: 302
Datum or Reference Elevation: NGVD 1929
Control Description: Government disk
Control Location from Subject Facility: 0.5 miles north on US60, right on Route 30 for 1.1 miles to station 302

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: MArch 2008
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☒ Unknown
Name of Site Work Contractor Who Constructed Facility: David A. Nice Builders, Inc.
Name of Professional Firm Who Routinely Monitored Construction: _____
Date of Completion for SWM/BMP Facility: August 2008
Date of Record Drawing/Construction Certification Submittal: _____

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

Section 3 - Owner / Designer / Contractor Information:

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

Name: David A. Nice Builders, Inc.
Mailing Address: 4571 Ware Creek Road, Williamsburg, VA 23188

Business Phone: 757 566 3032 Fax: 757 566 4686
Contact Person: Amy Kessler Title: Project Engineer

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: DJG, Inc.
Mailing Address: 449 McLaws Circle, Williamsburg, VA 23185

Business Phone: 757 253 0673
Fax: 757 253 2319
Responsible Plan Preparer: Kenneth M. Stewart
Title: P.E.
Plan Name: Andersons Corner Animal Hospital
Firm's Project No. 2060810
Plan Date: 12/12/2007
Sheet No.'s Applicable to SWM/BMP Facility: C3 / C9 / ____ / ____ / ____

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

Name: David A. Nice Builders, Inc.
Mailing Address: 4571 Ware Creek Road, Williamsburg, VA 23188

Business Phone: 757 566 3032
Fax: 757 566 4686
Contact Person: Amy Kessler
Site Foreman/Supervisor: William Apperson or Chris Nice
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 - Professional Certifications:

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

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: Sebert Surveying
Mailing Address: PO Box 6304
Williamsburg, VA 23188
Business Phone: 757-345-0931
Fax: 757-345-0931

Name: A. D. Sebert
Title: OWNER

Signature: A. D. Sebert
Date: 3/31/10

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
3/31/10
A.D. SEBERT
No. 002221
LAND SURVEYOR

A. D. Sebert (Seal)

Virginia Registered Professional Engineer or Certified Land Surveyor

Construction Certification

Firm Name: DJG, Inc.
Mailing Address: 449 McLaws Circle
Williamsburg, VA 23185
Business Phone: 7572530673
Fax: 7572532319

Name: Daniel J. DeYoung
Title: PE

Signature: Daniel J. DeYoung
Date: 4-21-10

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
DANIEL JACKSON
DeYOUNG
Lic. No. 003517
4-21-10
PROFESSIONAL ENGINEER

Daniel J. DeYoung

Virginia Registered Professional Engineer

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

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

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

AKT

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

AKT

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

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

Tina Creech

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

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

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

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

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

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

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

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

N/A 4. All plan sheet revision blocks modified to indicate date and record drawing status.

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

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

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

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

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

N/A 4. Top widths, berm widths and embankment side slopes.

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

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

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

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

N/A 9. Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc.

N/A 10. Dimensions, locations and elevations of outlet orifices, weirs, slots and drains.

___ 11. Type and size of anti-vortex and trash rack device. Height, diameter, dimensions, bar spacings (if applicable) and elevations relative to the principal spillway crest. Indicate if lockable hatch is present or not.

___ 12. Type, location, size and number of anti-seep collars or documentation of other methods utilized for seepage control. **May need to obtain this information during construction.**

___ 13. Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. **May need to obtain this information during construction.**

___ 14. Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert.

___ 15. Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall.

___ 16. Outfall protection dimension, type and depth of rock and if underlain filter fabric is present.

N/A 17. BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan.

✓ 18. Maintenance plan taken from approved design plan transposed onto record drawing set.

N/A 19. Fencing location and type, if applicable to facility.

___ 20. BMP vicinity properly cleaned of stockpiles and construction debris.

___ 21. No visual signs of erosion or channel degradation immediately downstream of facility.

___ 22. Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility.

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

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

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

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

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

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

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

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

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

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

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

___ A10. Low flow orifice has a non-clogging mechanism.

___ A11. A pond drain pipe with valve was provided.

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

___ B2. Minimum 2:1 length to width flow path provided across the facility.

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

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

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

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

___ B7. Topsoil or wetland mulch provided to support vigorous growth of wetland plants.

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

✓ C1. All requirements of Section II, Minimum Standards, apply to Group C facilities as applicable.

✓ C2. Facility is not located on fill slopes or on natural ground in excess of six (6) percent.

N/A C3. Pretreatment devices provided prior to entry into the infiltration facility. Acceptable pretreatment devices include sediment forebays, sediment basins, sediment traps, sump pits or inlets, grass channels, plunge pools or other acceptable measures.

✓ C4. Three (3) or more of the following pretreatment devices provided to protect long term integrity of structure: grass channel; grass filter strip; bottom sand layer; upper filter fabric layer; use of washed ~~bank run gravel aggregate~~. VDOT #1 Stone

✓ C5. Sides of infiltration practice lined with filter fabric.

✓ C6. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.

✓ C7. Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.

✓ C8. Minimum one hundred (100) foot separation horizontally from any known water supply well and minimum one hundred (100) foot separation upslope from any building.

✓ C9. Minimum twenty-five (25) foot separation down gradient from any structure.

✓ C10. Stormwater outfalls provided for overflow associated with larger design storms.

✓ C11. No visual signs of erosion or channel degradation immediately downstream of facility.

✓ C12. Facility does not currently cause any apparent surface or subsurface water problems to downgrade properties.

✓ C13. Observation well provided.

Inc. C14. Adequate, direct access provided to the facility for future maintenance, operation and inspection.

Infiltration basin is within fenced area; inspection access requires permission from owner and entry through 3' wide gate.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

N/A D1. All requirements of Section II, Minimum Standards, apply to Group D facilities.

___ D2. Sediment pretreatment devices provided.

___ D3. For D-1 BMPs (Bioretention Cells), pretreatment consisting of a grass filter strip below level spreader (deflector); a gravel diaphragm; and mulch and planting soil layers were provided.

___ D4. For D-1 BMPs (Bioretention Cells), plantings consist of native plant species; vegetation provided was based on zones of hydric tolerances; trees and understory of shrubs and herbaceous materials were provided; woody vegetation is absent from inflow locations; and trees are located around facility perimeter.

___ D5. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.

___ D6. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed .

___ D7. Filtering system is off-line from storm drainage conveyance system.

___ D8. Overflow outlet has adequate erosion protection.

___ D9. Deflector, diversion, flow splitter or regulator structure provided to divert the water quality volume to the filtering structure.

___ D10. Minimum four (4) inch perforated underdrain provided in a clean aggregate envelope layer beneath the facility.

___ D11. Minimum fifty (50) foot separation from any slope fifteen (15) percent or greater. Minimum one hundred (100) foot separation horizontally from any known water supply well. Minimum one hundred (100) foot separation upslope and twenty-five (25) foot separation downslope from any building.

___ D12. Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.

___ D13. No visual signs of erosion or channel degradation immediately downstream of facility.

___ D14. Adequate, direct access provided to the pretreatment area and/or filter bed for future maintenance.

STORMWATER MANAGEMENT / BMP FACILITIES
AS-BUILT PLAN CHECKLIST

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

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

N/A E1. All requirements of Section II, Minimum Standards, apply to Group E facilities as applicable.

___ E2. Open channel system has constructed longitudinal slope of less than four (4) percent.

___ E3. No visual signs of erosion in the open channel system's soil and/or vegetative cover.

___ E4. Open channel side slopes are no steeper than 2H:1V at any location. Preferred channel sideslope is 3H:1V or flatter.

___ E5. No visual signs of ponding are present at any location in the open channel system, except at rock check dam locations for E-1 systems (Wet Swales).

___ E6. For E-2 BMPs (Dry Swales), an underdrain system was provided.

___ E7. Treated timber or rock check dams provided as pretreatment devices for the open channel system.

___ E8. Gravel diaphragm provided in areas where lateral sheet flow from impervious surfaces are directly connected to the open channel system.

___ E9. Grass cover/stabilization in the open channel system appears adaptable to the specific soils and hydric conditions for the site and along the channel system.

___ E10. Open channel system areas with grass covers higher than four (4) to six (6) inches were properly mowed.

___ E11. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.

___ E12. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.

___ E13. For E-3 BMPs (Biofilters), the bottom width is six (6) feet maximum at any location.

___ E14. For E-3 BMPs (Biofilters), sideslopes are 3H:1V maximum at any location.

___ E15. For E-3 BMPs (Biofilters), the constructed channel slope is less than or equal to three (3) percent at any location.

___ E16. For E-3 BMPs (Biofilters), the constructed grass channel is approximately equivalent to the constructed roadway length.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

N/A F1. All requirements of Section II, Minimum Standards, apply to Group F facilities.

____ F2. Basin bottom has positive slope and drainage from all basin inflow points to the riser (or outflow) location.

____ F3. Timber wall BMP used in intermittent stream only. (ie. Prohibited in perennial streams.)

____ F4. Forebay provided approximately 20 ft. upstream of the facility. Forebays generally 4 to 6 feet in depth.

____ F5. A reverse slope pipe, vertical stand pipe or mini-barrel and riser was provided to prevent clogging.

____ F6. Principal spillway and outlet barrel provided consisting of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.

____ F7. Mini-barrel and riser, if used, contains a removable trash rack to reduce clogging.

____ F8. Low flow orifice, if used, has a minimum diameter of three (3) inches or two (2) inches if internal orifice control was utilized and a small, cage type external trash rack.

____ F9. Timbers properly reinforced or concrete footing provided if soil conditions were prohibitive.

____ F10. Timber wall cross members extended to a minimum depth of two (2) feet below ground elevation.

____ F11. Protection against erosion and scour from the low flow orifice and weir-flow trajectory provided.

____ F12. Stilling basin or standard outlet protection provided at principal spillway outlet.

____ F13. Adequate, direct access provided to the facility. Access corridor to facility is at least ten (10) feet wide, slope is less than twenty (20) percent and appropriate stabilization provided for equipment and vehicle use. Access extends to forebay, standpipe and timber wall, as applicable.

____ F14. No visual signs of undercutting of timber walls or clogging of the low orifice were present.

____ F15. No visual signs of erosion or channel degradation immediately downstream of facility.

____ F16. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

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

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

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

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

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

OD As built SD2. Horizontal location of all pipe and structures relative to the SWM/BMP facility.

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

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

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

XII. Other Systems

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

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

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

XIII. References

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

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

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DC018_ANDERSONS_CORNER_ANIMAL_HOSPITAL - 023

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: Anderson Corner Animal Hospital
Structure/BMP Name: Infiltration Basin
Project Location: 8391 Richmond Road, Toano, VA 23168
BMP Location: N 3,671,608.0 E 11,974,847.8
County Plan No.: 12-1 - 12-2 -

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

Tax Map/Parcel No.: 1240100001
BMP ID Code (if known): C2
Zoning District:: A1
Land Use: Animal Hospital
Site Area (sf or acres): 6.19 a

Brief Description of Stormwater Management/BMP Facility:

Nearest Visible Landmark to SWM/BMP Facility:

Nearest Vertical Ground Control (if known):
☑ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☐ Other
Station Number or Name: 302
Datum or Reference Elevation: NGVD 1929
Control Description: Government Disk
Control Location from Subject Facility: 0.5 miles north on US 60, right on Route 30 for 1.1 miles to station 302.

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: MArch 2008
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☒ Unknown
Name of Site Work Contractor Who Constructed Facility: David A. Nice Builders, Inc.
Name of Professional Firm Who Routinely Monitored Construction: _____
Date of Completion for SWM/BMP Facility: August 2008
Date of Record Drawing/Construction Certification Submittal: _____

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

Section 3 - Owner / Designer / Contractor Information:

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

Name: David A. Nice Builders, Inc.
Mailing Address: 4571 Ware Creek Road, Williamsburg, VA 23188

Business Phone: 757 566 3032 Fax: 757 566 4686
Contact Person: Amy Kessler Title: Project Engineer

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: DJG, Inc.
Mailing Address: 449 McLaws Circle, Williamsburg, VA 23185

Business Phone: 757 253 0673
Fax: 757 253 2319
Responsible Plan Preparer: Kenneth M. Stewart
Title: P.E.
Plan Name: Anderson's Corner Animal Hospital
Firm's Project No. 2060810
Plan Date: 12/12/2007
Sheet No.'s Applicable to SWM/BMP Facility: C3 / C9 / ____ / ____ / ____

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

Name: David A. Nice Builders, Inc.
Mailing Address: 4571 Ware Creek Road, Williamsburg, VA 23188

Business Phone: 757 566 3032
Fax: 757 566 4686
Contact Person: Amy Kessler
Site Foreman/Supervisor: William Apperson or Chris Nice
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 - Professional Certifications:

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

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: Sebert Surveying
Mailing Address: PO Box 6304
Williamsburg, VA 23188
Business Phone: 757-345-0931
Fax: 757-345-0931

Name: A. D. Sebert
Title: OWNER

Signature: A. D. Sebert
Date: 3/31/10

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
3/31/10
A.D. SEBERT
No. 002221
LAND SURVEYOR

A. D. Sebert (Seal)

Virginia Registered Professional Engineer or Certified Land Surveyor

Construction Certification

Firm Name: DJG, Inc.
Mailing Address: 449 McLaws Circle
Williamsburg, VA 23185
Business Phone: 757.253.0673
Fax: 757.253.2319

Name: Daniel J DeYoung
Title: PE

Signature: Daniel J DeYoung
Date: 4-21-10

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
DANIEL JACKSON
DeYOUNG
Lic. No. 003517
4-21-10
PROFESSIONAL ENGINEER

Daniel J DeYoung (Seal)

Virginia Registered Professional Engineer

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

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

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

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

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

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

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

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

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

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

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

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

Alt

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

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

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

N/A 4. All plan sheet revision blocks modified to indicate date and record drawing status.

✓ 5. Not All plan sheets have certification statements and certifying professional's signature and seal.

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

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

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

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

N/A 4. Top widths, berm widths and embankment side slopes.

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

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

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

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

N/A 9. Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc.

N/A 10. Dimensions, locations and elevations of outlet orifices, weirs, slots and drains.

___ 11. Type and size of anti-vortex and trash rack device. Height, diameter, dimensions, bar spacings (if applicable) and elevations relative to the principal spillway crest. Indicate if lockable hatch is present or not.

___ 12. Type, location, size and number of anti-seep collars or documentation of other methods utilized for seepage control. **May need to obtain this information during construction.**

___ 13. Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. **May need to obtain this information during construction.**

___ 14. Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert.

___ 15. Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall.

___ 16. Outfall protection dimension, type and depth of rock and if underlain filter fabric is present.

N/A 17. BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan.

✓ 18. Maintenance plan taken from approved design plan transposed onto record drawing set.

N/A 19. Fencing location and type, if applicable to facility.

___ 20. BMP vicinity properly cleaned of stockpiles and construction debris.

___ 21. No visual signs of erosion or channel degradation immediately downstream of facility.

___ 22. Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility.

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

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

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

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

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

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

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

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

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

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

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

___ A10. Low flow orifice has a non-clogging mechanism.

___ A11. A pond drain pipe with valve was provided.

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

___ B2. Minimum 2:1 length to width flow path provided across the facility.

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

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

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

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

___ B7. Topsoil or wetland mulch provided to support vigorous growth of wetland plants.

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

✓ C1. All requirements of Section II, Minimum Standards, apply to Group C facilities as applicable.

✓ C2. Facility is not located on fill slopes or on natural ground in excess of six (6) percent.

N/A C3. Pretreatment devices provided prior to entry into the infiltration facility. Acceptable pretreatment devices include sediment forebays, sediment basins, sediment traps, sump pits or inlets, grass channels, plunge pools or other acceptable measures.

✓ C4. Three (3) or more of the following pretreatment devices provided to protect long term integrity of structure: grass channel; grass filter strip; bottom sand layer; upper filter fabric layer; use of washed ~~bank run gravel aggregate~~. VDOT #1 stone.

✓ C5. Sides of infiltration practice lined with filter fabric.

✓ C6. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.

✓ C7. Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.

✓ C8. Minimum one hundred (100) foot separation horizontally from any known water supply well and minimum one hundred (100) foot separation upslope from any building.

✓ C9. Minimum twenty-five (25) foot separation down gradient from any structure.

✓ C10. Stormwater outfalls provided for overflow associated with larger design storms.

✓ C11. No visual signs of erosion or channel degradation immediately downstream of facility.

✓ C12. Facility does not currently cause any apparent surface or subsurface water problems to downgrade properties.

✓ C13. Observation well provided.

Inc. C14. Adequate, direct access provided to the facility for future maintenance, operation and inspection.
Infiltration basin is within fenced area; inspection access requires permission from owner and entry through 3' gate.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

N/A D1. All requirements of Section II, Minimum Standards, apply to Group D facilities.

___ D2. Sediment pretreatment devices provided.

___ D3. For D-1 BMPs (Bioretention Cells), pretreatment consisting of a grass filter strip below level spreader (deflector); a gravel diaphragm; and mulch and planting soil layers were provided.

___ D4. For D-1 BMPs (Bioretention Cells), plantings consist of native plant species; vegetation provided was based on zones of hydric tolerances; trees and understory of shrubs and herbaceous materials were provided; woody vegetation is absent from inflow locations; and trees are located around facility perimeter.

___ D5. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.

___ D6. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed .

___ D7. Filtering system is off-line from storm drainage conveyance system.

___ D8. Overflow outlet has adequate erosion protection.

___ D9. Deflector, diversion, flow splitter or regulator structure provided to divert the water quality volume to the filtering structure.

___ D10. Minimum four (4) inch perforated underdrain provided in a clean aggregate envelope layer beneath the facility.

___ D11. Minimum fifty (50) foot separation from any slope fifteen (15) percent or greater. Minimum one hundred (100) foot separation horizontally from any known water supply well. Minimum one hundred (100) foot separation upslope and twenty-five (25) foot separation downslope from any building.

___ D12. Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.

___ D13. No visual signs of erosion or channel degradation immediately downstream of facility.

___ D14. Adequate, direct access provided to the pretreatment area and/or filter bed for future maintenance.

STORMWATER MANAGEMENT / BMP FACILITIES
AS-BUILT PLAN CHECKLIST

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

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

N/A E1. All requirements of Section II, Minimum Standards, apply to Group E facilities as applicable.

____ E2. Open channel system has constructed longitudinal slope of less than four (4) percent.

____ E3. No visual signs of erosion in the open channel system's soil and/or vegetative cover.

____ E4. Open channel side slopes are no steeper than 2H:1V at any location. Preferred channel sideslope is 3H:1V or flatter.

____ E5. No visual signs of ponding are present at any location in the open channel system, except at rock check dam locations for E-1 systems (Wet Swales).

____ E6. For E-2 BMPs (Dry Swales), an underdrain system was provided.

____ E7. Treated timber or rock check dams provided as pretreatment devices for the open channel system.

____ E8. Gravel diaphragm provided in areas where lateral sheet flow from impervious surfaces are directly connected to the open channel system.

____ E9. Grass cover/stabilization in the open channel system appears adaptable to the specific soils and hydric conditions for the site and along the channel system.

____ E10. Open channel system areas with grass covers higher than four (4) to six (6) inches were properly mowed.

____ E11. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.

____ E12. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.

____ E13. For E-3 BMPs (Biofilters), the bottom width is six (6) feet maximum at any location.

____ E14. For E-3 BMPs (Biofilters), sideslopes are 3H:1V maximum at any location.

____ E15. For E-3 BMPs (Biofilters), the constructed channel slope is less than or equal to three (3) percent at any location.

____ E16. For E-3 BMPs (Biofilters), the constructed grass channel is approximately equivalent to the constructed roadway length.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

N/A F1. All requirements of Section II, Minimum Standards, apply to Group F facilities.

____ F2. Basin bottom has positive slope and drainage from all basin inflow points to the riser (or outflow) location.

____ F3. Timber wall BMP used in intermittent stream only. (ie. Prohibited in perennial streams.)

____ F4. Forebay provided approximately 20 ft. upstream of the facility. Forebays generally 4 to 6 feet in depth.

____ F5. A reverse slope pipe, vertical stand pipe or mini-barrel and riser was provided to prevent clogging.

____ F6. Principal spillway and outlet barrel provided consisting of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.

____ F7. Mini-barrel and riser, if used, contains a removable trash rack to reduce clogging.

____ F8. Low flow orifice, if used, has a minimum diameter of three (3) inches or two (2) inches if internal orifice control was utilized and a small, cage type external trash rack.

____ F9. Timbers properly reinforced or concrete footing provided if soil conditions were prohibitive.

____ F10. Timber wall cross members extended to a minimum depth of two (2) feet below ground elevation.

____ F11. Protection against erosion and scour from the low flow orifice and weir-flow trajectory provided.

____ F12. Stilling basin or standard outlet protection provided at principal spillway outlet.

____ F13. Adequate, direct access provided to the facility. Access corridor to facility is at least ten (10) feet wide, slope is less than twenty (20) percent and appropriate stabilization provided for equipment and vehicle use. Access extends to forebay, standpipe and timber wall, as applicable.

____ F14. No visual signs of undercutting of timber walls or clogging of the low orifice were present.

____ F15. No visual signs of erosion or channel degradation immediately downstream of facility.

____ F16. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

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

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

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

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

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

OK As built

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

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

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

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

XII. Other Systems

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

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

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

XIII. References

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

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

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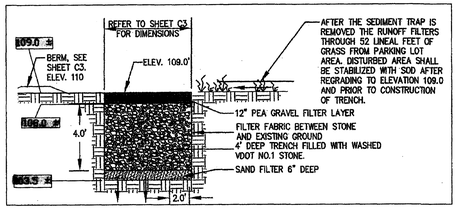
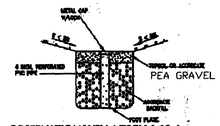




OBSERVATION WELL VESCH 3.10-4
NOT TO SCALE

STORMWATER MANAGEMENT NARRATIVE

PROJECT DESCRIPTION: THIS PROJECT IS THE CONSTRUCTION OF A 9,188 SF ANIMAL HOSPITAL BUILDING AND 34 SPACE PARKING LOT AND INSTALLATION OF A PRIVATE FORCE MAIN AND PRIVATE WATER LINE AT ANDERSON'S CORNER, JAMES CITY COUNTY, VIRGINIA.

EXISTING DRAINAGE: THE SITE TOPOGRAPHY DRAINS VIA OVERLAND FLOW AND EARTHEN SWALES TOWARDS AN RPA BUFFER, ADJACENT PROPERTIES, AND A VDOT RIGHT OF WAY DRAINAGE SWALE. TOPOGRAPHY IS MODERATELY TO STEEPLY SLOPED. THERE ARE NO CRITICAL EROSION AREAS ON THE SITE.

SEDIMENT TRAP: A TEMPORARY SEDIMENT TRAP TO BE UTILIZED TO CONTROL SEDIMENT DURING CONSTRUCION SHALL BE PLACED BETWEEN THE PLANNED LOCATION OF THE INFILTRATION TRENCH AND THE LOWER END OF THE PLANNED PARKING LOT. DO NOT DISTURB ANY AREA WITHIN 5 FEET OF PLANNED INFILTRATION TRENCH.

STORMWATER MANAGEMENT FACILITIES: 1 INFILTRATION TRENCH BMP-TYPE C-2, PROVIDES BOTH WATER QUALITY AND QUANTITY CONTROL FOR THE IMPERVIOUS AREAS AND ANIMAL EXERCISE YARD. APPROXIMATELY 1.10 ACRE OF DEVELOPED LAND DRAINS VIA DOWN SPOUTS FROM THE ROOF GUTTERS, AND SHEET FLOW FROM THE PARKING LOT AND ANIMAL EXERCISE YARD TO THE INFILTRATION TRENCH.

STORMWATER WILL FLOW THROUGH A 52' WIDE GRASS BUFFER BEFORE ENTERING THE INFILTRATION TRENCH PROVIDING WATER QUALITY AND QUANTITY. THE BMP HAS BEEN DESIGNED TO ENHANCE THE REMOVAL OF COLIFORM BACTERIA IN ACCORDANCE WITH POWHATAN CREEK STORMWATER MASTER PLAN. INFILTRATION TRENCH WILL NOT BE INSTALLED UNTIL A LEAST 90% OF THE SITE HAS BEEN STABILIZED AND THE 52' WIDE AREA BETWEEN THE PARKING AND THE INFRILTRATION TRENCH IS AT FINAL GRADE AND SODDED TO IMMEDIATELY STABILIZE THE AREA.

STORMWATER QUALITY BMP MAINTENANCE:
1. MAINTENANCE OF THE BMP SHALL BE THE RESPONSIBILITY OF THE PROPERTY OWNER. PROPER MAINTENANCE WILL ENSURE THAT THE BMP CONTINUES TO FUNCTION AS DESIGNED, TO IMPROVE WATER QUALITY. INSPECTION IS TO INCLUDE THE OBSERVATION WELLS, PEA GRAVEL, TOP LAYER OF FILTER FABRIC, SHEET FLOWS, ANY OUTLET CHANNELS ANDE STABILIZATION MATTING.

2. 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 GUAGED RAINFALL WITHIN 24 HOUR PERIOD. ONCE PER YEAR (MORE OR LESS) 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 OR STRUCTURE SHALL BE MAKE AVAILABLE TO THE COUNTY UPON REQUEST.

SCHEDULED BMP MAINTENANCE PRACTICES:
1. GENERAL:

A. CHECK OBSERVATION WELLS IMMEDIATELY AFTER A SIGNICICANT RAINFALL EVENT HAS CEASED OR ITS INTENSITY HAS SLOWED. IF THE TRENCH IS FULL OF STORMWATER RUNOFF, WATER SHOULD BE WITHIN THE FILTER ZONE STONE AREAS. IF THE OVERFLOW CHANNEL IS CONVEYING RUNOFF AND THE WATER LEVEL IN THE TRENCH IS RELATIVELY LOW, IT IS LIKELY THAT THE SURFACE LAYERS OF THE FILTERING STONE OR THE FILTER FABRIC ARE CLOGGED. IF THIS CONDITION IS PRESENT, THE TOP LAYERS OF THE FILTERING STONE AND FILTER FABRIC SHOULD BE REPLACED WITH CLEAN MATERIAL.

B. CHECK OBSERVATION WELLS 2 TO 3 DAYS FOLLOWING A SIGNICICANT RAINFALL EVENT. IF STORMWATER IS PRESENT IN THE BOTTOM OF THE WELLS, COMPLETE REPLACEMENT OF THE FILTERING STONE AND FILTER FABRIC IS NECESSRY. ALTHOUGHT THE LOCATION OF THE SEASONAL WATER TABLE SHOULD HAVE BEEN IDENTIFIED AS BELOW THE FACILITY DURING DESIGN, CARE SHOULD BE TAKEN TO ENSURE WATER PRESENT AT THE BOTTOM OF THE WELLS IS NOT DUE TO A HIGH GROUNDWATER TABLE RATHER THAN NON-OPERATON OF THE INFILTRATION SYSTEM. FOR EXAMPLE, IF THERE IS WATER IN THE OBSERVATION WELLS 48 HOURS FOLLOWING A RAINFALL EVENT IN THE SPRING APRIL-MAY, BUT NOT IN THE SUMMER JULY-AUGUST, THE SEASONAL HIGH WATER TABLE MAY BE HIGHER THAN ORIGINALLY ANTICIPATED.

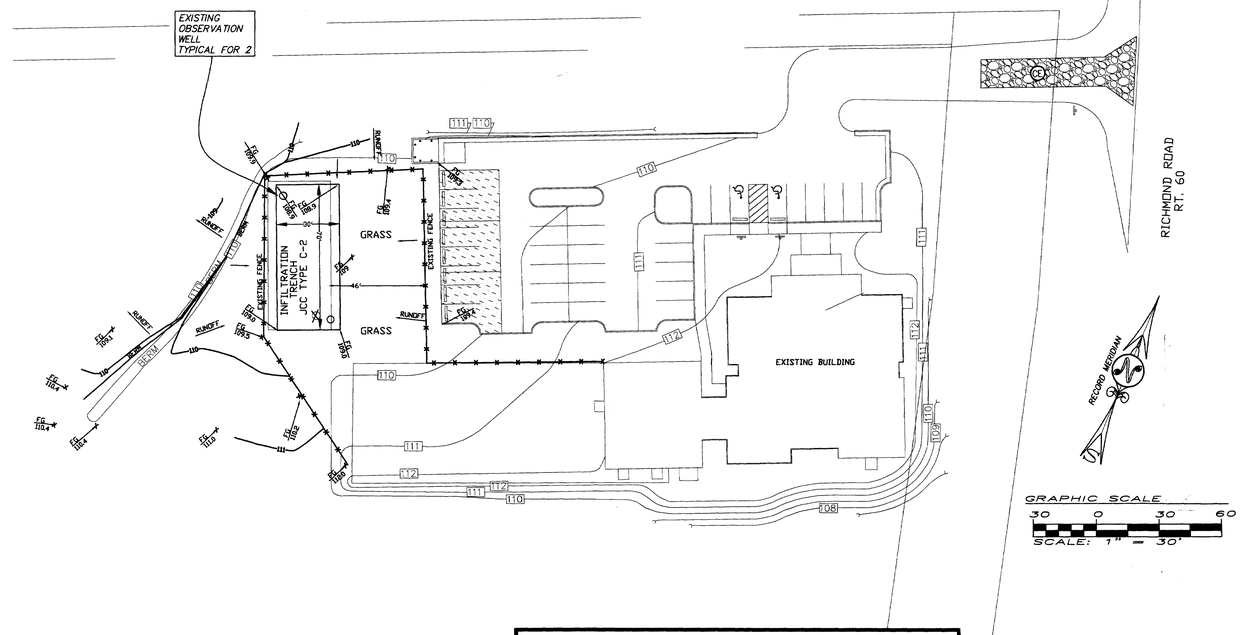
C. MANY FACTORS WILL AFFECT THE OPERATION OF AN INFILTRATION SYSTEM. ROUTINE INSPECTIONS AND MAINTENANCE SHOULD BE PERFORMED BY THE SAME ASSIGNED INDIVIDUAL IN ORDER TO ESTABLISH A BASELINE KNOWLEDGE OF HOW THE SYSTEM FUNCTIONS UNDER DIFFERENT SITE AND WEATHER CONDITIONS.

D. RECORD KEEPING: THE OWNER SHALL KEEP REASONABLE, ACCURATE WRITTEN RECORDS OF INSPECTIONS PERFORMED FOR THE STRUCTURE. RECORDS SHALL DOCUMENT ROUTINE MAINTENANCE AND/OR REPAIRS PERFORMED. COPIES SHALL BE PROVIDED TO THE COUNTY UPON REQUEST.

E. THE FACILITY SHALL NOT ACCEPT ADDITIONAL DRAINAGE OR BE MODIFIED IN ANY WAY WITHOUT PRIOR CONSENT OR APPROVED BY THE ENVIRONMENTAL DIVISION OF JAMES CITY COUNTY.

2. WEEKLY (DURING GROWING SEASON): INSPECT HEIGHT OF GRASS IN GRASS BUFFER TO MAINTAIN A HEIGHT OF 3-6 INCHES. MOW AS NEEDED, A MINIMUM OF TWICE A YEAR. INSPECT THE OUTFALL FOR BLOCKAGES AND REMOVE AS NECESSARY.
3. MONTHLY: REMOVE DEBRIS AND TRASH.
4. SPRING AND FALL: REPAIR BARE SPOTS IN VEGETATION AND REMOVE BRUSH, ROOTS AND ANIMAL BURROWS.

AS NEEDED BMP MAINTENANCE PRACTICIES
1. REGRADE ERODED AREAS AND STABILIZE.
2. ELIMINATE ANY STAGNANT WATER TO PREVENT MOSQUITO BREEDING HABITAT.
3. CONTROL OF WEEDS.



ANDERSON'S CORNER ANIMAL HOSPITAL
AND SURGICAL CENTER
JAMES CITY COUNTY, VIRGINIA

RECORD DRAWINGS
PREPARED BY
SEBERT SURVEYING &
LAYOUT, LLC
AND
BASED UPON DESIGN DRAWINGS
PREPARED BY
DJG, INC.
SEALED ON DATE MARCH 3, 2008

A07-1654

PERMIT DATED MARCH 3, 2008

I HEREBY CERTIFY THAT THE UTILITIES AND RELATIVE ELEVATIONS SHOWN HEREON REPRESENT A FIELD LOCATION SURVEY PERFORMED ON AUGUST 19, 2009. THE PROJECT APPEARS TO BE IN GENERAL CONFORMANCE WITH THE APPROVED SITEPLAN AND THE DRAINAGE STRUCTURES APPEAR TO BE FUNCTIONING PROPERTLY

A. D. SEBERT, L.S. — 3/25/10 DATE

COMMONWEALTH OF VIRGINIA
03/25/2010
A.D. SEBERT
LIC. NO. 2021
LAND SURVEYOR

RESUBMITTAL DATE: DECEMBER 31, 2010.
FIELD SURVEY OF INFILTRATION TRENCH AND ADDITIONS TO THIS DRAWING.

A. D. SEBERT, L.S. — 12/31/10 DATE

RECORD DRAWINGS
SHEET 1 OF 1

REVISIONS

1	INFILTRATION TRENCH	12/31/10

LEGEND:
N/F NOW OR FORMERLY
IRF IRON ROD FOUND
IPF IRON PIPE FOUND
CMC CONCRETE MONUMENT FOUND
WL WALL
BSL BUILDING SETBACK LINE
R/W RIGHT-OF-WAY
SMH SANITARY MANHOLE
CO SANITARY CLEANOUT
WV WATER VALVE
X 98.2 EXISTING SPOT ELEVATION
• 98.2 PROPOSED SPOT ELEVATION

Environmental Division
JAN 05 2011
RECEIVED

SEBERT SURVEYING & LAYOUT, LLC
173 BARLOW ROAD
WILLIAMSBURG, VA
PHONE (757) 345-0931
CELL: (757) 784-2413

RECORD DRAWINGS
ANDERSON'S CORNER ANIMAL HOSPITAL
JAMES CITY COUNTY VIRGINIA

DATE MARCH 25, 2010
SCALE 1"= 30'
PROJECT NO. J124-1
DRAWING NO.
1 OF 1

\dwg\J124-1SD.DWG 1/3/2011 2:17:58 PM EST

Source: Va. DSWC

INFILTRATION TRENCH MAINTENANCE

302
303

INSTALLATION OF PIPE BEDDING
CIRCULAR PIPE BEDDING AND BACKFILL - METHOD "A"
VIRGINIA DEPARTMENT OF TRANSPORTATION
REV. 7/05
107.01

STORMWATER MANAGEMENT NARRATIVE

PROJECT DESCRIPTION: THIS PROJECT IS THE CONSTRUCTION OF A 9,118 SF ANIMAL HOSPITAL BUILDING AND 34 SPACE PARKING LOT AND INSTALLATION OF A PRIVATE FORCE MAIN AND PRIVATE WATER LINE AT ANDERSON'S CORNER, JAMES CITY COUNTY, VIRGINIA.

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SEDIMENT TRAP: A TEMPORARY SEDIMENT TRAP TO BE UTILIZED TO CONTROL SEDIMENT DURING CONSTRUCTION SHALL BE PLACED BETWEEN THE PLANNED LOCATION OF THE INFILTRATION TRENCH AND THE LOWER END OF THE PLANNED PARKING LOT. DO NOT DISTURB ANY AREA WITHIN 5 FEET OF PLANNED INFILTRATION TRENCH.

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STORMWATER WILL FLOW THROUGH A 52' WIDE GRASS BUFFER BEFORE ENTERING THE INFILTRATION TRENCH PROVIDING WATER QUALITY AND QUANTITY. THE BMP HAS BEEN DESIGNED TO ENHANCE THE REMOVAL OF COLIFORM BACTERIA IN ACCORDANCE WITH THE POWHATAN CREEK STORMWATER MASTER PLAN. INFILTRATION TRENCH WILL NOT BE INSTALLED UNTIL AT LEAST 90% OF THE SITE HAS BEEN STABILIZED AND THE 52' WIDE AREA BETWEEN THE PARKING LOT AND THE INFILTRATION TRENCH IS AT FINAL GRADE AND SODDED TO IMMEDIATELY STABILIZE THE AREA.

STORMWATER QUALITY BMP MAINTENANCE:

1. MAINTENANCE OF BMP SHALL BE THE RESPONSIBILITY OF THE PROPERTY OWNER. PROPER MAINTENANCE WILL ENSURE THAT THE BMP CONTINUES TO FUNCTION AS DESIGNED, TO IMPROVE WATER QUALITY. INSPECTION IS TO INCLUDE THE OBSERVATION WELLS, PEA GRAVEL, TOP LAYER OF FILTER FABRIC, SHEET FLOWS, ANY OUTLET CHANNEL AND STABILIZATION MATTING.

2. 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 24 HOUR PERIOD. ONCE PER YEAR (MORE OR LESS) 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 OR STRUCTURE SHALL BE MADE AVAILABLE TO THE COUNTY UPON REQUEST.

SCHEDULED BMP MAINTENANCE PRACTICES:

1. GENERAL:
A. CHECK OBSERVATION WELLS IMMEDIATELY AFTER A SIGNIFICANT RAINFALL EVENT HAS CEASED OR ITS INTENSITY HAS SLOWED. IF THE TRENCH IS FULL OF STORMWATER RUNOFF, WATER SHOULD BE WITHIN THE FILTER ZONE STONE AREAS. IF THE OVERFLOW CHANNEL IS CONVEYING RUNOFF AND THE WATER LEVEL IN THE TRENCH IS RELATIVELY LOW, IT IS LIKELY THAT THE SURFACE LAYERS OF THE FILTERING STONE OR THE FILTER FABRIC ARE CLOGGED. IF THIS CONDITION IS PRESENT, THE TOP LAYERS OF THE FILTERING STONE AND FILTER FABRIC SHOULD BE REPLACED WITH CLEAN MATERIAL.

B. CHECK OBSERVATION WELLS 2 TO 3 DAYS FOLLOWING A SIGNIFICANT RAINFALL EVENT. IF STORMWATER IS PRESENT IN THE BOTTOM OF THE WELLS, COMPLETE REPLACEMENT OF THE FILTERING STONE AND FILTER FABRIC IS NECESSARY. ALTHOUGH THE LOCATION OF THE SEASONAL WATER TABLE SHOULD HAVE BEEN IDENTIFIED AS BELOW THE FACILITY DURING DESIGN, CARE SHOULD BE TAKEN TO ENSURE WATER PRESENT A THE BOTTOM OF THE WELLS IS NOT DUE TO A HIGH GROUNDWATER TABLE RATHER THAN NON–OPERATION OF THE INFILTRATION SYSTEM. FOR EXAMPLE, IF THERE IS WATER IN THE OBSERVATION WELLS 48 HOURS FOLLOWING A RAINFALL EVENT IN THE SPRING APRIL–MAY, BUT NOT IN THE SUMMER JULY–AUGUST, THE SEASONAL HIGH WATER TABLE MAY BE HIGHER THAN ORIGINALLY ANTICIPATED.

C. MANY FACTORS WILL AFFECT THE OPERATION OF AN INFILTRATION SYSTEM. ROUTINE INSPECTIONS AND MAINTENANCE SHOULD BE PERFORMED BY THE SAME ASSIGNED INDIVIDUAL IN ORDER TO ESTABLISH A BASELINE KNOWLEDGE OF HOW THE SYSTEM FUNCTIONS UNDER DIFFERENT SITE AND WEATHER CONDITIONS.

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

E. THE FACILITY SHALL NOT ACCEPT ADDITIONAL DRAINAGE OR BE MODIFIED IN ANY WAY WITHOUT PRIOR CONSENT OR APPROVED BY THE ENVIRONMENTAL DIVISION OF JAMES CITY COUNTY.

2. WEEKLY (DURING GROWING SEASON): INSPECT HEIGHT OF GRASS IN GRASS BUFFER TO MAINTAIN A HEIGHT OF 3–6 INCHES. MOW AS NEEDED, A MINIMUM OF TWICE A YEAR. INSPECT THE OUTFALL FOR BLOCKAGES AND REMOVE AS NECESSARY.
3. MONTHLY: REMOVE DEBRIS AND TRASH
4. SPRING AND FALL: REPAIR BARE SPOTS IN VEGETATION AND REMOVE BRUSH, ROOTS AND ANIMAL BURROWS.

AS NEEDED BMP MAINTENANCE PRACTICES
1. RE–GRADE ERODED AREAS AND STABILIZE
2. ELIMINATE ANY STAGNANT WATER TO PREVENT MOSQUITO BREEDING HABITAT
3. CONTROL OF WEEDS

EGATE

DC018_ANDERSONS_CORNER_ANIMAL_HOSPITAL - 041

COMMONWEALTH OF VIRGINIA
KENNETH MILLET STEWART
Lic. No. 032339
12/12/07
PROFESSIONAL ENGINEER

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REVISIONS

NO.	DATE	DESCRIPTION
1	7/13/07	REVISED PER PLANNING COMMENTS RECIEVED 3/30/07
2	10/17/07	REVISED PER PLANNING COMMENTS RECIEVED 8/13/07
3	12/12/07	REVISED PER PLANNING COMMENTS RECIEVED 11/21/07

S AND BORING LOGS

LLC

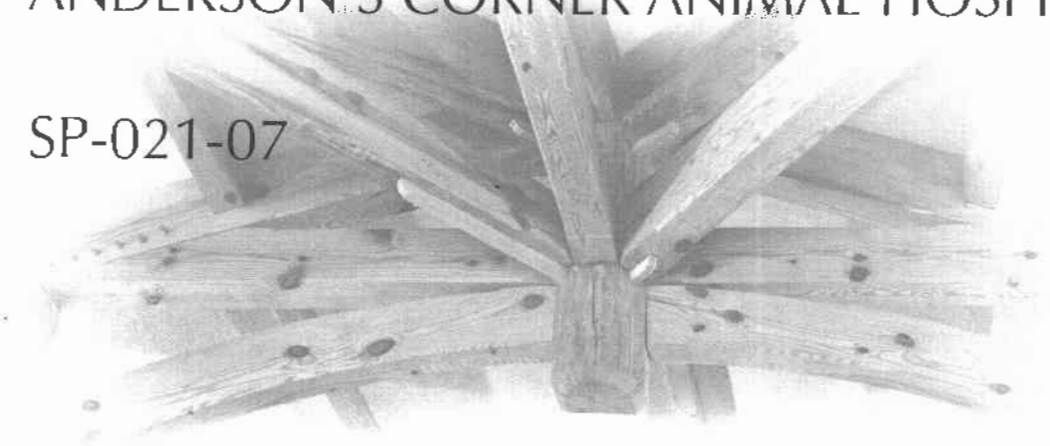
R ANIMAL HOSPITAL

UNTY, VIRGINIA

DRAINAGE CALCULATIONS

ANDERSON'S CORNER ANIMAL HOSPITAL

SP-021-07



COMMONWEALTH OF VIRGINIA
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WILLIAMSBURG, VIRGINIA 23185

SP-21-07

DJG COMMISSION: 2060810

DATE: JANUARY 10, 2008

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On Site Soils

Soils Map
Soil Characteristics

SURVEY OF JAMES CITY AND YORK COUNTIES AND THE CITY OF WILLIAMSBURG, VIRGINIA — SHEET NUMBER 5

DJG INC.
Committed to Excellence
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PROJECT Anderson's Corner Animal Hosp
DATE 2-14-07 COMM NO. 2060 810
CAL BEK CKD MJG PAGE # 3
TITLE Soils.

From James City County Soils Survey.

Building site is within soil type 31B

31B = Suffolk = 'B' Hydrologic Group

See attached for Properties of Soil Type

ie: Suffolk Soils are Deep, well drained Soils that are dominantly are Loamy and are gently sloping to Very steep; on upland ridges and side slopes.

minor soils include the moderately well drained Izagora soils on positions similar to those of the Slagle soils and small areas of well drained Caroline soils on high knolls. Areas of Urban land are along major highways and in the City of Williamsburg.

About 40 percent of the acreage has been cleared and is used for industry, housing developments, and farming. The wooded areas are military bases, private woodland, and cooperatively owned land.

In most farmed areas, the soils are used for small grains, corn, soybeans, and pasture. Wetness, soil acidity, and the hazard of erosion are the main limitations in these areas. Overgrazing and grazing when the soils are wet are major concerns of pasture management.

The soils in this unit are suited to trees, mostly oak, hickory, beech, sweetgum, and pine. Many reforested areas are in loblolly pines. Productivity is moderately high. Steep slopes and wetness restrict the use of logging equipment. Erosion on steep slopes is a hazard along logging roads and skid trails.

The soils in this map unit are poorly suited to sanitary facilities and to community development. Wetness, shrink-swell potential, slope, and low strength are the main limitations.

7. Emporia-Craven-Uchee

Deep, well drained and moderately well drained soils that dominantly are loamy or clayey and are gently sloping to very steep; on upland ridges and side slopes

In this unit the landscape consists mostly of gently sloping upland ridges and sloping to very steep side slopes. Drainageways emptying into the York River generally have steeper side slopes than those emptying into the James or Chickahominy Rivers. Also, the ridges leading toward the York River are generally more narrow than those leading toward the James or Chickahominy. In most places, the soils are highly dissected by small streams and the ridges have benches. On most ridges, the slope ranges from 2 to 10 percent, and on side slopes it ranges from 10 to 50 percent.

This map unit makes up about 27 percent of the land area. The unit is about 37 percent Emporia soils, 19 percent Craven soils, 13 percent Uchee soils, and 31 percent soils of minor extent.

The Emporia soils are well drained and are gently sloping on ridges and strongly sloping to very steep on side slopes. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown firm sandy clay loam in the lower part.

The Craven soils are moderately well drained soils that are on narrow to medium, gently sloping ridges and strongly sloping side slopes. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is yellowish brown clay in the upper part and mottled, yellowish brown sandy clay loam in the lower part.

The Uchee soils are well drained and are gently sloping and strongly sloping. Uchee soils are on narrow to medium ridges and side slopes. They have a surface layer of dark grayish brown loamy fine sand. The subsoil is strong brown sandy clay loam in the upper part and mottled, strong brown sandy clay loam and clay in the lower part.

Of minor extent in this map unit are the well drained Kempsville and Suffolk soils on gently sloping ridges, the very poorly drained Johnston soils along drainageways, and the well drained Kenansville and Caroline soils and moderately well drained Slagle soils that are scattered throughout the unit.

About 30 percent of the acreage has been cleared and is used for farming. The farmland is scattered throughout the unit. Also in this unit are urban areas, water reservoirs, and recreation facilities. Wooded areas include some military bases and parks in addition to privately owned land.

The farmland consists of gently sloping soils that are used mostly for soybeans, corn, and small grains. A few areas of hay and pasture are in this unit. Soil acidity, low fertility, and the hazard of erosion are the main limitations to farming. Overgrazing and grazing when the soils are wet are major concerns of pasture management.

The soils in this unit are suited to trees. The native climax forest is a mixture of hardwoods—oak, hickory, and beech; however, several large areas have been reforested with pines. Productivity is moderately high. Steep slopes restrict the use of logging equipment and cause erosion to be a hazard along logging roads and skid trails.

The soils in this unit are moderately well suited to sanitary facilities and community development. Slopes, shrink-swell potential, and the seasonal high water table are the main limitations.

8. Kempsville-Emporia-Suffolk

Deep, well drained soils that dominantly are loamy and are gently sloping to very steep; on upland ridges and side slopes

The landscape in this map unit consists mostly of broad, gently sloping upland ridges and sloping to very steep side slopes. This map unit is on the drainage divide between the York and James Rivers. The headwaters of creeks and streams that lead to the York River and to the James and Chickahominy Rivers are in this unit. The slope on most ridges ranges from 2 to 10 percent, and on side slopes it ranges from 10 to 50 percent.

This map unit makes up about 10 percent of the land area. The unit is about 30 percent Kempsville soils, 28

percent Emporia soils, 18 percent Suffolk soils, and 24 percent soils of minor extent (fig. 5).

The Kempsville soils are well drained and gently sloping soils on medium to broad ridges. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is mostly yellowish brown and strong brown fine sandy loam and sandy clay loam in the upper part and mottled fine sandy loam and sandy clay loam in the lower part.

The Emporia soils are well drained. They are on medium to narrow, gently sloping and strongly sloping ridges and moderately steep to very steep side slopes. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part.

The Suffolk soils are well drained and are on broad, gently sloping ridges. They have a surface layer of very dark grayish brown fine sandy loam. The subsoil is mostly strong brown fine sandy loam and sandy clay loam.

Of minor extent in this map unit are the well drained Kenansville, Norfolk, and Caroline soils on ridges, the moderately well drained Slagle soils in slight depressions, the moderately well drained Craven and well drained Uchee soils on side slopes, and the very poorly drained Johnston soils along drainageways.

About 50 percent of the acreage is used for farming. The farmland is scattered throughout the unit. Also, some areas are used for industry and community development. The wooded areas consist of mixed hardwoods and pine.

The farmed areas are used mostly for soybeans, corn, and small grains. Some areas are used for pasture and hay. Soil acidity, low fertility, and the hazard of erosion are the main limitations to farming. Overgrazing and grazing when the soils are wet are the major concerns of pasture management.

The soils in this unit are suited to trees. The native climax forest is mixed hardwoods; however, some areas have been reforested with loblolly pine. Productivity is moderately high. Steep slopes restrict the use of logging equipment and cause erosion to be a hazard along logging roads and skid trails.

The soils in this unit are moderately well suited to sanitary facilities and community development. Slope, the seasonal high perched water table, and restricted permeability are the main limitations.

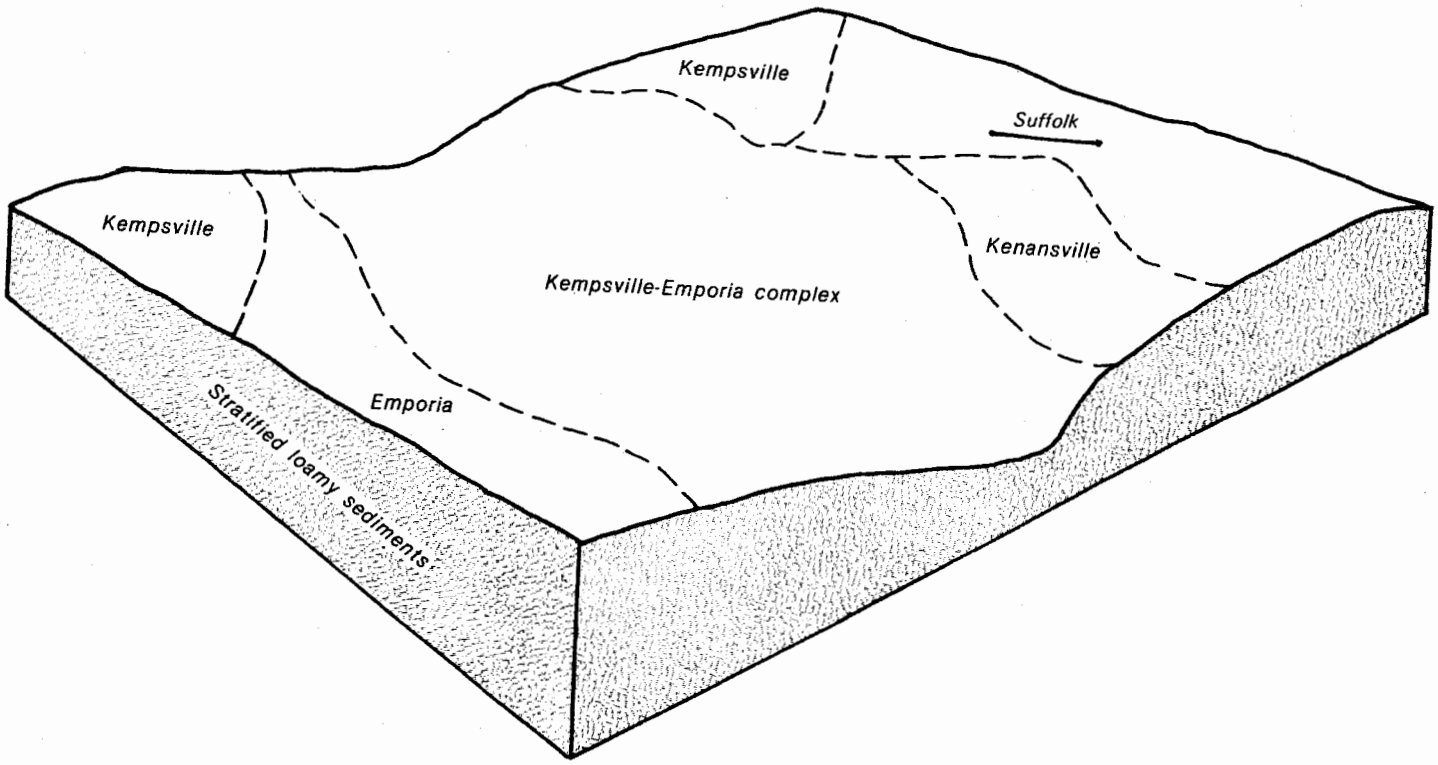

Figure 5.—Pattern of soils and underlying material in the Kempsville-Emporia-Suffolk map unit.

ot zone extends to a depth of 60 inches or more. The il is low in organic matter content and natural fertility. It ranges from extremely acid through strongly acid, but reaction in the surface layer varies because of local ming practices. A high perched water table is at a depth 1 1/2 to 3 feet in winter and spring.

In most areas this soil is in woodland. In a few areas it is cultivated, and in a few it is in pasture.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer, but the soil is wet and cold in spring, and wetness often interferes with tillage. Drainage helps to protect crops from damage caused by wetness. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce surface crusting, increase water infiltration, and reduce erosion.

This soil is well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is too wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, oak, and sweetgum. Seeds and seedlings grow well if competing vegetation is controlled. When the soil is wet, it is soft, thus limiting the use of heavy timber equipment.

The seasonal high water table and the low strength and slow permeability of the subsoil are the main limitations of the soil for community development. The high water table and slow permeability of the subsoil limit the use of the soil as a building site or site for sanitary landfills or septic tank absorption fields and for most types of recreation. The low strength limits its use as a subgrade material for roads and streets.

This soil is in capability subclass IIe.

30—State fine sandy loam. This soil is deep, nearly level, and well drained. It is on low-lying terraces. Areas range from about 3 to 25 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer of this soil is very dark grayish brown fine sandy loam about 5 inches thick. The subsoil is mostly dark yellowish brown fine sandy loam and dark brown loam, clay loam, and sandy clay loam 47 inches thick. The substratum is dark brown fine sandy loam to a depth of at least 97 inches.

Included with this soil in mapping are small areas of well drained Pamunkey soils, moderately well drained Altavista, Dogue, and Tetotum soils, and somewhat poorly drained Augusta soils. The Pamunkey soils are in slightly higher areas, the Altavista, Dogue, and Tetotum soils are in similar areas, and the Augusta soils are in slightly lower areas and in slight depressions throughout the unit. Included soils make up about 15 percent of the unit.

The permeability of this State soil is moderate, and available water capacity is moderate. Surface runoff is medium. The erosion hazard is slight. The surface layer is friable and easily tilled throughout a wide range of moisture conditions. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly is very strongly acid or strongly acid in the surface layer and subsoil, but reaction in the surface layer varies because of local liming practices. The substratum ranges from very strongly acid through medium acid. A high water table is at a depth of 4 to 6 feet in winter and spring.

In most areas this soil is farmed, but in some areas it is in woodland.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing causes compaction of the surface layer and reduces the stands of grasses and legumes.

The productivity for trees on this soil is very high, especially for loblolly pine, yellow-poplar, sweetgum, and oak. Seeds and seedlings grow well if competing vegetation is controlled.

Moderate permeability and the seasonal high water table are the main limitations if the soil is used for community development. The moderate permeability may cause effluent to seep into the ground water and nearby streams if this soil is used for septic tank absorption fields or sanitary landfills.

This soil is in capability class I.

31B—Suffolk fine sandy loam, 2 to 6 percent slopes. This soil is deep, gently sloping, and well drained. It is in long, narrow areas on broad uplands and on side slopes next to drainageways. Areas range from about 3 to 50 acres.

Typically, the surface layer of this soil is very dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is yellowish brown fine sandy loam 10 inches thick. The subsoil is strong brown fine sandy loam and sandy clay loam 26 inches thick. The substratum is brown loamy fine sand to a depth of at least 64 inches.

Included with this soil in mapping are small areas of well drained Emporia, Kempsville, and Kenansville soils and moderately well drained Slagle soils. The Kempsville and Kenansville soils are throughout the unit. The

Emporia and Slagle soils are in slightly lower areas or in depressions. Included soils make up about 20 percent of the unit.

The permeability of this Suffolk soil is moderate, and available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate. The surface layer is friable and easily tilled throughout a wide range of moisture conditions. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly ranges from extremely acid through strongly acid in the surface layer and upper part of the subsoil, but reaction in the surface layer varies because of local liming practices. The lower part of the subsoil and the substratum range from extremely acid through medium acid.

In most areas this soil is farmed, but in some it is in woodland.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content, reduce crusting, increase water infiltration, and control erosion.

This soil is well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing causes compaction of the surface layer and reduces the stands of grasses and legumes.

The productivity for trees on this soil is moderately high, especially for loblolly pine, Virginia pine, yellow-poplar, sweetgum, and oak. Seeds and seedlings grow well if competing vegetation is controlled.

The rapidly permeable substratum is the main limitation for community development. Because of the permeability, effluent can seep into ground water and nearby streams if the soil is used for septic tank absorption fields, sewage lagoons, or sanitary landfills.

This soil is in capability subclass IIe.

32—Tetotum silt loam. This soil is deep, nearly level, and moderately well drained. It is on low-lying terraces. Areas of this soil are commonly elongated, irregularly oval, or irregularly rectangular. They range from about 2 to 15 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark brown loam 5 inches thick. The subsoil is mostly yellowish brown silt loam, silty clay loam, clay loam, and loam 41 inches thick. It has gray mottles at a depth of more than 27 inches. The substratum is mottled yellowish brown, gray, and strong brown fine sandy loam to a depth of at least 65 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Augusta and Newflat soils, poorly drained Chickahominy soils, and well drained State and Pamunkey soils. The Augusta, Chickahominy, and Newflat soils are in slight depressions, and the State and Pamunkey soils are in slightly higher areas throughout the unit. Included soils make up about 15 percent of the unit.

The permeability of this Tetotum soil is moderate, and available water capacity is high. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled throughout a wide range of moisture conditions. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It ranges from extremely acid through strongly acid, but reaction in the surface layer varies because of local liming practices. A high water table is at a depth of 1 1/2 to 2 1/2 feet in winter and early in spring.

In most areas this soil is farmed. In some areas it is in woodland, and in a few it is in pasture.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. The soil is wet and cold early in spring. Drainage helps to alleviate spring wetness and protects crops from damage. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, yellow-poplar, sweetgum, and oak. Seeds and seedlings grow well. The soil is soft when wet, thus limiting the use of heavy timber equipment.

The seasonal high water table and the low strength of the soil are the main limitations for community development. The high water table limits use of the soil as a building site or a site for sanitary landfills or for septic tank absorption fields. The soil needs a suitable base material to provide enough strength and stability to support vehicular traffic.

This soil is in capability subclass IIw.

33—Tomotley fine sandy loam. This soil is deep, nearly level, and poorly drained. It is on broad low-lying flats. Areas of this soil commonly are irregularly oval or rectangular. They range from about 3 to 100 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is very dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is grayish brown fine sandy loam 4 inches thick. The subsoil is mostly grayish brown fine

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to a cemented pan, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to a cemented pan, a high water table, flooding, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 10 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if

soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to a cemented pan, and flooding affect absorption of the effluent. A cemented pan interferes with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to a cemented pan, flooding, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and cemented pans can cause construction problems.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, highly organic layers, soil reaction, and content of salts affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over a cemented pan or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil

properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by a high water table and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in

construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones, organic matter, or salts. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. The content of large stones affects the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to a cemented pan or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 14, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

Some soils in table 15 are assigned to two hydrologic soil groups. Dual grouping is used for soils that have a seasonal high water table but can be drained. The first letter applies to the drained condition of the soil and the second letter to the undrained condition.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is based on many soil borings and on observations during soil mapping.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

15

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam; moderate medium granular structure; friable, slightly sticky, slightly plastic; many coarse medium and fine roots; few tubular pores; few fine flakes of mica; strongly acid; clear smooth boundary.

B1—5 to 11 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine subangular blocky structure and moderate medium granular structure; friable, slightly sticky, slightly plastic; many fine medium and coarse roots; few tubular pores; few quartz pebbles; few krotovinas filled with A1 material; few fine flakes of mica; strongly acid; clear smooth boundary.

B21t—11 to 19 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable, sticky, plastic; common fine and medium roots; few tubular pores; thin continuous clay films on faces of peds; few quartz pebbles; few krotovinas filled with A1 material; few fine flakes of mica; strongly acid; clear smooth boundary.

B22t—19 to 33 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; friable, sticky, plastic; common fine and medium roots; few tubular pores; thin continuous clay films on faces of peds; few quartz pebbles; few krotovinas; common fine flakes of mica; strongly acid; clear smooth boundary.

B23t—33 to 43 inches; dark brown (7.5YR 4/4) sandy clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium and coarse subangular blocky structure; friable, sticky, plastic; common fine and medium roots; few tubular pores; thin discontinuous clay films on faces of peds; few quartz pebbles; common fine flakes of mica; strongly acid; clear smooth boundary.

B3t—43 to 52 inches; dark brown (7.5YR 4/4) sandy clay loam; few fine faint light yellowish brown (10YR 6/4) mottles; weak coarse subangular blocky structure; friable, slightly sticky, slightly plastic; few fine and medium roots; few tubular pores; thin patchy clay films on faces of peds; few quartz pebbles; common fine flakes of mica; strongly acid; gradual smooth boundary.

C—52 to 97 inches; dark brown (7.5YR 4/4) fine sandy loam; few medium faint light yellowish brown (10YR 6/4) mottles; massive; slightly compact in place; very friable, slightly sticky, nonplastic; few quartz pebbles; common fine flakes of mica; strongly acid.

The solum thickness ranges from 40 to 60 inches. The soil is very strongly acid or strongly acid in the A and B horizons unless limed. The C horizon ranges from very strongly acid through medium acid. Pebbles make up 0 to 2 percent of the soil. Flakes of mica are throughout the soil.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 2 through 4. Some pedons have an A2 horizon that has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 3 through 6. The A horizon is fine sandy loam or loam.

The B1 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 through 6. It is fine sandy loam or loam.

The upper part of the B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 through 6. In the lower part of the B2t horizon and in the B3 horizon, hue is 7.5YR through 2.5Y, value is 4 or 5, and chroma is 4 through 6. The B2t horizon is sandy clay loam, clay loam, loam, sandy loam, or silt loam.

The B3 horizon is sandy loam, fine sandy loam, loam, or sandy clay loam.

The C horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 4 through 6; or it is mottled. The C horizon ranges from sand to fine sandy loam. It commonly is stratified.

Suffolk Series

Soils of the Suffolk series are deep and well drained. They formed in loamy fluvial and marine sediments. Suffolk soils are on uplands on the Coastal Plain. Slopes range from 2 to 6 percent.

Suffolk soils commonly are near Emporia, Kempsville, Kenansville, and Uchee soils. Suffolk soils do not have a perched water table, which is characteristic of Emporia soils. They have a thinner subsoil than that of Kempsville soils. They do not have a thick sandy surface layer characteristic of Kenansville or Uchee soils.

Typical pedon of Suffolk fine sandy loam, 2 to 6 percent slopes, approximately 900 feet west of VA-612 at Chisel Run Swamp, and 200 feet southwest of the road leading into Middle Plantation subdivision, James City County:

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak fine granular structure; very friable; many medium and fine roots; many fine and medium pores; extremely acid; clear smooth boundary.

A2—4 to 14 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium granular structure; very friable; common fine and medium and few coarse roots; many fine and medium pores; strongly acid; clear smooth boundary.

B1t—14 to 19 inches; strong brown (7.5YR 5/6) fine sandy loam; common fine faint light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure and moderate medium granular structure; friable; common fine and medium roots; common fine and medium pores; few sand grains bridged with clay; strongly acid; clear smooth boundary.

B2t—19 to 32 inches; strong brown (7.5YR 5/6) sandy clay loam; moderate medium subangular blocky structure; friable; common fine and medium roots; common fine and medium pores; thin patchy clay films on faces of peds; strongly acid; clear smooth boundary.

B3t—32 to 40 inches; strong brown (7.5YR 5/6) fine sandy loam; weak fine subangular blocky structure and weak fine granular structure; friable; few fine roots; common fine and medium pores; few sand grains bridged with clay; medium acid; clear smooth boundary.

C1—40 to 50 inches; yellowish brown (10YR 5/8) loamy fine sand; few fine faint pale brown (10YR 6/3) mottles; massive; very friable; few fine and medium roots; many fine and medium pores; few concretions; medium acid; abrupt wavy boundary.

C2—50 to 64 inches; strong brown (7.5YR 5/6) loamy fine sand; massive; friable; few medium roots; many fine and few medium pores; few very fine dark mineral grains; strongly acid.

The solum thickness ranges from 30 to 50 inches. The soil ranges from extremely acid through strongly acid in the A horizon and upper part of the B horizon unless limed, and it ranges from extremely acid through medium acid in the lower part of the B horizon and in the C horizon. Quartz pebbles and ferricrete fragments make up 0 to 2 percent of the soil.

The Ap or A1 horizon has hue of 10YR, value of 3 through 6, and chroma of 2 through 4. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 through 6. The A horizon is loamy sand or fine sandy loam.

The B1 horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 through 6. It is sandy loam or fine sandy loam.

The B2t and B3 horizons have hue of 7.5YR or 10YR, value of 4 through 6, and chroma of 4 through 8. The B2t horizon is sandy loam, fine sandy loam, or sandy clay loam. The B3 horizon is loamy sand, sandy loam, or fine sandy loam.

The C horizon has hue of 7.5YR through 2.5Y, value of 5 through 7, and chroma of 2 through 8. In some pedons, mottles in the lower part of the C horizon have high and low chroma. The C horizon is sand, fine sand, loamy sand, or loamy fine sand.

Tetotum Series

Soils of the Tetotum series are deep and moderately well drained. They formed in loamy fluvial sediments. Tetotum soils are on stream terraces on the Coastal Plain. Slopes range from 0 to 2 percent.

Tetotum soils commonly are near Chickahominy, Newflat, Pamunkey, and State soils. Tetotum soils have less clay and are not as poorly drained as Chickahominy or Newflat soils. They are not as well drained as State or Pamunkey soils.

Typical pedon of Tetotum silt loam, approximately 1.7 miles east of Jamestown Island parking lot on Loop Road and 500 feet north of Loop Road, James City County:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable, slightly sticky, slightly plastic; many fine medium and coarse roots; common fine tubular pores; few fine flakes of mica; very strongly acid; clear smooth boundary.

A2—5 to 10 inches; dark brown (10YR 4/3) loam; moderate medium granular structure and weak fine subangular blocky structure; friable, sticky, plastic; common fine and medium and few coarse roots; common fine tubular pores; few fine flakes of mica; very strongly acid; clear smooth boundary.

B1t—10 to 14 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable, sticky, plastic; common fine and medium roots; common fine tubular pores; thin patchy clay films and silt coatings on faces of peds; common fine flakes of mica; common fine prominent dark brown (10YR 3/3) mineral stains; very strongly acid; clear smooth boundary.

B21t—14 to 27 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable, sticky, plastic; common fine and medium roots; common fine tubular pores; thin continuous clay films and silt coatings on faces of peds; common fine flakes of mica; common fine prominent dark brown (10YR 3/3) mineral stains; strongly acid; gradual smooth boundary.

B22t—27 to 35 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; moderate medium and fine subangular blocky structure; friable, sticky, plastic; few fine roots; common fine tubular pores; thin discontinuous clay films and silt coatings on faces of peds; common fine flakes of mica; common fine prominent dark brown (10YR 3/3) mineral stains; very strongly acid; gradual smooth boundary.

B23t—35 to 46 inches; mottled yellowish brown (10YR 5/6), strong brown (7.5YR 5/8), and light brownish gray (10YR 6/2) clay loam; moderate medium and coarse subangular blocky structure; firm, sticky, plastic; few fine roots; few fine tubular pores; thin discontinuous clay films on faces of peds; common fine flakes of mica; common fine prominent dark brown (10YR 3/3) mineral stains; very strongly acid; gradual smooth boundary.

B3t—46 to 51 inches; mottled yellowish brown (10YR

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
25B---------- Norfolk	Moderate: wetness.	Slight---------	Moderate: wetness.	Moderate: slope.	Slight---------	Slight.
26B*---------- Pamunkey	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength.	Slight.
27---------- Peawick	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
28---------- Seabrook	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: droughty.
29A---------- Slagle	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
29B---------- Slagle	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Moderate: wetness.
30---------- State	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: low strength.	Slight.
31B---------- Suffolk	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
32---------- Tetotum	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: low strength, wetness.	Moderate: wetness.
33---------- Tomotley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
34B---------- Uchee	Severe: cutbanks cave.	Slight---------	Moderate: wetness, shrink-swell.	Moderate: slope.	Slight---------	Moderate: droughty.
34C---------- Uchee	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, shrink-swell, slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
35. Udorthents						
36*: Udorthents.						
Dumps.						
37*. Urban land						
38---------- Yemassee	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

18

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
25B---------- Norfolk	Moderate: wetness.	Moderate: seepage.	Slight----------	Slight----------	Good.
26B*---------- Pamunkey	Slight----------	Severe: seepage.	Severe: seepage.	Slight----------	Good.
27---------- Peawick	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
28---------- Seabrook	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
29A, 29B---------- Slagle	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: wetness.
30---------- State	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness.	Moderate: wetness.	Fair: thin layer.
31B---------- Suffolk	Slight----------	Severe: seepage.	Severe: seepage.	Slight----------	Fair: thin layer.
32---------- Tetotum	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey.
33---------- Tomotley	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
34B---------- Uchee	Severe: wetness, percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
34C---------- Uchee	Severe: wetness, percs slowly.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.
35. Udorthents					
36*: Udorthents.					
Dumps.					
37*. Urban land					
38---------- Yemassee	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
29B Slagle	Moderate: seepage, slope.	Moderate: wetness.	Severe: no water.	Deep to water	Wetness, percs slowly.	Percs slowly.
30 State	Moderate: seepage.	Moderate: thin layer, piping.	Severe: cutbanks cave.	Deep to water	Soil blowing	Favorable.
31B Suffolk	Moderate: seepage, slope.	Severe: piping, thin layer.	Severe: no water.	Deep to water	Soil blowing	Favorable.
32 Tetotum	Moderate: seepage.	Severe: wetness.	Severe: cutbanks cave.	Favorable	Wetness	Favorable.
33 Tomotley	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Favorable	Wetness, soil blowing.	Wetness.
34B Uchee	Moderate: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy	Droughty.
34C Uchee	Moderate: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, too sandy.	Slope, droughty.
35. Udorthents						
36*: Udorthents.						
Dumps.						
37*. Urban land						
38 Yemassee	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Favorable	Wetness, soil blowing.	Wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
31B---------- Suffolk	0-14	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	95-100	90-100	50-80	25-60	<20	NP-7
	14-40	Sandy clay loam, clay loam, sandy loam.	SC, CL	A-2, A-6	0	95-100	90-100	50-95	25-75	20-40	10-25
	40-64	Loamy fine sand, fine sandy loam, sand.	SP, SM, SM-SC	A-1, A-2, A-3, A-4	0	75-100	60-100	30-80	3-50	<18	NP-7
32---------- Tetotum	0-10	Silt loam--------	SM, SC, ML, CL	A-4, A-6	0	85-100	80-100	65-95	45-85	<30	NP-15
	10-51	Sandy clay loam, clay loam, silty clay loam.	SC, CL	A-6, A-7	0-2	85-100	80-100	60-95	35-85	30-45	10-20
	51-65	Stratified sandy clay loam to loamy fine sand.	SM, SC, ML, CL	A-2, A-4, A-6	0-2	80-100	75-100	50-95	15-75	<30	NP-15
33---------- Tomotley	0-8	Fine sandy loam	SM	A-2, A-4	0	98-100	95-100	75-98	25-50	<30	NP-7
	8-50	Fine sandy loam, sandy clay loam, clay loam.	SM-SC, SC, CL-ML, CL	A-2, A-4, A-6	0	98-100	95-100	75-98	30-70	20-40	6-18
	50-68	Stratified loamy sand to fine sandy loam.	SM, SM-SC	A-2, A-3, A-4	0	85-100	75-100	40-90	15-50	<25	NP-7
34B, 34C--------- Uchee	0-24	Loamy fine sand	SM	A-2, A-1-B	0	90-100	80-100	40-70	15-30	---	NP
	24-36	Sandy loam, sandy clay loam.	SC, SM-SC	A-2, A-4, A-6	0	90-100	80-100	50-80	25-50	20-40	6-20
	36-56	Sandy clay loam, sandy clay, clay.	MH, CH, CL, SC	A-7	0	90-100	80-100	65-90	40-70	41-70	18-38
	56-65	Sandy loam, sandy clay loam, sandy clay.	MH, CH, CL, SC	A-6, A-7, A-2-6, A-2-7	0	85-100	80-100	50-80	30-65	35-65	15-35
35. Udorthents											
36*: Udorthents.											
Dumps.											
37*. Urban land											
38---------- Yemassee	0-11	Fine sandy loam	SM	A-2, A-4	0	100	100	75-100	25-50	<30	NP-7
	11-51	Sandy clay loam, clay loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-2, A-4, A-6	0	100	100	75-100	30-70	16-38	4-18
	51-63	Sandy clay loam, fine sandy loam, sandy clay.	SC, SM, CL-ML, SM-SC	A-2, A-4, A-6	0	100	100	75-100	25-55	<35	NP-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth*	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
22---------- Munden	B	None---------	---	---	1.5-2.5	Apparent	Dec-Apr	>60	---	Low------	High.
23---------- Newflat	D	None---------	---	---	0.5-1.5	Apparent	Nov-Apr	>60	---	High-----	High.
24---------- Nimmo	D	None---------	---	---	0-0.5	Apparent	Dec-Apr	>60	---	Low------	High.
25B---------- Norfolk	B	None---------	---	---	4.0-6.0	Perched	Jan-Mar	>60	---	Moderate	High.
26B**---------- Pamunkey	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
27---------- Peawick	D	None---------	---	---	1.5-3.0	Perched	Nov-Mar	>60	---	High-----	High.
28---------- Seabrook	C	None---------	---	---	2.0-4.0	Apparent	Dec-Mar	>60	---	Low------	Moderate.
29A, 29B---------- Slagle	C	None---------	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	Moderate	High.
30---------- State	B	None---------	---	---	4.0-6.0	Apparent	Dec-Jun	>60	---	Moderate	High.
31B---------- Norfolk	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High.
32---------- Tetotum	C	None---------	---	---	1.5-2.5	Apparent	Dec-Apr	>60	---	High-----	High.
33---------- Tomotley	B/D	None---------	---	---	0-1.0	Apparent	Dec-Mar	>60	---	High-----	High.
34B, 34C---------- Uchee	A	None---------	---	---	3.5-5.0	Perched	Jan-Apr	>60	---	Low------	High.
35**. Udorthents											
36**. Udorthents.											
Dumps.											
37**. Urban land											
38---------- Wemassee	C	None---------	---	---	1.0-1.5	Apparent	Dec-Mar	>60	---	High-----	High.

* A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

** See description of the map unit for composition and behavior characteristics of the map unit.

Driveway Culvert Calculations

VDOT Right of Way Culvert

DJG INC.
Committed to Excellence
449 McLaws Circle • P. O. Box 3505, Williamsburg, VA 23187
(757) 253-0673 • Fax (757) 253-2319 • E-Mail: williamsburg@djginc.com
Norfolk - Virginia Beach Area (757) 874-5015

PROJECT Anderson's Corner Animal Hospital
DATE 10-11-07 COMM NO. 2060810
CAL BEK CKD MJG PAGE # 23
TITLE Drive Culvert

1 POINT OF CHECK: Drive Pipe

2 LIMITS & DESCRIPTION OF DRAINAGE AREA:
Overland & Pavement

3 AREA X COEF. OF RUNOFF "C" = AC

0.69 Ac	@	0.30	= 0.207	Weighted C = 0.36
0.08 Ac	@	0.9	= 0.072	
0.77			0.279	

4 TIME OF CONCENTRATION (t_c) AND INTENSITY (i): *
OVERLAND:
LENGTH: ____; "C" ____; SLOPE: ____; t_o = ____ MINUTES (FIG 6D-1)
GUTTER
HEIGHT: ____; LENGTH: ____; t_g: ____ MINUTES (FIG 6D-5)

~~FIG~~ $\frac{B}{(t_c+D)^E}$ FIND i_{10} = 7.5 INCHES PER HOUR. t_c = 5 MINUTES. minimum

* SPREAD ON PAVEMENT BASED ON RAINFALL INTENSITY ____ in/h

5 $Q = C i A$: $Q = (AC)i$ = (0.279)(7.5) = 2.09 cfs.
BYPASS = — cfs.
TOTAL = 2.09 cfs

6 INLET TYPE:

7 SPREAD & DEPTH
LONGITUDINAL SLOPE (GUTTER) IN ft/ft (S) ____
PAV'T CROSS SLOPE IN ft/ft (S_x) ____
CROSS SLOPE OF GUTTER IN ft/ft (S_w) ____
WIDTH OF GUTTER (W) ____
FROM CHART ____ SPREAD = ____; DEPTH = ____

8 COMMENTS: B 55.61
D 10.00
E 0.74

$i_{10} = \frac{B}{(t_c+D)^E} = \frac{55.61}{(5+10)^{0.74}} = 7.5$

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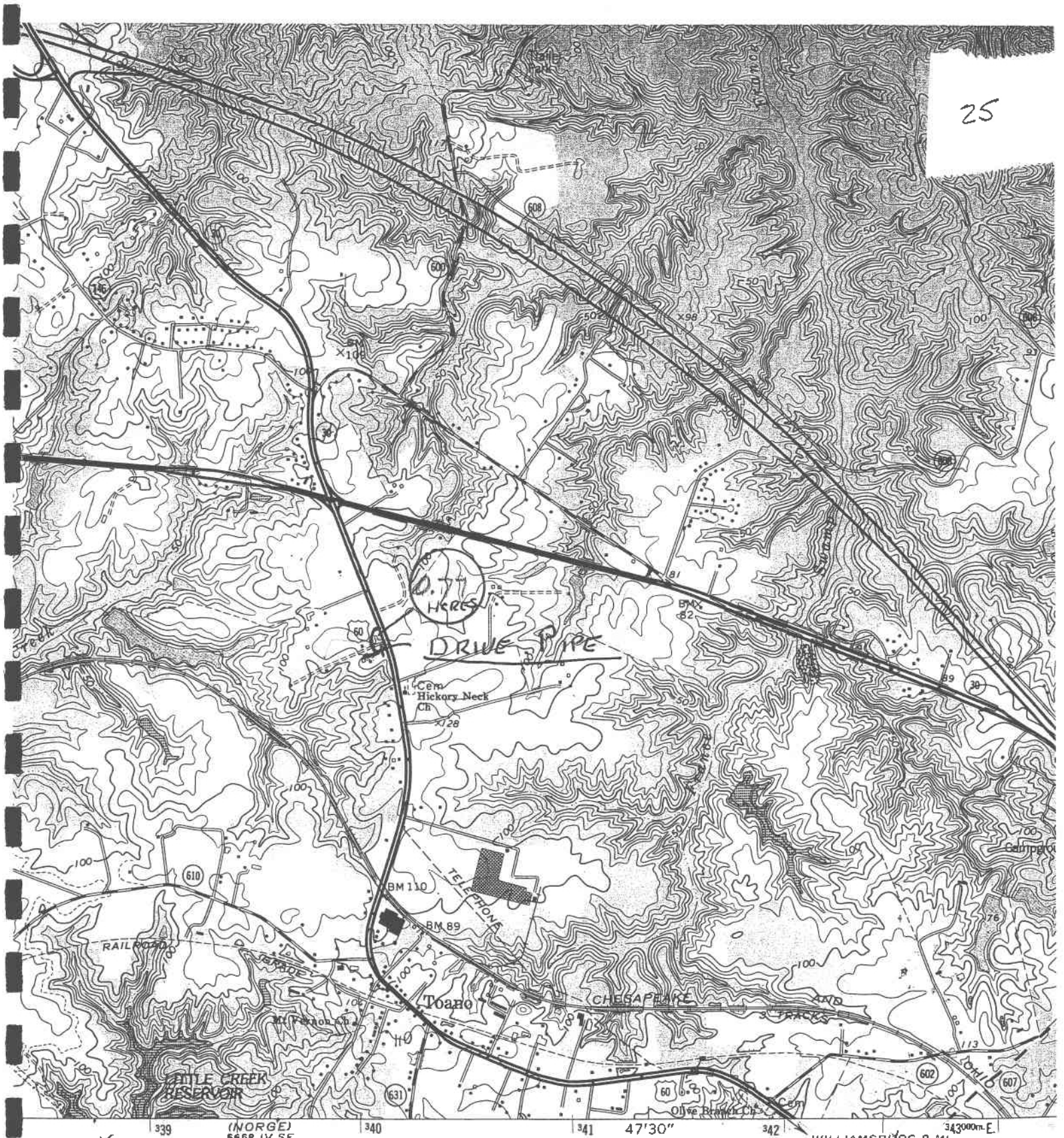
PROJECT ANDERSON'S Corner Animal Hospita
DATE 7-5-07 COMM NO. 2060810
CAL BEK. CKD MJG PAGE # 24
TITLE DRIVE Culvert

① AREA:
100' x 300' = 0.69 Acres Field
300 * 12 = 0.08 Acres. Pavt

② 'C' = Flat Grass & Field = 0.3
Pavement = 0.9

③ TIME = 5 MINUTES.



(NORGE)
5658 IV SE
SCALE 1:24 000

1 MILE

0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 2.8 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092

ANDERSON'S CORNER
ANIMAL HOSPITAL
DRIVE PIPE

VIRGINIA

QUADRANGLE LOCATION

Revisions shown in purple compiled in cooperation with Commonw
of Virginia agencies from aerial photographs taken 1982 and other

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Committed to Excellence

PROJECT Anderson's Corner Animal Hospital
DATE 10-11-07 COMM NO. 2060810
CAL BEK CKD MJG PAGE # 26
TITLE DRIVE CULVERT

HYDROLOGIC AND CHANNEL INFORMATION:

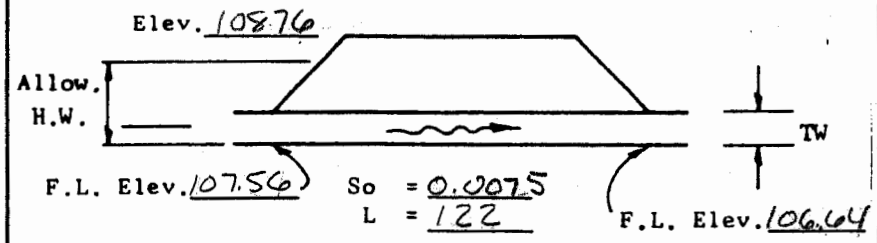
Skew: 0

Drainage Area: 0.77

Q_1 = 2.09 cfs
Q_2 =
TW_1 =
TW_2 =

SKETCH:

Station:
Headwalls:



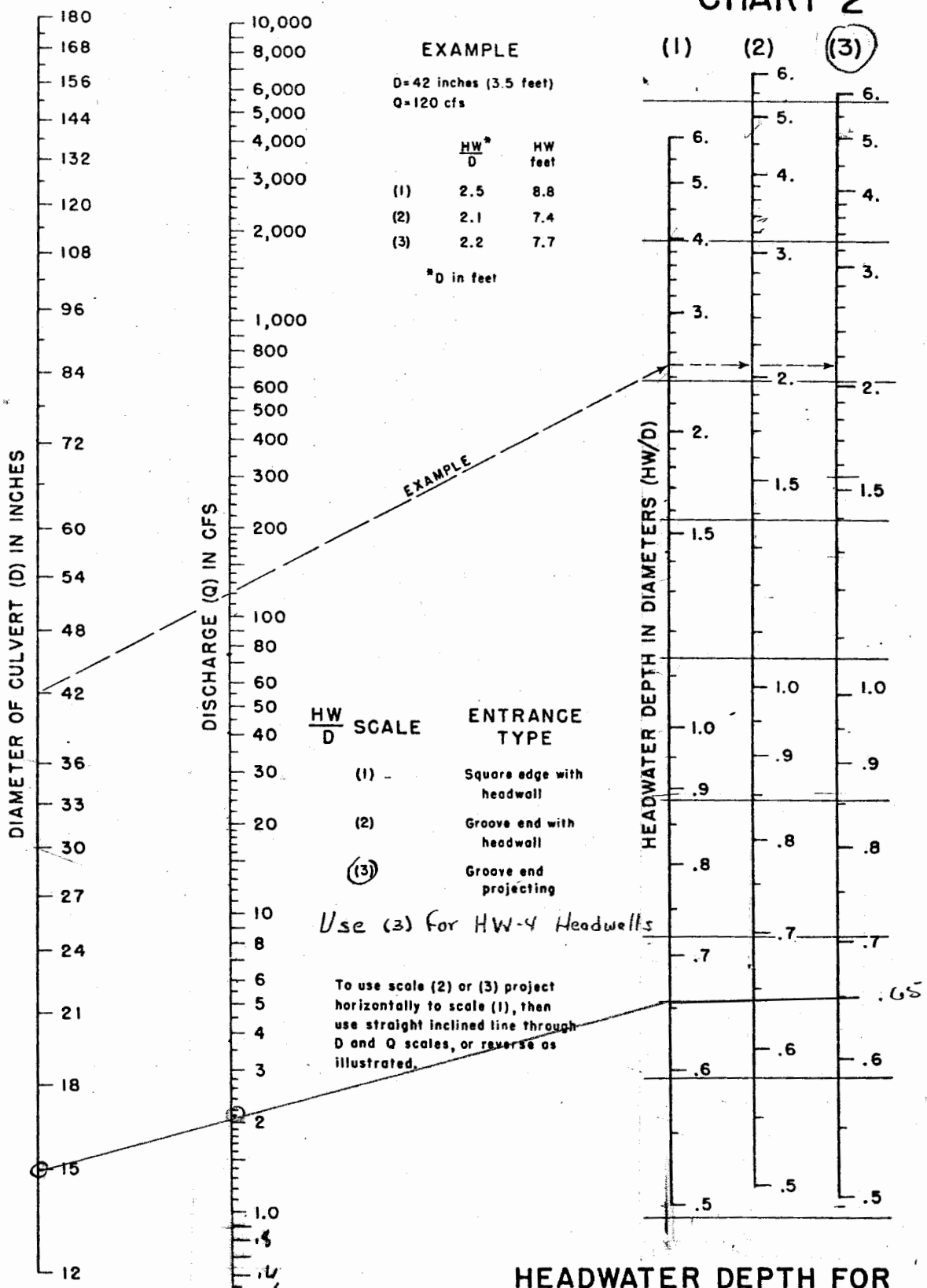
Allow. Outlet Velocity =

CULVERT TYPE	Q cfs	SIZE	INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL K_e	d_c	$\frac{d_c+D}{2}$	h_o	H	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	REMARKS
ROUND RCP	4.93	15"	0.65	0.81	0.2	0.6	0.925	0.925	0.1	0.34	1.03	OUTLET 107.67	3.0		

Calculations - Recommendations

27

CHART 2



HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

5-22

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

ANDERSON'S Corner Animal Hosp.
Drive Pipe

TABLE 1 - ENTRANCE LOSS COEFFICIENTS

Outlet Control, Full or Partly Full

Entrance head loss $H_e = k_e \frac{V^2}{2g}$

Type of Structure and Design of Entrance	Coefficient k_e
Pipe, Concrete	
Projecting from fill, socket end (groove-end) . . .	0.2
Projecting from fill, sq. cut end	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove-end)	0.2
Square-edge	0.5
Rounded (radius = 1/12D)	0.2
Mitered to conform to fill slope	0.7
*End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side-or slope-tapered inlet	0.2
Pipe, or Pipe-Arch, Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge . .	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
*End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side-or slope-tapered inlet	0.2
Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of 1/12 barrel dimension, or beveled edges on 3 sides . . .	0.2
Wingwalls at 30° to 75° to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge	0.2
Wingwall at 10° to 25° to barrel	
Square-edged at crown	0.5
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7
Side-or slope-tapered inlet	0.2

*Note: "End Section conforming to fill slope," made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper in their design have a superior hydraulic performance. These latter sections can be designed using the information given for the beveled inlet, p. 5-13.

ANDERSON'S Corner
Drive Pipe

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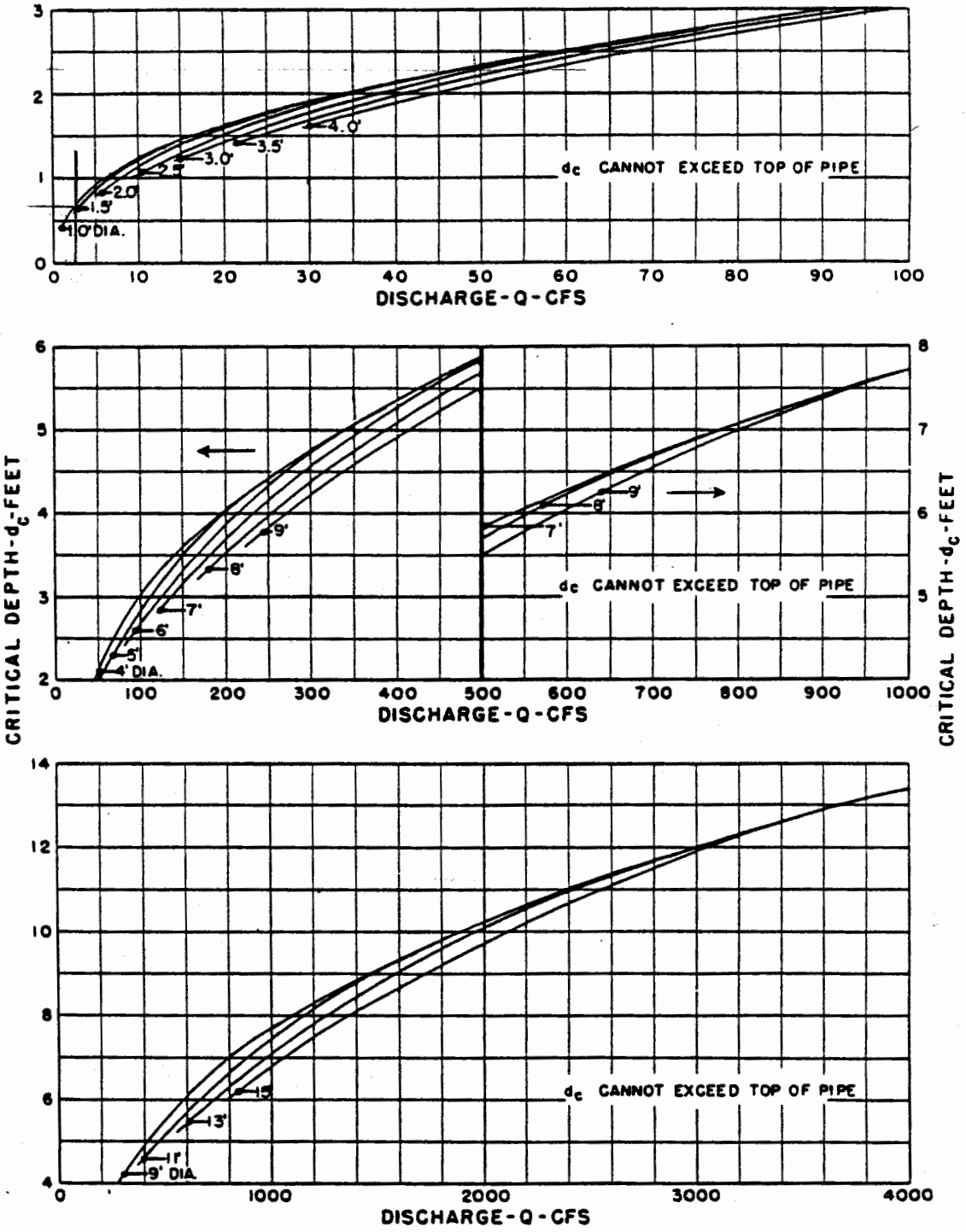
CHART 4



BUREAU OF PUBLIC ROADS

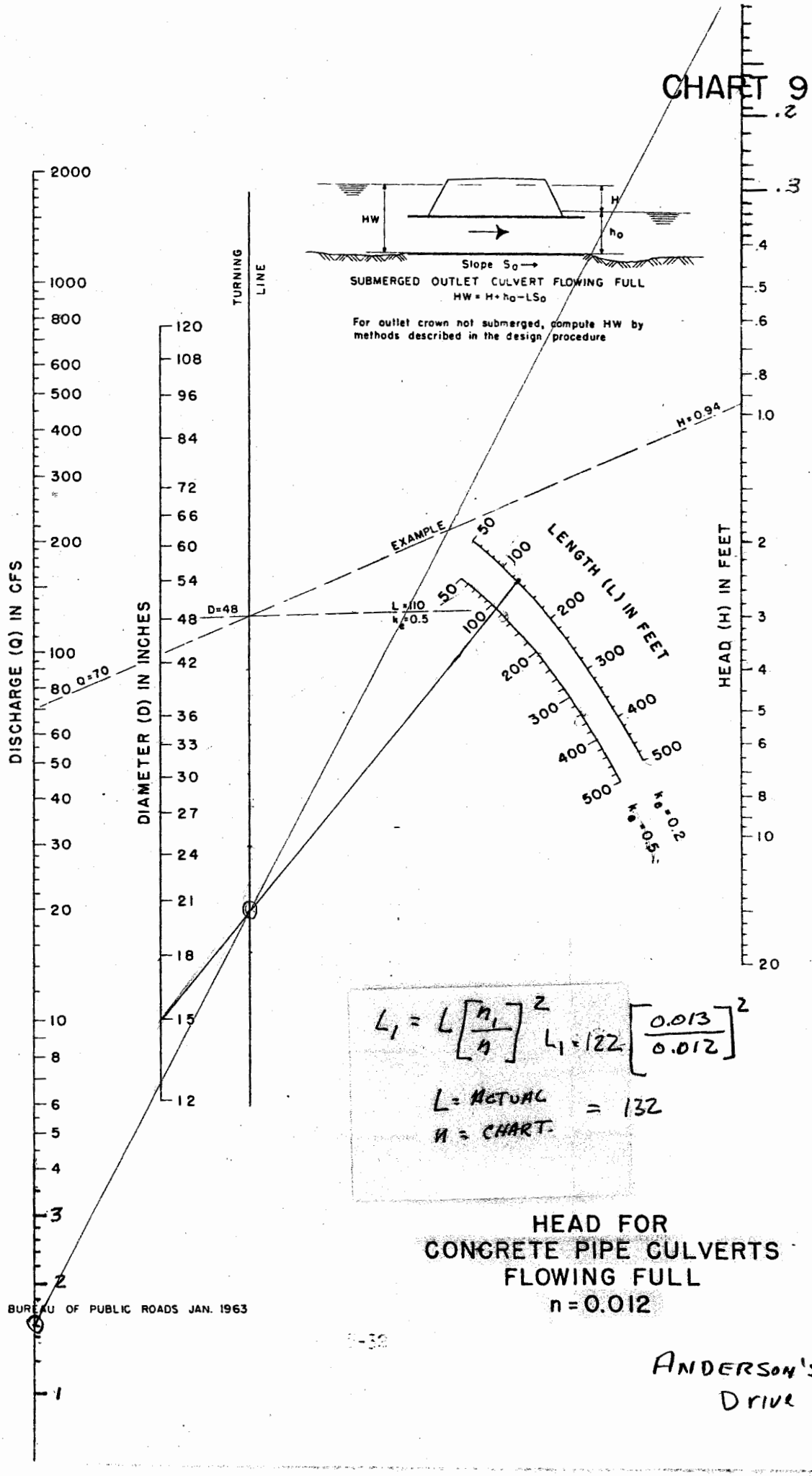
JAN. 1964

CRITICAL DEPTH
CIRCULAR PIPE

ANDERSONS Corner
Drive Pipe

30

CHART 9



$$L_1 = L\left[\frac{n_1}{n}\right]^2 \quad L_1 = 122\left[\frac{0.013}{0.012}\right]^2$$

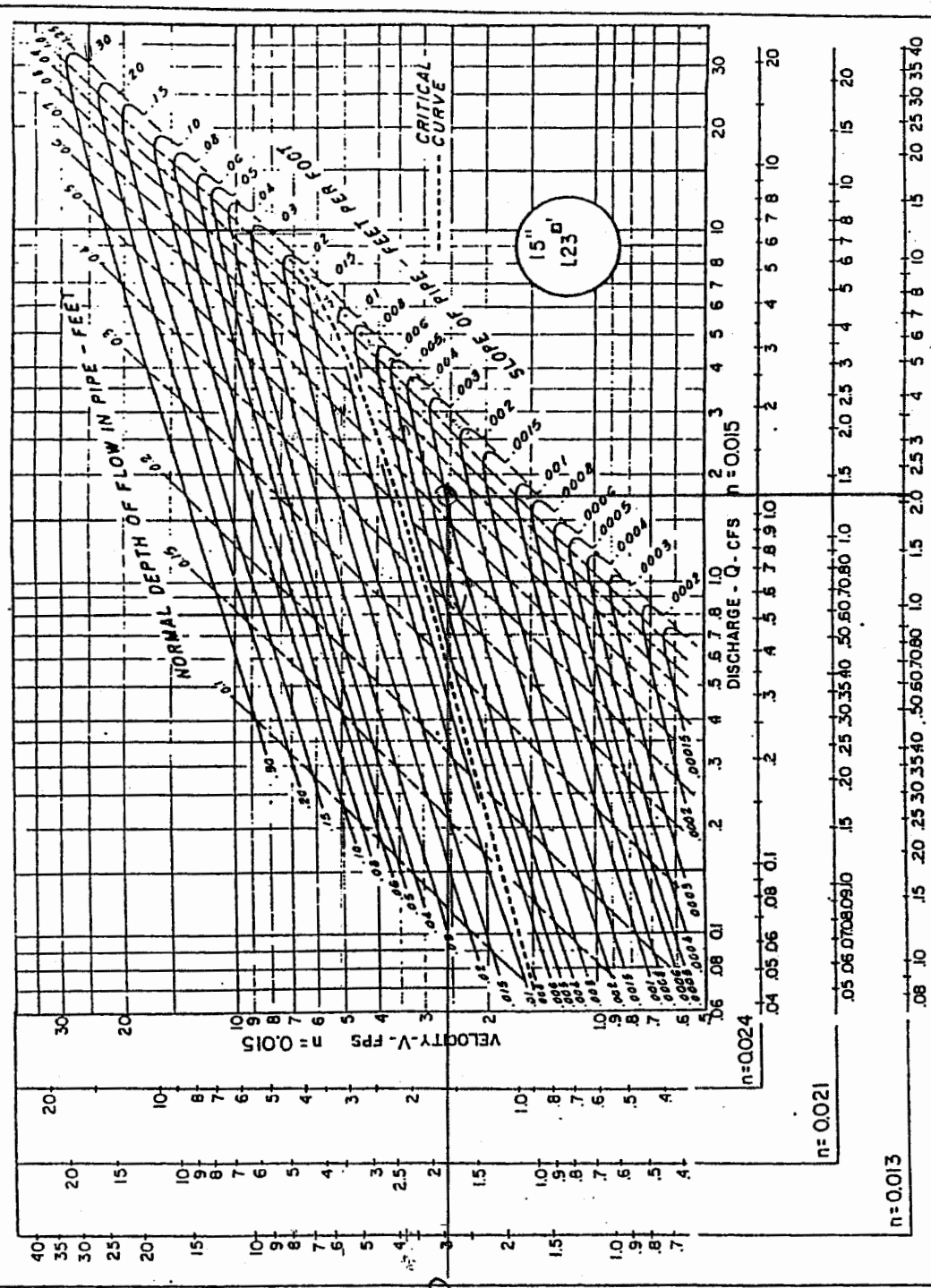
L = ACTUAL = 132

n = CHART.

HEAD FOR CONCRETE PIPE CULVERTS FLOWING FULL n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963

ANDERSON'S Corner
Drive Pipe



PIPE FLOW CHART 15- INCH DIAMETER

MARYLAND STATE HIGHWAY ADMINISTRATION 9/78 SHA-61.1-440.15

Temporary Sediment Trap Calculations
And
Infiltration Trench Calculations

Water Quality Work Sheets
Infiltration Trench Sizing Calculations

minimizing the distance between the elevation of the outfall and the water surface elevation in the mainstem or its associated wetlands. Slotted orifices or weirs should be considered, as opposed to round orifices, to spread the discharge across a wider area.

Table 5: Stormwater Practice Modifications Recommended for Use in the Powhatan Creek Mainstem

BMP	Recommended for Mainstem	Design Considerations to Maximize Bacteria Removal*
Wet Pond		
Small Wet Pond	• •	■ Create high light conditions in the water column. Storage can be provided in a series of separate and rather shallow cells. The last cells should have lower turbidity and therefore permit greater UV light penetration. ■ Provide a minimum of 48 hour detention. ■ Design inlet and outlet structures to prevent bacteria-laden bottom sediments from being resuspended and exported. ■ Reduce turf and open water areas around ponds so that resident geese and waterfowl populations do not become established and become an internal bacterial source. ■ Add shallow benches and wetland areas to enhance the plankton community and therefore increase bacterial predation.
Wet Pond	• •	
Wet ED Pond	• •	
Wetlands		
Shallow Marsh	• •	■ Create high light conditions in the water column. Storage can be provided in a series of separate and rather shallow cells. The last cells should have lower turbidity and therefore permit greater UV light penetration. ■ Provide a minimum of 48 hour detention. ■ Design inlet and outlet structures to prevent bacteria-laden bottom sediments from being resuspended and exported. ■ Reduce turf and open water areas around ponds so that resident geese and waterfowl populations do not become established and become an internal bacterial source. ■ Add shallow benches and wetland areas to enhance the plankton community and therefore increase bacterial predation.
ED Shallow Marsh	• •	
Pond/Wetland System	• •	
Pocket Wetland	• •	
Infiltration		
Infiltration Trench	• •	■ Minimum of 2-foot separation from the water table is recommended.
Infiltration Basin	• •	

DC018_ANDERSONS_CORNER_ANIMAL_HOSPITAL - 076

Table 5: Stormwater Practice Modifications Recommended for Use in the Powhatan Creek Mainstem

BMP	Recommended for Mainstem	Design Considerations to Maximize Bacteria Removal*
Filtering Systems		
Bioretention	• •	■ Employ finer-grained media in the filter bed with a small diameter (say, 15 microns), or provide a finer-grained layer at mid-depth in the filter profile. The typical "concrete-grade" sand used in most sand filters may be too coarse-grained to prevent coliform breakouts. ■ The process for pretreatment and/or filtration should be 40 hours or more. This is most easily done by extending the detention time in the sedimentation chamber used for pretreatment. ■ Remove trapped sediments from filter pretreatment chambers on a more frequent basis during the growing season. Dry pretreatment chambers may be more desirable since bacteria-laden sediment would be subject to both sunlight and desiccation. ■ Filters should be oriented to provide maximum solar exposure.
Surface SF	• •	
Underground SF	• •	
Perimeter SF	• •	
Organic Filter	• •	
Pocket SF	• •	
Open Channel Systems		
Wet Swale	• •	■ Open channels should be designed to be either self-cleansing or promote maximum sediment retention. ■ Dry swales are preferable, wet swales and biofilters are not recommended.
Dry Swale	• •	
Biofilters	• •	
Extended Dry Detention		
Timber Walls	• •	
Dry ED w/ Forebay	• •	

• • Yes
• • No
* Adapted from Schueler, 2000

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PROJECT Anderson's Corner Animal Hospital
DATE 10-16-07 COMM NO. 2060810
CAL BEK CKD KMS PAGE # 35
TITLE SITE Acreage

1/ TOTAL SITE Acerage: = 34.26 Ac.

2/ PROPOSED Developed Site Area: = 6.19 Acres.

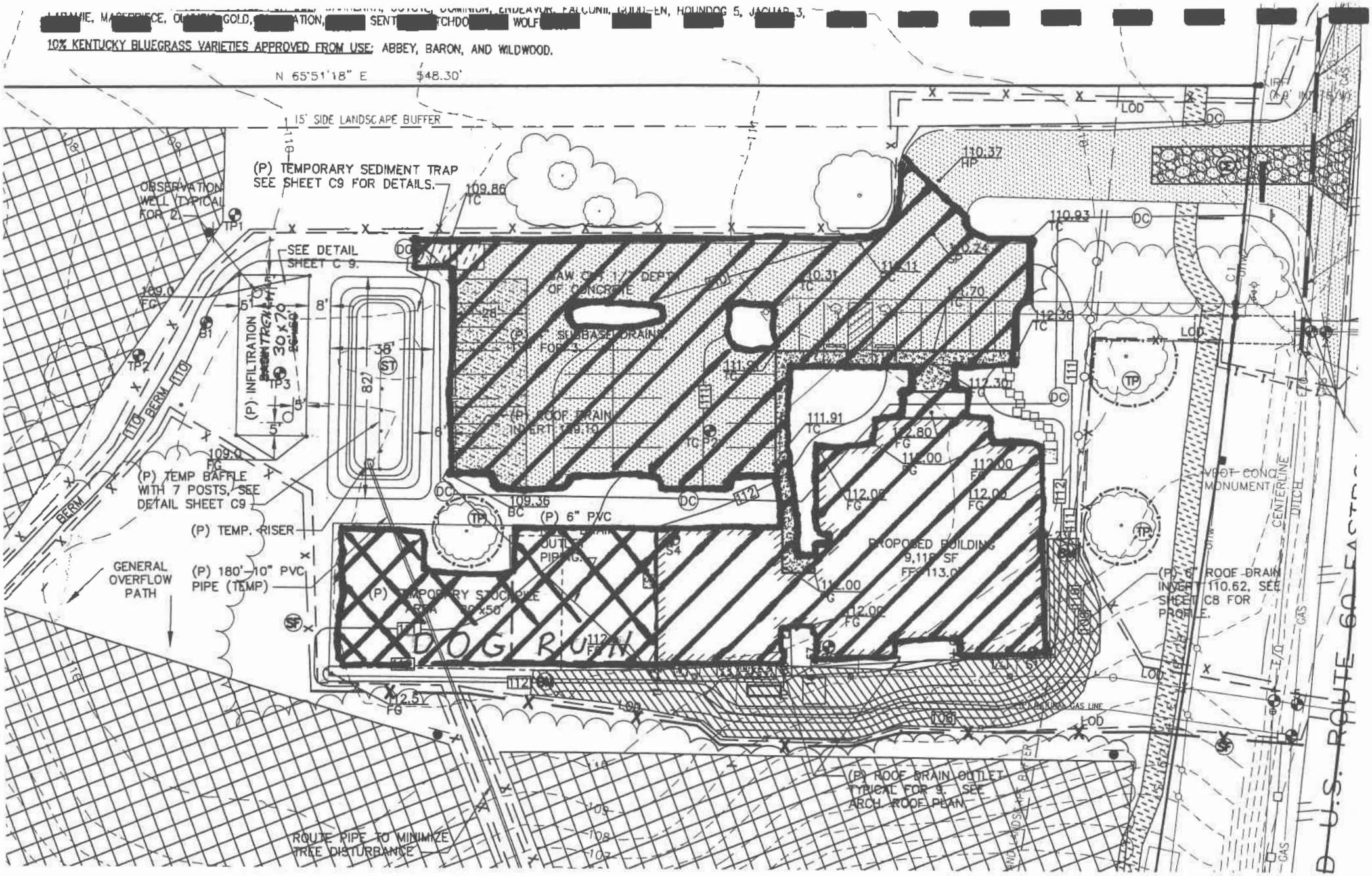
3/ PROPOSED Disturbed Area: = 1.79 Acres.

4/ EXISTING SITE OPEN AREA: = 5.94 Acres.

5/ EXISTING SITE IMPERVIOUS AREA: = 0.25 Acres

6/ PROPOSED SITE OPEN AREA: = 5.57 Acres.

7/ PROPOSED SITE Impervious AREA: = 0.62 ACRES.



IMPERVIOUS WATER QUALITY AREAS

PARKING LOT & BUILDING 0.573 Ac

DOG RUN 0.118 Ac

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Worksheet 1

Page 1 of 3

STEP 1 **Determine the applicable area (A) and the post-developed impervious cover (I_{post}).**

Applicable area (A)* = 6.19 acres

Post-development impervious cover:

structures = 0.21 acres (9,118 S.F)

parking lot = 0.29 acres (12,419 S.F)

roadway = 0.08 acres (3,445 S.F)

other:

Incidental Impervious = 0.04 acres (1,841 S.F)

_____ = _____ acres

Total = 0.62 acres

I_{post} = (total post-development impervious cover ÷ A) × 100 = 10.02%

* The area subject to the criteria may vary from locality to locality. Therefore, consult the locality for proper determination of this value.

STEP 2 **Determine the average land cover condition ($I_{watershed}$) or the existing impervious cover ($I_{existing}$).**

Average land cover condition ($I_{watershed}$):
If the locality has determined land cover conditions for individual watersheds within its jurisdiction, use the watershed specific value determined by the locality as $I_{watershed}$.

$I_{watershed}$ = 10 %

Otherwise, use the Chesapeake Bay default value:

$I_{watershed}$ = 16%

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Worksheet 1
Page 2 of 3

Existing impervious cover ($I_{existing}$):

Determine the existing impervious cover of the development site if present.

Existing impervious cover:

structures = 0.14 acres

parking lot = _____ acres

roadway = 0.11 acres

other:

_____ = _____ acres

_____ = _____ acres

Total = 0.25 acres

$I_{existing}$ = (total existing impervious cover ÷ A*) × 100 = 4 %

* The area should be the same as used in STEP 1.

STEP 3 **Determine the appropriate development situation.**

The site information determined in STEP 1 and STEP 2 provide enough information to determine the appropriate development situation under which the performance criteria will apply. Check (✔) the appropriate development situation as follows:

_____ **Situation 1:** This consists of land development where the existing percent impervious cover ($I_{existing}$) is less than or equal to the average land cover condition ($I_{watershed}$) and the proposed improvements will create a total percent impervious cover (I_{post}) which is less than or equal to the average land cover condition ($I_{watershed}$).

I_{post} 10 % ≤ $I_{watershed}$ 10 %

Worksheet 1
Page 3 of 3

_____ **Situation 2**: This consists of land development where the existing percent impervious cover ($I_{existing}$) is less than or equal to the average land cover condition ($I_{watershed}$) and the proposed improvements will create a total percent impervious cover (I_{post}) which is greater than the average land cover condition ($I_{watershed}$).

$I_{existing}$ _____% ≤ $I_{watershed}$ _____%; **and**

I_{post} _____% > $I_{watershed}$ _____%

_____ **Situation 3**: This consists of land development where the existing percent impervious cover ($I_{existing}$) is greater than the average land cover condition ($I_{watershed}$).

$I_{existing}$ _____% > $I_{watershed}$ _____%

_____ **Situation 4**: This consists of land development where the existing percent impervious cover ($I_{existing}$) is served by an existing stormwater management BMP(s) that addresses water quality.

If the proposed development meets the criteria for development Situation 1, than the low density development is considered to be the BMP and no pollutant removal is required. The calculation procedure for Situation 1 stops here. If the proposed development meets the criteria for development Situations 2, 3, or 4, then proceed to STEP 4 on the appropriate worksheet.

Worksheet 2 : Situation 2

Page 1 of 4

Summary of Situation 2 criteria: from calculation procedure **STEP 1** thru **STEP 3**, Worksheet 1:

Applicable area (A)* = 6.19 acres

I_{post} = (total post-development impervious cover ÷ A) × 100 = 10 %

$I_{watershed}$ = 10 % **or** $I_{watershed}$ = 16%

$I_{existing}$ = (total existing impervious cover ÷ A*) × 100 = 4 %

$I_{existing}$ 4 % ≤ $I_{watershed}$ 10 %; **and**

I_{post} 10.02% > $I_{watershed}$ 10 %

STEP 4 **Determine the relative pre-development pollutant load (L_{pre}).**

$L_{pre(watershed)} = [0.05 + (0.009 \times I_{watershed})] \times A \times 2.28$ **(Equation 5-16)**

where: $L_{pre(watershed)}$ = relative pre-development total phosphorous load (pounds per year)
$I_{watershed}$ = average land cover condition for specific watershed or locality **or** the Chesapeake Bay default value of 16% (percent expressed in whole numbers)
A = applicable area (acres)

$L_{pre(watershed)} = [0.05 + (0.009 \times 10)] \times 6.19 \times 2.28$

= 1.97 pounds per year

Worksheet 2 : Situation 2

Page 2 of 4

STEP 5 **Determine the relative post-development pollutant load (L_{post}).**

$L_{post} = [0.05 + (0.009 \times I_{post})] \times A \times 2.28$ **(Equation 5-21)**

where: L_{post} = relative post-development total phosphorous load (pounds per year)
I_{post} = post-development percent impervious cover (percent expressed in whole numbers)
A = applicable area (acres)

L_{post} = [0.05 + (0.009 × 10.)] × 6.19 × 2.28

= 1.98 pounds per year

STEP 6 **Determine the relative pollutant removal requirement (RR).**

$RR = L_{post} - L_{pre(watershed)}$

RR = 1.98 - 1.97

= 0.01 pounds per year

STEP 7 **Identify best management practice (BMP) for the site.**

1. Determine the required pollutant removal efficiency for the site:

$EFF = (RR \div L_{post}) \times 100$ **(Equation 5-22)**

where: EFF = required pollutant removal efficiency (percent expressed in whole numbers)
RR = pollutant removal requirement (pounds per year)
L_{post} = relative post-development total phosphorous load (pounds per year)

EFF = (0.01 ÷ 1.98) × 100

= 0.50 %

Worksheet 2 : Situation 2

Page 3 of 4

2. Select BMP(s) from **Table 5-~~13~~ 14** and locate on the site:

BMP 1: Infiltration Trench C-2

BMP 2: _____

BMP 3: _____

3. Determine the pollutant load entering the proposed BMP(s):

$L_{BMP} = [0.05 + (0.009 \times I_{BMP})] \times A \times 2.28$ **(Equation 5-23)**

where: L_{BMP} = relative post-development total phosphorous load entering proposed BMP (pounds per year)

I_{BMP} = post-development percent impervious cover of BMP drainage area (percent expressed in whole numbers)

A = drainage area of proposed BMP (acres)

$L_{BMP1} = [0.05 + (0.009 \times$ 10 $)] \times$ 6.19 $\times 2.28$

= 1.98 pounds per year

$L_{BMP2} = [0.05 + (0.009 \times$ _____ $)] \times$ _____ $\times 2.28$

= _____ pounds per year

$L_{BMP3} = [0.05 + (0.009 \times$ _____ $)] \times$ _____ $\times 2.28$

= _____ pounds per year

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Worksheet 2 : Situation 2

Page 4 of 4

4. Calculate the pollutant load removed by the proposed BMP(s):

$L_{removed} = Eff_{BMP} \times L_{BMP}$ **(Equation 5-24)**

where: $L_{removed}$ = Post-development pollutant load removed by proposed BMP (pounds per year)
Eff_{BMP} = pollutant removal efficiency of BMP (expressed in decimal form)
L_{BMP} = relative post-development total phosphorous load entering proposed BMP (pounds per year)

$L_{removed/BMP1}$ = 0.50 × 1.98 = 0.99 pounds per year

$L_{removed/BMP2}$ = _____ × _____ = _____ pounds per year

$L_{removed/BMP3}$ = _____ × _____ = _____ pounds per year

5. Calculate the total pollutant load removed by the BMP(s):

$L_{removed/total} = L_{removed/BMP1} + L_{removed/BMP2} + L_{removed/BMP3} + \ldots$ **(Equation 5-25)**

where: $L_{removed/total}$ = **total** pollutant load removed by proposed BMPs
$L_{removed/BMP1}$ = pollutant load removed by proposed BMP No. 1
$L_{removed/BMP2}$ = pollutant load removed by proposed BMP No. 2
$L_{removed/BMP3}$ = pollutant load removed by proposed BMP No. 3

$L_{removed/total}$ = 0.99 + _____ + _____ + . . .

= 0.99 pounds per year

6. Verify compliance:

$L_{removed/total} \geq RR$

0.99 ≥ 0.01

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PROJECT Anderson's Corner Animal Hospital
DATE 10-9-07 COMM NO. 2060810
CAL BEK CKD KMS PAGE # 44
TITLE Temporary Sediment TRAP.

Impervious Area: Parking = 15,625 S.F.
Building = 9328 S.F.
24,953 S.F. = 0.573 Ac.

SIZE OF BASIN:

USE STANDARD CONFIGURATION OF SEDIMENT BASIN WITHOUT EMERGENCY SPILLWAY.

Q_{25} by Rational Method = J.CC B = 48.54, D = 8.5, E = 0.67
t_c = 5 minutes minimum

$$i_{25} = \frac{B}{(t_c + D)^E} = \frac{48.54}{(5.0 + 8.5)^{.67}}$$

$$= 8.48 \text{ in/hr.}$$

$$Q_{25} = AC_i = 0.573 \text{ Ac} @ 0.9 * 8.48$$

$$= 4.37 \text{ cfs.}$$

Q_{25} by Graphical Peak Discharge method.

25yr Q_p = 4.98 cfs.

Volume = 134 C.Y. per Acre impervious.

134 cy * 0.573 Ac = 76.782 C.y * 27 = 2073 C.F.

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PROJECT Anderson's Corner Animal Hospital
DATE 10-9-07 COMM NO. 2060810
CAL BEK CKD KMS PAGE # 45
TITLE Temporary Sediment TRAP.

EXISTING GROUND = TOP. = 109.0 : Use 2:1 Sideslopes,

(Surface Area = 82' * 38')

25 YEAR STORM WITH NO EMERGENCY SPILLWAY SET @
2.0 FT BELOW TOP ELEV = 107.0 (PLATE 3.14-2)
(SURFACE AREA 74' * 30')

Top Proposed Wet Storage @ Elev 104.8, Area = 65.2' * 21.2' = 1382.24 S.F.

BOTTOM OF TRAP @ Elev 103.9, Area = 61.6 * 17.6 = 1084.16 S.F
0.9 2466.40 S.F

Depth = 0.9 * $\frac{2466.40}{2}$ = 1109.88 C.Y.

Calculated Wet Storage needed.

67 C.Y/Ac = 67 * 0.573 = 38.391 C.Y * 27 = 1036.56 CY

Prop. Vol. 1109.88 C.Y > 1036.56 CY needed.

Top Proposed Dry Storage @ Elev 105.5, Area 68' * 24' = 1632.00 SF.

BOTTOM DRY Storage @ Elev 104.8, Area 65.2 * 21.2 = 1382.24 S.F.
0.7 3014.24 S.F.

Depth = 0.7 * $\frac{3014.24}{2}$ = 1054.98 C.Y.

Calculated Wet Storage needed.

67 C.Y./Ac = 67 * 0.573 = 38.391 CY * 27 = 1036.56 CY.

Prop. Volume 1054.98 > 1036.56 CY needed.

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PROJECT Anderson's Corner Animal Hospital
DATE 10-9-07 COMM NO.
CAL BEK CKD KMS PAGE # 46
TITLE Temporary Sediment TRAP

Use a 12" Dia. cmp riser with a buried Steel Plate for anchorage / anti floatation

Use 10" Dia. PVC pipe as principal Spillway @ 0.004 ft/ft. (RISER PASSES 25 yr. STORM)

i_2 = B = 70.63, D = 12.75, E = 0.87

$$i_2 = \frac{B}{(t_c + D)^E} = \frac{70.63}{(5 + 12.75)^{0.87}}$$

$i_2 = 5.8$

Pre $Q_2 = CAi$ A: 0.573, C = 0.35, i_2 = 5.8

$0.200 * 5.8$

$= 1.16$ cfs,

check Pipe Capacity 8"

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$= \frac{1.486}{0.009}(0.349)(0.167)^{2/3}(0.004)^{1/2}$$

$Q = 1.11$ cfs ≈ 1.16 cfs

Anderson's Corner Animal Hospital
10-16-07

DJG 20060810

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET

(with or without an emergency spillway)

Project Anderson's Corner Animal Hospital

Basin # 1 Location James City County

Total area draining to basin: 0.573 acres.

Basin Volume Design

Wet Storage:

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

   67 cu. yds. x 0.573 acres = 38.391 cu. yds.

2. Available basin volume = 1110 cu. yds. at elevation 104.8. (From storage - elevation curve)

3. Excavate 397 cu. yds. to obtain required volume*.

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

4. Available volume before cleanout required.

   33 cu. yds. x _____ acres = _____ cu. yds.

5. Elevation corresponding to cleanout level = N/A.

   (From Storage - Elevation Curve)

6. Distance from invert of the dewatering orifice to cleanout level = N/A ft. (Min. = 1.0 ft.)

Dry Storage:

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

   67 cu. yds. x 0.573 acres = 38.391 cu. yds.

107.4
103.9
3.1

Anderson's Corner Animal Hosp
10-16-07
DIG 20608103.14

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8. Total available basin volume at crest of riser* = 189.67 cu. yds. at elevation 107.4. (From Storage - Elevation Curve)

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

9. Diameter of dewatering orifice = N/A in.

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

Preliminary Design Elevations

11. Crest of Riser = 105.5

Top of Dam = 109.0

Design High Water = _____

Upstream Toe of Dam = N/A

Basin Shape

12. Length of Flow / Effective Width — L / We = L = 68 (Flow path @ Elev. 105.5

Area @ 105.5 = 1632 S.F.

$\frac{82}{24} = 1$ $W_e = \frac{A}{L} = \frac{1632}{68} = 24$

If > 2, baffles are not required _____

If < 2, baffles are required 1.0

Runoff

13. Q_2 = _____ cfs (From Chapter 5)

14. Q_{25} = 4.98 cfs (From Chapter 5)

Principal Spillway Design

15. With emergency spillway, required spillway capacity $Q_p = Q_2$ = N/A cfs. (riser and barrel)

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

Anderson's Corner Animal Hosp
10-16-07

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16. With emergency spillway:

Assumed available head (h) = N/A ft. (Using Q_2)

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

Without emergency spillway:

Assumed available head (h) = 1.5 ft. (Using Q_{25})

h = Design High Water Elevation - Crest of Riser Elevation

17. Riser diameter (D_r) = 12 in. Actual head (h) = 1.5 ft.

(From Plate 3.14-8.)

Note: Avoid orifice flow conditions.

18. Barrel length (l) = 180 ft.

Head (H) on barrel through embankment = 3.28 ft. 103.2 107.0 103.2

(From Plate 3.14-7).

19. Barrel diameter = 10" PVC in.

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

20. Trash rack and anti-vortex device

Diameter = 18 inches.

Height = 6 inches.

(From Table 3.14-D).

Emergency Spillway Design

21. Required spillway capacity $Q_e = Q_{25} - Q_p$ = N/A cfs.

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

Anti-Seep Collar Design

23. Depth of water at principal spillway crest (Y) = N/A ft.

Slope of upstream face of embankment (Z) = N/A :1.

Slope of principal spillway barrel (S_b) = 0.40 %

Length of barrel in saturated zone (L_s) = N/A ft.

24. Number of collars required = N/A dimensions = N/A

(from Plate 3.14-12).

Final Design Elevations

25. Top of Dam = 109.0

Design High Water = 107.0

Emergency Spillway Crest = N/A

Principal Spillway Crest = N/A

Dewatering Orifice Invert = N/A

Cleanout Elevation = N/A

Elevation of Upstream Toe of Dam or Excavated Bottom of "Wet Storage Area" (if excavation was performed) = 103.9

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Worksheet 2: Runoff curve number and runoff

Temporary Sediment Trap

Project	By	Date
Anderson's Corner Animal Hosp	BEK	10-10-07
Location	**Checked**	**Date**
James City County	KMS	12/11/07

Check one: ☐ Present ☑ Developed OJG 2060810

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☑ acres ☐ mi² ☐ %	Product of CN x area
31.B Suffolk Hyd. group B.	Impervious. Parking & Building	92			0.573	52.72
					Totals ➡ 0.573	52.72

1/ Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{52.72}{0.573} = 92$; **Use CN** ➡ 92

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	25		
Rainfall, P (24-hour)	in	6.5		
Runoff, Q	in	5.565		

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
Anderson's Corner Animal Hospital	BEK	10-10-07
Location	**Checked**	**Date**
James City County	KMS	12/11/07

Check one: ☐ Present ☑ Developed DJG 2060810

Check one: ☐ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

	Segment ID		
1. Surface description (table 3-1)			
2. Manning's roughness coefficient, n (table 3-1)			
3. Flow length, L (total L † 300 ft) ft			
4. Two-year 24-hour rainfall, P_2 in			
5. Land slope, s ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr		+	=

Shallow concentrated flow

	Segment ID		
7. Surface description (paved or unpaved)			
8. Flow length, L ft			
9. Watercourse slope, s ft/ft			
10. Average velocity, V (figure 3-1) ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t hr		+	=

Channel flow

	Segment ID		
12. Cross sectional flow area, a ft^2			
13. Wetted perimeter, p_w ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft			
15 Channel slope, s ft/ft			
16. Manning's roughness coefficient, n			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s			
18. Flow length, L ft			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t hr		+	=

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr 0.08

Worksheet 4: Graphical Peak Discharge method

Project	By	Date
Anderson's Corner Animal Hospital	BEK	10-10-07
Location	**Checked**	**Date**
James City County	KMS	12/11/07

Check one: ☐ Present ☑ Developed D 36 2060810

1. Data

Drainage area .....0.573 AC..... A_m = 0.000895 mi² (acres/640)

Runoff curve number .....CN = 92 (From worksheet 2)

Time of concentration ..... T_c = 0.08 hr (From worksheet 3)

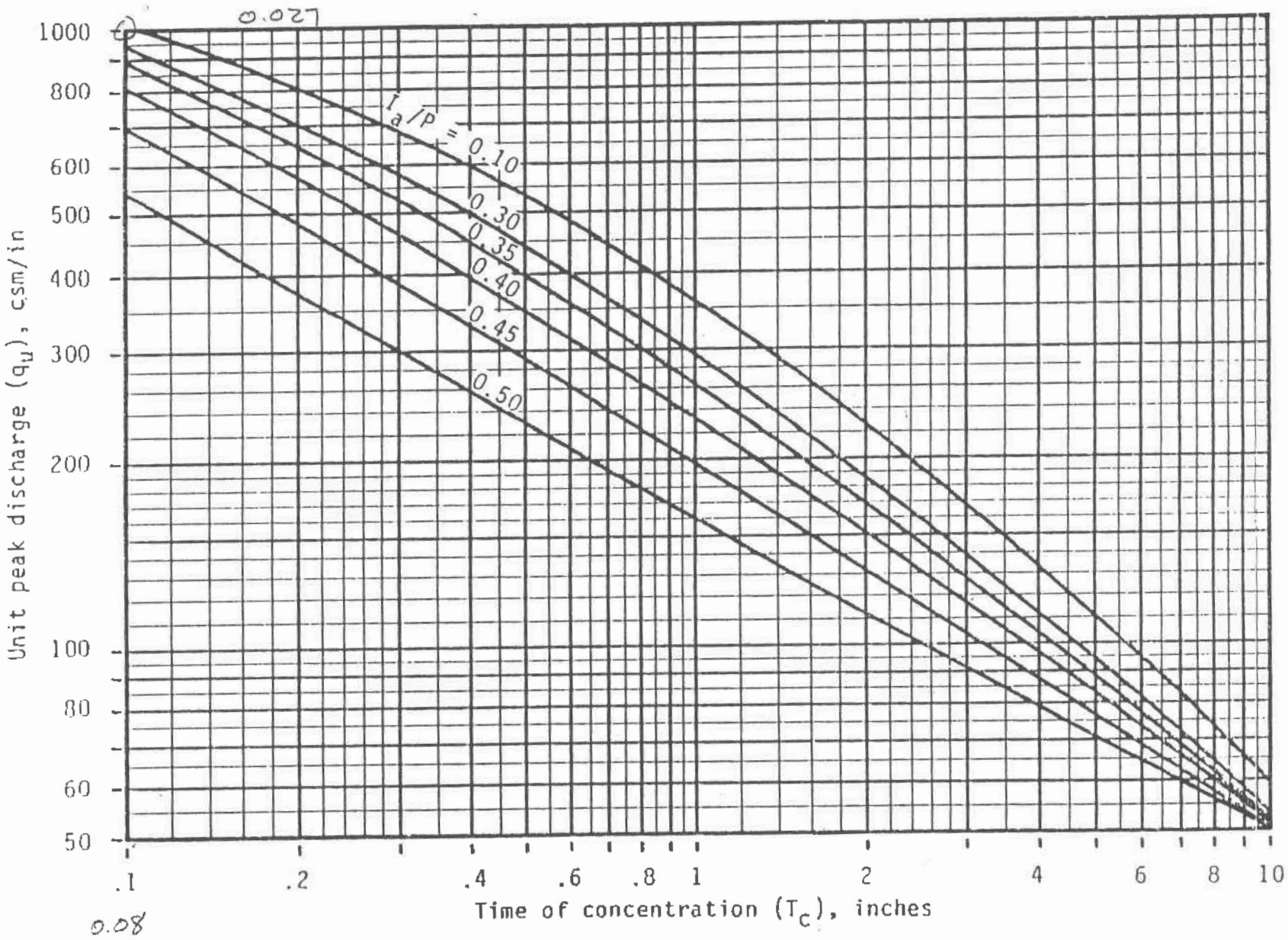
Rainfall distribution ..... = II (I, IA, II III)

Pond and swamp areas sprea
throughout watershed ..... = 1 percent of A_m (_____ acres or mi² covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	25		
3. Rainfall, P (24-hour)	in	6.5		
4. Initial abstraction, I_a (Use CN with table 4-1)	in	0.174		
5. Compute I_a/P		0.027		
6. Unit peak discharge, q_u (Use T_c and I_a/P with exhibit 4– 11)	csm/in	1000		
7. Runoff, Q (From worksheet 2) Figure 2-6	in	5.565		
8. Pond and swamp adjustment factor, F_p (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond ans swamp area.)		1		
9. Peak discharge, q_p	ft³/s	4.98		

(Where $q_p = q_u A_m Q F_p$)

Exhibit 4-II: Unit peak discharge (q_u) for SCS type II rainfall distribution



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PROJECT Anderson's Corner Animal Hospita
DATE 12-6-07 COMM NO. 2060810
CAL BEK CKD KMS PAGE # 55
TITLE Infiltration Trench (Revised)

Water Quality Volume.

WQV = (Area Impervious + Area Exercise Yard) * 43560 * 1st 1" of Rainfall

= (0.573 Ac + 0.118 Ac) * 43560 * 0.0833

= 2507 Cu. FT.

Per. Final Soils Report an infiltration rate of 3.0 in/hr. was observe

$f_d = (0.5)(3") = 1\frac{1}{2}"/hr.$ = design infiltration rate

$1\frac{1}{2}"/hr. = 0.1250$ ft/hr.

Depth of infiltration Trench

$$d_{max} = \frac{f_d T_{max}}{V_r}$$

$$= \frac{0.1250 * 48}{0.4}$$

$$d_{max} = 15.00 \text{ FT.}$$

f_d = design infiltration rate of trench.

T_{max} = Maximum allowable drain time = 48 hrs.

V_r = Void ratio of Stone reservoir expressed in terms of the percentage of porosity devided by 100 (0.4 Typ)

Proposed BMP's:

Based on the provided plan, the borings are located within 1 different BMP's . We have assumed that the BMP will be mostly in cut areas, and there will not be a need for an earthen dam. In the event fill is required, we recommend that any fill material be placed in horizontal lifts not exceeding 8 inches in loose thickness, moisture conditioned to within -1% to +3% of the optimum moisture content, and compacted to a minimum 95% of the maximum dry density obtained in accordance with ASTM Specification D-698, Standard Proctor method. Slopes should be constructed no greater than 3 horizontal to 1 vertical. Also, the side slopes should be seeded to promote vegetation growth and further add to the stability of the slopes.

Infiltration

The in-situ Field Permeability Rates were established utilizing the Guelph Permeameter Model 2800K1 near Boring Location TP-3. The 2800K1 Permeameter is a constant-head device, which operates on the Mariotte siphon principle and provides a method for determining field saturated hydraulic conductivity. We didn't have any information with respect to estimated depths to perform this test, accordingly we performed the test within a uniform soil layer. We observed an infiltration rate of 3.0 in/hr as measured utilizing the Guelph Permeameter at a depth of 2.5 feet below the existing ground surface. Similar material was encountered to the depths explored except for some interebedded layers of slightly less permeable material as indicated in the below table. Accordingly, some fluctuation in the permeability rates may be encountered depending on fines content and stratification of the soil subgrades.

The following table summarizes infiltration rates based on the USDA textural classification, laboratory tests, and field permeability tests. Two basic soil strata were encountered at boring locations:

Boring Location	Soil type I depth (feet)	Soil type II Depth (feet)	Water Table Depth (feet)
TP-1	0-8;13-15	8-13	-
TP-2	0-2;4-15	2-4	-
TP-3	0-15	-	-

Notes: - Not encountered

Typically, soils with the Hydrologic Soil Group designations of A and B are considered suitable for infiltration purposes. Some soils designated as C type soils are considered suitable for infiltration practices but these soils would need to be evaluated on a case specific basis. Soils with group designations of D are not considered suitable.

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PROJECT Anderson's Corner Animal Hospital
DATE 12-6-07 COMM NO. 2060810
CAL BEK CKD KMS PAGE # 57
TITLE Infiltration Trench (Revised)

The minimum surface area of the facility bottom.

$$SA_{min} = \frac{Vol_{wg}}{f_d \, T_{max}}$$

$$\text{Minimum Surface Area} = \frac{2507}{(0.1250)(48)}$$

= 418 S.F. REQUIRED; 2100 S.F Supplied

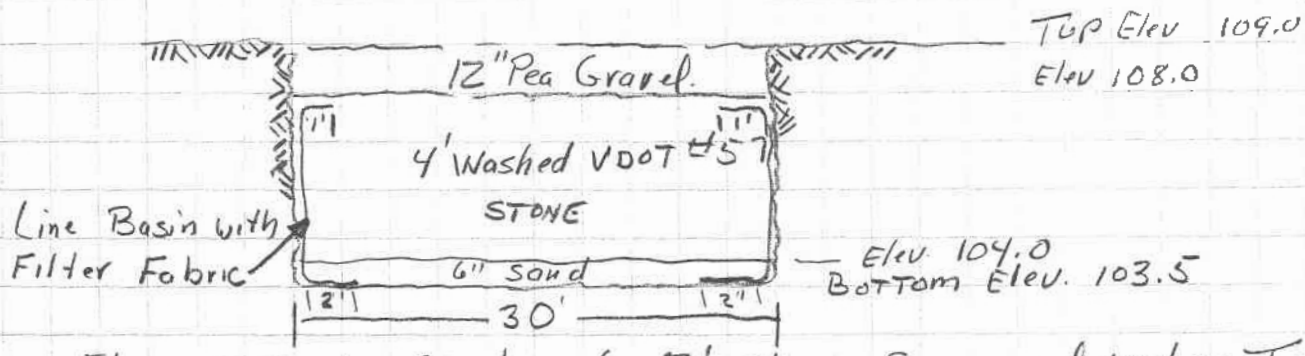
Soils report shows drilling to a depth of 15 feet at the location of the Infiltration trench. No Ground water was detected.

2507 Cu. FT of gravel Storage required with 40% Voids.

Set Size of Gravel Storage 30' wide, 70' Long, 4' Deep.

30 * 70 * 4' = 8400 C.F. = 311.1 C.Y. = Vol. Stone

Voids. 8400 C.F * 0.40 = 3360 C.F. = 124.4 C.Y. VOIDS.



Elev 103.2 is at least 2' above Seasonal Water Table.

AT THE DESIGN INFILTRATION RATE OF 0.1250 FT/hr THE TRENCH WILL EMPTY IN 48 HOURS.

Worksheet 2: Runoff curve number and runoff

Project	By	Date
ANDERSON'S Corner	BEK	12-7-07
Location	**Checked**	**Date**
James City Co.	KMS	12/11/07

Check one: ☐ Present ☑ Developed DJG 2060810

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☑ acres ☐ mi² ☐ %	Product of CN x area
31B, Suffolk Hyd. Group B	Impervious Parking & Building	92			0.573	52.72
31B Suffolk Hyd Group B	Grass, Poor Condition Dog Area	79			0.118	9.32
31B Suffolk Hyd Group B.	Sod & Grass Good Condition	61			0.349	21.29
					Totals ➡	1.04 / 83.33

1/ Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{83.33}{1.04} = 80.1$; **Use CN** ➡ 80.

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	1 yr.	2 yr.	10 yr.
Rainfall, P (24-hour)	in	* 2.8	3.5	6
Runoff, Q	in	1.10	1.64	3.78

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

* PER VDOT HDA 05-04 DATED 8-24-05

BY DM Le Grande Sr.
ASST STATE HYDRAULICS ENGINEER

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

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
ANDERSONS Corner.	BEK	12-7-07
Location	**Checked**	**Date**
James City Co.	KMS	12/11/07

Check one: ☐ Present ☑ Developed DJG 2060 810

Check one: ☐ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

	Segment ID		
1. Surface description (table 3-1)	See Attached		
2. Manning's roughness coefficient, n (table 3-1)			
3. Flow length, L (total L † 300 ft) ft			
4. Two-year 24-hour rainfall, P_2 in			
5. Land slope, s ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr		+	=

Shallow concentrated flow

	Segment ID		
7. Surface description (paved or unpaved)	See Attached.		
8. Flow length, L ft			
9. Watercourse slope, s ft/ft			
10. Average velocity, V (figure 3-1) ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t hr		+	=

Channel flow

	Segment ID		
12. Cross sectional flow area, a ft^2			
13. Wetted perimeter, p_w ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft			
15 Channel slope, s ft/ft			
16. Manning's roughness coefficient, n			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s			
18. Flow length, L ft			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t hr		+	=
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	25 minutes	Hr	0.417

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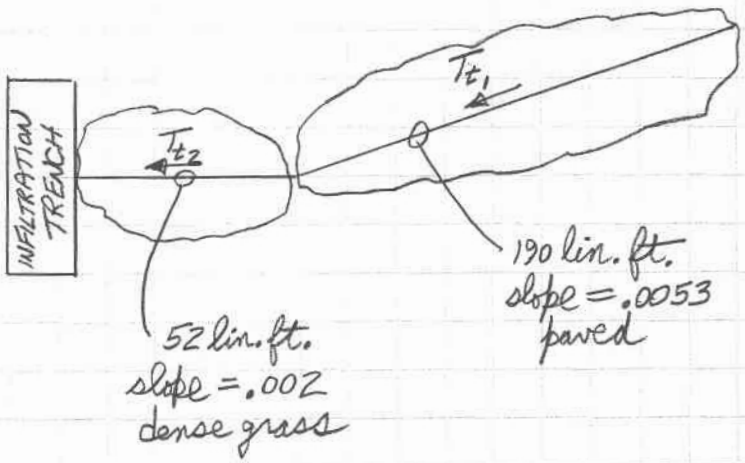
PROJECT ACAH
DATE 12/11/07 COMM NO.
CAL KMS CKD BEK PAGE # 60
TITLE

TIME OF CONCENTRATION



$$T_c = T_{t_1} + T_{t_2}$$

travel times

$$T_{t_1} = \frac{L}{60V} = \frac{190}{(60)(1.44)}$$

$$T_{t_1} = 2.2 \text{ minutes}$$

$$T_{t_2} = \frac{(0.42)(nL)^{0.8}}{(P)^{0.5}\, S^{0.4}}$$

where:
n = roughness coefficient (dense grass - 0.24)
L = flow length (feet)
P = 24 hour rainfall depth (inches)
S = slope (ft/ft)

$$T_{t_2} = \frac{(0.42)\left[(0.24)(52)\right]^{0.8}}{(2.8)^{0.5}(.002)^{0.4}}$$

$$T_{t_2} = \frac{(0.42)(7.533)}{(1.673)(.083)}$$

$$T_{t_2} = 22.8 \text{ minutes}$$

$$T_c = 2.2 + 22.8$$

$$T_c = 25 \text{ minutes}$$

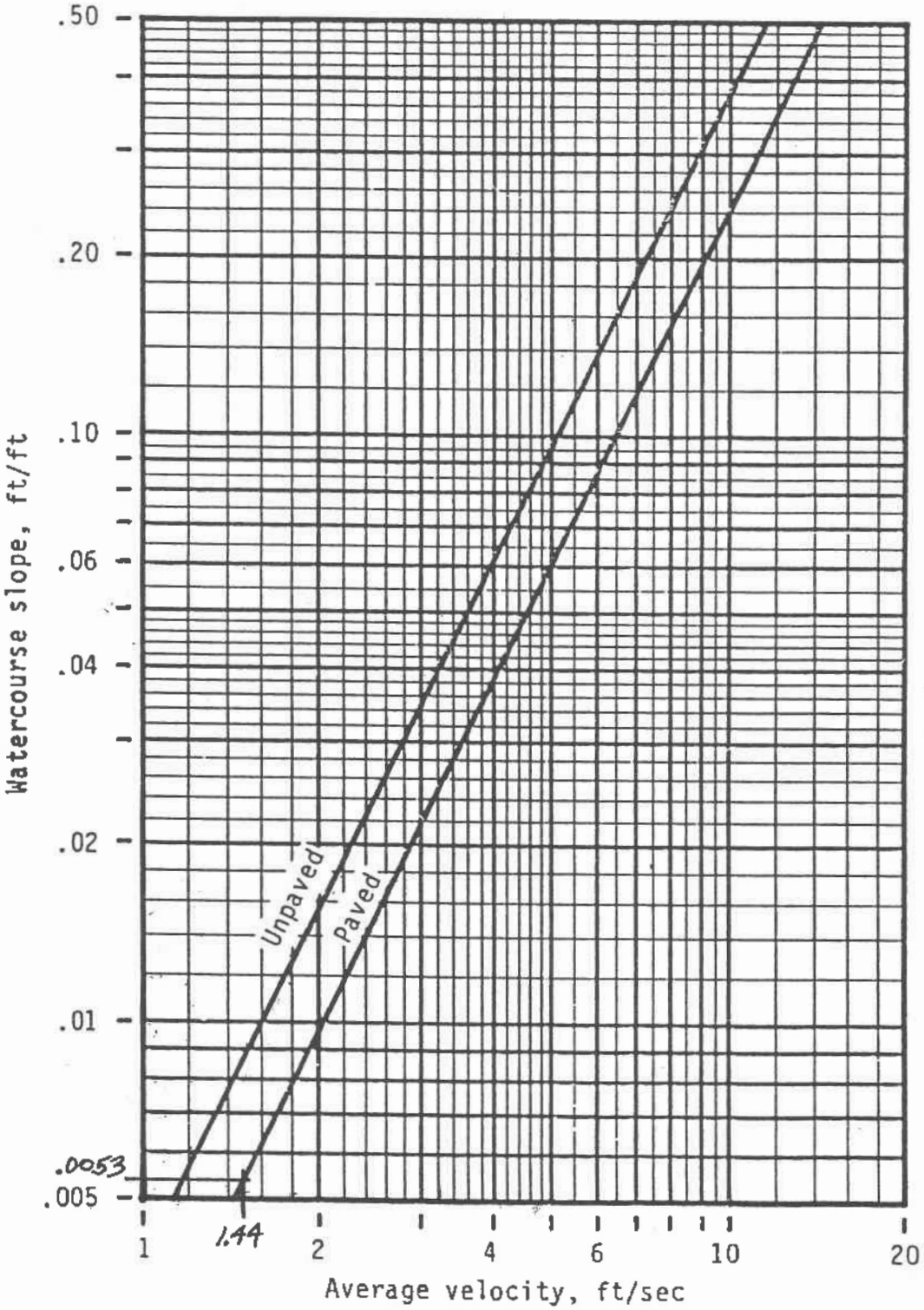


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

Worksheet 4: Graphical Peak Discharge method

Project	By	Date
ANDERSONS Corner	BEK	12-7-07
Location	**Checked**	**Date**
James City Co.	KMS	12/11/07

Check one: ☐ Present ☑ Developed

DJG 2060 810

1. Data

Drainage area ..... 1.04 Ac ..... A_m = 0.001625 mi² (acres/640)

Runoff curve number ..... CN = 80 (From worksheet 2)

Time of concentration ..... T_c = 0.417 hr (From worksheet 3)

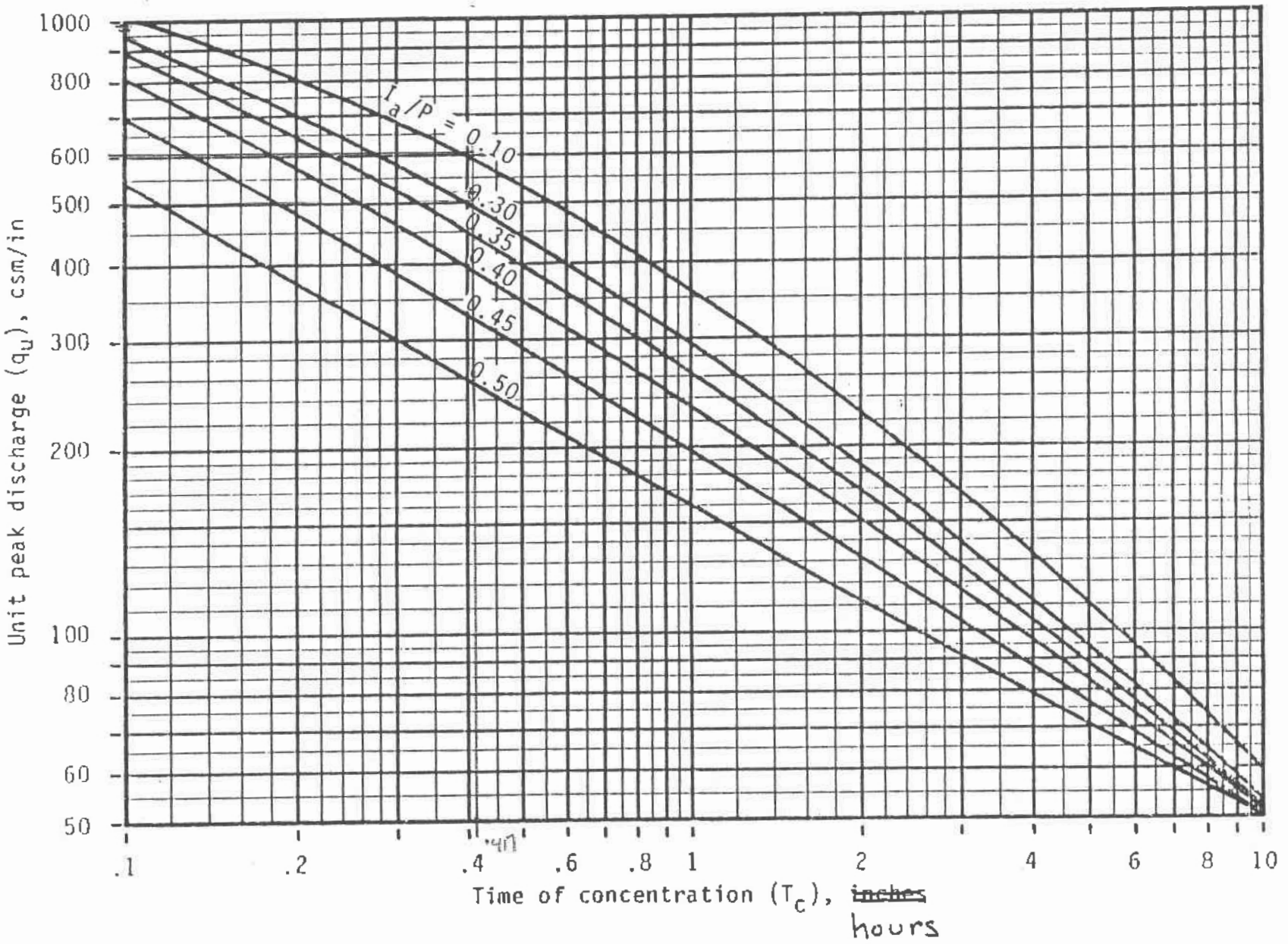
Rainfall distribution ..... = II (I, IA, II III)

Pond and swamp areas sprea throughout watershed ..... = 1 percent of A_m (_____ acres or mi² covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	1 yr	2 yr	10 yr.
3. Rainfall, P (24-hour)	in	2.8	3.5	6.
4. Initial abstraction, I_a (Use CN with table 4-1)	in	0.500	0.500	0.500
5. Compute I_a/P		0.18	0.14	0.08
6. Unit peak discharge, q_u (Use T_c and I_a/P with exhibit 4– II)	csm/in	500	525	600
7. Runoff, Q (From worksheet 2) Figure 2-6	in	1.10	1.64	3.78
8. Pond and swamp adjustment factor, F_p (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond ans swamp area.)		1	1	1
9. Peak discharge, q_p	ft³/s	0.90	1.40	3.69

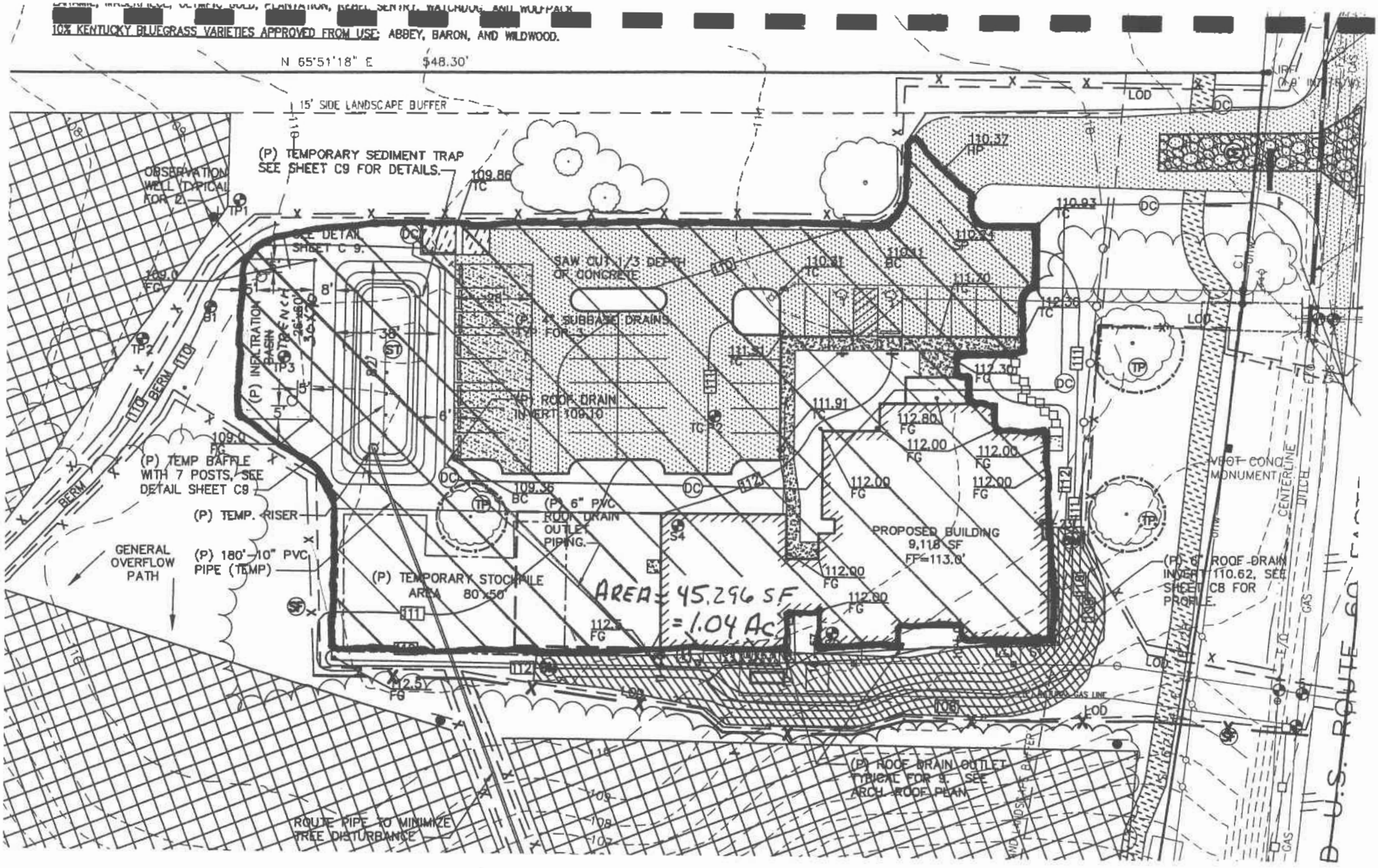
(Where $q_p = q_u A_m Q F_p$)

Exhibit 4-I Unit peak discharge (q_u) for SCS type II rainfall distribution



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

63



AREA FOR WATER QUANTITY

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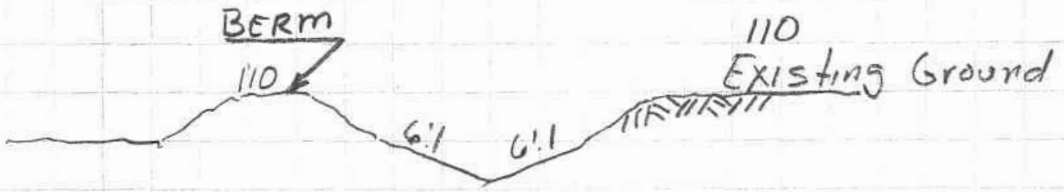
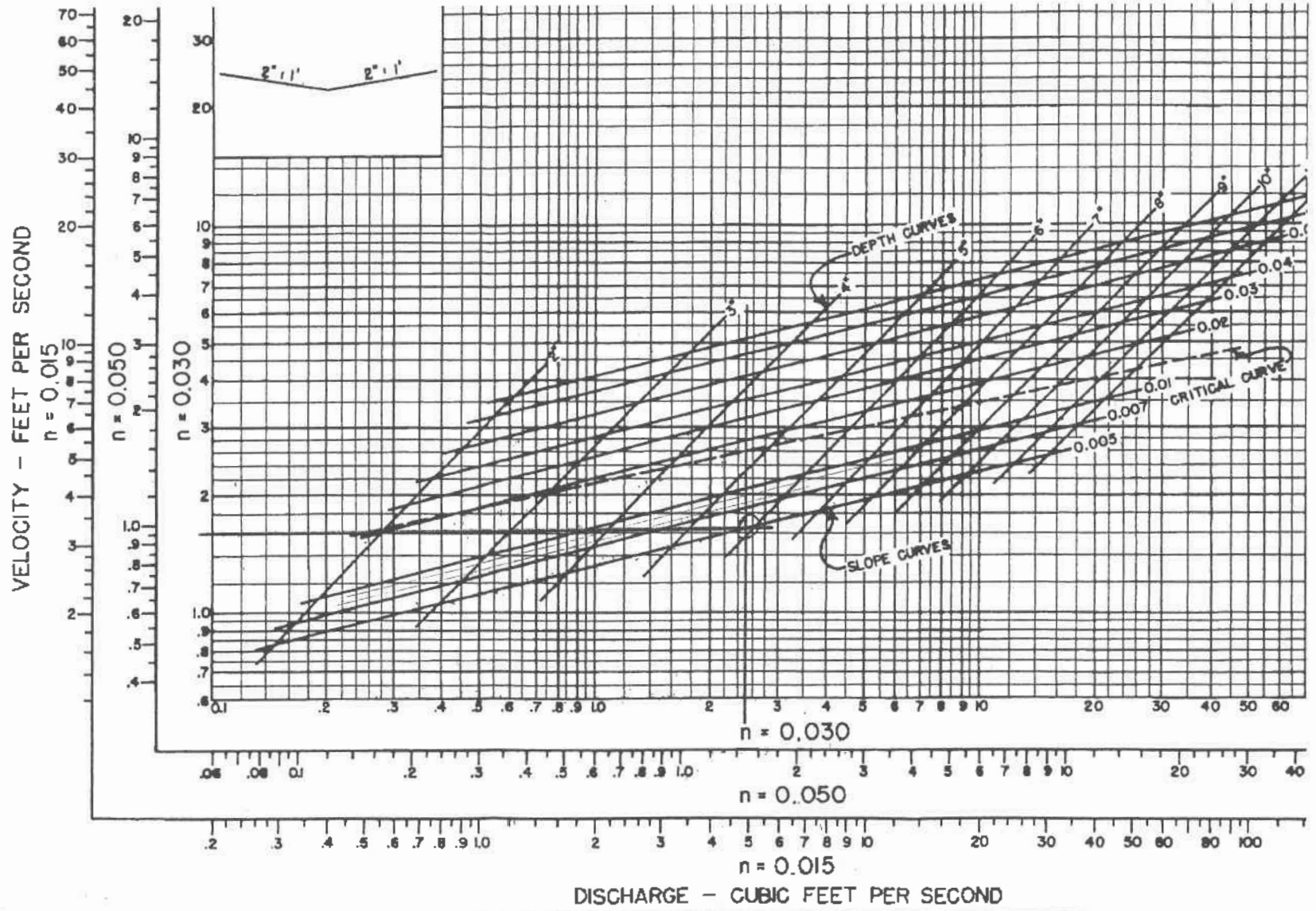
PROJECT ANDERSONS CORNER
DATE 12-7-07 COMM NO. 2060810
CAL BEK CKD KMS PAGE # 65
TITLE Check Proposed Overflow Channel.



Developed $Q_2 = 1.40$ cfs.

Slope = 0.005 ft/ft
"n" = 0.03
D = 6"
V = 1.6 ft/sec

Line channel with EC-3 matting
See sheet C-3



TRIANGULAR MEDIAN DITCH

SIDE SLOPES = 6:1, 6:1

66

VDOT

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PROJECT ACAH
DATE 12/11/07 COMM NO.
CAL KMS CKD BCK PAGE # 67
TITLE

EVALUATE THE ABILITY OF THE STORMWATER MANAGEMENT SYSTEM PROPOSED FOR ANDERSON'S CORNER ANIMAL HOSPITAL TO HANDLE A ONE YEAR, 24 HOUR STORM WITH TOTAL RAINFALL VOLUME OF 2.80 INCHES

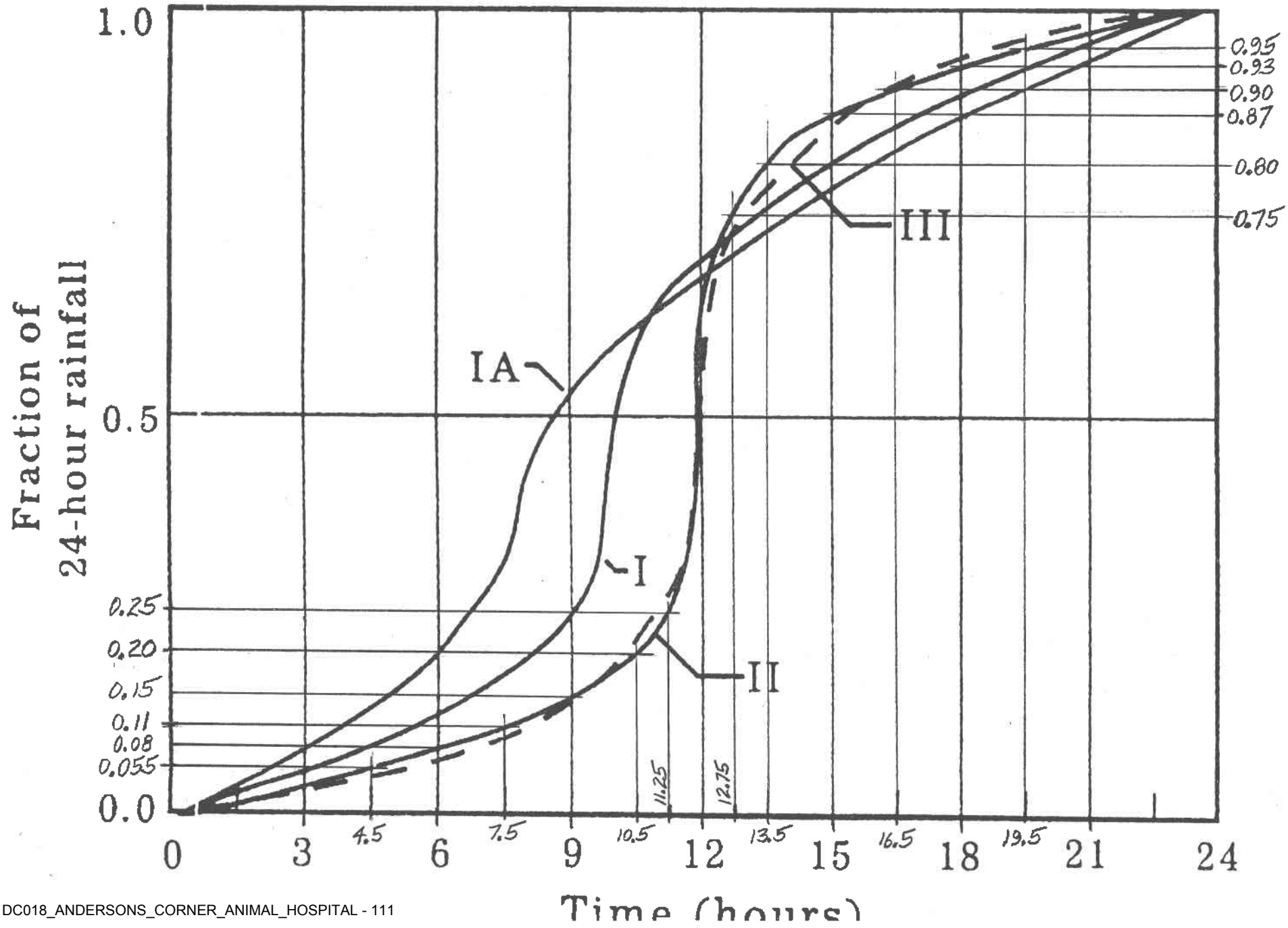
CONSIDER BOTH THE 2000 SQ.FT. OF PERVIOUS PAVEMENT AS WELL AS THE INFILTRATION TRENCH.

STORM RAINFALL DISTRIBUTION TO BE UTILIZED FOR THIS AREA IS A TYPE II DISTRIBUTION PER TR-55, APPENDIX B.

FROM FIGURE B-1 OF TR-55 (see next page), PREPARE A HYDROGRAPH OF RAINFALL INTENSITY (see table on page 3, and graph on page 4)

FOR SUCH A SMALL DRAINAGE AREA (1.04 ACRES) THAT IS PRIMARILY IMPERVIOUS (55%) AND HAS A RELATIVELY LOW TIME OF CONCENTRATION (25 minutes), THE RAINFALL INTENSITY HYDROGRAPH CAN BE USED AS THE RUNOFF HYDROGRAPH WITH PEAK RUNOFF RATE SUBSTITUTED FOR PEAK RAINFALL INTENSITY.

Figure B-1 SCS 24-hour rainfall distributions



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PROJECT ACAH
DATE 12/11/07 COMM NO.
CAL KMS CKD BEK PAGE # 69
TITLE

FOR 24 HOUR RAINFALL = 2.80 INCHES AND A TYPE II RAINFALL DISTRIBUTION –

TIME (HRS)	FRACTION OF 24-HR RAINFALL	RAINFALL QUANTITY (INCHES)	Δ BETWEEN TIMES (INCHES)	RAINFALL INTENSITY (IN/HR)
4.5	0.055	0.154		
			0.070	0.047
6.0	0.08	0.224		
			0.084	0.056
7.5	0.11	0.308		
			0.112	0.075
9.0	0.15	0.420		
			0.140	0.093
10.5	0.20	0.560		
			0.140	0.187
11.25	0.25	0.700		
			0.700	0.933
12.0	0.50	1.400		
			0.700	0.933
12.75	0.75	2.100		
			0.140	0.187
13.5	0.80	2.240		
			0.196	0.131
15.0	0.87	2.436		
			0.084	0.056
16.5	0.90	2.520		
			0.084	0.056
18.0	0.93	2.604		
			0.056	0.037
19.5	0.95	2.660		

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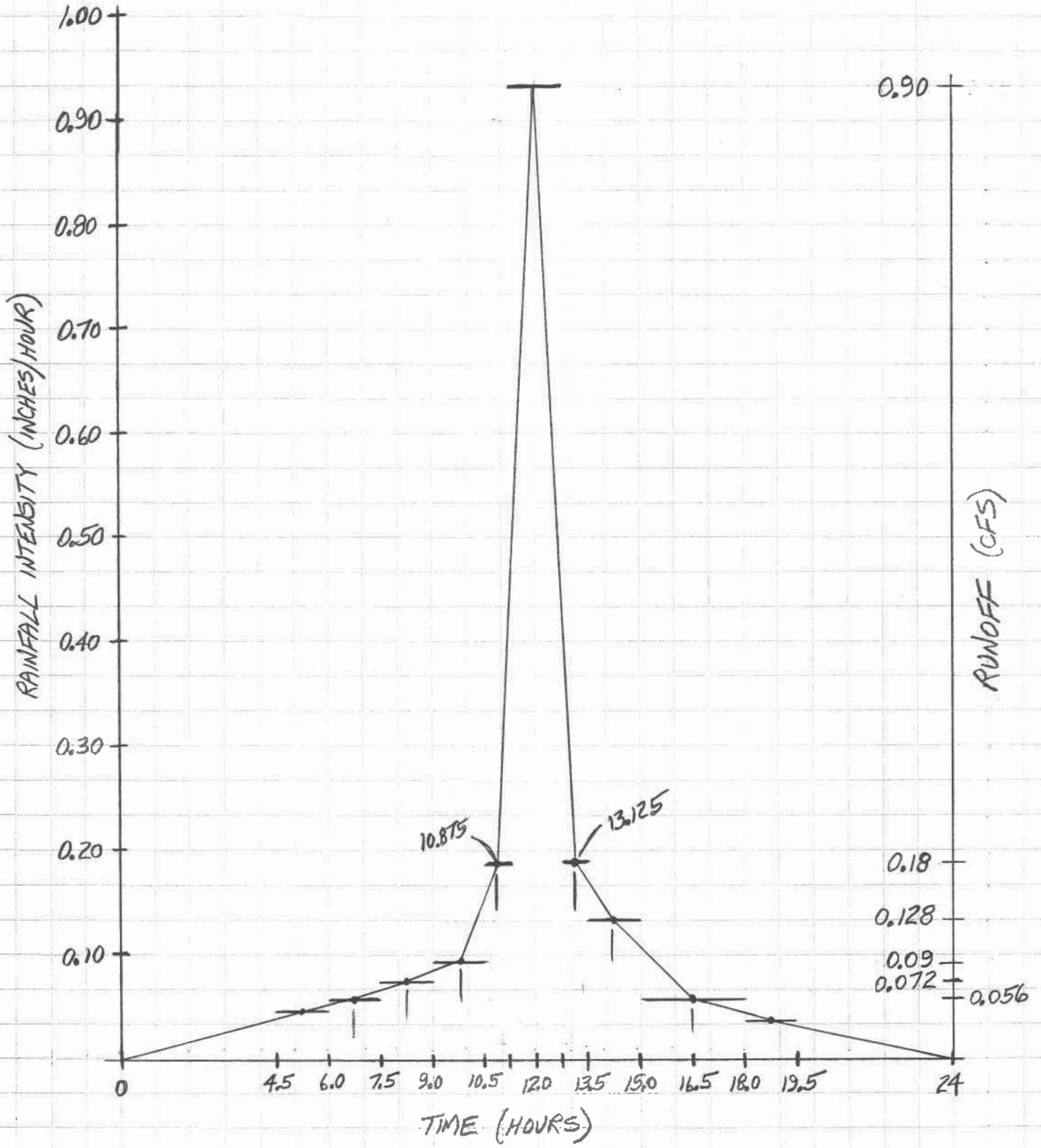
PROJECT ACAH
DATE 12/11/07 COMM NO.
CAL KMS CKD BEK PAGE # 70
TITLE



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PROJECT ACAH
DATE 12/11/07 COMM NO.
CAL KMS CKD BEK PAGE # 71
TITLE

AREA UNDER CURVE EQUALS VOLUME OF RUNOFF:

FROM 0 → 9.75 hours

$$V = (1/2)(6.75)(60)(60)(.056) + (1.5)(60)(60)\left(\frac{.072+.056}{2}\right) + (1.5)(60)(60)\left(\frac{.090+.072}{2}\right)$$

$$V = 680.40 + 345.60 + 437.40$$

$$V = 1463.40 \text{ cu. ft.}$$

using 2000 sq. ft. footprint under pervious pavement,
2100 sq. ft. footprint under infiltration trench
and 1.5 inch/hour infiltration rate

$$(4100)\left[\frac{(1.5)(9.75)}{12}\right] = 4996.88 \text{ cu. ft.}$$ max possible infiltration in this time period

calculated V is smaller, so all runoff from beginning of storm to 9.75 hours into storm will infiltrate

FROM 9.75 hours → 10.875 hours

$$V = (1.125)(60)(60)\left(\frac{.180+.090}{2}\right) = 546.75 \text{ cu. ft.}$$

$$(4100)\left[\frac{(1.5)(1.125)}{12}\right] = 576.56 \text{ cu. ft.}$$ max possible infiltration in this time period

calculated V is smaller, so all runoff in this time frame will infiltrate

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PROJECT ACAH
DATE 12/11/07 COMM NO.
CAL KMS CKD BEK PAGE # 72
TITLE

FROM 10.875 hours → 13.125 hours

$$V = (2.25)(60)(60)(0.18) + (1/2)(2.25)(60)(60)(0.90-0.18)$$

$$V = 1458.0 + 2916.0$$

$$V = 4374 \text{ cu.ft.}$$

$$(4100)\left[\frac{(1.5)(2.25)}{12}\right] = 1153.13 \text{ cu.ft.}$$ will infiltrate during this 2.25 hour time period

the balance (3,220.87 cu.ft.) will go into storage in the stone voids

void volume in stone under pervious pavement

$$(2{,}000 \text{ sq.ft})(1 \text{ ft thick})(0.30) = 600 \text{ cu.ft.}$$

void ratio of VDOT 57 stone

void volume in stone in infiltration trench

$$(30)(70)(4)(0.40) = 3360 \text{ cu.ft.}$$

void ratio of VDOT #1 stone

total void volume available for storage $= 600 + 3360 = 3960$ cu.ft.

since 3220.87 is less than 3960, the runoff volume that does not infiltrate in this time period will be "stored" in the stone

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PROJECT ACAH
DATE 12/11/07 COMM NO.
CAL KMS CKD BEK PAGE # 73
TITLE

FROM 13.125 hours → 14.25 hours

$$V = (1.125)(60)(60)\left(\frac{.180 + .128}{2}\right) = 623.70 \text{ cu.ft.}$$

$$(4100)\left[\frac{(1.5)(1.125)}{12}\right] = 576.56 \text{ cu.ft. will infiltrate during this 1.125 hour time period}$$

the balance (47.14 cu.ft.) will be "stored" in the stone

FROM 14.25 hours → 16.5 hours

$$V = (2.25)(60)(60)\left(\frac{.128 + .056}{2}\right) = 745.20 \text{ cu.ft.}$$

$$(4100)\left[\frac{(1.5)(2.25)}{12}\right] = 1153.13 \text{ cu.ft. will infiltrate during this 2.25 hour time period}$$

no current runoff will be "stored" in the stone and the total amount "stored" will actually drop by 407.93 cu.ft.

FROM 16.50 hours → 24.0 hours

$$V = (1/2)(7.50)(60)(60)(.056) = 756.00 \text{ cu ft.}$$

$$(4100)\left[\frac{(1.5)(7.50)}{12}\right] = 3843.75 \text{ cu.ft. could infiltrate during this 7.50 hour time period}$$

no current runoff will be "stored" in the stone and the total amount "stored" could be reduced by 3843.75 cu.ft.; however, since the volume "stored" in the stone was only 2860 cu.ft. at the start of this time frame, the infiltration trench will simply be empty by the end of the 24 hour storm event

BMP Point Worksheets

Worksheet for BMP Point System
Supporting Calculations

Table 2

Worksheet for BMP Point System (Revised 12-6-07)

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Points		Fraction of Site Served by BMP		Weighted BMP Points
Infiltration Trench	10	x	1.04/6.19	=	1.68
		x		=	
		x		=	
		x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: _____

B. NATURAL OPEN SPACE CREDIT

	Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
RPA	1.11/6.19	x	0.1 (0.1 per 1%)	=	1.79
CONS.	2.70/6.19	x	0.15 (0.15 per 1%)	=	6.54

TOTAL NATURAL OPEN SPACE CREDIT: 8.33

C. TOTAL WEIGHTED POINTS

1.68	+	8.33	=	10.01
Structural BMP Points		Natural Open Space Points		Total

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PROJECT Anderson-Corner Animal Hospital
DATE 12-7-07 COMM NO. 2060810
CAL LS CKD KMS PAGE # 76
TITLE

Values
Developed Site Area: 269,628 SF (6.19 AC)
Proposed Conservation Easement: 117,485 SF (2.70 AC)
RPA Buffer: 48,479 SF (1.11 AC)
Area BMP will handle: 45,542 SF (1.04 AC)

BMP Handles
$\left(\frac{1.04}{6.19}\right)10 =$ 1.68 structural weighted BMP Points

Natural open space credit (1% of total site area = 2,696 ft²)

RPA 1.11/6.19 X .1 = 1.79

Cons. 2.70/6.19 X .15 = 6.54

3.81

8.33 natural open space credit

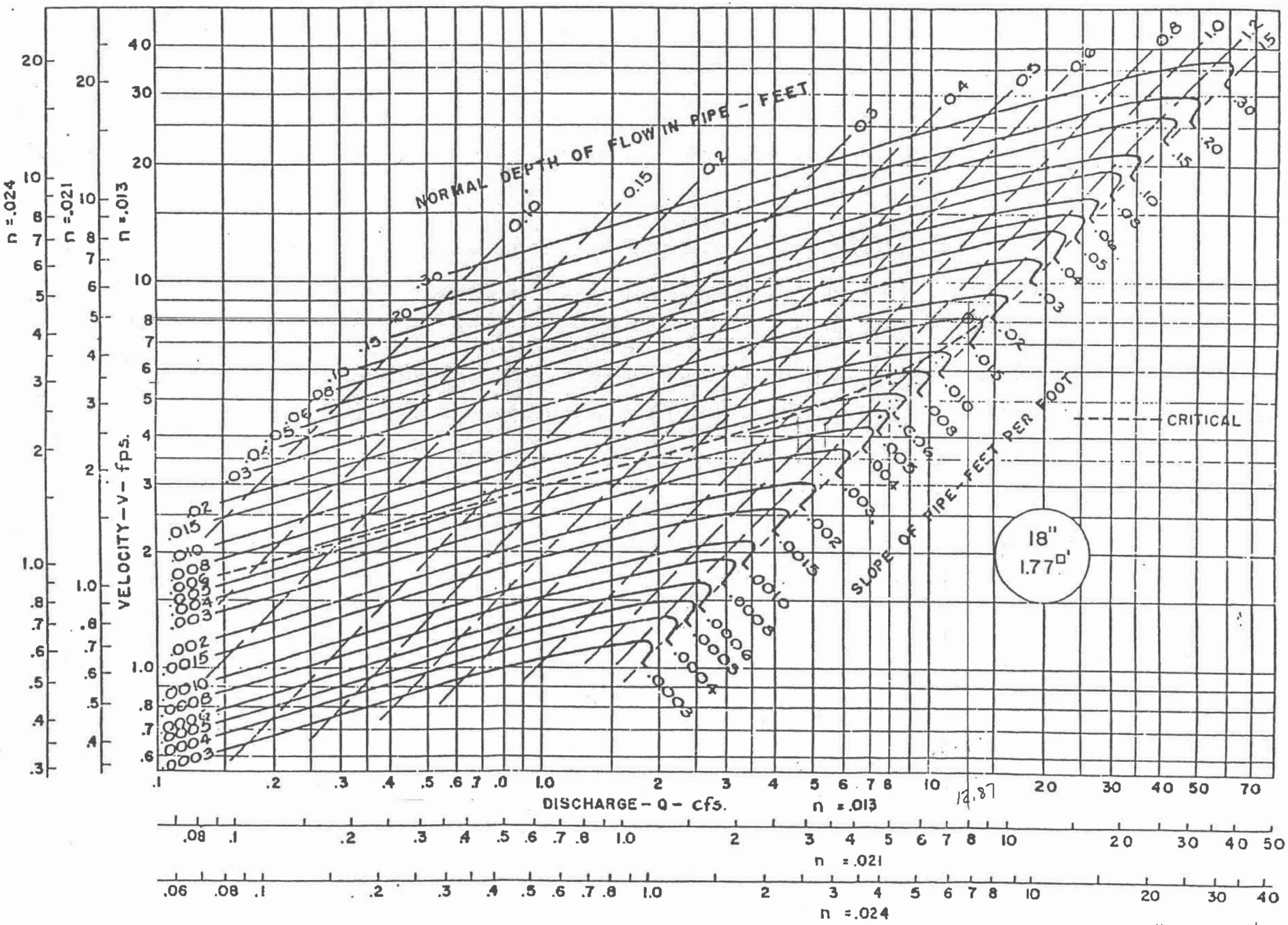
1.68 + 8.33 = 10.01 Total BMP points

Table 1: BMP Point System for evaluating acceptable water quality BMPs and preservation of open space

BMP		Treatment Volume (WQ_v)	Average Total P Removal Efficiency	Points
A.	**WET POND**			
1.	Small Wet Pond	1.5 in / imp acre	40%	6
2.	Wet Pond	2.0 in / imp acre	50%	8
3.	Wet ED Pond	2.0 in / imp acre	60%	10
B.	**WETLANDS**			
1.	Shallow Marsh	1.0 in / imp acre	40%	6
2.	ED Shallow Wetland	1.0 in / imp acre	40%	6
3.	Pond/Wetland System	1.0 in / imp acre	60%	10
4.	Pocket Wetland	1.0 in / imp acre	40%	6
C.	**INFILTRATION (TRENCH OR BASIN)**			
1.	Infiltration Trench	0.5 in / imp acre	50%	8
2.	Infiltration Trench	1.0 in / imp acre	60%	10
3.	Infiltration Basin	0.5 in / imp acre	50%	8
4.	Infiltration Basin	1.0 in / imp acre	60%	10
D.	**FILTERING SYSTEMS**			
1.	Bioretention	1.0 in / imp acre	50%	8
2.	Surface Sand Filter	1.0 in / imp acre	50%	8
3.	Underground Sand Filter	1.0 in / imp acre	50%	8
4.	Perimeter Sand Filter	1.0 in / imp acre	50%	8
5.	Organic Filter	1.0 in / imp acre	50%	8
6.	Pocket Sand Filter	1.0 in / imp acre	40%	6
E.	**OPEN CHANNEL SYSTEMS**			
1.	Wet Swale (check dams)	1.0 in / imp acre	30%	4
2.	Dry Swale	1.0 in / imp acre	60%	10
3.	Biofilters	1.0 in / imp acre	30%	4
F.	**EXTENDED DRY DETENTION**			
1.	Timber Walls	1.0 in / imp acre	30%	4
2.	Dry ED with forebay	1.0 in / imp acre	30%	4
G.	**OPEN SPACE CONSERVATION EASEMENTS**			
1.	Accepts and treats stormwater runoff from the development site per design specification		0.15 per 1% of site area	
2.	Adjacent to a wetland, mature forest, or RPA		0.15 per 1% of site area	
3.	All other open space		0.10 per 1% of site area	

PIPE FLOW CHART 18-INCH DIAMETER

MARYLAND STATE HIGHWAY ADMINISTRATION



12.87

18" Culvert under RT 60

6/61 IV-3-8-5 SHA-61.1-440.18

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PROJECT Anderson's Corner Animal Hosp
DATE 1-10-08 COMM NO. 2060810
CAL BEK CKD PAGE # 79
TITLE Capacity 18" Pipe Under RT 60

INLET Elev. 106.43 Length = 67'
Outlet Elev. 105.43
1.00 Slope = 1.50 %

Capacity EXISTING 18" PIPE.

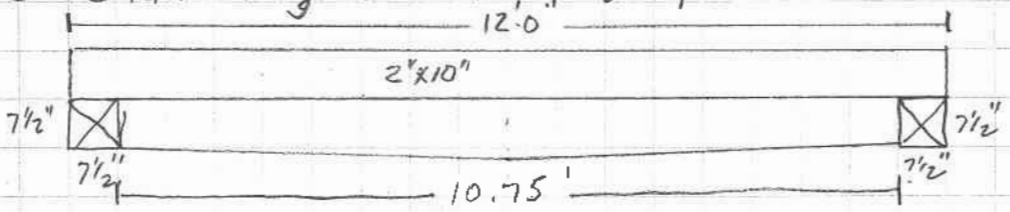
"n" = 0.013

$$Q = \left(\frac{1.486}{n} * A * R^{2/3}\right) S^{1/2}$$

(105.1) (0.1225)

Q = 12.87 cfs. Capacity.

From 18" PIPE chart V = 8.0 fps. outlet Velocity. There is an existing ENERGY DISSIPATER at the end of the Paved Flum. Therefor Outlet Velocity will be Substantially less than 8 fps.



Capacity under Puncheon.

A = 10.75 * 0.625 = 6.72 S.F.
WP = [(0.625)(2)] + 10.75 = 12.00 FT.
$R = \frac{A}{WP} = \frac{6.72}{12.00} = 0.56$

"n" = 0.05 Slope Under Puncheon = 0.0833'/'

Q. capacity = $Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

$$\frac{1.486}{0.05}(6.72)(0.56)^{2/3}(0.0833)^{1/2}$$

Q. = 39.16 cfs. Capacity under Puncheon.

$$V = \frac{1.486}{n} R^{2/3} S^{1/2}$$

= 5.8 fps.

DJG INC.
Committed to Excellence
449 McLaws Circle • P. O. Box 3505, Williamsburg, VA 23187
(757) 253-0673 • Fax (757) 253-2319 • E-Mail: williamsburg@djginc.com
Norfolk - Virginia Beach Area (757) 874-5015

PROJECT Anderson's Corner Animal Hospital
DATE 1-10-08 COMM NO. 2060810
CAL BCK CKD PAGE # 80
TITLE

Assume depth of 3¾" under Puncheon for 18" Pipe Q_{10} of 12.87 cfs.

$A = 10.75 * .3125 = 3.3594$ S.F.

$WP = (10.75) + [2(.3125)] = 11.375$

$R = \frac{A}{WP} = \frac{3.3594}{11.37} = .2953$

Slope under Puncheon = 0.0833'/'

'n' = 0.05

$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

$(29.72)(3.3594)(0.2953)^{2/3}(0.0833)^{1/2}$

$(29.72)(3.3594)(0.4434)(0.2886)$

$Q = 12.77$ cfs $\approx$ 12.87 cfs.

$V = \frac{1.486}{n} R^{2/3} S^{1/2}$

= 3.8 f.p.s. without the Existing Energy Dissipater.

Summary ≡ Available area for existing Q(12.87 cfs @ 3.8 fps) 6.72 S.F.

Area under Puncheon used to convey Qexisting 3.36 S.F.

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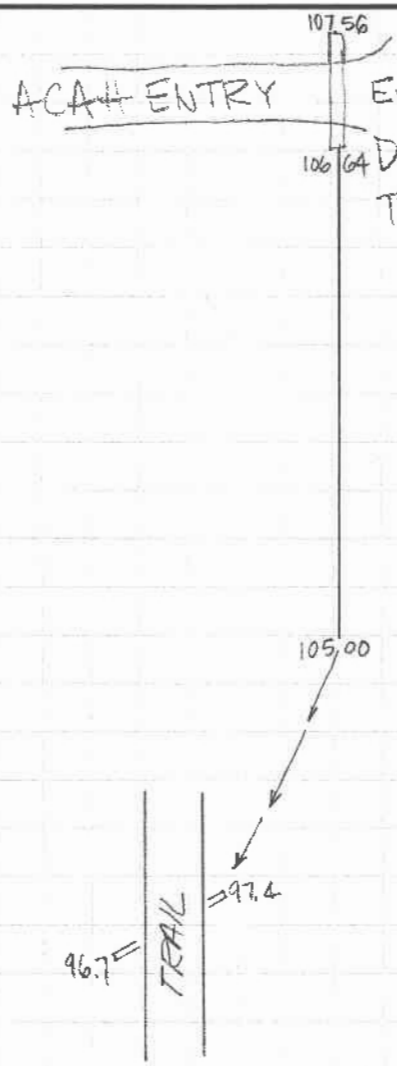
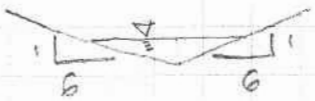
PROJECT ACAH
DATE 1/10/08 COMM NO. 2060810
CAL LJS CKD PAGE # 81
TITLE Pipe under 8' Trail



Existing 15" RCP Class III under driveway S = .008'/'
Discharge 2.1 cfs @ 3 fps
Tc 5'41" to end of pipe

V ditch 140'
S 1.18%
n .05
A .33 acre
Q 2.6 cfs
D 0.58'
V 2.8 fps
Tc 6'31"



D = .58'
A = 2.02 SF
$R = \frac{A}{WP} = \frac{2.02}{7.06}$

$V = \frac{1.486}{.05}(2.02)(.28)^{2/3}(.0118)^{1/2} = 2.8 \text{ fps}$

$= 29.72(2.02)(.43)(.11) = 2.8 \text{ fps}$

Overland Flow 102'
S 7.45%
n 0.07
A 0.12 acre
Q 2.7 cfs sheet flow to inlet
6" Riprap at both ends
V 2.0 fps
Tc 6'56"

Use HDPE Pipe 18" A 1.77 SF
n 0.01
S 5.00%
Q capacity 9.1 cfs
actual 2.9 cfs @ 4.3 fps
Sheet flow to channel 145' away

or
3 - 8" PVC or HDPE for equivalent capacity.

ECS LLC

MID-ATLANTIC

REPORT OF

SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING ANALYSIS

ANDERSON'S CORNER ANIMAL HOSPITAL
JAMES CITY COUNTY, VIRGINIA

FOR

DJG

Mr. Larry Slaughter

October 12, 2007

ECS Project No. 07:9386

ECS MID-ATLANTIC, LLC
Geotechnical • Construction Materials • Environmental • Facilities

October 12, 2007

Mr. Larry Slaughter
DJG
449 McLaws Circle
Williamsburg, Virginia 23185

ECS Project No. 07:9386

Reference: Subsurface Exploration and Geotechnical Engineering Analysis
Anderson's Corner Animal Hospital
James City County, Virginia

Dear Mr. Slaughter,

ECS Mid-Atlantic, LLC has completed a subsurface exploration and engineering evaluation of the above referenced project. This report presents the results of the subsurface exploration and engineering analyses for the proposed new animal hospital building, parking with associated access roadways, and BMP. This portion of the project has been completed in accordance with our proposal No. 07:13487 dated September 20, 2007 and signed by you.

Introduction:

The project site is located at 8391 Richmond Road in James City County, Virginia. We understand the project will consist of the construction of a new 9,328 square foot building, BMP, and parking with associated access roadways. We have also been requested to perform utility location. Due to the time sensitive nature of the report, the utilities had not been located at the time the report was written. When the utilities are located an addendum letter will be issued with the locations identified. The property contained an existing house and was relatively level with scattered trees and vegitation. We understand the existing house will be demolished to accommodate the new construction. We have assumed the column and wall loads will not exceed 60 kips and 4 kips per linear foot, respectively. If the assumed loads exceed this amount, ECS should be contacted and a revised report will be issued.

The purpose of this exploration was to explore the soil and groundwater conditions at the site and to develop soils-related engineering recommendations to guide design and construction of the planned building. Our investigation included drilling nine (9) soil test borings to explore the subsurface soil and groundwater conditions, performing a site reconnaissance to observe general topography, and analyzing field data to develop appropriate geotechnical engineering recommendations regarding the planned construction. A Boring Location Plan is included in Appendix I.

Field Exploration Procedures:

Four (4) soil test borings were drilled at the proposed building location (S-1 through S-4), three (3) soil test borings were drilled at the proposed BMP (TP-1 and TP-3), and two (2) soil test boring were drilled in the parking areas (P-1 and P-2). The soil test borings were performed with an ATV mounted drill rig utilizing continuous flight auger techniques. The boring locations were selected, located, and staked by personnel from DJG. A boring location plan is included in Appendix I.

Representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2-inch outside diameter split-barrel sampler is driven into the soil a distance of 24 inches by a 140-pound hammer falling 30 inches. After a 6-inch seating interval, the number of blows required to drive the sampler through the next 12-inch interval is termed the Standard Penetration Test (SPT) value and is indicated for each sample on the boring log. This value can be used as a qualitative indication of the in-place relative density and relative consistency of non-cohesive soils and cohesive soils, respectively. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

Field logs of the soils encountered in the borings were maintained by the drill crew. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were sealed in glass jars and delivered to our laboratory in Williamsburg, Virginia, for further visual examination and laboratory testing.

One (1) bulk soil sample was taken from the proposed roadway at the existing elevations. These soils were returned to the laboratory for California Bearing Ratio (CBR) testing. Laboratory results are summarized in Appendix III.

Subsurface Conditions:

Experienced personnel from our office classified each soil sample in accordance with the Unified Soil Classification System (USCS). Select samples from the test borings were subjected to classification testing to confirm our visual classifications. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. The geotechnical engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in situ, the transitions may be gradual. A brief explanation of the USCS and a Reference Notes for Boring Log sheet is provided in Appendix IV of this report.

Our subsurface exploration and site reconnaissance determined that the site is covered with approximately 3 to 4 inch of topsoil. Underlying the topsoil, we encountered mixed deposits of very loose to dense density Silty and Clayey SAND (SM, SC) extending to boring termination

DC018_ANDERSONS_CORNER_ANIMAL_HOSPITAL - 127

depths of 6 to 15 ft below existing ground surface (bgs). The Standard Penetration Test (SPT) N-values recorded for these layers ranged from 5 to 18 blows-per-foot (bpf).

Groundwater was not encountered at the boring locations. Please note that groundwater levels are influenced by seasonal conditions and by periods of significant precipitation or prolonged drought. Due to the presence of near surface fine grained soils, a perched water condition is possible. If ground water is encountered, we recommend it be pumped from sumps located below the bottom of foundation elevation.

Subgrade Preparation and Earthwork Operations:

The depth of topsoil recorded at the boring locations ranged from 3 to 4 inches. However, the depth of disturbance during clearing operations typically extends below the organic depths encountered. Therefore, for project planning purposes, we recommend a 6 inch stripping depth for this site to remove topsoil, or organic laden material. Isolated areas may require further cuts of an additional 12 to 18 inches or more due to tree stumps and heavy root mat from existing trees. Other areas may require an additional 12 to 18 inches to undercut very soft near surface soils as encountered. We recommend stripping of any organic or unstable material. The stripping depth should be evaluated at the time of construction by representatives of the Geotechnical Engineer. If additional stripping becomes necessary, suitable methods should be employed to determine additional stripping depths beyond the contract depth (such as elevations determined before and after additional stripping, etc.). If undercuts are recommended and extend into large areas, the undercut volume could be reduced by the use of geotextiles or geogrids. The use of geosynthetic reinforcement should be evaluated by the geotechnical engineer. Cut and fill operations should extend a minimum of 5 feet beyond the project limits.

After stripping or cutting to the desired grade, and prior to fill placement, subgrades should be observed by the Geotechnical Engineer. In an effort to densify any loose surficial subgrade soils, the stripped area should be proofrolled with a smooth drum roller with a minimum of two passes in two perpendicular directions, provided in-situ moisture contents are within $\pm 3\%$ of optimum in order to facilitate compaction.

Any soft or unsuitable materials encountered, which cannot be stabilized by reworking the soil, should be removed and replaced with an approved structural fill. Undercut volumes should be determined by cross-sectioning the area before and after undercut. We have found that calculating undercut volumes by truck counts is less accurate and generally results in additional expense to the owner. In order to minimize undercutting and issues during earthwork activities, we recommend earthwork operations be performed during the drier times of the year.

We recommend the contract documents include an allowance for undercutting and/or reworking soft near surface soils (if encountered) and replacement with engineered fill. Add/deduct unit prices should also be established so adjustment for the actual volume of undercut can be made.

Proposed BMP's:

Based on the provided plan, the borings are located within 1 different BMP's . We have assumed that the BMP will be mostly in cut areas, and there will not be a need for an earthen dam. In the event fill is required, we recommend that any fill material be placed in horizontal lifts not exceeding 8 inches in loose thickness, moisture conditioned to within -1% to +3% of the optimum moisture content, and compacted to a minimum 95% of the maximum dry density obtained in accordance with ASTM Specification D-698, Standard Proctor method. Slopes should be constructed no greater than 3 horizontal to 1 vertical. Also, the side slopes should be seeded to promote vegetation growth and further add to the stability of the slopes.

Infiltration

The in-situ Field Permeability Rates were established utilizing the Guelph Permeameter Model 2800K1 near Boring Location TP-3. The 2800K1 Permeameter is a constant-head device, which operates on the Mariotte siphon principle and provides a method for determining field saturated hydraulic conductivity. We didn't have any information with respect to estimated depths to perform this test, accordingly we performed the test within a uniform soil layer. We observed an infiltration rate of 3.0 in/hr as measured utilizing the Guelph Permeameter at a depth of 2.5 feet below the existing ground surface. Similar material was encountered to the depths explored except for some interebedded layers of slightly less permeable material as indicated in the below table. Accordingly, some fluctuation in the permeability rates may be encountered depending on fines content and stratification of the soil subgrades.

The following table summarizes infiltration rates based on the USDA textural classification, laboratory tests, and field permeability tests. Two basic soil strata were encountered at boring locations:

Boring Location	Soil type I depth (feet)	Soil type II Depth (feet)	Water Table Depth (feet)
TP-1	0-8;13-15	8-13	-
TP-2	0-2;4-15	2-4	-
TP-3	0-15	-	-

Notes: - Not encountered

Typically, soils with the Hydrologic Soil Group designations of A and B are considered suitable for infiltration purposes. Some soils designated as C type soils are considered suitable for infiltration practices but these soils would need to be evaluated on a case specific basis. Soils with group designations of D are not considered suitable.

The water table was not encountered through the depths explored of 15 feet below existing ground surface. Accordingly we do not believe a fluctuation in the ground water table or a seasonal high elevation will exceed or impact the depths explored. Further, based on the subsurface soils and our in-situ testing, we do not believe a perched ground water table will be encountered.

Construction Considerations:

The subgrade materials are moisture sensitive, and exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time; therefore, foundation concrete (or flowable fill) should be placed the same day that foundations are excavated. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, we recommend that a 1- to 3-inch thick "mud mat" of lean concrete be placed on the bearing soils before the placement of reinforcing steel.

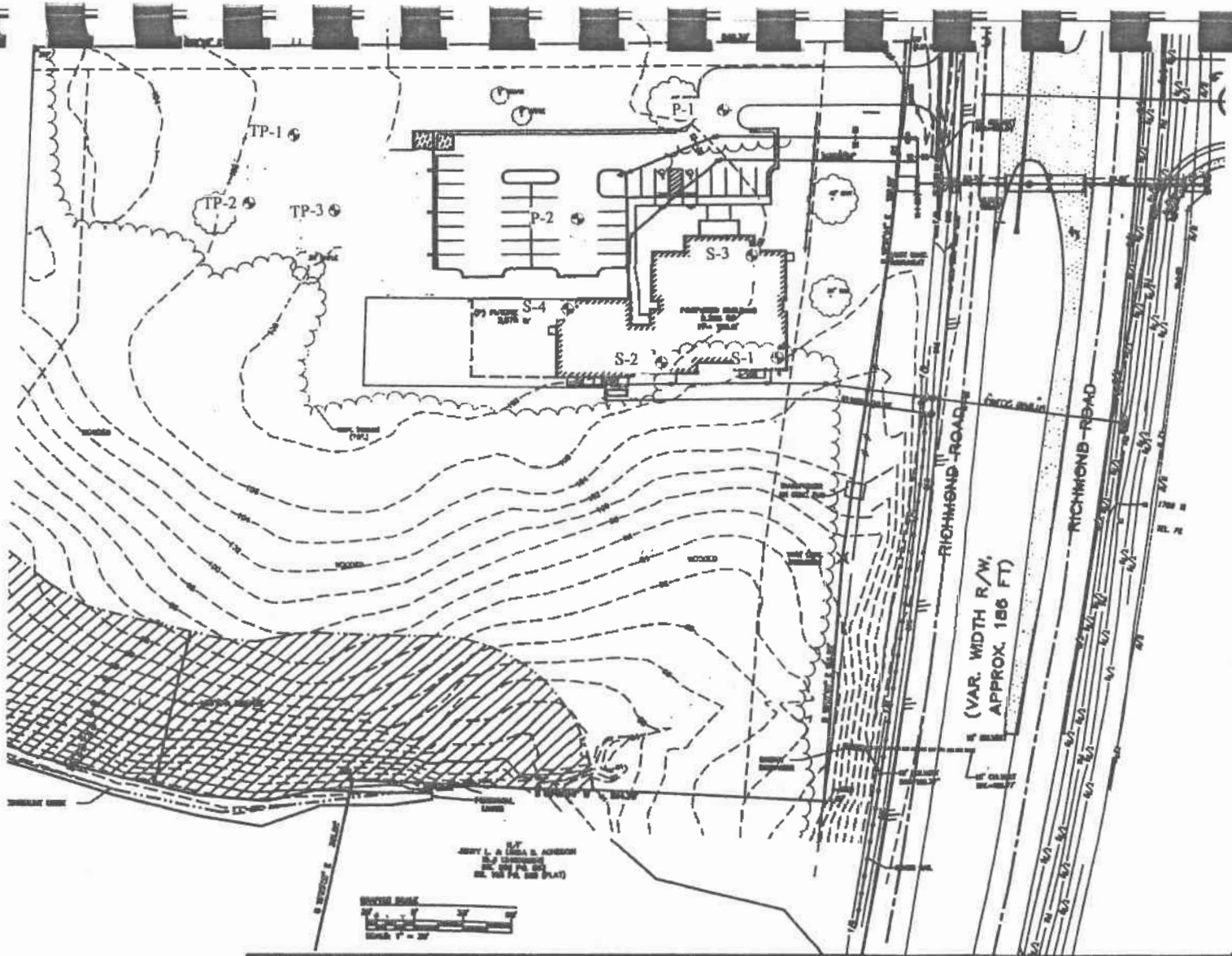
In a dry and undisturbed state, the soil at the site will provide good subgrade support for fill placement and construction operations; however, when wet, this soil will degrade quickly with disturbance from contractor operations. Good site drainage should be maintained during earthwork operations which would help maintain the integrity of the soil.

Proper compaction control of fill is an important aspect of this project. Therefore, we recommend that all fill operations be observed full-time by a qualified soil technician to determine if minimum compaction requirements are being met.

We encountered groundwater during drilling of the borings. We do not anticipate that ground water will impact foundation construction. Due to the presence of near surface fine grained soils the potential for a perched water condition is present. If ground water is encountered, we expect that dewatering in shallow trenches could be accomplished by pumping from sumps adjacent to the construction excavations. The specifications should, however, alert the contractor to the potential presence of subsurface water, and it should be incumbent on the contractor to provide the means by which to satisfactorily dewater the site.

General Comments:

This report has been prepared in order to aid in the evaluation of this site and to assist the Contractor, Architect and Engineer in the design and planning of the project. The report scope is limited to the specific project and location described, and the project description represents our understanding of the significant aspects relevant to soil and foundation characteristics.



LEGEND:

⊕ – APPROX. BORING LOCATION

*Base plan provided by DJG

ECS LLC MID-ATLANTIC	ECS Mid-Atlantic 108 Ingram Road, Unit 1 Williamsburg, Virginia 23188 Ph (757) 229-6677 Fax (757) 229-9978	BORING LOCATION PLAN Anderson's Corner Animal Hospital James City County, Virginia	CHECKED: D.J.G.	SCALE: N.T.S.	DATE: 9/24/07	FIGURE: Fig. 1
			DRAWN: J.A.R.	PROJECT NO. 07:9386		

CLIENT	JOB #	BORING #	SHEET
DJG	07:9386	TP-1	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Anderson's Corner Animal Hospital	DJG

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County

CALIBRATED PENETROMETER TONS/FT.^{2}: 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	18	TOPSOIL DEPTH 1"	11 (4-5-6-5)
	2	SS	24	20	Fine to Medium Silty SAND, Trace Organics Sampled as Root Fragments, Brown, Moist, Medium Dense, (SM)	7 (3-3-4-4)
5	3	SS	24	24	Fine to Medium Silty SAND, Orange-Brown to Tan to Orange-Brown, Moist, Loose to Very Loose to Loose, (SM)	5 (2-3-2-4)
	4	SS	24	24		6 (3-3-3-4)
	5	SS	24	18	Fine to Medium Clayey SAND, Orange-Brown, Moist, Loose, (SC)	10 (4-5-5-6)
10						
	6	SS	24	24	Fine Medium Silty SAND, Orange-Brown, Moist, Medium Dense, (SM)	18 (5-8-10-13)
15					END OF BORING @ 15.00'	
20						
25						
30						

WATER LEVELS — ELEVATION (FT)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL DRY — WS OR WD	BORING STARTED 9/26/07	
WL(BCR) — WL(ACR)	BORING COMPLETED 9/26/07	CAVE IN DEPTH @ 14.0
WL	RIG ATV — FOREMAN FDI	DRILLING METHOD AUGER

CLIENT	JOB #	BORING #	SHEET
DJG	07:9386	TP-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Anderson's Corner Animal Hospital	DJG

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County

CALIBRATED PENETROMETER TONS/FT.^{2}: 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	16	TOPSOIL DEPTH 1"	9 (3-4-5-5)
	2	SS	24	19	Fine to Medium Silty SAND, Trace Organics Sampled as Root Fragments, Brown, Moist, Loose, (SM)	7 (3-4-3-4)
5	3	SS	24	18	Fine to Medium Clayey SAND, Trace Organics Sampled as Root Fragmets, Orange-Brown, Moist, Loose, (SC)	5 (3-2-3-3)
	4	SS	24	24		7 (3-4-3-4)
	5	SS	24	20	Fine Medium Silty SAND, Orange-Brown, Moist, Very Loose to Loose to Medium Dense, (SM)	9 (3-4-5-6)
10						
	6	SS	24	21		11 (4-5-6-6)
15					END OF BORING @ 15.00'	
20						
25						
30						

WATER LEVELS — ELEVATION (FT)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL DRY — WS OR WD	BORING STARTED 9/26/07	
WL(BCR) — WL(ACR)	BORING COMPLETED 9/26/07	CAVE IN DEPTH @ 14.0
WL	RIG ATV — FOREMAN FDI	DRILLING METHOD AUGER

JAR (09-26-07) JAR (09-28-07) JAR (10-11-07) JAR (10-11-07)

CLIENT	JOB #	BORING #	SHEET
DJG	07:9386	TP-3	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Anderson's Corner Animal Hospital	DJG

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County

CALIBRATED PENETROMETER TONS/FT.^{2}: 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	20	TOPSOIL DEPTH 1"	8 (2-4-4-5)
	2	SS	24	18	Fine Medium Sandy SAND, Trace Organics Sampled as Root Fragments, Brown, Moist, Loose, (SM)	9 (3-4-5-5)
5	3	SS	24	19	Fine to Medium Silty SAND, Tan to Orange-Brown, Moist, Loose, (SM)	10 (4-5-5-5)
	4	SS	24	24		10 (4-5-5-6)
	5	SS	24	20		9 (4-5-4-5)
10						
	6	SS	24	19		13 (4-6-7-9)
15					END OF BORING @ 15.00'	
20						
25						
30						

WATER LEVELS — ELEVATION (FT)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL DRY — WS OR FD	BORING STARTED 9/26/07	
WL(BCR) — WL(ACR)	BORING COMPLETED 9/26/07	CAVE IN DEPTH @ 14.0
WL	RIG ATV — FOREMAN FDI	DRILLING METHOD AUGER

James City County Environmental Division
Stormwater Management / BMP Inspection Report
Infiltration Basin and Trench Facilities

County BMP ID Code (if known): DC-018

Name of Facility: INFILTRATION TRENCH BMP No.: 1 OF 1 Date: 7/20/2010

Location: ANDERSON'S CORNER ANIMAL HOSPITAL

Name of Owner: DAVID NICE BUILDERS

Name of Inspector: M. MAJDESKI

Type of Facility: INFILTATION TRENCH ; COUNTY TYPE C-2

Weather Conditions: SUNNY 85° Type: ☑ Final Inspection ☐ County BMP Inspection Program ☐ Owners Inspection

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

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

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

Facility Item	O.K.	Routine	Urgent	Comments
Accessibility:				
Roads	✓			
Parking Areas	✓			
Gates	✓			
Locks	✓			
Safety Fencing	✓			
Observation Wells/Areas:				
Trap Doors	N/A			
Manhole Covers	✓			
Grates	N/A			
Steps	N/A			
Pretreatment Devices: ☐ Inlet ☐ Sump ☐ Forebay ☑ Other - GRASS FILTER STRIP / PERVIOUS PAVERS				
Sediment	✓			
Trash & Debris	✓			
Structure	✓			
Other				

Facility Item	O.K.	Routine	Urgent	Comments
Primary Storage/ Infiltration Area:				
Trash & Debris	✓			
Sediment	✓			
Ponding / Drawdown	N/A			
Surface Aggregates	✓			
Aesthetics	✓			
Other	N/A			
Inlet Structure # 1 (Describe Location): N/A				
Condition of Structure				
Erosion				
Trash and Debris				
Sediment				
Aesthetics				
Other				
Inlet Structure # 2 (Describe Location): N/A				
Condition of Structure				
Erosion				
Trash and Debris				
Sediment				
Aesthetics				
Other				
Inlet Structure # 3 (Describe Location): N/A				
Condition of Structure				
Erosion				
Trash and Debris				
Sediment				
Aesthetics				
Other				
Outlets - Overflow or Bypass Control Structures (Describe Location):				
Condition of Structure				
Erosion				
Trash and Debris				
Sediment				
Other				
Nuisance Type Conditions:				

Facility Item	O.K.	Routine	Urgent	Comments
Mosquito Breeding	✓			
Animals, Rodents	✓			
Graffiti	✓			
Other				
Perimeter (Contributing Drainage Area) Conditions:				
Stabilization	✓			
Vegetation Condition	✓			
Trash and Debris	✓			
Aesthetics	✓			
Other				

Remarks:

-NONE-

Overall Environmental Division Internal Rating: 4/5

Signature: [illegible] **Date:** 7/20/2010

Title: SR. ENVIRONMENTAL INSPECTOR

SWMProg\BMP\CoInspProg\SubDetInfil.wpd

Parcel ID	1240100001	RPC Number	15339
Property Address	8391 RICHMOND ROAD	Election District	Stonehouse
Property City	TOANO	VA House District	1
Property State	VA	Census Tract #	804.01
Property Zip Code	231689207	Polling Place	Toano Middle School
Owner	ACAH LLC	Voting Precinct	Stonehouse A
Owner (Cont'd)		Elementary School	Stonehouse
Owner Mail Address	113 ASTRID LANE	Middle School	Toano
Owner Mail City	WILLIAMSBURG	High School	Warhill
Owner Mail State	VA	Primary Service Area	Yes
Owner Mail Zip Code	231881002	Agricultural/Forrest Dist	
Neighborhood Name	A-1 / 20-Less Than 100 Acres	Agricultural/Forrest Dist Number	
Zoning	A1	Foundation	Full Crawl
Property Class Description	Agricultural 20-99 acres	Roof Material	Comp sh to 235#
Acres	34.26000	External Covering	Alum siding
Legal Description	HICKORY NECK SPRING	Fire Place	Y
Story Height	1.00000	Heat Description	Forced hot air
Improvement Size for Record 1	1420	Central A/C	N
Year Built	1900	Total Basement Area	0
# Rooms	5	Finished Basement Area	0
# Bed Rooms	3	Attached Gar SqFt	0
# Half Baths	0	Detached Garage SqFt	0
# Full Baths	2	Enclosed Porch SqFt	0
Open Porch SqFt	0	Deck SqFt	0
Out Building #1	Residential Detached Garage	Out Building #2	
Out Building #3		Out Building #4	
Land Value (7/1/2007)	$385,400	Prev Land Value (7/1/2006)	$293,700
Improvement Vaue (7/1/2007)	$40,500	Prev Improv. Value (7/1/2006)	$40,500
Total Value (7/1/2007)	$425,900	Prev Total Value (7/1/2006)	$334,200
Previous Owner	STEWART, PATRICIA ANNE TRUSTEES & OW	2nd Prev Land Value (7/1/2005)	$216,900
Last Sale Date	07/28/2006	2nd Improv. Value (7/1/2005)	$40,500
Last Sale Amount	$487,500	2nd Total Value (7/1/2005)	$257,400
Doc # or Deed Book/Pg	060018437	.	
Second Previous Owner	OWENS, ETHEL I	Third Previous Owner	OWENS, WALTER D
Second Last Sale Date	11/14/2000	Third Last Sale Date	08/26/1993
Second Last Sale Amount	$0	Third Last Sale Amount	$0
Second Doc # or Deed Book/Pg	000021664	Third Doc # or Deed Book/Pg	0

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Permit Administration and Review System (PARS)

Edit SWMF: #DC018

SWMF successfully created. Click here to create a new SWMF at this site based on this SWMF.

SWMF Information

Site:	Andersons Corner Animal Hospital (Number: SP-021-07)
SWMF Id:*	DC018
DCR Classification:*	General Infiltration Practices
Ownership Type:*	Private
Predominant HUC:*	JL27 - Diascund Creek-Mill Creek
Local Watershed ID:	DC
Predominant Land Use Type:*	Neighborhood Commercial
Inspection Frequency (days):*	365
Contributing Drainage Area (ac):*	0.57
Nitrogen Removed (lbs/yr):*	0.001
Phosphorous Removed (lbs/yr):*	0.001
Has Maintenance Agreement:*	○ No ◉ Yes ○ N/A (e.g., schools)
Latitude:*	37.3945007597805
Longitude:*	-76.806492805481 Show/Find On Map
SWMF Status:*	Active
Date Online:	4/21/2010
Date of Last Inspection:	7/20/2010 (date last inspected before SWMF was entered into PARS)
Scheduled Inspection Month:	--Not Selected--

RESOLUTION

CASE NO. SUP-14-07: ANDERSON'S CORNER ANIMAL CARE FACILITY

WHEREAS, the Board of Supervisors of James City County has adopted by ordinances specific land uses that shall be subjected to a special use permit process; and

WHEREAS, the applicant has proposed to construct a 12,000 square foot veterinary hospital and kennel facility; and

WHEREAS, the property is currently zoned A-1, General Agriculture, and is designated General Industry on the 2003 Comprehensive Plan Land Use Map; and

WHEREAS, the property is located at 8391 Richmond Road on property more specifically identified as Parcel No. (1-1) on the James City County Real Estate Tax Map No. (12-4); and

WHEREAS, on June 6, 2007, the Planning Commission recommended approval of the application by a vote of 7-0.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, does hereby approve the issuance of SUP-14-07 as described herein with the following conditions:

1. This Special Use Permit shall be valid for a 12,500 square foot veterinary hospital and kennel facility. Development of the property shall be generally in accordance with the submitted master plan as determined by the Development Review Committee of the James City County Planning Commission. Minor changes may be permitted by the DRC, as long as they do not change the basic concept or character of the development.

2. A Phase I Archaeological Study for the disturbed area shall be submitted to the Director of Planning for review and approval prior to land disturbance. A treatment plan shall be submitted and approved by the Director of Planning for all sites in the Phase I study that are recommended for a Phase II evaluation and/or identified as eligible for inclusion on the National Register of Historic Places. If a Phase II study is undertaken, such a study shall be approved by the Director of Planning and a treatment plan for said sites shall be submitted to, and approved by, the Director of Planning for sites that are determined to be eligible for inclusion on the National Register of Historic Places and/or those sites that require a Phase III study. If in the Phase III study, a site is determined eligible for nomination to the National Register of Historic Places and said site is to be preserved in place, the treatment plan shall include nomination of the site to the National Register of Historic Places. If a Phase III study is undertaken for said sites, such studies shall be approved by the Director of Planning prior to land disturbance within the study areas. All Phase I, Phase II, and Phase III studies shall meet the Virginia Department of Historic Resources' *Guidelines for Preparing Archaeological Resource Management Reports* and the Secretary of the Interior's *Standards and Guidelines for Archaeological Documentation*, as applicable, and shall be conducted under the supervision of a qualified archaeologist who meets the qualifications set forth in the Secretary of the Interior's *Professional Qualification Standards*. All approved treatment plans shall be incorporated into the plan of development for the site and the clearing, grading or construction activities thereon.

3. Prior to final site plan approval, architectural elevations, building materials and colors shall be submitted to the Director of Planning for review and approval for compatibility with Hickory Neck Church and the Village of Toano in terms of design, scale, materials, and colors.

4. Any new exterior site lighting shall be limited to fixtures which are horizontally mounted on light poles not to exceed 15 feet in height and/or other structures and shall be recessed fixtures with no bulb, lens, or globe extending below the casing. The casing shall be opaque and shall completely surround the entire light fixture and light source in such a manner that all light will be directed downward and the light source is not visible from the side. No glare defined as 0.1 footcandle or higher shall extend outside the property lines.

5. The owner shall be responsible for developing and enforcing water conservation standards to be submitted to and approved by the James City Service Authority prior to final development plan approval. The standards may include, but shall not be limited to such water conservation measures as limitations on the installation and use of irrigation systems and irrigation wells, the use of approved landscaping materials including the use of drought tolerant plants where appropriate, and the use of water conserving fixtures and appliances to promote water conservation and minimize the use of public water resources.

6. If construction has not commenced on this project within thirty-six (36) months from the issuance of a special use permit, the special use permit shall become void. Construction shall be defined as obtaining permits for building construction and footings and/or foundation has passed required inspections.

7. A landscaping plan shall be approved by the Director of Planning prior to final site plan approval for this project. The landscaping plan shall include enhanced landscaping within the fifty-foot Community Character Corridor buffer along Richmond Road so that the required size of plants and trees equals, at a minimum, 125 percent of the landscaping otherwise required in Chapter 24, Article II, Division 4 of the James City County Code. A minimum of fifty percent of the plantings within the Community Character Corridor buffer shall be evergreen. Community Character Corridor buffer plantings shall include one-for-one replacement of trees to be removed from the site as identified on the site plan.

8. Only one entrance shall be allowed onto Route 60.

9. All parking shall be located either behind the proposed building or to the side, behind the front building face line with a 42 inch non-chain link vinyl or wood fence.

10. The BMP shall be designed to enhance the removal of coliform bacteria in addition to the standard water quality provisions in accordance with the Powhatan Creek Stormwater Master Plan, pages 69 to 71.

11. The owner shall use Low Impact Development ("LID") techniques such that the total extent of the LID on the property shall equal or exceed three unit measures as defined by *Special Stormwater Criteria in James City County* (adopted December 14, 2004). The proposed LID techniques to be implemented shall be approved by the Environmental Director prior to site plan approval. All approved LID techniques shall be constructed on the property prior to the release of the posted erosion and sediment control surety.

12. This special use permit is not severable. Invalidation of any word, phrase, clause, sentence, or paragraph shall invalidate the remainder.

John J. McGlennon
Chairman, Board of Supervisors

SUPERVISOR	VOTE
HARRISON	AYE
BRADSHAW	AYE
GOODSON	ABSENT
ICENHOUR	AYE
MCGLENNON	AYE

ATTEST:

Sanford B. Wanner
Clerk to the Board

Adopted by the Board of Supervisors of James City County, Virginia, this 10th day of July, 2007.

Sup14-07.res2