# CERTIFICATE OF AUTHENTICITY

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

**BMP NUMBER:** **YC035**

**DATE VERIFIED:** **December 31, 2019**

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

Charles E. Lovett II

**LOCATION: WILLIAMSBURG, VIRGINIA**

**NOTES: Uploaded and Certified Design Calculations and Reports**

# CERTIFICATE OF AUTHENTICITY

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**BMP NUMBER:** **YC035**

**DATE VERIFIED:** **June 28, 2017**

**QUALITY ASSURANCE TECHNICIAN:** **Jonathan Craig**

**LOCATION: WILLIAMSBURG, VIRGINIA**

# Stormwater Division

## M E M O R A N D U M

**DATE:** June 28, 2017

**SCANNER:** Jonathan Craig, Assistant Environment Coordinator

**RE:** Files Approved for Scanning

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

**General File ID or BMP ID:** YC035

**PIN:** 1240200022A

**Owner Name:** GORDON C. BERRYMAN AND RONALD T. CURTIS

**Legal Description:** 1.754 AC. LAND OF GORDON C. BERRYMAN AND RONALD T. CURTIS

**Address:** 7839 AND 7845 RICHMOND ROAD

**Easement:**

**Recorded Plat:**

Comments: Added maintenance agreement 060013964 dated 26 April 2006. Hard copies destroyed.

# 1. Maintenance Agreement

060013964

COUNTY OF JAMES CITY, VIRGINIA

DECLARATION OF COVENANTS

INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

THIS DECLARATION, made this 26th day of April, 2006, between Gordon C. Berryman & Ronald T. Curtis, and all successors in interest, ("COVENANTOR(S),") owner(s) of the following property:

Street Address: 7845 Richmond Road
Legal Description: 1.754 ac. Land of Gordon C. Berryman & Ronald T. Curtis
Project Name: 7839 & 7845 Richmond Road Parcel ID # 1240200022A
Document No. _____, Deed Book _____, Page No. _____;
Instrument No. 040031705, and the County of James City, Virginia ("COUNTY.")

WITNESSETH:

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

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

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

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

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

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

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

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)

Gordon C Berryman

Print Name/Title GORDON C. BERRYMAN, owner

ATTEST:

Rochelle A. Bessinn
Notary Public/Commonwealth of VA
Commission Expires 10-31-09

COVENANTOR(S)

Ronald Curtis

Print Name/Title Ronald Curtis owner

ATTEST:

STATE OF VIRGINIA COUNTY OF JAMES CITY, to wit:

The foregoing instrument was acknowledged before me this 1st day of [illegible], by Ronald Curtis.

My commission expires: 2/28/2010

Notary Public

COMMONWEALTH OF VIRGINIA

CITY/~~COUNTY~~ OF Williamsburg

I hereby certify that on this 1ST day of June, 2006, before the subscribed, a Notary Public for the Commonwealth of Virginia, personally appeared Gordon Berryman _____ and did acknowledge the aforegoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 1ST day of June, 2006.

Notary Public

My Commission expires: October 31, 2009

Approved as to form:

County Attorney

This Declaration of Covenants prepared by:

GORDON BERRYMAN
(Print Name)

OWNER
(Title)

124 Berkeley Lane
(Address)

Williamsburg VA 23185
(City) (State) (Zip)

537-7742
(Phone Number)

VIRGINIA: CITY OF WILLIAMSBURG & COUNTY OF JAMES CITY
This document was admitted to record on 15 June 06
at 3:59 AM/PM. The taxes imposed by Virginia Code
Section 58.1-801, 58.1-802 & 58.1-814 have been paid.

| STATE TAX | LOCAL TAX | ADDITIONAL TAX |
|---|---|---|
| $ — | $ — | $ — |

TESTE: BETSY B. WOOLRIDGE, CLERK
BY: Betsy B Woolridge Clerk

drainage1.pre

2.

Deeds/Easements/Agreements/Property Records

# 3. Construction Certificate

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

Project Name: 7839 & 7845 Richmond Road
County Plan No.: SP-31-05 Amend-SP-80-06
Stormwater Management Facility: Infiltration Basin
BMP Phase #: ☐ I ☐ II ☐ III ☐ IV (These are County assigned phasing/colors on GIS map.)

- ☐ Information/submittal package received. Date/By: _____
- ☐ Completeness Check:
  - ☑ Record drawing (asbuilt) Date/By: 10/4/07 Landtech
  - ☐ Construction certification Date/By: missing
  - ☑ RD/CC standard forms (Required for all BMPs after Feb 1st 2001Only)
  - ☑ Insp/maint. agreement # / Date: 0600139604 6/15/06
  - ☐ BMP Maintenance Plan Location: _____
  - ☐ Other: _____
- ☐ Standard County SWPPP Notes on approved plan requiring RD/CC and/or County comment at plan review
  - ☐ Yes ☐ No Location: _____
- ☑ Assign **County BMP ID Code #**: Code: 2C035
- ☐ Preliminary input/log into Division's "As-Built Tracking Log"
- ☐ Add Location to County GIS Map. Obtain basic site information (GPIN, Owner, Address, etc.)
- ☐ Preliminary log into MS Access database (BMP ID #, Plan No., GPIN, Project Name, etc.)
- ☐ Active approved plan project file review (correspondence, H&H, design computations, etc.).
- ☐ Initial As-Built file setup (File label, folder, copy plan/details/design information, etc.).
- ☐ Inspector first check/review of RD/CC (confirmation of what was observed during inspection).
- ☐ Pre-inspection drawing review of the Approved Plan (Quick look prior to Field Inspection).
- ☑ Final inspection (FI) performed Date: 6/12/08
- ☑ Record drawing (RD) review Date: 10/07
- ☐ Construction certification (CC) Review Date: _____
- ☐ Actions based on reviews and inspection:
  - ☐ No comments.
  - ☐ Comments. Letter Forwarded. Date: _____
  - ☐ Record drawing (RD) issues to resolve.
  - ☐ Construction certification (CC) issues to resolve.
  - ☐ Field construction-related (CR) issues to resolve.
  - ☐ Site issues (SI) to resolve (stabilization, remove E&S measures, etc.)
  - ☐ Other (list): _____
- ☐ Second submission: _____
- ☐ Re-inspection (if necessary): Date(s): _____
- ☐ Acceptable for SWPPP/SWM purposes (RD/CC/CR/Other). Ok to proceed with surety release.
- ☑ Complete "Surety Request Form". Released 6/13/08
- ☐ Check/Clean active file of any remaining material and finish "As-Built" file.
- ☐ Put final inspection report into the asbuilt file.
- ☐ Obtain representative digital photographs of BMP and save into County BMP Inventory electronic file.
- ☐ Request and obtain mylar/reproducible of asbuilt from As-Built plan preparer.
- ☐ Request and obtain digital file (CD-ROM, etc.) from As-Built plan preparer.
- ☐ Complete "As-built Tracking Log".
- ☐ Last check of BMP Access Database for completeness (County BMP Inventory).
- ☐ VSMP construction general permit, Notice-of-Termination (NOT) protocol.

## ***Final Sign-Off***

Inspector: _____ Date: 5/17/18

Chief Engineer: _____ Date: 5/17/18

released per Fran

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: SITE PLAN OF 7839 AND 7845 RICHMOND ROAD
Structure/BMP Name: INFILTRATION BASIN
Project Location: 7839 & 7845 RICHMOND ROAD
BMP Location: ALONG SOUTHERN PROPERTY LINE OF PARCEL
County Plan No.: SP - 31 - 05

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

Tax Map/Parcel No.: 1240200021 - 1240200022
BMP ID Code (if known): _____
Zoning District:: A1 - B1
Land Use: OFFICE / RETAIL
Site Area (sf or acres): 1.75

Brief Description of Stormwater Management/BMP Facility: BMP #2 IS AN INFILTRATION BASIN LOCATED AT SOUTH EASTERLY CORNER OF THE PARCEL. BMP #1 IS AN INFILTRATION BASIN LOCATED AT THE SOUTH WESTERLY CORNER OF THE PARCEL

Nearest Visible Landmark to SWM/BMP Facility: NEW OFFICE / RETAIL BUILDINGS

Nearest Vertical Ground Control ( if known ):
☐ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☒ Other
Station Number or Name: _____
Datum or Reference Elevation: 110.87
Control Description: SANITARY MANHOLE RIM
Control Location from Subject Facility: ALONG RT. 631 AT 3456 CHICKAHOMINY ROAD. LOCATED AT SOUTH EASTERLY CORNER OF PARCEL

**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: 6-06
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☐ Unknown
Name of Site Work Contractor Who Constructed Facility: REED ENTERPRISE
Name of Professional Firm Who Routinely Monitored Construction: GET SOLUTIONS, INC.
Date of Completion for SWM/BMP Facility: 8-07
Date of Record Drawing/Construction Certification Submittal: 10-04-07

***( 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: GORDON BERRYMAN
Mailing Address: 124 BERKLEY LANE
WILLIAMSBURG, VA 23185
Business Phone: 757-532-7742 Fax: 757-532-0677
Contact Person: _____ Title: _____

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

Firm Name: LANDTECH RESOURCES, INC.
Mailing Address: SUITE 201A BULIFANTS BLVD.
WILLIAMSBURG, VA 23188
Business Phone: 757-565-1677
Fax: 757-565-0787
Responsible Plan Preparer: KEN JENKINS
Title: PROJECT ENGINEER
Plan Name: SITE PLAN FOR 7839 AND 7845 RICHMOND ROAD
Firm's Project No. 05-001
Plan Date: 3-01-05
Sheet No.'s Applicable to SWM/BMP Facility: 3 / 4 / 5 / 9 / _____

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

Name: REED ENTERPRISE
Mailing Address: 145 SAW MILL ROAD
WILLIAMSBURG VA 23188
Business Phone: 757-259-9011
Fax: 757-282-2468
Contact Person: WAYNE REED
Site Foreman/Supervisor: WAYNE REED
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: LANDTECH RESOURCES, INC
Mailing Address: SUITE 201A BULIFANTS BLVD
Williamsburg, VA 23188
Business Phone: 757-565-1677
Fax: 757-565-0782

Name: MATTHEW H. CONNOLLY
Title: PRINCIPAL
Signature:
Date: 10-04-07

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.

( Seal )

Virginia Registered Professional Engineer or Certified Land Surveyor

**Construction Certification**

Firm Name: _____
Mailing Address: _____
_____
Business Phone: _____
Fax: _____

Name: _____
Title: _____

Signature: _____
Date: _____

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

_____ ( Seal )

Virginia Registered Professional Engineer

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

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

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

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

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

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

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

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

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

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

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

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

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

## STORMWATER MANAGEMENT / BMP FACILITIES
## RECORD DRAWING CHECKLIST

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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.

XX 8. Elevation of the principal spillway crest or outlet crest of the structure.

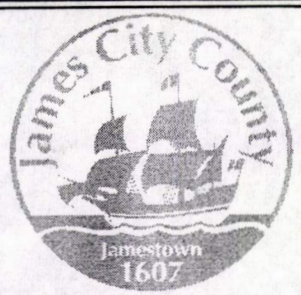
| | | |
|---|---|---|
| XX | 9. | Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc. |
| XX | 10. | Dimensions, locations and elevations of outlet orifices, weirs, slots and drains. |
| XX | 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. |
| XX | 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.** |
| XX | 13. | Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. **May need to obtain this information during construction.** |
| XX | 14. | Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert. |
| XX | 15. | Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall. |
| NA | 16. | Outfall protection dimension, type and depth of rock and if underlain filter fabric is present. |
| NA | 17. | BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan. |
| XX | 18. | Maintenance plan taken from approved design plan transposed onto record drawing set. |
| NA | 19. | Fencing location and type, if applicable to facility. |
| XX | 20. | BMP vicinity properly cleaned of stockpiles and construction debris. |
| XX | 21. | No visual signs of erosion or channel degradation immediately downstream of facility. |
| XX | 22. | Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility. |

## STORMWATER MANAGEMENT / BMP FACILITIES
## RECORD DRAWING CHECKLIST

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

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

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





**James City County, Virginia**
**Environmental Division**

# Erosion and Sediment Control and Stormwater Management Design Plan Checklists

*Table of Contents*

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GENERAL INFORMATION

Project Name: Site Plan of 7839 & 7845 Richmond Rd.
Owner / Applicant: Gordon Berryman
Plan Preparer: LandTech Resources, Inc Email: _____
Project Location: Intx of Rt 60 & 631
Tax Map / Parcel: 1240200021 & 1240200022
County Plan No. (if known): SP-31-05
County BMP Type: Infiltration Basin (C-4)
Other information submitted in addition to this checklist (Check all that apply):

- [X] Design or Construction Drawings (Plans, Profiles, Details, etc.).
- [X] Erosion & Sediment Control Plan (Plans, Details, etc.).
- [X] Erosion & Sediment Control Plan Design Report.
- [X] Stormwater Management Design Plan (Plans, Profiles, Details, etc.).
- [X] Stormwater Management Design Report.
- [X] Other, List: Variance Request

***Issue Date***
***March 1, 2001***

*JAMES CITY COUNTY, VIRGINIA*
*ENVIRONMENTAL DIVISION*

# *EROSION AND SEDIMENT CONTROL PLAN CHECKLIST*

## I. *GENERAL:*

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

## II. *SITE PLAN:*

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

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

Yes No N/A

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

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

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

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

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

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

III. ***NARRATIVE:***

Yes No N/A

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

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

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

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

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

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

Yes No N/A

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

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

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

## IV. *CALCULATIONS:*

Yes No N/A

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

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

*JAMES CITY COUNTY, VIRGINIA*
*ENVIRONMENTAL DIVISION*

# *STORMWATER MANAGEMENT DESIGN PLAN CHECKLIST*

## I. *GENERAL:*

| Yes | No | N/A | |
|---|---|---|---|
| ☒ | ☐ | ☐ | *FAMILIARITY* with current versions of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual; Chapter 8, Erosion and Sediment Control and Chapter 23, Chesapeake Bay Preservation ordinances of the Code of James City County, Virginia; the Virginia Erosion and Sediment Control Handbook (VESCH); and the Virginia Stormwater Management Handbook (VSMH). |
| ☐ | ☐ | ☒ | *WAIVER OR EXCEPTION* if necessary, requested in writing, for the plan approving authority to waive or except the requirements of Chapter 23, Chesapeake Bay Preservation ordinance in accordance with procedure established in Sections 23-14 through 23-17 of the ordinance. Applies to this review case only. |
| ☒ | ☐ | ☐ | *VARIANCE REQUEST* if necessary, requested in writing for the plan approving authority to waive or modify any of the minimum standards and specifications of the VESCH deemed inappropriate based on site conditions specific to this review case only. Variances which are approved shall be properly documented in the plan and become part of the approved erosion and sediment control plan for the site. |
| ☒ | ☐ | ☐ | *PROFESSIONAL SEAL AND SIGNATURE* required on final and complete approved stormwater management plans, drawings, technical reports and specifications. |
| ☒ | ☐ | ☐ | *WORKSHEET FOR BMP POINT SYSTEM* to ensure the stormwater management plan for the project attains at least 10 BMP points (New Development) or traditional pollutant load reduction computations per the Chesapeake Bay Local Assistance Manual (Redevelopment Only). |
| ☒ | ☐ | ☐ | *PROPOSED CONSERVATION EASEMENT AREAS* for any natural open space points claimed in the BMP worksheet. |
| ☒ | ☐ | ☐ | *INSPECTION/MAINTENANCE AGREEMENT* is required to be prepared and executed with the County for the project. Owner Action |
| ☒ | ☐ | ☐ | *FEMA FIRM PANEL* reference with designated special flood hazard areas or zone designations associated with the site, as applicable. |
| ☒ | ☐ | ☐ | *DRAINAGE AREA MAP* at a maximum scale of 1"=200' scale showing drainage area boundaries for pre- and postdevelopment conditions and associated time of concentration flow paths. Labels to include drainage area size, runoff coefficient or curve number and time of concentration for each subarea shown on the map. |

Yes No N/A

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

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

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

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

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

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

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

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

## II. *STORMWATER CONVEYANCE SYSTEMS:*

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

Yes No N/A

☒ ☐ ☐ *STORMWATER CONVEYANCE SYSTEM COMPUTATIONS*

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

## III. ***STORMWATER MANAGEMENT / BMP FACILITIES***:

Yes No N/A

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

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

☒ ☐ ☐ *FACILITY CONFIGURATION and MINIMUM SEPARATIONS*

- ☐ ☐ ☒ Screening and layout consistent with Section 24-98(d) of the Chapter 24 Zoning ordinance (landscaping, screening, visibility, etc.).
- ☒ ☐ ☐ Basic considerations for safety and unauthorized entry.
- ☒ ☐ ☐ Proper length to width ratio (Typically 2H:1V).
- ☐ ☐ ☒ Facilities with deep pools (4 feet or more in depth) provided with two benches. Fifteen (15) ft. safety bench outward from normal pool at maximum 6 percent slope and aquatic bench inward from normal shoreline below normal pool. Narrower widths may be considered on a case-by-case basis.
- ☐ ☐ ☒ Pond buffer minimum 25 feet outward from maximum design WSEL. Additional setbacks may be required to permanent structures.
- ☒ ☐ ☐ No trees, shrubs or woody plants within 15 feet of embankment toe or 25 feet from principal spillway structure.

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

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

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

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

| Yes | No | N/A | |
|---|---|---|---|
| ☐ | ☐ | ☒ | Riser / base structure flotation analyses. FS = 1.25 minimum. |
| ☐ | ☐ | ☒ | Downstream danger reach study and/or emergency action plan (if conditions warrant). |
| ☐ | ☐ | ☒ | Upstream backwater analyses onto offsite adjacent property (if conditions warrant). |
| ☒ | ☐ | ☐ | 100 year floodplain impacts (if conditions warrant). |

| Yes | No | N/A | |
|---|---|---|---|
| ☒ | ☐ | ☐ | *GEOTECHNICAL REQUIREMENTS* |
| ☒ | ☐ | ☐ | Geotechnical Report with recommendations specific to BMP facility type selected. Report prepared by a registered professional engineer. Requires submission, review and approval prior to issuance of Land Disturbance Permit. |
| ☒ | ☐ | ☐ | Initial Feasibility Testing requirements satisfied as per Appendix E of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual. (Infiltration, Bioretention and Filtering System BMP types only). |
| ☒ | ☐ | ☐ | Concept Design Testing requirements satisfied as per Appendix E of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual. (Infiltration, Bioretention and Filtering System BMP types only). |
| ☒ | ☐ | ☐ | Minimum Boring locations: borrow area, pool area, principal control structure, top of facility near one abutment and emergency spillway if provided. |
| ☒ | ☐ | ☐ | Boring logs with Unified Soil Classification (ASTM D2487), soils descriptions and depths to bedrock and the seasonal water table indicated. |
| ☒ | ☐ | ☐ | Standard County Record Drawing/Construction Certification note provided on plan. *Note: It is understood that preparation of record drawings and construction certifications as required for project facilities may not necessarily be performed by the plan preparer. These components may be performed by others.* |
| ☒ | ☐ | ☐ | *PRINCIPAL SPILLWAY PROFILE AND ASSOCIATED DETAILS* |
| ☒ | ☐ | ☐ | *EXISTING GROUND AND PROPOSED GRADE* |
| ☒ | ☐ | ☐ | Embankment or excavation side slopes labeled (3H:1V maximum). |
| ☒ | ☐ | ☐ | Minimum top width labeled (per VESCH or VSMH requirements). |
| ☒ | ☐ | ☐ | Removal of unsuitable material under proposed facility (per Geotechnical Report requirements). |

| Yes | No | N/A | |
|---|---|---|---|
| ☒ | ☐ | ☐ | *CORE TRENCH* |
| ☒ | ☐ | ☐ | Material (per plan or Geotechnical Report). |
| ☒ | ☐ | ☐ | Bottom width (4' minimum or greater as dictated by Geotechnical Report recommendations). |
| ☒ | ☐ | ☐ | Side slopes (1:1 maximum steepness) |
| ☒ | ☐ | ☐ | Depth (4' minimum or greater as dictated by Geotechnical Report). |
| ☒ | ☐ | ☐ | *PRINCIPAL CONTROL STRUCTURE. RISER OR SIMILAR STRUCTURE (DETAILS REQUIRED FOR ALL ITEMS)* |
| ☒ | ☐ | ☐ | Durable, watertight, resistant material (concrete preferred). |
| ☒ | ☐ | ☐ | Riser diameter is at least 1.25 times larger than barrel diameter. |
| ☒ | ☐ | ☐ | All pertinent dimensions and elevations shown. |
| ☒ | ☐ | ☐ | Control orifice or weir dimensions and elevations shown. |
| ☐ | ☐ | ☒ | Trash rack - removable - for each release. |
| ☐ | ☐ | ☒ | Anti-vortex device, baffle or plate. |
| ☒ | ☐ | ☐ | Riser base structure with dimensions and embedment specifications (concrete preferred). |
| ☒ | ☐ | ☐ | Interior access (steps, ladders, etc.) for maintenance for structures over 4 feet in height. Excessively high risers may need some form of exterior access on top portion. |
| ☐ | ☐ | ☒ | Low flow orifice with trash rack device. |
| ☒ | ☐ | ☐ | *PRINCIPAL CONTROL STRUCTURE OUTLET BARREL* |
| ☒ | ☐ | ☐ | Material (ASTM C-361 reinforced concrete pipe) with watertight joints. Prior approval required for all other pipe material (other RCP types, CMP, CPP, PVC, etc.). |
| ☐ | ☐ | ☒ | Support and bedding requirements for barrel - concrete cradles, etc. or as recommended by the Geotechnical Report. |
| ☒ | ☐ | ☐ | Pipe inverts, length, size, class and slope shown. |
| ☐ | ☐ | ☒ | Flared end section or endwall provided on barrel outlet. |
| ☐ | ☐ | ☒ | *SEEPAGE CONTROL* |
| ☐ | ☐ | ☒ | Phreatic line shown (4:1 slope measured from the intersection of the embankment and the principal spillway design high water). |
| ☐ | ☐ | ☒ | *ANTI-SEEP COLLARS* |
| ☐ | ☐ | ☒ | Anti-seep collar, concrete preferred. |
| ☐ | ☐ | ☒ | Size - 15 percent increase in length of saturation using outside pipe diameter. |
| ☐ | ☐ | ☒ | Spacing and location on barrel (located at least 2 feet from a pipe joint). |

☐ ☐ ☑ *FILTER DIAPHRAGMS*

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

**Yes No N/A**

☑ ☐ ☐ *ELEVATION AND DIMENSIONAL DESIGN DATA*

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

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

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

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

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

☑ ☐ ☐ *CROSS SECTION THROUGH FACILITY*

☐ ☐ ☑ Existing Ground.

☑ ☐ ☐ Proposed grade.

☑ ☐ ☐ Top of facility - constructed and settled.

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

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

☑ ☐ ☐ Location of each soil boring.

☑ ☐ ☐ Barrel location.

☐ ☐ ☑ Existing and proposed utility location/protection.

☐ ☐ ☑ *EMERGENCY SPILLWAY PROFILE*

☐ ☐ ☑ Existing ground.

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

☐ ☐ ☑ Spillway and crest elevations.

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

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

IV. ***OUTLET PROTECTIONS:***

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

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

An underdrain was not provided for the infiltration basin since the soil profile used for the basin floor is lower than the existing gravity stormwater outfall.

Plan Preparer: Kenneth Jenkins

Date: 3/15/05

SWMProg/BMP/Checklist/ChkList

# 4. Record Drawing (as-built plan)

# 5. Construction Drawings

# 6. Design Calculations

SP-031-05



# Erosion and Sediment Control Narrative

for

## 7839 & 7845 Richmond Rd.

**March 15, 2005**
**Revised June 2, 2005**
**Revised July, 21 2005**

**Project Number 05-001**

SP-31-05
YC035

**LandTech Resources, Inc.**
**5810-F Mooretown Road, Williamsburg, VA**
**Phone 757-565-1677** **Fax 757-565-0782**

# Erosion and Sediment Control Narrative

for

## 7839 & 7845 Richmond Rd.

**March 15, 2005**
**Revised June 2, 2005**
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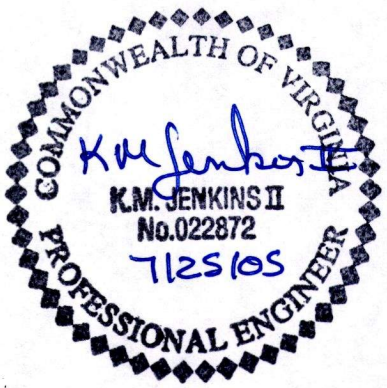
**Project Number 05-001**




**LandTech Resources, Inc.**
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## PROJECT DESCRIPTION

The project consists of the construction of two office/retail buildings totaling 10,000 sf at 7839 & 7845 Richmond Road in James City County, Virginia. The site is 1.75 acres with a total of 0.70 acres to be covered by impervious surfaces after construction is complete. The total disturbed area is approximately 1.85 acres.

## EXISTING CONDITIONS

Currently the front half of the site is open and the rear half is wooded. The site is high in the middle and slopes to the front and rear of the lot.

## ADJACENT AREAS

The site is bounded on the north by Richmond Rd., on the west by Chickahominy Rd., on the east by a vacant lot and on the south by Toano Middle School.

## OFF-SITE AREA

The only off-site areas to be disturbed with the development of this site is the removal of the existing entrance from Chickahominy Road and the construction of a new VDOT commercial entrance on Chickahominy Road and Richmond Road. A CE-7 Permit will be required to be obtained from VDOT.

## SOILS

### Slagle fine sandy loam (29B)

This soil is deep, gently sloping, and moderately well drained.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is light yellowish brown fine sandy loam 5 inches thick. The subsoil extends to a depth of 50 inches. It is mostly mottled yellowish brown clay loam to a depth of 25 inches. Below this depth, the subsoil is mostly mottled clay loam and sandy clay loam. The substratum is mottled sandy clay loam to a depth of at least 60 inches.

In this Slagle sois, permeability is moderate in the upper part of the subsoil and moderately slow or slow in the lower part. The erosion hazard is moderate. The subsoil has moderate shrink-swell potential.

### Suffolk fine sandy loam (31B)

This soil is deep, gently sloping, and well drained.

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.

The permeability of this Suffolk soil is moderate, and the erosion hazard is moderate. The subsoil has low shrink-swell potential.

See Report of Subsurface Investigation and Geotechnical Engineering Services in Appendix C.

## CRITCAL EROSION AREAS

The critical erosion area associated with this site is the adjacent school site behind the site. To prevent sediment from leaving the site to this area, it is imperative that the contractor install all erosion and sediment control measures shown on these plans before any land disturbing activities commence. Regular inspection and maintenance is also required for all erosion and sediment control measures to keep them functioning as designed.

## EROSION AND SEDIMENT CONTROL MEASURES

Unless otherwise indicated, all structural and vegetative erosion and sediment control practices shall be constructed and maintained according to minimum standards and specifications of the latest edition of Virginia Erosion and Sediment Control Handbook (VESCH). The minimum standards shall be adhered to unless otherwise waived or approved by variance.

## STRUCTURAL PRACTICES

### Temporary Stone Construction Entrance – 3.02

A construction entrance shall be provided at all points of ingress and egress to reduce the amount of mud transported onto paved public roads by motor vehicles and runoff.

### Silt Fence – 3.05

Silt fence shall be placed around the limits of clearing to intercept and detain small amounts of sediment from disturbed areas during construction operations.

### Storm Drain Inlet Protection – 3.07

Storm drain protection is installed at all drainage inlets to prevent sediment from entering the storm drainage systems prior to permanent stabilization for the disturbed areas.

### Culvert Inlet Protection – 3.08

Culvert inlet protection shall be installed at the inlet to storm sewer culverts as depicted on the plans.

**Temporary Diversion Dike – 3.09**

Temporary diversion dikes are to be installed along the perimeter of the disturbed area to divert sediment-laden runoff to the sediment trap.

**Temporary Sediment Trap – 3.13**

A temporary sediment trap will be installed to detain sediment-laden runoff from the disturbed site long enough to allow the majority of the sediment to settle out.

**Outlet Protection – 3.18**

Outlet protection shall be provided to prevent scour at the concrete swale outlet and to minimize the potential for downstream erosion.

**Rock Check Dam – 3.20**

A rock check dam shall be placed at the outlet of the parking lot concrete swale to trap sediment and reduce the velocity of the concentrated stormwater flow, thereby reducing erosion of the downstream swale.

**Soil Stabilization Blankets and Matting – 3.36**

Jute mesh shall be provided to aid in controlling erosion on the infiltration basin and forebay sideslopes by providing a microclimate which protects young vegetation and promotes its establishment.

**Tree Preservation and Protection – 3.38**

Tree preservation and protection shall be provided to protect desirable trees from mechanical and other injury during land disturbing and construction activity.

**Dust Control – 3.39**

Dust control will be applied as depicted on the plans to prevent surface and air movement of dust from exposed soil surfaces and reduce the presence of airborne substances which may present health hazards, traffic safety problems or harm animal or plant life.

**VEGETATIVE PRACTICES**

**Permanent Seeding – 3.32**

All denuded areas, which will be left dormant for extended periods of time, shall be seeded with permanent vegetation immediately following grading. Selection of the seed mixture will depend on the time of year it is applied.

## MANAGEMENT STRATEGIES

- Sediment trapping measures will be installed as the first step in grading and will be seeded and mulched immediately following installation.
- Temporary seeding or other stabilization will follow immediate after grading.
- The contractor shall be responsible for the installation and maintenance of all erosion and sediment control practices depicted on the Plans.
- After achieving adequate stabilization, the temporary controls will be cleaned and removed. Any areas disturbed in the removal process shall be graded, top soiled, and seeded accordingly.

## PERMANENT STABILIZATION

All areas disturbed by construction shall be stabilized with permanent seeding immediately following finish grading. Seeding shall be accomplished with Kentucky 31 Tall Fescue according to Standards and Specifications 3.32, Permanent Seeding of the VESCH. Soil stabilization blankets will be installed over slopes, which have been brought to final grade and have been seeded to protect the slopes from rill and gully erosion and to allow seed to germinate properly. Mulch (straw or fiber) will be used on relatively flat areas. In all seeding operations, seed, fertilizer and lime will be applied prior to mulching.

## STORMWATER MANAGEMENT

This project is for the construction of two office/retail buildings totaling 10,000 sf. The current site is partially wooded and contains 1.75 acres. After development the site will contain approximately 0.70 impervious acres. To meet the stormwater quality requirements of the James City County BMP Point System and the stormwater quantity requirements of Minimum Standard 19 of the Virginia Stormwater Management Handbook an infiltration basin (Type C-4 BMP) and infiltration trench (Type C-2 BMP) will be utilized to treat the additional stormwater runoff. The infiltration basin will treat the first one-inch of runoff, and the post-development runoff from the 1-year and 2-year storms. The outlet structure releases the 10-year post-development storm at 1.06 cfs, which is less than the pre-development rate of 1.08 cfs. The 2-year storm drains in approximately 40 hours and the 100-year post-development storm passes with 1.21 feet of freeboard. The infiltration trench treats the first one-inch of runoff from the rear of Building #2. BMP design calculations are provided in Appendix A. The infiltration basin outlet structure does not utilize a backup underdrain due to the fact that the depth of the pervious soil utilized for the infiltration basin floor is lower than the existing gravity stormwater outfall.

## CALCULATIONS

Appendix B contains design calculations for the onsite sediment trap.

## MAINTENANCE

In general, all erosion and sediment control measures will be checked daily and after each significant rainfall. The following items will be checked in particular:

**Temporary Stone Construction Entrance – 3.02**

The entrance shall be maintained in a condition, which will prevent tracking or flow of mud onto public rights-of-way. This may require periodic dressing with additional stone or the washing and reworking of existing stone as conditions demand. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately. The use of water trucks to remove materials dropped, washed, or tracked onto roadways will not be permitted under any circumstances.

**Silt Fence – 3.05**

Silt Fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.

Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting.

Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, the fabric shall be replaced promptly.

Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.

Any sediment deposits remaining in place after the silt fence is not longer required shall be dressed to conform with the existing grade, prepared and seeded.

**Storm Drain Inlet Protection – 3.07**

The structure shall be inspected after each rain and repairs made as needed.

Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to one-half the design depth of the trap. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

Structures shall be removed and the area stabilized when the remaining drainage area has been properly stabilized.

**Culvert Inlet Protection – 3.08**

The structure shall be inspected after each rain and repairs made as needed.

Aggregate shall be replaced or cleaned when inspection reveals that clogged voids are causing ponding, which interfere with on-site construction.

Sediment shall be removed and the impoundment restored to its original dimensions when sediment has accumulated to one-half the design depth. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode and cause sedimentation problems.

Temporary structures shall be removed when they have served their useful purpose but not before the upslope area has been permanently stabilized.

**Temporary Diversion Dike – 3.09**

The measure shall be inspected after every storm and repairs made to the dike, flow channel, outlet or sediment trapping facility, as necessary. Once every two weeks, whether a storm event has occurred or not, the measure shall be inspected and repairs made if needed. Damages caused by construction traffic or other activity must be repaired before the end of each working day.

**Temporary Sediment Trap – 3.13**

Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to one half the design volume of the wet storage. Sediment removal from the basin shall be deposited in a suitable area and in a manner that it will not erode and cause sedimentation problems.

Filter stone shall be regularly checked to ensure that filtration performance is maintained. Stone choked with sediment shall be removed and cleaned or replaced.

The structure should be checked regularly to ensure that it is structurally sound and has not been damaged by erosion or construction equipment. The height of the stone outlet should be checked to ensure that its center is at least 1 foot below the top of the embankment.

**Rock Check Dam – 3.20**

Check dams shall be checked for sediment accumulation after each runoff-producing storm event. Sediment shall be removed when it reaches one half of the original height of the measure.

Regular inspections shall be made to insure that the center of the dam is lower than the edges. Erosion caused by high flows around the edges of the dam shall be corrected immediately.

**Permanent Seeding – 3.32**

The seeded/mulched areas should be checked regularly to ensure that a good stand is established and maintained. Areas should be fertilized, mulched and re-seeded as needed. When it is clear that plants have not germinated on an area or have died, these areas must be re-seeded immediately to prevent erosion damage. However, it is extremely important to determine for what reason germination did not take place and make any corrective action necessary prior to re-seeding the area.

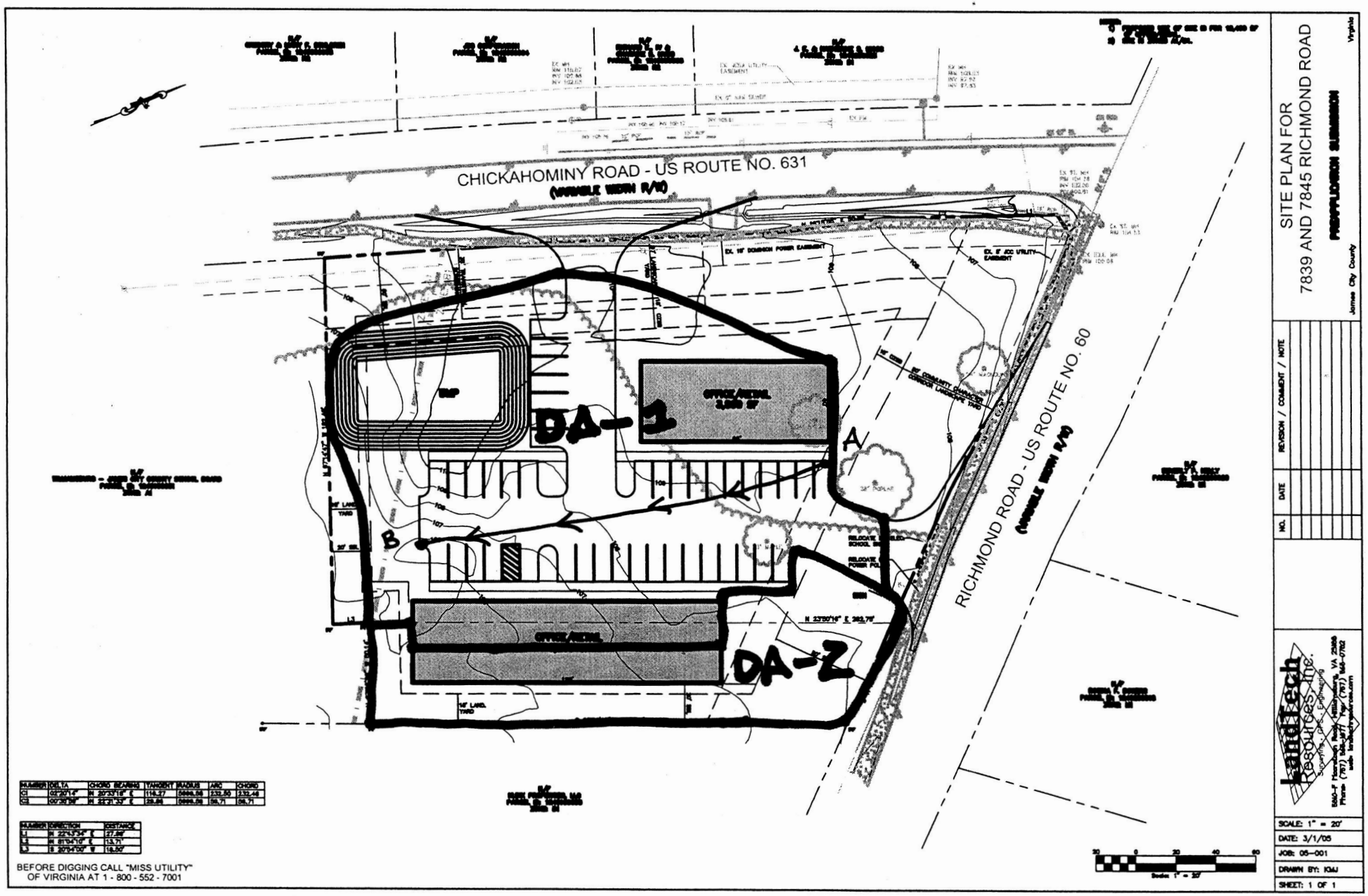
- Fertilizer shall be applied using approved fertilization methods and equipment.

- Formulations and application rates shall conform to the guidelines given in VESCH.
- Maintain a ground cover or organic mulch around trees that is adequate to prevent erosion, protect roots, and hold water.

**Soil Stabilization Blankets and Matting – 3.36**

All soil stabilization blankets and matting should be inspected periodically following installation, particularly after rainstorms to check for erosion and undermining. Any dislocation or failure should be repaired immediately. If washouts or breakage occurs, reinstall the material after repairing damage to the slope. Continue to monitor these areas until which time they become permanently stabilized; at that time an annual inspection should be adequate.

# APPENDIX A




POST-DEVELOPMENT DRAINAGE AREA MAP

# Design BMP #1

# Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| 7845 Richmond Rd. | KMJ | 3/1/05 |
| **Location** | **Checked** | **Date** |
| James City County, Va. | | |

Check one: ☐ Present ☒ Developed DA-1

## 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 |
|---|---|---|---|---|---|---|
| Suffolk (B) | Roof/Road | 98 | | | .59 | 57.82 |
| Suffolk (B) | Grass | 61 | | | .35 | 21.35 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| 1/ Use only one CN source per line | | | | Totals ➡ | .94 | 79.17 |

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{79.17}{.94} = 84.2$ ; Use CN ➡ 84

## 2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 | Storm #4 |
|---|---|---|---|---|---|
| Frequency | yr | 1 | 2 | 10 | 100 |
| Rainfall, P (24-hour) | in | 2.8 | 3.5 | 5.8 | 8.0 |
| Runoff, Q | in | 1.5 | 1.9 | 3.9 | 6.1 |

(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 |
|---|---|---|
| 7845 Richmond Rd. | KMJ | 3/1/05 |
| **Location** | **Checked** | **Date** |
| James City County | | |

Check one: ☐ Present ☒ Developed

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 | AB | |
|---|---|---|---|
| 1. | Surface description (table 3-1) | Paved | |
| 2. | Manning's roughness coefficient, n (table 3-1) | .011 | |
| 3. | Flow length, L (total L † 300 ft) ft | 215 | |
| 4. | Two-year 24-hour rainfall, $P_2$ in | 3.5 | |
| 5. | Land slope, s ft/ft | .01 | |
| 6. | $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute $T_t$ hr | | + = .05 |

## 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 | | .05 |

## Worksheet 5a: Basic watershed data

| Project | Location | By | Date |
|---|---|---|---|
| 7845 Richmond Rd. | James City County, Va. | KMS | 3/1/05 |
| Check one: ☐ Present ☒ Developed | Frequency (yr) | Checked | Date |

| ~~Subarea name~~ STORM | Drainage area $A_m$ ($mi^2$) | Time of concentration $T_c$ (hr) | Travel time through subarea $T_t$ (hr) | Downstream subarea names | Travel time summation to outlet $\Sigma T_t$ (hr) | 24-hr rainfall P (in) | Runoff curve number CN | Runoff Q (in) | $A_m Q$ ($mi^2$—in) | Initial abstraction $I_a$ (in) | $I_a/P$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .0015 | .05 | | | | 2.8 | 84 | 1.5 | .0022 | 0.381 | .14 |
| | | | | | | | | | | | |
| 2 | .0015 | .05 | | | | 3.5 | 84 | 1.9 | .0029 | 0.381 | .11 |
| | | | | | | | | | | | |
| 10 | .0015 | .05 | | | | 5.8 | 84 | 3.9 | .0059 | 0.381 | .07 |
| | | | | | | | | | | | |
| 100 | .0015 | .05 | | | | 8.0 | 84 | 6.1 | .0092 | 0.381 | .05 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

From worksheet 3 | From worksheet 2 | From table 5-1

# Worksheet 5b: Basic watershed data

| Project | Location | By | Date |
|---|---|---|---|
| 7845 Richmond Rd | James City County, Va. | KMJ | 3/1/05 |
| Check one: ☐ Present ☒ ~~Developed~~ | Frequency (yr) | Checked | Date |

| ~~Subarea~~ name | Basic watershed data used 1/ | | | | Select and enter hydrograph times in hours from exhibit 5-II 2/ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STORM | Subarea $T_c$ (hr) | $\Sigma T_t$ to outlet (hr) | $I_a/P$ | $A_mQ$ ($mi^2$—in) | | | | | 12.1 | | | | | | |
| | | | | | Discharges at selected hydrograph times 3/ (cfs) | | | | | | | | | | |
| 1 | .05 | | .14 | .0022 | | | | | 2.22 | | | | | | |
| | | | | | | | | | | | | | | | |
| 2 | .05 | | .11 | .0029 | | | | | 2.93 | | | | | | |
| | | | | | | | | | | | | | | | |
| 10 | .05 | | .07 | .0059 | | | | | 5.96 | | | | | | |
| | | | | | | | | | | | | | | | |
| 100 | .05 | | .05 | .0092 | | | | | 9.29 | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Composite hydrograph at outlet | | | | | | | | | | | | | | | |

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is $A_mQ$ multiplied by tabular discharge from appropriate exhibit 5.

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PROJECT NAME _____
PROJECT NO. 05-001
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 3/2/05
SCALE _____

# DESIGN INFILTRATION BASIN
## BMP C-4

Treatment Volume = 1.0 inches / impervious acre

Impervious Area = 0.59 ac = 25,700 sf

$$WQ_v = 25{,}700\,sf \left| \frac{1\,in}{12\,in} \right| \frac{1\,ft}{} = 2{,}150\,cf$$

# 1-Year Hydrograph

```
1*******************************     SCSHYDRO     *******************************
 *******************************   Version 3.21   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 06/07/2005   Tuesday
    Time: 09:23:34
   Input: RR1.IN
  Output: RR1.OUT



 ============================   PROGRAM EXECUTION   ============================


                        NUMBER OF STORMS TO BE MODELED    :     1
                        NUMBER OF CHANNELS                :     0
                        NUMBER OF SUBAREAS                :     1
                        UPSTREAM HYDROGRAPHS ENTER AT     :     0 LOCATIONS
                        NUMBER OF TIME STEPS              :   500
                        COMPUTATIONAL TIME INCREMENT      :  .040 Hours

 NOTE:   The DURATION of the final computed hydrograph(s) for this watershed
         system will be 20.000 hours.



 ========================   UNIT HYDROGRAPH METHODOLOGY   ========================


 The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff computations.
 The peak rate factor (PRF) for all unit hydrographs is 484 (U.S. Customary
 units) or 2.08356 (Metric units).
1*******************************     SCSHYDRO     *******************************
 *******************************   Version 3.21   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 06/07/2005   Tuesday
    Time: 09:23:34
   Input: RR1.IN
  Output: RR1.OUT


 ================================   SUBAREA DATA   ================================


                          TIME OF
 SUBAREA      AREA      CONCENTRATION   CURVE     BASEFLOW
  ID NO       (mi2)        (hrs)        NUMBER     (cfs)     DOWNSTREAM CHANNELS
 _______   _________   _____________   ________   ________   ____________________

       1       .0015           .050      84.00         .0


     Composite Watershed Curve Number = 84.00
 Minimum Subarea Time of Concentration =  .050 hours.
1*******************************     SCSHYDRO     *******************************
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********************************   Version 3.21   ********************************
******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ********************

PROJECT: 7845 RICHMOND RD
   User: LandTech Resources
   Date: 06/07/2005   Tuesday
   Time: 09:23:34
  Input: RR1.IN
 Output: RR1.OUT
                                                    RETURN PERIOD (yrs):      1

======================   RAINFALL HYETOGRAPH INFORMATION   ======================


        RAINFALL HYETOGRAPH: SCS TYPE II
        RAINFALL DURATION:    24.00 Hours
        RAINFALL DEPTH:        2.80 Inches


RAINFALL HYETOGRAPH,
SCS TYPE II
Time (Hours), Total Depth (Inches):

      .000,   .00      2.000,   .06      4.000,   .13      6.000,   .22
     7.000,   .27      8.000,   .34      8.500,   .37      9.000,   .41
     9.500,   .46      9.750,   .48     10.000,   .51     10.500,   .57
    11.000,   .66     11.500,   .79     11.750,  1.00     12.000,  1.86
    12.500,  2.06     13.000,  2.16     13.500,  2.24     14.000,  2.30
    16.000,  2.46     20.000,  2.67     24.000,  2.80
1********************************     SCSHYDRO     ********************************
********************************   Version 3.21   ********************************
******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ********************

PROJECT: 7845 RICHMOND RD
  Input: RR1.IN
 Output: RR1.OUT
                                                    RETURN PERIOD (yrs):      1

   SUBAREA     1       SUBAREA     1       SUBAREA     1       SUBAREA     1

    AREA (square miles)          :        .0015
    TIME OF CONCENTRATION (hrs):        .05
    RUNOFF CURVE NUMBER          :      84.00
    BASEFLOW (cfs)               :        .00
    DOWNSTREAM CHANNELS          :

                                SUBAREA RUNOFF (cfs)

TIME:     +.00    +.04    +.08    +.12    +.16    +.20    +.24    +.28    +.32    +.36
(hrs)     hrs     hrs     hrs     hrs     hrs     hrs     hrs     hrs     hrs     hrs
-------|-------  ------  ------  ------  ------  ------  ------  ------  ------  ------
       |
  .00  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  .40  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  .80  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 1.20  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 1.60  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 2.00  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 2.40  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 2.80  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 3.20  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 3.60  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 4.00  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 4.40  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 4.80  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 5.20  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 5.60  |     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
```

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 6.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 6.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 7.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 7.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 8.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 8.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 8.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 9.20 | .00 | .00 | .00 | .00 | .01 | .01 | .01 | .01 | .01 | .01 |
| 9.60 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 10.00 | .01 | .01 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| 10.40 | .02 | .02 | .02 | .02 | .03 | .03 | .03 | .03 | .03 | .03 |
| 10.80 | .04 | .04 | .04 | .04 | .04 | .04 | .05 | .06 | .07 | .07 |
| 11.20 | .07 | .07 | .07 | .08 | .08 | .08 | .08 | .08 | .13 | .22 |
| 11.60 | .27 | .30 | .31 | .33 | .49 | 1.12 | 1.56 | 1.79 | 1.95 | 2.08 |
| 12.00 | 2.19 | 1.14 | .50 | .33 | .29 | .28 | .28 | .28 | .28 | .28 |
| 12.40 | .28 | .28 | .28 | .25 | .18 | .16 | .15 | .15 | .15 | .15 |
| 12.80 | .15 | .15 | .15 | .15 | .15 | .15 | .13 | .11 | .11 | .11 |
| 13.20 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .10 | .09 |
| 13.60 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 |
| 14.00 | .09 | .09 | .09 | .09 | .09 | .09 | .08 | .08 | .08 | .08 |
| 14.40 | .08 | .08 | .08 | .07 | .07 | .07 | .07 | .07 | .07 | .07 |
| 14.80 | .07 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 15.20 | .06 | .06 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 15.60 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 16.00 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .04 | .04 |
| 16.40 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 16.80 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 17.20 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 17.60 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 18.00 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 18.40 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 18.80 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .03 | .03 | .03 |
| 19.20 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 |
| 19.60 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 |

PEAK RUNOFF (cfs): 2.19
TIME TO PEAK (hrs): 12.00

1********** SCSHYDRO **********
********** Version 3.21 **********
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS **********

PROJECT: 7845 RICHMOND RD
User: LandTech Resources
Date: 06/07/2005 Tuesday
Time: 09:23:34
Input: RR1.IN
Output: RR1.OUT

RETURN PERIOD (yrs): 1

========== DOWNSTREAM HYDROGRAPH ==========

DISCHARGE (cfs)

| TIME: (hrs) | +.00 hrs | +.04 hrs | +.08 hrs | +.12 hrs | +.16 hrs | +.20 hrs | +.24 hrs | +.28 hrs | +.32 hrs | +.36 hrs |
|---|---|---|---|---|---|---|---|---|---|---|
| .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| .40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| .80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 1.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 1.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 3.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 3.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 4.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 4.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 5.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 5.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 6.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 6.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 6.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 7.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 7.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 8.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 8.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 8.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 9.20 | .00 | .00 | .00 | .00 | .01 | .01 | .01 | .01 | .01 | .01 |
| 9.60 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 10.00 | .01 | .01 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| 10.40 | .02 | .02 | .02 | .02 | .03 | .03 | .03 | .03 | .03 | .03 |
| 10.80 | .04 | .04 | .04 | .04 | .04 | .04 | .05 | .06 | .07 | .07 |
| 11.20 | .07 | .07 | .07 | .08 | .08 | .08 | .08 | .08 | .13 | .22 |
| 11.60 | .27 | .30 | .31 | .33 | .49 | 1.12 | 1.56 | 1.79 | 1.95 | 2.08 |
| 12.00 | 2.19 | 1.14 | .50 | .33 | .29 | .28 | .28 | .28 | .28 | .28 |
| 12.40 | .28 | .28 | .28 | .25 | .18 | .16 | .15 | .15 | .15 | .15 |
| 12.80 | .15 | .15 | .15 | .15 | .15 | .15 | .13 | .11 | .11 | .11 |
| 13.20 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .10 | .09 |
| 13.60 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 |
| 14.00 | .09 | .09 | .09 | .09 | .09 | .09 | .08 | .08 | .08 | .08 |
| 14.40 | .08 | .08 | .08 | .07 | .07 | .07 | .07 | .07 | .07 | .07 |
| 14.80 | .07 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 15.20 | .06 | .06 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 15.60 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 16.00 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .04 | .04 |
| 16.40 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 16.80 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 17.20 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 17.60 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 18.00 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 18.40 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 18.80 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .03 | .03 | .03 |
| 19.20 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 |
| 19.60 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 |

PEAK DISCHARGE (cfs): 2.19
TIME TO PEAK (hrs): 12.00
Hydrograph Saved In: RR1.DAT

1********** SCSHYDRO **********
********** Version 3.21 **********
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS **********

PROJECT: 7845 RICHMOND RD
User: LandTech Resources
Date: 06/07/2005 Tuesday
Time: 09:23:34
Input: RR1.IN
Output: RR1.OUT

RETURN PERIOD (yrs): 1

========== HYDROLOGIC SUMMARY ==========
========== Volumes, Losses, and Discharges ==========

SCS TYPE II Hyetograph.
SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
APPLIED RAINFALL DEPTH (inches): 2.80

| | VOLUME OF RAINFALL APPLIED (ac-ft) | VOLUME OF RUNOFF (ac-ft) | RAINFALL LOSSES (percent) | PEAK DISCHARGE (cfs) | PEAK DISCHARGE (cfs/ac) |
|---|---|---|---|---|---|
| SUBAREA 1 | .22400 | .10087 | 54.97 | 2.187 | 2.278 |
| TOTAL WATERSHED | .22400 | .10087 | 54.97 | 2.187 | 2.278 |

TOTAL WATERSHED AREA (square miles): .0015
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): .1009
COMPOSITE WATERSHED CURVE NUMBER: 84.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .050 hours.

NOTE: "VOLUME OF RUNOFF" includes surface runoff only; baseflows are not included in this summation. The "TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED" includes all baseflows.

1

# 2-Year Hydrograph

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1*******************************     SCSHYDRO     *******************************
 *******************************   Version 3.21   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 06/07/2005   Tuesday
    Time: 09:24:22
   Input: RR2.IN
  Output: RR2.OUT
```

## PROGRAM EXECUTION

| | | |
|---|---|---|
| NUMBER OF STORMS TO BE MODELED | : | 1 |
| NUMBER OF CHANNELS | : | 0 |
| NUMBER OF SUBAREAS | : | 1 |
| UPSTREAM HYDROGRAPHS ENTER AT | : | 0 LOCATIONS |
| NUMBER OF TIME STEPS | : | 500 |
| COMPUTATIONAL TIME INCREMENT | : | .040 Hours |

NOTE: The DURATION of the final computed hydrograph(s) for this watershed system will be 20.000 hours.

## UNIT HYDROGRAPH METHODOLOGY

The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff computations.
The peak rate factor (PRF) for all unit hydrographs is 484 (U.S. Customary units) or 2.08356 (Metric units).

```
1*******************************     SCSHYDRO     *******************************
 *******************************   Version 3.21   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 06/07/2005   Tuesday
    Time: 09:24:22
   Input: RR2.IN
  Output: RR2.OUT
```

## SUBAREA DATA

| SUBAREA ID NO | AREA (mi2) | TIME OF CONCENTRATION (hrs) | CURVE NUMBER | BASEFLOW (cfs) | DOWNSTREAM CHANNELS |
|---|---|---|---|---|---|
| 1 | .0015 | .050 | 84.00 | .0 | |

Composite Watershed Curve Number = 84.00
Minimum Subarea Time of Concentration = .050 hours.

```
1*******************************     SCSHYDRO     *******************************
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```
********************************   Version 3.21   ********************************
******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

PROJECT: 7845 RICHMOND RD
   User: LandTech Resources
   Date: 06/07/2005   Tuesday
   Time: 09:24:22
  Input: RR2.IN
 Output: RR2.OUT
                                                    RETURN PERIOD (yrs):      2

======================   RAINFALL HYETOGRAPH INFORMATION   ======================


        RAINFALL HYETOGRAPH: SCS TYPE II
        RAINFALL DURATION:    24.00 Hours
        RAINFALL DEPTH:        3.50 Inches


RAINFALL HYETOGRAPH,
SCS TYPE II
Time (Hours), Total Depth (Inches):

      .000,   .00      2.000,   .08      4.000,   .17      6.000,   .28
     7.000,   .34      8.000,   .42      8.500,   .47      9.000,   .51
     9.500,   .57      9.750,   .60     10.000,   .63     10.500,   .71
    11.000,   .82     11.500,   .99     11.750,  1.25     12.000,  2.32
    12.500,  2.57     13.000,  2.70     13.500,  2.80     14.000,  2.87
    16.000,  3.08     20.000,  3.33     24.000,  3.50
1********************************     SCSHYDRO     ********************************
********************************   Version 3.21   ********************************
******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

PROJECT: 7845 RICHMOND RD
  Input: RR2.IN
 Output: RR2.OUT
                                                    RETURN PERIOD (yrs):      2

   SUBAREA     1       SUBAREA     1       SUBAREA     1       SUBAREA     1

    AREA (square miles)              :        .0015
    TIME OF CONCENTRATION (hrs):        :        .05
    RUNOFF CURVE NUMBER              :      84.00
    BASEFLOW (cfs)                   :        .00
    DOWNSTREAM CHANNELS              :

                                SUBAREA RUNOFF (cfs)

TIME:     +.00    +.04    +.08    +.12    +.16    +.20    +.24    +.28    +.32    +.36
(hrs)     hrs     hrs     hrs     hrs     hrs     hrs     hrs     hrs     hrs     hrs
-------|-------------------------------------------------------------------------------
  .00  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  .40  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  .80  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 1.20  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 1.60  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 2.00  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 2.40  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 2.80  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 3.20  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 3.60  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 4.00  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 4.40  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 4.80  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 5.20  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 5.60  |   .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
```

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 6.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 6.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 7.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 7.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 8.00 | .00 | .00 | .00 | .00 | .00 | .00 | .01 | .01 | .01 | .01 |
| 8.40 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 8.80 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .02 |
| 9.20 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| 9.60 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .03 | .03 | .03 |
| 10.00 | .03 | .03 | .03 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 10.40 | .04 | .04 | .04 | .05 | .05 | .06 | .06 | .06 | .06 | .06 |
| 10.80 | .07 | .07 | .07 | .07 | .07 | .07 | .09 | .11 | .12 | .12 |
| 11.20 | .12 | .12 | .13 | .13 | .13 | .13 | .14 | .14 | .22 | .36 |
| 11.60 | .44 | .47 | .49 | .51 | .76 | 1.70 | 2.32 | 2.61 | 2.80 | 2.94 |
| 12.00 | 3.06 | 1.59 | .70 | .46 | .40 | .38 | .38 | .38 | .38 | .38 |
| 12.40 | .38 | .38 | .39 | .34 | .25 | .21 | .20 | .20 | .20 | .20 |
| 12.80 | .20 | .20 | .20 | .20 | .20 | .20 | .17 | .15 | .15 | .15 |
| 13.20 | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .14 | .13 |
| 13.60 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 |
| 14.00 | .12 | .12 | .12 | .12 | .12 | .12 | .11 | .11 | .11 | .11 |
| 14.40 | .11 | .10 | .10 | .10 | .10 | .10 | .10 | .09 | .09 | .09 |
| 14.80 | .09 | .09 | .09 | .08 | .08 | .08 | .08 | .08 | .08 | .08 |
| 15.20 | .08 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .07 |
| 15.60 | .07 | .07 | .07 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 16.00 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 16.40 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 16.80 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 17.20 | .06 | .06 | .06 | .06 | .06 | .06 | .05 | .05 | .05 | .05 |
| 17.60 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 18.00 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 18.40 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 18.80 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 19.20 | .05 | .05 | .05 | .05 | .05 | .05 | .04 | .04 | .04 | .04 |
| 19.60 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |

PEAK RUNOFF (cfs): 3.06
TIME TO PEAK (hrs): 12.00

1********** SCSHYDRO **********
********** Version 3.21 **********
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS **********

PROJECT: 7845 RICHMOND RD
User: LandTech Resources
Date: 06/07/2005 Tuesday
Time: 09:24:22
Input: RR2.IN
Output: RR2.OUT

RETURN PERIOD (yrs): 2

========== DOWNSTREAM HYDROGRAPH ==========

DISCHARGE (cfs)

| TIME: (hrs) | +.00 hrs | +.04 hrs | +.08 hrs | +.12 hrs | +.16 hrs | +.20 hrs | +.24 hrs | +.28 hrs | +.32 hrs | +.36 hrs |
|---|---|---|---|---|---|---|---|---|---|---|
| .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| .40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| .80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 1.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 1.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 3.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 3.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 4.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 4.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 5.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 5.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 6.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 6.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 6.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 7.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 7.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 8.00 | .00 | .00 | .00 | .00 | .00 | .00 | .01 | .01 | .01 | .01 |
| 8.40 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 8.80 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .02 |
| 9.20 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| 9.60 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .03 | .03 | .03 |
| 10.00 | .03 | .03 | .03 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 10.40 | .04 | .04 | .04 | .05 | .05 | .06 | .06 | .06 | .06 | .06 |
| 10.80 | .07 | .07 | .07 | .07 | .07 | .07 | .09 | .11 | .12 | .12 |
| 11.20 | .12 | .12 | .13 | .13 | .13 | .13 | .14 | .14 | .22 | .36 |
| 11.60 | .44 | .47 | .49 | .51 | .76 | 1.70 | 2.32 | 2.61 | 2.80 | 2.94 |
| 12.00 | 3.06 | 1.59 | .70 | .46 | .40 | .38 | .38 | .38 | .38 | .38 |
| 12.40 | .38 | .38 | .39 | .34 | .25 | .21 | .20 | .20 | .20 | .20 |
| 12.80 | .20 | .20 | .20 | .20 | .20 | .20 | .17 | .15 | .15 | .15 |
| 13.20 | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .14 | .13 |
| 13.60 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 |
| 14.00 | .12 | .12 | .12 | .12 | .12 | .12 | .11 | .11 | .11 | .11 |
| 14.40 | .11 | .10 | .10 | .10 | .10 | .10 | .10 | .09 | .09 | .09 |
| 14.80 | .09 | .09 | .09 | .08 | .08 | .08 | .08 | .08 | .08 | .08 |
| 15.20 | .08 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .07 |
| 15.60 | .07 | .07 | .07 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 16.00 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 16.40 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 16.80 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 17.20 | .06 | .06 | .06 | .06 | .06 | .06 | .05 | .05 | .05 | .05 |
| 17.60 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 18.00 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 18.40 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 18.80 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 19.20 | .05 | .05 | .05 | .05 | .05 | .05 | .04 | .04 | .04 | .04 |
| 19.60 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |

PEAK DISCHARGE (cfs): 3.06
TIME TO PEAK (hrs): 12.00
Hydrograph Saved In: RR2.DAT

1********** SCSHYDRO **********
********** Version 3.21 **********
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS **********

PROJECT: 7845 RICHMOND RD
User: LandTech Resources
Date: 06/07/2005 Tuesday
Time: 09:24:22
Input: RR2.IN
Output: RR2.OUT

RETURN PERIOD (yrs): 2

========== HYDROLOGIC SUMMARY ==========
========== Volumes, Losses, and Discharges ==========

SCS TYPE II Hyetograph.
SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
APPLIED RAINFALL DEPTH (inches): 3.50

| | VOLUME OF RAINFALL APPLIED (ac-ft) | VOLUME OF RUNOFF (ac-ft) | RAINFALL LOSSES (percent) | PEAK DISCHARGE (cfs) | PEAK DISCHARGE (cfs/ac) |
|---|---|---|---|---|---|
| SUBAREA 1 | .28000 | .14522 | 48.14 | 3.056 | 3.183 |
| TOTAL WATERSHED | .28000 | .14522 | 48.14 | 3.056 | 3.183 |

TOTAL WATERSHED AREA (square miles): .0015
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): .1452
COMPOSITE WATERSHED CURVE NUMBER: 84.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .050 hours.

NOTE: "VOLUME OF RUNOFF" includes surface runoff only; baseflows are not included in this summation. The "TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED" includes all baseflows.

1

# 10-Year Hydrograph

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1*********************************     SCSHYDRO     *********************************
 *********************************   Version 3.21   *********************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 06/07/2005   Tuesday
    Time: 09:25:03
   Input: RR10.IN
  Output: RR10.OUT



 ==============================   PROGRAM EXECUTION   ==============================


                        NUMBER OF STORMS TO BE MODELED    :     1
                        NUMBER OF CHANNELS                :     0
                        NUMBER OF SUBAREAS                :     1
                        UPSTREAM HYDROGRAPHS ENTER AT     :     0 LOCATIONS
                        NUMBER OF TIME STEPS              :   500
                        COMPUTATIONAL TIME INCREMENT      :  .040 Hours

 NOTE:   The DURATION of the final computed hydrograph(s) for this watershed
         system will be 20.000 hours.



 ========================   UNIT HYDROGRAPH METHODOLOGY   ========================


 The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff computations.
 The peak rate factor (PRF) for all unit hydrographs is 484 (U.S. Customary
 units) or 2.08356 (Metric units).
1*********************************     SCSHYDRO     *********************************
 *********************************   Version 3.21   *********************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 06/07/2005   Tuesday
    Time: 09:25:03
   Input: RR10.IN
  Output: RR10.OUT


 ================================   SUBAREA DATA   ================================


                          TIME OF
 SUBAREA      AREA      CONCENTRATION   CURVE     BASEFLOW
  ID NO       (mi2)        (hrs)        NUMBER     (cfs)     DOWNSTREAM CHANNELS
 _______   _________   _____________   ________   _______   ___________________

       1       .0015           .050      84.00         .0


     Composite Watershed Curve Number = 84.00
 Minimum Subarea Time of Concentration =  .050 hours.
1*********************************     SCSHYDRO     *********************************
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******************************   Version 3.21   ******************************
*****************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

PROJECT: 7845 RICHMOND RD
   User: LandTech Resources
   Date: 06/07/2005   Tuesday
   Time: 09:25:03
  Input: RR10.IN
 Output: RR10.OUT
                                                 RETURN PERIOD (yrs):     10

=====================   RAINFALL HYETOGRAPH INFORMATION   ====================


        RAINFALL HYETOGRAPH: SCS TYPE II
        RAINFALL DURATION:    24.00 Hours
        RAINFALL DEPTH:        5.80 Inches


RAINFALL HYETOGRAPH,
SCS TYPE II
Time (Hours), Total Depth (Inches):

      .000,   .00      2.000,   .13      4.000,   .28      6.000,   .46
     7.000,   .57      8.000,   .70      8.500,   .77      9.000,   .85
     9.500,   .95      9.750,  1.00     10.000,  1.05     10.500,  1.18
    11.000,  1.36     11.500,  1.64     11.750,  2.07     12.000,  3.85
    12.500,  4.26     13.000,  4.48     13.500,  4.63     14.000,  4.76
    16.000,  5.10     20.000,  5.52     24.000,  5.80
1******************************     SCSHYDRO     ******************************
******************************   Version 3.21   ******************************
*****************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

PROJECT: 7845 RICHMOND RD
  Input: RR10.IN
 Output: RR10.OUT
                                                 RETURN PERIOD (yrs):     10

   SUBAREA     1       SUBAREA     1       SUBAREA     1       SUBAREA     1

    AREA (square miles)          :        .0015
    TIME OF CONCENTRATION (hrs):        .05
    RUNOFF CURVE NUMBER          :      84.00
    BASEFLOW (cfs)               :        .00
    DOWNSTREAM CHANNELS          :

                                SUBAREA RUNOFF (cfs)

TIME:    +.00    +.04    +.08    +.12    +.16    +.20    +.24    +.28    +.32    +.36
(hrs)     hrs     hrs     hrs     hrs     hrs     hrs     hrs     hrs     hrs     hrs
------  ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
   .00 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
   .40 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
   .80 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  1.20 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  1.60 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  2.00 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  2.40 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  2.80 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  3.20 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  3.60 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  4.00 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  4.40 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  4.80 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  5.20 |    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  5.60 |    .00     .00     .00     .00     .01     .01     .01     .01     .01     .01
```

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6.00 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 6.40 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .02 |
| 6.80 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| 7.20 | .02 | .02 | .02 | .02 | .03 | .03 | .03 | .03 | .03 | .03 |
| 7.60 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 |
| 8.00 | .03 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 8.40 | .04 | .04 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 8.80 | .05 | .05 | .05 | .06 | .06 | .06 | .06 | .06 | .07 | .07 |
| 9.20 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .08 | .08 |
| 9.60 | .08 | .08 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 |
| 10.00 | .09 | .11 | .12 | .12 | .12 | .12 | .12 | .13 | .13 | .13 |
| 10.40 | .13 | .13 | .13 | .14 | .17 | .18 | .18 | .18 | .19 | .19 |
| 10.80 | .19 | .19 | .19 | .19 | .20 | .20 | .26 | .30 | .31 | .32 |
| 11.20 | .32 | .33 | .33 | .33 | .33 | .34 | .34 | .34 | .55 | .88 |
| 11.60 | 1.06 | 1.12 | 1.15 | 1.18 | 1.72 | 3.73 | 4.96 | 5.43 | 5.68 | 5.84 |
| 12.00 | 5.97 | 3.09 | 1.34 | .88 | .76 | .73 | .72 | .72 | .72 | .73 |
| 12.40 | .73 | .73 | .73 | .63 | .48 | .40 | .38 | .38 | .38 | .38 |
| 12.80 | .38 | .38 | .38 | .38 | .38 | .38 | .32 | .29 | .28 | .28 |
| 13.20 | .28 | .28 | .28 | .28 | .28 | .28 | .28 | .28 | .26 | .23 |
| 13.60 | .22 | .22 | .22 | .22 | .22 | .22 | .22 | .22 | .22 | .22 |
| 14.00 | .22 | .22 | .23 | .22 | .22 | .22 | .21 | .21 | .20 | .20 |
| 14.40 | .20 | .19 | .19 | .19 | .18 | .18 | .18 | .17 | .17 | .17 |
| 14.80 | .16 | .16 | .16 | .16 | .15 | .15 | .15 | .15 | .14 | .14 |
| 15.20 | .14 | .14 | .14 | .13 | .13 | .13 | .13 | .13 | .12 | .12 |
| 15.60 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .11 | .11 |
| 16.00 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 |
| 16.40 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 |
| 16.80 | .11 | .11 | .11 | .10 | .10 | .10 | .10 | .10 | .10 | .10 |
| 17.20 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 |
| 17.60 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 |
| 18.00 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 |
| 18.40 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 |
| 18.80 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .08 | .08 | .08 |
| 19.20 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 |
| 19.60 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 |

PEAK RUNOFF (cfs): 5.97
TIME TO PEAK (hrs): 12.00

1********** SCSHYDRO **********
********** Version 3.21 **********
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS **********

PROJECT: 7845 RICHMOND RD
User: LandTech Resources
Date: 06/07/2005 Tuesday
Time: 09:25:03
Input: RR10.IN
Output: RR10.OUT

RETURN PERIOD (yrs): 10

========== DOWNSTREAM HYDROGRAPH ==========

DISCHARGE (cfs)

| TIME: (hrs) | +.00 hrs | +.04 hrs | +.08 hrs | +.12 hrs | +.16 hrs | +.20 hrs | +.24 hrs | +.28 hrs | +.32 hrs | +.36 hrs |
|---|---|---|---|---|---|---|---|---|---|---|
| .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| .40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| .80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 1.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 1.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 3.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 3.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 4.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 4.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 5.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 5.60 | .00 | .00 | .00 | .00 | .01 | .01 | .01 | .01 | .01 | .01 |
| 6.00 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 6.40 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .02 |
| 6.80 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| 7.20 | .02 | .02 | .02 | .02 | .03 | .03 | .03 | .03 | .03 | .03 |
| 7.60 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 |
| 8.00 | .03 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 8.40 | .04 | .04 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| 8.80 | .05 | .05 | .05 | .06 | .06 | .06 | .06 | .06 | .07 | .07 |
| 9.20 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .08 | .08 |
| 9.60 | .08 | .08 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 |
| 10.00 | .09 | .11 | .12 | .12 | .12 | .12 | .12 | .13 | .13 | .13 |
| 10.40 | .13 | .13 | .13 | .14 | .17 | .18 | .18 | .18 | .19 | .19 |
| 10.80 | .19 | .19 | .19 | .19 | .20 | .20 | .26 | .30 | .31 | .32 |
| 11.20 | .32 | .33 | .33 | .33 | .33 | .34 | .34 | .34 | .55 | .88 |
| 11.60 | 1.06 | 1.12 | 1.15 | 1.18 | 1.72 | 3.73 | 4.96 | 5.43 | 5.68 | 5.84 |
| 12.00 | 5.97 | 3.09 | 1.34 | .88 | .76 | .73 | .72 | .72 | .72 | .73 |
| 12.40 | .73 | .73 | .73 | .63 | .48 | .40 | .38 | .38 | .38 | .38 |
| 12.80 | .38 | .38 | .38 | .38 | .38 | .38 | .32 | .29 | .28 | .28 |
| 13.20 | .28 | .28 | .28 | .28 | .28 | .28 | .28 | .28 | .26 | .23 |
| 13.60 | .22 | .22 | .22 | .22 | .22 | .22 | .22 | .22 | .22 | .22 |
| 14.00 | .22 | .22 | .23 | .22 | .22 | .22 | .21 | .21 | .20 | .20 |
| 14.40 | .20 | .19 | .19 | .19 | .18 | .18 | .18 | .17 | .17 | .17 |
| 14.80 | .16 | .16 | .16 | .16 | .15 | .15 | .15 | .15 | .14 | .14 |
| 15.20 | .14 | .14 | .14 | .13 | .13 | .13 | .13 | .13 | .12 | .12 |
| 15.60 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .11 | .11 |
| 16.00 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 |
| 16.40 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 |
| 16.80 | .11 | .11 | .11 | .10 | .10 | .10 | .10 | .10 | .10 | .10 |
| 17.20 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 |
| 17.60 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 | .10 |
| 18.00 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 |
| 18.40 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 |
| 18.80 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .08 | .08 | .08 |
| 19.20 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 |
| 19.60 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 | .08 |

PEAK DISCHARGE (cfs): 5.97
TIME TO PEAK (hrs): 12.00
Hydrograph Saved In: RR10.DAT

1********** SCSHYDRO **********
********** Version 3.21 **********
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS **********

PROJECT: 7845 RICHMOND RD
User: LandTech Resources
Date: 06/07/2005 Tuesday
Time: 09:25:03
Input: RR10.IN
Output: RR10.OUT

RETURN PERIOD (yrs): 10

## HYDROLOGIC SUMMARY
### Volumes, Losses, and Discharges

SCS TYPE II Hyetograph.
SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
APPLIED RAINFALL DEPTH (inches): 5.80

| | VOLUME OF RAINFALL APPLIED (ac-ft) | VOLUME OF RUNOFF (ac-ft) | RAINFALL LOSSES (percent) | PEAK DISCHARGE (cfs) | PEAK DISCHARGE (cfs/ac) |
|---|---|---|---|---|---|
| SUBAREA 1 | .46400 | .30377 | 34.53 | 5.969 | 6.218 |
| TOTAL WATERSHED | .46400 | .30377 | 34.53 | 5.969 | 6.218 |

TOTAL WATERSHED AREA (square miles): .0015
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): .3038
COMPOSITE WATERSHED CURVE NUMBER: 84.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .050 hours.

NOTE: "VOLUME OF RUNOFF" includes surface runoff only; baseflows are not included in this summation. The "TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED" includes all baseflows.

1

# 100-Year Hydrograph

```
1*******************************     SCSHYDRO     *******************************
 *******************************   Version 3.21   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ********************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 06/07/2005   Tuesday
    Time: 09:25:48
   Input: RR100.IN
  Output: RR100.OUT


 ============================   PROGRAM EXECUTION   ============================


                        NUMBER OF STORMS TO BE MODELED    :     1
                        NUMBER OF CHANNELS                :     0
                        NUMBER OF SUBAREAS                :     1
                        UPSTREAM HYDROGRAPHS ENTER AT     :     0 LOCATIONS
                        NUMBER OF TIME STEPS              :   500
                        COMPUTATIONAL TIME INCREMENT      :  .040 Hours

 NOTE:   The DURATION of the final computed hydrograph(s) for this watershed
         system will be 20.000 hours.


 ========================   UNIT HYDROGRAPH METHODOLOGY   ========================


 The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff computations.
 The peak rate factor (PRF) for all unit hydrographs is 484 (U.S. Customary
 units) or 2.08356 (Metric units).
1*******************************     SCSHYDRO     *******************************
 *******************************   Version 3.21   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ********************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 06/07/2005   Tuesday
    Time: 09:25:48
   Input: RR100.IN
  Output: RR100.OUT


 ================================   SUBAREA DATA   ================================


                          TIME OF
 SUBAREA      AREA      CONCENTRATION   CURVE     BASEFLOW
  ID NO       (mi2)        (hrs)        NUMBER     (cfs)     DOWNSTREAM CHANNELS
 _______   _________   _____________   ________   ________   ___________________

       1       .0015           .050      84.00         .0


     Composite Watershed Curve Number = 84.00
 Minimum Subarea Time of Concentration =  .050 hours.
1*******************************     SCSHYDRO     *******************************
```

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********************************   Version 3.21   ********************************
******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ********************

PROJECT: 7845 RICHMOND RD
   User: LandTech Resources
   Date: 06/07/2005   Tuesday
   Time: 09:25:48
  Input: RR100.IN
 Output: RR100.OUT
                                                    RETURN PERIOD (yrs):    100

======================   RAINFALL HYETOGRAPH INFORMATION   ======================


        RAINFALL HYETOGRAPH: SCS TYPE II
        RAINFALL DURATION:    24.00 Hours
        RAINFALL DEPTH:        8.00 Inches


RAINFALL HYETOGRAPH,
SCS TYPE II
Time (Hours), Total Depth (Inches):

      .000,   .00      2.000,   .18      4.000,   .38      6.000,   .64
     7.000,   .78      8.000,   .96      8.500,  1.06      9.000,  1.18
     9.500,  1.30      9.750,  1.38     10.000,  1.45     10.500,  1.63
    11.000,  1.88     11.500,  2.26     11.750,  2.86     12.000,  5.30
    12.500,  5.88     13.000,  6.18     13.500,  6.39     14.000,  6.56
    16.000,  7.04     20.000,  7.62     24.000,  8.00
1********************************     SCSHYDRO     ********************************
 ********************************   Version 3.21   ********************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ********************

 PROJECT: 7845 RICHMOND RD
   Input: RR100.IN
  Output: RR100.OUT
                                                    RETURN PERIOD (yrs):    100

   SUBAREA     1       SUBAREA     1       SUBAREA     1       SUBAREA     1

    AREA (square miles)          :        .0015
    TIME OF CONCENTRATION (hrs):        .05
    RUNOFF CURVE NUMBER          :      84.00
    BASEFLOW (cfs)               :        .00
    DOWNSTREAM CHANNELS          :
```

SUBAREA RUNOFF (cfs)

| TIME: (hrs) | +.00 hrs | +.04 hrs | +.08 hrs | +.12 hrs | +.16 hrs | +.20 hrs | +.24 hrs | +.28 hrs | +.32 hrs | +.36 hrs |
|---|---|---|---|---|---|---|---|---|---|---|
| .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| .40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| .80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 1.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 1.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 3.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 3.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 4.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .01 |
| 4.40 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 4.80 | .01 | .01 | .01 | .01 | .01 | .02 | .02 | .02 | .02 | .02 |
| 5.20 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| 5.60 | .02 | .02 | .02 | .02 | .02 | .03 | .03 | .03 | .03 | .03 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6.00 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .04 | .04 | .04 |
| 6.40 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 6.80 | .04 | .04 | .04 | .04 | .04 | .04 | .05 | .05 | .06 | .06 |
| 7.20 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 7.60 | .06 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .07 |
| 8.00 | .07 | .08 | .08 | .09 | .09 | .09 | .09 | .09 | .09 | .09 |
| 8.40 | .09 | .09 | .09 | .10 | .10 | .10 | .10 | .10 | .10 | .11 |
| 8.80 | .11 | .11 | .11 | .11 | .11 | .11 | .12 | .13 | .13 | .13 |
| 9.20 | .13 | .13 | .13 | .13 | .13 | .13 | .14 | .14 | .14 | .15 |
| 9.60 | .15 | .16 | .16 | .16 | .16 | .16 | .16 | .16 | .16 | .16 |
| 10.00 | .17 | .19 | .21 | .21 | .22 | .22 | .22 | .22 | .22 | .22 |
| 10.40 | .23 | .23 | .23 | .25 | .29 | .31 | .31 | .32 | .32 | .32 |
| 10.80 | .32 | .32 | .33 | .33 | .33 | .33 | .44 | .50 | .52 | .53 |
| 11.20 | .53 | .54 | .54 | .54 | .55 | .55 | .55 | .56 | .89 | 1.42 |
| 11.60 | 1.69 | 1.78 | 1.82 | 1.85 | 2.68 | 5.74 | 7.55 | 8.17 | 8.45 | 8.63 |
| 12.00 | 8.75 | 4.52 | 1.96 | 1.29 | 1.10 | 1.05 | 1.05 | 1.05 | 1.05 | 1.05 |
| 12.40 | 1.05 | 1.05 | 1.05 | .91 | .69 | .58 | .55 | .55 | .54 | .54 |
| 12.80 | .54 | .54 | .54 | .54 | .54 | .55 | .46 | .42 | .40 | .40 |
| 13.20 | .40 | .40 | .40 | .40 | .40 | .40 | .40 | .40 | .37 | .34 |
| 13.60 | .32 | .31 | .31 | .31 | .31 | .31 | .31 | .31 | .31 | .31 |
| 14.00 | .31 | .32 | .32 | .32 | .31 | .31 | .30 | .30 | .29 | .29 |
| 14.40 | .28 | .28 | .27 | .27 | .26 | .26 | .25 | .25 | .24 | .24 |
| 14.80 | .23 | .23 | .23 | .22 | .22 | .22 | .21 | .21 | .21 | .20 |
| 15.20 | .20 | .20 | .19 | .19 | .19 | .19 | .18 | .18 | .18 | .18 |
| 15.60 | .17 | .17 | .17 | .17 | .17 | .17 | .17 | .16 | .16 | .16 |
| 16.00 | .16 | .16 | .16 | .16 | .16 | .16 | .16 | .16 | .16 | .16 |
| 16.40 | .16 | .16 | .16 | .16 | .15 | .15 | .15 | .15 | .15 | .15 |
| 16.80 | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .15 |
| 17.20 | .15 | .15 | .14 | .14 | .14 | .14 | .14 | .14 | .14 | .14 |
| 17.60 | .14 | .14 | .14 | .14 | .14 | .14 | .14 | .14 | .14 | .14 |
| 18.00 | .14 | .13 | .13 | .13 | .13 | .13 | .13 | .13 | .13 | .13 |
| 18.40 | .13 | .13 | .13 | .13 | .13 | .13 | .13 | .13 | .13 | .13 |
| 18.80 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 |
| 19.20 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .11 | .11 |
| 19.60 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 |

PEAK RUNOFF (cfs): 8.75
TIME TO PEAK (hrs): 12.00

1********** SCSHYDRO **********
********** Version 3.21 **********
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS **********

PROJECT: 7845 RICHMOND RD
User: LandTech Resources
Date: 06/07/2005 Tuesday
Time: 09:25:48
Input: RR100.IN
Output: RR100.OUT

RETURN PERIOD (yrs): 100

========== DOWNSTREAM HYDROGRAPH ==========

DISCHARGE (cfs)

| TIME: (hrs) | +.00 hrs | +.04 hrs | +.08 hrs | +.12 hrs | +.16 hrs | +.20 hrs | +.24 hrs | +.28 hrs | +.32 hrs | +.36 hrs |
|---|---|---|---|---|---|---|---|---|---|---|
| .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| .40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| .80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 1.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 1.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.40 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2.80 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 3.20 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 3.60 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .01 |
| 4.40 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 4.80 | .01 | .01 | .01 | .01 | .01 | .02 | .02 | .02 | .02 | .02 |
| 5.20 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| 5.60 | .02 | .02 | .02 | .02 | .02 | .03 | .03 | .03 | .03 | .03 |
| 6.00 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .04 | .04 | .04 |
| 6.40 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| 6.80 | .04 | .04 | .04 | .04 | .04 | .04 | .05 | .05 | .06 | .06 |
| 7.20 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| 7.60 | .06 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .07 | .07 |
| 8.00 | .07 | .08 | .08 | .09 | .09 | .09 | .09 | .09 | .09 | .09 |
| 8.40 | .09 | .09 | .09 | .10 | .10 | .10 | .10 | .10 | .10 | .11 |
| 8.80 | .11 | .11 | .11 | .11 | .11 | .11 | .12 | .13 | .13 | .13 |
| 9.20 | .13 | .13 | .13 | .13 | .13 | .13 | .14 | .14 | .14 | .15 |
| 9.60 | .15 | .16 | .16 | .16 | .16 | .16 | .16 | .16 | .16 | .16 |
| 10.00 | .17 | .19 | .21 | .21 | .22 | .22 | .22 | .22 | .22 | .22 |
| 10.40 | .23 | .23 | .23 | .25 | .29 | .31 | .31 | .32 | .32 | .32 |
| 10.80 | .32 | .32 | .33 | .33 | .33 | .33 | .44 | .50 | .52 | .53 |
| 11.20 | .53 | .54 | .54 | .54 | .55 | .55 | .55 | .56 | .89 | 1.42 |
| 11.60 | 1.69 | 1.78 | 1.82 | 1.85 | 2.68 | 5.74 | 7.55 | 8.17 | 8.45 | 8.63 |
| 12.00 | 8.75 | 4.52 | 1.96 | 1.29 | 1.10 | 1.05 | 1.05 | 1.05 | 1.05 | 1.05 |
| 12.40 | 1.05 | 1.05 | 1.05 | .91 | .69 | .58 | .55 | .55 | .54 | .54 |
| 12.80 | .54 | .54 | .54 | .54 | .54 | .55 | .46 | .42 | .40 | .40 |
| 13.20 | .40 | .40 | .40 | .40 | .40 | .40 | .40 | .40 | .37 | .34 |
| 13.60 | .32 | .31 | .31 | .31 | .31 | .31 | .31 | .31 | .31 | .31 |
| 14.00 | .31 | .32 | .32 | .32 | .31 | .31 | .30 | .30 | .29 | .29 |
| 14.40 | .28 | .28 | .27 | .27 | .26 | .26 | .25 | .25 | .24 | .24 |
| 14.80 | .23 | .23 | .23 | .22 | .22 | .22 | .21 | .21 | .21 | .20 |
| 15.20 | .20 | .20 | .19 | .19 | .19 | .19 | .18 | .18 | .18 | .18 |
| 15.60 | .17 | .17 | .17 | .17 | .17 | .17 | .17 | .16 | .16 | .16 |
| 16.00 | .16 | .16 | .16 | .16 | .16 | .16 | .16 | .16 | .16 | .16 |
| 16.40 | .16 | .16 | .16 | .16 | .15 | .15 | .15 | .15 | .15 | .15 |
| 16.80 | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .15 |
| 17.20 | .15 | .15 | .14 | .14 | .14 | .14 | .14 | .14 | .14 | .14 |
| 17.60 | .14 | .14 | .14 | .14 | .14 | .14 | .14 | .14 | .14 | .14 |
| 18.00 | .14 | .13 | .13 | .13 | .13 | .13 | .13 | .13 | .13 | .13 |
| 18.40 | .13 | .13 | .13 | .13 | .13 | .13 | .13 | .13 | .13 | .13 |
| 18.80 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 |
| 19.20 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .12 | .11 | .11 |
| 19.60 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 | .11 |

PEAK DISCHARGE (cfs): 8.75
TIME TO PEAK (hrs): 12.00
Hydrograph Saved In: RR100.DAT

1********** SCSHYDRO **********
********** Version 3.21 **********
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS **********

PROJECT: 7845 RICHMOND RD
User: LandTech Resources
Date: 06/07/2005 Tuesday
Time: 09:25:48
Input: RR100.IN
Output: RR100.OUT

RETURN PERIOD (yrs): 100

========== HYDROLOGIC SUMMARY ==========
========== Volumes, Losses, and Discharges ==========

SCS TYPE II Hyetograph.
SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
APPLIED RAINFALL DEPTH (inches): 8.00

| | VOLUME OF RAINFALL APPLIED (ac-ft) | VOLUME OF RUNOFF (ac-ft) | RAINFALL LOSSES (percent) | PEAK DISCHARGE (cfs) | PEAK DISCHARGE (cfs/ac) |
|---|---|---|---|---|---|
| SUBAREA 1 | .64000 | .46388 | 27.52 | 8.748 | 9.112 |
| TOTAL WATERSHED | .64000 | .46388 | 27.52 | 8.748 | 9.112 |

TOTAL WATERSHED AREA (square miles): .0015
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): .4639
COMPOSITE WATERSHED CURVE NUMBER: 84.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .050 hours.

NOTE: "VOLUME OF RUNOFF" includes surface runoff only; baseflows are not included in this summation. The "TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED" includes all baseflows.

1

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

PROJECT NAME _____
PROJECT NO. 05-001
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 3/2/05
SCALE _____

## BMP INFILTRATION BASIN
## STAGE-STORAGE

| ELEV (ft) | Δ ELEV (ft) | SA (sf) | STORAGE (cf) | ACCUM STORAGE (cf) |
|---|---|---|---|---|
| 103.0 | | 3598 | | 0 |
| | 1.0 | | 3846 | |
| 104.0 | | 4094 | | 3846 |
| | 1.0 | | 4355 | |
| 105.0 | | 4616 | | 8201 |
| | 1.0 | | 4889 | |
| 106.0 | | 5162 | | 13,090 |
| | 1.0 | | 5447 | |
| 107.0 | | 5732 | | 18,537 |
| | 1.0 | | 6030 | |
| 108.0 | | 6328 | | 24,567 |

Water Quality Volume of 2150 cf rises to Elev 103.56

1-Year Storm Volume of 4,394 cf rises to Elev 104.13

2-Year Storm Volume of 6,326 cf rises to Elev 104.57

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PROJECT NAME _____
PROJECT NO. 05-001
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 6/1/05
SCALE _____

## DETERMINE MAXIMUM PONDING TIME

Infiltration Rate, $f$ = 1.00 in/hr  Per Geotechnical Report dated 5/26/05

Design Infiltration Rate, $f_d = 0.5f$ = 0.50 in/hr

Ponding Time, $T = \frac{d}{f_d}$

Maximum Ponding Depth = 104.67 − 103.00 = 1.67 ft
At the Depth of 1.67 ft the water quality volume, 1-year storm and 2-year storm are infiltrated.

$$T = \frac{1.67\ ft \mid 12\ in}{0.5\ in/hr \mid 1\ ft} = 40\ hrs < 48\ hrs \quad \underline{OK}$$

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PROJECT NAME _____
PROJECT NO. 05-001
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 6/1/05
SCALE _____

## DESIGN ORIFICE TO PASS 10-YEAR POST-DEVELOPMENT STORM AT PRE-DEVELOPMENT RATE

$Q = 0.6 A \sqrt{2gh}$ – orifice equation

orifice invert @ Elev 104.67

$Q = 1.08$ cfs (10-year Pre-Development Storm)

$h = 106.03 - 104.67 = 1.36'$

$1.08 = 0.6 A \sqrt{2(32.2)(1.36)}$

$A = \pi r^2 = .1923 \text{ ft}^2$

$r = .2474'$

USE 5.75" DIAMETER ORIFICE AT ELEV 104.67
$A = 0.180 \text{ ft}^2$

| ELEV | H | Q |
|---|---|---|
| 104.67 | — | 0 |
| 105.00 | 0.33 | 0.50 |
| 106.00 | 1.33 | 1.00 |
| 107.00 | 2.33 | 1.32 |
| 108.00 | 3.33 | 1.58 |

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

PROJECT NAME _____
PROJECT NO. 05-001
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 6/1/05
SCALE _____

# DESIGN OUTLET WEIR

$Q = CLH^{3/2}$

$C = 3.1$

$L = 3.0 \times 4 = 12'$ (VDOT DI-7) RIM 106.40

| ELEV | H | Q |
|---|---|---|
| 106.40 | — | 0 |
| 107.00 | 0.60 | 17.29 |
| 108.00 | 1.60 | 75.29 |

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PROJECT NAME _____
PROJECT NO. 05-001
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 6/1/05
SCALE _____

# DESIGN OUTLET BARREL

50' OF 23" x 14" HE RCP @ 0.48%

$INV_{IN}$ = 104.03
$INV_{OUT}$ = 103.74
TW = 104.67

| Q | $d_n$ | $d_c$ | $V_n$ | R | H | $h_o$ | $LS_o$ | HW | HW ELEV |
|---|---|---|---|---|---|---|---|---|---|
| 0 | — | — | — | — | — | — | — | — | 104.03 |
| 5 | .71 | .67 | 4.44 | .33 | .75 | .92 | .29 | 1.38 | 105.41 |
| 10 | 1.17 | 1.17 | 5.65 | .29 | 1.30 | 1.17 | .29 | 2.18 | 106.21 |
| 15 | 1.17 | 1.17 | 8.47 | .29 | 2.92 | 1.17 | .29 | 3.80 | 107.83 |
| 20 | 1.17 | 1.17 | 11.30 | .29 | 5.19 | 1.17 | .29 | 6.07 | 110.10 |

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PROJECT NAME _____
PROJECT NO. 05-001
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 6/1/05
SCALE _____

## STAGE - STORAGE - DISCHARGE

| STAGE (ft) | STORAGE (ac-ft) | DISCHARGE (cfs) |
|---|---|---|
| 103.00 | 0.0826 | 0.00 |
| 104.00 | 0.0940 | 0.00 |
| 104.67 | 0.1020 | 0.00 |
| 105.00 | 0.1060 | 0.50 |
| 106.00 | 0.1185 | 1.00 |
| 106.40 | 0.1237 | 1.14 |
| 107.00 | 0.1316 | 12.44 |
| 108.00 | 0.1452 | 15.37 |

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PROJECT NAME _____
PROJECT NO. 05-001
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____
SCALE _____

## FOREBAY DESIGN

Forebay Volume - 25% of the WQv

Forebay Volume - (.25)(2150 cf) = 538 cf

Forebay Dimensions = 30'L x 18' x 1'D

## STAGE - STORAGE

| Elev (ft) | ΔElev (ft) | SA (sf) | STORAGE (cf) | ACCUM STORAGE (cf) |
|---|---|---|---|---|
| 105.0 | | 356 | | 0 |
| | 1.0 | | 443 | |
| 106.0 | | 530 | | 443 |
| | 1.0 | | 634 | |
| 107.0 | | 738 | | 1077 |

Forebay Volume is $\frac{1077}{538}$ = 2 times larger than required

Forebay is oversized to meet the requirements of SSCP # 20

# 10 -Year Routing

```
1*******************************     PONDOPT      *******************************
 *******************************   Version 1.83   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 07/21/2005  Thursday
    Time: 13:30:41
  Output: RRP10.OUT


 SOLUTION FOR  1  STORMS.

 TIME INCREMENT:   .040  Hours

 STORM
 NUMBER   HYDROGRAPH IN FILE:
 ______   ____________________________________________________________

   1      RR10.DAT
```

| STORM NUMBER | PEAK INFLOW (cfs) | ALLOWABLE PEAK DISCHARGE (cfs) | DURATION (min) | RUNOFF VOLUME (ft3) | TAILWATER STAGE (ft) |
|---|---|---|---|---|---|
| 1 | 5.969 | N/A | 1197.60 | .1323E+05 | 104.670 |

```
1*******************************     PONDOPT      *******************************
 *******************************   Version 1.83   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 07/21/2005  Thursday
    Time: 13:30:41
  Output: RRP10.OUT


 Stage-Area-Discharge
 Filename: RRPOND.DAT

          TAILWATER STAGE:  104.670 feet.
            INITIAL STAGE:  104.670 feet.

 ==================   STAGE-STORAGE-DISCHARGE RELATIONSHIP   ==================

 <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<   STORM  1      >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
```

| STAGE (ft) | STORAGE VOLUME (ac-ft) | DISCHARGE (cfs) |
|---|---|---|
| 103.000 | .0000 | .0000 |
| 104.000 | .8824E-01 | .0000 |
| 104.670 | .1539 | .0000 |
| 105.000 | .1882 | .5000 |
| 106.000 | .3004 | 1.000 |
| 106.400 | .3488 | 1.140 |
| 107.000 | .4254 | 12.44 |
| 108.000 | .5638 | 15.37 |

```
1*******************************     PONDOPT      *******************************
```

********** Version 1.83 **********
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS **********

PROJECT: 7845 RICHMOND RD
User: LandTech Resources
Date: 07/21/2005 Thursday
Time: 13:30:41
Output: RRP10.OUT

TAILWATER STAGE: 104.670 feet.
INITIAL STAGE: 104.670 feet.

<<<<<<<<<<<<<<<<<<<< ROUTING RESULTS FOR STORM 1 >>>>>>>>>>>>>>>>>>>>

MAXIMUM ELEVATION: 105.9 feet.
MAXIMUM INFLOW: 5.969 cfs.
MAXIMUM OUTFLOW: .9363 cfs.
MAXIMUM STORAGE: .2861 acre-feet.

CONTINUITY ERROR: .207E-05 percent.

| TIME (min) | INFLOW RATE (cfs) | OUTFLOW RATE (cfs) | POND SURFACE ELEVATION (ft) |
|---|---|---|---|
| 0 | .000 | .000 | 104.670 |
| 2 | .000 | .000 | 104.670 |
| 5 | .000 | .000 | 104.670 |
| 7 | .000 | .000 | 104.670 |
| 10 | .000 | .000 | 104.670 |
| 12 | .000 | .000 | 104.670 |
| 14 | .000 | .000 | 104.670 |
| 17 | .000 | .000 | 104.670 |
| 19 | .000 | .000 | 104.670 |
| 22 | .000 | .000 | 104.670 |
| 24 | .000 | .000 | 104.670 |
| 26 | .000 | .000 | 104.670 |
| 29 | .000 | .000 | 104.670 |
| 31 | .000 | .000 | 104.670 |
| 34 | .000 | .000 | 104.670 |
| 36 | .000 | .000 | 104.670 |
| 38 | .000 | .000 | 104.670 |
| 41 | .000 | .000 | 104.670 |
| 43 | .000 | .000 | 104.670 |
| 46 | .000 | .000 | 104.670 |
| 48 | .000 | .000 | 104.670 |
| 50 | .000 | .000 | 104.670 |
| 53 | .000 | .000 | 104.670 |
| 55 | .000 | .000 | 104.670 |
| 58 | .000 | .000 | 104.670 |
| 60 | .000 | .000 | 104.670 |
| 62 | .000 | .000 | 104.670 |
| 65 | .000 | .000 | 104.670 |
| 67 | .000 | .000 | 104.670 |
| 70 | .000 | .000 | 104.670 |
| 72 | .000 | .000 | 104.670 |
| 74 | .000 | .000 | 104.670 |
| 77 | .000 | .000 | 104.670 |
| 79 | .000 | .000 | 104.670 |
| 82 | .000 | .000 | 104.670 |
| 84 | .000 | .000 | 104.670 |
| 86 | .000 | .000 | 104.670 |
| 89 | .000 | .000 | 104.670 |
| 91 | .000 | .000 | 104.670 |
| 94 | .000 | .000 | 104.670 |
| 96 | .000 | .000 | 104.670 |
| 98 | .000 | .000 | 104.670 |
| 101 | .000 | .000 | 104.670 |

| | | | |
|---|---|---|---|
| 103 | .000 | .000 | 104.670 |
| 106 | .000 | .000 | 104.670 |
| 108 | .000 | .000 | 104.670 |
| 110 | .000 | .000 | 104.670 |
| 113 | .000 | .000 | 104.670 |
| 115 | .000 | .000 | 104.670 |
| 118 | .000 | .000 | 104.670 |
| 120 | .000 | .000 | 104.670 |
| 122 | .000 | .000 | 104.670 |
| 125 | .000 | .000 | 104.670 |
| 127 | .000 | .000 | 104.670 |
| 130 | .000 | .000 | 104.670 |
| 132 | .000 | .000 | 104.670 |
| 134 | .000 | .000 | 104.670 |
| 137 | .000 | .000 | 104.670 |
| 139 | .000 | .000 | 104.670 |
| 142 | .000 | .000 | 104.670 |
| 144 | .000 | .000 | 104.670 |
| 146 | .000 | .000 | 104.670 |
| 149 | .000 | .000 | 104.670 |
| 151 | .000 | .000 | 104.670 |
| 154 | .000 | .000 | 104.670 |
| 156 | .000 | .000 | 104.670 |
| 158 | .000 | .000 | 104.670 |
| 161 | .000 | .000 | 104.670 |
| 163 | .000 | .000 | 104.670 |
| 166 | .000 | .000 | 104.670 |
| 168 | .000 | .000 | 104.670 |
| 170 | .000 | .000 | 104.670 |
| 173 | .000 | .000 | 104.670 |
| 175 | .000 | .000 | 104.670 |
| 178 | .000 | .000 | 104.670 |
| 180 | .000 | .000 | 104.670 |
| 182 | .000 | .000 | 104.670 |
| 185 | .000 | .000 | 104.670 |
| 187 | .000 | .000 | 104.670 |
| 190 | .000 | .000 | 104.670 |
| 192 | .000 | .000 | 104.670 |
| 194 | .000 | .000 | 104.670 |
| 197 | .000 | .000 | 104.670 |
| 199 | .000 | .000 | 104.670 |
| 202 | .000 | .000 | 104.670 |
| 204 | .000 | .000 | 104.670 |
| 206 | .000 | .000 | 104.670 |
| 209 | .000 | .000 | 104.670 |
| 211 | .000 | .000 | 104.670 |
| 214 | .000 | .000 | 104.670 |
| 216 | .000 | .000 | 104.670 |
| 218 | .000 | .000 | 104.670 |
| 221 | .000 | .000 | 104.670 |
| 223 | .000 | .000 | 104.670 |
| 226 | .000 | .000 | 104.670 |
| 228 | .000 | .000 | 104.670 |
| 230 | .000 | .000 | 104.670 |
| 233 | .000 | .000 | 104.670 |
| 235 | .000 | .000 | 104.670 |
| 238 | .000 | .000 | 104.670 |
| 240 | .000 | .000 | 104.670 |
| 242 | .000 | .000 | 104.670 |
| 245 | .000 | .000 | 104.670 |
| 247 | .000 | .000 | 104.670 |
| 250 | .000 | .000 | 104.670 |
| 252 | .000 | .000 | 104.670 |
| 254 | .000 | .000 | 104.670 |
| 257 | .000 | .000 | 104.670 |
| 259 | .000 | .000 | 104.670 |
| 262 | .000 | .000 | 104.670 |
| 264 | .000 | .000 | 104.670 |
| 266 | .000 | .000 | 104.670 |
| 269 | .000 | .000 | 104.670 |
| 271 | .000 | .000 | 104.670 |

| | | | |
|---|---|---|---|
| 274 | .000 | .000 | 104.670 |
| 276 | .000 | .000 | 104.670 |
| 278 | .000 | .000 | 104.670 |
| 281 | .000 | .000 | 104.670 |
| 283 | .000 | .000 | 104.670 |
| 286 | .000 | .000 | 104.670 |
| 288 | .000 | .000 | 104.670 |
| 290 | .000 | .000 | 104.670 |
| 293 | .000 | .000 | 104.670 |
| 295 | .000 | .000 | 104.670 |
| 298 | .000 | .000 | 104.670 |
| 300 | .000 | .000 | 104.670 |
| 302 | .000 | .000 | 104.670 |
| 305 | .000 | .000 | 104.670 |
| 307 | .000 | .000 | 104.670 |
| 310 | .000 | .000 | 104.670 |
| 312 | .001 | .000 | 104.670 |
| 314 | .001 | .000 | 104.670 |
| 317 | .001 | .000 | 104.670 |
| 319 | .002 | .000 | 104.670 |
| 322 | .002 | .000 | 104.670 |
| 324 | .002 | .000 | 104.670 |
| 326 | .002 | .000 | 104.670 |
| 329 | .003 | .001 | 104.670 |
| 331 | .003 | .001 | 104.670 |
| 334 | .004 | .001 | 104.670 |
| 336 | .004 | .001 | 104.671 |
| 338 | .004 | .001 | 104.671 |
| 341 | .004 | .001 | 104.671 |
| 343 | .005 | .001 | 104.671 |
| 346 | .005 | .002 | 104.671 |
| 348 | .005 | .002 | 104.671 |
| 350 | .006 | .002 | 104.671 |
| 353 | .006 | .002 | 104.671 |
| 355 | .007 | .002 | 104.672 |
| 358 | .007 | .002 | 104.672 |
| 360 | .007 | .003 | 104.672 |
| 362 | .008 | .003 | 104.672 |
| 365 | .009 | .003 | 104.672 |
| 367 | .009 | .003 | 104.672 |
| 370 | .009 | .004 | 104.672 |
| 372 | .010 | .004 | 104.673 |
| 374 | .010 | .004 | 104.673 |
| 377 | .011 | .005 | 104.673 |
| 379 | .011 | .005 | 104.673 |
| 382 | .011 | .005 | 104.673 |
| 384 | .012 | .005 | 104.674 |
| 386 | .012 | .006 | 104.674 |
| 389 | .013 | .006 | 104.674 |
| 391 | .013 | .006 | 104.674 |
| 394 | .013 | .007 | 104.674 |
| 396 | .014 | .007 | 104.675 |
| 398 | .014 | .007 | 104.675 |
| 401 | .014 | .008 | 104.675 |
| 403 | .015 | .008 | 104.675 |
| 406 | .015 | .008 | 104.675 |
| 408 | .015 | .009 | 104.676 |
| 410 | .016 | .009 | 104.676 |
| 413 | .016 | .009 | 104.676 |
| 415 | .016 | .010 | 104.676 |
| 418 | .017 | .010 | 104.677 |
| 420 | .017 | .010 | 104.677 |
| 422 | .020 | .011 | 104.677 |
| 425 | .021 | .011 | 104.677 |
| 427 | .022 | .012 | 104.678 |
| 430 | .023 | .012 | 104.678 |
| 432 | .023 | .013 | 104.678 |
| 434 | .024 | .013 | 104.679 |
| 437 | .024 | .014 | 104.679 |
| 439 | .025 | .014 | 104.679 |
| 442 | .025 | .015 | 104.680 |

| | | | |
|---|---|---|---|
| 444 | .026 | .015 | 104.680 |
| 446 | .026 | .016 | 104.680 |
| 449 | .027 | .016 | 104.681 |
| 451 | .027 | .017 | 104.681 |
| 454 | .028 | .017 | 104.681 |
| 456 | .028 | .018 | 104.682 |
| 458 | .029 | .018 | 104.682 |
| 461 | .029 | .019 | 104.682 |
| 463 | .030 | .019 | 104.683 |
| 466 | .030 | .020 | 104.683 |
| 468 | .030 | .020 | 104.683 |
| 470 | .031 | .021 | 104.684 |
| 473 | .031 | .021 | 104.684 |
| 475 | .032 | .022 | 104.684 |
| 478 | .032 | .022 | 104.685 |
| 480 | .032 | .023 | 104.685 |
| 482 | .036 | .023 | 104.685 |
| 485 | .039 | .024 | 104.686 |
| 487 | .040 | .025 | 104.686 |
| 490 | .041 | .025 | 104.687 |
| 492 | .041 | .026 | 104.687 |
| 494 | .042 | .027 | 104.688 |
| 497 | .042 | .028 | 104.688 |
| 499 | .043 | .028 | 104.689 |
| 502 | .043 | .029 | 104.689 |
| 504 | .044 | .030 | 104.690 |
| 506 | .045 | .030 | 104.690 |
| 509 | .045 | .031 | 104.690 |
| 511 | .047 | .032 | 104.691 |
| 514 | .049 | .032 | 104.691 |
| 516 | .050 | .033 | 104.692 |
| 518 | .051 | .034 | 104.693 |
| 521 | .052 | .035 | 104.693 |
| 523 | .052 | .036 | 104.694 |
| 526 | .053 | .037 | 104.694 |
| 528 | .054 | .037 | 104.695 |
| 530 | .054 | .038 | 104.695 |
| 533 | .055 | .039 | 104.696 |
| 535 | .055 | .040 | 104.696 |
| 538 | .056 | .040 | 104.697 |
| 540 | .056 | .041 | 104.697 |
| 542 | .061 | .042 | 104.698 |
| 545 | .065 | .043 | 104.698 |
| 547 | .066 | .044 | 104.699 |
| 550 | .067 | .045 | 104.700 |
| 552 | .068 | .046 | 104.700 |
| 554 | .069 | .047 | 104.701 |
| 557 | .069 | .048 | 104.702 |
| 559 | .070 | .049 | 104.702 |
| 562 | .071 | .050 | 104.703 |
| 564 | .071 | .051 | 104.704 |
| 566 | .072 | .052 | 104.704 |
| 569 | .073 | .053 | 104.705 |
| 571 | .076 | .054 | 104.706 |
| 574 | .081 | .055 | 104.706 |
| 576 | .083 | .056 | 104.707 |
| 578 | .085 | .058 | 104.708 |
| 581 | .086 | .059 | 104.709 |
| 583 | .086 | .060 | 104.710 |
| 586 | .087 | .062 | 104.711 |
| 588 | .088 | .063 | 104.711 |
| 590 | .089 | .064 | 104.712 |
| 593 | .090 | .065 | 104.713 |
| 595 | .090 | .066 | 104.714 |
| 598 | .091 | .068 | 104.715 |
| 600 | .092 | .069 | 104.715 |
| 602 | .107 | .070 | 104.716 |
| 605 | .116 | .072 | 104.718 |
| 607 | .120 | .074 | 104.719 |
| 610 | .122 | .076 | 104.720 |
| 612 | .123 | .079 | 104.722 |

| | | | |
|---|---|---|---|
| 614 | .124 | .081 | 104.723 |
| 617 | .125 | .083 | 104.725 |
| 619 | .126 | .085 | 104.726 |
| 622 | .127 | .087 | 104.727 |
| 624 | .128 | .089 | 104.729 |
| 626 | .130 | .091 | 104.730 |
| 629 | .131 | .092 | 104.731 |
| 631 | .144 | .095 | 104.732 |
| 634 | .166 | .097 | 104.734 |
| 636 | .177 | .101 | 104.737 |
| 638 | .182 | .105 | 104.739 |
| 641 | .184 | .108 | 104.741 |
| 643 | .186 | .112 | 104.744 |
| 646 | .188 | .115 | 104.746 |
| 648 | .189 | .119 | 104.748 |
| 650 | .191 | .122 | 104.751 |
| 653 | .193 | .125 | 104.753 |
| 655 | .194 | .129 | 104.755 |
| 658 | .196 | .132 | 104.757 |
| 660 | .198 | .135 | 104.759 |
| 662 | .260 | .139 | 104.762 |
| 665 | .299 | .146 | 104.766 |
| 667 | .312 | .153 | 104.771 |
| 670 | .318 | .161 | 104.776 |
| 672 | .322 | .168 | 104.781 |
| 674 | .326 | .176 | 104.786 |
| 677 | .329 | .183 | 104.791 |
| 679 | .332 | .190 | 104.795 |
| 682 | .335 | .197 | 104.800 |
| 684 | .338 | .203 | 104.804 |
| 686 | .341 | .210 | 104.808 |
| 689 | .344 | .216 | 104.812 |
| 691 | .548 | .227 | 104.820 |
| 694 | .883 | .250 | 104.835 |
| 696 | 1.056 | .283 | 104.857 |
| 698 | 1.119 | .321 | 104.882 |
| 701 | 1.152 | .360 | 104.907 |
| 703 | 1.175 | .397 | 104.932 |
| 706 | 1.722 | .447 | 104.965 |
| 708 | 3.730 | .517 | 105.034 |
| 710 | 4.958 | .573 | 105.146 |
| 713 | 5.429 | .640 | 105.281 |
| 715 | 5.677 | .712 | 105.424 |
| 718 | 5.844 | .786 | 105.572 |
| 720 | 5.969 | .861 | 105.722 |
| 722 | 3.093 | .915 | 105.829 |
| 725 | 1.342 | .934 | 105.867 |
| 727 | .883 | .936 | 105.873 |
| 730 | .759 | .935 | 105.869 |
| 732 | .726 | .932 | 105.864 |
| 734 | .722 | .929 | 105.858 |
| 737 | .724 | .926 | 105.852 |
| 739 | .725 | .923 | 105.846 |
| 742 | .726 | .920 | 105.840 |
| 744 | .727 | .917 | 105.834 |
| 746 | .728 | .914 | 105.829 |
| 749 | .729 | .912 | 105.823 |
| 751 | .632 | .908 | 105.816 |
| 754 | .476 | .903 | 105.806 |
| 756 | .402 | .896 | 105.793 |
| 758 | .383 | .889 | 105.778 |
| 761 | .378 | .881 | 105.763 |
| 763 | .377 | .874 | 105.748 |
| 766 | .377 | .867 | 105.734 |
| 768 | .377 | .860 | 105.719 |
| 770 | .377 | .853 | 105.705 |
| 773 | .378 | .846 | 105.691 |
| 775 | .378 | .839 | 105.678 |
| 778 | .378 | .832 | 105.664 |
| 780 | .379 | .825 | 105.651 |
| 782 | .322 | .818 | 105.637 |

| | | | |
|---|---|---|---|
| 785 | .289 | .811 | 105.622 |
| 787 | .280 | .803 | 105.607 |
| 790 | .278 | .796 | 105.591 |
| 792 | .277 | .788 | 105.576 |
| 794 | .277 | .781 | 105.561 |
| 797 | .277 | .773 | 105.546 |
| 799 | .277 | .766 | 105.532 |
| 802 | .277 | .759 | 105.518 |
| 804 | .278 | .752 | 105.504 |
| 806 | .278 | .745 | 105.490 |
| 809 | .278 | .738 | 105.476 |
| 811 | .261 | .731 | 105.462 |
| 814 | .234 | .724 | 105.448 |
| 816 | .221 | .717 | 105.434 |
| 818 | .218 | .710 | 105.419 |
| 821 | .217 | .702 | 105.405 |
| 823 | .216 | .695 | 105.390 |
| 826 | .217 | .688 | 105.376 |
| 828 | .217 | .681 | 105.363 |
| 830 | .217 | .675 | 105.349 |
| 833 | .217 | .668 | 105.336 |
| 835 | .217 | .661 | 105.322 |
| 838 | .217 | .655 | 105.309 |
| 840 | .217 | .648 | 105.297 |
| 842 | .224 | .642 | 105.284 |
| 845 | .226 | .636 | 105.272 |
| 847 | .223 | .630 | 105.260 |
| 850 | .219 | .624 | 105.248 |
| 852 | .215 | .618 | 105.236 |
| 854 | .211 | .612 | 105.224 |
| 857 | .207 | .606 | 105.212 |
| 859 | .204 | .600 | 105.201 |
| 862 | .200 | .595 | 105.189 |
| 864 | .196 | .589 | 105.177 |
| 866 | .192 | .583 | 105.166 |
| 869 | .189 | .577 | 105.154 |
| 871 | .186 | .572 | 105.143 |
| 874 | .182 | .566 | 105.132 |
| 876 | .179 | .560 | 105.120 |
| 878 | .176 | .555 | 105.109 |
| 881 | .173 | .549 | 105.098 |
| 883 | .169 | .544 | 105.087 |
| 886 | .167 | .538 | 105.076 |
| 888 | .164 | .533 | 105.065 |
| 890 | .161 | .527 | 105.054 |
| 893 | .158 | .522 | 105.044 |
| 895 | .155 | .516 | 105.033 |
| 898 | .153 | .511 | 105.022 |
| 900 | .150 | .506 | 105.012 |
| 902 | .148 | .501 | 105.001 |
| 905 | .146 | .485 | 104.990 |
| 907 | .143 | .469 | 104.980 |
| 910 | .141 | .454 | 104.970 |
| 912 | .139 | .439 | 104.960 |
| 914 | .137 | .425 | 104.951 |
| 917 | .135 | .411 | 104.942 |
| 919 | .133 | .398 | 104.933 |
| 922 | .131 | .386 | 104.925 |
| 924 | .130 | .374 | 104.917 |
| 926 | .128 | .362 | 104.909 |
| 929 | .126 | .351 | 104.902 |
| 931 | .125 | .341 | 104.895 |
| 934 | .124 | .331 | 104.888 |
| 936 | .122 | .321 | 104.882 |
| 938 | .121 | .311 | 104.876 |
| 941 | .120 | .302 | 104.870 |
| 943 | .119 | .294 | 104.864 |
| 946 | .118 | .286 | 104.858 |
| 948 | .117 | .278 | 104.853 |
| 950 | .116 | .270 | 104.848 |
| 953 | .115 | .263 | 104.843 |

| | | | |
|---|---|---|---|
| 955 | .115 | .256 | 104.839 |
| 958 | .114 | .249 | 104.834 |
| 960 | .114 | .243 | 104.830 |
| 962 | .113 | .237 | 104.826 |
| 965 | .113 | .231 | 104.822 |
| 967 | .112 | .225 | 104.819 |
| 970 | .112 | .220 | 104.815 |
| 972 | .112 | .215 | 104.812 |
| 974 | .111 | .210 | 104.809 |
| 977 | .111 | .205 | 104.806 |
| 979 | .111 | .201 | 104.803 |
| 982 | .110 | .197 | 104.800 |
| 984 | .110 | .193 | 104.797 |
| 986 | .109 | .189 | 104.795 |
| 989 | .109 | .185 | 104.792 |
| 991 | .109 | .181 | 104.790 |
| 994 | .108 | .178 | 104.787 |
| 996 | .108 | .175 | 104.785 |
| 998 | .108 | .172 | 104.783 |
| 1001 | .107 | .169 | 104.781 |
| 1003 | .107 | .166 | 104.779 |
| 1006 | .106 | .163 | 104.778 |
| 1008 | .106 | .160 | 104.776 |
| 1010 | .106 | .158 | 104.774 |
| 1013 | .105 | .155 | 104.772 |
| 1015 | .105 | .153 | 104.771 |
| 1018 | .105 | .151 | 104.769 |
| 1020 | .104 | .148 | 104.768 |
| 1022 | .104 | .146 | 104.767 |
| 1025 | .104 | .144 | 104.765 |
| 1027 | .103 | .142 | 104.764 |
| 1030 | .103 | .141 | 104.763 |
| 1032 | .102 | .139 | 104.762 |
| 1034 | .102 | .137 | 104.760 |
| 1037 | .102 | .135 | 104.759 |
| 1039 | .101 | .134 | 104.758 |
| 1042 | .101 | .132 | 104.757 |
| 1044 | .101 | .131 | 104.756 |
| 1046 | .100 | .129 | 104.755 |
| 1049 | .100 | .128 | 104.754 |
| 1051 | .099 | .127 | 104.754 |
| 1054 | .099 | .125 | 104.753 |
| 1056 | .099 | .124 | 104.752 |
| 1058 | .098 | .123 | 104.751 |
| 1061 | .098 | .122 | 104.750 |
| 1063 | .097 | .121 | 104.750 |
| 1066 | .097 | .119 | 104.749 |
| 1068 | .097 | .118 | 104.748 |
| 1070 | .096 | .117 | 104.747 |
| 1073 | .096 | .116 | 104.747 |
| 1075 | .096 | .115 | 104.746 |
| 1078 | .095 | .114 | 104.746 |
| 1080 | .095 | .114 | 104.745 |
| 1082 | .094 | .113 | 104.744 |
| 1085 | .094 | .112 | 104.744 |
| 1087 | .094 | .111 | 104.743 |
| 1090 | .093 | .110 | 104.743 |
| 1092 | .093 | .109 | 104.742 |
| 1094 | .093 | .109 | 104.742 |
| 1097 | .092 | .108 | 104.741 |
| 1099 | .092 | .107 | 104.741 |
| 1102 | .091 | .106 | 104.740 |
| 1104 | .091 | .106 | 104.740 |
| 1106 | .091 | .105 | 104.739 |
| 1109 | .090 | .104 | 104.739 |
| 1111 | .090 | .104 | 104.738 |
| 1114 | .090 | .103 | 104.738 |
| 1116 | .089 | .102 | 104.738 |
| 1118 | .089 | .102 | 104.737 |
| 1121 | .089 | .101 | 104.737 |
| 1123 | .088 | .101 | 104.736 |

| | | | |
|---|---|---|---|
| 1126 | .088 | .100 | 104.736 |
| 1128 | .087 | .099 | 104.736 |
| 1130 | .087 | .099 | 104.735 |
| 1133 | .087 | .098 | 104.735 |
| 1135 | .086 | .098 | 104.734 |
| 1138 | .086 | .097 | 104.734 |
| 1140 | .086 | .097 | 104.734 |
| 1142 | .085 | .096 | 104.733 |
| 1145 | .085 | .096 | 104.733 |
| 1147 | .084 | .095 | 104.733 |
| 1150 | .084 | .095 | 104.732 |
| 1152 | .084 | .094 | 104.732 |
| 1154 | .083 | .094 | 104.732 |
| 1157 | .083 | .093 | 104.731 |
| 1159 | .083 | .093 | 104.731 |
| 1162 | .082 | .092 | 104.731 |
| 1164 | .082 | .092 | 104.730 |
| 1166 | .082 | .091 | 104.730 |
| 1169 | .081 | .091 | 104.730 |
| 1171 | .081 | .090 | 104.730 |
| 1174 | .080 | .090 | 104.729 |
| 1176 | .080 | .089 | 104.729 |
| 1178 | .080 | .089 | 104.729 |
| 1181 | .079 | .088 | 104.728 |
| 1183 | .079 | .088 | 104.728 |
| 1186 | .079 | .088 | 104.728 |
| 1188 | .078 | .087 | 104.727 |
| 1190 | .078 | .087 | 104.727 |
| 1193 | .077 | .086 | 104.727 |
| 1195 | .077 | .086 | 104.727 |
| 1198 | .077 | .085 | 104.726 |
| 1200 | .000 | .083 | 104.725 |
| 1202 | .000 | .079 | 104.722 |
| 1205 | .000 | .076 | 104.720 |
| 1207 | .000 | .072 | 104.718 |
| 1210 | .000 | .069 | 104.715 |
| 1212 | .000 | .065 | 104.713 |
| 1214 | .000 | .062 | 104.711 |
| 1217 | .000 | .059 | 104.709 |
| 1219 | .000 | .057 | 104.707 |
| 1222 | .000 | .054 | 104.706 |
| 1224 | .000 | .051 | 104.704 |
| 1226 | .000 | .049 | 104.702 |
| 1229 | .000 | .047 | 104.701 |
| 1231 | .000 | .044 | 104.699 |
| 1234 | .000 | .042 | 104.698 |
| 1236 | .000 | .040 | 104.697 |
| 1238 | .000 | .038 | 104.695 |
| 1241 | .000 | .037 | 104.694 |
| 1243 | .000 | .035 | 104.693 |
| 1246 | .000 | .033 | 104.692 |
| 1248 | .000 | .032 | 104.691 |
| 1250 | .000 | .030 | 104.690 |
| 1253 | .000 | .029 | 104.689 |
| 1255 | .000 | .027 | 104.688 |
| 1258 | .000 | .026 | 104.687 |
| 1260 | .000 | .025 | 104.686 |
| 1262 | .000 | .024 | 104.686 |
| 1265 | .000 | .023 | 104.685 |
| 1267 | .000 | .022 | 104.684 |
| 1270 | .000 | .021 | 104.684 |
| 1272 | .000 | .020 | 104.683 |
| 1274 | .000 | .019 | 104.682 |
| 1277 | .000 | .018 | 104.682 |
| 1279 | .000 | .017 | 104.681 |
| 1282 | .000 | .016 | 104.681 |
| 1284 | .000 | .015 | 104.680 |
| 1286 | .000 | .015 | 104.680 |
| 1289 | .000 | .014 | 104.679 |
| 1291 | .000 | .013 | 104.679 |
| 1294 | .000 | .013 | 104.678 |

| | | | | |
|---|---|---|---|---|
| 1296 | .000 | .012 | \| | 104.678 |
| 1298 | .000 | .012 | \| | 104.678 |
| 1301 | .000 | .011 | \| | 104.677 |
| 1303 | .000 | .010 | \| | 104.677 |
| 1306 | .000 | .010 | \| | 104.677 |
| 1308 | .000 | .010 | \| | 104.676 |
| 1310 | .000 | .009 | \| | 104.676 |
| 1313 | .000 | .009 | \| | 104.676 |
| 1315 | .000 | .008 | \| | 104.675 |
| 1318 | .000 | .008 | \| | 104.675 |
| 1320 | .000 | .007 | \| | 104.675 |
| 1322 | .000 | .007 | \| | 104.675 |
| 1325 | .000 | .007 | \| | 104.674 |
| 1327 | .000 | .006 | \| | 104.674 |
| 1330 | .000 | .006 | \| | 104.674 |
| 1332 | .000 | .006 | \| | 104.674 |
| 1334 | .000 | .006 | \| | 104.674 |
| 1337 | .000 | .005 | \| | 104.674 |
| 1339 | .000 | .005 | \| | 104.673 |
| 1342 | .000 | .005 | \| | 104.673 |
| 1344 | .000 | .005 | \| | 104.673 |
| 1346 | .000 | .004 | \| | 104.673 |
| 1349 | .000 | .004 | \| | 104.673 |
| 1351 | .000 | .004 | \| | 104.673 |
| 1354 | .000 | .004 | \| | 104.673 |
| 1356 | .000 | .004 | \| | 104.672 |
| 1358 | .000 | .003 | \| | 104.672 |
| 1361 | .000 | .003 | \| | 104.672 |
| 1363 | .000 | .003 | \| | 104.672 |
| 1366 | .000 | .003 | \| | 104.672 |
| 1368 | .000 | .003 | \| | 104.672 |
| 1370 | .000 | .003 | \| | 104.672 |
| 1373 | .000 | .003 | \| | 104.672 |
| 1375 | .000 | .002 | \| | 104.672 |
| 1378 | .000 | .002 | \| | 104.672 |
| 1380 | .000 | .002 | \| | 104.671 |
| 1382 | .000 | .002 | \| | 104.671 |
| 1385 | .000 | .002 | \| | 104.671 |
| 1387 | .000 | .002 | \| | 104.671 |
| 1390 | .000 | .002 | \| | 104.671 |
| 1392 | .000 | .002 | \| | 104.671 |
| 1394 | .000 | .002 | \| | 104.671 |
| 1397 | .000 | .002 | \| | 104.671 |
| 1399 | .000 | .002 | \| | 104.671 |
| 1402 | .000 | .001 | \| | 104.671 |
| 1404 | .000 | .001 | \| | 104.671 |
| 1406 | .000 | .001 | \| | 104.671 |
| 1409 | .000 | .001 | \| | 104.671 |
| 1411 | .000 | .001 | \| | 104.671 |
| 1414 | .000 | .001 | \| | 104.671 |
| 1416 | .000 | .001 | \| | 104.671 |
| 1418 | .000 | .001 | \| | 104.671 |
| 1421 | .000 | .001 | \| | 104.671 |
| 1423 | .000 | .001 | \| | 104.671 |
| 1426 | .000 | .001 | \| | 104.671 |
| 1428 | .000 | .001 | \| | 104.671 |
| 1430 | .000 | .001 | \| | 104.671 |
| 1433 | .000 | .001 | \| | 104.671 |
| 1435 | .000 | .001 | \| | 104.670 |
| 1438 | .000 | .001 | \| | 104.670 |
| 1440 | .000 | .001 | \| | 104.670 |
| 1442 | .000 | .001 | \| | 104.670 |
| 1445 | .000 | .001 | \| | 104.670 |
| 1447 | .000 | .001 | \| | 104.670 |
| 1450 | .000 | .001 | \| | 104.670 |
| 1452 | .000 | .001 | \| | 104.670 |
| 1454 | .000 | .001 | \| | 104.670 |
| 1457 | .000 | .000 | \| | 104.670 |

# 100-Year Routing

```
1*******************************      PONDOPT      *******************************
 *******************************   Version 1.83   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 07/21/2005  Thursday
    Time: 13:30:41
  Output: RRP10.OUT
```

ROUTING SUMMARY ----------
SIMULATION MODE ----------
FOR THE ABOVE CASE ----------

| STORM NUMBER | PEAK STAGE (ft) | PEAK STORAGE (ac-ft) | PEAK INFLOW (cfs) | PEAK OUTFLOW (cfs) |
|---|---|---|---|---|
| 1 | 105.873 | .286 | 5.969 | .936 |

```
1*******************************     PONDOPT      *******************************
 *******************************   Version 1.83   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 07/21/2005  Thursday
    Time: 13:32:42
  Output: RRP100.OUT


 SOLUTION FOR  1  STORMS.

 TIME INCREMENT:   .040  Hours

 STORM
 NUMBER   HYDROGRAPH IN FILE:
 ______   ____________________________________________________________

   1      RR100.DAT
```

| STORM NUMBER | PEAK INFLOW (cfs) | ALLOWABLE PEAK DISCHARGE (cfs) | DURATION (min) | RUNOFF VOLUME (ft3) | TAILWATER STAGE (ft) |
|---|---|---|---|---|---|
| 1 | 8.748 | N/A | 1197.60 | .2021E+05 | 104.670 |

```
1*******************************     PONDOPT      *******************************
 *******************************   Version 1.83   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 07/21/2005  Thursday
    Time: 13:32:42
  Output: RRP100.OUT


 Stage-Area-Discharge
 Filename: RRPOND.DAT

          TAILWATER STAGE:  104.670 feet.
            INITIAL STAGE:  104.670 feet.

 ==================   STAGE-STORAGE-DISCHARGE RELATIONSHIP   ==================

 <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<   STORM  1      >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
```

| STAGE (ft) | STORAGE VOLUME (ac-ft) | DISCHARGE (cfs) |
|---|---|---|
| 103.000 | .0000 | .0000 |
| 104.000 | .8824E-01 | .0000 |
| 104.670 | .1539 | .0000 |
| 105.000 | .1882 | .5000 |
| 106.000 | .3004 | 1.000 |
| 106.400 | .3488 | 1.140 |
| 107.000 | .4254 | 12.44 |
| 108.000 | .5638 | 15.37 |

```
1*******************************     PONDOPT      *******************************
```

```
******************************   Version 1.83   ******************************
*****************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

PROJECT: 7845 RICHMOND RD
   User: Landtech Resources
   Date: 07/21/2005  Thursday
   Time: 13:32:42
 Output: RRP100.OUT


         TAILWATER STAGE:  104.670 feet.
           INITIAL STAGE:  104.670 feet.

<<<<<<<<<<<<<<<<<<<<<<<   ROUTING RESULTS FOR STORM  1    >>>>>>>>>>>>>>>>>>>>>>>

    MAXIMUM ELEVATION:    106.5     feet.
       MAXIMUM INFLOW:    8.748     cfs.
      MAXIMUM OUTFLOW:    2.233     cfs.
      MAXIMUM STORAGE:    .3562     acre-feet.

     CONTINUITY ERROR:     .169E-04 percent.
```

| TIME (min) | INFLOW RATE (cfs) | OUTFLOW RATE (cfs) | POND SURFACE ELEVATION (ft) |
|---|---|---|---|
| 0 | .000 | .000 | 104.670 |
| 2 | .000 | .000 | 104.670 |
| 5 | .000 | .000 | 104.670 |
| 7 | .000 | .000 | 104.670 |
| 10 | .000 | .000 | 104.670 |
| 12 | .000 | .000 | 104.670 |
| 14 | .000 | .000 | 104.670 |
| 17 | .000 | .000 | 104.670 |
| 19 | .000 | .000 | 104.670 |
| 22 | .000 | .000 | 104.670 |
| 24 | .000 | .000 | 104.670 |
| 26 | .000 | .000 | 104.670 |
| 29 | .000 | .000 | 104.670 |
| 31 | .000 | .000 | 104.670 |
| 34 | .000 | .000 | 104.670 |
| 36 | .000 | .000 | 104.670 |
| 38 | .000 | .000 | 104.670 |
| 41 | .000 | .000 | 104.670 |
| 43 | .000 | .000 | 104.670 |
| 46 | .000 | .000 | 104.670 |
| 48 | .000 | .000 | 104.670 |
| 50 | .000 | .000 | 104.670 |
| 53 | .000 | .000 | 104.670 |
| 55 | .000 | .000 | 104.670 |
| 58 | .000 | .000 | 104.670 |
| 60 | .000 | .000 | 104.670 |
| 62 | .000 | .000 | 104.670 |
| 65 | .000 | .000 | 104.670 |
| 67 | .000 | .000 | 104.670 |
| 70 | .000 | .000 | 104.670 |
| 72 | .000 | .000 | 104.670 |
| 74 | .000 | .000 | 104.670 |
| 77 | .000 | .000 | 104.670 |
| 79 | .000 | .000 | 104.670 |
| 82 | .000 | .000 | 104.670 |
| 84 | .000 | .000 | 104.670 |
| 86 | .000 | .000 | 104.670 |
| 89 | .000 | .000 | 104.670 |
| 91 | .000 | .000 | 104.670 |
| 94 | .000 | .000 | 104.670 |
| 96 | .000 | .000 | 104.670 |
| 98 | .000 | .000 | 104.670 |
| 101 | .000 | .000 | 104.670 |

| | | | |
|---|---|---|---|
| 103 | .000 | .000 | 104.670 |
| 106 | .000 | .000 | 104.670 |
| 108 | .000 | .000 | 104.670 |
| 110 | .000 | .000 | 104.670 |
| 113 | .000 | .000 | 104.670 |
| 115 | .000 | .000 | 104.670 |
| 118 | .000 | .000 | 104.670 |
| 120 | .000 | .000 | 104.670 |
| 122 | .000 | .000 | 104.670 |
| 125 | .000 | .000 | 104.670 |
| 127 | .000 | .000 | 104.670 |
| 130 | .000 | .000 | 104.670 |
| 132 | .000 | .000 | 104.670 |
| 134 | .000 | .000 | 104.670 |
| 137 | .000 | .000 | 104.670 |
| 139 | .000 | .000 | 104.670 |
| 142 | .000 | .000 | 104.670 |
| 144 | .000 | .000 | 104.670 |
| 146 | .000 | .000 | 104.670 |
| 149 | .000 | .000 | 104.670 |
| 151 | .000 | .000 | 104.670 |
| 154 | .000 | .000 | 104.670 |
| 156 | .000 | .000 | 104.670 |
| 158 | .000 | .000 | 104.670 |
| 161 | .000 | .000 | 104.670 |
| 163 | .000 | .000 | 104.670 |
| 166 | .000 | .000 | 104.670 |
| 168 | .000 | .000 | 104.670 |
| 170 | .000 | .000 | 104.670 |
| 173 | .000 | .000 | 104.670 |
| 175 | .000 | .000 | 104.670 |
| 178 | .000 | .000 | 104.670 |
| 180 | .000 | .000 | 104.670 |
| 182 | .000 | .000 | 104.670 |
| 185 | .000 | .000 | 104.670 |
| 187 | .000 | .000 | 104.670 |
| 190 | .000 | .000 | 104.670 |
| 192 | .000 | .000 | 104.670 |
| 194 | .000 | .000 | 104.670 |
| 197 | .000 | .000 | 104.670 |
| 199 | .000 | .000 | 104.670 |
| 202 | .000 | .000 | 104.670 |
| 204 | .000 | .000 | 104.670 |
| 206 | .000 | .000 | 104.670 |
| 209 | .000 | .000 | 104.670 |
| 211 | .000 | .000 | 104.670 |
| 214 | .000 | .000 | 104.670 |
| 216 | .000 | .000 | 104.670 |
| 218 | .000 | .000 | 104.670 |
| 221 | .000 | .000 | 104.670 |
| 223 | .000 | .000 | 104.670 |
| 226 | .000 | .000 | 104.670 |
| 228 | .000 | .000 | 104.670 |
| 230 | .000 | .000 | 104.670 |
| 233 | .000 | .000 | 104.670 |
| 235 | .000 | .000 | 104.670 |
| 238 | .000 | .000 | 104.670 |
| 240 | .000 | .000 | 104.670 |
| 242 | .000 | .000 | 104.670 |
| 245 | .001 | .000 | 104.670 |
| 247 | .002 | .000 | 104.670 |
| 250 | .002 | .000 | 104.670 |
| 252 | .003 | .000 | 104.670 |
| 254 | .004 | .000 | 104.670 |
| 257 | .004 | .001 | 104.670 |
| 259 | .005 | .001 | 104.671 |
| 262 | .005 | .001 | 104.671 |
| 264 | .006 | .001 | 104.671 |
| 266 | .007 | .001 | 104.671 |
| 269 | .007 | .002 | 104.671 |
| 271 | .008 | .002 | 104.671 |

| | | | |
|---|---|---|---|
| 274 | .009 | .002 | 104.672 |
| 276 | .009 | .003 | 104.672 |
| 278 | .010 | .003 | 104.672 |
| 281 | .010 | .003 | 104.672 |
| 283 | .011 | .004 | 104.672 |
| 286 | .012 | .004 | 104.673 |
| 288 | .012 | .004 | 104.673 |
| 290 | .013 | .005 | 104.673 |
| 293 | .013 | .005 | 104.673 |
| 295 | .014 | .006 | 104.674 |
| 298 | .014 | .006 | 104.674 |
| 300 | .015 | .006 | 104.674 |
| 302 | .016 | .007 | 104.674 |
| 305 | .016 | .007 | 104.675 |
| 307 | .017 | .008 | 104.675 |
| 310 | .017 | .008 | 104.675 |
| 312 | .018 | .009 | 104.676 |
| 314 | .018 | .009 | 104.676 |
| 317 | .019 | .009 | 104.676 |
| 319 | .019 | .010 | 104.677 |
| 322 | .020 | .010 | 104.677 |
| 324 | .020 | .011 | 104.677 |
| 326 | .021 | .011 | 104.677 |
| 329 | .021 | .012 | 104.678 |
| 331 | .022 | .012 | 104.678 |
| 334 | .022 | .013 | 104.678 |
| 336 | .023 | .013 | 104.679 |
| 338 | .023 | .014 | 104.679 |
| 341 | .024 | .014 | 104.679 |
| 343 | .024 | .015 | 104.680 |
| 346 | .025 | .015 | 104.680 |
| 348 | .025 | .016 | 104.680 |
| 350 | .026 | .016 | 104.681 |
| 353 | .026 | .016 | 104.681 |
| 355 | .027 | .017 | 104.681 |
| 358 | .027 | .017 | 104.681 |
| 360 | .028 | .018 | 104.682 |
| 362 | .030 | .018 | 104.682 |
| 365 | .032 | .019 | 104.683 |
| 367 | .033 | .020 | 104.683 |
| 370 | .033 | .020 | 104.683 |
| 372 | .034 | .021 | 104.684 |
| 374 | .035 | .022 | 104.684 |
| 377 | .035 | .022 | 104.685 |
| 379 | .036 | .023 | 104.685 |
| 382 | .036 | .023 | 104.685 |
| 384 | .037 | .024 | 104.686 |
| 386 | .037 | .025 | 104.686 |
| 389 | .038 | .025 | 104.687 |
| 391 | .038 | .026 | 104.687 |
| 394 | .039 | .026 | 104.687 |
| 396 | .040 | .027 | 104.688 |
| 398 | .040 | .028 | 104.688 |
| 401 | .041 | .028 | 104.689 |
| 403 | .041 | .029 | 104.689 |
| 406 | .041 | .029 | 104.689 |
| 408 | .042 | .030 | 104.690 |
| 410 | .043 | .031 | 104.690 |
| 413 | .043 | .031 | 104.691 |
| 415 | .043 | .032 | 104.691 |
| 418 | .044 | .032 | 104.691 |
| 420 | .045 | .033 | 104.692 |
| 422 | .051 | .034 | 104.692 |
| 425 | .054 | .034 | 104.693 |
| 427 | .056 | .035 | 104.693 |
| 430 | .057 | .036 | 104.694 |
| 432 | .058 | .037 | 104.695 |
| 434 | .058 | .038 | 104.695 |
| 437 | .059 | .039 | 104.696 |
| 439 | .060 | .040 | 104.697 |
| 442 | .060 | .041 | 104.697 |

| | | | |
|---|---|---|---|
| 444 | .061 | .042 | 104.698 |
| 446 | .062 | .043 | 104.698 |
| 449 | .063 | .044 | 104.699 |
| 451 | .063 | .045 | 104.700 |
| 454 | .064 | .046 | 104.700 |
| 456 | .064 | .047 | 104.701 |
| 458 | .065 | .047 | 104.701 |
| 461 | .066 | .048 | 104.702 |
| 463 | .066 | .049 | 104.702 |
| 466 | .067 | .050 | 104.703 |
| 468 | .068 | .051 | 104.703 |
| 470 | .068 | .052 | 104.704 |
| 473 | .069 | .052 | 104.705 |
| 475 | .069 | .053 | 104.705 |
| 478 | .070 | .054 | 104.706 |
| 480 | .071 | .055 | 104.706 |
| 482 | .078 | .056 | 104.707 |
| 485 | .083 | .057 | 104.707 |
| 487 | .085 | .058 | 104.708 |
| 490 | .086 | .059 | 104.709 |
| 492 | .087 | .061 | 104.710 |
| 494 | .088 | .062 | 104.711 |
| 497 | .089 | .063 | 104.712 |
| 499 | .089 | .064 | 104.712 |
| 502 | .090 | .066 | 104.713 |
| 504 | .091 | .067 | 104.714 |
| 506 | .092 | .068 | 104.715 |
| 509 | .092 | .069 | 104.716 |
| 511 | .095 | .070 | 104.716 |
| 514 | .099 | .071 | 104.717 |
| 516 | .101 | .073 | 104.718 |
| 518 | .102 | .074 | 104.719 |
| 521 | .103 | .076 | 104.720 |
| 523 | .104 | .077 | 104.721 |
| 526 | .105 | .078 | 104.722 |
| 528 | .106 | .079 | 104.722 |
| 530 | .107 | .081 | 104.723 |
| 533 | .107 | .082 | 104.724 |
| 535 | .108 | .083 | 104.725 |
| 538 | .109 | .084 | 104.726 |
| 540 | .110 | .086 | 104.726 |
| 542 | .119 | .087 | 104.727 |
| 545 | .125 | .089 | 104.728 |
| 547 | .127 | .090 | 104.730 |
| 550 | .129 | .092 | 104.731 |
| 552 | .130 | .094 | 104.732 |
| 554 | .131 | .096 | 104.733 |
| 557 | .132 | .097 | 104.734 |
| 559 | .132 | .099 | 104.735 |
| 562 | .133 | .100 | 104.736 |
| 564 | .134 | .102 | 104.737 |
| 566 | .135 | .104 | 104.738 |
| 569 | .136 | .105 | 104.739 |
| 571 | .141 | .107 | 104.740 |
| 574 | .150 | .108 | 104.742 |
| 576 | .155 | .111 | 104.743 |
| 578 | .156 | .113 | 104.744 |
| 581 | .158 | .115 | 104.746 |
| 583 | .159 | .117 | 104.747 |
| 586 | .160 | .119 | 104.748 |
| 588 | .161 | .121 | 104.750 |
| 590 | .162 | .123 | 104.751 |
| 593 | .163 | .125 | 104.752 |
| 595 | .164 | .126 | 104.753 |
| 598 | .165 | .128 | 104.755 |
| 600 | .166 | .130 | 104.756 |
| 602 | .192 | .132 | 104.757 |
| 605 | .209 | .135 | 104.759 |
| 607 | .214 | .139 | 104.762 |
| 610 | .217 | .143 | 104.764 |
| 612 | .218 | .146 | 104.766 |

| | | | |
|---|---|---|---|
| 614 | .220 | .149 | 104.769 |
| 617 | .221 | .153 | 104.771 |
| 619 | .222 | .156 | 104.773 |
| 622 | .224 | .159 | 104.775 |
| 624 | .225 | .162 | 104.777 |
| 626 | .226 | .165 | 104.779 |
| 629 | .228 | .168 | 104.781 |
| 631 | .251 | .171 | 104.783 |
| 634 | .288 | .176 | 104.786 |
| 636 | .306 | .182 | 104.790 |
| 638 | .313 | .188 | 104.794 |
| 641 | .316 | .194 | 104.798 |
| 643 | .319 | .200 | 104.802 |
| 646 | .321 | .205 | 104.805 |
| 648 | .323 | .211 | 104.809 |
| 650 | .325 | .216 | 104.813 |
| 653 | .327 | .221 | 104.816 |
| 655 | .329 | .226 | 104.819 |
| 658 | .331 | .231 | 104.823 |
| 660 | .332 | .236 | 104.826 |
| 662 | .436 | .243 | 104.830 |
| 665 | .500 | .253 | 104.837 |
| 667 | .520 | .265 | 104.845 |
| 670 | .528 | .278 | 104.853 |
| 672 | .533 | .289 | 104.861 |
| 674 | .537 | .301 | 104.869 |
| 677 | .541 | .312 | 104.876 |
| 679 | .544 | .323 | 104.883 |
| 682 | .548 | .334 | 104.890 |
| 684 | .551 | .344 | 104.897 |
| 686 | .555 | .354 | 104.903 |
| 689 | .558 | .363 | 104.910 |
| 691 | .886 | .380 | 104.921 |
| 694 | 1.419 | .416 | 104.945 |
| 696 | 1.688 | .470 | 104.980 |
| 698 | 1.778 | .509 | 105.018 |
| 701 | 1.819 | .528 | 105.056 |
| 703 | 1.845 | .547 | 105.094 |
| 706 | 2.684 | .572 | 105.144 |
| 708 | 5.743 | .625 | 105.251 |
| 710 | 7.545 | .713 | 105.427 |
| 713 | 8.168 | .818 | 105.636 |
| 715 | 8.455 | .927 | 105.855 |
| 718 | 8.627 | 1.025 | 106.072 |
| 720 | 8.748 | 1.098 | 106.280 |
| 722 | 4.521 | 1.583 | 106.424 |
| 725 | 1.958 | 2.233 | 106.458 |
| 727 | 1.286 | 1.993 | 106.445 |
| 730 | 1.103 | 1.680 | 106.429 |
| 732 | 1.054 | 1.444 | 106.416 |
| 734 | 1.048 | 1.290 | 106.408 |
| 737 | 1.049 | 1.195 | 106.403 |
| 739 | 1.050 | 1.140 | 106.400 |
| 742 | 1.051 | 1.139 | 106.397 |
| 744 | 1.052 | 1.138 | 106.395 |
| 746 | 1.053 | 1.137 | 106.393 |
| 749 | 1.054 | 1.137 | 106.390 |
| 751 | .914 | 1.135 | 106.386 |
| 754 | .688 | 1.132 | 106.377 |
| 756 | .581 | 1.127 | 106.364 |
| 758 | .553 | 1.122 | 106.348 |
| 761 | .545 | 1.117 | 106.333 |
| 763 | .544 | 1.111 | 106.317 |
| 766 | .544 | 1.106 | 106.302 |
| 768 | .544 | 1.100 | 106.287 |
| 770 | .544 | 1.095 | 106.272 |
| 773 | .544 | 1.090 | 106.257 |
| 775 | .545 | 1.085 | 106.242 |
| 778 | .545 | 1.079 | 106.227 |
| 780 | .545 | 1.074 | 106.213 |
| 782 | .464 | 1.069 | 106.197 |

| | | | |
|---|---|---|---|
| 785 | .415 | 1.063 | 106.180 |
| 787 | .403 | 1.057 | 106.162 |
| 790 | .399 | 1.051 | 106.144 |
| 792 | .398 | 1.044 | 106.127 |
| 794 | .398 | 1.038 | 106.109 |
| 797 | .399 | 1.032 | 106.092 |
| 799 | .399 | 1.026 | 106.075 |
| 802 | .399 | 1.020 | 106.058 |
| 804 | .399 | 1.014 | 106.041 |
| 806 | .399 | 1.008 | 106.024 |
| 809 | .399 | 1.003 | 106.007 |
| 811 | .375 | .995 | 105.990 |
| 814 | .336 | .986 | 105.971 |
| 816 | .317 | .976 | 105.952 |
| 818 | .313 | .966 | 105.933 |
| 821 | .311 | .957 | 105.914 |
| 823 | .311 | .947 | 105.895 |
| 826 | .311 | .938 | 105.876 |
| 828 | .311 | .929 | 105.858 |
| 830 | .311 | .920 | 105.840 |
| 833 | .311 | .911 | 105.822 |
| 835 | .311 | .902 | 105.804 |
| 838 | .311 | .893 | 105.787 |
| 840 | .311 | .885 | 105.770 |
| 842 | .321 | .877 | 105.753 |
| 845 | .324 | .869 | 105.737 |
| 847 | .320 | .861 | 105.721 |
| 850 | .314 | .853 | 105.705 |
| 852 | .309 | .845 | 105.689 |
| 854 | .303 | .837 | 105.674 |
| 857 | .297 | .829 | 105.658 |
| 859 | .292 | .821 | 105.642 |
| 862 | .286 | .813 | 105.627 |
| 864 | .281 | .806 | 105.611 |
| 866 | .276 | .798 | 105.596 |
| 869 | .271 | .790 | 105.580 |
| 871 | .266 | .783 | 105.565 |
| 874 | .261 | .775 | 105.550 |
| 876 | .256 | .767 | 105.535 |
| 878 | .252 | .760 | 105.520 |
| 881 | .247 | .752 | 105.505 |
| 883 | .243 | .745 | 105.490 |
| 886 | .238 | .738 | 105.475 |
| 888 | .234 | .730 | 105.461 |
| 890 | .230 | .723 | 105.446 |
| 893 | .226 | .716 | 105.432 |
| 895 | .222 | .709 | 105.417 |
| 898 | .219 | .702 | 105.403 |
| 900 | .215 | .694 | 105.389 |
| 902 | .212 | .687 | 105.375 |
| 905 | .208 | .680 | 105.361 |
| 907 | .205 | .673 | 105.347 |
| 910 | .202 | .667 | 105.333 |
| 912 | .199 | .660 | 105.320 |
| 914 | .196 | .653 | 105.306 |
| 917 | .193 | .646 | 105.293 |
| 919 | .191 | .640 | 105.279 |
| 922 | .188 | .633 | 105.266 |
| 924 | .185 | .627 | 105.253 |
| 926 | .183 | .620 | 105.240 |
| 929 | .181 | .614 | 105.227 |
| 931 | .179 | .607 | 105.215 |
| 934 | .177 | .601 | 105.202 |
| 936 | .175 | .595 | 105.190 |
| 938 | .173 | .589 | 105.177 |
| 941 | .171 | .583 | 105.165 |
| 943 | .170 | .577 | 105.153 |
| 946 | .169 | .571 | 105.141 |
| 948 | .167 | .565 | 105.129 |
| 950 | .166 | .559 | 105.118 |
| 953 | .165 | .553 | 105.106 |

| | | | |
|---|---|---|---|
| 955 | .164 | .547 | 105.095 |
| 958 | .163 | .542 | 105.084 |
| 960 | .162 | .536 | 105.073 |
| 962 | .162 | .531 | 105.062 |
| 965 | .161 | .525 | 105.051 |
| 967 | .161 | .520 | 105.040 |
| 970 | .160 | .515 | 105.030 |
| 972 | .160 | .510 | 105.019 |
| 974 | .159 | .505 | 105.009 |
| 977 | .159 | .498 | 104.999 |
| 979 | .158 | .482 | 104.988 |
| 982 | .157 | .467 | 104.978 |
| 984 | .157 | .452 | 104.969 |
| 986 | .156 | .439 | 104.959 |
| 989 | .156 | .425 | 104.951 |
| 991 | .155 | .413 | 104.942 |
| 994 | .155 | .400 | 104.934 |
| 996 | .154 | .389 | 104.927 |
| 998 | .154 | .378 | 104.919 |
| 1001 | .153 | .367 | 104.912 |
| 1003 | .153 | .357 | 104.906 |
| 1006 | .152 | .348 | 104.899 |
| 1008 | .152 | .338 | 104.893 |
| 1010 | .151 | .330 | 104.888 |
| 1013 | .150 | .321 | 104.882 |
| 1015 | .150 | .313 | 104.877 |
| 1018 | .149 | .305 | 104.872 |
| 1020 | .149 | .298 | 104.867 |
| 1022 | .148 | .291 | 104.862 |
| 1025 | .148 | .284 | 104.858 |
| 1027 | .147 | .278 | 104.853 |
| 1030 | .147 | .272 | 104.849 |
| 1032 | .146 | .266 | 104.845 |
| 1034 | .146 | .260 | 104.842 |
| 1037 | .145 | .255 | 104.838 |
| 1039 | .145 | .250 | 104.835 |
| 1042 | .144 | .245 | 104.831 |
| 1044 | .143 | .240 | 104.828 |
| 1046 | .143 | .235 | 104.825 |
| 1049 | .142 | .231 | 104.822 |
| 1051 | .142 | .227 | 104.820 |
| 1054 | .141 | .223 | 104.817 |
| 1056 | .141 | .219 | 104.814 |
| 1058 | .140 | .215 | 104.812 |
| 1061 | .140 | .212 | 104.810 |
| 1063 | .139 | .208 | 104.807 |
| 1066 | .139 | .205 | 104.805 |
| 1068 | .138 | .202 | 104.803 |
| 1070 | .138 | .199 | 104.801 |
| 1073 | .137 | .196 | 104.799 |
| 1075 | .136 | .193 | 104.797 |
| 1078 | .136 | .190 | 104.796 |
| 1080 | .135 | .188 | 104.794 |
| 1082 | .135 | .185 | 104.792 |
| 1085 | .134 | .183 | 104.791 |
| 1087 | .134 | .181 | 104.789 |
| 1090 | .133 | .178 | 104.788 |
| 1092 | .133 | .176 | 104.786 |
| 1094 | .132 | .174 | 104.785 |
| 1097 | .132 | .172 | 104.784 |
| 1099 | .131 | .170 | 104.782 |
| 1102 | .131 | .168 | 104.781 |
| 1104 | .130 | .167 | 104.780 |
| 1106 | .129 | .165 | 104.779 |
| 1109 | .129 | .163 | 104.778 |
| 1111 | .128 | .162 | 104.777 |
| 1114 | .128 | .160 | 104.776 |
| 1116 | .127 | .159 | 104.775 |
| 1118 | .127 | .157 | 104.774 |
| 1121 | .126 | .156 | 104.773 |
| 1123 | .126 | .154 | 104.772 |

| | | | |
|---|---|---|---|
| 1126 | .125 | .153 | 104.771 |
| 1128 | .125 | .152 | 104.770 |
| 1130 | .124 | .150 | 104.769 |
| 1133 | .123 | .149 | 104.768 |
| 1135 | .123 | .148 | 104.768 |
| 1138 | .122 | .147 | 104.767 |
| 1140 | .122 | .145 | 104.766 |
| 1142 | .121 | .144 | 104.765 |
| 1145 | .121 | .143 | 104.765 |
| 1147 | .120 | .142 | 104.764 |
| 1150 | .120 | .141 | 104.763 |
| 1152 | .119 | .140 | 104.762 |
| 1154 | .119 | .139 | 104.762 |
| 1157 | .118 | .138 | 104.761 |
| 1159 | .118 | .137 | 104.761 |
| 1162 | .117 | .136 | 104.760 |
| 1164 | .117 | .135 | 104.759 |
| 1166 | .116 | .134 | 104.759 |
| 1169 | .116 | .134 | 104.758 |
| 1171 | .115 | .133 | 104.758 |
| 1174 | .114 | .132 | 104.757 |
| 1176 | .114 | .131 | 104.756 |
| 1178 | .113 | .130 | 104.756 |
| 1181 | .113 | .129 | 104.755 |
| 1183 | .112 | .129 | 104.755 |
| 1186 | .112 | .128 | 104.754 |
| 1188 | .111 | .127 | 104.754 |
| 1190 | .111 | .126 | 104.753 |
| 1193 | .110 | .126 | 104.753 |
| 1195 | .110 | .125 | 104.752 |
| 1198 | .109 | .124 | 104.752 |
| 1200 | .000 | .121 | 104.750 |
| 1202 | .000 | .115 | 104.746 |
| 1205 | .000 | .110 | 104.742 |
| 1207 | .000 | .105 | 104.739 |
| 1210 | .000 | .100 | 104.736 |
| 1212 | .000 | .095 | 104.733 |
| 1214 | .000 | .091 | 104.730 |
| 1217 | .000 | .086 | 104.727 |
| 1219 | .000 | .082 | 104.724 |
| 1222 | .000 | .078 | 104.722 |
| 1224 | .000 | .075 | 104.719 |
| 1226 | .000 | .071 | 104.717 |
| 1229 | .000 | .068 | 104.715 |
| 1231 | .000 | .065 | 104.713 |
| 1234 | .000 | .062 | 104.711 |
| 1236 | .000 | .059 | 104.709 |
| 1238 | .000 | .056 | 104.707 |
| 1241 | .000 | .053 | 104.705 |
| 1243 | .000 | .051 | 104.704 |
| 1246 | .000 | .048 | 104.702 |
| 1248 | .000 | .046 | 104.700 |
| 1250 | .000 | .044 | 104.699 |
| 1253 | .000 | .042 | 104.698 |
| 1255 | .000 | .040 | 104.696 |
| 1258 | .000 | .038 | 104.695 |
| 1260 | .000 | .036 | 104.694 |
| 1262 | .000 | .035 | 104.693 |
| 1265 | .000 | .033 | 104.692 |
| 1267 | .000 | .031 | 104.691 |
| 1270 | .000 | .030 | 104.690 |
| 1272 | .000 | .028 | 104.689 |
| 1274 | .000 | .027 | 104.688 |
| 1277 | .000 | .026 | 104.687 |
| 1279 | .000 | .025 | 104.686 |
| 1282 | .000 | .023 | 104.686 |
| 1284 | .000 | .022 | 104.685 |
| 1286 | .000 | .021 | 104.684 |
| 1289 | .000 | .020 | 104.683 |
| 1291 | .000 | .019 | 104.683 |
| 1294 | .000 | .018 | 104.682 |

| | | | |
|---|---|---|---|
| 1296 | .000 | .018 | 104.682 |
| 1298 | .000 | .017 | 104.681 |
| 1301 | .000 | .016 | 104.681 |
| 1303 | .000 | .015 | 104.680 |
| 1306 | .000 | .015 | 104.680 |
| 1308 | .000 | .014 | 104.679 |
| 1310 | .000 | .013 | 104.679 |
| 1313 | .000 | .013 | 104.678 |
| 1315 | .000 | .012 | 104.678 |
| 1318 | .000 | .011 | 104.678 |
| 1320 | .000 | .011 | 104.677 |
| 1322 | .000 | .010 | 104.677 |
| 1325 | .000 | .010 | 104.677 |
| 1327 | .000 | .009 | 104.676 |
| 1330 | .000 | .009 | 104.676 |
| 1332 | .000 | .009 | 104.676 |
| 1334 | .000 | .008 | 104.675 |
| 1337 | .000 | .008 | 104.675 |
| 1339 | .000 | .007 | 104.675 |
| 1342 | .000 | .007 | 104.675 |
| 1344 | .000 | .007 | 104.674 |
| 1346 | .000 | .006 | 104.674 |
| 1349 | .000 | .006 | 104.674 |
| 1351 | .000 | .006 | 104.674 |
| 1354 | .000 | .006 | 104.674 |
| 1356 | .000 | .005 | 104.673 |
| 1358 | .000 | .005 | 104.673 |
| 1361 | .000 | .005 | 104.673 |
| 1363 | .000 | .005 | 104.673 |
| 1366 | .000 | .004 | 104.673 |
| 1368 | .000 | .004 | 104.673 |
| 1370 | .000 | .004 | 104.673 |
| 1373 | .000 | .004 | 104.672 |
| 1375 | .000 | .004 | 104.672 |
| 1378 | .000 | .003 | 104.672 |
| 1380 | .000 | .003 | 104.672 |
| 1382 | .000 | .003 | 104.672 |
| 1385 | .000 | .003 | 104.672 |
| 1387 | .000 | .003 | 104.672 |
| 1390 | .000 | .003 | 104.672 |
| 1392 | .000 | .003 | 104.672 |
| 1394 | .000 | .002 | 104.672 |
| 1397 | .000 | .002 | 104.672 |
| 1399 | .000 | .002 | 104.671 |
| 1402 | .000 | .002 | 104.671 |
| 1404 | .000 | .002 | 104.671 |
| 1406 | .000 | .002 | 104.671 |
| 1409 | .000 | .002 | 104.671 |
| 1411 | .000 | .002 | 104.671 |
| 1414 | .000 | .002 | 104.671 |
| 1416 | .000 | .002 | 104.671 |
| 1418 | .000 | .002 | 104.671 |
| 1421 | .000 | .001 | 104.671 |
| 1423 | .000 | .001 | 104.671 |
| 1426 | .000 | .001 | 104.671 |
| 1428 | .000 | .001 | 104.671 |
| 1430 | .000 | .001 | 104.671 |
| 1433 | .000 | .001 | 104.671 |
| 1435 | .000 | .001 | 104.671 |
| 1438 | .000 | .001 | 104.671 |
| 1440 | .000 | .001 | 104.671 |
| 1442 | .000 | .001 | 104.671 |
| 1445 | .000 | .001 | 104.671 |
| 1447 | .000 | .001 | 104.671 |
| 1450 | .000 | .001 | 104.671 |
| 1452 | .000 | .001 | 104.671 |
| 1454 | .000 | .001 | 104.670 |
| 1457 | .000 | .001 | 104.670 |
| 1459 | .000 | .001 | 104.670 |
| 1462 | .000 | .001 | 104.670 |
| 1464 | .000 | .001 | 104.670 |

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        1466                .000                .001              |     104.670
        1469                .000                .001              |     104.670
        1471                .000                .001              |     104.670
        1474                .000                .000              |     104.670
1*******************************     PONDOPT      *******************************
 *******************************   Version 1.83   *******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: 7845 RICHMOND RD
    User: LandTech Resources
    Date: 07/21/2005  Thursday
    Time: 13:32:42
  Output: RRP100.OUT
```

ROUTING SUMMARY ----------
SIMULATION MODE ----------
FOR THE ABOVE CASE ----------

| STORM NUMBER | PEAK STAGE (ft) | PEAK STORAGE (ac-ft) | PEAK INFLOW (cfs) | PEAK OUTFLOW (cfs) |
|---|---|---|---|---|
| 1 | 106.458 | .356 | 8.748 | 2.233 |

# Design BMP #2

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

PROJECT NAME 05-001
PROJECT NO. _____
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 6/7/05
SCALE _____

# DESIGN INFILTRATION BASIN
## BMP C-2

Treatment Volume = 1.0 inches/impervious area

Impervious Area = 3100 sf

$$WQ_V = \frac{3{,}100\ sf \mid 1\ in \mid 1\ ft}{\mid \mid 12\ in} = 258\ cf$$

Infiltration Rate, f = 1.951 in/hr per HA-3 of Geotechnical Report dated 3/1/05

Design Infiltration Rate, $f_d$ = 0.5f.

$$f_d = (0.5)(1.951\ in/hr) = 0.98\ in/hr = .0817\ ft/hr$$

Void Ratio, $V_r$ = 0.40

$$\text{Maximum Depth, } d_{max} = \frac{f_d T_{max}}{V_r} = \frac{(.0817\ ft/hr)(48\ hr)}{0.40}$$

$$= 9.8\ ft$$

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PROJECT NAME 05-001
PROJECT NO.
SHEET NO. OF
CALCULATED BY KMJ DATE 6/7/05
SCALE

Determin Infiltration Basin Dimensions:

depth = 6'

Surface Area = $\frac{2,588\,cf}{0.40 \mid 6\,ft} = 108\,ft^2$

width = 2'

Length = $\frac{108\,sf}{2'} = 54'$

Trench Dimensions: 54' Long x 2' wide x 6' Deep

JOB 05-001

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY KMS DATE 6/7/05

SCALE _____

DA- 2

c= .37

A= .30 Ac.

| | C | A | CA |
|---|---|---|---|
| Roof | .90 | .07 | .06 |
| Grass | .20 | .23 | .05 |
| | | .30 | .11 |

OVERLAND FLOW

L= 105 ft.

S= 2.3 %

Tc= 12.5 min.

CHANNEL FLOW

H= .7 ft.

L= 140 ft.

Tc= 2.5 min.

Tc= 15 min.

$i_{10}$ = 5.1 in/hr

Q=CAi=( .37 )( .30 Ac.)( 5.1 in/hr)($C_f$ 1.0 )

$C_f$ for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q= 0.57 cfs

JOB 05-001

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

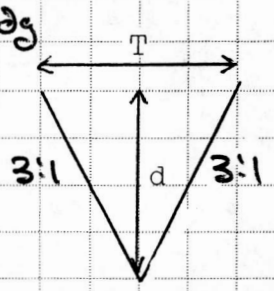
CHECKED BY _____ DATE _____

SCALE _____

# V-DITCH DESIGN

## DA-2

Behind 6,200sf Bldg




Q=0.57 cfs

S=0.5 %

L=140 ft.

T=6 ft.

d=0.5 ft.

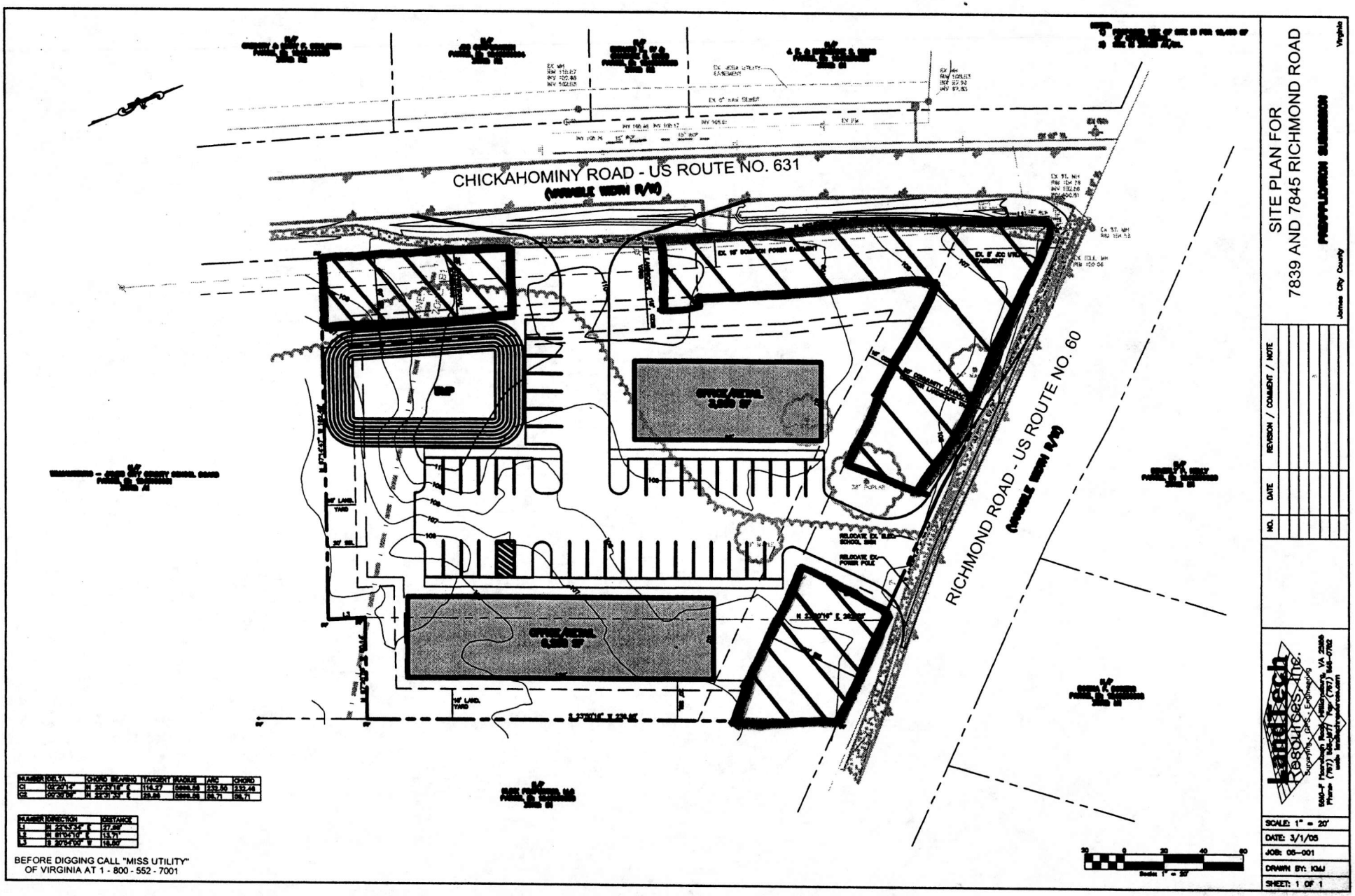
$R=\frac{zd}{2(z^2+1)^{\frac{1}{2}}}=\frac{(3)(0.5\text{ ft.})}{2(10)^{\frac{1}{2}}}=0.24\text{ ft.}$

n=.035

$A=zd^2=(3)(0.5\text{ ft.})^2=0.75\text{ ft.}^2$

d=0.43' V=1.04 fps

Use 6" Grass V-Ditch




COMMUNITY CHARACTER CORRIDOR + LANDSCAPE YARD AREA

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Area in Community Character Corridor and Landscape Yards that cannot be developed = 0.40 ac

Per Meeting with Bill Cain of the JCCED on 6/6/05 the 0.40 ac refevenced above will be subtract from the 1.75 ac site area to obtain an adjusted "Overall Site Area" of 1.35 ac for BMP Point System Calculations

# Worksheet for BMP Point System

A. STRUCTURAL BMP POINT ALLOCATION

"Overall Site Area" = 1.35ac

| | BMP | BMP Points | | Fraction of Site Served by BMP | | Weighted BMP Points |
|---|---|---|---|---|---|---|
| 0.94ac | C-4 | 10 | x | .70 | = | 7.0 |
| 0.30ac | C-2 | 10 | x | .22 | = | 2.2 |
| | | | x | | = | |
| | | | x | | = | |

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 9.2

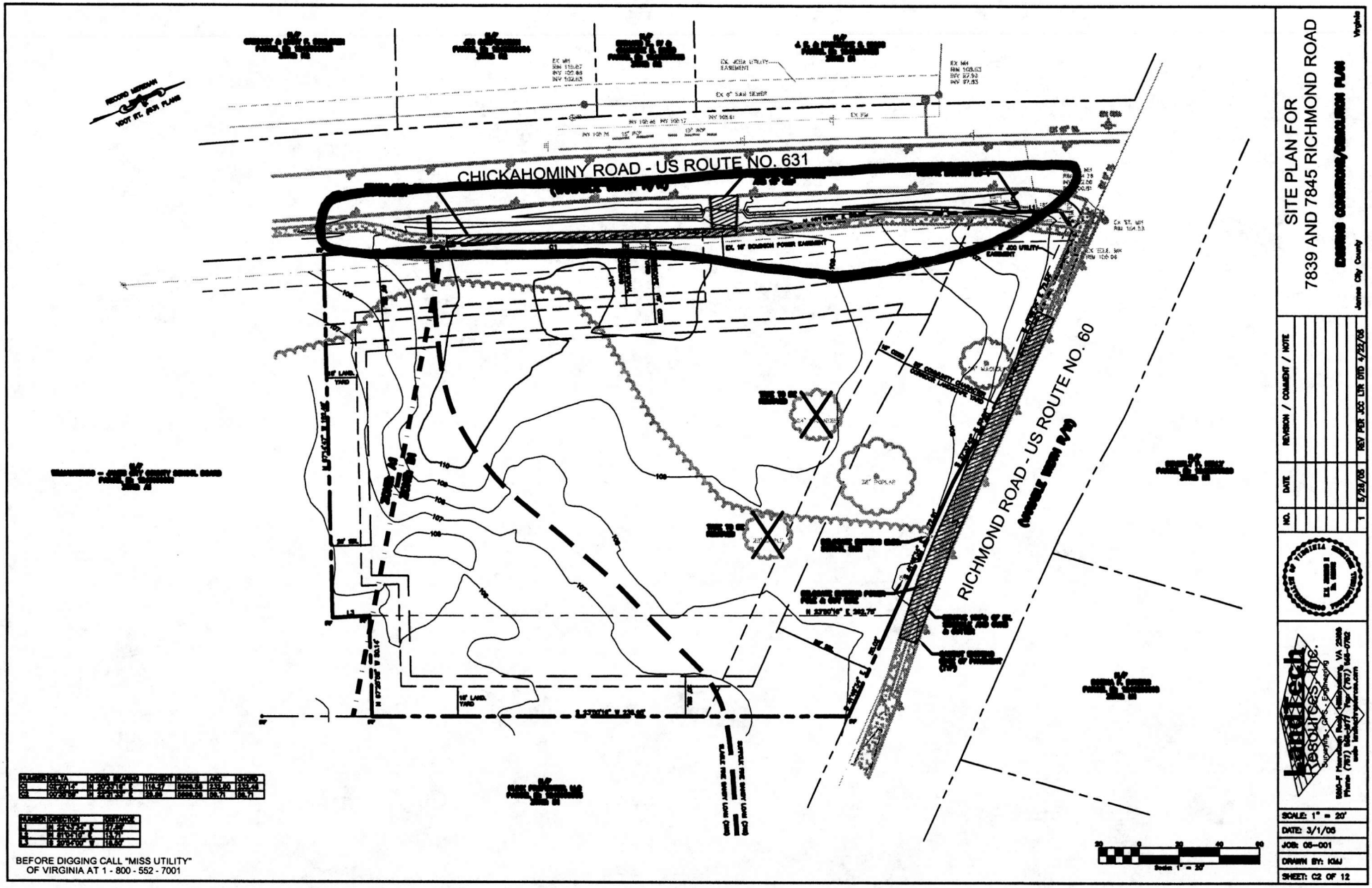
B. NATURAL OPEN SPACE CREDIT

| Fraction of Site | | Natural Open Space Credit | | Points for Natural Open Space |
|---|---|---|---|---|
| | x | (0.1 per 1%) | = | |
| | x | (0.15 per 1%) | = | |

TOTAL NATURAL OPEN SPACE CREDIT: Ø

C. TOTAL WEIGHTED POINTS

| 9.2 | + | Ø | = | 9.2 |
|---|---|---|---|---|
| Structural BMP Points | | Natural Open Space Points | | Total |




PRE-DEVELOPMENT DRAINAGE AREA

JOB

SHEET NO. 05-001 OF

CALCULATED BY DATE

CHECKED BY KMS DATE 6/1/05

SCALE

DA-Pre-Development

c=.35
A=.43 Ac.

| | C | A | CA |
|---|---|---|---|
| Road | .90 | .09 | .08 |
| Grass | .20 | .34 | .07 |
| | | .43 | .15 |

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 5 min.

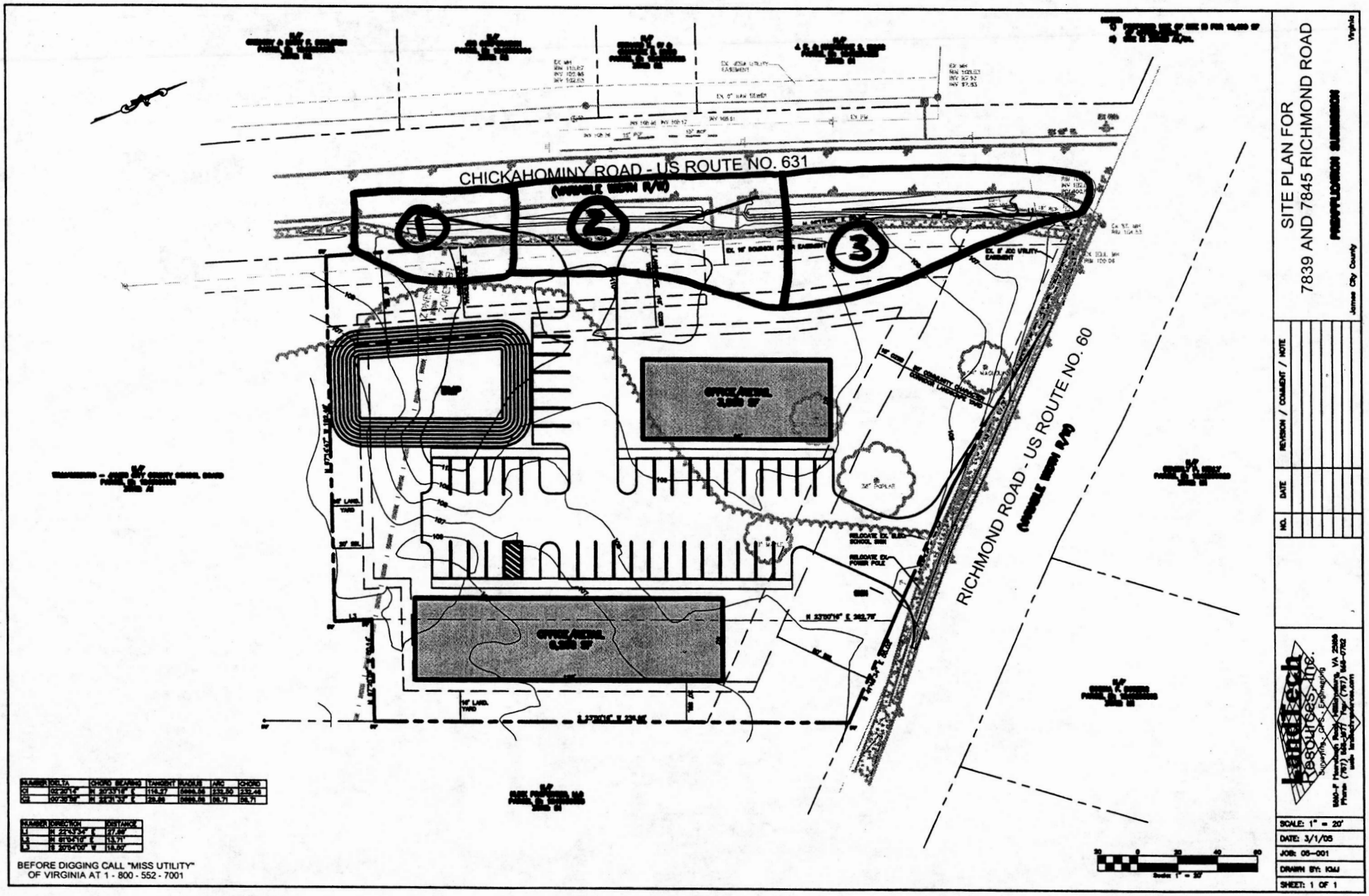
$i_{10}$= 7.2 in/hr

Q=CAi=(.35)(.43 Ac.)(7.2 in/hr)($C_f$ 1.0)

$C_f$ for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q= 1.08 cfs

10-year storm Pre-Development runoff to existing 15" RCP at the intersection of Richmond Rd. & Chickahominy Road.




STORM STRUCTURE DRAINAGE AREA MAP

JOB 05-001

SHEET NO. _____ OF _____

CALCULATED BY KMJ DATE 3/15/05

CHECKED BY _____ DATE _____

SCALE _____

DA- 1

c= .56
A= .09 Ac:

| | C | Δ | CA |
|---|---|---|---|
| Road | .90 | .04 | .04 |
| Grass | .20 | .05 | .01 |
| | | .09 | .05 |

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 5 min.

$i_{10}$ = 7.2 in/hr

Q=CAi=(.56)(.09 Ac.)(7.2 in/hr)($C_f$ 1.0)

$C_f$ for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q=0.36 cfs

$Q_{OI} = CAI = (.56)(.09)(4.0) = 0.20$ cfs

JOB 05-001

SHEET NO. _____ OF _____

CALCULATED BY KMS DATE 3/15/05

CHECKED BY _____ DATE _____

SCALE _____

DA- 2

c= .56
A= .16 Ac.

| | c | A | cA |
|---|---|---|---|
| Road | .90 | .09 | .08 |
| Grass | .20 | .07 | .01 |
| | | .16 | .09 |

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 5 min.

$i_{10}$= 7.2 in/hr

Q=CAi=(.56)(.16 Ac.)(7.2 in/hr)($C_f$ 1.0)

$C_f$ for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q=0.65 cfs

$Q_{OI} = CAI = (.56)(.16)(4.0) = 0.36$ cfs

JOB 05-001

SHEET NO. _____ OF _____

CALCULATED BY KMJ DATE 3/15/05

CHECKED BY _____ DATE _____

SCALE _____

DA- 3

c= .39
A= .18 Ac.

| | c | A | CA |
|---|---|---|---|
| Road | .90 | .06 | .05 |
| Grass | .20 | .12 | .02 |
| | | .18 | .07 |

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 5 min.

$i_{10}$= 7.2 in/hr

Q=CAi=(.39)(.18 Ac.)(7.2 in/hr)($C_f$ 1.0)

$C_f$ for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q= .51 cfs

$Q_{DI} = CAI = (.39)(.18)(4.0) = 0.28$ cfs

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## DESIGN DI #1

$Q = 0.20$ cfs

$S_x = .0208$ ft/ft

$W = 2.5'$

$L = 2.5'$

$P = 2(W+L) = 2(5) = 10'$

$d = 0.10'$

$T = \frac{d}{S_x} = \frac{.1}{.0208} = 4.8'$ OK

USE VDOT DI-1

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## DESIGN DI # 2

Q = 0.36 cfs

$S_x$ = .0208 ft/ft

W = 3.0'

L = 3.33'

P = 2(3.0 + 3.33') = 12.66'

d = 0.10'

$T = \frac{d}{S_x} = \frac{0.10}{.0208} = 4.8'$ OK

USE VDOT DI-5

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## DESIGN DI #3

$Q = 0.28$ cfs

$S_x = .0208$ ft/ft

$W = 3.0'$

$L = 3.33'$

$P = 2(3.0 + 3.33) = 12.66'$

$d = 0.10'$

$T = \frac{d}{S_x} = \frac{0.10}{.0208} = 4.8'$ OK

USE VDOT DI-5

**LandTech Resources, Inc.**

# *Storm Drainage Design*

Phone: (757) 565-1677 Fax: (757) 565-0782

*Project Manager* Kenny Jenkins
*Project Engineer* Kenny Jenkins

For Tc Accumulation, Use VELOCITY (1) from Pipe Slope or (2) V=Q/A : **1**

*Project Number:* **05-001** *Project:* **7839/7845 Richmond Rd** Year Storm: **10**

| Structure | | Rational Formula: Q = CiA | | | | | | | | | Pipe Data | | | | | | | Mannings Formula | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CA | | Inlet Time Tc (min) | | (in/hr) | Runoff, Q (cfs) | | Inverts | | (ft) | % | (in) | Velocity (ft/sec) | | | | N |
| From | To | Area "A" (ac) | Coefficient "C" | Incremental | Cumulative | Incremental | Cumulative | Rain | Incremental | Cumulative | UPstream | DOWN-stream | Length | Slope | Diameter | Based on Q/A | Based on pipe slope | Capacity (cfs) | Flow Time (min) | Manning's |
| From | To | Area | C | CAInc | CaCum | TimeInc | TimeCum | Rain | Qinc | Qcum | InvertUp | InvertDown | Length | Slope | Diameter | VelocityQA | VelocityS | Capacity | FlowTime | Manning/N |
| 1 | 2 | 0.09 | 0.6 | 0.05 | 0.05 | 5 | 5.00 | 6.96 | 0.35 | **0.35** | 3.74 | 3.22 | 172 | 0.30% | 15 | 0.29 | 2.89 | 3.55 | 0.99 | 0.013 |
| 2 | 3 | 0.16 | 0.6 | 0.09 | 0.14 | 5 | 5.99 | 6.72 | 0.60 | **0.94** | 3.17 | 2.78 | 130 | 0.30% | 15 | 0.77 | 2.88 | 3.54 | 0.75 | 0.013 |
| 3 | EXMH | 0.18 | 0.4 | 0.07 | 0.21 | 5 | 6.74 | 6.56 | 0.46 | **1.38** | 2.73 | 2.56 | 37 | 0.46% | 15 | 1.12 | 3.57 | 4.38 | 0.17 | 0.013 |

EXMH

**LandTech Resources, Inc.** **Hydraulic Grade Line (HGL) Calculations**

Project Number: ***05-001***

Project: ***7839/7845 Richmond Rd***

***Date:*** ***6.2.05***

| From Structure | HGL | | | | | ~~~~~~ STRUCTURE LOSSES ~~~~~~ | | | | | | | HGL | Performance Checks & Intermediate Computations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Bend Losses | | | ENTRANCE | | | (ft) | | | | | | | | | |
| | Slope (%) | Fall (ft) | Velocity Head V²/2g (ft) | Invert Shaped? | Surface Flow? | Angle (deg) | @ To (ft) | @ From (ft) | @ To (ft) | @ From (ft) | EXIT (ft) | TOTAL | @ FROM | Rim/Flowline (Max. Allow. Elevation) | Freeboard" (ft) | Elev., top of pipe @ From | Structure #'s: FROM-TO | TC plus Pipe Flow Time | Elevation at 80% Full Flow | Too Shallow? | Computed Pipe Dia. |
| | HGLSlope | HGLFall | VelocityHead | Shaped | Surface | BendAngle | BendatTo | BendatFrom | EntratTo | EntratFrom | Exit | TotalStruc | HGLatFrom | RimElev | Freeboard | PipeTopEl | FromTo | TCplusPipeTime | FlowRatio | Control | DiaComp |
| 1 | 0.003% | 0.005 | 0.00 | Y | Y | 0 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.74 | 8.38 | 3.64 | 5.18 | 1-2 | 5.99 | 4.74 | 80% D | 6.3 |
| 2 | 0.021% | 0.028 | 0.01 | Y | Y | 0 | 0.000 | 0.000 | 0.002 | 0.000 | 0.003 | 0.002 | 4.17 | 6.58 | 2.41 | 4.61 | 2-3 | 6.74 | 4.17 | 80% D | 9.1 |
| 3 | 0.046% | 0.017 | 0.02 | Y | Y | 0 | 0.000 | 0.000 | 0.005 | 0.002 | 0.007 | 0.006 | 3.73 | 5.83 | 2.10 | 4.17 | 3-EXMH | 6.91 | 3.73 | 80% D | 9.7 |

*Tailwater Elevation at Outfall point # EXMH ):* **3.56**

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# SPECIAL STORMWATER CRITERIA

- The site is located in the Yarmouth Creek watershed, therefore the Special Stormwater Criteria (SSC) shall be applied to the site.

Site Area = 1.175 ac

Soil Mapping Type B Suffolk = 1.20 ac

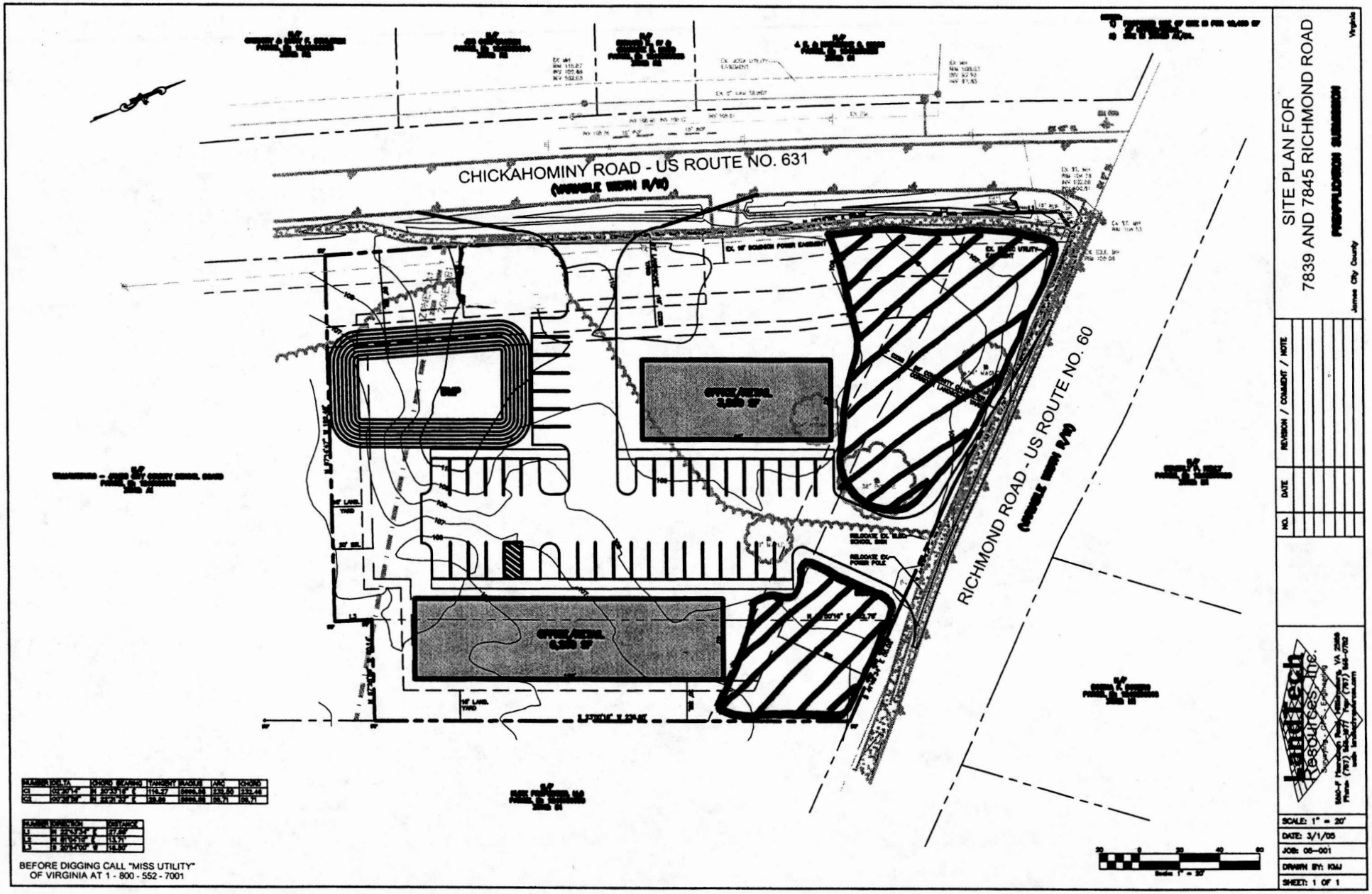
Disturbed Area = SSC Class 3 → 3 unit measures required

Special Stormwater Criteria Practices:

* SSCP #1 - Area Soil Type B saved = 0.35ac = 0.5 unit
SSCP #8 - No underground storm pipe onsite = 1.0 unit
SSCP #20 - Enhanced outlet protection at pipe = 1.0 unit
SSCP #39 - Provide asbuilt drawing of system = 0.5 unit

SSCP Total = 3.0 units

* See Map on next page for saved area




SPECIAL STORMWATER CRITERIA MAP

# APPENDIX B

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# DESIGN SEDIMENT TRAP

Area = 1.01 ac

Initial Storage = $1.01 \text{ ac} \times 134 \frac{\text{cyd}}{\text{ac}} = 136 \text{ cyd}$

Dry Storage = 68 cyd

Wet Storage = 68 cyd

Calculate Wet Storage:

$V_1 = 68 \text{ cyd} = 1836 \text{ cf}$
$D_1 = 1.5'$
$V_1 = .85 \times A_1 \times D_1$

$1836 \text{ cf} = .85 \times A_1 \times 1.5'$

$A_1 = 1{,}440 \text{ sf} = 30' \times 48'$

Calculate Dry Storage:

$V_2 = 68 \text{ cyd} = 1836 \text{ cf}$
$D_2 = 1.0$
$A_1 = 1440 \text{ sf}$

$V_2 = \frac{A_1 + A_2}{2} \times D_2 \Rightarrow 1836 = \frac{1440 + A_2}{2} \times 1.0'$

$A_2 = 2232 \text{ sf} = 34' \times 66'$

$L = 1.01 \times 6' = 6'$

# APPENDIX C

**Report of Subsurface Investigation and**
**Geotechnical Engineering Services**
**Proposed BMP Facility**
**7845 Richmond Road**
**James City County, Virginia**
**G E T Project No: WM05-107G**
**March 1, 2005**
**Prepared For: Mr. Gordon Berryman**

GET
Solutions, Inc.
Geotechnical · Environmental · Testing

GET Solutions, Inc.

Geotechnical · Environmental · Testing

March 1, 2005

TO: **Mr. Gordon Berryman**
124 Berkley Lane
Williamsburg, Virginia 23185

RE: Report of Subsurface Investigation and Geotechnical Engineering Services
**Proposed BMP Facility**
**7845 Richmond Road**
James City County, Virginia
**GET** Project No: WM05-107G

Dear Mr. Berryman:

In compliance with your instructions, we have completed our Subsurface Investigation and Geotechnical Engineering Services for the referenced project. The results of this study, together with our recommendations, are presented in this report.

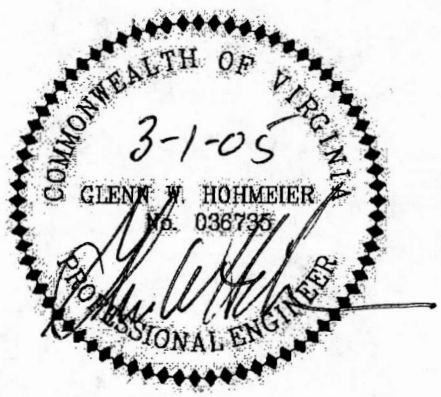
Often, because of design and construction details that occur on a project, questions arise concerning subsurface conditions. **G E T Solutions, Inc.** would be pleased to continue its role as Geotechnical Engineer during the final design phase and project implementation.

We trust that the information contained herein meets your immediate need, and we would ask that you call this office with any questions that you may have.

Respectfully Submitted,
**G E T Solutions, Inc.**

James Wheeler
Project Geologist

Glenn W. Hohmeier, P.E.
Sr. Project Engineer
VA Lic. #036735




Copies: (2) Client
(1) LandTech Resources (Attn: Mr. Kenny Jenkins)

1592 Penniman Road, Suite E • Williamsburg, VA 23185 • Phone (757) 564-6452 • Fax (757) 564-6453
info@getsolutionsinc.com

## TABLE OF CONTENTS

# 1.0 PROJECT INFORMATION

## 1.1 Project Authorization:

**G E T Solutions, Inc.** has completed our Geotechnical Engineering study for the proposed BMP facility located at 7845 Richmond Road in James City County, Virginia. The Geotechnical Engineering Services were conducted in accordance with the scope presented in **G E T** proposal No. PWM05-103G. Written authorization to proceed with the Geotechnical Engineering Services was received from Mr. Gordon Berryman.

## 1.2 Project Description:

The construction at this site is planned to consist of two office/retail buildings consisting of having a total floor area of 6,200 ft² per building. Also, new paved driveways and parking areas, BMP facility, along with other pertinent infrastructure components will also be constructed at this site. Our Geotechnical Engineering Services was limited to the construction of the BMP facility.

If any of the noted information is incorrect or has changed, please inform **G E T Solutions, Inc.** so that we may amend the recommendations presented in this report, if appropriate.

## 1.3 Purpose and Scope of Services:

The purpose of this study was to obtain information on the general subsurface conditions at the proposed project site within the BMP area. The subsurface conditions encountered were then evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

1. General assessment of the soils revealed by the borings performed at the proposed development within the BMP area.

2. General location and description of potentially deleterious material encountered in the borings that may interfere with construction progress, including existing fills or surficial/subsurface organics.

3. Evaluation of the permeability of the soils within the BMP area by means of performing in-situ infiltration tests.

4. Providing engineering recommendations with respect to BMP related construction parameters, including estimates of shallow subsurface soil permeability characteristics.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic material in the soil, bedrock, surface water, groundwater or air, on or below or around this site. Prior to development of this site, an environmental assessment is advisable.

## 2.0 FIELD AND LABORATORY PROCEDURES

### 2.1 Field Exploration:

In order to explore the general subsurface soil types and to aid in developing associated design parameters, three (3) 10-foot deep hand auger borings (designated as HA-1, HA-2 and HA-3) were performed by **G E T Solutions, Inc.** within the proposed BMP area. In addition, three infiltration tests (designated as INF-1, INF-2 and INF-3) were performed within the hand auger borings at various depths.

The boring locations were established, located and staked in the field by a representative of **G E T Solutions, Inc.** The approximate boring locations are shown on the "Boring Location Plan" (Figure 1) attached to this report (Appendix I).

### 2.2 Laboratory Testing:

Representative portions of all soil samples collected at the hand auger locations were sealed in plastic bags, labeled and transferred to our laboratory for classification and analysis. The soil classification was performed by a Geotechnical Engineer in accordance with ASTM D 2488.

Three representative soil samples were selected and subjected to laboratory testing, which included natural moisture and -#200 sieve wash, in order to corroborate the visual classification. These test results are noted in Table I and are presented on the "Log of Boring" sheet (Appendix II), included with this report.

## Table I – Laboratory Test Results

| Boring No. | Depth (Ft) | Natural Moisture (%) | #200 Sieve (%) | Atterberg Limits (LL/PL/PI) | Classification |
|---|---|---|---|---|---|
| HA-1/INF-1* | 2-3 | 18.5 | 39.3 | NOT TESTED | SM-SC |
| HA-2/INF-2* | 3-4 | 20.2 | 49.1 | 25/15/10 | SC |
| HA-3/INF-3* | 6.5-7.5 | 13.8 | 14.7 | NON PLASTIC | SM |

*Sample obtained from the infiltration test depth.

## 3.0 SITE AND SUBSURFACE CONDITIONS

### 3.1 Site Location and Description:

The project site is located at 7845 Richmond Road in James City County, Virginia. Currently, the site is an undeveloped, wooded area that is relatively level with grades ranging from 106 to 110 feet across the project site.

### 3.2 Subsurface Soil Conditions:

The results of our field exploration program indicated the presence of approximately 6 inches of topsoil material at the boring locations. The topsoil thickness could vary across the site. Underlying the topsoil and extending to the boring termination depth of 10 feet below existing grades, the subsurface soils were generally arranged in a 1-layer configuration.

The initial soil layer extended from beneath the topsoil material to boring termination of 10 feet. The recovered soils were generally granular in nature and were comprised of SAND (SP-SM, SM, SM-SC, SC), with varying amounts of Silt and Clay. As an exception, a cohesive layer comprised of Sandy CLAY (CL) was encountered at boring location HA-3 from a depth of 8 to 10 feet (boring termination depth).

The subsurface description is of a generalized nature provided to highlight the major soil strata encountered. The records of the subsurface exploration included in Appendix II (Log of Boring sheets) and in the Generalized Soil Profile presented in Appendix III, which should be reviewed for specific information as to the individual borings. The stratifications shown on the records of the subsurface exploration represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the transition may be gradual.

### 3.3 Groundwater Information:

The groundwater table depth was not encountered during our field exploration to the depth explored (10 feet below existing grades).

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, side walks, etc.). It is estimated normal seasonal high groundwater level will fluctuate within 2 feet of the current levels. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on this project.

## 4.0 EVALUATION AND RECOMMENDATIONS

### 4.1 Infiltration Testing

Three infiltration tests (INF-1, INF-2 and INF-3) were performed within the lateral limits of the proposed BMP facility, corresponding to boring location HA-1, HA-2 and HA-3. Specifically, infiltration test INF-1 was performed at a depth of 2 to 3 feet below existing grades within hand auger boring HA-1, while infiltration test INF-2 was performed at a depth of 3 to 4 feet below existing grades within hand auger boring HA-2, and infiltration test INF-3 was performed at a depth of 6.5 to 7.5 feet below existing grades within hand auger boring HA-3. The infiltration test borehole was prepared utilizing a planer auger to remove soil clippings from its base (test levels ranged from 2 to 7.5 below the ground surface). Infiltration testing was then conducted within the vadose zone utilizing a Precision Permeameter and the following testing procedures.

A support stand was assembled and placed adjacent to the borehole. This stand holds a calibrated reservoir (2000 ml) and a cable used to raise and lower the water control unit (WCU). The WCU establishes a constant water head within the borehole during testing by use of a precision valve and float assembly. The WCU was attached to the flow reservoir with a 2-meter (6.6 foot) braided PVC hose and then lowered by cable into the borehole to the test depth elevation. As required by the Glover solution, the WCU was suspended 6 – inches above the bottom of the borehole. The shut-off valve was then opened allowing water to pass through the WCU to fill the borehole to the constant water level elevation. The absorption rate slowed as the soil voids became filled and an equilibrium developed as a wetting bulb developed around the borehole. Water was continuously added until the flow rate stabilized. The reservoir was then re-filled in order to begin testing. During testing, as the water drained into the borehole and surrounding soils, the water level within the calibrated reservoir was recorded as well as the elapsed time during each interval. The test was continued until relatively consistent flow rates were documented. During testing

the quick release connections and shutoff valve were monitored to ensure that no leakage occurred. The flow rate (Q), height of the constant water level (H), and borehole diameter (D) were used to calculate $K_s$ utilizing the Glover Solution.

Based on the field testing and corroborated with laboratory testing results (published values compared to classification results), the hydraulic conductivity of the shallow soils at the tested depths (ranging from 2 to 7.5 feet) as identified at the location of the infiltration tests ranged from k = 4.46 x $10^{-5}$ cm/sec (or 0.063 in /hour) to k = 1.38 x $10^{-3}$ cm/sec (or 1.951 in/hour). The following provides the infiltration test results corresponding to the specific locations and depths.

**Table 2 – Infiltration Test Results**

| Infiltration Test | Boring Location | Depth Test Conducted (ft) | Percent Fines | Hyrdraulic Conductivity (cm/sec) |
|---|---|---|---|---|
| INF-1 | HA-1 | 1.5-2.5 | 39.3 | 7.09 x $10^{-5}$ |
| INF-2 | HA-2 | 3-4 | 39.5 | 4.46 x $10^{-5}$ |
| INF-3 | HA-3 | 6-7 | 14.7 | 1.38 x $10^{-3}$ |

## 4.2 Engineering Evaluation for BMP Area

Based on the results of our field and laboratory testing procedures and engineering analysis, the following observations, opinions, and recommendations are presented:

*Seepage:*

- ✓ The subsurface soils at the boring locations were primarily granular in nature and comprised of of SAND (SP-SM, SM, SM-SC, SC) with varying amounts of Silt and CLAY extending to boring termination depth of 10 feet below existing grades, with the exception of HA-3 consisting of Sandy CLAY (CL) at a depth of 8 to 10 feet. As such, and based on infiltration test results, the hydraulic conductivity values are anticipated to range between high and moderately low Ksat Class (on the order of 1.0 x $10^{-3}$ cm/sec to 1.0 x $10^{-5}$ cm/sec, respectively). Applicable safety factor should be applied for design purposes.

- ✓ The groundwater table was not encountered to the depth explored (10 feet below existing grades) during our field exploration.

*Borrow Material:*

- ✓ On the basis of the results of our soil test borings and laboratory testing procedures, the soils encountered to boring termination depth of 10 feet within the boring performed, were generally granular in nature. Some of the on-site granular soils (SP-SM, SM) encountered during our field exploration may be considered suitable for re-use as structural fill. However, in order to verify the acceptance or rejection of the existing soils for re-use as structural fill, additional classification tests (natural moisture and -#200 sieve) will have to be performed during construction [Suitable structural fill material should consist of sand or gravel containing less than 20% by weight of fines (SP, SM, SW, GP, GW), having a liquid limit less than 20 and plastic limit less than 6, and should be free of rubble, organics, clay, debris and other unsuitable material].

## 5.0 CONSTRUCTION CONSIDERATIONS

### 5.1 Drainage and Groundwater Concerns:

It is expected that dewatering will be required for excavations that extend near or below the groundwater level. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on this project.

It would be advantageous to construct all fills early in the construction. If this is not accomplished, disturbance of the existing site drainage could result in collection of surface water in some areas, thus rendering these areas wet and very loose. Temporary drainage ditches should be employed by the contractor to accentuate drainage during construction.

### 5.2 Excavations:

In Federal Register, Volume 54, No. 209 (October, 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new (OSHA) guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. **G E T Solutions, Inc.** is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

## 6.0 REPORT LIMITATIONS

The recommendations submitted are based on the available soil information obtained by **G E T Solutions, Inc.** and the information supplied by Mr. Gordon Berryman, and his consultants for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, **G E T Solutions, Inc.** should be notified immediately to determine if changes in the foundation recommendations are required. If **G E T Solutions, Inc.** is not retained to perform these functions, **G E T Solutions, Inc.** can not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete the Geotechnical Engineer should be provided the opportunity to review the final design plans and specifications to assure our engineering recommendations have been properly incorporated into the design documents, in order that the earthwork and foundation recommendations may be properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Mr. Gordon Berryman and his consultants for the specific application to the proposed BMP facility located at 7845 Richmond Road in James City County, Virginia.

## APPENDICES

I. BORING LOCATION PLAN

II. LOG OF BORINGS

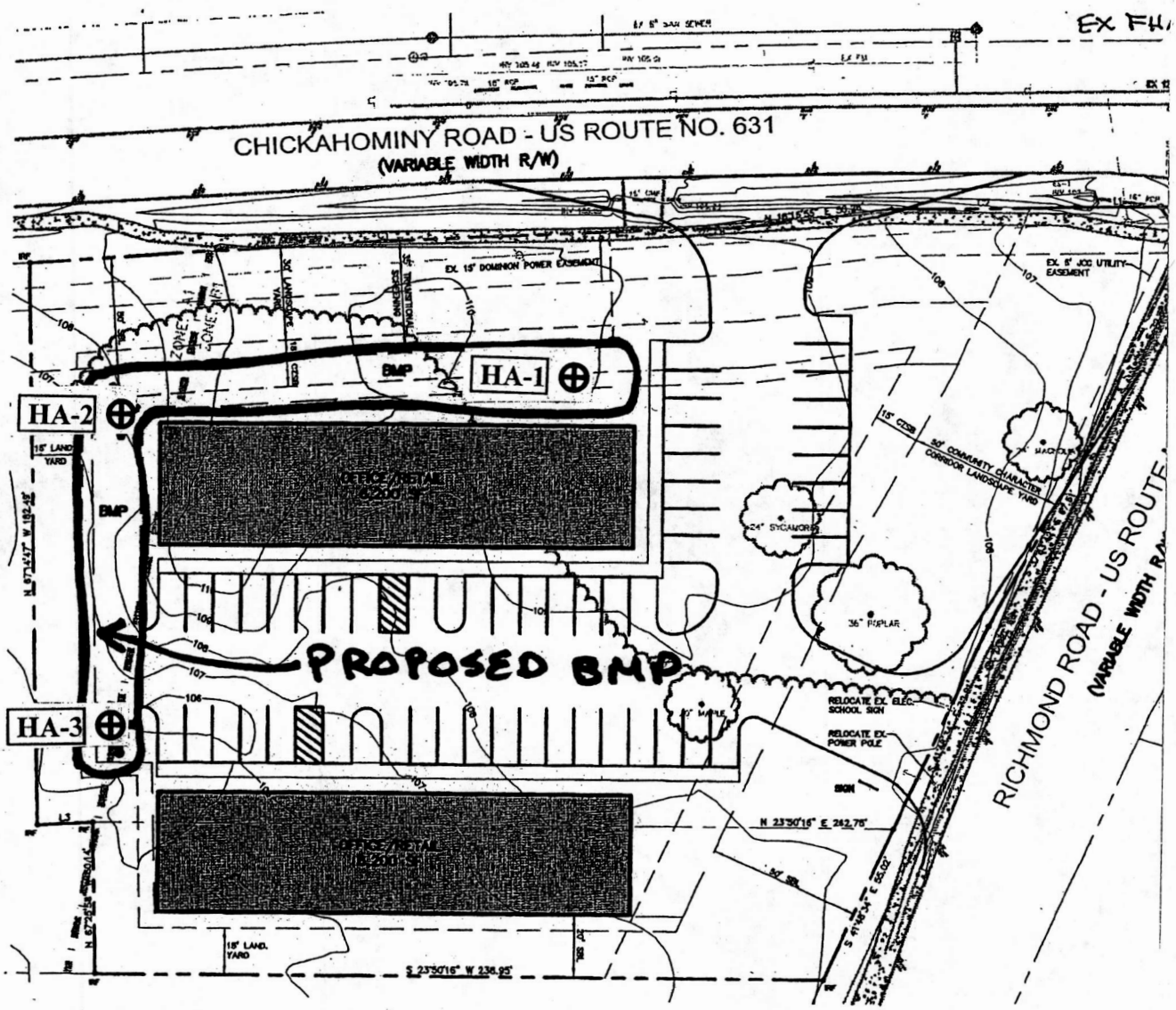
III. GENERALIZED SOIL PROFILE

IV. INFILTRATION TEST RESULTS

## APPENDIX I -

BORING LOCATION PLAN

Figure 1




**Locations are approximate**

## BORING LOCATION PLAN

| | |
|---|---|
| **PROJECT:** | **Proposed BMP Area, 7845 Richmond Road James City County, Virginia** |
| **PROJECT NO:** | **WM05-107G** |
| **CLIENT:** | **Mr. Gordon Berryman** |

**SCALE: NTS**
**DATE: 2/25/05**
**PLOT BY: LY**

**APPENDIX II -**

LOG OF BORINGS

Geotechnical Environmental Testing Solutions, Inc.

# LOG OF BORING No. HA-1

**PROJECT:** Proposed BMP Area, 7845 Richmond Road **PROJECT NO.:** WM05-107G

**CLIENT:** Mr. Gordon Berryman

**PROJECT LOCATION:** James City County, Virginia

**LOCATION:** See Attached Boring Location Plan **ELEVATION:**

**DRILLER:** GET Solutions, Inc. **LOGGED BY:** S Peterson

**DRILLING METHOD:** Hand Auger **DATE:** 02-05-05

**DEPTH TO - WATER> INITIAL:** ▽ **AFTER 24 HOURS:** ▽ **CAVING>**

| Depth (feet) | Description | Graphic | Sample No. | Blow Counts | % < #200 |
|---|---|---|---|---|---|
| 0 | 6 inches of topsoil | | | | |
| | Brown, moist, Silty, fine to medium SAND (SM), with trace organics | | | | |
| 1.5 | Brown, moist, Silty, Clayey SAND (SM-SC) | | | | 39 |
| 3 | Brown, moist, Silty, fine to medium SAND (SM), with trace Clay | | | | |
| 4 | Brown, moist, Clayey, fine to medium SAND (SC) | | | | |
| 6 | Tan, moist, poorly graded SAND (SP-SM) with trace Silt | | | | |
| 7 | Orangish brown, moist, Silty, Clayey SAND (SM-SC) | | | | |
| 9 | Tan, moist, Silty, fine to medium SAND (SM), with interbedded layers of Clay | | | | |
| 10 | Boring terminated at 10 ft. | | | | |

TEST RESULTS

Plastic Limit ⊢——⊣ Liquid Limit

Water Content - ●

Penetration - ▨

10 20 30 40 50 60 70

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Figure

Geotechnical Environmental Testing Solutions, Inc.

# LOG OF BORING No. HA-2

**PROJECT:** Proposed BMP Area, 7845 Richmond Road **PROJECT NO.:** WM05-107G

**CLIENT:** Mr. Gordon Berryman

**PROJECT LOCATION:** James City County, Virginia

**LOCATION:** See Attached Boring Location Plan **ELEVATION:**

**DRILLER:** GET Solutions, Inc. **LOGGED BY:** S Peterson

**DRILLING METHOD:** Hand Auger **DATE:** 02-05-05

**DEPTH TO - WATER> INITIAL:** ▽ **AFTER 24 HOURS:** ▽ **CAVING>** ℄

| Depth (feet) | Description | Graphic | Sample No. | Blow Counts | % < #200 |
|---|---|---|---|---|---|
| 0 | | | | | |
| | 6 inches of topsoil | | | | |
| | 0.5 | | | | |
| | Brown, moist, Silty, fine to medium SAND (SM), with trace organics | | | | |
| 2 | | | | | |
| | 3 | | | | |
| | Gray, moist, Clayey SAND (SC) | | | | 49 |
| 4 | | | | | |
| 6 | | | | | |
| | 6 | | | | |
| | Brown to tan, moist, Silty, fine to medium SAND (SM) | | | | |
| 8 | | | | | |
| | Trace Clay at 9 to 10 Feet | | | | |
| 10 | | | | | |
| | Boring terminated at 10 ft. | | | | |
| 12 | | | | | |
| 14 | | | | | |

TEST RESULTS

Plastic Limit ⊢——⊣ Liquid Limit

Water Content - ●

Penetration - ▨

10 20 30 40 50 60 70

Figure

Geotechnical Environmental Testing Solutions, Inc.

# LOG OF BORING No. HA-3

**PROJECT:** Proposed BMP Area, 7845 Richmond Road **PROJECT NO.:** WM05-107G

**CLIENT:** Mr. Gordon Berryman

**PROJECT LOCATION:** James City County, Virginia

**LOCATION:** See Attached Boring Location Plan **ELEVATION:**

**DRILLER:** GET Solutions, Inc. **LOGGED BY:** S Peterson

**DRILLING METHOD:** Hand Auger **DATE:** 02-05-05

**DEPTH TO - WATER> INITIAL:** ▽ **AFTER 24 HOURS:** ▽ **CAVING>** C

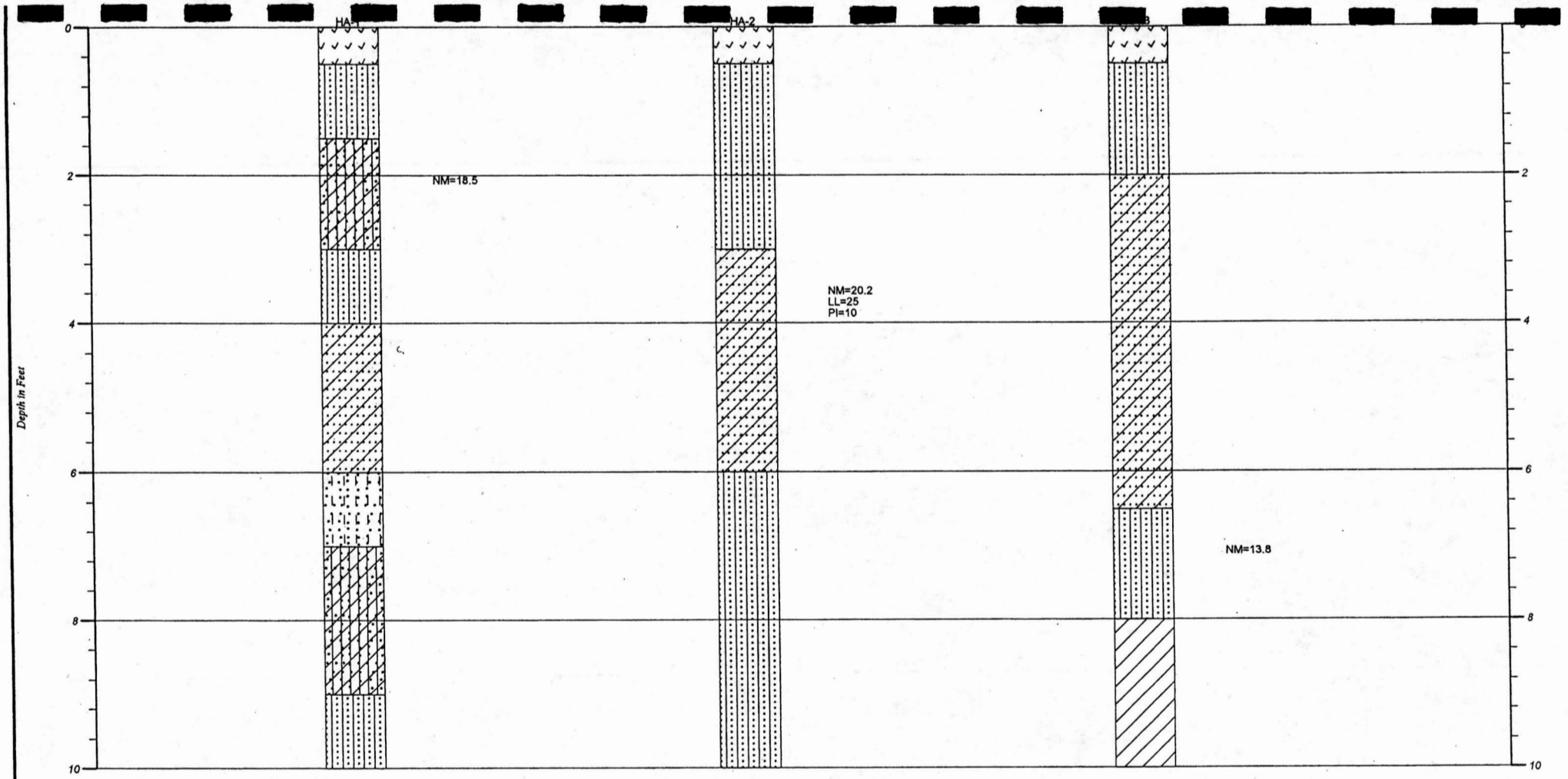
| Depth (feet) | Description | Graphic | Sample No. | Blow Counts | % < #200 | TEST RESULTS |
|---|---|---|---|---|---|---|
| 0 | | | | | | Plastic Limit ⊢—⊣ Liquid Limit |
| | 6 inches of topsoil | | | | | Water Content - ● |
| | | 0.5 | | | | Penetration - ▨ |
| | Brown, moist, Silty, fine to medium SAND (SM), with trace organics and Clay | | | | | 10 20 30 40 50 60 70 |
| 2 | | 2 | | | | |
| | Brown, moist, Clayey SAND (SC) | | | | | |
| 4 | | | | | | |
| 6 | | | | | | |
| | | 6.5 | | | | |
| | Tan, moist, Silty, fine to medium SAND (SM) | | | | 15 | ● |
| 8 | | 8 | | | | |
| | Gray, moist, Sandy CLAY (CL) | | | | | |
| 10 | | | | | | |
| | Boring terminated at 10 ft. | | | | | |
| 12 | | | | | | |
| 14 | | | | | | |

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

Figure

**APPENDIX III -**

GENERALIZED SOIL PROFILE




Strata symbols

- Topsoil
- Silty sand
- Poorly graded clayey silty sand
- Clayey sand
- Poorly graded sand with silt
- Low plasticity clay

GET Solutions, Inc.

GENERALIZED SOIL PROFILE

| HORIZONTAL SCALE: / VERTICAL SCALE: 1"=2' | DRAWN BY/APPROVED BY | DATE DRAWN |
|---|---|---|
| | S Peterson | 2/25/2005 |

Proposed BMP Area, 7845 Richmond Road
James City County, Virginia

PROJECT NO. WM05-107G

FIGURE NUMBER 1

## APPENDIX IV -

INFILTRATION TEST RESULTS

| GET SOLUTIONS, INC. | | SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET | | Sheet No.: 1 |
|---|---|---|---|---|
| **Project Name.:** | 7845 Richmond Rd. | **Location.....** | Proposed BMP Facility | **Terminology and Solution** |
| **Boring No.....:** | INF-1 at HA-1 | **Date.....:** | 2/25/2005 | Ksat : Saturated hydraulic conductivity |
| **Investigators.:** | J. Wheeler | **File Name.....:** | WM05-107G | Q: Steady-state rate of water flow into the soil |
| **Boring Depth.:** | 30 inches | **WCU Base. Ht. h:** | 15.0 cm | H: Constant height of water in borehole |
| **Boring Dia.....:** | 8.3 cm | **WCU Susp. Ht. S:** | 15.2 cm | r: Radius of cylindrical borehole |
| **Boring Rad. (r):** | 4.15 cm | **Const. Wtr. Ht. H:** | 30.2 cm | Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution] |

| VOLUME (ml) | Volume Out (ml) [a] | TIME (hr:min:sec a/p) | Elapsed Time (hr:min:sec) | Elapsed Time (min) [b] | Flow Rate Q (ml/min) [a/b] | Ksat Equivalent Values (cm/min) | (cm/sec) | (cm/day) | (in/hr) | (ft/day) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | | 11:00:00 AM | | | | | | | | |
| 1990 | 10 | 11:00:36 AM | 0:00:36 | 0.60 | 16.67 | 0.005 | 8.78E-05 | 7.6 | 0.124 | 0.25 |
| 1980 | 10 | 11:01:13 AM | 0:00:37 | 0.62 | 16.22 | 0.005 | 8.54E-05 | 7.4 | 0.121 | 0.24 |
| 1970 | 10 | 11:01:56 AM | 0:00:43 | 0.72 | 13.95 | 0.004 | 7.35E-05 | 6.3 | 0.104 | 0.21 |
| 1960 | 10 | 11:02:42 AM | 0:00:46 | 0.77 | 13.04 | 0.004 | 6.87E-05 | 5.9 | 0.097 | 0.19 |
| 1950 | 10 | 11:03:28 AM | 0:00:46 | 0.77 | 13.04 | 0.004 | 6.87E-05 | 5.9 | 0.097 | 0.19 |
| 1940 | 10 | 11:04:15 AM | 0:00:47 | 0.78 | 12.77 | 0.004 | 6.72E-05 | 5.8 | 0.095 | 0.19 |
| 1930 | 10 | 11:05:00 AM | 0:00:45 | 0.75 | 13.33 | 0.004 | 7.02E-05 | 6.1 | 0.100 | 0.20 |
| 1920 | 10 | 11:05:48 AM | 0:00:48 | 0.80 | 12.50 | 0.004 | 6.58E-05 | 5.7 | 0.093 | 0.19 |
| 1910 | 10 | 11:06:35 AM | 0:00:47 | 0.78 | 12.77 | 0.004 | 6.72E-05 | 5.8 | 0.095 | 0.19 |
| 1900 | 10 | 11:07:22 AM | 0:00:47 | 0.78 | 12.77 | 0.004 | 6.72E-05 | 5.8 | 0.095 | 0.19 |
| 1890 | 10 | 11:08:10 AM | 0:00:48 | 0.80 | 12.50 | 0.004 | 6.58E-05 | 5.7 | 0.093 | 0.19 |
| 1880 | 10 | 11:08:57 AM | 0:00:47 | 0.78 | 12.77 | 0.004 | 6.72E-05 | 5.8 | 0.095 | 0.19 |
| 1870 | 10 | 11:09:42 AM | 0:00:45 | 0.75 | 13.33 | 0.004 | 7.02E-05 | 6.1 | 0.100 | 0.20 |
| 1860 | 10 | 11:10:29 AM | 0:00:47 | 0.78 | 12.77 | 0.004 | 6.72E-05 | 5.8 | 0.095 | 0.19 |
| **Natural Moisture:** | Moist | **Init. Satur.Time:** | 10:45:00 AM | **ESTIMATED FIELD KSAT:** | | 0.004 | 7.09E-05 | 6.1 | 0.100 | 0.20 |
| **Texture/Classif:** | SAND (SM-SC) | **Consistency:** | Medium Dense | **Depth to an Impermeable Layer:** | N/A | **Notes:** | Ksat Class = Moderately Low | | | |
| **Structure/Fabric:** | N/A | **Slope/Landsc:** | slope | **Depth to Bedrock.....:** | N/A | | | | | |

| GET SOLUTIONS, INC. | SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET | Sheet No.: 2 |
|---|---|---|

| | | | | |
|---|---|---|---|---|
| **Project Name.:** | 7845 Richmond Rd. | **Location.....** | Proposed BMP Facility | **Terminology and Solution** |
| **Boring No.....:** | INF-2 at HA-2 | **Date.....:** | 2/5/2005 | Ksat : Saturated hydraulic conductivity |
| **Investigators.:** | J. Wheeler | **File Name.....:** | WM05-107G | Q: Steady-state rate of water flow into the soil |
| **Boring Depth.:** | 42 inches | **WCU Base. Ht. h:** | 15.0 cm | H: Constant height of water in borehole |
| **Boring Dia.....:** | 8.3 cm | **WCU Susp. Ht. S:** | 15.2 cm | r: Radius of cylindrical borehole |
| **Boring Rad. (r):** | 4.15 cm | **Const. Wtr. Ht. H:** | 30.2 cm | Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution] |

| VOLUME (ml) | Volume Out (ml) [a] | TIME (hr:min:sec a/p) | Elapsed Time (hr:min:sec) | Elapsed Time (min) [b] | Flow Rate Q (ml/min) [a/b] | Ksat Equivalent Values (cm/min) | (cm/sec) | (cm/day) | (in/hr) | (ft/day) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | | 1:00:00 PM | | | | | | | | |
| 1990 | 10 | 1:01:13 PM | 0:01:13 | 1.22 | 8.22 | 0.003 | 4.33E-05 | 3.7 | 0.061 | 0.12 |
| 1980 | 10 | 1:02:19 PM | 0:01:06 | 1.10 | 9.09 | 0.003 | 4.79E-05 | 4.1 | 0.068 | 0.14 |
| 1970 | 10 | 1:03:26 PM | 0:01:07 | 1.12 | 8.96 | 0.003 | 4.72E-05 | 4.1 | 0.067 | 0.13 |
| 1960 | 10 | 1:04:36 PM | 0:01:10 | 1.17 | 8.57 | 0.003 | 4.51E-05 | 3.9 | 0.064 | 0.13 |
| 1950 | 10 | 1:05:45 PM | 0:01:09 | 1.15 | 8.70 | 0.003 | 4.58E-05 | 4.0 | 0.065 | 0.13 |
| 1940 | 10 | 1:06:58 PM | 0:01:13 | 1.22 | 8.22 | 0.003 | 4.33E-05 | 3.7 | 0.061 | 0.12 |
| 1930 | 10 | 1:08:09 PM | 0:01:11 | 1.18 | 8.45 | 0.003 | 4.45E-05 | 3.8 | 0.063 | 0.13 |
| 1920 | 10 | 1:09:20 PM | 0:01:11 | 1.18 | 8.45 | 0.003 | 4.45E-05 | 3.8 | 0.063 | 0.13 |
| 1910 | 10 | 1:10:35 PM | 0:01:15 | 1.25 | 8.00 | 0.003 | 4.21E-05 | 3.6 | 0.060 | 0.12 |
| 1900 | 10 | 1:11:44 PM | 0:01:09 | 1.15 | 8.70 | 0.003 | 4.58E-05 | 4.0 | 0.065 | 0.13 |
| 1890 | 10 | 1:12:54 PM | 0:01:10 | 1.17 | 8.57 | 0.003 | 4.51E-05 | 3.9 | 0.064 | 0.13 |
| 1880 | 10 | 1:14:11 PM | 0:01:17 | 1.28 | 7.79 | 0.002 | 4.10E-05 | 3.5 | 0.058 | 0.12 |
| **ESTIMATED FIELD KSAT:** | | | | | | 0.003 | 4.46E-05 | 3.9 | 0.063 | 0.13 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Natural Moisture:** | Moist | **Init. Satur.Time:** | 12:45:00 AM | **Depth to an Impermeable Layer:** | N/A | **Notes:** Ksat Class = Moderately Low |
| **Texture/Classif:** | SAND (SC) | **Consistency:** | Medium Dense | | | |
| **Structure/Fabric:** | N/A | **Slope/Landsc:** | slope | **Depth to Bedrock.....:** | N/A | |

| GET SOLUTIONS, INC. | SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET | Sheet No.: 3 |
|---|---|---|
| **Project Name.:** 7845 Richmond Rd. | **Location.....** Proposed BMP Facility | **Terminology and Solution** |
| **Boring No.....:** INF-3 at HA-3 | **Date.....:** 2/5/2005 | Ksat : Saturated hydraulic conductivity |
| **Investigators.:** J. Wheeler | **File Name.....:** WM05-107G | Q: Steady-state rate of water flow into the soil |
| **Boring Depth.:** 84 inches | **WCU Base. Ht. h:** 15.0 cm | H: Constant height of water in borehole |
| **Boring Dia.....:** 8.3 cm | **WCU Susp. Ht. S:** 15.2 cm | r: Radius of cylindrical borehole |
| **Boring Rad. (r):** 4.15 cm | **Const. Wtr. Ht. H:** 30.2 cm | Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution] |

| VOLUME (ml) | Volume Out (ml) [a] | TIME (hr:min:sec a/p) | Elapsed Time (hr:min:sec) | Elapsed Time (min) [b] | Flow Rate Q (ml/min) [a/b] | Ksat Equivalent Values (cm/min) | (cm/sec) | (cm/day) | (in/hr) | (ft/day) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | | 2:00:00 PM | | | | | | | | |
| 1950 | 50 | 2:00:12 PM | 0:00:12 | 0.20 | 250.00 | 0.079 | 1.32E-03 | 113.7 | 1.866 | 3.73 |
| 1900 | 50 | 2:00:23 PM | 0:00:11 | 0.18 | 272.73 | 0.086 | 1.44E-03 | 124.1 | 2.035 | 4.07 |
| 1850 | 50 | 2:00:34 PM | 0:00:11 | 0.18 | 272.73 | 0.086 | 1.44E-03 | 124.1 | 2.035 | 4.07 |
| 1800 | 50 | 2:00:45 PM | 0:00:11 | 0.18 | 272.73 | 0.086 | 1.44E-03 | 124.1 | 2.035 | 4.07 |
| 1750 | 50 | 2:00:56 PM | 0:00:11 | 0.18 | 272.73 | 0.086 | 1.44E-03 | 124.1 | 2.035 | 4.07 |
| 1700 | 50 | 2:01:07 PM | 0:00:11 | 0.18 | 272.73 | 0.086 | 1.44E-03 | 124.1 | 2.035 | 4.07 |
| 1650 | 50 | 2:01:18 PM | 0:00:11 | 0.18 | 272.73 | 0.086 | 1.44E-03 | 124.1 | 2.035 | 4.07 |
| 1600 | 50 | 2:01:30 PM | 0:00:12 | 0.20 | 250.00 | 0.079 | 1.32E-03 | 113.7 | 1.866 | 3.73 |
| 1550 | 50 | 2:01:42 PM | 0:00:12 | 0.20 | 250.00 | 0.079 | 1.32E-03 | 113.7 | 1.866 | 3.73 |
| 1500 | 50 | 2:01:54 PM | 0:00:12 | 0.20 | 250.00 | 0.079 | 1.32E-03 | 113.7 | 1.866 | 3.73 |
| 1450 | 50 | 2:02:06 PM | 0:00:12 | 0.20 | 250.00 | 0.079 | 1.32E-03 | 113.7 | 1.866 | 3.73 |
| 1400 | 50 | 2:02:18 PM | 0:00:12 | 0.20 | 250.00 | 0.079 | 1.32E-03 | 113.7 | 1.866 | 3.73 |
| 1350 | 50 | 2:02:30 PM | 0:00:12 | 0.20 | 250.00 | 0.079 | 1.32E-03 | 113.7 | 1.866 | 3.73 |
| 1300 | 50 | 2:02:42 PM | 0:00:12 | 0.20 | 250.00 | 0.079 | 1.32E-03 | 113.7 | 1.866 | 3.73 |
| **Natural Moisture:** Moist | | **Init. Satur.Time:** 1:50:00 PM | | **ESTIMATED FIELD KSAT:** | | 0.083 | 1.38E-03 | 118.9 | 1.951 | 3.90 |
| **Texture/Classif:** SAND (SM) | | **Consistency:** Medium Dense | | **Depth to an Impermeable Layer:** N/A | | **Notes:** Ksat Class = High | | | | |
| **Structure/Fabric:** N/A | | **Slope/Landsc:** slope | | **Depth to Bedrock.....:** N/A | | | | | | |

**Report of Subsurface Exploration and Geotechnical Engineering Services**
**Proposed BMP Facility**
**7845 Richmond Road**
**James City County, Virginia**
**G E T Project No: WM05-107G**
**May 26, 2005**
**Prepared For: Mr. Gordon Berryman**

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GET Solutions, Inc.

*Geotechnical · Environmental · Testing*

GET
Solutions, Inc.

*Geotechnical · Environmental · Testing*

May 26, 2005

TO: **Mr. Gordon Berryman**
124 Berkley Lane
Williamsburg, Virginia 23185

RE: Addendum No. 1
Report of Subsurface Exploration and Geotechnical Engineering Services
**Proposed BMP Facility**
**7845 Richmond Road**
James City County, Virginia
**G E T** Project No. WM05-107G

Dear Mr. Berryman:

The following is an addendum to our original Geotechnical Report (**GET** Project No. WM05-107G, dated March 1, 2005). In compliance with your instructions, we have performed additional testing services within the proposed relocated BMP limits. These services have been requested due to the revisions in the BMP location and size. Also, the proposed elevation of the bottom of the BMP facility, which will be at an elevation of 101 feet has now been provided. Based on this information and the topography plan provided, **G E T Solutions, Inc.** has performed infiltration testing within the soils expected to be within the bottom of the BMP facility to a depth of 3 feet below the bottom of the BMP facility, as required by James City County.

*Field Exploration:*

Our additional services included advancing six (3) hand auger borings to depths ranging from 10 to 12 feet below existing grades (designated as HA-4 through HA-6) and performing three (3) associated infiltration tests within the lateral limits of the proposed relocated BMP facility in order to evaluate the permeability of the on-site soils.

1592 Penniman Road, Suite E • Williamsburg, VA 23185 • Phone (757) 564-6452 • Fax (757) 564-6453
info@getsolutionsinc.com

Addendum No. 1 May 26, 2005
Report of Subsurface Exploration and Geotechnical Engineering Services
**Proposed BMP Facility**
**7845 Richmond Road**
James City County, Virginia
**G E T** Project No. WM05-107G

*Subsurface Soil Conditions:*

The results of our field exploration program indicated the presence of about 6 inches of topsoil. The topsoil thickness could vary between boring locations. Underlying the topsoil materials, the natural subsurface soils generally consisted of granular soils, which were comprised of SAND (SC, SM, SM-SC) with varying amounts of Silt and Clay. As an exception, CLAY (CL) with varying amounts of Sand was encountered at boring location HA-6 at a depth of 5 to 6 feet and 7 to 12 feet and Sandy SILT (ML) was encountered at boring location HA-6 at a depth of 0.5 to 1 feet. The subsurface description is of a generalized nature provided to highlight the major soil strata encountered. The records of the subsurface exploration are included in Appendix II (Log of Boring sheets) and in the Generalized Soil Profile presented in Appendix III, which should be reviewed for specific information as to the individual borings. The stratifications shown on the records of the subsurface exploration represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the transition may be gradual.

*Groundwater Information:*

The groundwater table was not encountered within the hand auger borings to the depths explored. Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, side walks, etc.). It is estimated normal seasonal high groundwater level will fluctuate within 2 to 3 feet above the current (unexplored) levels. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on this project.

*Infiltration Testing:*

Three infiltration tests (INF-4 through INF-6) were performed within the lateral limits of the proposed BMP area, corresponding to boring locations HA-4 through HA-6. The infiltration test boreholes were prepared utilizing a planer auger to remove soil clippings from its base (test levels ranging from 0.5 to 6.5 feet below the existing ground surface). Infiltration testing was then conducted within the vadose zone utilizing a Precision Permeameter and the following testing procedures. Specifically, two of the infiltration tests (INF-4, and INF-5) were performed within the Silty SAND (SM) layer, and one of the infiltration test (INF-6) was performed within the CLAY (CL) with some Sand.

A support stand was assembled and placed adjacent to the borehole. This stand holds a calibrated reservoir (2000 ml) and a cable used to raise and lower the water control unit (WCU). The WCU establishes a constant water head within the borehole during testing by use of a precision valve and float assembly. The WCU was attached to the flow reservoir with a 2-meter (6.6 foot) braided PVC hose and then lowered by cable into the borehole to the test depth elevation. As required by the Glover solution, the WCU was suspended above the bottom of the borehole at an elevation of approximately 5 times the borehole diameter. The shut-off valve was then opened allowing water to pass through the WCU to fill the borehole to the constant water level elevation. The absorption rate slowed as the soil voids became filled and an equilibrium developed as a wetting bulb developed around the borehole. Water was continuously added until the flow rate stabilized. The reservoir was then re-filled in order to begin testing. During testing, as the water drained into the borehole and surrounding soils, the water level within the calibrated reservoir was recorded as well as the elapsed time during each interval. The test was continued until relatively consistent flow rates were documented. During testing the quick release connections and shutoff valve were monitored to ensure that no leakage occurred. The flow rate (Q), height of the constant water level (H), and borehole diameter (D) were used to calculate $K_s$ utilizing the Glover Solution.

Based on the field testing and corroborated with laboratory testing results (published values compared to classification results), the hydraulic conductivity of the shallow soils at the various depths and locations as identified at the location of the infiltration tests averaged $7.08 \times 10^{-4}$ cm/sec (or 1.00 in/hour) within the Silty SAND (SM) soils and $8.01 \times 10^{-6}$ cm/sec (or 0.011 in/hour) within the CLAY (CL) with some Sand. The individual infiltration test results and depths are provided within the table below.

**Table 1 – Infiltration Test Results**

| Infiltration Test | Test Depth (feet) | #200 Sieve (%) | Atterberg Limits (LL/PL/PI) | Classification | Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|
| INF-4 | 8-9 | 30.6 | Non Plastic | SM | $8.93 \times 10^{-4}$ cm/sec |
| INF-5 | 9-10 | 37.9 | Non Plastic | SM | $5.23 \times 10^{-4}$ cm/sec |
| INF-6 | 11-12 | 76.5 | Not Tested | CL | $8.01 \times 10^{-6}$ cm/sec |

Addendum No. 1 May 26, 2005
Report of Subsurface Exploration and Geotechnical Engineering Services
**Proposed BMP Facility**
**7845 Richmond Road**
James City County, Virginia
**G E T** Project No. WM05-107G

## *Engineering Evaluation for BMP Areas:*

Based on the results of our field and laboratory testing procedures and engineering analysis, the following observations, opinions, and recommendations are presented:

### *Seepage:*

- ✓ The soils encountered within the zone of infiltration (from bottom of BMP basin to 3 feet below bottom of BMP basin) at the BMP boring locations primarily consisted of granular and cohesive soils. The granular soils were comprised of Silty SAND (SM) and the cohesive soils comprised of CLAY (CL) with some sand. As such, and based on the laboratory gradation test and infiltration test results, the hydraulic conductivity values within the granular soils are anticipated to be moderately high Ksat Class (ranging from $1.0 \times 10^{-3}$ cm/sec to $1.0 \times 10^{-4}$ cm/sec), while the hydraulic conductivity values within the cohesive soils are anticipated to be low Ksat Class (ranging from $1.0 \times 10^{-6}$ cm/sec to $1.0 \times 10^{-7}$ cm/sec). Applicable safety factors should be applied for design purposes.

### *Borrow Material:*

- ✓ On the basis of the results of our soils test boring and laboratory testing procedures, the soils encountered generally consisted beneath of SAND (SC, SM, SM-SC) with varying amounts of Clay with some deposits of CLAY (CL) and Sandy SILT (ML) with varying amounts of Sand at the BMP boring locations. The CLAY (CL) and Clayey SAND (SC) soils encountered were not considered suitable for re-use as structural fill, but may be used as general fill within "green" areas. The CLAY (CL) soils encountered may potentially be used for construction of the dam associated with the BMP facility, if applicable. The Silty SAND (SM) soils encountered may be considered suitable for re-use as structural fill. However, in order to verify the acceptance or rejection of the existing soils for re-use as structural fill or dam fill (if applicable), additional classification tests (natural moisture and -#200 sieve) will have to be performed during construction. All unsuitable soils, if so deemed, may be re-used as fill within "green" areas.

All other recommendations provided in the original Geotechnical Report remain valid. It is recommended to permanently attach this addendum to the original Geotechnical Report.

Addendum No. 1 May 26, 2005
Report of Subsurface Exploration and Geotechnical Engineering Services
**Proposed BMP Facility**
**7845 Richmond Road**
James City County, Virginia
**G E T** Project No. WM05-107G

We trust that the information contained herein meets your immediate need, and we would ask that you call this office with any questions that you may have.

Respectfully Submitted,
**G E T Solutions, Inc.**

James R. Wheeler
Project Geologist

Glenn W. Hohmeier, P.E.
Senior Project Engineer
VA Lic. # 36735

COMMONWEALTH OF VIRGINIA
6-1-05
GLENN W. HOHMEIER
No. 036735
PROFESSIONAL ENGINEER

Additional original

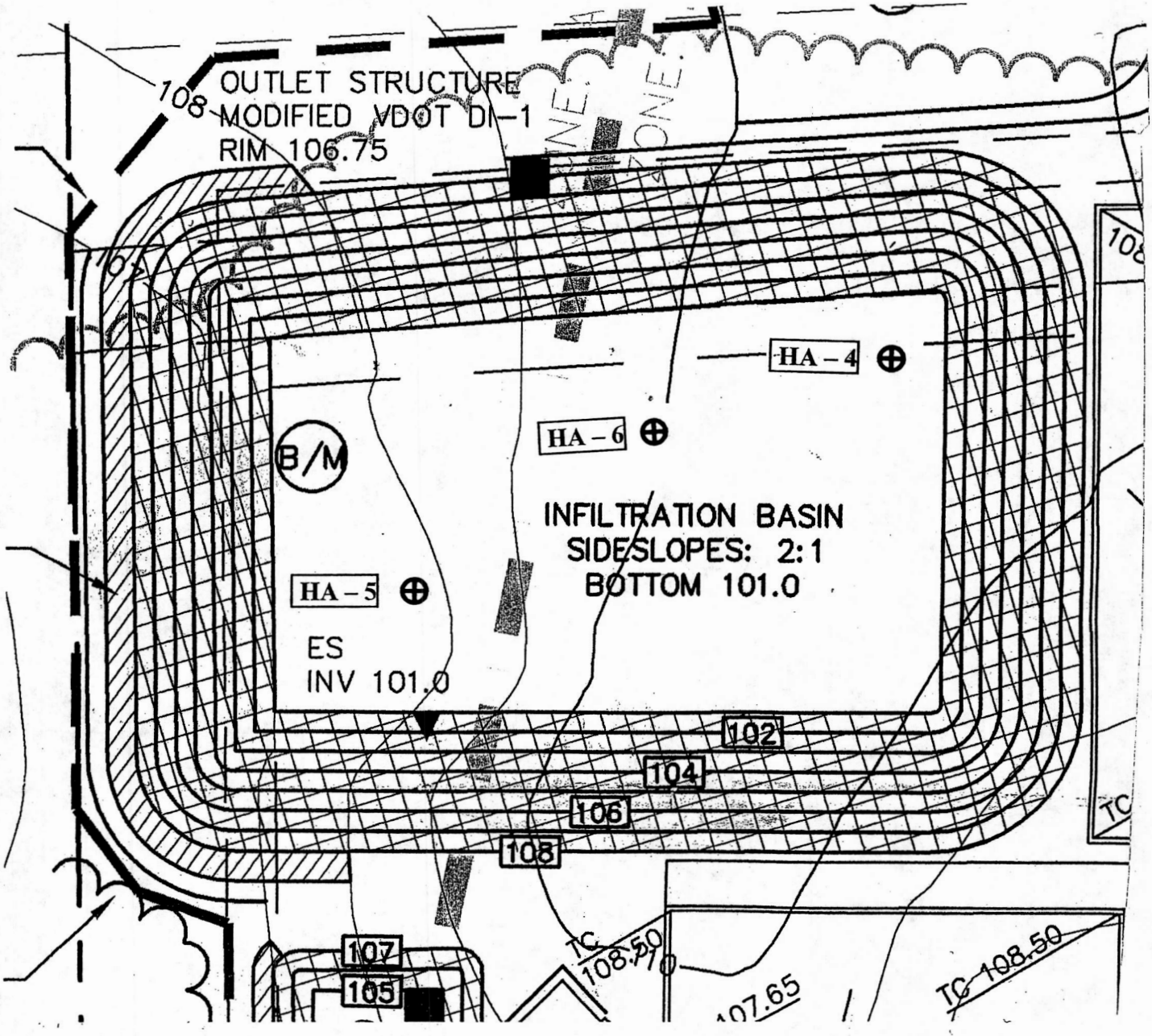
Copies: (2) Client
(1) LandTech Resources (Attn: Mr. Kenny Jenkins)

Attachments: Boring Location Plan
Log of Borings
Generalized Subsurface Profile
Infiltration Test Results

GET Solutions, Inc.

# BORING LOCATION PLAN

Figure 1




**Locations are approximate**

## BORING LOCATION PLAN

| | | |
|---|---|---|
| **PROJECT:** | **Proposed BMP Area**<br>**7845 Richmond Road** | **SCALE: NTS** |
| **PROJECT NO:** | **WM05-107G** | **DATE: 5/23/05** |
| **CLIENT:** | **Mr. Gordon Berryman** | **PLOT BY: LY** |

# LOG OF BORINGS

Geotechnical Environmental Testing Solutions, Inc.

# LOG OF BORING No. HA-4

PROJECT: Proposed BMP Area, 7845 Richmond Road — PROJECT NO.: WM05-107G

CLIENT: Mr. Gordon Berryman

PROJECT LOCATION: James City County, Virginia

LOCATION: See Attached Boring Location Plan — ELEVATION: 110 feet

DRILLER: GET Solutions, Inc. — LOGGED BY: L Young

DRILLING METHOD: Hand Auger — DATE: 05-13-05

DEPTH TO - WATER> INITIAL: ▽ ____ AFTER 24 HOURS: ▽ ____ CAVING> ____

| Depth (feet) | Description | Graphic | Sample No. | Blow Counts | % < #200 | TEST RESULTS: Plastic Limit ⊢—⊣ Liquid Limit; Water Content - ●; Penetration - ▨ (10 20 30 40 50) |
|---|---|---|---|---|---|---|
| 0 | | | | | | |
| | 6 inches of topsoil | | | | | |
| 0.5 | Brown, moist, Silty, fine to medium SAND (SM) | | | | | |
| 1 | Orangish brown, moist, Silty Clayey SAND (SM-SC) | | | | | |
| 2 | | | | | | |
| 4 | | | | | | |
| 4 | Orangish brown to Tan, moist, Silty, fine to medium SAND (SM) | | | | | |
| 6 | | | | | | |
| 7 | Tan, moist, Silty Clayey SAND (SM-SC) | | | | | |
| 8 | | | | | | |
| 8 | Gray, moist, Silty, fine to medium SAND (SM) | | | | 31 | ● |
| 9 | Gray, moist, Silty, fine to medium SAND (SM) with interbedded layers of Clay | | | | | |
| 10 | | | | | | |
| 12 | | | | | | |
| | Boring terminated at 12 ft. | | | | | |
| 14 | | | | | | |

Figure

Geotechnical Environmental Testing Solutions, Inc.

# LOG OF BORING No. HA-5

PROJECT: Proposed BMP Area, 7845 Richmond Road — PROJECT NO.: WM05-107G

CLIENT: Mr. Gordon Berryman

PROJECT LOCATION: James City County, Virginia

LOCATION: See Attached Boring Location Plan — ELEVATION: 108 feet

DRILLER: GET Solutions, Inc. — LOGGED BY: L Young

DRILLING METHOD: Hand Auger — DATE: 05-13-05

DEPTH TO - WATER> INITIAL: ▽ ____ AFTER 24 HOURS: ▽ ____ CAVING> ____

| Depth (feet) | Description | Graphic | Sample No. | Blow Counts | % < #200 | TEST RESULTS: Plastic Limit ⊢—⊣ Liquid Limit; Water Content - ●; Penetration - ▨ (10 20 30 40 50) |
|---|---|---|---|---|---|---|
| 0 | 6 inches of topsoil | | | | | |
| 0.5 | Brown, moist, Silty, fine to medium SAND (SM) with trace organics and gravel | | | | | |
| 1 | Orangish brown, moist, Silty Clayey SAND (SM-SC) | | | | | |
| 2 | | | | | | |
| 4 | | | | | | |
| 5 | Orangish brown to Gray, moist, Silty, fine to medium SAND (SM) | | | | | |
| 6 | | | | | | |
| 8 | | | | | | |
| 10 | | | | | 38 | ● |
| | Boring terminated at 10 ft. | | | | | |
| 12 | | | | | | |
| 14 | | | | | | |

ure

Geotechnical Environmental Testing Solutions, Inc.

# LOG OF BORING No. HA-6

PROJECT: Proposed BMP Area, 7845 Richmond Road — PROJECT NO.: WM05-107G

CLIENT: Mr. Gordon Berryman

PROJECT LOCATION: James City County, Virginia

LOCATION: See Attached Boring Location Plan — ELEVATION: 110 feet

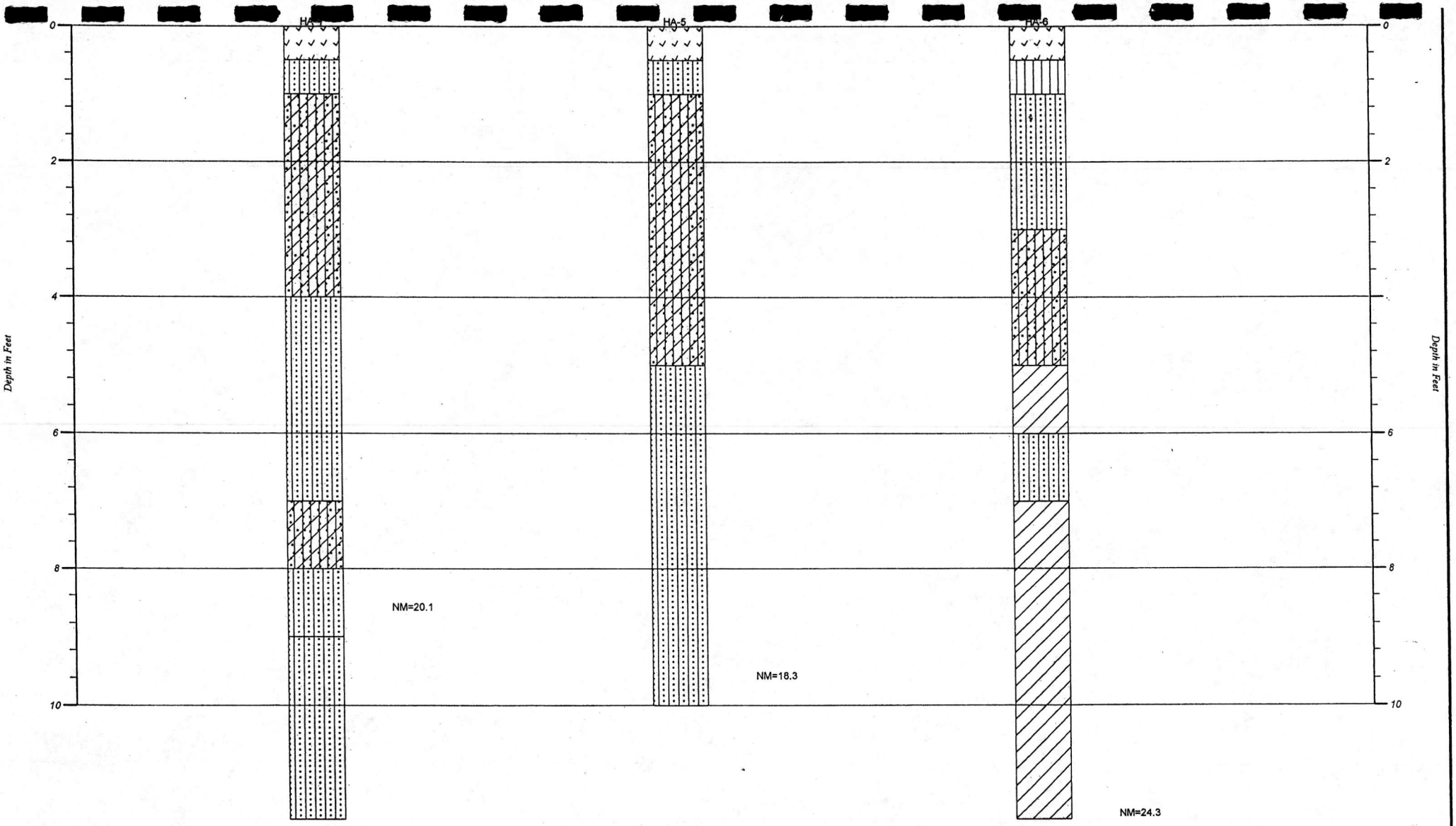
DRILLER: GET Solutions, Inc. — LOGGED BY: L Young

DRILLING METHOD: Hand Auger — DATE: 05-16-05

DEPTH TO - WATER> INITIAL: ▽ ____ AFTER 24 HOURS: ▽ ____ CAVING> ℄ ____

| Depth (feet) | Description | Graphic | Sample No. | Blow Counts | % < #200 | TEST RESULTS: Plastic Limit ⊢—⊣ Liquid Limit; Water Content - ●; Penetration - ▨ (10 20 30 40 50) |
|---|---|---|---|---|---|---|
| 0 | 6 inches of topsoil | | | | | |
| 0.5 | Brown, moist, Sandy SILT (ML) with trace organics | | | | | |
| 1 | Brown, moist, Silty, fine to medium SAND (SM) | | | | | |
| 2 | | | | | | |
| 3 | Orangish brown, moist, Silty, Clayey SAND (SM-SC) | | | | | |
| 4 | | | | | | |
| 5 | Orangish brown, moist, Sandy CLAY (CL) | | | | | |
| 6 | Orangish brown, moist, Silty, fine to medium SAND (SM) | | | | | |
| 7 | Orangish brown to gray, moist, CLAY (CL) with some Sand | | | | | |
| 8 | | | | | | |
| 10 | | | | | | |
| 12 | | | | | 77 | ● |
| | Boring terminated at 12 ft. | | | | | |
| 14 | | | | | | |

# GENERALIZED SUBSURFACE PROFILE




Strata symbols

- Topsoil
- Silty sand
- Poorly graded clayey silty sand
- Silt
- Low plasticity clay

GET Solutions, Inc.

GENERALIZED SOIL PROFILE

| HORIZONTAL SCALE: | DRAWN BY/APPROVED BY | DATE DRAWN |
|---|---|---|
| VERTICAL SCALE: 1"=2' | S Peterson | 5/24/2005 |

Proposed BMP Area, 7845 Richmond Road
James City County, Virginia

PROJECT NO. WM05-107G

FIGURE NUMBER 1a

# INFILTRATION TEST RESULTS

| GET SOLUTIONS, INC. | SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET | Sheet No.: 4 |
|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **Project Name.:** | 7845 Richmond Rd. | **Location.....** | Proposed BMP Facility | **Terminology and Solution** | |
| **Boring No.....:** | INF-4 at HA-4 | **Date.....:** | 5/13/2005 | Ksat : | Saturated hydraulic conductivity |
| **Investigators.:** | J. Wheeler | **File Name.....:** | WM05-107G | Q: | Steady-state rate of water flow into the soil |
| **Boring Depth.:** | 132 inches | **WCU Base. Ht. h:** | 15.0 **cm** | H: | Constant height of water in borehole |
| **Boring Dia.....:** | 8.3 **cm** | **WCU Susp. Ht. S:** | 15.2 **cm** | r: | Radius of cylindrical borehole |
| **Boring Rad. (r):** | 4.15 **cm** | **Const. Wtr. Ht. H:** | 30.2 **cm** | Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) | [Glover Solution] |

| VOLUME (ml) | Volume Out (ml) [a] | TIME (hr:min:sec a/p) | Elapsed Time (hr:min:sec) | Elapsed Time (min) [b] | Flow Rate Q (ml/min) [a/b] | Ksat Equivalent Values (cm/min) | (cm/sec) | (cm/day) | (in/hr) | (ft/day) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | | 2:00:00 PM | | | | | | | | |
| 1950 | 50 | 2:00:25 PM | 0:00:25 | 0.42 | 120.00 | 0.038 | 6.32E-04 | 54.6 | 0.896 | 1.79 |
| 1900 | 50 | 2:00:47 PM | 0:00:22 | 0.37 | 136.36 | 0.043 | 7.18E-04 | 62.0 | 1.018 | 2.04 |
| 1850 | 50 | 2:01:04 PM | 0:00:17 | 0.28 | 176.47 | 0.056 | 9.29E-04 | 80.3 | 1.317 | 2.63 |
| 1800 | 50 | 2:01:21 PM | 0:00:17 | 0.28 | 176.47 | 0.056 | 9.29E-04 | 80.3 | 1.317 | 2.63 |
| 1750 | 50 | 2:01:36 PM | 0:00:15 | 0.25 | 200.00 | 0.063 | 1.05E-03 | 91.0 | 1.493 | 2.99 |
| 1700 | 50 | 2:01:51 PM | 0:00:15 | 0.25 | 200.00 | 0.063 | 1.05E-03 | 91.0 | 1.493 | 2.99 |
| 1650 | 50 | 2:02:09 PM | 0:00:18 | 0.30 | 166.67 | 0.053 | 8.78E-04 | 75.8 | 1.244 | 2.49 |
| 1600 | 50 | 2:02:26 PM | 0:00:17 | 0.28 | 176.47 | 0.056 | 9.29E-04 | 80.3 | 1.317 | 2. |
| 1550 | 50 | 2:02:43 PM | 0:00:17 | 0.28 | 176.47 | 0.056 | 9.29E-04 | 80.3 | 1.317 | 2.63 |
| 1500 | 50 | 2:03:01 PM | 0:00:18 | 0.30 | 166.67 | 0.053 | 8.78E-04 | 75.8 | 1.244 | 2.49 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | **ESTIMATED FIELD KSAT:** | | 0.054 | 8.93E-04 | 77.1 | 1.265 | 2.53 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Natural Moisture:** | Moist | **Init. Satur.Time:** | 1:50:00 PM | **Depth to an Impermeable Layer:** | N/A | **Notes:** | Ksat Class = Moderately High |
| **Texture/Classif:** | SAND (SM) | **Consistency:** | Medium Dense | **Depth to Bedrock.....:** | N/A | | |
| **Structure/Fabric:** | N/A | **Slope/Landsc:** | slope | | | | |

| GET SOLUTIONS, INC. | SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET | Sheet No.: 5 |
|---|---|---|
| **Project Name.:** 7845 Richmond Rd. | **Location.....** Proposed BMP Facility | **Terminology and Solution** |
| **Boring No.....:** INF-5 at HA-5 | **Date.....:** 5/13/2005 | Ksat : Saturated hydraulic conductivity |
| **Investigators.:** J. Wheeler | **File Name.....:** WM05-107G | Q: Steady-state rate of water flow into the soil |
| **Boring Depth.:** 120 inches | **WCU Base. Ht. h:** 15.0 cm | H: Constant height of water in borehole |
| **Boring Dia.....:** 8.3 cm | **WCU Susp. Ht. S:** 15.2 cm | r: Radius of cylindrical borehole |
| **Boring Rad. (r):** 4.15 cm | **Const. Wtr. Ht. H:** 30.2 cm | Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution] |

| VOLUME (ml) | Volume Out (ml) [a] | TIME (hr:min:sec a/p) | Elapsed Time (hr:min:sec) | Elapsed Time (min) [b] | Flow Rate Q (ml/min) [a/b] | Ksat Equivalent Values (cm/min) | (cm/sec) | (cm/day) | (in/hr) | (ft/day) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | | 2:20:00 PM | | | | | | | | |
| 1950 | 50 | 2:20:27 PM | 0:00:27 | 0.45 | 111.11 | 0.035 | 5.85E-04 | 50.6 | 0.829 | 1.66 |
| 1900 | 50 | 2:20:57 PM | 0:00:30 | 0.50 | 100.00 | 0.032 | 5.27E-04 | 45.5 | 0.746 | 1.49 |
| 1850 | 50 | 2:21:24 PM | 0:00:27 | 0.45 | 111.11 | 0.035 | 5.85E-04 | 50.6 | 0.829 | 1.66 |
| 1800 | 50 | 2:21:53 PM | 0:00:29 | 0.48 | 103.45 | 0.033 | 5.45E-04 | 47.1 | 0.772 | 1.54 |
| 1750 | 50 | 2:22:23 PM | 0:00:30 | 0.50 | 100.00 | 0.032 | 5.27E-04 | 45.5 | 0.746 | 1.49 |
| 1700 | 50 | 2:22:54 PM | 0:00:31 | 0.52 | 96.77 | 0.031 | 5.10E-04 | 44.0 | 0.722 | 1.44 |
| 1650 | 50 | 2:23:25 PM | 0:00:31 | 0.52 | 96.77 | 0.031 | 5.10E-04 | 44.0 | 0.722 | 1.44 |
| 1600 | 50 | 2:23:57 PM | 0:00:32 | 0.53 | 93.75 | 0.030 | 4.94E-04 | 42.7 | 0.700 | 1. |
| 1550 | 50 | 2:24:29 PM | 0:00:32 | 0.53 | 93.75 | 0.030 | 4.94E-04 | 42.7 | 0.700 | 1.40 |
| 1500 | 50 | 2:25:04 PM | 0:00:35 | 0.58 | 85.71 | 0.027 | 4.51E-04 | 39.0 | 0.640 | 1.28 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | ESTIMATED FIELD KSAT: | 0.031 | 5.23E-04 | 45.2 | 0.741 | 1.48 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Natural Moisture:** | Moist | **Init. Satur.Time:** | 2:10:00 PM | **Depth to an Impermeable Layer:** | N/A | **Notes:** Ksat Class = Moderately High |
| **Texture/Classif:** | SAND (SM) | **Consistency:** | Medium Dense | | | |
| **Structure/Fabric:** | N/A | **Slope/Landsc:** | slope | **Depth to Bedrock.....:** | N/A | |

| GET SOLUTIONS, INC. | SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET | Sheet No.: 6 |
|---|---|---|
| **Project Name.:** 7845 Richmond Rd. | **Location.....** Proposed BMP Facility | **Terminology and Solution** |
| **Boring No.....:** INF-6 at HA-6 | **Date.....:** 5/16/2005 | Ksat : Saturated hydraulic conductivity |
| **Investigators.:** J. Wheeler | **File Name.....:** WM05-107G | Q: Steady-state rate of water flow into the soil |
| **Boring Depth.:** 144 inches | **WCU Base. Ht. h:** 15.0 **cm** | H: Constant height of water in borehole |
| **Boring Dia.....:** 8.3 **cm** | **WCU Susp. Ht. S:** 15.2 **cm** | r: Radius of cylindrical borehole |
| **Boring Rad. (r):** 4.15 **cm** | **Const. Wtr. Ht. H:** 30.2 **cm** | Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution] |

| VOLUME (ml) | Volume Out (ml) [a] | TIME (hr:min:sec a/p) | Elapsed Time (hr:min:sec) | Elapsed Time (min) [b] | Flow Rate Q (ml/min) [a/b] | Ksat Equivalent Values (cm/min) | (cm/sec) | (cm/day) | (in/hr) | (ft/day) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | | 2:20:00 PM | | | | | | | | |
| 1990 | 10 | 2:27:28 PM | 0:07:28 | 7.47 | 1.34 | 0.000 | 7.05E-06 | 0.6 | 0.010 | 0.02 |
| 1980 | 10 | 2:33:43 PM | 0:06:15 | 6.25 | 1.60 | 0.001 | 8.43E-06 | 0.7 | 0.012 | 0.02 |
| 1970 | 10 | 2:39:56 PM | 0:06:13 | 6.22 | 1.61 | 0.001 | 8.47E-06 | 0.7 | 0.012 | 0.02 |
| 1960 | 10 | 2:46:10 PM | 0:06:14 | 6.23 | 1.60 | 0.001 | 8.45E-06 | 0.7 | 0.012 | 0.02 |
| 1950 | 10 | 2:52:25 PM | 0:06:15 | 6.25 | 1.60 | 0.001 | 8.43E-06 | 0.7 | 0.012 | 0.02 |
| 1940 | 10 | 2:58:45 PM | 0:06:20 | 6.33 | 1.58 | 0.000 | 8.31E-06 | 0.7 | 0.012 | 0.02 |
| 1930 | 10 | 3:05:25 PM | 0:06:40 | 6.67 | 1.50 | 0.000 | 7.90E-06 | 0.7 | 0.011 | 0.02 |
| 1920 | 10 | 3:12:15 PM | 0:06:50 | 6.83 | 1.46 | 0.000 | 7.71E-06 | 0.7 | 0.011 | 0. |
| 1910 | 10 | 3:19:03 PM | 0:06:48 | 6.80 | 1.47 | 0.000 | 7.74E-06 | 0.7 | 0.011 | 0.02 |
| 1900 | 10 | 3:25:58 PM | 0:06:55 | 6.92 | 1.45 | 0.000 | 7.61E-06 | 0.7 | 0.011 | 0.02 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Natural Moisture:** Moist | **Init. Satur.Time:** 2:10:00 PM | | | **ESTIMATED FIELD KSAT:** | 0.000 | 8.01E-06 | 0.7 | 0.011 | 0.02 |
| **Texture/Classif:** CLAY (CL) | **Consistency:** Medium Dense | | | **Depth to an Impermeable Layer:** | N/A | **Notes:** | Ksat Class = Low | | |
| **Structure/Fabric:** N/A | **Slope/Landsc:** slope | | | **Depth to Bedrock.....:** | N/A | | | | |

# 7. Reports

# 8. Correspondence

# LandTech Resources, Inc.

**5810-F Mooretown Road, Williamsburg, VA 23188**

**Phone 757-565-1677** **Fax 757-565-0782**


March 17, 2005

Mr. Darryl Cook, P.E.
James City County Environmental Division
101-E Mounts Bay Rd.
Williamsburg, Va. 23185

Re: 7839 & 7845 Richmond Road
Office/Retail Site
Project No. 05-001

Dear Mr. Cook:

This letter is to request a waiver to Section 23-10(4) of the Chesapeake Bay Preservation Ordinance requiring the site to achieve 10 points based on the James City County BMP Point System.

The site achieves 7.2 points based on the BMP Point System, 5.8 points from 58% of the site draining to a 10-point infiltration basin and 1.4 points from 14% of the site being dedicated in a natural open space easement. The sites natural topography has a high point in the middle and slopes off to all sides, which prohibits the entire site from draining to the infiltration basin. The entire impervious area of the site drains to the infiltration basin, which has been designed to treat the first inch of runoff, 1-year, 2-year, 10-year and 100-year storms. The waiver is requested based on the natural topography and the BMP design criteria of infiltrating every post-development storm event up to the 100-year storm.

Thank you for your consideration with this waiver request and if additional information is required please contact me at your earliest convenience.

Sincerely,

LandTech Resources, Inc.

Kenneth M. Jenkins

Kenneth M. Jenkins, P.E.
Senior Engineer

***SP-031-05- 7839 Richmond Road – Gordon Berryman Site – BMP# YC-035 Needs***

1. ***Remove the cat tails and scarify the bottom of the pond to promote infiltration.***
2. ***Insure that the observation well is installed correctly.***
3. ***Install sod on all denuded areas.***

***These are the items necessary to satisfy the plan requirements for potential bond release.***

# DEVELOPMENT MANAGEMENT

101-A MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 FAX: (757) 253-6822 E-MAIL: devtman@james-city.va.us

ENVIRONMENTAL DIVISION (757) 253-6670 environ@james-city.va.us
PLANNING (757) 253-6685 planning@james-city.va.us
COUNTY ENGINEER (757) 253-6678
INTEGRATED PEST MANAGEMENT (757) 259-4116

July 18, 2005


Mr. Kenneth Jenkins
LandTech Resources, Inc.
5810-F Mooretown Road
Williamsburg, VA 23188

**RE: SP-031-05; 7839 & 7845 Richmond Road**

Dear Mr. Jenkins:

I have reviewed your site plan and have the following comments:

Planning:

KWJ 1.) The notation on the cover sheet calling for a maximum of 9,500 s.f. of retail and 500 s.f. of office space is useful. Please also designate on the site layouts which of the two buildings would house the minimum 500 s.f. of office space.
Provided on sheet C3

Landscape Architect:

KWJ Approved.

VDOT:

KWJ 1.) Provide a raise channelized island (symmetric "pork chop island) at the Richmond Road street connection to ensure the right-in/right-out only movements. Revised

KWJ 2.) We recommend shortening the MS-1 median on the internal side of the site by approximately 10 feet to avoid conflicts with the first parking space.
Revised

County Engineer:

KWJ Approved.

JCSA:

KWJ Please see attached comments.

Environmental:

KWS Previously faxed and attached here.

If you have any questions or comments, please contact me at 253-6685.

Sincerely,

Trey Davis
Planner

JAMES CITY SERVICE AUTHORITY

**MEMORANDUM**



Date: July 11, 2005

To: Trey Davis, Planner

From: Timothy O. Fortune, P.E. / Civil Engineer

Subject: SP-031-05, 7839 and 7845 Richmond Road (Construction Plans)

James City Service Authority has reviewed these plans for general compliance with the JCSA Standards and Specifications, Water Distribution and Sanitary Sewer Systems and have the following comments for the above project you forwarded on June 16, 2005. Quality control and back checking of the plans and calculations for discrepancies, errors, omissions, and conflicts is the sole responsibility of the professional engineer and/or surveyor who has signed, sealed, and dated the plans and calculations. It is the responsibility of the engineer or surveyor to ensure the plans and calculations comply with all governing regulations, standards, and specifications. Before the JCSA can approve these plans for general compliance with the JCSA Standards and Specifications, the following comments must be addressed. We may have additional comments when a revised plan incorporating these comments is submitted.

Sheet C5:

KMJ 1. Relocate the fire hydrant south of DI #1 and extend behind the existing sidewalk. Maintain a minimum horizontal clearance of 5-feet from the storm sewer system. This will eliminate the vertical offset required in the fire hydrant line. Revise plan and profile accordingly. Revised

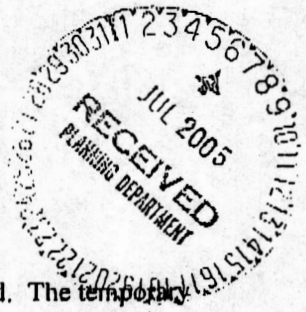
KMJ 2. Revise the proposed cleanout location to extend minimum 2-feet behind the proposed sidewalk. Provide a JCSA Utility Easement around the cleanout. Provided

Water Meter Design:

KMJ 1. Since this is a master metered site by JCSA definition, the water meter sizing calculations can total combined "Fixture Units" prior to estimating the demand (not on a per building basis). Using a total fixture count of 33.6 +50.4= 84 WFSU based on the Applicant's data presented, JCSA estimates the peaked demand as 39.2 gpm (+/-). Assuming 80% meter capacity, this would permit a 1-inch meter selection for the development. It is also probable that the water service line size could be reduced and still maintain less than 5 feet per second velocities. The Applicant shall verify the above and revise accordingly. Revise and resubmit Water and Sanitary Sewer Data Sheets accordingly to reflect the correct demand/flow. Revised

Please call me at 253-6836 if you have any questions or require any additional information.

MAW/WAC




**ENVIRONMENTAL DIVISION REVIEW COMMENTS**
**7839 & 7845 Richmond Road Office/Retail**
**SP-031-05**
*July 5, 2005*

***Erosion and Sediment Control:***

KWD 1. Temporary Sediment Trap. Previous comment has not been adequately addressed. The temporary sediment trap provided in the current site plan reflects that fill material will be required to obtain the grades shown for the proposed embankment; however, with the proposed contours not shown complete, it remains undetermined if the trap will be capable of serving the site at all. As shown, the top of the sediment trap is at elevation 108.00. This will require the embankment to extend along the northern, southern, and eastern property lines or require a substantial amount of fill material to be brought in, compacted, and stabilized, defeating the purpose of the erosion and sediment control plan. Additionally, the purposed berm location is directly atop the location of the proposed infiltration trench. This scenario has the potential to compact the soils and decrease the infiltration capacity from that reflected in the previously submitted geotechnical report. Further, the proposed grades provided on plan sheet C4 indicate that this area will be filled in during construction. Appropriate notes and sequencing must be provided to ensure that the proposed temporary sediment trap will be capable of remaining operational throughout the duration of land disturbing operations. Revise the plans so that all phases and stages of construction coordinate with the SOC as such that the site is under control and the design of the stormwater management facilities will not be affected by the construction operations. Infiltration basin relocated & layout revised on sheet C6

KWD 2. Sequence of Construction (SOC). It states in step #11 that the sediment trap is to be converted into the forebay prior to the construction of the buildings. These two items are not in the same physical location on the site. Therefore, the installation of the forebay will have to occur prior to the removal of the sediment trap. The building construction will have to be phased such that building #2 cannot be built until the sediment trap is closed out (which cannot occur until the majority of the site is stabilized) and backfilled appropriately. Revised on sheet C6

***Stormwater Management and Draining:***

KWD 3. Site BMP Points. Your waiver pertaining to the water quality BMP points is being evaluated at this time. Information relating to the approval or comments pertaining to the request will be forwarded to you as soon as possible.

KWD 4. Stormwater Routings. Information in the supporting documentation appears to indicate that a DI-1 was modeled as a weir using a length of 10'; however, the detail on plan sheet C9 indicates that a peaked roof trash rack is to be used in the design of the basin. If a VDOT DI-1 is to be used for the principal spillway, modeling as a standard weir cannot be accomplished due to the complexity of the top grate and Appendix 9C-13 of the VDOT drainage manual must be used to obtain the proper flow rates for various head elevations. If a manufactures top unit is to be installed, ensure that the weir length is consistent with the manufacturer's information and include that information with the next submittal to support the number used. Provide the model number or "Part Code" in the infiltration detail on plan sheet C9 consistent with the label in the detail on the same sheet. Revised on Sheet C5+C9

KWD 5. Riser Structure. Revise the riser structure information in the BMP detail on plan sheet C9 to indicate proper material and structure type for a free standing riser. A DI-1 is neither consistent with the detail nor an acceptable top unit for a riser structure. Riser revised to DI-7

# 9. Inspection Records

# James City County Environmental Division
# Stormwater Management / BMP Inspection Report
# Infiltration Basin and Trench Facilities

County BMP ID Code (if known): YC035

Name of Facility: 7839 Richmond Rd. BMP No.: _____ Date: 6/12/08

Location: Same as above

Name of Owner: Gordon Bemyman

Name of Inspector: Tina Cooke & Joe Buchite

Type of Facility: infiltration basin

Weather Conditions: Clear 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 | N/A | | | |
| Locks | N/A | | | |
| Safety Fencing | N/A | | | |
| **Observation Wells/Areas:** | | | | |
| Trap Doors | ✓ | | | |
| Manhole Covers | ✓ | | | |
| Grates | ✓ | | | |
| Steps | ✓ | | | |
| **Pretreatment Devices: ☐ Inlet ☐ Sump ☐ Forebay ☑ Other** | | | | |
| Sediment | ✓ | | | |
| Trash & Debris | ✓ | | | |
| Structure | ✓ | | | |
| Other | | | | |

| Facility Item | O.K. | Routine | Urgent | Comments |
|---|---|---|---|---|
| **Primary Storage/ Infiltration Area:** | | | | |
| Trash & Debris | ✓ | | | |
| Sediment | ✓ | | | |
| Ponding / Drawdown | ✓ | | | |
| Surface Aggregates | ✓ | | | |
| Aesthetics | ✓ | | | |
| Other | | | | |
| **Inlet Structure # 1 (Describe Location):** | | | | |
| Condition of Structure | ✓ | | | |
| Erosion | ✓ | | | |
| Trash and Debris | ✓ | | | |
| Sediment | ✓ | | | |
| Aesthetics | ✓ | | | |
| Other | | | | |
| **Inlet Structure # 2 (Describe Location):** | | | | |
| Condition of Structure | | | | |
| Erosion | | | | |
| Trash and Debris | | | | |
| Sediment | | | | |
| Aesthetics | | | | |
| Other | | | | |
| **Inlet Structure # 3 (Describe Location):** | | | | |
| Condition of Structure | | | | |
| Erosion | | | | |
| Trash and Debris | | | | |
| Sediment | | | | |
| Aesthetics | | | | |
| Other | | | | |
| **Outlets - Overflow or Bypass Control Structures (Describe Location):** | | | | |
| Condition of Structure | ✓ | | | * Correct trash rack installed |
| 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:**

All items on Punchlist completed as requested

**Overall Environmental Division Internal Rating:** 4

**Signature:** Tina Cooke **Date:** 6/13/08

**Title:** Inspector

SWMProg\BMP\CoInspProg\SubDetInfil.wpd

# 10. Misc. (ex. photos)


06/13/2008


06/13/2008


06/13/2008


APR 4 2005


APR 4 2005


7839 & 7845 Richmond Road
SP-031-05
3468 CHICKAHOMINY RD
D ROAD
7840 RICHMOND ROAD
Richmond Rd
Chickahominy Rd
7845 RICHMOND ROAD
7833 RICHMOND ROAD
7817 RICHMOND ROAD
7829 RICHMOND ROA
0
60
120
180
Feet
N


STOP
60
APR 4 2005


APR 4 2005


APR 4 2005


APR 4 2005