CERTIFICATE OF AUTHENTICITY

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

BMP NUMBER: **JR021**

DATE VERIFIED: **June 13, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

DATE: March 11, 2010

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

FROM: Jo Anna Ripley, Stormwater

PO: 270712

RE: Files Approved for Scanning

General File ID or BMP ID: JR021

PIN: 4511000001A

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

Property Description: Major Open Space Block C River Reach

Site Address:

(For internal use only) **Box** 16 **Drawer:** 7

Agreements: (in file as of scan date) **N** **Book or Doc#:** **Page:**

Comments

JR-021

Contents for Stormwater Management Facilities As-built Files

Each file is to contain:

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

15" inv 17.76

James City County, Virginia
Environmental Division

Pond A

Stormwater Management/BMP Facilities
Record Drawing/Construction Certification
Review Tracking Form

County Plan No.: 5-14-93?
Project Name: GOVERNORS LAND- Bennetts POND
Stormwater Management Facility: JR-021
Phase: ☒ I ☐ II ☐ III

- ☑ Information Received. Date: FEB 14 2002 AES
- ☐ Administrative Check.
  - ☑ Record Drawing Date: JAN 13 '02
  - ☐ Construction Certification Date: No 1/7/03
  - ☑ RD/CC Standard Forms (Required after Feb 1st 2001Only) RD does not provide complete data
  - ☐ No Insp/Maint Agreement Info: Not in file
  - ☐ No BMP Maintenance Plan Location:
  - ☐ Other:
- ☐ No Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review file.
  - ☐ Yes ☐ No Location: Not on plan or in file
- ☐ Assign County BMP ID Code Code: JR021
- ☑ Log into Division's "As-Built" Tracking Log
- ☑ Add Location to GIS Database Map. Obtain GIS site information (GPIN, Owner, Site Area, Address, etc.)
- ☑ Preliminary Log into BMP Database (BMP ID #, Site Plan #, GPIN, Project Name)
- ☑ Active Project File Review (correspondence, H&H, etc.).
- ☑ Initial As-Built File setup (label, copy hydraulics, BMP information, etc.).
- ☑ Inspector Check of RD/CC.
- ☑ Pre-Inspection Drawing Review - Approved Plan (Quick look prior to field inspection).
- ☑ Final Inspection (FI) Performed Date: 1/10/03 RH
- ☑ Record Drawing (RD) Review Date: 1/8/03 RH, 1/24/03 SJT
- ☑ Construction Certification (CC) Review Date: 1/24/03 SJT
- ☐ Actions:
  - ☐ No comments.
  - ☑ Comments. Letter Forwarded. Date: 1/24/03
    - ☑ Record Drawing (RD)
    - ☐ Construction Certification (CC)
    - ☑ Construction-Related (CR)
    - ☐ Site Issues (SI)
    - ☐ Other :
- ☐ Second Submission: 5/16/03 AES (RD)
- ☐ Third Submission:
- ☑ Acceptable for stormwater managment facility purposes (RD/CC/CR/Other). Proceed with bond release.
- ☑ Notify Darryl/Joan/Pat of acceptability using email (preferred), form or verbal.
- ☑ Check/Clean active file of any remaining material and finish "As-Built" file.
- ☑ Add to County BMP Inventory/Inspection schedule (Phase I, II or III).
- ☑ Copy Final Inspection Report into County BMP Inspection Program file.
- ☑ Digital Photographs obtained.
- ☐ Add to JCC Hydrology & Hydraulic database (optional).

BMP Certification Information Acceptable

Plan Reviewer: Scott J. Thomas P.E. Date: 6/26/03

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: GOVERNOR'S LAND AT TWO RIVERS
Structure/BMP Name: BENNETT'S POND
Project Location: EAST END OF GOVERNOR'S LAND PROJECT
BMP Location: NORTHEAST OF INTERSECTION OF PLANTERS ROAD AND TWO RIVERS ROAD
County Plan No.: S - 14 - 93

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

Tax Map/Parcel No.: 45 1 10000001A
BMP ID Code (if known): JR021
Zoning District:: R-5
Land Use: RESIDENTIAL
Site Area (sf or acres): _____

Brief Description of Stormwater Management/BMP Facility:
EXTENDED DETENTION WET POND. NOTE: POND HAS A SUBMERGED DEWATERING PIPE, DISCHARGING TO WINGFIELD LAKE. ~~NOTE~~ NO PRINCIPAL SPILLWAYS ARE DESIGNED INTO THIS FACILITY.

Nearest Visible Landmark to SWM/BMP Facility: ~~TR~~ LIFT STATION (LOCATED TO WEST OF POND)

Nearest Vertical Ground Control (if known):
☑ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☐ Other
Station Number or Name: 336
Datum or Reference Elevation: 78.20
Control Description: _____
Control Location from Subject Facility: NORTH OF ~~EXCEL~~ FACILITY APPROXIMATELY 6500 FEET

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: SUMMER / FALL 1993
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☑ Unknown
Name of Site Work Contractor Who Constructed Facility: C. L. WALTRIP INC.
Name of Professional Firm Who Routinely Monitored Construction: —
Date of Completion for SWM/BMP Facility: UNKNOWN
Date of Record Drawing/Construction Certification Submittal: / / 2/12/02

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

Section 3 - Owner / Designer / Contractor Information:

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

Name: GOVERNOR'S LAND ASSOCIATES
Mailing Address: 9701 MILL POND RUN
TOANO VIRGINIA
Business Phone: 234-5060 Fax: 234-5111
Contact Person: JAMES H. BENNETT Title: VICE PRESIDENT - DEVELOPMENT

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

Firm Name: AES CONSULTING ENGINEERS
Mailing Address: 5248 OLDE TOWNE ROAD, SUITE 1
WILLIAMSBURG, VA 23188
Business Phone: 757-253-0040
Fax: 757-220-8994
Responsible Plan Preparer: MARC BENNETT
Title: PROJECT MANAGER
Plan Name: GOVERNOR'S LAND - BAY 5, POD 2
Firm's Project No. 7173
Plan Date: MARCH 1993
Sheet No.'s Applicable to SWM/BMP Facility: 8 / 14 / ___ / ___ / ___

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

Name: C. L. WALTRIP INC.
Mailing Address: 1554 PENNIMAN ROAD
WILLIAMSBURG, VIRGINIA 23185
Business Phone: 757-253-1883
Fax:
Contact Person: MR. STAN DUKSTRA
Site Foreman/Supervisor: UNKNOWN
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 - Professional Certifications:

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

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

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

Name: V. Marc Bennett
Title: Senior Project Manager

Signature: [signature]
Date: 2/12/02

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

COMMONWEALTH OF VIRGINIA
VAN MARC BENNETT
No. 26023
PROFESSIONAL ENGINEER

[signature] (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.)*

NC 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. No

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

NC 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.

NC 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.

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

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

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

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

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

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

____ 13. Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. **May need to obtain this information during construction.** (SEE GEO-TECH REPORT)

N/A 14. Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert.

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

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

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

N/A 18. Maintenance plan taken from approved design plan transposed onto record drawing set.

N/A 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)

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

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

N/A A2. Principal spillway consists of reinforced concrete pipe with O-Ring gaskets for watertight joint construction. (NO PRINCIPAL SPILLWAY)

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

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

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

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

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

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

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

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

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

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

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

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

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

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

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

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

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

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

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

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

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

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

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

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

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

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

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

___ C13. Observation well provided.

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

___ D2. Sediment pretreatment devices provided.

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

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

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

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

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

___ D8. Overflow outlet has adequate erosion protection.

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

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

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

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

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
AS-BUILT PLAN CHECKLIST

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

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

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

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

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

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

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

VDOT RECORD DRAWINGS OF STORM SEWER SYSTEM ADJACENT TO BMP ARE AVAILABLE UPON REQUEST. ~~N/A~~

_____ SD1. All requirements of Section II, Minimum Standards, apply to Storm Drainage Systems.

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

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

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

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

XII. Other Systems

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

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

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

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

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

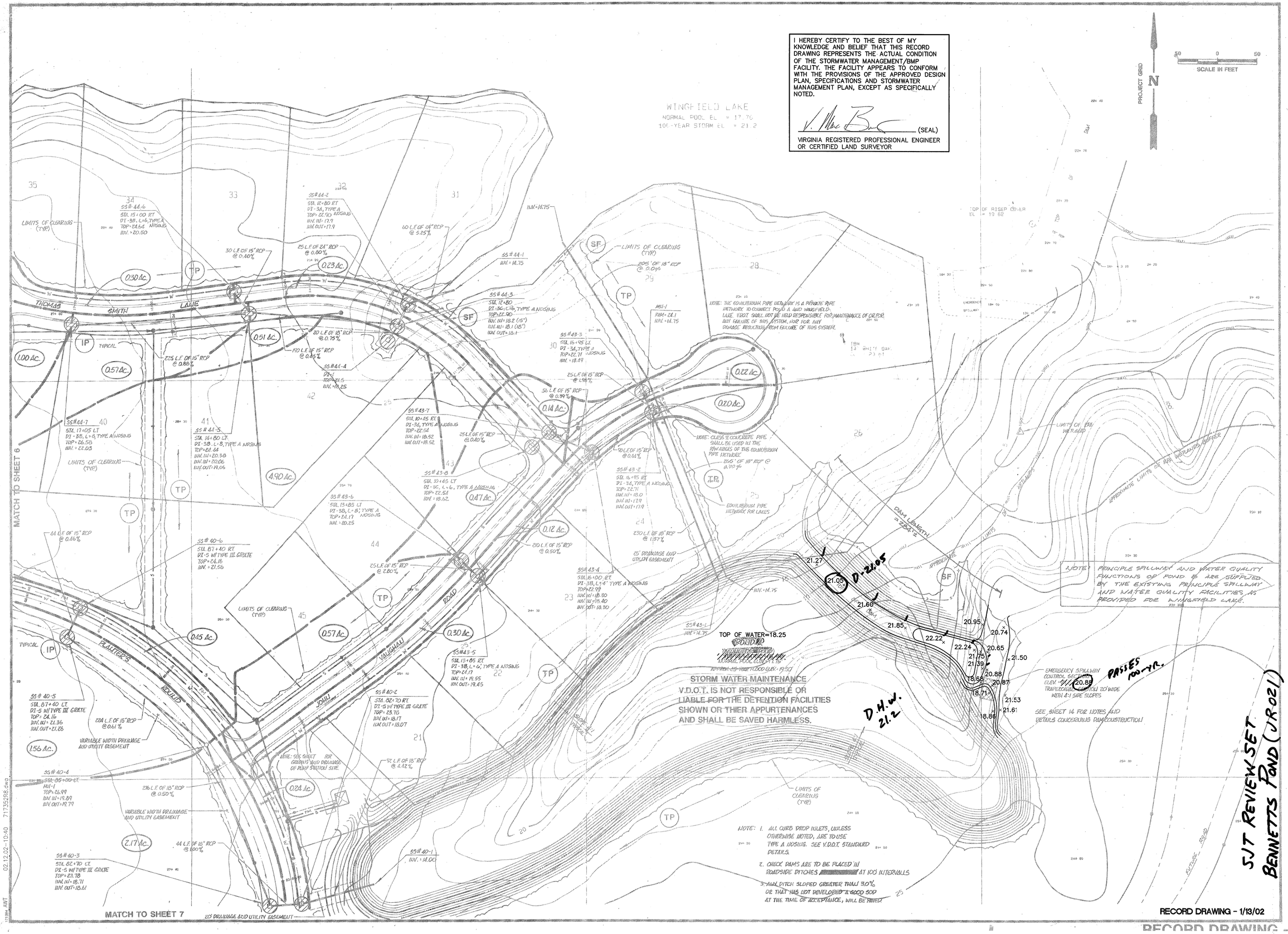
- ❒ Baltimore County, Maryland Soil Conservation District, As-Built Stormwater Management Pond Checklist.
- ❒ James City County, Virginia, Guidelines for Design and Construction of Stormwater Management BMP's (October 1999).
- ❒ James City County, Virginia, Stormwater Detention/Retention Basin Design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

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

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



No.	DATE	REVISION / COMMENT / NOTE	
3	1/13/02	RECORD DRAWING	VMB
2	12/19/97	REVISED DRAWING	VMB
1	5/21/93	ISSUED FOR AGENCY REVIEW	VMB

COMMONWEALTH OF VIRGINIA — G. ARCHER THURSTON III — No. 012822 — PROFESSIONAL ENGINEER — 12-19-97

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(804) 253-0040
Fax (804) 220-8994
CONSULTING ENGINEERS

DRAINAGE AND EROSION CONTROL PLAN
HEARTHSTONE, KITCHUM'S POND & PLANTER'S ROUND
THE GOVERNOR'S LAND
At Two Rivers
JAMES CITY COUNTY, VIRGINIA
POWHATAN DISTRICT

Designed VMB	Drawn
Scale 1"=50'	Date MAR. 1993
Project No. 7173	
Drawing No. 8	

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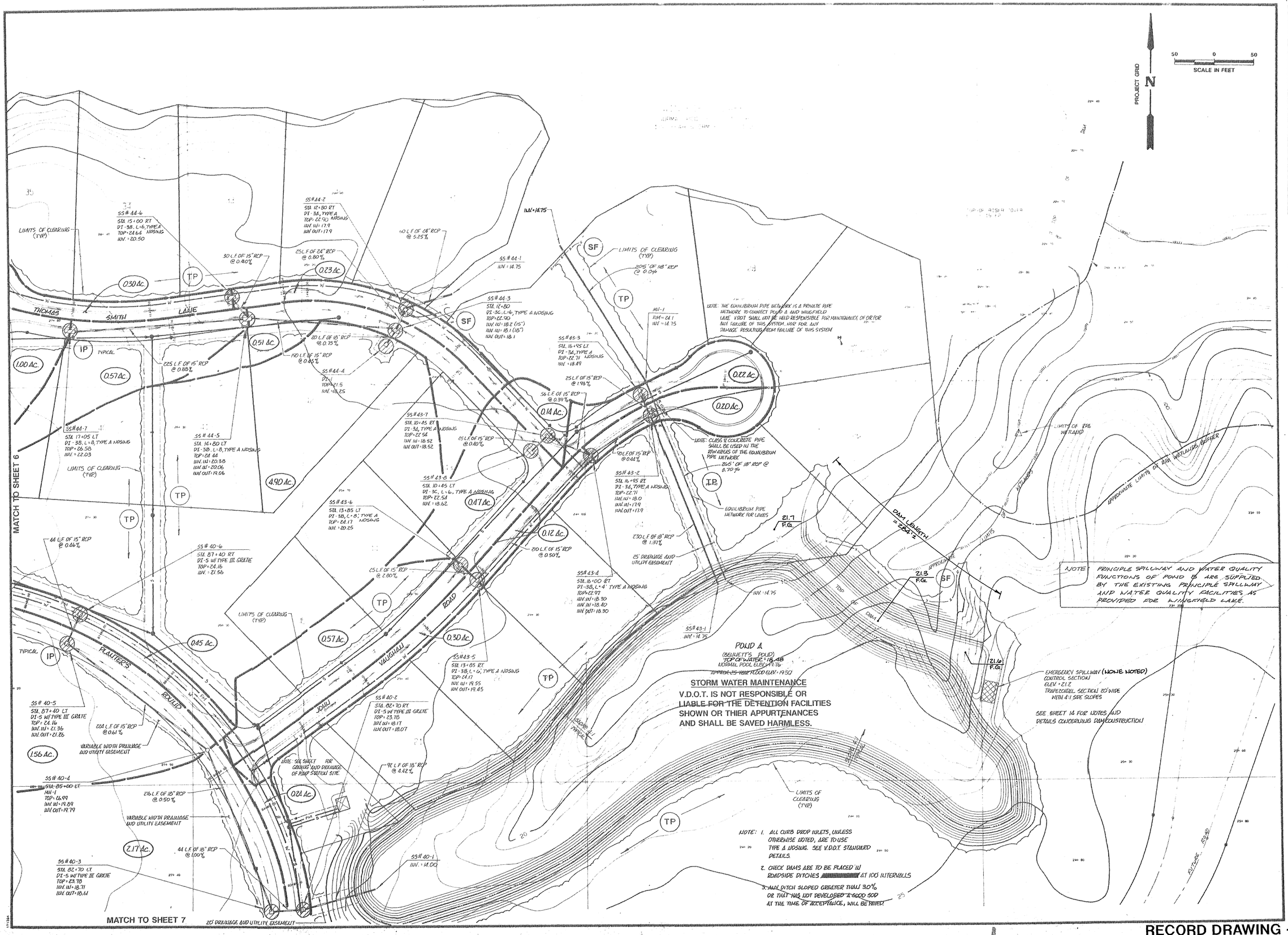
RECORD DRAWING – 2/19/97



No.	DATE	REVISION / COMMENT / NOTE	BY
2	2/19/97	RECORD DRAWING	WMB
1	5/8/93	REVISED PER AGENCY REVIEW	WMB

COMMONWEALTH OF VIRGINIA
S. ARCHER MARSTON
No. 011223
PROFESSIONAL ENGINEER
2/19/97

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(804) 253-0040
Fax (804) 220-8994
CONSULTING ENGINEERS

DRAINAGE AND EROSION CONTROL PLAN
HEARTHSTONE, KITCHUM'S POND & PLANTER'S ROUND
THE GOVERNOR'S LAND
At Town Ridge
JAMES CITY COUNTY, VIRGINIA
POWHATAN DISTRICT

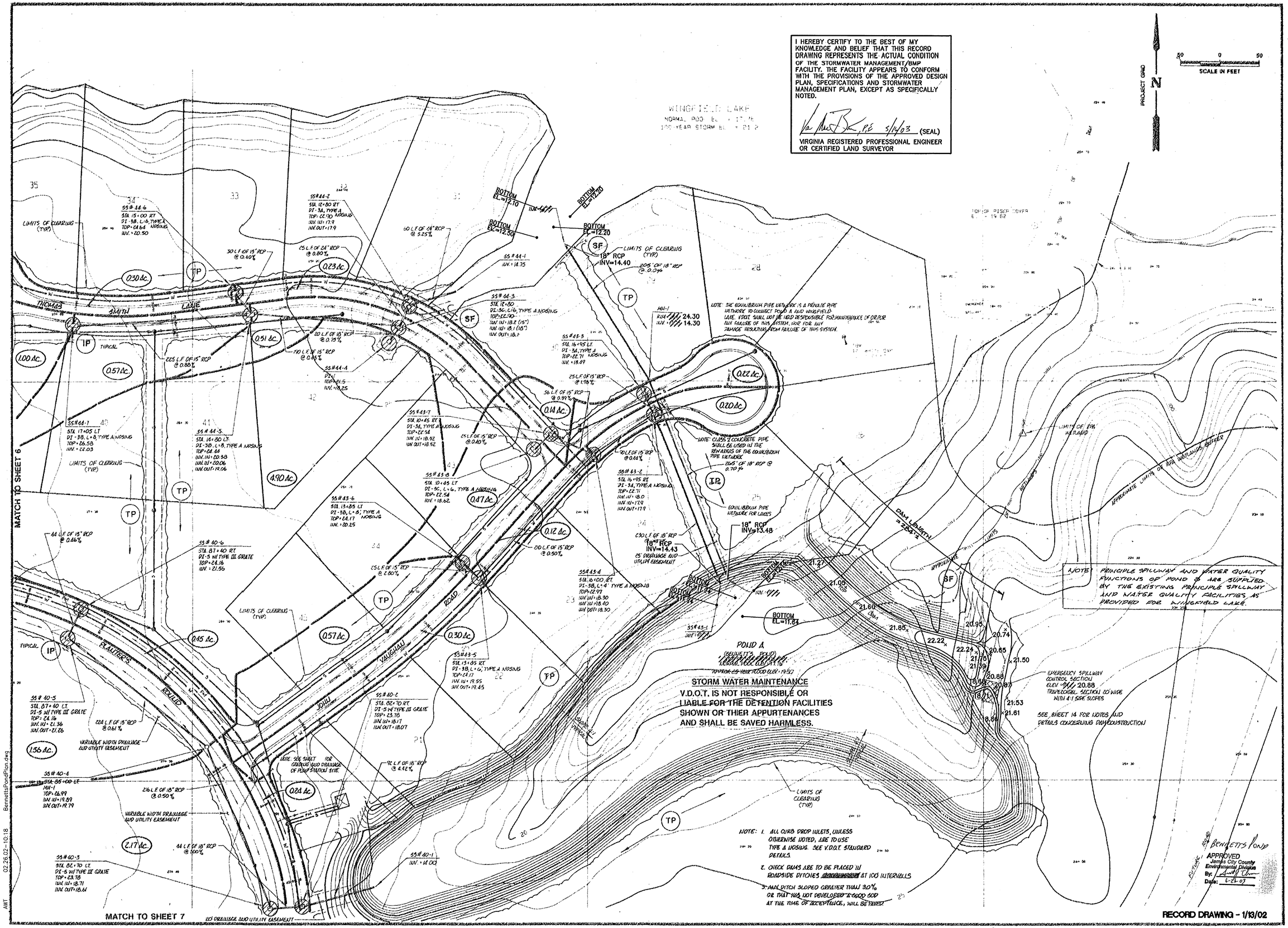
Designed: VMB	Drawn
Scale 1"=50'	Date MAR. 1993
Project No. 7173	
Drawing No. 8	

RECORD DRAWING – 2/19/97

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.

_____, P.E. 5/14/03 (SEAL)

VIRGINIA REGISTERED PROFESSIONAL ENGINEER OR CERTIFIED LAND SURVEYOR



NO.	DATE	REVISION / COMMENT / NOTE	BY
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3	1/13/02	RECORD DRAWING	VMB
2	2/19/97	RECORDED DRAWING	VMB
1	5/4/93	REVISED PER ASBUILT DRAWING	VMB

5248 Olde Towne Road, Suite 1
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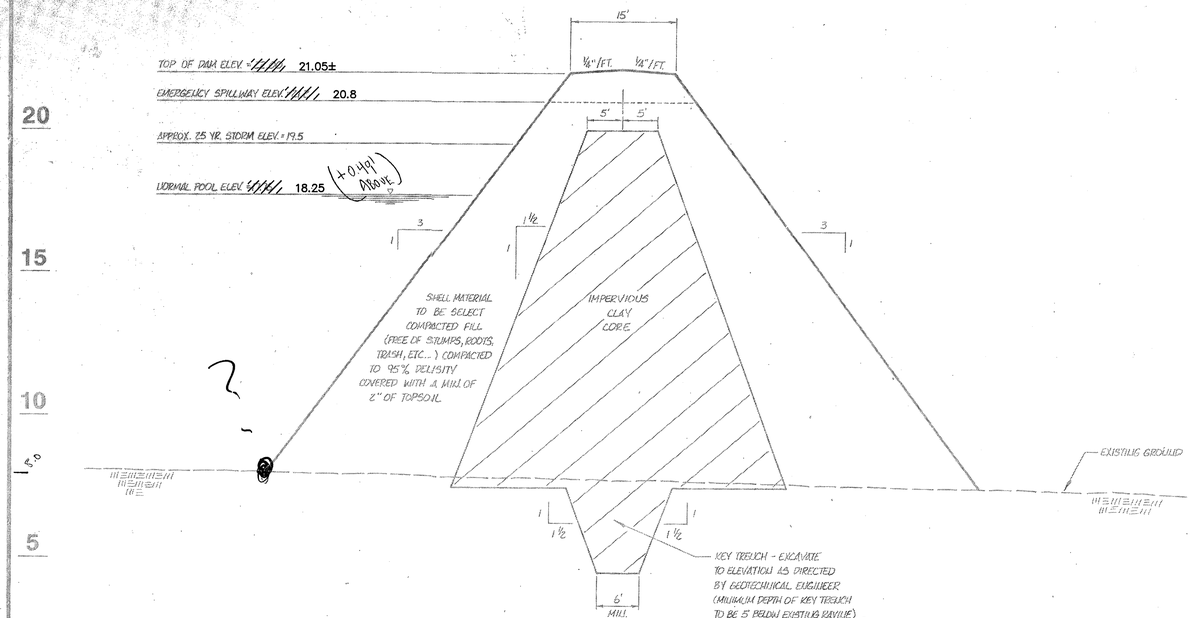
CONSULTING ENGINEERS

DRAINAGE AND EROSION CONTROL PLAN
HEARTHSTONE, KITCHUM'S POND & PLANTER'S ROUND
THE GOVERNOR'S LAND
JAMES CITY COUNTY — VIRGINIA — POWHATAN DISTRICT

Designed VMB	Drawn
Scale 1"=50'	Date MAR. 1993
Project No. 7173	
Drawing No. 8	

BennettsPondPlan.dwg 02.26.02-10:18 AWT



POND A
DAM CROSS-SECTION

SCALE: 1" = 2.5' VERTICAL
1" = 10' HORIZONTAL

Bennetts Pond

NOTES

1. SITE PREPARATION: THE CONTRACTOR SHALL STRIP ALL AREAS OF THE PERMANENT CONSTRUCTION TO REMOVE ALL UNSUITABLE MATERIALS. THE UNSUITABLE MATERIALS TO BE REMOVED BY STRIPPING SHALL INCLUDE ALL TOPSOILS, DEBRIS AND VEGETABLE MATTER, INCLUDING STUMPS AND ROOTS, AND ALL OTHER MATERIALS WHICH MAY BE UNSUITABLE FOR USE IN THE PERMANENT CONSTRUCTION.

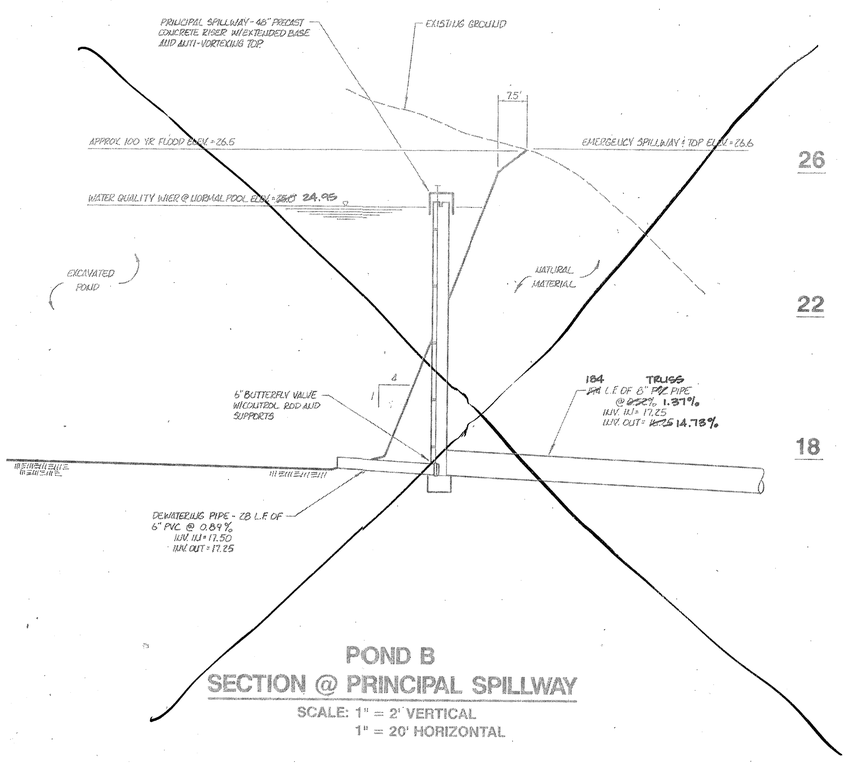
2. DAM EMBANKMENT: THE FILL MATERIAL SHALL BE TAKEN FROM APPROVED BORROW AREAS. IT SHALL BE CLEAN MINERAL SOIL, FREE OF ROOTS, WOODY VEGETATION, OVERSIZED STONES, ROCKS, OR OTHER OBJECTIONABLE MATERIAL. SOILS WHICH ARE APPROVABLE FOR THE CONSTRUCTION OF THE IMPERVIOUS CLAY CORE, AS DEFINED BY THE UNIFIED SOIL CLASSIFICATION SYSTEM, ARE CH, INORGANIC CLAYS OF HIGH PLASTICITY; CL, INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY. IMPERVIOUS CORE MATERIALS SHALL HAVE A COEFFICIENT OR PERMEABILITY (k-VALUE) LESS THAN 10^{-5} CM/SEC. MATERIALS TO BE USED FOR THE CONSTRUCTION OF THE SHELL SHALL BE SELECT BACKFILL FREE OF STUMPS, ROOTS, ROCKS, TRASH, ETC. AND SHALL CONTAIN A MINIMUM OF 15%, BUT NO MORE THAN 49%, PASSING THE NO. 200 SIEVE (SILT AND CLAY). AS DEFINED BY THE UNIFIED SOIL CLASSIFICATION SYSTEM, THE SOILS SHALL BE SM OR SC, SILTY SANDS, SILTY GRAVELLY SANDS, CLAYEY SANDS, OR CLAYEY GRAVELLY SANDS. AREAS ON WHICH FILL IS TO BE PLACED SHALL BE SCARIFIED PRIOR TO PLACEMENT OF FILL. THE FILL MATERIAL'S MOISTURE CONTENT SHALL BE +3 TO -2 PERCENTAGE POINTS OF OPTIMUM MOISTURE CONTENT AS DETERMINED BY ASTM D698 (I.E. IN GENERAL THE FILL MATERIAL SHOULD CONTAIN SUFFICIENT MOISTURE SO THAT IT CAN BE FORMED INTO A BALL WITHOUT CRUMBLING. IF WATER CAN BE SQUEEZED OUT OF THE BALL, IT IS TOO WET FOR PROPER COMPACTION). FILL MATERIAL WILL BE PLACED IN 6 TO 8-INCH CONTINUOUS LAYERS OVER THE ENTIRE LENGTH OF THE FILL. COMPACTION, AS NOTED ON PLAN, SHALL BE OBTAINED GENERALLY BY USING A SHEEPSFOOT COMPACTOR.

3. CUTOFF TRENCH/KEY TRENCH: THE TRENCH SHALL BE EXCAVATED ALONG THE CENTERLINE OF THE DAM. THE MINIMUM DEPTH SHALL BE AS DIRECTED BY THE GEOTECHNICAL ENGINEER AND SHALL EXTEND UP BOTH ABUTMENTS. THE MINIMUM BOTTOM WIDTH SHALL BE 6 FEET, BUT WIDE ENOUGH TO PERMIT OPERATION OF COMPACTION EQUIPMENT. THE SIDE SLOPES SHALL BE NO STEEPER THAN 1-1/2:1. COMPACTION REQUIREMENTS SHALL BE THE SAME AS THOSE FOR THE EMBANKMENT. THE TRENCH SHALL BE KEPT DRAINED DURING THE BACKFILLING-COMPACTING OPERATIONS.

4. EMERGENCY SPILLWAY: DESIGN ELEVATIONS, WIDTHS, ENTRANCE AND EXIT CHANNEL SLOPES ARE CRITICAL TO THE SUCCESSFUL OPERATION OF THE SPILLWAY AND SHOULD BE ADHERED TO CLOSELY DURING CONSTRUCTION.

5. VEGETATIVE STABILIZATION: FINAL VEGETATIVE COVER (STABILIZATION) SHALL CONSIST OF TOPSOILING, LIMING, FERTILIZING, SEEDING, AND MULCHING TO ASSURE A FIRM STAND OF GRASS AS SOON AS PRACTICAL. SEDIMENT BASINS AND OTHER TEMPORARY EROSION CONTROL MEASURES ARE TO BE REMOVED ONLY WHEN STABILIZATION IS COMPLETE. FINAL VEGETAL COVER SHALL BE PROVIDED IN ACCORDANCE WITH THE FOLLOWING:

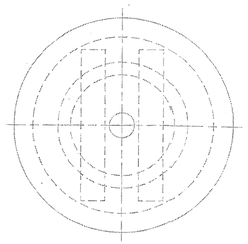
TOPSOIL: AT LEAST 2" THICKNESS OBTAINED FROM STOCKPILES ON SITE, FREE OF LARGE DEBRIS.
LIME: 4,000#/ACRE (90#/1,000 S.F.)
SEED: SEE SPECIFICATIONS
FERTILIZER: 10/20/10 MIX, 1,000#/ACRE (25#/1,000 S.F.)
MULCH: STRAW OR HAY (LOCALLY OBTAINED) 4,000#/ACRE (90#/1,000 S.F.)



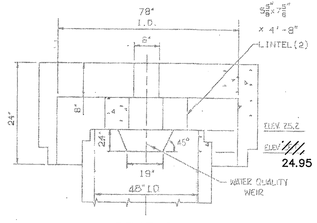
POND B
SECTION @ PRINCIPAL SPILLWAY

SCALE: 1" = 2' VERTICAL
1" = 20' HORIZONTAL

STAND-PIPE ID	CAP ID	CAP HEIGHT	LINTELS 48"x7 1/2"x8"	LINTELS 48"x7 1/2"x8"
24"	42"	1.115'	2'-8"	-
27"	48"	1.510'	3'-0"	-
30"	48"	1.510'	3'-4"	-
36"	60"	2.487'	4'-0"	-
42"	66"	2.965'	4'-4"	-
48"	78"	4.044'	4'-8"	-
54"	90"	4.844'	-	5'-4"
60"	96"	5.689'	-	5'-8"
66"	108"	7.150'	-	6'-0"
72"	114"	7.497'	-	6'-4"



PLAN



SECTION

NOTE: CONTRACTOR TO POSITION LINTELS SO AS NOT TO INTERFERE WITH PROPER FUNCTIONING OF WATER QUALITY WEIR, AND FOR PROPER SUPPORT OF ANTI-VORTEXING TOP

ANTI-VORTEXING TOP
NOT TO SCALE

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

RECORD DRAWING - 1/13/02

No.	DATE	REVISION / COMMENT / NOTE	BY
2	2/02	RECORD DRAWING FOR SWM / BMP	VMB
1	5/01	REVISED PER AGENCY REVIEW	JMAS

COMMONWEALTH OF VIRGINIA
G. ARCHER MANSTON III
No. 010202
PROFESSIONAL ENGINEER

5248 Olde Towne Road, Suite 1
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(804) 253-0040
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CONSULTING ENGINEERS

DAM SECTIONS AND DETAILS
HEARTHSTONE, KITCHUM'S POND & PLANTER'S ROUND
THE GOVERNOR'S LAND
JAMES CITY COUNTY VIRGINIA

Designed	Drawn
VMB	
Scale	Date
	MAR., 1993
Project No.	
7173	
Drawing No.	
14	

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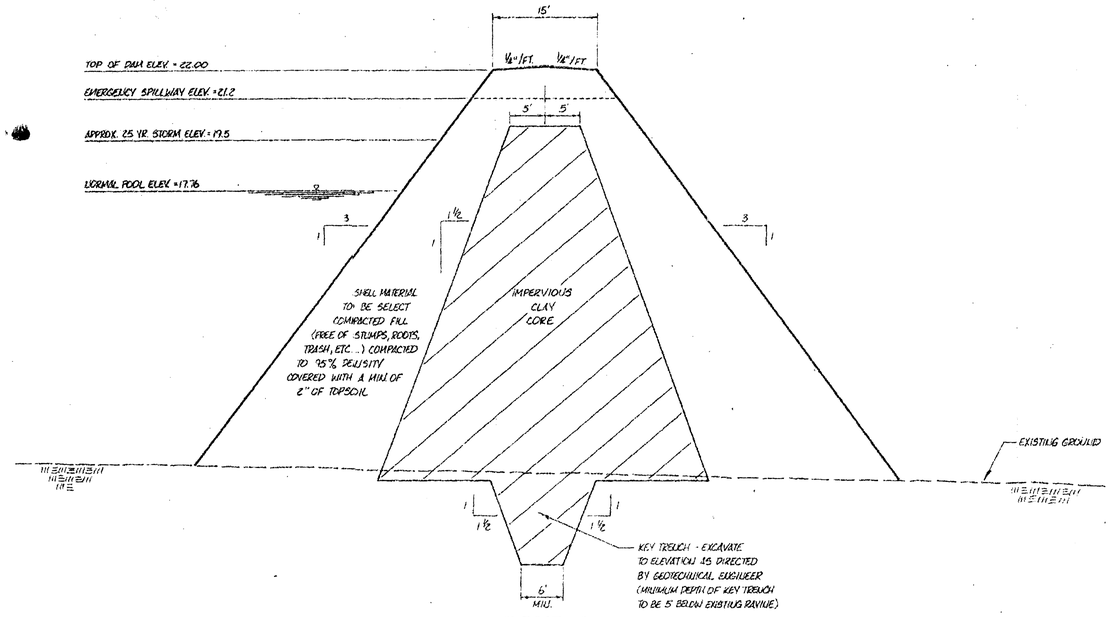

POND A
DAM CROSS-SECTION

SCALE: 1" = 2.5' VERTICAL
1" = 10' HORIZONTAL

NOTES

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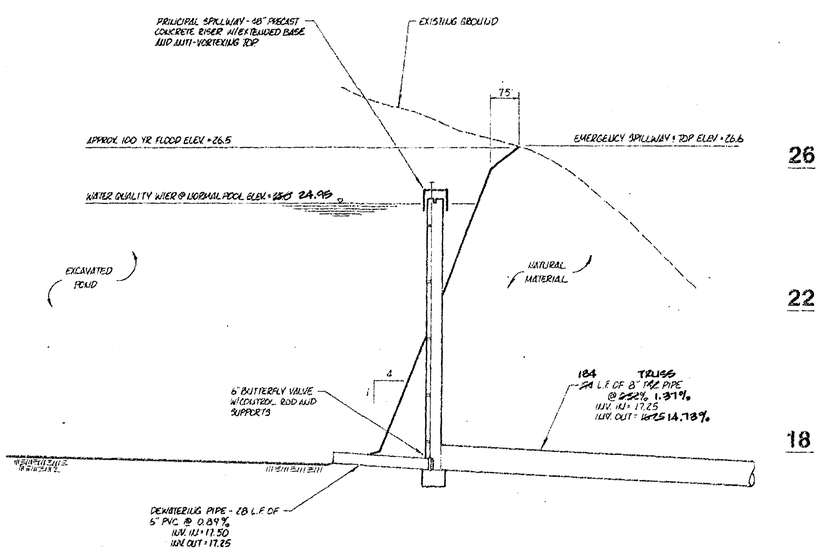
FERTILIZER: 10/20/10 MIX, 1,000$/ACRE (25$/1,000 S.F.)
MULCH: STRAW OR HAY (LOCALLY OBTAINED) 4,000$/ACRE (90$/1,000 S.F.)



POND B
SECTION @ PRINCIPAL SPILLWAY

SCALE: 1" = 2' VERTICAL
1" = 20' HORIZONTAL

STAND-PIPE ID	CAP ID	CAP WEIGHT	LINTELS 9"x7"x7'	LINTELS 12"x7"x7'
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30"	48"	1,510#	3'-10"	-
36"	60"	2,497#	4'-0"	-
42"	66"	2,965#	4'-4"	-
48"	78"	4,044#	4'-8"	-
54"	90"	4,844#	-	5'-4"
60"	96"	5,889#	-	5'-8"
66"	108"	7,150#	-	6'-0"
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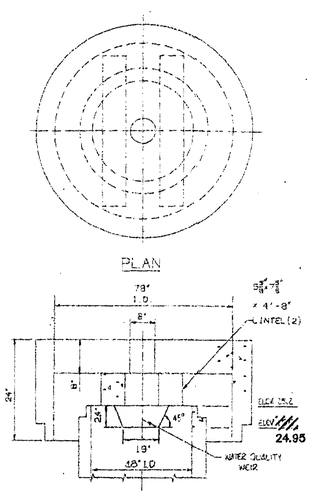

NOTE: CONTRACTOR TO POSITION LINTELS SO AS NOT TO INTERFERE WITH PROPER FUNCTIONING OF WATER QUALITY WEIR, AND FOR PROPER SUPPORT OF ANTI-VORTEXING TOP

ANTI-VORTEXING TOP
NOT TO SCALE

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_____ PE 1/13/03 (SEAL)
VIRGINIA REGISTERED PROFESSIONAL ENGINEER OR CERTIFIED LAND SURVEYOR

APPROVED
James City County
Environmental Division
By: _____
Date: 6-26-03

RECORD DRAWING - 1/13/02

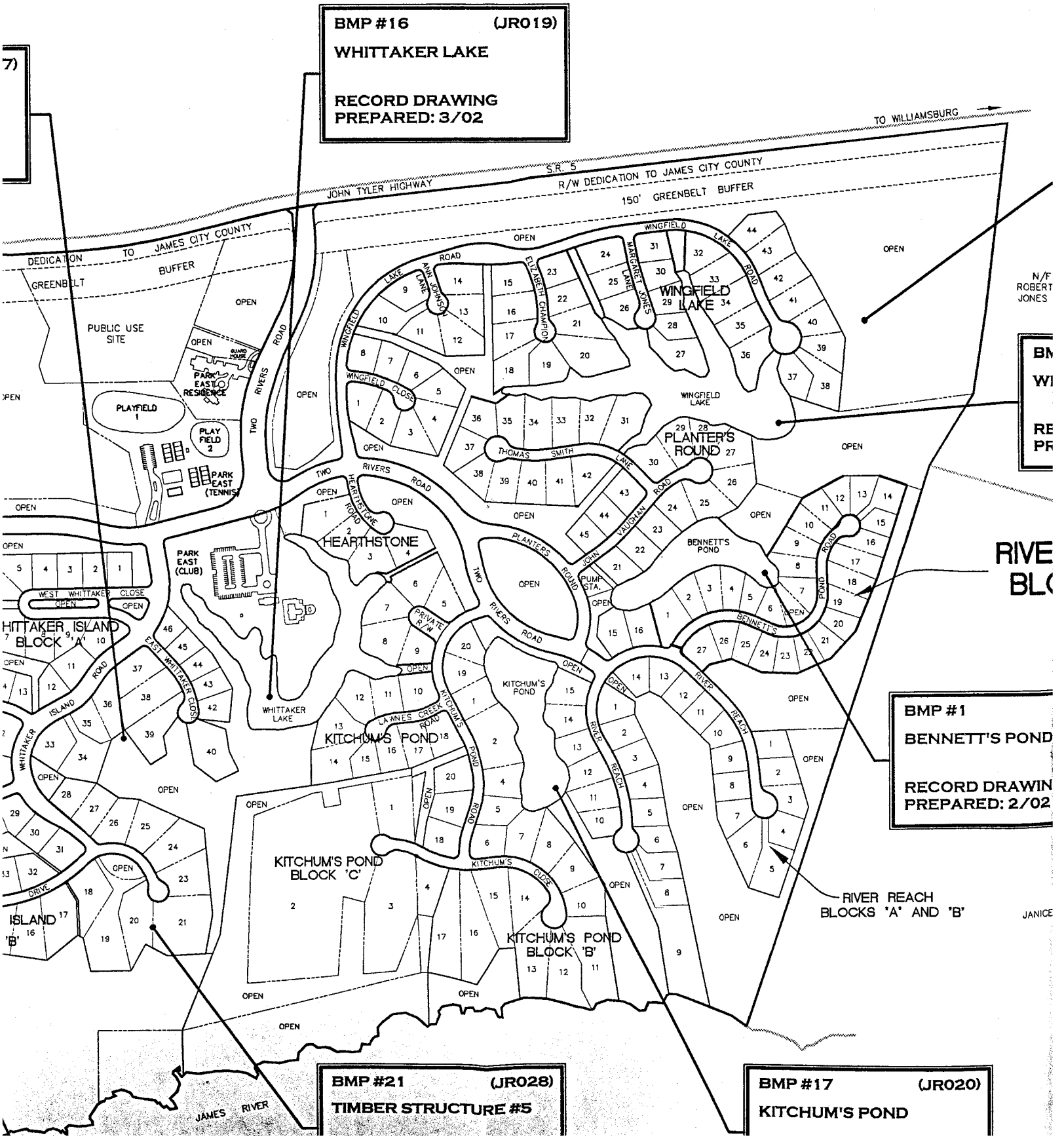
No.	DATE	REVISION / COMMENT / NOTE	BY
2	2/2/02	RECORD DRAWING FOR SWM / BMP	MAB
1	5/4/93	REVISED PER AGENCY REVIEW	WMS

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(804) 253-0040
Fax (804) 220-8994
CONSULTING ENGINEERS

DAM SECTIONS AND DETAILS
HEARTHSTONE, KITCHUM'S POND & PLANTER'S ROUND
THE GOVERNOR'S LAND
POQUOSON DISTRICT JAMES CITY COUNTY VIRGINIA

Designed VMB	Drawn
Scale	Date MAR. 1993
Project No. 7173	
Drawing No. 14	

BennettsPondDetail.dwg 02.26.02-09:24 AWF


BMP #16 (JR019)
WHITTAKER LAKE
RECORD DRAWING PREPARED: 3/02
TO WILLIAMSBURG
S.R. 5
JOHN TYLER HIGHWAY
R/W DEDICATION TO JAMES CITY COUNTY
150' GREENBELT BUFFER
DEDICATION TO JAMES CITY COUNTY
GREENBELT BUFFER
PUBLIC USE SITE
PARK EAST RESIDENCE
PLAYFIELD 1
PLAY FIELD 2
PARK EAST (TENNIS)
PARK EAST (CLUB)
TWO RIVERS ROAD
WINGFIELD LAKE
WINGFIELD LAKE ROAD
WINGFIELD CLOSE
ANN JOHNSON LANE
ELIZABETH CHAMPION
MARGARET JONES LANE
THOMAS SMITH LANE
PLANTER'S ROUND
HEARTHSTONE
HEARTHSTONE ROAD
PLANTERS ROUND
JOHN VAUGHAN ROAD
BENNETT'S POND
BENNETT'S POND ROAD
PUMP STA.
PRIVATE R/W
KITCHUM'S POND
KITCHUM'S POND ROAD
KITCHUM'S CLOSE
LAWNES CREEK ROAD
KITCHUM'S POND BLOCK 'C'
KITCHUM'S POND BLOCK 'B'
RIVER REACH
RIVER REACH BLOCKS 'A' AND 'B'
WHITTAKER ISLAND BLOCK 'A'
WEST WHITTAKER CLOSE
EAST WHITTAKER CLOSE
WHITTAKER ISLAND ROAD
WHITTAKER ISLAND DRIVE
ISLAND 'B'
WHITTAKER LAKE
JAMES RIVER
N/F ROBERT JONES
JANICE
BMP #1
BENNETT'S POND
RECORD DRAWIN
PREPARED: 2/02
BMP #21 (JR028)
TIMBER STRUCTURE #5
BMP #17 (JR020)
KITCHUM'S POND

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

LETTER OF TRANSMITTAL

DATE: 16-May-03	JOB NO. 7173-09
ATTENTION: Scott Thomas	
RE: Governor's Land	

MAY 2003

TO : James City County
Environmental Division
101 Mounts Bay Road
Williamsburg, VA 23187

WE ARE SENDING YOU: [X] Attached [ ] Under separate cover via _____ the following items:

[ ] Shop drawings [X] Prints [X] Plans [ ] Samples [ ] Specifications

[X] Copy of letter [ ] Change order [X] Other Construction Certification

COPIES	DATE	NO.	DESCRIPTION
1	5-15-03		As-Built drawing (Mylar) – Founder's Hill Timber Wall JR030
1	5-15-03		As-Built drawing (Black line) – Founder's Hill Timber Wall JR030
1	5-15-03		Memo responding to letter from County – Founder's Hill Timber Wall JR030
1	5-15-03		As-Built drawing (Mylar) – Fowler's Lake Block "B" Timber Wall JR054
1	5-15-03		As-Built drawing (Black line) – – Fowler's Lake Block "B" Timber Wall JR054
1	5-15-03		Memo responding to letter from County – – Fowler's Lake Block "B" Timber Wall JR054
1	5-15-03		As-Built drawing (Mylar) – The Harbor @ Two Rivers JR033
1	5-15-03		As-Built drawing (Black line) – The Harbor @ Two Rivers JR033
1	5-15-03		Memo responding to letter from County – The Harbor @ Two Rivers JR033
1	5-15-03		As-Built drawing (Mylar) – River Oaks North BMP JR034
1	5-15-03		As-Built drawing (Black line) – River Oaks North BMP JR034
1	5-15-03		Memo responding to letter from County – River Oaks North BMP JR034
1	5-16-03		As-Built drawing (Mylar) – Bennett's Pond JR021
1	5-16-03		As-Built drawing (Black line) – Bennett's Pond JR021
1	5-16-03		Memo responding to letter from County – Bennett's Pond JR021

THESE ARE TRANSMITTED as checked below:

[X] For Approval [ ] Approved as submitted [ ] Resubmit _____ copies for approval

[ ] For your use [ ] Approved as noted [ ] Submit _____ copies for distribution

[ ] As requested [ ] Returned for corrections [ ] Return _____ Corrected prints

[ ] For review and comment [ ] For Signature

[ ] FOR BIDS DUE _____ [ ] PRINTS RETURNED AFTER LOAN TO US

REMARKS:
If you have any questions please contact me. Thank you.

COPIES TO: file

SIGNED: Victoria Bains
Victoria Bains

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Rev. 5/16/03

AES CONSULTING ENGINEERS
Engineering, Surveying and Planning
5248 Olde Towne Road, Suite 1
WILLIAMSBURG, VIRGINIA 23188

(757) 253-0040
FAX (757) 220-8994

LETTER OF TRANSMITTAL

TO James City County Environmental Division

DATE	JOB NO.
January 24, 1999	7173

ATTENTION: Dave Medar

RE: Governor's Land
Hearthstone, Kitchum's Pond, & Planter's Round

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
2			Record Drawings for Bennett's Pond & Kitchum's Pond

7/27/99

Darryl:

This file can be closed out. L/C is 76,000 for E&S & Sub. As Builts & Calcs are on top.

David

Pond A - elev of dam too low 21.3 vs 22.0
No E. Spillway elev 21.2
Normal Pool too high 18.48 vs 17.76

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted

☒ For your use ☐ Approved as noted

☒ As requested ☐ Returned for corrections

☐ For review and comment ☐ _____

☐ FOR BIDS DUE _____

REMARKS

David,

These are forwarded ~~for~~ to you for ~~satisfaction~~ satisfaction to the letter of credit on this subdivision.

Please call if you have any questions.

COPY TO _____ SIGNED: V. Marc Bennett

If enclosures are not as noted, kindly notify us at once.

PRODUCT 239

4.90 Ac.

25+ 70

SS # 43-6
STA. 13+85 LT
DI-3B, L=8', TYPE A NOSING
TOP=24.17
INV.=20.25

STA. 10+45 LT
DI-3C, L=6, TYPE A NOSING
TOP=22.54
INV.=18.62

0.47 Ac.

DI-3A, TYPE A NOSING
TOP=22.71
INV. IN=18.0
INV. IN=17.9
INV. OUT=17.9

EQUILIBRIUM PIPE NETWORK FOR LAKES

25

24

230 L.F. OF 18" RCP @ 1.37%

25' DRAINAGE AND UTILITY EASEMENT

24+ 60

0.12 Ac.

210 L.F. OF 15" RCP @ 0.50%

RT.
III GRATE

44

25 L.F. OF 15" RCP @ 2.80%

TP

25+ 50

SS# 43-4
STA. 16+00 RT.
DI-3B, L=4' TYPE A NOSING
TOP=22.97
INV. IN=18.30
INV. IN=18.40
INV. OUT=18.30

23

24+ 30

INV.=14.75

TOP OF DAM

LIMITS OF CLEARING (TYP.)

45

0.57 Ac.

0.30 Ac.

VAUGHAN ROAD

25

SS#43-5
STA. 13+85 RT.
DI-3B, L=6', TYPE A NOSING
TOP=24.17
INV. IN=19.55
INV. OUT=19.45

22

TP

SS#43-1
INV.=14.75

POND A
(BENNETT'S POND)
NORMAL POOL ELEV.=17.76
APPROX. 25 YEAR FLOOD ELEV.=19.50

STORM WATER MAINTENANCE

V.D.O.T. IS NOT RESPONSIBLE OR LIABLE FOR THE DETENTION FACILITIES SHOWN OR THIER APPURTENANCES AND SHALL BE SAVED HARMLESS.

25+ 40

SS # 40-2
STA. 82+70 RT.
DI-5 W/ TYPE III GRATE
TOP=23.78
INV. IN=18.17
INV. OUT=18.07

JOHN

21

SLOPE 4:1 TYPICAL

NOTE: SEE SHEET FOR GRADING AND DRAINAGE OF PUMP STATION SITE.

92 L.F. OF 18" RCP @ 4.42%

0.24 Ac.

LIMITS OF CLEARING (TYP.)

TP

24+ 10

20

SS# 40-1
INV.=14.00

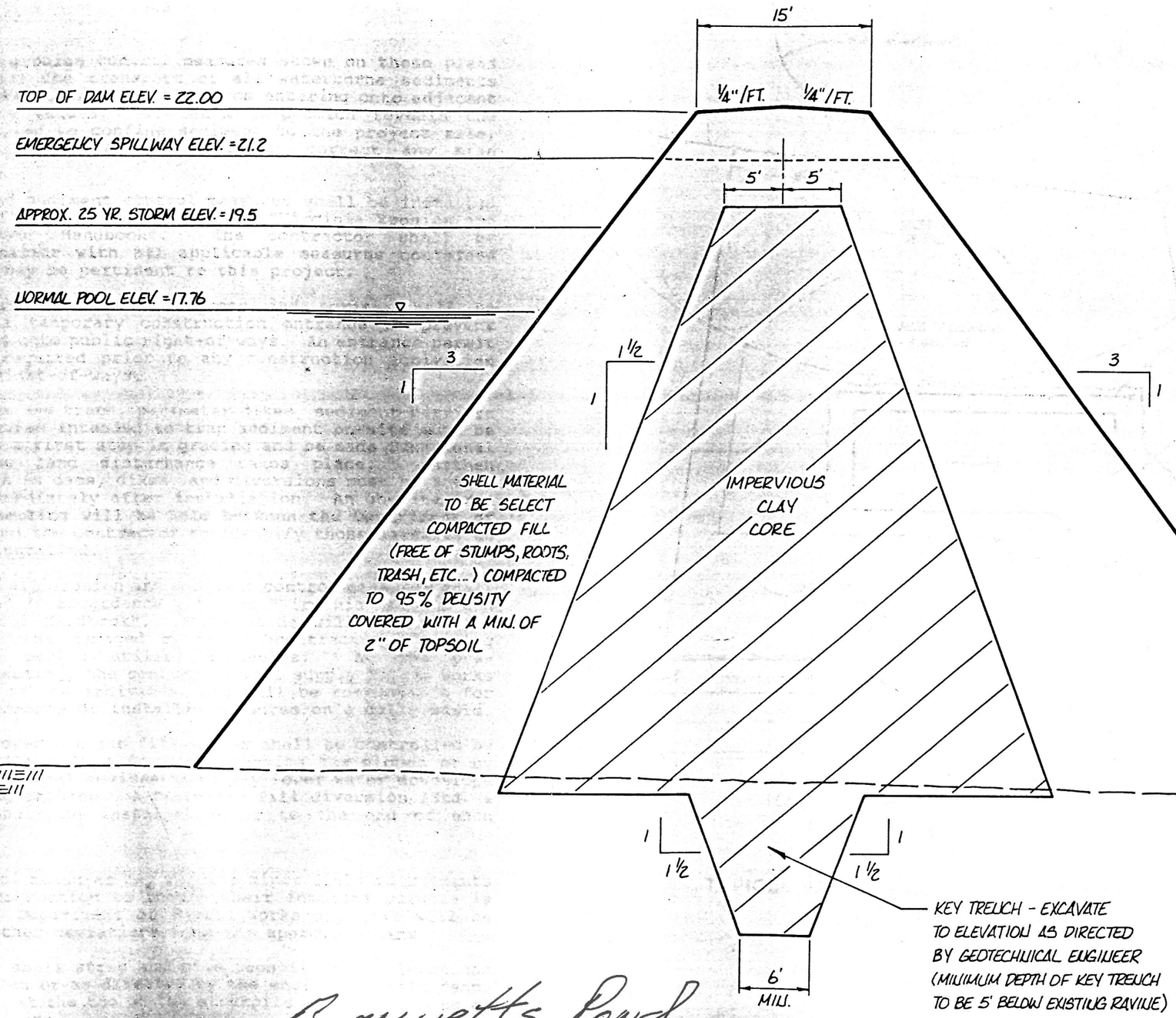
24+ 20

24+ 61

NOTE: 1. ALL CURB DROP INLETS, UNLESS OTHERWISE NOTED, ARE TO USE TYPE A NOSING. SEE V.D.O.T. STANDARD DETAILS.

2. CHECK DAMS ARE TO BE PLACED IN ROADSIDE DITCHES ~~AS NECESSARY~~ AT 100' IN

3. ~~ALL~~ DITCH SLOPED GREATER THAN 3.0% OR THAT ~~HAS~~ NOT DEVELOPED ~~A GOOD~~ SOD AT THE TIME OF ACCEPTANCE, WILL BE PAVED.



Bennetts Pond

POND A
DAM CROSS-SECTION

SCALE: 1" = 2.5' VERTICAL
1" = 10' HORIZONTAL

LEGUENDO'S LAND
BAY 5, POD 2
DESIGN OF POND A

Bennett Pond
JR021

JN 1113
1/25/93

PRE DEVELOPMENT CONDITIONS

- DRAINAGE AREA ~~24 AC~~ 23.3 AC

- SOIL TYPE BREAKDOWN

TYPE	HYDROLOGIC GROUP	PRE-DEVELOPMENT USE	CN ASSIGNED	ACRES
15E	C	WOODS, FAIR	73	1.7
11C	C	WOODS, FAIR	73	4.1
27	D	WOODS, FAIR	79	17.5

WEIGHTED CN VALUE (PRE-DEVELOPMENT) = 77.5

BASIN SLOPE = 1.46%
HYDRAULIC LENGTH = 1670'
(HYDROGRAPH 1) Q_p = 18.2 CFS for 2 year 24 HR STORM
VOLUME = 105875 CF OR 2.4 AC FT

POST DEVELOPMENT CONDITIONS

- DRAINAGE AREA 23.1 AC (APPROXIMATELY SAME)
- APPROXIMATE LAKE AREA 2.9 AC

- SOIL BREAKDOWN BY USE

USE	TYPE	HYDROLOGIC GROUP	CN ASSIGNED	ACRES	CN*A
LAKE	15E	C	100	1.5	150
LAKE	11C	C	100	1.0	100
LAKE	27	D	100	0.4	40
1/2 AC LOTS	11C	C	80	2.1	168
1/2 AC LOTS	27	D	87	18.1	1574.5

WEIGHTED CN VALUE (POST-DEVELOPMENT) = 87.9

REQUIRED VOLUME FOR 9 PT BMP (DESIGN 7) (4.0 VR)

VOL OF POND = (4)(1/2" / ACRE)(DA)(VR)
VR = 0.05 + (0.009)(% of IMPERVIOUS POST DEV. AREA)

VR = 0.05 + (0.009)(28) → VR = 0.302

2.0 AC IMPERVIOUS LOT DEV.
2.9 AC IMPERVIOUS LAKE
1.5 AC IMPERVIOUS ROADS DEV
6.4 AC IMPERVIOUS / 23.1 AC = VR = 028 28%

VOL OF POND = (4)(0.042 FT)(23.1 AC)(0.302) = 1.17 AC FT
= 51052 CU FT
= 1891 CY

1.17
0.90
2.13

.29 x 4 =

GOVERNOR'S LAND
BAY 5, POD 2
DESIGN OF POND A

JN 7173
1/25/93

?

REQUIRED VOLUME ABOVE 9 PT BMP DESIGN FOR ADDITIONAL 2 PT BMP

V_{OL} = (1/2 "over Acre) (23.1 Ac) = (0.0417)(23.1) = 0.96 Ac FT = 1549 cy

SEDIMENT CAPACITY OF POND MUST BE AT LEAST 67 CY / ACRE
SEDIMENT STORAGE = (67 CY) (23.1 Acres) (27 CF / CY) = 41,790 CUFT
= 0.96 AC FT
= 1548 CY

What is this based on?

1548 × 8 → = $10,836

GOVERNOR'S LAND
BAY 5, POD 2 POND A

1/25/93

ELEVATION	DEPTH	AREA SQ FT	VOLUME CY	Σ VOLUME CY
17.76 (NORMAL POOL)	0	141761	0	0
			1281	1281
18	0.24	146413		
			5537.0	6817.7
19	1.0	152586		
			5766.7	12584.5
20	1.0	158817		
			6006.3	18590.8
21	1.0	165525		
			6279.2	24870.0
22	1.0	173554		

POND HAS ALL NECESSARY VOLUMES FOR:
4.0 VR & WATER QUALITY
SEDIMENT STORAGE

GOVERNOR'S LAND, BAY 5, POD 2, POND A

THE FOLLOW PAGES PROVIDE INFORMATION REGARDING THE 2 YEAR 24 HR STORM, PRE-DEVELOPMENT HYDROGRAPH.

HYDROLOGIC REPORT

PRE-DEVELOPMENT.....
BAY 5, POD 2 POND.A..
..2 yr storm.....

Hyd. No. 1

Hydrograph type	= S.C.S. RUNOFF	Peak discharge	= 18.17 cfs
Storm frequency	= 2 yr	Time interval	= 5 min
Basin area	= 23.3 ac	Basin curve No.	= 77.5
Ave basin slope	= 1.46 %	Hydraulic len	= 1670 ft
Basin lag	= 25.7 min	Time of concen	= 42.87 min
Total precip.	= 3.70 in	Distribution	= S.C.S. II

HYDROGRAPH DISCHARGE TABLE

TIME--OUTFLOW (hrs cfs)		TIME--OUTFLOW (hrs cfs)		TIME--OUTFLOW (hrs cfs)		TIME--OUTFLOW (hrs cfS)	
11.42	0.73	11.50	0.84	11.58	1.02	11.67	1.35
11.75	1.96	11.83	3.14	11.92	5.40	12.00	8.32
12.08	11.27	12.17	14.09	12.25	16.56	12.33	18.17
12.42	18.07	12.50	16.95	12.58	15.65	12.67	14.20
12.75	12.61	12.83	10.92	12.92	9.18	13.00	7.46
13.08	5.86	13.17	4.56	13.25	3.89	13.33	3.58
13.42	3.32	13.50	3.11	13.58	2.93	13.67	2.78
13.75	2.65	13.83	2.54	13.92	2.43	14.00	2.33
14.08	2.24	14.17	2.15	14.25	2.07	14.33	2.00
14.42	1.93	14.50	1.87	14.58	1.82	14.67	1.78
14.75	1.73	14.83	1.70	14.92	1.66	15.00	1.63
15.08	1.61	15.17	1.58	15.25	1.55	15.33	1.53
15.42	1.50	15.50	1.47	15.58	1.45	15.67	1.42
15.75	1.40	15.83	1.37	15.92	1.34	16.00	1.32
16.08	1.29	16.17	1.26	16.25	1.24	16.33	1.21
16.42	1.19	16.50	1.17	16.58	1.15	16.67	1.13
16.75	1.12	16.83	1.11	16.92	1.09	17.00	1.08
17.08	1.07	17.17	1.06	17.25	1.05	17.33	1.04
17.42	1.03	17.50	1.03	17.58	1.02	17.67	1.01

Volume = 105 875 cf
2.431 Acft

GOVERNOR'S LAND, BAY 5, POD 2, POND A

THE FOLLOWING SHEET PROVIDES INFORMATION REGARDING THE 100 YEAR 24-HOUR STORM, POST DEVELOPMENT HYDROGRAPH FOR BAY 5 POD 2 POND A.

HYDROLOGIC REPORT

POST -DEVELOPMENT.....
BAY 5, POD 2 POND.A..
100 YR STORM.....

Hyd. No. 2

Hydrograph type	= S.C.S. RUNOFF	Peak discharge	= 98.83 cfs
Storm frequency	= 100 yr	Time interval	= 5 min
Basin area	= 23.1 ac	Basin curve No.	= 87.9
Ave basin slope	= 1.46 %	Hydraulic len	= 1670 ft
Basin lag	= 18.0 min	Time of concen	= 30.00 min
Total precip.	= 8.10 in	Distribution	= S.C.S. II

HYDROGRAPH DISCHARGE TABLE

TIME--OUTFLOW (hrs cfs)		TIME--OUTFLOW (hrs cfs)		TIME--OUTFLOW (hrs cfs)		TIME--OUTFLOW (hrs cfS)	
6.08	0.92	6.17	0.95	6.25	0.98	6.33	1.02
6.42	1.05	6.50	1.08	6.58	1.12	6.67	1.15
6.75	1.18	6.83	1.22	6.92	1.25	7.00	1.28
7.08	1.32	7.17	1.35	7.25	1.39	7.33	1.42
7.42	1.46	7.50	1.49	7.58	1.52	7.67	1.56
7.75	1.59	7.83	1.63	7.92	1.66	8.00	1.70
8.08	1.73	8.17	1.77	8.25	1.82	8.33	1.88
8.42	1.94	8.50	2.02	8.58	2.10	8.67	2.19
8.75	2.29	8.83	2.39	8.92	2.49	9.00	2.60
9.08	2.70	9.17	2.80	9.25	2.89	9.33	2.98
9.42	3.04	9.50	3.10	9.58	3.15	9.67	3.20
9.75	3.26	9.83	3.34	9.92	3.45	10.00	3.57
10.08	3.72	10.17	3.88	10.25	4.06	10.33	4.26
10.42	4.48	10.50	4.72	10.58	4.96	10.67	5.23
10.75	5.53	10.83	5.86	10.92	6.22	11.00	6.61
11.08	6.96	11.17	7.38	11.25	7.88	11.33	8.48
11.42	9.30	11.50	10.21	11.58	11.82	11.67	15.19
11.75	21.50	11.83	33.11	11.92	52.46	12.00	73.52
12.08	90.29	12.17	98.83	12.25	93.61	12.33	81.17
12.42	67.88	12.50	54.22	12.58	40.93	12.67	28.90
12.75	19.68	12.83	15.43	12.92	13.82	13.00	12.51
13.08	11.45	13.17	10.61	13.25	9.93	13.33	9.38
13.42	8.91	13.50	8.48	13.58	8.09	13.67	7.72
13.75	7.39	13.83	7.09	13.92	6.80	14.00	6.53
14.08	6.27	14.17	6.03	14.25	5.82	14.33	5.63
14.42	5.47	14.50	5.34	14.58	5.22	14.67	5.12
14.75	5.02	14.83	4.94	14.92	4.85	15.00	4.77
15.08	4.68	15.17	4.60	15.25	4.52	15.33	4.43
15.42	4.35	15.50	4.26	15.58	4.18	15.67	4.09

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME--OUTFLOW (hrs cfs)		TIME--OUTFLOW (hrs cfs)		TIME--OUTFLOW (hrs cfs)		TIME--OUTFLOW (hrs cfS)	
15.75	4.01	15.83	3.92	15.92	3.84	16.00	3.75
16.08	3.67	16.17	3.59	16.25	3.52	16.33	3.45
16.42	3.39	16.50	3.35	16.58	3.30	16.67	3.27
16.75	3.24	16.83	3.20	16.92	3.17	17.00	3.14
17.08	3.11	17.17	3.08	17.25	3.05	17.33	3.02
17.42	2.99	17.50	2.96	17.58	2.93	17.67	2.90
17.75	2.87	17.83	2.84	17.92	2.81	18.00	2.78
18.08	2.75	18.17	2.72	18.25	2.69	18.33	2.66
18.42	2.63	18.50	2.60	18.58	2.57	18.67	2.54
18.75	2.51	18.83	2.48	18.92	2.45	19.00	2.42
19.08	2.38	19.17	2.35	19.25	2.32	19.33	2.29
19.42	2.26	19.50	2.23	19.58	2.20	19.67	2.17
19.75	2.14	19.83	2.11	19.92	2.08	20.00	2.05
20.08	2.02	20.17	1.99	20.25	1.97	20.33	1.94
20.42	1.93	20.50	1.91	20.58	1.90	20.67	1.89
20.75	1.89	20.83	1.88	20.92	1.87	21.00	1.87
21.08	1.86	21.17	1.85	21.25	1.85	21.33	1.84
21.42	1.84	21.50	1.83	21.58	1.82	21.67	1.82
21.75	1.81	21.83	1.81	21.92	1.80	22.00	1.79
22.08	1.79	22.17	1.78	22.25	1.78	22.33	1.77
22.42	1.76	22.50	1.76	22.58	1.75	22.67	1.75
22.75	1.74	22.83	1.73	22.92	1.73	23.00	1.72
23.08	1.72	23.17	1.71	23.25	1.70	23.33	1.70
23.42	1.69	23.50	1.68	23.58	1.68	23.67	1.67
23.75	1.67	23.83	1.66	23.92	1.65	24.00	1.65
24.08	1.57	24.17	1.42	24.25	1.19	24.33	0.89

Volume = 445816 CF
10.235 Ac FT

THE FOLLOWING HYDROGRAPH ROUTES THE POST DEVELOPMENT 100 YEAR STORM THROUGH THE DESIGNED BAY 5, POD 2 POND A

NOTE:

BAY 5 POD 2 POND IS CONNECT BY A 15" BALANCE PIPE TO EQUALIZE NORMAL POOL ELEVATION WITH WINGFIELD LAKE.

WINGFIELD LAKE'S WATER QUALITY DEVICE WILL PROVIDE WATER QUALITY FOR BOTH PONDS.

ALSO NOTE:

THE HYDROGRAPH MODEL WAS ADJUSTED SO THAT THE BALANCE PIPE WOULD NOT DRAWDOWN THE NORMAL POOL OF THE BAY 5 POD 2 POND TO AN UNDESIRABLE LEVEL.
IN ACTUAL CONSTRUCTION, THE BALANCE PIPE WILL HAVE SUBMERGED INVERTS APPROXIMATELY 3 FEET BELOW NORMAL POOL.

EVEN THOUGH THE ACTUAL BALANCE PIPE WILL HAVE MORE HEAD ON IT, IT WILL ALSO HAVE A TAILWATER CONDITION TOO — THUS RESTRICTING FLOW THRU THE BALANCE PIPE. THE 6 ± CFS AS SHOWN IN THE CALCULATION IS PROBABLY ONLY A CONSERVATIVE ESTIMATE OF THE ACTUAL FLOW THRU THE BALANCE PIPE DURING STORM CONDITIONS

- need to increase pipe

$Q = Ca\sqrt{2g\Delta h}$

$C = \left(1.1 + \frac{0.026L}{d^{1.2}}\right)^{-1/2} =$

$L = 460$

$d = 15" = 1.25'$

$\frac{1}{\sqrt{1.1 + \frac{0.026(460)}{1.25^{1.2}}}} = \frac{1}{\sqrt{1.1 + \frac{(.026)(460)}{1.30}}}$

$= \frac{1}{3.2} = .31$

$Q = (.31)(1.23)\sqrt{64.4}\sqrt{(\Delta h)}$

$Q = 3.05 \times \sqrt{\Delta h}$

$h = 3.9'$

Try 18" $\frac{1}{\sqrt{1.1 + \frac{.026 \times 460}{1.63}}}$ $C = .344$

$Q = 1.77 \times .34 \times \sqrt{2gh} =$

$Q = 4.8\sqrt{\Delta h}$

$\Delta h = \cancel{1.25}\ 1.56'$ when $Q = 6$ cfs

Try 21" pipe

Try 21" pipe

$C = .37$ $A = 2.4$

$Q = (.37)(2.4)\sqrt{2g}\ \sqrt{h}$

$6 = 7.12\sqrt{h}$

$h = 0.7'$

HYDROLOGIC REPORT

STAGE / STORAGE / DISCHARGE

RESERVOIR NUMBER = 1 (POND A)

RESERVOIR NAME = BAY 5, POD 2
STORAGE VALUES WERE INPUT MANUALLY

DISCHARGE VALUES: CULVERT STRUCT A. Q = .6 *A*[2gh/k]^.5 * 1
CULVERT STRUCT B. Q = .6 *A*[2gh/k]^.5 * 0
~~WEIR STRUCT A.~~ Q = 2.63 * 21.2 * H ^ 1.5
WEIR STRUCT B. Q = 3 * 0 * H ^ 1.5

ELEVATION	DISCHARGE (cfs)			
	CULVERT A	CULVERT B	WEIR A	WEIR B
17.76	0.00	0.00	0.00	0.00
18.00	0.30	0.00	0.00	0.00
19.00	4.65	0.00	0.00	0.00
20.00	7.51	0.00	0.00	0.00
21.00	9.55	0.00	0.00	0.00
22.00	11.23	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00

STAGE	ELEVATION	INC STOR cu ft	TOT STOR cu ft	OUTFLOW cfs
0.00	17.76	0	0	0.00
0.24	18.00	34405	34405	0.30
1.24	19.00	149499	183904	4.65
2.24	20.00	155701	339605	7.51
3.24	21.00	162171	501776	9.55
4.24	22.00	169539	671315	11.23
0.00	0.00	0	0	0.00
0.00	0.00	0	0	0.00
0.00	0.00	0	0	0.00
0.00	0.00	0	0	0.00
0.00	0.00	0	0	0.00

Reservoir No. 1 OUTLET STRUCTURES

```
  VERT STRUC  A. Q=CoA[2gh/k]^.5      CULVERT STRUC  B. Q=CoA[2gh/k]^.5

 1. WIDTH  (in)     = 15.              9. WIDTH  (in)     = 0..
 2. HEIGHT (in)     = 15.             10. HEIGHT (in)     = 0..
 3. No. BARRELS     = 1..             11. No. BARRELS     = 0..
 4. INVERT ELEV.    = 17.76..(FOR MODEL)  12. INVERT ELEV.    = 0........
 5. Co = 0.60                         13. Co = 0.60
 6. CULVERT LENGTH (ft) = 375.(±)     14. CULVERT LENGTH (ft) = 0...
 7. CULVERT SLOPE (%)   = .4..        15. CULVERT SLOPE (%)   = 0...
 8. MANNING'S N-VALUE   = .013        16. MANNING'S N-VALUE   = .013
                                      17. MULTI-STAGE OPTION ? (Y/N) N

 WEIR STRUCTURE A.      Q=CwLH^EXP    WEIR STRUCTURE B.      Q=CwLH^EXP

 18. CREST LENGTH (ft)  =  24         23. CREST LENGTH (ft)  = 0......
 19. CREST ELEVATION    =  21.2       24. CREST ELEVATION    = 0......
 20. Cw = 2.63                        25. Cw = 3.00
 21. EXP = 1.50                       26. EXP = 1.50
 22. MULTI-STAGE OPTION ? (Y/N) N     27. MULTI-STAGE OPTION ? (Y/N) N
```

Change item number: 0 DY to cont

HYDROLOGIC REPORT

BAY 5 POD 2 POND. A
RESERVOIR ROUTED.....
HYDROGRAPH 100 YR POST

Hyd. No. 3

Hydrograph type = RESERVOIR ROUTE Peak discharge = 6.76 cfs
Storm frequency = 100 yr Time interval = 5 min
Inflow hyd. no. = 2 Reservoir no. = 1

HYDROGRAPH DISCHARGE TABLE

TIME hrs	INFLOW (i) cfs	INFLOW (j) cfs	2S/dt-O (i) cfs	2S/dt+O (j) cfs	OUTFLOW cfs
10.25	4.06	4.26	223.99	224.59	0.30
10.33	4.26	4.48	231.69	232.31	0.31
10.42	4.48	4.72	239.78	240.44	0.33
10.50	4.72	4.96	248.28	248.98	0.35
10.58	4.96	5.23	257.22	257.96	0.37
10.67	5.23	5.53	266.63	267.42	0.39
10.75	5.53	5.86	276.57	277.40	0.42
10.83	5.86	6.22	287.07	287.96	0.44
10.92	6.22	6.61	298.22	299.15	0.47
11.00	6.61	6.96	310.05	311.04	0.49
11.08	6.96	7.38	322.57	323.62	0.52
11.17	7.38	7.88	335.75	336.92	0.58
11.25	7.88	8.48	349.69	351.02	0.66
11.33	8.48	9.30	364.56	366.06	0.75
11.42	9.30	10.21	380.67	382.35	0.84
11.50	10.21	11.82	398.29	400.17	0.94
11.58	11.82	15.19	418.21	420.32	1.06
11.67	15.19	21.50	442.86	445.21	1.17
11.75	21.50	33.11	476.91	479.55	1.32
11.83	33.11	52.46	528.44	531.52	1.54
11.92	52.46	73.52	610.15	614.01	1.93
12.00	73.52	90.29	731.10	736.14	2.52
12.08	90.29	98.83	888.34	894.91	3.28
12.17	98.83	93.61	1069.63	1077.46	3.92
12.25	93.61	81.17	1252.56	1262.07	4.75

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW (i) cfs	INFLOW (j) cfs	2S/dt-O (i) cfs	2S/dt+O (j) cfs	OUTFLOW cfs
12.33	81.17	67.88	1416.74	1427.34	5.30
12.42	67.88	54.22	1554.36	1565.80	5.72
12.50	54.22	40.93	1664.40	1676.47	6.03
12.58	40.93	28.90	1747.02	1759.54	6.26
12.67	28.90	19.68	1804.02	1816.85	6.41
12.75	19.68	15.43	1839.59	1852.60	6.51
12.83	15.43	13.82	1861.58	1874.70	6.56
12.92	13.82	12.51	1877.62	1890.82	6.60
13.00	12.51	11.45	1890.67	1903.94	6.64
13.08	11.45	10.61	1901.30	1914.63	6.66
13.17	10.61	9.93	1909.99	1923.36	6.68
13.25	9.93	9.38	1917.13	1930.53	6.70
13.33	9.38	8.91	1923.00	1936.44	6.72
13.42	8.91	8.48	1927.84	1941.30	6.73
13.50	8.48	8.09	1931.76	1945.23	6.74
13.58	8.09	7.72	1934.83	1948.32	6.75
13.67	7.72	7.39	1937.13	1950.64	6.75
13.75	7.39	7.09	1938.74	1952.25	6.76
13.83	7.09	6.80	1939.69	1953.21	6.76
13.92	6.80	6.53	1940.06	1953.58	6.76
14.00	6.53	6.27	1939.87	1953.38	6.76
14.08	6.27	6.03	1939.14	1952.66	6.76
14.17	6.03	5.82	1937.93	1951.44	6.75
14.25	5.82	5.63	1936.28	1949.78	6.75
14.33	5.63	5.47	1934.23	1947.72	6.75
14.42	5.47	5.34	1931.85	1945.33	6.74
14.50	5.34	5.22	1929.20	1942.66	6.73
14.58	5.22	5.12	1926.30	1939.75	6.73
14.67	5.12	5.02	1923.20	1936.64	6.72
14.75	5.02	4.94	1919.93	1933.35	6.71
14.83	4.94	4.85	1916.49	1929.89	6.70
14.92	4.85	4.77	1912.90	1926.28	6.69
15.00	4.77	4.68	1909.16	1922.52	6.68
15.08	4.68	4.60	1905.27	1918.61	6.67
15.17	4.60	4.52	1901.23	1914.55	6.66
15.25	4.52	4.43	1897.04	1910.35	6.65
15.33	4.43	4.35	1892.71	1905.99	6.64
15.42	4.35	4.26	1888.23	1901.49	6.63
15.50	4.26	4.18	1883.60	1896.84	6.62
15.58	4.18	4.09	1878.83	1892.04	6.61
15.67	4.09	4.01	1873.92	1887.10	6.59
15.75	4.01	3.92	1868.86	1882.02	6.58

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW (i) cfs	INFLOW (j) cfs	2S/dt-O (i) cfs	2S/dt+O (j) cfs	OUTFLOW cfs
15.83	3.92	3.84	1863.66	1876.79	6.57
15.92	3.84	3.75	1858.31	1871.42	6.55
16.00	3.75	3.67	1852.82	1865.90	6.54
16.08	3.67	3.59	1847.20	1860.24	6.52
16.17	3.59	3.52	1841.43	1854.45	6.51
16.25	3.52	3.45	1835.55	1848.54	6.49
16.33	3.45	3.39	1829.56	1842.51	6.48
16.42	3.39	3.35	1823.48	1836.40	6.46
16.50	3.35	3.30	1817.32	1830.22	6.45
16.58	3.30	3.27	1811.12	1823.97	6.43
16.67	3.27	3.24	1804.86	1817.69	6.41
16.75	3.24	3.20	1798.57	1811.36	6.40
16.83	3.20	3.17	1792.25	1805.01	6.38
16.92	3.17	3.14	1785.90	1798.63	6.36
17.00	3.14	3.11	1779.53	1792.22	6.35
17.08	3.11	3.08	1773.12	1785.78	6.33
17.17	3.08	3.05	1766.70	1779.32	6.31
17.25	3.05	3.02	1760.24	1772.83	6.30
17.33	3.02	2.99	1753.76	1766.32	6.28
17.42	2.99	2.96	1747.25	1759.78	6.26
17.50	2.96	2.93	1740.72	1753.21	6.24
17.58	2.93	2.90	1734.16	1746.61	6.23
17.67	2.90	2.87	1727.58	1740.00	6.21
17.75	2.87	2.84	1720.97	1733.35	6.19
17.83	2.84	2.81	1714.34	1726.69	6.17
17.92	2.81	2.78	1707.69	1719.99	6.15
18.00	2.78	2.75	1701.01	1713.28	6.13
18.08	2.75	2.72	1694.31	1706.54	6.12
18.17	2.72	2.69	1687.59	1699.78	6.10
18.25	2.69	2.66	1680.84	1692.99	6.08
18.33	2.66	2.63	1674.07	1686.18	6.06
18.42	2.63	2.60	1667.27	1679.35	6.04
18.50	2.60	2.57	1660.45	1672.50	6.02
18.58	2.57	2.54	1653.61	1665.62	6.00
18.67	2.54	2.51	1646.75	1658.72	5.98
18.75	2.51	2.48	1639.86	1651.79	5.96
18.83	2.48	2.45	1632.95	1644.84	5.95
18.92	2.45	2.42	1626.02	1637.87	5.93
19.00	2.42	2.38	1619.07	1630.88	5.91
19.08	2.38	2.35	1612.10	1623.87	5.88
19.17	2.35	2.32	1605.11	1616.84	5.86
19.25	2.32	2.29	1598.10	1609.79	5.84

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW (i) cfs	INFLOW (j) cfs	2S/dt-O (i) cfs	2S/dt+O (j) cfs	OUTFLOW cfs
19.33	2.29	2.26	1591.07	1602.72	5.82
19.42	2.26	2.23	1584.02	1595.63	5.80
19.50	2.23	2.20	1576.95	1588.52	5.78
19.58	2.20	2.17	1569.86	1581.38	5.76
19.67	2.17	2.14	1562.75	1574.23	5.74
19.75	2.14	2.11	1555.62	1567.06	5.72
19.83	2.11	2.08	1548.47	1559.87	5.70
19.92	2.08	2.05	1541.30	1552.66	5.68
20.00	2.05	2.02	1534.12	1545.43	5.66
20.08	2.02	1.99	1526.91	1538.19	5.64
20.17	1.99	1.97	1519.69	1530.92	5.61
20.25	1.97	1.94	1512.47	1523.65	5.59
20.33	1.94	1.93	1505.24	1516.38	5.57
20.42	1.93	1.91	1498.01	1509.11	5.55
20.50	1.91	1.90	1490.80	1501.85	5.53
20.58	1.90	1.89	1483.60	1494.61	5.50
20.67	1.89	1.89	1476.44	1487.40	5.48
20.75	1.89	1.88	1469.29	1480.21	5.46
20.83	1.88	1.87	1462.18	1473.06	5.44
20.92	1.87	1.87	1455.10	1465.93	5.42
21.00	1.87	1.86	1448.05	1458.84	5.39
21.08	1.86	1.85	1441.03	1451.78	5.37
21.17	1.85	1.85	1434.05	1444.75	5.35
21.25	1.85	1.84	1427.09	1437.75	5.33
21.33	1.84	1.84	1420.17	1430.78	5.31
21.42	1.84	1.83	1413.28	1423.84	5.28
21.50	1.83	1.82	1406.42	1416.94	5.26
21.58	1.82	1.82	1399.59	1410.07	5.24
21.67	1.82	1.81	1392.80	1403.23	5.22
21.75	1.81	1.81	1386.04	1396.43	5.20
21.83	1.81	1.80	1379.31	1389.66	5.17
21.92	1.80	1.79	1372.61	1382.92	5.15
22.00	1.79	1.79	1365.95	1376.21	5.13
22.08	1.79	1.78	1359.31	1369.53	5.11
22.17	1.78	1.78	1352.71	1362.88	5.09
22.25	1.78	1.77	1346.13	1356.27	5.07
22.33	1.77	1.76	1339.59	1349.68	5.04
22.42	1.76	1.76	1333.08	1343.13	5.02
22.50	1.76	1.75	1326.60	1336.60	5.00
22.58	1.75	1.75	1320.15	1330.11	4.98
22.67	1.75	1.74	1313.73	1323.65	4.96
22.75	1.74	1.73	1307.34	1317.21	4.94

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW (i) cfs	INFLOW (j) cfs	2S/dt-O (i) cfs	2S/dt+O (j) cfs	OUTFLOW cfs
22.83	1.73	1.73	1300.98	1310.81	4.92
22.92	1.73	1.72	1294.65	1304.44	4.89
23.00	1.72	1.72	1288.35	1298.10	4.87
23.08	1.72	1.71	1282.09	1291.79	4.85
23.17	1.71	1.70	1275.85	1285.51	4.83
23.25	1.70	1.70	1269.64	1279.26	4.81
23.33	1.70	1.69	1263.46	1273.04	4.79
23.42	1.69	1.68	1257.31	1266.85	4.77
23.50	1.68	1.68	1251.19	1260.68	4.75
23.58	1.68	1.67	1245.09	1254.55	4.73
23.67	1.67	1.67	1239.03	1248.45	4.71
23.75	1.67	1.66	1232.99	1242.37	4.69
23.83	1.66	1.65	1226.99	1236.32	4.67
23.92	1.65	1.65	1221.01	1230.30	4.65
24.00	1.65	1.57	1215.09	1224.31	4.61
24.08	1.57	1.42	1209.17	1218.31	4.57
24.17	1.42	1.19	1203.09	1212.16	4.53
24.25	1.19	0.89	1196.72	1205.70	4.49
24.33	0.89	0.64	1189.91	1198.80	4.45
24.42	0.64	0.42	1182.64	1191.43	4.40
24.50	0.42	0.25	1174.99	1183.69	4.35
24.58	0.25	0.13	1167.07	1175.67	4.30
24.67	0.13	0.04	1158.96	1167.45	4.25
24.75	0.04	0.00	1150.74	1159.13	4.19
24.83	0.00	0.00	1142.49	1150.78	4.14
24.92	0.00	0.00	1134.32	1142.49	4.09
25.00	0.00	0.00	1126.24	1134.32	4.04
25.08	0.00	0.00	1118.23	1126.24	4.00

Maximum outflow (cfs) = 6.76
Maximum storage (cu ft) = 292023
Maximum elevation (ft) = 19.69

6 cfs - requires 3.9' head for 15" pipe
" " 1.6' " " 18" pipe
" " 0.7' head 21" pipe

GOVERNOR'S LAND, BAY 5, POD 2, POND A

THE NEXT HYDROGRAPH PROVIDES INFORMATION ON COMBINING THE ROUTED HYDROGRAPH THRU BAY 5 POD 2 POND, AND THE 100 YEAR 24 HR STORM, POST DEVELOPMENT, FOR THE DRAINAGE AREA OF WINGFIELD LAKE.

HYDROLOGIC REPORT

COMBINED HYDROGRAPHES.
RES. ROUTED BAY5, POD2
AND POST DEV. WINGFIELD

Hyd. No. 12

Hydrograph type = COMBINED
Storm frequency = 100 yr
Inflow hyd no's = 3 & 5

Peak discharge = 254.24 cfs
Time interval = 5 min

HYDROGRAPH DISCHARGE TABLE

TIME hrs	INFLOW cfs	HYDROGRAPHS cfs	OUTFLOW HYDROGRAPH cfs
9.58	0.22	10.07	10.29
9.67	0.25	10.42	10.66
9.75	0.27	10.76	11.03
9.83	0.28	11.10	11.38
9.92	0.28	11.45	11.73
10.00	0.29	11.80	12.09
10.08	0.29	12.18	12.47
10.17	0.30	12.58	12.88
10.25	0.30	13.03	13.33
10.33	0.31	13.51	13.82
10.42	0.33	14.04	14.37
10.50	0.35	14.63	14.98
10.58	0.37	15.26	15.63
10.67	0.39	15.96	16.35
10.75	0.42	16.73	17.15
10.83	0.44	17.58	18.02
10.92	0.47	18.52	18.98
11.00	0.49	19.54	20.03
11.08	0.52	20.61	21.13
11.17	0.58	21.81	22.39
11.25	0.66	23.16	23.82
11.33	0.75	24.69	25.43
11.42	0.84	26.41	27.25
11.50	0.94	28.34	29.28
11.58	1.06	31.03	32.09
11.67	1.17	35.43	36.61
11.75	1.32	42.63	43.95
11.83	1.54	54.83	56.37

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW cfs	HYDROGRAPHS cfs	OUTFLOW HYDROGRAPH cfs
11.92	1.93	75.04	76.96
12.00	2.52	99.47	101.99
12.08	3.28	124.37	127.65
12.17	3.92	149.57	153.49
12.25	4.75	174.89	179.64
12.33	5.30	199.31	204.60
12.42	5.72	221.16	226.87
12.50	6.03	238.56	244.59
12.58	6.26	247.98	254.24
12.67	6.41	244.37	250.78
12.75	6.51	233.67	240.18
12.83	6.56	221.76	228.32
12.92	6.60	208.80	215.40
13.00	6.64	194.95	201.59
13.08	6.66	180.36	187.03
13.17	6.68	165.26	171.94
13.25	6.70	149.82	156.52
13.33	6.72	134.18	140.89
13.42	6.73	118.38	125.11
13.50	6.74	102.48	109.22
13.58	6.75	86.85	93.60
13.67	6.75	72.11	78.86
13.75	6.76	58.95	65.71
13.83	6.76	48.71	55.47
13.92	6.76	43.27	50.03
14.00	6.76	40.41	47.17
14.08	6.76	37.96	44.72
14.17	6.75	35.84	42.60
14.25	6.75	34.03	40.78
14.33	6.75	32.45	39.20
14.42	6.74	31.07	37.81
14.50	6.73	29.83	36.56
14.58	6.73	28.69	35.41
14.67	6.72	27.65	34.37
14.75	6.71	26.72	33.43
14.83	6.70	25.88	32.58
14.92	6.69	25.12	31.81
15.00	6.68	24.43	31.11
15.08	6.67	23.79	30.47
15.17	6.66	23.21	29.87
15.25	6.65	22.67	29.32
15.33	6.64	22.17	28.81
15.42	6.63	21.70	28.33
15.50	6.62	21.26	27.88
15.58	6.61	20.84	27.44
15.67	6.59	20.43	27.03

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW cfs	HYDROGRAPHS cfs	OUTFLOW HYDROGRAPH cfs
15.75	6.58	20.04	26.62
15.83	6.57	19.66	26.23
15.92	6.55	19.28	25.84
16.00	6.54	18.91	25.45
16.08	6.52	18.54	25.06
16.17	6.51	18.17	24.68
16.25	6.49	17.80	24.30
16.33	6.48	17.44	23.92
16.42	6.46	17.10	23.56
16.50	6.45	16.76	23.21
16.58	6.43	16.44	22.87
16.67	6.41	16.14	22.55
16.75	6.40	15.85	22.25
16.83	6.38	15.59	21.97
16.92	6.36	15.34	21.70
17.00	6.35	15.11	21.45
17.08	6.33	14.89	21.22
17.17	6.31	14.69	21.00
17.25	6.30	14.50	20.80
17.33	6.28	14.33	20.60
17.42	6.26	14.16	20.42
17.50	6.24	14.00	20.25
17.58	6.23	13.85	20.08
17.67	6.21	13.71	19.91
17.75	6.19	13.57	19.76
17.83	6.17	13.43	19.60
17.92	6.15	13.30	19.45
18.00	6.13	13.16	19.30
18.08	6.12	13.03	19.14
18.17	6.10	12.89	18.99
18.25	6.08	12.76	18.84
18.33	6.06	12.62	18.68
18.42	6.04	12.49	18.53
18.50	6.02	12.36	18.38
18.58	6.00	12.22	18.22
18.67	5.98	12.09	18.07
18.75	5.96	11.95	17.92
18.83	5.95	11.82	17.76
18.92	5.93	11.68	17.61
19.00	5.91	11.55	17.45
19.08	5.88	11.41	17.30
19.17	5.86	11.28	17.14
19.25	5.84	11.14	16.99
19.33	5.82	11.01	16.83
19.42	5.80	10.87	16.68
19.50	5.78	10.74	16.52

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW cfs	HYDROGRAPHS cfs	OUTFLOW HYDROGRAPH cfs
19.58	5.76	10.60	16.37
19.67	5.74	10.47	16.21
19.75	5.72	10.33	16.05
19.83	5.70	10.20	15.90
19.92	5.68	10.06	15.74
20.00	5.66	9.93	15.59
20.08	5.64	9.79	15.43
20.17	5.61	9.66	15.27
20.25	5.59	9.53	15.12
20.33	5.57	9.40	14.97
20.42	5.55	9.28	14.83
20.50	5.53	9.16	14.69
20.58	5.50	9.05	14.55
20.67	5.48	8.95	14.43
20.75	5.46	8.85	14.31
20.83	5.44	8.77	14.20
20.92	5.42	8.69	14.11
21.00	5.39	8.62	14.01
21.08	5.37	8.56	13.93
21.17	5.35	8.50	13.85
21.25	5.33	8.45	13.78
21.33	5.31	8.40	13.71
21.42	5.28	8.36	13.64
21.50	5.26	8.32	13.58
21.58	5.24	8.29	13.53
21.67	5.22	8.26	13.47
21.75	5.20	8.23	13.42
21.83	5.17	8.20	13.37
21.92	5.15	8.17	13.32
22.00	5.13	8.15	13.28
22.08	5.11	8.12	13.23
22.17	5.09	8.09	13.18
22.25	5.07	8.07	13.13
22.33	5.04	8.04	13.08
22.42	5.02	8.01	13.03
22.50	5.00	7.99	12.99
22.58	4.98	7.96	12.94
22.67	4.96	7.93	12.89
22.75	4.94	7.90	12.84
22.83	4.92	7.88	12.79
22.92	4.89	7.85	12.75
23.00	4.87	7.82	12.70
23.08	4.85	7.80	12.65
23.17	4.83	7.77	12.60
23.25	4.81	7.74	12.55
23.33	4.79	7.72	12.51

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW cfs	HYDROGRAPHS cfs	OUTFLOW HYDROGRAPH cfs
23.42	4.77	7.69	12.46
23.50	4.75	7.66	12.41
23.58	4.73	7.64	12.36
23.67	4.71	7.61	12.32
23.75	4.69	7.58	12.27
23.83	4.67	7.56	12.22
23.92	4.65	7.53	12.18
24.00	4.61	7.50	12.11
24.08	4.57	7.41	11.98
24.17	4.53	7.25	11.78
24.25	4.49	7.02	11.51
24.33	4.45	6.73	11.18
24.42	4.40	6.37	10.77
24.50	4.35	5.95	10.30

THIS FINAL HYDROGRAPH IS THE RESULT OF ROUTING THE COMBINED HYDROGRAPH THRU THE RESERVOIR OF WINGFIELD LAKE.

HYDROLOGIC REPORT

STAGE / STORAGE / DISCHARGE

RESERVOIR NUMBER = 2

RESERVOIR NAME = WINGFIELD LA (* Controlled by Culv Structure A)
STORAGE VALUES WERE INPUT MANUALLY

DISCHARGE VALUES: CULVERT STRUCT A. Q = .6 *A*[2gh/k]^.5 * 1
* CULVERT STRUCT B. Q = .6 *A*[2gh/k]^.5 * 1
* WEIR STRUCT A. Q = 2.63 * 12.567 * H ^ 1.5
WEIR STRUCT B. Q = 2.63 * 24 * H ^ 1.5

ELEVATION	DISCHARGE (cfs)			
	CULVERT A	CULVERT B	WEIR A	WEIR B
17.76	30.98	0.00	0.00	0.00
18.00	31.26	0.00	0.00	0.00
19.00	32.40	0.00	21.47	0.00
20.00	33.49	0.00	76.51	0.00
21.00	34.56	0.00	150.73	0.00
22.00	35.59	0.00	240.01	45.16
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00

STAGE	ELEVATION	INC STOR cu ft	TOT STOR cu ft	OUTFLOW cfs
0.00	17.76	0	0	0.00
0.24	18.00	65508	65508	0.00
1.24	19.00	302952	368460	21.47
2.24	20.00	352614	721074	33.49
3.24	21.00	401636	1122710	34.56
4.24	22.00	462152	1584862	80.76
0.00	0.00	0	0	0.00
0.00	0.00	0	0	0.00
0.00	0.00	0	0	0.00
0.00	0.00	0	0	0.00
0.00	0.00	0	0	0.00

Reservoir No. 2 WINGFIELD OUTLET STRUCTURES

```
VERT STRUC   A. Q=CoA[2gh/k]^.5      CULVERT STRUC   B. Q=CoA[2gh/k]^.5

1. WIDTH  (in)     = 18.              9. WIDTH  (in)     = 6..
2. HEIGHT (in)     = 18.             10. HEIGHT (in)     = 6..
3. No. BARRELS     = 1..             11. No. BARRELS     = 1..
4. INVERT ELEV.    = 3.75.....       12. INVERT ELEV.    = 17.76....
5. Co = 0.60                         13. Co = 0.60
6. CULVERT LENGTH (ft) = 108.        14. CULVERT LENGTH (ft) = .5..
7. CULVERT SLOPE (%)   = .93.        15. CULVERT SLOPE (%)   = 0...
8. MANNING'S N-VALUE   = .013        16. MANNING'S N-VALUE   = .013
                                     17. MULTI-STAGE OPTION ? (Y/N) Y

WEIR STRUCTURE A.        Q=CwLH^EXP  WEIR STRUCTURE B.       Q=CwLH^EXP

18. CREST LENGTH (ft)   = 12.567.    23. CREST LENGTH (ft)   = 24.....
19. CREST ELEVATION     = 18.25..    24. CREST ELEVATION     = 21.2...
20. Cw = 2.63                        25. Cw = 2.63
21. EXP = 1.50                       26. EXP = 1.50
22. MULTI-STAGE OPTION ? (Y/N) Y     27. MULTI-STAGE OPTION ? (Y/N) N
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OUTLET

WATER QUALITY

PRINCIPAL SPILLWAY

EMERGENCY SPILLWAY

Change item number: 0 DY to cont

HYDROLOGIC REPORT

COMBINED HYDROGRAPH...
THROUGH.....
WINGFIELD LAKE.....

Hyd. No. 13

Hydrograph type = RESERVOIR ROUTE Peak discharge = 34.75 cfs
Storm frequency = 100 yr Time interval = 5 min
Inflow hyd. no. = 12 Reservoir no. = 2

HYDROGRAPH DISCHARGE TABLE

TIME hrs	INFLOW (i) cfs	INFLOW (j) cfs	2S/dt-O (i) cfs	2S/dt+O (j) cfs	OUTFLOW cfs
11.00	20.03	21.13	962.03	962.48	0.22
11.08	21.13	22.39	1002.61	1003.20	0.30
11.17	22.39	23.82	1045.35	1046.13	0.39
11.25	23.82	25.43	1090.08	1091.56	0.74
11.33	25.43	27.25	1137.12	1139.33	1.10
11.42	27.25	29.28	1186.83	1189.80	1.49
11.50	29.28	32.09	1239.57	1243.36	1.90
11.58	32.09	36.61	1295.92	1300.94	2.51
11.67	36.61	43.95	1358.22	1364.62	3.20
11.75	43.95	56.37	1430.77	1438.78	4.00
11.83	56.37	76.96	1520.70	1531.10	5.20
11.92	76.96	101.99	1640.39	1654.04	6.83
12.00	101.99	127.65	1800.64	1819.34	9.35
12.08	127.65	153.49	2004.53	2030.28	12.87
12.17	153.49	179.64	2250.47	2285.67	17.60
12.25	179.64	204.60	2536.75	2583.60	23.42
12.33	204.60	226.87	2861.21	2921.00	29.89
12.42	226.87	244.59	3227.14	3292.69	32.78
12.50	244.59	254.24	3632.67	3698.60	32.97
12.58	254.24	250.78	4065.16	4131.50	33.17
12.67	250.78	240.18	4503.44	4570.18	33.37
12.75	240.18	228.32	4927.29	4994.40	33.56
12.83	228.32	215.40	5328.35	5395.79	33.72
12.92	215.40	201.59	5704.33	5772.07	33.87
13.00	201.59	187.03	6053.30	6121.32	34.01

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW (i) cfs	INFLOW (j) cfs	2S/dt-O (i) cfs	2S/dt+O (j) cfs	OUTFLOW cfs
13.08	187.03	171.94	6373.65	6441.92	34.13
13.17	171.94	156.52	6664.12	6732.61	34.25
13.25	156.52	140.89	6923.88	6992.58	34.35
13.33	140.89	125.11	7152.41	7221.29	34.44
13.42	125.11	109.22	7349.37	7418.41	34.52
13.50	109.22	93.60	7514.53	7583.69	34.58
13.58	93.60	78.86	7648.09	7717.34	34.63
13.67	78.86	65.71	7751.22	7820.55	34.66
13.75	65.71	55.47	7826.42	7895.80	34.69
13.83	55.47	50.03	7878.19	7947.60	34.70
13.92	50.03	47.17	7914.26	7983.69	34.72
14.00	47.17	44.72	7942.01	8011.46	34.73
14.08	44.72	42.60	7964.43	8033.90	34.73
14.17	42.60	40.78	7982.27	8051.75	34.74
14.25	40.78	39.20	7996.16	8065.65	34.74
14.33	39.20	37.81	8006.64	8076.14	34.75
14.42	37.81	36.56	8014.15	8083.65	34.75
14.50	36.56	35.41	8019.02	8088.52	34.75
14.58	35.41	34.37	8021.49	8090.99	34.75
14.67	34.37	33.43	8021.77	8091.27	34.75
14.75	33.43	32.58	8020.06	8089.57	34.75
14.83	32.58	31.81	8016.58	8086.08	34.75
14.92	31.81	31.11	8011.47	8080.97	34.75
15.00	31.11	30.47	8004.90	8074.40	34.75
15.08	30.47	29.87	7996.99	8066.48	34.74
15.17	29.87	29.32	7987.85	8057.33	34.74
15.25	29.32	28.81	7977.57	8047.05	34.74
15.33	28.81	28.33	7966.24	8035.70	34.73
15.42	28.33	27.88	7953.92	8023.38	34.73
15.50	27.88	27.44	7940.68	8010.13	34.72
15.58	27.44	27.03	7926.56	7996.00	34.72
15.67	27.03	26.62	7911.60	7981.03	34.71
15.75	26.62	26.23	7895.82	7965.24	34.71
15.83	26.23	25.84	7879.27	7948.67	34.70
15.92	25.84	25.45	7861.93	7931.33	34.70
16.00	25.45	25.06	7843.84	7913.22	34.69
16.08	25.06	24.68	7824.98	7894.35	34.69
16.17	24.68	24.30	7805.36	7874.71	34.68
16.25	24.30	23.92	7784.98	7854.33	34.67
16.33	23.92	23.56	7763.87	7833.20	34.66
16.42	23.56	23.21	7742.04	7811.35	34.66
16.50	23.21	22.87	7719.51	7788.81	34.65

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW (i) cfs	INFLOW (j) cfs	2S/dt-O (i) cfs	2S/dt+O (j) cfs	OUTFLOW cfs
16.58	22.87	22.55	7696.30	7765.58	34.64
16.67	22.55	22.25	7672.45	7741.72	34.63
16.75	22.25	21.97	7648.00	7717.25	34.63
16.83	21.97	21.70	7622.98	7692.21	34.62
16.92	21.70	21.45	7597.43	7666.64	34.61
17.00	21.45	21.22	7571.38	7640.58	34.60
17.08	21.22	21.00	7544.88	7614.06	34.59
17.17	21.00	20.80	7517.94	7587.10	34.58
17.25	20.80	20.60	7490.60	7559.74	34.57
17.33	20.60	20.42	7462.88	7532.00	34.56
17.42	20.42	20.25	7434.80	7503.90	34.55
17.50	20.25	20.08	7406.38	7475.46	34.54
17.58	20.08	19.91	7377.64	7446.70	34.53
17.67	19.91	19.76	7348.60	7417.63	34.52
17.75	19.76	19.60	7319.25	7388.27	34.51
17.83	19.60	19.45	7289.62	7358.61	34.50
17.92	19.45	19.30	7259.70	7328.67	34.48
18.00	19.30	19.14	7229.50	7298.44	34.47
18.08	19.14	18.99	7199.02	7267.94	34.46
18.17	18.99	18.84	7168.25	7237.15	34.45
18.25	18.84	18.68	7137.21	7206.08	34.44
18.33	18.68	18.53	7105.89	7174.73	34.42
18.42	18.53	18.38	7074.28	7143.10	34.41
18.50	18.38	18.22	7042.39	7111.19	34.40
18.58	18.22	18.07	7010.22	7078.99	34.39
18.67	18.07	17.92	6977.77	7046.52	34.37
18.75	17.92	17.76	6945.04	7013.76	34.36
18.83	17.76	17.61	6912.02	6980.72	34.35
18.92	17.61	17.45	6878.73	6947.40	34.33
19.00	17.45	17.30	6845.15	6913.79	34.32
19.08	17.30	17.14	6811.28	6879.90	34.31
19.17	17.14	16.99	6777.14	6845.73	34.29
19.25	16.99	16.83	6742.71	6811.27	34.28
19.33	16.83	16.68	6708.00	6776.53	34.27
19.42	16.68	16.52	6673.00	6741.50	34.25
19.50	16.52	16.37	6637.72	6706.20	34.24
19.58	16.37	16.21	6602.16	6670.61	34.23
19.67	16.21	16.05	6566.31	6634.73	34.21
19.75	16.05	15.90	6530.18	6598.58	34.20
19.83	15.90	15.74	6493.77	6562.14	34.18
19.92	15.74	15.59	6457.08	6525.41	34.17
20.00	15.59	15.43	6420.10	6488.41	34.15

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW (i) cfs	INFLOW (j) cfs	2S/dt-O (i) cfs	2S/dt+O (j) cfs	OUTFLOW cfs
20.08	15.43	15.27	6382.84	6451.12	34.14
20.17	15.27	15.12	6345.30	6413.54	34.12
20.25	15.12	14.97	6307.48	6375.69	34.11
20.33	14.97	14.83	6269.38	6337.57	34.09
20.42	14.83	14.69	6231.02	6299.18	34.08
20.50	14.69	14.55	6192.41	6260.54	34.06
20.58	14.55	14.43	6153.56	6221.65	34.05
20.67	14.43	14.31	6114.48	6182.54	34.03
20.75	14.31	14.20	6075.19	6143.22	34.02
20.83	14.20	14.11	6035.70	6103.70	34.00
20.92	14.11	14.01	5996.04	6064.01	33.98
21.00	14.01	13.93	5956.22	6024.16	33.97
21.08	13.93	13.85	5916.26	5984.17	33.95
21.17	13.85	13.78	5876.16	5944.04	33.94
21.25	13.78	13.71	5835.95	5903.79	33.92
21.33	13.71	13.64	5795.63	5863.44	33.90
21.42	13.64	13.58	5755.20	5822.98	33.89
21.50	13.58	13.53	5714.69	5782.43	33.87
21.58	13.53	13.47	5674.09	5741.80	33.86
21.67	13.47	13.42	5633.41	5701.09	33.84
21.75	13.42	13.37	5592.66	5660.31	33.82
21.83	13.37	13.32	5551.84	5619.45	33.81
21.92	13.32	13.28	5510.95	5578.54	33.79
22.00	13.28	13.23	5470.00	5537.55	33.77
22.08	13.23	13.18	5428.99	5496.51	33.76
22.17	13.18	13.13	5387.91	5455.40	33.74
22.25	13.13	13.08	5346.77	5414.22	33.73
22.33	13.08	13.03	5305.57	5372.99	33.71
22.42	13.03	12.99	5264.30	5331.68	33.69
22.50	12.99	12.94	5222.97	5290.32	33.68
22.58	12.94	12.89	5181.58	5248.89	33.66
22.67	12.89	12.84	5140.12	5207.40	33.64
22.75	12.84	12.79	5098.60	5165.85	33.63
22.83	12.79	12.75	5057.02	5124.24	33.61
22.92	12.75	12.70	5015.37	5082.56	33.59
23.00	12.70	12.65	4973.66	5040.82	33.58
23.08	12.65	12.60	4931.90	4999.01	33.56
23.17	12.60	12.55	4890.06	4957.15	33.54
23.25	12.55	12.51	4848.17	4915.22	33.52
23.33	12.51	12.46	4806.22	4873.23	33.51
23.42	12.46	12.41	4764.20	4831.18	33.49
23.50	12.41	12.36	4722.13	4789.07	33.47

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW (i) cfs	INFLOW (j) cfs	2S/dt-O (i) cfs	2S/dt+O (j) cfs	OUTFLOW cfs
23.58	12.36	12.32	4680.00	4746.91	33.45
23.67	12.32	12.27	4637.82	4704.69	33.43
23.75	12.27	12.22	4595.58	4662.41	33.41
23.83	12.22	12.18	4553.29	4620.08	33.39
23.92	12.18	12.11	4510.94	4577.69	33.37
24.00	12.11	11.98	4468.52	4535.23	33.35
24.08	11.98	11.78	4425.94	4492.61	33.33
24.17	11.78	11.51	4383.07	4449.70	33.31
24.25	11.51	11.18	4339.77	4406.36	33.29
24.33	11.18	10.77	4295.91	4362.46	33.27
24.42	10.77	10.30	4251.35	4317.86	33.25
24.50	10.30	9.76	4205.96	4272.42	33.23
24.58	9.76	9.15	4159.59	4226.02	33.21
24.67	9.15	8.48	4112.13	4178.51	33.19
24.75	8.48	7.85	4063.43	4129.76	33.17
24.83	7.85	7.27	4013.48	4079.76	33.14
24.92	7.27	6.72	3962.36	4028.60	33.12
25.00	6.72	6.24	3910.16	3976.35	33.10
25.08	6.24	5.82	3856.98	3923.12	33.07
25.17	5.82	5.44	3802.94	3869.03	33.05
25.25	5.44	5.10	3748.15	3814.19	33.02
25.33	5.10	4.80	3692.70	3758.68	32.99
25.42	4.80	4.54	3636.65	3702.59	32.97
25.50	4.54	4.32	3580.10	3645.99	32.94
25.58	4.32	4.15	3523.14	3588.97	32.91
25.67	4.15	4.01	3465.83	3531.60	32.89
25.75	4.01	3.92	3408.26	3473.99	32.86
25.83	3.92	3.86	3350.52	3416.19	32.83
25.92	3.86	3.85	3292.69	3358.30	32.81
26.00	3.85	3.83	3234.84	3300.40	32.78
26.08	3.83	3.81	3177.02	3242.52	32.75
26.17	3.81	3.78	3119.38	3184.66	32.64
26.25	3.78	3.75	3062.71	3126.96	32.13
26.33	3.75	3.72	3007.01	3070.24	31.62
26.42	3.72	3.69	2952.24	3014.48	31.12
26.50	3.69	3.66	2898.40	2959.65	30.63
26.58	3.66	3.64	2846.57	2905.76	29.60
26.67	3.64	3.61	2796.71	2853.87	28.58
26.75	3.61	3.58	2748.76	2803.95	27.60
26.83	3.58	3.55	2702.63	2755.94	26.66
26.92	3.55	3.52	2658.24	2709.76	25.76
27.00	3.52	3.50	2615.44	2665.32	24.94

HYDROGRAPH DISCHARGE TABLE Cont'd

TIME hrs	INFLOW (i) cfs	INFLOW (j) cfs	2S/dt-O (i) cfs	2S/dt+O (j) cfs	OUTFLOW cfs
27.08	3.50	3.47	2574.18	2622.47	24.14
27.17	3.47	3.44	2534.39	2581.15	23.38
27.25	3.44	3.41	2496.02	2541.30	22.64
27.33	3.41	3.38	2459.01	2502.88	21.93
27.42	3.38	3.35	2423.36	2465.81	21.22
27.50	3.35	3.32	2389.07	2430.08	20.51

Maximum outflow (cfs) = 34.75
Maximum storage (cu ft) = 1208478
Maximum elevation (ft) = 21.19
17.76
3.43

GOVERNOR'S LAND
BAY 5, POD 2, POND A

SUMMARY

THE POST DEVELOPMENT RUNOFF OF BAY 5, POD 2 POND A DOES NOT SIGNIFICANTLY INCREASE THE 100 YEAR STORM ELEVATION OF WINGFIELD LAKE

WINGFIELD LAKE STATISTICS

	CURRENT	PROPOSED
PEAK RELEASE RATE	~33.2 CFS	34.75 CFS
100 YEAR STORM EL	~21.2	21.2

THE PEAK RELEASE RATE PROPOSED REMAINS LESS THAN THE 2 YEAR PRE-DEVELOPMENT PEAK RUNOFF RATE OF 35.2 CFS.

ADDITIONAL INFORMATION:

25 YEAR ~~FLOOD~~ STORM ROUTING THROUGH BAY 5, POD 2 POND

MAX. EL. = 19.3

MAX STORAGE = 230298 CF

Q_p = 5.6 CFS

Bennetts Pond
JR 021

REPORT OF

SUBSURFACE EXPLORATION
AND GEOTECHNICAL ENGINEERING ANALYSIS

DAMS BAY 5 - POD 2 SUBDIVISION

FOR

GOVERNOR'S LAND MANAGEMENT COMPANY

APRIL 9, 1993

ENGINEERING CONSULTING SERVICES, LTD.
Geotechnical • Construction Materials • Environmental

April 9, 1993

Mr. Jim Bennett, P.E.
Governor's Land Management Company
2700 Two Rivers Road
Williamsburg, Virginia 23185

ECS Project No. R1280

Reference: Report of Subsurface Exploration and Geotechnical Analysis, Dams Bay 5 - Pod 2 Subdivision
Governor's Land, James City County, Virginia

Dear Mr. Bennett:

Submitted herewith is our report of Geotechnical Exploration for the above referenced project. This study was performed in general accordance with our proposal R386-P.

This report contains our recommendations regarding geotechnical related design and construction issues for the proposed dams. These findings are expected to aid in the design and construction of earthen embankments and water retention structures for the two proposed ponds.

We have appreciated the opportunity to be of service to you in the design phases of this project and trust you will call on us if we can be of further assistance.

Respectfully,

ENGINEERING CONSULTING SERVICES, LTD.

David E. Stinnette
Project Engineer

Roland E. Dubbé, P.E.
Vice President
Norfolk Branch Manager

COMMONWEALTH OF VIRGINIA
ROLAND E. DUBBÉ
No. 8825
PROFESSIONAL ENGINEER

DES/MAP/R1280RPT.

copies: (3) Governor's Land Management Company
(1) AES Consulting Engineers (Attn. Marc Bennett)

341 Cleveland Place, Suite 105 • Virginia Beach, VA 23462 • (804) 499-9100 • Fax (804) 499-2404

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PROJECT OVERVIEW

Executive Summary

Engineering Consulting Services, Ltd. has compiled a Geotechnical study for the proposed Ponds A and B at the Governor's Land Bay 5 - Pod 2 subdivision located in James City County, Virginia. This investigation was accomplished by performing a total of three borings at each of the two pond sites to ascertain proposed dam foundation bearing quality of the in-situ soils and nature of excavated soils for use in dam construction.

The results of the soil test borings indicate the subsurface soils consist of interbedded deposits of Clayey and granular soils . As Pond B will be created by excavation of the lake below existing grades and groundwater is located about 7 to 10 feet below the existing surface (elevation 29.00 +/-), construction of the impoundment will not require critical embankment designs. At the site of Pond A, soils of relatively low permeability are located within a depth of about 5 to 6 feet from the ravine bottom (elevation 5.00 +/-). It is expected that the excavation for the proposed impoundment structure will include a "key" excavation. It is also expected that this "key" excavation will extend into the soil layer exhibiting relatively low permeabilities. It is, therefore, our opinion that seepage losses beneath the dam will be minimal.

Groundwater was encountered at the Pond A site in the bottom of the impoundment ravine. Therefore, dewatering and diverting of water will be of concern during construction. Furthermore, the presence of about 3 to 4 feet of heavy organics and alluvial sediments within the embankment bearing soils will require substantial undercutting from below the embankment.

Scope of Work

The conclusions and recommendations contained in this report are based upon a total of six borings (B-1 through B-6) drilled to depths of 15 to 25 feet below the existing grades, a site reconnaissance performed by the Geotechnical Engineer, laboratory test results of boring and bulk samples, and site plans indicating impoundment boundaries and dam profiles. The proposed field sampling locations were selected by the project Geotechnical Engineer.

The recommendations contained herein were developed from the data obtained in the soil test borings which indicate subsurface conditions at these specific locations at the time of the exploration. Soil conditions may vary between the borings. If during the course of construction variations appear evident, the Geotechnical Engineer should be informed so that the conditions can be addressed.

Purposes of Exploration

The purposes of this exploration were to explore the soil and groundwater conditions at the sites and to develop engineering recommendations to guide design and construction procedures. We accomplished these purposes by drilling borings to explore the subsurface soil and groundwater conditions, performing a field reconnaissance, and performing laboratory tests on selected representative soil samples from the borings to evaluate pertinent engineering properties, and analyzing the field and laboratory test results to develop appropriate engineering recommendations.

Project Characteristics

The Governor's Land Development is located along the south side of John Tyler Highway (Virginia State Route 5) just to the immediate north of the James River in James City County, Virginia. As part of the Bay 5 - Pod 2 Development, two ponds are to be constructed. Pond B, the southernmost impoundment, is to be constructed by excavation of the lake bottom below the water table in that location. No earthen dam

construction is planned at this location. Pond A, the easternmost impoundment will be constructed as an above grade, earthen impoundment structure which will block the water course of a shallow, slow flowing tributary of and surface runoff within the deep ravine in this area. The Pond A dam will have a crest elevation at 22 feet, about 17 feet above its ravine bottom. The earthen structure for Pond A will be constructed with a crest width of 15 feet and side slopes of 3 horizontal to 1 vertical. The Pond B impoundment will be excavated from existing ground elevation of about 29.00 to an elevation of about 18.00.

Normal pool elevations for Pond A will be approximately 10 to 12 feet above existing ground surface in the bottom of the ravine and normal pool elevation for Pond B will be approximately 4 feet below existing ground. The principal spillway structure for each pond will consist of an upright ACM pipe discharging to a horizontal ACM pipe which passes through the dam to discharge into the stilling basin at the dam's toe. The pipes will be provided with the appropriate anti-seep collars.

As noted on the plans provided to our office, it is expected that adjacent spillways will be provided to handle emergency flows of water.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

The soil borings were performed with an all terrain vehicle drilling rig which utilized continuous flight, hollow stem augers to advance the boreholes. Drilling fluid was not used in this process.

Three soil borings were performed at each pond site. At Pond A one boring was performed in the impoundment area, one on the dam shoulder at approximately crest height and one within the ravine bottom. At Pond B one boring was performed at the area of the principal spillway and two were performed within the impoundment area.

Representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2-inch O.D., split-barrel sampler is driven into the soil a distance of 18 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through a 12-inch interval is termed the Standard Penetration Test (SPT) value and is indicated for each sample on the boring logs. This value can be used as a qualitative indication of the in-place relative density of noncohesive soils. In a less reliable way, it also indicates the consistency of cohesive soils. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

After recovery, each sample was removed from the sampler and visually classified. A field log of the soils encountered in the borings was maintained by the drill crew. Representative portions of each sample were then sealed in glass jars and transported to our laboratory in Richmond, Virginia for further visual examination and laboratory testing.

Laboratory Testing Program

In the ECS testing program, representative soil samples were selected and tested in our laboratory to check the field classification and to determine pertinent engineering properties. The laboratory testing program included visual sample classifications, Atterberg Limits, and moisture content testing. All data obtained from the laboratory tests are included on the respective boring logs or on separate sheets in the text of this report.

For the ECS borings, an experienced Geotechnical Engineer classified each soil sample on the basis of texture and plasticity in accordance with the Unified Soil Classification System (ASTM D-2488 Description and Identification of Soils/Visual-Manual Procedures). The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the Unified System is included in the Appendix of this report. The Geotechnical Engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines indicating the interfaces between strata on the boring logs and profiles are approximate; in situ, the transitions may be gradual.

The soil samples will be retained in our laboratory for a period of 60 days, after which they will be discarded unless other instructions are received as to their disposition.

EXPLORATION RESULTS

Site Conditions

The Governor's Land development is situated on the south side of John Tyler Highway (Virginia State Route 5) and along the north bank of the James River in James City County, Virginia. The Bay 5 - Pod 2 subdivision development is situated near the easternmost section of Governor's Land. Most of the development area is heavily wooded with vegetation conditions typical of the growth within the impoundment and dam sites.

The site of Pond B is relatively flat with gentle to moderate slopes originating on the southernmost end and opening out to the James River. The location of Pond A contains steep ravine slopes with grades on the order of 15 to 20%. The ravine bottom is flat and about 20 feet across and is filled with organic and alluvial sediments. This ravine contained a shallow slow flowing creek and the surficial soils were soft and wet. Both pond locations are vegetated with underbrush and older growth hardwoods.

Geology

The project site is located in the Coastal Plain Physiographic Province. The Coastal Plain is typified by bands of sediments deposited during successive periods of advancing and receding shore lines and which generally dip downward towards the coast. Locally, the geologic profile has been affected by movements of the James and Chickahominy Rivers and their tributaries. During the Wisconsinan Stage, sea level fell some 300 feet below its current levels and these two rivers cut deeply into the local surficial geologic formations, most notably the Tabb, Windsor, and Yorktown formations. The tributaries of the Chesapeake Bay were inundated by the melting of the Wisconsinan glaciers and the James and Chickahominy changed from fluvial to esturine, tidal systems. As a result, the extensive tidal marshes and flats became prominent in the project area. All three dam sites are located at elevations just above the tidal system.

Soil Conditions

The soils encountered to depths of 25 feet within the Pond B impoundment (Borings B-1, B-2, B-3) generally consisted of interbedded layers of Silty CLAY (CL-CH) and Silty to Clayey SANDS (SM-SC). The Standard Penetration Test (SPT) results indicated these layers are generally of loose density and soft to stiff consistency.

The soils encountered to depths of 25 feet within the Pond A impoundment area (Borings B-4, B-5, B-6) generally consisted of erratic deposits of Clayey SILT (ML), Silty CLAY (CL) and fine to medium SANDS (SP-SM). The soils explored within the ravine bottom (B-5) primarily consisted of alluvial sediments containing trace to heavy organic concentrations to depths of about 5 to 6 feet. These soil deposits were typically of loose to medium density and very soft to medium stiff consistency.

Additional details concerning the subsurface soils and conditions encountered can be obtained from the test boring logs and laboratory test data sheets included in the Appendix of this report.

Groundwater Observations

At the Pond A site a free water surface (stream) was encountered in the bottom of the ravine at an elevation of about 4.0 feet. The borings performed in the Pond A impoundment area and dam shoulder indicated that groundwater is generally situated at elevations of about 9.00 to 14.00 feet. Considering the erratic nature of the subsurface soil deposits it is likely that groundwater perched above the ravine bottom elevation by impervious layers will be encountered. At the Pond B site, groundwater was encountered at depths of about elevation 18.00 to 22.00 feet, generally 7 to 11 feet below existing surface grade.

ANALYSIS AND RECOMMENDATIONS

Discussion

Pond A is to be created by construction of an earthen impoundment structure across the existing ravine. This dam will employ a core and cut-off trench or "key". The core and "key" will be constructed by the placement and compaction of a relatively impervious cohesive soil. We recommend the "key" of the Pond A dam be extended to a depth of at least 5 feet below the bottom of the existing ravine. In accomplishing this excavation it is expected that the existing loose organic sediments and more porous granular soils will be removed. Permeable Sands, if encountered, may remain in place below the bottom of key elevation. We do not anticipate that seepage losses through the existing natural soils will be excessive.

Pond B is to be constructed by excavating the impoundment area below the noted groundwater elevations. Original in-situ material will remain in place along the southern face of the pond to maintain proposed water elevations.

Dam Embankment and Core

It is recommended that the proposed structure for Pond A be constructed as an earthen embankment. As proposed, side slopes of 1 vertical to 3 horizontal can be employed with adequate protection against slope failure or excessive erosion. These slopes are considered stable for earthen dams on a stable foundation based on the U.S. Bureau of Reclamation criteria provided in Design of Small Dams. The proposed crest width of 15 feet is considered adequate.

Embankment cover fill or backfill beyond the core and key sections can consist of on site borrow which is free of organics. This material should be a soil classified as fine SAND (SM or SC) with a minimum 10% finer than the No. 200 Sieve. We anticipate

that this material will be readily available from the excavation for the Pond B impoundment.

In order to reduce seepage losses through and below the Pond A dam, we recommend a Clay core with a cut-off trench or key be employed in the design. Standard dimensioning criteria can be employed in the design of the core. We do recommend however that the key have a minimum width of 6 feet and that its base be located at least 5 feet below the bottom of the existing ravine. The key should be aligned along the longitudinal axis of the embankment and should extend up the sides of the ravine to an elevation approximately 1/3 the height of the embankment. The required depth of the key in the ravine slopes may be extended in the field based on recommendations by the Geotechnical Engineer if highly permeable soil strata are encountered.

We do not expect that seepage losses through the natural soils left below the 5 foot key penetration will be excessive. In order to estimate seepage losses, embankment cover material permeability can be estimated as 10^{-2} cm/sec. Core and key permeability can be taken as 10^{-5} cm/sec. Referencing the boring logs included in the Appendix, soils classified as CL and CH can be assumed to have a permeability of 10^{-5} cm/sec. All other granular soils indicated by the boring logs can be assumed to possess a permeability of 10^{-2} cm/sec to 10^{-3} cm/sec.

Soil fill to be used in embankment construction for the two sites can consist of borrow material taken from the impoundments. Based on the test borings performed within the proposed impoundments, these soils will consist of Clayey and Silty, to relatively clean, fine SANDS (SM, SP). Soil used in core and key construction should consist of a non-expansive Clay material having a permeability of 10^{-5} cm/sec or less and a maximum Liquid Limit of 60 and Plasticity Index of 30. Material suitable for use in embankment and core construction was encountered at varying depths in the borings and does appear to be present on site in sufficient quantity at convenient depths. Due to the erratic and interbedded nature of the subsurface granular and cohesive soil deposits within the impoundments, care will be required during excavation to minimize contamination of the suitable embankment fill from cohesive soil blending.

Groundwater and Seepage Control

In order to control seepage in the downhill toe of the Pond A dam, it is recommended that a drainage blanket be employed at embankment subgrade elevations; that is, an elevation consistent with the ground surface elevation just beyond the embankment toe. This blanket should extend into the dam from the toe a distance equal to about 20% of the embankment width at its base. The drainage blanket should extend up the shoulders of the ravine a vertical distance of at least 3 feet. Seepage into this drainage blanket should be collected in a toe drain aligned parallel to the downstream toe of the embankment with discharge through a perpendicular drain into the spillway stilling basin. The drainage blanket should consist of a 12 inch thick layer of coarse graded aggregate such as VDOT size No.57 stone wrapped in a medium duty, non-woven Geotextile filter fabric. The toe drain pipe should consist of a 6 inch slotted polyethylene tubing which satisfies the requirements of ASTM F-405.

In order to minimize piping and erosion due to seepage along the spillway conduit, it is recommended that seepage collars be spaced at intervals along that pipe upstream of the drainage blanket. The pipe should be designed to rest directly on the drainage blanket in that portion of the embankment where the drainage blanket is employed.

Dewatering during construction will be difficult, particularly if work is performed in other than the drier summer months. Surface grade stream flows are relatively low and temporary retention of surficial flows might be attained by temporary berms and dams upstream of the work area. It is anticipated that staged excavation supported by dewatering pumps of substantial capacity will be required to accomplish the key excavation.

Principal Spillway Pipe and Headwall Foundations

It is anticipated that foundations for the pond structures will bear directly in the compacted fill of the embankment and base or in original soils. In this regard, a bearing capacity for these structures foundations of 1500 lbs/sq ft should be suitable. The presence of water in these soils during construction, however, could result in their

disturbance and deterioration. We would recommend, therefore, that the foundations be provided with at least a 12 inch layer of crusher run placed and compacted under dry conditions to establish a working base. As an alternate, a lean concrete could be used below the foundations and spillway conduit to serve as a working mat. In order to minimize instability of foundation structures under wet, possibly hydrostatic conditions, foundations should be provided with a minimum width of 3 feet.

In order to minimize erosion due to seepage around the horizontal spillway conduit, the conduit should be placed directly over the drainage blanket in the downstream portion of the dam.

Settlements of structures bearing within the embankment fills and original ground will vary. We estimate that total settlements of structures located adjacent to the Pond B embankment will be minor considering that substantial existing material will be cut. Due to the presence of soft Clays and organic Silts in the subsurface profile of the Pond A dam, total settlement of the embankment could approach one foot. These settlements will occur primarily over the ravine bottom where the compressible layers of Silt and Clay exist. Settlements would diminish both upstream and downstream and toward the shoulders of the dam. If this potential settlement is considered excessive for structures which will be supported by the embankment fills, these structures should be located towards the shoulders of the dam where the presence of preconsolidated granular soils will result in substantially smaller total settlement.

Foundation Preparation

The presence of soft organic sediments and loose alluvium in the bottom of the ravine at the Pond A embankment site requires that careful subgrade preparation procedures be followed. The results of boring B-5 indicated that the ravine bottom generally contains about 5 to 6 feet of organic sediments which should be completely removed from below the embankment fills. As the embankment locations consist of relatively narrow ravines, the width of these undercuts will be relatively small. However, the undercuts will likely extend the full cross sectional length of the embankments along the axis of the existing streams. Backfilling of undercut foundation material can be

performed using embankment fill. Along the ravine shoulders, suitable soils are generally expected to be encountered at nominal stripping depths.

Erosion Control and Maintenance

Dam embankments should be protected from erosion due to wave action and surface runoff. While design of such protection is beyond the scope of this study, we would recommend that upstream erosion control consist of concrete members or rip rap placed over filter fabric. This protection should extend to an elevation just above the 100 year flood elevation. On the downstream side, slope protection could probably best be attained by seeding with heavy grass. Trees should not be planted on dam embankments.

Routine maintenance should be provided for the dams. This should include annual inspections for removal of bushes and trees, filling of animal burrows, inspection for surface erosion or vertical cracks in the embankment, etc. The toe drain and stilling basin should be inspected for erosion and loss of rip rap, seepage beyond the toe drain, or increased flow or movement of fines through the drains.

Construction Control

The excavations for the key trench and structures should be observed by the Soils Engineer prior to placement of core fill or structure concrete. Where unstable material or conditions are encountered, they should be treated at his direction. We would recommend that a representative of the Soils Engineer be on site full time during the earthwork phases such that the necessary tests and inspections can be performed in an expeditious manner.

All fill should be placed and compacted to a dry density of at least 95% of that soil's Standard Proctor maximum dry density (ASTM D698). The compaction should be accomplished by placing the fill in 6 to 10 inch loose lifts and mechanically compacting each lift to the required density prior to placement of subsequent lifts. At least a 5 ton

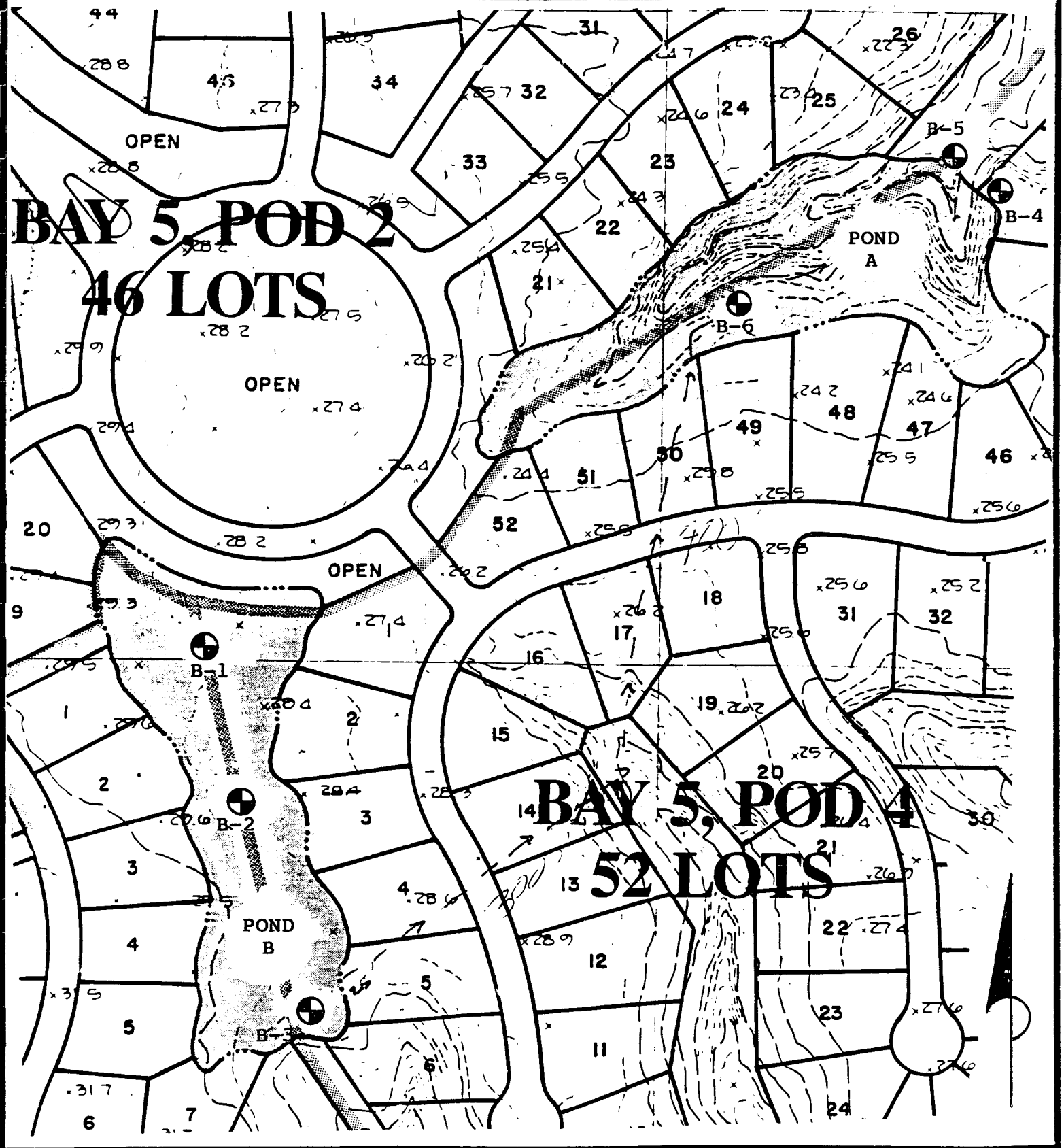
sheepsfoot roller should be employed to attain compaction of the cohesive soils used in core and key construction. Hand operated equipment should be employed around and immediately above pipes and foundations. Soils should be compacted at moisture contents within 3% above and 1% below optimum moisture content for the material used. We recommend field density tests be performed at a rate of at least one test per 5000 square feet per lift during construction.

The surface of each compacted lift should be scarified by backdragging to a depth of 2 inches prior to placement of the next lift, this to prevent development of horizontal seepage planes. Embankment fill should be placed in horizontal lifts on slopes no steeper than 1 vertical to 4 horizontal. Where greater slopes exist, they should be benched to receive fill. Bench heights should be limited to 4 feet. The natural shoulders of the ravines should be cleared of all vegetation, root matter, or other organic, unstable material prior to fill placement. Backfill along the principal spillway conduit should be placed equally on both sides of the pipe during filling.

Conclusion

Engineering Consulting Services, Ltd. would be pleased to provide our review of geotechnical design criteria and assist in the review of contractor construction submittals upon request.

Quality assurance during dam construction is considered essential and is best accomplished with full time inspectors. We would recommend that an experienced Geotechnical Engineering Firm be contracted by the owner to provide these services during the critical earthwork phases.



DAMS BAY 5 - POD 2 SUBDIVISION
JAMES CITY COUNTY, VIRGINIA
ECS PROJECT NO. R1280

ECS LTD
ENGINEERING CONSULTING SERVICES, LTD

APPENDIX I

TEST BORING LOCATION SKETCH

OWNER	JOB #	BORING #	SHEET
GOVERNOR'S LAND MGT. CO.	R1280	B-1	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
DAMS BAY 5 - POD 2 SUBDIVISION	AES CONSULTING ENGINEERS

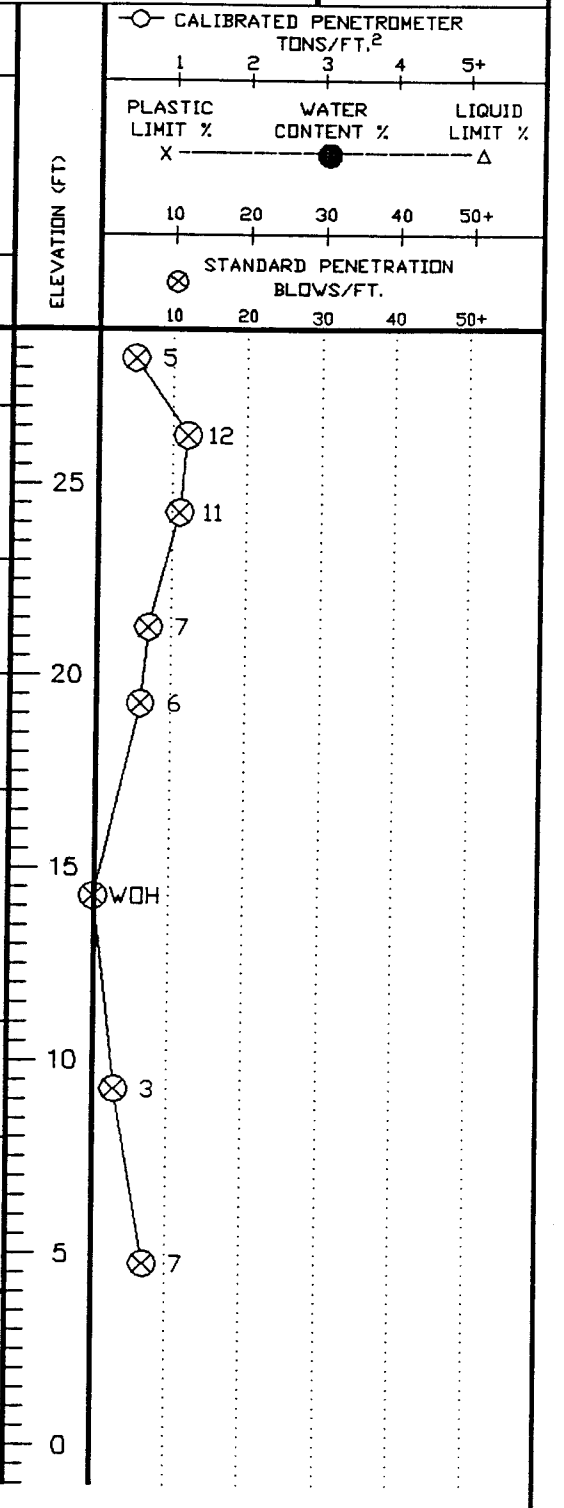
ECS LTD

SITE LOCATION
GOVERNOR'S LAND, JAMES CITY COUNTY, VA

SURFACE ELEVATION 29.00

SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL
1	SS	18	18	Fine Sandy SILT, Light Tan, Wet, Soft, (ML)
2	SS	18	18	Silty CLAY, Brown and Gray, Moist, Stiff, (CL)
3	SS	18	18	
4	SS	18	18	Silty to Clayey Fine SAND, Trace Clay Seams, Light Gray and Tan, Moist, Loose, (SM-SC)
5	SS	18	18	Silty CLAY, Trace Sand Lenses, Light Gray, Moist to Wet, Medium Stiff, (CH)
6	SS	18	18	Silty Fine SAND, Light Gray, Saturated, Very Loose, Very Soft, (SM) [Sample was liquid.]
7	SS	18	18	Silty CLAY, With Sand Seams, Brown and Gray, Moist, Soft, (CL)
8	SS	18	18	Fine Sandy Marine Clay, Dark Gray, Wet, Medium Stiff, (CL)

END OF BORING @ 25.0'



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL 7 FEET WS OR WD	BORING STARTED 03-10-93	TOPSOIL DEPTH: 6"
WL BCR ACR	BORING COMPLETED 03-10-93	CAVE IN DEPTH @
WL	RIG FOREMAN AYERS	DRILLING METHOD HOLLOW STEM AUGER

OWNER	JOB #	BORING #	SHEET
GOVERNOR'S LAND MGT. CO.	R1280	B-2	1 OF 1

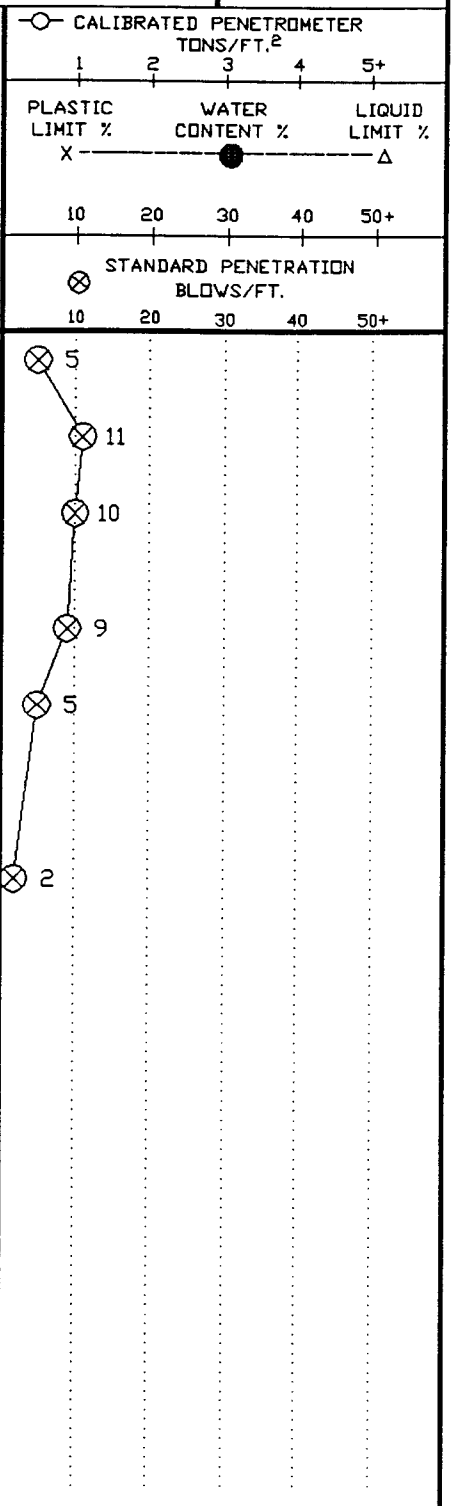
PROJECT NAME	ARCHITECT-ENGINEER
DAMS BAY 5 - POD 2 SUBDIVISION	AES CONSULTING ENGINEERS

ECS LTD

SITE LOCATION
GOVERNOR'S LAND, JAMES CITY COUNTY, VA

SURFACE ELEVATION 29.00

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)
0	1	SS	18	18	Silty CLAY, Brown and Gray, Moist, Soft to Medium Stiff, (CL)	
	2	SS	18	18		
5	3	SS	18	18		25
	4	SS	18	18	Silty to Clayey Fine SAND, Light Gray and Tan, Moist, Loose, (SM-SC)	
10	5	SS	18	18	Silty CLAY, With Sand Seams, Light Gray and Tan, Wet to Saturated, Very Soft to Soft, (CL) [Saturated from 11 feet.]	20
15	6	SS	18	18		15
					END OF BORING @ 15.0'	10
20						5
25						0
30						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL 11 FEET WS OR WD	BORING STARTED 03-10-93	TOPSOIL DEPTH: 6"
WL BCR ACR	BORING COMPLETED 03-10-93	CAVE IN DEPTH @
WL	RIG FOREMAN AYERS	DRILLING METHOD HOLLOW STEM AUGER

OWNER	JOB #	BORING #	SHEET
GOVERNOR'S LAND MGT. CO.	R1280	B-3	1 OF 1

PROJECT NAME: **DAMS BAY 5 - POD 2 SUBDIVISION**

ARCHITECT-ENGINEER: AES CONSULTING ENGINEERS

ECS LTD

SITE LOCATION: GOVERNOR'S LAND, JAMES CITY COUNTY, VA

SURFACE ELEVATION 27.00

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	18	18	Silty CLAY, Brown and Gray, Moist, Medium Stiff, (CL)	25	7
	2	SS	18	18			11
5	3	SS	18	18			11
	4	SS	18	18	Silty to Clayey Fine SAND, With Clay Seams, Gray and Tan, Moist, Loose, (SM-SC)	20	7
10	5	SS	18	18	Silty CLAY, Trace Fine Sand, Light Gray and Tan, Moist, Soft, (CL-CH)		4
15	6	SS	18	18	Silty Fine SAND, Trace Clay, Brown and Gray, Saturated, Very Loose to Very Soft, (SM)	15	3
20	7	SS	18	18	Silty Marine Clay, Dark Gray, Moist, Medium Stiff, (CH)	10	9
25	8	SS	18	18	Silty to Clayey Fine SAND, Brown and Light Gray, Saturated, Very Loose, (SM-SC)	5	3
30					END OF BORING @ 25.0'	0	

CALIBRATED PENETROMETER TONS/FT.^{2}: 1, 2, 3, 4, 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ

STANDARD PENETRATION BLOWS/FT.: 10, 20, 30, 40, 50+

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL 10.5 FEET WS OR WD	BORING STARTED 03-10-93	TOPSOIL DEPTH: 6"
WL BCR ACR	BORING COMPLETED 03-10-93	CAVE IN DEPTH @
WL	RIG FOREMAN AYERS	DRILLING METHOD HOLLOW STEM AUGER

OWNER	JOB #	BORING #	SHEET
GOVERNOR'S LAND MGT. CO.	R1280	B-4	1 OF 1

PROJECT NAME: **DAMS BAY 5 - POD 2 SUBDIVISION**

ARCHITECT-ENGINEER: AES CONSULTING ENGINEERS

ECS LTD

SITE LOCATION: GOVERNOR'S LAND, JAMES CITY COUNTY, VA

SURFACE ELEVATION: 20.00

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	18	18	Clayey SILT, Brownish Tan, Moist, Medium Stiff, (ML)		6
	2	SS	18	18	Silty CLAY, Trace Sand Lenses, Light Gray, Moist, Medium Stiff, (CL)		8
5	3	SS	18	18		15	9
	4	SS	18	18			12
10	5	SS	18	18	Fine to Medium SAND, Trace Silt and Gravel, Brownish Tan, Moist, Medium Dense, (SP-SM)	10	8
15	6	SS	18	18	Clayey Marine Silt, With Sand Lenses, Dark Gray, Saturated, Very Soft, (ML)	5	3
20	7	SS	18	18		0	4
25	8	SS	18	18		-5	4
30					END OF BORING @ 25.0'		

CALIBRATED PENETROMETER TONS/FT.^{2}: 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ: 10 20 30 40 50+

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50+

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL 11.0 FEET WS OR WD	BORING STARTED 03-10-93	TOPSOIL DEPTH: 2"
WL BCR ACR	BORING COMPLETED 03-10-93	CAVE IN DEPTH @
WL	RIG FOREMAN AYERS	DRILLING METHOD HOLLOW STEM AUGER

OWNER	JOB #	BORING #	SHEET
GOVERNOR'S LAND MGT. CO.	R1280	B-5	1 OF 1

PROJECT NAME: **DAMS BAY 5 - POD 2 SUBDIVISION**

ARCHITECT-ENGINEER: AES CONSULTING ENGINEERS

ECS LTD

SITE LOCATION: GOVERNOR'S LAND, JAMES CITY COUNTY, VA

SURFACE ELEVATION 5.00

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	18	18	Sand and Clay Layers, Trace Organics, Light Tan, Saturated, Very Soft, (SP-CL) [Alluvial Sediment]		1
	2	SS	18	18			2
5	3	SS	18	18	Sandy CLAY, With Sand Seams and Organics, Dark Gray, Saturated, Very Soft, (CL) [Alluvial Sediment]	0	2
	4	SS	18	18	Silty CLAY, With Sand Lenses, Trace Marsh Grass, Medium Gray, Saturated, Very Soft, (CH) [Organic Silt from 8 Feet]		1
10	5	SS	18	18	Clayey Marine Silt, Light Gray, Wet, Very Soft to Soft, (MH)	-5	3
	6	SS	18	18	Clayey Marine Silt, Medium Gray, Wet, Medium Stiff, (ML-MH)		4
15					END OF BORING @ 15.0'	-10	
20						-15	
25						-20	
30							

CALIBRATED PENETROMETER TONS/FT.^{2}: 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50+

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL 1.0 FEET WS OR WD	BORING STARTED 03-10-93	
WL BCR ACR	BORING COMPLETED 03-10-93	CAVE IN DEPTH @
WL	RIG FOREMAN AYERS	DRILLING METHOD HOLLOW STEM AUGER

OWNER	JOB #	BORING #	SHEET
GOVERNOR'S LAND MGT. CO.	R1280	B-6	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
DAMS BAY 5 - POD 2 SUBDIVISION	AES CONSULTING ENGINEERS

ECS LTD

SITE LOCATION
GOVERNOR'S LAND, JAMES CITY COUNTY, VA

CALIBRATED PENETROMETER TONS/FT.^{2} (1, 2, 3, 4, 5+)

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △ (10, 20, 30, 40, 50+)

STANDARD PENETRATION BLOWS/FT. ⊗ (10, 20, 30, 40, 50+)

SURFACE ELEVATION 23.00

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	18	18	Clayey SILT, Trace Organics, Light Tan, Moist, Medium Stiff, (ML)		8
	2	SS	18	18	Silty CLAY, With Sand Seams, Light Gray, Moist, Medium Stiff, (CH)	20	11
5	3	SS	18	18			7
	4	SS	18	18		15	9
10	5	SS	18	18			7
	6	SS	18	18	Silty Fine to Medium SAND, Light Gray, Saturated, Loose, (SP-SM)	10	5
15					END OF BORING @ 15.0'	5	
20						0	
25						-5	
30							

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL 9.0 FEET WS OR WD	BORING STARTED 03-10-93	TOPSOIL DEPTH: 4"
WL BCR ACR	BORING COMPLETED 03-10-93	CAVE IN DEPTH @
WL	RIG FOREMAN AYERS	DRILLING METHOD HOLLOW STEM AUGER

REFERENCE NOTES FOR BORING LOGS

I. Drilling and Sampling Symbols:

SS - Split Spoon Sampler
ST - Shelby Tube Sampler
RC - Rock Core: NX,BX,AX
PM - Pressuremeter
DC - Dutch Cone Penetrometer

RB - Rock Bit Drilling
BS - Bulk Sample of Cuttings
PA - Power Auger (no sample)
HSA - Hollow Stem Auger
WS - Wash Sample

Standard Penetration (Blows/Ft) refers to the blows per foot of a 140 lb hammer falling 30 inches on a 2 in. O.D. split spoon sampler, as specified in ASTM D-1586. The blow count is commonly referred to as the N value.

II. Correlation of Penetration Resistances to Soil Properties:

Relative Density-Sands, Silts

SPT-N	Relative Density
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50 - 80	Very Dense
over 80	Extremely Dense

Consistency of Cohesive Soils

Unconfined Compressive Strength, Qp, tsf	Consistency
under 0.25	Very Soft
0.25-0.49	Soft
0.50-0.99	Firm
1.00-1.99	Stiff
2.00-3.99	Very Stiff
4.00-8.00	Hard
over 8.00	Very Hard

III. Unified Soil Classification Symbols:

GP - Poorly Graded Gravel
GW - Well Graded Gravel
GM - Silty Gravel
GC - Clayey Gravels
SP - Poorly Graded Sands
SW - Well Graded Sands
SM - Silty Sands
SC - Clayey Sands

ML - Low Plasticity Silts
MH - High Plasticity Silts
CL - Low Plasticity Clays
CH - High Plasticity Clays
OL - Low Plasticity Organics
OH - High Plasticity Organics
CL-ML - Dual Classification (Typical)

IV. Water Level Measurement Symbols:

WL - Water Level
WS - While Sampling
WD - While Drilling

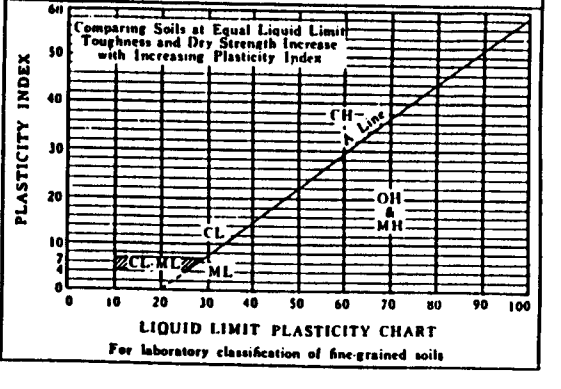
BCR - Before Casing Removal
ACR - After Casing Removal
WCI - Wet Cave In
DCI - Dry Cave In

The water levels are those water levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clays and plastic silts the accurate determination of water levels may require several days for the water level to stabilize. In such cases additional methods of measurement are generally applied.

Table VI-1—Unified Soil Classification (Including Identification and Description)

Adopted by Corps of Engineers and Bureau of Reclamation, January 1952

Major Divisions (1)	Major Divisions (2)		Group Symbols (3)	Typical Names (4)	Field Identification Procedures (Excluding particles larger than 75mm (3 inches) and basing fractions on estimated weights) (5)			Information Required for Describing Soils (6)	Laboratory Classification Criteria (7)
Coarse-grained Soils. More than half of material is larger than 0.075mm (No. 200) sieve size. The 0.075mm (No. 200) sieve size is about the smallest particle visible to the naked eye.	Gravels. More than half of coarse fraction is larger than 4.75mm (No. 4) sieve size. (For visual classifications, the 6.3mm (¼ in.) size may be used as equivalent to the 4.75mm (No. 4) sieve size.)	Clean Gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.			For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics.	Determine percentages of gravel and sand from grain-size curve. Depending on percentage of fines (fraction smaller than 0.075mm (No. 200) sieve size) coarse-grained soils are classified as follows: Less than 5% GW, GP, SW, SP. More than 12% GM, GC, SM, SC. 5% to 12% Borderline cases requiring use of dual symbols.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.				$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3 (See note, below)
		Gravels with Fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below.)			Give typical name; indicate approximate percentages of sand and gravel, max. size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbol in parentheses.	Not meeting all gradation requirements for GW
			GC	Clayey gravels, gravel-sand-clay mixtures.	Plastic fines (for identification procedures see CL below.)				Atterberg limits below "A" line or PI less than 4 — Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols.
	Sands. More than half of coarse fraction is smaller than 4.75mm (No. 4) sieve size.	Clean Sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.			Example: Silty sand, gravelly; about 20% hard, angular gravel particles 13mm (½ in.) maximum size; rounded and subangular sand grains coarse to fine; about 15% nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM).	Atterberg limits above "A" line with PI greater than 7
			SP	Poorly-graded sands, gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.				$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3 (See note, below)
		Sands with Fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below.)				Not meeting all gradation requirements for SW
			SC	Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below.)				Atterberg limits below "A" line or PI less than 4 — Limits plotting in hatched zone with PI between 4 and 7 are borderline cases requiring use of dual symbols.
Fine-grained Soils. More than half of material is smaller than 0.075mm (No. 200) sieve size.					Identification Procedures on Fraction Smaller than 0.425mm (No. 40) Sieve Size*				Atterberg limits above "A" line with PI greater than 7
					Dry Strength (Crushing characteristics)	Dilatancy (Reaction to shaking)	Toughness (Consistency near PL.)		
	Silts and Clays. Liquid limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	None to slight	Quick to slow	None	Give typical name, indicate degree and character of plasticity, amount and maximum size of coarse grains, color in wet condition, odor if any, local or geologic name, and other pertinent descriptive information; and symbol in parentheses.	Use grain-size curve in identifying the fractions as given under field identification.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium to high	None to very slow	Medium		
			OL	Organic silts and organic silty clays of low plasticity.	Slight to medium	Slow	Slight		
	Silts and Clays. Liquid limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Slight to medium	Slow to none	Slight to medium	For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions.	
			CH	Inorganic clays of high plasticity, fat clays.	High to very high	None	High		
			OH	Organic clays of medium to high plasticity, organic silts.	Medium to high	None to very slow	Slight to medium	Example: Clayey silt, brown, slightly plastic, small percentage of fine sand, numerous vertical root holes, firm and dry in place, loess, (ML).	
Highly Organic Soils			Pt	Peat and other highly organic soils.	Readily identified by color, odor, spongy feel and frequently by fibrous texture.				



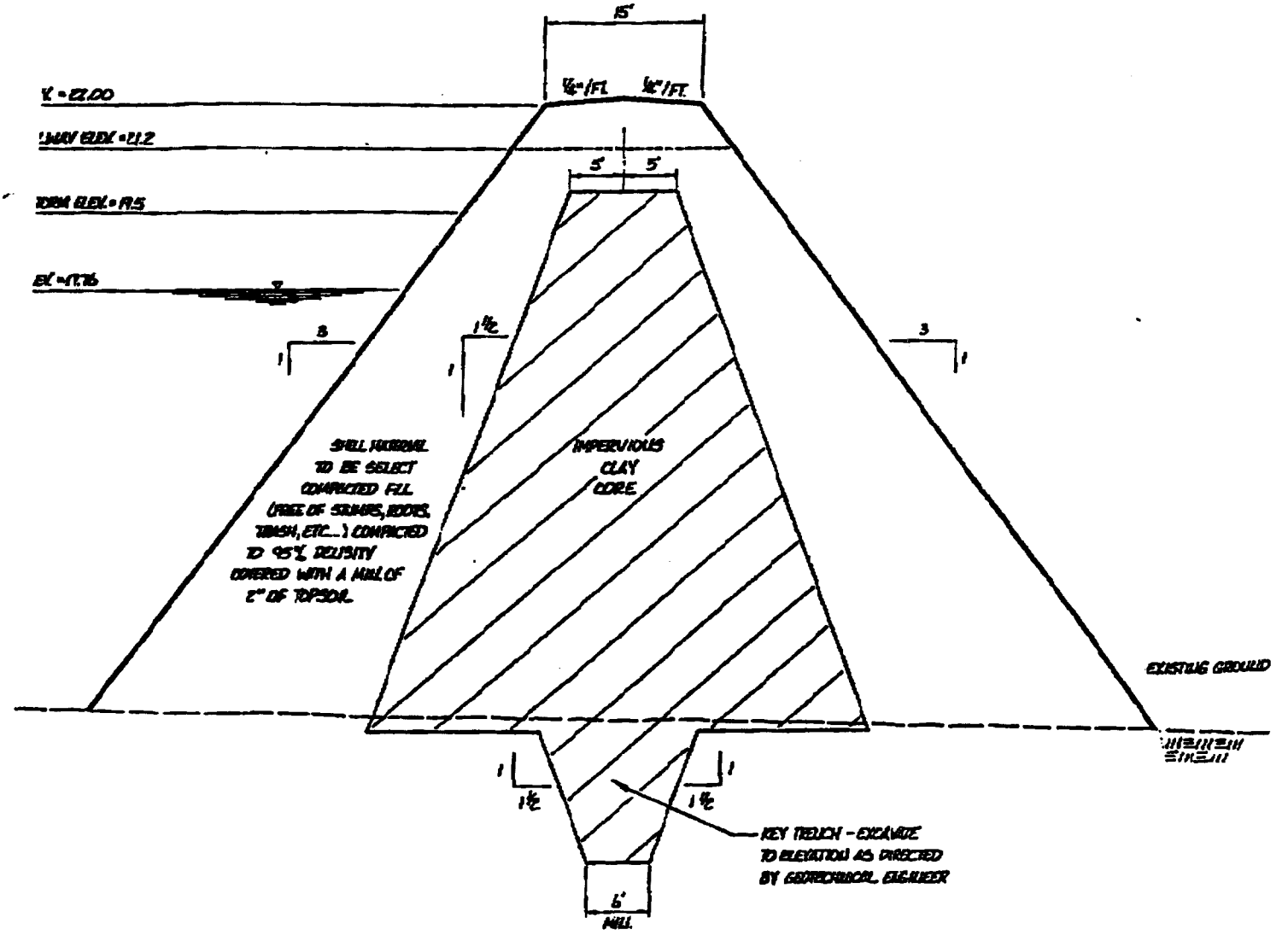
LIQUID LIMIT PLASTICITY CHART

For laboratory classification of fine-grained soils

(1) Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well-graded gravel-sand mixture with clay binder. (2) All sieve sizes on this chart are U.S. standard.

SUMMARY OF LABORATORY TEST DATA
DAMS BAY 5 - POD 2 SUBDIVISION
JAMES CITY COUNTY, VIRGINIA
ECS PROJECT NO. R1280

Boring No.	Sample No.	Depth (Ft)	Moisture Content (%)	Silt or Clay Franction (%)	Plasticity LL/PI	Classification
B-1	3	4-6	25.7	Not Tested	32.2/18.6	CL



POND A

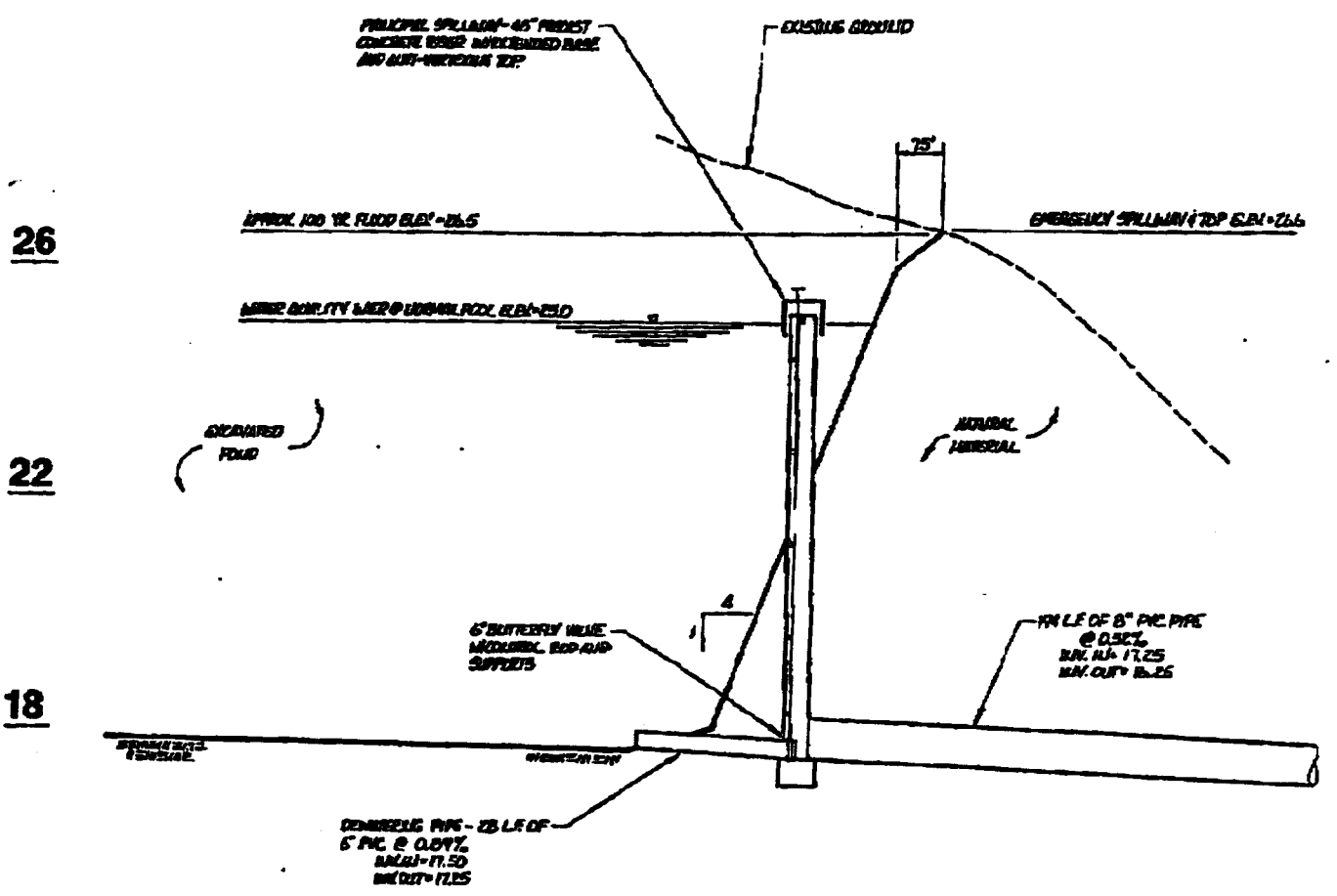
DAM CROSS-SECTION

DAMS BAY 5 - POD 2 SUBDIVISION
JAMES CITY COUNTY, VIRGINIA
ECS PROJECT NO. R1280

ECS LTD
ENGINEERING CONSULTING SERVICES, LTD

APPENDIX VI

SCHEMATIC DAM PROFILE



POND B

SECTION @ PRINCIPAL SPILLWAY

DAMS BAY 5 - POD 2 SUBDIVISION
JAMES CITY COUNTY, VIRGINIA
ECS PROJECT NO. R1280

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APPENDIX VI

SCHEMATIC DAM PROFILE

ENGINEERING CONSULTING SERVICES, LTD.
341 Cleveland Place, Suite 105
Virginia Beach, Virginia 23462
(804) 499-9100

- **Travis Pond Dam**

It is our estimation that the existing dam at Travis Pond is approximately 200 feet long. The front (pond) side of the dam was vegetated with manicured grass. The topography of the crest of the dam is relatively flat. The back (downstream) side of the dam was vegetated with manicured grass.

- **Whittaker's Lake Dam**

It is our estimation that the existing dam at Whittaker Lake is approximately 400 feet long. The front side of the dam was vegetated with grass. The topography of the crest of the dam is relatively flat. The backside of the dam was heavily vegetated with underbrush and small trees.

- **Bennett's Pond Dam** (JR021)

It is our estimation that the existing dam at Bennett's Pond is approximately 330 feet long. The front side of the dam was lightly vegetated with tall grass. The topography of the crest of the dam is relatively flat. The backside of the dam is vegetated with manicured grass.

- **Founder's Hill Pond Dam**

It is our estimation that the existing dam at Founder's Hill detention pond is approximately 85 feet long. The front side of the dam was lightly vegetated with tall grass. The topography of the crest of the dam is relatively flat. The backside of the dam is vegetated with manicured grass. Organic debris was observed partially blocking the spillway pipe on the backside of the dam, with 2 to 3 inches of water in the pipe.

- **Wingfield Lake Dam**

Plan and topography information was not available for Wingfield Lake Dam; however, from the site reconnaissance it is estimated that the dam is approximately 300 feet long. The front side of the dam was vegetated with grass. The topography of the crest of the dam is relatively flat. The backside of the dam is heavily wooded with underbrush and small to medium trees.

RESULTS OF THE BORINGS AND LABORATORY TESTING:

The following discussions provide a general overview of the composition of each dam and the underlying subsurface conditions.

It should be noted that mud-rotary drilling procedures involve the use of a "bentonite slurry" that temporarily seals the borehole, and therefore, groundwater readings are difficult to obtain during drilling. In this regard, the presence of water below the surface is determined from visual inspection of each soil sample obtained from the split-spoon sampler. Actual soil moisture and/or the water conditions within each soil strata can be obtained from the boring logs. Be advised that the water level referenced at completion of the drilling (lower left corner of the boring logs) may not accurately represent the static water table level. Groundwater commentary (provided below) for each dam is based on the visual inspection of each soil sample. It is common for most subsurface soils to possess moist to wet properties. Soils classified as very wet to saturated typically indicate the presence of the static water table.

It should also be noted that a majority of the fill samples evaluated contained some organic debris. Typically, the organic debris was in the form of small root and wood material (in trace amounts), which is considered typical in most cases when fill for dam embankments is obtained from on-site or nearby borrow sources where shallow excavating and/or scraping operations are performed. The presence of this organic material, in small quantities or trace amounts, is considered acceptable.

- **Fowler's Lake Dam**

The results of our soil test borings and laboratory testing indicates that the existing dam, at the areas and depths sampled, is generally comprised of fill material to depths of about 8 to 19 feet below top of dam surface. The fill layers, which comprise the top shell and the inner core, are classified as Clayey SAND (SC), Silty SAND (SM), and Fat CLAY (CH). The sandy soils are loose in density and the clay soils are very soft to very stiff in consistency. The transitions from the fill material into the natural original soils were relatively clean. In this regard, it appears that proper steps were taken to remove heavy topsoil and/or thick vegetation prior to fill placement. The transition between the fill (clay core) and the original ground surface in boring B-2, which was performed near the center of the dam, was marked by the presence of a layer of orangish brown, Sandy Lean CLAY (CL). This stratum was observed between the approximate depths of 14 feet and 18 feet, and appears to represent the original ground surface.

The natural soils underlying the fill material generally consist of erratic deposits of medium dense to dense Silty and Clayey SANDS (SM, SC and SP) and soft to very stiff Sandy Lean CLAY (CL).

approximate depths of 28 feet and 33 feet, and appears to represent the original ground surface.

The natural soils underlying the fill material generally consist of erratic deposits of medium dense Poorly Graded SAND (SP), soft to medium stiff Sandy Elastic SILT (MH), and medium stiff Sandy Lean CLAY (CL).

Significant moisture was not observed within the dam fill material.

- **Bennett's Pond Dam**

The results of our soil test borings and laboratory testing indicates that the existing dam, at the areas and depths sampled, is generally comprised of fill material to depths of about 13.5 to 15 feet below top of dam surface. The fill layers, which comprise the top shell and the inner core, are classified as Fat CLAY (CH), sandy SILT (ML), and sandy Lean CLAY (CL). The clay and silt soils are soft to stiff in consistency. The transitions from the fill material into the natural original soils were not determined along the shoulders of the dam (borings B-1 and B-3). With regard to the center boring (B-2), it appears that proper steps were taken to remove heavy topsoil and/or thick vegetation prior to fill placement. The transition between the fill material (clay core) and the original ground surface in boring B-2, which was performed near the center of the dam, was marked by the presence of a layer of orangish brown, Silty SAND (SM). This stratum was observed between the approximate depths of 13.5 feet and 18 feet, and appears to represent the original ground surface.

The natural soils underlying the fill material generally consist of erratic deposits of very loose Clayey SANDS (SC), loose Silty SAND (SM), very soft to soft Fat CLAY (CH), and soft, organic, Elastic SILT (OH).

Significant moisture was not observed within the dam fill material. Groundwater was encountered in boring B-2 at a depth of about 16 feet below top of the dam surface. The presence of water at this does not present a problem with the stability of the dam.

- **Founder's Hill Dam**

The results of our soil test borings and laboratory testing indicates that the existing dam, at the areas and depths sampled, is generally comprised of fill material to depths of about 4.0 to 8.0 feet below top of dam surface. The fill layers, which comprise the top shell and the inner core, are classified as Fat CLAY (CH) and clayey SAND (SC). The clay soils are medium stiff to very stiff in consistency, and the sand soils are loose to medium dense. The transitions from the fill material into the natural original soils were relatively clean. In this regard, it appears that proper steps were taken to remove heavy topsoil

ENGINEERING EVALUATION AND CONCLUSIONS:

Based on the results of our soil test borings and laboratory testing, **it is our opinion that** the existing dams ***satisfy*** the current state dam design criteria, and/or other commonly accepted dam design criteria, with regard to embankment composition (material type and density) and overall stability. In general, the dams are classified as Zoned Earthen Dam structures, comprised predominantly of an impervious clay core with clayey and sandy soils comprising the shell.

General maintenance, however, should be provided for each dam on a routine basis. This should include annual inspections for surface erosion or vertical and horizontal cracking in the embankment. In addition, the toe drain and stilling basin should be inspected for erosion and loss of rip-rap, seepage beyond the toe drain, or increased flow or movement of fines through the drains. All large bushes and trees should be removed from the embankment face (both front and back sides), and animal burrows or other holes/cavities along the embankment should be thoroughly inspected and filled as appropriate.

ECS, Ltd. has appreciated the opportunity to be of service to you on this project. Please contact this office should you have any questions or need further assistance.

Respectfully,

ENGINEERING CONSULTING SERVICES, LTD.

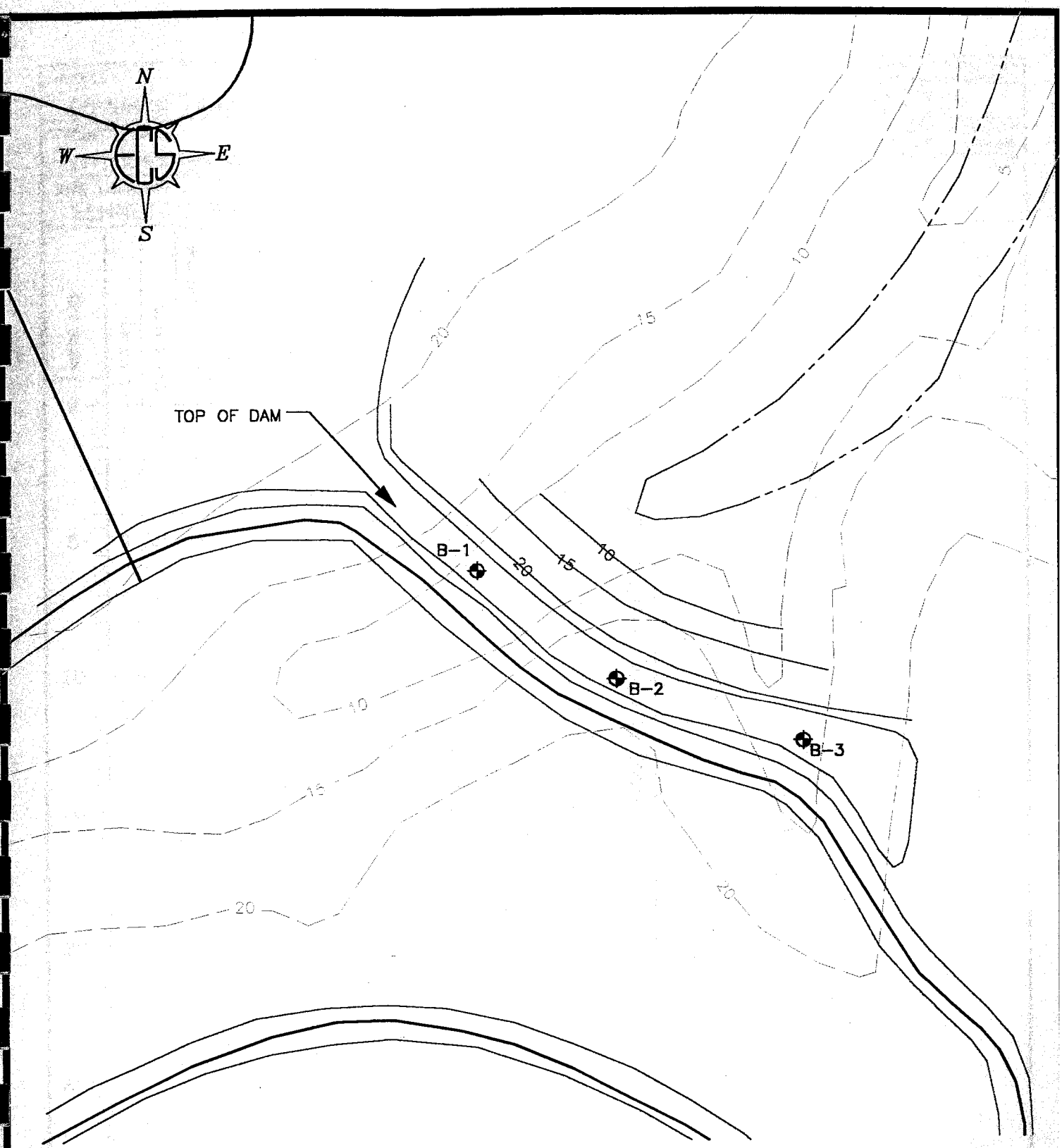
David J. Schlotterer
Staff Geologist/Project Manager

COMMONWEALTH OF VIRGINIA
DAVID E. STINNETTE
NO. 028419
PROFESSIONAL ENGINEER

David E. Stinnette, P.E.
Engineering Services Manager

Copies: (3) Jim Bennett (Dominion Land Management Co.)

Bennett's Pond Dam



⊕ – Approximate Boring Location

Scale: 1"=60'

PREPARED FOR:

DOMINON LAND MANAGEMENT

ECS LTD
ENGINEERING CONSULTING SERVICES, LTD

BORING LOCATION DIAGRAM

GOVERNOR'S LAND
BENNETT'S POND
JAMES CITY COUNTY, VIRGINIA

ECS, LTD. PROJECT NO. 6221

CLIENT	JOB #	BORING #	SHEET
DOMINION LAND MANAGEMENT CO.	6221	B-1	1 OF 1
PROJECT NAME: GOVERNOR'S LAND DAMS (EMBANKMENT EVAL.)	ARCHITECT-ENGINEER: AES, INC.		

ECS LTD

SITE LOCATION: BENNETT'S POND, JAMES CITY COUNTY, VIRGINIA

ENGLISH UNITS

SURFACE ELEVATION 22.00

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Topsoil-2", (FILL)	11
	2	SS	24	24	Fine Sandy SILT With Organics, Tan, Dry, Stiff, (ML-FILL)	13
5	3	SS	24	24	Fat CLAY, Trace Fine Sand, Orangish Brown and Gray, Moist, Stiff, (CH-FILL)	12
	4	SS	24	24		13
	5	SS	24	24		12
10	6	SS	24	24		13
	7	SS	24	24		13
15	8	SS	12	12		13
					END OF BORING @ 15.0'	

WATER LEVELS

ELEVATION (FT): 20, 15, 10, 5, 0, -5

CALIBRATED PENETROMETER TONS/FT.^{2}: 1, 2, 3, 4, 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ: 10, 20, 30, 40, 50+

STANDARD PENETRATION BLOWS/FT.: 10, 20, 30, 40, 50+

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL DRY WS OR WD	BORING STARTED 10-25-00	TOPSOIL DEPTH 2"
WL(AB) WL(AC)	BORING COMPLETED 10-25-00	CAVE IN DEPTH ●
WL	RIG FISHBURNE FOREMAN SONNY	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DOMINION LAND MANAGEMENT CO.	6221	B-2	1 OF 1

PROJECT NAME: GOVERNOR'S LAND DAMS (EMBANKMENT EVAL.)

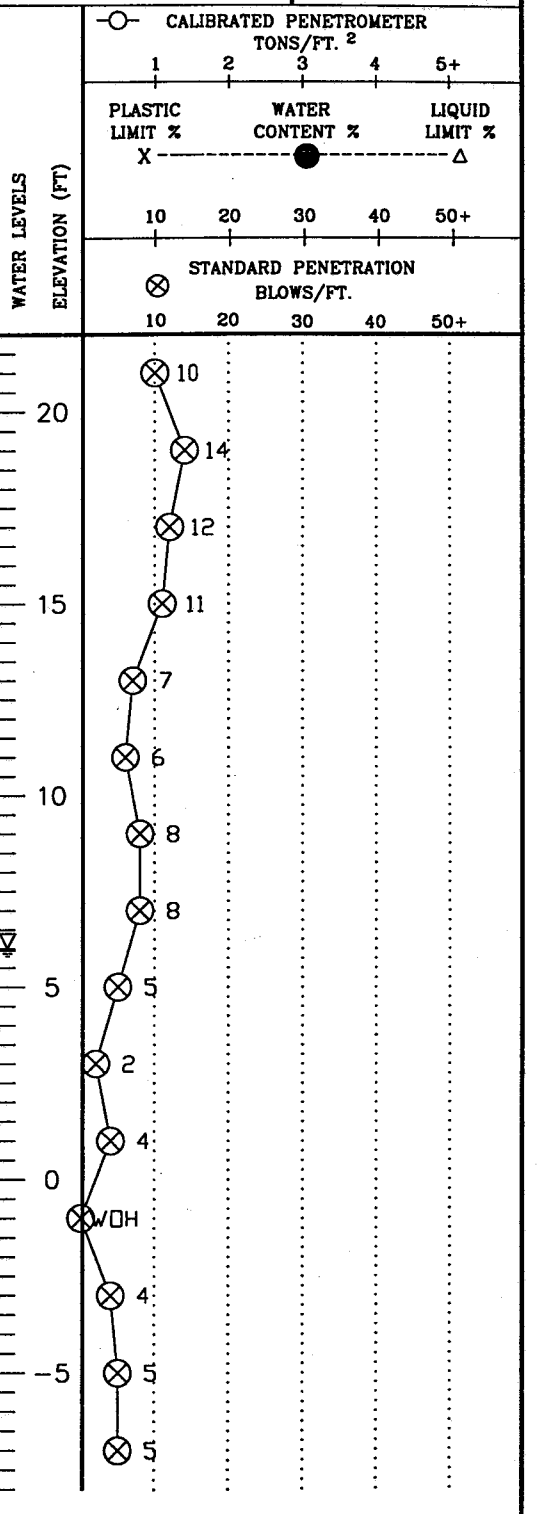
ARCHITECT-ENGINEER: AES, INC.

SITE LOCATION: BENNETT'S POND, JAMES CITY COUNTY, VIRGINIA

ENGLISH UNITS

SURFACE ELEVATION 22.00

SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL
1	SS	24	24	Topsoil-2", (FILL)
2	SS	24	24	Fine Sandy Lean CLAY, Tan, Moist, Medium Stiff, (CL-FILL)
3	SS	24	24	Fat CLAY With Trace Organics and Fine Sand, Orangish Brown and Gray, Moist, Stiff to Medium Stiff, (CH-FILL)
4	SS	24	24	
5	SS	24	24	
6	SS	24	24	
7	SS	24	24	
8	SS	24	24	Silty Fine to Medium SAND, Orangish Brown, Wet, Loose, (SM)
9	SS	24	24	
10	SS	24	24	Clayey Fine to Medium SAND, Medium Gray, Wet, Very Loose, (SC)
11	SS	24	24	
12	SS	24	24	Fat CLAY, Trace Fine Sand, Bluish Gray, Saturated, Very Soft to Soft, (CH)
13	SS	24	24	
14	SS	24	24	Organic Elastic SILT, Trace Fine Sand, Dark Gray and Black, Wet, Soft, (OH)
15	SS	24	24	



END OF BORING @ 30.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL 16.0' WS OR WD	BORING STARTED 10-25-00	TOPSOIL DEPTH 2"
WL(AB) WL(AC)	BORING COMPLETED 10-25-00	CAVE IN DEPTH ●
WL	RIG FISHBURNE FOREMAN SONNY	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DOMINION LAND MANAGEMENT CO.	6221	B-3	1 OF 1

PROJECT NAME: GOVERNOR'S LAND DAMS (EMBANKMENT EVAL.)

ARCHITECT-ENGINEER: AES, INC.

SITE LOCATION: BENNETT'S POND, JAMES CITY COUNTY, VIRGINIA

ENGLISH UNITS

SURFACE ELEVATION 22.00

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL
0	1	SS	24	24	Topsoil-2", (FILL)
	2	SS	24	24	Fine Sandy Lean CLAY With Organics, Grayish Brown, Moist, Medium Stiff, (CL-FILL)
5	3	SS	24	24	Fat CLAY, Trace Fine Sand and Tiny Roots, Orangish Brown and Gray, Moist, Soft to Stiff, (CH-FILL)
	4	SS	24	24	
	5	SS	24	24	
10	6	SS	24	24	
	7	SS	24	24	
	8	SS	12	12	
15					END OF BORING @ 15.0'
20					
25					
30					

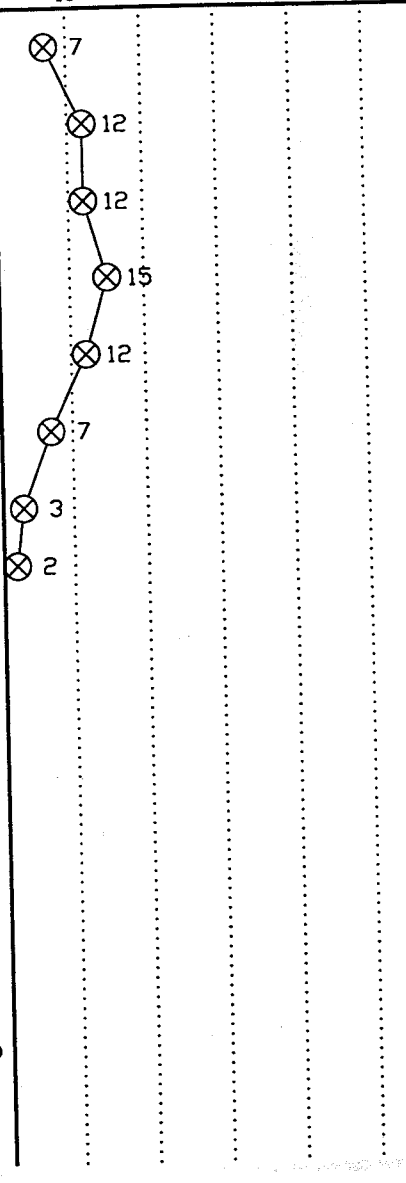
WATER LEVELS

ELEVATION (FT): 20, 15, 10, 5, 0, -5

CALIBRATED PENETROMETER TONS/FT.^{2}: 1, 2, 3, 4, 5+

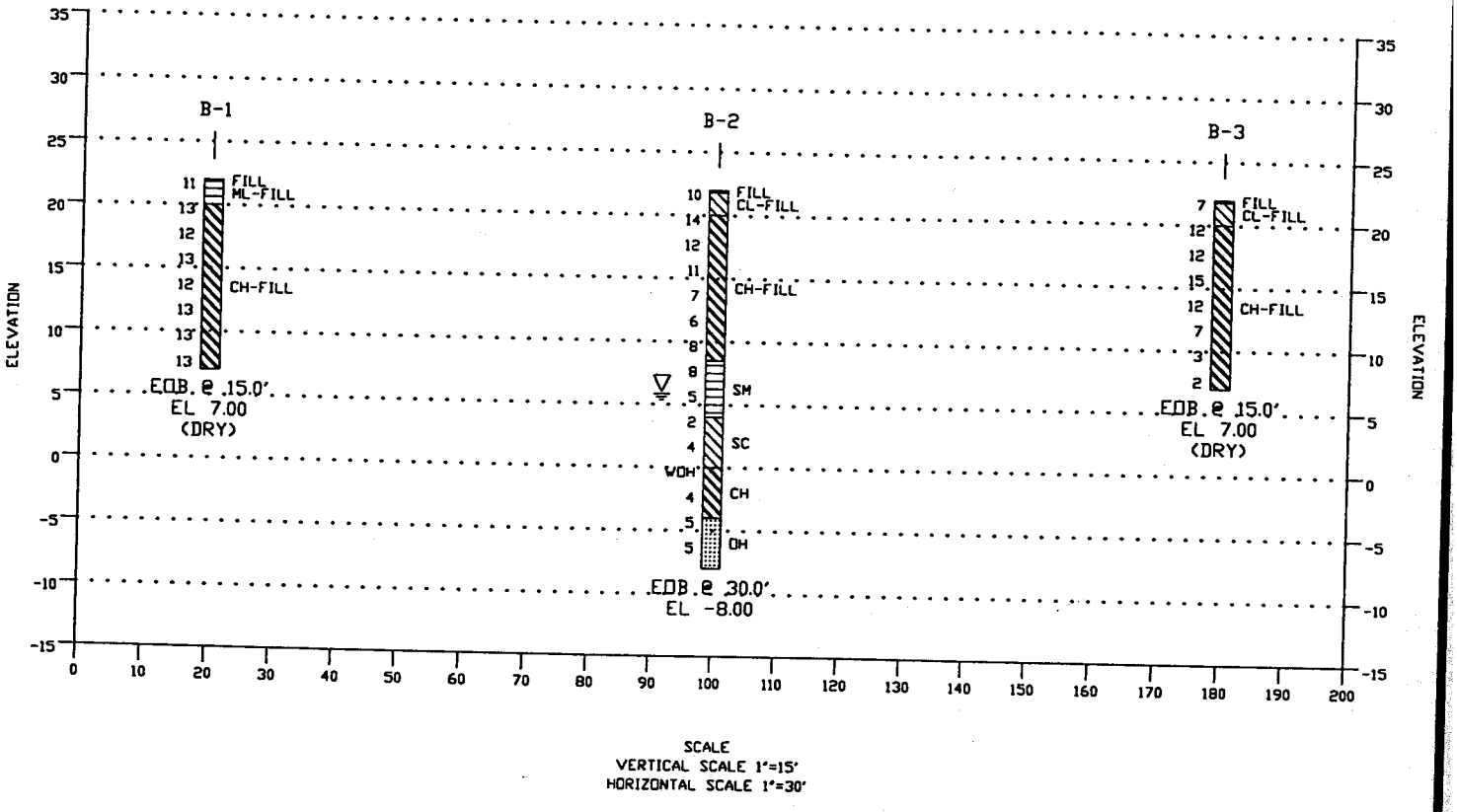
PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ

STANDARD PENETRATION BLOWS/FT.: 10, 20, 30, 40, 50+



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL DRY WS OR WD	BORING STARTED 10-25-00	TOPSOIL DEPTH 2"
▽WL(AB) ▽WL(AC)	BORING COMPLETED 10-25-00	CAVE IN DEPTH ●
▽WL	RIG FISHBURNE FOREMAN SONNY	DRILLING METHOD HOLLOW STEM AUGER



PREPARED FOR:

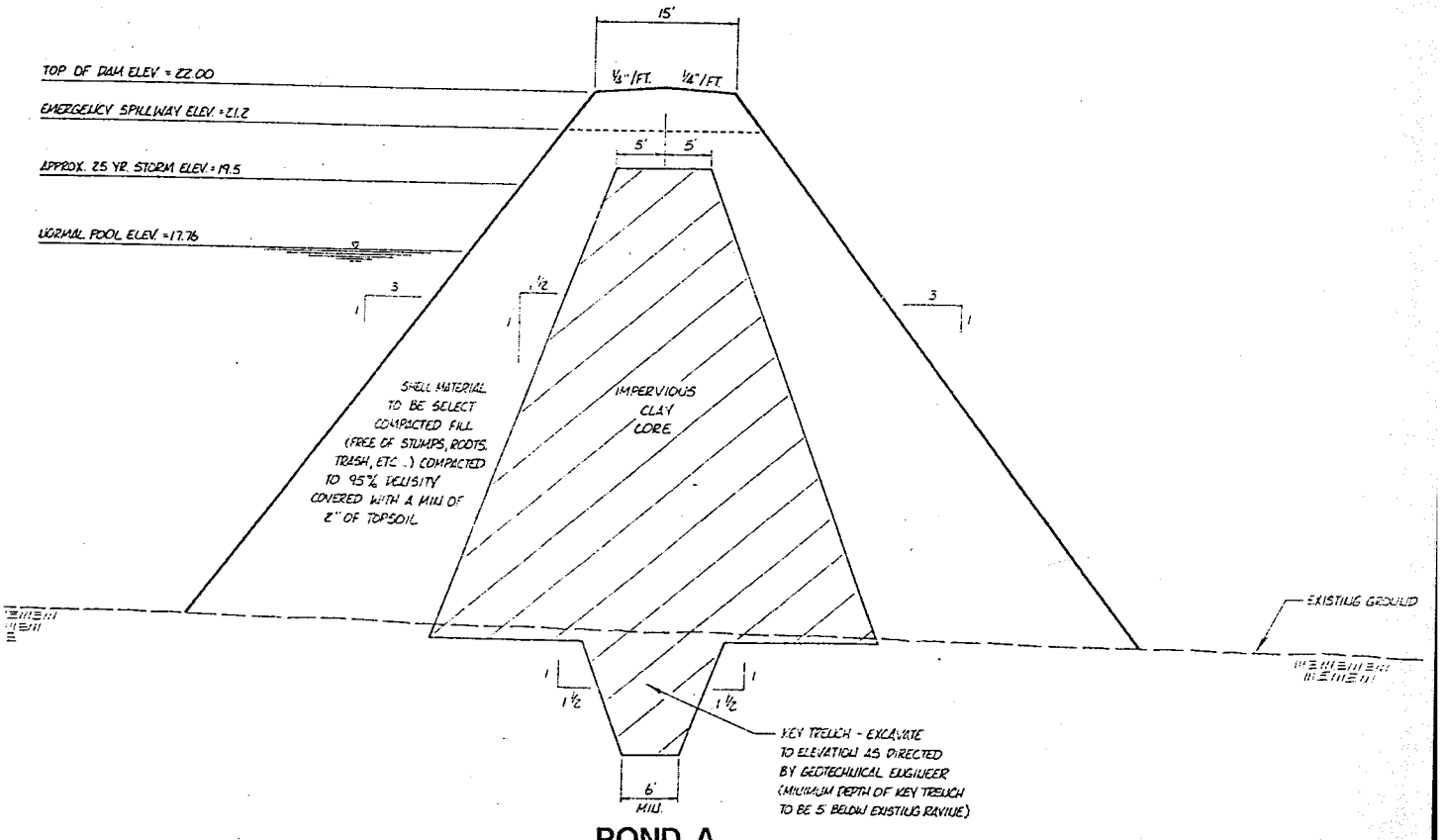
DOMINION LAND MGMNT. CO.

ECS LTD
ENGINEERING CONSULTING SERVICES, LTD

GENERALIZED CROSS SECTION

BENNETT'S POND
GOVERNOR'S LAND DAMS
JAMES CITY COUNTY, VIRGINIA

ECS, LTD. PROJECT NO. 6221



POND A

DAM CROSS-SECTION

PREPARED FOR:		DAM SCHEMATIC
DOMINION LAND MANAGEMENT	ECS LTD ENGINEERING CONSULTING SERVICES, LTD	GOVERNOR'S LAND BENNETT'S POND JAMES CITY COUNTY, VIRGINIA ECS, LTD. PROJECT NO. 6221

CONSULTING ENGINEERS

5248 Olde Towne Road • Suite 1 • Williamsburg, Virginia 23188
(757) 253-0040 • Fax (757) 220-8994 • E-mail aes@widomaker.com

March 11, 1997

MAR 1997
RECEIVED
CODE COMPLIANCE
OFFICE

Mr. Darryl E. Cook, P.E.
Environmental Director
James City County Environmental Division
P.O. Box 8784
Williamsburg, Virginia 23187-8784

RE: Governor's Land at Two Rivers
Hearthstone, Kitchum's Pond, Planter's Round
Letter of Credit Reduction
AES Job No. 7173-5-2

Dear Mr. Cook:

Attached are two copies of as-built drawings for stormwater management structures in the Hearthstone, Kitchum's Pond, Planter's Round subdivisions of Governor's Land. The outstanding Letter of Credit, S930114, is currently in the amount of $76,000.

Please note that the water level of Bennett's Pond is elevated due to a blockage at the Wingfield Lake riser structure. The maintenance staff at Governor's Land are trying to correct the situation.

With this information, please consider either substantial reduction, or relaese, of the Letter of Credit for this project.

Should you have any questions regarding these documents, please do not hesitate to call.

Sincerely,

AES Consulting Engineers

V. Marc Bennett

V. Marc Bennett, P.E.

Attachments

H:\7173\05-2\WORDPROC\DOCUMENTS\GL52L01.VMB

AES CONSULTING ENGINEERS
Engineering, Surveying and Planning
5248 Olde Towne Road, Suite 1
WILLIAMSBURG, VIRGINIA 23188

(757) 253-0040
FAX (757) 220-8994

LETTER OF TRANSMITTAL

DATE	JOB NO.
FEBRUARY 14, 2002	7173

ATTENTION: MR. MIKE WOOSON

RE: GOVERNOR'S LAND

TO JAMES CITY COUNTY ENVIRONMENTAL DIVISION

RECEIVED FEB 2002 ENVIRONMENTAL DIVISION

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items

☐ Shop drawings ☒ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1			RECORD DRAWING CERTIFICATION FOR BENNETT'S POND (JR021)
1			EXCERPT FROM GEO-TECHNICAL REPORT ON BENNETT'S POND
2			SETS OF RECORD DRAWINGS FOR BENNETT'S POND (JR020; 5-14-93)
1			RECORD DRAWING CERTIFICATION FOR KITCHEN'S POND
2			SETS OF RECORD DRAWINGS FOR KITCHEN'S POND

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval

☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution

☐ As requested ☐ Returned for corrections ☐ Return _____ corrected prints

☐ For review and comment ☐ _____

☐ FOR BIDS DUE _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS

MIKE,

THESE SWM/BMP FACILITIES ARE GETTING NEAR TEN YEARS OLD. TO PROVIDE SOME OF THE INFORMATION IN THE CERTIFICATION AND ON THE RECORD DRAWING, WE RESEARCHED OUR FILES, AND AUGMENTED THAT INFORMATION WITH MINIMAL SURVEYING MEASUREMENTS.

COPY TO _____ SIGNED: V. Marc B

If enclosures are not as noted, kindly notify us at once.

DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 Fax: (757) 253-6850 E-MAIL: devtman@james-city.va.us

CODE COMPLIANCE
(757) 253-6626
codecomp@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) 253-2620

January 24, 2003

Mr. James H. Bennett
Governors Land Associates
9701 Mill Pond Run
Toano, Va. 23168

Re: Governor's Land - Bennetts Pond
County Plan No. S-14-93
Stormwater Management Facility
County BMP ID Code: JR 021

Dear Mr. Bennett:

The Environmental Division has reviewed a record drawing and post-construction geotechnical report (ECS # 6221 dated December 31st 2000) as submitted to our office for the above referenced BMP. The record drawing provides as-built information for a large wet pond BMP facility situated in the eastern portion of Governor's Land.

Based on our review of the project and a concurrent field inspection as performed on January 10th 2003, the following items must be addressed prior to release of the developer's surety instrument for the stormwater management/BMP facility at the site and to proceed with closing out the project:

Record Drawing:

1. Some concern is warranted about the lack of information presented on the record drawing relative to the primary discharge device for the BMP. It is understood that this BMP is connected in some fashion to Wingfield Lake. The information packet as submitted with the record drawing indicates a "submerged dewatering pipe" and "no principal spillway" for the facility; however, the record drawing plan and detail shows no such information for approximate arrangement, location, size or elevation. The hydraulic model for the BMP shows a discharge device equivalent to a 15-inch pipe set, invert Elevation 17.76 and 375 ft. in length. As surveyed normal pool for the facility (El. 18.25) is approximately 0.5 feet higher than design elevation (El. 17.76), there must be some kind of determination made that the dewatering pipe as such is functional and not clogged or damaged. Please investigate as appropriate or indicate that additional information is not available.

2. Provide an asbuilt elevation for the bottom of the pond at the upstream toe to verify that design depth (elevation) was achieved and that excessive sedimentation does not exist in the bottom of the facility. Record drawing Sheet 2, Pond A Dam Cross Section, shows a design elevation at the upstream toe of dam at approximately El. 8.0. The upstream toe is approximately 10 ft. below normal pool.

Construction - Related Items:

3. Stabilize with seed and mulch or matting bare soil areas as observed within the emergency spillway. The emergency spillway is situated on the southeast side of the dam.

4. A subsidence hole was observed on the upstream face of the dam just above normal pool at about the center of the embankment. Fill with compacted material and seed and mulch.

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

Please contact me at 757-253-6639 or the assigned Environmental Division inspector, Joe Buchite at 757-253-6643 if you have any further comments or questions.

Sincerely,

Scott J. Thomas, P.E.
Civil Engineer
Environmental Division

cc: Marc Bennett, AES - via

G:\AsBuilts\S1493.jr021

DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 Fax: (757) 253-6850 E-MAIL: devtman@james-city.va.us

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environ@james-city.va.us

PLANNING
(757) 253-6685
planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620

January 24, 2003

Remspect 6-2-03

Mr. James H. Bennett
Governors Land Associates
9701 Mill Pond Run
Toano, Va. 23168

Re: Governor's Land - Bennetts Pond
County Plan No. S-14-93
Stormwater Management Facility
County BMP ID Code: JR 021

Dear Mr. Bennett:

The Environmental Division has reviewed a record drawing and post-construction geotechnical report (ECS # 6221 dated December 31st 2000) as submitted to our office for the above referenced BMP. The record drawing provides as-built information for a large wet pond BMP facility situated in the eastern portion of Governor's Land.

Based on our review of the project and a concurrent field inspection as performed on January 10th 2003, the following items must be addressed prior to release of the developer's surety instrument for the stormwater management/BMP facility at the site and to proceed with closing out the project:

Record Drawing:

EQUIVALENT PIPE ONLY. DATA SHOWN. OK

✓ 6-26-03

1. Some concern is warranted about the lack of information presented on the record drawing relative to the primary discharge device for the BMP. It is understood that this BMP is connected in some fashion to Wingfield Lake. The information packet as submitted with the record drawing indicates a "submerged dewatering pipe" and "no principal spillway" for the facility; however, the record drawing plan and detail shows no such information for approximate arrangement, location, size or elevation. The hydraulic model for the BMP shows a discharge device equivalent to a 15-inch pipe set, invert Elevation 17.76 and 375 ft. in length. As surveyed normal pool for the facility (El. 18.25) is approximately 0.5 feet higher than design elevation (El. 17.76), there must be some kind of determination made that the dewatering pipe as such is functional and not clogged or damaged. Please investigate as appropriate or indicate that additional information is not available.

✓ OK 6-26-03

2. Provide an asbuilt elevation for the bottom of the pond at the upstream toe to verify that design depth (elevation) was achieved and that excessive sedimentation does not exist in the bottom of the facility. Record drawing Sheet 2, Pond A Dam Cross Section, shows a design elevation at the upstream toe of dam at approximately El. 8.0. The upstream toe is approximately 10 ft. below normal pool.

12.0 AB ~ 4.0 deep, OK.

Construction - Related Items: Grass has germ. Not fully grown but OK

OK 6-2-03

3. Stabilize with seed and mulch or matting bare soil areas as observed within the emergency spillway. The emergency spillway is situated on the southeast side of the dam.

OK 6-2-03

4. A subsidence hole was observed on the upstream face of the dam just above normal pool at about the center of the embankment. Fill with compacted material and seed and mulch.

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

Please contact me at 757-253-6639 or the assigned Environmental Division inspector, Joe Buchite at 757-253-6643 if you have any further comments or questions.

Sincerely,

Scott J. Thomas, P.E.
Civil Engineer
Environmental Division

cc: Marc Bennett, AES - via

G:\AsBuilts\S1493.jr021

Memorandum

DATE: **April 23, 2003**

TO: **Scott Thomas**

FROM: **Victoria Bains**

SUBJECT: **Bennett's Pond, County BMP ID Code: JR021**

In response to your letter dated January 24, 2003 AES Consulting Engineers has taken several actions.

Construction Certification:
No further action required.

Record Drawings:
Elevations of inverts for the 18-inch equilibrium pipe and another 18-inch pipe that is draining into the pond were added to the plan view of the drawings.

Spot elevations for the bottom of the pond were added to plan view of the drawings. From this information, there is no significant sediment accumulation in this pond.

Construction – Related Items:
Trash and debris was cleared from entire facility. Depressions above inflow pipe from DI on the southeast corner of facility were filled. Bare areas had topsoil added then seeded and mulched to stabilize area.

AES CONSULTING ENGINEERS

5248 Olde Towne Road • Suite 1 • Williamsburg, Virginia 23188
(757) 253-0040 • Fax (757) 220-8994 • E-mail aes@aesva.com

Record Drawing/Construction Certification Submittal for a BMP Facility

Date: April 29 2002

Inspector:
- ☑ Pat Menichino
- ☐ Gerry Lewis
- ☐ Beth Davis
- ☐ Mike Woolson
- ☐ Joe Buchite
- ☐ Other: _____

Project: GOVERNORS LAND- BENNETTS POND
BMP Facility: (Bennetts Pond)
Plan No. S-14-93?
BMP ID Code: JR021

I have received a transmittal for a ☑ Record Drawing and ☐ Construction Certification for the above referenced facility on FEB 14 2002. Prior to full engineering review of these items and a field inspection, I am first forwarding the items to you to cursory review in case any major field changes were performed that I should be aware of and/or to ensure the record drawing accurately portrays what you saw in the field. Please review the drawing and return to me promptly so I can proceed with the review for certification purposes.

During my review, I will look at issues related to the BMP and its primary inflow and outflow conveyance systems, and will make comment in the following areas: Record Drawing (RD), Construction Certification (CC) and Construction-Related (CR) punch list items. If you have any other related non-BMP site issues such as erosion, stabilization, removal of erosion & sediment controls, etc. that are not related to the BMP, I can easily add these items to any comment letter that I may forward to the Owner/Engineer. Let me know if any outstanding site issues remain.

If I don't hear from you I will ask you if any other outstanding issues remain before I forward any letters to the Owner/Engineer.

Scott

SWMProg\BMP\ConInsp\Insp.trans

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

County BMP ID Code (if known): JR-021

Name of Facility: Bennetts Pond BMP No.: ____ of ____ Date: 1/10/03

Location: Governor's Land

Name of Owner: "

Name of Inspector: Rick Hall

Type of Facility: Wet Pond

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

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

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

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

Facility Item	O.K.	Routine	Urgent	Comments
Embankments and Side Slopes:				
Grass Height	✓			
Vegetation Condition	✓			
Tree Growth	✓			
Erosion	✓			
Trash & Debris	✓			
Seepage	✓			
Fencing or Benches				
Interior Landscaping/Planted Areas: ☒ None ☐ Constructed Wetland/Shallow Marsh ☐ Naturally Established Vegetation				
Vegetated Conditions	NA			
Trash & Debris	✓			
Floating Material	✓			
Erosion	✓			
Sediment	✓			
Dead Plant	✓			
Aesthetics	✓			
Other				
Notes:				

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools: ☑ Permanent Pool (Retention Basin) ☐ Shallow Marsh (Detention Basin) ☐ None, Dry (Detention Basin)				
Shoreline Erosion	✓			
Algae	✓			
Trash & Debris	✓			
Sediment	✓			
Aesthetics	✓			
Other				
Inflows (Describe Types/Locations): 18" RCP-north side, 18" RCP west side				
Condition of Structure				Submerged outlets
Erosion				could not be
Trash and Debris				observed-
Sediment				
Outlet Protection				
Other				
Principal Flow Control Structure - Riser, Intake, etc. (Describe Type): None				
Condition of Structure				
Corrosion				
Trash and Debris				
Sediment				
Vegetation				
Other				
Principal Outlet Structure - Barrel, Conduit, etc. : None				
Condition of Structure				
Settlement				
Trash & Debris				
Erosion/Sediment				
Outlet Protection				
Other				
Emergency Spillway (Overflow): east side- earthen				
Vegetation	✓	✓		Has some bare
Lining	✓	✓		areas with no
Erosion	✓			ground cover.
Trash & Debris	✓			
Other				
Notes:				

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	✓			
Animal Burrows		✓		One burrow just
Graffiti	✓			above water at
Other				midpoint of embk.
Surrounding Perimeter Conditions:				
Land Uses	✓			
Vegetation	✓			
Trash & Debris	✓			
Aesthetics	✓			
Access /Maintenance Roads or Paths				No direct access -
Other				

Remarks:

Aesthetic pond connected via 18" RCP to Wingfield Lake for equilibrium — water level control.

Overall Environmental Division Internal Rating: 3

Signature: [signature] **Date:** 1/10/03

Title: Envir. Specialist

SWMProg\BMP\CoInspProg\DetRet.wpd

Date Record Created:

Created By:

WS_BMPNO: JR021

Print Record

PRINTED ON
Thursday, March 11, 2010
2:38:39 PM

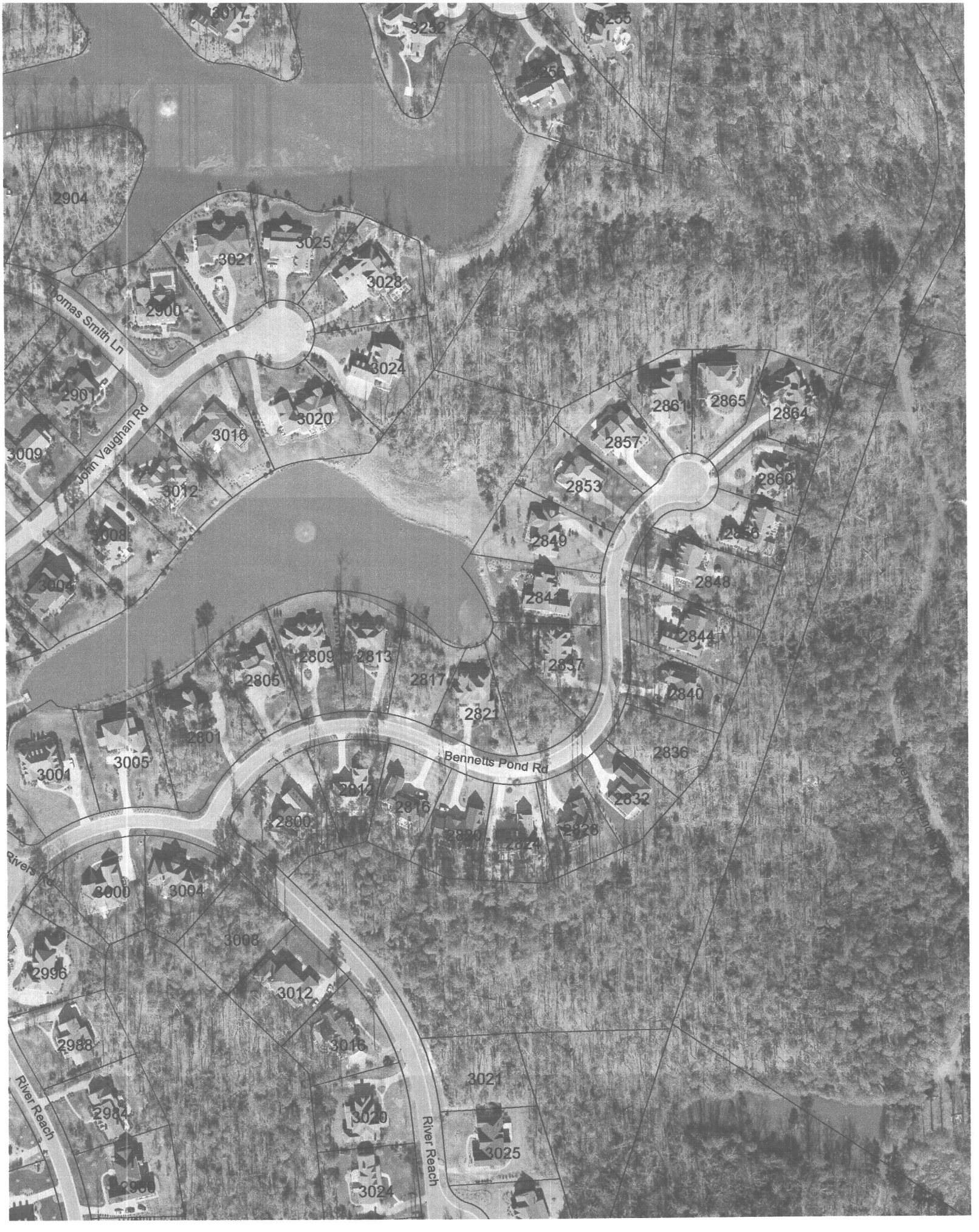
WATERSHED	JR
BMP ID NO	021
PLAN NO	S-14-93
TAX PARCEL	(44-5)(1)
PIN NO	4511000001A
CONSTRUCTION DATE	7/1/1993
PROJECT NAME	Governors Land - Bennetts Pond
FACILITY LOCATION	Behind 3020 John Vaughn Lane
CITY-STATE	Williamsburg, VA
CURRENT OWNER	Governors Land Foundation
OWNER ADDRESS	2700 Two Rivers Road
OWNER ADDRESS 2	
CITY-STATE-ZIP CODE	Williamsburg, VA 23185
OWNER PHONE	
MAINT AGREEMENT	Yes
EMERG ACTION PLAN	No

Get Last BMP No | Return to Menu

MAINTENANCE PLAN	No
SITE AREA acre	1444
LAND USE	SFRES
old BMP TYP	Wet Pond
JCC BMP CODE	A2 Wet Pond
POINT VALUE	11
SVC DRAIN AREA acres	23.1
SERVICE AREA DESCRI	SF Lots & Roadways
IMPERV AREA acres	
RECV STREAM	UT of James River
EXT DET-WQ-CTRL	Yes
WTR QUAL VOL acre-ft	2.13
CHAN PROT CTRL	No
CHAN PROT VOL acre-ft	0
SW/FLOOD CONTROL	Yes
GEOTECH REPORT	Yes

CTRL STRUC DESC	Dewat Pipe
CTRL STRUC SIZE inches	
OTLT BARRL DESC	Dewat Pipe
OTLT BARRL SIZE inch	
EMERG SPILLWAY	Yes
DESIGN HW ELEV	21.0
PERM POOL ELEV	18.25
2-YR OUTFLOW cfs	
10-YR OUTFLOW cfs	
REC DRAWING	Yes
CONSTR CERTIF	No
LAST INSP DATE	1/10/2003
Inspected by:	
INTERNAL RATING	3
MISC/COMMENTS	Pond A. Submerged dewatering pipe to Wingfield Lake. ES El 20.88

Additional Comments:


Thomas Smith Ln
John Vaughan Rd
Bennetts Pond Rd
River Reach
River Reach
2904
3021
3025
3028
2900
3024
2901
3020
3016
3009
3012
3008
3004
2861
2865
2864
2857
2853
2860
2849
2848
2844
2809
2813
2805
2817
2837
2840
2821
2801
3001
3005
2836
2832
2812
2816
2800
2820
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3000
3004
3008
2996
3012
2988
3016
3021
2984
3020
3025
2980
3024

James City County, Virginia
Environmental Division

Stormwater Management/BMP
Record Drawing Review Form

County Plan No. S-14-93

Project Name: Gov. Land - Bennetts Pond

Stromwater Management Faciltiy:

Component	Approved Plan	Record Drawing	OK
Top of dam (lowest point)		21.05	
Top of Dam (reported)	22.0	21.05	
Top width of dam	15'		
Crest of riser	None	~~[illegible]~~	
Crest of Emerg. Spillway	21.2	20.88	
Low Water elevation		NA	
Normal Water level	17.76	18.25	
Bottom of pond elevation		NA	
Inflow Pipe size (1)		18" RCP	
Inflow Pipe size (2)		18" RCP	
Inflow Pipe size (3)		18" RCP	
Barrel Diameter (inches)		~~8" [illegible]~~	
~~100~~ 25 yr Storm Elevation	19.5	19.5 ~~[illegible]~~	
Trash rack/anti-vortex type	None	~~[illegible]~~	
Forbay, baffle wall, etc.		None	
Pond drain elevation		NA	
No principal control?		No Seal on plans	

Date: 1/7/03

Name: [illegible]