Stormwater Division

MEMORANDUM

DATE: March 9, 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: PC181

PIN: 4710100066

Subdivision, Tract, Business or Owner Name (if known): Williamsburg Unitarian Universalists

Property Description: Church site

Site Address: 3041 Ironbound Road

(For internal use only) **Box** 7 **Drawer:** 4

Agreements: (in file as of scan date) **Y** **Book or Doc#:** 000022914 **Page:** 638 640

Comments

Date Record Created:

Created By:

Effective Year_Declaration of Covenants:

WS_BMPNO: PC181

WATERSHED	PC
BMP ID NO	181
PLAN NO	SP-39-99
TAX PARCEL	(47-1)(1-66)
PIN NO	4710100066
CONSTRUCTION DATE	1/1/2000
PROJECT NAME	Williamsburg Unitarian Universalist
FACILITY LOCATION	3041 Ironbound Road
CITY-STATE	Williamsburg, Va. 23185
CURRENT OWNER	Williamsburg Unitarian Universalists
OWNER ADDRESS	3051 Ironbound Road
OWNER ADDRESS 2	
CITY-STATE-ZIP CODE	Will
OWNER PHONE	
MAINT AGREEMENT	Yes
EMERG ACTION PLAN	No

Get Last BMP No | Return to Menu

Other affected parcels:

PIN_NO2: PIN_NO8:

PIN_NO3: PIN_NO9:

PIN_NO4:

PIN_NO5:

PIN_NO6:

PIN_NO7:

MAINTENANCE PLAN	No
SITE AREA acre	1.75
LAND USE	Parking Lot
old BMP TYP	Dry Pond
JCC BMP CODE	
POINT VALUE	
SVC DRAIN AREA acres	1.53
SERVICE AREA DESCRI	Parking Lot Expansion
IMPERV AREA acres	0.88
RECV STREAM	UT of Powhatan Creek
EXT DET-WQ-CTRL	Yes
WTR QUAL VOL acre-ft	0.0364
CHAN PROT CTRL	No
CHAN PROT VOL acre-ft	0
SW/FLOOD CONTROL	Yes
GEOTECH REPORT	No

CTRL STRUC DESC	DI-1 Riser
CTRL STRUC SIZE inches	
OTLT BARRL DESC	RCP Barrel
OTLT BARRL SIZE inch	24
EMERG SPILLWAY	Yes
DESIGN HW ELEV	68.55
PERM POOL ELE	na
2-YR OUTFLOW cfs	1.30
10-YR OUTFLOW cfs	9.29
REC DRAWING	Yes
CONSTR CERTI	No
LAST INSP DATE	4/4/2003
INTERNAL RATING	3

Inspected by:

MISC/COMMENTS

South of main building. BMP for gravel parking lot expansion.

Additional Comments:

DECLARATION OF COVENANTS

INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

COPY

THIS DECLARATION, made this 12 day of DECEMBER, ~~19~~ 20 00, between THE WILLIAMSBURG UNITARIAN UNIVERSALISTS, and all successors in interest, hereinafter referred to as the "COVENANTOR(S)," owner(s) of the following property: 3051 IRONBOUND ROAD, WMSBG., VA. 23185, Deed Book 638, Page No. 640 or Instrument No. —, and James City County, Virginia, hereinafter referred to as the "COUNTY."

WITNESSETH:

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

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

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

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

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

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

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

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

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

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

Recorded Dec. 13, 2000

Instrument # 000022914

IN WITNESS WHEREOF, the COVENANTOR(S) have executed this DECLARATION OF COVENANTS as of this 12 day of December, ~~19~~ 2000.

COVENANTOR(S)

Print Name/Title THOMAS C. PAYNE
WUV BOARD

ATTEST:

COVENANTOR(S)

Print Name/Title

ATTEST:

COMMONWEALTH OF VIRGINIA
CITY/COUNTY OF Virginia

I hereby certify that on this 12 day of December, ~~19~~ 2000, before the subscribed, a Notary Public of the State of Virginia, and for the City/County of James City, aforesaid personally appeared THOMAS C. PAYNE and did acknowledge the aforegoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 12 day of December, ~~19~~ 2000.

Notary Public

My Commission expires: 10/31/2004

Approved as to form:

Deputy County Attorney

This Declaration of Covenants prepared by:

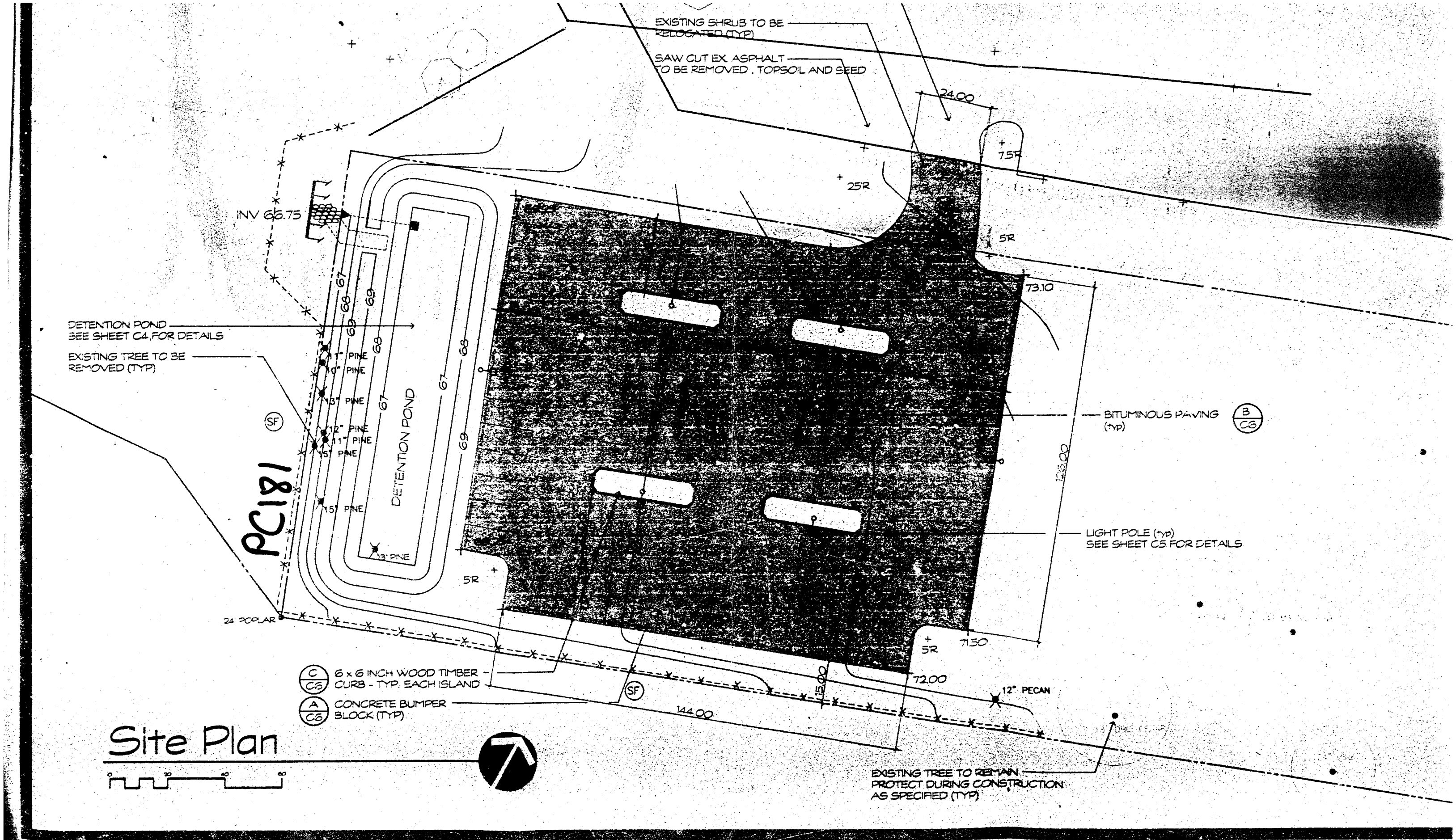
THOMAS C. PAYNE
(Print Name)

WUV BOARD
(Title)

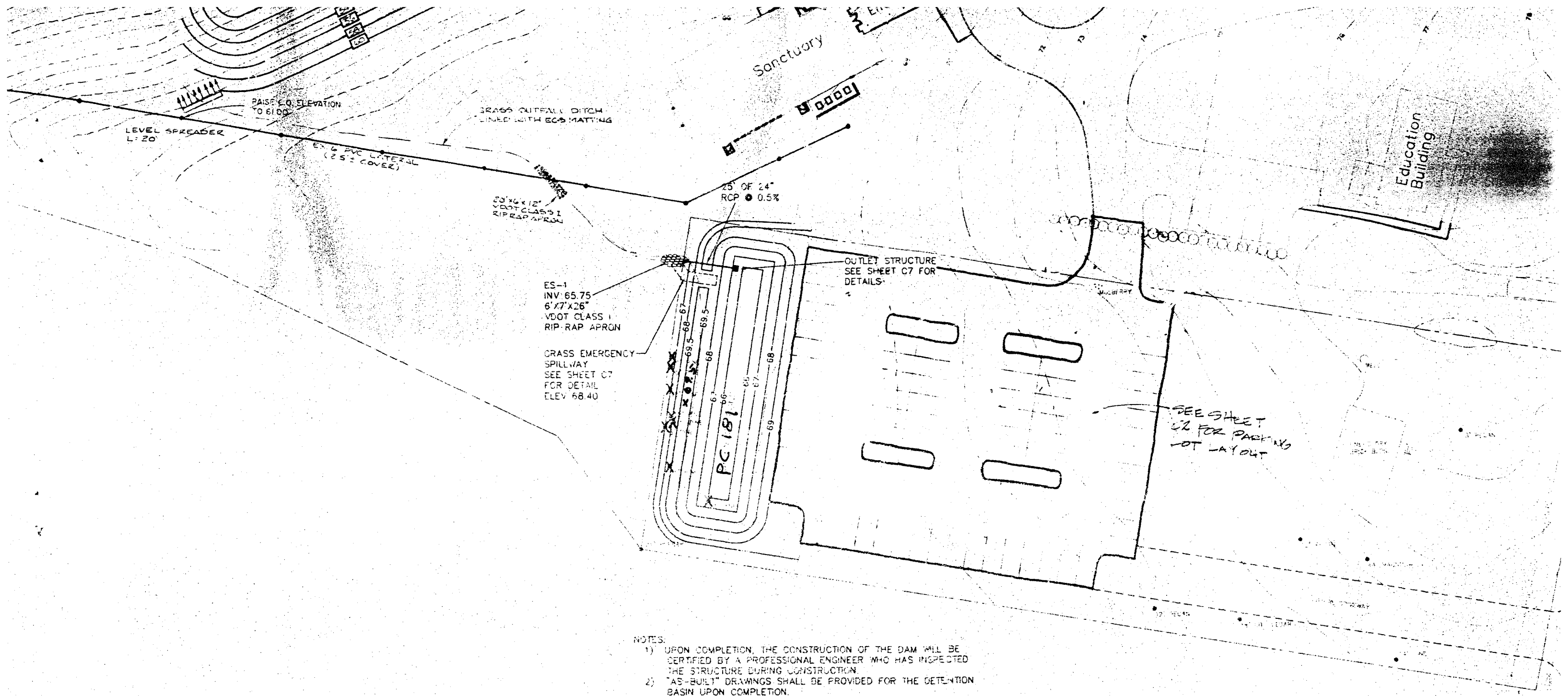
107 HALSTEAD LANE
(Address)

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

drainage.pre
Revised 2/97


EXISTING SHRUB TO BE RELOCATED (TYP)
SAW CUT EX. ASPHALT TO BE REMOVED, TOPSOIL AND SEED
24.00
7.5R
25R
INV 66.75
5R
73.10
DETENTION POND SEE SHEET C4, FOR DETAILS
EXISTING TREE TO BE REMOVED (TYP)
1" PINE
10" PINE
13" PINE
12" PINE
11" PINE
15" PINE
15" PINE
13" PINE
DETENTION POND
67
68
69
SF
BITUMINOUS PAVING (TYP)
B/C6
126.00
LIGHT POLE (TYP) SEE SHEET C5 FOR DETAILS
5R
24 POPLAR
5R
71.50
C/C6 6 x 6 INCH WOOD TIMBER CURB - TYP. EACH ISLAND
A/C6 CONCRETE BUMPER BLOCK (TYP)
SF
15.00
72.00
12" PECAN
144.00
EXISTING TREE TO REMAIN PROTECT DURING CONSTRUCTION AS SPECIFIED (TYP)
PC181

Site Plan



NOTES:

1) UPON COMPLETION, THE CONSTRUCTION OF THE DAM WILL BE CERTIFIED BY A PROFESSIONAL ENGINEER WHO HAS INSPECTED THE STRUCTURE DURING CONSTRUCTION.
2) "AS-BUILT" DRAWINGS SHALL BE PROVIDED FOR THE DETENTION BASIN UPON COMPLETION.
3) THE DETENTION POND SHALL BE USED AS A SEDIMENT BASIN DURING CONSTRUCTION BY PLUGGING THE LOW FLOW ORIFICE. ONCE THE SITE IS STABILIZED THE LOW FLOW ORIFICE SHALL BE UNPLUGGED TO ALLOW THE POND TO ACT AS A PERMANENT BMP. THE SEDIMENT IN THE BASIN SHALL BE REMOVED BEFORE THE LOW FLOW ORIFICE IS UNPLUGGED.
4) ALL LATERAL CLEANOUTS ALONG THE PROPOSED OUTFALL DITCH MUST BE INSPECTED AND REPAIRED, IF DAMAGED, TO ENSURE THEY ARE NOT A PATH FOR STORM WATER TO ENTER THE SANITARY SEWER SYSTEM.

Record Drawing / Construction Certification Submittal for a BMP

Date: 1/27/03

Inspector:
- ☒ Pat Menichino
- ☒ Joe Buchite
- ☐ Beth Davis
- ☐ Gerry Lewis
- ☐ Jim Rudnicky
- ☐ Other: _____

Project: Williamsburg Unitarian Universalists
BMP Facility: Dry Pond at Parking Lot Expansion
Plan No.: SP-39-99
Assigned County BMP ID Code: PC181

I have received a transmittal for a ☒ Record Drawing and ☐ Construction Certification for the above referenced facility on 1/15/03. 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 may make comment in the following areas: Inspection/Maintenance agreement, Record Drawings (RD), Construction Certification (CC) and Construction-Related (CR) field items as it pertains to the BMP. If you have any other related non-BMP site issues such as site erosion, stabilization, removal of erosion & sediment controls, etc. that are not related to the BMP, you must proceed with closing out these items on your own accord. If needed, I can easily add these items to any comment letter that I may generate the Owner/Engineer for the BMP. Let me know if I need to add items for site issues to my process.

Scott

AsBuilts\Admin\z-inspector

Scott,

There aren't any changes that I am aware of on this Record Drawing.

Joe

4710100066
3041 Ironbound Rd. 23185
Williamsburg Unitarian Universalists
3051 Ironbound Rd.
1.75 AC.
R 8

James City County, Virginia
Environmental Division

Owner:
3051 Ironbound Road

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

County Plan No.: SP-39-99; Amended SP-116-02 Parking Lot Expansion (South of Main Church)
Project Name: Williamsburg Unitarian Universalists
Stormwater Management Facility: Dry Pond
Phase: ☐ I ☒ II ☐ III

- ☐ Information Received. Date/By: 1/15/03 Rickmond
- ☐ Administrative Check.
  - ☐ Record Drawing Date/By: 1/15/03 Rickmond
  - ☐ Construction Certification Date/By:
  - ☐ RD/CC Standard Forms (Required for all BMPs after Feb 1st 2001 Only)
  - ☒ Insp/Maint Agreement #/Date: Comment #2, ED 4/14/99; I/m #0000 22914 Dec 13 2000
  - ☒ BMP Maintenance Plan Location: No.
  - ☐ Other:
- ☒ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review file.
  ☐ Yes ☒ No Location: Note 1 & 2, Sheet C4 AB & CC
- ☑ Assign County BMP ID Code Code: PC 181
- ☑ Preliminary Input into Division's "As-Built Tracking Log"
- ☑ Add Location to GIS Database Map. Obtain site information (GPIN, Owner, Site Area, Address, etc.)
- ☑ Preliminary Log into Access BMP Database (BMP ID #, Plan No., GPIN, Project Name)
- ☑ Active Project File Review (correspondence, H&H, etc.).
- ☑ Initial As-Built File setup (Label, copy hydraulics, BMP plan and detail information, etc.).
- ☑ Inspector Check of RD/CC (forward to inspector using transmittal for cursory review.). GFL
- ☑ Pre-Inspection Drawing Review - Approved Plan (Quick look prior to Field Inspection).
- ☑ Final Inspection (FI) Performed Date: 4/4/03 SJT
- ☑ Record Drawing (RD) Review (*) Date: 4/4/03 SJT
- ☑ Construction Certification (CC) Review Date: 4/4/03 SJT
- ☑ Actions:
  - ☐ No comments.
  - ☑ Comments. Letter Forwarded. Date: 4/4/03
    - ☐ Record Drawing (RD)
    - ☐ Construction Certification (CC)
    - ☐ Construction-Related (CR)
    - ☐ Site Issues (SI)
    - ☐ Other :
- ☐ Second Submission:
- ☐ Third Submission:
- ☐ Acceptable for stormwater managment facility purposes (RD/CC/CR/Other). Proceed with bond release.
- ☐ If ok for full release, notify Inspector and Inspector Supervisor using "Surety Request Form".
- ☐ Check/Clean active file of any remaining material and finish "As-Built" file.
- ☑ Add to County BMP Inventory/Inspection schedule (Phase I, II or III).
- ☐ Copy Final Inspection Report into County BMP Inspection Program file.
- ☑ Obtain Digital Photographs of BMP and log into computer.
- ☑ Add to JCC Hydrology & Hydraulic database (optional).
- ☐ Complete "As-built Tracking Log".

Also ED Comm #3 4/14/99 AB & CC

BMP Certification Information Acceptable

Plan Reviewer: _____ Date: _____

* See separate checklist.

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

December 2, 2004

Reinspect 12/02/04

Mr. Robert Cowling
Williamsburg Unitarian Universalist
3051 Ironbound Road
Williamsburg, Va. 23185

Re: Williamsburg Unitarian Universalist Church
Parking Lot Expansion Project
County Plan No. SP-39-99
County BMP ID Code: PC 181

Dear Mr. Cowling:

Based on our phone conversation on Monday November 29th 2004, the Environmental Division has considered your request to waive construction certification requirements associated with the BMP for the above referenced project. The BMP for the parking lot expansion is a small dry pond situated to the west of the gravel parking area. Reference is also made to a letter issued by our Division on April 4, 2004 (attached). For this specific project, Note # 1 on Sheet C4 of the approved plan set indicated the following:

> *"Upon completion, the construction of the dam will be certified by a professional engineer who has inspected the structure during construction."*

As this note was present on the approved plans and specifications, it was responsibility of the Owner or Contractor to ensure a professional engineer was present during the construction process to observe construction and to provide proper construction certification once the structure was completed.

Although recently, we have strengthened and provided better definition to the record drawing (as-built) and construction certification process for stormwater management facilities, the requirement for construction certification by a registered professional engineer has not changed since review and approval of this plan.

In full consideration of your request, there was an apparent failure by the Owner or Contractor to properly retain the services of a professional engineer to inspect and perform required testing of the BMP during it's construction and/or to provide subsequent construction certification. The basis of the variance request is that you were not aware of construction certification requirements and BMP construction was of a minor nature.

Although we agree that the earthen embankment for the BMP is of relatively small height, proper construction of the fill embankment for the basin is critical to the long-term structural integrity of the stormwater management best management practice and to ensure no impacts to adjacent offsite property. At a minimum, this portion of facility construction warranted proper observation and certification by an engineer.

However, based on field inspection of BMP and a full review of the approved design plan, onsite and offsite adjacent land uses and post-construction certification information as submitted including a record drawing by Rickmond Engineering, Inc. (January 15, 2003), it has been determined that for ***this specific review case only***, the construction certification requirement will be waived. Conditions that apply to the waiver are outlined below. The primary reasons for granting a waiver for this case are as follows:

- The dry pond serves a relatively small drainage area of about 1.7 acres.
- Topography is such that should an embankment failure or pond overflow occur, environmental or property damage would be confined to land owned by the church (GPIN 4710100065A, Williamsburg Unitarian Universalist)
- The earthen fill embankment, which would require proper certification, is of relatively small height (less than 3 feet above existing ground) and the 100-year design high water for the facility (El. 68.55) is generally below top of dam asbuilt elevations (El. 69.0).
- Our assigned Environmental Division inspector has not indicated any unusual observations about function of the BMP. *(Please note that inspections by the Environmental Division are for compliance, not construction inspection, purposes only.)*
- The dam embankment has not exhibited any unusual signs of seepage, stress, malfunction or failure since it's completion, even during Hurricane Isabel. The basin appears to fill and draw down per the intended design.
- Overall, there are no obvious signs indicating threatening conditions to the stormwater function or structural integrity of the stormwater management facility.
- The facility appears to have been reasonably maintained by the Owner since completion.

Conditions which apply to granting of the waiver request are construction (field) related items which need to be performed as follows:

- Mow the dam embankment.
- Clear and remove all debris and leaves from the grates on the principal spillway. The principal spillway (riser) is a EW-11 inlet structure at the north end of the basin. Flow out of the BMP shall not be obstructed by debris.

Our office will proceed with release of the erosion and sediment control surety in accordance with our usual administrative process under the assumption that these field items will be concurrently addressed in a satisfactory manner. Once these field-related items (conditions) are completed, contact our office for reinspection.

It should be realized that granting of variances of this nature are seldom performed by our Division. Lack of knowledge about the process or overlooking items that are clearly delineated on approved plans are not normally justification to grant a variance. For this specific case, many factors and the overall history and general function of the facility were weighed into the decision.

If you have any additional questions or comments, you can contact me at 253-6673 or the assigned Environmental Division inspector, Ms. Molly Roggero at 757-253-6839. Thank you for your consideration on this matter.

Sincerely,

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

Attachments
SJT/sjt

cc: Molly Roggero, Environmental Division Inspector

Asbuilts\Variances\SP3999.pc181

AB File

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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COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620

April 4, 2003

Mr. Thomas C. Payne
Williamsburg Unitarian Universalist
3051 Ironbound Road
Williamsburg, Va. 23185

Re: Williamsburg Unitarian Universalist
Parking Lot Expansion Project
County Plan No. SP-39-99; Amended Plan No.
County BMP ID Code: PC 181

Dear Mr. Payne:

The Environmental Division has reviewed a record drawing as submitted to our office on January 15th 2003 for the BMP associated with the above referenced project. The record drawing provides as-built information for a small dry pond BMP situated to the west of the gravel parking lot area. The gravel parking lot is situated to the south of the main building.

Based on our review of the project and a concurrent field inspection as performed on April 4th 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.

Construction Certification:

1. In accordance with the Note # 1 on Sheet C4 of the approved plan, construction certification is required for the stormwater management/BMP facility. None was provided. This is especially important since the facility has an engineered and compacted earthen embankment. The certification can be in letter format or by use of the certification statements in Section 4 of the *James City County, Stormwater Management/BMP Facilities, Record Drawing and Construction Certification, Standard Forms & Instructions*. A copy of these requirements are attached.

Record Drawing:

2. Along with the record drawing set, submit completed record drawing and construction certification forms, Sections 1 through 5, and applicable record drawing checklists from the *James City County, Stormwater Management/BMP Facilities, Record Drawing and Construction Certification, Standard Forms & Instructions* (packet). The Environmental Division began use of the forms and checklists in this packet effective February 1st 2001.

3. A certification statement is required for the record drawing. Refer to pages 3 and 4 of the *James City County, Stormwater Management/BMP Facilities, Record Drawing and Construction Certification, Standard Forms & Instructions* (packet).

4. Otherwise, the record drawing dated January 15th 2003 is **satisfactory.** Please forward one reproducible and one blue/black line set of the record drawings to our office.

Construction - Related Items:

5. Based on the approved plan, the top of dam for the embankment along the west side of the BMP was to be at Elevation 69.5 (minimum). This was to provide a required 1 ft. minimum of freeboard (separation) from the 100-year design high water (El. 68.55) to constructed top of dam. Based our review of the record drawing, the highest top of dam elevation shown is at El. 69; thus the dam was constructed approximately ½ ft. too low. Approximately only ½ ft. of freeboard is present. Normally, our division would require additional spot elevations to confirm highest top of dam elevation or the dam would need additional compacted soil fill to conform with the approved plan specifications. As this facility appears is a small dry detention facility, appears to be properly maintained, the emergency spillway was constructed and is lined with erosion control matting and any dam embankment overtopping would be conveyed onto the adjacent parcel which appears to be owned by the church (ie. no immediate danger to adjacent structures or property, we will not require reconstruction or raising the dam.

   However, it is important to note that since 1 foot of freeboard will not be present for the BMP design, proper long-term routine maintenance of the BMP should be a high priority. Dams which overtop have a high chance of failure due to erosive forces of water across the downstream face of the dam fill. To minimize the chance of overtopping, keep the dam embankment free and clear of trees, shrubs and woody vegetation and maintain a grass covering 2 to 4 inches in height. In addition, inspect the entire dam embankment frequently for signs of erosion, seepage or animal burrows (make any necessary repairs immediately) and ensure the principal flow control structure is regularly checked and cleared of any trash, debris, litter or sediment which may obstruct flow into the riser and barrel. As this is a dry detention facility one of the most visible signs of clogging of the spillway device is the presence of standing water in the bottom of the basin. When working properly, the water pool should draw down completely within 24 to 48 hours after a rainfall event. For further information on routine maintenance for dry pond facilities, refer to the BMP portion of the County's watershed education website www.protectedwithpride.org.

6. Remove silt fence and wooden stakes present at the south end of the basin.

7. The facility is intended to be a dry-type detention practice. Based on our field observations, standing water approximately 2 to 3 inches deep was present in the bottom of the facility. This is indicative of sediment or debris accumulations around the water quality control orifice. The water quality (or BMP) control orifice for this structure is EW-11 structure with a wire mesh screen covering and a small size circular orifice present in the bottom of the riser. It appears that clogging of the orifice, rather than the mesh screen, may be the cause of standing water as water is also present in the EW-11 structure. Completely clear and remove trash, sediment and debris from the mesh screen and the low flow orifice. *(Note: the DI-1 riser grate or the wire mesh screen may need to be temporarily removed to properly clean the devices.)*

8. Three small channels convey flow from the gravel parking area to the BMP basin. The channel approximately 25 ft. north of the south end of the parking lot has a sediment plume approximately 2 to 3 inches deep where the channel ends at the basin bottom. Clean and remove accumulated sediment. Inflow into the basin shall not be obstructed by sediment.

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

Attachments
SJT/sjt

cc: Mike Baust, Rickmond Engineering Inc. - via fax
Joe Buchite, JCC Environmental Division Inspector

G:\AsBuilts\SP3999.pc181

Letter of Transmittal	Date: January 15, 2003
Rickmond Engineering, Inc. 1643 Merrimac Trail Williamsburg, VA 23185 Phone: 757-229-1776 Fax: 757-229-4683 Email: rei@rickmond.com www.rickmond.com	Project Number: 02204 Project Title: Williamsburg Unitarian Universalist Church

JAN 2003 RECEIVED ENVIRONMENTAL DIVISION

SP-116-02
SP-39-99
PC 181

To: James City County Planning

Address: 101-E.Mounts Bay Road

City/State/Zip: Williamsburg, Virginia 23185

Attn: Ms. Joan Etchberger

Phone No.: 253-6685

We are sending you the following items:

( ) Project Manual (X) Drawings ( ) Copy of Letter ( ) Shop Drawings
( ) Samples ( ) Change Order (X) Other

Via : ( ) USPS Mail ( ) UPS ( ) Fed-Ex (X) Hand Delivery ( ) Fax Only

Copies	Date	No. of Pages	Description
1	1/03/02	1	Record Drawing of Detention Pond
1	1/13/02	1	Site Photos

These item are transmitted:

(X) For Approval ( ) For Your Use
( ) As Requested ( ) For Review and Comment

Remarks:

Should you have any questions or require additional information, please contact our office.

Copy to:

Signed:
Michael J. Baust
Project Manager

I:\02204\Correspondence\LOT's\Etchberger,JCC,MJB,1,15,'03.doc

December 13, 2002

Richmond

FROM: Mike Baust

SUBJECT: Site Photos of Williamsburg Unitarian Universalist Church

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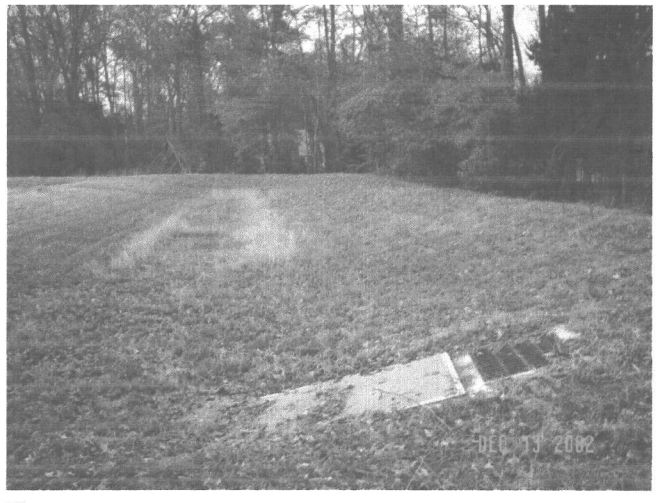
1)



2)

3)

4)

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

SP-39-99
4710100066

County BMP ID Code (if known): PC 181

Name of Facility: Williamsburg Unitarian Universalists Parking Expansion BMP No.: ____ of ____ Date: ____

Location: 3041 Ironbound Road (South of Main Building)

Name of Owner: Williamsburg Unitarian Universalists

Name of Inspector: SJ Thomas

Type of Facility: Dry Detention Basin

Weather Conditions: Sunny, Hot, 70's 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.

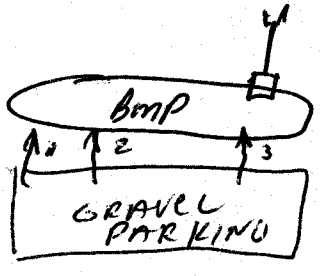
Facility Item	O.K.	Routine	Urgent	Comments
Embankments and Side Slopes: Small 3-4 High Berm Dam ≈ 150' Long				
Grass Height	✓			Maintained Grass
Vegetation Condition	✓			Grass/Leaves
Tree Growth	✓			None; Tall trees along toe
Erosion	✓			None.
Trash & Debris	✓			None.
Seepage	✓			None Observed.
Fencing or Benches				N/A
Interior Landscaping/Planted Areas: ☒ None ☐ Constructed Wetland/Shallow Marsh ☐ Naturally Established Vegetation				
Vegetated Conditions	✓			Grass bottom
Trash & Debris	✓			
Floating Material	✓			Some Leaves.
Erosion	✓			
Sediment	✓			
Dead Plant	✓			
Aesthetics	✓			
Other	✓			
Notes: Serves Gravel Parking Area + Adjacent (East) House + Yard.				

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools: ❒ Permanent Pool (Retention Basin) ❒ Shallow Marsh (Detention Basin) ☒ None, Dry (Detention Basin)				
Shoreline Erosion	✓			Little - none
Algae	✓			
Trash & Debris	✓			Leaves
Sediment	✓			Measured < 1"
Aesthetics	✓			Basic Pond Look.
Other			✓	2-3" standing water.
Inflows (Describe Types/Locations): 3 - small channelized inflow points; East side Dam				
Condition of Structure	✓			
Erosion		✓	✓	Clean sed plume at inflow #2
Trash and Debris				
Sediment		✓	✓	
Outlet Protection	✓			
Other	✓			
Principal Flow Control Structure - Riser, Intake, etc. (Describe Type): EW-11 with OI-1 RISER APPROX 2.5' deep				
Condition of Structure	✓			
Corrosion	✓			
Trash and Debris		✓	✓	clogged Mesh or Low Flow Orif.
Sediment	✓			
Vegetation	✓			
Other				
Principal Outlet Structure - Barrel, Conduit, etc. : 24" RCP w/ ES-1				
Condition of Structure	✓			
Settlement	✓			
Trash & Debris	✓			
Erosion/Sediment	✓			
Outlet Protection	✓			Class I 10'x10'
Other				
Emergency Spillway (Overflow): Small EC-3 lined ES, Northend, 5' TW; 3" deep				
Vegetation	✓			
Lining	✓			EC-3 ok
Erosion	✓			None.
Trash & Debris	✓			Some Leaves
Other				
Notes: No signs of Channel degradation.				

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	✓			None, but high potential due to
Animal Burrows	✓			standing water.
Graffiti	✓			
Other				
Surrounding Perimeter Conditions:	North - Church Yard; East - GRAVEL PARKING; South + EAST WOODED			
Land Uses	✓			stabilized all around
Vegetation	✓			
Trash & Debris	✓			
Aesthetics	✓			Basic Pond Look
Access /Maintenance Roads or Paths	✓			EASY access from bound ROAD TO GRAVEL PARKING
Other				

Remarks:

- 2-3" standing water, should be dry. Clean mesh trash rack and low flow orifice inside EW-11/Riser. Orifice may be clogged as standing water was also in the EW-11
- clean sediment 2" deep plume at channel inflow #2. 25' from south end of parking area.
- Remove silt fence + wooden stakes @ south end of basin
- D/S natural channel ok



Overall Environmental Division Internal Rating: 3 (once cleaned & dewatered could be 4)

Signature: [signature] P.E **Date:** 4/4/03 3:05pm

Title: Civil Engineer ENV DIV

SWMProg\BMP\CoInspProg\DetRet.wpd

APR 1999 RECEIVED PLANNING DEPARTMENT

ENVIRONMENTAL DIVISION REVIEW COMMENTS
WILLIAMSBURG UNITARIAN CHURCH PARKING LOT EXPANSION
PLAN NO. SP-39-99
April 14, 1999 MCE/DEL

KWJ 1. A Land Disturbing Permit and Siltation Agreement, with surety, are required for this project. Provided by Developer

KWJ 2. **An Inspection/Maintenance Agreement shall be executed with the county for the BMP facility** for this project. Provided by Developer

KWJ 3. **As-built drawings must be provided for the detention basin on completion. Also, a note shall be provided on the plan stating that upon completion, the construction of the dam will be certified** by a professional engineer who has inspected the structure during construction. Provided on C4

KWJ 4. Provide the revised James City County Erosion Control Notes dated 4/7/97 on the plan sheet. Provided on C7

KWJ 5. Submit an adequacy analysis for all receiving channels to ensure that the channel is stable for the 2-year velocity. Not required because detention reduces 2 year-post development storm to less than pre-development rate

KWJ 6. The outfall of the basin, even with the level spreader, will direct flows to an existing house in Chanco's Grant. Provide a method to direct water leaving the basin, into natural drainage on the northwestern side of the church property. Outfall Ditch provided to existing channel

KWJ 7. The emergency spillway appears to be located in a fill area. If so, then the spillway would have to be constructed of non erosive material, such as concrete. See Detail on C7. Pyramat has a long term velocity (50 hrs) capacity of 14

KWJ 8. The BMP design needs to be modified as follows:

A. The top of the principal spillway needs to be sloping such as was done on the church's other BMP facility. Revised on C7

B. The 10-year storm must be calculated and it must pass through the principal spillway structure. Provided

C. The amount of discharge for the emergency spillway seems excessive. According to the VESCH, an 8' wide spillway will discharge only 8 cfs with 0.6 foot of head. Please revise and rerun. Revised

D. There needs to be one foot of freeboard above the 100 year design high water. Provided

E. The principal spillway needs to have a surface that is not flat as proposed. Although the head is limited in this instance, a domed grate or a cage arrangement needs to be provided in place of the flat grate. Revised on C7 OI top is sloped to bank

F. The detail of the BMP shows the outlet structure protruding out from the dam side slopes. The riser structure should be moved into the fill section of the dam, so that the outlet structure becomes part of the dam face. The outlet structure should be similar to the one used for the first phase of construction of the church. Revised on C7

G. Provide an anti-seep collar for the principal spillway. Revised on C7

KWJ 9. It is stated in the notes that the BMP will be used as a sediment trap during construction of the parking lot. This could be accomplished by temporarily plugging the low orifice. Provide information that describes how it is to be used and then converted to a permanent BMP facility. See Note #3 on C4

PC024
PC181

BMP AND DRAINAGE CALCULATIONS

for

WILLIAMSBURG UNITARIAN UNIVERSALIST CHURCH

PC 181

January 18, 1999

REVISED

Rickmond

Rickmond Engineering, Inc.
1643 Merrimac Trail
Williamsburg, VA 23185
Phone: 757-229-1776
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e-mail: rickmond@tni.net
www.rickmond.com

Project No. 98199

COMMONWEALTH OF VIRGINIA
K.M. JENKINS II
No.022872
5/14/99
PROFESSIONAL ENGINEER

1984 - 1999
15
YEARS OF EXCELLENCE
Rickmond Engineering, Inc.

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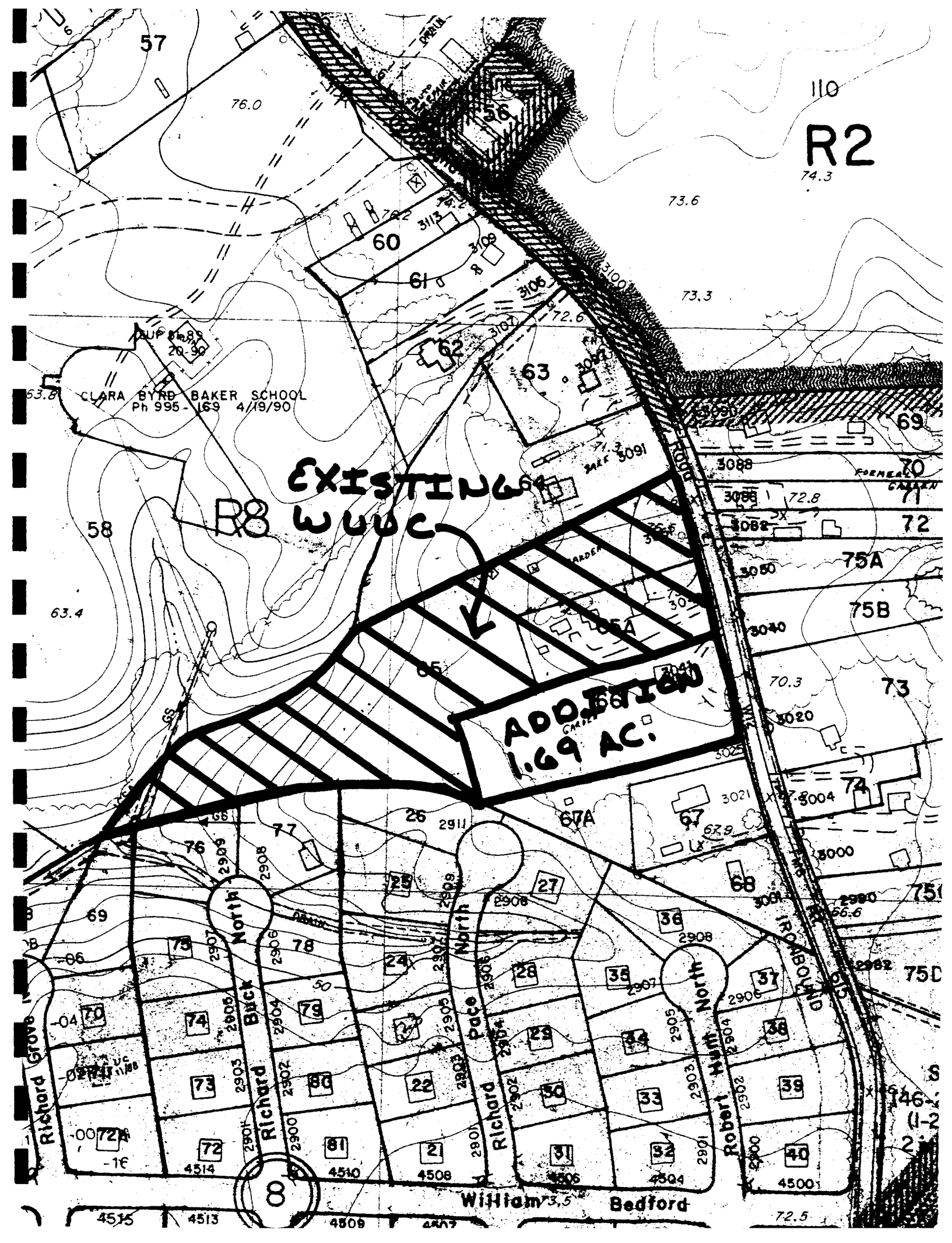
Preface

The following calculations pertain to the parking lot expansion of the Williamsburg Unitarian Universalist Church located on Ironbound Road in James City County, Virginia.

Currently the site consists of an existing church, parking lot, and detention pond located on 5.93 acres. The church has purchased an adjacent **1.69 acres** and plans to construct a parking lot and detention pond. The existing site attains 12.20 James City County BMP points. With the parking lot expansion and proposed detention pond the new site attains 10.06 JCC BMP points. The pond also reduces the 2 year post-development runoff rate of **5.11 cfs to 1.30 cfs**, which is less than the 2 year pre-development runoff rate of 1.44 cfs. The 100 year post development storm is also passed through the outlet structure with 1.0' of freeboard.


R2
CLARA BYRD BAKER SCHOOL
Ph 995-169 4/19/90
EXISTING
R8 WUUC
ADDITION
1.69 AC.
Richard Grove
Buck
Richard
North
Pace
Richard
North
Robert Hunt
IRONBOUND
William
Bedford
Road

RICKMOND ENGINEERING, INC.
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JOB 98199
SHEET NO. 2 OF
CALCULATED BY KMJ DATE 10/12/98
CHECKED BY DATE
SCALE

Existing Site

1.90 ac. of conservation easement in existing site

Adjusted site area for structural BMP purposes is
5.93 ac − 1.90 ac = 4.03 ac

Expanded Site

Total Area = 5.93 ac + 1.69 ac = 7.62 ac

Area from new parcel treated by existing pond = 0.0 ac

Total Area treated by existing pond = 4.09 ac

Adjusted site area for structural BMP purposes is
7.62 ac − 1.90 ac = 5.72 ac

Area treated by new pond = 1.53 ac

WORKSHEET FOR BMP POINT SYSTEM

Existing Site

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP POINTS		Fraction of Site Served by BMP		Weighted BMP Points
Design 4	9	X	1.0 (4.09ac)	=	9.00
		X		=	
		X		=	
		X		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 9.00

B. NATURAL OPEN SPACE CREDIT

	Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
(1.90 ac)	.32	X	10	=	3.20

C. TOTAL WEIGHTED POINTS

9.00	+	3.20	=	12.20
Structural BMP Points		Natural Open Space Points		TOTAL

WORKSHEET FOR BMP POINT SYSTEM

Expanded site

A. STRUCTURAL BMP POINT ALLOCATION

	BMP	BMP POINTS		Fraction of Site Served by BMP		Weighted BMP Points
Ex	Design 4	9	x	.72 (4.09ac)	=	6.48
	Design 2	4	x	.27 (1.53ac)	=	1.08
			x		=	
			x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 7.56

B. NATURAL OPEN SPACE CREDIT

	Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
x (1.90ac)	.25	x	10	=	2.5

C. TOTAL WEIGHTED POINTS

7.56	+	2.5	=	10.06
Structural BMP Points		Natural Open Space Points		TOTAL

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JOB 98199
SHEET NO. 5 OF
CALCULATED BY KMJ DATE 10/12/98
CHECKED BY DATE
SCALE

Size Pond as Extended Dry Pond Design 2

Use Sizing Rule 1 - volume equivalent to ½" of runoff distributed over the contributing watershed released over 12 hrs

Imp Area = 0.88ac Watershed Area = 1.53ac

$I = \frac{0.88ac}{1.53ac} = .58$

$Rv = .05 + .009I$
$Rv = .05 + .009(58)$

$Rv = .57$

$\text{Volume} = \frac{.57 \mid 1.53ac \mid 43560sf \mid 0.5in \mid 1ft}{\mid \mid 1ac \mid \mid 12in} = 1,585 cf$

Worksheet 2: Runoff curve number and runoff

Project WUUC Expansion By KWS Date 10/26/98

Location James City County, Va. Checked ____ Date ____

Circle one: (Present) Developed

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Craven Emporia (C)	Meadow	71			1.66	117.86
Craven Emporia (C)	Roof	98			.03	2.94
					Totals = 1.69	120.80

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{120.80}{1.69} = 71.5$; Use CN = 72

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2		
Rainfall, P (24-hour)	in	3.5		
Runoff, Q ..... (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in	1.1		

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

Project WUUC Expansion By KHJ Date 10/26/98

Location James City County, Va Checked ____ Date ____

Circle one: (Present) Developed

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID				
1. Surface description (table 3-1)		Grass				
2. Manning's roughness coeff., n (table 3-1) ..		0.15				
3. Flow length, L (total L ≤ 300 ft)	ft	300				
4. Two-yr 24-hr rainfall, P_2	in	3.5				
5. Land slope, s	ft/ft	.0233				
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	.35	+		=	

Shallow concentrated flow		Segment ID				
7. Surface description (paved or unpaved)		UNPAVED				
8. Flow length, L	ft	75				
9. Watercourse slope, s	ft/ft	.020				
10. Average velocity, V (figure 3-1)	ft/s	2.2				
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	.01	+		=	

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

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr .36

Worksheet 5a: Basic watershed data

Project WUUC Expansion Location James City County, Va. By HMJ Date 10/26/98

Circle one: (Present) Developed _____ Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
2		.0026	.36				3.5	72	1.1	.0029	0.778	.22

From worksheet 3 From worksheet 2 From table 5-1

Worksheet 5b: Tabular hydrograph discharge summary

Project WUUC Expansion Location James City County, Va. By KWJ Date 10/26/98

Circle one: (Present) Developed _____ Frequency (yr) _____ Checked _____ Date _____

Subarea name	Basic watershed data used 1/				Select and enter hydrograph times in hours from exhibit 5-II 2/											
	Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	A_mQ (mi²-in)				12.4								
					Discharges at selected hydrograph times 3/ (cfs)											
2	.36		.22	.0029				1.44								
Composite hydrograph at outlet																

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

Worksheet 2: Runoff curve number and runoff

Project WUUC Expansion By KWJ Date 10/26/98

Location James City County, Va. Checked ____ Date ____

Circle one: Present (Developed)

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Craven Emporia (C)	Meadow	71			0.81	57.51
Craven Emporia (C)	Roof / Road	98			0.88	86.24
					Totals = 1.69	143.75

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{143.75}{1.69} = 85.1$; Use CN = 85

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2	100	
Rainfall, P (24-hour)	in	3.5	8.0	
Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in	2.0	6.2	

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

Project WUUC Expansion By KWJ Date 10/26/98

Location James City County, Va Checked ____ Date ____

Circle one: Present (Developed)

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID			
1. Surface description (table 3-1)		PAVED			
2. Manning's roughness coeff., n (table 3-1) ..		.011			
3. Flow length, L (total L ≤ 300 ft)	ft	300			
4. Two-yr 24-hr rainfall, P_2	in	3.5			
5. Land slope, s	ft/ft	.0233			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	.04	+		=

Shallow concentrated flow		Segment ID			
7. Surface description (paved or unpaved)		PAVED			
8. Flow length, L	ft	75			
9. Watercourse slope, s	ft/ft	.020			
10. Average velocity, V (figure 3-1)	ft/s	2.8			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	.01	+		=

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

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr .05

Worksheet 5a: Basic watershed data

Project WUUC Expansion Location James City County, Va. By KWJ Date 10/26/98

Circle one: Present (Developed) _____ Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
2		.0026	.05				3.5	85	2.0	.0052	.353	.10
100		.0026	.05				8.0	85	6.2	.0161	.353	.04

From worksheet 3 From worksheet 2 From table 5-1

Worksheet 5b: Tabular hydrograph discharge summary

Project WUUC Expansion Location James City County, Va By KMJ Date 10/26/98

Circle one: Present (Developed) _____ Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Basic watershed data used 1/				Select and enter hydrograph times in hours from exhibit 5-II 2/											
		Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	A_mQ (mi^2-in)				12.1								
						Discharges at selected hydrograph times 3/ -(cfs)-											
2		.05		.10	.0052				5.25								
100		.05		.04	.0161				16.26								
	Composite hydrograph at outlet																

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

Worksheet 6a: Detention basin storage, peak outflow discharge (q_o) known

Project WUUC Expansion By HMJ Date 10/26/98

Location James City County, Va Checked ____ Date ____

Circle one: Present (Developed)

Elevation or stage

Detention basin storage

1. Data:
   Drainage area ..... A_m = .0026 mi^2
   Rainfall distribution type (I, IA, II, III) = II

	1st stage	2nd stage
2. Frequency ..... yr	2	
3. Peak inflow discharge, q_i .... cfs (From worksheet 4 or 5b)	5.25	
4. Peak outflow discharge, q_o .... cfs 1/	1.44	
5. Compute $\frac{q_o}{q_i}$	.27	
6. $\frac{V_s}{V_r}$ ..... (Use $\frac{q_o}{q_i}$ with figure 6-1)	.40	
7. Runoff, Q ..... in (From worksheet 2)	2.0	
8. Runoff volume, V_r ..... ac-ft ($V_r = QA_m 53.33$)	.28	
9. Storage volume, V_s ..... ac-ft ($V_s = V_r(\frac{V_s}{V_r})$)	.11 4,900 cf	
10. Maximum stage, E_{max} (From plot)		

1/ 2nd stage q_o includes 1st stage q_o.

2 YEAR HYDROGRAPH

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

 PROJECT: WUUC EXPANSION
    User: Rickmond Engineering
    Date: 10/26/1998    Monday
    Time: 14:35:46
   Input: WUUC2.IN
  Output: WUUC2.OUT



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


                         NUMBER OF STORMS TO BE MODELED    :     1
                         NUMBER OF CHANNELS                :     0
                         NUMBER OF SUBAREAS                :     1
                         UPSTREAM HYDROGRAPHS ENTER AT     :     0
LOCATIONS
                         NUMBER OF TIME STEPS              :   300
                         COMPUTATIONAL TIME INCREMENT      :  .100 Hours


 NOTE:   The DURATION of the final computed hydrograph(s) for this
watershed
         system will be 30.000 hours.



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


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

 PROJECT: WUUC EXPANSION
```

User: Rickmond Engineering
Date: 10/26/1998 Monday
Time: 14:35:46
Input: WUUC2.IN
Output: WUUC2.OUT

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

SUBAREA ID NO	AREA (mi2)	TIME OF CONCENTRATION (hrs)	CURVE NUMBER	BASEFLOW (cfs)	DOWNSTREAM CHANNELS
1	.0026	.050	85.00	.0	

Composite Watershed Curve Number = 85.00
Minimum Subarea Time of Concentration = .050 hours.

WARNING: The minimum subarea time of concentration (TCmin) should be greater than 1.2 times the time increment (DT) in order for the unit hydrograph computations to be valid. In this case,

DT = .100 hours, and
TCmin = .050 hours.

To correct this situation, break the model into larger subareas having longer times of concentration, or use a smaller DT.

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

PROJECT: WUUC EXPANSION
User: Rickmond Engineering
Date: 10/26/1998 Monday
Time: 14:35:46
Input: WUUC2.IN
Output: WUUC2.OUT

RETURN PERIOD (yrs): 2

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

RAINFALL HYETOGRAPH: SCS TYPE II

RAINFALL DURATION: 24.00 Hours
RAINFALL DEPTH: 3.50 Inches

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

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

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

PROJECT: WUUC EXPANSION
Input: WUUC2.IN
Output: WUUC2.OUT

RETURN PERIOD (yrs): 2

SUBAREA 1 SUBAREA 1 SUBAREA 1 SUBAREA 1

AREA (square miles) : .0026
TIME OF CONCENTRATION (hrs): .05
RUNOFF CURVE NUMBER : 85.00
BASEFLOW (cfs) : .00
DOWNSTREAM CHANNELS :

SUBAREA RUNOFF (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.01
8.00	.01	.01	.01	.01	.02	.02	.02	.02	.02	.02
9.00	.02	.03	.03	.03	.04	.04	.04	.05	.05	.05
10.00	.05	.07	.07	.07	.08	.08	.11	.12	.12	.13
11.00	.13	.20	.22	.23	.24	.25	.74	.87	2.31	4.37
12.00	5.11	1.27	.72	.65	.65	.66	.38	.35	.34	.34
13.00	.34	.26	.25	.25	.25	.25	.21	.20	.20	.20
14.00	.20	.21	.20	.19	.18	.17	.17	.16	.15	.15
15.00	.14	.13	.13	.12	.12	.12	.11	.11	.11	.11
16.00	.11	.10	.10	.10	.10	.10	.10	.10	.10	.10
17.00	.10	.10	.10	.09	.09	.09	.09	.09	.09	.09
18.00	.09	.09	.09	.09	.08	.08	.08	.08	.08	.08
19.00	.08	.08	.08	.08	.08	.08	.07	.07	.07	.07
20.00	.07	.07	.07	.07	.07	.07	.07	.07	.06	.06
21.00	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06
22.00	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06
23.00	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
24.00	.05	.01	.00	.00	.00	.00	.00	.00	.00	.00
25.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
26.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PEAK RUNOFF (cfs): 5.11
TIME TO PEAK (hrs): 12.00

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

PROJECT: WUUC EXPANSION
User: Rickmond Engineering

Date: 10/26/1998 Monday
Time: 14:35:46
Input: WUUC2.IN
Output: WUUC2.OUT

RETURN PERIOD (yrs): 2

DOWNSTREAM HYDROGRAPH

DISCHARGE (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.01
8.00	.01	.01	.01	.01	.02	.02	.02	.02	.02	.02
9.00	.02	.03	.03	.03	.04	.04	.04	.05	.05	.05
10.00	.05	.07	.07	.07	.08	.08	.11	.12	.12	.13
11.00	.13	.20	.22	.23	.24	.25	.74	.87	2.31	4.37
12.00	5.11	1.27	.72	.65	.65	.66	.38	.35	.34	.34
13.00	.34	.26	.25	.25	.25	.25	.21	.20	.20	.20
14.00	.20	.21	.20	.19	.18	.17	.17	.16	.15	.15
15.00	.14	.13	.13	.12	.12	.12	.11	.11	.11	.11
16.00	.11	.10	.10	.10	.10	.10	.10	.10	.10	.10
17.00	.10	.10	.10	.09	.09	.09	.09	.09	.09	.09
18.00	.09	.09	.09	.09	.08	.08	.08	.08	.08	

```
.08
 19.00 |     .08    .08    .08    .08    .08    .08    .07    .07    .07
.07
 20.00 |     .07    .07    .07    .07    .07    .07    .07    .07    .06
.06
 21.00 |     .06    .06    .06    .06    .06    .06    .06    .06    .06
.06
 22.00 |     .06    .06    .06    .06    .06    .06    .06    .06    .06
.06
 23.00 |     .05    .05    .05    .05    .05    .05    .05    .05    .05
.05
 24.00 |     .05    .01    .00    .00    .00    .00    .00    .00    .00
.00
 25.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 26.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 27.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 28.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 29.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00

                    PEAK DISCHARGE (cfs):       5.11
                      TIME TO PEAK (hrs):      12.00
 Hydrograph Saved In: WUUC2.DAT

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

 PROJECT: WUUC EXPANSION
    User: Rickmond Engineering
    Date: 10/26/1998    Monday
    Time: 14:35:46
   Input: WUUC2.IN
  Output: WUUC2.OUT
                                                        RETURN PERIOD
(yrs):      2


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


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


                VOLUME OF                                |
                 RAINFALL      VOLUME OF     RAINFALL    |      PEAK
PEAK
                 APPLIED        RUNOFF        LOSSES     |   DISCHARGE
```

		(ac-ft)	(ac-ft)	(percent)	(cfs)	DISCHARGE (cfs/ac)
SUBAREA	1	.48533	.27157	44.05	5.111	3.071
TOTAL WATERSHED		.48533	.27157	44.05	5.111	3.071

TOTAL WATERSHED AREA (square miles):	.0026
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft):	.2716
COMPOSITE WATERSHED CURVE NUMBER:	85.00
MINIMUM SUBAREA TIME OF CONCENTRATION:	.050 hours.

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

1

10 YEAR HYDROGRAPH

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

 PROJECT: WUUC EXPANSION
    User: Rickmond Engineering
    Date: 05/13/1999  Thursday
    Time: 12:52:38
   Input: WUUC10.IN
  Output: WUUC10.OUT


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


                          NUMBER OF STORMS TO BE MODELED    :     1
                          NUMBER OF CHANNELS                :     0
                          NUMBER OF SUBAREAS                :     1
                          UPSTREAM HYDROGRAPHS ENTER AT     :     0
LOCATIONS
                          NUMBER OF TIME STEPS              :   300
                          COMPUTATIONAL TIME INCREMENT      :  .100 Hours

 NOTE:   The DURATION of the final computed hydrograph(s) for this
watershed
         system will be 30.000 hours.


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


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

 PROJECT: WUUC EXPANSION
    User: Rickmond Engineering
```

Date: 05/13/1999 Thursday
Time: 12:52:38
Input: WUUC10.IN
Output: WUUC10.OUT

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

SUBAREA ID NO CHANNELS	AREA (mi2)	TIME OF CONCENTRATION (hrs)	CURVE NUMBER	BASEFLOW (cfs)	DOWNSTREAM
1	.0026	.050	85.00	.0	

Composite Watershed Curve Number = 85.00
Minimum Subarea Time of Concentration = .050 hours.

WARNING: The minimum subarea time of concentration (TCmin) should be greater than 1.2 times the time increment (DT) in order for the unit hydrograph computations to be valid. In this case,

DT = .100 hours, and
TCmin = .050 hours.

To correct this situation, break the model into larger subareas having longer times of concentration, or use a smaller DT.

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

PROJECT: WUUC EXPANSION
User: Rickmond Engineering
Date: 05/13/1999 Thursday
Time: 12:52:38
Input: WUUC10.IN
Output: WUUC10.OUT

RETURN PERIOD (yrs): 10

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

RAINFALL HYETOGRAPH: SCS TYPE II
RAINFALL DURATION: 24.00 Hours
RAINFALL DEPTH: 6.00 Inches

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

.000,	.00	2.000,	.13	4.000,	.29	6.000,	.48
7.000,	.59	8.000,	.72	8.500,	.80	9.000,	.88
9.500,	.98	9.750,	1.03	10.000,	1.09	10.500,	1.22
11.000,	1.41	11.500,	1.70	11.750,	2.14	12.000,	3.98
12.500,	4.41	13.000,	4.63	13.500,	4.79	14.000,	4.92
16.000,	5.28	20.000,	5.71	24.000,	6.00		

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

PROJECT: WUUC EXPANSION
Input: WUUC10.IN
Output: WUUC10.OUT

RETURN PERIOD (yrs): 10

SUBAREA 1 SUBAREA 1 SUBAREA 1 SUBAREA 1

AREA (square miles) : .0026
TIME OF CONCENTRATION (hrs): .05
RUNOFF CURVE NUMBER : 85.00
BASEFLOW (cfs) : .00
DOWNSTREAM CHANNELS :

SUBAREA RUNOFF (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.01	.01	.01	.01	.01	.01	.02	.02	.02
6.00	.02	.02	.03	.03	.03	.03	.03	.03	.03	.04
7.00	.04	.05	.05	.05	.05	.06	.06	.06	.06	

```
.06
  8.00 |     .07    .08    .08    .09    .09    .09    .10    .10    .11
.11
  9.00 |     .11    .13    .13    .13    .14    .14    .16    .16    .17
.17
 10.00 |     .17    .22    .23    .24    .24    .25    .33    .34    .35
.36
 11.00 |     .36    .55    .59    .60    .62    .63   1.82   2.07   5.22
9.29
 12.00 |   10.34   2.53   1.41   1.27   1.27   1.28    .74    .67    .66
.66
 13.00 |     .66    .51    .49    .48    .48    .48    .39    .38    .38
.38
 14.00 |     .38    .39    .38    .36    .35    .33    .32    .30    .29
.28
 15.00 |     .26    .25    .24    .24    .23    .22    .21    .21    .20
.20
 16.00 |     .20    .20    .19    .19    .19    .19    .19    .19    .19
.18
 17.00 |     .18    .18    .18    .18    .18    .17    .17    .17    .17
.17
 18.00 |     .17    .16    .16    .16    .16    .16    .16    .15    .15
.15
 19.00 |     .15    .15    .15    .14    .14    .14    .14    .14    .14
.13
 20.00 |     .13    .13    .13    .13    .13    .13    .12    .12    .12
.12
 21.00 |     .12    .12    .12    .12    .11    .11    .11    .11    .11
.11
 22.00 |     .11    .11    .11    .11    .11    .10    .10    .10    .10
.10
 23.00 |     .10    .10    .10    .10    .10    .10    .10    .10    .10
.10
 24.00 |     .10    .01    .00    .00    .00    .00    .00    .00    .00
.00
 25.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 26.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 27.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 28.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 29.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00

                    PEAK RUNOFF (cfs):       10.34
                   TIME TO PEAK (hrs):       12.00
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: WUUC EXPANSION
    User: Rickmond Engineering
    Date: 05/13/1999  Thursday
    Time: 12:52:38
   Input: WUUC10.IN
  Output: WUUC10.OUT
```

RETURN PERIOD (yrs): 10

DOWNSTREAM HYDROGRAPH

DISCHARGE (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.01	.01	.01	.01	.01	.01	.02	.02	.02
6.00	.02	.02	.03	.03	.03	.03	.03	.03	.03	.04
7.00	.04	.05	.05	.05	.05	.06	.06	.06	.06	.06
8.00	.07	.08	.08	.09	.09	.09	.10	.10	.11	.11
9.00	.11	.13	.13	.13	.14	.14	.16	.16	.17	.17
10.00	.17	.22	.23	.24	.24	.25	.33	.34	.35	.36
11.00	.36	.55	.59	.60	.62	.63	1.82	2.07	5.22	9.29
12.00	10.34	2.53	1.41	1.27	1.27	1.28	.74	.67	.66	.66
13.00	.66	.51	.49	.48	.48	.48	.39	.38	.38	.38
14.00	.38	.39	.38	.36	.35	.33	.32	.30	.29	.28
15.00	.26	.25	.24	.24	.23	.22	.21	.21	.20	.20
16.00	.20	.20	.19	.19	.19	.19	.19	.19	.19	.18
17.00	.18	.18	.18	.18	.18	.17	.17	.17	.17	.17
18.00	.17	.16	.16	.16	.16	.16	.16	.15	.15	.15
19.00	.15	.15	.15	.14	.14	.14	.14	.14	.14	.13
20.00	.13	.13	.13	.13	.13	.13	.12	.12	.12	.12

```
 21.00 |      .12     .12     .12     .12     .11     .11     .11     .11     .11
.11
 22.00 |      .11     .11     .11     .11     .11     .10     .10     .10     .10
.10
 23.00 |      .10     .10     .10     .10     .10     .10     .10     .10     .10
.10
 24.00 |      .10     .01     .00     .00     .00     .00     .00     .00     .00
.00
 25.00 |      .00     .00     .00     .00     .00     .00     .00     .00     .00
.00
 26.00 |      .00     .00     .00     .00     .00     .00     .00     .00     .00
.00
 27.00 |      .00     .00     .00     .00     .00     .00     .00     .00     .00
.00
 28.00 |      .00     .00     .00     .00     .00     .00     .00     .00     .00
.00
 29.00 |      .00     .00     .00     .00     .00     .00     .00     .00     .00
.00

                    PEAK DISCHARGE (cfs):       10.34
                      TIME TO PEAK (hrs):       12.00
 Hydrograph Saved In: WUUC10.DAT

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

 PROJECT: WUUC EXPANSION
    User: Rickmond Engineering
    Date: 05/13/1999  Thursday
    Time: 12:52:38
   Input: WUUC10.IN
  Output: WUUC10.OUT
                                                          RETURN PERIOD
(yrs):     10

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


 SCS TYPE II  Hyetograph.
 SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
 APPLIED RAINFALL DEPTH (inches):  6.00


                VOLUME OF                                |
                 RAINFALL      VOLUME OF     RAINFALL    |      PEAK
PEAK
                 APPLIED        RUNOFF        LOSSES     |    DISCHARGE
DISCHARGE
                 (ac-ft)        (ac-ft)      (percent)   |     (cfs)
(cfs/ac)
               ___________    ___________   __________   |  ___________
___________
                                                         |
```

SUBAREA	1	.83200	.57946	30.35	10.338
6.213					
TOTAL WATERSHED		.83200	.57946	30.35	10.338
6.213					

TOTAL WATERSHED AREA (square miles): .0026
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): .5795
COMPOSITE WATERSHED CURVE NUMBER: 85.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .050
hours.

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

1

100 YEAR HYDROGRAPH

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

 PROJECT: WUUC EXPANSION
    User: Rickmond Engineering
    Date: 10/26/1998    Monday
    Time: 14:38:55
   Input: WUUC100.IN
  Output: WUUC100.OUT


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


                         NUMBER OF STORMS TO BE MODELED    :     1
                         NUMBER OF CHANNELS                :     0
                         NUMBER OF SUBAREAS                :     1
                         UPSTREAM HYDROGRAPHS ENTER AT     :     0
LOCATIONS
                         NUMBER OF TIME STEPS              :   300
                         COMPUTATIONAL TIME INCREMENT      :  .100 Hours

 NOTE:   The DURATION of the final computed hydrograph(s) for this
watershed
         system will be 30.000 hours.


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


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

 PROJECT: WUUC EXPANSION
```

User: Rickmond Engineering
Date: 10/26/1998 Monday
Time: 14:38:55
Input: WUUC100.IN
Output: WUUC100.OUT

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

SUBAREA ID NO CHANNELS	AREA (mi2)	TIME OF CONCENTRATION (hrs)	CURVE NUMBER	BASEFLOW (cfs)	DOWNSTREAM
1	.0026	.050	85.00	.0	

Composite Watershed Curve Number = 85.00
Minimum Subarea Time of Concentration = .050 hours.

WARNING: The minimum subarea time of concentration (TCmin) should be greater than 1.2 times the time increment (DT) in order for the unit hydrograph computations to be valid. In this case,

DT = .100 hours, and
TCmin = .050 hours.

To correct this situation, break the model into larger subareas having longer times of concentration, or use a smaller DT.

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

PROJECT: WUUC EXPANSION
User: Rickmond Engineering
Date: 10/26/1998 Monday
Time: 14:38:55
Input: WUUC100.IN
Output: WUUC100.OUT

RETURN PERIOD (yrs): 100

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

RAINFALL HYETOGRAPH: SCS TYPE II

RAINFALL DURATION: 24.00 Hours
RAINFALL DEPTH: 8.00 Inches

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

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

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1*******************************      SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
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PROJECT: WUUC EXPANSION
Input: WUUC100.IN
Output: WUUC100.OUT

(yrs): 100 RETURN PERIOD

SUBAREA 1 SUBAREA 1 SUBAREA 1 SUBAREA
1

AREA (square miles) : .0026
TIME OF CONCENTRATION (hrs): .05
RUNOFF CURVE NUMBER : 85.00
BASEFLOW (cfs) : .00
DOWNSTREAM CHANNELS :

SUBAREA RUNOFF (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.01	.01	.01	.02	.02	.02	.02	.03	.03
5.00	.03	.03	.04	.04	.04	.04	.04	.05	.05	.05

6.00	.05	.06	.06	.07	.07	.07	.07	.08	.08
.08									
7.00	.08	.10	.11	.11	.11	.11	.12	.12	.12
.12									
8.00	.13	.15	.16	.16	.16	.16	.18	.18	.19
.19									
9.00	.19	.22	.23	.23	.24	.24	.27	.28	.28
.28									
10.00	.29	.36	.38	.38	.39	.39	.52	.55	.56
.56									
11.00	.57	.85	.91	.93	.94	.96	2.74	3.07	7.62
13.25									
12.00	14.50	3.53	1.96	1.76	1.76	1.76	1.03	.92	.91
.91									
13.00	.91	.70	.67	.67	.67	.67	.54	.52	.52
.52									
14.00	.52	.54	.52	.50	.47	.45	.43	.41	.40
.38									
15.00	.36	.35	.34	.32	.31	.30	.29	.29	.28
.28									
16.00	.27	.27	.27	.26	.26	.26	.26	.26	.25
.25									
17.00	.25	.25	.24	.24	.24	.24	.24	.23	.23
.23									
18.00	.23	.22	.22	.22	.22	.22	.21	.21	.21
.21									
19.00	.20	.20	.20	.20	.20	.19	.19	.19	.19
.18									
20.00	.18	.18	.18	.18	.17	.17	.17	.17	.17
.16									
21.00	.16	.16	.16	.16	.16	.15	.15	.15	.15
.15									
22.00	.15	.15	.15	.14	.14	.14	.14	.14	.14
.14									
23.00	.14	.14	.14	.14	.14	.14	.14	.14	.14
.14									
24.00	.14	.02	.00	.00	.00	.00	.00	.00	.00
.00									
25.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00									
26.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00									
27.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00									
28.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00									
29.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00									

PEAK RUNOFF (cfs): 14.50
TIME TO PEAK (hrs): 12.00

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1*******************************     SCSHYDRO
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 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************
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PROJECT: WUUC EXPANSION
User: Rickmond Engineering

Date: 10/26/1998 Monday
Time: 14:38:55
Input: WUUC100.IN
Output: WUUC100.OUT

(yrs): 100 RETURN PERIOD

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

DISCHARGE (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.01	.01	.01	.02	.02	.02	.02	.03	.03
5.00	.03	.03	.04	.04	.04	.04	.04	.05	.05	.05
6.00	.05	.06	.06	.07	.07	.07	.07	.08	.08	.08
7.00	.08	.10	.11	.11	.11	.11	.12	.12	.12	.12
8.00	.13	.15	.16	.16	.16	.16	.18	.18	.19	.19
9.00	.19	.22	.23	.23	.24	.24	.27	.28	.28	.28
10.00	.29	.36	.38	.38	.39	.39	.52	.55	.56	.56
11.00	.57	.85	.91	.93	.94	.96	2.74	3.07	7.62	13.25
12.00	14.50	3.53	1.96	1.76	1.76	1.76	1.03	.92	.91	.91
13.00	.91	.70	.67	.67	.67	.67	.54	.52	.52	.52
14.00	.52	.54	.52	.50	.47	.45	.43	.41	.40	.38
15.00	.36	.35	.34	.32	.31	.30	.29	.29	.28	.28
16.00	.27	.27	.27	.26	.26	.26	.26	.26	.25	.25
17.00	.25	.25	.24	.24	.24	.24	.24	.23	.23	.23
18.00	.23	.22	.22	.22	.22	.22	.21	.21	.21	

```
.21
 19.00 |     .20    .20    .20    .20    .20    .19    .19    .19    .19
.18
 20.00 |     .18    .18    .18    .18    .17    .17    .17    .17    .17
.16
 21.00 |     .16    .16    .16    .16    .16    .15    .15    .15    .15
.15
 22.00 |     .15    .15    .15    .14    .14    .14    .14    .14    .14
.14
 23.00 |     .14    .14    .14    .14    .14    .14    .14    .14    .14
.14
 24.00 |     .14    .02    .00    .00    .00    .00    .00    .00    .00
.00
 25.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 26.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 27.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 28.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 29.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00

                    PEAK DISCHARGE (cfs):      14.50
                      TIME TO PEAK (hrs):      12.00
 Hydrograph Saved In: WUUC100.DAT

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

 PROJECT: WUUC EXPANSION
    User: Rickmond Engineering
    Date: 10/26/1998    Monday
    Time: 14:38:55
   Input: WUUC100.IN
  Output: WUUC100.OUT
                                                        RETURN PERIOD
(yrs):    100


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


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


                VOLUME OF                                |
                 RAINFALL      VOLUME OF     RAINFALL    |      PEAK
PEAK
                 APPLIED        RUNOFF        LOSSES     |   DISCHARGE
```

		(ac-ft)	(ac-ft)	(percent)	(cfs)	DISCHARGE (cfs/ac)
SUBAREA	1	1.1093	.83680	24.57	14.501	8.714
TOTAL WATERSHED		1.1093	.83680	24.57	14.501	8.714

TOTAL WATERSHED AREA (square miles): .0026
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): .8368
COMPOSITE WATERSHED CURVE NUMBER: 85.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .050 hours.

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

1

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
Williamsburg, Virginia 23185-5624
(757) 229-1776 or (757) 898-7007
Fax Number (757) 229-4683
E-mail: rickmond@tni.net
www.rickmond.com

JOB 98199
SHEET NO. 36 OF
CALCULATED BY KMJ DATE 1115199
CHECKED BY DATE
SCALE

POND STAGE-STORAGE

ELEV (ft)	ΔELEV (ft)	SA (sf)	STORAGE (cf)	ACCUM STORAGE (cf)
66.0		1150		0
	1.0		1815	
67.0		2480		1815
	1.0		3240	
68.0		4000		5055
	1.0		4835	
69.0		5670		9890

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JOB 98199
SHEET NO. 37 OF
CALCULATED BY KMJ DATE 1/15/99
CHECKED BY DATE
SCALE

DESIGN ORIFICE TO RELEASE ONE HALF INCH OF RUNOFF OVER 12 HRS

$\forall = 1{,}585$ cf

$Q =$ Release Rate $= \frac{1{,}585 \text{ cf}}{12 \text{ hr}} \cdot \frac{1 \text{ hr}}{60 \text{ min}} \cdot \frac{1 \text{ min}}{60 \text{ s}} = .037$ cfs

$h = 66.87 - 66.00 = .87$ $\quad c = .6$

$Q = CA\sqrt{2gh}$

$.037 = (.6)A\sqrt{2(32.2)(.87)}$

$A = \pi r^2 = .008$ ft^2

$r = .051' = .61''$ USE $1\frac{3}{16}''$ diameter orifice @ ELEV 66.00

ELEV	H	Q
66.00	0	0
67.00	1	.04
68.00	2	.05
69.00	3	.07

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JOB 98199
SHEET NO. 38 OF
CALCULATED BY KMJ DATE 1/15/99
CHECKED BY DATE
SCALE

SIZE ORIFICE TO RELEASE 2-YEAR POST-DEVELOPMENT STORM AT PRE-DEVELOPMENT RATE

Q_2 = PRE-DEVELOPMENT = 1.44 cfs (assume flow through CBPA orifice is Ø)

$h = 68.30 - 66.87 = 1.43'$

$Q = CA\sqrt{2gh}$

$1.44 = .6A\sqrt{2(32.2)(1.43)}$

$A = \pi r^2 = .25\ ft^2$

$r = .28' = 3.39''$

use 12" x 3" rectangular orifice at ELEV 66.87

ELEV	H	Q
66.87	0	0
67.00	.13	.43
68.00	1.13	1.28
69.00	2.13	1.76

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JOB 98199
SHEET NO. 39 OF
CALCULATED BY KMJ DATE 1/15/99
CHECKED BY DATE
SCALE

DESIGN OUTLET WEIR

$Q = CLH^{3/2}$

TOP DI-1 @ ELEV 68.00

$C = 3.1$
$L = 2.5' \times 4 = 10'$

ELEV	H	Q
68.00	0	0
69.00	1	31.00

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JOB 98199
SHEET NO. 40 OF
CALCULATED BY KMJ DATE 5/13/99
CHECKED BY DATE
SCALE

DESIGN OUTLET BARREL

25' of 24" RCP @ 0.5%

$INV_{IN} = 66.00$
$INV_{OUT} = 65.87$

Q	d_n	d_c	y_n	R	H	h_o	LS_o	HW	HWELEV
0	—	—	—	—	—	—	—	—	66.00
5	0.77	0.79	4.50	.42	.59	1.40	.12	1.87	67.87
10	1.15	1.13	5.37	.55	.79	1.57	.12	2.24	68.24
15	1.54	1.40	5.79	.61	.90	1.70	.12	2.48	68.48
20	2.00	2.00	6.37	.50	1.14	2.00	.12	3.02	69.02

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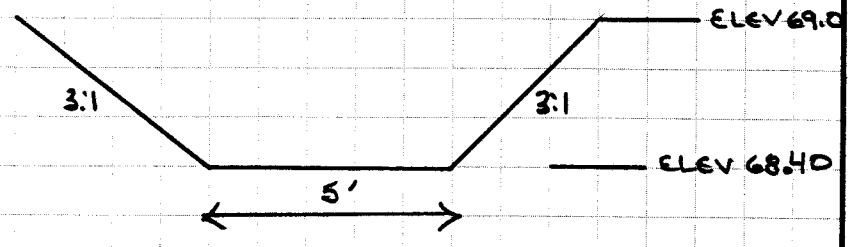
www.rickmond.com

JOB 98119
SHEET NO. 41 OF
CALCULATED BY KMJ DATE 1/15/99
CHECKED BY DATE
SCALE

DESIGN EMERGENCY SPILLWAY

Slope = 15%



ELEV	H	Q
68.40	0	0
69.00	.60	8.0

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JOB 98199
SHEET NO. 42 OF
CALCULATED BY KMJ DATE 1/15/99
CHECKED BY DATE
SCALE

STAGE - STORAGE - DISCHARGE

STAGE (ft)	STORAGE (ac-ft)	DISCHARGE (cfs)
66.0	.026	0
66.87	.053	.03
67.0	.057	.47
68.0	.092	1.33
68.40	.104	9.37
69.0	.130	27.81

2-YR STORM ROUTING

```
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 *******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
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PROJECT: WUUC EXPANSION
User: Rickmond Engineering
Date: 05/13/1999 Thursday
Time: 14:26:22
Output: WUUCP2.OUT

SOLUTION FOR 1 STORMS.

TIME INCREMENT: .100 Hours

STORM NUMBER	HYDROGRAPH IN FILE:
1	WUUC2.DAT

TAILWATER STAGE (ft)	STORM NUMBER	PEAK INFLOW (cfs)	ALLOWABLE PEAK DISCHARGE (cfs)	DURATION (min)	RUNOFF VOLUME (ft3)
60.000	1	5.111	N/A	1794.00	.1183E+05

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

PROJECT: WUUC EXPANSION
User: Rickmond Engineering
Date: 05/13/1999 Thursday
Time: 14:26:22
Output: WUUCP2.OUT

Stage-Area-Discharge
Filename: WUUCPOND.DAT

TAILWATER STAGE: 60.000 feet.
INITIAL STAGE: 66.000 feet.

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

<<

66.000	12	.000	.000
66.000	18	.000	.000
66.000	24	.000	.000
66.000	30	.000	.000
66.000	36	.000	.000
66.000	42	.000	.000
66.000	48	.000	.000
66.000	54	.000	.000
66.000	60	.000	.000
66.000	66	.000	.000
66.000	72	.000	.000
66.000	78	.000	.000
66.000	84	.000	.000
66.000	90	.000	.000
66.000	96	.000	.000
66.000	102	.000	.000
66.000	108	.000	.000
66.000	114	.000	.000
66.000	120	.000	.000
66.000	126	.000	.000
66.000	132	.000	.000
66.000	138	.000	.000
66.000	144	.000	.000
66.000	150	.000	.000
66.000	156	.000	.000
66.000	162	.000	.000
66.000	168	.000	.000
66.000	174	.000	.000
66.000	180	.000	.000
66.000	186	.000	.000
66.000	192	.000	.000

66.000				
	198	.000	.000	I
66.000				
	204	.000	.000	I
66.000				
	210	.000	.000	I
66.000				
	216	.000	.000	I
66.000				
	222	.000	.000	I
66.000				
	228	.000	.000	I
66.000				
	234	.000	.000	I
66.000				
	240	.000	.000	I
66.000				
	246	.000	.000	I
66.000				
	252	.000	.000	I
66.000				
	258	.000	.000	I
66.000				
	264	.000	.000	I
66.000				
	270	.000	.000	I
66.000				
	276	.000	.000	I
66.000				
	282	.000	.000	I
66.000				
	288	.000	.000	I
66.000				
	294	.000	.000	I
66.000				
	300	.000	.000	I
66.000				
	306	.000	.000	I
66.000				
	312	.000	.000	I
66.000				
	318	.000	.000	I
66.000				
	324	.000	.000	I
66.000				
	330	.000	.000	I
66.000				
	336	.000	.000	I
66.000				
	342	.000	.000	I
66.000				
	348	.000	.000	I
66.000				
	354	.000	.000	I
66.000				
	360	.000	.000	I
66.000				
	366	.000	.000	I
66.000				
	372	.000	.000	I
66.000				

66.000	378	.000	.000
66.000	384	.000	.000
66.000	390	.000	.000
66.000	396	.000	.000
66.000	402	.000	.000
66.000	408	.000	.000
66.000	414	.000	.000
66.000	420	.000	.000
66.000	426	.000	.000
66.000	432	.000	.000
66.000	438	.001	.000
66.001	444	.002	.000
66.001	450	.003	.000
66.002	456	.004	.000
66.003	462	.005	.000
66.004	468	.006	.000
66.006	474	.007	.000
66.007	480	.008	.000
66.009	486	.011	.000
66.012	492	.013	.000
66.014	498	.014	.000
66.017	504	.015	.001
66.021	510	.016	.001
66.024	516	.019	.001
66.028	522	.021	.001
66.032	528	.022	.001
66.037	534	.023	.001
66.042	540	.025	.001
66.047	546	.030	.002
66.054	552	.032	.002
	558	.033	.002

66.060			
	564	.035	.002
66.067			
	570	.037	.003
66.074			
	576	.043	.003
66.082			
	582	.045	.003
66.091			
	588	.047	.003
66.100			
	594	.049	.004
66.109			
	600	.051	.004
66.119			
	606	.066	.005
66.131			
	612	.071	.005
66.145			
	618	.074	.005
66.159			
	624	.077	.006
66.174			
	630	.080	.007
66.189			
	636	.108	.007
66.208			
	642	.116	.008
66.230			
	648	.121	.009
66.254			
	654	.126	.010
66.278			
	660	.130	.010
66.303			
	666	.200	.012
66.336			
	672	.218	.013
66.378			
	678	.229	.015
66.423			
	684	.238	.016
66.469			
	690	.247	.018
66.518			
	696	.736	.021
66.618			
	702	.866	.027
66.784			
	708	2.306	.476
67.007			
	714	4.368	.739
67.313			
	720	5.111	1.107
67.740			
	726	1.266	1.298
67.963			
	732	.717	1.270
67.930			
	738	.649	1.216
67.867			

67.807	744	.653	1.164	
67.753	750	.658	1.117	
67.689	756	.384	1.062	
67.614	762	.346	.998	
67.544	768	.342	.938	
67.481	774	.343	.883	
67.423	780	.344	.834	
67.366	786	.264	.785	
67.310	792	.254	.737	
67.259	798	.252	.692	
67.212	804	.253	.652	
67.169	810	.254	.615	
67.128	816	.205	.580	
67.087	822	.199	.545	
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	3852	.000	.002	I

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	4314	.000	.001	|
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	4320	.000	.001	|
66.026				

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

 PROJECT: WUUC EXPANSION
    User: Rickmond Engineering
    Date: 05/13/1999  Thursday
    Time: 14:26:22
  Output: WUUCP2.OUT


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


                 PEAK        PEAK          PEAK        PEAK
   STORM        STAGE      STORAGE        INFLOW      OUTFLOW
   NUMBER        (ft)       (ac-ft)        (cfs)       (cfs)
```

1	67.963	.112	5.111	1.298

10 -YR STORM ROUTING

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

PROJECT: WUUC EXPANSION
User: Rickmond Engineering
Date: 05/13/1999 Thursday
Time: 14:27:42
Output: WUUCP10.OUT

SOLUTION FOR 1 STORMS.

TIME INCREMENT: .100 Hours

STORM NUMBER	HYDROGRAPH IN FILE:
1	WUUC10.DAT

TAILWATER STAGE (ft)	STORM NUMBER	PEAK INFLOW (cfs)	ALLOWABLE PEAK DISCHARGE (cfs)	DURATION (min)	RUNOFF VOLUME (ft3)
60.000	1	10.338	N/A	1794.00	.2524E+05

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

PROJECT: WUUC EXPANSION
User: Rickmond Engineering
Date: 05/13/1999 Thursday
Time: 14:27:42
Output: WUUCP10.OUT

Stage-Area-Discharge
Filename: WUUCPOND.DAT

TAILWATER STAGE: 60.000 feet.
INITIAL STAGE: 66.000 feet.

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

<<

66.000	12	.000	.000	
66.000	18	.000	.000	
66.000	24	.000	.000	
66.000	30	.000	.000	
66.000	36	.000	.000	
66.000	42	.000	.000	
66.000	48	.000	.000	
66.000	54	.000	.000	
66.000	60	.000	.000	
66.000	66	.000	.000	
66.000	72	.000	.000	
66.000	78	.000	.000	
66.000	84	.000	.000	
66.000	90	.000	.000	
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66.000	102	.000	.000	
66.000	108	.000	.000	
66.000	114	.000	.000	
66.000	120	.000	.000	
66.000	126	.000	.000	
66.000	132	.000	.000	
66.000	138	.000	.000	
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66.000	156	.000	.000	
66.000	162	.000	.000	
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66.000	174	.000	.000	
66.000	180	.000	.000	
66.000	186	.000	.000	
66.000	192	.000	.000	

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	204	.000	.000	|
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	210	.000	.000	|
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	216	.000	.000	|
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	222	.000	.000	|
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	228	.000	.000	|
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	240	.000	.000	|
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	246	.000	.000	|
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	252	.000	.000	|
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	258	.000	.000	|
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	264	.000	.000	|
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	288	.001	.000	|
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	294	.003	.000	|
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	300	.004	.000	|
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	312	.007	.000	|
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	318	.009	.000	|
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	324	.011	.000	|
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	336	.014	.000	|
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	342	.015	.001	|
66.016				
	348	.017	.001	|
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	354	.018	.001	|
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	360	.019	.001	|
66.026				
	366	.023	.001	|
66.030				
	372	.025	.001	|
66.035				

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66.374	540	.110	.013	|
66.396	546	.127	.014	|
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	558	.135	.015	|

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66.689				
	612	.231	.025	
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	624	.241	.028	
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66.996				
	678	.604	.480	
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67.039				
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67.116				
	702	2.068	.696	
67.263				
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67.578				
	714	9.287	3.479	
68.107				
	720	10.338	9.292	
68.396				
	726	2.528	6.668	
68.266				
	732	1.410	2.355	
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	738	1.268	1.423	
68.005				

67.994	744	1.272	1.325	
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67.776	774	.660	1.137	
67.725	780	.661	1.093	
67.670	786	.508	1.047	
67.612	792	.486	.996	
67.557	798	.484	.949	
67.508	804	.485	.906	
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	1656	.000	.024	|

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	1686	.000	.023	|
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	2022	.000	.015	I

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

PROJECT: WUUC EXPANSION
User: Rickmond Engineering
Date: 05/13/1999 Thursday
Time: 14:27:42
Output: WUUCP10.OUT

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

STORM NUMBER	PEAK STAGE (ft)	PEAK STORAGE (ac-ft)	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)

1	68.396	.153	10.338	9.292

100-YR STORM ROUTING

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1*********************************      PONDOPT
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 *********************************   Version 1.83
*********************************
 *******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
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PROJECT: WUUC EXPANSION
User: Rickmond Engineering
Date: 05/13/1999 Thursday
Time: 14:28:46
Output: WUUCP100.OUT

SOLUTION FOR 1 STORMS.

TIME INCREMENT: .100 Hours

STORM NUMBER	HYDROGRAPH IN FILE:
1	WUUC100.DAT

TAILWATER STAGE (ft)	STORM NUMBER	PEAK INFLOW (cfs)	ALLOWABLE PEAK DISCHARGE (cfs)	DURATION (min)	RUNOFF VOLUME (ft3)
60.000	1	14.501	N/A	1794.00	.3645E+05

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1*********************************      PONDOPT
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 *********************************   Version 1.83
*********************************
 *******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
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PROJECT: WUUC EXPANSION
User: Rickmond Engineering
Date: 05/13/1999 Thursday
Time: 14:28:46
Output: WUUCP100.OUT

Stage-Area-Discharge
Filename: WUUCPOND.DAT

TAILWATER STAGE: 60.000 feet.
INITIAL STAGE: 66.000 feet.

==========
STAGE-STORAGE-DISCHARGE RELATIONSHIP
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	3486	.000	.003	I

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66.031	4176	.000	.001	
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66.031	4188	.000	.001	
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66.030	4206	.000	.001	
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	4218	.000	.001	

```
66.030
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          4320                .000                .001                |
66.026
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
*******************

 PROJECT: WUUC EXPANSION
    User: Rickmond Engineering
    Date: 05/13/1999  Thursday
    Time: 14:28:46
  Output: WUUCP100.OUT


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


                  PEAK        PEAK          PEAK        PEAK
    STORM         STAGE       STORAGE       INFLOW      OUTFLOW
    NUMBER        (ft)        (ac-ft)       (cfs)       (cfs)
```

1	68.552	.172	14.501	14.049

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
Williamsburg, Virginia 23185-5624
(757) 229-1776 or (757) 898-7007
Fax Number (757) 229-4683
E-mail: rickmond@tni.net
www.rickmond.com

JOB 98199
SHEET NO. 125 OF
CALCULATED BY KMJ DATE 1/15/99
CHECKED BY DATE
SCALE

DESIGN OUTLET PROTECTION

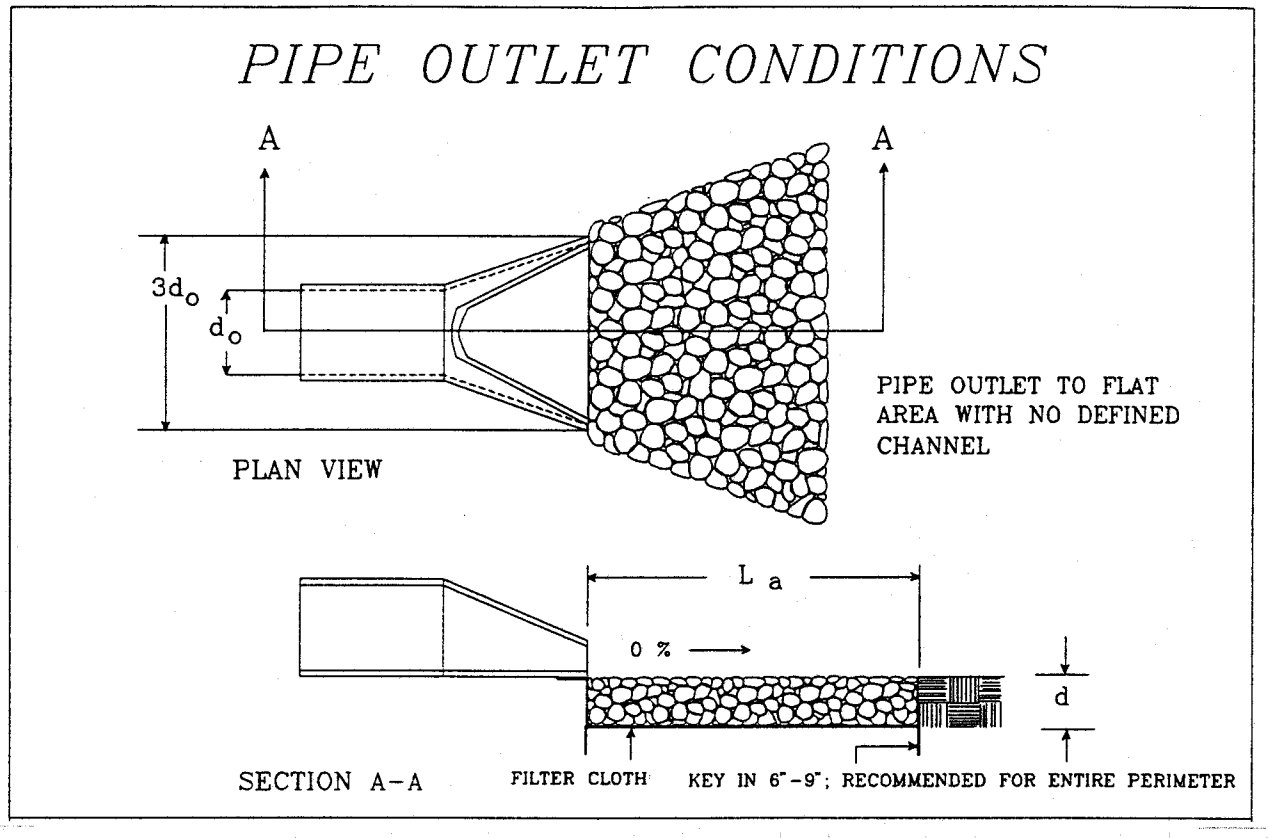


Plate 3.18-3
Q = 1.41 cfs
d = 1'
3d = 3'
La = 6'
W = d + La = 7'
d_{50} = .2'

USE 6' x 7' x 26"
VDOT CLASS I
RIP RAP APRON

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
WILLIAMSBURG, VIRGINIA 23185
(804) 229-1776

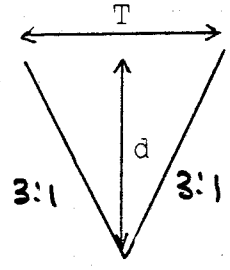
JOB 98199
SHEET NO. 126 OF
CALCULATED BY KMJ DATE 5/13/99
CHECKED BY DATE
SCALE

V-DITCH DESIGN

Outfall Ditch

Q= 9.29 cfs
S= 1.50%
L= 180 ft.

T= 6.0 ft.
d= 1.0 ft.



$$R=\frac{zd}{2(z^2+1)^{1/2}}=\frac{(3)(1\ \text{ft.})}{2(10)^{1/2}}=.47\ \text{ft.}$$

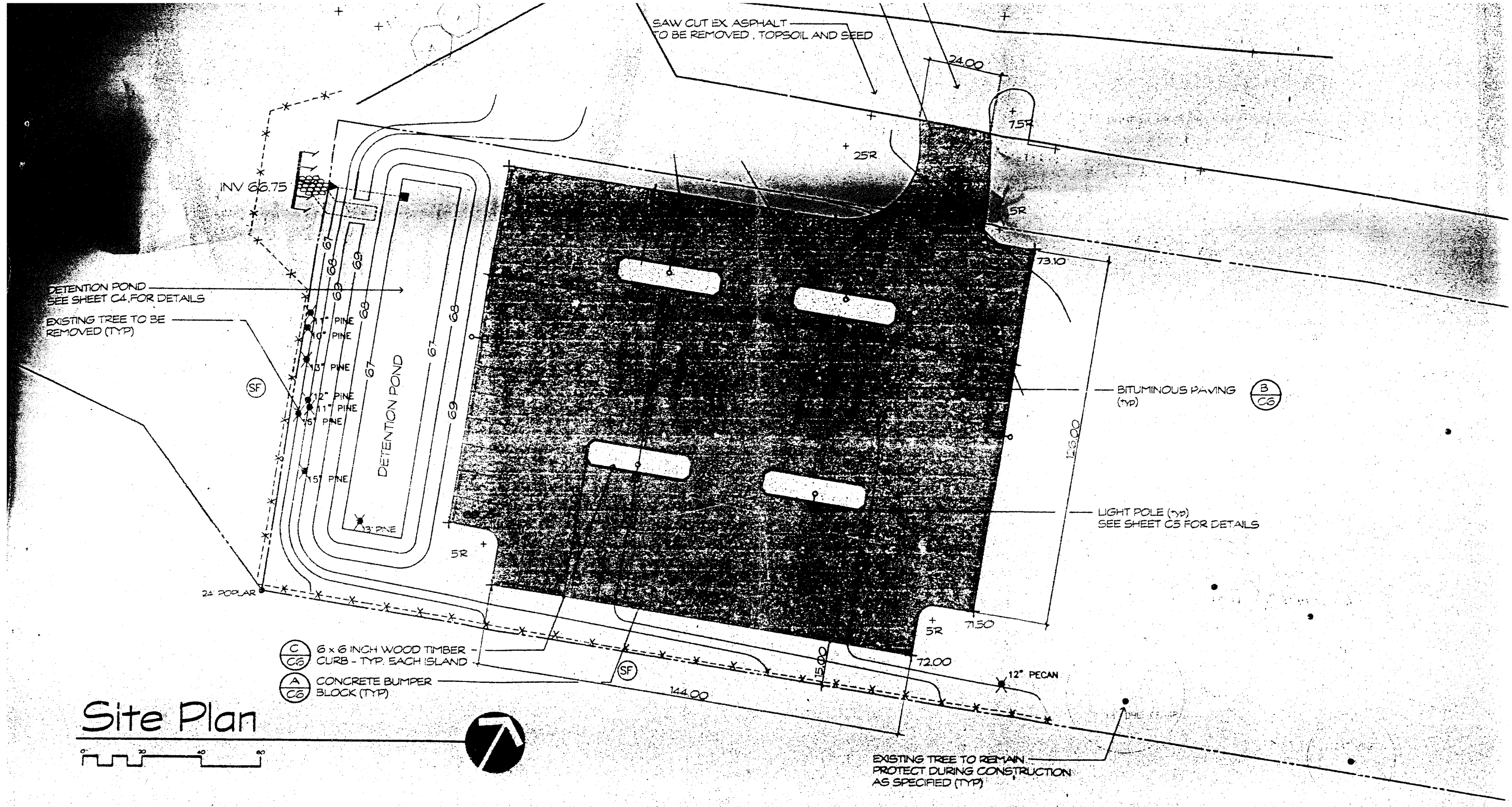
n=.035

$$A=zd^2=(3)(1\ \text{ft.})^2=3\ \text{ft.}^2$$

d=0.99' V=3.15 fps

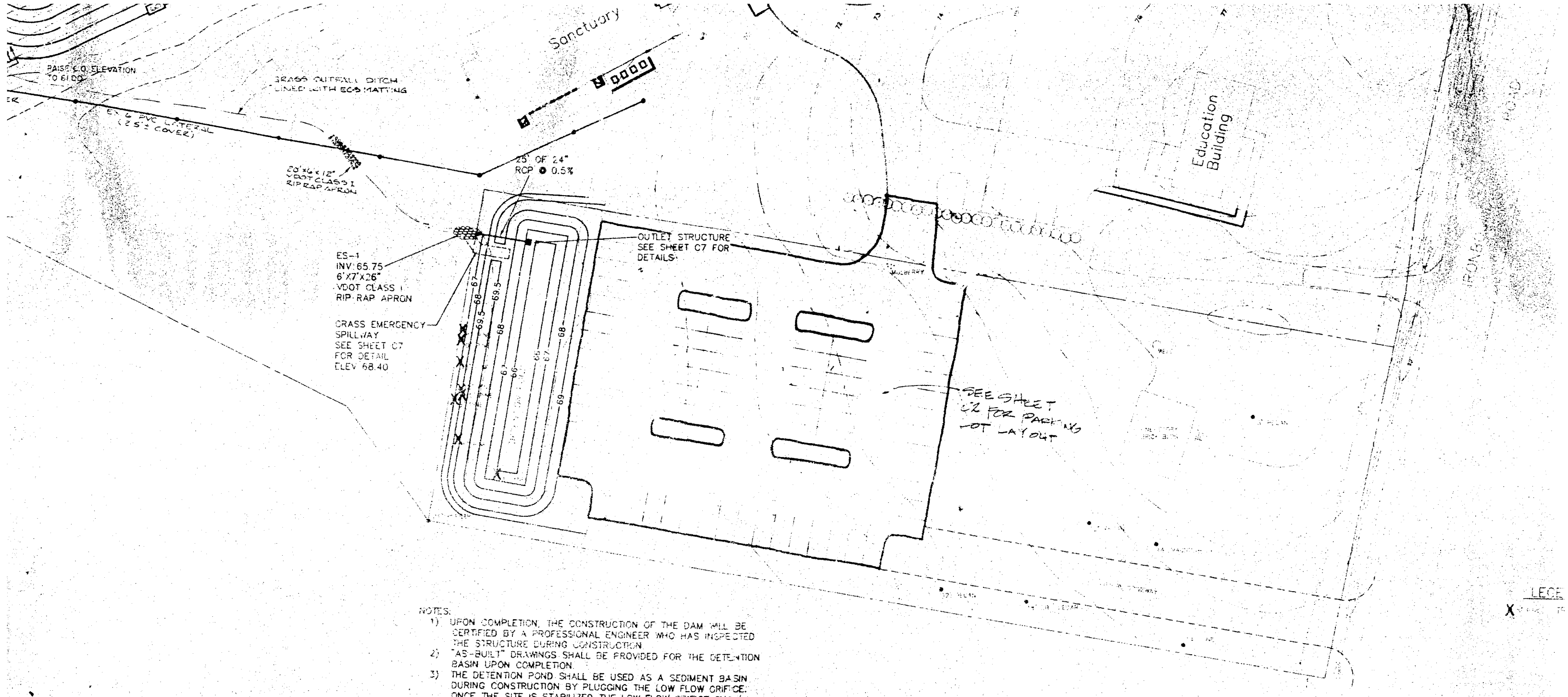
Permissible Velocity= 2.5 fps
(Fine Sandy Loam

Entire Ditch to be lined with EC-3 Matting



Site Plan

0' 20' 40' 80'



NOTES:

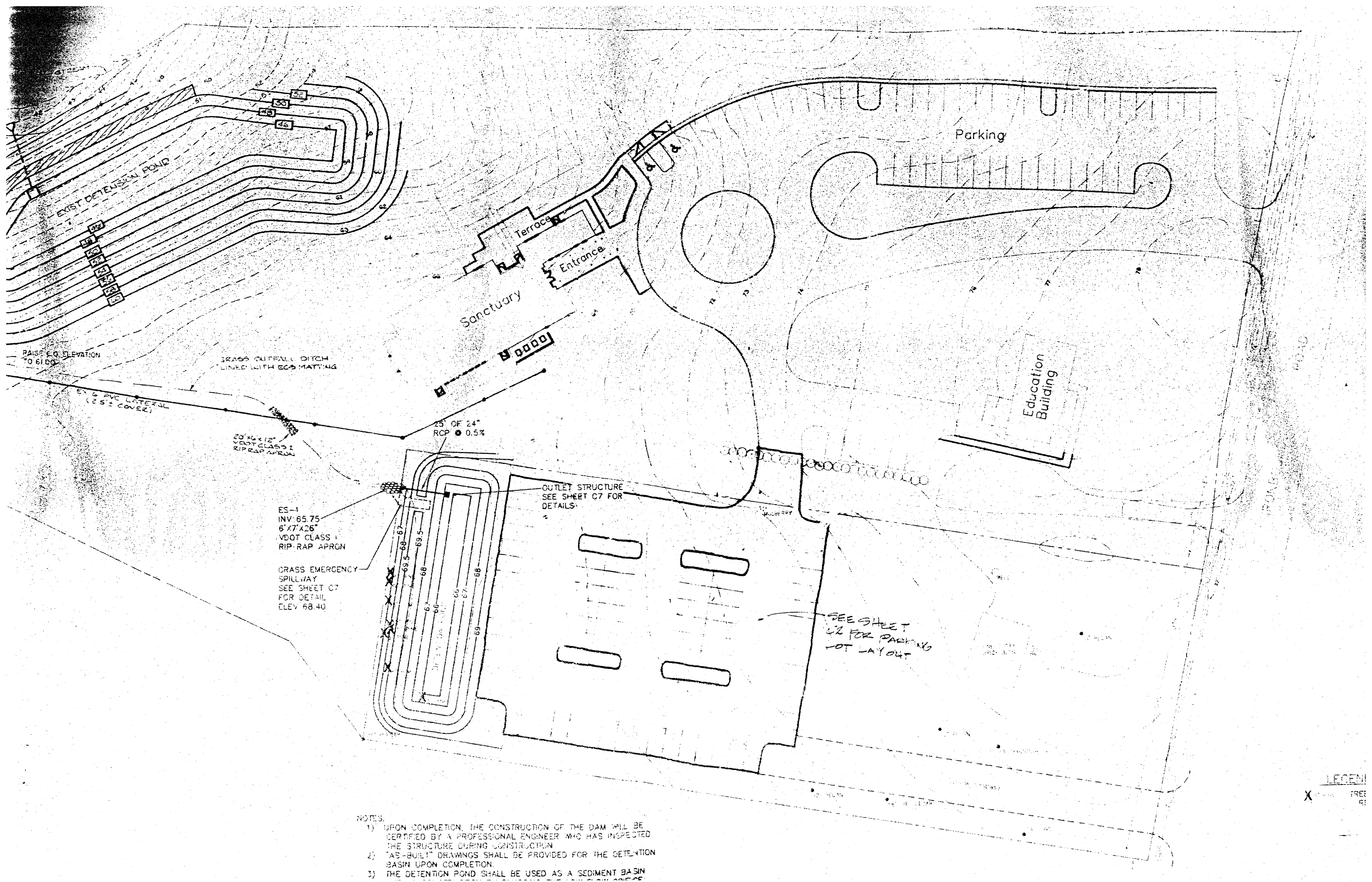
1) UPON COMPLETION, THE CONSTRUCTION OF THE DAM WILL BE CERTIFIED BY A PROFESSIONAL ENGINEER WHO HAS INSPECTED THE STRUCTURE DURING CONSTRUCTION.
2) "AS-BUILT" DRAWINGS SHALL BE PROVIDED FOR THE DETENTION BASIN UPON COMPLETION.
3) THE DETENTION POND SHALL BE USED AS A SEDIMENT BASIN DURING CONSTRUCTION BY PLUGGING THE LOW FLOW ORIFICE. ONCE THE SITE IS STABILIZED THE LOW FLOW ORIFICE SHALL BE UNPLUGGED TO ALLOW THE POND TO ACT AS A PERMANENT BMP. THE SEDIMENT IN THE BASIN SHALL BE REMOVED BEFORE THE LOW FLOW ORIFICE IS UNPLUGGED.
4) ALL LATERAL CLEANOUTS ALONG THE PROPOSED OUTFALL DITCH MUST BE INSPECTED AND REPAIRED, IF DAMAGED, TO ENSURE THEY ARE NOT A PATH FOR STORM WATER TO ENTER THE SANITARY SEWER SYSTEM.

30 0 30 60

Scale 1" = 30'

SP-39-99

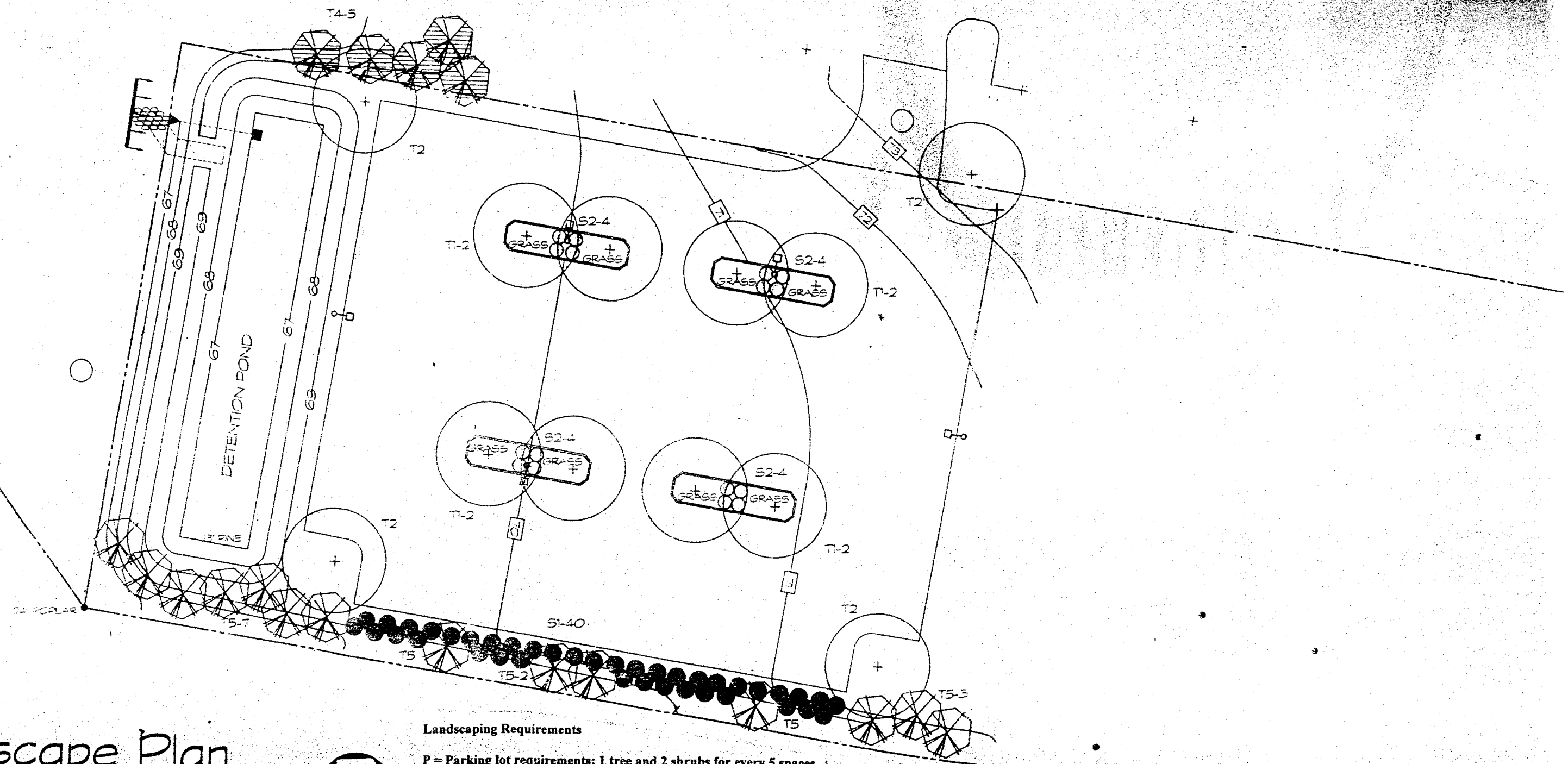
PC 181



NOTES:

1) UPON COMPLETION, THE CONSTRUCTION OF THE DAM WILL BE CERTIFIED BY A PROFESSIONAL ENGINEER WHO HAS INSPECTED THE STRUCTURE DURING CONSTRUCTION
2) "AS-BUILT" DRAWINGS SHALL BE PROVIDED FOR THE DETENTION BASIN UPON COMPLETION.
3) THE DETENTION POND SHALL BE USED AS A SEDIMENT BASIN

WITH MULCH (3 INCH MIN. DEPTH).
5. WHERE PLANTING BEDS ABUTT WALKS AND/OR CURBS, TOP OF BEDS SHALL BE DEPRESSED 1 INCH.
6. VERIFICATION OF PLANT QUANTIES AS SHOWN IN THE PLANT LIST SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR, AND THE KEYED PLAN SHALL GOVERN.
7. WHEN ADVERSE SOIL CONDITIONS ARE ENCOUNTERED(SUCH AS ROCK OR CLAY) BREAK UP SUBSOIL AN ADDITIONAL 12 INCHES TO PROVIDE DRAINAGE. IF DRAINAGE PROBLEMS PERSIST THE CONTRACTOR SHALL NOTIFY THE LANDSCAPE ARCHITECT BEFORE PROCEEDING WITH PLANTING.
9. PLANTING SEASON RESTRICTIONS:
ALL BALLED AND BURLAPPED PLANT MATERIAL SHALL BE INSTALLED FROM OCTOBER 15 - MARCH 31 UNLESS AUTHORIZED BY LANDSCAPE ARCHITECT.
ALL CONTAINER GROWN PLANT MATERIAL SHALL BE INSTALLED FROM SEPTEMBER 15 - MAY 15 UNLESS AUTHORIZED BY LANDSCAPE ARCHITECT.

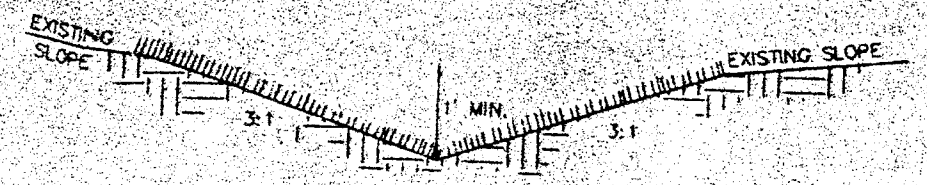


Landscape Plan

Landscaping Requirements

P = Parking lot requirements: 1 tree and 2 shrubs for every 5 spaces
Total new parking 68 spaces
Required: 14 trees and 28 shrubs
Proposed new parking lot landscaping: 12 trees and 40 shrubs
Proposed parking lot screening: 19 trees and 40 shrubs

Total proposed landscaping: 31 trees and 56 shrubs



GRASS DITCH DETAIL

EXIST. DETENTION POND

RAISE C.O. ELEVATION TO 61.00

LEVEL SPREADER L: 20'

GRASS OUTFALL DITCH LINED WITH SC-9 MATTING

E-6 PVC LATERAL (2.5' COVER)

20'x6'x12" VDOT CLASS I RIP RAP APRON

25' OF 24" RCP @ 0.5%

ES-1
INV. 65.75
6'X7'X26"
VDOT CLASS I
RIP-RAP APRON

GRASS EMERGENCY SPILLWAY
SEE SHEET C7 FOR DETAIL
ELEV. 68.40

OUTLET STRUCTURE
SEE SHEET C7 FOR DETAILS

Terrace

Entrance

Sanctuary

Parking

Education Building

SEE SHEET C2 FOR PARKING LOT LAYOUT

Williamsburg Unitarian Universalist Church

Parking Lot Expansion

Drainage & BMP Calculations

October 13, 1998

Rickmond

Rickmond Engineering, Inc.
1643 Merrimac Trail
Williamsburg, VA 23185
Phone: 757-229-1776
Fax: 757-229-4683
e-mail: rickmond@tni.net
www.rickmond.com

COMMONWEALTH OF VIRGINIA
K.M. Jenkins II
K.M. JENKINS II
No. 022872
10/14/98
PROFESSIONAL ENGINEER

Project No. 98199

Wmbg UU Church

1. Original Site

Area = 4.09 ac

T_c = .34 – Pre

Q_2 = 3.67 – Pre

Post T_c = 0.21 hr

Q_2 = 8.7

5495 CF – 1" release – EL 48.15

STORAGE VOL = 7835 CF – 2 yr storm volume – ≈ 48.65

1.5" Ø orifice

Volume Computed based on 3.67 cfs discharge – not 0.064 cfs

– need to recompute

Shallow Marsh – area of bottom = 0.114 ac @ 6" depth

2. Proposed Changes –

1.69 ac addl. ; Full Site 5.62

T_c = 0.34 – Pre ; Q_2 = 5.05 cfs

Post T_c = 0.21 ; Post Q_2 = 12.2 cfs

STOR VOL = 11,761 CF for 5.05 cfs

WQ VOL = 8772 CF Rel = 0.1 cfs – elev 49.0

2 yr q_o/q_i = .1/12.2 = .008 ⟹ V_s/V_r ≫ .55

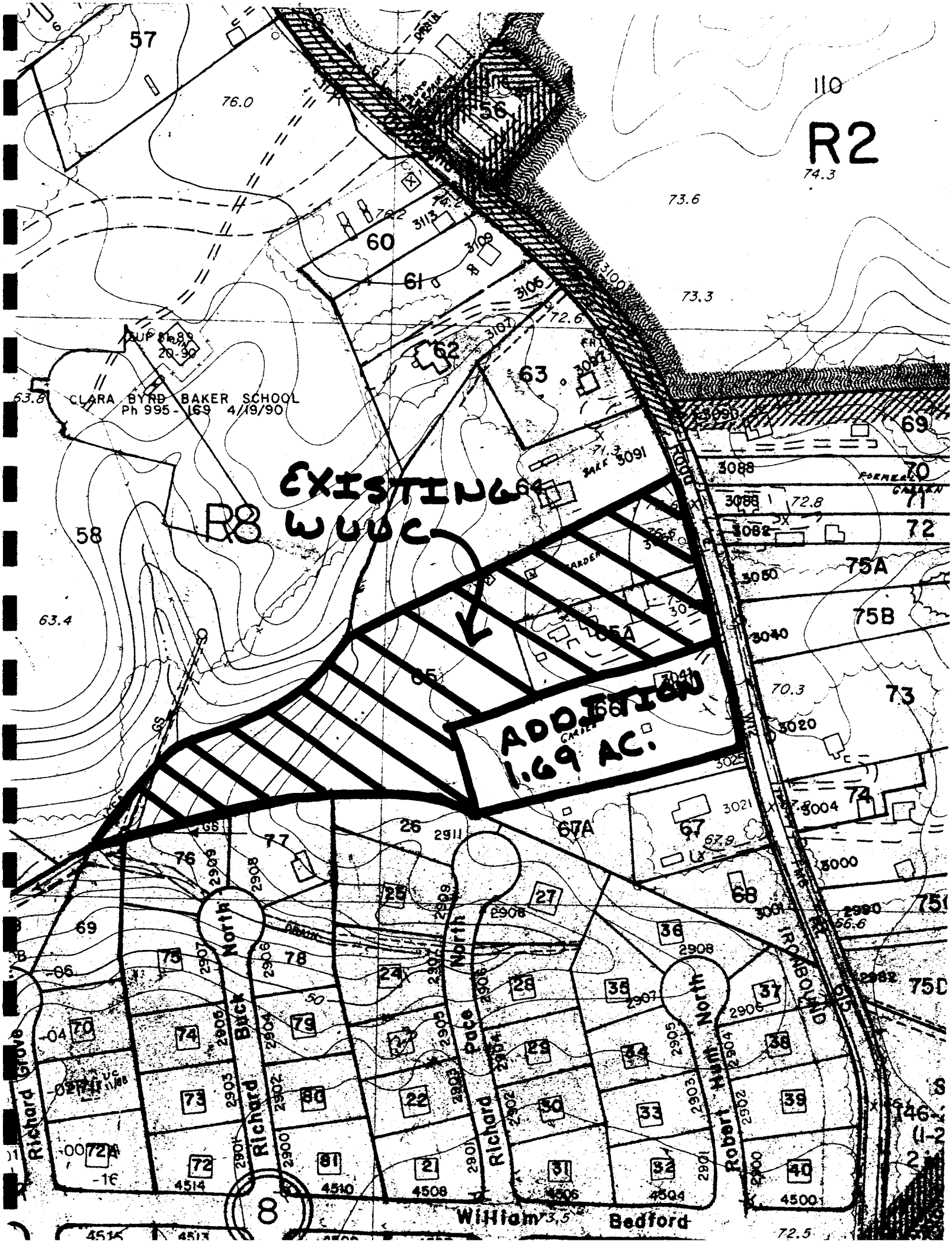
* Need to recalculate

Marsh would need to be 0.05 ac larger or 2100 SF

Preface

The following drainage and Best Management Practices (BMP) calculations pertain to the 1.69 acres purchased by the Williamsburg Unitarian Universalist Church (WUUC) adjacent to their existing building and parking lot. The newly purchased land will be used for a 75 space parking lot and entrance road off Ironbound Road.

The revised calculations verify that the existing detention pond is able to meet the county BMP and state stormwater management requirements with the modification of raising the outlet weir from elevation 48.65 to elevation 49.60. The site obtains 10.24 BMP points and releases the 2 year storm at below the pre-development rate while passing the 100 year storm without overtapping the dam.


R2
R8
EXISTING WUDC
ADDITION 1.69 AC.
CLARA BYRD BAKER SCHOOL
Ph 995-169 4/19/90
CUP 8-89
20-30
Richard Grove
Back
Richard
Pace
Robert Hunt
North
Bedford
William
ROAD
8

Worksheet 2: Runoff curve number and runoff

Project WWUC Expansion By KMS Date 10/13/98

Location James City County, Va. Checked ____ Date ____

Circle one: (Present) Developed

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Craven Emporia (C)	Woods (Good Cover)	70			1.39	97.3
Craven Emporia (C)	Meadow	71			4.19	297.49
Craven Emporia (C)	Roof	98			0.04	3.92
					Totals = 5.62	398.71

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{398.71}{5.62} = 70.9$; Use CN = 71

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2	10	
Rainfall, P (24-hour)	in	3.5	6.0	
Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in	1.0	2.9	

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

Project WWTC Expansion By KMS Date 10/13/98

Location James City County, Va Checked ____ Date ____

Circle one: (Present) Developed

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID				
1. Surface description (table 3-1)		Prairie Grass				
2. Manning's roughness coeff., n (table 3-1) ..		0.15				
3. Flow length, L (total L ≤ 300 ft)	ft	300				
4. Two-yr 24-hr rainfall, P_2	in	3.5				
5. Land slope, s	ft/ft	.03				
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	.32	+		=	

Shallow concentrated flow		Segment ID				
7. Surface description (paved or unpaved)		UNPAVED				
8. Flow length, L	ft	300				
9. Watercourse slope, s	ft/ft	.0783				
10. Average velocity, V (figure 3-1)	ft/s	4.5				
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	.02	+		=	

Channel flow		Segment ID				
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, p_w	ft					
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft					
15. Channel slope, s	ft/ft					
16. Manning's roughness coeff., n						
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s					
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr	.34				

Worksheet 5a: Basic watershed data

Project WUUC Expansion Location James City County, Va. By KWJ Date 10/13/98

Circle one: (Present) Developed _____ Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
2		.0088	.34				3.5	71	1.0	.0088	.817	.23
10		.0088	.34				6.0	71	2.9	.0255	.817	.14

From worksheet 3 From worksheet 2 From table 5-1

3

Worksheet 5b: Tabular hydrograph discharge summary

Project WWWC Expansion Location James City County, Va By KWJ Date 10/13/98

Circle one: (Present) Developed _____ Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Basic watershed data used 1/				Select and enter hydrograph times in hours from exhibit 5 ~~II~~ 2/											
		Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	A_mQ (mi^2-in)				12.3								
						Discharges at selected hydrograph times 3/ (cfs)											
2		.34		.23	.0088				5.05								
10		.34		.14	.0255				17.24								
	Composite hydrograph at outlet																

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

Worksheet 2: Runoff curve number and runoff

Project WUUC Expansion By KMJ Date 10/13/98

Location James City County, Va Checked _____ Date _____

Circle one: Present (Developed)

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Craven Emporia (C)	Woods (Good Cover)	70			0.91	63.70
Craven Emporia (C)	Grass (Good Condition)	74			2.36	174.64
Craven Emporia (C)	Roof / Road	98			2.35	230.30
					Totals =	5.62 468.64

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{468.64}{5.62} = 83.4$; Use CN = 83

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr	2	10	100
Rainfall, P (24-hour) ..... in	3.5	6.0	8.0
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	1.8	4.1	6.0

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

Project WWUC Expansion By KWJ Date 10/13/98

Location James City County, Va Checked ____ Date ____

Circle one: Present (Developed) ____

Circle one: (T_c) T_t through subarea ____

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID				
1. Surface description (table 3-1)		Dense Grass				
2. Manning's roughness coeff., n (table 3-1) ..		.24				
3. Flow length, L (total L ≤ 300 ft)	ft	100				
4. Two-yr 24-hr rainfall, P_2	in	3.5				
5. Land slope, s	ft/ft	.03				
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	.19	+		=	

Shallow concentrated flow		Segment ID				
7. Surface description (paved or unpaved)		Paved				
8. Flow length, L	ft	180				
9. Watercourse slope, s	ft/ft	.0389				
10. Average velocity, V (figure 3-1)	ft/s	4.0				
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	.01	+		=	

Channel flow		Segment ID	PIPE	CHANNEL		
12. Cross sectional flow area, a	ft^2		1.27	2.25		
13. Wetted perimeter, p_w	ft					
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft		.45	.39		
15. Channel slope, s	ft/ft		.01	.0588		
16. Manning's roughness coeff., n			.013	.051		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		6.68	3.77		
18. Flow length, L	ft		24	165		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		—	.01	=	.21
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr					

Worksheet 5a: Basic watershed data

Project WUUC Expansion Location James City County, Va By KMJ Date 10/13/98

Circle one: Present Developed _____ Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
2		.0088	.21				3.5	83	1.8	.0158	0.410	.12
10		.0088	.21				6.0	83	4.1	.0361	0.410	.07
100		.0088	.21				8.0	83	6.0	.0528	0.410	.05

From worksheet 3 From worksheet 2 From table 5-1

Worksheet 5b: Tabular hydrograph discharge summary

Project WUUC Expansion Location James City County, Va By KMJ Date 10/13/98

Circle one: Present (Developed) Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Basic watershed data used 1/ Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	$A_m Q$ (mi^2-in)	Select and enter hydrograph times in hours from exhibit 5-II 2/											
									12.2								
						Discharges at selected hydrograph times 3/ (cfs)											
2		.21		.12	.0158				12.64								
10		.21		.07	.0361				28.88								
100		.21		.05	.0528				42.24								
Composite hydrograph at outlet																	

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

Worksheet 6a: Detention basin storage, peak outflow discharge (q_o) known

Project WUUC Expansion By KWS Date 10/13/98

Location James City County, Va Checked _____ Date _____

Circle one: Present (Developed)

Elevation or stage

Detention basin storage

1. Data:
   Drainage area ..... A_m = .0088 mi^2
   Rainfall distribution type (I, IA, II, III) = II

	1st stage	2nd stage
2. Frequency ..... yr	2	
3. Peak inflow discharge, q_i .... cfs (From worksheet 4 or 5b)	12.64	
4. Peak outflow discharge, q_o .... cfs 1/	5.05	
5. Compute $\frac{q_o}{q_i}$ ...12....	.40	
6. $\frac{V_s}{V_r}$ ..... (Use $\frac{q_o}{q_i}$ with figure 6-1)	.32	
7. Runoff, Q ..... in (From worksheet 2)	1.8	
8. Runoff volume, V_r ..... ac-ft ($V_r = QA_m 53.33$)	0.84	
9. Storage volume, V_s ..... ac-ft ($V_s = V_r(\frac{V_s}{V_r})$)	.27 11,761 cf	
10. Maximum stage, E_{max} (From plot)		

1/ 2nd stage q_o includes 1st stage q_o.

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Size Pond as Extended Dry Pond Design 4

Use Sizing Rule 4 - volume equivalent to 1" of runoff distributed over the contributing watershed released over 24 hrs

Imp Area = 2.35 ac Watershed Area = 5.62 ac

$$I = \frac{2.35\,ac}{5.62\,ac} = 42$$

$$Rv = .05 + .009I$$
$$Rv = .05 + .009(42)$$

$$Rv = .43$$

$$\text{Volume} = \frac{.43 \mid 5.62\,ac \mid 43560\,sf. \mid 1in \mid 1ft}{\mid \mid 1ac \mid \mid 12in} = 8772\,cf$$

Volume required to be released over 24 hrs = 8772 cf
Volume required to control the 2yr storm = 11,761 cf

To simplify the outlet structure 11,761 cf will be released at the rate 8772 cf would be released over 24 hrs

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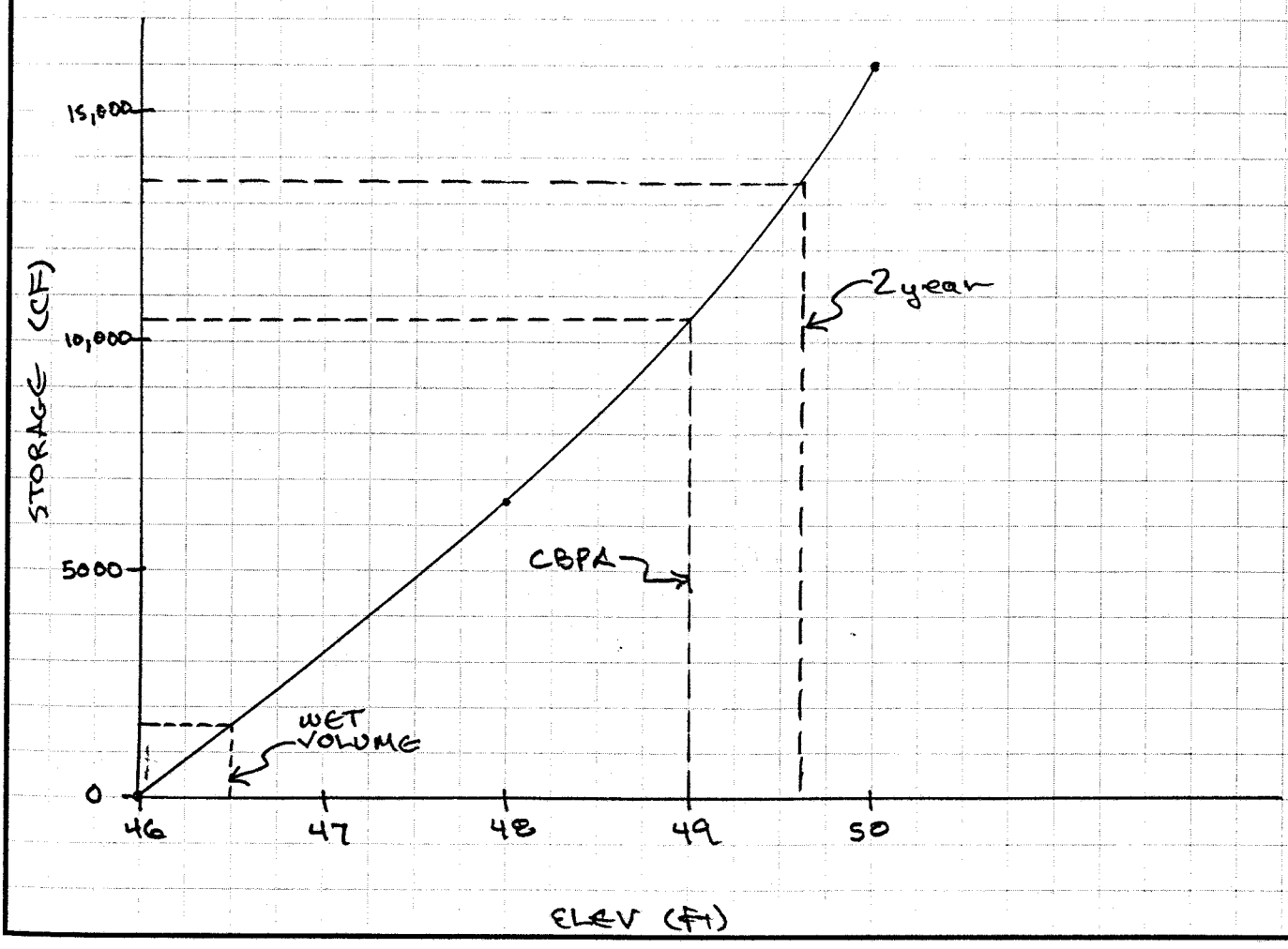
Stage - Storage

Elev (ft)	ΔElev (ft)	Area (ft²)	Increm Vol (ft³)	Accum Vol (ft³)
46		5160		0
	2		6,560	
48		7960		6,560
	2		9,410	
50		10,865		15,970



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REDESIGN ORIFICE TO RELEASE 8772 cfs OVER 24 HRS

$V = 8772$ cfs

$Q_R =$ 24 hr release rate $= \frac{8772 \text{ cf}}{24 \text{ hr}} \Big| \frac{1 \text{ hr}}{3600 \text{ s}} = .102$ cfs

Raise outlet weir to Elev 49.60 ←

H for storage of 8772 cfs is $49.60 - 46.50 = 3.1'$

$Q = CA\sqrt{2gh}$

$.102 = (.6)A\sqrt{2(32.2)(3.1)}$

$A = \pi r^2 = .0120 \text{ ft}^2$

$r = .062 = .74''$

USE 1.5" ø orifice
existing orifice is adequate

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DESIGN POND AS SHALLOW MARSH

STEP 1: The volume of the lower stage is equal to:

$\forall = [R_m R_v / 12] A$

$\forall = [(.45)(.43)/12]\ 5.62$

$\forall = .091$ ac-ft

STEP 2: Annual Nutrient Load to lower stage:

$[(P)(P_j)(R_v)/12](c)(A)(2.72)$

$N = [(45)(.9)(.43)/12](2.00)(5.62)(2.72) = 44.37$ lbs/yr

$P = [(45)(.9)(.43)/12](0.26)(5.62)(2.72) = 5.76$ lbs/yr

STEP 3: Area bottom stage $A = \frac{.091}{.5} = .182$ acres

Average Annual Loading per wetland acre:

$\frac{44.37}{.182} = 246.5$ lbs/acre/yr of N

$\frac{5.76}{.182} = 31.65$ lbs/acre/yr of P

STEP 4: 246.5 lbs/acre/yr ≈ 225 lbs/acre/yr **OK**

31.65 lbs/acre/yr < 45 lbs/acre/yr **OK**

Existing Pond area is .135 acres and is currently thriving with wetland. The additional load should not create a problem.

would need to be ~~0.5~~ 0.05 ac larger

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REDESIGN OUTLET WEIR

Weir Data:

Weir = 3'x3' square structure

C=3.1
L=3'x4 = 12'
Q= 42.24 cfs − 29.35 cfs = 12.89 cfs

The emergency spillway passes 29.35 cfs per previous WUUC drainage calculations

$Q = CLH^{3/2}$

$12.89 = (3.1)(12)\,H^{3/2}$

H = .49' above weir to pass 100 yr storm

The 100 yr storm rises to elev 50.09

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REDESIGN OUTLET BARREL

From Table 3.14-B of the VESCH

L=45'
d=24"
Q=42.24cfs - 29.35cfs = 12.89cfs

Head Required = <1.0'

The emergency spillway in conjuction with the outlet structure passes the 100 year storm without overtopping the dam

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Existing Site

1.13 ac. of conservation easement does not drain to detention pond:

Adjusted site area for structural BMP purposes is
5.93 ac − 1.13 ac = 4.80 ac

Expanded Site

Total Area = 5.93 ac + 1.69 ac = 7.62 ac

Area from new parcel treated by pond = 1.53 ac

Total Area treated by pond = 4.09 ac + 1.53 ac = 5.62 ac

Adjusted site area for structural BMP purposes is
7.62 ac − 1.13 ac = 6.49 ac

WORKSHEET FOR BMP POINT SYSTEM

Existing Site

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP POINTS		Fraction of Site Served by BMP		Weighted BMP Points
Design 4	9	x	.85 (4.09ac)	=	7.65
		x		=	
		x		=	
		x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 7.65

B. NATURAL OPEN SPACE CREDIT

	Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
(1.90 ac)	.32	x	10	=	3.20

C. TOTAL WEIGHTED POINTS

7.65	+	3.20	=	10.85
Structural BMP Points		Natural Open Space Points		TOTAL

WORKSHEET FOR BMP POINT SYSTEM

Expanded site

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP POINTS		Fraction of Site Served by BMP		Weighted BMP Points
Design 4	9	X	.86 (5.62ac)	=	7.74
		X		=	
Design 3	6	X	100	=	6.0
		X		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: _____

B. NATURAL OPEN SPACE CREDIT

	Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
(1.90 ac)	.25	X	10	=	2.50

C. TOTAL WEIGHTED POINTS

7.74	+	2.50	=	10.24
Structural BMP Points		Natural Open Space Points		TOTAL

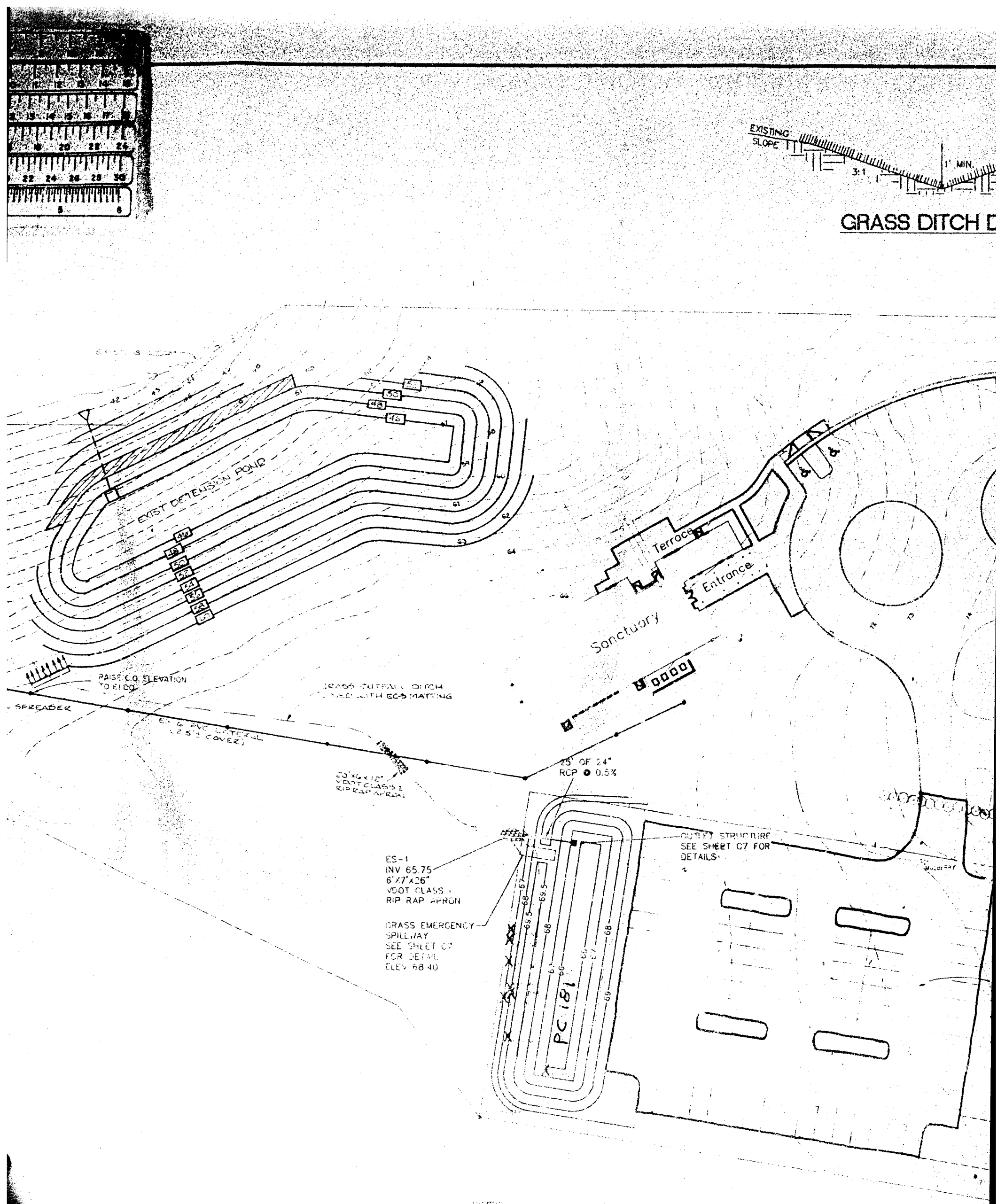
TOTAL SITE = 7.6 ac

Cons. Area = $\frac{1.9}{5.7}$ ac dev'd site = 2.5 PTS

$\frac{4.1}{5.7} = 0.72 \times 9 = 6.5$

$\frac{1.7}{5.7} = .3 \times 4 = 1.2$

10.2



NOTES:

1) UPON COMPLETION, THE CONSTRUCTION OF THE DAM WILL BE CERTIFIED BY A PROFESSIONAL ENGINEER WHO HAS INSPECTED THE STRUCTURE DURING CONSTRUCTION.
2) "AS-BUILT" DRAWINGS SHALL BE PROVIDED FOR THE DETENTION BASIN UPON COMPLETION.
3) THE DETENTION POND SHALL BE USED AS A SEDIMENT BASIN DURING CONSTRUCTION BY PLUGGING THE LOW FLOW ORIFICE. ONCE THE SITE IS STABILIZED THE LOW FLOW ORIFICE SHALL BE UNPLUGGED TO ALLOW THE POND TO ACT AS A PERMANENT BMP. THE SEDIMENT IN THE BASIN SHALL BE REMOVED BEFORE THE LOW FLOW ORIFICE IS UNPLUGGED.
4) ALL LATERAL CLEANOUTS ALONG THE PROPOSED OUTFALL DITCH MUST BE INSPECTED AND REPAIRED, IF DAMAGED, TO ENSURE THEY ARE NOT A PATH FOR STORM WATER TO ENTER THE SANITARY SEWER SYSTEM.