See also WC033

CERTIFICATE OF AUTHENTICITY

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

BMP NUMBER: **WC049**

DATE VERIFIED: **July 17, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

DATE: March 12, 2010

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

FROM: Tina Cantwell, Stormwater

PO: 270712

RE: Files Approved for Scanning

General File ID or BMP ID: WC049

PIN: 0530100004

Subdivision, Tract, Business or Owner Name (if known): Tradition Golf Club (The) at Stonehouse

Property Description: BMP #2 (Lake) SW Clubhouse & Park Area

Site Address: 9700 Mill Pond Road

(For internal use only) **Box** 13 **Drawer:** 9

Agreements: (in file as of scan date) Y **Book or Doc#:** 420 **Page:** 712

Comments

017615

DECLARATION OF COVENANTS

INSPECTION/MAINTENANCE OF RUNOFF CONTROL FACILITY

COPY

THIS DECLARATION, made this 17th day of October, 19 94, between Legends of Virginia, LC, and all successors in interest, hereinafter referred to as the "COVENANTOR(S)," owner(s) of the following property: Legends at Stonehouse Golf Course 245 Ac From 4699.33 Ac STONEHOUSE DEED BOOK NUMBER 420 PAGE 712, 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 runoff control facility, hereinafter referred to as the "FACILITY," located on and serving the above-described property to ensure that the FACILITY is and remains in proper working condition in accordance with approved design standards, and with the law and applicable executive regulations.

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

3. The COVENANTOR(S) shall provide and maintain perpetual access from public right-of-ways to the FACILITY 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 FACILITY for the purpose of inspecting, operating, installing, constructing, reconstructing, maintaining or repairing the FACILITY.

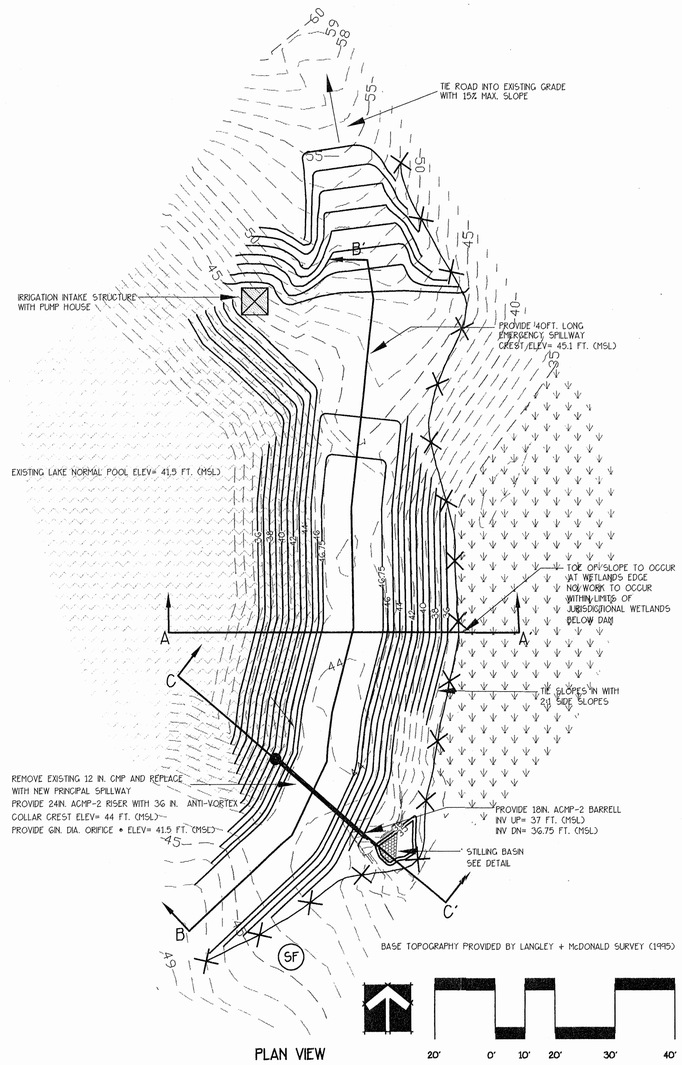
5. If, after reasonable notice by the COUNTY, the COVENANTOR(S) shall fail to maintain the FACILITY in accordance with the approved design standards and with the law and applicable executive regulations, the COUNTY may perform all necessary repair or maintenance work, and the COUNTY may assess the COVENANTOR(S)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

7. The COVENANTOR(s) shall promptly notify the COUNTY when the COVENANTOR(S) legally transfers any of the COVENANTOR(S)' responsibilities for the FACILITY. 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 FACILITY.

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



BASIN HYDROLOGY

Basin Characteristics	* DA acres	CN	Tc hours
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Post-development	44	79	0.62
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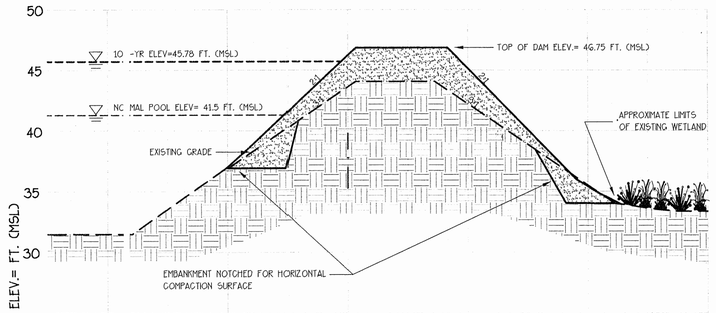
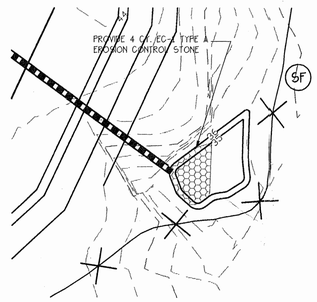
* SEE MASTER STORMWATER PLAN (SHEET 4) FOR EXTENT OF BMP DRAINAGE AREA



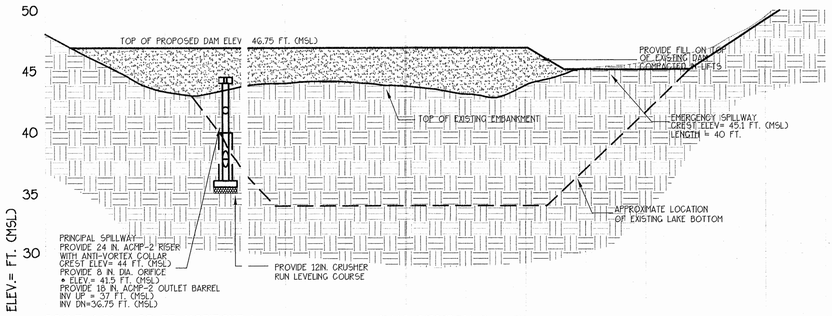
SCALE: 1 IN. 10 FT. HORIZONTAL
1 IN. 5 FT. VERTICAL

DAM SECTION A - A'



STILLING BASIN DETAIL
PLAN VIEW

SCALE: 1 IN. = 10 FT.



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DAM SECTION B - B'

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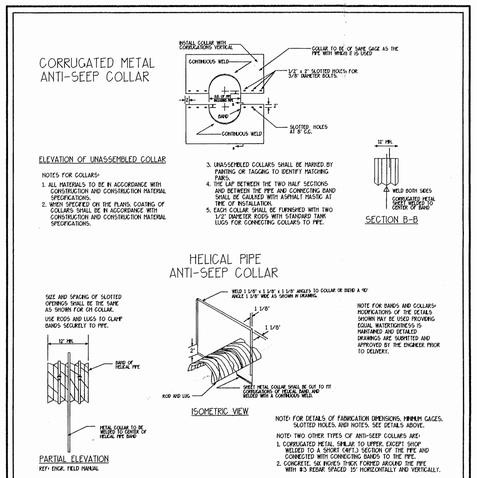
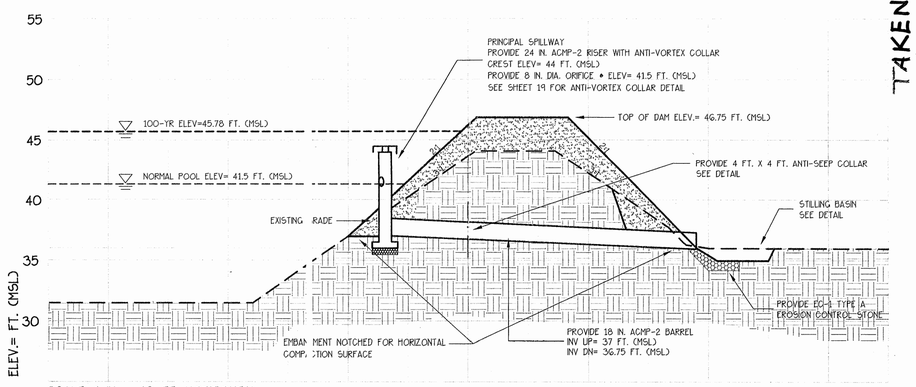


DETAIL: METAL ANTI-SEEP COLLAR'S

NTS



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DAM SECTION C - C'

TAKEN FROM PLAN SET S-34-95

REVISIONS:			
DATE		DATE	
6/26/95	ADDED TO MAINTENANCE FACILITY PLANS. SHEET NUMBER CHANGED TO 6.		

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.
Environmental Consultants
516-B South Henry Street, Williamsburg, Virginia 23185 (804) 220-5869

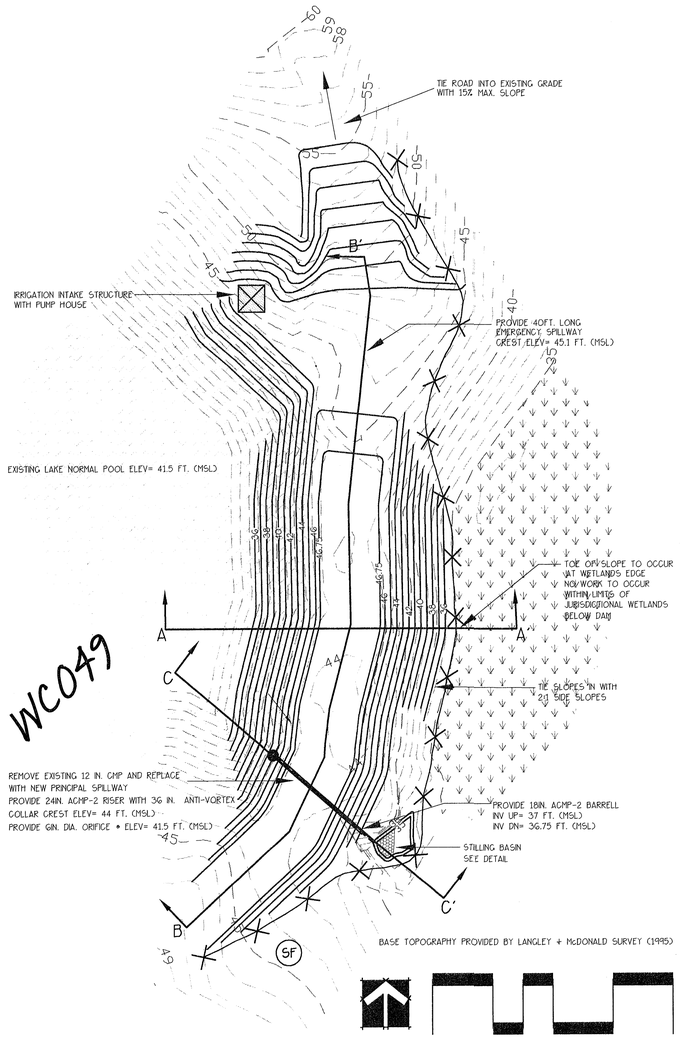
EXISTING RANGE LAKE/BMP #2 DETAIL SHEET
THE LEGENDS AT STONEHOUSE
JAMES CITY COUNTY, VIRGINIA

COMMONWEALTH OF VIRGINIA
RONALD L. BOYD
No. 020970
PROFESSIONAL ENGINEER

DRAWN BY: AEJ/ACAD	DESIGNED BY: BLF/EA
DATE: 6/6/95	CHECKED BY: EA\RB

SHEET: 6

JOB NUMBER: 318



PLAN VIEW

20' 0' 10' 20' 30' 40'

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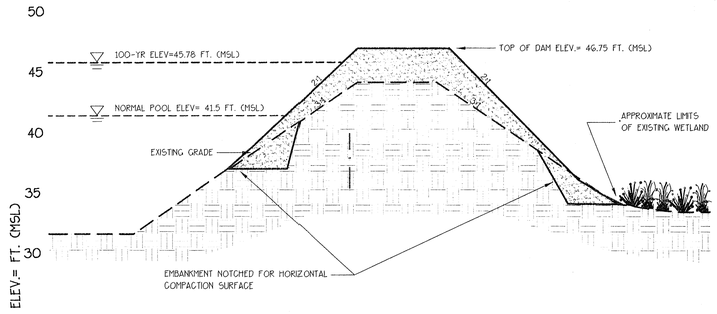

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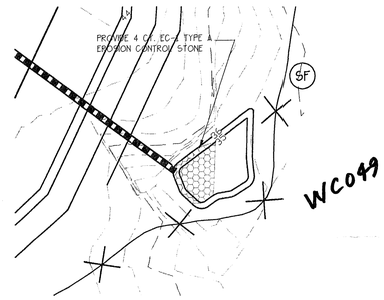
DAM SECTION A - A'

WC049



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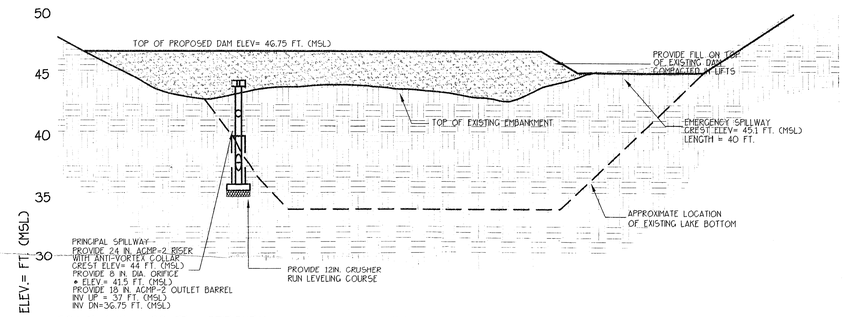

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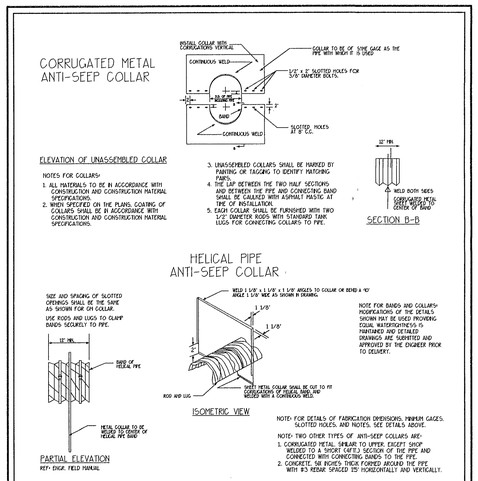

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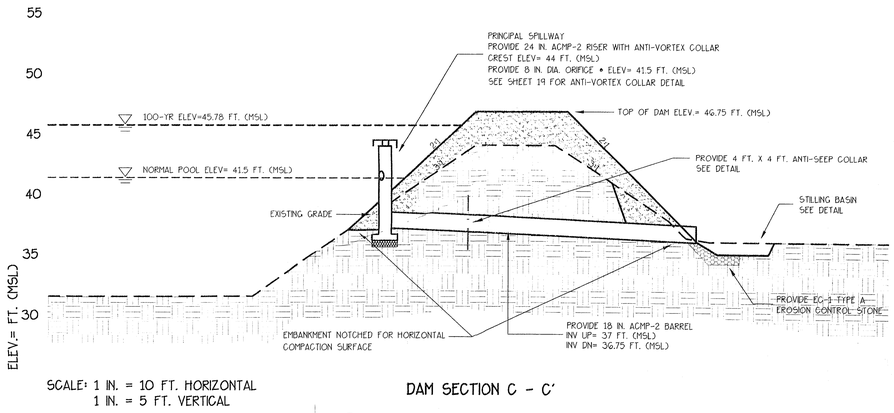

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DAM SECTION C - C'

WC049

REVISIONS:
DATE DATE

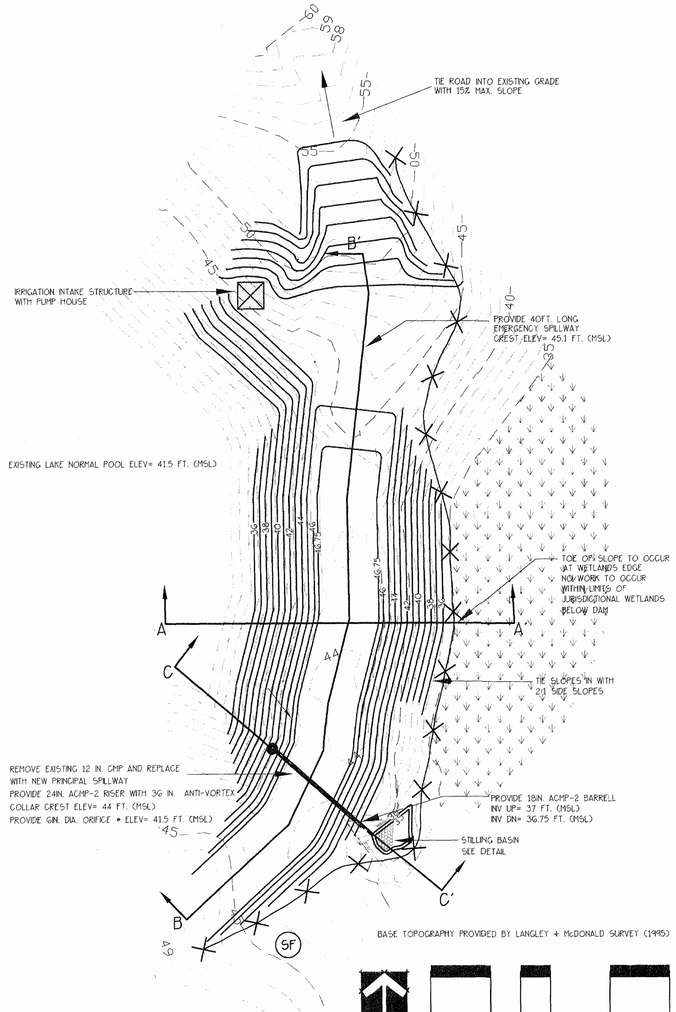
WILLIAMSBURG ENVIRONMENTAL GROUP, INC.
Environmental Consultants
516-B South Henry Street, Williamsburg, Virginia 23185 (804) 220-0869

EXISTING RANGE LAKE/BMP #2 DETAIL SHEET
STONEHOUSE GOLF COURSE
JAMES CITY COUNTY, VIRGINIA

WC049 BMP #2

COMMONWEALTH OF VIRGINIA
HOWARD L. LLOYD JR.
No. 020970
PROFESSIONAL ENGINEER

DRAWN BY: AEJ/ACAD
DESIGNED BY: BLF/EA
DATE: 6/6/95
CHECKED BY: EA\RB
SHEET: 21
JOB NUMBER: 318



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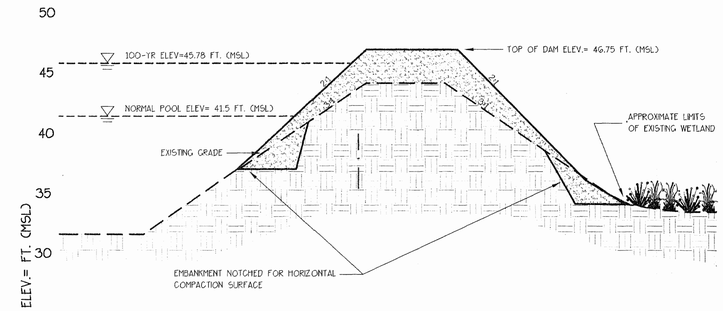

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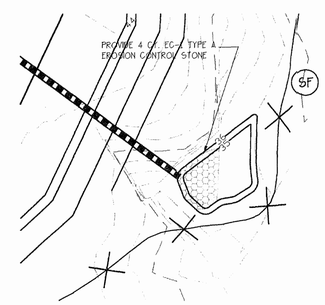
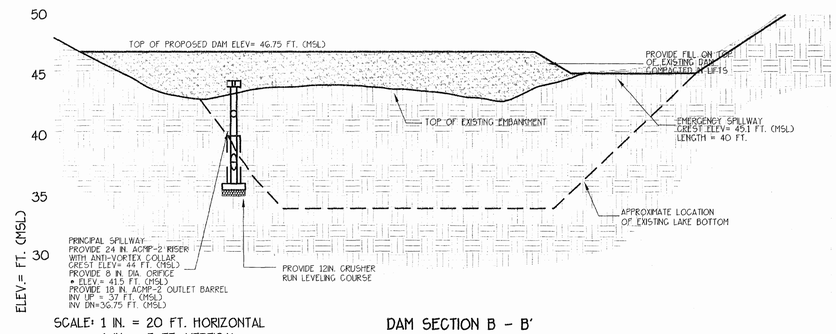
1 IN. = 5 FT. VERTICAL

DAM SECTION A - A'



STILLING BASIN DETAIL
PLAN VIEW

SCALE: 1 IN. = 10 FT.



SCALE: 1 IN. = 20 FT. HORIZONTAL
1 IN. = 5 FT. VERTICAL

DAM SECTION B - B'

GEOTECH NOTES

1)) AS THE EARTHWORK WILL REQUIRE DISTURBANCE TO THE EXISTING EMBANKMENTS, THE CONTRACTOR SHOULD BE PREPARED TO LOWER THE IMPOUNDMENT POOL LEVEL BY AT LEAST 5 OR 6 FEET IN THE CASE OF AN EMERGENCY. IN ORDER TO DRAIN THE LAKE TO A SUFFICIENT LEVEL TO BEGIN CONSTRUCTION, A TEMPORARY STILLING BASIN SHOULD BE PROVIDED AND THE PONDS PUMPED DOWN BY MECHANICAL MEANS. THE PUMPS SHOULD OPERATE WITH SUFFICIENT DURATION AND FREQUENCY SUCH THAT WATER LEVELS REMAIN GENERALLY CONSTANT. AS THE HORIZONTAL PIPE OF THE NEW SPILLWAY FOR THE DRIVING RANGE LAKE WILL BE ROUGHLY 6 FEET BELOW THE EXISTING TOP OF DAM POOL ELEVATION CHANGES OF AT LEAST 4 TO 6 FEET WILL BE REQUIRED DURING CONSTRUCTION.

2) ANTI-SEEPAGE COLLARS SHOULD BE EMPLOYED ON NEW SPILLWAY STRUCTURES.

3) SOILS USED TO CONSTRUCT THE NEW EMBANKMENTS SHOULD CONSIST OF A SOIL MATERIAL FREE OF ORGANICS AND DEBRIS, CLASSIFIED AS SM, SC, CL OR ML WHICH CONTAINS NO LESS THAN 15% PASSING THE NO. 200 SIEVE. SUCH SOILS SHOULD BE AVAILABLE FROM LOCAL, ON-SITE SOURCES.

4) PREPARATION OF THE EMBANKMENTS FOR FILL PLACEMENT SHOULD INCLUDE CUTTING OF ALL TREES WITHIN THE FILL AREA. TREES SHOULD BE CUT FLUSH TO THE GROUND SURFACE. AS STUMP REMOVAL WOULD LIKELY CAUSE MORE POTENTIAL DAMAGE TO THE DAM THAN THE PRESENCE OF ROTTING STUMPS WITHIN THE ENCAPSULATED EMBANKMENT. THE COMPLETE REMOVAL OF STUMPS IS NOT RECOMMENDED. THE CONTRACTOR SHOULD BE PREPARED TO EXCAVATE STUMPS FROM LARGER TREES (GREATER THAN 8 INCHES IN DIAMETER 4 FEET ABOVE THE GROUND) SHOULD THESE STUMPS BE LOCATED LESS THAN 4 FEET FROM THE FINAL EMBANKMENT SURFACE MEASURED HORIZONTALLY.

5) STRIPPING SHOULD INCLUDE REMOVAL OF ALL TOPSOIL AND BRUSH VEGETATION FROM AREAS OF FILL PLACEMENT.

6) FILL SHOULD BE PLACED AND COMPACTED IN MAXIMUM 10 INCH HORIZONTAL LIFTS, MEASURED LOOSE. TO PROVIDE FOR HORIZONTAL COMPACTION, THE UPSTREAM AND DOWNSTREAM FACE OF THE DAM WILL REQUIRE NOTCHING BY EXCAVATING SOIL AT TOE OF PROPOSED FILL TO PROVIDE FOR A BENCH ON WHICH TO COMPACT SUBSEQUENT LIFTS. AT AN ELEVATION WHERE THE DESIGN WIDTH OF THE NEW FILL EQUALS THE HORIZONTAL COMPACTION SURFACE WIDTH, THIS EXCESS FILL PLACEMENT EFFORT WOULD NOT BE REQUIRED, AND ANY FILL PLACED AND COMPACTED BEYOND THE DESIGN ZONE OF THE NEW FILL CAN BE REMOVED AND REUSED ELSEWHERE.

7) ALL SOFT ORGANIC SEDIMENT SHALL BE REMOVED ON UPSTREAM FACE OF DAM.

8) ALL EXISTING DAM SURFACES, HORIZONTAL OR OTHERWISE, ON WHICH FILL IS TO BE PLACED SHOULD BE SCARIFIED TO A DEPTH OF AT LEAST 4 INCHES PRIOR TO FILL PLACEMENT.

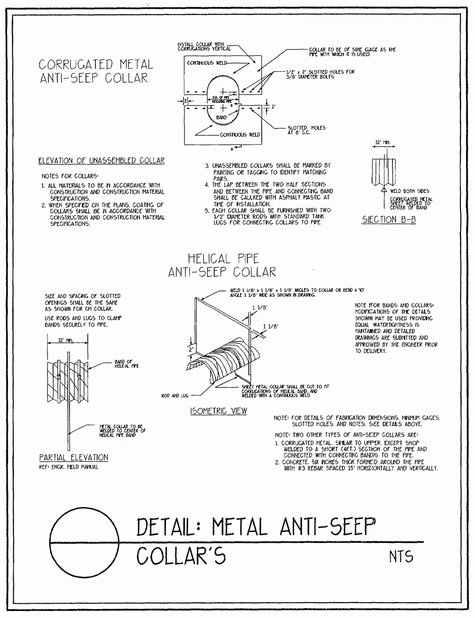
9) ALL FILL SHOULD BE PLACED IN MAXIMUM 10 INCH LOOSE, HORIZONTAL LIFTS AND MECHANGALLY COMPACTED TO A DRY DENSITY OF AT LEAST 95% OF THAT SOIL STANDARD PROCTOR MAXIMUM DRY DENSITY (ASTM D698). IN ORDER TO PROPERLY ACHIEVE COMPACTION OF THIS SOIL, THE SOIL SHOULD BE BROUGHT TO WITHIN +/-4% OF OPTIMUM PRIOR TO COMPACTING.

10) LOCAL BORROW SOILS AVAILABLE FOR USE IN DAM REHABILITATION ARE PRIMARILY GRANULAR IN NATURE, AND A DRUM ROLLER WOULD PROBABLY BE BEST SUITED FOR THIS COMPACTION. VIBRATORY COMPACTION CAN BE UTILIZED ON THE EMBANKMENT AND WILL ENHANCE THE COMPACTION EFFORT; HOWEVER, DEPENDING ON THE SIZE OF THE ROLLER USED, PROBLEMS WITH SOIL STABILITY AND MOISTURE COULD OCCUR. AND THE VIBRATORY RESULTS SHOULD BE CLOSELY MONITORED FOR POTENTIALLY DESTABILIZING EFFECTS. SHOULD SLOUGHING OR EXCESSIVE VIBRATION BE OBSERVED DURING VIBRATORY COMPACTION, THE VIBRATORY EFFORT SHOULD BE CEASED. SHOULD CLAYEY SOILS BE USED AS BORROW, A SHEEPS FOOT OR SIMILAR COMPACTIVE MACHINERY WOULD BE REQUIRED FOR ADEQUATE COMPACTION. CLAYEY SOILS SHOULD NOT BE COMPACTED WITH SMOOTH DRUM ROLLERS AS THESE TEND TO CREATE SEEPAGE PLANES ALONG EACH LIFTS COMPACTED SURFACE.

11) DAM EMBANKMENTS SHOULD BE PROTECTED FROM EROSION DUE TO WAVE ACTION AND SURFACE RUNOFF. ON THE UP AND DOWNSTREAM FACES, SLOPE PROTECTION SHOULD BE ATTAINED BY SEEDING WITH HEAVY GRASS. IF CONSTRUCTION OCCURS DURING A PERIOD NOT CONDUCIVE TO RAPID VEGETATIVE GROWTH, A TEMPORARY SYNTHETIC STABILIZATION MATTING COULD BE USED TO COVER THE SLOPE. TREES SHOULD NOT BE PLANTED ON DAM EMBANKMENTS.

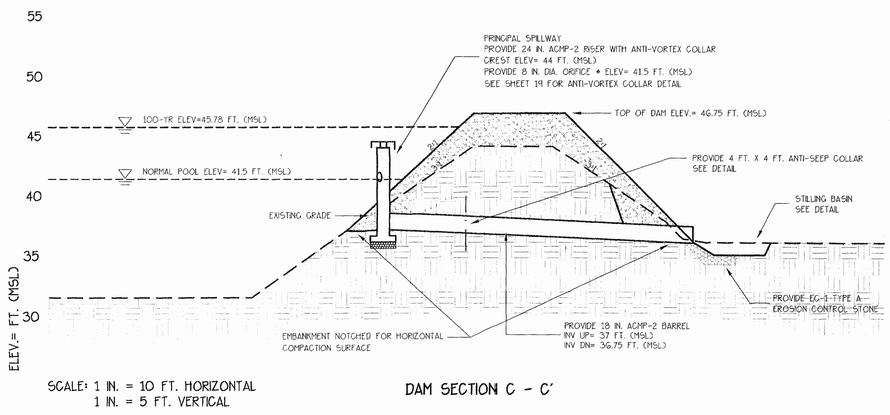
12) ROUTINE MAINTENANCE SHOULD BE PROVIDED FOR THE DAMS. THIS SHOULD INCLUDE ANNUAL INSPECTIONS FOR REMOVAL OF BUSHES AND TREES, FILLING OF ANIMAL BURROWS, INSPECTION FOR SURFACE EROSION OR VERTICAL CRACKS AND SEEPAGE WITHIN OR ABOVE THE TOE.

13) A REPRESENTATIVE OF THE SOILS ENGINEER SHOULD BE CALLED ON TO PERFORM CRITICAL SITE INSPECTIONS. THESE SHOULD INCLUDE, BUT NOT NECESSARILY BE LIMITED TO: INSPECTION OF SOIL MATERIALS FOR USE IN DAM REHABILITATION FOR CONFORMANCE TO THE SPECIFICATIONS; OBSERVATION OF STRIPPED SUBGRADE SURFACES PRIOR TO FILL PLACEMENT; DELINEATION OF SEEPAGE DRAIN IF REQUIRED; COMPACTION TESTING OF SOIL FILL, PARTICULARLY DURING INITIAL FILL PLACEMENT. TEST SHOULD BE PERFORMED AT A RATE OF AT LEAST ONE PER LIFT OR AS OTHERWISE DIRECTED BY THE ENGINEER; OBSERVATION OF FINISHED EMBANKMENT GRADES FOR SIGNS OF SEEPAGE OR EROSION.



DETAIL: METAL ANTI-SEEP COLLAR'S

NTS



SCALE: 1 IN. = 10 FT. HORIZONTAL
1 IN. = 5 FT. VERTICAL

DAM SECTION C - C'

REVISIONS:

DATE	DATE

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.
Environmental Consultants
516-B South Henry Street, Williamsburg, Virginia 23185 (804) 220-8669

EXISTING RANGE LAKE/BMP #2 DETAIL SHEET
STONEHOUSE GOLF COURSE
JAMES CITY COUNTY, VIRGINIA

COMMONWEALTH OF VIRGINIA
BOYD L. BOYD
No. 7029970
PROFESSIONAL ENGINEER

DRAWN BY: AEJ/ACAD
DESIGNED BY: BLF/EA
DATE: 6/8/95
CHECKED BY: EA\RB

SHEET: 21

JOB NUMBER: 318

WC049_TRADITION_GOLF_CLUB_AT_STONEHOUSE - 006

WILLIAMSBURG
ENVIRONMENTAL
GROUP, INC.

Environmental Consultants

Legends At Stonehouse
BMP #2
Hydrologic/Hydraulic Computations

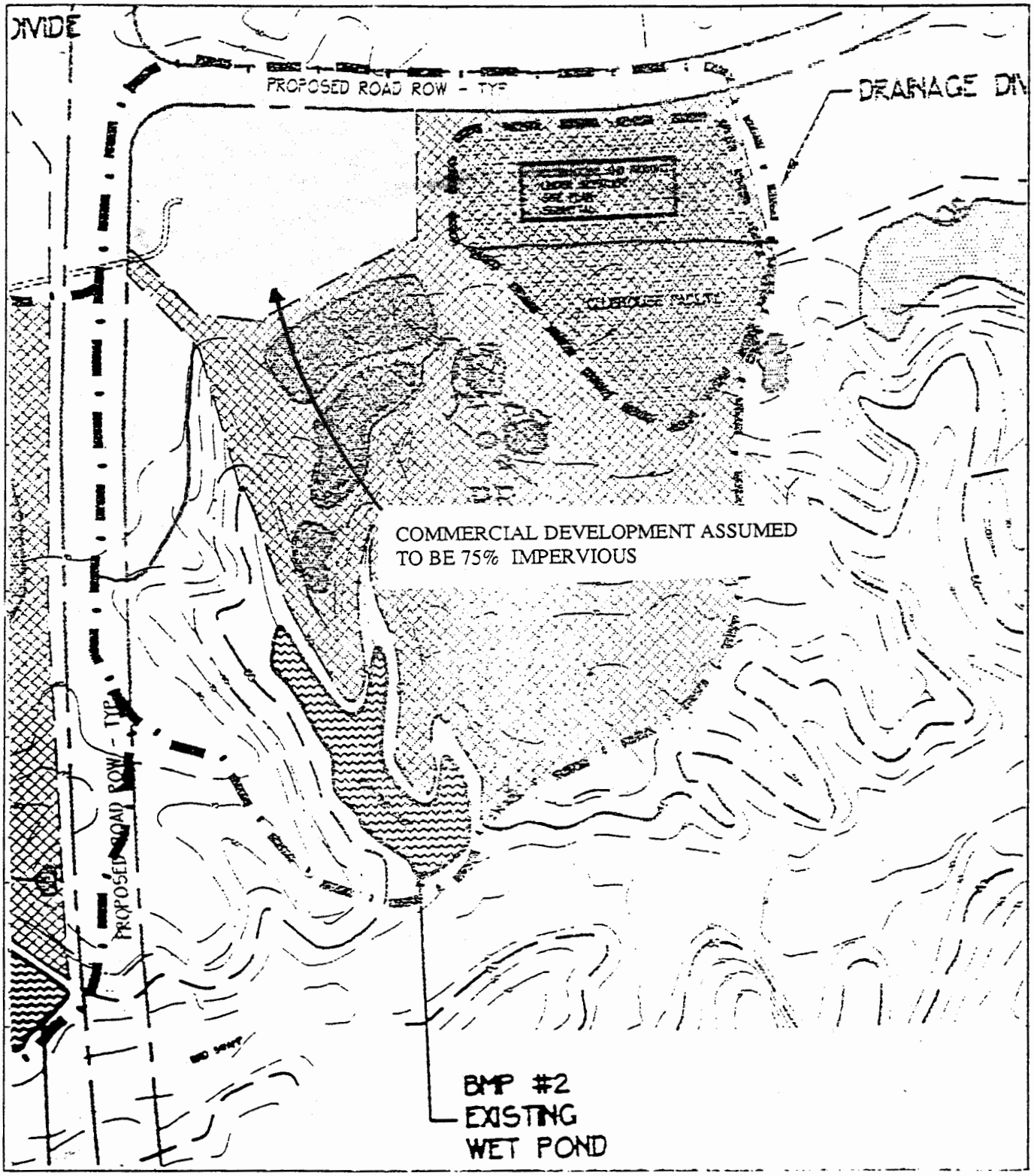
516-B South Henry Street Williamsburg, Virginia 23185 (804) 220-6869 FAX (804) 229-4507

Water Quality

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

PROJECT: LEGENDS AT STONEHOUSE
SUBJECT: COMMERCIAL CONTRIBUTIONS
BY: ELA JOB #: 318
DATE: 6-2-95 SHEET ___ OF ___

Environmental Consultants



516-B South Henry Street Williamsburg, Virginia 23185 (804) 220-6869 FAX (804) 229-4507

BMP #2 Sizing
For Entire Development

I Compute Rv

Drainage Area =	44	acre
Paved Area=	10	acre
Impervious %=	22.73	%
Golf Impervious	1	%
Total Impervious	23.73	%

Rv= (.05 + .009(Impervious %)
Rv= 0.26

II Compute Storage Volume

Design a wet pond to function as a 50% efficient BMP using guidelines presented in the
Removal efficiencies are taken from Local Assistance Manual. (CBLAD,1989)
Design based on A Framework For Evaluating Compliance With The 10% Rule In the Che

Vol=4(Runoff from mean storm)
Vol=4(Rv)(Rainfall of Mean Storm)(Drainage Area)
Vol = 1.62 ac-ft
Vol= 70717 cu-ft

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

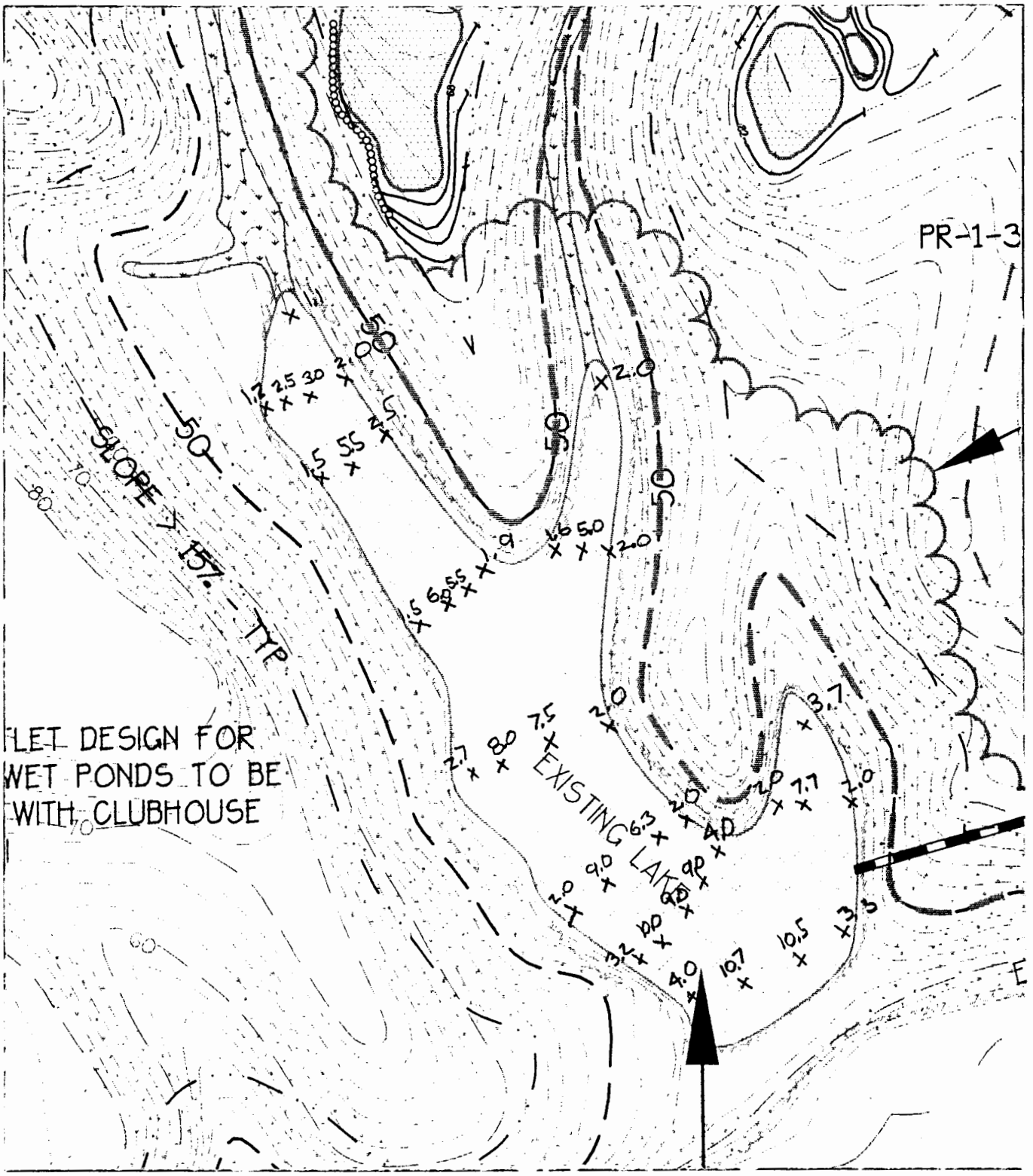
Environmental Consultants

PROJECT: LEGENDS AT STONEHOUSE

SUBJECT: SURVEYED LAKE DEPTHS

BY: ELA JOB #: 318

DATE: 6-2-95 SHEET ___ OF ___



516-B South Henry Street Williamsburg, Virginia 23185 (804) 220-6869 FAX (804) 229-4507

BMP #2
Composite Curve Numbers

Quick TR-55 Ver.5.44 S/N:1315400034
Executed: 19:19:42 11-14-1994

Stonehouse BMP #2
Pre-development Curve Numbers

RUNOFF CURVE NUMBER SUMMARY

::

Subarea Description	Area (acres)	CN (weighted)
	37.00	67

Quick TR-55 Ver.5.44 S/N:1315400034
Executed: 19:19:42 11-14-1994

Stonehouse BMP #2
Pre-development Curve Numbers

RUNOFF CURVE NUMBER DATA

::

Composite Area:

SURFACE DESCRIPTION	AREA (acres)	CN	
Forest (C soils)	30.00	70	
Forest (B soils)	7.00	55	
COMPOSITE AREA --->	37.00	67.2	(67)

::

Quick TR-55 Ver.5.44 S/N:1315400034
Executed: 19:32:58 11-14-1994

Stonehouse BMP #2
Postdevelopment Curve Numbers

RUNOFF CURVE NUMBER SUMMARY

Subarea Description	Area (acres)	CN (weighted)
	44.00	79

Quick TR-55 Ver.5.44 S/N:1315400034
Executed: 19:32:58 11-14-1994

Stonehouse BMP #2
Postdevelopment Curve Numbers

RUNOFF CURVE NUMBER DATA

::

Composite Area:

SURFACE DESCRIPTION	AREA (acres)	CN	
Forest (C soils)	14.60	70	
Forest (B soils)	0.00	55	
Grass (C soils)	12.00	74	
Grass (B soils)	0.00	61	
Industrial (C soils)	4.00	91	
Industrial (B soils)	12.00	88	
Lake	1.40	98	
COMPOSITE AREA --->	44.00	78.8	(79)

::

BMP #2
Time of Concentration Computations

Quick TR-55 Ver.5.44 S/N:1315400034
Executed: 19:17:46 11-14-1994 c:\pondpack\SH2PRE.TCT

Stonehouse
BMP #2
Pre-development Time of Concentration

Tc COMPUTATIONS FOR:

SHEET FLOW (Applicable to Tc only)

Segment ID		1	
Surface description		forest	
Manning's roughness coeff., n		0.6000	
Flow length, L (total < or = 300)	ft	300.0	
Two-yr 24-hr rainfall, P2	in	3.600	
Land slope, s	ft/ft	0.0500	
$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.78	= 0.78

SHALLOW CONCENTRATED FLOW

Segment ID		2	
Surface (paved or unpaved)?		Unpaved	
Flow length, L	ft	650.0	
Watercourse slope, s	ft/ft	0.0538	
$Avg.V = Csf * (s)^{0.5}$	ft/s	3.7424	
where: Unpaved Csf = 16.1345 Paved Csf = 20.3282			
T = L / (3600*V)	hrs	0.05	= 0.05

CHANNEL FLOW

Segment ID			
Cross Sectional Flow Area, a	sq.ft	0.00	
Wetted perimeter, Pw	ft	0.00	
Hydraulic radius, r = a/Pw	ft	0.000	
Channel slope, s	ft/ft	0.0000	
Manning's roughness coeff., n		0.0000	
$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	0.0000	
Flow length, L	ft	0	
T = L / (3600*V)	hrs	0.00	= 0.00

:::

TOTAL TIME (hrs) 0.83

Quick TR-55 Ver.5.44 S/N:1315400034
Executed: 19:17:46 11-14-1994 c:\pondpack\SH2PRE.TCT

SUMMARY SHEET FOR Tc or Tt COMPUTATIONS
(Solved for Time using TR-55 Methods)

Stonehouse
BMP #2
Pre-development Time of Concentration

Subarea descr.	Tc or Tt	Time (hrs)
	Tc	0.83

```
Quick TR-55 Ver.5.44   S/N:1315400034
Executed: 19:18:05   11-14-1994    c:\pondpack\SH2PST.TCT

                                 Stonehouse
                                   BMP #2
                      Postdevelopment Time of Concentration


                         Tc COMPUTATIONS FOR:

 SHEET FLOW (Applicable to Tc only)
     Segment ID                                      1
     Surface description                        forest
     Manning's roughness coeff., n                   0.4100
     Flow length, L (total < or = 300)       ft      300.0
     Two-yr 24-hr rainfall, P2               in      3.600
     Land slope, s                           ft/ft   0.0500
                              0.8
          .007 * (n*L)
     T =  --------------                     hrs       0.57              =   0.57
              0.5     0.4
            P2    *  s

 SHALLOW CONCENTRATED FLOW
     Segment ID                                      2
     Surface (paved or unpaved)?                     Unpaved
     Flow length, L                          ft      650.0
     Watercourse slope, s                    ft/ft   0.0538

                                0.5
     Avg.V =  Csf *  (s)                     ft/s    3.7424
     where:   Unpaved Csf = 16.1345
              Paved   Csf = 20.3282

     T = L / (3600*V)                        hrs       0.05              =   0.05


 CHANNEL FLOW
     Segment ID
     Cross Sectional Flow Area, a            sq.ft     0.00
     Wetted perimeter, Pw                    ft        0.00
     Hydraulic radius, r = a/Pw              ft        0.000
     Channel slope, s                        ft/ft     0.0000
     Manning's roughness coeff., n                     0.0000

                         2/3     1/2
          1.49   *  r    *  s
     V =  --------------------               ft/s      0.0000
                       n

     Flow length, L                          ft          0

     T = L / (3600*V)                        hrs       0.00              =   0.00

     ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                                  TOTAL TIME (hrs)       0.62
```

Quick TR-55 Ver.5.44 S/N:1315400034
Executed: 19:18:05 11-14-1994 c:\pondpack\SH2PST.TCT

SUMMARY SHEET FOR Tc or Tt COMPUTATIONS
(Solved for Time using TR-55 Methods)

Stonehouse
BMP #2
Postdevelopment Time of Concentration

Subarea descr.	Tc or Tt	Time (hrs)
	Tc	0.62

BMP #2
Pre-development Hydrology Computations

Return Frequency: 2 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:05:02
Watershed file: --> C:\PONDPACK\SH2PRE .MOP
Hydrograph file: --> C:\PONDPACK\SH2PR2.HYD

Stonehouse
BMP#2
Pre-development Flows

>>>> Summary of Subarea Times to Peak <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
1	19	12.7
Composite Watershed	19	12.7

Return Frequency: 2 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:05:02
Watershed file: --> C:\PONDPACK\SH2PRE .MOP
Hydrograph file: --> C:\PONDPACK\SH2PR2.HYD

Stonehouse
BMP#2
Pre-development Flows

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
1	0	0	0	0	0	1	2	5	10
Total (cfs)	0	0	0	0	0	1	2	5	10

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
1	15	18	19	18	13	9	7	6	5
Total (cfs)	15	18	19	18	13	9	7	6	5

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
1	4	3	3	2	2	2	2	2	2
Total (cfs)	4	3	3	2	2	2	2	2	2

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
1	1	1	1	1	0
Total (cfs)	1	1	1	1	0

Return Frequency: 10 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:05:02
Watershed file: --> C:\PONDPACK\SH2PRE .MOP
Hydrograph file: --> C:\PONDPACK\SH2PR10.HYD

Stonehouse
BMP#2
Pre-development Flows

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
1	37.00	67.0	0.75	0.00	5.70	2.31	I.17 .17

* Travel time from subarea outfall to composite watershed outfall point.
I -- Subarea where user specified interpolation between Ia/p tables.

Total area = 37.00 acres or 0.05781 sq.mi
Peak discharge = 52 cfs

>>>> Computer Modifications of Input Parameters <<<<<

Subarea Description	Input Values Tc (hr)	* Tt (hr)	Rounded Values Tc (hr)	* Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
1	0.83	0.00	0.75	0.00	Yes	--

* Travel time from subarea outfall to composite watershed outfall point.

Return Frequency: 10 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:05:02
Watershed file: --> C:\PONDPACK\SH2PRE .MOP
Hydrograph file: --> C:\PONDPACK\SH2PR10.HYD

Stonehouse
BMP#2
Pre-development Flows

>>>> Summary of Subarea Times to Peak <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
1	52	12.6
Composite Watershed	52	12.6

Return Frequency: 10 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:05:02
Watershed file: --> C:\PONDPACK\SH2PRE .MOP
Hydrograph file: --> C:\PONDPACK\SH2PR10.HYD

Stonehouse
BMP#2
Pre-development Flows

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	1	2	2	3	4	6	11	21	34
Total (cfs)	1	2	2	3	4	6	11	21	34

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	45	52	52	47	33	23	17	13	11
Total (cfs)	45	52	52	47	33	23	17	13	11

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	9	7	6	5	5	4	4	3	3
Total (cfs)	9	7	6	5	5	4	4	3	3

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	3	3	2	2	0
Total (cfs)	3	3	2	2	0

Return Frequency: 100 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:05:02
Watershed file: --> C:\PONDPACK\SH2PRE .MOP
Hydrograph file: --> C:\PONDPACK\SH2PR100.HYD

Stonehouse
BMP#2
Pre-development Flows

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
1	37.00	67.0	0.75	0.00	8.10	4.20	I.12 .12

* Travel time from subarea outfall to composite watershed outfall point.
I -- Subarea where user specified interpolation between Ia/p tables.

Total area = 37.00 acres or 0.05781 sq.mi
Peak discharge = 101 cfs

>>>> Computer Modifications of Input Parameters <<<<<

Subarea Description	Input Values Tc (hr)	* Tt (hr)	Rounded Values Tc (hr)	* Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
1	0.83	0.00	0.75	0.00	Yes	--

* Travel time from subarea outfall to composite watershed outfall point.

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:05:02
Watershed file: --> C:\PONDPACK\SH2PRE .MOP
Hydrograph file: --> C:\PONDPACK\SH2PR100.HYD

Stonehouse
BMP#2
Pre-development Flows

>>>> Summary of Subarea Times to Peak <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
1	101	12.6
Composite Watershed	101	12.6

Return Frequency: 100 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:05:02
Watershed file: --> C:\PONDPACK\SH2PRE .MOP
Hydrograph file: --> C:\PONDPACK\SH2PR100.HYD

Stonehouse
BMP#2
Pre-development Flows

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	3	4	5	8	10	15	26	44	68
Total (cfs)	3	4	5	8	10	15	26	44	68

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	90	101	98	89	61	42	30	23	18
Total (cfs)	90	101	98	89	61	42	30	23	18

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	15	12	10	9	8	7	6	6	5
Total (cfs)	15	12	10	9	8	7	6	6	5

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	5	4	4	3	0
Total (cfs)	5	4	4	3	0

BMP #2
Post-development Hydrology Computations

Return Frequency: 2 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:48:49
Watershed file: --> C:\PONDPACK\SH2PST .MOP
Hydrograph file: --> C:\PONDPACK\SH2PS2.HYD

Stonehouse
BMP#2
Post-development

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
1	44.00	79.0	0.50	0.00	3.60	1.64	I.15 .15

* Travel time from subarea outfall to composite watershed outfall point.
I -- Subarea where user specified interpolation between Ia/p tables.

Total area = 44.00 acres or 0.06875 sq.mi
Peak discharge = 57 cfs

>>>> Computer Modifications of Input Parameters <<<<<

Subarea Description	Input Values Tc (hr)	* Tt (hr)	Rounded Values Tc (hr)	* Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
1	0.62	0.00	0.50	0.00	Yes	--

* Travel time from subarea outfall to composite watershed outfall point.

Return Frequency: 2 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:48:49
Watershed file: --> C:\PONDPACK\SH2PST .MOP
Hydrograph file: --> C:\PONDPACK\SH2PS2.HYD

Stonehouse
BMP#2
Post-development

>>>> Summary of Subarea Times to Peak <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
1	57	12.4
Composite Watershed	57	12.4

Return Frequency: 2 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:48:49
Watershed file: --> C:\PONDPACK\SH2PST .MOP
Hydrograph file: --> C:\PONDPACK\SH2PS2.HYD

Stonehouse
BMP#2
Post-development

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	1	2	3	5	8	16	30	48	57
Total (cfs)	1	2	3	5	8	16	30	48	57

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	55	45	34	26	16	11	9	7	6
Total (cfs)	55	45	34	26	16	11	9	7	6

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	6	5	4	4	4	3	3	3	3
Total (cfs)	6	5	4	4	4	3	3	3	3

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	2	2	2	2	0
Total (cfs)	2	2	2	2	0

Return Frequency: 10 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:48:49
Watershed file: --> C:\PONDPACK\SH2PST .MOP
Hydrograph file: --> C:\PONDPACK\SH2PS10.HYD

Stonehouse
BMP#2
Post-development

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
I	44.00	79.0	0.50	0.00	5.70	3.41	I.09 .10

* Travel time from subarea outfall to composite watershed outfall point.
I -- Subarea where user specified interpolation between Ia/p tables.

Total area = 44.00 acres or 0.06875 sq.mi
Peak discharge = 124 cfs

>>>> Computer Modifications of Input Parameters <<<<<

Subarea Description	Input Values Tc (hr)	* Tt (hr)	Rounded Values Tc (hr)	* Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
1	0.62	0.00	0.50	0.00	No	Computed Ia/p < .1

* Travel time from subarea outfall to composite watershed outfall point.

Return Frequency: 10 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:48:49
Watershed file: --> C:\PONDPACK\SH2PST .MOP
Hydrograph file: --> C:\PONDPACK\SH2PS10.HYD

Stonehouse
BMP#2
Post-development

>>>> Summary of Subarea Times to Peak <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
1	124	12.4
Composite Watershed	124	12.4

Return Frequency: 10 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:48:49
Watershed file: --> C:\PONDPACK\SH2PST .MOP
Hydrograph file: --> C:\PONDPACK\SH2PS10.HYD

Stonehouse
BMP#2
Post-development

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	4	5	8	13	22	40	72	109	124
Total (cfs)	4	5	8	13	22	40	72	109	124

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	119	94	70	53	33	23	17	14	12
Total (cfs)	119	94	70	53	33	23	17	14	12

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	11	10	8	8	7	6	5	5	5
Total (cfs)	11	10	8	8	7	6	5	5	5

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	4	4	3	3	0
Total (cfs)	4	4	3	3	0

Return Frequency: 100 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:48:49
Watershed file: --> C:\PONDPACK\SH2PST .MOP
Hydrograph file: --> C:\PONDPACK\SH2PS100.HYD

Stonehouse
BMP#2
Post-development

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
1	44.00	79.0	0.50	0.00	8.10	5.60	I.07 .10

* Travel time from subarea outfall to composite watershed outfall point.
I -- Subarea where user specified interpolation between Ia/p tables.

Total area = 44.00 acres or 0.06875 sq.mi
Peak discharge = 204 cfs

>>>> Computer Modifications of Input Parameters <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
1	0.62	0.00	0.50	0.00	No	Computed Ia/p < .1

* Travel time from subarea outfall to composite watershed outfall point.

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:48:49
Watershed file: --> C:\PONDPACK\SH2PST .MOP
Hydrograph file: --> C:\PONDPACK\SH2PS100.HYD

Stonehouse
BMP#2
Post-development

>>>> Summary of Subarea Times to Peak <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
1	204	12.4
Composite Watershed	204	12.4

Return Frequency: 100 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 11-14-1994 19:48:49
Watershed file: --> C:\PONDPACK\SH2PST .MOP
Hydrograph file: --> C:\PONDPACK\SH2PS100.HYD

Stonehouse
BMP#2
Post-development

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
1	7	9	12	22	36	65	119	180	204
Total (cfs)	7	9	12	22	36	65	119	180	204

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
1	195	155	114	87	54	37	28	23	20
Total (cfs)	195	155	114	87	54	37	28	23	20

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
1	18	16	14	12	11	10	9	8	8
Total (cfs)	18	16	14	12	11	10	9	8	8

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
1	7	6	5	5	0
Total (cfs)	7	6	5	5	0

BMP #2
Pre-development
Outlet Structure

Outlet Structure File: SHLAKE2 .STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

***** COMPOSITE OUTFLOW SUMMARY ****

Elevation (ft)	Q (cfs)	Contributing Structures
41.50	0.0	2
41.70	0.2	2
41.90	0.6	2
42.10	1.1	2
42.30	1.7	2
42.50	2.3	2 +4
42.70	11.9	2 +4
42.90	28.7	2 +4
43.10	50.3	2 +4
43.30	75.7	2 +4
43.50	104.5	2 +4
43.70	136.2	2 +4
43.90	170.7	2 +4
44.10	207.7	2 +4
44.30	247.0	2 +4
44.50	288.6	2 +4
44.70	332.3	2 +4
44.90	378.0	2 +4
45.00	401.5	2 +4

Outlet Structure File: SHLAKE2 .STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

Outlet Structure File: c:\pondpack\SHLAKE2 .STR
Planimeter Input File: c:\pondpack\SHLAKE2 .VOL
Rating Table Output File: c:\pondpack\SHLAKE2 .PND

Min. Elev.(ft) = 41.5 Max. Elev.(ft) = 45 Incr.(ft) = .2

Additional elevations (ft) to be included in table:
* *

****
SYSTEM CONNECTIVITY
****

Structure	No.	Q Table		Q Table
CULVERT-CR	2		->	2
WEIR-VR	4		->	4

Outflow rating table summary was stored in file:
c:\pondpack\SHLAKE2 .PND

Outlet Structure File: SHLAKE2 .STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

>>>>>> Structure No. 2 <<<<<<
(Input Data)

CULVERT-CR
Circular Culvert (With Inlet Control)

E1 elev.(ft)?	41.5
E2 elev.(ft)?	45.001
Diam. (ft)?	1
Inv. el.(ft)?	41.5
Slope (ft/ft)?	.05
T1 ratio?	
T2 ratio?	
K Coeff.?	.0098
M Coeff.?	2
c Coeff.?	.0398
Y Coeff.?	.67
Form 1 or 2?	1
Slope factor?	-.5

Outlet Structure File: SHLAKE2 .STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

>>>>>> Structure No. 4 <<<<<<
(Input Data)

WEIR-VR
Weir - Vertical Rectangular

E1 elev.(ft)? 42.5
E2 elev.(ft)? 45.001
Weir coefficient? 3.33
Weir elev.(ft)? 42.5
Length (ft)? 30
Contracted/Suppressed (C/S)? S

Outlet Structure File: SHLAKE2 .STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

Outflow Rating Table for Structure #2
CULVERT-CR Circular Culvert (With Inlet Control)

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages		
41.50	0.0	No headwater		
41.70	0.2	Equ.1: HW =.2	dc=.163	Ac=.083
41.90	0.6	Equ.1: HW =.4	dc=.313	Ac=.21
42.10	1.1	Equ.1: HW =.6	dc=.442	Ac=.335
42.30	1.7	Equ.1: HW =.8	dc=.557	Ac=.45
42.50	2.3	Equ.1: HW =1.0	dc=.654	Ac=.544
42.70	2.9	Transition: HW =1.2		
42.90	3.4	Submerged: HW =1.4		
43.10	3.9	Submerged: HW =1.6		
43.30	4.2	Submerged: HW =1.8		
43.50	4.6	Submerged: HW =2.0		
43.70	4.9	Submerged: HW =2.2		
43.90	5.2	Submerged: HW =2.4		
44.10	5.5	Submerged: HW =2.6		
44.30	5.8	Submerged: HW =2.8		
44.50	6.0	Submerged: HW =3.0		
44.70	6.3	Submerged: HW =3.2		
44.90	6.5	Submerged: HW =3.4		
45.00	6.7	Submerged: HW =3.5		

Used Unsubmerged Equ. Form (1) for elev. less than 42.63 ft
Used Submerged Equation for elevations greater than 42.78 ft
HW=Headwater (ft) dc=Critical depth (ft) Ac=Area (sq.ft) at dc

Transition flows interpolated from the following values:
E1=42.63 ft; Q1=2.75 cfs; Dc=.71 ft; E2=42.78 ft; Q2=3.14 cfs

Outlet Structure File: SHLAKE2 .STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

Outflow Rating Table for Structure #4
WEIR-VR Weir - Vertical Rectangular

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
41.50	0.0	E < Inv.El.= 42.5
41.70	0.0	E < Inv.El.= 42.5
41.90	0.0	E < Inv.El.= 42.5
42.10	0.0	E < Inv.El.= 42.5
42.30	0.0	E < Inv.El.= 42.5
42.50	0.0	H =0.0
42.70	8.9	H =.2
42.90	25.3	H =.4
43.10	46.4	H =.6
43.30	71.5	H =.8
43.50	99.9	H =1.0
43.70	131.3	H =1.2
43.90	165.5	H =1.4
44.10	202.2	H =1.6
44.30	241.3	H =1.8
44.50	282.6	H =2.0
44.70	326.0	H =2.2
44.90	371.4	H =2.4
45.00	394.9	H =2.5

C = 3.33 L (ft) = 30
H (ft) = Table elev. - Invert elev. (42.5 ft)
Q (cfs) = C * L * (H**1.5) -- Suppressed Weir

BMP #2
Pre-development Routings

Inflow Hydrograph: c:\pondpack\SH2PR2 .HYD
Rating Table file: c:\pondpack\SHLAKE2 .PND

----INITIAL CONDITIONS----
Elevation = 41.50 ft
Outflow = 0.00 cfs
Storage = 4.32 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
41.50	0.0	4.317	1044.7	1044.7
41.70	0.2	4.609	1115.3	1115.5
41.90	0.6	4.907	1187.6	1188.2
42.10	1.1	5.213	1261.5	1262.6
42.30	1.7	5.526	1337.2	1338.9
42.50	2.3	5.845	1414.6	1416.9
42.70	11.9	6.172	1493.6	1505.5
42.90	28.7	6.506	1574.5	1603.2
43.10	50.3	6.848	1657.1	1707.4
43.30	75.7	7.196	1741.5	1817.2
43.50	104.5	7.553	1827.7	1932.2
43.70	136.2	7.916	1915.7	2051.9
43.90	170.7	8.288	2005.6	2176.3
44.10	207.7	8.667	2097.4	2305.1
44.30	247.0	9.056	2191.6	2438.6
44.50	288.6	9.455	2288.2	2576.8
44.70	332.3	9.865	2387.3	2719.6
44.90	378.0	10.285	2489.0	2867.0
45.00	401.5	10.499	2540.7	2942.2

Time increment (t) = 0.100 hrs.

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: c:\pondpack\SHLAKE2 .PND
Inflow Hydrograph: c:\pondpack\SH2PR2 .HYD
Outflow Hydrograph:

Starting Pond W.S. Elevation = 41.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 19.00 cfs
Peak Outflow = 2.09 cfs
Peak Elevation = 42.43 ft

***** Summary of Approximate Peak Storage *****

Initial Storage = 4.32 ac-ft
Peak Storage From Storm = 1.42 ac-ft

Total Storage in Pond = 5.73 ac-ft

Inflow Hydrograph: c:\pondpack\SH2PR10 .HYD
Rating Table file: c:\pondpack\SHLAKE2 .PND

----INITIAL CONDITIONS----
Elevation = 41.50 ft
Outflow = 0.00 cfs
Storage = 4.32 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
41.50	0.0	4.317	1044.7	1044.7
41.70	0.2	4.609	1115.3	1115.5
41.90	0.6	4.907	1187.6	1188.2
42.10	1.1	5.213	1261.5	1262.6
42.30	1.7	5.526	1337.2	1338.9
42.50	2.3	5.845	1414.6	1416.9
42.70	11.9	6.172	1493.6	1505.5
42.90	28.7	6.506	1574.5	1603.2
43.10	50.3	6.848	1657.1	1707.4
43.30	75.7	7.196	1741.5	1817.2
43.50	104.5	7.553	1827.7	1932.2
43.70	136.2	7.916	1915.7	2051.9
43.90	170.7	8.288	2005.6	2176.3
44.10	207.7	8.667	2097.4	2305.1
44.30	247.0	9.056	2191.6	2438.6
44.50	288.6	9.455	2288.2	2576.8
44.70	332.3	9.865	2387.3	2719.6
44.90	378.0	10.285	2489.0	2867.0
45.00	401.5	10.499	2540.7	2942.2

Time increment (t) = 0.100 hrs.

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: c:\pondpack\SHLAKE2 .PND
Inflow Hydrograph: c:\pondpack\SH2PR10 .HYD
Outflow Hydrograph:

Starting Pond W.S. Elevation = 41.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 52.00 cfs
Peak Outflow = 31.58 cfs
Peak Elevation = 42.93 ft

***** Summary of Approximate Peak Storage *****

Initial Storage = 4.32 ac-ft
Peak Storage From Storm = 2.23 ac-ft

Total Storage in Pond = 6.55 ac-ft

Warning: Inflow hydrograph truncated on left side.

Inflow Hydrograph: c:\pondpack\SH2PR100.HYD
Rating Table file: c:\pondpack\SHLAKE2 .PND

----INITIAL CONDITIONS----
Elevation = 41.50 ft
Outflow = 0.00 cfs
Storage = 4.32 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
41.50	0.0	4.317	1044.7	1044.7
41.70	0.2	4.609	1115.3	1115.5
41.90	0.6	4.907	1187.6	1188.2
42.10	1.1	5.213	1261.5	1262.6
42.30	1.7	5.526	1337.2	1338.9
42.50	2.3	5.845	1414.6	1416.9
42.70	11.9	6.172	1493.6	1505.5
42.90	28.7	6.506	1574.5	1603.2
43.10	50.3	6.848	1657.1	1707.4
43.30	75.7	7.196	1741.5	1817.2
43.50	104.5	7.553	1827.7	1932.2
43.70	136.2	7.916	1915.7	2051.9
43.90	170.7	8.288	2005.6	2176.3
44.10	207.7	8.667	2097.4	2305.1
44.30	247.0	9.056	2191.6	2438.6
44.50	288.6	9.455	2288.2	2576.8
44.70	332.3	9.865	2387.3	2719.6
44.90	378.0	10.285	2489.0	2867.0
45.00	401.5	10.499	2540.7	2942.2

Time increment (t) = 0.100 hrs.

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: c:\pondpack\SHLAKE2 .PND
Inflow Hydrograph: c:\pondpack\SH2PR100.HYD
Outflow Hydrograph:

Starting Pond W.S. Elevation = 41.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	101.00 cfs
Peak Outflow	=	82.32 cfs
Peak Elevation	=	43.35 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	4.32 ac-ft
Peak Storage From Storm	=	2.96 ac-ft
Total Storage in Pond	=	7.28 ac-ft

Warning: Inflow hydrograph truncated on left side.

BMP #2
Post-development
Outlet Structure

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

***** COMPOSITE OUTFLOW SUMMARY ****

Elevation (ft)	Q (cfs)	Contributing Structures
41.50	0.0	5
41.70	0.7	5
41.90	1.0	5
42.10	1.3	5
42.30	1.5	5
42.50	1.6	5
42.70	1.8	5
42.90	1.9	5
43.10	2.1	5
43.30	2.2	5
43.50	2.3	5
43.70	2.4	5
43.90	2.5	5
44.10	3.3	1 +5
44.30	6.2	1 +5
44.50	10.2	1 +5
44.70	15.2	1 +5
44.90	17.4	1 +5
45.10	19.0	1 +4 +5
45.30	32.4	1 +4 +5
45.50	55.5	1 +4 +5
45.70	85.0	1 +4 +5
45.90	119.6	1 +4 +5
46.10	158.6	1 +4 +5
46.30	201.6	1 +4 +5
46.50	248.2	1 +4 +5
46.70	298.2	1 +4 +5
46.90	351.2	1 +4 +5
47.10	407.3	1 +4 +5
47.30	465.7	2 +4 +5
47.50	526.6	2 +4 +5
47.70	590.1	2 +4 +5
47.90	656.1	2 +4 +5
48.10	724.5	2 +4 +5
48.30	795.2	2 +4 +5
48.50	868.2	2 +4 +5
48.70	943.2	2 +4 +5
48.90	1020.4	2 +4 +5
49.10	1099.7	2 +4 +5
49.30	1180.9	2 +4 +5
49.50	1264.1	2 +4 +5
49.70	1349.2	2 +4 +5
49.90	1436.1	2 +4 +5
50.00	1480.3	2 +4 +5

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

Outlet Structure File: c:\pondpack\SHLAKE2R.STR
Planimeter Input File: c:\pondpack\SHLAKE2 .VOL
Rating Table Output File: c:\pondpack\SHLAKE2R.PND

Min. Elev.(ft) = 41.5 Max. Elev.(ft) = 50 Incr.(ft) = .2

Additional elevations (ft) to be included in table:
* *

****
SYSTEM CONNECTIVITY
****

Structure	No.		Q Table		Q Table
STAND PIPE	1			->	1
CULVERT-CR	2	?	1	->	3
WEIR-VR	4			->	4
ORIFICE	5			->	5

Outflow rating table summary was stored in file:
c:\pondpack\SHLAKE2R.PND

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

>>>>>> Structure No. 1 <<<<<<
(Input Data)

STAND PIPE
Stand Pipe with weir or orifice flow

E1 elev.(ft)?	44
E2 elev.(ft)?	50.001
Crest elev.(ft)?	44.0
Diameter (ft)?	2.0
Weir coefficient?	3.33
Orifice coefficient?	.6
Start transition elev.(ft) @ ?	
Transition height (ft)?	

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

>>>>>> Structure No. 2 <<<<<<
(Input Data)

CULVERT-CR
Circular Culvert (With Inlet Control)

E1 elev.(ft)?	44.5
E2 elev.(ft)?	50.001
Diam. (ft)?	1.5
Inv. el.(ft)?	37
Slope (ft/ft)?	.05
T1 ratio?	
T2 ratio?	
K Coeff.?	.0098
M Coeff.?	2
c Coeff.?	.0398
Y Coeff.?	.67
Form 1 or 2?	1
Slope factor?	-.5

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

>>>>>> Structure No. 4 <<<<<<
(Input Data)

WEIR-VR
Weir - Vertical Rectangular

E1 elev.(ft)?	45.1
E2 elev.(ft)?	50.001
Weir coefficient?	3.33
Weir elev.(ft)?	45.1
Length (ft)?	40
Contracted/Suppressed (C/S)?	S

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

>>>>>> Structure No. 5 <<<<<<
(Input Data)

ORIFICE
Orifice - Based on Area and Datum Elevation

E1 elev.(ft)?	41.5
E2 elev.(ft)?	50.001
Orifice coeff.?	.6
Invert elev.(ft)?	41.5
Datum elev.(ft) ?	41.5
Orifice area (sq ft)?	.34

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

Outflow Rating Table for Structure #1
STAND PIPE Stand Pipe with weir or orifice flow

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
41.50	0.0	E < Inv.El.= 44
41.70	0.0	E < E1= 44
41.90	0.0	E < E1= 44
42.10	0.0	E < E1= 44
42.30	0.0	E < E1= 44
42.50	0.0	E < E1= 44
42.70	0.0	E < E1= 44
42.90	0.0	E < E1= 44
43.10	0.0	E < E1= 44
43.30	0.0	E < E1= 44
43.50	0.0	E < E1= 44
43.70	0.0	E < E1= 44
43.90	0.0	E < E1= 44
44.10	0.7	Weir: H =.1
44.30	3.4	Weir: H =.3
44.50	7.4	Weir: H =.5
44.70	12.3	Weir: H =.7
44.90	14.4	Orifice: H =.9
45.10	15.9	Orifice: H =1.1
45.30	17.2	Orifice: H =1.3
45.50	18.5	Orifice: H =1.5
45.70	19.7	Orifice: H =1.7
45.90	20.9	Orifice: H =1.9
46.10	21.9	Orifice: H =2.1
46.30	22.9	Orifice: H =2.3
46.50	23.9	Orifice: H =2.5
46.70	24.9	Orifice: H =2.7
46.90	25.8	Orifice: H =2.9
47.10	26.6	Orifice: H =3.1
47.30	27.5	Orifice: H =3.3
47.50	28.3	Orifice: H =3.5
47.70	29.1	Orifice: H =3.7

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

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Outflow Rating Table for Structure #1
STAND PIPE Stand Pipe with weir or orifice flow

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation	Messages
47.90	29.9	Orifice:	H =3.9
48.10	30.6	Orifice:	H =4.1
48.30	31.4	Orifice:	H =4.3
48.50	32.1	Orifice:	H =4.5
48.70	32.8	Orifice:	H =4.7
48.90	33.5	Orifice:	H =4.9
49.10	34.2	Orifice:	H =5.1
49.30	34.8	Orifice:	H =5.3
49.50	35.5	Orifice:	H =5.5
49.70	36.1	Orifice:	H =5.7
49.90	36.7	Orifice:	H =5.9
50.00	37.1	Orifice:	H =6.0

Weir Cw = 3.33 Weir length = 6.283186 ft
Orifice Co = .6 Orifice area = 3.141593 sq.ft.
Q (cfs) = (Cw * L * H**1.5) or (Co * A * sqr(2*g*H))
No transition used, transition height = 0.0
Weir equation = Orifice equation @ elev.= 44.72297 ft

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

Outflow Rating Table for Structure #2
CULVERT-CR Circular Culvert (With Inlet Control)

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
41.50	0.0	E < E1=44.5
41.70	0.0	E < E1=44.5
41.90	0.0	E < E1=44.5
42.10	0.0	E < E1=44.5
42.30	0.0	E < E1=44.5
42.50	0.0	E < E1=44.5
42.70	0.0	E < E1=44.5
42.90	0.0	E < E1=44.5
43.10	0.0	E < E1=44.5
43.30	0.0	E < E1=44.5
43.50	0.0	E < E1=44.5
43.70	0.0	E < E1=44.5
43.90	0.0	E < E1=44.5
44.10	0.0	E < E1=44.5
44.30	0.0	E < E1=44.5
44.50	22.6	Submerged: HW =7.5
44.70	23.0	Submerged: HW =7.7
44.90	23.3	Submerged: HW =7.900
45.10	23.7	Submerged: HW =8.1
45.30	24.0	Submerged: HW =8.3
45.50	24.3	Submerged: HW =8.5
45.70	24.6	Submerged: HW =8.700
45.90	24.9	Submerged: HW =8.900
46.10	25.3	Submerged: HW =9.1
46.30	25.6	Submerged: HW =9.3
46.50	25.9	Submerged: HW =9.5
46.70	26.2	Submerged: HW =9.700
46.90	26.5	Submerged: HW =9.900
47.10	26.8	Submerged: HW =10.1
47.30	27.1	Submerged: HW =10.3
47.50	27.3	Submerged: HW =10.5

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

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Outflow Rating Table for Structure #2
CULVERT-CR Circular Culvert (With Inlet Control)

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
47.70	27.6	Submerged: HW =10.7
47.90	27.9	Submerged: HW =10.9
48.10	28.2	Submerged: HW =11.1
48.30	28.5	Submerged: HW =11.3
48.50	28.8	Submerged: HW =11.5
48.70	29.0	Submerged: HW =11.7
48.90	29.3	Submerged: HW =11.9
49.10	29.6	Submerged: HW =12.1
49.30	29.8	Submerged: HW =12.3
49.50	30.1	Submerged: HW =12.5
49.70	30.4	Submerged: HW =12.7
49.90	30.6	Submerged: HW =12.9
50.00	30.7	Submerged: HW =13.0

Used Unsubmerged Equ. Form (1) for elev. less than 38.7 ft
Used Submerged Equation for elevations greater than 38.92 ft
HW=Headwater (ft) dc=Critical depth (ft) Ac=Area (sq.ft) at dc

Transition flows interpolated from the following values:
E1=38.7 ft; Q1=7.58 cfs; Dc=1.07 ft; E2=38.92 ft; Q2=8.66 cfs

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

Outflow Rating Table for Structure #4
WEIR-VR Weir - Vertical Rectangular

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
41.50	0.0	E < Inv.El.= 45.1
41.70	0.0	E < Inv.El.= 45.1
41.90	0.0	E < Inv.El.= 45.1
42.10	0.0	E < Inv.El.= 45.1
42.30	0.0	E < Inv.El.= 45.1
42.50	0.0	E < Inv.El.= 45.1
42.70	0.0	E < Inv.El.= 45.1
42.90	0.0	E < Inv.El.= 45.1
43.10	0.0	E < Inv.El.= 45.1
43.30	0.0	E < Inv.El.= 45.1
43.50	0.0	E < Inv.El.= 45.1
43.70	0.0	E < Inv.El.= 45.1
43.90	0.0	E < Inv.El.= 45.1
44.10	0.0	E < Inv.El.= 45.1
44.30	0.0	E < Inv.El.= 45.1
44.50	0.0	E < Inv.El.= 45.1
44.70	0.0	E < Inv.El.= 45.1
44.90	0.0	E < Inv.El.= 45.1
45.10	0.0	H =0.0
45.30	11.9	H =.2
45.50	33.7	H =.4
45.70	61.9	H =.6
45.90	95.3	H =.8
46.10	133.2	H =1.0
46.30	175.1	H =1.2
46.50	220.6	H =1.4
46.70	269.6	H =1.6
46.90	321.7	H =1.8
47.10	376.7	H =2.0
47.30	434.6	H =2.2
47.50	495.2	H =2.4
47.70	558.4	H =2.6
47.90	624.1	H =2.8
48.10	692.1	H =3.0

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

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Outflow Rating Table for Structure #4
WEIR-VR Weir - Vertical Rectangular

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
48.30	762.5	H =3.2
48.50	835.1	H =3.4
48.70	909.8	H =3.6
48.90	986.7	H =3.8
49.10	1065.6	H =4.0
49.30	1146.5	H =4.2
49.50	1229.4	H =4.4
49.70	1314.1	H =4.6
49.90	1400.8	H =4.8
50.00	1444.8	H =4.9

C = 3.33 L (ft) = 40
H (ft) = Table elev. - Invert elev. (45.1 ft)
Q (cfs) = C * L * (H**1.5) -- Suppressed Weir

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

Outflow Rating Table for Structure #5
ORIFICE Orifice - Based on Area and Datum Elevation

Elevation (ft)	Q (cfs)	Computation Messages
41.50	0.0	H =0.0
41.70	0.7	H =.2
41.90	1.0	H =.4
42.10	1.3	H =.6
42.30	1.5	H =.8
42.50	1.6	H =1.0
42.70	1.8	H =1.2
42.90	1.9	H =1.4
43.10	2.1	H =1.6
43.30	2.2	H =1.8
43.50	2.3	H =2.0
43.70	2.4	H =2.2
43.90	2.5	H =2.4
44.10	2.6	H =2.6
44.30	2.7	H =2.8
44.50	2.8	H =3.0
44.70	2.9	H =3.2
44.90	3.0	H =3.4
45.10	3.1	H =3.6
45.30	3.2	H =3.8
45.50	3.3	H =4.0
45.70	3.4	H =4.2
45.90	3.4	H =4.4
46.10	3.5	H =4.6
46.30	3.6	H =4.8
46.50	3.7	H =5.0
46.70	3.7	H =5.2
46.90	3.8	H =5.4
47.10	3.9	H =5.6
47.30	3.9	H =5.8
47.50	4.0	H =6.0
47.70	4.1	H =6.2
47.90	4.1	H =6.4
48.10	4.2	H =6.6

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

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Outflow Rating Table for Structure #5
ORIFICE Orifice - Based on Area and Datum Elevation

Elevation (ft)	Q (cfs)	Computation Messages
48.30	4.3	H =6.8
48.50	4.3	H =7.0
48.70	4.4	H =7.2
48.90	4.5	H =7.400
49.10	4.5	H =7.6
49.30	4.6	H =7.8
49.50	4.6	H =8.0
49.70	4.7	H =8.200
49.90	4.7	H =8.400
50.00	4.8	H =8.5

C = .6 A = .34 sq.ft.
H (ft) = Table elev. - Datum elev. (41.5 ft)
Q (cfs) = C * A * sqr(2g * H)

Outlet Structure File: SHLAKE2R.STR

POND-2 Version: 5.15 S/N: 1295100016
Date Executed: Time Executed:

Outflow Rating Table 3
Table 3 = 1 ? 2

Elevation (ft)	Q (cfs)	Contributing Structures
41.50	0.0	-
41.70	0.0	-
41.90	0.0	-
42.10	0.0	-
42.30	0.0	-
42.50	0.0	-
42.70	0.0	-
42.90	0.0	-
43.10	0.0	-
43.30	0.0	-
43.50	0.0	-
43.70	0.0	-
43.90	0.0	-
44.10	0.7	1
44.30	3.4	1
44.50	7.4	1
44.70	12.3	1
44.90	14.4	1
45.10	15.9	1
45.30	17.2	1
45.50	18.5	1
45.70	19.7	1
45.90	20.9	1
46.10	21.9	1
46.30	22.9	1
46.50	23.9	1
46.70	24.9	1
46.90	25.8	1
47.10	26.6	1
47.30	27.1	2
47.50	27.3	2
47.70	27.6	2
47.90	27.9	2
48.10	28.2	2
48.30	28.5	2
48.50	28.8	2
48.70	29.0	2
48.90	29.3	2
49.10	29.6	2
49.30	29.8	2
49.50	30.1	2
49.70	30.4	2
49.90	30.6	2
50.00	30.7	2

BMP #2
Post-development Routings

Inflow Hydrograph: c:\pondpack\SH2PS2 .HYD
Rating Table file: c:\pondpack\SHLAKE2R.PND

----INITIAL CONDITIONS----
Elevation = 41.50 ft
Outflow = 0.00 cfs
Storage = 4.32 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
41.50	0.0	4.317	1044.7	1044.7
41.70	0.7	4.609	1115.3	1116.0
41.90	1.0	4.907	1187.6	1188.6
42.10	1.3	5.213	1261.5	1262.8
42.30	1.5	5.526	1337.2	1338.7
42.50	1.6	5.845	1414.6	1416.2
42.70	1.8	6.172	1493.6	1495.4
42.90	1.9	6.506	1574.5	1576.4
43.10	2.1	6.848	1657.1	1659.2
43.30	2.2	7.196	1741.5	1743.7
43.50	2.3	7.553	1827.7	1830.0
43.70	2.4	7.916	1915.7	1918.1
43.90	2.5	8.288	2005.6	2008.1
44.10	3.3	8.667	2097.4	2100.7
44.30	6.2	9.056	2191.6	2197.8
44.50	10.2	9.455	2288.2	2298.4
44.70	15.2	9.865	2387.3	2402.5
44.90	17.4	10.285	2489.0	2506.4
45.10	19.0	10.716	2593.2	2612.2
45.30	32.4	11.157	2699.9	2732.3
45.50	55.5	11.609	2809.3	2864.8
45.70	85.0	12.072	2921.3	3006.3
45.90	119.6	12.546	3036.0	3155.6
46.10	158.6	13.029	3153.1	3311.7
46.30	201.6	13.515	3270.5	3472.1
46.50	248.2	14.000	3387.9	3636.1
46.70	298.2	14.485	3505.3	3803.5
46.90	351.2	14.970	3622.8	3974.0
47.10	407.3	15.455	3740.2	4147.5
47.30	465.7	15.940	3857.6	4323.3
47.50	526.6	16.426	3975.0	4501.6

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
47.70	590.1	16.911	4092.4	4682.5
47.90	656.1	17.396	4209.8	4865.9
48.10	724.5	17.881	4327.2	5051.7
48.30	795.2	18.366	4444.6	5239.8
48.50	868.2	18.851	4562.1	5430.3
48.70	943.2	19.337	4679.5	5622.7
48.90	1020.4	19.822	4796.9	5817.3
49.10	1099.7	20.307	4914.3	6014.0
49.30	1180.9	20.792	5031.7	6212.6
49.50	1264.1	21.277	5149.1	6413.2
49.70	1349.2	21.763	5266.5	6615.7
49.90	1436.1	22.248	5383.9	6820.0
50.00	1480.3	22.490	5442.6	6922.9

Time increment (t) = 0.100 hrs.

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: c:\pondpack\SHLAKE2R.PND
Inflow Hydrograph: c:\pondpack\SH2PS2 .HYD
Outflow Hydrograph:

Starting Pond W.S. Elevation = 41.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	57.00 cfs
Peak Outflow	=	2.47 cfs
Peak Elevation	=	43.84 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	4.32 ac-ft
Peak Storage From Storm	=	3.85 ac-ft
Total Storage in Pond	=	8.17 ac-ft

Warning: Inflow hydrograph truncated on left side.

Inflow Hydrograph: c:\pondpack\SH2PS10 .HYD
Rating Table file: c:\pondpack\SHLAKE2R.PND

----INITIAL CONDITIONS----
Elevation = 41.50 ft
Outflow = 0.00 cfs
Storage = 4.32 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
41.50	0.0	4.317	1044.7	1044.7
41.70	0.7	4.609	1115.3	1116.0
41.90	1.0	4.907	1187.6	1188.6
42.10	1.3	5.213	1261.5	1262.8
42.30	1.5	5.526	1337.2	1338.7
42.50	1.6	5.845	1414.6	1416.2
42.70	1.8	6.172	1493.6	1495.4
42.90	1.9	6.506	1574.5	1576.4
43.10	2.1	6.848	1657.1	1659.2
43.30	2.2	7.196	1741.5	1743.7
43.50	2.3	7.553	1827.7	1830.0
43.70	2.4	7.916	1915.7	1918.1
43.90	2.5	8.288	2005.6	2008.1
44.10	3.3	8.667	2097.4	2100.7
44.30	6.2	9.056	2191.6	2197.8
44.50	10.2	9.455	2288.2	2298.4
44.70	15.2	9.865	2387.3	2402.5
44.90	17.4	10.285	2489.0	2506.4
45.10	19.0	10.716	2593.2	2612.2
45.30	32.4	11.157	2699.9	2732.3
45.50	55.5	11.609	2809.3	2864.8
45.70	85.0	12.072	2921.3	3006.3
45.90	119.6	12.546	3036.0	3155.6
46.10	158.6	13.029	3153.1	3311.7
46.30	201.6	13.515	3270.5	3472.1
46.50	248.2	14.000	3387.9	3636.1
46.70	298.2	14.485	3505.3	3803.5
46.90	351.2	14.970	3622.8	3974.0
47.10	407.3	15.455	3740.2	4147.5
47.30	465.7	15.940	3857.6	4323.3
47.50	526.6	16.426	3975.0	4501.6

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + 0 (cfs)
47.70	590.1	16.911	4092.4	4682.5
47.90	656.1	17.396	4209.8	4865.9
48.10	724.5	17.881	4327.2	5051.7
48.30	795.2	18.366	4444.6	5239.8
48.50	868.2	18.851	4562.1	5430.3
48.70	943.2	19.337	4679.5	5622.7
48.90	1020.4	19.822	4796.9	5817.3
49.10	1099.7	20.307	4914.3	6014.0
49.30	1180.9	20.792	5031.7	6212.6
49.50	1264.1	21.277	5149.1	6413.2
49.70	1349.2	21.763	5266.5	6615.7
49.90	1436.1	22.248	5383.9	6820.0
50.00	1480.3	22.490	5442.6	6922.9

Time increment (t) = 0.100 hrs.

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: c:\pondpack\SHLAKE2R.PND
Inflow Hydrograph: c:\pondpack\SH2PS10 .HYD
Outflow Hydrograph:

Starting Pond W.S. Elevation = 41.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 124.00 cfs
Peak Outflow = 19.21 cfs
Peak Elevation = 45.10 ft

***** Summary of Approximate Peak Storage *****

Initial Storage = 4.32 ac-ft
Peak Storage From Storm = 6.41 ac-ft

Total Storage in Pond = 10.72 ac-ft

Warning: Inflow hydrograph truncated on left side.

Inflow Hydrograph: c:\pondpack\SH2PS100.HYD
Rating Table file: c:\pondpack\SHLAKE2R.PND

----INITIAL CONDITIONS----
Elevation = 41.50 ft
Outflow = 0.00 cfs
Storage = 4.32 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
41.50	0.0	4.317	1044.7	1044.7
41.70	0.7	4.609	1115.3	1116.0
41.90	1.0	4.907	1187.6	1188.6
42.10	1.3	5.213	1261.5	1262.8
42.30	1.5	5.526	1337.2	1338.7
42.50	1.6	5.845	1414.6	1416.2
42.70	1.8	6.172	1493.6	1495.4
42.90	1.9	6.506	1574.5	1576.4
43.10	2.1	6.848	1657.1	1659.2
43.30	2.2	7.196	1741.5	1743.7
43.50	2.3	7.553	1827.7	1830.0
43.70	2.4	7.916	1915.7	1918.1
43.90	2.5	8.288	2005.6	2008.1
44.10	3.3	8.667	2097.4	2100.7
44.30	6.2	9.056	2191.6	2197.8
44.50	10.2	9.455	2288.2	2298.4
44.70	15.2	9.865	2387.3	2402.5
44.90	17.4	10.285	2489.0	2506.4
45.10	19.0	10.716	2593.2	2612.2
45.30	32.4	11.157	2699.9	2732.3
45.50	55.5	11.609	2809.3	2864.8
45.70	85.0	12.072	2921.3	3006.3
45.90	119.6	12.546	3036.0	3155.6
46.10	158.6	13.029	3153.1	3311.7
46.30	201.6	13.515	3270.5	3472.1
46.50	248.2	14.000	3387.9	3636.1
46.70	298.2	14.485	3505.3	3803.5
46.90	351.2	14.970	3622.8	3974.0
47.10	407.3	15.455	3740.2	4147.5
47.30	465.7	15.940	3857.6	4323.3
47.50	526.6	16.426	3975.0	4501.6

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
47.70	590.1	16.911	4092.4	4682.5
47.90	656.1	17.396	4209.8	4865.9
48.10	724.5	17.881	4327.2	5051.7
48.30	795.2	18.366	4444.6	5239.8
48.50	868.2	18.851	4562.1	5430.3
48.70	943.2	19.337	4679.5	5622.7
48.90	1020.4	19.822	4796.9	5817.3
49.10	1099.7	20.307	4914.3	6014.0
49.30	1180.9	20.792	5031.7	6212.6
49.50	1264.1	21.277	5149.1	6413.2
49.70	1349.2	21.763	5266.5	6615.7
49.90	1436.1	22.248	5383.9	6820.0
50.00	1480.3	22.490	5442.6	6922.9

Time increment (t) = 0.100 hrs.

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: c:\pondpack\SHLAKE2R.PND
Inflow Hydrograph: c:\pondpack\SH2PS100.HYD
Outflow Hydrograph:

Starting Pond W.S. Elevation = 41.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 204.00 cfs
Peak Outflow = 100.01 cfs
Peak Elevation = 45.79 ft

***** Summary of Approximate Peak Storage *****

Initial Storage = 4.32 ac-ft
Peak Storage From Storm = 7.96 ac-ft

Total Storage in Pond = 12.28 ac-ft

Warning: Inflow hydrograph truncated on left side.

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration      = 24.0000 hrs     Rain Depth = 3.5000 in
Rain Dir      = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\HAESTAD\PPKW\SAMPLE\
HYG File - ID =  - SCS UH  10 ..2
Tc            = .5300 hrs
Drainage Area = 70.000 acres  Runoff CN= 91

============================================
Computational Time Increment   =   .07067 hrs
Computed Peak Time             =  12.2253 hrs
Computed Peak Flow             =   142.98 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.2000 hrs
Peak Flow, Interpolated Output =   142.96 cfs
============================================

                DRAINAGE AREA
              -------------------
              ID:None Selected
              CN   =   91
              Area =      70.000 acres
              S    =    .9890 in
              0.2S =    .1978 in

               Cumulative Runoff
              -------------------
                      2.5411 in
                      14.823 ac-ft

HYG Volume...         14.823 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc =   .53000 hrs (ID: None Selected)
Computational Incr, Tm =   .07067 hrs = 0.20000 Tp

Unit Hyd. Shape Factor =  483.432 (37.46% under rising limb)
K =  483.43/645.333,  K =    .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp =   1.6698 (solved from K =   .7491)

Unit peak,          qp =   149.65 cfs
Unit peak time      Tp =   .35333 hrs
Unit receding limb, Tr =  1.41333 hrs
Total unit time,    Tb =  1.76667 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 year storm
Duration      = 24.0000 hrs     Rain Depth = 5.8000 in
Rain Dir      = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\HAESTAD\PPKW\SAMPLE\
HYG File - ID =  - SCS UH  10 .10
Tc            = .5300 hrs
Drainage Area = 70.000 acres  Runoff CN= 91

============================================
Computational Time Increment   =   .07067 hrs
Computed Peak Time             =  12.1547 hrs
Computed Peak Flow             =   261.97 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.2000 hrs
Peak Flow, Interpolated Output =   260.91 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:None Selected
              CN   =   91
              Area =      70.000 acres
              S    =    .9890 in
              0.2S =    .1978 in

               Cumulative Runoff
              -------------------
                      4.7616 in
                      27.776 ac-ft

HYG Volume...         27.775 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc =   .53000 hrs (ID: None Selected)
Computational Incr, Tm =   .07067 hrs = 0.20000 Tp

Unit Hyd. Shape Factor =  483.432 (37.46% under rising limb)
K =  483.43/645.333,  K =    .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp =   1.6698 (solved from K =   .7491)

Unit peak,          qp =   149.65 cfs
Unit peak time      Tp =   .35333 hrs
Unit receding limb, Tr =  1.41333 hrs
Total unit time,    Tb =  1.76667 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration      = 24.0000 hrs     Rain Depth = 8.1000 in
Rain Dir      = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\HAESTAD\PPKW\SAMPLE\
HYG File - ID =  - SCS UH  10 100-YR
Tc            = .5300 hrs
Drainage Area = 70.000 acres  Runoff CN= 91

============================================
Computational Time Increment   =   .07067 hrs
Computed Peak Time             =  12.1547 hrs
Computed Peak Flow             =   379.56 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.2000 hrs
Peak Flow, Interpolated Output =   377.37 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:None Selected
              CN   =   91
              Area =      70.000 acres
              S    =    .9890 in
              0.2S =    .1978 in

               Cumulative Runoff
              -------------------
                      7.0232 in
                      40.969 ac-ft

HYG Volume...         40.968 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc =   .53000 hrs (ID: None Selected)
Computational Incr, Tm =   .07067 hrs = 0.20000 Tp

Unit Hyd. Shape Factor =  483.432 (37.46% under rising limb)
K =  483.43/645.333,  K =    .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp =   1.6698 (solved from K =   .7491)

Unit peak,          qp =   149.65 cfs
Unit peak time      Tp =   .35333 hrs
Unit receding limb, Tr =  1.41333 hrs
Total unit time,    Tb =  1.76667 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration      = 24.0000 hrs     Rain Depth = 3.5000 in
Rain Dir      = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\HAESTAD\PPKW\SAMPLE\
HYG File - ID =  - SCS UH  20 ..2
Tc            = .5000 hrs
Drainage Area = 256.000 acres  Runoff CN= 74

============================================
Computational Time Increment   =   .06667 hrs
Computed Peak Time             =  12.2000 hrs
Computed Peak Flow             =   258.92 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.2000 hrs
Peak Flow, Interpolated Output =   258.92 cfs
============================================

                 DRAINAGE AREA
               -------------------
               ID:None Selected
               CN   =   74
               Area =     256.000 acres
               S    =   3.5135 in
               0.2S =    .7027 in

                Cumulative Runoff
               -------------------
                       1.2399 in
                       26.452 ac-ft

HYG Volume...          26.452 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc =   .50000 hrs (ID: None Selected)
Computational Incr, Tm =   .06667 hrs = 0.20000 Tp

Unit Hyd. Shape Factor =  483.432 (37.46% under rising limb)
K =  483.43/645.333,  K =    .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp =   1.6698 (solved from K =   .7491)

Unit peak,          qp =   580.12 cfs
Unit peak time      Tp =   .33333 hrs
Unit receding limb, Tr =  1.33333 hrs
Total unit time,    Tb =  1.66667 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 year storm
Duration      = 24.0000 hrs     Rain Depth = 5.8000 in
Rain Dir      = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\HAESTAD\PPKW\SAMPLE\
HYG File - ID =  - SCS UH  20 .10
Tc            = .5000 hrs
Drainage Area = 256.000 acres  Runoff CN= 74

============================================
Computational Time Increment   =   .06667 hrs
Computed Peak Time             =  12.2000 hrs
Computed Peak Flow             =   658.26 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.2000 hrs
Peak Flow, Interpolated Output =   658.24 cfs
============================================

                 DRAINAGE AREA
               -------------------
               ID:None Selected
               CN   =   74
               Area =     256.000 acres
               S    =   3.5135 in
               0.2S =    .7027 in

                Cumulative Runoff
               -------------------
                       3.0174 in
                       64.372 ac-ft

HYG Volume...          64.372 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc =   .50000 hrs (ID: None Selected)
Computational Incr, Tm =   .06667 hrs = 0.20000 Tp

Unit Hyd. Shape Factor =  483.432 (37.46% under rising limb)
K =  483.43/645.333,  K =    .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp =   1.6698 (solved from K =   .7491)

Unit peak,          qp =   580.12 cfs
Unit peak time      Tp =   .33333 hrs
Unit receding limb, Tr =  1.33333 hrs
Total unit time,    Tb =  1.66667 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration      = 24.0000 hrs     Rain Depth = 8.1000 in
Rain Dir      = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\HAESTAD\PPKW\SAMPLE\
HYG File - ID =  - SCS UH  20 100-YR
Tc            = .5000 hrs
Drainage Area = 256.000 acres  Runoff CN= 74

============================================
Computational Time Increment   =   .06667 hrs
Computed Peak Time             =  12.2000 hrs
Computed Peak Flow             =  1094.34 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.2000 hrs
Peak Flow, Interpolated Output =  1094.31 cfs
============================================

                 DRAINAGE AREA
               -------------------
               ID:None Selected
               CN   =   74
               Area =     256.000 acres
               S    =   3.5135 in
               0.2S =    .7027 in

                Cumulative Runoff
               -------------------
                       5.0152 in
                      106.991 ac-ft

HYG Volume...        106.991 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc =   .50000 hrs (ID: None Selected)
Computational Incr, Tm =   .06667 hrs = 0.20000 Tp

Unit Hyd. Shape Factor =  483.432 (37.46% under rising limb)
K =  483.43/645.333,  K =    .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp =   1.6698 (solved from K =   .7491)

Unit peak,          qp =   580.12 cfs
Unit peak time      Tp =   .33333 hrs
Unit receding limb, Tr =  1.33333 hrs
Total unit time,    Tb =  1.66667 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration      = 24.0000 hrs     Rain Depth = 3.5000 in
Rain Dir      = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\HAESTAD\PPKW\SAMPLE\
HYG File - ID =  - SCS UH  30 ..2
Tc            = .2500 hrs
Drainage Area = 38.000 acres  Runoff CN= 80

============================================
Computational Time Increment   =   .03333 hrs
Computed Peak Time             =  12.0333 hrs
Computed Peak Flow             =    75.37 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.0500 hrs
Peak Flow, Interpolated Output =    75.22 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:None Selected
              CN   =   80
              Area =      38.000 acres
              S    =   2.5000 in
              0.2S =    .5000 in

               Cumulative Runoff
              -------------------
                      1.6364 in
                       5.182 ac-ft

HYG Volume...          5.182 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc =   .25000 hrs (ID: None Selected)
Computational Incr, Tm =   .03333 hrs = 0.20000 Tp

Unit Hyd. Shape Factor =  483.432 (37.46% under rising limb)
K =  483.43/645.333,  K =    .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp =   1.6698 (solved from K =   .7491)

Unit peak,          qp =   172.22 cfs
Unit peak time      Tp =   .16667 hrs
Unit receding limb, Tr =   .66667 hrs
Total unit time,    Tb =   .83333 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 year storm
Duration      = 24.0000 hrs     Rain Depth = 5.8000 in
Rain Dir      = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\HAESTAD\PPKW\SAMPLE\
HYG File - ID =  - SCS UH  30 .10
Tc            = .2500 hrs
Drainage Area = 38.000 acres  Runoff CN= 80

============================================
Computational Time Increment   =   .03333 hrs
Computed Peak Time             =  12.0333 hrs
Computed Peak Flow             =   165.96 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.0500 hrs
Peak Flow, Interpolated Output =   164.50 cfs
============================================

                DRAINAGE AREA
              -------------------
              ID:None Selected
              CN   =   80
              Area =      38.000 acres
              S    =   2.5000 in
              0.2S =    .5000 in

               Cumulative Runoff
              -------------------
                      3.6013 in
                      11.404 ac-ft

HYG Volume...         11.404 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc =   .25000 hrs (ID: None Selected)
Computational Incr, Tm =   .03333 hrs = 0.20000 Tp

Unit Hyd. Shape Factor =  483.432 (37.46% under rising limb)
K =  483.43/645.333,  K =    .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp =   1.6698 (solved from K =   .7491)

Unit peak,          qp =   172.22 cfs
Unit peak time      Tp =   .16667 hrs
Unit receding limb, Tr =   .66667 hrs
Total unit time,    Tb =   .83333 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration      = 24.0000 hrs     Rain Depth = 8.1000 in
Rain Dir      = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\HAESTAD\PPKW\SAMPLE\
HYG File - ID =  - SCS UH  30 100-YR
Tc            = .2500 hrs
Drainage Area = 38.000 acres  Runoff CN= 80

============================================
Computational Time Increment   =   .03333 hrs
Computed Peak Time             =  12.0333 hrs
Computed Peak Flow             =   259.82 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.0500 hrs
Peak Flow, Interpolated Output =   256.79 cfs
============================================

                 DRAINAGE AREA
               -------------------
               ID:None Selected
               CN   =   80
               Area =      38.000 acres
               S    =   2.5000 in
               0.2S =    .5000 in

                Cumulative Runoff
               -------------------
                       5.7188 in
                       18.110 ac-ft

HYG Volume...          18.110 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc =   .25000 hrs (ID: None Selected)
Computational Incr, Tm =   .03333 hrs = 0.20000 Tp

Unit Hyd. Shape Factor =  483.432 (37.46% under rising limb)
K =  483.43/645.333,  K =    .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp =   1.6698 (solved from K =   .7491)

Unit peak,          qp =   172.22 cfs
Unit peak time      Tp =   .16667 hrs
Unit receding limb, Tr =   .66667 hrs
Total unit time,    Tb =   .83333 hrs
```

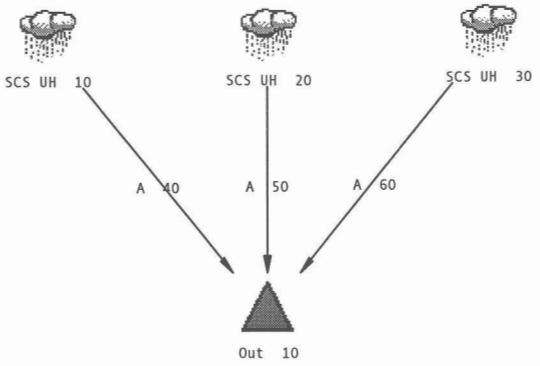
Legends @ Stonehouse
BMP #1 Repair

Tailwater Computations

The TR-55 method was used to compute runoff to the existing channel. Runoff was found for design storms of 2, 10 and 100-year events. (See attached sheet for areas and curve numbers). The tailwater computations were calculated based on a Manning's evaluation for each design storm. They are as follows:

Design Storm	*Calculated Channel Depth*	*Tailwater Elevation*
2-year	0.8 ft.	36.8 ft.
10-year	1.3 ft.	37.3 ft.
100-year	1.7 ft.	37.7 ft.

Using the calculated tailwater conditions it was determined that tailwater has no influence on both outlet discharges and design water surface elevations.


SCS UH 10
SCS UH 20
SCS UH 30
A 40
A 50
A 60
Out 10

WC033

BMP #1 DAM EVALUATION
THE LEGENDS AT STONEHOUSE
JAMES CITY COUNTY, VIRGINIA

Prepared for:
Mr. Eric Allen, P.E.
The Williamsburg Environmental Group
3000 Easter Circle
Williamsburg, Virginia 23188

March 14, 2000

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

March 14, 2000

Mr. Erik Allen, P.E.
The Williamsburg Environmental Group
3000 Easter Circle
Williamsburg, Virginia 23188

Reference: BMP # 1 Dam Evaluation
The Legends at Stonehouse
James City County, Virginia

ECS Project No. 5877

Dear Mr. Allen:

Submitted herein are the results of our evaluation made of the existing dam at the above referenced project site. The purpose of this evaluation was to visually inspect the dam and provide recommendations to guide the design and construction of dam upgrades and repairs. It is our understanding that the dam was breached during a severe storm event in 1999.

The BMP #1 dam site is located within the southwest corner of the Legends at Stonehouse golf course. The impoundment was created by the damming of a ravine extending westward from Bird Swamp. The impoundment appears to be fed by an intermittent creek. The impoundment drains into Bird Swamp, a tributary of Ware Creek and the York River.

It is not known when the dam was constructed, although based on tree growth, it appears to be 15 or 20 years old. The dam is approximately 18 feet high and has a crest width of approximately 25 feet. The dam appears to have been constructed of Sandy soils taken from adjacent slopes. An original spillway pipe was located on the southwest shoulder of the dam. This portion of the dam was breached creating an approximately 80 foot wide by 9 foot deep gully through the embankment. The dam is leaking on its northeast shoulder from a point about 2 feet in elevation above its toe. The downstream face of the northeastern third of the dam is excessively sloped at almost 1:1.

We understand that enhancement of the existing dam will include raising the crest elevation by up to about 2 feet. The crest width will be increased by about 5 feet. The dam will be regraded for a 2:1 downstream face slope in the northeastern third of the embankment and at least a 2:1 upstream face slope. A new emergency spillway will be constructed on the northeast dam shoulder. The emergency spillway will consist of a graded, grassed sluice which is paved where

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crossed by a golf cart path. A new principal spillway consisting of CMP will be added to the embankment. The dam is not subject to the Virginia Dam Safety program.

Based on our visual observations of the existing dam, we recommend that the following steps be taken to achieve dam embankment repairs and stabilization:

- The seepage occurring at the northeast shoulder should be chanelized prior to fill placement. This can be accomplished by excavating into the existing embankment a 12 by 12 inch ditch, lining that ditch with non-woven filter fabric, filling with No. 57 Stone, then folding the fabric over the top of the stone bed. The total length of this drain will be about 25 feet, extending from below grade at a point just beyond the location of the new toe to a point just above the seepage discharge point. This drain will essentially be aligned in the crease formed by the shoulder of the dam and the natural ground.

- In order to drain the pond to a sufficient level to begin construction, we recommend a temporary stilling basin be provided beyond the new location of the dam's toe and that the pond then be pumped down by mechanical means. Temporary diversion dikes should be constructed to eliminate water flows through the existing breach and new principal spillway excavation.

- As discharge points for the dam spillways will be in a highly sedimented flood plain, we do recommend stilling basins be provided.

- Preparation of the embankment for fill placement should include cutting of all trees within the fill area and from the embankment and removal of stumps. Stripping should include removal of all topsoil and brush vegetation from areas of new fill placement. The topsoil can be stockpiled for use in re-vegetation of the completed embankment.

- All existing dam surfaces, horizontal or otherwise, on or against which fill is to be placed should be scarified to a depth of at least 4 inches prior to fill placement. New fill should not be placed on or against sloughed or otherwise unstable slopes or surfaces. Fill should be placed in horizontal lifts against slopes no steeper than 1 vertical to 4 horizontal. Where greater slopes exist, and they do on the shoulders of the breech and dam face, they should be benched to receive fill. Bench heights should be limited to 3 feet with a horizontal terrace of at least 5 feet. Figures 1 and 2 illustrate the benching procedure. New fill slopes should be limited to 2:1.

- Fill should be placed and compacted in maximum 10-inch **horizontal** lifts, measured loose. To provide for horizontal compaction, the upstream face of the dam will require "notching" by excavating soil just above the original water level to provide for a bench on which to compact subsequent lifts. On the up and downstream faces of the dam, it will be necessary to extend the stripping and fill placement zone outward from the toe at least the width of the

compaction equipment so that the entire design portion of the fill is properly compacted. This will also help stabilize the toe by extending a wedge of compacted soil out into soft swamp or pond sediments. These sediments should be undercut and replaced with Embankment Fill or gravel wrapped in fabric. At an elevation where the design width of the new fill equals the horizontal compaction surface width, this excess fill placement effort would not be required, and any fill placed and compacted beyond the design zone of the new fill can be removed and reused elsewhere (see Figure 1).

- All fill should be placed in maximum 10 inch loose, horizontal lifts and mechanically compacted to a dry density of at least 95% of that soil's Standard Proctor maximum dry density (ASTM D698). In order to properly achieve compaction of this soil, the soil should be brought to within +/- 4% of optimum prior to compacting. At least a 5-ton sheepsfoot roller should be employed to attain compaction of cohesive materials. Hand operated equipment should be employed around and immediately above pipes and foundations.

- In order to minimize seepage and erosion, we recommend that fill used to repair the breach and backfill the new principal spillway excavation consist of a cohesive soil (Clay or Clayey Silt). In addition, we recommend that the emergency spillway be overexcavated at least 18 inches below line and grade and be backfilled with cohesive soil. Otherwise, fill to extend the embankment slopes can consist of a Sandy soil as recommended herein. The following fill types are recommended for use on this project:

  Breach and Spillway Fill (breach, emergency spillway liner, and embankment trenches): Soil Material classified as CL or ML which contains at least 60% by weight Clay, has a compacted permeability of 10^{-4} cm/sec or less, and is free of organic and rock larger than 4 inches in diameter. Fill should have a maximum Liquid Limit of 50 and maximum plasticity index of 30.

  Embankment Fill (up and downstream embankment face): Soil Material classified as SM, SC, CL, or ML which contains at least 20% by weight Clay, has a compacted permeability of 10^{-2} cm/sec or less, and is free of organics and rock larger than 4 inches in diameter.

  Drainage Fill (Toe Drain): - VDOT Open Graded Aggregate, Size No. 57 Stone.

The current dam soils consist of Silty and Clayey Sands (SM and SC) which should be suitable for reuse as Embankment Fill but are not sufficiently Clayey for reuse as Breach and Spillway Fill. Should the needed quantities of theses materials not be available in local borrow areas, importation may be required. Therefore, we recommend that the construction contract include unit rates for importation of the required fill types as well as additional gravel fill (No. 57 Stone) and medium duty, non-woven geotextile filter fabric.

The contractor should be required to submit fill materials to the Geotechnical Engineer for approval prior to their employment on this project. Fill operations should be observed by a qualified soil technician to determine of minimum compaction requirements are being met. In-place density tests should be performed with a minimum of 1 tests per 2,500 square feet for each lift of fill placed.

- We recommend that a toe drain be installed to control the long-term seepage along toe of the dam (see Figure 2). As it would not be efficient to retrofit the existing dam with a toe drain along its entire length, we recommend that it at least be installed below the new principal spillway. In general, it is recommended that the toe drain be employed at embankment subgraded elevations; that is, an elevation consistent with the ground surface elevation just beyond the embankment toe. This toe drain should extend into the dam from a daylight point at the toe to the first anti seep collar. The new principal spillway pipe can rest on the toe drain in this area. The toe drain should be placed generally horizontally, centered below the new principal spillway, with a width of at least 10 feet. The toe drain should consist of a 12 inch thick layer of coarse graded aggregate such as VDOT size No. 57 stone wrapped in a medium duty, non-woven geosynthetic filter fabric on all sides and overlapped 24 inches on an edge. It is noted that, depending on the degree of seepage and water present during construction, some adjustments to the placement and dimensioning of the toe drain could possibly be made by the Geotechnical Engineering during construction. Additional gravel wrapped in fabric may be required below the extended fill slopes on the up and downstream faces where ground conditions in the existing floodplain or pond will be soft and wet and will require undercutting prior to new fill placement.

- At least 2 anti-seepage collars should be employed on new principal spillway structure.

- In order to minimize erosion of the new emergency spillway when it is in service, we recommend that the emergency spillway be undercut 18 inches below final line and grade from the upstream embankment face to the downstream embankment toe and be backfilled with Breach and Spillway Fill, placed and compacted to the criteria discussed herein.

- Dam embankments should be protected from erosion due to wave action and surface runoff. On the up and downstream faces, slope protection could probably best be attained by seeding with heavy grass. If construction occurs during a period not conducive to rapid vegetative growth, a temporary synthetic stabilization matting could be used to cover the slope. Trees should not be planted on dam embankments.

- Routine maintenance should be provided for the dam. This should include annual inspections for removal of bushes and trees, filling of animal burrows, inspection for surface erosion or vertical cracks and seepage within or above the toe.

- A representative of the Soils Engineer should be called on to perform critical site inspections. These should include, but not necessarily be limited to:

  - Inspection of soil materials proposed for use in dam rehabilitation for conformance to the specifications.

  - Observation of exposed subgrade surfaces prior to fill placement. Observation of toe drain construction.

  - Compaction Testing of soil fill, particularly during initial fill placement. Test should be performed at a rate of at least one per 2500 square feet per lift or as otherwise directed by the engineer.

  - Observation of finished embankment grades for signs of seepage or erosion.

We have appreciated the opportunity to be use of service to you through the design phase of this project. If we can be of further assistance, such as by providing our testing services during construction, please contact our office.

Very Truly Yours,

ENGINEERING CONSULTING SERVICES, LTD.

Robert C. Moss, III, P.E.
Vice President/Richmond Branch Manager

COMMONWEALTH OF VIRGINIA
ROBERT C. MOSS, III
No. 019982
PROFESSIONAL ENGINEER

Copies: (3) Client

Geotech/Reports/5877

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

JUN 1995 RECEIVED CODE COMPLIANCE OFFICE

Environmental Consultants

TRANSMITTAL LETTER

TO DARRYL COOK

DATE 6-7-95

RE THE LEGENDS AT STONEHOUSE

WC049

WE ARE SENDING ☐ ATTACHED ☐ UNDER SEPERATE COVER VIA _____

☐ Plans ☐ Contracts ☐ Letters
☐ Prints ☐ Literature ☐ Other:
☐ Copies ☐ Samples

COPIES	DATED	DESCRIPTION
2		EXISTING RANGE LAKE/BMP #2 DETAIL SHEET
1		BMP #2 HYDROLOGIC/HYDRAULIC COMPUTATIONS

THESE ARE BEING SENT:

☐ As per your request ☐ For your comments ☐ For your signature
☐ For your review ☐ For your use/files ☐ For your _____

NOTES

COPY TO

SIGNATURE EWR

TITLE STAFF ENGINEER

DATE 6-7-95

516-B South Henry Street Williamsburg, Virginia 23185 (804) 220-6869 FAX (804) 229-4507

FILE - Stonehouse Golf Course

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

Environmental Consultants

FACSIMILE TRANSMITTAL

File: LEGENDS AT STONEHOUSE

Date: 6-13-94

To: DARYL COOK

From: ERIK ALLEN

Phone Number of Receiving Fax Machine: 253-6[illegible]

Number of Pages Following: 3

If you do not receive all pages of this transmittal, please contact _____ at (804) 220-6869 as soon as possible.

Special Instructions

- CORPS LETTER FOR DAM REHABILITATION

516-B South Henry Street Williamsburg, Virginia 23185 (804) 220-6869 FAX (804) 229-4507

DEPARTMENT OF THE ARMY
NORFOLK DISTRICT, CORPS OF ENGINEERS
FORT NORFOLK, 803 FRONT STREET
NORFOLK, VIRGINIA 23510-1096

REPLY TO
ATTENTION OF:

June 9, 1995

Southern Virginia Regulatory Section
94-0816a-15 (Ware Creek)

Stonehouse, Inc.
c/o Mr. James Franklin
Vice President, Stonehouse, Inc.
P.O. Box 1700
West Point, Virginia 23181

Dear Mr. Franklin:

This letter is in reference to the proposed utility line crossing and dam repair for the irrigation system that will service the Legends golf course at the Stonehouse Subdivision in James City County. In accordance with your request of May 15, 1995, your Department of the Army Permit, issued on December 16, 1994, is hereby modified to allow temporary impacts to wetlands for a utility line construction and minor impacts to wetlands for dam maintenance, as depicted on Figures 3 through 8, dated May 12, 1995 by Williamsburg Environmental Group (Figures 3 and 4 are entitled "Irrigation Transfer and Distribution Line, Wetland Crossing"; Figures 5 and 6 are entitled "Improvements to Existing Dam, Dam at Practice Range"; and Figures 7 and 8 are entitled "Improvements to Existing Dam, Dam at Hole #2"). All other conditions of the original permit remain unchanged.

The drawings indicate that the utility line will be installed in a manner consistent with the Corps' Nationwide 12 permit for temporary impacts due to utility line construction. The following conditions for installation of the utility line must be adhered to: The area of waters of the United States that is disturbed must be limited to the minimum necessary to construct the utility line. In wetlands, the top 6" to 12" of the trench should generally be backfilled with topsoil from the trench. Excess material must be removed to upland areas immediately upon completion of construction. Any exposed slopes and streambanks must be stabilized upon completion of the utility line. In addition, whenever possible, excavated material should be stockpiled in the upland. However, when this is not feasible, temporary stockpiling is authorized provided that all excavated material stockpiled in a vegetated wetland area is placed on filter cloth, mats, or some other impermeable surface. The material will be stabilized with straw bales, filter cloth, etc. to prevent reentry into the waterway. The excavated material must be placed back into the trench to the original contour, and all excess excavated material must be completely removed from the wetlands within 30 days after the utility line has been installed through the wetlands area.

Please obtain all necessary State and Local authorizations. Should you need further assistance or have any questions, please contact Ms. Melissa Schaup at (804) 441-7489.

BY AUTHORITY OF THE SECRETARY OF THE ARMY:

FOR AND ON BEHALF OF THE DISTRICT ENGINEER,
COLONEL ANDREW M. PERRINO, JR.:

Sincerely,

R. Harold Jones
Chief, Southern Virginia
Regulatory Section

Copy Furnished:

David Ramsey, Williamsburg Environmental Group, Inc.
Robert Kerr, Langley and McDonald, Inc.

Department of the Army
U.S. Army Corps of Engineers
Norfolk District
803 Front Street
Norfolk, Virginia 23510-1096

Facsimile Header

FROM: M. Schaup		OFFICE SYMBOL:	CENAO-CO-R
PHONE: 804	441-7489	FAX: 804	441-7678
TO: David Ramsey		OFFICE SYMBOL:	WEG
PHONE: 804	220-6869	FAX: 804	229-4507

TOTAL PAGES (Incl Header)	#PAGES	DATE	PRECEDENCE
	3	May 30, 1995	PRIORITY

RELEASER'S SIGNATURE: M. Schaup

REMARKS

I am faxing the letter for the utility line crossing and dam repair. Please call me if you have any questions.

Melissa

Jamestown-1607
JAMES CITY COUNTY

DEPARTMENT OF DEVELOPMENT MANAGEMENT
P. O. Box 8784
Williamsburg, Virginia 23187-8784

County Government Center, 101-E Mounts Bay Road

Development Manager
(804) 253-6671

Code Compliance
253-6626

County Engineer
253-6678

Planning
253-6685

Integrated Pest Management
253-2620

September 14, 1994

Mr. Ronald Boyd, President
516-B South Henry Street
Williamsburg Environmental Group, Inc.
Williamsburg, VA 23185

RE: Case No. SP-92-94. The Legends at Stonehouse Golf Course

Dear Mr. Boyd:

The Planning Commission has given staff the authority to work with you to address the agency comments listed below and, if addressed, grant preliminary approval of the site plan. If an agreement cannot be reached concerning any of the comments, the plan shall be brought back before the Development Review Committee. Staff will contact you to discuss the comments listed below.

Code Compliance/James City Service Authority

General Comments

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

2. An Inspection/Maintenance Agreement shall be executed with the County for the BMP facilities for this project.

3. As-built drawings must be provided for any detention facilities upon completion.

4. A Stormwater Management Plan must be submitted in order to evaluate the impact of the project on the reservoir and to ensure that the BMP plan can be implemented without conflicts from the golf course construction.

5. Provide detail of the super silt fence referred to in Narrative on Sheet 20. Also designate on the plans the locations this practice is used.

6. Provide detail of Rock Wall shown in several locations. Also, describe its installation in the narrative; is it at rough grading, final grading, etc.?

Fax: (804) 253-6663

7. The storm drain systems are to be designed on a 10-year not 2-year storm basis. Also, provide adequacy calculations for all outfalls that are not directly into wetlands.

8. Provide someway to designate on the plans which check dam design is used at each location.

9. Provide a detail of how the temporary slope drains will be installed in conjunction with the sediment traps.

10. Submit an exception request to disturb slopes of 25 percent and steeper to the Director of Code Compliance.

11. The Sensitive Area Clearing Note on Sheet 17 needs to be revised. In addition to the wetland areas, all areas of 25 percent slopes that are to be cleared and not graded must also be cleared by hand. No equipment is to be allowed on these slopes. Log removal will be done by cable only. These areas will be immediately stabilized upon clearing. The remaining areas of 25 percent slope shall be either immediately stabilized after clearing or protected with perimeter controls, either super silt fence or diversion dikes and sediment traps.

12. Slope Protection Note 1 needs to be modified to state slopes in excess of 10 percent not 15 percent will be stabilized immediately.

13. Slope Protection Note 2 needs to be clarified. Is the use of grasses with EC-2 matting to be used as an alternative to the sodding discussed in the same note? This shall only be allowed if the existing root mat remains in place.

14. Revise the plant list for the Sensitive Area Treatment to include species that will improve the wildlife habitat value of the buffer.

15. Clearing Note No. 3 on Sheet 17 and the proffers do not address clearing within the areas proffered for the reservoir pool, so no clearing below the 50-foot contour will be allowed as described in the comments for the individual holes.

<u>Practice Range</u>

1. All silt fence used at the toe of the slope around the wetland area shall be super silt fence.

2. ST R-2 is not included in the sediment trap table.

3. BMPs will be needed for the clubhouse area and the practice range is the most likely location for them; however, no provision has been made to site them on the range. This needs to be addressed.

Hole 1

1. In narrative, state that trap and basin will be removed upon stabilization of hole.

2. Reduce the clearing between Holes 1 and 9 to the north of the Hole 1 tees.

3. SB-1 top of dam must be raised 1 foot to Elevation 79 to achieve 3-foot separation between riser crest and top of dam.

4. The green must be relocated so that no clearing and grading occurs within 50 feet of the 50-foot contour (50/50 buffer). The full 50-foot buffer must be maintained in this area.

Hole 2

1. Provide a DD from the south end of ST 2-1 extending along the edge of clearing approximately 100 feet to the west.

2. Only hand clearing is allowed within the buffer and slopes steeper than 25 percent, therefore, eliminate grading for bunkers near the lake. Replacement vegetation in the 50/50 buffer must be with the "wildlife" type plants.

3. The tee shot to the southeast over the lake is very long. No future modification will be allowed to decrease the buffer in this area to make this a shorter shot.

4. Keep the 50/50 buffer intact in the ravine below Storm Drain 2-3-1.

5. The cart path in the vicinity of the tees needs to be shortened and removed from the steep slopes and 50/50 buffer area. Also, adjust the cart path location between the existing lake and the tees adjacent to Interstate 64 to eliminate as much clearing of the reservoir buffer above the 50-foot contour as possible.

Hole 3

Provide super silt fence where silt fence is shown around the wetlands.

Hole 4

1. Revise the location of the outlet to System 4-1 to discharge more directly into the wetlands and crossing less steep slope area.

2. Provide silt fence to control the runoff from the staging area.

3. Decrease clearing behind the moguls on the east side of the fairway. The grading can be made steeper to maintain their desired height.

Hole 5

1. Extend the DD to the west of ST 5-1 approximately 50 feet.

2. Provide silt fence at the limit of clearing below the grading for the bunkers proposed for the center of the fairway on the north side.

Hole 6

Decrease tree clearing and grading on the north and east sides of the hole on the steep slopes.

Hole 7

1. Reduce the clearing to the east of the fairway on the 25 percent slopes. There appears to be no need to clear this extensively on a nonplayable, steep slope area.

2. Provide super silt fence along the entire eastern edge of clearing.

3. Use super silt fence along the limit of clearing around the tee construction area continuing to the areas east of the Hole 6 green.

4. Provide a sediment trap at the swale just to the south of the tee area. Remove the silt fence and place the sediment trap at the edge of clearing. Utilize a TSD to convey the discharge from the trap over the slope.

5. Straighten the cart path between the 7th green and the 8th tee and remove it from the 50/50 buffer area.

Hole 8

1. Provide a rock outlet for the DD shown at the edge of grading northeast of the green. A silt fence cannot serve as a DD outlet.

2. Pull all clearing and grading out of the buffer including the cart path. The green location also needs to be adjusted to remove it and the bunkers from the 50/50 buffer.

3. The cart path in the vicinity of the tees needs to be shortened.

4. Without any plans for the road, we cannot approve the golf cart tunnel within the reservoir buffer.

Hole 9

1. ST 9-3 does not appear in the sediment trap table.

2. The silt fence at the south edge of the wetlands below the 25 percent slope shall be super silt fence.

3. Extend the 9-1 pipe system to the bottom of the slope to replace the TSD. The pipe could be installed initially removing the need for the TSD.

4. Utilize super silt fence below the tee construction adjacent to the wetlands.

5. Provide additional information/details on construction of the cart path between Holes 8 and 9. The route selected appears questionable and longer than necessary. Also, provide additional information on the construction of the cart path and bridge especially where it disturbs slopes in excess of 25 percent.

6. Move all tees out of the 50/50 buffer.

7. Reduce clearing on the east side of the fairway on the steep slopes with possible increased clearing on the west side.

Hole 10

1. Provide TSD from outfall of ST 10-1 or install the permanent pipe at the time of ST installation (Sheet 14).

2. Locate ST 10-1 at the limit of clearing and grading (Sheet 14).

3. Provide silt fence below cart path culvert at northern limit of clearing shown near top of Sheet 13.

4. On Sheet 12, provide silt fence at limit of clearing around wetlands.

5. Analyze the adequacy of the receiving channel from the Storm Drain System 10-1-1 (Sheet 12).

6. Justify the need to clear so much steep slope area on Sheet 12 in the vicinity of the graphical scale.

7. Show the access to the golf maintenance facility.

8. Pull the cart path and bridge out from below the 50-foot contour possibly onto the roadway bridge. Provide details for the cart bridge including the area of steep slopes to be disturbed for the path/bridge. The cart crossing of the road to reach the 16th tee needs to be relocated above the reservoir buffer.

9. Pull one tee to the north to eliminate clearing on the south side.

10. Provide BMP at 10-2-1.

11. Raise the bridge to a minimum elevation of 50.

12. Eliminate the clearing within the reservoir buffer to the east-northeast of the tees.

Hole 11

1. Provide approximately 200 feet of silt fence at the limit of grading to the northeast of the green.

2. Reduce clearing on the west side of the hole at wetlands crossing.

Hole 12

1. Provide silt fence below the two eastern most tees at the limit of grading and at the edge of the wetlands below these same tees.

2. Shorten cart path to the 13th tees.

Hole 13

1. Relocate silt fence below ST 13-2 from around the wetlands to along the edge of clearing extending approximately 100-150 feet northeast and about 50 feet to the south.

2. Provide details of access to the back tees across the wetland area.

3. The vegetation between tees and in the wetlands should be "wildlife" type.

4. Eliminate the clearing within the reservoir buffer to the east and southeast of the tees.

Hole 14

1. The Narrative needs to be clarified. It states ST 14-2 will be removed upon installation of 14-1 Storm System. This probably needs to state ST 14-3.

2. The toe of the slope below ST 14-3 needs to be protected by super silt fence upon removal of ST 14-3.

3. It is unclear how the outlet for ST 14-2 will function after the storm drain and fill are placed below the trap.

4. Pull green further upslope and possibly consider moving entire hole to the south on ridge to minimize disturbance of steep slopes.

Hole 15

1. All silt fence used around the wetlands needs to be super silt fence.

2. At green, remove all grading from the 50/50 buffer. Also, reduce width of tee area to minimize clearing. No clearing is allowed below the 50-foot contour.

3. Move the cart path from 15 to 16 off the steep slopes.

Hole 16

1. Install the fill area and pipe shown near the green to serve as a temporary sediment trap and include double-wall inlet protection.

2. Provide silt fence on Sheet 15 from end of silt fence shown at contour 60 north along the edge of clearing to the silt fence just below the tees.

Hole 17

1. All silt fence used around the wetlands needs to be super silt fence.

2. Move the green away from steep slope area to northeast further off the steep slopes. No grading is to occur on these steep slopes. Eliminate all clearing below the 50-foot contour.

3. Narrow the tee area to minimize clearing area.

Hole 18

1. Relocate the entire hole to the east including the green away from the steep area to protect this sensitive area.

2. Relocate ST 18-2 to below the edge of grading.

3. Revise the layout of Storm Drains 18-2-1 and 18-3-1 to have only one pipe go over the slope. Recommend that this remaining pipe be installed in place of the TSD proposed for ST 18-4.

4. Replace the silt fence to the east of ST 18-4 with DD starting at the trap and extending to contour 90.

Planning Division

Where golf holes come within 50 feet of any road, provide detailed landscape plans that shows how balls shall be prevented from entering the road.

Sincerely,

Michael A. Freda
Senior Planner

MAF/bkh
ronboyd.ltr

Response to James City County's Request For the Legends at Stonehouse To Comply With The County's 10-Point Stormwater Quality Criteria

I. The Following is an evaluation of the Current Legends at Stonehouse stormwater plan.

Five structural BMPs are planned to serve the Legends at Stonehouse stormwater treatment needs. These BMPs include:

1. Existing lake adjacent to Practice Range
2. Existing lake between hole #1 and hole #2.
3. Lake between hole #12 and hole #13.
4. Infiltration trench at hole #10 green.
5. Dry Pond adjacent to Maintenance Facility.

Impervious surfaces from the Maintenance facility and Clubhouse will be treated with structural BMPs

All untreated land will consist of high quality turf grass, sensitive area treatment grass mix, forested land, wetlands and cart path.

Nonpoint source pollutant transport is related to runoff rate. Research on The Effect of Nutrients and Pesticides Applied To Turf On The Quality Of Runoff And Percolating Water indicates that little or no runoff is generated from well maintained turf grass with a well established thatch, even for rain events that have a return period of greater than 100-yrs.

II Following is an evaluation based on four techniques commonly used in Virginia to determine compliance with water quality protection plans

A James City County 10 Point Analysis

With five (5) Structural BMPs and assuming all wooded space is open space, only **8.16 Points** can be achieved.

Ten (10) Points can be achieved by treating an additional 64 acres of golf course corridor. Site topography does not provide many satisfactory BMP sites and this method is not achievable.

Ten (10) points can also be achieved by adding an additional 135 acres of dedicated open space to the corridor and utilizing the five (5) major structural BMPs. This method is also not achievable.

B Land Use Loading Analysis

A performance based land use loading analysis based on published loading rates from the Northern Virginia Planning District Commission indicates that an **11% decrease** in phosphorus loading from the site to adjacent water bodies would occur if no structural BMPs were implemented. This is due mainly to conversion of agricultural land within the corridor to turf grass.

This analysis also indicates that a **31% post-development decrease** in phosphorus would occur if the four BMPs previously discussed were implemented.

This evaluation over-estimated the amount of impervious cover proposed for the golf course.

C James City County Reservoir Protection Overlay District Method

Article XI, Division I of the James City County Zoning Ordinance makes several references that would indicate that only impervious surfaces need to be treated by structural BMPs.

Section 20-176-a and b state:

> *Within the Reservoir Protection Overlay District, a buffer strip along any tributary stream shall be required to remain in its natural state or be planted with an* ***erosion retarding vegetative cover.*** *The width of the buffer strip shall be at least (100) feet.* ***All structures*** *shall be located outside of the required buffer strip. No septic tank or septic tank drain field shall be located within one hundred fifty (150) feet of a tributary stream.*
>
> ***All structures*** *shall be located at least two hundred (200) feet from any water supply reservoir. No septic tank or septic tank drain field shall be located within two hundred (200) feet of the normal pool elevation of a water supply reservoir. All land within two hundred (200) feet of the normal pool elevation of a water supply reservoir shall remain in its natural state or be planted with an* ***erosion retarding vegetative cover.***

Section 20-178-a-5 states:

> *Performance criteria proposed to assure an acceptable level of runoff quality and rate. At a minimum such criteria shall provide for a seventy-five (75) percent reduction of suspended solids and phosphorus, and the retention or infiltration of the first one-inch of* ***runoff from impervious surfaces.***

The Design Manual For Run-off Analysis allocates a 50%-85% removal efficiency for grassed filter strips which are defined as strips of close growing grasses established at the perimeter of disturbed or impervious areas. This is in essence what golf course turf grass is.

D Chesapeake Bay Local Assistance Department Local Assistance Manual

This method is based on impervious cover and no structural BMPs are required for sites that are less than 16% impervious. The Legends at Stonehouse will have less than 5% impervious cover.

Legends at Stonehouse
Landuse Loadings Analysis

I Pre-development

	Area (ac)	Phosphorus Loading Rate (lbs/ac)	Phosphorus Loading (lbs)
Forest	222	0.1	22.20
Wetlands	3.22	0.1	0.32
Minimum Till Agriculture	9.9	4.2	41.58
Conventional Till Agriculture	9.9	1.5	14.85
Total Pre-development	**245**	**0.32**	**78.95**

II Postdevelopment Without BMPs

	Area (ac)	Phosphorus Loading Rate (lbs/ac)	Phosphorus Loading (lbs)
Pavement	10	1.5	15.00
Greens	3.19	0.9	2.87
Tees	6.32	0.9	5.69
Fairways	36.8	0.5	18.40
Roughs	97	0.2	19.40
Forest	91.69	0.1	9.17
Buffer	0	0.2	0.00
Total Post-dev Untreated	**245**	**0.29**	**70.53**

III Postdevelopment With BMPs

	Area (ac)	Phosphorus Loading Rate (lbs/ac)	Untreated Phosphorus Loading (lbs)	BMP Efficiency	Treated Phosphorus Loading (lbs)
Untreated					
Pavement	0	1.5	0.00	0	0.00
Greens	2.09	0.9	1.88	0	1.88
Tees	3.96	0.9	3.56	0	3.56
Fairways	23.6	0.5	11.80	0	11.80
Roughs	75	0.2	15.00	0	15.00
Forest	62.45	0.1	6.25	0	6.25
Buffer	0	0.2	0.00	0	0.00
Total	167.1	0.23	38.49		38.49
Treated With Structural BMPs					
Pavement	10	1.5	15.00	0.5	7.50
Greens	1.1	0.9	0.99	0.5	0.50
Tees	2.36	0.9	2.12	0.5	1.06
Fairways	13.21	0.5	6.61	0.5	3.30
Roughs	24	0.2	4.80	0.5	2.40
Forest	27.23	0.1	2.72	0.5	1.36
Buffer	0	0.2	0.00	0.5	0.00
	77.9	0.41	32.24		16.12
Total Post-dev Treated	**245**		**70.73**		**54.61**

Net Phosphorus Reduction **31 %**

Stonehouse Existing Lake Evaluation

BMP #1 Sizing
For Golf Only

I Compute Rv

Drainage Area =	35.5 acre
Paved Area=	0 acre
Impervious %=	0.00 %
Golf Impervious	1 %
Total Impervious	1.00 %

Rv= (.05 + .009(Impervious %)
Rv= 0.06

II Compute Storage Volume

Design a wet pond to function as a 50% efficient BMP using guidelines presented in the
Removal efficiencies are taken from Local Assistance Manual. (CBLAD,1989)
Design based on A Framework For Evaluating Compliance With The 10% Rule in the Chesap

Vol=4(Runoff from mean storm)
Vol=4(Rv)(Rainfall of Mean Storm)(Drainage Area)
Vol = 0.29 ac-ft
Vol= 12773 cu-ft

Volume Provided= 6.35 ac-ft

BMP #2 Sizing
For Golf Only

I Compute Rv

Drainage Area =	22.7 acre
Paved Area=	3.5 acre
Impervious %=	15.42 %
Golf Impervious	1 %
Total Impervious	16.42 %

Rv= (.05 + .009(Impervious %)
Rv= 0.20

II Compute Storage Volume

Design a wet pond to function as a 50% efficient BMP using guidelines presented in the
Removal efficiencies are taken from Local Assistance Manual. (CBLAD,1989)
Design based on A Framework For Evaluating Compliance With The 10% Rule in the Chesap

Vol=4(Runoff from mean storm)
Vol=4(Rv)(Rainfall of Mean Storm)(Drainage Area)
Vol = 0.63 ac-ft
Vol= 27378 cu-ft

Volume Provided= 4.32 ac-ft

Stonehouse Existing Lake Evaluation

BMP #1 Sizing
For Entire Development

I Compute Rv

Drainage Area =	144 acre
Paved Area=	20 acre
Impervious %=	13.89 %
Golf Impervious	1 %
Total Impervious	14.89 %

Rv= (.05 + .009(Impervious %)
Rv= 0.18

II Compute Storage Volume

Design a wet pond to function as a 50% efficient BMP using guidelines presented in the
Removal efficiencies are taken from Local Assistance Manual. (CBLAD,1989)
Design based on A Framework For Evaluating Compliance With The 10% Rule In the Chesap

Vol=4(Runoff from mean storm)
Vol=4(Rv)(Rainfall of Mean Storm)(Drainage Area)
Vol = 3.71 ac-ft
Vol= 161583 cu-ft

Volume Provided= 6.35 ac-ft

BMP #2 Sizing
For Entire Development

I Compute Rv

Drainage Area =	41 acre
Paved Area=	10 acre
Impervious %=	24.39 %
Golf Impervious	1 %
Total Impervious	25.39 %

Rv= (.05 + .009(Impervious %)
Rv= 0.28

II Compute Storage Volume

Design a wet pond to function as a 50% efficient BMP using guidelines presented in the
Removal efficiencies are taken from Local Assistance Manual. (CBLAD,1989)
Design based on A Framework For Evaluating Compliance With The 10% Rule In the Chesap

Vol=4(Runoff from mean storm)
Vol=4(Rv)(Rainfall of Mean Storm)(Drainage Area)
Vol = 1.60 ac-ft
Vol= 69638 cu-ft

Volume Provided= 4.32 ac-ft

Response to James City County's Request For the Legends at Stonehouse To Comply With The County's 10-Point Stormwater Quality Criteria

I. The Following is an evaluation of the Current Legends at Stonehouse stormwater plan.

Five structural BMPs are planned to serve the Legends at Stonehouse stormwater treatment needs. These BMPs include:

1. Existing lake adjacent to Practice Range
2. Existing lake between hole #1 and hole #2.
3. Lake between hole #12 and hole #13.
4. Infiltration trench at hole #10 green.
5. Dry Pond adjacent to Maintenance Facility.

Impervious surfaces from the Maintenance facility and Clubhouse will be treated with structural BMPs

All untreated land will consist of high quality turf grass, sensitive area treatment grass mix, forested land, wetlands and cart path.

Nonpoint source pollutant transport is related to runoff rate. Research on The Effect of Nutrients and Pesticides Applied To Turf On The Quality Of Runoff And Percolating Water indicates that little or no runoff is generated from well maintained turf grass with a well established thatch, even for rain events that have a return period of greater than 100-yrs.

II Following is an evaluation based on four techniques commonly used in Virginia to determine compliance with water quality protection plans

A James City County 10 Point Analysis

With five (5) Structural BMPs and assuming all wooded space is open space, only **8.16 Points** can be achieved.

Ten (10) Points can be achieved by treating an additional 64 acres of golf course corridor. Site topography does not provide many satisfactory BMP sites and this method is not achievable.

Ten (10) points can also be achieved by adding an additional 135 acres of dedicated open space to the corridor and utilizing the five (5) major structural BMPs. This method is also not achievable.

B Land Use Loading Analysis

A performance based land use loading analysis based on published loading rates from the Northern Virginia Planning District Commission indicates that an **11% decrease** in phosphorus loading from the site to adjacent water bodies would occur if no structural BMPs were implemented. This is due mainly to conversion of agricultural land within the corridor to turf grass.

conservation tillage/conventional tillage - 50/50

This analysis also indicates that a **31% post-development decrease** in phosphorus would occur if the four BMPs previously discussed were implemented.

This evaluation over-estimated the amount of impervious cover proposed for the golf course.

C James City County Reservoir Protection Overlay District Method

Article XI, Division I of the James City County Zoning Ordinance makes several references that would indicate that only impervious surfaces need to be treated by structural BMPs.

Section 20-176-a and b state:

> *Within the Reservoir Protection Overlay District, a buffer strip along any tributary stream shall be required to remain in its natural state or be planted with an* ***erosion retarding vegetative cover.*** *The width of the buffer strip shall be at least (100) feet.* ***All structures*** *shall be located outside of the required buffer strip. No septic tank or septic tank drain field shall be located within one hundred fifty (150) feet of a tributary stream.*
>
> ***All structures*** *shall be located at least two hundred (200) feet from any water supply reservoir. No septic tank or septic tank drain field shall be located within two hundred (200) feet of the normal pool elevation of a water supply reservoir. All land within two hundred (200) feet of the normal pool elevation of a water supply reservoir shall remain in its natural state or be planted with an* ***erosion retarding vegetative cover.***

Section 20-178-a-5 states:

> *Performance criteria proposed to assure an acceptable level of runoff quality and rate. At a minimum such criteria shall provide for a seventy-five (75) percent reduction of suspended solids and phosphorus, and the retention or infiltration of the first one-inch of* ***runoff from impervious surfaces.***

The Design Manual For Run-off Analysis allocates a 50%-85% removal efficiency for grassed filter strips which are defined as strips of close growing grasses established at the perimeter of disturbed or impervious areas. This is in essence what golf course turf grass is.

D Chesapeake Bay Local Assistance Department Local Assistance Manual

This method is based on impervious cover and no structural BMPs are required for sites that are less than 16% impervious. The Legends at Stonehouse will have less than 5% impervious cover.

Legends at Stonehouse
Landuse Loadings Analysis

I Pre-development

	Area (ac)	Phosphorus Loading Rate (lbs/ac)	Phosphorus Loading (lbs)
Forest	222	0.1	22.20
Wetlands	3.22	0.1	0.32
Minimum Till Agriculture	9.9	4.2	41.58
Conventional Till Agriculture	9.9	1.5	14.85
Total Pre-development	**245**	**0.32**	**78.95**

II Postdevelopment Without BMPs

	Area (ac)	Phosphorus Loading Rate (lbs/ac)	Phosphorus Loading (lbs)
Pavement	10	1.5	15.00
Greens	3.19	0.9	2.87
Tees	6.32	0.9	5.69
Fairways	36.8	0.5	18.40
Roughs	97	0.2	19.40
Forest	91.69	0.1	9.17
Buffer	0	0.2	0.00
Total Post-dev Untreated	**245**	**0.29**	**70.53**

III Postdevelopment With BMPs

	Area (ac)	Phosphorus Loading Rate (lbs/ac)	Untreated Phosphorus Loading (lbs)	BMP Efficiency	Treated Phosphorus Loading (lbs)
Untreated					
Pavement	0	1.5	0.00	0	0.00
Greens	2.09	0.9	1.88	0	1.88
Tees	3.96	0.9	3.56	0	3.56
Fairways	23.6	0.5	11.80	0	11.80
Roughs	75	0.2	15.00	0	15.00
Forest	62.45	0.1	6.25	0	6.25
Buffer	0	0.2	0.00	0	0.00
Total	167.1	0.23	38.49		38.49
Treated With Structural BMPs					
Pavement	10	1.5	15.00	0.5	7.50
Greens	1.1	0.9	0.99	0.5	0.50
Tees	2.36	0.9	2.12	0.5	1.06
Fairways	13.21	0.5	6.61	0.5	3.30
Roughs	24	0.2	4.80	0.5	2.40
Forest	27.23	0.1	2.72	0.5	1.36
Buffer	0	0.2	0.00	0.5	0.00
	77.9	0.41	32.24		16.12
Total Post-dev Treated	**245**		**70.73**		**54.61**

Net Phosphorus Reduction **31 %**

WILLIAMSBURG
ENVIRONMENTAL
GROUP, INC.

Environmental Consultants

March 23, 2000

Mr. Darryl Cook
Development Engineer
James City County
101 Mounts Bay Road
Williamsburg, VA 23187-8784

RE: The Legends at Stonehouse
Modification to BMP#1

Dear Mr. Cook:

Enclosed are two copies of the Site Plan Amendment – Modification to BMP#1 for The Legends at Stonehouse. Also enclosed is a copy of the Hydrologic/Hydraulic Computations for the site plan amendment and a copy of the geotechnical report on the dam by ECS, Ltd. Please let me know if any additional information is required for your review. If you have any questions, please feel free to contact me.

Sincerely,

Erik L. Allen, P.E.
Senior Engineer

Enclosures

3000 Easter Circle Williamsburg, Virginia 23188 (757) 220-6869 FAX (757) 229-4507

WATERSHED	WC	MAINTENANCE PLAN	No	CTRL STRUC DESC	ACMP Riser
BMP ID NO	049	SITE AREA acre	245	CTRL STRUC SIZE inches	24
PLAN NO	SP-92-94	LAND USE	Res Planned Unit D	OTLT BARRL DESC	ACMP
TAX PARCEL	(05-03)(01-04)	old BMP TYP	Wet Pond	OTLT BARRL SIZE inch	18
PIN NO	0530100004	JCC BMP CODE			
CONSTRUCTION DATE	1/1/1996	POINT VALUE	11	EMERG SPILLWAY	Yes
PROJECT NAME	Legends at Stonehouse Golf Course			DESIGN HW ELEV	45.78
FACILITY LOCATION	BMP # 2 (Lake) SW Clubhouse & Park Area			PERM POOL ELE	41.5
CITY-STATE	Williamsburg, Va. 23188	SVC DRAIN AREA acres	44	2-YR OUTFLOW cfs	2.00
CURRENT OWNER	The Traditions Golf Club at Stonehouse			10-YR OUTFLOW cfs	19.00
OWNER ADDRESS	745 Atlantic Avenue			REC DRAWING	No
OWNER ADDRESS 2		SERVICE AREA DESCRI	Office, Clubhouse, Driv Range & Woods		
CITY-STATE-ZIP CODE	Boston, MA 02111-2735	IMPERV AREA acres	10.44	CONSTR CERTI	No
OWNER PHONE		RECV STREAM	UT of Bird Swamp		
MAINT AGREEMENT	Yes	EXT DET-WQ-CTRL	Yes	LAST INSP DATE	
EMERG ACTION PLAN	No	WTR QUAL VOL acre-ft	1.62	INTERNAL RATING	
		CHAN PROT CTRL	No	MISC/COMMENTS	
		CHAN PROT VOL acre-ft	0	Exist Lake near well lot. Upgrade per detail Sht 21 in plan SP-37-96 (1995).	
		SW/FLOOD CONTROL	Yes		
		GEOTECH REPORT	No		

Get Last BMP No

Return to Menu

CODE COMPLIANCE/JCSA REVIEW COMMENTS
STONEHOUSE GOLF COURSE
PLAN NO. SP-92-94 DEC
September 2, 1994

General Comments

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

2. An Inspection/Maintenance Agreement shall be executed with the county for the BMP facilities for this project.

3. As-built drawings must be provided for any detention facilities upon completion.

4. Stormwater management plan must be submitted in order to evaluate the impact of the project on the reservoir and to ensure that the BMP plan can be implemented without conflicts from the golf course construction.

5. Provide detail of the super silt fence referred to in Narrative on sheet 20. Also designate on the plans the locations this practice is used.

6. Provide detail of Rock Wall shown in several locations. Also, describe its installation in the narrative; is it at rough grading, final grading, etc.?

7. The storm drain systems are to be designed on a 10-year not 2-year storm basis. Also, provide adequacy calculations for all outfalls that are not directly into wetlands.

8. Provide some way to designate on the plans which check dam design is used at each location.

9. Provide a detail of how the temporary slope drains will be installed in conjunction with the sediment traps.

10. Submit an exception request to disturb slopes of 25% and steeper to the Director of Code Compliance.

11. The Sensitive Area Clearing Note on sheet 17 needs to be revised. In addition to the wetland areas, all areas of 25% slope that are to be cleared and not graded must also be cleared by hand. No equipment is to be allowed on these slopes. Log removal will be done by cable only. These areas will be immediately stabilized upon clearing. The remaining areas of 25% slope shall be either immediately stabilized after clearing or protected with perimeter controls, either super silt fence or diversion dikes and sediment traps.

12. Slope Protection Note 1 needs to be modified to state slopes in excess of 10% not 15% will be stabilized immediately. after reaching final grade.

13. Slope Protection Note 2 needs to be clarified. Is the use of grasses with EC-2 matting to be used as an alternative to the sodding discussed in the same note? This shall only be allowed if the existing root mat remains in place.

14. Revise the plant list for the Sensitive Area Treatment to include species that will improve the wildlife habitat value of the buffer.

15. Clearing note #3 on sheet 17 and the proffers do not address clearing within the areas proffered for the reservoir pool so no clearing below the 50-foot contour will be allowed as described in

the comments for the individual holes.

Practice Range

change SSF on south side to SF

1. All silt fence used at the toe of the slope around the wetland area shall be super silt fence. Same for the fence installed below the large tee construction area.

SSF · north side from I.C. to end of grading @ large tee - elim. SF near Rock wall -

2. ST R-2 is not included in the sediment trap table.

3. BMPs will be needed for the clubhouse area and the practice range is the most likely location for them, however, no provision has been made to site them on the range. This needs to be addressed.

Hole 1

1. In narrative, state that trap and basin will be removed upon stabilization of hole.

2. Reduce the clearing between holes 1 and 9 to the north of the hole 1 tees.

3. SB-1 top of dam must be raised 1 foot to elevation 79 to achieve 3 foot separation between riser crest and top of dam.

4. The green must be relocated so that no clearing and grading occurs within 50 feet of the 50 foot contour (50/50 buffer). The full 50 foot buffer must be maintained in this area.

Green + grading will be moved out of 50/50

Hole 2

1. Provide a DD from the south end of ST 2-1 extending along the edge of clearing approximately 100 feet to the west.

2. Only hand clearing is allowed within the buffer and slopes steeper than 25%, therefore, eliminate grading for bunkers near the lake. Replacement vegetation in the 50/50 buffer must be with the "wildlife" type plants.

3. The tee shot to the southeast over the lake is very long. No future modification will be allowed to decrease the buffer in this area to make this a shorter shot.

4. Keep the 50/50 buffer intact in the ravine below storm drain 2-3-1. - will be adjusted

5. The cart path in the vicinity of the tees needs to be shortened and removed from the steep slopes and 50/50 buffer area. Also, adjust the cart path location between the existing lake and the tees adjacent to Interstate 64 to eliminate as much clearing of the reservoir buffer above the 50-foot contour as possible.

Hole 3

1. Provide ~~super~~ silt fence where silt fence is shown around the wetlands.

Hole 4

1. Revise the location of the outlet to system 4-1 to discharge more directly into the wetlands and crossing less steep slope area.

2. Provide silt fence to control the runoff from the staging area.

3. Decrease clearing behind the moguls on the east side of the fairway. The grading can be made steeper to maintain their desired height. - will be done

Hole 5

1. Extend the DD to the west of ST 5-1 approximately 50 feet.

2. Provide silt fence at the limit of clearing below the grading for the bunkers proposed for the center of the fairway on the north side.

Hole 6

? 1. Decrease tree clearing and grading on the north and east sides of the hole on the steep slopes.

Hole 7

1. Reduce the clearing to the east of the fairway on the 25% slopes. There appears to be no need to clear this extensively on a non-playable, steep slope area. - Will be done

2. Provide super silt fence along the entire eastern edge of clearing. - either remove ~~bot~~ Bunkers @ midpoint of fairway or use SSF on steep slope areas

3. Use super silt fence along the limit of clearing around the tee construction area continuing to the areas east of the hole 6 green. - Not needed

4. Provide a sediment trap at the swale just to the south of the tee area. Remove the silt fence and place the sediment trap at the edge of clearing. Utilize a TSD to convey the discharge from the trap over the slope.

5. Straighten the cart path between the 7th green and the 8th tee and remove it from the 50/50 buffer area.
Near green - extend DD from Trap + either remove grading or use SSF

Hole 8

1. Provide a rock outlet for the DD shown at the edge of grading northeast of the green. A silt fence cannot serve as a DD outlet. - Leave SF - add DD to trap

2. Pull all clearing and grading out of the buffer including the cart path. The green location also needs to be adjusted to remove it and the bunkers from the 50/50 buffer. - will be done

3. The cart path in the vicinity of the tees needs to be shortened.

4. Without any plans for the road we cannot approve the golf cart tunnel within the reservoir buffer.

Hole 9

1. ST 9-3 does not appear in the sediment trap table.

2. The silt fence at the south edge of the wetlands below the 25% slope shall be super silt fence.

SSF in front of tees
Either SF + Hardcover on Ladies tee

3. Extend the 9-1 pipe system to the bottom of the slope to replace the TSD. The pipe could be installed initially removing the need for the TSD.

4. Utilize super silt fence below the tee construction adjacent to the wetlands.

5. Provide additional information/details on construction of the cart path between holes 8 and 9. The route selected appears questionable and longer than necessary. Also provide additional information on the construction of the cart path and bridge especially where it disturbs slopes in excess of 25%.

6. Move all tees out of the 50/50 buffer. - done

7. Reduce clearing on the east side of the fairway on the steep slopes with possible increased clearing on the west side. - done

Hole 10

1. Provide TSD from outfall of ST 10-1 or install the permanent pipe at the time of ST installation. (sheet 14)

2. Locate ST 10-1 at the limit of clearing and grading. (sheet 14)

3. Provide silt fence below cart path culvert at northern limit of clearing shown near top of sheet 13.

4. On sheet 12, provide silt fence at limit of clearing around wetlands.

5. Analyze the adequacy of the receiving channel from the storm drain system 10-1-1. (sheet 12)

6. Justify the need to clear so much steep slope area on sheet 12 in the vicinity of the graphical scale. - done

7. Show the access to the golf maintenance facility.

8. Pull the cart path and bridge out from below the 50 foot contour possibly onto the roadway bridge. Provide details for the cart bridge including the area of steep slopes to be disturbed for the path/bridge. The cart crossing of the road to reach the 16th tee needs to be relocated above the reservoir buffer.

9. Pull one tee to the north to eliminate clearing on the south side. - ok as is

10. Provide BMP at 10-2-1. - will provide - Analyze further

11. Raise the bridge to a minimum elevation of 50. - vertical curve (say)

12. Eliminate the clearing within the reservoir buffer to the east-northeast of the tees. - done

Hole 11

1. Provide approximately 200 feet of silt fence at the limit of grading to the northeast of the green.

2. Reduce clearing on the west side of the hole at wetlands crossing. - will be done

Hole 12

1. Provide silt fence below the two eastern most tees at the limit of grading and at the edge of the wetlands below these same tees.

2. Shorten cart path to the 13th tees.

Hole 13

1. Relocate silt fence below ST 13-2 from around the wetlands to along the edge of clearing extending approximately 100-150 feet northeast and about 50 feet to the south.

2. Provide details of access to back tees across wetland area.

3. The vegetation between tees and in the wetlands should be "wildlife" type.

4. Eliminate the clearing within the reservoir buffer to the east and southeast of the tees. will be done

Hole 14

1. The Narrative needs to be clarified. It states ST 14-2 will be removed upon installation of 14-1 storm system. This probably needs to state ST 14-3.

2. The toe of the slope below ST 14-3 needs to be protected by super silt fence upon removal of ST 14-3.

3. It is unclear how the outlet for ST 14-2 will function after the storm drain and fill are placed below the trap.

4. Pull green further upslope and possibly consider moving entire hole to the south on ridge to minimize disturbance of steep slopes.

Hole 15

1. All silt fence used around the wetlands needs to be super silt fence. ok

2. At green, remove all grading from the 50/50 buffer. Also reduce width of tee area to minimize clearing. No clearing is allowed below the 50 contour.

3. Move the cart path from 15 to 16 off the steep slopes.

Hole 16

1. Install the fill area and pipe shown near the green to serve as a temporary sediment trap and include double wall inlet protection.

2. Provide silt fence on sheet 15 from end of silt fence shown at contour 60 north along the edge of clearing to the silt fence just below the tees.

Hole 17

1. All silt fence used around the wetlands needs to be super silt fence. ok

2. Move the green away from steep slope area to northeast further off the steep slopes. No grading is to occur on these steep slopes. Eliminate all clearing below the 50 foot contour. will be done -

3. Narrow the tee area to minimize clearing area. - will look @ in field

Hole 18

1. Relocate the entire hole to the east including the green away from the steep slope area to protect this sensitive area.

2. Relocate ST 18-2 to below the edge of grading.

3. Revise the layout of storm drain 18-2-1 and 18-3-1 to have only one pipe go over the slope. Recommend that this remaining pipe be installed in place of the TSD proposed for ST 18-4.

4. Replace the silt fence to the east of ST 18-4 with DD starting at the trap and extending to contour 90.

SSF - 50/50 Area around wetlands

RISER

(9) Force mains designed to discharge to atmospheric pressure wherever this can be reasonably done;

(10) Check-valves at selected locations in the forcemain system;

(11) Expand the design process for force mains to include calculations related to transient pressures in addition to the static conditions which are normally considered in small force mains such as those anticipated on the Property; or

(12) Spill containment berms around pump stations.

(b) If the land conveyed to the County for the Reservoir pursuant to Condition 1 hereof reverts to Owner pursuant to that condition, then Owner shall no longer subject to any provision of Condition 8.1(a).

(c) Where acceptable to Owner, the County and the Service Authority, Owner shall consider the utilization in the construction of its sewer system of non-conventional technologies such as vacuum sewers and other new and improved technologies generally accepted by the engineering profession.

9. Watershed Protection.

9.1 Maintenance of BMPs. Owner and/or the Community Association shall enter into a maintenance agreement or agreements with the County in form and substance satisfactory to the County Attorney, the Owner and/or the Community Association

providing for the necessary maintenance by the County, at the cost of Owner and/or the Community Association, of all stormwater management systems and facilities constructed by Owner to preserve their design function. Owner and/or the Community Association shall provide the County with access easements to all such stormwater management facilities.

9.2 Reservoir Buffer. To protect more effectively the Reservoir and adjacent streams, Owner shall establish a variable width buffer adjacent to the Reservoir and associated streams generally as shown on the Master Plan (the "Buffer"). The Buffer shall have a minimum width of the greater of (i) 100 feet measured from the normal pool level of Reservoir or (ii) 50 feet measured from the adjacent 50 foot contour line and shall include any additional contiguous areas with slopes of 15 percent or greater, unless otherwise approved by the Director of Code Compliance. Once the Reservoir has been constructed and if the Reservoir has a normal pool elevation higher than the 35 foot contour, the Buffer shall have a minimum width of 100 feet from the normal pool elevation of Reservoir and shall include any additional contiguous areas with slopes of 15 percent or greater, unless otherwise approved by the Director of Code Compliance. The exact boundary of the Buffer shall be shown on subdivision and site plans for portions of the Property that include the Buffer. If the normal pool elevation of the Reservoir is raised,

and application of the Buffer of a minimum width of 100 feet from the normal pool elevation of the Reservoir would result in the loss of a buildable area on any lot or parcel recorded before the change in the normal pool elevation of the Reservoir, then modifications to the width of the Buffer shall be allowed so long as the modification to the width of the Buffer shall be the minimum necessary to achieve a reasonable buildable area for a principal structure and necessary utilities.

9.3 Conservation Area. Owner shall establish a conservation area (the "Conservation Area") below the Reservoir dam and adjacent to Ware Creek and York River. The Conservation Area shall include all land below the five foot contour and shall extend a minimum of 100 feet landward of the five foot contour or, at the discretion of the Director of Code Compliance or his designee, from the edge of wetlands as shown on final subdivision plats or site plans, and shall include any contiguous area with slopes of 15 percent or greater generally as shown on the Master Plan, unless otherwise approved by the Director of Code Compliance. The exact location of the Conservation Area shall be shown on subdivision or site plans for portions of the Property that include the Conservation Area.

9.4 Use of the Buffer. (a) The Buffer shall be maintained undisturbed and in its natural state preserving existing indigenous vegetation to the maximum extent possible as

Worksheet For BMP Point System
10 Point Analysis
Legends at Stonehouse
No Offsite Credit

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Points		Fraction of Site Served By BMP		Weighted BMP Points
Existing Lake	11	x	24%	=	2.64
Maintenance BMP& Hole 10 BMP	9	x	3%	=	0.30
Hole 12 and 13 BMP's	9	x	5%	=	0.42
Offsite Credit	0	x	71%	=	0.00
	TOTAL WEIGHTED BMP POINTS:				**3.36**

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
48%	x	0.10	=	**4.80**

C. TOTAL WEIGHTED POINTS

3.36		4.80	=	**8.16**
Structural BMP Points		Natural Open Space Points		**Total**

Worksheet For BMP Point System

Legends at Stonehouse
Allowing All Offsite Credit

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Points		Fraction of Site Served By BMP		Weighted BMP Points
Existing Lake	9	x	24%	=	2.16
Maintenance BMP& Hole 10 BMP	9	x	3%	=	0.30
Hole 12 and 13 BMP's	9	x	5%	=	0.42
Offsite Credit	9	x	71%	=	6.37
	TOTAL WEIGHTED BMP POINTS:				**9.26**

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
48%	x	0.10	=	**4.80**

C. TOTAL WEIGHTED POINTS

9.26		4.80	=	**14.06**
Structural BMP Points		Natural Open Space Points		**Total**

Total Site = 245 acres

Worksheet For BMP Point System

Legends at Stonehouse
Treating Additional 64 Acres of Golf With Structural BMP

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Points		Fraction of Site Served By BMP		Weighted BMP Points
Existing Lake	9	x	24%	=	2.16
Maintenance BMP& Hole 10 BMP	9	x	3%	=	0.30
Hole 12 and 13 BMP's	9	x	5%	=	0.42
Offsite Credit	9	x	26%	=	2.34
	TOTAL WEIGHTED BMP POINTS:				**5.22**

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
48%	x	0.10	=	**4.80**

C. TOTAL WEIGHTED POINTS

5.22	4.80	=	**10.02**
Structural BMP Points	Natural Open Space Points		**Total**

I Site = 245 acres

Worksheet For BMP Point System

Legends at Stonehouse
Adding 10000 acres of additional open space

A. STRUCTURAL BMP POINT ALLOCATION

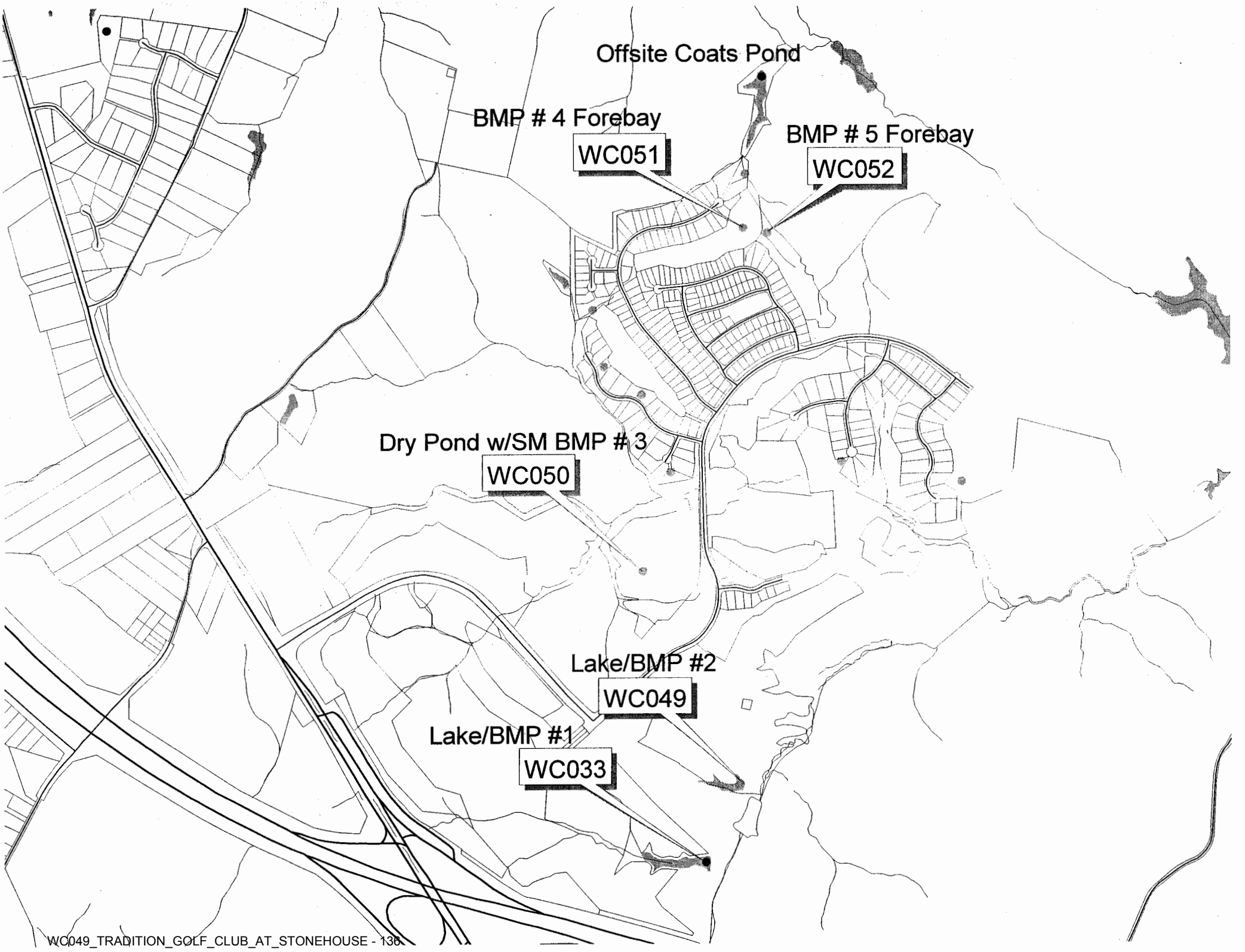
BMP	BMP Points		Fraction of Site Served By BMP		Weighted BMP Points
Existing Lake	11	x	1%	=	0.06
Maintenance BMP& Hole 10 BMP	9	x	0%	=	0.01
Hole 12 and 13 BMP's	9	x	0%	=	0.01
Offsite Credit	0	x	0%	=	0.00
	TOTAL WEIGHTED BMP POINTS:				**0.08**

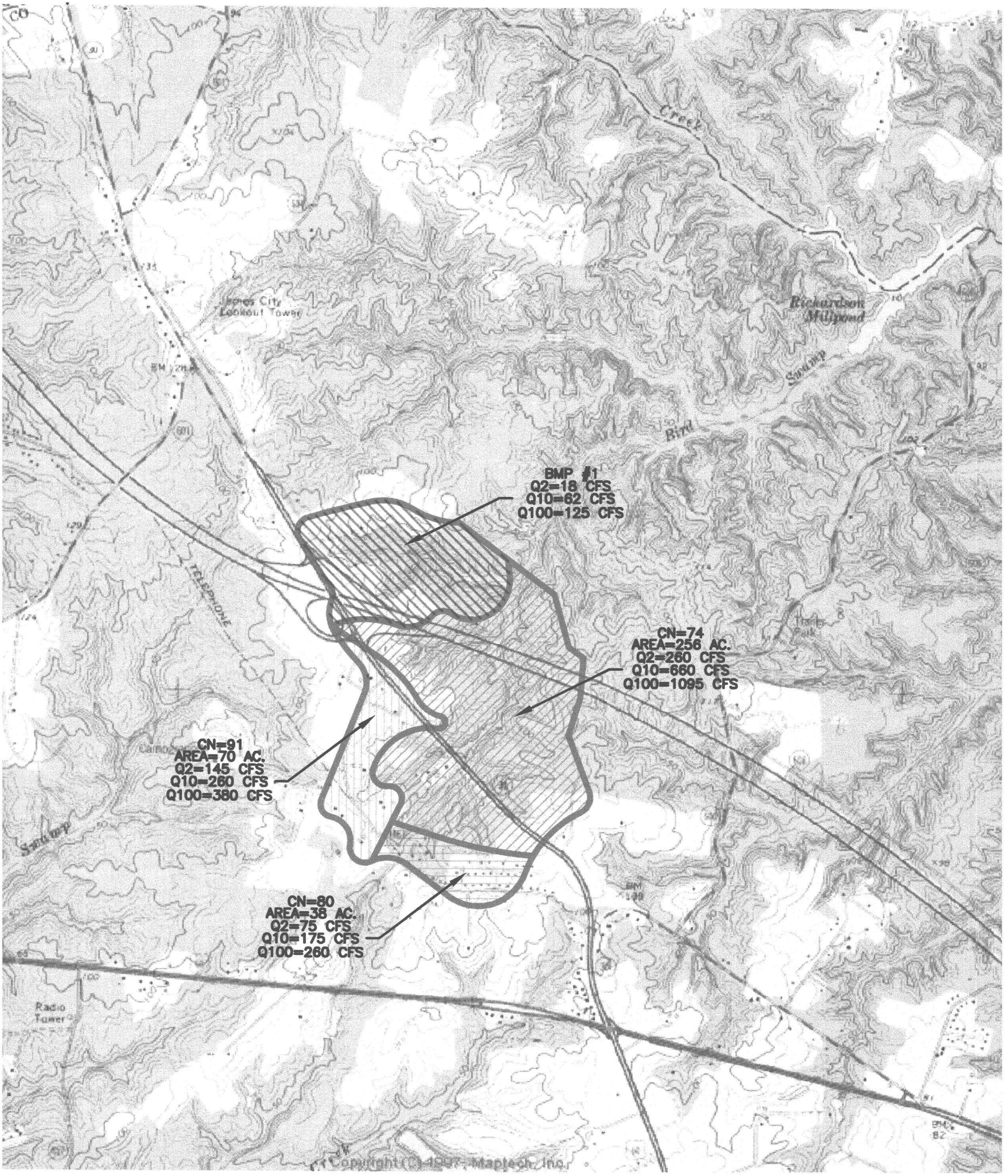
B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
99%	x	0.10	=	**9.87**

C. TOTAL WEIGHTED POINTS

0.08		9.87	=	**9.95**
Structural BMP Points		Natural Open Space Points		**Total**


Offsite Coats Pond
BMP # 4 Forebay
WC051
BMP # 5 Forebay
WC052
Dry Pond w/SM BMP # 3
WC050
Lake/BMP #2
WC049
Lake/BMP #1
WC033


BMP #1
Q2=18 CFS
Q10=62 CFS
Q100=125 CFS
CN=74
AREA=256 AC.
Q2=260 CFS
Q10=660 CFS
Q100=1095 CFS
CN=91
AREA=70 AC.
Q2=145 CFS
Q10=260 CFS
Q100=380 CFS
CN=80
AREA=38 AC.
Q2=75 CFS
Q10=175 CFS
Q100=260 CFS
Richardson Millpond
Sandhill
Creek
Sandhill
Bird
Sandhill
Radio Tower
Copyright (C) 1997 Maptech, Inc.

James City County Environmental Division
The Legends at Stonehouse DEL
BMP #1 Modification Plan Review Comments
4/17/00

General:

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

2. A standard Inspection / Maintenance agreement is required to be executed with the County for the BMP for this project (if one has not been executed already). – need to check status of this

3. Provide evidence that any necessary wetlands permits are being pursued or have been obtained for this project. Note 5 of the construction sequence indicates that work will be done in the wetlands while the plan view indicates no work in the wetlands. Please clarify.

Chesapeake Bay Preservation:

4. Water Quality Volume. The calculations for the water quality volume are based on a watershed of 144 acres while the drainage area for the pond used in the routing calculations is 100 acres. Please explain why there is a difference in the area.

Erosion & Sediment Control Plan:

5. Temporary Stockpile Areas. Show any temporary soil stockpile, staging and equipment storage areas and required erosion and sediment control measures or indicate on the plans that none are anticipated for the project site.

6. Offsite Land Disturbing Areas. Identify any offsite land disturbing areas (borrow, waste, disposal sites, etc.) and required erosion and sediment control measures or indicate on the plans that none are anticipated for this project.

7. Outlet Protection. For the stilling basin, specify riprap thickness in accordance with requirements of the VESCH, Minimum Standards 3.18 and 3.19.

Stormwater Management / Drainage:

8. Pond Tailwater. Tailwater conditions directly downstream of the SWM/BMP facility were not considered in the pond hydraulics and routings. Please evaluate the potential for a tailwater condition at the pond outlet and subsequent effects to the pond's outlet discharges and design water surface elevations.

9. Emergency Spillway. Change the lining of the emergency spillway outlet channel from EC-2 to an EC-3 liner.

10. Pipe Material. ACMP is not to be used in a permanent basin for the riser or barrel pipe. Use either concrete or HDPE pipe for the barrel. If concrete is chosen, specify watertight reinforced

Conflicts on Sht 3 - still called ACCMP -

concrete pipe meeting the requirements of ASTM C361for the pond outlet barrel. If HDPE is used, provide storm drain pipe specifications or reference the appropriate VDOT Road and Bridge Standards section for corrugated polyethylene pipe as intended for use at the site. Provide a typical bedding and installation detail and indicate minimum cover requirements during construction and the allowable maximum height of final and temporary cover for the class of pipe selected. However, the riser should not be made of HDPE.

11. Anti-Vortex/Trash Rack Device. Provide an access hatch in the top of the device for maintenance access.

12. Low Flow Orifice Protection. Provide a non-clogging, cage-type trash rack or grille for the two low flow rectangular orifices provided in the riser.

13. Pond Drain. Provide a pond drain and valve system that is capable of completely or partially draining the entire facility within 24 hours for future maintenance purposes.

14. Pond Side Slopes. Increase the pond side slopes so that the total of the front and back side slopes is 5:1.