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: **PC155**

DATE VERIFIED: **May 30, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

DATE: February 24, 2010

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

FROM: Jo Anna Ripley, Stormwater

PO: 270712

RE: Files Approved for Scanning

BMP ID or General File ID PC155

PIN: 3810600001B

Subdivision, Tract, Business or Owner Name (if known): Fords Colony

Property Description: Lake Section 13C

Site Address:

(For internal use only) **Box:** FC001 **Drawer:** 1

Agreements: (in file as of scan date) **Y** **Book or Doc#:** 603 **Page:** 268-269

Comments:

1512

FILE - COPY

DECLARATION OF COVENANTS

BOOK 603 PAGE 268

INSPECTION/MAINTENANCE OF RUNOFF CONTROL FACILITY

THIS DECLARATION, made this 4 day of JANUARY, 1993, between REALTEC INCORPORATED AND THE FORD'S COLONY AT WILLIAMSBURG HOMEOWNERS ASSOCIATION, INC, and all successors in interest, hereinafter referred to as the "COVENANTOR(S)," owner(s) of the following property: PARCEL B (POND) ≈ 2.4 AC OF FORD'S COLONY AT WILLIAMSBURG, SECTION XIII-C AES PLAT DATED NOVEMBER 1992, 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 rights-of-way 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 COVENANT shall be recorded in the County Land Records.

IN WITNESS WHEREOF, the COVENANTOR(S) have executed this DECLARATION OF COVENANTS as of this 4 day of January, 19 93.

COVENANTOR(S)

ATTEST:

V.P.
FOR REALTEC INCORPORATED

PRESIDENT
FOR FORD'S COLONY AT WILLIAMSBURG HOMEOWNERS' ASSOCIATION, INC

COVENANTOR(S)

ATTEST:

STATE OF VIRGINIA
~~CITY~~/COUNTY OF JAMES CITY

I hereby certify that on this 4TH day of JANUARY 19 93, before the subscribed, a Notary Public of the State of Virginia, and for the ~~City~~/County of JAMES CITY, aforesaid personally appeared before me DREW MULHARE
(Name of Acknowledging Party)
and did acknowledge the aforegoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 26TH day of JANUARY, 19 93.

William A Lawson Jr
Notary Public

My Commission expires: 10-31-1994

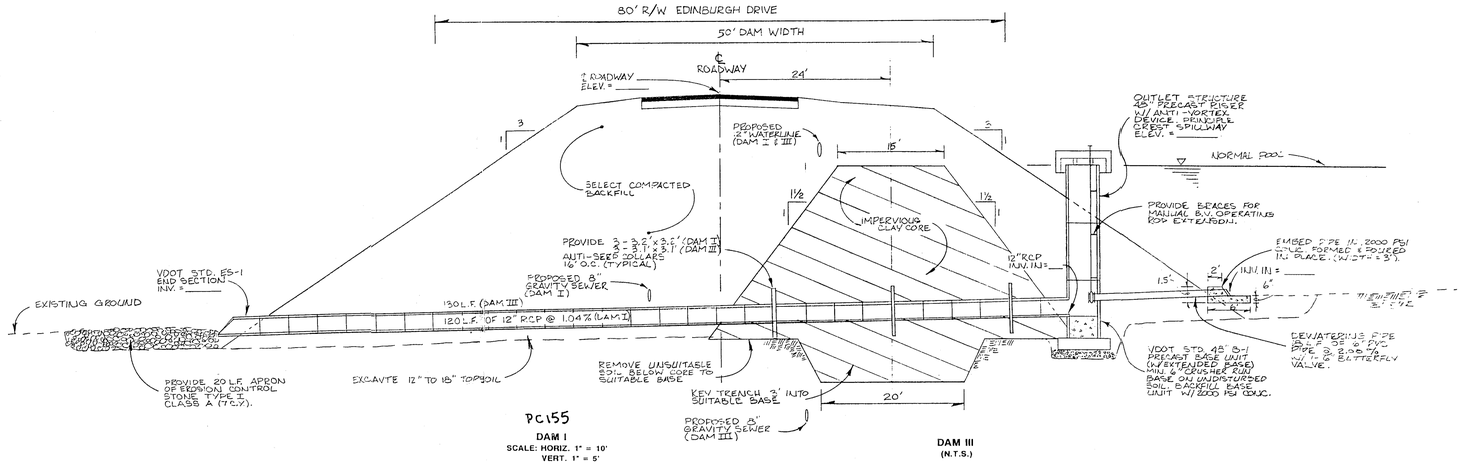
Approved as to form:

Leo P. Rogers

0261U
Revised 3/91

VIRGINIA: City of Williamsburg and County of James City, to Wit:
In the Clerk's office of the Circuit Court of the City of Williamsburg and County of James City the 2 day of Feb, 1993 This instrument was presented with certificate annexed and admitted to record at 10:44 o'clock
Teste: Helene S. Ward, Clerk
by Helene S. Ward
Deputy Clerk

DAM I & III



PC155

DAM I
SCALE: HORIZ. 1" = 10'
VERT. 1" = 5'

CENTER LINE ROADWAY ELEV. = 55.00'
NORMAL POOL ELEV. = 50.00'
PRINCIPLE CREST SPILLWAY ELEV. = 50.00'
2 YR. STORM ELEV. = 50.20'
10 YR. STORM ELEV. = 50.30'
100 YR. STORM ELEV. = 50.60'
6" PVC PIPE INV. IN ELEV. = 41.00'
12" RCP INV. IN ELEV. = 39.61'
12" RCP INV. OUT ELEV. = 38.37'

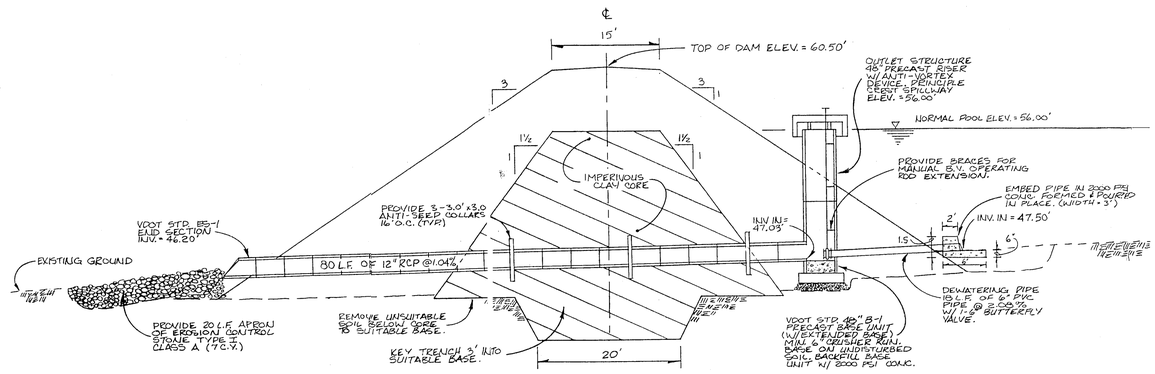
DAM III
(N.T.S.)

CENTER LINE ROADWAY ELEV. = 53.00'
NORMAL POOL ELEV. = 46.00'
PRINCIPLE CREST SPILLWAY ELEV. = 46.00'
2 YR. STORM ELEV. = 46.30'
10 YR. STORM ELEV. = 46.40'
100 YR. STORM ELEV. = 46.60'
6" PVC PIPE INV. IN ELEV. = 37.00'
12" RCP INV. IN ELEV. = 36.53'
12" RCP INV. OUT ELEV. = 35.18'

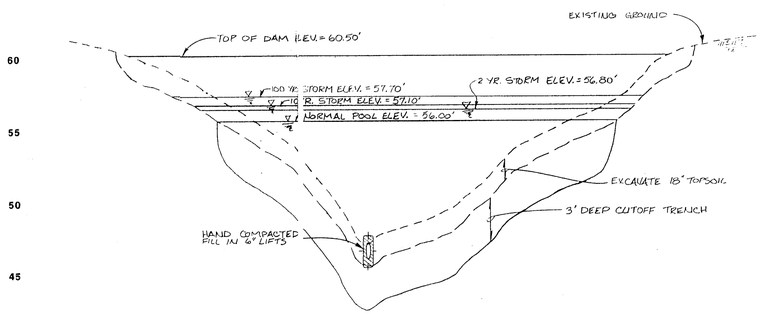
DAM I & III X-SECTION

130 x 15 x 3 = 1666 cy

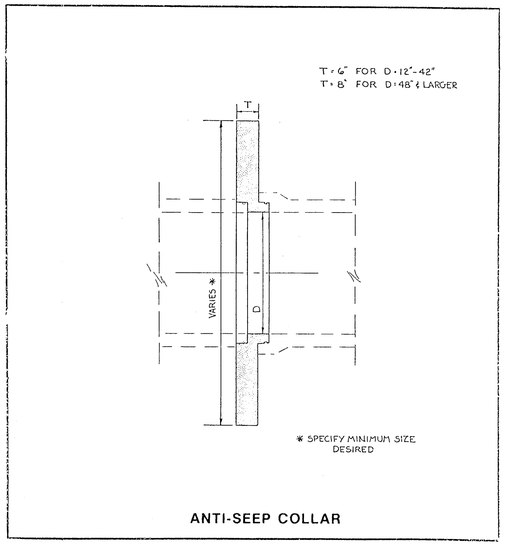
DAM II



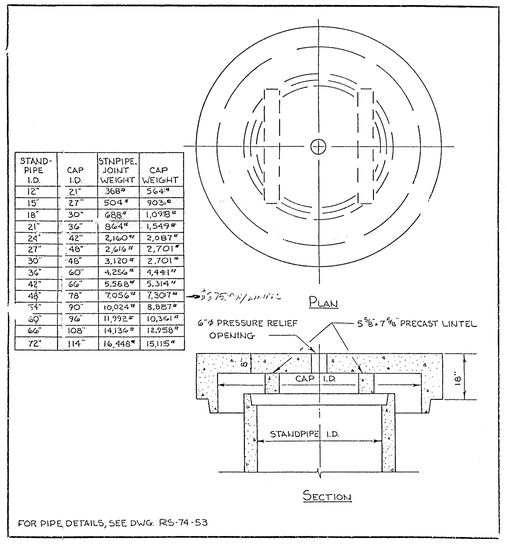
DAM II X-SECTION
SCALE: HORIZ. : 1" = 10'
VERT. : 1" = 5'



DAM II PROFILE
SCALE: HORIZ : 1" = 50'
VERT : 1" = 5'



ANTI-SEEP COLLAR



STAND-PIPE I.D.	CAP I.D.	STNPIPE. JOINT WEIGHT	CAP WEIGHT
12"	21"	368#	564#
15"	27"	504#	903.#
18"	30"	688#	1,098#
21"	39"	864#	1,549#
24"	42"	2,160#	2,087#
27"	48"	2,616#	2,701#
30"	48"	3,120#	2,701#
36"	60"	4,254#	4,481#
42"	66"	5,568#	5,314#
48"	78"	7,056#	7,307#
54"	90"	10,024#	8,987#
60"	96"	11,992#	10,361#
66"	108"	14,136#	12,958#
72"	114"	16,448#	15,115#

→ 3.75 cy/unit

PRECAST CONCRETE ANTI-VORTEX DEVICE

PRELIMINARY

NO.	DATE	REVISION / COMMENT / NOTE	BY

COMMONWEALTH OF VIRGINIA
JAMES H. BENNETT
No. 016125
PROFESSIONAL ENGINEER

AES, a professional corporation
1761 Jamestown Road
Williamsburg, Virginia 23185
804-253-0040
Engineering, Planning, Surveying

DAM DETAILS
FORD'S COLONY @ WILLIAMSBURG
SECTION XIII
OWNER/DEVELOPER : REALTEC, INCORPORATED
JAMES CITY COUNTY VIRGINIA

Designed	Drawn
SOW	SOW
Scale	Date
NOTED	NOV. 1988
Project No.	
5652	
Drawing No.	
28	

No.	DATE	REVISION / COMMENT / NOTE	BY

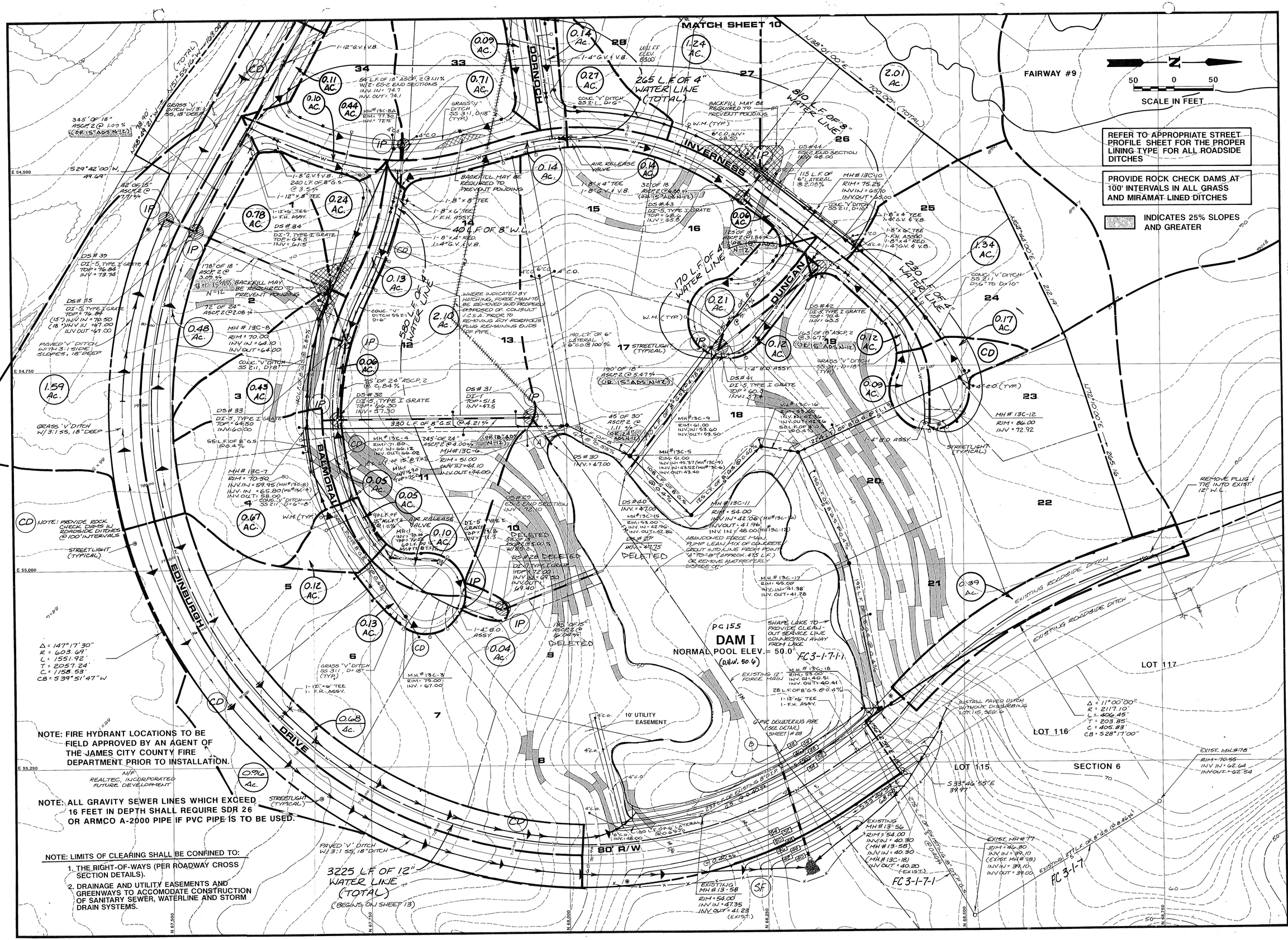
AES, a professional corporation
1761 Jamestown Road
Williamsburg, Virginia 23185
804-253-0040
Engineering, Planning, Surveying

OVERALL DRAINAGE PLAN
FORD'S COLONY @ WILLIAMSBURG
SECTION XIII

OWNER DEVELOPER: REALTEC INCORPORATED

BERKELEY DISTRICT — JAMES CITY COUNTY — VIRGINIA

Designed	Drawn
JHB	C.A.N.
Scale	Date
NOTED	NOV 1988
Project No.	
5652	
Drawing No.	
9	



No.	DATE	REVISION / COMMENT / NOTE	BY
4	1/9/04	ADDED PVC (CHANGED MATERIAL TO MULLINS ADS)	TJS
3	6/5/95	DELETED DR 21-25 & ADDED PVC TO SYSTEM ALONG SOUTH SIDE	SOW
2	5/5/94		
1	12/1/92	REVISED PER J.C.Co. COMMENTS	

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

COMMONWEALTH OF VIRGINIA
STEVEN D. WIGLEY
No. 019307
PROFESSIONAL ENGINEER

CONSULTING ENGINEERS

UTILITIES, DRAINAGE, AND EROSION & SEDIMENT CONTROL PLAN
FORD'S COLONY @ WILLIAMSBURG
SECTIONS XIII-C AND XIII-D

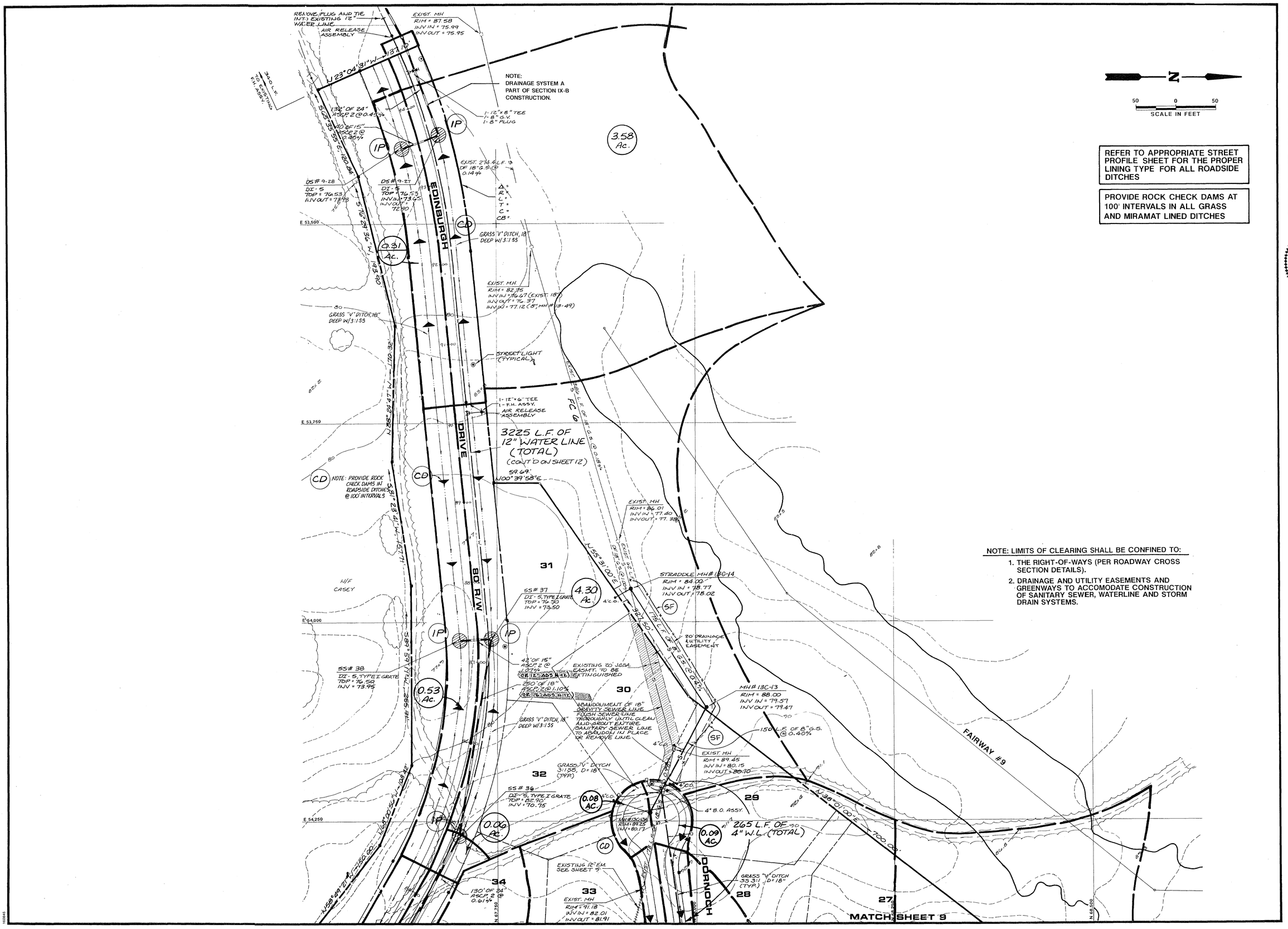
OWNER/DEVELOPER: REALTEC, INCORPORATED

JAMES CITY COUNTY VIRGINIA

Designed	Drawn
	RMS/EAW
Scale	Date
1"=50'	NOV,
Project No.	
5652	
Drawing No.	
9	

SP-84-92

PC155_FORDS_COLONY_GREENWAY_SEC_13C - 007



No.	DATE	REVISION / COMMENT / NOTE	BY
1	12/7/92	REVISED PER J.C.Co. COMMENTS	SGW

COMMONWEALTH OF VIRGINIA
STEVEN O. WIGLEY
No. 011500
PROFESSIONAL ENGINEER

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

CONSULTING ENGINEERS

UTILITIES, DRAINAGE, AND EROSION & SEDIMENT CONTROL PLAN
FORD'S COLONY @ WILLIAMSBURG
SECTIONS XIII-C AND XIII-D

OWNER/DEVELOPER: REALTEC, INCORPORATED

JAMES CITY COUNTY VIRGINIA

Designed	Drawn RMS/EAW
Scale 1"=50'	Date NOV., 1992
Project No. 5652	
Drawing No. 10	

160845

PC155_FORDS_COLONY_GREENWAY_SEC_13C - 008

163607

File - Fords Col - 13C

NOTE: ALL EROSION AND SEDIMENTATION CONTROL MEASURES (ST, DD, PS) ARE TO BE IN CONFORMANCE WITH J.C.C. AND STATE EROSION AND SEDIMENT CONTROL STANDARDS AND REGULATIONS

SEDIMENT TRAP

D.A. = 1.5 ACRE

STORAGE VOL. REQ'D = 1.5 × 134 = 201 C.Y.

WET STORAGE REQ'D = 100 C.Y.
WIDTH = 30 FT.
LENGTH = 45 FT.
DEPTH = 2 FT.

DRY STORAGE REQ'D = 100 C.Y.
WIDTH = 35 FT.
LENGTH = 50 FT.
DEPTH = 1.5 FT.

COMMONWEALTH OF VIRGINIA
STEVEN O. WIGLEY
No. 019307
PROFESSIONAL ENGINEER

N

NOTE: LOTS 21 TO 24 ARE OWNED BY REALTEC, INC.

NOTE: FILL MATERIAL ORIGINATED FROM THE EXCAVATION OF THE SECTION 13C LAKE OPERATION

APPROXIMATE WETLANDS

FILL AREA

ST

DD

PS

DD

RPA
RMA

30

R/W

JOHN POTT DRIVE

EXISTING LAKE
N.P. = 40

NOTE:
1. AVERAGE FILL DEPTH TO BE 10 FEET.
2. FILL SLOPES NOT TO EXCEED 3:1.

24
23
22
21
20
19
18

SECTION I
BLOCK F

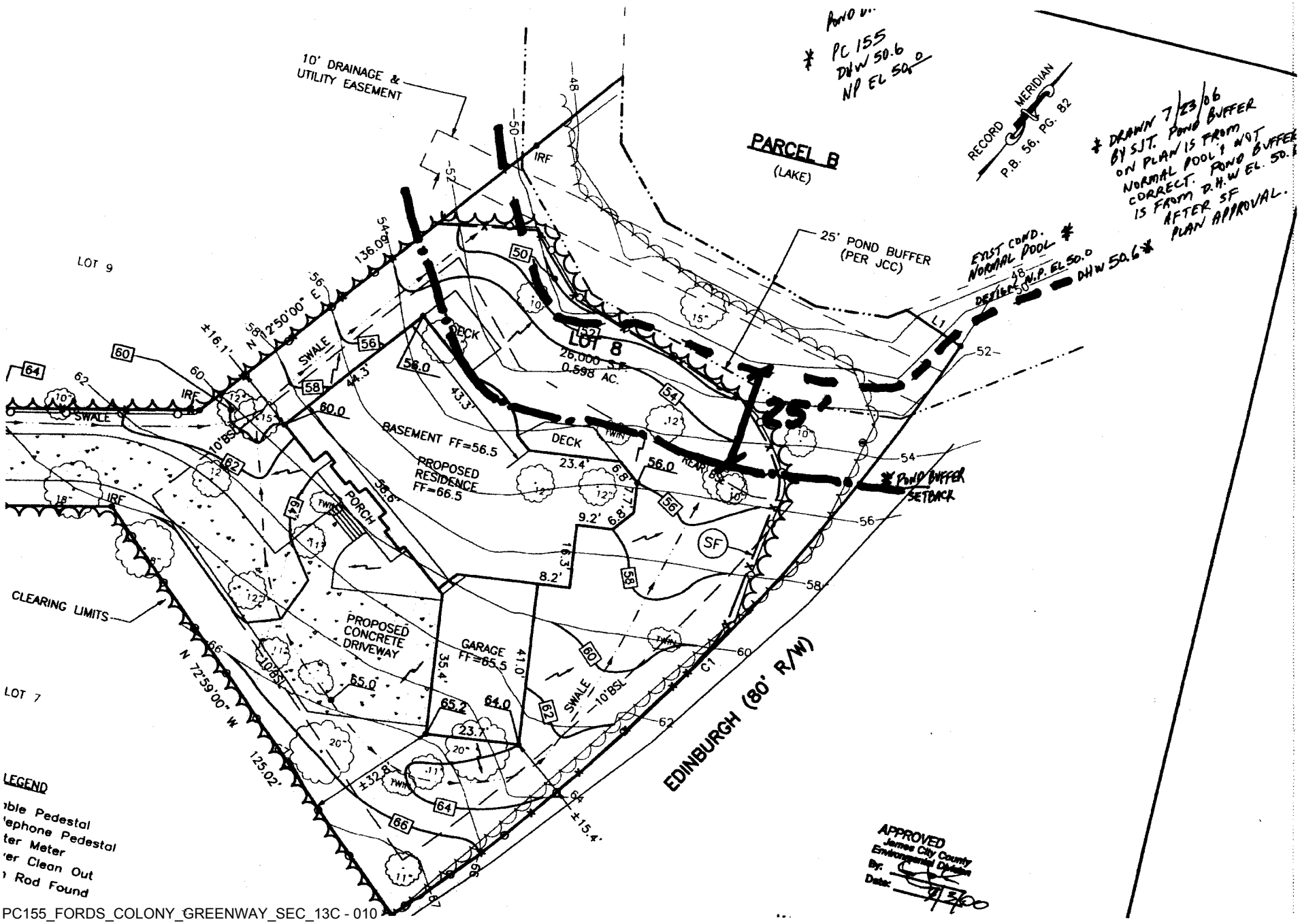
60
50

AES Consulting Engineers — Engineers, Surveyors, Planners — Williamsburg, Virginia

FORD'S COLONY, SECTION 13C
EROSION AND SEDIMENTATION CONTROL PLAN FOR FILL AREA ON JOHN POTT DRIVE

JAMES CITY COUNTY — REV. 5-9-94 — VIRGINIA

Scale: 1" = 100'	Ref.:	Date: 4-12-94	Job No.: 5652


10' DRAINAGE & UTILITY EASEMENT
PARCEL B
(LAKE)
RECORD MERIDIAN
P.B. 56, PG. 82
25' POND BUFFER (PER JCC)
LOT 9
LOT 8
26,000 S.F.
0.598 AC.
BASEMENT FF=56.5
PROPOSED RESIDENCE FF=66.5
DECK
PORCH
SWALE
CLEARING LIMITS
PROPOSED CONCRETE DRIVEWAY
GARAGE FF=65.5
LOT 7
N 72°59'00" W
125.02'
N 12°50'00" E
136.0'
EDINBURGH (80' R/W)
POND BUFFER SETBACK
EXIST COND. NORMAL POOL
W.P. EL 50.0
DHW 50.6
PC 155
DHW 50.6
NP EL 50.0
DRAWN 7/23/06 BY SJT. POND BUFFER ON PLAN IS FROM NORMAL POOL, NOT CORRECT. POND BUFFER IS FROM D.H.W EL. 50.6 AFTER SF PLAN APPROVAL.
APPROVED
James City County
Environmental Division
By:
Date:
LEGEND
Pedestal
Telephone Pedestal
Meter
Clean Out
Rod Found

163607

NOTE: ALL EROSION AND SEDIMENTATION CONTROL MEASURES (ST, DD, PS) ARE TO BE IN CONFORMANCE WITH J.C.C. AND STATE EROSION AND SEDIMENT CONTROL STANDARDS AND REGULATIONS.

SEDIMENT TRAP

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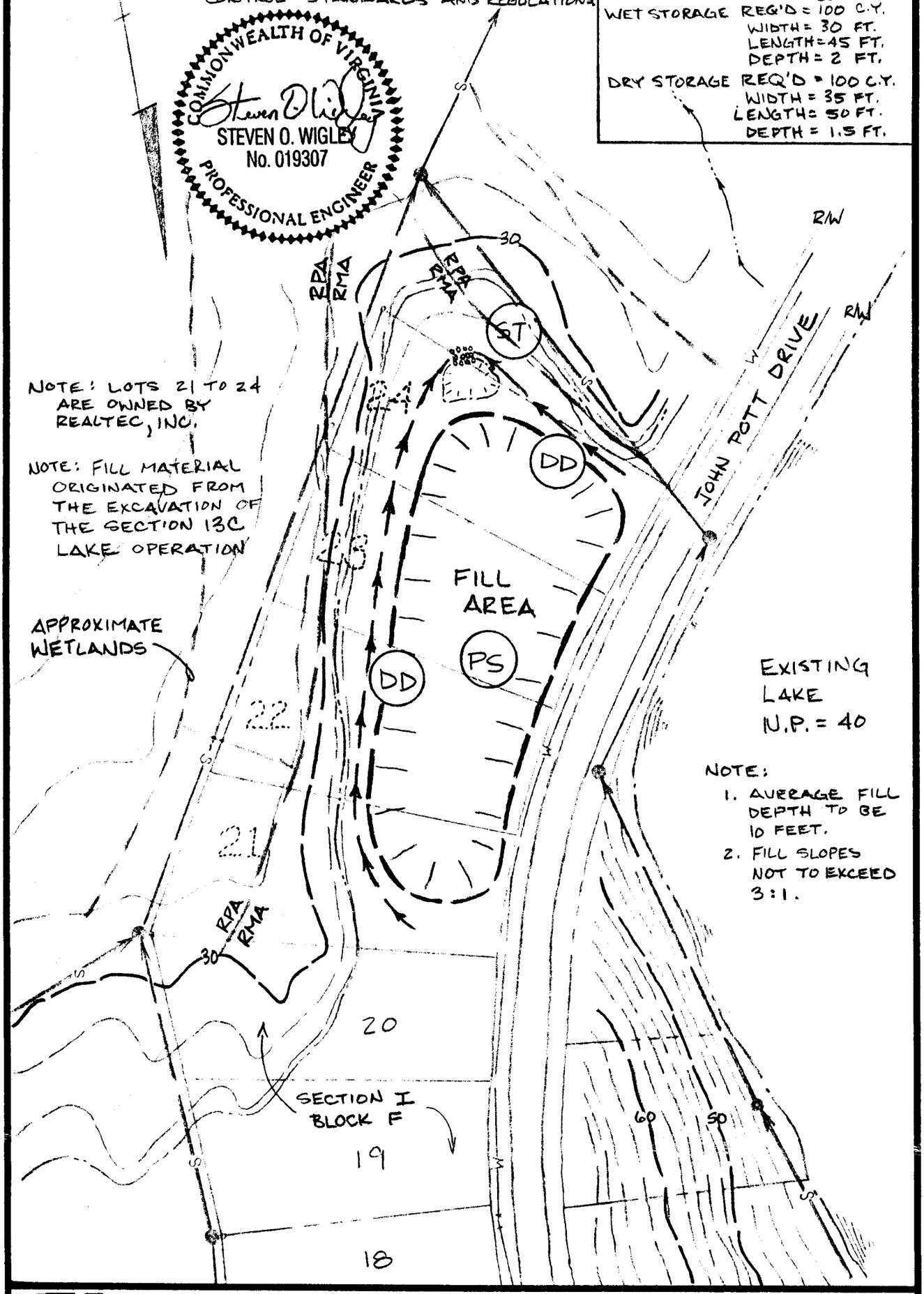
WIDTH = 35 FT.
LENGTH = 50 FT.
DEPTH = 1.5 FT.

COMMONWEALTH OF VIRGINIA
STEVEN O. WIGLEY
No. 019307
PROFESSIONAL ENGINEER



NOTE: LOTS 21 TO 24 ARE OWNED BY REALTEC, INC.

NOTE: FILL MATERIAL ORIGINATED FROM THE EXCAVATION OF THE SECTION 13C LAKE OPERATION

APPROXIMATE WETLANDS

NOTE:
1. AVERAGE FILL DEPTH TO BE 10 FEET.
2. FILL SLOPES NOT TO EXCEED 3:1.

AES Consulting Engineers — Engineers, Surveyors, Planners — Williamsburg, Virginia

FORD'S COLONY, SECTION 13C
EROSION AND SEDIMENTATION CONTROL PLAN FOR FILL AREA ON JOHN POTT DRIVE

JAMES CITY COUNTY — REV. 5-9-94 — VIRGINIA

Scale: 1" = 100'	Ref.:	Date: 4-12-94	Job No.: 5652

PC155_FORDS_COLONY_GREENWAY_SEC_13C - 011

Dam I Design Calculations (PC 155)

Pre-development

Area = 1,504,252 S.F. = 34.5 Ac.

C = 0.25 (Woodlands)

Overland Flow: L = 1750 ft. ΔElev. = 91.5 - 41 = 50.5' S = 2.89 %
(Fig 1.5.1.1 Seeyle)

T_c = 63 min.

I_2 = 1.5 in/hr., Q_2 = 12.9 cfs
I_{10} = 2.2 in/hr., Q_{10} = 19.0 cfs
I_{100} = 3.3 in/hr., Q_{100} = 28.5 cfs

Post-development

Based on storm sewer calculations for Rds E, F, G, H and Edinburgh Dr., Sec. 13 the time of concentration is 27 min

T_c = 27 min.

$$I = \frac{a}{b + T_c}$$

Norfolk Constants

a_2 = 126.3 a_{10} = 173.8 a_{100} = 260.3
b_2 = 17.3 a_{10} = 22.7 b_{100} = 25.8

I_2 = 2.85 in/hr.
I_{10} = 3.50 in/hr.
I_{100} = 4.93 in/hr.

Area = 1,414,804 S.F. = 32.5 Ac.

Critical Storm Duration For 100 yr. Post-Dev.

$$T_c = \sqrt{\frac{2CAa(b - t_c/4)}{q_o}} - b$$

given: C = 0.4 (Single Family)
A = 32.5 Ac.
t_c = 27 min
a_{100} = 260.3
b_{100} = 25.8
q_o = 9.5 cfs (allowable < 2 yr.)

$$T_c = \sqrt{\frac{2(0.4)32.5(260.3)(25.8 - 27/4)}{9.5}} - 25.8$$

T_c = 90.7 min.

3810600018

Peak Inflow

$$Q_o = CA\left(\frac{a}{b+T_c}\right) = 0.4(32.5)\left(\frac{260.3}{25.8+90.7}\right) = 29.0 \text{ cfs}$$

Required Storage for Critical 100 yr. Storm

$$V = \left(Q_o T_c + \frac{Q_o t_c}{4} - \frac{q_o T_c}{2} - \frac{3 q_o t_c}{4}\right) 60$$

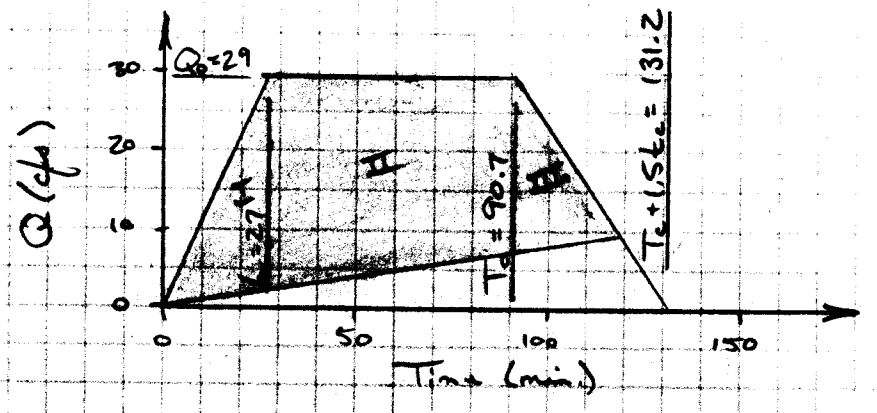
$$= \left(29.0(90.7) + \frac{29.0(27)}{4} - \frac{9.5(90.7)}{2} - \frac{3(9.5)27}{4}\right) 60$$

$$= 132{,}171 \text{ S.F.} = 3.03 \text{ Ac.-ft.}$$

Required Sediment Storage Vol.

$$V = 67(32.5)27 = 58792.5 \text{ ft}^3 = 1.35 \text{ Ac.-ft.}$$

check:



		Area
I	29(27)½ =	391.5
II	29(90.7-27) =	1847.3
III	29(131.2-90.7)½ =	587.25
		2826.05

Unshaded Area

$-9.5(131.2)½ = -623.20$

$$V = 2202.85(60) = 132171 \text{ S.F.}$$

- Critical Storm Duration For 2yr. Post-Dev.

$$T_c = \sqrt{\frac{2(0.4)32.5(126.3)(17.3 - 27/4)}{9.5}} - 17.3$$

$$= 43.1 \text{ min.}$$

given: $C = 0.4$ (Single Family)
$A = 32.5$ Ac.
$t_c = 27$ min.
$a_2 = 126.3$
$b_2 = 17.3$
$q_o = 9.5$ cfs

Peak Inflow

$$Q_o = CA\left(\frac{a}{b+T_c}\right) = 0.4(32.5)\left(\frac{126.3}{17.3+43.1}\right) = 27.2 \text{ cfs}$$

Required Storage for Critical 2yr. Storm

$$V = \left(27.2(43.1) + \frac{27.2(27)}{4} - \frac{9.5(43.1)}{2} - \frac{3(9.5)27}{4}\right)60$$

$$= 57529.2 \text{ ft}^3 = 1.32 \text{ Ac-ft.}$$

- Critical Storm Duration For 10yr Post-Dev.

$$T_c = \sqrt{\frac{2(0.4)32.5(173.8)(22.7 - 27/4)}{9.5}} - 22.7$$

$$= 64.4 \text{ min}$$

given: $C = 0.4$
$A = 32.5$ Ac.
$t_c = 27$ min.
$a_{10} = 173.8$
b_{10} 22.7
$q_o = 9.5$ cfs

Peak Inflow

$$Q_o = CA\left(\frac{a}{b+T_c}\right) = 0.4(32.5)\left(\frac{173.8}{22.7+64.4}\right) = 25.9$$

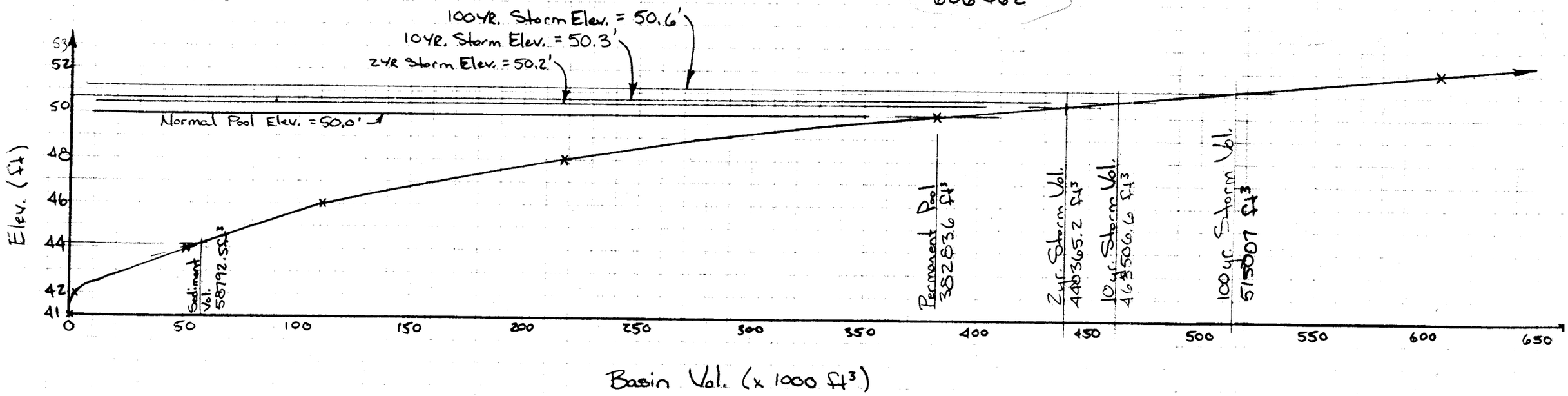
Required Storage for Critical 10yr Storm

$$V = \left(25.9(64.4) + \frac{25.9(27)}{4} - \frac{9.5(64.4)}{2} - \frac{3(9.5)27}{4}\right)60$$

$$= 80670.6 \text{ ft}^3 = 1.85 \text{ Ac.-ft.}$$

Dam I

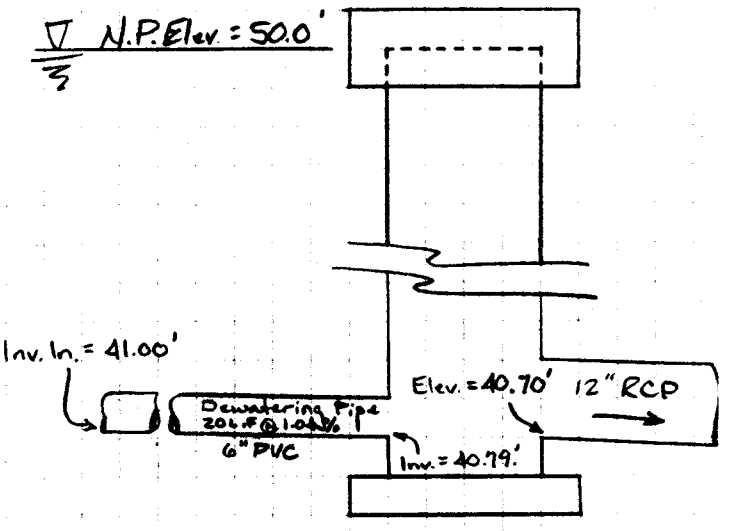
Dam I Elev. (ft)	Area (ft^2)	Avg. Area (ft^2)	Depth (ft)	Incremental Vol. (ft^3)	Σ Vol. (ft^3)
41	0				0
		2517	1	2517	
42	5034				2517
		24229	2	48458	
44	19195				50975
		29985	2	59970	
46	40775				110945
		53614.5	2	107229	
48	66454				218174
		82331	2	164662	
50	98208				382836
		111813	2	223626	
52	125418				606462



Outlet Structure Calculations

Outlet Structure to be of Precast concrete 4' dia. risers with antivortex device.

Storm Event	Pond Elev. (ft)
2yr.	50.2
10yr.	50.3
100yr.	50.6



Riser Inflow (Plate 1.26h)

Storm	Head (ft)	Q (cfs)
2yr.	0.2	3.0
10yr.	0.3	6.5
100yr.	0.6	18.0

Barrel Flow (Plate 1.26b) Use 12" RCP

L = 125 ft S = 1.04 % Inlet Controls

Storm	Head (ft)	Q (cfs)	Remarks
2yr.	1.2	2.90	(3.49)(Corr. Fac. = 0.83) [Table 1.26b V.DOT] & [Nomograph pg 28 (Step Sacyle)]
10yr.	3.0	4.62	
100yr.	9.3	8.15	Riser Full

Statistics

Pre-dev. Area = 1,504,252 S.F. = 34.5 Ac.
Post-dev. Area = 1,414,804 S.F. = 32.5 Ac.
N.P. Surface Area = 98208 S.F. = 2.25 Ac
Surface Area Ratio = 14.4 : 1

N.P. Elev. = 50.00'

Release Rate

STLINK

Q_2 = 2.9 cfs	.8'	$Q_{2\,pre}$ = 9.4	$Q_{2\,post}$ = 23.1	$Q_{2\,rel}$ = 3.5 cfs	V_s = 1.9 acft.
Q_{10} = 4.62 cfs	1.6'	$Q_{10\,pre}$ = 24.6	$Q_{10\,post}$ = 45.6	$Q_{10\,rel}$ = 6.4 cfs	V_s = 4.1 acft
Q_{100} = 8.15 cfs	2.0'	$Q_{100\,pre}$ = 53.7 cfs	$Q_{100\,post}$ = 82.8	$Q_{100\,rel}$ = 7.7 cfs	V_s = 5.1 "

S1 → 10
S2 → 10.5
S3 → 11
S4 → 11.5
S5 → 11.7
S6

ANTI-SEEP COLLAR DESIGN

16. Depth of water at principal spillway crest (Y) = 9.3 ft.

    Slope of upstream face of embankment (Z) = 3 :1

    Slope of principal spillway barrel (S_B) = 1.04 %

    Length of barrel in saturated zone (L_S) = 66 ft.
    (From Plate 1.26k, page III-81)

17. Number of collars req'd = 3 dimensions = 3.2' x 3.2'
    (From Plate 1.26l, page III-82)

FINAL DESIGN ELEVATIONS

18. Top of Dam = 55.0' (Rdwy Elev.) Design High Water 50.0'.

    Principal Spillway Crest 50.0'.

PC155_FORDS_COLONY_GREENWAY_SEC_13C - 017

Dam II
Design Calculations

Pre-development

Area = 2081126 S.F. = 47.78 Ac.

C = 0.25 (Woodlands)

Overland Flow: L = 1030 ft. ΔElev. = 87.8 - 66 = 21.8 S = 2.12%
(Fig. 1.5.1.1 Seelye) T_c = 35 min.

Swale/Channel Flow: L = 900 ft. ΔElev. = 66 - 47 = 19 ft S = 2.11%
(Fig 1.5.1.2 Seelye) T_c = 7 min.

Total T_c = 42 min

I_2 = 2.1 in/hr., Q_2 = 25.1 cfs
I_{10} = 2.9 in/hr., Q_{10} = 34.6 cfs
I_{100} = 4.3 in/hr., Q_{100} = 51.4 cfs

Post-development

Time of concentration is based on the longest length of travel for any one "particle" of water and is that overland flow time associated with the path traveling from lot 25 Sec. 13 across the 9th fairway to the pond in a well defined grassed surface

L = 1150 ft. ΔElev. = 89.1 - 59 = 30.1 ft S = 2.6 %
T_c = (7 min.) x 2 = 14 min
(fig. 1.5.1.2 Seelye)

$$I = \frac{a}{b + t_c}$$

Norfolk Constants
a_2 = 126.3, a_{10} = 173.8 a_{100} = 260.3
b_2 = 17.3, b_{10} = 22.7 b_{100} = 25.8

I_2 = 4.0 in/hr.
I_{10} = 4.7 in/hr.
I_{100} = 6.5 in/hr.

Area = 1,981,523 S.F. = 45.5 Ac.

Critical Storm Duration For 100 yr. Post-Dev.

$$T_c = \sqrt{\frac{2CA_a(b - t_c/4)}{q_o}} - b$$

given: $C = 0.4$ (Single family)
$A = 45.5$ Ac.
$t_c = 14$ min.
$a_{100} = 260.3$
$b_{100} = 25.8$
$q_o = 5$ cfs (allowable < 2yr.)

$$T_c = \sqrt{\frac{2(0.4)45.5(260.3)(25.8 - 14/4)}{5}} - 25.8$$

$T_c = 180$ min.

Peak Inflow

$$Q_o = CA\left(\frac{a}{b+T_c}\right) = 0.4(45.5)\left(\frac{260.3}{25.8+180}\right) = 23.0 \text{ cfs}$$

Required Storage for Critical 100yr. Storm

$$V = \left(Q_oT_o + \frac{Q_ot_c}{4} - \frac{q_oT_c}{2} - \frac{3q_ot_c}{4}\right)60$$

$$= \left(23(180) + \frac{23(14)}{4} - \frac{5(180)}{2} - \frac{3(5)14}{4}\right)60$$

$V = 223{,}080$ ft³ $= 5.12$ Ac.-ft.

Required Sediment Storage Vol.

$V = 67(45.5)(27) = 82309.5$ ft³ $= 1.89$ Ac.-ft.

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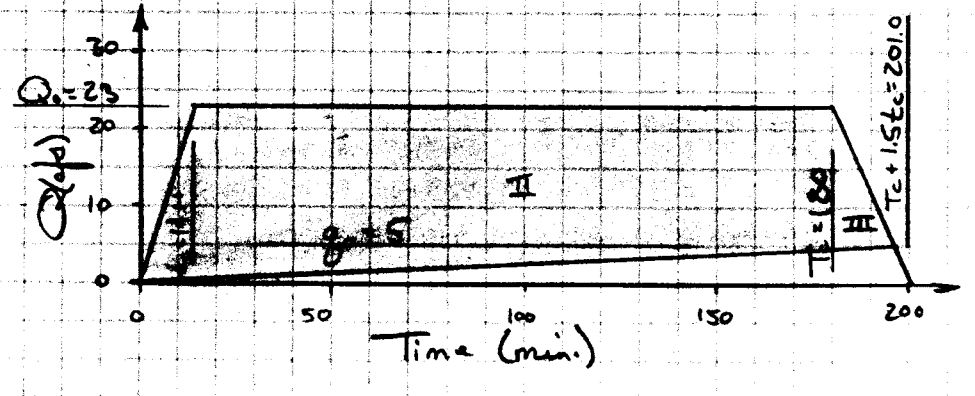


	Area	
I	$23(14)\frac{1}{2}$	= 161
II	$23(180-14)$	= 3818
III	$23(201-180)\frac{1}{2}$	= 241.5
		4220.5

Unshaded Area $= -5(201)\frac{1}{2} = -502.5$

$V = 3718.0(60) = 223{,}080.0$ ft³

Critical Storm Duration For 2yr. Post-Dev.

$$T_c = \sqrt{\frac{2CA_a(b - t_c/4)}{q_o}} - b$$

given: $C = 0.4$ (Single Family)
$A = 45.5$ Ac
$t_c = 14$ min
$a_2 = 126.3$
$b_2 = 17.3$
$q_o = 5$ cfs (allowable <2yr)

$$T_c = \sqrt{\frac{2(0.4)45.5(126.3)(17.3 - 14/4)}{5}} - 17.3$$

$T_c = 95.3$ min.

Peak Inflow

$$Q_o = CA\left(\frac{a}{b + T_c}\right) = 0.4(45.5)\left(\frac{126.3}{17.3 + 95.3}\right) = 20.4 \text{ cfs}$$

Required Storage for Critical 2yr. Storm

$$V = \left(Q_o T_c + \frac{Q_o t_c}{4} - \frac{q_o T_c}{2} - \frac{3 q_o t_c}{4}\right)60$$

$$= \left(20.4(95.3) + \frac{20.4(14)}{4} - \frac{5(95.3)}{2} - \frac{3(5)14}{4}\right)60$$

$V = 103{,}486.2$ ft^3 $= 2.38$ Ac.-ft.

Critical Storm Duration For 10yr. Post-Dev.

$$T_c = \sqrt{\frac{2(0.4)45.5(173.8)(22.7 - 14/4)}{5}} - 22.7$$

$= 133.2$ min.

given: $C = 0.4$
$A = 45.5$ Ac
$t_c = 14$ min
$a_{10} = 173.8$
$b_{10} = 22.7$
$q_o = 5$ cfs

Peak Inflow

$$Q_o = 0.4(45.5)\left(\frac{173.8}{22.7 + 133.2}\right) = 20.3 \text{ cfs}$$

Required Storage for Critical 10yr. Storm

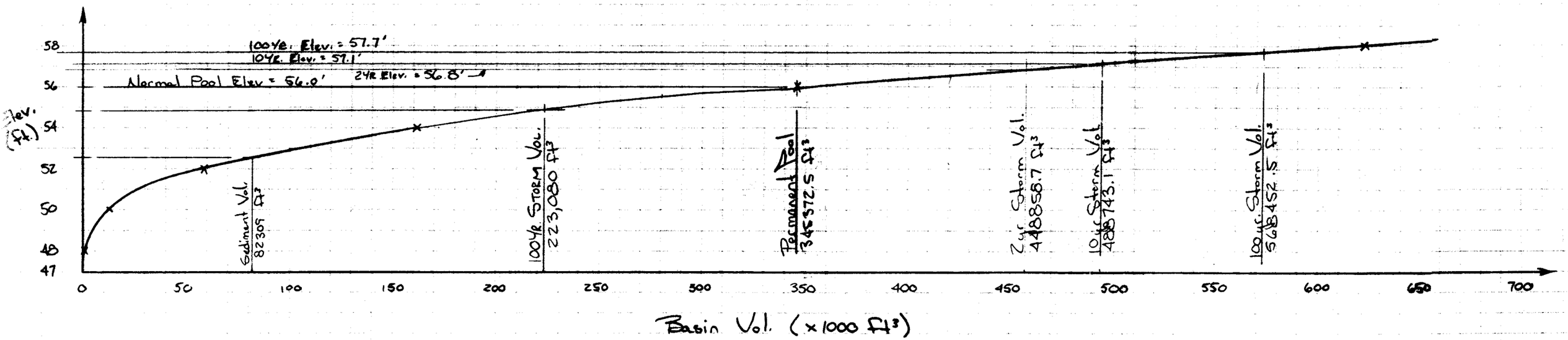
$$V = \left(20.3(133.2) + \frac{20.3(14)}{4} - \frac{5(133.2)}{2} - \frac{3(5)14}{4}\right)60$$

$V = 143{,}370.6$ ft^3 $= 3.29$ Ac.-ft.

Dam II

Dam II
Dt. 4-6

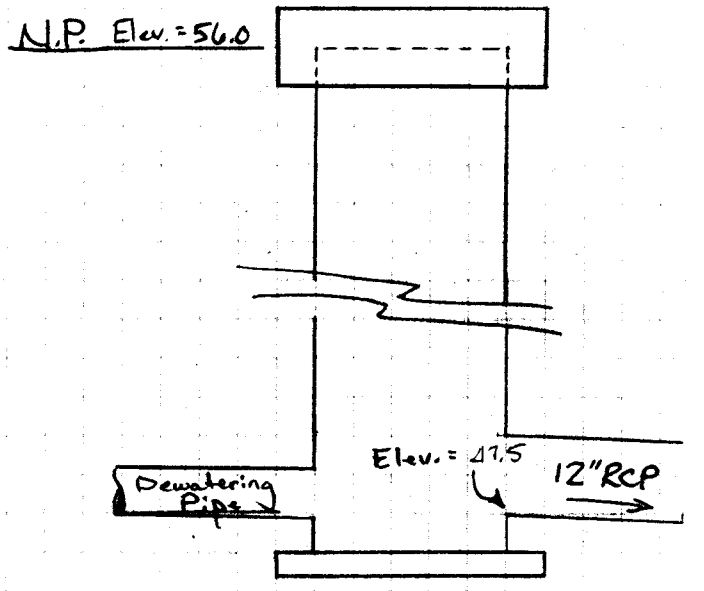
Elev. (ft.)	Area (ft^2)	Avg. Area (ft^2)	Depth (ft)	Incremental Vol. (ft^3)	ΣVol. (ft^3)
47	0				0
		560.5	1	560.5	
48	1121				560.5
		6221.0	2	12442	
50	11321				13002.5
		22860.0	2	45720	
52	34399				58722.5
		51596	2	103192	
54	68793				161914.5
		91729	2	183458	
56	114665				345372.5
		138521.5	2	277043	483894
58	162378				622415.5



Outlet Struc. Calculations

Outlet structure to be of Precast Conc 4' dia. Risers with antivortex device

Storm Event	Pond Elev. (ft)
2yr	56.8
10yr	57.1
100yr	57.7



Riser Inflow (Plate 1.26h)

Storm	Head (ft)	Q (cfs)
2yr.	0.8	28.0
10yr.	1.1	45.0
100yr.	1.7	80.0

Barrel Flow (Plate 1.26b) Use a 12" RCP

L = 80 ft. @ 1.04 %

During all storm events the riser will eventually fill up, since the release barrel is 12", and the head on the barrel will be 8.5'. L = 70 ft.

Storm	Head (ft)	Q (cfs)	Remarks
2yr.	9.3	9.37	(9.76)(Corr. fac. = 0.96) [Table 1.26b VDOT] & [Nomograph]
10yr.	9.6	9.60	(9.98)(0.96)
100yr.	10.2	9.90	(10.30)(0.96)

Statistics

Pre-dev. Area = 2,081,126 S.F. = 47.8 Ac.
Post-dev. Area = 1,981,523 S.F. = 45.5 Ac.
N.P. Surface Area = 114,665 S.F. = 2.6 Ac.
Surface Area Ratio = 17.5 : 1

N.P. Elev. = 56.0
Release Rates
Q_2 = 9.37 cfs
Q_{10} = 9.60 cfs
Q_{100} = 9.90 cfs

	Q_{PRE}	Q_{POST}	Q_{REL}	V_S	MAX D
2 yr	15.9	37.1	5.5	3.0	1.0
10 yr	38.7	70.0	9.1	6.2	1.9
100 yr	81.6	123.9	11.9	9.4	3.0

56 - 0
57 - 10
58 - 10.5
59 - 11
60 - 11.5

Dam II

ANTI-SEEP COLLAR DESIGN

16. Depth of water at principal spillway crest (Y) = 8.5 ft.

    Slope of upstream face of embankment (Z) = 3 :1

    Slope of principal spillway barrel (S_B) = 1.04 %

    Length of barrel in saturated zone (L_s) = 61 ft.
    (From Plate 1.26k, page III-81)

17. Number of collars req'd = 3 dimensions = 3.0x3.0'
    (From Plate 1.26l, page III-82)

FINAL DESIGN ELEVATIONS

18. Top of Dam = 60.5'. Design High Water 56.0'.

    Principal Spillway Crest 56.0'.

Dam III
Design Calculations

Pre-development

Area = 1,703,131 S.F. = 39.10 Ac.

C = 0.25 (Woodlands)

Overland Flow: L = 1000 ft. ΔElev. = 90.1 - 46 = 44.1 S = 4.41%
(Fig. 1.5.1.1 Seeyle) T_c = 30 min.

Swale/Channel Flow: L = 1150 ft. ΔElev. = 46 - 38 = 8.0 S = 0.7 %
(Fig. 1.5.1.2 Seeyle) T_c = 12 min.

Total T_c = 42 min.

I_2 = 2.1 in/hr., Q_2 = 20.5 cfs
I_{10} = 2.9 in/hr., Q_{10} = 28.3 cfs
I_{100} = 4.3 in/hr., Q_{100} = 42.0 cfs

Post-development

Based on storm sewer calculations for Rd. B, Sec. 13 the time of concentration is 13 min.

T_c = 13 min.

$$I = \frac{a}{b+T_c}$$

Norfolk Constants
a_2 = 126.3 a_{10} = 173.8 a_{100} = 260.3
b_2 = 17.3 b_{10} = 22.7 b_{100} = 25.8

I_2 = 4.2 in/hr.
I_{10} = 4.9 in/hr.
I_{100} = 6.7 in/hr.

Area = 2,022,582 S.F. = 46.4 Ac.

Critical Storm Duration For 100 yr. Post-Dev.

$$T_c = \sqrt{\frac{2CA_a(b - t_c/4)}{q_o}} - b$$

given: C = 0.4 (Single Family)
A = 46.4 Ac.
t_c = 13 min.
a_{100} = 260.3
b_{100} = 25.8
q_o = 9.5 cfs (allowable < 2yr.) (based on Dam II release rate)

$$T_c = \sqrt{\frac{2(0.4)46.4(260.3)(25.8 - 13/4)}{9.5}} - 25.8$$

T_c = 125.6 min.

Peak Inflow

$$Q_o = CA\left(\frac{a}{b+T_c}\right) = 0.4(46.4)\left(\frac{260.3}{25.8+125.6}\right) = 31.9 \text{ cfs}$$

Dam II Outflow = 10.3 cfs

Peak Inflow, Q_o = 42.2 cfs

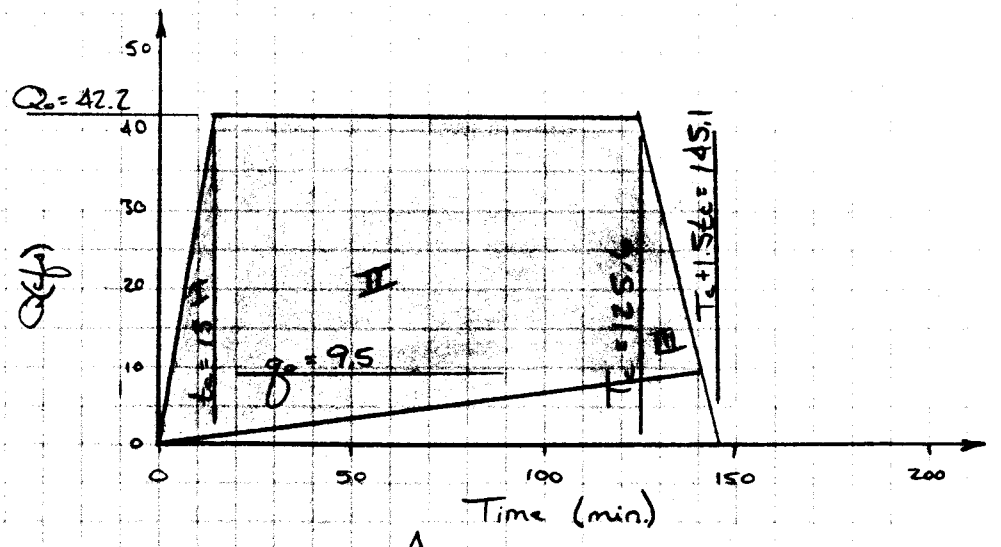
Required Storage for Critical 100 yr. Storm

$$V = \left(Q_o T_c + \frac{Q_o t_c}{4} - \frac{q_o T_c}{2} - \frac{3 q_o t_c}{4}\right) 60$$

$$= \left(42.2(125.6) + \frac{42.2(13)}{4} - \frac{9.5(125.6)}{2} - \frac{3(9.5)13}{4}\right) 60$$

$$= 284{,}894.7 \text{ ft}^3 = 6.54 \text{ Ac.-ft.}$$

check:



	Area	
I	42.2(13)½ =	274.3
II	42.2(125.6-13) =	4751.72
III	42.2(145.1-125.6)½ =	411.45
		5437.47

Unshaded Area = -9.5(145.1)½ = -689.23

V = 4748.25(60) = 284,894.7 ft³ ✓

Required Sediment Storage Vol.

$$V = 67(46.4)27 = 83937.6 \text{ ft}^3 = 1.93 \text{ Ac.-ft.}$$

- Critical Storm Duration For 2yr. Post-Dev.

$$T_c = \sqrt{\frac{2(0.4)46.4(126.3)(17.3 - 13/4)}{9.5}} - 17.3$$

given: $C = 0.4$
$A = 46.4$ Ac
$t_c = 13$ min
$a_2 = 126.3$
$b_2 = 17.3$
$q_o = 9.5$ cfs

$T_c = 65.0$ min.

Peak Inflow

$$Q_o = CA\left(\frac{a}{b+T_c}\right) = 0.4(46.4)\left(\frac{126.3}{17.3+65}\right) = 28.5 \text{ cfs}$$

Dam II Outflow = 9.76 cfs

Peak Inflow, Q_o = 38.3 cfs

Required Storage for Critical 2yr. Storm

$$V = \left(38.3(65) + \frac{38.3(13)}{4} - \frac{9.5(65)}{2} - \frac{3(9.5)13}{4}\right)60$$

$V = 132{,}756$ ft^3 = 3.05 Ac.-ft.

- Critical Storm Duration For 10yr. Post-Dev.

$$T_c = \sqrt{\frac{2(0.4)46.4(173.8)(22.7 - 13/4)}{9.5}} - 22.7$$

given: $C = 0.4$
$A = 46.4$ Ac.
$t_c = 13$ min.
$a_{10} = 173.8$
$b_{10} = 22.7$
$q_o = 9.5$ cfs

$T_c = 92.2$ min

Peak Inflow

$$Q_o = 0.4(46.4)\left(\frac{173.8}{22.7+92.2}\right) = 28.1 \text{ cfs}$$

Dam II Outflow = 9.90 cfs

Peak Inflow, Q_o = 38.1 cfs

Required Storage for Critical 10yr Storm

$$V = \left(38.1(92.2) + \frac{38.1(13)}{4} - \frac{9.5(92.2)}{2} - \frac{3(9.5)13}{4}\right)60$$

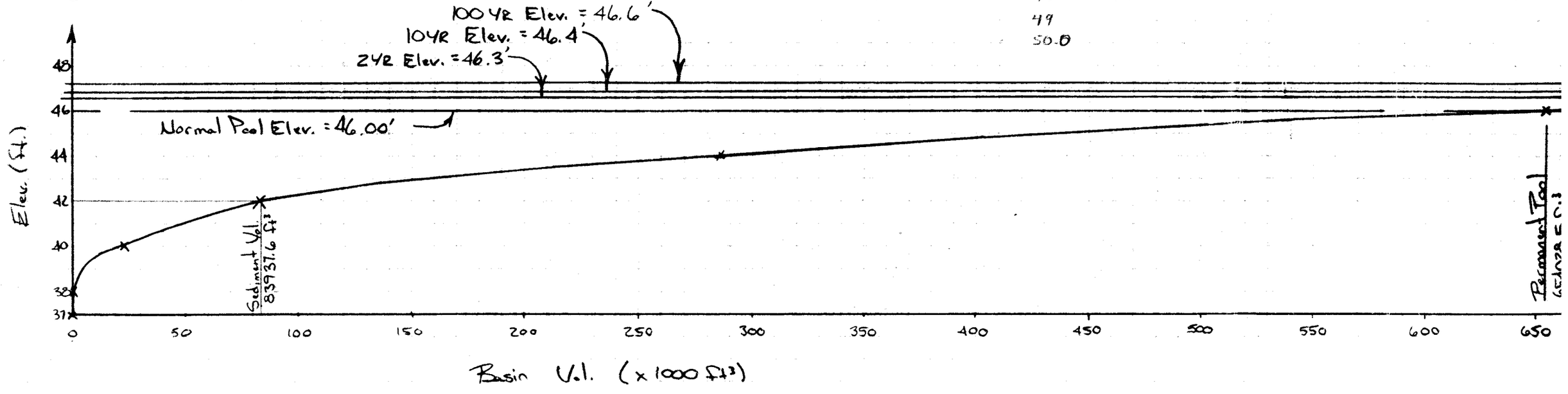
$V = 186{,}364.2$ ft^3 = 4.28 Ac.-ft.

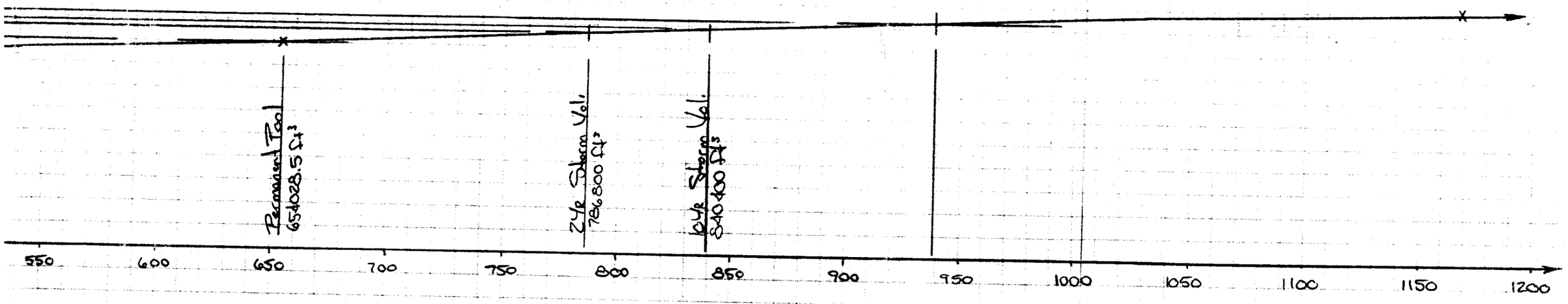
Dam III 4 of 6

Dam III

Elev. (ft)	Area (ft²)	Avg. Area (ft²)	Depth (ft)	Incremental Vol. (ft³)	Σ Vol. (ft³)
37	0				0
		633.5	1	633.5	
38	1267				633.5
		6169.0	2	12338.0	
40	11071				12971.5
		34964.5	2	69929.0	
42	58858				82900.5
		101573.0	2	203146.0	
44	144288				286046.5
		183991.0	2	367982.0	
46	223694				654028.5
		257400.5	2	514801.0	
48	291107				1168829.5

ELEV	STOR	DIS
46	0	
~~46.5~~	2.5	
47	5.5	
~~47.5~~	8.6	
48.0	11.8	
49		
50.0		

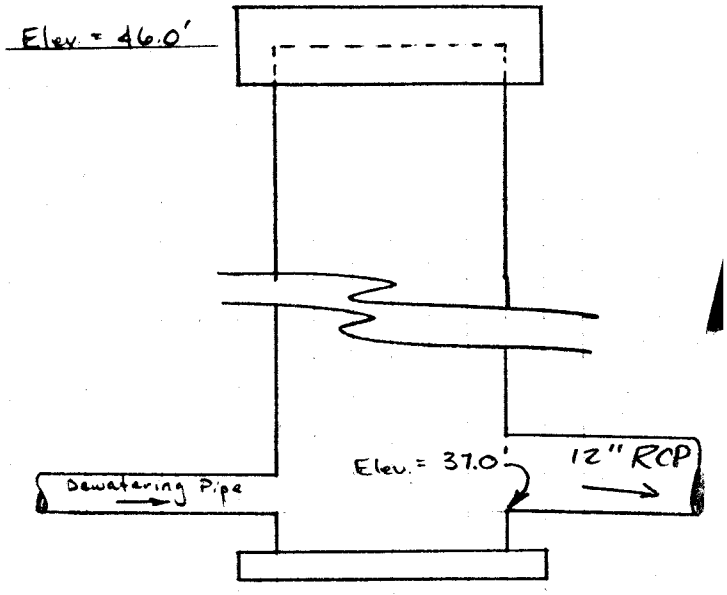



Permanent Pool
654028.5 ft³
24hr Storm Vol.
786,800 ft³
10yr Storm Vol.
840400 ft³
550
600
650
700
750
800
850
900
950
1000
1050
1100
1150
1200

Outlet Structure Calculations

Outlet structure to be of Precast 4' dia. Risers with antivortex device.

Storm Event	Pond Elev. (ft)
2yr.	46.3'
10yr.	46.4'
100yr.	46.6'



Riser Inflow (Plate 1.26h)

Storm	Head (ft)	Q(cfs)
2yr.	0.3	6.5
10yr.	0.4	10.0
100yr.	0.6	18.0

Barrel Flow (Plate 1.26b) Use a 12" RCP

L = 130 ft. @ 1.04 %

Inlet Control

2yr Q = 6.5 cfs HW/D = 3.1 HW = 3.1 ft.

Outlet Control

2yr. Q = 6.5 cfs

$HW = H + h_o - LS_o$

$H = 0.3'$

$h_o = \frac{d_c + D}{2} = \frac{0.96 + 1}{2} = 0.98'$

$LS_o = (130\ ft.)(0.0208) = 2.7'$

$HW = 0.3 + 0.98 - 2.7 = -1.42$

Inlet Controls

Storm	Head (ft.)	Q (cfs)	Remarks
2yr.	3.1	4.65	(5.67)(0.82)
10yr.	6.5	6.72	(8.2)(Corr. Fac. = .82)
100yr.	9.0	7.91	Riser Full

Q (Table 1.26b VDOT) & Head (Nomograph Pg. 22(5-7) by Sakyle)

Statistics

Pre-dev. Area = 1,703,131 S.F. = 39.1 Ac.
Post-dev. Area = 2,022,582 S.F. = 46.4 Ac.
N.P. Surface Area = 223694 S.F. = 5.1 Ac
Surface Area Ratio = 9:1
N.P. Elev. = 46.0'
Release Rates
Q_2 = 4.65 cfs
Q_{10} = 6.72 cfs

	Q_{pre}	Q_{post}	Q_{rel}	V_s	Max D
2YR	15.0	32.8	3.1	2.9	0.6
10YR	35.9	61.5	5.6	5.9	1.1
100YR	74.9	108.3	9.0	11.2	1.9

ANTI-SEEP COLLAR DESIGN

16. Depth of water at principal spillway crest (Y) = 9.0 ft.

    Slope of upstream face of embankment (Z) = 3 :1

    Slope of principal spillway barrel (S_B) = 1.04 %

    Length of barrel in saturated zone (L_S) = 65 ft.
    (From Plate 1.26k, page III-81)

17. Number of collars req'd = 3 dimensions = 3.1' x 3.1'
    (From Plate 1.26l, page III-82)

FINAL DESIGN ELEVATIONS

18. Top of Dam = 53.0' (Rd-way Elev) Design High Water 46.0'.

    Principal Spillway Crest 46.0'.

ROADSIDE DITCH DESIGN

PROJECT: FORD'S COLONY, SEC. 13
DATE: 11/17/88
PROJ. #: 5652

T_c = 5 MIN I_{10} = 7.1 IN/HR C = 0.50
I_2 = 5.7 IN/HR

NAME OF STREET: EDINBURGH DRIVE

FROM STATION (DIRECTION	TO STATION OF FLOW)	LEFT OR RIGHT	A (AC.)	Q_2 = CI_2A CFS	CUMULA. Q_2 CFS	AVG SLOPE FT/FT	ACTUAL VEL_2 FPS	ALLOWABLE VEL FPS	LINING TYPE	Q_{10} = $CI_{10}A$ CFS	CUM Q_{10} CFS	ACT. VEL_{10} FPS	DEPTH OF $FLOW_{10}$ IN.	REMARKS
77+50	77+00	L	0.05	0.14	0.14	0.0050	0.65	2.5	GRASS	0.17	0.17	.7	4	
77+50	77+00	R	0.05	0.14	0.14	0.0050	0.65	2.5	GRASS	0.17	0.17	.7	4	
77+00	76+00	L	0.09	0.26	0.4	0.01	1.1	2.5	GRASS	0.49	0.66	1.2	5	
77+00	76+00	R	0.09	0.26	0.4	0.01	1.1	2.5	GRASS	0.49	0.66	1.2	5	
76+00	75+00	L	0.10	0.29	0.69	0.0175	1.6	2.5	GRASS	0.86	1.52	2	6	
76+00	75+00	R	0.09	0.26	0.66	0.0175	1.6	2.5	GRASS	0.82	1.18	1.8	6	
75+00	74+00	L	0.27	0.77	1.46	0.0325	5.6		PAVED	1.82	3.34	2.2	5	
75+00	74+00	R	0.09	0.26	0.92	0.0325	5.4		PAVED	1.15	2.33	2	4	
74+00	73+00	L	0.18	0.51	1.97	0.04	6.8		PAVED	2.45	5.79	9	6	
74+00	73+00	R	0.09	0.26	1.18	0.04	6		PAVED	1.47	3.8	6.5	3	
73+00	72+00	L	0.09	0.26	2.23	0.0437	6.7		PAVED	2.78	8.6	10.5	6	
73+00	72+00	R	0.09	0.26	1.44	0.0437	6.5		PAVED	1.79	5.6	9.5	5.5	
72+00	71+00	L	0.09	0.26	2.49	0.0513	6.5		PAVED	3.1	11.7	12	7	
72+00	71+00	R	0.09	0.26	1.70	0.0513	7		PAVED	2.1	7.7	10.5	6	
71+00	70+00	L	0.09	0.26	2.75	0.055	8.5		PAVED	3.4	15.1	13	7.5	
71+00	70+00	R	0.09	0.26	1.96	0.055	8		PAVED	2.4	10.1	12	6	
70+00	OUTLET STR.	L	0.36	1.03	3.78	0.135	12		PAVED	4.7	19.8	19	7	
70+00	LAKE	R	0.08	0.23	2.19	0.0714	8.5		PAVED	2.7	12.8	13	7	

ROADSIDE DITCH DESIGN

PROJECT Ford's Colony, Sec. 13
DATE 11/17/88
PROJ. # 5652

T_c = 5 min I_{10} = 7.1 in/hr C = 0.50
I_2 = 5.7 in/hr

NAME OF STREET Edinburgh Drive

FROM STATION (DIRECTION	TO STATION OF FLOW)	LEFT OR RIGHT	A (Ac.)	$Q_2 = CI_2A$ CFS	CUMULA. Q_2 CFS	AVG SLOPE FT/FT	ACTUAL VEL_2 FPS	ALLOWABLE VEL FPS	LINING TYPE	$Q_{10} = CI_{10}A$ CFS	CUM Q_{10} CFS	ACT. Vel_{10} FPS	DEPTH OF FLOW/10 IN.	REMARKS
77+50	78+00	L	0.05	0.14	0.14	0.005	0.6	2.5	GRASS	0.17	0.17	.7	3	
77+50	78+00	R	0.05	0.14	0.14	0.005	1.6	2.5	GRASS	0.17	0.17	.7	3	
78+00	79+00	L	0.13	0.37	0.51	0.02	1.6	2.5	GRASS	0.46	0.64	1.6	4	
78+00	79+00	R	0.09	0.26	0.4	0.02	1.4	2.5	GRASS	0.32	0.5	1.5	4	
79+00	80+00	L	0.67	1.91	2.4	0.03	6.2		PAVED	2.4	3	7	5	
79+00	80+00	R	0.09	0.26	0.7	0.03	1.8	2.5	GRASS	0.33	0.9	2.1	5	
80+00	81+00	L	0.32	0.91	3.3	0.0169	5.5		PAVED	1.13	4.1	6	6	
80+00	81+00	R	0.09	0.26	0.9	0.0169	1.7	2.5	GRASS	0.32	1.1	1.8	6	
81+00	DS #43	L	0.02	0.06	3.4	0.0120	5		PAVED	0.07	4.2	5	6	
81+00	DS #36	R	0.08	0.23	1.15	0.0120	1.5	2.5	GRASS	0.29	1.4	1.6	7	
84+25	83+00	L	0.11	0.31	0.31	0.0100	1	2.5	GRASS	0.39	0.39	1.1	4	
84+25	DS #36a	R	0.07	0.20	0.20	0.0115	0.9	2.5	GRASS	0.25	0.25	1.0	3	
83+00	82+00	L	0.10	0.29	0.60	0.0288	1.7	2.5	GRASS	0.36	0.75	1.3	[illegible]	
83+00	82+00	R	0.07	0.20	0.20	0.0288	1.4	2.5	GRASS	0.25	0.25	1.0	3	
82+00	DS #43	L	0.19	0.54	1.14	0.0317	2.1	2.5	GRASS	0.67	1.42	2.4	5.[illegible]	
82+00	DS #36	R	0.08	0.23	0.43	0.0317	1.7	2.5	GRASS	0.28	0.53	1.8	4	

ROADSIDE DITCH DESIGN

PROJECT Ford's Colony Sec 13
DATE 11/17/88
PROJ. # 5652

Tc = 5 min I_{10} = 6.7 in/hr C = SEE REMARKS
I_2 = 4.75 in/hr

NAME OF STREET EDINBURGH DRIVE

FROM STATION (DIRECTION	TO STATION OF FLOW)	LEFT OR RIGHT	A (Ac.)	$Q_2 = CI_2A$ CFS	CUMULA. Q_2 CFS	AVG SLOPE FT/FT	ACTUAL VEL_2 FPS	ALLOWABLE VEL FPS	LINING TYPE	$Q_{10} = CI_{10}A$ CFS	CUM Q_{10} CFS	ACT. VEL_{10} FPS	DEPTH OF FLOW/10 IN.	REMARKS
84+25	85+00	L	0.07	0.20	0.20	0.0113	0.95	2.5	GRASS	0.25	0.25	1.0	3.5	C = 0.5 Tc = 5 min
84+25	85+00	R	0.07	0.26	0.26	0.0113	1.0	2.5	GRASS	0.32	0.32	1.1	4	C = 0.5 Tc = 5 min
85+00	86+00	L	0.09	0.26	0.46	0.0335	1.7	2.5	GRASS	0.32	0.57	1.8	5	C = 0.5 Tc = 5 min
85+00	86+00	R	0.21	0.35	0.35	0.0335	1.6	2.5	GRASS	0.44	0.44	1.8	3.5	C = 0.55
86+00	87+00	L	0.09	0.26	0.72	0.0233	1.8	2.5	GRASS	0.32	0.89	1.8	5	C = 0.5 Tc = 5 min
86+00	87+00	R	0.53	0.87	1.22	0.0233	2.0	2.5	GRASS	1.11	1.55	2.1	6	C = 0.5
87+00	DS #39	L	0.02	0.06	0.78	0.0028	0.85	2.5	GRASS	0.07	0.96	0.9	7.5	C = 0.5 Tc = 5 min
87+00	DS #38	R	0.16	0.26	1.04	0.0028	0.9	2.5	GRASS	0.33	1.30	0.95	8.5	C = 0.55
90+25	89+00	L	0.11	0.31	0.31	0.0114	1.2	2.5	GRASS	0.39	0.39	1.2	4	C = 0.5 Tc = 5 min
90+25	89+00	R	0.78	1.28	1.32	0.0114	2	2.5	GRASS	1.64	2.04	2.1	8	C = 0.55
89+00	88+00	L	0.09	0.26	0.57	0.0112	1.3	2.5	GRASS	0.32	0.71	1.3	5	C = 0.5 Tc = 5 min
89+00	88+00	R	1.53	2.52	4.84	0.0112	2.3	2.5	GRASS	3.21	6.15	2.4	11.5	C = 0.55
88+00	DS #39	L	0.08	0.23	0.80	0.0087	1.2	2.5	GRASS	0.28	0.78	1.4	6	C = 0.5 Tc = 5 min
88+00	DS #38	R	0.91	1.47	6.30	0.0087	2.1	2.5	GRASS	1.91	8.06	2.3	13	C = 0.55

ROADSIDE DITCH DESIGN

PROJECT Ford's Colony, Sec. 13
DATE 11/17/08
PROJ. # 5652

Tc = 10 5 MIN I_{10} = 6 7.1 in/HR C = [illegible]
I_2 = 1.1 5.7 in/HR

NAME OF STREET EDINBURGH

FROM STATION (DIRECTION	TO STATION OF FLOW)	LEFT OR RIGHT	A (Ac.)	Q_2 = CI_2A CFS	CUMULA. Q_2 CFS	AVG SLOPE FT/FT	ACTUAL VEL_2 FPS	ALLOWABLE VEL FPS	LINING TYPE	Q_{10} = $CI_{10}A$ CFS	CUM Q_{10} CFS	ACT. VEL_{10} FPS	DEPTH OF $FLOW_{10}$ IN.	REMARKS
90+25	91+00	L	0.07	0.20	0.20	0.0104	0.95	2.5	GRASS	0.25	0.25	1	3.5	C = [illegible] Tc = 5 min
90+25	91+00	R	0.07	0.20	0.20	0.0104	0.95	2.5	GRASS	0.25	0.25	1	3.5	C = 0.5 Tc = 5 min
91+00	92+00	L	0.09	0.27	0.47	0.0217	1.6	2.5	GRASS	0.32	0.57	1.6	4	C = 0.5 Tc = 5 min
91+00	92+00	R	0.54	0.88	1.08	0.0217	2	2.5	GRASS	1.13	1.38	2.1	6	C = 0.35
92+00	93+00	L	0.09	0.27	0.74	0.0066	1.1	2.5	GRASS	0.32	0.89	1.2	7	C = 0.5 Tc = 5 min
92+00	93+00	R	2.01	3.31	4.39	0.0066	1.7	2.5	GRASS	4.22	5.6	1.7	12	C = 0.35
93+00	DS #79A	L	0.04	0.11	0.85	0.005	1	2.5	GRASS	0.14	1.03	1.1	8	C = 0.50 Tc = 5 min
93+00	DS #78	R	0.48	0.79	5.18	0.005	1.6	2.5	GRASS	1.01	6.61	1.7	14	C = 0.35
94+00	DS #79A	L	0.04	0.11	0.11	0.005	0.6	2.5	GRASS	0.14	0.14	0.6	5	C = 0.50 Tc = 5 min

FORDS COLONY - 13C POND

A. - Normal Pool Storage = 654,028 ft^3 = 15 ac ft

B. For BMP calcs -

35% Imp - DA = 39.1 ac

V_R = 0.535 ac ft

15 V_R = 8.0 ac ft

∴ 10 Pt BMP

FL Sec 13 A-D

ROADSIDE DITCH DESIGN

PROJECT FORDS COLONY, SECTION 13
DATE NOVEMBER 12, 1988
PROJ. # 5652

T_C = 10 MIN I_{10} = 6.0 IN/HR C = 0.40
I_2 = 4.0 IN/HR

NAME OF STREET

FROM STATION (DIRECTION	TO STATION OF FLOW)	LEFT OR RIGHT	A (AC.)	$Q_2 = CI_2A$ CFS	CUMULA. Q_2 CFS	AVG SLOPE FT/FT	ACTUAL VEL_2 FPS	ALLOWABLE VEL FPS	LINING TYPE	$Q_{10} = CI_{10}A$ CFS	CUM Q_{10} CFS	ACT. VEL_{10} FPS	DEPTH OF FLOW$_{10}$ IN.	REMARKS
CUL-DE-SAC	13+00	L	1.00	1.84	1.84	0.03	2.4	2.5	GRASS	2.4	2.4	2.6	6.5	
CUL-DE-SAC	13+00	R	0.20	0.37	0.37	0.03	1.3	2.5	GRASS	0.48	0.48	1.4	2.5	
13+00	12+50	L	0.17	0.31	2.15	0.045	7.3	—	PAVED	0.41	2.8	7.5	4	
13+00	12+50	R	0.10	0.18	0.55	0.045	2.0	2.5	GRASS	0.24	0.72	2.2	4	
12+50	12+00	L	0.17	0.31	2.5	0.075	9	—	PAVED	0.41	3.2	9.6	4	
12+50	12+00	R	0.11	0.20	0.75	0.075	7.1	—	PAVED	0.26	0.98	7.4	2.5	
12+00	11+00	L	0.24	0.44	2.94	0.09	10	—	PAVED	0.58	3.8	10.8	4	
12+00	11+00	R	0.16	0.29	1.04	0.09	8	—	PAVED	0.38	1.4	8.5	3	
11+00	CROSS-CULVERT	L	0.42	0.77	3.7	0.0644	9.5	—	PAVED	1.01	4.8	10.1	5	
11+00	CROSS-CULVERT	R	0.18	0.33	1.4	0.0714	7.8	—	PAVED	0.43	1.8	8.2	3.5	

ROADSIDE DITCH DESIGN

PROJECT: FORD'S COLONY SECTION 13
DATE: NOV. 8, 1992
PROJECT NO: 5652

Tc = 10.00 MIN.
I2 = 4.10 IN/HR
I10= 5.40 IN/HR
C = 0.40

NAME OF STREET: BALMORAL AND DUNCAN

FROM STATION	TO STATION	LEFT\ RIGHT	AREA (AC.)	AVG. SLOPE (FT/FT)	2 YEAR STORM Q = (CFS)	CUM. Q = (CFS)	VEL. = (FPS)	ALLOWABLE VELOCITY	LINING TYPE	10 YEAR STORM Q = (CFS)	CUM. Q = (CFS)	VEL. = (FPS)	DEPTH OF FLOW	REMARKS
BALMORAL														
INVERNESS	12+35	L	0.13	0.0862	0.21	0.44	3.8	5	MIRAMAT	0.28	0.58	4.1	2.60	"V" DITCH SS 3:1 D=18"
13+40	12+35	L	0.06	0.0114	0.10	--	1.2	3	GRASS	0.13	--	1.30	2.2	
15+30	14+50	L	0.05	0.025	0.08	--	1.7	3	GRASS	0.11	--	1.8	1.8	
14+50	13+40	L	0.05	0.088	0.08	0.16	3.4	5	MIRAMAT	0.11	0.22	3.5	1.8	
15+30	CUL-D-SAC	L	0.10	0.025	0.16	--	2.0	3	GRASS	0.22	--	2.1	2.3	
INVERNESS	11+75	R	0.24	0.0862	0.39	0.55	4.1	5	MIRAMAT	0.52	0.74	4.4	2.9	
15+30	14+50	R	0.12	0.025	0.20	--	2.0	3	GRASS	0.26	--	2.1	2.5	
14+50	13+25	R	0.67	0.088	1.10	1.30	7.8	--	CONC.	1.45	1.71	8.3	4.0	"V" DITCH SS 2:1 D=6"
13+25	11+75	R	0.43	0.0114	0.71	2.01	3.9	--	CONC.	0.93	2.64	4.2	6.8	D=8"
15+30	CUL-D-SAC	R	0.13	0.025	0.21	--	2.0	3	GRASS	0.28	--	2.1	2.5	"V" DITCH SS 3:1 D=18"
DUNCAN														
10+30	CUL-D-SAC	L	0.12	0.0804	0.20	--	3.2	5	MIRAMAT	0.26	--	3.4	1.9	"V" DITCH SS 3:1 D=18"
10+30	CUL-D-SAC	R	0.33	0.0804	0.54	--	4.0	5	MIRAMAT	0.71	--	4.2	2.8	

ROADSIDE DITCH DESIGN

PROJECT: FORD'S COLONY SECTION 13
DATE: NOV. 8, 1992
PROJECT NO: 5652

Tc = 10 MIN.
I2 = 4.1 IN/HR
I10= 5.4 IN/HR
C = 0.4

NAME OF STREET: DORNOCH AND INVERNESS

FROM STATION	TO STATION	LEFT\ RIGHT	AREA (AC.)	AVG. SLOPE (FT/FT)	2 YEAR STORM Q = (CFS)	CUM. Q = (CFS)	VEL. = (FPS)	ALLOWABLE VELOCITY	LINING TYPE	10 YEAR STORM Q = (CFS)	CUM. Q = (CFS)	VEL. = (FPS)	DEPTH OF FLOW	REMARKS
DORNOCH														
CUL-D-SAC	11+70	L	0.08	0.01	0.13	--	1.3	3	GRASS	0.17	--	1.35	2.5	"V" DITCH SS 3:1 D=18"
11+70	INVERNESS	L	0.09	0.094	0.15	0.28	3.8	5	MIRAMAT	0.19	0.36	3.8	2.2	
CUL-D-SAC	11+70	R	0.09	0.01	0.15	--	1.3	3	GRASS	0.19	--	1.35	2.6	
11+70	INVERNESS	R	0.14	0.094	0.23	0.38	3.8	5	MIRAMAT	0.30	0.49	4.0	2.5	
INVERNESS														
EDINBURGH	12+10	L	0.55	0.043	0.9	--	3.4	5	MIRAMAT	1.19	--	2.4	1.5	"V" DITCH SS 3:1 D=18"
DORNOCH	12+10	L	0.71	0.0164	1.16	1.44	2.6	3	GRASS	1.53	1.89	2.8	5.6	
14+25	15+50	L	0.27	0.0657	0.44	0.82	6.0	--	CONC.	0.58	1.07	6.3	3.5	"V" DITCH SS 2:1 CONC. D=6"
15+50	16+75	L	1.24	0.0657	2.03	2.85	7.8	--	CONC.	2.68	3.75	8.8	5.2	
CUL-D-SAC	19+75	L	0.17	0.005	0.28	--	1.1	3	GRASS	0.37	--	1.2	3.9	"V" DITCH SS 3:1 D=18"
19+75	18+25	L	1.34	0.088	2.20	2.48	9.0	--	CONC	2.89	3.26	9.6	5.0	"V" DITCH SS 2:1 D=6"
18+25	16+75	L	2.01	0.020	3.30	5.78	6.5	--	CONC	4.34	7.6	7.0	9.0	D=10"
10+00	BALMORAL	R	0.10	0.043	0.16	--	2.5	3	GRASS	0.22	--	2.5	2.1	"V" DITCH SS 3:1 D=18"
14+25	BALMORAL	R	0.14	0.0164	0.23	--	1.7	3	GRASS	0.30	--	1.8	2.8	
14+25	16+75	R	0.14	0.0657	0.23	--	3.8	5	MIRAMAT	0.30	--	3.4	2.1	
17+50	16+75	R	0.06	0.020	0.10	--	1.7	3	GRASS	0.13	--	1.7	1.9	
CUL-D-SAC	19+75	R	0.09	0.005	0.15	--	1.5	3	GRASS	0.19	--	1.0	3.0	
19+75	18+00	R	0.12	0.088	0.19	0.34	3.5	5	MIRAMAT	0.26	0.45	4.0	2.4	

PROJECT: FORD'S COLONY SEC. 13
CONCORD CROSS CULVERT

DESIGNER: VMB

DATE: 11/14/08

HYDROLOGIC AND CHANNEL INFORMATION

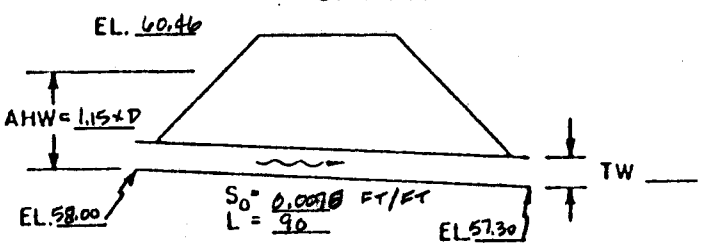
AREA = 3.59 Ac±
C = 0.40
T_c = 10 MIN.
I_2 = 4.6 IN/HR I_{10} = 6.0 IN/HR

Q_1 = 6.6 (2 YR) TW_1 = _____
Q_2 = 8.6 (10 YR) TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}.
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: 10+25



MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_0 - LS_0								CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_0	LS_0	HW				
PROJECTING	8.6	24	.81	1.62	0.9	0.7	1.1	1.55		1.55	0.70	1.55	INLET			GOOD
PROJECTING	8.6	18	1.4	2.10												TOO SMALL

SUMMARY & RECOMMENDATIONS:

Figure 7

Rev 3-83

Project: FORD'S COLONY SEC. 13
INVERNESS CROSS CULVERT

Plan Sheet No. 9 Designer SOW.
Rev. Date _____ Date 11-10-92

Sheet ____ of ____

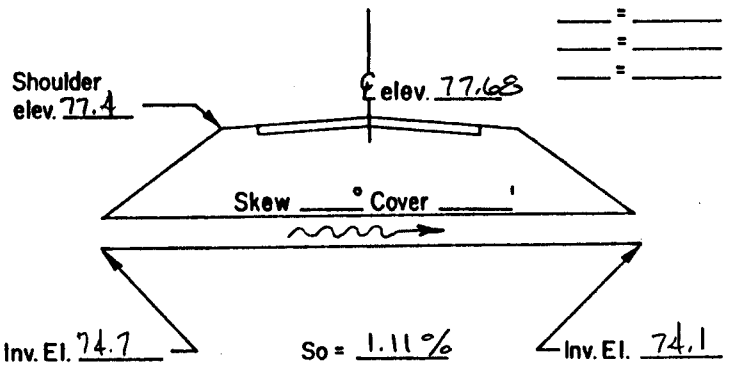
HYDROLOGICAL DATA:
D.A. = 1.43 AC.

C = 0.4
T_c = 10 min.
I_2 = 4.6 in/hr. , Q_2 = 2.63 cfs
I_{10} = 6.0 in/hr. , Q_{10} = 3.43 cfs

AHW Controls
100 yr. Flood plain _____ elev. _____
Design AHW depth _____ elev. _____
Structures _____ elev. _____

STATION: 12+10

freq. TWelev.
____ = ____
____ = ____
____ = ____
____ = ____
____ = ____



DISCHARGES USED
Q 2 = 2.63 CFS
Q 10 = 3.43 CFS
Q ____ = ____ CFS
Q ____ = ____ CFS
Q ____ = ____ CFS

RISK ASSESSMENT
ADT _____
Detours Available _____, Length _____
Overtopping Stage _____
Flood Plain Management _____
Criteria and Significant Impact _____

CULVERT TYPE & SIZE	Q	Q/B	HEADWATER COMPUTATIONS: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW = H + ho − LSo: Ke	dc	(dc+D)/2	ho	H	LSo	HW	CONT. HW. ELEV.	OUTLET VELOCITY C.M.	OUTLET VELOCITY Smooth	End Treat.	COMMENTS
18" ASCP TYPE 2 PROJECTING	3.43	N/A	0.66	0.99	0.2	0.5	1.0	1.0	0.3	0.6	0.7	0.99			ES-2	INLET CONTROLS
																18" GOOD

SUMMARY & RECOMMENDATIONS: 54 L.F. OF 18" ASCP, 2 @ 1.11 %

Design Flood Exceed. Prob. _____ Elev. _____
Overtop Flood Exceed. Prob. _____ Elev. _____
Base Flood 1% Exceed. Prob. _____ Elev. _____

22 (5-18)

(Rev. 1/85)

HYDRAULIC REPORT FOR

FORD'S COLONY

AT WILLIAMSBURG

SECTION 13

STORM SEWER DS#29 - DS#27

JOB NO. 5652

PREPARED BY

AES, A PROFESSIONAL CORP.

NOVEMBER 7, 1992

Return Period = 10 Yrs
Rainfall file: JCC

Run Date: 11-07-1992
File: a:FCSC13-3.ST3

LINE 1 / Q = 1.24 / HT = 15 / WID = 15 / N = .013 / L = 135 / JLC = 1

DS#28 - DS#27.... / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	50.00	15.00	47.75	1.01	50.02	0.00	1	1.23
UPSTRM	69.85	5.36	69.40	3.16	70.00	14.37	1.34	0.39

Drainage area (ac) =	0.04	Slope of invert (%)	=16.0370
Runoff coefficient =	0.45	Slope energy grade line (%)	=14.8043
Time of conc (min) =	5.43	Critical depth (in)	= 5.36
Inlet time (min) =	5.00	Natural ground elev. (ft)	= 72.00
Intensity (in/hr) =	6.95	Upstream surcharge (ft)	= 0.00
Cumulative C*A =	0.18	Additional Q (cfs)	= 0.00
Q = CA * I (cfs) =	1.24	Line capacity (cfs)	= 25.86
Q catchment (cfs) =	0.13	Inlet length (ft)	= 0.00
Q carryover (cfs) =	1.14	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	1.27	Ponding width (ft)	= N/A

LINE 2 / Q = 1.14 / HT = 15 / WID = 15 / N = .013 / L = 52 / JLC = 1

DS#29 - DS#28.... / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	70.00	6.02	69.50	2.48	70.10	9.50	1.25	0.46
UPSTRM	72.67	5.13	72.10	3.08	72.82	14.23	1.25	0.37

Drainage area (ac) =	0.23	Slope of invert (%)	= 5.0000
Runoff coefficient =	0.70	Slope energy grade line (%)	= 4.9566
Time of conc (min) =	5.00	Critical depth (in)	= 5.13
Inlet time (min) =	5.00	Natural ground elev. (ft)	= 74.60
Intensity (in/hr) =	7.09	Upstream surcharge (ft)	= 0.00
Cumulative C*A =	0.16	Additional Q (cfs)	= 0.00
Q = CA * I (cfs) =	1.14	Line capacity (cfs)	= 14.44
Q catchment (cfs) =	1.14	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	1.14	Ponding width (ft)	= N/A

HYDRAULIC REPORT FOR

FORD'S COLONY

AT WILLIAMSBURG

SECTION 13

STORM SEWER DS#44 - DS#40

JOB NO. 5652

PREPARED BY

AES, A PROFESSIONAL CORP.

NOVEMBER 8, 1992

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
Rainfall file: JCC

Run Date: 11-08-1992
File: a:FCSC13-5.ST3

LINE 1 / Q = 11.17 / HT = 18 / WID = 18 / N = .013 / L = 190 / JLC = 1

DS#41 - DS#40.... / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	50.00	18.00	47.00	6.32	50.62	0.00	N/A	1.77
UPSTRM	58.70	15.64	57.40	6.85	59.43	12.16	1.59	1.63

Drainage area (ac) =	0.33	Slope of invert (%) =	5.4737
Runoff coefficient =	0.70	Slope energy grade line (%) =	4.6376
Time of conc (min) =	15.89	Critical depth (in) =	15.64
Inlet time (min) =	5.00	Natural ground elev. (ft) =	60.50
Intensity (in/hr) =	4.82	Upstream surcharge (ft) =	0.00
Cumulative C*A =	2.32	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	11.17	Line capacity (cfs) =	24.57
Q catchment (cfs) =	1.64	Inlet length (ft) =	0.00
Q carryover (cfs) =	10.80	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	12.43	Ponding width (ft) =	N/A

LINE 2 / Q = 10.18 / HT = 18 / WID = 18 / N = .013 / L = 165 / JLC = 1

DS#42 - DS#41 ... / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	59.43	18.00	57.45	5.76	59.95	0.00	1.54	1.77
UPSTRM	64.72	14.61	63.50	6.63	65.40	14.08	5.4	1.54

Drainage area (ac) =	0.21	Slope of invert (%) =	3.6667
Runoff coefficient =	0.60	Slope energy grade line (%) =	3.3044
Time of conc (min) =	15.44	Critical depth (in) =	14.61
Inlet time (min) =	5.00	Natural ground elev. (ft) =	70.40
Intensity (in/hr) =	4.88	Upstream surcharge (ft) =	0.00
Cumulative C*A =	2.09	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	10.18	Line capacity (cfs) =	20.11
Q catchment (cfs) =	0.89	Inlet length (ft) =	0.00
Q carryover (cfs) =	9.90	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	10.80	Ponding width (ft) =	N/A

LINE 3 / Q = 9.66 / HT = 18 / WID = 18 / N = .013 / L = 125 / JLC = 1

DS#43 - DS#42.... / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	65.40	18.00	63.50	5.47	65.86	0.00	5.4	1.77
UPSTRM	66.99	14.23	65.80	6.45	67.63	14.65	1.29	1.50

Drainage area (ac) =	0.20	Slope of invert (%)	= 1.8400
Runoff coefficient =	0.50	Slope energy grade line (%)	= 1.4142 ✓
Time of conc (min) =	15.09	Critical depth (in)	= 14.23
Inlet time (min) =	5.00	Natural ground elev. (ft)	= 68.60
Intensity (in/hr) =	4.93	Upstream surcharge (ft)	= 0.00
Cumulative C*A =	1.96	Additional Q (cfs)	= 0.00
Q = CA * I (cfs) =	9.66	Line capacity (cfs)	= 14.24
Q catchment (cfs) =	0.71	Inlet length (ft)	= 0.00
Q carryover (cfs) =	9.19	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	9.90	Ponding width (ft)	= N/A

LINE 4 / Q = 9.19 / HT = 18 / WID = 18 / N = .013 / L = 32 / JLC = 1

DS#44 - DS#43.. / DNLN = 3

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	67.63	18.00	65.80	5.20	68.05	0.00	1.29	1.77
UPSTRM	69.77	13.88	68.00 ✓	6.29	70.38	15.12	-1.5	1.46

Drainage area (ac) =	5.03	Slope of invert (%)	= 6.8750
Runoff coefficient =	0.37	Slope energy grade line (%)	= 5.3708
Time of conc (min) =	15.00	Critical depth (in)	= 13.88
Inlet time (min) =	15.00	Natural ground elev. (ft)	= 68.00
Intensity (in/hr) =	4.94	Upstream surcharge (ft)	= 0.27
Cumulative C*A =	1.86	Additional Q (cfs)	= 0.00
Q = CA * I (cfs) =	9.19	Line capacity (cfs)	= 27.53
Q catchment (cfs) =	9.19	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	9.19	Ponding width (ft)	= N/A

INLET COMPS for DS 44

HYDRAULIC REPORT FOR

FORD'S COLONY

AT WILLIAMSBURG

SECTION 13

STORM SEWER DS#30 - DS#39

JOB NO. 5652

PREPARED BY

AES, A PROFESSIONAL CORP.

NOVEMBER 7, 1992

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
Rainfall file: JCC

Run Date: 11-07-1992
File: A:SEC13-4A.ST3

LINE 1 / Q = 19.42 / HT = 30 / WID = 30 / N = .017 / L = 45 / JLC = 1

DS#31 - DS#30.... / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	50.00	30.00	47.00	3.96	50.24	0.00	.5	4.91
UPSTRM	50.17	30.00	47.50	3.96	50.42	0.00	1.5	4.91

Drainage area (ac) =	2.10	Slope of invert (%) =	1.1111
Runoff coefficient =	0.45	Slope energy grade line (%) =	0.3834
Time of conc (min) =	26.88	Critical depth (in) =	17.67
Inlet time (min) =	16.00	Natural ground elev. (ft) =	51.50
Intensity (in/hr) =	3.72	Upstream surcharge (ft) =	0.17
Cumulative C*A =	5.22	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	19.42	Line capacity (cfs) =	33.06
Q catchment (cfs) =	4.54	Inlet length (ft) =	0.00
Q carryover (cfs) =	24.92	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	29.46	Ponding width (ft) =	N/A

LINE 2 / Q = 16.59 / HT = 24 / WID = 24 / N = .017 / L = 245 / JLC = 1

DS#32 - DS#31.... / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	50.42	24.00	47.50	5.28	50.85	0.00	2	3.14
UPSTRM	58.74	17.30	57.30	6.84	59.47	21.53	7	2.43

Drainage area (ac) =	0.10	Slope of invert (%) =	4.0000
Runoff coefficient =	0.50	Slope energy grade line (%) =	3.5183
Time of conc (min) =	24.83	Critical depth (in) =	17.30
Inlet time (min) =	5.00	Natural ground elev. (ft) =	66.30
Intensity (in/hr) =	3.88	Upstream surcharge (ft) =	0.00
Cumulative C*A =	4.28	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	16.59	Line capacity (cfs) =	34.59
Q catchment (cfs) =	0.35	Inlet length (ft) =	0.00
Q carryover (cfs) =	24.57	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	24.92	Ponding width (ft) =	N/A

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
Rainfall file: JCC

Run Date: 11-07-1992
File: A:SEC13-4A.ST3

LINE 3 / Q = 16.67 / HT = 24 / WID = 24 / N = .017 / L = 95 / JLC = 1

DS#33 - DS#32.... / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	59.47	24.00	57.30	5.31	59.91	0.00	7	3.14
UPSTRM	61.45	17.35	60.00	6.86	62.18	21.48	2.5	2.43

Drainage area (ac) =	1.74	Slope of invert (%) =	2.8421
Runoff coefficient =	0.40	Slope energy grade line (%) =	2.3891
Time of conc (min) =	24.04	Critical depth (in) =	17.35
Inlet time (min) =	6.00	Natural ground elev. (ft) =	64.50
Intensity (in/hr) =	3.94	Upstream surcharge (ft) =	0.00
Cumulative C*A =	4.23	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	16.67	Line capacity (cfs) =	29.16
Q catchment (cfs) =	4.72	Inlet length (ft) =	0.00
Q carryover (cfs) =	19.85	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	24.57	Ponding width (ft) =	N/A

LINE 4 / Q = 14.11 / HT = 24 / WID = 24 / N = .016 / L = 72 / JLC = 1

DS#34 - DS#33.... / DNLN = 3

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	62.18	24.00	60.00	4.49	62.49	0.00	2.5	3.14
UPSTRM	62.83	15.96	61.50	6.36	63.46	22.65	1	2.22

Drainage area (ac) =	2.34	Slope of invert (%) =	2.0833
Runoff coefficient =	0.40	Slope energy grade line (%) =	1.3459
Time of conc (min) =	23.44	Critical depth (in) =	15.96
Inlet time (min) =	7.00	Natural ground elev. (ft) =	64.50
Intensity (in/hr) =	4.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	3.53	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	14.11	Line capacity (cfs) =	26.52
Q catchment (cfs) =	6.08	Inlet length (ft) =	0.00
Q carryover (cfs) =	13.77	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	19.85	Ponding width (ft) =	N/A

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
Rainfall file: JCC

Run Date: 11-07-1992
File: A:SEC13-4A.ST3

LINE 5 / Q = 10.73 / HT = 18 / WID = 18 / N = .016 / L = 178 / JLC = 1.5

DS#35 - DS#34.... / DNLN = 4

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	63.46	18.00	61.50	6.07	64.03	0.00	1.5	1.77
UPSTRM	68.25	15.00	67.00	6.82	68.97	13.42	8.33	1.57

Drainage area (ac) =	0.48	Slope of invert (%)	= 3.0899
Runoff coefficient =	0.50	Slope energy grade line (%)	= 2.7758
Time of conc (min) =	21.96	Critical depth (in)	= 15.00
Inlet time (min) =	8.00	Natural ground elev. (ft)	= 76.84
Intensity (in/hr) =	4.13 0.56	Upstream surcharge (ft)	= 0.00
Cumulative C*A =	2.60	Additional Q (cfs)	= 0.00
Q = CA * I (cfs) =	10.73	Line capacity (cfs)	= 15.00
Q catchment (cfs) =	1.50	Inlet length (ft)	= 0.00
Q carryover (cfs) =	12.27	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	13.77	Ponding width (ft)	= N/A

LINE 6 / Q = 7.97 / HT = 18 / WID = 18 / N = .016 / L = 345 / JLC = 1

DS#36 - DS#35 .. / DNLN = 5

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	69.33	18.00	67.00	4.51	69.65	0.00	8.33	1.77
UPSTRM	72.24	17.87	70.75	4.51	72.56	3.04	10.65	1.77

Drainage area (ac) =	0.06	Slope of invert (%)	= 1.0870
Runoff coefficient =	0.50	Slope energy grade line (%)	= 0.8427
Time of conc (min) =	19.08	Critical depth (in)	= 12.92
Inlet time (min) =	5.00	Natural ground elev. (ft)	= 82.90
Intensity (in/hr) =	4.43	Upstream surcharge (ft)	= 0.00
Cumulative C*A =	1.80	Additional Q (cfs)	= 0.00
Q = CA * I (cfs) =	7.97	Line capacity (cfs)	= 8.90
Q catchment (cfs) =	0.21	Inlet length (ft)	= 0.00
Q carryover (cfs) =	8.83	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	9.04	Ponding width (ft)	= N/A

LINE 7 / Q = 8.27 / HT = 18 / WID = 18 / N = .016 / L = 250 / JLC = 1

DS#37 - DS#36.... / DNLN = 6

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	72.56	18.00	70.75	4.68	72.90	0.00	10.65	1.77
UPSTRM	74.77	15.27	73.50	5.17	75.19	12.91	1.5	1.60

Drainage area (ac)	= 4.30	Slope of invert (%)	= 1.1000
Runoff coefficient	= 0.35	Slope energy grade line (%)	= 0.9171
Time of conc (min)	= 17.00	Critical depth (in)	= 13.17
Inlet time (min)	= 17.00	Natural ground elev. (ft)	= 76.50
Intensity (in/hr)	= 4.67	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 1.77	Additional Q (cfs)	= 0.00
Q = CA * I (cfs)	= 8.27	Line capacity (cfs)	= 8.95
Q catchment (cfs)	= 7.03	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 1.80	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 8.83	Ponding width (ft)	= N/A

LINE 8 / Q = 1.80 / HT = 15 / WID = 15 / N = .013 / L = 42 / JLC = 1

DS#38 - DS#37.... / DNLN = 7

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	75.19	15.00	73.50	1.46	75.22	0.00	1.75	1.23
UPSTRM	75.23	15.00	73.95	1.46	75.27	0.00	1.3	1.23

Drainage area (ac)	= 0.53	Slope of invert (%)	= 1.0714
Runoff coefficient	= 0.50	Slope energy grade line (%)	= 0.1070
Time of conc (min)	= 6.00	Critical depth (in)	= 6.44
Inlet time (min)	= 6.00	Natural ground elev. (ft)	= 76.50
Intensity (in/hr)	= 6.78	Upstream surcharge (ft)	= 0.03
Cumulative C*A	= 0.26	Additional Q (cfs)	= 0.00
Q = CA * I (cfs)	= 1.80	Line capacity (cfs)	= 6.68
Q catchment (cfs)	= 1.80	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 1.80	Ponding width (ft)	= N/A

LINE 9 / Q = 3.23 / HT = 15 / WID = 15 / N = .013 / L = 42 / JLC = 1

DS#39 - DS#35.... / DNLN = 5

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	70.87	4.44	70.50	10.63	72.62	13.69	5.08	0.30
UPSTRM	75.86	4.44	73.74	10.63	77.62	13.69	1.84	0.30

Drainage area (ac) =	1.59	Slope of invert (%)	= 7.7143
Runoff coefficient =	0.35	Slope energy grade line (%)	= 7.7143
Time of conc (min) =	10.00	Critical depth (in)	= 8.62
Inlet time (min) =	10.00	Natural ground elev. (ft)	= 76.84
Intensity (in/hr) =	5.80	Upstream surcharge (ft)	= 0.87
Cumulative C*A =	0.56	Additional Q (cfs)	= 0.00
Q = CA * I (cfs) =	3.23	Line capacity (cfs)	= 17.94
Q catchment (cfs) =	3.23	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	3.23	Ponding width (ft)	= N/A

Note: Normal depth assumed

Rev. 3-83

22 (5-18)

Project: FORD'S COLONY SEC. 13
INVERNESS CROSS CULVERT

Plan Sheet No. 9 Designer SOW.
Rev. Date _____ Date 11-10-92

Sheet ____ of ____

HYDROLOGICAL DATA:

D.A. = 1.43 AC.

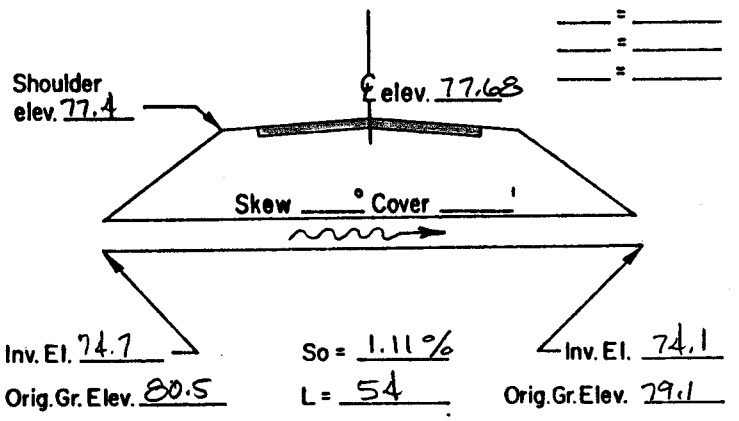
C = 0.4
T_c = 10 min.
I_2 = 4.6 in/hr. , Q_2 = 2.63 cfs
I_{10} = 6.0 in/hr. , Q_{10} = 3.43 cfs

AHW Controls

100 yr. Flood plain _____ elev. _____
Design AHW depth _____ elev. _____
Structures _____ elev. _____

STATION: 12+10

freq. TW elev.
____ = ____
____ = ____
____ = ____
____ = ____
____ = ____



DISCHARGES USED

Q 2 = 2.63 CFS
Q 10 = 3.43 CFS
Q ____ = ____ CFS
Q ____ = ____ CFS
Q ____ = ____ CFS

RISK ASSESSMENT ADT _____

Detours Available _____ , Length _____
Overtopping Stage _____
Flood Plain Management _____
Criteria and Significant Impact _____

CULVERT TYPE & SIZE	Q	Q/B	HEADWATER COMPUTATIONS: INLET CONT. HW/D	HW	OUTLET CONTROL HW=H+ho-LSo: Ke	dc	(dc+D)/2	ho	H	LSo	HW	CONT. HW. ELEV.	OUTLET VELOCITY C.M.	Smooth	End Treat.	COMMENTS
18" ASCP TYPE 2 PROJECTING	3.43	N/A	0.66	0.99	0.2	0.5	1.0	1.0	0.3	0.6	0.7	0.99			ES-2	INLET CONTROLS
																18" GOOD

SUMMARY & RECOMMENDATIONS: 54 L.F. OF 18" ASCP, 2 @ 1.11 %

Design Flood Exceed. Prob. _____ Elev. _____
Overtop Flood Exceed. Prob. _____ Elev. _____
Base Flood 1% Exceed. Prob. _____ Elev. _____

(Rev. 1/85)

ROADSIDE DITCH DESIGN

PROJECT FORDS COLONY, SECTION 13
DATE NOVEMBER 12, 1988
PROJ. # 5652

T_c = 10 MIN I_{10} = 6.0 IN/HR C = 0.40
I_2 = 4.0 IN/HR

NAME OF STREET

FROM STATION (DIRECTION	TO STATION OF FLOW)	LEFT OR RIGHT	A (Ac.)	$Q_2 = CI_2A$ CFS	CUMULA. Q_2 CFS	AVG SLOPE FT/FT	ACTUAL VEL_2 FPS	ALLOWABLE VEL FPS	LINING TYPE	$Q_{10} = CI_{10}A$ CFS	CUM Q_{10} CFS	ACT. VEL_{10} FPS	DEPTH OF FLOW$_{10}$ IN.	REMARKS
CUL-DE-SAC	13+00	L	1.00	1.84	1.84	0.03	2.4	2.5	GRASS	2.4	2.4	2.6	6.5	
CUL-DE-SAC	13+00	R	0.20	0.37	0.37	0.03	1.3	2.5	GRASS	0.48	0.48	1.4	2.5	
13+00	12+50	L	0.17	0.31	2.15	0.045	7.3	—	PAVED	0.41	2.8	7.5	4	
13+00	12+50	R	0.10	0.18	0.55	0.045	2.0	2.5	GRASS	0.24	0.72	2.2	4	
12+50	12+00	L	0.17	0.31	2.5	0.075	9	—	PAVED	0.41	3.2	9.6	4	
12+50	12+00	R	0.11	0.20	0.75	0.075	7.1	—	PAVED	0.26	0.98	7.4	2.5	
12+00	11+00	L	0.24	0.44	2.94	0.09	10	—	PAVED	0.58	3.8	10.8	4	
12+00	11+00	R	0.16	0.29	1.04	0.09	8	—	PAVED	0.38	1.4	8.5	3	
11+00	CROSS-CULVERT	L	0.42	0.77	3.7	0.0644	9.5	—	PAVED	1.01	4.8	10.1	5	
11+00	CROSS-CULVERT	R	0.18	0.33	1.4	0.0714	7.8	—	PAVED	0.43	1.8	8.2	3.5	

ROADSIDE DITCH DESIGN

PROJECT: FORD'S COLONY SECTION 13
DATE: NOV. 8, 1992
PROJECT NO: 5652

Tc = 10.00 MIN.
I2 = 4.10 IN/HR
I10= 5.40 IN/HR
C = 0.40

NAME OF STREET: BALMORAL AND DUNCAN

FROM STATION	TO STATION	LEFT\ RIGHT	AREA (AC.)	AVG. SLOPE (FT/FT)	2 YEAR STORM Q = (CFS)	CUM. Q = (CFS)	VEL. = (FPS)	ALLOWABLE VELOCITY	LINING TYPE	10 YEAR STORM Q = (CFS)	CUM. Q = (CFS)	VEL. = (FPS)	DEPTH OF FLOW	REMARKS
BALMORAL				does not include culvert drainage w/ 3.4 cfs										
INVERNESS	12+35	L	0.13	0.0862	0.21	0.44	3.8	5	MIRAMAT Paved	0.28	0.58	4.1	2.60	"V" DITCH SS 3:1 D=18"
13+40	12+35	L	0.06	0.0114	0.10	--	1.2	3	GRASS	0.13	--	1.30	2.2	
15+30	14+50	L	0.05	0.025	0.08	--	1.7	3	GRASS	0.11	--	1.8	1.8	
14+50	13+40	L	0.05	0.088	0.08	0.16	3.4	5	MIRAMAT	0.11	0.22	3.5	1.8	
15+30	CUL-D-SAC	L	0.10	0.025	0.16	--	2.0	3	GRASS	0.22	--	2.1	2.3	
INVERNESS	11+75	R	0.24 .39	0.0862	0.39	0.55	4.1	5	MIRAMAT	0.52	0.74	4.4	2.9	
15+30	14+50	R	0.12	0.025	0.20	--	2.0	3	GRASS	0.26	--	2.1	2.5	
14+50	13+25	R	0.67	0.088	1.10	1.30	7.8	--	CONC.	1.45	1.71	8.3	4.0	"V" DITCH SS 2:1 D=6"
13+25	11+75	R	0.43	0.0114	0.71	2.01	3.9	--	CONC.	0.93	2.64	4.2	6.8	D=8"
15+30	CUL-D-SAC	R	0.13	0.025	0.21	--	2.0	3	GRASS	0.28	--	2.1	2.5	"V" DITCH SS 3:1 D=18"
DUNCAN														
10+30	CUL-D-SAC	L	0.12	0.0804	0.20	--	3.2	5	MIRAMAT	0.26	--	3.4	1.9	"V" DITCH SS 3:1 D=18"
10+30	CUL-D-SAC	R	0.33	0.0804	0.54	--	4.0	5	MIRAMAT	0.71	--	4.2	2.8	

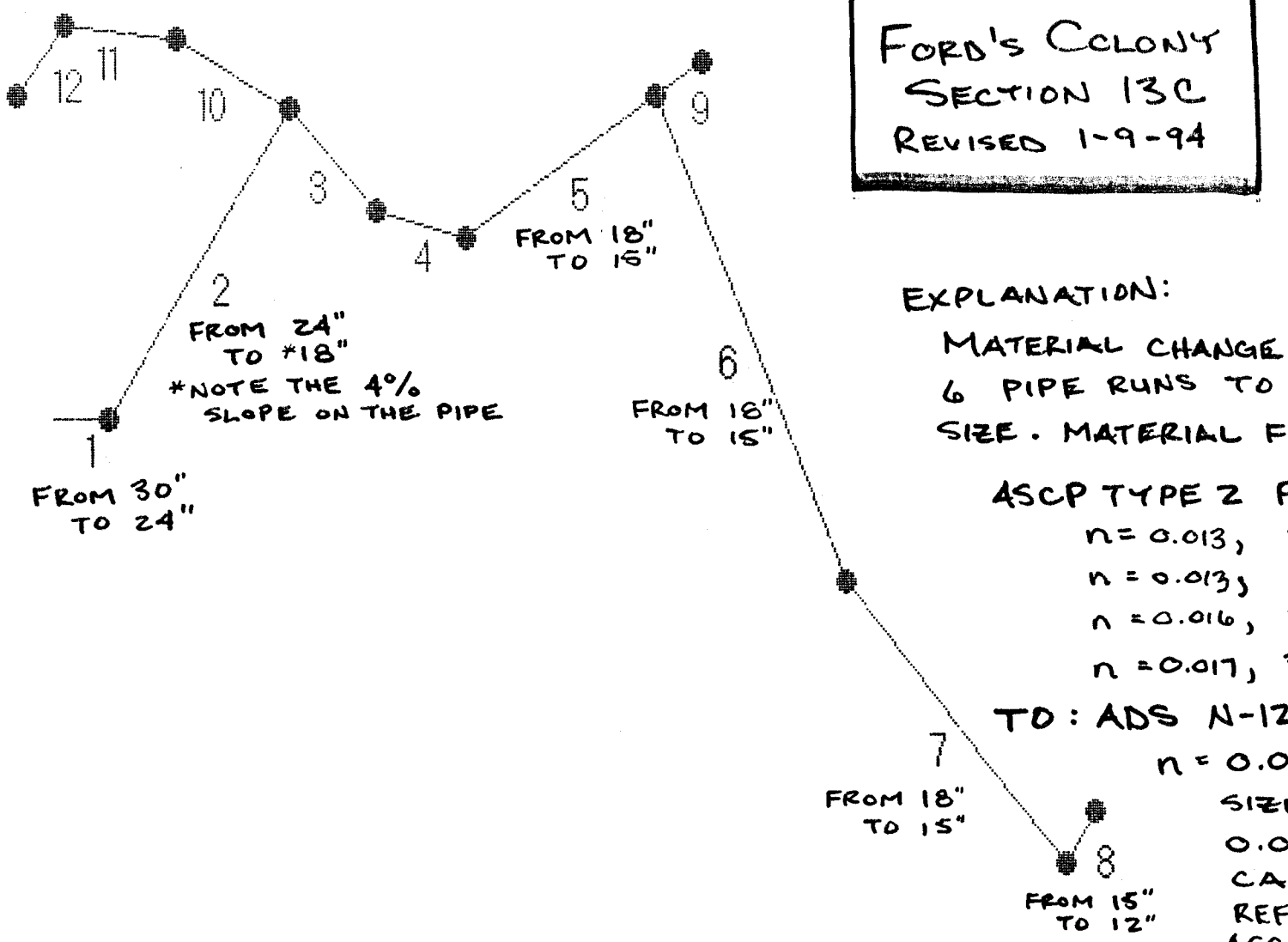
ROADSIDE DITCH DESIGN

PROJECT: FORD'S COLONY SECTION 13
DATE: NOV. 8, 1992
PROJECT NO: 5652

Tc = 10 MIN.
I2 = 4.1 IN/HR
I10= 5.4 IN/HR
C = 0.4

NAME OF STREET: DORNOCH AND INVERNESS

FROM STATION	TO STATION	LEFT\ RIGHT	AREA (AC.)	AVG. SLOPE (FT/FT)	2 YEAR STORM Q = (CFS)	CUM. Q = (CFS)	VEL. = (FPS)	ALLOWABLE VELOCITY	LINING TYPE	10 YEAR STORM Q = (CFS)	CUM. Q = (CFS)	VEL. = (FPS)	DEPTH OF FLOW	REMARKS
DORNOCH														
CUL-D-SAC	11+70	L	0.08	0.01	0.13	--	1.3	3	GRASS	0.17	--	1.35	2.5	"V" DITCH SS 3:1 D=18"
11+70	INVERNESS	L	0.09	0.094	0.15	0.28	3.8	5	MIRAMAT	0.19	0.36	3.8	2.2	
CUL-D-SAC	11+70	R	0.09	0.01	0.15	--	1.3	3	GRASS	0.19	--	1.35	2.6	
11+70	INVERNESS	R	0.14	0.094	0.23	0.38	3.8	5	MIRAMAT	0.30	0.49	4.0	2.5	
INVERNESS														
EDINBURGH	12+10	L	0.55	0.043	0.9	--	3.4	5	MIRAMAT	1.19	--	2.4	1.5	"V" DITCH SS 3:1 D=18"
DORNOCH	12+10	L	0.71	0.0164	1.16	1.44	2.6	3	GRASS	1.53	1.89	2.8	5.6	
14+25	15+50	L	0.27	0.0657	0.44	0.82	6.0	--	CONC.	0.58	1.07	6.3	3.5	"V" DITCH SS 2:1 CONC. D=6"
15+50	16+75	L	1.24	0.0657	2.03	2.85	7.8	--	CONC.	2.68	3.75	8.8	5.2	
CUL-D-SAC	19+75	L	0.17	0.005	0.28	--	1.1	3	GRASS	0.37	--	1.2	3.9	"V" DITCH SS 3:1 D=18"
19+75	18+25	L	1.34	0.088	2.20	2.48	9.0	--	CONC	2.89	3.26	9.6	5.0	"V" DITCH SS 2:1 D=6"
18+25	16+75	L	2.01	0.020	3.30	5.78	6.5	--	CONC	4.34	7.6	7.0	9.0	D=10"
10+00	BALMORAL	R	0.10	0.043	0.16	--	2.5	3	GRASS	0.22	--	2.5	2.1	"V" DITCH SS 3:1 D=18"
14+25	BALMORAL	R	0.14	0.0164	0.23	--	1.7	3	GRASS	0.30	--	1.8	2.8	
14+25	16+75	R	0.14	0.0657	0.23	--	3.8	5	MIRAMAT	0.30	--	3.4	2.1	
17+50	16+75	R	0.06	0.020	0.10	--	1.7	3	GRASS	0.13	--	1.7	1.9	
CUL-D-SAC	19+75	R	0.09	0.005	0.15	--	1.5	3	GRASS	0.19	--	1.0	3.0	
19+75	18+00	R	0.12	0.088	0.19	0.34	3.5	5	MIRAMAT	0.26	0.45	4.0	2.4	



FORD'S COLONY
SECTION 13C
REVISED 1-9-94

EXPLANATION:

MATERIAL CHANGE FOR 6 PIPE RUNS TO INCLUDE SIZE. MATERIAL FROM:

ASCP TYPE 2 PIPE

n = 0.013, 15"
n = 0.013, 18"
n = 0.016, 24"
n = 0.017, 30"

TO: ADS N-12 PIPE

n = 0.010 FOR ALL SIZES. I USED n = 0.011 FOR THE CALCULATIONS WHICH REFLECTS WHAT VDOT ACCEPTS FOR PVC A-2000 PIPE. SEE ATTACHED SPECS.

[← ↑ → ↓] Move [Space] Label's [Home] Reset

[PgUp] Enlarge [PgDn] Reduce [Esc] Exit

HYDRAULIC REPORT FOR

FORD'S COLONY

AT WILLIAMSBURG

SECTION 13C

STORM SEWER DS#30 - DS#39

JOB NO. 5652

PREPARED BY

AES, A PROFESSIONAL CORP.

REVISED 1-9-94

Return Period = 10 Yrs
Rainfall file: JCC

Run Date: 08-08-1993
File: a:SEC13-4R.ST3

LINE 1 / Q = 22.64 / HT = 24 / WID = 24 / N = .011 / L = 45 / JLC = 1

DS#31 - DS#30.... / Outfall ADS N-12 PIPE

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	50.00	24.00	47.00	7.21	50.81	0.00	1	3.14
UPSTRM	50.32	24.00	47.50	7.21	51.13	0.00	2	3.14

Drainage area (ac) =	2.10	Slope of invert (%) =	1.1111
Runoff coefficient =	0.45	Slope energy grade line (%) =	0.7178
Time of conc (min) =	19.69	Critical depth (in) =	20.22
Inlet time (min) =	16.00	Natural ground elev. (ft) =	51.50
Intensity (in/hr) =	4.21	Upstream surcharge (ft) =	0.82
Cumulative C*A =	5.38	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	22.64	Line capacity (cfs) =	28.18
Q catchment (cfs) =	4.37	Inlet length (ft) =	0.00
Q carryover (cfs) =	25.38	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	29.75	Ponding width (ft) =	N/A

LINE 2 / Q = 18.85 / HT = 18 / WID = 18 / N = .011 / L = 245 / JLC = 1

DS#32 - DS#31.... / DNLN = 1 ADS N-12 PIPE

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	51.13	18.00	47.50	10.67	52.90	0.00	2.5	1.77
UPSTRM	58.77	17.62	57.30	10.72	60.55	5.17	7.5	1.76

Drainage area (ac) =	0.10	Slope of invert (%) =	4.0000
Runoff coefficient =	0.50	Slope energy grade line (%) =	3.1249
Time of conc (min) =	19.31	Critical depth (in) =	17.62
Inlet time (min) =	5.00	Natural ground elev. (ft) =	66.30
Intensity (in/hr) =	4.24	Upstream surcharge (ft) =	0.00
Cumulative C*A =	4.44 ✓	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	18.85	Line capacity (cfs) =	24.82
Q catchment (cfs) =	0.35	Inlet length (ft) =	0.00
Q carryover (cfs) =	25.03	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	25.38	Ponding width (ft) =	N/A

LINE 3 / Q = 18.06 / HT = 24 / WID = 24 / N = .017 / L = 95 / JLC = 1

DS#33 - DS#32.... / DNLN = 2 NO CHANGE (EXISTING)

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	60.55	24.00	57.30	5.75	61.07	0.00	7	3.14
UPSTRM	61.50	18.06	60.00	7.12	62.29	20.72	2.5	2.54

Drainage area (ac) =	1.74	Slope of invert (%) =	2.8421
Runoff coefficient =	0.40	Slope energy grade line (%) =	1.2909
Time of conc (min) =	19.06	Critical depth (in) =	18.06
Inlet time (min) =	6.00	Natural ground elev. (ft) =	64.50
Intensity (in/hr) =	4.27	Upstream surcharge (ft) =	0.00
Cumulative C*A =	4.23	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	18.06	Line capacity (cfs) =	29.16
Q catchment (cfs) =	4.63	Inlet length (ft) =	0.00
Q carryover (cfs) =	19.28	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	23.90	Ponding width (ft) =	N/A

LINE 4 / Q = 15.17 / HT = 24 / WID = 24 / N = .016 / L = 72 / JLC = 1

DS#34 - DS#33.... / DNLN = 3 NO CHANGE (EXISTING)

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	62.29	24.00	60.00	4.83	62.65	0.00	2.5	3.14
UPSTRM	62.88	16.55	61.50	6.57	63.55	22.21	1	2.31

Drainage area (ac) =	2.34	Slope of invert (%) =	2.0833
Runoff coefficient =	0.40	Slope energy grade line (%) =	1.2413
Time of conc (min) =	18.85	Critical depth (in) =	16.55
Inlet time (min) =	7.00	Natural ground elev. (ft) =	64.50
Intensity (in/hr) =	4.29	Upstream surcharge (ft) =	0.00
Cumulative C*A =	3.53	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	15.17	Line capacity (cfs) =	26.52
Q catchment (cfs) =	5.94	Inlet length (ft) =	0.00
Q carryover (cfs) =	13.33	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	19.28	Ponding width (ft) =	N/A

LINE 5 / Q = 11.24 / HT = 15 / WID = 15 / N = .011 / L = 178 / JLC = 1.5

DS#35 - DS#34.... / DNLN = 4 ADS N-12 PIPE

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	63.55	15.00	61.50	9.16	64.85	0.00	1.75	1.23
UPSTRM	68.21	14.57	67.00	9.23	69.54	5.02	8.58	1.22

Drainage area (ac) =	0.48	Slope of invert (%) =	3.0899
Runoff coefficient =	0.50	Slope energy grade line (%) =	2.6331
Time of conc (min) =	18.53	Critical depth (in) =	14.57
Inlet time (min) =	8.00	Natural ground elev. (ft) =	76.84
Intensity (in/hr) =	4.33	Upstream surcharge (ft) =	0.00
Cumulative C*A =	2.60	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	11.24	Line capacity (cfs) =	13.41
Q catchment (cfs) =	1.46	Inlet length (ft) =	0.00
Q carryover (cfs) =	11.88	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	13.33	Ponding width (ft) =	N/A

LINE 6 / Q = 7.97 / HT = 15 / WID = 15 / N = .011 / L = 345 / JLC = 1

DS#36 - DS#35 .. / DNLN = 5 ADS N-12 PIPE

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	70.20	15.00	67.00	6.50	70.86	0.00	8.58	1.23
UPSTRM	73.96	15.00	70.75	6.50	74.62	0.00	10.9	1.23

Drainage area (ac) =	0.06	Slope of invert (%) =	1.0870
Runoff coefficient =	0.50	Slope energy grade line (%) =	1.0911
Time of conc (min) =	17.64	Critical depth (in) =	13.51
Inlet time (min) =	5.00	Natural ground elev. (ft) =	82.90
Intensity (in/hr) =	4.43	Upstream surcharge (ft) =	1.96
Cumulative C*A =	1.80	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	7.97	Line capacity (cfs) =	7.96
Q catchment (cfs) =	0.21	Inlet length (ft) =	0.00
Q carryover (cfs) =	8.54	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	8.75	Ponding width (ft) =	N/A

LINE 7 / Q = 7.97 / HT = 15 / WID = 15 / N = .011 / L = 250 / JLC = 1

DS#37 - DS#36.... / DNLN = 6 ADS N-12 PIPE

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	74.62	15.00	70.75	6.50	75.28	0.00	10.9	1.23
UPSTRM	77.35	15.00	73.50	6.50	78.00	0.00	1.75	1.23

Drainage area (ac)	= 4.30	Slope of invert (%)	= 1.1000
Runoff coefficient	= 0.35	Slope energy grade line (%)	= 1.0916
Time of conc (min)	= 17.00	Critical depth (in)	= 13.51
Inlet time (min)	= 17.00	Natural ground elev. (ft)	= 76.50
Intensity (in/hr)	= 4.50	Upstream surcharge (ft)	= 2.60
Cumulative C*A	= 1.77	Additional Q (cfs)	= 0.00
Q = CA * I (cfs)	= 7.97	Line capacity (cfs)	= 8.00
Q catchment (cfs)	= 6.78	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 1.76	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 8.54	Ponding width (ft)	= N/A

LINE 8 / Q = 1.76 / HT = 12 / WID = 12 / N = .011 / L = 42 / JLC = 1

DS#38 - DS#37.... / DNLN = 7 ADS N-12 PIPE

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	78.00	12.00	73.50	2.24	78.08	0.00	2	0.79
UPSTRM	78.16	12.00	73.95	2.24	78.23	0.00	1.55	0.79

Drainage area (ac)	= 0.53	Slope of invert (%)	= 1.0714
Runoff coefficient	= 0.50	Slope energy grade line (%)	= 0.3614
Time of conc (min)	= 6.00	Critical depth (in)	= 6.75
Inlet time (min)	= 6.00	Natural ground elev. (ft)	= 76.50
Intensity (in/hr)	= 6.65	Upstream surcharge (ft)	= 3.21
Cumulative C*A	= 0.26	Additional Q (cfs)	= 0.00
Q = CA * I (cfs)	= 1.76	Line capacity (cfs)	= 4.36
Q catchment (cfs)	= 1.76	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 1.76	Ponding width (ft)	= N/A

LINE 9 / Q = 3.13 / HT = 15 / WID = 15 / N = .013 / L = 42 / JLC = 1

DS#39 - DS#35.... / DNLN = 5 NO CHANGE (EXISTING)

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	70.86	4.27	70.50	10.87	72.69	13.53	5.08	0.29
UPSTRM	75.93	4.27	73.74	10.87	77.77	13.53	1.84	0.29

Drainage area (ac) =	1.59	Slope of invert (%) =	7.7143
Runoff coefficient =	0.35	Slope energy grade line (%) =	12.0841
Time of conc (min) =	10.00	Critical depth (in) =	8.49
Inlet time (min) =	10.00	Natural ground elev. (ft) =	76.84
Intensity (in/hr) =	5.62	Upstream surcharge (ft) =	0.94
Cumulative C*A =	0.56	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	3.13	Line capacity (cfs) =	17.94
Q catchment (cfs) =	3.13	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	3.13	Ponding width (ft) =	N/A

Note: Normal depth assumed

LINE 10 / Q = 1.06 / HT = 15 / WID = 15 / N = .013 / L = 100 / JLC = 1

100 to 32 / DNLN = 2 NO CHANGE (EXISTING)

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	62.21	2.55	62.00	7.69	63.13	11.27	3.05	0.14
UPSTRM	69.21	2.55	69.00	7.69	70.13	11.27	4.75	0.14

Drainage area (ac) =	0.00	Slope of invert (%) =	7.0000
Runoff coefficient =	0.00	Slope energy grade line (%) =	7.0000
Time of conc (min) =	6.14	Critical depth (in) =	4.95
Inlet time (min) =	0.00	Natural ground elev. (ft) =	75.00
Intensity (in/hr) =	6.60	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.16	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	1.06	Line capacity (cfs) =	17.08
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	1.13	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	1.13	Ponding width (ft) =	N/A

Note: Normal depth assumed

LINE 11 / Q = 1.10 / HT = 15 / WID = 15 / N = .013 / L = 90 / JLC = 1

101 to 100 / DNLN = 10 NO CHANGE (EXISTING)

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	70.13	13.56	69.00	0.95	70.14	14.26	4.75	1.17
UPSTRM	70.42	5.04	70.00	3.05	70.56	14.17	5.3	0.36

Drainage area (ac)	= 0.00	Slope of invert (%)	= 1.1111
Runoff coefficient	= 0.00	Slope energy grade line (%)	= 0.4671
Time of conc (min)	= 5.39	Critical depth (in)	= 5.04
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 76.55
Intensity (in/hr)	= 6.85	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 0.16	Additional Q (cfs)	= 0.00
Q = CA * I (cfs)	= 1.10	Line capacity (cfs)	= 6.81
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 1.13	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 1.13	Ponding width (ft)	= N/A

LINE 12 / Q = 1.13 / HT = 15 / WID = 15 / N = .013 / L = 60 / JLC = 1

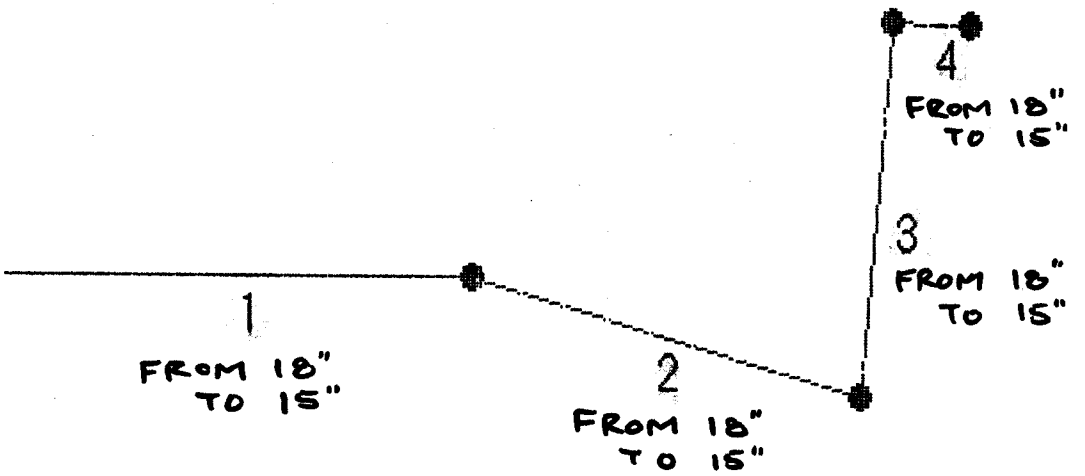
102 to 101 / DNLN = 11 NO CHANGE (EXISTING)

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	70.56	6.77	70.00	2.09	70.63	10.08	5.3	0.54
UPSTRM	71.87	5.09	71.30	3.06	72.02	14.21	2.75	0.37

Drainage area (ac)	= 0.23	Slope of invert (%)	= 2.1667
Runoff coefficient	= 0.70	Slope energy grade line (%)	= 2.0633
Time of conc (min)	= 5.00	Critical depth (in)	= 5.09
Inlet time (min)	= 5.00	Natural ground elev. (ft)	= 75.30
Intensity (in/hr)	= 6.99	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 0.16	Additional Q (cfs)	= 0.00
Q = CA * I (cfs)	= 1.13	Line capacity (cfs)	= 9.51
Q catchment (cfs)	= 1.13	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 1.13	Ponding width (ft)	= N/A

50'

FORD'S COLONY
SECTION 13C
REVISED 1-9-94



EXPLANATION:
MATERIAL CHANGE & SIZE DECREASE FOR ALL PIPE RUNS.
MATERIAL FROM:
ASCP TYPE 2 PIPE
n = 0.013, 18"
TO: ADS N-12 PIPE
n = 0.010, NOTE I USED n = 0.011 FOR THE CALCULATIONS WHICH REFLECTS WHAT VDOT ACCEPTS FOR PVC A-2000 PIPE.
SEE MATERIAL SPEC.S, ATTACHED

[← ↑ → ↓] Move [Space] Label's [Home] Reset

[PgUp] Enlarge [PgDn] Reduce [Esc] Exit

HYDRAULIC REPORT FOR

FORD'S COLONY

AT WILLIAMSBURG

SECTION 13C

STORM SEWER DS#44 - DS#40

JOB NO. 5652

PREPARED BY:

AES, A PROFESSIONAL CORP.

REVISED 1-9-94

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
Rainfall file: JCC

Run Date: 08-08-1993
File: a:SEC13-5R.ST3

LINE 1 / Q = 10.83 / HT = 15 / WID = 15 / N = .011 / L = 190 / JLC = 1

DS#41 - DS#40.... / Outfall ADS N-12 PIPE

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	50.00	15.00	47.00	8.82	51.21	0.00	N/A	1.23
UPSTRM	58.61	14.57	57.40	8.90	59.84	5.02	1.84	1.22

Drainage area (ac) =	0.33	Slope of invert (%) =	5.4737
Runoff coefficient =	0.70	Slope energy grade line (%) =	4.5440
Time of conc (min) =	15.69	Critical depth (in) =	14.57
Inlet time (min) =	5.00	Natural ground elev. (ft) =	60.50
Intensity (in/hr) =	4.67	Upstream surcharge (ft) =	0.00
Cumulative C*A =	2.32	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	10.83	Line capacity (cfs) =	17.85
Q catchment (cfs) =	1.61	Inlet length (ft) =	0.00
Q carryover (cfs) =	10.45	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	12.06	Ponding width (ft) =	N/A

LINE 2 / Q = 9.84 / HT = 15 / WID = 15 / N = .011 / L = 165 / JLC = 1

DS#42 - DS#41 ... / DNLN = 1 ADS N-12 PIPE

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	59.84	15.00	57.45	8.02	60.84	0.00	1.79	1.23
UPSTRM	64.69	14.28	63.50	8.16	65.73	6.41	5.65	1.21

Drainage area (ac) =	0.21	Slope of invert (%) =	3.6667
Runoff coefficient =	0.60	Slope energy grade line (%) =	2.9594
Time of conc (min) =	15.35	Critical depth (in) =	14.28
Inlet time (min) =	5.00	Natural ground elev. (ft) =	70.40
Intensity (in/hr) =	4.72	Upstream surcharge (ft) =	0.00
Cumulative C*A =	2.09	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	9.84	Line capacity (cfs) =	14.61
Q catchment (cfs) =	0.88	Inlet length (ft) =	0.00
Q carryover (cfs) =	9.56	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	10.45	Ponding width (ft) =	N/A

LINE 3 / Q = 9.32 / HT = 15 / WID = 15 / N = .011 / L = 125 / JLC = 1

DS#43 - DS#42.... / DNLN = 2 ADS N-12 PIPE

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	65.73	15.00	63.50	7.60	66.62	0.00	5.65	1.23
UPSTRM	67.59	15.00	65.80	7.60	68.49	0.00	1.54	1.23

Drainage area (ac) =	0.20	Slope of invert (%) =	1.8400
Runoff coefficient =	0.50	Slope energy grade line (%) =	1.4925
Time of conc (min) =	15.07	Critical depth (in) =	14.11
Inlet time (min) =	5.00	Natural ground elev. (ft) =	68.60
Intensity (in/hr) =	4.75	Upstream surcharge (ft) =	0.54
Cumulative C*A =	1.96	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	9.32	Line capacity (cfs) =	10.35
Q catchment (cfs) =	0.70	Inlet length (ft) =	0.00
Q carryover (cfs) =	8.87	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	9.56	Ponding width (ft) =	N/A

LINE 4 / Q = 8.87 / HT = 15 / WID = 15 / N = .011 / L = 32 / JLC = 1

DS#44 - DS#43.. / DNLN = 3 ADS N-12 PIPE

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	68.49	15.00	65.80	7.23	69.30	0.00	1.54	1.23
UPSTRM	70.03	13.93	68.00	7.46	70.89	7.73	-1.25	1.19

Drainage area (ac) =	5.03	Slope of invert (%) =	6.8750
Runoff coefficient =	0.37	Slope energy grade line (%) =	2.2728
Time of conc (min) =	15.00	Critical depth (in) =	13.93
Inlet time (min) =	15.00	Natural ground elev. (ft) =	68.00
Intensity (in/hr) =	4.76	Upstream surcharge (ft) =	0.78
Cumulative C*A =	1.86	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	8.87	Line capacity (cfs) =	20.01
Q catchment (cfs) =	8.87	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	8.87	Ponding width (ft) =	N/A

PC 155

Scott Thomas

From: Scott Thomas
Sent: Monday, July 23, 2007 5:57 PM
To: 'Barry Crane'
Cc: Amy Parker
Subject: RE: Pond buffer requirements request
Attachments: 123Balmoral.pbs.pdf; 123Balmoral.pbs.map.pdf; PBS.packet.pdf

Mr. & Mrs. Crane:

Attached is your pond buffer/setback variance approval. The pond buffer/setback is 25 feet back from the design high water elevation of the stormwater management facility; therefore, the pond buffer line shown on the map was incorrect as it was shown 25 feet upland from the normal pool elevation of the pond. Therefore encroachment was more extensive than shown and actually included a portion the permanent structure. I've also attached a map sketch which shows the extent of the pond buffer/setback line and some of our educational material on pond buffer/setbacks.

The pond buffer/setback line is referenced in the County BMP manual which is referenced in both the Chesapeake Bay Preservation and Erosion and Sediment Control ordinances. The manual became effective January 1, 2000. We have had the pond buffer/setback program since that time also.

Thank you for working with me and Amy Parker on this important watershed education matter. Please call me at 757-253-6639 or email if you have any questions about pond buffer/setbacks.

Scott J. Thomas, P.E.
Director
James City County
Environmental Division

Visit:
http://www.james-city.va.us/resources/devmgmt/div_devmgmt_environ.html
and
www.protectedwithpride.org

From: Barry Crane [mailto:bccranes@verizon.net]
Sent: Sunday, July 22, 2007 6:17 AM
To: Scott Thomas
Cc: Amy Parker
Subject: Re: Pond buffer requirements request

Dear Mr. Thomas

Thanks for help of your staff on our landscaping of our new single family residential lot.

We have not received a reply to a July 12, 2007 request. Our lot and pond frontage does not lie in an RPA.

Please provide a written reply to me for all of the James City County Ordinances requiring us to establish pond buffers outside an RPA.
I cannot delay landscaping any further without significant additional costs and chance of erosion.

We are making every effort to minimize erosion with a Ford's Colony ECC Approved Landscaping Plan using an experienced landscaper.

I need a reply no later than 24 July 2007 to make any changes for a 25 July completion date of our project.

Please call only me with any questions.

Thanks for your service to our community.

Dr. Barry Crane
703-371-8589
(world wide coverage)
571-218-5477 ; blackberry bcrane@ida.org.

----- Original Message ----
From: Barry Crane <bccranes@verizon.net>
To: scottt@james-city.va.us
Cc: aparker@james-city.va.us
Sent: Thursday, July 12, 2007 11:40:19 PM
Subject: Pond buffer waiver request

Dear Mr. Thomas,

Re: our property at: 123 Balmoral in Fords Colony, Williamsburg , VA 23188

Our landscaper cleared down to the pond without our knowledge of the pond buffer program.

Since the area is disturbed to the water we would like to be granted a waiver with the understanding that we will replant with native species vegetation, to restore the 25' pond buffer.

Regards

Barry and Cheryl Crane
757-206-1819

Scott Thomas

From: Barry Crane [bccranes@verizon.net]
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Barry and Cheryl Crane
757-206-1819

Amy Parker

From: Barry Crane [bccranes@verizon.net]
Sent: Thursday, July 12, 2007 11:40 PM
To: Scott Thomas
Cc: Amy Parker
Subject: Pond buffer waiver request

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Re: our property at: 123 Balmoral in Fords Colony, Williamsburg, VA 23188

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Barry and Cheryl Crane
757-206-1819

LOCATION: Lot 8, Ford's Colony Section 13-C, 123 Balmoral (County BMP ID Code: PC 155)

Variance request as submitted by Owner dated July 12, 2007 for clearing, grading and a permanent structure in the pond buffer/setback was reviewed and found to be acceptable. The pond buffer/setback extends 25 feet outward from the maximum water surface elevation of the adjacent stormwater management pond facility. Based on available information, it appears the 100-year design high water elevation for the adjacent stormwater management facility (Dam No. I, County BMP ID Code: PC 155) is at Elevation 50.6.

As this is a post-construction variance request, as a condition of approval efforts should be made to landscape or stabilize impacted buffer to resemble meadow or forest area with native trees, shrubs and ground cover; and to refrain from turfing to the water's edge to the greatest extent possible.

Scott J. Thomas, P.E.
Director
Environmental Division

07-23-07
Date

Amy Parker

From: Barry Crane [bccranes@verizon.net]
Sent: Thursday, July 12, 2007 11:40 PM
To: Scott Thomas
Cc: Amy Parker
Subject: Pond buffer waiver request

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