Stormwater Division

MEMORANDUM

DATE: July 23, 2014
TO: Michael J. Gillis, Virginia Correctional Enterprises Document Management Services
FROM: Jacob Smith, Stormwater Intern
PO: 110426
RE: Files Approved for Scanning

NAME PDF/SCANNED FILE:	WJCC 8TH ELEMENTARY SCHOOL FILE #2 MATOAKA		
BMP ID OR GEN FILE NUMBER:	GC006, GC007	**OWNER NAME:**	WILLIAMSBURG JAMES CITY COUNTY SCHOOLS
PIN:	3630100001	**SITE ADDRESS:**	4001 BRICK BAT ROAD
		LEGAL DESCRIPTION:	ELEMENTARY SCHOOL SITE PAR-A & B

MAINTENANCE AGREEMENT IN FILE:	N/A	**BOOK/PAGE OR DOCUMENT NO.:**	N/A	**OTHER DESCRIPTION:**	N/A

BOX NO.:	1	**COMMENTS:**	TRANSMITTAL

TRANSMITTAL SHEET

ENGINEERING & RESOURCE PROTECTION → STORMWATER

Project: **WJCC Schools 8th Elem**

County Plan No.: **SP-023-06**

Assigned BMP No.: **GC006 GC007**

BMP Type: **Infiltration – Wet Pond**

Information Enclosed:

X Computations

X Other: Project file information. Required final documents never provided. No remaining bond.

X approved plan

Name: **Tina Creech**

Date: **11/21/2013**

Signature: TCreech

Active; already created L327

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

Project Name: 8th Elem School / WJCC
County Plan No. (List any amendments): SP-028-06
Stormwater Management Facility Type: Infiltration & wet Pond
BMP Phase #: ☐ I ☐ II ☐ III

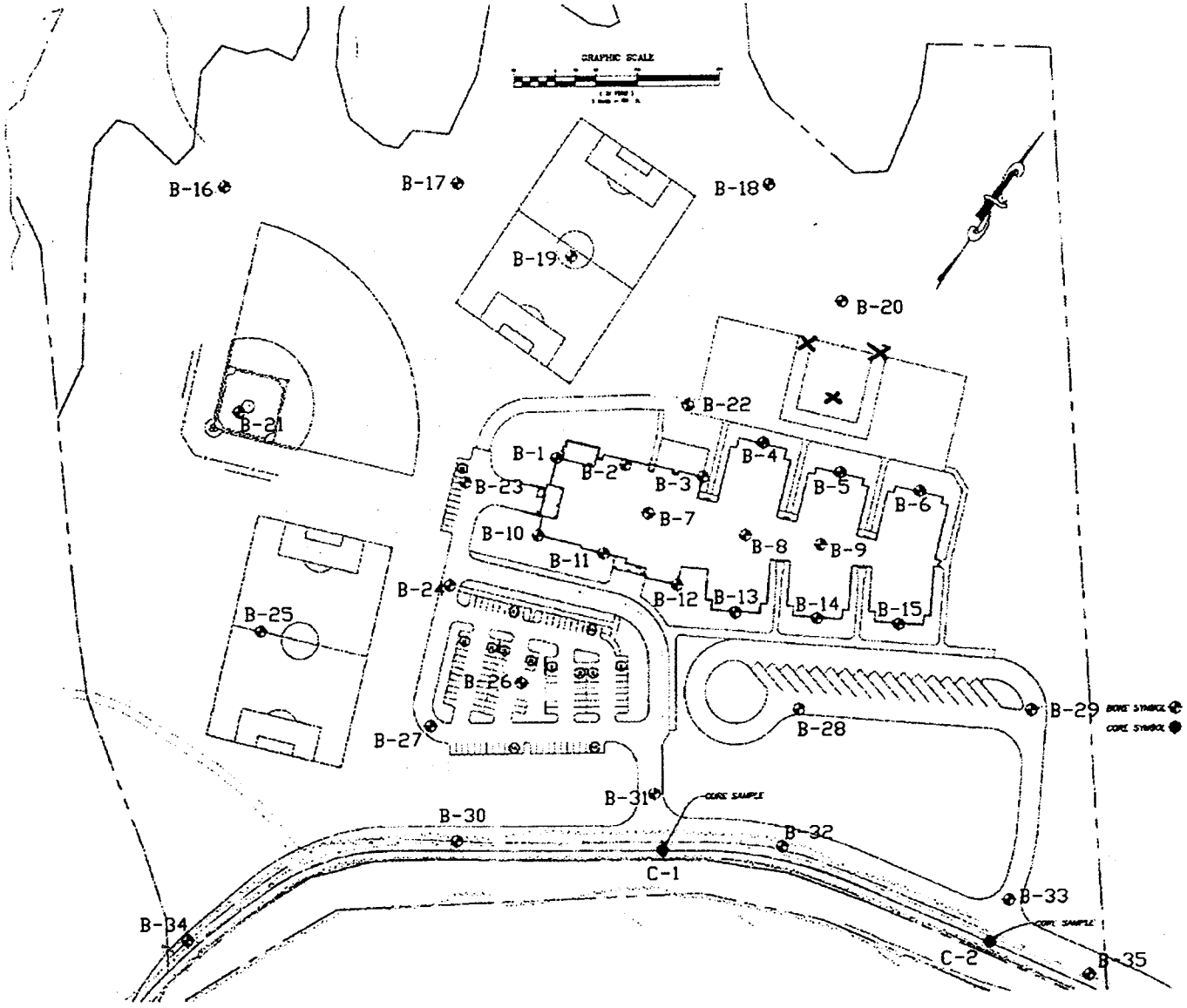
- ☐ Information Package Submittal Date: No interims / AB/CC submitted
- ☐ Completeness Check:
  - ☐ Record Drawing Date/By: No Bond associated with project.
  - ☐ Construction Certification Date/By:
  - ☐ RD/CC Standard Forms (Ensure that all forms for the BMP type are included)
  - ☐ Insp/Maint Agreement # / Date:
  - ☐ BMP Maintenance Plan Location:
  - ☐ Special Considerations:
- ☐ Standard E&SC Notes on Approved Plan Requiring RD/CC or County comment in plan review
  Location (sheet #):
- ☐ **County BMP ID Code #:** GC006 GC007
- ☑ Log into Division's "As-Built Tracking Log"
- ☑ Obtain basic site information (GPIN, Owner, Address, etc.)
- ☑ Log into Access Database (BMP ID #, Plan No., GPIN, Project Name, etc.)
- ☑ Copy from Active Project File (correspondence, H&H, design computations, etc.).
- ☐ Create As-Built File using Project File information (File label, folder, copy plan/details/design information, etc.). N/A NO AB
- ☐ Inspector Review of RD/CC (consult with Chief Engineer prior to completion of comments).
- ☐ Record Drawing Review against Approved Plan prior to Field Inspection.
- ☐ Final Site Inspection (FI) Performed Date:
- ☐ Record Drawing (RD) Review Date:
- ☐ Construction Certification (CC) Review Date:
- ☐ Actions: N/A
  - ☐ No comments.
  - ☐ Comments. Letter Forwarded. Date:
  - ☐ Record Drawing (RD)
  - ☐ Construction Certification (CC)
  - ☐ Construction-Related (CR)
  - ☐ Site Issues (SI)
  - ☐ Other :
- ☐ Resubmittal (# and date):
- ☐ Re-inspection (if necessary):
- ☐ Drainage System Information Acceptable (RD/CC/System Info). Ok for bond release.
- ☐ Complete "Surety Request Form".
- ☐ Final Inspection of active file copying any relevant information to "As-Built" file.
- ☐ On County BMP Inventory (Phase I, II or III).
- ☐ Copy Final Inspection Report into County BMP Inspection Program file.
- ☐ Provide Digital Photographs of BMP and save into County BMP Inventory.
- ☐ Request mylar/reproducible from As-Built plan preparer.
- ☐ Complete "As-built Tracking Log".
- ☐ Last check of BMP Access Database (County BMP Inventory).
- ☐ Add BMP to JCC Hydrology & Hydraulic database (optional).
- ☐ Add BMP to Municipal BMP list (if a County-owned facility)
- ☐ Add BMP to PRIDE BMP ratings database.

Final Sign-Off

Inspector: J Creek Date: 11/21/13

Chief Engineer: [signature] Date: 11/21/13

*** See separate checklist, if needed.



ECS LLC MID-ATLANTIC	ECS Mid-Atlantic 108 Ingram Road, Unit 1 Williamsburg, Virginia 23188 Ph (757) 229-6677 Fax (757) 229-9978	**Boring Location Plan** Proposed Williamsburg – JCC Eighth Elementary School Williamsburg, Virginia	CHECKED: D.J.G.	SCALE: NTS	DATE: 3/13/06	FIGURE: Fig. 1
			DRAWN: R. Lyles 07-8263-1.dwg	PROJECT NO. 07-8263		

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-4	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		
SITE LOCATION: James City County, Virginia			

ECS LLC MID-ATLANTIC

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

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

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 82.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"		6 (4-3-3-3)
	2	SS	24	24	Fine Medium Clayey SAND, Light Brown, Moist, Loose, (SC)	80	18 (6-8-10-13)
5	3	SS	24	24	Sandy CLAY, Brown to Red-Brown, Moist, Very Stiff, (CL)		29 (10-13-16-16)
	4	SS	24	24		75	(16-20-20-20) 40
10	5	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Dense, (SC)		(21-22-18-17) 40
						70	
15	6	SS	24	24	Fine to Coarse Clayey SAND, Trace Marine Shell Fragments, Orange-Brown, Wet, Medium Dense, (SC)		21 (8-11-10-12)
						65	
20	7	SS	24	24	Fine to Coarse Silty SAND, Trace Marine Shell Fragments, Orange-Brown, Wet, Medium Dense, (SM)		13 (6-6-7-9)
						60	
25	8	SS	24	24			14 (5-7-7-9)
					END OF BORING @ 25.00'	55	
30							

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

▽ WL DRY WS OR ⓦD	BORING STARTED 03/20/06	
▽ WL(AB) DRY ▼ WL(AC) DRY	BORING COMPLETED 03/20/06	CAVE IN DEPTH @ N/A
▽ WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-5	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% 40% 60% 80% 100%

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

DESCRIPTION OF MATERIAL

ENGLISH UNITS

SURFACE ELEVATION 79.7

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"		6 (1-2-4-5)
	2	SS	24	24	Sandy CLAY, Brown, Moist, Medium Stiff, (CL)		16 (6-8-8-12)
5	3	SS	24	24	Fine to Medium Clayey SAND, Brown to Red-Brown, Moist, Medium Dense, (SC)	75	26 (10-11-15-16)
	4	SS	24	24			(16-16-16-16) 32
	5	SS	24	24		70	27 (14-15-12-12)
10	6	SS	24	24			18 (5-7-11-13)
15					Fine to Coarse Clayey SAND, Red-Brown, Moist, Medium Dense, (SC)	65	
20	7	SS	24	24	Fine to Medium Silty SAND, Trace Fine Gravel, Orange-Brown, Wet, Medium Dense, (SM)	60	13 (7-6-7-5)
25	8	SS	24	24	Fine to Medium Silty SAND, Orange-Brown, Wet, Medium Dense, (SM)	55	15 (7-7-8-8)
30					END OF BORING @ 25.00'	50	

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

WL DRY WS OR WD	BORING STARTED 03/20/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 03/20/06	CAVE IN DEPTH @ N/A
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

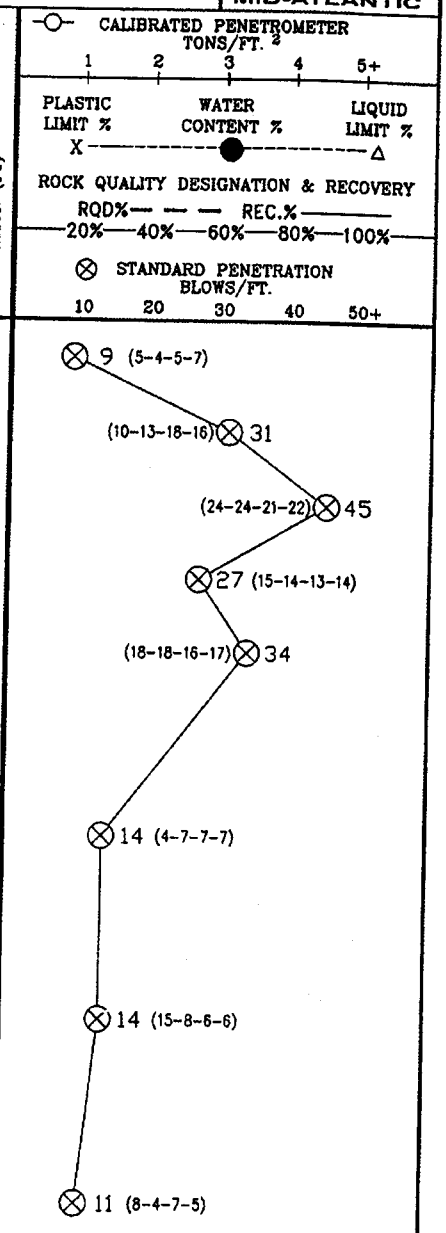
RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-6	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		
SITE LOCATION: James City County, Virginia			

ECS LLC MID-ATLANTIC

SURFACE ELEVATION 79.5 (ENGLISH UNITS)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)
0	1	SS	24	24	TOPSOIL DEPTH 3"		
	2	SS	24	24	Sandy CLAY, Brown to Red-Brown, Moist, Medium Stiff to Very Stiff, (CH)		
5	3	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Medium Dense to Dense, (SC)		75
	4	SS	24	24			
	5	SS	24	24			
10							70
	6	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Orange-Brown, Wet, Medium Dense, (SC)		
15							65
	7	SS	24	24	Fine to Medium Silty SAND, Trace Fine Gravel, Red-Brown, Wet, Medium Dense, (SM)		
20							60
	8	SS	24	24	Sandy CLAY, Orange-Brown, Wet, Stiff, (CL)		
25					END OF BORING @ 25.00'		55
30							50



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

WL DRY WS OR WD	BORING STARTED 03/21/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 03/21/06	CAVE IN DEPTH @ N/A
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-20	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		
SITE LOCATION: James City County, Virginia			

ECS LLC MID-ATLANTIC

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 82.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 3"		4 (2-2-2-3)
	2	SS	24	24	Sandy CLAY, Brown to Orange-Brown, Moist, Soft to Hard, (CL)	80	13 (4-6-7-7)
5	3	SS	24	24			(16-21-21-23) 42
	4	SS	24	24		75	17 (5-8-9-11)
	5	SS	24	24	Fine to Medium Clayey SAND, Light Red-Brown, Moist, Medium Dense, (SC)		13 (2-6-7-8)
10						70	
	6	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Orange-Brown, Moist, Loose, (SC)		7 (3-3-4-4)
15					END OF BORING @ 15.00'	65	
20						60	
25						55	
30							

WATER LEVELS

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

▽WL DRY WS OR WD	BORING STARTED 3/28/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 3/28/06	CAVE IN DEPTH ● NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-22	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		
SITE LOCATION: James City County, Virginia			

ECS LLC MID-ATLANTIC

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

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

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 84.7

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"		4 (2-2-2-3)
	2	SS	24	24	Fine to Medium Silty SAND, Light Brown, Moist, Very Loose, (SM)		21 (6-10-11-15)
5	3	SS	24	24	Sandy CLAY, Brown to Brown with Red-Brown Mottling, Moist, Very Stiff to Hard, (CL)	80	(13-16-15-15) 31
	4	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Dense, (SC)		(13-15-18-19) 33
	5	SS	24	24			(17-21-18-15) 39
10					END OF BORING @ 10.00'	75	
15						70	
20						65	
25						60	
30						55	

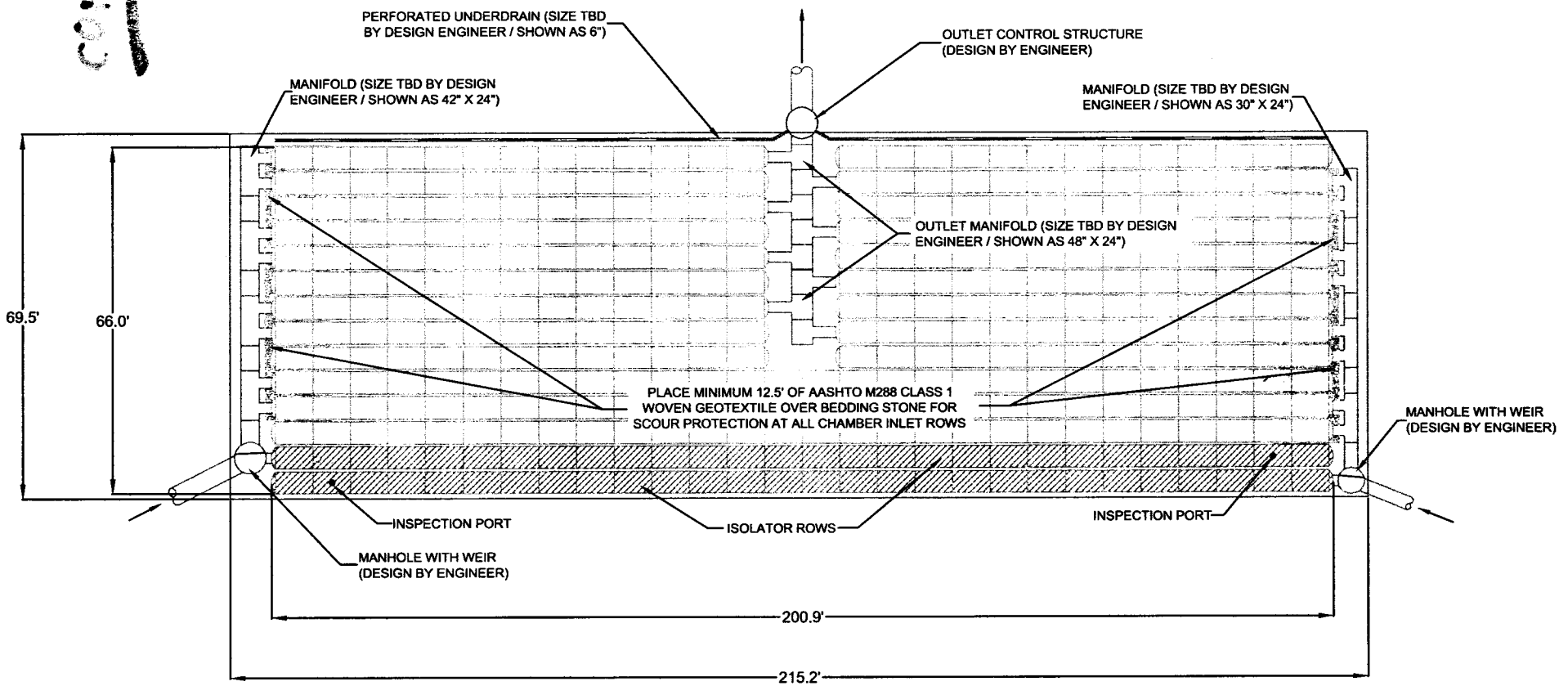
WATER LEVELS

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

▽WL DRY WS OR WD	BORING STARTED 03/20/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 03/20/06	CAVE IN DEPTH ● N/A
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

374 SC-740 STORMTECH CHAMBERS
STORAGE PER INSTALLED CHAMBER w/ 6" STONE BELOW / 6" STONE ABOVE / 40% STONE VOID - 74.9 CF
TOTAL STORAGE PROVIDED - 28012 CF



* NOTE: CHAMBER SYSTEM DESIGN MUST BE IN ACCORDANCE WITH STORMTECH DESIGN MANUAL

STORMTECH LLC CONCEPTUAL PLAN DISCLAIMER

THIS STORMTECH CHAMBER SYSTEM LAYOUT WAS PRODUCED TO DEMONSTRATE A BED LAYOUT THAT WILL HANDLE THE DESIGN VOLUME LISTED ABOVE. THE SIZING, FIT AND APPLICABILITY OF THE STORMTECH CHAMBER SYSTEM FOR THIS SPECIFIC PROJECT HAS NOT BEEN DETERMINED. IT IS THE ULTIMATE RESPONSIBILITY OF THE DESIGN ENGINEER TO ASSURE THAT THE STORMWATER SYSTEM DESIGN IS IN FULL COMPLIANCE WITH ALL APPLICABLE LAWS AND REGULATIONS. STORMTECH PRODUCTS MUST BE DESIGNED AND INSTALLED IN ACCORDANCE WITH STORMTECH'S MINIMUM REQUIREMENTS. STORMTECH LLC DOES NOT APPROVE PLANS, SIZING, OR SYSTEM DESIGNS. THE DESIGNING ENGINEER IS RESPONSIBLE FOR ALL DESIGN DECISIONS.

StormTech
Detention•Retention•Recharge
Subsurface Stormwater Management™

20 Beaver Road, Suite 104
Wethersfield, CT 06109
Phone: 888-892-2694
Fax: 866-328-8401
www.stormtech.com

JAMES CITY 8TH ELEMENTARY SCHOOL

SCALE:	NTS	CHECKED	
DATE:	5/11/2006	ACAD No.	
DRAWN BY:	MDK	SHEET	OF

Scott Thomas

From: Scott Thomas
Sent: Tuesday, May 09, 2006 2:51 PM
To: Wayland Bass; William A. Cain
Cc: Darryl Cook; Darryl Cook; Mike Woolson
Subject: Underground Infiltration/Detention Storage Chambers at 8th Elem School

I gotten some preliminary feedback from Brian Rustia with StormTech on the possible use of underground polyethylene storage chamber in the back area of the 8th elementary school. I faxed him information late last week giving him some of the basic location, size, design and volume parameters. I asked him to give me a price for two options. One to provide treatment for 1 acre-foot of storage volume and the second was for the volume associated with a 1-year, 24 hour storm. I provided him numbers on the volume for the 1-year storm (DA=3.3 acres, CN of 96, Tc of 0.1 hours).

Here are the results. Both resulted in a unit cost of $5.56/cubic foot of storage volume:

Assumptions common to both:

- Use of the typical SC-740 unit
- 6 inches of stone base
- 6 inches of stone between rows
- 6 inches of stone above unit
- Minimum 12 inches of cover over units to finished grade

1 acre-foot Design
Installed Cost: $ 246,043
Approx. size: 232' L x 87' W x 4.5' deep
Total of 582 chambers
18 rows at 32 chambers per row

1-year storm Design
Installed Cost: $ 161,888
Approx. Size: 180' L x 75' W x 4.5' deep
Total of 374 chambers
15 rows at 25 chambers per row

Brian will be forwarding me some schematic diagrams on the layout and configuration later this week. It would be expected that in order to meet the 30 percent LID proffer as imposed in the SUP, that about $ 100,000 would be spent to meet that condition regardless of the type of method used. Use of this system, depending on the selected option, would cost anywhere from about $ 60,000 to $ 150,000 above that amount. If you want to discuss more at engineers meeting let me know.

Scott J. Thomas, P.E.
Chief Engineer - Stormwater
James City County
Environmental Division

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

Scott Thomas

From: Brian Rustia [brustia@stormtech.com]
Sent: Tuesday, May 09, 2006 10:59 AM
To: Scott Thomas
Cc: Dave.Garrett@ads-pipe.com
Subject: Williamsburg 8th elementary
Attachments: Williamsburg8thElementary1yrstrom.pdf; Williamsburg8thElementary1acft.pdf

Scott,

I've enclosed two cost estimates on the systems we spoke about last week. PDF versions of proposed layouts will follow- probably by Thursday or Friday of this week. Call me if you have questions.

Brian Rustia, PE
Mid-Atlantic Product Manager
StormTech, LLC
www.stormtech.com
Cell 866-405-9292
Office 703-425-2096
Fax 888-691-1082

6" stone between rows
6" stone base
6" stone above units
12" cover above system to F.G.

1- AC.FT

582 chambers
232' x 87'
18 rows
32 per row

$246,043
$5.56/CF OF STORAGE

1- YR

374 chambers
180' L x 75' W

$161,888.60
15 rows
25 per row

Project: 8th Elementary School- 1yr Storm

Cells must be manually entered
Cell A20 formula must be adjusted to the chamber you select. Cell F8 or F16.
Cell A16 formula must be adjusted to the chamber you select. Cell F9 or F17.
Cell A17 must be adjusted to the chamber you select. Choose from cell F11 or F19.

374	Number of SC-740s or SC 310s
15	Number of Rows
25	Number of SC-740s or SC 310s Per Row
6	" Stone Between Rows
6	" Stone Base
6	" Stone Above
12	" Cover Above System

System Dimensions	
179.276	Length
72.75	Width
4.50	Depth

58690.48	CF	System Hole
17166.6	CF	Chamber Volume
28481.55	CF	Stone Quantity
	0.4	Porosity Multiplier
11392.62	CF	Stone Storage
17166.6	CF	Chamber Storage
28559	CF	Total Storage

SC-740 SetUp	
45.9	Chamber Storage
4.75	Chamber Width
7.11	Chamber Length
4.50	System Depth
200	Chamber Cost
33	EndCap Cost

SC-310 SetUp	
14.7	Chamber Storage
3.33	Chamber Width
7.11	Chamber Length
2.33	System Depth
75	Chamber Cost
25	EndCap Cost

1.5	Perimeter Width Adjustment
2	Length Adjustment
1.35	Ton Multiplier

Material Quantity Calculations

Excavation
58,690 CF LxWxD
2,174 CY (27cf/cy)

Stone
28481.55 cf
1054.87 cy (27cf/cy)
1424 ton

Cover
13042.33 cf
483 cy (27cf/cy)

Geotextile (6 oz)
Top & Bottom
26085 sf
2898 sy (9sf/sy)
Sides
1764 sf
196 sy (9sf/sy)
Total Geotextile
3234 sy

Woven Geotextile
201 sy

Material Quantities		Schedule of Values		
374	SC 310 or 740	$195.00	each	
30	EndCaps	$34.00	each	
1424	Stone Tons	$20.00	ton	
3234	Geotextile (sy)	$1.00	sy	
2,174	Excavation	$12.00	cy	
483	Cover Fill	$12.00	cy	
		$6.67	each	Chamber Placement
		$12.00	ton	Stone Placement
		$0.25	sy	Geotextile Placement

Cost Estimate 8th Elementary School- 1yr Storm

Material		Quantity	Unit Cost	Total
Chambers		374	$195.00	$72,930.00
	Handling	374	$6.67	$2,494.58
EndCaps		30	$34.00	$1,020.00
	Handling	30	$6.67	$200.10
Header		1.5	$2,500.00	$3,750.00
Excavation		2,174	$12.00	$26,084.66
Geotextile		3234	$1.00	$3,233.75
	Handling	3234	$0.25	$808.44
Stone		1424	$20.00	$28,481.55
	Handling	1424	$12.00	$17,088.93
Cover		483	$12.00	$5,796.59
				$161,888.60 Installed Cost Estimate
				$5.67 Cost / Cubic Foot of Storage

Chamber Labor Validation
30 chambers per hour with 4 laborer crew
Labor rate of $50 per hour
4 man hours per 30 chambers
$200 / 30 chambers = **$6.67 each**

Note: **Typical installation rate is 30 SC-740s per hour with 2 laborers.**

Note: To fax this report you will need to clear the fill coloring from the selected cell. The fill coloring will blacken out a cell and the cell contents will not be visible. Create a file folder on your desktop and save individually named estimates so you do not clear fill from your template.

Project: 8th Elementary School- 1ac-ft

Cells must be manually entered
Cell A20 formula must be adjusted to the chamber you select. Cell F8 or F16.
Cell A16 formula must be adjusted to the chamber you select. Cell F9 or F17.
Cell A17 must be adjusted to the chamber you select. Choose from cell F11 or F19.

582	Number of SC-740s or SC 310s
18	Number of Rows
32	Number of SC-740s or SC 310s Per Row
6	" Stone Between Rows
6	" Stone Base
6	" Stone Above
12	" Cover Above System

System Dimensions	
231.89	Length
87	Width
4.50	Depth

90784.94	CF	System Hole
26713.8	CF	Chamber Volume
43896.71	CF	Stone Quantity
	0.4	Porosity Multiplier
17558.68	CF	Stone Storage
26713.8	CF	Chamber Storage
44272	CF	Total Storage

SC-740 SetUp	
45.9	Chamber Storage
4.75	Chamber Width
7.11	Chamber Length
4.50	System Depth
200	Chamber Cost
33	EndCap Cost

SC-310 SetUp	
14.7	Chamber Storage
3.33	Chamber Width
7.11	Chamber Length
2.33	System Depth
75	Chamber Cost
25	EndCap Cost

1.5	Perimeter Width Adjustment
2	Length Adjustment
1.35	Ton Multiplier

Material Quantity Calculations

Excavation
90,785 CF LxWxD
3,362 CY (27cf/cy)

Stone
43896.71 cf
1625.80 cy (27cf/cy)
2195 ton

Cover
20174.43 cf
747 cy (27cf/cy)

Geotextile (6 oz)
Top & Bottom
40349 sf
4483 sy (9sf/sy)
Sides
2232 sf
248 sy (9sf/sy)
Total Geotextile
4912 sy

Woven Geotextile
250 sy

Material Quantities		Schedule of Values		
582	SC 310 or 740	$190.00	each	
36	EndCaps	$32.00	each	
2195	Stone Tons	$20.00	ton	
4912	Geotextile (sy)	$1.00	sy	
3,362	Excavation	$12.00	cy	
747	Cover Fill	$12.00	cy	
		$6.67	each	Chamber Placement
		$12.00	ton	Stone Placement
		$0.25	sy	Geotextile Placement

Cost Estimate 8th Elementary School- 1ac-ft

Material		Quantity	Unit Cost	Total
Chambers		582	$190.00	$110,580.00
	Handling	582	$6.67	$3,881.94
EndCaps		36	$32.00	$1,152.00
	Handling	36	$6.67	$240.12
Header		1.5	$3,000.00	$4,500.00
Excavation		3,362	$12.00	$40,348.86
Geotextile		4912	$1.00	$4,911.59
	Handling	4912	$0.25	$1,227.90
Stone		2195	$20.00	$43,896.71
	Handling	2195	$12.00	$26,338.02
Cover		747	$12.00	$8,966.41

$246,043.55 Installed Cost Estimate

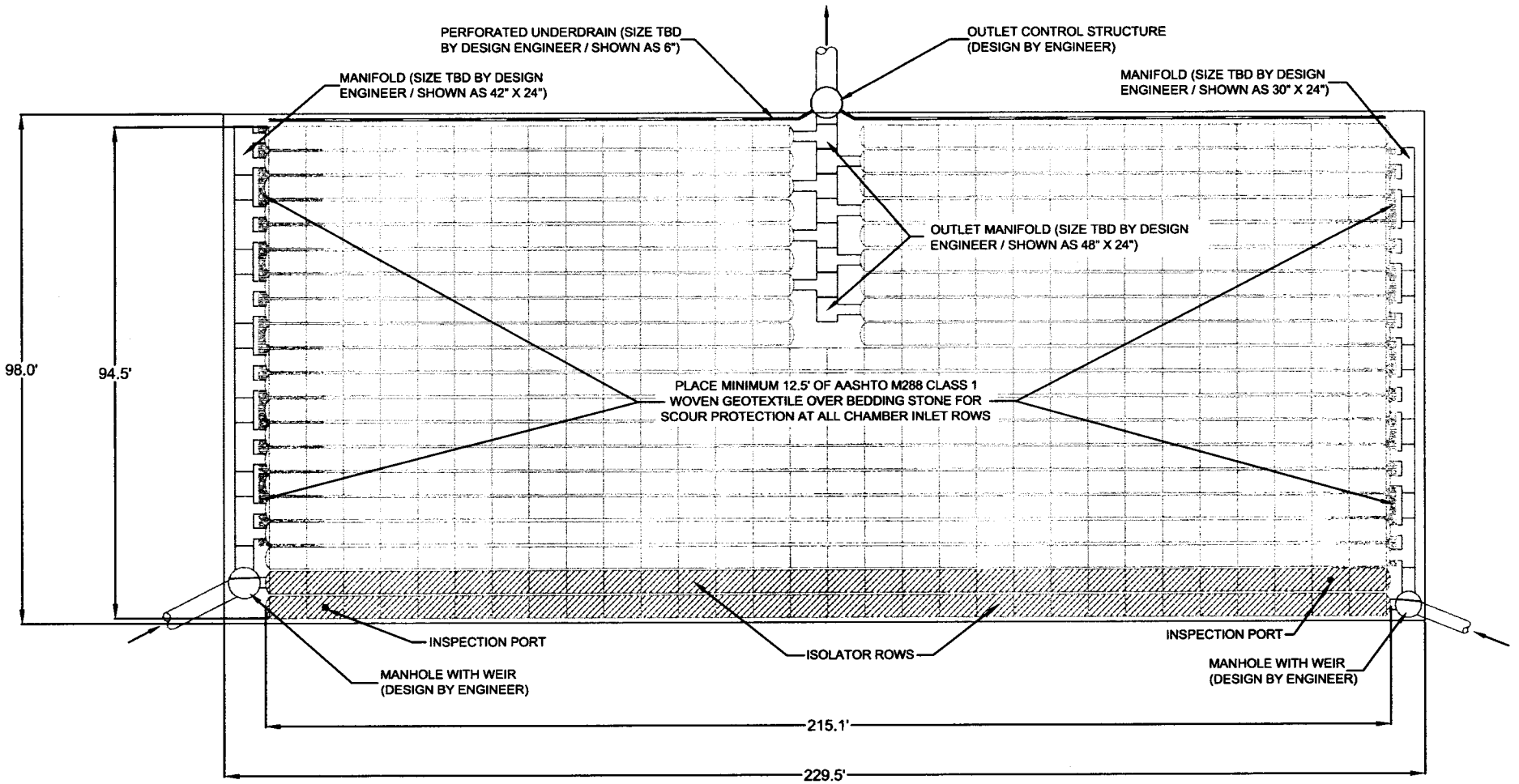
$5.56 Cost / Cubic Foot of Storage

Chamber Labor Validation
30 chambers per hour with 4 laborer crew
Labor rate of $50 per hour
4 man hours per 30 chambers
$200 / 30 chambers = **$6.67 each**

Note: **Typical installation rate is 30 SC-740s per hour with 2 laborers.**

Note: To fax this report you will need to clear the fill coloring from the selected cell. The fill coloring will blacken out a cell and the cell contents will not be visible. Create a file folder on your desktop and save individually named estimates so you do not clear fill from your template.

582 SC-740 STORMTECH CHAMBERS
STORAGE PER INSTALLED CHAMBER w/ 6" STONE BELOW / 6" STONE ABOVE / 40% STONE VOID - 74.9 CF
TOTAL STORAGE PROVIDED - 43591 CF



* NOTE: CHAMBER SYSTEM DESIGN MUST BE IN ACCORDANCE WITH STORMTECH DESIGN MANUAL

STORMTECH LLC CONCEPTUAL PLAN DISCLAIMER

THIS STORMTECH CHAMBER SYSTEM LAYOUT WAS PRODUCED TO DEMONSTRATE A BED LAYOUT THAT WILL HANDLE THE DESIGN VOLUME LISTED ABOVE. THE SIZING, FIT AND APPLICABILITY OF THE STORMTECH CHAMBER SYSTEM FOR THIS SPECIFIC PROJECT HAS NOT BEEN DETERMINED. IT IS THE ULTIMATE RESPONSIBILITY OF THE DESIGN ENGINEER TO ASSURE THAT THE STORMWATER SYSTEM DESIGN IS IN FULL COMPLIANCE WITH ALL APPLICABLE LAWS AND REGULATIONS. STORMTECH PRODUCTS MUST BE DESIGNED AND INSTALLED IN ACCORDANCE WITH STORMTECH'S MINIMUM REQUIREMENTS. STORMTECH LLC DOES NOT APPROVE PLANS, SIZING, OR SYSTEM DESIGNS. THE DESIGNING ENGINEER IS RESPONSIBLE FOR ALL DESIGN DECISIONS.

StormTech
Detention•Retention•Recharge
Subsurface Stormwater Management™

20 Beaver Road, Suite 104
Wethersfield, CT 06109
Phone: 888-892-2694
Fax: 866-328-8401
www.stormtech.com

JAMES CITY 8TH ELEMENTARY SCHOOL

SCALE:	NTS	CHECKED	
DATE:	5/11/2006	ACAD No.	
DRAWN BY:	MDK	SHEET	OF

MASTER DESIGN STORM SUMMARY

Network Storm Collection: JCC.Data

Return Event	Total Depth in	Rainfall Type	RNF ID
5	4.7000	Synthetic Curve	TypeII 24hr
100	8.0000	Synthetic Curve	TypeII 24hr
1	2.8000	Synthetic Curve	TypeII 24hr
2	3.5000	Synthetic Curve	TypeII 24hr
10	5.8000	Synthetic Curve	TypeII 24hr
25	6.4000	Synthetic Curve	TypeII 24hr
50	7.2000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10	JCT	5	1.175		11.9500	18.72		
*OUT 10	JCT	100	2.087		11.9500	32.31		
*OUT 10	JCT	1	.654		11.9500	10.79		
*OUT 10	JCT	2	.845		11.9500	13.73		
*OUT 10	JCT	10	1.479		11.9500	23.26		
*OUT 10	JCT	25	1.644		11.9500	25.74		
*OUT 10	JCT	50	1.866		11.9500	29.03		
SUBAREA 10	AREA	5	1.175		11.9500	18.72		
SUBAREA 10	AREA	100	2.087		11.9500	32.31		
SUBAREA 10	AREA	1	.654		11.9500	10.79		
SUBAREA 10	AREA	2	.845		11.9500	13.73		
SUBAREA 10	AREA	10	1.479		11.9500	23.26		
SUBAREA 10	AREA	25	1.644		11.9500	25.74		
SUBAREA 10	AREA	50	1.866		11.9500	29.03		

File.... C:\Program Files\Haestad\PPKW\Libraries\
Title... Project Date: 5/8/2006
Project Engineer: James City County
Project Title: Watershed
Project Comments:
Test 8th ES

DESIGN STORMS SUMMARY

Design Storm File,ID = JCC.Data

Storm Tag Name = 5
Description: This is Data Specific to James City County Virginia
Taken from VSMH, Chapter 4, Volume II

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 4.7000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 100
Description: This is Data Specific to James City County Virginia
Taken from VSMH, Chapter 4, Volume II

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 8.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 1
Description: This is Data Specific to James City County Virginia
Taken from VSMH, Chapter 4, Volume II

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 2
Description: This is Data Specific to James City County Virginia
Taken from VSMH, Chapter 4, Volume II

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... C:\Program Files\Haestad\PPKW\Libraries\
Title... Project Date: 5/8/2006
Project Engineer: James City County
Project Title: Watershed
Project Comments:
Test 8th ES

DESIGN STORMS SUMMARY

Design Storm File,ID = JCC.Data

Storm Tag Name = 10
Description: This is Data Specific to James City County Virginia
Taken from VSMH, Chapter 4, Volume II

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25
Description: This is Data Specific to James City County Virginia
Taken from VSMH, Chapter 4, Volume II

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.4000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 50
Description: This is Data Specific to James City County Virginia
Taken from VSMH, Chapter 4, Volume II

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.2000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 1 year storm
Duration      = 24.0000 hrs     Rain Depth = 2.8000 in
Rain Dir      = C:\Program Files\Haestad\PPKW\Libraries\
Rain File -ID =  - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Program Files\Haestad\PPKW\Libraries\
HYG File - ID = work_pad.hyg - SUBAREA 10 1
Tc            = .1000 hrs
Drainage Area = 3.330 acres  Runoff CN= 96

==========================================
Computational Time Increment  =   .01333 hrs
Computed Peak Time            =  11.9200 hrs
Computed Peak Flow            =    11.13 cfs

Time Increment for HYG File   =    .0500 hrs
Peak Time, Interpolated Output =  11.9500 hrs
Peak Flow, Interpolated Output =    10.79 cfs
WARNING: The difference between calculated peak flow
and interpolated peak flow is greater than 1.50%
==========================================

                DRAINAGE AREA
             -------------------
             ID:SUBAREA 10
             CN   =   96
             Area =       3.330 acres
             S    =    .4167 in
             0.2S =    .0833 in

              Cumulative Runoff
             -------------------
                     2.3554 in
                       .654 ac-ft

HYG Volume...           .654 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .10000 hrs (ID: SUBAREA 10)
Computational Incr, Tm =   .01333 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 =    37.73 cfs
Unit peak time      Tp =   .06667 hrs
Unit receding limb, Tr =   .26667 hrs
Total unit time,    Tb =   .33333 hrs
```

File.... C:\Program Files\Haestad\PPKW\Libraries\TEST.PPW

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Impervious Areas - Paved parking lo	98	3.000			98.00
Open space (Lawns,parks etc.) - Poo	79	.330			79.00
COMPOSITE AREA & WEIGHTED CN --->		3.330			96.12 (96)

::

DA = 3.3 AC
CN_w = 96
T_c = 0.10 HR

SJT

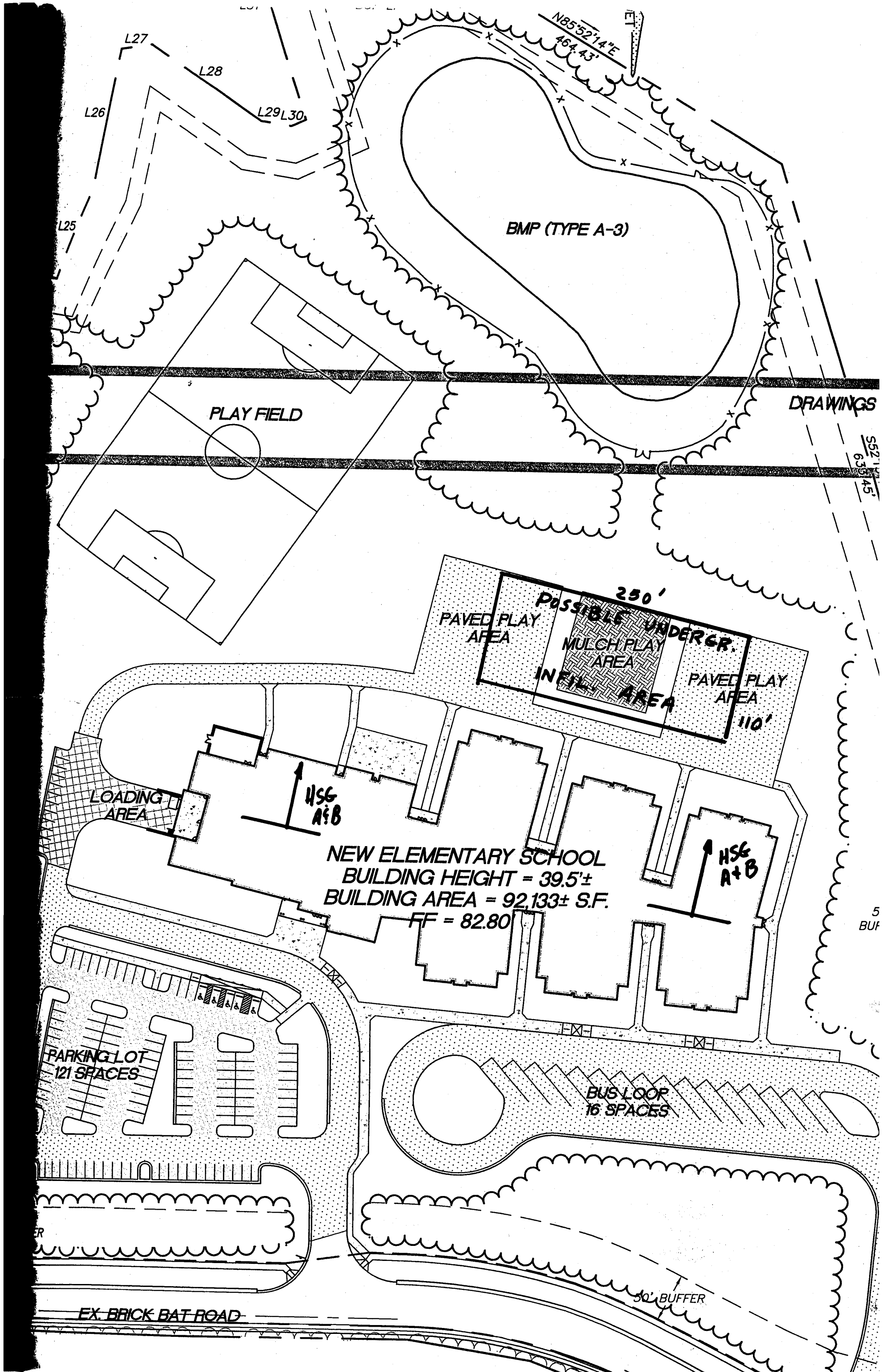
8ES
8th Elem Underground Infil Chamber System
James City County, Virginia

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Building	Open space; grass cover 50% to 75% (fair)	C	.3	79
	Paved parking lots, roofs, driveways	C	3	98
	Total Area / Weighted Curve Number		3.3	96

	Peak Flow CFS	Runoff (in) wat-inches	Runoff Vol (AC-FT)	Runoff (CF)
1-	11.19 CFS	2.338 in. IN.	0.6430 AC-FT	28,007 CF
2-	14.68 CFS	3.130 in.	0.8608 AC-FT	37,494 CF
5-	19.88 CFS	4.325 in.	1.1894 AC-FT	51,809 CF
10-	24.19 CFS	5.322 in.	1.464 AC-FT	63,752 CF
25-	27.19 CFS	6.020 in.	1.655 AC-FT	72,113 CF
50-	30.62 CFS	6.818 in.	1.875 AC-FT	81,673 CF
100-	33.62 CFS	7.517 in.	2.067 AC-FT	90,046

$$\text{in.} \times 3.3\,AC \times \frac{ft}{12\,in.} = AC\text{-}FT$$


N85°52'14"E
464.43'
L27
L28
L26
L29
L30
L25
BMP (TYPE A-3)
PLAY FIELD
DRAWINGS
S52°
633.45'
250'
POSSIBLE UNDERGR.
INFILL AREA
PAVED PLAY AREA
MULCH PLAY AREA
PAVED PLAY AREA
110'
LOADING AREA
HSG A&B
NEW ELEMENTARY SCHOOL
BUILDING HEIGHT = 39.5'±
BUILDING AREA = 92,133± S.F.
FF = 82.80
HSG A+B
PARKING LOT
121 SPACES
BUS LOOP
16 SPACES
50' BUFFER
EX. BRICK BAT ROAD

0.43
2.86ac

0.33
1.94ac

0.58
0.94ac

0.77
0.33ac

0.27
3.40ac

0.30
1.90ac

0.92
0.15ac

0.85
0.32ac

0.91
0.09ac

0.85
0.39ac

0.68
0.65ac

0.85
1.03ac

0.72
1.07ac

0.27
4.17ac

0.92
0.15ac

0.95
0.10ac

250'

100'

AVAILABLE AREA 41,000 S.F.

50' MIN. ROW

BUILDING AREA
92,133 ± S.F.

SUBAREA C/A?

? SUBAREA C/A

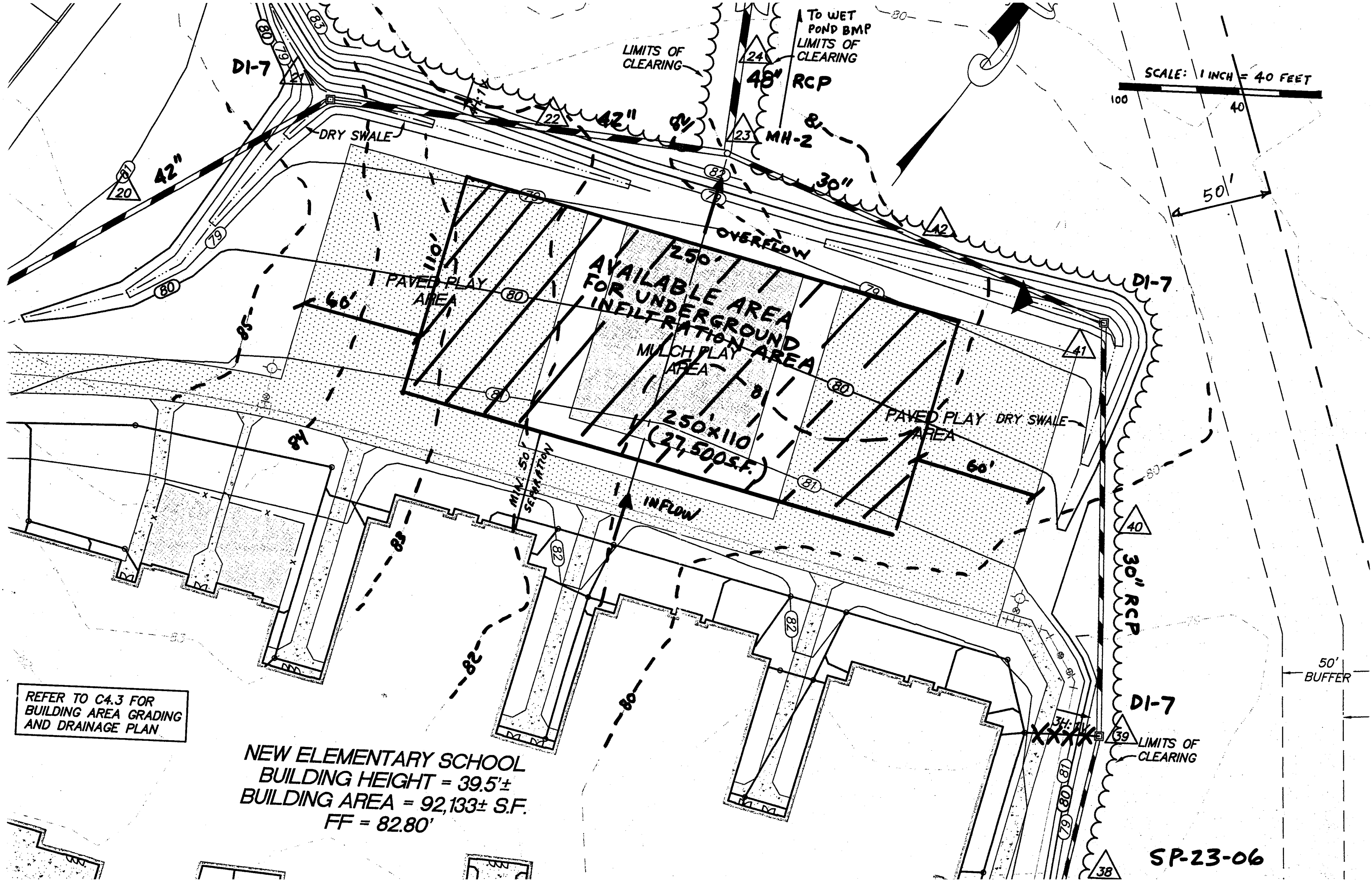
250
35 CHAMBERS LONG
7 ROWS

100
12 CHAMB LONG
20 ROWS

WHERE'S THE

NO CONNECT

1" = 80'


SCALE: 1 INCH = 40 FEET
100
40
D1-7
LIMITS OF CLEARING
TO WET POND BMP
LIMITS OF CLEARING
48" RCP
42"
MH-2
30"
DRY SWALE
OVERFLOW
50'
D1-7
PAVED PLAY AREA
110'
60'
250'
AVAILABLE AREA FOR UNDERGROUND INFILTRATION AREA
MULCH PLAY AREA
250'x110' (27,500 S.F.)
PAVED PLAY AREA
DRY SWALE
60'
MIN. 50' SEPARATION
INFLOW
30" RCP
50' BUFFER
D1-7
LIMITS OF CLEARING
REFER TO C4.3 FOR BUILDING AREA GRADING AND DRAINAGE PLAN
NEW ELEMENTARY SCHOOL
BUILDING HEIGHT = 39.5'±
BUILDING AREA = 92,133± S.F.
FF = 82.80'
SP-23-06

SJT 8ES

8th Elem Underground Infil Chamber System
James City County, Virginia

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)	1-Yr (cfs)
SUBAREAS							
Building	14.68	19.88	24.19	27.19	30.62	33.62	11.19
REACHES							
OUTLET	14.68	19.88	24.19	27.19	30.62	33.62	11.19

SC-740 STORMTECH PE CHAMBERS

2 OPTIONS [1-YR STORM + 1 AC-FT]

(1) FULLY CAPTURE + CONTAIN 1-YR STORM RUNOFF VOL @ $5/CF
0.6430 AC-FT; 28,007 CF; 18" COVER

$ 140,000

140'
100' (139.43) #CHAMB LONG = 19
ROWS = 20

250
60 (55.77) #CHAMB LONG = 35
ROWS = 11

#CHAMB 375
BEDSIZE 13,943 SF
STONE 1,549 TON
EXCAV 2,269 CY
FABRIC 4,261 SY

(2) 1 AC-FT ~ 2 YR STORM 0.8608 AC-FT (37,494 CF)
~ 5 YR STORM 1.1894 AC-FT (51,809 CF)
USE 2-YR. @ $5/CF

$ 187,500

190'
100 (186.28) #CHAMB L = 26
ROWS = 19

250
75 (74.51) #CHAMB L = 35
ROWS = 14

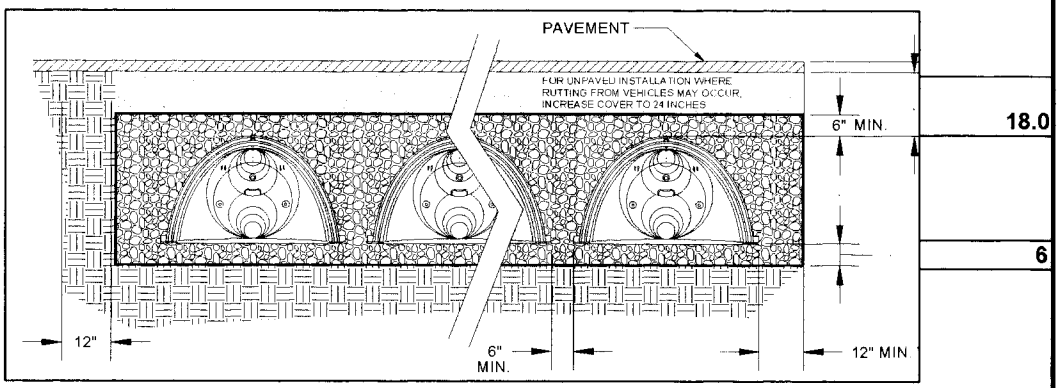
#CHAMB 501
BEDSIZE 18,628 SF
TON STONE 2070 TON
EXCAV 3032 CY
FABRIC 5692 SF

StormTech
Detention • Retention • Recharge
Subsurface Stormwater Management

Project:
By:
POC:
Date:

System Requirements

Required Storage Volume (Vs)	Vs	**28,007**	CF
Stormtech System		SC-740	
Stone Foundation Depth		6"	
Storage Volume Per Chamber		74.9	CF
Total Cover over Chamber		**18.0**	Inches
Number of Chambers Required	C	375	Each
Required Bed Size (S)	S	13,943	SF
Tons of Stone Required (Tst)	Tst	1,549	Tons
Volume of Excavation (Ex)	Ex	2,269	CY
Area of Filter Fabric (F)	F	4,261	SY
# of End Caps Required	Ec	**4**	Each



Controlled by Width		Controlled by Length	
Width	**100** FT	Length	**250** FT
Length	139.43 FT	Width	55.77 FT
# of Chambers Long	19 EA	# of Chambers Long	35 EA
# of Rows	20 EA	# of Rows	11 EA
Actual Length	136.92 FT	Actual Length	250.78 FT
Actual Width	95.5 FT	Actual Width	52.75 FT

System Cost - CONCEPTUAL BUDGET

*** PLEASE CALL STORMTECH @ 888-892-2694 FOR CONCEPTUAL COST ESTIMATES DUE TO GEOGRAPHICAL VARIABLES.**
***Budgetary Installed Costs for StormTech Systems range from $3.50 - $7.00 / CF of Storage.**

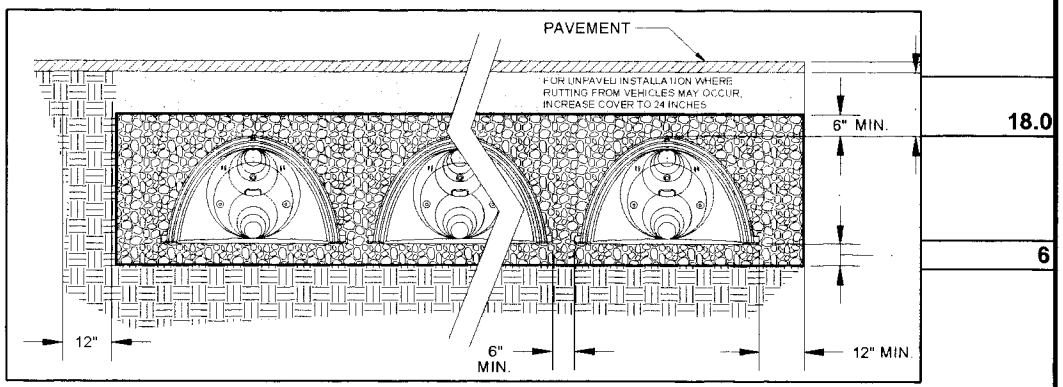
***Many geographical variables can effect Installed Costs and should be taken into account when estiamating budgets.**

StormTech®
Detention • Retention • Recharge
Subsurface Stormwater Management

Project:
By:
POC:
Date:

System Requirements

Required Storage Volume (Vs)	Vs	**37,494**	CF
Stormtech System		SC-740	
Stone Foundation Depth		6"	
Storage Volume Per Chamber		74.9	CF
Total Cover over Chamber		**18.0**	Inches
Number of Chambers Required	C	501	Each
Required Bed Size (S)	S	18,628	SF
Tons of Stone Required (Tst)	Tst	2,070	Tons
Volume of Excavation (Ex)	Ex	3,032	CY
Area of Filter Fabric (F)	F	5,692	SY
# of End Caps Required	Ec	**4**	Each



Controlled by Width		Controlled by Length	
Width	**100** FT	Length	**250** FT
Length	186.28 FT	Width	74.51 FT
# of Chambers Long	26 EA	# of Chambers Long	35 EA
# of Rows	19 EA	# of Rows	14 EA
Actual Length	186.73 FT	Actual Length	250.78 FT
Actual Width	90.75 FT	Actual Width	67.00 FT

System Cost - CONCEPTUAL BUDGET

*** PLEASE CALL STORMTECH @ 888-892-2694 FOR CONCEPTUAL COST ESTIMATES DUE TO GEOGRAPHICAL VARIABLES.**
***Budgetary Installed Costs for StormTech Systems range from $3.50 - $7.00 / CF of Storage.**

***Many geographical variables can effect Installed Costs and should be taken into account when estiamating budgets.**

SP-23-06

TOTAL IMPER = 7.3 AC. (Timmons)
9.3 AC. (WARFORD)

New A = 3.3 AC.

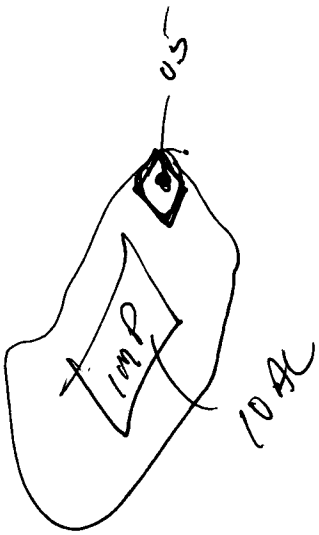
3.3
0.10
0
3.3.0

3.30
0.33
2.97

3.3/7.3 = 45.2%

3.3/9.3 = 35.4%

	9.3	
PLAY	0.8	3.3 AC.
BLDG	2.5	
LOAD	0.4	
PKG	2.2	
BLS	1.1	
BLS	0.5	
BRKR-B	0.9	
BRKR-B	0.9	
	9.4	
POND ?		



10% OF D.A. AS GRASS, LANDSCAPE CN = 79

JAMES CITY COUNTY - ENVIRONMENTAL DIVISION

Office Phone: 757-253-6670 Fax Number: 757-259-4032

DATE SENT: 05/02/06

Name: Brian Rustia

Firm or Company: STORM TECH

Facsimile Number: 888-691-1082

Number of pages including this transmittal: 10

From: Scott J. Thomas

James City County
P O Box 8784
Williamsburg VA 23187-8784

Comments: W-JCC 8th ELEM SCHOOL CONCEPT

If you do not receive all pages, call 757-253-6670 as soon as possible

SCOTT J. THOMAS, P.E.
SENIOR ENGINEER

ENVIRONMENTAL DIVISION

101 MOUNTS BAY ROAD, P.O. BOX 8784
WILLIAMSBURG, VIRGINIA 23187-8784

(757) 253-6639
FAX: (757) 259-4032
E-MAIL: scottt@james-city.va.us

W-JCC 8TH ELEM. SCHOOL
BRICK BAT ROAD
JAMES CITY COUNTY

CONCEPT UNDERGROUND
STORMWATER CHAMBER SYSTEM
(DETENTION & INFILTRATION

COUNTY PLAN NO. SP-23-06

BRIAN

COUNTY PLAN NO. SP-23-06

THIS IS THE PRELIMINARY INFORMATION ON THE IDEA FOR AN UNDERGROUND STORMWATER CHAMBER INFILTRATION AREA AT THE WILLIAMSBURG-JAMES CITY 8TH ELEM. SCHOOL. PRELIM. SOILS ARE HSG A & B AT THIS LOCATION. AVAIL. SIZE IS ABOUT 250'X100' (25,000 SF). GRADING IS CUT 1 TO ABOUT 4 FT.

- DA = 3.3 AC.; CN = 96; TC = 0.1 HR
- SUP CONDITION TO TREAT 30% OF SITE IMPERV AREA (3.3 AC IS ABOUT 35.4%)
- CHAMBER SYSTEM NOT ONLINE; WILL COLLECT & TREAT BUILDING AREA. ROOF LEADERS TO CONVEY TO TREATMENT AREA.
- DOWNSTREAM WET POND BMP.

TREATMENT

1. 1.0 AC-FT (43,560 C.F.) PREFERRED
2. 1-YEAR STORM VOL. 0.643 AC-FT (28,007 CF) - ALTERN.

NEED

1. CONCEPT LAYOUT, SIZE + CONFIGURATION.
2. APPROX. COST, BALL PARK (IF POSSIBLE.)

DA = 3.3 AC
CN_w = 96
T_c = 0.10 HR

SJT

8ES
8th Elem Underground Infil Chamber System
James City County, Virginia

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Building	Open space; grass cover 50% to 75% (fair)	C	.3	79
	Paved parking lots, roofs, driveways	C	3	98
	Total Area / Weighted Curve Number		3.3	96

	Peak Flow CFS	Runoff (in) wat-inches	Runoff Vol (AC-FT)	Runoff (CF)
1-	11.19 CFS	2.338 in. IN.	0.6430 AC-FT	28,007 CF
2-	14.68 CFS	3.130 in.	0.8608 AC-FT	37,494 CF
5-	19.88 CFS	4.325 in.	1.1894 AC-FT	51,809 CF
10-	24.19 CFS	5.322 in.	1.464 AC-FT	63,752 CF
25-	27.19 CFS	6.020 in.	1.655 AC-FT	72,113 CF
50-	30.62 CFS	6.818 in.	1.875 AC-FT	81,672 CF
100-	33.62 CFS	7.517 in.	2.067 AC-FT	90,046

$$\text{in.} \times 3.3\,AC \times \frac{ft}{12\,in.} = AC\text{-}FT$$

POOR QUALITY

ORIGINAL(S) FOLLOW

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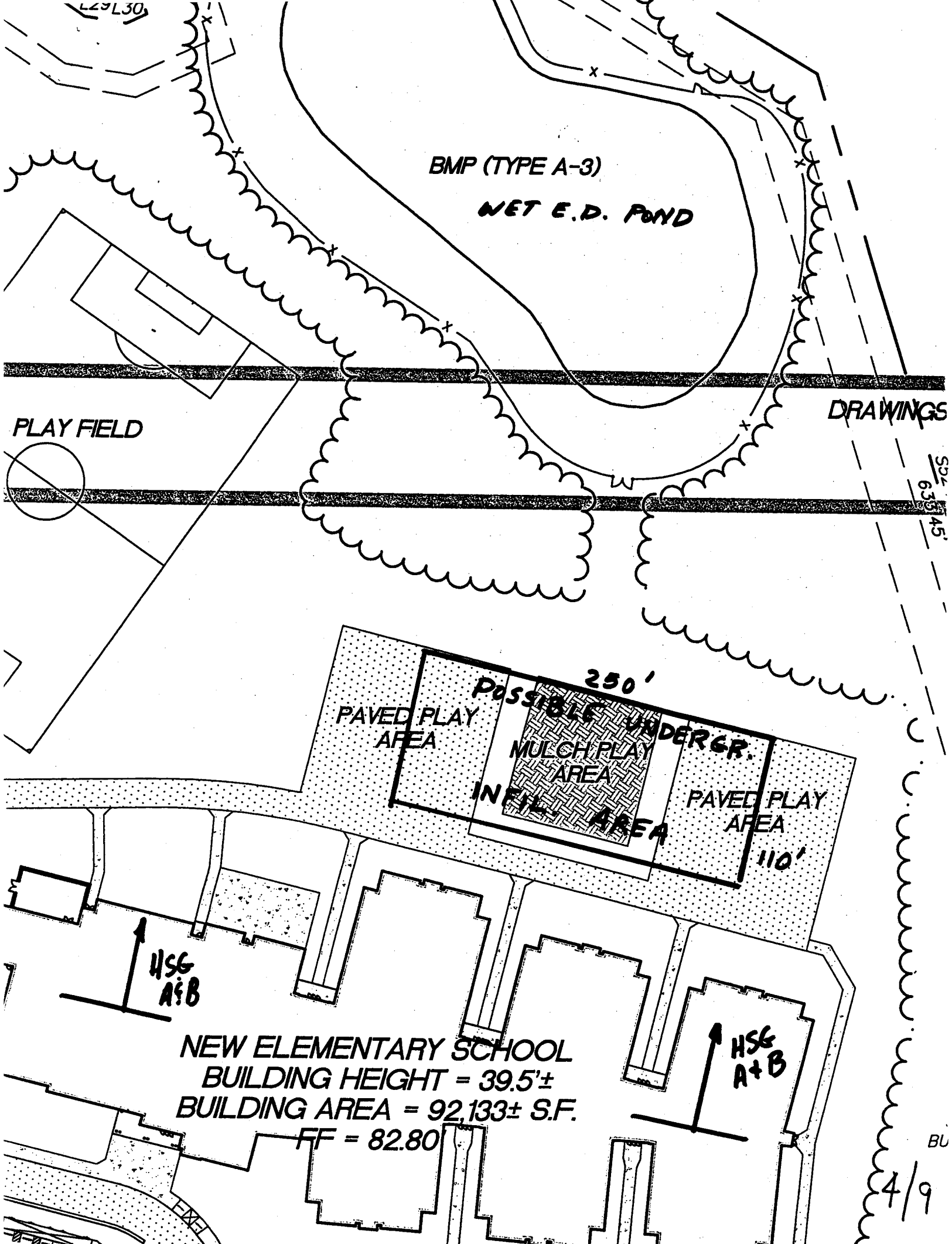
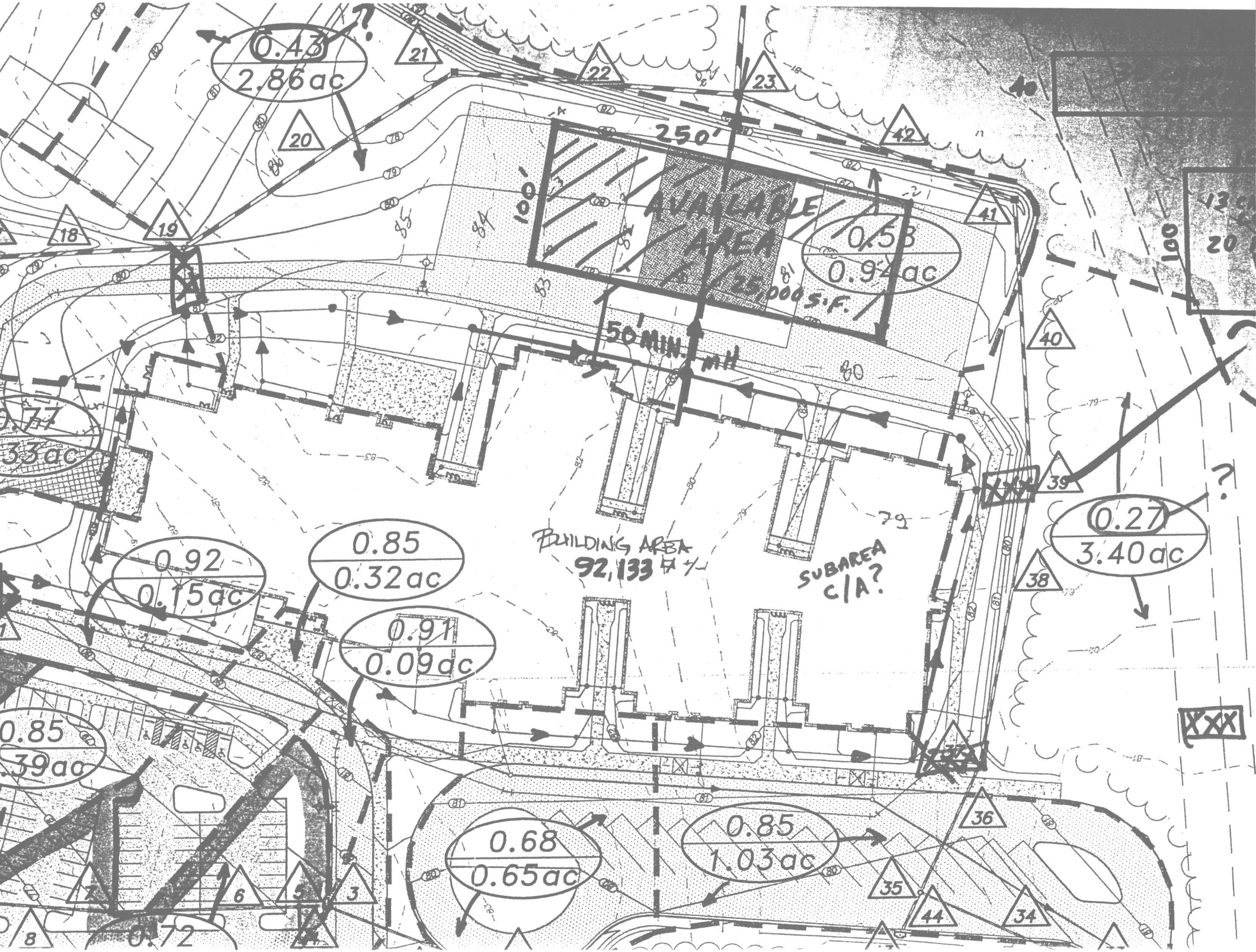
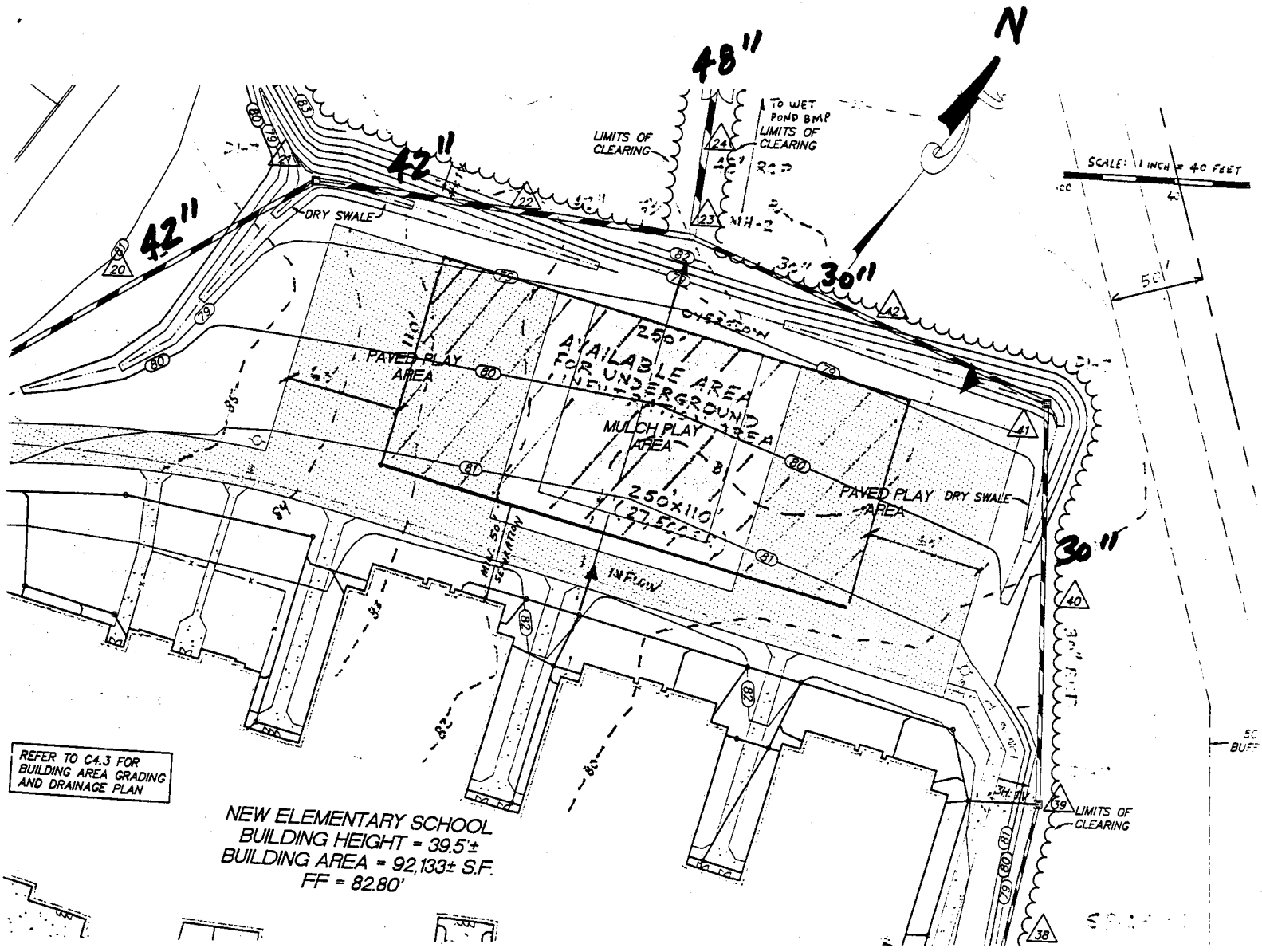
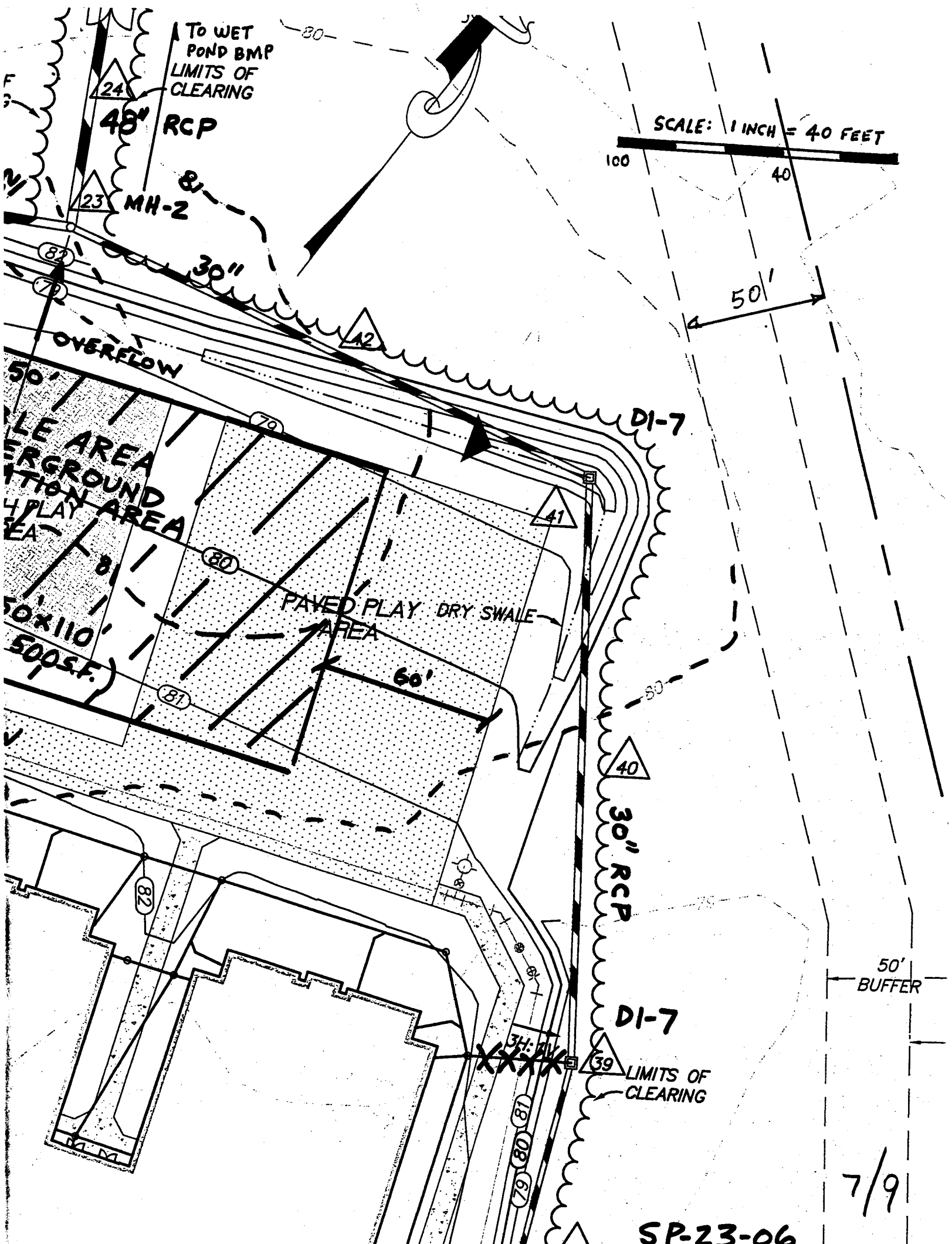
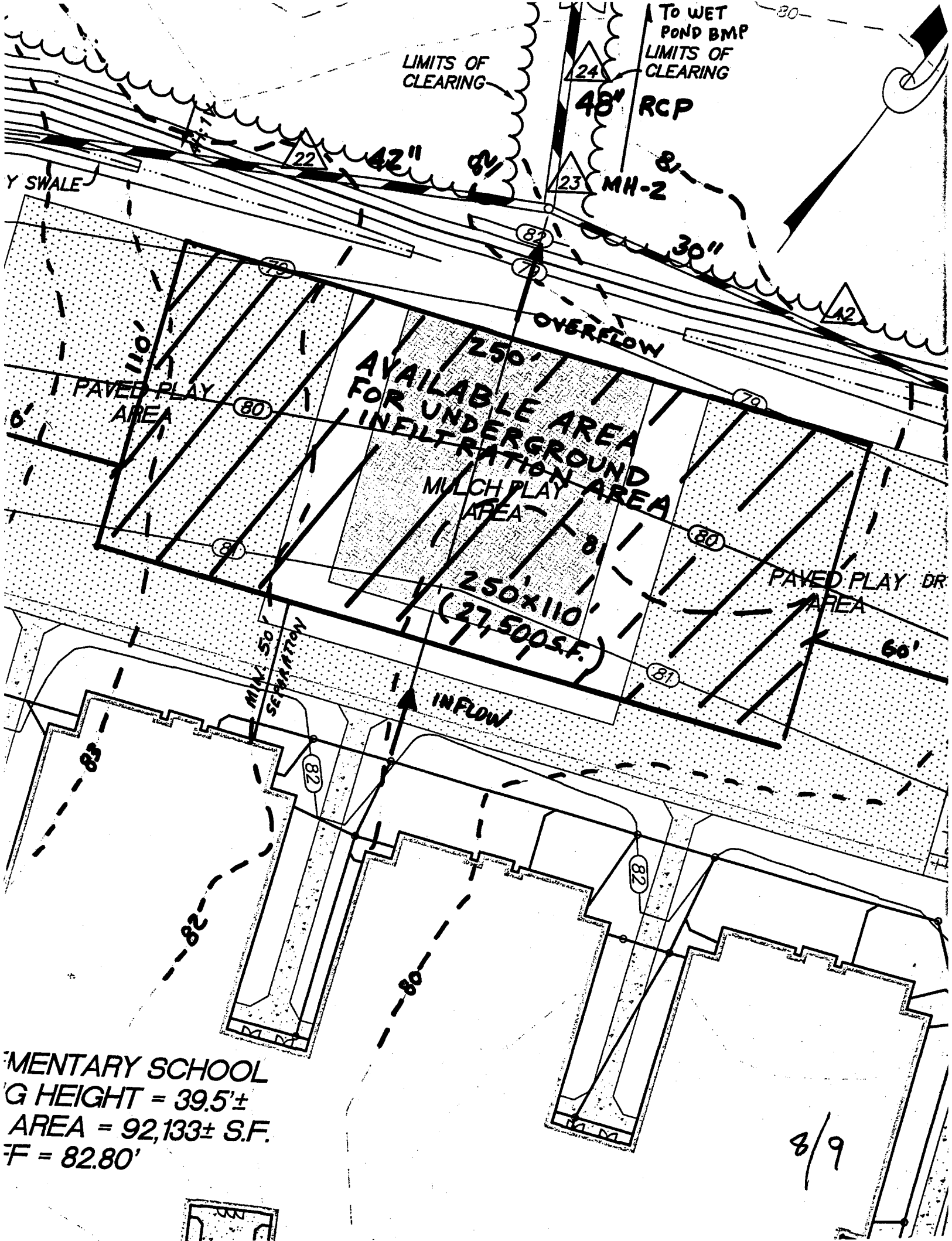

L29L30
BMP (TYPE A-3)
NET E.D. POND
PLAY FIELD
DRAWINGS
SDE
635
45'
250'
POSSIBLE UNDERGR.
INFIL. AREA
PAVED PLAY AREA
MULCH PLAY AREA
PAVED PLAY AREA
110'
HSG A&B
HSG A+B
NEW ELEMENTARY SCHOOL
BUILDING HEIGHT = 39.5'±
BUILDING AREA = 92,133± S.F.
FF = 82.80
BU
4/9

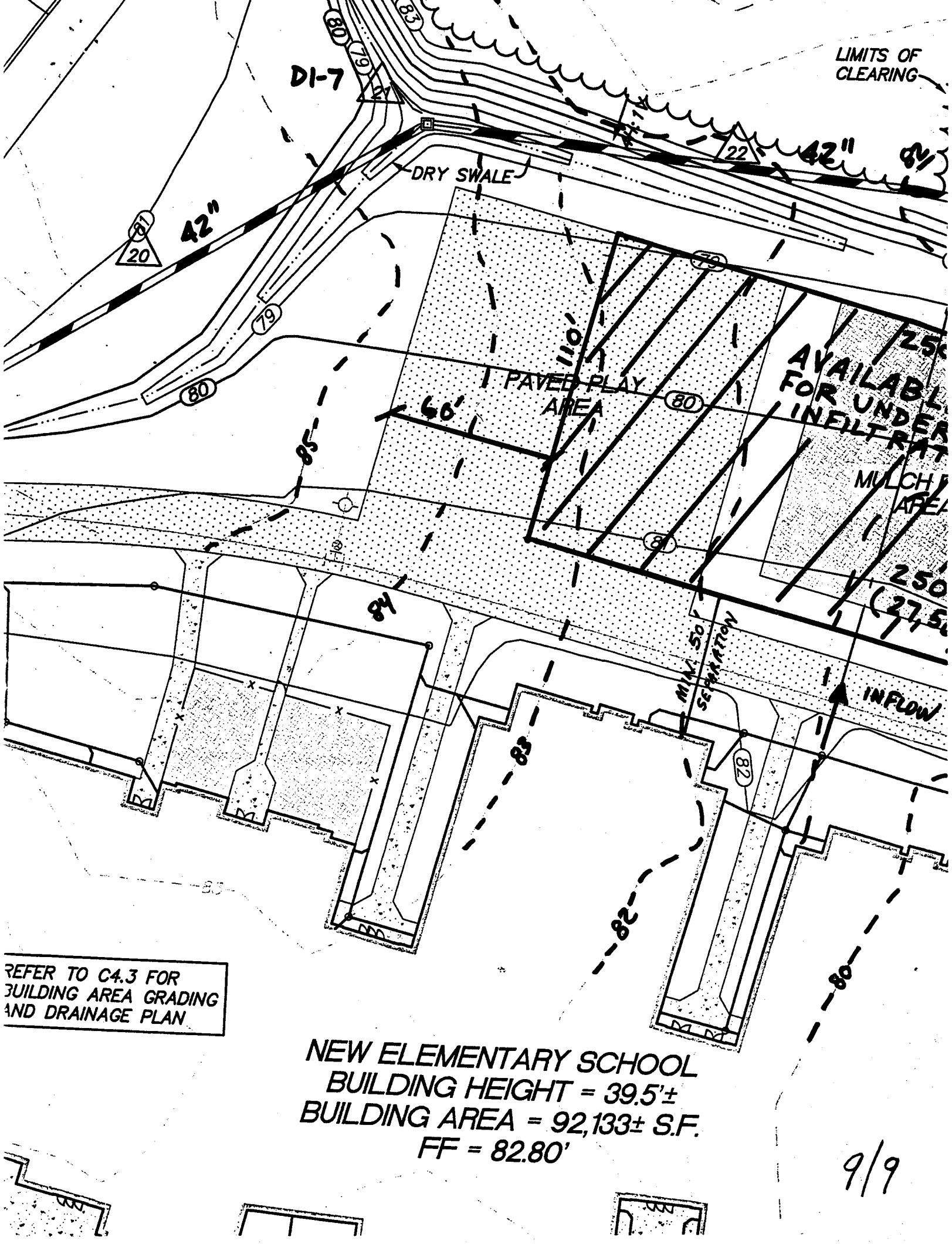

0.43
2.86ac
250'
100'
AVAILABLE AREA 4/5 5000 S.F.
0.53
0.94ac
50' MIN
mH
0.77
.33ac
0.27
3.40ac
?
0.92
0.15ac
0.85
0.32ac
0.91
0.09ac
BUILDING AREA
92,133 ☐' +/-
SUBAREA C/A?
0.85
.39ac
0.68
0.65ac
0.85
1.03ac
0.72
XXX
XXX


N
48"
42"
42"
30"
30"
30"
TO WET POND BMP
LIMITS OF CLEARING
LIMITS OF CLEARING
SCALE: 1 INCH = 40 FEET
DRY SWALE
PAVED PLAY AREA
AVAILABLE AREA FOR UNDERGROUND
MULCH PLAY AREA
250'
250'x110'
(27,500 S.F.)
PAVED PLAY AREA
DRY SWALE
INFLOW
OVERFLOW
MH-2
LIMITS OF CLEARING
REFER TO C4.3 FOR BUILDING AREA GRADING AND DRAINAGE PLAN
NEW ELEMENTARY SCHOOL
BUILDING HEIGHT = 39.5'±
BUILDING AREA = 92,133± S.F.
FF = 82.80'

N.T.S.


TO WET POND BMP
LIMITS OF CLEARING
48" RCP
MH-2
30"
OVERFLOW
SCALE: 1 INCH = 40 FEET
100
40
50'
D1-7
PAVED PLAY AREA
DRY SWALE
60'
30" RCP
50' BUFFER
D1-7
3H:1V
LIMITS OF CLEARING
7/9
SP-23-06


TO WET POND BMP
LIMITS OF CLEARING
LIMITS OF CLEARING
24
48" RCP
22
42"
23
MH-2
30"
Y SWALE
82
79
OVERFLOW
42
110'
PAVED PLAY AREA
80
250'
AVAILABLE AREA FOR UNDERGROUND INFILTRATION AREA
MULCH PLAY AREA
81
250x110
(27,500 S.F.)
PAVED PLAY AREA
DR
60'
MIN. 50' SEPARATION
INFLOW
83
82
80
MENTARY SCHOOL
G HEIGHT = 39.5'±
AREA = 92,133± S.F.
F = 82.80'
8/9



NEW ELEMENTARY SCHOOL
BUILDING HEIGHT = 39.5'±
BUILDING AREA = 92,133± S.F.
FF = 82.80'

9/9

WJCC – 8th ELEMENTARY SCHOOL

UNDERGROUND INFILTRATION CHAMBERS (SUBSURFACE POLYETHYELENE)

CONCEPTUAL DESIGN

Does 2.115 AC meet 30% requirement?

APRIL 2006

62.5
119.5

RESOLUTION

CASE NO. SUP-05-06. WILLIAMSBURG-JAMES CITY COUNTY 8TH ELEMENTARY SCHOOL

WHEREAS, the Board of Supervisors of James City County has adopted by ordinance specific land uses that shall be subjected to a Special Use Permit (SUP) process; and

WHEREAS, Mr. Sanford Wanner has applied on behalf of James City County for an SUP to allow for an elementary school on approximately 44 acres of land on a parcel zoned A-1, General Agricultural; and

WHEREAS, the proposed school site is shown on a conceptual layout prepared by Timmons Group, entitled "New Elementary School" and dated March 7, 2006; and

WHEREAS, the property is located on land zoned A-1, General Agricultural, and can be further identified as a portion of James City County Real Estate Tax Map/Parcel No. (36-3)(1-1); and

WHEREAS, the Planning Commission of James City County, following its public hearing on April 3, 2006, recommended approval of this application by a vote of 7-0; and

WHEREAS, the Board of Supervisors of James City County, Virginia, finds this use to be consistent with the 2003 Comprehensive Plan Land Use Map designation for this site.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, does hereby approve the issuance of Special Use Permit No. 05-06 as described herein with the following conditions:

1. The Property shall be developed generally as shown on the Master Plan entitled "New Elementary School" and dated March 7, 2006 (the "Master Plan"), with only changes thereto that the Director of Planning determines do not change the basic concept or character of the development.

2. There shall be a 50-foot perimeter buffer generally as shown on the Master Plan. The buffer shall be exclusive of any structures or paving and shall be undisturbed, except for the entrances and sidewalks shown generally on the Master Plan, and with the approval of the Director of Planning, for lighting, entrance features, fencing, and signs. Dead, diseased and dying trees or shrubbery, invasive or poisonous plants may be removed from the buffer area with the approval of the Director of Planning. With the prior approval of the Director of Planning, utilities may intrude into or cross the perimeter buffer; provided, however, that such crossings or intrusions are generally perpendicular to the perimeter buffer and are given prior approval from the Director of Planning

3. Any new exterior site or building lighting shall have recessed fixtures with no bulb, lens, or globe extending below the casing. The casing shall be opaque and shall completely surround the entire light fixture and light source in such a manner that all light will be directed downward and the light source are not visible from the side.

7. The developer shall integrate LID techniques and measures into the site development plan and shall work with the James City County Environmental Division to determine the most appropriate locations and techniques to be used based on the intended road, building and athletic facilities layout, grading, and drainage plan and site soils information. At a minimum 30 percent of the stormwater runoff generated from impervious surfaces shall be captured and treated by LID components above and beyond what is currently shown in the approved stormwater master plan. More than 30 percent is encouraged should greater opportunity for LID be present on the site. The LID measures shall not be used to comply with the James City County 10-point Best Management Plan (BMP) system or with the James City County special stormwater criteria as required by any applicable approved County watershed management plan. All stormwater basin components shall be in compliance with all Federal, State, and local regulations including, but not limited to, aquatic benches, forebays, landscaping, buffers/setbacks, and safety requirements. The percentage of impervious surface for the site shall not exceed 60 percent.

100 x 100
DA =
VOL

1 AC-FT.

1-YR
1"
0.75 AC-FT

8. If construction has not commenced on this project within 36 months from the issuance of a special use permit, the special use permit shall become void. Construction shall be defined as obtaining permits for building construction and footings and/or foundation has passed required inspections.

9. This SUP is not severable. Invalidation of any word, phrase, clause, sentences, or paragraph shall invalidate the remainder.

Bruce C. Goodson
Chairman, Board of Supervisors

ATTEST:

Sanford B. Wanner
Clerk to the Board

Adopted by the Board of Supervisors of James City County, Virginia, this 25th day of April, 2006.

Sup-05-06.res

SUMMARY:

DA = 2.115 AC
CN = 98
Tc = 0.10 HR

- < 48 HOUR DETENTION
- CONFIRM SUBGRADE SOILS

DESIGN VOL = 0.4461 AC-FT = 19,428 CF

DETAIN TOTAL RUNOFF FROM THE POSTDEV 1-YR 24 HR STORM FROM THE 92,133 S.F. BUILDING AREA. COLLECT BY PERIMETER ROOF LEADERS & COLLECTORS. AVAILABLE AREA 250 x 100 (25,000 SF) BEHIND MAIN BLDG IN HSG A & B.

USING STORMTECH SC-740 OR EQUAL CHAMBERS
AVAIL AREA = 250' L x 100' W

1. 250' L x 40' WIDE
   35 CHAMBERS LONG
   7 ROWS
2. 100' L x 100' W
   13 CHAMBERS LONG
   20 ROWS

COST
~ $100,000

USING PERFORATED PE PIPE

3 PIPES @ 250' L
NEED 720' OF PIPE IN STONE

AMPAD 22-141 50 SHEETS 22-142 100 SHEETS 22-144 200 SHEETS

8TH ELEMENTARY SCHOOL
UNDERGROUND INFILTRATION CHAMBER (U.I.C.)
CONCEPTUAL DESIGN

Building Size = 92,133 SF = 2.115 AC.

- UIC in back of main building area at mulched playground area
- In cut area, ranging from -1 to -4. Therefore subsurface facility if ~~60"~~ 54" deep is into existing original ground.
- HSG A & B soils, concept passes. Need geotech information for final design. Must confirm groundwater table.
- UIC based on stormTech information (ADS)
- Assume UIC will treat main building area only (2.115 AC), ~~underdrain~~ small downspout leader system conveys drainage to UIC
- References TR55, VSMH Appendix 4, MS&S 3.10E, WIN TR 20/WIN TR-55
- SIZE UIC/STONE SYSTEM TO HOLD RUNOFF VOLUME, THEN INFILTRATE (<48 HR)

HYDROLOGY

DRAINAGE AREA = 2.115 AC
CN = 98
Tc = 0.1 HR (MIN) = 6 MIN. (very quick, highly impervious area)

P, RAINFALL	1-	2-	5-	10-	25-	50-	100-
WIN TR-55	2.8	3.6	4.8	5.7	6.5	7.3	8.0
VSMH CHAPT 4	2.8	3.5	4.7	5.8	6.4	7.2	8.0
USE →	2.8	3.6	4.8	5.8	6.5	7.3	8.0

SJT

8th Elem Infil Area
LID Infiltration Chamber s
James City County, Virginia

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.6	4.8	5.7	6.5	7.3	8.0	2.8
USMH 3.5	4.7	5.8	6.4	7.2	8.0	

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

WinTR-20: Version 1.0 8th Elem Infil Area LID Infiltration Chamber s	0	0	0.05
SUB-AREA: Bldg Area Outlet	.00331	98.	.1
STREAM REACH:			
STORM ANALYSIS: 2-Yr 1-Yr	 3.6 2.8	 Type II Type II	 2 2
STRUCTURE RATING:			
GLOBAL OUTPUT: 2 0.05	YYYYN	YYYYNN	

HYDROLOGIC METHODS **APPENDIX 4B**

YEAR

COUNTY	1	2	5	10	25	50	100
Isle of Wight	2.9	3.7	5.0	5.8	6.6	7.5	8.4
James City	2.8	3.5	4.7	5.8	6.4	7.2	8.0
King and Queen	2.8	3.4	4.5	5.7	6.2	7.0	7.9
King George	2.8	3.2	4.5	5.5	6.0	7.0	7.5
King William	2.8	3.4	4.5	5.7	6.2	7.0	7.9

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21

3TH ELEM (V.I.C)

DA = 2.115 AC
CN = 98
Tc = 0.1 HR

SJT

James City County, Virginia

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)	1-Yr (cfs)
SUBAREAS							
Bldg	9.69	12.98	15.43	17.62	19.81	21.70	7.49
REACHES							
OUTLET	9.69	12.98	15.43	17.62	19.81	21.70	7.49

STORM EVENT	PEAK FLOW (CFS)	RUNOFF (IN.) WATERSHED-INCHES	RUNOFF VOLUME (ACRE-FT)	RUNOFF VOLUME (CF)
1 - 2.8"	7.49	2.531	0.4461	19,428
2 - 3.6"	9.69	3.341	0.5885	25,635
5 - 4.8	12.98	4.548	0.801	34,891
10 - 5.7	15.43	5.451	0.9607	41,848
25 - 6.5	17.62	6.253	1.102	48,003
50 - 7.3	19.81	7.054	1.24	54,014
100 - 8.0	21.70	7.754	1.36	59,242
WQV from Impervious Area				
0.5" WQ STORM			0.0882	3,840
1" WQ STORM			0.1763	7,680

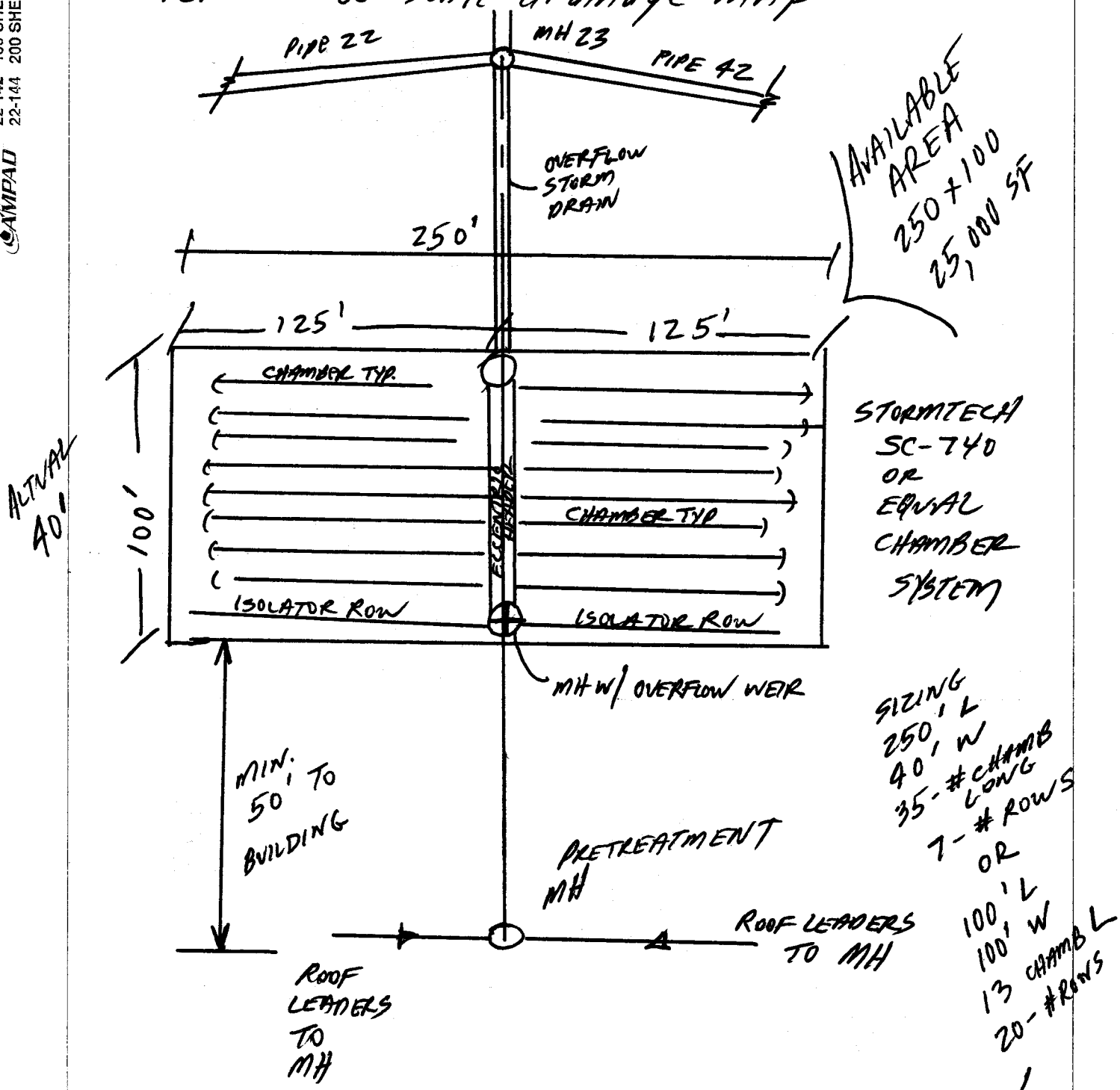
8TH ELEM (U.I.C)

DA = 2.115 AC < 10 AC. OK w/ VSMH

Emerg. Spillway not necessary

Provide Overflow

PER 1" = 80' scale drainage map



5/

TOTAL RUNOFF FROM POSTDEVELOPMENT
1-YEAR, 24 HOUR STORM FROM
92,133 SF (2.115 AC) BUILDING AREA

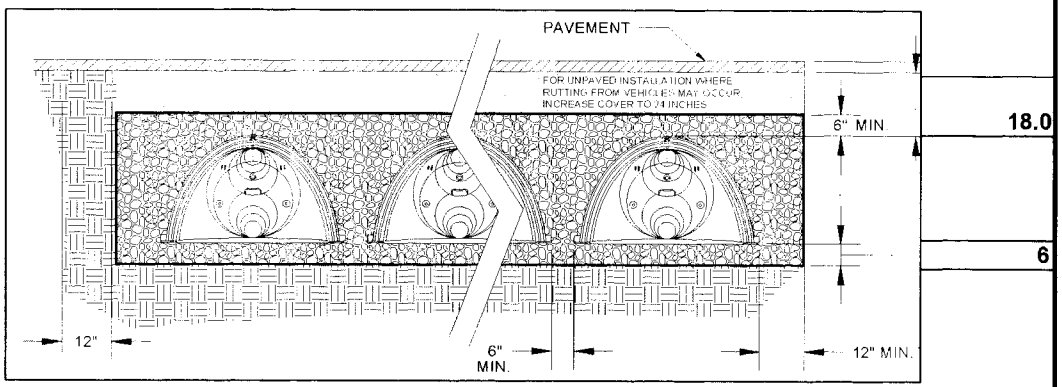
StormTech®
Subsurface Stormwater Management

Project:
By:
POC:
Date:

VOL = 19,428 CF

System Requirements

Required Storage Volume (Vs)	Vs	**19,428**	CF
Stormtech System		SC-740	
Stone Foundation Depth		6"	
Storage Volume Per Chamber		74.9	CF
Total Cover over Chamber		**18.0**	Inches
Number of Chambers Required	C	260	Each
Required Bed Size (S)	S	9,667	SF
Tons of Stone Required (Tst)	Tst	1,074	Tons
Volume of Excavation (Ex)	Ex	1,573	CY
Area of Filter Fabric (F)	F	2,954	SY
# of End Caps Required	Ec	**40**	Each



Controlled by Width		Controlled by Length	
Width	**100** FT	Length	**250** FT
Length	96.67 FT	Width	38.67 FT
# of Chambers Long	13 EA	# of Chambers Long	35 EA
# of Rows	20 EA	# of Rows	7 EA
Actual Length	94.22 FT	Actual Length	250.78 FT
Actual Width	95.5 FT	Actual Width	33.75 FT

System Cost - CONCEPTUAL BUDGET

*** PLEASE CALL STORMTECH @ 888-892-2694 FOR CONCEPTUAL COST ESTIMATES DUE TO GEOGRAPHICAL VARIABLES.**
***Budgetary Installed Costs for StormTech Systems range from $3.50 - $7.00 / CF of Storage.**

***Many geographical variables can effect Installed Costs and should be taken into account when estiamating budgets.**

$3.50/CF × $19,428 = $67,998 $68,000
$5.25/CF = $101,997 $102,000
$7.00/CF = $135,996 $136,000

AVG $102,000.

2.0 Product Information

StormTech

2.1 PRODUCT APPLICATIONS

StormTech chamber systems may function as stormwater detention, retention, first-flush storage, or some combination of these. The StormTech chambers can be used for commercial, municipal, industrial, recreational, and residential applications including installation under parking lots and commercial roadways.

One of the key advantages of the StormTech chamber system is its design flexibility. Chambers may be configured into beds or trenches of various sizes or shapes. They can be centralized or decentralized, and fit on nearly all sites. Chamber lengths enhance the ability to develop on both existing and pre-developed projects. The systems can be designed easily and efficiently around utilities, natural or man-made structures and any other limiting boundaries.

2.2 CHAMBERS FOR STORMWATER DETENTION

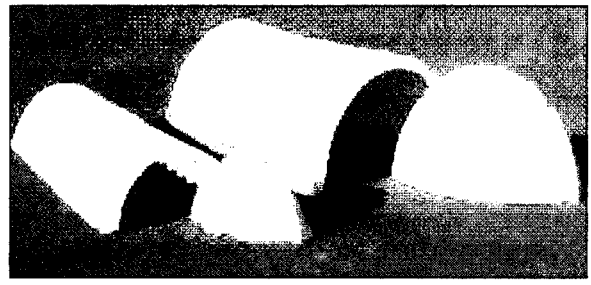
Chamber systems have been used effectively for stormwater detention for over 15 years. A detention system temporarily holds water while it is released at a defined rate through an outlet. While some infiltration may occur in a detention system, it is often considered an environmental benefit and a storage safety factor. Over 70% of StormTech's installations are non-watertight detention systems. There are only a few uncommon situations where a detention system might need to be watertight: The subgrade soil's bearing capacity is significantly affected by saturation such as with expansive clays or karst soils, and; in sensitive aquifer areas where the depth to groundwater does not meet EPA's guidelines of 2 – 4 feet. Adequate pretreatment could eliminate concerns for the latter case. An impermeable liner may be considered for both situations to create a watertight chamber system. Contact StormTech's Technical service department for more information on using Stormtech chambers in your application.

2.3 STONE POROSITY ASSUMPTION

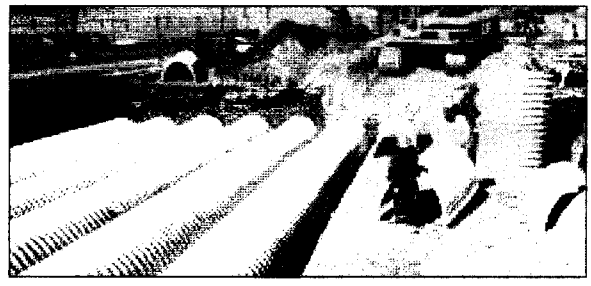
A StormTech chamber system requires the application of washed angular stone below, between and above the chambers. This stone serves as a structural component while allowing conveyance and storage of stormwater. Storage volume examples throughout this Design Manual are calculated with an assumption that the angular stone has a porosity of 40%. Actual stone porosity may vary. Contact StormTech for information on calculating stormwater volumes with varying stone porosity assumptions.

2.4 CHAMBER SELECTION

StormTech currently offers two chamber sizes for stormwater management. These chambers have been designed to optimize and balance storage volumes with respect to depth and area constraints.



The SC-310 and SC-740 chambers and end plates.



StormTech systems can be integrated into retrofit and new construction projects.

StormTech chambers may be configured into beds or trenches.

Primary considerations when selecting between the SC-740™ and SC-310™ chambers are the depth to groundwater, available area for subsurface storage and outfall restrictions.

The StormTech SC-740 chamber shown in **Figure 1** on page 4 optimizes storage volumes in relatively small footprints. By providing 2.2 ft^3/ft^2 (minimum) of storage, the SC-740 chambers can minimize excavation, backfill and associated costs.

The StormTech SC-310 chamber shown in **Figure 2** on page 4 is ideal for systems requiring low-rise and wide-span solutions. This low profile chamber allows the storage of large volumes, 1.3 ft^3/ft^2 (minimum), at minimum depths. *Product Specifications: 2.2 and 2.5*

15.0 StormTech Product Specifications

1.0 GENERAL

1.1 StormTech chambers are designed to control stormwater runoff. As a subsurface retention system, StormTech chambers retain and allow effective infiltration of water into the soil. As a subsurface detention system, StormTech chambers detain and allow for the metered flow of water to an outfall.

2.0 CHAMBER PARAMETERS

2.1 The Chamber shall be injection molded of Polypropylene resin to be inherently resistant to environmental stress cracking (ESCR), and to maintain adequate stiffness through higher temperatures experienced during installation and service.

2.2 The nominal chamber dimensions of the StormTech SC-740 shall be 30.0 inches tall, 51.0 inches wide and 90.7 inches long. The nominal chamber dimensions of the StormTech SC-310 shall be 16.0 inches tall, 34.0 inches wide and 90.7 inches long. The installed length of a joined chamber shall be 85.4 inches.

2.3 The chamber shall have a continuously curved section profile.

2.4 The chamber shall be open-bottomed.

2.5 The chamber shall incorporate an overlapping corrugation joint system to allow chamber rows of almost any length to be created. The overlapping corrugation joint system shall be effective while allowing a chamber to be trimmed to shorten its overall length.

2.6 The nominal storage volume of a joined StormTech SC-740 chamber shall be 74.9 cubic feet per chamber when installed per StormTech's typical details (includes the volume of crushed angular stone with an assumed 40% porosity). This equates to 2.2 cubic feet of storage/square foot of bed. The nominal storage volume of an installed StormTech SC-310 chamber shall be 31.0 cubic feet per chamber when installed per StormTech's typical details (includes the volume of crushed angular stone with an assumed 40% porosity). This equates to 1.3 cubic feet of storage/square foot of bed.

2.7 The chamber shall have forty-eight orifices penetrating the sidewalls to allow for lateral conveyance of water.

2.8 The chamber shall have two orifices near its top to allow for equalization of air pressure between its interior and exterior.

2.9 The chamber shall have both of its ends open to allow for unimpeded hydraulic flows and visual inspections down a row's entire length.

2.10 The chamber shall have 14 corrugations.

2.11 The chamber shall have a circular, indented, flat surface on the top of the chamber for an optional 4-inch inspection port or clean-out.

2.12 The chamber shall be analyzed and designed using AASHTO methods for thermoplastic culverts contained in the LRFD Bridge Design Specifications, 2nd Edition, including Interim Specifications through 2001. Design live load shall be the AASHTO HS20 truck. Design shall consider earth and live loads as appropriate for the minimum to maximum specified depth of fill.

2.13 The chamber shall be manufactured in an ISO 9001:2000 certified facility.

3.0 END CAP PARAMETERS

3.1 The end cap shall be injection molded of Polypropylene resin to be inherently resistant to environmental stress cracking, and to maintain adequate stiffness through higher temperatures experienced during installation and service.

3.2 The end cap shall be designed to fit into any corrugation of a chamber, which allows: capping a chamber that has its length trimmed; segmenting rows into storage basins of various lengths.

3.3 The end cap shall have saw guides to allow easy cutting for various diameters of pipe that may be used to inlet the system.

3.4 The end cap shall have excess structural adequacies to allow cutting an orifice of any size at any invert elevation.

3.5 The primary face of an end cap shall be curved outward to resist horizontal loads generated near the edges of beds.

3.6 The end cap shall be manufactured in an ISO 9001:2000 certified facility.

12.0 Detail Drawings

Figure 13
Plan View Detail – StormTech SC-740 Chamber (not to scale)

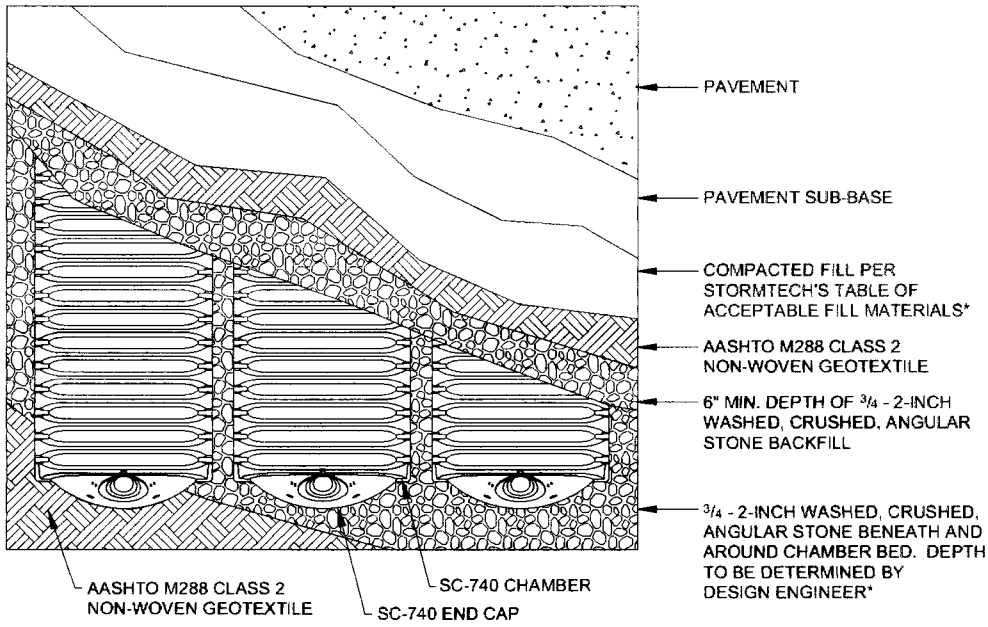
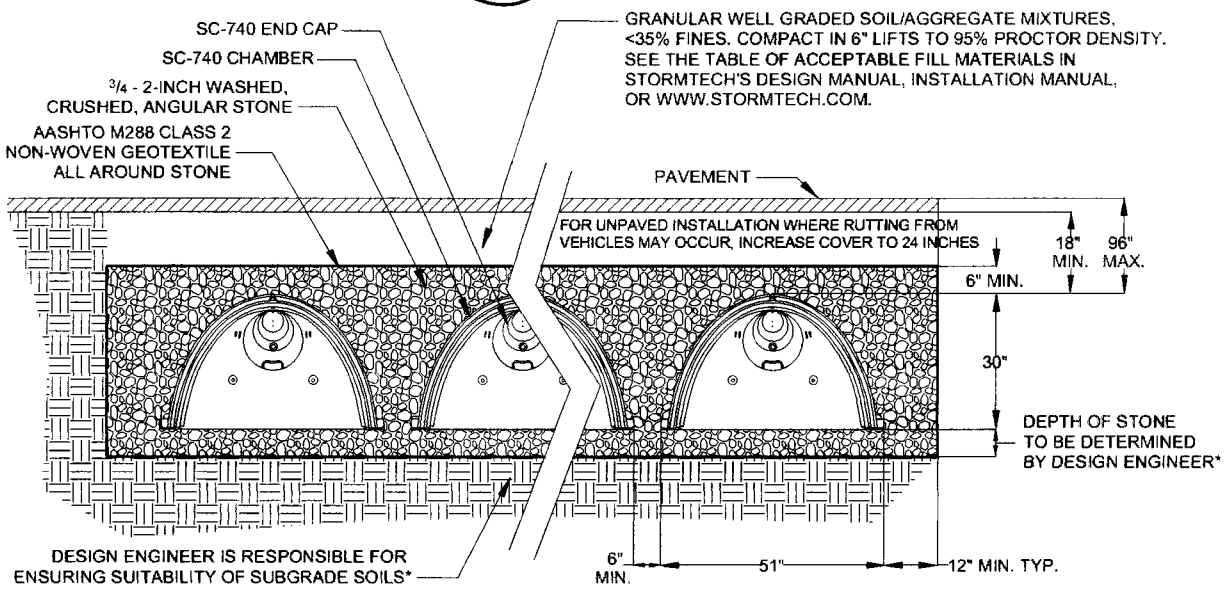


Figure 14
Typical Cross Section Detail – StormTech SC-740 Chamber (not to scale)



See Section 4 of this Design Manual.

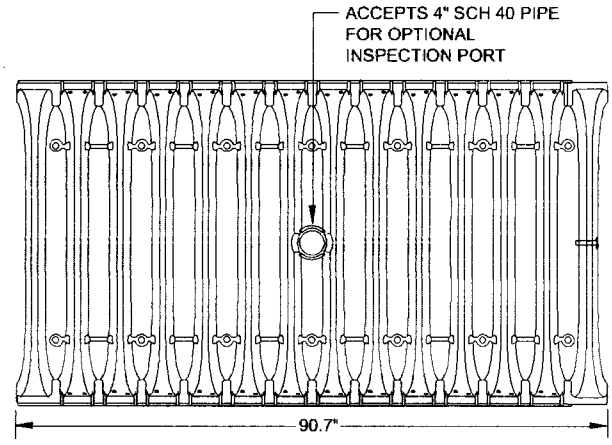
Detail drawings available in AutoCad Rev. 14 format at www.stormtech.com.

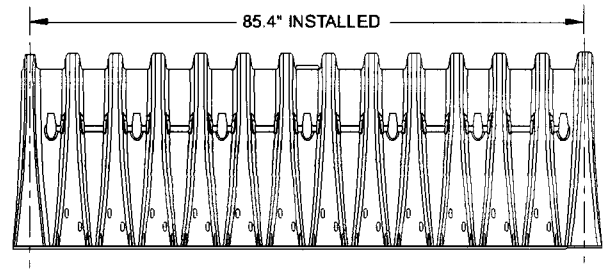
2.0 Product Information

Figure 1
StormTech SC-740 Chamber (not to scale)

Nominal Chamber Specifications

Size (W x H x Installed L)	51.0" x 30.0" x 85.4"
Chamber Storage	45.9 ft³
Minimum Installed Storage*	74.9 ft³
Weight	74 lbs





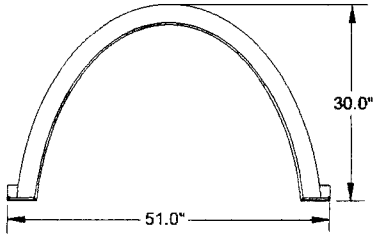
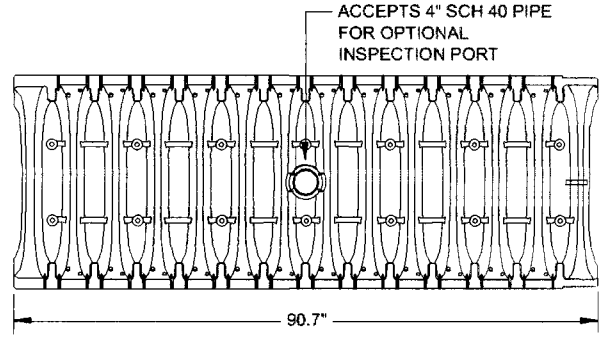
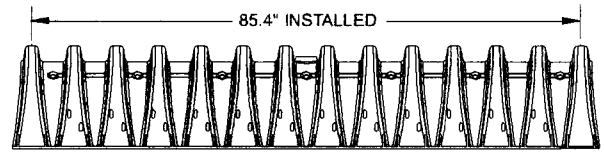


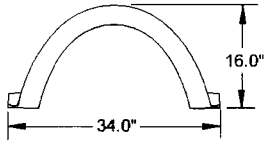
Figure 2
StormTech SC-310 Chamber (not to scale)

Nominal Chamber Specifications

Size (W x H x Installed L)	34.0" x 16.0" x 85.4"
Chamber Storage	14.7 ft³
Minimum Installed Storage*	31.0 ft³
Weight	37 lbs







*This assumes a minimum of 6-inches of stone below, above and between chamber rows and 40% stone porosity.

Detention-Retention-Recharge

The StormTech SC-740 chamber optimizes storage volumes in relatively small footprints by providing 2.2 ft^3/ft^2 (0.67 m^3/m^2) (minimum) of storage. This can decrease excavation, backfill and associated costs. The StormTech SC-310 chamber is ideal for systems requiring low-rise and wide-span solutions. The chamber allows the storage of large volumes, 1.3 ft^3/ft^2 (0.4 m^3/m^2) (minimum), at minimum depths.

StormTech SC-740 Chamber
(not to scale)

Nominal Chamber Specifications

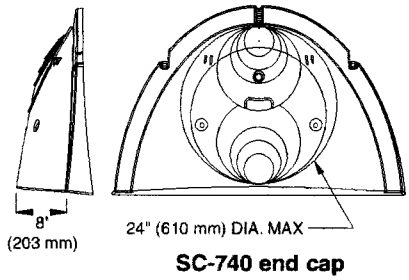
Size (L x W x H)
85.4" x 51.0" x 30.0"
(2170 x 1295 x 762 mm)

Chamber Storage
45.9 ft^3 (1.30 m^3)

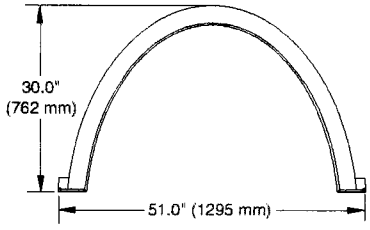
Minimum Installed Storage*
74.9 ft^3 (2.12 m^3)

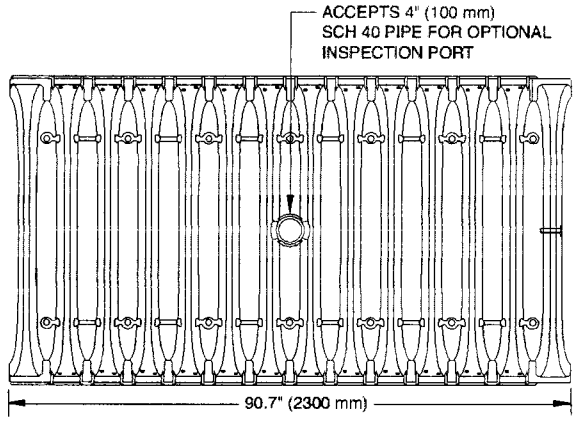
Weight
74.0 lbs (33.6 kg)

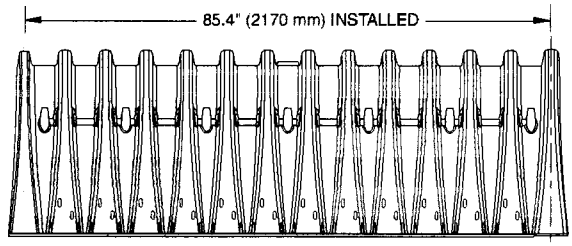
Shipping
30 chambers/pallet
60 end caps/pallet
12 pallets/truck



SC-740 end cap







SC-740 chamber

StormTech SC-310 Chamber
(not to scale)

Nominal Chamber Specifications

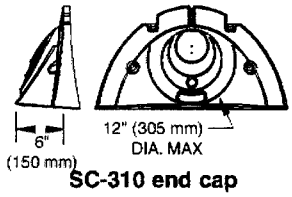
Size (L x W x H)
85.4" x 34.0" x 16.0"
(2170 x 864 x 406 mm)

Chamber Storage
14.7 ft^3 (0.42 m^3)

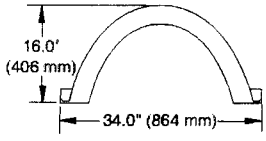
Minimum Installed Storage*
31.0 ft^3 (0.88 m^3)

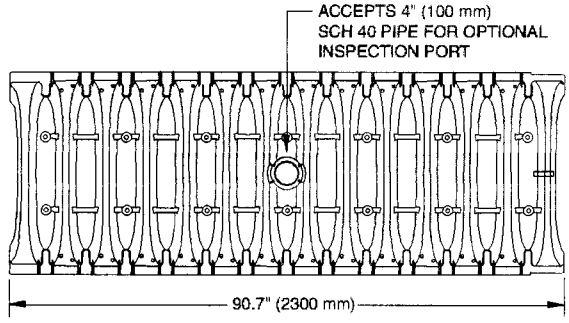
Weight
37.0 lbs (16.8 kg)

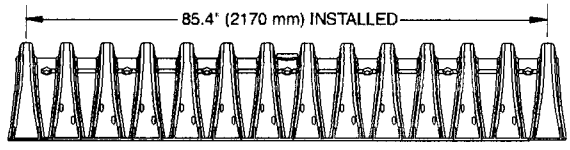
Shipping
41 chambers/pallet
108 end caps/pallet
18 pallets/truck



SC-310 end cap

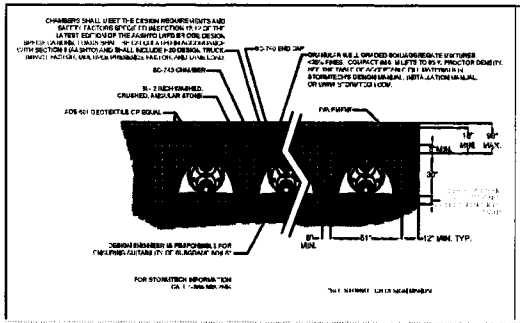




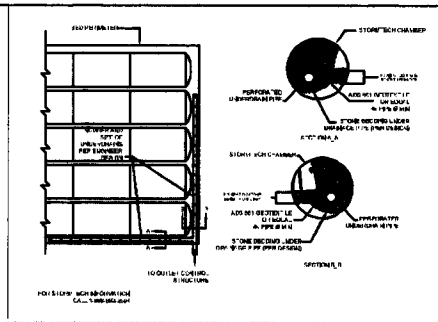


SC-310 chamber

*This assumes a minimum of 6 inches (150 mm) of stone below, above and between chamber rows.



ST 1.0 SC-740 TYPICAL CROSS SECTION



ST 2.0 STORMTECH UNDERDRAIN DETAIL

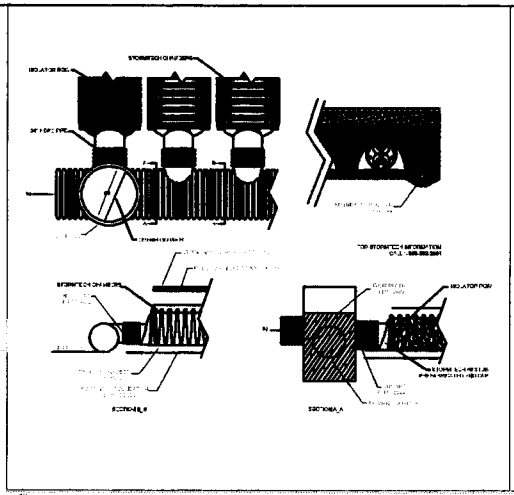
ACCEPTABLE FILL MATERIALS
STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION	DESCRIPTION	AASHTO M43 DESIGNATION	AASHTO M145 DESIGNATION	COMPACTION/DENSITY REQUIREMENT
FILL MATERIAL FROM 18" TO GRADE ABOVE CHAMBERS	ANY SOIL/ROCK MATERIALS, NATIVE SOILS OR PER ENGINEERS PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS	NA	NA	PREPARE PER ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS
FILL MATERIAL FOR 9" TO 18" ELEVATION ABOVE CHAMBERS (24" FOR UNPAVED INSTALLATIONS)	CRUSHED/ANGULAR WELL-GRADED SOILS/AGGREGATE MIXTURES, <35% FINES.	3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	A-1 A-2 A-3	COMPACT IN 9" LIFTS TO A MINIMUM 95% STANDARD PROCTOR DENSITY. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 LBS. DYNAMIC FORCE NOT TO EXCEED 20,000 LBS.
CHAMBER/ENDCAP STONE SURROUNDING AND TO 9" ELEVATION ABOVE CHAMBERS	CRUSHED ANGULAR STONE WITH THE MAJORITY OF PARTICLES BETWEEN 1/4 - 2 INCH	3, 357, 4, 467, 5, 56, 57	NA	NO COMPACTION REQUIRED.
FOUNDATION STONE BELOW CHAMBERS	WASHED ANGULAR STONE WITH THE MAJORITY OF PARTICLES BETWEEN 1/4 - 2 INCH	3, 357, 4, 467, 5, 56, 57	NA	PLATE COMPACT OR ROLL TO ACHIEVE A MINIMUM STANDARD PROCTOR DENSITY

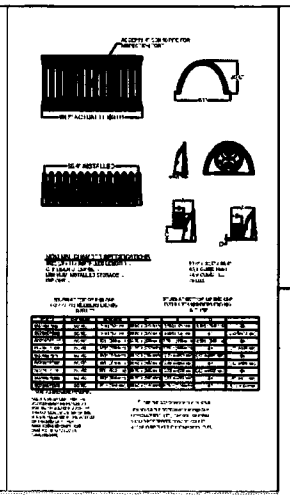
PLEASE NOTE: THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE WASHED CRUSHED ANGULAR. FOR EXAMPLE, THE STONE MUST BE SPECIFIED AS WASHED, CRUSHED, ANGULAR NO. 4 STONE.

ST 3.0 STORMTECH ACCEPTABLE FILL MATERIALS

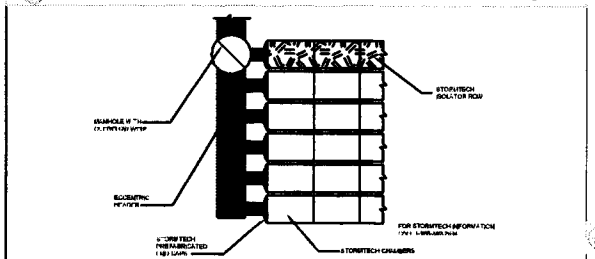
NOTES:
1. ALL DESIGN SPECIFICATIONS FOR STORMTECH CHAMBERS SHALL BE IN ACCORDANCE WITH THE STORMTECH DESIGN MANUAL.
2. THE INSTALLATION OF STORMTECH CHAMBERS SHALL BE IN ACCORDANCE WITH THE LATEST STORMTECH INSTALLATION INSTRUCTIONS.
3. THE CONTRACTOR IS ADVISED TO REVIEW AND UNDERSTAND THE INSTALLATION INSTRUCTIONS PRIOR TO BEGINNING SYSTEM INSTALLATION. CALL **1-888-892-2694** OR VISIT **WWW.STORMTECH.COM** TO RECEIVE A COPY OF THE LATEST STORMTECH INSTALLATION INSTRUCTIONS.
4. CHAMBERS SHALL MEET THE DESIGN REQUIREMENTS AND SAFETY FACTORS SPECIFIED IN SECTION 12.12 OF THE LATEST EDITION OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.



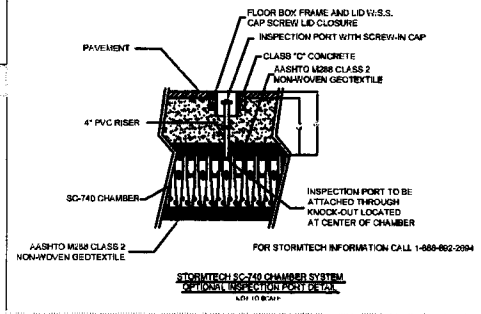
ST 8.0 STORMTECH ELEVATIONS



ST 9.0 TECHNICAL DETAILS

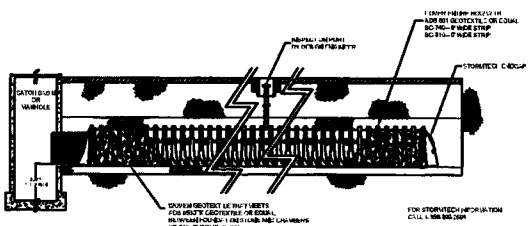


ST 4.0 STORMTECH ISOLATOR ROW MANIFOLD DETAIL

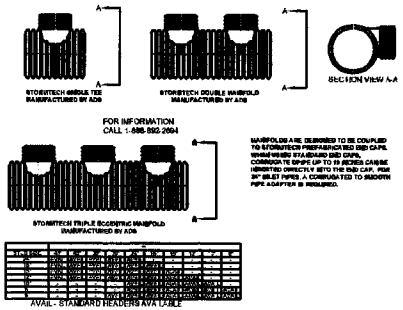


STORMTECH SC-740 CHAMBER SYSTEM
OPTIONAL INSPECTION PORT DETAIL

ST 5.0 STORMTECH INSPECTION PORT DETAIL



ST 6.0 STORMTECH ISOLATOR ROW DETAIL



ST 7.0 ADS MANIFOLD DETAILS

STORMTECH CHAMBER LAYOUT TO BE PLACED HERE

FIELDS IN RED MUST BE REVIEWED AND MODIFIED BY DESIGNING ENGINEER WITH PROJECT SPECIFIC DATA

CHAMBERS SHALL MEET THE DESIGN REQUIREMENTS AND SAFETY FACTORS SPECIFIED IN SECTION 12.12 OF THE LATEST EDITION OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS. LOADS SHALL BE CALCULATED IN ACCORDANCE WITH SECTION 3 AND SHALL INCLUDE H20 DESIGN TRUCK, IMPACT FACTOR, MULTIPLE PRESENCE, AND LANE LOAD.

ST 10.0 STORMTECH SC-740 CHAMBER LAYOUT

StormTech
Detention/Retention/Recharge
Subsurface Stormwater Management™

PROJECT NAME

This drawing was prepared to support the design engineer for the proposed conversion. It is the ultimate responsibility of the design engineer to ensure that the stormwater system's design is in full compliance with all applicable laws and regulations. It is the design engineer's responsibility to ensure that the StormTech products are designed in accordance with StormTech's minimum requirements. StormTech LLC does not approve grading, siting, or system designs. The designing engineer is responsible for all design decisions.

REVISIONS	DATE

STORMTECH, LLC
20 BEAVER RD. SUITE 104
WETHERSFIELD, CT 06109
tel. 888-892-2694
fax 888-328-8401
WWW.STORMTECH.COM

DRAWING TITLE

STORMTEC-1SC-740
CHAMBER DETAIL SHEET

SURVEYED		
DRAWN BY	CHECKED BY	
SCALE	DRAWING NO.	
DATE		
PROJECT NO.		

MINIMUM STANDARD 3.10E

PLASTIC CHAMBER SYSTEMS

Definition

Plastic chambers are arch-shaped, open bottom, high-density plastic structures of various sizes and related storage capacities.

Purpose

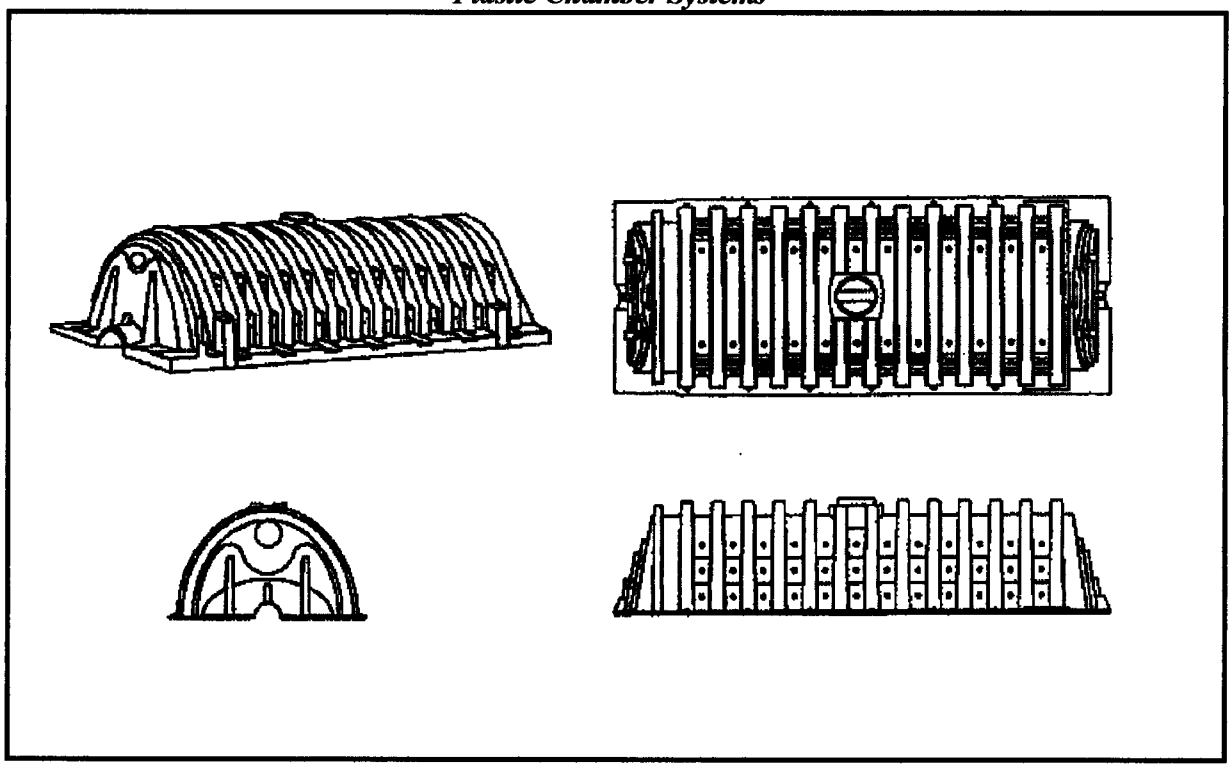
Plastic chambers are typically used as a component to a water quality BMP for providing increased subsurface storage volume for stormwater runoff. Infiltration trenches rely on the void ratio of the stone reservoir to hold the runoff while it slowly infiltrates into the subsoil. These chambers provide a large void capacity and can be used to increase the storage volume in order to store and therefore infiltrate a greater volume of runoff, or they can be used to decrease the required trench size and stone necessary to provide the equivalent required volume. The large open-bottom chamber design is also intended to provide increased water quality enhancement due to the relatively large area of bio-mat formation under the chambers, similar to the chambers' function when used for septic drain fields.

Plastic chamber systems can also be used to provide detention storage for purposes of stream channel erosion control, i.e. detention of runoff from the 1-year, 2-year, or even 10-year frequency storm.

It should be noted that these chambers can be used in a linear configuration, in place of conveyance pipe, from inlet structures to stormwater BMPs. Some of the larger chambers currently manufactured are capable of conveyance comparable to a 48 inch diameter pipe. An advantage of this alternative conveyance approach is to encourage infiltration in areas where it otherwise would not be provided.

FIGURE 3.10E – 1

Plastic Chamber Systems



Note: Refer to manufacturer specification for dimensions. Several sizes and shapes are available.

Conditions Where Practice Applies

Plastic chamber systems are presented here as a component of infiltration practices. *Drainage Area* and *Development Condition* considerations and limitations associated with Infiltration Practices and Bioretention Basins will apply here, with the exception of allowing increased drainage area size as a function of the increased storage volume provided by utilizing the chambers. These chamber systems can be placed in the subsurface storage area of infiltration trenches, roof down spout systems, porous pavement, and bioretention basins and filters.

These chamber systems are most effective where the subsoil is sufficiently permeable to provide a reasonable infiltration rate and where the water table is low enough to prevent pollution of groundwater. However, where the subsoil is not sufficiently permeable to provide a reasonable infiltration rate, plastic chamber systems can be used as subsurface detention facilities for purposes of stream channel erosion or flood control. When these systems are used for detention purposes, the economics of placing detention underground, and therefore freeing up property which would otherwise be dedicated to a detention facility, must be weighed against the initial cost of the chamber system and the long term maintenance costs of the system. In general, a pretreatment design which prevents trash, debris, or excessive sediment from entering the chambers and potentially clogging the outlet device must be provided. Underground detention of stormwater raises concerns regarding maintenance. The structure will remain full of water for extended periods if debris clogs the outlet pipe. In some cases this may result in increased opportunities for infiltration. However, if the soils are not permeable, the structure will remain full and possibly cause the next storm to bypass or backup the system.

Plastic chambers are well suited for retrofit of existing stormwater systems to provide a water quality BMP and/or runoff quantity control benefits. This is particularly applicable in highly developed areas with storm sewer systems with little or no integrated water quality BMPs or water quantity controls. Relatively small plastic chamber systems can be "tucked" into available areas, can be used to replace existing stormwater conveyance pipe, or used in place of conveyance pipe for new construction.

Plastic chambers can also be used as an integral component of other infiltration facilities. When used in place of perforated pipe in an infiltration trench, the functional life of the infiltration trench can be extended due to the open bottom area of the chambers. When used within the base area of a bioretention facility, they increase the amount of water which can be filtered through the engineered soil media during storms which produce runoff in excess of the infiltration capacity of the underlying soils.

Infiltration facilities are not recommended for areas where Karst topography is present due to the possibility of causing subsurface collapse and solution channel formation.

Drainage Area

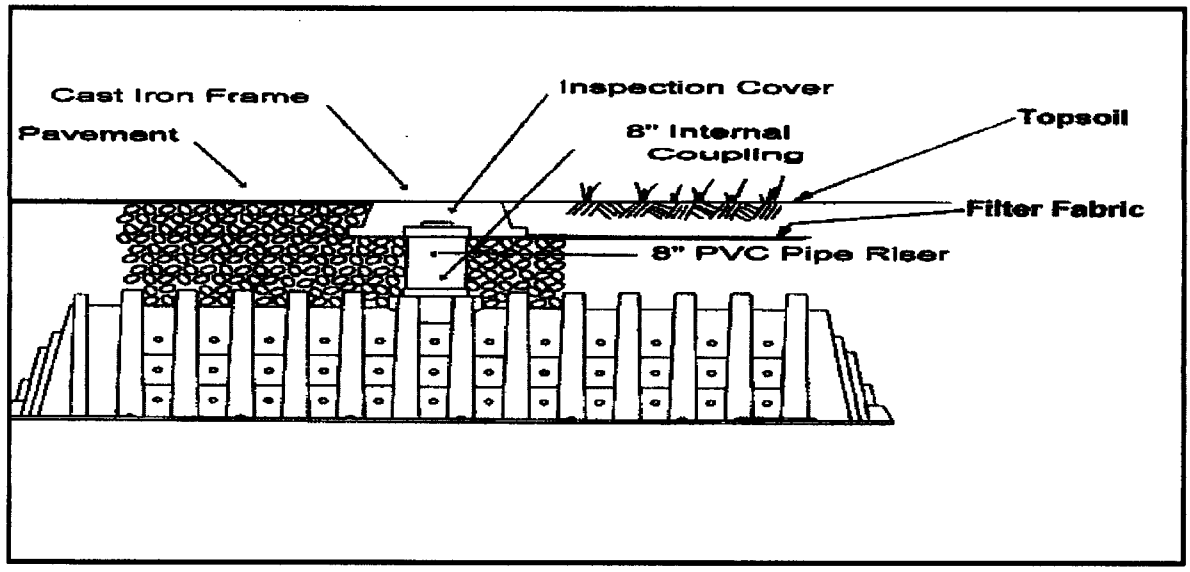
Plastic chamber systems are practical for small to medium sized drainage areas. Generally, plastic chamber systems can be used for drainage areas of up to 10 acres. For infiltration facilities which rely on the bottom surface area for infiltrating into the subsoil, the designer must check to verify that the facility will drain within the required time period. When the chambers are used under a Bioretention Filter (with an under drain system), the surface or planting area of the facility will determine the allowable drainage area.

Development Conditions

Because plastic chamber systems can be installed under trafficked or non-trafficked, open space or paved areas, they are equally well suited for low- to high- density residential, commercial, and industrial developments. They can be installed under roadways or within the roadway shoulder, or under parking lots, landscaped areas, tennis and basketball courts, play areas, or athletic fields. Smaller, multiple systems can be scattered throughout a site, under various types of land uses, each separate from the others with its own inlet structures. Due to their great flexibility in configuration and installation, plastic chamber systems can be configured in a single long line or in a rectangular or square "block" of numerous parallel rows of chambers. Other configurations are also possible by altering the number of chambers in different rows.

FIGURE 3.10E – 2

Application of Plastic Chamber System Under Porous Pavement and Open Space



Planning Considerations

Planning considerations include site conditions: soil permeability, depth to seasonal high groundwater table and bedrock, topographic conditions; sediment (and debris) control: construction runoff and urban runoff; and maintenance. Site conditions must be reviewed to verify that the site does not overlay Karst topography. Soil permeability will determine whether the plastic chambers can be utilized as a water quality BMP to promote infiltration, or simply for temporary detention of stormwater. For further discussion, refer to the **Planning Considerations** previously discussed in **General Infiltration Practices, Minimum Standard 3.10**, and **Bioretention Basin Practices, Minimum Standard 3.10.**

Design Criteria

The purpose of this section is to provide recommendations and minimum criteria for the design of plastic chamber systems. The designer must verify that the use of the selected product is in accordance with the manufacturers specifications.

Plastic stormwater chambers shall be designed to exceed the American Association of State Highway and Transportation Officials (AASHTO) recommended Load and Resistance Factor Design (LRFD) for earth loads and HS-20 live loads, with consideration for impact and multiple presences, when installed per the manufacturer's minimum requirements. It is the ultimate responsibility of the design engineer to seek verification from the plastic stormwater chamber's manufacturer that these structural requirements are met.

General

Plastic chamber systems can be designed in many configurations to meet the specific limitations of the site and the main purpose for which they are being used, e.g. temporary storage of runoff as either detention or retention, for a water quality BMP, or for stormwater conveyance. This section shall focus on the use of plastic chamber systems for temporary storage of runoff and for a water quality BMP.

The reader should refer to **Minimum Standard 3.10B: Infiltration Trench** for soils investigation requirements, topographic conditions and limitations, design infiltration rate, and maximum storage time and trench depth. (Refer to manufacturers specifications for maximum depth and loading capacities of specific product models.)

The storage volume of a plastic chamber system is calculated by summing the void space provided by the chambers and that of the surrounding stone.

Runoff Pretreatment

Preventative maintenance of subsurface storage systems, i.e. catch basins with sumps, silt diversion structures, siltation basins, etc. is in accordance with sound BMP practices. Additional chambers may be

added to the system to compensate for potential loss of storage capacity. This has been achieved with some installations by replacing the inflow and/or outflow manifold pipes with chambers, and/or by using plastic chambers in place of conveyance pipe. Another approach includes segregating the first two or three chambers of each row from the rest of the plastic chamber system with high density plastic pipe connecting the upper holes in the end walls of the chambers. The first set of plastic chambers functions as a sediment trap. In this type of configuration, eight inch PVC risers can be placed on the first, and/or second chambers of the first two "up-flow" plastic chamber rows for observation and clean-out.

Backfill Material

Backfill material for plastic chamber systems should be clean 1½ to 2 inch hard granite-type stone aggregate up to at least the top of the chambers. Limestone aggregate should not be used in order to avoid the "pasting" of limestone fines that can deter infiltration. Additional aggregate of the same specifications can be added for the remaining fill to also function as the base for porous pavement (refer to **Minimum Standard 3.10D: Porous Pavement**), or to a height suitable for the addition of sufficient soil for grass and/or shrub placement.

A minimum of 6 inches of clean 1½ to 2 inch hard granite-type stone aggregate should also be placed as a base, underlying the plastic chamber system. A geotechnical investigation should be undertaken to determine if stabilization of the system base is needed.

Filter Fabric

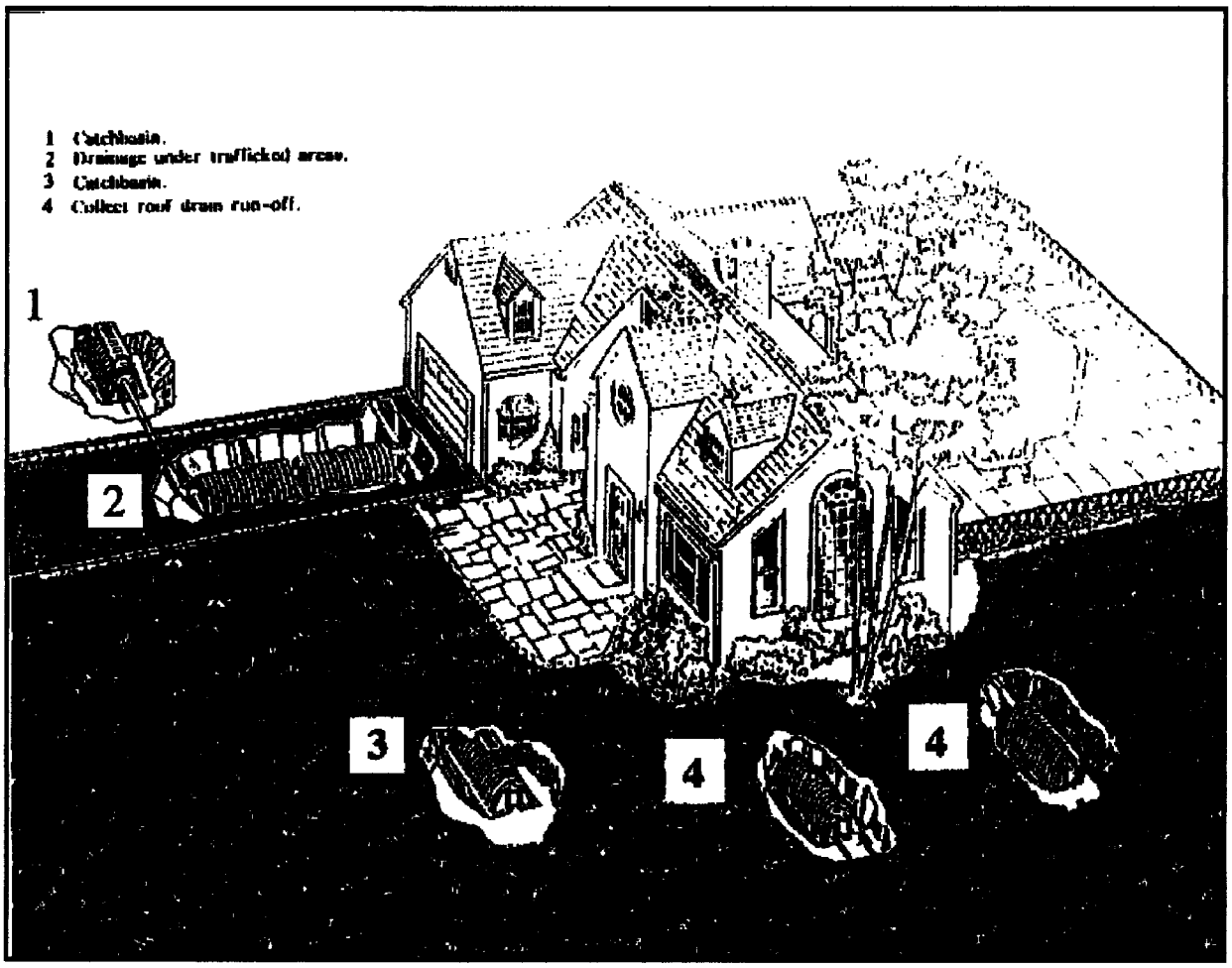
The top of the aggregate fill material should be covered with an engineering filter fabric. It is also recommended that an engineering filter fabric should be placed along the sides of the trench. Note, however, that filter fabric should **not** be placed on the trench bottom.

Overflow Channel

Because of the small drainage areas controlled by a plastic chamber system, an emergency spillway is not necessary. Due to their relatively higher void capacity, plastic chamber systems can hold relatively higher storage volumes. Plastic chamber systems, particularly with the larger chambers, are capable of retaining significant storm events without an overflow facility in many cases.

However, the overland flow path to be taken by the surface runoff, when the capacity of the plastic chamber system is exceeded, should always be evaluated. A nonerosive overflow channel leading to a stabilized watercourse should be provided, as necessary, to insure that uncontrolled, erosive, concentrated flow does not develop.

FIGURE 3.10E – 3
Example Site Design Using Plastic Chamber Systems



Observation Well

An observation well should be installed through the top of the first chambers of the first two rows receiving the runoff flow. The observation well will show how quickly the plastic chamber system drains following a storm, as well as providing a means of determining when maintenance is needed.

The observation wells should consist of perforated PVC pipe, 8 inches in diameter. They should be installed flush with the ground elevation of the plastic chamber system. The top of the well should be capped to discourage vandalism and tampering.

Construction Specifications

Accepted construction standards and specifications should be followed where applicable. Specifications for the work should conform to the methods and procedures indicated for installing earthwork, concrete, reinforcing steel, pipe, water gates, metal work, woodwork and masonry, as they apply to the site and the purpose of the structure. The specification should also satisfy any requirements of the local government.

The use and installation of plastic chamber systems must be in conformance with all manufacturers specifications. Construction of a plastic chamber system should also be in conformance with the following:

Sequence of Construction

A plastic chamber system should not be constructed or placed into service until all of the contributing drainage area has been stabilized. Runoff from untreated, recently constructed areas within the drainage area may load the newly formed plastic chamber system and/or pretreatment facility with a large volume of fine sediment. Other devises, such as temporary inlet structure silt sacks, can be used until site stabilization is achieved.

The specifications for the construction of a plastic chamber system should state the following: 1) *the earliest point at which storm drainage may be directed to the plastic chamber system, and 2) the means by which this delay in use is to be accomplished.* Due to the wide variety of conditions encountered among development projects, each project should be evaluated separately to postpone the plastic chamber system use for as long as possible.

Trench Preparation

Trench excavation and preparation, stone placement, and filter fabric placement should conform to the Construction Specifications of **Infiltration Trenches: Minimum Standard 3.10B**.

The trench should be excavated with a backhoe or similar device that allows the equipment to stand away from the trench bottom. This bottom surface should be scarified with the excavator bucket teeth on the final pass to eliminate any smearing or shearing of the soil surface. Similarly, the stone aggregate base should be placed on the trench bottom so that it does not compact or smear the soil surface. Clean, washed, broken hard granite-type stone, 1½ to 2 inches, should be used instead of limestone. Limestone and its associated fines, with prolonged exposure to water, tends to leave a pasty residue which retards infiltration.

Large tree roots must be trimmed flush with the trench sides to prevent the fabric from puncturing or tearing during subsequent installation procedures. No void between the filter fabric and the excavation walls should be present. If boulders or similar obstacles are removed from the excavated walls, natural soils should be placed in these voids before the filter fabric in installed. The sidewalls of the trench should be roughened where sheared and sealed by heavy equipment.

Plastic Chamber System Placement

The first chamber of each row of the plastic chamber system is placed upon the stone aggregate base and the inlet manifold system installed. Sufficient additional stone aggregate is placed around the chambers and the inlet manifold system to hold the chambers in place so that the next chamber in each row can be installed. Additional stone aggregate is then placed on these chambers to hold them in place. The process progresses until all chambers are in place and the outlet manifold, if utilized, is installed. Extra care should be taken when placing stone at the end walls at the end of each chamber row. Place stone along the centerline of the top of the end chambers to spill over the ends. Placing a large amount of stone directly against the end walls could cause them to deform.

Inlet Manifold Installation

An inlet manifold is used to disperse the runoff into the rows of the plastic chamber system. Under normal conditions, laterals are used off of the header pipe into every other row. Where large flash flows are anticipated, laterals should be placed into every row of the plastic chamber system. A minimum diameter for the laterals is 4 inches; 12 inch laterals are recommended for sites where typical flow conditions are anticipated. Some of the larger plastic chambers can accommodate up to 24 inch laterals.

Outlet Manifold Installation

An outlet manifold can be used at the down-flow end of a plastic chamber system. Construction specifications are the same as for the inlet manifold. Alternatives to an outlet manifold include placing the plastic chamber system off-line or directing chamber flow from the inlet structure at a lower elevation than the excess flow.

Stone Aggregate Fill Placement

At a minimum, place enough additional fill of the 1½ to 2 inch washed stone aggregate to just cover the chambers. The top of this fill should be level.

Backfill

Plastic chamber systems are typically backfilled with soil. Additional 1½ to 2 inch washed stone aggregate can also be used up to the minimum depth needed for soil to support a vegetative cover or for placement of the base for porous pavement.

Surface Cover Placement
For areas proposed for open space, grass, ground cover or shrubs can be used. The use of trees is not recommended to avoid possible problems with roots extending into the chambers.

For areas proposed for porous pavement, sufficient depth should be left for placement of the pavement base and the overlying pavement.

Observation Wells
Observation wells should be provided as specified in the design criteria. The depth of the well at the time of installation should be clearly marked on the well cap.

The following maintenance and inspection guidelines are not intended to be all-inclusive. Specific facilities may require other measures not discussed here.

Maintenance / Inspection Guidelines

Inspection Schedule

Same as for **Infiltration Trench, Minimum Standard 3.10B.**

Sediment Control

Sediment buildup within the pretreatment structure should be monitored on the same schedule as the observation well within the trench and chamber system.

Manufacturer Contacts

StormTech, Inc. P.O. Box 619 Old Saybrook, CT 06475 Info@StormTech.com www.stormtech.com (888) 892-2694	**CULTEC, Inc.** P.O. Box 280, 878 Federal Road Brookefield, CT 06804 custservice@cultec.com www.cultec.com (800) 428-5832 or (203) 775-4416	**StormChamber** P.O. Box 672 Occoquan, VA 22125 Info@hydrologicsolutions www.hydrologicsolution.com (703) 492-0686

PIPE EQUIVALENT

PIPE AREA

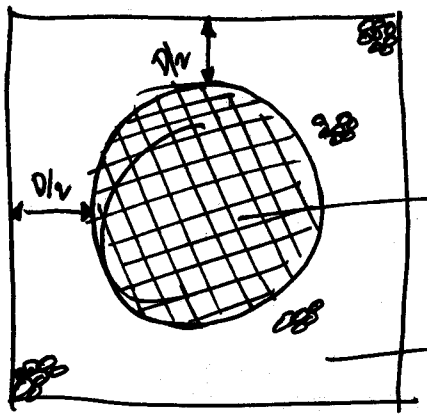
48" PIPE $\pi \frac{D^2}{4} = \pi \frac{4^2}{4} = 12.57^{\square}$

STONE VOID

DEPTH = 2D ∴ D = 8
WIDTH = 2D ∴ W = 8

8"
30
6"
18"
60" depth

$A = D \times W - (\text{PIPE AREA})$
$= [(8 \times 8) - 12.57]\, 0.3$
$= (51.33)(0.3)$
$= 15.4^{\square}$



PIPE AREA ($\pi D^2/4$)

STONE AREA ($e = 0.3$)

PIPE AREA = $12.57^{\square}$
STONE AREA = $15.43^{\square}$
TOTAL STORAGE PER LF = $28^{\square}$ ≅

1-YEAR STORM
3 - 48" ϕ pipes @ 250' LONG EACH

$\therefore \frac{28\ CF}{LF} = \frac{1\ CY}{LF}$

1 Acre-ft 43560 CF
1613
1615 CY 1615 LF

1-YR 0.4461 AC-FT
19,428 CF = 720 CY
720' = 3 pipes @ 250'

16 pipes @ 100' L

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

ECS MID-ATLANTIC, LLC
Geotechnical • Construction Materials • Environmental • Facilities

JUN 2006
RECEIVED
PLANNING DEPARTMENT

May 12, 2006

Mr. Alan Robertson
Williamsburg/JCC Public Schools
597 Jolly Pond Road
Williamsburg, Virginia 23188

ECS Project No. 07:8263-A

Reference: Subsurface Exploration and Geotechnical Engineering Analysis
Williamsburg/JCC Eighth Elementary School
BMP and Infiltration Areas
Williamsburg, Virginia

Dear Mr. Robertson,

ECS Mid-Atlantic, LLC has completed a subsurface exploration and engineering evaluation of the above referenced project. This report presents the results of the subsurface exploration and engineering analyses for the BMP and two (2) infiltration areas at the above referenced project. This portion of the project has been completed in accordance with our proposal No. 07:12264-A, dated April 17, 2006 and signed by you.

Introduction:

The project site is located off of Brick Bat Road in James City County, Virginia. We understand the project will consist of the development of the new 8th Elementary school. A Geotechnical report for the new school was previously issued in a report dated April 17, 2006. However, at the time that report was issued, final BMP locations had not been determined. This study has been performed at the final BMP and the two (2) infiltration trench locations. The proposed BMP and infiltration areas consist of open, sparsely, and heavily wooded areas. The BMP is located in a ravine.

The purpose of this exploration was to explore the soil and groundwater conditions at the site and to develop soils-related engineering recommendations to guide design and construction of the BMP and infiltration areas. This additional investigation included drilling of two (2) soil test borings at the BMP and three (3) soil test borings in the infiltration areas, to explore the subsurface soil and groundwater conditions, perform a site reconnaissance to observe general topography, and analyzing field data to develop appropriate geotechnical engineering recommendations regarding the planned construction. Borings B-20, B-28 and B-29 were

completed with our initial investigation and are within the infiltration areas. A Boring Location Plan is included in Appendix I.

Field Exploration Procedures:

Two (2) soil test borings were drilled for the proposed BMP location (B-36 and B-37), and six (6) soil test borings were drilled for the proposed infiltration areas (B- 20, B-28, B-29, and B-38 through B-40). The soil test borings were performed with an ATV mounted drill rig utilizing mud rotary techniques. Drilling fluid was used in this process.

Representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2-inch outside diameter split-barrel sampler is driven into the soil a distance of 24 inches by a 140-pound hammer falling 30 inches. After a 6-inch seating interval, the number of blows required to drive the sampler through the next 12-inch interval is termed the Standard Penetration Test (SPT) value and is indicated for each sample on the boring log. This value can be used as a qualitative indication of the in-place relative density and relative consistency of non-cohesive soils and cohesive soils, respectively. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

Field logs of the soils encountered in the borings were maintained by the drill crew. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were sealed in glass jars and delivered to our laboratory in Williamsburg, Virginia, for further visual examination and laboratory testing.

Subsurface Conditions:

Experienced personnel from our office classified each soil sample in accordance with the Unified Soil Classification System (USCS) and USDA Textural Classification System. Select samples from the test borings were subjected to classification testing to confirm our visual classifications. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. The geotechnical engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in situ, the transitions may be gradual. A brief explanation of the USCS and a Reference Notes for Boring Log sheet is provided in Appendix IV of this report.

Our subsurface exploration and site reconnaissance determined that the sites are generally covered with approximately 4 to 12 inches of topsoil. Below the topsoil, we encountered Stratum I. Stratum I primarily consisted of very loose to medium dense density SAND (SM, SC) with varying amounts of Silt and Clay that extended to the depths explored at 10 to 30 feet below

the ground surface (bgs). Intermixed with these mostly coarse-grained soils, we also encountered soft to very stiff consistency Sandy CLAY (CL). The Standard Penetration Test (SPT) N-value recorded within these layers ranged from 2 to 28 blows-per-foot (bpf).

Groundwater was encountered at boring locations B-36 and B-37 at depths ranging from 8.0 to 23.0 feet bgs. Please note that groundwater levels are influenced by seasonal conditions and by periods of significant precipitation or prolonged drought. If ground water is encountered, we recommend it be pumped from sumps located below the base subgrade elevation.

BMP Location (Borings, B-36 and B-37)

Earthen Embankments and Slope Stability:

Based on the provided plan, we understand that a 10 to 12 foot high earth dam is proposed to be constructed for the BMP. Existing elevations across the BMP site range from Elevation 53 to 81 ft, mean sea level (msl), sloping downward to the Northwest. The bottom of pond elevation is approximately 58 ft, msl. The proposed top of Dam elevation is 70 ft, msl and the toe elevation of dam is 58 ft, msl. Generally, we encountered mixed deposits of Silty and Clayey SAND (SM and SC) that extended from the ground surface to the depths explored at 30 feet below site grades. Interbedded within these coarse-grained layers, we encountered Sandy CLAY (CL). We encountered ground water at depths of 8.0 to 23.0 ft below site grades at these locations.

Based on the planned construction, we recommend a 6 ft wide key trench be constructed to a minimum depth of 4 ft below the existing stripped subgrades. The key trench may be extended deeper if the underlying soils are not considered suitable for support of fill at the time of construction.

The soils located within the base of the pond area consist of Silty or Clayey SAND (SM or SC) materials. These soils would not be generally considered suitable for reuse as dam core material. As such, we recommend the core of the dam be constructed with a lower permeability clay material. Clay core material should classify as CL or CH material. This material should be placed in horizontal lifts not exceeding 8 inches in loose thickness, moisture conditioned to within -1% to +3% of the optimum moisture content, and compacted to a minimum 95% of the maximum dry density obtained in accordance with ASTM Specification D-698, Standard Proctor method. Slopes should be constructed no greater than 3 horizontal to 1 vertical. All slopes should be seeded to promote vegetation growth and further add to the stability of the slopes.

Infiltration

The soils encountered from the ground surface to 6 feet below the ground surface (bgs) and 8 to 18 feet at B-36 and from the ground surface to 13 feet bgs from existing ground surface at B-37 appeared to match Hydrologic Soil Group designations of B to C (Sandy Loam to Sandy Clay

Loam) with estimated infiltration rates of 1.02 to 0.17 inches per hour. The soils encountered between 6 to 8 feet and 18 to 28 feet at B-36 and 13 to 20 feet bgs at B-37 appeared to match a Hydrologic Soil Group designation of D (Clay Loam to Sandy Clay), with estimated infiltration rates of approximately 0.09 to 0.05 inches per hour.

Infiltration Area (Borings B-20, B-38 and B-39)

Infiltration

The soils encountered from the ground surface to 2 feet below the ground surface (bgs) at boring location B-39 appeared to match a Hydrologic Soil Group designation of B (Sandy Loam to Loam) with estimated infiltration rates of 1.02 to 0.52 inches per hour. The soils encountered from a depth of 2 feet to 10 feet bgs at Boring location B-39 and from the ground surface to depths of 10 to 15 ft bgs at boring locations B-20 and B-38, appeared to match Hydrologic Soil Group designations of C to D (Sandy Clay Loam to Sandy Clay), with estimated infiltration rates of approximately 0.17 to 0.05 inches per hour. The soils encountered between 6 to 10 feet bgs appeared to match Hydrologic Soil Group designations of C to D (Sandy Clay Loam to Clay Loam), with estimated infiltration rates of approximately 0.17 to 0.09 inches per hour.

Infiltration Area (Borings B-28, B-29 and B-40)

Infiltration

The soils encountered between 2 to 4 feet bgs at boring location B-28 and 4 to 6 feet bgs at boring location B-29, appeared to match a Hydrologic Soil Group designation of D (Clay Loam to Sandy Clay), with estimated infiltration rates of approximately 0.09 to 0.05 inches per hour. The remainder soils encountered in the infiltration area appeared to match Hydrologic Soil Group designations of B to C (Loam to Sandy Clay Loam), with estimated infiltration rates of approximately 0.52 to 0.17 inches per hour.

Typically, soils with the Hydrologic Soil Group designations of A and B are considered suitable for SWMP's that may utilize on-site filtration in their designs. Some soils designated as C type soils are considered suitable for infiltration practices but these soils would need to be evaluated on a case specific basis. Soils with group designations of D are considered suitable for a wet pond.

General Construction Considerations:

The existing slopes generally ranged between 3H:1V throughout the planned pond area. All topsoil and organics should be removed to suitable natural soils within the construction area. The stripping depth should extend up the slopes to at least the 100 year flood elevation. As such, some of the side slopes may need to be reconstructed. The slopes should be reconstructed utilizing engineered fill placed in controlled, compacted lifts that are benched into the existing

slopes. On-site sandy or clayey soils are considered suitable for engineered fill to regrade the slopes. This material should be placed in horizontal lifts not exceeding 8 inches in loose thickness, moisture conditioned to within +/-3% of the optimum moisture content, and compacted to a minimum 95% of the maximum dry density obtained in accordance with ASTM Specification D-698, Standard Proctor method. Slopes should be constructed no greater than 3:1. Also, the side slopes should be seeded to promote vegetation growth and further add to the stability of the slopes.

Exposure to the environment may weaken the soils at the bearing level if the excavations remain open for too long a time. Therefore, excavations should be backfilled the same day that the excavations are made whenever possible. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the excavation bottom immediately prior to placement of the next lift of fill.

Proper compaction control of fill is an important aspect of this project. All fill materials should be placed, compacted and tested in accordance with the recommendations contained in this report. We recommend that all cut and fill operations be observed full-time by a qualified Soil Technician to determine if minimum earthwork and compaction requirements are being met.

In a dry and undisturbed state, the subgrade soils at the site will provide adequate subgrade support for fill placement and construction operations. When over optimum moisture, the moisture sensitive subgrade soils may degrade quickly with disturbance from contractor operations. Therefore, good site drainage and dewatering operation should be maintained during earthwork operations so as to help maintain the stability of the soil.

General Comments:

This report has been prepared in order to aid in the evaluation of this site and to assist the Contractor, Architect and Engineer in the design and planning of the project. The report scope is limited to the specific project and location described, and the project description represents our understanding of the significant aspects relevant to soil and foundation characteristics.

We have appreciated being of service to you during the design phase of this project and look forward to its successful construction. If you should have any questions regarding the information and recommendations contained in this report or if we can be of any further assistance, please contact our office.

Respectfully,

ECS MID-ATLANTIC, LLC.

David Gordinier, E.I.T.
Project Engineer

MICHAEL J. GALLI
No. 030084
5/12/06
PROFESSIONAL ENGINEER

Michael J. Galli, P.E.
Principal Engineer

DJG:RNL:MJG;abs

Appendix:
- I. Boring Location Plan (1)
- II. Soil Test Boring Logs (8)
- III. Laboratory Test Summary (1)
- IV. Unified Soil Classification System and Reference Notes for Boring Logs (2)

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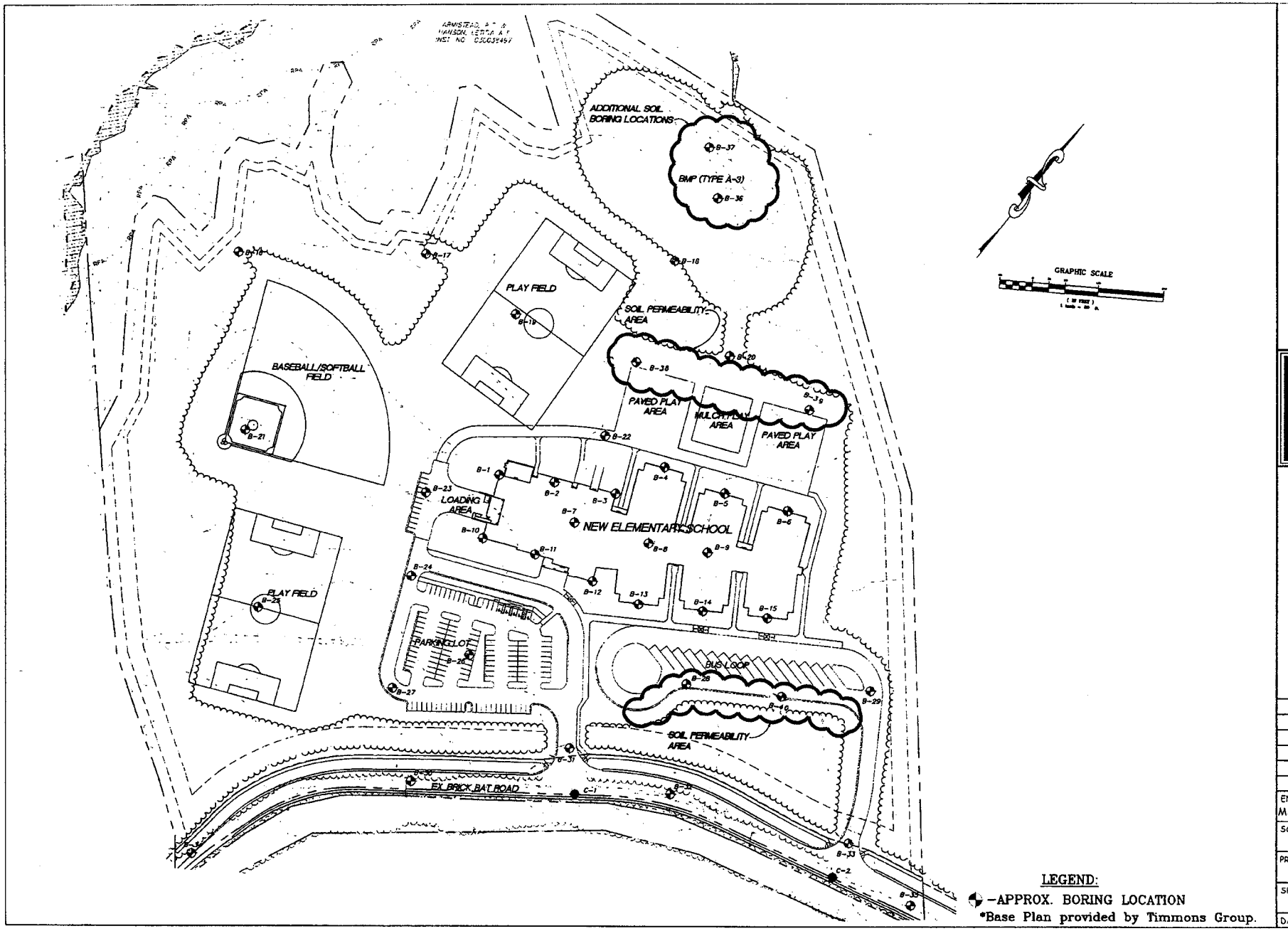
APPENDIX I

BORING LOCATION PLAN



LEGEND:

-APPROX. BORING LOCATION

*Base Plan provided by Timmons Group.

Wmbg-JCC 8th Elementary School-BMP

James City County, Virginia

ECS LLC MID-ATLANTIC

BORING LOCATION PLAN

ECS REVISIONS

ENGINEER	DRAFTING
MJG/DJG	RNL

SCALE: see scale

PROJECT NO. 8263-A

SHEET 1

DATE 09/03/06

APPENDIX II

SOIL TEST BORING LOGS

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-20	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 82.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					TOPSOIL DEPTH 3"		
	1	SS	24	24	Sandy CLAY, Brown to Orange-Brown, Moist, Soft to Hard, (CL)	80	4 (2-2-2-3)
	2	SS	24	24			13 (4-6-7-7)
5	3	SS	24	24			42 (16-21-21-23)
	4	SS	24	24		75	17 (5-8-9-11)
	5	SS	24	24	Fine to Medium Clayey SAND, Light Red-Brown, Moist, Medium Dense, (SC)		13 (2-6-7-8)
10						70	
	6	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Orange-Brown, Moist, Loose, (SC)		7 (3-3-4-4)
15					END OF BORING @ 15.00'	65	
20						60	
25						55	
30							

WATER LEVELS

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

▽WL DRY WS OR WD	BORING STARTED 3/28/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 3/28/06	CAVE IN DEPTH ● NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-28	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 82.3

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Fine to Medium Silty SAND, Trace Organics Sampled as Root Material, Orange-Brown, Moist, Loose, (SM)		80	7 (1-3-4-4)
	2	SS	24	24				23 (6-8-15-15)
5	3	SS	24	24	Sandy CLAY, Orange-Brown, Moist, Very Stiff, (CL)			32 (8-15-17-18)
	4	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Orange-Brown, Moist, Dense to Medium Dense, (SC)		75	32 (14-15-17-9)
	5	SS	24	24				24 (9-11-13-11)
10					END OF BORING @ 10.00'		70	
15							65	
20							60	
25							55	
30								

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

WL DRY WS OR WD	BORING STARTED 3/22/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/22/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-29	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — REC.% — 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 81.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 6"	80	4 (4-2-2-1)
	2	SS	24	24	Fine to Medium Silty SAND, Light Brown, Moist, Very Loose, (SM)		18 (5-8-10-11)
5	3	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Medium Dense, (SC)		20 (5-7-13-15)
	4	SS	24	24	Sandy CLAY, Red-Brown, Moist, Very Stiff, (CL)	75	(18-20-21-21) 41
	5	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Dense, (SC)		(18-19-18-19) 37
10					END OF BORING @ 10.00'	70	
15						65	
20						60	
25						55	
30							

WATER LEVELS

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

WL DRY WS OR WD	BORING STARTED 3/29/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/29/06	CAVE IN DEPTH ● NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg-JCC Public Schools	8263-A	B-36	1 OF 1

PROJECT NAME: Wmbg-JCC Eighth Elementary School-BMP

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION 76.0

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

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY RQD% — REC.% 20% 40% 60% 80% 100%

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

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 12"	75	3 (1-1-2-1)
	2	SS	24	24	Fine to Medium Silty SAND, Trace Organics Sampled as Root Material, Light Brown, Moist, Very Loose, (SM)		3 (1-2-1-2)
5	3	SS	24	24	Fine to Medium Clayey SAND, Light Brown, Moist, Very Loose to Loose, (SC)	70	6 (1-2-4-2)
	4	SS	24	24			8 (3-4-4-5)
	5	SS	24	24	Sandy CLAY, Light Brown, Moist, Medium Stiff, (CL)		10 (3-5-5-5)
10					Fine to Medium Clayey SAND, Light Brown, Moist, Loose, (SC)	65	
	6	SS	24	24	Fine to Coarse Silty SAND, Trace Fine Gravel, Light Brown, Moist, Medium Dense, (SM)		19 (5-10-9-7)
15						60	
	7	SS	24	24	Sandy CLAY, Brown, Moist to Wet, Soft, (CL)		3 (2-1-2-3)
20						55	
	8	SS	24	24			2 (1-1-1-1)
25						50	
	9	SS	24	24	Fine to Coarse Silty SAND, With Marine Shell Fragments, Light Brown, Wet, Medium Dense, (SM)		13 (5-6-7-6)
30							

END OF BORING @ 30.00'

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

WL 23.0 WS OR WD	BORING STARTED 4/28/06	
WL(AB) 23.0 WL(AC) 23.0	BORING COMPLETED 4/28/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (05-01-06) RNL (05-05-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg-JCC Public Schools	8263-A	B-37	1 OF 1

PROJECT NAME: Wmbg-JCC Eighth Elementary School-BMP

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION 67.0

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

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

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 12"			2 (1-1-1-1)
	2	SS	24	24	Fine to Medium Silty SAND, With Organics Sampled as Root Material, Light Brown, Moist, Very Loose, (SM)		65	3 (1-2-1-2)
5	3	SS	24	24	Fine to Medium Clayey SAND, Light Brown, Moist, Very Loose to Loose, (SC)			4 (1-2-2-1)
	4	SS	24	24			60	7 (2-3-4-4)
	5	SS	24	24	Fine to Medium Silty SAND, Light Brown, Wet, Very Loose, (SM)			4 (1-1-3-3)
10							55	
	6	SS	24	24	Sandy CLAY, Brown, Wet, Medium Stiff to Soft, (CL)			8 (2-3-5-7)
15							50	
	7	SS	24	24				3 (2-1-2-1)
20					END OF BORING @ 20.00'		45	
25							40	
30								

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

WL 8.0 WS OR WD	BORING STARTED 4/28/06	
WL(AB) 8.0 WL(AC) 8.0	BORING COMPLETED 4/28/06	CAVE IN DEPTH ● NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (05-01-06) RNL (05-05-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg-JCC Public Schools	8263-A	B-38	1 OF 1

PROJECT NAME: Wmbg-JCC Eighth Elementary School-BMP

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — REC.% — 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 84.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"			4 (2-2-2-2)
	2	SS	24	24	Sandy CLAY, Brown to Red-Brown, Moist, Soft to Very Stiff, (CL)		80	14 (3-6-8-12)
5	3	SS	24	24				18 (4-8-10-12)
	4	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Medium Dense, (SC)			28 (9-13-15-17)
	5	SS	24	24			75	20 (6-9-11-14)
10					END OF BORING @ 10.00'			
15							70	
20							65	
25							60	
30							55	

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

WL DRY WS OR WD	BORING STARTED 4/28/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 4/28/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (05-05-06) RNL (05-01-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg-JCC Public Schools	8263-A	B-39	1 OF 1

PROJECT NAME: Wmbg-JCC Eighth Elementary School-BMP

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 80.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 5"	80	5 (3-3-2-3)
	2	SS	24	24	Fine to Medium Silty SAND, Light Brown, Moist, Loose, (SM)		9 (3-4-5-8)
5	3	SS	24	24	Sandy CLAY, Red-Brown, Moist, Stiff to Very Stiff, (CL)	75	15 (3-6-9-13)
	4	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Medium Dense, (SC)		20 (6-8-12-13)
	5	SS	24	24	Fine to Medium Clayey SAND, Trace Fine Gravel, Red-Brown, Moist, Medium Dense, (SC)		20 (7-8-12-14)
10						70	
					END OF BORING @ 10.00'		
15						65	
20						60	
25						55	
30							

WATER LEVELS

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

WL DRY WS OR WD	BORING STARTED 4/28/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 4/28/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (05-01-06) RNL (05-05-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg-JCC Public Schools	8263-A	B-40	1 OF 1

PROJECT NAME: Wmbg-JCC Eighth Elementary School-BMP

ARCHITECT-ENGINEER:

SITE LOCATION: James City County, Virginia

ECS LLC MID-ATLANTIC

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

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

ROCK QUALITY DESIGNATION & RECOVERY

RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 78.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"			2 (1-1-1-1)
	2	SS	24	24	Fine to Medium Clayey SAND, Light Brown to Brown, Moist, Very Loose to Medium Dense, (SC)		75	10 (3-3-7-9)
5	3	SS	24	24				19 (5-6-13-15)
	4	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Red-Brown, Moist, Medium Dense, (SC)		70	19 (9-10-9-12)
	5	SS	24	24				28 (11-13-15-17)
10					END OF BORING @ 10.00'		65	
15							60	
20							55	
25							50	
30								

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

▽WL DRY WS OR WD	BORING STARTED 4/28/06	
▼WL(AB) DRY ▼WL(AC) DRY	BORING COMPLETED 4/28/06	CAVE IN DEPTH @ NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (05-01-06) RNL (05-05-06)

APPENDIX III

LABORATORY TEST SUMMARY

Engineering Consulting Services Mid Atlantic LLC

Williamsburg, VA

Laboratory Testing Summary

Date: 05/05/2006

Project Number: 8263-A **Project Name:** Williamsburg JCC 8th Elem.

Project Engineer: DJG **Principal Engineer:** MJG **Summary By:** SIW

Boring Number	Sample Number	Depth (Feet)	Moisture Content (%)	USC	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Compaction		CBR Value	Other
									Maximum Density (pcf)	Optimum Moisture (%)		
B-36	S-9	28-30	16.3	SM	NP	NP	NP	12.9	*	*	*	
B-37	S-2	2-4	12.7	SC	44	23	21	40.8	*	*	*	
B-38	S-2	2-4	18.5	CL	48	19	29	53.4	*	*	*	
B-39	S-3	4-6	21.7	CL	45	16	29	51.3	*	*	*	
B-40	S-3	4-6	25.9	SC	39	13	26	47.0	*	*	*	

Summary Key:

V = Virginia Test Method
S = Standard Proctor
M= Modified Proctor

Hyd = Hydrometer
Con = Consolidation
DS = Direct Shear
GS = Specific Gravity

UCS = Unconfined Compression Soil
UCR = Unconfined Compression Rock
LS = Lime Stabilization
CS = Cement Stabilization

OC = Organic Content
SA = See Attached
NP = Non Plastic
* = Test Not Conducted

APPENDIX IV

UNIFIED SOIL CLASSIFICATION SYSTEM AND REFERENCE NOTES FOR BORING LOGS

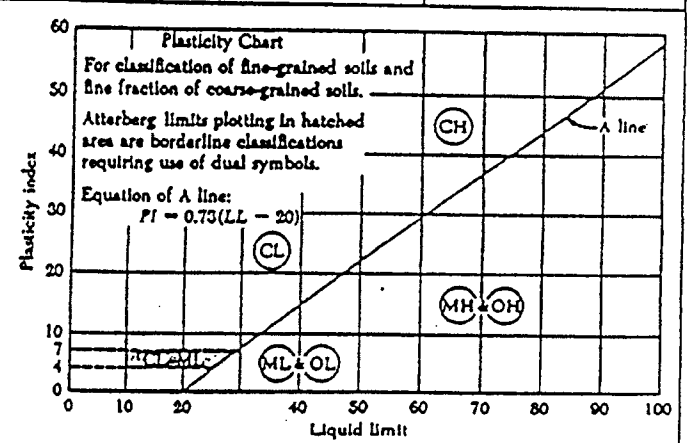
UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

Table Unified System of Classification

Major divisions			Group symbols	Typical names
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes No. 200 sieve	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Table ** (Continued)

	Classification criteria	
Classification on basis of percentage of fines Less than 5% pass No. 200 sieve: GW, GP, SW, SP; More than 12% pass No. 200 sieve: GM, GC, SM, SC; 5% to 12% pass No. 200 sieve: Borderline classification requiring use of dual symbols	$C_u = D_{60}/D_{10}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
	Not meeting both criteria for GW	
	Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
	Atterberg limits plot above "A" line and plasticity index greater than 7	
	$C_u = D_{60}/D_{10}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
	Not meeting both criteria for SW	
	Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
	Atterberg limits plot above "A" line and plasticity index greater than 7	



Visual-manual identification, see ASTM Designation D2488.

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Engineering Consulting Services, Ltd

REFERENCE NOTES FOR BORING LOGS

I. Drilling and Sampling Symbols:

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

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

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

II. Correlation of Penetration Resistances to Soil Properties:

Relative Density-Sands, Silts

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

Consistency of Cohesive Soils

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

III. Unified Soil Classification Symbols:

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

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

IV. Water Level Measurement Symbols:

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

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

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

SP-23-06

ECS MID-ATLANTIC, LLC

Geotechnical • Construction Materials • Environmental • Facilities

May 12, 2006

Mr. Alan Robertson
Williamsburg/JCC Public Schools
597 Jolly Pond Road
Williamsburg, Virginia 23188

COPY

ECS Project No. 07:8263-A

Reference: Subsurface Exploration and Geotechnical Engineering Analysis
Williamsburg/JCC Eighth Elementary School
BMP and Infiltration Areas
Williamsburg, Virginia

COPY

Dear Mr. Robertson,

ECS Mid-Atlantic, LLC has completed a subsurface exploration and engineering evaluation of the above referenced project. This report presents the results of the subsurface exploration and engineering analyses for the BMP and two (2) infiltration areas at the above referenced project. This portion of the project has been completed in accordance with our proposal No. 07:12264-A, dated April 17, 2006 and signed by you.

Introduction:

The project site is located off of Brick Bat Road in James City County, Virginia. We understand the project will consist of the development of the new 8th Elementary school. A Geotechnical report for the new school was previously issued in a report dated April 17, 2006. However, at the time that report was issued, final BMP locations had not been determined. This study has been performed at the final BMP and the two (2) infiltration trench locations. The proposed BMP and infiltration areas consist of open, sparsely, and heavily wooded areas. The BMP is located in a ravine.

The purpose of this exploration was to explore the soil and groundwater conditions at the site and to develop soils-related engineering recommendations to guide design and construction of the BMP and infiltration areas. This additional investigation included drilling of two (2) soil test borings at the BMP and three (3) soil test borings in the infiltration areas, to explore the subsurface soil and groundwater conditions, perform a site reconnaissance to observe general topography, and analyzing field data to develop appropriate geotechnical engineering recommendations regarding the planned construction. Borings B-20, B-28 and B-29 were

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Williamsburg, VA • Winchester, VA • York, PA

completed with our initial investigation and are within the infiltration areas. A Boring Location Plan is included in Appendix I.

Field Exploration Procedures:

Two (2) soil test borings were drilled for the proposed BMP location (B-36 and B-37), and six (6) soil test borings were drilled for the proposed infiltration areas (B- 20, B-28, B-29, and B-38 through B-40). The soil test borings were performed with an ATV mounted drill rig utilizing mud rotary techniques. Drilling fluid was used in this process.

Representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2-inch outside diameter split-barrel sampler is driven into the soil a distance of 24 inches by a 140-pound hammer falling 30 inches. After a 6-inch seating interval, the number of blows required to drive the sampler through the next 12-inch interval is termed the Standard Penetration Test (SPT) value and is indicated for each sample on the boring log. This value can be used as a qualitative indication of the in-place relative density and relative consistency of non-cohesive soils and cohesive soils, respectively. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

Field logs of the soils encountered in the borings were maintained by the drill crew. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were sealed in glass jars and delivered to our laboratory in Williamsburg, Virginia, for further visual examination and laboratory testing.

Subsurface Conditions:

Experienced personnel from our office classified each soil sample in accordance with the Unified Soil Classification System (USCS) and USDA Textural Classification System. Select samples from the test borings were subjected to classification testing to confirm our visual classifications. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. The geotechnical engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in situ, the transitions may be gradual. A brief explanation of the USCS and a Reference Notes for Boring Log sheet is provided in Appendix IV of this report.

Our subsurface exploration and site reconnaissance determined that the sites are generally covered with approximately 4 to 12 inches of topsoil. Below the topsoil, we encountered Stratum I. Stratum I primarily consisted of very loose to medium dense density SAND (SM, SC) with varying amounts of Silt and Clay that extended to the depths explored at 10 to 30 feet below

the ground surface (bgs). Intermixed with these mostly coarse-grained soils, we also encountered soft to very stiff consistency Sandy CLAY (CL). The Standard Penetration Test (SPT) N-value recorded within these layers ranged from 2 to 28 blows-per-foot (bpf).

Groundwater was encountered at boring locations B-36 and B-37 at depths ranging from 8.0 to 23.0 feet bgs. Please note that groundwater levels are influenced by seasonal conditions and by periods of significant precipitation or prolonged drought. If ground water is encountered, we recommend it be pumped from sumps located below the base subgrade elevation.

BMP Location (Borings, B-36 and B-37)

Earthen Embankments and Slope Stability:

Based on the provided plan, we understand that a 10 to 12 foot high earth dam is proposed to be constructed for the BMP. Existing elevations across the BMP site range from Elevation 53 to 81 ft, mean sea level (msl), sloping downward to the Northwest. The bottom of pond elevation is approximately 58 ft, msl. The proposed top of Dam elevation is 70 ft, msl and the toe elevation of dam is 58 ft, msl. Generally, we encountered mixed deposits of Silty and Clayey SAND (SM and SC) that extended from the ground surface to the depths explored at 30 feet below site grades. Interbedded within these coarse-grained layers, we encountered Sandy CLAY (CL). We encountered ground water at depths of 8.0 to 23.0 ft below site grades at these locations.

Based on the planned construction, we recommend a 6 ft wide key trench be constructed to a minimum depth of 4 ft below the existing stripped subgrades. The key trench may be extended deeper if the underlying soils are not considered suitable for support of fill at the time of construction.

The soils located within the base of the pond area consist of Silty or Clayey SAND (SM or SC) materials. These soils would not be generally considered suitable for reuse as dam core material. As such, we recommend the core of the dam be constructed with a lower permeability clay material. Clay core material should classify as CL or CH material. This material should be placed in horizontal lifts not exceeding 8 inches in loose thickness, moisture conditioned to within -1% to +3% of the optimum moisture content, and compacted to a minimum 95% of the maximum dry density obtained in accordance with ASTM Specification D-698, Standard Proctor method. Slopes should be constructed no greater than 3 horizontal to 1 vertical. All slopes should be seeded to promote vegetation growth and further add to the stability of the slopes.

Infiltration

The soils encountered from the ground surface to 6 feet below the ground surface (bgs) and 8 to 18 feet at B-36 and from the ground surface to 13 feet bgs from existing ground surface at B-37 appeared to match Hydrologic Soil Group designations of B to C (Sandy Loam to Sandy Clay

Loam) with estimated infiltration rates of 1.02 to 0.17 inches per hour. The soils encountered between 6 to 8 feet and 18 to 28 feet at B-36 and 13 to 20 feet bgs at B-37 appeared to match a Hydrologic Soil Group designation of D (Clay Loam to Sandy Clay), with estimated infiltration rates of approximately 0.09 to 0.05 inches per hour.

Infiltration Area (Borings B-20, B-38 and B-39)

Infiltration

The soils encountered from the ground surface to 2 feet below the ground surface (bgs) at boring location B-39 appeared to match a Hydrologic Soil Group designation of B (Sandy Loam to Loam) with estimated infiltration rates of 1.02 to 0.52 inches per hour. The soils encountered from a depth of 2 feet to 10 feet bgs at Boring location B-39 and from the ground surface to depths of 10 to 15 ft bgs at boring locations B-20 and B-38, appeared to match Hydrologic Soil Group designations of C to D (Sandy Clay Loam to Sandy Clay), with estimated infiltration rates of approximately 0.17 to 0.05 inches per hour. The soils encountered between 6 to 10 feet bgs appeared to match Hydrologic Soil Group designations of C to D (Sandy Clay Loam to Clay Loam), with estimated infiltration rates of approximately 0.17 to 0.09 inches per hour.

Infiltration Area (Borings B-28, B-29 and B-40)

Infiltration

The soils encountered between 2 to 4 feet bgs at boring location B-28 and 4 to 6 feet bgs at boring location B-29, appeared to match a Hydrologic Soil Group designation of D (Clay Loam to Sandy Clay), with estimated infiltration rates of approximately 0.09 to 0.05 inches per hour. The remainder soils encountered in the infiltration area appeared to match Hydrologic Soil Group designations of B to C (Loam to Sandy Clay Loam), with estimated infiltration rates of approximately 0.52 to 0.17 inches per hour.

Typically, soils with the Hydrologic Soil Group designations of A and B are considered suitable for SWMP's that may utilize on-site filtration in their designs. Some soils designated as C type soils are considered suitable for infiltration practices but these soils would need to be evaluated on a case specific basis. Soils with group designations of D are considered suitable for a wet pond.

General Construction Considerations:

The existing slopes generally ranged between 3H:1V throughout the planned pond area. All topsoil and organics should be removed to suitable natural soils within the construction area. The stripping depth should extend up the slopes to at least the 100 year flood elevation. As such, some of the side slopes may need to be reconstructed. The slopes should be reconstructed utilizing engineered fill placed in controlled, compacted lifts that are benched into the existing

slopes. On-site sandy or clayey soils are considered suitable for engineered fill to regrade the slopes. This material should be placed in horizontal lifts not exceeding 8 inches in loose thickness, moisture conditioned to within +/-3% of the optimum moisture content, and compacted to a minimum 95% of the maximum dry density obtained in accordance with ASTM Specification D-698, Standard Proctor method. Slopes should be constructed no greater than 3:1. Also, the side slopes should be seeded to promote vegetation growth and further add to the stability of the slopes.

Exposure to the environment may weaken the soils at the bearing level if the excavations remain open for too long a time. Therefore, excavations should be backfilled the same day that the excavations are made whenever possible. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the excavation bottom immediately prior to placement of the next lift of fill.

Proper compaction control of fill is an important aspect of this project. All fill materials should be placed, compacted and tested in accordance with the recommendations contained in this report. We recommend that all cut and fill operations be observed full-time by a qualified Soil Technician to determine if minimum earthwork and compaction requirements are being met.

In a dry and undisturbed state, the subgrade soils at the site will provide adequate subgrade support for fill placement and construction operations. When over optimum moisture, the moisture sensitive subgrade soils may degrade quickly with disturbance from contractor operations. Therefore, good site drainage and dewatering operation should be maintained during earthwork operations so as to help maintain the stability of the soil.

General Comments:

This report has been prepared in order to aid in the evaluation of this site and to assist the Contractor, Architect and Engineer in the design and planning of the project. The report scope is limited to the specific project and location described, and the project description represents our understanding of the significant aspects relevant to soil and foundation characteristics.

We have appreciated being of service to you during the design phase of this project and look forward to its successful construction. If you should have any questions regarding the information and recommendations contained in this report or if we can be of any further assistance, please contact our office.

Respectfully,

ECS MID-ATLANTIC, LLC.

David Gordinier, E.I.T.
Project Engineer

MICHAEL J. GALLI
No. 030084
5/12/06
PROFESSIONAL ENGINEER

Michael J. Galli, P.E.
Principal Engineer

DJG:RNL:MJG;abs

Appendix:
- I. Boring Location Plan (1)
- II. Soil Test Boring Logs (8)
- III. Laboratory Test Summary (1)
- IV. Unified Soil Classification System and Reference Notes for Boring Logs (2)

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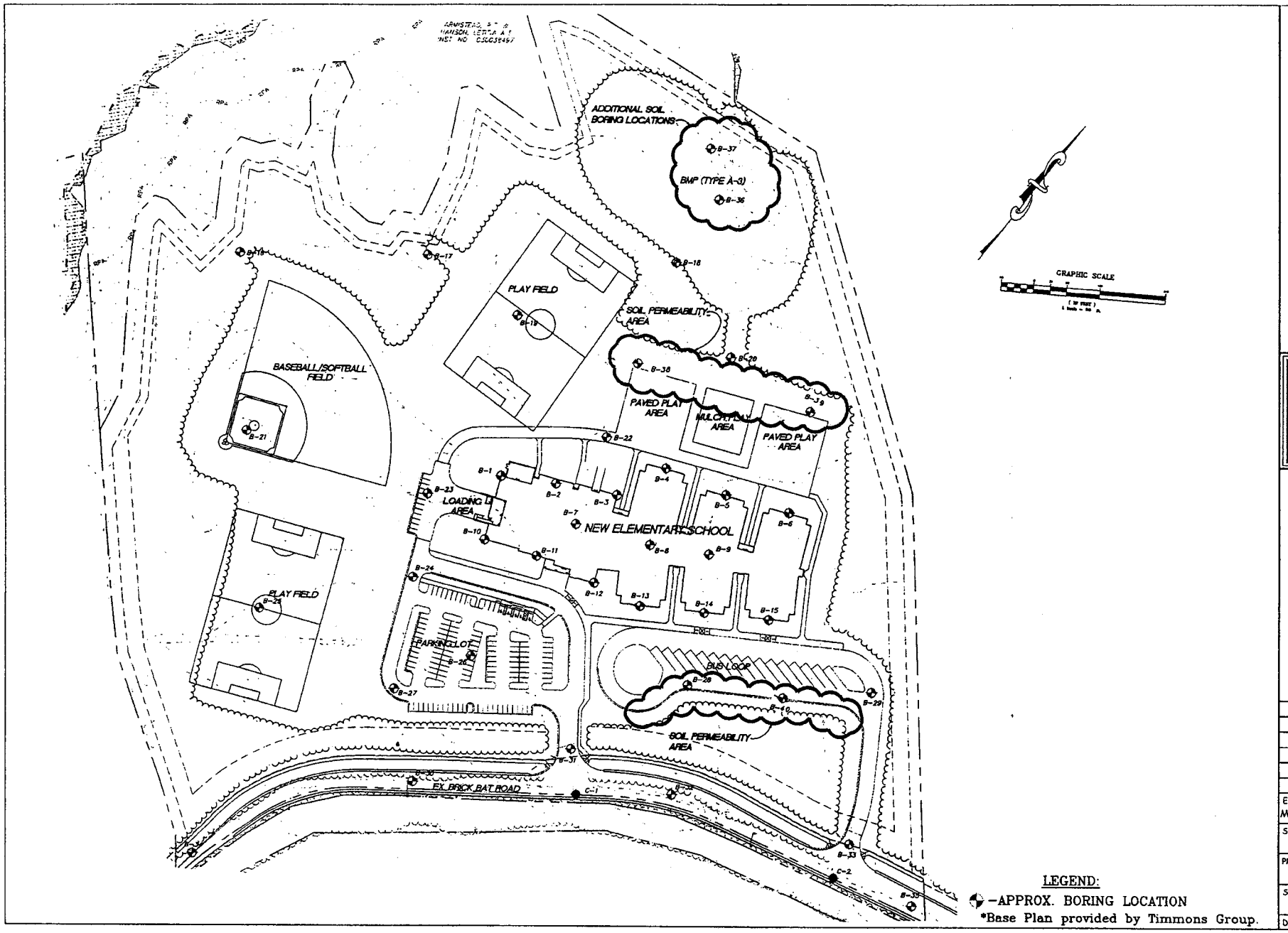
APPENDIX I

BORING LOCATION PLAN



LEGEND:

⊕ –APPROX. BORING LOCATION

*Base Plan provided by Timmons Group.

Wmbg-JCC 8th Elementary School-BMP

James City County, Virginia

ECS LLC MID-ATLANTIC

BORING LOCATION PLAN

ECS REVISIONS	
ENGINEER MJG/DJG	DRAFTING RNL
SCALE	see scale
PROJECT NO.	8263-A
SHEET	1
DATE	05/02/06

APPENDIX II

SOIL TEST BORING LOGS

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-20	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION 82.0

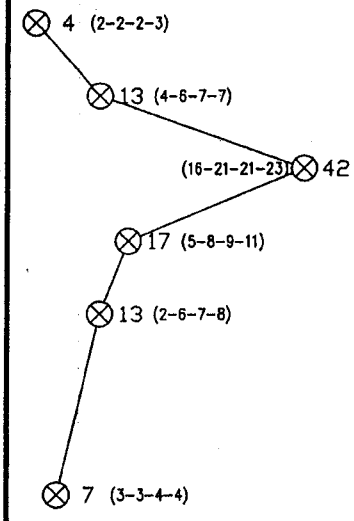
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)
0	1	SS	24	24	TOPSOIL DEPTH 3"		
	2	SS	24	24	Sandy CLAY, Brown to Orange-Brown, Moist, Soft to Hard, (CL)		80
5	3	SS	24	24			
	4	SS	24	24			75
	5	SS	24	24	Fine to Medium Clayey SAND, Light Red-Brown, Moist, Medium Dense, (SC)		
10							70
	6	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Orange-Brown, Moist, Loose, (SC)		
15					END OF BORING @ 15.00'		65
20							60
25							55
30							

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— (20%, 40%, 60%, 80%, 100%)

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



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

WL DRY WS OR WD	BORING STARTED 3/28/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/28/06	CAVE IN DEPTH ● NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-28	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 82.3

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Fine to Medium Silty SAND, Trace Organics Sampled as Root Material, Orange-Brown, Moist, Loose, (SM)	80	7 (1-3-4-4)
	2	SS	24	24	Sandy CLAY, Orange-Brown, Moist, Very Stiff, (CL)		23 (6-8-15-15)
5	3	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Orange-Brown, Moist, Dense to Medium Dense, (SC)		32 (8-15-17-18)
	4	SS	24	24		75	32 (14-15-17-9)
	5	SS	24	24			24 (9-11-13-11)
10					END OF BORING @ 10.00'	70	
15						65	
20						60	
25						55	
30							

WATER LEVELS

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

▽WL DRY WS OR WD	BORING STARTED 3/22/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 3/22/06	CAVE IN DEPTH @ NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-29	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 81.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 6"		80	4 (4-2-2-1)
	2	SS	24	24	Fine to Medium Silty SAND, Light Brown, Moist, Very Loose, (SM)			18 (5-8-10-11)
5	3	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Medium Dense, (SC)			20 (5-7-13-15)
	4	SS	24	24	Sandy CLAY, Red-Brown, Moist, Very Stiff, (CL)		75	(18-20-21-21) 41
	5	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Dense, (SC)			(18-19-18-19) 37
10					END OF BORING @ 10.00'		70	
15							65	
20							60	
25							55	
30								

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

▽WL DRY WS OR WD	BORING STARTED 3/29/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 3/29/06	CAVE IN DEPTH ● NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg-JCC Public Schools	8263-A	B-36	1 OF 1
PROJECT NAME: Wmbg-JCC Eighth Elementary School-BMP	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION 76.0

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— (20%, 40%, 60%, 80%, 100%)

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

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 12"	75	3 (1-1-2-1)
	2	SS	24	24	Fine to Medium Silty SAND, Trace Organics Sampled as Root Material, Light Brown, Moist, Very Loose, (SM)		3 (1-2-1-2)
5	3	SS	24	24	Fine to Medium Clayey SAND, Light Brown, Moist, Very Loose to Loose, (SC)	70	6 (1-2-4-2)
	4	SS	24	24			8 (3-4-4-5)
	5	SS	24	24	Sandy CLAY, Light Brown, Moist, Medium Stiff, (CL)		10 (3-5-5-5)
10					Fine to Medium Clayey SAND, Light Brown, Moist, Loose, (SC)	65	
	6	SS	24	24	Fine to Coarse Silty SAND, Trace Fine Gravel, Light Brown, Moist, Medium Dense, (SM)		19 (5-10-9-7)
15						60	
	7	SS	24	24	Sandy CLAY, Brown, Moist to Wet, Soft, (CL)		3 (2-1-2-3)
20						55	
	8	SS	24	24			2 (1-1-1-1)
25						50	
	9	SS	24	24	Fine to Coarse Silty SAND, With Marine Shell Fragments, Light Brown, Wet, Medium Dense, (SM)		13 (5-6-7-6)
30							

END OF BORING @ 30.00'

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

▽WL 23.0 WS OR WD	BORING STARTED 4/28/06	
▼WL(AB) 23.0 ▼WL(AC) 23.0	BORING COMPLETED 4/28/06	CAVE IN DEPTH ● NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RML (05-01-06) RML (05-05-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg-JCC Public Schools	8263-A	B-37	1 OF 1

PROJECT NAME: Wmbg-JCC Eighth Elementary School-BMP

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 67.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 12"		2 (1-1-1-1)
	2	SS	24	24	Fine to Medium Silty SAND, With Organics Sampled as Root Material, Light Brown, Moist, Very Loose, (SM)	65	3 (1-2-1-2)
5	3	SS	24	24	Fine to Medium Clayey SAND, Light Brown, Moist, Very Loose to Loose, (SC)		4 (1-2-2-1)
	4	SS	24	24		60	7 (2-3-4-4)
	5	SS	24	24	Fine to Medium Silty SAND, Light Brown, Wet, Very Loose, (SM)		4 (1-1-3-3)
10						55	
	6	SS	24	24	Sandy CLAY, Brown, Wet, Medium Stiff to Soft, (CL)		8 (2-3-5-7)
15						50	
	7	SS	24	24			3 (2-1-2-1)
20					END OF BORING @ 20.00'	45	
25						40	
30							

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

▽WL 8.0 WS OR WD	BORING STARTED 4/28/06	
▽WL(AB) 8.0 ▽WL(AC) 8.0	BORING COMPLETED 4/28/06	CAVE IN DEPTH ● NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (05-01-06) RNL (05-03-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg-JCC Public Schools	8263-A	B-38	1 OF 1

PROJECT NAME: Wmbg-JCC Eighth Elementary School-BMP

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% — 40% — 60% — 80% — 100%

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

ENGLISH UNITS

SURFACE ELEVATION 84.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"	4 (2-2-2-2)
	2	SS	24	24	Sandy CLAY, Brown to Red-Brown, Moist, Soft to Very Stiff, (CL)	14 (3-6-8-12)
5	3	SS	24	24		18 (4-8-10-12)
	4	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Medium Dense, (SC)	28 (9-13-15-17)
	5	SS	24	24		20 (6-9-11-14)
10					END OF BORING @ 10.00'	
15						
20						
25						
30						

WATER LEVELS / ELEVATION (FT): 80, 75, 70, 65, 60, 55

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

WL DRY WS OR WD	BORING STARTED 4/28/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 4/28/06	CAVE IN DEPTH ● NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (05-01-06) RNL (05-05-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg-JCC Public Schools	8263-A	B-39	1 OF 1

PROJECT NAME: Wmbg-JCC Eighth Elementary School-BMP

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — REC.% — 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 80.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 5"	80	5 (3-3-2-3)
	2	SS	24	24	Fine to Medium Silty SAND, Light Brown, Moist, Loose, (SM)		9 (3-4-5-8)
5	3	SS	24	24	Sandy CLAY, Red-Brown, Moist, Stiff to Very Stiff, (CL)	75	15 (3-6-9-13)
	4	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Medium Dense, (SC)		20 (6-8-12-13)
	5	SS	24	24	Fine to Medium Clayey SAND, Trace Fine Gravel, Red-Brown, Moist, Medium Dense, (SC)		20 (7-8-12-14)
10					END OF BORING @ 10.00'	70	
15						65	
20						60	
25						55	
30							

WATER LEVELS

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

WL DRY WS OR WD	BORING STARTED 4/28/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 4/28/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (05-01-06) RNL (05-05-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg-JCC Public Schools	8263-A	B-40	1 OF 1
PROJECT NAME: Wmbg-JCC Eighth Elementary School-BMP	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 78.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"			2 (1-1-1-1)
	2	SS	24	24	Fine to Medium Clayey SAND, Light Brown to Brown, Moist, Very Loose to Medium Dense, (SC)		75	10 (3-3-7-9)
5	3	SS	24	24				19 (5-6-13-15)
	4	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Red-Brown, Moist, Medium Dense, (SC)		70	19 (9-10-9-12)
	5	SS	24	24				28 (11-13-15-17)
10					END OF BORING @ 10.00'		65	
15							60	
20							55	
25							50	
30								

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

▽WL DRY WS OR WD	BORING STARTED 4/28/06	
▼WL(AB) DRY ▼WL(AC) DRY	BORING COMPLETED 4/28/06	CAVE IN DEPTH ● NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RWL (05-05-06) RWL (05-05-06)

APPENDIX III

LABORATORY TEST SUMMARY

Engineering Consulting Services Mid Atlantic LLC

Williamsburg, VA

Laboratory Testing Summary

Date: 05/05/2006

Project Number: 8263-A **Project Name:** Williamsburg JCC 8th Elem.

Project Engineer: DJG **Principal Engineer:** MJG **Summary By:** SIW

Boring Number	Sample Number	Depth (Feet)	Moisture Content (%)	USC	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Compaction		CBR Value	Other
									Maximum Density (pcf)	Optimum Moisture (%)		
B-36	S-9	28-30	16.3	SM	NP	NP	NP	12.9	*	*	*	
B-37	S-2	2-4	12.7	SC	44	23	21	40.8	*	*	*	
B-38	S-2	2-4	18.5	CL	48	19	29	53.4	*	*	*	
B-39	S-3	4-6	21.7	CL	45	16	29	51.3	*	*	*	
B-40	S-3	4-6	25.9	SC	39	13	26	47.0	*	*	*	

Summary Key:

V = Virginia Test Method
S = Standard Proctor
M= Modified Proctor

Hyd = Hydrometer
Con = Consolidation
DS = Direct Shear
GS = Specific Gravity

UCS = Unconfined Compression Soil
UCR = Unconfined Compression Rock
LS = Lime Stabilization
CS = Cement Stabilization

OC = Organic Content
SA = See Attached
NP = Non Plastic
* = Test Not Conducted

APPENDIX IV

UNIFIED SOIL CLASSIFICATION SYSTEM AND REFERENCE NOTES FOR BORING LOGS

REFERENCE NOTES FOR BORING LOGS

I. Drilling and Sampling Symbols:

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

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

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

II. Correlation of Penetration Resistances to Soil Properties:

Relative Density-Sands, Silts

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

Consistency of Cohesive Soils

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

III. Unified Soil Classification Symbols:

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

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

IV. Water Level Measurement Symbols:

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

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

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

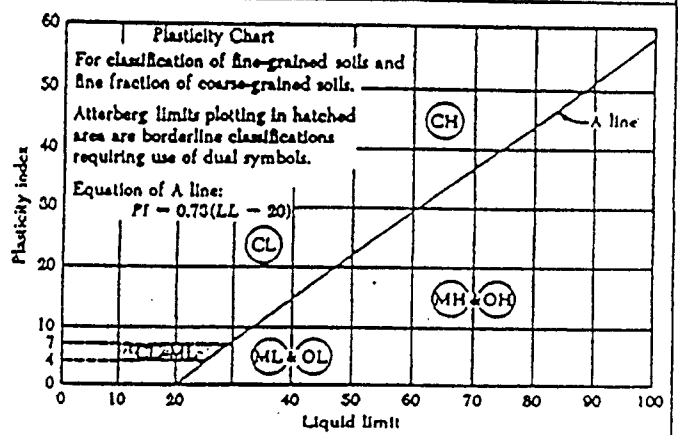
UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

Table Unified System of Classification

Major divisions			Group symbols	Typical names
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes No. 200 sieve	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Table (Continued)

Classification criteria		
Classification on basis of percentage of fines Less than 5% pass No. 200 sieve GW, GP, SW, SP More than 12% pass No. 200 sieve GM, GC, SM, SC 5% to 12% pass No. 200 sieve Borderline classification requiring use of dual symbols	$C_u = D_{60}/D_{10}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
	Not meeting both criteria for GW	
	Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
	Atterberg limits plot above "A" line and plasticity index greater than 7	
	$C_u = D_{60}/D_{10}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
	Not meeting both criteria for SW	
	Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
	Atterberg limits plot above "A" line and plasticity index greater than 7	



Visual-manual identification, see ASTM Designation D2488.

Reprinted from the Annual Book of ASTM Standards

Engineering Consulting Services, Ltd

ECS MID-ATLANTIC, LLC
Geotechnical • Construction Materials • Environmental • Facilities

April 17, 2006

Mr. Alan Robertson
Williamsburg/JCC Public Schools
597 Jolly Pond Road
Williamsburg, Virginia 23188

ECS Project No. 07:8263

Reference: Subsurface Exploration and Geotechnical Engineering Analysis
Williamsburg/JCC Eighth Elementary School
Williamsburg, Virginia

Dear Mr. Robertson:

ECS Mid-Atlantic, LLC has completed a subsurface exploration and geotechnical analysis for the above referenced project in accordance with our proposal No. 07:12264 dated March 8, 2006 and authorized by you. This report provides the results of our subsurface exploration and provides recommendations for the design and construction of the proposed elementary school building and surrounding parking and access roadway areas.

We have enjoyed being of service to Williamsburg/JCC Public Schools during the design phase of this project. If you should have any questions regarding the information and recommendations contained in the accompanying report or if we can be of further assistance, please do not hesitate to contact us.

Respectfully,

ECS MID-ATLANTIC, LLC

David J. Gordinier, E.I.T.
Project Geotechnical Engineer

MICHAEL J. GALLI
No. 038284
4/17/06
PROFESSIONAL ENGINEER

Michael Galli, P.E.
Principal Engineer

DJG:RNL:MJG:abf

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Williamsburg, VA • Winchester, VA • York, PA

REPORT

PROJECT

Subsurface Exploration
and Geotechnical Engineering Analysis
Williamsburg/JCC Eighth Elementary School
Williamsburg, Virginia

CLIENT

Mr. Alan Robertson
Facilities Manager
Williamsburg/James City County Public Schools
597 Jolly Pond Road
Williamsburg, Virginia 23188

SUBMITTED BY

ECS Mid-Atlantic, LLC
108 Ingram Road, Unit 1
Williamsburg, Virginia 23188

ECS Project No.: 07:8263

April 17, 2006

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APPENDIX

I. Boring Location Plan
II. Soil Boring Logs and Subsurface Profile
III. Laboratory Test Summary, and Moisture Density Relationship Curves
IV. Unified Soil Classification System and Reference Notes for Boring Logs

PROJECT OVERVIEW

Executive Summary

The project site is located off of Brick Bat Road in James City County, Virginia. We understand the proposed project will consist of the construction of a new 1 to 2-story Eighth Elementary School, associated parking lots and access drives, ball fields, soccer fields, and storm water management ponds. We also understand that building loads will not exceed 150 kips for columns and 5 kips per linear foot for walls. The site is rolling and densely wooded. Based on the site plan, it appears that the elevations across the new school building pad varies from about Elevation (El) 79 to El 84, msl. We have not been provided with planned finished floor for the school building. However, we have assumed cut and fills across the building pad of about 5 feet (+/-). Project details were obtained from Moseley Architects and Timmons Engineers.

The project site is generally comprised of mixed deposits of medium dense to dense density Silty and Clayey Sands and medium stiff to stiff consistency Sandy Clays considered suitable for support of the planned construction. However, we also encountered very soft and loose near surface soils across most of the project site from the ground surface to depths of about 2 ft below site grades. Depending on the time of year for construction, some of these soils may be considered suitable for support of the various structures or site improvements. However, while many of these near surface soils may be considered suitable or capable for improvements for floor slabs, parking lot, or athletic field support, they may not be considered suitable for direct bearing support of the proposed building foundations and may need to be removed (undercut).

Based on the conditions encountered, shallow spread footings would be considered suitable for support of the building and are recommended. For footings, a net allowable soil bearing pressure of 3,000 pounds per square foot is recommended for structures with maximum column loads of 150 kips and wall loads up to 5 kips per linear foot. Based on the design bearing pressure and the anticipated structural loads, total post-construction building settlements are estimated to be less than 1.0 inch. The building floor slab may be constructed as a slab-on-grade.

We have evaluated the seismic site coefficient in accordance with the IBC 2003. We consider the soils to match Site-Class Type D based on the IBC 2003 "Site Class Definitions", Section 1615.1.1 and our experience in the area.

Additionally, the soil conditions encountered across the site are generally considered suitable for support of the proposed parking lots, roadways, and athletic fields. However, some subgrade modification or improvements may be required depending on planned finished site grades. Recommendations for specific subgrade improvements (if any) are provided herein.

Results of our field exploration indicated that the location of the groundwater table should not interfere with the construction of foundations or placement of controlled fill. However, due to the near surface fine-grained soils encountered, a perched water condition may be encountered. If groundwater is encountered during construction, it can be controlled by dewatering through the use of sumps, drainage swales and/or pumps.

Further information regarding the subsurface exploration procedures used, groundwater conditions, foundations, borrow area, earthwork operations, and construction considerations are included in the text of this report.

Scope of Work

Fifteen (15) soil test borings were drilled at the proposed building location (B-1 through B-15), thirteen (13) soil test borings were drilled at the proposed access drive and parking areas (B-22 through B-24, B-26 through B-35), three (3) soil test borings were drilled within the proposed soccer and ball fields (B-19, B-21, and B-25), and four (4) soil test borings were drilled at the proposed BMP areas (B-16 through B-18, B-20). The approximate boring locations are shown on the Boring Location Plan in Appendix I.

Our investigation included exploration of groundwater conditions, performing a site reconnaissance to observe general topography, and analyzing field data to develop appropriate geotechnical engineering recommendations regarding design and construction of the structures and the proposed roadways.

The recommendations contained herein were developed from the data obtained in the soil test borings, which indicate subsurface conditions at these specific locations at the time of the exploration. If during the course of construction variations appear evident; the Geotechnical Engineer should be informed so that differing conditions may be addressed. Design recommendations were developed based on building design criteria considered typical for this type of structure.

Purposes of Exploration

The purposes of this exploration were to explore the soil and groundwater conditions at the site and to develop soils-related engineering recommendations to guide design and construction of the project. We accomplished these purposes by drilling soil test borings and analyzing the soil samples from the borings to evaluate pertinent engineering properties in order to develop geotechnical engineering design recommendations.

Proposed Construction

Proposed for construction is the new one- to two-story steel-framed 8th Elementary School building with the first floor constructed as slabs-on-grade. We have assumed column and wall loads will not exceed 150 kips and 5 kips per linear foot, respectively. The floor slabs are estimated to be subjected to maximum loading of 200 pounds per square foot. We have assumed the first floor of the school building will be within about 5 ft (+/-) of existing site grades. Other areas of site improvements will be the associated parking lots and access drives, in addition to new soccer and ball fields, and the associated Storm Water Management Ponds (SWM). Final grades have not been provided. Also, final site locations have not been selected for the SWM Pond(s).

PE comments

Should foundation loading or finished floor elevations be determined to differ from those reported herein, or if the described building characteristics are significantly different, this office should be informed so that a review of these conditions may be performed.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

The soil borings were performed with a ATV-mounted auger drill rig, utilizing hollow stem augers and mud-rotary drilling techniques to advance the boreholes. Drilling fluid was used in this process.

Representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2.25-inch O.D., split-barrel sampler is driven into the soil a distance of 24 inches by a 140-pound hammer falling 30 inches. After an initial 6-inch seating interval, the number of blows required to drive the sampler through the next 12-inch interval is termed the Standard Penetration Test (SPT) value and is indicated for each sample on the boring logs. This value can be used as a qualitative indication of the in-place relative density of cohesionless soils and the relative consistency of cohesive soils. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

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

Also, eight (8) bulk soil samples were taken from the proposed parking lot areas at the existing elevations. These soils were returned to the laboratory for California Bearing Ratio (CBR) testing.

Also, Two (2) pavement cores were performed along Brick Bat Road to determine the asphalt pavement and stone thicknesses at the specified locations. Core locations C-1 and C-2 are shown on the attached Boring Location Plan in Appendix I.

Laboratory Analysis Program

Experienced personnel from our office visually classified each soil sample from the test borings on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS) and ASTM D-2488 (Description and Identification of Soils-Visual/Manual Procedures). A brief explanation of the USCS is included in Appendix IV of this report. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. Representative jar samples were selected and subjected to classification testing consisting of natural moisture content, gradation (#200 wash procedure), and Atterberg Limits analysis. In

addition, samples of the subgrade soil were subjected to California Bearing Ratio (CBR) testing to ascertain relevant engineering properties for use in pavement design. Laboratory test results are summarized in Appendix III. The geotechnical engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in situ, the transitions may be gradual. The soil samples will be retained in our laboratory for a period of 60 days, after which they will be discarded unless other instructions are received as to their disposition.

EXPLORATION RESULTS

Site Characteristics

The project site is located off of Brick Bat Road in James City County, Virginia. The project site has moderately rolling terrain with mature woods.

Subsurface Conditions

Our subsurface exploration and site reconnaissance determined that the site is covered with 1 to 8 inches of topsoil. Below the topsoil, we encountered Stratum I. Stratum I primarily consisted of very loose to dense density SAND (SM, SC) with varying amounts of Silt and Clay that extended to the depths explored at 10 to 25 feet below the ground surface (bgs). Intermixed with these mostly coarse-grained soils, we also encountered soft to hard consistency Sandy CLAY (CL). The Standard Penetration Test (SPT) N-value recorded within these layers ranged from 2 to 52 blows-per-foot (bpf).

Groundwater Observations

Observations for groundwater were made during sampling and upon completion of the drilling operations at each boring location.

Groundwater was encountered at boring locations B-2, B-7, and B-10 through B-12 and ranged between 21 and 24 feet bgs. Please note that groundwater levels are influenced by seasonal conditions and by periods of significant precipitation or prolonged drought. It is also noted that perched groundwater conditions may be encountered at shallower depths in other areas due to the confining Clay soils encountered above the observed groundwater level. If groundwater or perched water is encountered during the construction of excavations, it should be pumped from sumps excavated adjacent to the construction excavations.

ANALYSIS AND RECOMMENDATIONS

Discussion

The near surface soils encountered across the project site consist of very soft and loose density sands and clays from the ground surface to depths of about 2 ft below site grades. Depending on the time of year for construction, some of these soils may be considered suitable for support of the various structures or site improvements. However, while many of these near surface soils may be considered suitable or capable for improvements for floor slabs, parking lot, or athletic field support, they may not be considered suitable for direct bearing support of the proposed building foundations and may need to be removed.

Subgrade Preparation and Earthwork Operations

Prior to the placement of compacted structural fill for building or roadway support, or general site improvements, it is recommended that all topsoil, rootmatting, unsuitable or unstable uncontrolled fill and any otherwise soft or unsuitable materials be removed. The prepared areas should be observed by an experienced Geotechnical Engineer from ECS during the time of construction in order to aid in locating any unsuitable materials that should be removed. In an effort to densify soft or loose surficial subgrade soils, the prepared areas should be proofrolled with a smooth drum roller with a minimum of two passes in perpendicular directions, provided

in-situ moisture contents are within +/-3% of optimum in order to facilitate compaction.

We encountered various thicknesses of topsoil at the boring locations. Generally, we recommend all topsoil or deleterious materials be stripped from the site. We suggest an average stripping depth of 8 inches be considered for planning purposes. Additionally, the near-surface soils generally consist of very loose density sands and very soft consistency clays. Cuts of an additional 12 to 24 inches may be expected in some areas due to these loose and soft soil conditions. Also, isolated areas may require further cuts of an additional 12 inches due to tree stumps and heavy root mat from closely spaced trees, etc. The stripping depth should be evaluated at the time of construction by representatives of the Geotechnical Engineer. If the undercuts extend into large areas, the undercut volume could be reduced by the use of geotextiles or geogrids. The use of geosynthetic reinforcement should be evaluated by the geotechnical engineer at the time of construction.

Engineered fill (select) material required to raise the building site to the design subgrade elevation should consist of an approved inorganic material classified as SM, SM-SP, SP, SC, or better containing less than about 40% by weight Silt or Clay and free of debris. Some of coarse-grained on-site soils are expected to meet these criteria. However, they may be at or above their natural moisture content depending on the time of year of construction. Significant drying time may be necessary to achieve an adequate moisture content for compaction purposes. Also, this material should be placed in horizontal lifts not exceeding 8 inches in loose thickness; moisture conditioned to within +/-3% of the optimum moisture content, and compacted to a minimum

95% of the maximum dry density obtained in accordance with ASTM-698, Standard Proctor method. Select fill should extend a minimum of 10 feet beyond building limits at finish subgrade elevation and then slope no greater than 2 horizontal to 1 vertical. All proposed fill materials should be submitted to the Geotechnical Engineer for approval prior to their use in the project.

Foundations

Based on the results of our exploration and analysis, it is our opinion that the proposed elementary school building can be supported by shallow spread footings bearing on suitable natural soils or in properly compacted select fill extending to stable, undisturbed subgrade. For footings placed on suitable natural soils or compacted engineered fill, we recommend that a net allowable soil bearing pressure of 3000 psf be utilized for proportioning the foundations. The base of the footings should be a minimum of 24 inches wide for wall footings and 36 inches wide for column footings to minimize potential failure of the bearing soils by local or punching shear action.

The fine-grained soils encountered in the test borings are considered to have a moderate to high shrink-swell potential based on laboratory testing. However, the anticipated structural loads are considered sufficient to counteract the pressures induced by the soils' volume expansion potential. Typically, the foundation loads encountered on commercial projects are such that the potential swell pressure that might develop due to seasonal moisture content variation will not be

sufficient to exceed the foundation bearing pressure. Therefore, we believe the potential for this structure to be adversely affected by shrink-swell behavior is limited. As such, we recommend foundations be embedded a minimum of 24 inches below site grades for shrink-swell, frost protection, and bearing capacity considerations.

We recommend that all topsoil, rootmatting, uncontrolled fill, and any otherwise soft or unstable subgrade encountered in the footing excavations should be removed from below all new footings. In areas where soft or unsuitable material is undercut, the excavation may be backfilled with a compacted structural fill to re-establish the desired footing elevations. We recommend that an angular crushed stone (VDOT No. 57 Stone) be used for backfilling footing undercuts in the coarse-grained soils, and flowable fill be utilized in fine-grained soil conditions due to these soils shrink-swell behavior. The type of backfill material (if any) should be evaluated at the time of construction and the specific soil types encountered.

The net allowable soil bearing pressure refers to that pressure which may be transmitted to the foundation bearing soils in excess of the final minimum surrounding overburden pressure. Based on foundations designed and constructed herein utilizing a net allowable bearing pressure of 3000 psf, the post construction settlement for the building is estimated to not exceed one inch, with differential settlements between adjacent columns estimated to not exceed one-half inch.

Seismic Design

We have evaluated the seismic site coefficient in accordance with the IBC 2003. Based on the test boring data, site specific shear wave velocity testing on nearby sites, and our experience in the area, we consider the soils to match Site-Class Type D in accordance with the IBC 2003 "Site Class Definitions", Section 1615.1.1.

Floor Slab Design

We recommend the slab-on-grade be directly supported by a minimum of 4 inches of a well graded, clean granular material (porous fill) having a maximum aggregate size of 1.5 inch and no more than 15% passing the #200 Sieve (GM, GW, GP, SM, SW, SP). Both VDOT No. 57 stone and VDOT Grade A Fine Aggregate meet the criteria for porous fill.

These granular layers below the floor slab will facilitate the fine grading of the subgrade, provide more uniform bearing conditions, and help minimize the rise of water to the bottom of the slab via capillary action. The slab should also be directly underlain by a suitable polyethylene vapor retarder to minimize moisture intrusion into the slab. Provided the design and construction recommendations discussed herein are followed, the slab may be designed assuming a Modulus of Subgrade Reaction, K_S, of 200 psi per inch.

Below Grade Walls

Below grade walls may be used on portions of the site or building. However, at this time it is unknown as to the wall height, the type of construction, and/or location. Once final grading plans and wall design are established, we request that we review final drawings to check and modify our recommendations accordingly, if necessary. Lateral earth pressures as presented below may be subject to change once this information is available.

The wall should be structurally designed to resist the forces imposed by the lateral earth pressures for the restrained soils. Drainage behind the wall is recommended to limit the build-up of hydrostatic forces on the wall face. As such, only a free draining clean sandy soil or crushed stone material should be used as backfill within 1 foot behind retaining walls. Backfill placed behind the retaining wall shall be placed and compacted as recommended in the previous sections. For walls where no movement is allowed such as a basement or retaining wall, we recommend that the walls be designed to resist "at rest" K_o lateral earth pressures. The at-rest earth pressure assumes no movement of the wall facing is allowed. If the wall is free to rotate, the active earth pressure, K_a may be used to design the wall. To aid in evaluating the various forces imposed on the walls, the following table is presented which outlines soils parameters for the fine and/or coarse-grained soils observed in the test borings. The soils encountered in our explanation were mixed deposits of fine- and coarse-grained soils. These soils cannot avoid

being mixed during excavation and placement, therefore, we recommend utilizing the following soil parameters to represent all the on-site cut soils:

Table 1: Soil Design Parameters

Soil Design Parameters		
USCS Classification	CL	SM/SC
Cohesion, c (psf)	1000	0
Angle of Internal Friction, ϕ (Unconsolidated-Undrained)	0	32
At-Rest Lateral Earth Pressure Coefficient, K_o	1.0	0.47
Active Lateral Earth Pressure Coefficient, K_a	1.0	0.31
Passive Lateral Earth Pressure Coefficient, K_P	1.0	3.25
Moist Unit Weight, γ (pcf)	110	125
Buoyant Unit Weight, γ (pcf)	48	63

Pavements

Once the design pavement subgrade elevation is reached, the subgrade should be proofrolled and carefully observed at the time of construction in order to aid in identifying any localized soft or unsuitable materials. An outcome of the proofrolling may be a recommendation to scarify, aerate, and recompact the soils at near the soil's optimum moisture content. Soils which are still unstable will require undercutting and replacement with structural fill material under the direction of the geotechnical engineer. If site work is performed during the wetter winter

months, we anticipate that slightly cohesive and moisture-sensitive subgrade soils subjected to wet conditions and/or ponding water will become unstable and require undercuts and replacement with dryer, suitable material. Ideally, site work should be performed during the dryer late summer and early fall months to minimize potential undercuts due to moisture intrusion and facilitate compaction. Exposed subgrade soils should be graded to drain surface moisture, and covered as soon as possible with full design depths of select materials that are compacted in accordance with VDOT design criteria. Construction traffic should be confined to specific stabilized construction roads, and not allowed to degrade the pavement subgrade or new pavement section once it is placed.

An important consideration with the design and construction of new pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Furthermore, good drainage should minimize the possibility of the subgrade materials becoming saturated over a long period of time. Based upon the results of the soil test borings, the groundwater table should not significantly affect the performance of pavements; however, surface runoff water that is trapped during construction on the exposed subgrade soils could create localized deterioration of the soil's bearing capacity. Standing water that may develop on the surface of the pavement may be minimized by adequate design (surface graded to control runoff to desired locations - catch basins, drain inlets, gutters, etc.), adequate compaction of each lift of pavement material (to minimize localized settlements that result in ponding), and accurate fine grading of each lift of pavement material (to achieve the desired

design grades). Standing water that tends to develop within the base course layer may be minimized by installing temporary weep holes in drainage structures, construction of drainage swales and diversion ditches, and proper backfill and grading behind curbs to minimize water intrusion from behind the curbs.

The subgrade soils across the site in the parking and access road areas generally consist of Silty and Clayey SAND (SM, SC) and Sandy Fat CLAY (CH). Based on these soil types and the laboratory testing results, we recommend a design CBR value of 5. A Resiliency Factor (RF) of 2.5 and the resulting Soil Support Value (SSV) of 12 should also be used in this design. The following pavement sections are based on VDOT Vaswani design methods, our experience in the project area, and are recommended for this project:

<u>Flexible Pavement – Light Duty Section</u> (Automobile Parking Spaces - up to 500 vpd)

Asphalt Surface	- 2.0 inches Asphalt Concrete Surface Mix, Type SM-9.5.
Aggregate Subbase	- 8.0 inches untreated Aggregate Base Material, Type I, Size 21A/B.
Subgrade	- Stable and compacted to a dry density of at least 95% of the soil's Standard Proctor maximum dry density (ASTM D-1557)

<u>Flexible Pavement – Heavy Duty Section</u> (Main Drive Isles / Bus Loops - up to 1500 vpd)

Asphalt Surface	- 1.5 inches Asphalt Concrete Surface Mix, Type SM-9.5.
Asphalt Base	- 3.0 inches Asphalt Concrete Base Mix, Type BM-25.5
Aggregate Base	- 8 inches untreated Aggregate Base Material, Type I, Size 21A/B.
Subbase	- Variable Select Material (Sand); If Required.
Subgrade	- Stable and compacted to a dry density of at least 95% of the soil's Standard Proctor maximum dry density (ASTM D-1557) to a depth of 8.0 inches below subgrade elevation.

It should be noted that the natural moisture contests within the existing soils are above optimum. This may cause instability during construction. Some undercut and replacement with base stone may be required. The pavement sections recommended herein are considered to be minimums with regard to recognized pavement design practices, and any reductions in the pavement sections could result in less than satisfactory pavement performance.

Please note these soils are considered expansive soils. As such, these soils are highly moisture sensitive and easily disturbed. Depending on the time of year for construction, these soils could be difficult to manage and some form of stabilization may be required such as lime stabilizing the roadway subgrades. This can also increase the soils CBR value by as much as 20 to 50 percent. Stabilization techniques may include but not limited to 5% lime additive or 12 inches of base stone with an appropriate stabilization fabric.

We recommend that any dumpster pads (including the area the collection truck will be on while emptying the dumpster) and loading dock pavements be rigid (concrete) pavement sections. We

recommend that concrete pavements be comprised of a minimum of 6 inches of Portland cement concrete having a minimum 28-day compression strength of 4000 psi. The concrete should be air entrained and should be reinforced with welded wire mesh-type reinforcement or Fibermesh concrete should be used. Construction joints or sawcut joints should be provided at a maximum spacing of 12 feet. Four inches of untreated aggregate base material, Type I - Size 21A/B, are recommended beneath exterior concrete pavements.

Coring Results

We were requested to observe the existing asphalt pavement and aggregate base thicknesses along Brick Bat Road. Utilizing a standard concrete coring machine, we collected three-inch diameter cores from the specified locations. We observed about 3.5 inches of asphaltic pavement overlying a stone/soil matrix ranging from about 4.0 to 4.5 inches at these locations. No apparent distress was noted during our site visit. Table 1 summarizes the results of our field measurements.

Table 2: Field Measurements of Brick Bat Road

Core #	Asphalt Thickness	Base Thickness
C-1	3.5"	4.5"
C-2	3.5"	4.0"

E-MAILED

Construction Considerations

Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed

the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, we recommend that a 1- to 3-inch thick "mud mat" of lean concrete be placed on the bearing soils before the placement of reinforcing steel.

Proper compaction control of fill is an important aspect of this project. Therefore, we recommend that all fill operations be observed full-time by a qualified ECS soil technician to determine if minimum compaction requirements are being met.

When wet, the shallower moisture sensitive subgrade soils will degrade quickly with disturbance from contractor operations. Therefore, good site drainage should be maintained during earthwork operations so as to help maintain the integrity of the soil. Also, construction traffic should be limited to prepared haul roads to minimize disturbance to the building pad or other areas of the site which requires improvements.

Closing

We recommend that the construction activities be monitored by a qualified geotechnical engineering firm to provide the necessary overview and to check the suitability of the subgrade soils for support of the foundations. ECS can provide these services and would be pleased to submit unit rates for the required services during project planning stages.

APPENDIX

I. Boring Location Plan (1)

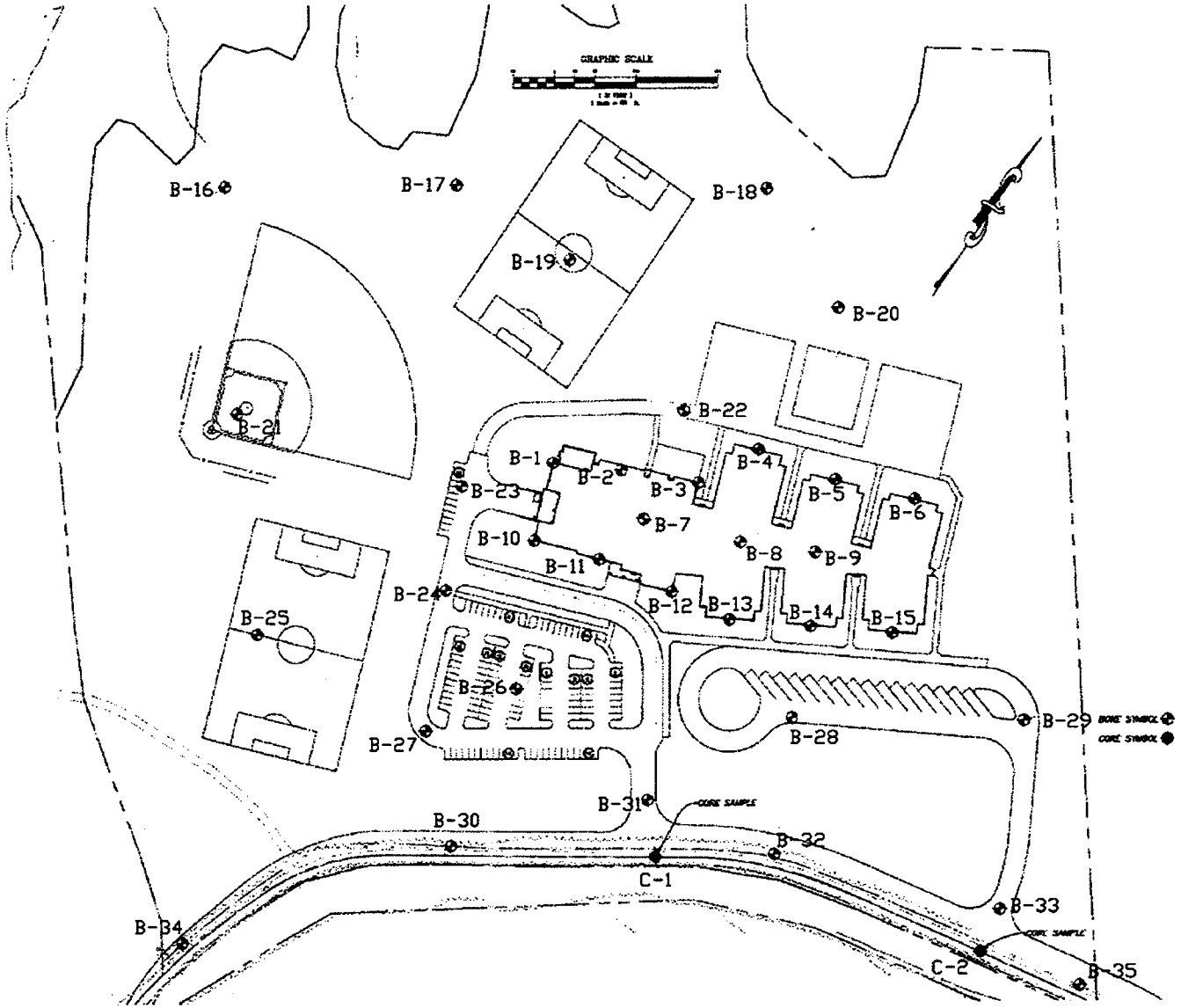
II. Soil Boring Logs and Subsurface Profile (39)

III. Laboratory Testing Summary, and Moisture Density Relationship Curves (9)

IV. Unified Soil Classification System and Reference Notes for Boring Logs (2)

Appendix I

Boring Location Plan



ECS LLC MID-ATLANTIC	ECS Mid-Atlantic 108 Ingram Road, Unit 1 Williamsburg, Virginia 23188 Ph (757) 229-6677 Fax (757) 229-9978	**Boring Location Plan** **Proposed Williamsburg – JCC Eighth Elementary School** **Williamsburg, Virginia**	CHECKED: D.J.G.	SCALE: NTS	DATE: 3/13/06	FIGURE: Fig. 1
			DRAWN: R. Lyles 07-8263-1.dwg	PROJECT NO. 07-8263		

Appendix II

Soil Boring Logs
And
Subsurface Profile

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-1	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— (20%, 40%, 60%, 80%, 100%)

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

ENGLISH UNITS

SURFACE ELEVATION 80.7

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 2"	80	4 (1-2-2-2)
	2	SS	24	24	Fine to Medium Silty SAND, Trace Clay, Light Brown, Moist, Very Loose to Medium Dense, (SM)		15 (5-6-9-9)
5	3	SS	24	24	Fine to Medium Clayey SAND, Light Brown, Moist, Dense, (SC)	75	(13-16-21-35) 37
	4	SS	24	24	Sandy CLAY, Graywith Brown and Red-Brown Mottling, Moist, Very Stiff, (CL)		(14-14-16-17) 30
	5	SS	24	24			(7-23-18-21) 41
10					Fine to Medium Clayey SAND, Gray with Light Brown and Light Red-Brown Mottling, Moist, Dense, (SC)	70	
	6	SS	24	24	Fine to Coarse Silty SAND, Trace Fine Gravel and Clay, Orange-Brown to Light Brown, Moist, Medium Dense, (SM)		13 (8-6-7-6)
15						65	
	7	SS	24	24			26 (13-13-13-16)
20						60	
	8	SS	24	24	Sandy CLAY, Light Brown, Moist, Soft, (CL)		4 (6-1-3-4)
25					END OF BORING @ 25.00'	55	
30							

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

▽WL DRY WS OR WD	BORING STARTED 3/27/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 3/27/06	CAVE IN DEPTH @ NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-2	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 83.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 3"		3 (2-2-1-2)
	2	SS	24	24	Fine to Medium Silty SAND, Trace Clay, Light Brown, Moist, Very Loose to Medium Dense, (SM)	80	17 (4-7-10-12)
5	3	SS	24	24			16 (6-7-9-12)
	4	SS	24	24	Fine to Medium Clayey SAND, Light Brown with Red-Brown Mottling to Red-Brown, Moist, Medium Dense, (SC)	75	27 (14-13-14-4)
	5	SS	24	24			15 (6-7-8-9)
10							
	6	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Orange-Brown, Moist, Medium Dense, (SC)	70	25 (8-12-13-15)
15							
	7	SS	24	24	Fine to Coarse Silty SAND, Trace Fine Gravel, Light Brown with Orange-Brown Mottling, Moist, Loose, (SM)	65	8 (6-5-3-4)
20							
	8	SS	24	24	Fine to Medium Silty SAND, Orange-Brown, Moist to Wet, Medium Dense, (SM)	60	20 (13-10-10-12)
25					END OF BORING @ 25.00'		
30						55	

WATER LEVELS

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

WL 24.0 WS OR WD	BORING STARTED 3/27/06	
WL(AB) 24.0 WL(AC) 24.0	BORING COMPLETED 3/27/06	CAVE IN DEPTH ● NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-3	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — REC.% (20%, 40%, 60%, 80%, 100%)

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

ENGLISH UNITS

SURFACE ELEVATION 83.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"		5 (2-2-3-2)
	2	SS	24	24	Sandy CLAY, Brown with Orange-Brown and Red-Brown Mottling, Moist, Medium Stiff to Very Stiff, (CH)	80	20 (4-7-13-14)
5	3	SS	24	24	Fine to Medium Clayey SAND, Light Brown to Red-Brown to Brown with Red-Brown Mottling, Moist, Medium Dense to Dense, (SC)		27 (11-9-18-10)
	4	SS	24	24			(12-20-17-17) 37
	5	SS	24	24		75	(12-19-20-22) 39
10					Fine to Medium Silty SAND, Trace Clay, Red-Brown with Orange-Brown Mottling, Moist, Dense, (SM)		
	6	SS	24	24	Fine to Coarse Silty SAND, Trace Fine Gravel, Orange-Brown, Wet, Loose, (SM)	70	9 (4-4-5-6)
15							
	7	SS	24	24	Fine to Coarse Silty SAND, Orange-Brown, Wet, Medium Dense, (SM)	65	12 (4-6-6-9)
20							
	8	SS	24	24	Fine to Medium Silty SAND, Light Brown, Wet, Medium Dense, (SM)	60	12 (6-5-7-8)
25					END OF BORING @ 25.00'		
						55	
30							

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

WL DRY WS OR WD	BORING STARTED 03/20/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 03/20/06	CAVE IN DEPTH @ N/A
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-4	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION 82.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL
0	1	SS	24	24	TOPSOIL DEPTH 4"
	2	SS	24	24	Fine Medium Clayey SAND, Light Brown, Moist, Loose, (SC)
5	3	SS	24	24	Sandy CLAY, Brown to Red-Brown, Moist, Very Stiff, (CL)
	4	SS	24	24	
	5	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Dense, (SC)
10					
	6	SS	24	24	Fine to Coarse Clayey SAND, Trace Marine Shell Fragments, Orange-Brown, Wet, Medium Dense, (SC)
15					
	7	SS	24	24	Fine to Coarse Silty SAND, Trace Marine Shell Fragments, Orange-Brown, Wet, Medium Dense, (SM)
20					
	8	SS	24	24	
25					END OF BORING @ 25.00'
30					

WATER LEVELS

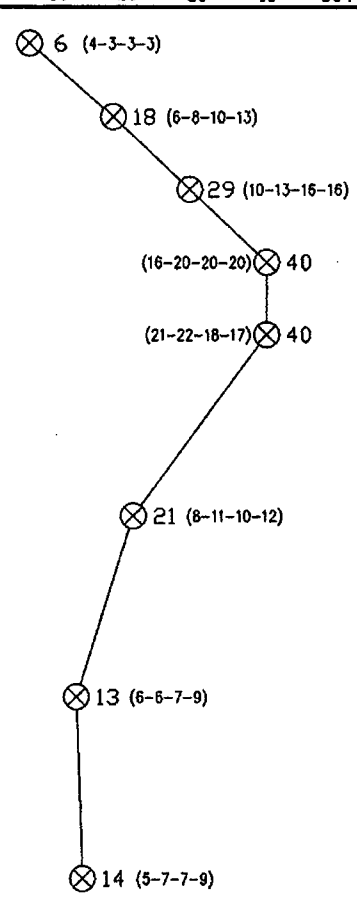
ELEVATION (FT): 80, 75, 70, 65, 60, 55

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

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — REC.% — 20% 40% 60% 80% 100%

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



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

WL DRY WS OR WD	BORING STARTED 03/20/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 03/20/06	CAVE IN DEPTH @ N/A
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-5	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 79.7

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"		6 (1-2-4-5)
	2	SS	24	24	Sandy CLAY, Brown, Moist, Medium Stiff, (CL)		16 (6-8-8-12)
5	3	SS	24	24	Fine to Medium Clayey SAND, Brown to Red-Brown, Moist, Medium Dense, (SC)	75	26 (10-11-15-16)
	4	SS	24	24			(16-16-16-16) 32
10	5	SS	24	24		70	27 (14-15-12-12)
	6	SS	24	24			18 (5-7-11-13)
15					Fine to Coarse Clayey SAND, Red-Brown, Moist, Medium Dense, (SC)	65	
20	7	SS	24	24	Fine to Medium Silty SAND, Trace Fine Gravel, Orange-Brown, Wet, Medium Dense, (SM)	60	13 (7-6-7-5)
25	8	SS	24	24	Fine to Medium Silty SAND, Orange-Brown, Wet, Medium Dense, (SM)	55	15 (7-7-8-8)
30					END OF BORING @ 25.00'	50	

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

WL DRY WS OR WD	BORING STARTED 03/20/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 03/20/06	CAVE IN DEPTH @ N/A
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-6	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 79.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 3"			9 (5-4-5-7)
	2	SS	24	24	Sandy CLAY, Brown to Red-Brown, Moist, Medium Stiff to Very Stiff, (CH)			(10-13-18-16) 31
5	3	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Medium Dense to Dense, (SC)		75	(24-24-21-22) 45
	4	SS	24	24				27 (15-14-13-14)
	5	SS	24	24			70	(18-18-16-17) 34
10								
	6	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Orange-Brown, Wet, Medium Dense, (SC)		65	14 (4-7-7-7)
15								
	7	SS	24	24	Fine to Medium Silty SAND, Trace Fine Gravel, Red-Brown, Wet, Medium Dense, (SM)		60	14 (15-8-6-6)
20								
	8	SS	24	24	Sandy CLAY, Orange-Brown, Wet, Stiff, (CL)		55	11 (8-4-7-5)
25					END OF BORING @ 25.00'			
30							50	

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

WL DRY WS OR WD	BORING STARTED 03/21/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 03/21/06	CAVE IN DEPTH @ N/A
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-7	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION: 82.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL
0	1	SS	24	24	TOPSOIL DEPTH 2"
	2	SS	24	24	Sandy CLAY, Trace Organics Sampled as Root Fragments, Light Brown, Moist, Soft, (CL)
5	3	SS	24	24	Fine to Medium Clayey SAND, Light Brown to Light Brown with Red-Brown Mottling, Moist, Dense, (SC)
	4	SS	24	24	
	5	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Light Red-Brown to Orange-Brown, Moist, Medium Dense, (SC)
10					
	6	SS	24	24	
15					
	7	SS	24	24	Fine to Medium Silty SAND, Light Gray with Light Brown Mottling to Light Gray, Moist to Wet, Medium Dense, (SM)
20					
	8	SS	24	24	
25					END OF BORING @ 25.00'
30					

WATER LEVELS

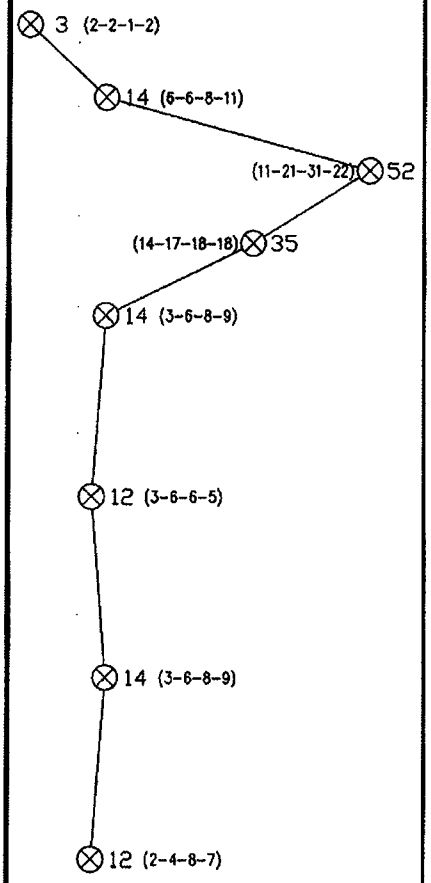
ELEVATION (FT): 80, 75, 70, 65, 60, 55

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

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — REC.% — 20% 40% 60% 80% 100%

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



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

WL 24.0 WS OR WD	BORING STARTED 3/27/06	
WL(AB) 24.0 WL(AC) 24.0	BORING COMPLETED 3/27/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-8	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— (20%, 40%, 60%, 80%, 100%)

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

DESCRIPTION OF MATERIAL

ENGLISH UNITS

SURFACE ELEVATION 82.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"	4 (2-2-2-3)
	2	SS	24	24	Sandy CLAY, Brown to Brown with Red-Brown Mottling, Moist, Soft to Very Stiff, (CL)	20 (7-9-11-16)
5	3	SS	24	24		28 (11-14-14-14)
	4	SS	24	24	Fine to Medium Clayey SAND, Red-Brown to Orange-Brown, Moist, Dense to Medium Dense, (SC)	(13-20-21-17) 41
	5	SS	24	24		(19-21-22-23) 43
10						
	6	SS	24	24		16 (7-9-7-14)
15						
	7	SS	24	24	Fine to Medium Silty SAND, Orange-Brown to Light Brown, Wet, Medium Dense, (SM)	24 (8-11-13-13)
20						
	8	SS	24	24		29 (10-12-17-13)
25					END OF BORING @ 25.00'	
30						

WATER LEVELS ELEVATION (FT): 80, 75, 70, 65, 60, 55

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

WL DRY WS OR WD	BORING STARTED 03/21/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 03/21/06	CAVE IN DEPTH @ N/A
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-9	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 79.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"		4 (1-2-2-2)
	2	SS	24	24	Fine to Medium Clayey SAND, Light Brown, Moist, Very Loose, (SC)		19 (5-9-10-10)
5	3	SS	24	24	Sandy CLAY, Light Brown, Moist, Very Stiff, (CL)	75	32 (8-16-16-19)
	4	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Dense, (SC)		38 (16-18-20-22)
	5	SS	24	24	Sandy CLAY, Red-Brown with Gray Mottling to Red-Brown, Moist, Hard, (CL)	70	46 (22-24-22-22)
10							
	6	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Red-Brown, Moist, Medium Dense, (SC)	65	17 (6-7-10-10)
15							
	7	SS	24	24	Fine to Medium Clayey SAND, Orange-Brown, Wet, Loose, (SC)	60	7 (4-3-4-5)
20							
	8	SS	24	24	Fine to Medium Silty SAND, Orange-Brown, Wet, Medium Dense, (SM)	55	12 (4-6-6-6)
25					END OF BORING @ 25.00'		
30						50	

WATER LEVELS

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

WL DRY WS OR WD	BORING STARTED 03/20/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 03/20/06	CAVE IN DEPTH ● N/A
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-10	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION 78.5

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

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

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% (20%, 40%, 60%, 80%, 100%)

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

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 3"		4 (3-2-2-4)
	2	SS	24	24	Fine to Medium Silty SAND, Trace Clay and Organics Sampled as Root Material, Light Brown, Moist, Very Loose, (SM)	75	11 (3-5-6-9)
5	3	SS	24	24	Fine to Medium Clayey SAND, Light Brown, Moist, Medium Dense, (SC)		12 (4-5-7-9)
	4	SS	24	24			(8-14-19-15) 33
	5	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Light Brown, Moist, Dense to Medium Dense, (SC)	70	13 (5-5-8-9)
10							
	6	SS	24	24		65	18 (9-8-10-12)
15							
	7	SS	24	24	Fine to Medium Silty SAND, Trace Clay, Orange-Brown, Moist, Medium Dense, (SM)	60	12 (6-4-8-6)
20							
	8	SS	24	24	Sandy CLAY, Trace Fine Gravel, Light Brown, Wet, (CL)	55	12 (4-6-6-4)
25					END OF BORING @ 25.00'		
						50	
30							

WATER LEVELS

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

WL 23.0 WS OR WD	BORING STARTED 3/23/06	
WL(AB) 23.0 WL(AC) 23.0	BORING COMPLETED 3/23/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-11	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION: 83.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	CALIBRATED PENETROMETER TONS/FT.² (1 2 3 4 5+)	PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT %	ROCK QUALITY DESIGNATION & RECOVERY (RQD% 20% 40% 60% 80% 100%, REC.%)	STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50+)
0	1	SS	24	24	TOPSOIL DEPTH 3"					5 (2-2-3-4)
	2	SS	24	24	Sandy CLAY, Brown, Moist, Medium Stiff, (CL)	80				13 (5-6-7-7)
5	3	SS	24	24	Fine to Medium Clayey SAND, Light Brown to Orange-Brown, Moist, Medium Dense, (SC)					11 (5-5-6-6)
	4	SS	24	24						26 (9-13-13-11)
10	5	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Light Brown to Orange-Brown, Moist, Medium Dense, (SC)	75				16 (3-6-10-10)
15	6	SS	24	24		70				13 (2-7-6-5)
20	7	SS	24	24	Fine to Coarse Silty SAND, Orange-Brown, Moist to Wet, Loose, (SM)	65				9 (2-4-5-5)
25	8	SS	24	24	Sandy CLAY, Light Brown with Light Gray Mottling, Wet, Very Soft, (CL)	60				WOH (WOH/18"-6)
					END OF BORING @ 25.00'	55				
30										

WATER LEVELS

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

WL 21.0 WS OR WD	BORING STARTED 3/23/06	
WL(AB) 21.0 WL(AC) 21.0	BORING COMPLETED 3/23/06	CAVE IN DEPTH ● NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RML (04-04-06) RML (04-05-06) RML (04-17-06) RML (04-17-06) RML (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-12	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 83.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Fine to Medium Silty SAND, Trace Clay, Light Brown, Moist, Very Loose, (SM)			4 (2-2-2-3)
	2	SS	24	24	Fine to Medium Clayey SAND, Brown, Moist, Medium Dense, (SC)		80	14 (5-6-8-10)
5	3	SS	24	24				16 (5-8-8-11)
	4	SS	24	24	Sandy CLAY, Brown with Red-Brown Mottling, Moist, Very Stiff, (CL)			(14-18-16-17) 34
	5	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine to Coarse Gravel, Red-Brown with Light Gray Mottling to Red-Brown, Moist, Dense to Medium Dense, (SC)		75	15 (4-7-8-13)
10								
	6	SS	24	24	Fine to Coarse Clayey SAND, Orange, Brown, Moist, Loose, (SC)		70	10 (3-5-5-6)
15								
	7	SS	24	24	Fine to Medium Silty SAND, Orange-Brown, Moist to Wet, Loose to Medium Dense, (SM)		65	10 (4-4-6-5)
20								
	8	SS	24	24		▼	60	12 (5-5-7-8)
25					END OF BORING @ 25.00'			
							55	
30								

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

▽WL 23.0 WS OR WD	BORING STARTED 3/23/06	
▽WL(AB) 23.0 ▽WL(AC) 23.0	BORING COMPLETED 3/23/06	CAVE IN DEPTH ● NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-13	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — REC.% — (20%, 40%, 60%, 80%, 100%)

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

ENGLISH UNITS

SURFACE ELEVATION 84.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 3"		5 (2-2-3-3)
	2	SS	24	24	Fine to Medium Silty SAND, Light Brown, Moist, Loose, (SM)		20 (4-10-10-15)
5	3	SS	24	24	Sandy CLAY, Brown, Moist, Very Stiff to Hard, (CL)	80	(18-17-15-15) 32
	4	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Red-Brown with Orange-Brown Mottling to Light Brown with Orange-Brown Mottling, Moist, Dense, (SC)		(18-17-18-15) 35
	5	SS	24	24		75	(18-17-18-15) 35
10							
	6	SS	24	24	Fine to Medium Clayey SAND, Orange-Brown, Wet, Medium Dense, (SC)	70	13 (7-7-6-6)
15							
	7	SS	24	24	Fine to Medium Silty SAND, Orange-Brown to Red-Brown, Wet, Medium Dense, (SM)	65	12 (5-6-6-7)
20							
	8	SS	24	24		60	13 (8-8-5-8)
25					END OF BORING @ 25.00'		
						55	
30							

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

▽WL DRY WS OR WD	BORING STARTED 03/21/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 03/21/06	CAVE IN DEPTH @ N/A
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg – JCC Public Schools	8263	B–14	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT–ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION: 80.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Fine to Medium Clayey SAND, Light Brown to Brown with Red–Brown Mottling, Moist, Very Loose to Medium Dense, (SC)	80	4 (2–2–2–3)
	2	SS	24	24			15 (7–8–7–9)
5	3	SS	24	24		75	14 (4–5–9–12)
	4	SS	24	24	Sandy CLAY, Red–Brown, Moist, Hard, (CL)		(12–17–17–19) 34
	5	SS	24	24	Fine to Coarse Clayey SAND, Red–Brown to Brown, Moist, Medium Dense, (SC)		15 (4–6–9–12)
10						70	
	6	SS	24	24			16 (4–6–10–10)
15						65	
	7	SS	24	24	Fine to Medium Silty SAND, Light Brown, Moist, Loose, (SM)		10 (6–5–5–7)
20						60	
	8	SS	24	24	Sandy CLAY, Brown, Moist, Medium Stiff, (CL)		6 (4–3–3–4)
25					END OF BORING @ 25.00'	55	
30							

WATER LEVELS

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

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

WL DRY WS OR WD	BORING STARTED 3/22/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/22/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-15	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 78.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Fine to Medium Silty SAND, Trace Clay, Light Brown, Moist, Very Loose, (SM)			4 (1-2-2-3)
	2	SS	24	24	Fine to Medium Clayey SAND, Brown, Moist, Medium Dense, (SC)		75	18 (4-8-10-14)
5	3	SS	24	24	Sandy CLAY, Brown, Moist, Very Stiff, (CL)			16 (3-6-10-13)
	4	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine to Coarse Gravel, Red-Brown to Light Brown, Moist, Dense to Medium Dense, (SC)			(18-20-22-17) 42
	5	SS	24	24			70	15 (3-6-9-11)
10								
	6	SS	24	24			65	21 (3-9-12-12)
15								
	7	SS	24	24	Sandy CLAY, Orange-Brown to Brown, Moist, Medium Stiff to Soft, (CL)		60	8 (2-4-4-6)
20								
	8	SS	24	24			55	4 (2-2-2-2)
25					END OF BORING @ 25.00'		50	
30								

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

▽WL DRY WS OR WD	BORING STARTED 3/22/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 3/22/06	CAVE IN DEPTH @ NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-16	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION 75.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)
0	1	SS	24	24	TOPSOIL DEPTH 8"	
	2	SS	24	24	Fine to Medium Silty SAND, Trace Clay and Organics Sampled as Root Fragments, Light Brown, Moist, Very Loose, (SM)	
5	3	SS	24	24	Fine to Medium Silty SAND, Trace Clay, Light Brown, Moist, Very Loose, (SM)	70
	4	SS	24	24		
	5	SS	24	24	Sandy CLAY, Brown, Moist, Stiff to Very Stiff, (CL)	
10					Fine to Medium Clayey SAND, Orange-Brown, Moist, Medium Dense, (SC)	65
	6	SS	24	24	Fine to Medium Clayey SAND, Trace Fine Gravel, Orange-Brown, Moist, Medium Dense, (SC)	
15						60
20						55
25						50
30						

END OF BORING @ 15.00'

WATER LEVELS

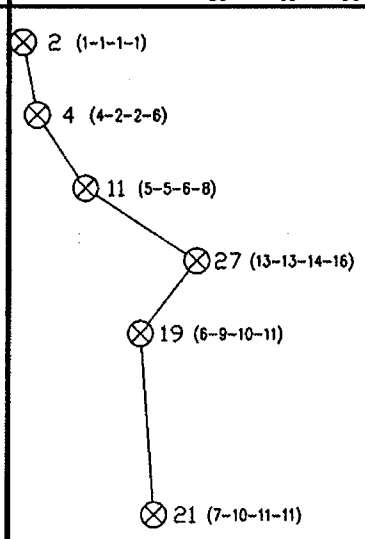
CALIBRATED PENETROMETER TONS/FT.^{2} 1 2 3 4 5+

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

ROCK QUALITY DESIGNATION & RECOVERY

RQD% — — — REC.% ——— 20% — 40% — 60% — 80% — 100%

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



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

WL DRY WS OR WD	BORING STARTED 3/28/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/28/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-17	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

DESCRIPTION OF MATERIAL

ENGLISH UNITS

SURFACE ELEVATION 77.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 2"			5 (2-2-3-4)
	2	SS	24	24	Sandy CLAY, Brown to Brown with Red-Brown Mottling, Moist, Medium Stiff to Hard, (CL)		75	21 (8-8-13-13)
5	3	SS	24	24	Sandy CLAY, Orange-Brown with Gray Mottling, Moist, Hard, (CH)			(14-18-23-24) 41
	4	SS	24	24			70	(24-18-23-17) 41
	5	SS	24	24	Fine to Medium Clayey SAND, Orange-Brown with Red-Brown Mottling, Moist, Loose, (SC)			6 (2-2-4-8)
10							65	
	6	SS	24	24	Fine to Coarse Silty SAND, Trace Fine Gravel, Orange-Brown, Moist, Loose, (SM)			9 (3-4-5-5)
15					END OF BORING @ 15.00'		60	
20							55	
25							50	
30								

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

▽WL DRY WS OR WD	BORING STARTED 3/28/06	
▽WL(AB) DRY ▼WL(AC) DRY	BORING COMPLETED 3/28/06	CAVE IN DEPTH @ NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-18	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% — 40% — 60% — 80% — 100%

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

ENGLISH UNITS

SURFACE ELEVATION 78.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					TOPSOIL DEPTH 2"		
	1	SS	24	24	Sandy CLAY, Brown to Red-Brown, Moist, Medium Stiff to Very Stiff, (CL)		7 (3-4-3-5)
	2	SS	24	24		75	27 (9-12-15-16)
5	3	SS	24	24			21 (3-8-13-13)
	4	SS	24	24	Fine to Medium Clayey SAND, Red-Brown to Orange-Brown, Moist, Medium Dense, (SC)		28 (13-14-14-16)
	5	SS	24	24		70	18 (6-8-10-10)
10							
	6	SS	24	24	Fine to Coarse Silty SAND, Trace Fine to Coarse Gravel, Orange-Brown, Moist, Medium Dense, (SM)	65	15 (7-7-8-6)
15					END OF BORING @ 15.00'		
						60	
20							
						55	
25							
						50	
30							

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

▽WL DRY WS OR WD	BORING STARTED 3/28/06	
▽WL(AB) DRY ▼WL(AC) DRY	BORING COMPLETED 3/28/06	CAVE IN DEPTH ● NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-19	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 85.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 1"		85	9 (6-6-3-4)
	2	SS	24	24	Fine to Medium Silty SAND, Trace Clay, Light Brown, Moist, Loose, (SM)			20 (7-8-12-12)
5	3	SS	24	24	Sandy CLAY, Orange-Brown with Red-Brown Mottling to Red-Brown, Moist, Stiff to Hard, (CL)		80	15 (4-7-8-11)
	4	SS	24	24				(17-17-18-19) 35
	5	SS	24	24				(21-19-21-24) 40
10					END OF BORING @ 10.00'		75	
15							70	
20							65	
25							60	
30								

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

▽WL DRY WS OR WD	BORING STARTED 3/28/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 3/28/06	CAVE IN DEPTH ● NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-20	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — REC.% (20%, 40%, 60%, 80%, 100%)

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

ENGLISH UNITS

SURFACE ELEVATION 82.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 3"		4 (2-2-2-3)
	2	SS	24	24	Sandy CLAY, Brown to Orange-Brown, Moist, Soft to Hard, (CL)	80	13 (4-6-7-7)
5	3	SS	24	24			(16-21-21-23) 42
	4	SS	24	24		75	17 (5-8-9-11)
	5	SS	24	24	Fine to Medium Clayey SAND, Light Red-Brown, Moist, Medium Dense, (SC)		13 (2-6-7-8)
10						70	
	6	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Orange-Brown, Moist, Loose, (SC)		7 (3-3-4-4)
15					END OF BORING @ 15.00'	65	
20						60	
25						55	
30							

WATER LEVELS

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

WL DRY WS OR WD	BORING STARTED 3/28/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/28/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-21	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 80.2

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"			4 (2-2-2-2)
	2	SS	24	24	Sandy CLAY, Brown to Orange-Brown with Gray and Red-Brown Mottling, Moist, Soft to Hard, (CL)			25 (6-10-15-16)
5	3	SS	24	24			75	17 (5-6-11-13)
	4	SS	24	24				(20-18-17-19) 35
	5	SS	24	24				(23-18-18-20) 36
10					END OF BORING @ 10.00'		70	
15							65	
20							60	
25							55	
30								

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

▽WL DRY WS OR WD	BORING STARTED 3/28/06	
▼WL(AB) DRY ▼WL(AC) DRY	BORING COMPLETED 3/28/06	CAVE IN DEPTH @ NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-22	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— (20%, 40%, 60%, 80%, 100%)

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

ENGLISH UNITS

SURFACE ELEVATION 84.7

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"		4 (2-2-2-3)
	2	SS	24	24	Fine to Medium Silty SAND, Light Brown, Moist, Very Loose, (SM)		21 (6-10-11-15)
5	3	SS	24	24	Sandy CLAY, Brown to Brown with Red-Brown Mottling, Moist, Very Stiff to Hard, (CL)	80	(13-16-15-15) 31
	4	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Dense, (SC)		(13-15-18-19) 33
	5	SS	24	24		75	(17-21-18-15) 39
10					END OF BORING @ 10.00'		
15						70	
20						65	
25						60	
30						55	

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

WL DRY WS OR WD	BORING STARTED 03/20/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 03/20/06	CAVE IN DEPTH ● N/A
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RWL (04-04-06) RWL (04-05-06) RWL (04-17-06) RWL (04-17-06) RWL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-23	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION 80.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)
0	1	SS	24	24	TOPSOIL DEPTH 4"	
	2	SS	24	24	Fine to Medium Silty SAND, Brown, Moist, Very Loose, (SM)	
5	3	SS	24	24	Sandy CLAY, Orange-Brown with Gray Mottling, Moist, Soft to Hard, (CL)	75
	4	SS	24	24		
	5	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Orange-Brown with Gray Mottling, Moist, Dense, (SC)	
10						70
					END OF BORING @ 10.00'	
15						65
20						60
25						55
30						

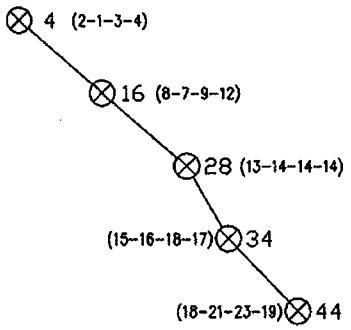
WATER LEVELS

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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



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

WL DRY WS OR WD	BORING STARTED 3/27/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/27/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-24	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

DESCRIPTION OF MATERIAL

ENGLISH UNITS

SURFACE ELEVATION 77.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					TOPSOIL DEPTH 2"		
	1	SS	24	24	Sandy CLAY, Light Brown to Gray with Light Brown Mottling, Moist, Medium Stiff to Hard, (CL)	75	5 (3-2-3-6)
	2	SS	24	24			22 (10-11-11-15)
5	3	SS	24	24			(20-21-23-19) 44
	4	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Gray with Light Brown Mottling, Moist, Dense, (SC)	70	(15-15-16-19) 31
	5	SS	24	24			(15-15-16-17) 31
10					END OF BORING @ 10.00'		
						65	
15							
						60	
20							
						55	
25							
						50	
30							

WATER LEVELS

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

WL DRY WS OR WD	BORING STARTED 3/27/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/27/06	CAVE IN DEPTH ● NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD MUD

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-25	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

DESCRIPTION OF MATERIAL

ENGLISH UNITS

SURFACE ELEVATION 74.8

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					TOPSOIL DEPTH 6"			
	1	SS	24	24	Sandy CLAY, Light Brown to Gray, Moist, Medium Stiff, Hard, (CL)			5 (2-2-3-4)
	2	SS	24	24				18 (7-9-9-7)
5	3	SS	24	24			70	13 (4-5-8-10)
	4	SS	24	24				(22-17-18-24) 35
	5	SS	24	24	Fine to Medium Clayey SAND, Gray with Light Brown Mottling, Dense, (SC)			(26-22-21-23) 43
10					END OF BORING @ 10.00'		65	
15							60	
20							55	
25							50	
30								

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

▽WL DRY WS OR WD	BORING STARTED 3/28/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 3/28/06	CAVE IN DEPTH ● NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-26	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— (20%, 40%, 60%, 80%, 100%)

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

ENGLISH UNITS

SURFACE ELEVATION 77.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"		2 (2-1-1-3)
	2	SS	24	24	Fine to Medium Silty SAND, Light Brown, Moist, Very Loose, (SM)	75	16 (4-5-11-12)
5	3	SS	24	24	Sandy CLAY, Light Brown, Moist, Very Stiff, (CL)		(15-17-18-19) 35
	4	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Gray with Light Brown Mottling, Dense, (SC)	70	(19-17-15-14) 32
	5	SS	24	24			(15-17-20-15) 37
10					END OF BORING @ 10.00'	65	
15						60	
20						55	
25						50	
30							

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

WL DRY WS OR WD	BORING STARTED 3/27/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/27/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-27	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 74.3

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
0					TOPSOIL DEPTH 2"	
	1	SS	24	24	Sandy CLAY, Light Brown to Gray with Light Brown Mottling, Moist, Medium Stiff to Hard, (CL)	7 (5-4-3-3)
	2	SS	24	24		18 (7-9-9-3)
5	3	SS	24	24		24 (13-12-12-12)
	4	SS	24	24		29 (15-16-13-18)
	5	SS	24	24		(16-20-15-16) 35
10					END OF BORING @ 10.00'	
15						
20						
25						
30						

WATER LEVELS — ELEVATION (FT): 70, 65, 60, 55, 50, 45

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

WL DRY WS OR WD	BORING STARTED 3/27/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/27/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-28	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% 40% 60% 80% 100%

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

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					SURFACE ELEVATION 82.3			
	1	SS	24	24	Fine to Medium Silty SAND, Trace Organics Sampled as Root Material, Orange-Brown, Moist, Loose, (SM)			7 (1-3-4-4)
	2	SS	24	24			80	23 (6-8-15-15)
5	3	SS	24	24	Sandy CLAY, Orange-Brown, Moist, Very Stiff, (CL)			(8-15-17-18) 32
	4	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Orange-Brown, Moist, Dense to Medium Dense, (SC)		75	(14-15-17-9) 32
	5	SS	24	24				24 (9-11-13-11)
10					END OF BORING @ 10.00'		70	
15							65	
20							60	
25							55	
30								

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

WL DRY WS OR WD	BORING STARTED 3/22/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/22/06	CAVE IN DEPTH ● NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-29	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

ENGLISH UNITS

SURFACE ELEVATION: 81.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL
0	1	SS	24	24	TOPSOIL DEPTH 6"
	2	SS	24	24	Fine to Medium Silty SAND, Light Brown, Moist, Very Loose, (SM)
5	3	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Medium Dense, (SC)
	4	SS	24	24	Sandy CLAY, Red-Brown, Moist, Very Stiff, (CL)
	5	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Dense, (SC)
10					END OF BORING @ 10.00'
15					
20					
25					
30					

WATER LEVELS

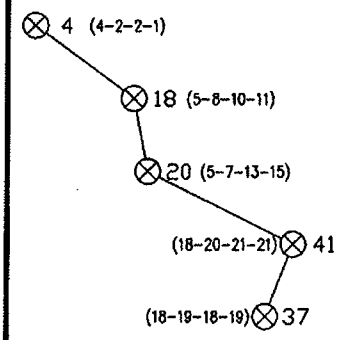
ELEVATION (FT): 80, 75, 70, 65, 60, 55

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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



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

WL DRY WS OR WD	BORING STARTED 3/29/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/29/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-30	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 73.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 6"		5 (2-2-3-5)
	2	SS	24	24	Sandy CLAY, Trace Organics Sampled as Root Material, Gray, Moist, Medium Stiff, (CH)	70	11 (3-5-6-6)
5	3	SS	24	24	Sandy CLAY, Gray, Moist, Stiff to Very Stiff, (CL)		18 (8-7-11-11)
	4	SS	24	24	Fine to Medium Clayey SAND, Gray, Moist, Medium Dense, (SC)		28 (12-14-14-9)
	5	SS	24	24	Sandy CLAY, Trace Fine Gravel, Gray, Moist, Very Stiff, (CL)	65	20 (10-11-9-10)
10					END OF BORING @ 10.00'		
						60	
15							
						55	
20							
						50	
25							
						45	
30							

WATER LEVELS

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

WL DRY WS OR WD	BORING STARTED 3/28/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/28/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-31	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% 40% 60% 80% 100%

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

DESCRIPTION OF MATERIAL

ENGLISH UNITS

SURFACE ELEVATION 81.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"		80	4 (2-2-2-3)
	2	SS	24	24	Sandy CLAY, Light Brown, Moist, Soft, (CL)			20 (6-9-11-12)
5	3	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Light Brown, Moist, Medium Dense, (SC)		75	12 (6-5-7-10)
	4	SS	24	24				22 (11-10-12-12)
	5	SS	24	24				24 (11-11-13-15)
10					END OF BORING @ 10.00'		70	
15							65	
20							60	
25							55	
30								

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

▽WL DRY WS OR WD	BORING STARTED 3/29/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 3/29/06	CAVE IN DEPTH @ NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-32	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— (20%, 40%, 60%, 80%, 100%)

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

ENGLISH UNITS

SURFACE ELEVATION 80.7

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 4"	80	7 (5-4-3-4)
	2	SS	24	24	Fine to Medium Silty SAND, Light Brown to Brown, Moist, Loose to Medium Dense, (SM)		14 (5-8-6-8)
5	3	SS	24	24		75	20 (8-10-10-14)
	4	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Brown to Gray, Moist, Medium Dense to Dense, (SC)		28 (10-12-16-16)
	5	SS	24	24			(18-20-21-24) 41
10					END OF BORING @ 10.00'	70	
15						65	
20						60	
25						55	
30							

WATER LEVELS

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

WL DRY WS OR PD	BORING STARTED 3/29/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/29/06	CAVE IN DEPTH ● NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-33	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 79.2

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Fine to Medium Silty SAND, Trace Clay and Organics Sampled as Root Material, Light Brown, Moist, Very Loose, (SM)			4 (2-1-3-2)
	2	SS	24	24				10 (2-3-7-9)
5	3	SS	24	24	Sandy CLAY, Red-Brown, Moist, Stiff to Hard, (CL)		75	(7-16-19-17) 35
	4	SS	24	24				(16-17-20-17) 37
10	5	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Red-Brown, Moist, Dense, (SC)		70	(15-16-22-21) 38
					END OF BORING @ 10.00'			
15							65	
20							60	
25							55	
30							50	

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

▽WL DRY WS OR FD	BORING STARTED 3/29/06	
▽WL(AB) DRY ▽WL(AC) DRY	BORING COMPLETED 3/29/06	CAVE IN DEPTH ● NA
▽WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-34	1 OF 1

PROJECT NAME: JCC Eighth Elementary Schools

ARCHITECT-ENGINEER:

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 79.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 6"		9 (3-4-5-5)
	2	SS	24	24	Fine to Medium Silty SAND, Trace Clay, Light Brown, Moist, Loose, (SM)		20 (9-10-10-11)
5	3	SS	24	24	Fine to Medium Clayey SAND, Trace Fine Gravel, Light Brown, Moist, Medium Dense, (SC)	75	27 (13-13-14-12)
	4	SS	24	24	Sandy CLAY, Trace Fine Gravel, Gray, Moist, Hard, (CL)		(14-16-15-15) 31
	5	SS	24	24	Fine to Coarse Clayey SAND, Trace Fine Gravel, Light Brown, Moist, Dense, (SC)	70	(24-24-19-20) 43
10					END OF BORING @ 10.00'		
15						65	
20						60	
25						55	
30						50	

WATER LEVELS

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

WL DRY WS OR WD	BORING STARTED 3/29/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/29/06	CAVE IN DEPTH ● NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RNL (04-04-06) RNL (04-05-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06) RNL (04-17-06)

CLIENT	JOB #	BORING #	SHEET
Williamsburg - JCC Public Schools	8263	B-35	1 OF 1
PROJECT NAME: JCC Eighth Elementary Schools	ARCHITECT-ENGINEER		

ECS LLC MID-ATLANTIC

SITE LOCATION: James City County, Virginia

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

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% — 20% 40% 60% 80% 100%

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

ENGLISH UNITS

SURFACE ELEVATION 79.5

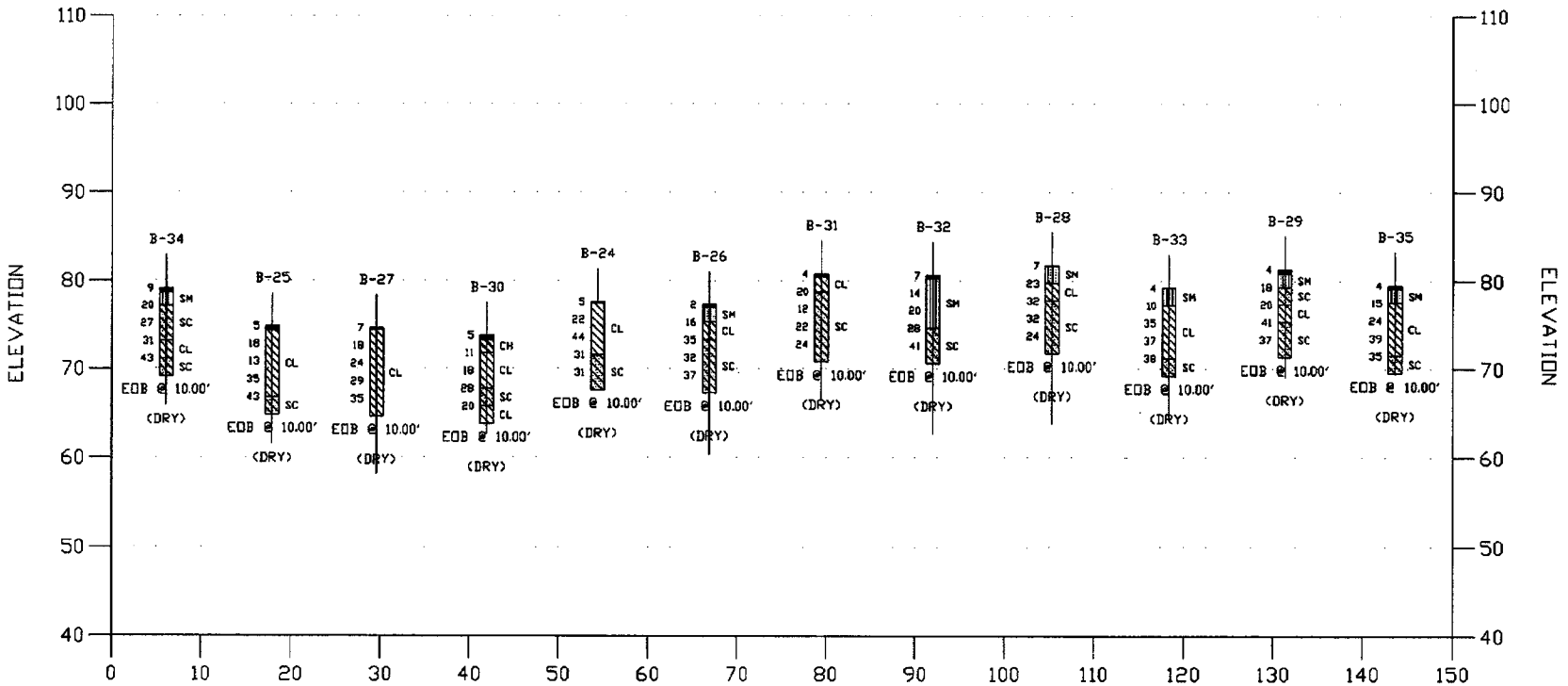
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	TOPSOIL DEPTH 5"		4 (1-2-2-2)
	2	SS	24	24	Fine to Medium Silty SAND, Trace Organics Sampled as Root Material, Brown, Moist, Very Loose, (SM)		15 (4-6-9-12)
5	3	SS	24	24	Sandy CLAY, Red-Brown, Moist, Stiff to Hard, (CL)	75	24 (8-11-13-18)
	4	SS	24	24			(17-19-20-22) 39
	5	SS	24	24	Fine to Medium Clayey SAND, Red-Brown, Moist, Dense, (SC)	70	(22-18-17-17) 35
10					END OF BORING @ 10.00'		
15						65	
20						60	
25						55	
30						50	

WATER LEVELS

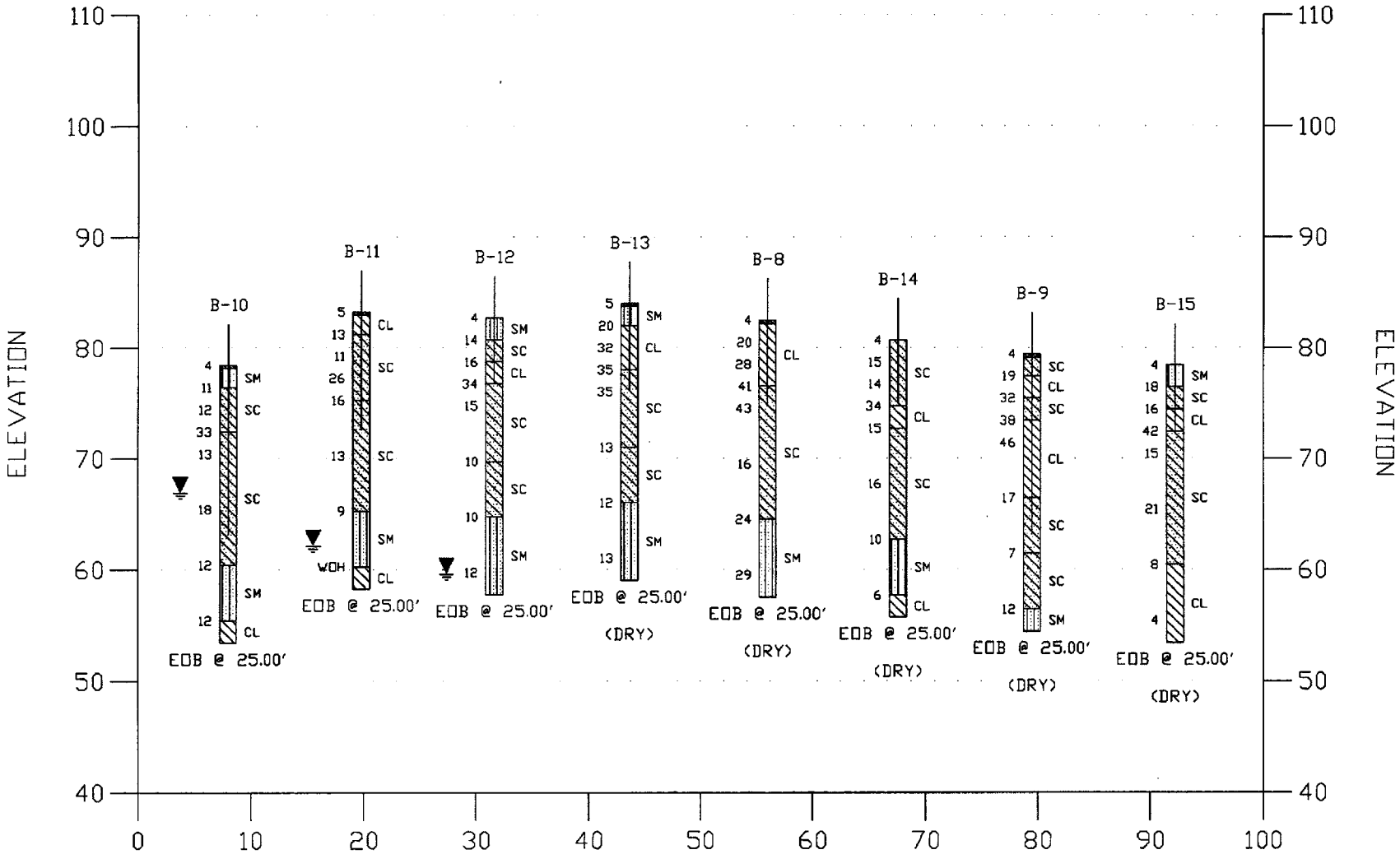
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL DRY WS OR WD	BORING STARTED 3/29/06	
WL(AB) DRY WL(AC) DRY	BORING COMPLETED 3/29/06	CAVE IN DEPTH @ NA
WL	RIG ATV FOREMAN FDI	DRILLING METHOD AUGER

RWL (04-04-06) RWL (04-05-06) RWL (04-17-06) RWL (04-17-06) RWL (04-17-06)



SCALE						
VERTICAL SCALE 1"=10' HORIZONTAL SCALE 1"=10'	ECS LLC MID-ATLANTIC	ECS Mid-Atlantic 108 Ingram Road, Unit 1 Williamsburg, Virginia 23188	Front Quadrant Subsurface Profile Proposed Williamsburg – JCC Eighth Elementary School Williamsburg, Virginia	D.J.G.	1"=10'	3/17/06	FIGURE: Fig. 1
				DRAWN:	PROJECT NO. 07-8263		



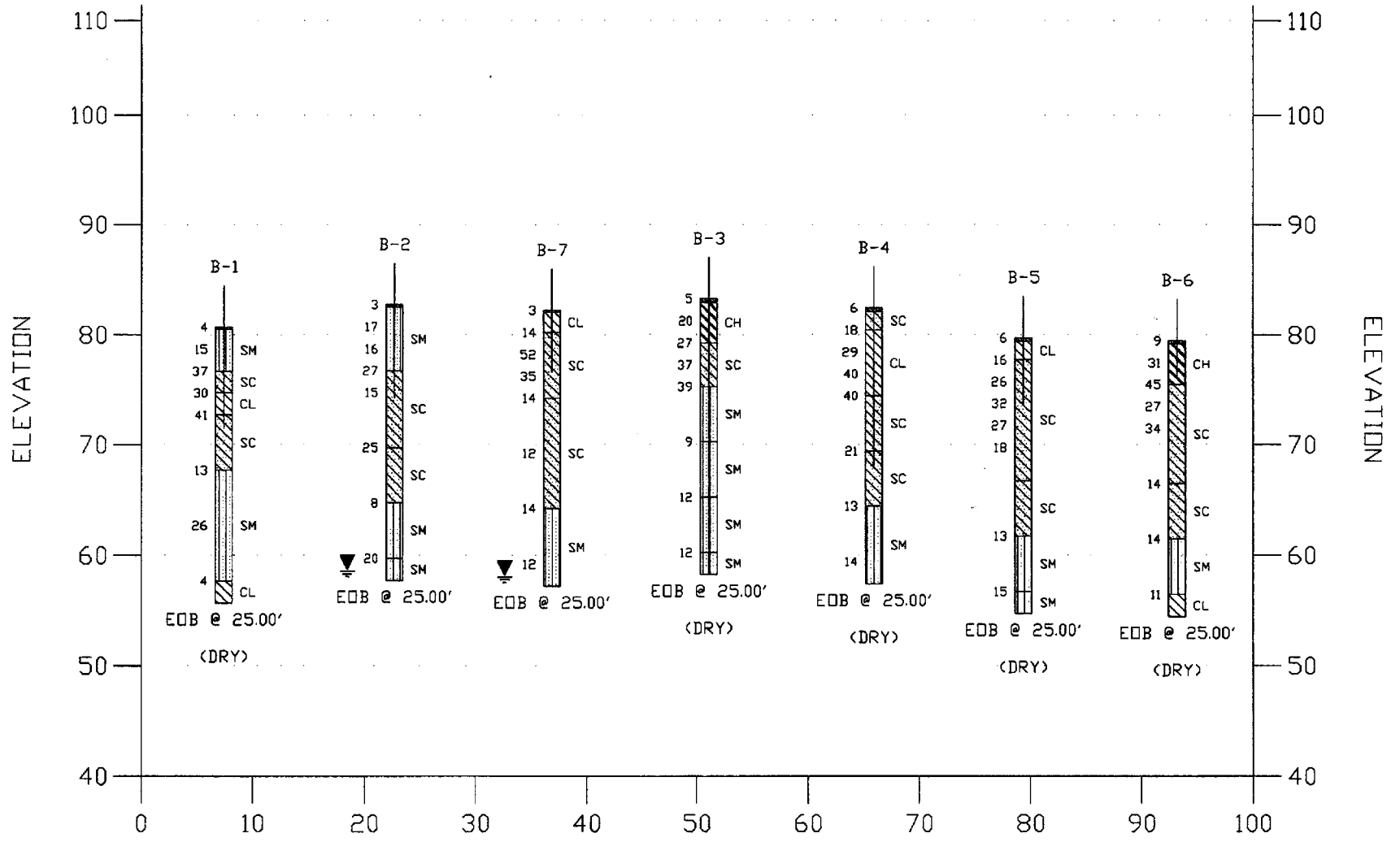
SCALE
VERTICAL SCALE 1"=10'
HORIZONTAL SCALE 1"=10'

ECS LLC MID-ATLANTIC

ECS Mid-Atlantic
108 Ingram Road, Unit 1
Williamsburg, Virginia 23188
Ph (757) 229-6677 Fax (757) 229-9978

Building
Subsurface Profile
Proposed Williamsburg - JCC
Eighth Elementary School
Williamsburg, Virginia

CHECKED:	SCALE:	DATE:	FIGURE:
D.J.G.	1"=10'	3/17/06	Fig. 2
DRAWN: R. Lyles 07-8263-1.dwg	PROJECT NO. 07-8263		



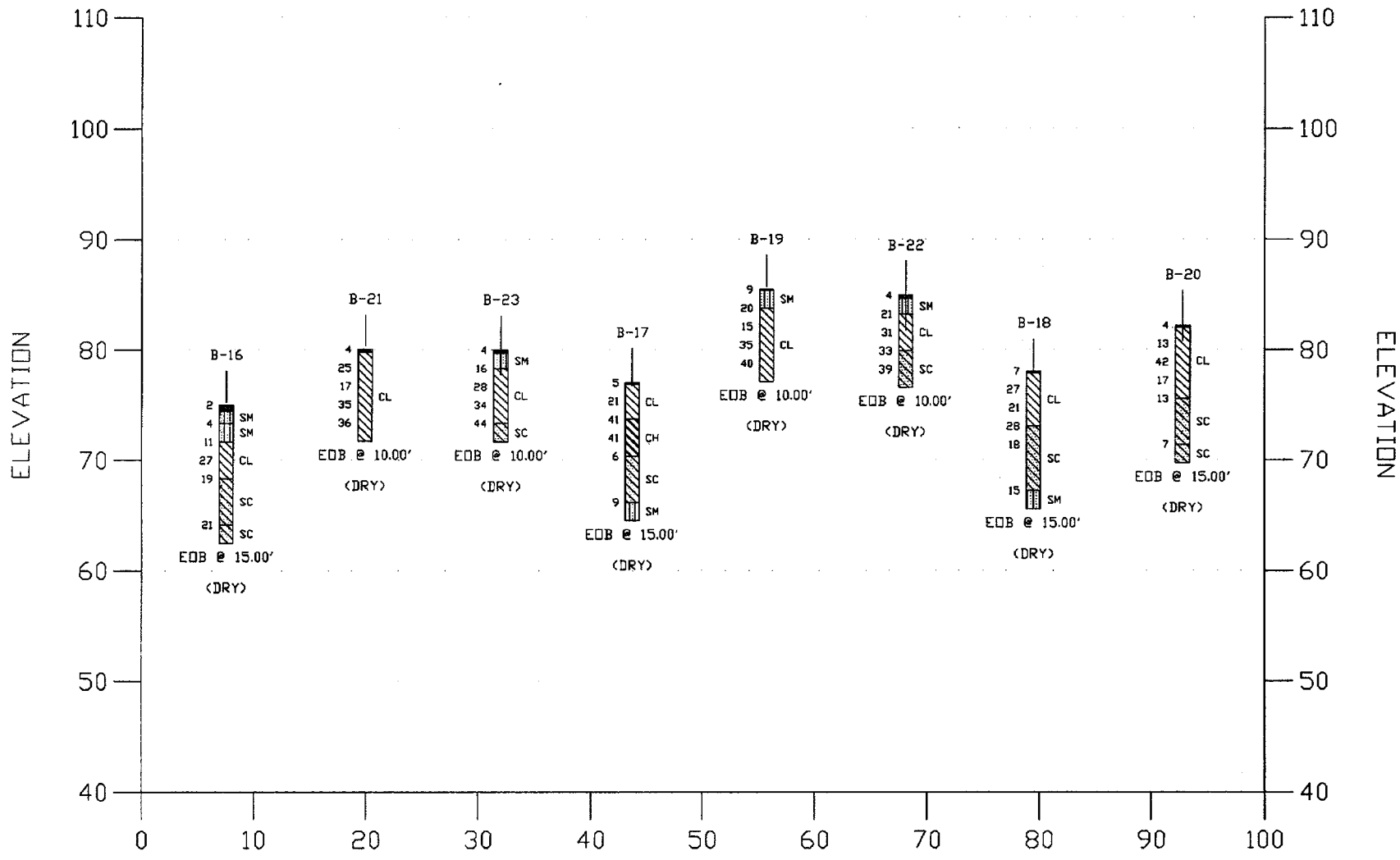
SCALE
VERTICAL SCALE 1"=10'
HORIZONTAL SCALE 1"=10'

ECS LLC MID-ATLANTIC

ECS Mid-Atlantic
108 Ingram Road, Unit 1
Williamsburg, Virginia 23188
Ph (757) 229-6677 Fax (757) 229-9978

Building
Subsurface Profile
Proposed Williamsburg - JCC
Eighth Elementary School
Williamsburg, Virginia

CHECKED:	SCALE:	DATE:	FIGURE:
D.J.G.	1"=10'	3/17/06	Fig. 3
DRAWN: R. Lyles 07-8263-1.dwg	PROJECT NO. 07-8263		



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

ECS LLC MID-ATLANTIC

ECS Mid-Atlantic
108 Ingram Road, Unit 1
Williamsburg, Virginia 23188

Rear Quadrant
Subsurface Profile
Proposed Williamsburg - JCC
Eighth Elementary School
Williamsburg, Virginia

D.J.G.	1"=10'	3/17/06	FIGURE: Fig. 4
DRAWN:	PROJECT NO. 07-8263		

Appendix III

Laboratory Testing Summary and Moisture Density Relationship Curves

Engineering Consulting Services Mid Atlantic LLC

Williamsburg, VA

Laboratory Testing Summary

Date: 04/06/2006

Project Number: 8263 **Project Name:** JCC 8th Elementary School

Project Engineer: DJG **Principal Engineer:** MJG **Summary By:** SIW

Boring Number	Sample Number	Depth (Feet)	Moisture Content (%)	USC	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Compaction Maximum Density (pcf)	Compaction Optimum Moisture (%)	CBR Value	Other
B-3	S-2	2-4	22.5	CH	60	21	39	59.7	*	*	*	
B-6	S-2	2-4	25.2	CH	58	28	30	60.9	*	*	*	
B-8	S-2	2-4	17.0	CL	49	24	25	54.3	*	*	*	
B-10	S-2	2-4	12.8	SC	30	19	11	43.7	*	*	*	
B-16	S-3	4-6	17.4	CL	41	17	24	52.4	*	*	*	
B-17	S-3	4-6	22.9	CH	66	24	42	71.8	*	*	*	
B-18	S-3	4-6	24.0	CL	47	23	24	53.3	*	*	*	
B-22	BULK	1-3	13.7	SM	NP	NP	NP	32.5	115.9	14.0	11.0	
B-23	BULK	1-3	13.0	SM	NP	NP	NP	32.4	119.5	11.0	8.7	
B-26	BULK	1-3	14.1	SM	NP	NP	NP	31.9	116.1	14.2	8.2	
B-28	BULK	1-3	16.0	SM	NP	NP	NP	24.9	121.2	11.0	27.9	
B-30	BULK	1-3	18.1	CH	52	22	30	60.8	115.8	14.5	1.8	
B-32	BULK	1-3	9.7	SM	NP	NP	NP	30.6	118.8	12.8	9.1	
B-34	BULK	1-3	11.3	SC	NP	NP	NP	36.2	117.9	12.0	5.0	
B-35	BULK	1-3	9.0	SC	NP	NP	NP	35.3	115.3	14.2	4.6	

Summary Key:

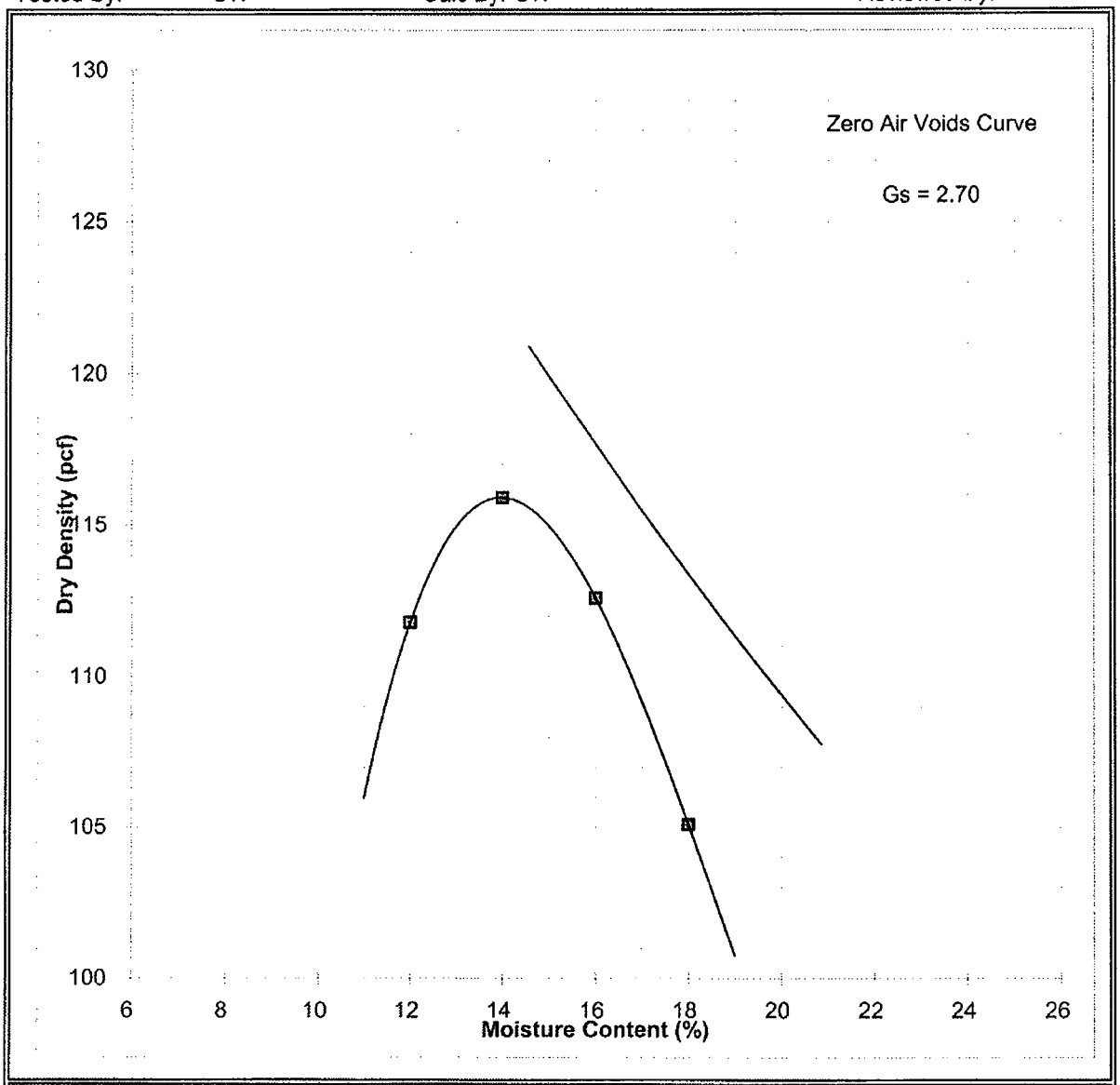
V = Virginia Test Method
S = Standard Proctor
M= Modified Proctor

Hyd = Hydrometer
Con = Consolidation
DS = Direct Shear
GS = Specific Gravity

UCS = Unconfined Compression Soil
UCR = Unconfined Compression Rock
LS = Lime Stabilization
CS = Cement Stabilization

OC = Organic Content
SA = See Attached
NP = Non Plastic
* = Test Not Conducted

Tested By: SW Calc By: SW Reviewed By: DJC

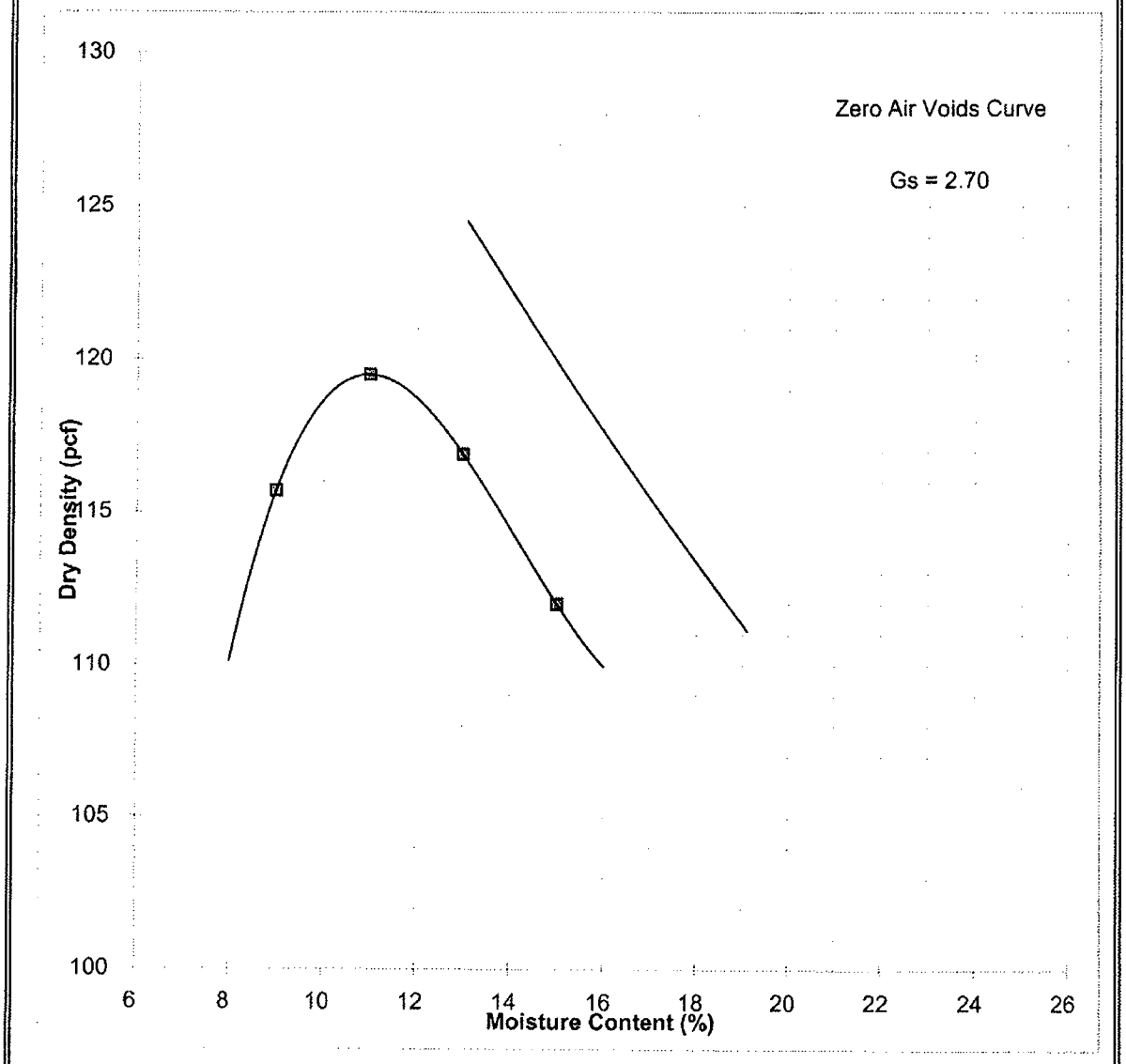


Sample No.	B-22	Natural Moisture Content	13.7
Street		Percent Passing No. 200 Sieve	32.5
Station		Percent Retained on No. 4 Sieve	0.0
Liquid Limit (LL)	NP	Percent Retained on 3/4" Sieve	0.0
Plastic Limit (PL)	NP	Maximum Dry Density (pcf)	115.9
Plasticity Index (PI	NP	Optimum Moisture Content (%)	14.0
Liquidity Index (LI)		Corr. Maximum Dry Density (pcf)	115.9
Description	Silty SAND w/ Clay Pockets Brown	Corr. Optimum Moisture Content (%	14.0
Classification	SM	Percent (%) Gravel as Tested	0.0
Specific Gravity	2.70	Percent (%) Gravel Total	0.0
Test Standard	VTM-8	Test Method	A

Project: JCC 8th Elementary School	**ECS Mid-Atlantic, LLC**
Project No.: 8263	**Williamsburg,Virginia**
Date: 03/24/06	**Moisture Density Relationship Curve**

PROCTOR B-22

Tested By: SW Calc By: SW Reviewed By: DJL

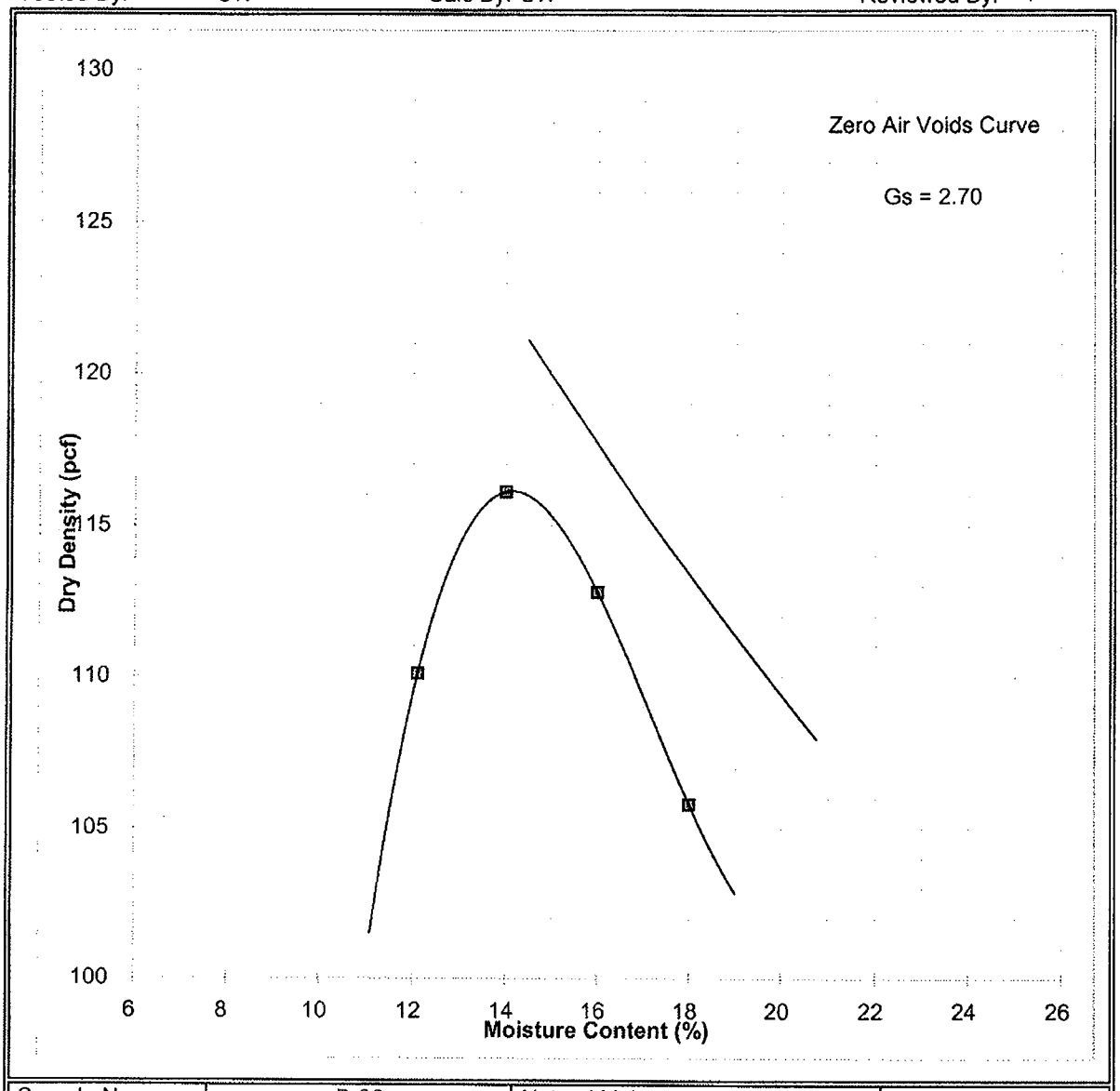


Sample No.	B-23	Natural Moisture Content	13.0
Street		Percent Passing No. 200 Sieve	32.4
Station		Percent Retained on No. 4 Sieve	0.0
Liquid Limit (LL)	NP	Percent Retained on 3/4" Sieve	0.0
Plastic Limit (PL)	NP	Maximum Dry Density (pcf)	119.5
Plasticity Index (PI	NP	Optimum Moisture Content (%)	11.0
Liquidity Index (LI)		Corr. Maximum Dry Density (pcf)	119.5
Description	Silty SAND w/ Clay Pockets Brown	Corr. Optimum Moisture Content (%	11.0
Classification	SM	Percent (%) Gravel as Tested	0.0
Specific Gravity	2.70	Percent (%) Gravel Total	0.0
Test Standard	VTM-8	Test Method	A

Project: JCC 8th Elementary School	**ECS Mid-Atlantic, LLC**
Project No.: 8263	**Williamsburg,Virginia**
Date: 04/06/06	**Moisture Density Relationship Curve**

PROCTOR B-23

Tested By: SW Calc By: SW Reviewed By: DJL

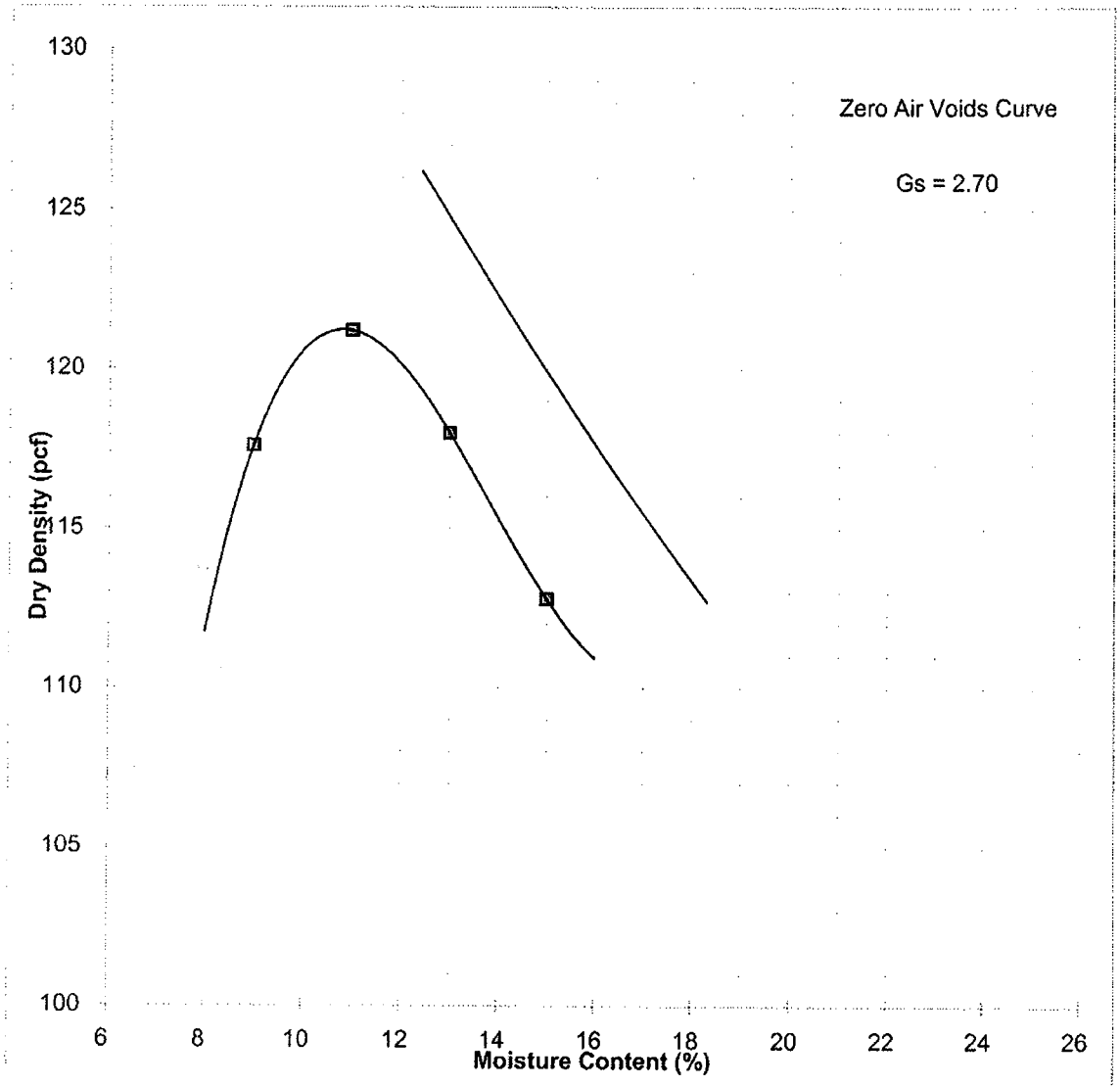


Sample No.	B-26	Natural Moisture Content	14.1
Street		Percent Passing No. 200 Sieve	31.9
Station		Percent Retained on No. 4 Sieve	0.0
Liquid Limit (LL)	NP	Percent Retained on 3/4" Sieve	0.0
Plastic Limit (PL)	NP	Maximum Dry Density (pcf)	116.1
Plasticity Index (PI	NP	Optimum Moisture Content (%)	14.2
Liquidity Index (LI)		Corr. Maximum Dry Density (pcf)	116.1
Description	Silty SAND w/ Clay Pockets Brown	Corr. Optimum Moisture Content (%	14.2
Classification	SM	Percent (%) Gravel as Tested	0.0
Specific Gravity	2.70	Percent (%) Gravel Total	0.0
Test Standard	VTM-8	Test Method	A

Project: JCC 8th Elem.	**ECS Mid-Atlantic, LLC**
Project No.: 8263	**Williamsburg,Virginia**
Date: 03/29/06	**Moisture Density Relationship Curve**

PROCTOR B-26

Tested By: SW Calc By: SW Reviewed By: DJL



Sample No.	B-28	Natural Moisture Content	16.0
Street		Percent Passing No. 200 Sieve	24.9
Station		Percent Retained on No. 4 Sieve	0.0
Liquid Limit (LL)	NP	Percent Retained on 3/4" Sieve	0.0
Plastic Limit (PL)	NP	Maximum Dry Density (pcf)	121.2
Plasticity Index (PI	NP	Optimum Moisture Content (%)	11.0
Liquidity Index (LI)		Corr. Maximum Dry Density (pcf)	121.2
Description	Silty SAND Brown	Corr. Optimum Moisture Content (%	11.0
Classification	SM	Percent (%) Gravel as Tested	0.0
Specific Gravity	2.70	Percent (%) Gravel Total	0.0
Test Standard	VTM-8	Test Method	A

Project: JCC 8th Elementary School

Project No.: 8263

Date: 03/29/06

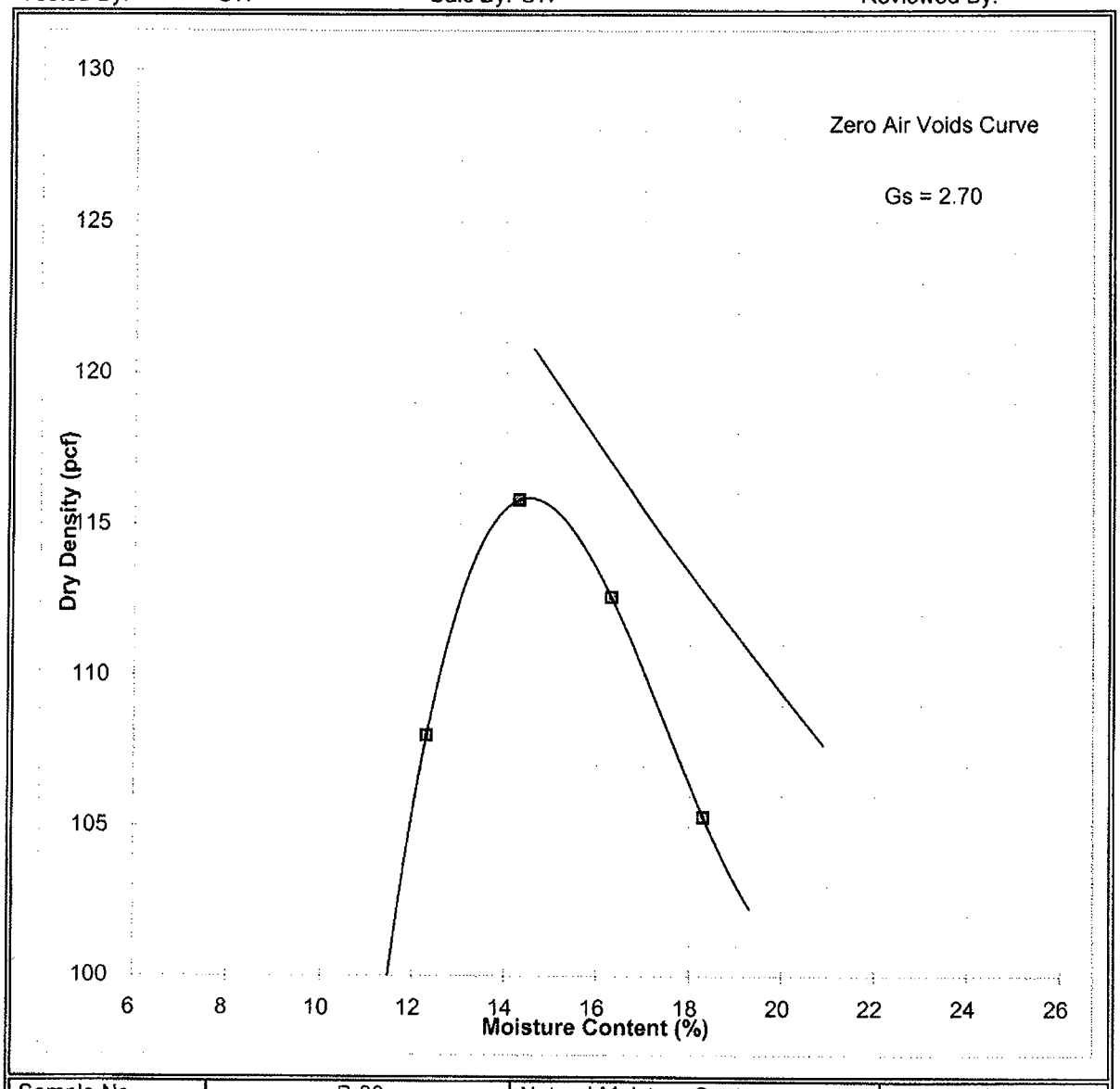
ECS Mid-Atlantic, LLC

Williamsburg,Virginia

Moisture Density Relationship Curve

PROCTOR B-28

Tested By: SW Calc By: SW Reviewed By: DJL



Sample No.	B-30	Natural Moisture Content	18.1
Street		Percent Passing No. 200 Sieve	60.8
Station		Percent Retained on No. 4 Sieve	0.0
Liquid Limit (LL)	52	Percent Retained on 3/4" Sieve	0.0
Plastic Limit (PL)	22	Maximum Dry Density (pcf)	115.8
Plasticity Index (PI	30	Optimum Moisture Content (%)	14.5
Liquidity Index (LI)		Corr. Maximum Dry Density (pcf)	115.8
Description	Sandy FAT CLAY Brown	Corr. Optimum Moisture Content (%	14.5
Classification	CH	Percent (%) Gravel as Tested	0.0
Specific Gravity	2.70	Percent (%) Gravel Total	0.0
Test Standard	VTM-8	Test Method	A

Project: JCC 8th Elem.

Project No.: 8263

Date: 03/28/06

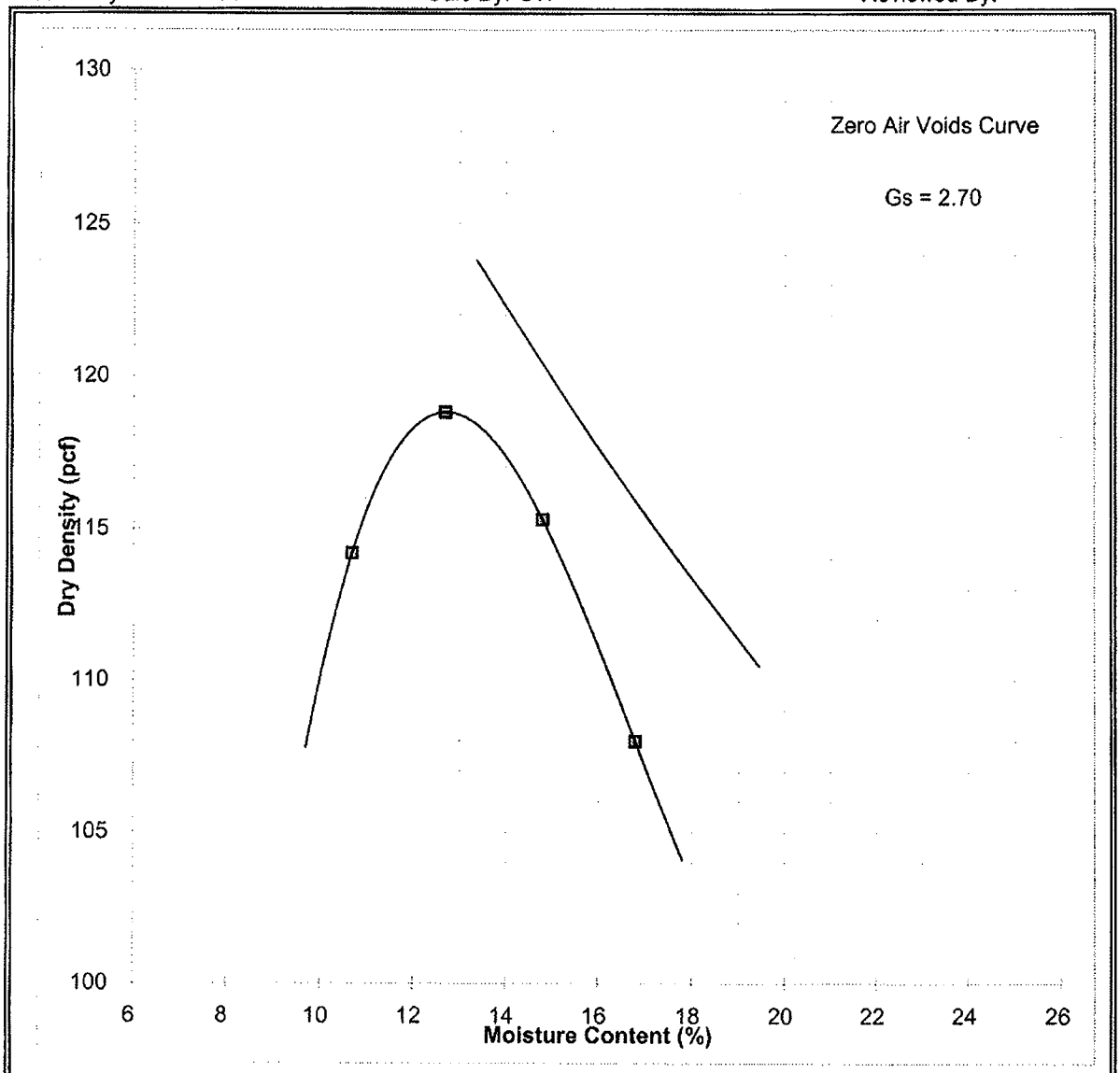
ECS Mid-Atlantic, LLC

Williamsburg,Virginia

Moisture Density Relationship Curve

PROCTOR B-30

Tested By: SW Calc By: SW Reviewed By: DJL

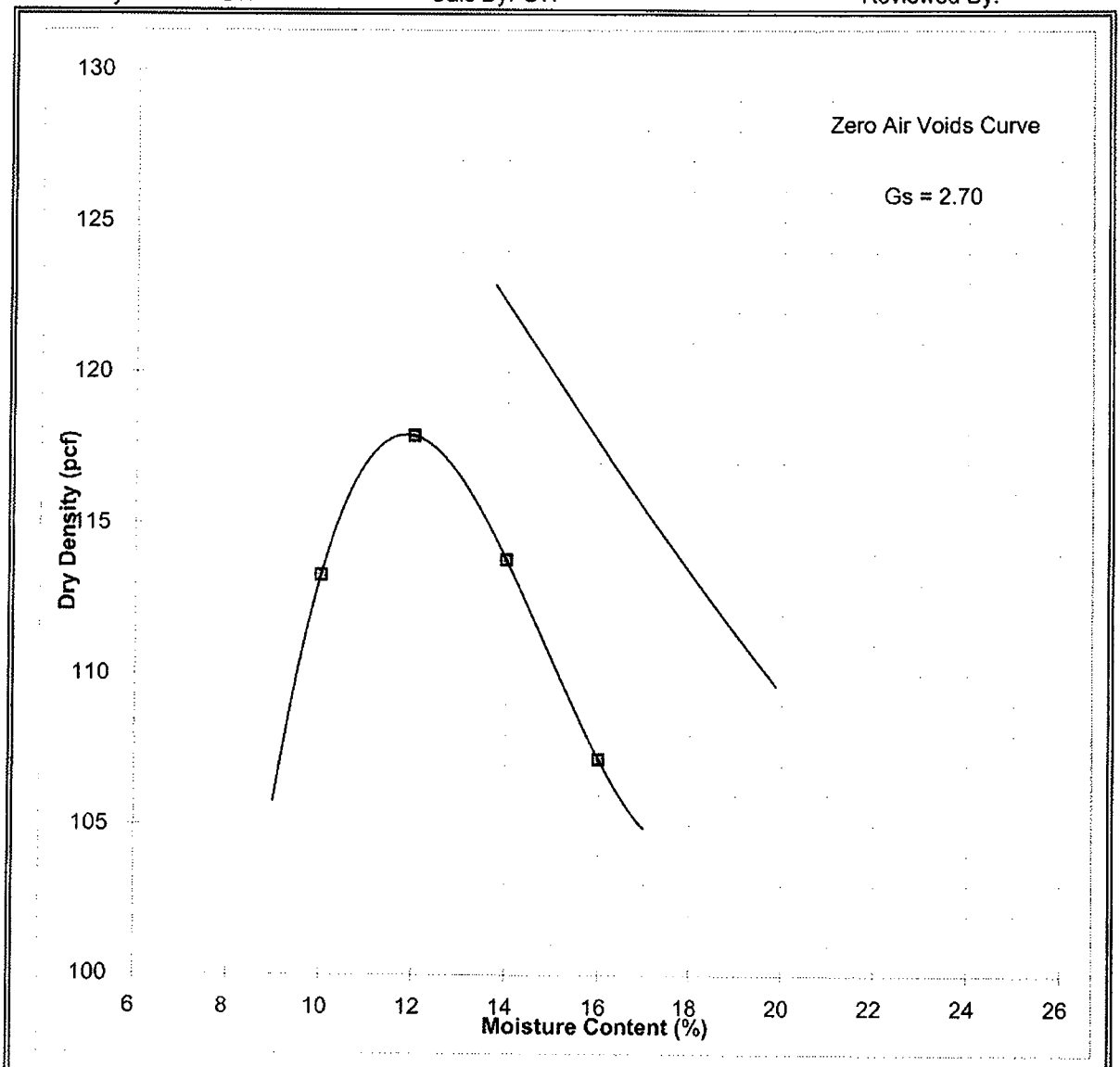


Sample No.	B-32	Natural Moisture Content	9.7
Street		Percent Passing No. 200 Sieve	30.6
Station		Percent Retained on No. 4 Sieve	0.0
Liquid Limit (LL)	NP	Percent Retained on 3/4" Sieve	0.0
Plastic Limit (PL)	NP	Maximum Dry Density (pcf)	118.8
Plasticity Index (PI	NP	Optimum Moisture Content (%)	12.8
Liquidity Index (LI)		Corr. Maximum Dry Density (pcf)	118.8
Description	Silty SAND w/ Clay Pockets Brown	Corr. Optimum Moisture Content (%	12.8
Classification	SM	Percent (%) Gravel as Tested	0.0
Specific Gravity	2.70	Percent (%) Gravel Total	0.0
Test Standard	VTM-8	Test Method	A

Project: JCC 8th Elem.	**ECS Mid-Atlantic, LLC**
Project No.: 8263	**Williamsburg,Virginia**
Date: 03/29/06	**Moisture Density Relationship Curve**

PROCTOR B-32

Tested By: SW Calc By: SW Reviewed By: DJL

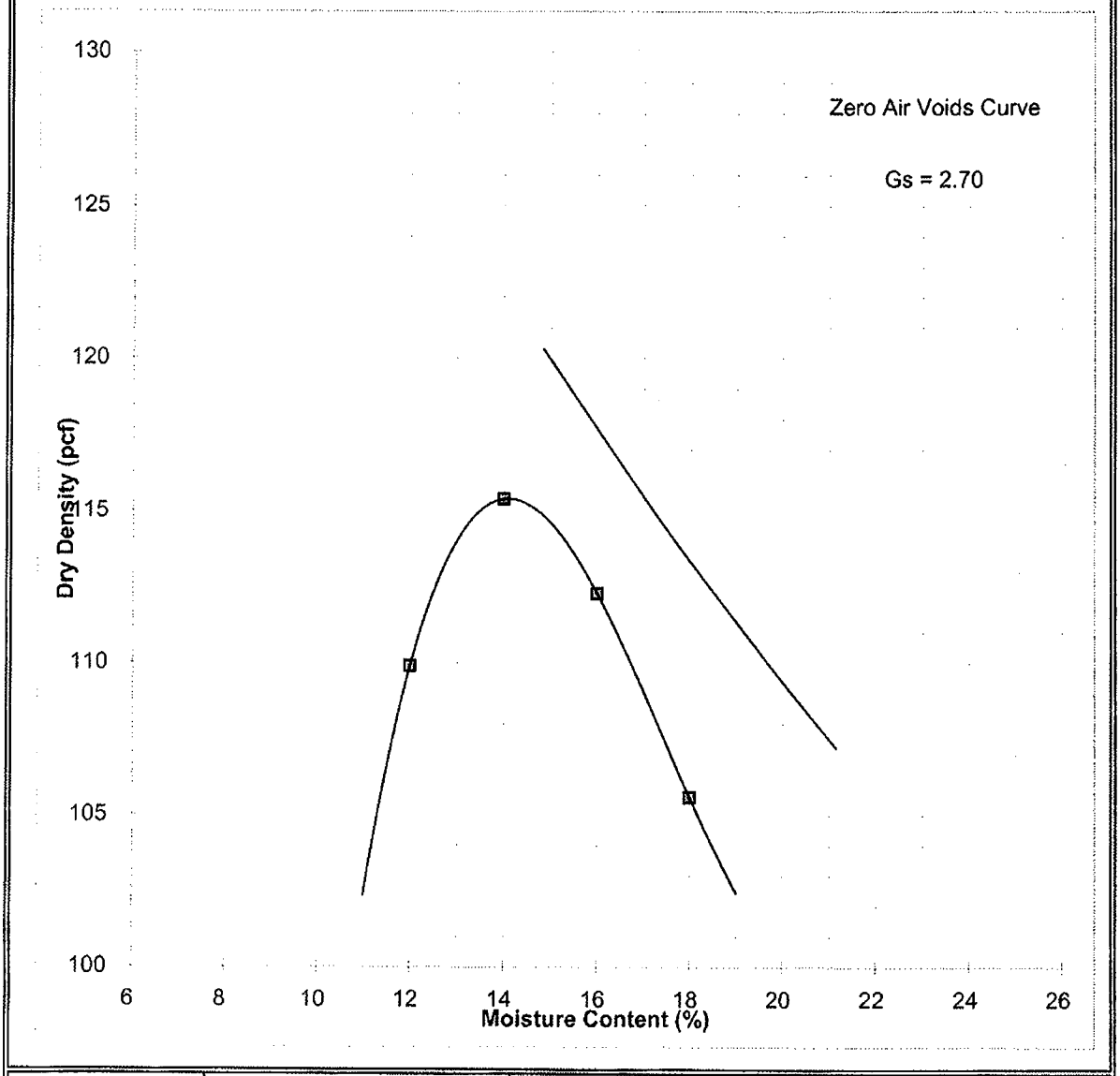


Sample No.	B-34	Natural Moisture Content	11.3
Street		Percent Passing No. 200 Sieve	36.2
Station		Percent Retained on No. 4 Sieve	0.0
Liquid Limit (LL)	NP	Percent Retained on 3/4" Sieve	0.0
Plastic Limit (PL)	NP	Maximum Dry Density (pcf)	117.9
Plasticity Index (PI	NP	Optimum Moisture Content (%)	12.0
Liquidity Index (LI)		Corr. Maximum Dry Density (pcf)	117.9
Description	Clayey Silty SAND Brown	Corr. Optimum Moisture Content (%	12.0
Classification	SC	Percent (%) Gravel as Tested	0.0
Specific Gravity	2.70	Percent (%) Gravel Total	0.0
Test Standard	VTM-8	Test Method	A

Project: JCC 8th Elementary	**ECS Mid-Atlantic, LLC**
Project No.: 8263	**Williamsburg,Virginia**
Date: 03/29/06	**Moisture Density Relationship Curve**

PROCTOR B-34

Tested By: SW Calc By: SW Reviewed By: DJh



Sample No.	B-35	Natural Moisture Content	9.0
Street		Percent Passing No. 200 Sieve	35.3
Station		Percent Retained on No. 4 Sieve	0.0
Liquid Limit (LL)	NP	Percent Retained on 3/4" Sieve	0.0
Plastic Limit (PL)	NP	Maximum Dry Density (pcf)	115.3
Plasticity Index (PI	NP	Optimum Moisture Content (%)	14.2
Liquidity Index (LI)		Corr. Maximum Dry Density (pcf)	115.3
Description	Clayey SILTY SAND Brown	Corr. Optimum Moisture Content (%	14.2
Classification	SC	Percent (%) Gravel as Tested	0.0
Specific Gravity	2.70	Percent (%) Gravel Total	0.0
Test Standard	VTM-8	Test Method	A

Project: JCC 8th Elem.	**ECS Mid-Atlantic, LLC**
Project No.: 8263	**Williamsburg,Virginia**
Date: 03/29/06	**Moisture Density Relationship Curve**

PROCTOR B-35

Appendix IV

Unified Soil Classification System
and
Reference Notes for Boring Logs

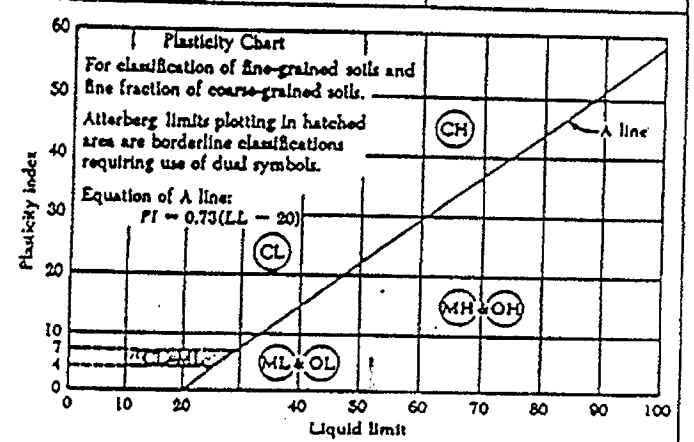
UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

Table Unified System of Classification

Major divisions			Group symbols	Typical names
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes No. 200 sieve	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Table (Continued)

Classification criteria		
Classification on basis of percentage of fines: Less than 5% pass No. 200 sieve — GW, GP, SW, SP; More than 12% pass No. 200 sieve — GM, GC, SM, SC; 5% to 12% pass No. 200 sieve — Borderline classification requiring use of dual symbols	$C_u = D_{60}/D_{10}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
	Not meeting both criteria for GW	
	Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
	Atterberg limits plot above "A" line and plasticity index greater than 7	
	$C_u = D_{60}/D_{10}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
	Not meeting both criteria for SW	
	Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
	Atterberg limits plot above "A" line and plasticity index greater than 7	



Visual-manual identification, see ASTM Designation D2488.

Reprinted from the Annual Book of ASTM Standards

REFERENCE NOTES FOR BORING LOGS

I. Drilling and Sampling Symbols:

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

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

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

II. Correlation of Penetration Resistances to Soil Properties:

Relative Density-Sands, Silts

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

Consistency of Cohesive Soils

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

III. Unified Soil Classification Symbols:

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

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

IV. Water Level Measurement Symbols:

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

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

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

APR 2006
RECEIVED
PLANNING DEPARTMENT

WJCC ELEMENTARY SCHOOL #8

COUNTY SUBMITTAL
CALCULATIONS PACKAGE

WILLIAMSBURG-JAMES CITY COUNTY

SAVE
ME
_W_C

April 28, 2006

WJCC ELEMENTARY SCHOOL #8
DESIGN CALCULATION PACKAGE

TABLE OF CONTENTS

SECTION	TITLE
1	EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT DESIGN PLAN CHECKLISTS
2	TEMPORARY SEDIMENT BASIN CALCULATIONS
3	BMP CALCULATIONS
4	BMP PRE-DEVELOPMENT POND ROUTING
5	BMP POST-DEVELOPMENT POND ROUTING
6	STORM SEWER, HYDRAULIC GRADE LINE, CURB INLET AND DITCH CALCULATIONS
7	BRICK BAT ROAD STORM SEWER, HYDRAULIC GRADE LINE AND ROADSIDE DITCH CALCUALTIONS

TIMMONS
711 N. Courthouse Road
Richmond, Virginia 23236-4099
Telephone: (804) 794-3500
Fax: (804) 794-7639

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET
(with or without an emengency spillway)

Revised:4/27/2006

PROJECT: WJCC #8 Elementary School

BASIN #: 1 LOCATION: rear of site

Total area draining to basin: 38.50 acres.

Basin Volume Design

Wet Storage:

1) Minimum required volume = 67 cu. yds. x Total Drainage Area (acres)
   67 cu. yds x 38.50 acres = 2,580 cu. yds.

2) Available basin volume = 5,161 cu. yds. at elevation 63.70

3) Excavate - cu. yds. to obtain required volume*.
   * Elevation corresponding to required volume = invert of the dewatering orifice.

4) Available volume before cleanout required.
   33 cu. yds. x 38.50 acres = 1,271 cu. yds.

5) Elevation corresponding to cleanout level = 57.50

6) Distance from invert of the dewatering orifice to cleanout level = 6.20 ft.
   (Min = 1.0 ft.)

Dry Storage:

7) Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).
   67 cu. yds x 38.5 acres = 2,580 cu. yds.

8) Total available basin volume at crest of riser* = 8,920 cu. yds. at elevation 65.00
   * Minimum = 134 cu. yds. / acre of total drainage area.

9) Diameter of dewatering orifice. 18 inches ***Refer to included routings**

A = flow area of orifice, in square feet
d = diameter of circular orifice, in inches
h = average driving head (maximum possible head measured from radius of orifice to crest of principal spillway divided by 2), in feet
Q = volumetric flowrate through orifice needed to achieve approximate 6-hour drawdown, cubic feet per second
S = total storage available in dry storage area, cubic feet

h = 0.65 ft.
S = 101482 cu.ft.
Q = S / 21,000 seconds
= 4.83 cfs
A = Q / (SQRT(64.32 x (h/2))) x 0.6
= 1.762 sq.ft.
d = (2 x (SQRT(A / 3.14))) x 12
= 18 in.

Diameter of dewatering orifice should never be less than 3 inches in order to help prevent clogging by soil or debris.

Basin Volume Design (Cont.)

TIMMONS
711 N. Courthouse Road
Richmond, Virginia 23236-4099
Telephone: (804) 794-3500
Fax: (804) 794-7639

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET
(with or without an emengency spillway)

Revised:4/27/2006

Diameter of dewatering orifice. (cont.)

Note: Flexible tubimg used should be at least 2 inches larger in diameter than the calculated orifice to promote improved flow characteristics.

Preliminary Design Elevations

11) Crest of Riser = 65.00
Top of Dam = 72.00
Design High Water = 71.00
Upstream Toe of Dam = 52.50

Basin Shape

12) Length-to-width Ratio = L / We

We = A / L = the effective width
A = the surface area of the normal pool
L = the length of the flow path from the inflow to the outflow. If there is more than one point, any inflow which carries more than 30% of the peak rate of inflow must me these criteria.

L = 260.00 ft.
A = 18,607 sq.ft.
We = 71.57 ft.
Length-to-width Ratio = 3.63304

If > 2, baffles are required X
If < 2, baffles are not required _____

Runoff

Q = C x i x A

Q = peak rate of runoff in cubic feet per second
C = runoff coefficient
i = average intensity of rainfall for the time of concentration (Tc) for a selected desig
A = drainage area in acres

A = 38.50 acres
C = 0.6 Bare packed soil (rough)
i_2 = 3.29 in/hr
i_{25} = 5.07 in/hr

13) Q_2 = 76.00 cfs

14) Q_{25} = 117.12 cfs

Principal Spillway Design

TIMMONS
711 N. Courthouse Road
Richmond, Virginia 23236-4099
Telephone: (804) 794-3500
Fax: (804) 794-7639

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET
(with or without an emengency spillway)

Revised:4/27/2006

15) With emergency spillway, required spillway capacity Qp = Q_2 = 76.00 cfs
(riser and barrel)
Without emergency spillway, required spillway capacity Qp = Q_{25} = 117.12 cfs
(riser and barrel)

16) With emergency spillway:
h = Crest of Emergency Spillway Elevation - Crest of Riser Elevation
Assumed available head (h) = 1.00 ft.

Without emergency spillway:
h = Design High Water Elevation - Crest of Riser Elevation
Assumed available head (h) = N/A ft.

17) Riser diameter (Dr) = 108 in. ***Refer to included routings**
Actual head (h) = 1.00 ft.
(From Plate 3.14-8 of the Virginia Erosion and Sediment Handbook third edition 1992)
Note: Aviod orifice flow conditions.

18) Barrel length (l) = 69 ft.
Head (H) on barrel through embankment = 6.50 ft.
(From Plate 3.14-7 of the Virginia Erosion and Sediment Handbook third edition 1992)

19) Barrel diameter = 36 in. RCP ***Refer to included routings**
(From Plate 3.14-A of the Virginia Erosion and Sediment Handbook third edition 1992 for corrugated pipe)
(From Plate 3.14-B of the Virginia Erosion and Sediment Handbook third edition 1992 for concrete pipe)

20) Trash rack and anti-vortex device
Diameter = 120 inches ***Refer to detail on plan**
Height = 42 inches

Emergency Spillway Design

21) Required spillway capacity Qe = Q25 - Qp = 41.12 cfs
22) Bottom width (b) = 24 ft ; the slope of the exit channel (s) = 2.7 ft/foot; and the minimum length of the exit channel (x) = 63 ft.
(From Table 3.14-C)
***Refer to included routings**

Anti-Seep Collar Design

23) Ls = Y x (Z + 4) x (1 + (S / (0.25 -S)))

Ls = length of barrel in the saturated zone, feet
Y = the depth of water at the principal spillway crest, feet
Z = slope of the upstream face of embankment in Z feet horizontal to one vertical
S = slope of the barrel in feet per foot

Anti-Seep Collar Design (Cont.)

Y = 12.50 ft.
Z = 4.00 ft.
S = 0.0100 ft. / foot

TIMMONS
711 N. Courthouse Road
Richmond, Virginia 23236-4099
Telephone: (804) 794-3500
Fax: (804) 794-7639

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET
(with or without an emengency spillway)

Revised:4/27/2006

Ls = 104.17 ft.

24) Number of collars required = 3
Dimensions = 8.0' X 8.0'
(From Plate 3.14-12 of the Virginia Erosion and Sediment Handbook third edition 1992)

Final Design Elevations

25)

Top of Dam =	72.00
Design High Water =	71.30
Emergency Spillway Crest =	71.00
Principal Spillway Crest =	70.00
Dewatering Orifice Invert =	63.70
Cleanout Elevation =	57.50
Elevation of Upstream Toe of Dam or Excavated Bottom of "Wet Storage Area " (if excavation was performed) =	52.50

***Refer to included routings**

2

Job File: S:\301\22943\Calcs\pondpack\BASIN.PPW
Rain Dir: S:\301\22943\Calcs\pondpack\

==========
JOB TITLE
==========

TEMPORARY SEDIMENT BASIN

Project Date: 4/26/2006
Project Engineer: Timmons Group
Project Title: WJCC #8 Elementary School
Project Comments:

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MASTER DESIGN STORM SUMMARY

Network Storm Collection: James City Count

Return Event	Total Depth in	Rainfall Type	RNF ID
Dev 1	2.8000	Synthetic Curve	TypeII 24hr
Dev 2	3.5000	Synthetic Curve	TypeII 24hr
Dev 10	5.8000	Synthetic Curve	TypeII 24hr
Dev 25	6.4000	Synthetic Curve	TypeII 24hr
Dev 50	7.2000	Synthetic Curve	TypeII 24hr
Dev100	8.0000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
BASIN1	IN POND	1	3.726		12.2000	32.25		
BASIN1	IN POND	2	5.480		12.2000	48.65		
BASIN1	IN POND	10	11.874		12.2000	107.21		
BASIN1	IN POND	25	13.631		12.2000	122.99		
BASIN1	IN POND	50	16.010		12.2000	144.14		
BASIN1	IN POND	100	18.418		12.2000	165.37		
BASIN1	OUT POND	1	3.723		15.0000	2.42	66.07	6.563
BASIN1	OUT POND	2	5.477		15.4000	3.03	67.22	7.785
BASIN1	OUT POND	10	11.870		13.6000	12.30	70.30	11.622
BASIN1	OUT POND	25	13.628		13.0000	24.58	70.63	12.085
BASIN1	OUT POND	50	16.006		12.8000	46.19	71.02	12.636
BASIN1	OUT POND	100	18.415		12.6000	72.60	71.30	13.053

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 20	JCT	1	3.723		15.0000	2.42		
*OUT 20	JCT	2	5.477		15.4000	3.03		
*OUT 20	JCT	10	11.870		13.6000	12.30		
*OUT 20	JCT	25	13.628		13.0000	24.58		
*OUT 20	JCT	50	16.006		12.8000	46.19		
*OUT 20	JCT	100	18.415		12.6000	72.60		
TO BASIN1	AREA	1	3.726		12.2000	32.25		
TO BASIN1	AREA	2	5.480		12.2000	48.65		
TO BASIN1	AREA	10	11.874		12.2000	107.21		
TO BASIN1	AREA	25	13.631		12.2000	122.99		
TO BASIN1	AREA	50	16.010		12.2000	144.14		
TO BASIN1	AREA	100	18.418		12.2000	165.37		

File.... S:\301\22943\Calcs\pondpack\
Title... Project Date: 4/26/2006
Project Engineer: Timmons Group
Project Title: WJCC #8 Elementary School
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = James City Count

Storm Tag Name = Dev 1

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 2

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 10

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 25

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.4000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 50

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.2000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... S:\301\22943\Calcs\pondpack\
Title... Project Date: 4/26/2006
Project Engineer: Timmons Group
Project Title: WJCC #8 Elementary School
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = James City Count

Storm Tag Name = Dev100

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 8.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... S:\301\22943\Calcs\pondpack\BASIN.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400	
Hydraulic Length	250.00	ft
2yr, 24hr P	3.5000	in
Slope	.025000	ft/ft

Avg.Velocity .16 ft/sec

Segment #1 Time: .4329 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	342.00	ft
Slope	.010000	ft/ft
Unpaved		

Avg.Velocity 1.61 ft/sec

Segment #2 Time: .0589 hrs

Segment #3: Tc: User Defined

Segment #3 Time: .1000 hrs

==========
Total Tc: .5918 hrs
==========

File.... S:\301\22943\Calcs\pondpack\BASIN.PPW

Tc Equations used...

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

File.... S:\301\22943\Calcs\pondpack\BASIN.PPW

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
B WOODS	55	4.300			55.00
C WOODS	70	5.600			70.00
OPEN SPACE (WAS B,NOW C)	79	7.000			79.00
OPEN SPACE	79	6.500			79.00
BUILDING	98	2.200			98.00
IMPERVIOUS (ROADS/WALKS/ETC)	98	7.200			98.00
ROAD FRONTAGE	92	4.500			92.00
OFF-SITE S OF ROAD	70	1.200			70.00
COMPOSITE AREA & WEIGHTED CN --->		38.500			80.89 (81)

::

File.... S:\301\22943\Calcs\pondpack\BASIN.PPW

USER DEFINED VOLUME RATING TABLE

Elevation (ft)	Volume (ac-ft)	
52.50	.000	
53.50	.107	
54.50	.242	
55.50	.402	
56.50	.593	
57.50	.812	
58.50	1.222	53,299 > 9487 ft
59.00	1.444	62,786
60.00	1.940	83,042 ft
61.00	2.508	
62.00	3.148	
63.00	3.865	
64.00	4.659	
65.00	5.534	241,061
66.00	6.492	
67.00	7.534	
68.00	8.664	
69.00	9.883	
70.00	11.194	787,610
71.00	12.602	
72.00	14.102	

NOT PART OF TEMP. SED. BASIN TO BE EXCAVATED WHEN CONVERTED.

APPEAR OK. BY PLANIMETER

File.... S:\301\22943\Calcs\pondpack\BASIN.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 52.50 ft
Increment = .50 ft
Max. Elev.= 72.00 ft

Spot Elevations, ft
58.50

TOP OF DAM

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Stand Pipe	99	--->	CV	70.000	72.000
Orifice-Circular	O0	--->	CV	63.700	72.000
Culvert-Circular	CV	--->	TW	53.680	72.000
Weir-XY Points	W0	--->	TW	71.000	72.000
TW SETUP, DS Channel					

NORMAL POOL

File.... S:\301\22943\Calcs\pondpack\BASIN.PPW

OUTLET STRUCTURE INPUT DATA

FOR 10-YR, 25-YR 185'

```
Structure ID       = 99
Structure Type     = Stand Pipe
-----------------------------------
# of Openings      =         1
Invert Elev.       =     70.00 ft
Diameter           =    5.0000 ft
Orifice Area       =   19.6350 sq.ft
Orifice Coeff.     =      .600
Weir Length        =     15.71 ft
Weir Coeff.        =     2.600
K, Reverse         =     1.000
Mannings n         =     .0000
Kev,Charged Riser  =      .000
Weir Submergence   = (No)
```

```
Structure ID       = 00
Structure Type     = Orifice-Circular
-----------------------------------
# of Openings      =         1
Invert Elev.       =     63.70 ft
Diameter           =     .6700 ft
Orifice Coeff.     =      .600
```

File.... S:\301\22943\Calcs\pondpack\BASIN.PPW

OUTLET STRUCTURE INPUT DATA

```
Structure ID      = CV
Structure Type    = Culvert-Circular
-----------------------------------
No. Barrels       =         1
Barrel Diameter   =    3.0000 ft
Upstream Invert   =     53.68 ft
Dnstream Invert   =     53.00 ft
Horiz. Length     =     68.50 ft
Barrel Length     =     68.50 ft
Barrel Slope      =    .00993 ft/ft

OUTLET CONTROL DATA...
Mannings n        =     .0130
Ke                =     .5000  (forward entrance loss)
Kb                =   .007228  (per ft of full flow)
Kr                =     .5000  (reverse entrance loss)
HW Convergence    =      .001  +/- ft

INLET CONTROL DATA...
Equation form     =         1
Inlet Control K   =     .0098
Inlet Control M   =    2.0000
Inlet Control c   =    .03980
Inlet Control Y   =     .6700
T1 ratio (HW/D)   =     1.155
T2 ratio (HW/D)   =     1.302
Slope Factor      =     -.500
```

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 57.15 ft ---> Flow = 42.85 cfs
At T2 Elev = 57.59 ft ---> Flow = 48.97 cfs

File.... S:\301\22943\Calcs\pondpack\BASIN.PPW

OUTLET STRUCTURE INPUT DATA

Structure ID = W0
Structure Type = Weir-XY Points

# of Openings = 1
WEIR X-Y GROUND POINTS

X, ft	Elev, ft
.00	72.00
3.00	71.00
13.00	71.00
16.00	72.00

Lowest Elev. = 71.00 ft

Weir Coeff. = 3.367000

Weir TW effects (Use adjustment equation)

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 30
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .10 cfs
Max. Q tolerance = .10 cfs

LEVEL POOL ROUTING DATA

HYG Dir = S:\301\22943\Calcs\pondpack\
Inflow HYG file = work_pad.hyg - BASIN1 IN Dev 1
Outflow HYG file = work_pad.hyg - BASIN1 OUT Dev 1

Pond Node Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 63.70 ft
Starting Volume = 4.421 ac-ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = .2000 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Infilt. cfs	Q Total cfs	2S/t + O cfs
52.50	.00	.000	.00	.00	.00
53.00	.00	.054	.00	.00	6.47
53.50	.00	.107	.00	.00	12.95
53.68	.00	.131	.00	.00	15.88
54.00	.00	.174	.00	.00	21.10
54.50	.00	.242	.00	.00	29.25
55.00	.00	.322	.00	.00	38.96
55.50	.00	.402	.00	.00	48.68
56.00	.00	.497	.00	.00	60.19
56.50	.00	.593	.00	.00	71.69
57.00	.00	.702	.00	.00	84.97
57.50	.00	.812	.00	.00	98.25
58.00	.00	1.017	.00	.00	123.08
58.50	.00	1.222	.00	.00	147.90
59.00	.00	1.444	.00	.00	174.75
59.50	.00	1.692	.00	.00	204.76
60.00	.00	1.940	.00	.00	234.78
60.50	.00	2.224	.00	.00	269.14
61.00	.00	2.508	.00	.00	303.50
61.50	.00	2.828	.00	.00	342.22

Name.... BASIN1
File.... S:\301\22943\Calcs\pondpack\BASIN.PPW

LEVEL POOL ROUTING DATA

HYG Dir = S:\301\22943\Calcs\pondpack\
Inflow HYG file = work_pad.hyg - BASIN1 IN Dev 1
Outflow HYG file = work_pad.hyg - BASIN1 OUT Dev 1

Pond Node Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 63.70 ft
Starting Volume = 4.421 ac-ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = .2000 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Infilt. cfs	Q Total cfs	2S/t + O cfs
62.00	.00	3.148	.00	.00	380.94
62.50	.00	3.507	.00	.00	424.32
63.00	.00	3.865	.00	.00	467.70
63.50	.00	4.262	.00	.00	515.74
63.70	.00	4.421	.00	.00	534.95
64.00	.23	4.659	.00	.23	564.00
64.50	1.08	5.097	.00	1.08	617.79
65.00	1.67	5.534	.00	1.67	671.32
65.50	2.06	6.013	.00	2.06	729.62
66.00	2.38	6.492	.00	2.38	787.85
66.50	2.67	7.013	.00	2.67	851.20
67.00	2.93	7.534	.00	2.93	914.53
67.50	3.16	8.099	.00	3.16	983.11
68.00	3.38	8.664	.00	3.38	1051.68
68.50	3.59	9.273	.00	3.59	1125.66
69.00	3.78	9.883	.00	3.78	1199.62
69.50	3.98	10.539	.00	3.98	1279.15
70.00	4.15	11.194	.00	4.15	1358.66
70.50	17.56	11.898	.00	17.56	1457.26
71.00	44.08	12.602	.00	44.08	1568.96

LEVEL POOL ROUTING DATA

HYG Dir = S:\301\22943\Calcs\pondpack\
Inflow HYG file = work_pad.hyg - BASIN1 IN Dev 1
Outflow HYG file = work_pad.hyg - BASIN1 OUT Dev 1

Pond Node Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 63.70 ft
Starting Volume = 4.421 ac-ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = .2000 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Infilt. cfs	Q Total cfs	2S/t + O cfs
71.50	91.55	13.352	.00	91.55	1707.15
72.00	160.05	14.102	.00	160.05	1866.36

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev  1
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev  1

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    63.70 ft
Starting Volume    =    4.421 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =     32.25 cfs    at   12.2000 hrs
Peak Outflow      =      2.42 cfs    at   15.0000 hrs
-----------------------------------------------------
Peak Elevation    =     66.07 ft
Peak Storage =          6.563 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       4.421
+ HYG Vol IN   =       3.726
- Infiltration =        .000
- HYG Vol OUT  =       3.723
- Retained Vol =       4.424
                  ----------
Unrouted Vol =       -.000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev  2
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev  2

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    63.70 ft
Starting Volume    =    4.421 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =     48.65 cfs    at   12.2000 hrs
Peak Outflow      =      3.03 cfs    at   15.4000 hrs
-----------------------------------------------------
Peak Elevation    =     67.22 ft
Peak Storage =          7.785 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       4.421
+ HYG Vol IN   =       5.480
- Infiltration =        .000
- HYG Vol OUT  =       5.477
- Retained Vol =       4.424
                  ----------
Unrouted Vol =       -.000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev 10
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev 10

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    63.70 ft
Starting Volume    =    4.421 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =    107.21 cfs    at   12.2000 hrs
Peak Outflow      =     12.30 cfs    at   13.6000 hrs
-----------------------------------------------------
Peak Elevation    =     70.30 ft
Peak Storage =         11.622 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       4.421
+ HYG Vol IN   =      11.874
- Infiltration =        .000
- HYG Vol OUT  =      11.870
- Retained Vol =       4.424
                  ----------
Unrouted Vol =        .000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev 25
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev 25

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    63.70 ft
Starting Volume    =    4.421 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =    122.99 cfs    at   12.2000 hrs
Peak Outflow      =     24.58 cfs    at   13.0000 hrs
-----------------------------------------------------
Peak Elevation    =     70.63 ft
Peak Storage =         12.085 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       4.421
+ HYG Vol IN   =      13.631
- Infiltration =        .000
- HYG Vol OUT  =      13.628
- Retained Vol =       4.424
                  ----------
Unrouted Vol =        .000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev 50
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev 50

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    63.70 ft
Starting Volume    =    4.421 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =    144.14 cfs    at   12.2000 hrs
Peak Outflow      =     46.19 cfs    at   12.8000 hrs
-----------------------------------------------------
Peak Elevation    =     71.02 ft
Peak Storage =         12.636 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       4.421
+ HYG Vol IN   =      16.010
- Infiltration =        .000
- HYG Vol OUT  =      16.006
- Retained Vol =       4.424
                 ----------
Unrouted Vol =       -.000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev100
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev100

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    63.70 ft
Starting Volume    =    4.421 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =    165.37 cfs    at   12.2000 hrs
Peak Outflow      =     72.60 cfs    at   12.6000 hrs
-----------------------------------------------------
Peak Elevation    =     71.30 ft
Peak Storage =         13.053 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       4.421
+ HYG Vol IN   =      18.418
- Infiltration =        .000
- HYG Vol OUT  =      18.415
- Retained Vol =       4.424
                  ----------
Unrouted Vol =        .000 ac-ft  (.000% of Inflow Volume)
```

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----- B -----
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7.06, 7.07, 7.08, 7.09

----- J -----
James City Count... 2.01

----- O -----
Outlet 1... 6.01

----- T -----
TO BASIN1... 3.01, 4.01

----- W -----
Watershed... 1.01

3

Table 2

Worksheet for BMP Point System

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Points		Fraction of Site Served by BMP		Weighted BMP Points
TYPE A-3	10	x	① $\frac{38.5}{40}$ = .9625	=	9.6
		x		=	
		x		=	
		x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: _____

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
	x	(0.1 per 1%)	=	
9.25 %	x	0.15 per 1% (0.15 per 1%)	=	1.4

TOTAL NATURAL OPEN SPACE CREDIT: 1.4

C. TOTAL WEIGHTED POINTS

9.6	+	1.4	=	11.0
Structural BMP Points		Natural Open Space Points		Total

① SITE AREA = 40± ACRES

BMP D.A.
ON-SITE = 32.7 ACRES
OFF-SITE = 5.8 ACRES
TOTAL D.A. = 38.5 ACRES

TIMMONS GROUP

YOUR VISION ACHIEVED THROUGH OURS.

ESTIMATED POND VOLUME FOR CHANNEL PROTECTION

Project: WILLIAMSBURG ELEMENTARY SCHOOL
Subarea Number: 1

By: Chris Thompson
Date: 4/26/2006

	1-Year Storm	10-Year Storm	50-Year Storm	100-Year Storm
Q_{out}/Q_{in}	0.041	*PER APPENDIX B FIG. B.7		
V_s/V_r	0.627	*Vs/Vr=0.683+1.43(Qo/Qin)^2-0.804(Qo/Qin)^3		
V_s, acre-ft	2.34	*Vs=(Vs/Vr)*q*A*(1/12)		
Q_{in}, cfs	30.05			
Q_{out}, cfs	1.23			

TIMMONS GROUP

YOUR VISION ACHIEVED THROUGH OURS.

WORKSHEET FOR SCS GRAPHICAL PEAK DISCHARGE

Project: WILLIAMSBURG ELEMENTARY SCHOOL
Subarea Number: 1

By: Chris Thompson
Date: 4/26/2006

Existing Conditions

Existing Project Data Summary		
Drainage Area	12.5 acres	0.020 square mi
Runoff Curve Number	57.0	
Time of Concentration	0.74 hours	
Rainfall Distribution Assumed Type II		

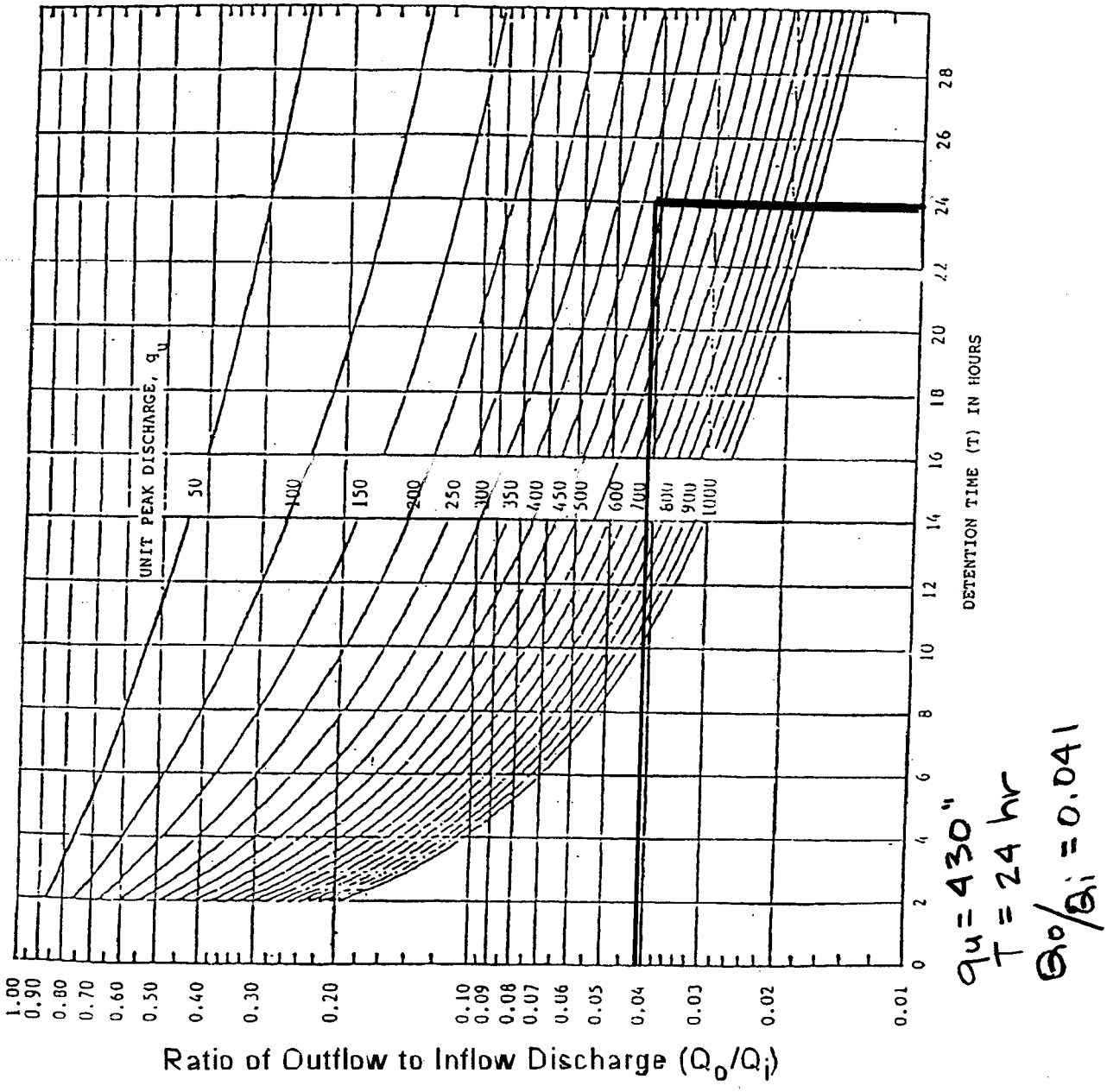
		Storm 1	Storm 2	Storm 3	Storm 4
Frequency	yr	1			
P, 24-hour rainfall	in	2.8			
Initial Abstraction, I_a	in	1.509			
Compute I_a/P		0.54			
Unit Peak Discharge, q_u	csm/in	190			
Runoff, q	in	0.19			
Peak Discharge, Q	cfs	0.70			

Proposed Conditions

Proposed Project Data Summary		
Drainage Area	38.5 acres	0.060 square mi
Runoff Curve Number	81.0	
Time of Concentration	0.59 hours	
Rainfall Distribution Assumed Type II		

		Storm 1	Storm 2	Storm 3	Storm 4
Frequency	yr	1			
P, 24-hour rainfall	in	2.8			
Initial Abstraction, I_a	in	0.469			
Compute I_a/P		0.17			
Unit Peak Discharge, q_u	csm/in	430			
Runoff, q	in	1.16			
Peak Discharge, Q	cfs	30.05			

Figure B.7: Detention Time vs. Discharge Ratios (Qo/Qi)
(Source: Maryland Stormwater Design Manual, 1997)



WILLIAMSBURG E.S. - WATER QUALITY CALCS

BMP

$WQV_{req.} = 2''/ACRE_{IMP}$ $\qquad ACRE_{IMP} = 13$ ACRES

$WQV_{req.} = 2.17$ AC-FT $= 94{,}500$ FT^3

$\frac{1}{2}$ $WET_{req} = 1.08$ AC-FT $\qquad \frac{1}{2}$ $WET_{prov} = 1.22$ AC-FT @ 58.50'

$\frac{1}{2}$ $ED_{req} = 1.08 + 1.22 = 2.30$ $\qquad \frac{1}{2}$ $ED_{prov} = 2.30$ AC-FT @ 60.63'

$Q = \frac{V}{T} \Rightarrow T = 30$ H.R. $\cdot$ 3600 S/HR $= 108{,}000$ S

$Q = \frac{1.08}{108{,}000} = .44$ CFS

$h = 60.63' - 58.50' = 2.13'$

$Q = 0.6A\sqrt{2gh} = 0.44$ CFS

$A = .062$ ft$^2 = \frac{\pi d^2}{4}$

$d = 3.4''$ $\qquad$ USE 3" ORIFICE

GRASS SWALE - [STR #21 BEHIND PAVED PLAY AREA]

$WQV_{req} = 1''/ACRE_{IMP}$ $\qquad ACRE_{IMP} = 0.6$ ACRES

$WQV_{req} = .05$ AC-FT $= 2178$ FT^3

$WQV_{prov} = 2600$ FT^3 $\qquad$ TOP OF STR. = 77.00

GRASS SWALE - [STR # 41 BEHIND PLAY AREA]

$WQV_{req} = 1''/ACRE_{IMP}$ $\qquad ACRE_{IMP} = 0.5$ ACRES

$WQV_{req} = .042$ AC-FT $= 1815$ FT^3

$WQV_{prov} = 1930$ FT^3 $\qquad$ TOP OF STR = 77.00

WATER QUALITY CALCS CONT...

GRASS SWALE · [STR #43, FRONT OF BUSLOOP]

$WQV_{req} = 1''/ACRE_{IMP}$ $ACRE_{IMP} = 0.8$ ACRES

$WQV_{req} = 0.07$ AC·FT $= 2904$ FT^3

$WQV_{prov} = 3223$ FT^3 TOP OF STR = 76.50

Anti-Floatation Calculations

Z_1 = 100 yr Water Surface Elevation = 71.30 [Elev. taken from [illegible]

Z_2 = Riser Bottom = 53.68

D_1 = Riser Diameter = 5 ft

t = Riser / Pipe Thickness = .5625 ft

D_2 = Assumed Anchor Diameter

H_1 = Assumed Anchor Depth

Weight of water = 62.4 lb/ft³

Weight of concrete = 150 lb/ft³

FS = 1.2

Top of Riser = 70.0

Trial 1 → D_2 = 6 ft H_1 = 1 ft

$$\text{Volume of Displaced Water} = \underbrace{\left[(D_1 + 2 \times t)^2 * (\pi/4)\right]}_{\text{Area of riser}} * \underbrace{(Z_1 - Z_2)}_{\text{Height of water}} + \underbrace{\left[D_2^2 * (\pi/4) * H_1\right]}_{\text{Anchor Volume}}$$

$$= \left[\left(5\,ft + 2(.5625)\right)^2 * \pi/4\right] * (71.30 - 53.68) + \left[6^2 * (\pi/4) * 1\right]$$

$$= \left[29.46\,ft^2 * 17.62\,ft\right] + \left[28.27\,ft^2 * 1\,ft\right]$$

$$\boxed{V_{WATER} = 547\,ft^3}$$

$$\text{Volume of Concrete} = \underbrace{\left[(D_1 + 2 \times t)^2 - (D_1)^2\right]}_{\text{Outside Area of Riser} - \text{Inside Area}} * (\pi/4) * \underbrace{(Top - Z_2)}_{\text{Height of Riser}} - \left(\text{Volume of all openings } 6'' \; 8'' \; 10''\right)$$

$$+ \underbrace{\left(D_2^2 + (\pi/4) * H_1\right)}_{\text{Anchor Volume}} - \underbrace{\left[(D_{barrel} + t_{barrel})^2 * (\pi/4) * t_{riser}\right]}_{\text{Outside Area of Barrel}}$$

$$= \left[(5 + 2(.5625))^2 - (5)^2\right] * \frac{\pi}{4} * (70 - 53.68) - \left[(.5^2 + .667^2 + .833^2) \times \frac{\pi}{4}\right] * 3$$

$$+ \left(6^2 * (\pi/4) * 1\right) - \left[(3 + .333)^2 * (\pi/4) * (.5625)\right]$$

$$= \underbrace{160.42\,ft^3}_{\text{Riser Volume}} - \underbrace{.613\,ft^3}_{\text{SWM Openings}} + \underbrace{28.27\,ft^3}_{\text{Base Volume}} - \underbrace{4.91\,ft^3}_{\text{barrel opening}}$$

$$\boxed{V_{conc} = 182.75\,ft^3}$$

$$F_b = V_{WATER} * (62.4\ lb/ft^3) = 547\ ft^3\ (62.4\ lb/ft^3) = 34132.8\ lb$$

$$F_c = V_{conc} * (150\ lb/ft^3) = 182.75\ ft^3\ (150\ lb/ft^3) = 27412.5\ lb$$

$$F_c/F_b > 1.2 \Rightarrow \frac{34132.8\ lb}{27412.5\ lb} = \boxed{1.25 > 1.2 \quad OK}$$

Riser Base Diameter = 72 inches
Height = 12 inches

4

Job File: S:\301\22943\Calcs\pondpack\22943_PRE.PPW
Main Dir: S:\301\22943\Calcs\pondpack\

==========
JOB TITLE
==========

PRE - DEVELOPMENT

Project Date: 4/26/2006
Project Engineer: Timmons Group
Project Title: WJCC #8 Elementary School
Project Comments:

CANNOT FIND PRE-DEV. DRAINAGE AREA MAP.

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MASTER DESIGN STORM SUMMARY

Network Storm Collection: James City Count

Return Event	Total Depth in	Rainfall Type	RNF ID
Pre 1	2.8000	Synthetic Curve	TypeII 24hr
Pre 2	3.5000	Synthetic Curve	TypeII 24hr
Pre 10	5.8000	Synthetic Curve	TypeII 24hr
Pre 25	6.4000	Synthetic Curve	TypeII 24hr
Pre 50	7.2000	Synthetic Curve	TypeII 24hr
Pre100	8.0000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 20	JCT	1	.197		12.6000	.56		
*OUT 20	JCT	2	.433		12.5000	1.98		
*OUT 20	JCT	10	1.621		12.4000	11.14		
*OUT 20	JCT	25	2.004		12.4000	14.23		
*OUT 20	JCT	50	2.549		12.3500	18.63		
*OUT 20	JCT	100	3.127		12.3500	23.35		
PRE DA 1	AREA	1	.197		12.6000	.56		
PRE DA 1	AREA	2	.433		12.5000	1.98		
PRE DA 1	AREA	10	1.621		12.4000	11.14		
PRE DA 1	AREA	25	2.004		12.4000	14.23		
PRE DA 1	AREA	50	2.549		12.3500	18.63		
PRE DA 1	AREA	100	3.127		12.3500	23.35		

File.... S:\301\22943\Calcs\pondpack\
Title... Project Date: 4/26/2006
Project Engineer: Timmons Group
Project Title: WJCC #8 Elementary School
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = James City Count

Storm Tag Name = Pre 1

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 2

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 10

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 25

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.4000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 50

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.2000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... S:\301\22943\Calcs\pondpack\
Title... Project Date: 4/26/2006
Project Engineer: Timmons Group
Project Title: WJCC #8 Elementary School
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = James City Count

Storm Tag Name = Pre100

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 8.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... S:\301\22943\Calcs\pondpack\22943_PRE.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	300.00 ft
2yr, 24hr P	3.5000 in
Slope	.013300 ft/ft
Avg.Velocity	.13 ft/sec

Segment #1 Time: .6447 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	405.00 ft
Slope	.015000 ft/ft
Unpaved	
Avg.Velocity	1.98 ft/sec

Segment #2 Time: .0569 hrs

Segment #3: Tc: TR-55 Shallow

Hydraulic Length	389.00 ft
Slope	.033000 ft/ft
Unpaved	
Avg.Velocity	2.93 ft/sec

Segment #3 Time: .0369 hrs

==========
Total Tc: .7385 hrs
==========

File.... S:\301\22943\Calcs\pondpack\22943_PRE.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS TR-55 Shallow Concentrated Flow ==========

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

File.... S:\301\22943\Calcs\pondpack\22943_PRE.PPW

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
B SOIL WOODS	55	10.700			55.00
C SOIL WOODS	70	1.800			70.00
COMPOSITE AREA & WEIGHTED CN --->		12.500			57.16 (57)

::

ONLY 5 AC TO POINT OF BMP OUTFALL

SCS UNIT HYDROGRAPH METHOD
(Computational Notes)

DEFINITION OF TERMS: ----------

```
At    = Total area (acres):  At = Ai+Ap
Ai    = Impervious area (acres)
Ap    = Pervious area (acres)
CNi   = Runoff curve number for impervious area
CNp   = Runoff curve number for pervious area
fLoss = f loss constant infiltration (depth/time)
gKs   = Saturated Hydraulic Conductivity (depth/time)
Md    = Volumetric Moisture Deficit
Psi   = Capillary Suction (length)
hK    = Horton Infiltration Decay Rate (time^-1)
fo    = Initial Infiltration Rate (depth/time)
fc    = Ultimate(capacity)Infiltration Rate (depth/time)
Ia    = Initial Abstraction (length)
dt    = Computational increment (duration of unit excess rainfall)
        Default dt is smallest value of 0.1333Tc, rtm, and th
        (Smallest dt is then adjusted to match up with Tp)
UDdt  = User specified override computational main time increment
        (only used if UDdt is => .1333Tc)
D(t)  = Point on distribution curve (fraction of P) for time step t

K     = 2 / (1 + (Tr/Tp)):  default K = 0.75: (for Tr/Tp = 1.67)
Ks    = Hydrograph shape factor
      = Unit Conversions * K:
      = ((1hr/3600sec) * (1ft/12in) * ((5280ft)**2/sq.mi)) * K
        Default Ks = 645.333 * 0.75 = 484

Lag   = Lag time from center of excess runoff (dt) to Tp:  Lag = 0.6Tc
P     = Total precipitation depth, inches
Pa(t) = Accumulated rainfall at time step t
Pi(t) = Incremental rainfall at time step t
qp    = Peak discharge (cfs) for 1in. runoff, for 1hr, for 1 sq.mi.
      = (Ks * A * Q) / Tp   (where Q = 1in. runoff, A=sq.mi.)
Qu(t) = Unit hydrograph ordinate (cfs) at time step t
Q(t)  = Final hydrograph ordinate (cfs) at time step t
Rai(t)= Accumulated runoff (inches) at time step t for impervious area
Rap(t)= Accumulated runoff (inches) at time step t for pervious area
Rii(t)= Incremental runoff (inches) at time step t for impervious area
Rip(t)= Incremental runoff (inches) at time step t for pervious area
R(t)  = Incremental weighted total runoff (inches)
Rtm   = Time increment for rainfall table
Si    = S for impervious area:  Si = (1000/CNi) - 10
Sp    = S for pervious area:    Sp = (1000/CNp) - 10
t     = Time step (row) number
Tc    = Time of concentration
Tb    = Time (hrs) of entire unit hydrograph:  Tb = Tp + Tr
Tp    = Time (hrs) to peak of a unit hydrograph:  Tp = (dt/2) + Lag
Tr    = Time (hrs) of receding limb of unit hydrograph:  Tr = ratio of Tp
```

SCS UNIT HYDROGRAPH METHOD
(Computational Notes)

```
PRECIPITATION: ------------------------------------------------------------
Column (1):  Time for time step t
Column (2):  D(t)  = Point on distribution curve for time step t
Column (3):  Pi(t) = Pa(t) - Pa(t-1): Col.(4) - Preceding Col.(4)
Column (4):  Pa(t) = D(t) x P:        Col.(2) x P


PERVIOUS AREA RUNOFF (using SCS Runoff CN Method) ------------------------
Column (5):  Rap(t) = Accumulated pervious runoff for time step t
             If (Pa(t) is <= 0.2Sp) then use: Rap(t) = 0.0
             If (Pa(t) is >  0.2Sp) then use:

             Rap(t) = (Col.(4)-0.2Sp)**2 / (Col.(4)+0.8Sp)

Column (6):  Rip(t) = Incremental pervious runoff for time step t
             Rip(t) =         Rap(t)          -         Rap(t-1)
             Rip(t) = Col.(5) for current row - Col.(5) for preceding row.

IMPERVIOUS AREA RUNOFF ----------------------------------------------------
Column (7 & 8)... Did not specify to use impervious areas.


INCREMENTAL WEIGHTED RUNOFF: ----------------------------------------------
Column (9):  R(t)  = (Ap/At) x Rip(t)   +  (Ai/At) x Rii(t)
             R(t)  = (Ap/At) x Col.(6)  +  (Ai/At) x Col.(8)


SCS UNIT HYDROGRAPH METHOD: -----------------------------------------------
Column (10): Q(t)   is computed with the SCS unit hydrograph method
                    using R() and Qu().
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 1 year storm
Duration      = 24.0000 hrs     Rain Depth = 2.8000 in
Rain Dir      = S:\301\22943\Calcs\pondpack\
Rain File -ID =  - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = S:\301\22943\Calcs\pondpack\
HYG File - ID = work_pad.hyg - PRE DA 1 Pre  1
Tc            = .7385 hrs
Drainage Area = 12.500 acres  Runoff CN= 57

==========================================
Computational Time Increment   =   .09847 hrs
Computed Peak Time             =  12.6045 hrs
Computed Peak Flow             =      .56 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.6000 hrs
Peak Flow, Interpolated Output =      .56 cfs
==========================================

                DRAINAGE AREA
             -------------------
             ID:PRE DA 1
             CN   =   57
             Area =      12.500 acres
             S    =   7.5439 in
             0.2S =   1.5088 in

              Cumulative Runoff
             -------------------
                      .1887 in
                       .197 ac-ft

HYG Volume...           .197 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .73855 hrs (ID: PRE DA 1)
Computational Incr, Tm =   .09847 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 =    19.18 cfs
Unit peak time      Tp =   .49236 hrs
Unit receding limb, Tr =  1.96945 hrs
Total unit time,    Tb =  2.46182 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration      = 24.0000 hrs     Rain Depth = 3.5000 in
Rain Dir      = S:\301\22943\Calcs\pondpack\
Rain File -ID =  - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = S:\301\22943\Calcs\pondpack\
HYG File - ID = work_pad.hyg - PRE DA 1 Pre  2
Tc            = .7385 hrs
Drainage Area = 12.500 acres  Runoff CN= 57

============================================
Computational Time Increment   =   .09847 hrs
Computed Peak Time             =  12.5060 hrs
Computed Peak Flow             =     1.98 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.5000 hrs
Peak Flow, Interpolated Output =     1.98 cfs
============================================

                DRAINAGE AREA
              -------------------
              ID:PRE DA 1
              CN   =   57
              Area =      12.500 acres
              S    =   7.5439 in
              0.2S =   1.5088 in

               Cumulative Runoff
              -------------------
                       .4158 in
                        .433 ac-ft

HYG Volume...           .433 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .73855 hrs (ID: PRE DA 1)
Computational Incr, Tm =   .09847 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 =    19.18 cfs
Unit peak time      Tp =   .49236 hrs
Unit receding limb, Tr =  1.96945 hrs
Total unit time,    Tb =  2.46182 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 year storm
Duration      = 24.0000 hrs     Rain Depth = 5.8000 in
Rain Dir      = S:\301\22943\Calcs\pondpack\
Rain File -ID =  - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = S:\301\22943\Calcs\pondpack\
HYG File - ID = work_pad.hyg - PRE DA 1 Pre 10
Tc            = .7385 hrs
Drainage Area = 12.500 acres  Runoff CN= 57

==========================================
Computational Time Increment   =   .09847 hrs
Computed Peak Time             =  12.4076 hrs
Computed Peak Flow             =    11.16 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.4000 hrs
Peak Flow, Interpolated Output =    11.14 cfs
==========================================

                DRAINAGE AREA
             -------------------
             ID:PRE DA 1
             CN   =   57
             Area =      12.500 acres
             S    =   7.5439 in
             0.2S =   1.5088 in

              Cumulative Runoff
             -------------------
                     1.5559 in
                      1.621 ac-ft

HYG Volume...          1.621 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .73855 hrs (ID: PRE DA 1)
Computational Incr, Tm =   .09847 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 =    19.18 cfs
Unit peak time      Tp =   .49236 hrs
Unit receding limb, Tr =  1.96945 hrs
Total unit time,    Tb =  2.46182 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 6.4000 in
Rain Dir      = S:\301\22943\Calcs\pondpack\
Rain File -ID =  - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = S:\301\22943\Calcs\pondpack\
HYG File - ID = work_pad.hyg - PRE DA 1 Pre 25
Tc            = .7385 hrs
Drainage Area = 12.500 acres  Runoff CN= 57

==========================================
Computational Time Increment   =   .09847 hrs
Computed Peak Time             =  12.4076 hrs
Computed Peak Flow             =    14.24 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.4000 hrs
Peak Flow, Interpolated Output =    14.23 cfs
==========================================

                DRAINAGE AREA
              -------------------
              ID:PRE DA 1
              CN   =   57
              Area =      12.500 acres
              S    =   7.5439 in
              0.2S =   1.5088 in

               Cumulative Runoff
              -------------------
                      1.9239 in
                       2.004 ac-ft

HYG Volume...          2.004 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .73855 hrs (ID: PRE DA 1)
Computational Incr, Tm =   .09847 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 =    19.18 cfs
Unit peak time      Tp =   .49236 hrs
Unit receding limb, Tr =  1.96945 hrs
Total unit time,    Tb =  2.46182 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 50 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = S:\301\22943\Calcs\pondpack\
Rain File -ID =  - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = S:\301\22943\Calcs\pondpack\
HYG File - ID = work_pad.hyg - PRE DA 1 Pre 50
Tc            = .7385 hrs
Drainage Area = 12.500 acres  Runoff CN= 57

==========================================
Computational Time Increment   =   .09847 hrs
Computed Peak Time             =  12.3091 hrs
Computed Peak Flow             =    18.65 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.3500 hrs
Peak Flow, Interpolated Output =    18.63 cfs
==========================================

                DRAINAGE AREA
             -------------------
             ID:PRE DA 1
             CN   =   57
             Area =      12.500 acres
             S    =   7.5439 in
             0.2S =   1.5088 in

              Cumulative Runoff
             -------------------
                     2.4473 in
                      2.549 ac-ft

HYG Volume...          2.549 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .73855 hrs (ID: PRE DA 1)
Computational Incr, Tm =   .09847 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 =    19.18 cfs
Unit peak time      Tp =   .49236 hrs
Unit receding limb, Tr =  1.96945 hrs
Total unit time,    Tb =  2.46182 hrs
```

```
SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration      = 24.0000 hrs     Rain Depth = 8.0000 in
Rain Dir      = S:\301\22943\Calcs\pondpack\
Rain File -ID =  - TypeII  24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = S:\301\22943\Calcs\pondpack\
HYG File - ID = work_pad.hyg - PRE DA 1 Pre100
Tc            = .7385 hrs
Drainage Area = 12.500 acres  Runoff CN= 57

==========================================
Computational Time Increment   =   .09847 hrs
Computed Peak Time             =  12.3091 hrs
Computed Peak Flow             =    23.43 cfs

Time Increment for HYG File    =    .0500 hrs
Peak Time, Interpolated Output =  12.3500 hrs
Peak Flow, Interpolated Output =    23.35 cfs
==========================================

                 DRAINAGE AREA
              -------------------
              ID:PRE DA 1
              CN   =   57
              Area =      12.500 acres
              S    =   7.5439 in
              0.2S =   1.5088 in

               Cumulative Runoff
              -------------------
                      3.0022 in
                       3.127 ac-ft

HYG Volume...          3.127 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .73855 hrs (ID: PRE DA 1)
Computational Incr, Tm =   .09847 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 =    19.18 cfs
Unit peak time      Tp =   .49236 hrs
Unit receding limb, Tr =  1.96945 hrs
Total unit time,    Tb =  2.46182 hrs
```

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Watershed... 1.01

5

Job File: S:\301\22943\Calcs\pondpack\22943_POST.PPW
Rain Dir: S:\301\22943\Calcs\pondpack\

==========
JOB TITLE
==========

POST-DEVELOPMENT MODEL

Project Date: 4/26/2006
Project Engineer: Timmons Group
Project Title: WJCC #8 Elementary School
Project Comments:

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MASTER DESIGN STORM SUMMARY

Network Storm Collection: James City Count

Return Event	Total Depth in	Rainfall Type	RNF ID
Dev 1	2.8000	Synthetic Curve	TypeII 24hr
Dev 2	3.5000	Synthetic Curve	TypeII 24hr
Dev 10	5.8000	Synthetic Curve	TypeII 24hr
Dev 25	6.4000	Synthetic Curve	TypeII 24hr
Dev 50	7.2000	Synthetic Curve	TypeII 24hr
Dev100	8.0000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
BASIN1	IN POND	1	3.726		12.2000	32.25		
BASIN1	IN POND	2	5.480		12.2000	48.65		
BASIN1	IN POND	10	11.874		12.2000	107.21		
BASIN1	IN POND	25	13.631		12.2000	122.99		
BASIN1	IN POND	50	16.010		12.2000	144.14		
BASIN1	IN POND	100	18.418		12.2000	165.37		
BASIN1	OUT POND	1	3.720		24.2000	.54	63.71	4.426
BASIN1	OUT POND	2	5.474		18.6000	1.82	64.71	5.283
BASIN1	OUT POND	10	11.868		13.8000	9.94	67.83	8.477
BASIN1	OUT POND	25	13.626		13.8000	11.34	68.75	9.581
BASIN1	OUT POND	50	16.004		13.8000	12.86	69.95	11.130
BASIN1	OUT POND	100	18.413		13.2000	29.59	70.53	11.943

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 20	JCT	1	3.720	--	24.2000	.54		
*OUT 20	JCT	2	5.474		18.6000	1.82		
*OUT 20	JCT	10	11.868		13.8000	9.94		
*OUT 20	JCT	25	13.626		13.8000	11.34		
*OUT 20	JCT	50	16.004		13.8000	12.86		
*OUT 20	JCT	100	18.413		13.2000	29.59		
TO BASIN1	AREA	1	3.726		12.2000	32.25		
TO BASIN1	AREA	2	5.480		12.2000	48.65		
TO BASIN1	AREA	10	11.874		12.2000	107.21		
TO BASIN1	AREA	25	13.631		12.2000	122.99		
TO BASIN1	AREA	50	16.010		12.2000	144.14		
TO BASIN1	AREA	100	18.418		12.2000	165.37		

File.... S:\301\22943\Calcs\pondpack\
Title... Project Date: 4/26/2006
Project Engineer: Timmons Group
Project Title: WJCC #8 Elementary School
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = James City Count

Storm Tag Name = Dev 1

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 2

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 10

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 25

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.4000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 50

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.2000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... S:\301\22943\Calcs\pondpack\
Title... Project Date: 4/26/2006
Project Engineer: Timmons Group
Project Title: WJCC #8 Elementary School
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = James City Count

Storm Tag Name = Dev100

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 8.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... S:\301\22943\Calcs\pondpack\22943_POST.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n .2400
Hydraulic Length 250.00 ft
2yr, 24hr P 3.5000 in
Slope .025000 ft/ft

Avg.Velocity .16 ft/sec

Segment #1 Time: .4329 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length 342.00 ft
Slope .010000 ft/ft
Unpaved

Avg.Velocity 1.61 ft/sec

Segment #2 Time: .0589 hrs

Segment #3: Tc: User Defined

Segment #3 Time: .1000 hrs

==========
Total Tc: .5918 hrs
==========

File.... S:\301\22943\Calcs\pondpack\22943_POST.PPW

Tc Equations used...

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

File.... S:\301\22943\Calcs\pondpack\22943_POST.PPW

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
B WOODS	55	4.300			55.00
C WOODS	70	5.600			70.00
OPEN SPACE (WAS B,NOW C)	79	7.000			79.00
OPEN SPACE	79	6.500			79.00
BUILDING	98	2.200			98.00
IMPERVIOUS (ROADS/WALKS/ETC)	98	7.200			98.00
ROAD FRONTAGE	92	4.500			92.00
OFF-SITE S OF ROAD	70	1.200			70.00
COMPOSITE AREA & WEIGHTED CN --->		38.500			80.89 (81)

File.... S:\301\22943\Calcs\pondpack\22943_POST.PPW

USER DEFINED VOLUME RATING TABLE

Elevation (ft)	Volume (ac-ft)
52.50	.000
53.50	.107
54.50	.242
55.50	.402
56.50	.593
57.50	.812
58.50	1.222
59.00	1.444
60.00	1.940
61.00	2.508
62.00	3.148
63.00	3.865
64.00	4.659
65.00	5.534
66.00	6.492
67.00	7.534
68.00	8.664
69.00	9.883
70.00	11.194
71.00	12.602
72.00	14.102

NO CHANGES FROM TSB

File.... S:\301\22943\Calcs\pondpack\22943_POST.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 52.50 ft
Increment = .50 ft
Max. Elev.= 72.00 ft

Spot Elevations, ft
58.50

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

TOP OF DAM

Structure	No.		Outfall		E1, ft	E2, ft
Orifice-Circular	O0	--->	CV	12"	63.700	72.000
Orifice-Circular	O1	--->	CV	8"	64.700	72.000
Stand Pipe	99	--->	CV		70.000	72.000
Orifice-Circular	WQ	--->	CV	6"	58.500	72.000 — NORMAL POOL
Culvert-Circular	CV	--->	TW		53.680	72.000
TW SETUP, DS Channel						

t SPILLWAY?

File.... S:\301\22943\Calcs\pondpack\22943_POST.PPW

OUTLET STRUCTURE INPUT DATA

```
Structure ID       = O0
Structure Type     = Orifice-Circular
-----------------------------------
# of Openings      =         1
Invert Elev.       =     63.70 ft
Diameter           =     .6700 ft
Orifice Coeff.     =      .600
```

8"

```
Structure ID       = O1
Structure Type     = Orifice-Circular
-----------------------------------
# of Openings      =         1
Invert Elev.       =     64.70 ft
Diameter           =    1.0000 ft
Orifice Coeff.     =      .600
```

12"

```
Structure ID       = 99
Structure Type     = Stand Pipe
-----------------------------------
# of Openings      =         1
Invert Elev.       =     70.00 ft
Diameter           =    5.0000 ft
Orifice Area       =   19.6350 sq.ft
Orifice Coeff.     =      .600
Weir Length        =     15.71 ft
Weir Coeff.        =     2.600
K, Reverse         =     1.000
Mannings n         =     .0000
Kev,Charged Riser  =      .000
Weir Submergence   = No
```

RISER

File.... S:\301\22943\Calcs\pondpack\22943_POST.PPW

OUTLET STRUCTURE INPUT DATA

```
Structure ID       = WQ
Structure Type     = Orifice-Circular
-----------------------------------
# of Openings      =          1
Invert Elev.       =      58.50 ft
Diameter           =      .2500 ft
Orifice Coeff.     =       .600
```

3"

? 0.33

```
Structure ID       = CV
Structure Type     = Culvert-Circular
-----------------------------------
No. Barrels        =          1
Barrel Diameter    =     3.0000 ft
Upstream Invert    =      53.68 ft
Dnstream Invert    =      53.00 ft
Horiz. Length      =      68.50 ft
Barrel Length      =      68.50 ft
Barrel Slope       =     .00993 ft/ft

OUTLET CONTROL DATA...
Mannings n         =      .0130
Ke                 =      .5000  (forward entrance loss)
Kb                 =    .007228  (per ft of full flow)
Kr                 =      .5000  (reverse entrance loss)
HW Convergence     =       .001  +/- ft

INLET CONTROL DATA...
Equation form      =          1
Inlet Control K    =      .0098
Inlet Control M    =     2.0000
Inlet Control c    =     .03980
Inlet Control Y    =      .6700
T1 ratio (HW/D)    =      1.155
T2 ratio (HW/D)    =      1.302
Slope Factor       =      -.500
```

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 57.15 ft ---> Flow = 42.85 cfs
At T2 Elev = 57.59 ft ---> Flow = 48.97 cfs

File.... S:\301\22943\Calcs\pondpack\22943_POST.PPW

OUTLET STRUCTURE INPUT DATA

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 30
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .10 cfs
Max. Q tolerance = .10 cfs

LEVEL POOL ROUTING DATA

HYG Dir = S:\301\22943\Calcs\pondpack\
Inflow HYG file = work_pad.hyg - BASIN1 IN Dev 1
Outflow HYG file = work_pad.hyg - BASIN1 OUT Dev 1

Pond Node Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 58.50 ft
Starting Volume = 1.222 ac-ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = .2000 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Infilt. cfs	Q Total cfs	2S/t + O cfs
52.50	.00	.000	.00	.00	.00
53.00	.00	.054	.00	.00	6.47
53.50	.00	.107	.00	.00	12.95
53.68	.00	.131	.00	.00	15.89
54.00	.00	.175	.00	.00	21.11
54.50	.00	.242	.00	.00	29.28
55.00	.00	.322	.00	.00	38.96
55.50	.00	.402	.00	.00	48.64
56.00	.00	.498	.00	.00	60.20
56.50	.00	.593	.00	.00	71.75
57.00	.00	.703	.00	.00	85.00
57.50	.00	.812	.00	.00	98.25
58.00	.00	1.017	.00	.00	123.06
58.50	.00	1.222	.00	.00	147.86
59.00	.12	1.444	.00	.12	174.84
59.50	.17	1.692	.00	.17	204.90
60.00	.20	1.940	.00	.20	234.94
60.50	.23	2.224	.00	.23	269.34
61.00	.36	2.508	.00	.36	303.83
61.50	.40	2.828	.00	.40	342.59

LEVEL POOL ROUTING DATA

HYG Dir = S:\301\22943\Calcs\pondpack\
Inflow HYG file = work_pad.hyg - BASIN1 IN Dev 1
Outflow HYG file = work_pad.hyg - BASIN1 OUT Dev 1

Pond Node Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 58.50 ft
Starting Volume = 1.222 ac-ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = .2000 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Infilt. cfs	Q Total cfs	2S/t + O cfs
62.00	.44	3.148	.00	.44	381.35
62.50	.46	3.507	.00	.46	424.75
63.00	.49	3.865	.00	.49	468.16
63.50	.52	4.262	.00	.52	516.23
63.70	.53	4.421	.00	.53	535.45
64.00	.78	4.659	.00	.78	564.52
64.50	1.57	5.096	.00	1.57	618.24
64.70	1.80	5.271	.00	1.80	639.65
65.00	2.39	5.534	.00	2.39	672.01
65.50	4.28	6.013	.00	4.28	731.85
66.00	6.21	6.492	.00	6.21	791.74
66.50	7.45	7.013	.00	7.45	856.02
67.00	8.48	7.534	.00	8.48	920.09
67.50	9.40	8.099	.00	9.40	989.38
68.00	10.21	8.664	.00	10.21	1058.56
68.50	10.98	9.274	.00	10.98	1133.07
69.00	11.69	9.883	.00	11.69	1207.53
69.50	12.37	10.539	.00	12.37	1287.53
70.00	12.91	11.194	.00	12.91	1367.38
70.50	27.86	11.898	.00	27.86	1467.52

LEVEL POOL ROUTING DATA

HYG Dir = S:\301\22943\Calcs\pondpack\
Inflow HYG file = work_pad.hyg - BASIN1 IN Dev 1
Outflow HYG file = work_pad.hyg - BASIN1 OUT Dev 1

Pond Node Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 58.50 ft
Starting Volume = 1.222 ac-ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = .2000 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Infilt. cfs	Q Total cfs	2S/t + O cfs
71.00	54.79	12.602	.00	54.79	1579.63
71.50	89.44	13.352	.00	89.44	1705.04
72.00	126.33	14.102	.00	126.33	1832.67

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev  1
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev  1

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    58.50 ft
Starting Volume    =    1.222 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =     32.25 cfs    at   12.2000 hrs
Peak Outflow      =       .54 cfs    at   24.2000 hrs
-----------------------------------------------------
Peak Elevation    =     63.71 ft
Peak Storage =          4.426 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       1.222
+ HYG Vol IN   =       3.726
- Infiltration =        .000
- HYG Vol OUT  =       3.720
- Retained Vol =       1.228
                   ----------
Unrouted Vol =        .000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev  2
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev  2

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    58.50 ft
Starting Volume    =    1.222 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =     48.65 cfs    at   12.2000 hrs
Peak Outflow      =      1.82 cfs    at   18.6000 hrs
-----------------------------------------------------
Peak Elevation    =     64.71 ft
Peak Storage =          5.283 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       1.222
+ HYG Vol IN   =       5.480
- Infiltration =        .000
- HYG Vol OUT  =       5.474
- Retained Vol =       1.228
                   ----------
Unrouted Vol =       -.000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev 10
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev 10

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    58.50 ft
Starting Volume    =    1.222 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =    107.21 cfs    at   12.2000 hrs
Peak Outflow      =      9.94 cfs    at   13.8000 hrs
-----------------------------------------------------
Peak Elevation    =     67.83 ft
Peak Storage =          8.477 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       1.222
+ HYG Vol IN   =      11.874
- Infiltration =        .000
- HYG Vol OUT  =      11.868
- Retained Vol =       1.228
                  ----------
Unrouted Vol =        .000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev 25
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev 25

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    58.50 ft
Starting Volume    =    1.222 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =    122.99 cfs    at   12.2000 hrs
Peak Outflow      =     11.34 cfs    at   13.8000 hrs
-----------------------------------------------------
Peak Elevation    =     68.75 ft
Peak Storage =          9.581 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       1.222
+ HYG Vol IN   =      13.631
- Infiltration =        .000
- HYG Vol OUT  =      13.626
- Retained Vol =       1.228
                  ----------
Unrouted Vol =       -.000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev 50
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev 50

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    58.50 ft
Starting Volume    =    1.222 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =    144.14 cfs    at   12.2000 hrs
Peak Outflow      =     12.86 cfs    at   13.8000 hrs
-----------------------------------------------------
Peak Elevation    =     69.95 ft
Peak Storage =         11.130 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       1.222
+ HYG Vol IN   =      16.010
- Infiltration =        .000
- HYG Vol OUT  =      16.004
- Retained Vol =       1.228
                   ----------
Unrouted Vol =       -.000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = S:\301\22943\Calcs\pondpack\
Inflow  HYG file = work_pad.hyg - BASIN1       IN  Dev100
Outflow HYG file = work_pad.hyg - BASIN1       OUT Dev100

Pond Node   Data = BASIN1
Pond Volume Data = BASIN1
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    58.50 ft
Starting Volume    =    1.222 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =    165.37 cfs    at   12.2000 hrs
Peak Outflow      =     29.59 cfs    at   13.2000 hrs
-----------------------------------------------------
Peak Elevation    =     70.53 ft
Peak Storage =         11.943 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       1.222
+ HYG Vol IN   =      18.418
- Infiltration =        .000
- HYG Vol OUT  =      18.413
- Retained Vol =       1.228
                  ----------
Unrouted Vol =        .000 ac-ft  (.000% of Inflow Volume)
```

Index of Starting Page Numbers for ID Names

----- B -----
BASIN1... 5.01, 7.01, 7.04, 7.05,
7.06, 7.07, 7.08, 7.09

----- J -----
James City Count... 2.01

----- O -----
Outlet 1... 6.01

----- T -----
TO BASIN1... 3.01, 4.01

----- W -----
Watershed... 1.01

6

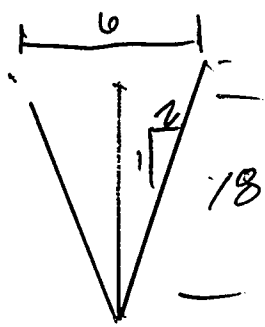
Hydraulic Grade Line Analysis

STORM SEWER DESIGN COMPUTATIONS

PROJECT: WJCC Elementary School #8 JOB # 22943
COUNTY: Williamsburg-James City County
DESCRIPTION: Storm Sewer
DATE: 4/28/2006

Storm Frequency 10 year
n = 0.013
* = Manual Input of Data

FROM POINT	PIPE NAME	TO POINT	DRAINAGE AREA (acres)	RUNOFF)EFFICIE	CA INCRE.	CA ACCUM.	INLET TIME (min)	RAIN-FALL (in/hr)	RUNOFF Q (cfs)	TOP STR (elev)	HEIGHT STR (ft)	INV UPPER (ft)	INV. LOWER (ft)	LENGTH (ft)	SLOPE (ft/ft)	DIA (in)	CAPACITY (cfs)	VELOCITY (ft/s)	FLOW TIME (min)	FLAG	Addition BLDG A	Additional C*A	STR TYPE	PIPE TYPE
1	2	3	0.87	0.60	0.52	0.52	5.00	7.00	3.7	79.47	6.27	73.20	72.50	140.42	0.0050	15	4.6	4.14	0.57	ok	0	0	DI-3C, L=6'	CLASS III RCP
3	4	5	0.22	0.76	0.17	0.69	5.57	6.90	4.8	79.71	7.47	72.25	72.16	18.50	0.0050	18	7.4	4.47	0.07	ok	0	0	DI-3B, L=4'	CLASS III RCP
45	46	5	0.27	0.78	0.21	0.21	5.00	7.00	1.5	78.61	5.20	73.41	72.31	105.03	0.0105	15	6.6	4.35	0.40	ok	0	0	DI-3B, L=6'	CLASS III RCP
5	6	7	0.00	0.30	0.00	0.69	5.63	6.88	4.7	79.30	7.25	72.06	71.40	131.53	0.0050	18	7.4	4.47	0.49	ok	0	0	MH-2	CLASS III RCP
7	8	9	0.32	0.85	0.27	0.96	6.13	6.77	6.5	78.15	6.85	71.30	66.67	146.79	0.0315	18	18.6	9.63	0.25	ok	0	0	DI-3B, L=8'	CLASS III RCP
27	28	29	4.78	0.28	1.34	1.34	20.30	4.46	6.0	72.80	6.43	66.37	65.87	100.00	0.0050	33	37.4	4.62	0.36	ok	0	0	DI-7 W/DI-1 TOI	CLASS III RCP
29	30	9	4.72	0.53	2.50	3.84	20.66	4.42	17.0	74.79	9.03	65.77	65.42	49.30	0.0070	33	44.3	6.98	0.12	ok	0	0	DI-4CC, L=10'	CLASS III RCP
9	10	11	0.39	0.85	0.33	5.13	6.38	6.71	34.4	75.27	11.10	64.17	63.26	182.00	0.0050	48	101.6	7.32	0.41	ok	0	0	DI-4BB, L=8'	CLASS III RCP
11	12	13	0.15	0.92	0.14	5.44	6.79	6.59	35.9	79.11	15.95	63.16	62.59	114.85	0.0050	48	101.6	7.40	0.26	ok	0.179	0.17005	DI-4BB, L=6'	CLASS III RCP
13	14	15	1.16	0.32	0.37	5.81	7.05	6.50	37.8	76.52	14.03	62.49	61.79	138.43	0.0050	48	101.6	7.50	0.31	ok	0	0	DI-7 W/DI-1 TOI	CLASS III RCP
15	16	17	0.33	0.77	0.25	6.07	7.36	6.44	39.1	77.32	15.63	61.69	61.20	99.26	0.0050	48	101.6	7.57	0.22	ok	0	0	DI-4BB, L=8'	CLASS III RCP
47	48	17	2.61	0.30	0.78	0.78	18.00	4.71	3.7	78.50	4.00	74.50	63.70	158.00	0.0684	18	27.5	10.85	0.24	ok	0	0	DI-1	CLASS III RCP
17	18	19	1.67	0.32	0.53	7.39	7.58	6.40	47.3	75.51	14.42	61.10	60.36	147.01	0.0050	48	101.6	7.95	0.31	ok	0	0	DI-7 W/DI-1 TOI	CLASS IV RCP
19	20	21	0.00	0.30	0.00	7.53	7.89	6.34	47.8	79.31	19.05	60.26	59.13	227.08	0.0050	48	101.6	7.97	0.48	ok	0.154	0.1463	MH-2	CLASS IV RCP
21	22	23	3.11	0.42	1.31	8.84	8.36	6.24	55.2	77.00	17.97	59.03	58.05	194.92	0.0050	48	101.6	8.27	0.39	ok	0	0	DI-7 W/DI-1 TOI	CLASS IV RCP
31	32	33	2.42	0.61	1.48	1.48	5.00	7.00	10.3	80.50	7.66	72.84	71.88	191.94	0.0050	21	11.2	5.30	0.60	ok	0	0	DI-3B, L=4'	N-12 PERF
33	34	35	0.00	0.30	0.00	1.48	5.60	6.88	10.2	81.04	9.26	71.78	71.11	134.05	0.0050	21	11.2	5.29	0.42	ok	0	0	MH-2	CLASS III RCP
43	44	35	2.62	0.50	1.31	1.31	16.70	4.87	6.4	76.50	4.00	72.50	71.36	53.00	0.0215	18	15.4	8.33	0.11	ok	0	0	DI-3C, L=12'	CLASS III RCP
35	36	37	0.00	0.30	0.00	2.79	6.03	6.80	18.9	79.54	8.93	70.61	70.12	99.01	0.0050	27	21.9	6.21	0.27	ok	0	0	MH-2	CLASS III RCP
37	38	39	0.00	0.30	0.00	3.40	6.29	6.74	22.9	81.18	11.31	69.87	68.88	196.01	0.0050	30	29.0	6.56	0.50	ok	0.644	0.6118	MH-2	CLASS III RCP
39	40	41	3.40	0.27	0.92	5.41	6.79	6.59	35.6	78.50	9.72	68.78	66.75	203.90	0.0100	30	41.0	9.43	0.36	ok	1.15	1.0925	DI-7 W/DI-1 TOI	CLASS III RCP
41	42	23	0.94	0.58	0.55	5.95	7.15	6.48	38.6	77.00	10.35	66.65	59.55	203.11	0.0349	30	76.7	15.67	0.22	ok	0	0	DI-7 W/DI-1 TOI	CLASS IV RCP
23	24	25	0.00	0.30	0.00	14.79	8.75	6.16	91.1	82.00	24.05	57.95	52.91	127.00	0.0397	48	286.3	20.27	0.10	ok	0	0	MH-2	CLASS V O-RING
25	26	END	0.00	0.30	0.00	14.79	8.86	6.14	90.8	72.50	19.69	52.81	52.50	62.00	0.0050	48	101.6	9.16	0.11	ok	0	0	MH-2	CLASS IV O-RING



z = 2
d = 1.5
18" = 1.5'
A = zd² = 4.5 ft²
P = 6.83

Hydraulic Grade Line Analysis

Mannings N Value: 0.013 Job #: 22943 Project: WJCC Elementary School #8 Date: 4/27/2006

Initial Water Surface Elevation	Inlet Sta.	Inlet Q	Outfall Invert Elev.	Outlet Water Surf. Elev.	Do	Qo	Lo	Sfo %	Hf	Vo	Ho	Qi	Vi	QiVi	Junction Loss Vi sq. 2g	Hi	Ang.	H delta	Ht	1.30 Ht	0.50 Ht	Final H	Inlet Water Surf. Elev.	Rim Elev.	Fig. Hi Y/N	Fig. H delta Y/N	Shap Inlet Y/N	Comments 10 year Storm
67.80	25		52.50	67.80	48"	90.82	62.0	0.40%	0.25	7.23	0.20	91.12	7.25	660.7	0.82	0.29			0.49		0.24	0.49	68.29	72.50	y	y	Y	OK -4.21 Ft.
68.29	23		52.91	68.29	48"	91.12	127.0	0.40%	0.51	7.25	0.20	55.15	4.39	242.0	0.30	0.10	90	0.21	0.52		0.26	0.77	69.06	82.00	y	y	Y	OK -12.94 Ft.
69.06	21	8.15	58.05	69.06	48"	55.15	194.9	0.15%	0.29	4.39	0.07	47.75	3.80	181.5	0.22	0.08	37	0.09	0.24		0.12	0.41	69.47	77.00	y	y	Y	OK -7.53 Ft.
69.47	19		59.13	69.47	48"	47.75	227.1	0.11%	0.25	3.80	0.06	47.27	3.76	177.8	0.22	0.08	30	0.06	0.19		0.10	0.35	69.82	79.31	y	y	Y	OK -9.50 Ft.
69.82	17	3.42	60.36	69.82	48"	47.27	147.0	0.11%	0.16	3.76	0.05	39.08	3.11	121.5	0.15	0.05	68	0.09	0.20		0.10	0.26	70.08	75.51	y	y	Y	OK -5.44 Ft.
70.08	15	1.64	61.20	70.08	48"	39.08	99.3	0.07%	0.07	3.11	0.04	37.79	3.01	113.7	0.14	0.05	12	0.01	0.10		0.05	0.12	70.20	77.32	y	y	Y	OK -7.12 Ft.
70.20	13	2.43	61.79	70.20	48"	37.79	138.4	0.07%	0.10	3.01	0.04	35.86	2.85	102.3	0.13	0.04	90	0.09	0.17		0.08	0.18	70.38	76.52	y	y	Y	OK -6.13 Ft.
70.38	11	0.91	62.59	70.38	48"	35.86	114.9	0.06%	0.07	2.85	0.03	34.44	2.74	94.4	0.12	0.04	71	0.08	0.15		0.07	0.15	70.53	79.11	y	y	Y	OK -8.58 Ft.
70.53	9	2.22	63.26	70.53	48"	34.44	182.0	0.06%	0.10	2.74	0.03	6.51	3.68	24.0	0.21	0.07	99	0.15	0.25		0.13	0.23	70.76	75.27	y	y	Y	OK -4.51 Ft.
70.76	7	1.84	66.67	70.76	18"	6.51	146.8	0.38%	0.56	3.68	0.05	4.74	2.68	12.7	0.11	0.04	6	0.01	0.10	0.13	0.07	0.63	71.39	78.15	y	y	Y	OK -6.76 Ft.
71.39	5		71.40	72.60	18"	4.74	131.5	0.20%	0.27	2.68	0.03	4.76	2.69	12.8	0.11	0.04			0.07		0.03	0.30	72.90	79.30	y	y	Y	OK -6.41 Ft.
72.90	3	1.15	72.16	73.36	18"	4.76	18.5	0.20%	0.04	2.69	0.03	3.65	2.98	10.9	0.14	0.05	23	0.03	0.11	0.14	0.07	0.11	73.46	79.71	y	y	Y	OK -6.25 Ft.
73.46	1	3.65	72.50	73.50	15"	3.65	140.4	0.32%	0.45	2.98	0.03								0.03	0.04	0.02	0.47	73.97	79.47	y	y	Y	OK -5.50 Ft.
69.06	41	3.53	59.55	69.06	30"	38.58	203.1	0.88%	1.80	7.86	0.24	34.44	7.26	250.1	0.82	0.29	67	0.50	1.03		0.51	2.31	71.37	77.00	y	y	Y	OK -5.63 Ft.
71.37	39	6.05	66.75	71.37	30"	35.64	203.9	0.76%	1.54	7.26	0.20	6.51	4.67	30.4	0.34	0.12	13	0.03	0.36		0.18	1.72	73.09	78.50	y	y	Y	OK -5.41 Ft.
73.09	37		68.88	73.09	30"	22.90	196.0	0.31%	0.61	4.67	0.08	4.74	4.76	22.6	0.35	0.12	15	0.04	0.24		0.12	0.73	73.82	81.18	y	y	Y	OK -7.35 Ft.
73.82	35		70.12	73.82	27"	18.95	99.0	0.37%	0.37	4.76	0.09	4.76	4.22	20.1	0.28	0.10	90	0.20	0.38		0.19	0.56	74.39	79.54	y	y	Y	OK -5.15 Ft.
74.39	33		71.11	74.39	21"	10.16	134.0	0.41%	0.55	4.22	0.07	3.65	4.30	15.7	0.29	0.10	68	0.17	0.34		0.17	0.72	75.11	81.04	y	y	Y	OK -5.93 Ft.
75.11	31	10.33	71.88	75.11	21"	10.33	191.9	0.43%	0.82	4.30	0.07								0.07	0.09	0.05	0.86	75.97	80.50	y	y	Y	OK -4.53 Ft.
70.76	29	11.06	65.42	70.76	33"	16.97	49.3	0.10%	0.05	2.86	0.03	3.65	1.00	3.7	0.02	0.01	12	0.00	0.04	0.05	0.03	0.08	70.83	74.79	y	y	Y	OK -3.96 Ft.
70.83	27	5.97	65.87	70.83	33"	5.97	100.0	0.01%	0.01	1.00	0.00								0.00	0.01	0.00	0.02	70.85	72.80	y	y	Y	OK -1.95 Ft.
72.90	45	1.47	72.31	73.31	15"	1.47	105.0	0.05%	0.05	1.20	0.01								0.01	0.01	0.00	0.06	73.37	78.61	y	y	Y	OK -5.24 Ft.
74.39	43	6.38	71.36	74.39	18"	6.39	53.0	0.37%	0.20	3.61	0.05								0.05	0.07	0.03	0.23	74.61	76.50	y	y	Y	OK -1.89 Ft.

All Channels Report

Label	Worksheet Type	Mannings Coefficient	Slope (%)	Depth (ft)	Left Side Slope (ft/ft (H:V))	Right Side Slope (ft/ft (H:V))	Bottom Width (ft)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	Critical Depth (ft)	Critical Slope (%)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
A-A_10YR	Trapezoidal	0.030	0.60	0.56	3.00	3.00	1.00	1.5	4.57	4.39	0.42	2.14	1.84	0.05	0.62	0.55	Subcritical
A-A_2YR	Trapezoidal	0.030	0.60	0.49	3.00	3.00	1.00	1.2	4.13	3.97	0.36	2.22	1.71	0.05	0.54	0.54	Subcritical
B-B_10YR	Trapezoidal	0.030	1.20	0.06	20.00	25.00	5.00	0.4	7.82	7.81	0.04	3.89	0.75	0.01	0.07	0.58	Subcritical
B-B_2YR	Trapezoidal	0.030	1.20	0.06	20.00	25.00	5.00	0.4	7.82	7.81	0.04	3.89	0.75	0.01	0.07	0.58	Subcritical
C-C_10YR	Trapezoidal	0.030	1.00	0.30	3.00	4.00	1.00	0.6	3.17	3.08	0.24	2.48	1.65	0.04	0.34	0.65	Subcritical
C-C_2YR	Trapezoidal	0.030	1.00	0.27	3.00	4.00	1.00	0.5	2.94	2.87	0.21	2.56	1.55	0.04	0.30	0.64	Subcritical
D-D_10YR	Trapezoidal	0.030	1.00	0.34	3.00	3.00	1.00	0.7	3.12	3.01	0.27	2.40	1.78	0.05	0.38	0.66	Subcritical
D-D_2YR	Trapezoidal	0.030	1.00	0.29	3.00	3.00	1.00	0.5	2.84	2.75	0.23	2.50	1.65	0.04	0.33	0.65	Subcritical
E-E_10YR	Trapezoidal	0.030	1.00	0.31	3.00	3.00	1.00	0.6	2.94	2.84	0.24	2.46	1.70	0.04	0.35	0.66	Subcritical
E-E_2YR	Trapezoidal	0.030	1.00	0.26	3.00	3.00	1.00	0.5	2.62	2.54	0.20	2.59	1.54	0.04	0.29	0.64	Subcritical
F-F_10YR	Trapezoidal	0.030	1.00	0.28	4.00	4.00	4.00	1.4	6.29	6.22	0.22	2.33	1.83	0.05	0.33	0.68	Subcritical
F-F_2YR	Trapezoidal	0.030	1.00	0.25	4.00	4.00	4.00	1.2	6.03	5.97	0.19	2.42	1.71	0.05	0.29	0.67	Subcritical
G-G_10YR	Trapezoidal	0.030	1.00	0.30	4.00	4.00	4.00	1.6	6.48	6.40	0.24	2.27	1.92	0.06	0.36	0.69	Subcritical
G-G_2YR	Trapezoidal	0.030	1.00	0.27	4.00	4.00	4.00	1.3	6.19	6.12	0.21	2.36	1.79	0.05	0.31	0.67	Subcritical
H-H_10YR	Trapezoidal	0.030	3.00	0.05	4.00	4.50	4.00	0.2	4.39	4.38	0.04	3.84	1.06	0.02	0.06	0.89	Subcritical
H-H_2YR	Trapezoidal	0.030	3.00	0.03	4.00	4.50	4.00	0.1	4.26	4.25	0.03	4.44	0.81	0.01	0.04	0.84	Subcritical
I-I_10YR	Trapezoidal	0.030	2.70	0.18	4.00	3.00	1.00	0.3	2.31	2.26	0.18	2.67	2.05	0.07	0.24	1.01	Supercritical
I-I_2YR	Trapezoidal	0.030	2.70	0.16	4.00	3.00	1.00	0.3	2.19	2.14	0.16	2.74	1.95	0.06	0.22	0.99	Subcritical
J-J_10YR	Trapezoidal	0.030	1.80	0.18	4.00	4.00	4.00	0.8	5.47	5.43	0.16	2.54	1.91	0.06	0.23	0.85	Subcritical
J-J_2YR	Trapezoidal	0.030	1.80	0.16	4.00	4.00	4.00	0.7	5.30	5.26	0.14	2.64	1.78	0.05	0.21	0.84	Subcritical
K-K_10YR	Trapezoidal	0.030	2.60	0.25	3.00	3.00	1.00	0.4	2.60	2.52	0.26	2.43	2.46	0.09	0.35	1.03	Supercritical
K-K_2YR	Trapezoidal	0.030	2.60	0.23	3.00	3.00	1.00	0.4	2.45	2.37	0.23	2.50	2.33	0.08	0.31	1.02	Supercritical
L-L_10YR	Trapezoidal	0.030	1.70	0.11	5.50	5.50	1.00	0.2	2.20	2.18	0.09	3.25	1.17	0.02	0.13	0.74	Subcritical
L-L_2YR	Trapezoidal	0.030	1.70	0.07	5.50	5.50	1.00	0.1	1.83	1.82	0.06	3.63	0.96	0.01	0.09	0.70	Subcritical
M-M_10YR	Trapezoidal	0.030	1.90	0.16	4.00	4.00	4.00	0.7	5.28	5.25	0.14	2.64	1.81	0.05	0.21	0.86	Subcritical
M-M_2YR	Trapezoidal	0.030	1.90	0.14	4.00	4.00	4.00	0.6	5.16	5.13	0.13	2.72	1.71	0.05	0.19	0.85	Subcritical
N-N_10YR	Trapezoidal	0.030	3.40	0.14	4.00	4.00	4.00	0.6	5.13	5.10	0.15	2.60	2.24	0.08	0.22	1.13	Supercritical
N-N_2YR	Trapezoidal	0.030	3.40	0.13	4.00	4.00	4.00	0.6	5.03	5.00	0.13	2.68	2.12	0.07	0.20	1.11	Supercritical

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STORM SEWER DESIGN COMPUTATIONS

J.N. 22943 **PROJECT** JCC E.S. #8

L&D 229 COUNTY JAMES CITY COUNTY

STORM SEWER DESIGN COMPUTATIONS

DESIGNED BY MBP 4/26/2006

CHECKED BY DATE 4/26/2006

FROM	TO	AREA DRAIN. "A" acres	RUN-OFF COEF. C	CA INCRE-MENT	CA ACCUM-ULATED	INLET TIME tc min.	RAIN-FALL I-10 yr. in/hr	RUN-OFF Q c.f.s.	INV. ELEV. IN	INV. ELEV. OUT	LEN. ft.	SLOPE %	DIA. in.	FULL FLOW RATE c.f.s.	VEL. 10 yr. f.p.s.	FLOW TIME min.	RUN-OFF 100 yr. c.f.s.	VEL. 100 yr. f.p.s.
- 1 -	- 2 -	- 3 -	- 4 -	- 5 -	- 6 -	- 7 -	- 8 -	- 9 -	- 10 -	- 11 -	- 12 -	- 13 -	- 14 -	- 15 -	- 16 -	- 17 -	- 18 -	- 19 -
3-1	3-2	2.23	0.4	0.89	0.89	15	5.2	**4.6**	71.58	68.75	54	5.24%	15	15.8	10.0	0.1	**8.0**	8.0
3-2	3-3	1.42	0.6	0.85	1.74	15	5.2	**9.1**	68.50	67.17	166	0.80%	24	10.1	6.0	0.5	**15.7**	
3-4	3-5	0.12	0.6	0.07	0.07	5	7.1	**0.5**	78.00	77.60	80	0.50%	15	4.9	2.2	0.6	**0.9**	
4-1	4-2	0.66	0.9	0.59	0.59	10	6	**3.6**	77.00	74.10	60	4.83%	15	15.7	7.9	0.1	**6.2**	
4-2	4-4	0.41	0.7	0.29	0.88	10	6	**5.3**	74.00	73.34	104	0.63%	15	6.2	5.0	0.3	**9.3**	
4-3	4-4	1.25	0.4	0.50	0.50	13	5.5	**2.8**	77.00	76.61	78	0.50%	15	4.9	4.0	0.3	**4.8**	

Hydraulic Grade Line Calculations

Mannings N Value: 0.013 Job #: 22943 Project: wjcc es #8 Prepared by: mbp

Override Outlet Water Surface Elevation	Inlet Sta.	Inlet Q	Outfall Invert Elev.	Outlet Water Surf. Elev.	Do	Qo	Lo	Sfo %	Hf	Junction Loss Vo	Ho	Qi	Vi	QiVi	Vi sq. 2g	Hi	Ang.	H delta	Ht	1.30 Ht	0.50 Ht	Final H	Inlet Water Surf. Elev.	Rim Elev.	Fig. Hi Y/N	Fig. H delta Y/N	Shap Inlet Y/N	Comments	
70.83	3-2	4.42	67.17	70.83	24"	9.1	166.0	0.16%	0.27	6.0	0.14	4.6	10.0	46.2	1.57	0.55	40	0.59	1.28	1.67	0.83	1.10	71.93	72.00	y	Y	y	OK	-0.07 Ft.
71.93	3-1	4.60	68.75	71.93	15"	4.6	54.0	0.51%	0.27	10.0	0.39								0.39	0.50	0.25	0.53	72.46	72.83	y	y	y	OK	-0.37 Ft.
																									y	y	n	OK	
	3-4	0.50	75.00	76.00	15"	0.5	80.0	0.01%	0.00	2.2	0.02								0.02	0.02		0.03	76.03	78.85	y	y	n	OK	-2.82 Ft.
																									y	y	n	OK	
75.97	4-2	1.70	73.34	75.97	15"	5.3	83.0	0.67%	0.56	5.0	0.10	3.6	7.9	28.4	0.97	0.34	60	0.53	0.97	1.26	0.63	1.19	77.16	77.25	y	y	y	OK	-0.09 Ft.
75.76	4-1	3.60	73.34	75.76	15"	3.6	56.0	0.31%	0.17	7.9	0.24								0.24	0.31		0.49	76.25	78.25	y	y	n	OK	-2.00 Ft.
																									y	y	n	OK	
75.97	4-3	2.80	76.61	75.97	15"	2.8	78.0	0.19%	0.15	4.0	0.06								0.06	0.08		0.23	76.20	78.25	y	y	n	OK	-2.05 Ft.
																									y	y	n	OK	
																									y	y	n	OK	

Roadside Ditch Computations

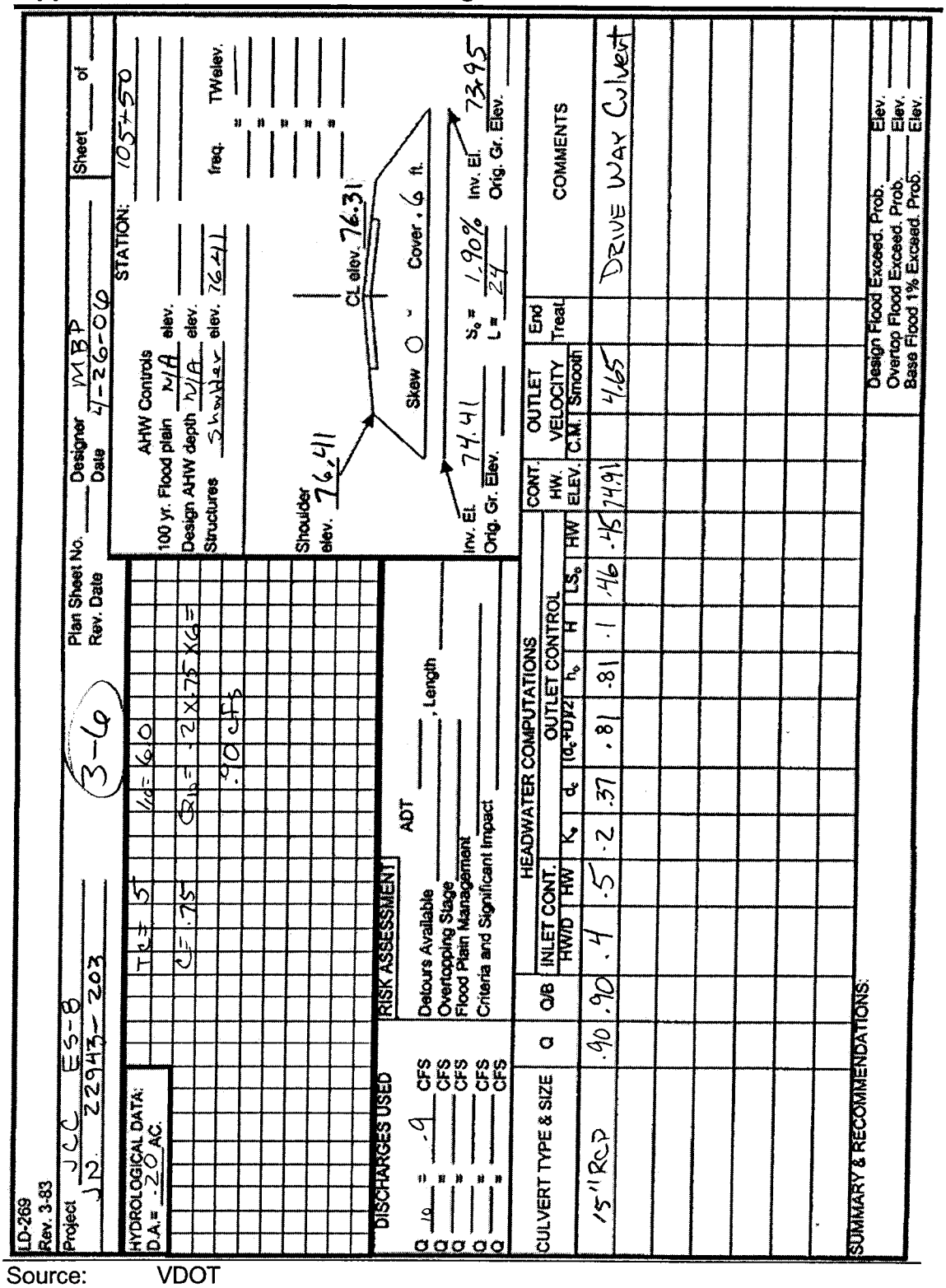
Project Name: JCC E.S. #8 **Job Number:** 22943 **Designed By:** MBP

Road Name: Brick Bat Road

Side: left

Reverse Stations?	Sta From	Sta To	T_c (min)	C Value	Area (ac.)	CA accum	I_2 (in/hr)	Q_2 (cfs)	Slope (ft/ft)	Max S=5.0% Max V=2.5 fps Earth (n=0.03) Vel.	Earth (n=0.03) Depth	Max V=4.0 fps Jute(Sod) (n=0.05) Vel.	Jute(Sod) (n=0.05) Depth	Paved (n=0.015) Vel.	Paved (n=0.015) Depth	I_{10} (in/hr)	Q_{10} (cfs)	$Depth_{10}$ (ft)	Min.Design (Depth)	Min.Design (Type)
n	101+50	103+00	5	0.60	0.07	0.04	5.6	0.2	0.0140	*1.4 fps*	0.24 ft	*0.9 fps*	0.29 ft	*2.2 fps*	0.19 ft	7.1	0.3	0.27 ft	3"	Earth
n	103+00	104+00	6	0.60	0.06	0.08	5.4	0.4	0.0140	*1.6 fps*	0.30 ft	*1.0 fps*	0.37 ft	*2.7 fps*	0.23 ft	6.9	0.5	0.33 ft	4"	Earth
n	104+00	105+00	7	0.60	0.06	0.11	5.2	0.6	0.0046	*1.1 fps*	0.42 ft	*0.8 fps*	0.51 ft	*1.8 fps*	0.33 ft	6.7	0.8	0.46 ft	5"	Earth
n	105+00	106+00	8	0.60	0.06	0.15	4.9	0.7	0.0108	*1.6 fps*	0.39 ft	*1.1 fps*	0.47 ft	*2.7 fps*	0.30 ft	6.5	1.0	0.43 ft	5"	Earth
n	106+00	107+00	9	0.60	0.06	0.19	4.7	0.9	0.0134	*1.8 fps*	0.40 ft	*1.3 fps*	0.48 ft	*3.0 fps*	0.31 ft	6.2	1.2	0.44 ft	5"	Earth
n	107+00	108+00	10	0.60	0.06	0.22	4.6	1.0	0.0084	*1.6 fps*	0.46 ft	*1.1 fps*	0.56 ft	*2.6 fps*	0.36 ft	6.0	1.3	0.51 ft	6"	Earth
n	108+00	109+11	11	0.60	0.07	0.26	4.4	1.2	0.0112	*1.8 fps*	0.46 ft	*1.3 fps*	0.55 ft	*3.2 fps*	0.35 ft	5.8	1.5	0.51 ft	6"	Earth
y	109+11	110+00	9	0.60	0.18	0.59	4.7	2.8	0.0054	*1.7 fps*	0.73 ft	*1.2 fps*	0.88 ft	*2.9 fps*	0.56 ft	6.2	3.7	0.80 ft	9"	Earth
y	110+00	111+00	8	0.60	0.20	0.48	4.9	2.4	0.0092	*2.0 fps*	0.62 ft	*1.4 fps*	0.75 ft	*3.4 fps*	0.48 ft	6.5	3.1	0.69 ft	8"	Earth
y	111+00	112+00	7	0.60	0.20	0.36	5.2	1.9	0.0092	*1.9 fps*	0.57 ft	*1.3 fps*	0.69 ft	*3.2 fps*	0.44 ft	6.7	2.4	0.62 ft	7"	Earth
y	112+00	113+00	6	0.60	0.20	0.24	5.4	1.3	0.0352	*2.8 fps*	0.39 ft	*2.0 fps*	0.47 ft	*4.8 fps*	0.30 ft	6.9	1.7	0.51 ft	6"	Jute
y	113+00	113+50	5	0.60	0.20	0.12	5.6	0.7	0.0196	*1.9 fps*	0.34 ft	*1.3 fps*	0.41 ft	*3.3 fps*	0.26 ft	7.1	0.9	0.37 ft	4"	Earth
n	113+50	114+00	5	0.70	0.04	0.01	5.6	0.1	0.0040	*0.6 fps*	0.18 ft	*0.4 fps*	0.22 ft	*1.0 fps*	0.14 ft	7.1	0.1	0.20 ft	2"	Earth
n	114+00	115+00	6	0.70	0.08	0.03	5.4	0.2	0.0198	*1.4 fps*	0.20 ft	*0.9 fps*	0.24 ft	*2.1 fps*	0.16 ft	6.9	0.2	0.22 ft	2"	Earth
n	115+00	116+00	7	0.70	0.08	0.07	5.2	0.4	0.0112	*1.3 fps*	0.30 ft	*0.9 fps*	0.36 ft	*2.3 fps*	0.23 ft	6.7	0.5	0.33 ft	4"	Earth
y	116+00	117+00	5	0.70	0.21	0.15	5.6	0.8	0.0110	*1.7 fps*	0.40 ft	*1.1 fps*	0.49 ft	*2.9 fps*	0.31 ft	7.1	1.0	0.44 ft	5"	Earth
y	117+00	118+00	13	0.40	0.38	0.50	4.1	2.1	0.0034	*1.4 fps*	0.71 ft	*0.9 fps*	0.85 ft	*2.3 fps*	0.55 ft	5.5	2.8	0.61 ft	7"	
y	118+00	119+00	12	0.40	0.42	0.35	4.3	1.5	0.0230	*2.6 fps*	0.44 ft	*1.8 fps*	0.53 ft	*4.3 fps*	0.34 ft	5.7	2.0	0.59 ft	6"	Jute
y	119+00	120+00	11	0.40	0.30	0.18	4.4	0.8	0.0264	*2.3 fps*	0.34 ft	*1.6 fps*	0.41 ft	*3.9 fps*	0.26 ft	5.8	1.0	0.45 ft	5"	Jute
y	120+00	120+50	10	0.40	0.15	0.06	4.6	0.3	0.0080	*1.1 fps*	0.29 ft	*0.8 fps*	0.35 ft	*1.9 fps*	0.22 ft	6.0	0.4	0.32 ft	4"	Earth
n	120+50	122+00	5	0.60	0.07	0.04	5.6	0.2	0.0140	*1.4 fps*	0.24 ft	*0.9 fps*	0.29 ft	*2.2 fps*	0.19 ft	7.1	0.3	0.27 ft	3"	Earth

Appendix 8B-1 Culvert Design Form LD-269



LD-269
Rev. 3-83

Project JCC ES-8 / 22943-203 — Plan Sheet No. ____ Rev. Date ____ — Designer MBP — Date 4-26-06 — Sheet ____ of ____

3-6

STATION: 105+50

AHW Controls
100 yr. Flood plain N/A elev. ____
Design AHW depth N/A elev. ____
Structures Shoulder elev. 76.41 freq. ____ TWelev. ____

HYDROLOGICAL DATA: D.A.= .20 AC.
Tc = 5 Id = 6.0
C = .75 Qp = .2 X .75 X 6 = .90 CFS

Shoulder elev. 76.41 — CL elev. 76.31 — Skew 0° — Cover 6 ft. — Inv. El. 74.41 — Orig. Gr. Elev. ____ — S_o = 1.90% — L = 24 — Inv. El. 73.95 — Orig. Gr. Elev. ____

DISCHARGES USED
Q10 = .9 CFS
Q = ____ CFS
Q = ____ CFS
Q = ____ CFS
Q = ____ CFS

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

HEADWATER COMPUTATIONS

CULVERT TYPE & SIZE	Q	Q/B	INLET CONT. HW/D	INLET CONT. HW	K_e	d_c	OUTLET CONTROL $(d_c+D)/2$	h_o	H	LS_o	HW	CONT. HW. ELEV.	OUTLET VELOCITY C.M.	OUTLET VELOCITY Smooth	End Treat.	COMMENTS
15" RCP	.90	.90	.4	.5	.2	.37	.81	.81	.1	.46	.45	74.91		4.65		DRIVE WAY Culvert

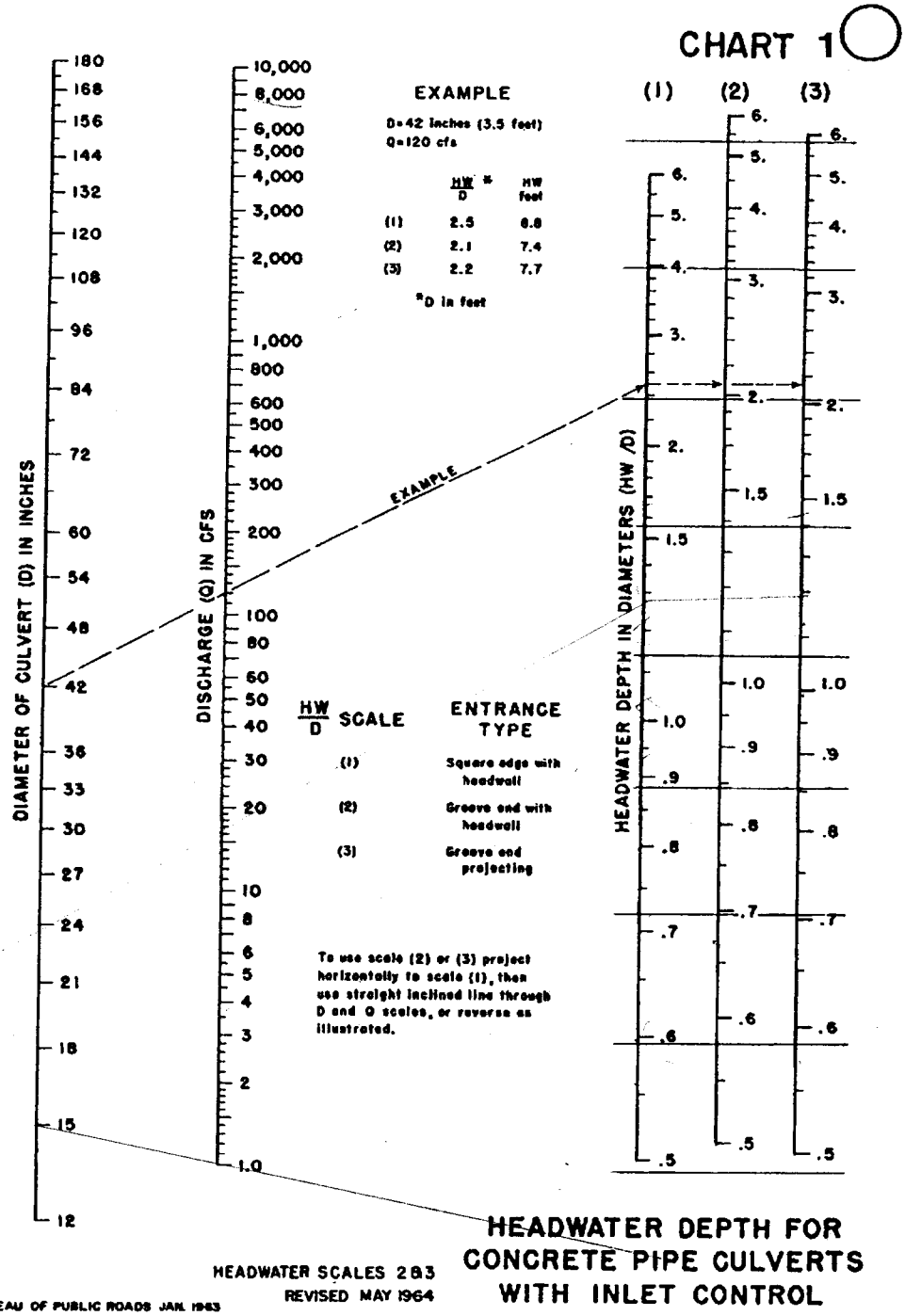
SUMMARY & RECOMMENDATIONS:
Design Flood Exceed. Prob. ____ Elev. ____
Overtop Flood Exceed. Prob. ____ Elev. ____
Base Flood 1% Exceed. Prob. ____ Elev. ____

Source: VDOT

JN 22943-203

Appendix 8C-1 Inlet Control, Circular Concrete

3-6



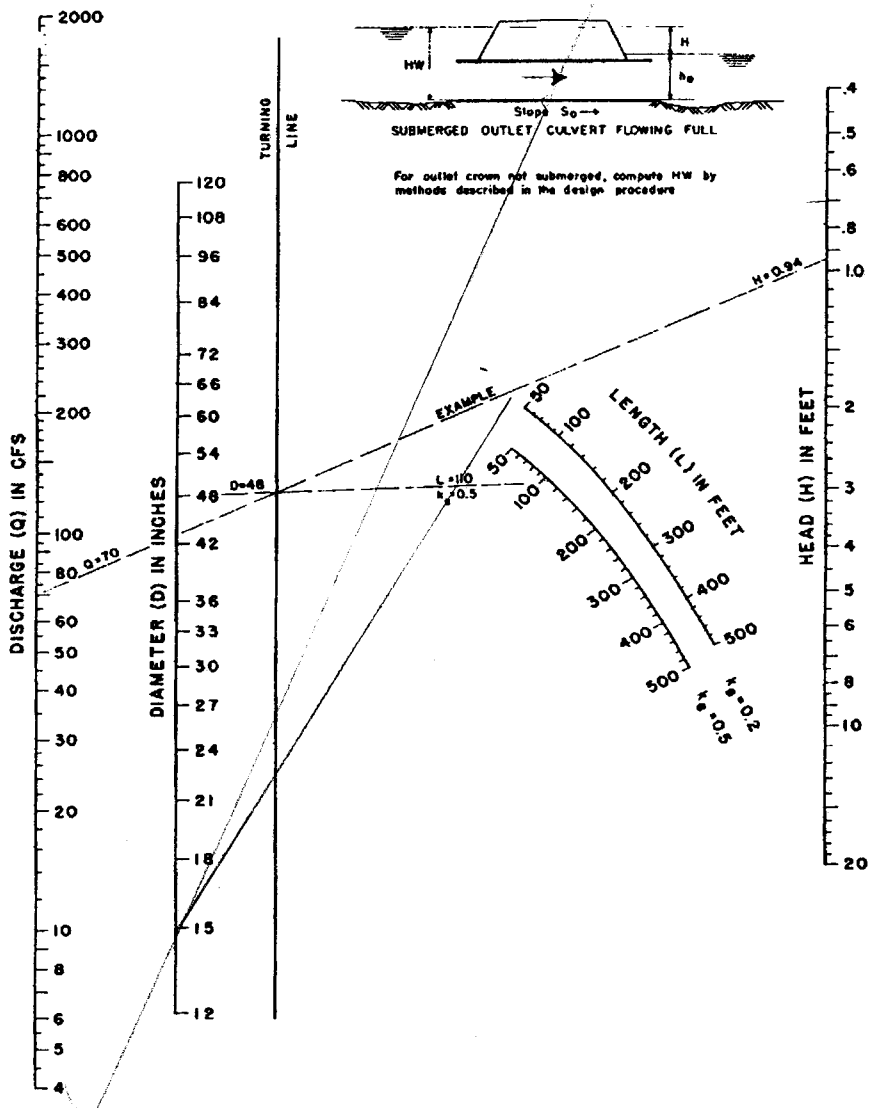
Source: HDS -5

JN 22943-203

Appendix 8C-5 Outlet Control, Circular Concrete

3-6

CHART 5



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963

Source: HDS-5

Geotechnical Engineering Study