CERTIFICATE OF AUTHENTICITY

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

BMP NUMBER: **JR038**

DATE VERIFIED: **June 14, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

DATE: March 12, 2010

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

FROM: Jo Anna Ripley, Stormwater

PO: 270712

RE: Files Approved for Scanning

General File ID or BMP ID: JR038

PIN: 5920100055

Subdivision, Tract, Business or Owner Name (if known): James River Commerce Center

Property Description: Stormwater Management Parcel

Site Address: 8903 Columbia Drive

(For internal use only) **Box** 18 **Drawer:** N/A

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

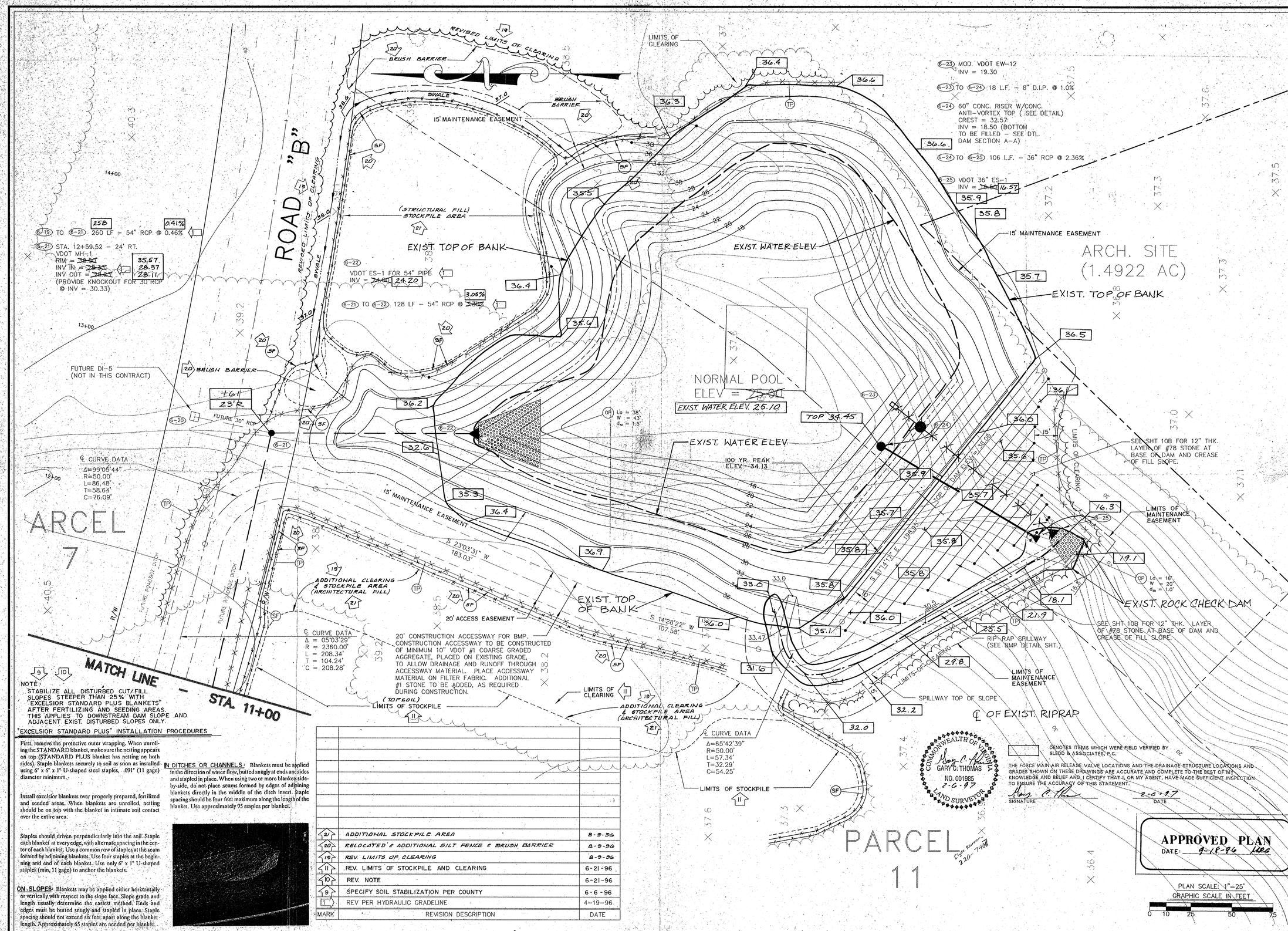
Comments

JR038

Contents for Stormwater Management Facilities As-built Files

Each file is to contain:

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



NOTE:
STABILIZE ALL DISTURBED CUT/FILL SLOPES STEEPER THAN 25% WITH "EXCELSIOR STANDARD PLUS BLANKETS" AFTER FERTILIZING AND SEEDING AREAS. THIS APPLIES TO DOWNSTREAM DAM SLOPE AND ADJACENT EXIST. DISTURBED SLOPES ONLY.

"EXCELSIOR STANDARD PLUS" INSTALLATION PROCEDURES

First, remove the protective outer wrapping. When unrolling the STANDARD blanket, make sure the netting appears on top (STANDARD PLUS blanket has netting on both sides). Staple blankets securely to soil as soon as installed using 6" x 6" x 1" U-shaped steel staples, .091" (11 gage) diameter minimum.

Install excelsior blankets over properly prepared, fertilized and seeded areas. When blankets are unrolled, netting should be on top with the blanket in intimate soil contact over the entire area.

Staples should driven perpendicularly into the soil. Staple each blanket at every edge, with alternate spacing in the center of each blanket. Use a common row of staples at the seam formed by adjoining blankets. Use four staples at the beginning and end of each blanket. Use only 6" x 1" U-shaped staples (min, 11 gage) to anchor the blankets.

ON SLOPES: Blankets may be applied either horizontally or vertically with respect to the slope face. Slope grade and length usually determine the easiest method. Ends and edges must be butted snugly and stapled in place. Staple spacing should not exceed six feet apart along the blanket length. Approximately 65 staples are needed per blanket.

IN DITCHES OR CHANNELS: Blankets must be applied in the direction of water flow, butted snugly at ends and sides and stapled in place. When using two or more blankets side-by-side, do not place seams formed by edges of adjoining blankets directly in the middle of the ditch invert. Staple spacing should be four feet maximum along the length of the blanket. Use approximately 95 staples per blanket.

MARK	REVISION DESCRIPTION	DATE
21	ADDITIONAL STOCKPILE AREA	8-9-96
20	RELOCATED & ADDITIONAL SILT FENCE & BRUSH BARRIER	8-9-96
19	REV. LIMITS OF CLEARING	8-9-96
11	REV. LIMITS OF STOCKPILE AND CLEARING	6-21-96
10	REV. NOTE	6-21-96
9	SPECIFY SOIL STABILIZATION PER COUNTY	6-6-96
1	REV PER HYDRAULIC GRADELINE	4-19-96

COMMONWEALTH OF VIRGINIA
JOHN L. HUTCHERSON
No. 7752
PROFESSIONAL ENGINEER
4/23/96

Langley and McDonald, P.C.
Engineers • Surveyors • Planners
Landscape Architects • Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

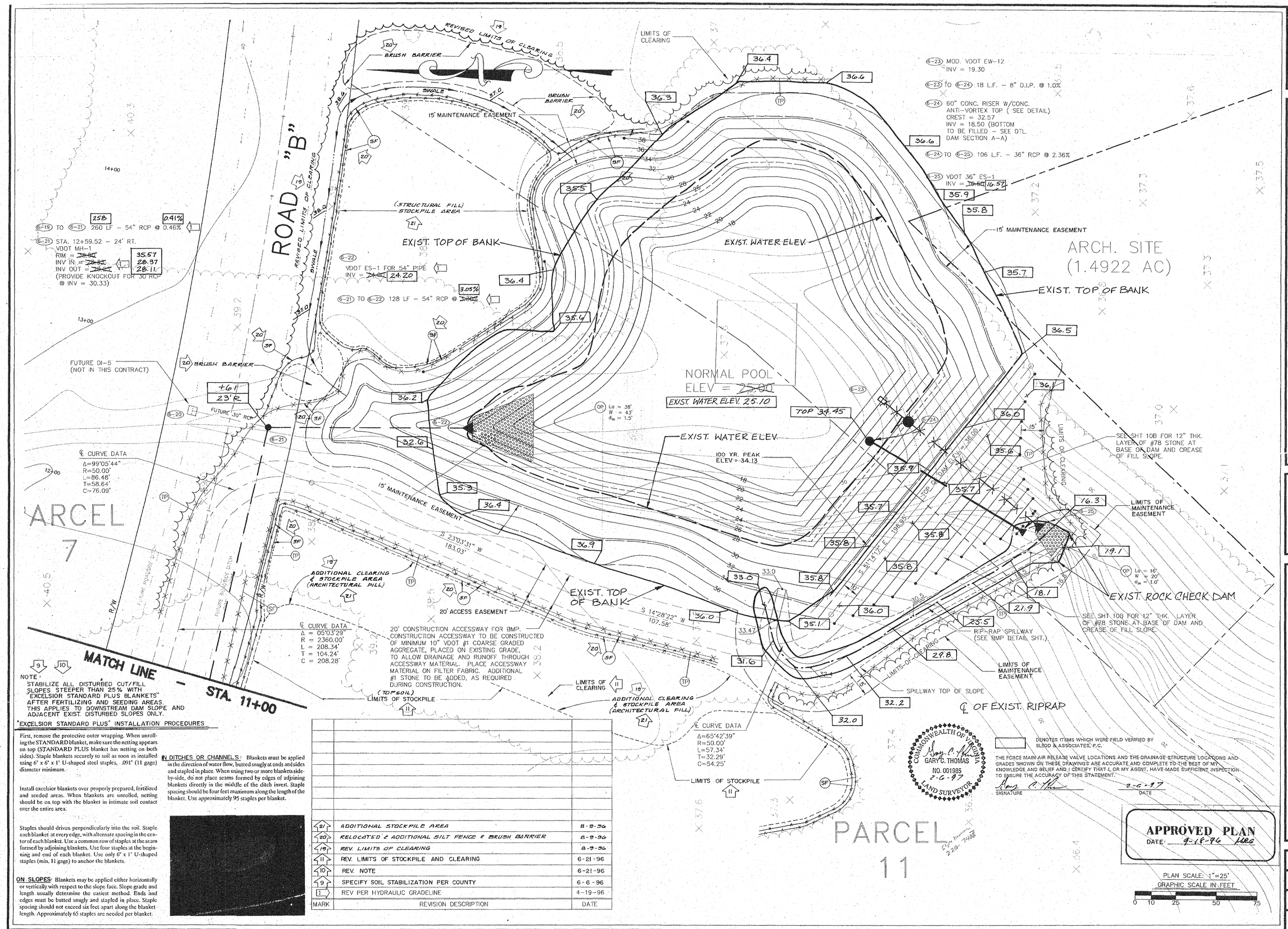
DES.	MRG
DWN.	MRG
CHK.	NHM
DATE	4-4-96

RECORD DRAWING
ENTRANCE ROAD PLAN
James River Commerce Center
JAMES CITY COUNTY, VIRGINIA

PROJ. NO. 95016-28
SCALE: 1" = 25'
RECORD DRAWING
8 OF 8
DWG. 6210Y.W

JR038; SP-82-97

JR038_JAMES_RIVER_COMMERCE_CENTER - 004



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DENOTES ITEMS WHICH WERE FIELD VERIFIED BY SLBDD & ASSOCIATES, P.C.

THE FORCE MAIN AIR RELEASE VALVE LOCATIONS AND THE DRAINAGE STRUCTURE LOCATIONS AND GRADES SHOWN ON THESE DRAWINGS ARE ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF AND I CERTIFY THAT I, OR MY AGENT, HAVE MADE SUFFICIENT INSPECTION TO ENSURE THE ACCURACY OF THIS STATEMENT.

SIGNATURE — DATE 2-6-97

APPROVED PLAN
DATE: 9-18-96 MRG

PLAN SCALE: 1"=25'
GRAPHIC SCALE IN FEET
0 10 25 50 75

COMMONWEALTH OF VIRGINIA
JOHN L. HUTCHERSON
No. 7752
4/23/96
PROFESSIONAL ENGINEER

Langley and McDonald, P.C.
Engineers • Surveyors • Planners
Landscape Architects • Environmental Consultants
VIRGINIA BEACH — WILLIAMSBURG

DES.	MRG
DWN.	MRG
CHK.	NHM
DATE	4-4-96

RECORD DRAWING
ENTRANCE ROAD PLAN
James River Commerce Center
JAMES CITY COUNTY, VIRGINIA

PROJ. NO. 95016-28
SCALE: 1" = 25'
RECORD DRAWING
8 OF 8
DWG. 6210Y W

Bernie

JR038_JAMES_RIVER_COMMERCE_CENTER - 005

VIRTUAL SHELL BUILDING NOTE:

THIS PROJECT IS TO BE PRESENTED AS A "VIRTUAL SHELL BUILDING" BY THE JAMES CITY COUNTY INDUSTRIAL DEVELOPMENT AUTHORITY. THIS PLAN REPRESENTS THE MINIMUM EFFORT REQUIRED TO DEVELOP THE PROPERTY TO THE AUTHORITIES STANDARDS. THE FOLLOWING ITEMS HAVE BEEN OMITTED PENDING THE IDENTIFICATION OF A SPECIFIC OCCUPANT/TENANT:

1. PARKING AREAS WILL BE EXPANDED AND/OR MODIFIED TO SUIT OCCUPANT AND USE.

2. WATER AND SEWER SERVICE CONNECTIONS WILL BE SIZED AND LOCATED TO SUIT OCCUPANT AND USE.

JAMES RIVER

COMMERCE CENTER SHELL BUILDING

ROBERTS MAGISTERIAL DISTRICT
JAMES CITY COUNTY, VIRGINIA
FOR

JAMES CITY COUNTY INDUSTRIAL DEVELOPMENT AUTHORITY

APRIL 1, 2003

CASE NO. SP - 056 - 03

SHEET INDEX

SHT. NO.	DESCRIPTION
C100	COVER SHEET
C101	EROSION & SEDIMENT CONTROL/ DEMOLITION
C102	SITE PLAN
C103	PROFILES
C104	EROSION CONTROL DETAILS & NOTES
C105	VDOT DETAILS AND NOTES

ACCESS TO THE SUBJECT PROPERTY WILL BE FROM COLUMBIA WAY AND ENDEAVOR DRIVE.
THE SITE PLAN FOR THE DEVELOPMENT OF COLUMBIA WAY -- CASE NO: SP-049-03 HAS NOT RECEIVED FINAL APPROVAL.

STATISTICAL DATA

PARCEL I.D. NUMBER:	5920100046
TAX MAP NO:	59-2-46
ZONING:	M-1, WITH PROFFERS.

PROPERTY IS SUBJECT OF PROFFERS SET FORTH IN RE-ZONIG CASE NO. Z-14-95

PROPOSED USE:	LIGHT INDUSTRIAL
GROSS SITE ACREAGE:	70.26 Ac. (11.37 Ac. POSSIBLE SUBDIVISION)
SITE COVERAGE BY BUILDINGS:	81,609 SQ. FT.
TOTAL SITE IMPERVIOUS AREA:	3.3 AC. (29% OF POSSIBLE SUBDIVISION)
AREA DISTURBED:	8.8 AC. (12.5% OF PROPERTY)
F.E.M.A. PANEL NUMBER	510201 0060 B - DATED: FEB. 6, 1991
F.E.M.A. F.I.R.M. ZONE	ZONE X
BUILDING DATA:	
TOTAL FLOOR AREA :	81,609 SQ. FT. (PHASE 1)
PROPOSED HEIGHT:	32'
PROPOSED FLOORS:	ONE FLOOR
PROPOSED BUILDING TYPE:	TYPE 2C
PARKING REQUIREMENTS:	
USE CATEGORY:	CATEGORY C
PARKING REQUIRED:	*
PARKING PROPOSED:	26 SPACES
HANDICAPPED SPACES REQUIRED:	*
HANDICAPPED SPACES PROPOSED:	2 H.C. SPACES (1 VAN ACCESSIBLE)
TOTAL PROPOSED SITE PARKING:	28 SPACES

OWNER / DEVELOPER:
JAMES CITY COUNTY
INDUSTRIAL DEVELOPMENT AUTHORITY
CONTACT PERSON: BERNARD M. FARMER
CAPITAL PROJECTS ADMINISTRATOR
105 TEWNING ROAD
WILLIAMSBURG, VA 23185

SITE ENGINEER:
LANDMARK DESIGN GROUP
4029 IRONBOUND ROAD, SUITE 100
WILLIAMSBURG, VA 23188
TELEPHONE: (757)-253-2975
FAX: (757)-229-0049

RESPONSIBLE LAND DISTURBER:
THE RESPONSIBLE LAND DISTURBER FOR THIS PROJECT WILL BE RICHARD S. PHILLIPS, P.E. NO. 023631, OF LANDMARK DESIGN GROUP, UP TO THE TIME OF THE PRECONSTRUCTION MEETING FOR LAND DISTURBING PERMIT. AT THAT TIME THE OWNER WILL REDESIGNATE THAT RESPONSIBILITY.

NOTES

ANY EXISTING UNUSED WELLS SHALL BE ABANDONED IN ACCORDANCE WITH STATE PRIVATE WELL REGULATIONS AND JAMES CITY COUNTY CODE.

STORMWATER GENERAL PERMIT NOTES

THE CONTRACTOR SHALL ENSURE COMPLIANCE WITH THE REQUIREMENTS OF VR 680-14-19 – VIRGINIA POLLUTANT DISCHARGE ELIMINATION SYSTEM (VPDES) GENERAL PERMIT FOR STORM WATER DISCHARGES FROM CONSTRUCTION SITES, INCLUDING BUT NOT LIMITED TO THE FOLLOWING ITEMS:

IMPLEMENTATION, DOCUMENTATION, AND INSPECTIONS NECESSARY FOR COMPLIANCE WITH STORM WATER GENERAL PERMIT

1. IMPLEMENTATION OF THE STORM WATER POLLUTION PREVENTION PLAN AS DEVELOPED FOR THE SITE AND IN ACCORDANCE WITH THE GENERAL PERMIT REQUIREMENTS WITH REGARD TO EROSION AND SEDIMENT CONTROL, POST-CONSTRUCTION STORM WATER MANAGEMENT, AND OTHER CONTROLS REGARDING SOLID MATERIALS, SEDIMENTS AND DUST, AND THE DEMONSTRATED COMPLIANCE WITH APPLICABLE STATE AND/OR LOCAL WASTE DISPOSAL, SANITARY SEWER OR SEPTIC SYSTEM REGULATIONS.

2. RETENTION OF THE STORM WATER POLLUTION PREVENTION PLAN AT THE CONSTRUCTION SITE. THE PLAN AND OTHER RELATED DOCUMENTS SHALL BE MADE AVAILABLE UPON REQUEST TO AUTHORIZED LOCAL, STATE, OR FEDERAL REPRESENTATIVES.

3. AMENDMENT OF THE STORM WATER POLLUTION PREVENTION PLAN WHENEVER THERE IS A CHANGE IN DESIGN, CONSTRUCTION, OPERATION, OR MAINTENANCE, WHICH HAS A SIGNIFICANT EFFECT ON THE POTENTIAL FOR THE DISCHARGE OF POLLUTANTS TO THE SURFACE WATERS OF THE STATE, OR IF THE STORM WATER POLLUTION PREVENTION PLAN PROVES TO BE INEFFECTIVE IN ELIMINATING OR SIGNIFICANTLY MINIMIZING POLLUTANTS FROM THE CONSTRUCTION ACTIVITY.

4. DOCUMENTATION OF THE DATES WHEN MAJOR GRADING ACTIVITIES OCCUR, WHEN CONSTRUCTION ACTIVITIES TEMPORARILY OR PERMANENTLY CEASE ON A PORTION OF THE SITE, AND WHEN STABILIZATION MEASURES ARE IMPLEMENTED.

5. INSPECTIONS OF DISTURBED AREAS OF THE CONSTRUCTION SITE AND AREAS USED FOR STORAGE OF MATERIALS THAT ARE EXPOSED TO PRECIPITATION THAT HAVE NOT BEEN FINALLY STABILIZED, STRUCTURAL CONTROL MEASURES, AND LOCATIONS WHERE VEHICLES ENTER OR EXIT THE SITE SHALL BE CONDUCTED AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND WITHIN 24 HOURS OF THE END OF A STORM EVENT THAT PRODUCES SURFACE RUNOFF AS REQUIRED BY THE GENERAL PERMIT REGULATIONS. REPORTS SUMMARIZING THE INSPECTIONS SHALL BE MADE IN ACCORDANCE TO THE REGULATIONS AND RETAINED AS PART OF THE STORM WATER POLLUTION PREVENTION PLAN.

6. ALL CONTRACTORS AND SUBCONTRACTORS SHALL SIGN A COPY OF THE CERTIFICATION STATEMENT AS DESCRIBED IN THE GENERAL PERMIT BEFORE CONDUCTING ANY PROFESSIONAL SERVICES AT THE SITE IDENTIFIED IN THE POLLUTION PREVENTION PLAN. ALL CERTIFICATIONS SHALL BE INCLUDED IN THE STORM WATER POLLUTION PREVENTION PLAN.

7. ALL DOCUMENTS, RECORDS, REPORTS, AND OTHER INFORMATION RELEVANT TO THE GENERAL PERMIT REGULATIONS SHALL BE GIVEN TO THE OWNER FOLLOWING FINAL STABILIZATION OF THE SITE.

8. WHERE THE SITE HAS BEEN FINALLY STABILIZED AND ALL STORM WATER DISCHARGES FROM CONSTRUCTION ACTIVITIES THAT ARE AUTHORIZED BY THE GENERAL PERMIT ARE ELIMINATED, A NOTICE OF TERMINATION SHALL BE PREPARED FOR THE OWNER TO SIGN AND SUBMIT TO THE VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY, WATER DIVISION.

9. THE STRUCTURAL STABILITY OF THE PERMITTED FACILITIES SHALL BE ENSURED.

PROHIBITION AND REPORTING OF RELEASES OF SUBSTANCES OTHER THAN STORM WATER

10. EXECUTION OF REPORTING REQUIREMENTS IN THE EVENT OF NONCOMPLIANCE OF THE GENERAL PERMIT OR IF ANY UNPERMITTED, UNUSUAL OR EXTRAORDINARY DISCHARGE ENTERS OR COULD BE EXPECTED TO ENTER SURFACE WATERS OF THE STATE.

11. PROHIBITION OF NON-STORMWATER DISCHARGES EXCEPT AS PROVIDED FOR IN THE GENERAL PERMIT. APPROPRIATE POLLUTION PREVENTION MEASURES FOR NON-STORM WATER COMPONENTS OF DISCHARGE SHALL BE IMPLEMENTED.

12. EXECUTION OF REPORTING REQUIREMENTS OF 40 CFR PART 117 (1992) AND 40 CFR PART 302 (1992). IN ADDITION, THE DISCHARGE OF HAZARDOUS SUBSTANCES OR OIL IN THE STORM WATER DISCHARGE FROM THE CONSTRUCTION SITE SHALL BE PREVENTED OR MINIMIZED IN ACCORDANCE WITH THE STORM WATER POLLUTION PREVENTION PLAN.

13. PROHIBITION OF DISCHARGE OF HAZARDOUS SUBSTANCES, OIL, OR POLLUTANTS RESULTING FROM ON-SITE SPILLS OR RELEASES.

MANAGEMENT MEASURES AND RESPONSE TO UNINTENTIONAL RELEASES

14. ALL WASTE COLLECTING, CONTROL, TREATMENT, MANAGEMENT OF POLLUTANT ACTIVITIES AND DISPOSAL FACILITIES SHALL BE OPERATED IN A MANNER CONSISTENT WITH THE GENERAL PERMIT REGULATIONS.

15. ALL FEASIBLE STEPS TO MINIMIZE ANY ADVERSE IMPACTS TO STATE WATERS RESULTING FROM NON-COMPLIANCE WITH CONDITIONS SPECIFIED IN THE GENERAL PERMIT SHALL BE TAKEN.

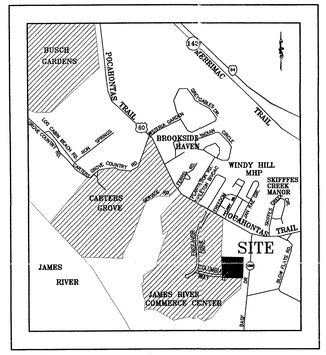
16. ALL REASONABLE STEPS TO MINIMIZE, CORRECT OR PREVENT ANY DISCHARGE IN VIOLATION OF THE GENERAL PERMIT WHICH HAS A REASONABLE LIKELIHOOD OF ADVERSELY AFFECTING HUMAN HEALTH OR THE ENVIRONMENT SHALL BE TAKEN.

Bernie

LEGEND

EXISTING		PROPOSED
SAN	SANITARY SEWER	SAN
W	WATER	W
S	STORM SEWER	S
E	ELECTRIC LINE	E
T	TELEPHONE	T
G	GAS LINE	G
TV	CABLE TV LINE	TV
FM	FORCE MAIN	FM
OH	OVERHEAD CABLE	OH
	MANHOLE	
	CURB DROP INLET	
	YARD DROP INLET	
	CLEANOUT	
	FLARED END SECTION	
	VALVE	
	WATER METER	
	FIRE HYDRANT	
	POWER POLE	
	LIGHT POLE	
	TELEPHONE PEDESTAL	
	TELEPHONE POLE	
25	GROUND ELEVATION	25.10 F.C.
	CEMENT CONCRETE	
	BITUMINOUS CONCRETE	
	CONCRETE CURB	
	CG-6 CURB & GUTTER	
	CG-6(MOD) CURB & GUTTER	
	CURB TRANSITION CG-6 TO CG-6(MOD)	
	PROJECT LIMITS	
	CENTERLINE/BASELINE	
	PROPERTY LINE	
	DITCH SWALE LINE	
	DIRECTION OF FLOW	
	TREE LINE	
X	FENCE	X
	BORING	
	BENCH MARK	
	EASEMENT LINE	
	BLOW-OFF VALVE	
	FILL DIVERSION DIKE	FD
	CONSTRUCTION ENTRANCE	CE
	SILT FENCE	SF
	INLET PROTECTION	IP

NOTE: SOME SYMBOLS SHOWN IN THIS LEGEND MAY NOT NECESSARILY BE USED FOR THIS PROJECT.



VICINITY MAP SCALE : 1"=2000'

JAMES RIVER - GRICES RUN WATERSHED

Miss Utility of Virginia
204 BYRNES BOND BOULEVARD
CHESTER, VIRGINIA 23831

48 HOURS BEFORE YOU DIG CALL MISS UTILITY OF VIRGINIA

BEFORE YOU DIG ANYWHERE IN VIRGINIA! CALL 1-800-552-7001

VA LAW REQUIRES 48 HOURS NOTICE BEFORE YOU EXCAVATE.

LANDMARK DESIGN GROUP
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McKINNEY AND COMPANY
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MAIN OFFICE
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ASHLAND, VIRGINIA 23005
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SHELL BUILDING
JAMES RIVER COMMERCE CENTER
JAMES CITY COUNTY, VIRGINIA

COMMONWEALTH OF VIRGINIA
1/14/04
RICHARD S. PHILLIPS
No. 023631
PROFESSIONAL ENGINEER

DESIGN: RSP
DRAWN: GSW
CHECKED: RSP
REVISIONS: 1/14/04 COUNTY COMMENTS
DATE: APRIL 1, 2003
JOB NO. 2002138-000.01
CAD NO. 100cover
DRAWING TITLE: COVER SHEET
14439 W
SHEET NO. C100

N/F
BALL METTAL CONTAINER CORP.

CHAIN LINK FENCE

ARCEL 7

PROPOSED PROPERTY LINE

PROPOSED LIMITS OF CLEARING

TEMPORARY TOPSOIL STOCKPILE

PROPOSED SHELL BULDING

400'

200'

APPROX. LOCATION 42" RCP (STORM SEWER)
REMOVE EXISTING 42" RCP AT COMPLETION OF 42" BM STORM DRAIN BY-PASS

BM STORM DRAIN BY-PASS / SHEET C102

SEDIMENT BASIN = SB=2
WET STORAGE SURFACE ELEV.=38.0
L @ ELEV. 38.0=230', W @ ELEV. 38.0=30'

8' WIDE EMERGENCY SPILLWAY, ELEV.=41.00
EC-3 STABILIZATION MAT.

SEDIMENT BASIN BOTTOM ELEV.=35.0

PROPOSED RISER
INV. 38.00

REMOVE 7-2A
COLUMBIA WAY

MODIFY 7-2
COLUMBIA WAY

REMOVE RCP INLET TO 7=2

7-2B
COLUMBIA WAY
REMOVE END SECTION *

PROVIDE TEMPORARY 12" CULVER FOR CONSTRUCTION ACCESS

BM STORM DRAIN BY-PASS / SHEET C102

75 L.F. GRASS SWALE @ 2.31%

75 L.F. GRASS SWALE @ 2.95%

Sta. 21+23.80
CL X CL

45° HORIZ. BEND

PROPOSED LIMITS OF CLEARING

6-23
COLUMBIA WAY

6-25
COLUMBIA WAY

6-24
COLUMBIA WAY

42 L.F.-24" RCP @ 1.00%
INV. IN=35.47

BEGIN 150 L.F. PG-2A PIPE C1 D=8"

EXIST. A.R.V.

REMOVE EXIST. 24" RCP

4" PVC FORCEMAIN

FIRE HYDRANT COLUMBIA WAY

STATION 15+80 AIR RELEASE VALVE

TMP NO. 59-2-1-17

TMR NO. 59-2-1-45

25' NEWPORT NEWS WATERWORKS UTILITY EASEMENT

* SEE E&S NOTES 6 THRU 9 SHEET / C104

GRAPHIC SCALE
0 30 60 120
(IN FEET)
1 inch = 30 ft.

McKINNEY AND COMPANY
planning • design • construction

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JAMES RIVER COMMERCE CENTER
JAMES CITY COUNTY, VIRGINIA

COMMONWEALTH OF VIRGINIA
RICHARD S. PHILLIPS
No. 02363
PROFESSIONAL ENGINEER

DESIGN: RSP
DRAWN: GSW
CHECKED: RSP

REVISIONS:
1/14/04 COUNTY COMMENTS

DATE: APRIL 1, 2003
JOB NO. 2002138-000.01
CAD NO. C101E&S.dwg

DRAWING TITLE:
EROSION AND SEDIMENT CONTROL AND DEMOLITION PLAN
14438 W

SHEET NO.
C101

JR038_JAMES_RIVER_COMMERCE_CENTER - 007

N/F
BALL METTAL CONTAINER CORP.

CHAIN LINK FENCE

PROPERTY

PROPOSED LIMITS OF CLEARING

CONTROLLED FILL

REMOVE TEMPORARY SEDIMENT BASIN
DISPOSE OF SEDIMENTS BACK FILL
WITH FILL COMPACTED

SWALE EC-2 MATTING

BM-4
VDOT STD. MH-1 WITH DI-1 TOP
(60"ø MH REQ'D.)
TOP=53.50
INV. IN=45.35
INV. OUT=45.03

PT=28+80.75

PROFILE #2 – SEE SHEET C103

287 L.F.-42" CL. III RCP @ 0.70%

60 L.F.-21" CL. III RCP @ 0.50%

200 L.F.-21" CL. III RCP @ 0.50%

140 L.F.-21" CL. III RCP @ 0.50%

BM-3
VDOT STD. MH-1
(60"ø MH REQ'D.)
TOP=57.50
INV. IN=43.02
INV. OUT=42.92
SAFETY SLAB
SL-1 @ ELV.49.50

PC=27+39.38

A-9
VDOT STD. DI-7/ TYPE I GRATE
TOP=53.00
INV.=49.10

A-8
VDOT STD. DI-7
TYPE I GRATE
TOP=50.75
INV. IN=48.10
INV. OUT=48.00

A-7
VDOT STD. MH-1
RIM=55.00
INV. IN=47.70
INV. OUT=47.60

A-6
VDOT STD. DI-7
TYPE I GRATE
TOP=54.00
INV. IN=46.90
INV. OUT=46.80

APPROX. LOCATION
42" RCP (STORM SEWER)

NOTE: PROVIDE INVERT SHAPING ON ALL
STORM WATER INLETS AND MAN HOLES

PROPOSED SHELL BULDING
F.F.EL. 55.25

228 L.F.-21" CL. III RCP @ 0.50%

PROPOSED LIMITS OF CLEARING

A-4
VDOT STD. MH-1
RIM=51.50
INV. IN=44.60
INV. OUT=44.00

A-5
VDOT STD. DI-7
TYPE I GRATE
TOP=49.50
INV. IN=45.66
INV. OUT=45.56

66 L.F.-24" CL. III RCP @ 0.50%

191 L.F.-24" CL. III RCP @ 0.50%

PT=25+25.33

PC=1+25.51
PT=16+42.14 (END)

PC=14+08.84

10 SPACES @ 9' = 90'

16 SPACES @ 9' = 144'

PROFILE #1 – SEE SHEET C103

150 L.F.-24" CL. III RCP @ 0.50%

400 L.F.-42" CL. III RCP @ 0.70%

VDOT STD. DI-7
TOP=39.47
INV.=35.89

292 L.F. PG-2A (TYPE II) @ 0.40%

TRANSITION PG-2A
TO DI-7

42 L.F.-24" RCP @ 1.00%
INV. IN=35.47

REMOVE EXIST. 24" RCP

4" PVC FORCEMAIN

STATION 15+80
AIR RELEASE VALVE

PROFILE #2
SEE SHEET C103

VDOT STD. ES-1
INV. IN=41.60

PC=23+42.01

BM-2
VDOT STD. MH-1
WITH DI-7 TOP/ TYPE I GRATE
(60"ø MH REQ'D.)
TOP=48.50
INV. IN=40.91
INV. OUT=40.81

PROPOSED LIMITS
OF CLEARING

VDOT STD. ES-1
INV. OUT=41.36

A-3
VDOT STD. DI-3A
TOP=50.23
INV. IN=43.67
INV. OUT=43.50

PT=23+14.95
PI=10+00.00
48 L.F.-15" CLASS V RCP @ 0.50%
(INCLUDING ES-1)

CONCEPTUAL LOT
BOUNDARY

POINT OF CONNECTION
FORCE MAIN

POSSIBLE POINT OF CONNECTION
TO EXISTING WATERLINE
TAPPING SLEEVE, VALVE AND
SERVICE TO BE SIZED FOR TENANT

25" NEWPORT NEWS
UTILITY EASEMENT

A-2
VDOT STD. MH-1
TOP=54.00
INV. IN=42.75
INV. OUT=42.00

A-1
EXISTING DI-5
REPLACE WITH DI-7A TOP
WITH FLUME CONNECTION
TOP=40.10 (NEW)
NEW INV. IN=37.00
INV. OUT=36.86 (EXIST.)

BM-1
EXIST. DI-4D
(MOD. W/ MH-1 TOP)
RIM=43.75 (EXIST.)
NEW RIM=50.10
INV. IN=38.03 (EXIST.)
INV. OUT=37.93 (EXIST.)

REMOVE 42"RCP
FROM NORTH AND
PLUG OPENING
WITH MASONRY.

TMR NO. 59-2-1-45

STORM WATER MANAGEMENT
FOR THIS SITE IS PROVIDED
BY AN EXISTING BMP SITUATED OFF SITE
REFER TO APPROVAL SP-82-97
AND COUNTY BMP ID CODE JR 038.

MONITOR BMP DURING CONSTRUCTION ACTIVITIES.
REMOVE ANY SEDIMENTS MIGRATING FROM
CONSTRUCTION AREA.

GRAPHIC SCALE
0 30 60 120
(IN FEET)
1 inch = 30 ft.

McKINNEY AND COMPANY
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100 SOUTH RAILROAD AVE.
ASHLAND, VIRGINIA 23005
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JAMES RIVER COMMERCE CENTER
JAMES CITY COUNTY, VIRGINIA

190 375
120 285
310 780

COMMONWEALTH OF VIRGINIA
RICHARD S. PHILLIPS
No. 023631
PROFESSIONAL ENGINEER

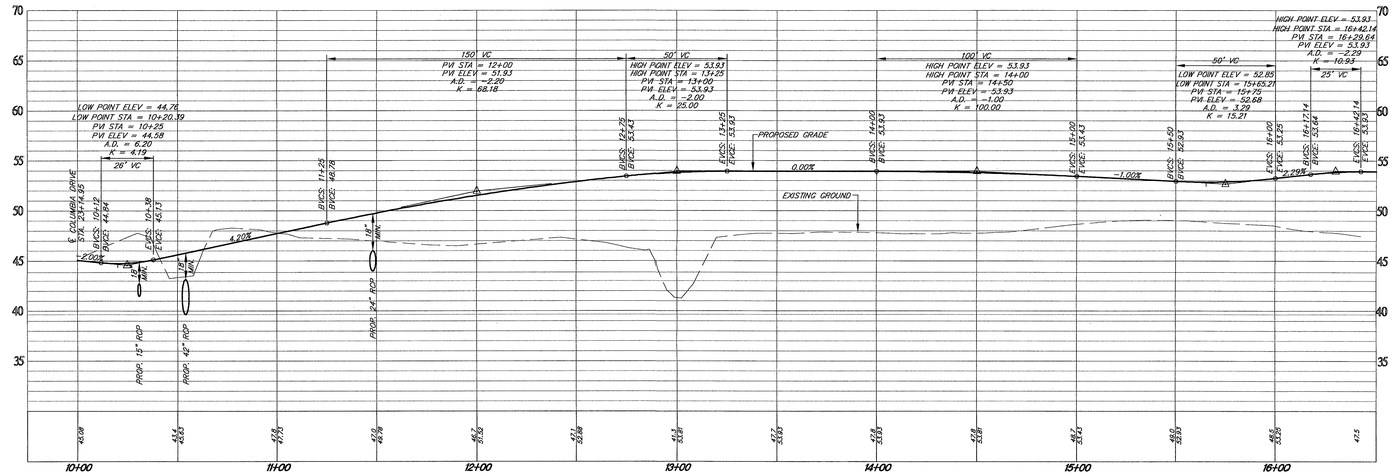
DESIGN: RSP
DRAWN: GSW
CHECKED: RSP

REVISIONS:
1/14/04 COUNTY COMMENTS

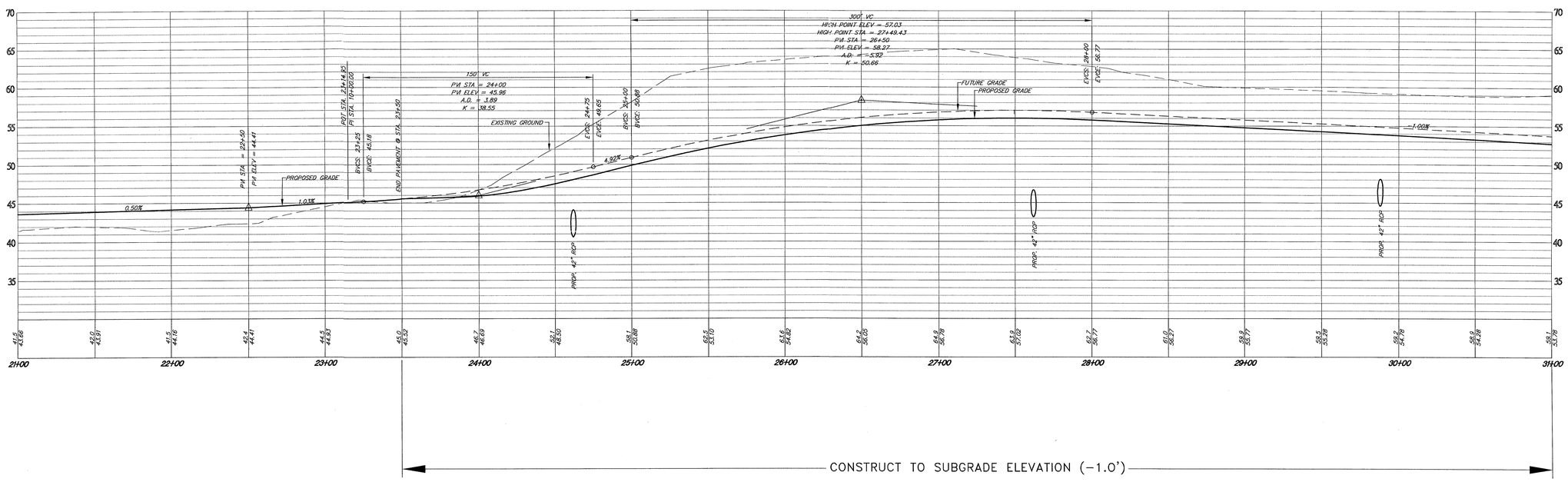
DATE: APRIL 1, 2003
JOB NO. 2002138-000.01
CAD NO. C102site
DRAWING TITLE: SITE PLAN

14437 W

SHEET NO. C102



PROFILE # 1



PROFILE # 2

HORIZONTAL GRAPHIC SCALE

0 6 12 24

(IN FEET)
1 inch = 6 ft.

GRAPHIC SCALE

0 30 60 120

(IN FEET)
1 inch = 30 ft.

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JAMES CITY COUNTY, VIRGINIA

COMMONWEALTH OF VIRGINIA
RICHARD S. PHILLIPS
No. 023631
PROFESSIONAL ENGINEER
1/19/04

DESIGN: RSP
DRAWN: GSW
CHECKED: RSP
REVISIONS:

DATE: APRIL 1, 2003
JOB NO. 2002138-000.01
CAD NO. C103profiles
DRAWING TITLE: PROFILES

14436 W

SHEET NO. C103

JR038_JAMES_RIVER_COMMERCE_CENTER - 009

JAMES CITY COUNTY
EROSION AND SEDIMENT CONTROL NOTES
REVISED 07/6/01

THE PURPOSE OF THE EROSION MEASURES SHOWN ON THESE PLANS SHALL BE TO PRECLUDE THE TRANSPORT OF ALL WATERBORNE SEDIMENTS RESULTING FROM CONSTRUCTION ACTIVITIES FROM ENTERING ONTO ADJACENT PROPERTIES OR STATE WATERS. IF FIELD INSPECTION REVEALS THE INADEQUACY OF THE PLAN TO CONFINE SEDIMENT TO THE PROJECT SITE, ALL APPROPRIATE MODIFICATIONS WILL BE MADE TO CORRECT ANY PLAN DEFICIENCIES. IN ADDITION TO THESE NOTES, ALL PROVISIONS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL REGULATIONS SHALL APPLY TO THIS PROJECT.

1. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK, 3RD EDITION, 1992. THE CONTRACTOR SHALL BE THOROUGHLY FAMILIAR WITH ALL APPLICABLE MEASURES CONTAINED THEREIN THAT MAY BE PERTINENT TO THIS PROJECT, INCLUDING MINIMUM STANDARDS 1 THROUGH 19. IF THE APPROVED EROSION AND SEDIMENT CONTROL PLAN IS FOUND TO BE INADEQUATE IN THE FIELD, THE MINIMUM STANDARDS WILL APPLY IN ADDITION TO THE PROVISIONS OF THE APPROVED PLAN.

2. AS A PREREQUISITE TO APPROVAL OF AN EROSION AND SEDIMENT CONTROL PLAN FOR LAND-DISTURBING ACTIVITIES, THE NAME OF A RESPONSIBLE LAND-DISTURBER SHALL BE PROVIDED. THE RESPONSIBLE LAND-DISTURBER SHALL BE AN INDIVIDUAL WHO HOLDS A VALID CERTIFICATE OF COMPETENCE ISSUED BY THE VIRGINIA DEPARTMENT OF CONSERVATION AND IS DEFINED AS THE PERSON IN CHARGE OF AND RESPONSIBLE FOR CARRYING OUT THE LAND-DISTURBING ACTIVITY. PERMITS OR PLANS WITHOUT THIS INFORMATION ARE DEEMED INCOMPLETE AND WILL NOT BE APPROVED UNTIL PROPER NOTIFICATION IS RECEIVED. ALSO, IF THE PERSON DESIGNATED AS RESPONSIBLE LAND-DISTURBER CHANGES BETWEEN THE TIME OF PLAN APPROVAL AND THE SCHEDULED PRECONSTRUCTION MEETING, THE ENVIRONMENTAL DIVISION SHALL BE INFORMED OF THE CHANGE, IN WRITING, 24-HOURS IN ADVANCE OF THE PRECONSTRUCTION MEETING.

3. A PRECONSTRUCTION MEETING SHALL BE HELD ON-SITE BETWEEN THE COUNTY, THE DEVELOPER, THE PROJECT ENGINEER, THE RESPONSIBLE LAND-DISTURBER AND THE CONTRACTOR PRIOR TO ISSUANCE OF THE LAND DISTURBING PERMIT. THE CONTRACTOR SHALL SUBMIT A SEQUENCE OF CONSTRUCTION TO THE COUNTY FOR APPROVAL PRIOR TO THE PRECONSTRUCTION MEETING. THE DESIGNATED RESPONSIBLE LAND-DISTURBER IS REQUIRED TO ATTEND THE PRECONSTRUCTION MEETING FOR THE PROJECT.

4. ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS SHALL BE PROTECTED BY A TEMPORARY CONSTRUCTION ENTRANCE TO PREVENT TRACKING OF MUD ONTO PUBLIC RIGHT-OF-WAYS. AN ENTRANCE PERMIT FROM VDOT IS REQUIRED PRIOR TO ANY CONSTRUCTION ACTIVITIES WITHIN STATE RIGHT-OF-WAYS. WHERE SEDIMENT IS TRANSPORTED ONTO A PUBLIC ROAD SURFACE, THE ROAD SHALL BE THOROUGHLY CLEANED AT THE END OF EACH DAY (STD. & SPEC. 3.02).

5. SEDIMENT BASINS AND TRAPS (STD. & SPEC. 3.13 AND 3.14), PERIMETER DIKES (STD. & SPEC. 3.09 AND 3.12), SEDIMENT FILTER BARRIERS (STD. & SPEC. 3.05) AND OTHER MEASURES INTENDED TO TRAP SEDIMENT ON-SITE MUST BE CONSTRUCTED AS A FIRST STEP IN GRADING AND MUST BE MADE FUNCTIONAL PRIOR TO ANY UPSLOPE LAND DISTURBANCE TAKING PLACE. EARTHEN STRUCTURES SUCH AS DAMS, DIKES AND DIVERSIONS MUST BE SEEDED AND MULCHED IMMEDIATELY AFTER INSTALLATION. PERIODIC INSPECTIONS OF THE EROSION CONTROL MEASURES BY THE OWNER OR OWNER'S REPRESENTATIVE SHALL BE MADE TO ASSESS THEIR CONDITION. ANY NECESSARY MAINTENANCE OF THE MEASURES SHALL BE ACCOMPLISHED IMMEDIATELY AND SHALL INCLUDE THE REPAIR OF MEASURES DAMAGED BY ANY SUBCONTRACTOR INCLUDING THOSE OF THE PUBLIC UTILITY COMPANIES.

6. SURFACE FLOWS OVER CUT AND FILL SLOPES SHALL BE CONTROLLED BY EITHER REDIRECTING FLOWS FROM TRANSVERSING THE SLOPES OR BY INSTALLING MECHANICAL DEVICES TO SAFELY LOWER WATER DOWNSLOPE WITHOUT CAUSING EROSION. A TEMPORARY FILL DIVERSION (STD. & SPEC. 3.10) AND SLOPE DRAIN (STD. & SPEC. 3.15) SHALL BE INSTALLED PRIOR TO THE END OF EACH WORKING DAY.

7. SEDIMENT CONTROL MEASURES MAY REQUIRE MINOR FIELD ADJUSTMENTS AT TIME OF CONSTRUCTION TO INSURE THEIR INTENDED PURPOSE IS ACCOMPLISHED. ENVIRONMENTAL DIVISION APPROVAL WILL BE REQUIRED FOR OTHER DEVIATIONS FROM THE APPROVED PLAN.

8. THE CONTRACTOR SHALL PLACE SOIL STOCKPILES AT THE LOCATIONS SHOWN ON THE PLAN. SOIL STOCKPILES SHALL BE STABILIZED OR PROTECTED WITH SEDIMENT TRAPPING MEASURES. OFF-SITE WASTE OR BORROW AREAS SHALL BE APPROVED BY THE ENVIRONMENTAL DIVISION PRIOR TO THE IMPORT OF ANY BORROW OR EXPORT OF ANY WASTE TO OR FROM THE PROJECT SITE.

9. THE CONTRACTOR SHALL COMPLETE DRAINAGE FACILITIES WITHIN 30 DAYS FOLLOWING COMPLETION OF ROUGH GRADING AT ANY POINT WITHIN THE PROJECT. THE INSTALLATION OF DRAINAGE FACILITIES SHALL TAKE PRECEDENCE OVER ALL UNDERGROUND UTILITIES. OUTFALL DITCHES FROM DRAINAGE STRUCTURES SHALL BE STABILIZED IMMEDIATELY AFTER CONSTRUCTION OF THE SAME (STD. & SPEC. 3.18). THIS INCLUDES INSTALLATION OF EROSION CONTROL STONE OR PAVED DITCHES WHERE REQUIRED. ANY DRAINAGE OUTFALLS REQUIRED FOR A STREET MUST BE COMPLETED BEFORE STREET GRADING OR UTILITY INSTALLATION BEGINS.

10. PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DENUDED AREAS WITHIN SEVEN DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. TEMPORARY SOIL STABILIZATION SHALL BE APPLIED WITHIN SEVEN DAYS TO DENUDED AREAS THAT MAY BE AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN 30 DAYS. PERMANENT STABILIZATION SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.

11. NO MORE THAN 300 FEET OF SANITARY SEWER, STORM DRAIN, WATER OR UNDERGROUND UTILITY LINES ARE TO BE OPEN AT ONE TIME. FOLLOWING INSTALLATION OF ANY PORTION OF THESE ITEMS, ALL DISTURBED AREAS ARE TO BE IMMEDIATELY STABILIZED (I.E., THE SAME DAY).

12. IF DISTURBED AREA STABILIZATION IS TO BE ACCOMPLISHED DURING THE MONTHS OF DECEMBER, JANUARY OR FEBRUARY, STABILIZATION SHALL CONSIST OF MULCHING (STD. & SPEC. 3.35). SEEDING WILL THEN TAKE PLACE AS SOON AS THE SEASON PERMITS.

13. THE TERM SEEDING, FINAL VEGETATIVE COVER OR STABILIZATION ON THIS PLAN SHALL MEAN THE SUCCESSFUL GERMINATION AND ESTABLISHMENT OF A STABLE GRASS COVER FROM A PROPERLY PREPARED SEEDBED CONTAINING THE SPECIFIED AMOUNTS OF SEED, LIME AND FERTILIZER (STD. & SPEC. 3.32). IRRIGATION SHALL BE REQUIRED AS NECESSARY TO ENSURE ESTABLISHMENT OF GRASS COVER.

14. ALL SLOPES STEEPER THAN 3H:1V SHALL REQUIRE THE USE OF EROSION CONTROL BLANKETS AND MATTINGS TO AID IN THE ESTABLISHMENT OF A VEGETATIVE COVER. INSTALLATION SHALL BE IN ACCORDANCE WITH STD. & SPEC. 3.35, MULCHING, STD. & SPEC. 3.36, SOIL STABILIZATION BLANKETS AND MATTING AND MANUFACTURERS INSTRUCTIONS. NO SLOPES SHALL BE CREATED STEEPER THAN 2H:1V.

15. INLET PROTECTION (STD. & SPEC., 3.07 AND 3.08) SHALL BE PROVIDED FOR ALL STORM DRAIN AND CULVERT INLETS FOLLOWING CONSTRUCTION OF THE SAME.

16. TEMPORARY LINERS, SUCH AS POLYETHYLENE SHEETS, SHALL BE PROVIDED FOR ALL PAVED DITCHES UNTIL THE PERMANENT CONCRETE LINER IS INSTALLED.

17. PAVED DITCHES SHALL BE REQUIRED WHEREVER ACCELERATED EROSION IS EVIDENT. PARTICULAR ATTENTION SHALL BE PAID TO THOSE AREAS WHERE GRADES EXCEED 3 PERCENT.

18. TEMPORARY EROSION CONTROL MEASURES SUCH AS SILT FENCE ARE NOT TO BE REMOVED UNTIL ALL DISTURBED AREAS ARE STABILIZED. TRAPPED SEDIMENT SHALL BE SPREAD, SEEDED AND MULCHED. AFTER THE PROJECT AND STABILIZATION IS COMPLETE, ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS.

19. NO SEDIMENT TRAP OR SEDIMENT BASIN SHALL BE REMOVED UNTIL A) AT LEAST 75 PERCENT OF THE LOTS WITHIN THE DRAINAGE AREA TO THE TRAP OR BASIN HAVE BEEN SOLD TO A THIRD PARTY (UNRELATED TO THE DEVELOPER) FOR THE CONSTRUCTION OF HOMES AND/OR B) 60 PERCENT OF THE SINGLE FAMILY LOTS WITHIN THE DRAINAGE AREA TO THE TRAP OR BASIN HAVE BEEN COMPLETED AND THE SOIL STABILIZED. A BULK SALE OF THE LOTS TO ANOTHER BUILDER DOES NOT SATISFY THIS PROVISION. SEDIMENT TRAPS AND SEDIMENT BASINS SHALL NOT BE REMOVED WITHOUT THE EXPRESS AUTHORIZATION OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION.

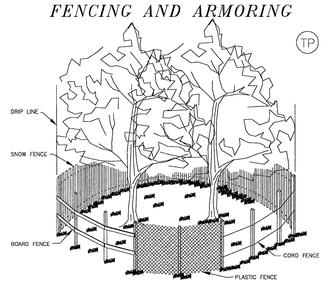
20. RECORD DRAWINGS (AS-BUILTS) AND CONSTRUCTION CERTIFICATIONS ARE BOTH REQUIRED FOR NEWLY CONSTRUCTED OR MODIFIED STORMWATER MANAGEMENT/BMP FACILITIES. CERTIFICATION ACTIVITIES SHALL BE ADEQUATELY COORDINATED AND PERFORMED BEFORE, DURING AND FOLLOWING CONSTRUCTION IN ACCORDANCE WITH THE CURRENT VERSION OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION, STORMWATER MANAGEMENT/BMP FACILITIES, RECORD DRAWINGS AND CONSTRUCTION CERTIFICATION, STANDARD FORMS & INSTRUCTIONS.

21. DESIGN AND CONSTRUCTION OF PRIVATE-TYPE SITE DRAINAGE SYSTEMS OUTSIDE VDOT RIGHTS-OF-WAY SHALL BE PERFORMED IN ACCORDANCE WITH THE CURRENT VERSION OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION, STORMWATER DRAINAGE CONVEYANCE SYSTEMS (NON-BMP RELATED), GENERAL DESIGN AND CONSTRUCTION GUIDELINES.

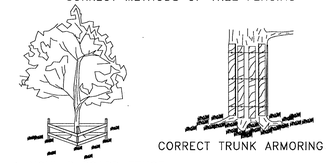
CONSTRUCTION SEQUENCE

1. INSTALL CONSTRUCITON ENTRANCE AND SILT FENCE ALONG COLUMBIA DRIVE.
2. CONSTRUCT CULVERT INLET PROTECTION AT INLET 7-2B.
3. CLEAR SITE BEGINNING AT EASTERN END OF SITE.
4. CONSTRUCT SEDIMENT BASIN (SB-1) CONNECTING OUTFALL TO INLET 6-24.
5. INSTALL REMAINING SILT FENCE AND DIVERSIOIN DIKES.
6. ~~START CONSTRUCTION OF BM STORM DRAIN BY-PASS AT EASTERN END OF SILT TRAP (ST-1).~~
7. COORDINATE EARTH MOVING WITH CONSTRUCTION OF BM STORM DRAIN BY-PASS. APPLY SLOPE STABILIZATION MEASURES.
8. STOCK PILE TOP SOIL IN NORTH WEST SECTION OF CONTROLLED FILL AREA.
9. REMOVE CULVERT INLET PROTECTION TO COMPLETE BM STORM DRAIN BY-PASS.
10. REMOVE EXISTING 42" RCP PIPE, PLUG INLET TO 7-2 (BM-1).
11. COMPLETE EARTH MOVING.
12. STABILIZE ALL DISTURBED OUTSIDE OF BUILDING LIMITS WITH PERMANENT SEED.
13. MAINTAIN ALL EROSION CONTROL MEASURES THROUGH OUT PROJECT.

FENCING AND ARMORING (TP)



CORRECT METHODS OF TREE FENCING

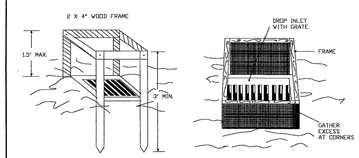


CORRECT TRUNK ARMORING

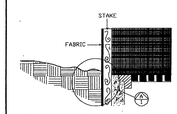
TRIANGULAR BOARD FENCE

Plate 3.38-2

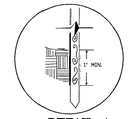
SILT FENCE DROP INLET PROTECTION



PERSPECTIVE VIEWS



ELEVATION OF STAKE AND FABRIC ORIENTATION



DETAIL A

SPECIFIC APPLICATION

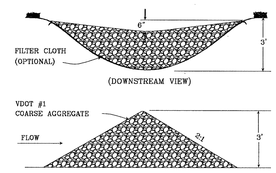
THIS METHOD OF INLET PROTECTION IS APPLICABLE WHERE THE INLET DRAINS A RELATIVELY FLAT AREA (SLOPE NO GREATER THAN 5%) WHERE THE INLET SHEET OR OVERLAND FLOWS (NOT EXCEEDING 1 C.F.S.) ARE TYPICAL. THE METHOD SHALL NOT APPLY TO INLETS RECEIVING CONCENTRATED FLOWS, SUCH AS IN STREET OR HIGHWAY MEDIANS.

SOURCE: N.C. Erosion and Sediment Control Planning and Design Manual 1988

PLATE 3.07-1

ROCK CHECK DAM

2 ACRES OR LESS OF DRAINAGE AREA:



2-10 ACRES OF DRAINAGE AREA:

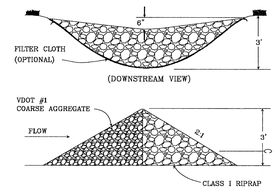
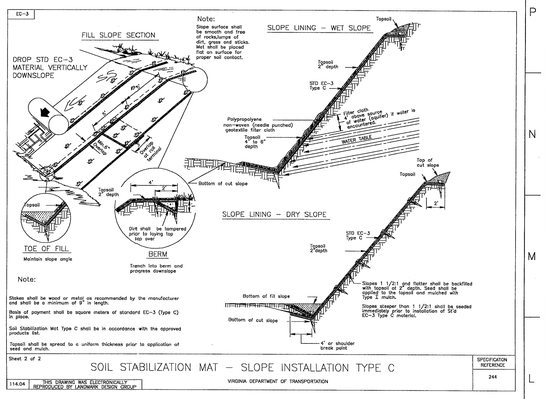


PLATE. 3.20-1



CONSTRUCTION OF A SILT FENCE (WITH WIRE SUPPORT) (SF)

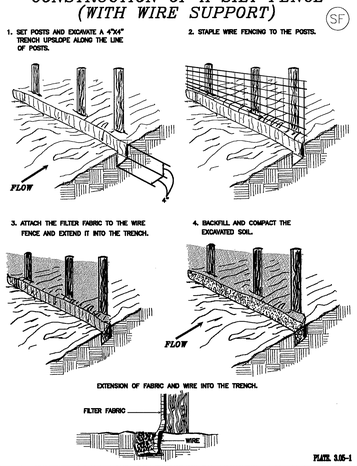
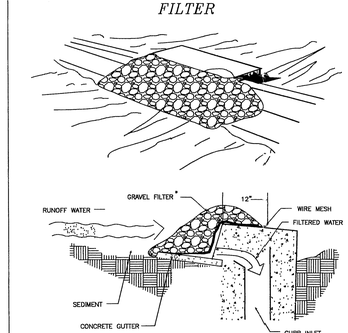


PLATE 3.05-1

FILTER



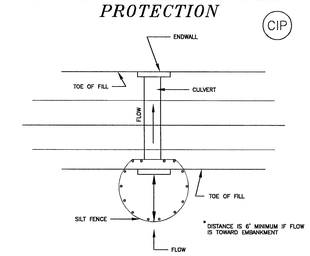
SPECIFIC APPLICATION

AREAS.

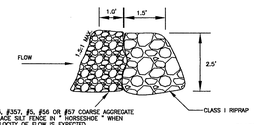
SOURCE: VA. DSWC

PLATE 3.07-6

SILT FENCE CULVERT INLET PROTECTION (CIP)



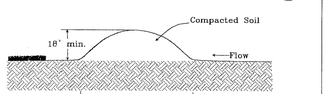
*OPTIONAL STONE COMBINATION



*VDOT #3, #357, #5, #56 OR #57 COARSE AGGREGATE TO REPLACE SILT FENCE IN " HORSESHOE " WHEN HIGH VELOCITY OF FLOW IS EXPECTED

PLATE. 3.08-1

TEMPORARY DIVERSION DIKE (DD)



SOURCE: VA. DSWC

PLATE 3.09-1

STONE CONSTRUCTION ENTRANCE (CE)

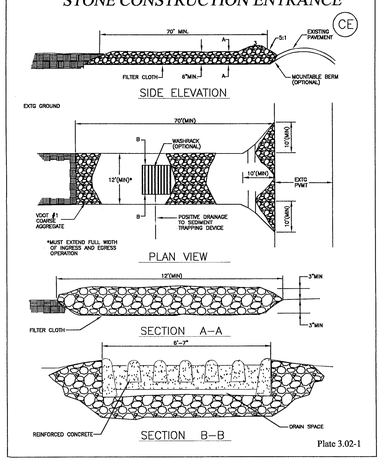
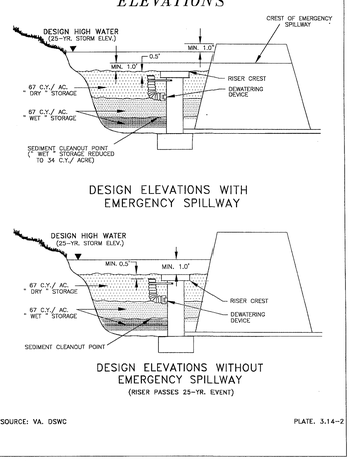


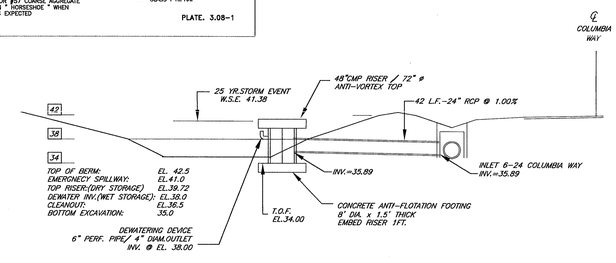
Plate 3.02-1

SEDIMENT BASIN SCHEMATIC ELEVATIONS



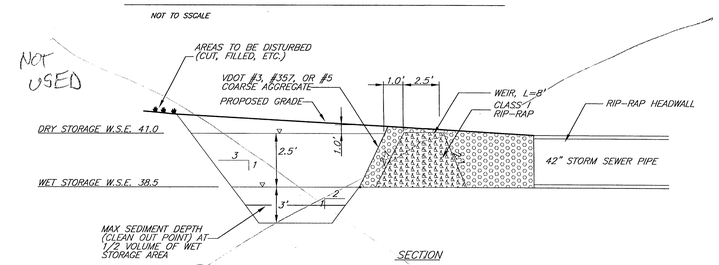
SOURCE: VA. DSWC

PLATE. 3.14-2



TEMPORARY SEDIMENT BASIN SECTION

NOT TO SSCALE



SECTION

ST SEDIMENT TRAP DETAIL

NOT TO SCALE

STORM STRUCTURE	TOP EMBANK. ELEVATION	TOP GRATE ELEVATION	STORM SEWER INVERT	SEDIMENT TRAP DRAINAGE AREA	WET/DRY STORAGE REQ'D.	WET STORAGE PROVIDED	DRY STORAGE PROVIDED
	42.0	N/A	38.5	1.38 Ac.	92 C.Y.	118 C.Y.	271 C.Y.

McKINNEY AND COMPANY
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JAMES CITY COUNTY
VIRGINIA

COMMONWEALTH OF VIRGINIA
1/9/04
RONALD S. PHELPS
No. 02343
PROFESSIONAL ENGINEER

DESIGN: RSP
DRAWN: EMP
CHECKED: RSP
REVISIONS: 1/14/04 COUNTY COMMENTS

DATE: APRIL 1, 2003
JOB NO. 2002138-000.01
CAD NO. C104erosion

DRAWING TITLE: EROSION CONTROL DETAILS AND NOTES
14435 W

SHEET NO. C104

VIRGINIA DEPARTMENT OF TRANSPORTATION
GENERAL NOTES - REVISED 08/02

1. A LAND USE PERMIT MUST BE OBTAINED FROM VDOT BEFORE ANY CONSTRUCTION IS STARTED WITHIN THE EXISTING STATE RIGHT OF WAY. CONTACT THE VDOT RESIDENCY FOR THE PERMIT FEE AND BOND AMOUNT. ALL LAND USE PERMIT APPLICATIONS MUST HAVE TWO (2) SETS OF APPROVED PLANS, A CHECK FOR THE PROCESSING FEE MADE PAYABLE TO VDOT, AND SURETY IN THE REQUIRED AMOUNT.

2. THE DEVELOPER IS RESPONSIBLE FOR THE RELOCATION OF ANY UTILITIES OR PAVEMENT MARKINGS WITHIN THE EXISTING RIGHT OF WAY OR PROPOSED RIGHT OF WAY REQUIRED BY THE DEVELOPMENT OF THE SITE/SUBDIVISION.

3. THE DEVELOPER IS RESPONSIBLE FOR THE COST OF A TRAFFIC SIGNAL OR ANY MODIFICATIONS TO AN EXISTING TRAFFIC SIGNAL THAT ARE DETERMINED TO BE NECESSARY. THESE COSTS WILL BE CHARGED UNDER AN OPERATIONAL PROJECT (ACCOUNTS RECEIVABLE) NUMBER. CONTACT THE VDOT RESIDENCY FOR THE PROPER PROCEDURE.

4. PRIOR TO ANY CONSTRUCTION, THE CONTRACTOR SHALL CONSULT WITH THE DEVELOPER'S ENGINEER TO VERIFY THE FINAL APPROVAL OF THE PLANS, OR ANY REVISED PLANS, BY THE VARIOUS AGENCIES (COUNTY, VDOT, ETC.).

5. VDOT APPROVAL OF THESE PLANS WILL EXPIRE IN FIVE (5) YEARS FROM THE DATE OF APPROVAL.

6. VDOT IS TO RECEIVE WRITTEN NOTIFICATION 48 HOURS PRIOR TO THE START OF ANY WORK. A PRE-CONSTRUCTION MEETING WILL BE REQUIRED PRIOR TO ANY LAND DISTURBANCE OF THE SITE. THE DEVELOPER, HIS ENGINEER, GEOTECHNICAL (SOILS) ENGINEER, AND CONTRACTOR SHALL ATTEND THE PRE-CONSTRUCTION MEETING. THE DEVELOPER'S CONTRACTOR SHALL HAVE A PROPOSED PROGRESS SCHEDULE OF WORK.

7. ANY ERRORS, CONFLICTS, OR DISCREPANCIES FOUND ON THE APPROVED PLANS SHALL BE REPORTED TO THE DEVELOPER'S ENGINEER AND VDOT FOR RESOLUTION BEFORE PROCEEDING FURTHER WITH THE WORK.

8. THE DEVELOPER'S ENGINEER AND CONTRACTOR (SUB-CONTRACTOR) SHALL VERIFY IN THE FIELD THE ELEVATIONS OF ALL POINTS OF CONNECTION OF PROPOSED WORK TO EXISTING CURBS, SANITARY SEWER, STORM SEWER, DRAINAGE STRUCTURES, WATERLINES, ETC., PRIOR TO THE CONSTRUCTION IN THE FIELD.

9. AN OPERATIONAL PROJECT (ACCOUNTS RECEIVABLE) NUMBER MAY BE ASSIGNED TO THE SITE/SUBDIVISION. THE DEVELOPER WILL BE RESPONSIBLE FOR THIS BY PROVIDING THE NECESSARY INFORMATION REQUESTED BY VDOT.

10. ALL MATERIALS AND CONSTRUCTION WITHIN THE PROPOSED PUBLIC RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE CURRENT VDOT SPECIFICATIONS AND STANDARDS.

11. ANY REQUEST FOR A CHANGE OF SPECIFIED MATERIALS OR DESIGN FROM THE APPROVED PLANS WILL NEED TO BE SUBMITTED TO VDOT. A LETTER MUST ACCOMPANY THE PROPOSED CHANGES AND REVISED PLAN SHEETS AND/OR DRAINAGE CALCULATIONS FOR REVIEW AND APPROVAL BY THE VDOT RESIDENT ENGINEER.

12. THE DEVELOPER WILL BE RESPONSIBLE FOR PROVIDING THE GEOTECHNICAL (SOILS) ENGINEER. A PROFESSIONAL ENGINEER OR PROFESSIONAL GEOLOGIST WILL SUBMIT A COMPLETE REPORT WITH BORING DATA AND RECOMMENDATIONS TO VDOT FOR APPROVAL OF HIS PROPOSED METHOD OF CONSTRUCTION. THIS REPORT SHALL INCLUDE SHRINK SWELL VALUES OF THE SOILS, MOISTURE SENSITIVE SOILS, SIEVE ANALYSES, DRY AND WET CBR VALUES, STANDARD PROCTOR AND ATTERBERG LIMITS. THE REPORT WILL SHOW THE BORE LOCATIONS, TYPES OF SOILS ENCOUNTERED, AND STABILIZATION RECOMMENDATIONS FOR SOILS WITH POOR SUPPORT VALUES, HIGH MOISTURE, AND SILT CONTENT. THE REPORT SHALL INCLUDE A PAVEMENT STRUCTURAL DESIGN RECOMMENDATION BASED ON LABORATORY TESTS OF THE ACTUAL SOILS AND APPROVED TRAFFIC VOLUME FOR THE SITE/SUBDIVISION IN ACCORDANCE WITH THE LATEST VDOT PAVEMENT DESIGN GUIDE FOR SUBDIVISION AND SECONDARY ROADS IN VIRGINIA.

13. WHEN SOILS OCCUR THAT ARE UNSUITABLE FOR FOUNDATIONS, EMBANKMENT FILL, PIPE BACKFILL, SUBGRADE, OR OTHER ROADWAY PURPOSES, THE DEVELOPER'S CONTRACTOR SHALL EXCAVATE SAID MATERIAL UNDER THE DIRECTION OF THE DEVELOPER'S SOILS ENGINEER, BY UNDERCUTTING SUCH MATERIAL BELOW THE PROPOSED GRADES SHOWN ON THE PLANS. THE CONTRACTOR SHALL NOTIFY THE DEVELOPER'S ENGINEER AND VDOT UPON THE DISCOVERY OF THE UNSUITABLE MATERIAL. CONCURRENCE OF THE ENGINEER SHALL BE OBTAINED BEFORE ADDITIONAL WORK IS UNDERTAKEN.

14. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. ALL EROSION CONTROL MEASURES WILL BE IN PLACE AND REVIEWED BY THE CONTRACTOR DAILY AND AFTER ALL INCLEMENT WEATHER TO INSURE COMPLIANCE FOR THE CONTROL OF ANY EROSION AND SILTATION. ANY CORRECTIONS OR REPAIRS WILL BE MADE IMMEDIATELY. IN ACCORDANCE WITH ROAD AND BRIDGE SPECIFICATIONS, VDOT REQUIRES AN INDIVIDUAL CERTIFIED BY THE VIRGINIA DEPARTMENT OF CONSERVATION AND RECREATION, HOLDING A RESPONSIBLE LAND DISTURBER CERTIFICATION, TO BE IN CHARGE OF THE LAND DISTURBING ACTIVITY AND ON THE WORK SITE AT ALL TIMES.

15. THE CONTRACTOR AND SUBCONTRACTOR(S) SHALL HAVE A COPY OF THE CURRENT VDOT ROAD AND BRIDGE SPECIFICATIONS AND THE VDOT ROAD AND BRIDGE STANDARDS. THE CONTRACTOR SHALL HAVE AT LEAST ONE (1) SET OF APPROVED PLANS WITH ALL APPROVED REVISIONS. THE LAND USE PERMIT WILL BE AT THE SITE AT ALL TIMES.

16. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND AND OVERHEAD UTILITIES, WHETHER OR NOT THEY ARE SHOWN ON THE PLANS. THE CONTRACTOR WILL BE RESPONSIBLE FOR REPAIRS AT HIS OWN EXPENSE OF ANY UTILITIES DAMAGED BY HIS CONSTRUCTION METHODS. MISS UTILITY MUST BE CONTACTED AT 1-800-552-7001 AT LEAST 72 HOURS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.

17. THE CONTRACTOR WILL BE RESPONSIBLE FOR REPLACING, WITH MATCHING MATERIALS, ANY PAVEMENT, CURB AND GUTTER, DRIVEWAY, PIPE, SIDEWALK, ETC. THAT ARE DAMAGED DURING THE CONSTRUCTION OF THE SITE/SUBDIVISION.

18. CERTIFICATION AND SOURCE OF MATERIALS ARE TO BE SUBMITTED TO VDOT. ALL MATERIALS MUST MEET VDOT SPECIFICATIONS AND STANDARDS.

19. THE DEVELOPER'S GEOTECHNICAL ENGINEER AND/OR HIS CERTIFIED MATERIALS TECHNICIANS WILL PERFORM COMPACTION (DENSITY) TESTS FOR REVIEW BY VDOT. ALL TESTS WILL BE PERFORMED IN ACCORDANCE WITH THE CURRENT VDOT SPECIFICATIONS AND STANDARDS. BACKFILL MATERIAL FOR PIPE, STRUCTURES, AND UTILITIES LOCATED WITHIN THE PROPOSED RIGHT OF WAY WILL BE COMPACTED AND TESTED AS THE FILL MATERIAL IS PLACED IN UNIFORM LIFTS. A MINIMUM OF 95% DENSITY WITH THE SOILS STANDARD PROCTOR WILL BE OBTAINED WITH THE PROPER MOISTURE CONTENT ON EMBANKMENT AND FILLS MATERIAL. FOR THE FINAL 6" OF THE FINISHED SUBGRADE, 100% DENSITY WILL BE OBTAINED. THE TEST RESULTS WILL BE SUBMITTED TO VDOT FOR REVIEW AND COMPLIANCE OF THE MATERIALS, PRIOR TO THE DEVELOPER'S CONTRACTOR REQUESTING AN INSPECTION FOR A PROOF ROLL ON THE SUBGRADE, AGGREGATE STONE, BASE MIX (ASPHALT) OR THE PLACEMENT OF THE SURFACE MIX.

20. ALL DRAINAGE EASEMENTS SHALL BE LABELED AS EITHER "DRAINAGE EASEMENTS" OR "COUNTY DRAINAGE EASEMENTS" AND SHALL NOT BE DEDICATED TO VDOT OR BECOME THE RESPONSIBILITY OF VDOT.

21. TEMPORARY DRAINAGE MEASURES WILL BE MAINTAINED BY THE CONTRACTOR DURING CONSTRUCTION TO RELIEVE AREAS THAT MAY CAUSE DAMAGE TO THE RIGHT OF WAY, ROADWAY, OR ADJACENT PROPERTIES.

22. DRY GUTTER (RIP RAP) IS NOT ALLOWED IN THE DITCHES ON VDOT RIGHT OF WAY.

23. ALL STORM SEWER PIPES SHALL BE REINFORCED CONCRETE PIPE (TONGUE AND GROOVE) IN ACCORDANCE WITH ASTM-C-76 OR AN ALTERNATIVE THAT HAS BEEN APPROVED ON THE PLANS.

24. INSTALLATION OF PIPE CULVERTS, STORM SEWERS, AND DRAINAGE STRUCTURES SHALL HAVE BEDDING MATERIAL PLACED UNDER THE PIPES AND STRUCTURES IN ACCORDANCE WITH VDOT SPECIFICATIONS (A MINIMUM OF 4" UNDER PIPES AND A MINIMUM OF 6" UNDER DRAINAGE STRUCTURES). THE BACKFILL MATERIAL SHALL BE SUITABLE MATERIAL FREE OF DEBRIS, SILT, TREE ROOTS (ORGANIC MATERIAL), AND EXCESS MOISTURE. THE FILL MATERIAL WILL BE COMPACTED IN UNIFORM LIFTS AND TESTED FOR DENSITY.

25. ALL VEGETATION (ORGANIC MATERIAL, ROOTS, STUMPS) AND OVERBURDEN ARE TO BE REMOVED FROM THE SHOULDERS PRIOR TO THE CONSTRUCTION OF THE ROAD'S SUBGRADE.

26. ALL CONCRETE SHALL BE CLASS A3-AE (3000PSI WITH AIR ENTRAINED ADDITIVE) AND TESTED BY THE DEVELOPER'S GEOTECHNICAL ENGINEER FOR CONFORMANCE TO VDOT SPECIFICATIONS AND STANDARDS.

27. THERE SHALL BE A MINIMUM OF 6" OF COMPACTED 21-B AGGREGATE MATERIAL OR STONE DEPTH SHALL MATCH THE EXISTING PAVEMENT TYPICAL UNDER THE CURB AND GUTTER; THIS MATERIAL SHALL EXTEND 1' BEYOND THE BACK OF THE CURB AND GUTTER. DENSITY TESTS SHALL BE TAKEN PRIOR TO A PROOF ROLL OF THE MATERIAL AND PLACEMENT OF THE CURB/CURB AND GUTTER. UNDERDRAINS WILL BE INSTALLED ON RAISED CURB MEDIANS IN ACCORDANCE WITH CURRENT VDOT SPECIFICATIONS AND STANDARDS.

28. ALL STREETS WITH CURB AND GUTTER SHALL HAVE A STANDARD CG ENTRANCE INSTALLED IN ACCORDANCE WITH THE CURRENT VDOT ROAD AND BRIDGE SPECIFICATIONS AND STANDARDS. THE CURB AND GUTTER PAN SHALL BE REMOVED PRIOR TO THE INSTALLATION OF THE ENTRANCE UNLESS A WIPE-DOWN OF THE CURB WAS MADE DURING THE INSTALLATION OF THE CURB AND GUTTER. THE SAW CUTTING AND REMOVAL OF ONLY THE CURB PORTION IS NOT ALLOWED. IT IS THE DEVELOPER'S RESPONSIBILITY TO INSURE THAT THE BUILDERS HAVE INSTALLED ALL CONCRETE ENTRANCES IN ACCORDANCE WITH VDOT SPECIFICATIONS AND STANDARDS.

29. ALL UNDERGROUND UTILITIES ARE TO BE IN PLACE PRIOR TO THE PLACEMENT OF THE BASE MATERIAL AND SHALL HAVE A MINIMUM COVERING OF 36". ON CURB AND GUTTER STREETS, THE AREA DIRECTLY BEHIND THE CURB TO THE RIGHT OF WAY LINE SHALL BE RELATIVELY FLAT AT THE PRIVATE ENTRANCE LOCATION. THE DEVELOPER'S CONTRACTOR SHOULD CUT EMBANKMENTS TO THE RIGHT OF WAY LINE PRIOR TO THE INSTALLATION OF ALL UNDERGROUND UTILITIES TO INSURE A MINIMUM 36" OF COVER.

30. THE SUB-BASE AND/OR BASE MATERIAL SHALL HAVE A ROLLER PATTERN AND A CONTROL STRIP WITH DENSITIES PERFORMED ON THE MATERIAL AND THE TEST RESULTS SUBMITTED TO VDOT PRIOR TO THE PROOF ROLL OF THE MATERIAL AND THE PLACEMENT OF THE ASPHALT (HOT MIX) COURSE. THE MATERIAL SHALL BE AT FINISHED GRADE, HAVE THE TEMPLATE AS SHOWN ON THE PAVEMENT TYPICAL, AND HAVE A STONE DEPTH AND PROOF ROLL PERFORMED BY VDOT AND THE DEVELOPER'S SOILS ENGINEER. DENSITY (COMPACTION) TESTS WILL BE PERFORMED USING A ROLLER PATTERN AND A CONTROL STRIP IN ACCORDANCE WITH CURRENT VDOT SPECIFICATIONS AND STANDARDS TO ACQUIRE THE THEORETICAL DENSITY OF THE MATERIAL. OPTIMUM MOISTURE SHALL COME FROM THE SUPPLIER OF THE MATERIAL. ANY YIELD MATERIAL MUST BE CORRECTED PRIOR TO THE PLACEMENT OF THE HOT MIX (ASPHALT). THE HOT MIX SHALL BE PLACED WITHIN 72 HOURS AFTER THE PROOF ROLL HAS BEEN COMPLETED SATISFACTORILY. ANY SIGNIFICANT RAINFALL PRIOR TO THE PLACEMENT OF THE PRIME COAT AND/OR HOT MIX WILL REQUIRE ANOTHER PROOF ROLL TO INSURE THE MATERIAL IS STABILIZED AND NON-YIELDING.

31. IN ACCORDANCE WITH SECTION 311 OF THE VDOT ROAD AND BRIDGE SPECIFICATIONS , A PRIME COAT OF .30 GAL. /SQ. YD. WILL BE REQUIRED FOR ANY PAVEMENT TYPICAL WITH LESS THAN 4" OF HOT MIX PRIOR TO THE PLACEMENT OF THE SURFACE COURSE.

32. ALL HOT MIX (ASPHALT) COURSES SHALL BE PLACED IN ACCORDANCE WITH SECTION 315 OF THE CURRENT VDOT ROAD AND BRIDGE SPECIFICATIONS . THE WEATHER LIMITATIONS OF A 40° F SURFACE TEMPERATURE OR 50° F AND RISING AIR TEMPERATURE SHALL BE FOLLOWED. THE DEVELOPER'S GEOTECHNICAL ENGINEER SHALL TEST THE MATERIAL TO INSURE COMPLIANCE WITH CURRENT VDOT SPECIFICATIONS AND THE SUPPLIER'S JOB MIX DESIGN. THE DEVELOPER'S GEOTECHNICAL ENGINEER SHALL ALSO PERFORM A ROLLER PATTERN AND A CONTROL STRIP FOR THE THEORETICAL DENSITY (COMPACTION) OF THE MATERIAL IN CONFORMANCE WITH THE CURRENT VDOT SPECIFICATIONS.

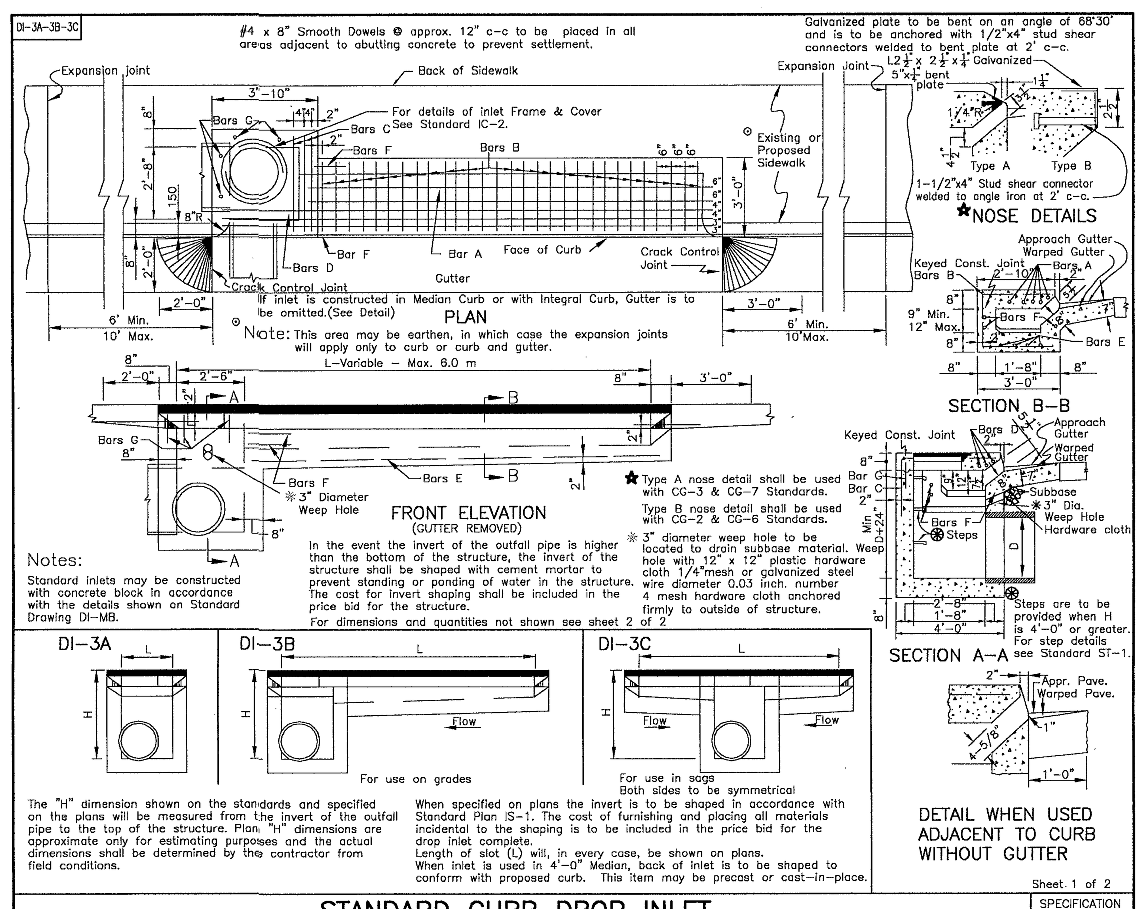
33. ALL UTILITY CABINETS, PEDESTALS, AND STREETLIGHTS SHALL BE LOCATED IN ACCORDANCE WITH VDOT REQUIREMENTS, AS NOTED IN THE ROAD DESIGN MANUAL. THERE SHALL NOT BE ANY CABINETS, PEDESTALS, OR FIRE HYDRANTS LOCATED ON THE SHOULDER.

34. ALL STORM PIPE, DROP INLET STRUCTURES, DITCHES, AND CURB AND GUTTER SHALL BE CLEANED OF DEBRIS AND SILT DURING THE LAST STAGES OF CONSTRUCTION.

35. FLOWERS, SHRUBS, AND TREES SHALL NOT BE PLACED WITHIN THE PROPOSED RIGHT OF WAY BY THE DEVELOPER OR HOMEOWNER WITHOUT AN APPROVED SET OF PLANS AND AN APPROVED PLANTING AGREEMENT. NO IRRIGATION (SPRINKLER) SYSTEMS SHALL BE LOCATED WITHIN THE PROPOSED RIGHT OF WAY. ANY IRRIGATION SYSTEM FOUND WITHIN THE RIGHT OF WAY WILL BE REMOVED PRIOR TO THE ACCEPTANCE OF THE STREETS AND ALL COSTS WILL BE BORNE BY THE OWNER. NO EASEMENTS SHALL ENCROACH UPON THE PROPOSED RIGHT OF WAY; ANY EASEMENTS LOCATED WITHIN THE PROPOSED RIGHT OF WAY MUST BE REMOVED FROM THE PLAT PRIOR TO THE RECORDATION OF THE PLAT. A DEED OF QUIT CLAIM WILL BE REQUIRED ON ANY EASEMENTS LOCATED WITHIN THE PROPOSED RIGHT OF WAY PRIOR TO THE ACCEPTANCE OF THE STREETS INTO THE STATE SECONDARY ROAD SYSTEM. NO BRICK COLUMNS, ENDWALLS, AND/OR BRICK MAILBOXES WILL BE CONSTRUCTED OR INSTALLED IN THE PROPOSED RIGHT OF WAY. ANY OF THE ABOVE ITEMS FOUND IN THE PROPOSED RIGHT OF WAY WILL BE REMOVED, AND ALL COSTS OF THE REMOVAL WILL BE BORNE BY THE OWNER AND/OR DEVELOPER.

36. CONTACT MR. SAL SIBILIA 72 HOURS IN ADVANCE OF ALL PAVEMENT MARKINGS/SIGN INSTALLATIONS AT (757) 925-1679. FAILURE TO DO SO MAY RESULT IN ADDITIONAL COST TO THE DEVELOPER.

37. CONTACT TRAFFIC ENGINEERING AT (757) 925-2693 A MINIMUM OF 48 HOURS IN ADVANCE WHENEVER AN OPEN CUT OR BORING OF A UTILITY LINE ACROSS A ROAD IS WITHIN 400 FEET OF A TRAFFIC SIGNAL, SO THE LINES CAN BE MARKED. FAILURE TO DO SO COULD BE A COSTLY REPAIR FOR THE DEVELOPER.



Notes:
Standard inlets may be constructed with concrete block in accordance with the details shown on Standard Drawing DI-MB.

The "H" dimension shown on the standards and specified on the plans will be measured from the invert of the outfall pipe to the top of the structure. Plan "H" dimensions are approximate only for estimating purposes and the actual dimensions shall be determined by the contractor from field conditions.

When specified on plans the invert is to be shaped in accordance with Standard Plan IS-1. The cost of furnishing and placing all material incidental to the shaping is to be included in the price bid for the drop inlet complete. Length of slot (L) will, in every case, be shown on plans. When inlet is used in 4'-0" Median, back of inlet is to be shaped to conform with proposed curb. This item may be precast or cast-in-place.

Sheet 1 of 2

STANDARD CURB DROP INLET
12" - 30" PIPE MAXIMUM DEPTH (H)=8'
VIRGINIA DEPARTMENT OF TRANSPORTATION
104.09 | SPECIFICATION REFERENCE 233 XXX 302
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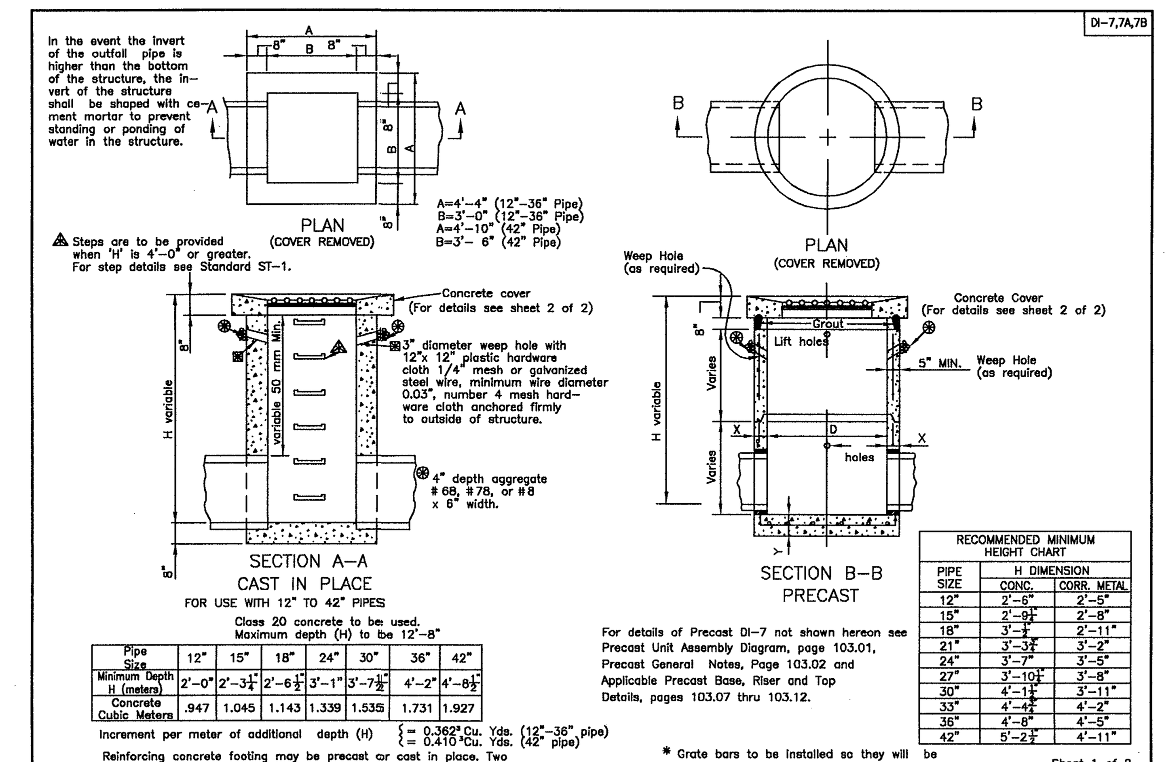

Class 20 concrete to be used. Maximum depth (H) to be 12'-8"

Pipe Size	12"	15"	18"	24"	30"	36"	42"
Minimum Depth H (meters)	2'-0"	2'-3¼"	2'-6½"	3'-1"	3'-7½"	4'-2"	4'-8½"
Concrete Cubic Meters	.947	1.045	1.143	1.339	1.535	1.731	1.927

Increment per meter of additional depth (H) = 0.362 Cu. Yds. (12"-36" pipe); = 0.410 Cu. Yds. (42" pipe)

Reinforcing concrete footing may be precast or cast in place. Two lifting hooks of fabricator's design to be provided in precast footing.

RECOMMENDED MINIMUM HEIGHT CHART		
PIPE SIZE	H DIMENSION CONC.	CORR. METAL
12"	2'-6"	2'-5"
15"	2'-9½"	2'-8"
18"	3'-½"	2'-11"
21"	3'-3½"	3'-2"
24"	3'-7"	3'-5"
27"	3'-10½"	3'-8"
30"	4'-1½"	3'-11"
33"	4'-4½"	4'-2"
36"	4'-8"	4'-5"
42"	5'-2½"	4'-11"

For details of Precast DI-7 not shown hereon see Precast Unit Assembly Diagram, page 103.01, Precast General Notes, Page 103.02 and Applicable Precast Base, Riser and Top Details, pages 103.07 thru 103.12.

* Grate bars to be installed so they will be aligned parallel to the ditch flow.

Sheet 1 of 2

General Notes:
DI-7 - No gutter
DI-7A - Single gutter when drop inlet is on a grade.
DI-7B - Double gutter when drop inlet is in a sag between two grades.
The type of inlet detailed hereon to be constructed will be at the option of the contractor.

When specified on plans the invert is to be shaped in accordance with standard IS-1.
For details of concrete cover, collar and grate, and method of placing approach gutter see sheet 2 of 2.

Increments shown are for inlets without pipes. Pipe displacement's must be deducted to obtain true quantities. Paved ditches are to be transitioned to meet inlet gutter as shown in Standard PG-1. Safety Slabs are to be provided at 8' minimum and 12' maximum vertical intervals and are to be spaced so as not to conflict with openings for pipes as directed by the Engineer.

STANDARD MEDIAN DROP INLET
VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIFICATION REFERENCE 241 503 | 104.22
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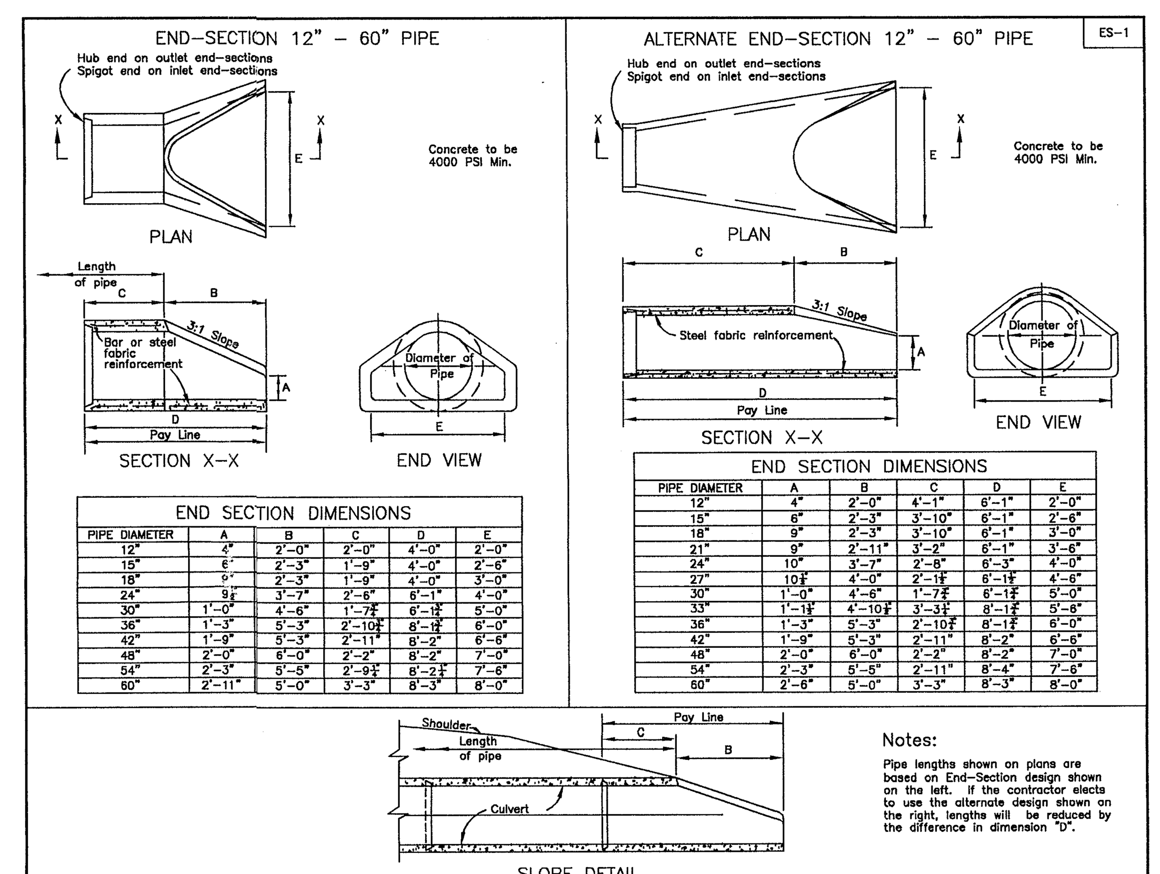

END SECTION DIMENSIONS

PIPE DIAMETER	A	B	C	D	E
12"	4"	2'-0"	2'-0"	4'-0"	2'-0"
15"	6"	2'-3"	1'-9"	4'-0"	2'-6"
18"	9"	2'-3"	1'-9"	4'-0"	3'-0"
24"	9½"	3'-7"	2'-6"	6'-1"	4'-0"
30"	1'-0"	4'-6"	1'-7¾"	6'-1½"	5'-0"
36"	1'-3"	5'-3"	2'-10¾"	8'-1½"	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"
54"	2'-3"	5'-5"	2'-9½"	8'-2½"	7'-6"
60"	2'-11"	5'-0"	3'-3"	8'-3"	8'-0"

END SECTION DIMENSIONS (ALTERNATE)

PIPE DIAMETER	A	B	C	D	E
12"	4"	2'-0"	4'-1"	6'-1"	2'-0"
15"	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	9"	2'-3"	3'-10"	6'-1"	3'-0"
21"	9"	2'-11"	3'-2"	6'-1"	3'-6"
24"	10"	3'-7"	2'-8"	6'-3"	4'-0"
27"	10½"	4'-0"	2'-1½"	6'-1½"	4'-6"
30"	1'-0"	4'-6"	1'-7¾"	6'-1½"	5'-0"
33"	1'-1½"	4'-10½"	3'-3½"	8'-1½"	5'-8"
36"	1'-3"	5'-3"	2'-10¾"	8'-1½"	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"
54"	2'-3"	5'-5"	2'-11"	8'-4"	7'-6"
60"	2'-6"	5'-0"	3'-3"	8'-3"	8'-0"

Notes:
Pipe lengths shown on plans are based on End-Section design shown on the left. If the contractor elects to use the alternate design shown on the right, lengths will be reduced by the difference in dimension "D".

FLARED END-SECTION FOR CONCRETE PIPE CULVERTS
VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIFICATION REFERENCE 302 | 102.01
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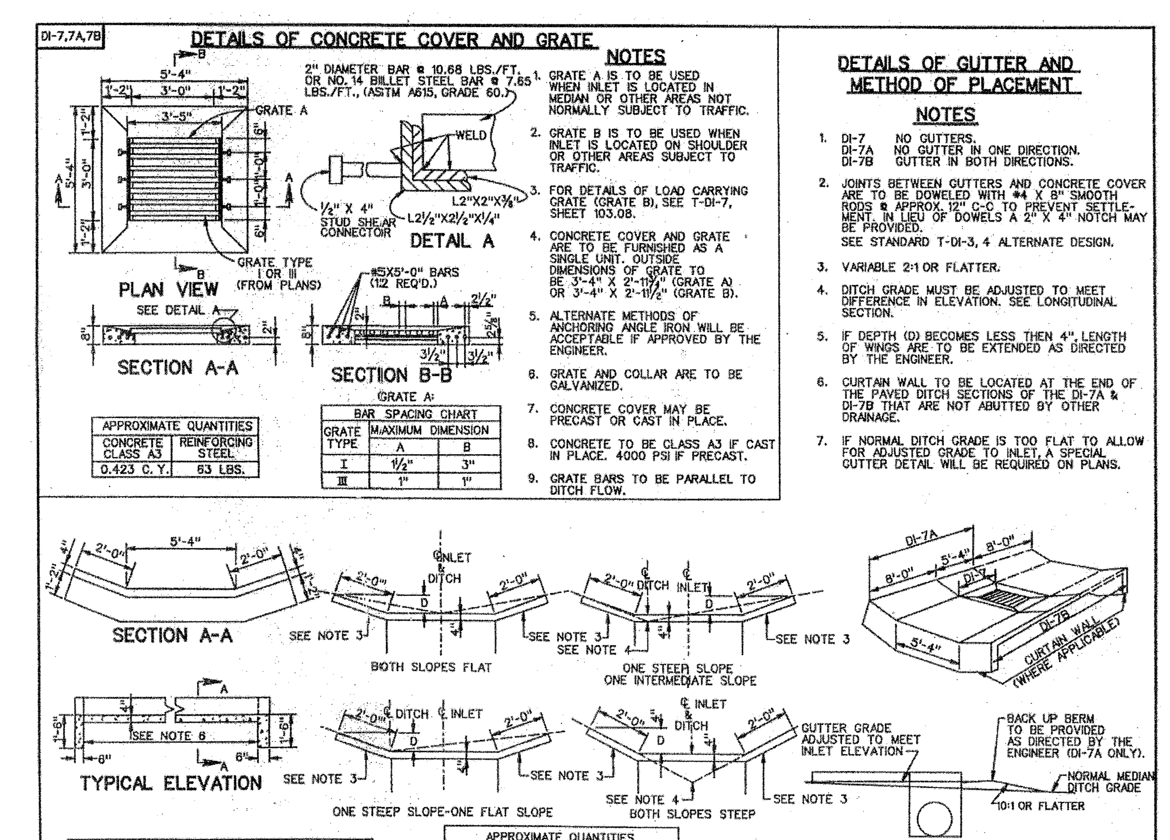


APPROXIMATE QUANTITIES	
CONCRETE CLASS A3	REINFORCING STEEL
0.423 C. Y.	63 LBS.

GRATE A: BAR SPACING CHART

GRATE TYPE	MAXIMUM DIMENSION A	B
I	½"	3"
III	1"	1"

NOTES
1. GRATE A IS TO BE USED WHEN INLET IS LOCATED IN MEDIAN OR OTHER AREAS NOT NORMALLY SUBJECT TO TRAFFIC.
2. GRATE B IS TO BE USED WHEN INLET IS LOCATED ON SHOULDER OR OTHER AREAS SUBJECT TO TRAFFIC.
3. FOR DETAILS OF LOAD CARRYING GRATE (GRATE B), SEE T-DI-7, SHEET 103.08.
4. CONCRETE COVER AND GRATE ARE TO BE FURNISHED AS A SINGLE UNIT. OUTSIDE DIMENSIONS OF GRATE TO BE 3'-4" X 2'-11¾" (GRATE A) OR 3'-4" X 2'-11½" (GRATE B).
5. ALTERNATE METHODS OF ANCHORING ANGLE IRON WILL BE ACCEPTABLE IF APPROVED BY THE ENGINEER.
6. GRATE AND COLLAR ARE TO BE GALVANIZED.
7. CONCRETE COVER MAY BE PRECAST OR CAST IN PLACE.
8. CONCRETE TO BE CLASS A3 IF CAST IN PLACE. 4000 PSI IF PRECAST.
9. GRATE BARS TO BE PARALLEL TO DITCH FLOW.

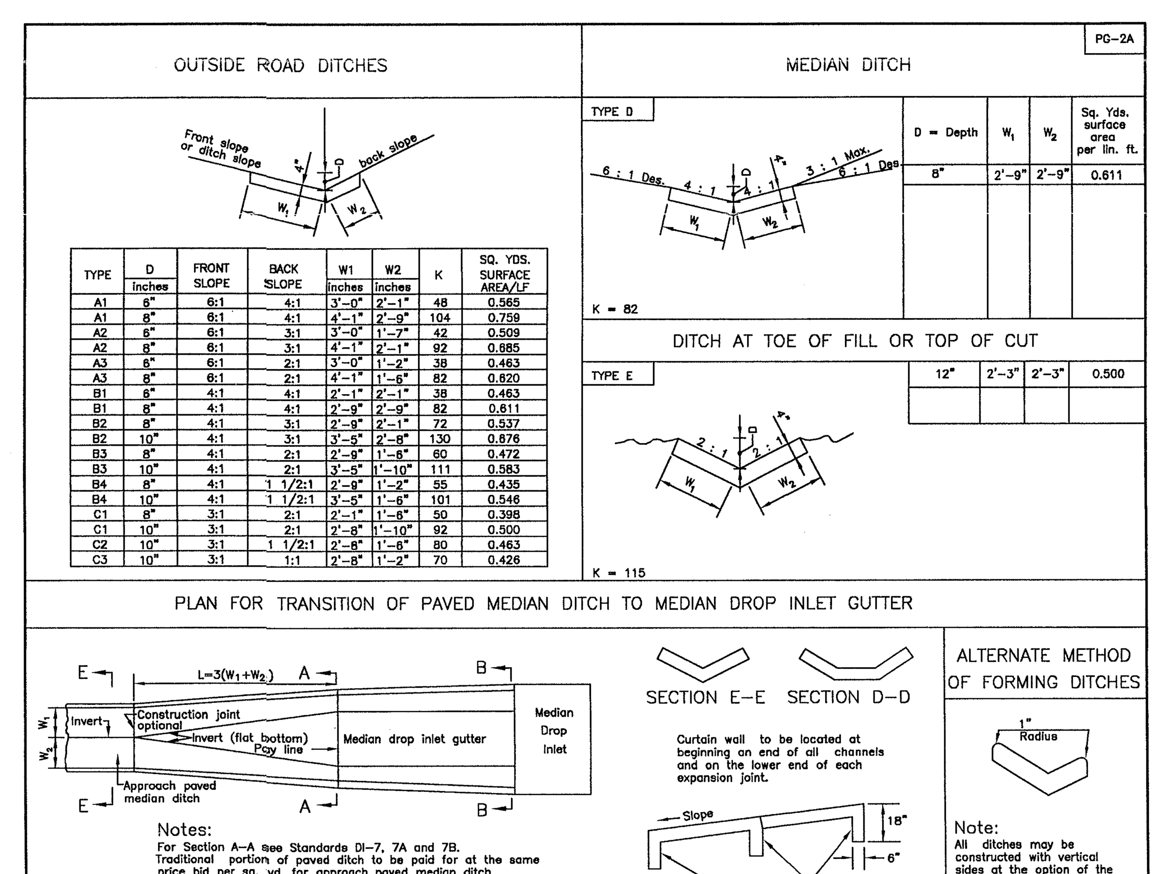
DETAILS OF GUTTER AND METHOD OF PLACEMENT
NOTES
1. DI-7 NO GUTTERS. DI-7A NO GUTTER IN ONE DIRECTION. DI-7B GUTTER IN BOTH DIRECTIONS.
2. JOINTS BETWEEN GUTTERS AND CONCRETE COVER ARE TO BE DOWELED WITH #4 X 8" SMOOTH RODS @ APPROX. 12" C-C TO PREVENT SETTLEMENT. IN LIEU OF DOWELS A 2" X 4" NOTCH MAY BE PROVIDED. SEE STANDARD T-DI-3, 4 ALTERNATE DESIGN.
3. VARIABLE 2:1 OR FLATTER.
4. DITCH GRADE MUST BE ADJUSTED TO MEET DIFFERENCE IN ELEVATION. SEE LONGITUDINAL SECTION.
5. IF DEPTH (D) BECOMES LESS THEN 4", LENGTH OF WINGS ARE TO BE EXTENDED AS DIRECTED BY THE ENGINEER.
6. CURTAN WALL TO BE LOCATED AT THE END OF THE PAVED DITCH SECTIONS OF THE DI-7A & DI-7B THAT ARE NOT ABUTTED BY OTHER DRAINAGE.
7. IF NORMAL DITCH GRADE IS TOO FLAT TO ALLOW FOR ADJUSTED GRADE TO INLET, A SPECIAL GUTTER DETAIL WILL BE REQUIRED ON PLANS.

APPROXIMATE QUANTITY FOR ONE CURTAIN WALL, MEASURED FROM BOTTOM OF GUTTER	
CONCRETE CLASS A3	0.241 CU. YDS.

APPROXIMATE QUANTITIES			
CONCRETE CLASS A3	DI-7	DI-7A	DI-7B
(CU. YDS.)	NONE	1.211	2.148

SHEET 2 OF 3

STANDARD MEDIAN DROP INLET
12" TO 42" PIPE
VIRGINIA DEPARTMENT OF TRANSPORTATION
104.23 | SPECIFICATION REFERENCE 241 503

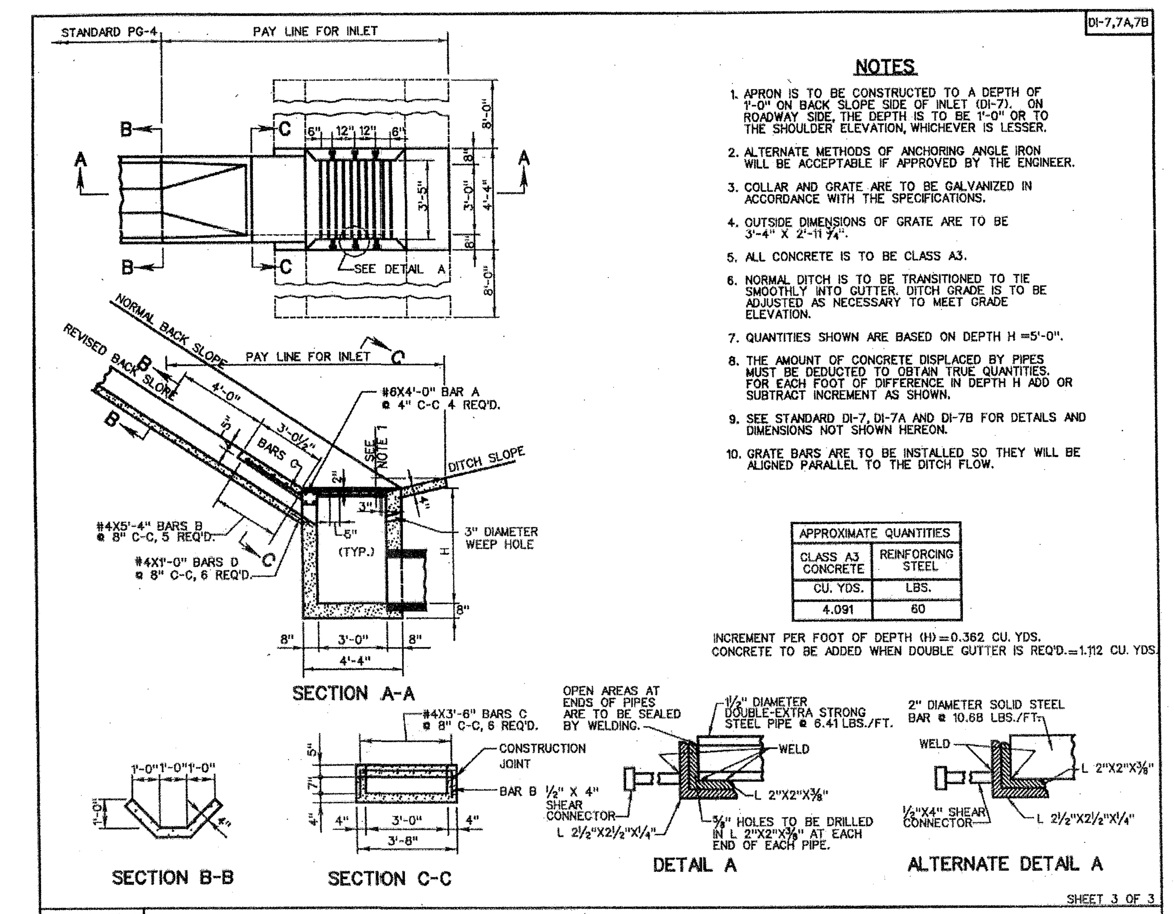


TYPE	D Inches	FRONT SLOPE	BACK SLOPE	W1 Inches	W2 Inches	K	SQ. YDS. SURFACE AREA/LF
A1	6"	6:1	4:1	3'-0"	2'-1"	48	0.565
A1	8"	6:1	4:1	4'-1"	2'-9"	104	0.759
A2	6"	6:1	3:1	3'-0"	1'-7"	42	0.509
A2	8"	6:1	3:1	4'-1"	2'-1"	92	0.685
A3	6"	6:1	2:1	3'-0"	1'-2"	38	0.463
A3	8"	6:1	2:1	4'-1"	1'-6"	82	0.620
B1	6"	4:1	4:1	2'-1"	2'-1"	38	0.463
B1	8"	4:1	4:1	2'-9"	2'-9"	82	0.611
B2	8"	4:1	3:1	2'-9"	2'-1"	72	0.537
B2	10"	4:1	3:1	3'-5"	2'-8"	130	0.676
B3	8"	4:1	2:1	2'-9"	1'-6"	60	0.472
B3	10"	4:1	2:1	3'-5"	1'-10"	111	0.583
B4	8"	4:1	1 1/2:1	2'-9"	1'-2"	55	0.435
B4	10"	4:1	1 1/2:1	3'-5"	1'-6"	101	0.546
C1	8"	3:1	2:1	2'-1"	1'-6"	50	0.398
C1	10"	3:1	2:1	2'-8"	1'-10"	92	0.500
C2	10"	3:1	1 1/2:1	2'-8"	1'-6"	80	0.463
C3	10"	3:1	1:1	2'-8"	1'-2"	70	0.426

	D = Depth	W_1	W_2	Sq. Yds. surface area per lin. ft.
TYPE D (K = 82)	8"	2'-9"	2'-9"	0.611
TYPE E (K = 115)	12"	2'-3"	2'-3"	0.500

Notes:
For Section A-A see Standards DI-7, 7A and 7B.
Traditional portion of paved ditch to be paid for at the same price bid per sq. yd. for approach paved median ditch.
Standard PG-2A ditches to be Class A3 Concrete.

STANDARD PAVED DITCHES
VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIFICATION REFERENCE 502 | 109.01
THIS DRAWING WAS ELECTRONICALLY REPRODUCED BY LANDMARK DESIGN GROUP



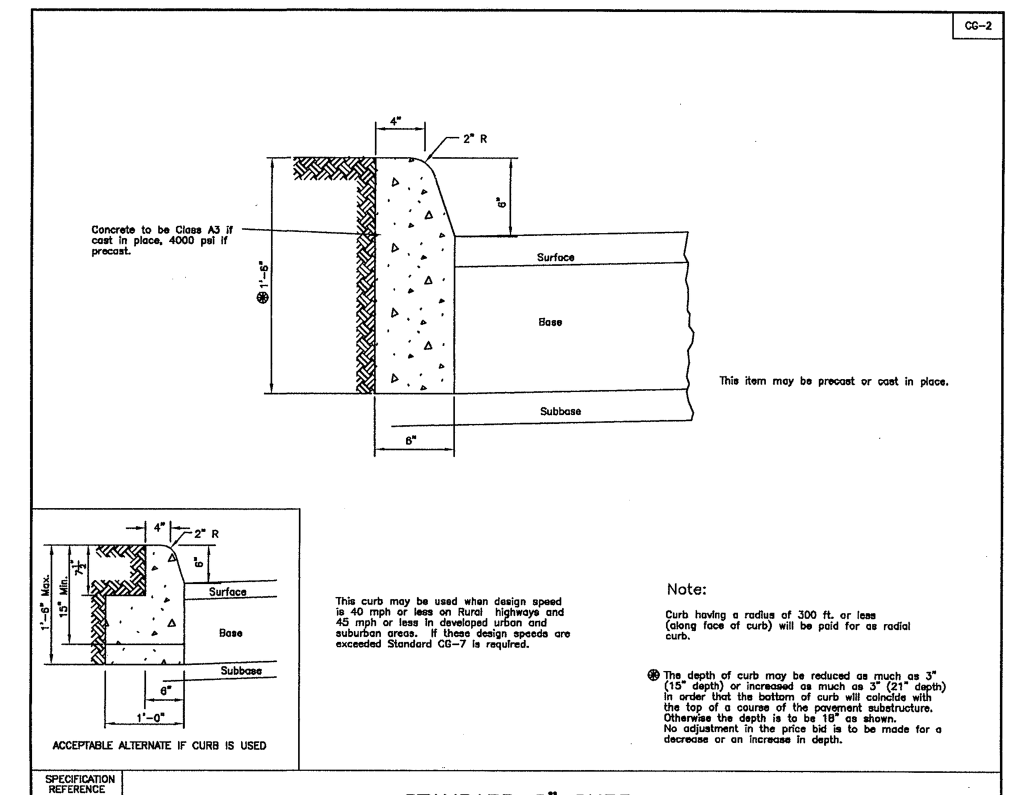
NOTES
1. APRON IS TO BE CONSTRUCTED TO A DEPTH OF 1'-0" ON BACK SLOPE SIDE OF INLET (DI-7). ON ROADWAY SIDE, THE DEPTH IS TO BE 1'-0" OR TO THE SHOULDER ELEVATION, WHICHEVER IS LESSER.
2. ALTERNATE METHODS OF ANCHORING ANGLE IRON WILL BE ACCEPTABLE IF APPROVED BY THE ENGINEER.
3. COLLAR AND GRATE ARE TO BE GALVANIZED IN ACCORDANCE WITH THE SPECIFICATIONS.
4. OUTSIDE DIMENSIONS OF GRATE ARE TO BE 3'-4" X 2'-11 ¾".
5. ALL CONCRETE IS TO BE CLASS A3.
6. NORMAL DITCH IS TO BE TRANSITIONED TO TIE SMOOTHLY INTO GUTTER. DITCH GRADE IS TO BE ADJUSTED AS NECESSARY TO MEET GRADE ELEVATION.
7. QUANTITIES SHOWN ARE BASED ON DEPTH H =5'-0".
8. THE AMOUNT OF CONCRETE DISPLACED BY PIPES MUST BE DEDUCTED TO OBTAIN TRUE QUANTITIES. FOR EACH FOOT OF DIFFERENCE IN DEPTH H ADD OR SUBTRACT INCREMENT AS SHOWN.
9. SEE STANDARD DI-7, DI-7A AND DI-7B FOR DETAILS AND DIMENSIONS NOT SHOWN HEREON.
10. GRATE BARS ARE TO BE INSTALLED SO THEY WILL BE ALIGNED PARALLEL TO THE DITCH FLOW.

APPROXIMATE QUANTITIES	
CLASS A3 CONCRETE	REINFORCING STEEL
CU. YDS.	LBS.
4.091	60

INCREMENT PER FOOT OF DEPTH (H)=0.362 CU. YDS.
CONCRETE TO BE ADDED WHEN DOUBLE GUTTER IS REQ'D.=1.112 CU. YDS.

SHEET 3 OF 3

STANDARD DI-7, 7A OR 7B WITH FLUME CONNECTION
12" TO 36" PIPE
VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIFICATION REFERENCE 502 | 104.24



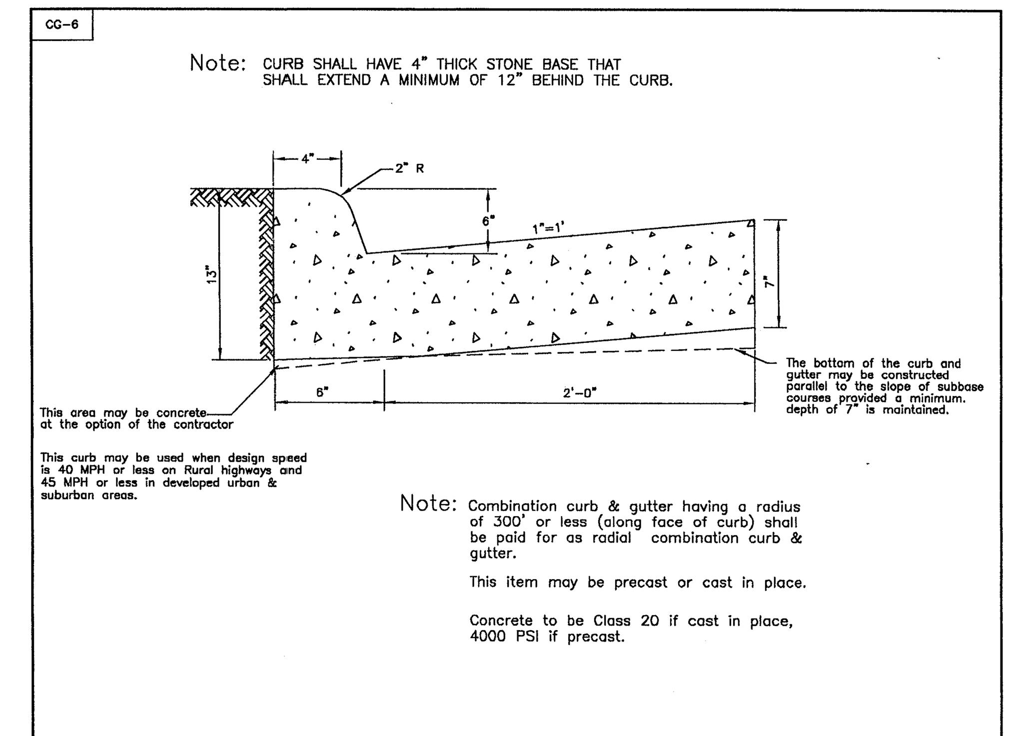
This item may be precast or cast in place.

This curb may be used when design speed is 40 mph or less on Rural highways and 45 mph or less in developed urban and suburban areas. If these design speeds are exceeded Standard CG-7 is required.

Note:
Curb having a radius of 300 ft. or less (along face of curb) will be paid for as radial curb.

The depth of curb may be reduced as much as 3" (15" depth) or increased as much as 3" (21" depth) in order that the bottom of curb will coincide with the top of a course of the pavement substructure. Otherwise the depth is to be 18" as shown. No adjustment in the price bid is to be made for a decrease or an increase in depth.

STANDARD 6" CURB
VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIFICATION REFERENCE 105 502 | 201.01
THIS DRAWING FILE WAS ELECTRONICALLY REPRODUCED BY LANDMARK DESIGN GROUP



Note: CURB SHALL HAVE 4" THICK STONE BASE THAT SHALL EXTEND A MINIMUM OF 12" BEHIND THE CURB.

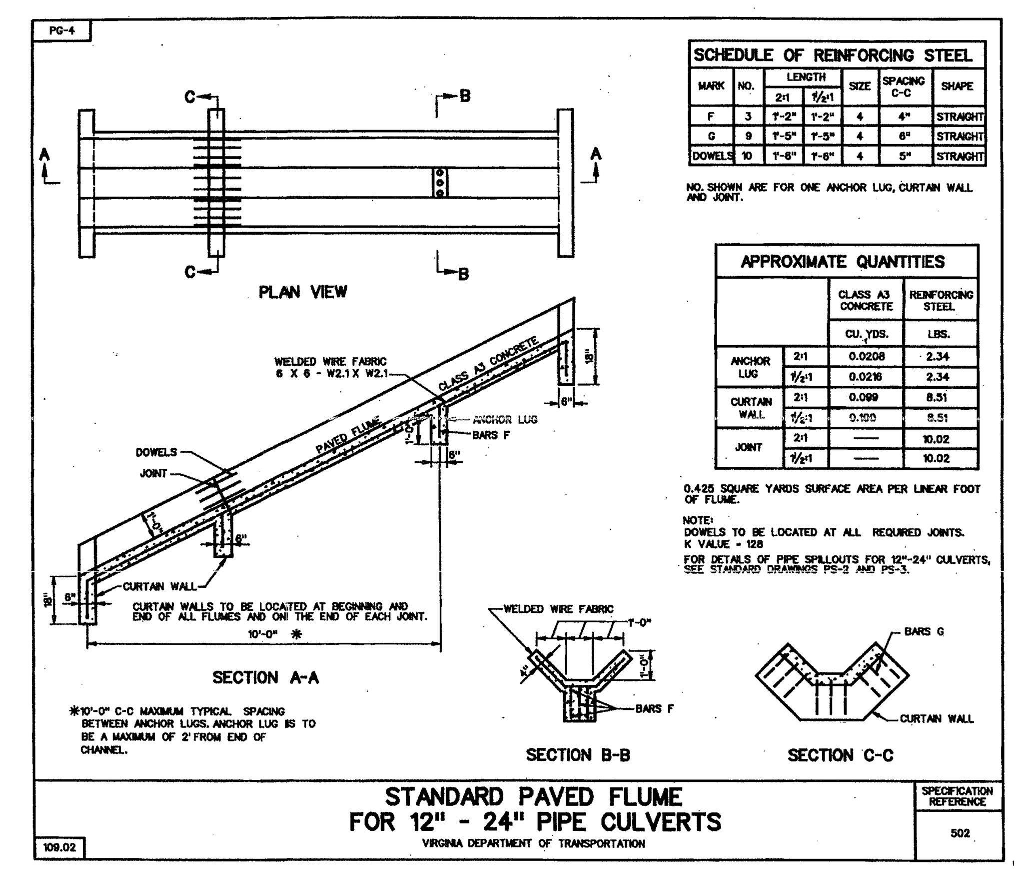
This curb may be used when design speed is 40 MPH or less on Rural highways and 45 MPH or less in developed urban & suburban areas.

Note: Combination curb & gutter having a radius of 300' or less (along face of curb) shall be paid for as radial combination curb & gutter.

This item may be precast or cast in place.

Concrete to be Class 20 if cast in place, 4000 PSI if precast.

COMBINATION 6" CURB & GUTTER
VIRGINIA DEPARTMENT OF TRANSPORTATION
201.03 | SPECIFICATION REFERENCE 105 502
THIS DRAWING WAS ELECTRONICALLY REPRODUCED BY LANDMARK DESIGN GROUP



SCHEDULE OF REINFORCING STEEL

MARK	NO.	LENGTH 2:1	LENGTH 1½:1	SIZE	SPACING C-C	SHAPE
F	3	1'-2"	1'-2"	4	4"	STRAIGHT
G	9	1'-5"	1'-5"	4	6"	STRAIGHT
DOWELS	10	1'-8"	1'-6"	4	5"	STRAIGHT

NO. SHOWN ARE FOR ONE ANCHOR LUG, CURTAIN WALL AND JOINT.

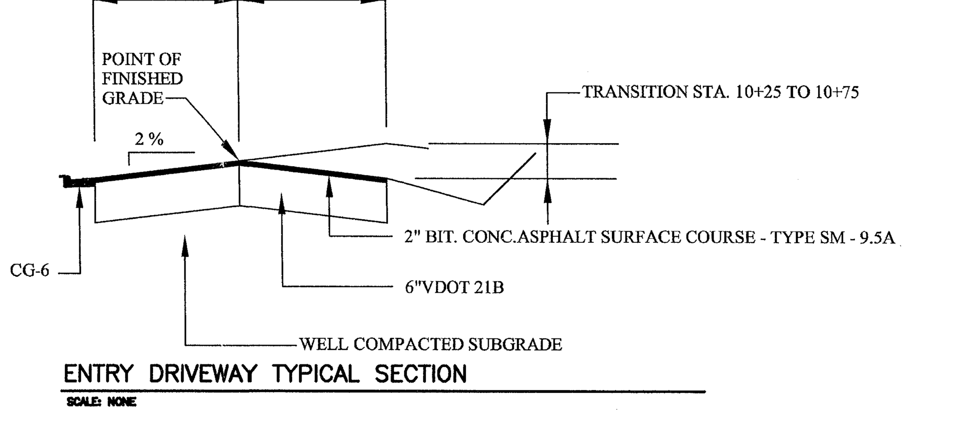
APPROXIMATE QUANTITIES

		CLASS A3 CONCRETE CU. YDS.	REINFORCING STEEL LBS.
ANCHOR LUG	2:1	0.0208	2.34
ANCHOR LUG	1½:1	0.0216	2.34
CURTAIN WALL	2:1	0.099	8.51
CURTAIN WALL	1½:1	0.100	8.51
JOINT	2:1	—	10.02
JOINT	1½:1	—	10.02

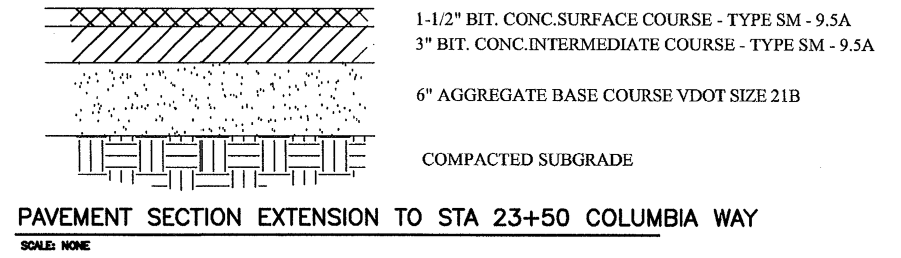
0.425 SQUARE YARDS SURFACE AREA PER LINEAR FOOT OF FLUME.

NOTE:
DOWELS TO BE LOCATED AT ALL REQUIRED JOINTS.
K VALUE = 128
FOR DETAILS OF PIPE SPILLOUTS FOR 12"-24" CULVERTS, SEE STANDARD DRAWINGS PS-2 AND PS-3.

STANDARD PAVED FLUME
FOR 12" - 24" PIPE CULVERTS
VIRGINIA DEPARTMENT OF TRANSPORTATION
109.02 | SPECIFICATION REFERENCE 502



ENTRY DRIVEWAY TYPICAL SECTION
SCALE: NONE



PAVEMENT SECTION EXTENSION TO STA 23+50 COLUMBIA WAY
SCALE: NONE

McKINNEY AND COMPANY
planning • design • construction
MAIN OFFICE
100 SOUTH RAILROAD AVE.
ASHLAND, VIRGINIA 23005
(804)798.1451 FAX: (804)798.7072
WILLIAMSBURG OFFICE
460 MCLAWS CIRCLE, SUITE 150
WILLIAMSBURG, VA. 23185
(757)220.5400 FAX: (757)229.6301
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SHELL BUILDING
JAMES RIVER COMMERCE CENTER
JAMES CITY COUNTY
VIRGINIA

COMMONWEALTH OF VIRGINIA
RICHARD S. PHILLIPS
No. 023631
1/10/04
PROFESSIONAL ENGINEER

DESIGN: RSP
DRAWN: EMP
CHECKED: RSP
REVISIONS:

DATE: APRIL 1, 2003
JOB NO. 2002138-000.01
CAD NO. C105vdot
DRAWING TITLE: VDOT DETAILS AND NOTES
14434 W
SHEET NO. C105

JAMES CITY COUNTY
INVITATION FOR BID (IFB)04-0033

JAMES RIVER
COMMERCE CENTER
COLUMBIA WAY

ROBERTS MAGISTERIAL DISTRICT
JAMES CITY COUNTY, VIRGINIA
FOR

JAMES CITY COUNTY INDUSTRIAL DEVELOPMENT AUTHORITY

JANUARY 17, 2003

REVISION SEPTEMBER 10, 2003

ADDENDUM NO. 1 FEBRUARY 17, 2004

LEGEND

EXISTING		PROPOSED
SAN	SANITARY SEWER	SAN
W	WATER	W
S	STORM SEWER	S
E	ELECTRIC LINE	E
T	TELEPHONE	T
G	GAS LINE	G
TV	CABLE TV LINE	TV
FM	FORCE MAIN	FM
OH	OVERHEAD CABLE	OH
	MANHOLE	
	CURB DROP INLET	
	YARD DROP INLET	
	CLEANOUT	
	FLARED END SECTION	
	VALVE	
	WATER METER	
	FIRE HYDRANT	
	POWER POLE	
	LIGHT POLE	
	TELEPHONE PEDESTAL	
	TELEPHONE POLE	
25.1	GROUND ELEVATION	25.10 F.C.
	CEMENT CONCRETE	
	BITUMINOUS CONCRETE	
	CONCRETE CURB	
	CG-6 CURB & GUTTER	
	CG-6(MOD) CURB & GUTTER	
	CURB TRANSITION CG-6 TO CG-6(MOD)	
	PROJECT LIMITS	
	CENTERLINE/BASELINE	
	PROPERTY LINE	
	DITCH SWALE LINE	
	DIRECTION OF FLOW	
	TREE LINE	
—X—X—	FENCE	—X—X—
	BORING	
	BENCH MARK	
	EASEMENT LINE	
	BLOW-OFF VALVE	
	FILL DIVERSION DIKE	FD
	CONSTRUCTION ENTRANCE	CE
	SILT FENCE	SF
	INLET PROTECTION	IP

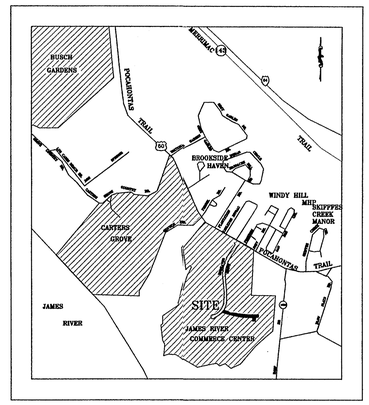
NOTE: SOME SYMBOLS SHOWN IN THIS LEGEND MAY NOT NECESSARILY BE USED FOR THIS PROJECT.

Miss Utility of Virginia
234 BYRES BEND BOULEVARD
CHESTER, VIRGINIA 23831

72 HOURS BEFORE YOU DIG CALL MISS UTILITY OF VIRGINIA

BEFORE YOU DIG ANYWHERE IN VIRGINIA! CALL 1-800-552-7001

VA LAW REQUIRES 72 HOURS NOTICE BEFORE YOU EXCAVATE.



VICINITY MAP SCALE : 1"=2000'

LANDMARK DESIGN GROUP
Engineers • Planners • Surveyors
Landscape Architects • Environmental Consultants

SHEET INDEX

SHT. NO.	DESCRIPTION
C1	COVER SHEET
C2	OVERALL PLAN & ENVIRONMENTAL INVENTORY
C3	DEMOLITION & EROSION CONTROL PLAN
C4	GRADING, DRAINAGE & UTILITIES PLAN
C4A	PROFILE - COLUMBIA WAY
C5	SITE DETAILS & NOTES
C6	EROSION CONTROL DETAILS & NOTES
C7	VDOT DETAILS AND NOTES

OWNER/DEVELOPER
JAMES CITY COUNTY
INDUSTRIAL DEVELOPMENT AUTHORITY
CONTACT PERSON: BERNARD M. FARMER
CAPITAL PROJECTS ADMINISTRATOR
105 TEWNING ROAD
WILLIAMSBURG, VA 23185

SITE ENGINEER
LANDMARK DESIGN GROUP
CONTACT PERSON: NORMAN MASON
4029 IRONBOUND ROAD, SUITE 100
WILLIAMSBURG VA, 23188
PHONE: (757) 253-2975
FAX: (757) 229-0049

STATISTICAL DATA

PARCEL ID	5920100017
TAX MAP NO.	59-2-17
ZONING	M-1
USE	ROADWAY
PROJECT AREA	72,800 sq.ft.
DISTURBED AREA	72,800 sq.ft.
DESIGN SPEED	30 MPH

RESPONSIBLE LAND DISTURBER
NORMAN MASON
LANDMARK DESIGN GROUP
4029 IRONBOUND ROAD, SUITE 100
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LANDMARK DESIGN GROUP
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REVISIONS:

No.	Date	Comment	By
1	1/29/03	REVISED PER COUNTY COMMENTS	JRW
2	1/29/04	REVISED FOR BID	LFV

DRAWING STATUS
- 9/27/03 Interoffice Review
- Client for Review
- Pre Approval Bidding
- COUNTY APPROVAL
- 3/28/03 1st Submittal
- 9/10/03 2nd Submittal
- 3rd Submittal
- Approved

COVER SHEET

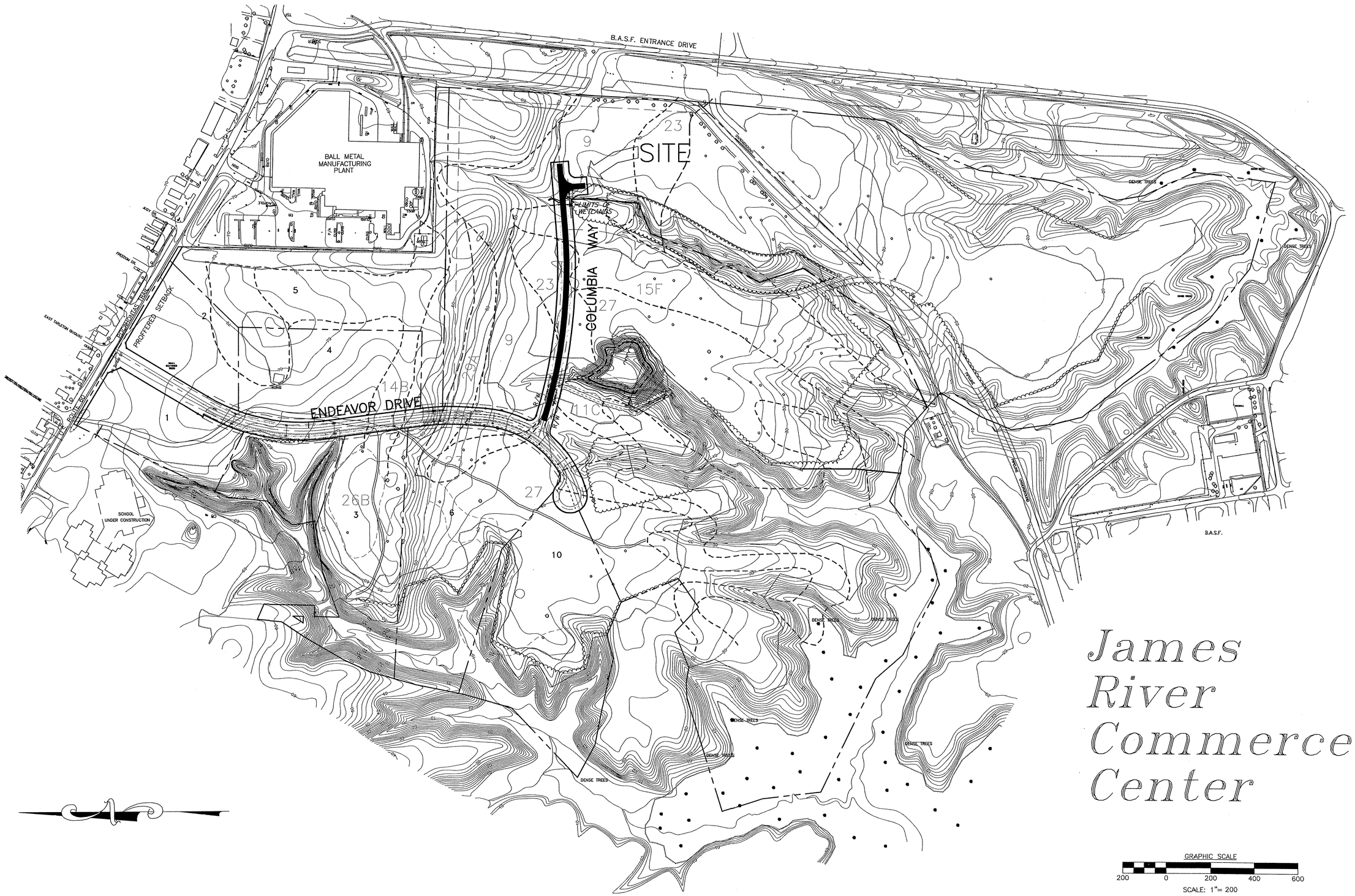
JAMES RIVER COMMERCE CENTER
COLUMBIA WAY
ROBERTS MAGISTERIAL DISTRICT
JAMES CITY COUNTY, VIRGINIA
FOR
JAMES CITY COUNTY INDUSTRIAL DEVELOPMENT AUTHORITY

Designed: AJR	Date: 1/15/03
Checked: RSP	Scale: NONE
File Mgr./Drawn: LFV/AJR	CADD File name: COVER.dwg
Project Number: 2002248-000.01	Plot. File : cover.plt
Drawing Number	C-1

1 OF 8

Bernie

1405.3W



GRAPHIC SCALE

200 0 200 400 600

SCALE: 1"= 200

CONTOUR INTERVAL=2'

COMMONWEALTH OF VIRGINIA
2/17/04
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1	7/23/03	REVISED PER COUNTY COMMENTS	HWU
2			
3			
4			
5			
6			

DRAWING STATUS	
3/27/03	Interoffice Review
	Client for Review
	Pre Approval Bidding

COUNTY APPROVAL	
3/28/03	1st Submittal
9/10/03	2nd Submittal
	3rd Submittal
	Approved

OVERALL PLAN & ENVIRONMENTAL INVENTORY

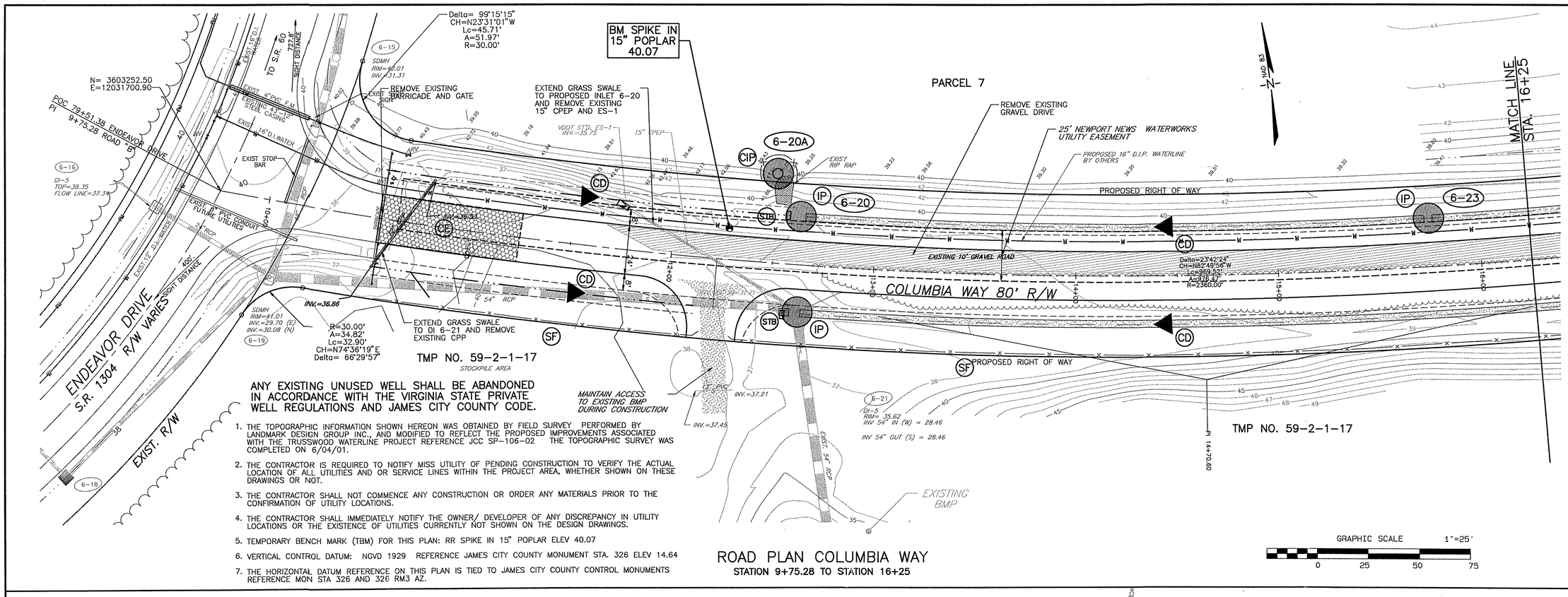
JAMES RIVER COMMERCE CENTER

COLUMBIA WAY
ROBERTS MAGISTERIAL DISTRICT
JAMES CITY COUNTY, VIRGINIA
FOR
JAMES CITY COUNTY INDUSTRIAL DEVELOPMENT AUTHORITY

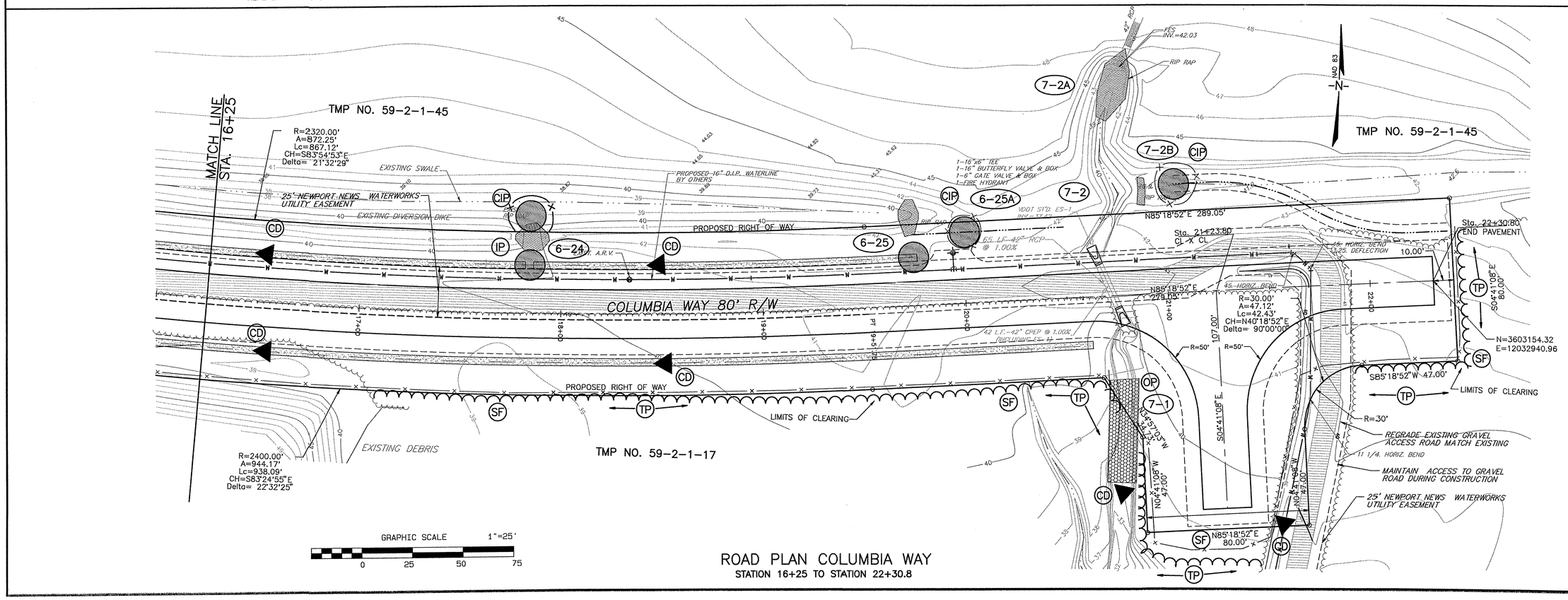
Designed: AJR	Date: 1/15/03
Checked: RSP	Scale: 1"=200'
File Mgr./Drawn: LFV/AJR	CADD File name: Overall.dwg
Project Number: 2002248-000.01	Plot. File : overall.plt
Drawing Number 2 OF 8	C-2

14052W

JR038_JAMES_RIVER_COMMERCE_CENTER - 013



ROAD PLAN COLUMBIA WAY
STATION 9+75.28 TO STATION 16+25



ROAD PLAN COLUMBIA WAY
STATION 16+25 TO STATION 22+30.8

COMMONWEALTH OF VIRGINIA
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1	8/12/03	REVISED PER COUNTY COMMENTS	AJR
2	2/18/04	REVISED PER JCSA COMMENTS	AJR

DRAWING STATUS
1/20/03 Interdiscip. Review
Client for Review
Pre Approval Bidding

COUNTY APPROVAL
2/27/03 1st Submittal
9/10/03 2nd Submittal
3rd Submittal
Approved

DEMOLITION & EROSION CONTROL PLAN

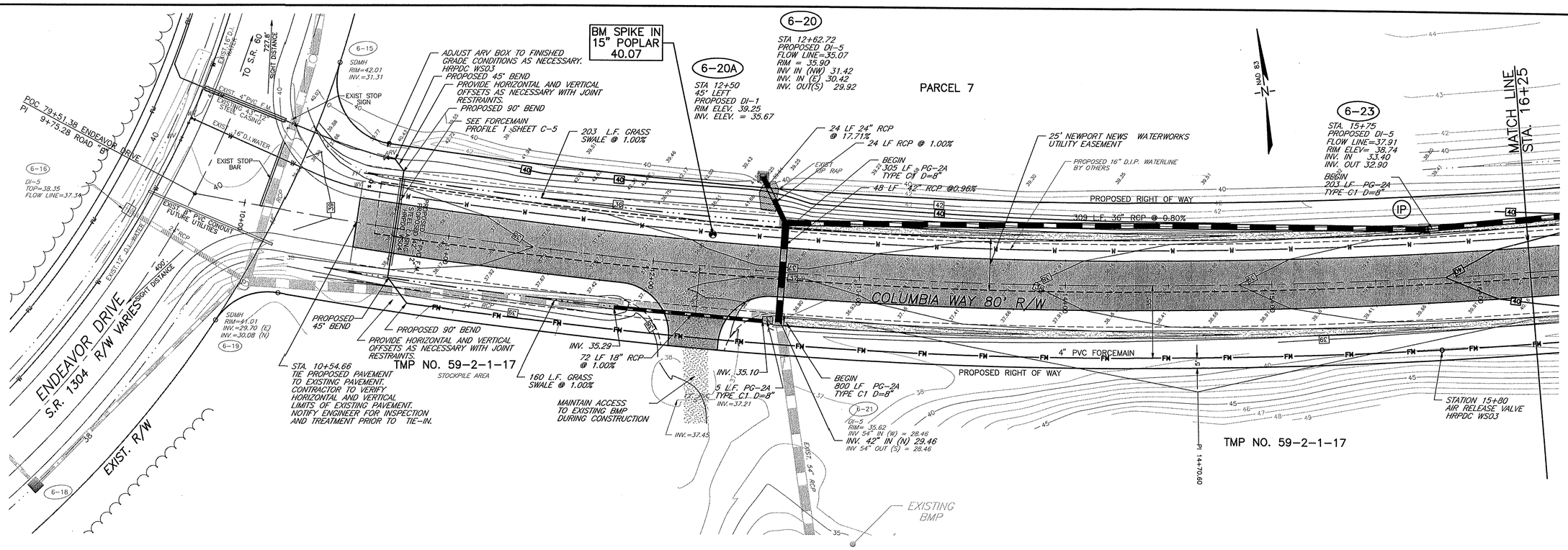
JAMES RIVER COMMERCE CENTER
COLUMBIA WAY
ROBERTS MAGESTERIAL DISTRICT
JAMES CITY COUNTY, VIRGINIA
FOR
JAMES CITY COUNTY INDUSTRIAL DEVELOPMENT AUTHORITY

Designed: AJR	Date: 1/20/03
Checked: RSP	Scale: 1"=25'
Drawn: LFV/AJR	CADD File name: COLUMBIA02003
Project Number: 2002248-000.01	Dwg. File No.: C-3.PLT
Drawing Number	

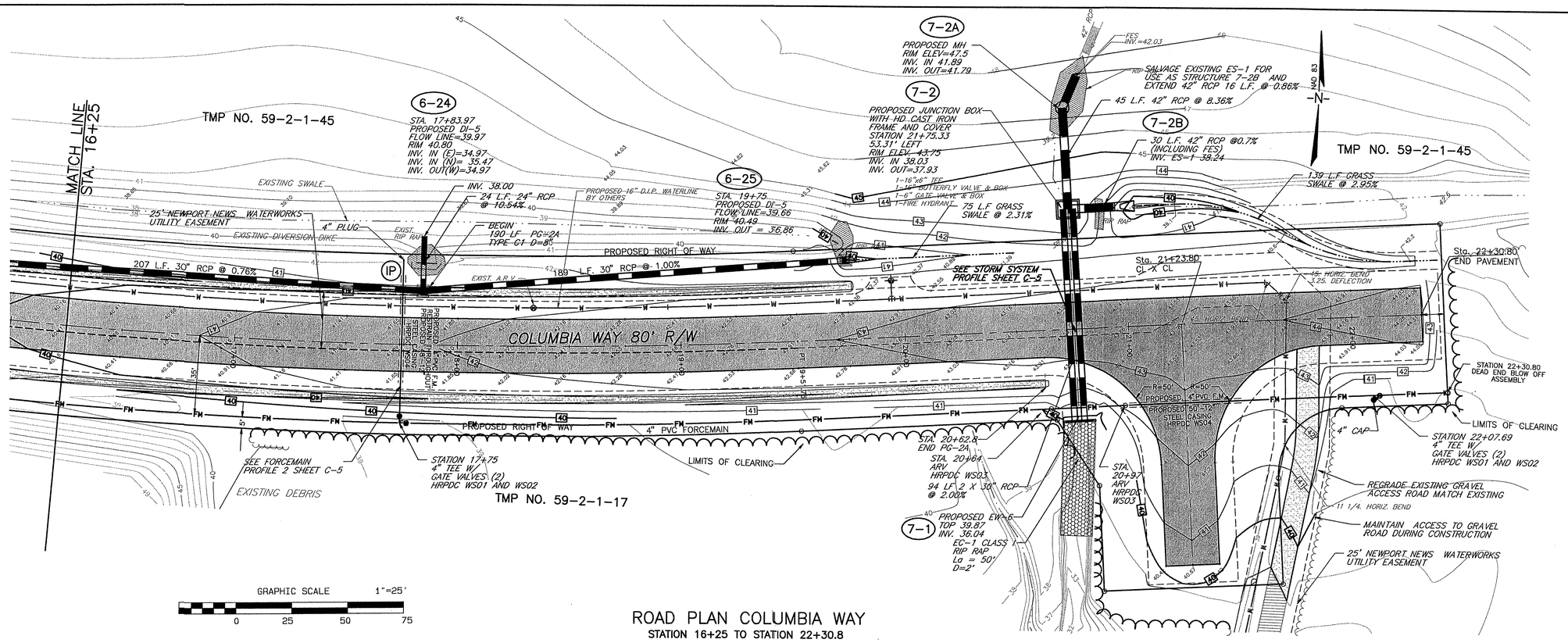
3 OF 8 C-3

1405IW

JR038_JAMES_RIVER_COMMERCE_CENTER - 014



ROAD PLAN COLUMBIA WAY
STATION 9+75.28 TO STATION 16+25



ROAD PLAN COLUMBIA WAY
STATION 16+25 TO STATION 22+30.8

COMMONWEALTH OF VIRGINIA
2/17/04
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Email: lmdg@landmarkdg.com

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1	8/12/03	REVISED PER COUNTY COMMENTS	AJR
2	2/06/04	REVISED PER JCSA COMMENTS	AJR

DRAWING STATUS		COUNTY APPROVAL	
1/28/03	Interoffice Review	3/27/03	1st Submittal
	Client for Review	9/10/03	2nd Submittal
	Pre Approval Bidding		3rd Submittal
			Approved

GRADING DRAINAGE AND UTILITIES PLAN

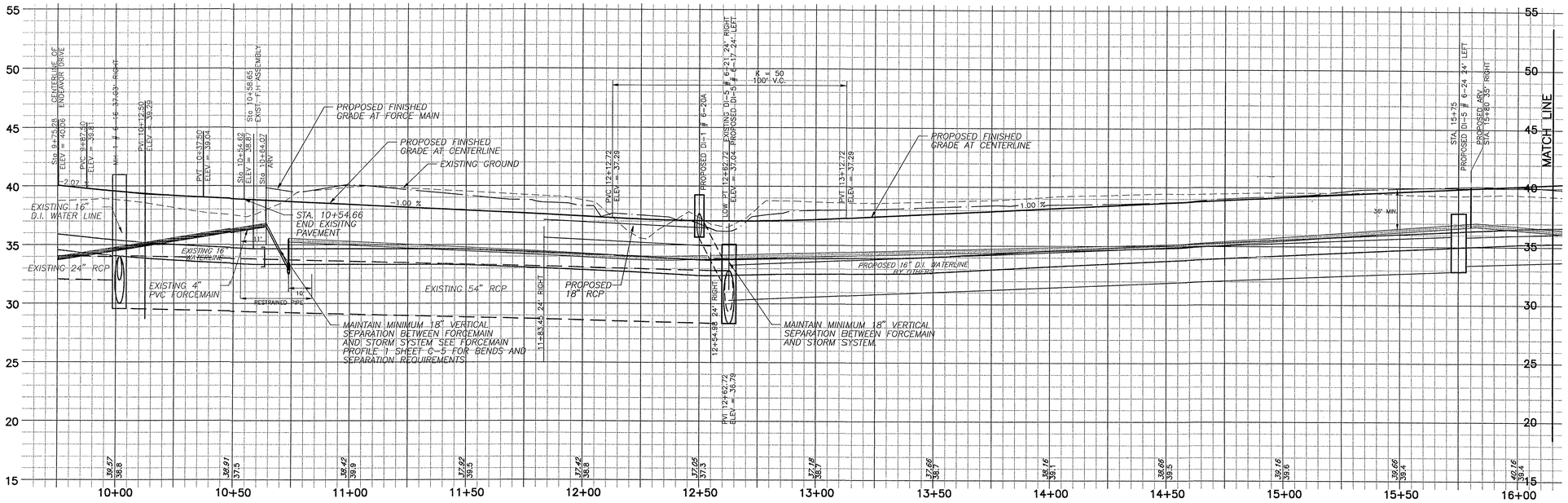
JAMES RIVER COMMERCE CENTER
COLUMBIA WAY
ROBERTS MAGESTERIAL DISTRICT
JAMES CITY COUNTY, VIRGINIA
FOR
JAMES CITY COUNTY INDUSTRIAL DEVELOPMENT AUTHORITY

Designed: AJR	Date: 1/20/03
Checked: RSP	Scale: 1" = 25'
Drawn: LFV/AJR	CADD File name: COLUMBIAR2003
Project Number: 2002248-000.01	Dwg. File No.: C-3A.PLT

Drawing Number
4 OF 8
C-4

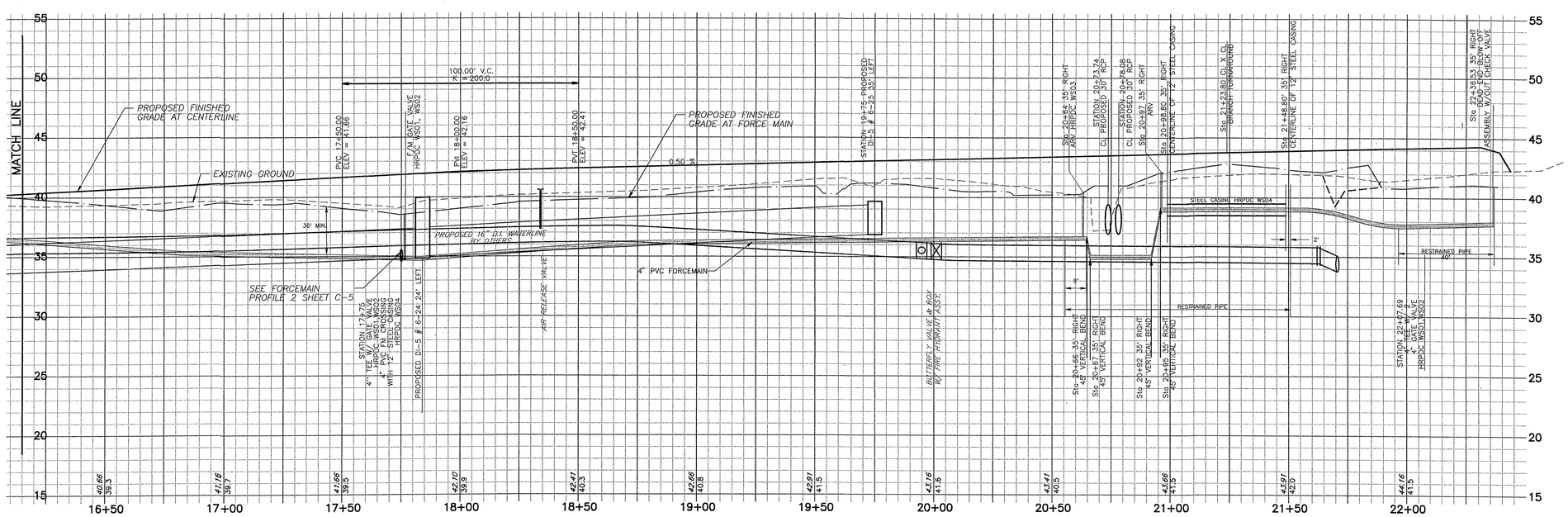
1405|AW

JR038_JAMES_RIVER_COMMERCE_CENTER - 015



PROFILE COLUMBIA WAY
STATION 9+75.28 TO STATION 16+25
scale: 1" = 25' horizontal 1" =5' vertical

1. STATION ON WATER LINE IS BASED UPON THE CONNECTION POINT TO EXISTING BEING 10+00



PROFILE COLUMBIA WAY
STATION 16+25 TO STATION 22+30.8
scale: 1" = 25' horizontal 1" =5' vertical

COMMONWEALTH OF VIRGINIA
RICHARD S. PHILLIPS
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REVISIONS:

No.	Date	Comment	By
1	8/12/03	REVISED PER COUNTY COMMENTS	AJR
2	9/26/04	REVISED PER JCSA COMMENTS	AJR
3			
4			
5			
6			
7			

DRAWING STATUS
1/21/03 Interdiffice Review
Client for Review
Pre Approval Bidding

COUNTY APPROVAL
3/22/03 1st Submittal
9/10/03 2nd Submittal
3rd Submittal
Approved

PROFILE COLUMBIA WAY

JAMES RIVER COMMERCE CENTER
COLUMBIA WAY
ROBERTS MAGESTERIAL DISTRICT
JAMES CITY COUNTY, VIRGINIA
FOR
JAMES CITY COUNTY INDUSTRIAL DEVELOPMENT AUTHORITY

Designed: AJR	Date: 1/21/03
Checked: RSP	Scale: 1" = 25'
Drawn: LFV/AJR	CADD File name: COLUMBIAR2003
Project Number: 20022248-000.01	Plot. File.: C-4
Drawing Number	

5 OF 8 C-4A

14050W

JR038_JAMES_RIVER_COMMERCE_CENTER - 016

GENERAL NOTES

1. ALL WORK TO BE IN ACCORDANCE WITH THE VIRGINIA DEPARTMENT OF TRANSPORTATION, "ROAD AND BRIDGE SPECIFICATIONS", LATEST EDITION, AND THE VIRGINIA DEPARTMENT OF TRANSPORTATION, "ROAD AND BRIDGE STANDARDS" LATEST EDITION, VDOT AGGREGATE COMPACTION MANUAL, AND VIRGINIA WORK AREA PROTECTION MANUAL, UNLESS OTHERWISE NOTED.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITTING AND POSTING EROSION AND SEDIMENT CONTROL BOND.
3. SELECT CLEARING AND GRUBBING SHALL CONSIST OF REMOVAL OF ALL TREES, ROOTS, STUMPS AND SNAGS EXCEPT THOSE TREES DESIGNATED BY OWNER TO REMAIN, ALL TREES SO DESIGNATED WILL BE PROTECTED FROM DAMAGE TO THE TRUNK AND ROOT SYSTEM.
4. NO BURNING PERMITTED. CONTRACTOR MUST DISPOSE OF ALL DEBRIS PROPERLY.
5. ALL DRAINAGE STRUCTURES TO CONFORM TO VIRGINIA DEPARTMENT OF TRANSPORTATION, "ROAD AND BRIDGE STANDARDS" UNLESS OTHERWISE INDICATED. ALL INLET STRUCTURES TO INCORPORATE INLET SHAPING.
6. ALL LOCATIONS OF UNDERGROUND UTILITIES SHOWN ON THIS PLAN ARE APPROXIMATE. PRIOR TO COMMENCEMENT OF CONSTRUCTION, CONTRACTOR TO NOTIFY OWNERS OF ALL UTILITIES (VIRGINIA POWER, VERIZON, ETC.) OF PROPOSED CONSTRUCTION SO THAT THEY MAY LOCATE AND SAFEGUARD THEIR FACILITIES. ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
7. THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING EXCAVATION. VERIFICATION SHALL CONSIST OF EXPOSING THE UTILITY BY EXCAVATION AND ESTABLISHING THE EXACT HORIZONTAL AND VERTICAL LOCATION.
8. CONTRACTOR SHALL BE RESPONSIBLE FOR MAKING SURE THAT TRUCKS LEAVING SITE ARE CLEANED SUFFICIENTLY SO AS NOT TO CREATE A ROADWAY NUISANCE AND/OR HAZARD.
9. STORM SEWER PIPE SHALL BE REINFORCED CONCRETE PIPE (RCP) CONFORMING TO ASTM C76, CLASS III, B-WALL THICKNESS, TONGUE AND GROOVE, UNLESS OTHERWISE NOTED.
10. ALL STOCKPILES (IMPORTED FILL MATERIAL, TOPSOIL) TO BE LOCATED ON SITE AT THE DIRECTION OF THE OWNER. SILT FENCE SHALL BE PLACED AT THE TOE OF THE STOCKPILE. USE ONSITE MATERIAL PREVIOUSLY STOCKPILED FIRST.
11. ALL SITE CONCRETE SHALL BE CLASS A3-AE (AIR ENTRAINED) WITH A MINIMUM LABORATORY COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.
12. ALL SITE CONCRETE, INCLUDING DROP INLET TOPS, ENDWALLS ETC. SHALL HAVE AN BROOM FINISH SURFACE.
13. THE CONTRACTOR IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH COMPLETION OF REQUIRED EARTHWORK. IF ADDITIONAL FILL MATERIAL IS REQUIRED, IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE SUCH AT NO ADDITIONAL EXPENSE TO THE OWNER.
14. SHOULD UNSUITABLE MATERIAL BE ENCOUNTERED DURING CONSTRUCTION OF THE UTILITIES, ROADWAYS, OR SIDEWALKS, IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO REMOVE THE UNSUITABLE MATERIAL AND REPLACE IT WITH SUITABLE MATERIAL. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPORTING SELECT MATERIAL IF ON-SITE SUITABLE MATERIAL IS NOT AVAILABLE. THE CONTRACTOR WILL BE PERMITTED AND IS ENCOURAGED TO VISIT THE SITE IN ADVANCE OF THE BID DATE TO SAMPLE AND EVALUATE INSITU MATERIAL AS NECESSARY TO PREPARE HIS/HER BID AND AT HIS/HER EXPENSE.
15. THE CONTRACTOR SHALL PROVIDE THE ENGINEER ONE SET OF DEVELOPMENT PLANS WITH THE AS-BUILT LOCATIONS OF THE STORM SEWER SYSTEM. IN ADDITION, ALL LOCATIONS WHERE UNSUITABLE MATERIAL WAS ENCOUNTERED AND THE LIMITS OF UNDERCUT NECESSARY TO CONSTRUCT THIS PROJECT SHALL BE SHOWN ON THE AS-BUILT DRAWINGS.
16. THE CONTRACTOR IS TO FURNISH AND INSTALL STOP SIGNS, NO PARKING SIGNS, AND ANY OTHER SIGNAGE AS REQUIRED. ALL ROADWAY SIGNS AND THEIR INSTALLATION WILL BE IN ACCORDANCE WITH THE VIRGINIA DEPARTMENT OF TRANSPORTATION STANDARDS AND SPECIFICATIONS.
17. ANY SUBSEQUENT REVISIONS, ADDITIONS, AND/OR DELETIONS SHALL REQUIRE SPECIFIC WRITTEN APPROVAL OF THE ENGINEER.
18. SELECT FILL: FILL AND OR BACKFILL MATERIAL UNDER PAVEMENTS, WALKS, AND STRUCTURES SHALL HAVE LESS THAN 1 % ORGANIC MATERIAL BY WEIGHT AND SHALL BE FREE FROM DELETEROUS SUBSTANCES. FILL SHALL NOT CONTAIN ANY MATERIAL OVER 4 INCHES IN ITS GREATEST DIMENSION. MATERIALS HAVING DIMENSIONS GREATER THAN 2 INCHES SHOULD NOT BE USED FOR FILL OR BACKFILL IN THE UPPER 6 INCHES OF THE FILL. FILL MATERIAL SHALL BE CLASSIFIED SP-SM, SP OR SW BY THE UNIFIED SOILS CLASSIFICATION SYSTEM, WITH NO MORE THAN 12 % PASSING THE NO. 200 SIEVE. ALL MATERIALS USED SHALL BE TESTED AND APPROVED BY THE GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT ON THE SITE. USE FILL MATERIAL OBTAINED FROM THE ON-SITE STOCKPILES LOCATED NEAR THE EXISTING BMP AS SHOWN ON THE OFFSITE DRAINAGE PLANS. ALL FILL MATERIALS SHALL BE PLACED IN LIFTS NOT MORE THAN 6 TO 8 INCHES IN LOOSE DEPTH. BEFORE COMPACTION, MOISTEN OR AERATE EACH LIFT AS NECESSARY TO PROVIDE THE PROPER MOISTURE CONTENT. COMPACT EACH LIFT TO REQUIRED PERCENTAGE OF MAXIMUM DENSITY FOR EACH AREA CLASSIFICATIONS. DO NOT PLACE FILL OR BACKFILL ON SURFACES THAT ARE MUDDY, FROZEN, OR WHICH CONTAIN FROST OR ICE. PERFORM COMPACTION OF SOIL MATERIALS FOR FILLS USING SUITABLE SOIL COMPACTION EQUIPMENT FOR THE TYPE OF MATERIAL TO BE COMPACTED. SUBGRADE UNDER STRUCTURES, WALKWAYS, PAVEMENTS, SHALL BE PROOF ROLLED PRIOR TO PLACEMENT OF FILL. FILLS IN THESE AREAS SHALL BE COMPACTED TO 95% MAXIMUM DRY DENSITY IN ACCORDANCE WITH THE STANDARD PROCTOR COMPACTION TEST (ASTM D-698). COMPACTION OF MATERIALS IN NON-PAVED AREAS SHALL BE COMPACTED TO A MAXIMUM DRY DENSITY OF 85%.
19. THE CONTRACTOR SHALL FURNISH THE ENGINEER CBR TESTS ON SUBGRADE OF PAVEMENT AT INTERVALS NOT TO EXCEED 500 FEET. PROVIDE LOCATION PLAN FOR EACH TEST. (MINIMUM 2 (TWO) TESTS)
20. THE CONTRACTOR SHALL MAINTAIN ALL EROSION AND SEDIMENT CONTROL MEASURES DURING CONSTRUCTION AND PERFORM DAILY INSPECTIONS OF ALL RECEIVING DRAINAGE OUTFALLS, SEDIMENT BASIN OUTFALLS, AND PERIMETER OF WETLANDS FOR SEDIMENT TRANSPORT FROM SITE. ACCUMULATED SEDIMENT BUILD UP IS TO BE REMOVED AND DISPOSED OF ON-SITE AFTER EACH STORM EVENT. THE CONTRACTOR WILL BE RESPONSIBLE FOR ANY ADDITIONAL SEDIMENT CONTROLS AND REMOVAL OF SEDIMENT CAUSED BY CONSTRUCTION. THE OFFSITE BMP FACILITY IS NOT TO BE USED FOR SEDIMENT CONTROL AND ADDITIONAL CONTROLS/MEASURES MAY BE NEEDED.

SEQUENCE OF CONSTRUCTION

1. CONTRACTOR MUST ORGANIZE A PRE-CONSTRUCTION MEETING BETWEEN THE OWNER, THE ENGINEER, THE CONTRACTOR AND THE JAMES CITY COUNTY INSPECTOR PRIOR TO STARTING ANY CONSTRUCTION, CLEARING AND GRUBBING OR EARTHWORK.
2. FLAG LIMITS OF CLEARING AND INSTALL SILT FENCE AND TREE PROTECTION WHERE REQUIRED AT PERIMETER OF WORK AREAS AS INDICATED, OR AS OTHERWISE NECESSARY TO PREVENT SEDIMENT FROM MIGRATING INTO ADJACENT AREAS. THE OWNER MUST BE NOTIFIED PRIOR TO ANY CLEARING OPERATIONS.
3. INSTALL CONSTRUCTION ENTRANCE AS INDICATED ON THE EROSION AND SEDIMENT PLANS.
4. EXTEND GRASS SWALE ON THE SOUTH SIDE OF COLUMBIA FROM ENDEAVOR DRIVE TO STRUCTURE 6-21. REMOVE EXISTING 12"CPP.
5. EXTEND GRASS SWALE ON NORTH SIDE OF COLUMBIA WAY FROM ENDEAVOR DRIVE TO PROPOSED STRUCTURE 6-20A. REMOVE EXISTING 15" CPEP, ES-1. RECONSTRUCT DI 6-21. INSTALL 42" RCP FROM STRUCTURE 6-21 TO STRUCTURE 6-20.
6. CLEAR AND GRUB AREAS WITHIN FLAGGED LIMITS OF CLEARING. PROTECT TREES WITHIN THESE AREAS AS INDICATED BY OWNER TO BE SAVED.
7. INSTALL STRUCTURES 6-24, 6-25, 6-25A, & ASSOCIATED PIPING.
8. ROUGH GRADE ROAD.
9. ALL DENUDED AREAS THAT WILL REMAIN DENUDED FOR A LONGER PERIOD OF TIME THAN 7 DAYS MUST RECEIVE TEMPORARY SEEDING.
10. CLEAN AND REMOVE SEDIMENT FROM INLETS AND ALL EROSION AND SEDIMENT CONTROL DEVICES AS NECESSARY.
11 FINE GRADE ROAD. PLACE STONE AND PAVE.
12. ALL DISTURBED AREAS MUST RECEIVE PERMANENT SEEDING AS SOON AS FINISHED GRADES ARE ACHIEVED.
13. COMPLETE PERMANENT SEEDING. FERTILIZE AND MULCH AS REQUIRED.
14 UPON ACHIEVING FINAL SITE STABILIZATION, REMOVE SILT FENCE, TREE PROTECTION, DIVERSIONS AND SEDIMENT CONTROL MEASURES.

GENERAL NOTES FOR WATER DISTRIBUTION AND SANITARY SEWER SYSTEMS: (FOR SANITARY SEWER SYSTEM ONLY)

NOTE: WATERLINE CONSTRUCTION IS NOT PART OF THIS PROJECT. WATERLINE WILL BE CONSTRUCTED IN ACCORDANCE WITH NEWPORT NEWS WATERWORKS REQUIREMENTS REFERENCE JAMES CITY SP-106-02

THE FOLLOWING NOTES SHALL BE PROVIDED ON ALL DEVELOPER CONSTRUCTED WATER DISTRIBUTION AND SANITARY SEWER SYSTEM FACILITY CONSTRUCTION PLANS AND SPECIFICATIONS AND COMPLIANCE IS REQUIRED BY THE CONTRACTOR/DEVELOPER:

A. ALL COMPONENTS OF THE WATER DISTRIBUTION AND SANITARY SEWER SYSTEM SHALL BE INSTALLED AND TESTED IN ACCORDANCE WITH THE LATEST EDITION OF THE JAMES CITY SERVICE AUTHORITY (JCSA) STANDARDS AND SPECIFICATIONS FOR WATER DISTRIBUTION AND SANITARY SEWER SYSTEMS, THE HRPDC REGIONAL STANDARDS, AND THE COMMONWEALTH OF VIRGINIA WATERWORKS AND SANITARY SEWERAGE REGULATIONS. THE CONTRACTOR SHALL USE ONLY NEW MATERIALS, PARTS, AND PRODUCTS ON ALL PROJECTS. ALL MATERIALS SHALL BE STORED SO AS TO ASSURE THE PRESERVATION OF THEIR QUALITY AND FITNESS FOR THE WORK. A COPY OF THE JCSA STANDARDS
AND REGIONAL STANDARDS MUST BE KEPT ON-SITE BY THE CONTRACTOR DURING FULL TIME OF INSTALLING, TESTING, AND CONVEYING FACILITIES TO THE JCSA.

B. THE DEVELOPER'S REPRESENTATIVE SHALL SUBMIT SHOP DRAWINGS FOR ALL MATERIALS FOR APPROVAL TO THE AUTHORITY PRIOR TO COMMENCEMENT OF CONSTRUCTION. ALL MATERIALS ORDERED AND INSTALLED PRIOR TO THE AUTHORITY'S REVIEW AND ACCEPTANCE WILL BE AT THE CONTRACTOR'S/DEVELOPER'S RISK.

C. PIPE LINES AND SERVICES SHALL BE INSTALLED AFTER GRADING TO WITHIN 6-INCHES OF FINAL GRADE AND PRIOR TO PLACEMENT OF BASE MATERIAL.

D. ALL APPROVED EROSION AND SEDIMENT CONTROL REQUIREMENTS SHALL BE ADHERED TO DURING CONSTRUCTION.

E. ALL WATER MAINS SHALL BE DISINFECTED AND PRESSURE TESTED, AND SATISFACTORY, BACTERIOLOGICAL SAMPLES OBTAINED, IN ACCORDANCE WITH THE AUTHORITY STANDARDS.

F. ONLY JCSA PERSONNEL ARE AUTHORIZED TO OPERATE VALVES ON THE EXISTING SANITARY FORCE MAIN.

G. AFTER TESTING IS COMPLETE AND ALL COMPONENTS OF THE WATER AND SANITARY SEWER SYSTEM ARE ACCEPTABLE THEN THE RECORD DRAWINGS SHALL BE SUBMITTED TO THE AUTHORITY. NO WATER METERS WILL BE INSTALLED UNTIL COMPLIANCE WITH SECTION 3 HAS BEEN FOUND SATISFACTORY BY THE AUTHORITY. ANY DISCREPANCIES NOTED DURING THE FINAL INSPECTION SHALL BE CORRECTED BY THE DEVELOPER'S REPRESENTATIVES WITHIN 30 DAYS.

H. ROUTINE PERIODIC INSPECTIONS DURING CONSTRUCTION WILL BE PROVIDED BY THE AUTHORITY. THESE INSPECTIONS DO NOT RELIEVE THE DEVELOPER FROM HIS OBLIGATION AND RESPONSIBILITY FOR CONSTRUCTING A WATER DISTRIBUTION AND SANITARY SEWER SYSTEM IN STRICT ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS OF THE AUTHORITY.

I. ANY CHANGES TO THE FINAL PLANS SHALL BE APPROVED BY THE AUTHORITY AND SHALL BE ACCURATELY INDICATED ON THE RECORD DRAWINGS.

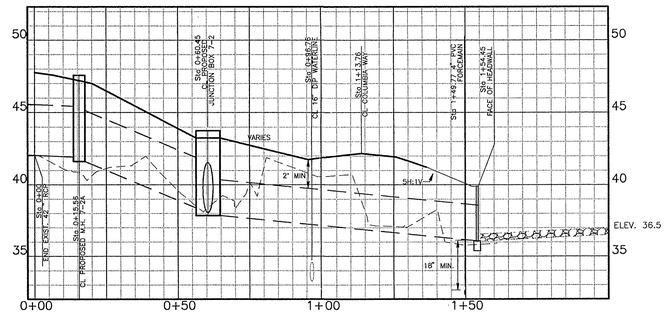
J. ALL LOTS SHALL BE PROVIDED WITH WATER SERVICE AND SANITARY SEWER CONNECTIONS. THE CONNECTIONS SHALL BE EXTENDED FROM THE MAIN TO THE PROPERTY LINE OR EASEMENT LINE, AND SHALL TERMINATE WITH A YOKE IN A METER BOX, OR AT THE CLEAN OUT, SET AT FINAL FINISHED GRADE. METERS FOR ALL LOTS (UNITS) SHALL BE PAID FOR BY THE DEVELOPER OR BUILDER AND INSTALLED BY THE AUTHORITY.

K. THE DEVELOPER IS REQUIRED TO SUBMIT WATER AND SANITARY SEWER DATA SHEETS.

L. THE CONTRACTOR/DEVELOPER SHALL ACQUIRE A CERTIFICATE TO CONSTRUCT WATER AND SEWER FACILITIES FROM THE JAMES CITY COUNTY, ENVIRONMENTAL DIVISION OF THE OFFICE OF DEVELOPMENT MANAGEMENT, PRIOR TO COMMENCEMENT OF CONSTRUCTION.

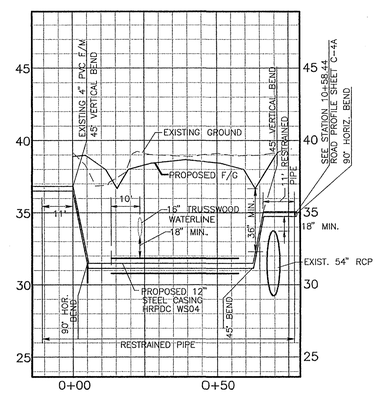
M. ANY REQUIRED EASEMENTS, PERMITS AND APPROVALS SHALL BE ACQUIRED BY THE DEVELOPER PRIOR TO COMMENCEMENT OF WATER MAIN OR SANITARY SEWER CONSTRUCTION.

N. THE CONSTRUCTOR SHALL COMPLY WITH ALL APPLICABLE LAWS, RULES, REGULATIONS AND ORDERS OF ANY PUBLIC BODY HAVING JURISDICTION. THE CONTRACTOR SHALL ERECT AND MAINTAIN, AS REQUIRED BY THE CONDITIONS AND PROGRESS OF THE WORK, ALL NECESSARY SAFEGUARDS FOR SAFETY AND PROTECTION. THE CONTRACTOR SHALL ALSO NOTIFY "MISS UTILITY" PRIOR TO PERFORMING ANY UNDERGROUND EXCAVATION.



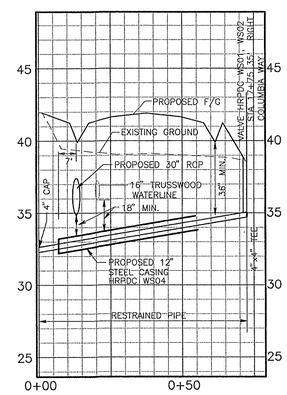
STORM DRAINAGE SYSTEM 7 PROFILE

SCALE: 1" = 5' VERT.
1" = 25' HORIZ.



FORCE MAIN PROFILE 1

SCALE: 1" = 5' VERT.
1" = 25' HORIZ.



FORCE MAIN PROFILE 2

SCALE: 1" = 5' VERT.
1" = 25' HORIZ.

COMMONWEALTH OF VIRGINIA
2/17/04
RICHARD S. PHILLIPS
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LANDMARK DESIGN GROUP
Engineers • Planners • Surveyors
Landscape Architects • Environmental Consultants

REVISIONS:			
No.	Date	Comment	By
1	8/12/03	REVISED PER COUNTY COMMENTS	AJR
2	2/06/04	REVISED PER JCSA COMMENTS	AJR
3			
4			
5			
6			
7			

DRAWING STATUS	
1/21/03	Interoffice Review
	Client for Review
	Pre Approval Bidding

COUNTY APPROVAL	
3/27/03	1st Submittal
9/10/03	2nd Submittal
	3rd Submittal
	Approved

SITE DETAILS & NOTES

JAMES RIVER COMMERCE CENTER
COLUMBIA WAY
ROBERTS MAGESTERIAL DISTRICT
JAMES CITY COUNTY, VIRGINIA
FOR
JAMES CITY COUNTY INDUSTRIAL DEVELOPMENT AUTHORITY

Designed: AJR	Date: 1/21/03
Checked: RSP	Scale: 1" = 25'
Drawn: LPV/AJR	CADD File name: COLUMBIAR2003
Project Number: 2002248-000.01	Plot. File.: C-4

Drawing Number
6 OF 8
C-5

14049W

JAMES CITY COUNTY

EROSION AND SEDIMENT CONTROL NOTES

REVISED 07/6/01

THE PURPOSE OF THE EROSION MEASURES SHOWN ON THESE PLANS SHALL BE TO PRECLUDE THE TRANSPORT OF ALL WATERBORNE SEDIMENTS RESULTING FROM CONSTRUCTION ACTIVITIES FROM ENTERING ONTO ADJACENT PROPERTIES OR STATE WATERS. IF FIELD INSPECTION REVEALS THE INADEQUACY OF THE PLAN TO CONFINE SEDIMENT TO THE PROJECT SITE, ALL APPROPRIATE MODIFICATIONS WILL BE MADE TO CORRECT ANY PLAN DEFICIENCIES. IN ADDITION TO THESE NOTES, ALL PROVISIONS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL REGULATIONS SHALL APPLY TO THIS PROJECT.

1. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK, 3RD EDITION, 1992. THE CONTRACTOR SHALL BE THOROUGHLY FAMILIAR WITH ALL APPLICABLE MEASURES CONTAINED THEREIN THAT MAY BE PERTINENT TO THIS PROJECT, INCLUDING MINIMUM STANDARDS 1 THROUGH 19. IF THE APPROVED EROSION AND SEDIMENT CONTROL PLAN IS FOUND TO BE INADEQUATE IN THE FIELD, THE MINIMUM STANDARDS WILL APPLY IN ADDITION TO THE PROVISIONS OF THE APPROVED PLAN.

2. AS A PREREQUISITE TO APPROVAL OF AN EROSION AND SEDIMENT CONTROL PLAN FOR LAND-DISTURBING ACTIVITIES, THE NAME OF A RESPONSIBLE LAND-DISTURBER SHALL BE PROVIDED. THE RESPONSIBLE LAND-DISTURBER SHALL BE AN INDIVIDUAL WHO HOLDS A VALID CERTIFICATE OF COMPETENCE ISSUED BY THE VIRGINIA DEPARTMENT OF CONSERVATION AND IS DEFINED AS THE PERSON IN CHARGE OF AND RESPONSIBLE FOR CARRYING OUT THE LAND-DISTURBING ACTIVITY. PERMITS OR PLANS WITHOUT THIS INFORMATION ARE DEEMED INCOMPLETE AND WILL NOT BE APPROVED UNTIL PROPER NOTIFICATION IS RECEIVED. ALSO, IF THE PERSON DESIGNATED AS RESPONSIBLE LAND-DISTURBER CHANGES BETWEEN THE TIME OF PLAN APPROVAL AND THE SCHEDULED PRECONSTRUCTION MEETING, THE ENVIRONMENTAL DIVISION SHALL BE INFORMED OF THE CHANGE, IN WRITING, 24-HOURS IN ADVANCE OF THE PRECONSTRUCTION MEETING.

3. A PRECONSTRUCTION MEETING SHALL BE HELD ON-SITE BETWEEN THE COUNTY, THE DEVELOPER, THE PROJECT ENGINEER, THE RESPONSIBLE LAND-DISTURBER AND THE CONTRACTOR PRIOR TO ISSUANCE OF THE LAND DISTURBING PERMIT. THE CONTRACTOR SHALL SUBMIT A SEQUENCE OF CONSTRUCTION TO THE COUNTY FOR APPROVAL PRIOR TO THE PRECONSTRUCTION MEETING. THE DESIGNATED RESPONSIBLE LAND-DISTURBER IS REQUIRED TO ATTEND THE PRECONSTRUCTION MEETING FOR THE PROJECT.

4. ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS SHALL BE PROTECTED BY A TEMPORARY CONSTRUCTION ENTRANCE TO PREVENT TRACKING OF MUD ONTO PUBLIC RIGHT-OF-WAYS. AN ENTRANCE PERMIT FROM VDOT IS REQUIRED PRIOR TO ANY CONSTRUCTION ACTIVITIES WITHIN STATE RIGHT-OF-WAYS. WHERE SEDIMENT IS TRANSPORTED ONTO A PUBLIC ROAD SURFACE, THE ROAD SHALL BE THOROUGHLY CLEANED AT THE END OF EACH DAY (STD. & SPEC. 3.02).

5. SEDIMENT BASINS AND TRAPS (STD. & SPEC. 3.13 AND 3.14), PERIMETER DIKES (STD. & SPEC. 3.09 AND 3.12), SEDIMENT FILTER BARRIERS (STD. & SPEC. 3.05) AND OTHER MEASURES INTENDED TO TRAP SEDIMENT ON-SITE MUST BE CONSTRUCTED AS A FIRST STEP IN GRADING AND MUST BE MADE FUNCTIONAL PRIOR TO ANY UPSLOPE LAND DISTURBANCE TAKING PLACE. EARTHEN STRUCTURES SUCH AS DAMS, DIKES AND DIVERSIONS MUST BE SEEDED AND MULCHED IMMEDIATELY AFTER INSTALLATION. PERIODIC INSPECTIONS OF THE EROSION CONTROL MEASURES BY THE OWNER OR OWNER'S REPRESENTATIVE SHALL BE MADE TO ASSESS THEIR CONDITION. ANY NECESSARY MAINTENANCE OF THE MEASURES SHALL BE ACCOMPLISHED IMMEDIATELY AND SHALL INCLUDE THE REPAIR OF MEASURES DAMAGED BY ANY SUBCONTRACTOR INCLUDING THOSE OF THE PUBLIC UTILITY COMPANIES.

6. SURFACE FLOWS OVER CUT AND FILL SLOPES SHALL BE CONTROLLED BY EITHER REDIRECTING FLOWS FROM TRANSVERSING THE SLOPES OR BY INSTALLING MECHANICAL DEVICES TO SAFELY LOWER WATER DOWNSLOPE WITHOUT CAUSING EROSION. A TEMPORARY FILL DIVERSION (STD. & SPEC. 3.10) AND SLOPE DRAIN (STD. & SPEC. 3.15) SHALL BE INSTALLED PRIOR TO THE END OF EACH WORKING DAY.

7. SEDIMENT CONTROL MEASURES MAY REQUIRE MINOR FIELD ADJUSTMENTS AT TIME OF CONSTRUCTION TO INSURE THEIR INTENDED PURPOSE IS ACCOMPLISHED. ENVIRONMENTAL DIVISION APPROVAL WILL BE REQUIRED FOR OTHER DEVIATIONS FROM THE APPROVED PLAN.

8. THE CONTRACTOR SHALL PLACE SOIL STOCKPILES AT THE LOCATIONS SHOWN ON THE PLAN. SOIL STOCKPILES SHALL BE STABILIZED OR PROTECTED WITH SEDIMENT TRAPPING MEASURES. OFF-SITE WASTE OR BORROW AREAS SHALL BE APPROVED BY THE ENVIRONMENTAL DIVISION PRIOR TO THE IMPORT OF ANY BORROW OR EXPORT OF ANY WASTE TO OR FROM THE PROJECT SITE.

9. THE CONTRACTOR SHALL COMPLETE DRAINAGE FACILITIES WITHIN 30 DAYS FOLLOWING COMPLETION OF ROUGH GRADING AT ANY POINT WITHIN THE PROJECT. THE INSTALLATION OF DRAINAGE FACILITIES SHALL TAKE PRECEDENCE OVER ALL UNDERGROUND UTILITIES. OUTFALL DITCHES FROM DRAINAGE STRUCTURES SHALL BE STABILIZED IMMEDIATELY AFTER CONSTRUCTION OF THE SAME (STD. & SPEC. 3.18). THIS INCLUDES INSTALLATION OF EROSION CONTROL STONE OR PAVED DITCHES WHERE REQUIRED. ANY DRAINAGE OUTFALLS REQUIRED FOR A STREET MUST BE COMPLETED BEFORE STREET GRADING OR UTILITY INSTALLATION BEGINS.

10. PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DENUDED AREAS WITHIN SEVEN DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. TEMPORARY SOIL STABILIZATION SHALL BE APPLIED WITHIN SEVEN DAYS TO DENUDED AREAS THAT MAY BE AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN 30 DAYS. PERMANENT STABILIZATION SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.

11. NO MORE THAN 300 FEET OF SANITARY SEWER, STORM DRAIN, WATER OR UNDERGROUND UTILITY LINES ARE TO BE OPEN AT ONE TIME. FOLLOWING INSTALLATION OF ANY PORTION OF THESE ITEMS, ALL DISTURBED AREAS ARE TO BE IMMEDIATELY STABILIZED (I.E., THE SAME DAY).

12. IF DISTURBED AREA STABILIZATION IS TO BE ACCOMPLISHED DURING THE MONTHS OF DECEMBER, JANUARY OR FEBRUARY, STABILIZATION SHALL CONSIST OF MULCHING (STD. & SPEC. 3.35). SEEDING WILL THEN TAKE PLACE AS SOON AS THE SEASON PERMITS.

13. THE TERM SEEDING, FINAL VEGETATIVE COVER OR STABILIZATION ON THIS PLAN SHALL MEAN THE SUCCESSFUL GERMINATION AND ESTABLISHMENT OF A STABLE GRASS COVER FROM A PROPERLY PREPARED SEEDBED CONTAINING THE SPECIFIED AMOUNTS OF SEED, LIME AND FERTILIZER (STD. & SPEC. 3.32). IRRIGATION SHALL BE REQUIRED AS NECESSARY TO ENSURE ESTABLISHMENT OF GRASS COVER.

14. ALL SLOPES STEEPER THAN 3H:1V SHALL REQUIRE THE USE OF EROSION CONTROL BLANKETS AND MATTINGS TO AID IN THE ESTABLISHMENT OF A VEGETATIVE COVER. INSTALLATION SHALL BE IN ACCORDANCE WITH STD. & SPEC. 3.35, MULCHING, STD. & SPEC. 3.36, SOIL STABILIZATION BLANKETS AND MATTING AND MANUFACTURER'S INSTRUCTIONS. NO SLOPES SHALL BE CREATED STEEPER THAN 2H:1V.

15. INLET PROTECTION (STD. & SPEC., 3.07 AND 3.08) SHALL BE PROVIDED FOR ALL STORM DRAIN AND CULVERT INLETS FOLLOWING CONSTRUCTION OF THE SAME.

16. TEMPORARY LINERS, SUCH AS POLYETHYLENE SHEETS, SHALL BE PROVIDED FOR ALL PAVED DITCHES UNTIL THE PERMANENT CONCRETE LINER IS INSTALLED.

17. PAVED DITCHES SHALL BE REQUIRED WHEREVER ACCELERATED EROSION IS EVIDENT. PARTICULAR ATTENTION SHALL BE PAID TO THOSE AREAS WHERE GRADES EXCEED 3 PERCENT.

18. TEMPORARY EROSION CONTROL MEASURES SUCH AS SILT FENCE ARE NOT TO BE REMOVED UNTIL ALL DISTURBED AREAS ARE STABILIZED. TRAPPED SEDIMENT SHALL BE SPREAD, SEEDED AND MULCHED. AFTER THE PROJECT AND STABILIZATION IS COMPLETE, ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS.

19. NO SEDIMENT TRAP OR SEDIMENT BASIN SHALL BE REMOVED UNTIL A) AT LEAST 75 PERCENT OF THE LOTS WITHIN THE DRAINAGE AREA TO THE TRAP OR BASIN HAVE BEEN SOLD TO A THIRD PARTY (UNRELATED TO THE DEVELOPER) FOR THE CONSTRUCTION OF HOMES AND/OR B) 60 PERCENT OF THE SINGLE FAMILY LOTS WITHIN THE DRAINAGE AREA TO THE TRAP OR BASIN HAVE BEEN COMPLETED AND THE SOIL STABILIZED. A BULK SALE OF THE LOTS TO ANOTHER BUILDER DOES NOT SATISFY THIS PROVISION. SEDIMENT TRAPS AND SEDIMENT BASINS SHALL NOT BE REMOVED WITHOUT THE EXPRESS AUTHORIZATION OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION.

20. RECORD DRAWINGS (AS-BUILTS) AND CONSTRUCTION CERTIFICATIONS ARE BOTH REQUIRED FOR NEWLY CONSTRUCTED OR MODIFIED STORMWATER MANAGEMENT/BMP FACILITIES. CERTIFICATION ACTIVITIES SHALL BE ADEQUATELY COORDINATED AND PERFORMED BEFORE, DURING AND FOLLOWING CONSTRUCTION IN ACCORDANCE WITH THE CURRENT VERSION OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION, STORMWATER MANAGEMENT/BMP FACILITIES, RECORD DRAWINGS AND CONSTRUCTION CERTIFICATION, STANDARD FORMS & INSTRUCTIONS.

21. DESIGN AND CONSTRUCTION OF PRIVATE-TYPE SITE DRAINAGE SYSTEMS OUTSIDE VDOT RIGHTS-OF-WAY SHALL BE PERFORMED IN ACCORDANCE WITH THE CURRENT VERSION OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION, STORMWATER DRAINAGE CONVEYANCE SYSTEMS (NON-BMP RELATED), GENERAL DESIGN AND CONSTRUCTION GUIDELINES.

STONE CONSTRUCTION ENTRANCE (CE)

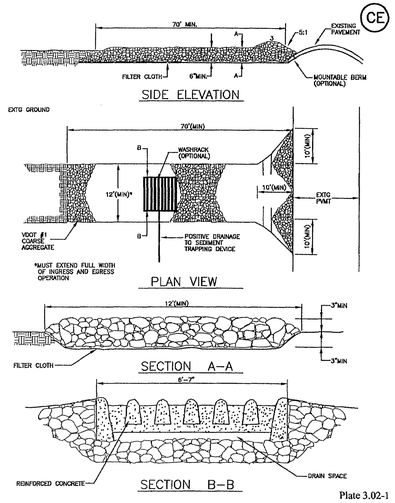
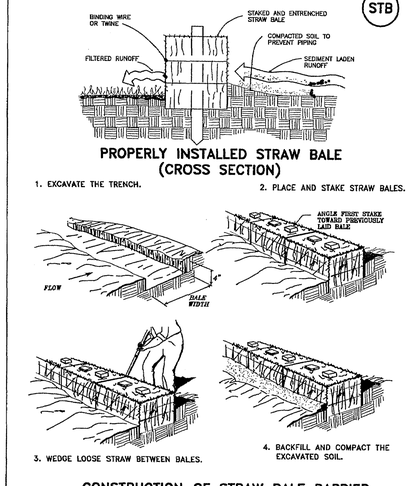


Plate 3.02-1

STRAW BALE BARRIER (STB)



PROPERLY INSTALLED STRAW BALE (CROSS SECTION)

1. EXCAVATE THE TRENCH.
2. PLACE AND STAKE STRAW BALES.
3. WEDGE LOOSE STRAW BETWEEN BALES.
4. BACKFILL AND COMPACT THE EXCAVATED SOIL.

CONSTRUCTION OF STRAW BALE BARRIER

SOURCE: VA. DSWC — PLATE. 3.04-1

ROCK CHECK DAM

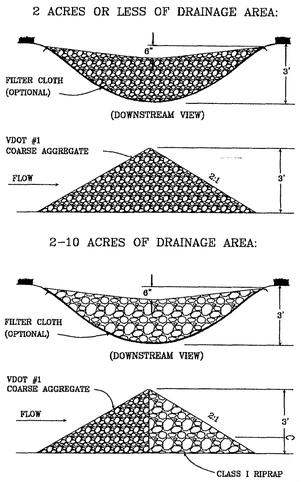


PLATE. 3.20-1

SILT FENCE CULVERT INLET PROTECTION (CIP)

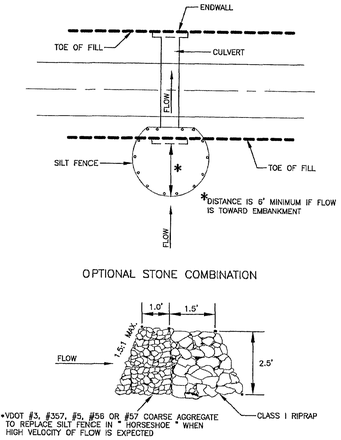


PLATE 3.08-1

CONSTRUCTION OF A SILT FENCE (WITH WIRE SUPPORT) (SF)

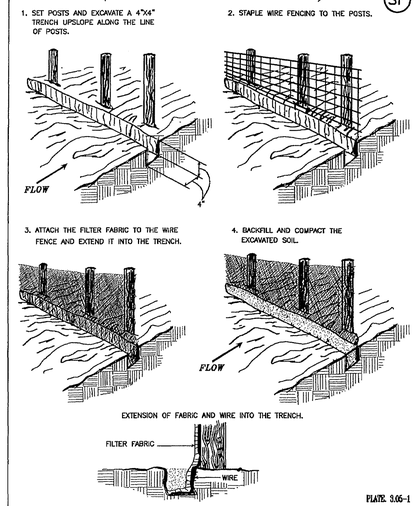
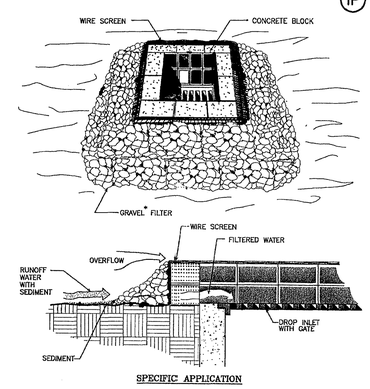


PLATE 3.05-1

BLOCK AND GRAVEL DROP INLET SEDIMENT FILTER (IP)



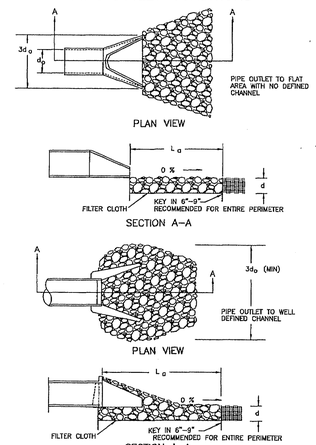
SPECIFIC APPLICATION

THIS METHOD OF INLET PROTECTION IS APPLICABLE WHERE HEAVY FLOWS ARE EXPECTED AND WHERE AN OVERFLOW CAPACITY IS NECESSARY TO PREVENT EXCESSIVE PONDING AROUND THE STRUCTURE.

* GRAVEL SHALL BE VDOT #3, #357 OR #5 COARSE AGGREGATE.

PLATE. 3.07-3

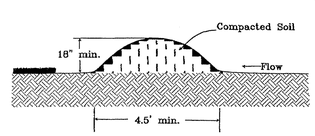
PIPE OUTLET CONDITIONS (OP)



NOTES: 1. APRON LINING MAY BE RIPRAP, GROUTED RIPRAP, GABION, BASKET, OR CONCRETE.
2. La IS THE LENGTH OF THE RIPRAP APRON AS CALCULATED USING PLATES 3.18-3 AND 3.18-4
3. d = 1.5 TIMES THE MAXIMUM STONE DIAMETER, BUT NOT LESS THAN 6 INCHES.

PLATE 3.18 - 1

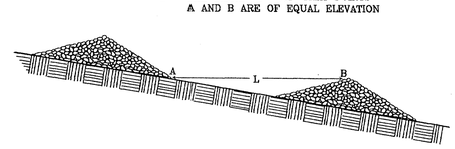
TEMPORARY DIVERSION DIKE (DD)



SOURCE: VA. DSWC — PLATE 3.09-1

SPACING BETWEEN CHECK DAMS

L = THE DISTANCE SUCH THAT POINTS A AND B ARE OF EQUAL ELEVATION



SOURCE: VA. DSWC — PLATE. 3.20-2

COMMONWEALTH OF VIRGINIA
2/17/04
RICHARD S. PHILLIPS
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PROFESSIONAL ENGINEER

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LANDMARK DESIGN GROUP
Engineers • Planners • Surveyors
Landscape Architects • Environmental Consultants

REVISIONS:			
No.	Date	Comment	By
1	1/23/03	REVISED PER COUNTY COMMENTS	HWJ

DRAWING STATUS
3/27/03 Interoffice Review
___ Client for Review
___ Pre Approval Bidding

COUNTY APPROVAL
3/28/03 1st Submittal
9/10/03 2nd Submittal
___ 3rd Submittal
___ Approved

EROSION CONTROL DETAILS & NOTES

JAMES RIVER COMMERCE CENTER
COLUMBIA WAY
ROBERTS MAGISTERIAL DISTRICT
JAMES CITY COUNTY, VIRGINIA
FOR
JAMES CITY COUNTY INDUSTRIAL DEVELOPMENT AUTHORITY

Designed: AJR	Date: 1/15/03
Checked: RSP	Scale: NONE
File Mgr./Drawn: LFV/AJR	CADD File name: dtl-ero.dwg
Project Number: 2002248-000.01	Plot. File : dtl-ero.plt

Drawing Number C-6

7 OF 8

14048W

VDOT

VIRGINIA DEPARTMENT OF TRANSPORTATION
GENERAL NOTES - REVISED 08/02

1. A LAND USE PERMIT MUST BE OBTAINED FROM VDOT BEFORE ANY CONSTRUCTION IS STARTED WITHIN THE EXISTING STATE RIGHT OF WAY. CONTACT THE VDOT RESIDENCY FOR THE PERMIT FEE AND BOND AMOUNT. ALL LAND USE PERMIT APPLICATIONS MUST HAVE TWO (2) SETS OF APPROVED PLANS, A CHECK FOR THE PROCESSING FEE MADE PAYABLE TO VDOT, AND SURETY IN THE REQUIRED AMOUNT.
2. THE DEVELOPER IS RESPONSIBLE FOR THE RELOCATION OF ANY UTILITIES OR PAVEMENT MARKINGS WITHIN THE EXISTING RIGHT OF WAY OR PROPOSED RIGHT OF WAY REQUIRED BY THE DEVELOPMENT OF THE SITE/SUBDIVISION.
3. THE DEVELOPER IS RESPONSIBLE FOR THE COST OF A TRAFFIC SIGNAL OR ANY MODIFICATIONS TO AN EXISTING TRAFFIC SIGNAL THAT ARE DETERMINED TO BE NECESSARY. THESE COSTS WILL BE CHARGED UNDER AN OPERATIONAL PROJECT (ACCOUNTS RECEIVABLE) NUMBER. CONTACT THE VDOT RESIDENCY FOR THE PROPER PROCEDURE.
4. PRIOR TO ANY CONSTRUCTION, THE CONTRACTOR SHALL CONSULT WITH THE DEVELOPER'S ENGINEER TO VERIFY THE FINAL APPROVAL OF THE PLANS, OR ANY REVISED PLANS, BY THE VARIOUS AGENCIES (COUNTY, VDOT, ETC.).
5. VDOT APPROVAL OF THESE PLANS WILL EXPIRE IN FIVE (5) YEARS FROM THE DATE OF APPROVAL.
6. VDOT IS TO RECEIVE WRITTEN NOTIFICATION 48 HOURS PRIOR TO THE START OF ANY WORK. A PRE-CONSTRUCTION MEETING WILL BE REQUIRED PRIOR TO ANY LAND DISTURBANCE OF THE SITE. THE DEVELOPER, HIS ENGINEER, GEOTECHNICAL (SOILS) ENGINEER, AND CONTRACTOR SHALL ATTEND THE PRE-CONSTRUCTION MEETING. THE DEVELOPER'S CONTRACTOR SHALL HAVE A PROPOSED PROGRESS SCHEDULE OF WORK.
7. ANY ERRORS, CONFLICTS, OR DISCREPANCIES FOUND ON THE APPROVED PLANS SHALL BE REPORTED TO THE DEVELOPER'S ENGINEER AND VDOT FOR RESOLUTION BEFORE PROCEEDING FURTHER WITH THE WORK.
8. THE DEVELOPER'S ENGINEER AND CONTRACTOR (SUB-CONTRACTOR) SHALL VERIFY IN THE FIELD THE ELEVATIONS OF ALL POINTS OF CONNECTION OF PROPOSED WORK TO EXISTING CURBS, SANITARY SEWER, STORM SEWER, DRAINAGE STRUCTURES, WATERLINES, ETC., PRIOR TO THE CONSTRUCTION IN THE FIELD.
9. AN OPERATIONAL PROJECT (ACCOUNTS RECEIVABLE) NUMBER MAY BE ASSIGNED TO THE SITE/SUBDIVISION. THE DEVELOPER WILL BE RESPONSIBLE FOR THIS BY PROVIDING THE NECESSARY INFORMATION REQUESTED BY VDOT.
10. ALL MATERIALS AND CONSTRUCTION WITHIN THE PROPOSED PUBLIC RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE CURRENT VDOT SPECIFICATIONS AND STANDARDS.
11. ANY REQUEST FOR A CHANGE OF SPECIFIED MATERIALS OR DESIGN FROM THE APPROVED PLANS WILL NEED TO BE SUBMITTED TO VDOT. A LETTER MUST ACCOMPANY THE PROPOSED CHANGES AND REVISED PLAN SHEETS AND/OR DRAINAGE CALCULATIONS FOR REVIEW AND APPROVAL BY THE VDOT RESIDENT ENGINEER.
12. THE DEVELOPER WILL BE RESPONSIBLE FOR PROVIDING THE GEOTECHNICAL (SOILS) ENGINEER. A PROFESSIONAL ENGINEER OR PROFESSIONAL GEOLOGIST WILL SUBMIT A COMPLETE REPORT WITH BORING DATA AND RECOMMENDATIONS TO VDOT FOR APPROVAL OF HIS PROPOSED METHOD OF CONSTRUCTION. THIS REPORT SHALL INCLUDE SHRINK SWELL VALUES OF THE SOILS, MOISTURE SENSITIVE SOILS, SIEVE ANALYSES, DRY AND WET CBR VALUES, STANDARD PROCTOR AND ATTERBERG LIMITS. THE REPORT WILL SHOW THE BORE LOCATIONS, TYPES OF SOILS ENCOUNTERED, AND STABILIZATION RECOMMENDATIONS FOR SOILS WITH POOR SUPPORT VALUES, HIGH MOISTURE, MICA, AND SILT CONTENT. THE REPORT SHALL INCLUDE A PAVEMENT STRUCTURAL DESIGN RECOMMENDATION BASED ON LABORATORY TESTS OF THE ACTUAL SOILS AND APPROVED TRAFFIC VOLUME FOR THE SITE/SUBDIVISION IN ACCORDANCE WITH THE LATEST VDOT PAVEMENT DESIGN GUIDE FOR SUBDIVISION AND SECONDARY ROADS IN VIRGINIA.
13. WHEN SOILS OCCUR THAT ARE UNSUITABLE FOR FOUNDATIONS, EMBANKMENT FILL, PIPE BACKFILL, SUBGRADE, OR OTHER ROADWAY PURPOSES, THE DEVELOPER'S CONTRACTOR SHALL EXCAVATE SAID MATERIAL UNDER THE DIRECTION OF THE DEVELOPER'S SOILS ENGINEER, BY UNDERCUTTING SUCH MATERIAL BELOW THE PROPOSED GRADES SHOWN ON THE PLANS. THE CONTRACTOR SHALL NOTIFY THE DEVELOPER'S ENGINEER AND VDOT UPON THE DISCOVERY OF THE UNSUITABLE MATERIAL. CONCURRENCE OF THE ENGINEER SHALL BE OBTAINED BEFORE ADDITIONAL WORK IS UNDERTAKEN.
14. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. ALL EROSION CONTROL MEASURES WILL BE IN PLACE AND REVIEWED BY THE CONTRACTOR DAILY AND AFTER ALL INCLEMENT WEATHER TO INSURE COMPLIANCE FOR THE CONTROL OF ANY EROSION AND SILTATION. ANY CORRECTIONS OR REPAIRS WILL BE MADE IMMEDIATELY. IN ACCORDANCE WITH ROAD AND BRIDGE SPECIFICATIONS, VDOT REQUIRES AN INDIVIDUAL CERTIFIED BY THE VIRGINIA DEPARTMENT OF CONSERVATION AND RECREATION, HOLDING A RESPONSIBLE LAND DISTURBER CERTIFICATION, TO BE IN CHARGE OF THE LAND DISTURBING ACTIVITY AND ON THE WORK SITE AT ALL TIMES.
15. THE CONTRACTOR AND SUBCONTRACTOR(S) SHALL HAVE A COPY OF THE CURRENT VDOT ROAD AND BRIDGE SPECIFICATIONS AND THE VDOT ROAD AND BRIDGE STANDARDS. THE CONTRACTOR SHALL HAVE AT LEAST ONE (1) SET OF APPROVED PLANS WITH ALL APPROVED REVISIONS. THE LAND USE PERMIT WILL BE AT THE SITE AT ALL TIMES.
16. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND AND OVERHEAD UTILITIES, WHETHER OR NOT THEY ARE SHOWN ON THE PLANS. THE CONTRACTOR WILL BE RESPONSIBLE FOR REPAIRS AT HIS OWN EXPENSE OF ANY UTILITIES DAMAGED BY HIS CONSTRUCTION METHODS. MISS UTILITY MUST BE CONTACTED AT 1-800-552-7001 AT LEAST 72 HOURS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
17. THE CONTRACTOR WILL BE RESPONSIBLE FOR REPLACING, WITH MATCHING MATERIALS, ANY PAVEMENT, CURB AND GUTTER, DRIVEWAY, PIPE, SIDEWALK, ETC. THAT ARE DAMAGED DURING THE CONSTRUCTION OF THE SITE/SUBDIVISION.
18. CERTIFICATION AND SOURCE OF MATERIALS ARE TO BE SUBMITTED TO VDOT. ALL MATERIALS MUST MEET VDOT SPECIFICATIONS AND STANDARDS.
19. THE DEVELOPER'S GEOTECHNICAL ENGINEER AND/OR HIS CERTIFIED MATERIALS TECHNICIANS WILL PERFORM COMPACTION (DENSITY) TESTS FOR REVIEW BY VDOT. ALL TESTS WILL BE PERFORMED IN ACCORDANCE WITH THE CURRENT VDOT SPECIFICATIONS AND STANDARDS. BACKFILL MATERIAL FOR PIPE, STRUCTURES, AND UTILITIES LOCATED WITHIN THE PROPOSED RIGHT OF WAY WILL BE COMPACTED AND TESTED AS THE FILL MATERIAL IS PLACED IN UNIFORM LIFTS. A MINIMUM OF 95 % DENSITY WITH THE SOILS STANDARD PROCTOR WILL BE OBTAINED WITH THE PROPER MOISTURE CONTENT ON EMBANKMENT AND FILLS MATERIAL. FOR THE FINAL 6" OF THE FINISHED SUBGRADE, 100 % DENSITY WILL BE OBTAINED. THE TEST RESULTS WILL BE SUBMITTED TO VDOT FOR REVIEW AND COMPLIANCE OF THE MATERIALS, PRIOR TO THE DEVELOPER'S CONTRACTOR REQUESTING AN INSPECTION FOR A PROOF ROLL ON THE SUBGRADE, AGGREGATE STONE, BASE MIX (ASPHALT) OR THE PLACEMENT OF THE SURFACE MIX.
20. ALL DRAINAGE EASEMENTS SHALL BE LABELED AS EITHER "DRAINAGE EASEMENTS" OR "COUNTY DRAINAGE EASEMENTS" AND SHALL NOT BE DEDICATED TO VDOT OR BECOME THE RESPONSIBILITY OF VDOT.
THE DEVELOPER.
21. TEMPORARY DRAINAGE MEASURES WILL BE MAINTAINED BY THE CONTRACTOR DURING CONSTRUCTION TO RELIEVE AREAS THAT MAY CAUSE DAMAGE TO THE RIGHT OF WAY, ROADWAY, OR ADJACENT PROPERTIES.
22. DRY GUTTER (RIP RAP) IS NOT ALLOWED IN THE DITCHES ON VDOT RIGHT OF WAY.
23. ALL STORM SEWER PIPES SHALL BE REINFORCED CONCRETE PIPE (TONGUE AND GROOVE) IN ACCORDANCE WITH ASTM-C-76 OR AN ALTERNATIVE THAT HAS BEEN APPROVED ON THE PLANS.
24. INSTALLATION OF PIPE CULVERTS, STORM SEWERS, AND DRAINAGE STRUCTURES SHALL HAVE BEDDING MATERIAL PLACED UNDER THE PIPES AND STRUCTURES IN ACCORDANCE WITH VDOT SPECIFICATIONS (A MINIMUM OF 4" UNDER PIPES AND A MINIMUM OF 6" UNDER DRAINAGE STRUCTURES). THE BACKFILL MATERIAL SHALL BE SUITABLE MATERIAL FREE OF DEBRIS, SILT, TREE ROOTS (ORGANIC MATERIAL), AND EXCESS MOISTURE. THE FILL MATERIAL WILL BE COMPACTED IN UNIFORM LIFTS AND TESTED FOR DENSITY.
25. ALL VEGETATION (ORGANIC MATERIAL, ROOTS, STUMPS) AND OVERBURDEN ARE TO BE REMOVED FROM THE SHOULDERS PRIOR TO THE CONSTRUCTION OF THE ROAD'S SUBGRADE.
26. ALL CONCRETE SHALL BE CLASS A3-AE (3000PSI WITH AIR ENTRAINED ADDITIVE) AND TESTED BY THE DEVELOPER'S GEOTECHNICAL ENGINEER FOR CONFORMANCE TO VDOT SPECIFICATIONS AND STANDARDS.
27. THERE SHALL BE A MINIMUM OF 6" OF COMPACTED 21-B AGGREGATE MATERIAL OR STONE DEPTH SHALL MATCH THE EXISTING PAVEMENT TYPICAL UNDER THE CURB AND GUTTER; THIS MATERIAL SHALL EXTEND 1' BEYOND THE BACK OF THE CURB AND GUTTER. DENSITY TESTS SHALL BE TAKEN PRIOR TO A PROOF ROLL OF THE MATERIAL AND PLACEMENT OF THE CURB/CURB AND GUTTER. UNDERDRAINS WILL BE INSTALLED ON RAISED CURB MEDIANS IN ACCORDANCE WITH CURRENT VDOT SPECIFICATIONS AND STANDARDS.
28. ALL STREETS WITH CURB AND GUTTER SHALL HAVE A STANDARD CG ENTRANCE INSTALLED IN ACCORDANCE WITH THE CURRENT VDOT ROAD AND BRIDGE SPECIFICATIONS AND STANDARDS. THE CURB AND GUTTER PAN SHALL BE REMOVED PRIOR TO THE INSTALLATION OF THE ENTRANCE UNLESS A WIPE-DOWN OF THE CURB WAS MADE DURING THE INSTALLATION OF THE CURB AND GUTTER. THE SAW CUTTING AND REMOVAL OF ONLY THE CURB PORTION IS NOT ALLOWED. IT IS THE DEVELOPER'S RESPONSIBILITY TO INSURE THAT THE BUILDERS HAVE INSTALLED ALL CONCRETE ENTRANCES IN ACCORDANCE WITH VDOT SPECIFICATIONS AND STANDARDS.
29. ALL UNDERGROUND UTILITIES ARE TO BE IN PLACE PRIOR TO THE PLACEMENT OF THE BASE MATERIAL AND SHALL HAVE A MINIMUM COVERING OF 36". ON CURB AND GUTTER STREETS, THE AREA DIRECTLY BEHIND THE CURB TO THE RIGHT OF WAY LINE SHALL BE RELATIVELY FLAT AT THE PRIVATE ENTRANCE LOCATION. THE DEVELOPER'S CONTRACTOR SHOULD CUT EMBANKMENTS TO THE RIGHT OF WAY LINE PRIOR TO THE INSTALLATION OF ALL UNDERGROUND UTILITIES TO INSURE A MINIMUM 36" OF COVER.
30. THE SUB-BASE AND/OR BASE MATERIAL SHALL HAVE A ROLLER PATTERN AND A CONTROL STRIP WITH DENSITIES PERFORMED ON THE MATERIAL AND THE TEST RESULTS SUBMITTED TO VDOT PRIOR TO THE PROOF ROLL OF THE MATERIAL AND THE PLACEMENT OF THE ASPHALT (HOT MIX) COURSE. THE MATERIAL SHALL BE AT FINISHED GRADE, HAVE THE TEMPLATE AS SHOWN ON THE PAVEMENT TYPICAL, AND HAVE A STONE DEPTH AND PROOF ROLL PERFORMED BY VDOT AND THE DEVELOPER'S SOILS ENGINEER. DENSITY (COMPACTION) TESTS WILL BE PERFORMED USING A ROLLER PATTERN AND A CONTROL STRIP IN ACCORDANCE WITH CURRENT VDOT SPECIFICATIONS AND STANDARDS TO ACQUIRE THE THEORETICAL DENSITY OF THE MATERIAL. OPTIMUM MOISTURE SHALL COME FROM THE SUPPLIER OF THE MATERIAL. ANY YIELD MATERIAL MUST BE CORRECTED PRIOR TO THE PLACEMENT OF THE HOT MIX (ASPHALT). THE HOT MIX SHALL BE PLACED WITHIN 72 HOURS AFTER THE PROOF ROLL HAS BEEN COMPLETED SATISFACTORILY. ANY SIGNIFICANT RAINFALL PRIOR TO THE PLACEMENT OF THE PRIME COAT AND/OR HOT MIX WILL REQUIRE ANOTHER PROOF ROLL TO INSURE THE MATERIAL IS STABILIZED AND NON-YIELDING.
31. IN ACCORDANCE WITH SECTION 311 OF THE VDOT ROAD AND BRIDGE SPECIFICATIONS, A PRIME COAT OF .30 GAL. /SQ. YD. WILL BE REQUIRED FOR ANY PAVEMENT TYPICAL WITH LESS THAN 4" OF HOT MIX PRIOR TO THE PLACEMENT OF THE SURFACE COURSE.
32. ALL HOT MIX (ASPHALT) COURSES SHALL BE PLACED IN ACCORDANCE WITH SECTION 315 OF THE CURRENT VDOT ROAD AND BRIDGE SPECIFICATIONS. THE WEATHER LIMITATIONS OF A 40° F SURFACE TEMPERATURE OR 50° F AND RISING AIR TEMPERATURE SHALL BE FOLLOWED. THE DEVELOPER'S GEOTECHNICAL ENGINEER SHALL TEST THE MATERIAL TO INSURE COMPLIANCE WITH CURRENT VDOT SPECIFICATIONS AND THE SUPPLIER'S JOB MIX DESIGN. THE DEVELOPER'S GEOTECHNICAL ENGINEER SHALL ALSO PERFORM A ROLLER PATTERN AND A CONTROL STRIP FOR THE THEORETICAL DENSITY (COMPACTION) OF THE MATERIAL IN CONFORMANCE WITH THE CURRENT VDOT SPECIFICATIONS.
33. ALL UTILITY CABINETS, PEDESTALS, AND STREETLIGHTS SHALL BE LOCATED IN ACCORDANCE WITH VDOT REQUIREMENTS, AS NOTED IN THE ROAD DESIGN MANUAL. THERE SHALL NOT BE ANY CABINETS, PEDESTAL, OR FIRE HYDRANTS LOCATED ON THE SHOULDER.
34. ALL STORM PIPE, DROP INLET STRUCTURES, DITCHES, AND CURB AND GUTTER SHALL BE CLEANED OF DEBRIS AND SILT DURING THE LAST STAGES OF CONSTRUCTION.
35. FLOWERS, SHRUBS, AND TREES SHALL NOT BE PLACED WITHIN THE PROPOSED RIGHT OF WAY BY THE DEVELOPER OR HOMEOWNER WITHOUT AN APPROVED SET OF PLANS AND AN APPROVED PLANTING AGREEMENT. NO IRRIGATION (SPRINKLER) SYSTEMS SHALL BE LOCATED WITHIN THE PROPOSED RIGHT OF WAY. ANY IRRIGATION SYSTEM FOUND WITHIN THE RIGHT OF WAY WILL BE REMOVED PRIOR TO THE ACCEPTANCE OF THE STREETS AND ALL COSTS WILL BE BORNE BY THE OWNER. NO EASEMENTS SHALL ENCROACH UPON THE PROPOSED RIGHT OF WAY; ANY EASEMENTS LOCATED WITHIN THE PROPOSED RIGHT OF WAY MUST BE REMOVED FROM THE PLAT PRIOR TO THE RECORDATION OF THE PLAT. A DEED OF QUIT CLAIM WILL BE REQUIRED ON ANY EASEMENTS LOCATED WITHIN THE PROPOSED RIGHT OF WAY PRIOR TO THE ACCEPTANCE OF THE STREETS INTO THE STATE SECONDARY ROAD SYSTEM. NO BRICK COLUMNS, ENDWALLS, AND/OR BRICK MAILBOXES WILL BE CONSTRUCTED OR INSTALLED IN THE PROPOSED RIGHT OF WAY. ANY OF THE ABOVE ITEMS FOUND IN THE PROPOSED RIGHT OF WAY WILL BE REMOVED, AND ALL COSTS OF THE REMOVAL WILL BE BORNE BY THE OWNER AND/OR DEVELOPER.
36. CONTACT MR. SAL SIBILIA 72 HOURS IN ADVANCE OF ALL PAVEMENT MARKINGS/SIGN INSTALLATIONS AT (757) 925-1679. FAILURE TO DO SO MAY RESULT IN ADDITIONAL COST TO THE DEVELOPER.
37. CONTACT TRAFFIC ENGINEERING AT (757) 925-2693 A MINIMUM OF 48 HOURS IN ADVANCE WHENEVER AN OPEN CUT OR BORING OF A UTILITY LINE ACROSS A ROAD IS WITHIN 400 FEET OF A TRAFFIC SIGNAL, SO THE LINES CAN BE MARKED. FAILURE TO DO SO COULD BE A COSTLY REPAIR FOR THE DEVELOPER.

DI-1

Steps are to be provided when H is 4'-0" or greater. For details see standard ST-1.

PLAN (Grate Removed)

SECTION A-A

Notes:
Maximum depth (H) to be 10'. For greater depth use Standard DI-1A.
When specified on plans the invert is to be shaped in accordance with Standard Plan IS-1. The cost of furnishing and placing all materials incidental to the shaping is to be included in the price bid for the drop inlet complete.
This item may be precast or cast in place.
All cast in place concrete to be Class 20. For precast See Sheet 103.03.
The "H" dimension shown on the Standards and specified on the plans will be measured from the invert of the outfall pipe to the top of the structure. Plan "H" dimensions are approximate only for estimating purposes and the actual dimensions shall be determined by the Contractor from field conditions.
In the event the invert of the outfall pipe is higher than the bottom of the structure, the invert of the structure shall be shaped with cement mortar to prevent standing or ponding of water in the structure. The cost for invert shaping shall be included in the price bid for the structure.

* Weep hole with 12"x12" plastic hardware cloth 1/4" mesh or galvanized steel wire, minimum wire diameter 0.03 inch, number 4 mesh hardware cloth anchored firmly to outside of structure.
#4x8" Smooth Dowels @ approximately 12" c-c to be placed in all areas adjacent to abutting concrete to prevent settlement. In lieu of dowels a 2"x 4" notch may be provided. See Standard T-DI-3, 4 alternate design.

CONCRETE QUANTITIES FOR MIN. DEPTH
12" concrete pipe - 1.440 Cu. Yds. Concrete
15" concrete pipe - 1.528 Cu. Yds. Concrete
18" concrete pipe - 1.620 Cu. Yds. Concrete
24" concrete pipe - 1.817 Cu. Yds. Concrete
Add 0.469 Cu. Yds. per additional foot of depth.

SECTION B-B — DETAILS OF COLLAR AND GRATE — SECTION C-C

Notes:
Any alternate methods of anchorage, meeting the approval of the Engineer, may be substituted for the cast iron lugs as shown hereon.

APPROXIMATE WEIGHT
Cast Iron Grate 363 ± 18 lbs.

STANDARD DROP INLET
12"- 24" PIPE MAXIMUM DEPTH (H)=10'
VIRGINIA DEPARTMENT OF TRANSPORTATION
THIS DRAWING FILE WAS ELECTRONICALLY REPRODUCED BY LANDMARK DESIGN GROUP
SPECIFICATION REFERENCE 233 302
104.01

END-SECTION 12" - 60" PIPE

Hub end on outlet end-sections
Spigot end on inlet end-sections
Concrete to be 4000 PSI Min.
PLAN — SECTION X-X — END VIEW

END SECTION DIMENSIONS

PIPE DIAMETER	A	B	C	D	E
12"	4"	2'-0"	2'-0"	4'-0"	2'-0"
15"	6"	2'-3"	1'-9"	4'-0"	2'-6"
18"	9"	2'-3"	1'-9"	4'-0"	3'-0"
24"	9½"	3'-7"	2'-6"	6'-1"	4'-0"
30"	1'-0"	4'-6"	1'-7½"	6'-1½"	5'-0"
36"	1'-3"	5'-3"	2'-10½"	8'-1½"	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"
54"	2'-3"	5'-5"	2'-9½"	8'-2½"	7'-6"
60"	2'-11"	5'-0"	3'-3"	8'-3"	8'-0"

ALTERNATE END-SECTION 12" - 60" PIPE
ES-1

Hub end on outlet end-sections
Spigot end on inlet end-sections
Concrete to be 4000 PSI Min.
PLAN — SECTION X-X — END VIEW

END SECTION DIMENSIONS

PIPE DIAMETER	A	B	C	D	E
12"	4"	2'-0"	4'-1"	6'-1"	2'-0"
15"	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	9"	2'-3"	3'-10"	6'-1"	3'-0"
21"	9"	2'-11"	3'-2"	6'-1"	3'-6"
24"	10"	3'-7"	2'-6"	6'-3"	4'-0"
27"	10½"	4'-0"	2'-1½"	6'-1½"	4'-6"
30"	1'-0"	4'-6"	1'-7½"	6'-1½"	5'-0"
33"	1'-1½"	4'-10½"	3'-3½"	8'-1½"	5'-6"
36"	1'-3"	5'-3"	2'-10½"	8'-1½"	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"
54"	2'-3"	5'-5"	2'-11"	8'-4"	7'-6"
60"	2'-6"	5'-0"	3'-3"	8'-3"	8'-0"

SLOPE DETAIL

Notes:
Pipe lengths shown on plans are based on End-Section design shown on the left. If the contractor elects to use the alternate design shown on the right, lengths will be reduced by the difference in dimension "D".

FLARED END-SECTION FOR CONCRETE PIPE CULVERTS
VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIFICATION REFERENCE 302
THIS DRAWING FILE WAS ELECTRONICALLY REPRODUCED BY LANDMARK DESIGN GROUP 102.01

EW-6

3/4" Chamfer shall be provided on all exposed edges.

FRONT ELEVATION — SIDE ELEVATION

Notes: On shallow fills, where endwall are 1' or less below shoulder line, the top of the endwall shall be constructed parallel to the grade of the road.
This item may be precast or cast in place.
In no case shall top of endwall project above fill slope, ditch slope or shoulder.
This Std to be used with straight crossings and skew angles to 15°.
All cast in place Concrete to be Class A3.
For precast see Sheet 101.12.
Quantities given are for one endwall.
All dimensions not given in table are same as those for single endwalls for same size of pipe.
Headwall to be beveled in all areas except where a conflict with invert or wingwalls occur.
a=1.25" ± / foot diameter
b=1"/ foot diameter

FOR CONCRETE PIPE

DIA. D OF PIPE	S	G	L	Cu.Yds. Concrete One Double Endwall	Increase Cu.Yds. for Each Additional Pipe	a	b
12"	1'-10"	2'-0"	5'-10"	0.329	0.088	0'-2"	0'-1 1/4"
15"	2'-3"	2'-6"	7'-3"	0.671	0.179	0'-2"	0'-1 1/4"
18"	2'-8"	3'-0"	8'-8"	0.941	0.244	0'-21/2"	0'-1 1/2"
21" or 24"	3'-6"	4'-0"	11'-6"	1.763	0.444	0'-3"	0'-2"
27" or 30"	4'-4"	5'-0"	14'-4"	2.730	0.683	0'-4"	0'-2 1/2"
33" or 36"	5'-2"	6'-0"	17'-2"	3.854	0.907	0'-41/2"	0'-3"

FOR CORRUGATED SHEET METAL

DIA. D OF PIPE	S	G	L	Cu.Yds. Concrete One Double Endwall	Increase Cu.Yds. for Each Additional Pipe	a	b
12"	1'-7"	2'-0"	5'-7"	0.344	0.087	0'-2"	0'-1 1/4"
15"	1-111/2"	2'-6"	6'-111/2"	0.696	0.175	0'-2"	0'-1 1/4"
18"	2'-4"	3'-0"	8'-4"	0.980	0.241	0'-21/2"	0'-1 1/2"
24"	3'-1"	4'-0"	11'-1"	1.840	0.442	0'-3"	0'-2"
27" or 30"	3'-10"	5'-0"	13'-10"	2.868	0.670	0'-4"	0'-2 1/2"
36"	4'-7"	6'-0"	16'-7"	4.076	0.931	0'-41/2"	0'-3"

Bevel edge is required on the headwall at the inlet end of the culvert (where the flow enters the culvert).
Headwall at the outlet end of the culvert may be either square edge or bevel edge.

STANDARD ENDWALLS FOR MULTIPLE PIPE CULVERTS
12"-36" PIPE
VIRGINIA DEPARTMENT OF TRANSPORTATON
SPECIFICATION REFERENCE 105.04 302
THIS DRAWING WAS ELECTRONICALLY REPRODUCED BY LANDMARK DESIGN GROUP 101.11

PROP R/W — ℄ — PROP R/W
40' — 40'
4' 8' 12' 12' 8' 4'
5' MIN.
POINT OF FINISHED GRADE
3' — 3'
5/8":1' 1/4":1' 1/4":1' 5/8":1'
3:1 MAX 3:1 — 3:1 3:1 MAX
EXISTING
4" FM

COLUMBIA WAY
SCALE: NONE

1 1/2" BIT. CONC. ASPHALT SURFACE COURSE - TYPE SM-9.5A
3 1/2" BIT. CONC. ASPHALT BASE COURSE - TYPE BM-25.0
8"CEMENT TREATED AGGREGATE - TYPE 21B
4"UNTREATED AGGREGATE - TYPE 21B
WELL COMPACTED SUBGRADE

TYP. PVMT. SECTION (ROADWAYS)
SCALE: NONE

UB-1

COMPACTED BACKFILL
INITIAL BACKFILL SEE SECTION 520.03 VDOT SPECIFICATION
AGGREGATE # 57 OR 58 BEDDING
12" MIN. — 2" MIN. — O.D./2 — O.D. + 24" * — 12"+O.D./2 — 4" MIN.

TYPE 1 — TYPE 2 — TYPE 3

INITIAL BACKFILL SEE SECTION 520.03
PROPOSED STORM DRAINAGE PIPE
CLASS A3 CONCRETE
POUR TO UNDISTURBED EARTH
PREPOSED STORM DRAINAGE PIPE
AGGREGATE #57 OR 58 BEDDING
CONCRETE CRADLE OR CAP SHALL FOLLOW THE PIPE CONTOUR A MINIMUM OF 4" ABOVE OR BELOW THE CROWN.

CONCRETE ENCASEMENT — CONCRETE CRADLE — CONCRETE CAP

NOTES:
1. WHERE THE TRENCH BOTTOM IS IN ROCK, IT SHALL BE EXCAVATED TO A MINIMUM OF 8" BELOW THE BOTTOM OF THE PIPE AND BACKFILLED WITH BEDDING MATERIAL.
2. WHERE PIPE FOUNDATIONS ARE YIELDING, PIPE SHALL BE BEDDED ON A MINIMUM OF 8" BEDDING MATERIAL.
* FOR PIPE LESS THAN 12" THE TRENCH WIDTH MAY BE 36" MAXIMUM.

UTILITY BEDDING AND PROTECTION
WATER AND SANITARY SEWER FACILITIES
VIRGINIA DEPARTMENT OF TRANSPORTATION
THIS DRAWING FILE WAS ELECTRONICALLY REPRODUCED BY LANDMARK DESIGN GROUP 1401.01

PG-2A

OUTSIDE ROAD DITCHES

Front slope or ditch slope — back slope

TYPE	D inches	FRONT SLOPE	BACK SLOPE	W1 inches	W2 inches	K	SQ. YDS. SURFACE AREA/LF
A1	6"	6:1	4:1	3'-0"	2'-1"	48	0.565
A1	8"	6:1	4:1	4'-1"	2'-9"	104	0.759
A2	6"	6:1	3:1	3'-0"	1'-7"	42	0.509
A2	8"	6:1	3:1	4'-1"	2'-1"	92	0.685
A3	6"	6:1	2:1	3'-0"	1'-2"	38	0.463
A3	8"	6:1	2:1	4'-1"	1'-6"	82	0.620
B1	6"	4:1	4:1	2'-1"	2'-1"	38	0.463
B1	8"	4:1	4:1	2'-9"	2'-9"	82	0.611
B2	8"	4:1	3:1	2'-9"	2'-1"	72	0.537
B2	10"	4:1	3:1	3'-5"	2'-8"	130	0.676
B3	8"	4:1	2:1	2'-9"	1'-6"	60	0.472
B3	10"	4:1	2:1	3'-5"	1'-10"	111	0.583
B4	8"	4:1	1 1/2:1	2'-9"	1'-2"	55	0.435
B4	10"	4:1	1 1/2:1	3'-5"	1'-6"	101	0.546
C1	8"	3:1	2:1	2'-1"	1'-6"	50	0.398
C1	10"	3:1	2:1	2'-8"	1'-10"	92	0.500
C2	10"	3:1	1 1/2:1	2'-8"	1'-6"	80	0.463
C3	10"	3:1	1:1	2'-8"	1'-2"	70	0.426

MEDIAN DITCH

TYPE D — 6' : 1 Des. 4 : 1 — 4 : 1 3 : 1 Max. 6 : 1 Des.

D = Depth	W_1	W_2	Sq. Yds. surface area per lin. ft.
8"	2'-9"	2'-9"	0.611

K = 82

DITCH AT TOE OF FILL OR TOP OF CUT

TYPE E — 2 : 1 — 2 : 1

12"	2'-3"	2'-3"	0.500

K = 115

PLAN FOR TRANSITION OF PAVED MEDIAN DITCH TO MEDIAN DROP INLET GUTTER

L=3(W1+W2)
Construction joint optional — Invert (flat bottom) Pay line — Median drop inlet gutter — Median Drop Inlet
Approach paved median ditch

SECTION E-E — SECTION D-D
Curtain wall to be located at beginning an end of all channels and on the lower end of each expansion joint.
Slope — Curtain wall — 18" — 6"

ALTERNATE METHOD OF FORMING DITCHES
1" Radius

Notes:
For Section A-A see Standards DI-7, 7A and 7B.
Traditional portion of paved ditch to be paid for at the same price bid per sq. yd. for approach paved median ditch.
Standard PG-2A ditches to be Class A3 Concrete.

Note:
All ditches may be constructed with vertical sides at the option of the contractor.

STANDARD PAVED DITCHES
VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIFICATION REFERENCE 502
THIS DRAWING WAS ELECTRONICALLY REPRODUCED BY LANDMARK DESIGN GROUP 109.01

DI-5

DITCH PLAN — MEDIAN PLAN — SECTION A-A — SECTION B-B — DETAIL A
5'-4" — 3'-0" — 3'-4" GRATE — 3'-5" COLLAR — SEE DETAIL A

■ 3" ø WEEP HOLE WITH 12"X12" PLASTIC HARDWARE CLOTH 1/4" MESH OR GALVANIZED STEEL WIRE, MINIMUM, WIRE ø 0.03", NUMBER 4 MESH HARDWARE CLOTH ANCHORED FIRMLY TO OUTSIDE OF STRUCTURE.

WELD — 2"ø BAR @ 10.68 LBS/FT OR NO.14 BILLET STEEL BAR @ 7.65 LBS/FT (ASTM, A615, GRADE 60)

NO. 5X5'-0" BARS 20 REQ'D MIN. CONC. COVER 1 1/2"
STEPS STD.ST-1
SEE STD. DI-7 FOR CHAMBER DETAILS
DITCH LINE SECTION — MEDIAN DITCH SECTION
GRATE (GALVANIZED) — COLLAR (GALVANIZED)
** COLLAR DIMENSIONS TO BE 1/4" LARGER THAN GRATE DIMENSIONS W3 & W4.
\# 4" DEPTH AGGREGATE #68, #78, #8 X 6 WIDE.
*TOLERANCE ½" ±

INVERT OF STRUCTURE TO BE SHAPED WITH CEMENT MORTAR TO PREVENT STANDING OR PONDING OF WATER WHEN REQUIRED.
DITCH FROM PLANS FOR SAG CONDITION OR BACK-UP BERM ON GRADE AS DIRECTED BY THE ENGINEER.
PAVED OR UNPAVED DITCH AS REQUIRED ON PLANS
WHERE PAVED DITCHES ARE REQUIRED JOINTS ARE TO BE DOWELED WITH #4X8 SMOOTH ROD @ APPROX. 12" C-C TO PREVENT SETTLEMENT.
IN LIEU OF DOWELS A 2"X4" NOTCH MAY BE PROVIDED. SEE STANDARD T-DI-3, 4 ALTERNATE DESIGN.

ST'D PG-2A TYPE	W_1	W_2	W_3	W_4	D	D_1	D_2	X	Z
	COVER DIMENSIONS								
A1,,A2	3'-0½"	2'-0¾"	2'-0 5/16"	1'-0⅜"	6"	4"	[illegible]	14"	2'-2"
A3	4'-0⅝"	1'-5⅞"	2'-10½"	NA	8"	5⅝"	NA	16"	1'-3"
B1,,B2	2'-9"	2'-9"	1'-6 9/16"	1'-6 9/16"	8"	4½"	4½"	16"	2'-8"
B3,,B4	3'-5½"	1'-10⅜"	2'-2½"	11¼"	10"	6½"	5"	18"	2'-0"
C1,,C2	2'-7⅝"	1'-10⅜"	1'-11½"	1'-3⅜"	10"	7⅜"	7"	18"	2'-4"
C3	2'-7⅝"	1'-2⅛"	2'-5½"	11⅞"	10"	9⅜"	8"	18"	1'-8"
E	2'-7 1/16"	1'-2¼"	2'-5½"	11⅜"	9 5/16"	9⅝"	8 1/16"	1'-6"	1'-8 1/16"

GRATE BAR SPACING CHART

GRATE TYPE	MAX. DIMENSION A	B
I	1½"	[illegible]
III	1"	1"

THE "H" DIMENSION SHOWN ON THE STANDARDS AND SPECIFIED ON THE PLANS WILL BE MEASURED FROM THE INVERT OF THE OUTFALL PIPE TO THE TOP OF THE STRUCTURE. PLAN "H" DIMENSIONS ARE APPROXIMATE ONLY FOR ESTIMATING PURPOSES AND THE ACTUAL DIMENSIONS SHALL BE DETERMINED BY THE CONTRACTOR FROM FIELD CONDITIONS.
CHAMBER MAY BE CAST IN PLACE, PRECAST, BRICK, OR CONCRETE BLOCK. FOR DETAILS SEE ST'D. DI-7.
ALL CAST IN PLACE CONCRETE TO BE CLASS A3.
STEPS IN ACCORDANCE WITH ST'D. ST-1 ARE TO BE PROVIDED WHEN DIMENSIONS "H" IS 4'-0" OR GREATER.

STANDARD DITCH DROP INLET
VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIFICATION REFERENCE 241 503
THIS DRAWING WAS ELECTRONICALLY REPRODUCED BY LANDMARK DESIGN GROUP
104.21

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2/17/04

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LANDMARK DESIGN GROUP
Engineers • Planners • Surveyors
Landscape Architects • Environmental Consultants

REVISIONS

No.	Date	Comment	By
1	7/23/03	REVISED PER COUNTY COMMENTS	HWU

DRAWING STATUS

3/27/03	Interoffice Review
	Client for Review
	Pre Approval Bidding

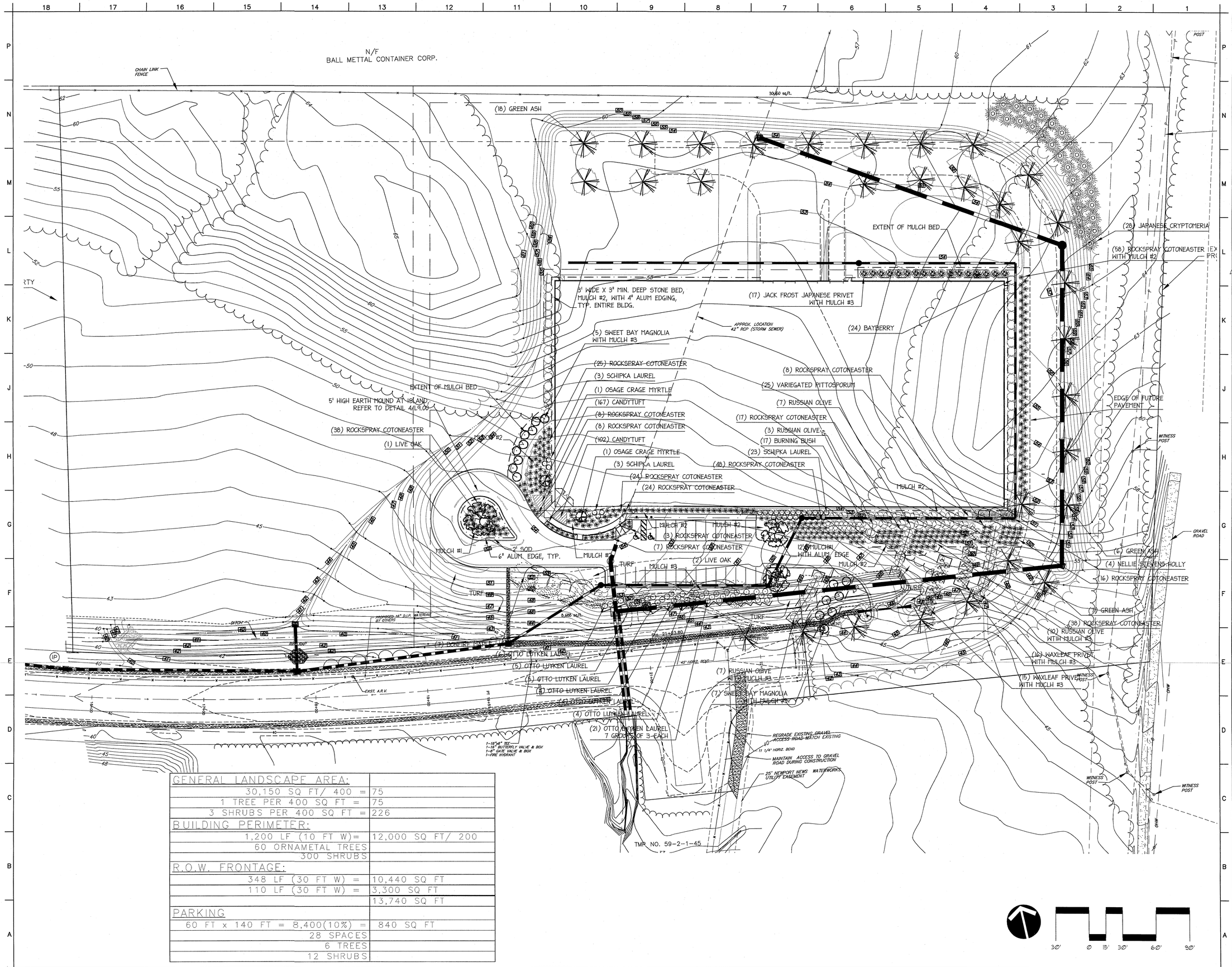
COUNTY APPROVAL

3/28/03	1st Submittal
9/10/03	2nd Submittal
	3rd Submittal
	Approved

VDOT DETAILS & NOTES
JAMES RIVER COMMERCE CENTER
COLUMBIA WAY
ROBERTS MAGISTERIAL DISTRICT
JAMES CITY COUNTY, VIRGINIA
FOR
JAMES CITY COUNTY INDUSTRIAL DEVELOPMENT AUTHORITY

Designed: AJR	Date: 1/15/03
Checked: RSP	Scale: NONE
File Mgr./Drawn: LFV/AJR	CADD File name: dtl-vdot.dwg
Project Number: 2002248-000.01	Plot. File: dtl-vdot.plt
Drawing Number C-7	8 OF 8

14047W



GENERAL LANDSCAPE AREA:	
30,150 SQ FT/ 400 =	75
1 TREE PER 400 SQ FT =	75
3 SHRUBS PER 400 SQ FT =	226
BUILDING PERIMETER:	
1,200 LF (10 FT W)=	12,000 SQ FT/ 200
60 ORNAMETAL TREES	
300 SHRUBS	
R.O.W. FRONTAGE:	
348 LF (30 FT W) =	10,440 SQ FT
110 LF (30 FT W) =	3,300 SQ FT
	13,740 SQ FT
PARKING	
60 FT x 140 FT = 8,400(10%) =	840 SQ FT
28 SPACES	
6 TREES	
12 SHRUBS	

McKINNEY AND COMPANY
planning • design • construction

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000590
13 JAN 04
LANDSCAPE ARCHITECT

SHELL BUILDING
JAMES RIVER COMMERCE CENTER
JAMES CITY COUNTY, VIRGINIA

DESIGN: S.Harned
DRAWN: S.Harned
CHECKED: G.Clower
REVISIONS:

1 CNTY CMNTS 01.12.04

DATE: 02 MAY 2003
JOB NO. 11595-02
CAD NO. 1595pr.dwg
DRAWING TITLE: **PLANTING PLAN**

SHEET NO. **L8.01**

GENERAL NOTES

1. ALL PLANTS SHALL CONFORM TO CURRENT AAN STANDARDS AND SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM FINAL ACCEPTANCE.

2. LANDSCAPE ARCHITECT RESERVES THE RIGHT TO INSPECT ALL MATERIALS AT SOURCE.

3. PLANTING MIX SHALL CONSIST OF A UNIFORM MIXTURE OF 75% TOPSOIL, 20% COMPOSTED COW MANURE AND 5% CLEAN SAND.

4. FERTILIZE ALL PLANTS PRIOR TO COMPLETION WITH OSMOCOTE 14-14-14 PER MANUFACTURER'S LABEL.

5. CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES AND SHALL MAINTAIN A CURRENT MISS UTILITY NUMBER THROUGHOUT WORK PERIOD.

6. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTENANCE AND WATERING OF ALL PLANT MATERIAL UNTIL FINAL ACCEPTANCE.

7. CONTRACTOR SHALL PROVIDE LANDSCAPE ARCHITECT WITH DETAILED, WRITTEN LANDSCAPE MAINTENANCE INSTRUCTIONS PRIOR TO FINAL ACCEPTANCE.

8. REMOVE ALL HOSE, WIRE AND STAKES AT END OF GUARANTEE PERIOD, OR 1 YEAR AFTER INSTALLATION.

9. ALL SELECTIVE THINNING AND CLEAR VIEWING SHALL BE DONE AT THE DIRECTION OF OWNER'S REPRESENTATIVE.

10. LANDSCAPE CONTRACTOR SHALL PROTECT EXISTING TREES FROM ANY DAMAGE DUE TO LANDSCAPE WORK.

11. IN AREAS WHERE PLANTING OCCURS IN WET SOILS, RAISE PLANT 4" ABOVE NORMAL PLANTING DEPTH AND PROVIDE 4" #68 STONE AT BOTTOM OF PLANTING PIT. SHAPE SURROUNDING GRADE TO MATCH.

12. ALL PLANTING MATERIAL SHALL BE MAINTAINED IN A MULCH BED AND ALL BEDS SHALL BE MULCHED AND EDGED CLEANLY WHERE ADJACENT TO ANY EXISTING LAWN, SODDED, OR SEEDED AREA.

13. FIELD PLANTING ADJUSTMENTS MAY BE NECESSARY BECAUSE OF SITE CONDITIONS (EX.: ROOT BALL AND UTILITY CONFLICT) MAJOR ADJUSTMENTS MUST BE APPROVED BY LANDSCAPE ARCHITECT. 'MISS UTILITY' MUST BE CONTACTED BEFORE ANY PLANTING OR GRADING CAN COMMENCE.

14. ROUGH GRADING SHALL BE DONE BY GENERAL SITE CONTRACTOR. ANY FINE GRADING ASSOCIATED WITH PLANTING SHALL BE DONE BY THE LANDSCAPE CONTRACTOR.

15. IF SOMEONE OTHER THAN THE LANDSCAPE ARCHITECT (OWNER, BUILDER, ETC.) ADVERTISES, SOLICITS AND/OR RECEIVES BIDS FOR WORK, THE LANDSCAPE CONTRACTOR SHALL STILL PROVIDE UNIT COPIES OF UNIT PRICE BID TO THE LANDSCAPE ARCHITECT.

16. TREE PROTECTION MEASURES SHALL BE CONSTRUCTED BEFORE ANY CLEARING MEASURES BEGIN, REMAIN IN PLACE AT ALL TIMES AND PROPERLY MAINTAINED UNTIL FINAL ACCEPTANCE OF THE PROJECT.

17. WHEN A PLAN REQUIRES A TREE PROTECTION DEVICE AND AN EROSION CONTROL DEVICE, THE EROSION CONTROL DEVICE SHALL BE ON THE UPGRADE SIDE OF THE TREE PROTECTION FENCING.

18. SEE PROJECT SPECIFICATIONS FOR ALL LAWN AND SEEDING AREAS. ALL AREAS NEXT TO MULCH BEDS SHALL BE LAWN UNLESS OTHERWISE SPECIFIED.

19. LANDSCAPE CONTRACTOR SHALL REFER TO THE AMERICAN STANDARD FOR NURSERY STOCK (PROVIDE BY AAN) FOR ADDITIONAL INFORMATION. THE CONTRACTORS SHALL ABIDE BY ITS CONTENTS; HOWEVER ANY NOTES OR SPECIFICATIONS ON PLANS SHALL SUPERSEDE THOSE OUTLINED IN THE MANUAL.

20. ALL WORK SHALL BE COORDINATED WITH OTHER TRADES.

21. LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING AMOUNT OF ANY LAWN COVERAGE AS INDICATED ON PLANS.

22. THE OWNER RESERVES THE RIGHT TO SUBSTITUTE PLANT MATERIAL TYPE, SIZE AND/OR QUANTITY.

23. THE DEPARTMENT OF PUBLIC UTILITIES AND THE DEPARTMENT OF PUBLIC WORKS ARE NOT RESPONSIBLE FOR REPLACEMENT OF ANY PLANTINGS, IRRIGATION OR LIGHT POLES DAMAGED OR REMOVED BY THE DEPARTMENT OF PUBLIC UTILITIES OR PUBLIC WORKS, OR THEIR AGENTS, AS REQUIRED FOR MAINTENANCE OF COUNTY OWNED WATER AND SEWER, DRAINAGE FACILITIES OR ROADWAYS.

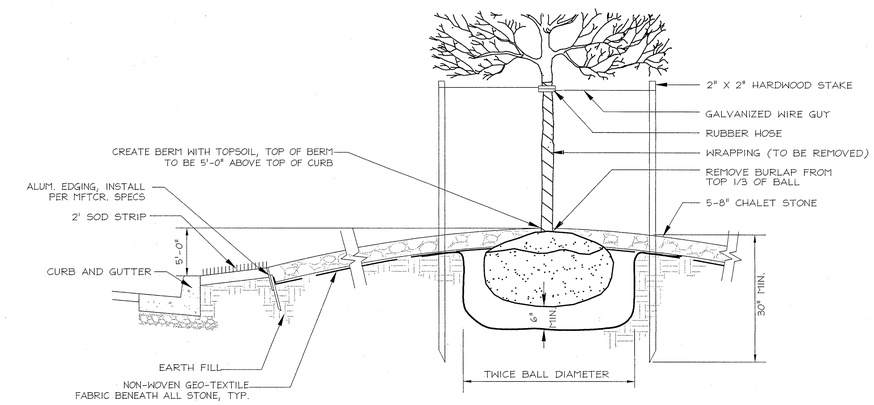
24. ALL PLANT MATERIAL QUANTITY COUNTS ON THE PLAN ARE THE RESPONSIBILITY OF THE CONTRACTOR. PLANT SCHEDULE TOTALS ARE FOR CONVENIENCE ONLY AND SHALL BE VERIFIED PRIOR TO BIDDING.

25. IT IS THE CONTRACTORS RESPOSIBILITY TO VERIFY LOCATION OF ALL EXISTING UTILITIES. CONTRACTOR SHALL CO-ORDINATE WITH MISS UTILITY 48 HRS PRIOR TO START OF CONSTRUCTION.

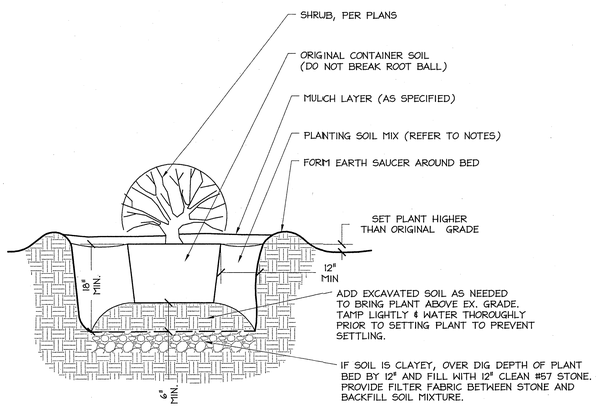
26. PROVIDE NON-WOVEN GEOTEXTILE FABRIC UNDER ALL MINERAL MULCHES. INSTALL WEED BARRIER PER MANUFACTURER'S SPECIFICATIONS.

PLANT SCHEDULE

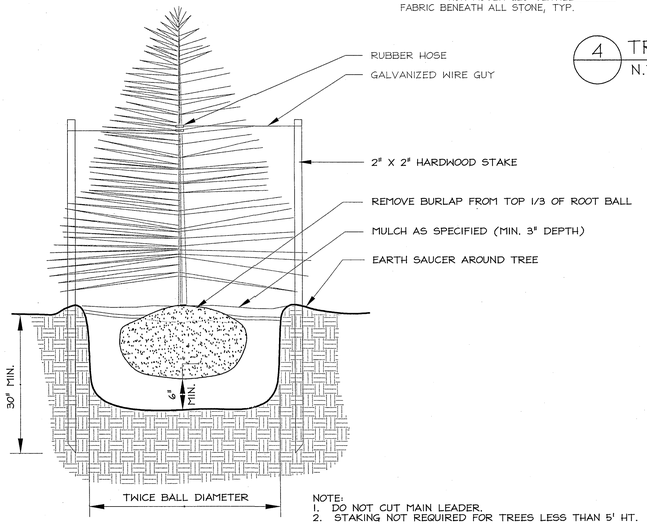
CODE	QUAN.	BOTANICAL NAME	COMMON NAME	CALIPER	HEIGHT	SPREAD	SPEC.	REMARKS
		LARGE DECIDUOUS TREES						
AS	7	Acer saccharum 'Bonfire'	'Bonfire' Sugar Maple	2-2 1/2"			B&B	UNIFORM CROWN
FP	31	Fraxinus pennsylvanica 'Patmore'	Green Ash	2-1/2"			B&B	UNIFORM CROWN, 50' O.C.
		EVERGREEN TREES						
CJ	28	Cryptomeria japonica 'Yoshino'	'Yoshino' Japanese Cryptomeria		6-7'		B&B	UNIFORM SHAPE, 12' O.C.
IX	4	Ilex x 'Nellie R. Stevens'	'Nellie Stevens' Holly		6-7'		B&B	UNIFORM SHAPE, 10' O.C.
QV	3	Quercus virginiana	Live Oak	3-1/2"-4"			B&B	SPECIMEN QUALITY, UNIFORM CROWN
		SMALL TREE						
LI	2	Lagerstroemia indica 'Osage'	'Osage' Crape Myrtle		6-7'		Cont.	UNIFORM SHAPE
MV	12	Magnolia virginiana	Sweet Bay Magnolia		6-8'		Cont.	UNIFORM SHAPE, 15' O.C.
		LARGE SHRUBS						
EA	27	Eleagnus angustifolia	Russian Olive		2-3'		Cont.	UNIFORM SHAPE, 7' O.C.
LL	30	Ligustrum lucidum 'Davidson Hardy'	'Davidson Hardy' Waxleaf Privet		4'		Cont.	7' O.C.
LJ	17	Ligustrum japonicum 'Jack Frost'	'Jack Frost' Japanese Privet		24-30"		Cont.	8' O.C.
MP	24	Myrica pennsylvanica	Bayberry		24-30"		Cont.	8' O.C.
PT	25	Pittosporum tobira 'Variegata'	Variegated Pittosporum		36"		Cont.	8' O.C.
		MEDIUM/ SMALL SHRUBS						
CH	326	Cotoneaster horizontalis	Rockspray Cotoneaster		18-21"		Cont.	5' O.C.
EA	17	Euonymus alatus 'Compacta'	Compact Burning Bush		24-30"		Cont.	4' O.C.
PL	49	Prunus laurocerasus 'Otto Luyken'	Otto Luyken Laurel		24-30"		Cont.	5' O.C.
PS	29	Prunus laurocerasus 'Schipkaensis'	Schipka Laurel		24-30"		Cont.	5' O.C.
		GROUND COVER/ WILD FLOWER MIX						
IS	269	Iberis sempervirens	Candytuft		1 Gal.		Cont.	12" O.C.
		MULCH						
38	Ton	Mulch #1	5-8" Chalet Stone, supplied by Luck Stone, or eq.					At Live Oaks only, 6" Alum. Edge at borders, typ.
237	Ton	Mulch #2	1" Berkely Stone, supplied by Luck Stone, or eq.					3" min. depth, 4" Alum. Edge at borders, typ.
96	CY	Mulch #3	Shredded Hardwood Mulch					3" min. depth, 4" Alum. Edge at borders, typ.
		ALUMINUM EDGING						
2600+/-	LF	Curv-Rite Aluminum Edging, or eq.	4" and 6" size					at edge of all mulch and plant beds



4 TREE PLANTING WITH STONE MULCH
N.T.S.

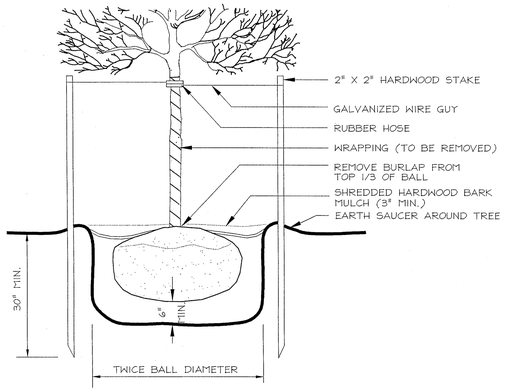


1 SINGLE SHRUB (CONTAINER) IN MULCH PLANTING AREA
N.T.S.



NOTE:
1. DO NOT CUT MAIN LEADER.
2. STAKING NOT REQUIRED FOR TREES LESS THAN 5' HT.

2 CONIFEROUS TREE PLANTING - OVER 5' HT.
N.T.S.



3 TREE PLANTING - UP TO 4" CALIPER
N.T.S.

McKINNEY AND COMPANY
planning • design • construction

MAIN OFFICE
109 SOUTH RAILROAD AVE.
ASHLAND, VIRGINIA 23005
(804)798.3451 FAX: (804)798.7072

WILLIAMSBURG OFFICE
460 MCLAWS CIRCLE, SUITE 150
WILLIAMSBURG, VA. 23185
(757)220.5400 FAX: (757)229.6381

www.mckinney-usa.com

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COMMONWEALTH OF VIRGINIA
GROBERT D. ANDERSON
000590
12 JAN 04
LANDSCAPE ARCHITECT

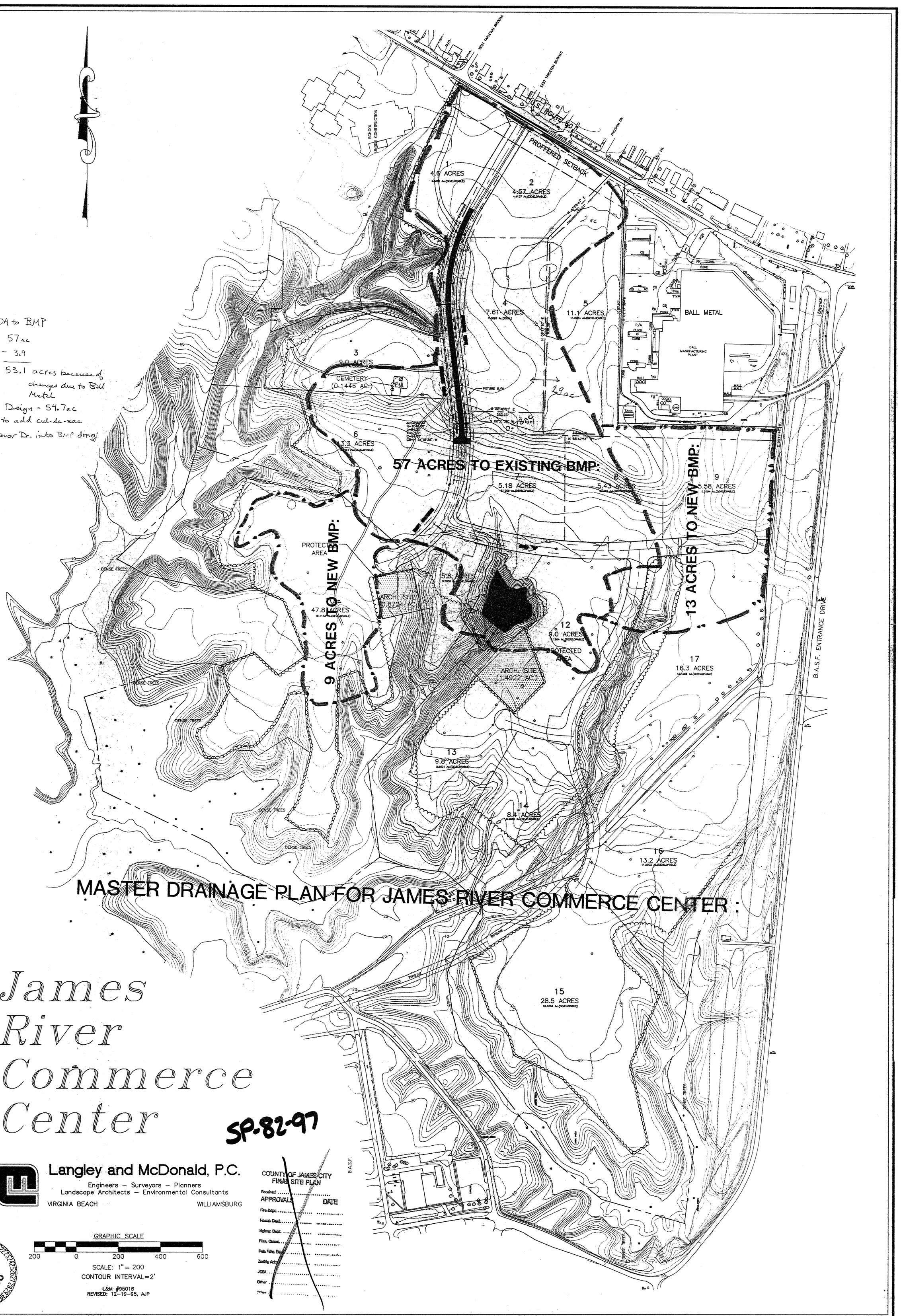
SHELL BUILDING
JAMES RIVER COMMERCE CENTER
JAMES CITY COUNTY, VIRGINIA

DESIGN: S. HARNED
DRAWN: S. HARNED
CHECKED: G. CLOWER
REVISIONS:

△1 CNTY CMNTS 01.12.04

DATE: 02 MAY 2003
JOB NO. 11595-02
CAD NO. 1595L900.dwg
DRAWING TITLE: PLANT SCHEDULE, DETAILS, AND NOTES
SHEET NO. L9.00

DA to BMP
57 ac
- 3.9
53.1 acres because of changes due to Ball Metal
Original Design - 54.7ac
Proposed to add cul-de-sac for Endeavor Dr. into BMP drng.



MASTER DRAINAGE PLAN FOR JAMES RIVER COMMERCE CENTER :

James River Commerce Center

SP-82-97

Langley and McDonald, P.C.
Engineers – Surveyors – Planners
Landscape Architects – Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

COUNTY OF JAMES CITY
FINAL SITE PLAN
Received .....
APPROVALS DATE
Fire Dept. .....
Health Dept. .....
Highway Dept. .....
Plan. Comm. .....
Pub. Wks. Dir. .....
Zoning Adm. .....
JCSA .....
Other .....
Other .....

GRAPHIC SCALE
200 0 200 400 600
SCALE: 1" = 200
CONTOUR INTERVAL=2'
L&M #95016
REVISED: 12-19-95, AJP

AUG 1997
RECEIVED
PLANNING DEPARTMENT

DWG.	
PROJ. NO.	95016-28
DISK	
SHEET	1A OF

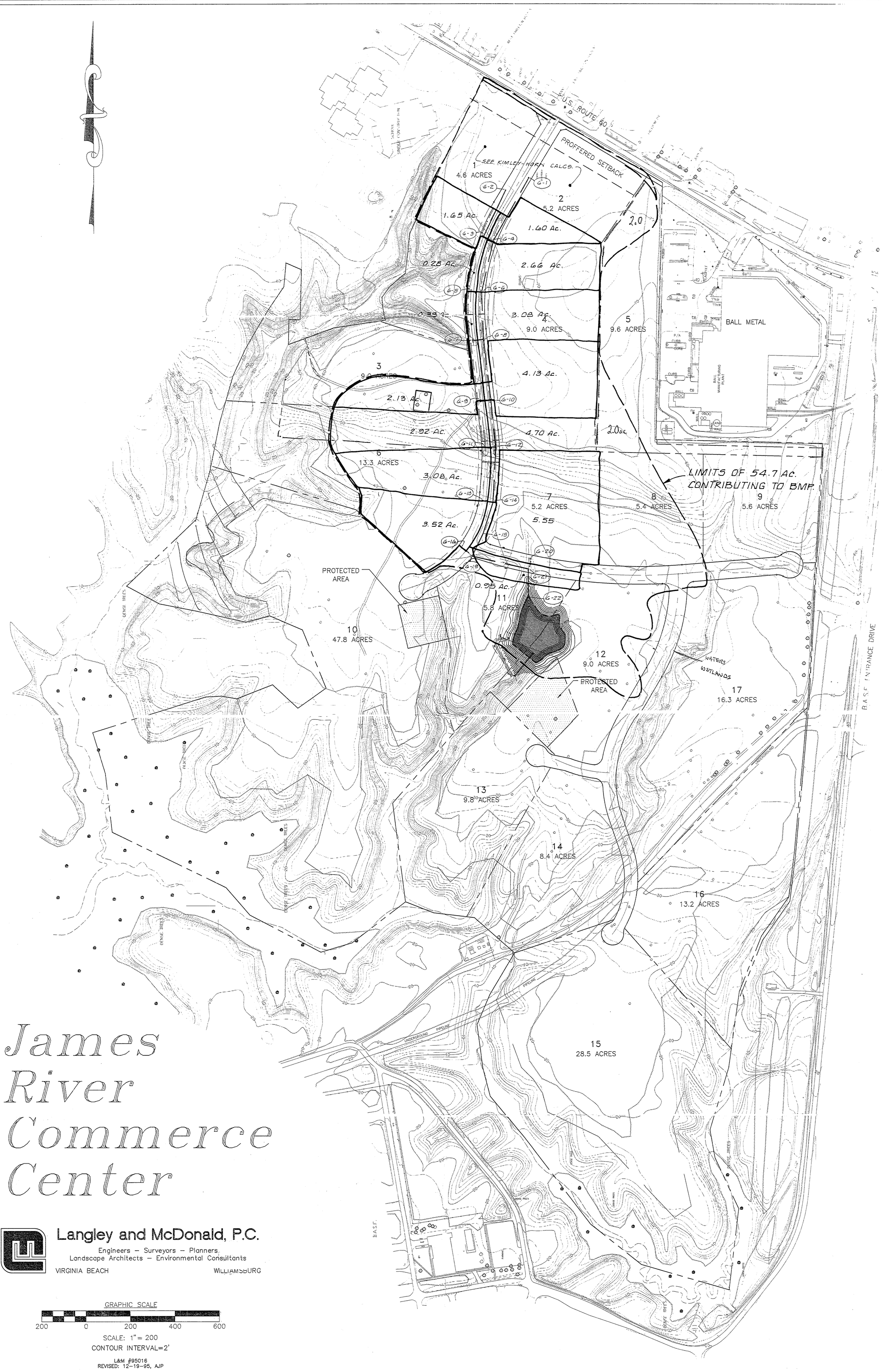
MASTER PLAN
James River Commerce Center
JAMES CITY COUNTY, VIRGINIA

DES.	MRG
DWN.	MRG
CHK.	NHM
DATE	4-4-96

Langley and McDonald, P.C.
Engineers • Surveyors • Planners
Landscape Architects • Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

COMMONWEALTH OF VIRGINIA
JOHN L. HUTCHESON
No. 7753
PROFESSIONAL ENGINEER

JR038_JAMES_RIVER_COMMERCE_CENTER - 022



James River Commerce Center

Langley and McDonald, P.C.

Engineers – Surveyors – Planners
Landscape Architects – Environmental Consultants

VIRGINIA BEACH WILLIAMSBURG

GRAPHIC SCALE

200 0 200 400 600

SCALE: 1" = 200
CONTOUR INTERVAL=2'

L&M #95016
REVISED: 12-19-95, AJP

DWG.	
PROJ. NO.	95016-28
DISK	
SHEET	1A (C) OF

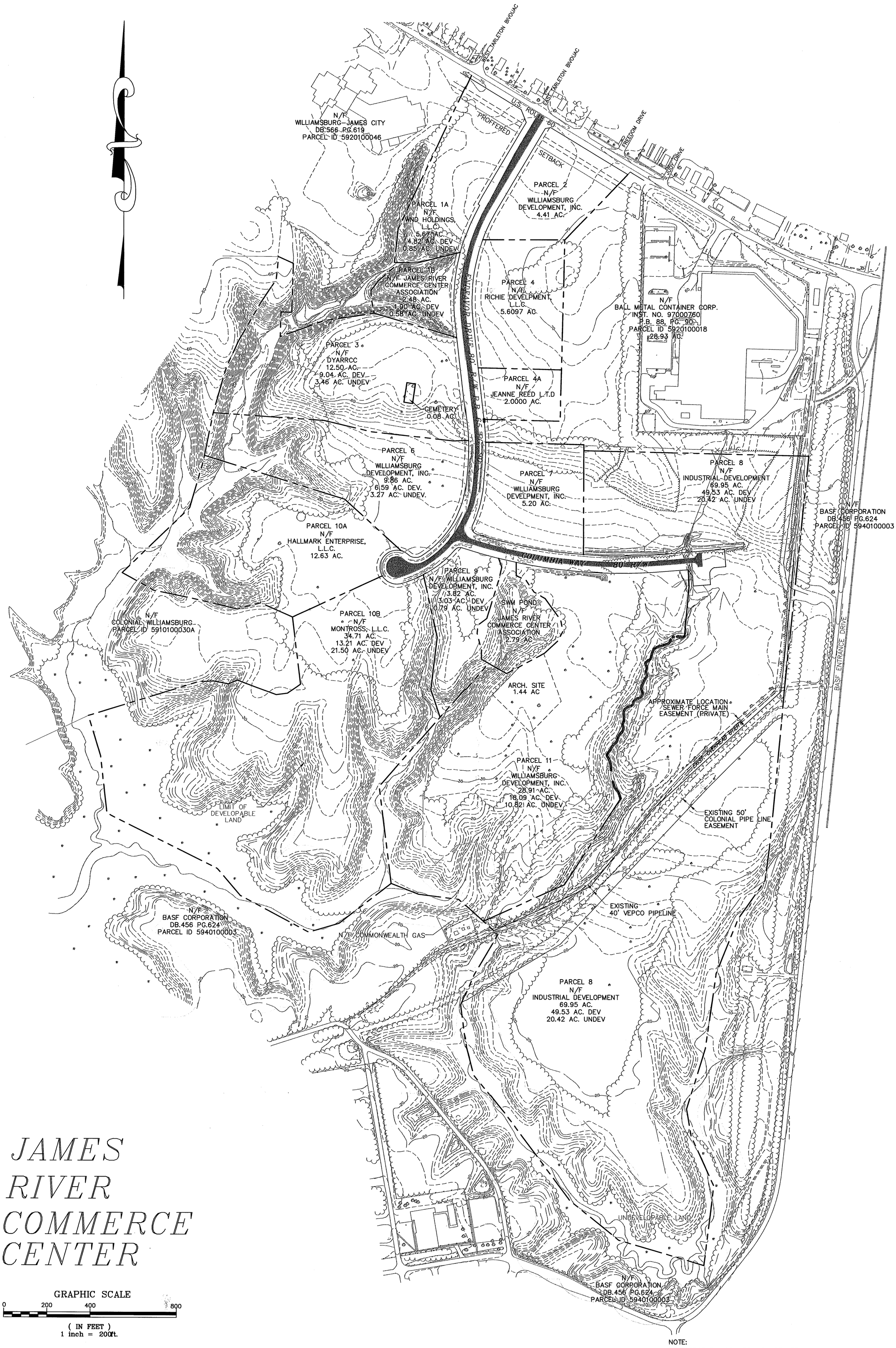
DRAINAGE AREA MAP
PROPOSED & FUTURE CONDITION
James River Commerce Center
JAMES CITY COUNTY, VIRGINIA

DES.	MRG
DWN.	MRG
CHK.	NHM
DATE	4-4-96

Langley and McDonald, P.C.
Engineers • Surveyors • Planners
Landscape Architects • Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

COMMONWEALTH OF VIRGINIA

JR038_JAMES_RIVER_COMMERCE_CENTER - 023



JAMES RIVER COMMERCE CENTER

GRAPHIC SCALE

0 200 400 800

(IN FEET)
1 inch = 200ft.

NOTE:
DEVELOPABLE LAND AREA IS NOT NET OF ANY ADDITIONAL RESTRICTIONS PLACED UPON THE SUBJECT TRACT AS DEFINED BY JAMES CITY COUNTY ZONING ORDINANCES.

LANDMARK DESIGN GROUP
Engineers • Planners • Surveyors
Landscape Architects • Environmental Consultants

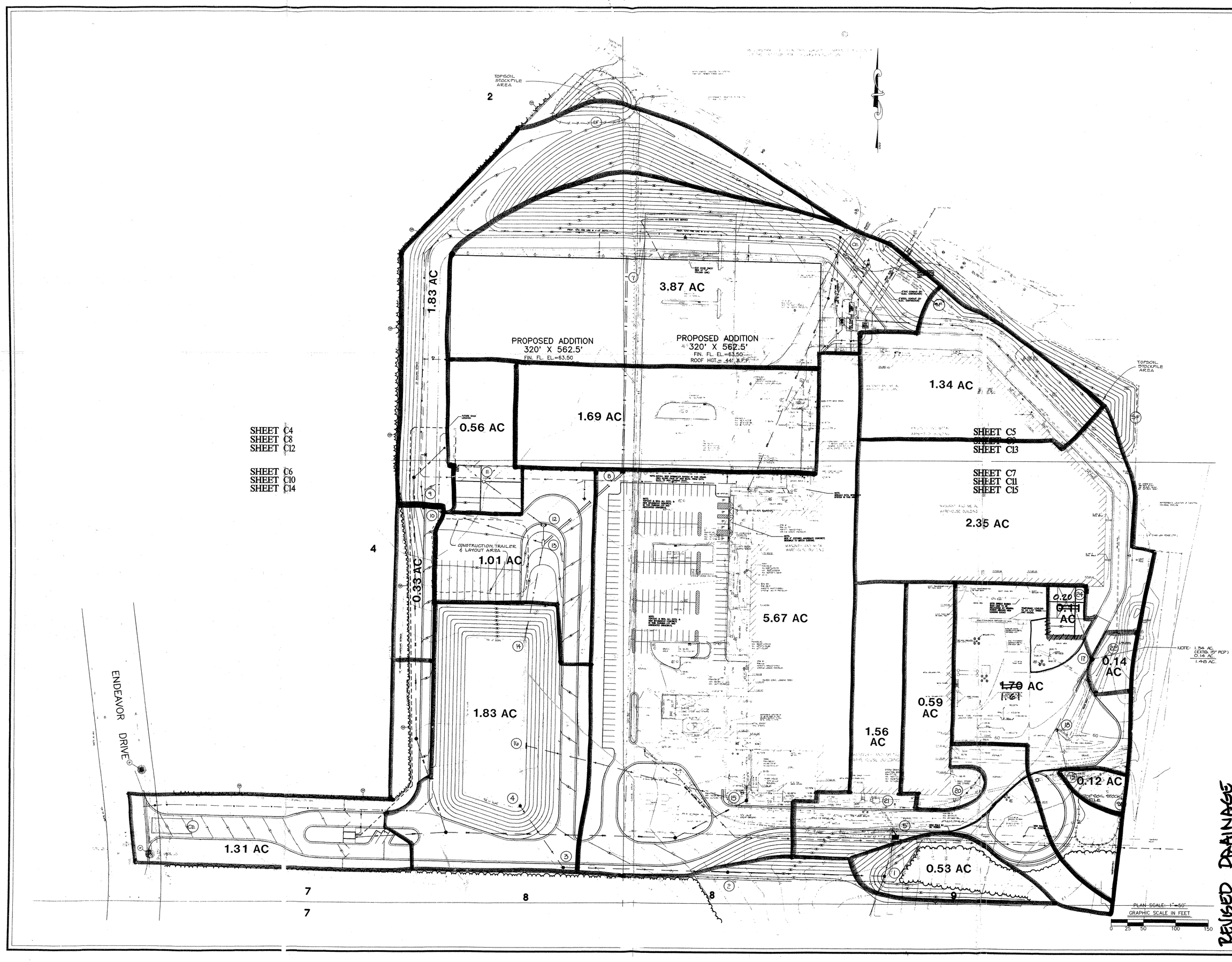
4029 Ironbound Road
Suite 100
Williamsburg, VA 23188
Tel. (757) 253-2975
Fax (757) 229-0049
Email: lmdg@landmarkdg.com

5544 Greenwich Road
Suite 200
Virginia Beach, VA 23462
Tel. (757) 473-2000
Fax (757) 497-7933
Email: lmdg@landmarkdg.com

MASTER PLAN
JAMES RIVER COMMERCE CENTER
JAMES CITY COUNTY, VIRGINIA

DRAWN: CRO
CHECKED: PF
DATE: 2-8-06
SCALE: 1"=200'
PROJ. NO. 1950016-000.55

16836W



COMMONWEALTH OF VIRGINIA
7-28-97
STEPHEN A. ROMEO
No. 14498
LAND SURVEYOR

Langley and McDonald, P.C.
Engineers · Surveyors · Planners
Landscape Architects · Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

DES.	WEG
DWN.	MRG
CHK.	SAR
DATE	25 JUL 97

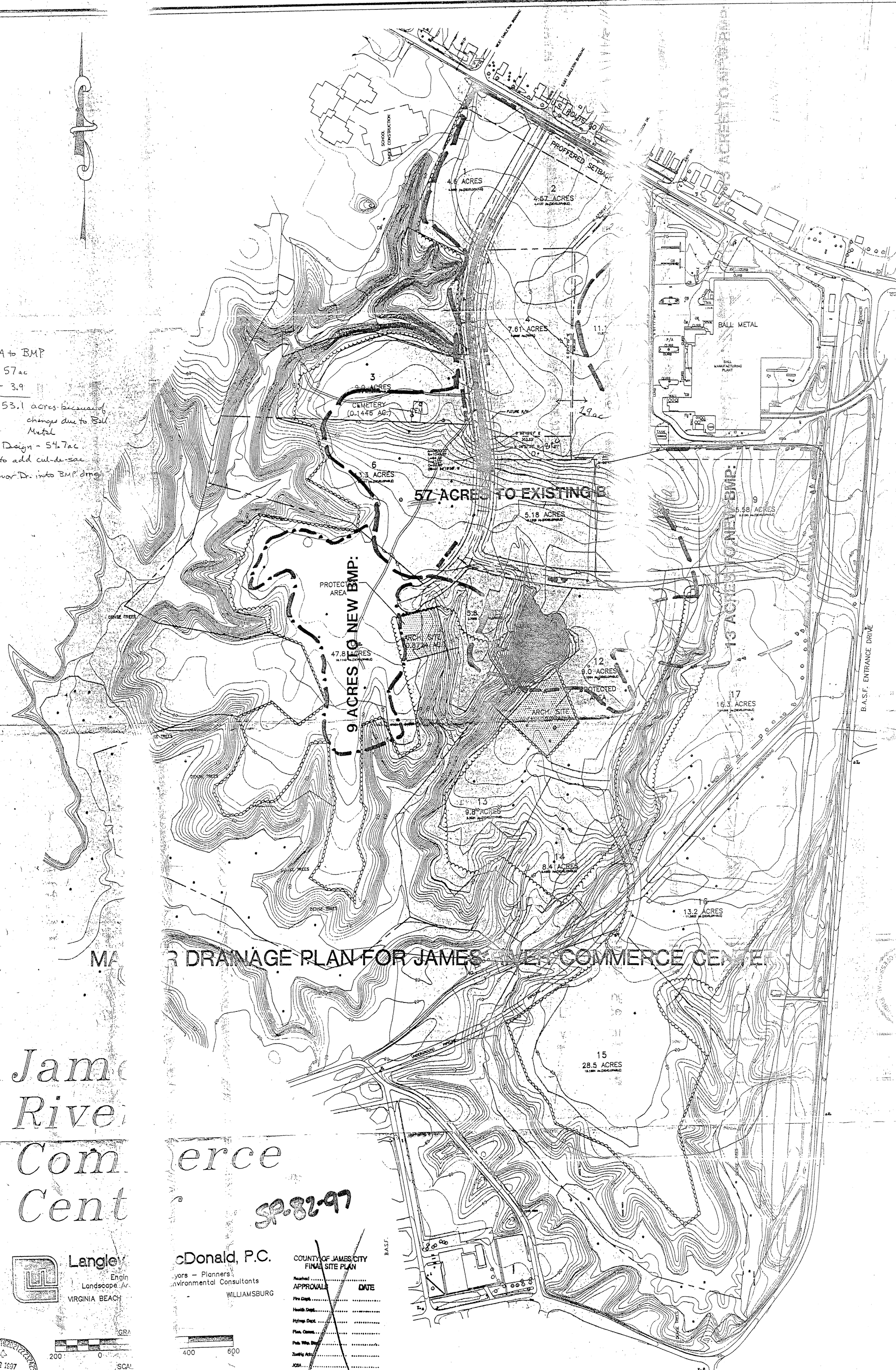
DRAINAGE AREA MAP
BALL METAL - CONTAINER DIVISION
FOR
BALL CORPORATION
SITUATED IN ROBERTS DISTRICT
JAMES CITY COUNTY, VIRGINIA

REVISED DRAINAGE MAP

SHEET C3 OF
BALL.DWG
PROJ. NO. 95094-03
DWG. 6636W

JR038_JAMES_RIVER_COMMERCE_CENTER - 025

DA to BMP
57ac
- 3.9
53.1 acres because of changes due to Ball Metal
Original Design - 54.7ac
Proposed to add cul-de-sac for Endeavor Dr. into BMP drng.



MA R DRAINAGE PLAN FOR JAMES RIVER COMMERCE CENTER

Jam
Rive
Com erce
Cent

SP-82-97

Langley
Engin
Landscape Ar
VIRGINIA BEACH

cDonald, P.C.
yors – Planners
nvironmental Consultants
WILLIAMSBURG

COUNTY OF JAMES CITY
FINAL SITE PLAN
Received
APPROVALS DATE
Fire Dept.
Health Dept.
Highway Dept.
Plan. Comm.
Pub. Wks. Dir.
Zoning Adm.
JCSA
Other
Other

200 0 400 600
SCAL
CONTOU
REVISED

AUG 1997 RECEIVED

TER PLAN
Commerce Center
Y COUNTY, VIRGINIA

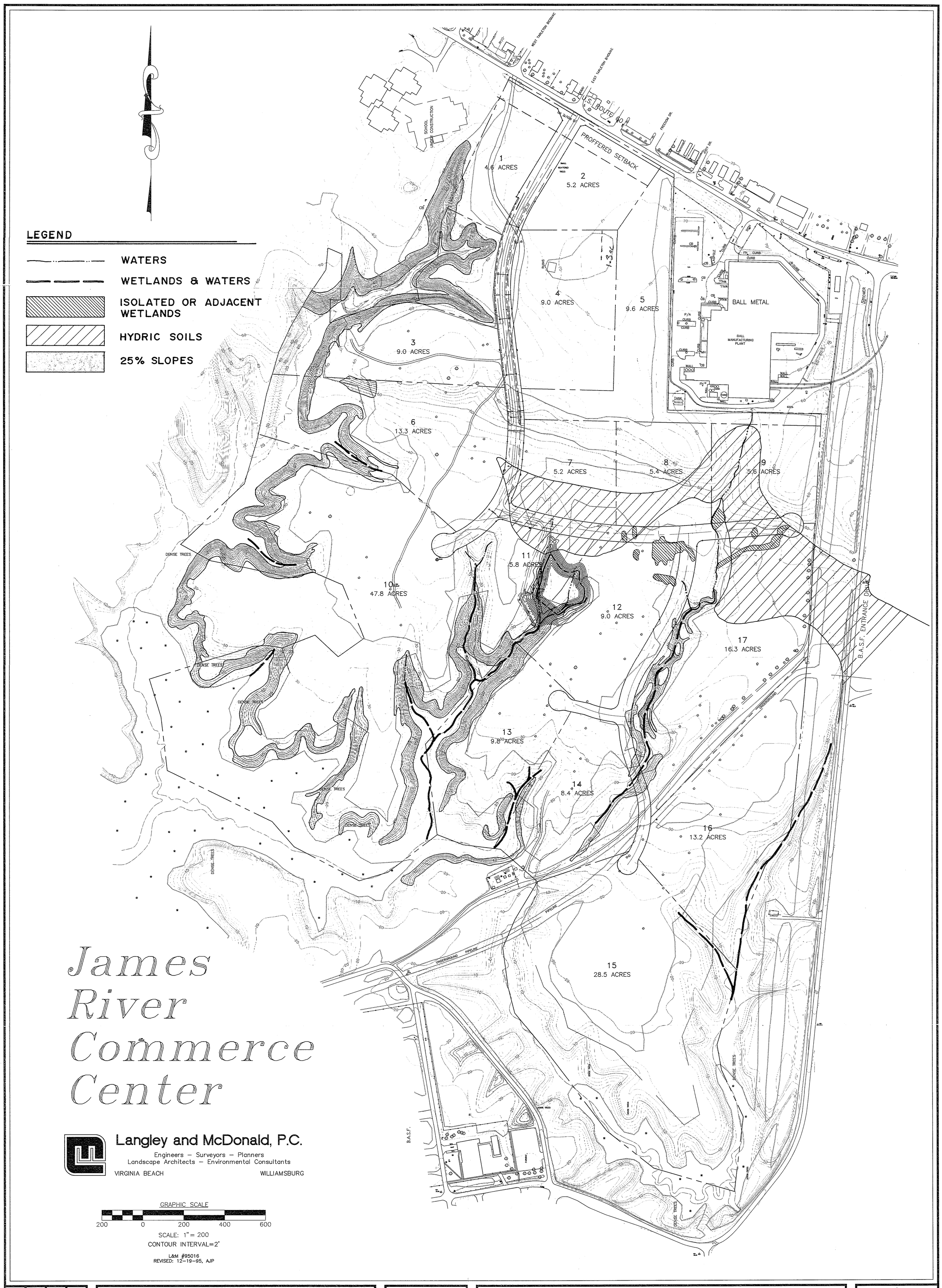
DES.	MRG
DWN.	MRG
CHK.	NHM
DATE	4-4-96

Langley and McDonald, P.C.
Engineers • Surveyors • Planners
Landscape Architects • Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

PROFESSIONAL ENGINEER

PROJ. NO. 95016-28
DWG. 1A OF

JR038_JAMES_RIVER_COMMERCE_CENTER - 026



James River Commerce Center

Langley and McDonald, P.C.
Engineers – Surveyors – Planners
Landscape Architects – Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

GRAPHIC SCALE
200 0 200 400 600
SCALE: 1" = 200
CONTOUR INTERVAL=2'

L&M #95016
REVISED: 12-19-95, AJP

DWG.
PROJ. NO. 95016-28
DISK
SHEET 1A OF

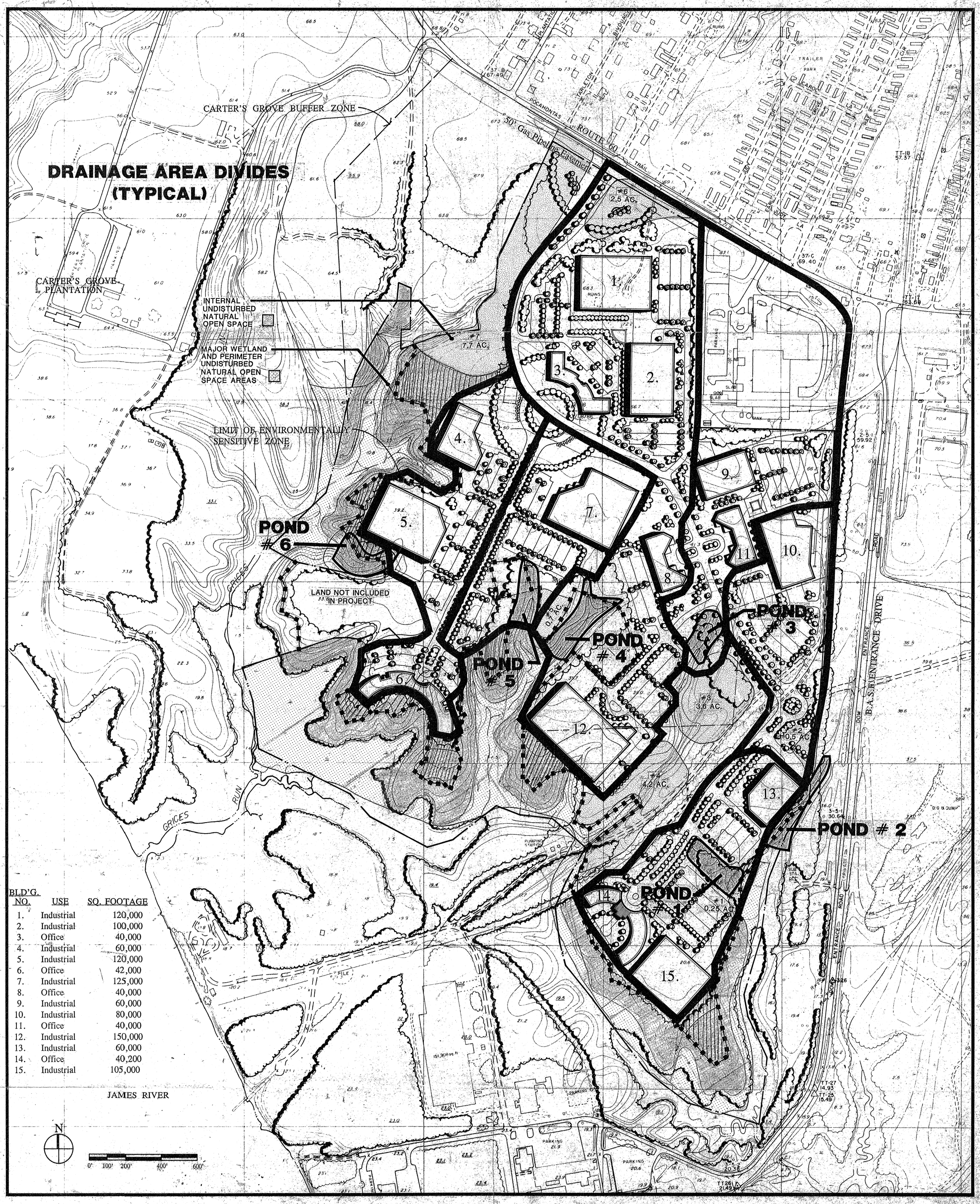
ENVIRONMENTAL INVENTORY
James River Commerce Center
JAMES CITY COUNTY, VIRGINIA

DES.	MRG
DWN.	MRG
CHK.	NHM
DATE	4-4-96

Langley and McDonald, P.C.
Engineers • Surveyors • Planners
Landscape Architects • Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

COMMONWEALTH OF VIRGINIA
JOHN L. HUTCHERSON
No. 7753
PROFESSIONAL ENGINEER

JR038_JAMES RIVER COMMERCE CENTER 1027



BLD'G. NO.	USE	SQ. FOOTAGE
1.	Industrial	120,000
2.	Industrial	100,000
3.	Office	40,000
4.	Industrial	60,000
5.	Industrial	120,000
6.	Office	42,000
7.	Industrial	125,000
8.	Office	40,000
9.	Industrial	60,000
10.	Industrial	80,000
11.	Office	40,000
12.	Industrial	150,000
13.	Industrial	60,000
14.	Office	40,200
15.	Industrial	105,000

Master Plan For Chesapeake Bay Preservation Ordinance Compliance

JAMES RIVER COMMERCE CENTER

JAMES CITY COUNTY, VIRGINIA

James City County and Williamsburg Developments, Inc. *

*(a subsidiary of the Colonial Williamsburg Foundation)

Base Illustrative Plan By:

RANCORN WILDMAN KRAUSE BREZINSKI Architects

Chesapeake Bay Preservation Ordinance Compliance Information By:

LANGLEY AND McDONALD, P. C.

1523

1523W

JR038_JAMES_RIVER_COMMERCE_CENTER - 028

James River Commerce Center

GRAPHIC SCALE 1"=200'

0 200 400 600

NOTE:

1. DEVELOPABLE LAND AREA IS NOT NET OF ANY ADDITIONAL RESTRICTIONS PLACED UPON THE SUBJECT TRACT AS DEFINED BY JAMES CITY COUNTY ZONING ORDINANCES.

LANDMARK DESIGN GROUP
Engineers • Planners • Surveyors
Landscape Architects • Environmental Consultants

4029 Ironbound Road
Suite 100
Williamsburg, VA 23188
Tel. (757) 253-2975
Fax (757) 229-0049
Email: lmdg@landmarkdgwb.com

5544 Greenwich Road
Suite 200
Virginia Beach, VA 23462
Tel. (757) 473-2000
Fax (757) 497-7933
Email: lmdg@landmarkdg.com

MASTER PLAN

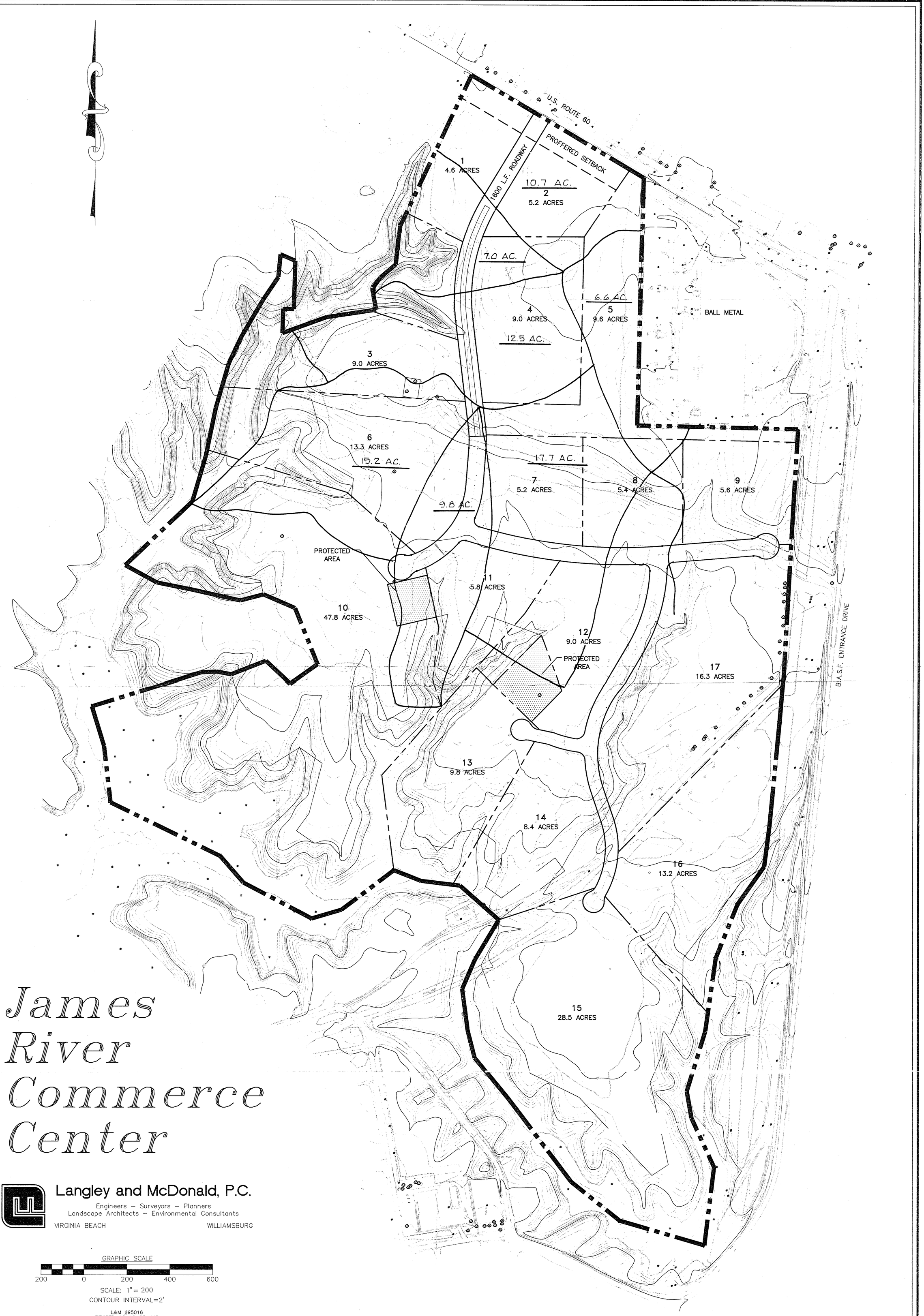
James River Commerce Center

JAMES CITY COUNTY VIRGINIA

DRAWN: A.J.R.
CHECKED: N.H.M.
DATE: 10-07-02
SCALE: 1" = 200'
PROJ. NO. 1950016-000.49

UPDATED w/ WDI to JCCIDA EXCHANGE

13901w



James River Commerce Center

Langley and McDonald, P.C.

Engineers – Surveyors – Planners
Landscape Architects – Environmental Consultants

VIRGINIA BEACH WILLIAMSBURG

GRAPHIC SCALE

200 0 200 400 600

SCALE: 1" = 200
CONTOUR INTERVAL=2'

L&M #95016
REVISED: 12-19-95, AJP

DWG.	
PROJ. NO.	95016-28
DISK	
SHEET	1A OF (C)

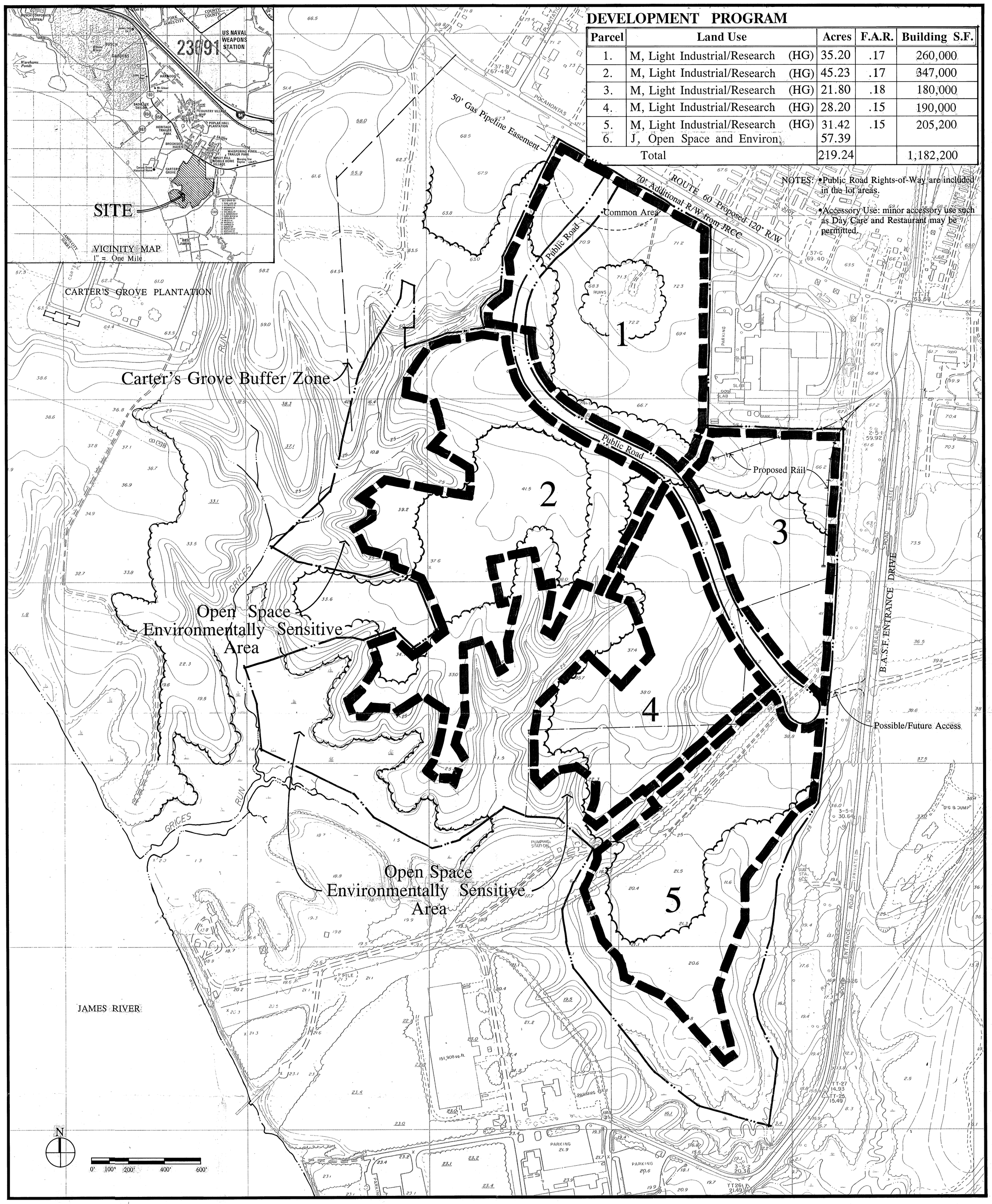
DRAINAGE AREA MAP (EXIST. CONDITION)
James River Commerce Center
JAMES CITY COUNTY, VIRGINIA

DES.	MRG
DWN.	MRG
CHK.	NHM
DATE	4-4-96

Langley and McDonald, P.C.
Engineers • Surveyors • Planners
Landscape Architects • Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

COMMONWEALTH OF VIRGINIA
JOHN L. HUTCHERSON
No. 17753
PROFESSIONAL ENGINEER

JR038_JAMES_RIVER_COMMERCE_CENTER - 030



DEVELOPMENT PROGRAM

Parcel	Land Use	Acres	F.A.R.	Building S.F.
1.	M, Light Industrial/Research (HG)	35.20	.17	260,000
2.	M, Light Industrial/Research (HG)	45.23	.17	347,000
3.	M, Light Industrial/Research (HG)	21.80	.18	180,000
4.	M, Light Industrial/Research (HG)	28.20	.15	190,000
5.	M, Light Industrial/Research (HG)	31.42	.15	205,200
6.	J, Open Space and Environ.	57.39		
	Total	219.24		1,182,200

NOTES: •Public Road Rights-of-Way are included in the lot areas.

•Accessory Use: minor accessory use such as Day Care and Restaurant may be permitted.

2-4-92

Master Plan

JAMES RIVER COMMERCE CENTER

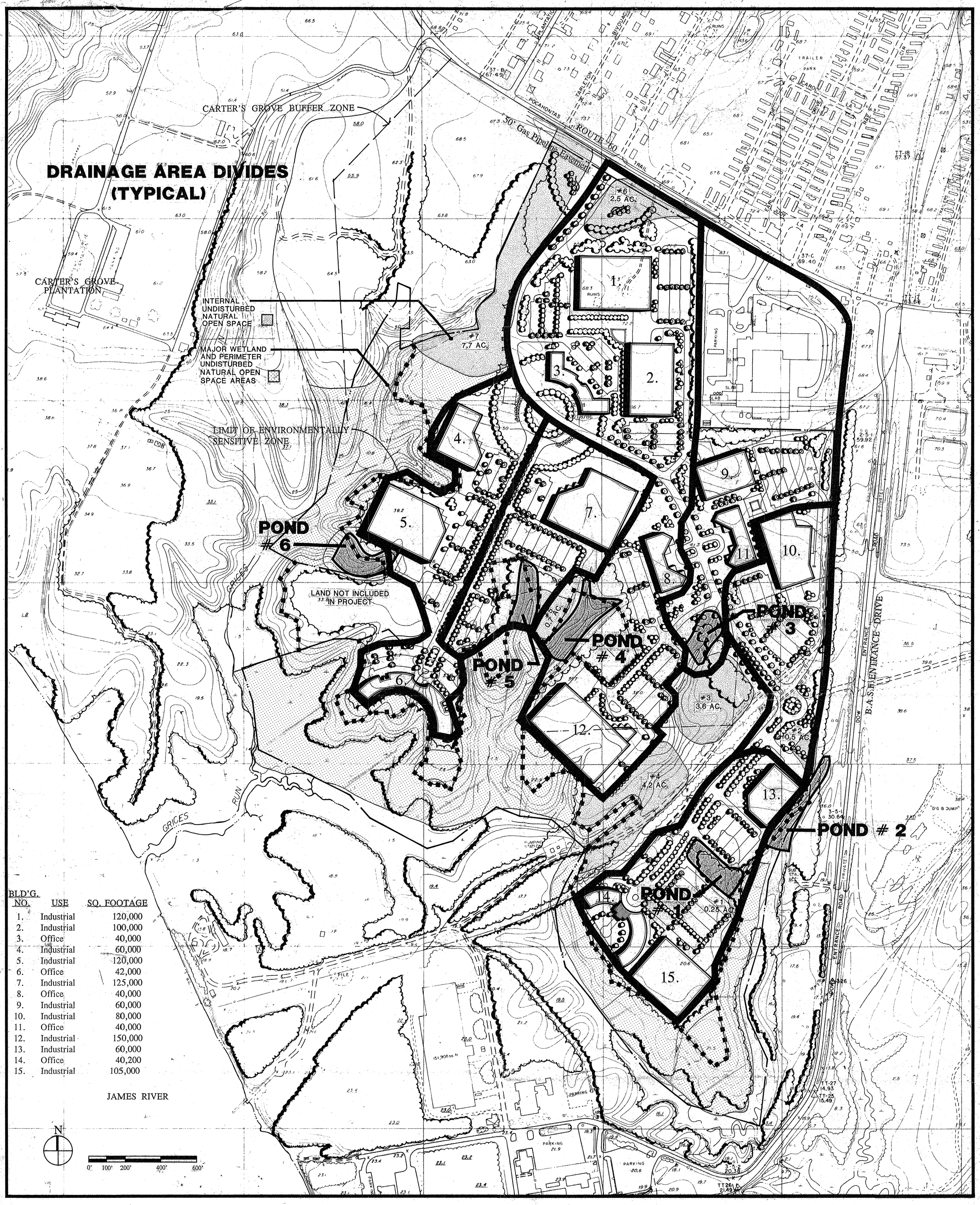
JAMES CITY COUNTY, VIRGINIA

James City County and Williamsburg Developments, Inc. *

*(a subsidiary of the Colonial Williamsburg Foundation)

RANCORN WILDMAN KRAUSE BREZINSKI Architects

JR038_JAMES_RIVER_COMMERCE_CENTER - 031



BLD'G. NO.	USE	SQ. FOOTAGE
1.	Industrial	120,000
2.	Industrial	100,000
3.	Office	40,000
4.	Industrial	60,000
5.	Industrial	120,000
6.	Office	42,000
7.	Industrial	125,000
8.	Office	40,000
9.	Industrial	60,000
10.	Industrial	80,000
11.	Office	40,000
12.	Industrial	150,000
13.	Industrial	60,000
14.	Office	40,200
15.	Industrial	105,000

Master Plan For Chesapeake Bay Preservation Ordinance Compliance

JAMES RIVER COMMERCE CENTER

JAMES CITY COUNTY, VIRGINIA

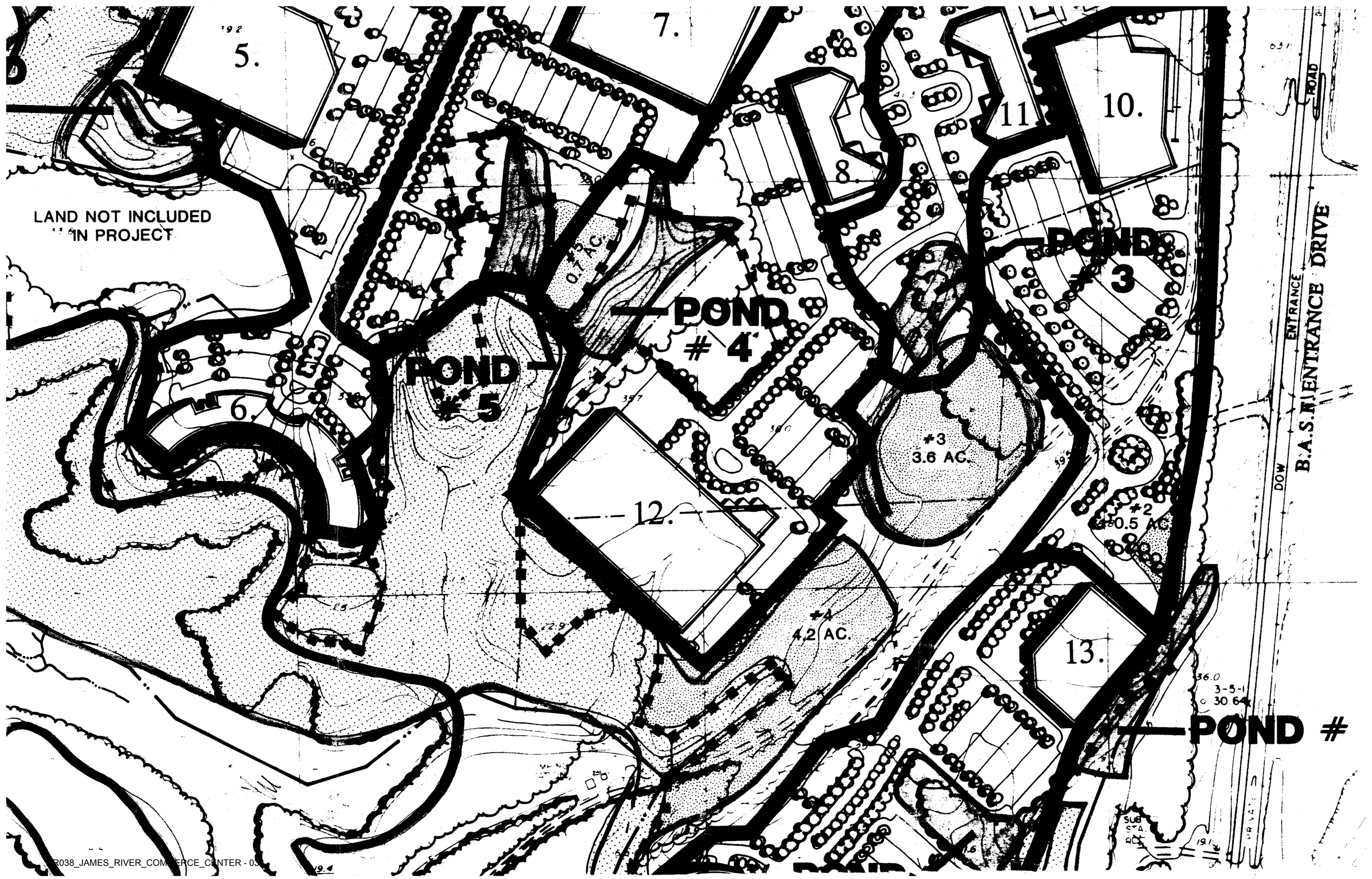
James City County and Williamsburg Developments, Inc. *

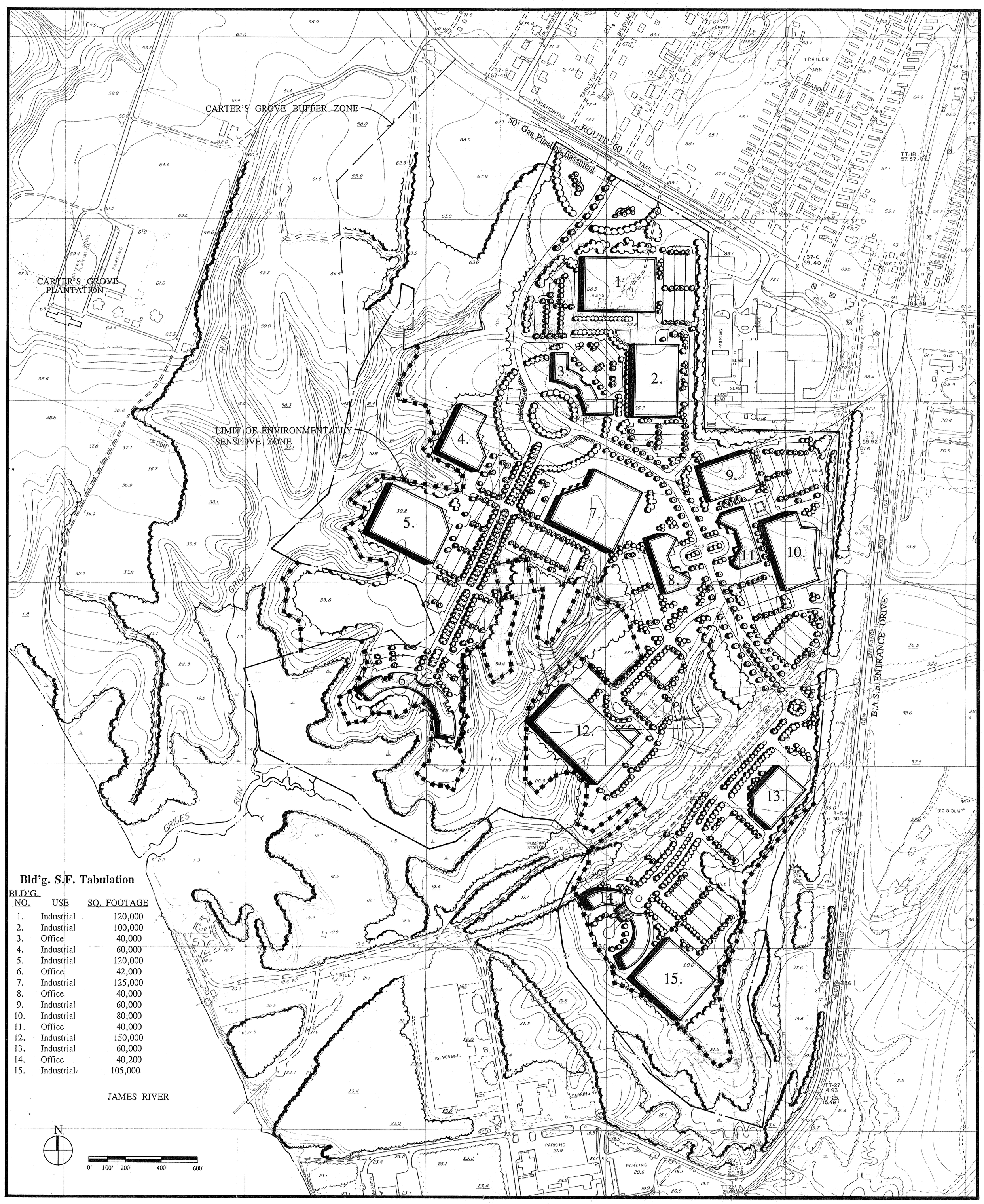
*(a subsidiary of the Colonial Williamsburg Foundation)

Base Illustrative Plan By
RANCORN WILDMAN KRAUSE BREZINSKI Architects

Chesapeake Bay Preservation Ordinance Compliance Information By
LANGLEY AND McDONALD, P. C.

JR038_JAMES_RIVER_COMMERCE_CENTER - 032


LAND NOT INCLUDED
IN PROJECT
5.
7.
8.
10.
11
6.
12.
13.
POND
#5
POND
#4
POND
#3
#3
3.6 AC.
#2
0.5 AC.
#4
4.2 AC.
POND #
B.A.S.E. ENTRANCE DRIVE
ENTRANCE
ROAD
DOW
SUB
STA.
R038_JAMES_RIVER_COMMERCE_CENTER - 03



Bld'g. S.F. Tabulation

BLD'G. NO.	USE	SQ. FOOTAGE
1.	Industrial	120,000
2.	Industrial	100,000
3.	Office	40,000
4.	Industrial	60,000
5.	Industrial	120,000
6.	Office	42,000
7.	Industrial	125,000
8.	Office	40,000
9.	Industrial	60,000
10.	Industrial	80,000
11.	Office	40,000
12.	Industrial	150,000
13.	Industrial	60,000
14.	Office	40,200
15.	Industrial	105,000

Illustrative Master Plan

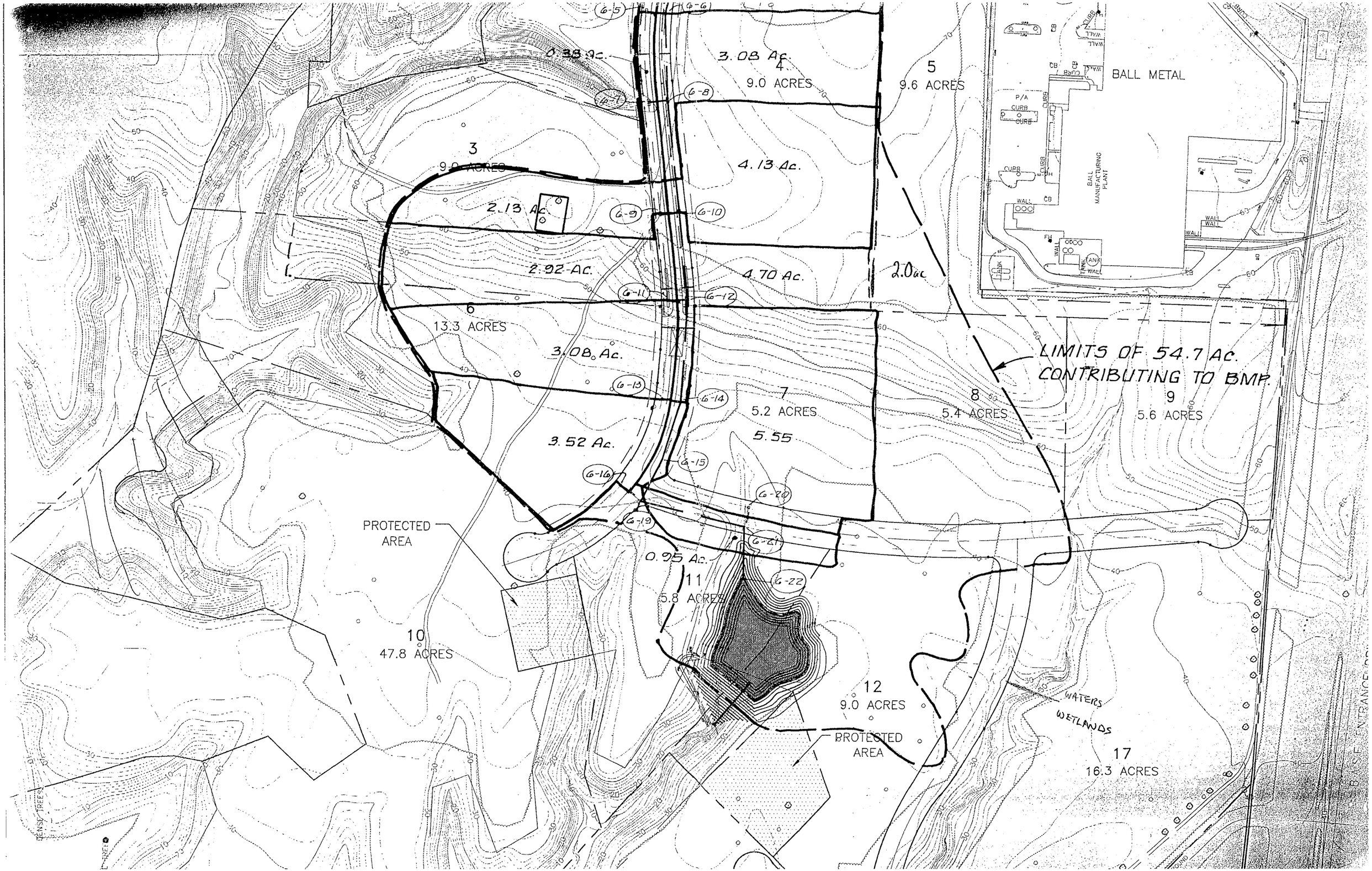
JAMES RIVER COMMERCE CENTER

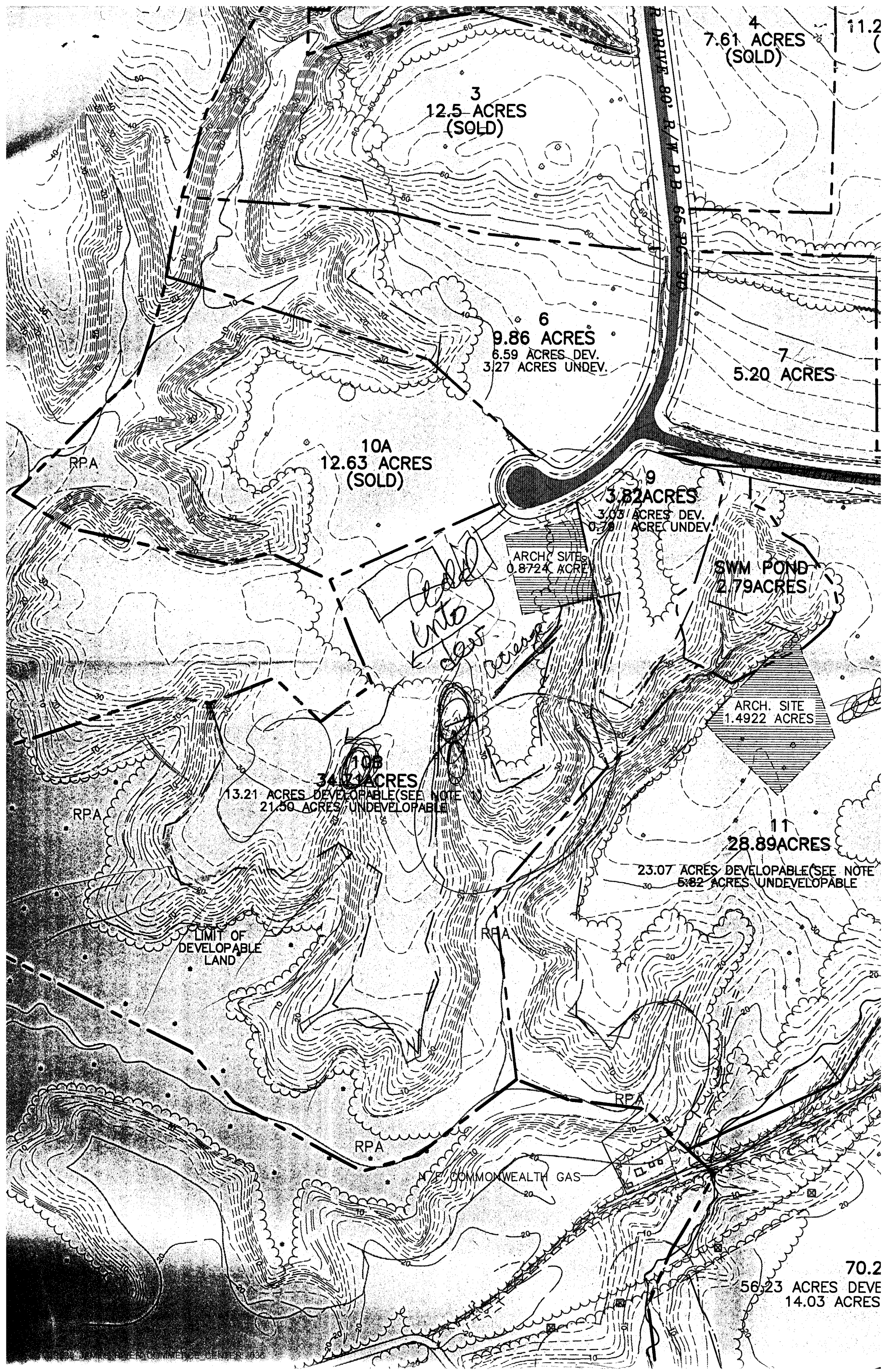
JAMES CITY COUNTY, VIRGINIA

James City County and Williamsburg Developments, Inc. *

*(a subsidiary of the Colonial Williamsburg Foundation)

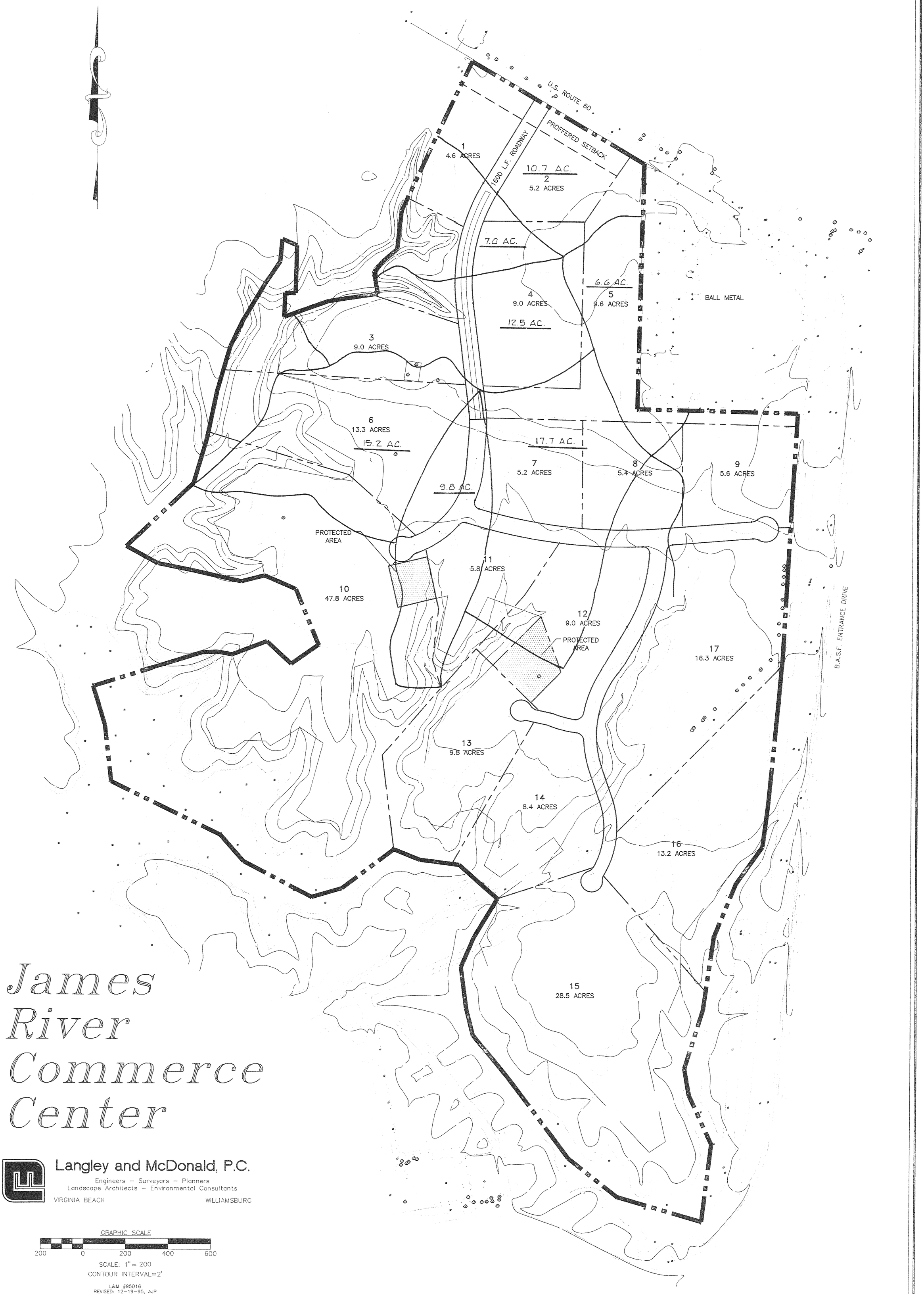
RANCORN WILDMAN KRAUSE BREZINSKI Architects


0.38 Ac.
3.08 Ac.
4
9.0 ACRES
5
9.6 ACRES
BALL METAL
BALL MANUFACTURING PLANT
3
9.0 ACRES
4.13 Ac.
2.13 Ac.
2.92 Ac.
4.70 Ac.
2.0ac
6
13.3 ACRES
3.08 Ac.
LIMITS OF 54.7 Ac. CONTRIBUTING TO BMP.
7
5.2 ACRES
8
5.4 ACRES
9
5.6 ACRES
3.52 Ac.
5.55
PROTECTED AREA
0.95 Ac.
11
5.8 ACRES
10
47.8 ACRES
12
9.0 ACRES
PROTECTED AREA
WATERS WETLANDS
17
16.3 ACRES


4
7.61 ACRES
(SOLD)
3
12.5 ACRES
(SOLD)
DRIVE 80' R/W PB 65 PG 97
6
9.86 ACRES
6.59 ACRES DEV.
3.27 ACRES UNDEV.
7
5.20 ACRES
10A
12.63 ACRES
(SOLD)
RPA
9
3.82ACRES
3.03 ACRES DEV.
0.79 ACRES UNDEV.
ARCH. SITE
0.8724 ACRES
SWM POND
2.79ACRES
ARCH. SITE
1.4922 ACRES
10B
34.71 ACRES
13.21 ACRES DEVELOPABLE(SEE NOTE 1)
21.50 ACRES UNDEVELOPABLE
RPA
11
28.89ACRES
23.07 ACRES DEVELOPABLE(SEE NOTE
5.82 ACRES UNDEVELOPABLE
LIMIT OF
DEVELOPABLE
LAND
RPA
RPA
RPA
N.F. COMMONWEALTH GAS
70.2
56.23 ACRES DEVE
14.03 ACRES

0.98 Ac.
3.08 Ac.
4
9.0 ACRES
5
9.6 ACRES
BALL METAL
P/A
CURB
BALL MANUFACTURING PLANT
WALL
TANK
3
9.0 ACRES
4.13 Ac.
2.13 Ac.
2.92 Ac.
4.70 Ac.
2.0ac
6
13.3 ACRES
3.08 Ac.
LIMITS OF 54.7 AC. CONTRIBUTING TO BMP.
7
5.2 ACRES
8
5.4 ACRES
9
5.6 ACRES
3.52 Ac.
5.55
PROTECTED AREA
0.95 Ac.
11
5.8 ACRES
10
47.8 ACRES
12
9.0 ACRES
PROTECTED AREA
WATERS
WETLANDS
17
16.3 ACRES
DENSE TREES

3
9.0 ACRES
CEMETERY
(0.1445 AC.)
CEM
FUTURE R/W
29ac
BALL
MANUFACTURING
PLANT
TANK
6
3.3 ACRES
57 ACRES TO EXISTING B
5.18 ACRES
9
5.58 ACRES
PROTECTED
AREA
9 ACRES TO NEW BMP:
47.8 ACRES
ARCH. SITE
12
9.0 ACRES
PROTECTED
AREA
ARCH. SITE
13 ACRES TO NEW BMP:
17
16.3 ACRES
B.A.S.F. ENTRANCE DRIVE
UNDERGROUND
DOUBLE TREES
13
9.8 ACRES



James River Commerce Center

Langley and McDonald, P.C.
Engineers – Surveyors – Planners
Landscape Architects – Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

DWG.	
PROJ. NO.	95016-28
DISK	
SHEET	1A OF (C)

DRAINAGE AREA MAP (EXIST. CONDITION)
James River Commerce Center
JAMES CITY COUNTY, VIRGINIA

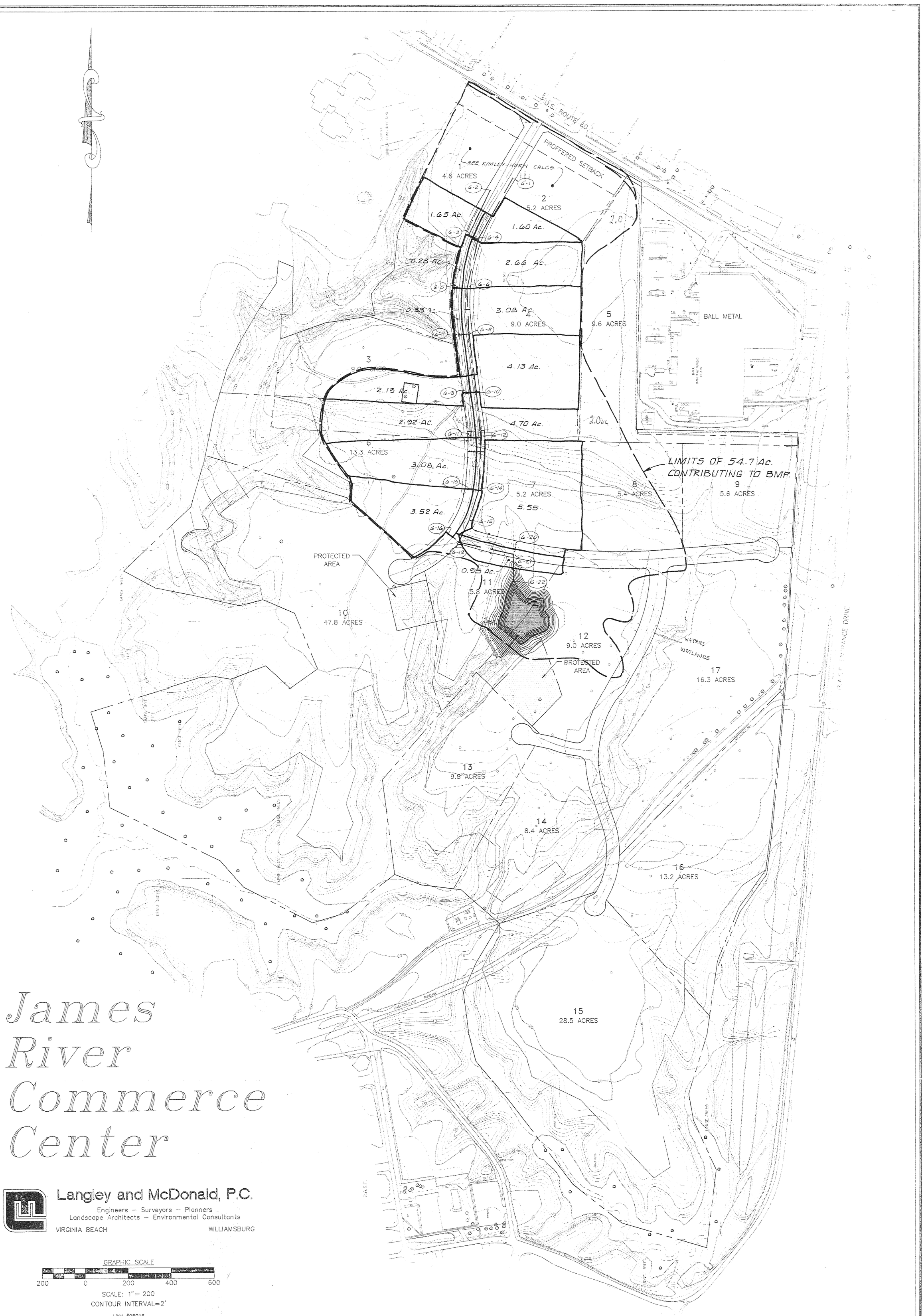
DES.	MRG
DWN.	MRG
CHK.	NHM
DATE	4-4-96

Langley and McDonald, P.C.
Engineers • Surveyors • Planners
Landscape Architects • Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

COMMONWEALTH OF VIRGINIA
JOHN L. HUTCHERSON
No. 7753
PROFESSIONAL ENGINEER

Bernie

JR038_JAMES_RIVER_COMMERCE_CENTER - 039



James River Commerce Center

Langley and McDonald, P.C.

Engineers – Surveyors – Planners
Landscape Architects – Environmental Consultants

VIRGINIA BEACH WILLIAMSBURG

GRAPHIC SCALE

200 0 200 400 600

SCALE: 1" = 200
CONTOUR INTERVAL=2'

L&M #95016
REVISED: 12-19-95, AJP

DWG.	
PROJ. NO.	95016-28
DISK	
SHEET	1A OF (C)

DRAINAGE AREA MAP
PROPOSED & FUTURE CONDITION
James River Commerce Center
JAMES CITY COUNTY, VIRGINIA

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DWN.	MRG
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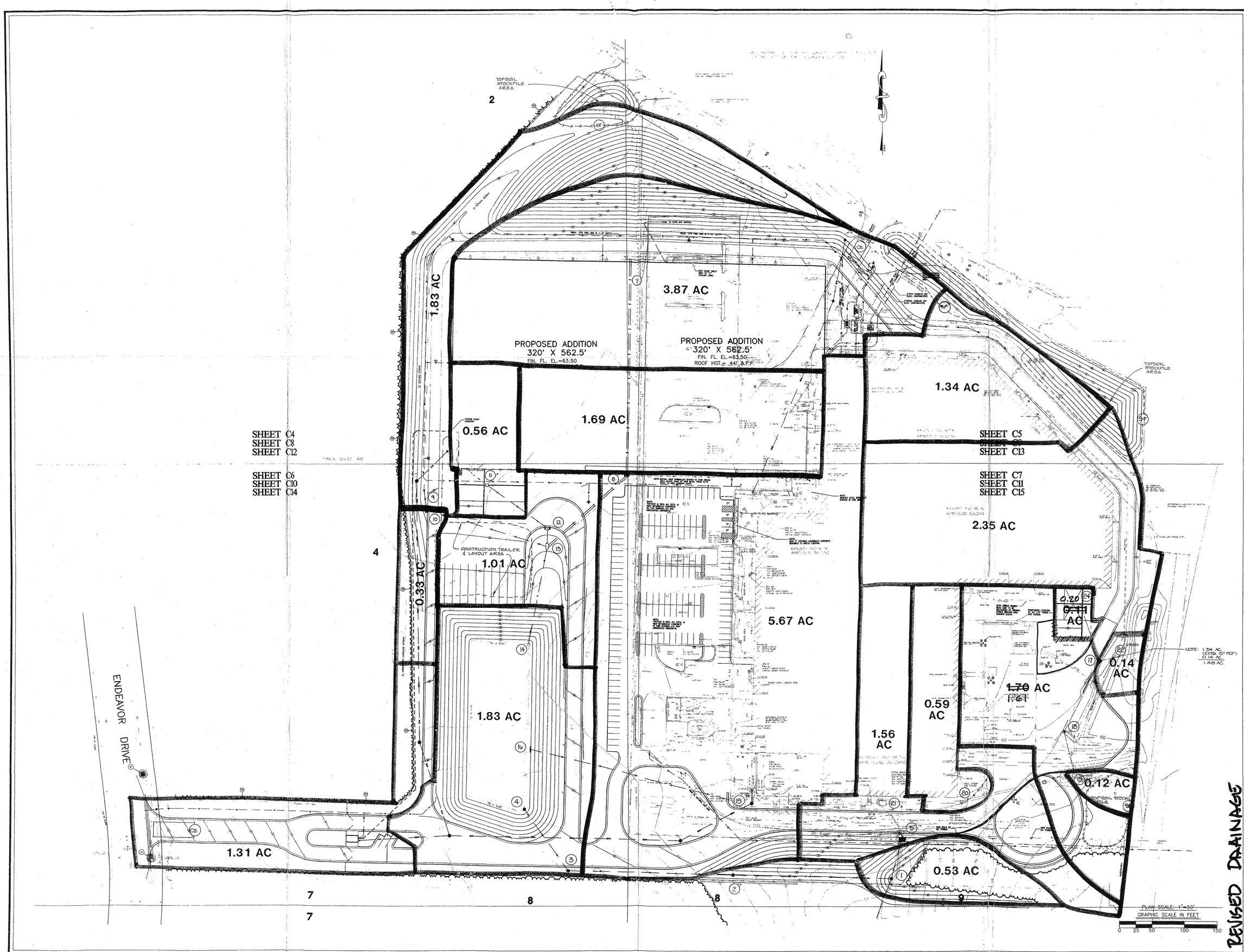
Landscape Architects • Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

COMMONWEALTH OF VIRGINIA

Bernie

JR038_JAMES_RIVER_COMMERCE_CENTER - 040



COMMONWEALTH OF VIRGINIA
7-28-95
STEPHEN A. ROMEO
No. 1448
LAND SURVEYOR

Langley and McDonald, P.C.
Engineers · Surveyors · Planners
Landscape Architects · Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

DES.	WEG
DWN.	MRG
CHK.	SAR
DATE	25 JUL 97

DRAINAGE AREA MAP
BALL METAL - CONTAINER DIVISION
FOR
BALL CORPORATION
SITUATED IN ROBERTS DISTRICT
JAMES CITY COUNTY, VIRGINIA

REVISED DRAINAGE ~~AREA~~ MAP

SHEET	C3 OF
FILE	BALL.DWG
PROJ. NO.	95094-03
DWG.	6636W

JR038_JAMES_RIVER_COMMERCE_CENTER - 041

Stormwater Management Design Calculations

James City County Commerce Center

James City County, Virginia

Prepared by:
AES Consulting Engineers
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COMMONWEALTH OF VIRGINIA
VAN MARC BENNETT
3/21/07
No. 26628
PROFESSIONAL ENGINEER

Date: March 23, 2006

AES
CONSULTING ENGINEERS

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James River Commerce Center - Shell Building
Stormwater Management and
Erosion and Sediment Control Narrative

The James City County Industrial Development Authority intends to construct an industrial shell building to attract, clean, capital intensive industry to James City County. The proposed construction consists of an 80,000 square foot shell building in the James River Commerce Center, which is owned by both James City County and Williamsburg Development Inc. (a division of Colonial Williamsburg).

The site of the proposed construction occupies a portion of Lot 8 as designated by the latest Master Plan of James River Commerce Center. According to the USDA Soils Map of James City County, the project area consists primarily of Chickahominy, Newflat and Slagle soils. However the mapped soils were disturbed by fill, which was placed within the proposed project area by an earthwork project at the adjacent Ball Metal Facility, during the period of December 1997 through July of 1998. Borings indicate fill depths from 2 feet to 13 feet within the proposed limits of construction.

The project area is approximately 11.84 acres of which 8.8 acres will be disturbed by construction activity. The project will require 1.8 acres of clearing. Drainage calculations anticipate the creation of 3.3 acres of impervious surface and include pavement of future truck access and loading areas. In addition to the customary construction entrance, silt fence, diversion dikes and seeding, both a sediment trap and a sediment basin have been included to protect the project area during construction. The sediment trap will provide protection during the relocation of an existing storm pipe. It will be removed when the by-pass is complete. The sediment basin with its diversion dikes will protect the entire site including an area allocated for future expansion. It may remain in place indefinitely.

The original development plan approved in 1996, proposed to achieve Chesapeake Bay water quality requirements by capturing drainage from 54.7 acres of the total property and directing it through a BMP with a permanent water volume sufficient to compensate for the entire Development of James River Commerce Center. That proposal has been re-evaluated in light of revisions to James City County Chesapeake Bay guidelines and "as-built" measurements of the BMP. This evaluation found that the existing BMP had sufficient volume to treat more acreage. Analysis shows that the existing BMP can also provide adequate channel protection without modification until the developed area reaches the 54.7 acres originally proposed. Since James City County is a partner in this development any modifications to the BMP could be deferred until the level of development approaches this amount.

Narrative and Supporting Data

JR038_JAMES_RIVER_COMMERCE_CENTER - 045

James City County Commerce Center
STORMWATER NARRATIVE

The James City County Commerce Center, located just off of Route 60 east of Williamsburg, Virginia, includes a best management practice (BMP) which collects the runoff from the commercial development. This BMP was designed 1996 and intended to satisfy the stormwater management requirements for the entire commerce center. Since that time, James City County has upgraded the requirements for proper stormwater management, therefore requiring modifications to the BMP in order to be compliant with current standards prior to new development commencing at the commerce center.

James City County has contracted AES Consulting Engineers to complete an analysis of the BMP and determine what modifications, in any, need to be completed for the development to be in compliance with the current standards. In 2003, Landmark Design Group, Inc. modeled the entire development, using data from the original design as well as data that was current at that time. This report references that report, dated April 18, 2003 and Landmark Design Group Project #2002138-000.01. This report also references record drawings of the BMP completed by Langley and McDonald, P.C. (Landmark Design Group, Inc.), approved on 09/18/1996, and provided by Bernie Farmer, Capital Projects Administrator, of James City County General Services Division.

This report includes a Hydraflow Hydrographs 2004 recreation of the Landmark Design Group's model of the storm system at the James City County Commerce Center. The data from Landmark's model was entered into Hydraflow and then the data was analyzed to ensure the results correlated with the results obtained by Landmark Design Group in 2003. There were small discrepancies, due to differences in rainfall coefficients, variables, etc. between Hydraflow and Landmark's modeling software. However, correlation between the data was obvious and it was determined that the re-model was accurate and acceptable. Next, the pond data, based on the record drawings, was entered into the model and the system was routed through the pond. Modifications were made to the pond so that it would comply with current James City County Environmental Division standards and policies.

Below is the Hydrograph Return Period Recap's and Summary Pages for both Part 1 & Part 2 of the remodeled stormwater system. Also, the hydrograph for the reservoir routing was included as well as the pond data for the modified BMP.

Pre-Development Conditions

JR038_JAMES_RIVER_COMMERCE_CENTER - 047

Introduction:

The following analysis has been done using the HydroCAD Stormwater Modeling System. Its computational method is based upon the procedures developed by the Soils Conservation Service (SCS) and presented in technical releases TR-20 and TR-55.

The calculations presented with the original plans in 1996 were based upon the TR -55 Tabular method. The SCS unit hydrograph procedure used in HydroCAD is less limited and more precise. The "existing conditions" presented are calculated using the pertinent data of the original calculations to provide a basis of comparison. Three cases of post development conditions have been calculated to show the impact of progressive stages of development. Case 1 is a model of the 1996 Post development condition. Case 2 considers the current status of the development and that more than 25% is not yet sold or committed to development. Case 3 demonstrates that adequate channel protection can be maintained by relatively minor changes in the outlet riser. The channel adequacy results are tabulated below:

SUMMARY OF FLOW, DEPTH AND VELOCITY DOWN STREAM OF BMP

Storm Frequency	Pre Development			Case 1 Post Development 1996			Case 2 Post Devlopment Shell Building / Partial Build-out			Case 3 Post Devlopment Shell Building Full Build-out / Modified BMP		
	Q cfs	V fps	d ft.	Q cfs	V fps	d ft.	Q cfs	V fps	d ft.	Q cfs	V fps	d ft.
One Year	6.92	2.10	0.52	5.71	1.90	0.49	5.27	1.90	0.45	6.25	2.00	0.45
Two Year	11.68	2.60	0.63	7.10	2.10	0.53	6.73	2.10	0.52	7.69	2.20	0.54
Ten Year	30.10	3.21	1.03	22.94	3.10	1.03	19.83	3.00	0.81	21.63	3.00	0.85
100 Year	49.39	3.40	1.45	150.49	4.30	2.33	158.45	4.30	2.40	165.41	4.40	2.46

Post Development Conditions

Return Period Recap and Summary (Part 1 Sub-catchments)

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-------	7.60	10.57	-------	-------	20.52	23.11	-------	30.03	1S: LOT 2-N
2	SCS Runoff	-------	8.53	11.82	-------	-------	22.79	25.65	-------	33.23	2S: LOT 1-N
3	SCS Runoff	-------	2.05	2.86	-------	-------	5.58	6.29	-------	8.18	3S: LOT 1-S
4	SCS Runoff	-------	2.42	3.59	-------	-------	7.77	8.88	-------	11.88	4S: LOT 2-S
5	SCS Runoff	-------	0.95	1.21	-------	-------	2.07	2.29	-------	2.88	5S: ROAD TO 6-5
6	SCS Runoff	-------	7.60	10.44	-------	-------	19.92	22.38	-------	28.91	6S: LOT 4-N
7	SCS Runoff	-------	1.62	2.07	-------	-------	3.54	3.92	-------	4.93	7S: ROAD TO 6-7
8	SCS Runoff	-------	9.20	12.64	-------	-------	24.12	27.10	-------	35.01	8S: LOT 4-M
9	SCS Runoff	-------	5.63	7.75	-------	-------	14.82	16.66	-------	21.53	9S: LOT 3-S
10	SCS Runoff	-------	6.87	9.56	-------	-------	18.58	20.94	-------	27.20	10S: LOT 4-S
11	SCS Runoff	-------	6.68	9.23	-------	-------	17.77	19.99	-------	25.88	11S: LOT 6-N
12	SCS Runoff	-------	3.33	4.58	-------	-------	8.72	9.79	-------	12.64	12S: LOT 5
13	SCS Runoff	-------	6.38	8.83	-------	-------	17.03	19.17	-------	24.84	13S: LOT 6-M
14	SCS Runoff	-------	0.83	1.06	-------	-------	1.81	2.01	-------	2.52	15S: ROW TO INLET 6-15
15	SCS Runoff	-------	6.29	8.72	-------	-------	16.81	18.92	-------	24.51	16S: LOT 6-S
16	SCS Runoff	-------	5.03	6.45	-------	-------	11.03	12.22	-------	15.37	17S: ROW LOT 10
17	SCS Runoff	-------	2.23	2.85	-------	-------	4.89	5.41	-------	6.81	18S: ROW CUL-DE-SAC
18	SCS Runoff	-------	3.51	4.50	-------	-------	7.68	8.50	-------	10.70	19S: COLUMBIA ROAD / SHOULDE
19	Reach	1	7.34	10.38	-------	-------	20.46	23.07	-------	30.00	1R: 6-1 TO 6-4
20	Reach	2	8.44	11.77	-------	-------	22.79	25.65	-------	33.28	2R: 6-2 TO 6-3
21	Combine	3, 20	10.04	13.97	-------	-------	27.12	30.55	-------	39.64	3S + 2R
22	Reach	21	10.06	14.00	-------	-------	27.13	30.55	-------	39.72	3R: 6-3 TO 6-4
23	Combine	4, 22	11.43	16.19	-------	-------	32.37	36.64	-------	48.04	4S + 3R
24	Reach	23	11.31	16.14	-------	-------	32.37	36.70	-------	48.17	4R: 6-4 TO 6-6
25	Reach	5	0.93	1.20	-------	-------	2.09	2.32	-------	2.93	5R: 6-5 TO 6-6
26	Combine	6, 24, 25	15.86	22.96	-------	-------	47.03	53.34	-------	70.11	6S + 4R + 5R
27	Reach	26	15.62	22.79	-------	-------	47.05	53.36	-------	70.17	6R: 6-6 TO 6-8
28	Reach	7	1.62	2.09	-------	-------	3.61	4.00	-------	5.04	7R: 6-7 TO 6-8
29	Combine	8, 27, 28	24.83	35.61	-------	-------	72.15	81.69	-------	107.03	8S + 6R + 7R
30	Reach	29	24.49	35.53	-------	-------	72.48	82.14	-------	107.68	8R: 6-8 TO 6-10

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Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
31	Reach	9	5.65	7.81	-------	-------	14.95	16.80	-------	21.72	9R: 6-9 TO 6-10
32	Combine	10, 30, 31	34.91	50.05	-------	-------	100.17	113.38	-------	148.36	10S + 8R + 9R
33	Reach	32	34.71	50.04	-------	-------	100.89	114.17	-------	149.24	10R: 6-10 TO 6-12
34	Reach	11	6.69	9.24	-------	-------	17.79	20.03	-------	25.95	11R: 6-11 TO 6-12
35	Combine	12, 33, 34	42.52	61.00	-------	-------	122.60	138.62	-------	180.94	12S + 10R + 11R
36	Reach	35	42.14	60.83	-------	-------	122.90	138.92	-------	181.03	12R: 6-12 TO 6-14
37	Reach	13	6.39	8.84	-------	-------	17.07	19.22	-------	24.93	13R: 6-13 TO 6-14
38	Combine	36, 37	48.48	69.46	-------	-------	139.20	157.30	-------	204.96	12R + 13R
39	Reach	38	48.48	69.59	-------	-------	139.61	157.53	-------	205.37	14R: 6-14 TO 6-15
40	Combine	14, 39	48.59	69.78	-------	-------	140.11	158.08	-------	206.40	15S + 14R
41	Reach	40	48.63	69.86	-------	-------	140.38	158.68	-------	207.40	15R: 6-15 TO 6-19
42	Reach	15	6.30	8.72	-------	-------	16.84	18.96	-------	24.59	16R: 6-16 TO 6-19
43	Reach	16	5.06	6.49	-------	-------	11.11	12.31	-------	15.49	17R: 6-17 TO 6-18
44	Combine	17, 43	7.27	9.31	-------	-------	15.93	17.65	-------	22.20	18S + 17R
45	Reach	44	7.23	9.30	-------	-------	15.94	17.66	-------	22.22	18R: 6-18 TO 6-19
46	Combine	18, 41, 42, 45	60.03	86.30	-------	-------	172.66	194.67	-------	256.21	19S + 15R + 16R + 18R
47	Reach	46	59.60	86.09	-------	-------	172.70	196.18	-------	259.81	19R: 6-19 TO 6-21

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	7.60	1	727	25,799	----	------	------	1S: LOT 2-N
2	SCS Runoff	8.53	1	722	22,962	----	------	------	2S: LOT 1-N
3	SCS Runoff	2.05	1	733	8,755	----	------	------	3S: LOT 1-S
4	SCS Runoff	2.42	1	719	5,110	----	------	------	4S: LOT 2-S
5	SCS Runoff	0.95	1	715	1,841	----	------	------	5S: ROAD TO 6-5
6	SCS Runoff	7.60	1	717	14,550	----	------	------	6S: LOT 4-N
7	SCS Runoff	1.62	1	715	3,146	----	------	------	7S: ROAD TO 6-7
8	SCS Runoff	9.20	1	717	17,619	----	------	------	8S: LOT 4-M
9	SCS Runoff	5.63	1	718	11,488	----	------	------	9S: LOT 3-S
10	SCS Runoff	6.87	1	728	24,440	----	------	------	10S: LOT 4-S
11	SCS Runoff	6.68	1	721	16,896	----	------	------	11S: LOT 6-N
12	SCS Runoff	3.33	1	715	5,968	----	------	------	12S: LOT 5
13	SCS Runoff	6.38	1	722	17,165	----	------	------	13S: LOT 6-M
14	SCS Runoff	0.83	1	715	1,611	----	------	------	15S: ROW TO INLET 6-15
15	SCS Runoff	6.29	1	722	16,937	----	------	------	16S: LOT 6-S
16	SCS Runoff	5.03	1	717	11,055	----	------	------	17S: ROW LOT 10
17	SCS Runoff	2.23	1	717	4,895	----	------	------	18S: ROW CUL-DE-SAC
18	SCS Runoff	3.51	1	715	6,828	----	------	------	19S: COLUMBIA ROAD / SHOULDE
19	Reach	7.34	1	730	25,796	1	------	------	1R: 6-1 TO 6-4
20	Reach	8.44	1	724	22,961	2	------	------	2R: 6-2 TO 6-3
21	Combine	10.04	1	724	31,715	3, 20	------	------	3S + 2R
22	Reach	10.06	1	725	31,714	21	------	------	3R: 6-3 TO 6-4
23	Combine	11.43	1	723	36,823	4, 22	------	------	4S + 3R
24	Reach	11.31	1	725	36,820	23	------	------	4R: 6-4 TO 6-6
25	Reach	0.93	1	717	1,693	5	------	------	5R: 6-5 TO 6-6
26	Combine	15.86	1	718	53,063	6, 24, 25	------	------	6S + 4R + 5R
27	Reach	15.62	1	720	53,062	26	------	------	6R: 6-6 TO 6-8
28	Reach	1.62	1	716	3,145	7	------	------	7R: 6-7 TO 6-8
29	Combine	24.83	1	718	73,826	8, 27, 28	------	------	8S + 6R + 7R
30	Reach	24.49	1	719	73,826	29	------	------	8R: 6-8 TO 6-10

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Reach	5.65	1	718	11,487	9	------	------	9R: 6-9 TO 6-10
32	Combine	34.91	1	719	109,753	10, 30, 31	------	------	10S + 8R + 9R
33	Reach	34.71	1	721	109,752	32	------	------	10R: 6-10 TO 6-12
34	Reach	6.69	1	722	16,895	11	------	------	11R: 6-11 TO 6-12
35	Combine	42.52	1	720	132,616	12, 33, 34	------	------	12S + 10R + 11R
36	Reach	42.14	1	722	132,615	35	------	------	12R: 6-12 TO 6-14
37	Reach	6.39	1	723	17,163	13	------	------	13R: 6-13 TO 6-14
38	Combine	48.48	1	722	149,778	36, 37	------	------	12R + 13R
39	Reach	48.48	1	723	149,778	38	------	------	14R: 6-14 TO 6-15
40	Combine	48.59	1	723	151,389	14, 39	------	------	15S + 14R
41	Reach	48.63	1	724	151,389	40	------	------	15R: 6-15 TO 6-19
42	Reach	6.30	1	723	16,936	15	------	------	16R: 6-16 TO 6-19
43	Reach	5.06	1	718	11,054	16	------	------	17R: 6-17 TO 6-18
44	Combine	7.27	1	718	15,949	17, 43	------	------	18S + 17R
45	Reach	7.23	1	719	15,949	44	------	------	18R: 6-18 TO 6-19
46	Combine	60.03	1	723	191,102	18, 41, 42, 45	------	------	19S + 15R + 16R + 18R
47	Reach	59.60	1	724	191,102	46	------	------	19R: 6-19 TO 6-21

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	10.57	1	727	35,960	----	------	------	1S: LOT 2-N
2	SCS Runoff	11.82	1	722	32,006	----	------	------	2S: LOT 1-N
3	SCS Runoff	2.86	1	733	12,203	----	------	------	3S: LOT 1-S
4	SCS Runoff	3.59	1	719	7,587	----	------	------	4S: LOT 2-S
5	SCS Runoff	1.21	1	715	2,400	----	------	------	5S: ROAD TO 6-5
6	SCS Runoff	10.44	1	716	20,281	----	------	------	6S: LOT 4-N
7	SCS Runoff	2.07	1	715	4,101	----	------	------	7S: ROAD TO 6-7
8	SCS Runoff	12.64	1	716	24,559	----	------	------	8S: LOT 4-M
9	SCS Runoff	7.75	1	717	16,013	----	------	------	9S: LOT 3-S
10	SCS Runoff	9.56	1	728	34,065	----	------	------	10S: LOT 4-S
11	SCS Runoff	9.23	1	721	23,551	----	------	------	11S: LOT 6-N
12	SCS Runoff	4.58	1	715	8,318	----	------	------	12S: LOT 5
13	SCS Runoff	8.83	1	722	23,925	----	------	------	13S: LOT 6-M
14	SCS Runoff	1.06	1	715	2,100	----	------	------	15S: ROW TO INLET 6-15
15	SCS Runoff	8.72	1	722	23,608	----	------	------	16S: LOT 6-S
16	SCS Runoff	6.45	1	717	14,413	----	------	------	17S: ROW LOT 10
17	SCS Runoff	2.85	1	717	6,381	----	------	------	18S: ROW CUL-DE-SAC
18	SCS Runoff	4.50	1	715	8,902	----	------	------	19S: COLUMBIA ROAD / SHOULDE
19	Reach	10.38	1	729	35,958	1	------	------	1R: 6-1 TO 6-4
20	Reach	11.77	1	723	32,004	2	------	------	2R: 6-2 TO 6-3
21	Combine	13.97	1	724	44,207	3, 20	------	------	3S + 2R
22	Reach	14.00	1	724	44,206	21	------	------	3R: 6-3 TO 6-4
23	Combine	16.19	1	722	51,793	4, 22	------	------	4S + 3R
24	Reach	16.14	1	724	51,791	23	------	------	4R: 6-4 TO 6-6
25	Reach	1.20	1	716	2,277	5	------	------	5R: 6-5 TO 6-6
26	Combine	22.96	1	718	74,348	6, 24, 25	------	------	6S + 4R + 5R
27	Reach	22.79	1	720	74,347	26	------	------	6R: 6-6 TO 6-8
28	Reach	2.09	1	716	4,100	7	------	------	7R: 6-7 TO 6-8
29	Combine	35.61	1	718	103,007	8, 27, 28	------	------	8S + 6R + 7R
30	Reach	35.53	1	719	103,006	29	------	------	8R: 6-8 TO 6-10

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Reach	7.81	1	718	16,012	9	------	------	9R: 6-9 TO 6-10
32	Combine	50.05	1	719	153,084	10, 30, 31	------	------	10S + 8R + 9R
33	Reach	50.04	1	720	153,084	32	------	------	10R: 6-10 TO 6-12
34	Reach	9.24	1	722	23,550	11	------	------	11R: 6-11 TO 6-12
35	Combine	61.00	1	720	184,953	12, 33, 34	------	------	12S + 10R + 11R
36	Reach	60.83	1	721	184,953	35	------	------	12R: 6-12 TO 6-14
37	Reach	8.84	1	723	23,924	13	------	------	13R: 6-13 TO 6-14
38	Combine	69.46	1	721	208,877	36, 37	------	------	12R + 13R
39	Reach	69.59	1	722	208,877	38	------	------	14R: 6-14 TO 6-15
40	Combine	69.78	1	722	210,977	14, 39	------	------	15S + 14R
41	Reach	69.86	1	723	210,977	40	------	------	15R: 6-15 TO 6-19
42	Reach	8.72	1	723	23,607	15	------	------	16R: 6-16 TO 6-19
43	Reach	6.49	1	718	14,412	16	------	------	17R: 6-17 TO 6-18
44	Combine	9.31	1	718	20,794	17, 43	------	------	18S + 17R
45	Reach	9.30	1	719	20,793	44	------	------	18R: 6-18 TO 6-19
46	Combine	86.30	1	722	264,280	18, 41, 42, 45	------	------	19S + 15R + 16R + 18R
47	Reach	86.09	1	723	264,279	46	------	------	19R: 6-19 TO 6-21

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	20.52	1	727	71,281	----	------	------	1S: LOT 2-N
2	SCS Runoff	22.79	1	722	63,443	----	------	------	2S: LOT 1-N
3	SCS Runoff	5.58	1	733	24,189	----	------	------	3S: LOT 1-S
4	SCS Runoff	7.77	1	718	16,697	----	------	------	4S: LOT 2-S
5	SCS Runoff	2.07	1	715	4,258	----	------	------	5S: ROAD TO 6-5
6	SCS Runoff	19.92	1	716	40,201	----	------	------	6S: LOT 4-N
7	SCS Runoff	3.54	1	715	7,274	----	------	------	7S: ROAD TO 6-7
8	SCS Runoff	24.12	1	716	48,681	----	------	------	8S: LOT 4-M
9	SCS Runoff	14.82	1	717	31,741	----	------	------	9S: LOT 3-S
10	SCS Runoff	18.58	1	728	67,526	----	------	------	10S: LOT 4-S
11	SCS Runoff	17.77	1	721	46,684	----	------	------	11S: LOT 6-N
12	SCS Runoff	8.72	1	715	16,489	----	------	------	12S: LOT 5
13	SCS Runoff	17.03	1	722	47,425	----	------	------	13S: LOT 6-M
14	SCS Runoff	1.81	1	715	3,725	----	------	------	15S: ROW TO INLET 6-15
15	SCS Runoff	16.81	1	722	46,797	----	------	------	16S: LOT 6-S
16	SCS Runoff	11.03	1	717	25,564	----	------	------	17S: ROW LOT 10
17	SCS Runoff	4.89	1	717	11,318	----	------	------	18S: ROW CUL-DE-SAC
18	SCS Runoff	7.68	1	715	15,789	----	------	------	19S: COLUMBIA ROAD / SHOULDE
19	Reach	20.46	1	728	71,279	1	------	------	1R: 6-1 TO 6-4
20	Reach	22.79	1	723	63,442	2	------	------	2R: 6-2 TO 6-3
21	Combine	27.12	1	723	87,630	3, 20	------	------	3S + 2R
22	Reach	27.13	1	724	87,630	21	------	------	3R: 6-3 TO 6-4
23	Combine	32.37	1	722	104,327	4, 22	------	------	4S + 3R
24	Reach	32.37	1	722	104,327	23	------	------	4R: 6-4 TO 6-6
25	Reach	2.09	1	716	4,257	5	------	------	5R: 6-5 TO 6-6
26	Combine	47.03	1	718	148,785	6, 24, 25	------	------	6S + 4R + 5R
27	Reach	47.05	1	719	148,785	26	------	------	6R: 6-6 TO 6-8
28	Reach	3.61	1	716	7,273	7	------	------	7R: 6-7 TO 6-8
29	Combine	72.15	1	717	204,739	8, 27, 28	------	------	8S + 6R + 7R
30	Reach	72.48	1	718	204,740	29	------	------	8R: 6-8 TO 6-10

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Reach	14.95	1	718	31,741	9	------	------	9R: 6-9 TO 6-10
32	Combine	100.17	1	718	304,006	10, 30, 31	------	------	10S + 8R + 9R
33	Reach	100.89	1	719	304,007	32	------	------	10R: 6-10 TO 6-12
34	Reach	17.79	1	721	46,684	11	------	------	11R: 6-11 TO 6-12
35	Combine	122.60	1	719	367,179	12, 33, 34	------	------	12S + 10R + 11R
36	Reach	122.90	1	720	367,181	35	------	------	12R: 6-12 TO 6-14
37	Reach	17.07	1	722	47,425	13	------	------	13R: 6-13 TO 6-14
38	Combine	139.20	1	720	414,605	36, 37	------	------	12R + 13R
39	Reach	139.61	1	721	414,616	38	------	------	14R: 6-14 TO 6-15
40	Combine	140.11	1	721	418,342	14, 39	------	------	15S + 14R
41	Reach	140.38	1	721	418,371	40	------	------	15R: 6-15 TO 6-19
42	Reach	16.84	1	722	46,796	15	------	------	16R: 6-16 TO 6-19
43	Reach	11.11	1	718	25,564	16	------	------	17R: 6-17 TO 6-18
44	Combine	15.93	1	718	36,882	17, 43	------	------	18S + 17R
45	Reach	15.94	1	719	36,882	44	------	------	18R: 6-18 TO 6-19
46	Combine	172.66	1	721	517,838	18, 41, 42, 45	------	------	19S + 15R + 16R + 18R
47	Reach	172.70	1	722	517,856	46	------	------	19R: 6-19 TO 6-21

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	23.11	1	727	80,751	----	------	------	1S: LOT 2-N
2	SCS Runoff	25.65	1	722	71,872	----	------	------	2S: LOT 1-N
3	SCS Runoff	6.29	1	733	27,402	----	------	------	3S: LOT 1-S
4	SCS Runoff	8.88	1	718	19,214	----	------	------	4S: LOT 2-S
5	SCS Runoff	2.29	1	715	4,745	----	------	------	5S: ROAD TO 6-5
6	SCS Runoff	22.38	1	716	45,543	----	------	------	6S: LOT 4-N
7	SCS Runoff	3.92	1	715	8,105	----	------	------	7S: ROAD TO 6-7
8	SCS Runoff	27.10	1	716	55,149	----	------	------	8S: LOT 4-M
9	SCS Runoff	16.66	1	717	35,958	----	------	------	9S: LOT 3-S
10	SCS Runoff	20.94	1	728	76,498	----	------	------	10S: LOT 4-S
11	SCS Runoff	19.99	1	721	52,887	----	------	------	11S: LOT 6-N
12	SCS Runoff	9.79	1	715	18,680	----	------	------	12S: LOT 5
13	SCS Runoff	19.17	1	722	53,726	----	------	------	13S: LOT 6-M
14	SCS Runoff	2.01	1	715	4,151	----	------	------	15S: ROW TO INLET 6-15
15	SCS Runoff	18.92	1	722	53,015	----	------	------	16S: LOT 6-S
16	SCS Runoff	12.22	1	717	28,487	----	------	------	17S: ROW LOT 10
17	SCS Runoff	5.41	1	717	12,613	----	------	------	18S: ROW CUL-DE-SAC
18	SCS Runoff	8.50	1	715	17,594	----	------	------	19S: COLUMBIA ROAD / SHOULDE
19	Reach	23.07	1	728	80,750	1	------	------	1R: 6-1 TO 6-4
20	Reach	25.65	1	723	71,871	2	------	------	2R: 6-2 TO 6-3
21	Combine	30.55	1	723	99,274	3, 20	------	------	3S + 2R
22	Reach	30.55	1	723	99,273	21	------	------	3R: 6-3 TO 6-4
23	Combine	36.64	1	721	118,486	4, 22	------	------	4S + 3R
24	Reach	36.70	1	722	118,486	23	------	------	4R: 6-4 TO 6-6
25	Reach	2.32	1	716	4,744	5	------	------	5R: 6-5 TO 6-6
26	Combine	53.34	1	718	168,773	6, 24, 25	------	------	6S + 4R + 5R
27	Reach	53.36	1	719	168,773	26	------	------	6R: 6-6 TO 6-8
28	Reach	4.00	1	716	8,105	7	------	------	7R: 6-7 TO 6-8
29	Combine	81.69	1	717	232,027	8, 27, 28	------	------	8S + 6R + 7R
30	Reach	82.14	1	718	232,028	29	------	------	8R: 6-8 TO 6-10

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Reach	16.80	1	718	35,958	9	------	------	9R: 6-9 TO 6-10
32	Combine	113.38	1	718	344,484	10, 30, 31	------	------	10S + 8R + 9R
33	Reach	114.17	1	719	344,486	32	------	------	10R: 6-10 TO 6-12
34	Reach	20.03	1	721	52,886	11	------	------	11R: 6-11 TO 6-12
35	Combine	138.62	1	719	416,052	12, 33, 34	------	------	12S + 10R + 11R
36	Reach	138.92	1	720	416,056	35	------	------	12R: 6-12 TO 6-14
37	Reach	19.22	1	722	53,726	13	------	------	13R: 6-13 TO 6-14
38	Combine	157.30	1	720	469,783	36, 37	------	------	12R + 13R
39	Reach	157.53	1	721	469,808	38	------	------	14R: 6-14 TO 6-15
40	Combine	158.08	1	721	473,959	14, 39	------	------	15S + 14R
41	Reach	158.68	1	721	474,006	40	------	------	15R: 6-15 TO 6-19
42	Reach	18.96	1	722	53,014	15	------	------	16R: 6-16 TO 6-19
43	Reach	12.31	1	718	28,487	16	------	------	17R: 6-17 TO 6-18
44	Combine	17.65	1	718	41,099	17, 43	------	------	18S + 17R
45	Reach	17.66	1	719	41,099	44	------	------	18R: 6-18 TO 6-19
46	Combine	194.67	1	721	585,713	18, 41, 42, 45	------	------	19S + 15R + 16R + 18R
47	Reach	196.18	1	721	585,761	46	------	------	19R: 6-19 TO 6-21

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	30.03	1	726	106,272	----	------	------	1S: LOT 2-N
2	SCS Runoff	33.23	1	722	94,587	----	------	------	2S: LOT 1-N
3	SCS Runoff	8.18	1	733	36,062	----	------	------	3S: LOT 1-S
4	SCS Runoff	11.88	1	718	26,080	----	------	------	4S: LOT 2-S
5	SCS Runoff	2.88	1	715	6,045	----	------	------	5S: ROAD TO 6-5
6	SCS Runoff	28.91	1	716	59,936	----	------	------	6S: LOT 4-N
7	SCS Runoff	4.93	1	715	10,327	----	------	------	7S: ROAD TO 6-7
8	SCS Runoff	35.01	1	716	72,579	----	------	------	8S: LOT 4-M
9	SCS Runoff	21.53	1	717	47,323	----	------	------	9S: LOT 3-S
10	SCS Runoff	27.20	1	728	100,674	----	------	------	10S: LOT 4-S
11	SCS Runoff	25.88	1	721	69,601	----	------	------	11S: LOT 6-N
12	SCS Runoff	12.64	1	715	24,583	----	------	------	12S: LOT 5
13	SCS Runoff	24.84	1	722	70,706	----	------	------	13S: LOT 6-M
14	SCS Runoff	2.52	1	715	5,289	----	------	------	15S: ROW TO INLET 6-15
15	SCS Runoff	24.51	1	722	69,769	----	------	------	16S: LOT 6-S
16	SCS Runoff	15.37	1	717	36,295	----	------	------	17S: ROW LOT 10
17	SCS Runoff	6.81	1	717	16,070	----	------	------	18S: ROW CUL-DE-SAC
18	SCS Runoff	10.70	1	715	22,417	----	------	------	19S: COLUMBIA ROAD / SHOULDE
19	Reach	30.00	1	728	106,271	1	------	------	1R: 6-1 TO 6-4
20	Reach	33.28	1	722	94,586	2	------	------	2R: 6-2 TO 6-3
21	Combine	39.64	1	723	130,649	3, 20	------	------	3S + 2R
22	Reach	39.72	1	723	130,648	21	------	------	3R: 6-3 TO 6-4
23	Combine	48.04	1	721	156,727	4, 22	------	------	4S + 3R
24	Reach	48.17	1	722	156,728	23	------	------	4R: 6-4 TO 6-6
25	Reach	2.93	1	716	6,045	5	------	------	5R: 6-5 TO 6-6
26	Combine	70.11	1	718	222,709	6, 24, 25	------	------	6S + 4R + 5R
27	Reach	70.17	1	718	222,709	26	------	------	6R: 6-6 TO 6-8
28	Reach	5.04	1	716	10,326	7	------	------	7R: 6-7 TO 6-8
29	Combine	107.03	1	717	305,614	8, 27, 28	------	------	8S + 6R + 7R
30	Reach	107.68	1	718	305,616	29	------	------	8R: 6-8 TO 6-10

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Reach	21.72	1	718	47,322	9	------	------	9R: 6-9 TO 6-10
32	Combine	148.36	1	718	453,612	10, 30, 31	------	------	10S + 8R + 9R
33	Reach	149.24	1	719	453,624	32	------	------	10R: 6-10 TO 6-12
34	Reach	25.95	1	721	69,600	11	------	------	11R: 6-11 TO 6-12
35	Combine	180.94	1	719	547,807	12, 33, 34	------	------	12S + 10R + 11R
36	Reach	181.03	1	720	547,831	35	------	------	12R: 6-12 TO 6-14
37	Reach	24.93	1	722	70,705	13	------	------	13R: 6-13 TO 6-14
38	Combine	204.96	1	720	618,537	36, 37	------	------	12R + 13R
39	Reach	205.37	1	720	618,607	38	------	------	14R: 6-14 TO 6-15
40	Combine	206.40	1	720	623,896	14, 39	------	------	15S + 14R
41	Reach	207.40	1	720	637,898	40	------	------	15R: 6-15 TO 6-19
42	Reach	24.59	1	722	69,769	15	------	------	16R: 6-16 TO 6-19
43	Reach	15.49	1	718	36,295	16	------	------	17R: 6-17 TO 6-18
44	Combine	22.20	1	718	52,365	17, 43	------	------	18S + 17R
45	Reach	22.22	1	719	52,365	44	------	------	18R: 6-18 TO 6-19
46	Combine	256.21	1	720	782,449	18, 41, 42, 45	------	------	19S + 15R + 16R + 18R
47	Reach	259.81	1	721	822,584	46	------	------	19R: 6-19 TO 6-21

Return Period Recap and Summary (Part 2 Sub-catchments)

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-------	6.42	10.78	-------	-------	27.45	32.12	-------	45.04	POND 1P: DRAINAGE PRE-DEV
3	SCS Runoff	-------	9.66	13.40	-------	-------	25.90	29.16	-------	37.86	14S: LOT 7
4	SCS Runoff	-------	9.37	14.15	-------	-------	31.21	35.80	-------	48.13	20S: REMAINING SITE
5	SCS Runoff	-------	0.96	1.21	-------	-------	2.02	2.23	-------	2.79	21S: ENTRY CIRCLE
6	SCS Runoff	-------	0.88	1.11	-------	-------	1.85	2.04	-------	2.55	22S: FRONT PARKING LOT
7	SCS Runoff	-------	3.70	5.12	-------	-------	9.87	11.11	-------	14.39	23S: LOT TO S-23
8	SCS Runoff	-------	6.73	9.35	-------	-------	18.12	20.40	-------	26.49	24S: LOT TO S-24
9	SCS Runoff	-------	4.29	5.94	-------	-------	11.45	12.89	-------	16.70	25S: REMAINING SHELL BUILDING
10	SCS Runoff	-------	3.15	3.95	-------	-------	6.59	7.28	-------	9.10	26S: FRONT ROOF
11	SCS Runoff	-------	0.63	0.86	-------	-------	1.63	1.84	-------	2.37	27S: FUTURE DRIVE / SHOULDER
12	SCS Runoff	-------	0.30	0.54	-------	-------	1.50	1.77	-------	2.52	28S: REAR YARD / FUTURE DRIVE
13	SCS Runoff	-------	4.70	5.90	-------	-------	9.84	10.87	-------	13.60	29S: REAR ROOF
14	SCS Runoff	-------	1.34	1.69	-------	-------	2.81	3.10	-------	3.88	30S: FUTURE LOADING DOCK
15	SCS Runoff	-------	1.86	2.58	-------	-------	4.99	5.62	-------	7.29	33S: REAR YARD 50% FUTURE PA
16	SCS Runoff	-------	0.33	0.57	-------	-------	1.49	1.75	-------	2.46	36S: SE FRONT YARD
17	SCS Runoff	-------	0.66	1.14	-------	-------	2.98	3.50	-------	4.93	37S: FRONT YARD SLOPE
18	Manual	-------	7.60	86.09	-------	-------	172.70	196.18	-------	259.81	19R: 6-19 TO 6-21
19	Reach	15	1.82	2.55	-------	-------	4.99	5.61	-------	7.29	41R: A-9 TO A-8
20	Combine	14, 19	2.27	3.10	-------	-------	5.88	6.61	-------	8.55	30S + 41R
21	Reach	20	2.24	3.08	-------	-------	5.91	6.65	-------	8.62	40R: A-8 TO A-7
22	Combine	13, 21	6.74	8.73	-------	-------	15.35	17.08	-------	21.69	29S + 40R
23	Reach	22	6.72	8.73	-------	-------	15.36	17.08	-------	21.75	39R: A-7 TO A-6
24	Combine	12, 23	6.92	9.14	-------	-------	16.58	18.54	-------	23.77	28S + 39R
25	Reach	24	6.75	9.05	-------	-------	16.58	18.54	-------	24.03	30R: A-6 TO A-5
26	Combine	11, 25	7.22	9.68	-------	-------	17.90	20.12	-------	26.05	27S + 30R
27	Reach	26	7.03	9.58	-------	-------	17.95	20.23	-------	26.33	29R: A-5 TO A-4
28	Combine	10, 27	8.94	12.09	-------	-------	22.61	25.37	-------	32.76	26S + 29R
29	Reach	28	8.95	12.10	-------	-------	22.67	25.44	-------	32.86	28R: A-4 TO A-3
30	Combine	6, 29	9.63	12.96	-------	-------	24.06	26.98	-------	34.77	22S + 28R

Proj. file: 932237-remodel of existing BMP (part 2).gpw | Tuesday, Mar 20 2007, 8:34 AM

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
31	Reach	30	9.58	12.96	-------	-------	24.12	27.03	-------	34.78	26R: A-3 TO A-2
32	Reach	31	9.60	13.01	-------	-------	24.40	27.46	-------	35.66	22R: A-2 TO A-1
33	Reach	17	0.63	1.13	-------	-------	3.04	3.59	-------	5.09	42R: DRIVEWAY CULVERT
34	Combine	17, 33	1.24	2.23	-------	-------	6.02	7.09	-------	10.01	37S + 42R
35	Reach	34	1.14	2.08	-------	-------	5.74	6.79	-------	9.70	43R: PAVED DITCH PG-2
36	Reach	6	0.90	1.14	-------	-------	1.90	2.10	-------	2.62	27R: PAVED FLUME PG-4
37	Combine	9, 32, 35, 36	15.26	21.24	-------	-------	41.68	47.19	-------	61.96	25S + 22R + 27R + 43R
38	Reach	37	15.15	21.21	-------	-------	42.02	47.61	-------	62.57	25R: 6-25 TO 6-24
39	Combine	8, 38	21.38	29.48	-------	-------	57.22	64.78	-------	85.02	24S + 25R
40	Reach	39	21.27	29.47	-------	-------	57.61	65.31	-------	85.81	24R: 6-24 TO 6-23
41	Combine	7, 40	24.93	34.54	-------	-------	67.24	76.16	-------	99.91	23S + 24R
42	Reach	41	24.66	34.49	-------	-------	67.43	76.49	-------	100.53	23R: 6-23 TO 6-20
43	Combine	3, 42	34.24	47.88	-------	-------	92.44	104.53	-------	137.77	14S + 23R
44	Reach	43	34.37	47.90	-------	-------	93.57	106.73	-------	206.54	20R: 6-20 TO 6-21
45	Combine	18, 44	41.81	133.48	-------	-------	266.27	300.06	-------	396.86	19R + 20R
46	Reach	45	41.73	134.07	-------	-------	268.10	305.72	-------	614.61	21R: 6-21 TO 6-22
47	Combine	4, 46	51.08	148.07	-------	-------	297.81	339.89	-------	655.20	20S + 21R
49	Reservoir	47	3.53	9.74	-------	-------	26.83	37.55	-------	144.23	POND 1P: EXISTING BMP

Proj. file: 932237-remodel of existing BMP (part 2).gpw | Tuesday, Mar 20 2007, 8:34 AM

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	6.42	6	744	40,232	----	------	------	POND 1P: DRAINAGE PRE-DEV
3	SCS Runoff	9.66	1	724	28,601	----	------	------	14S: LOT 7
4	SCS Runoff	9.37	1	726	29,924	----	------	------	20S: REMAINING SITE
5	SCS Runoff	0.96	1	715	2,011	----	------	------	21S: ENTRY CIRCLE
6	SCS Runoff	0.88	1	715	1,836	----	------	------	22S: FRONT PARKING LOT
7	SCS Runoff	3.70	1	722	9,946	----	------	------	23S: LOT TO S-23
8	SCS Runoff	6.73	1	725	21,029	----	------	------	24S: LOT TO S-24
9	SCS Runoff	4.29	1	722	11,538	----	------	------	25S: REMAINING SHELL BUILDING
10	SCS Runoff	3.15	1	715	6,557	----	------	------	26S: FRONT ROOF
11	SCS Runoff	0.63	1	715	1,119	----	------	------	27S: FUTURE DRIVE / SHOULDER
12	SCS Runoff	0.30	1	722	866	----	------	------	28S: REAR YARD / FUTURE DRIVE
13	SCS Runoff	4.70	1	715	9,792	----	------	------	29S: REAR ROOF
14	SCS Runoff	1.34	1	715	2,798	----	------	------	30S: FUTURE LOADING DOCK
15	SCS Runoff	1.86	1	724	5,507	----	------	------	33S: REAR YARD 50% FUTURE PA
16	SCS Runoff	0.33	1	716	598	----	------	------	36S: SE FRONT YARD
17	SCS Runoff	0.66	1	716	1,196	----	------	------	37S: FRONT YARD SLOPE
18	Manual	7.60	1	727	25,801	----	------	------	19R: 6-19 TO 6-21
19	Reach	1.82	1	726	5,504	15	------	------	41R: A-9 TO A-8
20	Combine	2.27	1	716	8,301	14, 19	------	------	30S + 41R
21	Reach	2.24	1	717	8,301	20	------	------	40R: A-8 TO A-7
22	Combine	6.74	1	716	18,094	13, 21	------	------	29S + 40R
23	Reach	6.72	1	717	18,093	22	------	------	39R: A-7 TO A-6
24	Combine	6.92	1	717	18,960	12, 23	------	------	28S + 39R
25	Reach	6.75	1	718	18,959	24	------	------	30R: A-6 TO A-5
26	Combine	7.22	1	718	20,078	11, 25	------	------	27S + 30R
27	Reach	7.03	1	719	20,078	26	------	------	29R: A-5 TO A-4
28	Combine	8.94	1	718	26,635	10, 27	------	------	26S + 29R
29	Reach	8.95	1	719	26,635	28	------	------	28R: A-4 TO A-3
30	Combine	9.63	1	717	28,471	6, 29	------	------	22S + 28R

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Reach	9.58	1	718	28,471	30	------	------	26R: A-3 TO A-2
32	Reach	9.60	1	719	28,471	31	------	------	22R: A-2 TO A-1
33	Reach	0.63	1	717	1,071	17	------	------	42R: DRIVEWAY CULVERT
34	Combine	1.24	1	716	2,267	17, 33	------	------	37S + 42R
35	Reach	1.14	1	719	2,147	34	------	------	43R: PAVED DITCH PG-2
36	Reach	0.90	1	716	1,770	6	------	------	27R: PAVED FLUME PG-4
37	Combine	15.26	1	719	43,926	9, 32, 35, 36	------	------	25S + 22R + 27R + 43R
38	Reach	15.15	1	721	43,926	37	------	------	25R: 6-25 TO 6-24
39	Combine	21.38	1	722	64,955	8, 38	------	------	24S + 25R
40	Reach	21.27	1	723	64,954	39	------	------	24R: 6-24 TO 6-23
41	Combine	24.93	1	723	74,900	7, 40	------	------	23S + 24R
42	Reach	24.66	1	725	74,900	41	------	------	23R: 6-23 TO 6-20
43	Combine	34.24	1	724	103,501	3, 42	------	------	14S + 23R
44	Reach	34.37	1	725	103,501	43	------	------	20R: 6-20 TO 6-21
45	Combine	41.81	1	725	129,302	18, 44	------	------	19R + 20R
46	Reach	41.73	1	727	129,302	45	------	------	21R: 6-21 TO 6-22
47	Combine	51.08	1	726	159,226	4, 46	------	------	20S + 21R
49	Reservoir	3.53	1	808	155,021	47	26.41	289,978	POND 1P: EXISTING BMP

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	10.78	6	744	63,631	----	------	------	POND 1P: DRAINAGE PRE-DEV
3	SCS Runoff	13.40	1	724	39,866	----	------	------	14S: LOT 7
4	SCS Runoff	14.15	1	725	44,431	----	------	------	20S: REMAINING SITE
5	SCS Runoff	1.21	1	715	2,557	----	------	------	21S: ENTRY CIRCLE
6	SCS Runoff	1.11	1	715	2,334	----	------	------	22S: FRONT PARKING LOT
7	SCS Runoff	5.12	1	722	13,864	----	------	------	23S: LOT TO S-23
8	SCS Runoff	9.35	1	725	29,312	----	------	------	24S: LOT TO S-24
9	SCS Runoff	5.94	1	722	16,082	----	------	------	25S: REMAINING SHELL BUILDING
10	SCS Runoff	3.95	1	715	8,337	----	------	------	26S: FRONT ROOF
11	SCS Runoff	0.86	1	715	1,560	----	------	------	27S: FUTURE DRIVE / SHOULDER
12	SCS Runoff	0.54	1	722	1,441	----	------	------	28S: REAR YARD / FUTURE DRIVE
13	SCS Runoff	5.90	1	715	12,450	----	------	------	29S: REAR ROOF
14	SCS Runoff	1.69	1	715	3,557	----	------	------	30S: FUTURE LOADING DOCK
15	SCS Runoff	2.58	1	724	7,676	----	------	------	33S: REAR YARD 50% FUTURE PA
16	SCS Runoff	0.57	1	716	995	----	------	------	36S: SE FRONT YARD
17	SCS Runoff	1.14	1	716	1,990	----	------	------	37S: FRONT YARD SLOPE
18	Manual	86.09	1	723	264,280	----	------	------	19R: 6-19 TO 6-21
19	Reach	2.55	1	726	7,673	15	------	------	41R: A-9 TO A-8
20	Combine	3.10	1	716	11,230	14, 19	------	------	30S + 41R
21	Reach	3.08	1	717	11,230	20	------	------	40R: A-8 TO A-7
22	Combine	8.73	1	716	23,680	13, 21	------	------	29S + 40R
23	Reach	8.73	1	717	23,680	22	------	------	39R: A-7 TO A-6
24	Combine	9.14	1	717	25,121	12, 23	------	------	28S + 39R
25	Reach	9.05	1	718	25,121	24	------	------	30R: A-6 TO A-5
26	Combine	9.68	1	718	26,680	11, 25	------	------	27S + 30R
27	Reach	9.58	1	719	26,680	26	------	------	29R: A-5 TO A-4
28	Combine	12.09	1	718	35,017	10, 27	------	------	26S + 29R
29	Reach	12.10	1	719	35,017	28	------	------	28R: A-4 TO A-3
30	Combine	12.96	1	717	37,352	6, 29	------	------	22S + 28R

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Reach	12.96	1	718	37,352	30	------	------	26R: A-3 TO A-2
32	Reach	13.01	1	719	37,352	31	------	------	22R: A-2 TO A-1
33	Reach	1.13	1	717	1,989	17	------	------	42R: DRIVEWAY CULVERT
34	Combine	2.23	1	716	3,979	17, 33	------	------	37S + 42R
35	Reach	2.08	1	718	3,978	34	------	------	43R: PAVED DITCH PG-2
36	Reach	1.14	1	716	2,305	6	------	------	27R: PAVED FLUME PG-4
37	Combine	21.24	1	719	59,718	9, 32, 35, 36	------	------	25S + 22R + 27R + 43R
38	Reach	21.21	1	720	59,718	37	------	------	25R: 6-25 TO 6-24
39	Combine	29.48	1	722	89,030	8, 38	------	------	24S + 25R
40	Reach	29.47	1	723	89,029	39	------	------	24R: 6-24 TO 6-23
41	Combine	34.54	1	722	102,893	7, 40	------	------	23S + 24R
42	Reach	34.49	1	724	102,892	41	------	------	23R: 6-23 TO 6-20
43	Combine	47.88	1	724	142,758	3, 42	------	------	14S + 23R
44	Reach	47.90	1	725	142,758	43	------	------	20R: 6-20 TO 6-21
45	Combine	133.48	1	723	407,038	18, 44	------	------	19R + 20R
46	Reach	134.07	1	724	407,038	45	------	------	21R: 6-21 TO 6-22
47	Combine	148.07	1	724	451,470	4, 46	------	------	20S + 21R
49	Reservoir	9.74	1	804	444,682	47	29.08	462,208	POND 1P: EXISTING BMP

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	27.45	6	744	154,851	----	------	------	POND 1P: DRAINAGE PRE-DEV
3	SCS Runoff	25.90	1	724	79,023	----	------	------	14S: LOT 7
4	SCS Runoff	31.21	1	725	97,783	----	------	------	20S: REMAINING SITE
5	SCS Runoff	2.02	1	715	4,354	----	------	------	21S: ENTRY CIRCLE
6	SCS Runoff	1.85	1	715	3,975	----	------	------	22S: FRONT PARKING LOT
7	SCS Runoff	9.87	1	722	27,481	----	------	------	23S: LOT TO S-23
8	SCS Runoff	18.12	1	725	58,104	----	------	------	24S: LOT TO S-24
9	SCS Runoff	11.45	1	722	31,878	----	------	------	25S: REMAINING SHELL BUILDING
10	SCS Runoff	6.59	1	715	14,196	----	------	------	26S: FRONT ROOF
11	SCS Runoff	1.63	1	715	3,092	----	------	------	27S: FUTURE DRIVE / SHOULDER
12	SCS Runoff	1.50	1	721	3,784	----	------	------	28S: REAR YARD / FUTURE DRIVE
13	SCS Runoff	9.84	1	715	21,200	----	------	------	29S: REAR ROOF
14	SCS Runoff	2.81	1	715	6,057	----	------	------	30S: FUTURE LOADING DOCK
15	SCS Runoff	4.99	1	724	15,215	----	------	------	33S: REAR YARD 50% FUTURE PA
16	SCS Runoff	1.49	1	716	2,613	----	------	------	36S: SE FRONT YARD
17	SCS Runoff	2.98	1	716	5,225	----	------	------	37S: FRONT YARD SLOPE
18	Manual	172.70	1	722	517,775	----	------	------	19R: 6-19 TO 6-21
19	Reach	4.99	1	725	15,213	15	------	------	41R: A-9 TO A-8
20	Combine	5.88	1	716	21,270	14, 19	------	------	30S + 41R
21	Reach	5.91	1	717	21,270	20	------	------	40R: A-8 TO A-7
22	Combine	15.35	1	716	42,470	13, 21	------	------	29S + 40R
23	Reach	15.36	1	717	42,470	22	------	------	39R: A-7 TO A-6
24	Combine	16.58	1	717	46,254	12, 23	------	------	28S + 39R
25	Reach	16.58	1	718	46,254	24	------	------	30R: A-6 TO A-5
26	Combine	17.90	1	717	49,345	11, 25	------	------	27S + 30R
27	Reach	17.95	1	718	49,345	26	------	------	29R: A-5 TO A-4
28	Combine	22.61	1	718	63,542	10, 27	------	------	26S + 29R
29	Reach	22.67	1	719	63,542	28	------	------	28R: A-4 TO A-3
30	Combine	24.06	1	717	67,517	6, 29	------	------	22S + 28R

932237-remodel of existing BMP (part B) Return Period: 10 Year | Tuesday, Mar 20 2007, 8:36 AM

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Reach	24.12	1	718	67,517	30	------	------	26R: A-3 TO A-2
32	Reach	24.40	1	718	67,517	31	------	------	22R: A-2 TO A-1
33	Reach	3.04	1	716	5,225	17	------	------	42R: DRIVEWAY CULVERT
34	Combine	6.02	1	716	10,450	17, 33	------	------	37S + 42R
35	Reach	5.74	1	717	10,450	34	------	------	43R: PAVED DITCH PG-2
36	Reach	1.90	1	716	3,974	6	------	------	27R: PAVED FLUME PG-4
37	Combine	41.68	1	718	113,819	9, 32, 35, 36	------	------	25S + 22R + 27R + 43R
38	Reach	42.02	1	719	113,819	37	------	------	25R: 6-25 TO 6-24
39	Combine	57.22	1	719	171,923	8, 38	------	------	24S + 25R
40	Reach	57.61	1	720	171,922	39	------	------	24R: 6-24 TO 6-23
41	Combine	67.24	1	720	199,404	7, 40	------	------	23S + 24R
42	Reach	67.43	1	721	199,404	41	------	------	23R: 6-23 TO 6-20
43	Combine	92.44	1	723	278,427	3, 42	------	------	14S + 23R
44	Reach	93.57	1	722	278,427	43	------	------	20R: 6-20 TO 6-21
45	Combine	266.27	1	722	796,204	18, 44	------	------	19R + 20R
46	Reach	268.10	1	722	796,220	45	------	------	21R: 6-21 TO 6-22
47	Combine	297.81	1	722	894,004	4, 46	------	------	20S + 21R
49	Reservoir	26.83	1	769	884,851	47	32.80	702,974	POND 1P: EXISTING BMP

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	32.12	6	744	180,850	----	------	------	POND 1P: DRAINAGE PRE-DEV
3	SCS Runoff	29.16	1	724	89,523	----	------	------	14S: LOT 7
4	SCS Runoff	35.80	1	725	112,521	----	------	------	20S: REMAINING SITE
5	SCS Runoff	2.23	1	715	4,823	----	------	------	21S: ENTRY CIRCLE
6	SCS Runoff	2.04	1	715	4,403	----	------	------	22S: FRONT PARKING LOT
7	SCS Runoff	11.11	1	722	31,133	----	------	------	23S: LOT TO S-23
8	SCS Runoff	20.40	1	725	65,823	----	------	------	24S: LOT TO S-24
9	SCS Runoff	12.89	1	722	36,114	----	------	------	25S: REMAINING SHELL BUILDING
10	SCS Runoff	7.28	1	715	15,726	----	------	------	26S: FRONT ROOF
11	SCS Runoff	1.84	1	715	3,502	----	------	------	27S: FUTURE DRIVE / SHOULDER
12	SCS Runoff	1.77	1	721	4,468	----	------	------	28S: REAR YARD / FUTURE DRIVE
13	SCS Runoff	10.87	1	715	23,484	----	------	------	29S: REAR ROOF
14	SCS Runoff	3.10	1	715	6,710	----	------	------	30S: FUTURE LOADING DOCK
15	SCS Runoff	5.62	1	724	17,236	----	------	------	33S: REAR YARD 50% FUTURE PA
16	SCS Runoff	1.75	1	716	3,085	----	------	------	36S: SE FRONT YARD
17	SCS Runoff	3.50	1	716	6,170	----	------	------	37S: FRONT YARD SLOPE
18	Manual	196.18	1	721	585,558	----	------	------	19R: 6-19 TO 6-21
19	Reach	5.61	1	725	17,234	15	------	------	41R: A-9 TO A-8
20	Combine	6.61	1	716	23,944	14, 19	------	------	30S + 41R
21	Reach	6.65	1	717	23,944	20	------	------	40R: A-8 TO A-7
22	Combine	17.08	1	716	47,429	13, 21	------	------	29S + 40R
23	Reach	17.08	1	717	47,429	22	------	------	39R: A-7 TO A-6
24	Combine	18.54	1	717	51,897	12, 23	------	------	28S + 39R
25	Reach	18.54	1	717	51,897	24	------	------	30R: A-6 TO A-5
26	Combine	20.12	1	717	55,399	11, 25	------	------	27S + 30R
27	Reach	20.23	1	718	55,399	26	------	------	29R: A-5 TO A-4
28	Combine	25.37	1	718	71,125	10, 27	------	------	26S + 29R
29	Reach	25.44	1	719	71,125	28	------	------	28R: A-4 TO A-3
30	Combine	26.98	1	717	75,528	6, 29	------	------	22S + 28R

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Reach	27.03	1	718	75,529	30	------	------	26R: A-3 TO A-2
32	Reach	27.46	1	718	75,529	31	------	------	22R: A-2 TO A-1
33	Reach	3.59	1	716	6,169	17	------	------	42R: DRIVEWAY CULVERT
34	Combine	7.09	1	716	12,339	17, 33	------	------	37S + 42R
35	Reach	6.79	1	717	12,339	34	------	------	43R: PAVED DITCH PG-2
36	Reach	2.10	1	716	4,403	6	------	------	27R: PAVED FLUME PG-4
37	Combine	47.19	1	718	128,384	9, 32, 35, 36	------	------	25S + 22R + 27R + 43R
38	Reach	47.61	1	719	128,384	37	------	------	25R: 6-25 TO 6-24
39	Combine	64.78	1	719	194,207	8, 38	------	------	24S + 25R
40	Reach	65.31	1	720	194,207	39	------	------	24R: 6-24 TO 6-23
41	Combine	76.16	1	720	225,339	7, 40	------	------	23S + 24R
42	Reach	76.49	1	721	225,340	41	------	------	23R: 6-23 TO 6-20
43	Combine	104.53	1	721	314,863	3, 42	------	------	14S + 23R
44	Reach	106.73	1	724	314,873	43	------	------	20R: 6-20 TO 6-21
45	Combine	300.06	1	722	900,431	18, 44	------	------	19R + 20R
46	Reach	305.72	1	722	902,918	45	------	------	21R: 6-21 TO 6-22
47	Combine	339.89	1	722	1,015,437	4, 46	------	------	20S + 21R
49	Reservoir	37.55	1	761	1,005,886	47	33.73	763,271	POND 1P: EXISTING BMP

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	45.04	6	738	252,781	----	------	------	POND 1P: DRAINAGE PRE-DEV
3	SCS Runoff	37.86	1	723	117,815	----	------	------	14S: LOT 7
4	SCS Runoff	48.13	1	725	152,732	----	------	------	20S: REMAINING SITE
5	SCS Runoff	2.79	1	715	6,074	----	------	------	21S: ENTRY CIRCLE
6	SCS Runoff	2.55	1	715	5,546	----	------	------	22S: FRONT PARKING LOT
7	SCS Runoff	14.39	1	722	40,972	----	------	------	23S: LOT TO S-23
8	SCS Runoff	26.49	1	724	86,626	----	------	------	24S: LOT TO S-24
9	SCS Runoff	16.70	1	722	47,527	----	------	------	25S: REMAINING SHELL BUILDING
10	SCS Runoff	9.10	1	715	19,807	----	------	------	26S: FRONT ROOF
11	SCS Runoff	2.37	1	715	4,609	----	------	------	27S: FUTURE DRIVE / SHOULDER
12	SCS Runoff	2.52	1	721	6,381	----	------	------	28S: REAR YARD / FUTURE DRIVE
13	SCS Runoff	13.60	1	715	29,578	----	------	------	29S: REAR ROOF
14	SCS Runoff	3.88	1	715	8,451	----	------	------	30S: FUTURE LOADING DOCK
15	SCS Runoff	7.29	1	723	22,683	----	------	------	33S: REAR YARD 50% FUTURE PA
16	SCS Runoff	2.46	1	715	4,406	----	------	------	36S: SE FRONT YARD
17	SCS Runoff	4.93	1	715	8,812	----	------	------	37S: FRONT YARD SLOPE
18	Manual	259.81	1	721	568,069	----	------	------	19R: 6-19 TO 6-21
19	Reach	7.29	1	724	22,682	15	------	------	41R: A-9 TO A-8
20	Combine	8.55	1	716	31,133	14, 19	------	------	30S + 41R
21	Reach	8.62	1	717	31,133	20	------	------	40R: A-8 TO A-7
22	Combine	21.69	1	716	60,711	13, 21	------	------	29S + 40R
23	Reach	21.75	1	716	60,711	22	------	------	39R: A-7 TO A-6
24	Combine	23.77	1	717	67,091	12, 23	------	------	28S + 39R
25	Reach	24.03	1	717	67,092	24	------	------	30R: A-6 TO A-5
26	Combine	26.05	1	717	71,701	11, 25	------	------	27S + 30R
27	Reach	26.33	1	718	71,701	26	------	------	29R: A-5 TO A-4
28	Combine	32.76	1	718	91,508	10, 27	------	------	26S + 29R
29	Reach	32.86	1	719	91,507	28	------	------	28R: A-4 TO A-3
30	Combine	34.77	1	717	97,053	6, 29	------	------	22S + 28R

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Reach	34.78	1	718	97,053	30	------	------	26R: A-3 TO A-2
32	Reach	35.66	1	718	97,054	31	------	------	22R: A-2 TO A-1
33	Reach	5.09	1	716	8,811	17	------	------	42R: DRIVEWAY CULVERT
34	Combine	10.01	1	716	17,623	17, 33	------	------	37S + 42R
35	Reach	9.70	1	717	17,622	34	------	------	43R: PAVED DITCH PG-2
36	Reach	2.62	1	716	5,546	6	------	------	27R: PAVED FLUME PG-4
37	Combine	61.96	1	718	167,749	9, 32, 35, 36	------	------	25S + 22R + 27R + 43R
38	Reach	62.57	1	719	167,756	37	------	------	25R: 6-25 TO 6-24
39	Combine	85.02	1	719	254,382	8, 38	------	------	24S + 25R
40	Reach	85.81	1	720	254,386	39	------	------	24R: 6-24 TO 6-23
41	Combine	99.91	1	720	295,358	7, 40	------	------	23S + 24R
42	Reach	100.53	1	721	295,386	41	------	------	23R: 6-23 TO 6-20
43	Combine	137.77	1	723	413,201	3, 42	------	------	14S + 23R
44	Reach	206.54	1	734	425,025	43	------	------	20R: 6-20 TO 6-21
45	Combine	396.86	1	721	993,093	18, 44	------	------	19R + 20R
46	Reach	614.61	1	730	1,029,304	45	------	------	21R: 6-21 TO 6-22
47	Combine	655.20	1	730	1,182,034	4, 46	------	------	20S + 21R
49	Reservoir	144.23	1	737	1,172,945	47	35.29	864,235	POND 1P: EXISTING BMP

Reservoir Hydrographs

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Tuesday, Mar 20 2007, 8:38 AM

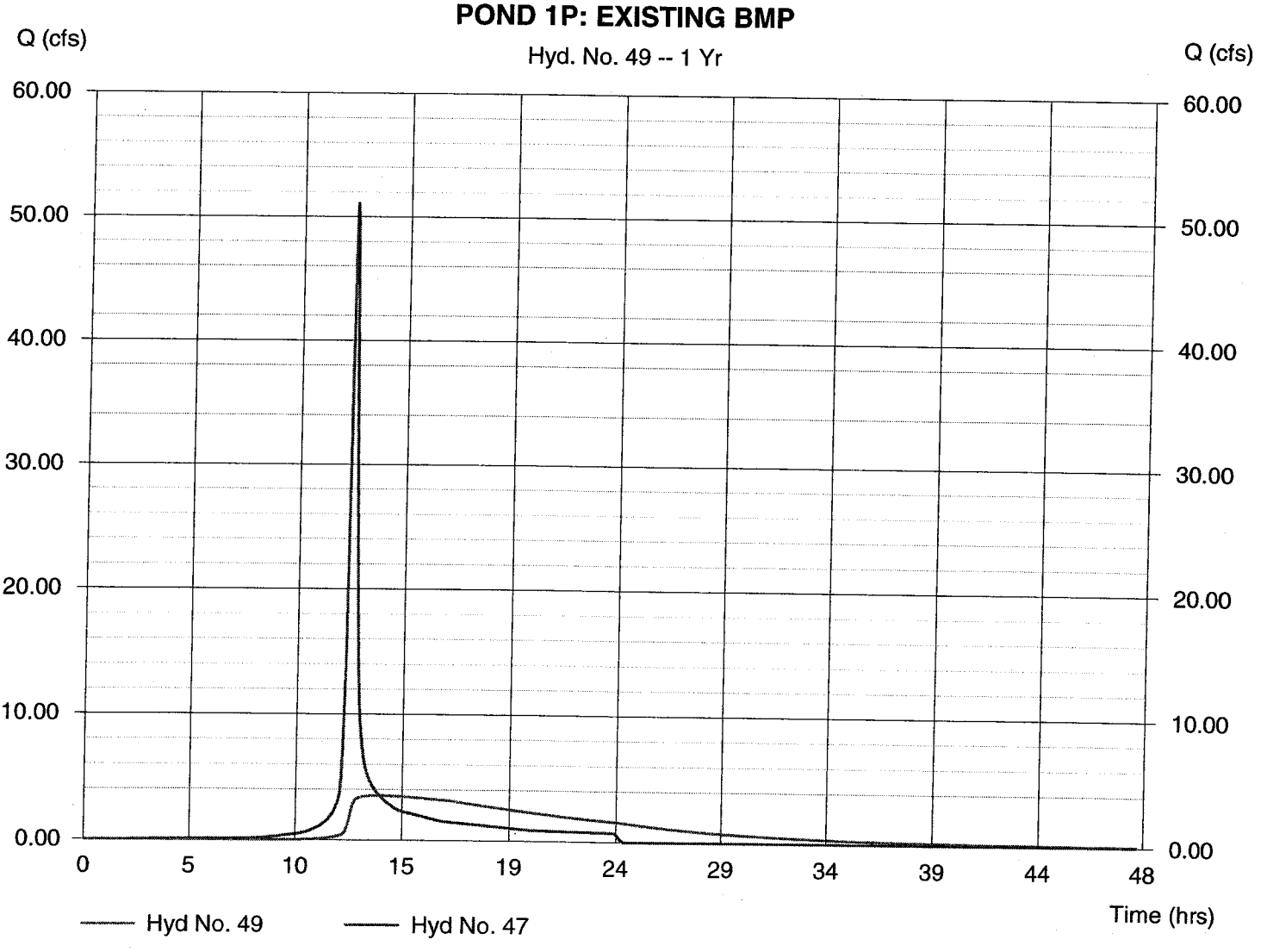
Hyd. No. 49

POND 1P: EXISTING BMP

Hydrograph type	= Reservoir	Peak discharge	= 3.53 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hyd. No.	= 47	Max. Elevation	= 26.41 ft
Reservoir name	= POND 1P: EXISTING BMP	Max. Storage	= 289,978 cuft

Storage Indication method used. Wet pond routing start elevation = 25.00 ft.

Hydrograph Volume = 155,021 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Tuesday, Mar 20 2007, 8:38 AM

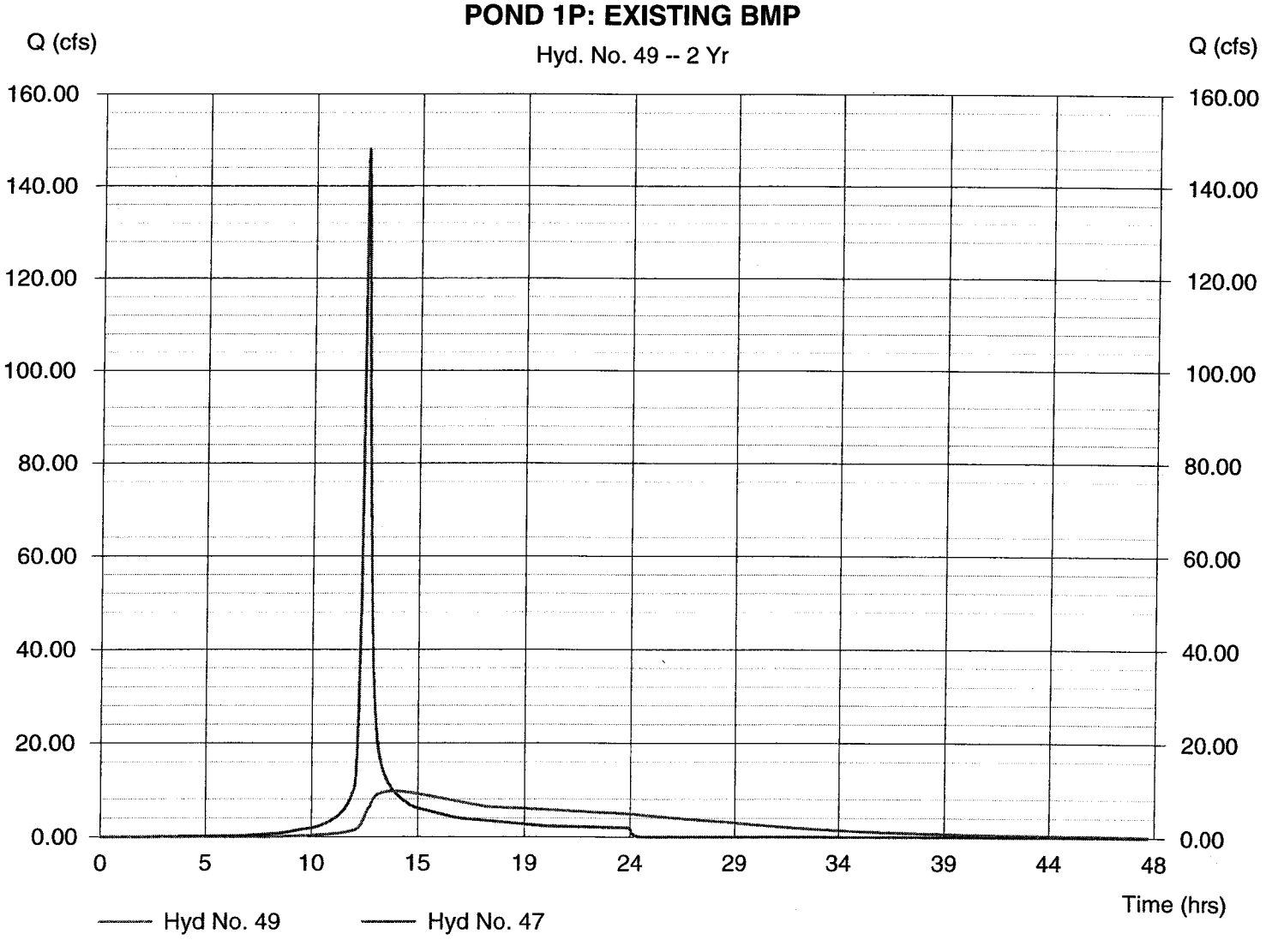
Hyd. No. 49

POND 1P: EXISTING BMP

Hydrograph type	= Reservoir	Peak discharge	= 9.74 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyd. No.	= 47	Max. Elevation	= 29.08 ft
Reservoir name	= POND 1P: EXISTING BMP	Max. Storage	= 462,208 cuft

Storage Indication method used. Wet pond routing start elevation = 25.00 ft.

Hydrograph Volume = 444,682 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Tuesday, Mar 20 2007, 8:38 AM

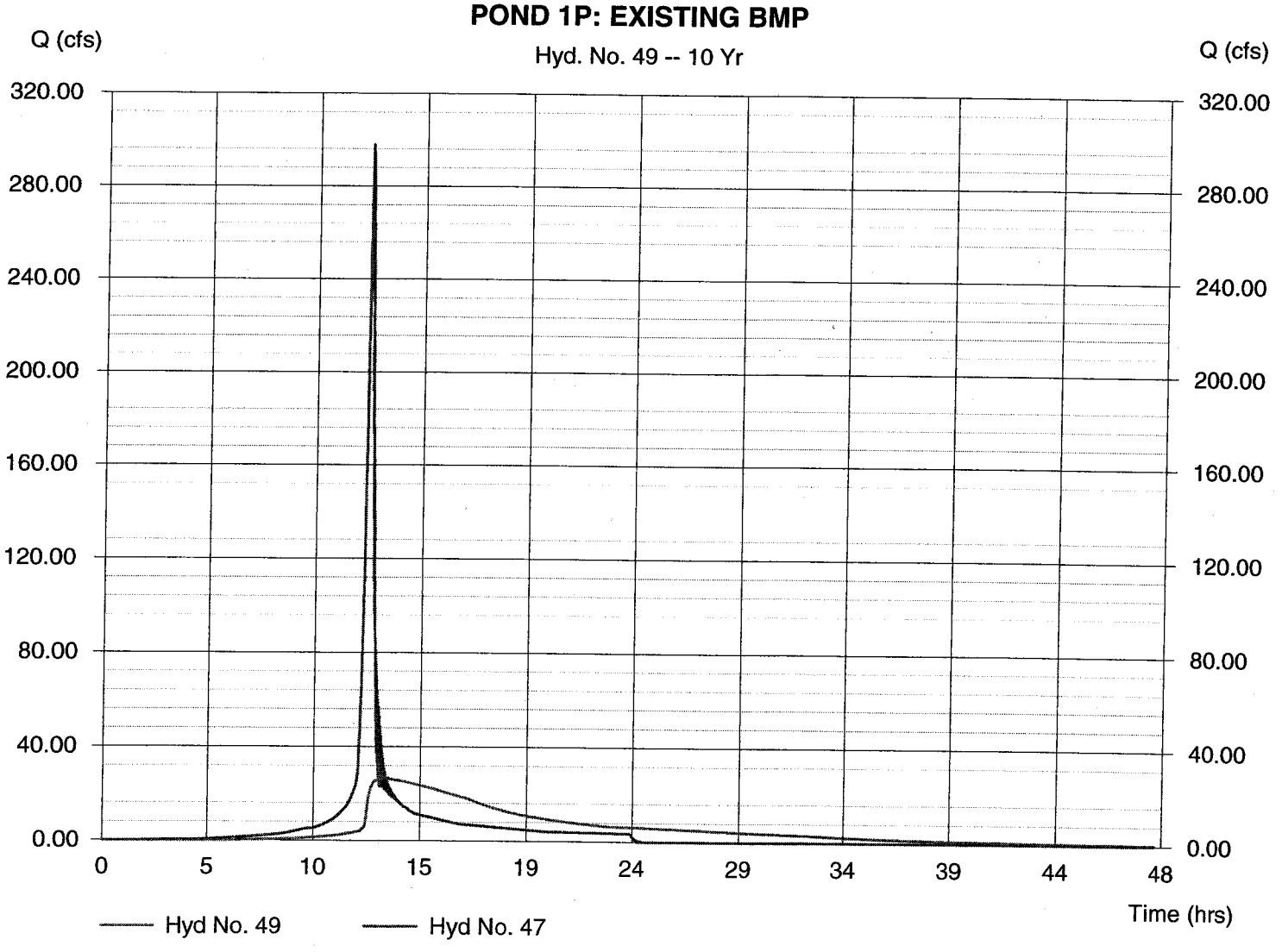
Hyd. No. 49

POND 1P: EXISTING BMP

Hydrograph type	= Reservoir	Peak discharge	= 26.83 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyd. No.	= 47	Max. Elevation	= 32.80 ft
Reservoir name	= POND 1P: EXISTING BMP	Max. Storage	= 702,974 cuft

Storage Indication method used. Wet pond routing start elevation = 25.00 ft.

Hydrograph Volume = 884,851 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Tuesday, Mar 20 2007, 8:38 AM

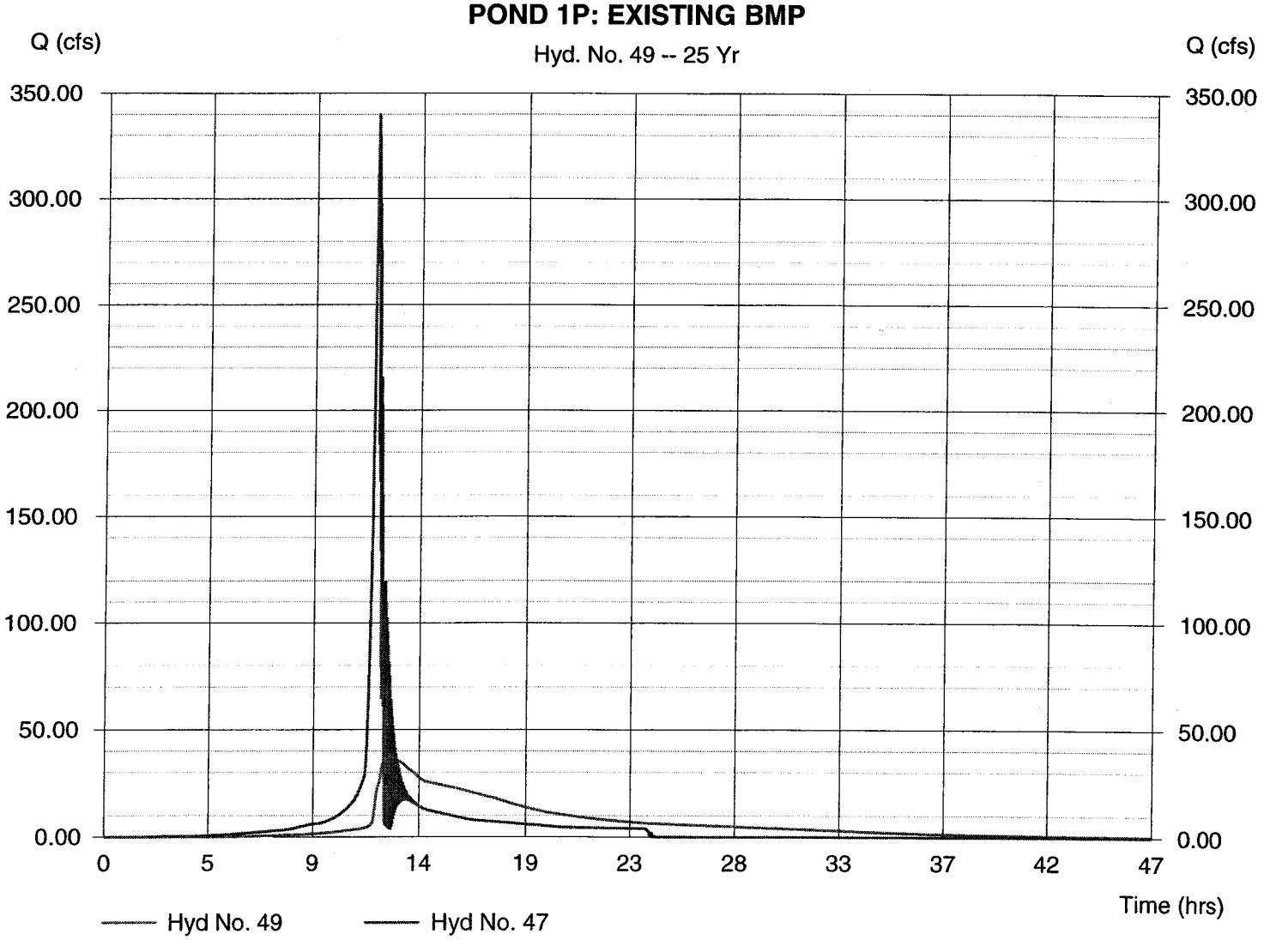
Hyd. No. 49

POND 1P: EXISTING BMP

Hydrograph type	= Reservoir	Peak discharge	= 37.55 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyd. No.	= 47	Max. Elevation	= 33.73 ft
Reservoir name	= POND 1P: EXISTING BMP	Max. Storage	= 763,271 cuft

Storage Indication method used. Wet pond routing start elevation = 25.00 ft.

Hydrograph Volume = 1,005,886 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Tuesday, Mar 20 2007, 8:38 AM

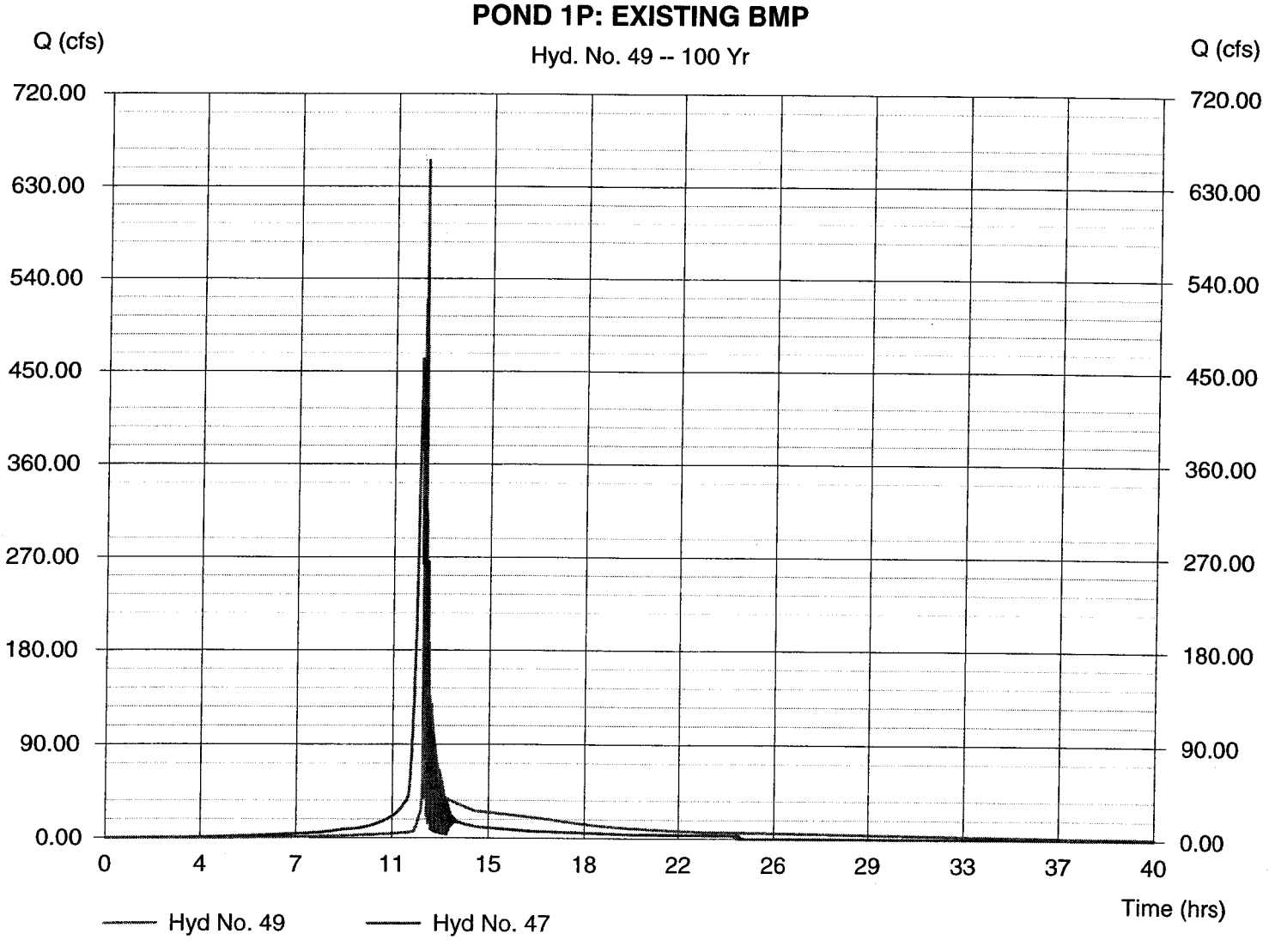
Hyd. No. 49

POND 1P: EXISTING BMP

Hydrograph type	= Reservoir	Peak discharge	= 144.23 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 47	Max. Elevation	= 35.29 ft
Reservoir name	= POND 1P: EXISTING BMP	Max. Storage	= 864,235 cuft

Storage Indication method used. Wet pond routing start elevation = 25.00 ft.

Hydrograph Volume = 1,172,945 cuft



Pond Report

Pond Report

Hydraflow Hydrographs by Intelisolve — Tuesday, Mar 20 2007, 8:39 AM

Pond No. 1 - POND 1P: EXISTING BMP

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	18.00	21,217	0	0
2.00	20.00	25,046	46,263	46,263
4.00	22.00	29,209	54,255	100,518
6.00	24.00	33,705	62,914	163,432
7.00	25.00	41,012	37,359	200,791
7.10	25.10	46,500	4,376	205,166
18.00	36.00	82,812	704,750	909,917

Culvert / Orifice Structures

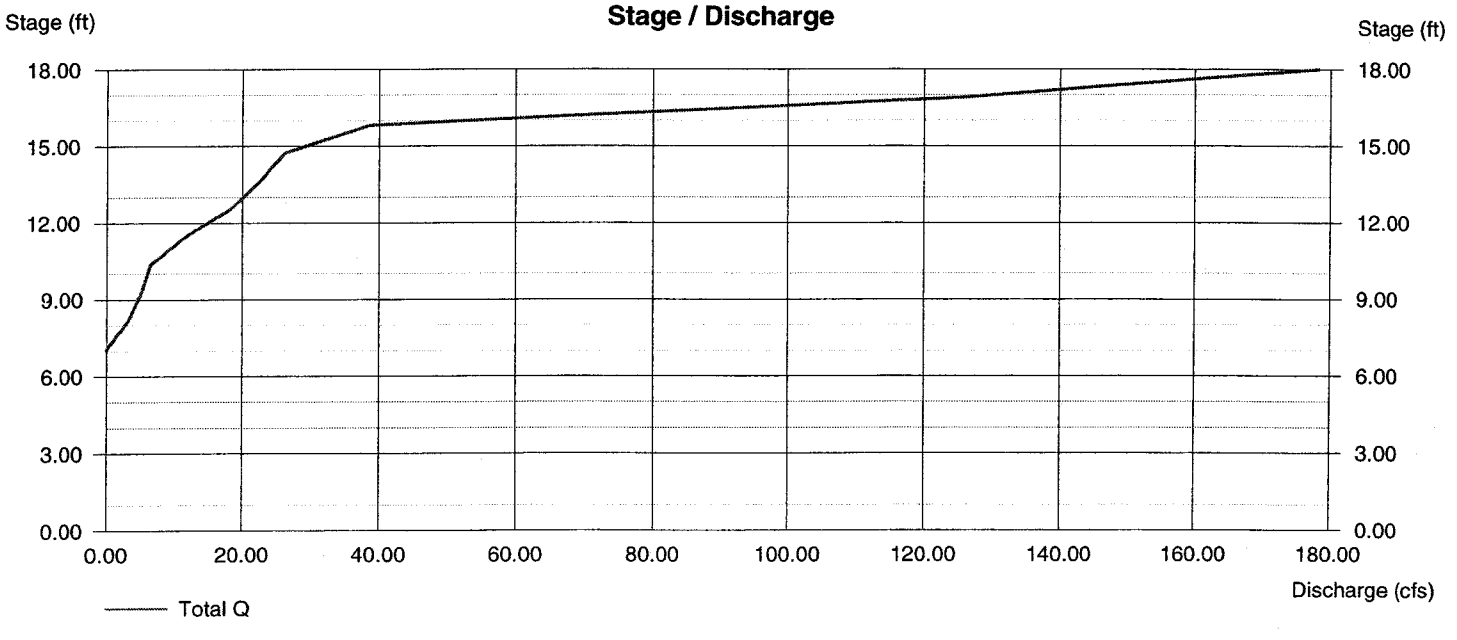
	[A]	[B]	[C]	[D]
Rise (in)	= 36.00	12.00	18.00	0.00
Span (in)	= 36.00	12.00	18.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 18.50	25.00	28.50	0.00
Length (ft)	= 106.00	1.00	1.00	0.00
Slope (%)	= 2.08	1.00	1.00	0.00
N-Value	= .013	.013	.013	.013
Orif. Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.71	6.00	0.00	0.00
Crest El. (ft)	= 33.50	34.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	0.00
Weir Type	= Riser	Broad	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



JAMES RIVER COMMERCE CENTER
SHELL BUILDING

CALCULATIONS

Prepared for:

James City County
Industrial Development Authority

Roberts District
James City County, Virginia

Project # 2002138-000.01

April 18, 2003

COMMONWEALTH OF VIRGINIA
RICHARD S. PHILLIPS
No. 23631
PROFESSIONAL ENGINEER

LANDMARK
DESIGN GROUP

Engineers • Planners • Surveyors
Landscape Architects • Environmental Consultants

Drainage & Hydraulic Grade Line Calculations

STORM SEWER DESIGN / RATIONAL METHOD 10 YEAR RETURN PERIOD James City Co. James River Commerce Center - Shell Building 2002138-000.01

Concrete Pipe,"n" = 0.013 Capacity @ 100% Full Depth

VDOT L&D 229		Area Drained	Run-off Coeff.	"C x A		Inlet Time	Time of Conc.	Rainfall Intensity	RUNOFF	INVERT ELEVATIONS		LENGTH	SLOPE	DIAM	CAPACITY	VELOCITY	TRAVEL"t"	REMARKS
FROM PT.	TO PT.	"Acres"	"C"	INCR.	ACCUM	"t"	"tc"	"I"	"QRational"	UPPER END	LOWER END	ft.	ft/ft	inch	cfs	fps	min.	
(1)	(2)	(3)	(4)	(5)	(6)	*	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	
Rear Yard Future Condition	A-9	0.98	0.80	0.78	0.78	17.10	17.10	4.9	3.83									
Structure A-9	A-8								3.83	49.10	48.10	200	0.0050	15	4.57	3.72	0.90	TOP EL. 53.00
Loading Dock Area Future	A-8	0.32	0.90	0.29	1.07	0.67	17.99	4.8	5.11									
Structure A-8	A-7								5.11	48.00	47.70	60	0.0050	21	11.20	4.66	0.21	TOP EL. 50.75
Roof Rear Drain System	A-7	1.12	0.90	1.01	2.08	1.77	18.21	4.7	9.87									
MH-1 @ A-7	A-6								9.87	47.60	46.90	140	0.0050	21	11.20	4.66	0.50	TOP EL. 54.50
Rear yard	A-6	0.40	0.70	0.28	2.36	7.32	18.71	4.7	11.05									
DI @ A-6	A-5								11.05	46.80	45.66	228	0.0050	21	11.20	4.66	0.82	TOP EL. 54.00
Side Yard Future Driveway	A-5	0.21	0.80	0.17	2.53	3.06	19.53	4.6	11.60									
DI @ A-5	A-4								11.60	45.56	44.60	191	0.0050	24	16.04	5.11	0.62	TOP EL. 49.50
Roof Front System	A-4	0.75	0.90	0.68	3.20	1.18	20.15	4.5	14.47									
Mh-1 @ A-4	A-3								14.47	44.00	43.67	66	0.0050	24	16.00	5.09	0.22	TOP EL. 51.50
Front Parking Lot	A-3	0.21	0.90	0.19	3.39	2.45	20.37	4.5	15.25									
Inlet A-3	A-2								15.25	43.50	42.75	150	0.0050	24	16.00	5.09	0.49	TOP EL. 50.23
MH-1 @ A-2	A-1								15.25	42.00	37.00	98	0.0510	24	51.10	16.27	0.10	TOP EL. 54.00
		3.99																
Passenger Dropoff Area	C-1	0.23	0.90	0.21	0.21	1.28	5.00	7.2	1.49									
PG-2 at Curb Opening	A-1								1.49	52.63	40.39	77	0.1590	na				
outheast Corner Front Yard	C-2	0.29	0.70	0.20	0.20	0.69	5.00	7.2	1.44									
C-2 Driveway Culvert	PG-2								1.44	41.45	41.25	40	0.0050	15	4.57	3.72	0.18	
Front Yard Slope	A-1@ 6-25	0.58	0.70	0.41	0.41	1.00	5.00	7.2	2.92									
Inlet 6-25 a.k.a. A-1	6-25								21.11	36.86	34.97	189	0.0100	30	41.02	8.36	0.38	
		5.09																
Ball Metal By-pass																		
Ball Metal Site	BM-4	24.61	0.80	19.69	19.69	46.00	46.00	2.8	54.53									
Shell Side Slope	BM-4	0.22	0.70	0.15	19.84	2.00	46.00	2.8	54.96									
Inlet BM-4	BM-3								54.96	45.03	43.02	287	0.0070	42	84.20	8.75	0.55	TOP EL. 53.50
Inlet BM-3	BM-2								54.96	42.92	40.91	287	0.0070	42	84.20	8.75	0.55	TOP EL. 57.50
Shell Side Slope	BM-2	0.24	0.70	0.17	20.01	1.00	47.09	2.7	54.54									
Inlet BM-2	BM-1								54.54	40.81	38.24	367	0.0070	42	84.19	8.75	0.70	TOP EL. 48.50
Junction Box	BM-0								54.54	37.50	35.50	94	0.0213	30	59.83	12.19	0.13	One of two pipes / TOP 51.10

HYDRAULIC GRADELINE CALCULATION — **James River Commerce Center - Shell Building**

INLET STATION	Outlet Wate	D_o	Q_o	L_o	n_o	S_{fo} / S_o		H_f	V_o	H_o	Q_i	V_i	Q_i x V_i	V^2/ 2g	H_i	Δ	H_{delta}	H_t	.3 x H_t	0.5 x H_t	H Adjusted	Inlet Water Surface Elevation	Rim Elevation
	FRICTION LOSS IN PIPE												JUNCTION LOSS										
1	2.00	3	4	5	5A	6		7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Ball Metal By-pass																							
Junction Box	**37.50**	30	54.55	100	0.013	0.02		1.769	13.42	0.70	54.55	9.31	507.85	1.35	0.47	90	0.94	2.11	0.63	-1.06	3.46	40.96	1 of 2 pipes/ Top 51.10
Inlet BM-2	**40.96**	42	54.55	367	0.013	0.00		1.079	9.31	0.34	54.55	9.31	507.85	1.35	0.47	80	0.89	1.70	0.51	-0.85	2.44	43.39	EL. 48.50
Inlet BM-3	**43.39**	42	54.52	287	0.013	0.00		0.843	9.31	0.34	54.52	9.32	508.15	1.35	0.47	80	0.89	1.70	0.51	-0.85	2.20	45.60	EL. 57.50
Inlet BM-4	**45.60**	42	54.79	287	0.013	0.00		0.851	9.32	0.34	54.79	9.32	510.68	1.35	0.47	90	0.94	1.75	0.53	-0.88	2.25	47.85	EL. 53.50
Shell building Site																							
Inlet 6-25 a.k.a. A-1	**36.23**	30	20.74	189	0.013	0.00		0.483	8.38	0.27	14.88	12.73	189.40	2.52	0.88	30	0.70	1.86	0.56	-0.93	1.97	38.20	40.50
MH-1 @ A-2	**38.20**	24	14.88	130	0.013	0.00		0.562	12.73	0.63	14.88	5.78	86.00	0.52	0.18	45	0.20	1.01	0.30	-0.50	1.37	39.57	54.00
Inlet A-3	**39.57**	24	14.88	120	0.013	0.00		0.519	5.78	0.13	14.10	5.75	81.09	0.51	0.18	60	0.28	0.59	0.18	-0.30	0.99	40.56	50.23
Mh-1 @ A-4	**40.56**	24	14.10	66	0.013	0.00		0.257	5.75	0.13	11.23	5.51	61.85	0.47	0.17	60	0.26	0.55	0.17	-0.28	0.70	41.26	51.50
DI @ A-5	**41.26**	24	11.23	191	0.013	0.00		0.47	5.51	0.12	11.04	5.31	58.65	0.44	0.15	90	0.31	0.58	0.17	-0.29	0.93	42.19	49.50
DI @ A-6	**42.19**	21	11.04	228	0.013	0.00		1.108	5.31	0.11	9.86	5.25	51.76	0.43	0.15	90	0.30	0.56	0.17	-0.28	1.55	43.75	54.00
MH-1 @ A-7	**43.75**	21	9.86	140	0.013	0.00		0.542	5.25	0.11	5.11	4.53	23.16	0.32	0.11	0	0.00	0.22	0.07	-0.11	0.72	44.46	54.50
Structure A-8	**44.46**	18	4.55	60	0.013	0.00		0.113	4.53	0.08	3.83	4.17	15.96	0.27	0.09	0	0.00	0.17	0.05	-0.09	0.25	44.72	Rim elev. 50.75
Structure A-9	**44.72**	15	3.83	200	0.013	0.00		0.702	4.17	0.07	0.00	0	0.00	0.00	0.00	0	0.00	0.07	0.02	-0.03	0.76	45.47	Rim elev. 53.00

B.M.P. Calculation

James City County
VIRGINIA
Jamestown 1607

CERTIFICATE OF AUTHENTICITY

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

BMP NUMBER: **JR038**

DATE VERIFIED: **June 14, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Subject SHELL BUILDING

Computed RSP Checked

LANDMARK DESIGN GROUP

Project #

Client

Date 4/15/03 Sheet #

Engineers • Planners • Surveyors • Landscape Architects • Environmental Scientists

POND VOLUME REQUIRED AT FULL BUILD OUT

A B WET POND 2 IN/IMP. ACRE

@ 50% IMPERVIOUS

$$V = .5 \times 62.32 \times \frac{2}{12} \times 43560 = 226222 \text{ ft.}$$

AVAILABLE IN EXISTING POND AT EL. 25.4

CURRENT UTILIZATION CASE 2.

$$62.32 - 17.24 = 45.08 \text{ ACRES}$$

$$V = .5 \times 45.08 \times \frac{2}{12} \times 43560 = 163640 \text{ ft.}$$

PERMANENT POOL EXISTING: 200,000 + ft^3

Table 2

Worksheet for BMP Point System

A. STRUCTURAL BMP POINT ALLOCATION

JAMES RIVER COMMERCE CENTER

BMP	BMP Points		Fraction of Site Served by BMP		Weighted BMP Points
A.3 #1	10	x	62.32/136.4	=	4.57
		x		=	
BALL METAL	4	x	23.3/136.4	=	0.68
		x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 5.25

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
35.1/219.2 x 100	x	0.1 (0.1 per 1%)	=	1.60
RPA: 46.9/219.2 x 100	x	0.15 (0.15 per 1%)	=	3.21

TOTAL NATURAL OPEN SPACE CREDIT: 4.81

C. TOTAL WEIGHTED POINTS

5.25	+	4.81	=	10.06
Structural BMP Points		Natural Open Space Points		Total

Pond 1P: Existing BMP

[63] Warning: Exceeded Reach 21R inflow depth by 3.84' @ 13.32 hrs

Inflow Area =	55.200 ac,	Inflow Depth =	4.27"		
Inflow =	221.17 cfs @	12.07 hrs,	Volume=	19.638 af	
Outflow =	22.94 cfs @	13.04 hrs,	Volume=	19.264 af,	Atten= 90%, Lag= 58.0 min
Primary =	22.94 cfs @	13.04 hrs,	Volume=	19.264 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 32.75' Surf.Area= 71,990 sf Storage= 699,884 cf (499,094 cf above starting storage)
Plug-Flow detention time= 711.1 min calculated for 14.651 af (75% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166 ← W.S.E. "As-Built" Drawings
36.00	82,812	704,750	909,917

Primary OutFlow Max=22.85 cfs @ 13.04 hrs HW=32.75' (Free Discharge)
└─**4=Culvert** (Passes 22.85 cfs of 121.54 cfs capacity)
  ├─**1=Orifice/Grate** (Controls 10.18 cfs)
  ├─**2=Orifice/Grate** (Controls 8.70 cfs)
  └─**3=Orifice/Grate** (Controls 3.97 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	32.57'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	33.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Stormwater Model Calculations

James River Commerce Center
Hydrologic Analysis

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Introduction:

The following analysis has been done using the HydroCAD Stormwater Modeling System. Its computational method is based upon the procedures developed by the Soils Conservation Service (SCS) and presented in technical releases TR-20 and TR-55.

The calculations presented with the original plans in 1996 were based upon the TR -55 Tabular method. The SCS unit hydrograph procedure used in HydroCAD is less limited and more precise. The "existing conditions" presented are calculated using the pertinent data of the original calculations to provide a basis of comparison. Three cases of post development conditions have been calculated to show the impact of progressive stages of development. Case 1 is a model of the 1996 Post development condition. Case 2 considers the current status of the development and that more than 25% is not yet sold or committed to development. Case 3 demonstrates that adequate channel protection can be maintained by relatively minor changes in the outlet riser. ,The channel adequacy results are tabulated below:

SUMMARY OF FLOW, DEPTH AND VELOCITY DOWN STREAM OF BMP

Storm Frequency	Pre Development			Case 1 Post Devlopment 1996			Case 2 Post Devlopment Shell Building / Partial Build-out			Case 3 Post Devlopment Shell Building Full Build-out / Modified BMP		
	Q cfs	V fps	d ft.	Q cfs	V fps	d ft.	Q cfs	V fps	d ft.	Q cfs	V fps	d ft.
One Year	6.92	2.10	0.52	5.71	1.90	0.49	5.27	1.90	0.45	6.25	2.00	0.45
Two Year	11.68	2.60	0.63	7.10	2.10	0.53	6.73	2.10	0.52	7.69	2.20	0.54
Ten Year	30.10	3.21	1.03	22.94	3.10	1.03	19.83	3.00	0.81	21.63	3.00	0.85
100 Year	49.39	3.40	1.45	150.49	4.30	2.33	158.45	4.30	2.40	165.41	4.40	2.46

Subcatchment 100S: Predeveloped DA to BMP Location

Runoff = 6.92 cfs @ 12.44 hrs, Volume= 0.947 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=2.80"

Area (ac)	CN	Description
14.500	74	Undeveloped Land

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	300	0.0200	0.2		**Sheet Flow, Filed** Range n= 0.130 P2= 3.50"
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Filed** Short Grass Pasture Kv= 7.0 fps
1.8	130	0.0600	1.2		**Shallow Concentrated Flow, Wooded Slope** Woodland Kv= 5.0 fps
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Field** Short Grass Pasture Kv= 7.0 fps
42.1	1,630	Total			

Reach 100R: Ravine channel below BMP

Inflow Area = 14.500 ac, Inflow Depth = 0.78"
Inflow = 6.92 cfs @ 12.44 hrs, Volume= 0.947 af
Outflow = 6.91 cfs @ 12.46 hrs, Volume= 0.947 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.1 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.52'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Subcatchment 100S: Predeveloped DA to BMP Location

Runoff = 11.68 cfs @ 12.40 hrs, Volume= 1.498 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=3.50"

Area (ac)	CN	Description
14.500	74	Undeveloped Land

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	300	0.0200	0.2		**Sheet Flow, Filed** Range n= 0.130 P2= 3.50"
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Filed** Short Grass Pasture Kv= 7.0 fps
1.8	130	0.0600	1.2		**Shallow Concentrated Flow, Wooded Slope** Woodland Kv= 5.0 fps
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Field** Short Grass Pasture Kv= 7.0 fps
42.1	1,630	Total			

Reach 100R: Ravine channel below BMP

Inflow Area = 14.500 ac, Inflow Depth = 1.24"
Inflow = 11.68 cfs @ 12.40 hrs, Volume= 1.498 af
Outflow = 11.66 cfs @ 12.43 hrs, Volume= 1.498 af, Atten= 0%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.6 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.63'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Subcatchment 100S: Predeveloped DA to BMP Location

Runoff = 30.10 cfs @ 12.40 hrs, Volume= 3.646 af, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=5.80"

Area (ac)	CN	Description
14.500	74	Undeveloped Land

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	300	0.0200	0.2		**Sheet Flow, Filed** Range n= 0.130 P2= 3.50"
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Filed** Short Grass Pasture Kv= 7.0 fps
1.8	130	0.0600	1.2		**Shallow Concentrated Flow, Wooded Slope** Woodland Kv= 5.0 fps
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Field** Short Grass Pasture Kv= 7.0 fps
42.1	1,630	Total			

Reach 100R: Ravine channel below BMP

Inflow Area = 14.500 ac, Inflow Depth = 3.02"
Inflow = 30.10 cfs @ 12.40 hrs, Volume= 3.646 af
Outflow = 30.06 cfs @ 12.41 hrs, Volume= 3.646 af, Atten= 0%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.2 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.0 min

Peak Depth= 1.03'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Subcatchment 100S: Predeveloped DA to BMP Location

Runoff = 49.44 cfs @ 12.39 hrs, Volume= 5.952 af, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=8.00"

Area (ac)	CN	Description
14.500	74	Undeveloped Land

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	300	0.0200	0.2		**Sheet Flow, Filed** Range n= 0.130 P2= 3.50"
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Filed** Short Grass Pasture Kv= 7.0 fps
1.8	130	0.0600	1.2		**Shallow Concentrated Flow, Wooded Slope** Woodland Kv= 5.0 fps
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Field** Short Grass Pasture Kv= 7.0 fps
42.1	1,630	Total			

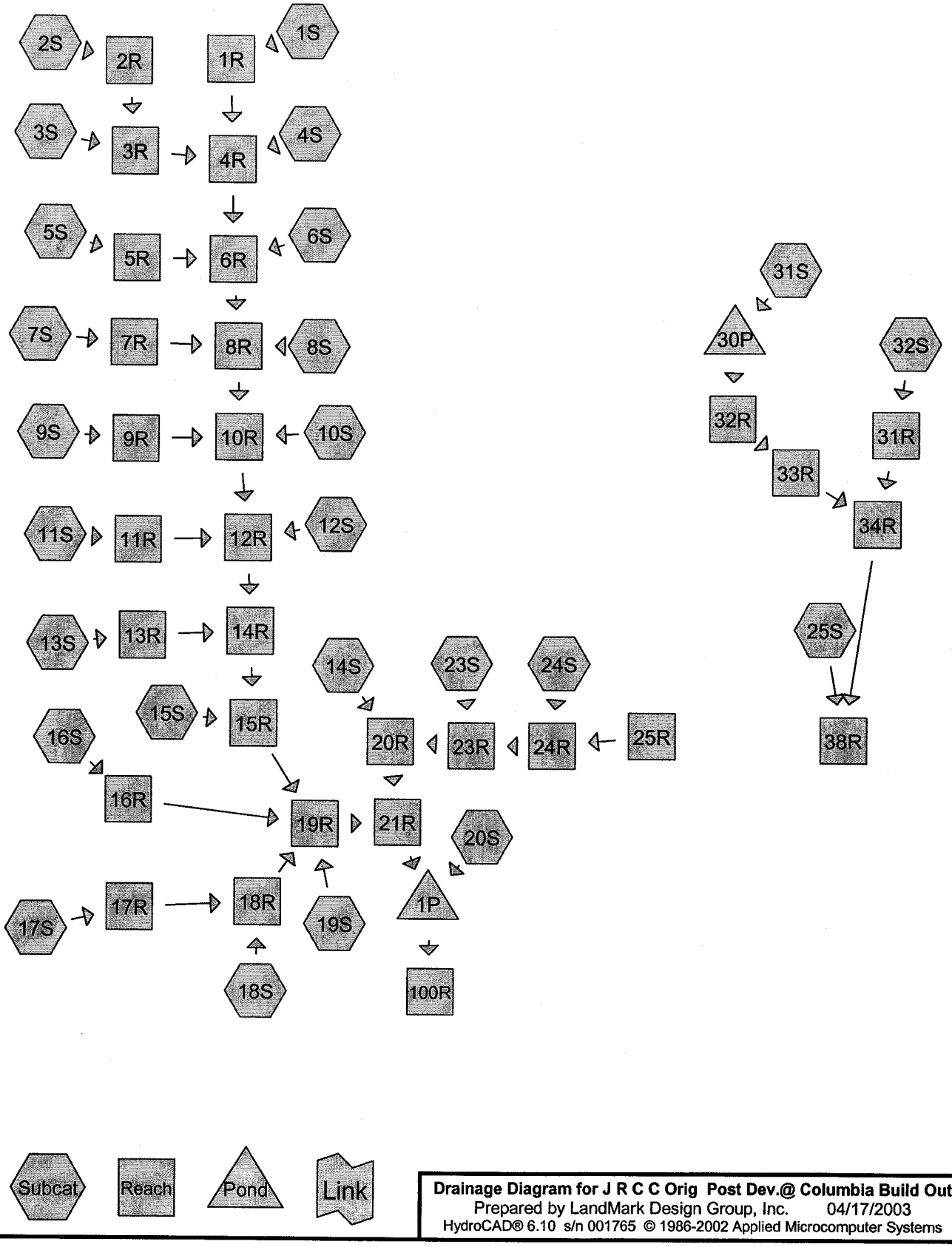
Reach 100R: Ravine channel below BMP

Inflow Area = 14.500 ac, Inflow Depth = 4.93"
Inflow = 49.44 cfs @ 12.39 hrs, Volume= 5.952 af
Outflow = 49.39 cfs @ 12.41 hrs, Volume= 5.952 af, Atten= 0%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.4 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.0 min

Peak Depth= 1.45'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45



Drainage Diagram for J R C C Orig Post Dev.@ Columbia Build Out
Prepared by LandMark Design Group, Inc. 04/17/2003
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Pond 1P: Existing BMP

Inflow Area =	55.200 ac,	Inflow Depth = 1.54"		
Inflow =	90.01 cfs @	12.04 hrs, Volume=	7.072 af	
Outflow =	5.71 cfs @	13.86 hrs, Volume=	6.867 af,	Atten= 94%, Lag= 108.9 min
Primary =	5.71 cfs @	13.86 hrs, Volume=	6.867 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 27.78' Surf.Area= 55,440 sf Storage= 378,675 cf (177,885 cf above starting storage)
Plug-Flow detention time= 1,030.2 min calculated for 2.257 af (32% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=5.71 cfs @ 13.86 hrs HW=27.78' (Free Discharge)
└─**4=Culvert** (Passes 5.71 cfs of 94.95 cfs capacity)
  ├─**1=Orifice/Grate** (Controls 5.71 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	32.57'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	33.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 55.200 ac, Inflow Depth = 1.49"
Inflow = 5.71 cfs @ 13.86 hrs, Volume= 6.867 af
Outflow = 5.71 cfs @ 13.89 hrs, Volume= 6.866 af, Atten= 0%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.9 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.49'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Pond 1P: Existing BMP

Inflow Area =	55.200 ac,	Inflow Depth = 2.15"		
Inflow =	126.37 cfs @	12.04 hrs,	Volume=	9.869 af
Outflow =	7.10 cfs @	14.00 hrs,	Volume=	9.618 af, Atten= 94%, Lag= 117.2 min
Primary =	7.10 cfs @	14.00 hrs,	Volume=	9.618 af
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 29.03' Surf.Area= 59,578 sf Storage= 458,992 cf (258,201 cf above starting storage)
Plug-Flow detention time= 918.3 min calculated for 5.007 af (51% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=7.10 cfs @ 14.00 hrs HW=29.03' (Free Discharge)
└─**4=Culvert** (Passes 7.10 cfs of 102.25 cfs capacity)
  ├─**1=Orifice/Grate** (Controls 7.10 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	32.57'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	33.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 55.200 ac, Inflow Depth = 2.09"
Inflow = 7.10 cfs @ 14.00 hrs, Volume= 9.618 af
Outflow = 7.10 cfs @ 14.02 hrs, Volume= 9.618 af, Atten= 0%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.1 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.53'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Type II 24-hr Rainfall=5.80"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=4.33"
Length=605' Tc=23.5 min CN=87 Runoff= 19.63 cfs 1.651 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=4.33"
Length=500' Tc=13.6 min CN=87 Runoff= 22.92 cfs 1.456 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=4.33"
Length=320' Tc=32.9 min CN=87 Runoff= 5.40 cfs 0.559 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=3.60"
Length=375' Tc=7.6 min CN=80 Runoff= 7.81 cfs 0.393 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=5.21"
Length=240' Tc=2.0 min CN=95 Runoff= 2.20 cfs 0.104 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=4.33"
Length=575' Tc=4.4 min CN=87 Runoff= 19.68 cfs 0.923 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=5.21"
Length=215' Tc=1.8 min CN=95 Runoff= 3.79 cfs 0.178 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=4.33"
Length=590' Tc=4.2 min CN=87 Runoff= 23.99 cfs 1.118 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=4.33"
Tc=5.0 min CN=87 Runoff= 14.77 cfs 0.707 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=4.33"
Length=545' Tc=24.8 min CN=87 Runoff= 17.86 cfs 1.550 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=4.33"
Length=500' Tc=12.7 min CN=87 Runoff= 17.65 cfs 1.089 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=4.33"
Length=350' Tc=2.9 min CN=87 Runoff= 9.04 cfs 0.404 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=4.33"
Length=700' Tc=14.3 min CN=87 Runoff= 16.79 cfs 1.089 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=4.33"
Length=570' Tc=18.3 min CN=87 Runoff= 25.13 cfs 1.835 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=5.21"
Tc=2.0 min CN=95 Runoff= 1.93 cfs 0.091 af

Subcatchment 16S: Lot 6-S Runoff Area=2.980 ac Runoff Depth=4.33"
Length=600' Tc=15.1 min CN=87 Runoff= 16.15 cfs 1.074 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=5.21"
Tc=5.0 min CN=95 Runoff= 10.97 cfs 0.569 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=5.21"
Tc=5.0 min CN=95 Runoff= 4.86 cfs 0.252 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=5.21"
Tc=2.0 min CN=95 Runoff= 8.17 cfs 0.387 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=3.60"
Tc=20.0 min CN=80 Runoff= 29.88 cfs 2.245 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=4.33"
Tc=10.0 min CN=87 Runoff= 11.17 cfs 0.631 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=4.33"
Tc=10.0 min CN=87 Runoff= 23.61 cfs 1.334 af

Reach 1R: 6-1 to 6-4 Peak Depth= 1.09' Max Vel= 9.5 fps Inflow= 19.63 cfs 1.651 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow= 19.62 cfs 1.651 af

Reach 2R: 6-2 to 6-3 Peak Depth= 1.21' Max Vel= 11.6 fps Inflow= 22.92 cfs 1.456 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow= 22.88 cfs 1.456 af

Reach 3R: 6-3 to 6-4 Peak Depth= 2.25' Max Vel= 6.0 fps Inflow= 26.24 cfs 2.015 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow= 21.87 cfs 2.015 af

Reach 4R: 6-4 to 6-6 Peak Depth= 1.60' Max Vel= 12.8 fps Inflow= 42.41 cfs 4.059 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow= 42.40 cfs 4.059 af

Reach 5R: 6-5 to 6-6 Peak Depth= 0.36' Max Vel= 7.5 fps Inflow= 2.20 cfs 0.104 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow= 2.20 cfs 0.104 af

Reach 6R: 6-6 to 6-8 Peak Depth= 2.51' Max Vel= 8.8 fps Inflow= 55.69 cfs 5.087 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow= 55.51 cfs 5.087 af

Reach 7R: 6-7 to 6-8 Peak Depth= 0.48' Max Vel= 8.8 fps Inflow= 3.79 cfs 0.178 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow= 3.78 cfs 0.178 af

Reach 8R: 6-8 to 6-10 Peak Depth= 3.00' Max Vel= 10.9 fps Inflow= 78.39 cfs 6.382 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow= 70.92 cfs 6.382 af

Reach 9R: 6-9 to 6-10 Peak Depth= 2.00' Max Vel= 3.6 fps Inflow= 14.77 cfs 0.707 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow= 9.91 cfs 0.707 af

Reach 10R: 6-10 to 6-12 Peak Depth= 1.78' Max Vel= 19.0 fps Inflow= 93.11 cfs 8.639 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow= 93.23 cfs 8.639 af

Reach 11R: 6-11 to 6-12 Peak Depth= 2.00' Max Vel= 4.6 fps Inflow= 17.65 cfs 1.089 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow= 13.24 cfs 1.089 af

Reach 12R: 6-12 to 6-14 Peak Depth= 1.88' Max Vel= 18.8 fps Inflow= 109.46 cfs 10.132 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow= 108.98 cfs 10.132 af

Reach 13R: 6-13 to 6-14 Peak Depth= 2.00' Max Vel= 4.9 fps Inflow= 16.79 cfs 1.089 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow= 13.86 cfs 1.089 af

Reach 14R: 6-14 to 6-15 Peak Depth= 2.55' Max Vel= 14.3 fps Inflow= 121.02 cfs 11.220 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow= 120.75 cfs 11.220 af

Reach 15R: 6-15 to 6-19 Peak Depth= 2.68' Max Vel= 13.6 fps Inflow= 122.05 cfs 11.312 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow= 121.78 cfs 11.312 af

Reach 16R: 6-16 to 6-19 Peak Depth= 2.00' Max Vel= 4.9 fps Inflow= 16.15 cfs 1.074 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow= 14.46 cfs 1.074 af

Reach 17R: 6-17 to 6-18 Peak Depth= 1.50' Max Vel= 3.7 fps Inflow= 10.97 cfs 0.569 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow= 5.89 cfs 0.569 af

Reach 18R: 6-18 to 6-19 Peak Depth= 1.64' Max Vel= 3.8 fps Inflow= 10.53 cfs 0.821 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow= 10.49 cfs 0.821 af

Reach 19R: 6-19 to 6-21 Peak Depth= 4.50' Max Vel= 9.7 fps Inflow= 149.64 cfs 13.594 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow= 144.47 cfs 13.594 af

Reach 20R: 6-20 to 6-21 Peak Depth= 2.32' Max Vel= 8.5 fps Inflow= 57.74 cfs 3.800 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow= 57.69 cfs 3.800 af

Reach 21R: 6-21 to 6-22 Peak Depth= 2.36' Max Vel= 22.9 fps Inflow= 193.50 cfs 17.393 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow= 193.44 cfs 17.393 af

Reach 23R: 6-23 to 6-20 Peak Depth= 1.64' Max Vel= 8.7 fps Inflow= 34.60 cfs 1.965 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow= 34.49 cfs 1.965 af

Reach 24R: 6-24 to 6-23 Peak Depth= 1.44' Max Vel= 7.0 fps Inflow= 23.61 cfs 1.334 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow= 23.53 cfs 1.334 af

Reach 25R: 6-25 to 6-24 Peak Depth= -36.86' Max Vel= 0.0 fps
D=30.0" n=0.013 L=189.0' S=0.0100 '/' Capacity=41.02 cfs Outflow= 0.00 cfs 0.000 af

Total Runoff Area = 55.200 ac Runoff Volume = 19.638 af Average Runoff Depth = 4.27"

Pond 1P: Existing BMP

Inflow Area =	55.200 ac,	Inflow Depth =	4.27"		
Inflow =	221.17 cfs @	12.07 hrs,	Volume=	19.638 af	
Outflow =	22.94 cfs @	13.04 hrs,	Volume=	19.264 af,	Atten= 90%, Lag= 58.0 min
Primary =	22.94 cfs @	13.04 hrs,	Volume=	19.264 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 32.75' Surf.Area= 71,990 sf Storage= 699,884 cf (499,094 cf above starting storage)
Plug-Flow detention time= 711.1 min calculated for 14.651 af (75% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=22.85 cfs @ 13.04 hrs HW=32.75' (Free Discharge)
└─**4=Culvert** (Passes 22.85 cfs of 121.54 cfs capacity)
  ├─**1=Orifice/Grate** (Controls 10.18 cfs)
  ├─**2=Orifice/Grate** (Controls 8.70 cfs)
  └─**3=Orifice/Grate** (Controls 3.97 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	32.57'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	33.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 55.200 ac, Inflow Depth = 4.19"
Inflow = 22.94 cfs @ 13.04 hrs, Volume= 19.264 af
Outflow = 22.94 cfs @ 13.06 hrs, Volume= 19.263 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.1 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 0.9 min

Peak Depth= 0.88'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Pond 1P: Existing BMP

Inflow Area =	55.200 ac,	Inflow Depth =	6.38"		
Inflow =	256.02 cfs @	12.12 hrs,	Volume=	29.353 af	
Outflow =	150.49 cfs @	12.61 hrs,	Volume=	28.935 af,	Atten= 41%, Lag= 29.6 min
Primary =	128.37 cfs @	12.61 hrs,	Volume=	28.110 af	
Secondary =	22.15 cfs @	12.61 hrs,	Volume=	0.826 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 34.23' Surf.Area= 76,908 sf Storage= 795,328 cf (594,538 cf above starting storage)
Plug-Flow detention time= 511.0 min calculated for 24.326 af (83% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=128.37 cfs @ 12.61 hrs HW=34.23' (Free Discharge)
└─**4=Culvert** (Controls 128.37 cfs)
  ├─**1=Orifice/Grate** (Passes < 11.17 cfs capacity)
  ├─**2=Orifice/Grate** (Passes < 11.28 cfs capacity)
  └─**3=Orifice/Grate** (Passes < 109.50 cfs capacity)

Secondary OutFlow Max=22.07 cfs @ 12.61 hrs HW=34.23' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 22.07 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	32.57'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	33.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 55.200 ac, Inflow Depth = 6.29"
Inflow = 150.49 cfs @ 12.61 hrs, Volume= 28.935 af
Outflow = 150.48 cfs @ 12.62 hrs, Volume= 28.934 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.3 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.2 fps, Avg. Travel Time= 0.9 min

Peak Depth= 2.33'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Type II 24-hr Rainfall=5.80"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 25S: Shell Building Site Runoff Area=8.040 ac Runoff Depth=4.33"
Tc=15.0 min CN=87 Runoff= 43.64 cfs 2.898 af

Subcatchment 31S: Ball Metal Expansion Runoff Area=23.300 ac Runoff Depth=4.76"
Tc=9.6 min CN=91 Runoff= 160.65 cfs 9.245 af

Subcatchment 32S: Ball Metal Original Site Runoff Area=1.310 ac Runoff Depth=3.11"
Tc=5.0 min CN=75 Runoff= 7.52 cfs 0.340 af

Reach 31R: Existing BM 5-1 Peak Depth= 0.41' Max Vel= 12.1 fps Inflow= 7.52 cfs 0.340 af
D=42.0" n=0.013 L=60.0' S=0.0687 '/' Capacity=263.64 cfs Outflow= 7.51 cfs 0.340 af

Reach 32R: Existing BM 3-2 Peak Depth= 2.00' Max Vel= 5.2 fps Inflow= 33.58 cfs 9.039 af
D=24.0" n=0.013 L=250.0' S=0.0040 '/' Capacity=14.31 cfs Outflow= 15.22 cfs 9.038 af

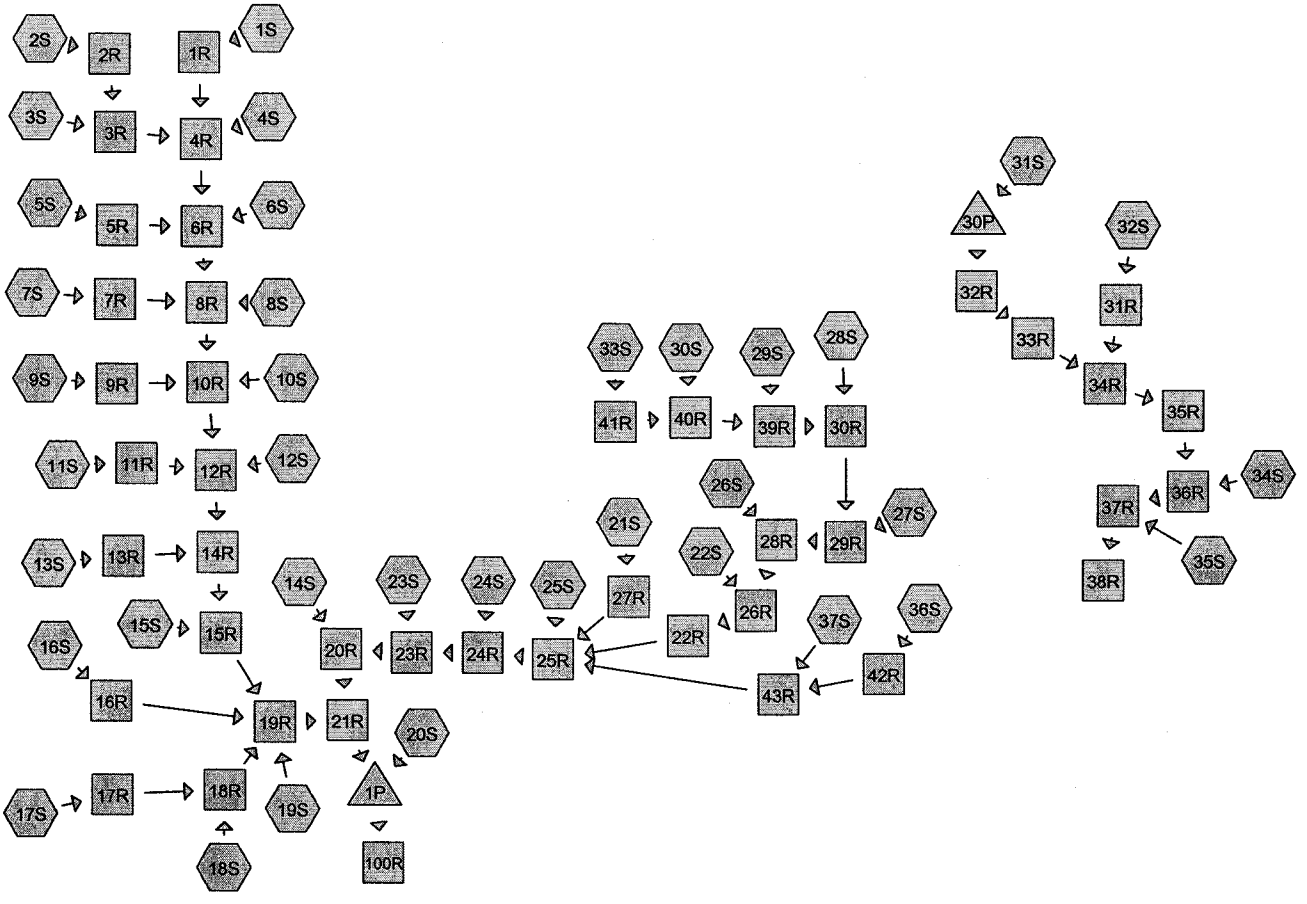
Reach 33R: Existing BM 2-1 Peak Depth= 1.71' Max Vel= 5.2 fps Inflow= 15.22 cfs 9.038 af
D=24.0" n=0.013 L=240.0' S=0.0040 '/' Capacity=14.31 cfs Outflow= 14.80 cfs 9.037 af

Reach 34R: Existing Ball Metal outfall Peak Depth= 1.08' Max Vel= 7.7 fps Inflow= 19.52 cfs 9.376 af
D=42.0" n=0.013 L=460.0' S=0.0086 '/' Capacity=93.35 cfs Outflow= 19.42 cfs 9.374 af

Reach 38R: Dual Pipe Peak Depth= 1.25' Max Vel= 12.8 fps Inflow= 62.60 cfs 12.273 af
D=30.0" n=0.012 L=100.0' S=0.0200 '/' Capacity=125.68 cfs Outflow= 62.58 cfs 12.273 af

Pond 30P: Ball Metal BMP Peak Storage= 207,181 cf @ 57.50' Inflow= 160.65 cfs 9.245 af
Primary= 33.58 cfs 9.039 af Outflow= 33.58 cfs 9.039 af

Total Runoff Area = 32.650 ac Runoff Volume = 12.484 af Average Runoff Depth = 4.59"



Subcat Reach Pond Link

Drainage Diagram for James River C C with Shell Bldg. 2003
Prepared by LandMark Design Group, Inc. 04/17/2003
HydroCAD® 6.10 s/n 001765 © 1986-2002 Applied Microcomputer Systems

Pond 1P: Existing BMP

Inflow Area =	62.320 ac,	Inflow Depth = 1.24"		
Inflow =	82.53 cfs @	12.03 hrs, Volume=	6.455 af	
Outflow =	5.27 cfs @	13.94 hrs, Volume=	6.259 af,	Atten= 94%, Lag= 114.4 min
Primary =	5.27 cfs @	13.94 hrs, Volume=	6.259 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 27.45' Surf.Area= 54,316 sf Storage= 356,853 cf (156,062 cf above starting storage)
Plug-Flow detention time= 1,111.1 min calculated for 1.649 af (26% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=5.28 cfs @ 13.94 hrs HW=27.45' (Free Discharge)
└─**4=Culvert** (Passes 5.28 cfs of 92.87 cfs capacity)
  ├─**1=Orifice/Grate** (Controls 5.28 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	32.57'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	33.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 62.320 ac, Inflow Depth = 1.21"
Inflow = 5.27 cfs @ 13.94 hrs, Volume= 6.259 af
Outflow = 5.27 cfs @ 13.97 hrs, Volume= 6.258 af, Atten= 0%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.9 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.45'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Pond 1P: Existing BMP

Inflow Area =	62.320 ac,	Inflow Depth =	1.79"		
Inflow =	119.73 cfs @	12.03 hrs,	Volume=	9.277 af	
Outflow =	6.73 cfs @	14.09 hrs,	Volume=	9.035 af,	Atten= 94%, Lag= 123.6 min
Primary =	6.73 cfs @	14.09 hrs,	Volume=	9.035 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 28.67' Surf.Area= 58,387 sf Storage= 435,862 cf (235,071 cf above starting storage)
Plug-Flow detention time= 937.1 min calculated for 4.426 af (48% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=6.73 cfs @ 14.09 hrs HW=28.67' (Free Discharge)
└─**4=Culvert** (Passes 6.73 cfs of 100.20 cfs capacity)
  ├─**1=Orifice/Grate** (Controls 6.73 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	32.57'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	33.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 62.320 ac, Inflow Depth = 1.74"
Inflow = 6.73 cfs @ 14.09 hrs, Volume= 9.035 af
Outflow = 6.73 cfs @ 14.12 hrs, Volume= 9.035 af, Atten= 0%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.1 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.52'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Type II 24-hr Rainfall=5.80"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=3.11"
Length=605' Tc=24.2 min CN=75 Runoff= 14.20 cfs 1.188 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=3.11"
Length=500' Tc=14.2 min CN=75 Runoff= 16.75 cfs 1.048 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=3.11"
Length=320' Tc=33.4 min CN=75 Runoff= 3.90 cfs 0.402 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=3.11"
Length=375' Tc=8.5 min CN=75 Runoff= 6.62 cfs 0.340 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=5.21"
Length=240' Tc=2.0 min CN=95 Runoff= 2.20 cfs 0.104 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=4.33"
Length=575' Tc=4.4 min CN=87 Runoff= 19.68 cfs 0.923 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=5.21"
Length=215' Tc=1.8 min CN=95 Runoff= 3.79 cfs 0.178 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=4.33"
Length=590' Tc=4.2 min CN=87 Runoff= 23.99 cfs 1.118 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=4.33"
Tc=5.0 min CN=87 Runoff= 14.77 cfs 0.707 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=4.33"
Length=545' Tc=24.8 min CN=87 Runoff= 17.86 cfs 1.550 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=3.11"
Length=500' Tc=13.4 min CN=75 Runoff= 12.85 cfs 0.783 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=4.33"
Length=350' Tc=2.9 min CN=87 Runoff= 9.04 cfs 0.404 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=3.11"
Length=700' Tc=15.5 min CN=75 Runoff= 12.00 cfs 0.783 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=3.11"
Length=570' Tc=18.5 min CN=75 Runoff= 18.44 cfs 1.320 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=5.21"
Tc=2.0 min CN=95 Runoff= 1.93 cfs 0.091 af

Subcatchment 16S: Lot 6-S & Lot 10A Runoff Area=2.980 ac Runoff Depth=4.33"
Length=600' Tc=15.1 min CN=87 Runoff= 16.15 cfs 1.074 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=5.21"
Tc=5.0 min CN=95 Runoff= 10.97 cfs 0.569 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=5.21"
Tc=5.0 min CN=95 Runoff= 4.86 cfs 0.252 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=5.21"
Tc=2.0 min CN=95 Runoff= 8.17 cfs 0.387 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=3.60"
Tc=20.0 min CN=80 Runoff= 29.88 cfs 2.245 af

Subcatchment 21S: Entry Circle Runoff Area=0.230 ac Runoff Depth=5.56"
Tc=1.3 min CN=98 Runoff= 2.19 cfs 0.107 af

Subcatchment 22S: Front Parking Lot Runoff Area=0.210 ac Runoff Depth=5.56"
Length=130' Tc=1.2 min CN=98 Runoff= 2.00 cfs 0.097 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=3.11"
Tc=10.0 min CN=75 Runoff= 8.38 cfs 0.454 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=3.11"
Tc=10.0 min CN=75 Runoff= 17.72 cfs 0.960 af

Subcatchment 25S: Remaining Shell Building Site Runoff Area=2.030 ac Runoff Depth=4.33"
Tc=10.0 min CN=87 Runoff= 12.95 cfs 0.732 af

Subcatchment 26S: Front Roof Runoff Area=0.750 ac Runoff Depth=5.56"
Length=267' Tc=1.8 min CN=98 Runoff= 7.06 cfs 0.348 af

Subcatchment 27S: Future dirive / Shoulder Runoff Area=0.210 ac Runoff Depth=4.33"
Length=54' Tc=1.7 min CN=87 Runoff= 1.76 cfs 0.076 af

Subcatchment 28S: Rear Yard / Future Drive Runoff Area=0.400 ac Runoff Depth=2.65"
Length=150' Tc=13.0 min CN=70 Runoff= 1.47 cfs 0.088 af

Subcatchment 29S: Rear Roof Runoff Area=1.120 ac Runoff Depth=5.56"
Length=333' Tc=2.6 min CN=98 Runoff= 10.29 cfs 0.519 af

Subcatchment 30S: Future Loading Dock Runoff Area=0.320 ac Runoff Depth=5.56"
Length=120' Tc=1.8 min CN=98 Runoff= 3.01 cfs 0.148 af

Subcatchment 33S: Rear Yard 50% future paved Runoff Area=0.980 ac Runoff Depth=4.33"
Length=150' Tc=17.1 min CN=87 Runoff= 4.99 cfs 0.353 af

Subcatchment 36S: SE Front Yard Runoff Area=0.290 ac Runoff Depth=2.65"
Length=100' Tc=2.3 min CN=70 Runoff= 1.58 cfs 0.064 af

Subcatchment 37S: Front Yard Slope Runoff Area=0.580 ac Runoff Depth=2.65"
Length=60' Tc=2.3 min CN=70 Runoff= 3.16 cfs 0.128 af

Reach 1R: 6-1 to 6-4 Peak Depth= 0.92' Max Vel= 8.7 fps Inflow= 14.20 cfs 1.188 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow= 14.17 cfs 1.188 af

Reach 2R: 6-2 to 6-3 Peak Depth= 0.99' Max Vel= 10.7 fps Inflow= 16.75 cfs 1.048 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow= 16.71 cfs 1.048 af

Reach 3R: 6-3 to 6-4 Peak Depth= 1.68' Max Vel= 6.0 fps Inflow= 19.04 cfs 1.450 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow= 19.02 cfs 1.450 af

Reach 4R: 6-4 to 6-6 Peak Depth= 1.39' Max Vel= 12.2 fps Inflow= 34.42 cfs 2.977 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow= 34.40 cfs 2.977 af

Reach 5R: 6-5 to 6-6 Peak Depth= 0.36' Max Vel= 7.5 fps Inflow= 2.20 cfs 0.104 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow= 2.20 cfs 0.104 af

Reach 6R: 6-6 to 6-8 Peak Depth= 2.02' Max Vel= 8.6 fps Inflow= 43.57 cfs 4.005 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow= 43.49 cfs 4.005 af

Reach 7R: 6-7 to 6-8 Peak Depth= 0.48' Max Vel= 8.8 fps Inflow= 3.79 cfs 0.178 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow= 3.78 cfs 0.178 af

Reach 8R: 6-8 to 6-10 Peak Depth= 2.45' Max Vel= 11.0 fps Inflow= 67.81 cfs 5.300 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow= 67.50 cfs 5.300 af

Reach 9R: 6-9 to 6-10 Peak Depth= 2.00' Max Vel= 3.6 fps Inflow= 14.77 cfs 0.707 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow= 9.91 cfs 0.707 af

Reach 10R: 6-10 to 6-12 Peak Depth= 1.70' Max Vel= 18.7 fps Inflow= 87.01 cfs 7.557 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow= 86.90 cfs 7.557 af

Reach 11R: 6-11 to 6-12 Peak Depth= 1.67' Max Vel= 4.6 fps Inflow= 12.85 cfs 0.783 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow= 12.83 cfs 0.783 af

Reach 12R: 6-12 to 6-14 Peak Depth= 1.82' Max Vel= 18.6 fps Inflow= 103.41 cfs 8.744 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow= 103.28 cfs 8.744 af

Reach 13R: 6-13 to 6-14 Peak Depth= 1.47' Max Vel= 4.8 fps Inflow= 12.00 cfs 0.783 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow= 11.99 cfs 0.783 af

Reach 14R: 6-14 to 6-15 Peak Depth= 2.44' Max Vel= 14.1 fps Inflow= 112.60 cfs 9.527 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow= 112.49 cfs 9.527 af

Reach 15R: 6-15 to 6-19 Peak Depth= 2.54' Max Vel= 13.4 fps Inflow= 113.23 cfs 9.619 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow= 113.13 cfs 9.619 af

Reach 16R: 6-16 to 6-19 Peak Depth= 2.00' Max Vel= 4.9 fps Inflow= 16.15 cfs 1.074 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow= 14.46 cfs 1.074 af

Reach 17R: 6-17 to 6-18 Peak Depth= 1.50' Max Vel= 3.7 fps Inflow= 10.97 cfs 0.569 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow= 5.89 cfs 0.569 af

Reach 18R: 6-18 to 6-19 Peak Depth= 1.64' Max Vel= 3.8 fps Inflow= 10.53 cfs 0.821 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow= 10.49 cfs 0.821 af

Reach 19R: 6-19 to 6-21 Peak Depth= 3.82' Max Vel= 9.7 fps Inflow= 140.01 cfs 11.901 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow= 139.60 cfs 11.901 af

Reach 20R: 6-20 to 6-21 Peak Depth= 2.94' Max Vel= 8.8 fps Inflow= 75.60 cfs 5.394 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow= 75.56 cfs 5.394 af

Reach 21R: 6-21 to 6-22 Peak Depth= 2.50' Max Vel= 23.5 fps Inflow= 213.04 cfs 17.294 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow= 212.92 cfs 17.294 af

Reach 22R: A-2 to A-1 Peak Depth= 0.79' Max Vel= 14.6 fps Inflow= 16.93 cfs 1.630 af
D=24.0" n=0.013 L=98.0' S=0.0510 '/' Capacity=51.10 cfs Outflow= 16.84 cfs 1.630 af

Reach 23R: 6-23 to 6-20 Peak Depth= 2.45' Max Vel= 9.6 fps Inflow= 59.53 cfs 4.074 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow= 59.33 cfs 4.074 af

Reach 24R: 6-24 to 6-23 Peak Depth= 2.51' Max Vel= 8.1 fps Inflow= 51.31 cfs 3.620 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow= 51.15 cfs 3.620 af

Reach 25R: 6-25 to 6-24 Peak Depth= 1.73' Max Vel= 9.3 fps Inflow= 33.87 cfs 2.660 af
D=30.0" n=0.013 L=189.0' S=0.0100 '/' Capacity=41.02 cfs Outflow= 33.82 cfs 2.660 af

Reach 26R: A-3 to A-2 Peak Depth= 2.00' Max Vel= 5.8 fps Inflow= 18.34 cfs 1.630 af
D=24.0" n=0.013 L=150.0' S=0.0050 '/' Capacity=16.00 cfs Outflow= 16.93 cfs 1.630 af

Reach 27R: Paved Flume PG-4 Peak Depth= 0.17' Max Vel= 11.2 fps Inflow= 2.19 cfs 0.107 af
n=0.015 L=65.0' S=0.1902 '/' Capacity=56.04 cfs Outflow= 2.19 cfs 0.107 af

Reach 28R: A-4 to A-3 Peak Depth= 2.00' Max Vel= 5.8 fps Inflow= 20.59 cfs 1.532 af
D=24.0" n=0.013 L=66.0' S=0.0050 '/' Capacity=16.00 cfs Outflow= 16.55 cfs 1.532 af

Reach 29R: A-5 to A-4 Peak Depth= 1.42' Max Vel= 5.7 fps Inflow= 13.72 cfs 1.185 af
D=24.0" n=0.013 L=191.0' S=0.0050 '/' Capacity=16.04 cfs Outflow= 13.68 cfs 1.185 af

Reach 30R: A-6 to A-5 Peak Depth= 1.75' Max Vel= 5.3 fps Inflow= 12.85 cfs 1.109 af
D=21.0" n=0.013 L=228.0' S=0.0050 '/' Capacity=11.20 cfs Outflow= 12.05 cfs 1.109 af

Reach 39R: A-7 to A-6 Peak Depth= 1.75' Max Vel= 5.3 fps Inflow= 15.53 cfs 1.021 af
D=21.0" n=0.013 L=140.0' S=0.0050 '/' Capacity=11.20 cfs Outflow= 11.84 cfs 1.021 af

Reach 40R: A-8 to A-7 Peak Depth= 0.85' Max Vel= 4.6 fps Inflow= 5.29 cfs 0.502 af
D=21.0" n=0.013 L=60.0' S=0.0050 '/' Capacity=11.20 cfs Outflow= 5.27 cfs 0.502 af

Reach 41R: A-9 to A-8 Peak Depth= 1.19' Max Vel= 4.2 fps Inflow= 4.99 cfs 0.353 af
D=15.0" n=0.013 L=200.0' S=0.0050 '/' Capacity=4.57 cfs Outflow= 4.91 cfs 0.353 af

Reach 42R: Driveway Culvert Peak Depth= 0.51' Max Vel= 3.4 fps Inflow= 1.58 cfs 0.064 af
D=15.0" n=0.013 L=40.0' S=0.0050 '/' Capacity=4.57 cfs Outflow= 1.57 cfs 0.064 af

Reach 43R: Paved Ditch PG-2 Peak Depth= 0.79' Max Vel= 3.3 fps Inflow= 4.72 cfs 0.192 af
n=0.015 L=292.0' S=0.0043 '/' Capacity=8.47 cfs Outflow= 4.50 cfs 0.192 af

Total Runoff Area = 62.320 ac Runoff Volume = 19.539 af Average Runoff Depth = 3.76"

Pond 1P: Existing BMP

Inflow Area =	62.320 ac,	Inflow Depth =	3.76"		
Inflow =	237.57 cfs @	12.04 hrs,	Volume=	19.539 af	
Outflow =	19.83 cfs @	13.27 hrs,	Volume=	19.158 af,	Atten= 92%, Lag= 73.6 min
Primary =	19.83 cfs @	13.27 hrs,	Volume=	19.158 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 32.63' Surf.Area= 71,594 sf Storage= 692,192 cf (491,401 cf above starting storage)
Plug-Flow detention time= 722.4 min calculated for 14.548 af (74% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=19.36 cfs @ 13.27 hrs HW=32.63' (Free Discharge)
└─**4=Culvert** (Passes 19.36 cfs of 120.97 cfs capacity)
  ├─**1=Orifice/Grate** (Controls 10.10 cfs)
  ├─**2=Orifice/Grate** (Controls 8.46 cfs)
  └─**3=Orifice/Grate** (Controls 0.80 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	32.57'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	33.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 62.320 ac, Inflow Depth = 3.69"
Inflow = 19.83 cfs @ 13.27 hrs, Volume= 19.158 af
Outflow = 19.83 cfs @ 13.29 hrs, Volume= 19.157 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.0 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 0.9 min

Peak Depth= 0.81'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Pond 1P: Existing BMP

Inflow Area =	62.320 ac,	Inflow Depth =	5.79"		
Inflow =	256.01 cfs @	12.12 hrs,	Volume=	30.055 af	
Outflow =	158.45 cfs @	12.52 hrs,	Volume=	29.626 af,	Atten= 38%, Lag= 24.3 min
Primary =	129.34 cfs @	12.52 hrs,	Volume=	28.702 af	
Secondary =	29.11 cfs @	12.52 hrs,	Volume=	0.924 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 34.44' Surf.Area= 77,617 sf Storage= 809,098 cf (608,307 cf above starting storage)
Plug-Flow detention time= 505.2 min calculated for 25.011 af (83% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=129.33 cfs @ 12.52 hrs HW=34.44' (Free Discharge)
└─**4=Culvert** (Controls 129.33 cfs)
  ├─**1=Orifice/Grate** (Passes < 11.31 cfs capacity)
  ├─**2=Orifice/Grate** (Passes < 11.60 cfs capacity)
  └─**3=Orifice/Grate** (Passes < 129.28 cfs capacity)

Secondary OutFlow Max=28.97 cfs @ 12.52 hrs HW=34.44' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 28.97 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	32.57'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	33.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 62.320 ac, Inflow Depth = 5.70"
Inflow = 158.45 cfs @ 12.52 hrs, Volume= 29.626 af
Outflow = 158.28 cfs @ 12.53 hrs, Volume= 29.625 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.3 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.2 fps, Avg. Travel Time= 0.9 min

Peak Depth= 2.40'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Pond 1P: Existing BMP/Modified

Inflow Area =	62.320 ac,	Inflow Depth = 1.56"		
Inflow =	99.47 cfs @	12.04 hrs, Volume=	8.119 af	
Outflow =	6.25 cfs @	13.94 hrs, Volume=	7.897 af,	Atten= 94%, Lag= 113.7 min
Primary =	6.25 cfs @	13.94 hrs, Volume=	7.897 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 28.23' Surf.Area= 56,921 sf Storage= 407,411 cf (206,620 cf above starting storage)
Plug-Flow detention time= 969.5 min calculated for 3.287 af (40% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=6.25 cfs @ 13.94 hrs HW=28.23' (Free Discharge)
└─**4=Culvert** (Passes 6.25 cfs of 97.63 cfs capacity)
  ├─**1=Orifice/Grate** (Controls 6.25 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	34.00'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	34.50'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 62.320 ac, Inflow Depth = 1.52"
Inflow = 6.25 cfs @ 13.94 hrs, Volume= 7.897 af
Outflow = 6.25 cfs @ 13.96 hrs, Volume= 7.897 af, Atten= 0%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.0 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.51'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Pond 1P: Existing BMP/Modified

Inflow Area =	62.320 ac,	Inflow Depth =	2.17"		
Inflow =	139.06 cfs @	12.04 hrs,	Volume=	11.277 af	
Outflow =	7.69 cfs @	14.09 hrs,	Volume=	11.000 af,	Atten= 94%, Lag= 122.9 min
Primary =	7.69 cfs @	14.09 hrs,	Volume=	11.000 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 29.64' Surf.Area= 61,621 sf Storage= 498,643 cf (297,853 cf above starting storage)
Plug-Flow detention time= 904.0 min calculated for 6.389 af (57% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=7.69 cfs @ 14.09 hrs HW=29.64' (Free Discharge)
└─**4=Culvert** (Passes 7.69 cfs of 105.67 cfs capacity)
  ├─**1=Orifice/Grate** (Controls 7.69 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	34.00'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	34.50'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 62.320 ac, Inflow Depth = 2.12"
Inflow = 7.69 cfs @ 14.09 hrs, Volume= 11.000 af
Outflow = 7.69 cfs @ 14.12 hrs, Volume= 11.000 af, Atten= 0%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.2 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.54'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Type II 24-hr Rainfall=5.80"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=4.33"
Length=605' Tc=23.5 min CN=87 Runoff= 19.63 cfs 1.651 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=4.33"
Length=500' Tc=13.6 min CN=87 Runoff= 22.92 cfs 1.456 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=4.33"
Length=320' Tc=32.9 min CN=87 Runoff= 5.40 cfs 0.559 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=3.60"
Length=375' Tc=7.6 min CN=80 Runoff= 7.81 cfs 0.393 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=5.21"
Length=240' Tc=2.0 min CN=95 Runoff= 2.20 cfs 0.104 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=4.33"
Length=575' Tc=4.4 min CN=87 Runoff= 19.68 cfs 0.923 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=5.21"
Length=215' Tc=1.8 min CN=95 Runoff= 3.79 cfs 0.178 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=4.33"
Length=590' Tc=4.2 min CN=87 Runoff= 23.99 cfs 1.118 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=4.33"
Tc=5.0 min CN=87 Runoff= 14.77 cfs 0.707 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=4.33"
Length=545' Tc=24.8 min CN=87 Runoff= 17.86 cfs 1.550 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=4.33"
Length=500' Tc=12.7 min CN=87 Runoff= 17.65 cfs 1.089 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=4.33"
Length=350' Tc=2.9 min CN=87 Runoff= 9.04 cfs 0.404 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=4.33"
Length=700' Tc=14.3 min CN=87 Runoff= 16.79 cfs 1.089 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=4.33"
Length=570' Tc=18.3 min CN=87 Runoff= 25.13 cfs 1.835 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=5.21"
Tc=2.0 min CN=95 Runoff= 1.93 cfs 0.091 af

Subcatchment 16S: Lot 6-S Runoff Area=2.980 ac Runoff Depth=4.33"
Length=600' Tc=15.1 min CN=87 Runoff= 16.15 cfs 1.074 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=5.21"
Tc=5.0 min CN=95 Runoff= 10.97 cfs 0.569 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=5.21"
Tc=5.0 min CN=95 Runoff= 4.86 cfs 0.252 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=5.21"
Tc=2.0 min CN=95 Runoff= 8.17 cfs 0.387 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=3.60"
Tc=20.0 min CN=80 Runoff= 29.88 cfs 2.245 af

Subcatchment 21S: Entry Circle Runoff Area=0.230 ac Runoff Depth=5.56"
Tc=1.3 min CN=98 Runoff= 2.19 cfs 0.107 af

Subcatchment 22S: Front Parking Lot Runoff Area=0.210 ac Runoff Depth=5.56"
Length=130' Tc=1.2 min CN=98 Runoff= 2.00 cfs 0.097 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=4.33"
Tc=15.0 min CN=87 Runoff= 9.50 cfs 0.631 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=4.33"
Tc=20.0 min CN=87 Runoff= 17.41 cfs 1.334 af

Subcatchment 25S: Shell Building Site Runoff Area=2.030 ac Runoff Depth=4.33"
Tc=15.0 min CN=87 Runoff= 11.02 cfs 0.732 af

Subcatchment 26S: Front Roof Runoff Area=0.750 ac Runoff Depth=5.56"
Length=267' Tc=1.8 min CN=98 Runoff= 7.06 cfs 0.348 af

Subcatchment 27S: Future dirive / Shoulder Runoff Area=0.210 ac Runoff Depth=4.33"
Length=54' Tc=1.7 min CN=87 Runoff= 1.76 cfs 0.076 af

Subcatchment 28S: Rear Yard / Future Drive Runoff Area=0.400 ac Runoff Depth=2.65"
Length=150' Tc=13.0 min CN=70 Runoff= 1.47 cfs 0.088 af

Subcatchment 29S: Rear Roof Runoff Area=1.120 ac Runoff Depth=5.56"
Length=333' Tc=2.6 min CN=98 Runoff= 10.29 cfs 0.519 af

Subcatchment 30S: Future Loading Dock Runoff Area=0.320 ac Runoff Depth=5.56"
Length=120' Tc=1.8 min CN=98 Runoff= 3.01 cfs 0.148 af

Subcatchment 33S: Rear Yard 50% future paved Runoff Area=0.980 ac Runoff Depth=4.33"
Length=150' Tc=17.1 min CN=87 Runoff= 4.99 cfs 0.353 af

Subcatchment 36S: SE Front Yard Runoff Area=0.290 ac Runoff Depth=2.65"
Length=100' Tc=2.3 min CN=70 Runoff= 1.58 cfs 0.064 af

Subcatchment 37S: Front Yard Slope Runoff Area=0.580 ac Runoff Depth=2.65"
Length=60' Tc=2.3 min CN=70 Runoff= 3.16 cfs 0.128 af

Reach 1R: 6-1 to 6-4 Peak Depth= 1.09' Max Vel= 9.5 fps Inflow= 19.63 cfs 1.651 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow= 19.62 cfs 1.651 af

Reach 2R: 6-2 to 6-3 Peak Depth= 1.21' Max Vel= 11.6 fps Inflow= 22.92 cfs 1.456 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow= 22.88 cfs 1.456 af

Reach 3R: 6-3 to 6-4 Peak Depth= 2.25' Max Vel= 6.0 fps Inflow= 26.24 cfs 2.015 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow= 21.87 cfs 2.015 af

Reach 4R: 6-4 to 6-6 Peak Depth= 1.60' Max Vel= 12.8 fps Inflow= 42.41 cfs 4.059 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow= 42.40 cfs 4.059 af

Reach 5R: 6-5 to 6-6 Peak Depth= 0.36' Max Vel= 7.5 fps Inflow= 2.20 cfs 0.104 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow= 2.20 cfs 0.104 af

Reach 6R: 6-6 to 6-8 Peak Depth= 2.51' Max Vel= 8.8 fps Inflow= 55.69 cfs 5.087 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow= 55.51 cfs 5.087 af

Reach 7R: 6-7 to 6-8 Peak Depth= 0.48' Max Vel= 8.8 fps Inflow= 3.79 cfs 0.178 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow= 3.78 cfs 0.178 af

Reach 8R: 6-8 to 6-10 Peak Depth= 3.00' Max Vel= 10.9 fps Inflow= 78.39 cfs 6.382 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow= 70.92 cfs 6.382 af

Reach 9R: 6-9 to 6-10 Peak Depth= 2.00' Max Vel= 3.6 fps Inflow= 14.77 cfs 0.707 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow= 9.91 cfs 0.707 af

Reach 10R: 6-10 to 6-12 Peak Depth= 1.78' Max Vel= 19.0 fps Inflow= 93.11 cfs 8.639 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow= 93.23 cfs 8.639 af

Reach 11R: 6-11 to 6-12 Peak Depth= 2.00' Max Vel= 4.6 fps Inflow= 17.65 cfs 1.089 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow= 13.24 cfs 1.089 af

Reach 12R: 6-12 to 6-14 Peak Depth= 1.88' Max Vel= 18.8 fps Inflow= 109.46 cfs 10.132 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow= 108.98 cfs 10.132 af

Reach 13R: 6-13 to 6-14 Peak Depth= 2.00' Max Vel= 4.9 fps Inflow= 16.79 cfs 1.089 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow= 13.86 cfs 1.089 af

Reach 14R: 6-14 to 6-15 Peak Depth= 2.55' Max Vel= 14.3 fps Inflow= 121.02 cfs 11.220 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow= 120.75 cfs 11.220 af

Reach 15R: 6-15 to 6-19 Peak Depth= 2.68' Max Vel= 13.6 fps Inflow= 122.05 cfs 11.312 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow= 121.78 cfs 11.312 af

Reach 16R: 6-16 to 6-19 Peak Depth= 2.00' Max Vel= 4.9 fps Inflow= 16.15 cfs 1.074 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow= 14.46 cfs 1.074 af

Reach 17R: 6-17 to 6-18 Peak Depth= 1.50' Max Vel= 3.7 fps Inflow= 10.97 cfs 0.569 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow= 5.89 cfs 0.569 af

Reach 18R: 6-18 to 6-19 Peak Depth= 1.64' Max Vel= 3.8 fps Inflow= 10.53 cfs 0.821 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow= 10.49 cfs 0.821 af

Reach 19R: 6-19 to 6-21 Peak Depth= 4.50' Max Vel= 9.7 fps Inflow= 149.64 cfs 13.594 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow= 144.47 cfs 13.594 af

Reach 20R: 6-20 to 6-21 Peak Depth= 3.50' Max Vel= 8.8 fps Inflow= 80.00 cfs 6.460 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow= 79.98 cfs 6.460 af

Reach 21R: 6-21 to 6-22 Peak Depth= 2.52' Max Vel= 23.5 fps Inflow= 215.79 cfs 20.053 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow= 215.47 cfs 20.053 af

Reach 22R: A-2 to A-1 Peak Depth= 0.79' Max Vel= 14.6 fps Inflow= 16.93 cfs 1.630 af
D=24.0" n=0.013 L=98.0' S=0.0510 '/' Capacity=51.10 cfs Outflow= 16.84 cfs 1.630 af

Reach 23R: 6-23 to 6-20 Peak Depth= 2.27' Max Vel= 9.6 fps Inflow= 54.93 cfs 4.625 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow= 54.87 cfs 4.625 af

Reach 24R: 6-24 to 6-23 Peak Depth= 2.24' Max Vel= 8.1 fps Inflow= 45.57 cfs 3.994 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow= 45.56 cfs 3.994 af

Reach 25R: 6-25 to 6-24 Peak Depth= 1.60' Max Vel= 9.1 fps Inflow= 30.37 cfs 2.660 af
D=30.0" n=0.013 L=189.0' S=0.0100 '/' Capacity=41.02 cfs Outflow= 30.34 cfs 2.660 af

Reach 26R: A-3 to A-2 Peak Depth= 2.00' Max Vel= 5.8 fps Inflow= 18.34 cfs 1.630 af
D=24.0" n=0.013 L=150.0' S=0.0050 '/' Capacity=16.00 cfs Outflow= 16.93 cfs 1.630 af

Reach 27R: Paved Flume PG-4 Peak Depth= 0.17' Max Vel= 11.2 fps Inflow= 2.19 cfs 0.107 af
n=0.015 L=65.0' S=0.1902 '/' Capacity=56.04 cfs Outflow= 2.19 cfs 0.107 af

Reach 28R: A-4 to A-3 Peak Depth= 2.00' Max Vel= 5.8 fps Inflow= 20.59 cfs 1.532 af
D=24.0" n=0.013 L=66.0' S=0.0050 '/' Capacity=16.00 cfs Outflow= 16.55 cfs 1.532 af

Reach 29R: A-5 to A-4 Peak Depth= 1.42' Max Vel= 5.7 fps Inflow= 13.72 cfs 1.185 af
D=24.0" n=0.013 L=191.0' S=0.0050 '/' Capacity=16.04 cfs Outflow= 13.68 cfs 1.185 af

Reach 30R: A-6 to A-5 Peak Depth= 1.75' Max Vel= 5.3 fps Inflow= 12.85 cfs 1.109 af
D=21.0" n=0.013 L=228.0' S=0.0050 '/' Capacity=11.20 cfs Outflow= 12.05 cfs 1.109 af

Reach 39R: A-7 to A-6 Peak Depth= 1.75' Max Vel= 5.3 fps Inflow= 15.53 cfs 1.021 af
D=21.0" n=0.013 L=140.0' S=0.0050 '/' Capacity=11.20 cfs Outflow= 11.84 cfs 1.021 af

Reach 40R: A-8 to A-7 Peak Depth= 0.85' Max Vel= 4.6 fps Inflow= 5.29 cfs 0.502 af
D=21.0" n=0.013 L=60.0' S=0.0050 '/' Capacity=11.20 cfs Outflow= 5.27 cfs 0.502 af

Reach 41R: A-9 to A-8 Peak Depth= 1.19' Max Vel= 4.2 fps Inflow= 4.99 cfs 0.353 af
D=15.0" n=0.013 L=200.0' S=0.0050 '/' Capacity=4.57 cfs Outflow= 4.91 cfs 0.353 af

Reach 42R: Driveway Culvert Peak Depth= 0.51' Max Vel= 3.4 fps Inflow= 1.58 cfs 0.064 af
D=15.0" n=0.013 L=40.0' S=0.0050 '/' Capacity=4.57 cfs Outflow= 1.57 cfs 0.064 af

Reach 43R: Paved Ditch PG-2 Peak Depth= 0.79' Max Vel= 3.3 fps Inflow= 4.72 cfs 0.192 af
n=0.015 L=292.0' S=0.0043 '/' Capacity=8.47 cfs Outflow= 4.50 cfs 0.192 af

Total Runoff Area = 62.320 ac Runoff Volume = 22.298 af Average Runoff Depth = 4.29"

Pond 1P: Existing BMP/Modified

Inflow Area =	62.320 ac,	Inflow Depth = 4.29"		
Inflow =	244.41 cfs @	12.09 hrs,	Volume=	22.298 af
Outflow =	21.63 cfs @	13.26 hrs,	Volume=	21.896 af, Atten= 91%, Lag= 70.3 min
Primary =	21.63 cfs @	13.26 hrs,	Volume=	21.896 af
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 33.86' Surf.Area= 75,693 sf Storage= 771,756 cf (570,965 cf above starting storage)
Plug-Flow detention time= 678.2 min calculated for 17.283 af (78% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=21.63 cfs @ 13.26 hrs HW=33.86' (Free Discharge)
└─**4=Culvert** (Passes 21.63 cfs of 126.72 cfs capacity)
  ├─**1=Orifice/Grate** (Controls 10.94 cfs)
  ├─**2=Orifice/Grate** (Controls 10.70 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	34.00'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	34.50'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 62.320 ac, Inflow Depth = 4.22"
Inflow = 21.63 cfs @ 13.26 hrs, Volume= 21.896 af
Outflow = 21.63 cfs @ 13.28 hrs, Volume= 21.895 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.0 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 0.9 min

Peak Depth= 0.85'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Pond 1P: Existing BMP/Modified

Inflow Area =	62.320 ac,	Inflow Depth =	6.40"		
Inflow =	256.01 cfs @	12.12 hrs,	Volume=	33.257 af	
Outflow =	165.51 cfs @	12.60 hrs,	Volume=	32.809 af,	Atten= 35%, Lag= 29.0 min
Primary =	135.94 cfs @	12.60 hrs,	Volume=	31.924 af	
Secondary =	29.57 cfs @	12.60 hrs,	Volume=	0.886 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 35.95' Surf.Area= 82,656 sf Storage= 906,892 cf (706,102 cf above starting storage)
Plug-Flow detention time= 496.1 min calculated for 28.194 af (85% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

Primary OutFlow Max=135.94 cfs @ 12.60 hrs HW=35.95' (Free Discharge)
└─**4=Culvert** (Controls 135.94 cfs)
  ├─**1=Orifice/Grate** (Passes < 12.23 cfs capacity)
  ├─**2=Orifice/Grate** (Passes < 13.69 cfs capacity)
  └─**3=Orifice/Grate** (Passes < 132.13 cfs capacity)

Secondary OutFlow Max=29.45 cfs @ 12.60 hrs HW=35.95' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 29.45 cfs)

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	34.00'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	34.50'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Reach 100R: Ravine channel below BMP

Inflow Area = 62.320 ac, Inflow Depth = 6.32"
Inflow = 165.51 cfs @ 12.60 hrs, Volume= 32.809 af
Outflow = 165.47 cfs @ 12.61 hrs, Volume= 32.809 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.4 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.2 fps, Avg. Travel Time= 0.9 min

Peak Depth= 2.46'
Capacity at bank full= 170.45 cfs
Inlet Invert= 17.00', Outlet Invert= 0.16'
Custom cross-section table, n= 0.150 Length= 117.0' Slope= 0.1439 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.82
1.50	15.0	17.2	1,755	51.46
2.50	39.0	31.1	4,563	170.45

Miscellaneous Calculations

ST-1 DRAINED AREA = 1.38 acres

WS / DS VOLUME REQD = 92 c.y.

	L_{TOP}	B_{TOP}	$AREA_{TOP}$	Z : 1	D_{EXC} / H_O	L_{BOTTOM}	B_{BOTTOM}	$AREA_{BTM}$	VOLUME PROVIDED trapezoid	VOLUME PROVIDED conic
WET STORAGE :	120	15	1800	2	3	108	3	324	118	107
					/					
DRY STORAGE :	135	30	4050	3	2.5	120	15	1800	271	264

WET STORAGE SURFACE / GRATE ELEV. : 38.50

BOTTOM ELEV. : 35.50

DRY STORAGE SURFACE ELEV. : 41.00

EMBANKMENT TOP ELEV. : 42.00

WEIR LENGTH REQD., L_{OUTLET} = 8 feet

H = 3.5 feet

W = 3.5 feet

SHELL SB-1 DRAINED AREA = 8.8 acres **WS / DS VOLUME REQD = 590 c.y.**

	L_{TOP}	B_{TOP}	$AREA_{TOP}$	Z : 1	D_{EXC} / H_O	L_{BOTTOM}	B_{BOTTOM}	$AREA_{BTM}$	VOLUME PROVIDED trapezoid	conic
WET STORAGE :	230	30	6900	2	3	218	18	3924	601	594
DRY STORAGE :	244.64	44.64	10921	4	/ 1.83	230	30	6900	604	599

WET STORAGE SURFACE ELEV. : 38.00 Q_{25} = 49.28 c.f.s.

BOTTOM ELEV. : 35.00 Diameter of Riser, D_R = 48 inches

DRY STORAGE SURFACE ELEV. : 39.83 Weir flow Head, h = 1.17 feet

EMBANKMENT TOP ELEV. : 43.00 w/o Emergency Spillway

42.00 with Emergency Spillway

ESTIMATED POND FULL DRAWDOWN

H_{AVG} = 0.91 Feet A_o = 0.16 sq. ft. d_o = 5.42 inches

Low Flow Orifice, $D_{ORIFICE}$ = 5 inches Yields T= 7.04 Hours

Selected Size, $D_{ORIFICE}$ = 4 inches Yields T= 11.00 Hours

0 0.917771

Natural Channel below BMP **JAmes River Commerce Park**

Station	Reach #	Elevation	O/S Left	O/S Right	d	W_{base}	A_{inc}	A_{accum}	P_W	R_h
150.00	Pond Out	16.5	0	0	0	0	0		0.00	
		17	5	3	0.5	8	3	3	8.07	0.33
Slope =	-0.01	18	9	8	1.5	17	13	15	17.22	0.88
		19	15	16	2.5	31	24	39	31.15	1.26

Erosion and Sediment Control Narrative

for

Volvo Rents
8907 Pocahontas Trail

February 20, 2006
Revised April 11, 2006

Project Number 05-918

LandTech Resources, Inc.
5810-F Mooretown Road, Williamsburg, VA
Phone 757-565-1677 **Fax 757-565-0782**

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PROJECT DESCRIPTION

The project consists of the construction of one sales/service retail building totaling 8,400 sf and 1.01 ac. Gravel storage yard at 8907 Pocahontas Trail (James River Commerce Center) in James City County, Virginia. The site is 5.67 acres with a total of 1.40 acres to be covered by impervious surfaces after construction is complete. The total disturbed area is approximately 2.6 acres.

EXISTING CONDITIONS

Currently the entire site is wooded and slopes from the front to rear at approximately 3%. The southwest corner of the site contains 100' RPA Buffer and slopes greater than 25%.

ADJACENT AREAS

The site is bounded on the north by Pocahontas Trail, on the west by the existing James River Elementary School, on the east by Endeavor Drive and on the south by a developed parcel in the James River Commerce Center.

OFF-SITE AREA

There are no off-site areas proposed to be disturbed in association with this project. However, if it becomes necessary to disturb off-site areas, a revised erosion and sediment control plan will be prepared and submitted to the county for review and approval.

SOILS

Slagle fine sandy loam (29B)

This soil is deep, gently sloping, and moderately well drained.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is light yellowish brown fine sandy loam 5 inches thick. The subsoil extends to a depth of 50 inches. It is mostly mottled yellowish brown clay loam to a depth of 25 inches. Below this depth, the subsoil is mostly mottled clay loam and sandy clay loam. The substratum is mottled sandy clay loam to a depth of at least 60 inches.

The permeability of this Slagle soil is moderate in the upper part of the subsoil and moderately slow to slow in the lower part. The erosion hazard is moderate and the subsoil has moderate shrink-swell potential.

CRITCAL EROSION AREAS

The critical erosion area associated with this site is the existing ravine and wetlands located along the southwestern portion of the site. To prevent sediment from contaminating this area, it is imperative that the contractor install all erosion and sediment control measures shown on these

plans before any land disturbing activities commence. Regular inspection and maintenance is also required for all erosion and sediment control measures to keep them functioning as designed.

EROSION AND SEDIMENT CONTROL MEASURES

Unless otherwise indicated, all structural and vegetative erosion and sediment control practices shall be constructed and maintained according to minimum standards and specifications of the latest edition of Virginia Erosion and Sediment Control Handbook (VESCH). The minimum standards shall be adhered to unless otherwise waived or approved by variance.

STRUCTURAL PRACTICES

Temporary Stone Construction Entrance – 3.02

A construction entrance shall be provided at all points of ingress and egress to reduce the amount of mud transported onto paved public roads by motor vehicles and runoff.

Silt Fence – 3.05

Silt fence shall be placed around the limits of clearing to intercept and detain small amounts of sediment from disturbed areas during construction operations.

Storm Drain Inlet Protection – 3.07

Storm drain protection is installed at all drainage inlets to prevent sediment from entering the storm drainage systems prior to permanent stabilization for the disturbed areas.

Culvert Inlet Protection – 3.08

Culvert inlet protection shall be installed at the inlet to storm sewer culverts as depicted on the plans.

Temporary Diversion Dike – 3.09

Temporary diversion dikes are to be installed along the perimeter of the disturbed area to divert sediment-laden runoff to the sediment trap.

Temporary Sediment Trap – 3.13

Temporary sediment traps will be installed to detain sediment-laden runoff from the disturbed site long enough to allow the majority of the sediment to settle out.

Rock Check Dam – 3.20

Rock check dams will be provided to reduce the velocity of concentrated stormwater flows, thereby reducing erosion of existing ditches.

Soil Stabilization Blankets and Matting – 3.36

Jute mesh shall be provided to aid in controlling erosion on the outfall ditches from the sediment traps by providing a microclimate which protects young vegetation and promotes its establishment.

Tree Preservation and Protection – 3.38

Tree preservation and protection shall be installed along the perimeter of the disturbed site to protect desirable trees from mechanical and other injury during land disturbing and construction activity.

Dust Control – 3.39

Dust control will be applied as depicted on the plans to prevent surface and air movement of dust from exposed soil surfaces and reduce the presence of airborne substances which may present health hazards, traffic safety problems or harm animal or plant life.

VEGETATIVE PRACTICES

Permanent Seeding – 3.32

All denuded areas, which will be left dormant for extended periods of time, shall be seeded with permanent vegetation immediately following grading. Selection of the seed mixture will depend on the time of year it is applied.

MANAGEMENT STRATEGIES

- Sediment trapping measures will be installed as the first step in grading and will be seeded and mulched immediately following installation.
- Temporary seeding or other stabilization will follow immediate after grading.
- The contractor shall be responsible for the installation and maintenance of all erosion and sediment control practices depicted on the Plans.
- After achieving adequate stabilization, the temporary controls will be cleaned and removed. Any areas disturbed in the removal process shall be graded, top soiled, and seeded accordingly.

PERMANENT STABILIZATION

All areas disturbed by construction shall be stabilized with permanent seeding immediately following finish grading. Seeding shall be accomplished with Kentucky 31 Tall Fescue

according to Standards and Specifications 3.32, Permanent Seeding of the VESCH. Soil stabilization blankets will be installed over slopes, which have been brought to final grade and have been seeded to protect the slopes from rill and gully erosion and to allow seed to germinate properly. Mulch (straw or fiber) will be used on relatively flat areas. In all seeding operations, seed, fertilizer and lime will be applied prior to mulching.

STORMWATER MANAGEMENT

This project is for the construction of one sales/service building totaling 8,400 sf and 1.01 ac. Gravel storage yard. The current site is wooded and contains 5.67 acres. After development the site will contain approximately 1.42 impervious acres. The proposed Volvo Rents site will drain to an existing off-site James City County BMP JR038, which was designed to meet the stormwater quality requirements of the James City County BMP Point System and the stormwater quantity requirements of Minimum Standard 19 of the Virginia Stormwater Management Handbook. The stormwater runoff from the proposed and future site development will be conveyed to the BMP via the existing storm sewer pipe system located in Endeavor Drive.

CALCULATIONS

Appendix A contains onsite drainage design.
Appendix B contains design calculations for the onsite sediment traps.

MAINTENANCE

In general, all erosion and sediment control measures will be checked daily and after each significant rainfall. The following items will be checked in particular:

Temporary Stone Construction Entrance – 3.02

The entrance shall be maintained in a condition, which will prevent tracking or flow of mud onto public rights-of-way. This may require periodic dressing with additional stone or the washing and reworking of existing stone as conditions demand. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately. The use of water trucks to remove materials dropped, washed, or tracked onto roadways will not be permitted under any circumstances.

Silt Fence – 3.05

Silt Fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.

Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting.

Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, the fabric shall be replaced promptly.

Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.

Any sediment deposits remaining in place after the silt fence is not longer required shall be dressed to conform with the existing grade, prepared and seeded.

Storm Drain Inlet Protection – 3.07

The structure shall be inspected after each rain and repairs made as needed.

Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to one-half the design depth of the trap. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

Structures shall be removed and the area stabilized when the remaining drainage area has been properly stabilized.

Culvert Inlet Protection – 3.08

The structure shall be inspected after each rain and repairs made as needed.

Aggregate shall be replaced or cleaned when inspection reveals that clogged voids are causing ponding, which interfere with on-site construction.

Sediment shall be removed and the impoundment restored to its original dimensions when sediment has accumulated to one-half the design depth. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode and cause sedimentation problems.

Temporary structures shall be removed when they have served their useful purpose but not before the upslope area has been permanently stabilized.

Temporary Diversion Dike – 3.09

The measure shall be inspected after every storm and repairs made to the dike, flow channel, outlet or sediment trapping facility, as necessary. Once every two weeks, whether a storm event has occurred or not, the measure shall be inspected and repairs made if needed. Damages caused by construction traffic or other activity must be repaired before the end of each working day.

Temporary Sediment Trap – 3.13

Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to one half the design volume of the wet storage. Sediment removal from the

basin shall be deposited in a suitable area and in a manner that it will not erode and cause sedimentation problems.

Filter stone shall be regularly checked to ensure that filtration performance is maintained. Stone choked with sediment shall be removed and cleaned or replaced.

The structure should be checked regularly to ensure that it is structurally sound and has not been damaged by erosion or construction equipment. The height of the stone outlet should be checked to ensure that its center is at least 1 foot below the top of the embankment.

Rock Check Dam – 3.20

Check dams shall be checked for sediment accumulation after each run-off producing storm event. Sediment shall be removed when it reaches one half of the original height of the measure.

Regular inspections shall be made to insure that the center of the dam is lower than the edges. Erosion caused by high flows around the edges of the dam shall be corrected immediately.

Permanent Seeding – 3.32

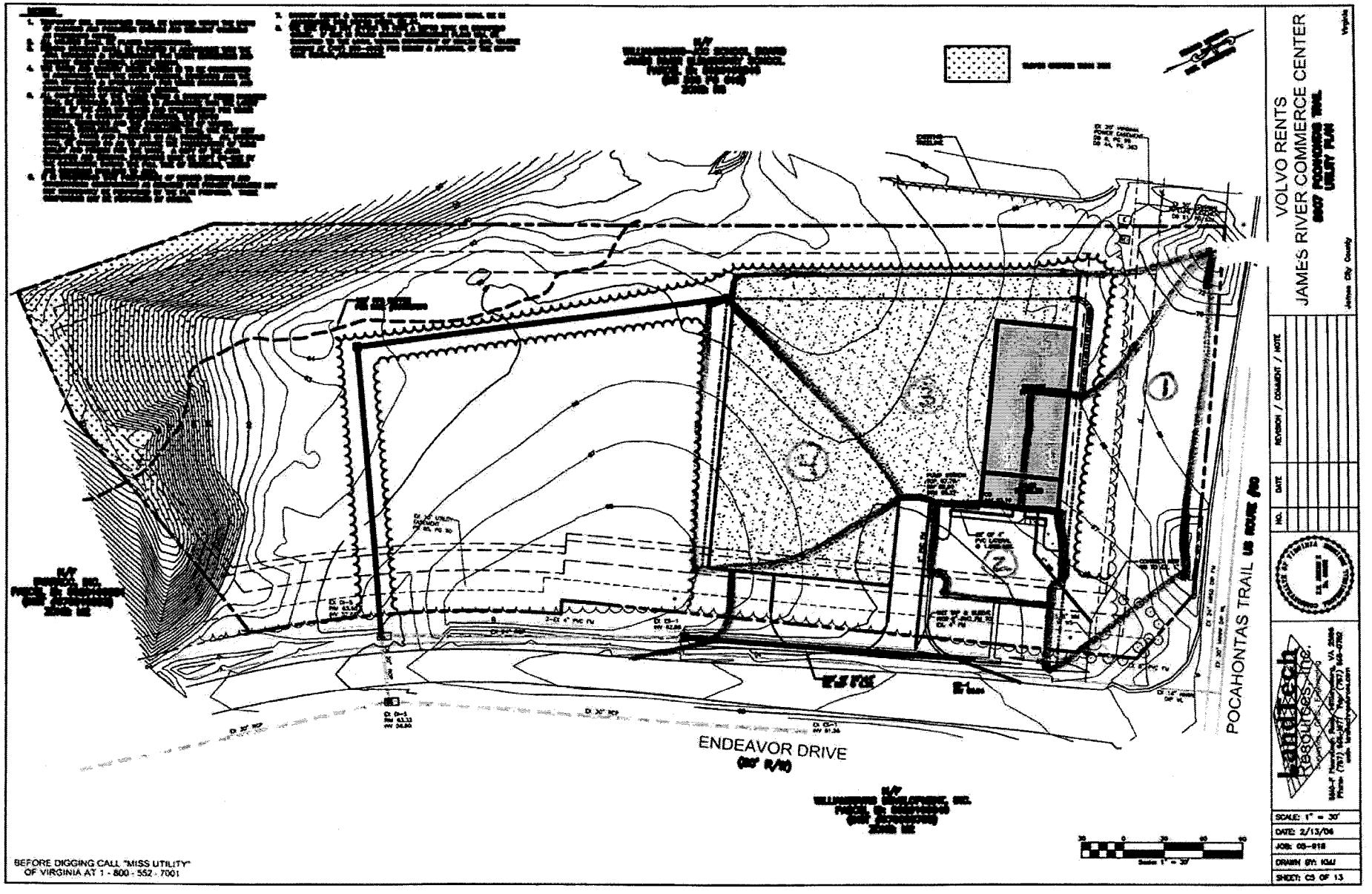
The seeded/mulched areas should be checked regularly to ensure that a good stand is established and maintained. Areas should be fertilized, mulched and re-seeded as needed. When it is clear that plants have not germinated on an area or have died, these areas must be re-seeded immediately to prevent erosion damage. However, it is extremely important to determine for what reason germination did not take place and make any corrective action necessary prior to re-seeding the area.

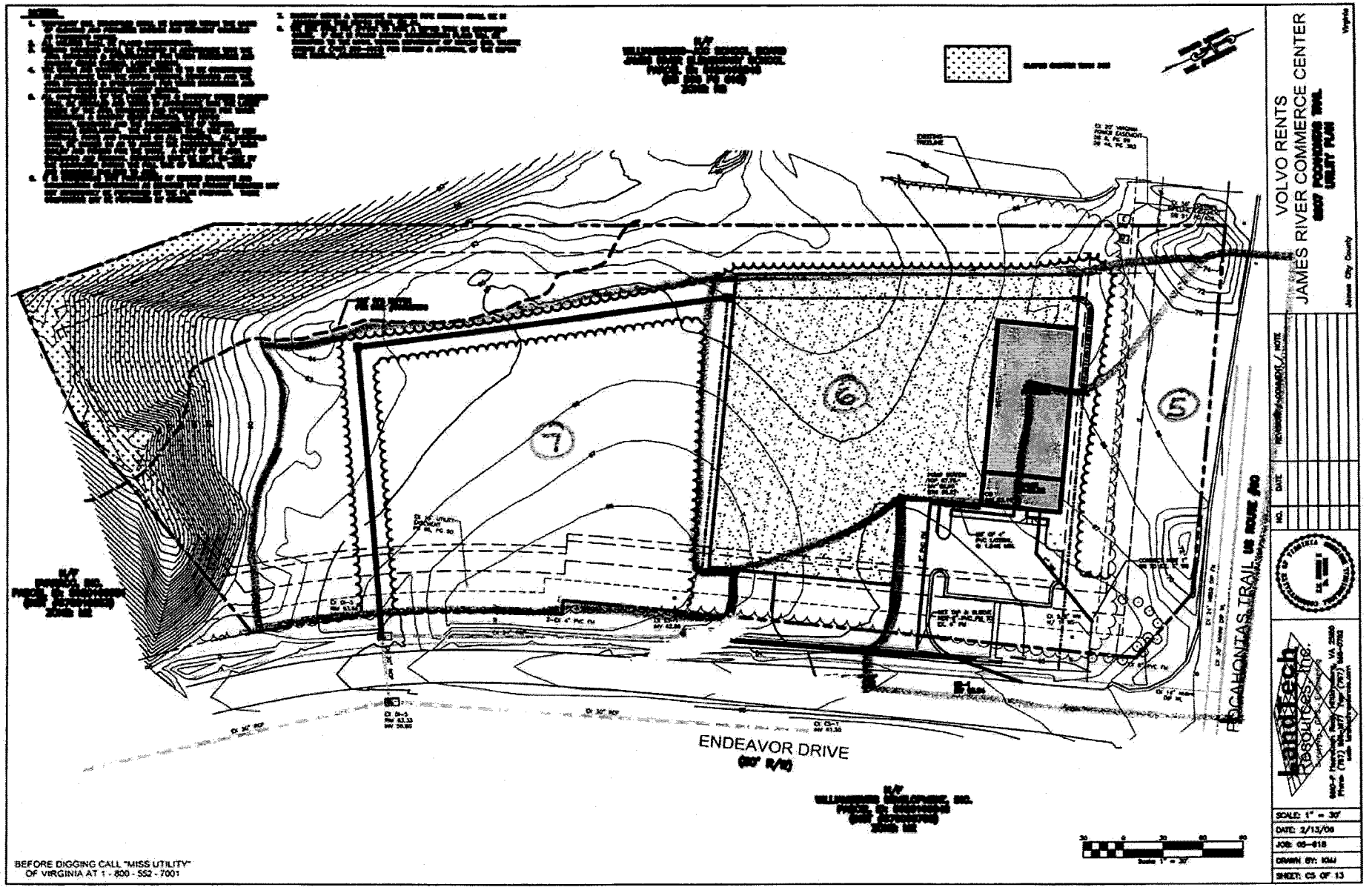
- Fertilizer shall be applied using approved fertilization methods and equipment.
- Formulations and application rates shall conform to the guidelines given in VESCH.
- Maintain a ground cover or organic mulch around trees that is adequate to prevent erosion, protect roots, and hold water.

Soil Stabilization Blankets and Matting – 3.36

All soil stabilization blankets and matting should be inspected periodically following installation, particularly after rainstorms to check for erosion and undermining. Any dislocation or failure should be repaired immediately. If washouts or breakage occurs, reinstall the material after repairing damage to the slope. Continue to monitor these areas until which time they become permanently stabilized; at that time an annual inspection should be adequate.

APPENDIX A


VOLVO RENTS
JAMES RIVER COMMERCE CENTER
UTILITY PLAN
Virginia
James City County
NO.
DATE
REVISION / COMMENT / NOTE
landtech
RESOURCES, INC.
SCALE: 1" = 30'
DATE: 2/13/06
JOB: 05-918
DRAWN BY: KMJ
SHEET: C5 OF 13
POCAHONTAS TRAIL
ENDEAVOR DRIVE
BEFORE DIGGING CALL "MISS UTILITY"
OF VIRGINIA AT 1 - 800 - 552 - 7001


VOLVO RENTS
JAMES RIVER COMMERCE CENTER
UTILITY PLAN
Virginia
James City County
NO.
DATE
REVISIONS / COMMENTS / NOTE
POCAHONTAS TRAIL US ROUTE #60
ENDEAVOR DRIVE
landtech RESOURCES, INC.
SCALE: 1" = 30'
DATE: 2/13/06
JOB: 05-618
DRAWN BY: KMJ
SHEET: C5 OF 13
BEFORE DIGGING CALL "MISS UTILITY"
OF VIRGINIA AT 1 - 800 - 552 - 7001

JOB 05-918

SHEET NO. ____ OF ____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY ____ DATE ____

SCALE ____

DA- 1

c= .40
A= .48 Ac.

	c	A	CA
Roof	.90	.13	.12
Woods/Grass	.20	.35	.07
		.48	.19

OVERLAND FLOW

L= 150 ft.
S= 4.3 %
Tc= 11.5 min.

CHANNEL FLOW

H= 3.5 ft.
L= 205 ft.
Tc= 2.5 min.

Tc= 14.0 min.

i_{10}= 5.3 in/hr

Q=CAi=(.40)(.48 Ac.)(5.3 in/hr)(C_f 1.0)

C_f for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q= 1.02 cfs

JOB 05-918

SHEET NO. ____ OF ____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY ____ DATE ____

SCALE ____

DA- 2

c= .80
A= .15 Ac.

	c	A	cA
Road	.90	.13	.12
Grass	.20	.02	0.0
		.15	.12

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 5 min.

i_{10}= 7.2 in/hr

Q=CAi=(.80)(.15 Ac.)(7.2 in/hr)(C_f 1.0)

C_f for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q=0.86 cfs

Q_{DI} = CAI = (.80)(.15)(4.0) = 0.48 cfs

JOB 05-918

SHEET NO. ____ OF ____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY ____ DATE ____

SCALE ____

DA- 3

c= .78
A= .89 Ac.

	C	A	CA
Roof/Gravel	.90	.73	.66
Grass/Woods	.20	.16	.03
		.89	.69

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= — ft.
l= — ft.
Tc= — min.

Tc= 5 min.

i_{10}= 7.2 in/hr

Q=CAi=(.89)(.78 Ac.)(7.2 in/hr)(C_f 1.0)

C_f for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q= 5.00 cfs

JOB 05-918

SHEET NO. ____ OF ____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY ____ DATE ____

SCALE ____

DA- 4

C= .90
A= .41 Ac.

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 5 min.

i_{10}= 7.2 in/hr

Q=CAi=(.90)(.41 Ac.)(7.2 in/hr)(C_f 1.0)

C_f for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q= 2.66 cfs

JOB 05-918

SHEET NO. ____ OF ____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY ____ DATE ____

SCALE ____

DA- 5

c= .54
A= 1.44 Ac.

	C	A	CA
Roof / Road	.90	.70	.63
Grass / Woods	.20	.74	.15
		1.44	.78

OVERLAND FLOW

L= 150 ft.
S= 4.3 %
Tc= 11.5 min.

0.40 ac of impervious area is off-site

CHANNEL FLOW

H= 4 ft.
L= 425 ft.
Tc= 3.0 min.

Tc= 14.5 min.

i_{10}= 5.25 in/hr

Q=CAi=(.54)(1.44 Ac.)(5.25 in/hr)(C_f 1.0)

C_f for storms 25 yr+ (VDOT Manual Pg. 1-11)

Q= 4.08 cfs

JOB 05-918

SHEET NO. ____ OF ____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY ____ DATE ____

SCALE ____

DA- 6

c= .82
A= 1.30 Ac.

	C	A	CA
Roof/Gravel	.90	1.14	1.03
Grass/Woods	.20	.16	.03
		1.30	1.06

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 5 min.

i_{10}= 7.2 in/hr

Q=CAi=(.82)(1.30 Ac.)(7.2 in/hr)(C_f 1.0)

C_f for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q= 7.68cfs

$Q_{DI} = CAI = (.82)(1.30)(4.0) = 4.26$ cfs

JOB 05-918

SHEET NO. _____ OF _____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY _____ DATE _____

SCALE _____

DA- 7 (Future Development)

c= .90
A= 1.85 Ac.

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 5 min.

i_{10}= 7.2 in/hr

Q=CAi=(.90)(1.85 Ac.)(7.2 in/hr)(C_f 1.0) C_f for storms 25 yr+ (VDOT Manual Pg. 1-11)

Q=11.99 cfs

$Q_{DI} = CAI = (.90)(1.85)(4.0) = 6.66$ cfs

JOB 05-918

SHEET NO. _____ OF _____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY _____ DATE _____

SCALE _____

V-DITCH DESIGN

DA-1

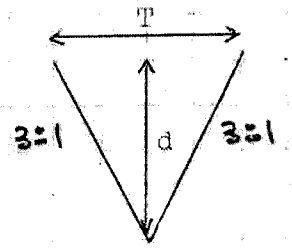
Q= 1.02 cfs

S= 1.7 %

L= 205 ft.

T= 6 ft.

d= 1 ft.



$$R=\frac{zd}{2(z^2+1)^{1/2}}=\frac{(3)(1\ ft.)}{2(10)^{1/2}}=0.47\ ft.$$

n = .035

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

d = 0.42' V = 1.90 fps

USE GRASS V-DITCH

User Name: Charles Calhoun
Project: 05-758

Date: 02-20-06
Time: 08:20:04
Page: 1

Hec22 Calculation Report: Curb Cut In DA #2

==========

Results:

Flow Intercepted:	0.48	cfs
Flow Bypassed:	0.00	cfs
Inlet Length:	2.47	ft
Splash-over Velocity:	0.00	ft/s
Ponding Width:	18.00	ft
Depth at Curb:	0.50	ft

Efficiency:

Curb	100.00	%
Grate	*	%
Slotted	*	%
Total:	100.00	%

Flow Data Input:

Input Method:	Known Flow	
Known Flow:	0.48	cfs

Inlet Parameters:

Computation Type:	Sag	
Inlet Type:	Curb	
Longitudinal Slope:	0.00	ft/ft
Manning's n:	0.016	
Pavement Cross Slope:	0.03	ft/ft
Gutter Cross Slope:	0.08	ft/ft
Local Depression:	2.00	in
Gutter Width:	2.00	ft
Curb Opening Length:	2.47	ft
Curb Throat Type:	Horizontal	
Inclined Throat Angle:	90.0000	deg
Inlet Opening Height:	0.50	in
Curb Weir Coefficient:	2.300	
Curb Orifice Coefficient:	0.670	

JOB 05-918

SHEET NO ____ OF ____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY ____ DATE ____

SCALE ____

TRAPEZOIDAL-DITCH DESIGN

DA -2

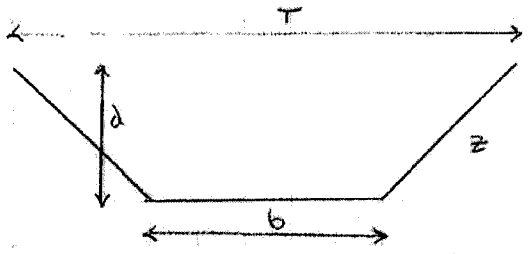
Q= 0.86 cfs

S= 2.5 %

L= 40 ft.

T= 4 ft.

d= 0.5 ft.



$$R = \frac{bd + zd^2}{b + 2d(z^2 + 1)^{1/2}} = \frac{(3\ ft)(.5\ ft) + (2)(.5\ ft)^2}{(3\ ft) + 2(.5\ ft)(5)^{1/2}} = 0.38\ ft$$

n= .013

$$A = bd + zd^2 = (3\ ft)(.5\ ft) + (2)(.5\ ft)^2 = 2.0\ ft^2$$

$\partial = .08$ $V = 3.23$ fps

USE CONCRETE RECTANGULAR CHANNEL

JOB 05-918

SHEET NO. _____ OF _____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY _____ DATE _____

SCALE _____

V-DITCH DESIGN

DA-4

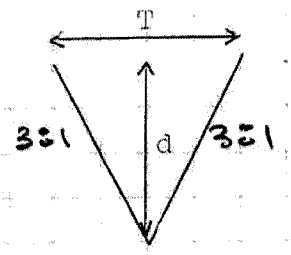
Q= 2.66 cfs

S= 2.25 %

L= 200 ft.

T= 6 ft.

d= 1 ft.



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

n= .035

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

d = 0.58' V = 2.68 fps

USE GRASS V-DITCH

JOB 05-918

SHEET NO. ____ OF ____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY ____ DATE ____

SCALE ____

V-DITCH DESIGN

DA-5

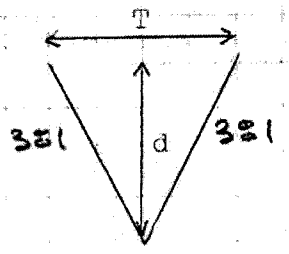
Q= 5.30 cfs

S= .02 %

L= 20 ft.

T= 6 ft.

d= 1 ft.



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

n=.013

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

d = 0.53' V = 6.40 fps

USE CONCRETE V-DITCH FOR ENTRANCE TO CULVERT PIPE

JOB 05-918

SHEET NO ____ OF ____

CALCULATED BY KMJ DATE 2/20/06

CHECKED BY ____ DATE ____

SCALE ____

CULVERT DESIGN

DA-5

Entrance Culvert

c= .54

A= 1.44 Ac.

OVERLAND FLOW

L= 150 ft.

S= 4.3 %

Tc= 11.5 min.

CHANNEL FLOW

H= 4 ft.

L= 425 ft.

Tc= 3.0 min.

Tc= 14.5 min

i_{10}= 5.25 in/hr

Q=CAi=(.54)(1.44 Ac.)(5.25 in/hr)

Q= 4.08 cfs

L= 112 ft.

S= 0.3 %

HW= 1.5 ft.

Inv_i= 63.54

Inv_o= 63.20

INLET CONTROL

D= 14 in. or 1.17 ft.

23" x 14" HE RCP

HW/D= .75

HW=(1.17 ft.)(.75)= 0.88 ft. < 1.5 ft.

JOB 05-918

SHEET NO. _____ OF _____

CALCULATED BY KMS DATE 2/20/06

CHECKED BY _____ DATE _____

SCALE _____

OUTLET CONTROL

$d_c = 0.60$

$h_o = \frac{d_c + D}{2} = \frac{0.60 + 1.17}{2} = 0.89$

$S_oL = (.003)(112) = 0.34$

$d_n = 0.93$

$\frac{d}{D} = 0.73$ $\frac{r}{D} = .2839$ P.E. Manual Pg 3-43

$R = .43$

$v = 3.53$ fps

$H = (1 + k_e + \frac{29n^2L}{R^{4/3}})\frac{v^2}{2g} = 0.62$

$HW = H + h_o - S_oL = 1.17' < 1.50'$ OK

Outlet Control Governs

LandTech
Resources, Inc.
Surveying • Engineering • GPS
5810-F Mooretown Road, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME Volvo Rents
PROJECT NO. 05-918
SHEET NO. ____ OF ____
CALCULATED BY KMJ DATE 2/20/06
SCALE ____

DESIGN DI IN DA # 6
DI-"A"

Q = 4.26 cfs

VDOT DI-7

W = 3', L = 3'

P = 2(W+L) = 12'

From Chart 14" d = 0.24' OK

USE DI-7

LandTech
Resources, Inc.
Surveying • Engineering • GPS
5810-F Mooretown Road, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
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PROJECT NAME Volvo Rents
PROJECT NO. 05-918
SHEET NO. ____ OF ____
CALCULATED BY KMJ DATE 2/20/06
SCALE ____

DESIGN DI IN DA #7
DI-"B"

Q = 6.66 cfs

VDOT DI-7

W = 3', L = 3'

P = 2(W+L) = 12'

From Chart 14: d = 0.33' OK

USE VDOT DI-7

LandTech Resources, Inc. **Storm Drainage Design**

Phone: (757) 565-1677 Fax: (757) 565-0782

Project Manager Kenny Jenkins
Project Engineer Kenny Jenkins

For Tc Accumulation, Use VELOCITY (1) from Pipe Slope or (2) V=Q/A : 1

Project Number: 05-918 *Project:* VOLVO RENTS Year Storm: 10

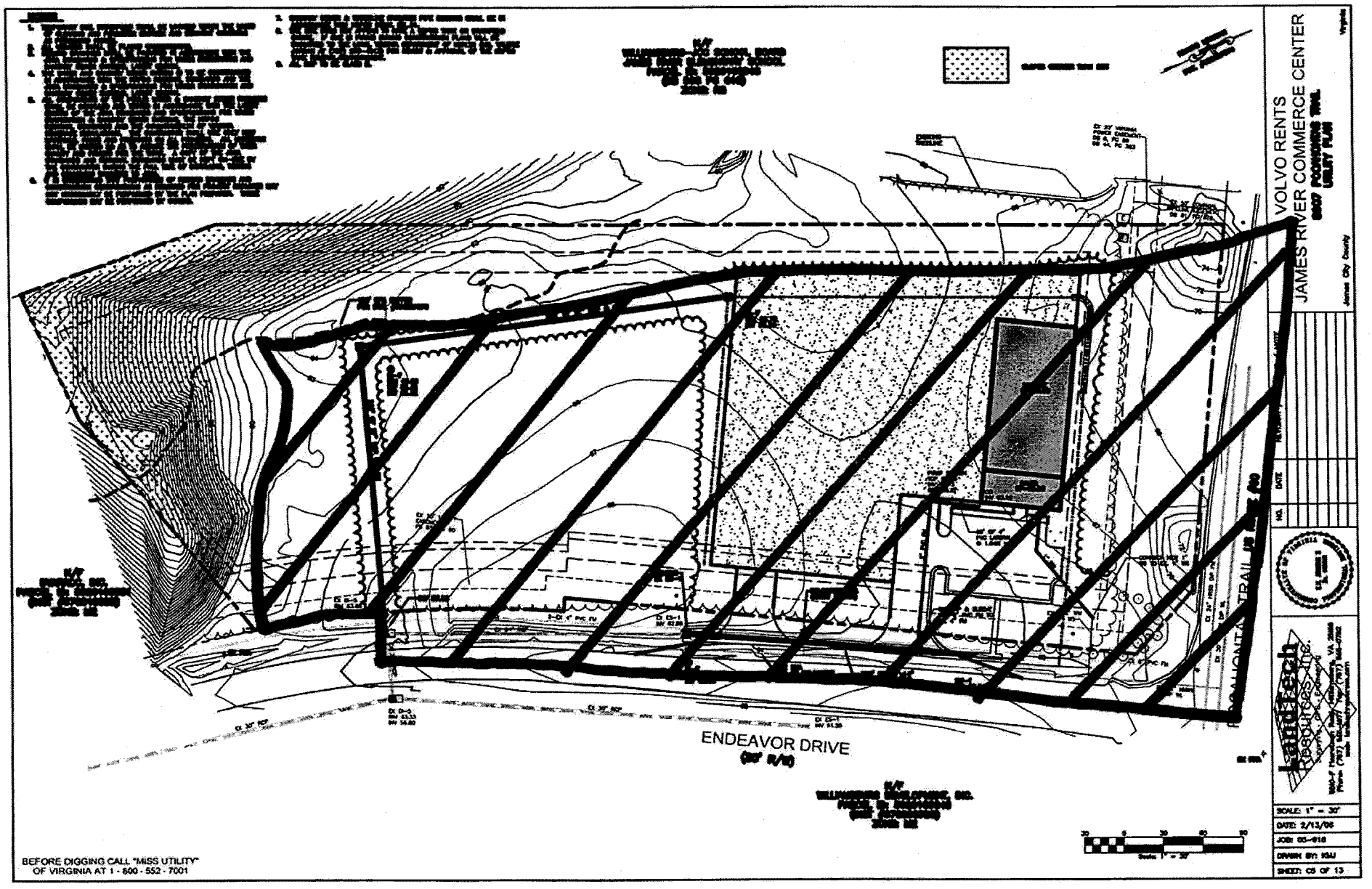
Structure		Rational Formula: Q = CiA									Pipe Data									Mannings Formula
				CA		Inlet Time Tc (min)		(in/hr)	Runoff, Q (cfs)		Inverts		(ft)	%	(in)	Velocity (ft/sec)				N
From	To	Area "A" (ac)	Coefficient "C"	Incremental	Cumulative	Incremental	Cumulative	Rain	Incremental	Cumulative	UPstream	DOWN-stream	Length	Slope	Diameter	Based on Q/A	Based on pipe slope	Capacity (cfs)	Flow Time (min)	Manning's
From	To	Area	C	CAInc	CACum	TimeInc	TimeCum	Rain	Qinc	Qcum	InvertUp	InvertDown	Length	Slope	Diameter	VelocityQA	VelocityS	Capacity	FlowTime	ManningsN
A	B	1.30	0.8	1.07	1.07	5	5.00	6.96	7.41	7.41	59.26	58.42	280	0.30%	21	3.08	3.61	8.68	1.29	0.013
B	EX	1.30	0.8	1.07	2.13	5	6.29	6.66	7.10	14.19	58.32	57.66	220	0.30%	27	3.57	4.27	16.96	0.86	0.013
EX																				

LandTech Resources, Inc. ***Hydraulic Grade Line (HGL) Calculations***

Project Number: ***05-918***
Project: ***VOLVO RENTS***
Date: 2.20.06

From Structure	HGL Slope (%)	HGL Fall (ft)	Velocity Head V²/2g (ft)	Invert Shaped?	Surface Flow?	~~~~~ STRUCTURE LOSSES ~~~~~ Bend Losses Angle (deg)	Bend Losses @ To (ft)	Bend Losses @ From (ft)	ENTRANCE @ To (ft)	ENTRANCE @ From (ft)	EXIT (ft)	TOTAL (ft)	HGL @ FROM	Performance Checks & Intermediate Computations: Rim/Flowline (Max. Allow. Elevation)	"Freeboard" (ft)	Elev. top of pipe @ From	Structure #'s FROM-To	TC plus Pipe Flow Time	Elevation at 80% Full Flow	Too Shallow?	Computed Pipe Dia
	HGLSlope	HGLFall	VelocityHead	Shaped	Surface	BendAngle	BendToTo	BendFrom	EntranTo	EntranFrom	Exit	TotalStruc	HGLatFrom	RimElev	Freeboard	PipeTopEl	FromTo	TCplusPipeTime	FlowRatio	Contro	DiaComp
A	0.219%	0.614	0.15	*Y*	*Y*	*0*	0.000	0.000	0.037	0.000	0.052	0.034	**60.84**	*62.75*	1.91	61.24	A-B	6.29	60.66	**HGL**	19.8
B	0.210%	0.463	0.20	*Y*	*Y*	*90*	0.142	0.000	0.049	0.037	0.069	0.069	**60.19**	*63.00*	2.81	60.84	B-EX	7.15	60.12	**HGL**	25.3

Tailwater Elevation at Outfall point # EX): ***59.66***



EX. 30" RCP DRAINAGE AREA

JOB 05-918

SHEET NO. ____ OF ____

CALCULATED BY ____ DATE ____

CHECKED BY KMJ DATE 4/11/06

SCALE ____

DA-To Ex 30" RCP under Endeavor Drive

c= .74
A=5.21 Ac.

OVERLAND FLOW

	C	A	CA
Road/Roof/Gravel	.90	4.06	3.65
Grass	.20	1.15	0.23
		5.21	3.88

L= 150 ft.
S= 4.3 %
Tc= 11.5 min.

CHANNEL FLOW

H= 9 ft.
L= 650 ft.
Tc= 6 min.

Tc= 17.5 min.

i_{10}= 4.8 in/hr

Q=CA1=(.74)(5.21 Ac.)(4.8 in/hr)(C_f 1.0)

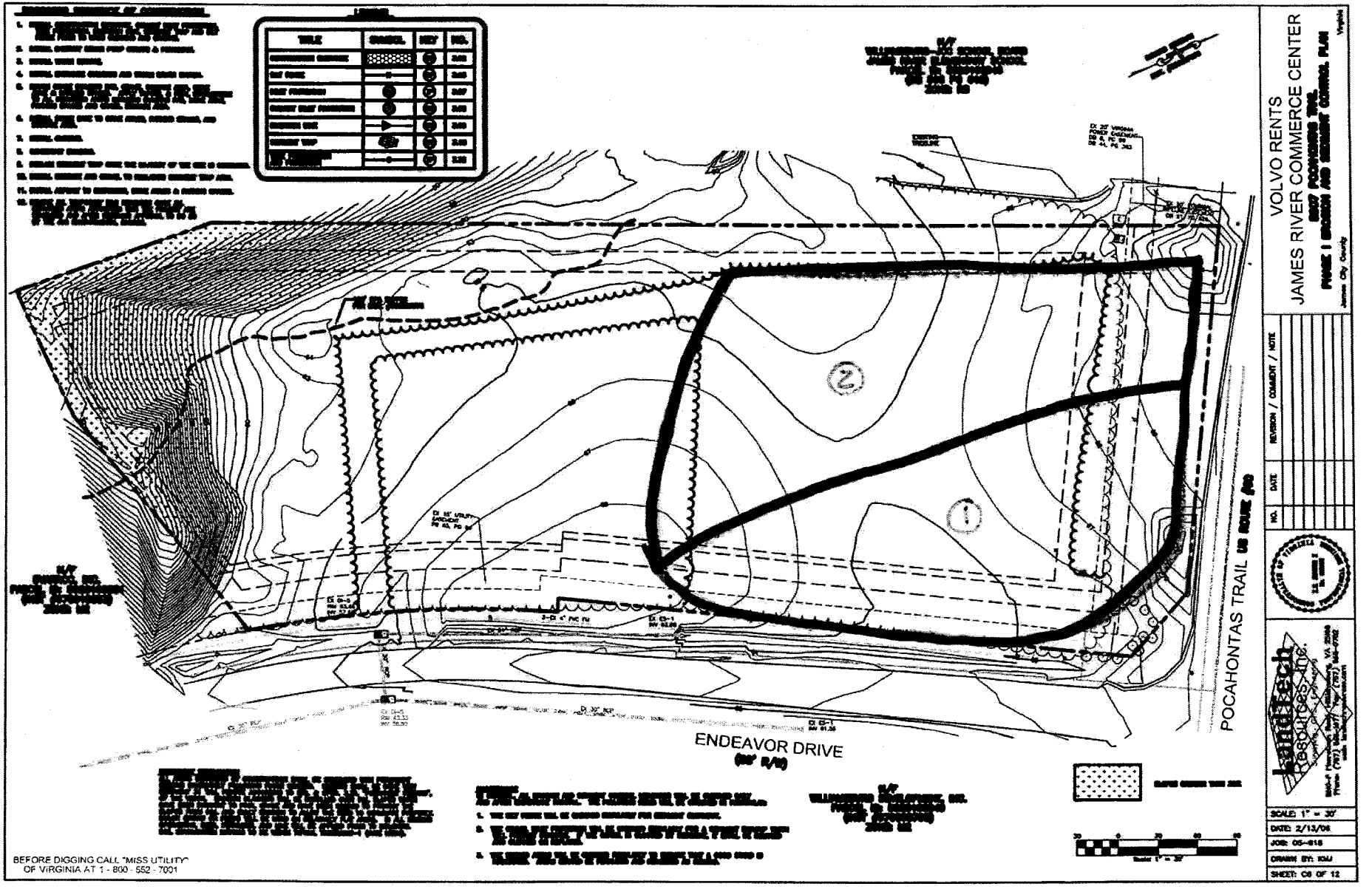
C_f for storms 25 yr+ (VDOT Manual Pg. 1-11)

Q= 18.51 cfs

Capacity of 30" RCP @ 1.91% is 56.69 cfs

Since 56.69 cfs > 18.51 cfs the existing 30" RCP under Endeavor Drive is adequate

APPENDIX B



SEDIMENT TRAP DRAINAGE AREA

LandTech Resources, Inc.
Surveying • Engineering • GPS
5810-F Mooretown Road, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME Volvo Rents
PROJECT NO. 05-918
SHEET NO. ____ OF ____
CALCULATED BY KMS DATE 2/20/06
SCALE ____

DESIGN SEDIMENT TRAP NO. 1

Drainage Area = 1.12 ac

Initial Storage = 1.12ac × 134 cyd/ac = 150 cyd

Dry Storage = 75 cyd

Wet Storage = 75 cyd

Calculate Wet Storage:

V_1 = 75 cyd = 2025 cf
D_1 = 2'

$V_1 = .85 \times A_1 \times D_1$

2025cf = .85 × A_1 × 2

A_1 = 1191 sf Elev 63.5

Calculate Dry Storage:

V_2 = 75 cyd = 2025 cf
D_2 = 1.5
A_1 = 1191 sf

$V_2 = (A_1 + A_2)/2 \times D_2 \Rightarrow$ 2025 cf = (1191 + A_2)/2 × 1.5

A_2 = 1509 sf elev 65.0

L = 6 × 1.12 = 7'

LandTech Resources, Inc.
Surveying • Engineering • GPS
5810-F Mooretown Road, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME Volvo Rents
PROJECT NO. 05-9198
SHEET NO. ____ OF ____
CALCULATED BY KMJ DATE 2/20/06
SCALE ____

DESIGN SEDIMENT TRAP NO. 2

Drainage Area = 1.30 ac

Initial Storage = 1.30ac x 134 cyd/ac = 174 cyd

Dry Storage = 87 cyd

Wet Storage = 87 cyd

Calculate Wet Storage:

V_1 = 87 cyd = 2349 cf
D_1 = 2.0'

$V_1 = .85 \times A_1 \times D_1$

2349 cyd = .85 x A_1 x 2.0

A_1 = 1382 sf Elev 61.0

Calculate Dry Storage:

V_2 = 89 cyd = 2349 cf
D_2 = 1.5
A_1 = 1382 sf

$V_2 = (A_1 + A_2)/2 \times D_2 \Rightarrow$ 2349 sf = (1382 + A_2) / 2 x 1.5

A_2 = 1750 sf Elev 62.5

L = 6' x 1.3 = 8'

MAY 2006
RECEIVED
PLANNING DEPARTMENT

DRAINAGE CALCULATIONS
JEANNE REED'S
SITE PLAN
PARCEL 4A
JAMES RIVER COMMERCE CENTER
REVISED 5/5/06

CAMPBELL LAND SURVEYING, INC.
P.O. BOX 855
YORKTOWN, VIRGINIA 23692
890-0837

COMMONWEALTH OF VIRGINIA
DAVID J. CAMPBELL
LICENSE NO.
14198
5/17/06
LAND SURVEYOR B

MAY 17, 2006

REVISIONS TO THE ORIGINAL APPROVED SITE PLAN

REVISIONS WERE MADE TO THE ORIGINAL SITE PLAN TO REDUCE SITE DEVELOPMENT COSTS AND TO ADD THE DESIGN OF A SECOND BUILDING FOR FUTURE USE. THE FOLLOWING ITEMS ON THE ORIGINAL SITE PLAN HAVE BEEN REVISED AND ARE REFERRED TO AS **PHASE I**

- 6 SPACES WERE REMOVED FROM THE FRONT PARKING LOT
- 9 NEW SPACES WERE ADDED AT THE REAR OF THE SITE TO THE EAST OF THE TRUCK WELL
- THE PARKING ISLAND WAS REMOVED FROM THE FRONT PARKING LOT
- THE FIRE HYDRANT WAS MOVED TO THE END OF THE FRONT PARKING LOT
- THE DRIVE AISLE TO THE REAR WAS NARROWED DOWN TO 30' WIDE FOR THE ENTIRE LENGTH
- DUMPSTER PAD WAS RELOCATED TO THE NORTHERN CURB LINE
- LANDSCAPING WAS ADDED TO THE DRIVE AISLE AND REVISED AT THE FRONT PARKING LOT AREA
- CLEARING LIMITS WERE REVISED ACCORDINGLY
- A NEW DRAINAGE PIPE AND CURB INLET WERE ADDED TO SERVE THE NEW PARKING LOT AT THE REAR
- THE FIRE HYDRANT ON THE SOUTH SIDE OF THE DRIVE AISLE WAS RELOCATED TO THE REAR PARKING AREA

A NEW 12,000 S.F. BUILDING WAS ADDED AT THE REAR OF THE SITE WITH ASSOCIATED DRAINAGE , A NEW TRUCK WELL AND A SIDEWALK ENTRANCE TO THE REAR PARKING AREA. THESE ADDITIONAL IMPROVEMENTS ARE FOR POSSIBLE DEVELOPMENT AT A FUTURE DATE AND ARE REFERRED TO AS **PHASE II.** THE EXISTING DRAINAGE SYSTEM WAS DESIGNED TO ACCOMMODATE THIS NEW IMPERVIOUS AREA AND NO REVISIONS WERE MADE TO THE EXISTING SYSTEM (NEW CALCULATIONS ARE ATTACHED SHOWING THE NEW DRAINAGE PIPES IN PHASE II). THE LANDSCAPING AROUND THE NEW BUILDING WILL BE INSTALLED WHEN PHASE II BUILDING IS BUILT.

STORM WATER NARRATIVE

EXISTING CONDITIONS

THE SITE IS A 2.00 ACRE WOODED LOT IN A INDUSTRIAL PARK. THE ENTIRE LOT IS WOODED EXCEPT FOR THE UTILITY EASEMENT STRIP ADJACENT TO THE STREET R/W. EXISTING DRAINAGE IS ENTIRELY OVERLAND SHEET FLOW TO THE ROAD DITCH AT THE FRONT OF THE PROPERTY.THE ROAD DITCH EMPTIES INTO A LARGE YARD DRAIN IN THE MIDDLE OF OUR LOT. AN EXISTING STORM DRAINAGE SYSTEM TAKES ALL RUNOFF TO AN EXISTING STORM WATER DETENTION POND DESIGNED FOR THE SUBDIVISION. EXISTING 10 YEAR STORM RUNOFF FOR THE SITE WILL BE 2.95 CFS.

POST DEVELOPMENT CONDITIONS

THE PHASE I SITE IMPROVEMENTS WILL CONSIST OF A 12,000 S.F. BUILDING WITH PARKING IN THE FRONT AND A TRUCK LOADING/ UNLOADING FACILITY ON THE LEFT SIDE. A 12,000 S.F. PHASE II BUILDING AND TRUCK WELL WILL BE ADDED IN THE FUTURE. THIS WILL INCREASE THE IMPERVIOUS AREA OF THE SITE FROM 0% TO 52% . NEW DRAINAGE WILL BE OVERLAND SHEET FLOW TO NEW CURB INLETS IN THE PARKING LOT AND LOADING AREAS. ONE HALF OF THE NEW BUILDINGS ROOF RUNOFF WILL GO DIRECTLY INTO A COLLECTOR PIPE. THESE IMPROVEMENTS WILL INCREASE THE TOTAL SITE RUNOFF TO 6.42 CFS. THE EXISTING SYSTEM HAS MORE THAN ENOUGH CAPACITY TO HANDLE THE INCREASE.

PRE-DEVELOPMENT RUNOFF

AREA : 2.0000 AC.
Tc – 18 MIN. (OVERLAND SHEET FLOW)
I10 – 4.92" / HR.
C- 0.3 (WOODED)
Q10 = 2.95 CFS

POST DEVELOPMENT RUNOFF

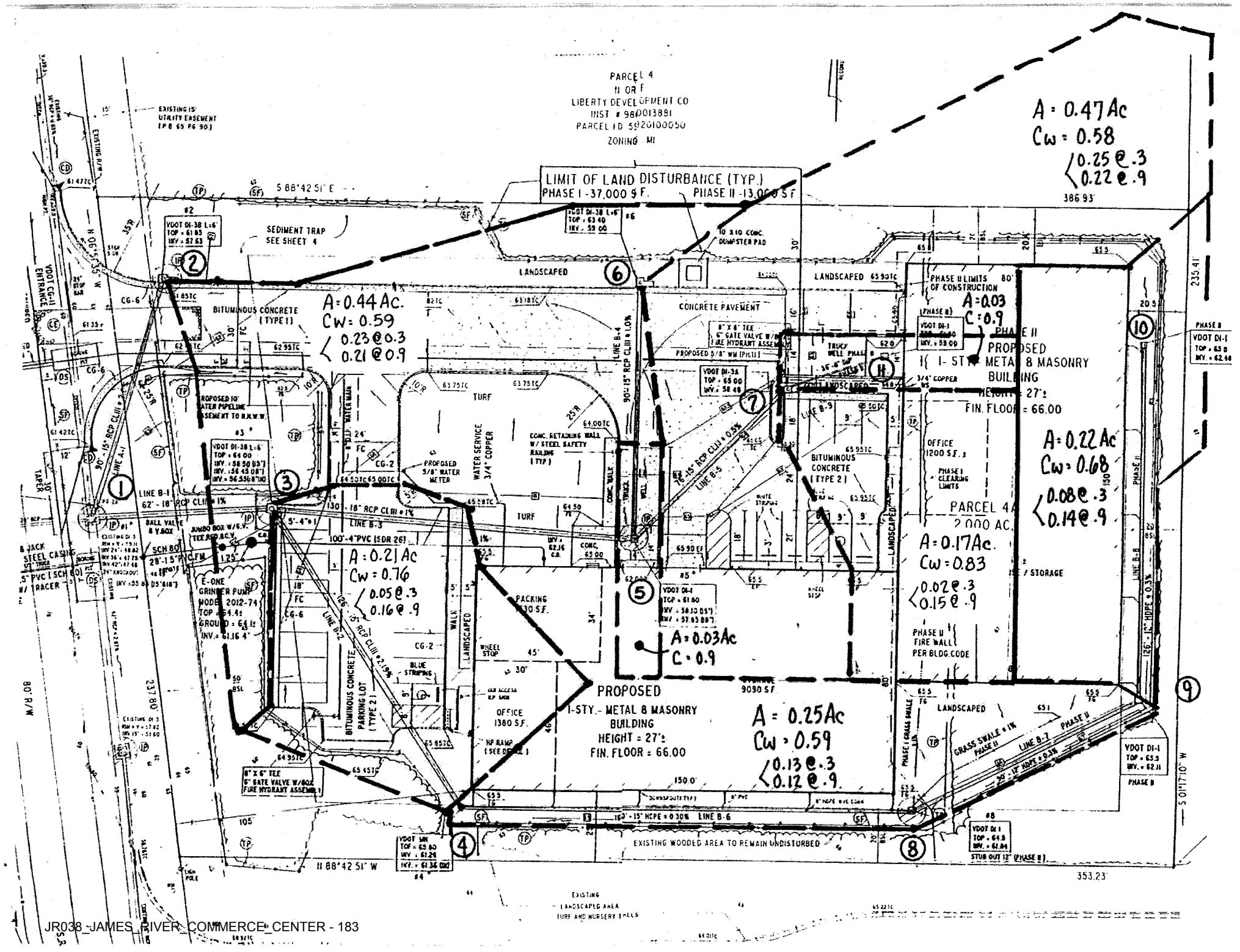
AREA = 2.0000 AC.
Tc – 15 MIN. (OVERLAND & PIPE FLOW)
110 – 5.25 " / HR.
Cw – 1.04 AC @ C=0.9
0.96 AC @ C=0.3
Cw – 0.61
Q10 = 6.42 CFS

AVAILABLE CAPACITY OF EXISTING RECEIVING 42" CULVERT

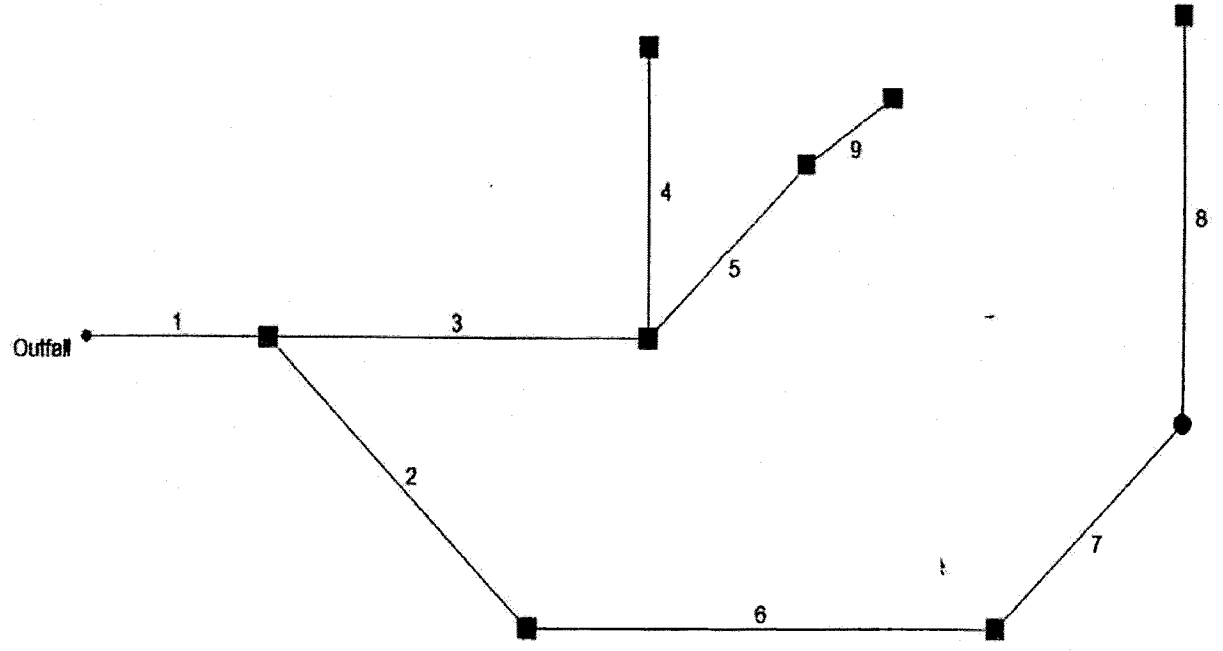
42" RCP OUTLET FROM EXISTING DI-5 @ 2.87% Qfull = 170 CFS

EXISTING RUNOFF INTO DI-5:
36" RCP @ 0.85% , AVAILABLE CAPACITY Qfull = 61 CFS
24" RCP @ 2.00% , AVAILABLE CAPACITY Qfull = 32 CFS
TOTAL EXISTING AVAILABLE CAPACITY INPUT= 93 CFS

EXCESS CAPACITY AVAILABLE TO OUR SITE = 83 CFS
ACTUAL Q10 RUNOFF FROM OUR STORM SYSTEM = 4.9 CFS OK


PARCEL 4
N OR F
LIBERTY DEVELOPMENT CO
INST # 980013881
PARCEL ID 5920100050
ZONING MI
LIMIT OF LAND DISTURBANCE (TYP.)
PHASE I - 37,000 S.F.
PHASE II - 13,000 S.F.
A = 0.47 Ac
Cw = 0.58
0.25 @ .3
0.22 @ .9
A = 0.44 Ac.
Cw = 0.59
0.23 @ 0.3
0.21 @ 0.9
A = 0.21 Ac
Cw = 0.76
0.05 @ .3
0.16 @ .9
A = 0.03 Ac
C = 0.9
A = 0.22 Ac
Cw = 0.68
0.08 @ .3
0.14 @ .9
A = 0.17 Ac.
Cw = 0.83
0.02 @ .3
0.15 @ .9
A = 0.25 Ac
Cw = 0.59
0.13 @ .3
0.12 @ .9
PROPOSED
1-STY.- METAL & MASONRY
BUILDING
HEIGHT = 27'±
FIN. FLOOR = 66.00
OFFICE
1380 S.F.
PARCEL 4A
2.000 AC.
EXISTING WOODED AREA TO REMAIN UNDISTURBED
SEDIMENT TRAP
SEE SHEET 4
BITUMINOUS CONCRETE (TYPE 1)
BITUMINOUS CONCRETE (TYPE 2)
BITUMINOUS CONCRETE PARKING LOT (TYPE 2)
CONCRETE PAVEMENT
LANDSCAPED
TURF
PACKING
9090 S.F.
S 88°42'51" E
N 88°42'51" W
S 01°17'10" W
353.23'
386.93'
235.41'
237.80'
80' R/W

Hydraflow Plan View



Project file: Line B.stm	IDF file: jamescity.IDF	No. Lines: 9	05-02-2006

Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	62.0	0.21	1.38	0.76	0.16	0.92	5.0	13.2	5.3	4.90	10.50	4.01	18	1.00	56.45	55.83	57.30	57.03	64.00	59.11	#3-#1
2	1	126.0	0.00	0.47	0.00	0.00	0.30	5.0	11.7	5.5	1.65	9.56	4.63	15	2.19	61.26	58.50	61.77	58.85	65.80	64.00	#4-#3
3	1	130.0	0.03	0.70	0.90	0.03	0.47	5.0	11.2	5.6	2.64	10.50	2.96	18	1.00	57.85	56.55	58.47	57.56	61.80	64.00	#5-#3
4	3	90.0	0.47	0.47	0.58	0.27	0.27	10.0	10.0	5.9	1.60	6.46	3.29	15	1.00	59.00	58.10	59.51	58.64	63.40	61.80	#6-#5
5	3	76.0	0.17	0.20	0.83	0.14	0.17	5.0	6.1	6.7	1.13	4.57	2.65	15	0.50	58.48	58.10	58.91	58.64	65.00	61.80	#7-#5
6	2	160.0	0.25	0.47	0.59	0.15	0.30	8.0	9.9	5.9	1.75	4.60	3.48	15	0.30	61.84	61.36	62.37	61.89	64.50	65.80	#8-#4
7	6	90.0	0.00	0.22	0.00	0.00	0.15	5.0	8.7	6.1	0.92	2.54	2.39	12	0.30	62.11	61.84	62.53	62.44	65.50	64.50	#9-#8
8	7	126.0	0.22	0.22	0.68	0.15	0.15	7.0	7.0	6.5	0.97	2.51	2.90	12	0.29	62.48	62.11	62.90	62.58	65.00	65.50	#10-#9
9	5	36.0	0.03	0.03	0.90	0.03	0.03	5.0	5.0	7.0	0.19	1.89	1.38	8	1.44	59.00	58.48	59.21	58.98	61.80	65.00	#11-#7

Project File: Line B.stm | IDF File: jamescity.IDF | Total number of lines: 9 | Run Date: 05-02-2006

NOTES: Intensity = 106.80 / (Inlet time + 16.60) ^ 0.88; Return period = 10 Yrs. ; Initial tailwater elevation = 57.03 (ft)

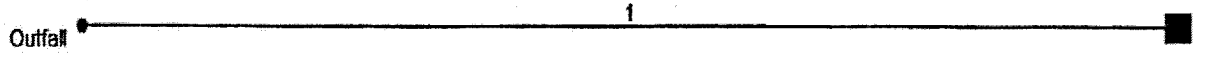
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	18	4.90	55.83	57.03	1.20	1.52	3.24	0.16	57.19	0.228	62.0	56.45	57.30	0.85**	1.03	4.78	0.36	57.65	0.588	0.408	N/A	0.75	0.27
2	15	1.65	58.50	58.85	0.35*	0.28	5.80	0.52	59.37	2.156	126	61.26	61.77	0.51**	0.48	3.47	0.19	61.96	0.520	1.338	N/A	0.50	0.09
3	18	2.64	56.55	57.56	1.01	1.27	2.08	0.07	57.63	0.100	130	57.85	58.47	0.62**	0.69	3.83	0.23	58.70	0.494	0.297	N/A	0.75	0.17
4	15	1.60	58.10	58.64	0.54	0.51	3.14	0.15	58.79	0.405	90.0	59.00	59.51	0.51**	0.47	3.43	0.18	59.69	0.517	0.461	N/A	0.50	0.09
5	15	1.13	58.10	58.64	0.54	0.51	2.23	0.08	58.72	0.204	76.0	58.48	58.91	0.43**	0.37	3.07	0.15	59.05	0.493	0.348	N/A	0.50	0.07
6	15	1.75	61.36	61.89	0.53*	0.50	3.49	0.19	62.08	0.299	160	61.84	62.37	0.53	0.50	3.48	0.19	62.56	0.298	0.299	0.478	0.35	0.07
7	12	0.92	61.84	62.44	0.60	0.49	1.86	0.05	62.49	0.087	90.0	62.11	62.53	0.42	0.31	2.92	0.13	62.66	0.287	0.187	0.168	0.35	0.05
8	12	0.97	62.11	62.58	0.47	0.36	2.71	0.11	62.69	0.224	126	62.48	62.90	0.42	0.31	3.10	0.15	63.05	0.324	0.274	0.345	0.35	0.05
9	8	0.19	58.48	58.98	0.50	0.28	0.68	0.01	58.99	0.018	36.0	59.00	59.21	0.21**	0.09	2.08	0.07	59.27	0.344	0.181	N/A	0.35	0.02

Project File: Line B.stm	IDF File: jamescity.IDF	Total number of lines: 9	Run Date: 05-02-2006

NOTES: Initial tailwater elevation = 57.03 (ft) , * Normal depth assumed., ** Critical depth assumed., I Under Inlet control.

Hydraflow Plan View



Project file: Line A.stm	IDF file: jamescity.IDF	No. Lines: 1	05-02-2006

Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	90.0	0.44	0.44	0.59	0.26	0.26	5.0	5.0	7.0	1.83	9.13	2.67	15	2.00	57.63	55.83	58.17	56.83	61.85	59.11	#2-#1

Project File: Line A.stm | IDF File: jamescity.IDF | Total number of lines: 1 | Run Date: 05-02-2006

NOTES: Intensity = 106.80 / (Inlet time + 16.60) ^ 0.88; Return period = 10 Yrs. ; Initial tailwater elevation = 56.83 (ft)

Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	15	1.83	55.83	56.83	1.00	1.05	1.74	0.05	56.88	0.084	90.0	57.63	58.17	0.54**	0.51	3.59	0.20	58.37	0.530	0.307	N/A	0.50	0.10

Project File: Line A.stm	IDF File: jamescity.IDF	Total number of lines: 1	Run Date: 05-02-2006

NOTES: Initial tailwater elevation = 56.83 (ft) , * Normal depth assumed., ** Critical depth assumed., i Under inlet control.

JAMES RIVER COMMERCE CENTER

HYDROLOGICAL ANALYSIS

BMP JR 038

FOR
DEVELOPMENT OF COLUMBIA DRIVE
AND A SHELL BUILDING

March 15, 2004

COMMONWEALTH OF VIRGINIA
3/15/04
RICHARD S. PHILLIPS
No. 023631
PROFESSIONAL ENGINEER

LANDMARK
DESIGN GROUP

Engineers ♦ Planners ♦ Surveyors ♦ Landscape Architects ♦ Environmental Scientists
4029 Ironbound Road, Suite 100, Williamsburg, VA 23188 (757) 253-2975 FAX: (757) 229-0049
lmdg@landmarkdg.com

James River Commerce Center
Hydrologic Analysis

Summary:

The following report recompiles the analysis presented under the title of "James River Commerce Center Shell Building Calculations" dated April 18, 2003. This report focuses on the diversion of the proposed Shell Building site into existing BMP JR 038 and the impact such an increase in the drainage area could have on the BMP and the channel immediately down stream of it. A computer model for each of four levels of development was created, using data from the approved and as-built documents.

The Pre Development analysis is the watershed above the BMP location as it was before the original plan. The three Post Development cases are as follows:

Case 1 is the watershed including the construction of Columbia Drive and is consistent with the approval of 1997. The existing BMP is unchanged.

Case 2 is the watershed with the developed Shell Building site diverted to it. With some other sites within the watershed remain undeveloped the existing BMP remains unchanged.

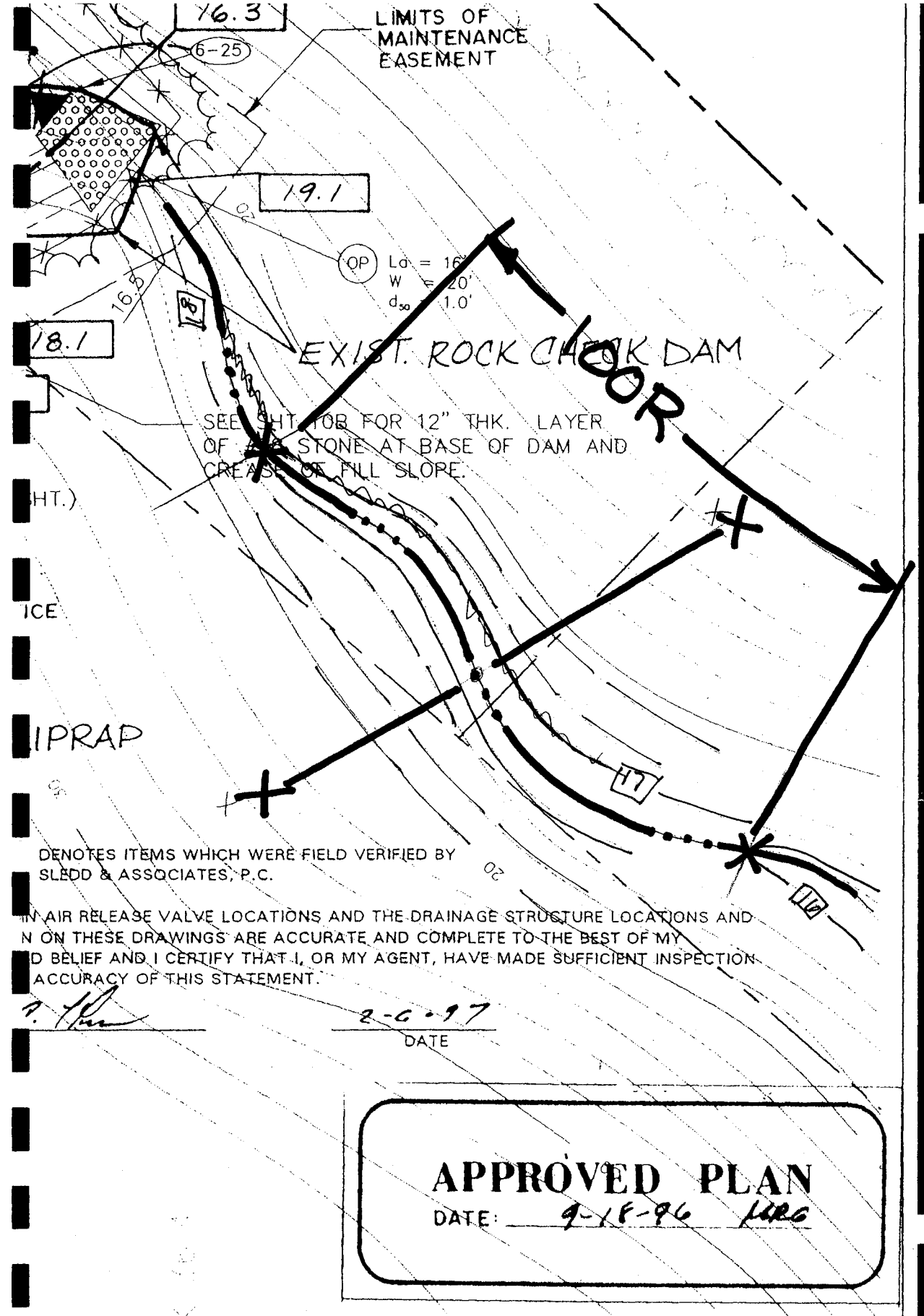
Case 3 is the watershed including the Shell Building site and all other sites fully developed. The BMP is slightly modified to maintain consistent outflow characteristics.

Conclusion: BMP JR 038 can support the addition of the Shell Building site to its watershed without adverse impact on the channel downstream of it.

SUMMARY OF FLOW, DEPTH AND VELOCITY DOWN STREAM OF BMP

Storm Frequency	Pre Development Watershed Area above BMP Site 14.5 +/- Acres			Case 1 Post Development 1997 Watershed Area 55.2 +/- Acres			Case 2 Post Development Shell Building / Partial Build-out 62.32+/- Ac.			Case 3 Post Development Full Build-out 62.32+/- Ac./ Modified BMP		
	Q cfs	V fps	d ft.	Q cfs	V fps	d ft.	Q cfs	V fps	d ft.	Q cfs	V fps	d ft.
One Year	6.91	2.00	0.54	5.71	1.80	0.51	5.28	1.80	0.50	6.25	1.90	0.52
Two Year	11.66	2.40	0.65	7.10	2.00	0.54	6.73	2.00	0.53	7.69	2.10	0.56
Ten Year	30.05	3.00	1.09	22.94	2.80	0.92	19.84	2.80	0.85	21.64	2.80	0.89
100 Year	49.40	3.20	1.52	150.49	4.00	2.45	158.45	4.00	2.52	165.52	4.00	2.59

MS-19 Comparison



COPIED FROM

JR038: SP-82-97

DES.	MRG
DWN.	MRG
CHK.	NHM
DATE	

RECORD DRAWING
ENTRANCE ROAD PLAN

James River Commerce Center
JAMES CITY COUNTY, VIRGINIA

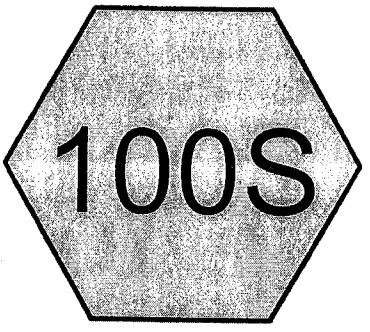
PROJ. NO.
95016-28

SCALE:
1" = 25'

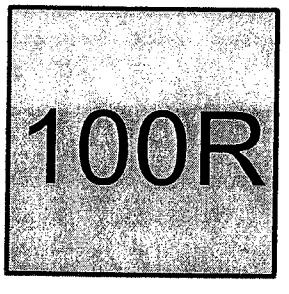
RECORD DRAWIN

8 OF 8

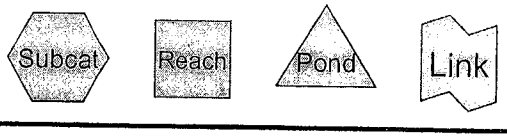
DWG. FIG. 1



Predeveloped DA to BMP Location



Ravine channel below BMP



Drainage Diagram for JCC Predvelopment
Prepared by LandMark Design Group, Inc. 03/02/2004
HydroCAD® 7.00 s/n 001765 © 1986-2003 Applied Microcomputer Systems

Subcatchment 100S: Predeveloped DA to BMP Location

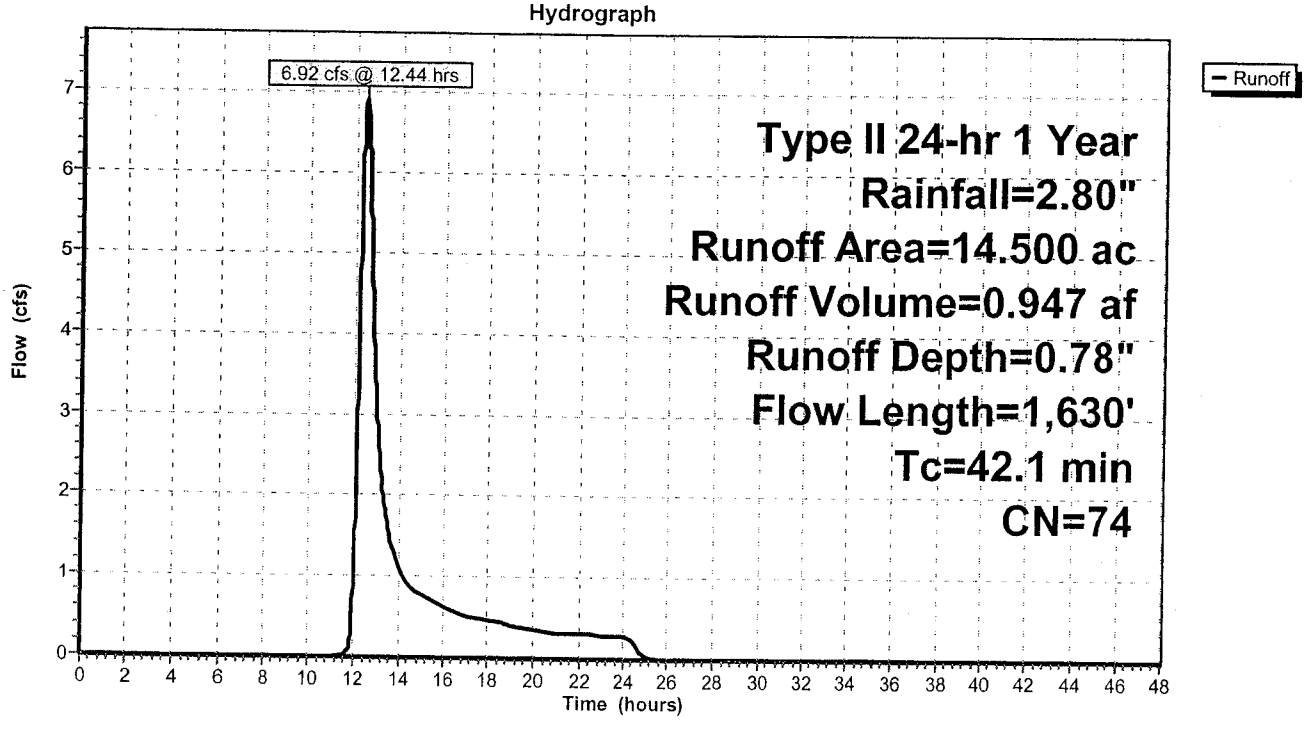
Runoff = 6.92 cfs @ 12.44 hrs, Volume= 0.947 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 Year Rainfall=2.80"

Area (ac)	CN	Description
14.500	74	Undeveloped Land

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	300	0.0200	0.2		**Sheet Flow, Filed** Range n= 0.130 P2= 3.50"
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Filed** Short Grass Pasture Kv= 7.0 fps
1.8	130	0.0600	1.2		**Shallow Concentrated Flow, Wooded Slope** Woodland Kv= 5.0 fps
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Field** Short Grass Pasture Kv= 7.0 fps
42.1	1,630	Total			

Subcatchment 100S: Predeveloped DA to BMP Location



Reach 100R: Ravine channel below BMP

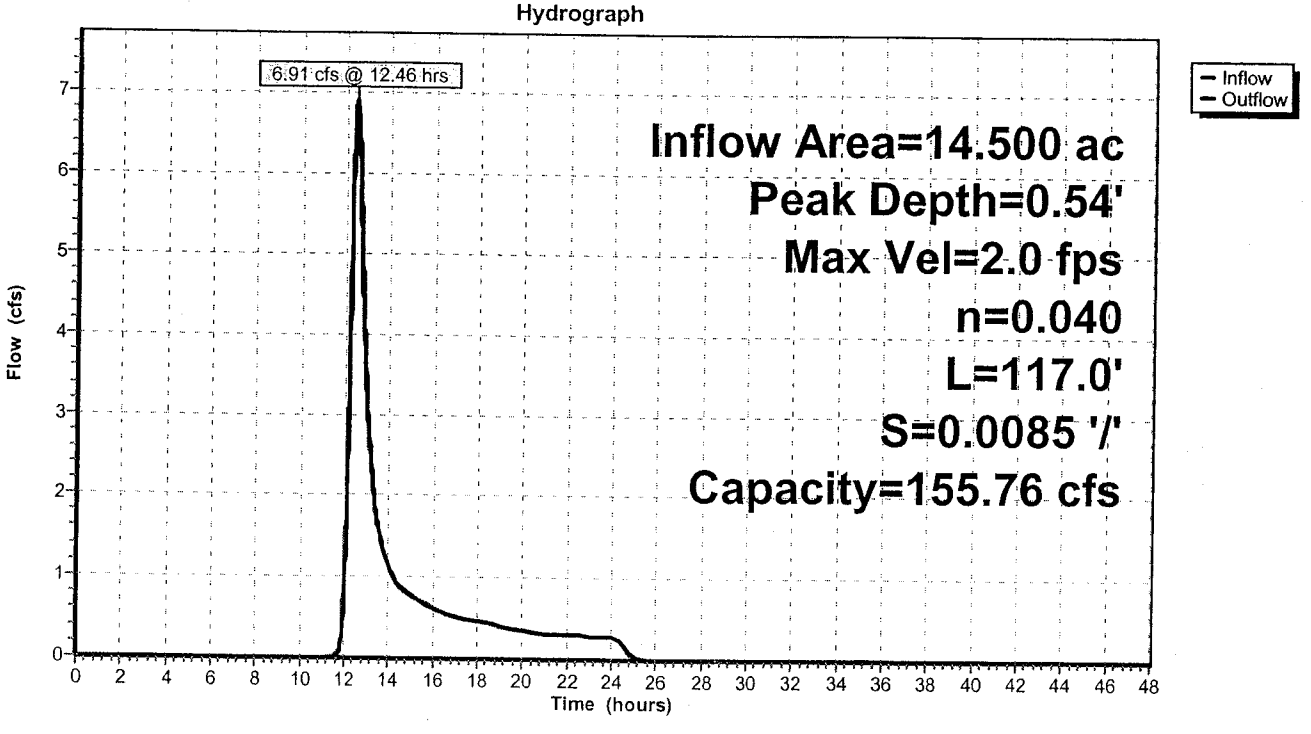
Inflow Area = 14.500 ac, Inflow Depth = 0.78" for 1 Year event
Inflow = 6.92 cfs @ 12.44 hrs, Volume= 0.947 af
Outflow = 6.91 cfs @ 12.46 hrs, Volume= 0.947 af, Atten= 0%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.0 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.54' @ 12.45 hrs
Capacity at bank full= 155.76 cfs
Inlet Invert= 17.00', Outlet Invert= 16.00'
Custom cross-section table, n= 0.040 Length= 117.0' Slope= 0.0085 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.31
1.50	15.0	17.2	1,755	47.03
2.50	39.0	31.1	4,563	155.76

Reach 100R: Ravine channel below BMP



Subcatchment 100S: Predeveloped DA to BMP Location

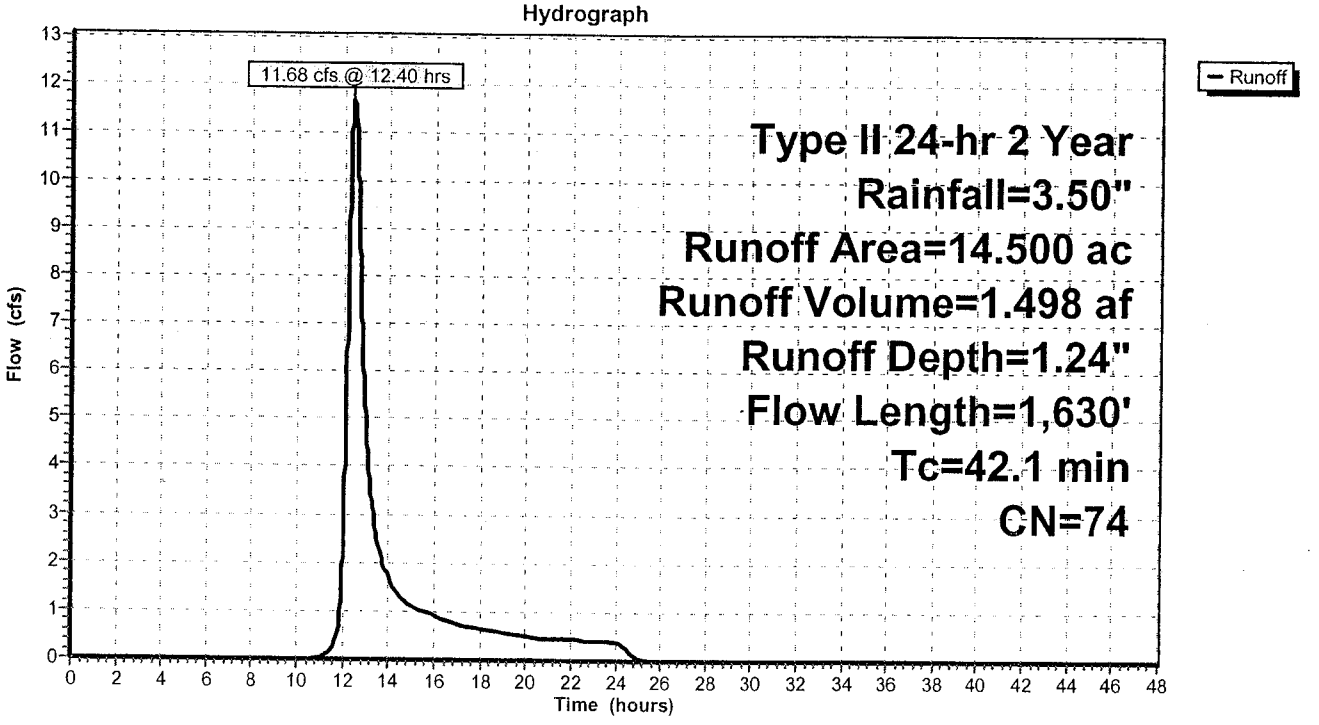
Runoff = 11.68 cfs @ 12.40 hrs, Volume= 1.498 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 Year Rainfall=3.50"

Area (ac)	CN	Description
14.500	74	Undeveloped Land

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	300	0.0200	0.2		**Sheet Flow, Filed** Range n= 0.130 P2= 3.50"
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Filed** Short Grass Pasture Kv= 7.0 fps
1.8	130	0.0600	1.2		**Shallow Concentrated Flow, Wooded Slope** Woodland Kv= 5.0 fps
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Field** Short Grass Pasture Kv= 7.0 fps
42.1	1,630	Total			

Subcatchment 100S: Predeveloped DA to BMP Location



Reach 100R: Ravine channel below BMP

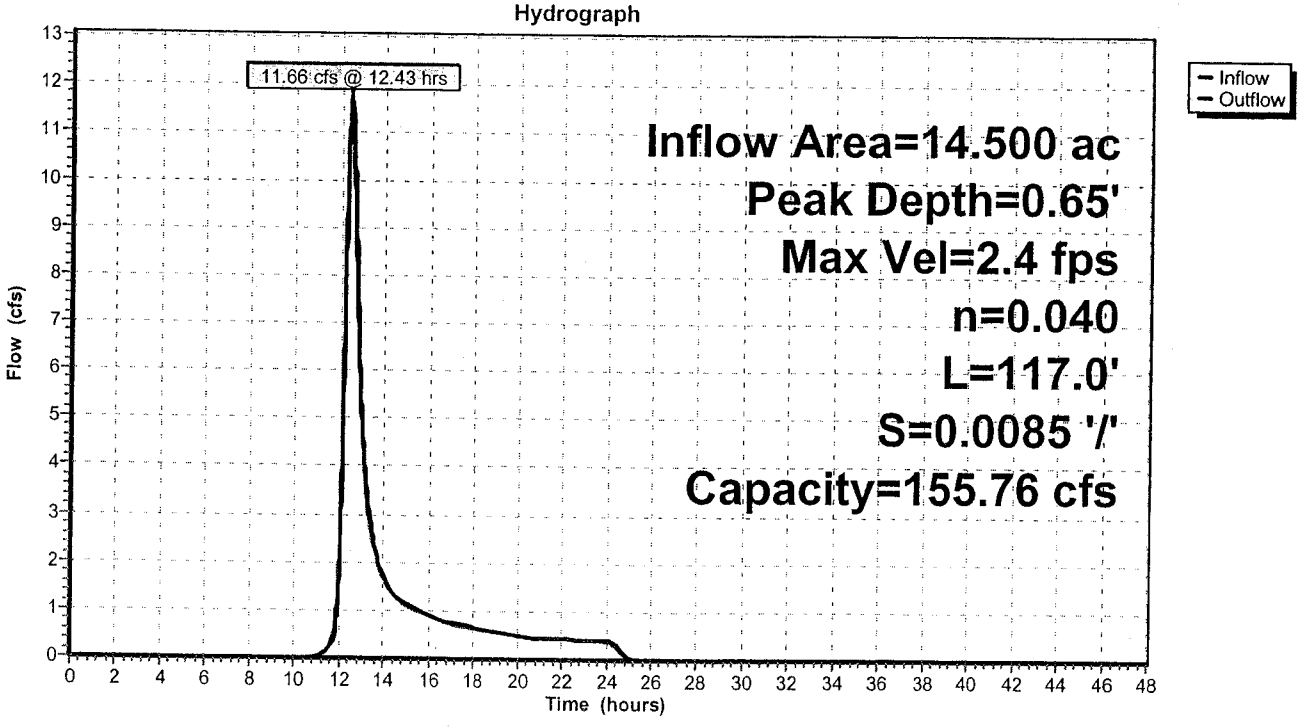
Inflow Area = 14.500 ac, Inflow Depth = 1.24" for 2 Year event
Inflow = 11.68 cfs @ 12.40 hrs, Volume= 1.498 af
Outflow = 11.66 cfs @ 12.43 hrs, Volume= 1.498 af, Atten= 0%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.4 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.65' @ 12.41 hrs
Capacity at bank full= 155.76 cfs
Inlet Invert= 17.00', Outlet Invert= 16.00'
Custom cross-section table, n= 0.040 Length= 117.0' Slope= 0.0085 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.31
1.50	15.0	17.2	1,755	47.03
2.50	39.0	31.1	4,563	155.76

Reach 100R: Ravine channel below BMP



Subcatchment 100S: Predeveloped DA to BMP Location

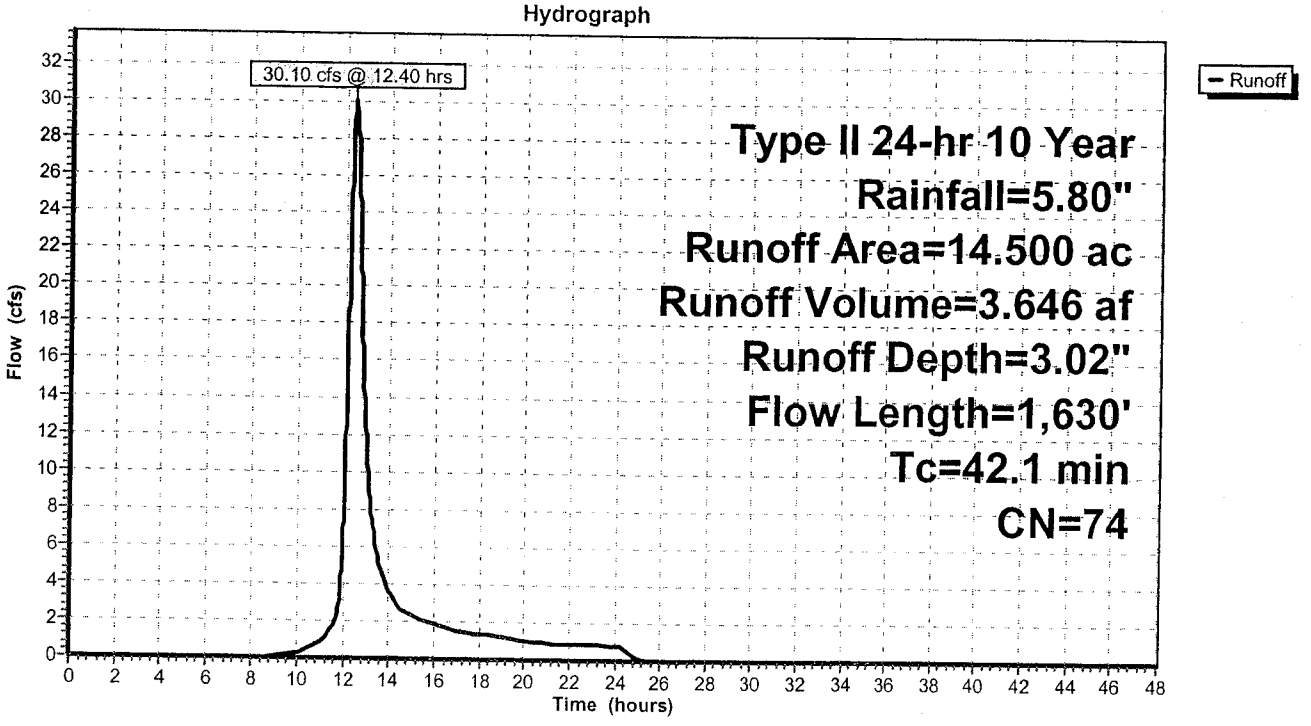
Runoff = 30.10 cfs @ 12.40 hrs, Volume= 3.646 af, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
14.500	74	Undeveloped Land

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	300	0.0200	0.2		**Sheet Flow, Filed** Range n= 0.130 P2= 3.50"
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Filed** Short Grass Pasture Kv= 7.0 fps
1.8	130	0.0600	1.2		**Shallow Concentrated Flow, Wooded Slope** Woodland Kv= 5.0 fps
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Field** Short Grass Pasture Kv= 7.0 fps
42.1	1,630	Total			

Subcatchment 100S: Predeveloped DA to BMP Location



Reach 100R: Ravine channel below BMP

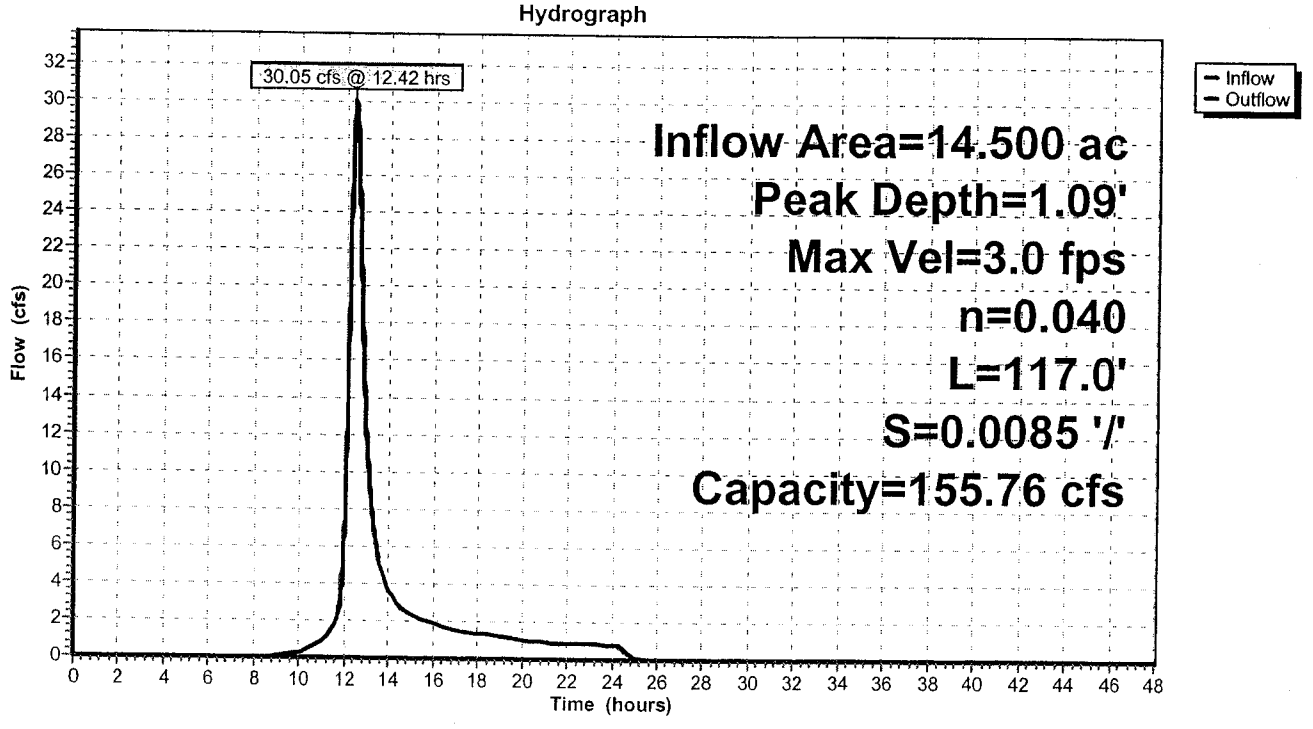
Inflow Area = 14.500 ac, Inflow Depth = 3.02" for 10 Year event
Inflow = 30.10 cfs @ 12.40 hrs, Volume= 3.646 af
Outflow = 30.05 cfs @ 12.42 hrs, Volume= 3.646 af, Atten= 0%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.0 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 1.1 min

Peak Depth= 1.09' @ 12.40 hrs
Capacity at bank full= 155.76 cfs
Inlet Invert= 17.00', Outlet Invert= 16.00'
Custom cross-section table, n= 0.040 Length= 117.0' Slope= 0.0085 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.31
1.50	15.0	17.2	1,755	47.03
2.50	39.0	31.1	4,563	155.76

Reach 100R: Ravine channel below BMP



Subcatchment 100S: Predeveloped DA to BMP Location

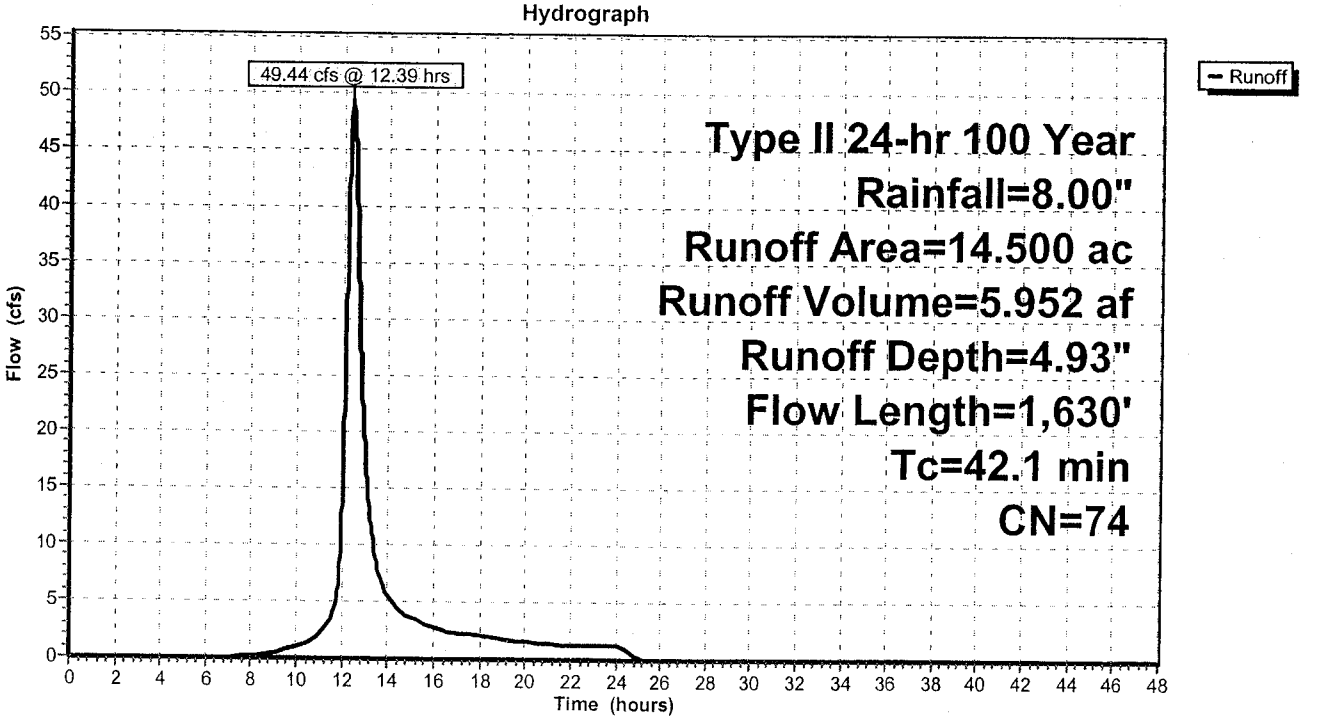
Runoff = 49.44 cfs @ 12.39 hrs, Volume= 5.952 af, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 Year Rainfall=8.00"

Area (ac)	CN	Description
14.500	74	Undeveloped Land

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	300	0.0200	0.2		**Sheet Flow, Filed** Range n= 0.130 P2= 3.50"
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Filed** Short Grass Pasture Kv= 7.0 fps
1.8	130	0.0600	1.2		**Shallow Concentrated Flow, Wooded Slope** Woodland Kv= 5.0 fps
10.1	600	0.0200	1.0		**Shallow Concentrated Flow, Field** Short Grass Pasture Kv= 7.0 fps
42.1	1,630	Total			

Subcatchment 100S: Predeveloped DA to BMP Location



Reach 100R: Ravine channel below BMP

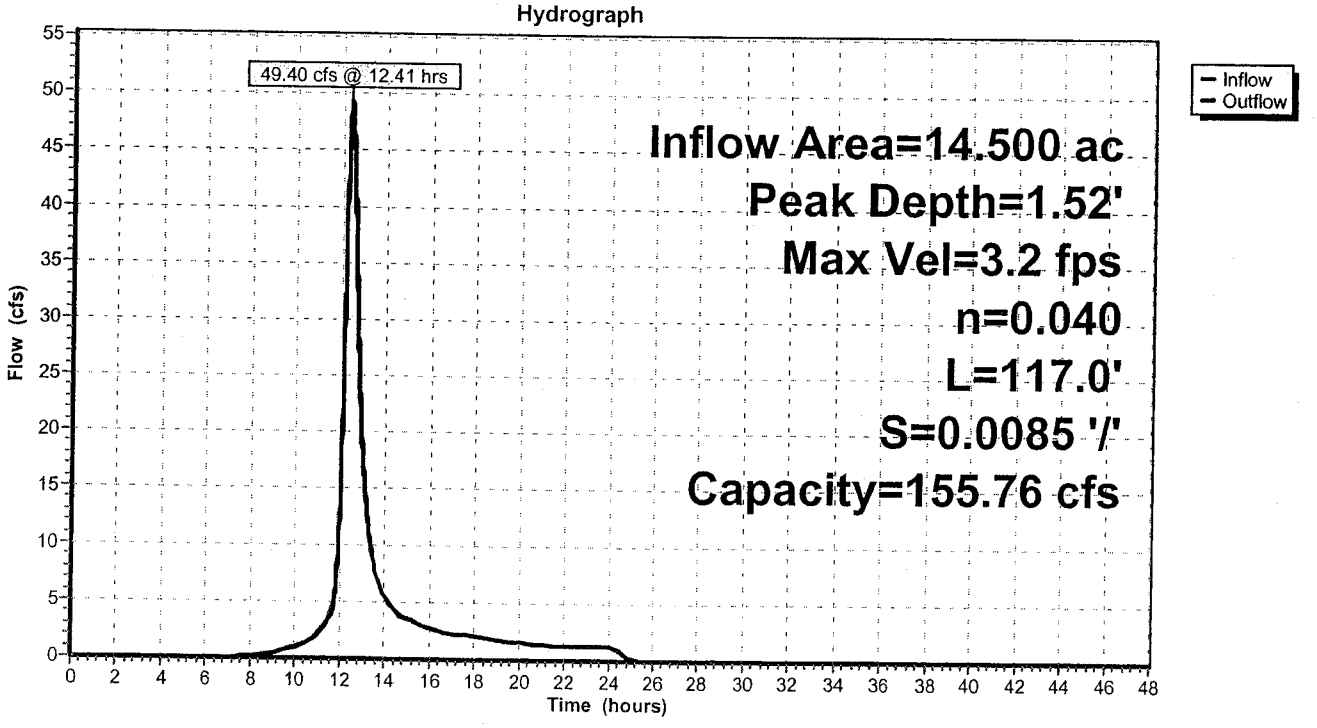
Inflow Area = 14.500 ac, Inflow Depth = 4.93" for 100 Year event
Inflow = 49.44 cfs @ 12.39 hrs, Volume= 5.952 af
Outflow = 49.40 cfs @ 12.41 hrs, Volume= 5.952 af, Atten= 0%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.2 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 1.0 min

Peak Depth= 1.52' @ 12.40 hrs
Capacity at bank full= 155.76 cfs
Inlet Invert= 17.00', Outlet Invert= 16.00'
Custom cross-section table, n= 0.040 Length= 117.0' Slope= 0.0085 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.31
1.50	15.0	17.2	1,755	47.03
2.50	39.0	31.1	4,563	155.76

Reach 100R: Ravine channel below BMP



JAMES RIVER COMMERCE CENTER

DRAINAGE AREAS AT COMPLETION OF COLUMBIA WAY

CASE 1

ANALYSIS OF EXISTING BMP JR 038 AS-BUILT

POST DEVELOPMENT CONDITIONS
IN ACCORDANCE WITH SP-82-97

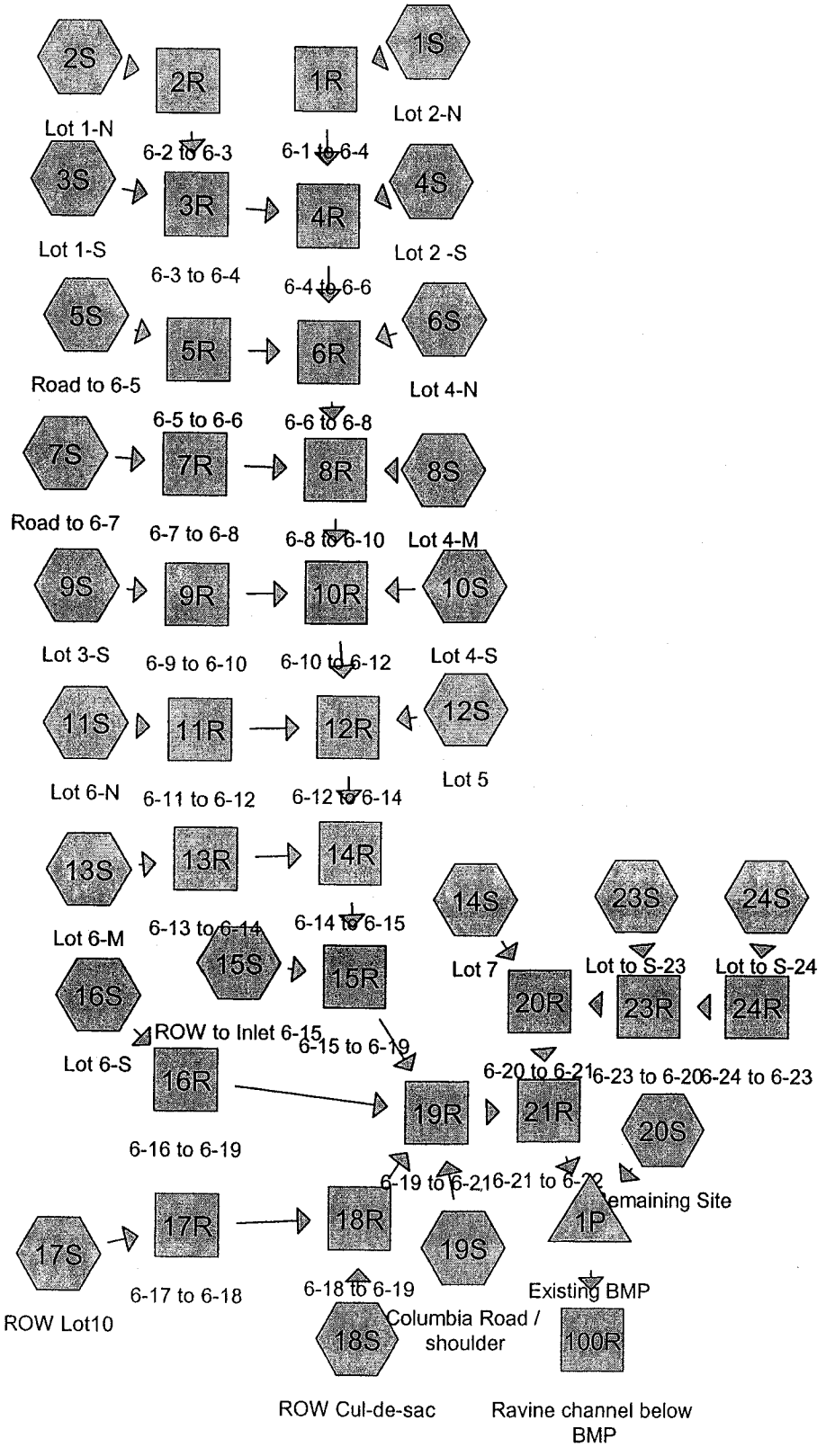
TOTAL DRAINAGE AREA 55.2 ACRES

DRAINAGE AREA
NOT PASSING THROUGH
BMP 1P

LANDMARK
DESIGN GROUP
Engineers • Planners • Surveyors
Landscape Architects • Environmental Consultants
4029 IRONBOUND ROAD SUITE 100
WILLIAMSBURG, VIRGINIA
(757) 253-2975 FAX: (757) 229-0049

MARCH 3, 2004

2002138-000.01 \ jrcc-postda.dwg



Drainage Diagram for J R C C Orig Post Dev.@ Columbia Build Out
Prepared by LandMark Design Group, Inc. 03/02/2004
HydroCAD® 7.00 s/n 001765 © 1986-2003 Applied Microcomputer Systems

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=1.57"
Flow Length=605' Tc=23.5 min CN=87 Runoff=7.25 cfs 0.598 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=1.57"
Flow Length=500' Tc=13.6 min CN=87 Runoff=8.58 cfs 0.527 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=1.57"
Flow Length=320' Tc=32.9 min CN=87 Runoff=1.98 cfs 0.202 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=1.10"
Flow Length=375' Tc=7.6 min CN=80 Runoff=2.43 cfs 0.120 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=2.25"
Flow Length=240' Tc=2.0 min CN=95 Runoff=1.01 cfs 0.045 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=1.57"
Flow Length=575' Tc=4.4 min CN=87 Runoff=7.52 cfs 0.334 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=2.25"
Flow Length=215' Tc=1.8 min CN=95 Runoff=1.74 cfs 0.077 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=1.57"
Flow Length=590' Tc=4.2 min CN=87 Runoff=9.18 cfs 0.404 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=1.57"
Tc=5.0 min CN=87 Runoff=5.64 cfs 0.256 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=1.57"
Flow Length=545' Tc=24.8 min CN=87 Runoff=6.59 cfs 0.561 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=1.57"
Flow Length=500' Tc=12.7 min CN=87 Runoff=6.61 cfs 0.394 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=1.57"
Flow Length=350' Tc=2.9 min CN=87 Runoff=3.47 cfs 0.146 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=1.57"
Flow Length=700' Tc=14.3 min CN=87 Runoff=6.28 cfs 0.394 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=1.57"
Flow Length=570' Tc=18.3 min CN=87 Runoff=9.33 cfs 0.664 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=2.25"
Tc=2.0 min CN=95 Runoff=0.88 cfs 0.039 af

Subcatchment 16S: Lot 6-S Runoff Area=2.980 ac Runoff Depth=1.57"
Flow Length=600' Tc=15.1 min CN=87 Runoff=6.02 cfs 0.389 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=2.25"
Tc=5.0 min CN=95 Runoff=5.01 cfs 0.246 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=2.25"
Tc=5.0 min CN=95 Runoff=2.22 cfs 0.109 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=2.25"
Tc=2.0 min CN=95 Runoff=3.74 cfs 0.167 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=1.10"
Tc=20.0 min CN=80 Runoff=8.97 cfs 0.687 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=1.57"
Tc=10.0 min CN=87 Runoff=4.21 cfs 0.228 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=1.57"
Tc=10.0 min CN=87 Runoff=8.90 cfs 0.483 af

Reach 1R: 6-1 to 6-4 Peak Depth=0.65' Max Vel=7.2 fps Inflow=7.25 cfs 0.598 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow=7.24 cfs 0.598 af

Reach 2R: 6-2 to 6-3 Peak Depth=0.69' Max Vel=9.0 fps Inflow=8.58 cfs 0.527 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow=8.56 cfs 0.527 af

Reach 3R: 6-3 to 6-4 Peak Depth=1.08' Max Vel=5.2 fps Inflow=9.75 cfs 0.729 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow=9.75 cfs 0.729 af

Reach 4R: 6-4 to 6-6 Peak Depth=0.93' Max Vel=10.2 fps Inflow=16.96 cfs 1.447 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow=16.94 cfs 1.447 af

Reach 5R: 6-5 to 6-6 Peak Depth=0.24' Max Vel=6.0 fps Inflow=1.01 cfs 0.045 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow=1.01 cfs 0.045 af

Reach 6R: 6-6 to 6-8 Peak Depth=1.24' Max Vel=7.1 fps Inflow=19.45 cfs 1.826 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow=19.43 cfs 1.826 af

Reach 7R: 6-7 to 6-8 Peak Depth=0.32' Max Vel=7.1 fps Inflow=1.74 cfs 0.077 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow=1.73 cfs 0.077 af

Reach 8R: 6-8 to 6-10 Peak Depth=1.35' Max Vel=9.2 fps Inflow=28.25 cfs 2.308 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow=28.16 cfs 2.308 af

Reach 9R: 6-9 to 6-10 Peak Depth=1.09' Max Vel=3.2 fps Inflow=5.64 cfs 0.256 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow=5.62 cfs 0.256 af

Reach 10R: 6-10 to 6-12 Peak Depth=1.07' Max Vel=14.8 fps Inflow=36.94 cfs 3.125 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow=36.89 cfs 3.125 af

Reach 11R: 6-11 to 6-12 Peak Depth=1.03' Max Vel=4.1 fps Inflow=6.61 cfs 0.394 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow=6.60 cfs 0.394 af

Reach 12R: 6-12 to 6-14 Peak Depth=1.16' Max Vel=14.7 fps Inflow=44.83 cfs 3.665 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow=44.74 cfs 3.665 af

Reach 13R: 6-13 to 6-14 Peak Depth=0.96' Max Vel=4.2 fps Inflow=6.28 cfs 0.394 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow=6.26 cfs 0.394 af

Reach 14R: 6-14 to 6-15 Peak Depth=1.52' Max Vel=11.5 fps Inflow=50.06 cfs 4.059 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow=50.00 cfs 4.059 af

Reach 15R: 6-15 to 6-19 Peak Depth=1.57' Max Vel=11.0 fps Inflow=50.27 cfs 4.098 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=50.21 cfs 4.098 af

Reach 16R: 6-16 to 6-19 Peak Depth=0.93' Max Vel=4.2 fps Inflow=6.02 cfs 0.389 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=6.02 cfs 0.389 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.09' Max Vel=3.6 fps Inflow=5.01 cfs 0.246 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=4.99 cfs 0.246 af

Reach 18R: 6-18 to 6-19 Peak Depth=1.21' Max Vel=3.6 fps Inflow=7.21 cfs 0.355 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=7.17 cfs 0.355 af

Reach 19R: 6-19 to 6-21 Peak Depth=2.15' Max Vel=8.4 fps Inflow=63.01 cfs 5.009 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=62.86 cfs 5.009 af

Reach 20R: 6-20 to 6-21 Peak Depth=1.30' Max Vel=6.7 fps Inflow=21.66 cfs 1.375 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=21.64 cfs 1.375 af

Reach 21R: 6-21 to 6-22 Peak Depth=1.47' Max Vel=18.3 fps Inflow=82.98 cfs 6.385 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=82.92 cfs 6.385 af

Reach 23R: 6-23 to 6-20 Peak Depth=0.95' Max Vel=6.7 fps Inflow=13.02 cfs 0.711 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=12.94 cfs 0.711 af

Reach 24R: 6-24 to 6-23 Peak Depth=0.85' Max Vel=5.4 fps Inflow=8.90 cfs 0.483 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=8.87 cfs 0.483 af

Reach 100R: Ravine channel below BMP Peak Depth=0.51' Max Vel=1.8 fps Inflow=5.71 cfs 6.866 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=5.71 cfs 6.865 af

Pond 1P: Existing BMP Peak Elev=27.78' Storage=378,732 cf Inflow=90.01 cfs 7.072 af
Primary=5.71 cfs 6.866 af Secondary=0.00 cfs 0.000 af Outflow=5.71 cfs 6.866 af

Total Runoff Area = 55.200 ac Runoff Volume = 7.072 af Average Runoff Depth = 1.54"

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=2.18"
Flow Length=605' Tc=23.5 min CN=87 Runoff=10.09 cfs 0.833 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=2.18"
Flow Length=500' Tc=13.6 min CN=87 Runoff=11.88 cfs 0.735 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=2.18"
Flow Length=320' Tc=32.9 min CN=87 Runoff=2.76 cfs 0.282 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=1.64"
Flow Length=375' Tc=7.6 min CN=80 Runoff=3.62 cfs 0.179 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=2.94"
Flow Length=240' Tc=2.0 min CN=95 Runoff=1.29 cfs 0.059 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=2.18"
Flow Length=575' Tc=4.4 min CN=87 Runoff=10.34 cfs 0.466 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=2.94"
Flow Length=215' Tc=1.8 min CN=95 Runoff=2.22 cfs 0.100 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=2.18"
Flow Length=590' Tc=4.2 min CN=87 Runoff=12.60 cfs 0.564 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=2.18"
Tc=5.0 min CN=87 Runoff=7.75 cfs 0.356 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=2.18"
Flow Length=545' Tc=24.8 min CN=87 Runoff=9.17 cfs 0.782 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=2.18"
Flow Length=500' Tc=12.7 min CN=87 Runoff=9.16 cfs 0.549 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=2.18"
Flow Length=350' Tc=2.9 min CN=87 Runoff=4.76 cfs 0.204 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=2.18"
Flow Length=700' Tc=14.3 min CN=87 Runoff=8.69 cfs 0.549 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=2.18"
Flow Length=570' Tc=18.3 min CN=87 Runoff=12.96 cfs 0.926 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=2.94"
Tc=2.0 min CN=95 Runoff=1.13 cfs 0.051 af

Subcatchment 16S: Lot 6-S Runoff Area=2.980 ac Runoff Depth=2.18"
Flow Length=600' Tc=15.1 min CN=87 Runoff=8.35 cfs 0.542 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=2.94"
Tc=5.0 min CN=95 Runoff=6.42 cfs 0.321 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=2.94"
Tc=5.0 min CN=95 Runoff=2.84 cfs 0.142 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=2.94"
Tc=2.0 min CN=95 Runoff=4.79 cfs 0.218 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=1.64"
Tc=20.0 min CN=80 Runoff=13.53 cfs 1.020 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=2.18"
Tc=10.0 min CN=87 Runoff=5.81 cfs 0.318 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=2.18"
Tc=10.0 min CN=87 Runoff=12.29 cfs 0.673 af

Reach 1R: 6-1 to 6-4 Peak Depth=0.77' Max Vel=7.9 fps Inflow=10.09 cfs 0.833 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow=10.08 cfs 0.833 af

Reach 2R: 6-2 to 6-3 Peak Depth=0.82' Max Vel=9.8 fps Inflow=11.88 cfs 0.735 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow=11.86 cfs 0.735 af

Reach 3R: 6-3 to 6-4 Peak Depth=1.32' Max Vel=5.6 fps Inflow=13.54 cfs 1.017 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow=13.53 cfs 1.017 af

Reach 4R: 6-4 to 6-6 Peak Depth=1.12' Max Vel=11.2 fps Inflow=23.80 cfs 2.028 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow=23.78 cfs 2.028 af

Reach 5R: 6-5 to 6-6 Peak Depth=0.27' Max Vel=6.5 fps Inflow=1.29 cfs 0.059 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow=1.29 cfs 0.059 af

Reach 6R: 6-6 to 6-8 Peak Depth=1.51' Max Vel=7.8 fps Inflow=27.68 cfs 2.553 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow=27.65 cfs 2.553 af

Reach 7R: 6-7 to 6-8 Peak Depth=0.36' Max Vel=7.6 fps Inflow=2.22 cfs 0.100 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow=2.21 cfs 0.100 af

Reach 8R: 6-8 to 6-10 Peak Depth=1.65' Max Vel=10.0 fps Inflow=39.72 cfs 3.217 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow=39.61 cfs 3.217 af

Reach 9R: 6-9 to 6-10 Peak Depth=1.34' Max Vel=3.5 fps Inflow=7.75 cfs 0.356 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow=7.72 cfs 0.356 af

Reach 10R: 6-10 to 6-12 Peak Depth=1.28' Max Vel=16.3 fps Inflow=51.88 cfs 4.355 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow=51.79 cfs 4.355 af

Reach 11R: 6-11 to 6-12 Peak Depth=1.26' Max Vel=4.4 fps Inflow=9.16 cfs 0.549 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow=9.14 cfs 0.549 af

Reach 12R: 6-12 to 6-14 Peak Depth=1.39' Max Vel=16.2 fps Inflow=62.85 cfs 5.108 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow=62.74 cfs 5.108 af

Reach 13R: 6-13 to 6-14 Peak Depth=1.17' Max Vel=4.6 fps Inflow=8.69 cfs 0.549 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow=8.68 cfs 0.549 af

Reach 14R: 6-14 to 6-15 Peak Depth=1.83' Max Vel=12.5 fps Inflow=70.12 cfs 5.657 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow=70.03 cfs 5.657 af

Reach 15R: 6-15 to 6-19 Peak Depth=1.89' Max Vel=12.0 fps Inflow=70.41 cfs 5.709 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=70.35 cfs 5.709 af

Reach 16R: 6-16 to 6-19 Peak Depth=1.13' Max Vel=4.5 fps Inflow=8.35 cfs 0.542 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=8.34 cfs 0.542 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.50' Max Vel=3.7 fps Inflow=6.42 cfs 0.321 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=6.03 cfs 0.321 af

Reach 18R: 6-18 to 6-19 Peak Depth=1.39' Max Vel=3.7 fps Inflow=8.81 cfs 0.463 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=8.68 cfs 0.463 af

Reach 19R: 6-19 to 6-21 Peak Depth=2.62' Max Vel=9.1 fps Inflow=87.21 cfs 6.932 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=87.04 cfs 6.932 af

Reach 20R: 6-20 to 6-21 Peak Depth=1.55' Max Vel=7.3 fps Inflow=29.98 cfs 1.917 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=29.95 cfs 1.917 af

Reach 21R: 6-21 to 6-22 Peak Depth=1.76' Max Vel=20.0 fps Inflow=115.42 cfs 8.849 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=115.35 cfs 8.849 af

Reach 23R: 6-23 to 6-20 Peak Depth=1.13' Max Vel=7.4 fps Inflow=18.00 cfs 0.991 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=17.91 cfs 0.991 af

Reach 24R: 6-24 to 6-23 Peak Depth=1.01' Max Vel=5.9 fps Inflow=12.29 cfs 0.673 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=12.25 cfs 0.673 af

Reach 100R: Ravine channel below BMP Peak Depth=0.54' Max Vel=2.0 fps Inflow=7.10 cfs 9.618 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=7.10 cfs 9.617 af

Pond 1P: Existing BMP Peak Elev=29.03' Storage=459,046 cf Inflow=126.37 cfs 9.869 af
Primary=7.10 cfs 9.618 af Secondary=0.00 cfs 0.000 af Outflow=7.10 cfs 9.618 af

Total Runoff Area = 55.200 ac Runoff Volume = 9.869 af Average Runoff Depth = 2.15"

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=4.33"
Flow Length=605' Tc=23.5 min CN=87 Runoff=19.63 cfs 1.651 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=4.33"
Flow Length=500' Tc=13.6 min CN=87 Runoff=22.92 cfs 1.456 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=4.33"
Flow Length=320' Tc=32.9 min CN=87 Runoff=5.40 cfs 0.559 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=3.60"
Flow Length=375' Tc=7.6 min CN=80 Runoff=7.81 cfs 0.393 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=5.21"
Flow Length=240' Tc=2.0 min CN=95 Runoff=2.20 cfs 0.104 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=4.33"
Flow Length=575' Tc=4.4 min CN=87 Runoff=19.68 cfs 0.923 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=5.21"
Flow Length=215' Tc=1.8 min CN=95 Runoff=3.79 cfs 0.178 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=4.33"
Flow Length=590' Tc=4.2 min CN=87 Runoff=23.99 cfs 1.118 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=4.33"
Tc=5.0 min CN=87 Runoff=14.77 cfs 0.707 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=4.33"
Flow Length=545' Tc=24.8 min CN=87 Runoff=17.86 cfs 1.550 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=4.33"
Flow Length=500' Tc=12.7 min CN=87 Runoff=17.65 cfs 1.089 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=4.33"
Flow Length=350' Tc=2.9 min CN=87 Runoff=9.04 cfs 0.404 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=4.33"
Flow Length=700' Tc=14.3 min CN=87 Runoff=16.79 cfs 1.089 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=4.33"
Flow Length=570' Tc=18.3 min CN=87 Runoff=25.13 cfs 1.835 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=5.21"
Tc=2.0 min CN=95 Runoff=1.93 cfs 0.091 af

Subcatchment 16S: Lot 6-S Runoff Area=2.980 ac Runoff Depth=4.33"
Flow Length=600' Tc=15.1 min CN=87 Runoff=16.15 cfs 1.074 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=5.21"
Tc=5.0 min CN=95 Runoff=10.97 cfs 0.569 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=5.21"
Tc=5.0 min CN=95 Runoff=4.86 cfs 0.252 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=5.21"
Tc=2.0 min CN=95 Runoff=8.17 cfs 0.387 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=3.60"
Tc=20.0 min CN=80 Runoff=29.88 cfs 2.245 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=4.33"
Tc=10.0 min CN=87 Runoff=11.17 cfs 0.631 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=4.33"
Tc=10.0 min CN=87 Runoff=23.61 cfs 1.334 af

Reach 1R: 6-1 to 6-4 Peak Depth=1.09' Max Vel=9.5 fps Inflow=19.63 cfs 1.651 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow=19.62 cfs 1.651 af

Reach 2R: 6-2 to 6-3 Peak Depth=1.21' Max Vel=11.6 fps Inflow=22.92 cfs 1.456 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow=22.88 cfs 1.456 af

Reach 3R: 6-3 to 6-4 Peak Depth=2.25' Max Vel=6.0 fps Inflow=26.24 cfs 2.015 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow=21.87 cfs 2.015 af

Reach 4R: 6-4 to 6-6 Peak Depth=1.60' Max Vel=12.8 fps Inflow=42.41 cfs 4.059 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow=42.40 cfs 4.059 af

Reach 5R: 6-5 to 6-6 Peak Depth=0.36' Max Vel=7.5 fps Inflow=2.20 cfs 0.104 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow=2.20 cfs 0.104 af

Reach 6R: 6-6 to 6-8 Peak Depth=2.51' Max Vel=8.8 fps Inflow=55.69 cfs 5.087 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow=55.51 cfs 5.087 af

Reach 7R: 6-7 to 6-8 Peak Depth=0.48' Max Vel=8.8 fps Inflow=3.79 cfs 0.178 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow=3.78 cfs 0.178 af

Reach 8R: 6-8 to 6-10 Peak Depth=3.00' Max Vel=10.9 fps Inflow=78.39 cfs 6.382 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow=70.92 cfs 6.382 af

Reach 9R: 6-9 to 6-10 Peak Depth=2.00' Max Vel=3.6 fps Inflow=14.77 cfs 0.707 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow=9.91 cfs 0.707 af

Reach 10R: 6-10 to 6-12 Peak Depth=1.78' Max Vel=19.0 fps Inflow=93.11 cfs 8.639 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow=93.23 cfs 8.639 af

Reach 11R: 6-11 to 6-12 Peak Depth=2.00' Max Vel=4.6 fps Inflow=17.65 cfs 1.089 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow=13.24 cfs 1.089 af

Reach 12R: 6-12 to 6-14 Peak Depth=1.88' Max Vel=18.8 fps Inflow=109.46 cfs 10.132 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow=108.98 cfs 10.132 af

Reach 13R: 6-13 to 6-14 Peak Depth=2.00' Max Vel=4.9 fps Inflow=16.79 cfs 1.089 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow=13.86 cfs 1.089 af

Reach 14R: 6-14 to 6-15 Peak Depth=2.55' Max Vel=14.3 fps Inflow=121.02 cfs 11.220 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow=120.75 cfs 11.220 af

Reach 15R: 6-15 to 6-19 Peak Depth=2.68' Max Vel=13.6 fps Inflow=122.05 cfs 11.312 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=121.78 cfs 11.312 af

Reach 16R: 6-16 to 6-19 Peak Depth=2.00' Max Vel=4.9 fps Inflow=16.15 cfs 1.074 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=14.46 cfs 1.074 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.50' Max Vel=3.7 fps Inflow=10.97 cfs 0.569 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=5.89 cfs 0.569 af

Reach 18R: 6-18 to 6-19 Peak Depth=1.64' Max Vel=3.8 fps Inflow=10.53 cfs 0.821 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=10.49 cfs 0.821 af

Reach 19R: 6-19 to 6-21 Peak Depth=4.50' Max Vel=9.7 fps Inflow=149.64 cfs 13.594 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=144.47 cfs 13.594 af

Reach 20R: 6-20 to 6-21 Peak Depth=2.32' Max Vel=8.5 fps Inflow=57.74 cfs 3.800 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=57.69 cfs 3.800 af

Reach 21R: 6-21 to 6-22 Peak Depth=2.36' Max Vel=22.9 fps Inflow=193.50 cfs 17.393 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=193.44 cfs 17.393 af

Reach 23R: 6-23 to 6-20 Peak Depth=1.64' Max Vel=8.7 fps Inflow=34.60 cfs 1.965 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=34.49 cfs 1.965 af

Reach 24R: 6-24 to 6-23 Peak Depth=1.44' Max Vel=7.0 fps Inflow=23.61 cfs 1.334 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=23.53 cfs 1.334 af

Reach 100R: Ravine channel below BMP Peak Depth=0.92' Max Vel=2.8 fps Inflow=22.94 cfs 19.264 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=22.94 cfs 19.263 af

Pond 1P: Existing BMP Peak Elev=32.75' Storage=699,903 cf Inflow=221.17 cfs 19.638 af
Primary=22.94 cfs 19.264 af Secondary=0.00 cfs 0.000 af Outflow=22.94 cfs 19.264 af

Total Runoff Area = 55.200 ac Runoff Volume = 19.638 af Average Runoff Depth = 4.27"

Subcatchment 1S: Lot 2-N

Runoff = 19.63 cfs @ 12.16 hrs, Volume= 1.651 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
4.580	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	220	0.0100	0.2		**Sheet Flow, Natural and landscaped** Range n= 0.130 P2= 3.50"
2.8	385	0.0130	2.3		**Shallow Concentrated Flow, Improved / paved** Paved Kv= 20.3 fps
23.5	605	Total			

Subcatchment 2S: Lot 1-N

Runoff = 22.92 cfs @ 12.05 hrs, Volume= 1.456 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
4.040	87	Lot 1 to Inlet 6-2

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	150	0.0200	0.2		**Sheet Flow, Natural and landscped** Range n= 0.130 P2= 3.50"
2.0	350	0.0200	2.9		**Shallow Concentrated Flow, Improved / paved** Paved Kv= 20.3 fps
13.6	500	Total			

Subcatchment 3S: Lot 1-S

Runoff = 5.40 cfs @ 12.25 hrs, Volume= 0.559 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
1.550	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.3	120	0.0100	0.1		**Sheet Flow, Naturla / Landscaped** Woods: Light underbrush n= 0.400 P2= 3.50"
1.6	200	0.0100	2.0		**Shallow Concentrated Flow, Paved** Paved Kv= 20.3 fps
32.9	320	Total			

Subcatchment 4S: Lot 2 -S

Runoff = 7.81 cfs @ 11.99 hrs, Volume= 0.393 af, Depth= 3.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
1.310	80	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	40	0.0200	0.2		**Sheet Flow, Natural / Landscaped** Range n= 0.130 P2= 3.50"
3.6	335	0.0060	1.6		**Shallow Concentrated Flow, Improved / paved** Paved Kv= 20.3 fps
7.6	375	Total			

Subcatchment 5S: Road to 6-5

Runoff = 2.20 cfs @ 11.92 hrs, Volume= 0.104 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.240	95	Road and shoulder

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	240	0.0100	2.0		**Shallow Concentrated Flow, Road gutter** Paved Kv= 20.3 fps

Subcatchment 6S: Lot 4-N

Runoff = 19.68 cfs @ 11.95 hrs, Volume= 0.923 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
2.560	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	280	0.0200	2.3		**Shallow Concentrated Flow, Unimproved** Unpaved Kv= 16.1 fps
2.4	295	0.0100	2.0		**Shallow Concentrated Flow, IMproved /paved** Paved Kv= 20.3 fps
4.4	575	Total			

Subcatchment 7S: Road to 6-7

Runoff = 3.79 cfs @ 11.92 hrs, Volume= 0.178 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.410	95	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	215	0.0100	2.0		**Shallow Concentrated Flow, gutter** Paved Kv= 20.3 fps

Subcatchment 8S: Lot 4-M

Runoff = 23.99 cfs @ 11.95 hrs, Volume= 1.118 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
3.100	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	295	0.0300	2.8		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.4	295	0.0100	2.0		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.2	590	Total			

Subcatchment 9S: Lot 3-S

Runoff = 14.77 cfs @ 11.96 hrs, Volume= 0.707 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
1.960	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 10S: Lot 4-S

Runoff = 17.86 cfs @ 12.18 hrs, Volume= 1.550 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
4.300	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.3	255	0.0100	0.2		**Sheet Flow,** Range n= 0.130 P2= 3.50"
1.5	290	0.0250	3.2		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.8	545	Total			

Subcatchment 11S: Lot 6-N

Runoff = 17.65 cfs @ 12.04 hrs, Volume= 1.089 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
3.020	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	150	0.0300	0.3		**Sheet Flow,** Range n= 0.130 P2= 3.50"
2.9	350	0.0100	2.0		**Shallow Concentrated Flow, gutter** Paved Kv= 20.3 fps
12.7	500	Total			

Subcatchment 12S: Lot 5

Runoff = 9.04 cfs @ 11.93 hrs, Volume= 0.404 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
1.120	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	350	0.0100	2.0		**Shallow Concentrated Flow, Gutter** Paved Kv= 20.3 fps

Subcatchment 13S: Lot 6-M

Runoff = 16.79 cfs @ 12.06 hrs, Volume= 1.089 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
3.020	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	150	0.0300	0.3		**Sheet Flow,** Range n= 0.130 P2= 3.50"
4.5	550	0.0100	2.0		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.3	700	Total			

Subcatchment 14S: Lot 7

Runoff = 25.13 cfs @ 12.10 hrs, Volume= 1.835 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
5.090	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	280	0.0250	0.3		**Sheet Flow,** Range n= 0.130 P2= 3.50"
0.9	290	0.0700	5.4		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
18.3	570	Total			

Subcatchment 15S: ROW to Inlet 6-15

Runoff = 1.93 cfs @ 11.92 hrs, Volume= 0.091 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.210	95	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0					**Direct Entry, Pavement / Shoulder**

Subcatchment 16S: Lot 6-S

Runoff = 16.15 cfs @ 12.06 hrs, Volume= 1.074 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
2.980	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	100	0.0100	0.2		**Sheet Flow,** Range n= 0.130 P2= 3.50"
4.1	500	0.0100	2.0		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
15.1	600	Total			

Subcatchment 17S: ROW Lot10

Runoff = 10.97 cfs @ 11.96 hrs, Volume= 0.569 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
1.310	95	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 18S: ROW Cul-de-sac

Runoff = 4.86 cfs @ 11.96 hrs, Volume= 0.252 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.580	95	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 19S: Columbia Road / shoulder

Runoff = 8.17 cfs @ 11.92 hrs, Volume= 0.387 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.890	95	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0					**Direct Entry,**

Subcatchment 20S: Remaining Site

Runoff = 29.88 cfs @ 12.12 hrs, Volume= 2.245 af, Depth= 3.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
7.480	80	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0					**Direct Entry,**

Subcatchment 23S: Lot to S-23

Runoff = 11.17 cfs @ 12.01 hrs, Volume= 0.631 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
1.750	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 24S: Lot to S-24

Runoff = 23.61 cfs @ 12.01 hrs, Volume= 1.334 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
3.700	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Reach 1R: 6-1 to 6-4

Inflow Area = 4.580 ac, Inflow Depth = 4.33" for 10 Year event
Inflow = 19.63 cfs @ 12.16 hrs, Volume= 1.651 af
Outflow = 19.62 cfs @ 12.17 hrs, Volume= 1.651 af, Atten= 0%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.5 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 3.2 fps, Avg. Travel Time= 1.7 min

Peak Depth= 1.09' @ 12.16 hrs
Capacity at bank full= 49.51 cfs
Inlet Invert= 61.85', Outlet Invert= 57.10'
30.0" Diameter Pipe n= 0.013 Length= 326.0' Slope= 0.0146 '/'

Reach 2R: 6-2 to 6-3

Inflow Area = 4.040 ac, Inflow Depth = 4.33" for 10 Year event
Inflow = 22.92 cfs @ 12.05 hrs, Volume= 1.456 af
Outflow = 22.88 cfs @ 12.06 hrs, Volume= 1.456 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.6 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.7 fps, Avg. Travel Time= 1.1 min

Peak Depth= 1.21' @ 12.05 hrs
Capacity at bank full= 33.79 cfs
Inlet Invert= 62.98', Outlet Invert= 57.76'
24.0" Diameter Pipe n= 0.013 Length= 234.0' Slope= 0.0223 '/'

Reach 3R: 6-3 to 6-4

Inflow Area = 5.590 ac, Inflow Depth = 4.33" for 10 Year event
Inflow = 26.24 cfs @ 12.07 hrs, Volume= 2.015 af
Outflow = 21.87 cfs @ 12.00 hrs, Volume= 2.015 af, Atten= 17%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.0 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.2 fps, Avg. Travel Time= 0.4 min

Peak Depth= 2.25' @ 12.01 hrs
Capacity at bank full= 20.97 cfs
Inlet Invert= 57.76', Outlet Invert= 57.54'
27.0" Diameter Pipe n= 0.013 Length= 48.0' Slope= 0.0046 '/'

Reach 4R: 6-4 to 6-6

Inflow Area = 11.480 ac, Inflow Depth = 4.24" for 10 Year event
Inflow = 42.41 cfs @ 12.15 hrs, Volume= 4.059 af
Outflow = 42.40 cfs @ 12.16 hrs, Volume= 4.059 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 12.8 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 4.5 fps, Avg. Travel Time= 0.9 min

Peak Depth= 1.60' @ 12.16 hrs
Capacity at bank full= 57.57 cfs
Inlet Invert= 56.51', Outlet Invert= 51.88'
30.0" Diameter Pipe n= 0.013 Length= 235.0' Slope= 0.0197 '/'

Reach 5R: 6-5 to 6-6

Inflow Area = 0.240 ac, Inflow Depth = 5.21" for 10 Year event
Inflow = 2.20 cfs @ 11.92 hrs, Volume= 0.104 af
Outflow = 2.20 cfs @ 11.93 hrs, Volume= 0.104 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.5 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 0.4 min

Peak Depth= 0.36' @ 11.92 hrs
Capacity at bank full= 12.23 cfs
Inlet Invert= 55.35', Outlet Invert= 53.63'
15.0" Diameter Pipe n= 0.013 Length= 48.0' Slope= 0.0358 '/'

Reach 6R: 6-6 to 6-8

Inflow Area = 14.280 ac, Inflow Depth = 4.27" for 10 Year event
Inflow = 55.69 cfs @ 12.00 hrs, Volume= 5.087 af
Outflow = 55.51 cfs @ 12.01 hrs, Volume= 5.087 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.8 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.9 fps, Avg. Travel Time= 1.2 min

Peak Depth= 2.51' @ 12.00 hrs
Capacity at bank full= 54.65 cfs
Inlet Invert= 51.38', Outlet Invert= 49.95'
36.0" Diameter Pipe n= 0.013 Length= 213.0' Slope= 0.0067 '/'

Reach 7R: 6-7 to 6-8

Inflow Area = 0.410 ac, Inflow Depth = 5.21" for 10 Year event
Inflow = 3.79 cfs @ 11.92 hrs, Volume= 0.178 af
Outflow = 3.78 cfs @ 11.92 hrs, Volume= 0.178 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.8 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 0.3 min

Peak Depth= 0.48' @ 11.92 hrs
Capacity at bank full= 12.26 cfs
Inlet Invert= 53.93', Outlet Invert= 52.20'
15.0" Diameter Pipe n= 0.013 Length= 48.0' Slope= 0.0360 '/'

Reach 8R: 6-8 to 6-10

Inflow Area = 17.790 ac, Inflow Depth = 4.31" for 10 Year event
Inflow = 78.39 cfs @ 11.97 hrs, Volume= 6.382 af
Outflow = 70.92 cfs @ 11.95 hrs, Volume= 6.382 af, Atten= 10%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 10.9 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.7 fps, Avg. Travel Time= 1.3 min

Peak Depth= 3.00' @ 11.95 hrs
Capacity at bank full= 67.90 cfs
Inlet Invert= 49.85', Outlet Invert= 47.00'
36.0" Diameter Pipe n= 0.013 Length= 275.0' Slope= 0.0104 '/'

Reach 9R: 6-9 to 6-10

Inflow Area = 1.960 ac, Inflow Depth = 4.33" for 10 Year event
Inflow = 14.77 cfs @ 11.96 hrs, Volume= 0.707 af
Outflow = 9.91 cfs @ 11.89 hrs, Volume= 0.707 af, Atten= 33%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.6 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.2 fps, Avg. Travel Time= 0.6 min

Peak Depth= 2.00' @ 11.89 hrs
Capacity at bank full= 9.80 cfs
Inlet Invert= 48.58', Outlet Invert= 48.49'
24.0" Diameter Pipe n= 0.013 Length= 48.0' Slope= 0.0019 '/'

Reach 10R: 6-10 to 6-12

Inflow Area = 24.050 ac, Inflow Depth = 4.31" for 10 Year event
Inflow = 93.11 cfs @ 12.09 hrs, Volume= 8.639 af
Outflow = 93.23 cfs @ 12.09 hrs, Volume= 8.639 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 19.0 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 6.0 fps, Avg. Travel Time= 0.6 min

Peak Depth= 1.78' @ 12.09 hrs
Capacity at bank full= 182.07 cfs
Inlet Invert= 47.00', Outlet Invert= 40.45'
42.0" Diameter Pipe n= 0.013 Length= 200.0' Slope= 0.0327 '/'

Reach 11R: 6-11 to 6-12

Inflow Area = 3.020 ac, Inflow Depth = 4.33" for 10 Year event
Inflow = 17.65 cfs @ 12.04 hrs, Volume= 1.089 af
Outflow = 13.24 cfs @ 11.96 hrs, Volume= 1.089 af, Atten= 25%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.6 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 0.5 min

Peak Depth= 2.00' @ 11.97 hrs
Capacity at bank full= 12.65 cfs
24.0" Diameter Pipe n= 0.013 Length= 48.0' Slope= 0.0031 '/'

Reach 12R: 6-12 to 6-14

Inflow Area = 28.190 ac, Inflow Depth = 4.31" for 10 Year event
Inflow = 109.46 cfs @ 11.95 hrs, Volume= 10.132 af
Outflow = 108.98 cfs @ 11.96 hrs, Volume= 10.132 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 18.8 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 5.9 fps, Avg. Travel Time= 0.7 min

Peak Depth= 1.88' @ 11.96 hrs
Capacity at bank full= 242.92 cfs
Inlet Invert= 40.35', Outlet Invert= 33.20'
48.0" Diameter Pipe n= 0.013 Length= 250.0' Slope= 0.0286 '/'

Reach 13R: 6-13 to 6-14

Inflow Area = 3.020 ac, Inflow Depth = 4.33" for 10 Year event
Inflow = 16.79 cfs @ 12.06 hrs, Volume= 1.089 af
Outflow = 13.86 cfs @ 11.99 hrs, Volume= 1.089 af, Atten= 17%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.9 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 0.5 min

Peak Depth= 2.00' @ 12.00 hrs
Capacity at bank full= 13.46 cfs
Inlet Invert= 35.92', Outlet Invert= 35.75'
24.0" Diameter Pipe n= 0.013 Length= 48.0' Slope= 0.0035 '/'

Reach 14R: 6-14 to 6-15

Inflow Area = 31.210 ac, Inflow Depth = 4.31" for 10 Year event
Inflow = 121.02 cfs @ 11.96 hrs, Volume= 11.220 af
Outflow = 120.75 cfs @ 11.97 hrs, Volume= 11.220 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.3 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.5 fps, Avg. Travel Time= 0.5 min

Peak Depth= 2.55' @ 11.97 hrs
Capacity at bank full= 163.86 cfs
Inlet Invert= 33.21', Outlet Invert= 31.31'
48.0" Diameter Pipe n= 0.013 Length= 146.0' Slope= 0.0130 '/'

Reach 15R: 6-15 to 6-19

Inflow Area = 31.420 ac, Inflow Depth = 4.32" for 10 Year event
Inflow = 122.05 cfs @ 11.97 hrs, Volume= 11.312 af
Outflow = 121.78 cfs @ 11.98 hrs, Volume= 11.312 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 13.6 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.3 fps, Avg. Travel Time= 0.4 min

Peak Depth= 2.68' @ 11.97 hrs
Capacity at bank full= 154.48 cfs
Inlet Invert= 31.36', Outlet Invert= 30.03'
48.0" Diameter Pipe n= 0.013 Length= 115.0' Slope= 0.0116 '/'

Reach 16R: 6-16 to 6-19

Inflow Area = 2.980 ac, Inflow Depth = 4.33" for 10 Year event
Inflow = 16.15 cfs @ 12.06 hrs, Volume= 1.074 af
Outflow = 14.46 cfs @ 12.02 hrs, Volume= 1.074 af, Atten= 10%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.9 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 0.6 min

Peak Depth= 2.00' @ 12.03 hrs
Capacity at bank full= 13.59 cfs
Inlet Invert= 32.25', Outlet Invert= 32.03'
24.0" Diameter Pipe n= 0.013 Length= 61.0' Slope= 0.0036 '/'

Reach 17R: 6-17 to 6-18

Inflow Area = 1.310 ac, Inflow Depth = 5.21" for 10 Year event
Inflow = 10.97 cfs @ 11.96 hrs, Volume= 0.569 af
Outflow = 5.89 cfs @ 11.84 hrs, Volume= 0.569 af, Atten= 46%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.7 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.4 fps, Avg. Travel Time= 0.6 min

Peak Depth= 1.50' @ 11.85 hrs
Capacity at bank full= 5.67 cfs
Inlet Invert= 32.95', Outlet Invert= 32.81'
18.0" Diameter Pipe n= 0.013 Length= 48.0' Slope= 0.0029 '/'

Reach 18R: 6-18 to 6-19

Inflow Area = 1.890 ac, Inflow Depth = 5.21" for 10 Year event
Inflow = 10.53 cfs @ 11.96 hrs, Volume= 0.821 af
Outflow = 10.49 cfs @ 11.97 hrs, Volume= 0.821 af, Atten= 0%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.8 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.3 fps, Avg. Travel Time= 1.6 min

Peak Depth= 1.64' @ 11.97 hrs
Capacity at bank full= 10.50 cfs
Inlet Invert= 32.31', Outlet Invert= 32.03'
24.0" Diameter Pipe n= 0.013 Length= 130.0' Slope= 0.0022 '/'

Reach 19R: 6-19 to 6-21

Inflow Area = 37.180 ac, Inflow Depth = 4.39" for 10 Year event
Inflow = 149.64 cfs @ 11.97 hrs, Volume= 13.594 af
Outflow = 144.47 cfs @ 11.97 hrs, Volume= 13.594 af, Atten= 3%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.7 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.3 fps, Avg. Travel Time= 1.3 min

Peak Depth= 4.50' @ 11.98 hrs
Capacity at bank full= 135.81 cfs
Inlet Invert= 29.70', Outlet Invert= 28.46'
54.0" Diameter Pipe n= 0.013 Length= 260.0' Slope= 0.0048 '/'

Reach 20R: 6-20 to 6-21

Inflow Area = 10.540 ac, Inflow Depth = 4.33" for 10 Year event
Inflow = 57.74 cfs @ 12.06 hrs, Volume= 3.800 af
Outflow = 57.69 cfs @ 12.06 hrs, Volume= 3.800 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.5 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.7 fps, Avg. Travel Time= 0.3 min

Peak Depth= 2.32' @ 12.06 hrs
Capacity at bank full= 74.05 cfs
Inlet Invert= 30.22', Outlet Invert= 29.96'
42.0" Diameter Pipe n= 0.013 Length= 48.0' Slope= 0.0054 '/'

Reach 21R: 6-21 to 6-22

Inflow Area = 47.720 ac, Inflow Depth = 4.37" for 10 Year event
Inflow = 193.50 cfs @ 12.06 hrs, Volume= 17.393 af
Outflow = 193.44 cfs @ 12.06 hrs, Volume= 17.393 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 22.9 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 7.1 fps, Avg. Travel Time= 0.3 min

Peak Depth= 2.36' @ 12.06 hrs
Capacity at bank full= 357.48 cfs
Inlet Invert= 28.23', Outlet Invert= 24.00'
54.0" Diameter Pipe n= 0.013 Length= 128.0' Slope= 0.0330 '/'

Reach 23R: 6-23 to 6-20

Inflow Area = 5.450 ac, Inflow Depth = 4.33" for 10 Year event
Inflow = 34.60 cfs @ 12.02 hrs, Volume= 1.965 af
Outflow = 34.49 cfs @ 12.04 hrs, Volume= 1.965 af, Atten= 0%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.7 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.6 fps, Avg. Travel Time= 2.0 min

Peak Depth= 1.64' @ 12.03 hrs
Capacity at bank full= 59.63 cfs
Inlet Invert= 33.19', Outlet Invert= 30.72'
36.0" Diameter Pipe n= 0.013 Length= 309.0' Slope= 0.0080 '/'

Reach 24R: 6-24 to 6-23

Inflow Area = 3.700 ac, Inflow Depth = 4.33" for 10 Year event
Inflow = 23.61 cfs @ 12.01 hrs, Volume= 1.334 af
Outflow = 23.53 cfs @ 12.03 hrs, Volume= 1.334 af, Atten= 0%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.0 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 1.6 min

Peak Depth= 1.44' @ 12.02 hrs
Capacity at bank full= 50.36 cfs
Inlet Invert= 34.87', Outlet Invert= 33.69'
36.0" Diameter Pipe n= 0.013 Length= 207.0' Slope= 0.0057 '/'

Reach 100R: Ravine channel below BMP

Inflow Area = 55.200 ac, Inflow Depth = 4.19" for 10 Year event
Inflow = 22.94 cfs @ 13.04 hrs, Volume= 19.264 af
Outflow = 22.94 cfs @ 13.06 hrs, Volume= 19.263 af, Atten= 0%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.8 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.92' @ 13.05 hrs
Capacity at bank full= 155.76 cfs
Inlet Invert= 17.00', Outlet Invert= 16.00'
Custom cross-section table, n= 0.040 Length= 117.0' Slope= 0.0085 '/'

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	3.0	8.1	351	5.31
1.50	15.0	17.2	1,755	47.03
2.50	39.0	31.1	4,563	155.76

Pond 1P: Existing BMP

Inflow Area =	55.200 ac,	Inflow Depth =	4.27"	for	10 Year event
Inflow =	221.17 cfs @	12.07 hrs,	Volume=	19.638 af	
Outflow =	22.94 cfs @	13.04 hrs,	Volume=	19.264 af,	Atten= 90%, Lag= 58.0 min
Primary =	22.94 cfs @	13.04 hrs,	Volume=	19.264 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 25.00' Surf.Area= 41,012 sf Storage= 200,791 cf
Peak Elev= 32.75' @ 13.04 hrs Surf.Area= 71,991 sf Storage= 699,903 cf (499,113 cf above start)
Plug-Flow detention time= 711.1 min calculated for 14.651 af (75% of inflow)
Center-of-Mass det. time= 466.2 min (1,270.6 - 804.4)

#	Invert	Avail.Storage	Storage Description
1	18.00'	909,917 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	21,217	0	0
20.00	25,046	46,263	46,263
22.00	29,209	54,255	100,518
24.00	33,705	62,914	163,432
25.00	41,012	37,359	200,791
25.10	46,500	4,376	205,166
36.00	82,812	704,750	909,917

#	Routing	Invert	Outlet Devices
1	Device 4	25.00'	**12.0" Vert. Orifice/Grate** C= 0.600
2	Device 4	29.96'	**15.0" Vert. Orifice/Grate** C= 0.600
3	Device 4	32.57'	**60.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
4	Primary	18.50'	**36.0" x 106.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 16.30' S= 0.0208 '/' n= 0.013 Cc= 0.900
5	Secondary	33.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=22.86 cfs @ 13.04 hrs HW=32.75' (Free Discharge)
└─**4=Culvert** (Passes 22.86 cfs of 121.54 cfs potential flow)
  ├─**1=Orifice/Grate** (Orifice Controls 10.18 cfs @ 13.0 fps)
  ├─**2=Orifice/Grate** (Orifice Controls 8.70 cfs @ 7.1 fps)
  └─**3=Orifice/Grate** (Weir Controls 3.98 cfs @ 1.4 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=6.45"
Flow Length=605' Tc=23.5 min CN=87 Runoff=28.76 cfs 2.462 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=6.45"
Flow Length=500' Tc=13.6 min CN=87 Runoff=33.44 cfs 2.171 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=6.45"
Flow Length=320' Tc=32.9 min CN=87 Runoff=7.93 cfs 0.833 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=5.63"
Flow Length=375' Tc=7.6 min CN=80 Runoff=11.93 cfs 0.614 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=7.40"
Flow Length=240' Tc=2.0 min CN=95 Runoff=3.07 cfs 0.148 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=6.45"
Flow Length=575' Tc=4.4 min CN=87 Runoff=28.55 cfs 1.376 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=7.40"
Flow Length=215' Tc=1.8 min CN=95 Runoff=5.28 cfs 0.253 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=6.45"
Flow Length=590' Tc=4.2 min CN=87 Runoff=34.80 cfs 1.666 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=6.45"
Tc=5.0 min CN=87 Runoff=21.44 cfs 1.053 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=6.45"
Flow Length=545' Tc=24.8 min CN=87 Runoff=26.14 cfs 2.311 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=6.45"
Flow Length=500' Tc=12.7 min CN=87 Runoff=25.73 cfs 1.623 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=6.45"
Flow Length=350' Tc=2.9 min CN=87 Runoff=13.11 cfs 0.602 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=6.45"
Flow Length=700' Tc=14.3 min CN=87 Runoff=24.50 cfs 1.623 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=6.45"
Flow Length=570' Tc=18.3 min CN=87 Runoff=36.74 cfs 2.736 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=7.40"
Tc=2.0 min CN=95 Runoff=2.69 cfs 0.130 af

Subcatchment 16S: Lot 6-S Runoff Area=2.980 ac Runoff Depth=6.45"
Flow Length=600' Tc=15.1 min CN=87 Runoff=23.58 cfs 1.602 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=7.40"
Tc=5.0 min CN=95 Runoff=15.28 cfs 0.808 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=7.40"
Tc=5.0 min CN=95 Runoff=6.77 cfs 0.358 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=7.40"
Tc=2.0 min CN=95 Runoff=11.38 cfs 0.549 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=5.63"
Tc=20.0 min CN=80 Runoff=46.16 cfs 3.506 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=6.45"
Tc=10.0 min CN=87 Runoff=16.26 cfs 0.941 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=6.45"
Tc=10.0 min CN=87 Runoff=34.37 cfs 1.989 af

Reach 1R: 6-1 to 6-4 Peak Depth=1.37' Max Vel=10.5 fps Inflow=28.76 cfs 2.462 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow=28.73 cfs 2.462 af

Reach 2R: 6-2 to 6-3 Peak Depth=1.62' Max Vel=12.3 fps Inflow=33.44 cfs 2.171 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow=33.38 cfs 2.171 af

Reach 3R: 6-3 to 6-4 Peak Depth=2.25' Max Vel=6.0 fps Inflow=38.38 cfs 3.004 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow=22.05 cfs 3.004 af

Reach 4R: 6-4 to 6-6 Peak Depth=1.88' Max Vel=13.3 fps Inflow=52.52 cfs 6.080 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow=52.51 cfs 6.080 af

Reach 5R: 6-5 to 6-6 Peak Depth=0.43' Max Vel=8.3 fps Inflow=3.07 cfs 0.148 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow=3.06 cfs 0.148 af

Reach 6R: 6-6 to 6-8 Peak Depth=3.00' Max Vel=8.8 fps Inflow=75.59 cfs 7.604 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow=57.00 cfs 7.604 af

Reach 7R: 6-7 to 6-8 Peak Depth=0.57' Max Vel=9.6 fps Inflow=5.28 cfs 0.253 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow=5.26 cfs 0.253 af

Reach 8R: 6-8 to 6-10 Peak Depth=3.00' Max Vel=10.9 fps Inflow=94.14 cfs 9.523 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow=70.91 cfs 9.523 af

Reach 9R: 6-9 to 6-10 Peak Depth=2.00' Max Vel=3.6 fps Inflow=21.44 cfs 1.053 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow=10.35 cfs 1.053 af

Reach 10R: 6-10 to 6-12 Peak Depth=1.89' Max Vel=19.5 fps Inflow=103.84 cfs 12.888 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow=103.84 cfs 12.888 af

Reach 11R: 6-11 to 6-12 Peak Depth=2.00' Max Vel=4.6 fps Inflow=25.73 cfs 1.623 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow=13.01 cfs 1.623 af

Reach 12R: 6-12 to 6-14 Peak Depth=1.97' Max Vel=19.2 fps Inflow=117.96 cfs 15.113 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow=117.95 cfs 15.113 af

Reach 13R: 6-13 to 6-14 Peak Depth=2.00' Max Vel=4.9 fps Inflow=24.50 cfs 1.623 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow=13.89 cfs 1.623 af

Reach 14R: 6-14 to 6-15 Peak Depth=2.71' Max Vel=14.5 fps Inflow=131.42 cfs 16.736 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow=131.41 cfs 16.736 af

Reach 15R: 6-15 to 6-19 Peak Depth=2.84' Max Vel=13.8 fps Inflow=131.69 cfs 16.866 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=131.68 cfs 16.866 af

Reach 16R: 6-16 to 6-19 Peak Depth=2.00' Max Vel=4.9 fps Inflow=23.58 cfs 1.602 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=14.36 cfs 1.602 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.50' Max Vel=3.7 fps Inflow=15.28 cfs 0.808 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=5.98 cfs 0.808 af

Reach 18R: 6-18 to 6-19 Peak Depth=2.00' Max Vel=3.8 fps Inflow=12.44 cfs 1.166 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=11.31 cfs 1.166 af

Reach 19R: 6-19 to 6-21 Peak Depth=4.50' Max Vel=9.7 fps Inflow=165.13 cfs 20.182 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=143.45 cfs 20.182 af

Reach 20R: 6-20 to 6-21 Peak Depth=3.50' Max Vel=8.8 fps Inflow=84.14 cfs 5.665 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=77.30 cfs 5.665 af

Reach 21R: 6-21 to 6-22 Peak Depth=2.50' Max Vel=23.5 fps Inflow=213.11 cfs 25.847 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=212.48 cfs 25.847 af

Reach 23R: 6-23 to 6-20 Peak Depth=2.11' Max Vel=9.5 fps Inflow=50.39 cfs 2.929 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=50.22 cfs 2.929 af

Reach 24R: 6-24 to 6-23 Peak Depth=1.82' Max Vel=7.7 fps Inflow=34.37 cfs 1.989 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=34.25 cfs 1.989 af

Reach 100R: Ravine channel below BMP Peak Depth=2.45' Max Vel=4.0 fps Inflow=150.49 cfs 28.935 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=150.47 cfs 28.934 af

Pond 1P: Existing BMP Peak Elev=34.23' Storage=795,331 cf Inflow=256.02 cfs 29.353 af
Primary=128.37 cfs 28.110 af Secondary=22.16 cfs 0.826 af Outflow=150.49 cfs 28.935 af

Total Runoff Area = 55.200 ac Runoff Volume = 29.353 af Average Runoff Depth = 6.38"

JAMES RIVER COMMERCE CENTER

DRAINAGE AREAS

CASE 2

ANALYSIS OF EXISTING BMP JR 038 AS-BUILT

POST DEVELOPMENT CONDITIONS WITH ADDITION OF SHELL BUILDING. ANALYSIS WITH CERTAIN LOTS REMAINING UNDEVELOPED.

TOTAL DRAINAGE AREA 62.32 ACRES

LOTS WITHIN DRAINAGE AREA CONSIDERED UNDEVELOPED

DRAINAGE AREA NOT PASSING THROUGH BMP 1P

MARCH 3, 2004

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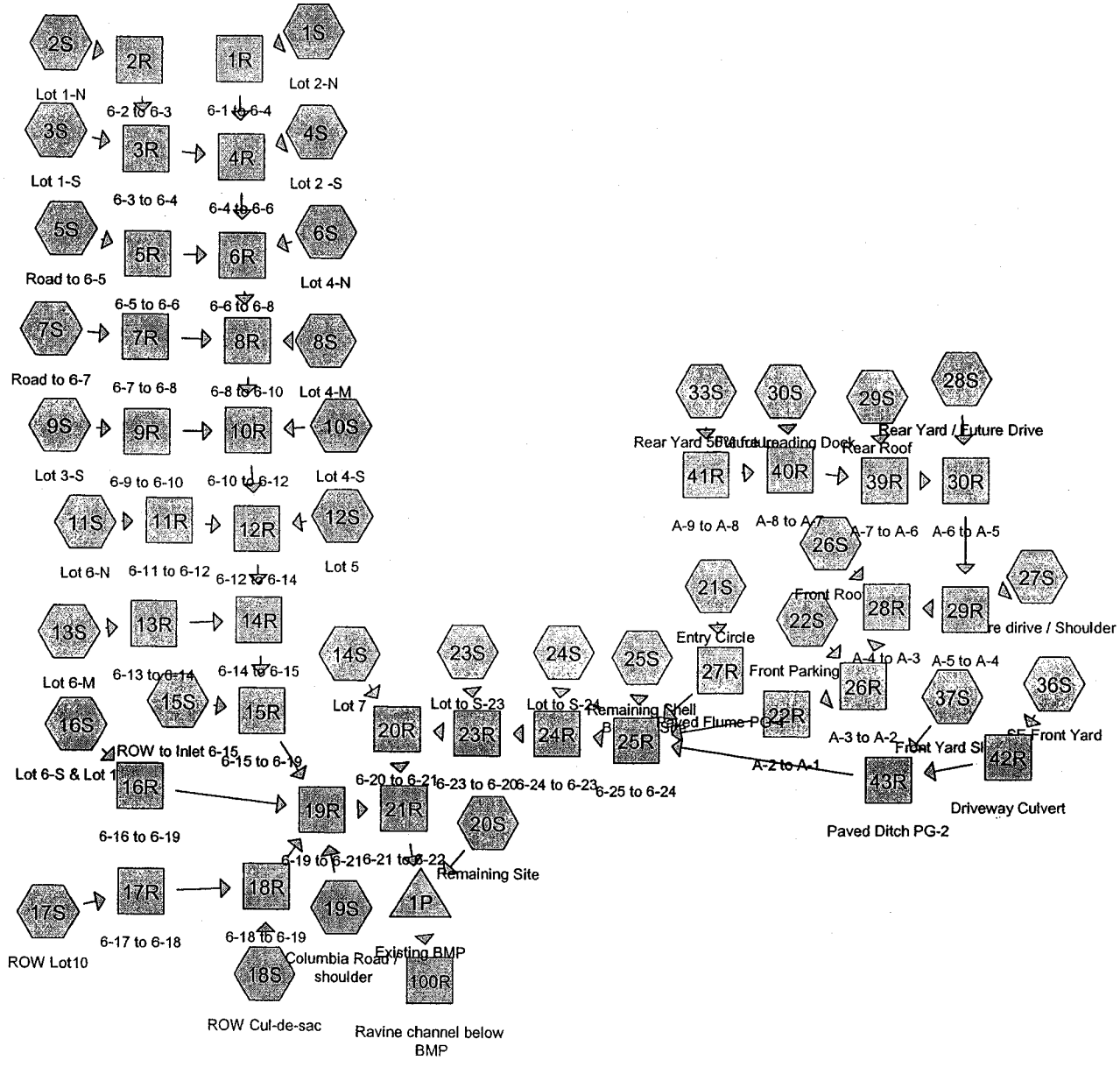

Drainage Diagram for James River C C with Shell Bldg. 2003
Prepared by LandMark Design Group, Inc. 03/03/2004
HydroCAD® 7.00 s/n 001765 © 1986-2003 Applied Microcomputer Systems

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=0.83"
Flow Length=605' Tc=24.2 min CN=75 Runoff=3.49 cfs 0.318 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=0.83"
Flow Length=500' Tc=14.2 min CN=75 Runoff=4.25 cfs 0.280 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=0.83"
Flow Length=320' Tc=33.4 min CN=75 Runoff=0.94 cfs 0.108 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=0.83"
Flow Length=375' Tc=8.5 min CN=75 Runoff=1.73 cfs 0.091 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=2.25"
Flow Length=240' Tc=2.0 min CN=95 Runoff=1.01 cfs 0.045 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=1.57"
Flow Length=575' Tc=4.4 min CN=87 Runoff=7.52 cfs 0.334 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=2.25"
Flow Length=215' Tc=1.8 min CN=95 Runoff=1.74 cfs 0.077 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=1.57"
Flow Length=590' Tc=4.2 min CN=87 Runoff=9.18 cfs 0.404 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=1.57"
Tc=5.0 min CN=87 Runoff=5.64 cfs 0.256 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=1.57"
Flow Length=545' Tc=24.8 min CN=87 Runoff=6.59 cfs 0.561 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=0.83"
Flow Length=500' Tc=13.4 min CN=75 Runoff=3.27 cfs 0.210 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=1.57"
Flow Length=350' Tc=2.9 min CN=87 Runoff=3.47 cfs 0.146 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=0.83"
Flow Length=700' Tc=15.5 min CN=75 Runoff=3.03 cfs 0.210 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=0.83"
Flow Length=570' Tc=18.5 min CN=75 Runoff=4.60 cfs 0.353 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=2.25"
Tc=2.0 min CN=95 Runoff=0.88 cfs 0.039 af

Subcatchment 16S: Lot 6-S & Lot 10A Runoff Area=2.980 ac Runoff Depth=1.57"
Flow Length=600' Tc=15.1 min CN=87 Runoff=6.02 cfs 0.389 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=2.25"
Tc=5.0 min CN=95 Runoff=5.01 cfs 0.246 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=2.25"
Tc=5.0 min CN=95 Runoff=2.22 cfs 0.109 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=2.25"
Tc=2.0 min CN=95 Runoff=3.74 cfs 0.167 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=1.10"
Tc=20.0 min CN=80 Runoff=8.97 cfs 0.687 af

Subcatchment 21S: Entry Circle Runoff Area=0.230 ac Runoff Depth=2.57"
Tc=1.3 min CN=98 Runoff=1.05 cfs 0.049 af

Subcatchment 22S: Front Parking Lot Runoff Area=0.210 ac Runoff Depth=2.57"
Flow Length=130' Tc=1.2 min CN=98 Runoff=0.96 cfs 0.045 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=0.83"
Tc=10.0 min CN=75 Runoff=2.17 cfs 0.121 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=0.83"
Tc=10.0 min CN=75 Runoff=4.59 cfs 0.257 af

Subcatchment 25S: Remaining Shell Building Site Runoff Area=2.030 ac Runoff Depth=1.57"
Tc=10.0 min CN=87 Runoff=4.88 cfs 0.265 af

Subcatchment 26S: Front Roof Runoff Area=0.750 ac Runoff Depth=2.57"
Flow Length=267' Tc=1.8 min CN=98 Runoff=3.37 cfs 0.161 af

Subcatchment 27S: Future dirive / Shoulder Runoff Area=0.210 ac Runoff Depth=1.57"
Flow Length=54' Tc=1.7 min CN=87 Runoff=0.68 cfs 0.027 af

Subcatchment 28S: Rear Yard / Future Drive Runoff Area=0.400 ac Runoff Depth=0.61"
Flow Length=150' Tc=13.0 min CN=70 Runoff=0.30 cfs 0.020 af

Subcatchment 29S: Rear Roof Runoff Area=1.120 ac Runoff Depth=2.57"
Flow Length=333' Tc=2.6 min CN=98 Runoff=4.92 cfs 0.240 af

Subcatchment 30S: Future Loading Dock Runoff Area=0.320 ac Runoff Depth=2.57"
Flow Length=120' Tc=1.8 min CN=98 Runoff=1.44 cfs 0.069 af

Subcatchment 33S: Rear Yard 50% future paved Runoff Area=0.980 ac Runoff Depth=1.57"
Flow Length=150' Tc=17.1 min CN=87 Runoff=1.86 cfs 0.128 af

Subcatchment 36S: SE Front Yard Runoff Area=0.290 ac Runoff Depth=0.61"
Flow Length=100' Tc=2.3 min CN=70 Runoff=0.35 cfs 0.015 af

Subcatchment 37S: Front Yard Slope Runoff Area=0.580 ac Runoff Depth=0.61"
Flow Length=60' Tc=2.3 min CN=70 Runoff=0.69 cfs 0.029 af

Reach 1R: 6-1 to 6-4 Peak Depth=0.45' Max Vel=5.8 fps Inflow=3.49 cfs 0.318 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow=3.48 cfs 0.318 af

Reach 2R: 6-2 to 6-3 Peak Depth=0.48' Max Vel=7.3 fps Inflow=4.25 cfs 0.280 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow=4.24 cfs 0.280 af

Reach 3R: 6-3 to 6-4 Peak Depth=0.73' Max Vel=4.3 fps Inflow=4.74 cfs 0.388 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow=4.74 cfs 0.388 af

Reach 4R: 6-4 to 6-6 Peak Depth=0.64' Max Vel=8.3 fps Inflow=8.31 cfs 0.796 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow=8.30 cfs 0.796 af

Reach 5R: 6-5 to 6-6 Peak Depth=0.24' Max Vel=6.0 fps Inflow=1.01 cfs 0.045 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow=1.01 cfs 0.045 af

Reach 6R: 6-6 to 6-8 Peak Depth=0.96' Max Vel=6.2 fps Inflow=12.24 cfs 1.176 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow=12.20 cfs 1.176 af

Reach 7R: 6-7 to 6-8 Peak Depth=0.32' Max Vel=7.1 fps Inflow=1.74 cfs 0.077 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow=1.73 cfs 0.077 af

Reach 8R: 6-8 to 6-10 Peak Depth=1.17' Max Vel=8.6 fps Inflow=22.06 cfs 1.657 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow=21.96 cfs 1.657 af

Reach 9R: 6-9 to 6-10 Peak Depth=1.09' Max Vel=3.2 fps Inflow=5.64 cfs 0.256 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow=5.62 cfs 0.256 af

Reach 10R: 6-10 to 6-12 Peak Depth=0.97' Max Vel=14.1 fps Inflow=30.72 cfs 2.474 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow=30.65 cfs 2.474 af

Reach 11R: 6-11 to 6-12 Peak Depth=0.69' Max Vel=3.4 fps Inflow=3.27 cfs 0.210 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow=3.27 cfs 0.210 af

Reach 12R: 6-12 to 6-14 Peak Depth=1.03' Max Vel=13.8 fps Inflow=35.43 cfs 2.830 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow=35.34 cfs 2.830 af

Reach 13R: 6-13 to 6-14 Peak Depth=0.64' Max Vel=3.5 fps Inflow=3.03 cfs 0.210 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow=3.02 cfs 0.210 af

Reach 14R: 6-14 to 6-15 Peak Depth=1.30' Max Vel=10.6 fps Inflow=37.35 cfs 3.039 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow=37.28 cfs 3.039 af

Reach 15R: 6-15 to 6-19 Peak Depth=1.34' Max Vel=10.1 fps Inflow=37.63 cfs 3.078 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=37.57 cfs 3.078 af

Reach 16R: 6-16 to 6-19 Peak Depth=0.93' Max Vel=4.2 fps Inflow=6.02 cfs 0.389 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=6.02 cfs 0.389 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.09' Max Vel=3.6 fps Inflow=5.01 cfs 0.246 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=4.99 cfs 0.246 af

Reach 18R: 6-18 to 6-19 Peak Depth=1.21' Max Vel=3.6 fps Inflow=7.21 cfs 0.355 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=7.17 cfs 0.355 af

Reach 19R: 6-19 to 6-21 Peak Depth=1.90' Max Vel=7.9 fps Inflow=50.73 cfs 3.990 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=50.57 cfs 3.990 af

Reach 20R: 6-20 to 6-21 Peak Depth=1.44' Max Vel=7.0 fps Inflow=26.18 cfs 1.779 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=26.16 cfs 1.779 af

Reach 21R: 6-21 to 6-22 Peak Depth=1.41' Max Vel=17.8 fps Inflow=75.88 cfs 5.768 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=75.81 cfs 5.768 af

Reach 22R: A-2 to A-1 Peak Depth=0.61' Max Vel=12.8 fps Inflow=10.39 cfs 0.689 af
D=24.0" n=0.013 L=98.0' S=0.0510 '/' Capacity=51.10 cfs Outflow=10.39 cfs 0.689 af

Reach 23R: 6-23 to 6-20 Peak Depth=1.28' Max Vel=7.8 fps Inflow=22.62 cfs 1.425 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=22.53 cfs 1.425 af

Reach 24R: 6-24 to 6-23 Peak Depth=1.33' Max Vel=6.8 fps Inflow=20.52 cfs 1.304 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=20.47 cfs 1.304 af

Reach 25R: 6-25 to 6-24 Peak Depth=1.09' Max Vel=7.9 fps Inflow=16.23 cfs 1.047 af
D=30.0" n=0.013 L=189.0' S=0.0100 '/' Capacity=41.02 cfs Outflow=16.19 cfs 1.047 af

Reach 26R: A-3 to A-2 Peak Depth=1.17' Max Vel=5.4 fps Inflow=10.42 cfs 0.689 af
D=24.0" n=0.013 L=150.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=10.39 cfs 0.689 af

Reach 27R: Paved Flume PG-4 Peak Depth=0.11' Max Vel=8.8 fps Inflow=1.05 cfs 0.049 af
n=0.015 L=65.0' S=0.1902 '/' Capacity=56.04 cfs Outflow=1.04 cfs 0.049 af

Reach 28R: A-4 to A-3 Peak Depth=1.13' Max Vel=5.3 fps Inflow=9.72 cfs 0.644 af
D=24.0" n=0.013 L=66.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=9.71 cfs 0.644 af

Reach 29R: A-5 to A-4 Peak Depth=0.96' Max Vel=5.0 fps Inflow=7.50 cfs 0.484 af
D=24.0" n=0.013 L=191.0' S=0.0050 '/' Capacity=16.04 cfs Outflow=7.45 cfs 0.484 af

Reach 30R: A-6 to A-5 Peak Depth=1.01' Max Vel=4.9 fps Inflow=7.12 cfs 0.456 af
D=21.0" n=0.013 L=228.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=7.02 cfs 0.456 af

Reach 39R: A-7 to A-6 Peak Depth=1.00' Max Vel=4.9 fps Inflow=7.05 cfs 0.436 af
D=21.0" n=0.013 L=140.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=6.99 cfs 0.436 af

Reach 40R: A-8 to A-7 Peak Depth=0.52' Max Vel=3.6 fps Inflow=2.15 cfs 0.196 af
D=21.0" n=0.013 L=60.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=2.14 cfs 0.196 af

Reach 41R: A-9 to A-8 Peak Depth=0.55' Max Vel=3.5 fps Inflow=1.86 cfs 0.128 af
D=15.0" n=0.013 L=200.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=1.85 cfs 0.128 af

Reach 42R: Driveway Culvert Peak Depth=0.23' Max Vel=2.2 fps Inflow=0.35 cfs 0.015 af
D=15.0" n=0.013 L=40.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=0.34 cfs 0.015 af

Reach 43R: Paved Ditch PG-2 Peak Depth=0.44' Max Vel=2.2 fps Inflow=1.03 cfs 0.044 af
n=0.015 L=292.0' S=0.0043 '/' Capacity=8.47 cfs Outflow=0.93 cfs 0.044 af

Reach 100R: Ravine channel below BMP Peak Depth=0.50' Max Vel=1.8 fps Inflow=5.28 cfs 6.258 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=5.28 cfs 6.257 af

Pond 1P: Existing BMP Peak Elev=27.45' Storage=356,946 cf Inflow=82.53 cfs 6.455 af
Primary=5.28 cfs 6.258 af Secondary=0.00 cfs 0.000 af Outflow=5.28 cfs 6.258 af

Total Runoff Area = 62.320 ac Runoff Volume = 6.455 af Average Runoff Depth = 1.24"

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=1.30"
Flow Length=605' Tc=24.2 min CN=75 Runoff=5.73 cfs 0.497 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=1.30"
Flow Length=500' Tc=14.2 min CN=75 Runoff=6.88 cfs 0.438 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=1.30"
Flow Length=320' Tc=33.4 min CN=75 Runoff=1.56 cfs 0.168 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=1.30"
Flow Length=375' Tc=8.5 min CN=75 Runoff=2.76 cfs 0.142 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=2.94"
Flow Length=240' Tc=2.0 min CN=95 Runoff=1.29 cfs 0.059 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=2.18"
Flow Length=575' Tc=4.4 min CN=87 Runoff=10.34 cfs 0.466 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=2.94"
Flow Length=215' Tc=1.8 min CN=95 Runoff=2.22 cfs 0.100 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=2.18"
Flow Length=590' Tc=4.2 min CN=87 Runoff=12.60 cfs 0.564 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=2.18"
Tc=5.0 min CN=87 Runoff=7.75 cfs 0.356 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=2.18"
Flow Length=545' Tc=24.8 min CN=87 Runoff=9.17 cfs 0.782 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=1.30"
Flow Length=500' Tc=13.4 min CN=75 Runoff=5.28 cfs 0.328 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=2.18"
Flow Length=350' Tc=2.9 min CN=87 Runoff=4.76 cfs 0.204 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=1.30"
Flow Length=700' Tc=15.5 min CN=75 Runoff=4.91 cfs 0.328 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=1.30"
Flow Length=570' Tc=18.5 min CN=75 Runoff=7.50 cfs 0.552 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=2.94"
Tc=2.0 min CN=95 Runoff=1.13 cfs 0.051 af

Subcatchment 16S: Lot 6-S & Lot 10A Runoff Area=2.980 ac Runoff Depth=2.18"
Flow Length=600' Tc=15.1 min CN=87 Runoff=8.35 cfs 0.542 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=2.94"
Tc=5.0 min CN=95 Runoff=6.42 cfs 0.321 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=2.94"
Tc=5.0 min CN=95 Runoff=2.84 cfs 0.142 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=2.94"
Tc=2.0 min CN=95 Runoff=4.79 cfs 0.218 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=1.64"
Tc=20.0 min CN=80 Runoff=13.53 cfs 1.020 af

Subcatchment 21S: Entry Circle Runoff Area=0.230 ac Runoff Depth=3.27"
Tc=1.3 min CN=98 Runoff=1.31 cfs 0.063 af

Subcatchment 22S: Front Parking Lot Runoff Area=0.210 ac Runoff Depth=3.27"
Flow Length=130' Tc=1.2 min CN=98 Runoff=1.20 cfs 0.057 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=1.30"
Tc=10.0 min CN=75 Runoff=3.48 cfs 0.190 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=1.30"
Tc=10.0 min CN=75 Runoff=7.36 cfs 0.401 af

Subcatchment 25S: Remaining Shell Building Site Runoff Area=2.030 ac Runoff Depth=2.18"
Tc=10.0 min CN=87 Runoff=6.74 cfs 0.369 af

Subcatchment 26S: Front Roof Runoff Area=0.750 ac Runoff Depth=3.27"
Flow Length=267' Tc=1.8 min CN=98 Runoff=4.23 cfs 0.204 af

Subcatchment 27S: Future dirive / Shoulder Runoff Area=0.210 ac Runoff Depth=2.18"
Flow Length=54' Tc=1.7 min CN=87 Runoff=0.93 cfs 0.038 af

Subcatchment 28S: Rear Yard / Future Drive Runoff Area=0.400 ac Runoff Depth=1.01"
Flow Length=150' Tc=13.0 min CN=70 Runoff=0.53 cfs 0.034 af

Subcatchment 29S: Rear Roof Runoff Area=1.120 ac Runoff Depth=3.27"
Flow Length=333' Tc=2.6 min CN=98 Runoff=6.17 cfs 0.305 af

Subcatchment 30S: Future Loading Dock Runoff Area=0.320 ac Runoff Depth=3.27"
Flow Length=120' Tc=1.8 min CN=98 Runoff=1.81 cfs 0.087 af

Subcatchment 33S: Rear Yard 50% future paved Runoff Area=0.980 ac Runoff Depth=2.18"
Flow Length=150' Tc=17.1 min CN=87 Runoff=2.58 cfs 0.178 af

Subcatchment 36S: SE Front Yard Runoff Area=0.290 ac Runoff Depth=1.01"
Flow Length=100' Tc=2.3 min CN=70 Runoff=0.60 cfs 0.024 af

Subcatchment 37S: Front Yard Slope Runoff Area=0.580 ac Runoff Depth=1.01"
Flow Length=60' Tc=2.3 min CN=70 Runoff=1.19 cfs 0.049 af

Reach 1R: 6-1 to 6-4 Peak Depth=0.57' Max Vel=6.7 fps Inflow=5.73 cfs 0.497 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow=5.71 cfs 0.497 af

Reach 2R: 6-2 to 6-3 Peak Depth=0.61' Max Vel=8.4 fps Inflow=6.88 cfs 0.438 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow=6.86 cfs 0.438 af

Reach 3R: 6-3 to 6-4 Peak Depth=0.95' Max Vel=4.9 fps Inflow=7.74 cfs 0.606 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow=7.73 cfs 0.606 af

Reach 4R: 6-4 to 6-6 Peak Depth=0.83' Max Vel=9.6 fps Inflow=13.72 cfs 1.245 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow=13.71 cfs 1.245 af

Reach 5R: 6-5 to 6-6 Peak Depth=0.27' Max Vel=6.5 fps Inflow=1.29 cfs 0.059 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow=1.29 cfs 0.059 af

Reach 6R: 6-6 to 6-8 Peak Depth=1.21' Max Vel=7.0 fps Inflow=18.86 cfs 1.770 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow=18.82 cfs 1.770 af

Reach 7R: 6-7 to 6-8 Peak Depth=0.36' Max Vel=7.6 fps Inflow=2.22 cfs 0.100 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow=2.21 cfs 0.100 af

Reach 8R: 6-8 to 6-10 Peak Depth=1.45' Max Vel=9.5 fps Inflow=32.09 cfs 2.434 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow=31.96 cfs 2.434 af

Reach 9R: 6-9 to 6-10 Peak Depth=1.34' Max Vel=3.5 fps Inflow=7.75 cfs 0.356 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow=7.72 cfs 0.356 af

Reach 10R: 6-10 to 6-12 Peak Depth=1.17' Max Vel=15.6 fps Inflow=44.20 cfs 3.572 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow=44.11 cfs 3.572 af

Reach 11R: 6-11 to 6-12 Peak Depth=0.90' Max Vel=3.8 fps Inflow=5.28 cfs 0.328 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow=5.28 cfs 0.328 af

Reach 12R: 6-12 to 6-14 Peak Depth=1.25' Max Vel=15.3 fps Inflow=51.45 cfs 4.104 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow=51.34 cfs 4.104 af

Reach 13R: 6-13 to 6-14 Peak Depth=0.84' Max Vel=3.9 fps Inflow=4.91 cfs 0.328 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow=4.90 cfs 0.328 af

Reach 14R: 6-14 to 6-15 Peak Depth=1.59' Max Vel=11.7 fps Inflow=54.78 cfs 4.431 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow=54.69 cfs 4.431 af

Reach 15R: 6-15 to 6-19 Peak Depth=1.65' Max Vel=11.3 fps Inflow=55.16 cfs 4.483 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=55.08 cfs 4.483 af

Reach 16R: 6-16 to 6-19 Peak Depth=1.13' Max Vel=4.5 fps Inflow=8.35 cfs 0.542 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=8.34 cfs 0.542 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.50' Max Vel=3.7 fps Inflow=6.42 cfs 0.321 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=6.03 cfs 0.321 af

Reach 18R: 6-18 to 6-19 Peak Depth=1.39' Max Vel=3.7 fps Inflow=8.81 cfs 0.463 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=8.68 cfs 0.463 af

Reach 19R: 6-19 to 6-21 Peak Depth=2.33' Max Vel=8.7 fps Inflow=72.16 cfs 5.706 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=71.97 cfs 5.706 af

Reach 20R: 6-20 to 6-21 Peak Depth=1.78' Max Vel=7.8 fps Inflow=38.20 cfs 2.552 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=38.17 cfs 2.552 af

Reach 21R: 6-21 to 6-22 Peak Depth=1.71' Max Vel=19.7 fps Inflow=109.30 cfs 8.257 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=109.23 cfs 8.257 af

Reach 22R: A-2 to A-1 Peak Depth=0.70' Max Vel=13.7 fps Inflow=13.46 cfs 0.903 af
D=24.0" n=0.013 L=98.0' S=0.0510 '/' Capacity=51.10 cfs Outflow=13.45 cfs 0.903 af

Reach 23R: 6-23 to 6-20 Peak Depth=1.57' Max Vel=8.6 fps Inflow=32.24 cfs 1.999 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=32.14 cfs 1.999 af

Reach 24R: 6-24 to 6-23 Peak Depth=1.63' Max Vel=7.4 fps Inflow=28.86 cfs 1.810 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=28.78 cfs 1.810 af

Reach 25R: 6-25 to 6-24 Peak Depth=1.30' Max Vel=8.5 fps Inflow=21.92 cfs 1.408 af
D=30.0" n=0.013 L=189.0' S=0.0100 '/' Capacity=41.02 cfs Outflow=21.87 cfs 1.408 af

Reach 26R: A-3 to A-2 Peak Depth=1.41' Max Vel=5.7 fps Inflow=13.50 cfs 0.903 af
D=24.0" n=0.013 L=150.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=13.46 cfs 0.903 af

Reach 27R: Paved Flume PG-4 Peak Depth=0.12' Max Vel=9.5 fps Inflow=1.31 cfs 0.063 af
n=0.015 L=65.0' S=0.1902 '/' Capacity=56.04 cfs Outflow=1.31 cfs 0.063 af

Reach 28R: A-4 to A-3 Peak Depth=1.34' Max Vel=5.6 fps Inflow=12.61 cfs 0.846 af
D=24.0" n=0.013 L=66.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=12.60 cfs 0.846 af

Reach 29R: A-5 to A-4 Peak Depth=1.12' Max Vel=5.3 fps Inflow=9.76 cfs 0.642 af
D=24.0" n=0.013 L=191.0' S=0.0050 '/' Capacity=16.04 cfs Outflow=9.71 cfs 0.642 af

Reach 30R: A-6 to A-5 Peak Depth=1.20' Max Vel=5.2 fps Inflow=9.22 cfs 0.604 af
D=21.0" n=0.013 L=228.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=9.10 cfs 0.604 af

Reach 39R: A-7 to A-6 Peak Depth=1.18' Max Vel=5.2 fps Inflow=9.01 cfs 0.570 af
D=21.0" n=0.013 L=140.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=8.94 cfs 0.570 af

Reach 40R: A-8 to A-7 Peak Depth=0.60' Max Vel=3.9 fps Inflow=2.87 cfs 0.265 af
D=21.0" n=0.013 L=60.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=2.86 cfs 0.265 af

Reach 41R: A-9 to A-8 Peak Depth=0.67' Max Vel=3.8 fps Inflow=2.58 cfs 0.178 af
D=15.0" n=0.013 L=200.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=2.57 cfs 0.178 af

Reach 42R: Driveway Culvert Peak Depth=0.30' Max Vel=2.6 fps Inflow=0.60 cfs 0.024 af
D=15.0" n=0.013 L=40.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=0.59 cfs 0.024 af

Reach 43R: Paved Ditch PG-2 Peak Depth=0.54' Max Vel=2.6 fps Inflow=1.78 cfs 0.073 af
n=0.015 L=292.0' S=0.0043 '/' Capacity=8.47 cfs Outflow=1.66 cfs 0.073 af

Reach 100R: Ravine channel below BMP Peak Depth=0.53' Max Vel=2.0 fps Inflow=6.73 cfs 9.035 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=6.73 cfs 9.035 af

Pond 1P: Existing BMP Peak Elev=28.67' Storage=435,949 cf Inflow=119.73 cfs 9.277 af
Primary=6.73 cfs 9.035 af Secondary=0.00 cfs 0.000 af Outflow=6.73 cfs 9.035 af

Total Runoff Area = 62.320 ac Runoff Volume = 9.277 af Average Runoff Depth = 1.79"

Reach 15R: 6-15 to 6-19 Peak Depth=2.54' Max Vel=13.4 fps Inflow=113.23 cfs 9.619 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=113.13 cfs 9.619 af

Reach 16R: 6-16 to 6-19 Peak Depth=2.00' Max Vel=4.9 fps Inflow=16.15 cfs 1.074 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=14.46 cfs 1.074 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.50' Max Vel=3.7 fps Inflow=10.97 cfs 0.569 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=5.89 cfs 0.569 af

Reach 18R: 6-18 to 6-19 Peak Depth=1.64' Max Vel=3.8 fps Inflow=10.53 cfs 0.821 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=10.49 cfs 0.821 af

Reach 19R: 6-19 to 6-21 Peak Depth=3.82' Max Vel=9.7 fps Inflow=140.01 cfs 11.901 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=139.60 cfs 11.901 af

Reach 20R: 6-20 to 6-21 Peak Depth=2.94' Max Vel=8.8 fps Inflow=75.60 cfs 5.394 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=75.56 cfs 5.394 af

Reach 21R: 6-21 to 6-22 Peak Depth=2.50' Max Vel=23.5 fps Inflow=213.04 cfs 17.294 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=212.92 cfs 17.294 af

Reach 22R: A-2 to A-1 Peak Depth=0.79' Max Vel=14.6 fps Inflow=16.93 cfs 1.630 af
D=24.0" n=0.013 L=98.0' S=0.0510 '/' Capacity=51.10 cfs Outflow=16.84 cfs 1.630 af

Reach 23R: 6-23 to 6-20 Peak Depth=2.45' Max Vel=9.6 fps Inflow=59.53 cfs 4.074 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=59.33 cfs 4.074 af

Reach 24R: 6-24 to 6-23 Peak Depth=2.51' Max Vel=8.1 fps Inflow=51.31 cfs 3.620 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=51.15 cfs 3.620 af

Reach 25R: 6-25 to 6-24 Peak Depth=1.73' Max Vel=9.3 fps Inflow=33.87 cfs 2.660 af
D=30.0" n=0.013 L=189.0' S=0.0100 '/' Capacity=41.02 cfs Outflow=33.82 cfs 2.660 af

Reach 26R: A-3 to A-2 Peak Depth=2.00' Max Vel=5.8 fps Inflow=18.34 cfs 1.630 af
D=24.0" n=0.013 L=150.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=16.93 cfs 1.630 af

Reach 27R: Paved Flume PG-4 Peak Depth=0.17' Max Vel=11.2 fps Inflow=2.19 cfs 0.107 af
n=0.015 L=65.0' S=0.1902 '/' Capacity=56.04 cfs Outflow=2.19 cfs 0.107 af

Reach 28R: A-4 to A-3 Peak Depth=2.00' Max Vel=5.8 fps Inflow=20.59 cfs 1.532 af
D=24.0" n=0.013 L=66.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=16.55 cfs 1.532 af

Reach 29R: A-5 to A-4 Peak Depth=1.42' Max Vel=5.7 fps Inflow=13.72 cfs 1.185 af
D=24.0" n=0.013 L=191.0' S=0.0050 '/' Capacity=16.04 cfs Outflow=13.68 cfs 1.185 af

Reach 30R: A-6 to A-5 Peak Depth=1.75' Max Vel=5.3 fps Inflow=12.85 cfs 1.109 af
D=21.0" n=0.013 L=228.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=12.05 cfs 1.109 af

Reach 39R: A-7 to A-6 Peak Depth=1.75' Max Vel=5.3 fps Inflow=15.53 cfs 1.021 af
D=21.0" n=0.013 L=140.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=11.84 cfs 1.021 af

Reach 40R: A-8 to A-7 Peak Depth=0.85' Max Vel=4.6 fps Inflow=5.29 cfs 0.502 af
D=21.0" n=0.013 L=60.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=5.27 cfs 0.502 af

Reach 41R: A-9 to A-8 Peak Depth=1.19' Max Vel=4.2 fps Inflow=4.99 cfs 0.353 af
D=15.0" n=0.013 L=200.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=4.91 cfs 0.353 af

Reach 42R: Driveway Culvert Peak Depth=0.51' Max Vel=3.4 fps Inflow=1.58 cfs 0.064 af
D=15.0" n=0.013 L=40.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=1.57 cfs 0.064 af

Reach 43R: Paved Ditch PG-2 Peak Depth=0.79' Max Vel=3.3 fps Inflow=4.72 cfs 0.192 af
n=0.015 L=292.0' S=0.0043 '/' Capacity=8.47 cfs Outflow=4.50 cfs 0.192 af

Reach 100R: Ravine channel below BMP Peak Depth=0.85' Max Vel=2.8 fps Inflow=19.84 cfs 19.158 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=19.84 cfs 19.157 af

Pond 1P: Existing BMP Peak Elev=32.63' Storage=692,223 cf Inflow=237.57 cfs 19.539 af
Primary=19.84 cfs 19.158 af Secondary=0.00 cfs 0.000 af Outflow=19.84 cfs 19.158 af

Total Runoff Area = 62.320 ac Runoff Volume = 19.539 af Average Runoff Depth = 3.76"

Subcatchment 21S: Entry Circle

Runoff = 2.19 cfs @ 11.91 hrs, Volume= 0.107 af, Depth= 5.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.230	98	Sidewalk / Pavement

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3					**Direct Entry, From calcs**

Subcatchment 22S: Front Parking Lot

Runoff = 2.00 cfs @ 11.91 hrs, Volume= 0.097 af, Depth= 5.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.210	98	Pavement

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	130	0.0300	1.8		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.50"

Subcatchment 25S: Remaining Shell Building Site

Runoff = 12.95 cfs @ 12.01 hrs, Volume= 0.732 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
2.030	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 26S: Front Roof

Runoff = 7.06 cfs @ 11.92 hrs, Volume= 0.348 af, Depth= 5.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.750	98	Roof

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	67	0.0100	1.0		**Sheet Flow, Roof Membrane** Smooth surfaces n= 0.011 P2= 3.50"
0.7	200	0.0100	4.5	1.57	**Circular Channel (pipe), Roof Leader** Diam= 8.0" Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.010
1.8	267	Total			

Subcatchment 27S: Future dirive / Shoulder

Runoff = 1.76 cfs @ 11.92 hrs, Volume= 0.076 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.210	87	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	24	0.0200	1.1		**Sheet Flow, Drive Cross slope** Smooth surfaces n= 0.011 P2= 3.50"
1.3	30	0.2500	0.4		**Sheet Flow, Grassed Slope** Grass: Short n= 0.150 P2= 3.50"
1.7	54	Total			

Subcatchment 28S: Rear Yard / Future Drive

Runoff = 1.47 cfs @ 12.05 hrs, Volume= 0.088 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.400	70	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	150	0.0200	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.50"

Subcatchment 29S: Rear Roof

Runoff = 10.29 cfs @ 11.93 hrs, Volume= 0.519 af, Depth= 5.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
1.120	98	Membrane Roof

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	133	0.0100	1.2		**Sheet Flow, Roof** Smooth surfaces n= 0.011 P2= 3.50"
0.7	200	0.0100	4.5	1.57	**Circular Channel (pipe), Roof Leader** Diam= 8.0" Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.010
2.6	333	Total			

Subcatchment 30S: Future Loading Dock

Runoff = 3.01 cfs @ 11.92 hrs, Volume= 0.148 af, Depth= 5.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.320	98	Paved Ramp

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	120	0.0100	1.1		**Sheet Flow, Paved Ramp** Smooth surfaces n= 0.011 P2= 3.50"

Subcatchment 33S: Rear Yard 50% future paved

Runoff = 4.99 cfs @ 12.09 hrs, Volume= 0.353 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.980	87	Lawn and Paving

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	150	0.0100	0.1		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.50"

Subcatchment 36S: SE Front Yard

Runoff = 1.58 cfs @ 11.93 hrs, Volume= 0.064 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.290	70	Lawn

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	50	0.2000	0.4		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.50"
0.2	50	0.0500	3.4		**Shallow Concentrated Flow, Swale** Grassed Waterway Kv= 15.0 fps
2.3	100	Total			

Subcatchment 37S: Front Yard Slope

Runoff = 3.16 cfs @ 11.93 hrs, Volume= 0.128 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 Year Rainfall=5.80"

Area (ac)	CN	Description
0.580	70	Grassed Slope

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	60	0.2500	0.4		**Sheet Flow, Steep Slope Lawn** Grass: Short n= 0.150 P2= 3.50"

Reach 22R: A-2 to A-1

Inflow Area = 3.990 ac, Inflow Depth = 4.90" for 10 Year event
Inflow = 16.93 cfs @ 11.89 hrs, Volume= 1.630 af
Outflow = 16.84 cfs @ 11.89 hrs, Volume= 1.630 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.6 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.8 fps, Avg. Travel Time= 0.3 min

Peak Depth= 0.79' @ 11.89 hrs
Capacity at bank full= 51.10 cfs
Inlet Invert= 42.00', Outlet Invert= 37.00'
24.0" Diameter Pipe n= 0.013 Length= 98.0' Slope= 0.0510 '/'

Reach 25R: 6-25 to 6-24

Inflow Area = 7.120 ac, Inflow Depth = 4.48" for 10 Year event
Inflow = 33.87 cfs @ 11.99 hrs, Volume= 2.660 af
Outflow = 33.82 cfs @ 12.00 hrs, Volume= 2.660 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.3 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.0 fps, Avg. Travel Time= 1.1 min

Peak Depth= 1.73' @ 11.99 hrs
Capacity at bank full= 41.02 cfs
Inlet Invert= 36.86', Outlet Invert= 34.97'
30.0" Diameter Pipe n= 0.013 Length= 189.0' Slope= 0.0100 '/'

Reach 26R: A-3 to A-2

Inflow Area = 3.990 ac, Inflow Depth = 4.90" for 10 Year event
Inflow = 18.34 cfs @ 11.88 hrs, Volume= 1.630 af
Outflow = 16.93 cfs @ 11.89 hrs, Volume= 1.630 af, Atten= 8%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.8 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 1.2 min

Peak Depth= 2.00' @ 11.89 hrs
Capacity at bank full= 16.00 cfs
Inlet Invert= 43.50', Outlet Invert= 42.75'
24.0" Diameter Pipe n= 0.013 Length= 150.0' Slope= 0.0050 '/'

Reach 27R: Paved Flume PG-4

Inflow Area = 0.230 ac, Inflow Depth = 5.56" for 10 Year event
Inflow = 2.19 cfs @ 11.91 hrs, Volume= 0.107 af
Outflow = 2.19 cfs @ 11.92 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.2 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 0.4 min

Peak Depth= 0.17' @ 11.92 hrs
Capacity at bank full= 56.04 cfs
Inlet Invert= 52.46', Outlet Invert= 40.10'
1.00' x 1.00' deep channel, n= 0.015 Length= 65.0' Slope= 0.1902 '/'
Side Slope Z-value= 1.0 '/'

Reach 28R: A-4 to A-3

Inflow Area = 3.780 ac, Inflow Depth = 4.86" for 10 Year event
Inflow = 20.59 cfs @ 11.93 hrs, Volume= 1.532 af
Outflow = 16.55 cfs @ 11.88 hrs, Volume= 1.532 af, Atten= 20%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.8 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 0.5 min

Peak Depth= 2.00' @ 11.89 hrs
Capacity at bank full= 16.00 cfs
Inlet Invert= 44.00', Outlet Invert= 43.67'
24.0" Diameter Pipe n= 0.013 Length= 66.0' Slope= 0.0050 '/'

Reach 29R: A-5 to A-4

Inflow Area = 3.030 ac, Inflow Depth = 4.69" for 10 Year event
Inflow = 13.72 cfs @ 11.92 hrs, Volume= 1.185 af
Outflow = 13.68 cfs @ 11.94 hrs, Volume= 1.185 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.7 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 1.7 min

Peak Depth= 1.42' @ 11.93 hrs
Capacity at bank full= 16.04 cfs
Inlet Invert= 45.56', Outlet Invert= 44.60'
24.0" Diameter Pipe n= 0.013 Length= 191.0' Slope= 0.0050 '/'

Reach 30R: A-6 to A-5

Inflow Area = 2.820 ac, Inflow Depth = 4.72" for 10 Year event
Inflow = 12.85 cfs @ 12.07 hrs, Volume= 1.109 af
Outflow = 12.05 cfs @ 11.97 hrs, Volume= 1.109 af, Atten= 6%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.3 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 2.0 min

Peak Depth= 1.75' @ 11.98 hrs
Capacity at bank full= 11.20 cfs
Inlet Invert= 46.80', Outlet Invert= 45.66'
21.0" Diameter Pipe n= 0.013 Length= 228.0' Slope= 0.0050 '/'

Reach 39R: A-7 to A-6

Inflow Area = 2.420 ac, Inflow Depth = 5.06" for 10 Year event
Inflow = 15.53 cfs @ 11.93 hrs, Volume= 1.021 af
Outflow = 11.84 cfs @ 11.89 hrs, Volume= 1.021 af, Atten= 24%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.3 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 1.2 min

Peak Depth= 1.75' @ 11.89 hrs
Capacity at bank full= 11.20 cfs
Inlet Invert= 47.60', Outlet Invert= 46.90'
21.0" Diameter Pipe n= 0.013 Length= 140.0' Slope= 0.0050 '/'

Reach 40R: A-8 to A-7

Inflow Area = 1.300 ac, Inflow Depth = 4.63" for 10 Year event
Inflow = 5.29 cfs @ 11.93 hrs, Volume= 0.502 af
Outflow = 5.27 cfs @ 11.94 hrs, Volume= 0.502 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.6 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 0.7 min

Peak Depth= 0.85' @ 11.93 hrs
Capacity at bank full= 11.20 cfs
Inlet Invert= 48.00', Outlet Invert= 47.70'
21.0" Diameter Pipe n= 0.013 Length= 60.0' Slope= 0.0050 '/'

Reach 41R: A-9 to A-8

Inflow Area = 0.980 ac, Inflow Depth = 4.33" for 10 Year event
Inflow = 4.99 cfs @ 12.09 hrs, Volume= 0.353 af
Outflow = 4.91 cfs @ 12.11 hrs, Volume= 0.353 af, Atten= 2%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.2 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 2.2 min

Peak Depth= 1.19' @ 12.11 hrs
Capacity at bank full= 4.57 cfs
Inlet Invert= 49.10', Outlet Invert= 48.10'
15.0" Diameter Pipe n= 0.013 Length= 200.0' Slope= 0.0050 '/'

Reach 42R: Driveway Culvert

Inflow Area = 0.290 ac, Inflow Depth = 2.65" for 10 Year event
Inflow = 1.58 cfs @ 11.93 hrs, Volume= 0.064 af
Outflow = 1.57 cfs @ 11.94 hrs, Volume= 0.064 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.4 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 0.6 min

Peak Depth= 0.51' @ 11.93 hrs
Capacity at bank full= 4.57 cfs
Inlet Invert= 41.45', Outlet Invert= 41.25'
15.0" Diameter Pipe n= 0.013 Length= 40.0' Slope= 0.0050 '/'

Reach 43R: Paved Ditch PG-2

Inflow Area = 0.870 ac, Inflow Depth = 2.65" for 10 Year event
Inflow = 4.72 cfs @ 11.93 hrs, Volume= 0.192 af
Outflow = 4.50 cfs @ 11.97 hrs, Volume= 0.192 af, Atten= 5%, Lag= 2.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.3 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.1 fps, Avg. Travel Time= 4.3 min

Peak Depth= 0.79' @ 11.95 hrs
Capacity at bank full= 8.47 cfs
Inlet Invert= 41.36', Outlet Invert= 40.10'
0.00' x 1.00' deep channel, n= 0.015 Length= 292.0' Slope= 0.0043 '/'
Side Slope Z-value= 2.2 '/'

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=5.04"
Flow Length=605' Tc=24.2 min CN=75 Runoff=22.97 cfs 1.924 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=5.04"
Flow Length=500' Tc=14.2 min CN=75 Runoff=26.88 cfs 1.697 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=5.04"
Flow Length=320' Tc=33.4 min CN=75 Runoff=6.33 cfs 0.651 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=5.04"
Flow Length=375' Tc=8.5 min CN=75 Runoff=10.58 cfs 0.550 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=7.40"
Flow Length=240' Tc=2.0 min CN=95 Runoff=3.07 cfs 0.148 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=6.45"
Flow Length=575' Tc=4.4 min CN=87 Runoff=28.55 cfs 1.376 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=7.40"
Flow Length=215' Tc=1.8 min CN=95 Runoff=5.28 cfs 0.253 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=6.45"
Flow Length=590' Tc=4.2 min CN=87 Runoff=34.80 cfs 1.666 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=6.45"
Tc=5.0 min CN=87 Runoff=21.44 cfs 1.053 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=6.45"
Flow Length=545' Tc=24.8 min CN=87 Runoff=26.14 cfs 2.311 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=5.04"
Flow Length=500' Tc=13.4 min CN=75 Runoff=20.64 cfs 1.269 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=6.45"
Flow Length=350' Tc=2.9 min CN=87 Runoff=13.11 cfs 0.602 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=5.04"
Flow Length=700' Tc=15.5 min CN=75 Runoff=19.32 cfs 1.269 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=5.04"
Flow Length=570' Tc=18.5 min CN=75 Runoff=29.75 cfs 2.139 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=7.40"
Tc=2.0 min CN=95 Runoff=2.69 cfs 0.130 af

Subcatchment 16S: Lot 6-S & Lot 10A Runoff Area=2.980 ac Runoff Depth=6.45"
Flow Length=600' Tc=15.1 min CN=87 Runoff=23.58 cfs 1.602 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=7.40"
Tc=5.0 min CN=95 Runoff=15.28 cfs 0.808 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=7.40"
Tc=5.0 min CN=95 Runoff=6.77 cfs 0.358 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=7.40"
Tc=2.0 min CN=95 Runoff=11.38 cfs 0.549 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=5.63"
Tc=20.0 min CN=80 Runoff=46.16 cfs 3.506 af

Subcatchment 21S: Entry Circle Runoff Area=0.230 ac Runoff Depth=7.76"
Tc=1.3 min CN=98 Runoff=3.02 cfs 0.149 af

Subcatchment 22S: Front Parking Lot Runoff Area=0.210 ac Runoff Depth=7.76"
Flow Length=130' Tc=1.2 min CN=98 Runoff=2.77 cfs 0.136 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=5.04"
Tc=10.0 min CN=75 Runoff=13.41 cfs 0.735 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=5.04"
Tc=10.0 min CN=75 Runoff=28.36 cfs 1.555 af

Subcatchment 25S: Remaining Shell Building Site Runoff Area=2.030 ac Runoff Depth=6.45"
Tc=10.0 min CN=87 Runoff=18.86 cfs 1.091 af

Subcatchment 26S: Front Roof Runoff Area=0.750 ac Runoff Depth=7.76"
Flow Length=267' Tc=1.8 min CN=98 Runoff=9.75 cfs 0.485 af

Subcatchment 27S: Future dirive / Shoulder Runoff Area=0.210 ac Runoff Depth=6.45"
Flow Length=54' Tc=1.7 min CN=87 Runoff=2.55 cfs 0.113 af

Subcatchment 28S: Rear Yard / Future Drive Runoff Area=0.400 ac Runoff Depth=4.46"
Flow Length=150' Tc=13.0 min CN=70 Runoff=2.47 cfs 0.149 af

Subcatchment 29S: Rear Roof Runoff Area=1.120 ac Runoff Depth=7.76"
Flow Length=333' Tc=2.6 min CN=98 Runoff=14.22 cfs 0.724 af

Subcatchment 30S: Future Loading Dock Runoff Area=0.320 ac Runoff Depth=7.76"
Flow Length=120' Tc=1.8 min CN=98 Runoff=4.16 cfs 0.207 af

Subcatchment 33S: Rear Yard 50% future paved Runoff Area=0.980 ac Runoff Depth=6.45"
Flow Length=150' Tc=17.1 min CN=87 Runoff=7.30 cfs 0.527 af

Subcatchment 36S: SE Front Yard Runoff Area=0.290 ac Runoff Depth=4.46"
Flow Length=100' Tc=2.3 min CN=70 Runoff=2.62 cfs 0.108 af

Subcatchment 37S: Front Yard Slope Runoff Area=0.580 ac Runoff Depth=4.46"
Flow Length=60' Tc=2.3 min CN=70 Runoff=5.23 cfs 0.216 af

Reach 1R: 6-1 to 6-4 Peak Depth=1.20' Max Vel=9.9 fps Inflow=22.97 cfs 1.924 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow=22.93 cfs 1.924 af

Reach 2R: 6-2 to 6-3 Peak Depth=1.35' Max Vel=11.9 fps Inflow=26.88 cfs 1.697 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow=26.85 cfs 1.697 af

Reach 3R: 6-3 to 6-4 Peak Depth=2.25' Max Vel=6.0 fps Inflow=30.73 cfs 2.349 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow=21.86 cfs 2.349 af

Reach 4R: 6-4 to 6-6 Peak Depth=1.71' Max Vel=13.1 fps Inflow=46.63 cfs 4.823 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow=46.62 cfs 4.823 af

Reach 5R: 6-5 to 6-6 Peak Depth=0.43' Max Vel=8.3 fps Inflow=3.07 cfs 0.148 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow=3.06 cfs 0.148 af

Reach 6R: 6-6 to 6-8 Peak Depth=3.00' Max Vel=8.8 fps Inflow=68.75 cfs 6.347 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow=57.01 cfs 6.347 af

Reach 7R: 6-7 to 6-8 Peak Depth=0.57' Max Vel=9.6 fps Inflow=5.28 cfs 0.253 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow=5.26 cfs 0.253 af

Reach 8R: 6-8 to 6-10 Peak Depth=3.00' Max Vel=10.9 fps Inflow=96.39 cfs 8.266 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow=71.47 cfs 8.266 af

Reach 9R: 6-9 to 6-10 Peak Depth=2.00' Max Vel=3.6 fps Inflow=21.44 cfs 1.053 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow=10.35 cfs 1.053 af

Reach 10R: 6-10 to 6-12 Peak Depth=1.89' Max Vel=19.5 fps Inflow=103.84 cfs 11.631 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow=103.84 cfs 11.631 af

Reach 11R: 6-11 to 6-12 Peak Depth=2.00' Max Vel=4.6 fps Inflow=20.64 cfs 1.269 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow=12.86 cfs 1.269 af

Reach 12R: 6-12 to 6-14 Peak Depth=1.97' Max Vel=19.2 fps Inflow=117.96 cfs 13.502 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow=117.95 cfs 13.502 af

Reach 13R: 6-13 to 6-14 Peak Depth=2.00' Max Vel=4.9 fps Inflow=19.32 cfs 1.269 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow=14.00 cfs 1.269 af

Reach 14R: 6-14 to 6-15 Peak Depth=2.71' Max Vel=14.5 fps Inflow=131.42 cfs 14.770 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow=131.41 cfs 14.770 af

Reach 15R: 6-15 to 6-19 Peak Depth=2.84' Max Vel=13.8 fps Inflow=131.69 cfs 14.900 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=131.68 cfs 14.900 af

Reach 16R: 6-16 to 6-19 Peak Depth=2.00' Max Vel=4.9 fps Inflow=23.58 cfs 1.602 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=14.36 cfs 1.602 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.50' Max Vel=3.7 fps Inflow=15.28 cfs 0.808 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=5.98 cfs 0.808 af

Reach 18R: 6-18 to 6-19 Peak Depth=2.00' Max Vel=3.8 fps Inflow=12.44 cfs 1.166 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=11.31 cfs 1.166 af

Reach 19R: 6-19 to 6-21 Peak Depth=4.50' Max Vel=9.7 fps Inflow=161.47 cfs 18.216 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=143.94 cfs 18.216 af

Reach 20R: 6-20 to 6-21 Peak Depth=3.50' Max Vel=8.8 fps Inflow=91.48 cfs 8.332 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=79.45 cfs 8.332 af

Reach 21R: 6-21 to 6-22 Peak Depth=2.52' Max Vel=23.5 fps Inflow=215.26 cfs 26.548 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=214.89 cfs 26.548 af

Reach 22R: A-2 to A-1 Peak Depth=0.79' Max Vel=14.6 fps Inflow=16.86 cfs 2.340 af
D=24.0" n=0.013 L=98.0' S=0.0510 '/' Capacity=51.10 cfs Outflow=16.77 cfs 2.340 af

Reach 23R: 6-23 to 6-20 Peak Depth=2.71' Max Vel=9.6 fps Inflow=63.77 cfs 6.194 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=63.62 cfs 6.194 af

Reach 24R: 6-24 to 6-23 Peak Depth=3.00' Max Vel=8.1 fps Inflow=70.63 cfs 5.458 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=53.02 cfs 5.458 af

Reach 25R: 6-25 to 6-24 Peak Depth=2.16' Max Vel=9.5 fps Inflow=42.79 cfs 3.904 af
D=30.0" n=0.013 L=189.0' S=0.0100 '/' Capacity=41.02 cfs Outflow=42.69 cfs 3.904 af

Reach 26R: A-3 to A-2 Peak Depth=2.00' Max Vel=5.8 fps Inflow=18.77 cfs 2.340 af
D=24.0" n=0.013 L=150.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=16.86 cfs 2.340 af

Reach 27R: Paved Flume PG-4 Peak Depth=0.20' Max Vel=12.4 fps Inflow=3.02 cfs 0.149 af
n=0.015 L=65.0' S=0.1902 '/' Capacity=56.04 cfs Outflow=3.02 cfs 0.149 af

Reach 28R: A-4 to A-3 Peak Depth=2.00' Max Vel=5.8 fps Inflow=23.62 cfs 2.205 af
D=24.0" n=0.013 L=66.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=16.33 cfs 2.205 af

Reach 29R: A-5 to A-4 Peak Depth=1.46' Max Vel=5.8 fps Inflow=14.36 cfs 1.720 af
D=24.0" n=0.013 L=191.0' S=0.0050 '/' Capacity=16.04 cfs Outflow=14.21 cfs 1.720 af

Reach 30R: A-6 to A-5 Peak Depth=1.75' Max Vel=5.3 fps Inflow=13.68 cfs 1.607 af
D=21.0" n=0.013 L=228.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=12.13 cfs 1.607 af

Reach 39R: A-7 to A-6 Peak Depth=1.75' Max Vel=5.3 fps Inflow=21.75 cfs 1.458 af
D=21.0" n=0.013 L=140.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=11.63 cfs 1.458 af

Reach 40R: A-8 to A-7 Peak Depth=1.06' Max Vel=5.0 fps Inflow=7.60 cfs 0.734 af
D=21.0" n=0.013 L=60.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=7.58 cfs 0.734 af

Reach 41R: A-9 to A-8 Peak Depth=1.25' Max Vel=4.2 fps Inflow=7.30 cfs 0.527 af
D=15.0" n=0.013 L=200.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=4.86 cfs 0.527 af

Reach 42R: Driveway Culvert Peak Depth=0.68' Max Vel=3.8 fps Inflow=2.62 cfs 0.108 af
D=15.0" n=0.013 L=40.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=2.60 cfs 0.108 af

Reach 43R: Paved Ditch PG-2 Peak Depth=0.96' Max Vel=3.7 fps Inflow=7.83 cfs 0.324 af
n=0.015 L=292.0' S=0.0043 '/' Capacity=8.47 cfs Outflow=7.55 cfs 0.324 af

Reach 100R: Ravine channel below BMP Peak Depth=2.52' Max Vel=4.0 fps Inflow=158.45 cfs 29.626 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=158.32 cfs 29.625 af

Pond 1P: Existing BMP Peak Elev=34.44' Storage=809,109 cf Inflow=256.01 cfs 30.055 af
Primary=129.34 cfs 28.701 af Secondary=29.12 cfs 0.925 af Outflow=158.45 cfs 29.626 af

Total Runoff Area = 62.320 ac Runoff Volume = 30.055 af Average Runoff Depth = 5.79"

JAMES RIVER COMMERCE CENTER

DRAINAGE AREAS

CASE 3

ANALYSIS OF EXISTING BMP WITH OUTLETS MODIFIED TO MAINTAIN MS-19 FLOW DOWNSTREAM.

POST DEVELOPMENT CONDITIONS ASSUME ALL SITES FULLY DEVELOPED

TOTAL DRAINAGE AREA 62.32 ACRES

DRAINAGE AREA NOT PASSING THROUGH BMP 1P

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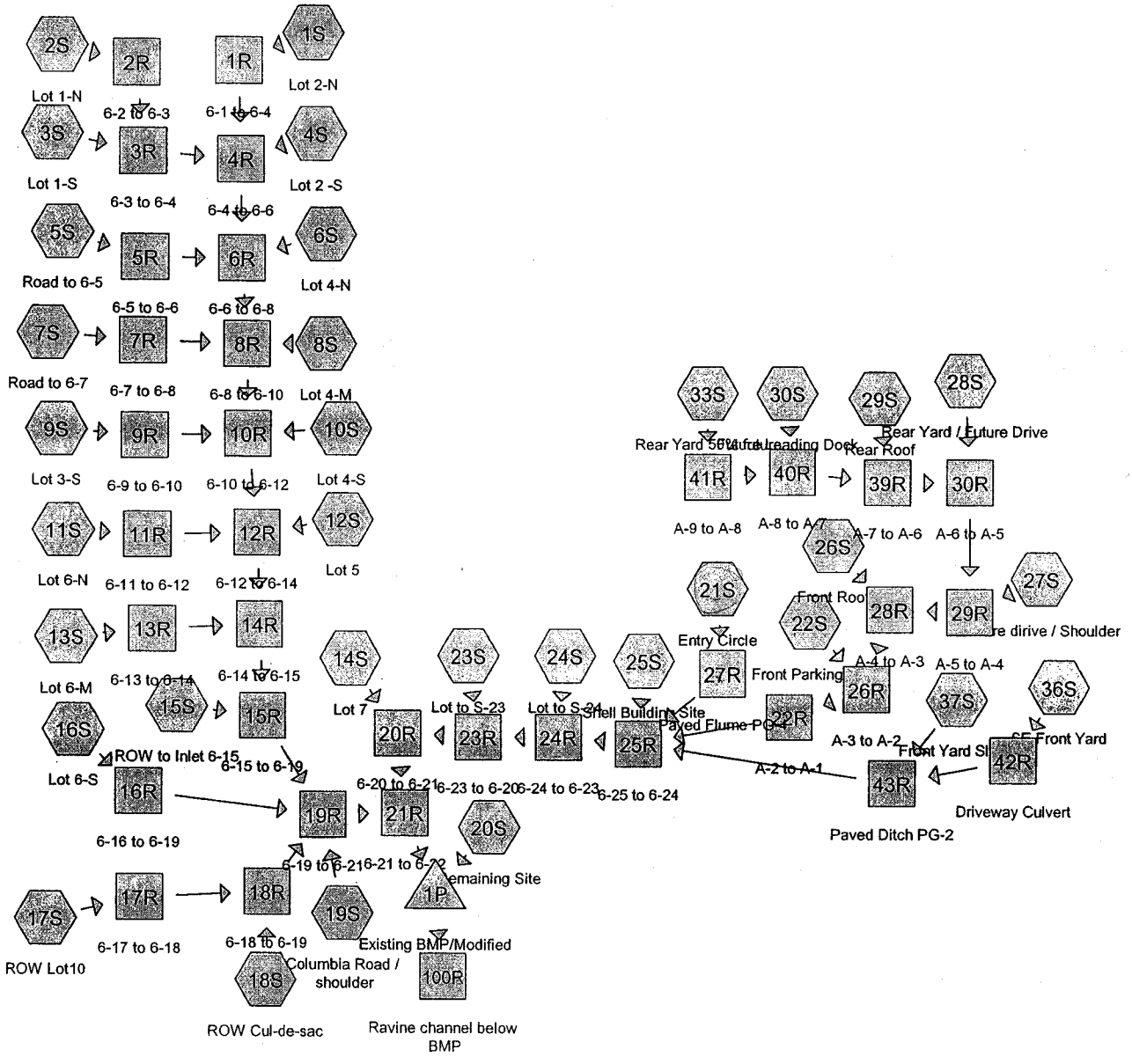

Drainage Diagram for James River Commerce Center Build Out
Prepared by LandMark Design Group, Inc. 03/03/2004
HydroCAD® 7.00 s/n 001765 © 1986-2003 Applied Microcomputer Systems

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=1.57"
Flow Length=605' Tc=23.5 min CN=87 Runoff=7.25 cfs 0.598 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=1.57"
Flow Length=500' Tc=13.6 min CN=87 Runoff=8.58 cfs 0.527 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=1.57"
Flow Length=320' Tc=32.9 min CN=87 Runoff=1.98 cfs 0.202 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=1.10"
Flow Length=375' Tc=7.6 min CN=80 Runoff=2.43 cfs 0.120 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=2.25"
Flow Length=240' Tc=2.0 min CN=95 Runoff=1.01 cfs 0.045 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=1.57"
Flow Length=575' Tc=4.4 min CN=87 Runoff=7.52 cfs 0.334 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=2.25"
Flow Length=215' Tc=1.8 min CN=95 Runoff=1.74 cfs 0.077 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=1.57"
Flow Length=590' Tc=4.2 min CN=87 Runoff=9.18 cfs 0.404 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=1.57"
Tc=5.0 min CN=87 Runoff=5.64 cfs 0.256 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=1.57"
Flow Length=545' Tc=24.8 min CN=87 Runoff=6.59 cfs 0.561 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=1.57"
Flow Length=500' Tc=12.7 min CN=87 Runoff=6.61 cfs 0.394 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=1.57"
Flow Length=350' Tc=2.9 min CN=87 Runoff=3.47 cfs 0.146 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=1.57"
Flow Length=700' Tc=14.3 min CN=87 Runoff=6.28 cfs 0.394 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=1.57"
Flow Length=570' Tc=18.3 min CN=87 Runoff=9.33 cfs 0.664 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=2.25"
Tc=2.0 min CN=95 Runoff=0.88 cfs 0.039 af

Subcatchment 16S: Lot 6-S Runoff Area=2.980 ac Runoff Depth=1.57"
Flow Length=600' Tc=15.1 min CN=87 Runoff=6.02 cfs 0.389 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=2.25"
Tc=5.0 min CN=95 Runoff=5.01 cfs 0.246 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=2.25"
Tc=5.0 min CN=95 Runoff=2.22 cfs 0.109 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=2.25"
Tc=2.0 min CN=95 Runoff=3.74 cfs 0.167 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=1.10"
Tc=20.0 min CN=80 Runoff=8.97 cfs 0.687 af

Subcatchment 21S: Entry Circle Runoff Area=0.230 ac Runoff Depth=2.57"
Tc=1.3 min CN=98 Runoff=1.05 cfs 0.049 af

Subcatchment 22S: Front Parking Lot Runoff Area=0.210 ac Runoff Depth=2.57"
Flow Length=130' Tc=1.2 min CN=98 Runoff=0.96 cfs 0.045 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=1.57"
Tc=15.0 min CN=87 Runoff=3.55 cfs 0.228 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=1.57"
Tc=20.0 min CN=87 Runoff=6.45 cfs 0.483 af

Subcatchment 25S: Shell Building Site Runoff Area=2.030 ac Runoff Depth=1.57"
Tc=15.0 min CN=87 Runoff=4.12 cfs 0.265 af

Subcatchment 26S: Front Roof Runoff Area=0.750 ac Runoff Depth=2.57"
Flow Length=267' Tc=1.8 min CN=98 Runoff=3.37 cfs 0.161 af

Subcatchment 27S: Future dirive / Shoulder Runoff Area=0.210 ac Runoff Depth=1.57"
Flow Length=54' Tc=1.7 min CN=87 Runoff=0.68 cfs 0.027 af

Subcatchment 28S: Rear Yard / Future Drive Runoff Area=0.400 ac Runoff Depth=0.61"
Flow Length=150' Tc=13.0 min CN=70 Runoff=0.30 cfs 0.020 af

Subcatchment 29S: Rear Roof Runoff Area=1.120 ac Runoff Depth=2.57"
Flow Length=333' Tc=2.6 min CN=98 Runoff=4.92 cfs 0.240 af

Subcatchment 30S: Future Loading Dock Runoff Area=0.320 ac Runoff Depth=2.57"
Flow Length=120' Tc=1.8 min CN=98 Runoff=1.44 cfs 0.069 af

Subcatchment 33S: Rear Yard 50% future paved Runoff Area=0.980 ac Runoff Depth=1.57"
Flow Length=150' Tc=17.1 min CN=87 Runoff=1.86 cfs 0.128 af

Subcatchment 36S: SE Front Yard Runoff Area=0.290 ac Runoff Depth=0.61"
Flow Length=100' Tc=2.3 min CN=70 Runoff=0.35 cfs 0.015 af

Subcatchment 37S: Front Yard Slope Runoff Area=0.580 ac Runoff Depth=0.61"
Flow Length=60' Tc=2.3 min CN=70 Runoff=0.69 cfs 0.029 af

Reach 1R: 6-1 to 6-4 Peak Depth=0.65' Max Vel=7.2 fps Inflow=7.25 cfs 0.598 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow=7.24 cfs 0.598 af

Reach 2R: 6-2 to 6-3 Peak Depth=0.69' Max Vel=9.0 fps Inflow=8.58 cfs 0.527 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow=8.56 cfs 0.527 af

Reach 3R: 6-3 to 6-4 Peak Depth=1.08' Max Vel=5.2 fps Inflow=9.75 cfs 0.729 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow=9.75 cfs 0.729 af

Reach 4R: 6-4 to 6-6 Peak Depth=0.93' Max Vel=10.2 fps Inflow=16.96 cfs 1.447 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow=16.94 cfs 1.447 af

Reach 5R: 6-5 to 6-6 Peak Depth=0.24' Max Vel=6.0 fps Inflow=1.01 cfs 0.045 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow=1.01 cfs 0.045 af

Reach 6R: 6-6 to 6-8 Peak Depth=1.24' Max Vel=7.1 fps Inflow=19.45 cfs 1.826 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow=19.43 cfs 1.826 af

Reach 7R: 6-7 to 6-8 Peak Depth=0.32' Max Vel=7.1 fps Inflow=1.74 cfs 0.077 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow=1.73 cfs 0.077 af

Reach 8R: 6-8 to 6-10 Peak Depth=1.35' Max Vel=9.2 fps Inflow=28.25 cfs 2.308 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow=28.16 cfs 2.308 af

Reach 9R: 6-9 to 6-10 Peak Depth=1.09' Max Vel=3.2 fps Inflow=5.64 cfs 0.256 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow=5.62 cfs 0.256 af

Reach 10R: 6-10 to 6-12 Peak Depth=1.07' Max Vel=14.8 fps Inflow=36.94 cfs 3.125 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow=36.89 cfs 3.125 af

Reach 11R: 6-11 to 6-12 Peak Depth=1.03' Max Vel=4.1 fps Inflow=6.61 cfs 0.394 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow=6.60 cfs 0.394 af

Reach 12R: 6-12 to 6-14 Peak Depth=1.16' Max Vel=14.7 fps Inflow=44.83 cfs 3.665 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow=44.74 cfs 3.665 af

Reach 13R: 6-13 to 6-14 Peak Depth=0.96' Max Vel=4.2 fps Inflow=6.28 cfs 0.394 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow=6.26 cfs 0.394 af

Reach 14R: 6-14 to 6-15 Peak Depth=1.52' Max Vel=11.5 fps Inflow=50.06 cfs 4.059 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow=50.00 cfs 4.059 af

Reach 15R: 6-15 to 6-19 Peak Depth=1.57' Max Vel=11.0 fps Inflow=50.27 cfs 4.098 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=50.21 cfs 4.098 af

Reach 16R: 6-16 to 6-19 Peak Depth=0.93' Max Vel=4.2 fps Inflow=6.02 cfs 0.389 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=6.02 cfs 0.389 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.09' Max Vel=3.6 fps Inflow=5.01 cfs 0.246 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=4.99 cfs 0.246 af

Reach 18R: 6-18 to 6-19 Peak Depth=1.21' Max Vel=3.6 fps Inflow=7.21 cfs 0.355 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=7.17 cfs 0.355 af

Reach 19R: 6-19 to 6-21 Peak Depth=2.15' Max Vel=8.4 fps Inflow=63.01 cfs 5.009 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=62.86 cfs 5.009 af

Reach 20R: 6-20 to 6-21 Peak Depth=1.58' Max Vel=7.4 fps Inflow=31.13 cfs 2.423 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=31.11 cfs 2.423 af

Reach 21R: 6-21 to 6-22 Peak Depth=1.56' Max Vel=18.9 fps Inflow=92.43 cfs 7.432 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=92.37 cfs 7.432 af

Reach 22R: A-2 to A-1 Peak Depth=0.61' Max Vel=12.8 fps Inflow=10.39 cfs 0.689 af
D=24.0" n=0.013 L=98.0' S=0.0510 '/' Capacity=51.10 cfs Outflow=10.39 cfs 0.689 af

Reach 23R: 6-23 to 6-20 Peak Depth=1.27' Max Vel=7.8 fps Inflow=22.47 cfs 1.758 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=22.41 cfs 1.758 af

Reach 24R: 6-24 to 6-23 Peak Depth=1.28' Max Vel=6.6 fps Inflow=19.18 cfs 1.530 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=19.14 cfs 1.530 af

Reach 25R: 6-25 to 6-24 Peak Depth=1.04' Max Vel=7.7 fps Inflow=14.79 cfs 1.047 af
D=30.0" n=0.013 L=189.0' S=0.0100 '/' Capacity=41.02 cfs Outflow=14.76 cfs 1.047 af

Reach 26R: A-3 to A-2 Peak Depth=1.17' Max Vel=5.4 fps Inflow=10.42 cfs 0.689 af
D=24.0" n=0.013 L=150.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=10.39 cfs 0.689 af

Reach 27R: Paved Flume PG-4 Peak Depth=0.11' Max Vel=8.8 fps Inflow=1.05 cfs 0.049 af
n=0.015 L=65.0' S=0.1902 '/' Capacity=56.04 cfs Outflow=1.04 cfs 0.049 af

Reach 28R: A-4 to A-3 Peak Depth=1.13' Max Vel=5.3 fps Inflow=9.72 cfs 0.644 af
D=24.0" n=0.013 L=66.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=9.71 cfs 0.644 af

Reach 29R: A-5 to A-4 Peak Depth=0.96' Max Vel=5.0 fps Inflow=7.50 cfs 0.484 af
D=24.0" n=0.013 L=191.0' S=0.0050 '/' Capacity=16.04 cfs Outflow=7.45 cfs 0.484 af

Reach 30R: A-6 to A-5 Peak Depth=1.01' Max Vel=4.9 fps Inflow=7.12 cfs 0.456 af
D=21.0" n=0.013 L=228.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=7.02 cfs 0.456 af

Reach 39R: A-7 to A-6 Peak Depth=1.00' Max Vel=4.9 fps Inflow=7.05 cfs 0.436 af
D=21.0" n=0.013 L=140.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=6.99 cfs 0.436 af

Reach 40R: A-8 to A-7 Peak Depth=0.52' Max Vel=3.6 fps Inflow=2.15 cfs 0.196 af
D=21.0" n=0.013 L=60.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=2.14 cfs 0.196 af

Reach 41R: A-9 to A-8 Peak Depth=0.55' Max Vel=3.5 fps Inflow=1.86 cfs 0.128 af
D=15.0" n=0.013 L=200.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=1.85 cfs 0.128 af

Reach 42R: Driveway Culvert Peak Depth=0.23' Max Vel=2.2 fps Inflow=0.35 cfs 0.015 af
D=15.0" n=0.013 L=40.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=0.34 cfs 0.015 af

Reach 43R: Paved Ditch PG-2 Peak Depth=0.44' Max Vel=2.2 fps Inflow=1.03 cfs 0.044 af
n=0.015 L=292.0' S=0.0043 '/' Capacity=8.47 cfs Outflow=0.93 cfs 0.044 af

Reach 100R: Ravine channel below BMP Peak Depth=0.52' Max Vel=1.9 fps Inflow=6.25 cfs 7.897 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=6.25 cfs 7.896 af

Pond 1P: Existing BMP/Modified Peak Elev=28.23' Storage=407,487 cf Inflow=99.47 cfs 8.119 af
Primary=6.25 cfs 7.897 af Secondary=0.00 cfs 0.000 af Outflow=6.25 cfs 7.897 af

Total Runoff Area = 62.320 ac Runoff Volume = 8.119 af Average Runoff Depth = 1.56"

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=2.18"
Flow Length=605' Tc=23.5 min CN=87 Runoff=10.09 cfs 0.833 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=2.18"
Flow Length=500' Tc=13.6 min CN=87 Runoff=11.88 cfs 0.735 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=2.18"
Flow Length=320' Tc=32.9 min CN=87 Runoff=2.76 cfs 0.282 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=1.64"
Flow Length=375' Tc=7.6 min CN=80 Runoff=3.62 cfs 0.179 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=2.94"
Flow Length=240' Tc=2.0 min CN=95 Runoff=1.29 cfs 0.059 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=2.18"
Flow Length=575' Tc=4.4 min CN=87 Runoff=10.34 cfs 0.466 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=2.94"
Flow Length=215' Tc=1.8 min CN=95 Runoff=2.22 cfs 0.100 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=2.18"
Flow Length=590' Tc=4.2 min CN=87 Runoff=12.60 cfs 0.564 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=2.18"
Tc=5.0 min CN=87 Runoff=7.75 cfs 0.356 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=2.18"
Flow Length=545' Tc=24.8 min CN=87 Runoff=9.17 cfs 0.782 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=2.18"
Flow Length=500' Tc=12.7 min CN=87 Runoff=9.16 cfs 0.549 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=2.18"
Flow Length=350' Tc=2.9 min CN=87 Runoff=4.76 cfs 0.204 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=2.18"
Flow Length=700' Tc=14.3 min CN=87 Runoff=8.69 cfs 0.549 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=2.18"
Flow Length=570' Tc=18.3 min CN=87 Runoff=12.96 cfs 0.926 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=2.94"
Tc=2.0 min CN=95 Runoff=1.13 cfs 0.051 af

Subcatchment 16S: Lot 6-S Runoff Area=2.980 ac Runoff Depth=2.18"
Flow Length=600' Tc=15.1 min CN=87 Runoff=8.35 cfs 0.542 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=2.94"
Tc=5.0 min CN=95 Runoff=6.42 cfs 0.321 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=2.94"
Tc=5.0 min CN=95 Runoff=2.84 cfs 0.142 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=2.94"
Tc=2.0 min CN=95 Runoff=4.79 cfs 0.218 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=1.64"
Tc=20.0 min CN=80 Runoff=13.53 cfs 1.020 af

Subcatchment 21S: Entry Circle Runoff Area=0.230 ac Runoff Depth=3.27"
Tc=1.3 min CN=98 Runoff=1.31 cfs 0.063 af

Subcatchment 22S: Front Parking Lot Runoff Area=0.210 ac Runoff Depth=3.27"
Flow Length=130' Tc=1.2 min CN=98 Runoff=1.20 cfs 0.057 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=2.18"
Tc=15.0 min CN=87 Runoff=4.92 cfs 0.318 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=2.18"
Tc=20.0 min CN=87 Runoff=8.96 cfs 0.673 af

Subcatchment 25S: Shell Building Site Runoff Area=2.030 ac Runoff Depth=2.18"
Tc=15.0 min CN=87 Runoff=5.70 cfs 0.369 af

Subcatchment 26S: Front Roof Runoff Area=0.750 ac Runoff Depth=3.27"
Flow Length=267' Tc=1.8 min CN=98 Runoff=4.23 cfs 0.204 af

Subcatchment 27S: Future dirive / Shoulder Runoff Area=0.210 ac Runoff Depth=2.18"
Flow Length=54' Tc=1.7 min CN=87 Runoff=0.93 cfs 0.038 af

Subcatchment 28S: Rear Yard / Future Drive Runoff Area=0.400 ac Runoff Depth=1.01"
Flow Length=150' Tc=13.0 min CN=70 Runoff=0.53 cfs 0.034 af

Subcatchment 29S: Rear Roof Runoff Area=1.120 ac Runoff Depth=3.27"
Flow Length=333' Tc=2.6 min CN=98 Runoff=6.17 cfs 0.305 af

Subcatchment 30S: Future Loading Dock Runoff Area=0.320 ac Runoff Depth=3.27"
Flow Length=120' Tc=1.8 min CN=98 Runoff=1.81 cfs 0.087 af

Subcatchment 33S: Rear Yard 50% future paved Runoff Area=0.980 ac Runoff Depth=2.18"
Flow Length=150' Tc=17.1 min CN=87 Runoff=2.58 cfs 0.178 af

Subcatchment 36S: SE Front Yard Runoff Area=0.290 ac Runoff Depth=1.01"
Flow Length=100' Tc=2.3 min CN=70 Runoff=0.60 cfs 0.024 af

Subcatchment 37S: Front Yard Slope Runoff Area=0.580 ac Runoff Depth=1.01"
Flow Length=60' Tc=2.3 min CN=70 Runoff=1.19 cfs 0.049 af

Reach 1R: 6-1 to 6-4 Peak Depth=0.77' Max Vel=7.9 fps Inflow=10.09 cfs 0.833 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow=10.08 cfs 0.833 af

Reach 2R: 6-2 to 6-3 Peak Depth=0.82' Max Vel=9.8 fps Inflow=11.88 cfs 0.735 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow=11.86 cfs 0.735 af

Reach 3R: 6-3 to 6-4 Peak Depth=1.32' Max Vel=5.6 fps Inflow=13.54 cfs 1.017 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow=13.53 cfs 1.017 af

Reach 4R: 6-4 to 6-6 Peak Depth=1.12' Max Vel=11.2 fps Inflow=23.80 cfs 2.028 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow=23.78 cfs 2.028 af

Reach 5R: 6-5 to 6-6 Peak Depth=0.27' Max Vel=6.5 fps Inflow=1.29 cfs 0.059 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow=1.29 cfs 0.059 af

Reach 6R: 6-6 to 6-8 Peak Depth=1.51' Max Vel=7.8 fps Inflow=27.68 cfs 2.553 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow=27.65 cfs 2.553 af

Reach 7R: 6-7 to 6-8 Peak Depth=0.36' Max Vel=7.6 fps Inflow=2.22 cfs 0.100 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow=2.21 cfs 0.100 af

Reach 8R: 6-8 to 6-10 Peak Depth=1.65' Max Vel=10.0 fps Inflow=39.72 cfs 3.217 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow=39.61 cfs 3.217 af

Reach 9R: 6-9 to 6-10 Peak Depth=1.34' Max Vel=3.5 fps Inflow=7.75 cfs 0.356 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow=7.72 cfs 0.356 af

Reach 10R: 6-10 to 6-12 Peak Depth=1.28' Max Vel=16.3 fps Inflow=51.88 cfs 4.355 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow=51.79 cfs 4.355 af

Reach 11R: 6-11 to 6-12 Peak Depth=1.26' Max Vel=4.4 fps Inflow=9.16 cfs 0.549 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow=9.14 cfs 0.549 af

Reach 12R: 6-12 to 6-14 Peak Depth=1.39' Max Vel=16.2 fps Inflow=62.85 cfs 5.108 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow=62.74 cfs 5.108 af

Reach 13R: 6-13 to 6-14 Peak Depth=1.17' Max Vel=4.6 fps Inflow=8.69 cfs 0.549 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow=8.68 cfs 0.549 af

Reach 14R: 6-14 to 6-15 Peak Depth=1.83' Max Vel=12.5 fps Inflow=70.12 cfs 5.657 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow=70.03 cfs 5.657 af

Reach 15R: 6-15 to 6-19 Peak Depth=1.89' Max Vel=12.0 fps Inflow=70.41 cfs 5.709 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=70.35 cfs 5.709 af

Reach 16R: 6-16 to 6-19 Peak Depth=1.13' Max Vel=4.5 fps Inflow=8.35 cfs 0.542 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=8.34 cfs 0.542 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.50' Max Vel=3.7 fps Inflow=6.42 cfs 0.321 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=6.03 cfs 0.321 af

Reach 18R: 6-18 to 6-19 Peak Depth=1.39' Max Vel=3.7 fps Inflow=8.81 cfs 0.463 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=8.68 cfs 0.463 af

Reach 19R: 6-19 to 6-21 Peak Depth=2.62' Max Vel=9.1 fps Inflow=87.21 cfs 6.932 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=87.04 cfs 6.932 af

Reach 20R: 6-20 to 6-21 Peak Depth=1.90' Max Vel=8.0 fps Inflow=42.64 cfs 3.325 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=42.61 cfs 3.325 af

Reach 21R: 6-21 to 6-22 Peak Depth=1.86' Max Vel=20.6 fps Inflow=128.11 cfs 10.257 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=128.04 cfs 10.257 af

Reach 22R: A-2 to A-1 Peak Depth=0.70' Max Vel=13.7 fps Inflow=13.46 cfs 0.903 af
D=24.0" n=0.013 L=98.0' S=0.0510 '/' Capacity=51.10 cfs Outflow=13.45 cfs 0.903 af

Reach 23R: 6-23 to 6-20 Peak Depth=1.52' Max Vel=8.5 fps Inflow=30.66 cfs 2.399 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=30.59 cfs 2.399 af

Reach 24R: 6-24 to 6-23 Peak Depth=1.53' Max Vel=7.2 fps Inflow=26.12 cfs 2.081 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=26.07 cfs 2.081 af

Reach 25R: 6-25 to 6-24 Peak Depth=1.23' Max Vel=8.3 fps Inflow=19.98 cfs 1.408 af
D=30.0" n=0.013 L=189.0' S=0.0100 '/' Capacity=41.02 cfs Outflow=19.95 cfs 1.408 af

Reach 26R: A-3 to A-2 Peak Depth=1.41' Max Vel=5.7 fps Inflow=13.50 cfs 0.903 af
D=24.0" n=0.013 L=150.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=13.46 cfs 0.903 af

Reach 27R: Paved Flume PG-4 Peak Depth=0.12' Max Vel=9.5 fps Inflow=1.31 cfs 0.063 af
n=0.015 L=65.0' S=0.1902 '/' Capacity=56.04 cfs Outflow=1.31 cfs 0.063 af

Reach 28R: A-4 to A-3 Peak Depth=1.34' Max Vel=5.6 fps Inflow=12.61 cfs 0.846 af
D=24.0" n=0.013 L=66.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=12.60 cfs 0.846 af

Reach 29R: A-5 to A-4 Peak Depth=1.12' Max Vel=5.3 fps Inflow=9.76 cfs 0.642 af
D=24.0" n=0.013 L=191.0' S=0.0050 '/' Capacity=16.04 cfs Outflow=9.71 cfs 0.642 af

Reach 30R: A-6 to A-5 Peak Depth=1.20' Max Vel=5.2 fps Inflow=9.22 cfs 0.604 af
D=21.0" n=0.013 L=228.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=9.10 cfs 0.604 af

Reach 39R: A-7 to A-6 Peak Depth=1.18' Max Vel=5.2 fps Inflow=9.01 cfs 0.570 af
D=21.0" n=0.013 L=140.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=8.94 cfs 0.570 af

Reach 40R: A-8 to A-7 Peak Depth=0.60' Max Vel=3.9 fps Inflow=2.87 cfs 0.265 af
D=21.0" n=0.013 L=60.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=2.86 cfs 0.265 af

Reach 41R: A-9 to A-8 Peak Depth=0.67' Max Vel=3.8 fps Inflow=2.58 cfs 0.178 af
D=15.0" n=0.013 L=200.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=2.57 cfs 0.178 af

Reach 42R: Driveway Culvert Peak Depth=0.30' Max Vel=2.6 fps Inflow=0.60 cfs 0.024 af
D=15.0" n=0.013 L=40.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=0.59 cfs 0.024 af

Reach 43R: Paved Ditch PG-2 Peak Depth=0.54' Max Vel=2.6 fps Inflow=1.78 cfs 0.073 af
n=0.015 L=292.0' S=0.0043 '/' Capacity=8.47 cfs Outflow=1.66 cfs 0.073 af

Reach 100R: Ravine channel below BMP Peak Depth=0.56' Max Vel=2.1 fps Inflow=7.69 cfs 11.000 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=7.69 cfs 11.000 af

Pond 1P: Existing BMP/Modified Peak Elev=29.64' Storage=498,710 cf Inflow=139.06 cfs 11.277 af
Primary=7.69 cfs 11.000 af Secondary=0.00 cfs 0.000 af Outflow=7.69 cfs 11.000 af

Total Runoff Area = 62.320 ac Runoff Volume = 11.277 af Average Runoff Depth = 2.17"

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=4.33"
Flow Length=605' Tc=23.5 min CN=87 Runoff=19.63 cfs 1.651 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=4.33"
Flow Length=500' Tc=13.6 min CN=87 Runoff=22.92 cfs 1.456 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=4.33"
Flow Length=320' Tc=32.9 min CN=87 Runoff=5.40 cfs 0.559 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=3.60"
Flow Length=375' Tc=7.6 min CN=80 Runoff=7.81 cfs 0.393 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=5.21"
Flow Length=240' Tc=2.0 min CN=95 Runoff=2.20 cfs 0.104 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=4.33"
Flow Length=575' Tc=4.4 min CN=87 Runoff=19.68 cfs 0.923 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=5.21"
Flow Length=215' Tc=1.8 min CN=95 Runoff=3.79 cfs 0.178 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=4.33"
Flow Length=590' Tc=4.2 min CN=87 Runoff=23.99 cfs 1.118 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=4.33"
Tc=5.0 min CN=87 Runoff=14.77 cfs 0.707 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=4.33"
Flow Length=545' Tc=24.8 min CN=87 Runoff=17.86 cfs 1.550 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=4.33"
Flow Length=500' Tc=12.7 min CN=87 Runoff=17.65 cfs 1.089 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=4.33"
Flow Length=350' Tc=2.9 min CN=87 Runoff=9.04 cfs 0.404 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=4.33"
Flow Length=700' Tc=14.3 min CN=87 Runoff=16.79 cfs 1.089 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=4.33"
Flow Length=570' Tc=18.3 min CN=87 Runoff=25.13 cfs 1.835 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=5.21"
Tc=2.0 min CN=95 Runoff=1.93 cfs 0.091 af

Subcatchment 16S: Lot 6-S Runoff Area=2.980 ac Runoff Depth=4.33"
Flow Length=600' Tc=15.1 min CN=87 Runoff=16.15 cfs 1.074 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=5.21"
Tc=5.0 min CN=95 Runoff=10.97 cfs 0.569 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=5.21"
Tc=5.0 min CN=95 Runoff=4.86 cfs 0.252 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=5.21"
Tc=2.0 min CN=95 Runoff=8.17 cfs 0.387 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=3.60"
Tc=20.0 min CN=80 Runoff=29.88 cfs 2.245 af

Subcatchment 21S: Entry Circle Runoff Area=0.230 ac Runoff Depth=5.56"
Tc=1.3 min CN=98 Runoff=2.19 cfs 0.107 af

Subcatchment 22S: Front Parking Lot Runoff Area=0.210 ac Runoff Depth=5.56"
Flow Length=130' Tc=1.2 min CN=98 Runoff=2.00 cfs 0.097 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=4.33"
Tc=15.0 min CN=87 Runoff=9.50 cfs 0.631 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=4.33"
Tc=20.0 min CN=87 Runoff=17.41 cfs 1.334 af

Subcatchment 25S: Shell Building Site Runoff Area=2.030 ac Runoff Depth=4.33"
Tc=15.0 min CN=87 Runoff=11.02 cfs 0.732 af

Subcatchment 26S: Front Roof Runoff Area=0.750 ac Runoff Depth=5.56"
Flow Length=267' Tc=1.8 min CN=98 Runoff=7.06 cfs 0.348 af

Subcatchment 27S: Future dirive / Shoulder Runoff Area=0.210 ac Runoff Depth=4.33"
Flow Length=54' Tc=1.7 min CN=87 Runoff=1.76 cfs 0.076 af

Subcatchment 28S: Rear Yard / Future Drive Runoff Area=0.400 ac Runoff Depth=2.65"
Flow Length=150' Tc=13.0 min CN=70 Runoff=1.47 cfs 0.088 af

Subcatchment 29S: Rear Roof Runoff Area=1.120 ac Runoff Depth=5.56"
Flow Length=333' Tc=2.6 min CN=98 Runoff=10.29 cfs 0.519 af

Subcatchment 30S: Future Loading Dock Runoff Area=0.320 ac Runoff Depth=5.56"
Flow Length=120' Tc=1.8 min CN=98 Runoff=3.01 cfs 0.148 af

Subcatchment 33S: Rear Yard 50% future paved Runoff Area=0.980 ac Runoff Depth=4.33"
Flow Length=150' Tc=17.1 min CN=87 Runoff=4.99 cfs 0.353 af

Subcatchment 36S: SE Front Yard Runoff Area=0.290 ac Runoff Depth=2.65"
Flow Length=100' Tc=2.3 min CN=70 Runoff=1.58 cfs 0.064 af

Subcatchment 37S: Front Yard Slope Runoff Area=0.580 ac Runoff Depth=2.65"
Flow Length=60' Tc=2.3 min CN=70 Runoff=3.16 cfs 0.128 af

Reach 1R: 6-1 to 6-4 Peak Depth=1.09' Max Vel=9.5 fps Inflow=19.63 cfs 1.651 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow=19.62 cfs 1.651 af

Reach 2R: 6-2 to 6-3 Peak Depth=1.21' Max Vel=11.6 fps Inflow=22.92 cfs 1.456 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow=22.88 cfs 1.456 af

Reach 3R: 6-3 to 6-4 Peak Depth=2.25' Max Vel=6.0 fps Inflow=26.24 cfs 2.015 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow=21.87 cfs 2.015 af

Reach 4R: 6-4 to 6-6 Peak Depth=1.60' Max Vel=12.8 fps Inflow=42.41 cfs 4.059 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow=42.40 cfs 4.059 af

Reach 5R: 6-5 to 6-6 Peak Depth=0.36' Max Vel=7.5 fps Inflow=2.20 cfs 0.104 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow=2.20 cfs 0.104 af

Reach 6R: 6-6 to 6-8 Peak Depth=2.51' Max Vel=8.8 fps Inflow=55.69 cfs 5.087 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow=55.51 cfs 5.087 af

Reach 7R: 6-7 to 6-8 Peak Depth=0.48' Max Vel=8.8 fps Inflow=3.79 cfs 0.178 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow=3.78 cfs 0.178 af

Reach 8R: 6-8 to 6-10 Peak Depth=3.00' Max Vel=10.9 fps Inflow=78.39 cfs 6.382 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow=70.92 cfs 6.382 af

Reach 9R: 6-9 to 6-10 Peak Depth=2.00' Max Vel=3.6 fps Inflow=14.77 cfs 0.707 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow=9.91 cfs 0.707 af

Reach 10R: 6-10 to 6-12 Peak Depth=1.78' Max Vel=19.0 fps Inflow=93.11 cfs 8.639 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow=93.23 cfs 8.639 af

Reach 11R: 6-11 to 6-12 Peak Depth=2.00' Max Vel=4.6 fps Inflow=17.65 cfs 1.089 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow=13.24 cfs 1.089 af

Reach 12R: 6-12 to 6-14 Peak Depth=1.88' Max Vel=18.8 fps Inflow=109.46 cfs 10.132 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow=108.98 cfs 10.132 af

Reach 13R: 6-13 to 6-14 Peak Depth=2.00' Max Vel=4.9 fps Inflow=16.79 cfs 1.089 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow=13.86 cfs 1.089 af

Reach 14R: 6-14 to 6-15 Peak Depth=2.55' Max Vel=14.3 fps Inflow=121.02 cfs 11.220 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow=120.75 cfs 11.220 af

Reach 15R: 6-15 to 6-19 Peak Depth=2.68' Max Vel=13.6 fps Inflow=122.05 cfs 11.312 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=121.78 cfs 11.312 af

Reach 16R: 6-16 to 6-19 Peak Depth=2.00' Max Vel=4.9 fps Inflow=16.15 cfs 1.074 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=14.46 cfs 1.074 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.50' Max Vel=3.7 fps Inflow=10.97 cfs 0.569 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=5.89 cfs 0.569 af

Reach 18R: 6-18 to 6-19 Peak Depth=1.64' Max Vel=3.8 fps Inflow=10.53 cfs 0.821 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=10.49 cfs 0.821 af

Reach 19R: 6-19 to 6-21 Peak Depth=4.50' Max Vel=9.7 fps Inflow=149.64 cfs 13.594 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=144.47 cfs 13.594 af

Reach 20R: 6-20 to 6-21 Peak Depth=3.50' Max Vel=8.8 fps Inflow=80.00 cfs 6.460 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=79.98 cfs 6.460 af

Reach 21R: 6-21 to 6-22 Peak Depth=2.52' Max Vel=23.5 fps Inflow=215.79 cfs 20.053 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=215.47 cfs 20.053 af

Reach 22R: A-2 to A-1 Peak Depth=0.79' Max Vel=14.6 fps Inflow=16.93 cfs 1.630 af
D=24.0" n=0.013 L=98.0' S=0.0510 '/' Capacity=51.10 cfs Outflow=16.84 cfs 1.630 af

Reach 23R: 6-23 to 6-20 Peak Depth=2.27' Max Vel=9.6 fps Inflow=54.93 cfs 4.625 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=54.87 cfs 4.625 af

Reach 24R: 6-24 to 6-23 Peak Depth=2.24' Max Vel=8.1 fps Inflow=45.57 cfs 3.994 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=45.56 cfs 3.994 af

Reach 25R: 6-25 to 6-24 Peak Depth=1.60' Max Vel=9.1 fps Inflow=30.37 cfs 2.660 af
D=30.0" n=0.013 L=189.0' S=0.0100 '/' Capacity=41.02 cfs Outflow=30.34 cfs 2.660 af

Reach 26R: A-3 to A-2 Peak Depth=2.00' Max Vel=5.8 fps Inflow=18.34 cfs 1.630 af
D=24.0" n=0.013 L=150.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=16.93 cfs 1.630 af

Reach 27R: Paved Flume PG-4 Peak Depth=0.17' Max Vel=11.2 fps Inflow=2.19 cfs 0.107 af
n=0.015 L=65.0' S=0.1902 '/' Capacity=56.04 cfs Outflow=2.19 cfs 0.107 af

Reach 28R: A-4 to A-3 Peak Depth=2.00' Max Vel=5.8 fps Inflow=20.59 cfs 1.532 af
D=24.0" n=0.013 L=66.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=16.55 cfs 1.532 af

Reach 29R: A-5 to A-4 Peak Depth=1.42' Max Vel=5.7 fps Inflow=13.72 cfs 1.185 af
D=24.0" n=0.013 L=191.0' S=0.0050 '/' Capacity=16.04 cfs Outflow=13.68 cfs 1.185 af

Reach 30R: A-6 to A-5 Peak Depth=1.75' Max Vel=5.3 fps Inflow=12.85 cfs 1.109 af
D=21.0" n=0.013 L=228.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=12.05 cfs 1.109 af

Reach 39R: A-7 to A-6 Peak Depth=1.75' Max Vel=5.3 fps Inflow=15.53 cfs 1.021 af
D=21.0" n=0.013 L=140.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=11.84 cfs 1.021 af

Reach 40R: A-8 to A-7 Peak Depth=0.85' Max Vel=4.6 fps Inflow=5.29 cfs 0.502 af
D=21.0" n=0.013 L=60.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=5.27 cfs 0.502 af

Reach 41R: A-9 to A-8 Peak Depth=1.19' Max Vel=4.2 fps Inflow=4.99 cfs 0.353 af
D=15.0" n=0.013 L=200.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=4.91 cfs 0.353 af

Reach 42R: Driveway Culvert Peak Depth=0.51' Max Vel=3.4 fps Inflow=1.58 cfs 0.064 af
D=15.0" n=0.013 L=40.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=1.57 cfs 0.064 af

Reach 43R: Paved Ditch PG-2 Peak Depth=0.79' Max Vel=3.3 fps Inflow=4.72 cfs 0.192 af
n=0.015 L=292.0' S=0.0043 '/' Capacity=8.47 cfs Outflow=4.50 cfs 0.192 af

Reach 100R: Ravine channel below BMP Peak Depth=0.89' Max Vel=2.8 fps Inflow=21.64 cfs 21.896 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=21.64 cfs 21.895 af

Pond 1P: Existing BMP/Modified Peak Elev=33.86' Storage=771,791 cf Inflow=244.41 cfs 22.298 af
Primary=21.64 cfs 21.896 af Secondary=0.00 cfs 0.000 af Outflow=21.64 cfs 21.896 af

Total Runoff Area = 62.320 ac Runoff Volume = 22.298 af Average Runoff Depth = 4.29"

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 2-N Runoff Area=4.580 ac Runoff Depth=6.45"
Flow Length=605' Tc=23.5 min CN=87 Runoff=28.76 cfs 2.462 af

Subcatchment 2S: Lot 1-N Runoff Area=4.040 ac Runoff Depth=6.45"
Flow Length=500' Tc=13.6 min CN=87 Runoff=33.44 cfs 2.171 af

Subcatchment 3S: Lot 1-S Runoff Area=1.550 ac Runoff Depth=6.45"
Flow Length=320' Tc=32.9 min CN=87 Runoff=7.93 cfs 0.833 af

Subcatchment 4S: Lot 2 -S Runoff Area=1.310 ac Runoff Depth=5.63"
Flow Length=375' Tc=7.6 min CN=80 Runoff=11.93 cfs 0.614 af

Subcatchment 5S: Road to 6-5 Runoff Area=0.240 ac Runoff Depth=7.40"
Flow Length=240' Tc=2.0 min CN=95 Runoff=3.07 cfs 0.148 af

Subcatchment 6S: Lot 4-N Runoff Area=2.560 ac Runoff Depth=6.45"
Flow Length=575' Tc=4.4 min CN=87 Runoff=28.55 cfs 1.376 af

Subcatchment 7S: Road to 6-7 Runoff Area=0.410 ac Runoff Depth=7.40"
Flow Length=215' Tc=1.8 min CN=95 Runoff=5.28 cfs 0.253 af

Subcatchment 8S: Lot 4-M Runoff Area=3.100 ac Runoff Depth=6.45"
Flow Length=590' Tc=4.2 min CN=87 Runoff=34.80 cfs 1.666 af

Subcatchment 9S: Lot 3-S Runoff Area=1.960 ac Runoff Depth=6.45"
Tc=5.0 min CN=87 Runoff=21.44 cfs 1.053 af

Subcatchment 10S: Lot 4-S Runoff Area=4.300 ac Runoff Depth=6.45"
Flow Length=545' Tc=24.8 min CN=87 Runoff=26.14 cfs 2.311 af

Subcatchment 11S: Lot 6-N Runoff Area=3.020 ac Runoff Depth=6.45"
Flow Length=500' Tc=12.7 min CN=87 Runoff=25.73 cfs 1.623 af

Subcatchment 12S: Lot 5 Runoff Area=1.120 ac Runoff Depth=6.45"
Flow Length=350' Tc=2.9 min CN=87 Runoff=13.11 cfs 0.602 af

Subcatchment 13S: Lot 6-M Runoff Area=3.020 ac Runoff Depth=6.45"
Flow Length=700' Tc=14.3 min CN=87 Runoff=24.50 cfs 1.623 af

Subcatchment 14S: Lot 7 Runoff Area=5.090 ac Runoff Depth=6.45"
Flow Length=570' Tc=18.3 min CN=87 Runoff=36.74 cfs 2.736 af

Subcatchment 15S: ROW to Inlet 6-15 Runoff Area=0.210 ac Runoff Depth=7.40"
Tc=2.0 min CN=95 Runoff=2.69 cfs 0.130 af

Subcatchment 16S: Lot 6-S Runoff Area=2.980 ac Runoff Depth=6.45"
Flow Length=600' Tc=15.1 min CN=87 Runoff=23.58 cfs 1.602 af

Subcatchment 17S: ROW Lot10 Runoff Area=1.310 ac Runoff Depth=7.40"
Tc=5.0 min CN=95 Runoff=15.28 cfs 0.808 af

Subcatchment 18S: ROW Cul-de-sac Runoff Area=0.580 ac Runoff Depth=7.40"
Tc=5.0 min CN=95 Runoff=6.77 cfs 0.358 af

Subcatchment 19S: Columbia Road / shoulder Runoff Area=0.890 ac Runoff Depth=7.40"
Tc=2.0 min CN=95 Runoff=11.38 cfs 0.549 af

Subcatchment 20S: Remaining Site Runoff Area=7.480 ac Runoff Depth=5.63"
Tc=20.0 min CN=80 Runoff=46.16 cfs 3.506 af

Subcatchment 21S: Entry Circle Runoff Area=0.230 ac Runoff Depth=7.76"
Tc=1.3 min CN=98 Runoff=3.02 cfs 0.149 af

Subcatchment 22S: Front Parking Lot Runoff Area=0.210 ac Runoff Depth=7.76"
Flow Length=130' Tc=1.2 min CN=98 Runoff=2.77 cfs 0.136 af

Subcatchment 23S: Lot to S-23 Runoff Area=1.750 ac Runoff Depth=6.45"
Tc=15.0 min CN=87 Runoff=13.87 cfs 0.941 af

Subcatchment 24S: Lot to S-24 Runoff Area=3.700 ac Runoff Depth=6.45"
Tc=20.0 min CN=87 Runoff=25.48 cfs 1.989 af

Subcatchment 25S: Shell Building Site Runoff Area=2.030 ac Runoff Depth=6.45"
Tc=15.0 min CN=87 Runoff=16.08 cfs 1.091 af

Subcatchment 26S: Front Roof Runoff Area=0.750 ac Runoff Depth=7.76"
Flow Length=267' Tc=1.8 min CN=98 Runoff=9.75 cfs 0.485 af

Subcatchment 27S: Future dirive / Shoulder Runoff Area=0.210 ac Runoff Depth=6.45"
Flow Length=54' Tc=1.7 min CN=87 Runoff=2.55 cfs 0.113 af

Subcatchment 28S: Rear Yard / Future Drive Runoff Area=0.400 ac Runoff Depth=4.46"
Flow Length=150' Tc=13.0 min CN=70 Runoff=2.47 cfs 0.149 af

Subcatchment 29S: Rear Roof Runoff Area=1.120 ac Runoff Depth=7.76"
Flow Length=333' Tc=2.6 min CN=98 Runoff=14.22 cfs 0.724 af

Subcatchment 30S: Future Loading Dock Runoff Area=0.320 ac Runoff Depth=7.76"
Flow Length=120' Tc=1.8 min CN=98 Runoff=4.16 cfs 0.207 af

Subcatchment 33S: Rear Yard 50% future paved Runoff Area=0.980 ac Runoff Depth=6.45"
Flow Length=150' Tc=17.1 min CN=87 Runoff=7.30 cfs 0.527 af

Subcatchment 36S: SE Front Yard Runoff Area=0.290 ac Runoff Depth=4.46"
Flow Length=100' Tc=2.3 min CN=70 Runoff=2.62 cfs 0.108 af

Subcatchment 37S: Front Yard Slope Runoff Area=0.580 ac Runoff Depth=4.46"
Flow Length=60' Tc=2.3 min CN=70 Runoff=5.23 cfs 0.216 af

Reach 1R: 6-1 to 6-4 Peak Depth=1.37' Max Vel=10.5 fps Inflow=28.76 cfs 2.462 af
D=30.0" n=0.013 L=326.0' S=0.0146 '/' Capacity=49.51 cfs Outflow=28.73 cfs 2.462 af

Reach 2R: 6-2 to 6-3 Peak Depth=1.62' Max Vel=12.3 fps Inflow=33.44 cfs 2.171 af
D=24.0" n=0.013 L=234.0' S=0.0223 '/' Capacity=33.79 cfs Outflow=33.38 cfs 2.171 af

Reach 3R: 6-3 to 6-4 Peak Depth=2.25' Max Vel=6.0 fps Inflow=38.38 cfs 3.004 af
D=27.0" n=0.013 L=48.0' S=0.0046 '/' Capacity=20.97 cfs Outflow=22.05 cfs 3.004 af

Reach 4R: 6-4 to 6-6 Peak Depth=1.88' Max Vel=13.3 fps Inflow=52.52 cfs 6.080 af
D=30.0" n=0.013 L=235.0' S=0.0197 '/' Capacity=57.57 cfs Outflow=52.51 cfs 6.080 af

Reach 5R: 6-5 to 6-6 Peak Depth=0.43' Max Vel=8.3 fps Inflow=3.07 cfs 0.148 af
D=15.0" n=0.013 L=48.0' S=0.0358 '/' Capacity=12.23 cfs Outflow=3.06 cfs 0.148 af

Reach 6R: 6-6 to 6-8 Peak Depth=3.00' Max Vel=8.8 fps Inflow=75.59 cfs 7.604 af
D=36.0" n=0.013 L=213.0' S=0.0067 '/' Capacity=54.65 cfs Outflow=57.00 cfs 7.604 af

Reach 7R: 6-7 to 6-8 Peak Depth=0.57' Max Vel=9.6 fps Inflow=5.28 cfs 0.253 af
D=15.0" n=0.013 L=48.0' S=0.0360 '/' Capacity=12.26 cfs Outflow=5.26 cfs 0.253 af

Reach 8R: 6-8 to 6-10 Peak Depth=3.00' Max Vel=10.9 fps Inflow=94.14 cfs 9.523 af
D=36.0" n=0.013 L=275.0' S=0.0104 '/' Capacity=67.90 cfs Outflow=70.91 cfs 9.523 af

Reach 9R: 6-9 to 6-10 Peak Depth=2.00' Max Vel=3.6 fps Inflow=21.44 cfs 1.053 af
D=24.0" n=0.013 L=48.0' S=0.0019 '/' Capacity=9.80 cfs Outflow=10.35 cfs 1.053 af

Reach 10R: 6-10 to 6-12 Peak Depth=1.89' Max Vel=19.5 fps Inflow=103.84 cfs 12.888 af
D=42.0" n=0.013 L=200.0' S=0.0327 '/' Capacity=182.07 cfs Outflow=103.84 cfs 12.888 af

Reach 11R: 6-11 to 6-12 Peak Depth=2.00' Max Vel=4.6 fps Inflow=25.73 cfs 1.623 af
D=24.0" n=0.013 L=48.0' S=0.0031 '/' Capacity=12.65 cfs Outflow=13.01 cfs 1.623 af

Reach 12R: 6-12 to 6-14 Peak Depth=1.97' Max Vel=19.2 fps Inflow=117.96 cfs 15.113 af
D=48.0" n=0.013 L=250.0' S=0.0286 '/' Capacity=242.92 cfs Outflow=117.95 cfs 15.113 af

Reach 13R: 6-13 to 6-14 Peak Depth=2.00' Max Vel=4.9 fps Inflow=24.50 cfs 1.623 af
D=24.0" n=0.013 L=48.0' S=0.0035 '/' Capacity=13.46 cfs Outflow=13.89 cfs 1.623 af

Reach 14R: 6-14 to 6-15 Peak Depth=2.71' Max Vel=14.5 fps Inflow=131.42 cfs 16.736 af
D=48.0" n=0.013 L=146.0' S=0.0130 '/' Capacity=163.86 cfs Outflow=131.41 cfs 16.736 af

Reach 15R: 6-15 to 6-19 Peak Depth=2.84' Max Vel=13.8 fps Inflow=131.69 cfs 16.866 af
D=48.0" n=0.013 L=115.0' S=0.0116 '/' Capacity=154.48 cfs Outflow=131.68 cfs 16.866 af

Reach 16R: 6-16 to 6-19 Peak Depth=2.00' Max Vel=4.9 fps Inflow=23.58 cfs 1.602 af
D=24.0" n=0.013 L=61.0' S=0.0036 '/' Capacity=13.59 cfs Outflow=14.36 cfs 1.602 af

Reach 17R: 6-17 to 6-18 Peak Depth=1.50' Max Vel=3.7 fps Inflow=15.28 cfs 0.808 af
D=18.0" n=0.013 L=48.0' S=0.0029 '/' Capacity=5.67 cfs Outflow=5.98 cfs 0.808 af

Reach 18R: 6-18 to 6-19 Peak Depth=2.00' Max Vel=3.8 fps Inflow=12.44 cfs 1.166 af
D=24.0" n=0.013 L=130.0' S=0.0022 '/' Capacity=10.50 cfs Outflow=11.31 cfs 1.166 af

Reach 19R: 6-19 to 6-21 Peak Depth=4.50' Max Vel=9.7 fps Inflow=165.13 cfs 20.182 af
D=54.0" n=0.013 L=260.0' S=0.0048 '/' Capacity=135.81 cfs Outflow=143.45 cfs 20.182 af

Reach 20R: 6-20 to 6-21 Peak Depth=3.50' Max Vel=8.8 fps Inflow=100.80 cfs 9.569 af
D=42.0" n=0.013 L=48.0' S=0.0054 '/' Capacity=74.05 cfs Outflow=77.82 cfs 9.569 af

Reach 21R: 6-21 to 6-22 Peak Depth=2.50' Max Vel=23.5 fps Inflow=213.63 cfs 29.751 af
D=54.0" n=0.013 L=128.0' S=0.0330 '/' Capacity=357.48 cfs Outflow=212.82 cfs 29.751 af

Reach 22R: A-2 to A-1 Peak Depth=0.79' Max Vel=14.6 fps Inflow=16.86 cfs 2.340 af
D=24.0" n=0.013 L=98.0' S=0.0510 '/' Capacity=51.10 cfs Outflow=16.77 cfs 2.340 af

Reach 23R: 6-23 to 6-20 Peak Depth=2.78' Max Vel=9.6 fps Inflow=65.31 cfs 6.833 af
D=36.0" n=0.013 L=309.0' S=0.0080 '/' Capacity=59.63 cfs Outflow=64.07 cfs 6.833 af

Reach 24R: 6-24 to 6-23 Peak Depth=3.00' Max Vel=8.1 fps Inflow=59.29 cfs 5.893 af
D=36.0" n=0.013 L=207.0' S=0.0057 '/' Capacity=50.36 cfs Outflow=53.45 cfs 5.893 af

Reach 25R: 6-25 to 6-24 Peak Depth=1.89' Max Vel=9.5 fps Inflow=37.73 cfs 3.904 af
D=30.0" n=0.013 L=189.0' S=0.0100 '/' Capacity=41.02 cfs Outflow=37.69 cfs 3.904 af

Reach 26R: A-3 to A-2 Peak Depth=2.00' Max Vel=5.8 fps Inflow=18.77 cfs 2.340 af
D=24.0" n=0.013 L=150.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=16.86 cfs 2.340 af

Reach 27R: Paved Flume PG-4 Peak Depth=0.20' Max Vel=12.4 fps Inflow=3.02 cfs 0.149 af
n=0.015 L=65.0' S=0.1902 '/' Capacity=56.04 cfs Outflow=3.02 cfs 0.149 af

Reach 28R: A-4 to A-3 Peak Depth=2.00' Max Vel=5.8 fps Inflow=23.62 cfs 2.205 af
D=24.0" n=0.013 L=66.0' S=0.0050 '/' Capacity=16.00 cfs Outflow=16.33 cfs 2.205 af

Reach 29R: A-5 to A-4 Peak Depth=1.46' Max Vel=5.8 fps Inflow=14.36 cfs 1.720 af
D=24.0" n=0.013 L=191.0' S=0.0050 '/' Capacity=16.04 cfs Outflow=14.21 cfs 1.720 af

Reach 30R: A-6 to A-5 Peak Depth=1.75' Max Vel=5.3 fps Inflow=13.68 cfs 1.607 af
D=21.0" n=0.013 L=228.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=12.13 cfs 1.607 af

Reach 39R: A-7 to A-6 Peak Depth=1.75' Max Vel=5.3 fps Inflow=21.75 cfs 1.458 af
D=21.0" n=0.013 L=140.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=11.63 cfs 1.458 af

Reach 40R: A-8 to A-7 Peak Depth=1.06' Max Vel=5.0 fps Inflow=7.60 cfs 0.734 af
D=21.0" n=0.013 L=60.0' S=0.0050 '/' Capacity=11.20 cfs Outflow=7.58 cfs 0.734 af

Reach 41R: A-9 to A-8 Peak Depth=1.25' Max Vel=4.2 fps Inflow=7.30 cfs 0.527 af
D=15.0" n=0.013 L=200.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=4.86 cfs 0.527 af

Reach 42R: Driveway Culvert Peak Depth=0.68' Max Vel=3.8 fps Inflow=2.62 cfs 0.108 af
D=15.0" n=0.013 L=40.0' S=0.0050 '/' Capacity=4.57 cfs Outflow=2.60 cfs 0.108 af

Reach 43R: Paved Ditch PG-2 Peak Depth=0.96' Max Vel=3.7 fps Inflow=7.83 cfs 0.324 af
n=0.015 L=292.0' S=0.0043 '/' Capacity=8.47 cfs Outflow=7.55 cfs 0.324 af

Reach 100R: Ravine channel below BMP Peak Depth=2.59' Max Vel=4.0 fps Inflow=165.52 cfs 32.809 af
n=0.040 L=117.0' S=0.0085 '/' Capacity=155.76 cfs Outflow=165.48 cfs 32.808 af

Pond 1P: Existing BMP/Modified Peak Elev=35.95' Storage=906,900 cf Inflow=256.01 cfs 33.257 af
Primary=135.94 cfs 31.924 af Secondary=29.58 cfs 0.886 af Outflow=165.52 cfs 32.809 af

Total Runoff Area = 62.320 ac Runoff Volume = 33.257 af Average Runoff Depth = 6.40"

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VIRGINIA BEACH - WILLIAMSBURG, VIRGINIA

Subject BALL METAL
CHES. BAY COMPLIANCE
Computed By _____ Checked By _____

Project No. _____
Client _____
Date 4/22/96 Sheet No. _____

TOTAL AREA OF EXISTING DEV. — 17 Ac.
AREA OF PROPOSED EXPANSION — 9.3 Ac.

CALCULATION IS TO DETERMINE HOW MUCH OF EXISTING DEVELOPMENT, ASSUMED TO BE OFFSITE CREDIT, MUST GO THROUGH A 4 POINT B.M.P., ASSUMING ALL OF NEW DEVELOPMENT GOES TO THE SAME 4 POINT B.M.P. CHANGES WILL OCCUR ON EXISTING DEVELOPED AREA, BUT NO CHANGES IN IMPERVIOUS SURFACE AREA WILL OCCUR.

NEW DEV. OFFSITE CREDIT

$$\left[\frac{9.3\ Ac.}{9.3\ Ac.} \times 4\ PTS.\right] + \frac{X}{9.3\ Ac.}(4\ POINTS) = 10\ POINTS$$

$$(1 \times 4) + \frac{4X}{9.3} = 10$$

$$\frac{4X}{9.3} = 6$$

$$X = 13.9\ Ac.$$

LEFT W/ WNB & DEC IN MTG. OF 4/25/96

TOTAL IMPERVIOUS SURFACE
EXIST. — 13.9 AC. X 0.70 = 9.73 Ac.
FUTURE. — 9.3 Ac. X 0.60 = 5.58 Ac.
15.3 Ac. IMPERV.

CHES. BAY VOL. = 1/2" / IMPERV. ACRE.

$$15.3\ Ac. \times \frac{1/2"}{12"} \times 43560\ SF/Ac. = 27,769\ c.f.$$

0.63 AC.FT.

THIS VOL OCCURS @
ELEV. 52.14 @ t = 1476 MIN.

200 MIN - 1476 MIN. = 524 MIN ÷ 60 = 8.7 HRS.

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Subject BMP REQMTS w/ BALL ONSITE
Computed By _____ Checked By _____

Project No. _____
Client _____
Date _____ Sheet No. 1.

TOTAL ACREAGE = 219.2 Ac.
TOTAL DEVELOPED Ac. = 136.4 Ac.
TOTAL UNDEV./UNOS = 82.8 Ac.

AREA TO BMP # 1 = 54.7 Ac.
AREA TO BALL METAL BMP - ONSITE @ BALL = 9.3 Ac. + 14 Ac = 23.3 Ac.

POINT CALCULATION

BMP # 1

$$\frac{54.7 \text{ Ac}}{219.2 - 82.8} \times 9 = 3.6 \text{ POINTS}$$

BALL METAL (CONSIDERED OFFSITE CREDIT)

16.71 ac. to new onsite BMP + rest to new undesignated ea. terminus BMP @ JRCC

$$\frac{23.3 \text{ Ac.}}{219.2 - 82.8} \times 4 = 0.7 \text{ POINTS}$$

OPEN SPACE POINTS

$$\frac{82.8 \text{ Ac.}}{219.2} \times 10 = 3.8 \text{ POINTS}$$

FROM JRCC TO SCHOOL BMP

$$\frac{7.2}{219.2 - 82.8} \times 6 = 0.3 \text{ POINTS}$$

TOTAL POINTS = 8.4 POINTS
10 - 8.4 = 1.6 POINTS STILL REQ'D.

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Subject _____

Computed By _____ Checked By _____

Project No. _____

Client _____

Date _____ Sheet No. 2.

$$\frac{X \text{ Ac.}}{219.2 - 82.8} \times 9 = 1.6 \text{ POINTS}$$

$$\frac{9X}{136.4} = 1.6$$

$$9X = 218.24$$

$$X = 24.2 \text{ Ac.}$$

TO 2 ADD'L. BMP'S

$$\frac{9.2 \text{ Ac.} + 13.3 \text{ Ac}}{219.2 - 82.8} \times 9 = 1.5 \text{ POINTS}$$

REMAINDER OF BALC (3 Ac.) TO EAST BMP AS OFFSITE CREDIT

$$\frac{3 \text{ Ac.}}{219.2 - 82.8} \times 9 = 0.2 \text{ POINTS}$$

$$1.5 + 0.2 = 1.7 \text{ POINTS}$$

1.7 > 1.6 POINTS ∴ CHES. BAY 10 POINTS IS MET.

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Subject BALL METAL
CHES. BAY COMPLIANCE
Computed By _____ Checked By _____

Project No. _____
Client _____
Date 4/22/96 Sheet No. _____

TOTAL AREA OF EXISTING DEV. — 17 Ac.
AREA OF PROPOSED EXPANSION — 9.3 Ac.

CALCULATION IS TO DETERMINE HOW MUCH OF EXISTING DEVELOPMENT, ASSUMED TO BE OFFSITE CREDIT, MUST GO THROUGH A 4 POINT BMP., ASSUMING ALL OF NEW DEVELOPMENT GOES TO THE SAME 4 POINT BMP. CHANGES WILL OCCUR ON EXISTING DEVELOPED AREA, BUT NO CHANGES IN IMPERVIOUS SURFACE AREA WILL OCCUR.

NEW DEV. — OFFSITE CREDIT

$$\left[\frac{9.3\ Ac.}{9.3\ Ac.} \times 4\ PTS\right] + \frac{X}{9.3\ Ac.}(4\ POINTS) = 10\ POINTS$$

$$(1 \times 4) + \frac{4X}{9.3} = 10$$

$$\frac{4X}{9.3} = 6$$

$$X = 13.9\ Ac.$$

LEFT W/ WNB & DEC IN MTG. OF 4/25/96

TOTAL IMPERVIOUS SURFACE
EXIST. — 13.9 AC. X 0.70 = 9.73 Ac.
FUTURE. — 9.3 Ac. X 0.60 = 5.58 Ac.
15.3 Ac. IMPERV.

CHES. BAY VOL. = 1/2" / IMPERV. ACRE.

$$15.3\ Ac. \times \frac{1/2''}{12''} \times 43560\ SF/Ac. = 27,769\ c.f.$$

0.63 AC.FT.

THIS VOL. OCCURS @
ELEV. 52.14 @ t = 1476 MIN.
ESTIMATING TIME = 524 MIN ÷ 60 = 8.7 HRS.

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Subject BMP REQMTS w/ BALL ONSITE
Computed By _____ Checked By _____

Project No. _____
Client _____
Date _____ Sheet No. 1

TOTAL ACREAGE = 219.2 Ac.
TOTAL DEVELOPED Ac. = 136.4 Ac.
TOTAL UNDEV./UNDS = 82.8 Ac.

AREA TO BMP # 1 = 54.7 Ac.
AREA TO BALL METAL BMP - ONSITE @ BALL = 9.3 Ac. + 14 Ac = 23.3 Ac.

POINT CALCULATION

BMP # 1

$\frac{54.7 \text{ Ac}}{219.2 - 82.8} \times 9 =$ 3.6 POINTS

BALL METAL (CONSIDERED OFFSITE CREDIT)

16.71 ac. to new onsite BMP + rest to new undesigned eastern BMP @ JRCC

$\frac{23.3 \text{ Ac.}}{219.2 - 82.8} \times 4 =$ 0.7 POINTS

OPEN SPACE POINTS

$\frac{82.8 \text{ Ac.}}{219.2} \times 1.0 =$ 3.8 POINTS

FROM JRCC TO SCHOOL BMP

$\frac{7.2}{219.2 - 82.8} \times 6 =$ 0.3 POINTS

TOTAL POINTS = 8.4 POINTS
10 - 8.4 = 1.6 POINTS STILL REQ'D.

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VIRGINIA BEACH - WILLIAMSBURG, VIRGINIA

Subject _____

Computed By _____ Checked By _____

Project No. _____
Client _____
Date _____ Sheet No. 2.

$$\frac{X \text{ Ac.}}{219.2 - 82.8} \times 9 = 1.6 \text{ POINTS}$$

$$\frac{9X}{136.4} = 1.6$$

$$9X = 218.24$$

$$X = 24.2 \text{ Ac.}$$

TO 2 ADD'L. BMP'S

$$\frac{9.2 \text{ Ac.} + 13.3 \text{ Ac}}{219.2 - 82.8} \times 9 = 1.5 \text{ POINTS}$$

see attached dwg. provided by DEQ in 5/10/02 meeting.

REMAINDER OF BALC (3 Ac.) TO EAST BMP AS OFFSITE CREDIT

$$\frac{3 \text{ Ac.}}{219.2 - 82.8} \times 9 = 0.2 \text{ POINTS}$$

$$1.5 + 0.2 = 1.7 \text{ POINTS}$$

1.7 > 1.6 POINTS ∴ CHES. BAY 10 POINTS IS MET.

Superceded

JAMES RIVER COMMERCE CENTER

JAMES CITY COUNTY, VIRGINIA

CHESAPEAKE BAY PRESERVATION ORDINANCE COMPLIANCE

JAMES RIVER COMMERCE CENTER

JAMES CITY COUNTY, VIRGINIA

CHESAPEAKE BAY PRESERVATION ORDINANCE COMPLIANCE

James City County and Williamsburg Developments, Inc. have embarked on a coordinated effort to promote economic development in James City County. This effort has resulted in the proposed James River Commerce Center, involving approximately 220 acres. The land lies in eastern James City County between Carter's Grove Plantation and the entrance road to the BASF/Mann Industries plant, and is bound on the north by U.S. Route 60 and on the south by the upper reaches of Grice's Run and Wood Creek.

Langley and McDonald was asked to review the proposed Master Development Plan as it relates to James City County's Chesapeake Bay Preservation Ordinance. Compliance with that Ordinance had a direct impact on the total development square footage that could be provided within the James River Commerce Center. Compliance with the County's Chesapeake Bay Preservation Ordinance was very dependent upon two primary factors: (1) the area of proposed development for which pollutant reduction treatment could be provided for its stormwater runoff, and (2) the amount of land that would remain in undisturbed natural open space after development was complete.

To meet the requirements of the first factor of Chesapeake Bay Preservation Ordinance compliance, it is necessary to pass large volumes of runoff water through detention ponds or to infiltrate similarly large volumes into porous soils, if they exist. The soils maps do not indicate that such soils underlie the area of the James River Commerce Center, therefore making it necessary to base the stormwater treatment on passing runoff water through detention ponds.

Ponds for this purpose are generally provided in the James City County/Williamsburg area by placing a small dam across the upper reaches of ravines, providing a basin to hold stormwater runoff for the requisite time period needed to provide the required pollutant reduction. These ponds can be either dry ponds or wet ponds, depending upon whether or not they drain completely after a storm event. The wet pond provides a higher degree of pollutant reduction , and is the facility proposed for meeting the Chesapeake Bay Preservation Ordinance requirement at the James River Commerce Center.

As noted previously, the wet pond facility provides a higher level of treatment to the stormwater runoff flowing to it. The higher level of treatment is needed when the area of flow that can be directed to the detention pond is limited by topographic or other factors. In the case of the James River Commerce Center, the area that can be directed to flow to the detention ponds is limited by where in the drainage courses the dams forming the ponds can be located.

Placement of the dams beyond certain limits on the drainage courses, results in conflicts with wetlands and many complications presented by the need to obtain various federal and state permits. Because of these factors, the area of the proposed development, from which stormwater runoff can be directed to detention ponds, is limited. Consequently, the wet pond, with its higher level of pollutant reduction removal is needed.

The plan proposed for the James River Commerce Center involves six basins as shown on the Chesapeake Bay Preservation Ordinance Master Plan. The drainage area of each detention pond is shown on this plan.

The other primary component of compliance with the County's Chesapeake Bay Preservation Ordinance, "undisturbed natural open space," is indicated on the Chesapeake Bay Preservation Ordinance Master Plan also.

In addition to water quality improvement provided by the six detention basins, peak flow attenuation will also be provided. The storage volume provided in each basin is in excess of that required for water quality improvement alone. That additional volume will provide for the flow attenuation requirement. More detailed drainage design and planning will be required to determine peak water surface elevations resulting in each basin. Such studies, which are beyond the scope of this review, will be a component of the preliminary road and site design at a later stage of the planning and design process for James River Commerce Center.

The following tables present the data to accompany the Stormwater Management Master Plan:

TABLE 1

AREA OF DRAINAGE BASINS FOR EACH DETENTION POND

DETENTION POND NUMBER	AREA (AC.)
1	18.8
2*	14.2
3	14.7 (+ 17.2 IN BALL METAL)
4	53.3
5	17.3
6	19.5
TOTAL AREA	137.8 (EXCLUSIVE OF BALL METAL)

*MAY REQUIRE EASEMENT FOR IMPOUNDMENT FROM BASF/MANN INDUSTRIES

TABLE 2

AREA OF UNDISTURBED NATURAL OPEN SPACE

A.	MAJOR WETLAND AND PERIMETER AREAS	55.4 AC.
B.	UPLAND INTERNAL AREAS	
	AREA 1	0.25 AC.
	AREA 2	0.5 AC.
	AREA 3	3.6 AC.
	AREA 4	4.2 AC.
	AREA 5	0.7 AC.
	AREA 6	2.5 AC.
	AREA 7	7.7 AC.
	TOTAL AREA	19.4 AC.

Identified on map — see back pocket #4528W

TOTAL UNDISTURBED NATURAL OPEN SPACE
55.4 AC. + 19.4 AC. = 74.8 AC.

JR038_JAMES_RIVER_COMMERCE_CENTER - 294

TABLE 3

STORAGE VOLUMES FOR EACH DETENTION POND

POND NUMBER	CONTOUR	AREA (S.F.)	INCREMENTAL VOLUME (C.F.)	TOTAL VOLUME (C.F.)
1	20	40,000		272,000
			185,000	
	15	34,000		87,000
			87,000	
	12	24,000		
2	25	48,000		260,000
			180,000	
	20	24,000		80,000
			80,000	
	15	8,000		
3	35	40,000		145,000
			120,000	
	30	8,000		25,000
			25,000	
	25	2,000		

TABLE 3 (CONTINUED)

STORAGE VOLUMES FOR EACH DETENTION POND

POND NUMBER	CONTOUR	AREA (S.F.)	INCREMENTAL VOLUME (C.F.)	TOTAL VOLUME (C.F.)
4	30	56,000		380,000
			220,000	
	25	32,000		160,000
			115,000	
	20	14,000		45,000
			45,000	
	15	4,000		
5	35	44,000		225,000
			160,000	
	30	20,000		65,000
			65,000	
	25	6,000		
6	30	52,000		350,000
			200,000	
	25	28,000		150,000
			105,000	
	20	14,000		45,000
			45,000	
	15	4,000		

TABLE 4

REQUIRED STORAGE VOLUME FOR A VOLUME EQUAL TO FOUR TIMES THE MEAN STORM RUNOFF

ASSUME MEAN STORM = 0.45 INCHES OF RAINFALL

ASSUME IMPERVIOUS COVER IN EACH BASIN EQUALS 70 PERCENT

VOLUME REQUIREMENT = 4 x MEAN STORM RUNOFF

WHERE

$$\text{MEAN STORM RUNOFF IN AC. FT.} = \frac{(Rm)(Rv)}{12} \times A$$

Rm = VOLUME OF MEAN STORM (0.45 IN.)

Rv = RAINFALL/RUNOFF COEFFICIENT

Rv = 0.05 + 0.009 (IMPERVIOUS PERCENTAGE)

A = AREA OF CONTRIBUTING WATERSHED IN ACRES

DETENTION POND NUMBER	REQUIRED STORAGE VOLUME (C.F.)	AVAILABLE STORAGE VOLUME (C.F.)
1	83,530	272,000
2	63,093	260,000
3	142,000	145,000*
4	237,000	380,000
5	76,865	225,000
6	86,640	350,000

*ADDITIONAL VOLUME FOR FLOW ATTENUATION MAY BE REQUIRED THROUGH EXCAVATION

JR038_JAMES_RIVER_COMMERCE_CENTER - 297

TABLE 5

WORKSHEET FOR BMP POINT SYSTEM

(SEE FOLLOWING PAGE FOR SUPERSCRIPT ITEMS)

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP POINTS	FRACTION OF SITE SERVED BY	WEIGHTED BMP POINTS
WET POND (4v)	9	0.64[1]	6.0
DRY POND	6	0.03[2]	0.2
TOTAL STRUCTURAL BMP POINTS			6.2

B. NATURAL OPEN SPACE CREDIT

FRACTION OF SITE	NATURAL OPEN SPACE CREDIT	POINTS FOR NATURAL OPEN SPACE
0.34[3]	10	3.4

C. TOTAL WEIGHTED POINTS

6.2	+	3.4	9.6
STRUCTURAL BMP POINTS		NATURAL OPEN SPACE POINTS	TOTAL

OFF-SITE CREDIT
FOR INCLUSION OF BALL METAL
SITE IN DETENTION POND NO. 3

17.2 AC. = 0.07 X 9 = 0.6
236.4 AC. (TOTAL LAND AREA ON-SITE PLUS 17.2 AC. BALL METAL SITE)

TOTAL POINTS = 9.6 + 0.6 = 10.2

1. 137.8 DEVELOPED AC.
   6.8 UNDISTURBED NAT. OPEN SPACE AC. (2.5 AC. + 0.7 AC.)
   141.0 AC.

$$\frac{141.0 \text{ AC}}{219.2 \text{ AC.}} = 0.64$$

2. $\frac{7.7 \text{ AC.}}{219.2 \text{ AC.}} = 0.03$ THIS IS AREA DRAINING THROUGH BMP FOR ADJACENT SCHOOL SITE

3. UNDISTURBED NATURAL OPEN SPACE AREAS

MAJOR WETLAND AND PERIMETER AREAS	=	55.4 AC.
UPLAND INTERNAL AREAS	=	+19.4 AC.
		74.8 AC.

$$\frac{74.8 \text{ AC.}}{219.2 \text{ AC.}} = 0.34$$

POND 3 SECOND TRIAL

DRAINS 50 ACRES

ELEV	AREA	ΔV	ΣV	ΔV/FT
20	0.14	—	—	—
25	0.94	2.7	2.7	0.54
30	2.19	7.8	10.5	1.57

WET POND (9 POINT) 3920 CF/AC

(60% IMPERV) ~~37~~

3920 × 50 × 1/43560 = 4.5 AF

POND 4

54 ACRE ~~DRAINAGE~~ WATERSHED

ELEV	AREA	ΔV	ΣV	ΔV/FT
15	0.17	—	—	—
20	0.50	1.68	1.68	0.34
25	1.15	4.12	5.80	0.83
30	1.96	7.78	11.90	1.54

POND 4 TR-55

PREDEVELOPMENT CONDITIONS

SAME AS POND 3

PEAK FLOW = 17 CFS

RUNOFF = 1 IN

POST DEV COND SAME AS

POND 3

PEAK FLOW = 151 CFS

RUNOFF = 2.4 IN

STORAGE VOLUME REQ'D

1.32 INCHES

6 ACRE FT

TR 55

POND #3 DRAINS ~~44~~ 50 AC

PREDEV CONDITIONS -

GOOD WOODS C SOILS

RCN = 70 Tc = 2 HRS

PEAK FLOW = ~~14~~ 15 CFS

RUNOFF = 1 IN

POST DEV CONDITIONS

65% IMP

RCN = 90 Tc = 0.25 HRS

PEAK FLOW = ~~123~~ 140 CFS

RUNOFF = 2.4 IN

STORAGE VOLUME REQ'D.

1.34 INCHES ~~4.8~~ 5.4 AF

POND # 3 DRAINS 44 AC

ELEV.	AREA	ΔV	ΣV	ΔV/FT
20	0.07	—	—	—
25	0.48	1.4	1.4	0.3
30	1.10	3.9	5.3	0.8

POND # 4 DRAINS 54 AC

ELEV.	AREA	ΔV	ΣV	ΔV/FT.
15	0.13	—	—	—
20	0.34	1.2	1.2	0.2
25	0.78	2.8	4.0	0.6
30	1.50	5.7	9.7	1.1

James River Commerce Park

6/15/01

Endeavor Drive Extension

- Additional Drainage to be diverted to stormdrain system
- critical section of storm system is 54" pipe from 6-19 to 6-21
  - it is designed @ a slope of 0.46% w/ a Q capacity of 133.86 cfs
  - this is also design Q - so no excess capacity
- Field Check of Actual Slope Revealed actual slope = 0.49%

  this yields a capacity of 137.72 cfs

Excess capacity is now 137.72 - 133.86 cfs = 3.86 cfs ≈ 4 cfs

Examples

Assume $C = 0.75$

$T_c = 10\text{ min} \Rightarrow I = 5.93''/\text{hr}$

$Q = 4\text{ cfs}$

$$A = \frac{Q}{CI} = \frac{4\text{ cfs}}{(0.75)(5.93)} = 0.9\text{ ac}$$

Sort Order: Name

James City County Government - Environmental Division

Letter of Credit Expirations - Siltation

Beginning Date: 9/25/2000

Ending Date: 10/1/2000

NAME		EXPIRATION DATE	COMMENTS
GREENSPRINGS PLANTATION - COMMERCIAL DEVELOPMENT	$10,000 - ck w/	9/25/2000	9/18
WILLIAMSBURG POTTERY - FILL SITE	$2000 - Scott	9/27/2000	9/20

Number Listed: 2

$5K
const cert, repair pipe outfall into BMP
remove sed. @ inflow pts

$Q = C\ IA$

Q → 4
C → .75
I → 10min → 5.93
A → ?

$\frac{4}{4.48} = 0.9ac$

Langley and McDonald
A PROFESSIONAL CORPORATION
ENGINEERS • PLANNERS • SURVEYORS
VIRGINIA BEACH - WILLIAMSBURG, VIRGINIA

Subject BMP REQMTS w/ BALL DUSITE

Computed By _____ Checked By _____

Project No. _____
Client _____
Date _____ Sheet No. 1

TOTAL AVERAGE = 219.2 Ac.
TOTAL DEVELOPED Ac. = 136.4 Ac.
TOTAL UNDEV. LANDS = 82.8 Ac.

AREA TO BMP #1 = 54.7 Ac.
AREA TO BALL METAL BMP - ONSITE @ BALL = 9.3 Ac. + 14 Ac = 23.3 Ac.

POINT CALCULATION

BMP #1

$\frac{54.7 \text{ Ac}}{219.2 - 82.8} \times 9 =$ 3.6 POINTS

BALL METAL (CONSIDERED OFFSITE CREDIT)

$\frac{23.3 \text{ Ac.}}{219.2 - 82.8} \times 4 =$ 0.7 POINTS

now 6 pts.

OPEN SPACE POINTS

$\frac{82.8 \text{ Ac.}}{219.2} \times 10 =$ 3.8 POINTS

FROM AREA TO SCHOOL BMP

$\frac{7.2}{219.2 - 82.8} \times 6 =$ 0.3 POINTS

TOTAL POINTS = 8.4 POINTS
10 - 8.4 = 1.6 POINTS STILL REQ'D.

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ENGINEERS • PLANNERS • SURVEYORS
VIRGINIA BEACH - WILLIAMSBURG, VIRGINIA

Subject _____

Computed By _____ Checked By _____

Project No. _____

Client _____

Date _____ Sheet No. 2.

$$\frac{x \text{ Ac.}}{219.2 - 82.8} \times 9 = 1.6 \text{ Points}$$

$$\frac{9x}{136.4} = 1.6$$

$$9x = 218.24$$

$$x = 24.2 \text{ Ac.}$$

TO 2 ADD'L. BMP'S

$$\frac{9.2 \text{ Ac.} + 13.3 \text{ Ac}}{219.2 - 82.8} \times 9 = 1.5 \text{ Points}$$

REMAINDER OF BALL (3 Ac.) TO EAST BMP AS OFFSITE CREDIT

$$\frac{3 \text{ Ac.}}{219.2 - 82.8} \times 9 = 0.2 \text{ Points}$$

$$1.5 + 0.2 = 1.7 \text{ Points}$$

1.7 > 1.6 POINTS ∴ CHES. BAY 10 POINTS IS MET.

DRAINAGE, STORMWATER MANAGEMENT
AND
B.M.P. CALCULATIONS

JAMES RIVER COMMERCE CENTER

APRIL 25, 1996

Langley and McDonald, P.C.

Engineers
Surveyors
Planners
Landscape Architects
Environmental Consultants

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(804) 253-2975 FAX: (804) 229-0049

DRAINAGE CALCULATIONS

FILE: JRCC1.MRG
Project: JAMES RIVER COMMERCE CENTER
Location: James City County, Virginia
Design: M. Gordon
Date: March 12, 1996
Revision: April 18, 1996
Yr. Storm: 10
N Value: 0.013

LANGLEY and McDONALD, P.C.
201 Packets Court
Williamsburg, Virginia 23185

STORM SEWER DESIGN COMPUTATIONS

FROM PT.	TO PT.	DRAIN. AREA	RUN-OFF COEFF.	C x A INCR.	C x A ACCUM.	INLET TIME	RAIN FALL	RUNOFF "Q" INCR.	RUNOFF "Q" ACCUM.	INVERT ELEV. UP	INVERT ELEV. LOW	LENGTH	SLOPE	PIPE DIAM.
		acres	"C"			min.	in/hr	cfs	cfs			ft.	ft./ft.	inches
		[E]	[E]			[E]				[E]		[E]		[E]
6-2	6-3	0.00	0.00	0.00	2.49	13.00	5.45	0.00	13.56	62.98	57.83	231	0.0223	24
6-3	6-4	1.65	0.75	1.24	3.73	13.39	5.39	6.67	20.09	57.58	57.36	48	0.0046	27
6-1	6-4	0.00	0.00	0.00	3.56	17.00	4.91	0.00	17.50	61.85	57.11	325	0.0146	30
6-4	6-6	1.60	0.75	1.20	8.49	17.60	4.84	5.81	41.10	57.01	52.38	235	0.0197	30
6-5	6-6	0.28	0.75	0.21	0.21	10.00	5.93	1.25	1.25	55.35	53.63	48	0.0358	15
6-6	6-8	2.66	0.75	2.00	10.69	17.91	4.81	9.59	51.40	51.88	50.45	213	0.0067	36
6-7	6-8	0.38	0.75	0.29	0.29	10.00	5.93	1.69	1.69	53.93	52.20	48	0.0360	15
6-8	6-10	3.08	0.75	2.31	13.29	18.31	4.76	11.00	63.27	50.35	47.49	275	0.0104	36
6-9	6-10	2.13	0.75	1.60	1.60	15.00	5.17	8.25	8.25	48.58	48.49	48	0.0020	24
6-10	6-12	4.13	0.75	3.10	17.98	18.72	4.72	14.61	84.80	46.99	40.91	212	0.0287	42
6-11	6-12	2.92	0.75	2.19	2.19	15.00	5.17	11.32	11.32	42.56	42.41	48	0.0031	24
6-12	6-14	4.70	0.75	3.53	23.70	18.92	4.69	16.54	111.23	40.41	33.25	250	0.0286	48
6-13	6-14	3.08	0.75	2.31	2.31	15.00	5.17	11.94	11.94	35.92	35.75	48	0.0035	24
6-14	6-15	0.18	0.75	0.14	26.14	19.15	4.67	0.63	122.07	33.15	31.46	146	0.0116	48
6-15	6-19	0.13	0.75	0.10	26.24	19.33	4.65	0.45	122.02	31.36	30.03	115	0.0116	48
6-16	6-19	3.52	0.75	2.64	2.64	15.00	5.17	13.64	13.64	32.25	32.03	61	0.0037	24
6-19	6-21	MH-1	0.00	0.00	28.88	19.46	4.64	0.00	133.86	29.53	28.33	260	0.0046	54
6-20	6-21	5.55	0.75	4.16	4.16	18.00	4.80	19.97	19.97	30.48	30.33	48	0.0032	30
6-21	6-22	0.95	0.75	0.71	33.76	19.98	4.58	3.26	154.62	28.23	24.00	128	0.0330	54

FILE: JRCC1.MRG
Date: March 12, 1996
Rev: April 18, 1996

FROM PT.	TO PT.	VELOCITY ft./sec.	CAPACITY cfs	FLOW TIME min.	FLOW RATIO Qp/Qf	VELOCITY RATIO Vp/Vf	REMARKS
6-2	6-3	9.98	33.70	0.39	0.40	0.93	"CA" FROM KIMLEY-HORN CALCS.
6-3	6-4	6.06	20.86	0.13	0.96	1.16	
6-1	6-4	8.97	49.45	0.60	0.35	0.89	"CA" FROM KIMLEY-HORN CALCS.
6-4	6-6	12.76	57.52	0.31	0.71	1.09	
6-5	6-6	5.86	12.18	0.14	0.10	0.59	
6-6	6-8	8.91	54.55	0.40	0.94	1.15	
6-7	6-8	6.41	12.21	0.12	0.14	0.64	
6-8	6-10	11.07	67.90	0.41	0.93	1.15	
6-9	6-10	3.58	10.00	0.22	0.83	1.13	
6-10	6-12	17.58	170.30	0.20	0.50	0.99	
6-11	6-12	4.56	12.50	0.18	0.91	1.15	
6-12	6-14	18.70	243.10	0.22	0.46	0.97	
6-13	6-14	4.87	13.40	0.16	0.89	1.14	
6-14	6-15	13.72	154.60	0.18	0.79	1.12	
6-15	6-19	13.72	154.60	0.14	0.79	1.12	
6-16	6-19	4.34	13.64	0.23	1.00	1.00	
6-19	6-21	8.42	133.86	0.51	1.00	1.00	
6-20	6-21	5.32	23.00	0.15	0.87	1.14	
6-21	6-22	21.41	357.50	0.10	0.43	0.95	

HYDRAULIC GRADE LINE CALCULATIONS

25-Apr-96

LANGLEY and McDONALD, P.C.
201 Packets Court
Williamsburg, Virginia 23185

Project: JAMES RIVER COMMERCE CENTER
Location: James City County, Virginia

HYDRAULIC GRADE LINE CALCULATIONS

1. Enter Tailwater Elev.(ft.)? 32.22 (10 yr. Peak)

2. Enter "N" value for pipe? 0.013

3. Enter the following data: [E]

90 deg K=0.70	40 deg K=0.38
80 deg K=0.66	30 deg K=0.28
70 deg K=0.61	25 deg K=0.22
60 deg K=0.55	20 deg K=0.16
50 deg K=0.47	15 deg K=0.10

FROM PT.	TO PT.	Q OUT (cfs)	PIPE DIA.	L OUT (ft.)	FRICTION SLOPE	DNSTREAM INVERT	V OUT (FPS)	M.H.	INLET SHAPE	Q IN (cfs)	PIPE DIA.	ANGLE "K"	V IN (fps)	F.L.E.	H.G.E.
[E]	[E]	[E]	[E]	[E]		[E]		[E]	[E]			[E]		[E]	
6-1	6-4	17.50	30	325	0.0018	57.11	3.57	N	Y	0.00	0	0.00	0.00	64.60	59.74
6-4	6-6	41.10	30	235	0.0101	52.38	8.37	N	Y	17.50	30	0.12	3.57	64.28	57.40
6-6	6-8	51.40	36	213	0.0060	50.45	7.27	N	Y	41.10	30	0.10	8.37	59.74	54.74
6-8	6-10	63.27	36	275	0.0090	47.49	8.95	N	Y	51.40	36	0.10	7.27	58.24	52.91
6-10	6-12	84.80	42	212	0.0071	40.91	8.81	N	Y	63.27	36	0.00	8.95	58.90	45.81
6-12	6-14	111.23	48	250	0.0060	33.25	8.85	N	Y	84.80	42	0.10	8.81	53.92	41.91
6-14	6-15	122.07	48	146	0.0072	31.46	9.71	N	Y	111.23	48	0.10	8.85	43.51	39.73
6-15	6-19	122.02	48	115	0.0072	30.03	9.71	N	Y	122.07	48	0.10	9.71	40.05	37.94
6-19	6-21	133.86	54	260	0.0046	28.33	8.42	Y	Y	122.02	48	0.70	9.71	41.00	36.29
6-21	6-22	154.62	54	128	0.0062	24.00	9.72	N	Y	133.86	54	0.65	8.42	37.02	34.18
6-2	6-3	13.56	24	231	0.0036	57.83	4.32	N	Y	0.00	0	0.00	0.00	65.72	60.58
6-3	6-4	20.09	27	48	0.0042	57.36	5.05	N	Y	13.56	24	0.70	4.32	64.28	59.69
6-5	6-6	1.25	15	48	0.0004	53.63	1.02	N	Y	1.25	0	0.00	0.00	59.74	54.76
6-7	6-8	1.69	15	48	0.0007	52.20	1.38	N	Y	1.69	0	0.00	0.00	58.24	53.24
6-9	6-10	8.25	24	48	0.0013	48.49	2.63	N	Y	8.25	24	0.00	0.00	58.90	50.18
6-11	6-12	11.32	24	48	0.0025	42.41	3.60	N	Y	11.32	24	0.00	3.60	53.92	44.23
6-13	6-14	11.94	24	48	0.0028	35.75	3.80	N	Y	11.94	24	0.00	3.80	43.51	39.97
6-16	6-19	13.64	24	61	0.0037	32.03	4.34	N	Y	13.64	24	0.00	4.34	38.23	36.66
6-20	6-21	19.97	30	48	0.0024	30.33	4.07	N	Y	19.97	30	0.00	4.07	37.02	34.42

HF	HO	HI	HD	HT	.3HT	.5HT	H
0.59	0.05	0.00	0.00	0.05	0.01	0.02	0.04
2.37	0.27	0.07	0.02	0.36	0.11	0.18	0.29
1.27	0.21	0.38	0.11	0.70	0.21	0.35	0.56
2.48	0.31	0.29	0.08	0.68	0.20	0.34	0.54
1.51	0.30	0.44	0.00	0.74	0.22	0.37	0.59
1.50	0.30	0.42	0.12	0.85	0.25	0.42	0.68
1.05	0.37	0.43	0.12	0.91	0.27	0.46	0.73
0.83	0.37	0.51	0.15	1.03	0.31	0.51	0.82
1.20	0.27	0.51	1.02	1.81	0.00	0.91	0.91
0.79	0.37	0.38	0.71	1.47	0.44	0.73	1.17
0.83	0.07	0.00	0.00	0.07	0.02	0.04	0.06
0.20	0.10	0.10	0.20	0.40	0.12	0.20	0.32
0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.03	0.01	0.00	0.00	0.01	0.00	0.00	0.01
0.06	0.03	0.00	0.00	0.03	0.01	0.01	0.02
0.12	0.05	0.07	0.00	0.12	0.04	0.06	0.10
0.13	0.06	0.08	0.00	0.13	0.04	0.07	0.11
0.22	0.07	0.10	0.00	0.18	0.05	0.09	0.14
0.11	0.06	0.09	0.00	0.15	0.05	0.08	0.12

STORMWATER MANAGEMENT SUMMARY

STORMWATER MANAGEMENT SUMMARY			
STORM FREQUENCY	PRE DEVELOPED Q (cfs)	POST DEVELOPED Q (cfs)	WATER SURFACE ELEVATION (ft)
2 YR.	114.00	7.67	29.59
10 YR.	202.00	17.36	32.22
25 YR.	268.00	54.50	33.31
100 YR.	348.00	131.13	34.13

B.M.P. CALCULATIONS

TOTAL AREA OF PROPERTY: 54.7 AC.

USE 50% IMPERVIOUS AREA

The Drainage, Stormwater Management, and Erosion Control facilities for this project have been developed in basic conformance with he "Overall Drainage and Stormwater Management Plan." We have designed the wet pond as a 9 point BMP using 4 V_R Wet Pond required by the Chesapeake Bay Preservation Act. The design volume required is as follows:

REQUIRED VOLUME OF BMP

$$V_R = \frac{(R_m)(R_v)}{12} \times AC.$$

$R_v = (0.05 + 0.009\ I) =$ $[0.05 + 0.009(50)] = 0.50$

$R_m = 0.45"$

$A_c = 54.7$

$$\frac{0.45 \times 0.50}{12} \times 54.7 = 1.026 \text{ AC. FT.}$$

$4\ V_R = 4(1.026) = 4.1$ AC. FT.

The BMP pond was designed using the TR-55 Method and run on Haestad Method's Inc.'s Quick TR-55 and Pond-2 software. Intensity, Duration, and Frequency Curve data used was taken from the VDOT Drainage Manual for Norfolk (Rev. 6/92).

POND-2 Version: 5.17
S/N:

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
PROPOSED CONTOURS - EARTHEN DAM
REVISED: 4-17-96

CALCULATED 04-25-1996 10:25:49
DISK FILE: C:\PONDPACK\95016-28\MOD-4 .VOL

Planimeter scale: 1 inch = 25 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
18.00	33.95	0.49	0.00	0.00	0.00
20.00	40.07	0.57	1.59	1.06	1.06
22.00	46.73	0.67	1.87	1.24	2.31
24.00	53.93	0.77	2.16	1.44	3.75
24.00	61.63	0.88	2.49	0.00	3.75
25.00	65.62	0.94	2.74	0.91	4.66
26.00	69.86	1.00	2.92	0.97	5.63
28.00	78.67	1.13	3.19	2.13	7.76
30.00	89.42	1.28	3.62	2.41	10.17
32.00	100.51	1.44	4.09	2.72	12.90
34.00	113.45	1.63	4.60	3.07	15.96
36.00	131.50	1.89	5.27	3.51	19.48

Elevations With Areas Interpolated From
The Closest Two Planimeter Readings

27.25	-----	1.08	3.12	1.30	6.93
32.57	-----	1.49	4.40	0.84	13.73

$$IA = (sq.rt(Area1) + ((Ei-E1)/(E2-E1))*(sq.rt(Area2)-sq.rt(Area1)))^2$$

where: E1, E2 = Closest two elevations with planimeter data
Ei = Elevation at which to interpolate area
Area1,Area2 = Areas computed for E1, E2, respectively
IA = Interpolated area for Ei

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

EXISTING CONDITIONS
INFLOW HYDROGRAPH

Return Frequency: 2 years

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

Executed: 04-25-1996 09:13:48
Watershed file: --> C:\PONDPACK\95016-28\EXIST .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\EX-2.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EXISTING CONDITIONS

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
	14.50	74.0	0.50	0.00	3.40	1.17	I.21 .21

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

Total area = 14.50 acres or 0.02266 sq.mi
Peak discharge = 13 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.55	0.00	0.50	0.00	Yes	--

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

Return Frequency: 2 years

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

Executed: 04-25-1996 09:13:48
Watershed file: --> C:\PONDPACK\95016-28\EXIST .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\EX-2.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EXISTING CONDITIONS

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

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
	13	12.4
Composite Watershed	13	12.4

Return Frequency: 2 years

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

Executed: 04-25-1996 09:13:48
Watershed file: --> C:\PONDPACK\95016-28\EXIST .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\EX-2.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EXISTING CONDITIONS

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	0	0	0	1	1	3	6	10	13
Total (cfs)	0	0	0	1	1	3	6	10	13

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	12	10	8	6	4	3	2	2	2
Total (cfs)	12	10	8	6	4	3	2	2	2

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

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

Return frequency: 10 years

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

Executed: 04-25-1996 09:13:48
Watershed file: --> C:\PONDPACK\95016-28\EXIST .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\EX-10.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EXISTING CONDITIONS

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
	14.50	74.0	0.50	0.00	5.10	2.44	I.14 .14

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

Total area = 14.50 acres or 0.02266 sq.mi
Peak discharge = 28 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.55	0.00	0.50	0.00	Yes	--

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

Return Frequency: 10 years

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

Executed: 04-25-1996 09:13:48
Watershed file: --> C:\PONDPACK\95016-28\EXIST .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\EX-10.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EXISTING CONDITIONS

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

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
	28	12.4
Composite Watershed	28	12.4

Return Frequency: 10 years

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

Executed: 04-25-1996 09:13:48
Watershed file: --> C:\PONDPACK\95016-28\EXIST .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\EX-10.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EXISTING CONDITIONS

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	1	1	1	3	4	8	15	24	28
Total (cfs)	1	1	1	3	4	8	15	24	28

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	27	22	16	13	8	6	4	4	3
Total (cfs)	27	22	16	13	8	6	4	4	3

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

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

Quick TR-55 Ver.5.46 S/N:
Executed: 09:56:06 04-25-1996 c:\pondpack\95016-28\FUTURE.TCT

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

Tc COMPUTATIONS FOR:

SHEET FLOW (Applicable to Tc only)

Segment ID			
Surface description		GRASS	
Manning's roughness coeff., n		0.2400	
Flow length, L (total < or = 300)	ft	50.0	
Two-yr 24-hr rainfall, P2	in	3.360	
Land slope, s	ft/ft	0.0100	

$$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$$ hrs 0.18 = 0.18

SHALLOW CONCENTRATED FLOW

Segment ID			
Surface (paved or unpaved)?			
Flow length, L	ft	0.0	
Watercourse slope, s	ft/ft	0.0000	

$$Avg.V = Csf * (s)^{0.5}$$ ft/s 0.0000

where: Unpaved Csf = 16.1345
Paved Csf = 20.3282

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

CHANNEL FLOW

Segment ID			
Cross Sectional Flow Area, a	sq.ft	3.14	
Wetted perimeter, Pw	ft	6.28	
Hydraulic radius, r = a/Pw	ft	0.500	
Channel slope, s	ft/ft	0.0100	
Manning's roughness coeff., n		0.0130	

$$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$$ ft/s 7.2203

flow length, L	ft	2350	

T = L / (3600*V) hrs 0.09 = 0.09

::

TOTAL TIME (hrs) 0.27

Quick TR-55 Ver.5.46 S/N:
Executed: 09:56:06 04-25-1996 c:\pondpack\95016-28\FUTURE.TCT

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

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

Subarea descr.	Tc or Tt	Time (hrs)
	Tc	0.27

Quick TR-55 Ver.5.46 S/N:
Executed: 10:03:10 04-25-1996

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EXISTING CONDITIONS

RUNOFF CURVE NUMBER DATA

::

Composite Area:

SURFACE DESCRIPTION	AREA (acres)	CN	
EX. UNDEV. TO BMP LOCATION, C	7.20	70	
EX. UNDEV. TO BMP LOCATION, D	7.30	77	
COMPOSITE AREA --->	14.50	73.5	(74)

::

Quick TR-55 Ver.5.46 S/N:
Executed: 10:03:10 04-25-1996

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EXISTING CONDITIONS

RUNOFF CURVE NUMBER SUMMARY

::

Subarea Description	Area (acres)	CN (weighted)
	14.50	74

FUTURE CONDITIONS
INFLOW HYDROGRAPH

Return Frequency: 2 years

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-2.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
	54.70	86.0	0.30	0.00	3.36	1.97	I.1	.10

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

Total area = 54.70 acres or 0.08547 sq.mi
Peak discharge = 114 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.27	0.00	0.30	0.00	No	Computed Ia/p < .1

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

Return Frequency: 2 years

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-2.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

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

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
	114	12.2
Composite Watershed	114	12.2

Return Frequency: 2 years

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-2.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	3	5	7	20	40	75	114	114	77
Total (cfs)	3	5	7	20	40	75	114	114	77

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	48	33	25	19	13	11	10	9	8
Total (cfs)	48	33	25	19	13	11	10	9	8

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

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

Return Frequency: 10 years

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-10.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
	54.70	86.0	0.30	0.00	5.04	3.50	I.06 .10

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

Total area = 54.70 acres or 0.08547 sq.mi
Peak discharge = 202 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.27	0.00	0.30	0.00	No	Computed Ia/p < .1

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

Return Frequency: 10 years

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-10.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

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

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
	202	12.2
Composite Watershed	202	12.2

Return Frequency: 10 years

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-10.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	6	8	12	35	70	134	202	202	137
Total (cfs)	6	8	12	35	70	134	202	202	137

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	85	59	44	34	24	20	17	15	14
Total (cfs)	85	59	44	34	24	20	17	15	14

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	13	11	10	9	8	7	7	6	6
Total (cfs)	13	11	10	9	8	7	7	6	6

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

Return frequency: 25 years

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-25.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
	54.70	86.0	0.30	0.00	6.24	4.64	I.05 .10

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

Total area = 54.70 acres or 0.08547 sq.mi
Peak discharge = 268 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.27	0.00	0.30	0.00	No	Computed Ia/p < .1

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

Return Frequency: 25 years

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-25.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

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

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
	268	12.2
Composite Watershed	268	12.2

Return Frequency: 25 years

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-25.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	8	11	16	47	93	177	268	268	182
Total (cfs)	8	11	16	47	93	177	268	268	182

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	112	78	58	45	32	26	23	20	18
Total (cfs)	112	78	58	45	32	26	23	20	18

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	17	15	13	12	11	10	9	8	8
Total (cfs)	17	15	13	12	11	10	9	8	8

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

Return Frequency: 100 years

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-100.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
	54.70	86.0	0.30	0.00	7.68	6.02	I.04 .10

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

Total area = 54.70 acres or 0.08547 sq.mi
Peak discharge = 348 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.27	0.00	0.30	0.00	No	Computed Ia/p < .1

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

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-100.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

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

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
	348	12.2
Composite Watershed	348	12.2

Return Frequency: 100 years

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

Executed: 04-25-1996 09:07:14
Watershed file: --> C:\PONDPACK\95016-28\FUTURE .MOP
Hydrograph file: --> C:\PONDPACK\95016-28\FUT-100.HYD

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE DEVELOPMENT

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	10	14	21	61	121	230	348	348	236
Total (cfs)	10	14	21	61	121	230	348	348	236

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	146	101	75	59	41	34	29	26	24
Total (cfs)	146	101	75	59	41	34	29	26	24

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	22	19	17	16	14	12	11	10	10
Total (cfs)	22	19	17	16	14	12	11	10	10

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	9	8	7	6	0
Total (cfs)	9	8	7	6	0

Quick TR-55 Ver.5.46 S/N:
Executed: 09:53:39 04-25-1996 c:\pondpack\95016-28\EXIST.TCT

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EXISTING DEVELOPMENT

Tc COMPUTATIONS FOR:

SHEET FLOW (Applicable to Tc only)

Segment ID			
Surface description		WOODS	
Manning's roughness coeff., n		0.4000	
Flow length, L (total < or = 300)	ft	150.0	
Two-yr 24-hr rainfall, P2	in	3.400	
Land slope, s	ft/ft	0.0260	
$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.43	= 0.43

SHALLOW CONCENTRATED FLOW

Segment ID				
Surface (paved or unpaved)?		Unpaved	Unpaved	
Flow length, L	ft	900.0	300.0	
Watercourse slope, s	ft/ft	0.0300	0.0470	
$Avg.V = Csf * (s)^{0.5}$	ft/s	2.7946	3.4979	
where: Unpaved Csf = 16.1345				
Paved Csf = 20.3282				
T = L / (3600*V)	hrs	0.09	+ 0.02	= 0.11

CHANNEL FLOW

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

::

TOTAL TIME (hrs) 0.55

Quick TR-55 Ver.5.46 S/N:
Executed: 09:53:39 04-25-1996 c:\pondpack\95016-28\EXIST.TCT

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

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EXISTING DEVELOPMENT

Subarea descr.	Tc or Tt	Time (hrs)
	Tc	0.55

Quick TR-55 Ver.5.46 S/N:
Executed: 10:01:58 04-25-1996

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE CONDITIONS

RUNOFF CURVE NUMBER DATA

::

Composite Area:

SURFACE DESCRIPTION	AREA (acres)	CN	
DEVELOPED, B SOIL	4.00	79	
DEVELOPED, C SOIL	34.70	86	
DEVELOPED, D SOIL	16.00	89	
COMPOSITE AREA --->	54.70	86.4	(86)

::

Quick TR-55 Ver.5.46 S/N:
Executed: 10:01:58 04-25-1996

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
FUTURE CONDITIONS

RUNOFF CURVE NUMBER SUMMARY

::

Subarea Description	Area (acres)	CN (weighted)
	54.70	86

VOLUME CALCULATIONS

POND-2 Version: 5.17
S/N:

JAMES RIVER COMMERCE CENTER
PROPOSED BMP
PROPOSED CONTOURS - EARTHEN DAM
REVISED: 4-17-96

CALCULATED 04-25-1996 10:29:34
DISK FILE: C:\PONDPACK\95016-28\MOD-4 .VOL

Planimeter scale: 1 inch = 25 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	* Volume (cubic-ft)	Volume Sum (cubic-ft)
18.00	33.95	21,217	0	0	0
20.00	40.07	25,046	69,314	46,209	46,209
22.00	46.73	29,209	81,301	54,201	100,410
24.00	53.93	33,705	94,289	62,860	163,270
24.00	61.63	38,519	108,255	0	163,270
25.00	65.62	41,012	119,277	39,759	203,029
26.00	69.86	43,661	126,989	42,330	245,359
28.00	78.67	49,172	139,168	92,778	338,137
30.00	89.42	55,890	157,485	104,990	443,127
32.00	100.51	62,819	177,962	118,642	561,769
34.00	113.45	70,909	200,470	133,647	695,415
36.00	131.50	82,187	229,436	152,958	848,373

Elevations With Areas Interpolated From
The Closest Two Planimeter Readings

27.25	-----	47,067	136,060	56,692	302,050
32.57	-----	65,075	191,831	36,448	598,216

$$IA = (sq.rt(Area1) + ((Ei-E1)/(E2-E1))*(sq.rt(Area2)-sq.rt(Area1)))^2$$

where: E1, E2 = Closest two elevations with planimeter data
Ei = Elevation at which to interpolate area
Area1,Area2 = Areas computed for E1, E2, respectively
IA = Interpolated area for Ei

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

OUTLET STRUCTURES

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

```
*****************************
JAMES RIVER COMMERCE CENTER
        PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

*****************************
```

Outlet Structure File: C:\PONDPACK\95016-28\BMP1 .STR
Planimeter Input File: C:\PONDPACK\95016-28\MOD-4 .VOL
Rating Table Output File: C:\PONDPACK\95016-28\BMP1 .PND

Min. Elev.(ft) = 25 Max. Elev.(ft) = 36 Incr.(ft) = .5

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

```
**********************************************
              SYSTEM CONNECTIVITY
**********************************************
```

Structure	No.		Q Table		Q Table
ORIFICE-VC	1			->	1
ORIFICE-VC	7	+	1	->	8
STAND PIPE	2	+	8	->	5
ORIFICE-VC	3	?	5	->	4
WEIR-XY	6			->	6

Outflow rating table summary was stored in file:
C:\PONDPACK\95016-28\BMP1 .PND

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

```
*****************************
JAMES RIVER COMMERCE CENTER
       PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

*****************************


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

ORIFICE-VC
Orifice - Vertical Circular


E1 elev.(ft)?          26.0
E2 elev.(ft)?           36.001
Orifice coeff.?        .6
Invert elev.(ft)?      25.0
Datum  elev.(ft)?      25.5
Diameter (ft)?         1.0
```

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

```
******************************
JAMES RIVER COMMERCE CENTER
        PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

******************************


>>>>>> Structure No. 7 <<<<<<
        (Input Data)

ORIFICE-VC
Orifice - Vertical Circular


E1 elev.(ft)?          31.21
E2 elev.(ft)?           36.001
Orifice coeff.?        .6
Invert elev.(ft)?      29.96
Datum  elev.(ft)?      30.585
Diameter (ft)?         1.25
```

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

```
******************************
JAMES RIVER COMMERCE CENTER
        PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

******************************


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

STAND PIPE
Stand Pipe with weir or orifice flow


E1 elev.(ft)?          32.57
E2 elev.(ft)?           36.001
Crest elev.(ft)?       32.57
Diameter (ft)?         5.0
Weir coefficient?      3.3
Orifice coefficient?   .6
Start transition elev.(ft) @ ?
Transition height (ft)?
```

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

```
*****************************
JAMES RIVER COMMERCE CENTER
       PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

*****************************


>>>>>> Structure No. 3 <<<<<<
       (Input Data)

ORIFICE-VC
Orifice - Vertical Circular


E1 elev.(ft)?          32.57
E2 elev.(ft)?           36.001
Orifice coeff.?        .6
Invert elev.(ft)?      19
Datum  elev.(ft)?      1.5
Diameter (ft)?         3.0
```

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

```
*****************************
JAMES RIVER COMMERCE CENTER
        PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

*****************************


>>>>>> Structure No. 6 <<<<<<
        (Input Data)

WEIR-XY
Weir - Defined by X, Y Coordinates
E1 (ft) =33.47     E2 (ft) = 36.001
```

X dist.(ft)	Y elev.(ft)
0	38
9.06	33.47
14.06	33.47
23.12	38

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

****

Outflow Rating Table for Structure #1
ORIFICE-VC Orifice - Vertical Circular

Elevation (ft)	Q (cfs)	Computation Messages
25.00	0.0	E < E1=26.0
25.50	0.0	E < E1=26.0
26.00	2.7	H =.5
26.50	3.8	H =1.0
27.00	4.6	H =1.5
27.50	5.3	H =2.0
28.00	6.0	H =2.5
28.50	6.6	H =3.0
29.00	7.1	H =3.5
29.50	7.6	H =4.0
30.00	8.0	H =4.5
30.50	8.5	H =5.0
31.00	8.9	H =5.5
31.50	9.3	H =6.0
32.00	9.6	H =6.5
32.50	10.0	H =7.0
33.00	10.4	H =7.5
33.50	10.7	H =8.0
34.00	11.0	H =8.5
34.50	11.3	H =9.0
35.00	11.7	H =9.5
35.50	12.0	H =10.0
36.00	12.3	H =10.5

C = .6 A = .7853982 sq.ft.
H (ft) = Table elev. - Datum elev. (25.5 ft)
Q (cfs) = C * A * sqr(2g * H)

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

****

Outflow Rating Table for Structure #7
ORIFICE-VC Orifice - Vertical Circular

Elevation (ft)	Q (cfs)	Computation Messages
25.00	0.0	E < E1=31.21
25.50	0.0	E < E1=31.21
26.00	0.0	E < E1=31.21
26.50	0.0	E < E1=31.21
27.00	0.0	E < E1=31.21
27.50	0.0	E < E1=31.21
28.00	0.0	E < E1=31.21
28.50	0.0	E < E1=31.21
29.00	0.0	E < E1=31.21
29.50	0.0	E < E1=31.21
30.00	0.0	E < E1=31.21
30.50	0.0	E < E1=31.21
31.00	0.0	E < E1=31.21
31.50	5.7	H =.915
32.00	7.0	H =1.415
32.50	8.2	H =1.915
33.00	9.2	H =2.415
33.50	10.1	H =2.915
34.00	10.9	H =3.415
34.50	11.7	H =3.915
35.00	12.4	H =4.415
35.50	13.1	H =4.915
36.00	13.8	H =5.415

C = .6 A = 1.227185 sq.ft.
H (ft) = Table elev. - Datum elev. (30.585 ft)
Q (cfs) = C * A * sqr(2g * H)

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

****

Outflow Rating Table for Structure #2
STAND PIPE Stand Pipe with weir or orifice flow

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

Elevation (ft)	Q (cfs)	Computation Messages
25.00	0.0	E < Inv.El.= 32.57
25.50	0.0	E < El=32.57
26.00	0.0	E < El=32.57
26.50	0.0	E < El=32.57
27.00	0.0	E < El=32.57
27.50	0.0	E < El=32.57
28.00	0.0	E < El=32.57
28.50	0.0	E < El=32.57
29.00	0.0	E < El=32.57
29.50	0.0	E < El=32.57
30.00	0.0	E < El=32.57
30.50	0.0	E < El=32.57
31.00	0.0	E < El=32.57
31.50	0.0	E < El=32.57
32.00	0.0	E < El=32.57
32.50	0.0	E < El=32.57
33.00	14.6	Weir: H =.43
33.50	46.5	Weir: H =.930
34.00	88.6	Weir: H =1.43
34.50	131.3	Orifice: H =1.93
35.00	147.4	Orifice: H =2.43
35.50	161.8	Orifice: H =2.93
36.00	175.1	Orifice: H =3.43

Weir Cw = 3.3 Weir length = 15.70796 ft
Orifice Co = .6 Orifice area = 19.63496 sq.ft.
Q (cfs) = (Cw * L * H**1.5) or (Co * A * sqr(2*g*H))
No transition used, transition height = 0.0
Weir equation = Orifice equation @ elev.= 34.39386 ft

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

****

Outflow Rating Table for Structure #3
ORIFICE-VC Orifice - Vertical Circular

Elevation (ft)	Q (cfs)	Computation Messages
25.00	0.0	E < E1=32.57
25.50	0.0	E < E1=32.57
26.00	0.0	E < E1=32.57
26.50	0.0	E < E1=32.57
27.00	0.0	E < E1=32.57
27.50	0.0	E < E1=32.57
28.00	0.0	E < E1=32.57
28.50	0.0	E < E1=32.57
29.00	0.0	E < E1=32.57
29.50	0.0	E < E1=32.57
30.00	0.0	E < E1=32.57
30.50	0.0	E < E1=32.57
31.00	0.0	E < E1=32.57
31.50	0.0	E < E1=32.57
32.00	0.0	E < E1=32.57
32.50	0.0	E < E1=32.57
33.00	191.0	H =31.5
33.50	192.5	H =32.0
34.00	194.0	H =32.5
34.50	195.5	H =33.0
35.00	197.0	H =33.5
35.50	198.5	H =34.0
36.00	199.9	H =34.5

C = .6 A = 7.068584 sq.ft.
H (ft) = Table elev. - Datum elev. (1.5 ft)
Q (cfs) = C * A * sqr(2g * H)

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

****

Outflow Rating Table for Structure #6
WEIR-XY Weir - Defined by X, Y Coordinates

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

Elevation (ft)	Q (cfs)	Computation Messages	
25.00	0.0	E < Y min= 33.47	
25.50	0.0	E < E1=33.47	
26.00	0.0	E < E1=33.47	
26.50	0.0	E < E1=33.47	
27.00	0.0	E < E1=33.47	
27.50	0.0	E < E1=33.47	
28.00	0.0	E < E1=33.47	
28.50	0.0	E < E1=33.47	
29.00	0.0	E < E1=33.47	
29.50	0.0	E < E1=33.47	
30.00	0.0	E < E1=33.47	
30.50	0.0	E < E1=33.47	
31.00	0.0	E < E1=33.47	
31.50	0.0	E < E1=33.47	
32.00	0.0	E < E1=33.47	
32.50	0.0	E < E1=33.47	
33.00	0.0	E < E1=33.47	
33.50	0.1	W(ft)=5.12	Max. D(ft)=.03
34.00	6.7	W(ft)=7.12	Max. D(ft)=.53
34.50	20.2	W(ft)=9.120	Max. D(ft)=1.03
35.00	40.7	W(ft)=11.12	Max. D(ft)=1.53
35.50	68.3	W(ft)=13.12	Max. D(ft)=2.03
36.00	103.6	W(ft)=15.12	Max. D(ft)=2.53

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

****

Outflow Rating Table 8
Table 8 = 1 + 7

Elevation (ft)	Q (cfs)	Contributing Structures
25.00	0.0	-
25.50	0.0	-
26.00	2.7	1
26.50	3.8	1
27.00	4.6	1
27.50	5.3	1
28.00	6.0	1
28.50	6.6	1
29.00	7.1	1
29.50	7.6	1
30.00	8.0	1
30.50	8.5	1
31.00	8.9	1
31.50	14.9	1 +7
32.00	16.7	1 +7
32.50	18.2	1 +7
33.00	19.5	1 +7
33.50	20.8	1 +7
34.00	21.9	1 +7
34.50	23.0	1 +7
35.00	24.1	1 +7
35.50	25.1	1 +7
36.00	26.0	1 +7

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

****

Outflow Rating Table 5
Table 5 = 8 + 2

Elevation (ft)	Q (cfs)	Contributing Structures
25.00	0.0	-
25.50	0.0	-
26.00	2.7	1
26.50	3.8	1
27.00	4.6	1
27.50	5.3	1
28.00	6.0	1
28.50	6.6	1
29.00	7.1	1
29.50	7.6	1
30.00	8.0	1
30.50	8.5	1
31.00	8.9	1
31.50	14.9	1 +7
32.00	16.7	1 +7
32.50	18.2	1 +7
33.00	34.2	1 +7 +2
33.50	67.3	1 +7 +2
34.00	110.6	1 +7 +2
34.50	154.4	1 +7 +2
35.00	171.4	1 +7 +2
35.50	186.9	1 +7 +2
36.00	201.1	1 +7 +2

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

****

Outflow Rating Table 4
Table 4 = 5 ? 3

Elevation (ft)	Q (cfs)	Contributing Structures
25.00	0.0	-
25.50	0.0	-
26.00	2.7	1
26.50	3.8	1
27.00	4.6	1
27.50	5.3	1
28.00	6.0	1
28.50	6.6	1
29.00	7.1	1
29.50	7.6	1
30.00	8.0	1
30.50	8.5	1
31.00	8.9	1
31.50	14.9	1 +7
32.00	16.7	1 +7
32.50	18.2	1 +7
33.00	34.2	1 +7 +2
33.50	67.3	1 +7 +2
34.00	110.6	1 +7 +2
34.50	154.4	1 +7 +2
35.00	171.4	1 +7 +2
35.50	186.9	1 +7 +2
36.00	199.9	3

Outlet Structure File: BMP1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
JAMES RIVER COMMERCE CENTER
PROPOSED BMP
EARTHEN DAM W/ EMER. SPILLWAY

****

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

Elevation (ft)	Q (cfs)	Contributing Structures
25.00	0.0	
25.50	0.0	
26.00	2.7	1
26.50	3.8	1
27.00	4.6	1
27.50	5.3	1
28.00	6.0	1
28.50	6.6	1
29.00	7.1	1
29.50	7.6	1
30.00	8.0	1
30.50	8.5	1
31.00	8.9	1
31.50	14.9	1 +7
32.00	16.7	1 +7
32.50	18.2	1 +7
33.00	34.2	1 +7 +2
33.50	67.4	1 +7 +2 +6
34.00	117.2	1 +7 +2 +6
34.50	174.6	1 +7 +2 +6
35.00	212.1	1 +7 +2 +6
35.50	255.2	1 +7 +2 +6
36.00	303.5	3 +6

ROUTING CALCULATIONS

```
*********************************
*                               *
* JAMES RIVER COMMERCE CENTER   *
*        PROPOSED BMP           *
*      REVISED: 4-17-96         *
*                               *
*                               *
*********************************
```

Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-2 .HYD
Rating Table file: C:\PONDPACK\95016-28\BMP1 .PND

----INITIAL CONDITIONS----
Elevation = 25.00 ft
Outflow = 0.00 cfs
Storage = 203,029 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
25.00	0.0	203,029	1127.9	1127.9
25.50	0.0	223,863	1243.7	1243.7
26.00	2.7	245,359	1363.1	1365.8
26.50	3.8	267,525	1486.3	1490.1
27.00	4.6	290,370	1613.2	1617.8
27.50	5.3	313,904	1743.9	1749.2
28.00	6.0	338,137	1878.5	1884.5
28.50	6.6	363,132	2017.4	2024.0
29.00	7.1	388,952	2160.8	2167.9
29.50	7.6	415,613	2309.0	2316.6
30.00	8.0	443,127	2461.8	2469.8
30.50	8.5	471,494	2619.4	2627.9
31.00	8.9	500,716	2781.8	2790.7
31.50	14.9	530,803	2948.9	2963.8
32.00	16.7	561,768	3120.9	3137.6
32.50	18.2	593,671	3298.2	3316.4
33.00	34.2	626,570	3480.9	3515.1
33.50	67.4	660,479	3669.3	3736.7
34.00	117.2	695,415	3863.4	3980.6
34.50	174.6	731,553	4064.2	4238.8
35.00	212.1	769,074	4272.6	4484.7
35.50	255.2	808,006	4488.9	4744.1
36.00	303.5	848,373	4713.2	5016.7

Time increment (t) = 6.0 min.

EXECUTED: 04-25-1996 11:46:21 Return Freq: 2 years

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-2 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\2-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
660.0	3.00	-----	1127.9	1127.9	0.00	25.00
666.0	4.00	7.0	1134.9	1134.9	0.00	25.03
672.0	4.00	8.0	1142.9	1142.9	0.00	25.06
678.0	5.00	9.0	1151.9	1151.9	0.00	25.10
684.0	6.00	11.0	1162.9	1162.9	0.00	25.15
690.0	6.00	12.0	1174.9	1174.9	0.00	25.20
696.0	7.00	13.0	1187.9	1187.9	0.00	25.26
702.0	11.00	18.0	1205.9	1205.9	0.00	25.34
708.0	16.00	27.0	1232.9	1232.9	0.00	25.45
714.0	20.00	36.0	1267.8	1268.9	0.56	25.60
720.0	40.00	60.0	1324.1	1327.8	1.86	25.84
726.0	75.00	115.0	1432.4	1439.1	3.35	26.29
732.0	114.00	189.0	1612.2	1621.4	4.62	27.01
738.0	114.00	228.0	1828.6	1840.2	5.77	27.84
744.0	77.00	191.0	2006.5	2019.6	6.58	28.48
750.0	48.00	125.0	2117.5	2131.5	6.97	28.87
756.0	33.00	81.0	2184.1	2198.5	7.20	29.10
762.0	25.00	58.0	2227.4	2242.1	7.35	29.25
768.0	19.00	44.0	2256.5	2271.4	7.45	29.35
774.0	16.00	35.0	2276.5	2291.5	7.52	29.42
780.0	13.00	29.0	2290.4	2305.5	7.56	29.46
786.0	12.00	25.0	2300.2	2315.4	7.60	29.50
792.0	11.00	23.0	2307.9	2323.2	7.62	29.52
798.0	10.00	21.0	2313.7	2328.9	7.63	29.54
804.0	10.00	20.0	2318.4	2333.7	7.64	29.56
810.0	10.00	20.0	2323.1	2338.4	7.66	29.57
816.0	9.00	19.0	2326.7	2342.1	7.67	29.58
822.0	8.00	17.0	2328.4	2343.7	7.67	29.59
828.0	8.00	16.0	2329.0	2344.4	7.67	29.59
834.0	8.00	16.0	2329.7	2345.0	7.67	29.59
840.0	7.00	15.0	2329.3	2344.7	7.67	29.59
846.0	7.00	14.0	2328.0	2343.3	7.67	29.59
852.0	6.00	13.0	2325.7	2341.0	7.66	29.58
858.0	6.00	12.0	2322.4	2337.7	7.66	29.57
864.0	6.00	12.0	2319.1	2334.4	7.65	29.56
870.0	6.00	12.0	2315.8	2331.1	7.64	29.55
876.0	6.00	12.0	2312.5	2327.8	7.63	29.54
882.0	6.00	12.0	2309.3	2324.5	7.62	29.53
888.0	6.00	12.0	2306.1	2321.3	7.61	29.52
894.0	5.00	11.0	2301.9	2317.1	7.60	29.50
900.0	5.00	10.0	2296.7	2311.9	7.58	29.48
906.0	5.00	10.0	2291.6	2306.7	7.57	29.47
912.0	5.00	10.0	2286.5	2301.6	7.55	29.45
918.0	5.00	10.0	2281.4	2296.5	7.53	29.43
924.0	5.00	10.0	2276.4	2291.4	7.52	29.42

EXECUTED: 04-25-1996 11:46:21 Return Freq: 2 years

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-2 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\2-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
930.0	5.00	10.0	2271.4	2286.4	7.50	29.40
936.0	5.00	10.0	2266.4	2281.4	7.48	29.38
942.0	5.00	10.0	2261.5	2276.4	7.46	29.36
948.0	4.00	9.0	2255.6	2270.5	7.44	29.34
954.0	4.00	8.0	2248.8	2263.6	7.42	29.32
960.0	4.00	8.0	2242.0	2256.8	7.40	29.30
966.0	4.00	8.0	2235.2	2250.0	7.38	29.28
972.0	4.00	8.0	2228.5	2243.2	7.35	29.25
978.0	4.00	8.0	2221.8	2236.5	7.33	29.23
984.0	4.00	8.0	2215.2	2229.8	7.31	29.21
990.0	4.00	8.0	2208.6	2223.2	7.29	29.19
996.0	4.00	8.0	2202.1	2216.6	7.26	29.16
1002.0	4.00	8.0	2195.6	2210.1	7.24	29.14
1008.0	3.00	7.0	2188.2	2202.6	7.22	29.12
1014.0	3.00	6.0	2179.8	2194.2	7.19	29.09
1020.0	3.00	6.0	2171.5	2185.8	7.16	29.06
1026.0	3.00	6.0	2163.2	2177.5	7.13	29.03
1032.0	3.00	6.0	2155.0	2169.2	7.10	29.00
1038.0	3.00	6.0	2146.9	2161.0	7.08	28.98
1044.0	3.00	6.0	2138.8	2152.9	7.05	28.95
1050.0	3.00	6.0	2130.7	2144.8	7.02	28.92
1056.0	3.00	6.0	2122.8	2136.7	6.99	28.89
1062.0	3.00	6.0	2114.8	2128.8	6.96	28.86
1068.0	3.00	6.0	2107.0	2120.8	6.94	28.84
1074.0	3.00	6.0	2099.1	2113.0	6.91	28.81
1080.0	3.00	6.0	2091.4	2105.1	6.88	28.78
1086.0	3.00	6.0	2083.7	2097.4	6.85	28.75
1092.0	3.00	6.0	2076.0	2089.7	6.83	28.73
1098.0	3.00	6.0	2068.4	2082.0	6.80	28.70
1104.0	3.00	6.0	2060.9	2074.4	6.78	28.68
1110.0	3.00	6.0	2053.4	2066.9	6.75	28.65
1116.0	3.00	6.0	2045.9	2059.4	6.72	28.62
1122.0	3.00	6.0	2038.5	2051.9	6.70	28.60
1128.0	3.00	6.0	2031.2	2044.5	6.67	28.57
1134.0	3.00	6.0	2023.9	2037.2	6.65	28.55
1140.0	3.00	6.0	2016.6	2029.9	6.62	28.52
1146.0	3.00	6.0	2009.5	2022.6	6.59	28.50
1152.0	3.00	6.0	2002.3	2015.5	6.56	28.47
1158.0	3.00	6.0	1995.3	2008.3	6.53	28.44
1164.0	3.00	6.0	1988.3	2001.3	6.50	28.42
1170.0	2.00	5.0	1980.3	1993.3	6.47	28.39
1176.0	2.00	4.0	1971.5	1984.3	6.43	28.36
1182.0	2.00	4.0	1962.7	1975.5	6.39	28.33
1188.0	2.00	4.0	1954.0	1966.7	6.35	28.29
1194.0	2.00	4.0	1945.3	1958.0	6.32	28.26
1200.0	2.00	4.0	1936.8	1949.3	6.28	28.23

EXECUTED: 04-25-1996 11:46:21 Return Freq: 2 years

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-2 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\2-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1206.0	2.00	4.0	1928.3	1940.8	6.24	28.20
1212.0	2.00	4.0	1919.9	1932.3	6.21	28.17
1218.0	2.00	4.0	1911.6	1923.9	6.17	28.14
1224.0	2.00	4.0	1903.3	1915.6	6.13	28.11
1230.0	2.00	4.0	1895.1	1907.3	6.10	28.08
1236.0	2.00	4.0	1887.0	1899.1	6.06	28.05
1242.0	2.00	4.0	1878.9	1891.0	6.03	28.02
1248.0	2.00	4.0	1870.9	1882.9	5.99	27.99
1254.0	2.00	4.0	1863.0	1874.9	5.95	27.96
1260.0	2.00	4.0	1855.2	1867.0	5.91	27.94
1266.0	2.00	4.0	1847.5	1859.2	5.87	27.91
1272.0	2.00	4.0	1839.8	1851.5	5.83	27.88
1278.0	2.00	4.0	1832.2	1843.8	5.79	27.85
1284.0	2.00	4.0	1824.7	1836.2	5.75	27.82
1290.0	2.00	4.0	1817.3	1828.7	5.71	27.79
1296.0	2.00	4.0	1810.0	1821.3	5.67	27.77
1302.0	2.00	4.0	1802.7	1814.0	5.63	27.74
1308.0	2.00	4.0	1795.5	1806.7	5.60	27.71
1314.0	2.00	4.0	1788.4	1799.5	5.56	27.69
1320.0	2.00	4.0	1781.3	1792.4	5.52	27.66
1326.0	2.00	4.0	1774.4	1785.3	5.49	27.63
1332.0	2.00	4.0	1767.5	1778.4	5.45	27.61
1338.0	2.00	4.0	1760.6	1771.5	5.42	27.58
1344.0	2.00	4.0	1753.9	1764.6	5.38	27.56
1350.0	2.00	4.0	1747.2	1757.9	5.34	27.53
1356.0	2.00	4.0	1740.6	1751.2	5.31	27.51
1362.0	2.00	4.0	1734.0	1744.6	5.28	27.48
1368.0	2.00	4.0	1727.5	1738.0	5.24	27.46
1374.0	2.00	4.0	1721.1	1731.5	5.21	27.43
1380.0	2.00	4.0	1714.8	1725.1	5.17	27.41
1386.0	1.00	3.0	1707.5	1717.8	5.13	27.38
1392.0	1.00	2.0	1699.3	1709.5	5.09	27.35
1398.0	1.00	2.0	1691.2	1701.3	5.05	27.32
1404.0	1.00	2.0	1683.2	1693.2	5.00	27.29
1410.0	1.00	2.0	1675.3	1685.2	4.96	27.26
1416.0	1.00	2.0	1667.5	1677.3	4.92	27.23
1422.0	1.00	2.0	1659.7	1669.5	4.88	27.20
1428.0	1.00	2.0	1652.1	1661.7	4.83	27.17
1434.0	1.00	2.0	1644.5	1654.1	4.79	27.14
1440.0	1.00	2.0	1637.0	1646.5	4.75	27.11
1446.0	1.00	2.0	1629.5	1639.0	4.71	27.08
1452.0	1.00	2.0	1622.2	1631.5	4.67	27.05
1458.0	1.00	2.0	1614.9	1624.2	4.63	27.02
1464.0	1.00	2.0	1607.7	1616.9	4.59	27.00
1470.0	1.00	2.0	1600.6	1609.7	4.55	26.97
1476.0	1.00	2.0	1593.6	1602.6	4.51	26.94

EXECUTED: 04-25-1996 11:46:21 Return Freq: 2 years

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-2 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\2-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1482.0	1.00	2.0	1586.7	1595.6	4.46	26.91
1488.0	1.00	2.0	1579.9	1588.7	4.42	26.89
1494.0	1.00	2.0	1573.1	1581.9	4.38	26.86
1500.0	0.00	1.0	1565.5	1574.1	4.33	26.83
1506.0	0.00	0.0	1556.9	1565.5	4.27	26.80
1512.0	0.00	0.0	1548.5	1556.9	4.22	26.76
1518.0	0.00	0.0	1540.2	1548.5	4.17	26.73
1524.0	0.00	0.0	1531.9	1540.2	4.11	26.70
1530.0	0.00	0.0	1523.8	1531.9	4.06	26.66
1536.0	0.00	0.0	1515.8	1523.8	4.01	26.63
1542.0	0.00	0.0	1507.9	1515.8	3.96	26.60
1548.0	0.00	0.0	1500.0	1507.9	3.91	26.57
1554.0	0.00	0.0	1492.3	1500.0	3.86	26.54

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

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-2 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\2-OUT1 .HYD

Starting Pond W.S. Elevation = 25.00 ft

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

Peak Inflow = 114.00 cfs
Peak Outflow = 7.67 cfs
Peak Elevation = 29.59 ft

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

Initial Storage = 203,029 cu-ft
Peak Storage From Storm = 217,697 cu-ft

Total Storage in Pond = 420,726 cu-ft

Warning: Inflow hydrograph truncated on left side.

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*********************************
*                               *
* JAMES RIVER COMMERCE CENTER   *
*        PROPOSED BMP           *
*      REVISED: 4-17-96         *
*                               *
*                               *
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Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-10 .HYD
Rating Table file: C:\PONDPACK\95016-28\BMP1 .PND

----INITIAL CONDITIONS----
Elevation = 25.00 ft
Outflow = 0.00 cfs
Storage = 203,029 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
25.00	0.0	203,029	1127.9	1127.9
25.50	0.0	223,863	1243.7	1243.7
26.00	2.7	245,359	1363.1	1365.8
26.50	3.8	267,525	1486.3	1490.1
27.00	4.6	290,370	1613.2	1617.8
27.50	5.3	313,904	1743.9	1749.2
28.00	6.0	338,137	1878.5	1884.5
28.50	6.6	363,132	2017.4	2024.0
29.00	7.1	388,952	2160.8	2167.9
29.50	7.6	415,613	2309.0	2316.6
30.00	8.0	443,127	2461.8	2469.8
30.50	8.5	471,494	2619.4	2627.9
31.00	8.9	500,716	2781.8	2790.7
31.50	14.9	530,803	2948.9	2963.8
32.00	16.7	561,768	3120.9	3137.6
32.50	18.2	593,671	3298.2	3316.4
33.00	34.2	626,570	3480.9	3515.1
33.50	67.4	660,479	3669.3	3736.7
34.00	117.2	695,415	3863.4	3980.6
34.50	174.6	731,553	4064.2	4238.8
35.00	212.1	769,074	4272.6	4484.7
35.50	255.2	808,006	4488.9	4744.1
36.00	303.5	848,373	4713.2	5016.7

Time increment (t) = 6.0 min.

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-10 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\10-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
660.0	6.00	-----	1127.9	1127.9	0.00	25.00
666.0	7.00	13.0	1140.9	1140.9	0.00	25.06
672.0	7.00	14.0	1154.9	1154.9	0.00	25.12
678.0	8.00	15.0	1169.9	1169.9	0.00	25.18
684.0	9.00	17.0	1186.9	1186.9	0.00	25.25
690.0	11.00	20.0	1206.9	1206.9	0.00	25.34
696.0	12.00	23.0	1229.9	1229.9	0.00	25.44
702.0	20.00	32.0	1261.1	1261.9	0.40	25.57
708.0	27.00	47.0	1305.3	1308.1	1.42	25.76
714.0	35.00	62.0	1361.9	1367.3	2.71	26.01
720.0	70.00	105.0	1459.7	1466.9	3.59	26.41
726.0	134.00	204.0	1654.0	1663.7	4.84	27.17
732.0	202.00	336.0	1977.1	1990.0	6.45	28.38
738.0	202.00	404.0	2365.5	2381.1	7.77	29.71
744.0	137.00	339.0	2687.2	2704.5	8.69	30.74
750.0	85.00	222.0	2883.1	2909.2	13.01	31.34
756.0	59.00	144.0	2996.0	3027.1	15.56	31.68
762.0	44.00	103.0	3066.4	3099.0	16.30	31.89
768.0	34.00	78.0	3110.9	3144.4	16.76	32.02
774.0	29.00	63.0	3139.9	3173.9	17.00	32.10
780.0	24.00	53.0	3158.6	3192.9	17.16	32.15
786.0	22.00	46.0	3170.1	3204.6	17.26	32.19
792.0	20.00	42.0	3177.4	3212.1	17.32	32.21
798.0	18.00	38.0	3180.7	3215.4	17.35	32.22
804.0	17.00	35.0	3181.0	3215.7	17.36	32.22
810.0	16.00	33.0	3179.3	3214.0	17.34	32.21
816.0	15.00	31.0	3175.7	3210.3	17.31	32.20
822.0	14.00	29.0	3170.2	3204.7	17.26	32.19
828.0	14.00	28.0	3163.7	3198.2	17.21	32.17
834.0	14.00	28.0	3157.4	3191.7	17.15	32.15
840.0	13.00	27.0	3150.3	3184.4	17.09	32.13
846.0	12.00	25.0	3141.2	3175.3	17.02	32.11
852.0	12.00	24.0	3131.4	3165.2	16.93	32.08
858.0	11.00	23.0	3120.7	3154.4	16.84	32.05
864.0	11.00	22.0	3109.2	3142.7	16.74	32.01
870.0	10.00	21.0	3096.9	3130.2	16.62	31.98
876.0	10.00	20.0	3084.0	3116.9	16.49	31.94
882.0	10.00	20.0	3071.3	3104.0	16.35	31.90
888.0	9.00	19.0	3057.9	3090.3	16.21	31.86
894.0	9.00	18.0	3043.7	3075.9	16.06	31.82
900.0	9.00	18.0	3029.9	3061.7	15.91	31.78
906.0	9.00	18.0	3016.4	3047.9	15.77	31.74
912.0	9.00	18.0	3003.1	3034.4	15.63	31.70
918.0	8.00	17.0	2989.1	3020.1	15.48	31.66
924.0	8.00	16.0	2974.5	3005.1	15.33	31.62

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-10 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\10-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
930.0	8.00	16.0	2960.1	2990.5	15.18	31.58
936.0	8.00	16.0	2946.1	2976.1	15.03	31.54
942.0	8.00	16.0	2932.4	2962.1	14.84	31.50
948.0	7.00	15.0	2918.7	2947.4	14.33	31.45
954.0	7.00	14.0	2905.1	2932.7	13.82	31.41
960.0	7.00	14.0	2892.4	2919.1	13.35	31.37
966.0	7.00	14.0	2880.6	2906.4	12.91	31.33
972.0	7.00	14.0	2869.6	2894.6	12.50	31.30
978.0	7.00	14.0	2859.3	2883.6	12.12	31.27
984.0	7.00	14.0	2849.8	2873.3	11.76	31.24
990.0	7.00	14.0	2840.9	2863.8	11.43	31.21
996.0	7.00	14.0	2832.7	2854.9	11.13	31.19
1002.0	7.00	14.0	2825.0	2846.7	10.84	31.16
1008.0	6.00	13.0	2816.9	2838.0	10.54	31.14
1014.0	6.00	12.0	2808.5	2828.9	10.23	31.11
1020.0	6.00	12.0	2800.6	2820.5	9.93	31.09
1026.0	6.00	12.0	2793.3	2812.6	9.66	31.06
1032.0	6.00	12.0	2786.5	2805.3	9.41	31.04
1038.0	6.00	12.0	2780.1	2798.5	9.17	31.02
1044.0	6.00	12.0	2774.2	2792.1	8.95	31.00
1050.0	6.00	12.0	2768.4	2786.2	8.89	30.99
1056.0	6.00	12.0	2762.7	2780.4	8.87	30.97
1062.0	6.00	12.0	2757.0	2774.7	8.86	30.95
1068.0	5.00	11.0	2750.3	2768.0	8.84	30.93
1074.0	5.00	10.0	2742.6	2760.3	8.83	30.91
1080.0	5.00	10.0	2735.0	2752.6	8.81	30.88
1086.0	5.00	10.0	2727.4	2745.0	8.79	30.86
1092.0	5.00	10.0	2719.9	2737.4	8.77	30.84
1098.0	5.00	10.0	2712.4	2729.9	8.75	30.81
1104.0	5.00	10.0	2704.9	2722.4	8.73	30.79
1110.0	5.00	10.0	2697.5	2714.9	8.71	30.77
1116.0	5.00	10.0	2690.1	2707.5	8.70	30.74
1122.0	5.00	10.0	2682.8	2700.1	8.68	30.72
1128.0	5.00	10.0	2675.4	2692.8	8.66	30.70
1134.0	5.00	10.0	2668.2	2685.4	8.64	30.68
1140.0	5.00	10.0	2660.9	2678.2	8.62	30.65
1146.0	5.00	10.0	2653.7	2670.9	8.61	30.63
1152.0	5.00	10.0	2646.5	2663.7	8.59	30.61
1158.0	5.00	10.0	2639.4	2656.5	8.57	30.59
1164.0	5.00	10.0	2632.3	2649.4	8.55	30.57
1170.0	4.00	9.0	2624.2	2641.3	8.53	30.54
1176.0	4.00	8.0	2615.2	2632.2	8.51	30.51
1182.0	4.00	8.0	2606.2	2623.2	8.49	30.49
1188.0	4.00	8.0	2597.3	2614.2	8.46	30.46
1194.0	4.00	8.0	2588.5	2605.3	8.43	30.43
1200.0	4.00	8.0	2579.6	2596.5	8.40	30.40

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-10 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\10-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1206.0	4.00	8.0	2570.9	2587.6	8.37	30.37
1212.0	4.00	8.0	2562.2	2578.9	8.35	30.35
1218.0	4.00	8.0	2553.6	2570.2	8.32	30.32
1224.0	4.00	8.0	2545.0	2561.6	8.29	30.29
1230.0	4.00	8.0	2536.5	2553.0	8.26	30.26
1236.0	4.00	8.0	2528.0	2544.5	8.24	30.24
1242.0	4.00	8.0	2519.6	2536.0	8.21	30.21
1248.0	4.00	8.0	2511.2	2527.6	8.18	30.18
1254.0	4.00	8.0	2502.9	2519.2	8.16	30.16
1260.0	4.00	8.0	2494.6	2510.9	8.13	30.13
1266.0	4.00	8.0	2486.4	2502.6	8.10	30.10
1272.0	4.00	8.0	2478.3	2494.4	8.08	30.08
1278.0	4.00	8.0	2470.2	2486.3	8.05	30.05
1284.0	4.00	8.0	2462.1	2478.2	8.03	30.03
1290.0	4.00	8.0	2454.1	2470.1	8.00	30.00
1296.0	4.00	8.0	2446.2	2462.1	7.98	29.97
1302.0	4.00	8.0	2438.2	2454.2	7.96	29.95
1308.0	4.00	8.0	2430.4	2446.2	7.94	29.92
1314.0	4.00	8.0	2422.5	2438.4	7.92	29.90
1320.0	4.00	8.0	2414.7	2430.5	7.90	29.87
1326.0	4.00	8.0	2407.0	2422.7	7.88	29.85
1332.0	4.00	8.0	2399.3	2415.0	7.86	29.82
1338.0	4.00	8.0	2391.6	2407.3	7.84	29.80
1344.0	4.00	8.0	2384.0	2399.6	7.82	29.77
1350.0	4.00	8.0	2376.4	2392.0	7.80	29.75
1356.0	3.00	7.0	2367.8	2383.4	7.77	29.72
1362.0	3.00	6.0	2358.3	2373.8	7.75	29.69
1368.0	3.00	6.0	2348.9	2364.3	7.72	29.66
1374.0	3.00	6.0	2339.5	2354.9	7.70	29.62
1380.0	3.00	6.0	2330.1	2345.5	7.68	29.59
1386.0	3.00	6.0	2320.8	2336.1	7.65	29.56
1392.0	3.00	6.0	2311.6	2326.8	7.63	29.53
1398.0	3.00	6.0	2302.4	2317.6	7.60	29.50
1404.0	3.00	6.0	2293.2	2308.4	7.57	29.47
1410.0	2.00	5.0	2283.1	2298.2	7.54	29.44
1416.0	2.00	4.0	2272.1	2287.1	7.50	29.40
1422.0	2.00	4.0	2261.2	2276.1	7.46	29.36
1428.0	2.00	4.0	2250.4	2265.2	7.43	29.33
1434.0	2.00	4.0	2239.6	2254.4	7.39	29.29
1440.0	2.00	4.0	2228.9	2243.6	7.35	29.25
1446.0	2.00	4.0	2218.2	2232.9	7.32	29.22
1452.0	2.00	4.0	2207.7	2222.2	7.28	29.18
1458.0	2.00	4.0	2197.2	2211.7	7.25	29.15
1464.0	2.00	4.0	2186.7	2201.2	7.21	29.11
1470.0	2.00	4.0	2176.4	2190.7	7.18	29.08
1476.0	1.00	3.0	2165.1	2179.4	7.14	29.04

EXECUTED: 04-25-1996 11:46:26 Return freq: 10 years

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-10 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\10-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1482.0	1.00	2.0	2152.9	2167.1	7.10	29.00
1488.0	1.00	2.0	2140.8	2154.9	7.05	28.95
1494.0	1.00	2.0	2128.8	2142.8	7.01	28.91
1500.0	1.00	2.0	2116.8	2130.8	6.97	28.87
1506.0	1.00	2.0	2105.0	2118.8	6.93	28.83
1512.0	1.00	2.0	2093.2	2107.0	6.89	28.79
1518.0	1.00	2.0	2081.5	2095.2	6.85	28.75
1524.0	1.00	2.0	2069.9	2083.5	6.81	28.71
1530.0	0.00	1.0	2057.4	2070.9	6.76	28.66
1536.0	0.00	0.0	2043.9	2057.4	6.72	28.62
1542.0	0.00	0.0	2030.6	2043.9	6.67	28.57
1548.0	0.00	0.0	2017.4	2030.6	6.62	28.52
1554.0	0.00	0.0	2004.2	2017.4	6.57	28.48

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

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-10 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\10-OUT1 .HYD

Starting Pond W.S. Elevation = 25.00 ft

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

Peak Inflow = 202.00 cfs
Peak Outflow = 17.36 cfs
Peak Elevation = 32.22 ft

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

Initial Storage = 203,029 cu-ft
Peak Storage from Storm = 372,674 cu-ft

Total Storage in Pond = 575,702 cu-ft

Warning: Inflow hydrograph truncated on left side.

EXECUTED: 04-25-1996 11:49:51 Return Freq: 25 years

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*********************************
*                               *
* JAMES RIVER COMMERCE CENTER   *
*        PROPOSED BMP           *
*      REVISED: 4-17-96         *
*                               *
*                               *
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Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-25 .HYD
Rating Table file: C:\PONDPACK\95016-28\BMP1 .PND

----INITIAL CONDITIONS----
Elevation = 25.00 ft
Outflow = 0.00 cfs
Storage = 203,029 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
25.00	0.0	203,029	1127.9	1127.9
25.50	0.0	223,863	1243.7	1243.7
26.00	2.7	245,359	1363.1	1365.8
26.50	3.8	267,525	1486.3	1490.1
27.00	4.6	290,370	1613.2	1617.8
27.50	5.3	313,904	1743.9	1749.2
28.00	6.0	338,137	1878.5	1884.5
28.50	6.6	363,132	2017.4	2024.0
29.00	7.1	388,952	2160.8	2167.9
29.50	7.6	415,613	2309.0	2316.6
30.00	8.0	443,127	2461.8	2469.8
30.50	8.5	471,494	2619.4	2627.9
31.00	8.9	500,716	2781.8	2790.7
31.50	14.9	530,803	2948.9	2963.8
32.00	16.7	561,768	3120.9	3137.6
32.50	18.2	593,671	3298.2	3316.4
33.00	34.2	626,570	3480.9	3515.1
33.50	67.4	660,479	3669.3	3736.7
34.00	117.2	695,415	3863.4	3980.6
34.50	174.6	731,553	4064.2	4238.8
35.00	212.1	769,074	4272.6	4484.7
35.50	255.2	808,006	4488.9	4744.1
36.00	303.5	848,373	4713.2	5016.7

Time increment (t) = 6.0 min.

EXECUTED: 04-25-1996 11:49:51 Return Freq: 25 years

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-25 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\25-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
660.0	8.00	-----	1127.9	1127.9	0.00	25.00
666.0	9.00	17.0	1144.9	1144.9	0.00	25.07
672.0	10.00	19.0	1163.9	1163.9	0.00	25.16
678.0	11.00	21.0	1184.9	1184.9	0.00	25.25
684.0	13.00	24.0	1208.9	1208.9	0.00	25.35
690.0	14.00	27.0	1235.9	1235.9	0.00	25.47
696.0	16.00	30.0	1265.0	1265.9	0.49	25.59
702.0	26.00	42.0	1304.2	1307.0	1.40	25.76
708.0	37.00	63.0	1361.7	1367.2	2.71	26.01
714.0	47.00	84.0	1438.9	1445.7	3.41	26.32
720.0	93.00	140.0	1570.2	1578.9	4.36	26.85
726.0	177.00	270.0	1828.7	1840.2	5.77	27.84
732.0	268.00	445.0	2258.8	2273.7	7.46	29.36
738.0	268.00	536.0	2776.7	2794.8	9.04	31.01
744.0	182.00	450.0	3191.8	3226.7	17.45	32.25
750.0	112.00	294.0	3422.1	3485.8	31.84	32.93
756.0	78.00	190.0	3514.6	3612.1	48.73	33.22
762.0	58.00	136.0	3541.6	3650.6	54.50	33.31
768.0	45.00	103.0	3537.4	3644.6	53.60	33.29
774.0	38.00	83.0	3520.5	3620.4	49.98	33.24
780.0	32.00	70.0	3499.5	3590.5	45.49	33.17
786.0	29.00	61.0	3478.5	3560.5	41.00	33.10
792.0	26.00	55.0	3459.6	3533.5	36.95	33.04
798.0	24.00	50.0	3442.1	3509.6	33.75	32.99
804.0	23.00	47.0	3424.9	3489.1	32.10	32.93
810.0	22.00	45.0	3408.8	3469.9	30.56	32.89
816.0	20.00	42.0	3392.7	3450.8	29.02	32.84
822.0	19.00	39.0	3376.8	3431.7	27.49	32.79
828.0	18.00	37.0	3361.7	3413.8	26.04	32.74
834.0	18.00	36.0	3348.2	3397.7	24.75	32.70
840.0	17.00	35.0	3336.0	3383.2	23.58	32.67
846.0	16.00	33.0	3324.2	3369.0	22.44	32.63
852.0	16.00	32.0	3313.4	3356.2	21.40	32.60
858.0	15.00	31.0	3303.4	3344.4	20.45	32.57
864.0	14.00	29.0	3293.5	3332.4	19.49	32.54
870.0	14.00	28.0	3284.2	3321.5	18.61	32.51
876.0	13.00	27.0	3274.9	3311.2	18.16	32.49
882.0	13.00	26.0	3264.8	3300.9	18.07	32.46
888.0	12.00	25.0	3253.8	3289.8	17.98	32.43
894.0	12.00	24.0	3242.1	3277.8	17.88	32.39
900.0	12.00	24.0	3230.5	3266.1	17.78	32.36
906.0	12.00	24.0	3219.2	3254.5	17.68	32.33
912.0	12.00	24.0	3208.0	3243.2	17.59	32.30
918.0	11.00	23.0	3196.0	3231.0	17.48	32.26
924.0	11.00	22.0	3183.3	3218.0	17.37	32.22

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-25 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\25-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
930.0	11.00	22.0	3170.7	3205.3	17.27	32.19
936.0	11.00	22.0	3158.4	3192.7	17.16	32.15
942.0	11.00	22.0	3146.3	3180.4	17.06	32.12
948.0	10.00	21.0	3133.4	3167.3	16.95	32.08
954.0	10.00	20.0	3119.7	3153.4	16.83	32.04
960.0	10.00	20.0	3106.3	3139.7	16.72	32.01
966.0	10.00	20.0	3093.1	3126.3	16.58	31.97
972.0	10.00	20.0	3080.2	3113.1	16.45	31.93
978.0	9.00	19.0	3066.6	3099.2	16.30	31.89
984.0	9.00	18.0	3052.3	3084.6	16.15	31.85
990.0	9.00	18.0	3038.3	3070.3	16.00	31.81
996.0	9.00	18.0	3024.6	3056.3	15.86	31.77
1002.0	9.00	18.0	3011.2	3042.6	15.72	31.73
1008.0	8.00	17.0	2997.0	3028.2	15.57	31.69
1014.0	8.00	16.0	2982.2	3013.0	15.41	31.64
1020.0	8.00	16.0	2967.7	2998.2	15.26	31.60
1026.0	8.00	16.0	2953.5	2983.7	15.11	31.56
1032.0	8.00	16.0	2939.6	2969.5	14.96	31.52
1038.0	8.00	16.0	2926.4	2955.6	14.62	31.48
1044.0	8.00	16.0	2914.0	2942.4	14.16	31.44
1050.0	8.00	16.0	2902.6	2930.0	13.73	31.40
1056.0	8.00	16.0	2891.9	2918.6	13.33	31.37
1062.0	8.00	16.0	2882.0	2907.9	12.96	31.34
1068.0	7.00	15.0	2871.8	2897.0	12.58	31.31
1074.0	7.00	14.0	2861.4	2885.8	12.20	31.27
1080.0	7.00	14.0	2851.7	2875.4	11.84	31.24
1086.0	7.00	14.0	2842.7	2865.7	11.50	31.22
1092.0	7.00	14.0	2834.4	2856.7	11.19	31.19
1098.0	7.00	14.0	2826.6	2848.4	10.90	31.17
1104.0	7.00	14.0	2819.3	2840.6	10.63	31.14
1110.0	6.00	13.0	2811.6	2832.3	10.34	31.12
1116.0	6.00	12.0	2803.5	2823.6	10.04	31.10
1122.0	6.00	12.0	2796.0	2815.5	9.76	31.07
1128.0	6.00	12.0	2789.0	2808.0	9.50	31.05
1134.0	6.00	12.0	2782.5	2801.0	9.26	31.03
1140.0	6.00	12.0	2776.4	2794.5	9.03	31.01
1146.0	6.00	12.0	2770.6	2788.4	8.89	30.99
1152.0	6.00	12.0	2764.9	2782.6	8.88	30.98
1158.0	6.00	12.0	2759.1	2776.9	8.87	30.96
1164.0	6.00	12.0	2753.4	2771.1	8.85	30.94
1170.0	6.00	12.0	2747.8	2765.4	8.84	30.92
1176.0	5.00	11.0	2741.1	2758.8	8.82	30.90
1182.0	5.00	10.0	2733.5	2751.1	8.80	30.88
1188.0	5.00	10.0	2725.9	2743.5	8.78	30.86
1194.0	5.00	10.0	2718.4	2735.9	8.77	30.83
1200.0	5.00	10.0	2710.9	2728.4	8.75	30.81

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-25 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\25-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1206.0	5.00	10.0	2703.5	2720.9	8.73	30.79
1212.0	5.00	10.0	2696.0	2713.5	8.71	30.76
1218.0	5.00	10.0	2688.7	2706.0	8.69	30.74
1224.0	5.00	10.0	2681.3	2698.7	8.67	30.72
1230.0	5.00	10.0	2674.0	2691.3	8.66	30.69
1236.0	5.00	10.0	2666.7	2684.0	8.64	30.67
1242.0	5.00	10.0	2659.5	2676.7	8.62	30.65
1248.0	5.00	10.0	2652.3	2669.5	8.60	30.63
1254.0	5.00	10.0	2645.1	2662.3	8.58	30.61
1260.0	5.00	10.0	2638.0	2655.1	8.57	30.58
1266.0	5.00	10.0	2630.9	2648.0	8.55	30.56
1272.0	5.00	10.0	2623.8	2640.9	8.53	30.54
1278.0	5.00	10.0	2616.8	2633.8	8.51	30.52
1284.0	5.00	10.0	2609.8	2626.8	8.50	30.50
1290.0	5.00	10.0	2602.8	2619.8	8.47	30.47
1296.0	5.00	10.0	2595.9	2612.8	8.45	30.45
1302.0	5.00	10.0	2589.1	2605.9	8.43	30.43
1308.0	5.00	10.0	2582.3	2599.1	8.41	30.41
1314.0	5.00	10.0	2575.5	2592.3	8.39	30.39
1320.0	5.00	10.0	2568.8	2585.5	8.37	30.37
1326.0	5.00	10.0	2562.1	2578.8	8.34	30.34
1332.0	5.00	10.0	2555.4	2572.1	8.32	30.32
1338.0	5.00	10.0	2548.8	2565.4	8.30	30.30
1344.0	4.00	9.0	2541.3	2557.8	8.28	30.28
1350.0	4.00	8.0	2532.8	2549.3	8.25	30.25
1356.0	4.00	8.0	2524.3	2540.8	8.22	30.22
1362.0	4.00	8.0	2515.9	2532.3	8.20	30.20
1368.0	4.00	8.0	2507.6	2523.9	8.17	30.17
1374.0	4.00	8.0	2499.3	2515.6	8.14	30.14
1380.0	4.00	8.0	2491.0	2507.3	8.12	30.12
1386.0	4.00	8.0	2482.9	2499.0	8.09	30.09
1392.0	4.00	8.0	2474.7	2490.9	8.07	30.07
1398.0	3.00	7.0	2465.6	2481.7	8.04	30.04
1404.0	3.00	6.0	2455.6	2471.6	8.01	30.01
1410.0	3.00	6.0	2445.7	2461.6	7.98	29.97
1416.0	3.00	6.0	2435.8	2451.7	7.95	29.94
1422.0	3.00	6.0	2425.9	2441.8	7.93	29.91
1428.0	3.00	6.0	2416.1	2431.9	7.90	29.88
1434.0	3.00	6.0	2406.4	2422.1	7.88	29.84
1440.0	2.00	5.0	2395.7	2411.4	7.85	29.81
1446.0	2.00	4.0	2384.0	2399.7	7.82	29.77
1452.0	2.00	4.0	2372.5	2388.0	7.79	29.73
1458.0	2.00	4.0	2361.0	2376.5	7.76	29.70
1464.0	2.00	4.0	2349.5	2365.0	7.73	29.66
1470.0	2.00	4.0	2338.1	2353.5	7.70	29.62
1476.0	2.00	4.0	2326.8	2342.1	7.67	29.58

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-25 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\25-OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1482.0	2.00	4.0	2315.5	2330.8	7.64	29.55
1488.0	2.00	4.0	2304.3	2319.5	7.61	29.51
1494.0	1.00	3.0	2292.1	2307.3	7.57	29.47
1500.0	1.00	2.0	2279.1	2294.1	7.52	29.42
1506.0	1.00	2.0	2266.1	2281.1	7.48	29.38
1512.0	1.00	2.0	2253.3	2268.1	7.44	29.34
1518.0	1.00	2.0	2240.5	2255.3	7.39	29.29
1524.0	1.00	2.0	2227.8	2242.5	7.35	29.25
1530.0	1.00	2.0	2215.2	2229.8	7.31	29.21
1536.0	0.00	1.0	2201.6	2216.2	7.26	29.16
1542.0	0.00	0.0	2187.2	2201.6	7.21	29.11
1548.0	0.00	0.0	2172.9	2187.2	7.16	29.06
1554.0	0.00	0.0	2158.6	2172.9	7.12	29.02

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

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-25 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\25-OUT1 .HYD

Starting Pond W.S. Elevation = 25.00 ft

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

Peak Inflow = 268.00 cfs
Peak Outflow = 54.50 cfs
Peak Elevation = 33.31 ft

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

Initial Storage = 203,029 cu-ft
Peak Storage From Storm = 444,277 cu-ft

Total Storage in Pond = 647,306 cu-ft

Warning: Inflow hydrograph truncated on left side.

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*********************************
*                               *
* JAMES RIVER COMMERCE CENTER   *
*        PROPOSED BMP           *
*      REVISED: 4-17-96         *
*                               *
*                               *
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Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-100 .HYD
Rating Table file: C:\PONDPACK\95016-28\BMP1 .PND

----INITIAL CONDITIONS----
Elevation = 25.00 ft
Outflow = 0.00 cfs
Storage = 203,029 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
25.00	0.0	203,029	1127.9	1127.9
25.50	0.0	223,863	1243.7	1243.7
26.00	2.7	245,359	1363.1	1365.8
26.50	3.8	267,525	1486.3	1490.1
27.00	4.6	290,370	1613.2	1617.8
27.50	5.3	313,904	1743.9	1749.2
28.00	6.0	338,137	1878.5	1884.5
28.50	6.6	363,132	2017.4	2024.0
29.00	7.1	388,952	2160.8	2167.9
29.50	7.6	415,613	2309.0	2316.6
30.00	8.0	443,127	2461.8	2469.8
30.50	8.5	471,494	2619.4	2627.9
31.00	8.9	500,716	2781.8	2790.7
31.50	14.9	530,803	2948.9	2963.8
32.00	16.7	561,768	3120.9	3137.6
32.50	18.2	593,671	3298.2	3316.4
33.00	34.2	626,570	3480.9	3515.1
33.50	67.4	660,479	3669.3	3736.7
34.00	117.2	695,415	3863.4	3980.6
34.50	174.6	731,553	4064.2	4238.8
35.00	212.1	769,074	4272.6	4484.7
35.50	255.2	808,006	4488.9	4744.1
36.00	303.5	848,373	4713.2	5016.7

Time increment (t) = 6.0 min.

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-100 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\100-OUT1.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
660.0	10.00	-----	1127.9	1127.9	0.00	25.00
666.0	11.00	21.0	1148.9	1148.9	0.00	25.09
672.0	13.00	24.0	1172.9	1172.9	0.00	25.19
678.0	14.00	27.0	1199.9	1199.9	0.00	25.31
684.0	16.00	30.0	1229.9	1229.9	0.00	25.44
690.0	19.00	35.0	1264.0	1264.9	0.47	25.59
696.0	21.00	40.0	1301.3	1304.0	1.33	25.75
702.0	34.00	55.0	1351.3	1356.3	2.49	25.96
708.0	48.00	82.0	1426.8	1433.3	3.30	26.27
714.0	61.00	109.0	1527.6	1535.8	4.09	26.68
720.0	121.00	182.0	1699.4	1709.6	5.09	27.35
726.0	230.00	351.0	2037.0	2050.4	6.69	28.59
732.0	348.00	578.0	2598.1	2615.0	8.46	30.46
738.0	348.00	696.0	3258.1	3294.1	18.01	32.44
744.0	236.00	584.0	3664.3	3842.1	88.91	33.72
750.0	146.00	382.0	3782.7	4046.3	131.79	34.13
756.0	101.00	247.0	3773.5	4029.7	128.11	34.09
762.0	75.00	176.0	3727.8	3949.5	110.84	33.94
768.0	59.00	134.0	3675.9	3861.8	92.93	33.76
774.0	50.00	109.0	3630.4	3784.9	77.24	33.60
780.0	41.00	91.0	3591.2	3721.4	65.11	33.47
786.0	38.00	79.0	3555.3	3670.2	57.43	33.35
792.0	34.00	72.0	3525.3	3627.3	51.01	33.25
798.0	32.00	66.0	3500.1	3591.3	45.61	33.17
804.0	29.00	61.0	3478.9	3561.1	41.09	33.10
810.0	28.00	57.0	3461.3	3535.9	37.31	33.05
816.0	26.00	54.0	3446.9	3515.3	34.22	33.00
822.0	25.00	51.0	3432.2	3497.9	32.81	32.96
828.0	24.00	49.0	3418.3	3481.2	31.47	32.91
834.0	23.00	47.0	3404.9	3465.3	30.19	32.87
840.0	22.00	45.0	3392.0	3449.9	28.95	32.84
846.0	21.00	43.0	3379.5	3435.0	27.75	32.80
852.0	20.00	41.0	3367.4	3420.5	26.58	32.76
858.0	19.00	39.0	3355.5	3406.4	25.44	32.73
864.0	18.00	37.0	3343.8	3392.5	24.33	32.69
870.0	18.00	36.0	3333.2	3379.8	23.31	32.66
876.0	17.00	35.0	3323.5	3368.2	22.37	32.63
882.0	17.00	34.0	3314.4	3357.5	21.51	32.60
888.0	16.00	33.0	3306.0	3347.4	20.70	32.58
894.0	16.00	32.0	3298.2	3338.0	19.94	32.55
900.0	16.00	32.0	3291.5	3330.2	19.31	32.53
906.0	16.00	32.0	3286.0	3323.5	18.78	32.52
912.0	15.00	31.0	3280.5	3317.0	18.25	32.50
918.0	15.00	30.0	3274.2	3310.5	18.15	32.48
924.0	14.00	29.0	3267.0	3303.2	18.09	32.46

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-100 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\100-OUT1.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
930.0	14.00	28.0	3259.0	3295.0	18.02	32.44
936.0	14.00	28.0	3251.1	3287.0	17.95	32.42
942.0	13.00	27.0	3242.3	3278.1	17.88	32.39
948.0	13.00	26.0	3232.7	3268.3	17.80	32.37
954.0	12.00	25.0	3222.3	3257.7	17.71	32.34
960.0	12.00	24.0	3211.1	3246.3	17.61	32.30
966.0	12.00	24.0	3200.0	3235.1	17.52	32.27
972.0	12.00	24.0	3189.2	3224.0	17.43	32.24
978.0	11.00	23.0	3177.5	3212.2	17.33	32.21
984.0	11.00	22.0	3165.1	3199.5	17.22	32.17
990.0	11.00	22.0	3152.9	3187.1	17.12	32.14
996.0	11.00	22.0	3140.8	3174.9	17.01	32.10
1002.0	11.00	22.0	3129.0	3162.8	16.91	32.07
1008.0	10.00	21.0	3116.4	3150.0	16.80	32.03
1014.0	10.00	20.0	3103.0	3136.4	16.69	32.00
1020.0	10.00	20.0	3089.9	3123.0	16.55	31.96
1026.0	10.00	20.0	3077.1	3109.9	16.41	31.92
1032.0	10.00	20.0	3064.5	3097.1	16.28	31.88
1038.0	10.00	20.0	3052.2	3084.5	16.15	31.85
1044.0	10.00	20.0	3040.2	3072.2	16.02	31.81
1050.0	10.00	20.0	3028.4	3060.2	15.90	31.78
1056.0	10.00	20.0	3016.9	3048.4	15.78	31.74
1062.0	10.00	20.0	3005.5	3036.9	15.66	31.71
1068.0	9.00	19.0	2993.5	3024.5	15.53	31.67
1074.0	9.00	18.0	2980.7	3011.5	15.39	31.64
1080.0	9.00	18.0	2968.2	2998.7	15.26	31.60
1086.0	9.00	18.0	2955.9	2986.2	15.13	31.56
1092.0	9.00	18.0	2943.9	2973.9	15.00	31.53
1098.0	9.00	18.0	2932.2	2961.9	14.83	31.49
1104.0	9.00	18.0	2921.4	2950.2	14.43	31.46
1110.0	8.00	17.0	2910.3	2938.4	14.02	31.43
1116.0	8.00	16.0	2899.1	2926.3	13.60	31.39
1122.0	8.00	16.0	2888.7	2915.1	13.21	31.36
1128.0	8.00	16.0	2879.0	2904.7	12.85	31.33
1134.0	8.00	16.0	2870.0	2895.0	12.52	31.30
1140.0	8.00	16.0	2861.6	2886.0	12.20	31.28
1146.0	8.00	16.0	2853.7	2877.6	11.91	31.25
1152.0	8.00	16.0	2846.5	2869.7	11.64	31.23
1158.0	8.00	16.0	2839.7	2862.5	11.39	31.21
1164.0	8.00	16.0	2833.4	2855.7	11.15	31.19
1170.0	8.00	16.0	2827.5	2849.4	10.93	31.17
1176.0	7.00	15.0	2821.1	2842.5	10.70	31.15
1182.0	7.00	14.0	2814.2	2835.1	10.44	31.13
1188.0	7.00	14.0	2807.8	2828.2	10.20	31.11
1194.0	7.00	14.0	2801.9	2821.8	9.98	31.09
1200.0	7.00	14.0	2796.3	2815.9	9.77	31.07

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-100 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\100-OUT1.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1206.0	7.00	14.0	2791.2	2810.3	9.58	31.06
1212.0	7.00	14.0	2786.4	2805.2	9.40	31.04
1218.0	7.00	14.0	2781.9	2800.4	9.24	31.03
1224.0	7.00	14.0	2777.7	2795.9	9.08	31.02
1230.0	7.00	14.0	2773.8	2791.7	8.94	31.00
1236.0	7.00	14.0	2770.1	2787.8	8.89	30.99
1242.0	7.00	14.0	2766.3	2784.1	8.88	30.98
1248.0	7.00	14.0	2762.5	2780.3	8.87	30.97
1254.0	7.00	14.0	2758.8	2776.5	8.87	30.96
1260.0	6.00	13.0	2754.1	2771.8	8.85	30.94
1266.0	6.00	12.0	2748.4	2766.1	8.84	30.92
1272.0	6.00	12.0	2742.8	2760.4	8.83	30.91
1278.0	6.00	12.0	2737.1	2754.8	8.81	30.89
1284.0	6.00	12.0	2731.6	2749.1	8.80	30.87
1290.0	6.00	12.0	2726.0	2743.6	8.78	30.86
1296.0	6.00	12.0	2720.4	2738.0	8.77	30.84
1302.0	6.00	12.0	2714.9	2732.4	8.76	30.82
1308.0	6.00	12.0	2709.4	2726.9	8.74	30.80
1314.0	6.00	12.0	2704.0	2721.4	8.73	30.79
1320.0	6.00	12.0	2698.5	2716.0	8.72	30.77
1326.0	6.00	12.0	2693.1	2710.5	8.70	30.75
1332.0	6.00	12.0	2687.8	2705.1	8.69	30.74
1338.0	6.00	12.0	2682.4	2699.8	8.68	30.72
1344.0	5.00	11.0	2676.1	2693.4	8.66	30.70
1350.0	5.00	10.0	2668.8	2686.1	8.64	30.68
1356.0	5.00	10.0	2661.6	2678.8	8.63	30.66
1362.0	5.00	10.0	2654.3	2671.6	8.61	30.63
1368.0	5.00	10.0	2647.2	2664.3	8.59	30.61
1374.0	5.00	10.0	2640.0	2657.2	8.57	30.59
1380.0	4.00	9.0	2631.9	2649.0	8.55	30.56
1386.0	4.00	8.0	2622.9	2639.9	8.53	30.54
1392.0	4.00	8.0	2613.8	2630.9	8.51	30.51
1398.0	4.00	8.0	2604.9	2621.8	8.48	30.48
1404.0	4.00	8.0	2596.0	2612.9	8.45	30.45
1410.0	4.00	8.0	2587.1	2604.0	8.42	30.42
1416.0	4.00	8.0	2578.3	2595.1	8.40	30.40
1422.0	3.00	7.0	2568.6	2585.3	8.37	30.37
1428.0	3.00	6.0	2557.9	2574.6	8.33	30.33
1434.0	3.00	6.0	2547.3	2563.9	8.30	30.30
1440.0	3.00	6.0	2536.8	2553.3	8.26	30.26
1446.0	3.00	6.0	2526.4	2542.8	8.23	30.23
1452.0	3.00	6.0	2516.0	2532.4	8.20	30.20
1458.0	3.00	6.0	2505.6	2522.0	8.16	30.16
1464.0	2.00	5.0	2494.4	2510.6	8.13	30.13
1470.0	2.00	4.0	2482.2	2498.4	8.09	30.09
1476.0	2.00	4.0	2470.1	2486.2	8.05	30.05

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-100 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\100-OUT1.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1482.0	2.00	4.0	2458.1	2474.1	8.01	30.01
1488.0	2.00	4.0	2446.1	2462.1	7.98	29.97
1494.0	2.00	4.0	2434.2	2450.1	7.95	29.94
1500.0	2.00	4.0	2422.4	2438.2	7.92	29.90
1506.0	1.00	3.0	2409.6	2425.4	7.88	29.85
1512.0	1.00	2.0	2395.9	2411.6	7.85	29.81
1518.0	1.00	2.0	2382.3	2397.9	7.81	29.77
1524.0	1.00	2.0	2368.7	2384.3	7.78	29.72
1530.0	1.00	2.0	2355.2	2370.7	7.74	29.68
1536.0	1.00	2.0	2341.8	2357.2	7.71	29.63
1542.0	0.00	1.0	2327.5	2342.8	7.67	29.59
1548.0	0.00	0.0	2312.2	2327.5	7.63	29.54
1554.0	0.00	0.0	2297.1	2312.2	7.59	29.49

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

Pond File: C:\PONDPACK\95016-28\BMP1 .PND
Inflow Hydrograph: C:\PONDPACK\95016-28\FUT-100 .HYD
Outflow Hydrograph: C:\PONDPACK\95016-28\100-OUT1.HYD

Starting Pond W.S. Elevation = 25.00 ft

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

Peak Inflow = 348.00 cfs
Peak Outflow = 131.79 cfs
Peak Elevation = 34.13 ft

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

Initial Storage = 203,029 cu-ft
Peak Storage From Storm = 501,574 cu-ft

Total Storage in Pond = 704,603 cu-ft

Warning: Inflow hydrograph truncated on left side.

James River Commerce Center

9/20/00

BMP #1 Watershed

1. - Original Design Assumption - 54.7 ac

   Ball Metal Expansion Removed
   4.0 ac from BMP Watershed — 4.0

   Total Watershed of BMP 1 50.7 acres

2. Area of Roadways in Watershed of BMP #1

   2180 LF x 80' ROW + 1070 LF x 80' = 5.97 ≈ 6.0 ac.
   (Endeavor Dr.)

3. Runoff Contribution From Roadways As Percentage of Total

   Assume ROW and all lots are 50% Imp.

   $$\frac{\text{ROW Area}}{\text{Total WSHED}} = \frac{6.0}{50.7} = \underline{\underline{11.8\ \%}}$$

James River Commerce Center 7/10/02

Two addl parcels 8 + 9 are going to drain to the existing BMP both are 5 acres each. A portion of 8 was already draining to the existing BMP. What does this make our share of the drainage or runoff now?

DA to BMP

1. From Previous Analysis

Orig. Design	54.7 ac
Ball Metal Exp Removed W/S	- 4.0
	50.7
Addl for Endeavor Drive Exp	0.9
	51.6 ac

2. Area of Roadways in WSHed of BMP #1

Previously computed as 6.0 acres

Ext. of Endeavor Drive

+ other access road

250 LF × 80' ROW +	1.3 ac
450 LF × 80' "	
	7.3 ac

3. Parcel 9 = 5.6 ac

Parcel 8 = 5.4 ac

11.0 ac

Subtract portion already in W/S 1.7 ac

9.3 ac

4. New WS Total =

51.6 ac
9.3
60.9 ac.

5. Runoff Contribution by Source
- assumes ROW + Lots are 50% impervious

a) ROW $\frac{7.3 \text{ ac}}{60.9 \text{ ac}} = 12\%$

b) Parcels 8+9 $\frac{11.0 \text{ ac}}{60.9 \text{ ac}} = 18.1\%$

c) New Part of Parcel 8 - 1.7 ac
Parcel 9 5.6
7.3 ac

$\frac{7.3 \text{ ac}}{60.9 \text{ ac}} = 12\%$

James City County, Virginia
Environmental Division

BMP Inventory & Inspection Program

(SP-82-97; JR 038)

JR038

JR038_JAMES_RIVER_COMMERCE_CENTER - 397

JAMES RIVER BMP #1

	Nor. Pool	Top Dam	Emer Sp.	Low Orif	2nd Orif	Riser
Design	25.0	36.0	33.47	25.0 - 12"	29.96	32.57
As-Built	25.1	35.6 (LP)	33.0	25.1		

	Elev	Out	In
2 yr	29.59'	7.67 cfs	114 cfs
10 yr	32.22	17.36 "	202 "
25 yr	33.31	54.5 "	268 "
100 yr	34.13	131.8 cfs	348 "

1 year storm volume

RCN = 86

Rainfall = 2.8" Runoff = 1.49"

$$\text{Volume} = \frac{1.49''}{12''/ft} \times 54.7ac = 6.79\,acft = 295{,}856\,ft^3$$

Storage Available @ Riser

32.5	-	593,671
25.0	-	203,029
		390,642 ft³

Between Low + ~~High~~ 2nd orifice

30.	-	443,127
25.	-	203,029
		240,098

Release Rate for 1 yr storm

$$\frac{295{,}856\,ft^3}{24\,hr \times 60\,min \times 60} = 3.42\,cfs$$

9" Ø orifice w/ 2.5' avg head will release avg of 3.4 cfs

- max release @ 5' head - 4.8 cfs
- to keep release below 3.4 cfs @ 5' head Ø = 7.6 in.

JAMES RIVER COMMERCE CENTER

JAMES CITY COUNTY, VIRGINIA

CHESAPEAKE BAY PRESERVATION ORDINANCE COMPLIANCE

Job # 88-18-87

MASTER PLAN IS DWG # 4523

1992 REPORT

Accompanied Ches-Bay Compliance Master Plan by RWKB

See attached w/ Division show overlays.

JAMES RIVER COMMERCE CENTER

JAMES CITY COUNTY, VIRGINIA

CHESAPEAKE BAY PRESERVATION ORDINANCE COMPLIANCE

James City County and Williamsburg Developments, Inc. have embarked on a coordinated effort to promote economic development in James City County. This effort has resulted in the proposed James River Commerce Center, involving approximately 220 acres. The land lies in eastern James City County between Carter's Grove Plantation and the entrance road to the BASF/Mann Industries plant, and is bound on the north by U.S. Route 60 and on the south by the upper reaches of Grice's Run and Wood Creek.

Langley and McDonald was asked to review the proposed Master Development Plan as it relates to James City County's Chesapeake Bay Preservation Ordinance. Compliance with that Ordinance had a direct impact on the total development square footage that could be provided within the James River Commerce Center. Compliance with the County's Chesapeake Bay Preservation Ordinance was very dependent upon two primary factors: (1) the area of proposed development for which pollutant reduction treatment could be provided for its stormwater runoff, and (2) the amount of land that would remain in undisturbed natural open space after development was complete.

To meet the requirements of the first factor of Chesapeake Bay Preservation Ordinance compliance, it is necessary to pass large volumes of runoff water through detention ponds or to infiltrate similarly large volumes into porous soils, if they exist. The soils maps do not indicate that such soils underlie the area of the James River Commerce Center, therefore making it necessary to base the stormwater treatment on passing runoff water through detention ponds.

Ponds for this purpose are generally provided in the James City County/Williamsburg area by placing a small dam across the upper reaches of ravines, providing a basin to hold stormwater runoff for the requisite time period needed to provide the required pollutant reduction. These ponds can be either dry ponds or wet ponds, depending upon whether or not they drain completely after a storm event. The wet pond provides a higher degree of pollutant reduction , and is the facility proposed for meeting the Chesapeake Bay Preservation Ordinance requirement at the James River Commerce Center.

As noted previously, the wet pond facility provides a higher level of treatment to the stormwater runoff flowing to it. The higher level of treatment is needed when the area of flow that can be directed to the detention pond is limited by topographic or other factors. In the case of the James River Commerce Center, the area that can be directed to flow to the detention ponds is limited by where in the drainage courses the dams forming the ponds can be located.

JR038_JAMES_RIVER_COMMERCE_CENTER - 400

Placement of the dams beyond certain limits on the drainage courses, results in conflicts with wetlands and many complications presented by the need to obtain various federal and state permits. Because of these factors, the area of the proposed development, from which stormwater runoff can be directed to detention ponds, is limited. Consequently, the wet pond, with its higher level of pollutant reduction removal is needed.

The plan proposed for the James River Commerce Center involves six basins as shown on the Chesapeake Bay Preservation Ordinance Master Plan. The drainage area of each detention pond is shown on this plan.

The other primary component of compliance with the County's Chesapeake Bay Preservation Ordinance, "undisturbed natural open space," is indicated on the Chesapeake Bay Preservation Ordinance Master Plan also.

In addition to water quality improvement provided by the six detention basins, peak flow attenuation will also be provided. The storage volume provided in each basin is in excess of that required for water quality improvement alone. That additional volume will provide for the flow attenuation requirement. More detailed drainage design and planning will be required to determine peak water surface elevations resulting in each basin. Such studies, which are beyond the scope of this review, will be a component of the preliminary road and site design at a later stage of the planning and design process for James River Commerce Center.

The following tables present the data to accompany the Stormwater Management Master Plan:

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TABLE 1

AREA OF DRAINAGE BASINS FOR EACH DETENTION POND

DETENTION POND NUMBER	AREA (AC.)
1	18.8
2*	14.2
3	14.7 (+ 17.2 IN BALL METAL)
4	53.3
5	17.3
6	19.5
TOTAL AREA	137.8 (EXCLUSIVE OF BALL METAL)

*MAY REQUIRE EASEMENT FOR IMPOUNDMENT FROM BASF/MANN INDUSTRIES

TABLE 2

AREA OF UNDISTURBED NATURAL OPEN SPACE

A.	MAJOR WETLAND AND PERIMETER AREAS	55.4 AC.
B.	UPLAND INTERNAL AREAS	
	AREA 1	0.25 AC.
	AREA 2	0.5 AC.
	AREA 3	3.6 AC.
	AREA 4	4.2 AC.
	AREA 5	0.7 AC.
	AREA 6	2.5 AC.
	AREA 7	7.7 AC.
	TOTAL AREA	19.4 AC.

TOTAL UNDISTURBED NATURAL OPEN SPACE
55.4 AC. + 19.4 AC. = 74.8 AC.

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TABLE 3

STORAGE VOLUMES FOR EACH DETENTION POND

POND NUMBER	CONTOUR	AREA (S.F.)	INCREMENTAL VOLUME (C.F.)	TOTAL VOLUME (C.F.)
1	20	40,000		272,000
			185,000	
	15	34,000		87,000
			87,000	
	12	24,000		
2	25	48,000		260,000
			180,000	
	20	24,000		80,000
			80,000	
	15	8,000		
3	35	40,000		145,000
			120,000	
	30	8,000		25,000
			25,000	
	25	2,000		

TABLE 3 (CONTINUED)

STORAGE VOLUMES FOR EACH DETENTION POND

POND NUMBER	CONTOUR	AREA (S.F.)	INCREMENTAL VOLUME (C.F.)	TOTAL VOLUME (C.F.)
4	30	56,000		380,000
			220,000	
	25	32,000		160,000
			115,000	
	20	14,000		45,000
			45,000	
	15	4,000		
5	35	44,000		225,000
			160,000	
	30	20,000		65,000
			65,000	
	25	6,000		
6	30	52,000		350,000
			200,000	
	25	28,000		150,000
			105,000	
	20	14,000		45,000
			45,000	
	15	4,000		

TABLE 4

REQUIRED STORAGE VOLUME FOR A VOLUME EQUAL TO FOUR TIMES THE MEAN STORM RUNOFF

ASSUME MEAN STORM = 0.45 INCHES OF RAINFALL

ASSUME IMPERVIOUS COVER IN EACH BASIN EQUALS 70 PERCENT

VOLUME REQUIREMENT = 4 x MEAN STORM RUNOFF

WHERE

$$\text{MEAN STORM RUNOFF IN AC. FT.} = \frac{(Rm)(Rv)}{12} \times A$$

Rm = VOLUME OF MEAN STORM (0.45 IN.)

Rv = RAINFALL/RUNOFF COEFFICIENT

Rv = 0.05 + 0.009 (IMPERVIOUS PERCENTAGE)

A = AREA OF CONTRIBUTING WATERSHED IN ACRES

DETENTION POND NUMBER	REQUIRED STORAGE VOLUME (C.F.)	AVAILABLE STORAGE VOLUME (C.F.)
1	83,530	272,000
2	63,093	260,000
3	142,000	145,000*
4	237,000	380,000
5	76,865	225,000
6	86,640	350,000

*ADDITIONAL VOLUME FOR FLOW ATTENUATION MAY BE REQUIRED THROUGH EXCAVATION

UNOS #1 UNOS #5

137.8 + 2.5 + 0.7 = 141.0

1. 137.8 DEVELOPED AC.
   6.8 UNDISTURBED NAT. OPEN SPACE AC. (2.5 AC. + 0.7 AC.)
   141.0 AC.

$$\frac{141.0 \text{ AC}}{219.2 \text{ AC.}} = 0.64$$

2. $\frac{7.7 \text{ AC.}}{219.2 \text{ AC.}} = 0.03$ THIS IS AREA DRAINING THROUGH BMP FOR ADJACENT SCHOOL SITE

3. UNDISTURBED NATURAL OPEN SPACE AREAS

MAJOR WETLAND AND PERIMETER AREAS	=	55.4 AC.
UPLAND INTERNAL AREAS	=	+19.4 AC.
		74.8 AC.

$$\frac{74.8 \text{ AC.}}{219.2 \text{ AC.}} = 0.34$$

Geotechnical Engineering Study
BMP Dam and Entrance Road
James River Commerce Center
James City County, Virginia

SCHNABEL
ENGINEERING
ASSOCIATES

Geotechnical Engineering Study
BMP Dam and Entrance Road
James River Commerce Center
James City County, Virginia

Project 963241

June 14, 1996

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EXECUTIVE SUMMARY

The project site is underlain by Windsor formation fluvial-estuarine soils consisting of clayey and silty sands and lean and fat clays. Beneath these soils, sand and clays of the Miocene age Yorktown formation were encountered to the maximum depth of penetration in the test borings. Recent alluvial soils may be encountered in the ravine bottoms at lower elevations on the site.

The embankment may be constructed as a homogenous earth embankment with an excavated key trench along the embankment centerline. Based on the U. S. Bureau of Reclamation criteria given in the text Design of Small Dams, Third Edition (1987), for small homogenous earth dams on stable foundations, the upstream and downstream slopes should be graded no steeper than 3H:1V and 2.5H:1V, respectively.

Based on the subsurface exploration and soil laboratory test data, the soils to be excavated in the pond area for embankment construction are generally expected to consist of lean and fat clays (both with varying amounts of sand) and silty and clayey sands. These soils are expected to be suitable for construction of the embankment. Excavation below the water table may be necessary to establish a pond floor at El 18.

The principal spillway pipe should be prestressed concrete pipe, designed as a pressure pipe and able to with stand the external loads due to the weight of the embankment soils above. A filter-drainage diaphragm should be installed around the principal spillway pipe in the embankment instead of the anti-seep collars shown on the plans. The principal spillway pipe upstream of the filter-drainage diaphragm should be supported on a concrete cradle and the remaining portions supported on suitable natural soils or compacted embankment fill. The riser structure for the principal spillway may be supported on a cast-in-place reinforced concrete mat founded on suitable natural soils or compacted embankment fill.

Toe drains are recommended at the downstream toe of the embankment.

Based on the hand auger probe data, soils along the proposed entrance road right of way are expected to be suitable for the construction of the entrance road. However, these soils will become extremely difficult to grade and compact during periods of wet weather resulting in possible undercutting to maintain suitable subgrade material.

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Appendices:
   Appendix A: Subsurface Exploration Data
   Appendix B: Soil Laboratory Test Results

1. INTRODUCTION

1.1 Scope of Services

The objective of this study is to evaluate the subsurface conditions and to provide recommendations regarding the design of the embankment, riser structure foundations, earthwork, and spillway for the BMP Pond and preliminary earthwork and grading recommendations for the entrance road for the James River Commerce Center Development. The scope of this study is as defined in our proposal for this project dated May 6, 1996 (P63173). Our services included subsurface exploration, field engineering, soil laboratory testing and development of geotechnical engineering recommendations.

1.2 Site Description

The project site is located along the south side of U. S. Route 60, across from the East and West Tarleton Bivouac in James City County, Virginia. The site is bordered to the east and south by the entrance drive to the BASF Facility and the BASF Facility, respectively. The area is made up of over 200 acres of open and wooded tracts. Grades generally slope down toward the south from about El 68 to 70 in the northern area along U. S. Route 60 to about El 2 along the southern boundary. The site is divided by three north/south trending drainage ravines formed by unnamed tributaries to Grices Run located near the southwest corner of the site.

The site for the proposed BMP Pond is located in a wooded area at the northern end of the middle tributary and about 2,200 ft south of U. S. Route 60. The embankment for the pond is to be constructed across the end of two small ravines. Grades generally slope down from about El 38 at the top of the ravines to the southeast and southwest respectively, to about El 16 near the area of the downstream toe of the proposed embankment. The western ravine was generally dry at the time of our site visit and some wet areas were observed along the bottom of the eastern ravine. No flowing water was observed. Grades in the pond area vary from about El 30 to 37.

We obtained the site information from the topographic site plan (Preliminary Master Plan) revised dated December 12, 1995, prepared by Langley and McDonald, P.C., and through our site visits.

1.3 Proposed Construction

The James River Commerce Center is to be a commercial development of over 200 acres, comprised of about 17 parcels ranging in size from about 4.6 to 47.8 acres. To meet storm water-runoff requirements, a BMP Pond is to be constructed near the central area of the Commerce Center. The pond is to have a normal pool at El 25 An earth embankment dam approximately 16 ft high, with a crest width of about 12 ft and a crest length of about 200 ft is proposed for construction. Upstream and downstream slopes of 3H:1V are planned for the embankment. A 6 ft wide bench at about El 24 is planned for the upstream slope. The embankment is proposed as a zoned structure with a clay core and a 6 ft wide, 3 ft minimum depth key trench.

The principal spillway is to consist of 106 linear ft of 36 inch diameter, Class III RCP through the embankment with invert grades at the upstream and downstream ends of El 19.0 and El 16.5, respectively. Three, precast, 7 ft square, anti-seep collars are proposed for installation at 24 ft intervals along the principal spillway pipe starting at the upstream end about 3.5 ft downstream of the riser structure. The upstream riser structure will be constructed with 60 inch diameter precast concrete pipe sections with an anti-votrex cap and top of riser grade at El 32.57. The emergency spillway is to be a riprap lined, excavated channel in the right abutment, around the embankment to the downstream toe.

An entrance road approximately 1.1 miles in length is proposed from U. S. Route 60 into the site. Approximately 1,600 ft of the road was evaluated for this study. Grades along the 1,600 ft section of roadway vary from about El 68 near U. S. Route 60 to El 54 approximately 1,600 ft south of U. S. Route 60.

Project details discussed above were obtained from the Preliminary Master Plan (Sheet 1A, 12/19/95), the Entrance Road Plan (Sheet 10,4/4/96) and the BMP Details Plan (Sheet 10B, 4/4/96). These plans were developed by Langley and McDonald, P.C.

2. DATA COLLECTION AND ANALYSIS

2.1 Geology

We reviewed existing geologic data and information in our files. Based on this review, the geologic stratigraphy in the vicinity of the site, from the ground surface down, consists of recent alluvial soils underlain by Pleistocene age Windsor formation soils. These soils are underlain by the Miocene age Yorktown formation soils that extend to depths in excess of several hundred feet.

The recent alluvial soils are expected to consist of silts, clays and sands generally of low to moderate strength and higher compressibility. The Windsor formation terrace deposits are fluvial-estuarine soils which typically consist of a poorly-sorted mixture of sand, clay and gravel exhibiting moderate strength and compressibility. The Miocene age Yorktown formation consists of marine-deposited sediments typically containing shell fragments. These soils exhibit moderate to high strength and low compressibility.

The above stratigraphy is typical in this area of James City County. In the immediate vicinity of the project site, some recent alluvial soils may be encountered in the ravine bottoms. On the remainder of the site the above strata have been encountered at the test boring and hand auger locations.

2.2 Data Collection Techniques

Four test borings were drilled at the embankment dam site under our observation by Ayers and Ayers, Inc. of Powhatan, Virginia. Additionally, personnel from our office excavated two hand auger probes at the embankment dam site and six hand auger probes in the entrance road right-of-way during our site visits. Specific observations, remarks, and logs for the borings and hand auger probes, classification criteria and sampling protocols are included in Appendix A. Approximate test boring and hand auger probe locations are shown in Figures A1 and A2 in Appendix A. Soil samples will be retained up to 45 days beyond the issuance of this report, unless other disposition is requested.

Our soils laboratory conducted tests on selected samples obtained in the test borings and hand auger probes. This testing aided in the classification of soils encountered in the subsurface exploration and provided data for use in the development of foundation and earthwork recommendations. The natural moisture content values of selected soil samples are shown in the logs in Appendix A. The results of the remaining laboratory tests are presented in Appendix B.

2.3 Generalized Subsurface Stratigraphy

We have characterized the following generalized subsurface soil stratigraphy based on the test boring and hand auger probe data presented in Appendix A:

Topsoil: Approximately 0.1 to 0.6 ft of forest litter and topsoil was encountered at the test boring and hand auger probe locations in the embankment dam area. Along the entrance road, approximately 0.2 to 0.8 ft of forest litter and topsoil was encountered at the hand auger probe locations.

Stratum A: Stratum A consists of loose to firm density fine to coarse SILTY SAND (SM) and CLAYEY SAND (SC). These soils were encountered in all the borings and the hand auger probes from the ground surface and interbedded with Stratum B to depths of 2 to 14 ft. N values from 4 to 14 were recorded in this stratum. These soils represent the coarse-grained portion of the Windsor formation soils.

Stratum B: Stratum B consists of medium to very stiff consistency LEAN CLAY (CL) and FAT CLAY (CH) with varying amounts of sand. Stratum B was encountered below the ground surface and interbedded with Stratum A to depths of 4 to 12 ft in the borings and hand auger probes. Standard Penetration Test N values from 5 to 18 were recorded in this stratum. Stratum B soils are fluvial-estuarine sediments and representative of the fine-grained soils of the Windsor formation. Laboratory tests conducted on two samples from this stratum indicated that they contained about 70 to 88 percent by weight of material finer than the No. 200 sieve. Using correlations with permeability and grain size, we anticipate that these soils will be of relatively low permeability.

Stratum C: Stratum C consists of medium consistency SANDY LEAN CLAY (CL), SANDY FAT CLAY (CH) and SANDY SILT (ML) containing shell fragments. Stratum C was encountered below Strata A and B to a depth of 15 ft (maximum depth of penetration) in Borings B-1 and B-3 and to a depth of 17 ft in Boring B-2. Standard Penetration Test N values from 6 to 8 were recorded in this stratum. Stratum C soils are marine sediments and representative of the fine-grained soils of the Yorktown formation.

Stratum D: This stratum consists of generally firm density fine to coarse SILTY SAND (SM) and CLAYEY SAND (SC) containing shell fragments. N values from 10 to 13 were recorded in this stratum. These soils were encountered below Stratum C to the maximum depth of penetration (30 ft) in Boring B-2 and in Hand Auger HA-8 to a depth of 6 ft, the maximum depth of penetration. This stratum was not encountered in the other borings or hand auger probes. These soils are representative of the coarse-grained

fraction of the Miocene age Yorktown formation. Like the Stratum C soils, soils from this formation are typically sensitive to disturbance, loosing their strength upon remolding. Therefore, the Standard Penetration Test values are typically not representative of the soils' undisturbed higher strength and lower compressibility.

2.4 Ground Water

Water level readings which were obtained in the borings during and after completion are noted in the logs. We observed ground water during drilling in two of the borings (B-2 and B-3) at depths of 19.0 and 7.0 ft, respectively and in Hand Auger HA-8 at a depth of about 4 ft. Following removal of the augers, test borings caved dry at depths of 1.2 to 2.6 ft. A water observation well was installed in Boring B-2. We recorded a ground water level in the well at a depth of 6.7 ft, El 18.3, three days after completion of the drilling. We did not obtain long-term water level readings as the remaining test borings and hand auger probes were backfilled upon completion for safety.

The ground water levels on the logs show our estimate of the hydrostatic water table at the time the borings were drilled. Fluctuations in the hydrostatic water table should be anticipated depending on variations in precipitation, surface runoff, pumping, evaporation, stream levels and similar factors.

During wetter times of the year, higher water levels representing a perched ground water condition may occur. Perched ground water can occur when infiltration of surface water is retarded by a lower permeability layer such as the clays of Stratum B.

3. GEOTECHNICAL RECOMMENDATIONS

3.1 Discussion

We have reviewed the BMP Details plan dated April 4, 1996 for the proposed embankment. The recommendations in this report including a homogeneous earth embankment, installation of a toe drain and the use of a filter diaphragm represent recommended changes in the proposed structure.

The soils for construction of this BMP embankment dam are expected to be excavated from the pond area upstream of the embankment. Excavation depths up to about 11 ft in the pond are planned to grade the pond bottom to El 18. Ground water was not encountered above El 18 at the riser structure location (Boring B-4). However, ground water was recorded at about El 18 at the center of the embankment (Boring B-2) and some surface water was observed in the ravine toward the left (east) abutment. Excavation below the water table may be necessary to establish a pond floor at El 18.

Based on the subsurface exploration and soil laboratory test data, the excavated soils are generally expected to consist of lean and fat clays (both with varying amounts of sand) and silty and clayey sands. These soils are expected to be suitable for construction of the embankment. Soils for impounding structures are generally best suited when their moisture contents are at or slightly above optimum moisture content at the time of placement. Therefore, depending on the time of year that construction proceeds, it may be necessary to provide some moisture conditioning for these soils. This conditioning may include scarifying, aerating and drying during wetter times of the year, or during dry periods it may be necessary to add moisture to achieve adequate compaction.

We believe that most of the soils for embankment construction will consist of the fine grained soils of Stratum B. Therefore, a homogenous dam is recommended since the soils anticipated for construction will be generally low permeability clays and silts. This is based on the soil types encountered during the subsurface exploration. However, we recommend that the finer grained cohesive soils of Stratum B be placed nearer to the central area of the embankment during construction. The sandier soils of Stratum A should be placed toward the upstream and downstream slopes. The embankment should be constructed with compacted embankment fill as described in Section 3.3.

The principal spillway pipe should be prestressed concrete pipe, designed as a pressure pipe and able to withstand the external loads due to the weight of the embankment soils above. A filter-drainage diaphragm should be installed around the principal spillway pipe

in the embankment instead of the anti-seep collars shown on the plans. The primary problem associated with anti-seep collars relates to construction quality control. It is very difficult to obtain the required quality of backfill adjacent to anti-seep collars. Anti-seep collars are not recommended as the method for the control of seepage through earth and rockfill dams by the designers of major dams, including the Soil Conservation Service, the U. S. Bureau of Reclamation and the U. S. Army Corps of Engineers.

The principal spillway pipe upstream of the filter-drainage diaphragm should be supported on a concrete cradle. The remaining portions of the pipe should be supported on drainage materials on suitable natural soils or compacted embankment fill. The filter diaphragm should be installed around the principal spillway pipe one-third of the distance upstream from the dam toe. The filter should extend to the toe as indicated in Section 3.4. The riser structure for the principal spillway may be supported on a cast-in-place reinforced concrete mat founded on suitable natural soils or compacted embankment fill.

Toe drains are recommended at the downstream toe of the embankment. They may be terminated at about El 22 at each abutment. The toe drains may outlet into the plunge pool of the principal spillway or may be tied into the spillway drainage-filter diaphragm system.

Based on the hand auger probe data, soils along the proposed entrance road right of way are expected to be suitable for the construction of the entrance road. However, these soils will become extremely difficult to grade and compact during periods of wet weather resulting in possible undercutting to maintain suitable subgrade material. California Bearing Ratio (CBR) values for soils encountered of between about 2 and 8 are considered reasonable for planning.

3.2 Stability Evaluation and Embankment Configuration

Based on the U. S. Bureau of Reclamation criteria given in the text Design of Small Dams, Third Edition (1987), for small homogenous earth dams on stable foundations, the upstream and downstream slopes of the dam should be built no steeper than 3H:1V and 2.5H:1V, respectively. These slopes consider the soil types encountered in the test borings and classified in the soils laboratory. A minimum crest width of at least 10 ft should be maintained. The proposed embankment includes up and downstream slopes of 3H:1V and a crest width of 12 ft.

The embankment may be constructed as a homogenous earth embankment with an excavated key trench along the embankment centerline. However, we recommend that

the fine-grained cohesive soils (Stratum B) be placed in the key trench and nearer to the central area of the embankment during construction. The key trench should be excavated to a depth of at least 3 ft along the abutments and across the ravine bottom. Where sands of Stratum A are encountered, it may be necessary to excavate the key trench through these soils but not deeper than about 6 ft. The width of the key trench should be at least 8 ft in the abutments and across the ravine floor to provide adequate width for proper placement and compaction of the embankment fill. The contractor should be prepared to dewater key trench subgrades in the ravine floor area to facilitate placement of compacted embankment fill.

3.3 Earthwork and Grading (Embankment Dam)

3.3.1 Subgrade Preparation

Topsoil was encountered to depths of about 0.1 to 0.6 ft at the test boring and hand auger probe locations along the center line of the proposed embankment and the alignment of the principal spillway conduit. However, stripping of wooded sites typically results in some disturbance and contamination of near-surface soils, particularly during periods of wet weather. Therefore, we recommended a topsoil stripping depth of 1.0 ft be considered for project planning.

The excavation for the principal spillway pipe should be wide enough to provide adequate access for the installation of the 36 inch diameter pipe and for proper placement and compaction of the embankment fill. Where necessary, the excavation should be benched on a slope not steeper than 2H:1V with bench heights not exceeding 18 inches.

Principal spillway subgrades, key trench and embankment subgrades should be stripped of all topsoil, organic matter, debris, soft or loose natural soils, etc. Stripped and undercut subgrades should be proofrolled with a loaded dump truck under the observation of the Geotechnical Engineer to detect any areas of weak soils which may exist. Areas which exhibit excessive pumping, weaving, or rutting should be excavated and replaced with compacted embankment fill as recommended by the Geotechnical Engineer. Proofrolling may be waived by the Geotechnical Engineer depending on subgrade conditions and site access.

Recent alluvial soils consisting of loose density sands and sort consistency clays are expected to be encountered during embankment construction in both ravine bottoms based on geostick penetrations recorded in these areas during our site visits. Undercut depths of between 2 to 3 ft should be anticipated to reach suitable embankment subgrades

in these areas. However, the actual extent and depth of undercut needed should be evaluated in the field by the Geotechnical Engineer.

3.3.2 Compacted Embankment Fill

Compacted embankment fill should consist of material classifying CH, CL, ML, SC, or SM per ASTM D-2487. Non-organic on-site soils are expected to meet this criteria. The natural moisture contents of the soils tested at the site were generally expected to be at or above the optimum moisture content values based on the soil types encountered for this study. However, the contractor should be prepared to provide moisture conditioning, either wetting or drying of soils to achieve adequate compaction. Off-site borrow soils are not expected to be required.

Compacted embankment fill should be placed in horizontal, loose lifts not exceeding 8 inches in thickness and should be compacted to at least 95 percent of maximum dry density per ASTM D-698, Standard Proctor. Soil moisture contents should be maintained at about optimum to 3 percent above optimum during placement and compaction. Where smooth drum or plate type compaction equipment is used, each lift should be scarified to a depth of 3 inches prior to placement of successive lifts of compacted embankment fill. Compacted fill subgrades steeper than 4H:1V should be benched to allow placement of horizontal lifts.

3.4 Principal Spillway

3.4.1 Riser Foundations

We recommend the spillway riser may be supported on a reinforced concrete mat founded on suitable natural soils of Strata C or D. Any soft or loose soils encountered at the riser structure footing subgrade should be undercut as recommended by the Geotechnical Engineer. Riser structure subgrades needing undercut should be concreted at the elevation of undercut The riser structure may be designed for its distributed contact pressure provided that it does not exceed a net allowable soil bearing pressure of about 2,000 psf. This allowable soil bearing pressure provides a factor of safety of at least three against general shear failure.

Riser structure subgrades should be observed by the Geotechnical Engineer. Any unsuitable soft or loose soils should be excavated from the foundation subgrades as recommended by the Geotechnical Engineer. Where ground water is encountered in foundation excavation, a mud mat working platform consisting of 4 to 6 inches of lean

concrete may be recommended by the Geotechnical Engineer for placement. This working platform may be recommended to reduce the disturbance of these soils prior to placement of reinforcing steel and foundation concrete.

Settlements of the riser structure foundations supported on suitable natural soils are expected to be negligible since the weight of the structure is expected to be nearly equal to the weight of soil excavated for its construction. However, the riser is expected to settle with the embankment.

3.4.2 Principal Spillway Pipe and Filter-Drainage Diaphragm

The principal spillway pipe upstream of the filter-drainage diaphragm (discussed below) should be supported on a concrete cradle founded on suitable natural soils. The downstream third of the pipe may be supported on subdrain material as discussed below and as shown on Figures 1 and 2. The cradle should extend to the spring line of the pipe. The sides of the cradle should not be vertical but be sloped at about 1H:10V to facilitate adequate compaction against the structure. Cradle joints should be provided to match pipe joints. The pipe should be designed to be watertight under the maximum internal hydraulic pressure and the maximum external embankment load of about 1.0 tsf.

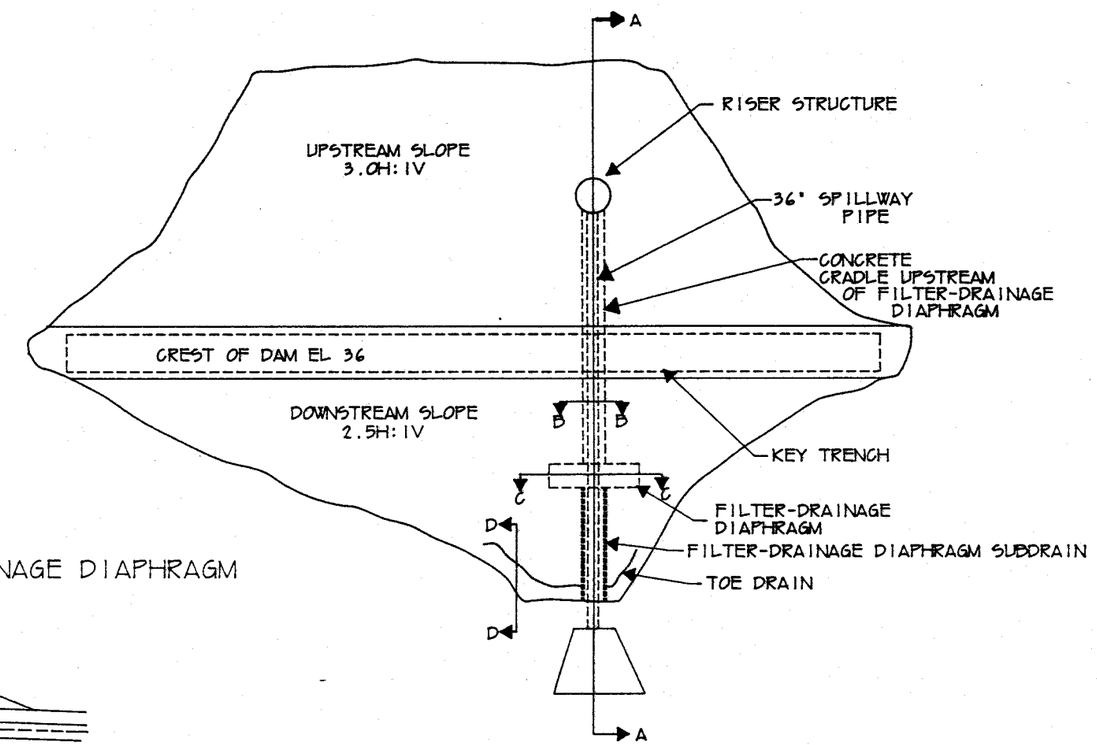
Joints of the precast pipe sections should be designed to allow for rotation and extension due to settlement of the embankment foundation and should incorporate water tight gaskets. The length of the joint must allow for the estimated extension due to these movements plus a factor of safety of at least 0.5 inch in joint length. Joints should also be wrapped with a geotextile extending at least 12 inches on both sides of the joint. We recommend that the pipe not have pick-up holes. However, if such holes are in the pipe delivered to the site, holes should be patched and covered with geotextile to prevent erosion of soil into the pipe.

The principal spillway pipe should be laid with a convex camber having a maximum vertical elevation at the dam centerline of about 3 inches above the horizontal. This upward camber is recommended to compensate for estimated settlements near the embankment center of about 3 inches due to the weight of the embankment fill placed after the pipe is in position.

Sufficient clearance should be provided for standard compaction equipment access during placement of compacted embankment fill along the spillway pipe. The embankment fill should be ramped against the pipe on a maximum slope of 1H:6V to improve the compactive effort. Where access is limited, thinner lift thicknesses, hand compaction and

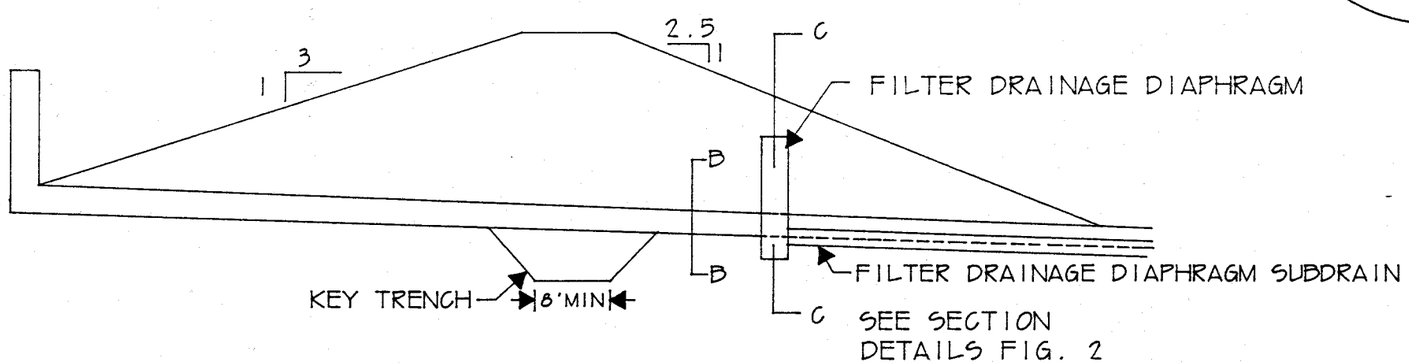
DAM PROFILE AND PLAN

PLAN



PROFILE

SECTION A-A



SCHNABEL ENGINEERING ASSOCIATES [redacted]

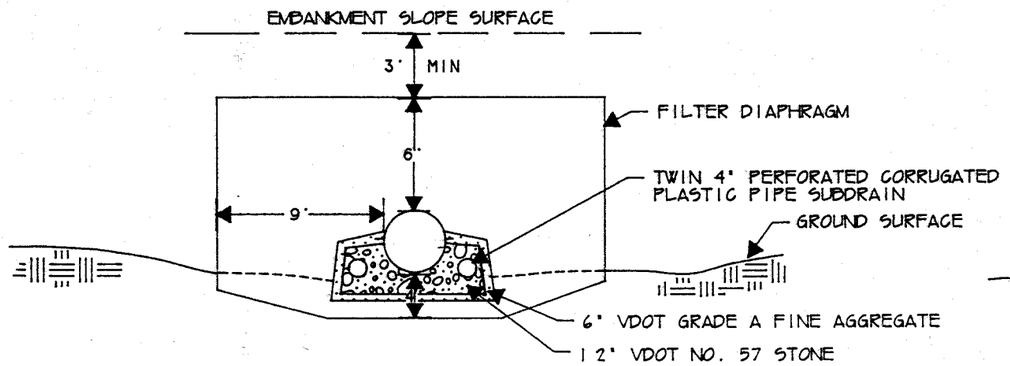
BMP DAM, JAMES RIVER COMMERCE CENTER

JAMES CITY COUNTY, VIRGINIA

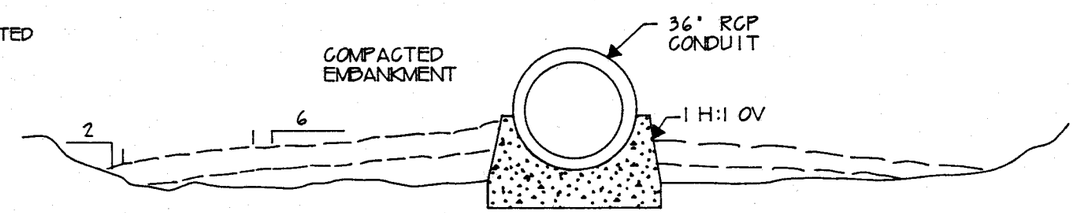
DAM DETAILS	SCALE NONE	DATE 6-14-96	REVISED DATE
	DRAWN BY VAM	CHECKED BY GS	REVISED DATE
	CONTRACT NO. 96324	FIGURE 1	REVISED DATE

FILTER-DRAINAGE DIAPHRAGM, PRINCIPAL SPILLWAY DETAILS, AND TOE DRAIN DETAILS

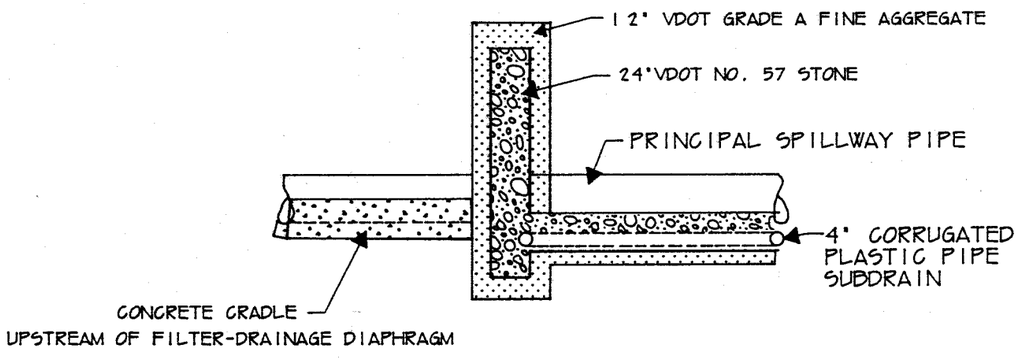
FILTER DIAPHRAGM SECTION
SECTION C-C



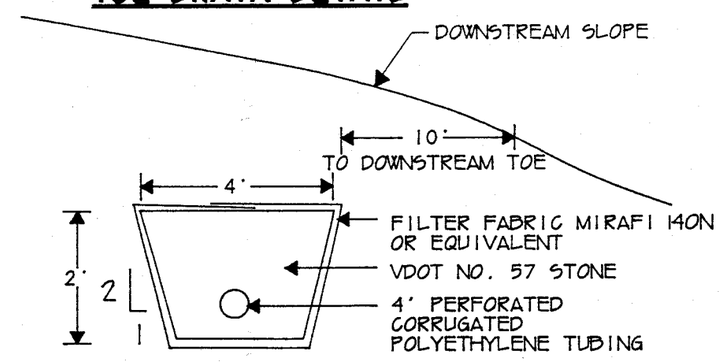
BACKFILL DETAIL
CRADLE ON SOIL FOUNDATIONS
SECTION B-B



FILTER-DRAINAGE DIAPHRAGM DETAIL



TOE DRAIN DETAIL



SCHNABEL ENGINEERING ASSOCIATES [redacted]

BMP DAM, JAMES RIVER COMMERCE CENTER
JAMES CITY COUNTY, VIRGINIA

DAM DETAILS	SCALE NONE	DATE 6-14-96	REVISED DATE
	DRAWN BY VAM	CHECKED BY GS	REVISED DATE
	CONTRACT NO. 963241	FIGURE 2	REVISED DATE

tight control on material quality will be necessary. Where trench excavation of the spillway pipe is necessary, cut slopes should not exceed 2H:1V as discussed in Section 3.3.1.

A filter-drain diaphragm should be installed around the spillway pipe at the one-third point from the downstream end. The filter diaphragm should consist of a 2 ft thick vertical layer of VDOT No. 57 stone surrounded by a 1 ft thick layer of VDOT Grade A fine aggregate. The filter diaphragm should extend at least 6 ft above the top of the pipe, 4 ft below the invert of the pipe, and 9 ft perpendicular to the pipe, toward each abutment. The filter diaphragm should be connected to a subdrain extending along the bottom of the downstream third of the spillway pipe. The subdrain should consist of a 12 inch layer of VDOT No. 57 stone underlain by a 6 inch layer of VDOT Grade A fine aggregate. This subdrain may also act as pipe bedding for the length of spillway pipe downstream of the filter-drain diaphragm. Twin 4-inch diameter slotted polyethylene tubing meeting the requirements of ASTM F-405 should be embedded in this drain on each side of the principal spillway pipe. Details of the filter-drain diaphragm and subdrain are shown on Figures 1 and 2.

3.5 Toe Drain

A toe drain consisting of slotted, corrugated tubing surrounded by coarse-graded aggregate wrapped by a geotextile should be installed at the downstream toe of the embankment. The toe drain should extend laterally to about El 22 on the abutments of the dam. The toe drain should outlet into the plunge pool at the outfall of the principal spillway or it may be outletted into the end of the filter-drain diaphragm subdrain.

The coarse-graded aggregate should consist of VDOT No. 57 size aggregate. The filter fabric should be a non-woven geotextile such as Mirafi 140N or equivalent. The toe drain should consist of a 4-inch slotted polyethylene tubing meeting the requirements of ASTM F-405. The minimum over all dimensions of the toe drain section are 4 ft wide by 2 ft thick.

3.6 Preliminary Entrance Road Evaluation

Subgrades to receive compacted structural fill for pavement support or compacted base course material should be stripped of vegetation, topsoil and organic matter. Our subsurface exploration indicated topsoil to depths of 0.2 to 0.8 ft below the ground surface. However, as previously described in Section 3.3.1, stripping of wooded or previously cultivated sites typically results in some disturbance and contamination of

near-surface soils, particularly during periods of wet weather. Accordingly, we recommend a topsoil stripping depth of 1.0 ft be considered along the entrance road for project planning. Actual stripping depths should be evaluated by the Geotechnical Engineer during construction.

Based on the limited hand auger probe data, we believe that undercutting of entrance road subgrades will be limited. Therefore, before any excavation below design subgrade level, the stripped subgrades should be proofrolled with a loaded dump truck (or scraper) under the observation of the Geotechnical Engineer. Areas which exhibit excessive pumping, weaving, or rutting should be excavated and replaced with compacted structural fill as recommended by the Geotechnical Engineer. Poor site drainage or grading during periods of wet weather may lead to disturbance and undercutting of pavement subgrades because these soils are extremely sensitive to changes in moisture.

Disturbed soft or loose near-surface soils could possibly be recompacted if earthwork is performed in the drier, warmer summer months. However, some scarifying and drying may be needed to recompact these soils.

California Bearing Ratio (CBR) values between about 2 to 8 may be considered for the soils along the entrance road when planning pavement requirements. Actual CBR values should be obtained for use in final pavement design.

Adequate control of surface drainage will be a very important consideration for the overall development related to the pavement design. The area surrounding pavements should be graded to direct surface water away from paved areas. Utility excavations within pavement areas should be backfilled with compacted structural fill.

Pavement subdrains or drainage ditches should be provided in cut areas where grades slope toward the pavement. The invert grade of ditches should be at least 1 ft below the pavement subgrade level. Pavement subdrains should be daylighted or connected to a storm sewer.

4. CONSTRUCTION CONSIDERATIONS

4.1 Earthwork

Site drainage should be provided to maintain subgrades free of water and to avoid saturation and disturbance of the subgrade soils prior to placing cradle concrete or embankment fill. This will be important during all phases of the construction work. Any subgrade soils which have been weakened due to saturation or disturbance should be removed as recommended by the Geotechnical Engineer.

The on-site soils are generally moisture sensitive and will be difficult to compact under wet weather conditions.

Care should be exercised during excavation for the principal spillway conduit so as little disturbance as possible occurs at the subgrade level. All loose or soft soils should be carefully cleaned from the excavation prior to placing cradle concrete or drainage layer material. Actual subgrades should be observed during construction by the Geotechnical Engineer.

Temporary dewatering may be necessary during construction of the spillway and key trench excavations, particularly near the downstream sections. Pumping from sumps from within the excavation or construction of temporary dikes and pumping water over the dikes may also be possible for controlling water. Temporary dewatering may also be required during excavation in the pond area.

We also recommend that the project specifications indicate the contractor's responsibility for providing adequate site drainage during construction. Inadequate drainage will most likely lead to disturbance of soils by construction traffic and increased volume of undercut.

It is difficult to accurately predict the subgrade conditions which will be encountered during construction based on the amount of data typically obtained during a geotechnical engineering design phase study. Our recommendations are intended as guidelines, and modifications will probably be necessary at the time of construction. Full-time, on-site observation during subgrade preparation should be provided by our firm so that we can provide further recommendation during this phase of the project. Unit prices and a contingency allowance should be provided to account for possible modifications.

4.2 Riser Structure Foundations

Care should be exercised during excavation for the riser structure mat foundation so that as little disturbance as possible occurs at the foundation level. All loose or soft soils should be carefully cleaned from the bottom of the excavation prior to placing concrete. Actual mat subgrades should be observed during construction by the Geotechnical Engineer so that subgrade soils meet the requirements as recommended herein.

Depending on riser structure foundation grades, ground water may be encountered during excavation for the mat. We anticipate that ground water can be controlled by pumping from sump pits within the mat excavation.

4.3 Engineering Services During Construction

The engineering recommendations provided in this report are based on the information obtained in the subsurface exploration and laboratory testing program. However, unlike other engineering materials like steel and concrete, the extent and properties of geologic materials (soil and rock) may vary significantly. Therefore, conditions on the site may vary between the discrete locations observed at the time of our subsurface exploration. The nature and extent of variations between borings may not become evident until during construction. To account for this variability, professional observation, monitoring and testing of actual subsurface conditions during all earthwork phases of the work including: embankment construction and slope grading, principal spillway installation, filter-drainage diaphragm and toe drain installation construction should be provided as an extension of our engineering services. These services will also help in evaluating the Contractor's conformance with the plans and specifications. Because of our unique position to understand the intent of the geotechnical engineering recommendations, retaining us for these services will allow us to provide consistent service through the project construction.

4.4 General Specification Recommendations

An allowance should be established to account for possible additional costs that may be required to construct earthwork and foundations as recommended in this report. Additional costs may be incurred for various reasons including variation of soil between borings, greater than anticipated unsuitable soils, need for borrow fill material, wet on-site soils, obstructions, rock excavation, temporary dewatering, etc.

This report may be made available to prospective bidders for informational purposes. We would recommend that the project specifications contain the following statement:

> "A geotechnical engineering report has been prepared for this project by Schnabel Engineering Associates. This report is for informational purposes only and should not be considered part of the contract documents. The opinions expressed represent the Geotechnical Engineer's interpretation of the subsurface conditions, tests, and the results of analyses conducted. Should the data contained in this report not be adequate for the Contractor's purposes, the Contractor may make, before bidding independent exploration, tests and analyses. This report may be examined by bidders at the office of the Engineer or copies may be obtained from the Engineer at nominal charge."

Test boring and hand auger data included in Appendix A should be included in the contract documents.

We recommend that the construction contract include unit prices for scarifying and drying wet and/or loose subgrade soils, and provide an allowance for this work. In addition, the construction contract should include an allowance for undercutting soft or loose, near-surface soils and replacement with compacted structural fill. Add/deduct unit prices should also be established in the contract so adjustments for the actual volume of undercut can be made.

The project specifications should indicate the Contractor's responsibility for providing adequate site drainage during construction. Inadequate drainage will most likely lead to disturbance of soils by construction traffic and increased volume of undercut.

5. LIMITATIONS

The analyses and recommendations submitted in this report are based on the information revealed by our exploration. An attempt has been made to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction.

This report has been prepared to aid in the evaluation of this site and to assist in the design of the project. It is intended for use concerning this specific project. Our recommendations are based on information on the site and proposed construction as described in Sections 1.2 and 1.3. Substantial changes in locations or grades should be brought to our attention so we can modify our recommendations as needed. We would appreciate an opportunity to review the plans and specifications as they pertain to the recommendations contained in this report and to submit our comments to you based on this review.

We have prepared this report according to generally accepted geotechnical engineering practices. No other warranty, express or implied, is made as to the professional advice included in this report.

SUBSURFACE EXPLORATION DATA

Subsurface Exploration Procedures
General Notes for Subsurface Exploration Logs
Identification of Soil
Test Boring Logs, B-1 through B-4
Hand Auger Logs, HA-1 through HA-8
Location Plans, Figures A1 and A2

SUBSURFACE EXPLORATION PROCEDURES

Test Boring Procedure

The borings were advanced by turning a hollow-stem auger. A plug device was used to block off the center opening in the hollow-stem auger to prevent cuttings from entering the augers during drilling. At the designated depth, drillers removed the plug and performed the Standard Penetration Test, as defined below. Water or drilling fluid was not introduced into the boring using this procedure, unless indicated on individual logs. Water level data are indicated on the logs.

Standard Penetration Test Results

The numbers in the Sampling Data Column of the boring logs represent Standard Penetration Test (SPT) results. Each number represents the blows needed to drive a 2-inch O.D., 1-3/8 inch I.D. split-spoon sampler 6 inches, using a 140-pound hammer falling 30 inches. The sampler is typically driven a total of 18 inches. The first 6 inches are considered a seating interval. The total of the number of blows for the second and third 6-inch intervals is the SPT N value. The Standard Penetration Test is conducted per ASTM D-1586.

Hand Auger Probes

Our personnel excavated hand auger probes using a 3-inch O.D. hand auger. We visually classified the soil encountered according to ASTM D-2487. Geostick Penetrometer readings were taken during excavation. Geostick Penetrometer readings give a general indication of the soil's in place density or consistency. Geostick penetrations are shown in the Remarks Column as "GP= ".

Soil Classification Criteria

The group symbols on the boring and hand auger logs represent the Unified Soil Classification System Group Symbols (ASTM D-2487) based on visual observation and limited laboratory testing of the samples. Criteria for visual identification of soil samples are included in this appendix. Some variation may be expected between samples visually classified and samples classified in the laboratory.

Pocket Penetrometer Results

The values following "PP=" in the remarks column of the boring logs represent pocket penetrometer readings. Pocket penetrometer readings provide an estimate of the unconfined compressive strength and undrained shear strength of fine-grained soils.

Water Observation Well

A temporary water observation well was installed in Boring B-2 by inserting a hand-slotted, 1¼-inch PVC pipe in the boring. The pipe was capped and area surrounding the pipe was backfilled with cuttings from the test boring.

Test Boring and Hand Auger Probe Location and Elevation Survey

Our personnel located test borings and hand auger probes by taping from the embankment dam centerline and entrance road centerline located in the field by Langley and McDonald, P.C. Approximate test boring and hand auger probe locations are shown in Figure A1. Ground surface elevations at the test boring and hand auger probe locations were scaled from the site plans by Langley and McDonald, P.C. dated December 12, 1995 and April 4, 1996. These locations and elevations should be considered no more accurate than the methods and plans used to obtain them.

SCHNABEL ENGINEERING ASSOCIATES, INC.

GENERAL NOTES FOR SUBSURFACE EXPLORATION LOGS

1. NUMBERS IN SAMPLING DATA COLUMN NEXT TO STANDARD PENETRATION TEST (SPT) SYMBOLS INDICATE BLOWS REQUIRED TO DRIVE A 2 INCH O.D., 1-3/8 INCH I.D. SAMPLING SPOON 6 INCHES USING A 140 POUND HAMMER FALLING 30 INCHES. THE STANDARD PENETRATION TEST N VALUE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE THE SAMPLER 12 INCHES, AFTER A 6 INCH SEATING INTERVAL. THE STANDARD PENETRATION TEST IS PERFORMED IN ACCORDANCE WITH ASTM D-1586.

2. VISUAL CLASSIFICATION OF SOIL IS IN ACCORDANCE WITH TERMINOLOGY SET FORTH IN "IDENTIFICATION OF SOIL." THE ASTM D-2487 GROUP SYMBOLS (e.g. CL) SHOWN IN THE CLASSIFICATION COLUMN ARE BASED ON VISUAL OBSERVATIONS.

3. ESTIMATED GROUND WATER LEVELS INDICATED BY ▼; THESE LEVELS ARE ONLY ESTIMATES FROM AVAILABLE DATA AND MAY VARY WITH PRECIPITATION, POROSITY OF THE SOIL, SITE TOPOGRAPHY, ETC.

4. REFUSAL AT THE SURFACE OF ROCK, BOULDER, OR OBSTRUCTION IS DEFINED AS AN SPT RESISTANCE OF 100 BLOWS FOR 2 INCHES OR LESS OF PENETRATION.

5. THE LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND AT THE PARTICULAR TIME WHEN DRILLED OR EXCAVATED. SOIL CONDITIONS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE SUBSURFACE SOIL AND GROUND WATER CONDITIONS AT THE TEST BORING, TEST PIT AND/OR HAND AUGER LOCATIONS.

6. THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL AND ROCK TYPES AS OBTAINED FROM THE SUBSURFACE EXPLORATION. SOME VARIATION MAY ALSO BE EXPECTED VERTICALLY BETWEEN SAMPLES TAKEN. THE SOIL PROFILE, WATER LEVEL OBSERVATIONS AND PENETRATION RESISTANCES PRESENTED ON THESE LOGS HAVE BEEN MADE WITH REASONABLE CARE AND ACCURACY AND MUST BE CONSIDERED ONLY AN APPROXIMATE REPRESENTATION OF SUBSURFACE CONDITIONS TO BE ENCOUNTERED AT THE PARTICULAR LOCATION.

7. KEY TO SYMBOLS AND ABBREVIATIONS:

5+10+15	STANDARD PENETRATION TEST
3T 24/18	2" OR 3" UNDISTURBED TUBE SAMPLE LENGTH PUSHED/RECOVERY (IN INCHES)
W	WATER CONTENT
PM	PRESSUREMETER TEST (IN REMARKS COLUMN)
do	DITTO
WOW	WATER OBSERVATION WELL
PP	POCKET PENETROMETER READING (TSF)
FID (OVA)	FLAME IONIZATION DETECTOR READING (PPM)
PID	PHOTOIONIZATION DETECTOR READING (PPM)
GP	GEOSTICK PENETRATION READING (INCHES)

SCHNABEL ENGINEERING ASSOCIATES, INC.

Consulting Geotechnical Engineers

IDENTIFICATION OF SOIL

I. DEFINITION OF SOIL GROUP NAMES (ASTM D-2487-83)

			SYMBOL	GROUP NAME
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels - More than 50% of coarse fraction retained on No. 4 sieve Coarse, 3/4" to 3" Fine, No. 4 to 3/4"	Clean Gravels Less than 5% fines	GW	Well graded gravel
			GP	Poorly graded gravel
		Gravels with Fines More than 12% fines	GM	Silty gravel
			GC	Clayey gravel
	Sands - 50% or more of coarse fraction passes No. 4 sieve Coarse, No. 10 to No. 4 Medium, No. 40 to No. 10 Fine, No. 200 to No. 40	Clean Sands Less than 5% fines	SW	Well-graded sand
			SP	Poorly graded sand
		Sands with Fines More than 12% fines	SM	Silty sand
			SC	Clayey sand
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays - Liquid Limit less than 50 Low to medium plasticity	Inorganic	CL	Lean clay
			ML	Silt
		Organic	OL	Organic clay
				Organic silt
	Silts and Clays - Liquid Limit 50 or more Medium to high plasticity	Inorganic	CH	Fat clay
			MH	Elastic silt
		Organic	OH	Organic clay
				Organic silt
Highly Organic Soils	Primarily organic matter, dark in color and organic odor		PT	Peat

II. DEFINITION OF MINOR COMPONENT PROPORTIONS

Minor Component	Approximate Percentage of Fraction by Weight
Adjective Form	
Gravelly, Sandy	30% or more coarse grained
With	
Sand, Gravel	15% or more coarse grained
Silty, Clay	5% to 12% fine grained
Trace	
Sand, Gravel	Less than 15% coarse grained
Silty, Clay	Less than 5% fine grained

III. GLOSSARY OF MISCELLANEOUS TERMS

SYMBOLS - Unified Soil Classification Symbols are shown above as group symbols. Use a Line Chart for laboratory identification. Dual symbols are used for borderline classifications.

BOULDERS & COBBLES - Boulders are considered rounded pieces of rock larger than 12 inches, while cobbles ranged from 3 to 12 inch size.

DISINTEGRATED ROCK - Residual rock material with a standard penetration resistance (SPT) between 60 blows per foot and refusal. Refusal is defined as a SPT of 100 blows for 2" or less penetration.

ROCK FRAGMENTS - Angular pieces of rock, distinguished from transported gravel, which have separated from original vein or strata and are present in a soil matrix.

QUARTZ - A hard silica mineral often found in residual soils.

IRONITE - Iron oxide deposited within a soil layer forming cemented deposits.

CEMENTED SAND - Usually localized rock-like deposits within a soil stratum composed of sand grains cemented by calcium carbonate or other materials.

MICA - A soft plate of silica mineral found in many rocks, and in residual or transported soil derived therefrom.

ORGANIC MATERIALS - (Excluding Peat):
Topsoil - Surface soils that support plant life and which contain considerable amounts of organic matter;
Organic Matter - Soil containing organic colloids throughout its structure;
Lignite - Hard, brittle decomposed organic matter with low fixed carbon content (a low grade of coal).

FILL - Man-made deposit containing soil, rock and often foreign matter.

PROBABLE FILL - Soils which contain no visually detected foreign matter but which are suspect with regard to origin.

LENSES - 0 to ½ inch seam of minor soil component.

LAYERS - ½ to 12 inch seam of minor soil component.

POCKET - Discontinuous body of minor soil component.

COLOR SHADES - Light to dark to indicate substantial difference in color.

MOISTURE CONDITIONS - Wet, moist, or dry to indicate visual appearance of specimen.

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** BMP Dam and Entrance Road James River Commerce Center James City County, Virginia	**Contract Number:** 963241 **Boring Number:** B-1 **Sheet:** 1 of 1

Boring Contractor: Ayers and Ayers, Inc.
Powhatan, Virginia

Boring Foreman: J. Ayers, Jr.

Drilling Method: 2¼" Hollow Stem Auger

Drilling Equipment: CME-45 ATV

SEA Representative: S. Pond

Dates Started: 5/30/96 **Finished:** 5/30/96

Location: See Boring Location Plan, Figure A2

Ground Surface Elevation: 35.0±

Ground Water Observations

	Date	Time	Depth	Casing	Caved
Encountered	5/30	--	Dry	--	--
Completion	5/30	1:15	Dry	--	--
Casing Pulled	5/30	1:20	Dry	--	1.3

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
.5	Forest litter, root mat and topsoil		34.5					
	Fine to medium sandy lean clay, contains root fragments, moist - brown	CL		B		2+3+6		Windsor Formation PP=3.4 TSF
2.0		SC	33.0			5+6+7	16.7	
	Fine to medium clayey sand, contains silty sand layers, moist - brown and gray			A	5	5+7+7	18.0	
6.0		SM	29.0					
	Fine to medium silty sand, contains clayey sand layers, moist - brown					3+3+2		
9.0		CH	26.0					
	Fine to medium sandy fat clay, contains clayey sand layers, moist-brown			B	10	2+3+3		PP=1.0 TSF
12.0		ML	23.0					
	Fine sandy silt, contains silty sand lenses, moist - gray			C		2+3+3		Yorktown Formation PP=1.0 TSF
15.0	Boring terminated at 15.0 ft		20.0		15			

Comments:
Backfilled upon completion

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** BMP Dam and Entrance Road James River Commerce Center James City County, Virginia	**Contract Number:** 963241 **Boring Number:** B-2 **Sheet:** 1 of 1

Boring Contractor: Ayers and Ayers, Inc.
Powhatan, Virginia

Boring Foreman: J. Ayers, Jr.

Drilling Method: 2¼" Hollow Stem Auger

Drilling Equipment: CME-45 ATV

SEA Representative: S. Pond

Dates Started: 5/30/96 **Finished:** 5/30/96

Location: See Boring Location Plan, Figure A2

Ground Surface Elevation: 25.0±

Ground Water Observations

	Date	Time	Depth	Casing	Caved
Encountered	5/30	11:05	19.0	--	--
Completion	5/30	11:25	25.2	--	--
Casing Pulled	5/30	11:30	--	--	1.3
W.O.W.	5/30	11:35	21.8	--	--
W.O.W.	6/2	11:50	6.7	--	--

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
.6	Forest litter, root mat and topsoil		24.4					Windsor Formation
2.0	Fine to medium clayey sand, contains root fragments, moist - yellow brown	SC	23.0	A		2+2+4		
	Fine sandy lean clay, moist - brown	CL				3+3+5	22.3	PP=1.5 TSF
	do, contains silty sand lenses				5	3+4+4	27.6	PP=1.0 TSF
7.0	Fine sandy fat clay, contains shell fragments and silty sand lenses, moist - brown	CH	18.0	B		3+3+4		PP=1.0 TSF
					10	2+3+2		PP=1.0 TSF
12.0	Fine to medium sandy lean clay, contains shell fragments, moist - gray	CL	13.0					Yorktown Formation
				C	15	2+3+5		PP=1.25 TSF
17.0	Fine to coarse clayey sand, contains shell fragments, wet - gray	SC	8.0					
					20	4+4+9		
22.0	Fine to coarse silty sand, contains shell fragments, wet - gray	SM	3.0	D				
					25	4+5+5		
	do, fine to medium					5+6+5		
30.0			-5.0		30			

Comments:
1) 1½" PVC Water Observation Well (WOW) installed to 29 ft upon completion

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** BMP Dam and Entrance Road James River Commerce Center James City County, Virginia	**Contract Number:** 963241 **Boring Number:** B-3 **Sheet:** 1 of 1

Boring Contractor: Ayers and Ayers, Inc.
Powhatan, Virginia

Boring Foreman: J. Ayers, Jr.

Drilling Method: 2¼" Hollow Stem Auger

Drilling Equipment: CME-45 ATV

SEA Representative: S. Pond

Dates Started: 5/30/96 **Finished:** 5/30/96

Location: See Boring Location Plan, Figure A2

Ground Surface Elevation: 36.0±

Ground Water Observations

	Date	Time	Depth	Casing	Caved
Encountered	5/30	11:50	7.0	--	--
Completion	5/30	11:55	Dry	--	--
Casing Pulled	5/30	12:00	Dry	--	1.2

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
.5	Forest litter, root mat and topsoil		35.5	A		2+3+6		Windsor Formation
1.2	Fine to medium silty sand, contains root fragments, moist - brown	SM	34.8					PP=3.0 TSF
	Fine to medium sandy fat clay, moist - brown	CH		B		4+9+9	19.5	PP=3.0 TSF
4.0	Fine to medium clayey sand, contains silty sand layers, moist - brown	SC	32.0		5	8+6+8	16.9	
6.0	Fine to medium silty sand, contains clayey sand layers, wet- brown	SM	30.0	A		3+2+2		
					10	2+2+2		
12.0	Fine sandy fat clay, contains shell fragments and silty sand lenses, moist - gray	CH	24.0	C		3+3+3		Yorktown Formation PP=1.25 TSF
15.0	Boring terminated at 15.0 ft		21.0		15			

Comments:
Backfilled upon completion

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** BMP Dam and Entrance Road James River Commerce Center James City County, Virginia	**Contract Number:** 963241 **Boring Number:** B-4 **Sheet:** 1 of 1

Boring Contractor: Ayers and Ayers, Inc.
Powhatan, Virginia

Boring Foreman: J. Ayers, Jr.

Drilling Method: 2¼" Hollow Stem Auger

Drilling Equipment: CME-45 ATV

SEA Representative: S. Pond

Dates Started: 5/30/96 **Finished:** 5/30/96

Location: See Boring Location Plan, Figure A2

Ground Surface Elevation: 28.0±

Ground Water Observations

	Date	Time	Depth	Casing	Caved
Encountered	5/30	--	Dry	--	--
Completion	5/30	12:45	Dry	--	--
Casing Pulled	5/30	12:50	Dry	--	2.6

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
.5	Forest litter, root mat and topsoil		27.5					
	Fine to medium clayey sand, contains root fragments, moist - brown	SC		A		2+2+4		Windsor Formation
2.0	Lean clay with sand, moist - brown	CL	26.0			3+3+5	20.1	
4.0	Fat clay, trace sand, moist - brown	CH	24.0			3+3+4	30.6	PP=1.25 TSF
					5			
	do, fine sandy			B		2+3+3		PP=1.0 TSF
						2+3+3		PP=1.25 TSF
9.5			18.5					Yorktown Formation
10.0	Fine sandy fat clay, contains silty sand lenses, moist - gray	CH	18.0	C	10			PP=1.25 TSF
	Boring terminated at 10.0 ft							

Comments:
Backfilled upon completion

SCHNABEL
ENGINEERING ASSOCIATES

[redacted]

HAND AUGER LOG

CONTRACT NO: 963241

HAND AUGER NO: HA-1

PROJECT: BMP Dam and Entrance Road
James City County, Virginia

DATE: 5/29/96

LOCATION: See Figure A1

SURFACE ELEVATION: 74.0±

SEA REPRESENTATIVE: S. Pond

GROUNDWATER ELEVATION: Not Encountered

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION OF SOILS & OBSERVATIONS.	STRATUM	REMARKS
		Forest litter and topsoil		Windsor Formation
0.8	73.2	Compact density, fine to medium silty sand (SM), moist - gray brown	A	GP = ½"
1.8	72.2	Stiff consistency, fine to medium sandy lean clay (CL), moist - brown	B	GP = 1"
2.9	71.1	Compact density, fine to medium clayey sand (SC), contains silty sand layers, moist - brown	A	GP = ½"
		do, gray and brown		GP = 1½"
		do, firm density		GP = 1½"
5.0	69.0	Hand auger terminated at 5.0 ft		

SCHNABEL
ENGINEERING ASSOCIATES

[redacted]

HAND AUGER LOG

CONTRACT NO: 963241

HAND AUGER NO: HA-2

PROJECT: BMP Dam and Entrance Road
James City County, Virginia

DATE: 5/30/96

LOCATION: See Figure A1

SURFACE ELEVATION: 76.0±

SEA REPRESENTATIVE: S. Pond

GROUNDWATER ELEVATION: Not Encountered

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION OF SOILS & OBSERVATIONS.	STRATUM	REMARKS
		Forest litter and topsoil		Windsor Formation
0.4	75.6	Compact density, fine to medium silty sand (SM), moist - yellow brown		
				GP = ½"
			A	
				GP = ½"
		do, contains lean clay layers		GP = ½"
3.1	72.9	Stiff consistency, lean clay with sand (CL), moist - brown and red brown		
		do, brown, red brown and gray	B	GP = ½"
				GP = ½"
5.0	71.0	Hand auger terminated at 5.0 ft		

SCHNABEL
ENGINEERING ASSOCIATES

[redacted]

HAND AUGER LOG

CONTRACT NO: 963241

HAND AUGER NO: HA-3

PROJECT: BMP Dam and Entrance Road
James City County, Virginia

DATE: 5/30/96

LOCATION: See Figure A1

SURFACE ELEVATION: 67.0±

SEA REPRESENTATIVE: S. Pond

GROUNDWATER ELEVATION: Not Encountered

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION OF SOILS & OBSERVATIONS.	STRATUM	REMARKS
		Forest litter and topsoil		
0.6	66.4	Compact density, fine to medium silty sand (SM), moist - gray brown	A	Windsor Formation
		do, brown		GP = ½"
1.7	65.3	Stiff consistency, fine to medium sandy lean clay (CL), moist - brown	B	GP = 1"
		do, trace sand - brown, red brown and gray		GP = 1"
				GP = ¼"
4.6	62.4	Compact density, fine to medium clayey sand (SC), moist - brown and gray	A	GP = ½"
5.0	62.0	Hand auger terminated at 5.0 ft		

SCHNABEL
ENGINEERING ASSOCIATES

[redacted]

HAND AUGER LOG

CONTRACT NO: 963241

HAND AUGER NO: HA-4

PROJECT: BMP Dam and Entrance Road
James City County, Virginia

DATE: 5/30/96

LOCATION: See Figure A1

SURFACE ELEVATION: 63.0±

SEA REPRESENTATIVE: S. Pond

GROUNDWATER ELEVATION: Not Encountered

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION OF SOILS & OBSERVATIONS.	STRATUM	REMARKS
0.2	62.8	Forest litter and topsoil		Windsor Formation
0.7	62.3	Compact density, fine to medium silty sand (SM), moist - gray brown	A	GP = ½"
		Stiff consistency, fine sandy lean clay (CL), moist - brown		
		do, brown and gray		GP = 1"
2.3	60.7	Stiff consistency, fine to medium sand fat clay (CH), moist - gray and brown	B	GP = ½"
3.3	59.7	Compact density, fine clayey sand (SC), contains fat clay layers, moist - gray brown	A	GP = ½"
				GP = ½"
5.0	58.0	Hand auger terminated at 5.0 ft		

SCHNABEL
ENGINEERING ASSOCIATES

[redacted]

HAND AUGER LOG

CONTRACT NO: 963241

HAND AUGER NO: HA-5

PROJECT: BMP Dam and Entrance Road
James City County, Virginia

DATE: 6/3/96

LOCATION: See Figure A1

SURFACE ELEVATION: 61.0±

SEA REPRESENTATIVE: S. Pond

GROUNDWATER ELEVATION: Not Encountered

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION OF SOILS & OBSERVATIONS.	STRATUM	REMARKS
		Compact density, fine silty sand (SM), contains root fragments, moist - brown	A	
0.6	60.4	Stiff consistency, lean clay with sand (CL), moist - brown	B	Windsor Formation GP = ½"
		do, fine sandy		GP = ½"
2.5	58.5	Firm density, fine clayey sand (SC), contains lean clay layers, moist - brown	A	GP = 1"
3.8	57.2	Compact density, fine to medium silty sand (SM), moist - brown		GP = ½" GP = 1"
5.0	56.0	Hand auger terminated at 5.0 ft		

SCHNABEL
ENGINEERING ASSOCIATES

[redacted]

HAND AUGER LOG

CONTRACT NO: 963241

HAND AUGER NO: HA-6

PROJECT: BMP Dam and Entrance Road
James City County, Virginia

DATE: 6/3/96

LOCATION: See Figure A1

SURFACE ELEVATION: 58.0±

SEA REPRESENTATIVE: S. Pond

GROUNDWATER ELEVATION: Not Encountered

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION OF SOILS & OBSERVATIONS.	STRATUM	REMARKS
		Forest litter, root mat and topsoil		
0.4	57.6			Windsor Formation
		Firm density, fine silty sand (SM), contains root fragments, moist - yellow brown		
0.9	57.1			GP = 1"
		Firm density, fine to medium clayey sand (SC), contains silty sand layers, moist - brown	A	
				GP = ½"
2.5	55.5			
		Stiff consistency, fine sandy lean clay (CL), moist - brown		GP = ½"
		do, contains silty sand pockets - brown and gray	B	
		do, contains fat clay layers		GP = ½"
4.1	53.9			
		Compact density, fine to medium clayey sand (SC), contains silty sand lenses, moist - gray and brown	A	GP = ½"
5.0	53.0			
		Hand auger terminated at 5.0 ft		

SCHNABEL
ENGINEERING ASSOCIATES

[redacted]

HAND AUGER LOG

CONTRACT NO: 963241

HAND AUGER NO: HA-7

PROJECT: BMP Dam and Entrance Road
James City County, Virginia

DATE: 6/3/96

LOCATION: See Figure A2

SURFACE ELEVATION: 37.0±

SEA REPRESENTATIVE: S. Pond

GROUNDWATER ELEVATION: Not Encountered

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION OF SOILS & OBSERVATIONS.	STRATUM	REMARKS
		Forest litter, root mat and topsoil		
0.4	36.6	Compact density, fine silty sand (SM), contains root fragments, moist - yellow brown	A	Windsor Formation
0.9	36.1	Stiff consistency, lean clay with sand (CL), moist - brown	B	GP = ½"
		do, fine to medium sandy - brown and gray		GP = ½"
2.8	34.2	Firm density, fine to medium clayey sand (SC), trace gravel, contains silty sand layers, moist - gray and brown	A	GP = 1"
		do, brown		GP = 1"
				GP = 1"
5.0	32.0	Hand auger terminated at 5.0 ft		

SCHNABEL
ENGINEERING ASSOCIATES

[redacted]

HAND AUGER LOG

CONTRACT NO: 963241

PROJECT: BMP Dam and Entrance Road
James City County, Virginia

LOCATION: See Figure A2

SEA REPRESENTATIVE: S. Pond

HAND AUGER NO: HA-8

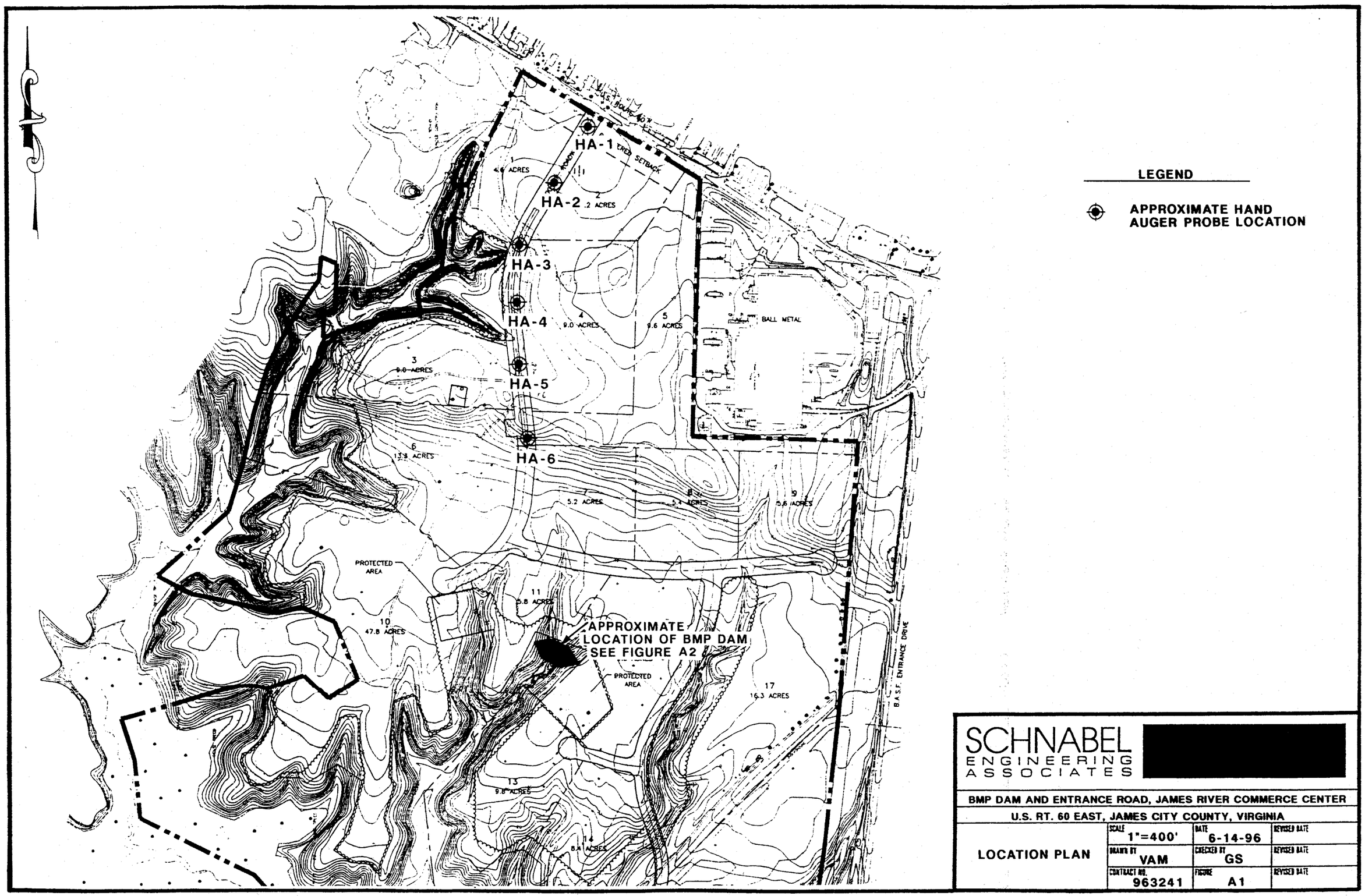
DATE: 6/3/96

SURFACE ELEVATION: 17.5±

GROUNDWATER ELEVATION: 13.3±

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION OF SOILS & OBSERVATIONS.	STRATUM	REMARKS
0.1	17.4	Forest litter and topsoil		Windsor Formation
		Loose density, fine to medium silty sand (SM), contains root fragments, moist - gray brown	A	GP = 12"
1.6	15.9	Medium stiff consistency, fat clay (CH), trace sand, moist - brown, gray and red brown	B	GP = 2"
		do, soft consistency		GP = 6"
		do, fine sandy		GP = 4"
		do, wet		
4.9	12.6	Compact density, fine to medium clayey sand (SC), contains shell fragments, wet - gray	D	GP = ½" Yorktown Formation
6.0	11.5	Hand auger terminated at 6.0 ft		

Note:
Measured water at 5.6 ft upon completion



SCHNABEL ENGINEERING ASSOCIATES

[redacted]

BMP DAM AND ENTRANCE ROAD, JAMES RIVER COMMERCE CENTER

U.S. RT. 60 EAST, JAMES CITY COUNTY, VIRGINIA

LOCATION PLAN	SCALE 1"=400'	DATE 6-14-96	REVISED DATE
	DRAWN BY VAM	CHECKED BY GS	REVISED DATE
	CONTRACT NO. 963241	FIGURE A1	REVISED DATE

ROAD "B"

ARCH. SITE
(1.4922 AC)

NORMAL POOL
ELEV = 25.00

HA-7

B-1

B-2

B-3

B-4

HA-8

260 LF - 54" RCP @ 0.46%

S.52 - 24" RT.

28.23'
(KNOCKOUT FOR 30"RCP
30.33)

VDOT ES-1 FOR 54" PIPE
INV = 24.00

TO 128 LF - 54" RCP @ 3.30%

℄ DI-5
IN THIS CONTRACT)

CURVE DATA
99°05'44"
50.00'
86.48'
58.64'
76.09'

EL

R/W

FUTURE ROADWAY DITCH

LIMITS OF CLEARING

S 23°03'31" W
183.03'

S 14°28'22" W
107.58'

S 17°51'17" E
196.9'

SEE SHT 10B FOR 12" THK. LAYER OF #78 STONE AT BASE OF DAM AND CREASE OF FILL SLOPE

RIP-RAP SPILLWAY
(SEE RMP DETAIL SHT.)

SPILLWAY TOP OF SLOPE

MATCH LINE - STA. 11+00

LEGEND

APPROXIMATE TEST BORING LOCATION

APPROXIMATE HAND AUGER PROBE LOCATION

SCHNABEL ENGINEERING ASSOCIATES

[redacted]

BMP DAM AND ENTRANCE ROAD, JAMES RIVER COMMERCE CENTER

U.S. RT. 60 EAST, JAMES CITY COUNTY, VIRGINIA

LOCATION PLAN	SCALE 1"=50'	DATE 6-14-96	REVISED DATE
	DRAWN BY VAM	CHECKED BY GS	REVISED DATE
	CONTRACT NO. 963241	FIGURE A2	REVISED DATE

Appendix B

SOIL LABORATORY TEST RESULTS

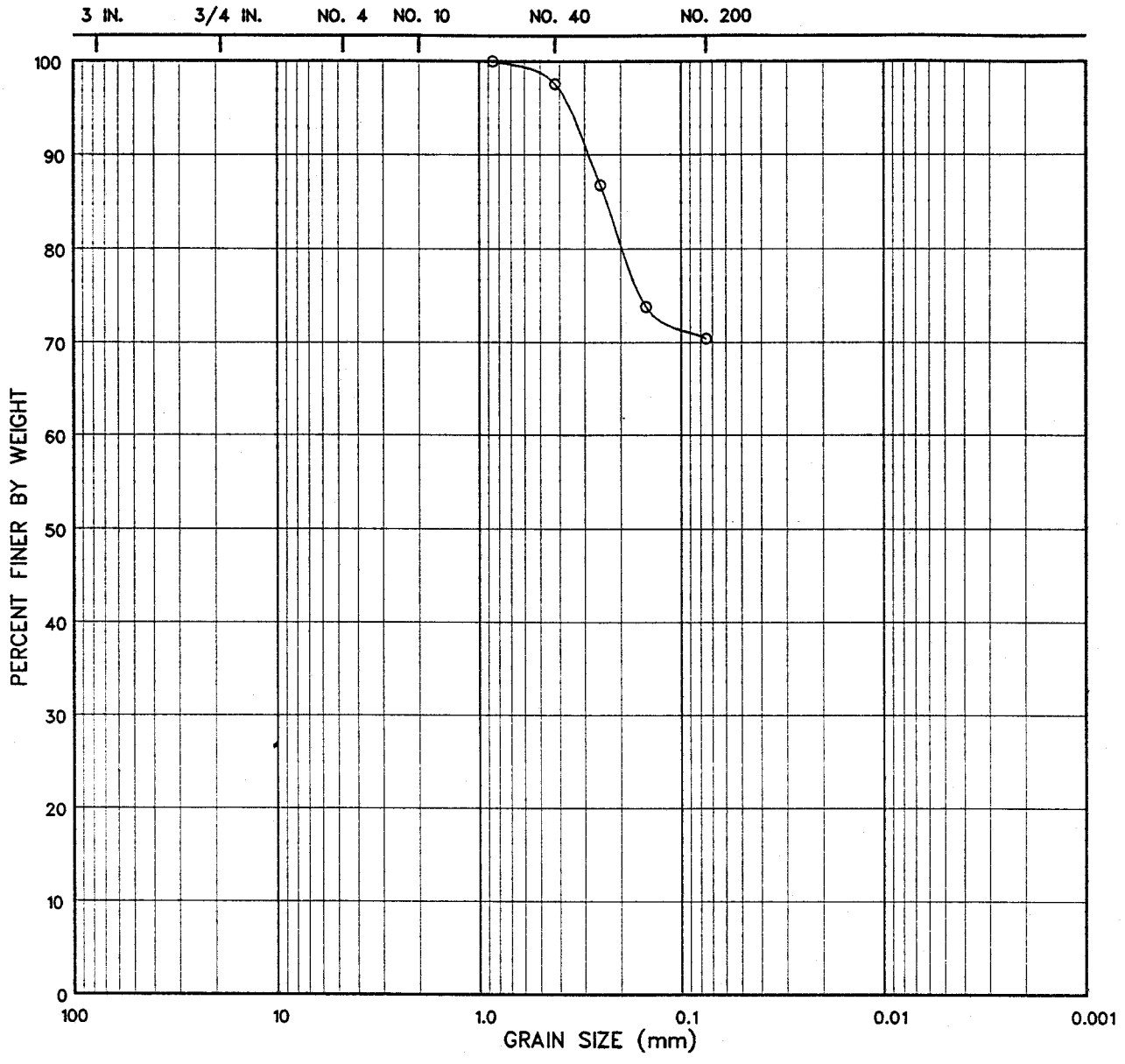
Summary of Soil Laboratory Tests (1)
Gradation Test Curve (1)

Appendix B
Contract 963241

SUMMARY OF SOIL LABORATORY TESTS

BORING	B-4	B-4		
DEPTH	2'-3.5'	4'-5.5'		
SAMPLE TYPE	JAR	JAR		
STRATUM	B	B		
SAMPLE DESCRIPTION	LEAN CLAY WITH SAND (CL), BROWN	FAT CLAY (CH), TRACE SAND, BROWN		
NATURAL MOISTURE CONTENT (%)	20.1	30.6		
NATURAL WET DENSITY (pcf)	-	-		
LIQUID LIMIT PLASTIC LIMIT PLASTICITY INDEX	37 16 21	53 19 34		
GRADATION DATA				
(% FINER THAN SIEVE)				
3/4"	100.0	-		
NO. 4	100.0	-		
NO. 200	70.4	88.6		
MOISTURE DENSITY RELATION DATA (ASTM D-698)				
MAXIMUM DRY DENSITY (pcf)	-	-		
OPTIMUM MOISTURE CONTENT (%)	-	-		
CBR TEST DATA (VTM-8)				
CBR	-	-		
% SWELL	-	-		
COMPACTED SAMPLE DRY DENSITY (pcf)	-	-		
COMPACTED SAMPLE MOISTURE CONTENT (%)	-	-		
REMARKS	SEE GRADATION CURVE	-		

NOTES: 1. Soil tests in accordance with applicable ASTM Standards



	SAMPLE ID AND SAMPLE DESCRIPTION:	SCHNABEL ENGINEERING ASSOCIATES, INC. RICHMOND, VIRGINIA
o	SAMPLE ID: B-4 / 2'-3.5' LEAN CLAY WITH SAND (CL), BROWN LIQUID LIMIT: 37 PLASTICITY INDEX: 21	GRADATION CURVES
		PROJECT: BMP DAM AND ENTRANCE RD., JAMES RIVER COMMERCE CENTER, U.S. RT. 60 EAST JAMES CITY COUNTY, VIRGINIA
		CONTRACT NO: 963241

Darryl,

Attached are the sketches that I had AES prepare for the modifications to the basin outfall for James River Commerce Center, based upon the modeling information that Landmark did previously (I provided you the modeling info and assumptions from the 2004 reports prepared by Landmark to demonstrate MS-19 compliance). The plan sheet attached has the "as built" elevations of the dam and emergency spillway. AES took the Landmark information and ran their own modeling based upon the modified elevation of the emergency spillway and determined the design elevations indicated on the attached cross section that accompanies this note. We propose to raise the dam approximately .5 feet, to an elevation of 36.30 so that 1' of freeboard is available with the 100 year storm. We also propose raising the emergency spillway to elevation 34 based upon the modeling assumptions.

Normal pool elevation is not proposed to change and will remain at elevation 25. We propose removing the top section of the riser and providing a new 60" riser section with a secondary 15" orifice at elevation 28.5, and rim elevation at 33.5. We will reuse the existing anti vortex device on top of the new riser section.

Please review and let me know if you agree that these basin modifications are sufficient to meet storage requirements for the added drainage from the proposed shell building.

Thanks in advance.

Bernie.

MEMORANDUM

Date: May 13, 2002

To: File

From: Darryl E. Cook, Environmental Director DEC

Subject: Stormwater Management Master Plan for James River Commerce Park

---

The relevant master plan for the above project is as shown on a submittal that was done for SP-82-97. It is titled Master Plan, James River Commerce Center and on the map itself there is another designation that states it is the Master Drainage Plan for the James River Commerce Center. The plan shows three BMPs; they have drainage areas of 9, 57, and 13 acres respectively. The 57 acre BMP has been constructed and its actual drainage area is 53.1 acres plus the additional area from the cul-de-sac extension of Endeavor Drive. The 9 acre BMP is on the site of the current Landmark Auto Parts project and the 13 acre BMP is on the east end of the site adjacent to BASF site.

The calculations dated 4/22/96 and 3/20/96 show that there is a requirement to provide 75 to 80 acres of natural open space along with the three BMPs to achieve the required 10 BMP points. The 10-point analysis should be updated based on the major revisions to the County's calculation procedure that were adopted in January, 2001, to fine tune the amount of natural open space required and account for the new BMP point values.

interoffice
MEMORANDUM

to: Leo Rogers, Deputy County Attorney
from: Darryl E. Cook, Environmental Director DEC
subject: James River Commerce Center Stormwater Facility
date: September 20, 2000

Based on your request, I evaluated what portion of the runoff to the existing stormwater facility (BMP 1) is generated by the rights-of-way for the roads. I based my analysis on all parcels and the rights-of-way being 50 percent impervious, full buildout conditions. While the Chesapeake Bay Ordinance would allow 60% impervious cover, given the topography of many of the lots, it is unlikely that they would develop at the full percentage allowed. The right-of-way impervious assumption is a fairly standard one with road surfaces and drainage facilities covering about ½ of the surface area.

Based on these assumptions, the calculation becomes a ratio of the area of the rights-of-way compared to the total area draining to the stormwater basin. I attached my worksheet where I computed the ratio. The result is that the roadways will contribute 11.8 percent of the runoff to the BMP, which has a watershed of 50.7 acres.

MEMORANDUM

Date: May 13, 2002

To: File

From: Darryl E. Cook, Environmental Director DEC

Subject: Stormwater Management Master Plan for James River Commerce Park

---

The relevant master plan for the above project is as shown on a submittal that was done for SP-82-97. It is titled Master Plan, James River Commerce Center and on the map itself there is another designation that states it is the Master Drainage Plan for the James River Commerce Center. The plan shows three BMPs; they have drainage areas of 9, 57, and 13 acres respectively. The 57 acre BMP has been constructed and its actual drainage area is 53.1 acres plus the additional area from the cul-de-sac extension of Endeavor Drive. The 9 acre BMP is on the site of the current Landmark Auto Parts project and the 13 acre BMP is on the east end of the site adjacent to BASF site.

The calculations dated 4/22/96 and 3/20/96 show that there is a requirement to provide 75 to 80 acres of natural open space along with the three BMPs to achieve the required 10 BMP points. The 10-point analysis should be updated based on the major revisions to the County's calculation procedure that were adopted in January, 2001, to fine tune the amount of natural open space required and account for the new BMP point values.

FILE - James River Comm. Ctr.

U.S. Army Corps of Engineers
Norfolk District, Eastern Virginia Regulatory Section
803 Front Street
Norfolk, Virginia 23510

December 6, 2000

Project Number: 95-R5751

Waterway: Wood Creek/Grices Run

1. Participant:
Victoria Gussman, Vice President
Williamsburg Developments Inc.
P. O. Box 1776
Williamsburg, VA 23187-1776

2. Authorized Agent:
LandMark Design Group
4029 Ironbound Road, Suite 100
Williamsburg, VA 23188
Attn: John Lowenthal

DEC 2000
RECEIVED
PLANNING DEPARTMENT

3. Address of Job Site:
James River Commerce Center, located east of Carter's Grove, south of Rt. 60, and west of the BASF plant in James City County near the Newport News City line.

4. Project Description:
You have requested reverification of the wetland delineation for the James River Commerce Center. The current wetland delineation for this property will expire on December 26, 2000.

DEC 2000
RECEIVED
ENVIRONMENTAL DIVISION

5. Findings

On October 5, 2000, Mr. Steven Martin of my staff met with your agent, Mr. John Lowenthal (LandMark Design Group) to reexamine the limits of waters of the United States (including wetlands) in the field. There were only minor differences between the 1995 and 2000 delineations. In the 1995 delineation, 6 different isolated wetland areas were delineated. Only 2 of those areas could be located in October 2000. Those isolated wetlands are located on lots 8 and 9 and total approximately 1,000 square feet (0.02 acre). These isolated wetland areas are without any apparent nexus to interstate commerce and are not considered jurisdictional wetlands in light of the decision by the U.S. Court of Appeals for the Fourth Circuit in the case of United States v. Wilson, 133 F. 3d 251 ("Wilson Decision").The other isolated wetlands that were mapped in 1995 appear to have been drained by increased transpiration associated with forest growth and development (greater transpiration) and by drainage effects from a downward cutting first order stream located on Lots 9, 12, and 17.

The location and extent of jurisdictional waters of the United States (including wetlands) on the property are accurately flagged in the field and approximated in the drawing entitled *Location of Upstream Boundary of Wetlands and Waters Within Tributaries and Isolated Wetlands, James River Commerce Center, Drawing Number 24305*" prepared by Langley and McDonald, P.C. and revised on 10-16-00. These waters of the U.S. (including wetlands) are regulated under Section 404 of the Clean Water Act. Our basis for this determination is the application of the Corps' 1987 Wetland Delineation Manual and the positive indicators of wetland hydrology, hydric soils, and hydrophytic vegetation. The wetlands on this parcel are waters of the United States and part of a tributary system to interstate waters (33 CFR 328.3(a)). The waters are intermittent and/or perennial drainages that meet the Corps' definition of waters of the United States, are part of a tributary system to interstate waters (33 CFR 328.3 (a)) and have a ordinary high water mark. We note that the extent of wetlands adjacent to Grices Run, or those wetland areas within the Chesapeake Bay Preservation Act Resource Protection Area (RPA) have not been mapped. However, because of their location within the RPA, those areas are most unlikely to be impacted under future development proposals.

Wetland impacts associated with development of the James River Commerce Center will be considered cumulatively. **To date, development of this parcel has entailed cumulative impacts to 0.07 acres of headwater wetlands.** Regarding future work in wetlands or waters on this property, please be advised that we would seek recordation of a restrictive covenant (such as the Declaration of Restrictions previously approved by our office of Counsel for this development) or similar mechanism to ensure that any residual wetlands, steep slope areas, and historic resources are protected on a given lot as part of any permit authorizing placement of fills in wetlands or waters of the U.S. on that lot.

During the October 5, 2000 site visit, Mr. Martin **noted that there is potential to restore a degraded and down cutting intermittent stream that is located on portions of Lots 9, 12, and 17. Restoration of this stream could be used as compensatory mitigation for unavoidable impacts to waters of the U.S.** associated with future development of this development.

This wetland jurisdictional determination and delineation verification is valid for a period of five years from the date of this letter unless new information warrants revision of the delineation before the expiration date. Please be advised that this letter does not constitute authorization to fill wetlands or other waters of the United States on this parcel.

Copy Furnished :

Planning Department, James City County

6. Corps Contact: Steven Martin at (757) 441-7787.

Nicholas L. Konchuba

Nicholas L. Konchuba
Chief, Eastern Virginia
Regulatory Section

NAO FL 13 REVISED DEC 90

Frances C. Geissler

From: ssors@apps.hrpdc.org
Sent: Friday, August 22, 2008 8:41 AM
To: prepadm@vdh.virginia.gov; troprep@deq.virginia.gov
Cc: Frances C. Geissler; Tom Ebert; dave.jordan@vdh.virginia.gov; George Adams; Larry Foster; david.trump@vdh.virginia.gov; Danny Poe; Bill Harris; Mitzi Holley; Jim Hopkins; Scott Thomas
Subject: Initial SSORS Notification From James City

SSORS ID: 101645
Reported Date: 8/22/2008 8:40:50 AM
Site Name: Endeavor Drive Commercial Park
Site Address: 1709 Endeavor Drive; Williamsburg
Responsible Party: JCSA
Spilled In Jurisdiction: James City
SSO Classification: Infrastructure
IncidentDescription: Grinder pump sewer force main failed in three places due to misalignment and extreme stress at the elbows. Newer section. Poor installation.
DatePhonedIn:
DateOfIncident: 8/21/2008 3:00:00 PM
DateUnderControl: 8/22/2008 1:30:00 AM
SpillDuration: 10 hour(s) 30 minute(s).
PossibleReceptor: Storm drain swell and BMP discharge point.
AmountOfMaterial: 1500
MaterialUnits: Gallons
MaterialDescription: Sewerage. Pipe failed previously without discharging to surface. Most contamination leached into surrounding soil 6.5-feet deep. Saturated and contaminated soils removed from trench. Surface sewer discharged only recently.
ZipCode: 23185
AmountMaterialsRec: 700
AmountMaterialsWater: 0
Corrective Action: Removed all contaminated soils from excavation site. Light disinfection of storm water drainage ditch with chlorine solution. Request guidance from the Health Dept or DEQ regarding enhanced disinfection of BMP.
SP Northing:
SP Easting:
Last Edited By: Tom Ebert

1996 meeting with Darryl Cook and Wayland Bass, and later approved by the County in 1996, as part of the Ball Metal site plan.

In the calculations for the Ball Metal site plan, and later calculations for Endeavor Drive, certain numbers appear at the top of page 1. These numbers must be tied back to the original 1992 Master Plan report. The first number on page 1 is 219.2 acres, noted as total acreage. This is the same number used in the 1992 report, and referenced in paragraph 5 above.

The next number on page 1 is 136.4 acres, noted as total developed acreage. This number compares to the area of 137.8 acres, from the 1992 report, reviewed in paragraph 7, above.

The third number on page 1 of the Ball Metal/Endeavor Drive calculations is 82.8 acres, identified as total undeveloped/UNOS. This number compares to 74.8 acres, from the 1992 report, appearing in paragraph 7, above. The difference between the area of 82.8 acres and 74.8 acres is the area shown on the RWKB Master Plan lying between the line representing limits of developable land (line formed by small squares connected by lines) and the heavy, broad line showing development areas draining to the various detention ponds. It is the area in blue lines over red on the 1992 Master Plan. On the RWKB Master Plan, this area is **part** of the area shown as "MAJOR WETLAND AND PERIMETER OPEN SPACE AREA", but it was not included in the 1992 calculations. UNOS, in the 1992 calculations, included 55.4 acres (see paragraph 6, above), and the 19.4 acres of, total 74.8 acres, "INTERNAL UNDISTURBED NATURAL OPEN SPACE".

In late 1999, the County revised their BMP calculation process to allow 10 points, rather than the previous 9 points used in the Ball / JRCC / Endeavor Drive calculations. Other types of BMP's were reduced in point value. The point values of undisturbed natural open space (UNOS) were also changed. Previously, all UNOS was assigned a point value of 0.10 per 1% of site area. The new calculation procedures assigned a point value of 0.15 per 1% of site area to UNOS that is "adjacent to a wetland, mature forest, or RPA".

In the Ball Metal /JRCC / Endeavor Drive calculations, there are several different BMP types that are involved in the calculations. Page 1 of these calculations (actually the second sheet of three) shows the various types and the assigned point values. The attached calculation spread sheet shows the original calculations and the revised calculations based on the County's revised computational procedures.

The spreadsheet shows that the point value of the main JRCC BMP, serving 54.7 acres, was changed from 9 points to 10 points. The drainage area of this BMP was also changed to reflect the addition of former Parcel 9, the eastern parcel involved in the shell building. The revised drainage area is 60 acres. Other BMP's were correspondingly reduced in point values, as set forth in the revised computational procedures. On the spreadsheet, it may be necessary to click on the cells, with the revised point values, to see the formulas used in the calculation and the changed point values.

This cannot include RPA areas - only additions to these buffers

The changes in the UNOS values are also reflected in the spreadsheet. UNOS, showing on the RWKB Master Plan between the edge of wetlands and the heavy, broad line representing the drainage divides and the areas of development (area in red on print of Ches. Bay Master Plan), are assigned a point value of 0.15 per 1% of site area. UNOS identified on the RWKB Master Plan as INTERNAL UNDISTURBED NATURAL OPEN SPACE (19.4 ac.) is also assigned a 0.15 point value. Areas of wetlands continue to be assigned a point value of 0.10 per 1% of site area. The total acreage of areas assigned a 0.15 point value is 46.9 acres. This is the total of 27.5 acres in red and 19.4 acres of INTERNAL UNDISTURBED NATURAL OPEN SPACE.

The spreadsheet shows that the accumulated point value in the revised calculation is 10.1 points, indicating that Chesapeake Bay Ordinance requirements, for water quality, for the entire JRCC, are met by the existing BMP and UNOS as shown on the RWKB Master Plan.

T. JOSEPH McDONALD
1906 • 1982

Langley and McDonald
A Professional Corporation

GEORGE E. LANGLEY
Consultant

FILE -
James River Commerce Ctr.

FAX TRANSMITTAL COVER SHEET

PLEASE DELIVER THE FOLLOWING MATERIAL AS SOON AS POSSIBLE

TO: Daryl Cook

TELECOPIER NUMBER: 253-6850

FROM: John Lowenthal

NUMBER OF PAGES: 5 (including cover page)

IF NOT RECEIVED PROPERLY PLEASE NOTIFY US IMMEDIATELY BY CALLING (804) 473-2000.

JOB NO. : _____

DATE SENT: _____

TIME SENT: _____

RETURN ORIGINAL TO: _____

IF YOU WISH TO RESPOND VIA FAX, OUR FAX NUMBER IS (804) 497-7933.

SPECIAL MESSAGE: Please call me with additional Requests

John Lowenthal

ENGINEERS • PLANNERS • SURVEYORS

MAIN OFFICES • 5844 GREENWICH ROAD • SUITE 200 • VIRGINIA BEACH • VIRGINIA • 23462 • TEL: (804) 473-2000 • FAX: (804) 497-7933
BUSCH CORPORATE CENTER • 201 PACKETS COURT • WILLIAMSBURG • VIRGINIA • 23185 • TEL. (804) 253-2975 • FAX: (804) 229-0049

Darryl Cook

From: Bernard M. Farmer
Sent: Wednesday, June 13, 2001 3:06 PM
To: Darryl Cook
Subject: My calculation for increased flow, re: yesterdays msg

OOOPPPSSS, the figures I sent you yesterday were off by a factor of 10 due to a misplaced decimal. (they seemed kind of high) Anyway, the pipe at full flow under design conditions flows 124.4 cfs.

The 54" pipe under actually installed conditions (with .49% slope) flows 128.4 cfs, or an increase of 4cfs. Being pretty conservative on duration time this would allow for an additional drainage area of over an acre and a half, far more than we added in to drain that way. I still think it is ok. Sorry about my mixup.

Bernie

U.S. Army Corps of Engineers
Norfolk District, Eastern Virginia Regulatory Section
803 Front Street
Norfolk, Virginia 23510-1096

July 3, 1996

Project Number: 96-5335

Waterway: Grices Run & Wood Creek

1. Participant:
Mr. A. Joe Poole, III
Williamsburg Development, Inc.
P.O. Box 1776
Williamsburg, VA 23187-1776

2. Authorized Agent:
Mr. John Lowenthal
Langley and McDonald, P.C.
5544 Greenwich Road
Virginia Beach, VA 23462

3. Address of Job Site:
A 200+ acre parcel located within the James River Commerce Center property located on Rt 60 just west of the James City County-Newport News boundary.

4. Project Description:
You plan to develop a light industry/business park known as the James River Commerce Center on this parcel. In order to develop the first phase of the development (approximately 55 acres), you plan to construct a stormwater pond (BMP) in the uppermost portion of a ravine located near the center of the property. Approximately 0.04 acres of wetlands would be impacted by this pond and in this phase of development.

5. Findings

The extent of wetlands and waters located on this parcel above the Resource Protection Area are approximated in the drawing entitled "Location of Upstream Boundary of Wetlands and Waters Within Tributaries and Isolated Wetlands, James River Commerce Center, Drawing Number 24305" prepared by Langley and McDonald, P.C. on 12/21/95.

The location and extent of the proposed stormwater BMP is shown on the drawing entitled "James River Commerce Center BMP Impoundment, In: Un-Named Tributary, At: Grices Run, James City County" prepared by Langley and McDonald and dated 5/14/96 (copy enclosed). **The wetlands that would be impacted by this proposed stormwater BMP are located above the headwaters** (33 CFR 330.2(d).

We have reviewed your request to perform work in the waters of the United States, as described in part 4 above and have found that **this activity satisfies the criteria contained in the Corps Nationwide Permit (NWP) 26**, attached. (The Corps Nationwide Permits and Regulations can be found in 33 CFR 330 published in Volume 56, Number 226 of the Federal Register dated November 22, 1991.)

Provided the enclosed conditions are met, an individual Department of the Army Permit will not be required. The Virginia Department of Environmental Quality - Water Division's 401 Certificate is also attached. Please note that the special conditions of the 401 Certificate are part of the Corps Nationwide Permit 33 CFR 330 Appendix A (Part B, Number 26).

The following measures are special conditions of this NWP 26 verification:

1) The restrictive covenant or other mechanism used to ensure that the wetlands, steep slope areas, and historic resources are protected must be recorded for a given lot prior to initiating any work in wetlands or waters of the US on that lot, other than the work covered under this NWP 26 verification, any other specific Nationwide Permit verification, or any specific Department of the Army authorization.

2) A final copy of the proposed restrictive covenant must be submitted to our office of counsel for review before it is recorded.

3) Because it lies in the affected area of this permit authorization, any work proposed for the site known as 44JC656 (site CG 11) must be coordinated with this office and the Virginia Department of Historic Resources.

4) None of the above special conditions or the restrictive covenant are intended to exclude additional research, exploration, or recovery of historic resources on this property. However, work must be consistent with the federal standards entitled "Archaeology and

Historic Preservation: Secretary of the Interior's Standards and Guidelines" (48 FR 44716-44742. September 29, 1983) and the results forwarded to this office and the Virginia Department of Historic Resources.

This Nationwide Permit verification is valid for two years from the date of this letter, unless the Norfolk District Engineer uses discretionary authority to modify, suspend or revoke this verification. The Chief of Engineers will periodically review the nationwide permits and their conditions and will decide to either modify, reissue or revoke the permits. If NWP 26 is reissued without modification or if your activity complies with any subsequent nationwide permit, the expiration date of this verification will not change. However, if NWP 26 is modified or revoked so that the activity listed above would no longer be authorized and you have commenced or are under contract to commence the work, you will have twelve months from the date of that permit change to complete the activity. Activities completed under the authorization of a nationwide permit which was in effect at the time the activity was completed continue to be authorized by that nationwide permit. If after consultation with Corps at the end of the 2-year period, there is no change in the nationwide permit, the activity remains authorized until the nationwide permits expire in January 1997.

It is your responsibility to remain informed of changes to the nationwide permits. We will issue a special public notice announcing any changes to the nationwide permits when they occur.

Copy Furnished :

Planning Department, James City County
Code Compliance, James City County
Virginia Department of Historic Resources, Richmond

6. Corps Contact: Steve Martin (804) 441-7787

Nicholas L. Konchuba

Nicholas L. Konchuba
Chief, Eastern Virginia Regulatory Section

NAO FL 13 REVISED DEC 90

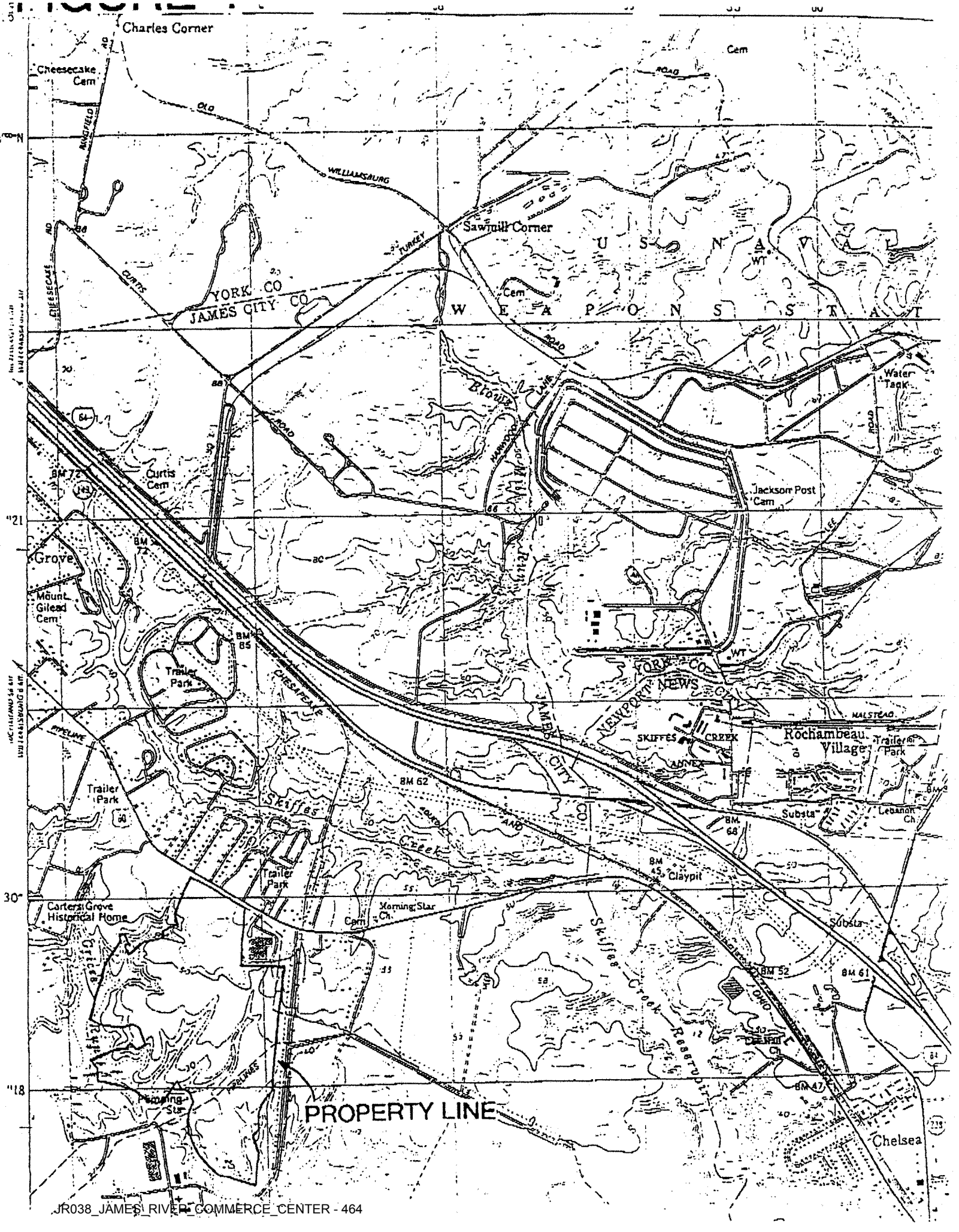
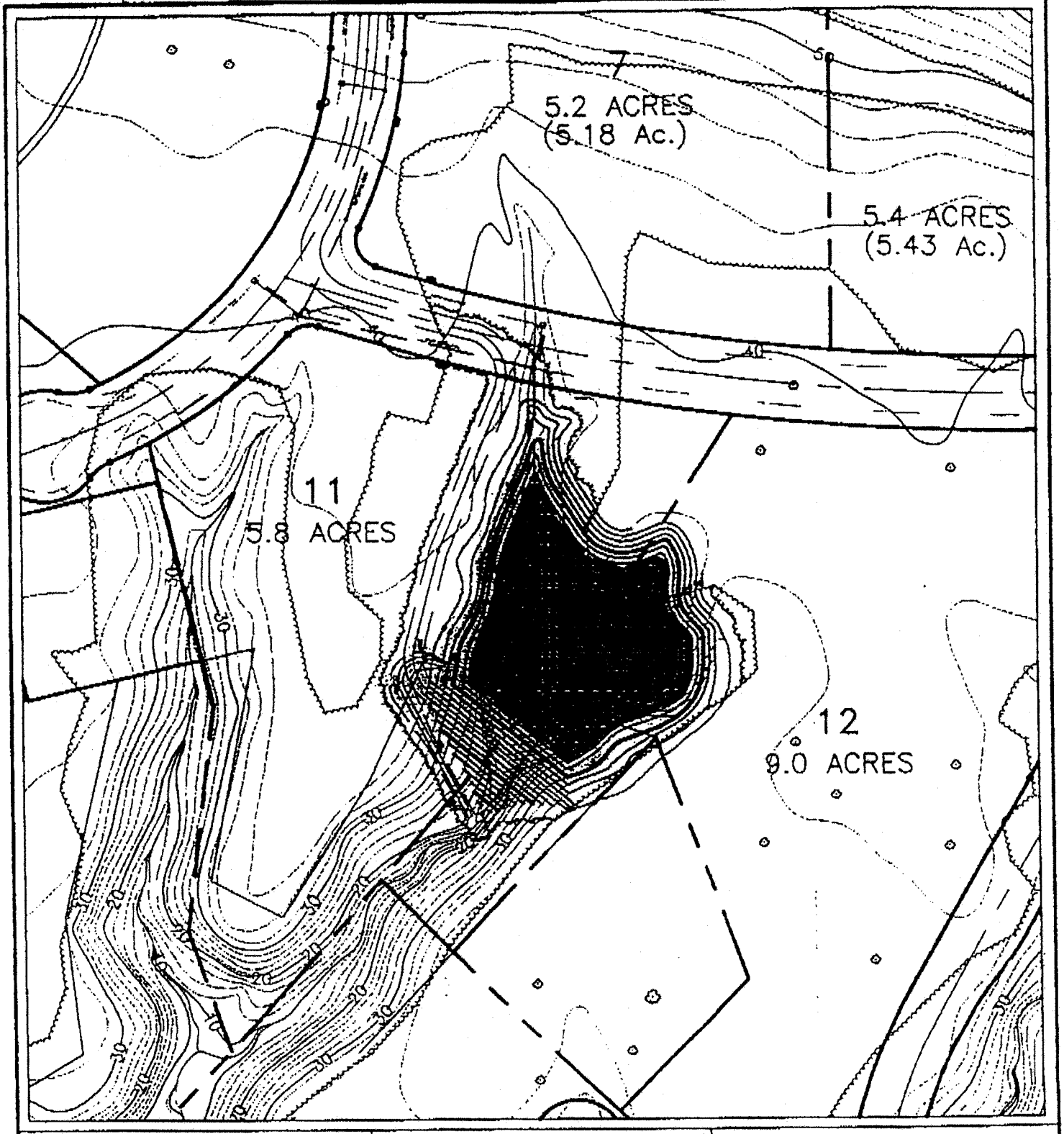

Charles Corner
Cheesecake Cem
Cem
OLD
ROAD
WILLIAMSBURG
Sawmill Corner
TURKEY
CURTIS
YORK CO
JAMES CITY CO
U S N A V A L
W E A P O N S S T A T
Cem
Water Tank
Blows Lake
Curtis Cem
BM 72
Jackson Post Cem
Grove
Mount Gilead Cem
BM 85
Trailer Park
CHESAPEAKE
PIPELINE
YORK CO
NEWPORT NEWS CITY
WT
HALSTEAD
SKIFFES CREEK
ANNEX
Rochambeau Village
Trailer Park
Substa
Lebanon Ch
BM 62
Skiffes Creek
BM 68
BM 45
Claypit
Carters Grove Historical Home
Morning Star Ch
Cem
Skiffes Creek Reservoir
BM 52
BM 61
Deerfield Ch
BM 47
Morning Star
PROPERTY LINE
Chelsea

FIGURE 2



PURPOSE: STORMWATER MANAGEMENT

DATUM:

ADJACENT PROPERTY OWNERS
1.
2.
3.

PLAN VIEW

JAMES RIVER COMMERCE CENTER
BMP IMPOUNDMENT

Langley and McDonald
A PROFESSIONAL CORPORATION
ENGINEERS · PLANNERS · SURVEYORS
VIRGINIA BEACH – WILLIAMSBURG, VIRGINIA

IN: UN-NAMED TRIBUTARY
AT: GRICES RUN
CITY/COUNTY: JAMES CITY CO.
APPLICATION BY: WILLIAMSBURG DEVELOPMENT INC.
SCALE: 1"=150'
DATE: 5/14/96 SHEET 1 OF 1

Scott - FYI
then file - in our
JR Comm ~~file~~ as-built
file

DEVELOPMENT MANAGEMENT

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

CODE COMPLIANCE
(757) 253-6626
codecomp@james-city.va.us

ENVIRONMENTAL DIVISION
(757) 253-6670
environ@james-city.va.us

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

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620

November 9, 2000

Tory Gussman
Colonial Williamsburg Foundation
P. O. Box 1776
Williamsburg VA 23187-1776

Re: James River Commerce Center:
Revising Natural Open Space at Site 5

Dear Tory:

General Comments

County Staff conceptually agrees that the natural open space adjacent to site 5 can be revised subject to the following:

1. Most of the suggested exchange area shown in green on your map is already protected according to your BMP Master Plan, therefore, different compensating areas would be required. The BMP Master Plan consists of an undated map entitled "Master Plan For Chesapeake Bay Preservation Ordinance Compliance" accompanied by an undated report which tabulates protected areas on page 3.

2. The natural areas adjacent to site 5 are sensitive because of steep slopes and adjacent wetlands and we recommend larger mitigation areas since they will be less environmentally sensitive than protected areas to be disturbed.

3. Our environmental concerns about disturbing these protected areas should be addressed as follows:

   - All stormwater should be diverted away from these areas during and after construction to reduce sediment and nutrient discharges.
   - These areas should be covered with EC-3 matting immediately after clearing to reduce sediment and nutrient discharges.
   - These areas should be landscaped with native/indigenous/non-ornamental plants as no mowing and no nutrient areas to reduce sediment and nutrient discharges.
   - Staff recommends that the County be granted natural open space easements on both the areas disturbed and the mitigation areas.

Specific Comments

Proposed Building Phase 1

1. Staff thinks the general comments above address disturbance of the protected area at the north corner of building 5.

2. The proposed exchanged area east of the north corner appears adequate subject to more precise mapping perhaps at the site plan stage.

Proposed Building Expansion

1. Staff has additional concerns about disturbing the protected area at the west corner of site 5.

   - If the building expanded as shown, the proposed disturbance would involve very steep slopes and reach nearby wetlands.
   - Staff suggests a setback at the end of the proposed building expansion to avoid steep slope disturbance near these wetlands;
   - and/or consider a retaining wall to reduce steep slope disturbance in this area.
   - The proposed disturbance of protected area at the south corner of the proposed expansion is conceptually ok

If you have any questions, please call me at (757) 253-6671.

Sincerely,

Wayland N. Bass
County Engineer

cc: Darryl Cook, Director, Environmental Division

Williamsburg Developments Inc.

AUG 2000
RECEIVED
DEVELOPMENT MANAGEMENT

August 10, 2000

Mr. John T. P. Horne
Office of Development Management
James City County
101 E Mounts Bay Road
Post Office Box 8784
Williamsburg, Virginia 23187

Re: James River Commerce Center, Adjustment of Non-Developable Area Boundary

Dear John:

It was nice to talk to you yesterday. Pursuant to our telephone conversation, I am enclosing two items. One is a master plan of James River Commerce Center. The non-developable area boundary line is indicated by a yellow line. The areas that we want to adjust are colored in -- red where we may need to reduce the non-developable area and green where we might enlarge the non-developable area to compensate.

The second item is a conceptual sketch of the building layout that is being considered so that you can see more clearly where the adjustments would be needed. The non-developable area boundary is highlighted.

I would welcome your thoughts on this.

Sincerely,

Victoria Gussman

VG/tr
Enclosures (2)
cc: Mark G. Rinaldi, AICP

A wholly owned subsidiary of the Colonial Williamsburg Foundation
POST OFFICE BOX 1776 • WILLIAMSBURG, VIRGINIA 23187-1776
Telephone: 804-220-7242 • Fax: 804-220-7398

DARRYL

FiG -

Langley and McDonald, P.C.

Engineers
Surveyors
Planners
Landscape Architects
Environmental Consultants

GEORGE E. LANGLEY
Consultant
T. JOSEPH McDONALD
1906-1982

JUL 1996
RECEIVED
DEVELOPMENT
MANAGEMENT

June 27, 1996

Mr. Wayland N. Bass, P.E.
James City County
P. O. Box 8784
Williamsburg, VA 23187-8784

Re: James River Commerce Center

Dear Wayland:

With this letter I am sending a copy of these soils engineering report for the James River Commerce Center BMP dam. Please give me a call if you have any questions or comments in regard to this.

Very truly yours,

LANGLEY AND McDONALD, P.C.

Norman H. Mason
Principal

NHM/dhm
Enclosure

MAIN OFFICE
5544 Greenwich Road
Virginia Beach, VA 23462
(804) 473-2000
FAX: (804) 497-7933

201 Packets Court
Williamsburg, VA 23185
(804) 253-2975
FAX: (804) 229-0049

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

County BMP ID Code (if known): JR038

Name of Facility: James River Commerce Center BMP No.: ____ of ____ Date: 11/8/01

Location: end of ~~Commerce~~ ENDEAVOR Road

Name of Owner: ____

Name of Inspector: Rick Hall

Type of Facility: Retention pond

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

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

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

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

Facility Item	O.K.	Routine	Urgent	Comments
Embankments and Side Slopes:				
Grass Height		✓		Tall grass, weeds,
Vegetation Condition		✓		small trees -
Tree Growth		✓		a few bare areas on
Erosion	✓			excated slopes.
Trash & Debris	✓			
Seepage	✓			
Fencing or Benches				
Interior Landscaping/Planted Areas: ☐ None ☐ Constructed Wetland/Shallow Marsh ☑ Naturally Established Vegetation				
Vegetated Conditions	✓			
Trash & Debris	✓			
Floating Material		✓		Algae mats -
Erosion	✓			
Sediment	✓			
Dead Plant	✓			
Aesthetics		✓		
Other				

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools: ☑ Permanent Pool (Retention Basin) ☐ Shallow Marsh (Detention Basin) ☐ None. Dry (Detention Basin)				
Shoreline Erosion	✓			
Algae		✓		
Trash & Debris	✓			
Sediment	✓			
Aesthetics		✓		
Other				
Inflows (Describe Types/Locations): North corner RCP				
Condition of Structure	✓			
Erosion	✓			
Trash and Debris	✓			
Sediment	✓			
Aesthetics	✓			
Other				
Principal Flow Control Structure - Riser, Intake, etc. (Describe Location): south end				
Condition of Structure	✓			
Corrosion	✓			
Trash and Debris	✓			
Sediment	✓			
Aesthetics	✓			
Other				
Principal Outlet Structure - Barrel, Conduit, etc. : RCP				
Condition of Structure	✓			
Settlement	✓			
Trash & Debris	✓			
Erosion Sediment	✓			
Outlet Protection	✓			
Other				
Emergency Spillway (Overflow): Rip RAP channel				
Vegetation		✓		small trees
Lining	✓			
Erosion	✓			
Trash & Debris	✓			
Other				

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	✓			
Animal Burrows	✓			
Graffiti	✓			
Other				
Surrounding Perimeter Conditions:				
Land Uses	✓			
Vegetation	✓			
Trash & Debris	✓			
Aesthetics	✓			
Access /Maintenance Roads or Paths	✓			
Other				

Remarks:

Approx. 1/2 acre pond in good condition.
Needs routine maintenance to control weeds, small trees and algae.

Overall Environmental Division Internal Rating: 3

Signature: [illegible] **Date:** 11/8/01

Title: Environmental Specialist

SWMProg\BMP\CoInspProg\DetRet.wpd

Date Record Created:

Created By:

WS_BMPNO: JR038

Print Record

PRINTED ON
Thursday, March 11, 2010
4:15:52 PM

WATERSHED	JR
BMP ID NO	038
PLAN NO	SP-82-97
TAX PARCEL	(59-2)(1-17)
PIN NO	5920100017
CONSTRUCTION DATE	
PROJECT NAME	James River Commerce Center
FACILITY LOCATION	8907 Pocahontas Trail
CITY-STATE	Williamsburg, VA
CURRENT OWNER	Williamsburg Development Incorporated
OWNER ADDRESS	PO Box 1776
OWNER ADDRESS 2	
CITY-STATE-ZIP CODE	Williamsburg, VA 23187
OWNER PHONE	
MAINT AGREEMENT	No
EMERG ACTION PLAN	No

Get Last BMP No

Return to Menu

MAINTENANCE PLAN	No
SITE AREA acre	2000
LAND USE	Limited Bus/Indust
old BMP TYP	Wet Pond
JCC BMP CODE	A2 Wet Pond
POINT VALUE	9
SVC DRAIN AREA acres	57
SERVICE AREA DESCRI	Industrial Park, Roadway & Woods
IMPERV AREA acres	15.30
RECV STREAM	UT of James River
EXT DET-WQ-CTRL	Yes
WTR QUAL VOL acre-ft	0.63
CHAN PROT CTRL	Yes
CHAN PROT VOL acre-ft	6.79
SW/FLOOD CONTROL	Yes
GEOTECH REPORT	Yes

CTRL STRUC DESC	RCP Riser
CTRL STRUC SIZE inches	60
OTLT BARRL DESC	RCP Barrel
OTLT BARRL SIZE inch	36
EMERG SPILLWAY	Yes
DESIGN HW ELEV	34.13
PERM POOL ELEV	25.10
2-YR OUTFLOW cfs	7.67
10-YR OUTFLOW cfs	17.36
REC DRAWING	Yes
CONSTR CERTIF	No
LAST INSP DATE	11/8/2001
Inspected by:	
INTERNAL RATING	3

MISC/COMMENTS

WQv & SCPv control. ES El. 33. Lforif 12" @ El. 25.1.

Additional Comments:

WATERSHED	JR	MAINTENANCE PLAN	No	CTRL STRUC DESC	RCP Riser
BMP ID NO	038	SITE AREA acre	2000	CTRL STRUC SIZE inches	60
PLAN NO	SP-82-97	LAND USE	Limited Bus/Indust	OTLT BARRL DESC	RCP Barrel
TAX PARCEL	(59-2)(1-17)	old BMP TYP	Wet Pond	OTLT BARRL SIZE inch	36
PIN NO	5920100017	JCC BMP CODE			
CONSTRUCTION DATE		POINT VALUE	9	EMERG SPILLWAY	Yes
PROJECT NAME	James River Commerce Center			DESIGN HW ELEV	34.13
FACILITY LOCATION	8907 Pocahontas Trail			PERM POOL ELE	25.10
CITY-STATE	Williamsburg, VA	SVC DRAIN AREA acres	57	2-YR OUTFLOW cfs	7.67
CURRENT OWNER	Williamsburg Development Incorporated			10-YR OUTFLOW cfs	17.36
OWNER ADDRESS	PO Box 1776			REC DRAWING	Yes
OWNER ADDRESS 2		SERVICE AREA DESCRI	Industrial Park, Roadway & Woods		
CITY-STATE-ZIP CODE	Williamsburg, VA 23187	IMPERV AREA acres	15.30	CONSTR CERTI	No
OWNER PHONE		RECV STREAM	UT of James River		
MAINT AGREEMENT	No	EXT DET-WQ-CTRL	Yes	LAST INSP DATE	11/8/2001
EMERG ACTION PLAN	No	WTR QUAL VOL acre-ft	0.63	INTERNAL RATING	3
		CHAN PROT CTRL	Yes	MISC/COMMENTS	
		CHAN PROT VOL acre-ft	6.79	WQv & SCPv control. ES El. 33. Lforif 12" @ El. 25.1.	
		SW/FLOOD CONTROL	Yes		
		GEOTECH REPORT	Yes		

Get Last BMP No

Return to Menu

James City County Stormwater Division

287 Mclaws Circle Suite 1
Williamsburg, VA 23185-5649
www.jccEgov.com

Phone: (757)259-1460
Fax: (757)259-5833
Email: stormwater@james-city.va.us

NOTICE OF SITE VISIT

On __08/21/08_____ James City County received the following complaint regarding a possible discharge of wastes to the storm sewer system:

Description: Sanitary Sewer Overflow

Location: 1709 Endeavor Drive – James River Commercial Park

James City County staff observed the following conditions at the above location:
Broken sanitary sewer force main resulting in an overflow into the drainage system. System leads to a BMP within the commercial complex. There appears to be signs that the sewer run off has reached the BMP.

These conditions currently constitute non-compliance with Ordinance No. 208A-1 of the Code of James City County:

§18A-22 Prohibitions,*(a) It shall be a violation of this ordinance to:*
(1) Discharge, or cause or allow to be discharged, sewage, industrial wastes or other wastes into the storm sewer system, or any component thereof, or onto driveways, sidewalks, parking lots or other areas draining to the storm sewer system; or (2) Connect, or cause or allow to be connected, any sanitary sewer to the storm sewer system, including any sanitary sewer connected to the storm sewer system as of the date of adoption of this article. (3) Throw, place or deposit or cause to be thrown, placed or deposited into the storm sewer system anything that impedes or interferes with the free flow of stormwater therein.

Recommended Corrective Action: JCSA filled out a SSO notification stating that 1500 gallons were Released and that contaminated soils were removed. JCSA made a light disinfection of storm water drainage ditch With a chlorine soloution.

Recommended corrective action deadline date: _____08/21/2008_____

Re-inspection Date:_____N/A_____

If listed condition(s) are not corrected by the deadline, a **Notice Of Corrective Action** and/or other enforcement actions may be issued to the person performing such discharges or to the property owner where such discharges are occurring.

Inspector:_David Greshamer_____**Site Visit Date:_08/21/08_____**

Acknowledgement of on-site receipt (if available):

Print Name _____**Signature Date:**_____

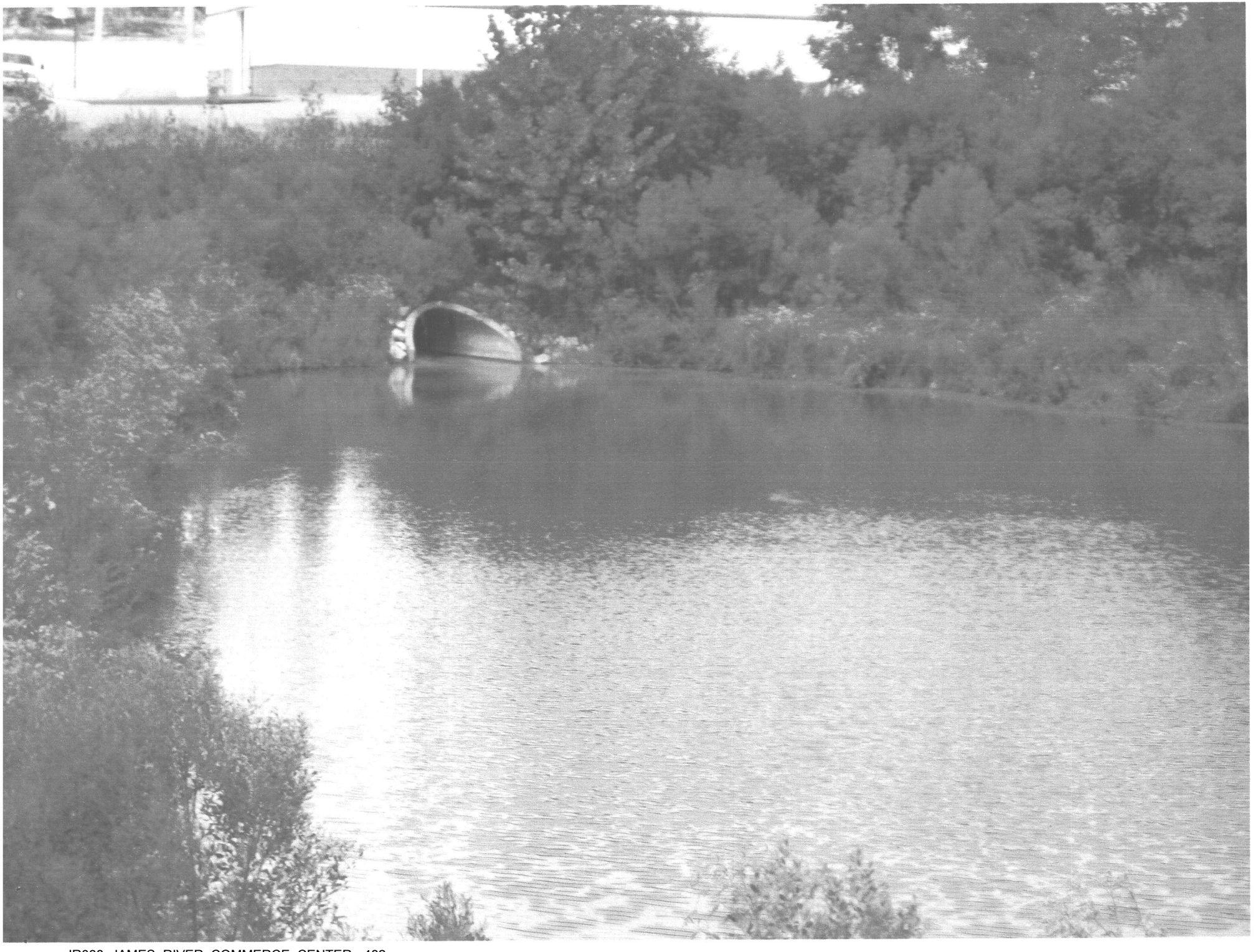
JR038_JAMES_RIVER_COMMERCE_CENTER - 476

JR038_JAMES_RIVER_COMMERCE_CENTER - 478

JR038_JAMES_RIVER_COMMERCE_CENTER - 479

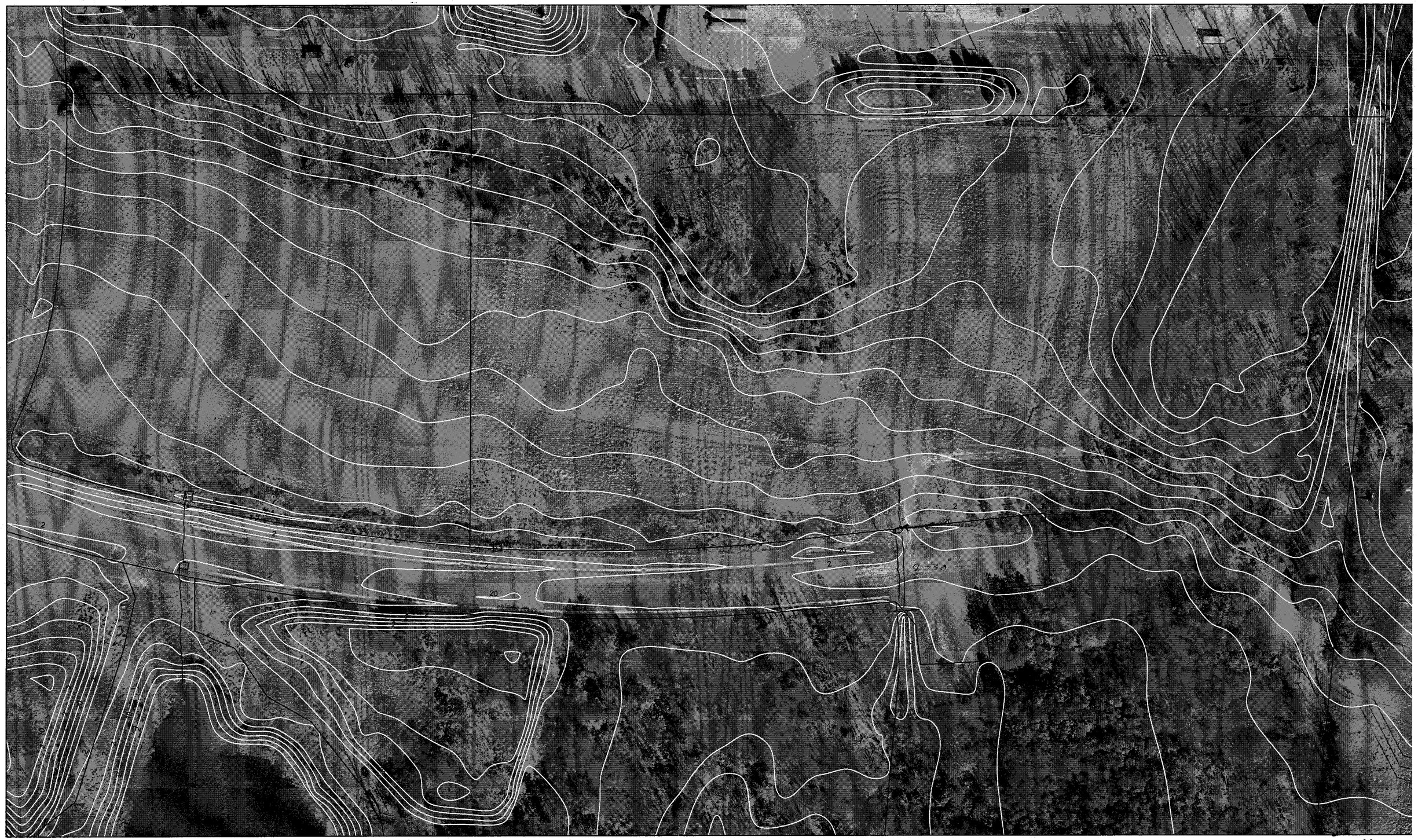
JR038_JAMES_RIVER_COMMERCE_CENTER - 480

JR038_JAMES_RIVER_COMMERCE_CENTER - 481



JR038_JAMES_RIVER_COMMERCE_CENTER - 482

James City County - Stormwater Division



This drawing is neither a legally recorded map nor a survey and is not intended to be used as such. The information displayed is a compilation of records, information, and data obtained from various sources, and James City County is not responsible for its accuracy or how current it may be. If discrepancies are found, please contact the Real Estate Assessment Division of James City County, Mapping/GIS Section.

1 inch = 100 feet

0 0.025 0.05 Miles

N

Langley and McDonald
A PROFESSIONAL CORPORATION
ENGINEERS • PLANNERS • SURVEYORS
VIRGINIA BEACH - WILLIAMSBURG, VIRGINIA

Subject JRCC BMP CALCS.
Computed By _____ Checked By _____

Project No. 95-16
Client WDI
Date 3/20/96 Sheet No. _____

TOTAL AREA = 219.2 Ac.
OPEN SPACE = 81.8 Ac.

FROM BALL TO 9 PT. BMP

$$\frac{17 \text{ Ac}}{219.2 - 81.8} \times 9 = 1.1 \text{ PTS.}$$

TO SCHOOL 6 PT. BMP

$$\frac{7.2 \text{ Ac}}{219.2 - 81.8} \times 6 = 0.3 \text{ PTS.}$$

OTHER ONSITE AREAS TO 9 PT. BMP

$$\frac{74.8 \text{ Ac.}}{219.2 - 81.8} \times 9 = 4.9 \text{ PTS.}$$

OPEN SPACE POINTS

$$\frac{81.8}{219.2} \times 10 = 3.7 \text{ PTS.}$$

TOTAL POINTS:

$$1.1 + 0.3 + 4.9 + 3.7 = 10.0 \text{ POINTS}$$

JRCC REVIEW OF BMP's AND OPEN SPACE AS RELATED TO CHESAPEAKE BAY ORDINANCE COMPLIANCE

With the proposed new shell building, it became appropriate to review the Chesapeake Bay compliance issue, in light of changes occurring in late 1999 in the computational process. At this time, point values for various BMP's were changed and allowable credits for undisturbed natural open space (UNOS) were changed for certain types of such open space.

The last overall reviews of JRCC were carried out in conjunction with the expansion of Ball Metal, when a new warehouse was developed in late 1995 and 1996 and in conjunction with the review and approval of Endeavor Drive. At that time, the calculations were reviewed in a meeting with Darryl Cook and Wayland Bass on April 25, 1996 and a later meeting with Darryl Cook on June 27, 1997. Copies of the calculations were left at the time of those meetings.

It is important to be able to follow, over several different studies, at different times, the various calculations relative to Ches. Bay since the original Ches. Bay Compliance Master Plan was prepared in 1992. That work was based upon a proposed development plan by the architectural firm of Rancorn, Wildman, Krause and Brezinski.

There are certain key numbers appearing in the study and report accompanying the 1992 Master Plan. These numbers appear in the Ches. Bay calculations in the study.

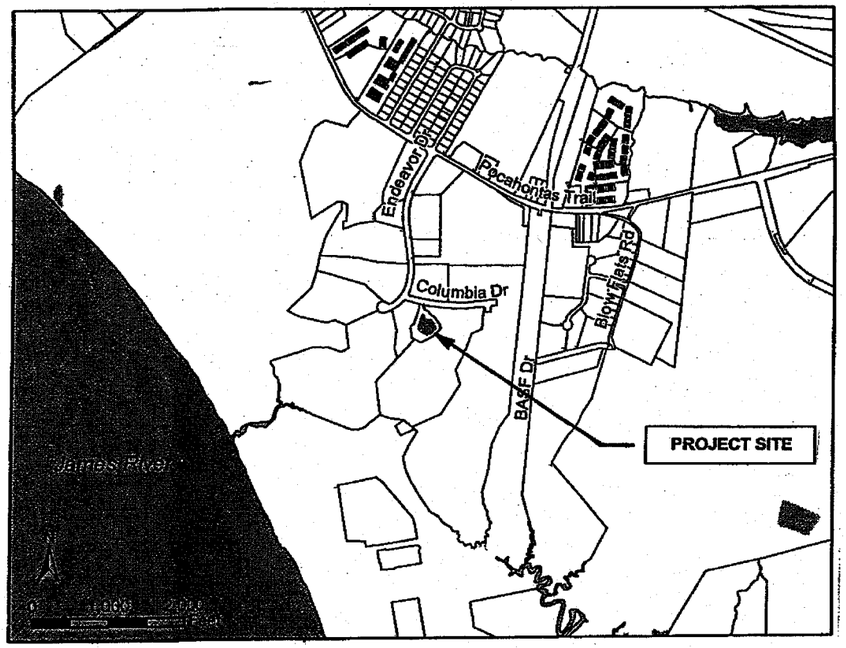
One of these numbers is the total site area used in the denominator of the point calculations. In the report, this number shows on page 8 as 219.2 acres. This number reflects total site area from plats of record in P.B. 56, Pg. 33 and P.B.55, Pg. 43. The total acreage on these plats is 216.10. I cannot explain the three acre difference, without further research, which I do not believe is warranted.

Another significant number is the area of UNOS showing on page 3 of the 1992 Ches. Bay Compliance study. That area is comprised of two different areas, A. and B. Area A is noted at 55.4 acres. This area reflects the undevelopable area showing on the two plats referenced in the previous paragraph. These plats show a total undevelopable area of 54.97 acres. Area B consists of various areas showing on the RWKB Master Plan as "INTERNAL UNDISTURBED NATURAL OPEN SPACE". These areas total 19.4 acres. The total of these UNOS areas is 74.8 acres, as shown on page 3 of the 1992 report (55.4+19.4=74.8).

At the top of page 3 of the 1992 report, a total area draining to various detention ponds of 137.8 acres is shown. That number appears again on page 8 of the 1992 report, and is noted as "DEVELOPED ACREAGE". This acreage is the area within the heavy, broad line on the RWKB Master Plan, showing the drainage divides between the various detention basins. This number is significant, because it will be noted later, as it relates to areas shown in the Ball Metal / JRCC calculations, reviewed in the April 25,

JAMES RIVER COMMERCE CENTER						
EXISTING				**REVISED**		
BMP POINT CALCULATION				**BMP POINT CALCULATION**		
TOTAL ACREAGE	219.2			TOTAL ACREAGE	219.2	
TOTAL DEVELOPED ACREAGE	136.4			TOTAL DEVELOPED ACREAGE	136.4	
TOTAL UNDEVELOPED/UNOS	82.8			TOTAL UNDEVELOPED/UNOS	82.8	
POINT CALCULATION				**POINT CALCULATION**		
BMP#1				BMP#1		
{54.7 AC/(219.2-82.8)} X 9 POINTS	3.6			{60 AC/(219.2-82.8)} X 10 POINTS	4.4	
TO BALL METAL ONSITE BMP				TO BALL METAL ONSITE BMP		
23.3AC/ (219.2- 82.8) X 4POINTS	0.7			23.3AC/ (219.2- 82.8) X 4POINTS	0.7	
FROM JRCC TO SCHOOL BMP				FROM JRCC TO SCHOOL BMP		
7.2AC/(219.2-82.8) X 6 POINTS	0.3			7.2AC/(219.2-82.8) X 4 POINTS	0.2	
TO TWO ADD'L. BMP'S						
{9.2 AC +13.3 AC/ (219.2-82.8)} X 9 POINTS	1.5					
REMAINDER OF BALL TO EAST BMP AS OFFSITE CREDIT	0.2					
OPEN SPACE CREDIT FOR 82.8 AC OUT OF 219.2AC TOTAL	3.8			OPEN SPACE: 46.9 AC AT 15%, (82-46.9)=35.1 AC AT 10%	4.8	
TOTAL POINTS	10.1			**TOTAL POINTS**	10.1	

JAMES CITY COUNTY
INVITATION FOR BID 07-0059
JAMES RIVER COMMERCE CENTER REGIONAL STORMWATER BASIN
JAMES CITY ECONOMIC DEVELOPMENT AUTHORITY



Parcel ID	(59-2(1-55)
Address	8903 Columbia Drive
Owner	James River Commerce Center Association
Zoning	M-1
Parcel Area	3.03 acres
Disturbed Area	1970 sf

GENERAL NOTES

1. THE PURPOSE OF THIS PROJECT IS TO MODIFY THE EXISTING REGIONAL STORMWATER BASIN TO ACCOMMODATE ADDITIONAL DRAINAGE AREA CREATED BY THE PLANNED CONSTRUCTION OF THE JAMES CITY COUNTY INDUSTRIAL SHELL BUILDING TO BE LOCATED ON COLUMBIA DRIVE. THE DAM HEIGHT IS BEING MODIFIED TO PROVIDE FOR ADDITIONAL FREEBOARD DURING A 100 YEAR STORM EVENT, AND THE OUTLET IS BEING MODIFIED TO PROVIDE ADDITIONAL STORAGE VOLUME. THE PRINCIPAL OUTLET AND NORMAL POOL ELEVATION REMAIN THE SAME. ACCESS TO THE SITE SHALL BE FROM COLUMBIA DRIVE.

2. THE CONTRACTOR SHALL NOTIFY MISS UTILITY (1-800-552-7001) PRIOR TO ANY EXCAVATION IN THE FIELD. THE LOCATION OF ANY UTILITIES ON THIS PLAN, OR LACK OF ANY NOTATION ON THE PLAN, IS BASED UPON KNOWN INFORMATION AND INTENDED TO BE APPROXIMATE. THE CONTRACTOR SHALL AT HIS OWN INTIATIVE AND EXPENSE, LOCATE ALL UNDERGROUND LINES, STRUCTURES AND UTILITIES WITHIN THE PROPOSED WORK AREA, AND IF ANY ARE FOUND, SHALL IMMEDIATELY NOTIFY THE PROJECT MANAGER FOR GUIDANCE. ANY WORK RELATED TO THE RELOCATION OF UNKNOWN OBSTRUCTIONS SHALL BE TREATED AS A CHANGE TO THE SCOPE OF THE PROJECT, EXCEPT THAT NO ADDITIONAL WORK TIME SHALL BE GRANTED.

3. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ANY AND ALL REQUIRED PERMITS, PERFORMING WORK IN ACCORDANCE WITH THESE PLANS AND ALL APPLICABLE LAWS AND REGULATIONS, INCLUDING ANY VIRGINIA STORMWATER PROTECTION PERMITS IF REQUIRED. FOR PURPOSES OF APPROVAL OF THIS PLAN, THE RESPONSIBLE LAND DISTURBER SHALL BE BERNARD M. FARMER, JR., P. E. VIRGINA # 14849. THE CONTRACTOR SHALL NAME A PERSON WHO IS CERTIFIED AS A VIRGINIA RESPONSIBLE LAND DISTURBER AND PROVIDE THEIR CREDENTIALS AND TRANSFER THE RESPONSIBLE LAND DISTURBER TO THAT DESIGNEE PRIOR TO OBTAINING THE LAND DISTURBANCE PERMIT, IF REQUIRED.

4. APPROVED COPIES OF THIS PLAN, ALL CONSTRUCTION DOCUMENTS, AND ANY PERMITS REQUIRED SHALL BE MAINTAINED ON SITE BY THE CONTRACTOR AT ALL TIMES.

5. AN EXISTING ON SITE SOIL STOCKPILE IS AVAILABLE FOR USE TO PROVIDE SOIL FOR THE DAM TOP AND SPILLWAY. IMPORT OF MATERIAL, OTHER THAN STONE TO PROVIDE ADEQUATE CONSTRUCTION ENTRANCE OR ACCESS, IS NOT ANTICIPATED. THE CONTRACTOR CAN REUSE RIP RAP IN THE EMERGENCY SPILLWAY MODIFICATION.

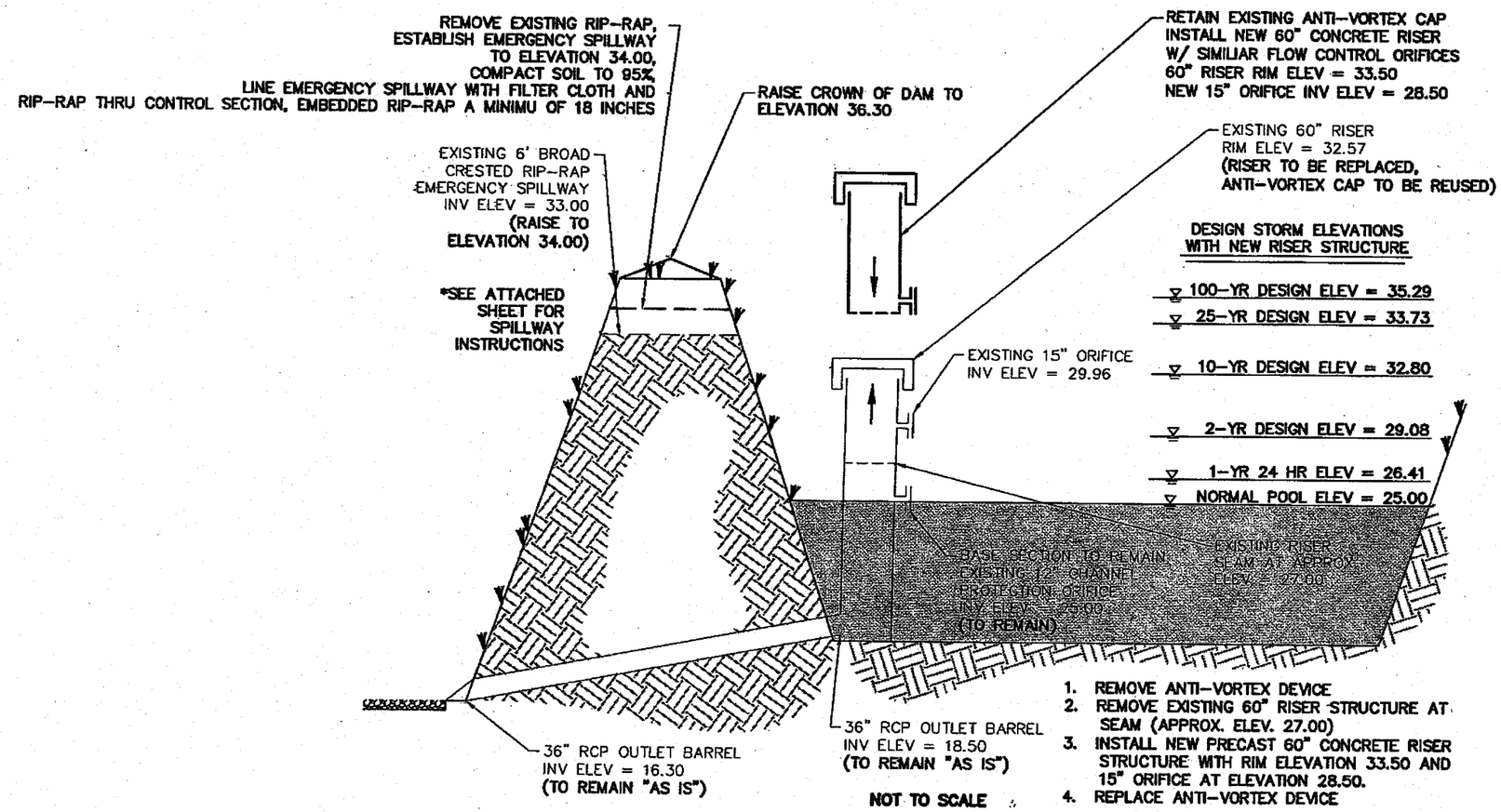
6. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT EROSION, AND CONTROL SEDIMENT ON SITE. MINIMUM STANDARDS AND SPECIFICATIONS AS CONTAINED IN THE *VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK*, THIRD EDITION, SHALL GOVERN ALL WORK. CONTRACTOR SHALL PREVENT TRACKING OF SOIL ONTO COLUMBIA DRIVE, PROVIDE TEMPORARY AND PERMANENT STABILIZATION AS NECESSARY, AND RESTORE ALL WORK AREAS OF THE SITE TO THEIR ORIGINAL CONDITION. WORK SHALL NOT BE CONSIDERED COMPELETE UNTIL FULL STABILIZATION OF ALL DISTURBED AREAS IS ACHIEVED.

COMMONWEALTH OF VIRGINIA
BERNARD M. FARMER, JR.
No. 14849
PROFESSIONAL ENGINEER
2/23/07

JAMES RIVER COMMERCE CENTER MODIFICATIONS
TO BMP JR 038

February 23, 2007
Drafting by AES
As Built Topo
From Original
Dwg by Landmark
Design Group
Revised:

RISER AND DAM MODIFICATIONS



1. REMOVE ANTI-VORTEX DEVICE
2. REMOVE EXISTING 60" RISER STRUCTURE AT SEAM (APPROX. ELEV. 27.00)
3. INSTALL NEW PRECAST 60" CONCRETE RISER STRUCTURE WITH RIM ELEVATION 33.50 AND 15" ORIFICE AT ELEVATION 28.50.
4. REPLACE ANTI-VORTEX DEVICE

COMMONWEALTH OF VIRGINIA
BERNARD M. FARMER, JR.
No. 14849
PROFESSIONAL ENGINEER
2/23/06

JAMES RIVER COMMERCE CENTER MODIFICATIONS, TO BMP JR 038

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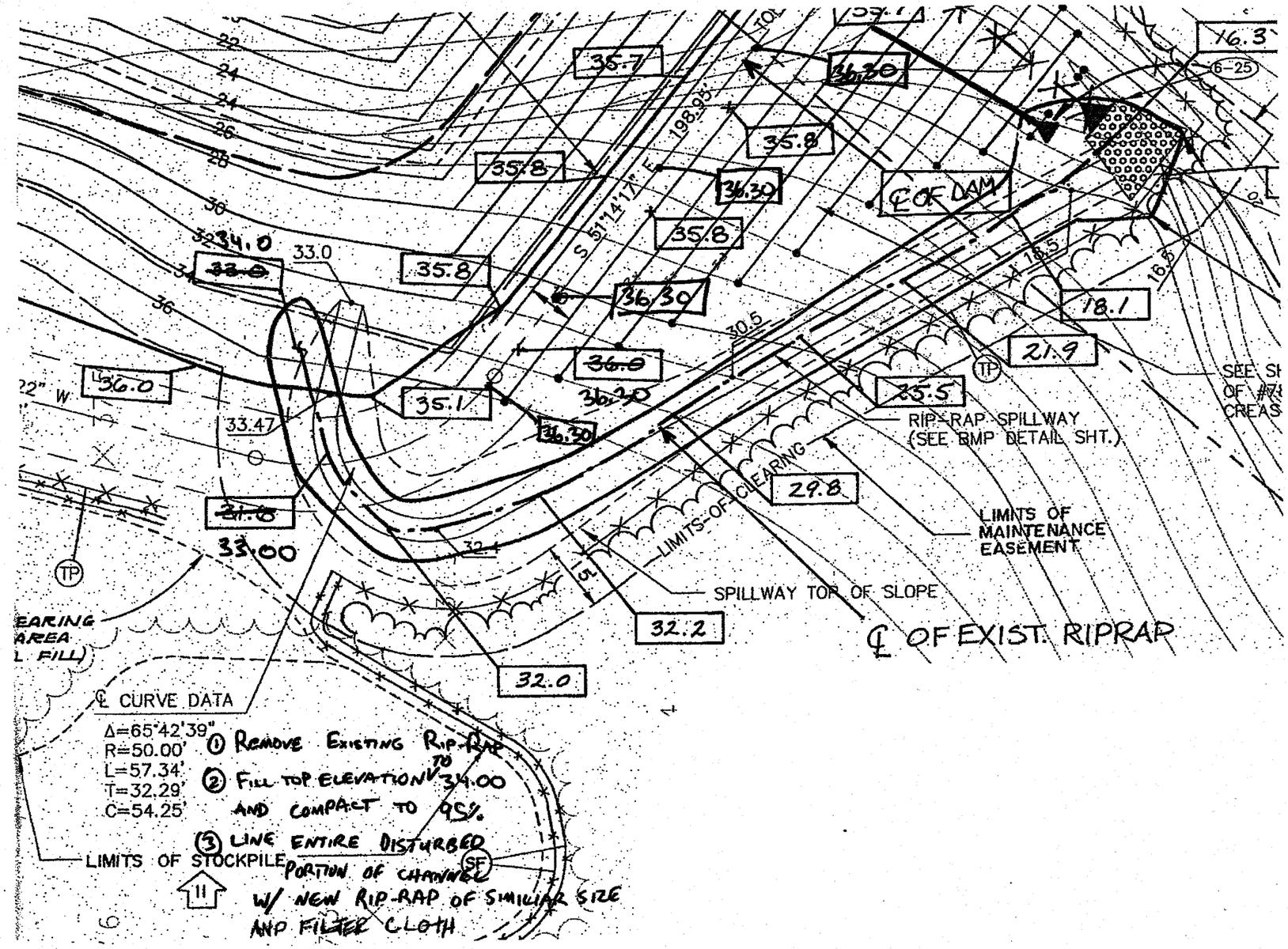
Revised:

James City County
Jamestown 1607

EMERGENCY SPILLWAY MODIFICATIONS



UNDERLYING SURVEY DATA ON THIS PLAN TAKEN FROM "AS BUILT" INORMATION PREPARED BY GARY C. THOMAS, LAND SURVEYOR, DATED 2/6/97.

COMMONWEALTH OF VIRGINIA
BERNARD M. FARMER, JR.
2/23/06 No. 14849
PROFESSIONAL ENGINEER

JAMES RIVER COMMERCE CENTER MODIFICATIONS
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