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: **WC068**

DATE VERIFIED: **July 18, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

DATE: March 13, 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: WC068

PIN: 0640100001

Subdivision, Tract, Business or Owner Name (if known): GS Stonehouse Green Land Sub LLC

Property Description: Parcel 27 Stonehouse Tract Division of Stonehouse @ Williamsburg LLC

Site Address: 9770 Six Mount Zion Road

(For internal use only) **Box** 23 **Drawer:** 9

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

Comments

James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities
Record Drawing and Construction Certification Forms

(Note: In accordance with the requirements of the Chesapeake Bay Preservation Ordinance, Chapter 23, Section 23-10(4), BMP's shall be designed and constructed in accordance with the manual entitled James City County Guidelines for Design and Construction of Stormwater Management BMP's. Erosion and sediment control policy and approved plans generally require that at the completion of the project and prior to release of surety, an "as-built plan prepared by a registered Professional Engineer or Certified Land Surveyor must be provided for the drainage system for the project, including any Best Management Practice (BMP) facilities. In addition, for BMP facilities involving the construction of an impounding structure or dam embankment, certification is required by a Professional Engineer who has inspected the structure during its construction. Currently there are over 20 water quality type BMP's accepted by the County.)

Section 1 – Site Information:

Project Name: La Grange Parkway Extension at Commerce Park
Structure/BMP Name: Attenuation Basin No. 1
Project Location: Stonehouse Commerce Park
BMP Location Station 41+00 left La Grange Parkway
County Plan No.: SP - 82 - 00

Project Type:
- ☐ Residential
- ☐ Commercial
- ☐ Institutional
- ☐ Public
- ☐ Other _____
- ☐ Business
- ☐ Office
- ☐ Industrial
- ☒ Roadway

Tax Map/Parcel No.: (12-1) (01-1)
BMP ID Code (if known): WC068
Zoning District: PUD-C
Land Use:
Site Area (sf or acres): 12 Ac.

Brief Description of Stormwater Management/BMP Facility: Dry Storage Detention Basin

Nearest Visible Landmark to SWM/BMP Facility: Interstate 64 overpass

Nearest Vertical Ground Control (if known):

☐ JCC Geodetic Ground Control ☐ USGA ☐ Temporary ☐ Arbitrary ☐ Other
Station Number or Name:
Datum or Reference Elevation:
Control Description:
Control Location from Subject Facility:

Section 2 – Stormwater Management / BMP Facility Construction Information:

Pre Construction Meeting Held for Construction of SWM/BMP Facility: ☐ Yes ☐ No ☒ Unknown
Approx. Construction Start Date for SWM/BMP Facility: June 2002
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☒ Unknown
Name of Site Work Contractor who Constructed Facility: Cantrell Construction
Name of Professional Firm Who Routinely Monitored Construction: LandMark Design Group
Date of Completion for SWM/BMP Facility: January 2004
Date of Record Drawing/Construction Certification Submittal: 02/16/04

(Note: Record Drawing and Construction Certifications are required within thirty (30) days of the completion of Stormwater Management and/or BMP facility construction. Record Drawings and Construction Certifications must be reviewed and approved by the James City County Environmental Division prior to final inspection, acceptance and bond or surety release.)

Section 3 – Owner/Designer/Contractor Information:

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*

Name: Stonehouse, Inc.
Mailing Address: P.O. Box 311
West Point, VA 23181
Business Phone: 804-843-3300 Fax: 804-843-4487
Contact Person: Steve Campitell Title:
804-843-4369 x103

Design Professional: *(Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater Management / BMP facility.)*

Firm Name: The LandMark Design Group, Inc.
Mailing Address: 4029 Ironbound Road, Suite 100
Williamsburg, VA 23188
Business Phone: 757-253-2975 Fax: 757-229-0049
Responsible Plan Preparer: Richard S. Phillips, P.E.
Title: Senior Associate
Plan Name: La Grange Parkway Extension
Firm's Project No. 1990140-000.05
Plan Date: 07/11/01
Sheet No.'s Applicable to SWM/BMP Facility: C-5 / / / /

BMP Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater Management / BMP facility.)*

Name: Wm. T. Cantrell, Inc.
Mailing Address: 10911 Paulbrook Drive
Midlothian, VA 23112
Business Phone: 804-745-9100 Fax: 804-745-9151
Contact Person: Taylor Cantrell
Site Foreman/Supervisor:
Specialty Subcontractors & Purpose (for BMP Construction Only): N/A

Section 4 - Professional Certifications:

Certifying Professionals: *(Note: A Registered Professional Engineer or Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the drainage system for the project including any Stormwater Management/BMP facilities during its construction.)*

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: _____
Mailing Address: _____

See As-Built Drawing

Business Phone: _____
Fax: _____

Name: _____
Title: _____

Signature: _____
Date: _____

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

_____ (Seal)

Virginia Registered Professional Engineer
or Certified Land Surveyor

Construction Certification

Firm Name: LandMark Design Group, Inc.
Mailing Address: 4029 Ironbound Road, Suite 100
Williamsburg, VA 23188
Business Phone: 757-253-2975
Fax: 757-229-0049

Name: Richard S. Phillips, P.E.
Title: Senior Associate

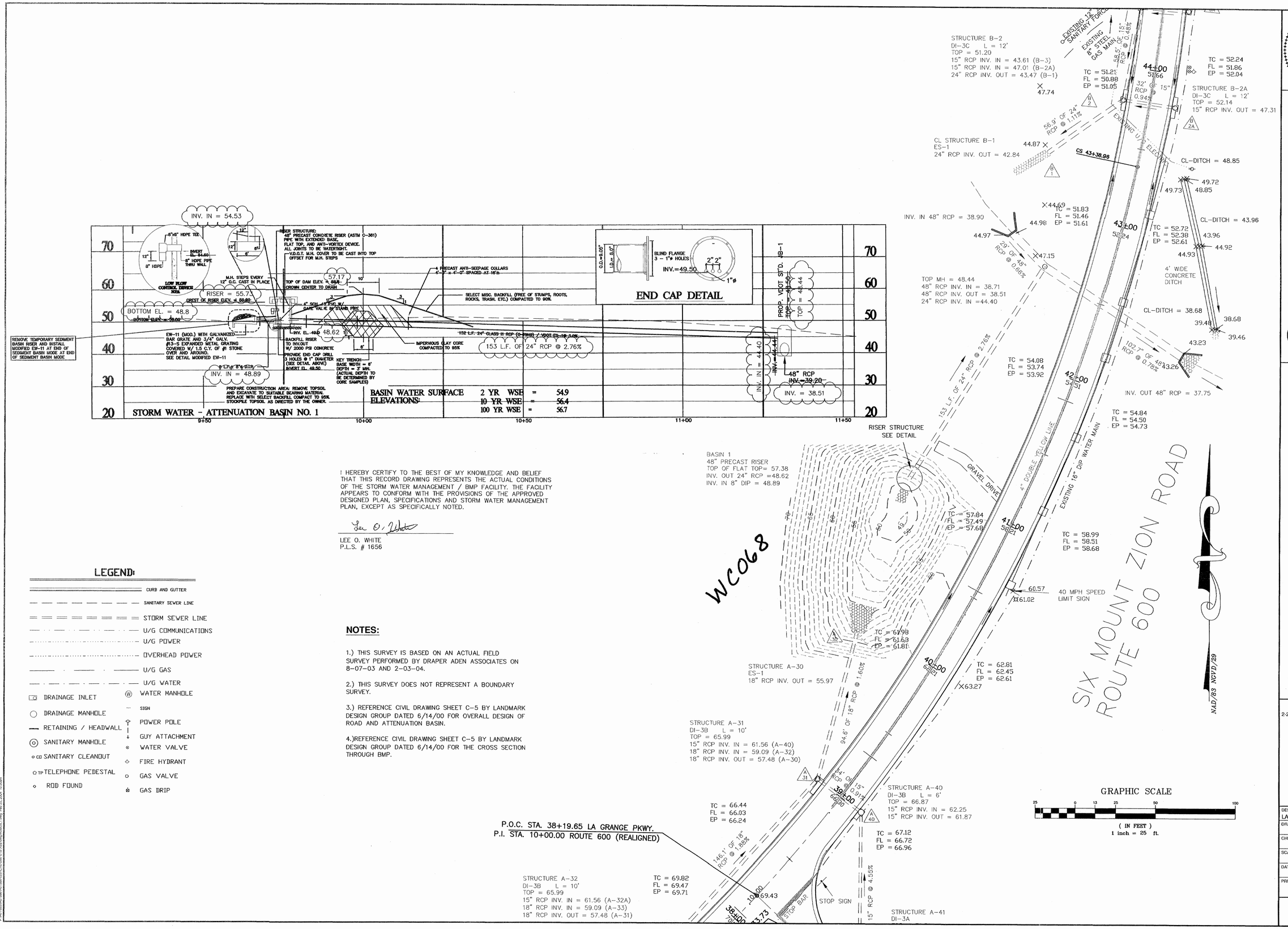
Signature: _____
Date: 3/3/06

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

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

_____ (Seal)

Virginia Registered Professional Engineer



I HEREBY CERTIFY TO THE BEST OF MY KNOWLEDGE AND BELIEF THAT THIS RECORD DRAWING REPRESENTS THE ACTUAL CONDITIONS OF THE STORM WATER MANAGEMENT / BMP FACILITY. THE FACILITY APPEARS TO CONFORM WITH THE PROVISIONS OF THE APPROVED DESIGNED PLAN, SPECIFICATIONS AND STORM WATER MANAGEMENT PLAN, EXCEPT AS SPECIFICALLY NOTED.

LEE O. WHITE
P.L.S. # 1656

LEGEND:

- CURB AND GUTTER
- SANITARY SEWER LINE
- STORM SEWER LINE
- U/G COMMUNICATIONS
- U/G POWER
- OVERHEAD POWER
- U/G GAS
- U/G WATER
- DRAINAGE INLET
- DRAINAGE MANHOLE
- RETAINING / HEADWALL
- SANITARY MANHOLE
- SANITARY CLEANOUT
- TELEPHONE PEDESTAL
- ROD FOUND
- WATER MANHOLE
- SIGN
- POWER POLE
- GUY ATTACHMENT
- WATER VALVE
- FIRE HYDRANT
- GAS VALVE
- GAS DRIP

NOTES:

1.) THIS SURVEY IS BASED ON AN ACTUAL FIELD SURVEY PERFORMED BY DRAPER ADEN ASSOCIATES ON 8-07-03 AND 2-03-04.

2.) THIS SURVEY DOES NOT REPRESENT A BOUNDARY SURVEY.

3.) REFERENCE CIVIL DRAWING SHEET C-5 BY LANDMARK DESIGN GROUP DATED 6/14/00 FOR OVERALL DESIGN OF ROAD AND ATTENUATION BASIN.

4.)REFERENCE CIVIL DRAWING SHEET C-5 BY LANDMARK DESIGN GROUP DATED 6/14/00 FOR THE CROSS SECTION THROUGH BMP.

COMMONWEALTH OF VIRGINIA
LEE O. WHITE
No. 1656
2/3/4
LAND SURVEYOR

Draper Aden Associates
Engineering • Surveying • Environmental Services
Blacksburg, VA
Charlottesville, VA
Hampton Roads, VA
Raleigh-Durham, NC
Richmond, VA
8090 Villa Park Drive
Henrico, VA 23228
804-264-2228 Fax: 804-264-8773
www.daa.com

MAP SHOWING ASBUILT CONDITIONS STORM WATER ATTENUATION BASIN # 1

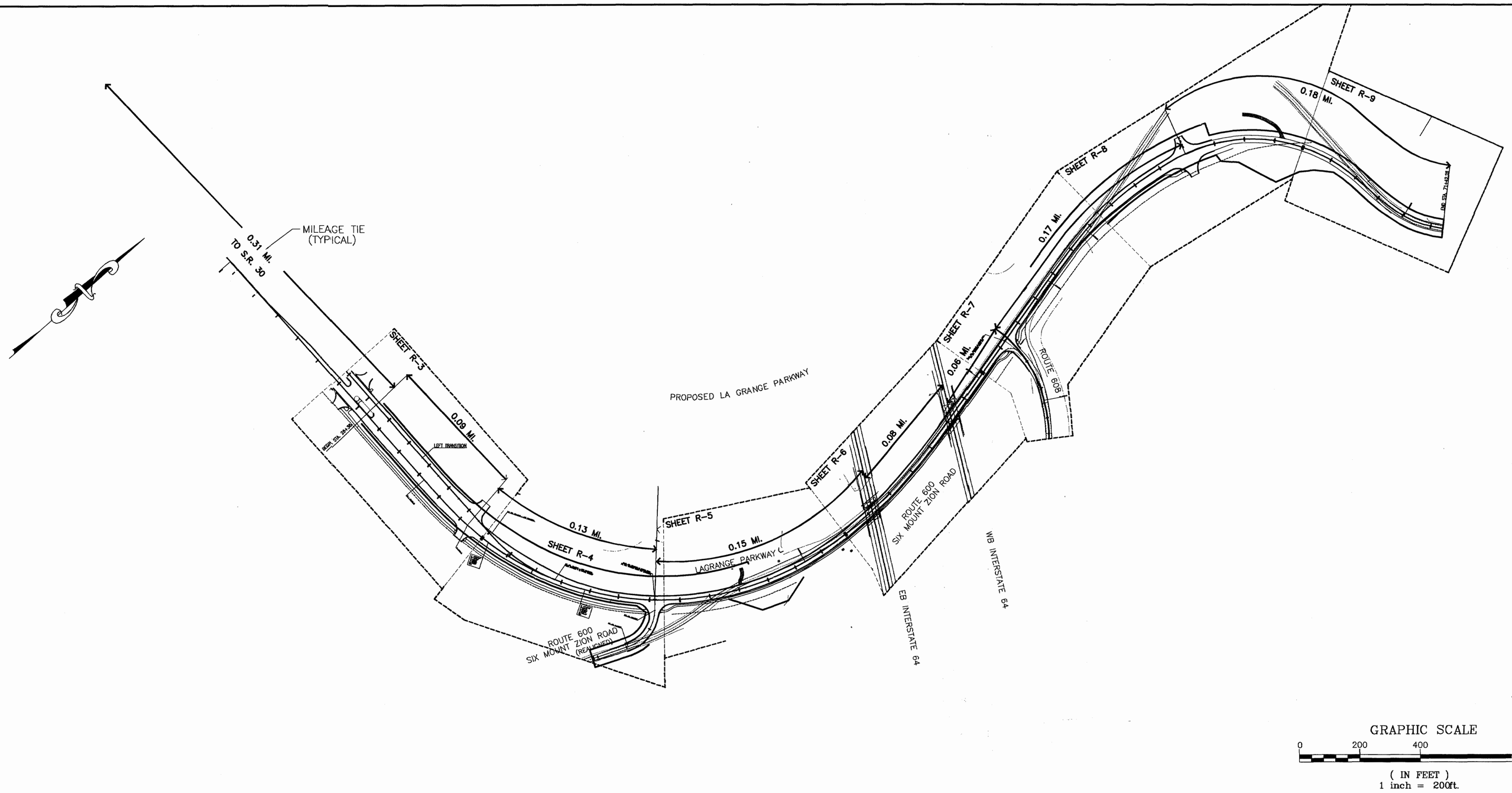
LA GRANGE PARKWAY EXTENSION

JAMES CITY COUNTY, VIRGINIA

REVISIONS
2-25-04 RMVD TEMP. RISER

DESIGNED BY:	LANDMARK DESIGN GROUP
DRAWN BY:	WGW
CHECKED BY:	LOW
SCALE:	1" = 25'
DATE:	8-7-03
PROJECT NUMBER:	R01586-02S

1 OF 1



COMMONWEALTH OF VIRGINIA
12-10-02
PETER FARRELL
NO. 002036
Peter Farrell
LAND SURVEYOR

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

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

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

V.D.O.T. RECORD DRAWINGS

SHEET LAYOUT

LA GRANGE PARKWAY EXTENSION
AT COMMERCE PARK
FOR STONEHOUSE, INC.
JAMES CITY COUNTY, VIRGINIA

Designed: LMDG	Date: 12-10-02
Checked: PF	Scale: 1"=200'
File Mgr./Drawn: AST	CADD File name: REC-R2
Project Number: 1990140-000.33	Dwg. File No.: 13884W
Drawing Number R-2	

WC068_LAGRANGE_PARKWAY_EXTENSION - 007

James City County, Virginia
Environmental Division

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

County Plan No.: SP-82-00
Project Name: LAGRANGE PARKWAY EXTENSION
Stormwater Management Facility: DRY BASIN
Phase: ☑ I ☐ II ☑ III

☑ Information Received.
Date/By: 2/3/04 DRAPER ARDEN / ASSOC.

☑ Administrative Check.

☑ Record Drawing
Date/By: 2/3/04 DRAPER ARDEN & ASSOC.

☑ Construction Certification
Date/By: 2/16/04 RICHARD PHILLIPS

☑ RD/CC Standard Forms (Required for all BMPs after Feb 1st 2001 Only)

☐ Insp/Maint Agreement #/Date:
SP-82-00 SUP 04

☐ BMP Maintenance Plan Location:
NONE

☐ Other:

☑ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review file.
☑ Yes ☐ No Location: LAST SHEET OF APP. PLAN

☑ Assign **County BMP ID Code**: WC068 Code:

☑ Preliminary Input into Division's "As-Built Tracking Log"
☑ Add Location to GIS Database Map. Obtain site information (GPIN, Owner, Site Area, Address, etc.)
☑ Preliminary Log into Access BMP Database (BMP ID #, Plan No., GPIN, Project Name, etc.)
☑ Active Project File Review (correspondence, H&H, etc.).
☑ Initial As-Built File setup (Label, copy hydraulics, BMP plan and detail information, etc.).
☑ Inspector Check of RD/CC (forward to inspector using transmittal for cursory review).

☑ Pre-Inspection Drawing Review - Approved Plan (Quick look prior to Field Inspection).

☑ Final Inspection (FI) Performed Date: ~~4/30/04~~ 11/4/04

☑ Record Drawing (RD) Review (***) Date: ~~4/30/04~~ 11/4/04

☐ Construction Certification (CC) Review Date: 4/30/04

☐ Actions:

☐ No comments.

☑ Comments. Letter Forwarded. Date:

☐ Record Drawing (RD)
☐ Construction Certification (CC)
☑ Construction-Related (CR)
☑ Site Issues (SI)
☐ Other : _____

☐ Second Submission: _____

☐ Reinspection (if necessary): _____

☑ Acceptable for stormwater managment facility purposes (RD/CC/CR/Other). Proceed with bond release.

☑ Notify Inspector and Inspector Supervisor using "Surety Request Form".

☐ Check/Clean active file of any remaining material and finish "As-Built" file.

☐ Add to County BMP Inventory/Inspection schedule (Phase I, II or III).

☐ Copy Final Inspection Report into County BMP Inspection Program file.

☐ Obtain Digital Photographs of BMP and log into computer.

☐ Complete "As-built Tracking Log"

☐ Last check of BMP Access Database. Add to PRIDE database.

☐ Add to JCC Hydrology & Hydraulic database (optional).

☐ Add to PRIDE BMP ratings database.

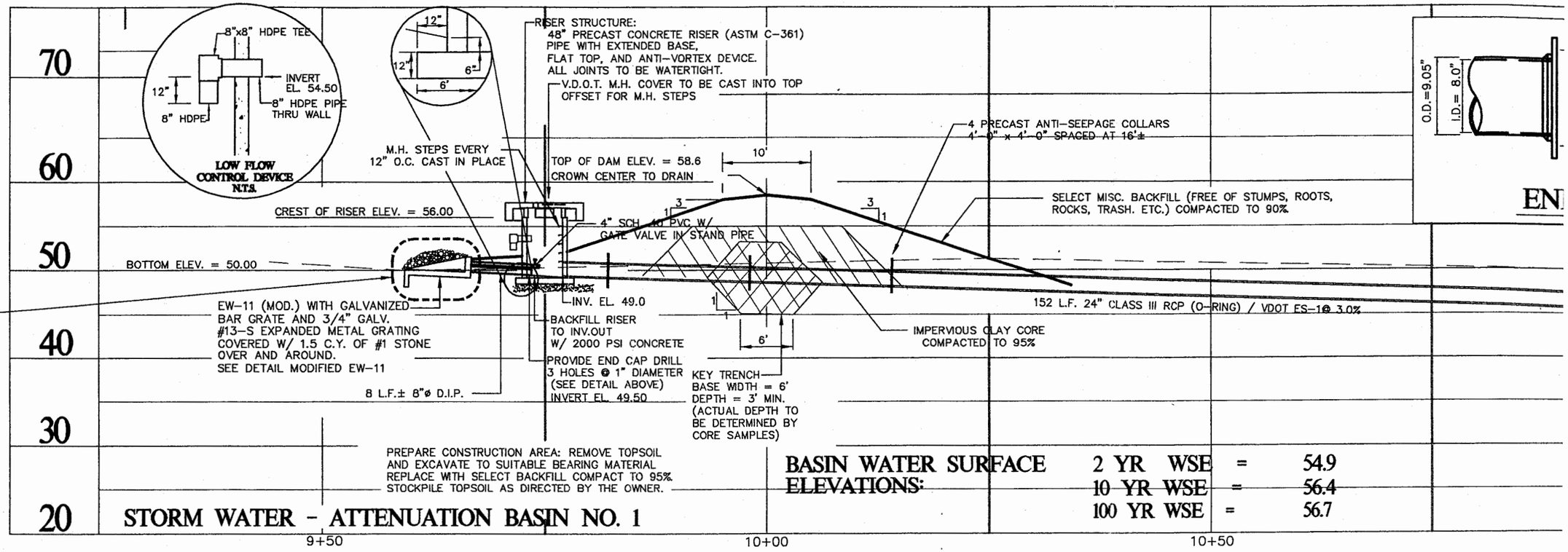
Plan Reviewer: _____ Date: _____

*** See separate checklist.

STALL BOTH 48" PERMANENT RISER AND
" CMP TEMPORARY RISER / 36" ANTIVORTEX
P TO BE INSTALLED FOR SEDIMENT BASIN REMOVE
EN DIRECTED AT COMPLETION OF WORK AND
TAL STABILIZATION OF DISTURBED AREAS.

P OF DAM ELEV. 58.6
ERGENCY SPILLWAY N.A.
5 HIGH WATER ELEV. 56.6
SER CREST ELEV. 56.0
T STORAGE SURFACE ELEV. 54.0
DIMENT CLEANOUT ELEV. 54.0
TTOM OF BASIN ELEV. 50.0

REMOVE TEMPORARY SEDIMENT BASIN RISER AND INSTALL MODIFIED EW-11 AT END OF SEDIMENT BASIN MODE AT END OF SEDIMENT BASIN MODE

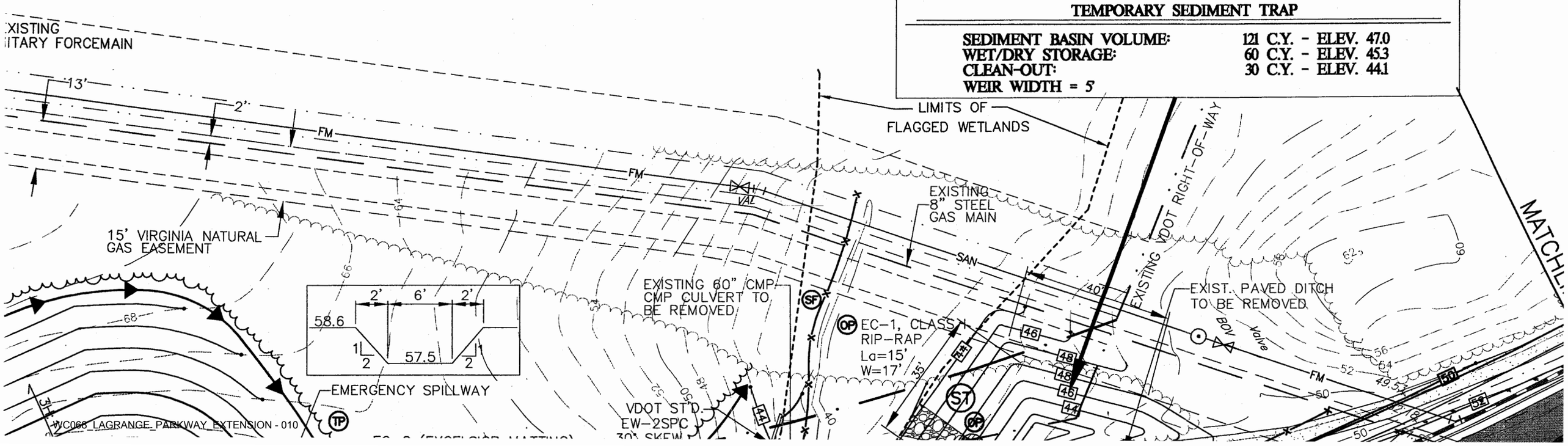


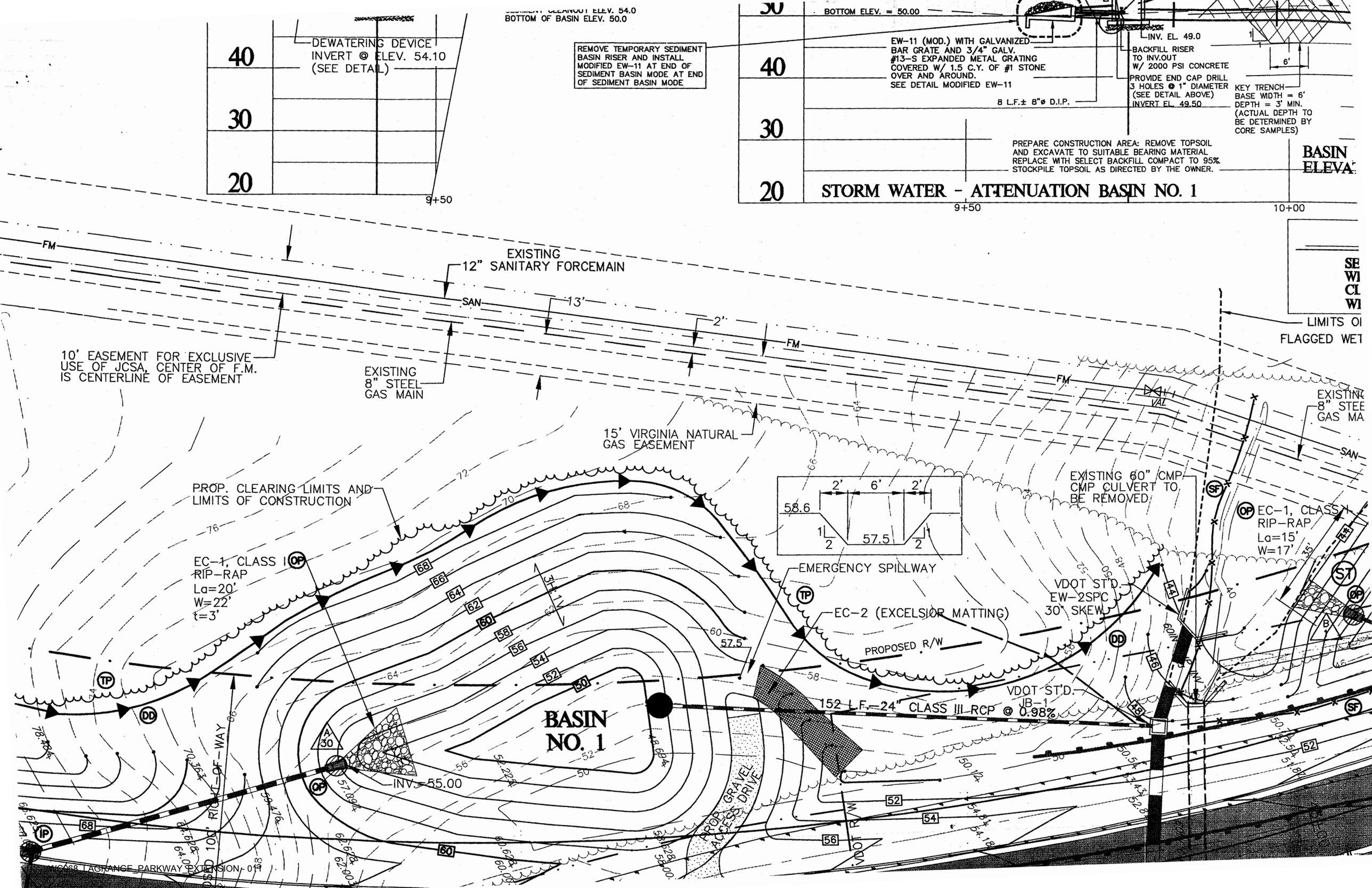
STORM WATER - ATTENUATION BASIN NO. 1

BASIN WATER SURFACE ELEVATIONS:			
	2 YR WSE	=	54.9
	10 YR WSE	=	56.4
	100 YR WSE	=	56.7

TEMPORARY SEDIMENT TRAP

SEDIMENT BASIN VOLUME:	121 C.Y. - ELEV. 47.0
WET/DRY STORAGE:	60 C.Y. - ELEV. 45.3
CLEAN-OUT:	30 C.Y. - ELEV. 44.1
WEIR WIDTH = 5'	



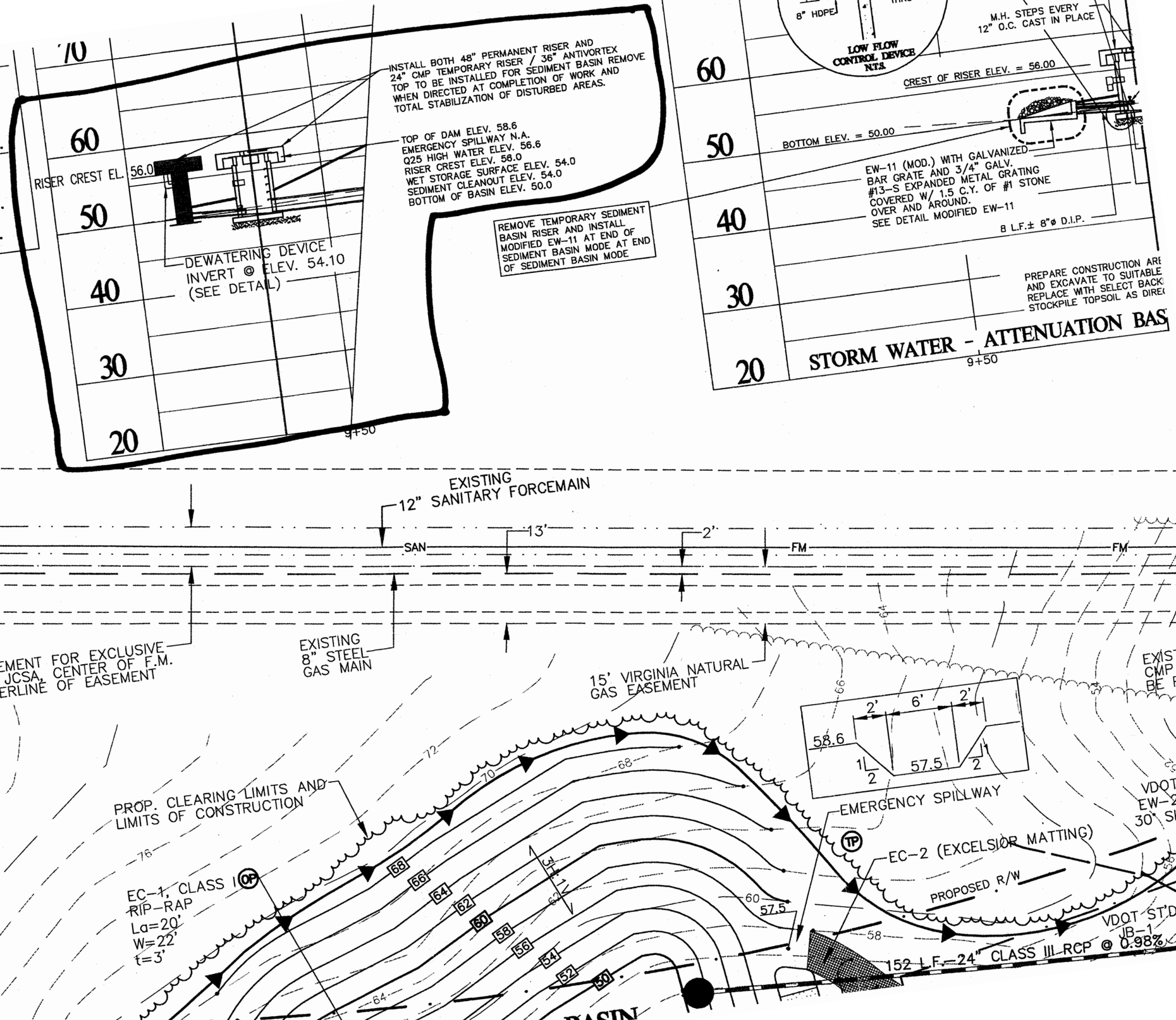

SEDIMENT CLEANOUT ELEV. 54.0
BOTTOM OF BASIN ELEV. 50.0
DEWATERING DEVICE
INVERT @ ELEV. 54.10
(SEE DETAIL)
REMOVE TEMPORARY SEDIMENT BASIN RISER AND INSTALL MODIFIED EW-11 AT END OF SEDIMENT BASIN MODE AT END OF SEDIMENT BASIN MODE
BOTTOM ELEV. = 50.00
EW-11 (MOD.) WITH GALVANIZED BAR GRATE AND 3/4" GALV. #13-S EXPANDED METAL GRATING COVERED W/ 1.5 C.Y. OF #1 STONE OVER AND AROUND.
SEE DETAIL MODIFIED EW-11
8 L.F.± 8"ø D.I.P.
INV. EL 49.0
BACKFILL RISER TO INV.OUT W/ 2000 PSI CONCRETE
PROVIDE END CAP DRILL 3 HOLES @ 1" DIAMETER (SEE DETAIL ABOVE) INVERT EL. 49.50
KEY TRENCH BASE WIDTH = 6' DEPTH = 3' MIN. (ACTUAL DEPTH TO BE DETERMINED BY CORE SAMPLES)
PREPARE CONSTRUCTION AREA: REMOVE TOPSOIL AND EXCAVATE TO SUITABLE BEARING MATERIAL REPLACE WITH SELECT BACKFILL COMPACT TO 95%. STOCKPILE TOPSOIL AS DIRECTED BY THE OWNER.
STORM WATER - ATTENUATION BASIN NO. 1
9+50
10+00
EXISTING 12" SANITARY FORCEMAIN
10' EASEMENT FOR EXCLUSIVE USE OF JCSA, CENTER OF F.M. IS CENTERLINE OF EASEMENT
EXISTING 8" STEEL GAS MAIN
15' VIRGINIA NATURAL GAS EASEMENT
PROP. CLEARING LIMITS AND LIMITS OF CONSTRUCTION
EC-1, CLASS I RIP-RAP La=20' W=22' t=3'
EMERGENCY SPILLWAY
EC-2 (EXCELSIOR MATTING)
PROPOSED R/W
EXISTING 60" CMP CMP CULVERT TO BE REMOVED
VDOT ST'D. EW-2SPC 30° SKEW
VDOT ST'D. JB-1
152 L.F.-24" CLASS III RCP @ 0.98%
BASIN NO. 1
INV.=55.00
PROP. GRAVEL ACCESS DRIVE
VDOT R/W
EC-1, CLASS I RIP-RAP La=15' W=17'
LIMITS OF FLAGGED WET
EXISTING 8" STEEL GAS MAIN
WC068 LAGRANGE PARKWAY EXTENSION 019

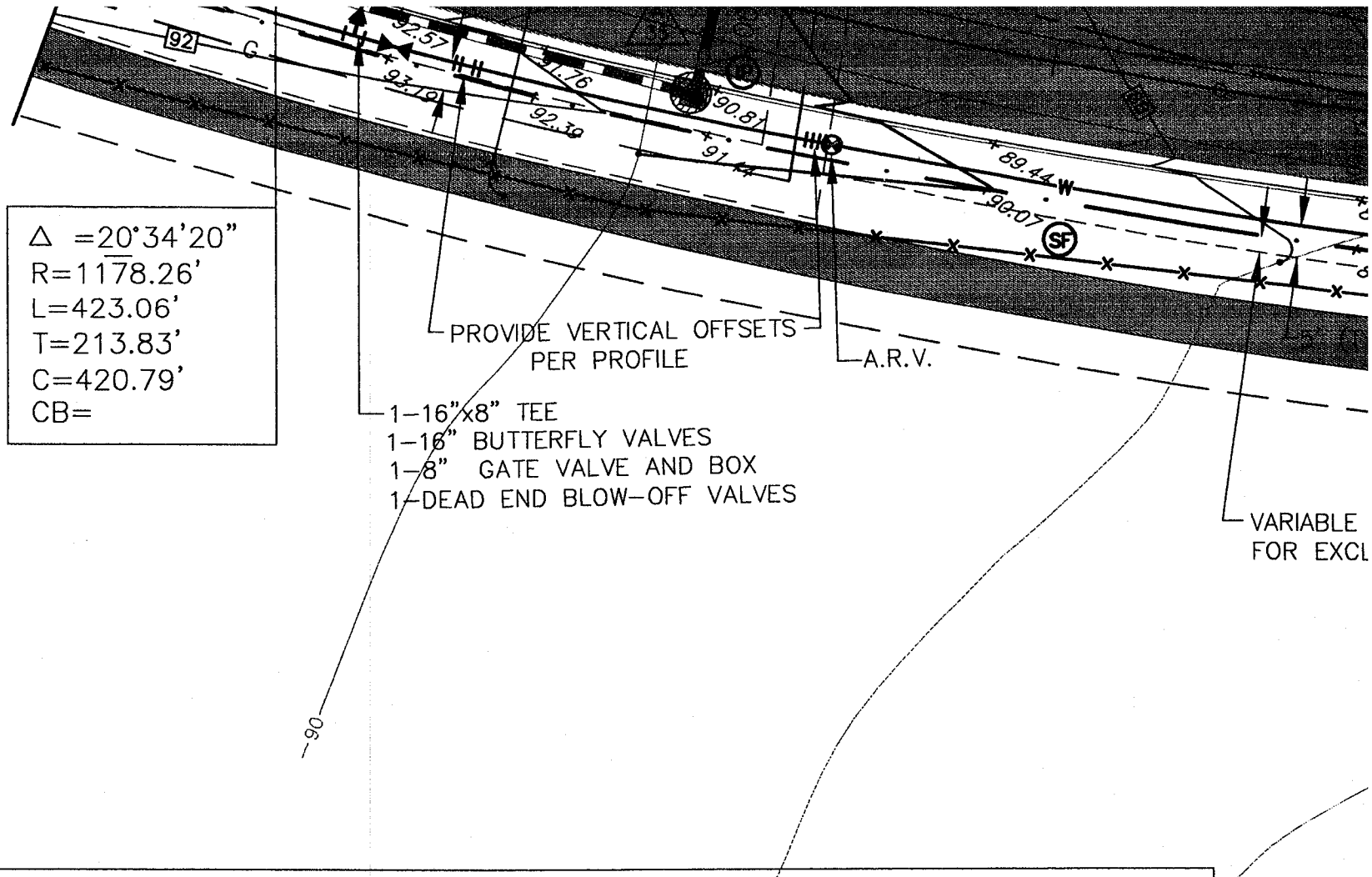
SEDIMENT BASIN DESIGN CALC

SEDIMENT BASIN #1:

DRAINAGE AREA: 5.39 Ac.

	W.S.E.	REQ'D. VOL.	VOL. PROV.
DRY STORAGE:	56.1	722 C.Y.	719 C.Y.
WET STORAGE:	54.1	361 C.Y.	372 C.Y.
CLEAN-OUT:	52.5	181 C.Y.	186 C.Y.





Inspection and maintenance of Storm Water Attenuation Basin #1 (Sheet C-5) will consist of the following additional measures:

1. Inspect for sediment buildup by visual observation and a physical determination of sediment depth within pond storage areas. If the depth of sediment reaches the Cleanout Elevation of 50.5 feet, removal is required.
At the same time, or at least once per year, clean pretreatment devices, the riser bottom and outlet pipes of accumulated sediments. Dispose of sediments removed from the facility at an acceptable disposal area.
(Note: Cleanout Elevation corresponds to 10 percent of the Water Quality Volume)

2. Perform maintenance mowing of pond grasses at least twice each year. Grasses such as tall fescue should be mowed in early summer after emergence of the heads on cool season grasses and in late fall to prevent seeds of annual weeds from maturing. Mowing of legumes can be less frequent. Trees, shrubs and woody vegetation are not to be permitted to grow along or any part of the embankment that was constructed using engineered (compacted) fills.

3. Perform soil sampling on stabilized pond soil areas at least once every 4 years. Soil sampling and testing should be performed by qualified independent soil testing laboratory such as VPI & SU. Apply additional lime and fertilizer in accordance with test recommendations.

4. In stabilized pond areas, if vegetation covers less than 40% of soil surfaces, lime, fertilize and seed in accordance with recommendations for new seedlings. If vegetation covers more than 40% but less than 70% of soil surfaces, lime, fertilize and over seed in accordance with current seeding recommendations or requirements of the Virginia Erosion and Sediment Control Handbook (VESCH).

5. Perform quarterly inspections of the riser section and crest spillway for the observance of collected trash and debris. Immediately remove any trash or debris that prevents the movement of water. Remove any trash and litter downstream and at the storm drain or channel inflow locations to maintain the integrity of the structure and provide an attractive appearance.

6. Perform yearly structural inspections of the facility for damage. Structural inspection shall be performed on the concrete riser, anti-vortex device, trash rack, orifices/weirs, outlet barrel and pond embankment. If damage is evident, further investigation by a professional engineer may be required to assess the integrity of the structure.

7. Perform quarterly inspections of the graded side slopes of the facility for signs of animal/rodent borrows or slope erosion. Immediately perform necessary repairs, refilling or reseeding.

8. Perform yearly observations of perimeter areas surrounding the facility to ensure changes in land use, topography or access have not occurred and do not affect the operation, maintenance, access or safety features as provided. Appropriate action is required to ensure adequacy and to provide a clear, safe passage for maintenance vehicles to the engineered embankment and principal flow control structures.

9. Inspect and excercise pond drain valves, if provided, on a regular basis.

10. Record keeping: The owner or designated representative shall keep reasonable, accurate written records of inspections performed for the structure. Records shall document routine maintenance and/or repairs performed. Copies shall be provided to the County upon request.

11. The facility shall not accept additional drainage or be modified in any way without prior consent or approval by the Environmental Division of James City County.

James City County, Virginia
Environmental Division
Stormwater Management Program

Stormwater Management Design Plan
Staff "Quick" Review

Plan No. SP - 82 - 00 Date/Time: 7/31/00 9:30AM
Project Name: LAGRANGE PARKWAY EXTENDED (STONEHOUSE COMMERCE PARK)
Rough Location: S.E. EXIT 227 I-64 ALONG US ROUTE 30
ADC Map: Sheet _____ Grid: _____ - _____ ☒ First Review 7/31/00
Flood Map / Zone: 510201- 00 10B Zone: X ☐ 2ND Review 03/06/01
Description: OUTSIDE 500-YEAR FLOODPLAIN ☒ 3RD REV 5/24/01
Drainage Area: ☐ Onsite Only ☐ Offsite Only ☒ Combination of Both
SR 600 STONEHOUSE COMM. PARK

Submitted:

Y	N		
☐	☒	Demolition Plan (if applicable)	Sheets:
☒	☐	Site, Geometric or Layout Plan	Sheets: C-2, C-3, C-4, C-5, C-7, C-8, C-9
☒	☐	Grading Plan	Sheets: SAME
☒	☐	Storm Drainage Plan	Sheets: SAME
☒	☐	E&SC Plan	Sheets: SAME
☐	☒	Environmental Inventory	Sheets:
☒	☐	Note & Detail Sheets	Sheets: C-20, C-21, C-22, C-23, C-24
☒	☐	Drainage Map(s)	D-1 SEPARATE ATTACH.
☐	☒	Soils Map	
☐	☐	E&SC and SWM plan checklists.	
☐	☐	E&SC Design Report (Attachment).	
☐	☐	E&SC and Stormwater Management / Drainage Narrative.	
☐	☐	Stormwater Management Design Report (Attachment).	
☐	☐	Geotechnical Report (Attachment).	
☐	☐	Waivers, Variances, Exceptions included (Attachments in Writing).	
		☐ VESCH ☐ CBPO (RPA, Steep Slope) ☐ Other:	
☐	☐	Other (List): PROFILES C-3A, C-4A, C-5A, C-6A, C-7A, C-7B, C-7C, C-8A C-9A	

JCC GIS Database: Zoning: PUD - C Tax Parcel ID: (12-1)(01-1)
Receiving Water: FRANCE SWAMP / WARE CR. Site Acreage: _____ acres / s.f.
Other Known Approvals: _____
Site Plan Information: Owner: STONE HOUSE INC.
Zoning: PUD - C Description: Commercial / Planned Unit Dev.
Site Area: 12.0 acres / s.f
Disturbed Area: 11.2 AC. acres / s.f. (. %)
☒ Disturbance > 5 acres, NPDES Notice of Intent required.
Impervious Cover: ? _____ acres / s.f. (. %)
☐ Less than or equal to 60 percent. Meets CBPO requirements.
☐ More than 60 percent. Does Not Meet CBPO requirements.
Open / Green Space: ? _____ acres / s.f. (. %)

Site Development Plan:
☐ Residential, Lots, etc. ☒ Commercial (B / O / R) ☐ Govern./Institutional ☐ Industrial
☒ Roadways or Entrances ☐ Parking or Loading ☒ Water ☒ Sanitary Sewer
☒ Landscaping ☒ SWM/BMP facilities ☒ Manmade Drainage ☐ Parks, Amenities
☐ Pump/Lift Station ☐ Dams (regulated) ☐ Other, 4500 L.F. PUBLIC ROADWAY IMPROVEMENT
LAGRANGE PARKWAY w/ MEDIAN C&GAN
LAGRANGE PARKWAY w/ SHOULD.
LAGRANGE PARKWAY w/ C&G
ROUTE 600 w/ SHOULD.
ROUTE 608 w/ SHOULD.

Soils Information: Site: _____ Hydric: ☐ Yes ☐ No

Soil Survey Sheet 5 DA: _____ HSG: _____

BMP: _____ Hydric: ☐ Yes ☐ No

Description of Soils at BMP: _____

BMP Control: ☐ None ☒ Onsite ☐ Offsite ☐ Previous Approved ☐ Manufactured BMP

BMP Types: 1- Name: BMP BASIN / (JCC BMP Type F - 2), Points 4

2- Name: _____ (JCC BMP Type _____ - _____), Points _____

3- Name: _____ (JCC BMP Type _____ - _____), Points _____

OnSite Drainage Type: ☒ Reinforced Concrete Pipe ☐ Corrugated Metal Pipe ☐ Aluminum Type Pipe

☐ Corrugated Polyethylene Pipe ☐ PVC Type Pipe ☒ Open Channel Type

☒ Culverts Type: RCP CLASS V

☐ Other (Specify): PAVED DITCH

1. VDOT Standards & Specifications Referenced for work **within** R/W: ☒ Yes ☐ No
2. VDOT Standards & Specifications Referenced for work **outside** R/W: ☒ Yes ☐ No

Site Limitations: ☐ RPA ☒ RMA -H ☒ Steep Slopes ☐ Delineated Wetlands

☒ Hydric Soils ☐ Critical Soils ☐ Vegetated ☐ Buffers

☒ Defined Natural Drainage Features onsite ☐ Downstream Storm/Culv.

☐ Evidence of Downstream Channel Erosion (by Field Observation) _____

☐ Floodplain ☐ Problem Drainage Area ☐ Stormwater Hotspot

☐ Site Activities may warrant a General VPDES Permit for Discharge of Stormwater Associated with Industrial Activities (ie. process water, batch plants, etc.).

☐ Other (Specify): Perennial Stream

Site Stormwater Management / BMP Control (Add sheets if necessary for Multiple Onsite Facilities):

☐ Yes ☐ No	# BMP #1 Dry ~~Det~~ Ext Det.			
Predev (Present)	DA = 8.36 ac.	C/CN = 50	Tc = ~~18.8~~ 0.24 min / hrs	
2-year	~~0.29~~ 0.7	cfs		
10-year	~~4.99~~ 4.2	cfs		
100-year	~~19.99~~ 16.3	cfs		
PostDev w/o Detention (Inflow)	DA = ~~7.54~~ 8.29 ac.	C/CN = 70	Tc = 0.32 min / ~~hrs~~	
2-year	~~5.67~~ 7.76	cfs		
10-year	~~14.92~~ 18.61	cfs		
100-year	~~35.30~~ 27.71	cfs		
PostDev with Detention (Routed)	DA = ac.	C/CN =	Tc =	min / hrs.
2-year	0.69cfs ~~0.74~~	cfs	54.9 at El.	
10-year	~~3.79~~ 11.19	cfs	at El.	56.4
100-year (DHW)	~~33.50~~ 27.71	cfs	at El.	56.7

STA.	P
1	2.8
2	3.36
10	5.04
100	7.68

1-YEAR ~~2.14 CFS~~ 0.05

1-YEAR ~~4.49~~ 4.72 CFS ~~3.9~~

1-YEAR ~~0.45 CFS~~ 0.71 CFS @ EL 54.3

Downstream Tailwater Assumption for Pond Routing: None Shown.

Routed Peak Discharges (Outflows) from BMP meets Predevelopment Allowables: ☒ Yes ☒ No

Appears to Meet VESCH / E&SC Ordinance / CBP Ordinance Requirements: ☒ Yes ☒ No UNCLEAR

Pond / BMP Design Data (Add Sheet If Necessary for Multiple Onsite Facilities): 4 POINT

☐ Check if None ☐ Provided: BMP # 1 Type: Dry TYPE F-4

Y N * See Below for Pertinent Water Quality Treatment Design Information.

☒ ☐	Top of Facility	El. 58.6 ✓	
☒ ☐	Design High Water	El. 56.8 57.1 ?	
☐ ☒	Emergency Spillway (E.S.) Crest	El. 57.5	BW: ? SS: ?
☒ ☐	FreeBoard	1.10	1 ft. or > with E.S.
	☒ Acceptable ☐ Not Acceptable.	1.8	2 ft. or > w/o E.S.
-2 ☒ ☐	Principal Spillway (Riser) Crest	El. 56.0	Size/Type: 48" CONC. 1.5'
☐ ☐	Principal Spillway Crest 1 ft. below crest of emergency spillway.		-2 ☒ Yes ☐ No ☐ N/A
☒ ☐	Stage-Storage Curve or Data		
-2 ☒ ☒	Outlet Rating Curve or Table (Discharge Structure Rating)		~~7282 CF.~~ RAD. 11649 CF
☒ ☐	1-year design storm	El. ~~53.35~~ 54.5	or Volume ~~7248 CF.~~
☒ ☐	1-year, 24 hour detention criteria for Stream Channel Protection.		☒ Yes ☐ No ☐ N/A 31.1 HRS
☒ ☐	Extended Detention Provided (Min. 24 hours)		☒ Yes ☐ No ☐ N/A
☐ ☒	Normal/Permanent Pool	El. N/A	☐ N/A
☒ ☐	Orifice/Weir #1 (highest El.)	El. 56.0	Type: 48" ø RCP
☒ ☐	Orifice/Weir #2	El. 50.0 ~~53.35~~ 54.5	Type: 8" HDPE
☒ ☐	Orifice/Weir #3	El. 50.0 ~~49.5~~	Type: ~~8" DIA~~ 3-1" ORIF
☐ ☒	Orifice/Weir #4	El.	Type:
☐ ☒	Orifice/Weir #5 (lowest El.)	El.	Type: 3-1" ORIF
☒ ☐	Low Flow Orifice (ExDet, CPv)	El. 50.0 ~~49.5~~	Type: ~~8" ORIF~~ EW-11 / NO. 2 STONE
☐ ☒	Pond Drain w/ Valve	El.	Type:
☒ ☐	Pond Bottom	El. 50.0	Riser Height: ~~7.0'~~ 6'
-2 ☒ ☒	Steps or Access Provided (for over 4 ft. depth)		☐ N/A ?
☒ ☐	Riser Base	Bottom El. ~~49.0~~ ?	Type: ?
☒ ☐	Core Trench	☐ N/A	
☒ ☐	Anti-Seep Collars or other acceptable Seepage Control Method.		☐ N/A
☒ ☐	Principal Spillway Anti-Vortex Device and Trash Rack.		Type:
☒ ☐	Low Flow Orifice Cage-Type Trash Rack.		Type: EW-11 GRATE + NO. 1 STONE
☒ ☐	Outlet Barrel:	Type/Class: RCP CL 3	Size: ~~24"~~ 24"
		Inv. U/S: 49.0	Inv D/S: ~~47.8~~ ~~49.0~~ 44.44
		Slope: ~~1.20%~~ 3.00	Length: ~~100'~~ 152 (ft.)
☒ ☐	Flared End Section. Matches Outlet Barrel material type.		
☐ ☐	Outlet Protection.		
	☒ Standard riprap outlet protection (OP)		Type: JB-1 ~~20' CLASS I riprap, 24" deep~~
	☐ Special Dissipator Structure (SDS)		Type:
☐ ☐	Sediment / Cleanout Elevation		El. _____ or Depth _____
☐ ☐	Adequate Channel Downstream of BMP:		☐ 1-year, 24-hour, or ☐ MS # 19 criteria.

Sketch or Notes, If Necessary:

4pt BMP w/ CPv

LAGrange 40+50 Lt.

* WQV Design Information. -2

Imperv. Area	2.2 AC.
WQTV	~~7248 CF.~~ 1" PIA
Vol. Required	~~7248~~ 7926
Vol. Provided	~~7282~~ 7926

Sediment Trap & Basins 3 SED TRAPS on Project.

☐ Temporary Sediment Trap # 1 _____ DA = _____ < 3 acres

☐ Temporary Sediment Trap # 2 _____ DA = _____ < 3 acres

☐ Temporary Sediment Basin # 1 _____ DA = _____ ☐ BMP # ____ convert.

☐ Temporary Sediment Basin # 2 _____ DA = _____ ☐ BMP # ____ convert.

E&SC Plan Comments: _____

Plan Review Steps & Components:

Y	N	
☒	☐	First "Look-Thru". Quick look through plan for familiarity.
☐	☒	Worksheet for BMP Point System. New plan meets 10 point system or redevelopment method.
☒	☐	FEMA Special Flood Hazard Areas. Check against property, site and development.
☒	☐	Check JCC Tax Parcel Maps for RPA / RMA locations and parcel identification.
☒	☐	Stormwater hotspot, general screening, layout or separation distances (if any) satisfactory.
☐	☒	Environmental Inventory for Chesapeake Bay Ordinance requirements satisfactory.
☒	☐	Highlight and check impact to environmental sensitive areas (wetlands, RPA, steep slope,etc.).
☐	☒	Demolition plan (if any) or offsite borrow, waste areas and onsite stockpiles.
☒	☐	Review existing topography to determine adequacy of E&SC plan (Phase I).
☒	☐	Review grading plan to check for conflicts (offsite grading, cut-fills, slopes,) & Phase II E&SC.
☒	☐	Review layout plan to check for conflicts (buildings, parking, buffers, etc.).
☒	☐	Highlight culverts and storm drains. Check pipe data, thickness and utility, cover conflicts.
☒	☐	Proper culvert and stormdrain specifications, notes, and details or reference to VDOT.
☒	☐	Review Sequence of Construction (for E&SC and SWM/BMP applicability to site work).
☐	☒	Review plan based on Chapter 19 Subdivision ordinance as it relates to SWM/BMP control.
☒	☐	Review plan based on Chapter 24 Zoning as it relates to SWM/BMP control.
☒	☐	Review plan based on Chapter 23 Chesapeake Bay ordinance requirements.
☒	☐	Review plan based on General Knowledge and Experience for Design/Construction.
☒	☐	Review plan based on JCC BMP manual for the BMP type selected for project.
☐	☒	Review plan based on JCC Stormwater Conveyance System D/C Guidelines (***Future***).
☒	☐	Review plan based on Virginia Erosion and Sediment Control Handbook (VESCH).
☐	☒	Review plan based on Virginia Stormwater Management Handbook (VSMH) for BMP type.
☐	☒	Review plan based on Hampton Roads BMP Design Guidance manual (***Optional***).
☐	☒	Review plan based on MWCOG, Controlling Urban Runoff BMP manual (***Optional***).
☐	☒	Review plan based on standard JCC E&SC and SWM Design Plan Checklists.
☐	☒	Review plan based on JCC BMP Construction Specifications (***Future***).
☐	☒	Review Maintenance Plan for SWM / BMP facility. Detailed and specific guidance.
☐	☐	Review BMP Landscaping Plan (deep pool, shallow water, shoreline fringes, etc.).
☐	☐	Review E&SC Plan Design Report and computations (Attached report).
☐	☐	Review SWM Design Report and computations (Attached Report).
☐	☐	Adequate Channels proven downstream of both uncontrolled or SWM/BMP areas.
☐	☐	Adequate function, conversion of Temp Sed Basins (volume, discharge, WSELs) to BMP's.
☐	☐	Geotechnical. Information per App. E JCC BMP manual or to substantiate use of other BMPs.
☐	☐	Provisions on plan requiring proper Record Drawing and Const. Cert of facility.
☐	☐	Drainage and Open Space Easements, if necessary, appear satisfactory.
☐	☐	Inclusion of H&H and SWM / BMP data into any JCC databases.
☐	☐	Other: VDOT SAFETY ISSUE BMP PROXIMITY TO ROAD.

Prepared Environmental Division comments for the following categories based on above review areas:

☒	☐	***General Comments:***	☒	☐	***Erosion & Sediment Control Plan:***
☒	☐	***Floodplain:***	☒	☐	***Chesapeake Bay Preservation:***
☒	☐	***Stormwater Management / Drainage:***	☐	☐	***Other:***

Additional Notes & Comments: _____

(Note: THIS FORM FOR COUNTY USE ONLY.)

☒ 1st Rev ☐ 2nd Rev ☐ 3rd Rev

Signature: [signature] Date: 08/13/10

[signature] 03/06/01

Calculations

for

La Grange Parkway Extension
at
Commerce Park

for

Stonehouse, Inc.

COMMONWEALTH OF VIRGINIA
1/29/2001
RICHARD S. PHILLIPS
No. 023631
PROFESSIONAL ENGINEER

June 27, 2000
Revised January 30, 2001

LANDMARK
DESIGN GROUP

Engineers • Planners • Surveyors • Landscape Architects • Environmental Consultants
4029 Ironbound Road, Suite 100, Williamsburg, VA 23188 (757) 253-2975 FAX: (757) 229-0049 lmdg@landmarkdgwb.com

Table of Contents

- SWM / E & S Narrative
- Site Drainage Analysis
- Culvert Analysis
- Storm Drain Calculations
  - Inlet Calculations
  - Rational Analysis VDOT 229
  - Hydraulic Gradeline VDOT 347
  - Outlet Protection
- Temporary Sediment Basin Calculations
- Detention Pond Calculations
- Environmental Inventory
- Pavement Calculations
- Soils and Drainage Area Map
- Storm System Drainage Areas A, B and C

P, RAINFALL

1-YR.	2.8"
2-YR.	3.36"
10-YR.	5.04"
100-YR.	7.68"

SOURCE: UPPER POWHATAN CREEK STUDY BY CDM.

SWM / E & S NARRATIVE

LaGrange Parkway Extension
Stormwater Management and
Erosion and Sediment Control Narrative

LaGrange Parkway is being extended by Stonehouse, Inc. to connect their industrial property on the northeast side of Interstate 64 with the developed areas of Stonehouse Commerce Park. The proposed construction consists of 1350 feet of new roadway to transition from the four-lane divided roadway to a two-lane roadway to a point of intersection with the Six Mount Zion Road (State Route 600). The project will then improve 2300 feet of the Six Mount Zion Road corridor to a curb and gutter section and construct 1350 feet along a new alignment, to replace a substandard section of Six Mount Zion Road. Since the intent of this project is to create a collector route directly to Barhamsville Road (Route 30), a portion of Six Mount Zion Road will be reconstructed as an intersection with LaGrange Parkway. The intersection of Six Mount Zion Road and Mount Laurel Road will also be reconstructed. Seventy percent (70%) of the project is a reconstruction of the existing Route 600 corridor.

The road extension traverses a wide range of soils. According to the USDA Soils Maps of James City County, the project area consists primarily of Craven, Craven-Uchee, Norfolk and Suffolk soils. Two areas of Emporia complex soil exist: one in the creek crossing southeast of the interstate and the other in a ravine crossing near the end of the project. K-factors range from .17 to .37. Slopes subject to cut range from flat to 50%. Fill will be placed laterally along the 2:1 embankments between the Interstate bridges, but will not require disturbance of the existing slopes. Fill will also be placed on the slopes on either side of the creek and ravine crossing. These slopes approach 50 % and will require clearing prior to fill placements. These fills will encompass 3.44 acres of slopes steeper than 25%.

The project will require 4.9 acres of clearing. The final roadway will consists of 4.21 acres of impervious pavement, curbing and paved channels, and will remove 2.31 acres of existing road way. This impervious area considered in relation only to parcels identified within the existing Commerce Park as reserved for roadways and roadside buffers amounts to less than 9%. This is below the threshold requiring special structural water quality measures prescribed by the Chesapeake Bay Protection ordinace. Such measures will be incorporated in future development plans for the individual sites.

There are three distinct drainage areas to the project: the area east of the creek, the area under the bridges, and the area north of the high point north of Interstate 64. The drainage divides are close to the divisions between new construction and reconstruction areas. Therefore, each drainage area received unique treatment in designing its stormwater management system.

PART 1 WEST

The area east of the creek will require the most intensive stormwater management measures. This section contains 2.12 acres of new impervious surface in a sub-drainage area of 8.29 acres, small detention basin will be built to attenuate peak stormwater discharges from this area and release the Wa-

ter quality volume over 24 hours. This basin was designed using the James City County Guidelines. It will also serve as a sediment basin during construction.

PART 2

The area under the bridges will require the least stormwater management measures. This part of the project is a reconstruction of a 20-foot roadway section with 6-foot wide paved ditches on each side to a 29-foot back of curb to back of curb section. The net result is a 10% decrease in impervious area. A small sub-area with the same construction characteristics will be drained into the existing paved ditches and culverts along Mount Laurel Road. This will result in a 1.95 cfs increase in runoff to the culverts under Interstate 64 during a 10-year storm.

PART 3 10,890 SF

The area north of the high point west of Interstate 64 consists the construction of a 24-foot wide, two-lane section with shoulders on a flatter radius curve, to replace an existing 18-foot wide section with a 250' radius. This results in a net increase of 0.25 acres in impervious area, but it is off set the dedicated buffers and reservations cited previously. However, flow attenuation will be provided at the head of the culvert under the new road section and a stilling basin will be provided at the outlet to maintain non-erosive velocities in the stormwater discharge into the existing ravine. The slopes on the upstream side of this fill will be flattened to 6:1. This will reduce the potential for erosion on these slopes. The slopes on the downstream side will need to be steeper to minimize wetland impacts. These slopes will be stabilized with erosion control mats. Concrete channels will be built along the interface of the fill slope and ravine sides to protect these areas from erosion. Sediment traps will be maintained at the end of these channels during construction, until a strong stand of grass is established on the slopes.

$$\begin{array}{r} 4.21 \\ 2.31 \\ \hline 1.91 \end{array}$$

$$\frac{4.21}{47.02} = 8.95\%$$

TABLE ONE **IMPERVIOUS AREA ASSESSMENT : La Grange Parkway Extension**

		Begin	End	Length	Width ROW	Pavement Width	Turning Lanes / Cuts (s.f.)	ROW Area (Acres)	Paved Area (s.f.)	Paved Area (Acres)
La Grange Parkway EXISTING These sections are served by existing BMP"s										
	Station :	1050	2600	1550	100	58	17056	3.56	106956	2.46
Westmont Drive										
	Station :	1050	1650	600	60	29	0	0.83	17400	0.40
John Deere Road										
	Station :	1050	1600	550	60	29	0	0.76	15950	0.37
								5.14		3.22
La Grange Parkway Extension										
Route 600										
	Station :	1015	1300	285	60	29	0	0.39	8265	0.19
Taper	Station :	1300	1350	50	60	20	0	0.07	1225	0.03
										0.22
Pavement Demo				650		20			13000	0.30
Prior plats dedicate 1.33 Acres for the reconstruciton of this Intersection.								0.46		-0.08
La Grange Parkway to Proposed intersection of Route 600										
	Station :	2600	3000	400	100	85	0	0.92	34000	0.78
Taper	Station :	3000	3500	500	100	29	0	1.15	28500	0.65
	Station :	3500	4200	700	100	29	0	1.61	20300	0.47
Does not take into account increase in R.O.W. for slopes / drainage.								3.67		1.90
I-64 RO	Station :									
		4200	5400	1200	n.a.	29	0	n.a.	34800	0.80
Pvmt. / Ditch Demo		4200	5400	1200		32			38400	0.88
Construction to take place within the Limits of existing I-64 R.O.W.										-0.08
Route 608										
	Station :	1015	1050	35		27	0		945	0.02
Taper	Station :	1050	1300	250		21	0		6000	0.14
										0.16
Pavement Demo							10875		10875	0.25
Construction to take place within the Limits of existing I-64 R.O.W.										-0.09
La Grange / Six Mount Zion Realignment										
	Station :	5400	6300	900	100	29	2700	2.07	28800	0.66
Taper	Station :	6300	6350	50	100	29	0	0.11	1450	0.03
	Station :	6350	7143	793	100	24	0	1.82	19032	0.44
										1.13
Pavement Demo				2140		18			38520	0.88
								4.00		0.25

DEVELOPMENT TOTALS: (Includes existing Commerce Park)

AREA SERVICED BY EXISTING 10 POINT BMP's :

Existing Stonehouse, Inc. Land dedicated to R.O.W.:	5.14	Acres
Area of Existing Paving within Commerce Park..:	3.22	Acres

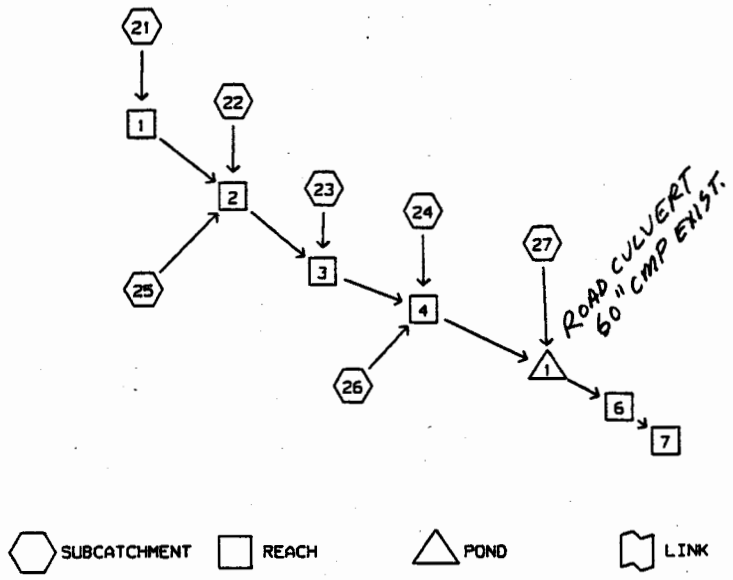
AREA ASSOCIATED WITH PROPOSED EXTENSION :

Area of land reserved for future I-64 Interchange :	16.3	Acres
Area of land reserved from NOS/CE tract for Rt. 600:	1.33	Acres
Area of La Grange Extension R.O.W. per above :	8.14	Acres
Other Buffers and Open Space :	21.25	Acres
Total :	47.02	
Area of Paving proposed by LaGrange extension project :	4.21	Acres ✓
Existing pavement to be demolished :	2.31	Acres

Percent Impervious 8.95%

SITE DRAINAGE ANALYSIS

WATERSHED ROUTING ==========



ROUTED SYSTEM TO STA. 42+50

PRE-DEVELOPMENT WATERSHED MODEL

@ NODE 7

2-YR. 24.02CFS @ 1.8FPS
10-YR. 63.22CFS @ 1.8FPS
100-YR. 138.3CFS @ 2.6FPS

WSEL'S @ CULV NODE 1

2- 41.3
10- 42.7
100- 45.0

SUBCATCHMENT 21 **North Far West**

PEAK= 12.11 CFS @ 12.93 HRS, VOLUME= 2.70 AF

ACRES	CN	
35.09	70	FUTURE DEVELOPED SITE

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Developed / wooded areas**	29.3
Grass: Dense n=.24 L=300' P2=3.5 in s=.0267 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Ravine / future BMP**	50.6
Forest w/Heavy Litter Kv=2.5 L=1200' s=.025 '/' V=.4 fps		
	Total Length= 1500 ft Total Tc=	79.9

SUBCATCHMENT 22 **North Mid-Interstate**

PEAK= 5.51 CFS @ 12.16 HRS, VOLUME= .58 AF

ACRES	CN	
10.29	65	Wooded some development

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**Ravine / Future BMP**	23.6
Woodland Kv=5 L=1000' s=.02 '/' V=.71 fps		

SUBCATCHMENT 23 **Future site / some woods**

PEAK= 10.43 CFS @ 12.04 HRS, VOLUME= .81 AF

ACRES	CN	
14.25	65	Wooded site

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**Future site / some woods**	14.1
L=900' s=.1 '/'		

SUBCATCHMENT 24 **Limited development area**

PEAK= 7.93 CFS @ 12.11 HRS, VOLUME= .73 AF

ACRES	CN	
12.88	65	Land between roads

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**Existing ravine**	19.6
Forest w/Heavy Litter Kv=2.5 L=600' s=.0417 '/' V=.51 fps		

SUBCATCHMENT 25 **Buffered site / woodland**

PEAK= 9.49 CFS @ 13.11 HRS, VOLUME= 2.53 AF

ACRES	CN	
44.70	65	Developed site BMP & Buffer

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Developed Site to BMP**	22.8
Grass: Dense n=.24 L=300' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Buffdered site**	66.1
Forest w/Heavy Litter Kv=2.5 L=1700' s=.0294 '/' V=.43 fps		
	Total Length= 2000 ft Total Tc=	88.9

SUBCATCHMENT 26 **Future site / interchange /BMP's**

PEAK= 17.39 CFS @ 12.34 HRS, VOLUME= 2.44 AF

ACRES	CN	
43.10	65	Site buffered by Slope / wetland

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Buffered site**	22.8
Grass: Dense n=.24 L=300' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Buffer**	13.6
Unpaved Kv=16.1345 L=1200' s=.0083 '/' V=1.47 fps		
	Total Length= 1500 ft Total Tc=	36.4

SUBCATCHMENT 27 **EXISTING ROUTE 600**

PEAK= 4.32 CFS @ 11.91 HRS, VOLUME= .23 AF

ACRES	CN	
1.78	80	ROADWAY AND SIDE SLOPES

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**ROAD AT UNDERPASS**	6.3

REACH 1 **Natural drainage course**

Qin = 12.11 CFS @ 12.93 HRS, VOLUME= 2.70 AF
Qout= 11.94 CFS @ 13.12 HRS, VOLUME= 2.70 AF, ATTEN= 1%, LAG= 11.2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
52.00	0.0	0.00
54.00	50.0	50.17
56.00	173.0	73.35
58.00	341.0	95.36

SPECIAL 900' CHANNEL
n= .08
LENGTH= 900 FT
SLOPE= .022 FT/FT
CAPACITY= 2196.9 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 52.17 FT
PEAK VELOCITY= 2.7 FPS
TRAVEL TIME = 5.5 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 2 **Natural Ravine**

Qin = 22.42 CFS @ 13.10 HRS, VOLUME= 5.81 AF
Qout= 22.23 CFS @ 13.23 HRS, VOLUME= 5.81 AF, ATTEN= 1%, LAG= 7.3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
48.00	0.0	0.00
50.00	47.0	47.22
52.00	159.0	65.74
54.00	277.0	100.45

SPECIAL 340' CHANNEL
n= .08
LENGTH= 340 FT
SLOPE= .0074 FT/FT
CAPACITY= 870.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 48.59 FT
PEAK VELOCITY= 1.6 FPS
TRAVEL TIME = 3.6 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 3 **Natural wetland**

Qin = 23.37 CFS @ 13.22 HRS, VOLUME= 6.62 AF
Qout= 22.72 CFS @ 13.51 HRS, VOLUME= 6.62 AF, ATTEN= 3%, LAG= 17.5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
42.00	0.0	0.00
44.00	47.0	47.18
46.00	172.0	78.46
48.00	340.0	90.67

SPECIAL 900' CHANNEL
n= .08
LENGTH= 900 FT
SLOPE= .0089 FT/FT
CAPACITY= 1438.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 42.55 FT
PEAK VELOCITY= 1.7 FPS
TRAVEL TIME = 8.6 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 4 **Wetland above culvert**

Qin = 31.29 CFS @ 12.33 HRS, VOLUME= 9.79 AF
Qout= 28.28 CFS @ 12.64 HRS, VOLUME= 9.79 AF, ATTEN= 10%, LAG= 18.2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
38.40	0.0	0.00
40.00	72.0	90.06
42.00	267.0	105.58
44.00	492.0	120.58

SPECIAL 400' CHANNEL
n= .08
LENGTH= 400 FT
SLOPE= .0025 FT/FT
CAPACITY= 1166.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 39.19 FT
PEAK VELOCITY= .8 FPS
TRAVEL TIME = 8.3 MIN
SPAN= 5-55 HRS, dt=.1 HRS

PRE 2

REACH 6 **Natural Cross Section @ 40'down stream**

Qin = 24.05 CFS @ 14.12 HRS, VOLUME= 10.02 AF
Qout= 24.04 CFS @ 14.15 HRS, VOLUME= 10.02 AF, ATTEN= 0%, LAG= 1.8 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
35.50	0.0	0.00
36.00	13.0	51.10
38.00	140.0	76.32
40.00	309.0	93.48

SPECIAL 40' CHANNEL
n= .08
LENGTH= 40 FT
SLOPE= .01 FT/FT
CAPACITY= 1273.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 36.08 FT
PEAK VELOCITY= 1.4 FPS
TRAVEL TIME = .5 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 7 **Natural Cross Section 120'downstream**

Qin = 24.04 CFS @ 14.15 HRS, VOLUME= 10.02 AF
Qout= 24.02 CFS @ 14.16 HRS, VOLUME= 10.02 AF, ATTEN= 0%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
34.90	0.0	0.00
36.00	42.0	77.03
38.00	206.0	87.80
40.00	352.0	101.56

SPECIAL 80' CHANNEL
n= .08
LENGTH= 80 FT
SLOPE= .02 FT/FT
CAPACITY= 2117.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 35.26 FT
PEAK VELOCITY= 1.8 FPS
TRAVEL TIME = .8 MIN
SPAN= 5-55 HRS, dt=.1 HRS

POND 1 **Road culvert / storage**

Qin = 28.62 CFS @ 12.63 HRS, VOLUME= 10.02 AF
Qout= 24.05 CFS @ 14.12 HRS, VOLUME= 10.02 AF, ATTEN= 16%, LAG= 89.4 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
39.3	0	0	0
40.0	30015	10505	10505
42.0	65126	95141	105646
44.0	106060	171186	276832
46.0	153438	259498	536330
50.0	250129	807134	1343464

STOR-IND METHOD
PEAK STORAGE = 72863 CF
PEAK ELEVATION= 41.3 FT
FLOOD ELEVATION= 50.0 FT
START ELEVATION= 39.3 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 60.7 MIN (10 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	39.3'	**60" CULVERT**
			n=.024 L=60' S=.008'/' Ke=.5 Cc=.9 Cd=.6

REACH 6 **Natural Cross Section @ 40'down stream**

Qin = 63.26 CFS @ 13.90 HRS, VOLUME= 24.01 AF
Qout= 63.23 CFS @ 13.91 HRS, VOLUME= 24.01 AF, ATTEN= 0%, LAG= .6 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
35.50	0.0	0.00
36.00	13.0	51.10
38.00	140.0	76.32
40.00	309.0	93.48

SPECIAL 40' CHANNEL
n= .08
LENGTH= 40 FT
SLOPE= .01 FT/FT
CAPACITY= 1273.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 36.28 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 7 **Natural Cross Section 120'downstream**

Qin = 63.23 CFS @ 13.91 HRS, VOLUME= 24.01 AF
Qout= 63.22 CFS @ 13.93 HRS, VOLUME= 24.01 AF, ATTEN= 0%, LAG= 1.4 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
34.90	0.0	0.00
36.00	42.0	77.03
38.00	206.0	87.80
40.00	352.0	101.56

SPECIAL 80' CHANNEL
n= .08
LENGTH= 80 FT
SLOPE= .02 FT/FT
CAPACITY= 2117.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 35.84 FT
PEAK VELOCITY= 1.8 FPS
TRAVEL TIME = .8 MIN
SPAN= 5-55 HRS, dt=.1 HRS

POND 1 **Road culvert / storage**

Qin = 92.03 CFS @ 12.47 HRS, VOLUME= 24.01 AF
Qout= 63.26 CFS @ 13.90 HRS, VOLUME= 24.01 AF, ATTEN= 31%, LAG= 85.4 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
39.3	0	0	0
40.0	30015	10505	10505
42.0	65126	95141	105646
44.0	106060	171186	276832
46.0	153438	259498	536330
50.0	250129	807134	1343464

STOR-IND METHOD
PEAK STORAGE = 168027 CF
PEAK ELEVATION= 42.7 FT
FLOOD ELEVATION= 50.0 FT
START ELEVATION= 39.3 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 50.7 MIN (23.96 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	39.3'	**60" CULVERT**
			n=.024 L=60' S=.008'/' Ke=.5 Cc=.9 Cd=.6

PRE-100

REACH 6 **Natural Cross Section @ 40'down stream**

Qin = 138.2 CFS @ 13.70 HRS, VOLUME= 50.99 AF
Qout= 138.2 CFS @ 13.71 HRS, VOLUME= 50.99 AF, ATTEN= 0%, LAG= .5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
35.50	0.0	0.00
36.00	13.0	51.10
38.00	140.0	76.32
40.00	309.0	93.48

SPECIAL 40' CHANNEL
n= .08
LENGTH= 40 FT
SLOPE= .01 FT/FT
CAPACITY= 1273.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 36.68 FT
PEAK VELOCITY= 2.5 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 7 **Natural Cross Section 120'downstream**

Qin = 138.2 CFS @ 13.71 HRS, VOLUME= 50.99 AF
Qout= 138.3 CFS @ 13.71 HRS, VOLUME= 50.99 AF, ATTEN= 0%, LAG= .4 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
34.90	0.0	0.00
36.00	42.0	77.03
38.00	206.0	87.80
40.00	352.0	101.56

SPECIAL 80' CHANNEL
n= .08
LENGTH= 80 FT
SLOPE= .02 FT/FT
CAPACITY= 2117.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 36.15 FT
PEAK VELOCITY= 2.6 FPS
TRAVEL TIME = .5 MIN
SPAN= 5-55 HRS, dt=.1 HRS

POND 1 **Road culvert / storage**

Qin = 220.9 CFS @ 12.40 HRS, VOLUME= 50.99 AF
Qout= 138.2 CFS @ 13.70 HRS, VOLUME= 50.99 AF, ATTEN= 37%, LAG= 77.8 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
39.3	0	0	0
40.0	30015	10505	10505
42.0	65126	95141	105646
44.0	106060	171186	276832
46.0	153438	259498	536330
50.0	250129	807134	1343464

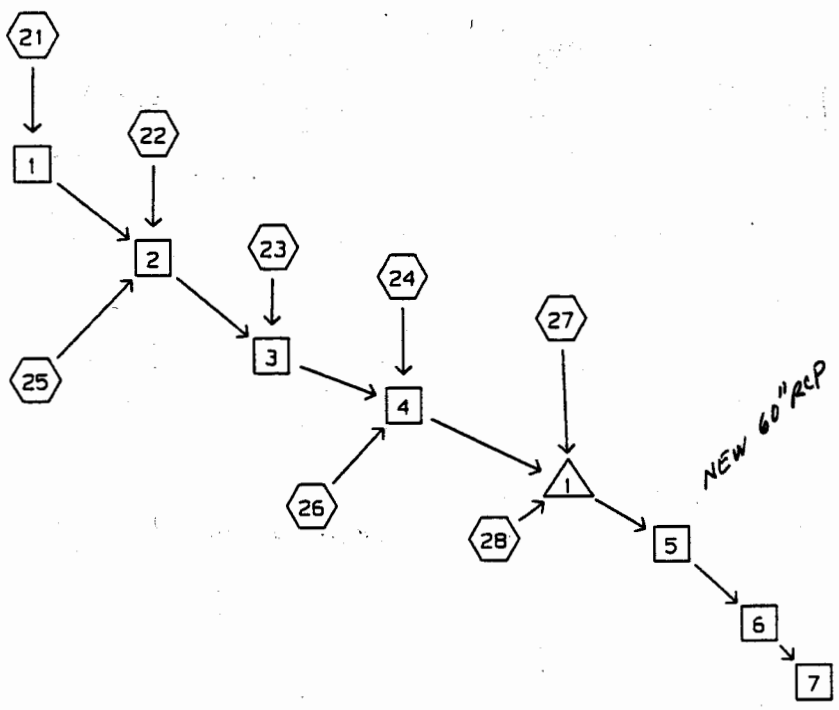
STOR-IND METHOD
PEAK STORAGE = 410823 CF
PEAK ELEVATION= 45.0 FT
FLOOD ELEVATION= 50.0 FT
START ELEVATION= 39.3 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 48.7 MIN (50.89 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	39.3'	**60" CULVERT**
			n=.024 L=60' S=.008'/' Ke=.5 Cc=.9 Cd=.6

WATERSHED ROUTING ==========

@ NODE 7
2-YR 23.84CFS @ 1.4FPS
10-YR 61.18CFS @ 1.4FPS
100-YR 125.7CFS @ 2.2FPS

WSEL's @ NODE 1
2- 41.5 +0.2'
10- 43.1 +0.4'
100- 45.8 +0.8'



ROUTED SYSTEM TO STA. 42+50

SUBCATCHMENT REACH POND LINK

POST DEVELOPMENT WATERSHED MODEL

SUBCATCHMENT 21	= North Far West	->	REACH 1
SUBCATCHMENT 22	= North Mid-Interstate	->	REACH 2
SUBCATCHMENT 23	= Future site / some woods	->	REACH 3
SUBCATCHMENT 24	= Limited development area	->	REACH 4
SUBCATCHMENT 25	= Buffered site / woodland	->	REACH 2
SUBCATCHMENT 26	= Future site / interchange /BMP's	->	REACH 4
SUBCATCHMENT 27	= RECONSTRUCTED LAGRANGE / 600	->	POND 1
SUBCATCHMENT 28	= SECTION "A"	->	POND 1
REACH 1	= Natural drainage course	->	REACH 2
REACH 2	= Natural Ravine	->	REACH 3
REACH 3	= Natural wetland	->	REACH 4

REACH 4	= Wetland above culvert	->	POND 1
REACH 5	= Roadway Culvert	->	REACH 6
REACH 6	= Natural Cross Section @ 40'down stream	->	REACH 7
REACH 7	= Natural Cross Section 120'downstream	->	
POND 1	= Road culvert / storage	->	REACH 5

Post 2

SUBCATCHMENT 21 **North Far West**

PEAK= 12.11 CFS @ 12.93 HRS, VOLUME= 2.70 AF

ACRES	CN	
35.09	70	FUTURE DEVELOPED SITE

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Developed / wooded areas**	29.3
Grass: Dense n=.24 L=300' P2=3.5 in s=.0267 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Ravine / future BMP**	50.6
Forest w/Heavy Litter Kv=2.5 L=1200' s=.025 '/' V=.4 fps		

	Total Length= 1500 ft Total Tc=	79.9

SUBCATCHMENT 22 **North Mid-Interstate**

PEAK= 5.51 CFS @ 12.16 HRS, VOLUME= .58 AF

ACRES	CN	
10.29	65	Wooded some development

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**Ravine / Future BMP**	23.6
Woodland Kv=5 L=1000' s=.02 '/' V=.71 fps		

SUBCATCHMENT 23 **Future site / some woods**

PEAK= 10.43 CFS @ 12.04 HRS, VOLUME= .81 AF

ACRES	CN	
14.25	65	Wooded site

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**Future site / some woods**	14.1
L=900' s=.1 '/'		

POST 2

SUBCATCHMENT 24 **Limited development area**

PEAK= 7.93 CFS @ 12.11 HRS, VOLUME= .73 AF

ACRES	CN	
12.88	65	Land between roads

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**Existing ravine**	19.6
Forest w/Heavy Litter Kv=2.5 L=600' s=.0417 '/' V=.51 fps		

SUBCATCHMENT 25 **Buffered site / woodland**

PEAK= 9.49 CFS @ 13.11 HRS, VOLUME= 2.53 AF

ACRES	CN	
44.70	65	Developed site BMP & Buffer

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Developed Site to BMP**	22.8
Grass: Dense n=.24 L=300' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Buffdered site**	66.1
Forest w/Heavy Litter Kv=2.5 L=1700' s=.0294 '/' V=.43 fps		

	Total Length= 2000 ft Total Tc=	88.9

SUBCATCHMENT 26 **Future site / interchange /BMP's**

PEAK= 13.86 CFS @ 12.34 HRS, VOLUME= 1.95 AF

ACRES	CN	
34.35	65	Site buffered by Slope / wetland

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Buffered site**	22.8
Grass: Dense n=.24 L=300' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Buffer**	13.6
Unpaved Kv=16.1345 L=1200' s=.0083 '/' V=1.47 fps		

	Total Length= 1500 ft Total Tc=	36.4

post 2

SUBCATCHMENT 27 **RECONSTRUCTED LAGRANGE / 600**

PEAK= 8.23 CFS @ 11.92 HRS, VOLUME= .44 AF

ACRES	CN	
3.47	80	ROADWAY AND SIDE SLOPES

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**DISCHARGE SYSTEM B**	6.7

SUBCATCHMENT 28 **SECTION "A"**

PEAK= 5.41 CFS @ 12.28 HRS, VOLUME= .64 AF

ACRES	CN	
6.09	60	GRASSED R.O.W.
2.20	98	PAVEMENT
8.29	70	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**DEVELOPED R.O.W.**	33.4

Post 2

REACH 1 **Natural drainage course**

Qin = 12.11 CFS @ 12.93 HRS, VOLUME= 2.70 AF
Qout= 11.94 CFS @ 13.12 HRS, VOLUME= 2.70 AF, ATTEN= 1%, LAG= 11.2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
52.00	0.0	0.00
54.00	50.0	50.17
56.00	173.0	73.35
58.00	341.0	95.36

SPECIAL 900' CHANNEL
n= .08
LENGTH= 900 FT
SLOPE= .022 FT/FT
CAPACITY= 2196.9 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 52.17 FT
PEAK VELOCITY= 2.7 FPS
TRAVEL TIME = 5.5 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 2 **Natural Ravine**

Qin = 22.42 CFS @ 13.10 HRS, VOLUME= 5.81 AF
Qout= 22.23 CFS @ 13.23 HRS, VOLUME= 5.81 AF, ATTEN= 1%, LAG= 7.3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
48.00	0.0	0.00
50.00	47.0	47.22
52.00	159.0	65.74
54.00	277.0	100.45

SPECIAL 340' CHANNEL
n= .08
LENGTH= 340 FT
SLOPE= .0074 FT/FT
CAPACITY= 870.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 48.59 FT
PEAK VELOCITY= 1.6 FPS
TRAVEL TIME = 3.6 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 3 **Natural wetland**

Qin = 23.37 CFS @ 13.22 HRS, VOLUME= 6.62 AF
Qout= 22.72 CFS @ 13.51 HRS, VOLUME= 6.62 AF, ATTEN= 3%, LAG= 17.5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
42.00	0.0	0.00
44.00	47.0	47.18
46.00	172.0	78.46
48.00	340.0	90.67

SPECIAL 900' CHANNEL
n= .08
LENGTH= 900 FT
SLOPE= .0089 FT/FT
CAPACITY= 1438.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 42.55 FT
PEAK VELOCITY= 1.7 FPS
TRAVEL TIME = 8.6 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 4 **Wetland above culvert**

Qin = 27.76 CFS @ 12.33 HRS, VOLUME= 9.30 AF
Qout= 26.30 CFS @ 13.72 HRS, VOLUME= 9.30 AF, ATTEN= 5%, LAG= 83.6 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
38.40	0.0	0.00
40.00	72.0	90.06
42.00	267.0	105.58
44.00	492.0	120.58

SPECIAL 400' CHANNEL
n= .08
LENGTH= 400 FT
SLOPE= .0025 FT/FT
CAPACITY= 1166.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 39.13 FT
PEAK VELOCITY= .8 FPS
TRAVEL TIME = 8.3 MIN
SPAN= 5-55 HRS, dt=.1 HRS

POST 2

REACH 5 **Roadway Culvert**

Qin = 23.88 CFS @ 14.15 HRS, VOLUME= 10.31 AF
Qout= 23.87 CFS @ 14.15 HRS, VOLUME= 10.31 AF, ATTEN= 0%, LAG= .4 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.40	.65	3.00
.80	1.79	12.58
1.20	3.17	28.13
2.80	9.40	120.26
3.20	10.78	140.41
3.60	11.91	153.09
3.76	12.26	154.51
3.88	12.46	153.09
4.00	12.57	143.64

48" PIPE
n= .013
LENGTH= 100 FT
SLOPE= .01 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.09 FT
PEAK VELOCITY= 8.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 6 **Natural Cross Section @ 40'down stream**

Qin = 23.87 CFS @ 14.15 HRS, VOLUME= 10.31 AF
Qout= 23.86 CFS @ 14.17 HRS, VOLUME= 10.31 AF, ATTEN= 0%, LAG= .9 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
35.50	0.0	0.00
36.00	13.0	51.10
38.00	140.0	76.32
40.00	309.0	93.48

SPECIAL 40' CHANNEL
n= .1
LENGTH= 40 FT
SLOPE= .01 FT/FT
CAPACITY= 1018.9 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 36.11 FT
PEAK VELOCITY= 1.2 FPS
TRAVEL TIME = .6 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 7 **Natural Cross Section 120'downstream**

Qin = 23.86 CFS @ 14.17 HRS, VOLUME= 10.31 AF
Qout= 23.84 CFS @ 14.20 HRS, VOLUME= 10.31 AF, ATTEN= 0%, LAG= 1.9 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
34.90	0.0	0.00
36.00	42.0	77.03
38.00	206.0	87.80
40.00	352.0	101.56

SPECIAL 80' CHANNEL
n= .1
LENGTH= 80 FT
SLOPE= .02 FT/FT
CAPACITY= 1694.2 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 35.35 FT
PEAK VELOCITY= 1.4 FPS
TRAVEL TIME = 1.0 MIN
SPAN= 5-55 HRS, dt=.1 HRS

MEETS 2-YEAR VELOCITY

POND 1 **Road culvert / storage**

Qin = 28.82 CFS @ 12.60 HRS, VOLUME= 10.37 AF
Qout= 23.88 CFS @ 14.15 HRS, VOLUME= 10.31 AF, ATTEN= 17%, LAG= 93.1 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
39.3	0	0	0
40.0	30015	10505	10505
42.0	65126	95141	105646
44.0	106060	171186	276832
46.0	153438	259498	536330
50.0	250129	807134	1343464

STOR-IND METHOD
PEAK STORAGE = 82124 CF
PEAK ELEVATION= 41.5 FT
FLOOD ELEVATION= 50.0 FT
START ELEVATION= 39.3 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 72 MIN (10.29 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	39.5'	**48" CULVERT**
			n=.013 L=30' S=.01'/' Ke=.5 Cc=.9 Cd=.6

POST 10

SUBCATCHMENT 21 **North Far West**

PEAK= 29.92 CFS @ 12.87 HRS, VOLUME= 6.04 AF

ACRES	CN	
35.09	70	FUTURE DEVELOPED SITE

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Developed / wooded areas**	29.3
Grass: Dense n=.24 L=300' P2=3.5 in s=.0267 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Ravine / future BMP**	50.6
Forest w/Heavy Litter Kv=2.5 L=1200' s=.025 '/' V=.4 fps		

	Total Length= 1500 ft Total Tc=	79.9

SUBCATCHMENT 22 **North Mid-Interstate**

PEAK= 16.26 CFS @ 12.14 HRS, VOLUME= 1.44 AF

ACRES	CN	
10.29	65	Wooded some development

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**Ravine / Future BMP**	23.6
Woodland Kv=5 L=1000' s=.02 '/' V=.71 fps		

SUBCATCHMENT 23 **Future site / some woods**

PEAK= 29.70 CFS @ 12.02 HRS, VOLUME= 2.00 AF

ACRES	CN	
14.25	65	Wooded site

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**Future site / some woods**	14.1
L=900' s=.1 '/'		

POST 10

SUBCATCHMENT 24 **Limited development area**

PEAK= 22.67 CFS @ 12.09 HRS, VOLUME= 1.80 AF

ACRES	CN	
12.88	65	Land between roads

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**Existing ravine**	19.6
Forest w/Heavy Litter Kv=2.5 L=600' s=.0417 '/' V=.51 fps		

SUBCATCHMENT 25 **Buffered site / woodland**

PEAK= 27.46 CFS @ 13.04 HRS, VOLUME= 6.26 AF

ACRES	CN	
44.70	65	Developed site BMP & Buffer

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Developed Site to BMP**	22.8
Grass: Dense n=.24 L=300' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Buffdered site**	66.1
Forest w/Heavy Litter Kv=2.5 L=1700' s=.0294 '/' V=.43 fps		

	Total Length= 2000 ft Total Tc=	88.9

SUBCATCHMENT 26 **Future site / interchange /BMP's**

PEAK= 40.69 CFS @ 12.31 HRS, VOLUME= 4.81 AF

ACRES	CN	
34.35	65	Site buffered by Slope / wetland

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Buffered site**	22.8
Grass: Dense n=.24 L=300' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Buffer**	13.6
Unpaved Kv=16.1345 L=1200' s=.0083 '/' V=1.47 fps		

	Total Length= 1500 ft Total Tc=	36.4

Post 10

SUBCATCHMENT 27 **RECONSTRUCTED LAGRANGE / 600**

PEAK= 15.79 CFS @ 11.91 HRS, VOLUME= .85 AF

ACRES	CN		
3.47	80	ROADWAY AND SIDE SLOPES	SCS TR-20 METHOD TYPE II 24-HOUR RAINFALL= 5.04 IN SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**DISCHARGE SYSTEM B**	6.7

SUBCATCHMENT 28 **SECTION "A"**

PEAK= 13.24 CFS @ 12.25 HRS, VOLUME= 1.43 AF

ACRES	CN		
6.09	60	GRASSED R.O.W.	SCS TR-20 METHOD TYPE II 24-HOUR RAINFALL= 5.04 IN SPAN= 5-55 HRS, dt=.1 HRS
2.20	98	PAVEMENT	
8.29	70		

Method	Comment	Tc (min)
DIRECT ENTRY	**DEVELOPED R.O.W.**	33.4

POST 10

REACH 1 **Natural drainage course**

Qin = 29.92 CFS @ 12.87 HRS, VOLUME= 6.04 AF
Qout= 29.48 CFS @ 13.06 HRS, VOLUME= 6.04 AF, ATTEN= 1%, LAG= 11.5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
52.00	0.0	0.00
54.00	50.0	50.17
56.00	173.0	73.35
58.00	341.0	95.36

SPECIAL 900' CHANNEL
n= .08
LENGTH= 900 FT
SLOPE= .022 FT/FT
CAPACITY= 2196.9 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 52.43 FT
PEAK VELOCITY= 2.7 FPS
TRAVEL TIME = 5.5 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 2 **Natural Ravine**

Qin = 59.26 CFS @ 13.04 HRS, VOLUME= 13.74 AF
Qout= 58.78 CFS @ 13.16 HRS, VOLUME= 13.74 AF, ATTEN= 1%, LAG= 7.2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
48.00	0.0	0.00
50.00	47.0	47.22
52.00	159.0	65.74
54.00	277.0	100.45

SPECIAL 340' CHANNEL
n= .08
LENGTH= 340 FT
SLOPE= .0074 FT/FT
CAPACITY= 870.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 49.58 FT
PEAK VELOCITY= 1.6 FPS
TRAVEL TIME = 3.6 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 3 **Natural wetland**

Qin = 61.38 CFS @ 13.15 HRS, VOLUME= 15.74 AF
Qout= 59.64 CFS @ 13.44 HRS, VOLUME= 15.74 AF, ATTEN= 3%, LAG= 17.3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
42.00	0.0	0.00
44.00	47.0	47.18
46.00	172.0	78.46
48.00	340.0	90.67

SPECIAL 900' CHANNEL
n= .08
LENGTH= 900 FT
SLOPE= .0089 FT/FT
CAPACITY= 1438.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 43.46 FT
PEAK VELOCITY= 1.7 FPS
TRAVEL TIME = 8.6 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 4 **Wetland above culvert**

Qin = 83.29 CFS @ 12.29 HRS, VOLUME= 22.35 AF
Qout= 80.84 CFS @ 12.50 HRS, VOLUME= 22.35 AF, ATTEN= 3%, LAG= 12.3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
38.40	0.0	0.00
40.00	72.0	90.06
42.00	267.0	105.58
44.00	492.0	120.58

SPECIAL 400' CHANNEL
n= .08
LENGTH= 400 FT
SLOPE= .0025 FT/FT
CAPACITY= 1166.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 40.12 FT
PEAK VELOCITY= 1.0 FPS
TRAVEL TIME = 6.9 MIN
SPAN= 5-55 HRS, dt=.1 HRS

Post 10

REACH 5 **Roadway Culvert**

Qin = 61.21 CFS @ 13.97 HRS, VOLUME= 24.55 AF
Qout= 61.21 CFS @ 13.97 HRS, VOLUME= 24.55 AF, ATTEN= 0%, LAG= .3 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.40	.65	3.00
.80	1.79	12.58
1.20	3.17	28.13
2.80	9.40	120.26
3.20	10.78	140.41
3.60	11.91	153.09
3.76	12.26	154.51
3.88	12.46	153.09
4.00	12.57	143.64

48" PIPE
n= .013
LENGTH= 100 FT
SLOPE= .01 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.77 FT
PEAK VELOCITY= 11.3 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 6 **Natural Cross Section @ 40'down stream**

Qin = 61.21 CFS @ 13.97 HRS, VOLUME= 24.55 AF
Qout= 61.19 CFS @ 13.98 HRS, VOLUME= 24.56 AF, ATTEN= 0%, LAG= .8 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
35.50	0.0	0.00
36.00	13.0	51.10
38.00	140.0	76.32
40.00	309.0	93.48

SPECIAL 40' CHANNEL
n= .1
LENGTH= 40 FT
SLOPE= .01 FT/FT
CAPACITY= 1018.9 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 36.35 FT
PEAK VELOCITY= 1.7 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 7 **Natural Cross Section 120'downstream**

Qin = 61.19 CFS @ 13.98 HRS, VOLUME= 24.56 AF
Qout= 61.18 CFS @ 14.01 HRS, VOLUME= 24.56 AF, ATTEN= 0%, LAG= 1.3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
34.90	0.0	0.00
36.00	42.0	77.03
38.00	206.0	87.80
40.00	352.0	101.56

SPECIAL 80' CHANNEL
n= .1
LENGTH= 80 FT
SLOPE= .02 FT/FT
CAPACITY= 1694.2 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 36.01 FT
PEAK VELOCITY= 1.4 FPS
TRAVEL TIME = .9 MIN
SPAN= 5-55 HRS, dt=.1 HRS

Post 10

POND 1 **Road culvert / storage**

Qin = 91.51 CFS @ 12.47 HRS, VOLUME= 24.62 AF
Qout= 61.21 CFS @ 13.97 HRS, VOLUME= 24.55 AF, ATTEN= 33%, LAG= 89.9 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
39.3	0	0	0
40.0	30015	10505	10505
42.0	65126	95141	105646
44.0	106060	171186	276832
46.0	153438	259498	536330
50.0	250129	807134	1343464

STOR-IND METHOD
PEAK STORAGE = 196105 CF
PEAK ELEVATION= 43.1 FT
FLOOD ELEVATION= 50.0 FT
START ELEVATION= 39.3 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 61.9 MIN (24.55 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	39.5'	**48" CULVERT**
			n=.013 L=30' S=.01'/' Ke=.5 Cc=.9 Cd=.6

Post 100

SUBCATCHMENT 21 **North Far West**

PEAK= 63.03 CFS @ 12.84 HRS, VOLUME= 12.25 AF

ACRES	CN	
35.09	70	FUTURE DEVELOPED SITE

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Developed / wooded areas**	29.3
Grass: Dense n=.24 L=300' P2=3.5 in s=.0267 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Ravine / future BMP**	50.6
Forest w/Heavy Litter Kv=2.5 L=1200' s=.025 '/' V=.4 fps		
	Total Length= 1500 ft Total Tc=	79.9

SUBCATCHMENT 22 **North Mid-Interstate**

PEAK= 36.96 CFS @ 12.13 HRS, VOLUME= 3.12 AF

ACRES	CN	
10.29	65	Wooded some development

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**Ravine / Future BMP**	23.6
Woodland Kv=5 L=1000' s=.02 '/' V=.71 fps		

SUBCATCHMENT 23 **Future site / some woods**

PEAK= 66.66 CFS @ 12.01 HRS, VOLUME= 4.32 AF

ACRES	CN	
14.25	65	Wooded site

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**Future site / some woods**	14.1
L=900' s=.1 '/'		

Post 100

SUBCATCHMENT 24 **Limited development area**

PEAK= 51.03 CFS @ 12.08 HRS, VOLUME= 3.90 AF

ACRES	CN	
12.88	65	Land between roads

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**Existing ravine**	19.6
Forest w/Heavy Litter Kv=2.5 L=600' s=.0417 '/' V=.51 fps		

SUBCATCHMENT 25 **Buffered site / woodland**

PEAK= 63.35 CFS @ 12.98 HRS, VOLUME= 13.55 AF

ACRES	CN	
44.70	65	Developed site BMP & Buffer

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Developed Site to BMP**	22.8
Grass: Dense n=.24 L=300' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Buffdered site**	66.1
Forest w/Heavy Litter Kv=2.5 L=1700' s=.0294 '/' V=.43 fps		

	Total Length= 2000 ft Total Tc=	88.9

SUBCATCHMENT 26 **Future site / interchange /BMP's**

PEAK= 93.19 CFS @ 12.29 HRS, VOLUME= 10.41 AF

ACRES	CN	
34.35	65	Site buffered by Slope / wetland

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Buffered site**	22.8
Grass: Dense n=.24 L=300' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Buffer**	13.6
Unpaved Kv=16.1345 L=1200' s=.0083 '/' V=1.47 fps		

	Total Length= 1500 ft Total Tc=	36.4

POST 100

SUBCATCHMENT 27 **RECONSTRUCTED LAGRANGE / 600**

PEAK= 28.21 CFS @ 11.91 HRS, VOLUME= 1.54 AF

ACRES	CN	
3.47	80	ROADWAY AND SIDE SLOPES

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**DISCHARGE SYSTEM B**	6.7

SUBCATCHMENT 28 **SECTION "A"**

PEAK= 27.85 CFS @ 12.24 HRS, VOLUME= 2.89 AF

ACRES	CN	
6.09	60	GRASSED R.O.W.
2.20	98	PAVEMENT
8.29	70	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**DEVELOPED R.O.W.**	33.4

Post 100

REACH 1 **Natural drainage course**

Qin = 63.03 CFS @ 12.84 HRS, VOLUME= 12.25 AF
Qout= 61.99 CFS @ 13.03 HRS, VOLUME= 12.25 AF, ATTEN= 2%, LAG= 11.6 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
52.00	0.0	0.00
54.00	50.0	50.17
56.00	173.0	73.35
58.00	341.0	95.36

SPECIAL 900' CHANNEL
n= .08
LENGTH= 900 FT
SLOPE= .022 FT/FT
CAPACITY= 2196.9 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 52.90 FT
PEAK VELOCITY= 2.7 FPS
TRAVEL TIME = 5.5 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 2 **Natural Ravine**

Qin = 130.0 CFS @ 13.00 HRS, VOLUME= 28.92 AF
Qout= 129.4 CFS @ 13.07 HRS, VOLUME= 28.92 AF, ATTEN= 0%, LAG= 4.5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
48.00	0.0	0.00
50.00	47.0	47.22
52.00	159.0	65.74
54.00	277.0	100.45

SPECIAL 340' CHANNEL
n= .08
LENGTH= 340 FT
SLOPE= .0074 FT/FT
CAPACITY= 870.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 50.29 FT
PEAK VELOCITY= 2.1 FPS
TRAVEL TIME = 2.8 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 3 **Natural wetland**

Qin = 134.7 CFS @ 13.06 HRS, VOLUME= 33.24 AF
Qout= 133.5 CFS @ 13.25 HRS, VOLUME= 33.24 AF, ATTEN= 1%, LAG= 11.6 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
42.00	0.0	0.00
44.00	47.0	47.18
46.00	172.0	78.46
48.00	340.0	90.67

SPECIAL 900' CHANNEL
n= .08
LENGTH= 900 FT
SLOPE= .0089 FT/FT
CAPACITY= 1438.1 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 44.24 FT
PEAK VELOCITY= 2.2 FPS
TRAVEL TIME = 7.0 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 4 **Wetland above culvert**

Qin = 202.3 CFS @ 12.25 HRS, VOLUME= 47.55 AF
Qout= 196.7 CFS @ 12.40 HRS, VOLUME= 47.55 AF, ATTEN= 3%, LAG= 9.2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
38.40	0.0	0.00
40.00	72.0	90.06
42.00	267.0	105.58
44.00	492.0	120.58

SPECIAL 400' CHANNEL
n= .08
LENGTH= 400 FT
SLOPE= .0025 FT/FT
CAPACITY= 1166.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 40.70 FT
PEAK VELOCITY= 1.4 FPS
TRAVEL TIME = 4.7 MIN
SPAN= 5-55 HRS, dt=.1 HRS

POST 100-YR.

REACH 5 **Roadway Culvert**

Qin = 125.7 CFS @ 13.83 HRS, VOLUME= 51.92 AF
Qout= 125.7 CFS @ 13.83 HRS, VOLUME= 51.92 AF, ATTEN= 0%, LAG= .2 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.40	.65	3.00
.80	1.79	12.58
1.20	3.17	28.13
2.80	9.40	120.26
3.20	10.78	140.41
3.60	11.91	153.09
3.76	12.26	154.51
3.88	12.46	153.09
4.00	12.57	143.64

48" PIPE
n= .013
LENGTH= 100 FT
SLOPE= .01 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 2.91 FT
PEAK VELOCITY= 12.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 6 **Natural Cross Section @ 40'down stream**

Qin = 125.7 CFS @ 13.83 HRS, VOLUME= 51.92 AF
Qout= 125.7 CFS @ 13.84 HRS, VOLUME= 51.92 AF, ATTEN= 0%, LAG= .6 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
35.50	0.0	0.00
36.00	13.0	51.10
38.00	140.0	76.32
40.00	309.0	93.48

SPECIAL 40' CHANNEL
n= .1
LENGTH= 40 FT
SLOPE= .01 FT/FT
CAPACITY= 1018.9 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 36.78 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 7 **Natural Cross Section 120'downstream**

Qin = 125.7 CFS @ 13.84 HRS, VOLUME= 51.92 AF
Qout= 125.7 CFS @ 13.84 HRS, VOLUME= 51.92 AF, ATTEN= 0%, LAG= 0.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
34.90	0.0	0.00
36.00	42.0	77.03
38.00	206.0	87.80
40.00	352.0	101.56

SPECIAL 80' CHANNEL
n= .1
LENGTH= 80 FT
SLOPE= .02 FT/FT
CAPACITY= 1694.2 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 36.19 FT
PEAK VELOCITY= 2.2 FPS
TRAVEL TIME = .6 MIN
SPAN= 5-55 HRS, dt=.1 HRS

POND 1 **Road culvert / storage**

Qin = 222.9 CFS @ 12.38 HRS, VOLUME= 51.99 AF
Qout= 125.7 CFS @ 13.83 HRS, VOLUME= 51.92 AF, ATTEN= 44%, LAG= 87.1 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
39.3	0	0	0
40.0	30015	10505	10505
42.0	65126	95141	105646
44.0	106060	171186	276832
46.0	153438	259498	536330
50.0	250129	807134	1343464

STOR-IND METHOD
PEAK STORAGE = 512906 CF
PEAK ELEVATION= 45.8 FT
FLOOD ELEVATION= 50.0 FT
START ELEVATION= 39.3 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 61.9 MIN (51.81 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	39.5'	**48" CULVERT**
			n=.013 L=30' S=.01'/' Ke=.5 Cc=.9 Cd=.6

CULVERT ANALYSIS

LAGRANGE
STA. 42+50

Culvert Calculator Report
Replacement Culvert Rte 600

Solve For: Headwater Elevation

2-YR.

Culvert Summary					
Allowable HW Elevation	0.00	ft	Headwater Depth/ Height	0.62	
Computed Headwater Elevation	41.98	ft	Discharge	28.82	cfs ✓
Inlet Control HW Elev	41.72	ft	Tailwater Elevation	0.00	ft ?
Outlet Control HW Elev	41.98	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	39.50	ft	Downstream Invert	38.20	ft
Length	130.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.22	ft
Slope Type	Steep		Normal Depth	1.22	ft
Flow Regime	Supercritical		Critical Depth	1.59	ft
Velocity Downstream	8.85	ft/s	Critical Slope	0.003618	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	41.98	ft	Upstream Velocity Head	0.59	ft
Ke	0.50		Entrance Loss	0.30	ft

Inlet Control Properties					
Inlet Control HW Elev	41.72	ft	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall		Area Full	12.6	ft^2
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

MODEL 8.5FPS
HAESTAD 8.85FPS

NEW 48"

Culvert Calculator Report
Replacement Culvert Rte 600

Solve For: Headwater Elevation

10-YR.

Culvert Summary					
Allowable HW Elevation	0.00	ft	Headwater Depth/ Height	1.24	
Computed Headwater Elevation	44.45	ft	Discharge	91.51	cfs
Inlet Control HW Elev	44.29	ft	Tailwater Elevation	0.00	ft ?
Outlet Control HW Elev	44.45	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	39.50	ft	Downstream Invert	38.20	ft
Length	130.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	2.38	ft
Slope Type	Steep		Normal Depth	2.32	ft
Flow Regime	Supercritical		Critical Depth	2.90	ft
Velocity Downstream	11.73	ft/s	Critical Slope	0.005293	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	44.45	ft	Upstream Velocity Head	1.37	ft
Ke	0.50		Entrance Loss	0.68	ft

Inlet Control Properties					
Inlet Control HW Elev	44.29	ft	Flow Control	Transition	
Inlet Type	Square edge w/headwall		Area Full	12.6	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

$V_{10} = 11.73$

New 48"

Culvert Calculator Report
Replacement Culvert Rte 600

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	0.00	ft	Headwater Depth/ Height	1.66	
Computed Headwater Elevation	46.14	ft	Discharge	125.70	cfs
Inlet Control HW Elev	46.14	ft	Tailwater Elevation	0.00	ft ?
Outlet Control HW Elev	45.76	ft	Control Type	Inlet Control	

222.9CFS PER MODEL

Grades					
Upstream Invert	39.50	ft	Downstream Invert	38.20	ft
Length	130.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	2.95	ft
Slope Type	Steep		Normal Depth	2.90	ft
Flow Regime	Supercritical		Critical Depth	3.36	ft
Velocity Downstream	12.63	ft/s	Critical Slope	0.007329	ft/ft

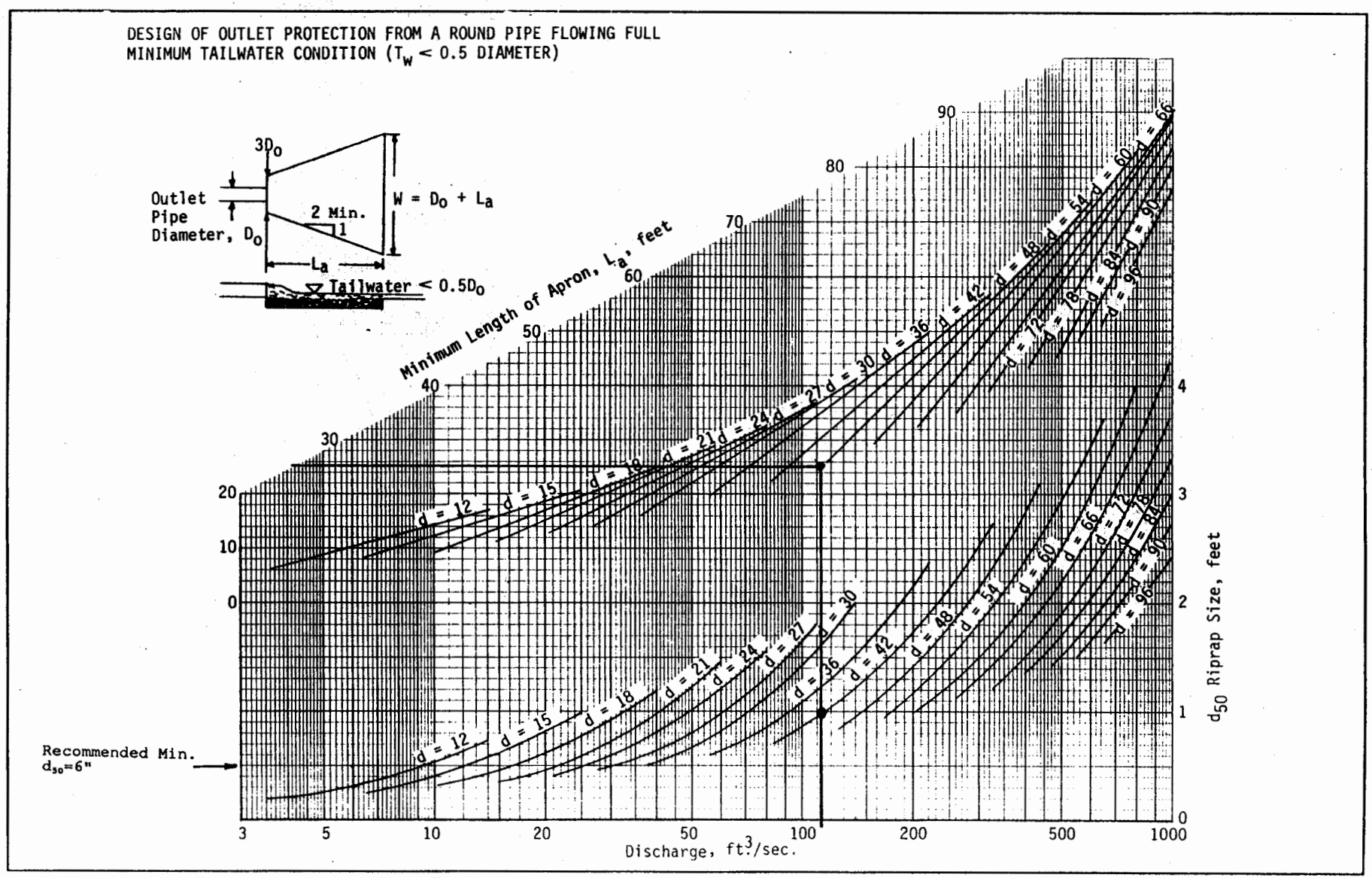
Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	45.76	ft	Upstream Velocity Head	1.93	ft
Ke	0.50		Entrance Loss	0.96	ft

Inlet Control Properties					
Inlet Control HW Elev	46.14	ft	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	12.6	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Q SHOULD MATCH Q IN FOR POND 1 (ROAD STORAGE) SIMILAR TO THE 2 AND 10-YEAR. 125.7 IS THE Q OUT VALUE IN THE COMPUTER MODEL AT POND 1 (NODE 1) ∴ USE 222.9CFS

Project Engineer: Louis M. Penci
CulvertMaster v1.0



Source: USDA-SCS

ROUTE 600 / LaGRANGE STATION 42+50
$Q_{50} \cong 115$ cfs $\phi = 48"$ $L_a = 25'$ $W = 27'$
CLASS I $d_{50} \cong 1'$ t=2'

STORM DRAINAGE CALCULATIONS

Inlet Structure Summary

Structure Designation	Structure Type	Inlet Length	Rim Elevation	Road Grade	Remarks
A-42	DI-3B	8.0	72.17	0.0300	
A-41	DI-3A	4.0	71.56	0.0300	
A-40	DI-3B	6.0	66.96	0.0400	
A-39	DI-3B	12.0	93.07	0.0178	
A-38	DI-3B	18.0	96.86	0.0192	
A-37	DI-3B	4.0	99.19	0.0192	
A-36	MH-1	~	94.80	~	
A-36A	DI-3C	6.0	92.40	~	SUMP
A-35	DI-3B	4.0	90.95	0.0400	
A-34	DI-3B	8.0	89.28	0.0350	
A-33	DI-3B	10.0	80.83	0.0380	
A-32	DI-3B	18.0	72.08	0.0400	
A-32A	DI-3B	6.0	72.96	0.0400	
A-31	DI-3B	10.0	66.00	0.0400	
B-5	DI-3B	10.0	54.13	0.0150	
B-4	DI-3B	14.0	53.16	0.0150	
B-3	DI-3B	12.0	51.48	0.0400	
B-3A	DI-3B	8.0	52.44	0.0400	
B-2	DI-3C	12.0	51.30	~	SUMP
B-2A	DI-3C	12.0	52.26	~	SUMP
C-14	DI-3B	8.0	100.44	0.0520	
C-13	DI-3B	16.0	100.20	0.0520	
C-12	MH-1	~		~	
C-12B	DI-3B	6.0	90.38	0.0700	
C-12A	DI-3B	10.0	90.38	0.0700	

PROJECT 1990140-000.11

HEC12 Version: V2.91 Run Date: 01-07-2001

INLET NUMBER A-42 LENGTH 8.0 STATION 10+75R

DRAINAGE AREA = 0.050 ACRES C VALUE = .900 CA = 0.045

DRAINAGE AREA = 0.360 ACRES C VALUE = .400 CA = 0.144

SUM CA= 0.189 INT= 4.00 CFS= 0.756 CO= 0.000 GUTTER FLOW= 0.756

GUTTER SLOPE = 0.0300 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
2.46	2.0	0.81	0.0833	4.0	1.00	3.5	0.146	0.166

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 6.8 EFFICIENCY= 1.00

CFS INTERCEPTED= 0.76 CFS CARRYOVER= 0.00

INLET NUMBER A-41 LENGTH ~~2.5~~ 4.0 STATION 10+75L

DRAINAGE AREA = 0.070 ACRES C VALUE = .900 CA = 0.063

SUM CA= 0.063 INT= 4.00 CFS= 0.252 CO= 0.000 GUTTER FLOW= 0.252

GUTTER SLOPE = 0.0300 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
1.40	2.0	1.42	0.0833	4.0	1.00	3.5	0.146	0.167

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 4.3 EFFICIENCY= 0.79

CFS INTERCEPTED= 0.20 CFS CARRYOVER= 0.05

INLET NUMBER A-40 LENGTH 6.0 STATION 36+00R

DRAINAGE AREA = 0.060 ACRES C VALUE = .900 CA = 0.054

DRAINAGE AREA = 0.050 ACRES C VALUE = .550 CA = 0.028

SUM CA= 0.082 INT= 4.00 CFS= 0.326 CO= 0.000 GUTTER FLOW= 0.326

GUTTER SLOPE = 0.0300 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
1.55	2.0	1.29	0.0833	4.0	1.00	3.5	0.146	0.167

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 4.8 EFFICIENCY= 1.00

CFS INTERCEPTED= 0.33 CFS CARRYOVER= 0.00

INLET NUMBER A-39 LENGTH 12.0 STATION 27+25L

DRAINAGE AREA = 0.490 ACRES C VALUE = .900 CA = 0.441

DRAINAGE AREA = 0.390 ACRES C VALUE = .500 CA = 0.195

SUM CA= 0.636 INT= 4.00 CFS= 2.544 CO= 0.000 GUTTER FLOW= 2.544

GUTTER SLOPE = 0.0178 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
7.45	2.0	0.27	0.0833	4.0	0.72	3.5	0.146	0.125

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 11.5 EFFICIENCY= 1.00

CFS INTERCEPTED= 2.54 CFS CARRYOVER= 0.00

INLET NUMBER A-38 LENGTH 18.0 STATION 30+00L

DRAINAGE AREA = 0.50 ACRES C VALUE = .900 CA = 0.450

DRAINAGE AREA = 1.360 ACR ES C VALUE = .500 CA = 0.680

SUM CA= 1.130 INT= 4.00 CFS= 4.520 CO= 0.000 GUTTER FLOW= 4.520

GUTTER SLOPE = 0.0192 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
9.67	2.0	0.21	0.0833	4.0	0.59	3.5	0.146	0.107

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 16.4 EFFICIENCY= 1.00

CFS INTERCEPTED= 4.52 CFS CARRYOVER= 0.00

INLET NUMBER A-37 LENGTH 4.0 STATION 30+00R

DRAINAGE AREA = 0.020 ACRES C VALUE = .900 CA = 0.018

DRAINAGE AREA = 0.030 ACRES C VALUE = .500 CA = 0.015

SUM CA= 0.033 INT= 4.00 CFS= 0.132 CO= 0.000 GUTTER FLOW= 0.132

GUTTER SLOPE = 0.0192 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
1.20	2.0	1.67	0.0833	4.0	1.00	3.5	0.146	0.167

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 2.9 EFFICIENCY= 1.00

CFS INTERCEPTED= 0.13 CFS CARRYOVER= 0.00

==========

INLET NUMBER A-36A LENGTH 6.0 STATION 2?+??L

DRAINAGE AREA = 0.300 ACRES C VALUE = .900 CA = 0.270

DRAINAGE AREA = 0.240 ACRES C VALUE = .500 CA = 0.120

FOR THE FIRST SIDE

SUM CA= 0.270 INT= 4.00 CFS= 1.080 CO= 0.000 GUTTER FLOW= 1.080

FOR THE OTHER SIDE

SUM CA= 0.120 INT= 4.00 CFS= 0.480 CO= 0.000 GUTTER FLOW= 0.480

AT THE INLET

SUM CA= 0.390 INT= 4.00 CFS= 1.560 CO= 0.000 GUTTER FLOW= 1.560

GUTTER SLOPE = 0.0001 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD AT A SLOPE OF .000 (ft./ft.) AND 1.08 (cfs) IS 16.13 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX

P EFFEC. LENGTH (ft) = 9.60 H (ft) = 0.458

DEPTH OF WATER (ft) = 0.17 SPREAD (ft) = 8.21

==========

INLET NUMBER A-35 LENGTH 4.0 STATION 3?+??R

DRAINAGE AREA = 0.010 ACRES C VALUE = .900 CA = 0.009

DRAINAGE AREA = 0.050 ACRES C VALUE = .500 CA = 0.025

SUM CA= 0.034 INT= 4.00 CFS= 0.136 CO= 0.000 GUTTER FLOW= 0.136

GUTTER SLOPE = 0.0400 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
1.06	2.0	1.89	0.0833	4.0	1.00	3.5	0.146	0.167

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 3.6 EFFICIENCY= 1.00

CFS INTERCEPTED= 0.14 CFS CARRYOVER= 0.00

INLET NUMBER A-34 LENGTH 8.0 STATION 3?+??L

DRAINAGE AREA = 0.180 ACRES C VALUE = .900 CA = 0.162

DRAINAGE AREA = 0.130 ACRES C VALUE = .400 CA = 0.052

SUM CA= 0.214 INT= 4.00 CFS= 0.856 CO= 0.000 GUTTER FLOW= 0.856

GUTTER SLOPE = 0.0350 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
2.60	2.0	0.77	0.0833	4.0	1.00	3.5	0.146	0.166

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 7.5 EFFICIENCY= 1.00

CFS INTERCEPTED= 0.86 CFS CARRYOVER= 0.00

INLET NUMBER A-33 LENGTH 10.0 STATION 3?+??L

DRAINAGE AREA = 0.180 ACRES C VALUE = .900 CA = 0.162

DRAINAGE AREA = 0.190 ACRES C VALUE = .550 CA = 0.105

SUM CA= 0.266 INT= 4.00 CFS= 1.066 CO= 0.000 GUTTER FLOW= 1.066

GUTTER SLOPE = 0.0380 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.16	2.0	0.63	0.0833	4.0	0.98	3.5	0.146	0.164

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 8.5 EFFICIENCY= 1.00

CFS INTERCEPTED= 1.07 CFS CARRYOVER= 0.00

INLET NUMBER A-32A LENGTH 6.0 STATION 35+??R

DRAINAGE AREA = 0.020 ACRES C VALUE = .900 CA = 0.018

DRAINAGE AREA = 0.160 ACRES C VALUE = .550 CA = 0.088

SUM CA= 0.106 INT= 4.00 CFS= 0.424 CO= 0.000 GUTTER FLOW= 0.424

GUTTER SLOPE = 0.0400 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
1.62	2.0	1.24	0.0833	4.0	1.00	3.5	0.146	0.167

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 5.8 EFFICIENCY= 1.00

CFS INTERCEPTED= 0.42 CFS CARRYOVER= 0.00

INLET NUMBER A-32 LENGTH 18.0 STATION 3?+??L

DRAINAGE AREA = 0.150 ACRES C VALUE = .900 CA = 0.135

DRAINAGE AREA = 1.710 ACRES C VALUE = .550 CA = 0.941

SUM CA= 1.076 INT= 4.00 CFS= 4.302 CO= 0.000 GUTTER FLOW= 4.302

GUTTER SLOPE = 0.0400 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
7.92	2.0	0.25	0.0833	4.0	0.69	3.5	0.146	0.121

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 18.6 EFFICIENCY= 1.00

CFS INTERCEPTED= 4.29 CFS CARRYOVER= 0.01

PROJECT 1990140-000.11
HEC12 Version: V2.91 Run Date: 01-23-2001

==========

INLET NUMBER A-31 LENGTH 10.0 STATION 36+00L

DRAINAGE AREA = 0.170 ACRES C VALUE = .900 CA = 0.153
DRAINAGE AREA = 0.280 ACRES C VALUE = .550 CA = 0.154
SUM CA= 0.307 INT= 4.00 CFS= 1.228 CO= 0.000 GUTTER FLOW= 1.228

GUTTER SLOPE = 0.0400 FT/FT PAVEMENT CROSS SLOPE = 0.0300 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.09	2.0	0.65	0.0833	2.8	0.97	3.3	0.137	0.162

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 9.2 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.23 CFS CARRYOVER= 0.00

==========

INLET NUMBER A-41 LENGTH 4.0 STATION 10+75L

DRAINAGE AREA = 0.070 ACRES C VALUE = .900 CA = 0.063
SUM CA= 0.063 INT= 4.00 CFS= 0.252 CO= 0.000 GUTTER FLOW= 0.252

GUTTER SLOPE = 0.0300 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
1.40	2.0	1.42	0.0833	4.0	1.00	3.5	0.146	0.167

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 4.3 EFFICIENCY= 0.99
CFS INTERCEPTED= 0.25 CFS CARRYOVER= 0.00

PROJECT 1990140-000.11

HEC12 Version: V2.91 Run Date: 01-07-2001

INLET NUMBER B-5 LENGTH 10.0 STATION 47+53R

DRAINAGE AREA = 0.110 ACRES C VALUE = .900 CA = 0.099

DRAINAGE AREA = 0.130 ACRES C VALUE = .400 CA = 0.052

DRAINAGE AREA = 0.890 ACRES C VALUE = .550 CA = 0.490

SUM CA= 0.641 INT= 4.00 CFS= 2.562 CO= 0.000 GUTTER FLOW= 2.562

GUTTER SLOPE = 0.0150 FT/FT PAVEMENT CROSS SLOPE = 0.0330 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
6.00	2.0	0.33	0.0833	2.5	0.73	3.2	0.134	0.130

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 10.7 EFFICIENCY= 0.99

CFS INTERCEPTED = 2.54 CFS CARRYOVER= 0.02

INLET NUMBER B-4 LENGTH 14.0 STATION 47+53L

DRAINAGE AREA = 0.500 ACRES C VALUE = .900 CA = 0.450

DRAINAGE AREA = 0.120 ACRES C VALUE = .400 CA = 0.048

DRAINAGE AREA = 1.080 ACRES C VALUE = .550 CA = 0.594

SUM CA= 1.092 INT= 4.00 CFS= 4.368 CO= 0.000 GUTTER FLOW= 4.368

GUTTER SLOPE = 0.0150 FT/FT PAVEMENT CROSS SLOPE = 0.0330 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
7.65	2.0	0.26	0.0833	2.5	0.61	3.2	0.134	0.115

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 14.4 EFFICIENCY= 1.00

CFS INTERCEPTED= 4.36 CFS CARRYOVER= 0.01

INLET NUMBER B-3 LENGTH 12.0 STATION 44+33L

DRAINAGE AREA = 0.160 ACRES C VALUE = .900 CA = 0.144

DRAINAGE AREA = 0.050 ACRES C VALUE = .400 CA = 0.020

DRAINAGE AREA = 0.320 ACRES C VALUE = .550 CA = 0.176

SUM CA= 0.340 INT= 4.00 CFS= 1.360 CO= 0.000 GUTTER FLOW= 1.360

GUTTER SLOPE = 0.0400 FT/FT PAVEMENT CROSS SLOPE = 0.0300 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.33	2.0	0.60	0.0833	2.8	0.95	3.3	0.137	0.160

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 9.7 EFFICIENCY= 1.00

CFS INTERCEPTED= 1.36 CFS CARRYOVER= 0.00

INLET NUMBER B-3A LENGTH 8.0 STATION 44+33R

DRAINAGE AREA = 0.010 ACRES C VALUE = .900 CA = 0.009

DRAINAGE AREA = 0.050 ACRES C VALUE = .400 CA = 0.020

DRAINAGE AREA = 0.310 ACRES C VALUE = .550 CA = 0.171

SUM CA= 0.200 INT= 4.00 CFS= 0.798 CO= 0.000 GUTTER FLOW= 0.798

GUTTER SLOPE = 0.0400 FT/FT PAVEMENT CROSS SLOPE = 0.0300 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
2.13	2.0	0.94	0.0833	2.8	1.00	3.3	0.137	0.167

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 7.6 EFFICIENCY= 1.00

CFS INTERCEPTED= 0.80 CFS CARRYOVER= 0.00

INLET NUMBER B-2A LENGTH 12.0 STATION 43+80

DRAINAGE AREA = 0.020 ACRES C VALUE = .900 CA = 0.018

DRAINAGE AREA = 0.090 ACRES C VALUE = .400 CA = 0.036

DRAINAGE AREA = 0.010 ACRES C VALUE = .900 CA = 0.009

DRAINAGE AREA = 0.010 ACRES C VALUE = .400 CA = 0.004

DRAINAGE AREA = 0.070 ACRES C VALUE = .550 CA = 0.038

FOR THE FIRST SIDE

SUM CA= 0.054 INT= 4.00 CFS= 0.216 CO= 0.000 GUTTER FLOW= 0.216

FOR THE OTHER SIDE

SUM CA= 0.052 INT= 4.00 CFS= 0.206 CO= 0.000 GUTTER FLOW= 0.206

AT THE INLET

SUM CA= 0.105 INT= 4.00 CFS= 0.422 CO= 0.000 GUTTER FLOW= 0.422

GUTTER SLOPE = 0.0001 FT/FT PAVEMENT CROSS SLOPE = 0.0300 FT/FT

SPREAD AT A SLOPE OF .000 (ft./ft.) AND 0.22 (cfs) IS 6.43 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX

P EFFEC. LENGTH (ft) = 15.60 H (ft) = 0.458

DEPTH OF WATER (ft) = 0.05 SPREAD (ft) = 1.72

INLET NUMBER B-2 LENGTH 12.0 STATION 43+80L

DRAINAGE AREA = 0.290 ACRES C VALUE = .900 CA = 0.261

DRAINAGE AREA = 0.090 ACRES C VALUE = .400 CA = 0.036

DRAINAGE AREA = 0.030 ACRES C VALUE = .900 CA = 0.027

DRAINAGE AREA = 0.010 ACRES C VALUE = .400 CA = 0.004

DRAINAGE AREA = 0.040 ACRES C VALUE = .550 CA = 0.022

FOR THE FIRST SIDE

SUM CA= 0.297 INT= 4.00 CFS= 1.188 CO= 0.000 GUTTER FLOW= 1.188

FOR THE OTHER SIDE

SUM CA= 0.053 INT= 4.00 CFS= 0.212 CO= 0.000 GUTTER FLOW= 0.212

AT THE INLET

SUM CA= 0.350 INT= 4.00 CFS= 1.400 CO= 0.000 GUTTER FLOW= 1.400

GUTTER SLOPE = 0.0001 FT/FT PAVEMENT CROSS SLOPE = 0.0300 FT/FT

SPREAD AT A SLOPE OF .000 (ft./ft.) AND 1.19 (cfs) IS 13.38 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX

P EFFEC. LENGTH (ft) = 15.60 H (ft) = 0.458

DEPTH OF WATER (ft) = 0.11 SPREAD (ft) = 3.83

INLET NUMBER C-14 LENGTH 8.0 STATION 55+95L

DRAINAGE AREA = 0.460 ACRES C VALUE = .400 CA = 0.184

SUM CA= 0.184 INT= 4.00 CFS= 0.736 CO= 0.000 GUTTER FLOW= 0.736

GUTTER SLOPE = 0.0520 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
1.89	2.0	1.06	0.0833	4.0	1.00	3.5	0.146	0.167

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 7.9 EFFICIENCY= 1.00

CFS INTERCEPTED= 0.74 CFS CARRYOVER= 0.00

INLET NUMBER C-13 LENGTH 16.0 STATION 55+95R

DRAINAGE AREA = 0.590 ACRES C VALUE = .900 CA = 0.531

DRAINAGE AREA = 0.560 ACRES C VALUE = .550 CA = 0.308

SUM CA= 0.839 INT= 4.00 CFS= 3.356 CO= 0.000 GUTTER FLOW= 3.356

GUTTER SLOPE = 0.0520 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
6.48	2.0	0.31	0.0833	4.0	0.78	3.5	0.146	0.135

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 17.0 EFFICIENCY= 0.99

CFS INTERCEPTED= 3.34 CFS CARRYOVER= 0.02

INLET NUMBER C-12B LENGTH 6.0 STATION 54+25L

DRAINAGE AREA = 0.050 ACRES C VALUE = .900 CA = 0.045

DRAINAGE AREA = 0.150 ACRES C VALUE = .400 CA = 0.060

SUM CA= 0.105 INT= 4.00 CFS= 0.420 CO= 0.000 GUTTER FLOW= 0.420

GUTTER SLOPE = 0.0700 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
1.45	2.0	1.38	0.0833	4.0	1.00	3.5	0.146	0.167

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 6.8 EFFICIENCY= 0.98

CFS INTERCEPTED= 0.41 CFS CARRYOVER= 0.01

INLET NUMBER C-12A LENGTH 10.0 STATION 54+25R

DRAINAGE AREA = 0.080 ACRES C VALUE = .900 CA = 0.072

DRAINAGE AREA = 0.120 ACRES C VALUE = .400 CA = 0.048

SUM CA= 0.120 INT= 4.00 CFS= 0.480 CO= 0.000 GUTTER FLOW= 0.480

GUTTER SLOPE = 0.0700 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
1.53	2.0	1.31	0.0833	4.0	1.00	3.5	0.146	0.167

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH (ft) = 7.2 EFFICIENCY= 1.00

CFS INTERCEPTED= 0.48 CFS CARRYOVER= 0.00

STORM SEWER DESIGN / RATIONAL METHOD 10 YEAR RETURN PERIOD

Extension of La Grange Parkway , Stonehouse Commerce Park, James City COunty
Concrete Pipe,"n" = 0.013 Capacity @ 80% 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)	
NEW CONSTRUCTION																		
FULL WIDTH PAVEMENT	A-39	0.49	0.90	0.44	0.44	1.30	5.00	7.2	3.18									
GRASS SITE UNIMPROVED	A-39	0.39	0.50	0.20	0.64	10.51	11.01	5.8	3.67									
A-39 / DI-3A, L=12', RIM.EL.103+/-	A-38								3.67	96.31	90.28	268	0.0225	15	9.47	9.00	0.50	**A-39 / DI-3A, L=12', RIM.EL.103+/-**
FULL WIDTH PAVEMENT	A-38	0.50	0.90	0.45	1.09	1.66	10.51	5.9	6.36									
GRASS SITE UNIMPROVED	A-38	1.36	0.50	0.68	1.77	23.53	23.53	4.1	7.26									
A-38 / DI-3A, L=18', RIM EL. 94+/-	A-37								7.26	90.03	89.15	88	0.0100	18	10.27	6.77	0.22	**A-38 / DI-3A, L=18', RIM EL. 94+/-**
HIGHSIDE GUTTER	A-37	0.02	0.90	0.02	1.78	2.60	23.75	4.1	7.30									
ROW / SHOULDER	A-37	0.30	0.50	0.15	1.93	31.16	31.37	3.5	6.77				2.50% PLAN					
A-37 /DI-3A, L=4' RIM EL. 98+/-	A-36								6.77	89.05	84.68	185	0.0236	18	15.78	10.41	0.30	**A-37 /DI-3A, L=4' RIM EL. 98+/-**
FULL WIDTH PAVEMENT	A-36A	0.30	0.90	0.27	0.27	3.67	5.00	7.2	1.94									
GRASS SITE UNIMPROVED	A-36A	0.24	0.50	0.12	0.39	3.58	5.00	7.2	2.81									
A-36A / RIM EL. 92	A-36								2.81	85.50	84.58	98	0.0094	15	6.12	5.81	0.28	**A-36A / RIM EL. 92**
MANHOLE A-36	A-35								8.03	84.33	80.82	117	0.0300	18	17.78	11.73	0.17	**MANHOLE A-36**
HIGHSIDE GUTTER	A-35	0.01	0.90	0.01	2.33	1.33	32.11	3.5	8.06									
ROW / SHOULDER	A-35	0.05	0.50	0.03	2.36	1.39	32.11	3.5	8.14									
A-35 / RIM EL. 90.93	A-34								8.14	80.72	79.98	49	0.0151	18	12.62	8.33	0.10	**A-35 / RIM EL. 90.93**
FULL WIDTH PAVEMENT	A-34	0.18	0.90	0.16	2.52	1.33	32.21	3.4	8.69									
ROW / SHOULDER	A-34	0.13	0.50	0.07	2.59	1.39	32.21	3.4	8.91									
A-34 / RIM EL. 89.44	A-33								8.91	79.88	70.96	223	0.0400	18	20.54	13.55	0.27	**A-34 / RIM EL. 89.44**
FULL WIDTH PAVEMENT	A-33	0.18	0.90	0.16	2.75	0.92	32.49	3.4	9.42									
SLOPE / SHOULDER	A-33	0.19	0.55	0.10	2.85	0.73	32.49	3.4	9.78									
A-33 / RIM EL. 81.00	A-32								9.78	70.86	62.06	220	0.0400	18	20.54	13.55	0.27	**A-33 / RIM EL. 81.00**
HIGHSIDE GUTTER	A-32A	0.02	0.90	0.02	0.02	1.84	35.57	3.2	0.06									
SLOPE / SHOULDER	A-32A	0.16	0.55	0.09	0.11	2.32	35.57	3.2	0.34									
A-32A / RIM EL. 72.96	A-32								0.34	68.00	67.68	32	0.0100	15	6.31	6.00	0.09	**A-32A / RIM EL. 72.96**
FULL WIDTH PAVEMENT	A-32	0.15	0.90	0.14	3.09	0.92	32.85	3.4	10.54									
SLOPE / SHOULDER	A-32	1.71	0.55	0.94	4.03	0.95	32.85	3.4	13.74				1.67% PLAN					
A-32 / RIM EL. 72.00	A-31								13.74	61.96	59.00	147	0.0201	18	14.57	9.61	0.25	**A-32 / RIM EL. 72.00**
ROUTE 600 INTERSECTION																		
PAVEMENT	A-42	0.05	0.90	0.05	0.05	0.95	5.00	7.2	0.32									
WOODS SHOULDER	A-42	0.36	0.40	0.14	0.19	0.67	5.00	7.2	1.36									
A-42 / DI-3B, L=6' RIM.EL.72.17	A-41								1.36	67.32	67.00	32	0.0100	15	6.31	6.00	0.09	**A-42 / DI-3B, L=6' RIM.EL.72.17**
PAVEMENT	A-41	0.07	0.90	0.06	0.25	1.18	5.00	7.2	1.81									
A-41/DI-3A, RIM EL. 71.56	A-40								1.81	66.90	62.10	98	0.0490	15	13.97	13.28	0.12	**A-41/DI-3A, RIM EL. 71.56**
RT 600 PAVEMENT	A-40	0.06	0.90	0.05	0.31	0.73	5.00	7.2	2.20									
RT 600 SHOULDER	A-40	0.05	0.55	0.03	0.33	0.73	5.00	7.2	2.40									
A-40 /DI-3B, L=6' RIM EL. 66.96	A-31								2.40	62.00	61.68	32	0.0100	15	6.31	6.00	0.09	**A-40 /DI-3B, L=6' RIM EL. 66.96**
FULL WIDTH PAVEMENT	A-31	0.17	0.90	0.15	4.52	0.61	33.40	3.4	15.25									
SLOPE / SHOULDER	A-31	0.28	0.55	0.15	4.67	0.49	33.40	3.4	15.77									
A-31 / RIM EL.66.00	A-30								15.77	56.50	55.00	100	0.0150	24	27.08	10.05	0.17	**A-31 / RIM EL.66.00**
		7.42																

STORM SEWER DESIGN / RATIONAL METHOD 10 YEAR RETURN PERIOD

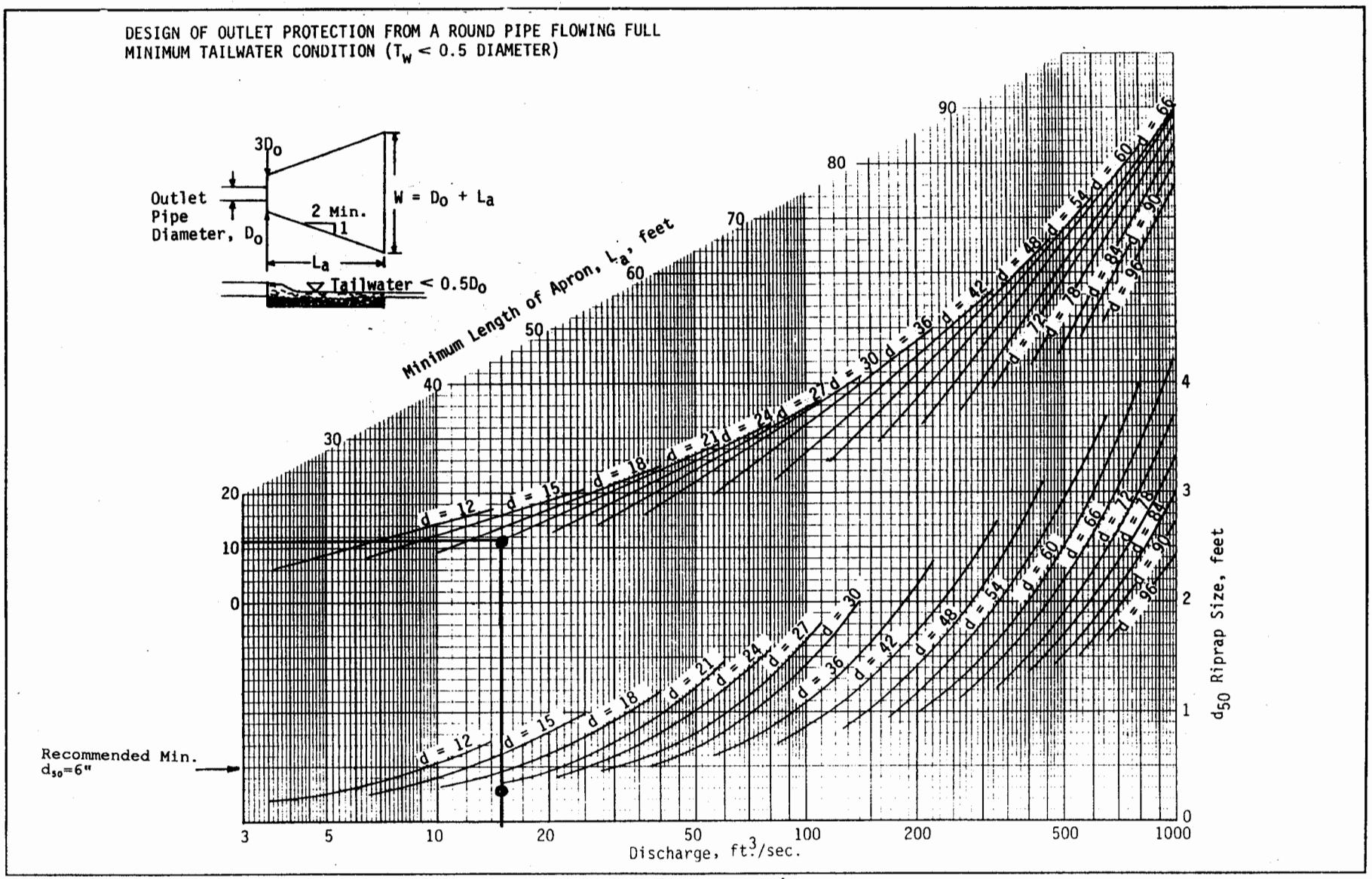
Extension of La Grange Parkway , Stonehouse Commerce Park, James City COunty
Concrete Pipe,"n" = 0.013 Capacity @ 80% Full Depth

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)	
REBUILD THRU I-64 & 608																		
HIGH SIDE GUTTER	B-5	0.11	0.90	0.10	0.10	4.06	5.00	7.2	0.71									
GRASS SHOULDER	B-5	0.13	0.40	0.05	0.15	5.11	5.11	7.2	1.08									
EXISTING CUT SLOPE	B-5	0.89	0.55	0.49	0.64	5.11	5.11	7.2	4.59									
B-5 @ STA 47+00 R	B-4								4.59	46.57	46.25	32	0.0100	15	6.31	6.00	0.09	**DI-3B, RIM EL. 53.56, L=10'**
PAVEMENT	B-4	0.50	0.90	0.45	1.09	4.06	5.20	7.1	7.79									
GRASSED SHOULDER	B-4	0.12	0.40	0.05	1.14	5.11	5.20	7.1	8.13									
EXISTING CUT SLOPE	B-4	1.08	0.55	0.59	1.73	5.11	5.20	7.1	12.37									
B-4 @ STA 47+00 L	B-3								12.37	45.50	44.18	265	0.0050	24	15.61	5.79	0.76	**DI-3B, RIM EL. 53.38, L= 14'**
HIGH SIDE GUTTER	B-3A	0.01	0.90	0.01	0.01	1.45	5.00	7.2	0.06									
GRASS SHOULDER	B-3A	0.05	0.40	0.02	0.03	1.83	5.00	7.2	0.21									
EXISTING CUT SLOPE	B-3A	0.31	0.55	0.17	0.20	1.83	5.00	7.2	1.44									
B-3A @ STA 44+33 R	B-3								1.44	47.50	47.18	32	0.0100	15	6.31	6.00	0.09	**DI-3B, RIM EL. 52.18, L= 6'**
PAVEMENT	B-3	0.16	0.90	0.14	2.08	1.45	6.05	6.9	14.32									
GRASSED SHOULDER	B-3	0.05	0.40	0.02	2.10	1.83	6.05	6.9	14.46									
EXISTING CUT SLOPE	B-3	0.32	0.55	0.18	2.27	1.83	6.05	6.9	15.67									
B-3 @ STA 44+33 L	B-2								15.67	44.08	43.80	53	0.0053	24	16.07	5.97	0.15	**DI-3B, RIM EL. 52.00, L= 12'**
HIGH SIDE GUTTER	B-2A	0.02	0.90	0.02	0.02	0.41	5.00	7.2	0.13									
GRASSED SHOULDER	B-2A	0.09	0.40	0.04	0.05	0.51	5.00	7.2	0.39									
PAVEMENT	B-2A	0.01	0.90	0.01	0.06	0.87	5.00	7.2	0.45									
GRASSED SHOULDER	B-2A	0.01	0.40	0.00	0.07	1.10	5.00	7.2	0.48									
EXISTING CUT SLOPE	B-2A	0.07	0.55	0.04	0.11	1.10	5.00	7.2	0.76									
B-2A @ STA 43+80 R	B-2								0.76	47.39	47.07	32	0.0100	15	6.31	6.00	0.09	**DI-3C, RIM EL. 51.71, L= 12'**
PAVEMENT	B-2	0.29	0.90	0.26	2.64	0.41	6.29	6.8	18.03									
GRASSED SHOULDER	B-2	0.09	0.40	0.04	2.67	0.51	6.29	6.8	18.27									
PAVEMENT	B-2	0.03	0.90	0.03	2.70	0.87	6.29	6.8	18.46									
GRASSED SHOULDER	B-2	0.01	0.40	0.00	2.71	1.10	6.29	6.8	18.48									
EXISTING CUT SLOPE	B-2	0.04	0.55	0.02	2.73	1.10	6.29	6.8	18.63			65	1.0010					
B-2 @ STA 43+80 L	B-1								18.63	43.70	42.50	81	0.0148	24	26.91	9.99	0.14	**DI-3C, RIM EL. 51.53, L= 12'**
		4.39																**OUTFALL ES-1, INV EL 42.50**
ROUTE 608 INTERSECTION																		
GRASSED SHOULDER	C-14	0.46	0.40	0.18	0.18	2.08	5.00	7.2	1.33									
C-14 @ STA. 56+00 LEFT	C-13								1.33	95.32	95.00	32	0.0100	15	6.31	6.00	0.09	**C-14 @ STA. 56+00 LEFT**
FULL WIDTH PAVEMENT	C-13	0.59	0.90	0.53	0.72	2.00	5.00	7.2	5.15									
SHOULDER	C-13	0.56	0.55	0.31	1.02	2.15	5.00	7.2	7.37									
C-13 @ STA. 56+00 RIGHT	C-12								7.37	94.90	87.46	186	0.0400	15	12.63	12.00	0.26	**C-13 @ STA. 56+00 RIGHT**
PAVEMENT	C-12B	0.05	0.90	0.05	0.05	0.54	5.00	7.2	0.32									
SHOULDER	C-12B	0.15	0.40	0.06	0.11	0.68	5.00	7.2	0.76									
C-12B @ STA. 54+25 LEFT	C-12A								0.76	86.10	85.78	32	0.0100	15	6.31	6.00	0.09	**C-12B @ STA. 54+25 LEFT**
PAVEMENT	C-12A	0.08	0.90	0.07	0.18	0.70	5.00	7.2	1.27									
SHOULDER	C-12A	0.12	0.40	0.05	0.23	0.73	5.00	7.2	1.62									
C-12A @ STA. 54+25 RIGHT	C-12	2.01							1.62	85.68	85.43	25	0.0100	15	6.31	6.00	0.07	**C-12A @ STA. 54+25 RIGHT**
MH-1 @ C-12	PG-2A								8.99	85.33	84.60	73	0.0100	18	10.27	6.77	0.18	**MH-1 @ C-12**
ROADSIDE SHOULDER	PG-2A	1.89	0.40	0.76	2.00	21.88	22.56	4.2	8.42									
PG-2A , Z=2:1, D=1.5, n=0.015									8.42	V" Ditch	d=1.5'	100.00	0.0050		24.00			
REPLACE EXISTING CMP / RCP	OUTFALL								8.42	84.10	80.60	70	0.0500	24	26.78	9.94	0.12	**REPLACE EXISTING CMP / RCP**
CUT SLOPE TO PG-2	OUTFALL	0.18	0.40	0.07	2.08	0.29	23.99	4.1	8.45	V" Ditch	1.00	100.00	0.0800		33.00			
		4.08																
WOODS AND FILL SLOPE	C-16	4.02	0.55	2.21	2.21	1.17	5.00	7.2	15.92									
INLET C-16,	C-15								15.92	104.00	86.00	255	0.0706	18	27.28	18.00	0.24	**INLET C-16,**

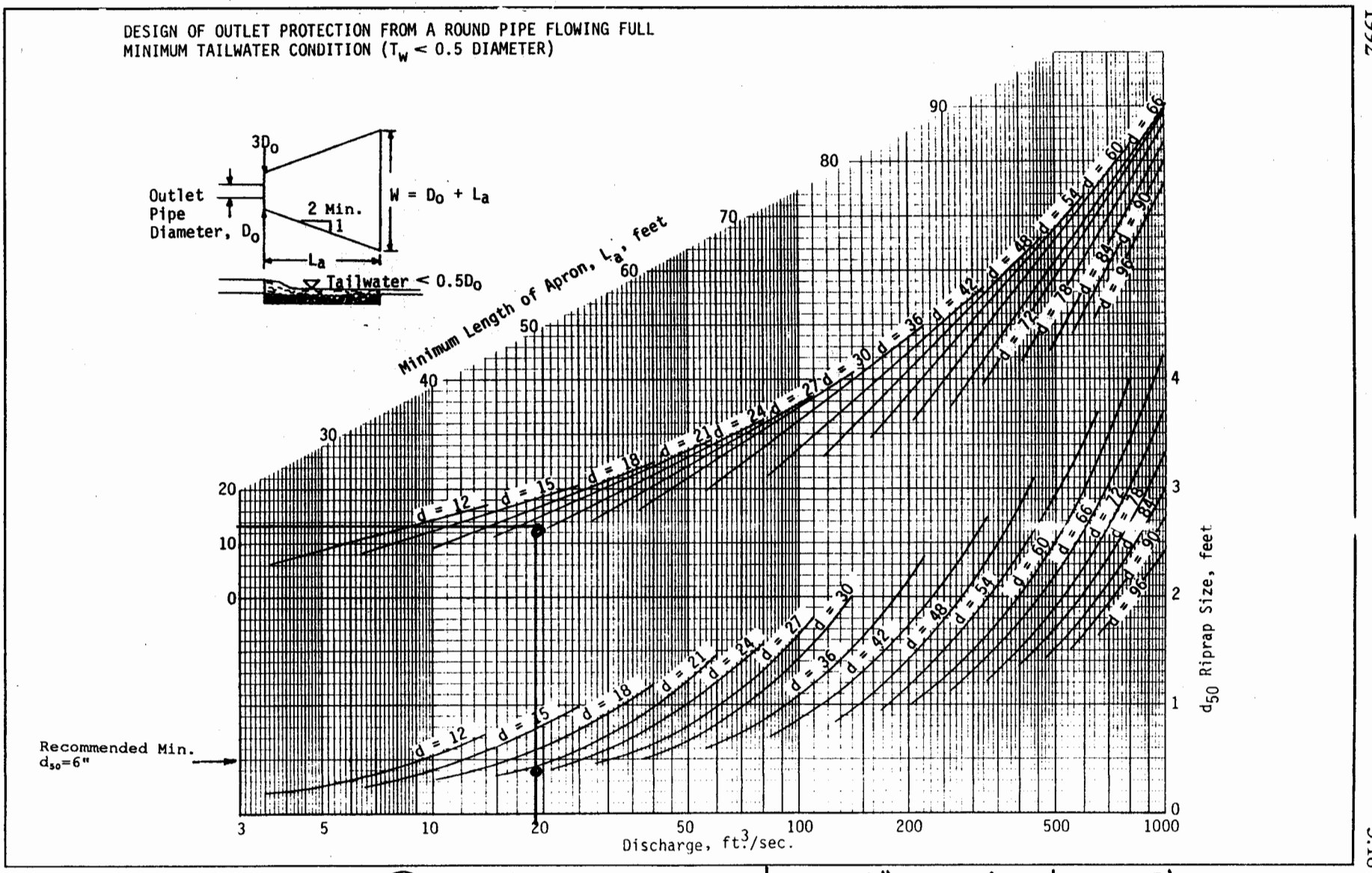
HYDRAULIC GRADELINE CALCULATION — **Extension of La Grange Parkway , Stonehouse Commerce Park, James City COunty**

INLET STATION	Outlet Water Surface	FRICTION LOSS IN PIPE							JUNCTION LOSS												H Adjusted	Inlet Water Surface Elevation	Rim Elevation
		Do	Qo	Lo	no	Sfo	/ So	Hf	Vo	Ho	Qi	Vi	Qi x Vi	V²/ 2g	Hi	Δ	Hdelta	Ht	.3 x Ht	0.5 x Ht			
SYSTEM "A"																							
A-31 / RIM EL.66.00	56.08	24	15.77	100	0.013	0.0049	0.0150	1.500	9.1	0.32	13.74	9.56	131.35	1.42	0.50	29	0.31	1.13	0.34	-0.57	2.40	58.48	A-31 / RIM EL.66.00
A-32 / RIM EL. 72.08	58.48	18	13.74	147	0.013	0.0171	0.0201	2.960	9.56	0.35	9.78	11.68	114.25	2.12	0.74	13	0.00	1.10	0.33	-0.55	3.84	62.32	A-32 / RIM EL. 72.08
A-33 / RIM EL. 80.83	62.32	18	9.78	220	0.013	0.0087	0.0400	8.800	11.68	0.53	8.91	11.4	101.60	2.02	0.71	14	0.00	1.24	0.37	-0.62	9.79	72.11	A-33 / RIM EL. 80.83
A-34 / RIM EL. 89.28	72.11	18	8.91	223	0.013	0.0072	0.0400	8.920	11.4	0.50	8.14	7.72	62.88	0.93	0.32	87	0.61	1.44	0.43	-0.72	10.07	82.18	A-34 / RIM EL. 89.28
A-35 / RIM EL. 90.93	82.18	18	8.14	49	0.013	0.0060	0.0151	0.740	7.72	0.23	8.03	9.98	80.14	1.55	0.54	90	1.08	1.86	0.56	-0.93	2.22	84.41	A-35 / RIM EL. 90.93
MANHOLE A-36	84.41	18	8.03	117	0.013	0.0058	0.03	3.510	9.98	0.39	6.77	8.74	59.20	1.19	0.42	6	0.00	0.80	0.24	-0.40	4.15	88.56	TOP EL. 94.80
A-37 /DI-3A, RIM EL. 99.19	88.56	18	6.77	185	0.013	0.0042	0.0236	4.370	8.74	0.30	7.26	6.41	46.55	0.64	0.22	90	0.45	0.97	0.29	-0.48	5.14	93.70	A-37 /DI-3A, RIM EL. 99.19
A-38 / DI-3A, RIM EL. 96.86	93.70	18	7.26	88	0.013	0.0048	0.0100	0.880	6.41	0.16	3.67	7.35	26.95	0.84	0.29	90	0.59	1.04	0.31	-0.52	1.71	95.41	A-38 / DI-3A, RIM EL. 96.86
A-39 / DI-3A, RIM.EL.93.07 102.92	95.41	15	3.67	268	0.013	0.0032	0.0225	6.030	7.35	0.21			0.00	0.00	0.00	0	0.00	0.21	0.06	-0.10	6.20	101.61	A-39 / DI-3A, RIM.EL.93.07
A-40 /DI-3B, RIM EL. 66.96	58.48	15	2.40	32	0.013	0.0014	0.0100	0.320	4.88	0.09	1.81	7.98	14.48	0.99	0.35	23	0.16	0.60	0.18	-0.30	0.80	59.28	A-40 /DI-3B, RIM EL. 66.96
A-41/DI-3A, RIM EL. 71.56	59.28	15	1.81	98	0.013	0.0008	0.0490	4.800	7.98	0.25	1.36	4.17	5.68	0.27	0.09	90	0.19	0.53	0.16	-0.27	5.22	64.51	A-41/DI-3A, RIM EL. 71.56
A-42 / DI-3B, RIM.EL.72.17	64.51	15	1.36	32	0.013	0.0004	0.0100	0.320	4.17	0.07			0.00	0.00	0.00	90	0.00	0.07	0.02	-0.03	0.37	64.88	A-42 / DI-3B, RIM.EL.72.17
A-32A / RIM EL. 72.08	62.32	15	0.34	32	0.013	0.0000	0.0100	0.320	2.79	0.03			0.00	0.00	0.00	90	0.00	0.03	0.01	-0.02	0.34	62.67	A-32A / RIM EL. 72.08
A-36A / RIM EL. 92.40	88.56	15	2.81	98	0.013	0.0019	0.0094	0.920	2.29	0.02			0.00	0.00	0.00	82	0.00	0.02	0.01	-0.01	0.94	89.49	A-36A / RIM EL. 92.40
SYSTEM "B"																							
B-2 @ STA 43+80 L	43.71	24	18.63	65	0.013	0.0068	0.0148	0.963	9.41	0.34	15.67	5.97	93.55	0.55	0.19	90	0.39	0.92	0.28	-0.46	1.70	45.41	RIM EL. 51.3
B-3 @ STA 44+33 L	45.41	24	15.67	53	0.013	0.0048	0.0053	0.280	5.97	0.14	12.37	5.62	69.53	0.49	0.17	90	0.34	0.65	0.20	-0.33	0.80	46.22	RIM EL. 51.48/
B-4 @ STA 47+00 L	46.22	24	12.37	265	0.013	0.0030	0.0050	1.320	5.62	0.12	4.59	5.71	26.21	0.51	0.18	90	0.35	0.65	0.20	-0.33	1.84	48.06	RIM EL. 53.16
B-5 @ STA 47+00 R	48.06	15	4.59	32	0.013	0.0051	0.0100	0.320	5.71	0.13			0.00	0.00	0.00	90	0.00	0.13	0.04	-0.06	0.42	48.48	RIM EL. 54.13
B-2A @ STA 43+80 R	45.41	15	0.76	32	0.013	0.0001	0.0100	0.320	0.62	0.00			0.00	0.00	0.00	90	0.00	0.00	0.00	-0.00	0.32	45.73	RIM EL. 52.26
B-3A @ STA 44+33 R	46.22	15	1.44	32	0.013	0.0005	0.0100	0.320	1.17	0.01			0.00	0.00	0.00	90	0.00	0.01	0.00	-0.00	0.32	46.54	RIM EL. 52.44
SYSTEM "C"																							
MH-1 @ C-12 / RIM EL.91.0	85.62	18	8.99	73	0.013	0.0073	0.0100	0.730	10.26	0.41	7.37	10.88	80.16	1.84	0.64	90	1.29	2.34	0.70	-1.17	2.60	88.22	MH-1 @ C-12 / RIM EL.91.0
C-13 @ STA. 56+00 RIGHT	88.22	15	7.37	186	0.013	0.0130	0.0400	7.440	10.88	0.46	1.33	4.14	5.49	0.27	0.09	90	0.19	0.74	0.22	-0.37	8.03	96.25	RIM EL. 100.20
C-14 @ STA. 56+00 LEFT	96.25	15	1.33	32	0.013	0.0004	0.0100	0.320	4.14	0.07			0.00	0.00	0.00	90	0.00	0.07	0.02	-0.03	0.37	96.63	RIM EL. 100.44
C-12A @ STA. 54+25 RIGHT	88.22	15	1.62	25	0.013	0.0006	0.0100	0.250	4.38	0.07	0.76	3.53	2.67	0.19	0.07	90	0.14	0.28	0.08	-0.14	0.47	88.69	RIM EL. 90.38
C-12B @ STA. 54+25 LEFT	88.69	15	0.76	32	0.013	0.0001	0.0100	0.320	3.53	0.05			0.00	0.00	0.00	90	0.00	0.05	0.01	-0.02	0.36	89.05	RIM EL. 90.38

PLAN 102.8



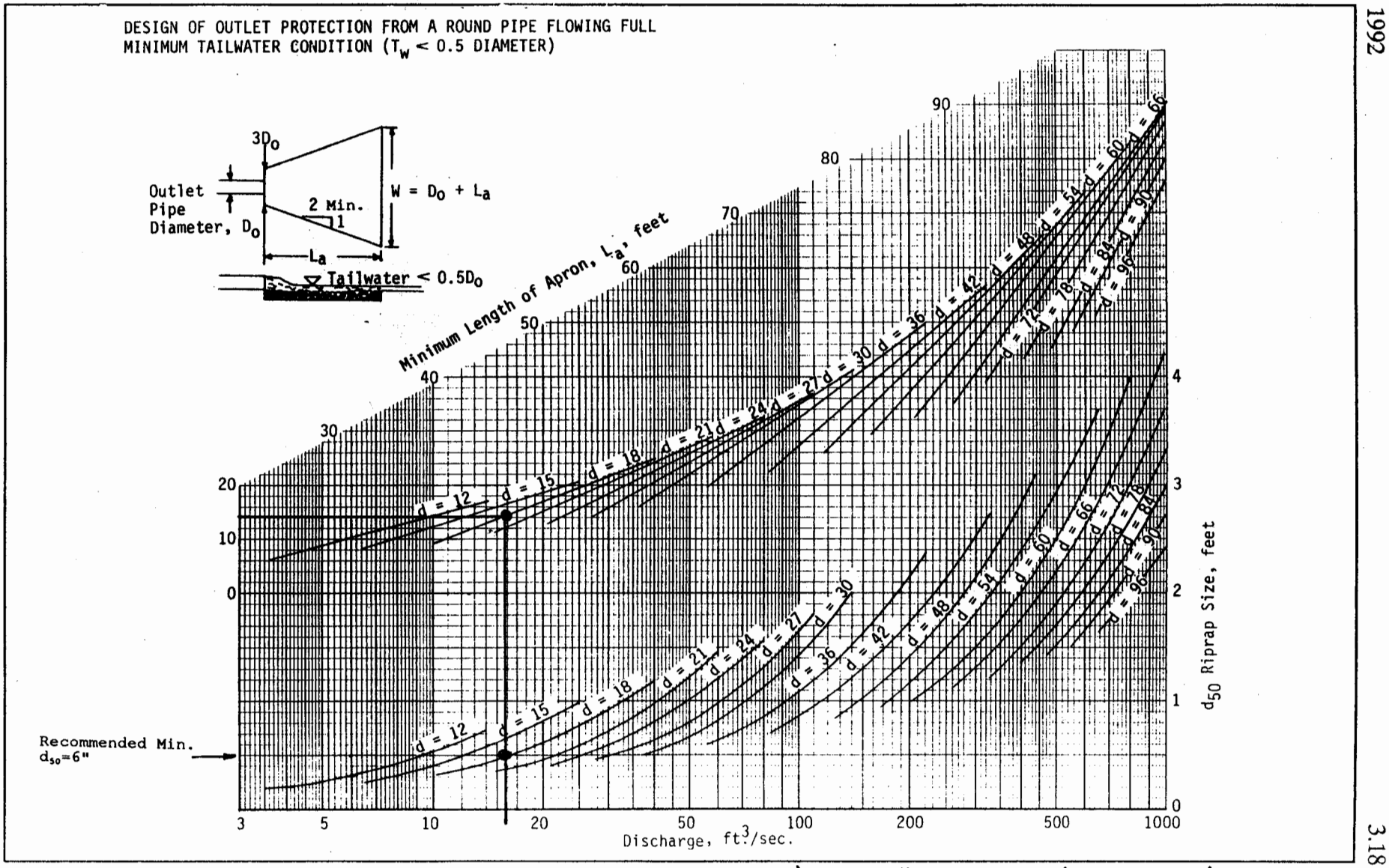
QUTLET A-30 Q_{10} = 15.77 cfs ϕ = 24" L_a = 11' ~ USE 20' (STEEP SLOPE)
W = 22'
CLASS I d_{50} ≤ 1 t = ~~1.5~~ 2'



OUTLET @ B-1 Q_{10} = 18.63 cfs ϕ = 24" $L_a \leq 15'$ USE 15'
W = 17'
$d_{50} \leq 1'$ USE CLASS I t=2'

Source: USDA-SCS

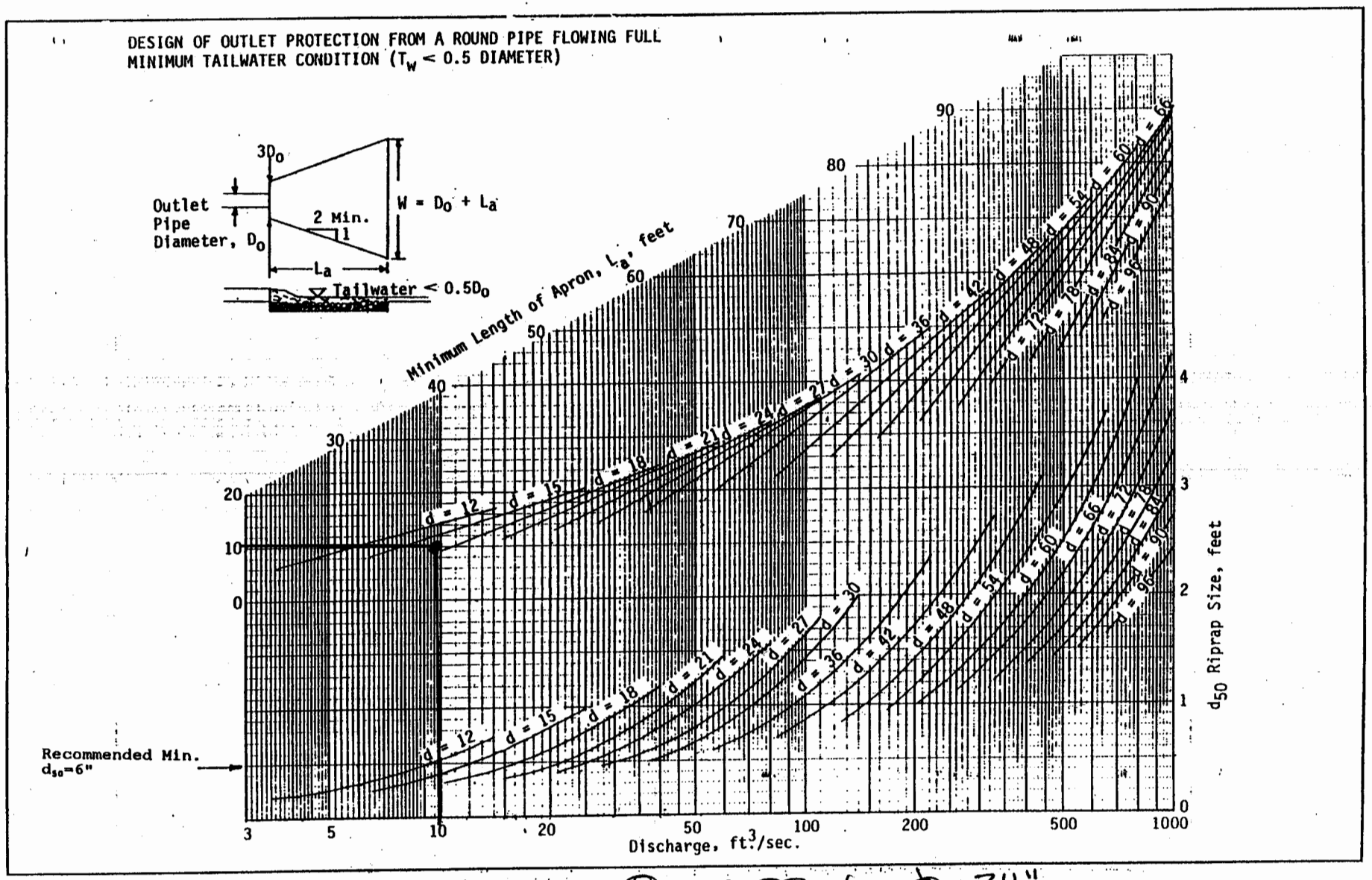
Plate 3.18-3



C-16 BASIN OUTFALL Q_{10}=15.92 ϕ=18" $L_a \leq 15'$ USE 15'
W = 15'
d_{50}<1 CLASS I t=2'

Source: USDA-SCS

Plate 3.18-3



Source: USDA-SCS

REPLACEMENT CULVERT ROUTE 608 Q_{10} = 8.99 cfs ϕ = 24"

$L_a \leq 10'$ USE 10'

W = 12' $d_{50} < 1$ USE CLASS I t = 2'

TEMPORARY SEDIMENT BASIN CALCULATIONS

SEDIMENT BASIN DESIGN CALCULATIONS

STA. 40+50 LT.

SEDMENT BASIN #1

Drainage Area :	5.39	acres		
Required Sediment Basin Volume :	722	cubic yard	19501	cubic feet
Wet / Dry Storage :	361	cubic yard	9751	cubic feet
Cleanout Volume :	181	cubic yard	4875	cubic feet

	W.S.E. (feet)	AREA s.f.	INC. VOL c.f.	STORAGE c.f
	58.00	7341	12787	31661
Dry Storage Surface Elevation :	**56.10**	5541	549	**19423**
	56.00	5446	9223	18874
Wet Storage Surface Elevation :	**54.10**	3860	382	**10033**
	54.00	3777	6113	9651
Cleanout Level Elevation :	**52.50**	2811	5017	**5017**
	52.00	2336	3538	3538
	50.00	1202	0	0

Distance to cleanout below dewatering invert : 1.60 feet

Dry Storage Dewatering Device :

Q_{AVG}= 0.43 c.f.s.
H_{AVG}= 1.00 feet
A_o= 0.09 sq. inches
d_o = 4.07 inches

STA. 64+00 LT.

SEDMENT BASIN #2

Drainage Area :	4.02	acres		
Required Sediment Basin Volume :	539	cubic yard	14544	cubic feet
Wet / Dry Storage :	269	cubic yard	7272	cubic feet
Cleanout Volume :	135	cubic yard	3636	cubic feet

	W.S.E. (feet)	AREA s.f.	INC. VOL c.f.	STORAGE c.f
	110.00	13628	18965	27142
Dry Storage Surface Elevation :	**109.00**	9483	7410	**15587**
	108.00	5337	6682	8177
Wet Storage Surface Elevation :	**107.80**	4938	5655	**7150**
Cleanout Level Elevation :	**106.80**	2942	1715	**3210**
	106.00	1345	1495	1495
	104.00	150	0	0

SEE REV COMPS.

Distance to cleanout below dewatering invert : 1.00 feet

Dry Storage Dewatering Device :

Q_{AVG}= 0.39 c.f.s.
H_{AVG}= 0.60 feet
A_o= 0.10 sq. inches
d_o = 4.38 inches

SUBCATCHMENT 25 **EXISTING DRAINAGE AREA**

PEAK= 2.86 CFS @ 12.02 HRS, VOLUME= .21 AF

ACRES	CN		
.33	98	EXISTING ROAD	SCS TR-20 METHOD
4.92	65	WOODS / RAVINE	TYPE II 24-HOUR
			RAINFALL= 2.80 IN
5.25	67		SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	12.0

SUBCATCHMENT 30 **SUMMIT DRAINAGE AREA**

PEAK= 1.88 CFS @ 12.01 HRS, VOLUME= .14 AF

ACRES	CN		
4.02	65	NATURAL AND RECLIAMED GREEN SPAC	SCS TR-20 METHOD
			TYPE II 24-HOUR
			RAINFALL= 2.80 IN
			SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	10.0

SUBCATCHMENT 31 **ROADWAY AND FILL SLOPE**

PEAK= 1.70 CFS @ 11.88 HRS, VOLUME= .08 AF

ACRES	CN		
.33	98	ROAD	SCS TR-20 METHOD
.90	65	FILL SLOPE	TYPE II 24-HOUR
			RAINFALL= 2.80 IN
1.23	74		SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	2.0

PRE/POST DEVELOPMENT CHANNEL ADEQUACY

REACH 25 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 2.86 CFS @ 12.02 HRS, VOLUME= .21 AF
Qout= 2.83 CFS @ 12.02 HRS, VOLUME= .21 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.02 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 26 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 2.83 CFS @ 12.02 HRS, VOLUME= .21 AF
Qout= 2.79 CFS @ 12.02 HRS, VOLUME= .21 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.02 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 27 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 2.79 CFS @ 12.02 HRS, VOLUME= .21 AF
Qout= 2.75 CFS @ 12.03 HRS, VOLUME= .21 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.02 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 28 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 2.75 CFS @ 12.03 HRS, VOLUME= .21 AF
Qout= 2.72 CFS @ 12.03 HRS, VOLUME= .21 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.04 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 30 **STILLING BASIN**

Qin = .12 CFS @ 15.06 HRS, VOLUME= .14 AF
Qout= .12 CFS @ 15.10 HRS, VOLUME= .14 AF, ATTEN= 0%, LAG= 2.4 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	2.24	.46
.40	4.56	1.47
.60	6.96	2.89
.86	10.20	5.26
1.20	14.64	9.17
1.60	20.16	14.86
2.00	26.00	21.66

11' x 2' CHANNEL
SIDE SLOPE= 1 '/'
n= .024
LENGTH= 15 FT
SLOPE= .0001 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .05 FT
PEAK VELOCITY= .2 FPS
TRAVEL TIME = 1.2 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 31 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 1.70 CFS @ 11.88 HRS, VOLUME= .22 AF
Qout= 1.69 CFS @ 11.88 HRS, VOLUME= .22 AF, ATTEN= 1%, LAG= 0.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.01 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 32 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 1.69 CFS @ 11.88 HRS, VOLUME= .22 AF
Qout= 1.66 CFS @ 11.89 HRS, VOLUME= .22 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.01 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 33 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 1.66 CFS @ 11.89 HRS, VOLUME= .22 AF
Qout= 1.64 CFS @ 11.89 HRS, VOLUME= .22 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.01 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 34 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 1.64 CFS @ 11.89 HRS, VOLUME= .22 AF
Qout= 1.62 CFS @ 11.89 HRS, VOLUME= .22 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.02 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

POND 30 **SEDIMENT BASIN #2**

Qin = 1.88 CFS @ 12.01 HRS, VOLUME= .14 AF
Qout= .12 CFS @ 15.06 HRS, VOLUME= .14 AF, ATTEN= 94%, LAG= 183.5 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
104.0	150	0	0
106.0	1345	1495	1495
108.0	5337	6682	8177
110.0	13628	18965	27142

STOR-IND METHOD
PEAK STORAGE = 9976 CF
PEAK ELEVATION= 108.2 FT
FLOOD ELEVATION= 110.0 FT
START ELEVATION= 107.8 FT
SPAN= 10-40 HRS, dt=.1 HRS

#	ROUTE	INVERT	OUTLET DEVICES
1	P	104.0'	**18" CULVERT**
			n=.013 L=255' S=.0706'/' Ke=.5 Cc=.9 Cd=.6
2	1	107.8'	**3" ORIFICE/GRATE**
			Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
3	1	109.0'	**48" HORIZONTAL ORIFICE/GRATE**
			Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)

Primary Discharge
└──1=Culvert
  ├──2=Orifice/Grate
  └──3=Orifice/Grate

SUBCATCHMENT 25 **EXISTING DRAINAGE AREA**

PEAK= 5.03 CFS @ 12.01 HRS, VOLUME= .34 AF

ACRES	CN		
.33	98	EXISTING ROAD	SCS TR-20 METHOD
4.92	65	WOODS / RAVINE	TYPE II 24-HOUR
5.25	67		RAINFALL= 3.36 IN
			SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	12.0

SUBCATCHMENT 30 **SUMMIT DRAINAGE AREA**

PEAK= 3.47 CFS @ 11.99 HRS, VOLUME= .23 AF

ACRES	CN		
4.02	65	NATURAL AND RECLIAMED GREEN SPAC	SCS TR-20 METHOD
			TYPE II 24-HOUR
			RAINFALL= 3.36 IN
			SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	10.0

SUBCATCHMENT 31 **ROADWAY AND FILL SLOPE**

PEAK= 2.50 CFS @ 11.88 HRS, VOLUME= .12 AF

ACRES	CN		
.33	98	ROAD	SCS TR-20 METHOD
.90	65	FILL SLOPE	TYPE II 24-HOUR
1.23	74		RAINFALL= 3.36 IN
			SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	2.0

REACH 25 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 5.03 CFS @ 12.01 HRS, VOLUME= .34 AF
Qout= 4.99 CFS @ 12.01 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.03 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 26 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 4.99 CFS @ 12.01 HRS, VOLUME= .34 AF
Qout= 4.93 CFS @ 12.01 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.04 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 27 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 4.93 CFS @ 12.01 HRS, VOLUME= .34 AF
Qout= 4.87 CFS @ 12.02 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.03 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 28 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 4.87 CFS @ 12.02 HRS, VOLUME= .34 AF
Qout= 4.81 CFS @ 12.02 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.06 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 30 **STILLING BASIN**

Qin = .17 CFS @ 15.41 HRS, VOLUME= .23 AF
Qout= .17 CFS @ 15.45 HRS, VOLUME= .23 AF, ATTEN= 0%, LAG= 2.4 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	2.24	.46
.40	4.56	1.47
.60	6.96	2.89
.86	10.20	5.26
1.20	14.64	9.17
1.60	20.16	14.86
2.00	26.00	21.66

11' x 2' CHANNEL
SIDE SLOPE= 1 '/'
n= .024
LENGTH= 15 FT
SLOPE= .0001 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .07 FT
PEAK VELOCITY= .2 FPS
TRAVEL TIME = 1.2 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 31 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 2.53 CFS @ 11.88 HRS, VOLUME= .34 AF
Qout= 2.51 CFS @ 11.88 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= 0.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.02 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 32 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 2.51 CFS @ 11.88 HRS, VOLUME= .34 AF
Qout= 2.48 CFS @ 11.88 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.02 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

5.4 fps & 4.7 fps directly D/S of TSD-2 outfall

SB #2

REACH 33 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 2.48 CFS @ 11.88 HRS, VOLUME= .34 AF
Qout= 2.45 CFS @ 11.88 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.01 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 34 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 2.45 CFS @ 11.88 HRS, VOLUME= .34 AF
Qout= 2.42 CFS @ 11.89 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.03 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

5.8 fps

SB #2

POND 30 **SEDIMENT BASIN #2**

Qin = 3.47 CFS @ 11.99 HRS, VOLUME= .23 AF
Qout= .17 CFS @ 15.41 HRS, VOLUME= .23 AF, ATTEN= 95%, LAG= 205.1 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
104.0	150	0	0
106.0	1345	1495	1495
108.0	5337	6682	8177
110.0	13628	18965	27142

STOR-IND METHOD
PEAK STORAGE = 12234 CF
PEAK ELEVATION= 108.4 FT
FLOOD ELEVATION= 110.0 FT
START ELEVATION= 107.8 FT
SPAN= 10-40 HRS, dt=.1 HRS
Tdet= 1047.7 MIN (.05 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	104.0'	**18" CULVERT**
			n=.013 L=255' S=.0706'/' Ke=.5 Cc=.9 Cd=.6
2	1	107.8'	**3" ORIFICE/GRATE**
			Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
3	1	109.0'	**48" HORIZONTAL ORIFICE/GRATE**
			Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)

```
Primary Discharge
└──1=Culvert
   ├──2=Orifice/Grate
   └──3=Orifice/Grate
```

SUBCATCHMENT 25 **EXISTING DRAINAGE AREA**

PEAK= 13.01 CFS @ 12.00 HRS, VOLUME= .80 AF

ACRES	CN		
.33	98	EXISTING ROAD	SCS TR-20 METHOD
4.92	65	WOODS / RAVINE	TYPE II 24-HOUR
			RAINFALL= 5.04 IN
5.25	67		SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	12.0

SUBCATCHMENT 30 **SUMMIT DRAINAGE AREA**

PEAK= 9.49 CFS @ 11.98 HRS, VOLUME= .56 AF

ACRES	CN		
4.02	65	NATURAL AND RECLIAMED GREEN SPAC	SCS TR-20 METHOD
			TYPE II 24-HOUR
			RAINFALL= 5.04 IN
			SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	10.0

SUBCATCHMENT 31 **ROADWAY AND FILL SLOPE**

PEAK= 5.21 CFS @ 11.87 HRS, VOLUME= .24 AF

ACRES	CN		
.33	98	ROAD	SCS TR-20 METHOD
.90	65	FILL SLOPE	TYPE II 24-HOUR
			RAINFALL= 5.04 IN
1.23	74		SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	2.0

SB#2 11/12

REACH 25 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 13.01 CFS @ 12.00 HRS, VOLUME= .80 AF
Qout= 12.93 CFS @ 12.00 HRS, VOLUME= .80 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.08 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 26 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 12.93 CFS @ 12.00 HRS, VOLUME= .80 AF
Qout= 12.80 CFS @ 12.00 HRS, VOLUME= .80 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.11 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 27 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 12.80 CFS @ 12.00 HRS, VOLUME= .80 AF
Qout= 12.68 CFS @ 12.00 HRS, VOLUME= .80 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.08 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 28 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 12.68 CFS @ 12.00 HRS, VOLUME= .80 AF
Qout= 12.55 CFS @ 12.01 HRS, VOLUME= .80 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.17 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

SB #2 11-7-K

REACH 30 **STILLING BASIN**

Qin = 1.23 CFS @ 12.52 HRS, VOLUME= .55 AF
Qout= 1.22 CFS @ 12.55 HRS, VOLUME= .55 AF, ATTEN= 1%, LAG= 1.5 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	2.24	.46
.40	4.56	1.47
.60	6.96	2.89
.86	10.20	5.26
1.20	14.64	9.17
1.60	20.16	14.86
2.00	26.00	21.66

11' x 2' CHANNEL
SIDE SLOPE= 1 '/'
n= .024
LENGTH= 15 FT
SLOPE= .0001 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .35 FT
PEAK VELOCITY= .3 FPS
TRAVEL TIME = .8 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 31 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 5.32 CFS @ 11.87 HRS, VOLUME= .79 AF
Qout= 5.28 CFS @ 11.87 HRS, VOLUME= .79 AF, ATTEN= 1%, LAG= 0.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.03 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 32 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 5.28 CFS @ 11.87 HRS, VOLUME= .79 AF
Qout= 5.23 CFS @ 11.88 HRS, VOLUME= .79 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.04 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 33 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 5.23 CFS @ 11.88 HRS, VOLUME= .79 AF
Qout= 5.17 CFS @ 11.88 HRS, VOLUME= .79 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.03 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 34 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 5.17 CFS @ 11.88 HRS, VOLUME= .79 AF
Qout= 5.12 CFS @ 11.88 HRS, VOLUME= .79 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.07 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

SB#2 10-YR

POND 30 **SEDIMENT BASIN #2**

Qin = 9.49 CFS @ 11.98 HRS, VOLUME= .56 AF
Qout= 1.23 CFS @ 12.52 HRS, VOLUME= .55 AF, ATTEN= 87%, LAG= 32.4 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
104.0	150	0	0
106.0	1345	1495	1495
108.0	5337	6682	8177
110.0	13628	18965	27142

STOR-IND METHOD
PEAK STORAGE = 18361 CF
PEAK ELEVATION= 109.1 FT
FLOOD ELEVATION= 110.0 FT
START ELEVATION= 107.8 FT
SPAN= 10-40 HRS, dt=.1 HRS
Tdet= 757.2 MIN (.38 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	104.0'	**18" CULVERT**
			n=.013 L=255' S=.0706'/' Ke=.5 Cc=.9 Cd=.6
2	1	107.8'	**3" ORIFICE/GRATE**
			Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
3	1	109.0'	**48" HORIZONTAL ORIFICE/GRATE**
			Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)

Primary Discharge
└──1=Culvert
  ├──2=Orifice/Grate
  └──3=Orifice/Grate

SB #2 100-YR.

SUBCATCHMENT 25 **EXISTING DRAINAGE AREA**

PEAK= 27.87 CFS @ 11.99 HRS, VOLUME= 1.68 AF

ACRES	CN	
.33	98	EXISTING ROAD
4.92	65	WOODS / RAVINE
5.25	67	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	12.0

SUBCATCHMENT 30 **SUMMIT DRAINAGE AREA**

PEAK= 20.89 CFS @ 11.97 HRS, VOLUME= 1.21 AF

ACRES	CN	
4.02	65	NATURAL AND RECLIAMED GREEN SPAC

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	10.0

SUBCATCHMENT 31 **ROADWAY AND FILL SLOPE**

PEAK= 9.83 CFS @ 11.87 HRS, VOLUME= .46 AF

ACRES	CN	
.33	98	ROAD
.90	65	FILL SLOPE
1.23	74	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 10-40 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	2.0

SB#2 100-YR

REACH 25 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 27.87 CFS @ 11.99 HRS, VOLUME= 1.68 AF
Qout= 27.71 CFS @ 11.99 HRS, VOLUME= 1.68 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.18 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 26 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 27.71 CFS @ 11.99 HRS, VOLUME= 1.68 AF
Qout= 27.47 CFS @ 12.00 HRS, VOLUME= 1.68 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.23 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 27 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 27.47 CFS @ 12.00 HRS, VOLUME= 1.68 AF
Qout= 27.24 CFS @ 12.00 HRS, VOLUME= 1.68 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.17 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 28 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 27.24 CFS @ 12.00 HRS, VOLUME= 1.68 AF
Qout= 27.00 CFS @ 12.00 HRS, VOLUME= 1.68 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.36 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 30 **STILLING BASIN**

Qin = 15.44 CFS @ 12.07 HRS, VOLUME= 1.19 AF
Qout= 15.15 CFS @ 12.09 HRS, VOLUME= 1.19 AF, ATTEN= 2%, LAG= .8 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	2.24	.46
.40	4.56	1.47
.60	6.96	2.89
.86	10.20	5.26
1.20	14.64	9.17
1.60	20.16	14.86
2.00	26.00	21.66

11' x 2' CHANNEL
SIDE SLOPE= 1 '/'
n= .024
LENGTH= 15 FT
SLOPE= .0001 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.62 FT
PEAK VELOCITY= .7 FPS
TRAVEL TIME = .3 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 31 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 16.58 CFS @ 12.08 HRS, VOLUME= 1.66 AF
Qout= 16.51 CFS @ 12.08 HRS, VOLUME= 1.66 AF, ATTEN= 0%, LAG= 0.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.10 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 32 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 16.51 CFS @ 12.08 HRS, VOLUME= 1.66 AF
Qout= 16.43 CFS @ 12.08 HRS, VOLUME= 1.66 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.14 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 33 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 16.43 CFS @ 12.08 HRS, VOLUME= 1.66 AF
Qout= 16.34 CFS @ 12.08 HRS, VOLUME= 1.66 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.10 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 34 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 16.34 CFS @ 12.08 HRS, VOLUME= 1.66 AF
Qout= 16.25 CFS @ 12.09 HRS, VOLUME= 1.66 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.21 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-40 HRS, dt=.1 HRS
3 x FINER ROUTING

POND 30 **SEDIMENT BASIN #2**

Qin = 20.89 CFS @ 11.97 HRS, VOLUME= 1.21 AF
Qout= 15.44 CFS @ 12.07 HRS, VOLUME= 1.19 AF, ATTEN= 26%, LAG= 5.9 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
104.0	150	0	0
106.0	1345	1495	1495
108.0	5337	6682	8177
110.0	13628	18965	27142

STOR-IND METHOD
PEAK STORAGE = 22445 CF
PEAK ELEVATION= 109.5 FT
FLOOD ELEVATION= 110.0 FT
START ELEVATION= 107.8 FT
SPAN= 10-40 HRS, dt=.1 HRS
Tdet= 338.6 MIN (1.02 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	104.0'	**18" CULVERT**
			n=.013 L=255' S=.0706'/' Ke=.5 Cc=.9 Cd=.6
2	1	107.8'	**3" ORIFICE/GRATE**
			Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
3	1	109.0'	**48" HORIZONTAL ORIFICE/GRATE**
			Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)

Primary Discharge
└──1=Culvert
  ├──2=Orifice/Grate
  └──3=Orifice/Grate

DETENTION POND CALCULATIONS

BASIN #1
LAGRANGE
STA. 40+50 LT.

CHANNEL PROTECTION VOLUME CALCULATION

Project : LaGrange Parkway Extnesion
Stonehouse Commerce Park, James City County, VA

Project # : 1990140-000.11

TABLE F1 / TR-55			
Coefficients for Rainfall Type II			
I_a/P	C_0	C_1	C_2
0.10	2.55323	-0.61512	-0.16403
0.30	2.46532	-0.62257	-0.11657
0.35	2.41896	-0.61594	-0.08820
0.40	2.36409	-0.59857	-0.05621
0.45	2.29238	-0.57005	-0.02281
0.50	2.20282	-0.51599	-0.01259

One Year Precipitation : P= 2.8 Inches

PRE-DEVELOPMENT CONDITIONS :

Drainage Area : DA_{PRE} = 8.36 Acres
SCS Curve Number : CN_{PRE} = 50 Unitless
Time of Concentration : T_{CPRE} = 0.24 Hours

Initial abstraction ; I_a=0.2x(1000/CN - 10) = 2.000 Inches
I_a/P = 0.71

Accumulated direct runoff : $Q_U = (P-I_a)^2 / (P+4xI_a)$ = 0.06 Inches

Unit Peak Discharge : q_u = 329 cfs/sq.mile/in.
$\log(q_u)=C_0+C_1\log(T_c)+C_2[\log(T]^2$
C_0, C_1, C_2 Coefficients from TABLE F1 above

Pre-development peak discharge :
$q_p = q_u \times DA \times Q_U / 640$ = 0.26 c.f.s.

POST DEVELOPMENT CONDITIONS :

Drainage Area : DA_{POST} = 8.29 Acres
SCS Curve Number : CN_{POST} = 70 Unitless
Time of Concentration T_{CPOST} = 0.32 Hours

Initial abstraction ; I_a = 0.857 Inches
I_a/P = 0.31
Accumulated direct runoff : Q_U = 0.61 Inches
Unit Peak Discharge : q_u = 556 cfs/sq.mile/in.
Post development peak discharge rate : $q_i = q_p$ = 4.36 c.f.s.

Ration of outflow to inflow : * $q_o/q_i = 11.98 \times q_u^{0.937}$ = 0.0321
* Direct calculation using equation for T=24hr. developed by Stewart Comstock,P.E., MDE

Peak outflow discharge : q_o = 0.1400 c.f.s.

Ratio of storage volume to runoff volume : V_s/V_r = 0.64
$V_s/V_r = 0.683-1.43(qq_i)+1.64(_o/q_i)^2-8.04(q_o/q_i)^3$ =

Required Storage Volume :
$V_s = V_s/V_r \times Q_u \times A/12 \times 43560$ = 11649 cubic feet

ESTIMATED POND FULL DRAWDOWN

H_{TRIAL} = 3
A_o = 0.016809
d_o = 1.755532

BMP POND

$D_{ORIFICE}$ = 2 inches; or 3 Holes @
D= 1 inches

W.S.E. (feet)	AREA s.f.	INC. VOL c.f.	STORAGE c.f	H_{AVG} ft.	Q_{AVG} cfs	dT hours	Q_{AVG} cfs	dT hours	
58.00	7341	12787	31661	7.00					
56.00	5446	9223	18874	5.00					
54.50	4194	1993	**11644**	4.25	**0.2144**	**2.6**	**0.1616**	**3.4**	**<WQVSE**
54.00	3777	6113	9651	3.00	0.1794	9.5	0.1355	12.5	
52.00	2336	3538	3538	1.00	0.1006	9.8	0.0771	12.7	
50.00	1202	0	0	0.00					
				DRAW DOWN TIME =		**21.8**		**28.7**	

1-YEAR
24 HOUR
DESIGN

Subject LaGrange Ext

Computed _____ Checked _____

LANDMARK DESIGN GROUP

Project # _____

Client _____

Date _____ Sheet # _____

Engineers • Planners • Surveyors • Landscape Architects • Environmental Consultants

EXTENDED DRY DETENTION BASIN No. 1

$$WQ_V = 2.2 Ac \times \frac{43560}{12} = 7986 = 0.18 \text{ AF.}$$

DRAWDOWN 24 HR. P REMOVAL 30%

$$T = 42 - 12.5 = 29.5 \text{ HRS.}$$

REFER TO POND 30 TABLE PAGES 2-11

POND 30 **STORM WATER MANAGEMENT POND**

Qin = 4.19 CFS @ 11.92 HRS, VOLUME= .43 AF
Qout= .57 CFS @ 13.24 HRS, VOLUME= .43 AF, ATTEN= 86%, LAG= 79.7 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
50.0	1202	0	0
52.0	2336	3538	3538
54.0	3777	6113	9651
56.0	5446	9223	18874
58.0	7341	12787	31661

STOR-IND METHOD
PEAK STORAGE = 8635 CF
PEAK ELEVATION= 53.7 FT
FLOOD ELEVATION= 58.0 FT
START ELEVATION= 50.0 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 494 MIN (.43 AF)

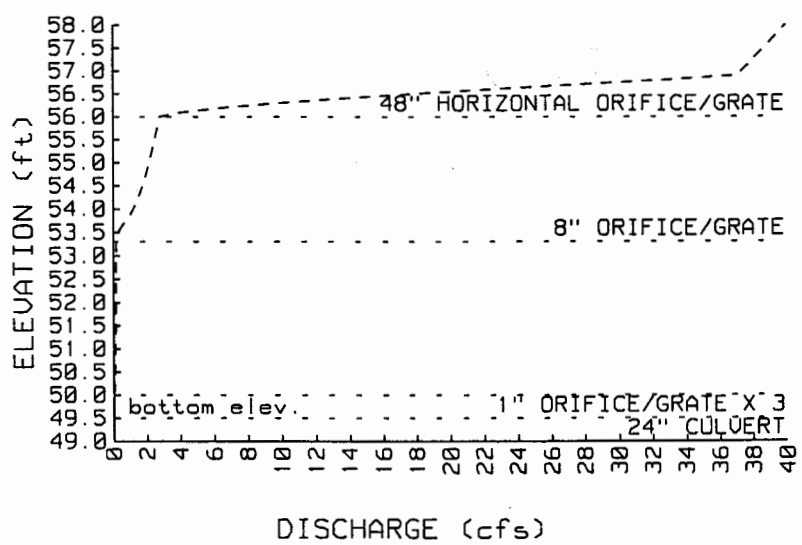
? 50.0

#	ROUTE	INVERT	OUTLET DEVICES
1	3	49.5'	**1" ORIFICE/GRATE X 3** Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
2	3	56.0' ✓	**48" HORIZONTAL ORIFICE/GRATE** Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)
3	P	49.0' ✓	**24" CULVERT** n=.013 L=100' S=.01'/' Ke=.6 Cc=.9 Cd=.56
4	3	53.3'	**8" ORIFICE/GRATE** Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)

54.5

Primary Discharge
└──3=Culvert
  ├──1=Orifice/Grate
  ├──2=Orifice/Grate
  └──4=Orifice/Grate

POND 30 DISCHARGE
STORM WATER MANAGEMENT POND



CALCULATIONS PERFORMED UP TO POND 30 AS NEEDED

RUNOFF SPAN = 5-55 HRS, dt= .10 HRS, 501 POINTS
RUNOFF BY SCS TR-20 METHOD: TYPE II 24-HOUR RAINFALL= 2.80 IN, SCS U.H.
REACH ROUTING BY STOR-IND+TRANS METHOD
POND ROUTING BY STOR-IND METHOD

POND 30

TIME-HRS	INFLOW-CFS	OUTFLOW-CFS	ELEV-FT	STORAGE-AF
5.00	0.00	0.00	50.00	0.00
5.10	0.00	0.00	50.00	0.00
5.20	0.00	0.00	50.00	0.00
5.30	0.00	0.00	50.00	0.00
5.40	0.00	0.00	50.00	0.00
5.50	0.00	0.00	50.00	0.00
5.60	0.00	0.00	50.00	0.00
5.70	0.00	0.00	50.00	0.00
5.80	0.00	0.00	50.00	0.00
5.90	0.00	0.00	50.00	0.00
6.00	0.00	0.00	50.00	0.00
6.10	0.00	0.00	50.00	0.00
6.20	0.00	0.00	50.00	0.00
6.30	0.00	0.00	50.00	0.00
6.40	0.00	0.00	50.00	0.00
6.50	0.00	0.00	50.00	0.00
6.60	0.00	0.00	50.00	0.00
6.70	0.00	0.00	50.00	0.00
6.80	0.00	0.00	50.00	0.00
6.90	0.00	0.00	50.00	0.00
7.00	0.00	0.00	50.00	0.00
7.10	0.00	0.00	50.00	0.00
7.20	0.00	0.00	50.00	0.00
7.30	0.00	0.00	50.00	0.00
7.40	0.00	0.00	50.00	0.00
7.50	0.00	0.00	50.00	0.00
7.60	0.00	0.00	50.00	0.00
7.70	0.00	0.00	50.01	0.00
7.80	0.00	0.00	50.01	0.00
7.90	0.00	0.00	50.01	0.00
8.00	0.00	0.00	50.01	0.00
8.10	0.00	0.00	50.01	0.00
8.20	0.00	0.00	50.01	0.00
8.30	0.00	0.00	50.01	0.00
8.40	0.00	0.00	50.01	0.00
8.50	0.00	0.00	50.01	0.00
8.60	0.00	0.00	50.01	0.00
8.70	0.00	0.00	50.01	0.00
8.80	.01	0.00	50.01	0.00
8.90	.01	0.00	50.01	0.00
9.00	.01	0.00	50.01	0.00
9.10	.01	0.00	50.01	0.00
9.20	.01	0.00	50.01	0.00
9.30	.01	0.00	50.01	0.00
9.40	.01	0.00	50.01	0.00

9.50	.01	0.00	50.01	0.00
9.60	.01	0.00	50.01	0.00
9.70	.01	.01	50.01	0.00
9.80	.01	.01	50.01	0.00
9.90	.01	.01	50.01	0.00
10.00	.01	.01	50.01	0.00
10.10	.01	.01	50.01	0.00
10.20	.01	.01	50.01	0.00
10.30	.01	.01	50.01	0.00
10.40	.02	.01	50.01	0.00
10.50	.02	.01	50.02	0.00
10.60	.02	.01	50.02	0.00
10.70	.03	.01	50.02	0.00
10.80	.04	.01	50.02	0.00
10.90	.04	.02	50.03	0.00
11.00	.05	.02	50.04	0.00
11.10	.07	.02	50.04	0.00
11.20	.08	.03	50.05	0.00
11.30	.10	.04	50.06	0.00
11.40	.12	.05	50.08	0.00
11.50	.20	.06	50.10	0.00
11.60	.45	.06	50.15	.01
11.70	1.02	.07	50.29	.01
11.80	2.50	.08	50.63	.03
11.90	4.16	.10	51.29	.05
12.00	3.28	.12	52.01	.08
12.10	2.96	.13	52.37	.11
12.20	2.70	.14	52.68	.13
12.30	2.22	.15	52.96	.15
12.40	1.73	.15	53.17	.16
12.50	1.35	.17	53.34	.17
12.60	1.11	.25	53.46	.18
12.70	.93	.35	53.54	.19
12.80	.82	.44	53.60	.19
12.90	.73	.50	53.63	.20
13.00	.66	.54	53.65	.20
13.10	.62	.56	53.66	.20
13.20	.58	.57	53.67	.20
13.30	.55	.57	53.67	.20
13.40	.52	.56	53.66	.20
13.50	.50	.55	53.66	.20
13.60	.47	.54	53.65	.20
13.70	.45	.52	53.64	.20
13.80	.43	.51	53.63	.20
13.90	.41	.49	53.63	.20
14.00	.40	.47	53.62	.19
14.10	.38	.46	53.61	.19
14.20	.37	.44	53.60	.19
14.30	.36	.43	53.59	.19
14.40	.36	.42	53.58	.19
14.50	.35	.41	53.58	.19
14.60	.34	.40	53.57	.19
14.70	.33	.39	53.56	.19
14.80	.33	.38	53.56	.19
14.90	.32	.37	53.55	.19
15.00	.32	.36	53.55	.19
15.10	.31	.35	53.54	.19

15.20	.30	.35	53.54	.19
15.30	.30	.34	53.53	.19
15.40	.29	.33	53.53	.19
15.50	.29	.32	53.52	.19
15.60	.28	.32	53.52	.19
15.70	.27	.31	53.51	.19
15.80	.27	.30	53.51	.19
15.90	.26	.30	53.50	.19
16.00	.25	.29	53.50	.19
16.10	.25	.29	53.50	.19
16.20	.24	.28	53.49	.19
16.30	.24	.28	53.49	.19
16.40	.24	.27	53.48	.19
16.50	.24	.27	53.48	.18
16.60	.23	.27	53.47	.18
16.70	.23	.26	53.47	.18
16.80	.23	.26	53.47	.18
16.90	.23	.25	53.46	.18
17.00	.22	.25	53.46	.18
17.10	.22	.25	53.46	.18
17.20	.22	.24	53.45	.18
17.30	.22	.24	53.45	.18
17.40	.21	.24	53.45	.18
17.50	.21	.24	53.45	.18
17.60	.21	.23	53.44	.18
17.70	.21	.23	53.44	.18
17.80	.21	.23	53.44	.18
17.90	.20	.23	53.43	.18
18.00	.20	.22	53.43	.18
18.10	.20	.22	53.43	.18
18.20	.20	.22	53.43	.18
18.30	.19	.21	53.42	.18
18.40	.19	.21	53.42	.18
18.50	.19	.21	53.42	.18
18.60	.19	.21	53.42	.18
18.70	.18	.20	53.41	.18
18.80	.18	.20	53.41	.18
18.90	.18	.20	53.41	.18
19.00	.18	.20	53.41	.18
19.10	.17	.19	53.40	.18
19.20	.17	.19	53.40	.18
19.30	.17	.19	53.40	.18
19.40	.17	.19	53.40	.18
19.50	.16	.19	53.39	.18
19.60	.16	.19	53.39	.18
19.70	.16	.19	53.39	.18
19.80	.16	.18	53.39	.18
19.90	.15	.18	53.38	.18
20.00	.15	.18	53.38	.18
20.10	.15	.18	53.37	.18
20.20	.15	.18	53.37	.18
20.30	.15	.18	53.37	.18
20.40	.15	.18	53.36	.18
20.50	.15	.18	53.36	.18
20.60	.14	.17	53.36	.18
20.70	.14	.17	53.35	.18
20.80	.14	.17	53.35	.18

20.90	.14	.17	53.35	.18
21.00	.14	.17	53.34	.18
21.10	.14	.17	53.34	.18
21.20	.14	.17	53.34	.18
21.30	.14	.17	53.33	.17
21.40	.14	.16	53.33	.17
21.50	.14	.16	53.33	.17
21.60	.14	.16	53.33	.17
21.70	.14	.16	53.32	.17
21.80	.14	.16	53.32	.17
21.90	.14	.16	53.32	.17
22.00	.14	.16	53.32	.17
22.10	.14	.16	53.31	.17
22.20	.14	.16	53.31	.17
22.30	.14	.16	53.31	.17
22.40	.14	.16	53.31	.17
22.50	.14	.15	53.30	.17
22.60	.14	.15	53.30	.17
22.70	.14	.15	53.30	.17
22.80	.13	.15	53.30	.17
22.90	.13	.15	53.30	.17
23.00	.13	.15	53.29	.17
23.10	.13	.15	53.29	.17
23.20	.13	.15	53.29	.17
23.30	.13	.15	53.29	.17
23.40	.13	.15	53.29	.17
23.50	.13	.15	53.28	.17
23.60	.13	.15	53.28	.17
23.70	.13	.15	53.28	.17
23.80	.13	.15	53.28	.17
23.90	.13	.15	53.27	.17
24.00	.09	.15	53.27	.17
24.10	.07	.15	53.26	.17
24.20	.05	.15	53.25	.17
24.30	.04	.15	53.24	.17
24.40	.02	.15	53.22	.17
24.50	.01	.15	53.21	.17
24.60	.01	.15	53.19	.16
24.70	0.00	.15	53.17	.16
24.80	0.00	.15	53.15	.16
24.90	0.00	.15	53.14	.16
25.00	0.00	.15	53.12	.16
25.10	0.00	.15	53.10	.16
25.20	0.00	.15	53.09	.16
25.30	0.00	.15	53.07	.16
25.40	0.00	.15	53.05	.15
25.50	0.00	.15	53.03	.15
25.60	0.00	.15	53.02	.15
25.70	0.00	.15	53.00	.15
25.80	0.00	.15	52.98	.15
25.90	0.00	.15	52.96	.15
26.00	0.00	.15	52.95	.15
26.10	0.00	.14	52.93	.15
26.20	0.00	.14	52.91	.15
26.30	0.00	.14	52.90	.14
26.40	0.00	.14	52.88	.14
26.50	0.00	.14	52.86	.14

26.60	0.00	.14	52.84	.14
26.70	0.00	.14	52.83	.14
26.80	0.00	.14	52.81	.14
26.90	0.00	.14	52.79	.14
27.00	0.00	.14	52.78	.14
27.10	0.00	.14	52.76	.13
27.20	0.00	.14	52.74	.13
27.30	0.00	.14	52.73	.13
27.40	0.00	.14	52.71	.13
27.50	0.00	.14	52.69	.13
27.60	0.00	.14	52.68	.13
27.70	0.00	.14	52.66	.13
27.80	0.00	.14	52.65	.13
27.90	0.00	.14	52.63	.13
28.00	0.00	.14	52.61	.12
28.10	0.00	.14	52.60	.12
28.20	0.00	.14	52.58	.12
28.30	0.00	.14	52.56	.12
28.40	0.00	.14	52.55	.12
28.50	0.00	.14	52.53	.12
28.60	0.00	.14	52.52	.12
28.70	0.00	.14	52.50	.12
28.80	0.00	.14	52.48	.12
28.90	0.00	.13	52.47	.11
29.00	0.00	.13	52.45	.11
29.10	0.00	.13	52.44	.11
29.20	0.00	.13	52.42	.11
29.30	0.00	.13	52.41	.11
29.40	0.00	.13	52.39	.11
29.50	0.00	.13	52.37	.11
29.60	0.00	.13	52.36	.11
29.70	0.00	.13	52.34	.11
29.80	0.00	.13	52.33	.10
29.90	0.00	.13	52.31	.10
30.00	0.00	.13	52.30	.10
30.10	0.00	.13	52.28	.10
30.20	0.00	.13	52.27	.10
30.30	0.00	.13	52.25	.10
30.40	0.00	.13	52.24	.10
30.50	0.00	.13	52.22	.10
30.60	0.00	.13	52.21	.10
30.70	0.00	.13	52.19	.09
30.80	0.00	.13	52.17	.09
30.90	0.00	.13	52.16	.09
31.00	0.00	.13	52.14	.09
31.10	0.00	.13	52.13	.09
31.20	0.00	.13	52.12	.09
31.30	0.00	.13	52.10	.09
31.40	0.00	.13	52.09	.09
31.50	0.00	.13	52.07	.09
31.60	0.00	.12	52.06	.09
31.70	0.00	.12	52.04	.08
31.80	0.00	.12	52.03	.08
31.90	0.00	.12	52.01	.08
32.00	0.00	.12	52.00	.08
32.10	0.00	.12	51.97	.08
32.20	0.00	.12	51.95	.08

32.30	0.00	.12	51.92	.08
32.40	0.00	.12	51.90	.08
32.50	0.00	.12	51.87	.08
32.60	0.00	.12	51.85	.08
32.70	0.00	.12	51.82	.07
32.80	0.00	.12	51.80	.07
32.90	0.00	.12	51.77	.07
33.00	0.00	.12	51.75	.07
33.10	0.00	.12	51.73	.07
33.20	0.00	.12	51.70	.07
33.30	0.00	.12	51.68	.07
33.40	0.00	.11	51.66	.07
33.50	0.00	.11	51.63	.07
33.60	0.00	.11	51.61	.07
33.70	0.00	.11	51.59	.06
33.80	0.00	.11	51.56	.06
33.90	0.00	.11	51.54	.06
34.00	0.00	.11	51.52	.06
34.10	0.00	.11	51.50	.06
34.20	0.00	.11	51.47	.06
34.30	0.00	.11	51.45	.06
34.40	0.00	.11	51.43	.06
34.50	0.00	.11	51.41	.06
34.60	0.00	.11	51.39	.06
34.70	0.00	.11	51.36	.06
34.80	0.00	.11	51.34	.05
34.90	0.00	.11	51.32	.05
35.00	0.00	.10	51.30	.05
35.10	0.00	.10	51.28	.05
35.20	0.00	.10	51.26	.05
35.30	0.00	.10	51.24	.05
35.40	0.00	.10	51.22	.05
35.50	0.00	.10	51.20	.05
35.60	0.00	.10	51.17	.05
35.70	0.00	.10	51.15	.05
35.80	0.00	.10	51.13	.05
35.90	0.00	.10	51.11	.05
36.00	0.00	.10	51.09	.04
36.10	0.00	.10	51.07	.04
36.20	0.00	.10	51.05	.04
36.30	0.00	.10	51.03	.04
36.40	0.00	.10	51.02	.04
36.50	0.00	.09	51.00	.04
36.60	0.00	.09	50.98	.04
36.70	0.00	.09	50.96	.04
36.80	0.00	.09	50.94	.04
36.90	0.00	.09	50.92	.04
37.00	0.00	.09	50.90	.04
37.10	0.00	.09	50.88	.04
37.20	0.00	.09	50.86	.04
37.30	0.00	.09	50.85	.03
37.40	0.00	.09	50.83	.03
37.50	0.00	.09	50.81	.03
37.60	0.00	.09	50.79	.03
37.70	0.00	.09	50.77	.03
37.80	0.00	.09	50.76	.03
37.90	0.00	.09	50.74	.03

38.00	0.00	.09	50.72	.03
38.10	0.00	.08	50.70	.03
38.20	0.00	.08	50.69	.03
38.30	0.00	.08	50.67	.03
38.40	0.00	.08	50.65	.03
38.50	0.00	.08	50.64	.03
38.60	0.00	.08	50.62	.03
38.70	0.00	.08	50.60	.02
38.80	0.00	.08	50.59	.02
38.90	0.00	.08	50.57	.02
39.00	0.00	.08	50.55	.02
39.10	0.00	.08	50.54	.02
39.20	0.00	.08	50.52	.02
39.30	0.00	.08	50.51	.02
39.40	0.00	.08	50.49	.02
39.50	0.00	.08	50.47	.02
39.60	0.00	.08	50.46	.02
39.70	0.00	.07	50.44	.02
39.80	0.00	.07	50.43	.02
39.90	0.00	.07	50.41	.02
40.00	0.00	.07	50.40	.02
40.10	0.00	.07	50.38	.02
40.20	0.00	.07	50.37	.01
40.30	0.00	.07	50.35	.01
40.40	0.00	.07	50.34	.01
40.50	0.00	.07	50.33	.01
40.60	0.00	.07	50.31	.01
40.70	0.00	.07	50.30	.01
40.80	0.00	.07	50.28	.01
40.90	0.00	.07	50.27	.01
41.00	0.00	.07	50.26	.01
41.10	0.00	.07	50.24	.01
41.20	0.00	.07	50.23	.01
41.30	0.00	.06	50.22	.01
41.40	0.00	.06	50.20	.01
41.50	0.00	.06	50.19	.01
41.60	0.00	.06	50.18	.01
41.70	0.00	.06	50.16	.01
41.80	0.00	.06	50.15	.01
41.90	0.00	.06	50.14	.01
42.00	0.00	.06	50.13	.01
42.10	0.00	.06	50.12	0.00
42.20	0.00	.06	50.10	0.00
42.30	0.00	.05	50.09	0.00
42.40	0.00	.05	50.08	0.00
42.50	0.00	.04	50.07	0.00
42.60	0.00	.04	50.06	0.00
42.70	0.00	.03	50.06	0.00
42.80	0.00	.03	50.05	0.00
42.90	0.00	.03	50.04	0.00
43.00	0.00	.02	50.04	0.00
43.10	0.00	.02	50.04	0.00
43.20	0.00	.02	50.03	0.00
43.30	0.00	.02	50.03	0.00
43.40	0.00	.01	50.02	0.00
43.50	0.00	.01	50.02	0.00
43.60	0.00	.01	50.02	0.00

43.70	0.00	.01	50.02	0.00
43.80	0.00	.01	50.02	0.00
43.90	0.00	.01	50.01	0.00
44.00	0.00	.01	50.01	0.00
44.10	0.00	.01	50.01	0.00
44.20	0.00	.01	50.01	0.00
44.30	0.00	0.00	50.01	0.00
44.40	0.00	0.00	50.01	0.00
44.50	0.00	0.00	50.01	0.00
44.60	0.00	0.00	50.01	0.00
44.70	0.00	0.00	50.01	0.00
44.80	0.00	0.00	50.00	0.00
44.90	0.00	0.00	50.00	0.00
45.00	0.00	0.00	50.00	0.00
45.10	0.00	0.00	50.00	0.00
45.20	0.00	0.00	50.00	0.00
45.30	0.00	0.00	50.00	0.00
45.40	0.00	0.00	50.00	0.00
45.50	0.00	0.00	50.00	0.00
45.60	0.00	0.00	50.00	0.00
45.70	0.00	0.00	50.00	0.00
45.80	0.00	0.00	50.00	0.00
45.90	0.00	0.00	50.00	0.00
46.00	0.00	0.00	50.00	0.00
46.10	0.00	0.00	50.00	0.00
46.20	0.00	0.00	50.00	0.00
46.30	0.00	0.00	50.00	0.00
46.40	0.00	0.00	50.00	0.00
46.50	0.00	0.00	50.00	0.00
46.60	0.00	0.00	50.00	0.00
46.70	0.00	0.00	50.00	0.00
46.80	0.00	0.00	50.00	0.00
46.90	0.00	0.00	50.00	0.00
47.00	0.00	0.00	50.00	0.00
47.10	0.00	0.00	50.00	0.00
47.20	0.00	0.00	50.00	0.00
47.30	0.00	0.00	50.00	0.00
47.40	0.00	0.00	50.00	0.00
47.50	0.00	0.00	50.00	0.00
47.60	0.00	0.00	50.00	0.00
47.70	0.00	0.00	50.00	0.00
47.80	0.00	0.00	50.00	0.00
47.90	0.00	0.00	50.00	0.00
48.00	0.00	0.00	50.00	0.00
48.10	0.00	0.00	50.00	0.00
48.20	0.00	0.00	50.00	0.00
48.30	0.00	0.00	50.00	0.00
48.40	0.00	0.00	50.00	0.00
48.50	0.00	0.00	50.00	0.00
48.60	0.00	0.00	50.00	0.00
48.70	0.00	0.00	50.00	0.00
48.80	0.00	0.00	50.00	0.00
48.90	0.00	0.00	50.00	0.00
49.00	0.00	0.00	50.00	0.00
49.10	0.00	0.00	50.00	0.00
49.20	0.00	0.00	50.00	0.00
49.30	0.00	0.00	50.00	0.00

49.40	0.00	0.00	50.00	0.00
49.50	0.00	0.00	50.00	0.00
49.60	0.00	0.00	50.00	0.00
49.70	0.00	0.00	50.00	0.00
49.80	0.00	0.00	50.00	0.00
49.90	0.00	0.00	50.00	0.00
50.00	0.00	0.00	50.00	0.00
50.10	0.00	0.00	50.00	0.00
50.20	0.00	0.00	50.00	0.00
50.30	0.00	0.00	50.00	0.00
50.40	0.00	0.00	50.00	0.00
50.50	0.00	0.00	50.00	0.00
50.60	0.00	0.00	50.00	0.00
50.70	0.00	0.00	50.00	0.00
50.80	0.00	0.00	50.00	0.00
50.90	0.00	0.00	50.00	0.00
51.00	0.00	0.00	50.00	0.00
51.10	0.00	0.00	50.00	0.00
51.20	0.00	0.00	50.00	0.00
51.30	0.00	0.00	50.00	0.00
51.40	0.00	0.00	50.00	0.00
51.50	0.00	0.00	50.00	0.00
51.60	0.00	0.00	50.00	0.00
51.70	0.00	0.00	50.00	0.00
51.80	0.00	0.00	50.00	0.00
51.90	0.00	0.00	50.00	0.00
52.00	0.00	0.00	50.00	0.00
52.10	0.00	0.00	50.00	0.00
52.20	0.00	0.00	50.00	0.00
52.30	0.00	0.00	50.00	0.00
52.40	0.00	0.00	50.00	0.00
52.50	0.00	0.00	50.00	0.00
52.60	0.00	0.00	50.00	0.00
52.70	0.00	0.00	50.00	0.00
52.80	0.00	0.00	50.00	0.00
52.90	0.00	0.00	50.00	0.00
53.00	0.00	0.00	50.00	0.00
53.10	0.00	0.00	50.00	0.00
53.20	0.00	0.00	50.00	0.00
53.30	0.00	0.00	50.00	0.00
53.40	0.00	0.00	50.00	0.00
53.50	0.00	0.00	50.00	0.00
53.60	0.00	0.00	50.00	0.00
53.70	0.00	0.00	50.00	0.00
53.80	0.00	0.00	50.00	0.00
53.90	0.00	0.00	50.00	0.00
54.00	0.00	0.00	50.00	0.00
54.10	0.00	0.00	50.00	0.00
54.20	0.00	0.00	50.00	0.00
54.30	0.00	0.00	50.00	0.00
54.40	0.00	0.00	50.00	0.00
54.50	0.00	0.00	50.00	0.00
54.60	0.00	0.00	50.00	0.00
54.70	0.00	0.00	50.00	0.00
54.80	0.00	0.00	50.00	0.00
54.90	0.00	0.00	50.00	0.00
55.00	0.00	0.00	50.00	0.00

--- end of calculations ---

ENVIRONMENTAL INVENTORY

- **August 18, 2000 - Department of the Army**
- **July 27, 2000 - Department of Environmental Quality**
- **September 15, 1997 - Department of Historic Resources**
- **September 11, 1997 - Langley and McDonald, P.C.**
- **May 13, 1997 - Langley and McDonald, P.C.**

Environmental Inventory
La Grange Parkway Extended

The roadway initiates in the Commerce Park at the farm field, joins the existing road, travels under Interstate 64, intercepts an additional farm field and rejoins the existing road. The canopy vegetation along the existing roadway is comprised of tulip poplar, (*Liriodendron tulipifera*), American beech (*Fagus gradnifolia*), loblolly pine (*Pinus taeda*), red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*) and black oak (*Quercus velutina*) with the understory comprised of flowering dogwood (*Cornus florida*), American holly (*Ilex opaca*). The shrub layer contains dense mountain laurel (*Kalmia latifolia*) and highbush blueberry (*Vaccinium corymbosum*). The herbaceous stratum consist of partridge berry (*Mitchella repens*), southern lady fern, (*Antherium asplenioides*), Christmas fern (*Polystichum acrostichoides*), sassafrass (*Sassafrass albidum*), strawberry bush (*Euonymus americanus*) and muscadine grape (*Vitus rotundifolia*).

The road crosses a tributary of France Swamp. The vegetation at the road crossing is typical of disturbed wetland areas adjacent to roadways and is comprised of black willow (*Salix nigra*), pine seedlings, dandelions (*Taraxacum officinale*) and rushes (*Juncus* sp.). This area has also been utilized as a garbage dumping area with many tires and deer carcasses and some old asphalt.

The wildlife usage of the area would include species typical of mature woods including mammals such as white tailed deer, raccoons, gray squirrel, beaver, Virginia opossum, red fox and birds including robins, cardinals, sparrows, black birds, blue jays, doves, meadowlarks and turkey vultures. Reptiles and amphibians usage would include toads, bull frogs, black snake, copperhead, cottonmouth water moccasin, and eastern garter snake.

Wetland Permits

A Joint Permit Application was submitted to the Corps of Engineers and DEQ on May 23, 2000 for impacts relating to construction of the roadway. Copies of letters approving the work are attached.

PAVEMENT CALCULATIONS

LANDMARK DESIGN GROUP
4029 Ironbound Road, Suite 100
Williamsburg, Virginia 23188

PAVEMENT DESIGN
VHRC 73-R21
as revised January 1996

PROJECT: La Grange Parkway Extension
LOCATION James City County, Stonehouse Commerce Center
STREET: La Grange Parkway
FROM STA. TO ST
DATE: June, 2000

TRAFFIC ANALYSIS

1. Vehicles Per Day =	5000	
2. % Heavy Traffic =	5	%
3. Equiv. Present ADT =	5000	
4. Design Period	20	Yrs.
5. % Growth =	0	%
6. Growth Factor =	1	
7. V.P.D. Projection =	5000	ADT

SUBGRADE ANALYSIS

1. CBR Values =	
2. Enter No. of Tests =	0
3. Average CBR =	6
4. Design CBR =	4.0002
5. Soil Resiliency Facto	2
6. Soil Support Value =	8.0004

PAVEMENT DESIGN

1. Thickness Index Required =	18.76581	inches	(General Formula)
	25.4	inches	(Limited formula)
			(use for ssv<15 &vpd<1000)
2. Design	USE T =	18.8 inches	

ALT. 'B'

Material	Factor	Thickness	Index	% Asphalt
SM	2.25	1.5	3.4	10%
BM	2.15	5	10.8	34%
Aggregate	0.6	8	4.8	
Sel. Material	0.4	0	0.0	
	TOTAL	14.5	18.9	45%
			OK	

LANDMARK DESIGN GROUP
4029 Ironbound Road, Suite 100
Williamsburg, Virginia 23188

PAVEMENT DESIGN
VHRC 73-R21
as revised January 1996

PROJECT: La Grange Parkway Extension
LOCATION James City County, Stonehouse Commerce Center
STREET: Rte 600 or Route 608
FROM STA. TO ST
DATE:

TRAFFIC ANALYSIS

1. Vehicles Per Day =	500	
2. % Heavy Traffic =	5	%
3. Equiv. Present ADT =	500	
4. Design Period	20	Yrs.
5. % Growth =	0	%
6. Growth Factor =	1	
7. V.P.D. Projection =	500	ADT

SUBGRADE ANALYSIS

1. CBR Values =			
2. Enter No. of Tests =			0
3. Average CBR =			6
4. Design CBR =			4.0002
5. Soil Resiliency Facto			2
6. Soil Support Value =			8.0004

PAVEMENT DESIGN

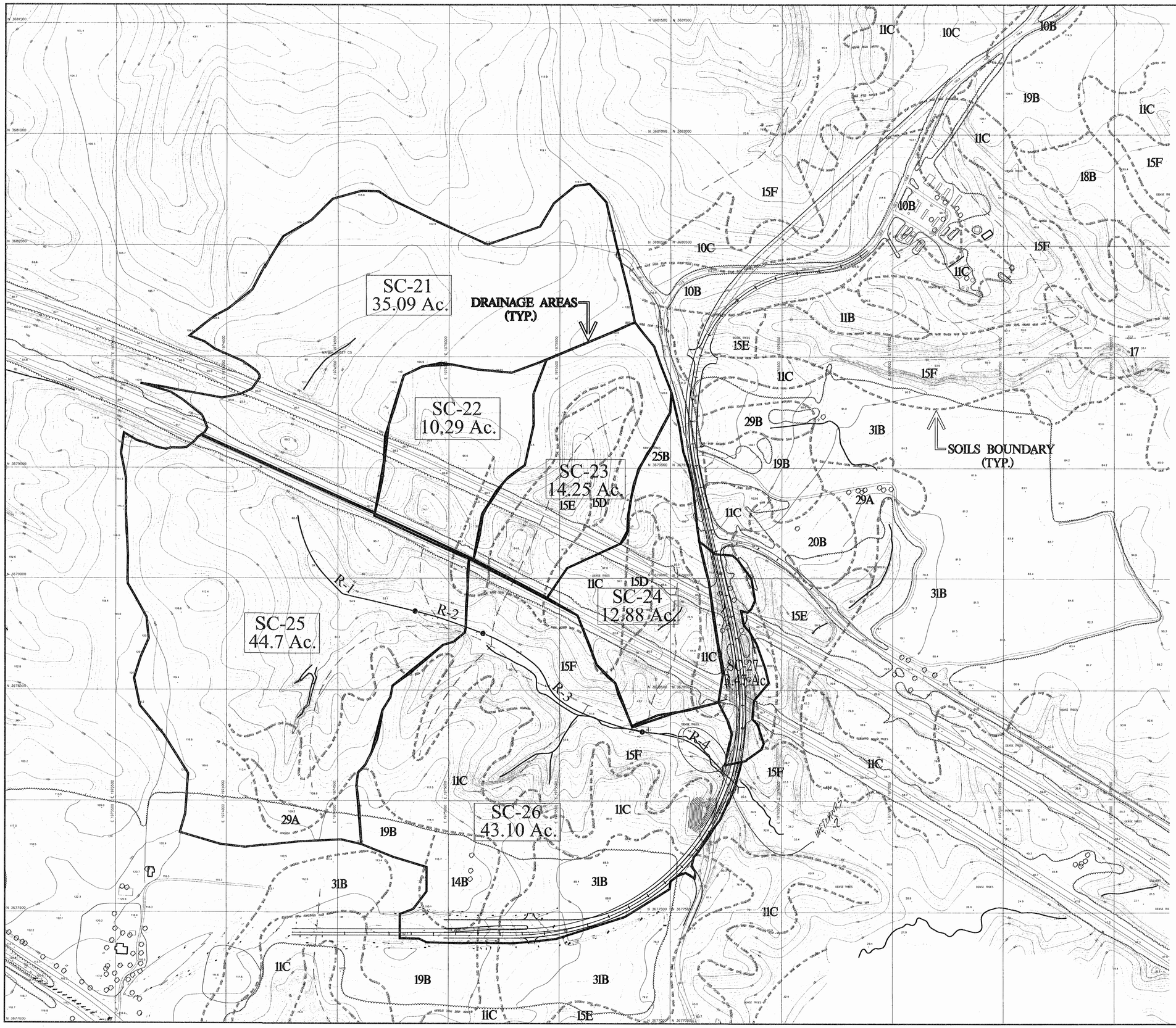
1. Thickness Index Required = 15.28581 inches (General Formula)
11.3 inches (Limited formula)
(use for ssv<15 &vpd<1000)

2. Design USE T = 11.3 inches

ALT. 'A'

Material	Factor	Thickness	Index	% Asphalt
SM-	1.67	2	3.3	20%
Aggregate	1	8	8.0	
Sel. Material	0.6	0	0.0	
TOTAL		10	11.3	20%
			OK	

SOILS AND DRAINAGE AREA MAP



VIRGINIA STATE PLANE COORDINATE SYSTEM (SOUTH ZONE) (NAD 83)

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

4029 Ironbound Road
Suite 100
Williamsburg, VA 23188
Tel. (757) 229-7575
Fax. (757) 229-0049
Email: lmdg@landmarkdgweb.com

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

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

REVISIONS

No.	Date	Comment	By
1	1/23/01	SOILS DATA ADDED	RSP

DRAWING STATUS
- Interdiscipline Review
- Client for Review
- Pre Approval Bidding
- NOTE

COUNTY APPROVAL
- 1st Submittal
- 2nd Submittal
- 3rd Submittal
- Approved

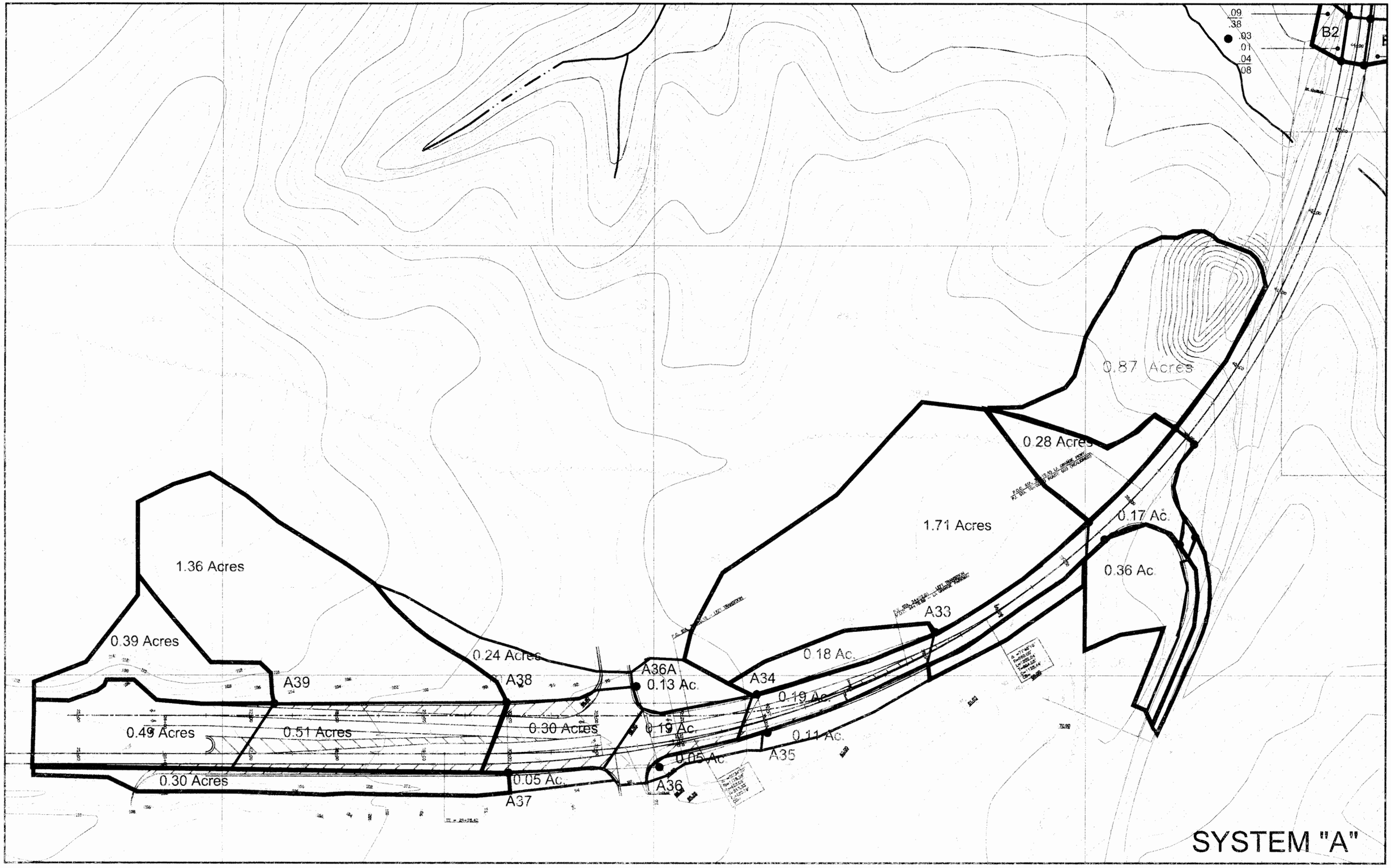
OVERALL SOILS AND SITE DRAINAGE MAP
LAGRANGE PARKWAY EXTENSION AT COMMERCE PARK FOR STONEHOUSE, INC.

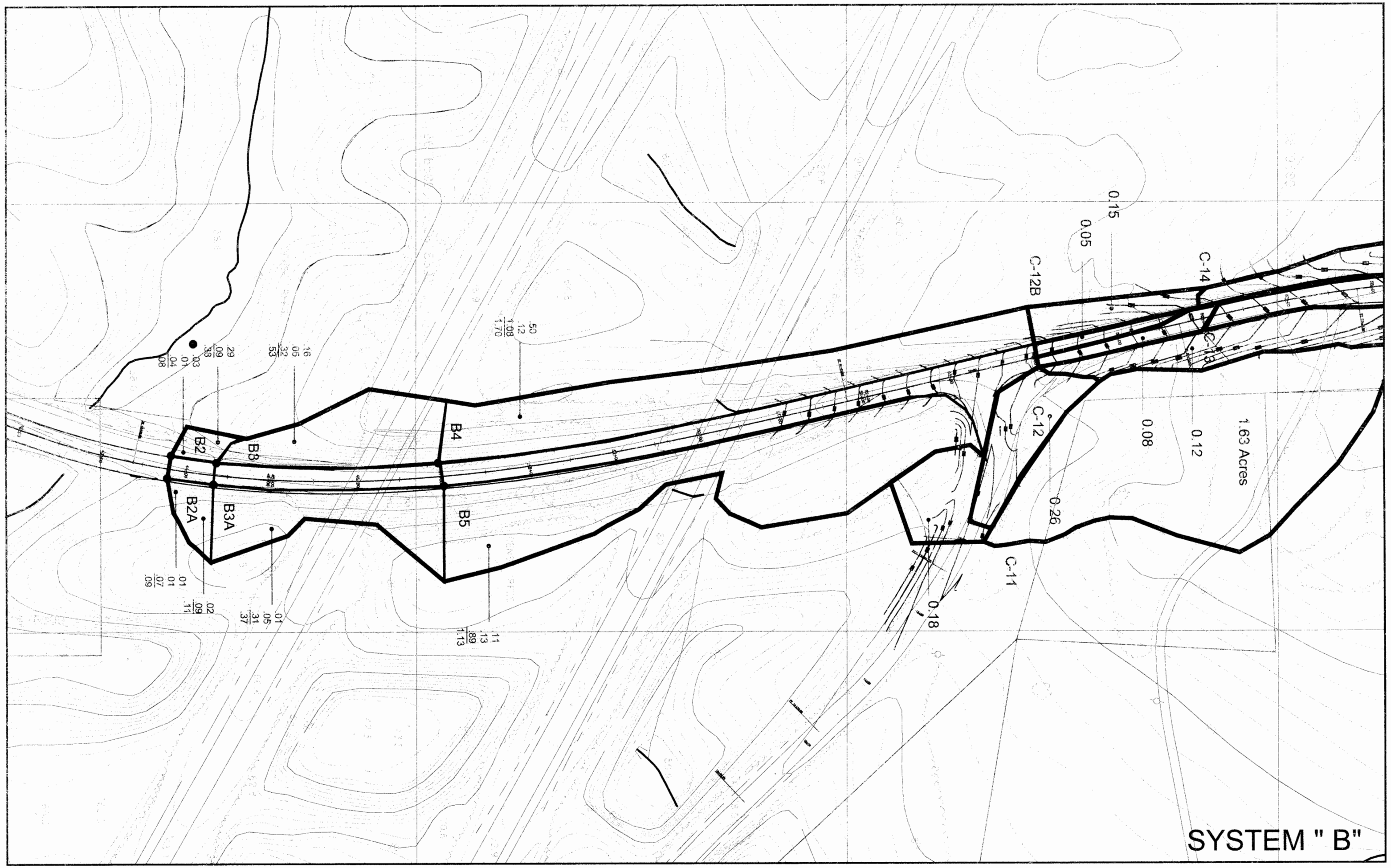
STONEHOUSE DISTRICT JAMES CITY COUNTY VIRGINIA

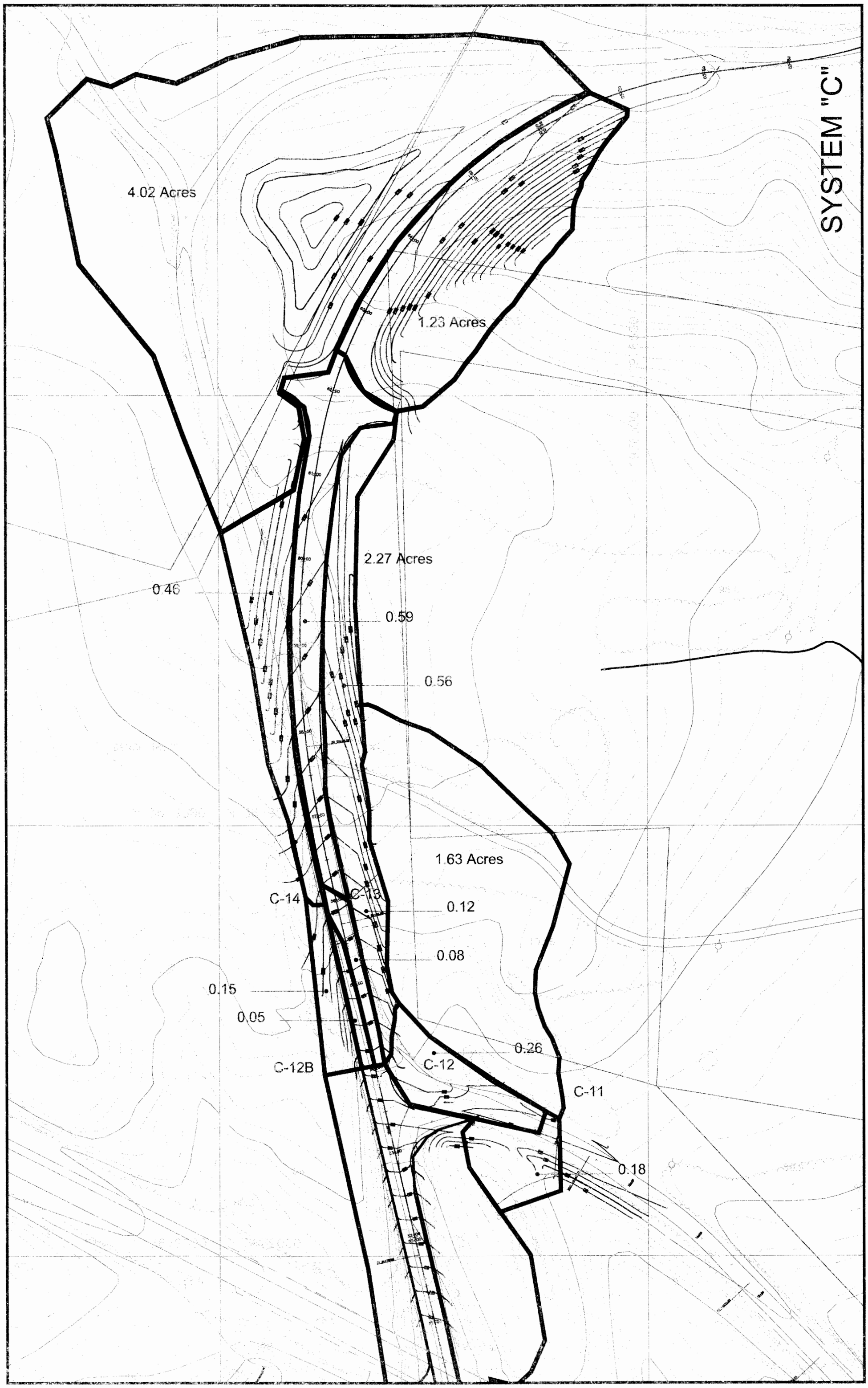
Designed: RSP	Date: 6/14/00
Checked: RSP	Scale: 1"=200'
File Mgr./Drawn: CMJ/EMP	CADD File name: DRAIN-SOIL-MAP.DWG
Project Number: 1990140-000.01	Dwg. File No.: 11599W
Drawing Number	D-1

1 OF 1

STORM SYSTEM DRAINAGE AREAS A, B AND C


.09
.38
.03
.01
.04
.08
B2
0.87 Acres
0.28 Acres
1.71 Acres
0.17 Ac.
0.36 Ac.
1.36 Acres
0.39 Acres
A33
0.24 Acres
A36A
0.13 Ac.
A34
0.18 Ac.
A39
A38
0.19 Ac.
0.49 Acres
0.51 Acres
0.30 Acres
0.19 Ac.
0.11 Ac.
0.05 Ac.
A35
0.30 Acres
0.05 Ac.
A36
A37
SYSTEM "A"


SYSTEM " B"
1.63 Acres
0.12
0.08
0.26
0.18
0.15
0.05
C-11
C-12
C-12B
C-13
C-14
B2
B2A
B3
B3A
B4
B5
29
09
33
.03
01
04
08
16
05
32
53
50
12
1.08
1.70
01
01
07
.09
02
09
.11
01
05
31
37
11
13
.89
1.13


SYSTEM "C"
4.02 Acres
1.23 Acres
2.27 Acres
0.46
0.59
0.56
1.63 Acres
C-14
C-13
0.12
0.08
0.15
0.05
0.26
C-12B
C-12
C-11
0.18

SUPPLEMENTAL DRAINAGE CALCULATIONS

LA GRANGE PARKWAY EXTENSION AT COMMERCE PARK FOR STONEHOUSE, INC.

COMMONWEALTH OF VIRGINIA
4/26/01
RICHARD S. PHILLIPS
No. 023631
PROFESSIONAL ENGINEER

April 26, 2001

LANDMARK
DESIGN GROUP

Engineers • Planners • Surveyors • Landscape Architects • Environmental Consultants
4029 Ironbound Road, Suite 100, Williamsburg, VA 23188 (757) 253-2975 FAX: (757) 229-0049 lmdg@landmarkdgwb.com

TEMPORARY SEDIMENT BASIN #2

- DESIGN DATA SHEET
- PRE / POST ROUTING DIAGRAM
- 25 YEAR ROUTING CALCULATION
- 2 YR. & 10 YR. WITH RISER REMOVED TO DETERMINE CHANNEL ADEQUACY

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET

(with or without an emergency spillway)

STA. 64+00 LEFT

Project LaGrange Parkway Extension

Basin # 2 Location Station 64+00

Total area draining to basin: 4.02 acres.

Basin Volume Design

Wet Storage:

1. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 4.02 acres = 269 cu. yds.

2. Available basin volume = ~~265~~ 269 cu. yds. at elevation ~~107.8~~ 107.9. (From storage - elevation curve)

3. Excavate ~ cu. yds. to obtain required volume*.

   * Elevation corresponding to required volume = invert of the dewatering orifice.

4. Available volume before cleanout required.

   33 cu. yds. x 4.02 acres = 133 cu. yds.

5. Elevation corresponding to cleanout level = 106.9 ~ 130 c.y.

   (From Storage - Elevation Curve)

6. Distance from invert of the dewatering orifice to cleanout level = 1.5 ft. (Min. = 1.0 ft.)

Dry Storage:

7. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 4.02 acres = 269 cu. yds.

8. Total available basin volume at crest of riser* = 577 cu. yds. at elevation 109°. (From Storage - Elevation Curve)

* Minimum = 134 cu. yds./acre of total drainage area.

9. Diameter of dewatering orifice = 4 in.

10. Diameter of flexible tubing = 6 in. (diameter of dewatering orifice plus 2 inches).

Preliminary Design Elevations

11. Crest of Riser = 109°

Top of Dam = 115 ± Road Embankment

Design High Water = 109 4/

Upstream Toe of Dam = 104

Basin Shape

12. Length of Flow / Effective Width — L / We = _____

If > 2, baffles are not required _____

If < 2, baffles are required _____

Runoff C = .55 $i_{10} \doteq 3.5$ $i_{25} \doteq 5.5$

13. Q_2 = 7.74 cfs (From Chapter 5)

14. Q_{25} = 12.16 cfs (From Chapter 5)

Principal Spillway Design

15. With emergency spillway, required spillway capacity $Q_p = Q_2$ = _____ cfs. (riser and barrel)

Without emergency spillway, required spillway capacity $Q_p = Q_{25}$ = _____ cfs. (riser and barrel)

16. With emergency spillway:

Assumed available head (h) = ~ ft. (Using Q_2)

h = Crest of Emergency Spillway Elevation - Crest of Riser Elevation

Without emergency spillway:

Assumed available head (h) = 6* ft. (Using Q_{25})

h = Design High Water Elevation - Crest of Riser Elevation

17. Riser diameter (D_r) = 48 in. Actual head (h) = .3 ft.

(From Plate 3.14-8.)

Note: Avoid orifice flow conditions.

18. Barrel length (l) = ~~255~~ 225 ft. 109.4 - 86°

Head (H) on barrel through embankment = 23.4 ft.

(From Plate 3.14-7).

19. Barrel diameter = 18" in.

(From Plate 3.14-B [concrete pipe] or Plate 3.14-A [corrugated pipe]).

20. Trash rack and anti-vortex device

Diameter = 72 inches.

Height = 21 inches.

(From Table 3.14-D).

Emergency Spillway Design

21. Required spillway capacity $Q_e = Q_{25} - Q_p$ = na cfs.

22. Bottom width (b) = _____ ft.; the slope of the exit channel (s) = _____ ft./foot; and the minimum length of the exit channel (x) = _____ ft.
(From Table 3.14-C).

Anti-Seep Collar Design

23. Depth of water at principal spillway crest (Y) = 5 ft.

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

Slope of principal spillway barrel (S_b) = 7.06 %

Length of barrel in saturated zone (L_s) = 49 ft.

24. Number of collars required = 2 dimensions = 4'

(from Plate 3.14-12).

Final Design Elevations

25. Top of Dam = 115

Design High Water = 109.3 ✓

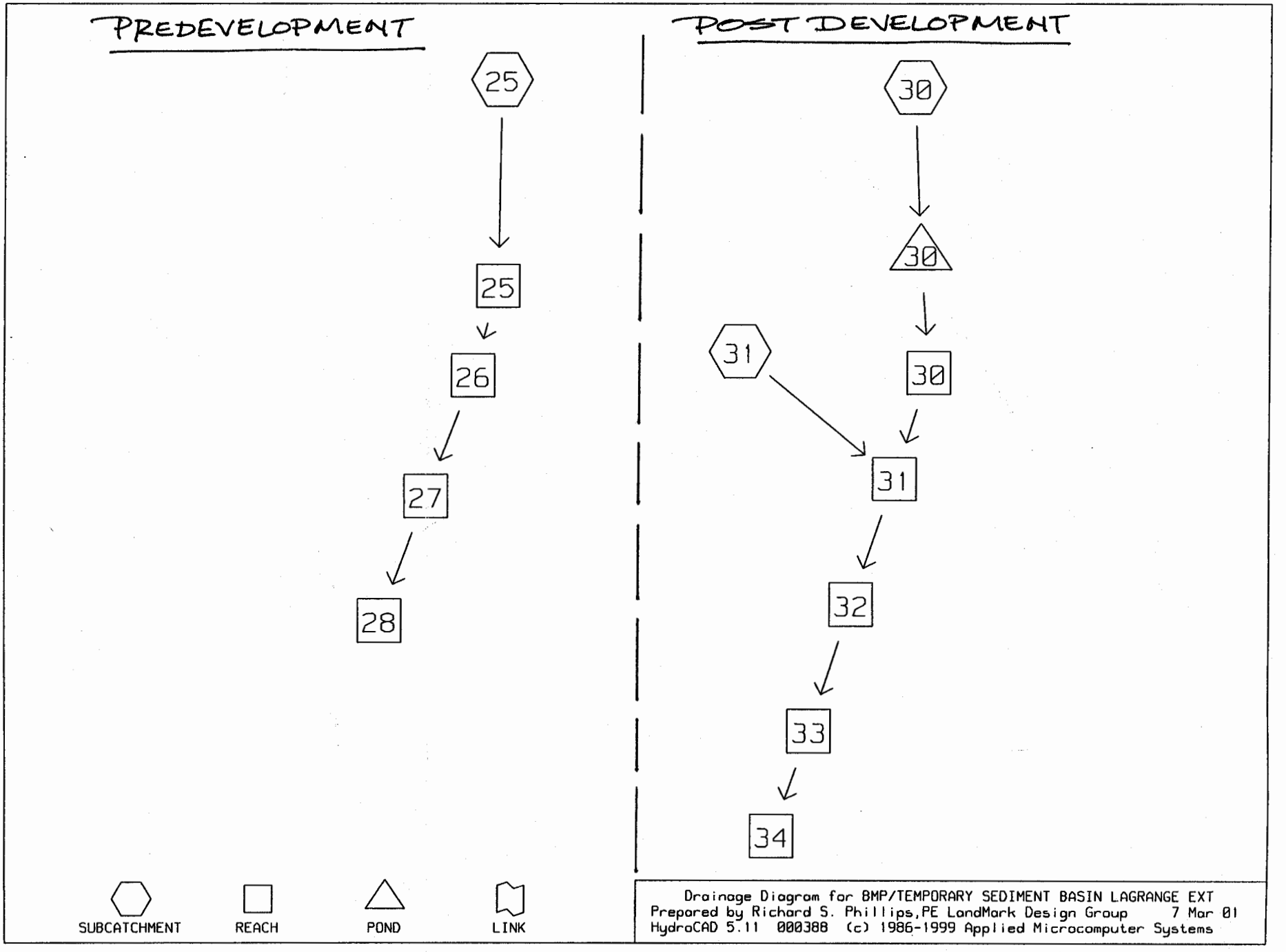
Emergency Spillway Crest = N.A.

Principal Spillway Crest = 109.0 ✓

Dewatering Orifice Invert = 107.9 ✓

Cleanout Elevation = 106.9 ✓

Elevation of Upstream Toe of Dam or Excavated Bottom of "Wet Storage Area" (if excavation was performed) = 104 ✓


PREDEVELOPMENT
25
25
26
27
28
POST DEVELOPMENT
30
30
30
31
31
32
33
34
SUBCATCHMENT
REACH
POND
LINK
Drainage Diagram for BMP/TEMPORARY SEDIMENT BASIN LAGRANGE EXT
Prepared by Richard S. Phillips,PE LandMark Design Group 7 Mar 01
HydroCAD 5.11 000388 (c) 1986-1999 Applied Microcomputer Systems

SUBCATCHMENT 25 **EXISTING DRAINAGE AREA**

PEAK= 19.54 CFS @ 11.99 HRS, VOLUME= 1.19 AF

ACRES	CN		
.33	98	EXISTING ROAD	SCS TR-20 METHOD
4.92	65	WOODS / RAVINE	TYPE II 24-HOUR
			RAINFALL= 6.24 IN
5.25	67		SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	12.0

SUBCATCHMENT 30 **SUMMIT DRAINAGE AREA**

PEAK= 14.47 CFS @ 11.98 HRS, VOLUME= .85 AF

ACRES	CN		
4.02	65	NATURAL AND RECLIAMED GREEN SPAC	SCS TR-20 METHOD
			TYPE II 24-HOUR
			RAINFALL= 6.24 IN
			SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	10.0

SUBCATCHMENT 31 **ROADWAY AND FILL SLOPE**

PEAK= 7.28 CFS @ 11.87 HRS, VOLUME= .35 AF

ACRES	CN		
.33	98	ROAD	SCS TR-20 METHOD
.90	65	FILL SLOPE	TYPE II 24-HOUR
			RAINFALL= 6.24 IN
1.23	74		SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	2.0

REACH 25 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 19.54 CFS @ 11.99 HRS, VOLUME= 1.19 AF
Qout= 19.42 CFS @ 12.00 HRS, VOLUME= 1.19 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.12 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 26 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 19.42 CFS @ 12.00 HRS, VOLUME= 1.19 AF
Qout= 19.24 CFS @ 12.00 HRS, VOLUME= 1.19 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.16 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 27 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 19.24 CFS @ 12.00 HRS, VOLUME= 1.19 AF
Qout= 19.07 CFS @ 12.00 HRS, VOLUME= 1.19 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.12 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 28 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 19.07 CFS @ 12.00 HRS, VOLUME= 1.19 AF
Qout= 18.89 CFS @ 12.00 HRS, VOLUME= 1.19 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.25 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 30 **STILLING BASIN**

Qin = 7.55 CFS @ 12.13 HRS, VOLUME= .85 AF
Qout= 6.95 CFS @ 12.15 HRS, VOLUME= .85 AF, ATTEN= 8%, LAG= .7 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	2.24	.46
.40	4.56	1.47
.60	6.96	2.89
.86	10.20	5.26
1.20	14.64	9.17
1.60	20.16	14.86
2.00	26.00	21.66

11' x 2' CHANNEL
SIDE SLOPE= 1 '/'
n= .024
LENGTH= 15 FT
SLOPE= .0001 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .99 FT
PEAK VELOCITY= .6 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 31 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 7.84 CFS @ 12.14 HRS, VOLUME= 1.19 AF
Qout= 7.77 CFS @ 12.14 HRS, VOLUME= 1.19 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL

n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.05 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 32 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 7.77 CFS @ 12.14 HRS, VOLUME= 1.19 AF
Qout= 7.32 CFS @ 12.16 HRS, VOLUME= 1.19 AF, ATTEN= 6%, LAG= .6 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL

n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.06 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 33 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 7.32 CFS @ 12.16 HRS, VOLUME= 1.19 AF
Qout= 7.33 CFS @ 12.17 HRS, VOLUME= 1.19 AF, ATTEN= 0%, LAG= .7 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.04 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 34 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 7.33 CFS @ 12.17 HRS, VOLUME= 1.19 AF
Qout= 7.34 CFS @ 12.18 HRS, VOLUME= 1.19 AF, ATTEN= 0%, LAG= .5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.10 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

POND 30 **SEDIMENT BASIN #2**

Qin = 14.47 CFS @ 11.98 HRS, VOLUME= .85 AF
Qout= 7.55 CFS @ 12.13 HRS, VOLUME= .85 AF, ATTEN= 48%, LAG= 9.4 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
104.0	150	0	0
106.0	1345	1495	1495
108.0	5337	6682	8177
110.0	13628	18965	27142

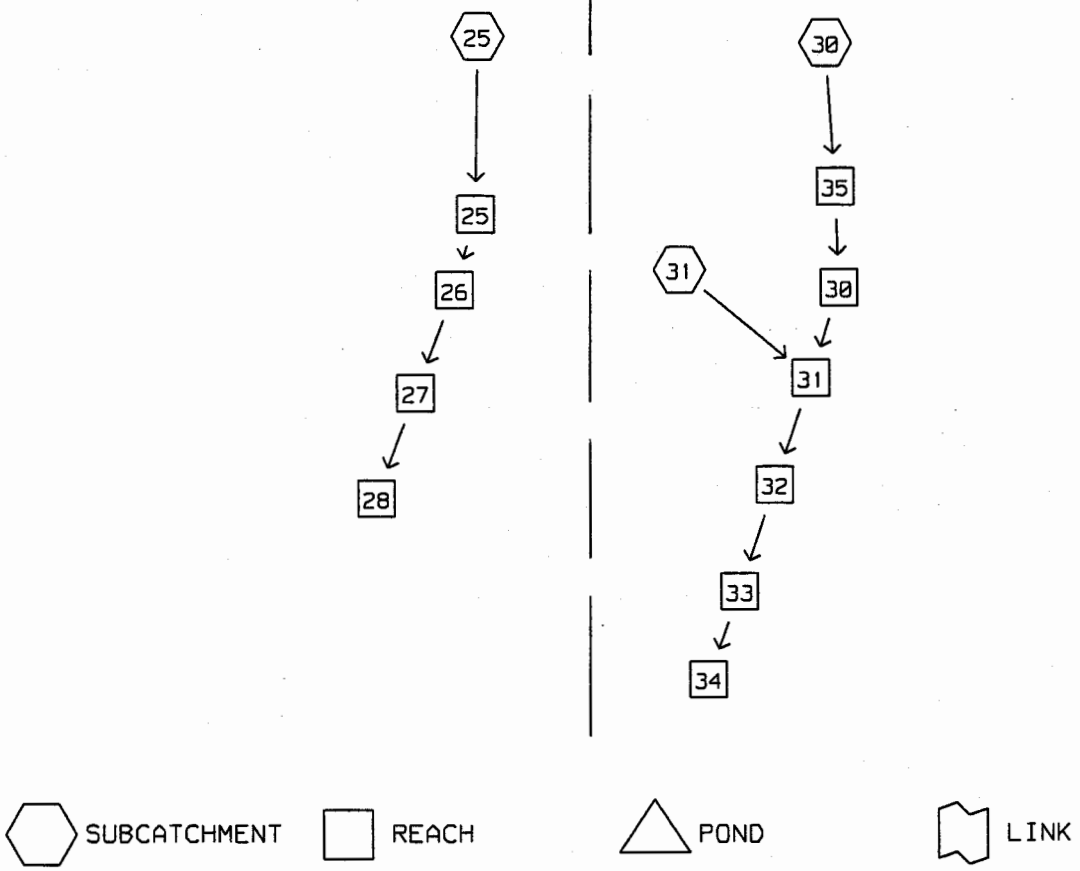
STOR-IND METHOD
PEAK STORAGE = 20511 CF
PEAK ELEVATION= 109.3 FT
FLOOD ELEVATION= 110.0 FT
START ELEVATION= 107.8 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 526.2 MIN (.67 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	104.0'	**18" CULVERT**
			n=.013 L=255' S=.0706'/' Ke=.5 Cc=.9 Cd=.6
2	1	107.8'	**3" ORIFICE/GRATE**
			Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
3	1	109.0'	**48" HORIZONTAL ORIFICE/GRATE**
			Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)

Primary Discharge
└─1=Culvert
  ├─2=Orifice/Grate
  └─3=Orifice/Grate

WATERSHED ROUTING ==========

PREDEVELOPMENT | POST DEVELOPMENT / RISER REMOVED



POST DEVELOPMENT - RISER REMOVED
CHANNEL ADEQUACY

SUBCATCHMENT 25 **EXISTING DRAINAGE AREA**

PEAK= 5.03 CFS @ 12.01 HRS, VOLUME= .34 AF

ACRES	CN	
.33	98	EXISTING ROAD
4.92	65	WOODS / RAVINE
5.25	67	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	12.0

SUBCATCHMENT 30 **SUMMIT DRAINAGE AREA**

PEAK= 3.47 CFS @ 11.99 HRS, VOLUME= .23 AF

ACRES	CN	
4.02	65	NATURAL AND RECLIAMED GREEN SPAC

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	10.0

SUBCATCHMENT 31 **ROADWAY AND FILL SLOPE**

PEAK= 2.50 CFS @ 11.88 HRS, VOLUME= .12 AF

ACRES	CN	
.33	98	ROAD
.90	65	FILL SLOPE
1.23	74	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	2.0

REACH 25 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 5.03 CFS @ 12.01 HRS, VOLUME= .34 AF
Qout= 4.99 CFS @ 12.01 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.03 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 26 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 4.99 CFS @ 12.01 HRS, VOLUME= .34 AF
Qout= 4.93 CFS @ 12.01 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.04 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 27 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 4.93 CFS @ 12.01 HRS, VOLUME= .34 AF
Qout= 4.87 CFS @ 12.02 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.03 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 28 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 4.87 CFS @ 12.02 HRS, VOLUME= .34 AF
Qout= 4.81 CFS @ 12.02 HRS, VOLUME= .34 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.06 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 30 **STILLING BASIN**

Qin = 3.39 CFS @ 12.00 HRS, VOLUME= .23 AF
Qout= 3.20 CFS @ 12.01 HRS, VOLUME= .23 AF, ATTEN= 5%, LAG= .6 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	2.24	.46
.40	4.56	1.47
.60	6.96	2.89
.86	10.20	5.26
1.20	14.64	9.17
1.60	20.16	14.86
2.00	26.00	21.66

11' x 2' CHANNEL
SIDE SLOPE= 1 '/'
n= .024
LENGTH= 15 FT
SLOPE= .0001 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .65 FT
PEAK VELOCITY= .4 FPS
TRAVEL TIME = .6 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 31 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 4.36 CFS @ 11.93 HRS, VOLUME= .35 AF
Qout= 4.33 CFS @ 11.93 HRS, VOLUME= .35 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.03 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 32 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 4.33 CFS @ 11.93 HRS, VOLUME= .35 AF
Qout= 4.28 CFS @ 11.94 HRS, VOLUME= .35 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.03 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 33 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 4.28 CFS @ 11.94 HRS, VOLUME= .35 AF
Qout= 4.23 CFS @ 11.94 HRS, VOLUME= .35 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.02 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 34 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 4.23 CFS @ 11.94 HRS, VOLUME= .35 AF
Qout= 4.18 CFS @ 11.95 HRS, VOLUME= .35 AF, ATTEN= 1%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.05 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 35 **Road Culvert**

Qin = 3.47 CFS @ 11.99 HRS, VOLUME= .23 AF
Qout= 3.39 CFS @ 12.00 HRS, VOLUME= .23 AF, ATTEN= 2%, LAG= .5 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.15	.09	.58
.30	.25	2.44
.45	.45	5.47
1.05	1.32	23.37
1.20	1.52	27.28
1.35	1.68	29.75
1.41	1.72	30.02
1.46	1.75	29.75
1.50	1.77	27.91

18" PIPE
n= .013
LENGTH= 225 FT
SLOPE= .0706 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .35 FT
PEAK VELOCITY= 10.9 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-55 HRS, dt=.1 HRS

SUBCATCHMENT 25 **EXISTING DRAINAGE AREA**

PEAK= 13.01 CFS @ 12.00 HRS, VOLUME= .80 AF

ACRES	CN	
.33	98	EXISTING ROAD
4.92	65	WOODS / RAVINE
5.25	67	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	12.0

SUBCATCHMENT 30 **SUMMIT DRAINAGE AREA**

PEAK= 9.49 CFS @ 11.98 HRS, VOLUME= .56 AF

ACRES	CN	
4.02	65	NATURAL AND RECLIAMED GREEN SPAC

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	10.0

SUBCATCHMENT 31 **ROADWAY AND FILL SLOPE**

PEAK= 5.21 CFS @ 11.87 HRS, VOLUME= .25 AF

ACRES	CN	
.33	98	ROAD
.90	65	FILL SLOPE
1.23	74	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	2.0

REACH 25 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 13.01 CFS @ 12.00 HRS, VOLUME= .80 AF
Qout= 12.93 CFS @ 12.00 HRS, VOLUME= .80 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.08 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 26 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 12.93 CFS @ 12.00 HRS, VOLUME= .80 AF
Qout= 12.80 CFS @ 12.00 HRS, VOLUME= .80 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.11 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 27 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 12.80 CFS @ 12.00 HRS, VOLUME= .80 AF
Qout= 12.68 CFS @ 12.00 HRS, VOLUME= .80 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.08 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 28 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 12.68 CFS @ 12.00 HRS, VOLUME= .80 AF
Qout= 12.55 CFS @ 12.01 HRS, VOLUME= .80 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.17 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 30 **STILLING BASIN**

Qin = 9.38 CFS @ 11.99 HRS, VOLUME= .56 AF
Qout= 9.08 CFS @ 11.99 HRS, VOLUME= .56 AF, ATTEN= 3%, LAG= .4 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	2.24	.46
.40	4.56	1.47
.60	6.96	2.89
.86	10.20	5.26
1.20	14.64	9.17
1.60	20.16	14.86
2.00	26.00	21.66

11' x 2' CHANNEL
SIDE SLOPE= 1 '/'
n= .024
LENGTH= 15 FT
SLOPE= .0001 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.20 FT
PEAK VELOCITY= .6 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 31 **NATURAL CHANNEL 20 FT DOWNSTREAM**

Qin = 11.81 CFS @ 11.93 HRS, VOLUME= .81 AF
Qout= 11.73 CFS @ 11.93 HRS, VOLUME= .81 AF, ATTEN= 1%, LAG= .1 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
84.00	0.0	0.00
86.00	58.0	50.19
88.00	190.0	82.25

SPECIAL 20' CHANNEL
n= .08
LENGTH= 20 FT
SLOPE= .07 FT/FT
CAPACITY= 1631.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 84.07 FT
PEAK VELOCITY= 5.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
6 x FINER ROUTING

REACH 32 **NATURAL CHANNEL 50 DOWNSTREAM**

Qin = 11.73 CFS @ 11.93 HRS, VOLUME= .81 AF
Qout= 11.61 CFS @ 11.93 HRS, VOLUME= .81 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
82.00	0.0	0.00
84.00	51.0	48.18
86.00	173.0	74.31

SPECIAL 30' CHANNEL
n= .08
LENGTH= 30 FT
SLOPE= .06 FT/FT
CAPACITY= 1382.7 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 82.09 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 33 **NATURAL CHANNEL 85 FT. DOWNSTREAM**

Qin = 11.61 CFS @ 11.93 HRS, VOLUME= .81 AF
Qout= 11.50 CFS @ 11.94 HRS, VOLUME= .81 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
80.00	0.0	0.00
82.00	56.0	48.21
84.00	174.0	70.37

SPECIAL 35' CHANNEL
n= .08
LENGTH= 35 FT
SLOPE= .08 FT/FT
CAPACITY= 1671.6 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 80.07 FT
PEAK VELOCITY= 5.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 34 **NATURAL CHANNEL 110 FT. DOWNSTREAM**

Qin = 11.50 CFS @ 11.94 HRS, VOLUME= .81 AF
Qout= 11.38 CFS @ 11.94 HRS, VOLUME= .81 AF, ATTEN= 1%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
78.00	0.0	0.00
80.00	39.0	36.26
82.00	135.0	60.35

SPECIAL 25' CHANNEL
n= .08
LENGTH= 25 FT
SLOPE= .04 FT/FT
CAPACITY= 857.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 78.14 FT
PEAK VELOCITY= 3.9 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS
3 x FINER ROUTING

REACH 35 **Road Culvert**

Qin = 9.49 CFS @ 11.98 HRS, VOLUME= .56 AF
Qout= 9.38 CFS @ 11.99 HRS, VOLUME= .56 AF, ATTEN= 1%, LAG= .3 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.15	.09	.58
.30	.25	2.44
.45	.45	5.47
1.05	1.32	23.37
1.20	1.52	27.28
1.35	1.68	29.75
1.41	1.72	30.02
1.46	1.75	29.75
1.50	1.77	27.91

18" PIPE
n= .013
LENGTH= 225 FT
SLOPE= .0706 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .58 FT
PEAK VELOCITY= 14.7 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-55 HRS, dt=.1 HRS

BMP # 1 ATTENUATION BASIN

LAGRANGE
STA. 40+50 Lt.
Dry Ext DET F-2

CHANNEL PROTECTION VOLUME CALCULATION

Project : LaGrange Parkway Extnesion BMP #1
Stonehouse Commerce Park, James City County, VA

Project # : 1990140-000.11

TABLE F1 / TR-55 Coefficients for Rainfall Type II			
I_a/P	C_0	C_1	C_2
0.10	2.55323	-0.61512	-0.16403
0.30	2.46532	-0.62257	-0.11657
0.35	2.41896	-0.61594	-0.08820
0.40	2.36409	-0.59857	-0.05621
0.45	2.29238	-0.57005	-0.02281
0.50	2.20282	-0.51599	-0.01259

One Year Precipitation : P= 2.8 Inches

PRE-DEVELOPMENT CONDITIONS :

Drainage Area : DA_{PRE} = 8.36 Acres
SCS Curve Number : CN_{PRE} = 50 Unitless
Time of Concentration : T_{CPRE} = 0.24 Hours

Initial abstraction ; $I_a=0.2x(1000/CN - 10)$ = 2.000 Inches
I_a/P = 0.71

Accumulated direct runoff : $Q_U = (P-I_a)^2 / (P+4xI_a)$ = 0.06 Inches

Unit Peak Discharge : q_u = 329 cfs/sq.mile/in.
$\log(q_u)=C_0+C_1\log(T_c)+C_2[\log(T]^2$
C_0,C_1,C_2 Coefficients from TABLE F1 above

Pre-development peak discharge :
$q_p = q_u \times DA \times Q_U / 640$ = 0.26 c.f.s.

POST DEVELOPMENT CONDITIONS :

Drainage Area : DA_{POST} = 8.29 Acres
SCS Curve Number : CN_{POST} = 70 Unitless
Time of Concentration T_{CPOST} = 0.32 Hours

Initial abstraction ; I_a = 0.857 Inches
I_a/P = 0.31
Accumulated direct runoff : Q_U = 0.61 Inches
Unit Peak Discharge : q_u = 556 cfs/sq.mile/in.
Post development peak discharge rate : $q_i = q_p$ = 4.36 c.f.s.

Ration of outflow to inflow : * $q_o/q_i = 11.98 \times q_u$^0.937 = 0.0321
* Direct calculation using equation for T=24hr. developed by Stewart Comstock,P.E., MDE

Peak outflow discharge : q_o = 0.1400 c.f.s.

Ratio of storage volume to runoff volume : V_s/V_r = 0.64
V_s/V_r= 0.683-1.43(qqi)+1.64(o/qi)^2-8.04(qo/qi)^3 =

Required Storage Volume :
$V_s = V_s/V_r \times Q_u \times A/12 \times 43560$ = 11649 cubic feet

ESTIMATED POND FULL DRAWDOWN

H_{TRIAL} = 3
A_o = 0.016809
d_o = 1.755532

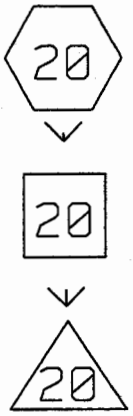
BMP POND

$D_{ORIFICE}$ = 2 inches; or 3 Holes @
D= 1 inches

W.S.E. (feet)	AREA s.f.	INC. VOL c.f.	STORAGE c.f	H_{AVG} ft.	Q_{AVG} cfs	dT hours	Q_{AVG} cfs	dT hours	
58.00	7341	12787	31661	7.00					
56.00	5446	9223	18874	5.00					
54.50	4194	1993	**11644**	4.25	**0.2144**	**2.6**	**0.1616**	**3.4**	**<WQVSE**
54.00	3777	6113	9651	3.00	0.1794	9.5	0.1355	12.5	
52.00	2336	3538	3538	1.00	0.1006	9.8	0.0771	12.7	
50.00	1202	0	0	0.00					
				DRAW DOWN TIME =		**21.8**		**28.7**	

2.2 AC IMPERV

10-YR



SUBCATCHMENT 20 **POST DEVELOPMENT**

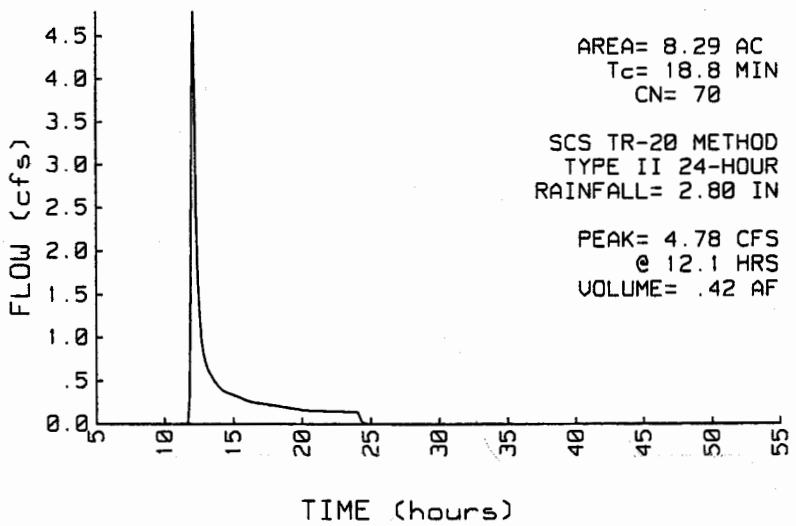
PEAK= 4.78 CFS @ 12.10 HRS, VOLUME= .42 AF

ACRES	CN	
6.09	60	GRASSED R.O.W.
2.20	98	ROADS & PAVING
8.29	70	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.80 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**DEVELOPED SITE**	13.1
Grass: Dense n=.24 L=150' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**PAVED GUTTER**	5.7
Paved Kv=20.3282 L=1400' s=.04 '/' V=4.07 fps		
	Total Length= 1550 ft Total Tc=	18.8

SUBCATCHMENT 20 RUNOFF
POST DEVELOPMENT



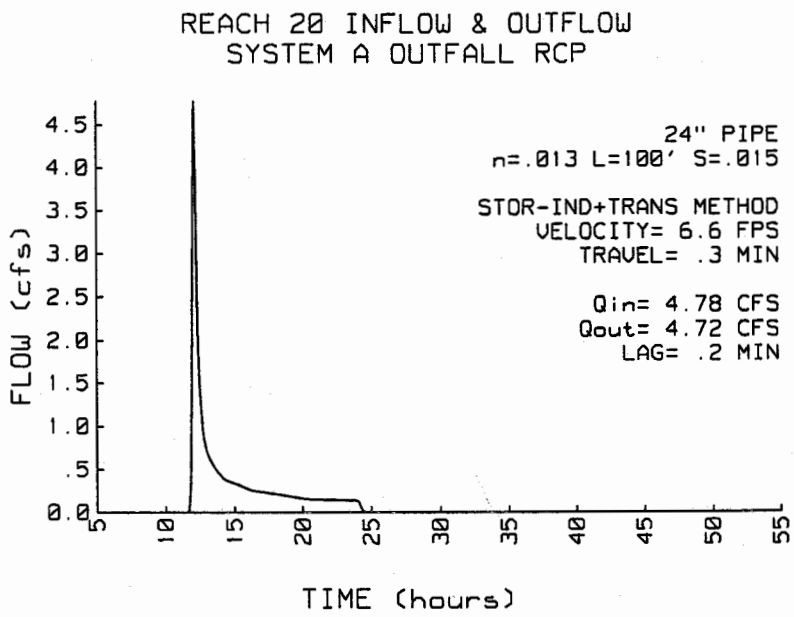
REACH 20 **SYSTEM A OUTFALL RCP**

Qin = 4.78 CFS @ 12.10 HRS, VOLUME= .42 AF
Qout= 4.72 CFS @ 12.10 HRS, VOLUME= .42 AF, ATTEN= 1%, LAG= .2 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.58
.40	.45	2.43
.60	.79	5.43
1.40	2.35	23.20
1.60	2.69	27.08
1.80	2.98	29.53
1.88	3.06	29.80
1.94	3.11	29.53
2.00	3.14	27.71

24" PIPE
n= .013
LENGTH= 100 FT
SLOPE= .015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .56 FT
PEAK VELOCITY= 6.6 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-55 HRS, dt=.1 HRS
2 x FINER ROUTING



POND 20 **STORM WATER MANAGEMENT POND**

Qin = 4.72 CFS @ 12.10 HRS, VOLUME= .42 AF
Qout= .17 CFS @ 19.57 HRS, VOLUME= .42 AF, ATTEN= 96%, LAG= 447.6 MIN

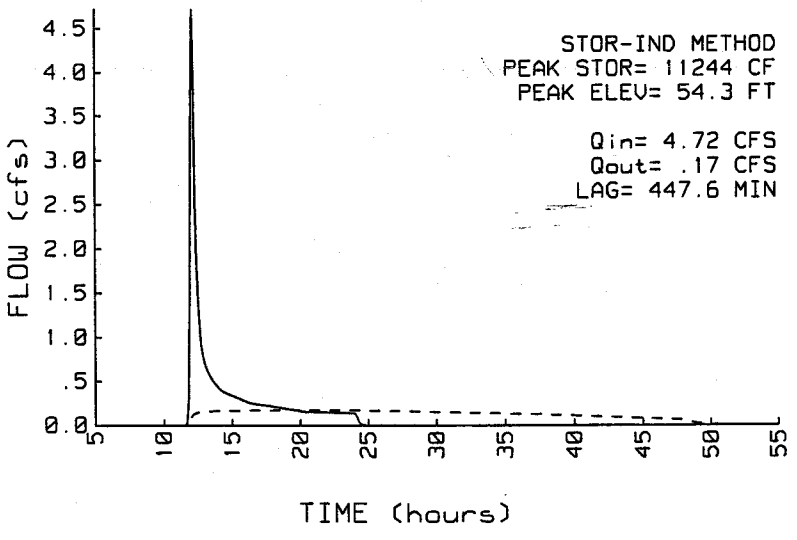
ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
50.0	1202	0	0
52.0	2336	3538	3538
54.0	3777	6113	9651
56.0	5446	9223	18874
58.0	7341	12787	31661

STOR-IND METHOD
PEAK STORAGE = 11244 CF
PEAK ELEVATION= 54.3 FT
FLOOD ELEVATION= 58.0 FT
START ELEVATION= 50.0 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 782.9 MIN (.42 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	3	49.5'	**1" ORIFICE/GRATE X 3** Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
2	3	56.0'	**48" HORIZONTAL ORIFICE/GRATE** Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)
3	P	49.0'	**24" CULVERT** n=.013 L=152' S=.03'/' Ke=.6 Cc=.9 Cd=.56
4	3	54.5'	**8" ORIFICE/GRATE** Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)

Primary Discharge
└──3=Culvert
  ├──1=Orifice/Grate
  ├──2=Orifice/Grate
  └──4=Orifice/Grate

POND 20 INFLOW & OUTFLOW
STORM WATER MANAGEMENT POND



SUBCATCHMENT 20 **POST DEVELOPMENT**

PEAK= 7.84 CFS @ 12.09 HRS, VOLUME= .64 AF

ACRES	CN	
6.09	60	GRASSED R.O.W.
2.20	98	ROADS & PAVING
8.29	70	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**DEVELOPED SITE**	13.1
Grass: Dense n=.24 L=150' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**PAVED GUTTER**	5.7
Paved Kv=20.3282 L=1400' s=.04 '/' V=4.07 fps		
	Total Length= 1550 ft Total Tc=	18.8

REACH 20 **SYSTEM A OUTFALL RCP**

Qin = 7.84 CFS @ 12.09 HRS, VOLUME= .64 AF
Qout= 7.76 CFS @ 12.09 HRS, VOLUME= .64 AF, ATTEN= 1%, LAG= .2 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.58
.40	.45	2.43
.60	.79	5.43
1.40	2.35	23.20
1.60	2.69	27.08
1.80	2.98	29.53
1.88	3.06	29.80
1.94	3.11	29.53
2.00	3.14	27.71

24" PIPE

n= .013
LENGTH= 100 FT
SLOPE= .015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .71 FT
PEAK VELOCITY= 7.8 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-55 HRS, dt=.1 HRS
2 x FINER ROUTING

POND 20 **STORM WATER MANAGEMENT POND**

Qin = 7.76 CFS @ 12.09 HRS, VOLUME= .64 AF
Qout= .69 CFS @ 13.71 HRS, VOLUME= .64 AF, ATTEN= 91%, LAG= 96.7 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
50.0	1202	0	0
52.0	2336	3538	3538
54.0	3777	6113	9651
56.0	5446	9223	18874
58.0	7341	12787	31661

STOR-IND METHOD
PEAK STORAGE = 13890 CF
PEAK ELEVATION= 54.9 FT
FLOOD ELEVATION= 58.0 FT
START ELEVATION= 50.0 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 635.6 MIN (.64 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	3	49.5'	**1" ORIFICE/GRATE X 3** Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
2	3	56.0'	**48" HORIZONTAL ORIFICE/GRATE** Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)
3	P	49.0'	**24" CULVERT** n=.013 L=152' S=.03'/' Ke=.6 Cc=.9 Cd=.56
4	3	54.5'	**8" ORIFICE/GRATE** Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)

Primary Discharge
└──3=Culvert
  ├──1=Orifice/Grate
  ├──2=Orifice/Grate
  └──4=Orifice/Grate

SUBCATCHMENT 20 **POST DEVELOPMENT**

PEAK= 18.78 CFS @ 12.08 HRS, VOLUME= 1.43 AF

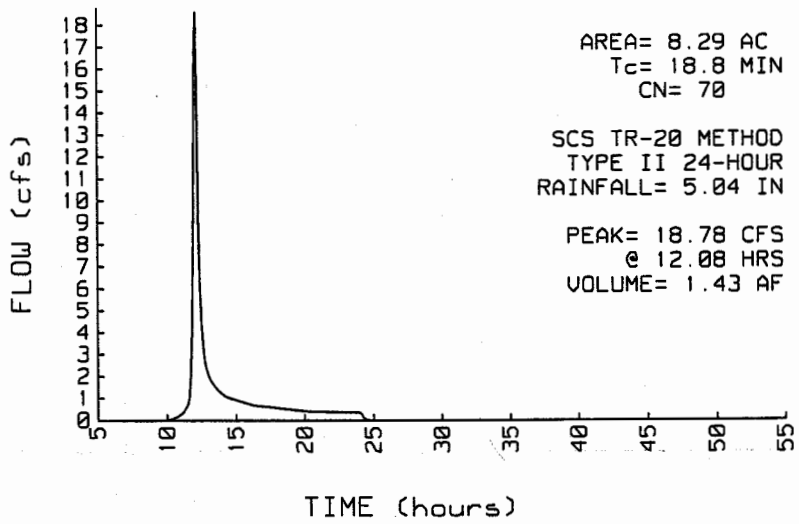
ACRES	CN	
6.09	60	GRASSED R.O.W.
2.20	98	ROADS & PAVING
8.29	70	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**DEVELOPED SITE**	13.1
Grass: Dense n=.24 L=150' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**PAVED GUTTER**	5.7
Paved Kv=20.3282 L=1400' s=.04 '/' V=4.07 fps		

	Total Length= 1550 ft Total Tc=	18.8

SUBCATCHMENT 20 RUNOFF
POST DEVELOPMENT



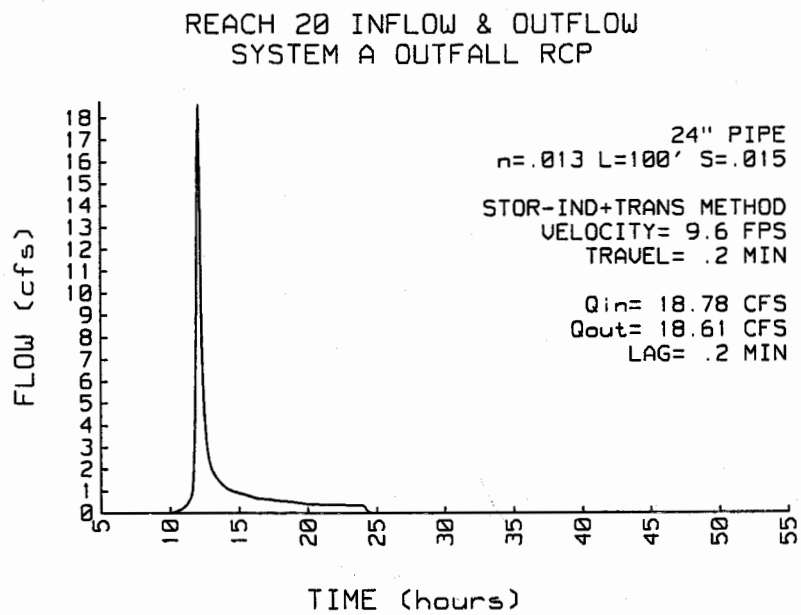
REACH 20 **SYSTEM A OUTFALL RCP**

Qin = 18.78 CFS @ 12.08 HRS, VOLUME= 1.43 AF
Qout= 18.61 CFS @ 12.08 HRS, VOLUME= 1.43 AF, ATTEN= 1%, LAG= .2 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.58
.40	.45	2.43
.60	.79	5.43
1.40	2.35	23.20
1.60	2.69	27.08
1.80	2.98	29.53
1.88	3.06	29.80
1.94	3.11	29.53
2.00	3.14	27.71

24" PIPE
n= .013
LENGTH= 100 FT
SLOPE= .015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.19 FT
PEAK VELOCITY= 9.6 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-55 HRS, dt=.1 HRS
2 x FINER ROUTING



POND 20 **STORM WATER MANAGEMENT POND**

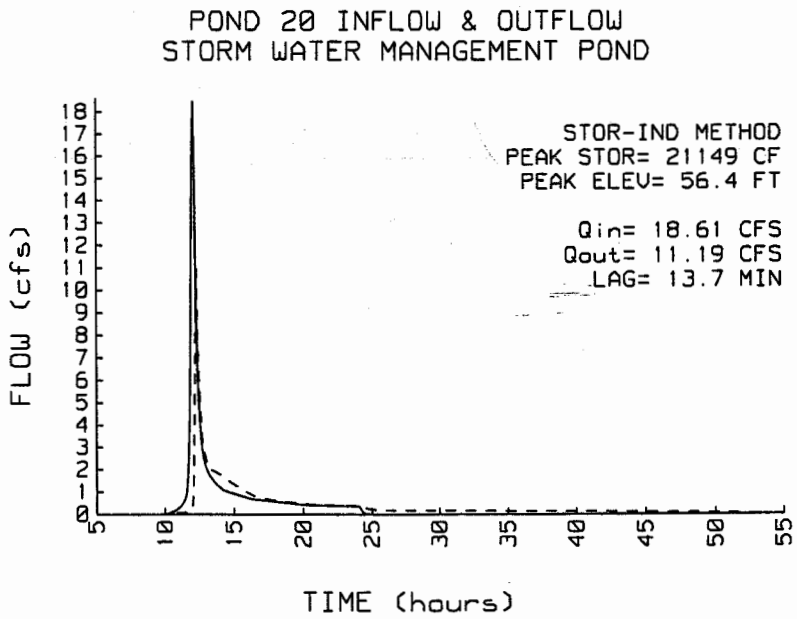
Qin = 18.61 CFS @ 12.08 HRS, VOLUME= 1.43 AF
Qout= 11.19 CFS @ 12.31 HRS, VOLUME= 1.43 AF, ATTEN= 40%, LAG= 13.7 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
50.0	1202	0	0
52.0	2336	3538	3538
54.0	3777	6113	9651
56.0	5446	9223	18874
58.0	7341	12787	31661

STOR-IND METHOD
PEAK STORAGE = 21149 CF
PEAK ELEVATION= 56.4 FT
FLOOD ELEVATION= 58.0 FT
START ELEVATION= 50.0 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 319.2 MIN (1.43 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	3	49.5'	**1" ORIFICE/GRATE X 3** Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
2	3	56.0'	**48" HORIZONTAL ORIFICE/GRATE** Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)
3	P	49.0'	**24" CULVERT** n=.013 L=152' S=.03'/' Ke=.6 Cc=.9 Cd=.56
4	3	54.5'	**8" ORIFICE/GRATE** Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)

Primary Discharge
└──3=Culvert
  ├──1=Orifice/Grate
  ├──2=Orifice/Grate
  └──4=Orifice/Grate



SUBCATCHMENT 20 **POST DEVELOPMENT**

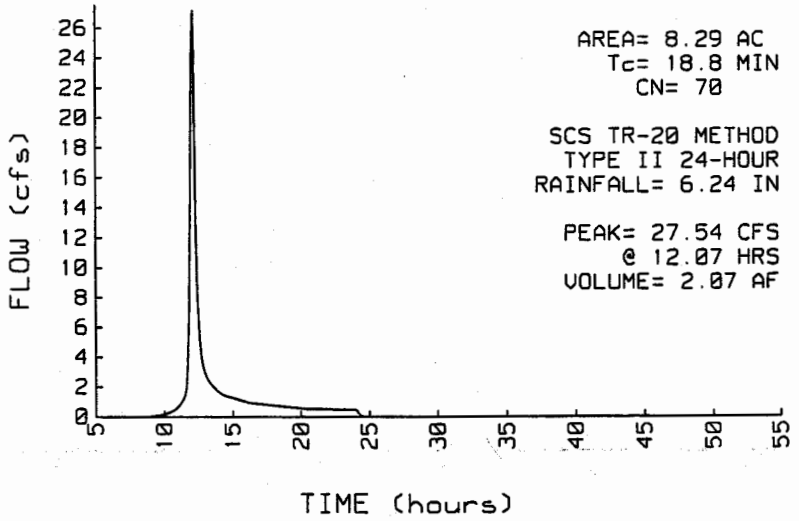
PEAK= 27.54 CFS @ 12.07 HRS, VOLUME= 2.07 AF

ACRES	CN	
6.09	60	GRASSED R.O.W.
2.20	98	ROADS & PAVING
8.29	70	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 6.24 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**DEVELOPED SITE**	13.1
Grass: Dense n=.24 L=150' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**PAVED GUTTER**	5.7
Paved Kv=20.3282 L=1400' s=.04 '/' V=4.07 fps		
	Total Length= 1550 ft Total Tc=	18.8

SUBCATCHMENT 20 RUNOFF
POST DEVELOPMENT



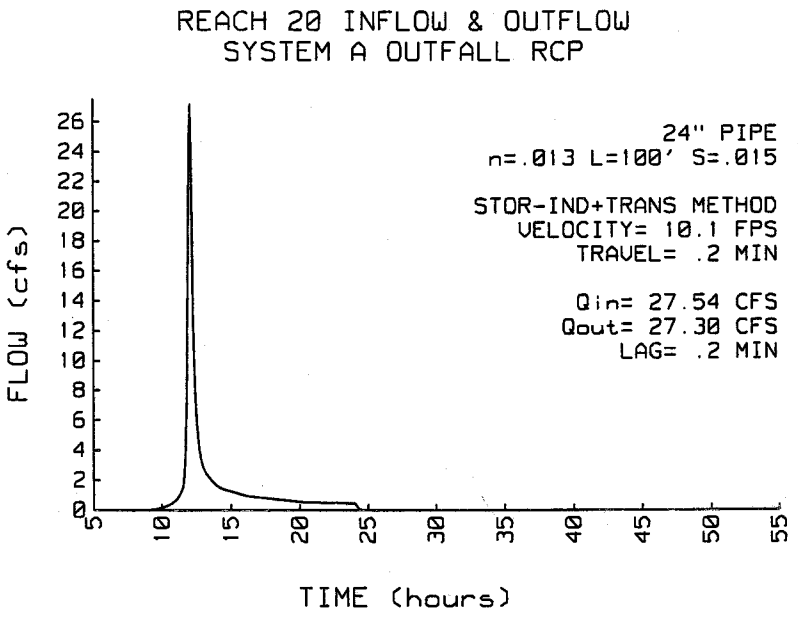
REACH 20 **SYSTEM A OUTFALL RCP**

Qin = 27.54 CFS @ 12.07 HRS, VOLUME= 2.07 AF
Qout= 27.30 CFS @ 12.08 HRS, VOLUME= 2.07 AF, ATTEN= 1%, LAG= .2 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.58
.40	.45	2.43
.60	.79	5.43
1.40	2.35	23.20
1.60	2.69	27.08
1.80	2.98	29.53
1.88	3.06	29.80
1.94	3.11	29.53
2.00	3.14	27.71

24" PIPE
n= .013
LENGTH= 100 FT
SLOPE= .015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.60 FT
PEAK VELOCITY= 10.1 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-55 HRS, dt=.1 HRS
2 x FINER ROUTING



POND 20 **STORM WATER MANAGEMENT POND**

Qin = 27.30 CFS @ 12.08 HRS, VOLUME= 2.07 AF
Qout= 24.34 CFS @ 12.19 HRS, VOLUME= 2.07 AF, ATTEN= 11%, LAG= 6.9 MIN

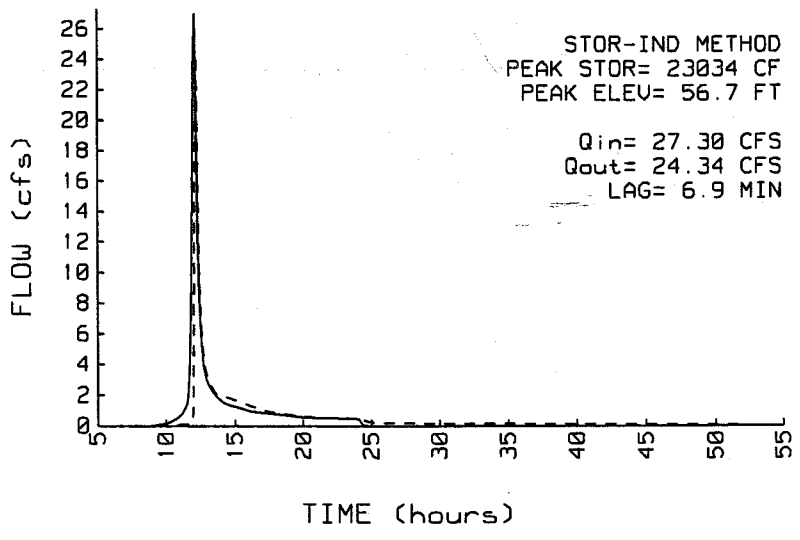
ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
50.0	1202	0	0
52.0	2336	3538	3538
54.0	3777	6113	9651
56.0	5446	9223	18874
58.0	7341	12787	31661

STOR-IND METHOD
PEAK STORAGE = 23034 CF
PEAK ELEVATION= 56.7 FT
FLOOD ELEVATION= 58.0 FT
START ELEVATION= 50.0 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 230 MIN (2.07 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	3	49.5'	**1" ORIFICE/GRATE X 3** Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
2	3	56.0'	**48" HORIZONTAL ORIFICE/GRATE** Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)
3	P	49.0'	**24" CULVERT** n=.013 L=152' S=.03'/' Ke=.6 Cc=.9 Cd=.56
4	3	54.5'	**8" ORIFICE/GRATE** Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)

Primary Discharge
└──3=Culvert
  ├──1=Orifice/Grate
  ├──2=Orifice/Grate
  └──4=Orifice/Grate

POND 20 INFLOW & OUTFLOW
STORM WATER MANAGEMENT POND



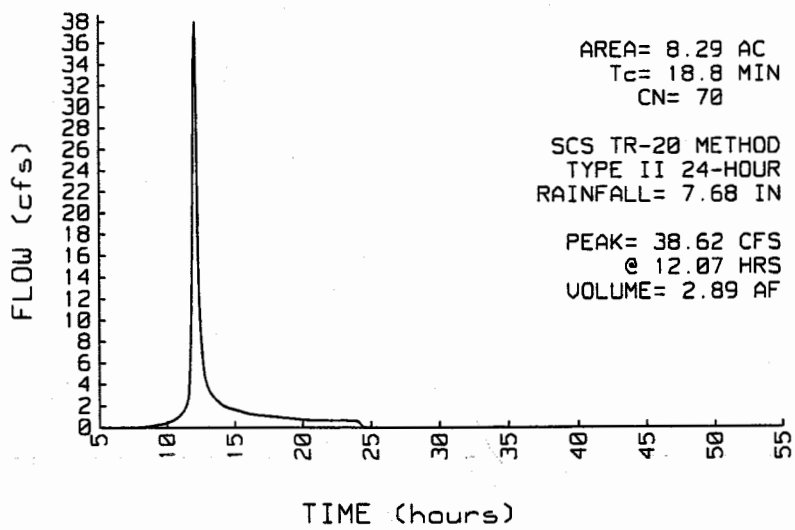
SUBCATCHMENT 20 **POST DEVELOPMENT**

PEAK= 38.62 CFS @ 12.07 HRS, VOLUME= 2.89 AF

ACRES	CN		
6.09	60	GRASSED R.O.W.	SCS TR-20 METHOD
2.20	98	ROADS & PAVING	TYPE II 24-HOUR
			RAINFALL= 7.68 IN
8.29	70		SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**DEVELOPED SITE**	13.1
Grass: Dense n=.24 L=150' P2=3.5 in s=.05 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**PAVED GUTTER**	5.7
Paved Kv=20.3282 L=1400' s=.04 '/' V=4.07 fps		
	Total Length= 1550 ft Total Tc=	18.8

SUBCATCHMENT 20 RUNOFF
POST DEVELOPMENT



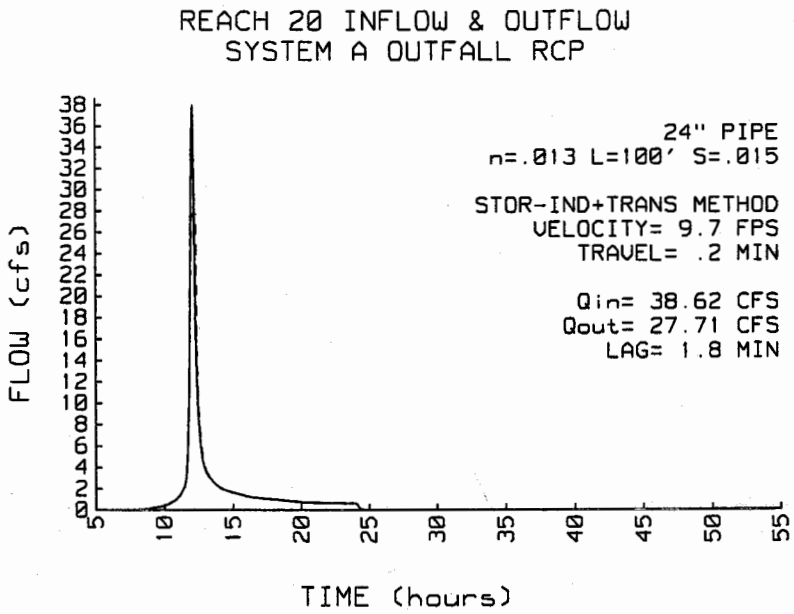
REACH 20 **SYSTEM A OUTFALL RCP**

Qin = 38.62 CFS @ 12.07 HRS, VOLUME= 2.89 AF
Qout= 27.71 CFS @ 12.10 HRS, VOLUME= 2.88 AF, ATTEN= 28%, LAG= 1.8 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.58
.40	.45	2.43
.60	.79	5.43
1.40	2.35	23.20
1.60	2.69	27.08
1.80	2.98	29.53
1.88	3.06	29.80
1.94	3.11	29.53
2.00	3.14	27.71

24" PIPE
n= .013
LENGTH= 100 FT
SLOPE= .015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 2.00 FT
PEAK VELOCITY= 9.7 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-55 HRS, dt=.1 HRS
2 x FINER ROUTING



POND 20 **STORM WATER MANAGEMENT POND**

Qin = 27.71 CFS @ 12.10 HRS, VOLUME= 2.88 AF
Qout= 27.71 CFS @ 12.30 HRS, VOLUME= 2.89 AF, ATTEN= 0%, LAG= 12.0 MIN

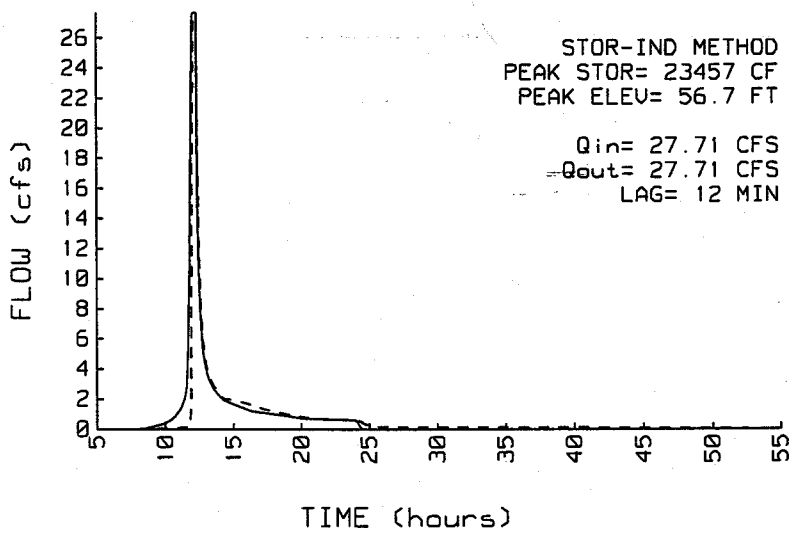
ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
50.0	1202	0	0
52.0	2336	3538	3538
54.0	3777	6113	9651
56.0	5446	9223	18874
58.0	7341	12787	31661

STOR-IND METHOD
PEAK STORAGE = 23457 CF
PEAK ELEVATION= 56.7 FT
FLOOD ELEVATION= 58.0 FT
START ELEVATION= 50.0 FT
SPAN= 5-55 HRS, dt=.1 HRS
4 x FINER ROUTING
Tdet= 161.2 MIN (2.87 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	3	49.5'	**1" ORIFICE/GRATE X 3**
			Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)
2	3	56.0'	**48" HORIZONTAL ORIFICE/GRATE**
			Q=.6 Area SQR(2gH) (Limited to weir flow @ low head)
3	P	49.0'	**24" CULVERT**
			n=.013 L=152' S=.03'/' Ke=.6 Cc=.9 Cd=.56
4	3	54.5'	**8" ORIFICE/GRATE**
			Q=.6 PI r^2 SQR(2g) SQR(H-r) (Use H/2 if H<d)

Primary Discharge
└─3=Culvert
  ├─1=Orifice/Grate
  ├─2=Orifice/Grate
  └─4=Orifice/Grate

POND 20 INFLOW & OUTFLOW
STORM WATER MANAGEMENT POND



ROUTE 600 REPLACEMENT CULVERT / TAILWATER

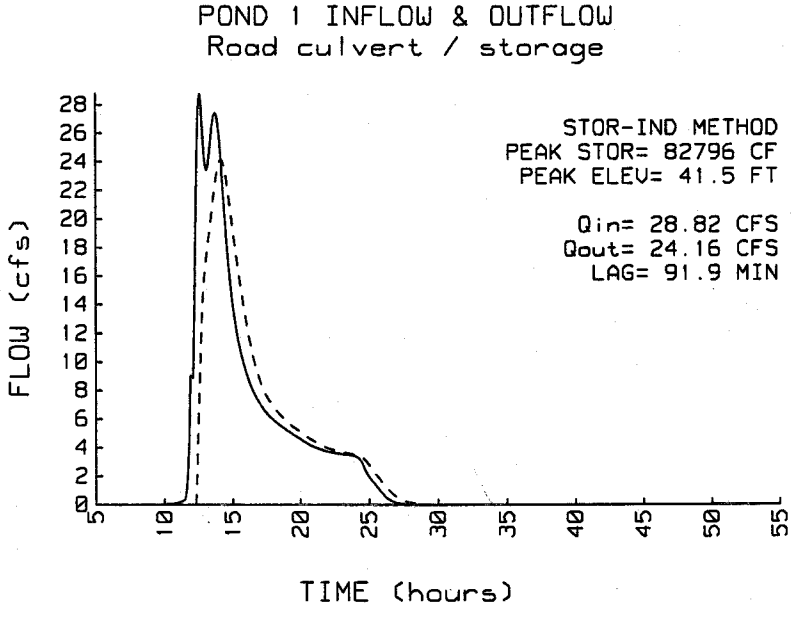
POND 1 **Road culvert / storage**

Qin = 28.82 CFS @ 12.60 HRS, VOLUME= 10.37 AF
Qout= 24.16 CFS @ 14.13 HRS, VOLUME= 9.81 AF, ATTEN= 16%, LAG= 91.9 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
39.3	0	0	0
40.0	30015	10505	10505
42.0	65126	95141	105646
44.0	106060	171186	276832
46.0	153438	259498	536330
50.0	250129	807134	1343464

STOR-IND METHOD
PEAK STORAGE = 82796 CF
PEAK ELEVATION= 41.5 FT
FLOOD ELEVATION= 50.0 FT
START ELEVATION= 39.3 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 84.1 MIN (9.81 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	39.5'	**48" CULVERT**
			n=.013 L=30' S=.01'/' Ke=.5 Cc=.9 Cd=.6 TW=40.3'



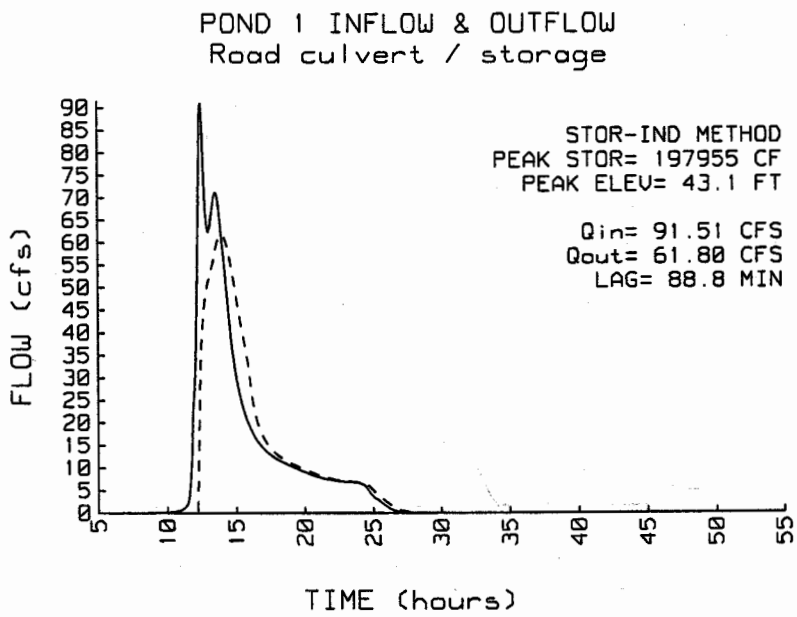
POND 1 **Road culvert / storage**

Qin = 91.51 CFS @ 12.47 HRS, VOLUME= 24.62 AF
Qout= 61.80 CFS @ 13.95 HRS, VOLUME= 23.40 AF, ATTEN= 32%, LAG= 88.8 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
39.3	0	0	0
40.0	30015	10505	10505
42.0	65126	95141	105646
44.0	106060	171186	276832
46.0	153438	259498	536330
50.0	250129	807134	1343464

STOR-IND METHOD
PEAK STORAGE = 197955 CF
PEAK ELEVATION= 43.1 FT
FLOOD ELEVATION= 50.0 FT
START ELEVATION= 39.3 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 71.3 MIN (23.4 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	39.5'	**48" CULVERT**
			n=.013 L=30' S=.01'/' Ke=.5 Cc=.9 Cd=.6 TW=41'



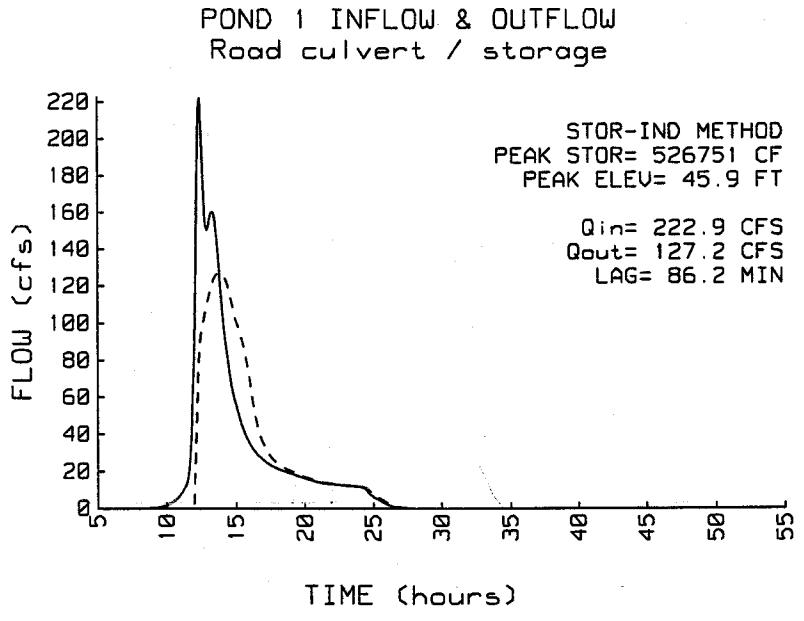
POND 1 **Road culvert / storage**

Qin = 222.9 CFS @ 12.38 HRS, VOLUME= 51.99 AF
Qout= 127.2 CFS @ 13.81 HRS, VOLUME= 49.37 AF, ATTEN= 43%, LAG= 86.2 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
39.3	0	0	0
40.0	30015	10505	10505
42.0	65126	95141	105646
44.0	106060	171186	276832
46.0	153438	259498	536330
50.0	250129	807134	1343464

STOR-IND METHOD
PEAK STORAGE = 526751 CF
PEAK ELEVATION= 45.9 FT
FLOOD ELEVATION= 50.0 FT
START ELEVATION= 39.3 FT
SPAN= 5-55 HRS, dt=.1 HRS
Tdet= 76.3 MIN (49.27 AF)

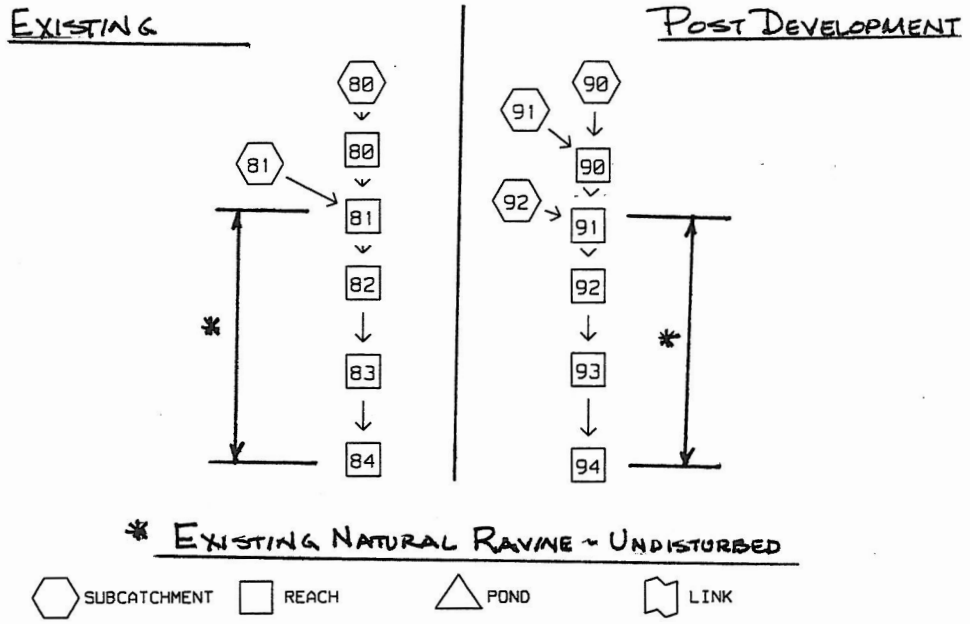
#	ROUTE	INVERT	OUTLET DEVICES
1	P	39.5'	**48" CULVERT**
			n=.013 L=30' S=.01'/' Ke=.5 Cc=.9 Cd=.6 TW=42.1'



ROUTE 608 CULVERT REPLACEMENT

- **CHANNEL ADEQUACY CALCULATIONS**

WATERSHED ROUTING ==========



SUBCATCHMENT 80 **EXISTING ROADWAY AND DRAINAGE AREA**

PEAK= 2.62 CFS @ 11.88 HRS, VOLUME= .13 AF

ACRES	CN	
2.58	70	WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.80 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**EXISTING ROADWAY/ADJACENT AREA**	1.5
Paved Kv=20.3282 L=500' s=.07 '/' V=5.38 fps		

SUBCATCHMENT 81 **ROADSIDE SLOPE AND SHOULDER**

PEAK= .18 CFS @ 11.90 HRS, VOLUME= .01 AF

ACRES	CN	
.18	70	GRADED SLOPE/SHOLUDER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.80 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**SLOPE/SHOULDER**	4.0

SUBCATCHMENT 90 **UNDISTRUBED ADJACENT AREA**

PEAK= .37 CFS @ 11.94 HRS, VOLUME= .04 AF

ACRES	CN	
1.63	60	FIELD/WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.80 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**UNDISTURBED ARCHEOLOGICAL SITE**	4.4
Short Grass Pasture Kv=7 L=500' s=.072 '/' V=1.88 fps		

SUBCATCHMENT 91 **URBAN COLLECTOR/SLOPES**

PEAK= 3.75 CFS @ 11.90 HRS, VOLUME= .18 AF

ACRES	CN	
1.29	70	SHOULDER/CUT SLOPE
.72	98	PAVEMENT
2.01	80	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.80 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**IMPROVED ROADWAY**	5.0

SUBCATCHMENT 92 **ROADSIDE SLOPE AND SHOULDER**

PEAK= .18 CFS @ 11.90 HRS, VOLUME= .01 AF

ACRES	CN	
.18	70	GRADED SLOPE/SHOLUDER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.80 IN
SPAN= 5-55 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**SLOPE/SHOULDER**	4.0

REACH 80 **EXISTING CULVERT**

Qin = 2.62 CFS @ 11.88 HRS, VOLUME= .13 AF
Qout= 2.56 CFS @ 11.89 HRS, VOLUME= .13 AF, ATTEN= 2%, LAG= .2 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.57
.40	.45	2.40
.60	.79	5.37
1.40	2.35	22.94
1.60	2.69	26.78
1.80	2.98	29.20
1.88	3.06	29.47
1.94	3.11	29.20
2.00	3.14	27.40

24" PIPE
n= .024
LENGTH= 70 FT
SLOPE= .05 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .41 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 81 **NATURAL RAVINE 00+50 BELOW CULVERT**

Qin = 2.74 CFS @ 11.89 HRS, VOLUME= .14 AF
Qout= 2.67 CFS @ 11.89 HRS, VOLUME= .14 AF, ATTEN= 2%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
76.00	0.0	0.00
78.00	38.0	38.23
80.00	136.0	60.37

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .08 FT/FT
CAPACITY= 982.3 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 76.03 FT
PEAK VELOCITY= 4.2 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 82 **NATURAL RAVINE 1+00 BELOW CULVERT**

Qin = 2.67 CFS @ 11.89 HRS, VOLUME= .14 AF
Qout= 2.62 CFS @ 11.90 HRS, VOLUME= .14 AF, ATTEN= 2%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
72.00	0.0	0.00
74.00	56.0	53.16
76.00	178.0	69.49

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .13 FT/FT
CAPACITY= 1785.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 72.02 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 83 **NATURAL RAVINE 1+50 BELOW CULVERT**

Qin = 2.62 CFS @ 11.90 HRS, VOLUME= .14 AF
Qout= 2.47 CFS @ 11.91 HRS, VOLUME= .14 AF, ATTEN= 6%, LAG= .6 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
65.50	0.0	0.00
66.00	15.0	42.02
68.00	115.0	58.64

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .07 FT/FT
CAPACITY= 708.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 65.54 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 84 **NATURAL RAVINE 2+00 BELOW CULVERT**

Qin = 2.47 CFS @ 11.91 HRS, VOLUME= .14 AF
Qout= 2.38 CFS @ 11.91 HRS, VOLUME= .14 AF, ATTEN= 4%, LAG= .5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
62.00	0.0	0.00
64.00	39.0	39.21
66.00	134.0	56.55

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .04 FT/FT
CAPACITY= 707.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 62.04 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 90 **REPLACEMENT CULVERT**

Qin = 4.10 CFS @ 11.91 HRS, VOLUME= .22 AF
Qout= 4.02 CFS @ 11.91 HRS, VOLUME= .22 AF, ATTEN= 2%, LAG= .2 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	1.20
.40	.45	5.05
.60	.79	11.29
1.40	2.35	48.29
1.60	2.69	56.38
1.80	2.98	61.47
1.88	3.06	62.04
1.94	3.11	61.47
2.00	3.14	57.68

24" PIPE
n= .013
LENGTH= 82 FT
SLOPE= .065 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .35 FT
PEAK VELOCITY= 10.8 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 91 **NATURAL RAVINE 00+50 BELOW CULVERT**

Qin = 4.20 CFS @ 11.91 HRS, VOLUME= .23 AF
Qout= 4.05 CFS @ 11.91 HRS, VOLUME= .23 AF, ATTEN= 3%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
76.00	0.0	0.00
78.00	38.0	38.23
80.00	136.0	60.37

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .08 FT/FT
CAPACITY= 982.3 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 76.05 FT
PEAK VELOCITY= 4.2 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 92 **NATURAL RAVINE 1+00 BELOW CULVERT**

Qin = 4.05 CFS @ 11.91 HRS, VOLUME= .23 AF
Qout= 3.95 CFS @ 11.92 HRS, VOLUME= .23 AF, ATTEN= 2%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
72.00	0.0	0.00
74.00	56.0	53.16
76.00	178.0	69.49

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .13 FT/FT
CAPACITY= 1785.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 72.03 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 93 **NATURAL RAVINE 1+50 BELOW CULVERT**

Qin = 3.95 CFS @ 11.92 HRS, VOLUME= .23 AF
Qout= 3.72 CFS @ 11.94 HRS, VOLUME= .23 AF, ATTEN= 6%, LAG= 1.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
65.50	0.0	0.00
66.00	15.0	42.02
68.00	115.0	58.64

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .07 FT/FT
CAPACITY= 708.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 65.56 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-55 HRS, dt=.1 HRS

REACH 94 **NATURAL RAVINE 2+00 BELOW CULVERT**

Qin = 3.72 CFS @ 11.94 HRS, VOLUME= .23 AF
Qout= 3.64 CFS @ 11.95 HRS, VOLUME= .23 AF, ATTEN= 2%, LAG= .9 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
62.00	0.0	0.00
64.00	39.0	39.21
66.00	134.0	56.55

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .04 FT/FT
CAPACITY= 707.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 62.06 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-55 HRS, dt=.1 HRS

SUBCATCHMENT 80 **EXISTING ROADWAY AND DRAINAGE AREA**

PEAK= 4.76 CFS @ 11.90 HRS, VOLUME= .20 AF

ACRES	CN	
2.58	70	WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**EXISTING ROADWAY/ADJACENT AREA**	1.5
Paved Kv=20.3282 L=500' s=.07 '/' V=5.38 fps		

SUBCATCHMENT 81 **ROADSIDE SLOPE AND SHOULDER**

PEAK= .30 CFS @ 11.93 HRS, VOLUME= .01 AF

ACRES	CN	
.18	70	GRADED SLOPE/SHOLUDER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**SLOPE/SHOULDER**	4.0

SUBCATCHMENT 90 **UNDISTRUBED ADJACENT AREA**

PEAK= 1.17 CFS @ 11.95 HRS, VOLUME= .06 AF

ACRES	CN	
1.63	60	FIELD/WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**UNDISTURBED ARCHEOLOGICAL SITE**	4.4
Short Grass Pasture Kv=7 L=500' s=.072 '/' V=1.88 fps		

SUBCATCHMENT 91 **URBAN COLLECTOR/SLOPES**

PEAK= 5.58 CFS @ 11.94 HRS, VOLUME= .26 AF

ACRES	CN	
1.29	70	SHOULDER/CUT SLOPE
.72	98	PAVEMENT
2.01	80	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**IMPROVED ROADWAY**	5.0

SUBCATCHMENT 92 **ROADSIDE SLOPE AND SHOULDER**

PEAK= .30 CFS @ 11.93 HRS, VOLUME= .01 AF

ACRES	CN	
.18	70	GRADED SLOPE/SHOLUDER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 3.36 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**SLOPE/SHOULDER**	4.0

REACH 80 **EXISTING CULVERT**

Qin = 4.76 CFS @ 11.90 HRS, VOLUME= .20 AF
Qout= 4.63 CFS @ 11.90 HRS, VOLUME= .20 AF, ATTEN= 3%, LAG= .2 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.57
.40	.45	2.40
.60	.79	5.37
1.40	2.35	22.94
1.60	2.69	26.78
1.80	2.98	29.20
1.88	3.06	29.47
1.94	3.11	29.20
2.00	3.14	27.40

24" PIPE
n= .024
LENGTH= 70 FT
SLOPE= .05 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .56 FT
PEAK VELOCITY= 6.6 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 81 **NATURAL RAVINE 00+50 BELOW CULVERT**

Qin = 4.91 CFS @ 11.90 HRS, VOLUME= .21 AF
Qout= 4.77 CFS @ 11.91 HRS, VOLUME= .21 AF, ATTEN= 3%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
76.00	0.0	0.00
78.00	38.0	38.23
80.00	136.0	60.37

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .08 FT/FT
CAPACITY= 982.3 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 76.06 FT
PEAK VELOCITY= 4.2 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 82 **NATURAL RAVINE 1+00 BELOW CULVERT**

Qin = 4.77 CFS @ 11.91 HRS, VOLUME= .21 AF
Qout= 4.67 CFS @ 11.91 HRS, VOLUME= .21 AF, ATTEN= 2%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
72.00	0.0	0.00
74.00	56.0	53.16
76.00	178.0	69.49

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .13 FT/FT
CAPACITY= 1785.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 72.03 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 83 **NATURAL RAVINE 1+50 BELOW CULVERT**

Qin = 4.67 CFS @ 11.91 HRS, VOLUME= .21 AF
Qout= 4.54 CFS @ 11.93 HRS, VOLUME= .21 AF, ATTEN= 3%, LAG= 1.0 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
65.50	0.0	0.00
66.00	15.0	42.02
68.00	115.0	58.64

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .07 FT/FT
CAPACITY= 708.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 65.57 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 84 **NATURAL RAVINE 2+00 BELOW CULVERT**

Qin = 4.54 CFS @ 11.93 HRS, VOLUME= .21 AF
Qout= 4.47 CFS @ 11.94 HRS, VOLUME= .21 AF, ATTEN= 2%, LAG= .5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
62.00	0.0	0.00
64.00	39.0	39.21
66.00	134.0	56.55

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .04 FT/FT
CAPACITY= 707.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 62.08 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 90 **REPLACEMENT CULVERT**

Qin = 6.73 CFS @ 11.94 HRS, VOLUME= .32 AF
Qout= 6.68 CFS @ 11.94 HRS, VOLUME= .32 AF, ATTEN= 1%, LAG= .1 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	1.20
.40	.45	5.05
.60	.79	11.29
1.40	2.35	48.29
1.60	2.69	56.38
1.80	2.98	61.47
1.88	3.06	62.04
1.94	3.11	61.47
2.00	3.14	57.68

24" PIPE
n= .013
LENGTH= 82 FT
SLOPE= .065 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .45 FT
PEAK VELOCITY= 12.4 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 91 **NATURAL RAVINE 00+50 BELOW CULVERT**

Qin = 6.98 CFS @ 11.94 HRS, VOLUME= .33 AF
Qout= 6.86 CFS @ 11.95 HRS, VOLUME= .33 AF, ATTEN= 2%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
76.00	0.0	0.00
78.00	38.0	38.23
80.00	136.0	60.37

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .08 FT/FT
CAPACITY= 982.3 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 76.09 FT
PEAK VELOCITY= 4.2 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 92 **NATURAL RAVINE 1+00 BELOW CULVERT**

Qin = 6.86 CFS @ 11.95 HRS, VOLUME= .33 AF
Qout= 6.77 CFS @ 11.95 HRS, VOLUME= .33 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
72.00	0.0	0.00
74.00	56.0	53.16
76.00	178.0	69.49

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .13 FT/FT
CAPACITY= 1785.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 72.04 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 93 **NATURAL RAVINE 1+50 BELOW CULVERT**

Qin = 6.77 CFS @ 11.95 HRS, VOLUME= .33 AF
Qout= 6.51 CFS @ 11.97 HRS, VOLUME= .33 AF, ATTEN= 4%, LAG= .8 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
65.50	0.0	0.00
66.00	15.0	42.02
68.00	115.0	58.64

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .07 FT/FT
CAPACITY= 708.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 65.61 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 94 **NATURAL RAVINE 2+00 BELOW CULVERT**

Qin = 6.51 CFS @ 11.97 HRS, VOLUME= .33 AF
Qout= 6.41 CFS @ 11.98 HRS, VOLUME= .33 AF, ATTEN= 1%, LAG= .7 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
62.00	0.0	0.00
64.00	39.0	39.21
66.00	134.0	56.55

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .04 FT/FT
CAPACITY= 707.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 62.11 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-30 HRS, dt=.05 HRS

SUBCATCHMENT 80 **EXISTING ROADWAY AND DRAINAGE AREA**

PEAK= 10.83 CFS @ 11.89 HRS, VOLUME= .44 AF

ACRES	CN	
2.58	70	WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**EXISTING ROADWAY/ADJACENT AREA**	1.5
Paved Kv=20.3282 L=500' s=.07 '/' V=5.38 fps		

SUBCATCHMENT 81 **ROADSIDE SLOPE AND SHOULDER**

PEAK= .69 CFS @ 11.93 HRS, VOLUME= .03 AF

ACRES	CN	
.18	70	GRADED SLOPE/SHOLUDER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**SLOPE/SHOULDER**	4.0

SUBCATCHMENT 90 **UNDISTRUBED ADJACENT AREA**

PEAK= 3.89 CFS @ 11.94 HRS, VOLUME= .18 AF

ACRES	CN	
1.63	60	FIELD/WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**UNDISTURBED ARCHEOLOGICAL SITE**	4.4
Short Grass Pasture Kv=7 L=500' s=.072 '/' V=1.88 fps		

SUBCATCHMENT 91 **URBAN COLLECTOR/SLOPES**

PEAK= 10.53 CFS @ 11.93 HRS, VOLUME= .49 AF

ACRES	CN	
1.29	70	SHOULDER/CUT SLOPE
.72	98	PAVEMENT
2.01	80	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**IMPROVED ROADWAY**	5.0

SUBCATCHMENT 92 **ROADSIDE SLOPE AND SHOULDER**

PEAK= .69 CFS @ 11.93 HRS, VOLUME= .03 AF

ACRES	CN	
.18	70	GRADED SLOPE/SHOLUDER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 5.04 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**SLOPE/SHOULDER**	4.0

REACH 80 **EXISTING CULVERT**

Qin = 10.83 CFS @ 11.89 HRS, VOLUME= .44 AF
Qout= 10.62 CFS @ 11.90 HRS, VOLUME= .44 AF, ATTEN= 2%, LAG= .1 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.57
.40	.45	2.40
.60	.79	5.37
1.40	2.35	22.94
1.60	2.69	26.78
1.80	2.98	29.20
1.88	3.06	29.47
1.94	3.11	29.20
2.00	3.14	27.40

24" PIPE
n= .024
LENGTH= 70 FT
SLOPE= .05 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .84 FT
PEAK VELOCITY= 8.5 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 81 **NATURAL RAVINE 00+50 BELOW CULVERT**

Qin = 11.26 CFS @ 11.90 HRS, VOLUME= .48 AF
Qout= 10.98 CFS @ 11.90 HRS, VOLUME= .48 AF, ATTEN= 3%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
76.00	0.0	0.00
78.00	38.0	38.23
80.00	136.0	60.37

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .08 FT/FT
CAPACITY= 982.3 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 76.14 FT
PEAK VELOCITY= 4.2 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 82 **NATURAL RAVINE 1+00 BELOW CULVERT**

Qin = 10.98 CFS @ 11.90 HRS, VOLUME= .48 AF
Qout= 10.78 CFS @ 11.91 HRS, VOLUME= .48 AF, ATTEN= 2%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
72.00	0.0	0.00
74.00	56.0	53.16
76.00	178.0	69.49

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .13 FT/FT
CAPACITY= 1785.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 72.07 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 83 **NATURAL RAVINE 1+50 BELOW CULVERT**

Qin = 10.78 CFS @ 11.91 HRS, VOLUME= .48 AF
Qout= 10.30 CFS @ 11.92 HRS, VOLUME= .48 AF, ATTEN= 4%, LAG= .9 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
65.50	0.0	0.00
66.00	15.0	42.02
68.00	115.0	58.64

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .07 FT/FT
CAPACITY= 708.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 65.68 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 84 **NATURAL RAVINE 2+00 BELOW CULVERT**

Qin = 10.30 CFS @ 11.92 HRS, VOLUME= .48 AF
Qout= 10.26 CFS @ 11.93 HRS, VOLUME= .48 AF, ATTEN= 0%, LAG= .6 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
62.00	0.0	0.00
64.00	39.0	39.21
66.00	134.0	56.55

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .04 FT/FT
CAPACITY= 707.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 62.17 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 90 **REPLACEMENT CULVERT**

Qin = 14.41 CFS @ 11.94 HRS, VOLUME= .67 AF
Qout= 14.35 CFS @ 11.94 HRS, VOLUME= .67 AF, ATTEN= 0%, LAG= .1 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	1.20
.40	.45	5.05
.60	.79	11.29
1.40	2.35	48.29
1.60	2.69	56.38
1.80	2.98	61.47
1.88	3.06	62.04
1.94	3.11	61.47
2.00	3.14	57.68

24" PIPE
n= .013
LENGTH= 82 FT
SLOPE= .065 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .66 FT
PEAK VELOCITY= 15.5 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 91 **NATURAL RAVINE 00+50 BELOW CULVERT**

Qin = 15.03 CFS @ 11.94 HRS, VOLUME= .70 AF
Qout= 14.82 CFS @ 11.94 HRS, VOLUME= .70 AF, ATTEN= 1%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
76.00	0.0	0.00
78.00	38.0	38.23
80.00	136.0	60.37

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .08 FT/FT
CAPACITY= 982.3 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 76.19 FT
PEAK VELOCITY= 4.2 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 92 **NATURAL RAVINE 1+00 BELOW CULVERT**

Qin = 14.82 CFS @ 11.94 HRS, VOLUME= .70 AF
Qout= 14.65 CFS @ 11.95 HRS, VOLUME= .70 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
72.00	0.0	0.00
74.00	56.0	53.16
76.00	178.0	69.49

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .13 FT/FT
CAPACITY= 1785.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 72.09 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 93 **NATURAL RAVINE 1+50 BELOW CULVERT**

Qin = 14.65 CFS @ 11.95 HRS, VOLUME= .70 AF
Qout= 14.14 CFS @ 11.96 HRS, VOLUME= .70 AF, ATTEN= 3%, LAG= .7 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
65.50	0.0	0.00
66.00	15.0	42.02
68.00	115.0	58.64

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .07 FT/FT
CAPACITY= 708.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 65.74 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 94 **NATURAL RAVINE 2+00 BELOW CULVERT**

Qin = 14.14 CFS @ 11.96 HRS, VOLUME= .70 AF
Qout= 13.83 CFS @ 11.97 HRS, VOLUME= .70 AF, ATTEN= 2%, LAG= .6 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
62.00	0.0	0.00
64.00	39.0	39.21
66.00	134.0	56.55

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .04 FT/FT
CAPACITY= 707.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 62.24 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-30 HRS, dt=.05 HRS

SUBCATCHMENT 80 **EXISTING ROADWAY AND DRAINAGE AREA**

PEAK= 15.60 CFS @ 11.89 HRS, VOLUME= .64 AF

ACRES	CN	
2.58	70	WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 6.24 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**EXISTING ROADWAY/ADJACENT AREA**	1.5
Paved Kv=20.3282 L=500' s=.07 '/' V=5.38 fps		

SUBCATCHMENT 81 **ROADSIDE SLOPE AND SHOULDER**

PEAK= .98 CFS @ 11.92 HRS, VOLUME= .04 AF

ACRES	CN	
.18	70	GRADED SLOPE/SHOLUDER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 6.24 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**SLOPE/SHOULDER**	4.0

SUBCATCHMENT 90 **UNDISTRUBED ADJACENT AREA**

PEAK= 6.24 CFS @ 11.94 HRS, VOLUME= .28 AF

ACRES	CN	
1.63	60	FIELD/WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 6.24 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**UNDISTURBED ARCHEOLOGICAL SITE**	4.4
Short Grass Pasture Kv=7 L=500' s=.072 '/' V=1.88 fps		

SUBCATCHMENT 91 **URBAN COLLECTOR/SLOPES**

PEAK= 14.17 CFS @ 11.93 HRS, VOLUME= .67 AF

ACRES	CN	
1.29	70	SHOULDER/CUT SLOPE
.72	98	PAVEMENT
2.01	80	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 6.24 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**IMPROVED ROADWAY**	5.0

SUBCATCHMENT 92 **ROADSIDE SLOPE AND SHOULDER**

PEAK= .98 CFS @ 11.92 HRS, VOLUME= .04 AF

ACRES	CN	
.18	70	GRADED SLOPE/SHOLUDER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 6.24 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**SLOPE/SHOULDER**	4.0

REACH 80 **EXISTING CULVERT**

Qin = 15.60 CFS @ 11.89 HRS, VOLUME= .64 AF
Qout= 15.37 CFS @ 11.89 HRS, VOLUME= .64 AF, ATTEN= 1%, LAG= .1 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.57
.40	.45	2.40
.60	.79	5.37
1.40	2.35	22.94
1.60	2.69	26.78
1.80	2.98	29.20
1.88	3.06	29.47
1.94	3.11	29.20
2.00	3.14	27.40

24" PIPE
n= .024
LENGTH= 70 FT
SLOPE= .05 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.06 FT
PEAK VELOCITY= 9.2 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 81 **NATURAL RAVINE 00+50 BELOW CULVERT**

Qin = 16.30 CFS @ 11.89 HRS, VOLUME= .69 AF
Qout= 15.89 CFS @ 11.90 HRS, VOLUME= .69 AF, ATTEN= 3%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
76.00	0.0	0.00
78.00	38.0	38.23
80.00	136.0	60.37

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .08 FT/FT
CAPACITY= 982.3 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 76.20 FT
PEAK VELOCITY= 4.2 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 82 **NATURAL RAVINE 1+00 BELOW CULVERT**

Qin = 15.89 CFS @ 11.90 HRS, VOLUME= .69 AF
Qout= 15.60 CFS @ 11.90 HRS, VOLUME= .69 AF, ATTEN= 2%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
72.00	0.0	0.00
74.00	56.0	53.16
76.00	178.0	69.49

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .13 FT/FT
CAPACITY= 1785.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 72.10 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 83 **NATURAL RAVINE 1+50 BELOW CULVERT**

Qin = 15.60 CFS @ 11.90 HRS, VOLUME= .69 AF
Qout= 14.92 CFS @ 11.92 HRS, VOLUME= .69 AF, ATTEN= 4%, LAG= .8 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
65.50	0.0	0.00
66.00	15.0	42.02
68.00	115.0	58.64

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .07 FT/FT
CAPACITY= 708.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 65.76 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 84 **NATURAL RAVINE 2+00 BELOW CULVERT**

Qin = 14.92 CFS @ 11.92 HRS, VOLUME= .69 AF
Qout= 14.84 CFS @ 11.93 HRS, VOLUME= .69 AF, ATTEN= 1%, LAG= .6 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
62.00	0.0	0.00
64.00	39.0	39.21
66.00	134.0	56.55

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .04 FT/FT
CAPACITY= 707.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 62.25 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 90 **REPLACEMENT CULVERT**

Qin = 20.41 CFS @ 11.93 HRS, VOLUME= .95 AF
Qout= 20.31 CFS @ 11.94 HRS, VOLUME= .95 AF, ATTEN= 0%, LAG= .1 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	1.20
.40	.45	5.05
.60	.79	11.29
1.40	2.35	48.29
1.60	2.69	56.38
1.80	2.98	61.47
1.88	3.06	62.04
1.94	3.11	61.47
2.00	3.14	57.68

24" PIPE
n= .013
LENGTH= 82 FT
SLOPE= .065 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .79 FT
PEAK VELOCITY= 17.3 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 91 **NATURAL RAVINE 00+50 BELOW CULVERT**

Qin = 21.30 CFS @ 11.94 HRS, VOLUME= 1.00 AF
Qout= 21.03 CFS @ 11.94 HRS, VOLUME= 1.00 AF, ATTEN= 1%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
76.00	0.0	0.00
78.00	38.0	38.23
80.00	136.0	60.37

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .08 FT/FT
CAPACITY= 982.3 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 76.26 FT
PEAK VELOCITY= 4.2 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 92 **NATURAL RAVINE 1+00 BELOW CULVERT**

Qin = 21.03 CFS @ 11.94 HRS, VOLUME= 1.00 AF
Qout= 20.81 CFS @ 11.94 HRS, VOLUME= 1.00 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
72.00	0.0	0.00
74.00	56.0	53.16
76.00	178.0	69.49

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .13 FT/FT
CAPACITY= 1785.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 72.13 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 93 **NATURAL RAVINE 1+50 BELOW CULVERT**

Qin = 20.81 CFS @ 11.94 HRS, VOLUME= 1.00 AF
Qout= 20.13 CFS @ 11.96 HRS, VOLUME= 1.00 AF, ATTEN= 3%, LAG= .7 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
65.50	0.0	0.00
66.00	15.0	42.02
68.00	115.0	58.64

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .07 FT/FT
CAPACITY= 708.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 65.85 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 94 **NATURAL RAVINE 2+00 BELOW CULVERT**

Qin = 20.13 CFS @ 11.96 HRS, VOLUME= 1.00 AF
Qout= 19.71 CFS @ 11.96 HRS, VOLUME= 1.00 AF, ATTEN= 2%, LAG= .5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
62.00	0.0	0.00
64.00	39.0	39.21
66.00	134.0	56.55

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .04 FT/FT
CAPACITY= 707.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 62.34 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-30 HRS, dt=.05 HRS

SUBCATCHMENT 80 **EXISTING ROADWAY AND DRAINAGE AREA**

PEAK= 21.57 CFS @ 11.89 HRS, VOLUME= .90 AF

ACRES	CN	
2.58	70	WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**EXISTING ROADWAY/ADJACENT AREA**	1.5
Paved Kv=20.3282 L=500' s=.07 '/' V=5.38 fps		

SUBCATCHMENT 81 **ROADSIDE SLOPE AND SHOULDER**

PEAK= 1.36 CFS @ 11.92 HRS, VOLUME= .06 AF

ACRES	CN	
.18	70	GRADED SLOPE/SHOLUDER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**SLOPE/SHOULDER**	4.0

SUBCATCHMENT 90 **UNDISTRUBED ADJACENT AREA**

PEAK= 9.32 CFS @ 11.93 HRS, VOLUME= .42 AF

ACRES	CN	
1.63	60	FIELD/WOODS

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
SHALLOW CONCENTRATED/UPLAND FLOW	**UNDISTURBED ARCHEOLOGICAL SITE**	4.4
Short Grass Pasture Kv=7 L=500' s=.072 '/' V=1.88 fps		

SUBCATCHMENT 91 **URBAN COLLECTOR/SLOPES**

PEAK= 18.58 CFS @ 11.93 HRS, VOLUME= .89 AF

ACRES	CN	
1.29	70	SHOULDER/CUT SLOPE
.72	98	PAVEMENT
2.01	80	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**IMPROVED ROADWAY**	5.0

SUBCATCHMENT 92 **ROADSIDE SLOPE AND SHOULDER**

PEAK= 1.36 CFS @ 11.92 HRS, VOLUME= .06 AF

ACRES	CN	
.18	70	GRADED SLOPE/SHOLUDER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 7.68 IN
SPAN= 5-30 HRS, dt=.05 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**SLOPE/SHOULDER**	4.0

REACH 80 **EXISTING CULVERT**

Qin = 21.57 CFS @ 11.89 HRS, VOLUME= .90 AF
Qout= 21.27 CFS @ 11.89 HRS, VOLUME= .90 AF, ATTEN= 1%, LAG= .1 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.57
.40	.45	2.40
.60	.79	5.37
1.40	2.35	22.94
1.60	2.69	26.78
1.80	2.98	29.20
1.88	3.06	29.47
1.94	3.11	29.20
2.00	3.14	27.40

24" PIPE
n= .024
LENGTH= 70 FT
SLOPE= .05 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.32 FT
PEAK VELOCITY= 9.7 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 81 **NATURAL RAVINE 00+50 BELOW CULVERT**

Qin = 22.56 CFS @ 11.89 HRS, VOLUME= .96 AF
Qout= 22.02 CFS @ 11.90 HRS, VOLUME= .96 AF, ATTEN= 2%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
76.00	0.0	0.00
78.00	38.0	38.23
80.00	136.0	60.37

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .08 FT/FT
CAPACITY= 982.3 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 76.28 FT
PEAK VELOCITY= 4.2 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 82 **NATURAL RAVINE 1+00 BELOW CULVERT**

Qin = 22.02 CFS @ 11.90 HRS, VOLUME= .96 AF
Qout= 21.64 CFS @ 11.90 HRS, VOLUME= .96 AF, ATTEN= 2%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
72.00	0.0	0.00
74.00	56.0	53.16
76.00	178.0	69.49

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .13 FT/FT
CAPACITY= 1785.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 72.14 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 83 **NATURAL RAVINE 1+50 BELOW CULVERT**

Qin = 21.64 CFS @ 11.90 HRS, VOLUME= .96 AF
Qout= 20.73 CFS @ 11.91 HRS, VOLUME= .96 AF, ATTEN= 4%, LAG= .8 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
65.50	0.0	0.00
66.00	15.0	42.02
68.00	115.0	58.64

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .07 FT/FT
CAPACITY= 708.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 65.86 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 84 **NATURAL RAVINE 2+00 BELOW CULVERT**

Qin = 20.73 CFS @ 11.91 HRS, VOLUME= .96 AF
Qout= 20.58 CFS @ 11.93 HRS, VOLUME= .96 AF, ATTEN= 1%, LAG= .7 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
62.00	0.0	0.00
64.00	39.0	39.21
66.00	134.0	56.55

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .04 FT/FT
CAPACITY= 707.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 62.35 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 90 **REPLACEMENT CULVERT**

Qin = 27.91 CFS @ 11.93 HRS, VOLUME= 1.31 AF
Qout= 27.80 CFS @ 11.93 HRS, VOLUME= 1.31 AF, ATTEN= 0%, LAG= .1 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	1.20
.40	.45	5.05
.60	.79	11.29
1.40	2.35	48.29
1.60	2.69	56.38
1.80	2.98	61.47
1.88	3.06	62.04
1.94	3.11	61.47
2.00	3.14	57.68

24" PIPE
n= .013
LENGTH= 82 FT
SLOPE= .065 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .95 FT
PEAK VELOCITY= 18.6 FPS
TRAVEL TIME = .1 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 91 **NATURAL RAVINE 00+50 BELOW CULVERT**

Qin = 29.17 CFS @ 11.93 HRS, VOLUME= 1.38 AF
Qout= 28.82 CFS @ 11.94 HRS, VOLUME= 1.38 AF, ATTEN= 1%, LAG= .3 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
76.00	0.0	0.00
78.00	38.0	38.23
80.00	136.0	60.37

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .08 FT/FT
CAPACITY= 982.3 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 76.36 FT
PEAK VELOCITY= 4.2 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 92 **NATURAL RAVINE 1+00 BELOW CULVERT**

Qin = 28.82 CFS @ 11.94 HRS, VOLUME= 1.38 AF
Qout= 28.54 CFS @ 11.94 HRS, VOLUME= 1.38 AF, ATTEN= 1%, LAG= .2 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
72.00	0.0	0.00
74.00	56.0	53.16
76.00	178.0	69.49

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .13 FT/FT
CAPACITY= 1785.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 72.18 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 93 **NATURAL RAVINE 1+50 BELOW CULVERT**

Qin = 28.54 CFS @ 11.94 HRS, VOLUME= 1.38 AF
Qout= 27.64 CFS @ 11.95 HRS, VOLUME= 1.38 AF, ATTEN= 3%, LAG= .7 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
65.50	0.0	0.00
66.00	15.0	42.02
68.00	115.0	58.64

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .07 FT/FT
CAPACITY= 708.4 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 65.98 FT
PEAK VELOCITY= 2.0 FPS
TRAVEL TIME = .4 MIN
SPAN= 5-30 HRS, dt=.05 HRS

REACH 94 **NATURAL RAVINE 2+00 BELOW CULVERT**

Qin = 27.64 CFS @ 11.95 HRS, VOLUME= 1.38 AF
Qout= 27.06 CFS @ 11.96 HRS, VOLUME= 1.38 AF, ATTEN= 2%, LAG= .5 MIN

ELEV (FT)	END AREA (SQ-FT)	PERIM (FT)
62.00	0.0	0.00
64.00	39.0	39.21
66.00	134.0	56.55

SPECIAL 50' CHANNEL
n= .1
LENGTH= 50 FT
SLOPE= .04 FT/FT
CAPACITY= 707.8 CFS

STOR-IND+TRANS METHOD
PEAK ELEV.= 62.47 FT
PEAK VELOCITY= 3.0 FPS
TRAVEL TIME = .3 MIN
SPAN= 5-30 HRS, dt=.05 HRS

TABLE ONE **IMPERVIOUS AREA ASSESSMENT : La Grange Parkway Extension**

		Begin	End	Length	Width ROW	Pavement Width	Turning Lanes / Cuts (s.f.)	ROW Area (Acres)	Paved Area (s.f.)	Paved Area (Acres)
La Grange Parkway EXISTING These sections are served by existing BMP"s										
	Station :	1050	2600	1550	100	58	17056	3.56	106956	2.46
Westmont Drive										
	Station :	1050	1650	600	60	29	0	0.83	17400	0.40
John Deere Road										
	Station :	1050	1600	550	60	29	0	0.76	15950	0.37
								5.14		3.22

La Grange Parkway Extension

Route 600										
	Station :	1015	1300	285	60	29	0	0.39	8265	0.19
Taper	Station :	1300	1350	50	60	20	0	0.07	1225	0.03
										0.22
Pavement Demo				650		20			13000	0.30
	Prior plats dedicate 1.33 Acres for the reconstruciton of this Intersection.							0.46		-0.08

La Grange Parkway to Proposed intersection of Route 600										
	Station :	2600	3000	400	100	85	0	0.92	34000	0.78
Taper	Station :	3000	3500	500	100	29	0	1.15	28500	0.65
	Station :	3500	4200	700	100	29	0	1.61	20300	0.47
	Does not take into account increase in R.O.W. for slopes / drainage.							3.67		1.90

I-64 RO	Station :									
		4200	5400	1200	n.a.	29	0	n.a.	34800	0.80
Pvmt. / Ditch Demo		4200	5400	1200		32			38400	0.88
	Construction to take place within the Limits of existing I-64 R.O.W.									-0.08

Route 608										
	Station :	1015	1050	35		27	0		945	0.02
Taper	Station :	1050	1300	250		21	0		6000	0.14
										0.16
Pavement Demo							10875		10875	0.25
	Construction to take place within the Limits of existing I-64 R.O.W.									-0.09

La Grange / Six Mount Zion Realignment										
	Station :	5400	6300	900	100	29	2700	2.07	28800	0.66
Taper	Station :	6300	6350	50	100	29	0	0.11	1450	0.03
	Station :	6350	7143	793	100	24	0	1.82	19032	0.44
										1.13
Pavement Demo				2140		18			38520	0.88
								4.00		0.25

DEVELOPMENT TOTALS: (Includes existing Commerce Park)

AREA SERVICED BY EXISTING 10 POINT BMP's :

Existing Stonehouse, Inc. Land dedicated to R.O.W.:	5.14	Acres
Area of Existing Paving within Commerce Park..:	3.22	Acres

AREA ASSOCIATED WITH PROPOSED EXTENSION :

Area of land reserved for future I-64 Interchange :	16.3	Acres
Area of land reserved from NOS/CE tract for Rt. 600:	1.33	Acres
Area of La Grange Extension R.O.W. per above :	8.14	Acres
Other Buffers and Open Space :	21.25	Acres
Total :	47.02	
Area of Paving proposed by LaGrange extension project :	4.21	Acres
Existing pavement to be demolished :	2.31	Acres
Percent Impervious	8.95%	

R/W = 13.29 AC.
4.21 AC. imp. (not to BMP)

STONEHOUSE COMMERCE PARK DEVELOPMENT INVENTORY

JCC PIN	CC SITE PLAN	LandMark #	PLAT ID.	DEED BK./PG.	OWNER NAME	AREA (Acres)	BLDG. AREA (square feet)	PARKING AND ROADS (square feet)	UNDEVELOPED OR OPEN SPACE (Acres)	DEDICATED UNDISTURBED NATURAL OPEN SPACE (Acres)
PARCELS DRAINING TO RICHARDSON MILL POND (Note: * Portions of Barre & Meadow View R.O.W. which also drain to RMP not included)										
1210100046	SP-46-00	11437W-11438W	SECTION C, PARCEL B	77 / 28&29	DESIGN MASTER	4.13	41245	64481	1.70	
1210100045	SP-47-99	0452W,10453W,11436	SECTION C, PARCEL C	73 / 38&39	JOHN DEERE					
					John Deere Phase 1	74.37	292000	318000	42.58	17.79
					John Deere Phase 2	Future > > >	162000	276000		
				TOTAL TO RICHARDSON MILL POND :		78.50	495245	658481	44.28	17.79
PARCELS DRAINING TO FRANCE SWAMP THROUGH EXISTING 10 PT. BMP's : (WQv Capable of supporting 30+ Acres of Impervious)										
1210100041	SP-11-95	11409W-11410W	SECTION A, PARCEL A-1	78 / 4&5	SOLAREX (Shell)	6.65	60000	37388	4.41	
1220100023		11409W-11410W	SECTION A, PARCEL A-2	78 / 4&5	J.C.C.I.D.A.	4.75			4.75	
1210100043	SP-7-98	11377W-11378W	SECTION B, LOT A	68 / 60&61	BARRE *	4.60	40000	35641	2.86	
1210100042	SP-96-95	5861W-5863W	SECTION A, PARCEL B	62 / 94,95,96	SOLAREX	15.00	66670	36000	12.64	
1210100044	SP-16-98	11377W-11378W	SECTION B, LOT B	68 / 60&61	AVID MEDICAL	3.10	30857	45007	1.36	
640100001			SECTION B, RESIDUAL		UNDEVELOPED	7.60			2.70	4.90
			AVID OPTION PARCEL		UNDEVELOPED	2.40			2.40	
OTHER LAND DRAINING TO FRANCE SWAMP:										
			SITE 15		UNDEVELOPED	7.40			6.29	1.11
			SITE 16		UNDEVELOPED	5.70			5.70	
			OPTION LOT		UNDEVELOPED	1.00			1.00	
			SITE 18		UNDEVELOPED	3.80			3.53	0.27
			SITE 19		UNDEVELOPED	10.00			6.81	3.19
			SITE 20		UNDEVELOPED	6.20			4.80	1.40
1210100047		11437W-11438W	SECTION C,	77/28&29,73/38&39	OWNER'S ASSOC.	16.85			16.85	
			PEDESTRIAN PATH		Future > > >	3.60		12000	3	
			SECTION B, BMP #1			1.80			1.80	
			SECTION A, BMP #2			1.80			1.80	
			BUFFERS & OPEN SPACE			21.25			14.55	6.70
		RESERVED FOR INTERCHANGE				16.30			16.30	
		ROAD RIGHTS OF WAY SOUTH OF I-64			*	9.28		140306	6.06	
				SUBTOTAL COMMERCE PARK TO FRANCE SWAMP :		149.07				
		POTENTIAL AREA NORTH OF I-64 OPENED BY LA GRANGE EXTENSION			UNDEVELOPED	216.70			216.70	
		PROPOSED ROAD RIGHTS OF WAY NORTH OF I-64				4.00		141572		
		5861W-5863W	SECTION A, NOS / CE TRAC	62 / 94,95,96		18.98			1.33	17.65
					TOTALS TO DATE:	388.75		645441		35.22

PERCENT IMPERVIOUS FRANCE SWAMP WATERSHED: 3.81%

Note: The area of Stonehouse, Inc. land exceeds 4,000 acres. This summary accounts for only that land which could front on the road improvments currently proposed.

TABLE TWO

LAGRANGE PARKWAY

#1

		Begin	End	Length	Width ROW	Pavement Width	Turning Lanes / Cuts (s.f.)	ROW Area (Acres)	Paved Area (s.f.)	Paved Area (Acres)
La Grange Parkway EXISTING These sections are served by existing BMP"s										
	Station :	1050	2600	1550	100	58	17056	3.56	106956	2.46
Westmont Drive										
	Station :	1050	1650	600	60	29	0	0.83	17400	0.40
John Deere Road										
	Station :	1050	1600	550	60	29	0	0.76	15950	0.37
								5.14		3.22
Route 600										
	Station :	1015	1300	285	60	29	0	0.39	8265	0.19
Taper	Station :	1300	1350	50	60	20	0	0.07	1225	0.03
										0.22
Pavement Demo				650		20			13000	0.30
Prior plats dedicate 1.33 Acres for the reconstruciton of this Intersection.								0.46		-0.08
La Grange Parkway EXTENSION										
	Station :	2600	3000	400	100	85	0	0.92	34000	0.78
Taper	Station :	3000	3500	500	100	29	0	1.15	28500	0.65
	Station :	3500	4200	700	100	29	0	1.61	20300	0.47
Does not take into account increase in R.O.W. for slopes / drainage.								3.67		1.90
I-64 RO	Station :									
		4200	5400	1200	n.a.	29	0	n.a.	34800	0.80
Pvmt. / Ditch Dem		4200	5400	1200		32			38400	0.88
Construction to take place within the Limits of existing I-64 R.O.W.										-0.08
Route 608										
	Station :	1015	1050	35		27	0		945	0.02
Taper	Station :	1050	1300	250		21	0		6000	0.14
										0.16
Pavement Demo							10875		10875	0.25
Construction to take place within the Limits of existing I-64 R.O.W.										-0.09
	Station :	5400	6300	900	100	29	2700	2.07	28800	0.66
Taper	Station :	6300	6350	50	100	29	0	0.11	1450	0.03
	Station :	6350	7143	793	100	24	0	1.82	19032	0.44
										1.13
Pavement Demo				2140		18			38520	0.88
								4.00		0.25

DEVELOPMENT TOTALS: (Includes existing Commerce Park)

AREA SERVICED BY EXISTING 10 POINT BMP's :

Existing Stonehouse, Inc. Land dedicated to R.O.W.:	5.14	Acres
Area of Existing Paving within Commerce Park..:	3.22	Acres

AREA ASSOCIATED WITH PROPOSED CONSTRUCTION :

Area of land reserved for future I-64 Interchange :	16.3	Acres
Area of land reserved from NOS/CE tract for Rt. 600:	1.33	Acres
Area of La Grange Extension R.O.W. per above :	8.14	Acres
Other Buffers and Open Space :	21.25	Acres
Total :	47.02	
Area of Paving proposed by LaGrange extension project :	4.21	Acres
Existing pavement to be demolished :	2.31	Acres
Percent Impervious	8.95%	

STONEHOUSE COMMERCE PARK DEVELOPMENT INVENTORY

JCC PIN	CC SITE PLAN	LandMark #	PLAT ID.	DEED BK./PG.	OWNER NAME	AREA (Acres)	BLDG. AREA (square feet)	PARKING AND ROADS (square feet)	UNDEVELOPED OR OPEN SPACE (Acres)	DEDICATED UNDISTURBED NATURAL OPEN SPACE (Acres)
PARCELS DRAINING TO RICHARDSON MILL POND (Note: * Portions of Barre & Meadow View R.O.W. which also drain to RMP not included)										
1210100046	SP-46-00	11437W-11438W	SECTION C, PARCEL B	77 / 28&29	DESIGN MASTER	4.13	41245	64481	1.70	
1210100045	SP-47-99	10452W,10453W,11436W	SECTION C, PARCEL C	73 / 38&39	JOHN DEERE					
					John Deere Phase 1	74.37	292000	318000	42.58	17.79
					John Deere Phase 2	Future > > >	162000	276000		
					TOTAL :	**78.50**	**495245**	**658481**	**44.28**	**17.79**
PARCELS DRAINING TO FRANCE SWAMP THROUGH EXISTING 10 PT. BMP's : (WQv Capable of supporting 30+ Acres of Impervious)										
#1 1210100041	SP-11-95	11409W-11410W	SECTION A, PARCEL A-1	78 / 4&5	SOLAREX (Shell)	6.65	60000	37388	4.41	
1220100023		11409W-11410W	SECTION A, PARCEL A-2	78 / 4&5	J.C.C.I.D.A.	4.75			4.75	
1210100043	SP-7-98	11377W-11378W	SECTION B, LOT A	68 / 60&61	BARRE *	4.60	40000	35641	2.86	
1210100042	SP-96-95	5861W-5863W	SECTION A, PARCEL B	62 / 94,95,96	SOLAREX	15.00	66670	36000	12.64	
#2 1210100044	SP-16-98	11377W-11378W	SECTION B, LOT B	68 / 60&61	AVID MEDICAL	3.10	30857	45007	1.36	
640100001			SECTION B, RESIDUAL		UNDEVELOPED	7.60			2.70	4.90
			AVID OPTION PARCEL		UNDEVELOPED	2.40			2.40	
OTHER LAND DRAINING TO FRANCE SWAMP:										
			SITE 15		UNDEVELOPED	7.40			6.29	1.11
			SITE 16		UNDEVELOPED	5.70			5.70	
			OPTION LOT		UNDEVELOPED	1.00			1.00	
			SITE 18		UNDEVELOPED	3.80			3.53	0.27
			SITE 19		UNDEVELOPED	10.00			6.81	3.19
			SITE 20		UNDEVELOPED	6.20			4.80	1.40
1210100047		11437W-11438W	SECTION C,	77/28&29,73/38&39	OWNER'S ASSOC.	16.85			16.85	
			PEDESTRIAN PATH		Future > > >	3.60		12000	3	
			SECTION B, BMP #1			1.80			1.80	
			SECTION A, BMP #2			1.80			1.80	
			BUFFERS & OPEN SPACE			21.25			14.55	6.70
		RESERVED FOR INTERCHANGE				16.30			16.30	
		ROAD RIGHTS OF WAY SOUTH OF I-64			*	9.28		140306	6.06	
		AREA NORTH OF I-64 OPEN BY LA GRANGE EXTENSION			UNDEVELOPED	216.70			216.70	
		ROAD RIGHTS OF WAY NORTH OF I-64				4.00		141572		
		5861W-5863W	SECTION A, NOS / CE TRACT	62 / 94,95,96		18.98			1.33	17.65
					TOTALS TO DATE:	**388.75**		**645441**		**35.22**
					PERCENT IMPERVIOUS :		**3.81%**			

Subject _____

Computed _____ Checked _____

LANDMARK DESIGN GROUP

Project # _____

Client _____

Date _____ Sheet # _____

Engineers • Planners • Surveyors • Landscape Architects • Environmental Consultants

COMMERCE PARK — 10 PT. ED POND — 2 IN/IMP ACRE

BMP #1

WET STORAGE VOLUME 138470 c.f. *

ΔV_{2Q} = 174220 c.f.

ΔV_{100Q} = 266371 c.f.

DRAINAGE AREA: 32.6 ACRES.

* CAN SUPPORT 19.1 ACRES IMPERVIOUS

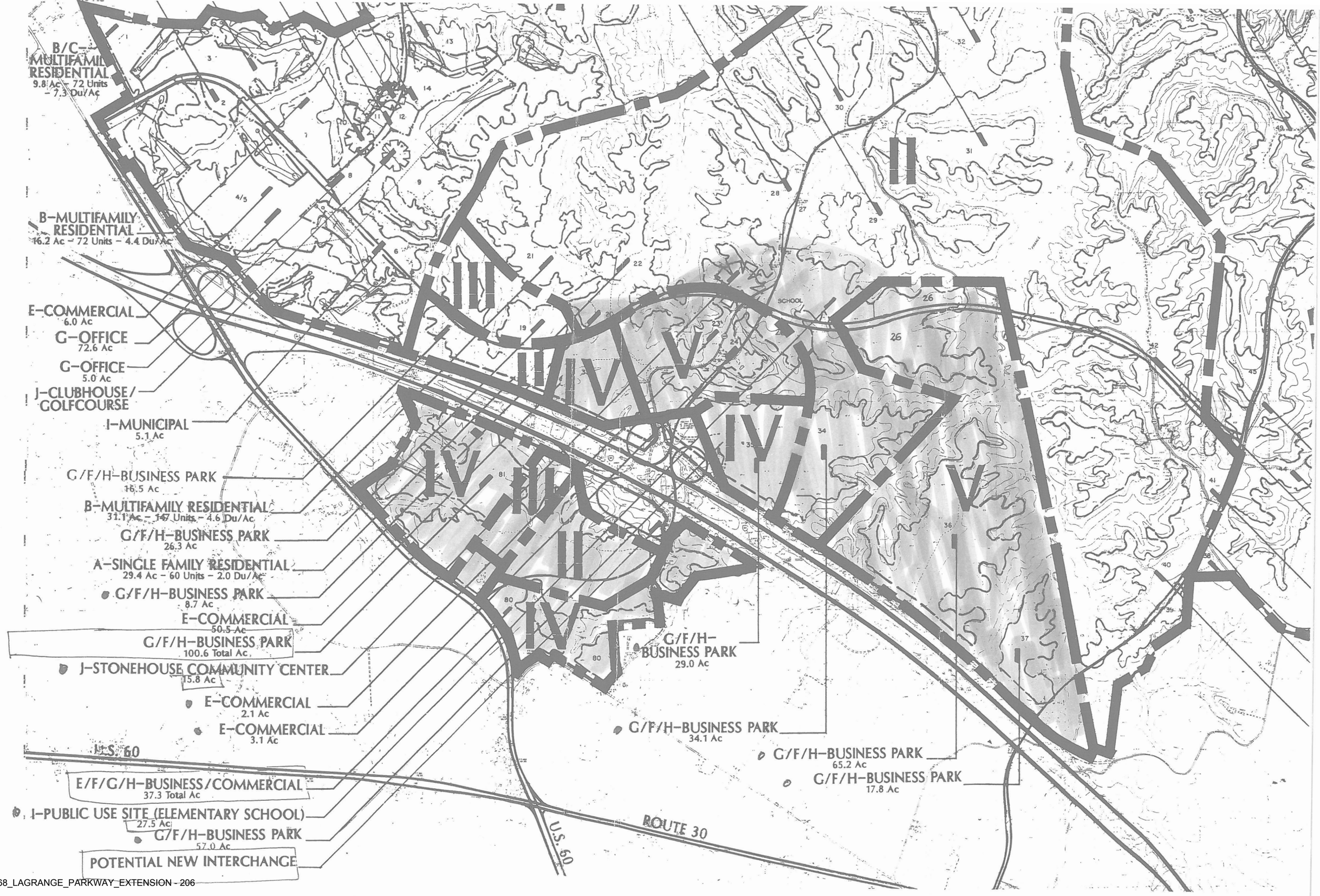
BMP # 2

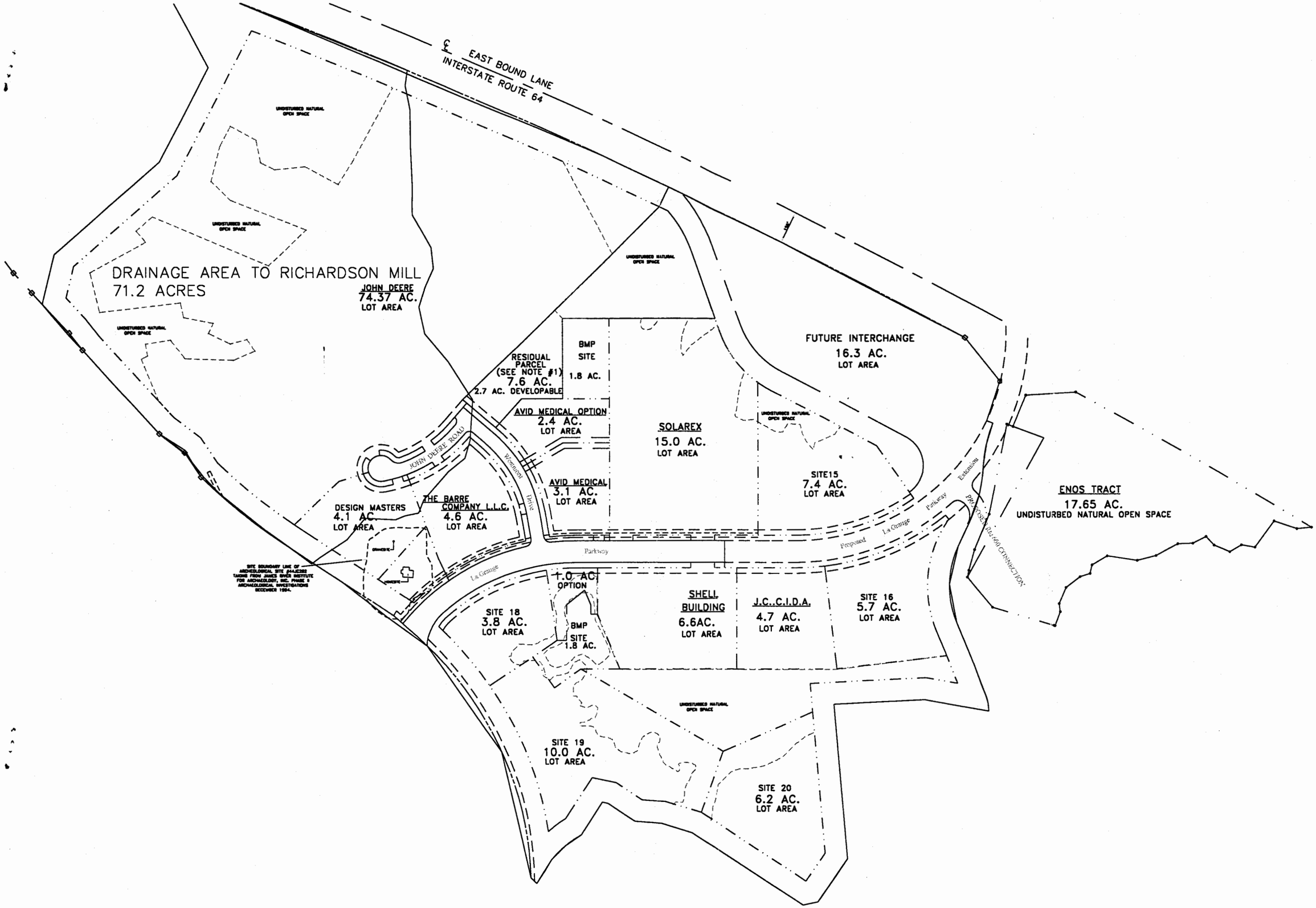
WET STORAGE 83635 c.f. *

DRAINAGE AREA: 25.1 ACRES @ I = 50

* CAN SUPPORT 11.52 ACRES

EXISTING POND DATA


B/C–MULTIFAMILY RESIDENTIAL
9.8 Ac – 72 Units – 7.3 Du/Ac
B–MULTIFAMILY RESIDENTIAL
16.2 Ac – 72 Units – 4.4 Du/Ac
E–COMMERCIAL
6.0 Ac
G–OFFICE
72.6 Ac
G–OFFICE
5.0 Ac
J–CLUBHOUSE/GOLFCOURSE
I–MUNICIPAL
5.1 Ac
G/F/H–BUSINESS PARK
16.5 Ac
B–MULTIFAMILY RESIDENTIAL
31.1 Ac – 147 Units – 4.6 Du/Ac
G/F/H–BUSINESS PARK
26.3 Ac
A–SINGLE FAMILY RESIDENTIAL
29.4 Ac – 60 Units – 2.0 Du/Ac
G/F/H–BUSINESS PARK
8.7 Ac
E–COMMERCIAL
50.5 Ac
G/F/H–BUSINESS PARK
100.6 Total Ac
J–STONEHOUSE COMMUNITY CENTER
15.8 Ac
E–COMMERCIAL
2.1 Ac
E–COMMERCIAL
3.1 Ac
U.S. 60
E/F/G/H–BUSINESS/COMMERCIAL
37.3 Total Ac
I–PUBLIC USE SITE (ELEMENTARY SCHOOL)
27.5 Ac
G/F/H–BUSINESS PARK
57.0 Ac
POTENTIAL NEW INTERCHANGE
G/F/H–BUSINESS PARK
29.0 Ac
G/F/H–BUSINESS PARK
34.1 Ac
G/F/H–BUSINESS PARK
65.2 Ac
G/F/H–BUSINESS PARK
17.8 Ac
SCHOOL
U.S. 60
ROUTE 30


℄ EAST BOUND LANE
INTERSTATE ROUTE 64
DRAINAGE AREA TO RICHARDSON MILL
71.2 ACRES
UNDISTURBED NATURAL OPEN SPACE
JOHN DEERE
74.37 AC.
LOT AREA
RESIDUAL PARCEL (SEE NOTE #1)
7.6 AC.
2.7 AC. DEVELOPABLE
BMP SITE
1.8 AC.
AVID MEDICAL OPTION
2.4 AC.
LOT AREA
AVID MEDICAL
3.1 AC.
LOT AREA
SOLAREX
15.0 AC.
LOT AREA
FUTURE INTERCHANGE
16.3 AC.
LOT AREA
SITE15
7.4 AC.
LOT AREA
ENOS TRACT
17.65 AC.
UNDISTURBED NATURAL OPEN SPACE
PROPOSED RIG-440 CONNECTION
Proposed La Grange Parkway Extension
JOHN DEERE ROAD
Westmont Drive
Parkway
La Grange
DESIGN MASTERS
4.1 AC.
LOT AREA
THE BARRE COMPANY L.L.C.
4.6 AC.
LOT AREA
SITE BOUNDARY LINE OF ARCHEOLOGICAL SITE (44JC202 TAKEN FROM JAMES RIVER INSTITUTE FOR ARCHAEOLOGY, INC. PHASE II ARCHAEOLOGICAL INVESTIGATIONS DECEMBER 1994.
1.0 AC.
OPTION
BMP SITE
1.8 AC.
SITE 18
3.8 AC.
LOT AREA
SHELL BUILDING
6.6AC.
LOT AREA
J.C..C.I.D.A.
4.7 AC.
LOT AREA
SITE 16
5.7 AC.
LOT AREA
SITE 19
10.0 AC.
LOT AREA
SITE 20
6.2 AC.
LOT AREA

REVISED MASTER PLAN WITH 25% SLOPE

1 PAR #	2 LAND USE	3 NET DV AREA	4 DENSTY DU/AC	5 # UNITS	6 SQ. FOOT X1,000	7 IMPRV RATE	8 BUFFER AREA	9 ROAD AREA	10 PATH AREA	11 WETLAND AREA	12 IMP AREA	13 NET IMP SURFAC
14	A- Single family residential	12.8	0.8	10.0		14%	45.1	0.0	0.0		2.2	4%
15	A- Single family residential	76.3	1.8	138.0		19%	23.2	3.7	1.5		17.4	17%
16	A- Single family residential	6.1	1.6	10.0		18%	11.9	0.0	0.0		1.2	7%
17	A- Single family residential	12.9	1.1	14.0		15%	11.8	0.0	0.0		2.1	8%
18	A- Single family residential	128.0	1.4	182		17%	122.6	3.2	1.3		25.3	10%
22	A - Single family residential	33.4	1.8	60		19%	59.0	0.0			6.9	8%
28	A - Single family residential	30.0	1.0	30		15%	22.7	0.0			4.7	9%
29	A - Single family residential	45.0	2.9	130		25%	47.1	1.0	0.9		12.6	13%
31	A - Single family residential	29.4	4.1	120		31%	46.2	0.0			9.6	13%
32	A - Single family residential	94.1	2.2	210		21%	147.8	5.0	0.6		24.4	10%
	Subtotal A - SFR	468.0		904.0			537.4	12.9	4.3	0.0	106.6	10%
1	B - Multifamily residential	26.8	6.0	161		45%	10.0	0.0	0.0		12.2	33%
7	B - Multifamily residential	15.2	5.1	78		40%	9.2	0.0			6.2	25%
21	B - Multifamily residential	44.8	3.3	147		26%	39.2	0.0			12.0	14%
30	B - Multifamily residential	29.1	1.0	30		15%	68.8	0.0			5.1	5%
	Subtotal B - MFR	115.9		416.0			127.2	0.0	0.0	0.0	35.4	15%
12	C/D - Multifamily residential	9.9	12.1	120		50%	18.1	0.0	0.1		5.2	18%
	Subtotal D - MFR	9.9		120			18.1	0.0	0.1	0.0	5.2	18%
8	E - Convention Center	8.8	0.0	0	250 Rooms	65%	10.4	0.8	0.3		6.4	32%
10	E - Commercial	5.2	0.0	0	25	70%	2.5	0.5	0.2		4.0	48%
23	E - Commercial	3.6	0.0	0	4	65%	0.6	2.3	0.3		3.8	56%
24	E - Commercial	2.8	0.0	0	8	65%	2.2	2.3	0.3		3.3	44%
33	E - Commercial	83.7	0.0	0.0	300	65%	29.2	0.0	0.0		54.7	48%
	Subtotal E - Comm.	104.1		0.0	337.0		44.9	5.9	1.1	0.0	72.3	46%
2	F/G - Office/Business	14.7	0.0	0	608	65%	5.9	3.9	0.8		12.2	48%
4	F/G - Office/Business	5.6	0.0	0		65%	2.1	3.0	0.6		5.7	50%
5	F/G - Office/Business	52.9	0.0	0		65%	20.9	9.9	2.1		41.2	48%
19	G - Office Park	9.0			90	65%	9.2	3.3	0.7		8.2	37%
20	G - Office Park	17.9	0.0	0	190	65%	2.9	5.7	1.2		15.5	56%
26	G - Office Park	55.1			400.0	65%	68.4	1.9	0.8		37.9	30%
34	G - Office Park	28.5			285.0	65%	32.2	0.0	0.0		18.8	31%
35	F - Business Park	31.5	0.0	0	280	65%	41.2	6.3	1.3		25.1	31%
81	F/G/H/ - R&D/Business	42.9	0.0	0	400	65%	33.1	0.0	0.0		28.2	37%
	Subtotal F/G/H	258.1		0	2253.0		215.9	34.0	7.5	0.0	192.8	37%
26	I - Municipal/School	21.0	0.0	0		55%	114.0	0.0	0.0		12.7	9%
38	I - Municipal Use	4.0	0.0	0		55%	0.0	0.0	0.0		2.2	55%
	Subtotal Public Use	25.0		0			114.0	0.0	0.0	0.0	14.9	11%
21	J - Park	3.0	0.0	0		1%	2.4	0.1	0.1		0.1	3%
25	J - Community Center	12.2	0.0	0		65%	6.9	0.0	0.0		8.0	42%
27	J - Park	7.6	0.0	0		1%	4.9	1.5	0.6		1.2	8%
	J - Recreation/Golf	242.2	0.0	0		2%	0.0	0.0	0.0		4.8	2%
6		13.8	0.0	0		1%	6.8	2.7	0.6		2.0	8%
9		6.3	0.0	0		1%	0.0	0.0	0.5		0.2	3%
13		7.2	0.0	0		1%	0.0	1.6	0.7		1.3	13%
	Subtotal J - Rec.	292.3		0.0			21.0	5.9	2.5	0.0	17.7	6%
	Total	1273.3		1440.0	2590.0		1078.5	58.7	15.5	0.0	444.9	18%
	Total area in acres	2426.0										

REVISED MASTER PLAN WITH 25% SLOPE
LAND DRAINING TO RICHARDSON'S MILL POND

1 PAR #	2 LAND USE	3 NET DV AREA	4 DENSTY DU/AC	5 # UNITS	6 SQ. FOOT X1,000	7 IMPRV RATE	8 BUFFER AREA	9 ROAD AREA	10 PATH AREA	11 WETLAND AREA	12 IMP AREA	13 NET IMP SURFAC
14	A- Single family residential	12.8	0.8	10.0		14%	45.1	0.0	0.0		2.2	4%
15	A- Single family residential	76.3	1.8	138.0		19%	23.2	3.7	1.5		17.4	17%
16	A- Single family residential	6.1	1.6	10.0		18%	11.9	0.0	0.0		1.2	7%
17	A- Single family residential	12.9	1.1	14.0		15%	11.8	0.0	0.0		2.1	8%
18	A- Single family residential	128.0	1.4	182		17%	122.6	3.2	1.3		25.3	10%
29	A - Single family residential	45.0	2.9	130		25%	47.1	1.0	0.9		12.6	13%
31	A - Single family residential	29.4	4.1	120		31%	46.2	0.0	0.0		9.6	13%
32A	A - Single family residential	57.0	0.7	40		13%	113.5	3.0	0.6		10.5	6%
	Subtotal A - SFR	367.5		644.0			421.4	10.9	4.3	0.0	81.0	10%
1	B - Multifamily residential	26.8	6.0	161		45%	10.0	0.0	0.0		12.2	33%
7	B - Multifamily residential	15.2	5.1	78		40%	9.2	0.0	0.0		6.2	25%
	Subtotal B - MFR	42.0		239.0			19.2	0.0	0.0	0.0	18.3	30%
12	C/D - Multifamily residential	9.9	12.1	120		50%	18.1	0.0	0.1		5.2	18%
	Subtotal D - MFR	9.9		120			18.1	0.0	0.1	0.0	5.2	18%
8	E - Convention Center	8.8	0.0	0	250 Rooms	65%	10.4	0.8	0.3		6.4	32%
10	E - Commercial	5.2	0.0	0	25	70%	2.5	0.5	0.2		4.0	48%
24	E - Commercial	2.8	0.0	0	8	65%	2.2	2.3	0.3		3.3	44%
	Subtotal E - Comm.	16.8		0.0	33.0		15.1	3.6	0.8	0.0	13.8	38%
2	F/G - Office/Business	14.7	0.0	0	608	65%	5.9	3.9	0.8		12.2	48%
4	F/G - Office/Business	5.6	0.0	0		65%	2.1	3.0	0.6		5.7	50%
5	F/G - Office/Business	52.9	0.0	0		65%	20.9	9.9	2.1		41.2	48%
26	G - Office Park	55.1			400.0	65%	68.4	1.9	0.8		37.9	30%
34	G - Office Park	28.5			285.0	65%	32.2	0.0	0.0		18.8	31%
35	F - Business Park	31.5	0.0	0	280	65%	41.2	6.3	1.3		25.1	31%
	Subtotal F/G/H	188.3		0.0	1573.0		170.7	25.0	5.6	0.0	141.0	36%
26	I - Municipal/School	21.0	0.0	0		55%	114.0	0.0	0.0		12.7	9%
38	I - Municipal Use	4.0	0.0	0		55%	0.0	0.0	0.0		2.2	55%
	Subtotal Public Use	25.0		0			114.0	0.0	0.0	0.0	14.9	11%
21	J - Park	3.0	0.0	0		1%	2.4	0.1	0.1		0.1	3%
27	J - Park	7.6	0.0	0		1%	4.9	1.5	0.6		1.2	8%
	J - Recreation/Golf	242.2	0.0	0		2%	0.0	0.0	0.0		4.8	2%
6		13.8	0.0	0		1%	6.8	2.7	0.6		2.0	8%
9		6.3	0.0	0		1%	0.0	0.0	0.5		0.2	3%
13		7.2	0.0	0		1%	0.0	1.6	0.7		1.3	13%
	Subtotal J - Rec.	280.1		0.0			14.1	5.9	2.5	0.0	9.7	3%
	Subtotal area draining to R. M. Pond	929.6		1003.0	1606.0		772.6	45.4	13.3	0.0	283.8	16%
	Total area	1760.9										

DEVELOPMENT TOTALS

	ACREAGE	UNITS	SQ FOOT
A - Single family residential	468.0	904	
B - Multi family residential	115.9	416	
D - Multi family residential	9.9	120	
Total Residential	593.8	1440	
Recreation/Community Center	292.3		
Pathway	15.5		
TOTAL RECREATIONAL	307.8		
TOTAL RESIDENTIAL/RECREATIONAL	901.6		
E - Commercial	104.1		8
G&FH - Office/Business	258.1		2253
TOTAL COMMERCIAL/OFFICE	362.2		2261
Public Use	25.0		
Roads	58.7		
TOTAL ROADS	58.7		
TOTAL DEVELOPMENT AREA	1347.5		

COLUMN DESCRIPTIONS

1	PARCEL	
2	LAND USE	
3	NET DEVELOPABLE AREA	
4	UNITS/NET DEVELOPABLE AREA	
5	NUMBER OF UNITS PER PARCEL	
8	IMPERVIOUS RATE (RPOD NUMBERS)	
9	BUFFER AREA	
10	ROAD AREA	
11	PATH AREA	
12	WETLANDS	
13	(NET DEVELOPABLE AREA * IMPERVIOUS RATE) + ((BUFFER + WETLANDS) * 1%) + (ROAD * 60%) + (PATH * 33%)	
14	(NET DEVELOPABLE AREA * IMPERVIOUS RATE) + ((BUFFER + WETLANDS) * 1%) + (ROAD * 60%) + (PATH * 33%) / (NET DEVELOPABLE AREA + BUFFER + ROAD + PATH + WETLANDS)	
15	COUNTY	
16	PHASE	7.0
0	ABOVE OR BELOW IMPOUNDMENT	

REVISED MASTER PLAN WITH 25% SLOPE
LAND NOT DRAINING TO RICHARDSON'S MILL POND

1 PAR #	2 LAND USE	3 NET DV AREA	4 DENSTY DU/AC	5 # UNITS	6 SQ. FOOT X1,000	7 IMPRV RATE	8 BUFFER AREA	9 ROAD AREA	10 PATH AREA	11 WETLAND AREA	12 IMP AREA	13 NET IMP SURFAC
22	A - Single family residential	33.4	1.8	60		19%	59.0	0.0			6.9	8%
28	A - Single family residential	30.0	1.0	30		15%	22.7	0.0	0.0		4.7	9%
32B	A - Single family residential	37.1	3.0	170		26%	34.3	2.0	0.0		11.2	15%
	Subtotal A - SFR	100.5		260.0			116.0	2.0	0.0	0.0	22.8	10%
21	B - Multifamily residential	44.8	3.3	147		26%	39.2	0.0	0.0		12.0	14%
30	B - Multifamily residential	29.1	1.0	30		15%	68.8	0.0			5.1	5%
	Subtotal B - MFR	73.9		177.0			108.0	0.0	0.0	0.0	17.1	9%
23	E - Commercial	3.6	0.0	0	4	65%	0.6	2.3	0.3		3.8	56%
33	E - Commercial	83.7	0.0	0.0	300	65%	29.2	0.0	0.0		54.7	48%
81	F/G/H/ - R&D/Business	42.9	0.0	0	400	65%	33.1	0.0	0.0		28.2	37%
19	G - Office Park	9.0			90	65%	9.2	3.3	0.7		8.2	37%
20	G - Office Park	17.9	0.0	0	190	65%	2.9	5.7	1.2		15.5	56%
	Subtotal F/G/H	157.1		0.0	984.0		75.0	11.3	2.2	0.0	110.4	45%
25	J - Community Center	12.2	0.0	0		65%	6.9	0.0	0.0	0.0	8.0	42%
	Subtotal J - Rec.	12.2		0.0			6.9	0.0	0.0	0.0	8.0	42%
	Subtotal area not draining to R. M. Pond	343.7		437.0	984.0		305.9	13.3	2.2	0.0	158.3	24%
	Total area	665.1										
	Overall Total	1273.3		1440.0	2590.0		1078.5	58.7	15.5	0.0	442.1	
	Total area in acres	2426.0										

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

REPLY TO
ATTENTION OF:

August 18, 2000

AUG 25 2000

Southern Virginia Regulatory Section
94-0816-16 (Bird Swamp, a tributary to Ware Creek)
(L&M No. 1990140-000.04)

Stonehouse, Inc.
Mr. Steve Campitell
9701 Mill Pond Run
Toano, Virginia 23168

Dear Mr. Campitell:

This letter is in reference to Stonehouse Inc.'s request to impact 0.23 acres of forested wetlands and 50 square feet of waters of the U.S. for the widening of Route 600 to facilitate development of a portion of the Stonehouse Commerce Park in James City County, Virginia. The proposed work is shown on the enclosed drawing entitled "Road Plan & Section, LaGrange Parkway Extension" dated May 22, 2000. In accordance with your request of May 24, 2000, your Department of the Army Permit, issued on December 16, 1994, is hereby modified to allow for the proposed impacts to wetlands and waters of the United States. All other conditions of the original permit remain unchanged. Please be advised that all conditions of the original and modified Virginia Water Protection Permit become conditions of this authorization.

The applicant proposes to create/enhance 10,192 square feet of wetlands as compensatory mitigation. The mitigation for the impacts associated with this permitted action and previous modifications to the permit will be completed at the Brookshire Road Site, which has been constructed.

Enclosed is a "compliance certification" form, which must be signed and returned within 30 days of completion of the project, including any required mitigation. Your signature on this form certifies that you have completed the work in accordance with the terms and conditions of this permit.

Please obtain all necessary State and Local authorizations for the proposed work. Should you need further assistance or have any questions, please contact Melissa Smith at (757) 441-7489.

Sincerely,

R. Harold Jones
Chief, Southern Virginia
Regulatory Section

FILE: 1990140-000 04

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

5636 Southern Boulevard
Virginia Beach, VA 23462
Tel# (757) 518-2000
http://www.deq.state.va.us

Dennis H. Treacy
Director

Francis L. Daniel
Tidewater Regional Director

FAX (757) 518-2003

July 27, 2000

Mr. Steve Campitell
c/o John Lowenthal
Langley and McDonald
4029 Ironbound Road, Suite 100
Williamsburg, Va. 23188

RE: Minor Modification of VWP Permit #94-0816: Stonehouse Development for 2000

Dear Mr. Campitell

We have received your request, dated May 23, 2000 to modify the above referenced permit. The requested modification involves widening a road crossing on the existing roadway for expansion of the Commerce Park.

Approximately 0.12 acres of wetlands will be impacted. Stonehouse has agreed to provide approximately 0.23 acres of forested wetland compensation for the above mentioned impacts. The mitigation will be completed at the Brookshire Road site in Westpoint, Virginia.

Based on our review of your request, we have determined that the proposed activities will have minimal water quality impacts. Therefore, provided the conditions of the original permit are complied with, this letter for minor modification of Permit #94-0816 will serve as approval for the above mentioned activities.

This does not relieve you from the responsibility of conducting the proposed activities in a manner to meet all the laws and regulations of the Commonwealth of Virginia, including the water quality standards, as may be applicable. Please note that all reports and notifications required in your original DEQ permit should be sent to the Tidewater Regional Office at the letterhead address.

If you have any questions regarding this modification, please feel free to contact me at (757) 518-2160.

Sincerely,

Michelle E. Fults

Michelle E. Fults
Environmental Engineer

cc: Virginia Marine Resources Commission
Army Corps
File

RECEIVED
JUL 28 2000
By

H. Alexander Wise, Jr., Director

COMMONWEALTH of VIRGINIA

Department of Historic Resources

221 Governor Street
Richmond, Virginia 23219

September 15, 1997

Robert P. Kerr
Senior Associate
Langley and McDonald, P.C.
5544 Greenwich Road
Virginia Beach, Virginia 23462

RE: Application No. 94-0816-16 (Frances Swamp, tributary to Ware Creek)
Proposed Stonehouse Project
James City and New Kent Counties, Virginia
DHR File No. 93-2422-F

Dear Mr. Kerr:

Thank you for your letter of September 11, 1997 transmitting a copy of the final report of the Identification (Phase I) Survey entitled, *A Phase I Archaeological Survey of the Proposed Stonehouse Development James City and New Kent Counties, Virginia*. The report was prepared by Samuel G. Margolin and Robert R. Hunter, Jr., of the Virginia Archaeological Services.

I am pleased to inform you that the document satisfactorily addresses the comments made in our letters of September 29, 1995 and June 12, 1997. The report will be a welcome addition to our archives.

Please do not hesitate to contact Ethel R. Eaton of our project review division at (804)786-6329, should you have any questions. I would like to take this opportunity to express our appreciation for your cooperation and assistance throughout the Section 106 process. We look forward to working with you on future projects.

Sincerely,

David H. Dutton, Director
Division of Project Review

c. Melissa Schaup, Corps of Engineers
Department of Development Management, James City County
Virginia Archaeological Services

① JML
Burg.

Langley and McDonald, P.C.

Engineers
Surveyors
Planners
Landscape Architects
Environmental Consultants

GEORGE E. LANGLEY
Consultant
T. JOSEPH McDONALD
1906-1982

September 11, 1997

Mr. David H. Dutton, Director
Division of Project Review
Virginia Department of Historic Resources
221 Governer Street
Richmond, VA 23219

Re: Corrected, Final Submittal - Phase I Archaeological Survey of the Proposed Stonehouse Development, James City and New Kent Counties, Virginia, VDHR File 93-2422-F (L&M No. 96-038-0342)

Dear Mr. Dutton:

On May 13, 1997 Langley and McDonald submitted, on behalf of Stonehouse L.L.C., Stonehouse Inc. and Virginia Archaeological Services (VAS), the final report "A Phase I Archaeological Survey of the Proposed Stonehouse Development, James City and new Kent Counties, Virginia" (Volumes I and II) prepared by VAS. Dr. Ethel Eaton of your staff reviewed the documents (two volumes) and notified us that the Survey was acceptable with one revision: the cover exhibits for each of the 11 study areas within Stonehouse needed to posses the VDHR site identification numbers (they only included VAS's internal tracking numbers). Dr. Eaton was kind enough to return her copy of the report to us so that we could revise the necessary exhibits and forward the corrected, final report to her.

By copy of this letter, we have provided Dr. Eaton with the corrected, final report. We therefore request that VDHR provide us (on behalf of Stonehouse L.L.C. and Stonehouse Inc.) a letter confirming that the Phase I Survey has been formally accepted as complete.

We have enjoyed working with you and Dr. Eaton on this project and have appreciated your office's responsiveness and cooperation. We believe that these initial studies will benefit both VDHR and Stonehouse during future endeavors to protect and record these unique cultural resources.

Sincerely,

LANGLEY AND McDONALD, P.C.

Robert P. Kerr, R.E.P., P.W. S.
Senior Associate

cc: Dr. Ethel R. Eaton, Archaeologist, VDHR Division of Project Review w/ revised final survey
Mr. James D. Franklin, Stonehouse L.L.C.
Mr. Sam Margolin, Hunter-Margolin Antiques

MAIN OFFICE
5544 Greenwich Road
Virginia Beach, VA 23462
(757) 473-2000
FAX: (757) 497-7933

201 Packets Court
Williamsburg, VA 23185
(757) 253-2975
FAX: (757) 229-0049

JML
-FYI

Langley and McDonald, P.C.

Engineers
Surveyors
Planners
Landscape Architects
Environmental Consultants

GEORGE E. LANGLEY
Consultant
T. JOSEPH McDONALD
1906-1982

May 13, 1997

Mr. David H. Dutton, Director
Division of Project Review
Virginia Department of Historic Resources
221 Governer Street
Richmond, VA 23219

Transmitted via Overnight Mail

Re: Final Submittal, Phase I Archaeological Survey of the Proposed Stonehouse Development, James City and New Kent Counties, Virginia, DHR File 93-2422-F (L&M No. 96-038-0142)

Dear Mr. Dutton:

On behalf of Stonehouse L.L.C., and Virginia Archaeological Services, Langley and McDonald is pleased to submit "A Phase I Archaeological Survey of the Proposed Stonehouse Development, James City and new Kent Counties, Virginia" (Volumes I and II) prepared by VAS. Volume I of the report (provided on acid free paper) is the revised report text and 8-1/2"x11" exhibits. Volume II is new and provides your Division with archaeological information on large-size (nine square foot) exhibits at 1":400' scale, as requested.

On September 29, 1995 you provided a letter to Mr. R. Harold Jones of the U.S. Army Corps of Engineers (enclosed in Volume I, Appendix D) stating that the Phase I report "successfully meets the federal standards... and our Departments Guidelines...(1992)." In this letter you also confirmed that "it is our opinion that issuance of United States Army Corps of Engineers (Corps) permits for the proposed project will have no adverse effect on properties listed or eligible for listing on the National Register..." provided certain conditions were met. You also requested "that minor technical points discussed in our attached memo be addressed in the final report." The balance of this letter summarizes the revisions your office requested and the methods employed to respond to your requests:

Summarized below are your offices requested revisions and the response provided by VAS:

- The sites determined by VDHR to be eligible for listing are: 44JC832, 44JC276, 44JC425, 44JC278, 44JC279, 44JC839, 44JC282 (VAS number JC8-1), 44JC821, 44NK195, 44NK196, 44NK197, 44NK143, 44NK198, while 44JC77 is already listed (Stonehouse archaeological site). VAS has made the necessary revisions throughout the text of Volume I, including the summary table on pages 74 and 75 and on all figures, including those of Volume II.

MAIN OFFICE
5544 Greenwich Road
Virginia Beach, VA 23462
(757) 473-2000
FAX: (757) 497-7933

201 Packets Court
Williamsburg, VA 23185
(757) 253-2975
FAX: (757) 229-0049

- All figures depicting the archaeological survey areas were revised to ensure that each site was clearly referenced by the state inventory number. This revision has been made on all exhibits where applicable.

- Figures for the: Resource Probability Models, (13-15), the Previously Documented Archaeological Sites in the Project Vicinity (16-18) and the Sites Located During the 1988 Survey (20-22) were to be reproduced using a method which results in sharper contrast. This request and consultation with Dr. Eaton resulted in the preparation of Volume II which includes nine sheets each nine square feet in size (scale of 1":400'). We are confident that these exhibits provide sufficient detail of site topography and archaeological data since this is the scale used for land planning work when evaluating the entire Stonehouse property. Based on the method of reproduction, however, you will find that the reduced scale exhibits found throughout the report (figures 13-18 and 20-22) are now black and white. This method of reproduction allows us to make additional large-scale copies upon request.

Based on conversations with Dr. Ethel Eaton, summarized in our letter of August 13, 1996 (enclosed in Appendix D), we have revised the Table of Site Recommendations By Resource Type to reflect the eligibility determinations provided in your September 29, 1995 and October 23, 1995 letters.

We appreciate your Division's review of these few minor revisions and look forward to receiving your Division's letter confirming that the Phase I report is complete. Please contact me at (757) 473-2000 should you or Dr. Eaton wish to discuss this matter further.

Sincerely,

LANGLEY AND McDONALD, P.C.

Robert P. Kerr, R.E.P., P.W. S.
Senior Associate

enclosures: Volumes I and II of the Phase I Report, acid free bond paper

cc: Dr. Ethel R. Eaton, Archaeologist, VDHR Division of Project Review w/o enclosure
Mr. James D. Franklin, Stonehouse L.L.C. w/o enclosure

Larry S. Barry, P.E., President
Norman H. Mason, L.S., Vice Pres.
Vaughn B. Rinner, C.L.A.
Kenneth A. Dierks
Robert P. Kerr, R.E.P., P.W.S.

LANDMARK
DESIGN GROUP

Clayton E. Massey, P.E.
Charles R. Orsborne, L.S.
Stephen A. Romeo, L.S.
Mark W. Strickland, P.E.
A. Gary Webb, P.E.

February 5, 2001

Mr. Scott Thomas, P.E.
Environmental Engineer
James City County
P.O. Box 8784
Williamsburg, VA 23187-8784

Re: Stonehouse Commerce Park
LaGrange Parkway Extension
SP-82-00
LandMark Design Group # 1990140-000.11

Dear Scott:

I appreciate your willingness to meet with me to discuss the application of the Chesapeake Bay Protection Ordinance with regard to the La Grange Parkway Extension plans now under review. Enclosed are two spreadsheets summarizing the impervious area in relation to other land of the developer. Table One is an assessment of the paved area at completion of the presently proposed work in relation to land identified on existing plats as reserved for or associated with road construction. Without including similar open space granted to the Owner's Association, the percent impervious at 8.95% is below the 10% allowed by the ordinance.

Table Two is an inventory of the Commerce Park development to date. Presently it contains 228 acres of which 78.5 acres drain to the Richardson Mill Pond watershed. The remaining 149 acres drain to French Swamp. Seven sites comprising 44.1 acres are served by two existing 10 Point BMP's. We have estimated that there are an additional 220 acres that would be opened for development by the currently proposed extension. This gives a percent impervious within the French Swamp watershed of less than 4%.

Also enclosed are a copy of the Drainage Master Plan as revised in 1998 and a copy of the letter dated May 3, 1995 which outlines the approach to water quality planning being followed by the Stonehouse Development.

Engineers ◆ Planners ◆ Surveyors ◆ Landscape Architects ◆ Environmental Consultants
4029 Ironbound Road, Suite 100, Williamsburg, VA 23188 (757) 253-2975 FAX: (757) 229-0049 lmdg@landmarkdgwb.com

I hope you find this helpful and will agree with our conclusion that structural BMP's are not necessary at this point. We fully expect to include such protections with the individual sites as they are developed.

Very truly yours,

The LandMark Design Group Inc.

Richard S. Phillips, P.E.
Senior Associate

RSP/cjp

Enclosure

Cc: Steve Campitell
File 1990140-000.11

Langley and McDonald, P.C.

Engineers
Surveyors
Planners
Landscape Architects
Environmental Consultants

GEORGE E. LANGLEY
Consultant
T. JOSEPH McDONALD
1906-1982

(1) JAM
(2) JLH
(3) FILE
89046

May 3, 1995

Mr. Wayland N. Bass
County Engineer
Department of Development Management
P.O. box 8784
Williamsburg, VA 23187-8784

RICHARDSONS MILL POND
(NO 3)

Re: Stonehouse Chesapeake Bay Preservation Ordinance Compliance

Dear Mr. Bass:

This letter is written as a review of our discussion of May 2, 1995. That discussion focussed on the Chesapeake Bay Ordinance compliance for Stonehouse. Our specific focus was the involvement of Richard's Mill Pond as a major BMP facility. Essentially, we are proposing that Richardson's Mill Pond be accepted as the BMP facility for water quality purposes under the Chesapeake Bay Preservation Ordinance. It is proposed that Richardson's Mill Pond serve this function for an area shown on the accompanying drawing as Development Area One. Development Area One includes all of the Phase I area of Stonehouse plus portions of Phase II and commercial development areas of Phases III-V. The drawing also shows the areas of Development Area One from which runoff flows to Richardson's Mill Pond and the areas that do not flow to Richardson's Mill Pond.

Accompanying this letter is a development summary of Stonehouse Development Area One showing land use areas and densities along with assumed impervious areas. The tabulations key to the parcel numbers shown on the Master Plan. The first tabulation is as summary of the entire area; the following two pages summarize the areas flowing to Richardson's Mill Pond and the areas that do not. The buffer areas included on these computations are areas of 25% plus slopes and wetland areas that would have been included in the reservoir had the reservoir been constructed. As you can see from the accompanying calculations, the overall impervious rate is determined to be 18%. The impervious rate is significant because it is the determining factor in storage volume required to meet certain BMP point designations.

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

Mr. Wayland N. Bass
County Engineer
Department of Development Management
P.O. box 8784
Williamsburg, VA

May 3, 1995

Also accompanying this letter are several sheets of computations. These sheets of computations include the three step 10 point system worksheet and calculations of volume and storage for Richardson's Mill Pond. The 10 point system worksheets indicate that a total of 10 points are derived considering that approximately 144 acres drain through already accepted 11 point BMP's before they actually drain into Richardson's Mill Pond. You will note that based on our discussions, no series computations have been utilized. The areas draining to these 11 point BMPs are assigned only the 11 points and no credit is taken for the series impact of additional treatment in Richardson's Mill Pond. The remaining acreage of 1,604 acres within Stonehouse that drains to Richardson's Mill Pond is shown as being treated by an 8 point BMP (Richardson's Mill Pond).

The available storage volume of 5,662,800 cubic feet in Richardson's Mill Pond is shown on the accompanying calculations. Assuming 20% impervious surface levels in Stonehouse, which is in excess of that anticipated, and 5% impervious for areas outside of Stonehouse which also drain to the pond, the calculations show that the volume of the pond is actually in excess of that required for a 9 point BMP. As we discussed in our May 2 meeting, the areas outside Stonehouse, some of which are in New Kent County, actually have virtually no impervious surface on them.

Our conclusion in going through these calculations is that Richardson's Mill Pond provides a BMP that is adequate to serve the Chesapeake Bay requirements of all of Development Area One. There would be no need for additional water quality BMPs in this area. It is recognized that water quantity (flow attenuation) BMPs will be required. These will be addressed in the development plans as they are produced.

We also discussed Stonehouse's concern with encumbering land with natural open space easements in the early stages of the development. James City County's computational system does not require structural BMPs until an impervious rate of over 10% occurs. It can be seen from the accompanying calculations and the acreage of buffer area that substantial development can occur prior

Mr. Wayland N. Bass
County Engineer
Department of Development Management
P.O. box 8784
Williamsburg, VA

May 3, 1995

to reaching an impervious rate of 10% in Development Area One. We are requesting that no open space easements be required until an impervious rate in excess of 10% is achieved in Development Area One. At that time, Stonehouse would expect to provide required open space easements for areas that have been developed to that point. These open space easements would be of an acreage necessary to meet the 10 point requirements of land developed to the point where such easements are required, that being the time when an impervious rate over 10% occurs.

We plan to provide a running account of the impervious rate with the submittal of each development plan within Development Area One. That impervious rate would be based upon the total area of Development Area One. It is shown in the 10 point system worksheet that a total of 984 acres of undisturbed natural open space would be necessary to achieve the 10 points over the total of 2,426 acres if the BMP credit for Richardson's Mill Pond were only 8 points. In actuality, the BMP credit for the pond will be greater than this. Net developable area within Development Area One is 1,347 acres. With our conservative 8 point BMP calculations, for every acre of development within Development Area One an area of .7 acres undisturbed natural open space is required. At such time as the 10% impervious rate occurs, we would expect to calculate the acreage of open easement required by a ratio of net developable area to required open space according to 10 point calculations reflecting impervious surface and agreed-upon Richardson's Mill Pond BMP point values.

Please review this letter and the accompanying drawing and calculations. We would appreciate your approval of our two requests which are again stated as follows:

1. That Richardson's Mill Pond be accepted as the Chesapeake Bay BMP for all of Development Area One, based upon the accompanying calculations.

2. That recordation of undisturbed natural space easements be delayed until such time as an impervious rate of 10% is achieved in Development Area One. At that time, open space

Mr. Wayland N. Bass
County Engineer
Department of Development Management
P.O. box 8784
Williamsburg, VA

May 3, 1995

easements would be required based upon an established ratio for all areas developed to the point of reaching a 10% impervious rate, and for additional development as it occurs.

The time which you and Darryl spent in reviewing this with us on May 2 and the additional time which we know will be required to review this transmittal is very much appreciated. We believe that this presents a very realistic and practical approach to water quality planning for the Stonehouse development, and your efforts in working with Stonehouse Inc. are appreciated.

Very truly yours,

LANGLEY AND McDONALD, P.C.

Vaughn B. Rinner
Principal

NHM/VBR/amh
Enclosures
cc: Jim Franklin w/enclosures

WC 068; SP-82-00

LANDMARK DESIGN GROUP

February 16, 2004

Scott Thomas, P.E.
Environmental Division
James City County
P.O. Box 8784
Williamsburg, VA 23187-8784

Re: Construction Certification
BMP Facilities - La Grange Parkway Extension
Case No. SP-82-00
BMP WC068

Dear Scott:

The subject stormwater management Facility is shown on Sheet C-5 of the construction documents entitled "La Grange Parkway Extension at Commerce Park for Stonehouse, Inc.". I monitored the construction on a periodic basis during the progress of the work.

I hereby certify to the best of my knowledge and belief the subject Stormwater Management Facility was constructed in accordance with the provisions of the approved design plan, specifications and stormwater management plan without exceptions.

Very truly yours,

The LandMark Design Group, Inc.

Richard S. Phillips, P.E.
Senior Associate

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

2/16/04 Seal

Virginia Registered Professional Engineer

RSP/tmp

Copy: Mr. Steve Campitell
File 1990140-000.39

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

WC 068; SP-82-00

LANDMARK DESIGN GROUP
TRANSMITTAL

RECEIVED

To: Scott Thomas, P.E.

Company: Environmental Division
James City County

From: Richard S. Phillips, P.E.

Date: 03/04/04

Subject: La Grange Parkway Extension at Commerce Park
Attenuation Basin No. 1

LMDG Job No.: 1990140-000.39

Attached please find:
- ☐ Prints
- ☐ Plans
- ☐ Specifications
- ☐ Drawings
- ☐ Report
- ☐ Letter
- ☐

Transmitted as checked below:
- ☒ For your use
- ☐ As requested
- ☐ For review and comment
- ☐ For approval
- ☐ Approved
- ☐

Copies	Date	Drawing No.	Description
1	03/03/04	N/A	Stormwater Management/BMP Facilities Record Drawing and Construction Certification Form
1	Rev. 2/25/04	1 of 1	Drawing from Draper Aden Associates Map showing Asbuilt Conditions Stormwater Attenuation Basin #1

Notes:

Copies	Enclosures
1. File: 1990140-000.39	☒
2. Steve Campitell, P.E.	☒
3.	☐
4.	☐

LandMark Design Group, Inc.

By: T. Penci

**Acknowledgment by Recipient: _____ _____
Name Date

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

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

May 4, 2004

All items addressed 11/1/04

Mr. Steve Campitell
P.O. Box 311
West Point, VA 23181

Re: Lagrange Parkway BMP As-Builts
County Plan No. SP-82-00
County BMP ID Code: WC 068

Dear Mr. Campitell:

The Environmental Division has reviewed the record drawing and construction certification information as submitted to our office for the BMP at the above referenced project. The record drawing provides as-built information for the dry pond BMP located at station 41+00 left on LaGrange Parkway.

Based on our review of the project and a concurrent field inspection performed on April 30th 2004, the following items must be addressed prior to release of the developer's surety instrument for the drainage and stormwater management facilities and proceeding with closing out the project:

Construction Certification:

1. The Construction Certification dated March 3rd, 2004 is satisfactory for the above mentioned facility.

Record Drawing:

2. The Record Drawing dated February 3rd, 2004 is satisfactory for the above mentioned facility.

Construction-Related:

3. The outfall into the BMP is in need of repair as major erosion has occurred, undermining the outlet protection and causing the formation of a 3' deep, 2' wide, and 25' long channel. Items required for repair include, but are not limited to, filter fabric beneath the outlet protection, rip rap replacement, replacement of the underlying soils, and removal of sediment deposition within the BMP resulting from said erosion.

4. Approximately 6" of sediment is required for removal from within the existing wing walls associated with the inlet side of the 48" culvert. Though this sediment may or may not be directly associated with the construction of the BMP, it is directly associated with functionality of the system in its entirety.

5. The gravel at the inlet of the low flow orifice requires removal. The stone in its current location will promote debris to collect in that location eventually clogging the inlet.

Once this work has been satisfactorily completed, contact our office so that a reinspection of the facility may be performed. It is then that the final release of surety and/or closing out the project may be performed. After the above items are adequately addressed, one reproducible and one blue/black line set of the record drawings must be submitted to the Environmental Division per county requirements.

If you have any further comments or questions, please feel free to contact me at 757-253-6702, or the assigned Environmental Division inspector Jim Rudnicky (757-259-4026).

Sincerely,

William A. Cain
Civil Engineer
Environmental Division

WAC/wac

cc: Scott J. Thomas, JCC Environmental Division
Jim Rudnicky, JCC Environmental Division Inspector

G:\AsBuilts\SP0602.YC034

LANDMARK DESIGN GROUP
TRANSMITTAL

2002
RECEIVED
ENVIRONMENTAL DIVISION

To: Darryl Cook

Company: JCC Environmental

From: Peter Farrell

Date: 12-10-02

Subject: Lagrange Parkway Extension

LMDG Job No.:

Attached please find:
- X Prints
- ☐ Plans
- ☐ Specifications
- ☐ Drawings
- ☐ Report
- x Letter
- ☐

Transmitted as checked below:
- x For your use
- ☐ As requested
- ☐ For review and comment
- ☐ For approval
- ☐ Approved
- ☐

Copies	Date	Drawing No.	Description
1	12-10-02	13884W	Sheet R-2 of VDOT Record Drawings

Notes: Darryl,

I am sending this to you upon the request of Cheryl Chance at VDOT. It is part of the requirements for street acceptance.

Thanks,

PF

Copies

1. File:
2.
3.

Enclosures

x

☐

☐

LandMark Design Group, Inc.

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

Larry S. Barry, P.E., President
Norman H. Mason, L.S., VP
Vaughn B. Rinner, C.L.A.
Elizabeth J. Anderson, P.E.
Kenneth A. Dierks
Robert P. Kerr, R.E.P., P.W.S.
Clayton E. Massey, P.E.

LANDMARK
DESIGN GROUP

Charles R. Orsborne, L.S.
Stephen A. Romeo, L.S.
Kenneth E. Rodman, Jr., P.E.
Mark W. Strickland, P.E.
William R. Turner, Jr., A.I.C.P.
A. Gary Webb, P.E.

December 11, 2002

Ms. Cheryl D. Chance
Commonwealth of Virginia
Department of Transportation
4451 Ironbound Road
Williamsburg, VA 23188

Dear Ms. Chance:

This letter is to serve as verification for the mileage ties as shown on sheet R-2 of the VDOT record drawings attached. These mileage ties were measured along the centerline, using the design drawings and/or the "as-built" survey data

Sincerely,

LandMark Design Group, Inc.

Peter Farrell

Peter Farrell, L.S.
Director of Surveys
Associate

Attachment

Copy: Darryl Cook, JCC-Environmental
File 1990140-000.33

Engineers • Planners • Surveyors • Landscape Architects • Environmental Scientists
4029 Ironbound Road, Suite 100, Williamsburg, VA 23188 (757) 253-2975 FAX: (757) 229-0049 lmdg@landmarkdgwb.com

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

County BMP ID Code (if known): WC068

Name of Facility: LAGRANGE PARKWAY EXT. BMP No.: 1 of _____ Date: _____

Location: STONEHOUSE COMMERCE PARK

Name of Owner: STONEHOUSE, INC.

Name of Inspector: BILL CAIN

Type of Facility: DRY POND

Weather Conditions: CLEAR & SUNNY 80° 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	O.K.			NEW STAND
Vegetation Condition	O.K.			
Tree Growth	O.K.			SEVERE EROSION @ OUTFALL TO POND
Erosion	O.K.			
Trash & Debris	O.K.			MINOR @ INLET
Seepage	O.K.			
Fencing or Benches	N/A			
Interior Landscaping/Planted Areas: ☑ None ☐ Constructed Wetland/Shallow Marsh ☐ Naturally Established Vegetation				
Vegetated Conditions				
Trash & Debris				
Floating Material				
Erosion				
Sediment				
Dead Plant				
Aesthetics				
Other				
Notes: BARE SOIL @ HIGH WATER. GOOD STAND THEREAFTER				

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools: ☐ Permanent Pool (Retention Basin) ☐ Shallow Marsh (Detention Basin) ☒ None, Dry (Detention Basin)				
Shoreline Erosion				NEED TO STABILIZE SIDE SLOPES OF BASIN
Algae	O.K.			
Trash & Debris	O.K.			
Sediment	O.K.			
Aesthetics	O.K.			
Other				
Inflows (Describe Types/Locations):				
Condition of Structure				24" W/ES-1
Erosion			DEEP SCOUR	3' DEEP @ 25' FROM OUTFALL
Trash and Debris	O.K.			
Sediment			✓	FROM INLET EROSION 7/- 1'
Outlet Protection	O.K.			REPLACE AFTER CORRECTION
Other				
Principal Flow Control Structure - Riser, Intake, etc. (Describe Type): 48" RISER W/4'X1' NOTCH. 7' DEEP				
Condition of Structure	O.K.			ROCK & 21-B STONE TO BE REMOVED 6" COLLAPSE
Corrosion		SHORELINE		RILLS
Trash and Debris	O.K.			
Sediment	O.K.			
Vegetation	O.K.			STABILIZE SIDES.
Other				24" BARREL
Principal Outlet Structure - Barrel, Conduit, etc. : 24" RCP TO INLET BOX				
Condition of Structure	O.K.			
Settlement	O.K.			
Trash & Debris	O.K.			
Erosion/Sediment	O.K.			
Outlet Protection	O.K.			
Other	O.K.			
Emergency Spillway (Overflow):				
Vegetation	O.K.			
Lining	~~O.K.~~		NO	LINING MUST BE INSTALLED
Erosion	O.K.			ES NOT USED YET
Trash & Debris	O.K.			
Other				
Notes: EXCELSIOR BM REQUIRED.				

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding				
Animal Burrows				
Graffiti				
Other	O.K.			
Surrounding Perimeter Conditions:				
Land Uses				
Vegetation				
Trash & Debris				
Aesthetics				
Access /Maintenance Roads or Paths	O.K.			
Other				

Remarks: - NEED TO REMOVE APPROX. 1' OF SEDIMENT FROM WITHIN WINGWALLS @ ~~OUTFALL~~ INLET OF 48" RCP.

- REMOVE STONE FROM AROUND LOW-FLOW ORIFICE INLET
- REMOVE SEDIMENT FROM WITHIN BMP AND REPAIR OUTLET PROTECTION AT ~~BMP~~ OUTFALL WITHIN BMP.

Overall Environmental Division Internal Rating: 2

Signature: [signature] **Date:** APRIL 30, 2004

Title: CIVIL ENGINEER

SWMProg\BMP\CoInspProg\InspForms\DetRet.wpd

Steve Campitell Campitell
P.O Box 311
West Point, VA 23181

Date Record Created:

Created By:

WS_BMPNO: WC068

Print Form

PRINTED ON:
Friday, March 12, 2010
4:42:58 PM

WATERSHED	WC
BMP ID NO	068
PLAN NO	SP-82-00
TAX PARCEL	(06-4)(1-1)
PIN NO	0640100001
CONSTRUCTION DATE	1/1/2004
PROJECT NAME	LaGrange Parkway
FACILITY LOCATION	9770 Six Mt. Zion Rd Station 41+00
CITY-STATE	JCC, VA
CURRENT OWNER	Stonehouse Inc. (Contact was Steve Campitell)
OWNER ADDRESS	P.O. box 311
OWNER ADDRESS 2	
CITY-STATE-ZIP CODE	West Point, VA 23181
OWNER PHONE	(804) 843-4364 X103
MAINT AGREEMENT	No
EMERG ACTION PLAN	No

Get Last BMP No

Return to Menu

MAINTENANCE PLAN	No	CTRL STRUC DESC	Precast Con
SITE AREA acre		CTRL STRUC SIZE inches	48
LAND USE	Industrial	OTLT BARRL DESC	Class III RC
old BMP TYP	Dry Pond	OTLT BARRL SIZE inch	24
JCC BMP CODE	F2 Dry ED with forebay		
POINT VALUE		EMERG SPILLWAY	No
		DESIGN HW ELEV	56.40
		PERM POOL ELEV	N/A
SVC DRAIN AREA acres	8.29	2-YR OUTFLOW cfs	7.76
		10-YR OUTFLOW cfs	11.19
		REC DRAWING	Yes
SERVICE AREA DESCRI	CN=70		
IMPERV AREA acres	0.00	CONSTR CERTIF	Yes
RECV STREAM			
EXT DET-WQ-CTRL	No	LAST INSP DATE	
WTR QUAL VOL acre-ft		INTERNAL RATING	
CHAN PROT CTRL	No		
CHAN PROT VOL acre-ft		MISC/COMMENTS	
SW/FLOOD CONTROL	No		
GEOTECH REPORT	No		

Inspected by:

Additional Comments:

CERTIFICATE OF SOURCE OF TITLE:

THE PROPERTY SHOWN ON THIS PLAT WAS CONVEYED BY STONEHOUSE, INC. TO STONEHOUSE AT WILLIAMSBURG, LLC BY DEED DATED 12/11/02 AND RECORDED IN THE OFFICE OF THE CLERK OF THE CIRCUIT COURT OF THE COUNTY OF JAMES CITY AS INSTRUMENT NO. 020030024.

OWNER'S CERTIFICATE:

THE SUBDIVISION OF LAND SHOWN ON THIS PLAT IS WITH THE FREE CONSENT AND IN ACCORDANCE WITH THE DESIRE OF THE UNDERSIGNED OWNERS, PROPRIETORS, AND/OR TRUSTEES.

OWNER: STONEHOUSE AT WILLIAMSBURG, LLC.:

BY: Kenneth G. McDermott, Manager 1/29/03
SIGNATURE DATE

KENNETH G. MCDERMOTT, MANAGER

CERTIFICATE OF NOTARIZATION:

STATE OF Virginia

~~CITY~~/COUNTY OF James City

I, Patricia M. Penci A NOTARY PUBLIC IN AND FOR THE CITY/COUNTY AND STATE AFORESAID, DO HEREBY CERTIFY THAT THE PERSONS WHOSE NAMES ARE SIGNED TO THE FOREGOING WRITING HAVE ACKNOWLEDGED THE SAME BEFORE ME IN THE CITY/COUNTY AFORESAID, GIVEN UNDER MY NAME THIS 29th DAY OF January, 2003. MY COMMISSION EXPIRES June 30, 2006.

Patricia M. Penci
(SIGNATURE)

SURVEYOR'S CERTIFICATE:

I HEREBY CERTIFY THAT TO THE BEST OF MY KNOWLEDGE OR BELIEF, THIS PLAT COMPLIES WITH ALL OF THE REQUIREMENTS OF THE BOARD OF SUPERVISORS AND ORDINANCES OF THE COUNTY OF JAMES CITY, VIRGINIA, REGARDING THE PLATTING OF SUBDIVISIONS WITHIN THE COUNTY.

1-16-03 Peter Farrell
DATE PETER FARRELL, LS NO. 002036

COMMONWEALTH OF VIRGINIA
1-16-03
PETER FARRELL
NO. 002036
Peter Farrell
LAND SURVEYOR

CERTIFICATE OF APPROVAL:

THIS SUBDIVISION IS APPROVED BY THE UNDERSIGNED IN ACCORDANCE WITH EXISTING SUBDIVISION REGULATIONS AND MAY BE ADMITTED TO RECORD.

1/28/2003
DATE VIRGINIA DEPARTMENT OF TRANSPORTATION

4/7/03
DATE SUBDIVISION AGENT OF JAMES CITY COUNTY

STATE OF VIRGINIA, COUNTY OF JAMES CITY:

IN THE CLERK'S OFFICE OF THE CIRCUIT COURT THE PLAT SHOWN HEREON WAS PRESENTED AND ADMITTED TO RECORD THIS _____ DAY OF _____ AS THE LAW DIRECTS.

TESTE: _____, CLERK

PLAT BOOK _____ PAGE _____

NOTES:

1. THIS PROPERTY IS JAMES CITY COUNTY TAX PARCEL 0640100001

2. TAX PARCEL 0640100001 APPEARS TO LIE WITHIN FLOOD ZONE X, ZONE X (SHADED), ZONE A AND AE, ACCORDING TO FEDERAL EMERGENCY MANAGEMENT AGENCY–NATIONAL FLOOD INSURANCE PROGRAM COMMUNITY PANEL NO. 510201 0010 B, DATED FEB. 6, 1991. THE PORTION OF THIS TAX PARCEL SHOWN ON THIS PLAT APPEARS TO LIE IN ZONE X (AREAS DETERMINED TO BE OUTSIDE THE 500 YEAR FLOOD–PLAIN AS SHOWN ON THE ABOVE REFERENCED F.I.R.M.

3. THIS PROPERTY IS ZONED "PUD–C" AND "PUD–R" PLANNED UNIT DEVELOPMENT DISTRICTS, WITH PROFFERS.

4. THIS PROPERTY WILL BE SERVED BY PUBLIC WATER AND SEWER.

5. ALL NEW UTILITIES SHALL BE PLACED UNDERGROUND.

6. THE REFERENCES USED IN THE PREPARATION OF THIS SURVEY ARE:

P.B. 50, PAGE 11	P.B. 62, PAGE 94–96
P.B. 50 PAGE 12	D.B. 420, PAGE 72
P.B. 29, PAGE 6	INST. NO. 020030024

V.D.O.T. PLANS FOR PROJECT NUMBERS:
0064–047–101 RW202
0064–047–101 G–302
0600–1347–04

7. COORDINATE VALUES SHOWN BASED ON JAMES CITY COUNTY GEODETIC CONTROL MONUMENT STA. NO. 340

8. THIS PLAT WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT AND THEREFORE MAY NOT DEPICT ALL TITLE MATTERS AND/OR ENCUMBRANCES AFFECTING THE SUBJECT PROPERTY.

9. UNLESS OTHERWISE NOTED, ALL DRAINAGE EASEMENTS DESIGNATED ON THIS PLAT SHALL REMAIN PRIVATE.

10. NEW MONUMENTS WILL BE SET IN ACCORDANCE WITH SECTIONS 19–34 through 19–36 OF THE JAMES CITY COUNTY SUBDIVISION ORDINANCE.

11. SIGNS SHALL COMPLY WITH ARTICLE 2, DIVISION 3 OF THE JAMES CITY COUNTY ZONING ORDINANCE.

12. PORTIONS OF THIS PROPERTY CONTAIN RESOURCE PROTECTION AREAS, AS DEFINED BY JAMES CITY COUNTY'S CHESAPEAKE BAY PRESERVATION ORDINANCE, AND THEREFORE ARE SUBJECT TO JAMES CITY COUNTY'S CHESAPEAKE BAY PRESERVATION ORDINANCE.

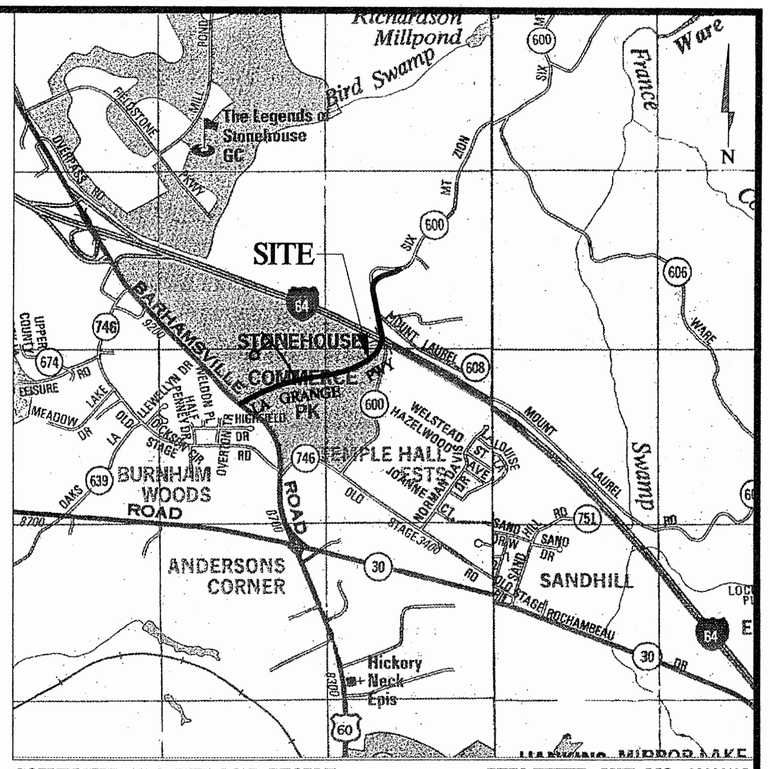
13. THIS PROPERTY LIES WITHIN A RESOURCE MANAGEMENT AREA AND IS SUBJECT TO JAMES CITY COUNTY 'S CHESAPEAKE BAY PRESERVATION ORDINANCE.

14. WETLANDS AND LANDS WITHIN RESOURCE PROTECTION AREAS SHALL REMAIN IN A NATURAL UNDISTURBED STATE EXCEPT FOR THOSE ACTIVITIES PERMITTED BY SECTION 23–9(c)(1) OF THE JAMES CITY COUNTY CODE.

15. NATURAL OPEN SPACE EASEMENTS SHALL REMAIN IN A NATURAL UNDISTURBED STATE EXCEPT FOR THOSE ACTIVITIES REFERENCED ON THE DEED OF EASEMENT.

16. ANY OLD WELLS THAT WILL NOT BE USED MUST BE PROPERLY ABANDONED IN ACCORDANCE WITH STATE PRIVATE WELL REGULATIONS AND THE JAMES CITY COUNTY CODE.

17. EASEMENTS DENOTED AS "JCSA UTILITY EASEMENTS ARE FOR THE EXCLUSIVE USE OF THE JAMES CITY SERVICE AUTHORITY AND THE PROPERTY OWNER. OTHER UTILITY SERVICE PROVIDERS DESIRING TO USE THESE EASEMENTS WITH THE EXCEPTION OF PERPENDICULAR UTILITY CROSSINGS MUST OBTAIN AUTHORIZATION FOR ACCESS AND USE FROM JCSA AND THE PROPERTY OWNER, ADDITIONALLY, JCSA SHALL NOT BE HELD RESPONSIBLE FOR ANY DAMAGE TO IMPROVEMENTS WITHIN THIS EASEMENT, FROM ANY CAUSE, OTHER THAN THE NEGLIGENCE OR WILLFUL MISCONDUCT OF JCSA.



COPYRIGHT ADC THE MAP PEOPLE PERMITTED USE NO. 20202125

VICINITY MAP

SCALE: 1"=2,000'

FINAL ADDRESS (ES)
RECEIVED 5/7/03
CODED

S-71-02

PLAT SHOWING
RIGHT OF WAY
BEING THE EXTENSION OF
LA GRANGE PARKWAY
AND RE–ALIGNMENT
OF A PORTION OF
STATE ROUTE 600

STONEHOUSE DISTRICT, JAMES CITY COUNTY, VIRGINIA
DATE: JULY 08, 2002 SCALE: AS SHOWN
REVISED: SEPT. 4, 2002
REVISED: SEPT. 16, 2002
REVISED: JAN. 16, 2003
SHEET 1 OF 4

APR 2003
RECEIVED
PLANNING DEPARTMENT

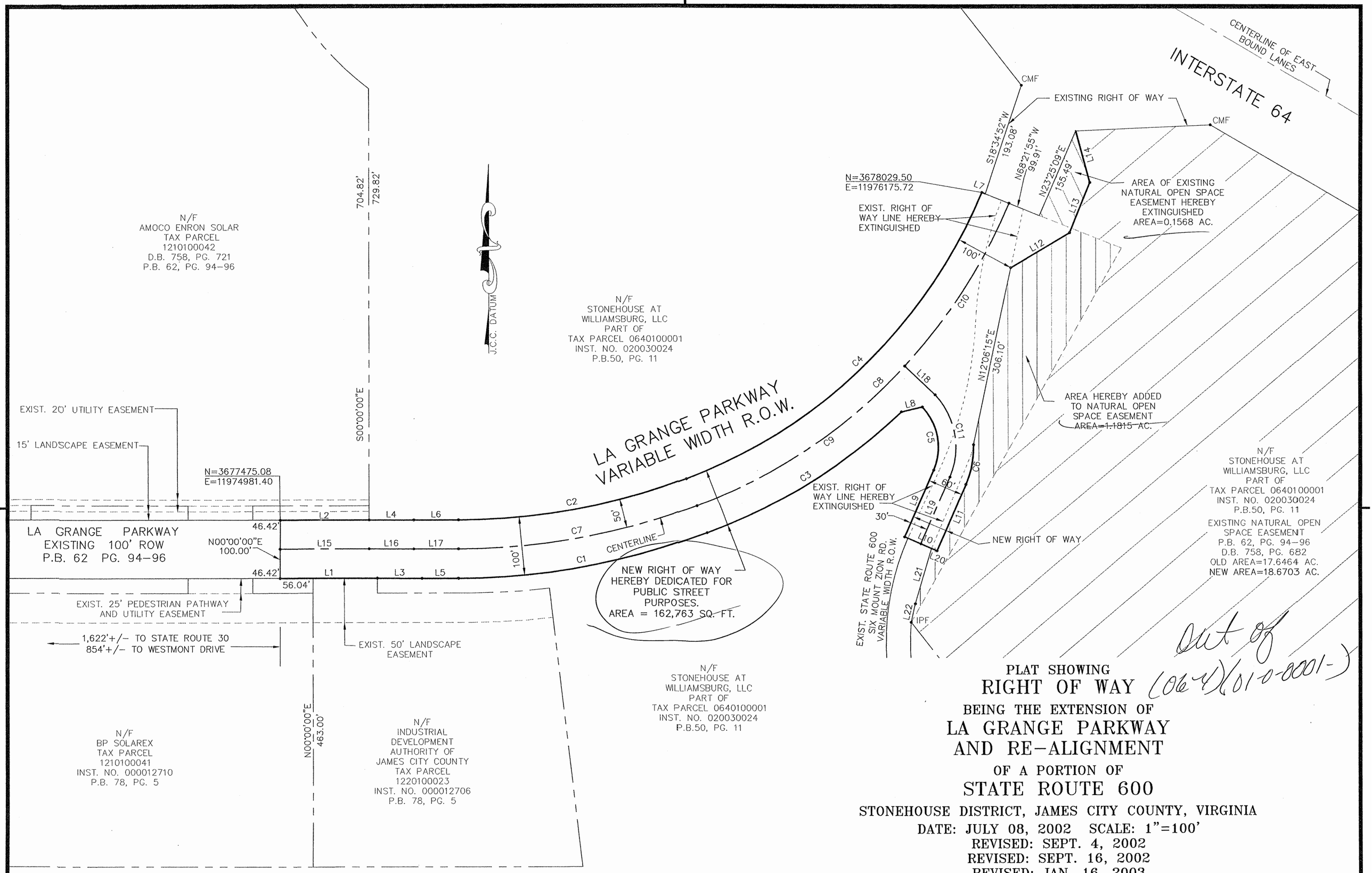
LANDMARK DESIGN GROUP
Engineers • Planners • Surveyors
Landscape Architects • Environmental Consultants

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

DRAWN BY : PF	PROJ. NO. : 1990140–000.32
CHKD BY : CPO	DWG. NO. : 13362W

1990140–000.32 Stonehouse LaGrange Pkwy Right Of Way Plat\LGEXT–plat.dwg



Out of (06-4)(01-0-0001-)

PLAT SHOWING

RIGHT OF WAY

BEING THE EXTENSION OF

LA GRANGE PARKWAY AND RE-ALIGNMENT

OF A PORTION OF

STATE ROUTE 600

STONEHOUSE DISTRICT, JAMES CITY COUNTY, VIRGINIA

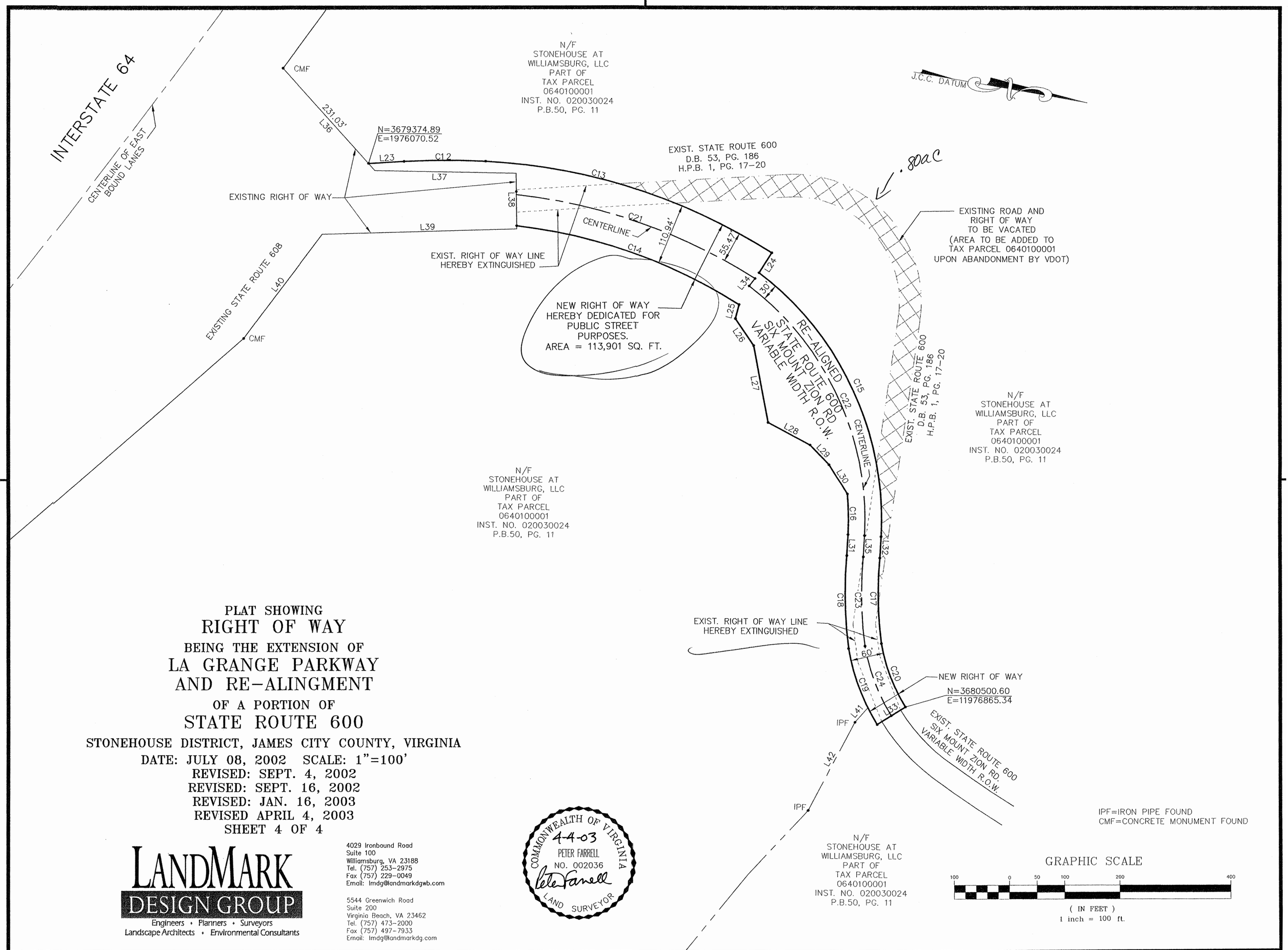
DATE: JULY 08, 2002 SCALE: 1"=100'
REVISED: SEPT. 4, 2002
REVISED: SEPT. 16, 2002
REVISED: JAN. 16, 2003
SHEET 3 OF 4

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

DRAWN BY : PF | PROJ. NO. : 1990140-000.32
CHKD. BY : GPO | DWG. NO. : 13360W



PLAT SHOWING

RIGHT OF WAY

BEING THE EXTENSION OF

LA GRANGE PARKWAY AND RE-ALINGMENT

OF A PORTION OF

STATE ROUTE 600

STONEHOUSE DISTRICT, JAMES CITY COUNTY, VIRGINIA

DATE: JULY 08, 2002 SCALE: 1"=100'

REVISED: SEPT. 4, 2002

REVISED: SEPT. 16, 2002

REVISED: JAN. 16, 2003

REVISED APRIL 4, 2003

SHEET 4 OF 4

COMMONWEALTH OF VIRGINIA
4-4-03
PETER FARRELL
NO. 002036
Peter Farrell
LAND SURVEYOR

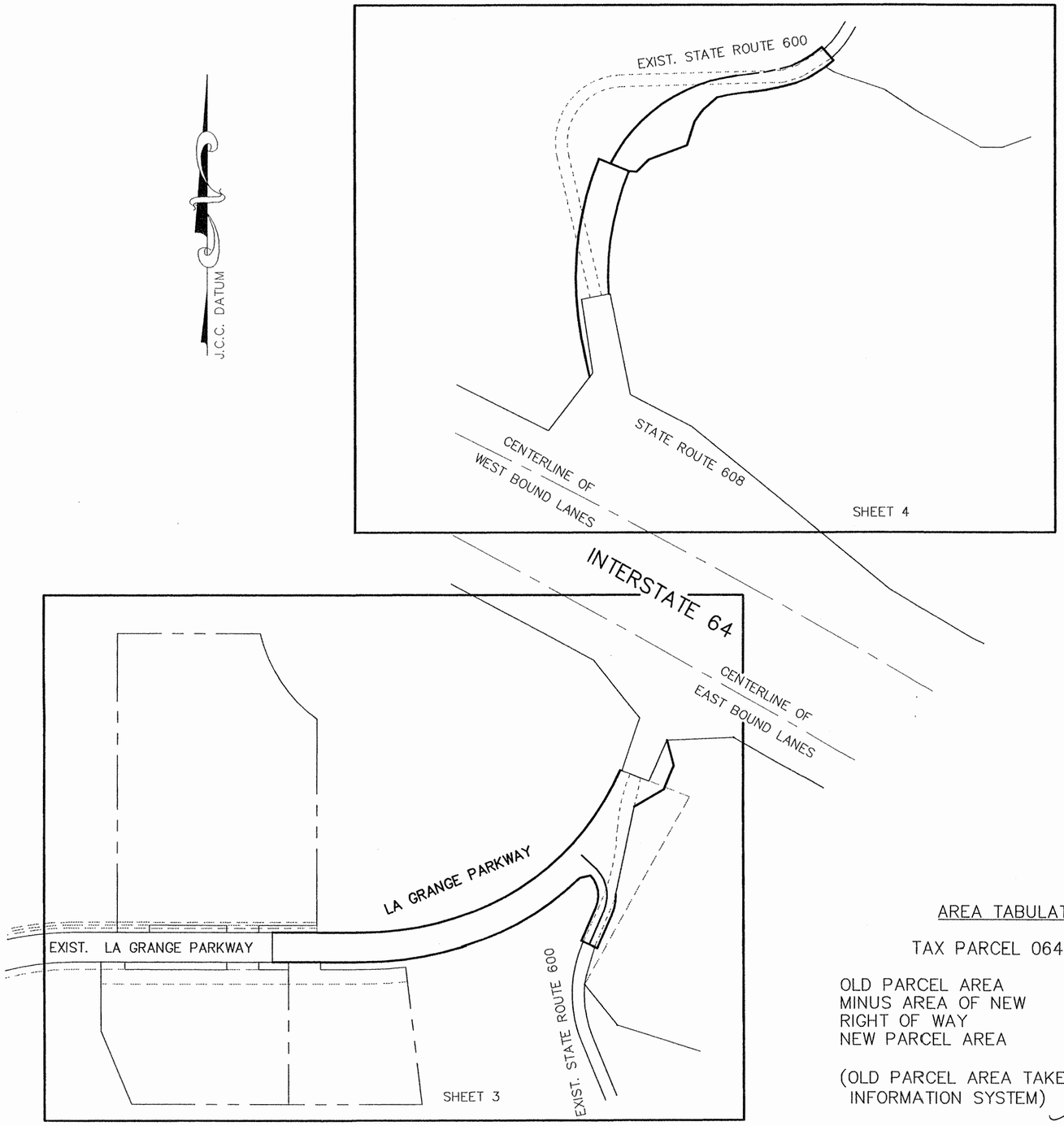
LANDMARK DESIGN GROUP
Engineers • Planners • Surveyors
Landscape Architects • Environmental Consultants

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

DRAWN BY : PF | PROJ. NO. : 1990140-000.32

CHKD. BY : CRO | DWG. NO. : 13359W



SHEET INDEX SCALE 1"=300'

CURVE TABLE						
CURVE	RADIUS	LENGTH	TANGENT	CHORD	CHORD BEARING	DELTA
C1	1200.20'	430.92'	217.80'	428.61'	S79°42'51"W	20°34'17"
C2	1100.20'	395.02'	199.66'	392.90'	N79°42'51"E	20°34'17"
C3	982.00'	392.85'	199.09'	390.24'	S57°58'04"W	22°55'17"
C4	882.00'	718.51'	380.54'	698.81'	N46°05'27"E	46°40'31"
C5	100.00'	115.66'	65.27'	109.32'	N09°59'30"W	66°15'58"
C6	160.00'	68.77'	34.93'	68.24'	S10°49'40"W	24°37'37"
C7	1150.20'	412.97'	208.73'	410.75'	N79°42'51"E	20°34'17"
C8	932.00'	760.25'	402.71'	739.35'	N46°03'36"E	46°44'15"
C9	932.00'	430.33'	219.07'	426.52'	N56°12'04"E	26°27'18"
C10	932.00'	329.92'	166.71'	328.20'	N32°49'57"E	20°16'56"
C11	130.00'	150.35'	84.85'	142.11'	S09°59'30"E	66°15'58"
C12	1400.00'	147.52'	73.83'	147.46'	N10°05'09"W	6°02'15"
C13	1069.45'	548.19'	280.26'	542.21'	N07°37'03"E	29°22'10"
C14	958.50'	429.26'	218.29'	425.68'	S09°28'22"W	25°39'34"
C15	555.00'	546.49'	297.70'	524.68'	N55°06'10"E	56°25'02"
C16	495.00'	74.01'	37.07'	73.94'	S79°01'41"W	8°33'59"
C17	694.08'	153.27'	76.95'	152.96'	N78°58'49"E	12°39'09"
C18	754.08'	166.76'	83.72'	166.42'	S78°53'24"W	12°40'15"
C19	382.49'	147.07'	74.46'	146.17'	S59°17'31"W	22°01'52"
C20	322.49'	122.85'	62.18'	122.11'	N59°11'23"E	21°49'35"
C21	1013.98'	460.55'	234.32'	456.60'	S09°15'29"W	26°05'35"
C22	525.00'	516.95'	281.60'	496.32'	N55°06'10"E	56°25'02"
C23	724.08'	160.03'	80.34'	159.70'	N78°55'59"E	12°39'47"
C24	352.49'	134.95'	68.31'	134.13'	N59°14'41"E	21°56'11"

LINE TABLE					
LINE	LENGTH	BEARING	LINE	LENGTH	BEARING
L1	166.04'	N90°00'00"W	L22	32.13'	S12°52'31"W
L2	152.24'	N90°00'00"E	L23	64.49'	N13°06'17"W
L3	76.02'	N89°43'25"W	L24	42.86'	S67°41'51"E
L4	76.02'	S89°43'25"E	L25	26.07'	S85°54'49"E
L5	62.23'	S90°00'00"W	L26	58.51'	S45°48'30"W
L6	76.04'	N90°00'00"E	L27	139.87'	S69°17'48"W
L7	6.32'	S68°26'22"E	L28	86.22'	S18°04'06"W
L8	36.79'	S76°43'27"W	L29	49.22'	S35°53'30"W
L9	124.52'	N23°28'13"E	L30	63.37'	S48°20'13"W
L10	60.00'	N66°31'47"W	L31	37.64'	S83°18'41"W
L11	124.52'	S23°28'13"W	L32	38.67'	N83°18'41"E
L12	116.73'	S59°30'01"W	L33	60.00'	S41°43'25"E
L13	92.00'	S21°56'37"W	L34	17.39'	S61°40'27"E
L14	89.91'	S15°24'03"E	L35	38.15'	N83°18'41"E
L15	152.12'	S90°00'00"E	L36	248.09'	S37°50'19"W
L16	76.02'	S89°43'25"E	L37	255.77'	S08°50'39"E
L17	76.16'	N90°00'00"E	L38	100.00'	S79°25'21"W
L18	70.62'	S47°01'35"E	L39	352.08'	N11°31'50"W
L19	123.95'	S23°28'13"W	L40	235.58'	N62°51'16"W
L20	10.14'	N66°31'47"W	L41	35.08'	S58°19'32"E
L21	97.82'	S16°26'02"W	L42	179.89'	S71°48'27"E

AREA TABULATION

TAX PARCEL 0640100001

OLD PARCEL AREA = ~~4,540.2070 ACRES~~ 2169.05
MINUS AREA OF NEW
RIGHT OF WAY = 6.3513 ACRES
NEW PARCEL AREA = ~~4,533.8557 ACRES~~ 2162.6987

(OLD PARCEL AREA TAKEN FROM J.C.C. PROPERTY INFORMATION SYSTEM) plus .80 for old road

New Total: 2169.85

PLAT SHOWING
RIGHT OF WAY
BEING THE EXTENSION OF
LA GRANGE PARKWAY AND RE-ALIGNMENT
OF A PORTION OF
STATE ROUTE 600

STONEHOUSE DISTRICT, JAMES CITY COUNTY, VIRGINIA
DATE: JULY 08, 2002 SCALE: 1"=100'
REVISED: SEPT. 4, 2002
REVISED: SEPT. 16, 2002
REVISED: JAN. 16, 2003
REVISED: APRIL 4, 2003
SHEET 2 OF 4

COMMONWEALTH OF VIRGINIA
4-4-03
PETER FARRELL
NO. 002036
Peter Farrell
LAND SURVEYOR

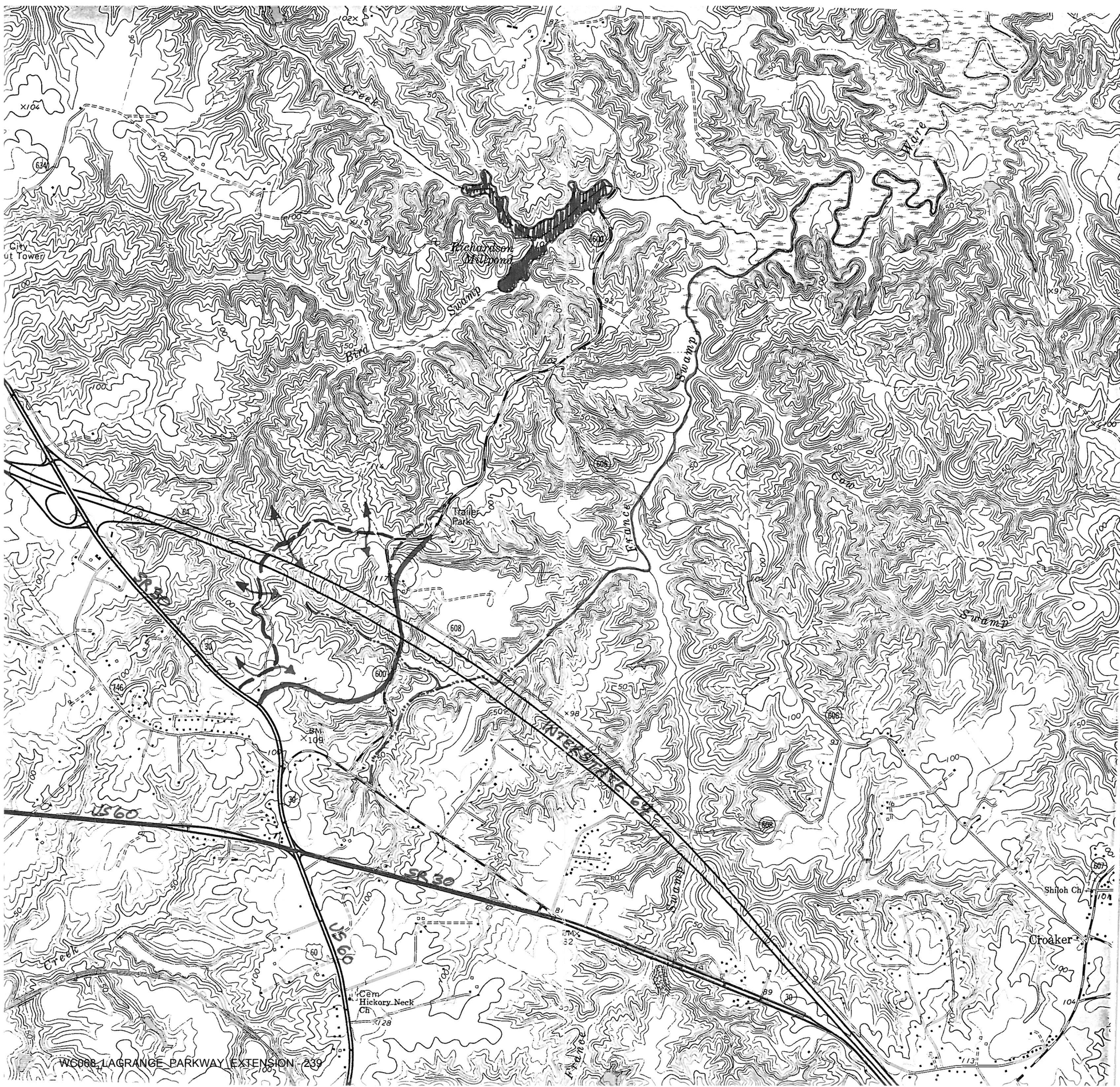
all out of (06-4)(010-0001)

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

DRAWN BY : PF | PROJ. NO. : 1990140-000.32
CHKD. BY : CRO | DWG. NO. : 13361W


Richardson Millpond
Swamp
Bird
Creek
Ware
Swamp
France
Swamp
Trailer Park
SR 30
Interstate 64
US 60
SR 30
US 60
Swamp
Swamp
Shiloh Ch
Croaker
Cem
Hickory Neck Ch
Creek
France

May 9, 1995

STONEHOUSE
RICHARDSON'S MILL POND (R.M.P.)

OVERALL AVERAGE (SEE ATTACHED)	18% IMPERVIOUS PROPOSED
ASSUME CONSERVATIVELY	20% IMPERVIOUS

CALCULATIONS ON BMP SHEET:

-	ASSUME	R.M.P.	8.0 MIN BMP
-	ASSUME	WEG #1	11.0 BMP
_	ASSUME	WEG #2	11.0 BMP

NEED FOR 10 PTS. 984 AC. UNDISTURBED NATURAL OPEN SPACE

TOTAL DEV. AREA ONE	2425 AC.
TOTAL STONEHOUSE TO R.M.P.	1761 AC.
BUFFER (25% SLOPE/WETLANDS)	1078 AC.

1748	ACRES WITHIN STONEHOUSE
+2268	ACRES OUTSIDE STONEHOUSE
4016	ACRES DRAINING TO RICHARDSON'S MILL POND

TABLE 3

WORKSHEET FOR BMP POINT SYSTEM

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Points		Fraction of Site Served by BMP		Weighted BMP Points
WEG #1	11	x	$\frac{100}{2425}$	=	0.45
WEG #2	11	x	$\frac{44}{2425}$	=	0.20
R.M.P.	8	x	$\frac{1748-144}{2425}$	=	5.29
		x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 5.94

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
$\frac{984}{2425}$	x	10 (0.1 per 1%)	=	4.06

C. TOTAL WEIGHTED POINTS

5.94	+	4.06	=	10.00
Structural BMP Points		Natural Open Space Points		TOTAL

WEG #1 = 100 AC.
WEG #2 = 44 AC.
TOTAL STONEHOUSE ACREAGE TO R.M.P. = 1748 AC.
TOTAL STONEHOUSE ACREAGE DEVELOPMENT AREA ONE 2425 AC.

AT 12.8% IMPERVIOUS COMPOSITE

VOLUME REQUIREMENTS — AT 20% IMPERVIOUS WITHIN STONEHOUSE (2426 AC.)/ 5% OUTSIDE STONEHOUSE (2268 AC.)

$$V_r - \frac{(R_m)(R_v)}{12} \times AC$$

$R_v = [0.05 + 0.009I] = 0.05 + 0.009\ (12.8) = 0.165$

R_m = 0.45" FOR WET DETENTION DESIGNS

$A_c = 4016$

$$V_r = \frac{(0.45)(0.165)}{12} \times 4016\ AC = 24.8\ ac.ft. = 1{,}082{,}422\ cu.ft.$$

FOR A 9 POINT BMP	V_r x 4	= 4,329,690 cu.ft.
FOR AN 8 POINT BMP	V_r x 2.5	= 2,706,055 cu.ft.

VOLUME AVAILABLE IN R.M.P.

130 ac.ft. X 43,560 = 5,662,800 cu.ft.

(GREATER THAN A 9 POINT BMP)

AT 20% IMPERVIOUS OVERALL

VOLUME REQUIREMENTS AT 20% IMPERVIOUS

$$V_r - \frac{(R_m)(R_v)}{12} \times AC$$

$R_v = [0.05 + 0.009I] = 0.05 + 0.009\ (20) = 0.230$

$R_m = 0.45"$ FOR WET DETENTION DESIGNS

$A_c = 4016$

$$V_r = \frac{(0.45)(0.23)}{12} \times 4016\ AC = 34.64\ ac.ft. = 1{,}508{,}831\ cu.ft.$$

FOR A 9 POINT BMP	V_r x 4	= 6,035,325 cu.ft.
FOR AN 8 POINT BMP	V_r x 2.5	= 3,772,078 cu.ft.

VOLUME AVAILABLE IN R.M.P.

130 ac.ft. X 43,560 = 5,662,800 cu.ft.

From this point forward the file is not certified. The list below details the documents that have been added to the file, the person that added the documents and the date they were added.

Name	Content	Date
Jo Anna Ripley	WC068, WC035, WC047	1/14/2014

12.1010000~~00~~ 48 AND
0640100001

Printed On 10/17/2011 By JCCATTY

BOOK 0732 PAGE 0988

004986

DECLARATION OF COVENANTS

INSPECTION/MAINTENANCE OF RUNOFF CONTROL FACILITY

WC035

WC068
WC035
WC011

THIS DECLARATION, made this 10TH day of March, 19 95, between Stonehouse, Inc., and all successors in interest, hereinafter referred to as the "COVENANTOR(S)," owner(s) of the following property: Part of Tax Map (6-4) Parcel (1)(1), D.B. 383, Pg. 285 and Tax Map (12-1) Parcel 38, D.B. 589, Pg. 32 (Stonehouse Commerce Park), and James City County, Virginia, hereinafter referred to as the "COUNTY."

S/B 48

WITNESSETH:

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

1. The COVENANTOR(S) shall provide maintenance for the runoff control facility, hereinafter referred to as the "FACILITY," located on and serving the above-described property to ensure that the FACILITY is and remains in proper working condition in accordance with approved design standards, and with the law and applicable executive regulations.

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

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

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

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

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

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

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

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

Printed On 10/17/2011 By JCCATTY

IN WITNESS WHEREOF, the COVENANTOR(S) have executed this DECLARATION OF COVENANTS as of this 10th day of March, 1995.

COVENANTOR(S)

James D. Franklin
VICE PRESIDENT

ATTEST:

Stephen D. Jan

COVENANTOR(S)

ATTEST:

COMMONWEALTH OF VIRGINIA
CITY/COUNTY OF Williamsburg

I, the undersigned Notary Public, in and for the jurisdiction aforesaid, do certify that James D. Franklin, whose name is signed as such to the foregoing writing bearing date 10th day of March, 1995 this day sworn the same before me in my jurisdiction aforesaid.

GIVEN under my hand this 10th day of March, of 1995.

Janice M. Thompson
Notary Public

My Commission expires: February 28, 1999

Approved as to form:

Leo P. Rogers

0261U.Wpf
Revised 9/92

VIRGINIA: City of Williamsburg and County of [illegible]
In the [illegible] Court of the City [illegible] James City the 5 April 95. This Covenant [illegible] annexed and admitted [illegible] 12:47 o'clock
Teste: [illegible] Clerk
Deputy Clerk

From this point forward the file is not certified. The list below details the documents that have been added to the file, the person that added the documents and the date they were added.

Name	Content	Date
Jo Anna Ripley	WC035, WC047, WC068, WC085 OUT OF PARCEL DEED OF SALE	1/14/2014

292

Comments are as of 11/3/14

100011092 100013960

Tax Map #'s: 0440100028, 0530100025, 0530100023, 0530100024, 0530100010, 0530100020, 1310100019, 1310100008A, 1210100047, 1210100048, and 0640100001

no BMP WC086 no BMP no BMP no BMP no BMP no BMP no BMP

Prepared By
And Return To: Christina E. Hassan, Esquire
Hogan Lovells US LLP
Park Place II Ninth Floor
7930 Jones Branch Drive
McLean, VA 22102-3302

WC085
WC035
WC041
WC068

THIS DEED IS EXEMPT FROM RECORDATION AND GRANTOR TAXES PURSUANT TO VA. CODE § 58.1-811 A. (10) AND C (1)

To be re-recorded in the correct sequence.

DEED OF BARGAIN AND SALE

THIS DEED OF BARGAIN AND SALE, made this 2nd day of June 2010, between **GS STONEHOUSE GREEN LAND LLC**, a Delaware limited liability company, Grantor, and **GS STONEHOUSE GREEN LAND SUB 3 LLC**, a Delaware limited liability company, Grantee, whose address is 50 North Water Street, South Norwalk, Connecticut 06854.

WITNESSETH:

That for and in consideration of the sum of Ten and 00/100 Dollars ($10.00), cash in hand paid, and other good and valuable consideration, the receipt of which is hereby acknowledged, the said Grantor does grant and convey, with **SPECIAL WARRANTY** unto the Grantee, in fee simple, the following described property, to-wit:

See Exhibit A attached hereto and incorporated herein.

Together with all the improvements thereon and appurtenances thereto and all right, title and interest of Grantor in and to the land lying in the bed of any streets, roads and highways adjacent to said property.

To have and to hold the above-described property, together with each and every title, right, privilege, appurtenance and advantage thereunto belong, or in anywise appertaining, unto

WC068
WC035
WC047
WC085

and for the proper use only, benefit and behoove forever of Grantee, its successors and assigns, in fee simple forever.

This conveyance is made subject to the following (a) conditions, restrictions, encroachments, protrusions, covenants, proffers and easements of record or apparent on the ground affecting the property conveyed hereby; (b) rights of riparian landowners to the use and continued flow of the rivers, streams and creeks running over, upon, adjacent to and through the Property; and (c) the terms of applicable zoning ordinances and proffers.

Grantor, for itself and its successors and assigns, does hereby covenant with the said Grantee, and its successors and assigns, to warrant specially the property hereby granted and conveyed, and to execute such further assurances of the said property as may be requisite.

REMAINDER OF PAGE INTENTIONALLY BLANK

WITNESS the following signature and seal:

GS STONEHOUSE GREEN LAND LLC, a Delaware limited liability company

By:_____(SEAL)
Barry P. Marcus, Senior Vice President

STATE OF Connecticut
CITY/COUNTY OF Norwalk / Fairfield

The foregoing instrument was acknowledged before me this 2 day of June, 2010, by Barry P. Marcus, Senior Vice President, of GS Stonehouse Green Land LLC on behalf of the company.

_____
NOTARY PUBLIC

My Commission Expires:_____
Notary Registration No. :_____

Jennifer Montanaro
Notary Public
Fairfield Cty. CT
My Commission Expires 5-31-13

Exhibit A
Property Description

LAND BAY 1

Tax Parcel ID No.: 0440100028

13.1105 acres shown as Parcel E on a "Boundary Line Adjustment Plat of Property Owned by Stonehouse, Inc. and Golf Trust of America, L.P." made by Langley and McDonald, P.C., dated 5/5/97, recorded in Plat Book 66, Pages 89-93.

Being a portion of the property conveyed to GS Stonehouse Green Land Sub, LLC, by Special Warranty Deed dated October 31, 2006 from Stonehouse Capital, LLC, Commerce Park at Stonehouse, LLC, Six Hundred North, LLC, Fairmont Investment, LLC, Mount Laurel, LLC, Stonehouse Glen, LLC, Fieldstone Investment, LLC, Tymar Capital, LLC, Cimarron Capital, LLC and JTL Stonewill Joint Venture, LLC, which deed is recorded in the Clerk's Office of the Circuit Court for the City of Williamsburg and County of James City as Instrument No. 060027006.

LAND BAY 8

Parcel I:

Tax Parcel ID No. 0530100025

That certain property shown as "Parcel R-5" on that certain "SUBDIVISION PLAT SHOWING STONEHOUSE GLEN SECTION 1 & 2 AND RIGHT OF WAY OF FIELDSTONE PARKWAY BEING A SUBDIVISION OF THE PROPERTY OF FIELDSTONE INVESTMENT, LLC AND STONEHOUSE GLEN, LLC" dated May 31, 2006, prepared by LandMark Design Group, recorded in the Clerk's Office for the City of Williamsburg and the County of James City as Instrument No. 060016179.

Being a portion of the property conveyed to GS Stonehouse Green Land Sub, LLC, by Special Warranty Deed dated October 31, 2006 from Stonehouse Capital, LLC, Commerce Park at Stonehouse, LLC, Six Hundred North, LLC, Fairmont Investment, LLC, Mount Laurel, LLC, Stonehouse Glen, LLC, Fieldstone Investment, LLC, Tymar Capital, LLC, Cimarron Capital, LLC and JTL Stonewill Joint Venture, LLC, which deed is recorded in the Clerk's Office of the Circuit Court for the City of Williamsburg and County of James City as Instrument No. 060027006.

Parcel II:

Tax Parcel ID Nos. 0530100023 and 0530100024

All that property shown as "BMP #6" and "Parcel R-4" on that certain plat entitled "SUBDIVISON PLAT SHOWING STONEHOUSE GLEN SECTION 1 & 2 AND RIGHT OF WAY OF FIELDSTONE PARKWAY BEING A SUBDIVISION OF THE PROPERTY OF FIELDSTONE INVESTMENT, LLC AND STONEHOUSE GLEN, LLC" dated May 31, 2006, prepared by LandMark Design Group, recorded in the Clerk's Office for the City of Williamsburg and the County of James City as Instrument Number 060016179. Together with all the rights, title and interest in and to that certain easement conveyed to Fieldstone Investment, LLC under that certain Benefit Pathway and Utility Easement dated May 15, 2006, recorded in the aforementioned Clerk's Office as Document No. 060012689.

Being a portion of the property conveyed to GS Stonehouse Green Land Sub, LLC, by Special Warranty Deed dated October 31, 2006 from Stonehouse Capital, LLC, Commerce Park at Stonehouse, LLC, Six Hundred North, LLC, Fairmont Investment, LLC, Mount Laurel, LLC, Stonehouse Glen, LLC, Fieldstone Investment, LLC, Tymar Capital, LLC, Cimarron Capital, LLC and JTL Stonewill Joint Venture, LLC, which deed is recorded in the Clerk's Office of the Circuit Court for the City of Williamsburg and County of James City as Instrument No. 060027006.

LAND BAY 14

Parcel I:

Tax Parcel ID No. 0530100010

Section III-C containing 16.0620 acres, all as shown on "Subdivision Plat of Stonehouse Development Area One, Phase 1, Section I-B, Section II-A, Section III-C, Being a Subdivision of Properties Owned by Stonehouse Limited Liability Company and Stonehouse, Inc.", made by Langley and McDonald, Inc., dated November 19, 1999, last revised December 9, 1999, recorded in Plat Book 75, Pages 93-97.

Being a portion of the property conveyed to GS Stonehouse Green Land Sub, LLC, by Special Warranty Deed dated October 31, 2006 from Stonehouse Capital, LLC, Commerce Park at Stonehouse, LLC, Six Hundred North, LLC, Fairmont Investment, LLC, Mount Laurel, LLC, Stonehouse Glen, LLC, Fieldstone Investment, LLC, Tymar Capital, LLC, Cimarron Capital, LLC and JTL Stonewill Joint Venture, LLC, which deed is recorded in the Clerk's Office of the Circuit Court for the City of Williamsburg and County of James City as Instrument No. 060027006.

Parcel II:

Tax Parcel ID No. 0530100020

All that certain piece, parcel or tract of land, situate, lying and being in Stonehouse Magisterial District, James City County, Virginia, and being more particularly shown and described on that certain plat entitled "Composite Plat Showing a Portion of Parcel A, Stonehouse Development Company, L.L.C., prepared by G.T. Wilson, Jr., L.S., dated January 14, 2004 and revised March 18, 2004, a copy of which is recorded in the Clerk's Office of the Circuit Court of the City of Williamsburg and County of James City as Instrument No. 040008576, which plat was recorded with that certain Deed of Bargain and Sale from Stonehouse Development Company, LLC, a Virginia limited liability company, to 2J Investments, LLC, a Virginia limited liability company, dated March 16, 2004 and recorded March 25, 2004 in the aforesaid Clerk's Office as Instrument No. 040008576, and to which plat reference is hereby made for a more particular description of such property.

Being a portion of the property conveyed to GS Stonehouse Green Land Sub, LLC by Special Warranty Deed dated December 15, 2006 from 2J Investments, L.L.C., which deed is recorded in the Clerk's Office of the Circuit Court of the City of Williamsburg and County of James City as Instrument No. 060030587.

TRACT 9

Tax Parcel ID No.: 1310100019

ALL THAT certain tract of land lying in Stonehouse District, James City County, Virginia, containing 48.21 acres, more or less, and being in the residue of the "Tankard" Tract, known among the tax recorded for said county as Tax Map 13-1 (1-19). Reference is made to that plat of survey recorded in the Clerk's Office, Circuit Court, James City County, Virginia, in Plat Book 50, Page 14, and Deed recorded in Deed Book 420, Page 712, that plat recorded in Plat Book 88, Pages 43-44, and that Deed recorded as Instrument Number 020027159.

Tax Parcel ID No.: 1310100008A

Parcel I: ALL THAT certain tract or parcel of land situate, lying and being in Stonehouse District, James City County, Virginia, known and designated as "35.0 Acres, +/-" on a certain plat entitled "Survey of 35 Acres +/- for Conveyance to: Jackie L., Gary M. & Steve L. Massie from: Leon Carr Avery & Maxie G. Avery", made by AES, a professional corporation, dated March 11, 1982, which plat is recorded in the Clerk's Office, Circuit Court, James City County, Virginia, in Plat Book 37, Page 24.

Parcel II: ALL THAT certain tract or parcel of land, situate, lying and being in Stonehouse District, James City County, Virginia, known and designated as "7.31 acres", on plat entitled "Boundary Survey of 7.31 Acres Located on the North Line of Route 30", made by AES, a professional corporation, dated December 17, 1984, and described by metes and bounds in that certain deed recorded in the Clerk's Office aforesaid in Deed Book 262, Page 455.

Portions of the property being further described as follows:

Legal Description for Massie Tract 1:

All that certain piece or parcel of land situated in James City County, Virginia containing 48.00 acres more or less, designated as Tax Parcel #1310100019 by the James City County Assessors office and being shown as Tract I on a plat titled SURVEY OF PROPERTIES STANDING IN THE NAME OF FIELDSTONE INVESTMENT, LLC AS DESIGNATED BY PARCEL IDENTIFICATION NUMBERS: PIN: 1310100008A & PIN: 1310100019 dated 10-9-06 and prepared by LandTech Resources, Williamsburg, VA. and being more particularly described as follows:

Beginning at the most southerly corner of Lot 10, Section 2 of the Sand Hill Subdivision, said point being marked by an iron pipe; thence from said Point Of Beginning following the line common with the property herein described and Lot 10, Lot 9 and Lot 8, Section 2 of the Sand Hill Subdivision N19°49'17"E, 441.90 feet to an iron pipe; thence following the line common with the property herein described and the property now or formerly of Kinney and Johnson, trustees N24°38'06"E, 677.11 feet to an iron rod at the southerly right of way line of Sand Hill Road; thence following the southerly right of way line of Sand Hill Road the following courses: along a curve to the left having a radius of 159.00 feet an arc length of 58.63 feet, a chord distance of 58.30 feet, and a chord bearing of N89°29'12"E to an iron rod; thence N78°55'23"E, 104.77 feet to an iron rod at the intersection of southerly right of way line of Sand Hill Road and the south westerly right of way line of Interstate Route 64; thence following the south westerly right of way line of Interstate Route 64 the following courses: along a curve to the right having a radius of 28,497.89 feet, an arc length of 2,005.99 feet, a chord distance of 2,005.57 feet, and a chord bearing of S40°58'22"E to an iron rod; thence S13°04'03'W, 62.18 feet to an iron rod; thence S59°46'58"E, 136.50 feet to an iron rod; thence along a curve to the right having a radius of 28,497.89 feet an arc length of 573.33 feet, a chord distance of 573.32 feet and a chord bearing of S38°02'47"E to an iron rod; thence leaving the south westerly right of way line of Interstate Route 64 and following the line common with the property herein described and the property now or formerly of Altizer the following courses: S32°01'54"W, 178.80 feet to an iron rod; thence S57°20'49"W, 161.50 feet to an iron T-bar; thence following the line common with the property herein described and the property now or formerly of Milton & Lee, Reilly and Jackson N56°00'33"W, 785.03 feet to an iron pipe; thence following the line common with the property herein described and the property now or formerly of Fieldstone Investment, LLC, said line being marked by painted and marked trees the following courses: N56°07'41"W, 1,326.91 feet to an iron pipe; thence S68°15'24"W, 259.77 feet to an iron T-bar; thence N86°43'56"W, 194.00 feet to a tree; thence N68°06'56"W, 179.71 feet to an iron T-bar; thence N72°18'56'W, 179.00 feet to an iron T-bar, thence N73°43'29"W, 159.47 feet to a Walnut Tree; thence following the line common with the property herein described and the property now or formerly of Mereau N66°08'23"E, 134.24 feet to a Hickory Tree; thence following the line common with the property herein described and the property now or formerly of Burrell the following courses: N69°17'01"E, 91.38 feet to an iron rod; thence S77°00'33"E, 236,30 feet to an iron pipe; thence following the line common with the property herein described and Lot 10, Section 2 of the Sand Hill Subdivision

S84°02'51"E, 105.35 feet and returning to the point of beginning.

Legal Description for Massie Tract 2:

All that certain piece or parcel of land situated in James City County, Virginia containing 41.95 acres more or less, designated as Tax Parcel #1310100008A by the James City County Assessors office and being shown as Tract 2 on a plat titled SURVEY OF PROPERTIES STANDING IN THE NAME OF FIELDSTONE INVESTMENT, LLC AS DESIGNATED BY PARCEL IDENTIFICATION NUMBERS: PIN: 1310100008A & PIN; 1310100019 dated 10-9-06 and prepared by LandTech Resources, Williamsburg, VA. and being more particularly described as follows:

Commencing at a Point on the northerly right of way line of Rochambeau Drive at its intersection with the easterly right of way line of Sand Hill Road; thence following the northerly right of way line of Rochambeau Drive in a south easterly direction approximately 823' feet to an iron pipe at the common corner of the property herein described and the property now or formerly of Bradby, said point being The True Point Of Beginning; thence from said Point Of Beginning, leaving the northerly right of way line of Rochambeau Drive and following the line common with the property herein described and the property now or formerly of Bradby N24°34'56"E, 537.26 feet to an iron pipe; thence N22°32'19'W, 165.63 feet to an iron pipe; thence following the line common with the property herein described and the property now or formerly of Bradby, Lapham and Carroll N70°42'20"W, 394.06 feet to an iron rod; thence following the line common with the property herein described and the property now or formerly of Sligh N25°11'45"E, 184.04 feet to a Walnut free; thence following the line common with the property herein described and the Property now or formerly of Fieldstone Investment, LLC, said line being marked by painted and marked trees the following courses: S73°43'29"E, 159.47 feet to an iron T-bar; thence S72°18'56"E, 179.00 feet to an iron T-bar; thence S68°06'56"E, 179.71 feet to tree; thence S86°43'56"E, 194.00 feet to an iron T-bar; thence N68°15'24"E, 259.77 feet to an iron pipe; thence S56°07'41"E., 1,326.91 feet to an iron pipe; thence following the line common with the property herein described and the property now or formerly of Jackson the following two courses: S18°47'32"W, 447.68 feet to an iron pipe; thence S22°59'39"W, 531.17 feet to an iron pipe; on the northerly right of way line of Rochambeau Drive thence following the northerly right of way line of Rochambeau Drive the following courses: N62°43'32"W, 141.29 feet; thence following the centerline of a stream along a tie line course of N09°03'49"W, 297.36 feet to the intersection of two streams; thence following a tie line course of S52°28'21"W, 264.72 feet to a point; thence N62'43'32'W, 1,304.46 feet and returning to the point of beginning.

TRACT 13

Tax Parcel ID Nos.: 1210100047, 1210100048, and 0640100001

"LAGRANGE" Tract, containing (i) 223.89 acres as depicted on that plat of survey dated August 26, 1988 made by Charles J. Kerns, Jr., L.S., recorded in Plat Book 50, Page 11, as conveyed to

Chesapeake Corporation by Sheldon Lumber Company, Incorporated, dated April 29. 1987, recorded in Deed Book 393, Page 285, and (ii) 4.75 acres, depicted as Parcel B on plat of survey dated 3/29/84 made by AES, recorded in Deed Book 246, page 313, as conveyed to Stonehouse Inc. by deed from Howard V. Clayton and Marion P. Clayton dated January 28, 1992, recorded Deed Book 549, Page 59. LESS AND EXCEPT the following described property:

1. 15.00 acres depicted on "Plat of Section A of Stonehouse Commerce Park at Stonehouse for Stonehouse, Inc." dated 10/10/95, made by Langley and McDonald, P.C., recorded in Plat Book 62, Pages 94-96, as conveyed to Amoco/Enron Solar by deed dated October 12, 1995, recorded in Deed Book 758, Page 721;

2. 11.1906 acres, depicted as Parcel A on "Plat of Section A of Stonehouse Commerce Park at Stonehouse for Stonehouse Inc." dated 10/10/95, made by Langley and McDonald, P.C. recorded in Plat Book 62, Pages 94-96, as conveyed to The Industrial Development Authority of James City County by deed dated September 30, 1996 recorded in Deed Book 809, Page 728;

3. 4.600 acres, depicted as Stonehouse Commerce Park, Section B, Parcel A on that plat entitled "Plat of Section B of Stonehouse Commerce Park at Stonehouse for Stonehouse Inc." made by Langley and McDonald, P.C., dated 1/23/98, recorded in Plat Book 68, Pages 60-61, as conveyed to The Barre Company, L.L.C., by deed dated March 3, 1998, recorded as Document No. 98-4099;

4. 6.245 acres, as depicted on "Plat of Boundary Line Adjustment Stonehouse Commerce Park Between Avid Realty, L.L.C. and Stonehouse Inc." dated May 2, 2002, made by AES Consulting Engineers, recorded in the Clerk's Office aforesaid in Plat Book 87, Page 89, of which 3.100 acres, depicted as Stonehouse Commerce Park, Section B, Parcel B on that plat entitled "Plat of Section B of Stonehouse Commerce Park at Stonehouse for Stonehouse Inc." made by Langley and McDonald, P.C., dated 1/23/98, recorded in Plat Book 68, Pages 60-61, was conveyed to Avid Realty, L.L.C., by deed from Stonehouse Inc., dated June 23, 1998, recorded as Document No. 98-11721;

5. 74.3712 acres, depicted as "Stonehouse Commerce Park, Section C, Parcel A" on the plat entitled "Plat of Section C of Stonehouse Commerce Park at Stonehouse Commerce Park at Stonehouse for Stonehouse Inc." made by Langley and McDonald, P.C., dated 3/22/99, recorded in Plat Book 73, Pages 38-39, as conveyed to Wachovia Capital Investments, Inc., by deed from Stonehouse Inc. dated May 17, 1999, recorded as Document No. 99-11248;

6. 4.1278 acres, depicted as "Stonehouse Commerce Park, New Parcel B-1, Section C" on the plat entitled "Resubdivision Plat of Section C, Parcel B of Stonehouse Commerce Park at Stonehouse Commerce Park at Stonehouse for Stonehouse Inc." made by Landmark Design Group, dated 4/5/00, recorded in Plat Book 77, Pages 28-29, as conveyed to Friendship Partnership, LLC. by deed from Stonehouse Inc. dated April 6, 2000, recorded as document No. 00-7666;

7. Parcel A-2B containing 4151 S.F., Parcel A-2A containing 2750 S.F. and Parcel A-lA containing 2050 S.F., all as depicted on "Resubdivision Plat of Section A, Parcel A of Stonehouse Commerce Park at Stonehouse for the Industrial Development Authority of the County of James City, Virginia"

Plats

PB 50 | 11

62 | 94-96

68 / 60-61

78/4-5

#030039997

030010861

060009197

made by Landmark Design Group, dated March 17, 2000, last revised June 23, 2000, recorded in Plat Book 78, Pages 4-5, and as conveyed to The Industrial Development Authority of James City County by three deeds from Stonehouse Inc. dated June 26, 2000, June 23, 2000 and June 23, 2000, recorded as Document Numbers 00-12706,00-12707 and 00-12708, respectively;

8. All that certain lot, piece or parcel of land with all improvements thereon and appurtenances thereunto belonging, situate, lying and being in the County of James City, Virginia, known and designated as "New Parcel," consisting of 10.3± acres, more or less, as shown on that certain plat entitled, "SUBDIVISION OF THE PROPERTY OF STONEHOUSE AT WILLIAMSBURG, LLC AT STONEHOUSE COMMERCE PARK STONEHOTJSE DISTRICT, JAMES CITY COUNTY, VIRGINIA, made by Landmark Design Group, dated October 24, 2003, and revised October 28, 2003, and recorded in the Clerk's Office of the Circuit Court for the County of James City, Virginia as Instrument No. 030039997, to which reference is here made;

9. All that certain lot, piece or parcel of land with all improvements thereon and appurtenances thereunto belonging, situate, lying and being in the County of James City, Virginia, known and designated as "Parcel A 24,157 S.F., .05689 AC." on that certain plat entitled, "SUBDIVISION PLAT OF PARCEL A & PARCEL B SECTION D, STONEHOUSE COMMERCE PARK BEING A PORTION OF THE PROPERTY OF COMMERCE PARK AT STONEHOUSE, LLC", made by Landmark Design Group, dated September 26, 2005, attached hereto as Exhibit A-I, and the easement rights to be conveyed therewith as noted on the aforementioned plat;

10. All that property shown as "NEW RIGHT OF WAY" on that certain plat entitled "PLAT SHOWING RIGHT OF WAY BEING THE EXTENSION OF LAGRANGE PARKWAY AND RE-ALIGNMENT OF A PORTION OF STATE ROUTE 600", dated July 8, 2002, last revised January 16, 2003, prepared by LandMark Design Group, recorded in the Clerk's Office for the City of Williamsburg and the County of James City as Instrument Number 030010861.

11. That certain lot or parcel of land located in the Stonehouse District of James City County, Virginia shown and set out as "Parcel B, 100,898 S. F., 2.3163 AC." on the plat of subdivision entitled "Subdivision Plat of Parcel A & Parcel B, Section D, Stonehouse Commerce Park Being a Portion of the Property of Commerce Park at Stonehouse, LLC", prepared by Landmark Design Group and dated February 16, 2006, consisting of three sheets, which plat of subdivision is recorded in the Clerk's Office of the Circuit Court of the City of Williamsburg and County of James City as Instrument No. 060009197.

Together with the reservation of easements set forth in the following Deeds of Conveyance: Deed Book 758 Page 721, Deed Book 809 Page 728, Document No. 980004099, Document No. 980011721, Document No. 990011248; Document No. 00007666; and Document No. 020022341.

VIRGINIA: CITY OF WILLIAMSBURG & COUNTY OF JAMES CITY
This document was admitted to record on 8 July 2010
at 10:45 AM/PM. The taxes imposed by Virginia Code Section 58.1-801, 58.1-802 & 58.1-814 have been paid.

STATE TAX	LOCAL TAX	ADDITIONAL TAX
$ —	$ —	$ —

TESTE: BETSY B. WOOLRIDGE, CLERK
BY: Betsy B. Woolridge Clerk

VIRGINIA: CITY OF WILLIAMSBURG & COUNTY OF JAMES CITY
This document was admitted to record on 7 June 2010
at 3:30 AM/PM. The taxes imposed by Virginia Code Section 58.1-801, 58.1-802 & 58.1-814 have been paid.

STATE TAX	LOCAL TAX	ADDITIONAL TAX
$ —	$ —	$ —

TESTE: BETSY B. WOOLRIDGE, CLERK
BY: Betsy B. Woolridge Clerk