Fieldcrest Subdivision
Floodstudy
James City County, Virginia

Prepared for

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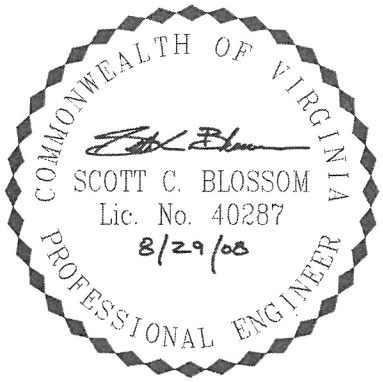

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Williamsburg Environmental Group, Inc. (WEG) has been retained by James City County to perform an engineering study to evaluate flooding issues at the Rt. 5 culvert crossing downstream of the Fieldcrest subdivision in James City County, Virginia. Various storm events have caused flooding issues in areas of the Fieldcrest subdivision, including flooding of garages, auxiliary structures, and at Rt. 5. The flooding issues are attributed to the culverts at Rt. 5 and to the configuration of the Fieldcrest BMP. After the 2006 Nor'easter James City County contracted WEG to perform an analysis of the Rt. 5 culverts (WEG, 2007). The analysis presented in this report is an update to the original study that addressed flooding issues, remediation potential, anticipated effects on downstream properties, and costs at the specified road crossing. The update incorporates the results of the *Powhatan Creek Floodplain Study* (WEG, 2008) to describe downstream boundary conditions and expands the floodplain mapping presented in the Powhatan Creek Floodplain Study into the unnamed tributary adjacent to the Fieldcrest subdivision.

The project site is located on Rt. 5 in James City County, to the north of the Fieldcrest subdivision on an unnamed tributary to Powhatan Creek (see Figures 1-1 and 1-2), located in subwatershed 201 of the Powhatan Creek watershed (catchment 201-101-1). The crossing is located between the intersections of Greensprings Plantation Road and Rt. 5 and Centerville Road and Rt. 5. The existing crossing consists of twin 18-inch RCP culverts and twin 24-inch RCP culverts, and it conveys drainage from approximately 583 acres underneath Rt. 5. Located immediately above the existing culverts are a series of beaver ponds and a stormwater best management practice (BMP) serving the Fieldcrest subdivision.

SCALE: 1 INCH = 2.4 MILES

SOURCE: VIRGINIA ATLAS AND GAZETTEER, DeLORME MAPPING CO., 1995.

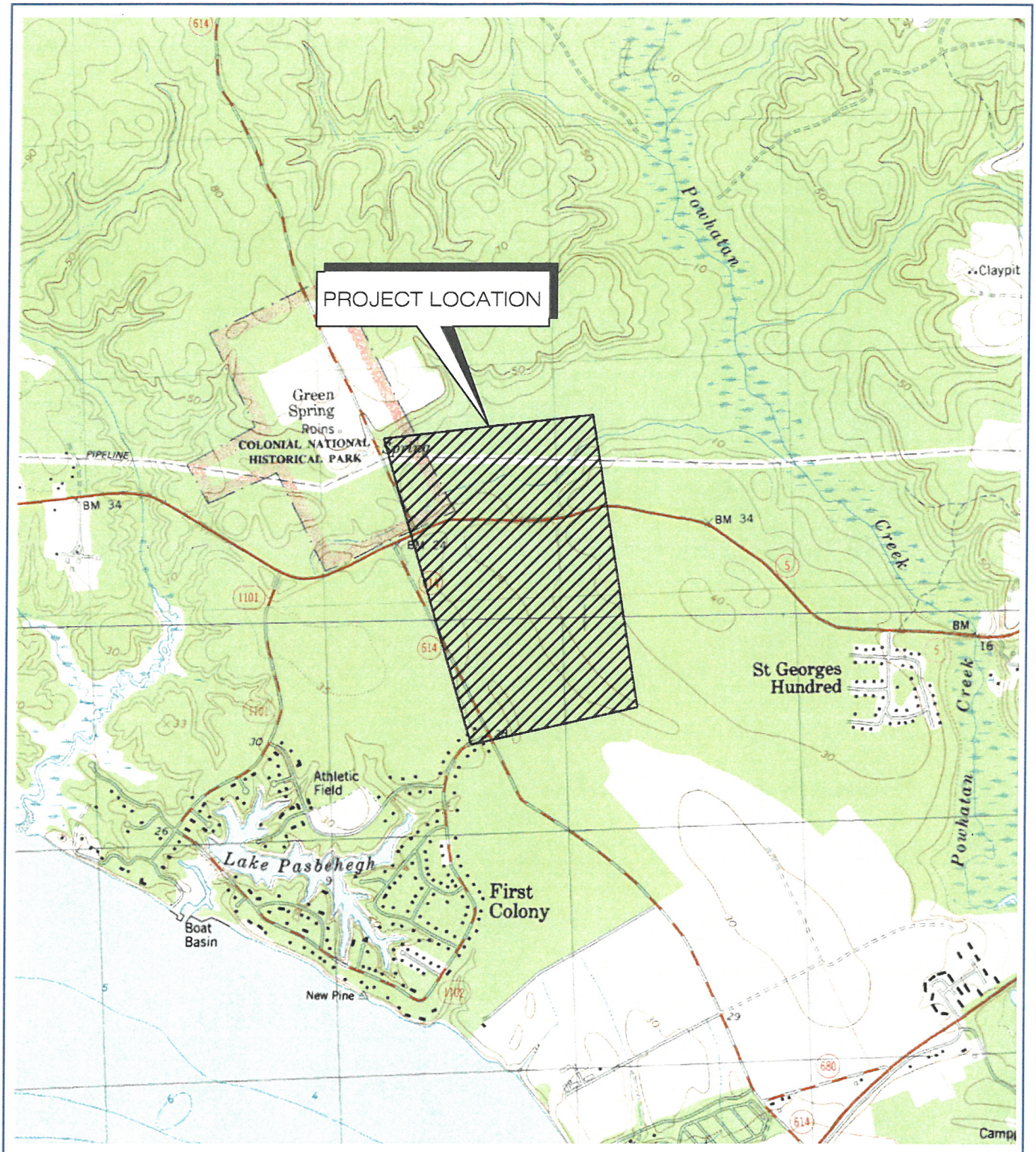
WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

FIGURE 1-1

PROJECT VICINITY MAP

FIELDCREST SUBDIVISION FLOODSTUDY

JAMES CITY COUNTY, VIRGINIA | AUGUST 2008



2000' 1000' 0' 2000'

SCALE: 1 INCH = 2000 FEET

LATITUDE: 37°15'14.06"N
LONGITUDE: 76°47'38.27"W

SOURCE: USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP, VIRGINIA BEACH, VA QUADRANGLE, 1983 (REVISED 1986)

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

FIGURE 1-2

PROJECT LOCATION MAP

FIELDCREST SUBDIVISION FLOODSTUDY

JAMES CITY COUNTY, VIRGINIA | AUGUST 2008

2.0 HYDROLOGY

The drainage area upstream of the Rt. 5 culvert crossing at the Fieldcrest subdivision measures approximately 583 acres as determined from the County's 2-ft GIS topography. The drainage area is characterized by predominantly open space with residential development along the periphery of the drainage area, as determined from 2007 aerial ortho-photography. A drainage area map is provided in Figure 2-1 below. The unnamed tributary to Powhatan Creek upstream of the Rt. 5 road crossing is characterized by a succession of two beaver dams with associated inundation and wetlands, as shown in Figure 2-1. For modeling purposes, the drainage area upstream of Rt. 5 was divided into eight sub watersheds. The hydrologic modeling also includes the storage capacity for the basin constituted by Rt. 5 and Greensprings Plantation Drive with its associated drainage area of approximately 413 acres to account for possible backwater effects associated with Greensprings Plantation Drive. Hydrologic soils groups (HSG) were determined from published soils data (Soil Survey Geographic (SSURGO) database for James City and York Counties and the City of Williamsburg, Virginia, published July 14, 2005). Times of Concentration (Tc) were established using TR-55 methodology. Table 2-1 below summarizes the drainage area characteristics for these basins, detailed computations are provided in Appendix A. Additionally, the floodplain modeling for Powhatan Creek has been utilized to assess tailwater conditions at the confluence and their possible influence on the modeling of the unnamed tributary in respect to the Rt. 5 culvert crossing and the Fieldcrest subdivision.

Table 2-1 Drainage Area Summary

Drainage Area	Area [ac]	CN [-]	Tc [hrs]
Berkley	29.39	87	0.25
Drummond	23.46	85	0.25
Fieldcrest	57.99	85	0.25
First	14.97	81	0.25
Rt. 5	46.89	83	0.91
School	45.26	85	0.25
St. George	246.28	78	0.98
Up Greensp	412.94	75	1.70
White Farm	118.78	79	1.39
Total	**995.96**	**78.3**	

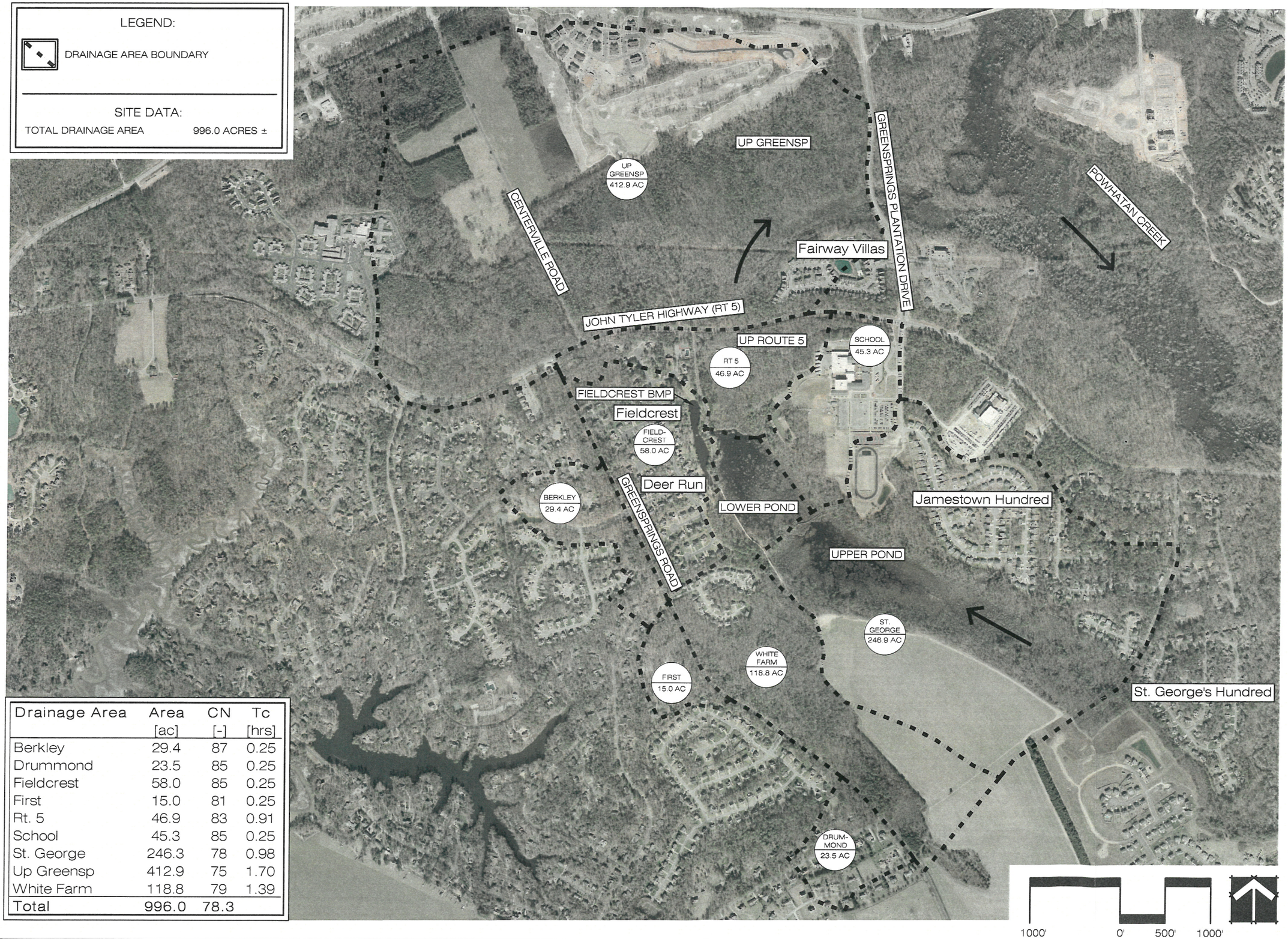
The hydrology modeling for this project was performed with Bentley's PondPack modeling software, utilizing TR-55 methodology. The model is explained in more detail in Section 3 below.

LEGEND:

DRAINAGE AREA BOUNDARY

SITE DATA:

TOTAL DRAINAGE AREA 996.0 ACRES ±



Drainage Area	Area [ac]	CN [-]	Tc [hrs]
Berkley	29.4	87	0.25
Drummond	23.5	85	0.25
Fieldcrest	58.0	85	0.25
First	15.0	81	0.25
Rt. 5	46.9	83	0.91
School	45.3	85	0.25
St. George	246.3	78	0.98
Up Greensp	412.9	75	1.70
White Farm	118.8	79	1.39
Total	996.0	78.3	

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FIGURE 2-1
DRAINAGE AREA MAP
FIELDCREST SUBDIVISION - FLOOD STUDY
JAMES CITY COUNTY, VIRGINIA

DATE: 8/29/08

JOB NUMBER: 3781

SCALE: 1 INCH = 1000 FEET

SOURCE: JAMES CITY COUNTY GIS
2007 JAMES CITY COUNTY ORTHO PHOTO

I:\3700's\3781 - Powhatan Creek Flood Study\Floodplain Analysis\Fieldcrest DA.dwg

Runoff hydrographs were developed and routed for 10-, 50-, 100-, and 500-year synthetic storm events (Type II 24-hour, Atlas 14 rainfall data) and for select storm events (2006 Nor'easter on October 6-7, 2006, Hurricane Floyd on September 15-16, 1999). Precipitation data for the storm events was obtained from the National Climatic Data Center (NCDC) for the Coop weather station Williamsburg N2 (Coop ID 449151). Figures 2-2 and 2-3 below provide graphical representations for these storm events. Hurricane Floyd is included in this report to provide consistency with the *Powhatan Creek Floodplain Study* (WEG, 2008). Routing for Hurricane Floyd was performed and the results are included in Appendix C; however, Hurricane Floyd is not further discussed in this report, nor are inundation boundaries mapped.

Figure 2-2 2006 Nor'easter

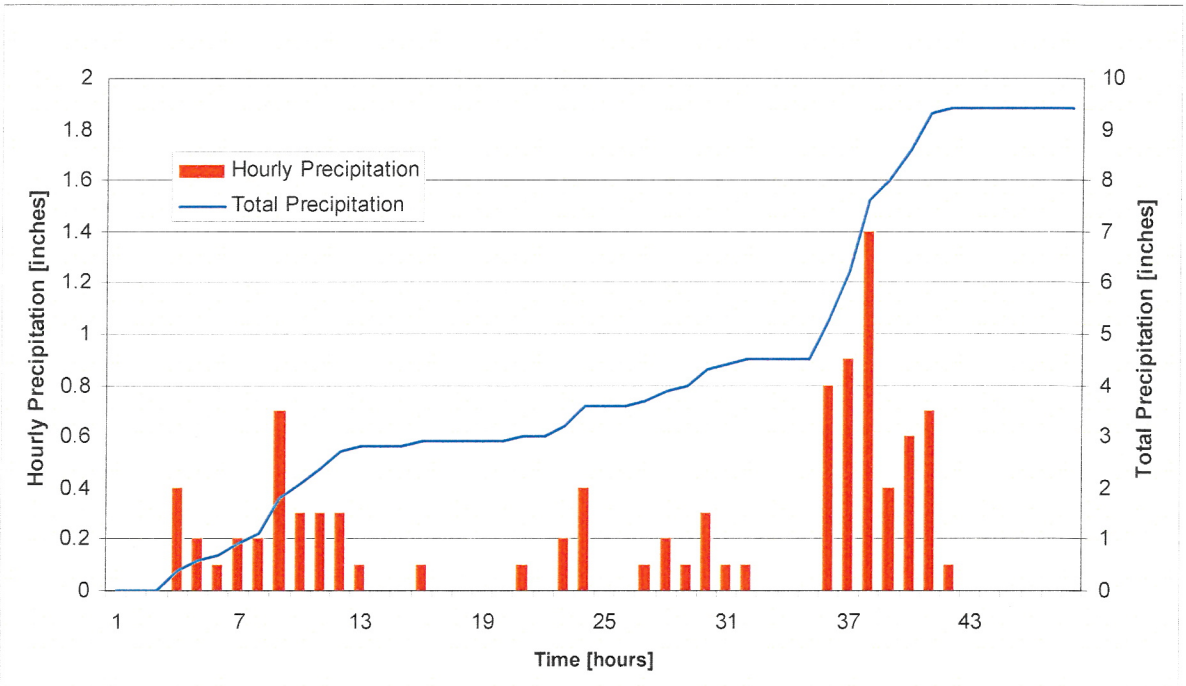


Figure 2-3 Hurricane Floyd

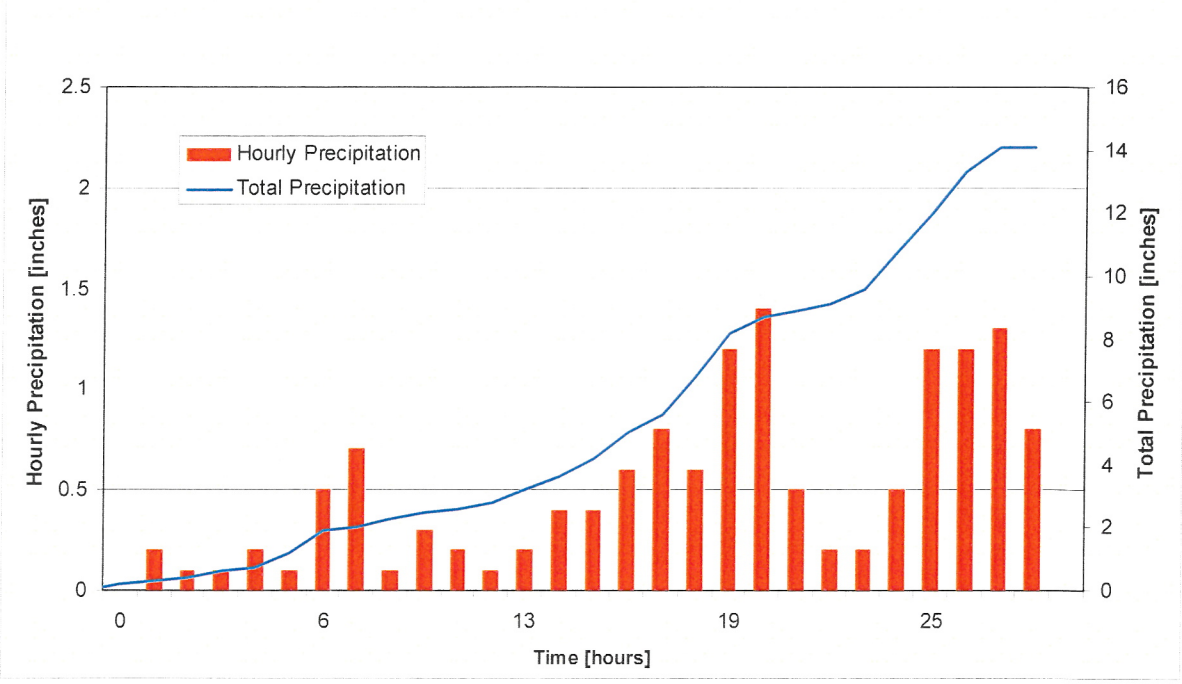


Table 2-2 summarizes the hydrograph peak flows and the hydrograph volumes of the drainage areas of the hydrologic model as well as of the combined hydrographs to the Rt. 5 crossing and the Greensprings Plantation Drive crossing. Although the total precipitation volume of the 2006 Nor'easter is somewhat higher with 9.4 inches of rainfall over approximately 40 hours, the modeled peak flows from a 100-year, 24-hour event with 9.15 inches of precipitation are significantly higher due to differences in the rainfall distribution. However, the overall runoff volume generated during these storm events is remarkably similar.

Table 2-2 Hydrology Summary

Hydrographs	Area	100-year Storm		2006 Nor'easter	
		Flow	Volume	Flow	Volume
	[ac]	[cfs]	[ac-ft]	[cfs]	[ac-ft]
Berkley	29.39	249.71	18.69	40.21	19.14
Drummond	23.46	194.72	14.43	31.76	14.80
Fieldcrest	57.99	481.31	35.68	78.52	36.57
First	14.97	117.61	8.59	19.76	8.82
Rt. 5	46.89	179.61	27.66	57.60	28.61
School	45.26	375.65	27.85	61.28	28.55
St. George	246.28	850.79	132.76	284.45	137.47
Up Greensp	412.94	890.64	209.27	404.46	217.47
White Farm	118.78	323.61	65.17	129.25	67.54
To Rt. 5 combined	583.02	661.56	277.22	271.25	240.05
To Greensprings combined	995.96	1018.76	536.57	519.05	478.32

3.0 HYDRAULIC MODELING OF THE RT. 5 ROAD CROSSING

The elevation data utilized to develop the hydraulic model originates from several sources (County GIS data, as-built surveys from Parks and Recreation, Greensprings Area Drainage Study by Mitchell-Wilson Associates (MWA, 1995), WEG field survey in the summer of 2007 (WEG, 2007), and the AES Consulting Engineers field survey in the spring of 2008 (AES, 2008)) and is referenced to the NAVD88 vertical datum. The two beaver impoundments (Upper Pond, Lower Pond), the Fieldcrest BMP (Green BMP), the basin upstream of the Rt. 5 road embankment (Up Route 5), and the basin upstream of the Greensprings Plantation road embankment (Up Greensp) were modeled as interconnected ponds. The beaver dams were, as an approximation, modeled as broad-crested weirs at the elevation of their corresponding upstream water surface elevations (WSE), 18.32 ft for the upper beaver dam and 17.28 ft for the lower beaver dam, respectively, as reported in the referenced MWA study. Stormwater conveyance at the Rt. 5 road crossing is provided in the form of four relatively small, circular RCP culverts through the road embankment with dimensions as summarized in Table 3-1 below. The low point on the roadway is at elevation 20.39 ft (msl) (AES, 2008). Stormwater conveyance at the Greensprings Plantation road crossing is provided by 7 large, circular RCP culverts with dimensions as summarized in Table 3-1 below. The low point of Greensprings Plantation Drive in the vicinity of the road crossing is at elevation 20.6 ft (msl)(AES, 2008).

Table 3-1 Rt. 5 and Greensprings Plantation Culvert Data (AES, 2008)

Culvert	US Invert [ft msl]	DS Invert [ft msl]	Diameter [ft]	Length [ft]	Material [-]
Rt. 5 #1	14.88	14.22	2.0	50	RCP
Rt. 5 #2	14.92	14.25	2.0	52	RCP
Rt. 5 #3	14.70	14.24	1.5	42	RCP
Rt. 5 #4	15.85	14.79	1.5	42	RCP
GS #1	9.20	9.20	5.0	74	RCP
GS #2	9.44	9.54	5.0	74	RCP
GS #3	9.37	9.52	5.0	74	RCP
GS #4	9.12	9.12	5.0	82	RCP
GS #5	9.50	9.42	5.0	82	RCP
GS #6	9.42	9.37	5.0	82	RCP
GS #7	9.55	9.34	6.0	115	RCP

Stage-storage data was developed for the ponding areas within the watershed of the unnamed tributary to Powhatan Creek for the upper beaver pond, the lower beaver pond, the area between Rt. 5 and the lower beaver dam, and for the area between Greensprings Plantation Drive and Rt. 5 based on 2-ft GIS data available from James City County and the AES survey in the spring of 2008.

The Fieldcrest subdivision is serviced by a retention pond for stormwater management purposes. This Best Management Practice (BMP) is included as a separate pond in the interconnected pond model. The volume estimate is based on the JCC 2-ft GIS topography and the outlet description is based on the 2008 AES survey. The principal spillway consists of a 24 inch corrugated HDPE pipe that is routed to a manhole upstream of Rt. 5 and from there underneath Rt. 5. Upstream invert is at elevation 14.21 and the downstream invert is at elevation 12.52. With an overall pipe length of approximately 830 ft the resulting longitudinal slope is with 0.2% very low, limiting the capacity of the primary outfall significantly. The BMP is equipped with an emergency spillway that discharges downstream of the lower beaver dam, with a low point at elevation 18.05 (AES, 2008). With this low point, overflow from the ponding area upstream of Rt. 5 is expected to occur frequently. The inundation characteristic of the BMP, and thus of the Fieldcrest subdivision, for larger storm events appears to be controlled primarily by the prevailing conditions at the Rt. 5 culvert crossing.

The hydrologic and hydraulic (H&H) model developed with PondPack is set up as an interconnected pond model that includes an estimate for the storage areas upstream of Greensprings Plantation Drive as previously described. The 2008 AES survey reflects one single Water Surface Elevation (WSE) point for the 2006 Nor'easter, located at a storage shed at the western edge of the Fieldcrest subdivision. The model reflects the overall inundation characteristic of the area upstream of Rt. 5 satisfactorily when compared with observed inundation from 2006 Nor'easter, as documented with photographs received from James City County (selected photographs in Appendix B). However, the modeling shows a peak WSE for this storm event of approximately 20.0 ft whereas the documented WSE is 20.62 ft. The documented WSE appears relatively high and could be verified with additional photographically documented locations. Figure 3-1 below gives a schematic for the PondPack model.

The hydraulic analysis demonstrates that the tailwater condition at the Rt. 5 culvert crossing is significantly influenced by the tailwater conditions created by the Greensprings Plantation Drive culvert crossing. Table 3-2 below summarizes Water Surface Elevation (WSE) data at the confluence of the unnamed tributary with Powhatan Creek at 2 cross-sections immediately upstream and downstream of the confluence, based on the modeling performed for the Powhatan Creek Floodplain Study. Figure 3-2 below illustrates the utilized tailwater dynamics for the interconnected pond modeling for the Fieldcrest area.

Figure 3-1 Pond Pack Schematic

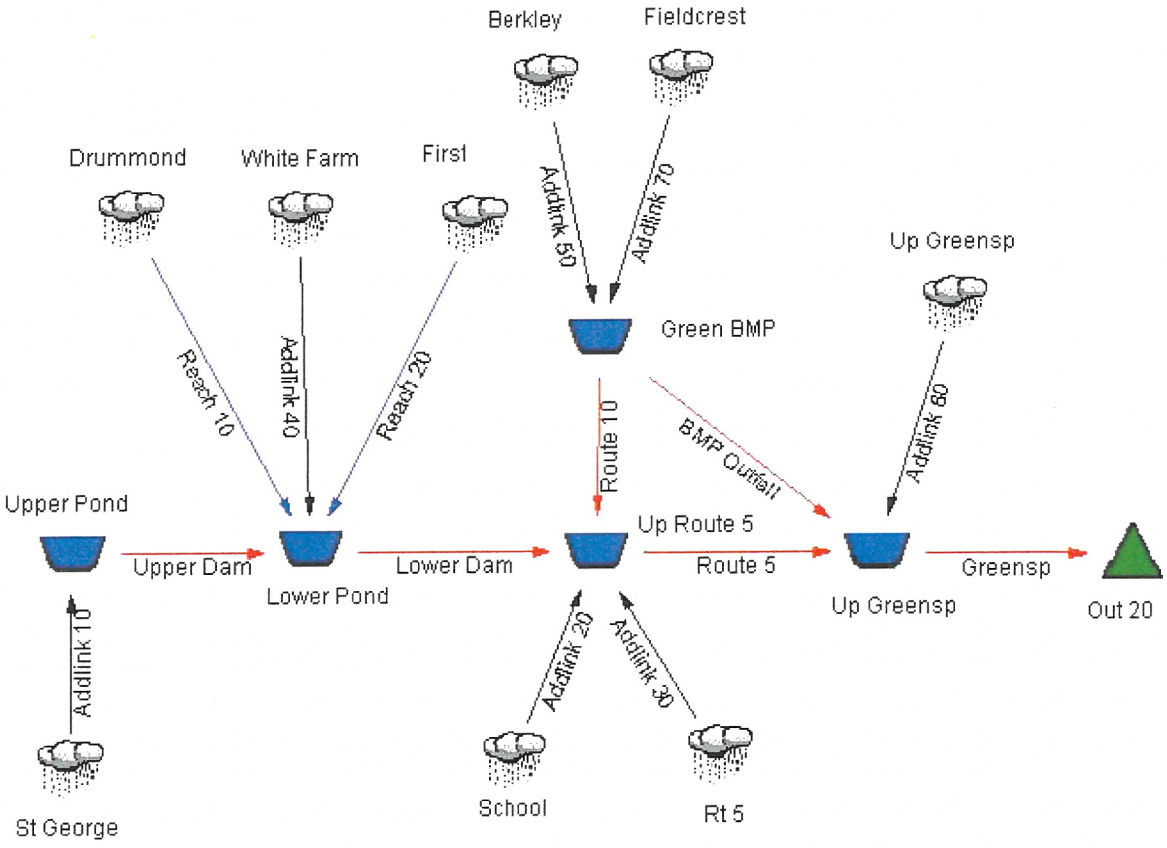
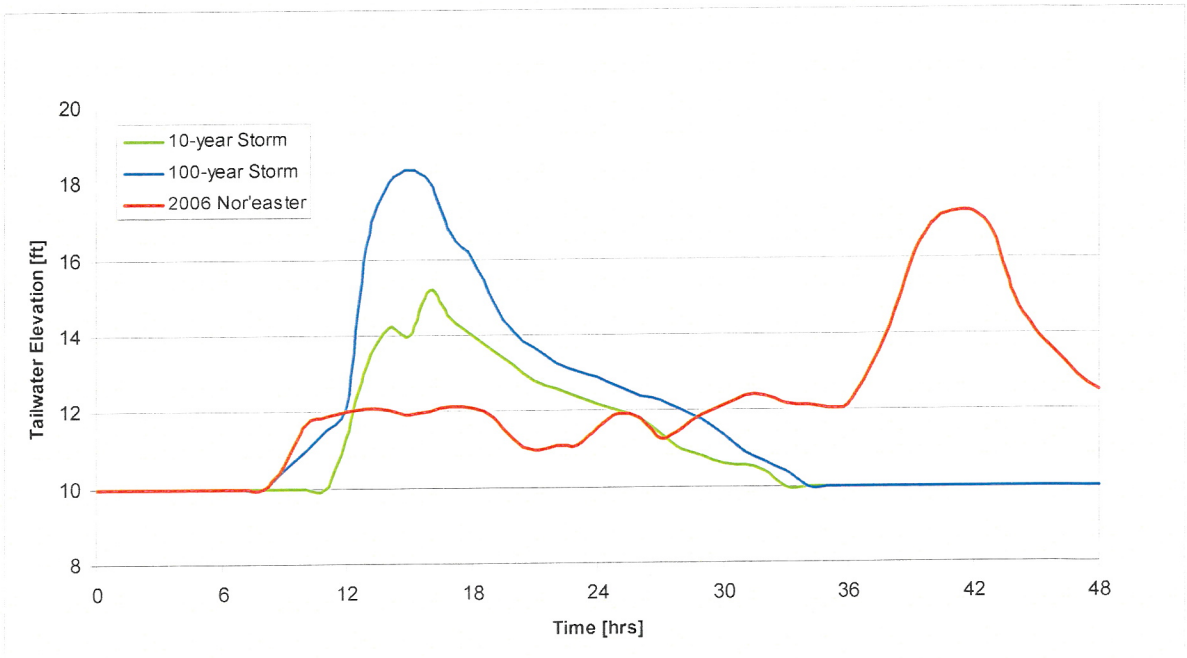


Table 3-2 WSE at Confluence with Powhatan Creek

Storm Event	RS 2.28 [ft]	RS 2.49 [ft]
10-year	14.57	15.66
50-year	17.46	18.05
100-year	18.39	19.01
500-year	20.55	21.27
2006 Nor'easter	17.32	17.9
Hurricane Floyd	18.66	19.28

Figure 3-2 Modeled Tailwater Conditions at Greensprings Plantation Drive



4.0 RESULTS SUMMARY FOR RT. 5 CULVERT CROSSING

4.1 100-YEAR STORM EVENT

The Rt. 5 culvert crossing has been analyzed for the existing culvert configuration with four relatively small, circular RCP culverts as described in Table 3-1 above, as well as for four box culvert configurations consisting of 6' wide (W) x 4' high (H) box culverts in groups of two, four, six, and eight culvert units. The height of the analyzed culverts is limited to 4' due to the local embankment conditions with the toe of the embankment at an approximate elevation of 14.25 ft and the top of the road at an approximate elevation of 20.4 ft. Minimum cover requirements may necessitate raising the road embankment in the area of the road crossing or a reduction of the culvert height. The existing culvert configuration has been evaluated for a 100-year storm event against three tailwater scenarios (no tailwater, 10-year storm event in Powhatan Creek, and 100-year storm event in Powhatan Creek. The summary provided in Table 4-1 shows that for the existing culvert configuration the resulting WSE differences in the Fieldcrest BMP and upstream of Rt. 5 are negligible. The WSE upstream of Greensprings Plantation Drive however is clearly influenced by the prevailing tailwater condition in Powhatan Creek. Table 4-2 shows that this pattern is virtually unchanged for the areas upstream of Rt. 5 with an increase of culvert capacity at Rt. 5 based on the example of a culvert group with (6) 6 ' W x 4' H box culverts. Peak WSEs upstream of Rt. 5 are still inlet controlled by the Rt. 5 crossing, however, peak elevations upstream of Greensprings Plantation Drive increase due to the increased capacity at the Rt. 5 crossing.

Table 4-1 Effect of Tailwater Scenario for existing Culvert Group

Powhatan Creek Tailwater Model	**Max WSE Fieldcrest BMP** [ft msl]	**Max. WSE Rt. 5** [ft msl]	**Max. WSE Greensprings** [ft msl]
No Tailwater	20.44	20.45	14.42
10-year Storm	20.44	20.45	15.22
100-year Storm	20.49	20.50	18.38

Table 4-2 Effect of Tailwater Scenario for 6 Box Culverts

Powhatan Creek Tailwater Model	**Max WSE Fieldcrest BMP** [ft msl]	**Max. WSE Rt. 5** [ft msl]	**Max. WSE Greensprings** [ft msl]
No Tailwater	19.20	18.95	16.13
10-year Storm	19.20	18.95	16.15
100-year Storm	19.20	18.95	18.64

Figure 4-1 gives time-elevation graphs for existing conditions for the Fieldcrest BMP and the storage areas upstream of Greensprings Plantation Drive, upstream of Rt. 5, and Lower and Upper Pond. The tailwater condition utilized corresponds with a 10-year storm in Powhatan Creek. The graphic depicts that the peak inundation elevations for areas upstream of the Rt. 5 crossing are influenced primarily by the Rt. 5 culvert crossing.

Figure 4-1 Time-Elevation Data For Existing Conditions (100-year)

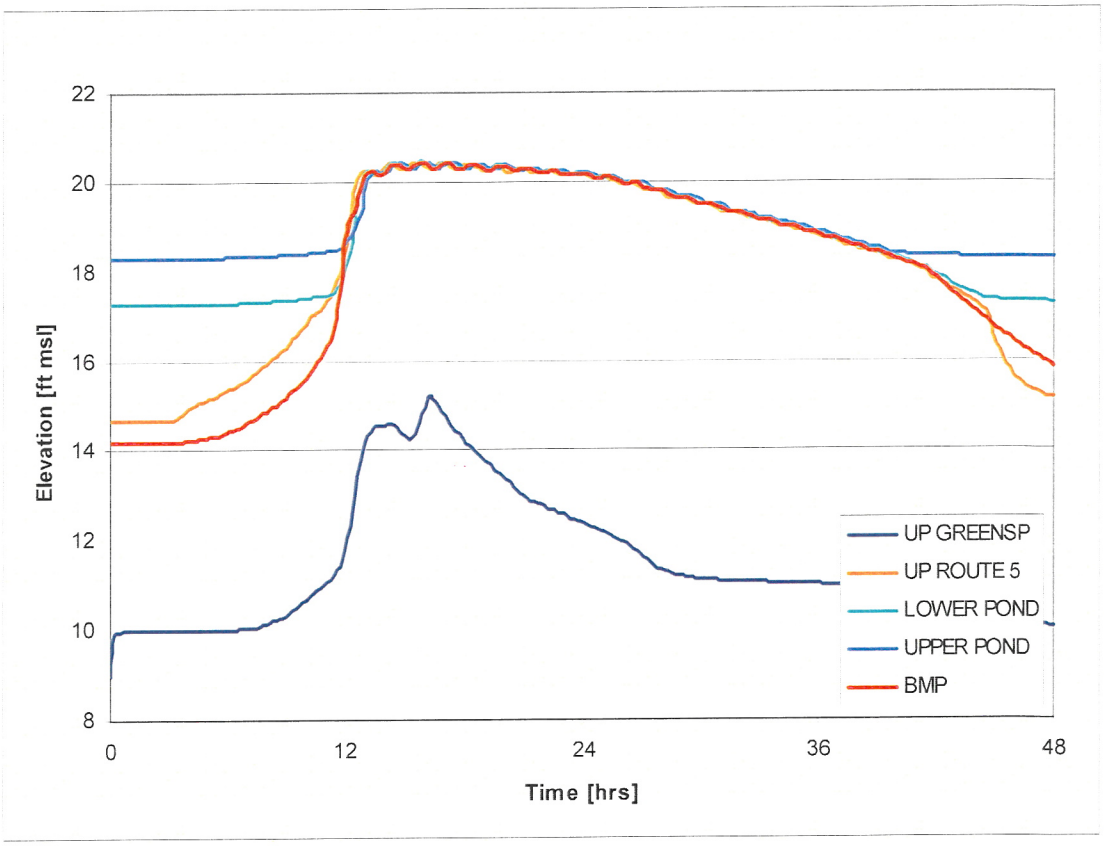


Figure 4-2 gives time-elevation graphs for a culvert configuration with 6 box culverts for the Fieldcrest BMP and the storage areas upstream of Greensprings Plantation Drive, upstream of Rt. 5, and Lower and Upper Pond. The graphic shows that although the WSE upstream of Rt. 5 are still influenced by the undersized Rt. 5 culvert crossing, the peak elevations are significantly lower. Figure 4-2 also demonstrates that although the situation for the Fieldcrest BMP is improved; emptying of the BMP is delayed due to the low available capacity of the principal spillway as described in the first paragraph on page 9.

Figure 4-2 Time-Elevation Data For Six (6) Box Culverts (100-year)

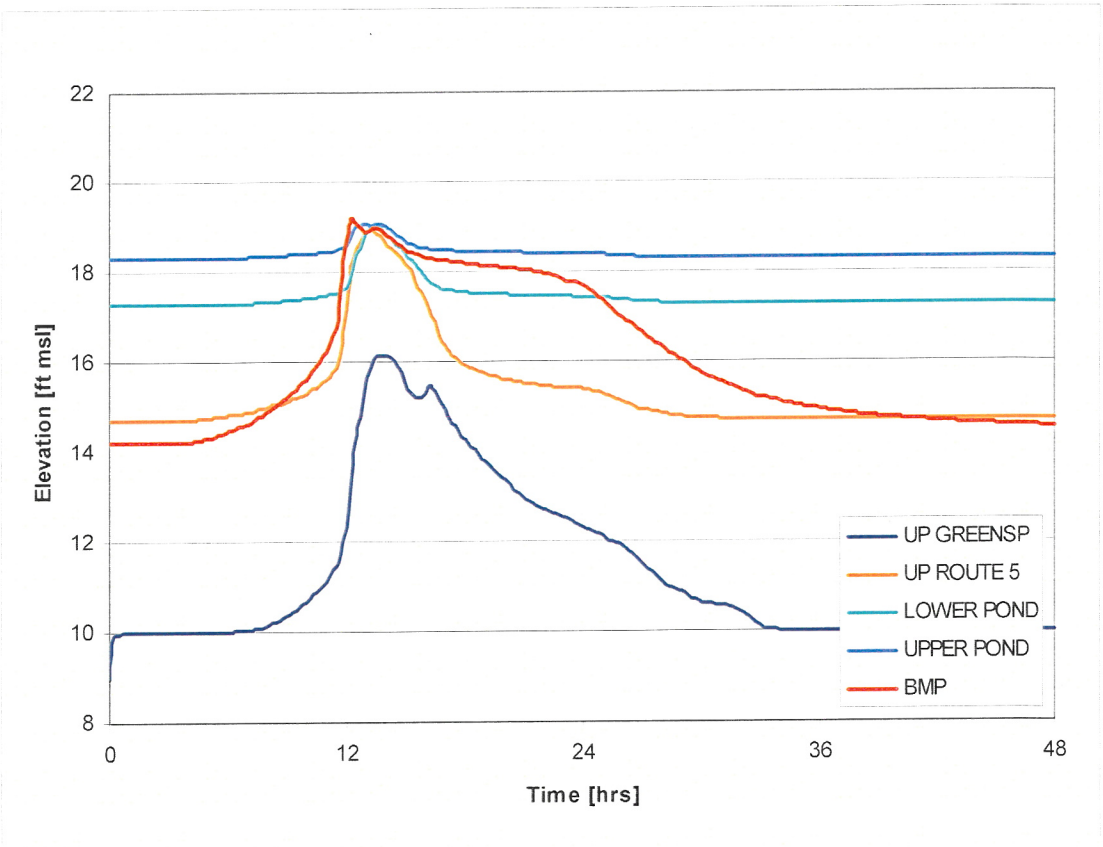


Table 4-3 summarizes the modeling results for the described culvert configuration scenarios at the Rt. 5 crossing. The table shows peak flows at the Rt. 5 crossing, the maximum expected WSEs in the area of the Fieldcrest subdivision, and the WSE reductions effected by the various culvert configurations WEG analyzed. The last column in the table shows the incremental reduction achieved with additional culverts. It should be noted that the capacity of the existing culverts is limited to approximately 110 cfs without overtopping of Rt. 5. It appears that a culvert configuration with 2 box culverts as described below will reduce WSEs sufficiently to contain 100-year storm flows (??? cfs)in the culvert and avoid overtopping of the road. With a headwater elevation corresponding

with top of road, a conveyance capacity of approximately 400 cfs is available under the (6) 4' x 6' box culvert scenario.

Table 4-3 Rt. 5 Crossing – WSE Reduction for Culvert Scenarios (100-year)

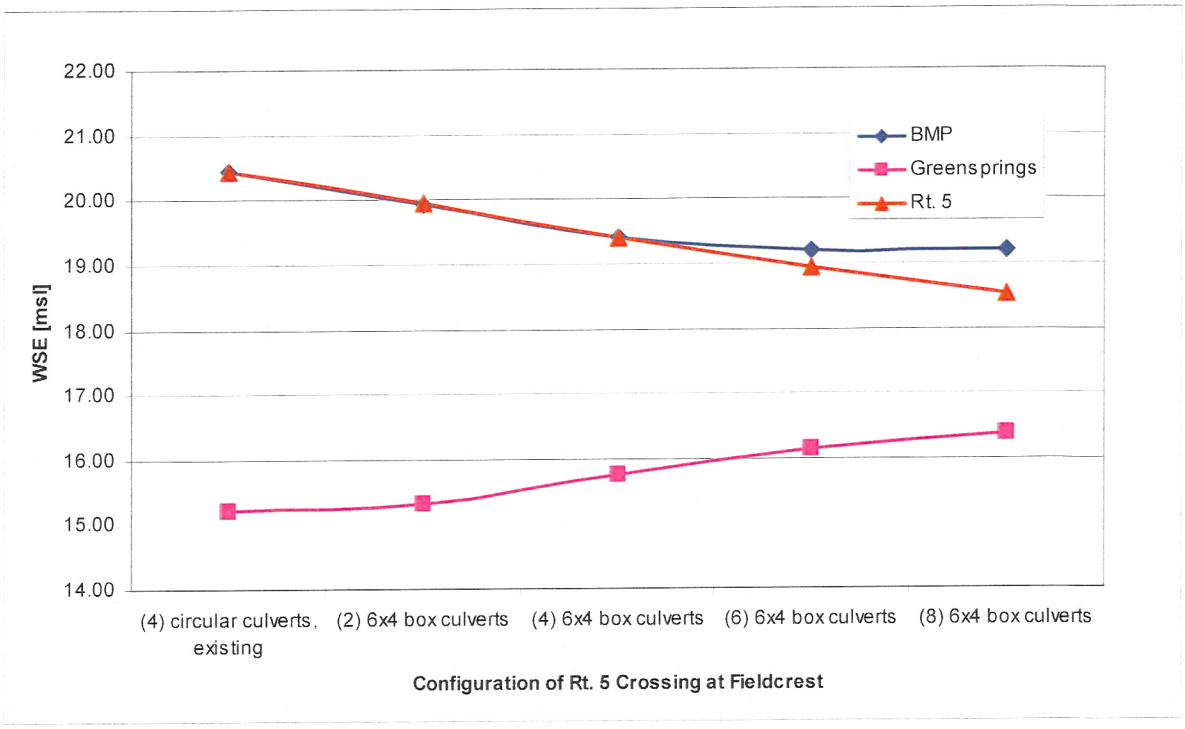
Culvert Configuration	Peak Flow [cfs]	Max. WSE [ft msl]	WSE Reduction [ft]	Incremental Reduction [ft]
(4) circular culverts, existing	116.08	20.45		
(2) 6x4 box culverts	353.46	19.95	0.50	0.50
(4) 6x4 box culverts	601.80	19.41	1.04	0.54
(6) 6x4 box culverts	770.94	18.95	1.50	0.46
(8) 6x4 box culverts	877.32	18.52	1.93	0.43

Table 4-4 gives a comparison of the maximum WSEs in the Fieldcrest BMP, upstream of Rt. 5 (Fieldcrest) and upstream of Greensprings Plantation Drive. Figure 4-3 is a graphical representation of the same data.

Table 4-4 Rt. 5 Crossing – WSE for Culvert Scenarios (100-year)

Culvert Configuration	Max WSE Fieldcrest BMP [ft msl]	Max. WSE Rt. 5 [ft msl]	Max. WSE Greensprings [ft msl]
(4) circular culverts, existing	20.44	20.45	15.22
(2) 6x4 box culverts	19.93	19.95	15.31
(4) 6x4 box culverts	19.41	19.41	15.76
(6) 6x4 box culverts	19.20	18.95	16.15
(8) 6x4 box culverts	19.20	18.52	16.37

Figure 4-3 Rt. 5 Crossing – Scenario Summary Grapic (100-year)

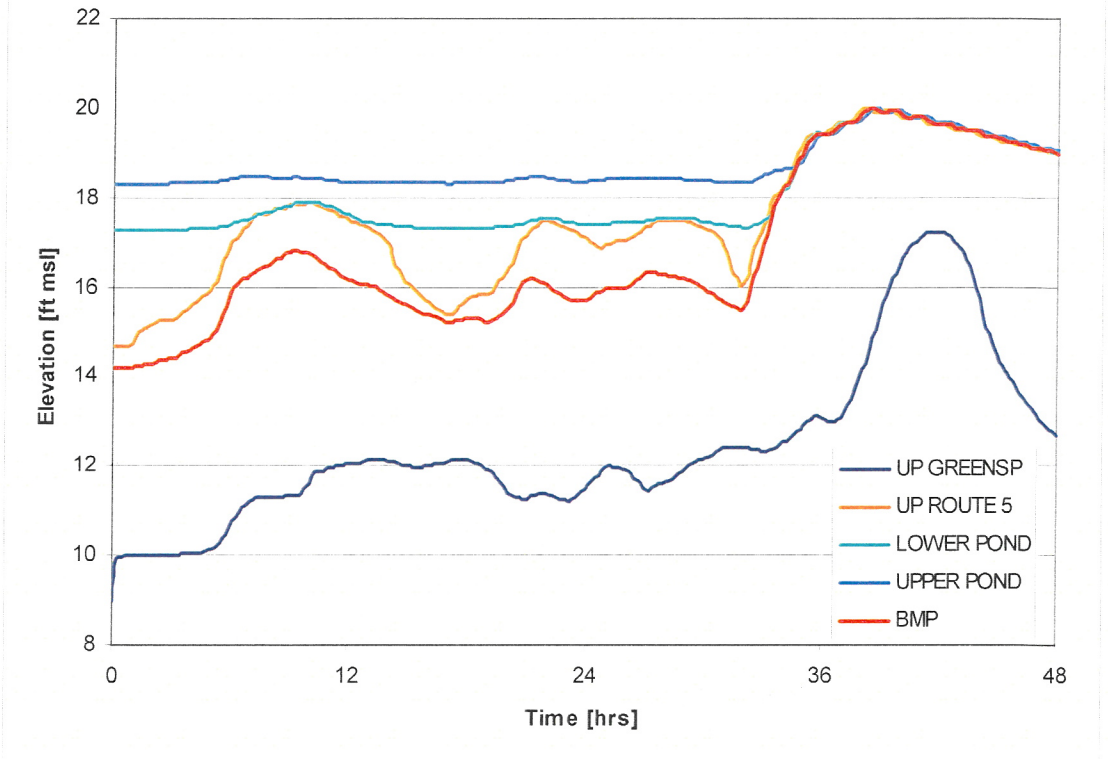


Based on the assessment of the various box culvert configurations, it appears that (2) 6' W x 4' H box culverts are necessary to increase the capacity of the Rt. 5 culvert crossing sufficiently to prevent overtopping of the road during a 100-year storm event. Every additional box culvert added will help reduce peak WSE upstream of Rt. 5.

4.2 2006 NOR'EASTER

For comparison purposes the same series of analyses that has been performed for a 100-year storm event (Section 4.1) has been performed for the 2006 Nor'easter storm event. Figure 4-4 gives time-elevation graphs for existing conditions for the storage areas upstream of Greensprings Plantation Drive, upstream of Rt. 5, and Lower and Upper Pond.

Figure 4-4 Time-Elevation Data For Existing Conditions (2006 Nor'easter)



The graphic shows a similar dynamic for the 2006 Nor'easter versus a synthetic 100-year storm event. Although the peak inflows from the various drainage areas are significantly smaller (as shown in Table 2-2), the existing capacity at Rt. 5 is limited and leads to a backup that influences the overall upstream basin.

Figure 4-5 gives time-elevation graphs for a culvert configuration with 6 box culverts for the storage area upstream of Greensprings Plantation Drive, upstream of Rt. 5, and Lower and Upper Pond. It appears that for the 2006 Nor'easter the increased capacity at Rt. 5 would be sufficient to prevent flooding upstream of Rt. 5 that is caused by the existing limited culvert capacity at the road crossing. The backwater influence on the upstream system appears to be significantly reduced. There may be remaining backwater influence, specifically during the end of the storm event, affecting the area upstream of Rt. 5, but the overall WSEs are significantly reduced.

Figure 4-5 Time-Elevation Data For Six (6) Box Culverts (2006 Nor'easter)

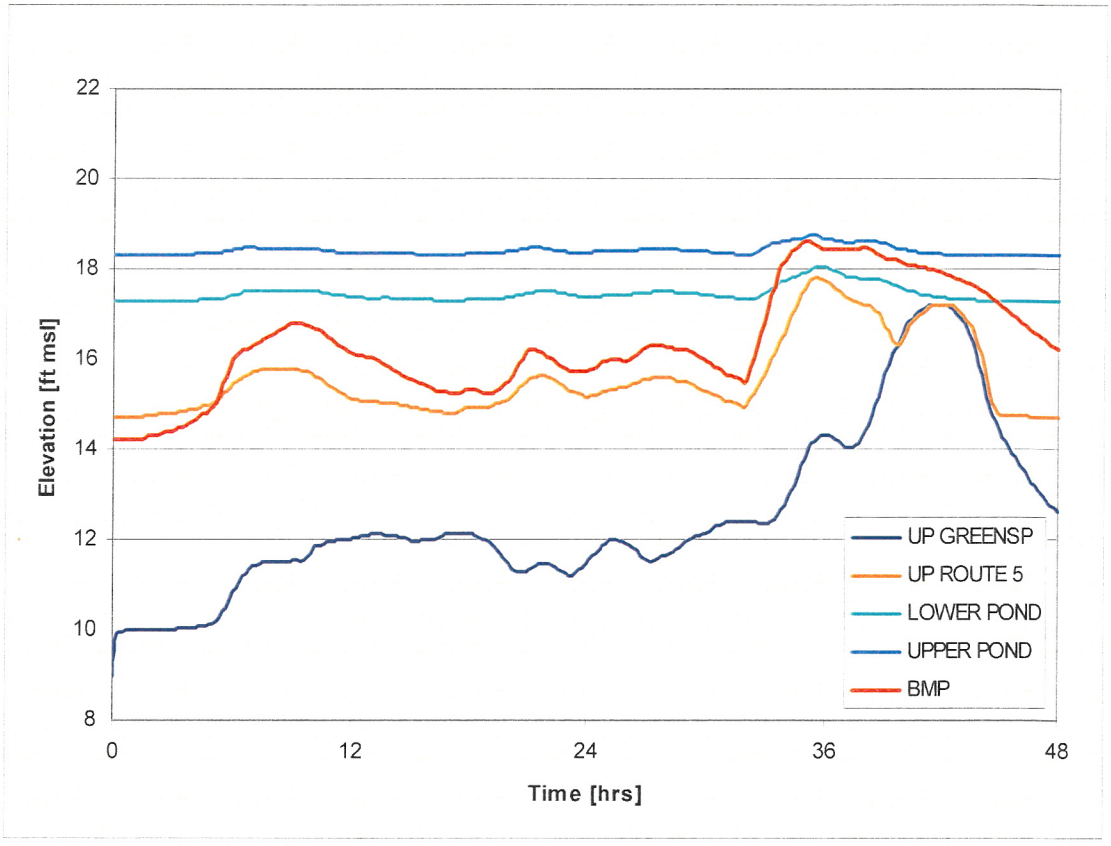


Table 4-5 summarizes the modeling results for the previously described culvert configuration scenarios at the Rt. 5 crossing. The table shows peak flows at the Rt. 5 crossing, the maximum expected WSEs in the area of the Fieldcrest subdivision, and the WSE reduction effected by the various culvert configurations analyzed. Table 4-6 gives a comparison of the maximum WSEs in the BMP, upstream of Rt. 5 (Fieldcrest) and upstream of Greensprings Plantation Drive. Figure 4-6 below is a graphical representation of the same data.

Table 4-5 Rt. 5 Crossing – WSE Reduction for Culvert Scenarios (2006 Nor'easter)

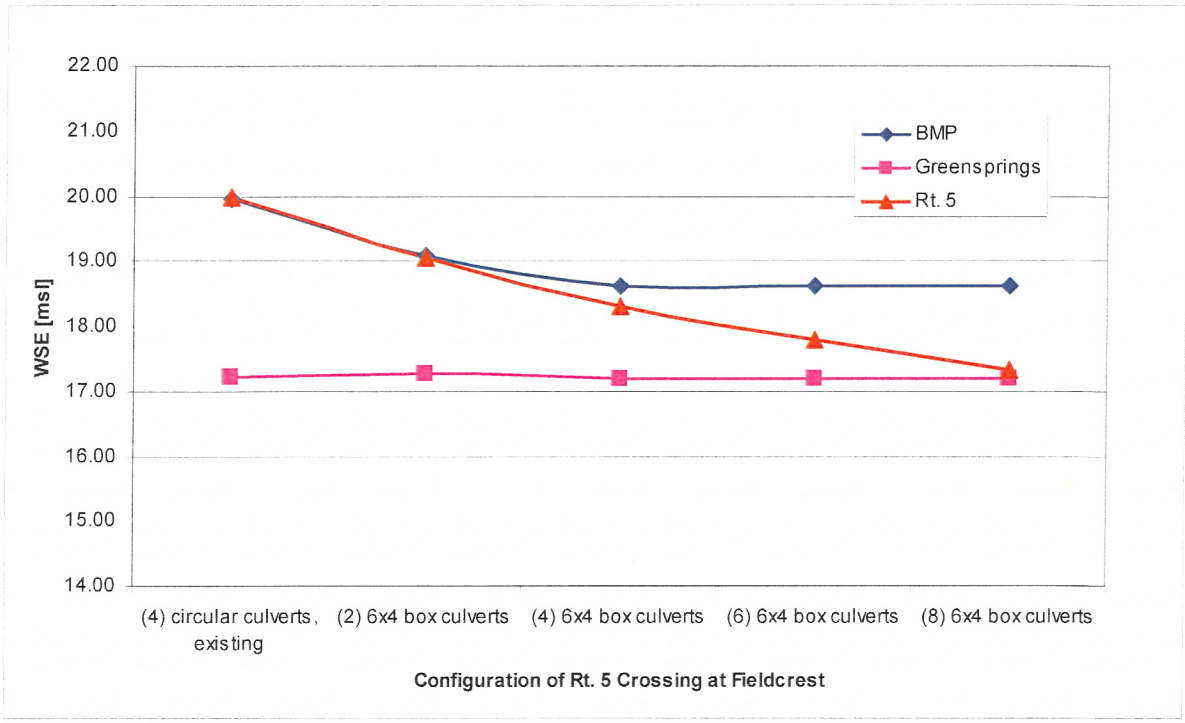
Outlet Configuration	Peak Flow [cfs]	Max. WSE [ft msl]	WSE Reduction [ft]	Incremental Reduction [ft]
(4) circular culverts, existing	106.07	19.98		
(2) 6x4 box culverts	267.20	19.06	0.92	0.92
(4) 6x4 box culverts	400.45	18.30	1.68	0.76
(6) 6x4 box culverts	480.61	17.80	2.18	0.50
(8) 6x4 box culverts	501.94	17.33	2.65	0.47

Table 4-6 Rt. 5 Crossing – WSE for Culvert Scenarios (2006 Nor'easter)

Outlet Configuration	Max WSE BMP [ft msl]	Max. WSE Rt. 5 [ft msl]	Max. WSE Greensprings [ft msl]
(4) circular culverts, existing	19.97	19.98	17.23
(2) 6x4 box culverts	19.09	19.06	17.27
(4) 6x4 box culverts	18.62	18.30	17.21
(6) 6x4 box culverts	18.62	17.80	17.21
(8) 6x4 box culverts	18.62	17.33	17.21

Based on the assessment of the various box culvert configurations, it appears that two 6' W x 4' H box culverts would provide sufficient capacity at the Rt. 5 culvert crossing to prevent overtopping of the road during a similar event as the 2006 Nor'easter and to reduce peak water surface elevations upstream of Rt. 5 by approximately 1 ft. Every additional box culvert added will help reduce peak WSE upstream of Rt. 5, with the third and fourth unit providing additional reductions of approximately 0.5 ft each. It appears for such a storm event the reduction potential is limited to approximately 2.65 ft as WSEs upstream and downstream of Rt. 5 equalize around an elevation of 17.3 ft. It should be noted that the WSE upstream of Greensprings Plantation Drive appears to be significantly influenced by tailwater conditions driven by Powhatan Creek. The flooding dynamic of the Fieldcrest BMP can be improved somewhat with the modification of the Rt. 5 culvert crossing. However, the dynamic of the BMP is strongly influenced by the capacity of the principal outfall structure of this BMP and by the tailwater condition downstream of Rt. 5.

Figure 4-6 Rt. 5 Crossing – Scenario Summary Grapic (2006 Nor'easter)



4.3 FIELDCREST BMP

The performed analysis demonstrates that the emergency spillway (crest elevation = 18.05 ft) of the Fieldcrest BMP is activated already with a 2-year storm event. However, the spillway is activated by inflows from the storage area upstream of Rt. 5 and by flows from the Fieldcrest BMP. For a 2-year storm event the inflows are not large enough to increase the peak WSE in the BMP and thus to impact the flooding scenario for the Fieldcrest subdivision. However, during a 5-year storm event the peak WSE in the BMP is clearly driven by the backflow into the BMP. The shaded rows in the Table 4-7 indicate the storm events for which the WSE in the BMP is determined by the backwater effect of the existing Rt. 5 crossing.

Table 4-7 Peak Elevation for Fieldcrest BMP

Storm Event	Water Surface Elevations	
	BMP [ft]	Upstream of Rt. 5 [ft]
1-year	16.71	17.91
2-year	17.84	18.24
5-year	18.72	18.74
10-year	19.14	19.15
25-year	19.72	19.73
50-year	20.10	20.11
100-year	20.44	20.45
500-year	20.95	20.96

The Fieldcrest BMP has an available storage of approximately 25 ac-ft to elevation 20.0 ft and an additional 16 ac-ft between elevation 20.0 and 21.0. As a preliminary assessment of the possible impact of an emergency spillway modification, WEG has analyzed an emergency spillway configuration with a crest elevation at 21.0 ft. Table 4-8 summarizes the results of this analysis. The analysis shows that for storm events with a return period of 2 – 10 years limited improvement of the flooding situation may be possible. However, for less frequent storm events the limited capacity of the principal spillway would worsen the flooding situation. The shaded rows in Table 4-8 indicate the storm events, where a modification of the emergency spillway (EM) as indicated would result in an improvement of the flooding situation associated with the BMP in the Fieldcrest subdivision

Table 4-8 Peak Elevation for Fieldcrest BMP with modifed EM Spillway

Storm Event	Water Surface Elevations		
	BMP w/mod. EM	BMP w/ EM [ft]	Upstream of Rt. 5 [ft]
1-year	16.71	16.71	17.91
2-year	17.60	17.84	18.24
5-year	18.50	18.72	18.74
10-year	19.11	19.14	19.15
25-year	20.02	19.72	19.73
50-year	20.38	20.10	20.11
100-year	20.80	20.44	20.45
500-year	21.36	20.95	20.96

4.4 FLOODPLAIN MAPPING

WEG has utilized the results of the present study to extend the floodplain mapping presented in the Powhatan Creek Floodplain Study into the unnamed tributary originating adjacent to the Fieldcrest subdivision. The mapping is based on the existing culvert configuration at the Rt. 5 crossing, utilizing the results of the Powhatan Creek Floodplain Study as the downstream boundary conditions in the interconnected pond model.

For the interpretation of these mapping results it should be noted that due to the prevailing topographic conditions in the area of the two beaver ponds no detailed elevation data exists as this area is not suitable for photogrammetric or terrestrial survey. Thus, the accuracy of the contour data for this area is somewhat limited. Additionally, ground elevations at the southeastern edge of the contributing drainage area are between 20.0 and 21.0 ft with very small elevation differences that make the determination of a clear ridgeline challenging. This provides for the possibility of outflow from this area towards the southeast during less frequent storm events.

5.0 DOWNSTREAM INUNDATION IMPACT

The storm inundation characteristics for the area between Greensprings Plantation Drive and Rt. 5 are, in addition to the runoff from the contributing watershed, controlled by two other factors, namely the downstream tailwater condition and the conveyance capacity at the Rt. 5 culvert crossing. As modifications at the Rt. 5 culvert crossing are geared towards increasing the conveyance capacity with the goal of reducing WSE during a storm event in the Fieldcrest subdivision, it is expected that the inundation characteristics between Rt. 5 and Greensprings Plantation Drive will change correspondingly.

The analysis summarized in Section 4 indicates that for an alternative with six (6) box culverts at Rt. 5 the WSE in the area between Greensprings Plantation Drive and Rt. 5 will increase by approximately 0.93 ft, from approximately 15.22 ft to approximately 16.15 ft, during a 100-year storm event based on a 10-year tailwater condition in Powhatan Creek. For a 100-year tailwater condition the increase is expected to be approximately 0.26 ft, from approximately 18.38 ft to 18.64 ft. Based on the available topographic information and the floodplain boundary established with this assessment, no flooding of structures is expected in this area.

6.0 CONCEPTUAL COST OPINION

WEG has developed a preliminary pre-design cost opinion for two alternatives for improvements at the Rt. 5 culvert crossing. The first alternative consists of the installation of 4 (four) box culverts of 6 ft width and 4 ft height underneath Rt. 5; the second consists of installation of 8 (eight) box culverts. The cost opinions are structured similarly as a cost opinion performed by the Environmental Division of James City County for the analyzed Route 31 Jamestown Road Box Culvert Improvements in November 2000. The unit costs were adjusted by approximately 25% to account for inflation. Unit costs for the box culverts are based on a budget quote from Americast, under the assumption of minimal cover (epoxy coated steel). Design costs (at 10% of construction costs) as well as a contingency (15%) were included in the cost estimate. Table 6-1 below summarizes the cost opinions and gives the approximate reduction of WSE achieved upstream of Rt. 5 for the two alternatives. The detailed cost opinions can be found in Appendix D.

Table 6-1 Conceptual Cost Estimate Summary

Project	Cost [$]	WSE Reduction upstream of Rt. 5 [ft]
4 Box Culverts	$ 306,900.00	1.05
8 Box Culverts	$ 454,810.00	1.93

The cost opinion presented here does not include any costs associated with permitting and mitigation for possible impacts on wetlands or waters of the U.S.

7.0 REFERENCES

AES, 2008
Fieldcrest and Greensprings Plantation Field Survey
AES Consulting Engineers
Williamsburg, May 2008

MWA, 1995
Greensprings Area Drainage Study
Mitchell-Wilson Associates, pc
West Point, Virginia, July 1995, revised August 1996

WEG, 2007
Fieldcrest Field Survey
Williamsburg Environmental Group, Inc.
Williamsburg, June 2007

WEG, 2007
Route 5 Culvert Crossing - Flooding Study
Williamsburg Environmental Group, Inc.
Williamsburg, July 2007, revised November 2007

WEG, 2008
Powhatan Creek Floodplain Study
Williamsburg Environmental Group, Inc.
Williamsburg, July 2008

Appendix A

Hydrologic Calculations

Appendix B

Select Photographs of the 2006 Nor'eastern

Appendix C

PondPack Modeling Results

100-year Storm

2006 Nor'easter

Appendix D

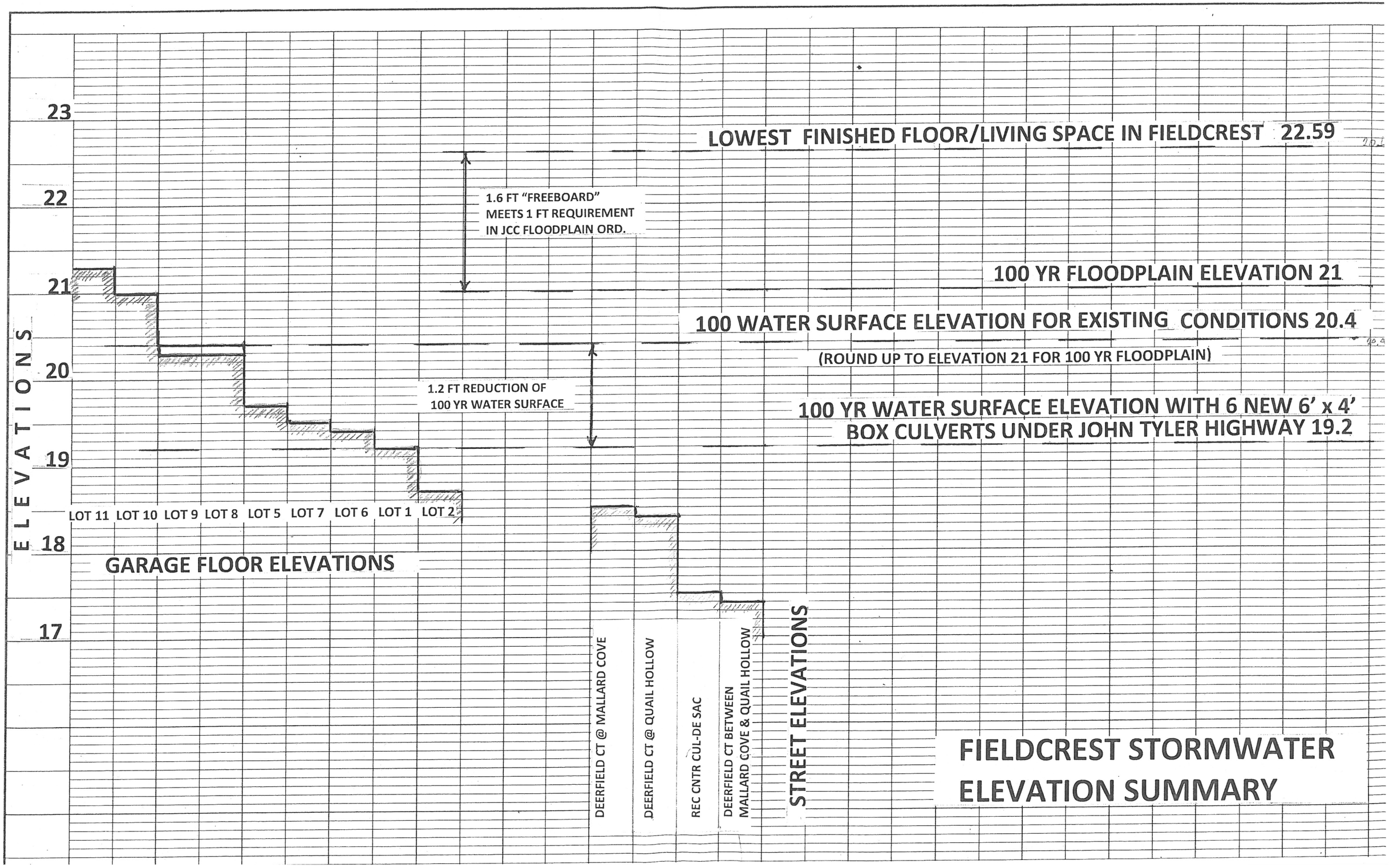
Preliminary Cost Opinion

Appendix A

Hydrologic Calculations

Sum of Area (ac)					
DA	Use	HSG	Total	CN	CN*Area
BERKLEY	QUART	B	1.037	75	77.8
		C	0.737	83	61.2
		D	27.612	87	2402.2
	QUART Total		29.386		
BERKLEY Total			**29.386**	**86.5**	**2541.2**
DRUMMOND	QUART	B	0.199	75	14.9
		C	9.894	83	821.2
		D	13.000	87	1131.0
	QUART Total		23.093		
	WO	C	0.001	70	0.1
		D	0.364	77	28.0
	WO Total		0.365		
DRUMMOND Total			**23.458**	**85.1**	**1995.2**
FIELDCREST	QUART	B	8.089	75	606.7
		C	1.308	83	108.5
		D	44.468	87	3868.7
	QUART Total		53.865		
	WO	D	4.122	77	317.4
	WO Total		4.122		
FIELDCREST Total			**57.987**	**84.5**	**4901.4**
FIRST	QUART	D	6.485	87	564.2
	QUART Total		6.485		
	WO	D	8.481	77	653.0
	WO Total		8.481		
FIRST Total			**14.966**	**81.3**	**1217.2**
GREEN	OP	B	2.088	61	127.3
		C	82.409	74	6098.3
		D	13.125	80	1050.0
	OP Total		97.622		
	QUART	C	17.127	83	1421.5
		D	8.532	87	742.2
	QUART Total		25.658		
	WO	B	2.731	55	150.2
		C	78.055	70	5463.8
		D	208.871	77	16083.0
	WO Total		289.657		
GREEN Total			**412.937**	**75.4**	**31136.5**
RT 5	QUART	B	2.052	75	153.9
		D	12.819	87	1115.2
	QUART Total		14.871		
	SCHOOL	C	1.725	90	155.3
		D	8.592	92	790.5
	SCHOOL Total		10.318		
	WA	D	0.940	98	92.1
	WA Total		0.940		
	WO	C	1.301	70	91.1
		D	19.456	77	1498.1
	WO Total		20.757		
RT 5 Total			**46.885**	**83.1**	**3896.2**

Sum of Area (ac)					
DA	Use	HSG	Total	CN	CN*Area
SCHOOL	SCHOOL	C	0.019	90	1.7
		D	25.833	92	2376.6
	SCHOOL Total		25.851		
	WA	C	0.042	98	4.1
		D	0.493	98	48.3
	WA Total		0.535		
	WO	C	3.609	70	252.6
		D	15.262	77	1175.2
	WO Total		18.871		
SCHOOL Total			**45.257**	**85.3**	**3858.5**
ST GEORGE	OP	B	49.731	61	3033.6
		D	15.688	80	1255.0
	OP Total		65.418		
	QUART	D	83.397	87	7255.5
	QUART Total		83.397		
	SCHOOL	D	0.226	92	20.8
	SCHOOL Total		0.226		
	WA	D	10.776	98	1056.0
	WA Total		10.776		
	WO	B	0.071	55	3.9
		C	0.758	70	53.1
		D	85.638	77	6594.1
	WO Total		86.467		
ST GEORGE Total			**246.283**	**78.3**	**19272.0**
WHITE FARM	OP	B	7.817	61	476.8
		C	8.096	74	599.1
		D	1.475	80	118.0
	OP Total		17.388		
	QUART	C	5.107	83	423.9
		D	10.571	87	919.6
	QUART Total		15.677		
	WA	D	13.287	98	1302.1
	WA Total		13.287		
	WO	B	1.652	55	90.9
		C	1.456	70	101.9
		D	69.321	77	5337.7
	WO Total		72.429		
WHITE FARM Total			**118.781**	**78.9**	**9370.1**
Grand Total			995.941		


ELEVATIONS
23
22
21
20
19
18
17
LOWEST FINISHED FLOOR/LIVING SPACE IN FIELDCREST 22.59
1.6 FT "FREEBOARD"
MEETS 1 FT REQUIREMENT
IN JCC FLOODPLAIN ORD.
100 YR FLOODPLAIN ELEVATION 21
100 WATER SURFACE ELEVATION FOR EXISTING CONDITIONS 20.4
(ROUND UP TO ELEVATION 21 FOR 100 YR FLOODPLAIN)
1.2 FT REDUCTION OF
100 YR WATER SURFACE
100 YR WATER SURFACE ELEVATION WITH 6 NEW 6' x 4'
BOX CULVERTS UNDER JOHN TYLER HIGHWAY 19.2
LOT 11 LOT 10 LOT 9 LOT 8 LOT 5 LOT 7 LOT 6 LOT 1 LOT 2
GARAGE FLOOR ELEVATIONS
DEERFIELD CT @ MALLARD COVE
DEERFIELD CT @ QUAIL HOLLOW
REC CNTR CUL-DE SAC
DEERFIELD CT BETWEEN
MALLARD COVE & QUAIL HOLLOW
STREET ELEVATIONS
FIELDCREST STORMWATER
ELEVATION SUMMARY

Fieldcrest BMP Neighborhood Association Meeting – February 18, 2009

The following summary of conditions in the Fieldcrest BMP is based on a review of County records and three reports prepared by Williamsburg Environmental Group, Inc for James City County. These reports include the Lower Powhatan Flood Study, the Route 5 Culvert Crossing Flooding Study, and the Fieldcrest BMP alternatives analysis.

1. Problems with the Fieldcrest BMP became apparent shortly after construction.
    a. Water levels in the adjacent wetland are higher than anticipated during plan approval phase.
    b. The pond, roadways and drainage channels were consistently built lower than the approved plans
2. The discrepancy between the actual and the approved plan conditions results in the inundation of four sections of roadway / intersections as well as up to eight garages during fairly frequent storm events. No flooding of first floor living area has been experienced or is expected.
3. Existing conditions met the requirements of the County Floodplain Management Ordinance at the time of construction.
4. Over the years three separate attempts to improve conditions within the neighborhood have been undertaken with limited success.
5. Elevations within the BMP are controlled by the existing Route 5 culvert conditions for 5 year frequency storms and greater.
6. Modifications to the Route 5 culverts can reduce instances of overtopping during large storm events.
7. Modifying the BMP emergency spillway without addressing conditions at the Route 5 crossing will barely improve neighborhood flooding for smaller storms and worsen conditions for larger storms.
8. Two additional options have been identified that should result in some improvement:
    a. The addition of another outlet barrel for the BMP
    b. The installation of a pump for pre-event draw-down.
9. Although both options have pros and cons, the pump option may provide the most improvement.
10. While providing the most improvement, flooding of roadways and garages will still occur with the pump option.
11. Flood-proofing of the existing structures should be evaluated.

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

Environmental Consultants

MEMORANDUM

To: Darryl E. Cook, P.E., County Engineer, James City County

From: Chris Kuhn, Water Resources Engineer II

Through: Scott Blossom, P.E., Senior Engineer

Subject: **Rt. 5 Culvert Flooding - Fieldcrest BMP**
WEG Project #3781

Date: December 10, 2008

cc: File

Dear Mr. Cook:

This memorandum serves as summary of the outfall alternatives evaluation performed regarding the Fieldcrest BMP as a result of our meeting on November 13, 2008. As discussed, we have evaluated potential modifications of the outfall structure for the Fieldcrest BMP in respect to improving backwater effects attributed to this BMP for storm events with a more frequent recurrence. The goal of the evaluation was to identify, on a conceptual level, potential modifications to the physical structure of the BMP outfall configuration or the operation of the BMP that would provide a mechanism to reduce flooding incidences in the Fieldcrest subdivision attributed to this BMP. The base scenario selected for this assessment is the existing BMP configuration at Fieldcrest coupled with an upgrade of the Rt. 5 Culvert Crossing with a group of (4) 4'x 6' box culverts, as identified as the preferred alternative during previous analysis. Therefore the model assumes that those culvert improvements have been made in order to reduce backwater effects at this downstream crossing. The following modifications of the BMP outfall structure have been analyzed with the hydrologic and hydraulic model developed for the Rt. 5 Culvert Flooding Study:

- **Alternative 1:** Increase the upstream invert of the principal outfall by 1.0 ft to increase the energy slope for the outfall culvert. Invert at 15.21 ft msl.
- **Alternative 2:** Increase the upstream culvert of the principal outfall and the crest elevation of the emergency spillway by 1.0 ft. Invert at 15.21 ft msl and emergency spillway at 19.0 ft msl
- **Alternative 3:** Increase the emergency spillway by 1.0 ft. Emergency spillway at 19.0 ft msl.
- **Alternative 4:** Double the outfall culvert. i.e. provide (2) 24" culverts.
- **Alternative 5:** Lower the normal pool elevation by 3.0 ft before a storm event. Normal pool at 11.21 ft msl, increase available storage by 3.45 ac-ft.

The analysis produces the following results:

- Alternatives 1 and 2, which increase the invert of the principal outfall structure with the intent to increase the capacity of the outfall structure by providing a higher static head at the upstream end of the outfall culvert will increase the flooding risk for the Fieldcrest subdivision. The increase of capacity is offset by the increase of the invert.
- Alternative 3 has no effect for storm events that do not activate the emergency spillway. However, as the emergency spillway is activated less frequently the routed water surface elevations will increase for storm events with a return period of less than 5 years.
- Alternative 4, an increase of the outfall capacity by means of increasing the conveyance area, will improve the flooding situation for higher frequency storms (1-, 2-, 5-year) by reducing peak water surface elevations up to 0.5 ft for the 2-year storm. However, for low-frequency, higher-intensity storms no significant improvement is expected.
- Alternative 5, reducing the normal pool elevation in the BMP (e.g. through pumping water out of the BMP in between events) could reduce flooding incidents significantly for storm with a return period of 5 years or less, and could reduce flooding incidents to a lesser extent for 10- and 25-year storms. Flooding caused by less-frequent, higher intensity storm events appears to be unaffected.

Based on this preliminary assessment it appears that that a temporary reduction of the water surface elevation in the BMP in advance of an expected storm event may be the most viable option to improve the flooding situation for events ranging from a 2-25 year recurrence interval. However, such an option should be assessed further (e.g. in regard to interaction with groundwater, necessary pump capacities for reasonable drawdown times, operation and maintenance issues, costs etc.). Additionally, this option does not appear to provide significant improvements for larger flood events including the 50 and 100-year storm events. The success of any of the analyzed improvements referenced above are, in part, dependent on increased culvert capacities at the Rt. 5 culvert crossing and/or prevention of backflow into the BMP via the existing emergency spillway.

Results of the alternatives analysis are provided in the summary table below:

Result Tables:

All alternatives are compared against the base scenario (existing outfall configuration for the BMP, (4) 4'x 6' box culverts at Rt. 5). Columns (1) and (2) give the routed water surface elevations (WSE) for the evaluated alternative, columns (3) and (4) give the WSE for the base scenario.

Alternative 1

	(1)	(2)	(3)	(4)	(1) - (3)	(2) - (4)
	BMP Alternative 1		**Rt. 5 (4 Culverts)**		**Difference**	
Event	**BMP**	**At Rt. 5**	**BMP**	**At Rt. 5**	**BMP**	**At Rt. 5**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]
1 - year	17.43	17.19	16.71	17.19	0.72	0.00
2 - year	18.11	17.19	17.60	17.19	0.51	0.00
5 - year	18.43	17.71	18.30	17.66	0.13	0.05
10 - year	18.63	18.13	18.53	18.11	0.10	0.02
25 - year	18.87	18.65	18.79	18.64	0.08	0.01
50 - year	19.07	19.06	19.04	19.04	0.03	0.02
100 - year	19.43	19.43	19.41	19.41	0.02	0.02
500 - year	20.22	20.22	20.22	20.22	0.00	0.00

Alternative 2

	(1)	(2)	(3)	(4)	(1) - (3)	(2) - (4)
	BMP Alternative 2		**Rt. 5 (4 Culverts)**		**Difference**	
Event	**BMP**	**At Rt. 5**	**BMP**	**At Rt. 5**	**BMP**	**At Rt. 5**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]
1 - year	17.43	17.19	16.71	17.19	0.72	0.00
2 - year	18.12	17.19	17.60	17.19	0.52	0.00
5 - year	18.79	17.59	18.30	17.66	0.49	-0.07
10 - year	19.25	18.04	18.53	18.11	0.72	-0.07
25 - year	19.58	18.59	18.79	18.64	0.79	-0.05
50 - year	19.81	19.05	19.04	19.04	0.77	0.01
100 - year	20.01	19.47	19.41	19.41	0.60	0.06
500 - year	20.38	20.30	20.22	20.22	0.16	0.08

Alternative 3

	(1)	(2)	(3)	(4)	(1) - (3)	(2) - (4)
	BMP Alternative 3		**Rt. 5 (4 Culverts)**		**Difference**	
Event	**BMP**	**At Rt. 5**	**BMP**	**At Rt. 5**	**BMP**	**At Rt. 5**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]
1 - year	16.71	17.19	16.71	17.19	0.00	0.00
2 - year	17.60	17.19	17.60	17.19	0.00	0.00
5 - year	18.50	17.59	18.30	17.66	0.20	-0.07
10 - year	19.10	18.02	18.53	18.11	0.57	-0.09
25 - year	19.47	18.56	18.79	18.64	0.68	-0.08
50 - year	19.72	19.03	19.04	19.04	0.68	-0.01
100 - year	19.95	19.45	19.41	19.41	0.54	0.04
500 - year	20.34	20.29	20.22	20.22	0.12	0.07

Alternative 4

	(1)	(2)	(3)	(4)	(1) - (3)	(2) - (4)
	BMP Alternative 4		**Rt. 5 (4 Culverts)**		**Difference**	
Event	**BMP**	**At Rt. 5**	**BMP**	**At Rt. 5**	**BMP**	**At Rt. 5**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]
1 - year	16.38	17.19	16.71	17.19	-0.33	0.00
2 - year	17.14	17.19	17.60	17.19	-0.46	0.00
5 - year	18.17	17.60	18.30	17.66	-0.13	-0.06
10 - year	18.44	18.07	18.53	18.11	-0.09	-0.04
25 - year	18.71	18.58	18.79	18.64	-0.08	-0.06
50 - year	18.98	18.99	19.04	19.04	-0.06	-0.05
100 - year	19.37	19.37	19.41	19.41	-0.04	-0.04
500 - year	20.18	20.19	20.22	20.22	-0.04	-0.03

Alternative 5

	(1)	(2)	(3)	(4)	(1) - (3)	(2) - (4)
	BMP Alternative 5		**Rt. 5 (4 Culverts)**		**Difference**	
Event	**BMP**	**At Rt. 5**	**BMP**	**At Rt. 5**	**BMP**	**At Rt. 5**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]
1 - year	15.76	17.19	16.71	17.19	-0.95	0.00
2 - year	16.04	17.19	17.60	17.19	-1.56	0.00
5 - year	17.51	17.59	18.30	17.66	-0.79	-0.07
10 - year	18.25	18.04	18.53	18.11	-0.28	-0.07
25 - year	18.59	18.57	18.79	18.64	-0.20	-0.07
50 - year	18.99	18.98	19.04	19.04	-0.05	-0.06
100 - year	19.38	19.38	19.41	19.41	-0.03	-0.03
500 - year	20.20	20.20	20.22	20.22	-0.02	-0.02

Table of Contents

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: User Defined

Segment #1 Time: .2500 hrs

Total Tc: .2500 hrs

Tc Equations used...

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .2500 hrs

Total Tc: .2500 hrs

Tc Equations used...

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: User Defined

Segment #1 Time: .2500 hrs

Total Tc: .2500 hrs

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .2500 hrs

Total Tc: .2500 hrs

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400	
Hydraulic Length	300.00	ft
2yr, 24hr P	3.5300	in
Slope	.006000	ft/ft
Avg.Velocity	.09	ft/sec

Segment #1 Time: .8827 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	400.00	ft
Slope	.045714	ft/ft
Unpaved		
Avg.Velocity	3.45	ft/sec

Segment #2 Time: .0322 hrs

Total Tc: .9149 hrs

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .2500 hrs

Total Tc: .2500 hrs

Tc Equations used...

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400	
Hydraulic Length	300.00	ft
2yr, 24hr P	3.5300	in
Slope	.006250	ft/ft
Avg.Velocity	.10	ft/sec

Segment #1 Time: .8684 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	776.00	ft
Slope	.014925	ft/ft
Unpaved		
Avg.Velocity	1.97	ft/sec

Segment #2 Time: .1094 hrs

==========
Total Tc: .9778 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: 1.7000 hrs

==========
Total Tc: 1.7000 hrs
==========

Tc Equations used...

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	300.00 ft
2yr, 24hr P	3.5300 in
Slope	.010204 ft/ft
Avg.Velocity	.12 ft/sec

Segment #1 Time: .7138 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	1165.00 ft
Slope	.002000 ft/ft
Unpaved	
Avg.Velocity	.72 ft/sec

Segment #2 Time: .4485 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	15.0000 sq.ft
Wetted Perimeter	10.00 ft
Hydraulic Radius	1.50 ft
Slope	.002600 ft/ft
Mannings n	.0350
Hydraulic Length	2315.00 ft
Avg.Velocity	2.84 ft/sec

Segment #3 Time: .2261 hrs

Total Tc: 1.3883 hrs

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== SCS Channel Flow ==

R = Aq / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where: R = Hydraulic radius
Aq = Flow area, sq.ft.
Wp = Wetted perimeter, ft
V = Velocity, ft/sec
Sf = Slope, ft/ft
n = Mannings n
Tc = Time of concentration, hrs
Lf = Flow length, ft

Index of Starting Page Numbers for ID Names

Appendix B

Select Photographs of the 2006 Nor'eastern

10/7/06

10/7/06


FOR SALE WITH
OWNER
(757) 221-0060


DEERFIELD COURT

3222 Fieldcrest Ct. 10/7/06

Appendix C

PondPack Modeling Results

100-year Storm

2006 Nor'easter

Existing
10-year Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: JCC Atlas 14

Return Event	Total Depth in	Rainfall Type	RNF ID
1	2.9000	Synthetic Curve	TypeII 24hr
2	3.5300	Synthetic Curve	TypeII 24hr
5	4.5600	Synthetic Curve	TypeII 24hr
10	5.4500	Synthetic Curve	TypeII 24hr
25	6.7500	Synthetic Curve	TypeII 24hr
50	7.8900	Synthetic Curve	TypeII 24hr
100	9.1500	Synthetic Curve	TypeII 24hr
500	12.6400	Synthetic Curve	TypeII 24hr

ICPM CALCULATION TOLERANCES

Target Convergence=	.001	cfs +/-
Max. Iterations =	35	loops
ICPM Time Step =	.2500	hrs
Output Time Step =	.2500	hrs
ICPM Ending Time =	48.0000	hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft

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-------------------------------
ICPM CALCULATION TOLERANCES
-------------------------------
Target Convergence=     .001 cfs +/-
Max. Iterations   =       35 loops
ICPM   Time Step  =    .2500 hrs
Output Time Step  =    .2500 hrs
ICPM Ending Time  =  48.0000 hrs
-------------------------------
```

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
FIRST	AREA	1	1.554		12.0000	20.97		
FIRST	AREA	2	2.177		12.0000	29.92		
FIRST	AREA	5	3.268		12.0000	45.37		
FIRST	AREA	10	4.256		12.0000	59.15		
FIRST	AREA	25	5.749		12.0000	79.60		
FIRST	AREA	50	7.088		12.0000	97.65		
FIRST	AREA	100	8.591		12.0000	117.61		
FIRST	AREA	500	12.827		12.0000	172.66		
GREEN BMP	POND	1	11.400		12.0000	157.74		
GREEN BMP	POND	2	15.396		12.0000	213.88		
GREEN BMP	POND	5	22.218		12.0000	307.93		
GREEN BMP	POND	10	28.292		12.0000	390.07		
GREEN BMP	POND	25	37.343		12.0000	510.24		
GREEN BMP	POND	50	45.391		12.0000	615.34		
GREEN BMP	POND	100	54.366		12.0000	731.02		
GREEN BMP	POND	500	79.473		12.0000	1048.72		
+GREEN BMP OUT	POND	1	10.852	R	13.2500	12.14	16.71	6.476
+GREEN BMP OUT	POND	1	.000	R	.0000	.00 (-Q)		
+GREEN BMP OUT	POND	2	14.792	R	13.2500	13.72	17.84	9.794
+GREEN BMP OUT	POND	2	.000	R	.0000	.00 (-Q)		
+GREEN BMP OUT	POND	5	22.229	R	12.7500	30.58	18.72	15.424
+GREEN BMP OUT	POND	5	-.784	R	13.5000	-16.59 (-Q)		
+GREEN BMP OUT	POND	10	28.721	R	12.5000	68.17	19.14	18.386
+GREEN BMP OUT	POND	10	-1.364	R	13.5000	-34.57 (-Q)		
+GREEN BMP OUT	POND	25	37.945	R	12.2500	126.85	19.72	22.522
+GREEN BMP OUT	POND	25	-1.919	R	13.2500	-49.59 (-Q)		
+GREEN BMP OUT	POND	50	46.170	R	12.2500	192.20	20.10	26.270
+GREEN BMP OUT	POND	50	-2.744	R	13.0000	-45.66 (-Q)		
+GREEN BMP OUT	POND	100	55.719	R	12.2500	265.07	20.44	32.011
+GREEN BMP OUT	POND	100	-5.113	R	13.0000	-80.54 (-Q)		
+GREEN BMP OUT	POND	500	72.462	R	12.2500	442.23	20.95	40.855
+GREEN BMP OUT	POND	500	-1.508	R	12.7500	-75.35 (-Q)		

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ICPM CALCULATION TOLERANCES
------------------------------
Target Convergence=     .001 cfs +/-
Max. Iterations   =       35 loops
ICPM   Time Step  =    .2500 hrs
Output Time Step  =    .2500 hrs
ICPM Ending Time  =  48.0000 hrs
------------------------------
```

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
LOWER POND	POND	1	37.290		12.7500	148.23		
LOWER POND	POND	1	.000		.0000	.00 (-Q)		
LOWER POND	POND	2	53.153		12.7500	218.27		
LOWER POND	POND	2	.000		.0000	.00 (-Q)		
LOWER POND	POND	5	81.235		12.7500	347.18		
LOWER POND	POND	5	.000		.0000	.00 (-Q)		
LOWER POND	POND	10	107.258		12.7500	467.30		
LOWER POND	POND	10	.000		14.0000	.00 (-Q)		
LOWER POND	POND	25	150.132		12.7500	639.24		
LOWER POND	POND	25	-3.898		13.5000	-127.49 (-Q)		
LOWER POND	POND	50	188.551		12.5000	753.57		
LOWER POND	POND	50	-6.375		13.2500	-88.82 (-Q)		
LOWER POND	POND	100	229.648		12.5000	922.78		
LOWER POND	POND	100	-10.526		13.2500	-148.45 (-Q)		
LOWER POND	POND	500	354.795	R	12.2500	1236.71		
LOWER POND	POND	500	-1.784	R	13.0000	-102.71 (-Q)		
LOWER POND	OUT POND	1	37.290		12.7500	77.39	17.93	9.864
LOWER POND	OUT POND	1	.000		.0000	.00 (-Q)		
LOWER POND	OUT POND	2	53.157		13.5000	118.06	18.27	16.230
LOWER POND	OUT POND	2	.000		.0000	.00 (-Q)		
LOWER POND	OUT POND	5	81.250		13.0000	180.70	18.76	25.845
LOWER POND	OUT POND	5	.000		.0000	.00 (-Q)		
LOWER POND	OUT POND	10	107.370		13.0000	201.88	19.16	33.854
LOWER POND	OUT POND	10	.000		14.0000	.00 (-Q)		
LOWER POND	OUT POND	25	147.445	R	13.0000	203.53	19.74	45.210
LOWER POND	OUT POND	25	.000	R	13.5000	.00 (-Q)		
LOWER POND	OUT POND	50	183.055	R	12.7500	208.20	20.11	53.329
LOWER POND	OUT POND	50	-.253	R	13.2500	-21.41 (-Q)		
LOWER POND	OUT POND	100	221.249	R	14.0000	228.31	20.46	62.462
LOWER POND	OUT POND	100	-.009	R	16.0000	-4.86 (-Q)		
LOWER POND	OUT POND	500	347.314	R	13.7500	432.98	20.98	76.023
LOWER POND	OUT POND	500	-1.180	R	13.0000	-88.76 (-Q)		

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
SCHOOL	AREA	1	5.716		12.0000	78.94		
SCHOOL	AREA	2	7.761		12.0000	107.80		
SCHOOL	AREA	5	11.264		12.0000	156.33		
SCHOOL	AREA	10	14.390		12.0000	198.83		
SCHOOL	AREA	25	19.056		12.0000	261.11		
SCHOOL	AREA	50	23.211		12.0000	315.63		
SCHOOL	AREA	100	27.847		12.0000	375.65		
SCHOOL	AREA	500	40.828		12.0000	540.55		
ST GEORGE	AREA	1	21.734		12.5000	132.11		
ST GEORGE	AREA	2	31.225		12.5000	195.66		
ST GEORGE	AREA	5	48.117		12.5000	307.75		
ST GEORGE	AREA	10	63.631		12.5000	409.51		
ST GEORGE	AREA	25	87.276		12.5000	562.52		
ST GEORGE	AREA	50	108.656		12.5000	698.93		
ST GEORGE	AREA	100	132.761		12.5000	850.79		
ST GEORGE	AREA	500	201.098		12.5000	1272.53		
UP GREENSP	AREA	1	30.777		13.0000	118.08		
UP GREENSP	AREA	2	45.450		13.0000	182.87		
UP GREENSP	AREA	5	72.058		13.0000	300.20		
UP GREENSP	AREA	10	96.846		13.0000	408.73		
UP GREENSP	AREA	25	135.024		13.0000	574.22		
UP GREENSP	AREA	50	169.821		13.0000	723.37		
UP GREENSP	AREA	100	209.266		13.0000	890.64		
UP GREENSP	AREA	500	321.844		13.0000	1359.21		

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ICPM CALCULATION TOLERANCES
-------------------------------
Target Convergence=     .001 cfs +/-
Max. Iterations   =       35 loops
ICPM   Time Step  =    .2500 hrs
Output Time Step  =    .2500 hrs
ICPM Ending Time  =  48.0000 hrs
-------------------------------
```

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
UP ROUTE 5	POND	1	48.344		12.7500	114.11		
UP ROUTE 5	POND	2	66.642		12.5000	145.00		
UP ROUTE 5	POND	5	100.657		13.0000	241.85		
UP ROUTE 5	POND	10	133.371		12.0000	286.64		
UP ROUTE 5	POND	25	183.621	R	12.0000	405.93		
UP ROUTE 5	POND	50	228.237	R	12.0000	483.37		
UP ROUTE 5	POND	100	277.216	R	12.2500	661.56		
UP ROUTE 5	POND	500	444.015	R	12.0000	1065.95		
UP ROUTE 5 OUT	POND	1	48.347		14.0000	70.31	17.91	4.092
UP ROUTE 5 OUT	POND	2	66.643		14.0000	77.23	18.24	7.868
UP ROUTE 5 OUT	POND	5	100.645		14.0000	86.51	18.74	14.904
UP ROUTE 5 OUT	POND	10	133.358		13.5000	93.44	19.15	20.662
UP ROUTE 5 OUT	POND	25	183.609	R	14.5000	102.61	19.73	28.954
UP ROUTE 5 OUT	POND	50	228.216	R	15.7500	108.00	20.11	35.292
UP ROUTE 5 OUT	POND	100	277.167	R	15.5000	116.08	20.45	43.099
UP ROUTE 5 OUT	POND	500	440.022	R	14.0000	376.76	20.96	54.783
UPPER POND	POND	1	21.734		12.5000	132.11		
UPPER POND	POND	2	31.225		12.5000	195.66		
UPPER POND	POND	5	48.117		12.5000	307.75		
UPPER POND	POND	10	63.631		12.5000	409.51		
UPPER POND	POND	25	87.276		12.5000	562.52		
UPPER POND	POND	50	108.656		12.5000	698.93		
UPPER POND	POND	100	132.761		12.5000	850.79		
UPPER POND	POND	500	201.098		12.5000	1272.53		

(2) 4'x6' Culvert
10-yr Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: JCC Atlas 14

Return Event	Total Depth in	Rainfall Type	RNF ID
100	9.1500	Synthetic Curve	TypeII 24hr
500	12.6400	Synthetic Curve	TypeII 24hr

ICPM CALCULATION TOLERANCES

Target Convergence	=	.001 cfs +/-
Max. Iterations	=	35 loops
ICPM Time Step	=	.2500 hrs
Output Time Step	=	.2500 hrs
ICPM Ending Time	=	48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
BERKLEY	AREA	100	18.687		12.0000	249.71		
BERKLEY	AREA	500	27.162		12.0000	356.13		
DRUMMOND	AREA	100	14.434		12.0000	194.72		
DRUMMOND	AREA	500	21.163		12.0000	280.19		
FIELDCREST	AREA	100	35.679		12.0000	481.31		
FIELDCREST	AREA	500	52.311		12.0000	692.58		
FIRST	AREA	100	8.591		12.0000	117.61		
FIRST	AREA	500	12.827		12.0000	172.66		

ICPM CALCULATION TOLERANCES

Target Convergence=	.001	cfs +/-
Max. Iterations =	35	loops
ICPM Time Step =	.2500	hrs
Output Time Step =	.2500	hrs
ICPM Ending Time =	48.0000	hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs		Max WSEL ft	Max Pond Storage ac-ft
UP GREENSP	AREA	100	209.266		13.0000	890.64			
UP GREENSP	AREA	500	321.844		13.0000	1359.21			
UP GREENSP	POND	100	539.269	R	13.0000	1261.21			
UP GREENSP	POND	500	816.911	R	13.0000	1807.45			
UP GREENSP	OUT POND	100	539.256	LR	13.5000	987.72		15.31	28.242
UP GREENSP	OUT POND	100	-.431	LR	.2500	-8.71	(-Q)		
UP GREENSP	OUT POND	500	816.894	LR	13.5000	1328.64		16.32	48.422
UP GREENSP	OUT POND	500	-.431	LR	.2500	-8.71	(-Q)		
UP ROUTE 5	POND	100	301.646		12.0000	707.37			
UP ROUTE 5	POND	500	460.424		12.2500	1114.00			
UP ROUTE 5	OUT POND	100	301.646		13.0000	353.46		19.95	31.955
UP ROUTE 5	OUT POND	500	460.426		14.0000	461.63		20.62	47.095
UPPER POND	POND	100	132.761		12.5000	850.79			
UPPER POND	POND	500	201.098		12.5000	1272.53			
UPPER POND	OUT POND	100	137.135		12.7500	530.51		19.96	49.985
UPPER POND	OUT POND	100	-4.370		13.2500	-151.35	(-Q)		
UPPER POND	OUT POND	500	214.547		12.5000	687.03		20.64	95.578
UPPER POND	OUT POND	500	-11.982		13.0000	-442.80	(-Q)		
WHITE FARM	AREA	100	65.171		12.7500	323.61			
WHITE FARM	AREA	500	98.239		12.7500	482.18			

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
GREEN BMP	POND	100	54.366		12.0000	731.02		
GREEN BMP	POND	500	79.473		12.0000	1048.72		
+GREEN BMP OUT	POND	100	53.605	R	12.2500	270.25	19.41	20.341
+GREEN BMP OUT	POND	500	78.677	R	12.2500	478.85	20.22	28.202
LOWER POND	POND	100	220.958		12.7500	972.94		
LOWER POND	POND	500	333.326		12.5000	1357.61		
LOWER POND OUT	POND	100	220.953		13.0000	546.32	19.45	39.422
LOWER POND OUT	POND	500	333.321		14.0000	642.73	20.24	56.758
*OUT 20	T-E	100	539.322	LR	13.5000	1171.84	15.20	
*OUT 20	T-E	100	-.431	LR	.2500	-8.71 (-Q)		
*OUT 20	T-E	500	815.582	LR	13.7500	1485.52	15.20	
*OUT 20	T-E	500	-.431	LR	.2500	-8.71 (-Q)		
RT 5	AREA	100	27.661		12.5000	179.61		
RT 5	AREA	500	40.923		12.5000	261.09		
SCHOOL	AREA	100	27.847		12.0000	375.65		
SCHOOL	AREA	500	40.828		12.0000	540.55		
ST GEORGE	AREA	100	132.761		12.5000	850.79		
ST GEORGE	AREA	500	201.098		12.5000	1272.53		

(6) 4'x6' Box Culvert
10-yr Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: JCC Atlas 14

Return Event	Total Depth in	Rainfall Type	RNF ID
100	9.1500	Synthetic Curve	TypeII 24hr
500	12.6400	Synthetic Curve	TypeII 24hr

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
BERKLEY	AREA	100	18.687		12.0000	249.71		
BERKLEY	AREA	500	27.162		12.0000	356.13		
DRUMMOND	AREA	100	14.434		12.0000	194.72		
DRUMMOND	AREA	500	21.163		12.0000	280.19		
FIELDCREST	AREA	100	35.679		12.0000	481.31		
FIELDCREST	AREA	500	52.311		12.0000	692.58		
FIRST	AREA	100	8.591		12.0000	117.61		
FIRST	AREA	500	12.827		12.0000	172.66		

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
UP GREENSP	AREA	100	209.266		13.0000	890.64		
UP GREENSP	AREA	500	321.844		13.0000	1359.21		
UP GREENSP	POND	100	539.340	R	13.0000	1654.18		
UP GREENSP	POND	500	815.602	R	13.0000	2393.79		
UP GREENSP	OUT POND	100	539.331	LR	13.5000	1275.62	16.15	43.089
UP GREENSP	OUT POND	100	-.431	LR	.2500	-8.71 (-Q)		
UP GREENSP	OUT POND	500	815.600	LR	14.0000	1597.69	17.63	90.413
UP GREENSP	OUT POND	500	-.431	LR	.2500	-8.71 (-Q)		
UP ROUTE 5	POND	100	305.285		12.7500	934.72		
UP ROUTE 5	POND	500	466.543		12.2500	1371.21		
UP ROUTE 5	OUT POND	100	305.286		13.2500	770.94	18.95	17.816
UP ROUTE 5	OUT POND	500	466.545		13.0000	1020.52	19.81	29.963
UPPER POND	POND	100	132.761		12.5000	850.79		
UPPER POND	POND	500	201.098		12.5000	1272.53		
UPPER POND	OUT POND	100	132.762		12.7500	607.53	19.09	14.866
UPPER POND	OUT POND	500	201.099		12.7500	825.80	19.88	46.604
WHITE FARM	AREA	100	65.171		12.7500	323.61		
WHITE FARM	AREA	500	98.239		12.7500	482.18		

ICPM CALCULATION TOLERANCES

Target Convergence	=	.001 cfs +/-
Max. Iterations	=	35 loops
ICPM Time Step	=	.2500 hrs
Output Time Step	=	.2500 hrs
ICPM Ending Time	=	48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
GREEN BMP	POND	100	54.366		12.0000	731.02		
GREEN BMP	POND	500	79.473		12.0000	1048.72		
+GREEN BMP OUT	POND	100	53.609	R	12.2500	270.25	19.20	18.809
+GREEN BMP OUT	POND	500	78.681	R	12.2500	480.27	19.68	22.241
LOWER POND	POND	100	220.959		12.7500	980.54		
LOWER POND	POND	500	333.330		12.7500	1409.43		
LOWER POND OUT	POND	100	220.956		13.2500	743.82	18.70	24.678
LOWER POND OUT	POND	500	333.327		13.0000	993.55	19.47	39.888
*OUT 20	T-E	100	539.329	LR	13.7500	1331.21	15.20	
*OUT 20	T-E	100	-.431	LR	.2500	-8.71 (-Q)		
*OUT 20	T-E	500	815.603	LR	14.0000	1670.70	15.20	
*OUT 20	T-E	500	-.431	LR	.2500	-8.71 (-Q)		
RT 5	AREA	100	27.661		12.5000	179.61		
RT 5	AREA	500	40.923		12.5000	261.09		
SCHOOL	AREA	100	27.847		12.0000	375.65		
SCHOOL	AREA	500	40.828		12.0000	540.55		
ST GEORGE	AREA	100	132.761		12.5000	850.79		
ST GEORGE	AREA	500	201.098		12.5000	1272.53		

Existing
No Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: JCC Atlas 14

Return Event	Total Depth in	Rainfall Type	RNF ID
1	2.9000	Synthetic Curve	TypeII 24hr
2	3.5300	Synthetic Curve	TypeII 24hr
5	4.5600	Synthetic Curve	TypeII 24hr
10	5.4500	Synthetic Curve	TypeII 24hr
25	6.7500	Synthetic Curve	TypeII 24hr
50	7.8900	Synthetic Curve	TypeII 24hr
100	9.1500	Synthetic Curve	TypeII 24hr
500	12.6400	Synthetic Curve	TypeII 24hr

ICPM CALCULATION TOLERANCES

Target Convergence	=	.001 cfs +/-
Max. Iterations	=	35 loops
ICPM Time Step	=	.2500 hrs
Output Time Step	=	.2500 hrs
ICPM Ending Time	=	48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft

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ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs		Max WSEL ft	Max Pond Storage ac-ft
FIRST	AREA	1	1.554		12.0000	20.97			
FIRST	AREA	2	2.177		12.0000	29.92			
FIRST	AREA	5	3.268		12.0000	45.37			
FIRST	AREA	10	4.256		12.0000	59.15			
FIRST	AREA	25	5.749		12.0000	79.60			
FIRST	AREA	50	7.088		12.0000	97.65			
FIRST	AREA	100	8.591		12.0000	117.61			
FIRST	AREA	500	12.827		12.0000	172.66			
GREEN BMP	POND	1	11.400		12.0000	157.74			
GREEN BMP	POND	2	15.396		12.0000	213.88			
GREEN BMP	POND	5	22.218		12.0000	307.93			
GREEN BMP	POND	10	28.292		12.0000	390.07			
GREEN BMP	POND	25	37.343		12.0000	510.24			
GREEN BMP	POND	50	45.391		12.0000	615.34			
GREEN BMP	POND	100	54.366		12.0000	731.02			
GREEN BMP	POND	500	79.473		12.0000	1048.72			
+GREEN BMP	OUT POND	1	10.850	R	13.2500	12.14		16.71	6.476
+GREEN BMP	OUT POND	1	.000	R	.0000	.00	(-Q)		
+GREEN BMP	OUT POND	2	14.786	R	13.2500	13.72		17.83	9.781
+GREEN BMP	OUT POND	2	.000	R	.0000	.00	(-Q)		
+GREEN BMP	OUT POND	5	22.230	R	12.7500	30.58		18.72	15.423
+GREEN BMP	OUT POND	5	-.784	R	13.5000	-16.59	(-Q)		
+GREEN BMP	OUT POND	10	28.723	R	12.5000	68.17		19.14	18.385
+GREEN BMP	OUT POND	10	-1.364	R	13.5000	-34.57	(-Q)		
+GREEN BMP	OUT POND	25	37.945	R	12.2500	126.85		19.72	22.520
+GREEN BMP	OUT POND	25	-1.917	R	13.2500	-49.59	(-Q)		
+GREEN BMP	OUT POND	50	46.233	R	12.2500	192.20		20.10	26.264
+GREEN BMP	OUT POND	50	-2.735	R	13.0000	-45.66	(-Q)		
+GREEN BMP	OUT POND	100	55.861	R	12.2500	265.07		20.44	31.998
+GREEN BMP	OUT POND	100	-5.230	R	13.0000	-80.54	(-Q)		
+GREEN BMP	OUT POND	500	72.463	R	12.2500	442.23		20.95	40.854
+GREEN BMP	OUT POND	500	-1.508	R	12.7500	-75.35	(-Q)		

ICPM CALCULATION TOLERANCES

Target Convergence=	.001	cfs +/-
Max. Iterations =	35	loops
ICPM Time Step =	.2500	hrs
Output Time Step =	.2500	hrs
ICPM Ending Time =	48.0000	hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
LOWER POND	POND	1	37.290		12.7500	148.23		
LOWER POND	POND	1	.000		.0000	.00 (-Q)		
LOWER POND	POND	2	53.153		12.7500	218.27		
LOWER POND	POND	2	.000		.0000	.00 (-Q)		
LOWER POND	POND	5	81.236		12.7500	347.18		
LOWER POND	POND	5	.000		.0000	.00 (-Q)		
LOWER POND	POND	10	107.123		12.7500	467.30		
LOWER POND	POND	10	.000		14.0000	.00 (-Q)		
LOWER POND	POND	25	150.079		12.7500	639.24		
LOWER POND	POND	25	-3.893		13.5000	-127.49 (-Q)		
LOWER POND	POND	50	185.224		12.5000	753.57		
LOWER POND	POND	50	-6.333		13.2500	-88.82 (-Q)		
LOWER POND	POND	100	230.039		12.5000	922.78		
LOWER POND	POND	100	-11.160		13.2500	-148.45 (-Q)		
LOWER POND	POND	500	354.738	R	12.2500	1236.71		
LOWER POND	POND	500	-1.767	R	13.0000	-102.71 (-Q)		
LOWER POND	OUT POND	1	37.290		12.7500	77.39	17.93	9.864
LOWER POND	OUT POND	1	.000		.0000	.00 (-Q)		
LOWER POND	OUT POND	2	53.157		13.5000	118.06	18.27	16.230
LOWER POND	OUT POND	2	.000		.0000	.00 (-Q)		
LOWER POND	OUT POND	5	81.251		13.0000	180.70	18.76	25.845
LOWER POND	OUT POND	5	.000		.0000	.00 (-Q)		
LOWER POND	OUT POND	10	107.146		13.0000	201.88	19.16	33.854
LOWER POND	OUT POND	10	.000		14.0000	.00 (-Q)		
LOWER POND	OUT POND	25	147.401	R	13.0000	203.53	19.74	45.205
LOWER POND	OUT POND	25	.000	R	13.5000	.00 (-Q)		
LOWER POND	OUT POND	50	179.907	R	12.7500	208.20	20.11	53.325
LOWER POND	OUT POND	50	-.253	R	13.2500	-21.41 (-Q)		
LOWER POND	OUT POND	100	221.027	R	14.0000	228.46	20.46	62.432
LOWER POND	OUT POND	100	-.009	R	16.0000	-4.87 (-Q)		
LOWER POND	OUT POND	500	347.420	R	13.7500	432.98	20.98	76.022
LOWER POND	OUT POND	500	-1.180	R	13.0000	-88.76 (-Q)		

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
SCHOOL	AREA	1	5.716		12.0000	78.94		
SCHOOL	AREA	2	7.761		12.0000	107.80		
SCHOOL	AREA	5	11.264		12.0000	156.33		
SCHOOL	AREA	10	14.390		12.0000	198.83		
SCHOOL	AREA	25	19.056		12.0000	261.11		
SCHOOL	AREA	50	23.211		12.0000	315.63		
SCHOOL	AREA	100	27.847		12.0000	375.65		
SCHOOL	AREA	500	40.828		12.0000	540.55		
ST GEORGE	AREA	1	21.734		12.5000	132.11		
ST GEORGE	AREA	2	31.225		12.5000	195.66		
ST GEORGE	AREA	5	48.117		12.5000	307.75		
ST GEORGE	AREA	10	63.631		12.5000	409.51		
ST GEORGE	AREA	25	87.276		12.5000	562.52		
ST GEORGE	AREA	50	108.656		12.5000	698.93		
ST GEORGE	AREA	100	132.761		12.5000	850.79		
ST GEORGE	AREA	500	201.098		12.5000	1272.53		
UP GREENSP	AREA	1	30.777		13.0000	118.08		
UP GREENSP	AREA	2	45.450		13.0000	182.87		
UP GREENSP	AREA	5	72.058		13.0000	300.20		
UP GREENSP	AREA	10	96.846		13.0000	408.73		
UP GREENSP	AREA	25	135.024		13.0000	574.22		
UP GREENSP	AREA	50	169.821		13.0000	723.37		
UP GREENSP	AREA	100	209.266		13.0000	890.64		
UP GREENSP	AREA	500	321.844		13.0000	1359.21		

ICPM CALCULATION TOLERANCES

Target Convergence=	.001	cfs +/-
Max. Iterations =	35	loops
ICPM Time Step =	.2500	hrs
Output Time Step =	.2500	hrs
ICPM Ending Time =	48.0000	hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
UP ROUTE 5	POND	1	48.344		12.7500	114.11		
UP ROUTE 5	POND	2	66.642		12.5000	145.00		
UP ROUTE 5	POND	5	100.481		13.0000	241.85		
UP ROUTE 5	POND	10	133.011		12.0000	286.64		
UP ROUTE 5	POND	25	183.425	R	12.0000	405.93		
UP ROUTE 5	POND	50	225.385	R	12.0000	483.37		
UP ROUTE 5	POND	100	276.847	R	12.2500	661.56		
UP ROUTE 5	POND	500	443.842	R	12.0000	1065.95		
UP ROUTE 5	OUT POND	1	48.347		14.0000	70.31	17.91	4.092
UP ROUTE 5	OUT POND	2	66.643		14.0000	77.23	18.24	7.868
UP ROUTE 5	OUT POND	5	100.468		14.0000	86.51	18.74	14.904
UP ROUTE 5	OUT POND	10	132.993		13.5000	93.44	19.15	20.662
UP ROUTE 5	OUT POND	25	183.414	R	14.5000	102.60	19.73	28.951
UP ROUTE 5	OUT POND	50	225.362	R	15.7500	107.99	20.11	35.288
UP ROUTE 5	OUT POND	100	276.790	R	15.5000	116.03	20.45	43.082
UP ROUTE 5	OUT POND	500	439.851	R	14.0000	376.74	20.96	54.781
UPPER POND	POND	1	21.734		12.5000	132.11		
UPPER POND	POND	2	31.225		12.5000	195.66		
UPPER POND	POND	5	48.117		12.5000	307.75		
UPPER POND	POND	10	63.631		12.5000	409.51		
UPPER POND	POND	25	87.276		12.5000	562.52		
UPPER POND	POND	50	108.656		12.5000	698.93		
UPPER POND	POND	100	132.761		12.5000	850.79		
UPPER POND	POND	500	201.098		12.5000	1272.53		

Existing
100-yr Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: JCC Atlas 14

Return Event	Total Depth in	Rainfall Type	RNF ID
1	2.9000	Synthetic Curve	TypeII 24hr
2	3.5300	Synthetic Curve	TypeII 24hr
5	4.5600	Synthetic Curve	TypeII 24hr
10	5.4500	Synthetic Curve	TypeII 24hr
25	6.7500	Synthetic Curve	TypeII 24hr
50	7.8900	Synthetic Curve	TypeII 24hr
100	9.1500	Synthetic Curve	TypeII 24hr
500	12.6400	Synthetic Curve	TypeII 24hr

ICPM CALCULATION TOLERANCES

Target Convergence	=	.001 cfs +/-
Max. Iterations	=	35 loops
ICPM Time Step	=	.2500 hrs
Output Time Step	=	.2500 hrs
ICPM Ending Time	=	48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft

Type.... Master Network Summary
Name.... Watershed
File.... L:\3700's\3781 - Powhatan Creek Floodplain Study\5000-Water Resources\3781 PondPa

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ICPM CALCULATION TOLERANCES

Target Convergence=	.001	cfs +/-
Max. Iterations =	35	loops
ICPM Time Step =	.2500	hrs
Output Time Step =	.2500	hrs
ICPM Ending Time =	48.0000	hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs		Max WSEL ft	Max Pond Storage ac-ft
FIRST	AREA	1	1.554		12.0000	20.97			
FIRST	AREA	2	2.177		12.0000	29.92			
FIRST	AREA	5	3.268		12.0000	45.37			
FIRST	AREA	10	4.256		12.0000	59.15			
FIRST	AREA	25	5.749		12.0000	79.60			
FIRST	AREA	50	7.088		12.0000	97.65			
FIRST	AREA	100	8.591		12.0000	117.61			
FIRST	AREA	500	12.827		12.0000	172.66			
GREEN BMP	POND	1	11.400		12.0000	157.74			
GREEN BMP	POND	2	15.396		12.0000	213.88			
GREEN BMP	POND	5	22.218		12.0000	307.93			
GREEN BMP	POND	10	28.292		12.0000	390.07			
GREEN BMP	POND	25	37.343		12.0000	510.24			
GREEN BMP	POND	50	45.391		12.0000	615.34			
GREEN BMP	POND	100	54.366		12.0000	731.02			
GREEN BMP	POND	500	79.473		12.0000	1048.72			
+GREEN BMP	OUT POND	1	12.277	R	20.5000	12.95		17.92	10.032
+GREEN BMP	OUT POND	1	-1.511	R	16.0000	-9.75	(-Q)		
+GREEN BMP	OUT POND	2	16.411	R	19.5000	14.47		18.39	13.078
+GREEN BMP	OUT POND	2	-1.713	R	15.0000	-16.57	(-Q)		
+GREEN BMP	OUT POND	5	22.353	R	12.7500	30.58		18.85	16.344
+GREEN BMP	OUT POND	5	-.964	R	13.5000	-17.88	(-Q)		
+GREEN BMP	OUT POND	10	28.716	R	12.5000	68.17		19.23	19.004
+GREEN BMP	OUT POND	10	-1.427	R	13.5000	-35.23	(-Q)		
+GREEN BMP	OUT POND	25	37.946	R	12.2500	126.85		19.78	22.939
+GREEN BMP	OUT POND	25	-2.019	R	13.2500	-49.81	(-Q)		
+GREEN BMP	OUT POND	50	46.030	R	12.2500	192.20		20.14	26.971
+GREEN BMP	OUT POND	50	-2.741	R	13.0000	-45.69	(-Q)		
+GREEN BMP	OUT POND	100	54.246	R	12.2500	265.07		20.49	32.892
+GREEN BMP	OUT POND	100	-4.556	R	13.0000	-80.61	(-Q)		
+GREEN BMP	OUT POND	500	72.367	R	12.2500	442.23		20.96	41.019
+GREEN BMP	OUT POND	500	-1.592	R	12.7500	-75.35	(-Q)		

ICPM CALCULATION TOLERANCES

Target Convergence=	.001	cfs +/-
Max. Iterations =	35	loops
ICPM Time Step =	.2500	hrs
Output Time Step =	.2500	hrs
ICPM Ending Time =	48.0000	hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 20	T-E	1	171.551	LR	17.2500	496.46	18.35	
*OUT 20	T-E	1	-81.989	LR	13.2500	-483.83 (-Q)		
*OUT 20	T-E	2	197.336	LR	17.2500	516.69	18.35	
*OUT 20	T-E	2	-69.428	LR	13.2500	-444.26 (-Q)		
*OUT 20	T-E	5	247.986	LR	17.2500	543.61	18.35	
*OUT 20	T-E	5	-51.506	LR	13.2500	-378.88 (-Q)		
*OUT 20	T-E	10	295.511	LR	17.2500	563.55	18.35	
*OUT 20	T-E	10	-36.899	LR	13.2500	-311.48 (-Q)		
*OUT 20	T-E	25	371.312	LR	17.2500	591.34	18.35	
*OUT 20	T-E	25	-17.192	LR	14.2500	-203.40 (-Q)		
*OUT 20	T-E	50	442.029	LR	17.2500	613.91	18.35	
*OUT 20	T-E	50	-4.274	LR	14.2500	-117.04 (-Q)		
*OUT 20	T-E	100	539.390	LR	17.2500	640.77	18.35	
*OUT 20	T-E	100	-.540	LR	14.2500	-21.68 (-Q)		
*OUT 20	T-E	500	809.521	LR	17.2500	856.14	18.35	
*OUT 20	T-E	500	-.431	LR	.2500	-8.71 (-Q)		
RT 5	AREA	1	5.338		12.5000	35.06		
RT 5	AREA	2	7.359		12.5000	48.77		
RT 5	AREA	5	10.855		12.5000	72.12		
RT 5	AREA	10	14.000		12.5000	92.77		
RT 5	AREA	25	18.720		12.5000	123.23		
RT 5	AREA	50	22.939		12.5000	150.02		
RT 5	AREA	100	27.661		12.5000	179.61		
RT 5	AREA	500	40.923		12.5000	261.09		

ICPM CALCULATION TOLERANCES

Target Convergence=	.001	cfs +/-
Max. Iterations =	35	loops
ICPM Time Step =	.2500	hrs
Output Time Step =	.2500	hrs
ICPM Ending Time =	48.0000	hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
UP GREENSP	POND	1	89.999	R	13.0000	196.33		
UP GREENSP	POND	2	128.353	R	13.0000	269.16		
UP GREENSP	POND	5	196.921	R	13.0000	396.06		
UP GREENSP	POND	10	259.063	R	13.0000	513.40		
UP GREENSP	POND	25	354.591	R	13.0000	690.56		
UP GREENSP	POND	50	438.279	R	13.0000	846.92		
UP GREENSP	POND	100	539.693	R	13.0000	1018.34		
UP GREENSP	POND	500	811.732	R	12.7500	1591.05		
UP GREENSP	OUT POND	1	171.551	LR	17.2500	496.46	18.26	116.116
UP GREENSP	OUT POND	1	-81.989	LR	13.2500	-483.83 (-Q)		
UP GREENSP	OUT POND	2	197.336	LR	17.2500	516.69	18.29	117.466
UP GREENSP	OUT POND	2	-69.428	LR	13.2500	-444.26 (-Q)		
UP GREENSP	OUT POND	5	247.986	LR	17.2500	543.61	18.31	118.776
UP GREENSP	OUT POND	5	-51.506	LR	13.2500	-378.88 (-Q)		
UP GREENSP	OUT POND	10	295.511	LR	17.2500	563.55	18.33	119.616
UP GREENSP	OUT POND	10	-36.899	LR	13.2500	-311.48 (-Q)		
UP GREENSP	OUT POND	25	371.312	LR	17.2500	591.34	18.35	120.692
UP GREENSP	OUT POND	25	-17.192	LR	14.2500	-203.40 (-Q)		
UP GREENSP	OUT POND	50	442.029	LR	17.2500	613.91	18.36	121.578
UP GREENSP	OUT POND	50	-4.274	LR	14.2500	-117.04 (-Q)		
UP GREENSP	OUT POND	100	539.390	LR	17.2500	640.77	18.38	122.546
UP GREENSP	OUT POND	100	-.540	LR	14.2500	-21.68 (-Q)		
UP GREENSP	OUT POND	500	809.521	LR	17.2500	856.14	18.60	134.401
UP GREENSP	OUT POND	500	-.431	LR	.2500	-8.71 (-Q)		

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
UPPER POND	OUT POND	1	21.733		13.0000	89.13	18.53	2.504
UPPER POND	OUT POND	1	.000		.0000	.00 (-Q)		
UPPER POND	OUT POND	2	31.227		13.0000	131.91	18.59	3.653
UPPER POND	OUT POND	2	.000		.0000	.00 (-Q)		
UPPER POND	OUT POND	5	48.116		13.0000	210.64	18.88	8.971
UPPER POND	OUT POND	5	.000		.0000	.00 (-Q)		
UPPER POND	OUT POND	10	65.401		12.7500	282.87	19.23	20.673
UPPER POND	OUT POND	10	-2.160		14.0000	-62.00 (-Q)		
UPPER POND	OUT POND	25	99.489		12.7500	389.21	19.79	43.181
UPPER POND	OUT POND	25	-14.150		13.5000	-257.90 (-Q)		
UPPER POND	OUT POND	50	123.883		12.7500	434.91	20.15	62.170
UPPER POND	OUT POND	50	-17.940		13.2500	-298.87 (-Q)		
UPPER POND	OUT POND	100	163.096		12.5000	503.46	20.50	85.752
UPPER POND	OUT POND	100	-28.253		13.2500	-401.32 (-Q)		
UPPER POND	OUT POND	500	239.739	R	12.2500	476.68	20.99	119.627
UPPER POND	OUT POND	500	-22.937	R	12.7500	-594.83 (-Q)		
WHITE FARM	AREA	1	11.040		12.7500	52.12		
WHITE FARM	AREA	2	15.724		12.7500	76.36		
WHITE FARM	AREA	5	24.011		12.7500	118.90		
WHITE FARM	AREA	10	31.589		12.7500	157.38		
WHITE FARM	AREA	25	43.101		12.7500	215.10		
WHITE FARM	AREA	50	53.484		12.7500	266.47		
WHITE FARM	AREA	100	65.171		12.7500	323.61		
WHITE FARM	AREA	500	98.239		12.7500	482.18		

Existing
2006 Nor'Easter Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Storms

Return Event	Total Depth in	Rainfall Type	RNF ID
40	9.4000	Time-Depth Curve	JCC 2006 Nor'eas
101	14.1000	Time-Depth Curve	JCC Hurricane Fl

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
BERKLEY	AREA	40	19.142		35.0000	40.21		
BERKLEY	AREA	101	30.494		19.0000	40.37		
DRUMMOND	AREA	40	14.796		35.0000	31.76		
DRUMMOND	AREA	101	23.814		19.0000	31.93		
FIELDCREST	AREA	40	36.574		35.0000	78.52		
FIELDCREST	AREA	101	58.864		19.0000	78.93		
FIRST	AREA	40	8.821		35.0000	19.76		
FIRST	AREA	101	14.505		19.0000	19.92		

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ICPM CALCULATION TOLERANCES
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Target Convergence=     .001 cfs +/-
Max. Iterations   =       35 loops
ICPM   Time Step  =    .2500 hrs
Output Time Step  =    .2500 hrs
ICPM Ending Time  =  48.0000 hrs
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MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs		Max WSEL ft	Max Pond Storage ac-ft
ST GEORGE	AREA	40	137.472		35.2500	284.45			
ST GEORGE	AREA	101	229.916		26.0000	304.44			
UP GREENSP	AREA	40	217.471		35.5000	404.46			
UP GREENSP	AREA	101	370.498		26.2500	481.46			
UP GREENSP	POND	40	474.278	R	35.5000	519.05			
UP GREENSP	POND	101	856.951	R	26.5000	905.00			
UP GREENSP	OUT POND	40	480.224	LR	43.7500	532.67		17.23	77.721
UP GREENSP	OUT POND	40	-12.887	LR	40.2500	-187.35	(-Q)		
UP GREENSP	OUT POND	101	884.483	LR	27.2500	849.34		17.23	77.673
UP GREENSP	OUT POND	101	-34.504	LR	40.2500	-252.01	(-Q)		
UP ROUTE 5	POND	40	238.792	R	34.5000	271.31			
UP ROUTE 5	POND	101	453.134	R	27.0000	443.09			
UP ROUTE 5	OUT POND	40	218.869	R	38.2500	106.07		19.98	32.370
UP ROUTE 5	OUT POND	101	432.113	R	27.0000	425.58		21.01	55.887
UPPER POND	POND	40	137.472		35.2500	284.45			
UPPER POND	POND	101	229.916		26.0000	304.44			
UPPER POND	OUT POND	40	127.680	R	34.7500	203.53		19.99	51.177
UPPER POND	OUT POND	40	-5.671	R	35.7500	-101.58	(-Q)		
UPPER POND	OUT POND	101	232.081	R	27.0000	194.58		21.02	121.685
UPPER POND	OUT POND	101	-5.248	R	20.7500	-61.88	(-Q)		

(2) 6'x4' Box Culverts
2006 Nor'Easter Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Storms

Return Event	Total Depth in	Rainfall Type	RNF ID
40	9.4000	Time-Depth Curve	JCC 2006 Nor'eas
101	14.1000	Time-Depth Curve	JCC Hurricane Fl

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
BERKLEY	AREA	40	19.142		35.0000	40.21		
BERKLEY	AREA	101	30.494		19.0000	40.37		
DRUMMOND	AREA	40	14.796		35.0000	31.76		
DRUMMOND	AREA	101	23.814		19.0000	31.93		
FIELDCREST	AREA	40	36.574		35.0000	78.52		
FIELDCREST	AREA	101	58.864		19.0000	78.93		
FIRST	AREA	40	8.821		35.0000	19.76		
FIRST	AREA	101	14.505		19.0000	19.92		

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs		Max WSEL ft	Max Pond Storage ac-ft
UP GREENSP	AREA	40	217.471		35.5000	404.46			
UP GREENSP	AREA	101	370.498		26.2500	481.46			
UP GREENSP	POND	40	564.049	R	35.5000	671.13			
UP GREENSP	POND	40	.000	R	.0000	.00	(-Q)		
UP GREENSP	POND	101	944.411	R	26.2500	858.10			
UP GREENSP	POND	101	-1.500	R	41.5000	-16.91	(-Q)		
UP GREENSP OUT	POND	40	560.850	LR	36.0000	637.02		17.27	78.845
UP GREENSP OUT	POND	40	-1.642	LR	40.2500	-60.79	(-Q)		
UP GREENSP OUT	POND	101	1004.081	LR	27.0000	822.07		17.19	76.371
UP GREENSP OUT	POND	101	-65.847	LR	40.2500	-355.26	(-Q)		
UP ROUTE 5	POND	40	299.966	R	35.0000	407.28			
UP ROUTE 5	POND	101	516.963	R	25.7500	412.75			
UP ROUTE 5 OUT	POND	40	311.418	R	38.2500	267.20		19.06	19.456
UP ROUTE 5 OUT	POND	40	.000	R	.0000	.00	(-Q)		
UP ROUTE 5 OUT	POND	101	531.005	R	27.0000	364.55		20.05	33.911
UP ROUTE 5 OUT	POND	101	-.847	R	41.5000	-12.55	(-Q)		
UPPER POND	POND	40	137.472		35.2500	284.45			
UPPER POND	POND	101	229.916		26.0000	304.44			
UPPER POND OUT	POND	40	137.472	R	35.2500	250.67		19.11	15.610
UPPER POND OUT	POND	101	229.919		28.0000	197.55		20.09	57.594

(4) 6'x4' Box Culverts
2006 Nor'easter Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Storms

Return Event	Total Depth in	Rainfall Type	RNF ID
40	9.4000	Time-Depth Curve	JCC 2006 Nor'eas
101	14.1000	Time-Depth Curve	JCC Hurricane Fl

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
BERKLEY	AREA	40	19.142		35.0000	40.21		
BERKLEY	AREA	101	30.494		19.0000	40.37		
DRUMMOND	AREA	40	14.796		35.0000	31.76		
DRUMMOND	AREA	101	23.814		19.0000	31.93		
FIELDCREST	AREA	40	36.574		35.0000	78.52		
FIELDCREST	AREA	101	58.864		19.0000	78.93		
FIRST	AREA	40	8.821		35.0000	19.76		
FIRST	AREA	101	14.505		19.0000	19.92		

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
UP GREENSP	AREA	40	217.471		35.5000	404.46		
UP GREENSP	AREA	101	370.498		26.2500	481.46		
UP GREENSP	POND	40	554.106	R	35.5000	812.27		
UP GREENSP	POND	40	.000	R	.0000	.00 (-Q)		
UP GREENSP	POND	101	932.938	R	26.5000	992.56		
UP GREENSP	POND	101	-2.602	R	41.5000	-20.82 (-Q)		
UP GREENSP	OUT POND	40	553.289	LR	36.0000	759.78	17.21	76.897
UP GREENSP	OUT POND	40	-3.975	LR	40.2500	-75.45 (-Q)		
UP GREENSP	OUT POND	101	1000.289	LR	27.0000	937.86	17.19	76.337
UP GREENSP	OUT POND	101	-74.582	LR	40.2500	-364.62 (-Q)		
UP ROUTE 5	POND	40	302.697	R	35.0000	457.57		
UP ROUTE 5	POND	101	524.458		26.0000	560.25		
UP ROUTE 5	OUT POND	40	302.685	R	36.0000	400.45	18.30	8.683
UP ROUTE 5	OUT POND	40	.000	R	.0000	.00 (-Q)		
UP ROUTE 5	OUT POND	101	525.518		26.7500	501.35	18.87	16.767
UP ROUTE 5	OUT POND	101	-1.061		41.5000	-13.95 (-Q)		
UPPER POND	POND	40	137.472		35.2500	284.45		
UPPER POND	POND	101	229.916		26.0000	304.44		
UPPER POND	OUT POND	40	137.472		35.5000	258.39	18.74	6.414
UPPER POND	OUT POND	101	229.918		19.2500	278.30	18.99	11.168

(6) 6'X4' Box Culvert
2006 Nor'easter Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Storms

Return Event	Total Depth in	Rainfall Type	RNF ID
40	9.4000	Time-Depth Curve	JCC 2006 Nor'eas
101	14.1000	Time-Depth Curve	JCC Hurricane Fl

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
BERKLEY	AREA	40	19.142		35.0000	40.21		
BERKLEY	AREA	101	30.494		19.0000	40.37		
DRUMMOND	AREA	40	14.796		35.0000	31.76		
DRUMMOND	AREA	101	23.814		19.0000	31.93		
FIELDCREST	AREA	40	36.574		35.0000	78.52		
FIELDCREST	AREA	101	58.864		19.0000	78.93		
FIRST	AREA	40	8.821		35.0000	19.76		
FIRST	AREA	101	14.505		19.0000	19.92		

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ICPM CALCULATION TOLERANCES
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Target Convergence=     .001 cfs +/-
Max. Iterations   =       35 loops
ICPM   Time Step  =    .2500 hrs
Output Time Step  =    .2500 hrs
ICPM Ending Time  =  48.0000 hrs
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MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs		Max WSEL ft	Max Pond Storage ac-ft
UP GREENSP	AREA	40	217.471		35.5000	404.46			
UP GREENSP	AREA	101	370.498		26.2500	481.46			
UP GREENSP	POND	40	554.120	R	35.5000	900.41			
UP GREENSP	POND	40	.000	R	.0000	.00	(-Q)		
UP GREENSP	POND	101	933.117	R	26.5000	1080.98			
UP GREENSP	POND	101	-2.718	R	41.5000	-21.43	(-Q)		
UP GREENSP	OUT POND	40	559.824	LR	36.0000	814.28		17.21	76.845
UP GREENSP	OUT POND	40	-10.486	LR	40.2500	-148.83	(-Q)		
UP GREENSP	OUT POND	101	1000.942	LR	27.0000	1020.18		17.19	76.335
UP GREENSP	OUT POND	101	-75.165	LR	40.2500	-365.02	(-Q)		
UP ROUTE 5	POND	40	302.733	R	35.0000	525.20			
UP ROUTE 5	POND	101	526.131		26.0000	634.80			
UP ROUTE 5	OUT POND	40	302.723	R	35.5000	480.61		17.80	3.639
UP ROUTE 5	OUT POND	40	.000	R	.0000	.00	(-Q)		
UP ROUTE 5	OUT POND	101	527.203		26.7500	590.08		18.26	8.060
UP ROUTE 5	OUT POND	101	-1.073		41.5000	-14.30	(-Q)		
UPPER POND	POND	40	137.472		35.2500	284.45			
UPPER POND	POND	101	229.916		26.0000	304.44			
UPPER POND	OUT POND	40	137.472		35.5000	258.39		18.74	6.414
UPPER POND	OUT POND	101	229.918		26.2500	296.07		18.78	7.139

(8) 6'x4' Box Culverts
2006 Nor'easter Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Storms

Return Event	Total Depth in	Rainfall Type	RNF ID
40	9.4000	Time-Depth Curve	JCC 2006 Nor'eas
101	14.1000	Time-Depth Curve	JCC Hurricane Fl

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
BERKLEY	AREA	40	19.142		35.0000	40.21		
BERKLEY	AREA	101	30.494		19.0000	40.37		
DRUMMOND	AREA	40	14.796		35.0000	31.76		
DRUMMOND	AREA	101	23.814		19.0000	31.93		
FIELDCREST	AREA	40	36.574		35.0000	78.52		
FIELDCREST	AREA	101	58.864		19.0000	78.93		
FIRST	AREA	40	8.821		35.0000	19.76		
FIRST	AREA	101	14.505		19.0000	19.92		

ICPM CALCULATION TOLERANCES

Target Convergence=	.001	cfs +/-
Max. Iterations =	35	loops
ICPM Time Step =	.2500	hrs
Output Time Step =	.2500	hrs
ICPM Ending Time =	48.0000	hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs		Max WSEL ft	Max Pond Storage ac-ft
UP GREENSP	AREA	40	217.471		35.5000	404.46			
UP GREENSP	AREA	101	370.498		26.2500	481.46			
UP GREENSP	POND	40	554.123	R	35.5000	921.00			
UP GREENSP	POND	40	.000	R	.0000	.00	(-Q)		
UP GREENSP	POND	101	933.134	R	26.2500	1130.25			
UP GREENSP	POND	101	-2.721	R	41.5000	-21.61	(-Q)		
UP GREENSP	OUT POND	40	560.025	LR	36.0000	831.06		17.21	76.844
UP GREENSP	OUT POND	40	-10.684	LR	40.2500	-150.75	(-Q)		
UP GREENSP	OUT POND	101	1000.972	LR	27.0000	1058.81		17.19	76.335
UP GREENSP	OUT POND	101	-75.181	LR	40.2500	-365.03	(-Q)		
UP ROUTE 5	POND	40	302.740	R	35.2500	529.16			
UP ROUTE 5	POND	101	526.242		26.0000	653.29			
UP ROUTE 5	OUT POND	40	302.732	R	35.7500	501.94		17.33	1.725
UP ROUTE 5	OUT POND	40	.000	R	.0000	.00	(-Q)		
UP ROUTE 5	OUT POND	101	527.318		26.5000	634.56		17.78	3.559
UP ROUTE 5	OUT POND	101	-1.076		41.5000	-14.47	(-Q)		
UPPER POND	POND	40	137.472		35.2500	284.45			
UPPER POND	POND	101	229.916		26.0000	304.44			
UPPER POND	OUT POND	40	137.472		35.5000	258.39		18.74	6.414
UPPER POND	OUT POND	101	229.919		26.2500	296.07		18.78	7.139

Existing
no Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Storms

Return Event	Total Depth in	Rainfall Type	RNF ID
40	9.4000	Time-Depth Curve	JCC 2006 Nor'eas
101	14.1000	Time-Depth Curve	JCC Hurricane Fl

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
BERKLEY	AREA	40	19.142		35.0000	40.21		
BERKLEY	AREA	101	30.494		19.0000	40.37		
DRUMMOND	AREA	40	14.796		35.0000	31.76		
DRUMMOND	AREA	101	23.814		19.0000	31.93		
FIELDCREST	AREA	40	36.574		35.0000	78.52		
FIELDCREST	AREA	101	58.864		19.0000	78.93		
FIRST	AREA	40	8.821		35.0000	19.76		
FIRST	AREA	101	14.505		19.0000	19.92		

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs		Max WSEL ft	Max Pond Storage ac-ft
ST GEORGE	AREA	40	137.472		35.2500	284.45			
ST GEORGE	AREA	101	229.916		26.0000	304.44			
UP GREENSP	AREA	40	217.471		35.5000	404.46			
UP GREENSP	AREA	101	370.498		26.2500	481.46			
UP GREENSP	POND	40	478.317	R	35.5000	519.05			
UP GREENSP	POND	101	860.912	R	26.5000	905.00			
UP GREENSP	OUT POND	40	475.367	LR	35.7500	490.35		13.06	5.566
UP GREENSP	OUT POND	40	-.428	LR	.2500	-8.71	(-Q)		
UP GREENSP	OUT POND	101	857.931	LR	27.2500	849.33		14.46	15.750
UP GREENSP	OUT POND	101	-.431	LR	.2500	-8.71	(-Q)		
UP ROUTE 5	POND	40	240.055	R	34.5000	271.31			
UP ROUTE 5	POND	101	454.500	R	27.0000	443.09			
UP ROUTE 5	OUT POND	40	220.890	R	38.2500	106.07		19.98	32.370
UP ROUTE 5	OUT POND	101	434.096	R	27.0000	425.58		21.01	55.887
UPPER POND	POND	40	137.472		35.2500	284.45			
UPPER POND	POND	101	229.916		26.0000	304.44			
UPPER POND	OUT POND	40	129.666	R	34.7500	203.53		19.99	51.177
UPPER POND	OUT POND	40	-5.610	R	35.7500	-101.58	(-Q)		
UPPER POND	OUT POND	101	233.722	R	27.0000	194.58		21.02	121.685
UPPER POND	OUT POND	101	-5.248	R	20.7500	-61.88	(-Q)		

Existing
10-year Tailwater

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Storms

Return Event	Total Depth in	Rainfall Type	RNF ID
40	9.4000	Time-Depth Curve	JCC 2006 Nor'eas
101	14.1000	Time-Depth Curve	JCC Hurricane Fl

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
BERKLEY	AREA	40	19.142		35.0000	40.21		
BERKLEY	AREA	101	30.494		19.0000	40.37		
DRUMMOND	AREA	40	14.796		35.0000	31.76		
DRUMMOND	AREA	101	23.814		19.0000	31.93		
FIELDCREST	AREA	40	36.574		35.0000	78.52		
FIELDCREST	AREA	101	58.864		19.0000	78.93		
FIRST	AREA	40	8.821		35.0000	19.76		
FIRST	AREA	101	14.505		19.0000	19.92		

ICPM CALCULATION TOLERANCES

Target Convergence= .001 cfs +/-
Max. Iterations = 35 loops
ICPM Time Step = .2500 hrs
Output Time Step = .2500 hrs
ICPM Ending Time = 48.0000 hrs

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
UP GREENSP	AREA	40	217.471		35.5000	404.46		
UP GREENSP	AREA	101	370.498		26.2500	481.46		
UP GREENSP	POND	40	478.315	R	35.5000	519.05		
UP GREENSP	POND	101	860.038	R	26.5000	898.79		
UP GREENSP	OUT POND	40	488.007	LR	35.7500	490.35	15.13	25.585
UP GREENSP	OUT POND	40	-13.070	LR	16.2500	-190.22 (-Q)		
UP GREENSP	OUT POND	101	857.057	LR	27.2500	844.38	15.23	27.076
UP GREENSP	OUT POND	101	-.431	LR	.2500	-8.71 (-Q)		
UP ROUTE 5	POND	40	240.053	R	34.5000	271.25		
UP ROUTE 5	POND	101	453.862	R	27.0000	442.58		
UP ROUTE 5	OUT POND	40	220.889	R	38.2500	106.07	19.98	32.369
UP ROUTE 5	OUT POND	101	433.454	R	27.2500	419.83	21.00	55.778
UPPER POND	POND	40	137.472		35.2500	284.45		
UPPER POND	POND	101	229.916		26.0000	304.44		
UPPER POND	OUT POND	40	129.656	R	34.7500	203.53	19.99	51.176
UPPER POND	OUT POND	40	-5.609	R	35.7500	-101.61 (-Q)		
UPPER POND	OUT POND	101	230.327	R	27.0000	197.86	21.01	121.344
UPPER POND	OUT POND	101	-2.711	R	19.5000	-55.70 (-Q)		
WHITE FARM	AREA	40	67.539		35.2500	129.25		
WHITE FARM	AREA	101	112.307		26.2500	143.93		

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ICPM CALCULATION TOLERANCES
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Target Convergence=     .001 cfs +/-
Max. Iterations   =       35 loops
ICPM   Time Step  =    .2500 hrs
Output Time Step  =    .2500 hrs
ICPM Ending Time  =  48.0000 hrs
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MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
GREEN BMP	POND	40	55.717		35.0000	118.73		
GREEN BMP	POND	101	89.359		19.0000	119.31		
+GREEN BMP OUT	POND	40	41.233	R	34.5000	52.37	19.97	24.296
+GREEN BMP OUT	POND	40	-2.358	R	15.5000	-8.24 (-Q)		
+GREEN BMP OUT	POND	101	72.348	R	26.0000	84.32	21.03	42.130
+GREEN BMP OUT	POND	101	-.000	R	42.7500	-.27 (-Q)		
LOWER POND	POND	40	216.346	R	35.0000	368.66		
LOWER POND	POND	101	371.828	R	26.0000	368.53		
LOWER POND OUT	POND	40	189.670	R	34.2500	150.96	19.99	50.235
LOWER POND OUT	POND	101	339.287	R	27.0000	335.86	21.03	77.439
*OUT 20	T-E	40	577.535	LR	35.7500	490.44	18.35	
*OUT 20	T-E	40	-102.596	LR	14.2500	-564.17 (-Q)		
*OUT 20	T-E	101	926.855	LR	27.2500	869.51	18.35	
*OUT 20	T-E	101	-75.718	LR	13.2500	-504.37 (-Q)		
RT 5	AREA	40	28.613		35.0000	57.60		
RT 5	AREA	101	46.535		19.0000	60.37		
SCHOOL	AREA	40	28.546		35.0000	61.28		
SCHOOL	AREA	101	45.942		19.0000	61.61		
ST GEORGE	AREA	40	137.472		35.2500	284.45		
ST GEORGE	AREA	101	229.916		26.0000	304.44		

Appendix D

Preliminary Cost Opinion

4 Box Culverts

Item Description	Quantity	Unit		Unit Cost		Total Cost
Mobilization	1	ea.	$	9,500.00	$	9,500.00
Box Culverts (4 - 4' x 6'; 60 ft each) ASTM C850	240	lf	$	350.00	$	84,000.00
Standard Precast Wingwalls	2	ea.	$	3,250.00	$	6,500.00
Select Clearing (15' wide on embankment)	2,250	sf	$	0.19	$	427.50
Excavation (75' top x 50 bottom; 60', 2H:1V cuts)	640	cy	$	21.25	$	13,600.00
Bedding (Compacted, 6 inch deep)	56	cy	$	31.25	$	1,750.00
Backfill (suitable as road base material)	450	cy	$	12.50	$	5,625.00
Compaction (Culvert and Road)	1	LS	$	4,400.00	$	4,400.00
Subsurface Drainage (Road and Culvert)	1	LS	$	1,250.00	$	1,250.00
Outlet Protection/Energy Dissipator	1	LS	$	12,500.00	$	12,500.00
Utility Identification & Surveys	1	LS	$	6,000.00	$	6,000.00
Traffic Control (2 weeks est.)	1	LS	$	30,000.00	$	30,000.00
Utility Relocation (gas, electric cable, water)	1	LS	$	35,000.00	$	35,000.00
Road Rough Grading	75	lf	$	25.00	$	1,875.00
Road Fine Grading	200	sy	$	15.00	$	3,000.00
Subbase (8 inch depth; 75' l x 24' w)	200	sy	$	10.00	$	2,000.00
Base (6 inch depth; 75' l x 24' w)	200	sy	$	18.75	$	3,750.00
Surface/Shoulders (overlay 100'; 24 w; 2 inch depth)	266	sy	$	10.00	$	2,660.00
Guiderail (75' each side)	150	lf	$	18.75	$	2,812.50
Slope Stabilization EC Matting	1,000	sf	$	1.50	$	1,500.00
E&SC - Seed & Mulch	1	ls	$	3,750.00	$	3,750.00
Subtotal					**$**	**231,900.00**
15% Contingency					**$**	**45,000.00**
10% Design					**$**	**30,000.00**
Total Amount					**$**	**306,900.00**

8 Box Culverts

Item Description	Quantity	Unit	Unit Cost	Total Cost
Mobilization	1	ea.	$ 9,500.00	$ 9,500.00
Box Culverts (8 - 4' x 6'; 60 ft each) ASTM C850	480	lf	$ 350.00	$ 168,000.00
Standard Precast Wingwalls	2	ea.	$ 3,250.00	$ 6,500.00
Select Clearing (15' wide on embankment)	3,000	sf	$ 0.19	$ 570.00
Excavation (100' top x 75 bottom; 60', 2H:1V cuts)	830	cy	$ 21.25	$ 17,637.50
Bedding (Compacted, 6 inch deep)	84	cy	$ 31.25	$ 2,625.00
Backfill (suitable as road base material)	580	cy	$ 12.50	$ 7,250.00
Compaction (Culvert and Road)	1	LS	$ 5,000.00	$ 5,000.00
Subsurface Drainage (Road and Culvert)	1	LS	$ 1,500.00	$ 1,500.00
Outlet Protection/Energy Dissipator	1	LS	$ 15,000.00	$ 15,000.00
Utility Identification & Surveys	1	LS	$ 6,000.00	$ 6,000.00
Traffic Control (2 weeks est.)	1	LS	$ 30,000.00	$ 30,000.00
Utility Relocation (gas, electric cable, water)	1	LS	$ 40,000.00	$ 40,000.00
Road Rough Grading	100	lf	$ 25.00	$ 2,500.00
Road Fine Grading	266	sy	$ 15.00	$ 3,990.00
Subbase (8 inch depth; 75' l x 24' w)	266	sy	$ 10.00	$ 2,660.00
Base (6 inch depth; 75' l x 24' w)	266	sy	$ 18.75	$ 4,987.50
Surface/Shoulders (overlay 125'; 24 w; 2 inch depth)	334	sy	$ 10.00	$ 3,340.00
Guiderail (100' each side)	200	lf	$ 18.75	$ 3,750.00
Slope Stabilization EC Matting	1,500	sf	$ 1.50	$ 2,250.00
E&SC - Seed & Mulch	1	ls	$ 4,250.00	$ 4,250.00
Subtotal				**$ 337,310.00**
15% Contingency				**$ 70,500.00**
10% Design				**$ 47,000.00**
Total Amount				**$ 454,810.00**