MD 200/INTERCOUNTY CONNECTOR
CONTRACT - A

SEGMENTS D1D2

FINAL STORMWATER MANAGEMENT REPORT

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Prepared By:

Intercounty Constructors
2 Taft Ct
Rockville, MD 20850

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1.0 INTRODUCTION

1.1 Project Description

The Maryland State Highway Administration (SHA) and Maryland Transportation Authority are proposing to connect the existing and proposed development areas between the I-270/I-370 and I-95/US 1 corridors within central and eastern Montgomery County and northwestern Prince George's County with a state-of-the-art, multi-model, east-west highway, the Inter County Connector (ICC), that limits access and accommodates passenger and goods movement.

The ICC is broken down into five different contracts (Contracts A, B, C, D and E). The Intercounty Constructors and Parsons/Jacobs was selected by SHA as the Design/Build team to design and construct the first contract - Contract A. KCI Technologies Inc. is the leading consultant for Water Resource Engineering for Contract A.

Contract A is in the design phase and construction started in October, 2007. Contract A is the first section, beginning 1000 feet west of MD 355 and ending 1700 feet east of MD 97, which is a total of 6.3 miles (see Figure 1). The project also includes three interchanges – MD 200/Metro Access Road (MAR), MAR/Shady Grove Rd, and MD 200/MD 97 interchanges. Over pass bridges will be proposed at Shady Grove Road and Crabbs Branch Way, while the ICC will go under Redland Road, Needwood Road, Olde Mill Run, Muncaster Mill Road, and Emory Lane. Bridges are also proposed at the major stream crossings of Rock Creek, North Branch, and North Branch Tributary. The proposed ICC will be six (6) lanes with a 30 foot median along existing I-370. It will be six (6) lanes with a 36 foot median from the MD 200/MAR interchange to Muncaster Mill Rd and for the last 2000 feet of MD 200 at MD 97. It will be six (6) lanes with a 50 foot median from Muncaster Mill Road to west of MD 97.

The majority of the project is located in the Rock Creek watershed. The area west of Oakmont Avenue and north of I-370 drains to Muddy Branch (Drainage Area B-1-1) while the area east of MD 97 drains to Northwest Branch watershed. The project is located entirely within the Washington Metropolitan Area (MDE # 02-14-02). Except for Drainage Area B-1-1, which is in a Use I water area, the entire project has a Maryland (COMAR 26.08.02.08) water use designation of Use III and IV. The North Branch of Rock Creek above Muncaster Mill Road is a Use III water, while the remainder of Rock Creek and its tributaries are Use IV waters. The project drains from north to south in vicinity of Mill Creek and Rock Creek and from south to north in the area of the unnamed tributary to the North Branch of Rock Creek.

Contract A is divided into three major segments (Segments B, C and D), each with sub-segments. Segment B includes sub-segments B1, B2, and B3. Segment C includes sub-segments C1 and C2. Segment D includes sub-segments D1, D2, and D3. Three (3) preliminary stormwater management reports have been provided for this project, one for each segment. Final stormwater management reports will be provided for the eight sub-segments based on the detailed design.

1.2 Purpose and Scope

The purpose of this report is to analyze the effects of the proposed ICC project on the existing water resources at the various outfall study points within Segments D1 and D2. Segments D1 and D2 begin at Sta. 1257+50 ICC and end at Sta. 1308+75 (see Figure 2). The drainage area boundaries of the study points are different than the segment limits, beginning at approximately Sta. 1261+50 ICC and ending at approximately Sta. 1312+50 ICC. There are six (6) study points in Segments D1 and D2 where runoff from the project leaves the SHA right-of-way. The necessity for stormwater management control (quantity and quality) is addressed for each of the defined study points.

2.0 METHODOLOGY

2.1 Design Standards and Criteria

Stormwater management has been designed in accordance with the *2000 Maryland Stormwater Design Manual, Volumes I &II* and the *Maryland Stormwater Management Guidelines for State and Federal Projects* dated July 2001.

2.1.1 Hydrology

In accordance with the Stormwater Design Manual, peak discharges were developed using the TR-20 model by USDA Natural Resources Conservation Service (NRCS).

2.1.1.1 Drainage Area Maps

Drainage areas were delineated using (in order of preference):

1. Project corridor topography provided by SHA (1 and 2 foot contour intervals), supplemented with field surveys.
2. Montgomery County GIS topography (5 foot contour interval).

2.1.1.2 Soils Information

The hydrologic soil information for the project was obtained from the Soil Survey for Montgomery County, Maryland, developed by the NRCS, dated July 1995.

2.1.1.3 Land Use

The land uses for the project were developed using county topographic maps dated April 2006 and information obtained during field investigations. For areas within the right of way, land uses were categorized as impervious, open space, or woods. Zoning information was used for the areas outside the right of way. Land uses were obtained from GIS Hydro (May 2007) and correspond to Maryland Department of Planning (2002).

2.1.1.4 Runoff Curve Numbers

Runoff curve numbers were developed using TR-55 Urban Hydrology for Small Watersheds by the NRCS. Soil type, land use, and area were used to generate the existing and proposed condition runoff curve numbers for the various study points.

2.1.1.5 Time of Concentration

Time of concentration flow paths were determined using topographic maps. Sheet flow, shallow concentrated flow, gutter flow, pipe flow, and open channel flow were the flow types used to calculate the time of concentration for each drainage area. Stream velocities for channel flow for the various slopes were based on the SHA Highway Drainage Manual (Table I, Page II-2-B-3).

2.1.1.6 Peak Discharge Rates

Peak discharges for existing and proposed conditions were calculated for the 1-year, 10-year, and 100-year, 24-hour storm events using TR-20.

2.1.2 Water Quality

2.1.2.1 General

Water quality BMPs have been designed in accordance with Chapter 3 of the Stormwater Design Manual, except areas where thermal impact reduction is necessary (Use III Waters and the Montgomery County Special Protection Area). In these special areas, BMPs were selected based on thermal considerations and then modified (as appropriate) to improve their thermal treatment capabilities (see Section 4 for more information on thermal impact reduction measures). Chapter 5 of the Stormwater Design Manual was used for any channels where grass channel credits were taken.

2.1.2.2 Water Quality Volume

Water quality volumes were calculated in accordance with Chapter 2 of the Stormwater Design Manual except that a rainfall depth of 1.5 inches was used for the ICC instead of the 1 inch required by the manual. This is a requirement of the Contract Documents. This results in capturing and treating the runoff from 95% of the average annual rainfall (instead of 90% if 1 inch were used).

2.1.2.3 Recharge Volume Requirements

Recharge volume requirements are in accordance with Chapter 2 of the Stormwater Design Manual.

2.1.3 Water Quantity

2.1.3.1 Channel Protection Storage Volume

Channel protection storage volume (Cpv) requirements are in accordance with Chapter 2 of the Stormwater Design Manual. For Use III and IV Waters, 12 hour extended detention of the one year, 24 hour storm event has been provided (instead of 24 hour detention for other water areas).

2.1.3.2 Overbank Flood Protection Volume

Chapter 2 of the Stormwater Design Manual states that "Overbank flood protection for the ten year storm shall only be required if local approval authorities have no control of floodplain development, no control over infrastructure and conveyance system design, or determine that downstream flooding will occur as a result of the proposed development." Segments D1 and D2 are located within Montgomery County, where 10-year water quantity management is only required if a history of downstream flooding activity exists. Since Segments D1 and D2 are located a short distance upgradient of Lake Needwood, a regional stormwater management facility, 10-year water quantity management is not required.

2.1.3.3 Extreme Flood Volume

Chapter 2 of the Stormwater Design Manual states that storage to attenuate the post development 100-year, 24 hour peak discharge is generally not needed if the downstream development is located out of the 100-year floodplain.

2.1.3.4 Stormwater Management Waivers and Variances

Stormwater management quantity control waivers and variances follow the criteria of Sections 3.3.B.3 and 3.6, respectively, of the *Maryland Stormwater Management Guidelines for State and Federal Projects* dated July 2001. For drainage areas where the proposed condition peak discharge does not exceed 2 cfs for a 1-year, 24-hour storm event, a waiver can be requested. For drainage areas where the proposed conditions do not result in an increase of 0.5 acres of additional impervious area, a variance can be requested.

2.1.4 Hydraulics

HY 8 was used for design of culverts.

3.0 ANALYSIS

3.1 Description of Study Points

Under existing conditions, there are six study points in Segments D1 and D2 where concentrated runoff leaves storm drain systems and discharges to streams, side ditches, and proposed SWM facilities. Under proposed conditions, there are four study points (due to combining some of the outfall points of some drainage areas).

3.1.1 Study Point D-1-1

Study Point D-1-1 is located about 300 feet right of Sta. 1277+50 ICC and consists of runoff from the left side of the ICC flowing across the SHA right-of-way. The land use is predominantly agricultural with row crops and pastures, open spaces and wooded areas. This area is defined as the runoff that leaves the SHA right-of-way (ROW) through the unnamed tributary to the North Branch of Rock Creek.

Under proposed conditions, pavement drainage between Sta. 1269+45 (high point) and Sta. 1283+00 of the newly constructed ICC will be conveyed through grass channels to 3 linear sand filters (D1-I, D1-J, and D1-K) and Sand Storage BMP D1-A, ultimately discharging upgradient of a proposed culvert under the ICC. 3.8 acres of new impervious area will be added at this study point. The drainage area will increase by 0.8 acres. The time of concentration remains relatively unchanged.

3.1.2 Study Point D-1-2

Study Point D-1-2 is located about 280 feet right of Sta. 1266+00 of the ICC and consists of runoff from the left side of the ICC flowing across the SHA right-of-way. The land use is predominantly open spaces and wooded areas with agricultural land outside the SHA right-of-way. This area is defined as the runoff that leaves the SHA right-of-way through a well-defined swale on the south side of the ICC.

The proposed ICC effectively cuts Drainage Area D-1-2 into 2 pieces, resulting in a north section and a south section, each separated by the ICC. The north section drains through 2 culverts beneath the ICC to the study point. The south section drains directly to the study point. Under ultimate conditions (pavement in place), runoff in the ICC ROW is collected and conveyed to a different study point outside Segments D1 and D2. However, during interim conditions, the ROW area still drains to Study Point D-1-2 and has been included in this report but without pavement in place. Thus, the impervious area does not increase. The drainage area will decrease by 1.7 acres (to 13.6 acres). There is no change in the time of concentration.

3.1.3 Study Point D-2-1

Study Point D-2-1 is located about 240 feet right of Sta. 1290+70 of the ICC and consists of runoff from the left side of the ICC flowing across the SHA right-of-way. The land use is predominantly open spaces and wooded areas with pasture land outside the SHA right-of-way.

Under proposed conditions, drainage north of the ICC is collected in a ditch at the toe of the roadway embankment and conveyed to Study Point D-2-2. Further, runoff in the ROW is collected in grass channels and BMPs and conveyed to Study Point D-2-2. Therefore, under proposed conditions, runoff no longer reaches Study Point D-2-1. Changes in drainage area, impervious area, and time of concentration are considered in Study Point D-2-2.

3.1.4 Study Point D-2-2

Study Point D-2-2 is located at the outfall on the east side of the North Branch of Rock Creek at approximate Sta. 1296+00, 200 feet right, and consists of runoff from the north side of the ICC flowing across the SHA right-of-way. The land use is predominantly open spaces and wooded areas with pasture land outside the SHA right-of-way.

Under proposed conditions, runoff north of the ICC (including runoff from Drainage Area D-2-1) is collected in a ditch at the toe of the roadway and conveyed to Study Point D-2-2 through a 36-inch culvert. Runoff in the ROW from Sta. 1283+00 to Sta. 1292+00 (essentially, runoff from Drainage Area D-2-1) is conveyed through grass channels to 3 linear sand filters (D1-L, D1-M, and D1-N), then to Sand Storage BMP D1-B, and finally to Study Point D-2-2 via a 24-inch storm drain. Runoff in the ROW from Sta. 1292+00 to Bridge 20 is conveyed through grass channels to 4 linear sand storage BMPs (D1-C, D1-D, D1-E1, and D1-E2) and 2 linear sand filters (D1-C1 and D1-C2), and then to Study Point D-2-2 through a 24-inch storm drain. Runoff from Bridge 20 is collected and routed through 2 storm filters that discharge into Linear Sand Storage BMP D1-D (westbound bridge deck) and Linear Sand Storage BMP D1-E2 (eastbound bridge deck).

Since runoff for Study Point D-2-1 is now being routed to Study Point D-2-2, there is a significant increase in drainage area and impervious area. The drainage area increases from 15.4 acres under existing conditions to 30.3 acres under proposed conditions. Impervious area increases from 0 acres under existing conditions to 5.4 acres under proposed conditions. The time of concentration increases slightly as the travel path increases when adding the drainage area of Study Point D-2-1.

3.1.5 Study Point D-2-3

Study Point D-2-3 is located at the outfall on the west side of the North Branch of Rock Creek at approximate Sta. 1301+80, 150 feet right, and consists of runoff from the north side of the ICC flowing across the SHA right-of-way. The land use is predominantly wooded.

Under proposed conditions, runoff from Drainage Areas D-2-3 and D-2-4 will both discharge at Study Point D-2-3. Runoff in the ROW from the east side of Bridge 20 to the east side of Bridge 21 is conveyed through grass channels to 3 linear sand storage BMPs (D1-F, D1-G, and D1-H) and 3 linear sand filters (D1-F1, D1-G1 and D1-H1), and then to Study Point D-2-3 through a 24-inch storm drain. Runoff from Bridge 21 is collected and routed through 2 stormwater filters that discharge into Linear Sand

Filter D1-G1 (westbound bridge deck) and Linear Sand Filter D1-H1 (eastbound bridge deck).

Since runoff for Study Point D-2-4 is now being routed to Study Point D-2-3, there is an increase in drainage area and impervious area. The drainage area increases from 2.7 acres under existing conditions to 3.9 acres under proposed conditions. Impervious area increases from 0 acres under existing conditions to 2.7 acres under proposed conditions. The time of concentration increases slightly as the travel path increases when adding the drainage area of Study Point D-2-4.

3.1.6 Study Point D-2-4

Study Point D-2-4 is located at the outfall to a tributary of the North Branch of Rock Creek at approximate Sta. 1306+70, 150 feet left, and consists of runoff from the south side of the ICC flowing across the SHA right-of-way to the north. The land use is predominantly wooded.

Under proposed conditions, runoff from Study Point D-2-4 is routed to Study Point D-2-3 (see Study Point D-2-3 discussion above). Changes in drainage area, impervious area, and time of concentration are considered in Study Point D-2-3.

3.2 Water Quality Management

3.2.1 Water Quality Volume

There is no impervious area within the project area under existing conditions. Thus, there are no impervious areas that will be reconstructed or removed. Under proposed conditions, 11.85 acres of new impervious area is added. Therefore, the total impervious area after construction will be 11.85 acres which is a net increase of 11.85 acres when compared to existing conditions. Table 1 summarizes this information. Based on the impervious area information, the area requiring water quality treatment is 11.85 acres (see Table 2 and Appendix C).

Table 1: Pavement Removal and Reconstruction Summary

Study Point	Existing Impervious Area (Ac)	New Impervious Area (Ac)	Reconstructed Impervious Area (Ac)	Existing Impervious Area Removed (Ac)	Total Proposed Impervious Area (Ac)	Net Impervious Area Increase/ Decrease (Ac)
(1)	(2)	(3)	(4)	(5)	(6) = (2) + (3)-(5)	(7) = (6) - (2)
D-1-1	0	3.78	0	0	3.78	3.78
D-1-2	0	0	0	0	0	0
D-2-1	0	0	0	0	0	0
D-2-2	0	5.39	0	0	5.39	5.39
D-2-3	0	2.68	0	0	2.68	2.68
D-2-4	0	0	0	0	0	0
Total	**0**	**11.85**	**0**	**0**	**11.85**	**11.85**

Table 2: Area Requiring Water Quality Treatment

Study Point	New Impervious Area (Ac)	Reconstructed Impervious Area (Ac)	Existing Impervious Area Removed (Ac)	Loss of Existing Water Quality (Ac)	Area Requiring Treatment (ART) = [(2)-(4) + 0.2 x {(3)+(4)} + 5] (Ac)
(1)	(2)	(3)	(4)	(5)	(6)
D-1-1	3.78	0	0	0	3.78
D-1-2	0	0	0	0	0
D-2-1	0	0	0	0	0
D-2-2	5.39	0	0	0	5.39
D-2-3	2.68	0	0	0	2.68
D-2-4	0	0	0	0	0
Total	**11.85**	**0**	**0**	**0**	**11.85**

Water quality treatment is provided by:

1. Grass channels in Study Points D-1-1, D-2-2, and D-2-3 (grass channels in Study Point D-2-1 convey water to Study Point D-2-2 and grass channels in Study Point D-2-4 convey water to Study Point D-2-3).
2. Four stormwater filters located in Study Points D-2-2 and D-2-3, which treat the runoff from Bridges 20 and 21.

Grass channels have been designed in accordance with Section 5 of the Stormwater Design Manual to ensure grass channel credit can be taken. Grass channels treat 3.78 acres of impervious area in Study Point D-1-1, 4.15 acres in study Point D-2-2, and 1.69 acres in Study Point D-2-3 (see Appendix G for calculations). Four stormwater filters will be designed by the manufacturer to treat 1.24 acres of impervious area in Study Point D-2-2 and 0.99 acres of impervious area in Study Point D-2-3. The total impervious area treated by these grass channels and stormwater filters is 11.85 acres. Note that sand storage BMPs, linear sand storage BMPs and linear sand filters are not discussed here as they provide quantity control and thermal treatment.

3.2.2 Recharge Volume

The total impervious area under proposed conditions is 11.85 acres. Of this area, 2.26 acres is from impervious area on and immediately adjacent to Bridges 20 and 21. The remaining 9.59 acres is from impervious areas outside of these bridges. According to Section 5 of the Stormwater Design Manual, "use of a grass channel will automatically meet the recharge volume requirements for impervious areas draining into the channel." As 9.59 acres of impervious area drains to grass channels in Segments D1 and D2, only the remaining 2.26 acres of impervious area must meet recharge volume requirements.

Recharge volume for the 2.26 acres is provided beneath Linear Sand Storage BMPs D1-D and D1-E2 and Linear Sand Filters D1-G1 and D1-H1. These are the systems receiving discharge water from the four stormwater filters that treat the impervious area associated with Bridges 20 and 21. The bottom 6 inch layer of gravel of these systems is located below their underdrain outlets to promote infiltration and groundwater recharge. The required recharge volume for the 2.26 acres of impervious area is 2,000 cubic feet (see Appendix E for calculations).

3.3 Water Quantity Management

As discussed in Section 2, channel protection volume requirements apply to Segments D1 and D2, while overbank flood protection volume and extreme flood volume requirements do not apply. As discharges in Segments D1 and D2 are to Use III Waters, 12 hour extended detention of the one year, 24 hour storm event is provided for Cpv. Peak discharges for existing and proposed conditions were calculated for the 1-year, 10-year, and 100-year, 24-hour storm events using TR-20. Table 3 presents a summary of the dataset used for determining the existing and proposed discharges, while Table 4 provides the peak discharges. Drainage area maps showing drainage boundaries, flow paths, land use and hydrologic soil groups for both existing and proposed conditions are provided in Appendix A. Hydrologic computations are included in Appendix B.

Table 3: TR-20 Dataset Summary

Study Point	Existing Conditions			Proposed Conditions		
	Drainage Area (Ac)	Runoff Curve Number	Time of Concentration (hrs)	Drainage Area (Ac)	Runoff Curve Number	Time of Concentration (hrs)
D-1-1	109.9	73	0.41	110.7	75	0.4
D-1-2	15.3	70	0.15	13.7	71	0.15
D-2-1[1/]	12.9	57	0.23	0	N/A	N/A
D-2-2[1/]	15.4	57	0.32	30.3	65	0.29
D-2-3[2/]	2.7	56	0.11	3.9	87	0.13
D-2-4[2/]	3.1	58	0.12	0	N/A	N/A
Total	**159.3**	---	---	**158.6**	---	---

1/ Under proposed conditions, runoff from Study Point D-2-1 discharges at Study Point D-2-2.
2/ Under proposed conditions, runoff from Study Point D-2-4 discharges at Study Point D-2-3.

Table 4: Summary of Peak Discharges

Study Point	Existing Conditions			Proposed Conditions		
	1-Yr (cfs)	10-Yr (cfs)	100-Yr (cfs)	1-Yr (cfs)	10-Yr (cfs)	100-Yr (cfs)
D-1-1	55.3	242.6	427.1	68.2	267.0	461.4
D-1-2	9.2	44.8	80.7	9.1	41.5	73.8
D-2-1	0.7[1/]	15.9	37.4	0[2/]	0[2/]	0[2/]
D-2-2	0.7[1/]	16.7	39.1	7.4	56.3	109.8
D-2-3	0.2[1/]	4.0	9.2	7.7	19.5	29.2
D-2-4	0.4[1/]	5.1	11.2	0[3/]	0[3/]	0[3/]

1/ 1-year discharge using TR-20 was 0.0 cfs. Thus, used 1-year discharge from TR-55.
2/ Under proposed conditions, discharge from Study Point D-2-1 is included with discharge of Study Point D-2-2.
3/ Under proposed conditions, discharge from Study Point D-2-4 is included with discharge of Study Point D-2-3.

In accordance with the *Maryland Stormwater Management Guidelines for State and Federal Projects* dated July 2001, a waiver can be requested for drainage areas where the proposed condition peak discharge does not exceed 2 cfs for a 1-year, 24-hour storm event. For drainage areas where the proposed conditions do not result in an increase of 0.5 acres of additional impervious area, a variance can be requested. Using these criteria, a waiver can be requested for Study Points D-2-1 and D-2-4 (based on Table 4 discharges) and a variance can be requested for Study Points D-1-2, D-2-1, and D-2-4 (based on Table 1 impervious area increases). Study Points D-2-1 and D-2-4 are eliminated by the proposed construction (being combined with Study Points D-2-2 and D-2-3, respectively). Thus, a waiver or variance is not required for these areas. However, a variance will be taken for Study Point D-1-2. The remaining study points (D-1-1, D-2-2, and D-2-3) do not meet the waiver or variance criteria. Therefore, they require water quantity control. In order to meet Cpv requirements for these areas, seven (7) linear sand storage BMPs and two (2) sand storage BMPs have been designed for these study points (see Appendix E for Cpv and BMP calculations). Also, eleven (11) linear sand filters are provided for additional water quality storage and to reduce thermal impacts of the runoff. The BMP controls are discussed below based on study point location.

3.3.1 Study Point D-1-1

Runoff in the ROW will be conveyed through grass channels to three (3) linear sand filters (D1-I, D1-J, and D1-K) and Sand Storage BMP D1-A. Sand Storage BMP D1-A will provide the required Cpv. The linear sand filters are not necessary for Cpv but are provided for thermal reduction purposes.

3.3.2 Study Point D-2-2

Drainage Area D-2-2 contains four (4) linear sand storage BMPs (D1-C, D1-D, D1-E1, and D1-E2), five (5) linear sand filters (D1-C1, D1-C2, D1-L, D1-M, D1-N) and

Sand Storage BMP D1-B. Linear Sand Storage BMPs D1-C, D1-D, D1-E1, and D1-E2 and Sand Storage BMP D1-B will provide the required Cpv. Linear Sand Filters D1-C1, D1-C2, D1-L, D1-M, and D1-N are not necessary for Cpv but are provided for thermal reduction purposes.

3.3.3 Study Point D-2-3

Drainage Area D-2-3 contains three (3) linear sand storage BMPs (D1-F, D1-G, D1-H) and three (3) linear sand filters (D1-F1, D1-G1, D1-H1). The linear sand storage BMPs will provide the required Cpv. The linear sand filters are not necessary for Cpv but are provided for thermal reduction purposes.

Table 5 presents the Cpv required and the Cpv provided at each of the water quantity BMPs.

Table 5: Cpv Required and Provided by BMPs

BMP No.	Cpv Required (cf)	Cpv Provided (cf)[1/]
D1-A	17,087	21,911
D1-B	11,659	19,036
D1-C	1,170	1,314
D1-D	6,377	7,464
D1-E	6,853	7,464
D1-F	504	597
D1-G	5,635	6,158
D1-H	6,892	7,837
Total	**56,177**	**71,781**

1/ Provided volume includes 1 foot of storage space above top of BMP's soil layer.

The drainage areas, runoff curve numbers and time of concentrations for these three study points under proposed conditions have been separated into 1) area draining through the BMPs and 2) area bypassing the BMPs. This information is summarized Table 6.

Table 6: TR-20 Dataset Summary for Study Points D-1-1, D-2-2 and D-2-3 with BMPs

Study Point	Drainage Scenario	Drainage Area (Ac.)	Runoff Curve Number	Time of Concentration (hrs)
D-1-1	Runoff Through BMP D1-A	7.7	80	0.10
	Runoff Bypassing BMP D1-A	103.0	74	0.40
TOTAL		110.7	75	---
D-2-2	Runoff Through BMP D1-B, D1-C, D1-D and D1-E (E1/E2)	5.1+0.7+ 1.7+1.8 = 9.3	84	0.10
	Runoff Bypassing BMPs	21.1	57	0.29
TOTAL		30.3	65	---
D-2-3	Runoff Through Linear Sand Storage BMPs	3.9	87	0.1
	Runoff Bypassing Linear Sand Storage BMPs	0	N/A	---
TOTAL		3.9	87	---

Based on the above information, the TR-20 analysis for proposed conditions was re-run for these study points with the BMPs in place. A summary of peak discharges for the 1-year, 10-year and 100-year flood events are given in the Table 7. Hydrologic computations are given in Appendix B and E.

Table 7: Summary of Peak Discharges with BMPs

Study Point	Existing Conditions			Proposed Conditions			Proposed Conditions with BMPs		
	1-Yr (cfs)	10-Yr (cfs)	100-Yr (cfs)	1-Yr (cfs)	10-Yr (cfs)	100-Yr (cfs)	1-Yr (cfs)	10-Yr (cfs)	100-Yr (cfs)
D-1-1	55.3	242.6	427.1	68.2	267.0	461.4	60.4	258.4	447.2
D-1-2	9.2	44.8	80.7	9.1	41.5	73.8	---	---	---
D-2-1	0.7[1/]	15.9	37.4	0[2/]	0[2/]	0[2/]	---	---	---
D-2-2	0.7[1/]	16.7	39.1	7.4	56.3	109.8	3.5[4/]	46.3	107.2
D-2-3	0.2[1/]	4.0	9.2	7.7	19.5	29.2	0.34[5/]	19.5	29.2
D-2-4	0.4[1/]	5.1	11.2	0[3/]	0[3/]	0[3/]	---	---	---

1/ 1-year discharge using TR-20 was 0.0 cfs. Thus, used 1-year discharge from TR-55.
2/ Under proposed conditions, discharge from Study Point D-2-1 is included with discharge of Study Point D-2-2.
3/ Under proposed conditions, discharge from Study Point D-2-4 is included with discharge of Study Point D-2-3.
4/ Sum of 1-year peak discharges for BMPs D1-B with bypass flow (3.1 cfs), D1-C (0.03 cfs), D1-D (0.17 cfs), and D1-E1/E2 (0.18 cfs) = 3.5 cfs.
5/ Sum of 1-year peak discharges for BMPs D1-F, D1-G and D1-H (0.01+0.15+0.18 =0.34 cfs).

3.4 Stormwater Management Summary

Table 8 summarizes the stormwater management quantity controls, quality controls, and whether variance and waiver criteria are met.

Table 8: Water Quantity/Quality Requirements and Waivers/Variances

Study Point	Water Quantity Control Req'd?	Provided By:	Water Quality Req'd?	Provided By:	Proposed Waiver/ Variance Section[1/]
D-1-1	Yes	Sand Storage BMP D1-A	Yes (3.78 Ac)	Grass Channels (3.78 Ac)	N/A
D-1-2	No	N/A	No	N/A	3.6 (Variance)
D-2-1	No	N/A	No	N/A	N/A (eliminated by the proposed construction)
D-2-2	Yes	Sand Storage BMP D1-B; Linear Sand Storage BMPs D1-C, D1-D, D1-E1, D1-E2	Yes (5.39 Ac)	Grass Channels (4.15 Ac); 2 Stormwater Filters (1.24 Ac)	N/A
D-2-3	Yes	Linear Sand Storage BMPs D1-F, D1-G, D1-H	Yes (2.68 Ac)	Grass Channels (1.69 Ac); 2 Stormwater Filters (0.99 Ac)	N/A
D-2-4	No	N/A	No	N/A	N/A (eliminated by the proposed construction)

1/ Section refers to section number in "Maryland Stormwater Management Guidelines for State and Federal Projects."

4.0 STORMWATER THERMAL IMPACT REDUCTION

4.1 Introduction

Segments D1 and D2 cross the Montgomery County SPA and Use III Waters. In these areas, stormwater management has been designed and will be constructed to reduce potential thermal impacts from discharge flows into receiving streams. Thermal impacts derive from two primary sources. The first is from the first flush of runoff over heated pavement surfaces. The second source is from solar heating of standing water in stormwater management facilities such as detention ponds. Our approach has been to mitigate the impacts of each of these sources.

4.2 Studies

Relatively little has been done in the way of creating design procedures to reduce thermal impacts. However, research is beginning to occur in this field. A study by the Water Environment Research Foundation (WERF) in 2004 recommended the following strategies to reduce the thermal impacts from stormwater runoff:

- Reduce surface temperatures by using light colored and more reflective pavement and building materials and by shading impervious areas.
- Promote infiltration of stormwater into the soils.
- Promote temperature loss in underground pipes. Use pipe materials with a higher convective heat transfer coefficient, such as concrete, to encourage heat loss before the flow is discharged at the end walls.
- Reduce direct solar inputs by maximizing shade of standing water in SWM facilities.

The study established that effective infiltration and adequate shading are the two key design criteria for successful protection of cold water streams from thermal impacts.

A study from the Wisconsin Department of Natural Resources, University of Wisconsin, and Dane County in Wisconsin, similar to the WERF study, recommends that, to reduce the impacts on streams, effective Best Management Practices (BMPs) such as rain gardens, rock catchment basins, rock cribs, swales, deep tilling, constructed wetlands, reforestation and buffer strips be used as a means to reduce thermal impacts. The rock cribs in this study were specifically designed, constructed and tested. They proved to be very successful at reducing stormwater runoff temperatures.

These studies point to the need to prevent thermal loading from occurring where possible, delaying and reducing discharges into streams, and treating any remaining thermal impacts.

There is a third ongoing Transportation Research Board study (sponsored by SHA and being completed by the University of Maryland) entitled "Improved Management of Stormwater Runoff – Mitigation of Thermal Effects." This study will not be completed until early 2008. This research project will develop a set of tools that the SHA can use to predict the outlet temperature from stormwater management practices.

4.3 Approach for Segments D1 and D2

The thermal stormwater management approach for Segments D1 and D2 has been to:

- reduce or prevent thermal loading from occurring (source reduction),
- delay or reduce thermal runoff into streams, and
- treat thermal impacts that do occur.

BMPs have been selected based on thermal considerations and then modified (as appropriate) to improve their thermal treatment capabilities.

4.3.1 Source Reduction

Because of the clear zone requirements, there is little opportunity to shade the ICC pavement. However, substantial shade has been provided for the bike trail pavement. Also, shade trees have been located along surface waters, including swales located outside the clear zone, the riparian buffer planting zone, and sand storage BMPs. In fact, planting berms have been intentionally placed across the middle of each sand storage BMP to allow planting of shade trees, thereby maximizing shade potential.

4.3.2 Delaying/Reducing Runoff

The stormwater management strategy has been to prevent runoff from impervious surfaces directly into streams by directing sheet flow through vegetation and into grass channels, which reduce runoff volume and velocities, and provides groundwater recharge through infiltration. In fact, grass channels are located along the entire alignment of Segments D1 and D2 except at the proposed bridges.

4.3.3 Treating Runoff

4.3.3.1 General

Underground facilities have been the first choice when selecting BMPs and open water surface facilities have been avoided intentionally to minimize the potential for solar heating. Underground thermal treatment will be provided by the two (2) sand storage BMPs, seven (7) linear sand storage BMPs, and eleven (11) linear sand filters. The two surface sand BMPs and the seven linear sand storage BMPs are provided for quantity control; however, because of their design, they also provide thermal reduction. The eleven linear sand filters have been added solely to provide thermal reduction of stormwater runoff. The storage volume provided by the filters and BMPs is 85,682 cubic feet while the Cpv required for segments D1 and D2 is 56,177 cubic feet. Thus, there is over 50 percent more Cpv provided than is required.

Wherever possible, stormwater in grass channels is conveyed to buried, linear sand filters and linear sand storage BMPs located along the roadway. Also, the four stormwater filters treating Bridge 20 and 21 discharge directly to linear sand filters and sand storage BMPs for thermal treatment reasons. The below grade sand storage BMPs and linear sand filters reduce peak discharges, reduce thermal loads, and promote groundwater recharge through infiltration. They have been designed to treat a 1.5-inch rainfall event which includes at least 95 percent of annual storm events (typical criteria is a 1-inch event equating to 90 percent of annual storm events). This will include capture of the "first flush" of runoff, which will be the most thermally affected by heated pavement surfaces. They have been designed for 12 hour extended detention of the one-year, 24 hour storm event (as opposed to the typical 24 hour extended detention) and will drain relatively quickly, avoiding solar heating.

4.3.3.2 Linear Sand Storage BMPs

The below grade linear sand storage BMPs are very similar to the rock cribs mentioned in the thermal treatment studies above and are very effective at reducing thermal impacts. The filters consist of a 6 inch bioretention soil layer and a 12 inch sand layer over various layers of gravel (total gravel thickness of 5 feet 10 inches). As the water passes through the media, the runoff temperature is reduced due to the heat exchange capacity of the sand and gravel. An underdrain system collects the treated water and slowly releases it to the storm drain system. The bottom 6 inch layer of gravel is located below the underdrain outlet to promote infiltration and groundwater recharge, which will supply cool, clean water for stream baseflow (see Drawing D1_DR_SW_DE-04 for details).

4.3.3.3 Sand Storage BMPs

The sand storage BMPs have been modified so they are similar to rock cribs and to minimize solar heating potential. They will have shade trees planted along the perimeter and on the planting berm located across the middle. They consist of a 6 inch bioretention soil layer and a 12 inch sand layer over various layers of gravel (total gravel thickness of 5 feet 10 inches). As the water passes through the sand and gravel, the runoff temperature is reduced due to the heat exchange capacity of the sand and gravel. An underdrain system collects the treated water and slowly releases it to the storm drain system. The bottom layer of gravel (6 inches thick for BMP D1-A, 10 inches thick for BMP D1-B) is located below the underdrain outlet to promote infiltration and groundwater recharge, which will supply cool, clean water for stream baseflow. This is essentially a modified MDE surface sand filter where the typical 18 inch thick sand layer has been replaced with a 6 feet 4 inch thick layer of sand and gravel for thermal reduction capabilities. Since the thicker sand layer is further below grade, it will remain cooler allowing for better thermal treatment of the stormwater that passes through it (see Drawings D1_DR_SW_DE-01 AND D1_DR_SW_DE-02 for details).

4.3.3.4 Linear Sand Filters

The below grade linear sand filters consist of a 6 inch bioretention soil layer and a 12 inch sand layer over various layers of gravel (total gravel thickness of 20 inches). As the water passes through the media, the runoff temperature is reduced due to the heat exchange capacity of the sand and gravel. An underdrain system collects the treated water and slowly releases it to the storm drain system. The bottom 6 inch layer of gravel is located below the underdrain outlet to promote infiltration and groundwater recharge, which will supply cool, clean water for stream baseflow (see Drawing D1_DR_SW_DE-03 for details).

4.3.3.5 Storm Drains

Since pipe networks can affect stormwater temperature, storm sewer materials have also been selected with thermal impacts in mind. Concrete pipe, which has a high convective heat transfer coefficient, has been used to encourage heat loss before the flow is discharged at the end walls.

Figure 3 provides a flow diagram for thermal treatment of stormwater through BMP D1-H in Drainage Area D-2-3. Flow diagrams through other BMPs and for other study points would be similar.

5.0 GEOTECHNICAL INVESTIGATIONS

Geotechnical investigations have been performed near the linear sand filters, linear storage BMPs, and sand storage BMPs. Table 9 summarizes the boring information, while Appendix D provides boring logs.

Table 9: Summary of Geotechnical Investigations

BMP No.	Bore Hole Number	Boring Location	Material Description	Ground Elev. (Ft)	Depth of Boring (Ft)	Water Table Elev. (Ft)	Bottom Elev. of BMP (Ft)
Sand Storage BMP D1-B	SWD2-B1	STA. 1289+25, 150' Rt. ICC	Silt with Sand	378	24.7	368	368
Sand Storage BMP D1-B	SWD2-B2	STA. 1289+25, 250' Rt. ICC	Silt with Sand	376	25	366.5	368
Sand Storage BMP D1-B	SWD2-B3	STA. 1289+50, 340' Rt. ICC	Sandy Silt	373	25	365	368
Sand Storage BMP D1-B	SWD2-B4	STA. 1290+00, 150' Rt. ICC	Sandy Silt	375	25	367.5	368
Sand Storage BMP D1-B	SWD2-B5	STA. 1290+00, 220' Rt. ICC	Silt	374	25	366	368
Sand Storage BMP D1-B	SWD2-B6	STA. 1290+25, 300' Rt. ICC	Sandy Silt	373	25	365	368
Sand Storage BMP D1-B	SWD2-B7	STA. 1290+75, 240' Rt. ICC	Silty Sand	372	25	363.9	368
Sand Storage BMP D1-B	SWD2-B8	STA. 1291+40, 140' Rt. ICC	Silty Sand	379	25	366	368
D1-C, D1-C1, D1-C2	RDD2-B8	STA. 1297+00, 50' Lt. ICC	Disintegrated Rock	392	8.6	Dry	370.5
D1-D	W-S-RB-0025	STA. 313+98, 0' Lt.	Sand and Silt	369.2	29.4	366.7	370.2
D1-E1, D1-E2	RDD2-B7	STA. 1295+95, 50' Rt. ICC	Sandy Silt	368	20	353.8	368.7
D1-F, D1-F1	RDD2-B9	STA. 1303+50, 50' Lt. ICC	Silty Sand	396	18.1	Dry	375.9
D1-G, D1-G1	W-S-RB-027	STA. 323+51, 2' Rt.	Gravel/Sand/Rock	391	29.9	Dry	375.5
D1-H, D1-H1	SWD2-B9	STA. 1303+00, 90' Rt. ICC	Silty Sand	391	22	Dry	373.9
D1-H, D1-H1	SWD2-B10	STA. 1303+75, 90' Rt. ICC	Silt/Silty Sand	386	25	Dry	374.6
D1-H, D1-H1	W-S-RB-028	STA. 323+52, 108' Rt.	Silt and Sand	382	30	364	375.1
D1-I	W-S-RB-022	STA. 316+26, 83' Lt.	Silt	406.7	25.5	384.8	397.3
D1-J	W-S-RB-023	STA. 316+38, 21' Rt.	Silt	413.9	25.5	Dry	398.0

Table 9: Summary of Geotechnical Investigations (Contd.)

BMP No.	Bore Hole Number	Boring Location	Material Description	Ground Elev. (Ft)	Depth of Boring (Ft)	Water Table Elev. (Ft)	Bottom Elev. of BMP (Ft)
D1-K	RDD2-B3B	STA. 1280+50, 50' Rt. ICC	Silty Sand	410	20	Dry	399.8
D1-K	RDD2-B4	STA. 1283+00, 52' Rt. ICC	Silty Sand	412	30	Dry	395.6
D1-L	RDD2-B6	STA. 1292+50, 25' Lt. ICC	Sandy Silt/Sandy Fat Clay	396	15	Dry	374.2
D1-M	RDD2-B6	STA. 1292+50, 25' Lt. ICC	Sandy Silt/Sandy Fat Clay	396	15	Dry	374.6
D1-N	SWD2-B8	STA. 1291+40, 140' Rt. ICC	Silty Sand	379	25	366	376.4

For Sand Storage BMP D1-B, borings indicate the presence of the water table at elevations ranging from 363.9 feet to 368 feet. Thus, the bottom of the BMP (invert underdrain) has been raised to an elevation of 368 feet and the storage volume calculations adjusted accordingly. A gravel layer below the underdrain will be constructed to promote groundwater recharge and further thermal treatment. For all other BMPs, the water table was found to be at least 2 feet below the bottom elevations of the stormwater management facilities.

6.0 POTENTIAL CHEMICAL SPILLS

Any chemical spills along the ICC would likely concentrate in the grass channels. The grass channels have been designed to drain to BMPs and sand filters directly or through the storm drain system. Because the channels will be vegetated, much of the liquid would be bound and detained within the vegetation and soil with relatively little contamination reaching the sand filters and BMPs. Any spills reaching the sand filters or BMPs will be detained for 12 hours as these facilities have been designed for a 12 hour extended detention time. This will afford the opportunity to remediate the effects of the spill before discharging to a receiving stream.

7.0 REFERENCES

1. Department of Agriculture, Soil Conservation Service, "Soil Survey Montgomery County Maryland", April 1967.

2. Department of Agriculture, Soil Conservation Service, "Computer Program for Project Formulation, Hydrology", Technical Release Number 20, May 1993. TR-20.

3. Department of Agriculture, Soil Conservation Service, "Urban Hydrology for Small Watersheds", Technical Release Number 55, June 1986. TR-55.

4. Maryland Department of the Environment, "Maryland Stormwater Management Guideline for State and Federal Projects", July 2001

5. SHA-MDE Stormwater Management Process Agreements and Interpretations, April 2003.

6. Maryland Department of the Environment, "2000 Maryland Stormwater Design Manual, Volumes I &II".

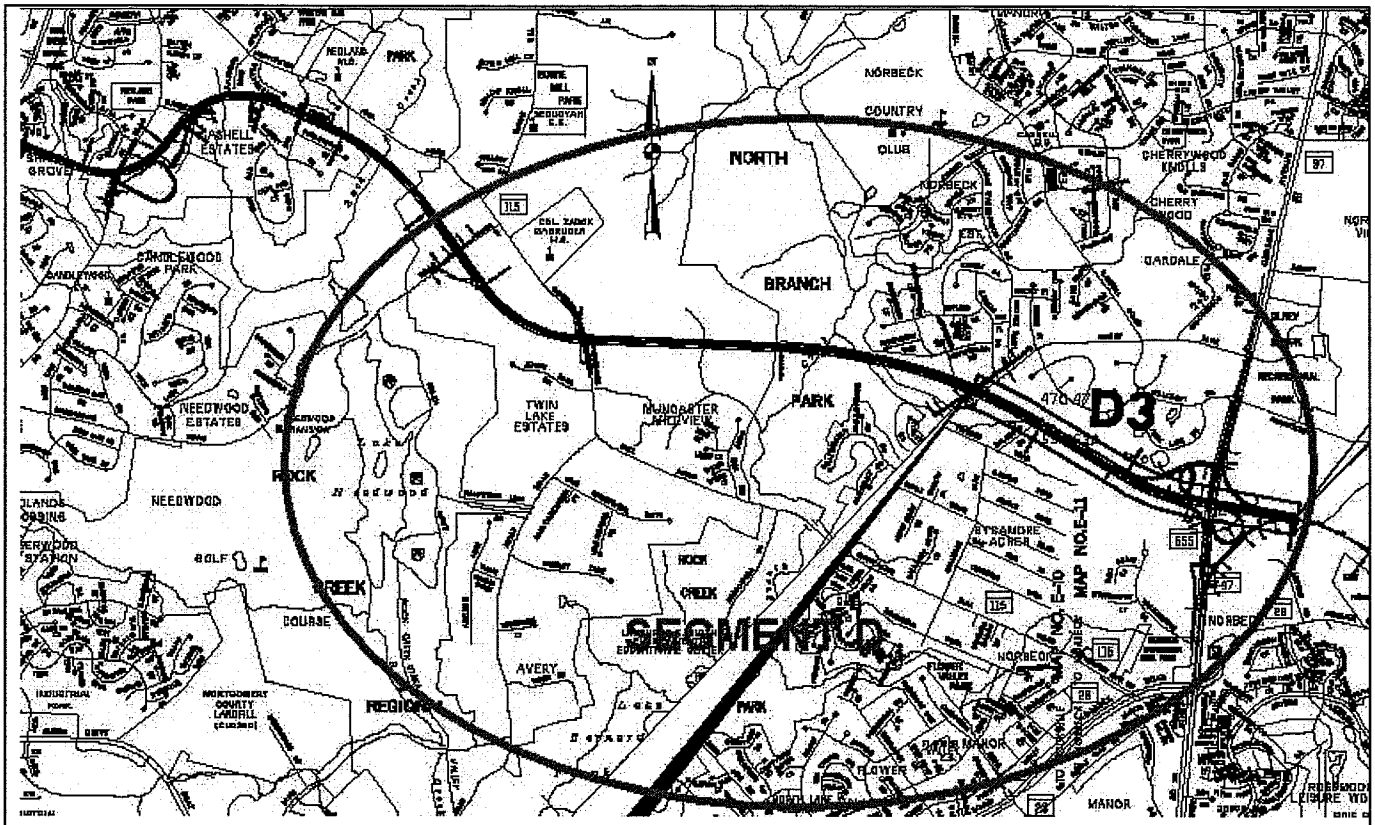
FIGURE 1

VICINITY MAP

NOT TO SCALE

FOR INFORMATION ONLY

Friday, December 14, 2007 AT 08:05 AM



KCI TECHNOLOGIES

Figure No. 2
Inter County Connector, Contract A
Location Map – Segment D
Not to Scale

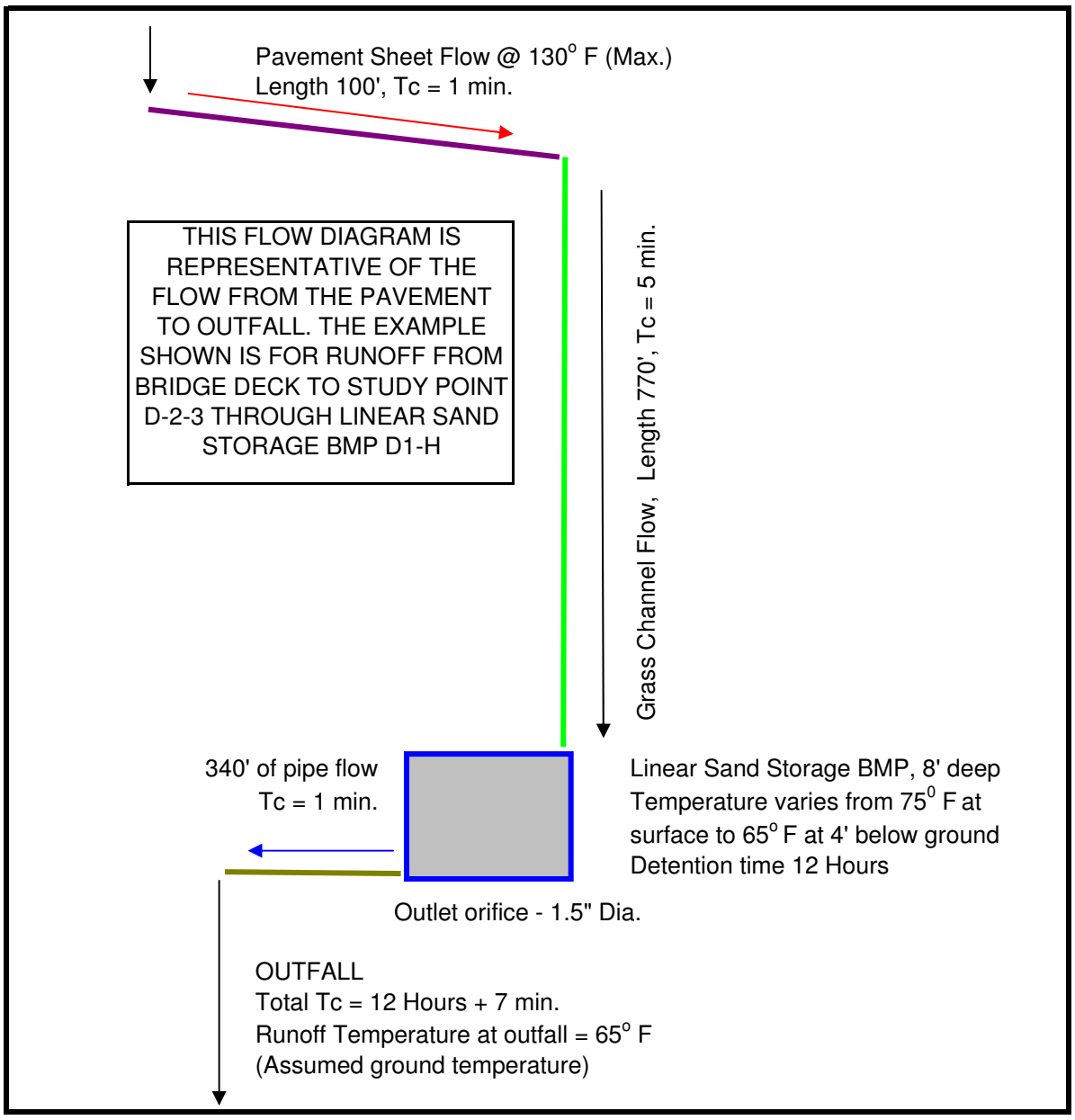


Figure 3: Typical Flow Diagram For Thermal Treatment of Stormwater

APPENDIX A

DRAINAGE AREA MAPS

DRAINAGE AREA MAP - SEGMENT D1-D2
EXISTING CONDITION
MD 200 / INTERCOUNTY CONNECTOR

JANUARY 2008

Legend

- Drainage Area Boundary
- Point of Investigation
- Tc_Path
- Soil Boundary
- Right of Way

EX_Land_Use

- Wood
- Pond
- Wood & Grass Mixed
- Grass
- Impervious

Zoning

- Agricultural Buildings
- Bare Exposed Rock
- Bare Ground
- Brush
- Commercial
- Cropland
- Deciduous Forest
- Evergreen Forest
- Extractive
- Feeding Operations
- High Density Residential
- Industrial
- Institutional
- Low Density Residential
- Medium Density Residential
- Mixed Forest
- Open Urban Land
- Orchards
- Pasture
- Water

200 100 0 200 400 600 Feet

INTERCOUNTY CONSTRUCTORS

TWO TAFT COURT * ROCKVILLE, MARYLAND 20850 * 301-354-8600

DA D-1-1
DA D-1-2
DA D-2-1
DA D-2-2
DA D-2-3
DA D-2-4
POI D-1-1
POI D-1-2
POI D-2-1
POI D-2-2
POI D-2-3
POI D-2-4

MUNCASTER MILL ROAD
MINUTEMAN TERRACE
MINUTEMAN CT
PROMONTORY CT
AVERY PARK DRIVE

MARYLAND 115

DRAINAGE AREA MAP - SEGMENT D1-D2
PROPOSED CONDITION
MD 200 / INTERCOUNTY CONNECTOR

JANUARY 2008

Legend

- Drainage Area Boundary
- PR_BMP_Boundary
- Point of Investigation
- Tc_Path
- Soil Boundary
- Right of Way

PR_Land_Use

- Wood
- Pond
- Wood & Grass Mixed
- Grass
- Impervious

Zoning

- Agricultural Buildings
- Bare Exposed Rock
- Bare Ground
- Brush
- Commercial
- Cropland
- Deciduous Forest
- Evergreen Forest
- Extractive
- Feeding Operations
- High Density Residential
- Industrial
- Institutional
- Low Density Residential
- Medium Density Residential
- Mixed Forest
- Open Urban Land
- Orchards
- Pasture
- Water

200 100 0 200 400 600 Feet

INTERCOUNTY CONSTRUCTORS

TWO TAFT COURT * ROCKVILLE, MARYLAND 20850 * 301-354-8600

DA D-1-1
DA D-1-2
DA D-2-2
DA D-3-3
POI D-1-1
POI D-1-2
POI D-2-2
POI D-2-3
HIGH POINT
LOW POINT
MUNCASTER MILL ROAD
MINUTEMAN DRIVE
MINUTEMAN TERRACE
AVERY PARK DRIVE
PROMONTORY CT
MONTY CT
EMORY
MAP CLASS 115

APPENDIX B

HYDROLOGIC COMPUTATIONS

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A- Existing Conditions DA D-1-1

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			5.74	315.7
B	3	Open Space (good) - grass >75%	61			3.13	190.9
D	65	Woods - (good)	77			1.4	107.8
D	3	Open Space (good) - grass >75%	80			0.26	20.8
		OUTSIDE RIGHT OF WAY					
B	24	Row crops - straight row (SR) - (good)	78			51.37	4006.9
B	65	Woods - (good)	55			9.57	526.4
B	12	Institutional	88			0.21	18.5
B	62	Woods/Grass combination - (good)	58			3.68	213.4
B	55	Pasture/grassland/range (grazing) -(good)	61			8.72	531.9
C	24	Row crops - straight row (SR) - (good)	85			3.4	289.0
C	65	Woods - (good)	70			2.55	178.5
C	55	Pasture/grassland/range (grazing) -(good)	74			0.18	13.3
D	24	Row crops - straight row (SR) - (good)	89			11.02	980.8
D	65	Woods - (good)	77			8.7	669.9
					Totals =	109.93	8063.8

0.17177 mi^2

CN (weighted) = total product / total area = 8063.8 / 109.93 = 73.4 Use CN = 73

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	0.6	2.4	4.1

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A | By CZJ | Date 1/23/2008

Location Montgomery County | Checked PS | Date 1/24/2008

Contract A- Existing Conditions | DA D-1-1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)

	Segment ID		A-B			
1. Surface description (table 3-1)			5 Grass - short			
2. Manning's roughness coeff., n (table 3-1)			0.15			
3. Flow Length, L (total L<= 300 ft)		ft	100			
4. Two-Year 24-hr rainfall, P_2		in	3.2			
5. Land Slope, s		ft / ft	0.05			
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$		hr	0.113	+		= 0.113

Shallow concentrated flow

	Segment ID		B-C			
7. Surface Description: paved (P) or unpaved (U) ?			U			
8. Flow Length, L		ft	2160			
9. Watercourse slope, s		ft / ft	0.0287			
10. Average velocity, V (figure 3-1)		ft / sec	2.7			
11. $T_t = L / 3600V$		hr	0.222	+		= 0.222

Channel flow

	Segment ID		C-D			
a. Assumed Q:						
b. Pipe (P) or Channel (C) ?			C			
c. If pipe, enter D (in):						
d. If channel, enter bottom width:						
e. if channel, enter side slope 1 (_:1):						
f. If channel, enter side slope 2 (_:1):						
12. Cross sectional flow area, a		sq ft				
13. Wetted perimeter, wp		ft				
14. Hydraulic radius, r = a / wp		ft				
15. Channel slope, s		ft / ft	0.0161			
16. Manning's roughness coeff., n						
17. $V = 1.49 r^{0.67} s^{0.5} / n$ Table II-2-B-3		ft / sec	5.8			
18. Flow length, L		ft	1429			
19. $T_t = L / 3600V$		hr	0.07	+		= 0.07
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)					hr	0.41

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A - Proposed Conditions DA D-1-1

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			1.47	80.9
B	3	Open Space (good) - grass >75%	61			4.78	291.6
B	4	Imperv. - paved parking lots,roofs,drives	98			3.38	331.2
D	65	Woods - (good)	77			0.48	37.0
D	3	Open Space (good) - grass >75%	80			0.78	62.4
D	4	Imperv. - paved parking lots,roofs,drives	98			0.4	39.2
		OUTSIDE RIGHT OF WAY					
B	24	Row crops - straight row (SR) - (good)	78			51.37	4006.9
B	65	Woods - (good)	55			9.57	526.4
B	12	Institutional	88			0.21	18.5
B	62	Woods/Grass combination - (good)	58			3.68	213.4
B	55	Pasture/grassland/range (grazing) -(good)	61			8.72	531.9
C	24	Row crops - straight row (SR) - (good)	85			3.4	289.0
C	65	Woods - (good)	70			2.55	178.5
C	55	Pasture/grassland/range (grazing) -(good)	74			0.18	13.3
D	24	Row crops - straight row (SR) - (good)	89			11.02	980.8
D	65	Woods - (good)	77			8.7	669.9
					Totals =	110.69	8270.8

0.17295 mi^2

CN (weighted) = total product / total area = 8270.8 / 110.69 = 74.7 Use CN = 75

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	0.7	2.5	4.3

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A | By CZJ | Date 1/23/2008

Location Montgomery County | Checked PS | Date 1/24/2008

Contract A - Proposed Conditions | DA D-1-1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)	Segment ID	A-B				
1. Surface description (table 3-1)		5 Grass - short				
2. Manning's roughness coeff., n (table 3-1)		0.15				
3. Flow Length, L (total L<= 300 ft)	ft	100				
4. Two-Year 24-hr rainfall, P_2	in	3.2				
5. Land Slope, s	ft / ft	0.05				
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$	hr	0.113	+		=	0.113

Shallow concentrated flow	Segment ID	B-C				
7. Surface Description: paved (P) or unpaved (U) ?		U				
8. Flow Length, L	ft	2160				
9. Watercourse slope, s	ft / ft	0.0287				
10. Average velocity, V (figure 3-1)	ft / sec	2.7				
11. $T_t = L / 3600V$	hr	0.222	+		=	0.222

Channel flow	Segment ID	C-D	E-F				
a. Assumed Q:			152.0				
b. Pipe (P) or Channel (C) ?		C	P				
c. If pipe, enter D (in):			66				
d. If channel, enter bottom width:							
e. if channel, enter side slope 1 (_:1):							
f. If channel, enter side slope 2 (_:1):							
12. Cross sectional flow area, a	sq ft		23.8				
13. Wetted perimeter, wp	ft		17.3				
14. Hydraulic radius, r = a / wp	ft		1.4				
15. Channel slope, s	ft / ft	0.01576	0.01				
16. Manning's roughness coeff., n			0.013				
17. $V = 1.49 r^{0.67} s^{0.5} / n$ Table II-2-B-3	ft / sec	5.5	14.1				
18. Flow length, L	ft	952	441				
19. $T_t = L / 3600V$	hr	0.05	+	0.01	=	0.06	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)					hr	0.40	

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A- SWM DA D-1-1

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	3	Open Space (good) - grass >75%	61			3.05	186.1
B	4	Imperv. - paved parking lots,roofs,drives	98			3.38	331.2
B	65	Woods - (good)	55			0.41	22.6
C	3	Open Space (good) - grass >75%	74			0	
C	4	Imperv. - paved parking lots,roofs,drives	98			0	
C	65	Woods - (good)	70			0	
D	3	Open Space (good) - grass >75%	80			0.25	20.0
D	4	Imperv. - paved parking lots,roofs,drives	98			0.40	39.2
D	65	Woods - (good)	77			0	
		OUTSIDE RIGHT OF WAY					
B	24	Row crops - straight row (SR) - (good)	78			0.18	14.0
					Totals =	7.67	613.1

0.01198 mi^2

CN (weighted) = total product / total area = 613.1 / 7.67 = 79.9 Use CN = 80

2. Runoff

Storm #1	Storm #2	Storm #3
1	10	100
2.6	5.1	7.2
1.0	3.0	4.9

Frequency. . . . . Yr

Rainfall, P (24-hour) . . . . . In

Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A | By CZJ | Date 1/23/2008

Location Montgomery County | Checked PS | Date 1/24/2008

Contract A- SWM | DA D-1-1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)	Segment ID	A-B					
1. Surface description (table 3-1)		5 Grass - short					
2. Manning's roughness coeff., n (table 3-1)		0.15					
3. Flow Length, L (total L<= 300 ft)	ft	44					
4. Two-Year 24-hr rainfall, P_2	in	3.2					
5. Land Slope, s	ft / ft	0.1					
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$	hr	0.044	+		=	0.044	
Shallow concentrated flow	Segment ID						
7. Surface Description: paved (P) or unpaved (U) ?							
8. Flow Length, L	ft						
9. Watercourse slope, s	ft / ft						
10. Average velocity, V (figure 3-1)	ft / sec						
11. $T_t = L / 3600V$	hr		+		=	0.000	
Channel flow	Segment ID	B-C		C-D			
a. Assumed Q:				16.0			
b. Pipe (P) or Channel (C) ?		C		P			
c. If pipe, enter D (in):				66			
d. If channel, enter bottom width:							
e. if channel, enter side slope 1 (_:1):							
f. If channel, enter side slope 2 (_:1):							
12. Cross sectional flow area, a	sq ft			23.8			
13. Wetted perimeter, wp	ft			17.3			
14. Hydraulic radius, r = a / wp	ft			1.4			
15. Channel slope, s	ft / ft	0.01		0.01			
16. Manning's roughness coeff., n				0.013			
17. $V = 1.49 r^{0.67} s^{0.5} / n$ Table II-2-B-3	ft / sec	4.8		14.1			
18. Flow length, L	ft	936		441			
19. $T_t = L / 3600V$	hr	0.05	+	0.01	=	0.06	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)						hr	0.10

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A - BYPASS DA D-1-1

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			1.06	58.3
B	3	Open Space (good) - grass >75%	61			1.73	105.5
B	4	Imperv. - paved parking lots,roofs,drives	98			0	
D	65	Woods - (good)	77			0.48	37.0
D	3	Open Space (good) - grass >75%	80			0.53	42.4
D	4	Imperv. - paved parking lots,roofs,drives	98			0	
		OUTSIDE RIGHT OF WAY					
B	24	Row crops - straight row (SR) - (good)	78			51.19	3992.8
B	65	Woods - (good)	55			9.57	526.4
B	12	Institutional	88			0.21	18.5
B	62	Woods/Grass combination - (good)	58			3.68	213.4
B	55	Pasture/grassland/range (grazing) -(good)	61			8.72	531.9
C	24	Row crops - straight row (SR) - (good)	85			3.4	289.0
C	65	Woods - (good)	70			2.55	178.5
C	55	Pasture/grassland/range (grazing) -(good)	74			0.18	13.3
D	24	Row crops - straight row (SR) - (good)	89			11.02	980.8
D	65	Woods - (good)	77			8.7	669.9
					Totals =	103.02	7657.7
						0.16097 mi^2	

CN (weighted) = total product / total area = 7657.7 / 103.02 = 74.3 Use CN = 74

2. Runoff

Storm #1	Storm #2	Storm #3
1	10	100
2.6	5.1	7.2
0.7	2.4	4.2

Frequency. . . . . Yr

Rainfall, P (24-hour) . . . . . In

Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A | By CZJ | Date 1/23/2008

Location Montgomery County | Checked PS | Date 1/24/2008

Contract A - BYPASS | DA D-1-1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)		Segment ID	A-B		
1. Surface description (table 3-1)			5 Grass - short		
2. Manning's roughness coeff., n (table 3-1)			0.15		
3. Flow Length, L (total L<= 300 ft)		ft	100		
4. Two-Year 24-hr rainfall, P_2		in	3.2		
5. Land Slope, s		ft / ft	0.05		
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$		hr	0.113	+	= 0.113

Shallow concentrated flow		Segment ID	B-C		
7. Surface Description: paved (P) or unpaved (U) ?			U		
8. Flow Length, L		ft	2160		
9. Watercourse slope, s		ft / ft	0.0287		
10. Average velocity, V (figure 3-1)		ft / sec	2.7		
11. $T_t = L / 3600V$		hr	0.222	+	= 0.222

Channel flow		Segment ID	C-D	E-F		
a. Assumed Q:				135.9		
b. Pipe (P) or Channel (C) ?			C	P		
c. If pipe, enter D (in):				66		
d. If channel, enter bottom width:						
e. if channel, enter side slope 1 (_:1):						
f. If channel, enter side slope 2 (_:1):						
12. Cross sectional flow area, a		sq ft		23.8		
13. Wetted perimeter, wp		ft		17.3		
14. Hydraulic radius, r = a / wp		ft		1.4		
15. Channel slope, s		ft / ft	0.01576	0.01		
16. Manning's roughness coeff., n				0.013		
17. $V = 1.49 r^{0.67} s^{0.5} / n$	Table II-2-B-3	ft / sec	5.5	14.1		
18. Flow length, L		ft	952	441		
19. $T_t = L / 3600V$		hr	0.05	+ 0.01	=	0.06
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)					hr	0.40

CHANNEL PROTECTION SIZING CRITERIA

Project	ICC DESIGN BUILD - A	By	CZJ	Date	1/20/2008
J.O.	D1D2 FINAL	Checked	PS	Date	1/25/2008

Drainage Area SS-D1-A

Time of Concentration (t_c) =	0.10 hrs. (TR-55)
1-yr post-development runoff depth (Q_a) =	1 in. (TR-55)
1-yr rainfall depth (P) =	2.6 in. (Table 3.B.1)
Runoff Coefficient Number (CN) =	80 (TR-55)
Drainage Area =	0.01166 mi^2

Initial Abstraction (I_a)

$I_a = 200/CN - 2$ = 0.50

I_a/P = 0.19

Post-development Peak Discharge (q_i)

Unit peak factor (q_u) = 970 csm/in (Fig. D.11.1)

$q_i = q_u A Q_a$ = 11.31 cfs

q_o/q_i (T = 12 hrs.) = 0.038 (from Fig. D.11.2)

$q_o = q_o/q_i \times q_i$ = 0.43 cfs

Extended Detention Storage Volume (V_s)

$$V_s/V_r = 0.683 - 1.43(q_o/q_i) + 1.64(q_o/q_i)^2 - 0.804(q_o/q_i)^3$$

V_s/V_r = 0.63

$V_s = V_s/V_r \times V_r$ = 0.39 ac.-ft (17087 cf) (Note: Vr = Qa)

Storage depth for the Extended Detention Volume = 8.00 ft.
Therefore, the required orifice area (A_o) for extended detention design is:

$A_o = q_o/(4.81 \times h_o^{1/2})$ = 0.03 $ft.^2$

The maximum orifice diameter (d_o) is therefore:

$d_o = (4 \times A_o / \pi)^{1/2}$ = 0.20 ft. (2.41 in.) *Use 3 in.

ICC CONTRACT A
Segment D1-D2

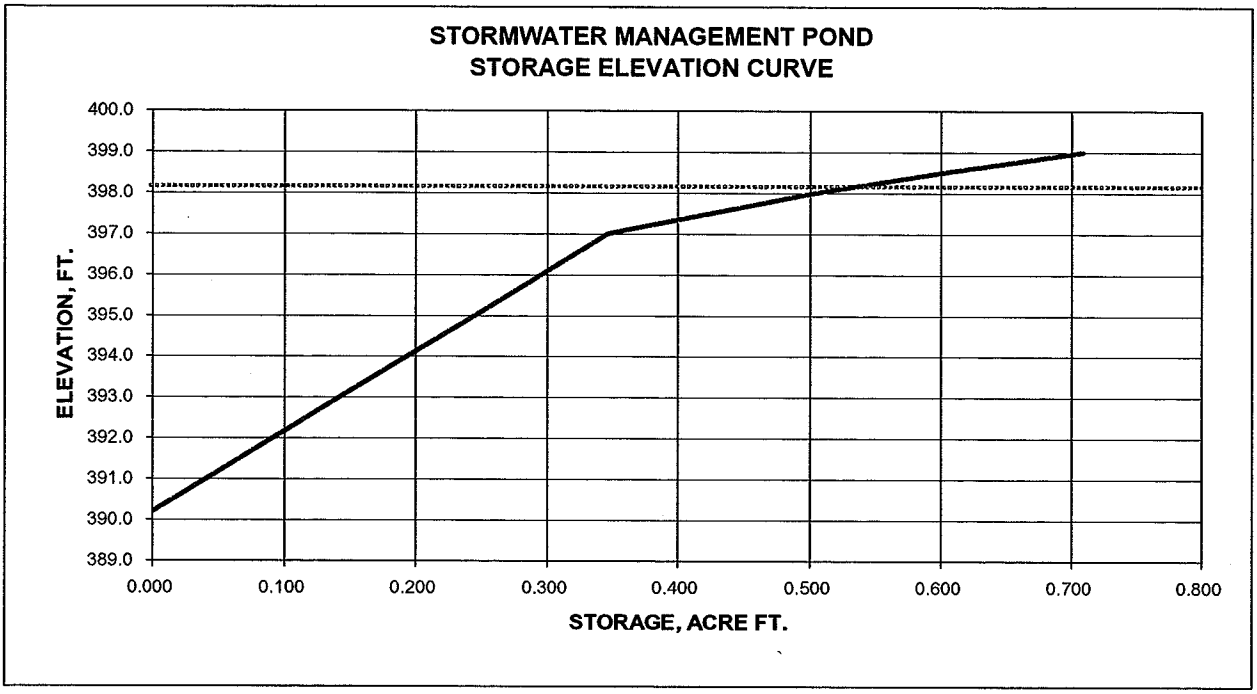
SAND STORAGE D-1-A

Stormwater Management Pond

Designed By: Partha Sarathi
25-Jan-08

Storage Computations

Elevation	Area	Ave. Area	Volume				
Ft.	sq. ft.	sq. ft.	Cu. ft.			Ft.	Acre Ft.
390.20	5548	0.00				390.2	0.000
391.00	5548	5548.00	1775.36	Porosity = 0.4		391.0	0.041
392.00	5548	5548.00	3994.56	Porosity = 0.4		392.0	0.092
393.00	5548	5548.00	6213.76	Porosity = 0.4		393.0	0.143
394.00	5548	5548.00	8432.96	Porosity = 0.4		394.0	0.194
395.00	5548	5548.00	10652.16	Porosity = 0.4		395.0	0.245
396.00	5548	5548.00	12871.36	Porosity = 0.4		396.0	0.295
397.00	5548	5548.00	15090.56	Porosity = 0.4		397.0	0.346
397.01	5548	5548.00	15146.04	Full area		397.0	0.348
398.00	8123	6835.50	21913.19			398.0	0.503
398.50	8969	8546.00	26186.19			398.5	0.601
399.00	9815	9392.00	30882.19			399.0	0.709



CPV VOLUME 17087 CF

Orifice Sizing

Use Average Hydraulic Head Method

Bottom elevation of drawdown orifice = 390.2 Ft.

Invert elevation of 2-year orifice = 390.2 Ft.

Maximum head = 8 Ft.

Average hydraulic head = Maximum head / 2 = 4 Ft.

Drawdown time for CPV = 12 hours

Required discharge through orifice = Volume / (12 hours x 3600) = 0.396 cfs

Orifice area, using Equation 11.1, rearranged $A = Q / [C \times (2 \times g \times h)^{1/2}]$

$C = 0.6$; $g = 32.2$

$A = 0.395 / [\, 0.6 \times (64.4 \times 4.5)^{1/2} \,] =$ 0.041 Sq. Ft.

Required CPV orifice size = 3 inches (Area 0.049 Sq. Ft.)

ICC CONTRACT A
Segment D1-D2

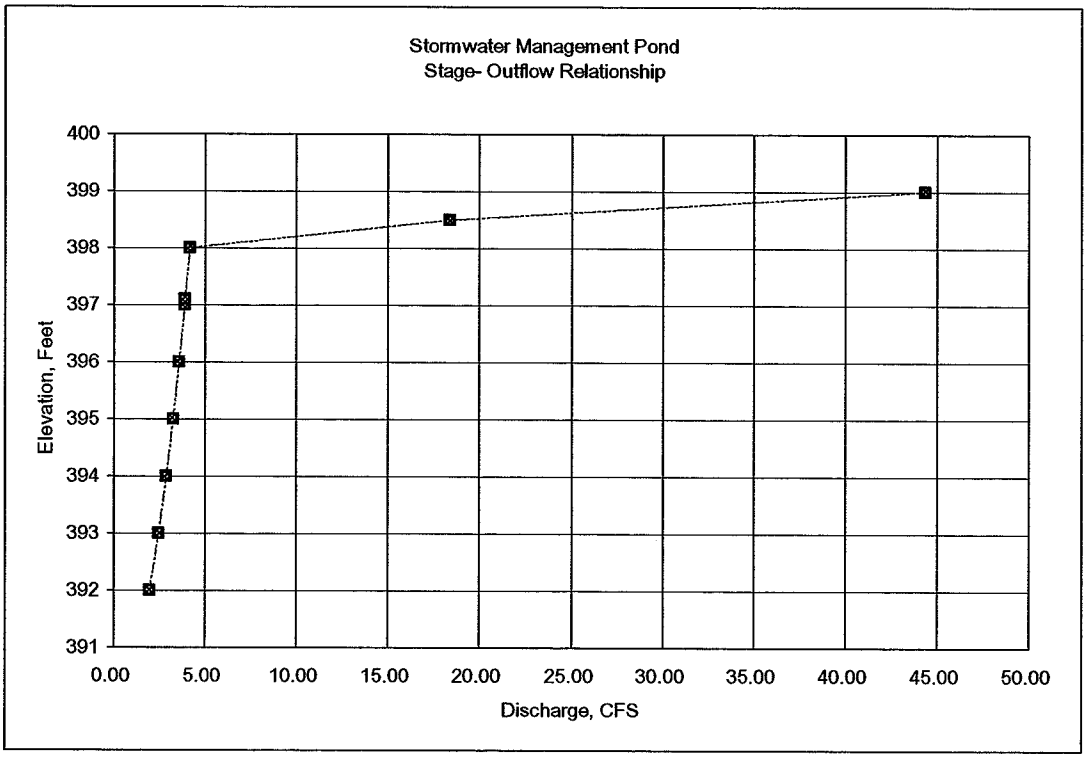
SAND STORAGE D-1-A

Stage Discharge Tabulation

Dia. of Riser Orifice, in.		**3.0**	Area:	0.0123	Sq, Ft.
c.l. Elevation		390.30			
Ten Year Spillway Std. K Inlet Structure		Size: 3' X 3.5'			
Weir Flow , Qw = 3.073 LH^1.5					
Weir Elevation =	**398.00**	L (Ft) =	3	W (Ft) =	3.5
Length of Weir =	13	Ft.	Area =	10.5	S.F.

Elevation	Effective Head	Qw	Qo	Q control (Qspilway)
FT	Ft.	CFS	CFS	CFS
398	0.00	0.00	0.00	0.00
398.5	0.50	14.12	35.75	14.12
399	1.00	39.95	50.56	39.95

Elevation, Ft.	Qo (3"), CFS	Qo (main), CFS	Qspillway, CFS	QEmer, CFS	Total, CFS
390.2	0.00				0.00
391	1.25				1.25
392	1.94				1.94
393	2.45				**2.45**
394	2.87				2.87
395	3.23				3.23
396	3.56				**3.56**
397	3.86				3.86
397.1	3.89				3.89
398	4.14		0.00		4.14
398.5	4.27		14.12		18.39
399	4.40		**39.95**		**44.35**



ICC CONTRACT A
Segment D1-D2

SAND STORAGE D-1-A

Design of Outflow Pipe

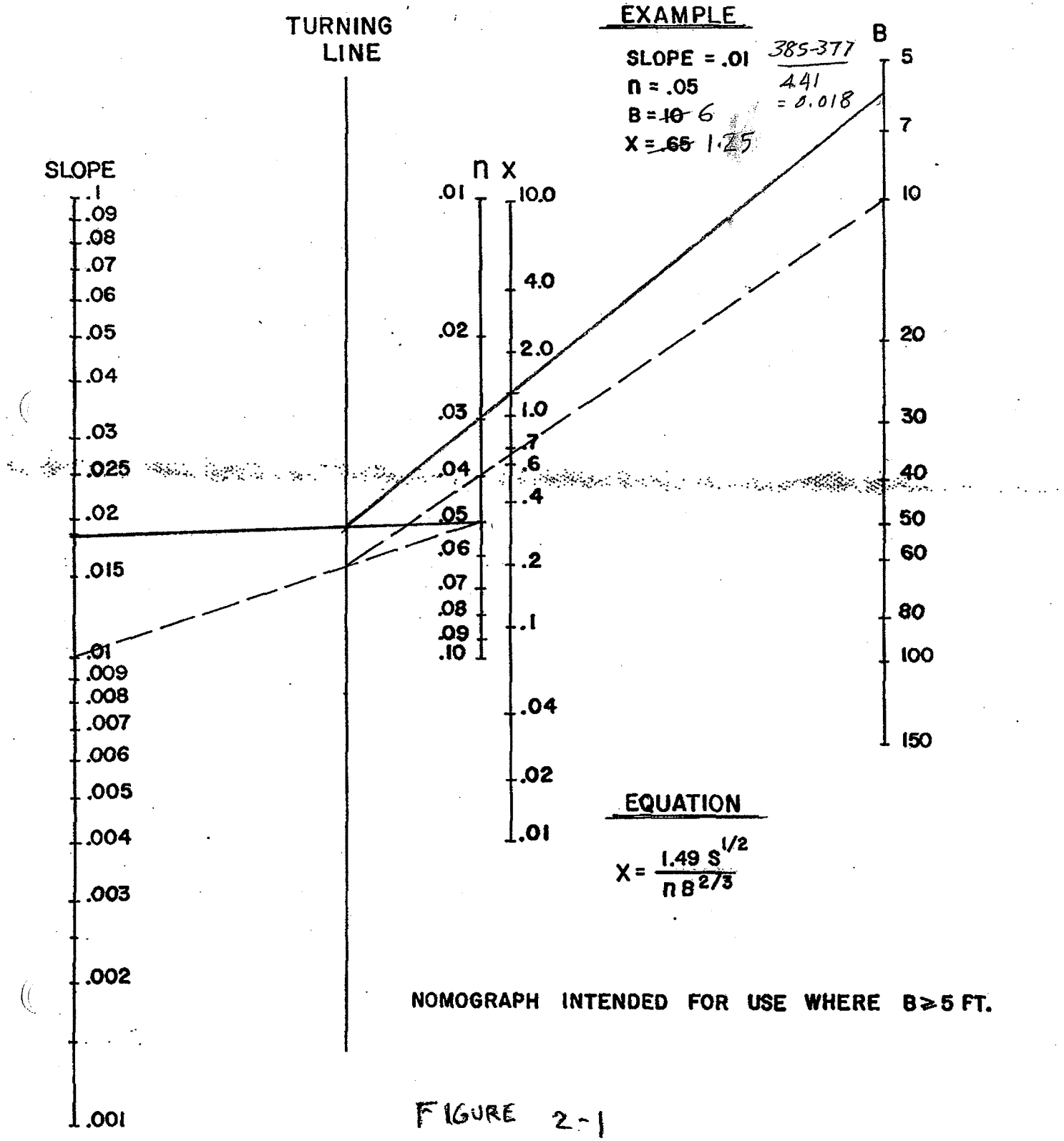
Q_{10} from SWM-1 Structure and Orifice (@ El. 389.00) 34.0 CFS

Length of Outflow Pipe	106.0	Ft.
Invert (In)	389.00	Ft.
Invert (Out)	386.00	Ft.
Slope	0.0283	%
Manning's n (Concrete Pipe)	0.013	
Diameter of Pipe	2.00	Ft.
Pipe Capacity	38.1	CFS
Pipe under pressure flow		
Area of Pipe	3.14	Sq. Ft.
Velocity of Flow	10.82	Ft./Sec.
Friction Loss	2.39	Ft.
Entrance & Exit Losses	1.09	Ft.
Flow Depth	2.00	Ft.
Invert El. Outflow Pipe	386.00	Ft.
Water Surface Elevation at barrel	391.49	
Actual Water Surface Elevation (10-Yr) from TR-20 Analysis		398
Provide ROP at outfall.		

NOMOGRAPH FOR ESTIMATING X FOR A TRAPEZOIDAL CHANNEL

$$Q = XA^M$$

SLOPE = BOTTOM SLOPE (FT/FT)
n = MANNING'S n
B = BOTTOM WIDTH (FT)



EXAMPLE

SLOPE = .01
n = .05
B = ~~10~~ 6
X = ~~.65~~ 1.25

385-377 = 8
441 = 0.018

EQUATION

$$X = \frac{1.49\,S^{1/2}}{n\,B^{2/3}}$$

NOMOGRAPH INTENDED FOR USE WHERE B ≥ 5 FT.

FIGURE 2-1

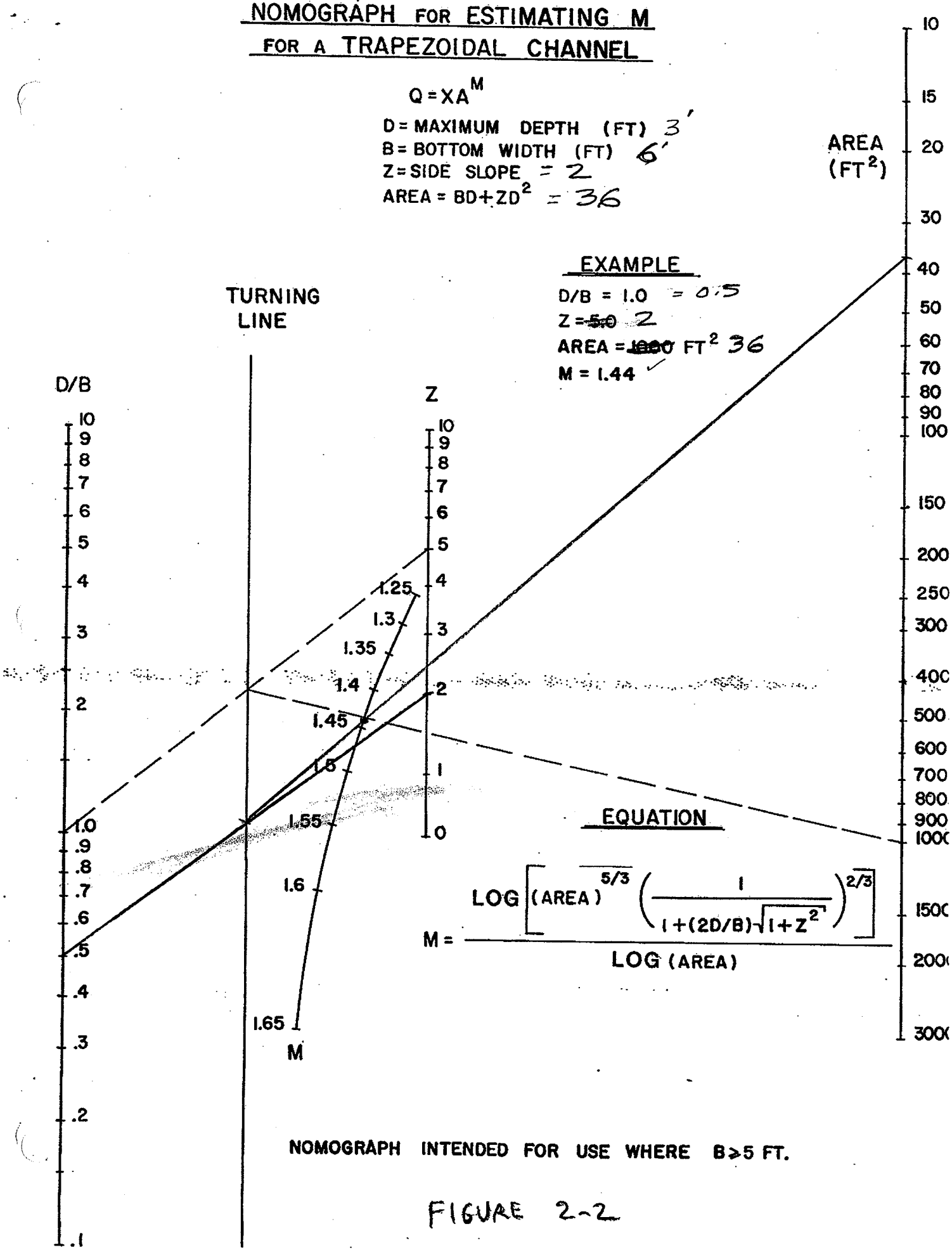
NOMOGRAPH FOR ESTIMATING M FOR A TRAPEZOIDAL CHANNEL

$Q = XA^M$

D = MAXIMUM DEPTH (FT) 3'
B = BOTTOM WIDTH (FT) 6'
Z = SIDE SLOPE = 2
AREA = $BD + ZD^2$ = 36

EXAMPLE

D/B = 1.0 = 0.5
Z = ~~5.0~~ 2
AREA = ~~1000~~ FT^2 36
M = 1.44 ✓



EQUATION

$$M = \frac{\log\left[(\text{AREA})^{5/3}\left(\frac{1}{1+(2D/B)\sqrt{1+Z^2}}\right)^{2/3}\right]}{\log(\text{AREA})}$$

NOMOGRAPH INTENDED FOR USE WHERE B≥5 FT.

FIGURE 2-2

```
*****************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****************

JOB TR-20                                                SUMMARY   NOPLOTS
TITLE     BMP D1-1
TITLE     FILE: BMPD1-1.DAT
 3 STRUCT      01
 8                      390.2       0.00        0.000
 8                      391.00      1.25        0.041
 8                      392.00      1.94        0.092
 8                      393.00      2.45        0.143
 8                      394.00      2.87        0.194
 8                      395.00      3.23        0.245
 8                      396.00      3.56        0.295
 8                      397.00      3.86        0.346
 8                      397.10      3.89        0.348
 8                      398.00      4.14        0.503
 8                      398.50      18.39       0.601
 8                      399.00      44.35       0.709
 9 ENDTBL
 6 RUNOFF 1 001        1      0.17177     73.0        0.41   1 1 1 1 1
 6 RUNOFF 1 002        2      0.17295     75.0        0.40   1 1 1 1 1
 6 RUNOFF 1 003        3      0.01198     80.0        0.10   1 1 1 1 1
 6 RESVOR 2    01 3    4                                     1 1 1 1 1
 6 RUNOFF 1 004        5      0.16097     74.0        0.40   1 1 1 1 1
 6 ADDHYD 4 005    4 5 6                                     1
 6 REACH  3 006    6   7 441.0       1.25        1.44        1        1
   ENDATA
 7 INCREM 6             .10
 7 COMPUT 7 001    006   0.0         2.6         1.0         2 2   1  01
   ENDCMP 1
 7 COMPUT 7 001    006   0.0         3.2         1.0         2 2   1  02
   ENDCMP 1
 7 COMPUT 7 001    006   0.0         5.1         1.0         2 2   1  10
   ENDCMP 1
 7 COMPUT 7 001    006   0.0         7.2         1.0         2 2   1  99
   ENDCMP 1
   ENDJOB 2

*******************************END OF 80-80 LIST*******************************
```

EXECUTIVE CONTROL INCREM MAIN TIME INCREMENT = .100 HOURS

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 6
STARTING TIME = .00 RAIN DEPTH = 2.60 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. = 1 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.16	55.3	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.17 SQ.MI.
11.60 CFS	.07	.76	3.98	14.11	33.87	52.75	54.58	44.14
12.40 CFS	32.66	24.95	19.75	16.03	13.47	11.73	10.51	9.57
13.20 CFS	8.79	8.20	7.75	7.36	7.01	6.68	6.38	6.11
14.00 CFS	5.85	5.60	5.38	5.19	5.05	4.94	4.84	4.75
14.80 CFS	4.67	4.59	4.50	4.42	4.34	4.25	4.17	4.08
15.60 CFS	3.99	3.90	3.81	3.72	3.63	3.54	3.46	3.39
16.40 CFS	3.34	3.30	3.26	3.23	3.19	3.16	3.13	3.10
17.20 CFS	3.07	3.04	3.01	2.98	2.95	2.91	2.88	2.85
18.00 CFS	2.82	2.78	2.75	2.72	2.68	2.65	2.62	2.58
18.80 CFS	2.55	2.51	2.48	2.45	2.41	2.38	2.34	2.31
19.60 CFS	2.27	2.23	2.20	2.16	2.13	2.09	2.06	2.04
20.40 CFS	2.02	2.01	2.00	1.99	1.98	1.98	1.97	1.97
21.20 CFS	1.96	1.95	1.95	1.94	1.94	1.93	1.92	1.92
22.00 CFS	1.91	1.91	1.90	1.89	1.89	1.88	1.88	1.87
22.80 CFS	1.86	1.86	1.85	1.84	1.84	1.83	1.83	1.82
23.60 CFS	1.81	1.81	1.80	1.79	1.78	1.67	1.33	.86
24.40 CFS	.48							

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.62 WATERSHED INCHES; 69 CFS-HRS; 5.7 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	6	4	3	2	2	2	0

--- XSECTION 1, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.15	68.2	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.17 SQ.MI.
11.50 CFS	.18	.65	2.23	7.10	20.24	44.87	65.77	65.38

12.30 CFS	51.04	36.96	28.02	22.00	17.77	14.87	12.96	11.61
13.10 CFS	10.55	9.70	9.05	8.56	8.13	7.74	7.37	7.04
13.90 CFS	6.73	6.44	6.16	5.92	5.72	5.56	5.44	5.33
14.70 CFS	5.23	5.13	5.04	4.95	4.85	4.76	4.67	4.57
15.50 CFS	4.47	4.37	4.28	4.18	4.08	3.98	3.88	3.78
16.30 CFS	3.71	3.65	3.61	3.57	3.53	3.49	3.46	3.42
17.10 CFS	3.39	3.35	3.32	3.28	3.25	3.21	3.18	3.14
17.90 CFS	3.11	3.07	3.03	3.00	2.96	2.92	2.89	2.85
18.70 CFS	2.81	2.77	2.74	2.70	2.66	2.62	2.58	2.55
19.50 CFS	2.51	2.47	2.43	2.39	2.35	2.31	2.27	2.24
20.30 CFS	2.21	2.19	2.18	2.17	2.16	2.16	2.15	2.14
21.10 CFS	2.13	2.13	2.12	2.12	2.11	2.10	2.10	2.09
21.90 CFS	2.08	2.08	2.07	2.06	2.05	2.05	2.04	2.03
22.70 CFS	2.03	2.02	2.01	2.01	2.00	1.99	1.98	1.98
23.50 CFS	1.97	1.96	1.96	1.95	1.94	1.93	1.82	1.41
24.30 CFS	.89	.48						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.71 WATERSHED INCHES; 79 CFS-HRS; 6.5 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	7	4	3	2	2	2	0

--- XSECTION 2, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.95	10.8	(RUNOFF)

*** WARNING - XSECTION 3, MAIN TIME INCREMENT TOO LARGE, COMPUTED PEAK
(10.84) EXCEEDS ADJACENT COORDINATE (10.19) BY 6 %. ***

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .01 SQ.MI.

HRS								
11.50 CFS	.34	.75	1.90	4.15	9.88	10.19	4.10	2.11
12.30 CFS	1.73	1.48	1.23	1.05	.97	.91	.85	.79
13.10 CFS	.75	.71	.68	.65	.61	.59	.56	.54
13.90 CFS	.51	.49						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.96 WATERSHED INCHES; 7 CFS-HRS; .6 ACRE-FEET.

DURATION(HRS)	2	2
FLOW(CFS)	1	0

--- XSECTION 3, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.10) FOR SUBWATERSHED XSECTION 3.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT -2.7%. ***

OPERATION RESVOR STRUCTURE 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.18	2.8	393.85

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .01 SQ.MI.			
10.50 CFS	.00	.01	.01	.02	.03	.05	.06	.08
10.50 ELEV	390.20	390.20	390.21	390.21	390.22	390.23	390.24	390.25
11.30 CFS	.11	.14	.18	.26	.50	1.06	1.79	2.48
11.30 ELEV	390.27	390.29	390.31	390.37	390.52	390.88	391.79	393.07
12.10 CFS	2.78	2.81	2.75	2.67	2.59	2.49	2.38	2.27
12.10 ELEV	393.80	393.85	393.71	393.53	393.32	393.10	392.87	392.64
12.90 CFS	2.16	2.05	1.95	1.82	1.70	1.59	1.49	1.40
12.90 ELEV	392.43	392.22	392.02	391.83	391.66	391.50	391.35	391.21
13.70 CFS	1.31	1.21	1.05	.93	.83	.75	.68	.63
13.70 ELEV	391.09	390.97	390.87	390.80	390.73	390.68	390.64	390.60
14.50 CFS	.59	.55	.53	.50	.48	.46	.45	.43
14.50 ELEV	390.58	390.55	390.54	390.52	390.51	390.50	390.49	390.48
15.30 CFS	.42	.41	.40	.39	.38	.37	.36	.35
15.30 ELEV	390.47	390.46	390.45	390.45	390.44	390.44	390.43	390.42
16.10 CFS	.34	.33	.32	.32	.31	.31	.30	.30
16.10 ELEV	390.42	390.41	390.41	390.40	390.40	390.40	390.39	390.39
16.90 CFS	.30	.29	.29	.29	.28	.28	.28	.27
16.90 ELEV	390.39	390.39	390.38	390.38	390.38	390.38	390.38	390.37
17.70 CFS	.27	.27	.26	.26	.26	.25	.25	.25
17.70 ELEV	390.37	390.37	390.37	390.37	390.36	390.36	390.36	390.36
18.50 CFS	.24	.24	.24	.23	.23	.23	.22	.22
18.50 ELEV	390.36	390.35	390.35	390.35	390.35	390.35	390.34	390.34
19.30 CFS	.22	.21	.21	.21	.21	.20	.20	.20
19.30 ELEV	390.34	390.34	390.34	390.33	390.33	390.33	390.33	390.32
20.10 CFS	.19	.19	.19	.18	.18	.18	.18	.18
20.10 ELEV	390.32	390.32	390.32	390.32	390.32	390.32	390.32	390.31
20.90 CFS	.18	.18	.18	.18	.18	.17	.17	.17
20.90 ELEV	390.31	390.31	390.31	390.31	390.31	390.31	390.31	390.31
21.70 CFS	.17	.17	.17	.17	.17	.17	.17	.17
21.70 ELEV	390.31	390.31	390.31	390.31	390.31	390.31	390.31	390.31
22.50 CFS	.17	.17	.17	.17	.17	.16	.16	.16
22.50 ELEV	390.31	390.31	390.31	390.31	390.31	390.31	390.31	390.30
23.30 CFS	.16	.16	.16	.16	.16	.16	.16	.16
23.30 ELEV	390.30	390.30	390.30	390.30	390.30	390.30	390.30	390.30
24.10 CFS	.14	.12	.09	.07	.05	.04	.03	.03
24.10 ELEV	390.29	390.27	390.26	390.25	390.23	390.23	390.22	390.22
24.90 CFS	.02	.02	.01					
24.90 ELEV	390.21	390.21	390.21					

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.96 WATERSHED INCHES; 7 CFS-HRS; .6 ACRE-FEET.

DURATION(HRS)	2	3
FLOW(CFS)	1	0

--- STRUCTURE 1, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.15	57.6	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .16 SQ.MI.

HRS								
11.60 CFS	.24	1.33	5.20	16.32	37.24	55.99	56.16	44.16
12.40 CFS	32.20	24.51	19.31	15.64	13.12	11.43	10.26	9.34
13.20 CFS	8.59	8.03	7.59	7.21	6.87	6.54	6.25	5.98
14.00 CFS	5.72	5.48	5.26	5.09	4.95	4.84	4.75	4.66
14.80 CFS	4.57	4.49	4.41	4.33	4.24	4.16	4.07	3.99
15.60 CFS	3.90	3.81	3.73	3.64	3.55	3.46	3.38	3.31
16.40 CFS	3.26	3.22	3.18	3.15	3.12	3.09	3.06	3.03
17.20 CFS	3.00	2.97	2.94	2.91	2.87	2.84	2.81	2.78
18.00 CFS	2.75	2.71	2.68	2.65	2.62	2.58	2.55	2.52
18.80 CFS	2.48	2.45	2.42	2.38	2.35	2.31	2.28	2.25
19.60 CFS	2.21	2.18	2.14	2.11	2.07	2.04	2.01	1.98
20.40 CFS	1.97	1.95	1.95	1.94	1.93	1.93	1.92	1.91
21.20 CFS	1.91	1.90	1.90	1.89	1.89	1.88	1.87	1.87
22.00 CFS	1.86	1.86	1.85	1.84	1.84	1.83	1.83	1.82
22.80 CFS	1.81	1.81	1.80	1.79	1.79	1.78	1.78	1.77
23.60 CFS	1.76	1.76	1.75	1.74	1.73	1.64	1.27	.80
24.40 CFS	.44							

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.67 WATERSHED INCHES; 69 CFS-HRS; 5.7 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	6	4	3	2	2	2	0

--- XSECTION 4, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION ADDHYD XSECTION 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (NULL)
12.15	60.4	

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.69 WATERSHED INCHES; 77 CFS-HRS; 6.3 ACRE-FEET.

*** WARNING - ROUTING COEFFICIENT (C) EQUALS 1.0,
CONSIDER SMALLER MAIN TIME INCREMENT FOR XSECTION 6. ***

OPERATION REACH XSECTION 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.15	60.4	(NULL)

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.69 WATERSHED INCHES; 77 CFS-HRS; 6.3 ACRE-FEET.

--- XSECTION 6, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 1

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 6
STARTING TIME = .00 RAIN DEPTH = 3.20 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. = 2 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.15	95.3	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.17 SQ.MI.
11.30 CFS	.35	.70	1.20	2.12	4.83	12.47	31.22	63.80
12.10 CFS	91.89	91.54	72.29	52.46	39.41	30.73	24.66	20.52
12.90 CFS	17.73	15.78	14.29	13.08	12.16	11.47	10.88	10.34
13.70 CFS	9.84	9.39	8.97	8.58	8.21	7.88	7.60	7.39
14.50 CFS	7.22	7.07	6.93	6.80	6.68	6.55	6.43	6.30
15.30 CFS	6.17	6.04	5.91	5.78	5.65	5.52	5.38	5.25
16.10 CFS	5.12	5.00	4.90	4.82	4.75	4.70	4.65	4.60
16.90 CFS	4.55	4.51	4.46	4.41	4.37	4.32	4.27	4.23
17.70 CFS	4.18	4.13	4.08	4.04	3.99	3.94	3.89	3.84
18.50 CFS	3.79	3.74	3.69	3.64	3.59	3.54	3.49	3.44
19.30 CFS	3.39	3.34	3.29	3.24	3.19	3.13	3.08	3.03
20.10 CFS	2.98	2.93	2.90	2.87	2.86	2.84	2.83	2.82
20.90 CFS	2.81	2.80	2.79	2.78	2.77	2.77	2.76	2.75
21.70 CFS	2.74	2.73	2.72	2.71	2.70	2.69	2.68	2.68
22.50 CFS	2.67	2.66	2.65	2.64	2.63	2.62	2.61	2.60
23.30 CFS	2.59	2.58	2.57	2.56	2.55	2.54	2.53	2.52
24.10 CFS	2.36	1.87	1.21	.67	.37			

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.98 WATERSHED INCHES; 109 CFS-HRS; 9.0 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	9	6	4	3	3	3	0

--- XSECTION 1, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.14	111.4	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .17 SQ.MI.

HRS								
11.00 CFS	.36	.62	.95	1.38	1.93	2.64	3.94	7.59
11.80 CFS	17.30	40.04	78.14	108.76	104.90	80.44	57.52	42.96
12.60 CFS	33.31	26.63	22.09	19.08	17.01	15.40	14.11	13.14
13.40 CFS	12.41	11.77	11.18	10.64	10.14	9.69	9.26	8.86
14.20 CFS	8.50	8.20	7.97	7.79	7.63	7.48	7.34	7.20
15.00 CFS	7.06	6.92	6.79	6.65	6.51	6.36	6.22	6.08
15.80 CFS	5.93	5.79	5.64	5.50	5.37	5.26	5.18	5.11
16.60 CFS	5.05	4.99	4.94	4.89	4.84	4.79	4.74	4.69
17.40 CFS	4.64	4.59	4.53	4.48	4.43	4.38	4.33	4.27
18.20 CFS	4.22	4.17	4.11	4.06	4.01	3.95	3.90	3.85
19.00 CFS	3.79	3.74	3.68	3.63	3.57	3.52	3.46	3.41
19.80 CFS	3.35	3.29	3.24	3.18	3.14	3.10	3.07	3.05
20.60 CFS	3.04	3.03	3.02	3.00	2.99	2.98	2.98	2.97
21.40 CFS	2.96	2.95	2.94	2.93	2.92	2.91	2.90	2.89
22.20 CFS	2.88	2.87	2.86	2.85	2.84	2.83	2.82	2.81
23.00 CFS	2.80	2.78	2.77	2.76	2.75	2.74	2.73	2.72
23.80 CFS	2.71	2.70	2.69	2.53	1.97	1.24	.68	.37

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.09 WATERSHED INCHES; 122 CFS-HRS; 10.1 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	10	6	4	3	3	3	0

--- XSECTION 2, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
11.95	15.9	

*** WARNING - XSECTION 3, MAIN TIME INCREMENT TOO LARGE, COMPUTED PEAK
(15.90) EXCEEDS ADJACENT COORDINATE (14.92) BY 6 %. ***

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2

HRS	MAIN TIME INCREMENT = .100 hr,			DRAINAGE AREA =			.01 SQ.MI.
11.30 CFS	.48	.58	.69	1.41	3.32	6.73	14.92	14.80
12.10 CFS	5.87	2.98	2.43	2.08	1.72	1.47	1.35	1.26
12.90 CFS	1.18	1.10	1.03	.98	.94	.89	.85	.81
13.70 CFS	.77	.74	.71	.67	.65	.63	.62	.61
14.50 CFS	.60	.59	.58	.57	.56	.54	.53	.52
15.30 CFS	.51	.50						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.40 WATERSHED INCHES; 11 CFS-HRS; .9 ACRE-FEET.

DURATION(HRS)	2	4
FLOW(CFS)	1	0

--- XSECTION 3, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.10) FOR SUBWATERSHED XSECTION 3.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT .0%. ***

OPERATION RESVOR STRUCTURE 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.20	3.6	396.11

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2

HRS	MAIN TIME INCREMENT = .100 hr,			DRAINAGE AREA =			.01 SQ.MI.
9.60 CFS	.00	.01	.01	.02	.02	.03	.04	.05
9.60 ELEV	390.20	390.20	390.21	390.21	390.22	390.22	390.23	390.23
10.40 CFS	.06	.07	.09	.11	.13	.15	.17	.20
10.40 ELEV	390.24	390.25	390.26	390.27	390.28	390.29	390.31	390.33
11.20 CFS	.24	.28	.34	.41	.55	.95	1.54	2.38
11.20 ELEV	390.35	390.38	390.42	390.46	390.55	390.81	391.42	392.86
12.00 CFS	3.16	3.55	3.59	3.55	3.48	3.40	3.30	3.20
12.00 ELEV	394.82	395.97	396.11	395.96	395.76	395.50	395.21	394.91
12.80 CFS	3.09	2.98	2.88	2.76	2.65	2.54	2.42	2.30
12.80 ELEV	394.61	394.32	394.03	393.74	393.47	393.20	392.95	392.71
13.60 CFS	2.18	2.07	1.97	1.85	1.72	1.61	1.51	1.42
13.60 ELEV	392.48	392.26	392.06	391.86	391.69	391.52	391.38	391.24
14.40 CFS	1.33	1.25	1.11	.99	.90	.82	.76	.71
14.40 ELEV	391.12	391.01	390.91	390.84	390.78	390.73	390.69	390.66
15.20 CFS	.67	.64	.61	.58	.56	.54	.52	.50
15.20 ELEV	390.63	390.61	390.59	390.57	390.56	390.54	390.53	390.52
16.00 CFS	.49	.47	.46	.45	.44	.43	.42	.42
16.00 ELEV	390.51	390.50	390.49	390.49	390.48	390.47	390.47	390.47
16.80 CFS	.41	.40	.40	.39	.39	.38	.38	.37
16.80 ELEV	390.46	390.46	390.45	390.45	390.45	390.45	390.44	390.44
17.60 CFS	.37	.37	.36	.36	.35	.35	.34	.34
17.60 ELEV	390.44	390.43	390.43	390.43	390.43	390.42	390.42	390.42
18.40 CFS	.33	.33	.33	.32	.32	.31	.31	.30

18.40	ELEV	390.41	390.41	390.41	390.41	390.40	390.40	390.40	390.39
19.20	CFS	.30	.30	.29	.29	.28	.28	.27	.27
19.20	ELEV	390.39	390.39	390.39	390.38	390.38	390.38	390.37	390.37
20.00	CFS	.26	.26	.26	.25	.25	.25	.25	.24
20.00	ELEV	390.37	390.37	390.36	390.36	390.36	390.36	390.36	390.36
20.80	CFS	.24	.24	.24	.24	.24	.24	.24	.23
20.80	ELEV	390.36	390.35	390.35	390.35	390.35	390.35	390.35	390.35
21.60	CFS	.23	.23	.23	.23	.23	.23	.23	.23
21.60	ELEV	390.35	390.35	390.35	390.35	390.35	390.35	390.35	390.35
22.40	CFS	.23	.23	.23	.22	.22	.22	.22	.22
22.40	ELEV	390.35	390.34	390.34	390.34	390.34	390.34	390.34	390.34
23.20	CFS	.22	.22	.22	.22	.22	.22	.21	.21
23.20	ELEV	390.34	390.34	390.34	390.34	390.34	390.34	390.34	390.34
24.00	CFS	.21	.19	.16	.12	.09	.07	.06	.04
24.00	ELEV	390.34	390.32	390.30	390.28	390.26	390.25	390.24	390.23
24.80	CFS	.03	.03	.02	.02	.01			
24.80	ELEV	390.22	390.22	390.21	390.21	390.21			

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.40 WATERSHED INCHES; 11 CFS-HRS; .9 ACRE-FEET.

DURATION(HRS)	2	4	4
FLOW(CFS)	2	1	0

--- STRUCTURE 1, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.14	96.3	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .16 SQ.MI.

HRS								
11.20	CFS	.44	.77	1.21	1.77	2.78	5.75	14.00	33.89
12.00	CFS	66.98	93.46	91.97	70.93	50.87	38.15	29.65	23.73
12.80	CFS	19.72	17.05	15.20	13.77	12.63	11.78	11.12	10.55
13.60	CFS	10.02	9.54	9.10	8.70	8.32	7.96	7.63	7.37
14.40	CFS	7.16	7.00	6.86	6.72	6.60	6.47	6.35	6.23
15.20	CFS	6.10	5.98	5.85	5.73	5.60	5.47	5.34	5.21
16.00	CFS	5.08	4.95	4.83	4.74	4.66	4.60	4.55	4.50
16.80	CFS	4.45	4.41	4.36	4.32	4.27	4.23	4.18	4.13
17.60	CFS	4.09	4.04	4.00	3.95	3.90	3.86	3.81	3.76
18.40	CFS	3.71	3.66	3.62	3.57	3.52	3.47	3.42	3.37
19.20	CFS	3.32	3.27	3.23	3.18	3.13	3.08	3.03	2.98
20.00	CFS	2.92	2.88	2.83	2.80	2.77	2.76	2.75	2.73
20.80	CFS	2.72	2.71	2.71	2.70	2.69	2.68	2.67	2.66
21.60	CFS	2.65	2.64	2.64	2.63	2.62	2.61	2.60	2.59
22.40	CFS	2.58	2.57	2.56	2.56	2.55	2.54	2.53	2.52
23.20	CFS	2.51	2.50	2.49	2.48	2.47	2.46	2.45	2.44
24.00	CFS	2.43	2.27	1.78	1.12	.61	.33		

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.04 WATERSHED INCHES; 108 CFS-HRS; 8.9 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	9	5	4	3	3	2	0

--- XSECTION 4, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION ADDHYD XSECTION 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.14	99.9	(NULL)

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.06 WATERSHED INCHES; 119 CFS-HRS; 9.8 ACRE-FEET.

*** WARNING - ROUTING COEFFICIENT (C) EQUALS 1.0,
CONSIDER SMALLER MAIN TIME INCREMENT FOR XSECTION 6. ***

OPERATION REACH XSECTION 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.14	99.9	(NULL)

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.06 WATERSHED INCHES; 119 CFS-HRS; 9.8 ACRE-FEET.

--- XSECTION 6, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 2

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 6
STARTING TIME = .00 RAIN DEPTH = 5.10 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =10 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.14	242.6	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .17 SQ.MI.			
9.50 CFS	.39	.54	.69	.86	1.05	1.27	1.51	1.77
10.30 CFS	2.08	2.42	2.81	3.23	3.71	4.27	4.93	5.67
11.10 CFS	6.51	7.51	8.79	10.40	12.39	15.99	25.63	48.86
11.90 CFS	99.96	180.25	237.98	229.85	176.49	124.55	91.83	70.30
12.70 CFS	55.41	45.33	38.66	34.08	30.66	27.90	25.83	24.28
13.50 CFS	22.97	21.78	20.69	19.69	18.78	17.93	17.13	16.40
14.30 CFS	15.81	15.34	14.97	14.64	14.34	14.06	13.78	13.50
15.10 CFS	13.23	12.95	12.68	12.40	12.12	11.84	11.56	11.28
15.90 CFS	11.00	10.72	10.44	10.18	9.97	9.80	9.66	9.55
16.70 CFS	9.44	9.33	9.23	9.13	9.03	8.93	8.83	8.73
17.50 CFS	8.63	8.53	8.43	8.33	8.23	8.13	8.02	7.92
18.30 CFS	7.82	7.72	7.61	7.51	7.41	7.30	7.20	7.10
19.10 CFS	6.99	6.89	6.78	6.68	6.57	6.47	6.36	6.26
19.90 CFS	6.15	6.04	5.94	5.85	5.78	5.72	5.69	5.66
20.70 CFS	5.63	5.61	5.59	5.57	5.55	5.53	5.51	5.49
21.50 CFS	5.47	5.45	5.43	5.41	5.39	5.37	5.35	5.33
22.30 CFS	5.31	5.29	5.27	5.25	5.23	5.21	5.19	5.17
23.10 CFS	5.15	5.13	5.11	5.09	5.07	5.05	5.03	5.01
23.90 CFS	4.99	4.96	4.68	3.69	2.38	1.33	.73	.40

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.35 WATERSHED INCHES; 261 CFS-HRS; 21.6 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	14	15
FLOW(CFS)	21	12	9	7	6	5	2	0

--- XSECTION 1, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.13	267.0	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .17 SQ.MI.			
9.00 CFS	.36	.51	.67	.84	1.00	1.17	1.33	1.51
9.80 CFS	1.70	1.93	2.19	2.47	2.79	3.16	3.57	4.02
10.60 CFS	4.52	5.09	5.74	6.50	7.36	8.33	9.51	11.00
11.40 CFS	13	15	19	30	58	117	204	264
12.20 CFS	249	187	130	96	73	57	47	40
13.00 CFS	35.47	31.89	29.07	27.02	25.44	24.06	22.81	21.66
13.80 CFS	20.62	19.67	18.78	17.93	17.17	16.55	16.06	15.67
14.60 CFS	15.33	15.02	14.72	14.43	14.14	13.84	13.55	13.26
15.40 CFS	12.97	12.68	12.39	12.09	11.79	11.49	11.19	10.90
16.20 CFS	10.63	10.41	10.24	10.10	9.97	9.86	9.75	9.64
17.00 CFS	9.54	9.43	9.33	9.22	9.12	9.01	8.91	8.80
17.80 CFS	8.69	8.59	8.48	8.37	8.27	8.16	8.05	7.94
18.60 CFS	7.83	7.73	7.62	7.51	7.40	7.29	7.18	7.07
19.40 CFS	6.96	6.85	6.74	6.63	6.52	6.41	6.29	6.19

20.20 CFS	6.09	6.02	5.96	5.92	5.89	5.87	5.85	5.82
21.00 CFS	5.80	5.78	5.76	5.74	5.72	5.70	5.68	5.66
21.80 CFS	5.64	5.62	5.60	5.57	5.55	5.53	5.51	5.49
22.60 CFS	5.47	5.45	5.43	5.41	5.39	5.36	5.34	5.32
23.40 CFS	5.30	5.28	5.26	5.24	5.22	5.19	5.15	4.82
24.20 CFS	3.77	2.38	1.29	.70	.38			

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.53 WATERSHED INCHES; 282 CFS-HRS; 23.3 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	14	16
FLOW(CFS)	22	13	9	7	6	5	3	0

--- XSECTION 2, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.94	33.6	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .01 SQ.MI.

HRS								
10.20 CFS	.48	.52	.57	.62	.68	.76	.84	.93
11.00 CFS	1.03	1.16	1.35	1.56	1.79	2.05	3.96	8.62
11.80 CFS	16.14	32.23	30.34	12.10	5.93	4.75	4.04	3.33
12.60 CFS	2.83	2.59	2.43	2.26	2.10	1.97	1.87	1.78
13.40 CFS	1.69	1.61	1.53	1.46	1.40	1.33	1.27	1.22
14.20 CFS	1.19	1.17	1.15	1.13	1.10	1.08	1.06	1.04
15.00 CFS	1.01	.99	.97	.95	.92	.90	.88	.86
15.80 CFS	.83	.81	.79	.77	.76	.75	.74	.74
16.60 CFS	.73	.72	.71	.71	.70	.69	.68	.67
17.40 CFS	.66	.66	.65	.64	.63	.62	.62	.61
18.20 CFS	.60	.59	.58	.58	.57	.56	.55	.54
19.00 CFS	.53	.53	.52	.51	.50			

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.98 WATERSHED INCHES; 23 CFS-HRS; 1.9 ACRE-FEET.

DURATION(HRS)	2	4	6	8	9
FLOW(CFS)	2	1	1	1	0

--- XSECTION 3, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.10) FOR SUBWATERSHED XSECTION 3.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT .2%. ***

OPERATION RESVOR STRUCTURE 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.10	18.7	398.51

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10

HRS		MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .01 SQ.MI.			
7.30	CFS	.00	.01	.01	.02	.02	.03	.03	.04
7.30	ELEV	390.20	390.21	390.21	390.21	390.21	390.22	390.22	390.23
8.10	CFS	.05	.06	.06	.07	.08	.09	.10	.12
8.10	ELEV	390.23	390.24	390.24	390.25	390.25	390.26	390.27	390.27
8.90	CFS	.13	.14	.16	.17	.19	.20	.22	.23
8.90	ELEV	390.28	390.29	390.30	390.31	390.32	390.33	390.34	390.35
9.70	CFS	.25	.26	.28	.30	.33	.36	.39	.42
9.70	ELEV	390.36	390.37	390.38	390.40	390.41	390.43	390.45	390.47
10.50	CFS	.46	.51	.55	.61	.67	.74	.82	.92
10.50	ELEV	390.50	390.52	390.55	390.59	390.63	390.67	390.72	390.79
11.30	CFS	1.04	1.18	1.29	1.48	1.97	2.74	3.89	10.77
11.30	ELEV	390.86	390.95	391.06	391.33	392.07	393.69	397.12	398.23
12.10	CFS	18.69	11.35	6.84	5.00	4.14	4.12	4.11	4.08
12.10	ELEV	398.51	398.25	398.09	398.03	397.99	397.94	397.87	397.80
12.90	CFS	4.06	4.04	4.01	3.98	3.95	3.92	3.89	3.78
12.90	ELEV	397.72	397.63	397.53	397.43	397.33	397.22	397.11	396.72
13.70	CFS	3.67	3.56	3.44	3.33	3.22	3.11	3.00	2.89
13.70	ELEV	396.36	396.00	395.65	395.31	394.97	394.65	394.35	394.06
14.50	CFS	2.78	2.67	2.57	2.47	2.36	2.25	2.15	2.06
14.50	ELEV	393.79	393.53	393.28	393.04	392.82	392.61	392.42	392.24
15.30	CFS	1.97	1.88	1.77	1.68	1.59	1.52	1.44	1.37
15.30	ELEV	392.07	391.91	391.76	391.62	391.50	391.38	391.28	391.18
16.10	CFS	1.31	1.25	1.15	1.06	.99	.93	.88	.85
16.10	ELEV	391.09	391.00	390.93	390.88	390.83	390.80	390.77	390.74
16.90	CFS	.82	.79	.77	.75	.73	.72	.71	.69
16.90	ELEV	390.72	390.71	390.69	390.68	390.67	390.66	390.65	390.64
17.70	CFS	.68	.67	.66	.65	.64	.64	.63	.62
17.70	ELEV	390.64	390.63	390.62	390.62	390.61	390.61	390.60	390.60
18.50	CFS	.61	.60	.59	.58	.58	.57	.56	.55
18.50	ELEV	390.59	390.58	390.58	390.57	390.57	390.56	390.56	390.55
19.30	CFS	.54	.53	.53	.52	.51	.50	.49	.48
19.30	ELEV	390.55	390.54	390.54	390.53	390.53	390.52	390.51	390.51
20.10	CFS	.48	.47	.46	.46	.45	.45	.45	.44
20.10	ELEV	390.50	390.50	390.50	390.49	390.49	390.49	390.49	390.48
20.90	CFS	.44	.44	.44	.43	.43	.43	.43	.43
20.90	ELEV	390.48	390.48	390.48	390.48	390.48	390.48	390.47	390.47
21.70	CFS	.42	.42	.42	.42	.42	.42	.41	.41
21.70	ELEV	390.47	390.47	390.47	390.47	390.47	390.47	390.47	390.46
22.50	CFS	.41	.41	.41	.41	.40	.40	.40	.40
22.50	ELEV	390.46	390.46	390.46	390.46	390.46	390.46	390.46	390.46
23.30	CFS	.40	.40	.40	.39	.39	.39	.39	.39
23.30	ELEV	390.45	390.45	390.45	390.45	390.45	390.45	390.45	390.45
24.10	CFS	.35	.29	.22	.17	.13	.10	.08	.06
24.10	ELEV	390.43	390.38	390.34	390.31	390.29	390.27	390.25	390.24
24.90	CFS	.05	.04	.03	.02	.02	.01	.01	

24.90 ELEV 390.23 390.22 390.22 390.21 390.21 390.21 390.21

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.97 WATERSHED INCHES; 23 CFS-HRS; 1.9 ACRE-FEET.

DURATION(HRS)	2	4	6	8	9
FLOW(CFS)	3	2	1	1	0

--- STRUCTURE 1, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.13	240.2	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .16 SQ.MI.

HRS								
9.30 CFS	.43	.57	.72	.86	1.02	1.19	1.39	1.61
10.10 CFS	1.86	2.13	2.44	2.80	3.19	3.62	4.12	4.69
10.90 CFS	5.34	6.08	6.93	7.96	9.27	10.90	12.89	16.47
11.70 CFS	26	50	102	182	237	224	168	118
12.50 CFS	86.28	65.77	51.95	42.66	36.50	32.25	29.01	26.46
13.30 CFS	24.58	23.15	21.92	20.78	19.73	18.78	17.92	17.11
14.10 CFS	16.34	15.65	15.09	14.65	14.29	13.98	13.70	13.43
14.90 CFS	13.16	12.90	12.63	12.37	12.10	11.84	11.57	11.30
15.70 CFS	11.04	10.77	10.50	10.22	9.95	9.71	9.51	9.35
16.50 CFS	9.22	9.11	9.01	8.91	8.81	8.71	8.62	8.52
17.30 CFS	8.43	8.33	8.24	8.14	8.04	7.95	7.85	7.75
18.10 CFS	7.65	7.56	7.46	7.36	7.26	7.16	7.06	6.96
18.90 CFS	6.87	6.77	6.67	6.57	6.47	6.36	6.26	6.16
19.70 CFS	6.06	5.96	5.86	5.76	5.66	5.57	5.50	5.46
20.50 CFS	5.42	5.39	5.37	5.35	5.33	5.31	5.29	5.27
21.30 CFS	5.25	5.23	5.22	5.20	5.18	5.16	5.14	5.12
22.10 CFS	5.10	5.08	5.06	5.05	5.03	5.01	4.99	4.97
22.90 CFS	4.95	4.93	4.91	4.89	4.87	4.85	4.83	4.81
23.70 CFS	4.79	4.78	4.76	4.72	4.42	3.45	2.19	1.19
24.50 CFS	.64	.34						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.44 WATERSHED INCHES; 253 CFS-HRS; 20.9 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	14	15
FLOW(CFS)	20	12	8	7	5	5	2	0

--- XSECTION 4, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION ADDHYD XSECTION 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.13	258.4	(NULL)

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.48 WATERSHED INCHES; 276 CFS-HRS; 22.8 ACRE-FEET.

*** WARNING - ROUTING COEFFICIENT (C) EQUALS 1.0,
CONSIDER SMALLER MAIN TIME INCREMENT FOR XSECTION 6. ***

OPERATION REACH XSECTION 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.13	258.4	(NULL)

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.48 WATERSHED INCHES; 276 CFS-HRS; 22.8 ACRE-FEET.

--- XSECTION 6, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 3

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 6
STARTING TIME = .00 RAIN DEPTH = 7.20 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =99 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.13	427.1	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .17 SQ.MI.

HRS								
7.80 CFS	.40	.53	.67	.81	.95	1.12	1.30	1.51
8.60 CFS	1.74	1.98	2.24	2.52	2.82	3.13	3.45	3.75
9.40 CFS	4.03	4.29	4.54	4.83	5.17	5.59	6.07	6.60
10.20 CFS	7.20	7.88	8.64	9.48	10.39	11.41	12.60	13.97
11.00 CFS	15.50	17.20	19.22	21.81	25.04	28.97	36.05	54.88
11.80 CFS	99	192	329	421	400	303	212	155
12.60 CFS	117	92	74	63	55	50	45	42
13.40 CFS	39.03	36.88	34.93	33.14	31.51	30.03	28.65	27.34
14.20 CFS	26.17	25.20	24.44	23.82	23.29	22.80	22.33	21.88
15.00 CFS	21.43	20.98	20.53	20.09	19.64	19.19	18.74	18.29
15.80 CFS	17.83	17.38	16.93	16.48	16.07	15.72	15.45	15.23

16.60 CFS	15.04	14.86	14.70	14.53	14.37	14.21	14.05	13.88
17.40 CFS	13.72	13.56	13.40	13.24	13.08	12.91	12.75	12.59
18.20 CFS	12.42	12.26	12.10	11.93	11.77	11.60	11.44	11.27
19.00 CFS	11.11	10.94	10.77	10.61	10.44	10.28	10.11	9.94
19.80 CFS	9.77	9.61	9.44	9.28	9.13	9.02	8.93	8.87
20.60 CFS	8.83	8.79	8.75	8.72	8.68	8.65	8.62	8.59
21.40 CFS	8.55	8.52	8.49	8.46	8.43	8.39	8.36	8.33
22.20 CFS	8.30	8.27	8.24	8.20	8.17	8.14	8.11	8.07
23.00 CFS	8.04	8.01	7.98	7.94	7.91	7.88	7.85	7.81
23.80 CFS	7.78	7.75	7.70	7.27	5.73	3.70	2.07	1.12
24.60 CFS	.61	.33						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
4.10 WATERSHED INCHES; 455 CFS-HRS; 37.6 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	14	16
FLOW(CFS)	35	20	14	11	9	8	7	1

DURATION(HRS)	17
FLOW(CFS)	0

--- XSECTION 1, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.12	461.4	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.17 SQ.MI.
7.30 CFS	.43	.56	.70	.84	.98	1.13	1.28	1.43
8.10 CFS	1.58	1.75	1.94	2.16	2.41	2.67	2.96	3.26
8.90 CFS	3.59	3.93	4.29	4.64	4.97	5.27	5.54	5.81
9.70 CFS	6.11	6.49	6.95	7.50	8.10	8.78	9.54	10.39
10.50 CFS	11.32	12.33	13.48	14.81	16.33	18.02	19.90	22.16
11.30 CFS	25	29	33	40	63	115	217	362
12.10 CFS	458	423	312	217	158	119	93	76
12.90 CFS	64.35	56.60	50.75	46.16	42.80	40.24	38.03	36.02
13.70 CFS	34.18	32.51	30.99	29.55	28.19	26.98	25.99	25.21
14.50 CFS	24.59	24.04	23.54	23.05	22.58	22.11	21.65	21.18
15.30 CFS	20.72	20.26	19.79	19.32	18.85	18.38	17.91	17.44
16.10 CFS	16.98	16.55	16.20	15.93	15.70	15.51	15.32	15.15
16.90 CFS	14.98	14.81	14.64	14.48	14.31	14.14	13.97	13.81
17.70 CFS	13.64	13.47	13.30	13.13	12.96	12.79	12.62	12.45
18.50 CFS	12.28	12.12	11.94	11.77	11.60	11.43	11.26	11.09
19.30 CFS	10.92	10.75	10.57	10.40	10.23	10.05	9.88	9.71
20.10 CFS	9.54	9.39	9.27	9.19	9.13	9.08	9.04	9.00
20.90 CFS	8.97	8.94	8.90	8.87	8.84	8.80	8.77	8.74
21.70 CFS	8.70	8.67	8.64	8.60	8.57	8.54	8.50	8.47
22.50 CFS	8.44	8.40	8.37	8.34	8.30	8.27	8.24	8.20

23.30 CFS	8.17	8.13	8.10	8.07	8.03	8.00	7.97	7.91
24.10 CFS	7.42	5.79	3.65	2.00	1.08	.58	.31	

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
4.33 WATERSHED INCHES; 483 CFS-HRS; 39.9 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	14	16
FLOW(CFS)	36	21	15	12	9	9	7	2

DURATION(HRS)	17
FLOW(CFS)	0

--- XSECTION 2, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.93	54.6	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .01 SQ.MI.			
8.80 CFS	.49	.53	.56	.59	.61	.63	.65	.66
9.60 CFS	.69	.74	.79	.85	.90	.97	1.05	1.13
10.40 CFS	1.22	1.31	1.43	1.56	1.72	1.87	2.04	2.27
11.20 CFS	2.60	2.97	3.37	3.80	7.24	15.26	27.44	52.83
12.00 CFS	48.14	18.87	9.20	7.34	6.23	5.13	4.34	3.98
12.80 CFS	3.72	3.47	3.22	3.01	2.86	2.72	2.58	2.45
13.60 CFS	2.33	2.22	2.12	2.03	1.93	1.85	1.81	1.78
14.40 CFS	1.74	1.71	1.67	1.64	1.60	1.57	1.54	1.50
15.20 CFS	1.47	1.43	1.40	1.37	1.33	1.30	1.26	1.23
16.00 CFS	1.19	1.16	1.15	1.14	1.12	1.11	1.10	1.09
16.80 CFS	1.07	1.06	1.05	1.04	1.02	1.01	1.00	.99
17.60 CFS	.98	.96	.95	.94	.93	.91	.90	.89
18.40 CFS	.88	.86	.85	.84	.83	.81	.80	.79
19.20 CFS	.77	.76	.75	.74	.72	.71	.70	.69
20.00 CFS	.67	.67	.66	.66	.66	.66	.65	.65
20.80 CFS	.65	.65	.64	.64	.64	.64	.63	.63
21.60 CFS	.63	.63	.62	.62	.62	.62	.61	.61
22.40 CFS	.61	.61	.60	.60	.60	.60	.59	.59
23.20 CFS	.59	.59	.58	.58	.58	.58	.57	.57
24.00 CFS	.56	.15						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
4.87 WATERSHED INCHES; 38 CFS-HRS; 3.1 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	14	15
FLOW(CFS)	3	2	1	1	1	1	1	0

--- XSECTION 3, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.10) FOR SUBWATERSHED XSECTION 3.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT .8%. ***

*** WARNING - DISCHARGE EXCEEDS HIGHEST RATING POINT FOR STRUCTURE 1,
VALUE EXTRAPOLATED. ***

OPERATION RESVOR STRUCTURE 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.02	50.6	399.12

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .01 SQ.MI.			
5.70 CFS	.00	.01	.02	.02	.03	.04	.05	.06
5.70 ELEV	390.20	390.21	390.21	390.21	390.22	390.22	390.23	390.24
6.50 CFS	.06	.07	.08	.09	.10	.12	.13	.14
6.50 ELEV	390.24	390.25	390.25	390.26	390.27	390.27	390.28	390.29
7.30 CFS	.15	.16	.17	.18	.20	.21	.22	.23
7.30 ELEV	390.30	390.30	390.31	390.32	390.33	390.33	390.34	390.35
8.10 CFS	.24	.26	.28	.29	.32	.34	.36	.39
8.10 ELEV	390.36	390.37	390.38	390.39	390.40	390.42	390.43	390.45
8.90 CFS	.42	.44	.47	.50	.53	.55	.58	.60
8.90 ELEV	390.47	390.48	390.50	390.52	390.54	390.55	390.57	390.58
9.70 CFS	.62	.66	.69	.73	.78	.83	.89	.95
9.70 ELEV	390.60	390.62	390.64	390.67	390.70	390.73	390.77	390.81
10.50 CFS	1.02	1.10	1.19	1.27	1.32	1.39	1.47	1.57
10.50 ELEV	390.86	390.91	390.96	391.03	391.11	391.20	391.32	391.47
11.30 CFS	1.70	1.86	2.02	2.29	2.90	3.88	17.11	49.95
11.30 ELEV	391.66	391.88	392.15	392.69	394.09	397.06	398.46	399.11
12.10 CFS	33.56	15.16	9.99	7.58	6.15	5.09	4.39	4.14
12.10 ELEV	398.79	398.39	398.21	398.12	398.07	398.03	398.01	397.99
12.90 CFS	4.13	4.12	4.11	4.09	4.07	4.05	4.03	4.01
12.90 ELEV	397.96	397.93	397.88	397.82	397.76	397.69	397.62	397.54
13.70 CFS	3.99	3.97	3.94	3.91	3.87	3.77	3.67	3.58
13.70 ELEV	397.46	397.37	397.28	397.19	397.03	396.69	396.38	396.07
14.50 CFS	3.49	3.39	3.30	3.21	3.12	3.03	2.94	2.86
14.50 ELEV	395.78	395.49	395.21	394.94	394.68	394.44	394.20	393.97
15.30 CFS	2.77	2.68	2.59	2.51	2.43	2.34	2.25	2.17
15.30 ELEV	393.75	393.54	393.34	393.14	392.95	392.78	392.61	392.44
16.10 CFS	2.09	2.01	1.94	1.86	1.78	1.71	1.64	1.58
16.10 ELEV	392.29	392.14	392.01	391.88	391.77	391.67	391.57	391.48
16.90 CFS	1.53	1.48	1.43	1.39	1.35	1.32	1.28	1.25
16.90 ELEV	391.41	391.33	391.27	391.20	391.15	391.09	391.05	391.00
17.70 CFS	1.19	1.14	1.09	1.06	1.03	1.00	.98	.96
17.70 ELEV	390.96	390.93	390.90	390.88	390.86	390.84	390.82	390.81
18.50 CFS	.94	.92	.90	.89	.87	.86	.84	.83
18.50 ELEV	390.80	390.79	390.78	390.77	390.76	390.75	390.74	390.73
19.30 CFS	.82	.80	.79	.78	.76	.75	.74	.73

19.30 ELEV	390.72	390.71	390.71	390.70	390.69	390.68	390.67	390.66
20.10 CFS	.71	.70	.69	.68	.68	.67	.67	.66
20.10 ELEV	390.66	390.65	390.64	390.64	390.63	390.63	390.63	390.62
20.90 CFS	.66	.66	.65	.65	.65	.64	.64	.64
20.90 ELEV	390.62	390.62	390.62	390.62	390.61	390.61	390.61	390.61
21.70 CFS	.64	.63	.63	.63	.63	.62	.62	.62
21.70 ELEV	390.61	390.61	390.60	390.60	390.60	390.60	390.60	390.60
22.50 CFS	.62	.61	.61	.61	.61	.60	.60	.60
22.50 ELEV	390.59	390.59	390.59	390.59	390.59	390.59	390.58	390.58
23.30 CFS	.60	.59	.59	.59	.59	.58	.58	.58
23.30 ELEV	390.58	390.58	390.58	390.58	390.57	390.57	390.57	390.57
24.10 CFS	.53	.43	.33	.26	.20	.16	.12	.09
24.10 ELEV	390.54	390.47	390.41	390.37	390.33	390.30	390.28	390.26
24.90 CFS	.07	.06	.04	.03	.03	.02	.02	.01
24.90 ELEV	390.25	390.24	390.23	390.22	390.22	390.21	390.21	390.21

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
4.92 WATERSHED INCHES; 38 CFS-HRS; 3.1 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	14	15
FLOW(CFS)	4	2	1	1	1	1	1	0

--- STRUCTURE 1, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.12	416.6	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99
HRS MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .16 SQ.MI.

7.60 CFS	.45	.58	.70	.84	.97	1.11	1.26	1.43
8.40 CFS	1.62	1.82	2.05	2.30	2.57	2.85	3.15	3.47
9.20 CFS	3.78	4.07	4.34	4.59	4.83	5.11	5.45	5.86
10.00 CFS	6.34	6.87	7.46	8.14	8.90	9.73	10.64	11.66
10.80 CFS	12.83	14.17	15.66	17.35	19.39	21.98	25.15	28.95
11.60 CFS	36	54	100	194	327	413	384	285
12.40 CFS	198	143	109	85	69	59	52	47
13.20 CFS	42.32	39.25	36.93	34.91	33.06	31.36	29.83	28.43
14.00 CFS	27.13	25.89	24.78	23.87	23.16	22.58	22.08	21.62
14.80 CFS	21.18	20.75	20.32	19.89	19.47	19.04	18.61	18.19
15.60 CFS	17.76	17.33	16.90	16.47	16.03	15.61	15.22	14.90
16.40 CFS	14.64	14.44	14.26	14.09	13.93	13.77	13.62	13.47
17.20 CFS	13.31	13.16	13.01	12.85	12.70	12.55	12.39	12.24
18.00 CFS	12.08	11.93	11.77	11.62	11.46	11.30	11.15	10.99
18.80 CFS	10.83	10.68	10.52	10.36	10.20	10.05	9.89	9.73
19.60 CFS	9.57	9.41	9.26	9.10	8.94	8.78	8.64	8.54
20.40 CFS	8.46	8.40	8.36	8.32	8.29	8.26	8.23	8.20
21.20 CFS	8.17	8.14	8.11	8.07	8.04	8.01	7.98	7.95
22.00 CFS	7.92	7.89	7.86	7.83	7.80	7.77	7.74	7.71

22.80 CFS	7.68	7.65	7.62	7.59	7.55	7.52	7.49	7.46
23.60 CFS	7.43	7.40	7.37	7.34	7.28	6.80	5.33	3.37
24.40 CFS	1.83	.98	.53	.29				

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
4.21 WATERSHED INCHES; 437 CFS-HRS; 36.1 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	14	16
FLOW(CFS)	33	19	14	11	8	8	7	2

DURATION(HRS)	17
FLOW(CFS)	0

--- XSECTION 4, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION ADDHYD XSECTION 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.11	447.2	(NULL)

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
4.26 WATERSHED INCHES; 475 CFS-HRS; 39.3 ACRE-FEET.

*** WARNING - ROUTING COEFFICIENT (C) EQUALS 1.0,
CONSIDER SMALLER MAIN TIME INCREMENT FOR XSECTION 6. ***

OPERATION REACH XSECTION 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.11	447.2	(NULL)

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
4.26 WATERSHED INCHES; 475 CFS-HRS; 39.3 ACRE-FEET.

--- XSECTION 6, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 4

SUMMARY TABLE 1

SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL IN ORDER PERFORMED.
A CHARACTER FOLLOWING THE PEAK DISCHARGE TIME AND RATE (CFS) INDICATES:
F-FLAT TOP HYDROGRAPH T-TRUNCATED HYDROGRAPH R-RISING TRUNCATED HYDROGRAPH

XSECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)
RAINFALL OF 2.60 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
RAINTABLE NUMBER 2, ARC 2							
MAIN TIME INCREMENT .100 HOURS							
ALTERNATE 1 STORM 1							
XSECTION 1	RUNOFF	.17	.62	---	12.16	55	323.5
XSECTION 2	RUNOFF	.17	.71	---	12.15	68	400.0
XSECTION 3	RUNOFF	.01	.96	---	11.95	11	1100.0
STRUCTURE 1	RESVOR	.01	.96	393.85	12.18	3	300.0
XSECTION 4	RUNOFF	.16	.67	---	12.15	58	362.5
XSECTION 5	ADDHYD	.17	.69	---	12.15	60	352.9
XSECTION 6	REACH	.17	.69	---	12.15	60	352.9
RAINFALL OF 3.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 2							
XSECTION 1	RUNOFF	.17	.98	---	12.15	95	558.8
XSECTION 2	RUNOFF	.17	1.09	---	12.14	111	652.9
XSECTION 3	RUNOFF	.01	1.40	---	11.95	16	1600.0
STRUCTURE 1	RESVOR	.01	1.40	396.11	12.20	4	400.0
XSECTION 4	RUNOFF	.16	1.04	---	12.14	96	600.0
XSECTION 5	ADDHYD	.17	1.06	---	12.14	100	588.2
XSECTION 6	REACH	.17	1.06	---	12.14	100	588.2
RAINFALL OF 5.10 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 10							
XSECTION 1	RUNOFF	.17	2.35	---	12.14	243	1429.4
XSECTION 2	RUNOFF	.17	2.53	---	12.13	267	1570.6
XSECTION 3	RUNOFF	.01	2.98	---	11.94	34	3400.0
STRUCTURE 1	RESVOR	.01	2.97	398.51	12.10	19	1900.0
XSECTION 4	RUNOFF	.16	2.44	---	12.13	240	1500.0

SUMMARY TABLE 1

SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL IN ORDER PERFORMED.
A CHARACTER FOLLOWING THE PEAK DISCHARGE TIME AND RATE (CFS) INDICATES:
F-FLAT TOP HYDROGRAPH T-TRUNCATED HYDROGRAPH R-RISING TRUNCATED HYDROGRAPH

XSECTION/ STRUCTURE ID		STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 10								
XSECTION	5	ADDHYD	.17	2.48	---	12.13	258	1517.6
XSECTION	6	REACH	.17	2.48	---	12.13	258	1517.6
RAINFALL OF 7.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.								
ALTERNATE 1 STORM 99								
XSECTION	1	RUNOFF	.17	4.10	---	12.13	427	2511.8
XSECTION	2	RUNOFF	.17	4.33	---	12.12	461	2711.8
XSECTION	3	RUNOFF	.01	4.87	---	11.93	55	5500.0
STRUCTURE	1	RESVOR	.01	4.92	399.12	12.02	51	5100.0
XSECTION	4	RUNOFF	.16	4.21	---	12.12	417	2606.3
XSECTION	5	ADDHYD	.17	4.26	---	12.11	447	2629.4
XSECTION	6	REACH	.17	4.26	---	12.11	447	2629.4

SUMMARY TABLE 2

MODIFIED ATT-KIN REACH ROUTING IN ORDER PERFORMED.
QUESTION MARK (?) AFTER: OUTFLOW PEAK - MAX. NUMBER ROUTING ITERATIONS USED;
LENGTH FACTOR - VALUE K* GREATER THAN 1.0;
ATT-KIN COEFF - VALUE C GREATER THAN 0.667.

			HYDROGRAPH INFORMATION				ROUTING PARAMETERS				
			INFLOW		OUTFLOW		Q-A EQ.			PEAK	ATT-
XSEC ID	REACH LENGTH (FT)	FLOOD PLAIN LENGTH (FT)	PEAK (CFS)	TIME (HR)	PEAK (CFS)	TIME (HR)	COEFF (X)	POWER (M)	LENGTH FACTOR (k*)	RATIO Q/I (Q*)	KIN COEFF (C)
BASEFLOW IS .0 CFS											
ALTERNATE 1 STORM 1											
6	441		59	12.2	59	12.2	1.25	1.44	.004	1.000	1.00?
ALTERNATE 1 STORM 2											
6	441		97	12.1	97	12.1	1.25	1.44	.004	1.000	1.00?
ALTERNATE 1 STORM 10											
6	441		256	12.1	256	12.1	1.25	1.44	.003	1.000	1.00?
ALTERNATE 1 STORM 99											
6	441		447	12.1	447	12.1	1.25	1.44	.002	1.000	1.00?

SUMMARY TABLE 3

STORM DISCHARGES (CFS) AT XSECTIONS AND STRUCTURES FOR ALL ALTERNATES
QUESTION MARK (?) AFTER: OUTFLOW PEAK - RISING TRUNCATED HYDROGRAPH.

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
STRUCTURE	1	.01				
ALTERNATE	1		3	4	19	51
XSECTION	1	.17				
ALTERNATE	1		55	95	243	427
XSECTION	2	.17				
ALTERNATE	1		68	111	267	461
XSECTION	3	.01				
ALTERNATE	1		11	16	34	55
XSECTION	4	.16				
ALTERNATE	1		58	96	240	417
XSECTION	5	.17				
ALTERNATE	1		60	100	258	447
XSECTION	6	.17				
ALTERNATE	1		60	100	258	447

END OF 1 JOBS IN THIS RUN

SCS TR-20, VERSION 2.04TEST
FILES

INPUT = dad1-1.dat , GIVEN DATA FILE
OUTPUT = dad1-1.OUT , DATED 01/25/**,09:46:15

FILES GENERATED - DATED 01/25/**,09:46:15

FILE dad1-1.TRD CONTAINS READHD INFORMATION

TOTAL NUMBER OF WARNINGS = 11, MESSAGES = 0

*** TR-20 RUN COMPLETED ***

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A- Existing Conditions DA D-1-2

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			0.26	14.3
B	3	Open Space (good) - grass >75%	61			6.21	378.8
C	65	Woods - (good)	70			0.75	52.5
C	3	Open Space (good) - grass >75%	74			1.09	80.7
		OUTSIDE RIGHT OF WAY					
B	24	Row crops - straight row (SR) - (good)	78			6.7	522.6
B	65	Woods - (good)	55			0.14	7.7
C	24	Row crops - straight row (SR) - (good)	85			0.13	11.1
C	65	Woods - (good)	70			0.06	4.2
		Totals =				15.34	1071.8

0.02397 mi^2

CN (weighted) = total product / total area = 1071.8 / 15.34 = 69.9 Use CN = 70

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	0.5	2.1	3.8

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A | By CZJ | Date 1/23/2008

Location Montgomery County | Checked PS | Date 1/24/2008

Contract A- Existing Conditions | DA D-1-2

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)		Segment ID	A-B				
1. Surface description (table 3-1)			5 Grass - short				
2. Manning's roughness coeff., n (table 3-1)			0.15				
3. Flow Length, L (total L<= 300 ft)		ft	100				
4. Two-Year 24-hr rainfall, P_2		in	3.2				
5. Land Slope, s		ft / ft	0.04				
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$		hr	0.124	+		=	0.124
Shallow concentrated flow		Segment ID					
7. Surface Description: paved (P) or unpaved (U) ?							
8. Flow Length, L		ft					
9. Watercourse slope, s		ft / ft					
10. Average velocity, V (figure 3-1)		ft / sec					
11. $T_t = L / 3600V$		hr		+		=	0.000
Channel flow		Segment ID	B-C				
a. Assumed Q:							
b. Pipe (P) or Channel (C) ?							
c. If pipe, enter D (in):							
d. If channel, enter bottom width:							
e. if channel, enter side slope 1 (_:1):							
f. If channel, enter side slope 2 (_:1):							
12. Cross sectional flow area, a		sq ft					
13. Wetted perimeter, wp		ft					
14. Hydraulic radius, r = a / wp		ft					
15. Channel slope, s		ft / ft	0.0382				
16. Manning's roughness coeff., n							
17. $V = 1.49 r^{0.67} s^{0.5} / n$	Table II-2-B-3	ft / sec	9.0				
18. Flow length, L		ft	890				
19. $T_t = L / 3600V$		hr	0.03	+		=	0.03
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)						hr	0.15

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A- Proposed Conditions DA D-1-2

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	3	Open Space (good) - grass >75%	61			4.8	292.8
C	3	Open Space (good) - grass >75%	74			1.83	135.4
Note: No imp. area for prop. DA D 1-2, because the paving of the ICC will occur with the C1/C2 submission.							
		OUTSIDE RIGHT OF WAY					
B	24	Row crops - straight row (SR) - (good)	78			6.69	521.8
B	65	Woods - (good)	55			0.14	7.7
C	24	Row crops - straight row (SR) - (good)	85			0.13	11.1
C	65	Woods - (good)	70			0.06	4.2
					Totals =	13.65	973.0

0.02133 mi^2

CN (weighted) = total product / total area = 973.0 / 13.65 = 71.3 Use CN = 71

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	0.5	2.2	3.9

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project	ICC-CONTRACT A	By	CZJ	Date	1/23/2008
Location	Montgomery County	Checked	PS	Date	1/24/2008
	Contract A- Proposed Conditions		DA D-1-2		

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)		Segment ID	A-B		
1. Surface description (table 3-1)			5 Grass - short		
2. Manning's roughness coeff., n (table 3-1)			0.15		
3. Flow Length, L (total L<= 300 ft)		ft	100		
4. Two-Year 24-hr rainfall, P_2		in	3.2		
5. Land Slope, s		ft / ft	0.04		
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$		hr	0.124	+	= 0.124

Shallow concentrated flow		Segment ID			
7. Surface Description: paved (P) or unpaved (U) ?					
8. Flow Length, L		ft			
9. Watercourse slope, s		ft / ft			
10. Average velocity, V (figure 3-1)		ft / sec			
11. $T_t = L / 3600V$		hr		+	= 0.000

Channel flow		Segment ID	B-C	C-D			
a. Assumed Q:				15.7			
b. Pipe (P) or Channel (C) ?			C	P			
c. If pipe, enter D (in):				24			
d. If channel, enter bottom width:							
e. if channel, enter side slope 1 (_:1):							
f. If channel, enter side slope 2 (_:1):							
12. Cross sectional flow area, a		sq ft		3.1			
13. Wetted perimeter, wp		ft		6.3			
14. Hydraulic radius, r = a / wp		ft		0.5			
15. Channel slope, s		ft / ft	0.038	0.01			
16. Manning's roughness coeff., n				0.013			
17. $V = 1.49 r^{0.67} s^{0.5} / n$	Table II-2-B-3	ft / sec	9.0	7.2			
18. Flow length, L		ft	549	380			
19. $T_t = L / 3600V$		hr	0.02	+ 0.01	=	0.03	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)					hr	0.15	

```
*****************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****************

JOB TR-20                                                SUMMARY   NOPLOTS
TITLE     DA D1-2
TITLE     FILE:DAD1-2.DAT
 6 RUNOFF 1 001       1      0.02397     70.0        0.15   1 1 1 1 1
 6 RUNOFF 1 002       2      0.02133     71.0        0.15   1 1 1 1 1
   ENDATA
 7 INCREM 6             .10
 7 COMPUT 7 001   002   0.0         2.6         1.0         2 2   1  01
   ENDCMP 1
 7 COMPUT 7 001   002   0.0         3.2         1.0         2 2   1  02
   ENDCMP 1
 7 COMPUT 7 001   002   0.0         5.1         1.0         2 2   1  10
   ENDCMP 1
 7 COMPUT 7 001   002   0.0         7.2         1.0         2 2   1  99
   ENDCMP 1
   ENDJOB 2

*******************************END OF 80-80 LIST*******************************
```

EXECUTIVE CONTROL INCREM MAIN TIME INCREMENT = .100 HOURS

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 2.60 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. = 1 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.01	9.2	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .02 SQ.MI.

HRS								
11.70 CFS	.07	1.06	5.36	9.19	6.59	3.15	2.27	1.89
12.50 CFS	1.59	1.35	1.22	1.14	1.07	1.01	.95	.90
13.30 CFS	.86	.83	.79	.75	.72	.69	.67	.64
14.10 CFS	.61	.60	.59	.58	.57	.56	.55	.54
14.90 CFS	.53	.52	.51	.50	.49			

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.50 WATERSHED INCHES; 8 CFS-HRS; .6 ACRE-FEET.

DURATION(HRS)	2	4
FLOW(CFS)	1	0

--- XSECTION 1, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.15) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT 4.4%. ***

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.01	9.1	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .02 SQ.MI.

HRS								
11.70 CFS	.16	1.29	5.52	9.04	6.37	3.01	2.16	1.79
12.50 CFS	1.50	1.28	1.15	1.08	1.01	.95	.89	.85
13.30 CFS	.81	.78	.74	.71	.68	.65	.63	.60
14.10 CFS	.58	.56	.55	.54	.53	.53	.52	.51
14.90 CFS	.50							

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.54 WATERSHED INCHES; 7 CFS-HRS; .6 ACRE-FEET.

DURATION(HRS) 2 3
FLOW(CFS) 1 0

--- XSECTION 2, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.15) FOR SUBWATERSHED XSECTION 2.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT 2.3%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 1

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 3.20 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. = 2 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.00	16.5	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .02 SQ.MI.

HRS								
11.60 CFS	.24	1.13	3.71	11.18	16.52	11.14	5.14	3.62
12.40 CFS	2.97	2.49	2.11	1.89	1.77	1.66	1.55	1.46
13.20 CFS	1.38	1.32	1.26	1.20	1.15	1.10	1.05	1.01
14.00 CFS	.97	.93	.90	.89	.87	.86	.84	.83
14.80 CFS	.81	.80	.78	.77	.75	.74	.72	.70
15.60 CFS	.69	.67	.66	.64	.62	.61	.60	.59
16.40 CFS	.59	.58	.58	.57	.56	.56	.55	.55
17.20 CFS	.54	.54	.53	.52	.52	.51	.51	.50
18.00 CFS	.50							

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.83 WATERSHED INCHES; 13 CFS-HRS; 1.1 ACRE-FEET.

DURATION(HRS) 2 4 6 6
FLOW(CFS) 1 1 1 0

--- XSECTION 1, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.15) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT -2.6%. ***

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.00	15.8	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .02 SQ.MI.

HRS								
11.60 CFS	.36	1.31	3.84	10.92	15.77	10.53	4.84	3.39
12.40 CFS	2.78	2.32	1.97	1.76	1.64	1.54	1.44	1.35
13.20 CFS	1.29	1.23	1.17	1.12	1.07	1.02	.98	.94
14.00 CFS	.90	.86	.84	.82	.81	.80	.78	.77
14.80 CFS	.75	.74	.73	.71	.70	.68	.67	.65
15.60 CFS	.64	.62	.61	.59	.57	.56	.55	.55
16.40 CFS	.54	.54	.53	.53	.52	.52	.51	.51
17.20 CFS	.50	.50						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.88 WATERSHED INCHES; 12 CFS-HRS; 1.0 ACRE-FEET.

DURATION(HRS)	2	4	6
FLOW(CFS)	1	1	0

--- XSECTION 2, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.15) FOR SUBWATERSHED XSECTION 2.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT -1.4%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 2

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 5.10 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =10 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.99	44.8	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .02 SQ.MI.

HRS								
10.80 CFS	.48	.57	.67	.80	.98	1.20	1.46	1.76
11.60 CFS	3.11	7.25	15.57	34.60	44.61	28.12	12.48	8.51
12.40 CFS	6.88	5.71	4.81	4.29	3.99	3.73	3.48	3.25
13.20 CFS	3.08	2.94	2.80	2.66	2.53	2.42	2.32	2.21

14.00 CFS	2.11	2.03	1.97	1.93	1.90	1.86	1.83	1.79
14.80 CFS	1.76	1.72	1.69	1.65	1.62	1.58	1.55	1.51
15.60 CFS	1.47	1.44	1.40	1.36	1.33	1.29	1.27	1.26
16.40 CFS	1.25	1.23	1.22	1.21	1.20	1.18	1.17	1.16
17.20 CFS	1.14	1.13	1.12	1.11	1.09	1.08	1.07	1.05
18.00 CFS	1.04	1.03	1.01	1.00	.99	.97	.96	.95
18.80 CFS	.93	.92	.90	.89	.88	.86	.85	.84
19.60 CFS	.82	.81	.79	.78	.77	.76	.75	.75
20.40 CFS	.74	.74	.74	.74	.73	.73	.73	.73
21.20 CFS	.72	.72	.72	.72	.71	.71	.71	.71
22.00 CFS	.70	.70	.70	.70	.69	.69	.69	.69
22.80 CFS	.68	.68	.68	.68	.67	.67	.67	.66
23.60 CFS	.66	.66	.66	.65	.65	.36		

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.11 WATERSHED INCHES; 33 CFS-HRS; 2.7 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	3	2	1	1	1	1	0

--- XSECTION 1, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.15) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT -.8%. ***

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.99	41.5	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .02 SQ.MI.

HRS								
10.70 CFS	.43	.51	.60	.70	.82	.99	1.21	1.45
11.50 CFS	1.73	3.03	6.97	14.75	32.29	41.29	25.90	11.46
12.30 CFS	7.80	6.30	5.23	4.40	3.92	3.64	3.41	3.18
13.10 CFS	2.97	2.81	2.68	2.55	2.43	2.31	2.21	2.11
13.90 CFS	2.02	1.93	1.85	1.80	1.76	1.73	1.70	1.67
14.70 CFS	1.63	1.60	1.57	1.54	1.51	1.47	1.44	1.41
15.50 CFS	1.37	1.34	1.31	1.27	1.24	1.21	1.18	1.16
16.30 CFS	1.15	1.13	1.12	1.11	1.10	1.09	1.08	1.06
17.10 CFS	1.05	1.04	1.03	1.02	1.01	.99	.98	.97
17.90 CFS	.96	.94	.93	.92	.91	.90	.88	.87
18.70 CFS	.86	.85	.83	.82	.81	.80	.78	.77
19.50 CFS	.76	.75	.73	.72	.71	.70	.69	.68
20.30 CFS	.68	.67	.67	.67	.67	.67	.66	.66
21.10 CFS	.66	.66	.65	.65	.65	.65	.65	.64
21.90 CFS	.64	.64	.64	.63	.63	.63	.63	.62
22.70 CFS	.62	.62	.62	.61	.61	.61	.61	.60
23.50 CFS	.60	.60	.60	.60	.59	.59	.32	

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.19 WATERSHED INCHES; 30 CFS-HRS; 2.5 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	2	1	1	1	1	1	0

--- XSECTION 2, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.15) FOR SUBWATERSHED XSECTION 2.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT .9%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 3

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 7.20 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =99 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
11.98	80.7	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .02 SQ.MI.

HRS								
9.60 CFS	.47	.52	.58	.64	.71	.79	.88	.98
10.40 CFS	1.09	1.21	1.34	1.51	1.70	1.90	2.12	2.40
11.20 CFS	2.80	3.28	3.81	4.40	7.40	16.08	31.95	65.18
12.00 CFS	79.97	49.01	21.37	14.38	11.55	9.54	8.01	7.12
12.80 CFS	6.61	6.18	5.75	5.37	5.07	4.83	4.60	4.37
13.60 CFS	4.15	3.96	3.79	3.62	3.45	3.31	3.21	3.15
14.40 CFS	3.09	3.03	2.97	2.92	2.86	2.80	2.74	2.68
15.20 CFS	2.62	2.56	2.50	2.44	2.38	2.32	2.26	2.20
16.00 CFS	2.14	2.09	2.05	2.03	2.01	1.99	1.97	1.94
16.80 CFS	1.92	1.90	1.88	1.86	1.84	1.82	1.79	1.77
17.60 CFS	1.75	1.73	1.71	1.69	1.67	1.64	1.62	1.60
18.40 CFS	1.58	1.56	1.53	1.51	1.49	1.47	1.45	1.42
19.20 CFS	1.40	1.38	1.36	1.33	1.31	1.29	1.27	1.24
20.00 CFS	1.22	1.20	1.19	1.19	1.18	1.18	1.18	1.17
20.80 CFS	1.17	1.16	1.16	1.15	1.15	1.15	1.14	1.14
21.60 CFS	1.13	1.13	1.12	1.12	1.12	1.11	1.11	1.10
22.40 CFS	1.10	1.10	1.09	1.09	1.08	1.08	1.07	1.07
23.20 CFS	1.06	1.06	1.06	1.05	1.05	1.04	1.04	1.03
24.00 CFS	1.03	.56	.11					

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
3.78 WATERSHED INCHES; 59 CFS-HRS; 4.8 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	14	15
FLOW(CFS)	4	3	2	2	1	1	1	0

--- XSECTION 1, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.15) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT -.2%. ***

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.98	73.8	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .02 SQ.MI.

HRS								
9.60	CFS	.49	.54	.59	.65	.72	.79	.88	.97
10.40	CFS	1.07	1.18	1.31	1.46	1.64	1.83	2.04	2.30
11.20	CFS	2.66	3.11	3.61	4.16	6.95	15.01	29.61	59.88
12.00	CFS	73.07	44.65	19.43	13.05	10.47	8.65	7.26	6.45
12.80	CFS	5.99	5.59	5.21	4.86	4.59	4.37	4.16	3.95
13.60	CFS	3.75	3.58	3.43	3.27	3.12	2.99	2.90	2.85
14.40	CFS	2.79	2.74	2.69	2.63	2.58	2.53	2.47	2.42
15.20	CFS	2.37	2.31	2.26	2.21	2.15	2.10	2.04	1.99
16.00	CFS	1.93	1.88	1.85	1.83	1.81	1.79	1.77	1.76
16.80	CFS	1.74	1.72	1.70	1.68	1.66	1.64	1.62	1.60
17.60	CFS	1.58	1.56	1.54	1.52	1.50	1.48	1.46	1.44
18.40	CFS	1.42	1.40	1.38	1.36	1.34	1.32	1.30	1.28
19.20	CFS	1.26	1.24	1.22	1.20	1.18	1.16	1.14	1.12
20.00	CFS	1.10	1.09	1.08	1.07	1.07	1.06	1.06	1.06
20.80	CFS	1.05	1.05	1.04	1.04	1.04	1.03	1.03	1.03
21.60	CFS	1.02	1.02	1.01	1.01	1.01	1.00	1.00	.99
22.40	CFS	.99	.99	.98	.98	.97	.97	.97	.96
23.20	CFS	.96	.96	.95	.95	.94	.94	.94	.93
24.00	CFS	.93	.51	.10					

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
3.89 WATERSHED INCHES; 54 CFS-HRS; 4.4 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	14	15
FLOW(CFS)	4	2	2	1	1	1	1	0

--- XSECTION 2, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.15) FOR SUBWATERSHED XSECTION 2.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT -.1%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 4

SUMMARY TABLE 1

SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL IN ORDER PERFORMED.
A CHARACTER FOLLOWING THE PEAK DISCHARGE TIME AND RATE (CFS) INDICATES:
F-FLAT TOP HYDROGRAPH T-TRUNCATED HYDROGRAPH R-RISING TRUNCATED HYDROGRAPH

XSECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)
RAINFALL OF 2.60 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
RAINTABLE NUMBER 2, ARC 2							
MAIN TIME INCREMENT .100 HOURS							
ALTERNATE 1 STORM 1							
XSECTION 1	RUNOFF	.02	.50	---	12.01	9	450.0
XSECTION 2	RUNOFF	.02	.54	---	12.01	9	450.0
RAINFALL OF 3.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 2							
XSECTION 1	RUNOFF	.02	.83	---	12.00	17	850.0
XSECTION 2	RUNOFF	.02	.88	---	12.00	16	800.0
RAINFALL OF 5.10 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 10							
XSECTION 1	RUNOFF	.02	2.11	---	11.99	45	2250.0
XSECTION 2	RUNOFF	.02	2.19	---	11.99	41	2050.0
RAINFALL OF 7.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 99							
XSECTION 1	RUNOFF	.02	3.78	---	11.98	81	4050.0
XSECTION 2	RUNOFF	.02	3.89	---	11.98	74	3700.0

SUMMARY TABLE 3

STORM DISCHARGES (CFS) AT XSECTIONS AND STRUCTURES FOR ALL ALTERNATES
QUESTION MARK (?) AFTER: OUTFLOW PEAK - RISING TRUNCATED HYDROGRAPH.

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
XSECTION	1	.02				
ALTERNATE	1		9	17	45	81
XSECTION	2	.02				
ALTERNATE	1		9	16	41	74

END OF 1 JOBS IN THIS RUN

SCS TR-20, VERSION 2.04TEST
FILES

INPUT = dad1-2.dat , GIVEN DATA FILE
OUTPUT = dad1-2.OUT , DATED 01/24/**,07:36:27

FILES GENERATED - DATED 01/24/**,07:36:27

FILE dad1-2.TRD CONTAINS READHD INFORMATION

TOTAL NUMBER OF WARNINGS = 8, MESSAGES = 0

*** TR-20 RUN COMPLETED ***

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A- Existing Conditions DA D-2-1

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			5.4	297.0
B	3	Open Space (good) - grass >75%	61			0.81	49.4
D	65	Woods - (good)	77			0.47	36.2
D	3	Open Space (good) - grass >75%	80			0.22	17.6
		OUTSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			5.55	305.3
B	55	Pasture/grassland/range (grazing) -(good)	61			0.45	27.5
D	65	Woods - (good)	77			0.03	2.3
					Totals =	12.93	735.2

0.02020 mi^2

CN (weighted) = total product / total area = 735.2 / 12.93 = 56.9 Use CN = 57

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	0.1	1.2	2.4

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A | By CZJ | Date 1/23/2008

Location Montgomery County | Checked PS | Date 1/24/2008

Contract A- Existing Conditions | DA D-2-1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)		Segment ID	A-B		
1. Surface description (table 3-1)			5 Grass - short		
2. Manning's roughness coeff., n (table 3-1)			0.15		
3. Flow Length, L (total L<= 300 ft)		ft	100		
4. Two-Year 24-hr rainfall, P_2		in	3.2		
5. Land Slope, s		ft / ft	0.03		
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$		hr	0.139	+	= 0.139

Shallow concentrated flow		Segment ID	B-C		
7. Surface Description: paved (P) or unpaved (U) ?			U		
8. Flow Length, L		ft	1173		
9. Watercourse slope, s		ft / ft	0.05115		
10. Average velocity, V (figure 3-1)		ft / sec	3.6		
11. $T_t = L / 3600V$		hr	0.091	+	= 0.091

Channel flow		Segment ID			
a. Assumed Q:					
b. Pipe (P) or Channel (C) ?					
c. If pipe, enter D (in):					
d. If channel, enter bottom width:					
e. if channel, enter side slope 1 (_:1):					
f. If channel, enter side slope 2 (_:1):					
12. Cross sectional flow area, a		sq ft			
13. Wetted perimeter, wp		ft			
14. Hydraulic radius, r = a / wp		ft			
15. Channel slope, s		ft / ft			
16. Manning's roughness coeff., n					
17. $V = 1.49 r^{0.67} s^{0.5} / n$	Table II-2-B-3	ft / sec			
18. Flow length, L		ft			
19. $T_t = L / 3600V$		hr		+	= 0.00
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)					hr 0.23

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A- Proposed Conditions DA D-2-1

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		NONE					
					Totals =	0.00	0.0

0.00000 mi^2

CN (weighted) = total product / total area = 0.0 / 0.00 = Use CN = 0

2. Runoff

Storm #1	Storm #2	Storm #3
1	10	100
2.6	5.1	7.2

Frequency. . . . . Yr

Rainfall, P (24-hour) . . . . . In

Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In

S=(1000/CN)-10

```
*****************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****************

JOB TR-20                                                SUMMARY   NOPLOTS
TITLE     DA D2-1
TITLE     FILE: DAD2-1.DAT
 6 RUNOFF 1 001       1      0.02020     57.0        0.23   1 1 1 1 1
   ENDATA
 7 INCREM 6             .10
 7 COMPUT 7 001   001   0.0         2.6         1.0        2 2   1  01
   ENDCMP 1
 7 COMPUT 7 001   001   0.0         3.2         1.0        2 2   1  02
   ENDCMP 1
 7 COMPUT 7 001   001   0.0         5.1         1.0        2 2   1  10
   ENDCMP 1
 7 COMPUT 7 001   001   0.0         7.2         1.0        2 2   1  99
   ENDCMP 1
   ENDJOB 2

*******************************END OF 80-80 LIST*******************************
```

```
EXECUTIVE CONTROL INCREM    MAIN TIME INCREMENT =    .100 HOURS


EXECUTIVE CONTROL COMPUT    FROM XSECTION   1  TO XSECTION   1
   STARTING TIME =    .00      RAIN DEPTH =  2.60       RAIN DURATION =  1.00
   ANT. RUNOFF COND. = 2       MAIN TIME INCREMENT =   .100 HOURS
   ALTERNATE NO. = 1           STORM NO. = 1            RAIN TABLE NO. = 2


OPERATION RUNOFF   XSECTION   1

*** MESSAGE - XSECTION   1, NO PEAK COMPUTED (ONLY 1 HYDROGRAPH POINT(S)). ***

   RUNOFF ABOVE BASEFLOW  (BASEFLOW =    .00 CFS)
                  .00 WATERSHED INCHES;     129 CFS-HRS;        .0 ACRE-FEET.


EXECUTIVE CONTROL ENDCMP    COMPUTATIONS COMPLETED FOR PASS   1


EXECUTIVE CONTROL COMPUT    FROM XSECTION   1  TO XSECTION   1
   STARTING TIME =    .00      RAIN DEPTH =  3.20       RAIN DURATION =  1.00
   ANT. RUNOFF COND. = 2       MAIN TIME INCREMENT =   .100 HOURS
   ALTERNATE NO. = 1           STORM NO. = 2            RAIN TABLE NO. = 2


OPERATION RUNOFF   XSECTION   1

   PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
      12.11                          2.6                        (RUNOFF)

                  HYDROGRAPH POINTS FOR   ALTERNATE = 1,   STORM = 2
    HRS      MAIN TIME INCREMENT =  .100 hr,      DRAINAGE AREA =    .02 SQ.MI.
   11.90 CFS       .32    1.59    2.59    1.91    1.39    1.14     .97     .83
   12.70 CFS       .73     .68     .64     .61     .57     .55     .52     .51
   13.50 CFS       .49

   RUNOFF ABOVE BASEFLOW  (BASEFLOW =    .00 CFS)
                  .31 WATERSHED INCHES;       4 CFS-HRS;        .3 ACRE-FEET.

   DURATION(HRS)   2
   FLOW(CFS)       0

--- XSECTION   1, ALTERNATE  1, STORM  2, HYDROGRAPH ADDED TO READHD FILE ---
```

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 2

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 1
STARTING TIME = .00 RAIN DEPTH = 5.10 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =10 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.06	15.9	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.02 SQ.MI.
11.70 CFS	.33	1.90	7.11	14.77	15.33	9.43	5.91	4.40
12.50 CFS	3.53	2.90	2.49	2.26	2.11	1.97	1.85	1.74
13.30 CFS	1.66	1.59	1.52	1.45	1.38	1.33	1.27	1.22
14.10 CFS	1.17	1.13	1.10	1.08	1.07	1.05	1.03	1.01
14.90 CFS	.99	.98	.96	.94	.92	.90	.88	.86
15.70 CFS	.84	.82	.80	.78	.76	.75	.74	.73
16.50 CFS	.72	.72	.71	.70	.70	.69	.68	.68
17.30 CFS	.67	.66	.65	.65	.64	.63	.63	.62
18.10 CFS	.61	.60	.60	.59	.58	.57	.57	.56
18.90 CFS	.55	.54	.54	.53	.52	.51	.50	.50

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.16 WATERSHED INCHES; 15 CFS-HRS; 1.2 ACRE-FEET.

DURATION(HRS)	2	4	6	8
FLOW(CFS)	1	1	1	0

--- XSECTION 1, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 3

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 1
STARTING TIME = .00 RAIN DEPTH = 7.20 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =99 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.04	37.4	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.02 SQ.MI.
11.20 CFS	.36	.51	.70	.94	1.55	3.62	8.76	21.02
12.00 CFS	36.00	34.41	20.29	12.28	8.87	6.98	5.67	4.82
12.80 CFS	4.36	4.05	3.78	3.53	3.32	3.15	3.01	2.86
13.60 CFS	2.72	2.60	2.49	2.38	2.28	2.18	2.10	2.05
14.40 CFS	2.01	1.98	1.94	1.91	1.87	1.84	1.80	1.76
15.20 CFS	1.73	1.69	1.65	1.62	1.58	1.54	1.50	1.46
16.00 CFS	1.43	1.39	1.36	1.34	1.33	1.31	1.30	1.29
16.80 CFS	1.28	1.26	1.25	1.24	1.22	1.21	1.20	1.18
17.60 CFS	1.17	1.16	1.14	1.13	1.11	1.10	1.09	1.07
18.40 CFS	1.06	1.04	1.03	1.02	1.00	.99	.97	.96
19.20 CFS	.95	.93	.92	.90	.89	.87	.86	.84
20.00 CFS	.83	.81	.81	.80	.80	.79	.79	.79
20.80 CFS	.79	.78	.78	.78	.78	.77	.77	.77
21.60 CFS	.77	.76	.76	.76	.76	.75	.75	.75
22.40 CFS	.74	.74	.74	.74	.73	.73	.73	.73
23.20 CFS	.72	.72	.72	.72	.71	.71	.71	.70
24.00 CFS	.70	.56	.24					

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.45 WATERSHED INCHES; 32 CFS-HRS; 2.6 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	3	2	1	1	1	1	0

--- XSECTION 1, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 4

SUMMARY TABLE 1

SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL IN ORDER PERFORMED.
A CHARACTER FOLLOWING THE PEAK DISCHARGE TIME AND RATE (CFS) INDICATES:
F-FLAT TOP HYDROGRAPH T-TRUNCATED HYDROGRAPH R-RISING TRUNCATED HYDROGRAPH

XSECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
RAINFALL OF 2.60 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
RAINTABLE NUMBER 2, ARC 2							
MAIN TIME INCREMENT .100 HOURS							
ALTERNATE 1 STORM 1							
XSECTION 1	RUNOFF	.02	.00	---	.00	0	.0
RAINFALL OF 3.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 2							
XSECTION 1	RUNOFF	.02	.31	---	12.11T	3T	150.0
RAINFALL OF 5.10 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 10							
XSECTION 1	RUNOFF	.02	1.16	---	12.06	16	800.0
RAINFALL OF 7.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 99							
XSECTION 1	RUNOFF	.02	2.45	---	12.04	37	1850.0

SUMMARY TABLE 3

STORM DISCHARGES (CFS) AT XSECTIONS AND STRUCTURES FOR ALL ALTERNATES
QUESTION MARK (?) AFTER: OUTFLOW PEAK - RISING TRUNCATED HYDROGRAPH.

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
XSECTION 1	.02				
ALTERNATE 1		0	3	16	37

END OF 1 JOBS IN THIS RUN

SCS TR-20, VERSION 2.04TEST
FILES

INPUT = dad2-1.dat , GIVEN DATA FILE
OUTPUT = dad2-1.OUT , DATED 01/24/**,07:22:02

FILES GENERATED - DATED 01/24/**,07:22:02

FILE dad2-1.TRD CONTAINS READHD INFORMATION

TOTAL NUMBER OF WARNINGS = 0, MESSAGES = 1

*** TR-20 RUN COMPLETED ***

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A- Existing Conditions DA D-2-2

1. Runoff Curve Number (CN)

Soil name and hydrologic group	Cover Description		CN			Area	Product of CN x area
(Appendix A)	No.		Table 2-2	Figure 2-3	Figure 2-4	(acres)	
		INSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			2.19	120.5
B	3	Open Space (good) - grass >75%	61			0.46	28.1
C	65	Woods - (good)	70			0.76	53.2
C	3	Open Space (good) - grass >75%	74			0.09	6.7
		OUTSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			9.09	500.0
B	55	Pasture/grassland/range (grazing) -(good)	61			2.35	143.4
C	65	Woods - (good)	70			0.44	30.8
					Totals =	15.38	882.5

0.02403 mi^2

CN (weighted) = total product / total area = 882.5 / 15.38 = 57.4 Use CN = 57

2. Runoff

Storm #1	Storm #2	Storm #3
1	10	100
2.6	5.1	7.2
0.1	1.2	2.4

Frequency. . . . . Yr

Rainfall, P (24-hour) . . . . . In

Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A | By CZJ | Date 1/23/2008

Location Montgomery County | Checked PS | Date 1/24/2008

Contract A- Existing Conditions | DA D-2-2

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)		Segment ID	A-B				
1. Surface description (table 3-1)			5 Grass - short				
2. Manning's roughness coeff., n (table 3-1)			0.15				
3. Flow Length, L (total L<= 300 ft)		ft	100				
4. Two-Year 24-hr rainfall, P_2		in	3.2				
5. Land Slope, s		ft / ft	0.015				
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$		hr	0.183	+		=	0.183
Shallow concentrated flow		Segment ID	B-C				
7. Surface Description: paved (P) or unpaved (U) ?			U				
8. Flow Length, L		ft	1640				
9. Watercourse slope, s		ft / ft	0.04451				
10. Average velocity, V (figure 3-1)		ft / sec	3.4				
11. $T_t = L / 3600V$		hr	0.134	+		=	0.134
Channel flow		Segment ID					
a. Assumed Q:							
b. Pipe (P) or Channel (C) ?							
c. If pipe, enter D (in):							
d. If channel, enter bottom width:							
e. if channel, enter side slope 1 (_:1):							
f. If channel, enter side slope 2 (_:1):							
12. Cross sectional flow area, a		sq ft					
13. Wetted perimeter, wp		ft					
14. Hydraulic radius, r = a / wp		ft					
15. Channel slope, s		ft / ft					
16. Manning's roughness coeff., n							
17. $V = 1.49 r^{0.67} s^{0.5} / n$		ft / sec					
18. Flow length, L	Table II-2-B-3	ft					
19. $T_t = L / 3600V$		hr		+		=	0.00
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)						hr	0.32

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A-Proposed Conditions DA D-2-2

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			0.76	41.8
B	3	Open Space (good) - grass >75%	61			4.55	277.6
B	4	Imperv. - paved parking lots,roofs,drives	98			3.64	356.7
C	65	Woods - (good)	70			0.05	3.5
C	3	Open Space (good) - grass >75%	74			0.86	63.6
C	4	Imperv. - paved parking lots,roofs,drives	98			1.15	112.7
D	65	Woods - (good)	77			0.01	0.8
D	3	Open Space (good) - grass >75%	80			0.63	50.4
D	4	Imperv. - paved parking lots,roofs,drives	98			0.57	55.9
		OUTSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			14.79	813.5
B	55	Pasture/grassland/range (grazing) -(good)	61			2.79	170.2
C	65	Woods - (good)	70			0.46	32.2
D	65	Woods - (good)	77			0.03	2.3
					Totals =	30.29	1981.1

0.04733 mi^2

CN (weighted) = total product / total area = 1981.1 / 30.29 = 65.4 Use CN = 65

2. Runoff

Storm #1	Storm #2	Storm #3
1	10	100
2.6	5.1	7.2
0.3	1.7	3.3

Frequency. . . . . Yr

Rainfall, P (24-hour) . . . . . In

Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A-Proposed Conditions DA D-2-2

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)		Segment ID	A-B			
1. Surface description (table 3-1)			5 Grass - short			
2. Manning's roughness coeff., n (table 3-1)			0.15			
3. Flow Length, L (total L<= 300 ft)		ft	100			
4. Two-Year 24-hr rainfall, P_2		in	3.2			
5. Land Slope, s		ft / ft	0.015			
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$		hr	0.183	+	=	0.183

Shallow concentrated flow		Segment ID	B-C			
7. Surface Description: paved (P) or unpaved (U) ?			U			
8. Flow Length, L		ft	786			
9. Watercourse slope, s		ft / ft	0.04771			
10. Average velocity, V (figure 3-1)		ft / sec	3.5			
11. $T_t = L / 3600V$		hr	0.062	+	=	0.062

Channel flow		Segment ID	C-D	D-E		
a. Assumed Q:				24.5		
b. Pipe (P) or Channel (C) ?			C	P		
c. If pipe, enter D (in):				36		
d. If channel, enter bottom width:						
e. if channel, enter side slope 1 (_:1):						
f. If channel, enter side slope 2 (_:1):						
12. Cross sectional flow area, a		sq ft		7.1		
13. Wetted perimeter, wp		ft		9.4		
14. Hydraulic radius, r = a / wp		ft		0.8		
15. Channel slope, s		ft / ft	0.02691	0.01		
16. Manning's roughness coeff., n				0.013		
17. $V = 1.49 r^{0.67} s^{0.5} / n$	Table II-2-B-3	ft / sec	8.0	9.4		
18. Flow length, L		ft	799	363		
19. $T_t = L / 3600V$		hr	0.03	+ 0.01	=	0.04
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)					hr	0.29

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A- SWM DA D-2-2

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			0.03	1.7
B	3	Open Space (good) - grass >75%	61			2.07	126.3
B	4	Imperv. - paved parking lots,roofs,drives	98			2.48	243.0
D	65	Woods - (good)	77			0.01	0.8
D	3	Open Space (good) - grass >75%	80			0.45	36.0
D	4	Imperv. - paved parking lots,roofs,drives	98			0.05	4.9
		OUTSIDE RIGHT OF WAY					
					Totals =	5.09	412.6

0.00795 mi^2

CN (weighted) = total product / total area = 412.6 / 5.09 = 81.1 Use CN = 81

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... Yr	1	10	100
Rainfall, P (24-hour) ..... In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$ ..... In	1.0	3.1	5.0

S=(1000/CN)-10

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A-Proposed Conditions - BYPASS DA D-2-2

1. Runoff Curve Number (CN) Excludes runoff to DI-B, D1-C, D1-D and D1-E

Soil name and hydrologic group	Cover Description		CN			Area	Product of CN x area
(Appendix A)	No.		Table 2-2	Figure 2-3	Figure 2-4	(acres)	
		INSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			0.73	40.2
B	3	Open Space (good) - grass >75%	61			1.71	104.3
B	4	Imperv. - paved parking lots,roofs,drives	98			0	
C	65	Woods - (good)	70			0.05	3.5
C	3	Open Space (good) - grass >75%	74			0.24	17.8
C	4	Imperv. - paved parking lots,roofs,drives	98			0	
D	3	Open Space (good) - grass >75%	80			0.18	14.4
D	4	Imperv. - paved parking lots,roofs,drives	98			0	
		OUTSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			14.79	813.5
B	55	Pasture/grassland/range (grazing) -(good)	61			2.79	170.2
C	65	Woods - (good)	70			0.46	32.2
D	65	Woods - (good)	77			0.03	2.3
					Totals =	20.98	1198.3

0.03278 mi^2

CN (weighted) = total product / total area = 1198.3 / 20.98 = 57.1 Use CN = 57

2. Runoff

Storm #1	Storm #2	Storm #3
1	10	100
2.6	5.1	7.2
0.1	1.2	2.4

Frequency. . . . . Yr

Rainfall, P (24-hour) . . . . . In

Runoff, $Q = (P-0.2S)^2/(P+0.8S)$. . . . . In

$S=(1000/CN)-10$

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A | By CZJ | Date 1/23/2008

Location Montgomery County | Checked PS | Date 1/24/2008

Contract A-Proposed Conditions - BYPASS | DA D-2-2

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)		Segment ID	A-B				
1. Surface description (table 3-1)			5 Grass - short				
2. Manning's roughness coeff., n (table 3-1)			0.15				
3. Flow Length, L (total L<= 300 ft)		ft	100				
4. Two-Year 24-hr rainfall, P_2		in	3.2				
5. Land Slope, s		ft / ft	0.015				
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$		hr	0.183	+		=	0.183
Shallow concentrated flow		Segment ID	B-C				
7. Surface Description: paved (P) or unpaved (U) ?			U				
8. Flow Length, L		ft	786				
9. Watercourse slope, s		ft / ft	0.04771				
10. Average velocity, V (figure 3-1)		ft / sec	3.5				
11. $T_t = L / 3600V$		hr	0.062	+		=	0.062
Channel flow		Segment ID	C-D	D-E			
a. Assumed Q:				16.1			
b. Pipe (P) or Channel (C) ?			C	P			
c. If pipe, enter D (in):				36			
d. If channel, enter bottom width:							
e. if channel, enter side slope 1 (_:1):							
f. If channel, enter side slope 2 (_:1):							
12. Cross sectional flow area, a		sq ft		7.1			
13. Wetted perimeter, wp		ft		9.4			
14. Hydraulic radius, r = a / wp		ft		0.8			
15. Channel slope, s		ft / ft	0.02691	0.01			
16. Manning's roughness coeff., n				0.013			
17. $V = 1.49 r^{0.67} s^{0.5} / n$	Table II-2-B-3	ft / sec	8.0	9.4			
18. Flow length, L		ft	799	363			
19. $T_t = L / 3600V$		hr	0.03	+ 0.01	=	0.04	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)					hr	0.29	

CHANNEL PROTECTION SIZING CRITERIA

Project	ICC DESIGN BUILD - A	By	CZJ	Date	1/20/2008
J.O.	D1D2 FINAL	Checked	PS	Date	1/25/2008

Drainage Area SS-D1-B

Time of Concentration (t_c) =	0.1 hrs. (TR-55)
1-yr post-development runoff depth (Q_a) =	1.00 in. (TR-55)
1-yr rainfall depth (P) =	2.6 in. (Table 2-2)
Runoff Coefficient Number (CN) =	81 (TR-55)
Drainage Area =	0.00795 mi^2

Initial Abstraction (I_a)

I_a = 200/CN - 2 = 0.47

I_a/P = 0.18

Post-development Peak Discharge (q_i)

Unit peak factor (q_u) = 620 csm/in (Fig. D.11.1)

$q_i = q_u A Q_a$ = 4.93 cfs

Peak Outflow Discharge (q_o)

q_o/q_i (T = 12 hrs.) = 0.038 (from Fig. D.11.2)

$q_o = q_o/q_i \times q_i$ = 0.19 cfs

Extended Detention Storage Volume (V_s)

$V_s/V_r = 0.683 - 1.43(q_o/q_i) + 1.64(q_o/q_i)^2 - 0.804(q_o/q_i)^3$

V_s/V_r = 0.63

$V_s = V_s/V_r \times V_r$ = 0.27 ac.-ft (11659 cf) (Note: Vr = Qa)

Storage depth for the Extended Detention Volume of 6.50 ft.
Therefore, the required orifice area (A_o) for extended detention design is:

$A_o = q_o/(4.81 \times h_o^{1/2})$ 0.02 $ft.^2$

The maximum orifice diameter (d_o) is therefore:

$d_o = (4 \times A_o / \pi)^{1/2}$ 0.14 ft. (1.67 in.) *Use 3 in.

ICC CONTRACT A
Segment D1-D2

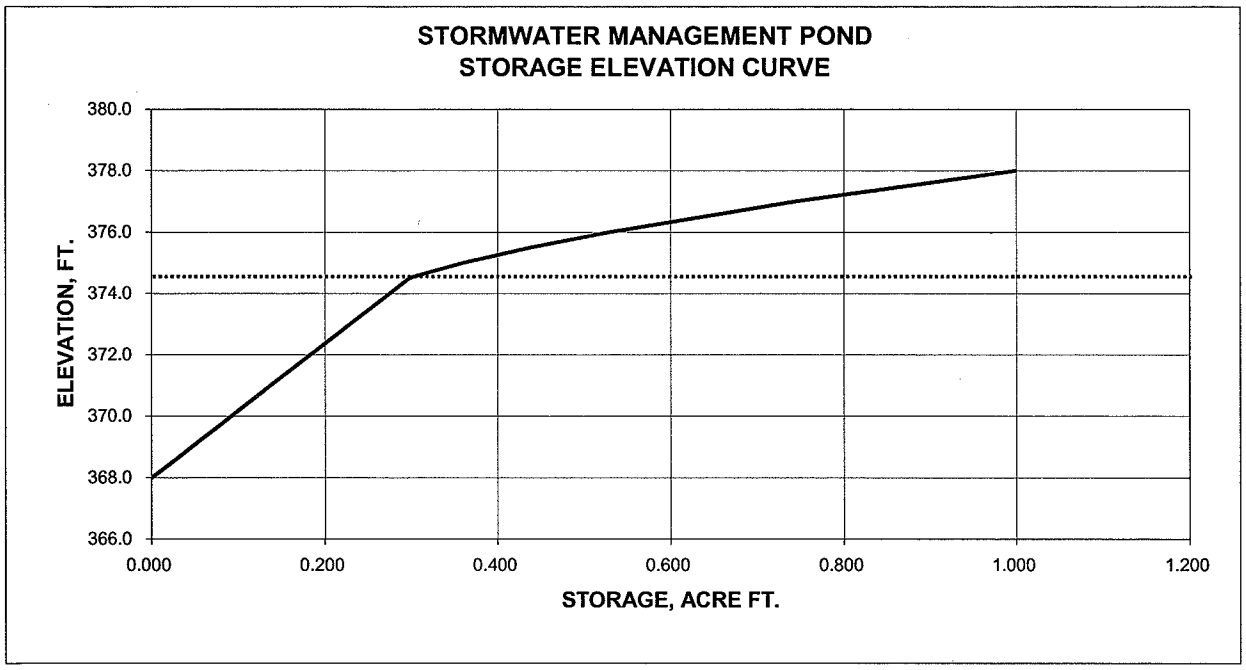
SAND STORAGE D-1-B

Stormwater Management Pond

Designed By: Partha Sarathi
25-Jan-08

Storage Computations

Elevation	Area	Ave. Area	Volume				
Ft.	sq. ft.	sq. ft.	Cu. ft.			**Ft.**	**Acre Ft.**
368.00	4975	0.00				368.0	0.000
369.00	4975	4975.00	1990.00	**Porosity = 0.4**		369.0	0.046
370.00	4975	4975.00	3980.00	**Porosity = 0.4**		370.0	0.091
371.00	4975	4975.00	5970.00	**Porosity = 0.4**		371.0	0.137
372.00	4975	4975.00	7960.00	**Porosity = 0.4**		372.0	0.183
373.00	4975	4975.00	9950.00	**Porosity = 0.4**		373.0	0.228
374.00	4975	4975.00	11940.00	**Porosity = 0.4**		374.0	0.274
374.50	4975	4975.00	12935.00	**Porosity = 0.4**		374.5	0.297
374.60	4975	4975.00	13432.50	**Full Area**		374.6	0.308
375.00	6164	5569.50	15660.30			375.0	0.360
375.50	7370	6766.75	19043.68			375.5	0.437
376.00	8575	7972.25	23029.80			376.0	0.529
377.00	10218	9396.50	32426.30			377.0	0.744
378.00	11963	11090.50	43516.80			378.0	0.999



CPV VOLUME 11659 CF

Orifice Sizing

Use Average Hydraulic Head Method

Bottom elevation of drawdown orifice = 368 Ft.

Invert elevation of 2-year orifice = 368 Ft.

Maximum head = 7.5 Ft.

Average hydraulic head = Maximum head / 2 = 3.75 Ft.

Drawdown time for CPV = 12 hours

Required discharge through orifice = Volume / (12 hours x 3600) 0.270 cfs

Orifice area, using Equation 11.1, rearranged $A = Q / [C \times (2 \times g \times h)^{1/2}]$

$C = 0.6$; $g = 32.2$

$A = 0.395 / [\ 0.6 \times (64.4 \times 4.5)^{1/2}\ ] =$ 0.029 Sq. Ft.

Required CPV orifice size = 3 inches (Area 0.049 Sq. Ft.)

ICC CONTRACT A
Segment D1-D2

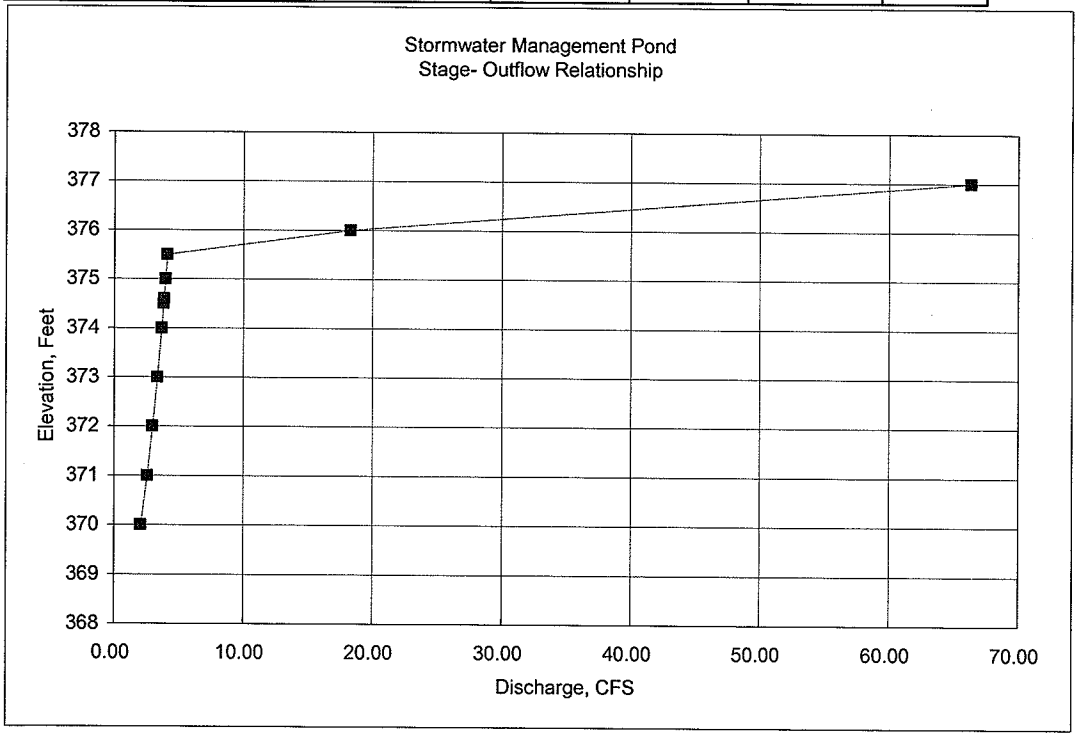
SAND STORAGE D-1-B

Stage Discharge Tabulation

Dia. of Riser Orifice, in.		**3.0**	Area:	0.0123	Sq, Ft.
c.l. Elevation		368.12			
Ten Year Spillway Std. K Inlet Structure		Size: 3' X 3.5'			
Weir Flow , Qw = 3.073 LH^1.5					
Weir Elevation =	**375.50**	L (Ft) =	3	W (Ft) =	3.5
Length of Weir =	13	Ft.	Area =	10.5	S.F.

Elevation	Effective Head	Qw	Qo	Q control (Qspilway)
FT	Ft.	CFS	CFS	CFS
375.5	0.00	0.00	0.00	0.00
376	0.50	14.12	35.75	14.12
377	1.50	73.39	61.92	61.92

Elevation, Ft.	Qo (3"), CFS	Qo (main), CFS	Qspillway, CFS	QEmer, CFS	Total, CFS
368	0.00				0.00
369	1.40				1.40
370	2.04				2.04
371	2.53				**2.53**
372	2.94				2.94
373	3.29				3.29
374	3.62				**3.62**
374.5	3.77				3.77
374.6	3.80				3.80
375	3.91				3.91
375.5	4.05		0.00		4.05
376	4.19		14.12		**18.31**
377	4.44		**61.92**		**66.36**



ICC CONTRACT A
Segment D1-D2

SAND STORAGE D-1-B

Design of Outflow Pipe

Q_{10} from SWM-1 Structure and Orifice (@ El. 368.00) 23.0 CFS

Length of Outflow Pipe	100.0	Ft.
Invert (In)	367.00	Ft.
Invert (Out)	365.00	Ft.
Slope	0.0200	%
Manning's n (Concrete Pipe)	0.013	
Diameter of Pipe	2.00	Ft.
Pipe Capacity	32.0	CFS
Pipe under pressure flow		
Area of Pipe	3.14	Sq. Ft.
Velocity of Flow	7.32	Ft./Sec.
Friction Loss	1.03	Ft.
Entrance & Exit Losses	0.50	Ft.
Flow Depth	2.00	Ft.
Invert El. Outflow Pipe	365.00	Ft.
Water Surface Elevation at barrel	368.53	

Actual Water Surface Elevation (10-Yr) from TR-20 Analys 375.6

Provide ROP at outfall.

```
*****************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****************

JOB TR-20                                                SUMMARY   NOPLOTS
TITLE     BMP D2-2
TITLE     FILE: BMPD2-2.DAT
 3 STRUCT      01
 8                        368.0        0.00         0.000
 8                        369.00       1.40         0.046
 8                        370.00       2.04         0.091
 8                        371.00       2.53         0.137
 8                        372.00       2.94         0.183
 8                        373.00       3.29         0.228
 8                        374.00       3.62         0.274
 8                        374.50       3.77         0.297
 8                        374.60       3.80         0.308
 8                        375.00       3.91         0.360
 8                        375.50       4.05         0.437
 8                        376.00       18.31        0.529
 8                        377.00       66.36        0.744
 9 ENDTBL
 6 RUNOFF 1 001        1      0.02403     57.0         0.32   1 1 1 1 1
 6 RUNOFF 1 002        2      0.04733     65.0         0.29   1 1 1 1 1
 6 RUNOFF 1 003        3      0.00795     81.0         0.10   1 1 1 1 1
 6 RESVOR 2    01 3    4                                      1 1 1 1 1
 6 RUNOFF 1 004        5      0.03303     57.0         0.29   1 1 1 1 1
 6 ADDHYD 4 005    4 5 6                                      1
   ENDATA
 7 INCREM 6             .10
 7 COMPUT 7 001    005    0.0          2.6          1.0          2 2   1  01
   ENDCMP 1
 7 COMPUT 7 001    005    0.0          3.2          1.0          2 2   1  02
   ENDCMP 1
 7 COMPUT 7 001    005    0.0          5.1          1.0          2 2   1  10
   ENDCMP 1
 7 COMPUT 7 001    005    0.0          7.2          1.0          2 2   1  99
   ENDCMP 1
   ENDJOB 2

*******************************END OF 80-80 LIST*******************************
```

EXECUTIVE CONTROL INCREM MAIN TIME INCREMENT = .100 HOURS

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 5
STARTING TIME = .00 RAIN DEPTH = 2.60 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. = 1 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

*** MESSAGE - XSECTION 1, NO PEAK COMPUTED (ONLY 1 HYDROGRAPH POINT(S)). ***

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.00 WATERSHED INCHES; 132 CFS-HRS; .0 ACRE-FEET.

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.12	7.4	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.05 SQ.MI.
11.80 CFS	.04	1.06	4.47	7.30	6.34	4.46	3.43	2.80
12.60 CFS	2.34	2.00	1.78	1.64	1.54	1.44	1.37	1.30
13.40 CFS	1.25	1.20	1.15	1.10	1.06	1.02	.98	.94
14.20 CFS	.91	.88	.87	.85	.84	.83	.82	.80
15.00 CFS	.79	.78	.76	.75	.74	.72	.71	.69
15.80 CFS	.68	.66	.65	.63	.62	.61	.60	.60
16.60 CFS	.59	.59	.58	.58	.57	.57	.56	.56
17.40 CFS	.55	.55	.54	.54	.53	.52	.52	.51
18.20 CFS	.51	.50	.50					

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.34 WATERSHED INCHES; 10 CFS-HRS; .8 ACRE-FEET.

DURATION(HRS)	2	4	6	7
FLOW(CFS)	1	1	1	0

--- XSECTION 2, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
11.95	7.6	

*** WARNING - XSECTION 3, MAIN TIME INCREMENT TOO LARGE, COMPUTED PEAK
(7.62) EXCEEDS ADJACENT COORDINATE (7.12) BY 6 %. ***

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .01 SQ.MI.			
11.50 CFS	.27	.58	1.42	3.04	7.03	7.12	2.86	1.47
12.30 CFS	1.20	1.03	.85	.73	.67	.63	.59	.55
13.10 CFS	.51	.49						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.01 WATERSHED INCHES; 5 CFS-HRS; .4 ACRE-FEET.

DURATION(HRS)	2	4	6	2
FLOW(CFS)	1	1	1	0

--- XSECTION 3, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.10) FOR SUBWATERSHED XSECTION 3.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT -5.5%. ***

OPERATION RESVOR STRUCTURE 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.14	2.4	370.76

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .01 SQ.MI.			
10.30 CFS	.00	.01	.01	.02	.02	.03	.04	.05
10.30 ELEV	368.00	368.00	368.01	368.01	368.02	368.02	368.03	368.03
11.10 CFS	.06	.08	.10	.12	.15	.21	.39	.80
11.10 ELEV	368.04	368.05	368.07	368.08	368.11	368.15	368.28	368.57
11.90 CFS	1.57	2.15	2.39	2.37	2.28	2.18	2.08	1.95
11.90 ELEV	369.27	370.22	370.71	370.67	370.49	370.29	370.08	369.86
12.70 CFS	1.81	1.68	1.56	1.45	1.30	1.12	.98	.86
12.70 ELEV	369.64	369.44	369.25	369.08	368.93	368.80	368.70	368.61
13.50 CFS	.77	.69	.62	.57	.52	.48	.45	.42
13.50 ELEV	368.55	368.49	368.44	368.41	368.37	368.34	368.32	368.30
14.30 CFS	.40	.38	.36	.35	.33	.32	.31	.31
14.30 ELEV	368.28	368.27	368.26	368.25	368.24	368.23	368.22	368.22
15.10 CFS	.30	.29	.28	.28	.27	.26	.26	.25
15.10 ELEV	368.21	368.21	368.20	368.20	368.19	368.19	368.18	368.18
15.90 CFS	.24	.24	.23	.23	.22	.22	.21	.21
15.90 ELEV	368.17	368.17	368.17	368.16	368.16	368.16	368.15	368.15
16.70 CFS	.21	.21	.20	.20	.20	.20	.19	.19
16.70 ELEV	368.15	368.15	368.14	368.14	368.14	368.14	368.14	368.14
17.50 CFS	.19	.19	.18	.18	.18	.18	.18	.17
17.50 ELEV	368.13	368.13	368.13	368.13	368.13	368.13	368.13	368.12
18.30 CFS	.17	.17	.17	.16	.16	.16	.16	.16
18.30 ELEV	368.12	368.12	368.12	368.12	368.12	368.11	368.11	368.11

19.10 CFS	.15	.15	.15	.15	.14	.14	.14	.14

19.10 ELEV	368.11	368.11	368.11	368.11	368.10	368.10	368.10	368.10
19.90 CFS	.14	.13	.13	.13	.13	.13	.13	.12
19.90 ELEV	368.10	368.10	368.09	368.09	368.09	368.09	368.09	368.09
20.70 CFS	.12	.12	.12	.12	.12	.12	.12	.12
20.70 ELEV	368.09	368.09	368.09	368.09	368.09	368.09	368.09	368.09
21.50 CFS	.12	.12	.12	.12	.12	.12	.12	.12
21.50 ELEV	368.09	368.08	368.08	368.08	368.08	368.08	368.08	368.08
22.30 CFS	.12	.12	.11	.11	.11	.11	.11	.11
22.30 ELEV	368.08	368.08	368.08	368.08	368.08	368.08	368.08	368.08
23.10 CFS	.11	.11	.11	.11	.11	.11	.11	.11
23.10 ELEV	368.08	368.08	368.08	368.08	368.08	368.08	368.08	368.08
23.90 CFS	.11	.11	.10	.08	.06	.05	.04	.03
23.90 ELEV	368.08	368.08	368.07	368.06	368.04	368.03	368.03	368.02
24.70 CFS	.02	.02	.01	.01				
24.70 ELEV	368.02	368.01	368.01	368.01				

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.01 WATERSHED INCHES; 5 CFS-HRS; .4 ACRE-FEET.

DURATION(HRS)	2	2
FLOW(CFS)	1	0

--- STRUCTURE 1, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 4

*** MESSAGE - NO SIGNIFICANT PEAK FOUND, MAX. DISCHARGE 1 CFS,
AT XSECTION 4 ***

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.20	.7	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .03 SQ.MI.

HRS								
12.00 CFS	.15	.52	.68	.67	.65	.62	.57	.52
12.80 CFS	.49							

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.14 WATERSHED INCHES; 3 CFS-HRS; .2 ACRE-FEET.

DURATION(HRS)	2	1
FLOW(CFS)	1	0

--- XSECTION 4, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION ADDHYD XSECTION 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.21	3.1	(NULL)

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.31 WATERSHED INCHES; 8 CFS-HRS; .7 ACRE-FEET.

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 1

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 5
STARTING TIME = .00 RAIN DEPTH = 3.20 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. = 2 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.17	2.5	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .02 SQ.MI.

HRS								
11.90	CFS	.19	1.09	2.32	2.45	1.94	1.56	1.32	1.13
12.70	CFS	.98	.88	.81	.76	.71	.68	.64	.62
13.50	CFS	.60	.57	.55	.53	.51	.49		

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.31 WATERSHED INCHES; 5 CFS-HRS; .4 ACRE-FEET.

DURATION(HRS)	2	2
FLOW(CFS)	1	0

--- XSECTION 1, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.11	16.6	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .05 SQ.MI.

HRS								
11.70	CFS	.04	.68	4.44	12.19	16.59	13.10	8.70	6.39
12.50	CFS	5.03	4.10	3.45	3.04	2.77	2.58	2.42	2.28
13.30	CFS	2.16	2.07	1.97	1.89	1.80	1.73	1.66	1.59
14.10	CFS	1.53	1.47	1.43	1.40	1.38	1.36	1.34	1.31
14.90	CFS	1.29	1.27	1.25	1.22	1.20	1.17	1.15	1.13
15.70	CFS	1.10	1.07	1.05	1.02	1.00	.98	.96	.95
16.50	CFS	.94	.93	.93	.92	.91	.90	.89	.88
17.30	CFS	.87	.87	.86	.85	.84	.83	.82	.81
18.10	CFS	.80	.79	.78	.77	.76	.75	.74	.73
18.90	CFS	.72	.72	.70	.70	.68	.67	.66	.65

19.70 CFS	.64	.63	.62	.61	.60	.60	.59	.59
20.50 CFS	.59	.58	.58	.58	.58	.58	.58	.57
21.30 CFS	.57	.57	.57	.57	.57	.56	.56	.56
22.10 CFS	.56	.56	.56	.55	.55	.55	.55	.55
22.90 CFS	.55	.54	.54	.54	.54	.54	.53	.53
23.70 CFS	.53	.53	.53	.52	.46			

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.60 WATERSHED INCHES; 18 CFS-HRS; 1.5 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	12
FLOW(CFS)	2	1	1	1	1	1	0

--- XSECTION 2, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.95	11.1	(RUNOFF)

*** WARNING - XSECTION 3, MAIN TIME INCREMENT TOO LARGE, COMPUTED PEAK
(11.08) EXCEEDS ADJACENT COORDINATE (10.45) BY 5 %. ***

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .01 SQ.MI.

HRS								
11.40 CFS	.43	.51	1.04	2.39	4.81	10.45	10.23	4.05
12.20 CFS	2.05	1.67	1.43	1.18	1.00	.92	.87	.81
13.00 CFS	.75	.71	.67	.64	.61	.58	.55	.53
13.80 CFS	.51	.48						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.47 WATERSHED INCHES; 8 CFS-HRS; .6 ACRE-FEET.

DURATION(HRS)	2	2
FLOW(CFS)	1	0

--- XSECTION 3, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.10) FOR SUBWATERSHED XSECTION 3.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT 1.5%. ***

OPERATION RESVOR STRUCTURE 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.15	3.0	372.28

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .01 SQ.MI.

HRS								
9.40 CFS	.00	.01	.01	.01	.02	.02	.03	.03
9.40 ELEV	368.00	368.01	368.01	368.01	368.01	368.02	368.02	368.02

10.20 CFS	.04	.05	.06	.07	.08	.09	.11	.12
10.20 ELEV	368.03	368.04	368.04	368.05	368.06	368.07	368.08	368.09
11.00 CFS	.14	.16	.19	.22	.26	.31	.41	.70
11.00 ELEV	368.10	368.12	368.13	368.16	368.19	368.22	368.29	368.50
11.80 CFS	1.35	2.07	2.73	3.03	3.03	2.96	2.86	2.75
11.80 ELEV	368.97	370.05	371.48	372.25	372.25	372.05	371.80	371.53
12.60 CFS	2.63	2.51	2.37	2.24	2.12	1.99	1.85	1.71
12.60 ELEV	371.24	370.96	370.68	370.41	370.16	369.92	369.70	369.49
13.40 CFS	1.59	1.48	1.36	1.18	1.03	.91	.81	.73
13.40 ELEV	369.30	369.13	368.97	368.84	368.74	368.65	368.58	368.52
14.20 CFS	.67	.61	.57	.54	.51	.48	.46	.44
14.20 ELEV	368.48	368.44	368.41	368.38	368.36	368.34	368.33	368.32
15.00 CFS	.43	.41	.40	.39	.38	.37	.36	.35
15.00 ELEV	368.31	368.30	368.29	368.28	368.27	368.26	368.26	368.25
15.80 CFS	.34	.33	.32	.32	.31	.30	.30	.29
15.80 ELEV	368.24	368.24	368.23	368.23	368.22	368.22	368.21	368.21
16.60 CFS	.29	.28	.28	.27	.27	.27	.26	.26
16.60 ELEV	368.20	368.20	368.20	368.20	368.19	368.19	368.19	368.19
17.40 CFS	.26	.25	.25	.25	.25	.24	.24	.24
17.40 ELEV	368.18	368.18	368.18	368.18	368.18	368.17	368.17	368.17
18.20 CFS	.23	.23	.23	.22	.22	.22	.22	.21
18.20 ELEV	368.17	368.16	368.16	368.16	368.16	368.16	368.15	368.15
19.00 CFS	.21	.21	.20	.20	.20	.19	.19	.19
19.00 ELEV	368.15	368.15	368.15	368.14	368.14	368.14	368.14	368.13
19.80 CFS	.19	.18	.18	.18	.17	.17	.17	.17
19.80 ELEV	368.13	368.13	368.13	368.13	368.12	368.12	368.12	368.12
20.60 CFS	.17	.17	.16	.16	.16	.16	.16	.16
20.60 ELEV	368.12	368.12	368.12	368.12	368.12	368.12	368.12	368.11
21.40 CFS	.16	.16	.16	.16	.16	.16	.16	.16
21.40 ELEV	368.11	368.11	368.11	368.11	368.11	368.11	368.11	368.11
22.20 CFS	.16	.15	.15	.15	.15	.15	.15	.15
22.20 ELEV	368.11	368.11	368.11	368.11	368.11	368.11	368.11	368.11
23.00 CFS	.15	.15	.15	.15	.15	.15	.15	.15
23.00 ELEV	368.11	368.11	368.11	368.11	368.11	368.11	368.11	368.10
23.80 CFS	.15	.15	.14	.13	.11	.08	.06	.05
23.80 ELEV	368.10	368.10	368.10	368.09	368.08	368.06	368.05	368.04
24.60 CFS	.04	.03	.02	.02	.01	.01		
24.60 ELEV	368.03	368.02	368.02	368.01	368.01	368.01		

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.47 WATERSHED INCHES; 8 CFS-HRS; .6 ACRE-FEET.

DURATION(HRS)	2	3
FLOW(CFS)	1	0

--- STRUCTURE 1, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.14	3.7	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .03 SQ.MI.			
11.90 CFS	.33	1.78	3.54	3.38	2.53	2.06	1.74	1.49
12.70 CFS	1.29	1.17	1.08	1.02	.96	.92	.88	.84
13.50 CFS	.81	.78	.75	.72	.69	.67	.64	.62
14.30 CFS	.61	.60	.59	.58	.57	.57	.56	.55
15.10 CFS	.54	.53	.52	.51	.50	.50		

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.31 WATERSHED INCHES; 7 CFS-HRS; .5 ACRE-FEET.

DURATION(HRS)	2	4
FLOW(CFS)	1	0

--- XSECTION 4, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION ADDHYD XSECTION 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.14	6.8	(NULL)

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.53 WATERSHED INCHES; 14 CFS-HRS; 1.2 ACRE-FEET.

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 2

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 5
STARTING TIME = .00 RAIN DEPTH = 5.10 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =10 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.11	16.7	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .02 SQ.MI.			
11.70 CFS	.21	1.23	5.07	12.21	16.69	13.99	9.56	6.83
12.50 CFS	5.27	4.21	3.49	3.02	2.71	2.49	2.32	2.17
13.30 CFS	2.06	1.96	1.87	1.78	1.70	1.63	1.56	1.50
14.10 CFS	1.43	1.38	1.34	1.31	1.28	1.26	1.24	1.22
14.90 CFS	1.20	1.18	1.15	1.13	1.11	1.09	1.06	1.04

15.70 CFS	1.02	.99	.97	.95	.92	.90	.89	.88
16.50 CFS	.87	.86	.85	.84	.83	.83	.82	.81
17.30 CFS	.80	.79	.78	.78	.77	.76	.75	.74
18.10 CFS	.73	.72	.72	.71	.70	.69	.68	.67
18.90 CFS	.66	.65	.64	.63	.62	.62	.61	.60
19.70 CFS	.59	.58	.57	.56	.55	.54	.54	.53
20.50 CFS	.53	.53	.53	.53	.52	.52	.52	.52
21.30 CFS	.52	.52	.52	.51	.51	.51	.51	.51
22.10 CFS	.51	.50	.50	.50	.50			

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.16 WATERSHED INCHES; 18 CFS-HRS; 1.5 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	11
FLOW(CFS)	2	1	1	1	1	0

--- XSECTION 1, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.08	56.3	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .05 SQ.MI.

HRS								
11.20 CFS	.48	.70	.98	1.33	2.07	4.56	10.89	26.17
12.00 CFS	48.81	55.97	40.94	25.69	18.01	13.63	10.82	8.93
12.80 CFS	7.74	7.00	6.48	6.03	5.65	5.35	5.09	4.84
13.60 CFS	4.61	4.39	4.20	4.02	3.84	3.68	3.54	3.44
14.40 CFS	3.36	3.30	3.24	3.18	3.12	3.06	3.00	2.94
15.20 CFS	2.88	2.82	2.76	2.70	2.64	2.57	2.51	2.45
16.00 CFS	2.39	2.32	2.27	2.24	2.21	2.18	2.16	2.14
16.80 CFS	2.12	2.10	2.07	2.05	2.03	2.01	1.99	1.96
17.60 CFS	1.94	1.92	1.90	1.87	1.85	1.83	1.81	1.78
18.40 CFS	1.76	1.74	1.71	1.69	1.67	1.64	1.62	1.60
19.20 CFS	1.57	1.55	1.53	1.50	1.48	1.45	1.43	1.40
20.00 CFS	1.38	1.36	1.34	1.33	1.32	1.31	1.31	1.31
20.80 CFS	1.30	1.30	1.29	1.29	1.28	1.28	1.28	1.27
21.60 CFS	1.27	1.26	1.26	1.25	1.25	1.25	1.24	1.24
22.40 CFS	1.23	1.23	1.22	1.22	1.22	1.21	1.21	1.20
23.20 CFS	1.20	1.19	1.19	1.18	1.18	1.18	1.17	1.17
24.00 CFS	1.16	1.02	.61	.27				

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.72 WATERSHED INCHES; 52 CFS-HRS; 4.3 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	4	3	2	1	1	1	0

--- XSECTION 2, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
11.94	23.0	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .01 SQ.MI.

HRS								
10.60	CFS	.49	.55	.61	.67	.73	.83	.96	1.10
11.40	CFS	1.26	1.44	2.79	6.01	11.14	22.08	20.71	8.09
12.20	CFS	4.01	3.22	2.73	2.26	1.91	1.75	1.64	1.53
13.00	CFS	1.42	1.33	1.26	1.20	1.14	1.08	1.03	.99
13.80	CFS	.94	.90	.86	.82	.80	.79	.77	.76
14.60	CFS	.74	.73	.71	.70	.68	.67	.65	.64
15.40	CFS	.62	.61	.59	.58	.56	.55	.53	.52
16.20	CFS	.51	.51	.50	.50				

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
3.07 WATERSHED INCHES; 16 CFS-HRS; 1.3 ACRE-FEET.

DURATION(HRS)	2	4	6
FLOW(CFS)	1	1	0

--- XSECTION 3, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.10) FOR SUBWATERSHED XSECTION 3.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT 1.6%. ***

OPERATION RESVOR STRUCTURE 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.13	6.9	375.60

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .01 SQ.MI.

HRS								
7.00	CFS	.00	.01	.01	.01	.02	.02	.02	.03
7.00	ELEV	368.00	368.00	368.01	368.01	368.01	368.01	368.02	368.02
7.80	CFS	.03	.04	.04	.05	.05	.06	.06	.07
7.80	ELEV	368.02	368.03	368.03	368.03	368.04	368.04	368.05	368.05
8.60	CFS	.08	.09	.10	.11	.12	.13	.14	.15
8.60	ELEV	368.06	368.06	368.07	368.08	368.08	368.09	368.10	368.11
9.40	CFS	.16	.17	.18	.19	.20	.21	.23	.25
9.40	ELEV	368.11	368.12	368.13	368.13	368.14	368.15	368.16	368.18
10.20	CFS	.27	.29	.31	.34	.37	.40	.44	.49
10.20	ELEV	368.19	368.21	368.22	368.24	368.26	368.29	368.32	368.35
11.00	CFS	.53	.59	.66	.74	.84	.95	1.21	1.66
11.00	ELEV	368.38	368.42	368.47	368.53	368.60	368.68	368.87	369.41
11.80	CFS	2.33	3.32	3.95	6.73	6.20	4.18	4.03	4.01
11.80	ELEV	370.60	373.10	375.13	375.59	375.58	375.50	375.44	375.36
12.60	CFS	3.98	3.95	3.92	3.88	3.84	3.79	3.69	3.56

12.60	ELEV	375.26	375.15	375.03	374.88	374.73	374.57	374.23	373.80
13.40	CFS	3.42	3.29	3.15	3.01	2.88	2.74	2.61	2.47
13.40	ELEV	373.39	372.99	372.59	372.21	371.85	371.51	371.19	370.88
14.20	CFS	2.33	2.20	2.08	1.95	1.82	1.70	1.59	1.49
14.20	ELEV	370.60	370.33	370.09	369.86	369.65	369.46	369.30	369.14
15.00	CFS	1.40	1.24	1.11	1.01	.92	.86	.80	.75
15.00	ELEV	369.00	368.89	368.79	368.72	368.66	368.61	368.57	368.54
15.80	CFS	.71	.68	.64	.62	.60	.58	.56	.55
15.80	ELEV	368.51	368.48	368.46	368.44	368.43	368.41	368.40	368.39
16.60	CFS	.53	.52	.52	.51	.50	.49	.48	.48
16.60	ELEV	368.38	368.37	368.37	368.36	368.36	368.35	368.35	368.34
17.40	CFS	.47	.47	.46	.45	.45	.44	.44	.43
17.40	ELEV	368.34	368.33	368.33	368.32	368.32	368.32	368.31	368.31
18.20	CFS	.43	.42	.41	.41	.40	.40	.39	.39
18.20	ELEV	368.30	368.30	368.30	368.29	368.29	368.28	368.28	368.28
19.00	CFS	.38	.38	.37	.36	.36	.35	.35	.34
19.00	ELEV	368.27	368.27	368.26	368.26	368.26	368.25	368.25	368.24
19.80	CFS	.34	.33	.33	.32	.31	.31	.31	.30
19.80	ELEV	368.24	368.24	368.23	368.23	368.22	368.22	368.22	368.22
20.60	CFS	.30	.30	.30	.30	.29	.29	.29	.29
20.60	ELEV	368.22	368.21	368.21	368.21	368.21	368.21	368.21	368.21
21.40	CFS	.29	.29	.29	.29	.28	.28	.28	.28
21.40	ELEV	368.21	368.21	368.20	368.20	368.20	368.20	368.20	368.20
22.20	CFS	.28	.28	.28	.28	.28	.27	.27	.27
22.20	ELEV	368.20	368.20	368.20	368.20	368.20	368.20	368.20	368.19
23.00	CFS	.27	.27	.27	.27	.27	.27	.26	.26
23.00	ELEV	368.19	368.19	368.19	368.19	368.19	368.19	368.19	368.19
23.80	CFS	.26	.26	.26	.24	.19	.15	.12	.09
23.80	ELEV	368.19	368.19	368.19	368.17	368.14	368.11	368.08	368.06
24.60	CFS	.07	.05	.04	.03	.03	.02	.02	.01
24.60	ELEV	368.05	368.04	368.03	368.02	368.02	368.01	368.01	368.01

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
3.06 WATERSHED INCHES; 16 CFS-HRS; 1.3 ACRE-FEET.

DURATION(HRS)	2	4	6
FLOW(CFS)	3	1	0

--- STRUCTURE 1, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.10	24.0	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .03 SQ.MI.

HRS								
11.70	CFS	.33	2.11	8.27	19.10	24.00	18.40	11.96	8.61
12.50	CFS	6.69	5.41	4.52	3.96	3.60	3.35	3.13	2.94
13.30	CFS	2.79	2.66	2.54	2.42	2.31	2.21	2.12	2.03

14.10 CFS	1.95	1.88	1.83	1.79	1.76	1.73	1.70	1.67
14.90 CFS	1.64	1.61	1.58	1.55	1.52	1.49	1.46	1.42
15.70 CFS	1.39	1.36	1.32	1.29	1.26	1.23	1.21	1.20
16.50 CFS	1.19	1.18	1.16	1.15	1.14	1.13	1.12	1.11
17.30 CFS	1.10	1.09	1.08	1.06	1.05	1.04	1.03	1.02
18.10 CFS	1.00	.99	.98	.97	.96	.94	.93	.92
18.90 CFS	.91	.89	.88	.87	.86	.84	.83	.82
19.70 CFS	.80	.79	.78	.76	.75	.74	.74	.73
20.50 CFS	.73	.73	.72	.72	.72	.72	.72	.71
21.30 CFS	.71	.71	.71	.71	.70	.70	.70	.70
22.10 CFS	.70	.69	.69	.69	.69	.68	.68	.68
22.90 CFS	.68	.68	.67	.67	.67	.67	.66	.66
23.70 CFS	.66	.66	.65	.65	.57	.34		

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.16 WATERSHED INCHES; 25 CFS-HRS; 2.0 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	12
FLOW(CFS)	2	1	1	1	1	1	0

--- XSECTION 4, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION ADDHYD XSECTION 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.11	30.8	(NULL)

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.53 WATERSHED INCHES; 40 CFS-HRS; 3.3 ACRE-FEET.

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 3

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 5
STARTING TIME = .00 RAIN DEPTH = 7.20 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =99 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.10	39.1	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .02 SQ.MI.

HRS								
11.30 CFS	.50	.69	.93	1.43	2.99	7.04	16.80	31.90

12.10 CFS	39.10	31.24	20.60	14.30	10.75	8.42	6.88	5.89
12.90 CFS	5.24	4.78	4.43	4.15	3.91	3.71	3.53	3.36
13.70 CFS	3.20	3.06	2.93	2.80	2.68	2.57	2.50	2.44
14.50 CFS	2.39	2.34	2.30	2.26	2.21	2.17	2.13	2.09
15.30 CFS	2.04	2.00	1.95	1.91	1.87	1.82	1.77	1.73
16.10 CFS	1.68	1.65	1.62	1.60	1.58	1.56	1.54	1.53
16.90 CFS	1.51	1.50	1.48	1.47	1.45	1.43	1.42	1.40
17.70 CFS	1.39	1.37	1.35	1.34	1.32	1.30	1.29	1.27
18.50 CFS	1.25	1.24	1.22	1.20	1.19	1.17	1.15	1.14
19.30 CFS	1.12	1.10	1.08	1.07	1.05	1.03	1.02	1.00
20.10 CFS	.98	.97	.96	.95	.95	.94	.94	.94
20.90 CFS	.93	.93	.93	.93	.92	.92	.92	.91
21.70 CFS	.91	.91	.90	.90	.90	.89	.89	.89
22.50 CFS	.88	.88	.88	.88	.87	.87	.87	.86
23.30 CFS	.86	.86	.85	.85	.85	.84	.84	.84
24.10 CFS	.75	.50						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.45 WATERSHED INCHES; 38 CFS-HRS; 3.1 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	3	2	1	1	1	1	0

--- XSECTION 1, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.07	109.8	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .05 SQ.MI.			
10.00 CFS	.47	.57	.68	.80	.94	1.10	1.27	1.47
10.80 CFS	1.71	1.98	2.29	2.64	3.09	3.67	4.38	5.22
11.60 CFS	7.12	13.27	28.04	58.32	99.16	108.29	77.28	47.93
12.40 CFS	32.74	24.51	19.19	15.72	13.55	12.20	11.26	10.46
13.20 CFS	9.78	9.24	8.77	8.34	7.92	7.54	7.20	6.88
14.00 CFS	6.57	6.28	6.04	5.86	5.72	5.61	5.50	5.40
14.80 CFS	5.29	5.19	5.08	4.98	4.87	4.77	4.66	4.55
15.60 CFS	4.45	4.34	4.23	4.12	4.01	3.91	3.82	3.75
16.40 CFS	3.71	3.66	3.62	3.59	3.55	3.51	3.47	3.43
17.20 CFS	3.40	3.36	3.32	3.28	3.24	3.20	3.17	3.13
18.00 CFS	3.09	3.05	3.01	2.97	2.93	2.89	2.85	2.81
18.80 CFS	2.77	2.73	2.69	2.65	2.61	2.57	2.53	2.49
19.60 CFS	2.45	2.41	2.37	2.33	2.29	2.25	2.22	2.20
20.40 CFS	2.18	2.17	2.17	2.16	2.15	2.14	2.14	2.13
21.20 CFS	2.12	2.11	2.11	2.10	2.09	2.08	2.08	2.07
22.00 CFS	2.06	2.05	2.04	2.04	2.03	2.02	2.01	2.01
22.80 CFS	2.00	1.99	1.98	1.98	1.97	1.96	1.95	1.94
23.60 CFS	1.94	1.93	1.92	1.91	1.90	1.67	1.00	.44

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
3.25 WATERSHED INCHES; 99 CFS-HRS; 8.2 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	14	14
FLOW(CFS)	8	5	3	3	2	2	1	0

--- XSECTION 2, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
11.93	36.8	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .01 SQ.MI.			
9.60 CFS	.49	.53	.56	.60	.64	.69	.74	.80
10.40 CFS	.86	.92	1.00	1.10	1.20	1.31	1.42	1.58
11.20 CFS	1.81	2.06	2.33	2.63	4.97	10.46	18.76	35.62
12.00 CFS	32.49	12.78	6.18	4.93	4.18	3.45	2.92	2.67
12.80 CFS	2.50	2.33	2.16	2.02	1.92	1.82	1.73	1.64
13.60 CFS	1.56	1.49	1.42	1.36	1.29	1.24	1.21	1.19
14.40 CFS	1.17	1.15	1.12	1.10	1.07	1.05	1.03	1.01
15.20 CFS	.98	.96	.94	.91	.89	.87	.84	.82
16.00 CFS	.80	.78	.77	.76	.75	.74	.74	.73
16.80 CFS	.72	.71	.70	.70	.69	.68	.67	.66
17.60 CFS	.65	.65	.64	.63	.62	.61	.60	.60
18.40 CFS	.59	.58	.57	.56	.55	.54	.54	.53
19.20 CFS	.52	.51	.50	.49				

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
4.98 WATERSHED INCHES; 26 CFS-HRS; 2.1 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10
FLOW(CFS)	2	1	1	1	0

--- XSECTION 3, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.10) FOR SUBWATERSHED XSECTION 3.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT 1.2%. ***

OPERATION RESVOR STRUCTURE 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.03	28.8	376.22

*** WARNING - STRUCTURE 1, MAIN TIME INCREMENT TOO LARGE, COMPUTED PEAK
(28.80) EXCEEDS ADJACENT COORDINATE (27.20) BY 5 %. ***

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .01 SQ.MI.			
5.40 CFS	.00	.01	.01	.01	.02	.02	.03	.03
5.40 ELEV	368.00	368.00	368.01	368.01	368.01	368.02	368.02	368.02
6.20 CFS	.04	.05	.05	.06	.07	.07	.08	.09
6.20 ELEV	368.03	368.03	368.04	368.04	368.05	368.05	368.06	368.06
7.00 CFS	.10	.10	.11	.12	.13	.14	.14	.15
7.00 ELEV	368.07	368.07	368.08	368.09	368.09	368.10	368.10	368.11
7.80 CFS	.16	.17	.18	.19	.20	.21	.22	.23
7.80 ELEV	368.11	368.12	368.13	368.13	368.14	368.15	368.16	368.17
8.60 CFS	.25	.27	.29	.30	.32	.35	.37	.38
8.60 ELEV	368.18	368.19	368.20	368.22	368.23	368.25	368.26	368.27
9.40 CFS	.40	.42	.43	.45	.47	.49	.52	.55
9.40 ELEV	368.29	368.30	368.31	368.32	368.34	368.35	368.37	368.40
10.20 CFS	.59	.63	.67	.72	.78	.84	.91	.98
10.20 ELEV	368.42	368.45	368.48	368.52	368.55	368.60	368.65	368.70
11.00 CFS	1.07	1.16	1.28	1.41	1.50	1.61	1.85	2.39
11.00 ELEV	368.76	368.83	368.92	369.02	369.16	369.33	369.71	370.72
11.80 CFS	3.24	4.01	27.20	22.82	11.56	6.87	5.06	4.09
11.80 ELEV	372.86	375.37	376.19	376.09	375.76	375.60	375.54	375.50
12.60 CFS	4.04	4.02	4.00	3.97	3.95	3.92	3.89	3.85
12.60 ELEV	375.45	375.39	375.31	375.23	375.13	375.04	374.92	374.79
13.40 CFS	3.82	3.77	3.67	3.55	3.43	3.31	3.19	3.07
13.40 ELEV	374.66	374.51	374.15	373.78	373.41	373.06	372.71	372.37
14.20 CFS	2.95	2.83	2.71	2.60	2.49	2.38	2.27	2.17
14.20 ELEV	372.04	371.73	371.45	371.18	370.92	370.69	370.46	370.26
15.00 CFS	2.07	1.96	1.86	1.76	1.67	1.59	1.51	1.44
15.00 ELEV	370.06	369.88	369.71	369.56	369.42	369.29	369.17	369.06
15.80 CFS	1.35	1.23	1.14	1.06	1.00	.94	.90	.87
15.80 ELEV	368.96	368.88	368.81	368.76	368.71	368.67	368.64	368.62
16.60 CFS	.84	.82	.80	.78	.76	.75	.73	.72
16.60 ELEV	368.60	368.58	368.57	368.56	368.54	368.53	368.52	368.52
17.40 CFS	.71	.70	.69	.68	.67	.66	.65	.65
17.40 ELEV	368.51	368.50	368.49	368.49	368.48	368.47	368.47	368.46
18.20 CFS	.64	.63	.62	.61	.60	.59	.59	.58
18.20 ELEV	368.46	368.45	368.44	368.44	368.43	368.42	368.42	368.41
19.00 CFS	.57	.56	.55	.54	.54	.53	.52	.51
19.00 ELEV	368.41	368.40	368.39	368.39	368.38	368.38	368.37	368.36
19.80 CFS	.50	.49	.49	.48	.47	.46	.46	.45
19.80 ELEV	368.36	368.35	368.35	368.34	368.34	368.33	368.33	368.32
20.60 CFS	.45	.45	.44	.44	.44	.44	.43	.43
20.60 ELEV	368.32	368.32	368.32	368.32	368.31	368.31	368.31	368.31
21.40 CFS	.43	.43	.43	.43	.42	.42	.42	.42
21.40 ELEV	368.31	368.31	368.30	368.30	368.30	368.30	368.30	368.30
22.20 CFS	.42	.41	.41	.41	.41	.41	.41	.40
22.20 ELEV	368.30	368.30	368.30	368.29	368.29	368.29	368.29	368.29
23.00 CFS	.40	.40	.40	.40	.40	.39	.39	.39
23.00 ELEV	368.29	368.29	368.29	368.28	368.28	368.28	368.28	368.28
23.80 CFS	.39	.39	.39	.35	.29	.22	.17	.13
23.80 ELEV	368.28	368.28	368.28	368.25	368.20	368.16	368.12	368.10

24.60 CFS	.10	.08	.06	.05	.04	.03	.02	.02
24.60 ELEV	368.07	368.06	368.05	368.04	368.03	368.02	368.02	368.01
25.40 CFS	.01	.01						
25.40 ELEV	368.01	368.01						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
4.92 WATERSHED INCHES; 25 CFS-HRS; 2.1 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10
FLOW(CFS)	3	2	1	1	0

--- STRUCTURE 1, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION RUNOFF XSECTION 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.08	56.0	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99
MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .03 SQ.MI.

HRS								
11.10 CFS	.34	.51	.73	1.01	1.36	2.10	4.60	10.92
11.90 CFS	26.11	48.57	55.62	40.65	25.50	17.87	13.51	10.73
12.70 CFS	8.85	7.67	6.94	6.42	5.98	5.60	5.30	5.04
13.50 CFS	4.80	4.57	4.35	4.16	3.98	3.81	3.64	3.50
14.30 CFS	3.40	3.33	3.26	3.21	3.15	3.09	3.03	2.97
15.10 CFS	2.91	2.85	2.79	2.73	2.67	2.61	2.55	2.49
15.90 CFS	2.42	2.36	2.30	2.25	2.21	2.19	2.16	2.14
16.70 CFS	2.12	2.10	2.07	2.05	2.03	2.01	1.99	1.97
17.50 CFS	1.94	1.92	1.90	1.88	1.86	1.83	1.81	1.79
18.30 CFS	1.76	1.74	1.72	1.70	1.67	1.65	1.63	1.60
19.10 CFS	1.58	1.56	1.53	1.51	1.49	1.46	1.44	1.41
19.90 CFS	1.39	1.37	1.34	1.33	1.31	1.31	1.30	1.30
20.70 CFS	1.29	1.29	1.28	1.28	1.27	1.27	1.27	1.26
21.50 CFS	1.26	1.25	1.25	1.25	1.24	1.24	1.23	1.23
22.30 CFS	1.22	1.22	1.22	1.21	1.21	1.20	1.20	1.19
23.10 CFS	1.19	1.18	1.18	1.18	1.17	1.17	1.16	1.16
23.90 CFS	1.15	1.15	1.01	.60	.27			

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.44 WATERSHED INCHES; 52 CFS-HRS; 4.3 ACRE-FEET.

DURATION(HRS)	2	4	6	8	10	12	13
FLOW(CFS)	4	3	2	1	1	1	0

--- XSECTION 4, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

OPERATION ADDHYD XSECTION 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.06	80.8	(NULL)

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.92 WATERSHED INCHES; 77 CFS-HRS; 6.4 ACRE-FEET.

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 4

SUMMARY TABLE 1

SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL IN ORDER PERFORMED.
A CHARACTER FOLLOWING THE PEAK DISCHARGE TIME AND RATE (CFS) INDICATES:
F-FLAT TOP HYDROGRAPH T-TRUNCATED HYDROGRAPH R-RISING TRUNCATED HYDROGRAPH

XSECTION/ STRUCTURE ID		STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)
RAINFALL OF 2.60 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.								
RAINTABLE NUMBER 2, ARC 2								
MAIN TIME INCREMENT .100 HOURS								
ALTERNATE 1 STORM 1								
XSECTION	1	RUNOFF	.02	.00	---	.00	0	.0
XSECTION	2	RUNOFF	.05	.34	---	12.12	7	140.0
XSECTION	3	RUNOFF	.01	1.01	---	11.95	8	800.0
STRUCTURE	1	RESVOR	.01	1.01	370.76	12.14	2	200.0
XSECTION	4	RUNOFF	.03	.14	---	12.20R	1R	33.3
XSECTION	5	ADDHYD	.04	.31	---	12.21T	3T	75.0
RAINFALL OF 3.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.								
ALTERNATE 1 STORM 2								
XSECTION	1	RUNOFF	.02	.31	---	12.17T	2T	100.0
XSECTION	2	RUNOFF	.05	.60	---	12.11	17	340.0
XSECTION	3	RUNOFF	.01	1.47	---	11.95	11	1100.0
STRUCTURE	1	RESVOR	.01	1.47	372.28	12.15	3	300.0
XSECTION	4	RUNOFF	.03	.31	---	12.14T	4T	133.3
XSECTION	5	ADDHYD	.04	.53	---	12.14	7	175.0
RAINFALL OF 5.10 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.								
ALTERNATE 1 STORM 10								
XSECTION	1	RUNOFF	.02	1.16	---	12.11	17	850.0
XSECTION	2	RUNOFF	.05	1.72	---	12.08	56	1120.0
XSECTION	3	RUNOFF	.01	3.07	---	11.94	23	2300.0
STRUCTURE	1	RESVOR	.01	3.06	375.60	12.13	7	700.0
XSECTION	4	RUNOFF	.03	1.16	---	12.10	24	800.0
XSECTION	5	ADDHYD	.04	1.53	---	12.11	31	775.0

SUMMARY TABLE 1

SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL IN ORDER PERFORMED.
A CHARACTER FOLLOWING THE PEAK DISCHARGE TIME AND RATE (CFS) INDICATES:
F-FLAT TOP HYDROGRAPH T-TRUNCATED HYDROGRAPH R-RISING TRUNCATED HYDROGRAPH

XSECTION/ STRUCTURE ID		STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
RAINFALL OF 7.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.								
ALTERNATE 1 STORM 99								
XSECTION	1	RUNOFF	.02	2.45	---	12.10	39	1950.0
XSECTION	2	RUNOFF	.05	3.25	---	12.07	110	2200.0
XSECTION	3	RUNOFF	.01	4.98	---	11.93	37	3700.0
STRUCTURE	1	RESVOR	.01	4.92	376.22	12.03	29	2900.0
XSECTION	4	RUNOFF	.03	2.44	---	12.08	56	1866.7
XSECTION	5	ADDHYD	.04	2.92	---	12.06	81	2025.0

SUMMARY TABLE 3

STORM DISCHARGES (CFS) AT XSECTIONS AND STRUCTURES FOR ALL ALTERNATES
QUESTION MARK (?) AFTER: OUTFLOW PEAK - RISING TRUNCATED HYDROGRAPH.

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
STRUCTURE 1	.01				
ALTERNATE 1		2	3	7	29
XSECTION 1	.02				
ALTERNATE 1		0	2	17	39
XSECTION 2	.05				
ALTERNATE 1		7	17	56	110
XSECTION 3	.01				
ALTERNATE 1		8	11	23	37
XSECTION 4	.03				
ALTERNATE 1		1?	4	24	56
XSECTION 5	.04				
ALTERNATE 1		3	7	31	81

END OF 1 JOBS IN THIS RUN

SCS TR-20, VERSION 2.04TEST
FILES

INPUT = DAD2-2R.DAT , GIVEN DATA FILE
OUTPUT = DAD2-2R.OUT , DATED 01/26/**,12:38:41

FILES GENERATED - DATED 01/26/**,12:38:41

FILE DAD2-2R.TRD CONTAINS READHD INFORMATION

TOTAL NUMBER OF WARNINGS = 7, MESSAGES = 2

*** TR-20 RUN COMPLETED ***

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A- Existing Conditions DA D-2-3

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			2.14	117.7
D	65	Woods - (good)	77			0.16	12.3
		OUTSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			0.43	23.7
					Totals =	2.73	153.7

0.00427 mi^2

CN (weighted) = total product / total area = 153.7 / 2.73 = 56.3 Use CN = 56

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	0.1	1.1	2.3

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A- Existing Conditions DA D-2-3

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)		Segment ID	A-B				
1.	Surface description (table 3-1)		5 Grass - short				
2.	Manning's roughness coeff., n (table 3-1)		0.15				
3.	Flow Length, L (total L<= 300 ft)	ft	100				
4.	Two-Year 24-hr rainfall, P_2	in	3.2				
5.	Land Slope, s	ft / ft	0.095				
6.	$T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$	hr	0.088	+		=	0.088
Shallow concentrated flow		Segment ID	B-C				
7.	Surface Description: paved (P) or unpaved (U) ?		U				
8.	Flow Length, L	ft	348				
9.	Watercourse slope, s	ft / ft	0.09483				
10.	Average velocity, V (figure 3-1)	ft / sec	5				
11.	$T_t = L / 3600V$	hr	0.019	+		=	0.019

Channel flow		Segment ID	B-C	C-D			
	a. Assumed Q:						
	b. Pipe (P) or Channel (C) ?						
	c. If pipe, enter D (in):						
	d. If channel, enter bottom width:						
	e. if channel, enter side slope 1 (_:1):						
	f. If channel, enter side slope 2 (_:1):						
12.	Cross sectional flow area, a	sq ft					
13.	Wetted perimeter, wp	ft					
14.	Hydraulic radius, r = a / wp	ft					
15.	Channel slope, s	ft / ft					
16.	Manning's roughness coeff., n						
17.	$V = 1.49 r^{0.67} s^{0.5} / n$ Table II-2-B-3	ft / sec					
18.	Flow length, L	ft					
19.	$T_t = L / 3600V$	hr		+		=	0.00
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)					hr	0.11

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A-Proposed Conditions DA D-2-3

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	3	Open Space (good) - grass >75%	61			1.05	64.1
B	4	Imperv. - paved parking lots,roofs,drives	98			1.92	188.2
D	3	Open Space (good) - grass >75%	80			0.15	12.0
D	4	Imperv. - paved parking lots,roofs,drives	98			0.76	74.5
		Totals =				3.88	338.7

0.00606 mi^2

CN (weighted) = total product / total area = 338.7 / 3.88 = 87.3 Use CN = 87

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	1.4	3.7	5.7

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A | By CZJ | Date 1/23/2008

Location Montgomery County | Checked PS | Date 1/24/2008

Contract A-Proposed Conditions | DA D-2-3

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)		Segment ID	A-B				
1. Surface description (table 3-1)			1 Smooth				
2. Manning's roughness coeff., n (table 3-1)			0.011				
3. Flow Length, L (total L<= 300 ft)		ft	53				
4. Two-Year 24-hr rainfall, P_2		in	3.2				
5. Land Slope, s		ft / ft	0.02				
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$		hr	0.012	+		=	0.012
Shallow concentrated flow		Segment ID	B-C				
7. Surface Description: paved (P) or unpaved (U) ?			U				
8. Flow Length, L		ft	488				
9. Watercourse slope, s		ft / ft	0.0089				
10. Average velocity, V (figure 3-1)		ft / sec	1.5				
11. $T_t = L / 3600V$		hr	0.090	+		=	0.090
Channel flow		Segment ID	C-D	D-E			
a. Assumed Q:				8.0			
b. Pipe (P) or Channel (C) ?			C	P			
c. If pipe, enter D (in):				24			
d. If channel, enter bottom width:							
e. if channel, enter side slope 1 (_:1):							
f. If channel, enter side slope 2 (_:1):							
12. Cross sectional flow area, a		sq ft		3.1			
13. Wetted perimeter, wp		ft		6.3			
14. Hydraulic radius, r = a / wp		ft		0.5			
15. Channel slope, s		ft / ft	0.01	0.01			
16. Manning's roughness coeff., n				0.013			
17. $V = 1.49 r^{0.67} s^{0.5} / n$	Table II-2-B-3	ft / sec	5.1	7.2			
18. Flow length, L		ft	283	343			
19. $T_t = L / 3600V$		hr	0.02	+ 0.01	=	0.03	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)					hr	0.13	

```
*****************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****************

JOB TR-20                                                SUMMARY   NOPLOTS
TITLE     DA D2-3
TITLE     FILE: DAD2-3.DAT
 6 RUNOFF 1 001       1      0.00427     56.0        0.11   1 1 1 1 1
 6 RUNOFF 1 002       2      0.00606     87.0        0.13   1 1 1 1 1
   ENDATA
 7 INCREM 6             .10
 7 COMPUT 7 001   002   0.0         2.6         1.0         2 2   1  01
   ENDCMP 1
 7 COMPUT 7 001   002   0.0         3.2         1.0         2 2   1  02
   ENDCMP 1
 7 COMPUT 7 001   002   0.0         5.1         1.0         2 2   1  10
   ENDCMP 1
 7 COMPUT 7 001   002   0.0         7.2         1.0         2 2   1  99
   ENDCMP 1
   ENDJOB 2

*******************************END OF 80-80 LIST*******************************
```

EXECUTIVE CONTROL INCREM MAIN TIME INCREMENT = .100 HOURS

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 2.60 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. = 1 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

*** MESSAGE - XSECTION 1, NO PEAK COMPUTED (ONLY 1 HYDROGRAPH POINT(S)). ***

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.00 WATERSHED INCHES; 126 CFS-HRS; .0 ACRE-FEET.

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.11) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT ****%. ***

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.97	7.7	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 1

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.01 SQ.MI.
11.50 CFS	.43	.77	1.68	3.28	6.66	7.45	3.94	1.72
12.30 CFS	1.24	1.03	.86	.72	.65	.60	.56	.53
13.10 CFS	.49							

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.39 WATERSHED INCHES; 5 CFS-HRS; .5 ACRE-FEET.

DURATION(HRS) 2
FLOW(CFS) 0

--- XSECTION 2, ALTERNATE 1, STORM 1, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.13) FOR SUBWATERSHED XSECTION 2.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT -3.5%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 1

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 3.20 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. = 2 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

*** MESSAGE - NO SIGNIFICANT PEAK FOUND, MAX. DISCHARGE 1 CFS,
AT XSECTION 1 ***

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.00	.6	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2
HRS MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .00 SQ.MI.
11.90 CFS .14 .59 .38

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.28 WATERSHED INCHES; 1 CFS-HRS; .1 ACRE-FEET.

DURATION(HRS) 0
FLOW(CFS) 0

--- XSECTION 1, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.11) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT ****%. ***

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.96	10.4	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.01 SQ.MI.
11.20 CFS	.44	.50	.58	.66	1.16	2.48	4.69	9.26
12.00 CFS	10.09	5.31	2.29	1.64	1.36	1.13	.95	.85
12.80 CFS	.79	.74	.69	.64	.61	.58	.55	.52
13.60 CFS	.50							

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.91 WATERSHED INCHES; 7 CFS-HRS; .6 ACRE-FEET.

DURATION(HRS) 2 2
FLOW(CFS) 1 0

--- XSECTION 2, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.13) FOR SUBWATERSHED XSECTION 2.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT 6.0%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 2

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 5.10 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =10 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.98	4.0	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.00 SQ.MI.
11.70 CFS	.13	.80	3.03	3.94	1.91	.97	.78	.68
12.50 CFS	.57	.49						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.09 WATERSHED INCHES; 3 CFS-HRS; .2 ACRE-FEET.

DURATION(HRS)	2	1
FLOW(CFS)	1	0

--- XSECTION 1, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.11) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT -1.6%. ***

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.96	19.5	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.01 SQ.MI.
10.30 CFS	.47	.50	.54	.58	.63	.69	.75	.81
11.10 CFS	.89	1.01	1.16	1.30	1.47	2.51	5.20	9.46
11.90 CFS	17.61	18.66	9.60	4.11	2.92	2.40	1.99	1.67
12.70 CFS	1.50	1.39	1.30	1.21	1.13	1.07	1.01	.96

13.50 CFS	.91	.87	.83	.79	.75	.72	.69	.67
14.30 CFS	.66	.64	.63	.62	.61	.59	.58	.57
15.10 CFS	.55	.54	.53	.52	.50	.49		

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
3.66 WATERSHED INCHES; 14 CFS-HRS; 1.2 ACRE-FEET.

DURATION(HRS)	2	4	5
FLOW(CFS)	1	1	0

--- XSECTION 2, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.13) FOR SUBWATERSHED XSECTION 2.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT 4.7%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 3

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 7.20 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =99 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.97	9.2	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99

HRS	MAIN TIME INCREMENT = .100 hr,			DRAINAGE AREA = .00 SQ.MI.				
11.60 CFS	.48	1.32	3.15	7.96	8.88	4.10	1.98	1.58
12.40 CFS	1.35	1.13	.96	.88	.83	.77	.72	.68
13.20 CFS	.65	.62	.59	.56	.53	.51	.49	

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.35 WATERSHED INCHES; 6 CFS-HRS; .5 ACRE-FEET.

DURATION(HRS)	2	2
FLOW(CFS)	1	0

--- XSECTION 1, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.11) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT .6%. ***

OPERATION RUNOFF XSECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
11.96	29.2	

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA = .01 SQ.MI.			
9.10 CFS	.50	.51	.52	.53	.53	.55	.58	.61
9.90 CFS	.65	.68	.73	.77	.83	.88	.94	1.01
10.70 CFS	1.09	1.18	1.28	1.38	1.51	1.70	1.92	2.16
11.50 CFS	2.40	4.09	8.26	14.78	26.79	27.92	14.49	6.22
12.30 CFS	4.34	3.55	2.94	2.46	2.21	2.05	1.91	1.77
13.10 CFS	1.65	1.56	1.49	1.41	1.34	1.27	1.21	1.16
13.90 CFS	1.10	1.05	1.01	.98	.96	.94	.92	.90
14.70 CFS	.88	.86	.85	.83	.81	.79	.77	.75
15.50 CFS	.73	.72	.70	.68	.66	.64	.62	.61
16.30 CFS	.61	.60	.59	.59	.58	.57	.57	.56
17.10 CFS	.55	.55	.54	.53	.53	.52	.51	.51
17.90 CFS	.50	.49						

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
5.66 WATERSHED INCHES; 22 CFS-HRS; 1.8 ACRE-FEET.

DURATION(HRS)	2	4	6	8	9
FLOW(CFS)	2	1	1	1	0

--- XSECTION 2, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.13) FOR SUBWATERSHED XSECTION 2.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT 3.7%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 4

SUMMARY TABLE 1

SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL IN ORDER PERFORMED.
A CHARACTER FOLLOWING THE PEAK DISCHARGE TIME AND RATE (CFS) INDICATES:
F-FLAT TOP HYDROGRAPH T-TRUNCATED HYDROGRAPH R-RISING TRUNCATED HYDROGRAPH

XSECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
RAINFALL OF 2.60 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
RAINTABLE NUMBER 2, ARC 2							
MAIN TIME INCREMENT .100 HOURS							
ALTERNATE 1 STORM 1							
XSECTION 1	RUNOFF	.00	.00	---	.00	0	********
XSECTION 2	RUNOFF	.01	1.39	---	11.97	8	800.0
RAINFALL OF 3.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 2							
XSECTION 1	RUNOFF	.00	.28	---	12.00R	1R	********
XSECTION 2	RUNOFF	.01	1.91	---	11.96	10	1000.0
RAINFALL OF 5.10 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 10							
XSECTION 1	RUNOFF	.00	1.09	---	11.98T	4T	********
XSECTION 2	RUNOFF	.01	3.66	---	11.96	19	1900.0
RAINFALL OF 7.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 99							
XSECTION 1	RUNOFF	.00	2.35	---	11.97	9	********
XSECTION 2	RUNOFF	.01	5.66	---	11.96	29	2900.0

SUMMARY TABLE 3

STORM DISCHARGES (CFS) AT XSECTIONS AND STRUCTURES FOR ALL ALTERNATES
QUESTION MARK (?) AFTER: OUTFLOW PEAK - RISING TRUNCATED HYDROGRAPH.

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
XSECTION	1	.00				
ALTERNATE	1		0	1?	4	9
XSECTION	2	.01				
ALTERNATE	1		8	10	19	29

END OF 1 JOBS IN THIS RUN

SCS TR-20, VERSION 2.04TEST
FILES

INPUT = dad2-3.dat , GIVEN DATA FILE
OUTPUT = dad2-3.OUT , DATED 01/24/**,08:34:15

FILES GENERATED - DATED 01/24/**,08:34:15

FILE dad2-3.TRD CONTAINS READHD INFORMATION

TOTAL NUMBER OF WARNINGS = 8, MESSAGES = 2

*** TR-20 RUN COMPLETED ***

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A- Existing Conditions DA D-2-4

1. Runoff Curve Number (CN)

Soil name and hydrologic group	Cover Description		CN			Area	Product of CN x area
(Appendix A)	No.		Table 2-2	Figure 2-3	Figure 2-4	(acres)	
		INSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			1.98	108.9
B	3	Open Space (good) - grass >75%	61			0.14	8.5
D	65	Woods - (good)	77			0.3	23.1
D	3	Open Space (good) - grass >75%	80			0.08	6.4
		OUTSIDE RIGHT OF WAY					
B	65	Woods - (good)	55			0.6	33.0
					Totals =	3.1	179.9

0.00484 mi^2

CN (weighted) = total product / total area = 179.9 / 3.10 = 58.0 Use CN = 58

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	0.2	1.2	2.5

S=(1000/CN)-10

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project ICC-CONTRACT A | By CZJ | Date 1/23/2008

Location Montgomery County | Checked PS | Date 1/24/2008

Contract A- Existing Conditions | DA D-2-4

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to T_c only)		Segment ID	A-B				
1. Surface description (table 3-1)			5 Grass - short				
2. Manning's roughness coeff., n (table 3-1)			0.15				
3. Flow Length, L (total L<= 300 ft)		ft	100				
4. Two-Year 24-hr rainfall, P_2		in	3.2				
5. Land Slope, s		ft / ft	0.095				
6. $T_t = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$		hr	0.088	+		=	0.088
Shallow concentrated flow		Segment ID	B-C				
7. Surface Description: paved (P) or unpaved (U) ?			U				
8. Flow Length, L		ft	453				
9. Watercourse slope, s		ft / ft	0.05519				
10. Average velocity, V (figure 3-1)		ft / sec	3.8				
11. $T_t = L / 3600V$		hr	0.033	+		=	0.033
Channel flow		Segment ID	B-C	C-D			
a. Assumed Q:							
b. Pipe (P) or Channel (C) ?							
c. If pipe, enter D (in):							
d. If channel, enter bottom width:							
e. if channel, enter side slope 1 (_:1):							
f. If channel, enter side slope 2 (_:1):							
12. Cross sectional flow area, a		sq ft					
13. Wetted perimeter, wp		ft					
14. Hydraulic radius, r = a / wp		ft					
15. Channel slope, s		ft / ft					
16. Manning's roughness coeff., n							
17. $V = 1.49 r^{0.67} s^{0.5} / n$	Table II-2-B-3	ft / sec					
18. Flow length, L		ft					
19. $T_t = L / 3600V$		hr		+		=	0.00
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)						hr	0.12

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 1/23/2008

Location Montgomery County Checked PS Date 1/24/2008

Contract A-Proposed Conditions DA D-2-4

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		NONE					
					Totals =	0.00	0.0

0.00000 mi^2

CN (weighted) = total product / total area = 0.0 / 0.00 = Use CN = 0

2. Runoff

Storm #1	Storm #2	Storm #3
1	10	100
2.6	5.1	7.2

Frequency. . . . . Yr

Rainfall, P (24-hour) . . . . . In

Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In

S=(1000/CN)-10

```
******************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY******************

JOB TR-20                                                SUMMARY   NOPLOTS
TITLE     DA D2-4
TITLE     FILE: DAD2-4.DAT
 6 RUNOFF 1 001       1      0.00484     58.0        0.12   1 1 1 1 1
   ENDATA
 7 INCREM 6             .10
 7 COMPUT 7 001   001   0.0         2.6         1.0         2 2   1  01
   ENDCMP 1
 7 COMPUT 7 001   001   0.0         3.2         1.0         2 2   1  02
   ENDCMP 1
 7 COMPUT 7 001   001   0.0         5.1         1.0         2 2   1  10
   ENDCMP 1
 7 COMPUT 7 001   001   0.0         7.2         1.0         2 2   1  99
   ENDCMP 1
   ENDJOB 2

*******************************END OF 80-80 LIST*******************************
```

EXECUTIVE CONTROL INCREM MAIN TIME INCREMENT = .100 HOURS

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 1
STARTING TIME = .00 RAIN DEPTH = 2.60 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. = 1 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

*** MESSAGE - XSECTION 1, NO PEAK COMPUTED (ONLY 1 HYDROGRAPH POINT(S)). ***

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.00 WATERSHED INCHES; 127 CFS-HRS; .0 ACRE-FEET.

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.12) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT ****%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 1

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 1
STARTING TIME = .00 RAIN DEPTH = 3.20 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. = 2 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

*** MESSAGE - NO SIGNIFICANT PEAK FOUND, MAX. DISCHARGE 1 CFS,
AT XSECTION 1 ***

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.00	.9	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM = 2
HRS MAIN TIME INCREMENT = .100 hr, DRAINAGE AREA = .00 SQ.MI.
11.90 CFS .35 .94 .63 .35

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
.34 WATERSHED INCHES; 1 CFS-HRS; .1 ACRE-FEET.

DURATION(HRS) 0
FLOW(CFS) 0

--- XSECTION 1, ALTERNATE 1, STORM 2, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.12) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT 2.3%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 2

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 1
STARTING TIME = .00 RAIN DEPTH = 5.10 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =10 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.98	5.1	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =10

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.00 SQ.MI.
11.70 CFS	.31	1.19	3.88	5.05	2.69	1.29	1.00	.85
12.50 CFS	.72	.61	.56	.53	.50			

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
1.22 WATERSHED INCHES; 4 CFS-HRS; .3 ACRE-FEET.

DURATION(HRS) 1
FLOW(CFS) 0

--- XSECTION 1, ALTERNATE 1, STORM 10, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.12) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT .9%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 3

EXECUTIVE CONTROL COMPUT FROM XSECTION 1 TO XSECTION 1
STARTING TIME = .00 RAIN DEPTH = 7.20 RAIN DURATION = 1.00
ANT. RUNOFF COND. = 2 MAIN TIME INCREMENT = .100 HOURS
ALTERNATE NO. = 1 STORM NO. =99 RAIN TABLE NO. = 2

OPERATION RUNOFF XSECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
11.97	11.2	(RUNOFF)

HYDROGRAPH POINTS FOR ALTERNATE = 1, STORM =99

HRS	MAIN TIME INCREMENT = .100 hr,				DRAINAGE AREA =			.00 SQ.MI.
11.50 CFS	.32	.67	1.73	3.94	9.44	10.95	5.52	2.55
12.30 CFS	1.95	1.65	1.38	1.17	1.06	1.00	.94	.87
13.10 CFS	.82	.78	.74	.71	.67	.64	.61	.59
13.90 CFS	.56	.54	.52	.50	.50			

RUNOFF ABOVE BASEFLOW (BASEFLOW = .00 CFS)
2.54 WATERSHED INCHES; 8 CFS-HRS; .7 ACRE-FEET.

DURATION(HRS)	2	3
FLOW(CFS)	1	0

--- XSECTION 1, ALTERNATE 1, STORM 99, HYDROGRAPH ADDED TO READHD FILE ---

*** WARNING - MAIN TIME INCREMENT (.100) IS GREATER THAN 50% OF THE
TIME OF CONCENTRATION (.12) FOR SUBWATERSHED XSECTION 1.
THIS WILL REDUCE THE COMPUTED PEAK BY ABOUT .9%. ***

EXECUTIVE CONTROL ENDCMP COMPUTATIONS COMPLETED FOR PASS 4

SUMMARY TABLE 1

SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL IN ORDER PERFORMED.
A CHARACTER FOLLOWING THE PEAK DISCHARGE TIME AND RATE (CFS) INDICATES:
F-FLAT TOP HYDROGRAPH T-TRUNCATED HYDROGRAPH R-RISING TRUNCATED HYDROGRAPH

XSECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
RAINFALL OF 2.60 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
RAINTABLE NUMBER 2, ARC 2							
MAIN TIME INCREMENT .100 HOURS							
ALTERNATE 1 STORM 1							
XSECTION 1	RUNOFF	.00	.00	---	.00	0	********
RAINFALL OF 3.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 2							
XSECTION 1	RUNOFF	.00	.34	---	12.00R	1R	********
RAINFALL OF 5.10 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 10							
XSECTION 1	RUNOFF	.00	1.22	---	11.98	5	********
RAINFALL OF 7.20 inches AND 24.00 hr DURATION, BEGINS AT .0 hrs.							
ALTERNATE 1 STORM 99							
XSECTION 1	RUNOFF	.00	2.54	---	11.97	11	********

SUMMARY TABLE 3

STORM DISCHARGES (CFS) AT XSECTIONS AND STRUCTURES FOR ALL ALTERNATES
QUESTION MARK (?) AFTER: OUTFLOW PEAK - RISING TRUNCATED HYDROGRAPH.

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
XSECTION 1	.00				
ALTERNATE 1		0	1?	5	11

END OF 1 JOBS IN THIS RUN

SCS TR-20, VERSION 2.04TEST
FILES

INPUT = DAD2-4.dat , GIVEN DATA FILE
OUTPUT = DAD2-4.OUT , DATED 01/23/**,10:59:15

FILES GENERATED - DATED 01/23/**,10:59:15

FILE DAD2-4.TRD CONTAINS READHD INFORMATION

TOTAL NUMBER OF WARNINGS = 4, MESSAGES = 2

*** TR-20 RUN COMPLETED ***

APPENDIX C

WATER QUALITY SUMMARY SHEET
WATER QUALITY MAP

MD SHA-ICC PROJECT-WATER QUALITY SUMMARY SHEET

SEGMENT NUMBER: CONTRACT A SEGMENT D1-D2
DESCRIPTION: ICC FROM I-370 TO EAST OF MD 97
CONTRACT: AT3765960
MDE NUMBER: 08-SF-0102

WATERSHED NUMBER: 02-14-02
DATE: 1/25/2008
PREPARED BY: ps

	PROJECT CHECKS		WATER QUALITY REQUIRED					WATER QUALITY PROVIDED				SUMMARY
A	B	C	D	E	F	G	H	I	J	K	L	M
				REDEVELOPMENT								
OUTFALL NUMBER	PRE-DEVELOPMENT IMPERVIOUS AREA (ACRES)	POST-DEVELOPMENT IMPERVIOUS AREA (ACRES)	NEW DEVELOPMENT (ACRES)	RE- CONSTRUCTED IMPERVIOUS AREA (ACRES)	EXISTING IMPERVIOUS AREA REMOVED (ACRES) excluding column L	LOSS OF EXISTING WATER QUALITY (ACRES)	AREA REQUIRING TREATMENT [(D - F) + 0.2(E + F) + G] (ACRES)	IMPERVIOUS AREA TREATED BY GRASS CHANNEL OR NON-STRUCTURAL CREDIT (ACRES)	IMPERVIOUS AREA TREATED BY STRUCTURAL BMP (ACRES)	BMP NUMBER	WATER QUALITY PAVEMENT REMOVAL (ACRES)	WATER QUALITY DEFICIT/CREDIT [I + J + L - H] (ACRES)
D-1-1	0.00	3.78	3.78	0.00	0.00		3.78	3.78				0.00
D-1-2	0.00	0.00	0.00	0.00	0.00		0.00	0.00				0.00
D-2-1	0.00	0.00	0.00	0.00	0.00		0.00	0.00				0.00
D-2-2	0.00	5.36	5.36	0.00	0.00		5.36	4.12	1.24			0.00
D-2-3	0.00	2.68	2.68	0.00	0.00		2.68	1.69	0.99			0.00
D-2-4	0.00	0.00	0.00	0.00	0.00		0.00	0.00				0.00
	0.00	11.82	11.82	0.00	0.00	0.00	11.82	9.59	2.23	0.00	0.00	0.00

WATER QUALITY CREDIT/DEBIT 0.00 **ACRES IN THE WASHINGTON METROPOLITAN WATERSHED (02-14-02)**

SHA State Highway Administration — SHA Highway Hydraulics Division, Chief

MDE — MDE Plan Review Division, Chief

IC INTERCOUNTY CONSTRUCTORS — ICC CORRIDOR PARTNERS — ICC Corridor Partners

3

WATER QUALITY MAP - SEGMENT D1-D2
PROPOSED CONDITION
MD 200 / INTERCOUNTY CONNECTOR

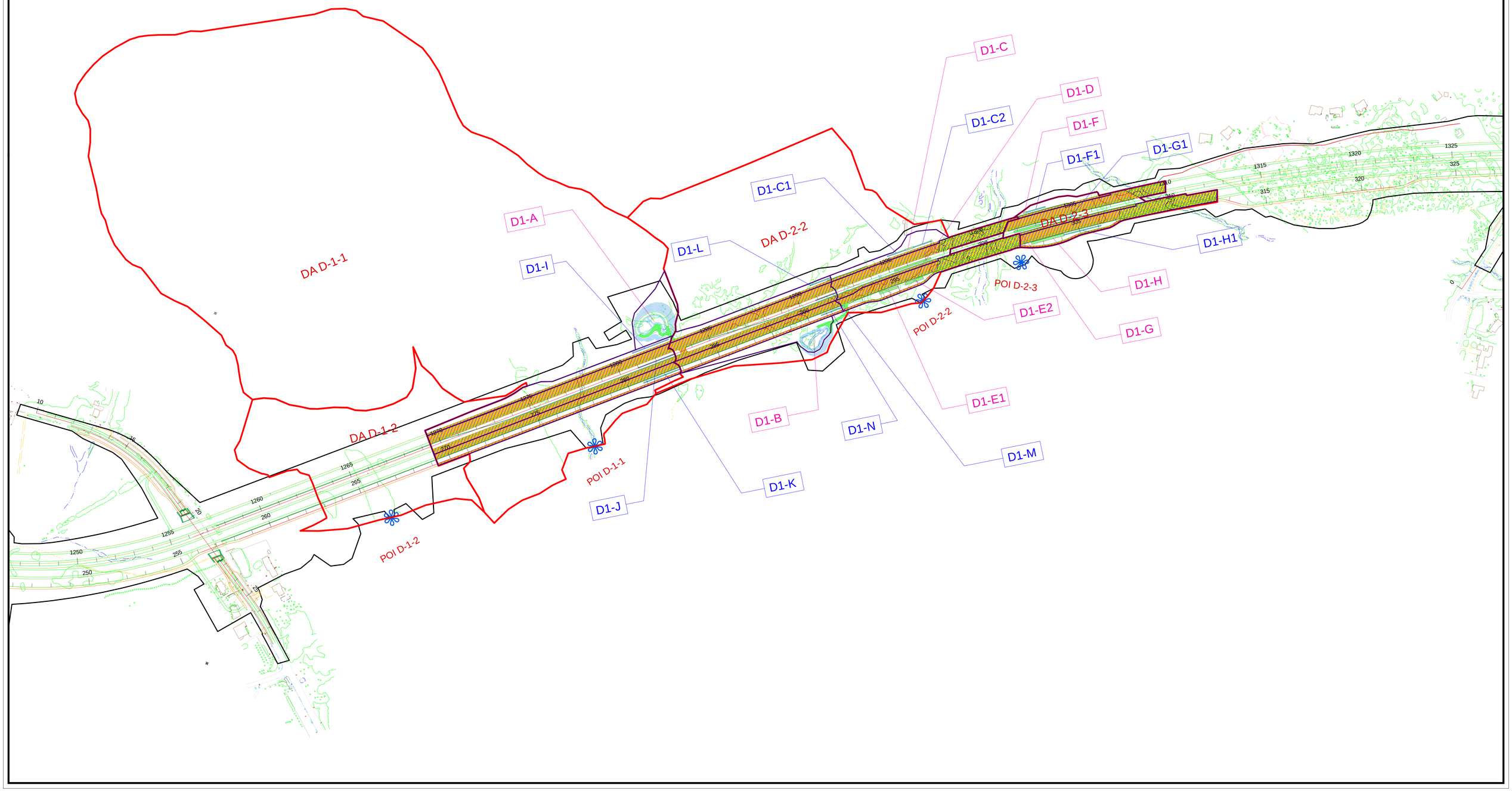
JANUARY 2008

Legend

- Drainage Area Boundary
- CPv Sub Drainage Area Boundary
- Point of Investigation
- Pavement Treated By Storm Filter
- Linear Sand Filter
- Linear Sand Storage
- Grass Channel Credit
- New Construction
- Right of Way

200 100 0 200 400 600 Feet

INTERCOUNTY CONSTRUCTORS
TWO TAFT COURT * ROCKVILLE, MARYLAND 20850 * 301-354-8600



APPENDIX D
GEOTECHNICAL BORING LOG

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: **SWD2-B1**
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: GEOMECHANICS, INC.
ELIZABETH, PENNSYLVANIA
Boring Foreman: Matt Hart
Schnabel Representative: P. Hutchins
Drilling Equipment: BK 51 Manual Track
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 8/6/07 Finished: 8/6/07
Station: 1289+25 Offset: +150

Ground Surface Elevation: 378.0± (ft) Total Depth: 24.7 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/6	2:21 PM	Dry	—	—
Completion	8/6	2:21 PM	Dry	23.5'	—
Casing Pulled ▽	8/6	2:44 PM	13.5'	—	15.5'
After Drilling ▽	8/7	8:00 AM	10.0'	—	10.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	TOPSOIL, 4 inches		377.7			S-1, SPT 3+6+11 REC=12" 67%	MC = 20.7%	0.0 ft: Residual
	SANDY SILT, moist, brown, contains roots	ML						
2.5	SILT WITH SAND, moist, orangeish brown		375.5			S-2, SPT 5+5+6 REC=18" 100%		
	Changes to contains mica				5	S-3, SPT 4+4+5 REC=14" 78%		
	Changes to brown					S-4, SPT 3+3+4 REC=8" 44%		
		ML		C	10			
	Changes to contains mica					S-5, SPT 3+3+3 REC=12" 67%		
					15			
18.5	SILTY SAND, moist, brown and yellow, contains mica		359.5			S-6, SPT 4+6+9 REC=18" 100%		
		SM			20			
23.5	DISINTEGRATED ROCK, sampled as silty sand, moist, brown and gray	DR	354.5	D		S-7, SPT 26+42+100/2" REC=14" 100%		23.5 ft: Disintegrated Rock
24.7			353.3					

Bottom of boring at 24.7 ft.
Boring offset 9-feet north from the staked location.

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_18.GDT 12/5/07

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: **SWD2-B2**
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: CONNELLY AND ASSOCIATES, INC.
FREDERICK, MARYLAND
Boring Foreman: Cody Hanes
Schnabel Representative: Brandon Glass
Drilling Equipment: Diedrich D-50 (ATV)
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 8/6/07 Finished: 8/6/07
Station: 1289+25 Offset: +250

Ground Surface Elevation: 376.0± (ft) Total Depth: 25 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Completion ▽	8/6	1:31 PM	23.0'	23.5'	---
Casing Pulled ▽	8/6	1:45 PM	17.5'	---	19.5'
After Drilling ▽	8/7	2:03 PM	9.5'	---	10.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	TOPSOIL, 4 inches		375.7			S-1 2+3+3 REC=8" 44%	MC = 16.9%	0.0 ft: Residual
	SILT WITH SAND, moist, brown, contains roots							
	Changes to no roots					S-2 5+6+8 REC=16" 89%		
	Changes to contains rock fragments, roots				5	S-3 3+5+8 REC=14" 78%		
	Changes to no rock fragments or roots, Sandy, contains mica ▽					S-4 4+5+5 REC=18" 100%		
		ML		C	10			
					15	S-5 4+5+6 REC=18" 100%		
	Changes to with sand ▽							
					20	S-6 9+13+16 REC=18" 100%		
	Changes to brown and white							
25.0			351.0		25	S-7 4+4+6 REC=18" 100%		
	Bottom of boring at 25.0 ft.							

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_16.GDT 12/5/07

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: SWD2-B3
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: Connelly And Associates, Inc.
Frederick, Maryland

Boring Foreman: C Hanes

Schnabel Representative: B Glass

Drilling Equipment: Diedrich D-50 (Track)

Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)

Dates Started: 8/7/07 **Finished:** 8/7/07

Station: 1289+50 **Offset:** +340

Ground Surface Elevation: 373.0± (ft) **Total Depth:** 25 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	8/7	8:35 AM	9.0'	8.5'	—
Completion ▽	8/7	8:45 AM	22.5'	—	—
Casing Pulled ▽	8/7	8:50 AM	12.5'	—	18.5'
After Drilling ▽	8/9	8:00 AM	8.0'	—	8.4'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.1	TOPSOIL, 1 inch		372.9					0.0 - 25.0 ft: Residual
	SANDY SILT, moist, brown, contains rock fragments	ML				S-1, SPT 5+6+7 REC=10" (56%)		
	Changes to with sand, contains rock fragments, orangeish-brown and gray					S-2, SPT 3+4+5 REC=8" (44%)		
5.0	SANDY LEAN CLAY, moist, brownish red and gray	CL	368.0		5	S-3, SPT 3+4+4 REC=18" (100%)		
8.5	SANDY SILT, moist, orangeish brown ▽		364.5			S-4, SPT 5+5+6 REC=16" (89%)		
		ML		C	10			
					15	S-5, SPT 4+8+9 REC=0" (0%)		
					20	S-6, SPT 4+5+8 REC=16" (89%)		
25.0	Bottom of boring at 25.0 ft.		348.0		25	S-7, SPT 5+9+13 REC=18" (100%)		

TEST BORING LOG SEGMENT D2.GPJ TEST 5-31-07.GPJ 12/10/07

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: SWD2-B4
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: CONNELLY AND ASSOCIATES, INC.
FREDERICK, MARYLAND
Boring Foreman: Cody Hanes
Schnabel Representative: Brandon Glass
Drilling Equipment: Diedrich D-50 (ATV)
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 8/6/07 **Finished:** 8/6/07
Station: 1290+00 **Offset:** +150

Ground Surface Elevation: 375.0± (ft) **Total Depth:** 25 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/6	12:00 AM	Dry	—	—
Completion	8/6	11:59 AM	Dry	—	—
Casing Pulled ▽	8/6	12:05 PM	21.5'	—	21.5'
After Drilling ▽	8/7	2:05 PM	7.5'	—	9.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	TOPSOIL, 3 inches		374.8					0.0 ft: Residual
	SANDY SILT, moist, brown, contains rock fragments					S-1 3+4+4 REC=16" 89%		
	Changes to contains mica					S-2 3+4+5 REC=18" 100%		
					5	S-3 3+4+5 REC=18" 100%		
	Changes to with sand	ML		C	10	S-4 2+2+2 REC=4" 22%		
	Changes to brown, white, and black				15	S-5 2+2+3 REC=18" 100%		
					20	S-6 3+4+7 REC=18" 100%		
25.0			350.0		25	S-7 2+3+5 REC=18" 100%		

Bottom of boring at 25.0 ft.
Boring offset 5-feet west of staked location.

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_16.GDT 12/5/07

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: SWD2-B5
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: CONNELLY AND ASSOCIATES, INC.
FREDERICK, MARYLAND
Boring Foreman: Cody Hanes
Schnabel Representative: Brandon Glass
Drilling Equipment: Diedrich D-50 (ATV)
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 8/6/07 **Finished:** 8/6/07
Station: 1290+00 **Offset:** +220

Ground Surface Elevation: 374.0± (ft) **Total Depth:** 25 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/6	12:00 AM	Dry	---	---
Completion	8/6	12:30 PM	Dry	---	---
Casing Pulled ▽	8/6	12:40 PM	18.5'	---	19.5'
After Drilling ▽	8/7	2:01 PM	8.0'	---	8.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	TOPSOIL, 2 inches		373.8					
	SILTY SAND, moist, brown					S-1 3+4+6 REC=7" 39%		0.0 ft: Residual
	Changes to brown and gray	SM				S-2 2+3+4 REC=18" 100%	MC = 27.7%	2.5 ft: USDA: LOAM
5.0	SILT, moist, brown and gray, contains sand		369.0		5	S-3 3+5+6 REC=16" 89%		
	Changes to contains mica				10	S-4 2+2+3 REC=7" 39%		
	Changes to no sand, brown	ML		C	15	S-5 4+4+7 REC=18" 100%		
					20	S-6 3+3+5 REC=18" 100%		
25.0	Changes to with sand, brown, white, and black		349.0		25	S-7 3+4+5 REC=16" 89%		
	Bottom of boring at 25.0 ft.							

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_16.GDT 1/15/08

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: SWD2-B6
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: CONNELLY AND ASSOCIATES, INC.
FREDERICK, MARYLAND
Boring Foreman: Cody Hanes
Schnabel Representative: Brandon Glass
Drilling Equipment: Diedrich D-50 (ATV)
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 8/6/07 **Finished:** 8/6/07
Station: 1290+25 **Offset:** +300

Ground Surface Elevation: 373.0± (ft) **Total Depth:** 25 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	8/6	12:00 AM	24.5'	23.5'	—
Completion ▽	8/6	2:10 PM	24.5'	23.5'	—
Casing Pulled ▽	8/6	2:20 PM	17.5'	—	19.5'
After Drilling ▽	8/7	2:18 PM	8.0'	—	8.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	TOPSOIL, 2 inches		372.8					0.0 ft: Residual
	SANDY SILT, moist, orangeish brown, contains roots					S-1 2+3+4 REC=14" 78%		
	Changes to no sand or roots					S-2 2+3+4 REC=18" 100%		
					5	S-3 5+3+4 REC=12" 67%		
	Changes to with sand, contains mica, multicolored	ML		C		S-4 4+5+6 REC=18" 100%		
					10			
	Changes to Sandy, white and brown					S-5 2+2+3 REC=4" 22%		
					15			
19.2	SILTY SAND, moist, brown and white, contains mica		353.8			S-6 7+7+8 REC=16" 89%		
		SM			20			
	Changes to white and gray					S-7 4+8+12 REC=16" 89%		
25.0			348.0		25			

Bottom of boring at 25.0 ft.

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_16.GDT 12/14/07

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: SWD2-B7
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: GEOMECHANICS, INC.
ELIZABETH, PENNSYLVANIA
Boring Foreman: Matt Hart
Schnabel Representative: P. Hutchins
Drilling Equipment: BK 51 Manual Track
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 8/6/07 **Finished:** 8/6/07
Station: 1290+75 **Offset:** +240

Ground Surface Elevation: 372.0± (ft) **Total Depth:** 25 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	8/6	3:34 PM	22.0'	23.5'	—
Completion ▽	8/6	3:35 PM	22.0'	23.5'	—
Casing Pulled ▽	8/6	3:46 PM	12.7'	—	14.0'
After Drilling ▽	8/7	7:35 AM	8.1'	—	9.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	TOPSOIL, 4 inches		371.7					
	SILTY SAND, moist, brown, contains roots	SM				S-1, SPT 2+4+6 REC=14" 78%	MC = 14.0%	0.0 ft: Residual 0.3 ft: USDA: LOAM
2.5	SILT, moist, light brown and orange, contains sand, roots		369.5			S-2, SPT 4+7+7 REC=14" 78%		
	Changes to no roots	ML			5	S-3, SPT 3+3+5 REC=12" 67%	PP = 1.0 tsf	5.0 ft: PP=1.0 TSF
8.5	SILTY SAND, moist, orangeish brown, contains mica		363.5			S-4, SPT 2+2+3 REC=18" 100%		
		SM		C	10			
13.5	SANDY SILT, moist, orangeish brown		358.5			S-5, SPT 2+2+3 REC=4" 22%		
	Changes to yellowish brown and white, contains mica	ML			15			
					20	S-6, SPT 3+3+4 REC=16" 89%		
	Changes to wet							
25.0			347.0		25	S-7, SPT 3+3+6 REC=18" 100%		

Bottom of boring at 25.0 ft.

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_16.GDT 12/6/07

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: SWD2-B8
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: GEOMECHANICS, INC.
ELIZABETH, PENNSYLVANIA
Boring Foreman: Matt Hart
Schnabel Representative: P. Hutchins
Drilling Equipment: BK 51 Manual Track
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 8/7/07 **Finished:** 8/7/07
Station: 1291+40 **Offset:** +140

Ground Surface Elevation: 379.0± (ft) **Total Depth:** 25 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/7	8:47 AM	Dry	—	—
Completion	8/7	8:47 AM	Dry	23.5'	—
Casing Pulled ▽	8/7	9:11 AM	18.0'	—	18.5'
After Drilling ▽	8/8	4:00 PM	13.0'	—	16.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.5	TOPSOIL, 6 inches		378.5			S-1, SPT 2+4+4 REC=18" 100%		0.0 ft: Residual
	SILT WITH SAND, moist, brown, contains roots							
	Changes to orangeish brown, contains sand, and rock fragments, trace organics	ML				S-2, SPT 4+6+8 REC=14" 78%		
5.0	SANDY SILT, moist, reddish orange, contains mica		374.0		5	S-3, SPT 5+5+6 REC=18" 100%		
	Changes to brown	ML				S-4, SPT 6+6+5 REC=14" 78%		8.5 ft: Iron stains/veins to 25-feet
13.5	SILTY SAND, moist, reddish orange		365.5	C	10			
					15	S-5, SPT 7+10+15 REC=18" 100%		
	Changes to orangeish brown	SM			20	S-6, SPT 6+8+10 REC=18" 100%		
25.0			354.0		25	S-7, SPT 6+10+11 REC=18" 100%		

Bottom of boring at 25.0 ft.
Boring offset 4-feet north from the staked location.

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_16.GDT 12/5/07

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: RDD2-B8
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: Connelly And Associates, Inc.
Frederick, Maryland
Boring Foreman: C Hanes
Schnabel Representative: B Glass
Drilling Equipment: Diedrich D-50 (Track)
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 8/7/07 **Finished:** 8/7/07
Station: 1297+00 **Offset:** -50

Ground Surface Elevation: 392.0± (ft) **Total Depth:** 8.6 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/7	10:40 AM	Dry	—	—
Completion	8/7	10:42 AM	Dry	—	—
Casing Pulled	8/7	10:45 AM	Dry	—	7.5'
After Drilling	8/9	—	Dry	—	8.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	TOPSOIL, 2 inches		391.8					
	DISINTEGRATED ROCK, sampled as silty sand, moist, brown; contains rock fragments and mica	DR		D		S-1, SPT 5+100/5" REC=9" (82%)		0.0 - 8.6 ft: Disintegrated Rock
						S-2, SPT 100/5" REC=3" (60%)		
	Changes to gray				5	S-3, SPT 100/1" REC=1" (100%)		5.0 ft: Shelby tube attempted at 5-feet but material was too dense
8.6	Bottom of boring at 8.6 ft. Auger refusal at 8.6 ft.		383.4			S-4, SPT 100/0.5" REC=0.5"		8.6 ft: Auger and spoon refusal

TEST BORING LOG SEGMENT D2.GPJ TEST 5-31-07.GPJ 12/10/07

SHA 73.0-46
8-25-2000

MARYLAND STATE HIGHWAY ADMINISTRATION
FOUNDATIONS BORING LOG

Sheet 1 of 1
Boring ____ of ____

Contract No. AT3765960 Project Description InterCounty Connector - Contract A: MD 355 to MD 97

Boring No. W-S-RB-025 Station/Offset 313+97.55 / 0.5 Right Coordinates N 531555 E 1283234

Boring By E2CR, Inc.

Surface Elevation 369.2 Date Started 4/13/06
Date Completed 4/13/06

Driller	Mark Knotts
Rig Type	Track Simco B-2000
Rig No.	-
Drive Hammer	140 LB.
Casing Auger Size	3.25 IN.
Size of Core	NA IN.
Size of Bit OD	NA IN.
Core Barrel Type	NA
Auger Depth	28.5

WATER TABLE

Depth Below Surface		Time (hours)	Date
Depth	Elev.		
▼ 4.5	364.7	0	4/13/06
▽ 2.5	366.7	24	4/14/06

Boring and Sampling Conforms to AASHTO:
T-206, T-207
T-225, T-306

DEPTH IN FEET	ELEV. IN FEET	MATERIAL DESCRIPTION	SPOON SAMPLE NO.	SPOON BLOWS	SPOON DEPTH	RECOVERY SPT (in) or Rock Core (%)	REMARKS
		Moist, Soft, Light Brown, SAND, Some Silt, Some Clay, Trace Gravel, Trace Organics ▽	S-1	2-2 2	0.0-1.5	10	NMC = 22.7%
3.5	365.68	(A-6)(5) [RS]	S-2	2-2 5	2.5-4.0	8	
		Moist, Medium Stiff, Mottled Light Brown and Light Gray, SILT, Little Sand, Trace Clay, Trace Organics, Low Mica	S-3	3-2 4	5.0-6.5	10	
		(a-4) [RS]	S-4	3-3 4	7.0-8.5	10	NMC = 27.9%
11.0	358.18	Sample S-5: Soft, Trace Fine Sand	S-5	2-2 2	9.0-10.5	8	
		Damp, Hard, Light Brown, SAND and SILT, Trace Clay	S-6	11-16 22	11.5-13.0	14	
		(A-4)(1) [RS]	S-7	18-28 32	14.0-15.5	16	CAVED @ 15.5 FT @ 24 HRS NMC = 11.9%
		Sample S-7: Light Brown, Light Gray and Black, Low Mica	S-8	18-22 50/4"	16.0-17.3	10	Water on Spoon at 16-ft
			S-9	7-20 17	18.5-20.0	6	
		Sample S-10: Brown and Black, Low Mica	S-10	17-30 38	23.5-25.0	9	NMC = 16.6%
26.0	343.18	COMPLETELY WEATHERED ROCK Sampled As:					
29.4	339.78	Damp, Hard, Brown and Black, SILT, Little Fine Sand, Low Mica (a-4) [RZ-1]	S-11	38-50/5"	28.5-29.4	11	
		Bottom of Boring @ 29.4 feet					

DEPTH	CASING BLOWS / FOOT
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MSHA BORING LOG DRAFT LOGS1.GPJ MARYLAND.GDT 8/11/06

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: RDD2-B7
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: Connelly And Associates, Inc.
Frederick, Maryland
Boring Foreman: C Hanes
Schnabel Representative: B Glass
Drilling Equipment: Diedrich D-50 (Track)
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 8/7/07 **Finished:** 8/7/07
Station: 1295+95 **Offset:** +50

Ground Surface Elevation: 368.0± (ft) **Total Depth:** 20 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/7	9:45 AM	Dry	---	---
Completion	8/7	9:50 AM	Dry	---	---
Casing Pulled ▽	8/7	9:55 AM	16.5'	---	17.5'
After Drilling ▽	8/9	8:00 AM	14.2'	---	17.2'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.1	TOPSOIL, 1 inch		367.9					
	SANDY SILT, moist, brown, contains roots					S-1, SPT 8+9+10 REC=14" (78%)		0.0 - 20.0 ft: Residual
	Changes to no roots, contains rock fragments, brownish-orange					S-2, SPT 7+10+11 REC=14" (78%)		
					5	S-3, SPT 7+9+9 REC=12" (67%)		
	Changes to no rock fragments	ML		C		S-4, SPT 4+5+9 REC=18" (100%)		
	Changes to contains mica ▽ ▽				10			
					15	S-5, SPT 9+15+22 REC=18" (100%)		
	Changes to gray and orangeish-brown					S-6, SPT 14+21+38 REC=16" (89%)		
20.0			348.0		20			

Bottom of boring at 20.0 ft.
Boring offset 5-feet west from the staked location..

TEST BORING LOG SEGMENT D2.GPJ TEST 5-31-07.GPJ 12/10/07

Schnabel Engineering | TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: RDD2-B9
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: GEOMECHANICS, INC.
ELIZABETH, PENNSYLVANIA
Boring Foreman: Matt Hart
Schnabel Representative: Kevin Bell
Drilling Equipment: BK 51 Manual Track
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 8/17/07 Finished: 8/17/07
Station: 1303+50 Offset: -50

Ground Surface Elevation: 396.0± (ft) Total Depth: 18.1 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/17	9:24 AM	Dry	—	—
Completion	8/17	9:24 AM	Dry	—	—
Casing Pulled	8/17	9:37 AM	Dry	—	14.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	TOPSOIL		395.7					
	LEAN CLAY, moist, yellowish brown, contains rock fragments, roots	CL				S-1 2+4+9 REC=9" 50%		0.0 - 4.5 ft: Residual
2.0	SILTY SAND, moist, reddish brown, contains rock fragments, mica	SM	394.0	C		S-2 9+19+22 REC=16" 89%		
4.5	DISINTEGRATED ROCK, sampled as silty sand, moist, reddish brown, contains rock fragments, mica	DR	391.5	D	5	S-3 29+39+32 REC=12" 67%		4.5 - 6.5 ft: Disintegrated Rock
6.5	SILTY SAND, fine to coarse grained sand, moist, yellowish brown, contains mica	SM	389.5	C	10	S-4 5+5+6 REC=18" 100%		6.5 - 17.5 ft: Residual 10.0 ft: Bag sample taken
					15	S-5 9+9+15 REC=12" 67%		
18.0			378.0					
18.1	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand, moist, gray, contains mica, rock fragments	DR	377.9	D		S-6 100/1" REC=1" 100%		17.5 - 18.0 ft: Rig chatter. 18.0 ft: Disintegrated Rock

Bottom of boring at 18.1 ft.
Auger refusal at 18.0 ft.

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_18.GDT 12/5/07

SHA 73.0-46
8-25-2000

MARYLAND STATE HIGHWAY ADMINISTRATION
FOUNDATIONS BORING LOG

Sheet 1 of 1
Boring ____ of ____

Contract No. AT3765960 Project Description InterCounty Connector - Contract A: MD 355 to MD 97

Boring No. W-S-RB-027 Station/Offset 323+50.58 / 1.9 Left Coordinates N 531460 E 1284182

Boring By E2CR, Inc

Surface Elevation 391.0 Date Started 3/28/06
Date Completed 3/28/06

Driller Tim Gray
Rig Type Track Simco B-2000
Rig No. -
Drive Hammer 140 LB.
Casing Auger Size 3.25 IN.
Size of Core NA IN.
Size of Bit OD NA IN.
Core Barrel Type NA
Auger Depth 28.5

WATER TABLE

Depth Below Surface		Time (hours)	Date
Depth	Elev.		
▼		DRY	3/28/06
▽		DRY	3/29/06

Boring and Sampling Conforms to AASHTO:
T-206, T-207
T-225, T-306

DEPTH IN FEET	ELEV. IN FEET	MATERIAL DESCRIPTION	SPOON SAMPLE NO.	SPOON BLOWS	SPOON DEPTH	RECOVERY SPT (in) or Rock Core (%)	REMARKS
		Damp, Medium Dense, Tan, Brown, Black and Light Gray, GRAVEL, Some Sand, Some Silt, Trace Clay	S-1	3-5 6	0.0-1.5	14	Bulk Sample Obtained from Auger Cuttings From 0 to 10-ft (A-4)(0) NMC = 3.9% 4-Inches Topsoil
		(A-2-4)(0)	S-2	15-22 32	2.0-3.5	15	
		[RS]	S-3	8-19 35	4.0-5.5 5.0	14	NMC = 7.8%
5.8	385.25	Sample S-2: Very Dense / Sample S-3: Very Dense	T-1		6.0-8.0	10	NMC = 4.6%
		Damp, Hard, SILT, Some Sand, Little Clay, Trace Gravel	S-4	13-28 22	8.5-10.0	8	NMC = 2.5%
		(A-5)(6)	S-5	14-24 49	11.0-12.5	10	
		[RS]					
		Sample S-6: Low Mica	S-6	17-21 30	13.5-15.0	12	
15.5	375.50						
		COMPLETELY WEATHERED ROCK Sampled As:	S-7	23-49 50/4"	16.0-17.3	12	NMC = 3.3%
		Damp, Hard, Light Gray and Light Brown, SILT, Trace Fine Sand, Low Mica	S-8	23-40 50/4"	18.5-19.8	12	
		(a-4)					
		[RZ-1]					
			S-9	24-40 45	23.5-25.0	16	CAVED @ 23-ft @ 24 HRS
29.9	361.10		S-10	25-38 50/5"	28.5-29.9	17	
		Bottom of Boring @ 29.9 feet					

DEPTH	CASING BLOWS / FOOT
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MSHA BORING LOG DRAFT LOGS1.GPJ MARYLAND.GDT 8/11/06

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: **SWD2-B9**
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: GEOMECHANICS, INC.
ELIZABETH, PENNSYLVANIA
Boring Foreman: Matt Hart
Schnabel Representative: Kevin Bell
Drilling Equipment: BK 51 Manual Track
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 8/17/07 Finished: 8/17/07
Station: 1303+00 Offset: +90

Ground Surface Elevation: 391.0± (ft) Total Depth: 22 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/17	8:08 AM	Dry	—	—
Completion	8/17	8:08 AM	Dry	—	—
Casing Pulled	8/17	8:40 AM	Dry	—	12.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	TOPSOIL, 4 inches		390.7					
	LEAN CLAY, moist, brown, contains rock fragments, roots, sand	CL		C		S-1 3+3+6 REC=16" 89%		0.0 - 2.0 ft: Residual
2.0	DISINTEGRATED ROCK, sampled as sandy lean clay, moist, brown, contains rock fragments, roots	DR	389.0	D		S-2 100/2" REC=1" 42%		1.9 ft: Rig chatter.
4.5	SILTY SAND, moist, reddish brown, contains mica	SM	386.5	C	5	S-3 12+10+15 REC=16" 89%		2.0 - 4.5 ft: Disintegrated Rock
					10	S-4 7+7+7 REC=14" 78%		4.5 - 12.0 ft: Residual
12.0	DISINTEGRATED ROCK, sampled as silty sand, moist, gray, contains rock fragments	DR	379.0	D	15	S-5 50+41+55 REC=17" 94%		12.0 - 22.0 ft: Disintegrated Rock
	Changes to reddish brown and banded black							12.5 ft: Rig chatter.
					20	S-6 100/2" REC=2" 100%		17.0 ft: Rig chatter/ auger grinding
22.0	Bottom of boring at 22.0 ft. Auger and spoon refusal at 22.0-feet.		369.0			S-7 REC=0"%		

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_16.GDT 12/5/07

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: SWD2-B10
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: GEOMECHANICS, INC.
ELIZABETH, PENNSYLVANIA
Boring Foreman: Matt Hart
Schnabel Representative: P. Hutchins
Drilling Equipment: BK 51 Manual Track
Drilling Method: 3-1/4" ID Hollow Stem Auger
Hammer Type: Safety Hammer (140 lb)
Dates Started: 8/16/07 **Finished:** 8/16/07
Station: 1303+75 **Offset:** +90
Ground Surface Elevation: 386.0± (ft) **Total Depth:** 25 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/16	3:40 PM	Dry	—	—
Completion	8/16	3:41 PM	Dry	18.5'	—
Casing Pulled	8/16	3:50 PM	Dry	—	18.5'
After Drilling	8/17	8:30 AM	Dry	—	18.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	TOPSOIL, 4 inches		385.7					0.0 ft: Residual
	SILT, moist, brown, contains sand, contains roots	ML				S-1, SPT 3+8+12 REC=11" 61%		
	Changes to brown and gray, no roots					S-2, SPT 10+15+31 REC=14" 78%		
	Changes to orange, contains rock fragments				5	S-3, SPT 8+8+10 REC=13" 72%		
8.5	SILTY SAND, moist, brownish orange and light yellow	SM	377.5	C	10	S-4, SPT 7+7+9 REC=14" 78%		
13.5	SANDY SILT, moist, yellowish orange and white	ML	372.5		15	S-5, SPT 7+8+10 REC=14" 78%		
18.5	SILTY SAND, moist, brown Changes to orange and white	SM	367.5		20	S-6A, SPT 12+16+16 REC=15" 83% S-6B, SPT		
25.0			361.0		25	S-7, SPT 10+11+20 REC=17" 94%		

Bottom of boring at 25.0 ft.
Boring offset 16-feet north from the staked location.
Elevation is 1.5-feet higher than the staked location.

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_16.GDT 12/5/07

SHA 73.0-46
8-25-2000

MARYLAND STATE HIGHWAY ADMINISTRATION
FOUNDATIONS BORING LOG

Sheet 1 of 1
Boring ____ of ____

Contract No. AT3765960 Project Description InterCounty Connector - Contract A: MD 355 to MD 97

Boring No. W-S-RB-028 Station/Offset 323+51.9 / 108.1 Right Coordinates N 531351 E 1284167

Boring By E2CR, Inc

Surface Elevation 382.0 Date Started 3/28/06
Date Completed 3/28/06

Driller	Tim Gray
Rig Type	Track Simco B-2000
Rig No.	-
Drive Hammer	140 LB.
Casing Auger Size	3.25 IN.
Size of Core	NA IN.
Size of Bit OD	NA IN.
Core Barrel Type	NA
Auger Depth	28.5

WATER TABLE

Depth Below Surface		Time (hours)	Date
Depth	Elev.		
▼ 21.5	360.5	0	3/28/06
▽ 18.0	364.0	24	3/29/06

Boring and Sampling Conforms to AASHTO:
T-206, T-207
T-225, T-306

DEPTH IN FEET	ELEV. IN FEET	MATERIAL DESCRIPTION	SPOON SAMPLE NO.	SPOON BLOWS	SPOON DEPTH	RECOVERY SPT (in) or Rock Core (%)	REMARKS
		Moist, Soft, Reddish-Brown, Sandy CLAY	S-1	2-1 2	0.0-1.5	8	4-Inches Topsoil
2.0	380.00	(a-6) [RS]					
			S-2	3-3 4	2.5-4.0	12	NMC = 16.8%
		Moist, Stiff, Red and Brown, SAND and SILT, Trace Clay, Trace Gravel, Trace Organics, Low Mica	S-3	5-6 7	5.0-6.5	16	
		(A-4)(0) [RS]	S-4	5-4 6	7.5-9.0	16	NMC = 23.6%
10.0	372.00	Sample S-2: Medium Stiff S-3: White, Brown and Black	S-5	4-4 5	10.0-11.5	18	NMC = 18.8%
		Moist, Loose, Red and Brown, SILT and SAND, Trace Clay, Trace Gravel	S-6	4-4 5	12.5-14.0	18	
		(A-4)(0)	T-1		15.0-17.0	24	NMC = 24.8%
		Sample S-7: Medium Dense ▽	S-7	4-6 7	17.0-18.5	18	NMC = 20%
		Sample S-8: Medium Dense ▼	S-8	4-5 8	18.5-20.0	18	
		Sample S-9: Medium Dense	S-9	3-5 7	23.5-25.0	18	
26.0	356.00						CAVED @ 25 FT @ 24 HRS
		Moist, Medium Dense, Red and Brown, SILT and SAND, Trace Clay, Trace Gravel					
		(A-4)(0)	S-10	4-6 9	28.5-30.0	18	NMC = 19.1%
30.0	352.00	[RS]					
		Bottom of Boring @ 30 feet					

DEPTH	CASING BLOWS / FOOT
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MSHA BORING LOG DRAFT LOGS1.GPJ MARYLAND.GDT 8/11/06

SHA 73.0-46
8-25-2000

MARYLAND STATE HIGHWAY ADMINISTRATION
FOUNDATIONS BORING LOG

Sheet 1 of 1
Boring ____ of ____

Contract No. AT3765960 Project Description InterCounty Connector - Contract A: MD 355 to MD 97

Boring No. W-S-RB-022 Station/Offset 316+26.37 / 83.4 Left Coordinates N 531694 E 1281932

Boring By E2CR, Inc.

Surface Elevation 406.7 Date Started 11/30/05
Date Completed 11/30/05

Driller	Ed Hill
Rig Type	Truck CME 55
Rig No.	-
Drive Hammer	140 LB.
Casing Auger Size	3.25 IN.
Size of Core	NA IN.
Size of Bit OD	NA IN.
Core Barrel Type	NA
Auger Depth	24

WATER TABLE

Depth Below Surface		Time (hours)	Date
Depth	Elev.		
▼ 20.7	386.0	0	11/30/05
▽ 21.9	384.8	24	12/1/05

Boring and Sampling Conforms to AASHTO:
T-206, T-207
T-225, T-306

DEPTH IN FEET	ELEV. IN FEET	MATERIAL DESCRIPTION	SPOON SAMPLE NO.	SPOON BLOWS	SPOON DEPTH	RECOVERY SPT (in) or Rock Core (%)	REMARKS
		Moist, Soft, Brown, SILT, Some Sand, Some Clay, Trace Gravel, Little Root Fragments	S-1	2-2 2	0.1 0.0-1.5	8	NMC = 20.7% NMC = 24.3%
		(A-6)(10) [RS] Sample S-2: Stiff	S-2	5-5 6	3.0-4.5	15	4-Inches Topsoil Bulk Sample Obtained From Auger Cuttings From 0 To 10-ft (A-6)(10)
			T-1		5.0-7.0	24	NMC = 24.8%
9.0	397.72						
		Damp, Loose, Tan, Reddish Brown and Black, Silty SAND, Little Sand, Little Clay	S-3	1-2 3	9.0-10.5	18	
12.0	394.72	(a-2-4) [RS]	S-4	2-3 4	12.0-13.5	18	NMC = 41.8%
		Damp, Medium Stiff, Reddish Brown and Black, SILT, Some to And Sand, Trace Clay	S-5	2-3 5	15.0-16.5	18	
		(A-5)(8) [RS]	T-2		17.0-19.0	24	NMC = 34.9%
		▼ ▽ Sample S-6: Stiff, Brown, Gray and Black, Trace Clay	S-6	4-4 6	21.0-22.5	18	CAVED @ 21.8 FT @ 0 HR CAVED @ 23.2 FT @ 21 HRS
25.5	381.22	Sample S-7: Very Stiff, Brown, Reddish Brown and Black	S-7	4-6 10	24.0-25.5	18	Moisture on Spoon at 25-ft
		Bottom of Boring @ 25.5 feet					

DEPTH	CASING BLOWS / FOOT
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MSHA BORING LOG ICC ALL.GPJ MARYLAND.GDT 6/24/06

SHA 73.0-46
8-25-2000

MARYLAND STATE HIGHWAY ADMINISTRATION
FOUNDATIONS BORING LOG

Sheet 1 of 1
Boring ____ of ____

Contract No. AT3765960 Project Description InterCounty Connector - Contract A: MD 355 to MD 97

Boring No. W-S-RB-023 Station/Offset 316+37.71 / 21.2 Right Coordinates N 531589 E 1281939

Boring By E2CR, Inc.

Surface Elevation 413.9 Date Started 11/30/05
Date Completed 11/30/05

Driller	Ed Hill
Rig Type	Truck CME 55
Rig No.	-
Drive Hammer	140 LB.
Casing Auger Size	3.25 IN.
Size of Core	NA IN.
Size of Bit OD	NA IN.
Core Barrel Type	NA
Auger Depth	24

WATER TABLE

Depth Below Surface		Time (hours)	Date
Depth	Elev.		
▼		DRY	11/30/05
▽		DRY	12/1/05

Boring and Sampling Conforms to AASHTO:
T-206, T-207
T-225, T-306

DEPTH IN FEET	ELEV. IN FEET	MATERIAL DESCRIPTION	SPOON SAMPLE NO.	SPOON BLOWS	SPOON DEPTH	RECOVERY SPT (In) or Rock Core (%)	REMARKS
		Damp, Very Loose, Brown, Silty SAND, Trace Root Fragments	S-1	2-1 2	0.0-1.5	18	NMC = 20.3% 4-Inches Topsoil
		(a-4)					
		[RS]	S-2	3-4 3	2.5-4.0	13	Bulk Sample Obtained from Auger Cuttings from 0 to 10-ft (A-6)(10)
5.5	408.37	Sample S-2: Loose, Brown, Reddish Brown and Black, Trace Gravel					
		Damp, Stiff, Reddish Brown and Black, SILT, Some Sand, Trace Clay	T-1		5.5-7.5	24	
		(A-4)(0)	S-3	3-5 5	7.5-9.0	12	
		[RS]	S-4	4-8 10	10.0-11.5	16	NMC = 15.3%
		Sample S-4: Very Stiff					
		Sample S-5: Very Stiff	S-5	5-7 10	14.0-15.5	18	
			T-2		16.0-18.0	17	NMC = 23.6%
		Sample S-6: Very Stiff	S-6	4-7 13	19.0-20.5	18	
							DRY AND CAVED @ 22.8 FT @ 24 HRS
25.5	388.37	Sample S-7: Very Stiff	S-7	8-11 14	24.0-25.5	18	NMC = 23.5%
		Bottom of Boring @ 25.5 feet					

DEPTH	CASING BLOWS / FOOT
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MSHA BORING LOG ICC ALL.GPJ MARYLAND.GDT 6/24/06

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: RDD2-B3B
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: CONNELLY AND ASSOCIATES, INC.
FREDERICK, MARYLAND

Boring Foreman: Cody Hanes

Schnabel Representative: P. Hutchins

Drilling Equipment: Diedrich D-50 (ATV)

Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)

Dates Started: 8/6/07 **Finished:** 8/6/07

Station: 1280+50 **Offset:** +50

Ground Surface Elevation: 410.0± (ft) **Total Depth:** 20 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/6	9:00 AM	Dry	—	—
Completion	8/6	9:20 AM	Dry	18.5'	—
Casing Pulled	8/6	9:30 AM	Dry	—	16.0'
After Drilling	8/7	—	Dry	—	16.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	TOPSOIL, 2 inches		409.8					0.0 ft: Residual
	SILTY ROCK FRAGMENTS, moist, brown, contains roots	GM				S-1, SPT 6+9+12 REC=8" 44%		
2.5	SILTY SAND, moist, orangeish brown and gray, contains rock fragments, roots		407.5			S-2, SPT 12+16+15 REC=18" 100%		
	Changes to brown and gray, trace rock fragments	SM		C	5	S-3, SPT 12+15+22 REC=10" 56%		
					10	S-4, SPT 9+16+20 REC=10" 56%		
13.5	DISINTEGRATED ROCK, sampled as silty sand, moist, brown and gray, contains rock fragments, trace mica	DR	396.5	D	15	S-5, SPT 8+23+47 REC=16" 89%		13.5 ft: Disintegrated Rock
18.5	SILTY ROCK FRAGMENTS, moist, brown and gray	GM	391.5	C				18.5 ft: Residual
20.0			390.0		20	S-6, SPT 7+8+10 REC=7" 39%		

Bottom of boring at 20.0 ft.
Boring offset northwest from the staked location.

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_16.GDT 12/5/07

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: RDD2-B4
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: CONNELLY AND ASSOCIATES, INC.
FREDERICK, MARYLAND
Boring Foreman: Cody Hanes
Schnabel Representative: Brandon Glass
Drilling Equipment: Diedrich D-50 (ATV)
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 8/6/07 **Finished:** 8/6/07
Station: 1283+00 **Offset:** +52

Ground Surface Elevation: 412.0± (ft) **Total Depth:** 30 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/6	12:00 AM	Dry	—	—
Completion	8/6	10:45 AM	Dry	—	—
Casing Pulled	8/6	10:53 AM	Dry	—	27.0'
After Drilling	8/7	2:13 PM	Dry	—	26.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.1	TOPSOIL, 1 inch		411.9					
	SILT, moist, brown, contains sand, rock fragments	ML				S-1 3+5+6 REC=6" 33%		0.0 ft: Residual
						S-2 3+6+8 REC=8" 44%		
					5	S-3 4+7+12 REC=8" 44%	MC = 7.9%	
7.0	SILTY SAND, brown, trace rock fragments, (A-5)	SM	405.0	C				7.0 ft: Bag Sample from 7 to 12-feet
					10	S-4 4+9+11 REC=14" 78%	LL = 42 PL = 33 MC = 11.2%	
					15	S-5 11+12+24 REC=18" 100%		13.7 ft: 3" gray rock fragment layer at 13.7'-13.9'
19.0	DISINTEGRATED ROCK, sampled as silt, moist, brown, contains mica	DR	393.0	D	20	S-6 19+43+45 REC=18" 100%		19.0 ft: Disintegrated Rock
	Changes to gray				25	S-7 100/5" REC=5" 100%		
30.0			382.0		30	S-8 41+100/3" REC=7" 78%		

Bottom of boring at 30.0 ft.
Boring offset 2.0-feet south of staked location.

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_16.GDT 12/5/07

Schnabel Engineering

TEST BORING LOG

Project: Intercounty Connectors - Contract A
Segment D2
Montgomery County, Maryland

Boring Number: RDD2-B6
Contract Number: 07120080.D2
Sheet: 1 of 1

Boring Contractor: GEOMECHANICS, INC.
ELIZABETH, PENNSYLVANIA
Boring Foreman: Matt Hart
Schnabel Representative: P. Hutchins
Drilling Equipment: BK 51 Manual Track
Drilling Method: 3-1/4" ID Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 8/7/07 **Finished:** 8/7/07
Station: 1292+50 **Offset:** -25

Ground Surface Elevation: 396.0± (ft) **Total Depth:** 15 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/7	9:59 AM	Dry	—	—
Completion	8/7	10:00 AM	Dry	13.5'	—
Casing Pulled	8/7	10:07 AM	Dry	—	9.5'
After Drilling	8/8	4:10 PM	Dry	—	7.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	TOPSOIL, 4 inches		395.7					0.0 ft: Residual
	SANDY SILT, moist, brown, contains rock fragments	ML				S-1, SPT 2+4+9 REC=14" 78%		
	Changes to reddish orange, no rock fragments					S-2, SPT 6+6+8 REC=13" 72%		
5.0	SANDY FAT CLAY, dark brown, (A-7-6)	CH	391.0	C	5	S-3, SPT 5+6+9 REC=13" 72%	LL = 55 PL = 25 MC = 21.2%	5.0 ft: Iron veins/stains to 15-feet 6.0 ft: Bag sample from 5 to 10-feet
					10	S-4, SPT 4+4+6 REC=18" 100%	MC = 29.1%	
13.5	DISINTEGRATED ROCK, sampled as silt, moist, orange and green	DR	382.5	D				13.5 ft: Disintegrated Rock
15.0			381.0		15	S-5, SPT 15+38+50 REC=16" 89%		

Bottom of boring at 15.0 ft.
Boring offset 3-feet southwest from the staked location.

TEST BORING LOG SEGMENT D2.GPJ SCHNABEL DATA TEMPLATE 2007_10_16.GDT 12/5/07

APPENDIX E

BMP SIZING COMPUTATIONS

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 11/28/2007

Location Montgomery County Checked PS Date 11/29/2007

Contract A- Proposed Conditions DA SS-D1-A

1. Runoff Curve Number (CN)

Soil name and hydrologic group	Cover Description		CN			Area	Product of CN x area
(Appendix A)	No.		Table 2-2	Figure 2-3	Figure 2-4	(acres)	
		INSIDE RIGHT OF WAY					
B	3	Open Space (good) - grass >75%	61			3.05	186.1
B	4	Imperv. - paved parking lots,roofs,drives	98			3.38	331.2
B	65	Woods - (good)	55			0.41	22.6
C	3	Open Space (good) - grass >75%	74			0	
C	4	Imperv. - paved parking lots,roofs,drives	98			0	
C	65	Woods - (good)	70			0	
D	3	Open Space (good) - grass >75%	80			0.25	20.0
D	4	Imperv. - paved parking lots,roofs,drives	98			0.40	39.2
D	65	Woods - (good)	77			0	
		OUTSIDE RIGHT OF WAY					
					Totals =	7.49	599.0

0.01170 mi^2

CN (weighted) = total product / total area = 599.0 / 7.49 = 80.0 Use CN = 80

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	1.0	3.0	4.9

S=(1000/CN)-10

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 11/28/2007

Location Montgomery County Checked PS Date 11/29/2007

Contract A- Proposed Conditions DA SS-D1-B

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	3	Open Space (good) - grass >75%	61			2.07	126.3
B	4	Imperv. - paved parking lots,roofs,drives	98			2.48	243.0
B	65	Woods - (good)	55			0.03	1.7
C	3	Open Space (good) - grass >75%	74			0	
C	4	Imperv. - paved parking lots,roofs,drives	98			0	
C	65	Woods - (good)	70			0	
D	3	Open Space (good) - grass >75%	80			0.45	36.0
D	4	Imperv. - paved parking lots,roofs,drives	98			0.05	4.9
D	65	Woods - (good)	77			0.01	0.8
		OUTSIDE RIGHT OF WAY					
					Totals =	5.09	412.6

0.00795 mi^2

CN (weighted) = total product / total area = 412.6 / 5.09 = 81.1 Use CN = 81

2. Runoff

Storm #1	Storm #2	Storm #3
1	10	100
2.6	5.1	7.2
1.0	3.1	5.0

Frequency. . . . . Yr

Rainfall, P (24-hour) . . . . . In

Runoff, $Q = (P-0.2S)^2/(P+0.8S)$. . . . . In

$S=(1000/CN)-10$

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 11/28/2007

Location Montgomery County Checked PS Date 11/29/2007

Contract A- Proposed Conditions DA SS-D1-C

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	3	Open Space (good) - grass >75%	61			0.24	14.6
B	4	Imperv. - paved parking lots,roofs,drives	98			0.08	7.8
B	65	Woods - (good)	55			0	
C	3	Open Space (good) - grass >75%	74			0.35	25.9
C	4	Imperv. - paved parking lots,roofs,drives	98			0.06	5.9
C	65	Woods - (good)	70				
D	3	Open Space (good) - grass >75%	80				
D	4	Imperv. - paved parking lots,roofs,drives	98				
D	65	Woods - (good)	77				
		OUTSIDE RIGHT OF WAY					
		Totals =				0.73	54.3

0.00114 mi^2

CN (weighted) = total product / total area = 54.3 / 0.73 = 74.3 Use CN = 74

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	0.7	2.4	4.2

S=(1000/CN)-10

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 11/28/2007

Location Montgomery County Checked PS Date 11/29/2007

Contract A- Proposed Conditions DA SS-D1-D

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	3	Open Space (good) - grass >75%	61			0.27	16.5
B	4	Imperv. - paved parking lots,roofs,drives	98			0.53	51.9
B	65	Woods - (good)	55			0	
C	3	Open Space (good) - grass >75%	74			0.17	12.6
C	4	Imperv. - paved parking lots,roofs,drives	98			0.55	53.9
C	65	Woods - (good)	70			0	
D	3	Open Space (good) - grass >75%	80			0	
D	4	Imperv. - paved parking lots,roofs,drives	98			0.22	21.6
D	65	Woods - (good)	77			0	
		OUTSIDE RIGHT OF WAY					
		Totals =				1.74	156.5

0.00272 mi^2

CN (weighted) = total product / total area = 156.5 / 1.74 = 89.9 Use CN = 90

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	1.6	4.0	6.0

S=(1000/CN)-10

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 11/28/2007

Location Montgomery County Checked PS Date 11/29/2007

Contract A- Proposed Conditions DA SS-D1-E

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	3	Open Space (good) - grass >75%	61			0.26	15.9
B	4	Imperv. - paved parking lots,roofs,drives	98			0.55	53.9
B	65	Woods - (good)	55			0	
C	3	Open Space (good) - grass >75%	74			0.1	7.4
C	4	Imperv. - paved parking lots,roofs,drives	98			0.55	53.9
C	65	Woods - (good)	70			0	
D	3	Open Space (good) - grass >75%	80			0.00	
D	4	Imperv. - paved parking lots,roofs,drives	98			0.30	29.4
D	65	Woods - (good)	77			0	
		OUTSIDE RIGHT OF WAY					
					Totals =	1.76	160.5
						0.00275 mi^2	

CN (weighted) = total product / total area = 160.5 / 1.76 = 91.2 Use CN = 91

2. Runoff

Storm #1	Storm #2	Storm #3
1	10	100
2.6	5.1	7.2
1.7	4.1	6.1

Frequency. . . . . Yr

Rainfall, P (24-hour) . . . . . In

Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In

S=(1000/CN)-10

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 11/28/2007

Location Montgomery County Checked PS Date 11/29/2007

Contract A- Proposed Conditions DA SS-D1-F

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	3	Open Space (good) - grass >75%	61			0.32	19.5
B	4	Imperv. - paved parking lots,roofs,drives	98			0.1	9.8
B	65	Woods - (good)	55			0	
C	3	Open Space (good) - grass >75%	74			0	
C	4	Imperv. - paved parking lots,roofs,drives	98			0	
C	65	Woods - (good)	70			0	
D	3	Open Space (good) - grass >75%	80			0.01	0.8
D	4	Imperv. - paved parking lots,roofs,drives	98			0.01	1.0
D	65	Woods - (good)	77			0	
		OUTSIDE RIGHT OF WAY					
		Totals =				0.44	31.1

0.00069 mi^2

CN (weighted) = total product / total area = 31.1 / 0.44 = 70.7 Use CN = 71

2. Runoff

Storm #1	Storm #2	Storm #3
1	10	100
2.6	5.1	7.2
0.5	2.2	3.9

Frequency. . . . . Yr

Rainfall, P (24-hour) . . . . . In

Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In

S=(1000/CN)-10

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 11/28/2007

Location Montgomery County Checked PS Date 11/29/2007

Contract A- Proposed Conditions DA SS-D1-G

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	3	Open Space (good) - grass >75%	61			0.39	23.8
B	4	Imperv. - paved parking lots,roofs,drives	98			0.76	74.5
B	65	Woods - (good)	55			0	
C	3	Open Space (good) - grass >75%	74			0	
C	4	Imperv. - paved parking lots,roofs,drives	98			0	
C	65	Woods - (good)	70			0	
D	3	Open Space (good) - grass >75%	80			0.13	10.4
D	4	Imperv. - paved parking lots,roofs,drives	98			0.36	35.3
D	65	Woods - (good)	77			0	
		OUTSIDE RIGHT OF WAY					
		Totals =				1.64	144.0

0.00256 mi^2

CN (weighted) = total product / total area = 144.0 / 1.64 = 87.8 Use CN = 88

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, $Q = (P-0.2S)^2/(P+0.8S)$. . . . . In	1.5	3.8	5.8

S=(1000/CN)-10

Worksheet 2: Runoff curve number and runoff

Project ICC-CONTRACT A By CZJ Date 11/28/2007

Location Montgomery County Checked PS Date 11/29/2007

Contract A- Proposed Conditions DA SS-D1-H

1. Runoff Curve Number (CN)

Soil name and hydrologic group (Appendix A)	Cover Description No.		CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area (acres)	Product of CN x area
		INSIDE RIGHT OF WAY					
B	3	Open Space (good) - grass >75%	61			0.33	20.1
B	4	Imperv. - paved parking lots,roofs,drives	98			1.06	103.9
B	65	Woods - (good)	55			0	
C	3	Open Space (good) - grass >75%	74			0	
C	4	Imperv. - paved parking lots,roofs,drives	98			0	
C	65	Woods - (good)	70			0	
D	3	Open Space (good) - grass >75%	80			0.00	
D	4	Imperv. - paved parking lots,roofs,drives	98			0.39	38.2
D	65	Woods - (good)	77			0	
		OUTSIDE RIGHT OF WAY					
					Totals =	1.78	162.2

0.00278 mi^2

CN (weighted) = total product / total area = 162.2 / 1.78 = 91.1 Use CN = 91

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency. . . . . Yr	1	10	100
Rainfall, P (24-hour) . . . . . In	2.6	5.1	7.2
Runoff, Q = $(P-0.2S)^2/(P+0.8S)$. . . . . In	1.7	4.1	6.1

S=(1000/CN)-10

STORMWATER SIZING CRITERIA

Project ICC DESIGN BUILD - A By CZJ Date 1/20/2008
J.O. D1D2 FINAL Checked PS Date 1/25/2008

Recharge Volume (Re_v)							
Drainage Area	Total area (ac)	Soil "A" Area (ac)	Soil "B" Area (ac)	Soil "C" Area (ac)	Soil "D" Area (ac)	Recharge Factor (S)	Rev* (cf)
SS-D1-A	7.49		6.81	0.00	0.66	0.24	3313
SS-D1-B	5.09		4.58	0.00	0.51	0.24	2205
SS-D1-C	0.73		0.32	0.41	0.00	0.19	110
SS-D1-D	1.74		0.79	0.71	0.22	0.18	815
SS-D1-E	1.76		0.81	0.65	0.30	0.18	870
SS-D1-F	0.44		0.42	0.00	0.03	0.25	111
SS-D1-G	1.64		1.15	0.00	0.49	0.20	792
SS-D1-H	1.77		1.39	0.00	0.39	0.22	1100
BR20	1.24		1.24			0.26	1112
BR21	0.99		0.99			0.26	888

*Percent Volume Method

LINEAR SAND FILTERS

STATION LIMIT						REMARKS
FROM	TO	OFFSET	LT/RT	WIDTH (FT)	LENGTH (FT)	
1280+98	1282+98	83'	LT	4	200	
1280+98	1282+98	0'	MEDIAN	4	200	
1280+98	1282+98	83'	RT	4	200	
1290+88	1291+98	83'	LT	4	110	
1290+88	1291+98	0'	MEDIAN	4	110	
1290+88	1291+98	83'	RT	4	110	
1295+16	1296+16	83'	LT	4	100	
1296+60	1297+60	83'	LT	4	100	
1302+78	1303+78	83'	LT	4	100	
1303+20	1305+20	0'	MEDIAN	4	200	
1304+30	1306+30	83'	RT	4	200	

LINEAR SAND STORAGE BMPs

STATION LIMIT						
FROM	TO	OFFSET	LT/RT	WIDTH	LENGTH (FT)	BMP NO.
1296+16	1296+60	83'	LT	8	44	D1-C
1295+26	1297+26	0'	MEDIAN	10	200	D1-D
1294+12	1295+12	83'	RT	10	100	D1-E1
1295+55	1296+55	83'	RT	10	100	D1-E2
1295+02	1295+22	83'	LT	8	20	D1-F
1301+70	1303+20	0'	MEDIAN	11	150	D1-G
1302+52	1304+27	83'	RT	12	175	D1-H

CHANNEL PROTECTION SIZING CRITERIA

Project	ICC DESIGN BUILD - A	By	CZJ	Date	1/20/2008
J.O.	D1D2 FINAL	Checked	PS	Date	1/25/2008

Drainage Area SS-D1-A

Time of Concentration (t_c) =	0.10 hrs. (TR-55)
1-yr post-development runoff depth (Q_a) =	1 in. (TR-55)
1-yr rainfall depth (P) =	2.6 in. (Table 3.B.1)
Runoff Coefficient Number (CN) =	80 (TR-55)
Drainage Area =	0.01170 mi^2

Initial Abstraction (I_a)

I_a = 200/CN - 2 = 0.50

I_a/P = 0.19

Post-development Peak Discharge (q_i)

Unit peak factor (q_u) = 970 csm/in (Fig. D.11.1)

$q_i = q_u A Q_a$ = 11.35 cfs

q_o/q_i (T = 12 hrs.) = 0.038 (from Fig. D.11.2)

$q_o = q_o/q_i \times q_i$ = 0.43 cfs

Extended Detention Storage Volume (V_s)

$$V_s/V_r = 0.683 - 1.43(q_o/q_i) + 1.64(q_o/q_i)^2 - 0.804(q_o/q_i)^3$$

V_s/V_r = 0.63

$V_s = V_s/V_r \times V_r$ = 0.39 ac.-ft (17156 cf) (Note: Vr = Qa)

Storage depth for the Extended Detention Volume = 8.00 ft.
See TR-20 analysis for SP D-1-1 for storage computations.
Therefore, the required orifice area (A_o) for extended detention design is:

$A_o = q_o/(4.81 \times h_o^{1/2})$ 0.03 $ft.^2$

The maximum orifice diameter (d_o) is therefore:

$d_o = (4 \times A_o / \pi)^{1/2}$ 0.20 ft. (2.41 in.) *Use 3 in.

CHANNEL PROTECTION SIZING CRITERIA

Project	ICC DESIGN BUILD - A	By	CZJ	Date	1/20/2008
J.O.	D1D2 FINAL	Checked	PS	Date	1/25/2008

Drainage Area SS-D1-B

Time of Concentration (t_c) =	0.1 hrs. (TR-55)
1-yr post-development runoff depth (Q_a) =	1.00 in. (TR-55)
1-yr rainfall depth (P) =	2.6 in. (Table 2-2)
Runoff Coefficient Number (CN) =	81 (TR-55)
Drainage Area =	0.00795 mi^2

Initial Abstraction (I_a)

I_a = 200/CN - 2 = 0.47

I_a/P = 0.18

Post-development Peak Discharge (q_i)

Unit peak factor (q_u) = 980 csm/in (Fig. D.11.1)

$q_i = q_u A Q_a$ = 7.79 cfs

Peak Outflow Discharge (q_o)

q_o/q_i (T = 12 hrs.) = 0.038 (from Fig. D.11.2)

$q_o = q_o/q_i \times q_i$ = 0.30 cfs

Extended Detention Storage Volume (V_s)

$$V_s/V_r = 0.683 - 1.43(q_o/q_i) + 1.64(q_o/q_i)^2 - 0.804(q_o/q_i)^3$$

V_s/V_r = 0.63

$V_s = V_s/V_r \times V_r$ = 0.27 ac.-ft (11659 cf) (Note: Vr = Qa)

Storage depth for the Extended Detention Volume = 6.50 ft.
See TR-20 analysis for SP D-1-1 for storage computations.
Therefore, the required orifice area (A_o) for extended detention design is:

$A_o = q_o/(4.81 \times h_o^{1/2})$ 0.02 $ft.^2$

The maximum orifice diameter (d_o) is therefore:

$d_o = (4 \times A_o / \pi)^{1/2}$ 0.18 ft. (2.10 in.) *Use 3 in.

CHANNEL PROTECTION SIZING CRITERIA

Project	ICC DESIGN BUILD - A	By	CZJ	Date	1/20/2008
J.O.	D1D2 FINAL	Checked	PS	Date	1/25/2008

Drainage Area SS-D1-C

Time of Concentration (t_c) =	0.10 hrs. (TR-55)
1-yr post-development runoff depth (Q_a) =	0.70 in. (TR-55)
1-yr rainfall depth (P) =	2.6 in. (Table 2-2)
Runoff Coefficient Number (CN) =	74.0 (TR-55)
Drainage Area =	0.00114 mi^2

Initial Abstraction (I_a)

I_a = 200/CN - 2 = 0.70

I_a/P = 0.27

Post-development Peak Discharge (q_i)

Unit peak factor (q_u) = 950 csm/in (Fig. D.11.1)

$q_i = q_u A Q_a$ = 0.76 cfs

Peak Outflow Discharge (q_o)

q_o/q_i (T = 12 hrs.) = 0.038 (from Fig. D.11.2)

$q_o = q_o/q_i \times q_i$ = 0.03 cfs

Extended Detention Storage Volume (V_s)

$V_s/V_r = 0.683 - 1.43(q_o/q_i) + 1.64(q_o/q_i)^2 - 0.804(q_o/q_i)^3$

V_s/V_r = 0.63

$V_s = V_s/V_r \times V_r$ = 0.03 ac.-ft (1170 cf) (Note: Vr = Qa)

Storage depth for the Extended Detention Volume: 6.83 ft Ponding: 1 ft.
Storage Volume = 1314 cf
Therefore, the required orifice area (A_o) for extended detention design is:

$A_o = q_o/(4.81 \times h_o^{1/2})$ 0.002 $ft.^2$

The maximum orifice diameter (d_o) is therefore:

$d_o = (4 \times A_o / \pi)^{1/2}$ 0.05 ft. (0.66 in.) Use 1 in.

CHANNEL PROTECTION SIZING CRITERIA

Project	ICC DESIGN BUILD - A	By	CZJ	Date	1/20/2008
J.O.	D1D2 FINAL	Checked	PS	Date	1/25/2008

Drainage Area SS-D1-D

Time of Concentration (t_c) =	0.10 hrs. (TR-55)
1-yr post-development runoff depth (Q_a) =	1.6 in. (TR-55)
1-yr rainfall depth (P) =	2.6 in. (Table 2-2)
Runoff Coefficient Number (CN) =	90 (TR-55)
Drainage Area =	0.00272 mi^2

Initial Abstraction (I_a)

I_a = 200/CN - 2 = 0.22

I_a/P = 0.09

Post-development Peak Discharge (q_i)

Unit peak factor (q_u) = 1000 csm/in (Fig. D.11.1)

$q_i = q_u A Q_a$ = 4.35 cfs

Peak Outflow Discharge (q_o)

q_o/q_i (T = 12 hrs.) = 0.038 (from Fig. D.11.2)

$q_o = q_o/q_i \times q_i$ = 0.17 cfs

Extended Detention Storage Volume (V_s)

$$V_s/V_r = 0.683 - 1.43(q_o/q_i) + 1.64(q_o/q_i)^2 - 0.804(q_o/q_i)^3$$

V_s/V_r = 0.63

$V_s = V_s/V_r \times V_r$ = 0.15 ac.-ft (6377 cf) (Note: Vr = Qa)

Storage depth for the Extended Detention Volume: 6.83 ft Ponding: 1 ft.
Storage Volume = 7464 cf
Therefore, the required orifice area (A_o) for extended detention design is:

$A_o = q_o/(4.81 \times h_o^{1/2})$ 0.01 $ft.^2$

The maximum orifice diameter (d_o) is therefore:

$d_o = (4 \times A_o / \pi)^{1/2}$ 0.12 ft. (1.49 in.) Use 1.5 in.

CHANNEL PROTECTION SIZING CRITERIA

Project	ICC DESIGN BUILD - A	By	CZJ	Date	1/20/2008
J.O.	D1D2 FINAL	Checked	PS	Date	1/25/2008

Drainage Area SS-D1-E

Time of Concentration (t_c) =	0.1	hrs. (TR-55)
1-yr post-development runoff depth (Q_a) =	1.7	in. (TR-55)
1-yr rainfall depth (P) =	2.6	in. (Table 2-2)
Runoff Coefficient Number (CN) =	91	(TR-55)
Drainage Area =	0.00275	mi^2

Initial Abstraction (I_a)

I_a = 200/CN - 2 = 0.20

I_a/P = 0.08

Post-development Peak Discharge (q_i)

Unit peak factor (q_u) = 1000 csm/in (Fig. D.11.1)

$q_i = q_u A Q_a$ = 4.68 cfs

Peak Outflow Discharge (q_o)

q_o/q_i (T = 12 hrs.) = 0.038 (from Fig. D.11.2)

$q_o = q_o/q_i \times q_i$ = 0.18 cfs

Extended Detention Storage Volume (V_s)

$$V_s/V_r = 0.683 - 1.43(q_o/q_i) + 1.64(q_o/q_i)^2 - 0.804(q_o/q_i)^3$$

V_s/V_r = 0.63

$V_s = V_s/V_r \times V_r$ = 0.16 ac.-ft (6853 cf) (Note: Vr = Qa)

Storage depth for the Extended Detention Volume: 6.83 ft Ponding: 1 ft.
Storage Volume = 7464 cf
Therefore, the required orifice area (A_o) for extended detention design is:

$A_o = q_o/(4.81 \times h_o^{1/2})$ 0.01 $ft.^2$

The maximum orifice diameter (d_o) is therefore:

$d_o = (4 \times A_o / \pi)^{1/2}$ 0.13 ft. (1.55 in.) Use 1.5 in.

CHANNEL PROTECTION SIZING CRITERIA

Project	ICC DESIGN BUILD - A	By	CZJ	Date	1/20/2008
J.O.	D1D2 FINAL	Checked	PS	Date	1/25/2008

Drainage Area SS-D1-F

Time of Concentration (t_c) =	0.1 hrs. (TR-55)
1-yr post-development runoff depth (Q_a) =	0.5 in. (TR-55)
1-yr rainfall depth (P) =	2.6 in. (Table 2-2)
Runoff Coefficient Number (CN) =	71 (TR-55)
Drainage Area =	0.00069 mi^2

Initial Abstraction (I_a)

I_a = 200/CN - 2 = 0.82

I_a/P = 0.31

Post-development Peak Discharge (q_i)

Unit peak factor (q_u) = 930 csm/in (Fig. D.11.1)

$q_i = q_u A Q_a$ = 0.32 cfs

Peak Outflow Discharge (q_o)

q_o/q_i (T = 12 hrs.) = 0.038 (from Fig. D.11.2)

$q_o = q_o/q_i \times q_i$ = 0.01 cfs

Extended Detention Storage Volume (V_s)

$$V_s/V_r = 0.683 - 1.43(q_o/q_i) + 1.64(q_o/q_i)^2 - 0.804(q_o/q_i)^3$$

V_s/V_r = 0.63

$V_s = V_s/V_r \times V_r$ = 0.01 ac.-ft (504 cf) (Note: Vr = Qa)

Storage depth for the Extended Detention Volume: 6.83 ft Ponding: 1 ft.
Storage Volume = 597 cf
Therefore, the required orifice area (A_o) for extended detention design is:

$A_o = q_o/(4.81 \times h_o^{1/2})$ 0.00 $ft.^2$

The maximum orifice diameter (d_o) is therefore:

$d_o = (4 \times A_o / \pi)^{1/2}$ 0.03 ft. (0.40 in.) Use 1 in.

CHANNEL PROTECTION SIZING CRITERIA

Project	ICC DESIGN BUILD - A	By	CZJ	Date	1/20/2008
J.O.	D1D2 FINAL	Checked	PS	Date	1/25/2008

Drainage Area SS-D1-G

Time of Concentration (t_c) =	0.10 hrs. (TR-55)
1-yr post-development runoff depth (Q_a) =	1.50 in. (TR-55)
1-yr rainfall depth (P) =	2.6 in. (Table 3.B.1)
Runoff Coefficient Number (CN) =	88 (TR-55)
Drainage Area =	0.00256 mi^2

Initial Abstraction (I_a)

$I_a = 200/CN - 2 =$ 0.27

$I_a/P =$ 0.10

Post-development Peak Discharge (q_i)

Unit peak factor (q_u) = 1000 csm/in (Fig. D.11.1)

$q_i = q_u A Q_a =$ 3.84 cfs

q_o/q_i (T = 24 hrs.) = 0.038 (from Fig. D.11.2)

$q_o = q_o/q_i \times q_i =$ 0.15 cfs

Extended Detention Storage Volume (V_s)

$$V_s/V_r = 0.683 - 1.43(q_o/q_i) + 1.64(q_o/q_i)^2 - 0.804(q_o/q_i)^3$$

$V_s/V_r =$ 0.63

$V_s = V_s/V_r \times V_r =$ 0.13 ac.-ft (5635 cf) (Note: Vr = Qa)

Storage depth for the Extended Detention Volume: 6.83 ft Ponding: 1 ft.

Storage Volume = 6158 cf

Therefore, the required orifice area (A_o) for extended detention design is:

$A_o = q_o/(4.81 \times h_o^{1/2})$ 0.01 $ft.^2$

The maximum orifice diameter (d_o) is therefore:

$d_o = (4 \times A_o / \pi)^{1/2}$ 0.12 ft. (1.40 in.) Use 1.5 in.

CHANNEL PROTECTION SIZING CRITERIA

Project	ICC DESIGN BUILD - A	By	CZJ	Date	1/20/2008
J.O.	D1D2 FINAL	Checked	PS	Date	1/25/2008

Drainage Area SS-D1-H

Time of Concentration (t_c) =	0.10	hrs. (TR-55)
1-yr post-development runoff depth (Q_a) =	1.70	in. (TR-55)
1-yr rainfall depth (P) =	2.6	in. (Table 2-2)
Runoff Coefficient Number (CN) =	91	(TR-55)
Drainage Area =	0.00277	mi^2

Initial Abstraction (I_a)

I_a = 200/CN - 2 = 0.20

I_a/P = 0.08

Post-development Peak Discharge (q_i)

Unit peak factor (q_u) = 1000 csm/in (Fig. D.11.1)

$q_i = q_u A Q_a$ = 4.70 cfs

Peak Outflow Discharge (q_o)

q_o/q_i (T = 12 hrs.) = 0.038 (from Fig. D.11.2) (USE IV Stream)

$q_o = q_o/q_i \times q_i$ = 0.18 cfs

Extended Detention Storage Volume (V_s)

$$V_s/V_r = 0.683 - 1.43(q_o/q_i) + 1.64(q_o/q_i)^2 - 0.804(q_o/q_i)^3$$

V_s/V_r = 0.63

$V_s = V_s/V_r \times V_r$ = 0.16 ac.-ft (6892 cf) (Note: Vr = Qa)

Storage depth for the Extended Detention Volume: 6.83 ft Ponding: 1 ft.
Storage Volume = 7837 cf
Therefore, the required orifice area (A_o) for extended detention design is:

$A_o = q_o/(4.81 \times h_o^{1/2})$ = 0.01 $ft.^2$

The maximum orifice diameter (d_o) is therefore:

$d_o = (4 \times A_o / \pi)^{1/2}$ = 0.14 ft. (1.63 in.) Use 1.5 in.

APPENDIX F

GRASS CHANNEL DESIGN COMPUTATIONS

ICC CONTRACT A GRASS CHANNEL DESIGN-SEGMENT D1D2

Designed By: M.B. Date: 1/25/2008
Checked By: K.H. Date: 1/26/2008

Outlet Point	Drainage Area and Channel Data															Water Quality Design											
	Impervious Area (sf)	Grass Area (sf)			Total Area (sf)	Total Area (ac)	% Impervious Area I	Volumetric Runoff Coef. (Rv)	Tc (hr)	Initial Abstration Ia = (200/CN)-2	Channel					WQv P (in)	Runoff Volume Qa = P*Rv (in)	CN	Ia/P	Unit Peak Discharge qu (csm/in)	WQ Peak Flow Qw (cfs)	Assumed Flow Depth (in)	Cross Section A(sf)	Wet Perimeter P (ft)	Hydraulic Radius - R	Manning's n	Manning's Equation Q (cfs)	WQv Velocity (fps)	Remark
		B	C	D							B (ft)	SS 1 (Z1:1)	SS 2 (Z2:1)	Depth (in)	slope S (ft/ft)													
I-447	12720.755	8249	0	0	20969	0.481	60.7	0.60	0.10	0.40	4	6	3	20.0	0.016	1.5	0.89	93.40	0.26	950	0.64	3.25	1.41	6.50	0.22	0.15	0.64	0.45	OK
I-448	16495	11246	0	0	27741	0.637	59.5	0.59	0.10	0.41	4	10	10	15.6	0.016	1.5	0.88	93.17	0.27	947	0.83	3.40	1.94	9.69	0.20	0.15	0.83	0.43	OK
I-449	12731.39	12675	0	0	25406	0.583	50.1	0.50	0.10	0.51	4	6	4	20.0	0.016	1.5	0.75	91.19	0.34	895	0.61	3.12	1.38	6.65	0.21	0.15	0.61	0.44	OK
I-450	33109	23213	0	3512.3	59834	1.374	55.3	0.55	0.10	0.42	4	4	6	20.0	0.0156	1.5	0.82	92.33	0.28	943	1.66	4.97	2.51	8.23	0.31	0.13	1.66	0.66	OK
I-451	43035.115	25112	0	4354	72501	1.664	59.4	0.58	0.10	0.38	4	10	10	15.6	0.0156	1.5	0.88	93.15	0.25	954	2.17	5.06	3.46	12.48	0.28	0.13	2.17	0.63	OK
I-452	33494.574	28266	0	4768.6	66529	1.527	50.3	0.50	0.10	0.47	4	4	6	20.0	0.0156	1.5	0.75	91.25	0.31	926	1.67	4.98	2.52	8.24	0.31	0.13	1.67	0.66	OK
I-465	30557	29805	0	796.11	61158	1.404	50.0	0.50	0.10	0.51	4	4	6	20.0	0.0234	1.5	0.75	91.16	0.34	905	1.49	4.36	2.11	7.71	0.27	0.14	1.49	0.70	OK
I-466	39596	27002	0	0	66598	1.529	59.5	0.59	0.10	0.41	4	10	10	15.6	0.0234	1.5	0.88	93.17	0.27	947	1.99	4.53	2.94	11.59	0.25	0.13	1.99	0.68	OK
I-467	30818.821	20584	0	0	51402	1.180	60.0	0.59	0.10	0.40	4	4	6	20.0	0.0234	1.5	0.88	93.26	0.27	950	1.55	4.44	2.16	7.78	0.28	0.14	1.55	0.72	OK
I-468-A	23345.747	10414	0	0	33759	0.775	69.2	0.67	0.10	0.31	4	4	4	20.4	0.0008	1.5	1.01	94.95	0.21	972	1.19	6.34	3.23	8.36	0.39	0.11	0.67	0.37	OK
I-468-B	37710.153	1477	0	0	39187	0.900	96.2	0.92	0.10	0.07	4	4	4	20.4	0.0008	1.5	1.37	98.90	0.05	1010	1.95	7.56	4.10	9.19	0.45	0.09	1.12	0.48	OK
I-469-A	26174.004	13027	0	0	39201	0.900	66.8	0.65	0.10	0.33	4	4	4	24.0	0.0008	1.5	0.98	94.53	0.22	965	1.32	7.95	4.41	9.46	0.47	0.08	1.32	0.30	OK
I-469-B	31239.233	4880	0	0	36119	0.829	86.5	0.83	0.10	0.15	4	4	4	24.0	0.0008	1.5	1.24	97.62	0.10	1010	1.63	8.46	4.81	9.81	0.49	0.08	1.63	0.34	OK
I-470-A	4535.8309	11293	0	0	15829	0.363	28.7	0.31	0.10	0.79	4	3	6	12.0	0.0008	1.5	0.46	85.25	0.53	508	0.13	3.10	1.33	6.39	0.21	0.15	0.13	0.10	OK
I-470-B	1583.9292	14230	0	0	15814	0.363	10.0	0.14	0.10	1.09	4	3	6	12.0	0.008	1.5	0.21	77.03	0.73	508	0.06	1.00	0.36	4.77	0.08	0.15	0.06	0.17	OK
I-476	62484	11815	0	408.64	74707	1.715	83.6	0.80	0.10	0.17	4	4	4	20.0	0.0089	1.5	1.20	97.22	0.12	1006	3.25	7.23	3.86	8.97	0.43	0.10	3.25	0.84	OK
I-477	48796	14698	0	7799	71293	1.637	68.4	0.67	0.10	0.26	4	2	2	20.9	0.0089	1.5	1.00	94.83	0.17	983	2.51	6.96	2.99	6.59	0.45	0.10	2.51	0.84	OK
I-478	4920	11591	0	2807	19318	0.443	25.5	0.28	0.10	0.73	4	3	6	12.0	0.0089	1.5	0.42	84.13	0.49	575	0.17	1.80	0.70	5.39	0.13	0.15	0.17	0.24	OK

NOTE:

1. Time of concentration is assumed to be 0.10 hr for all the 'K' inlets
2. When sand storage BMP is proposed the actual bottom of grass channel may be wider but 4' is used for all WQ computations and 10-YR storm computation
3. When inlet is located at the sump an average slope of 50' from inlet to upstream is used for channel design

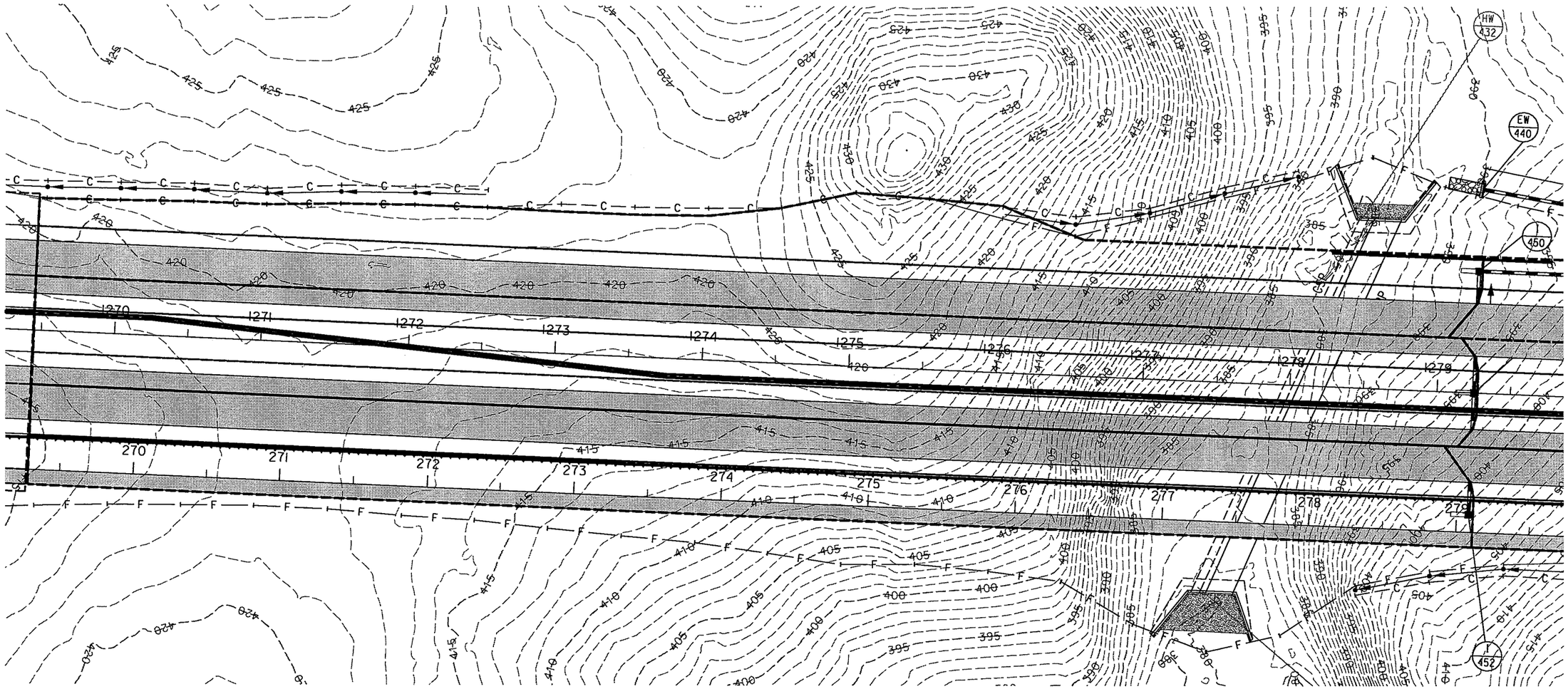
ICC CONTRACT A GRASS CHANNEL DESIGN-SEGMENT D1D2

Designed By: M.B. Date: 1/25/2008
Checked By: K.H. Date: 1/26/2008

Outlet Point	Drainage Area and Channel Data															10-YR Channel Capicity and Velocity												Remark
	Impervious Area (sf)	Grass Area (sf)			Total Area (sf)	Total Area (ac)	% Impervious Area I	Volumetric Runoff Coef. (Rv)	Tc (hr)	Initial Abstration Ia = (200/CN)-2	Channel					10- YR P (in)	S = 1000/CN - 10	Runoff Volume Qa = (P-0.2*S)^2 / (P+0.8*S) (in)	CN	Ia/P	Unit Peak Discharge qu (csm/in)	10-yr Peak Discharge (cfs)	Assumed Flow Depth (in)	Cross Section A(sf)	Wet Perimeter P (ft)	Hydraulic Radius - R	Manning's n	Manning's Equation Q (cfs)	10-yr Velocity (fps)	
		B	C	D							B (ft)	SS 1 (Z1:1)	SS 2 (Z2:1)	Depth (in)	slope S (ft/ft)														
I-447	12720.755	8249	0	0	20969	0.481	60.7	0.60	0.10	0.40	4	6	3	20.0	0.016	5.0	2.0	3.22	83.4	0.079	1010	2.44	3.28	1.43	6.52	0.22	0.04	2.44	1.71	OK
I-448	16495	11246	0	0	27741	0.637	59.5	0.59	0.10	0.41	4	10	10	15.6	0.016	5.0	2.0	3.17	83.0	0.082	1010	3.19	3.44	1.97	9.76	0.20	0.04	3.19	1.62	OK
I-449	12731.39	12675	0	0	25406	0.583	50.1	0.50	0.10	0.51	4	6	4	20.0	0.016	5.0	2.6	2.85	79.5	0.103	1010	2.62	3.38	1.52	6.87	0.22	0.04	2.62	1.73	OK
I-450	33109	23213	0	3512.3	59834	1.374	55.3	0.55	0.10	0.42	4	4	6	20.0	0.0156	5.0	2.1	3.13	82.6	0.084	1010	6.80	5.66	3.00	8.81	0.34	0.04	6.80	2.27	OK
I-451	43035.115	25112	0	4354	72501	1.664	59.4	0.58	0.10	0.38	4	10	10	15.6	0.0156	5.0	1.9	3.28	84.1	0.076	1010	8.62	5.65	4.09	13.46	0.30	0.04	8.62	2.10	OK
I-452	33494.574	28266	0	4768.6	66529	1.527	50.3	0.50	0.10	0.47	4	4	6	20.0	0.0156	5.0	2.3	2.98	81.0	0.094	1010	7.19	5.83	3.12	8.95	0.35	0.04	7.19	2.31	OK
I-465	30557	29805	0	796.11	61158	1.404	50.0	0.50	0.10	0.51	4	4	6	20.0	0.0234	5.0	2.5	2.87	79.7	0.102	1010	6.36	4.91	2.48	8.18	0.30	0.04	6.36	2.57	OK
I-466	39596	27002	0	0	66598	1.529	59.5	0.59	0.10	0.41	4	10	10	15.6	0.0234	5.0	2.0	3.17	83.0	0.082	1010	7.66	4.84	3.24	12.10	0.27	0.04	7.66	2.37	OK
I-467	30818.821	20584	0	0	51402	1.180	60.0	0.59	0.10	0.40	4	4	6	20.0	0.0234	5.0	2.0	3.19	83.2	0.081	1010	5.94	4.74	2.36	8.03	0.29	0.04	5.94	2.52	OK
I-468-A	23345.747	10414	0	0	33759	0.775	69.2	0.67	0.10	0.31	4	4	4	20.4	0.0008	5.0	1.5	3.53	86.6	0.062	1010	4.31	9.91	6.03	10.81	0.56	0.04	4.31	0.71	OK
I-468-B	37710.153	1477	0	0	39187	0.900	96.2	0.92	0.10	0.07	4	4	4	20.4	0.0008	5.0	0.4	4.60	96.6	0.014	1010	6.53	12.17	8.17	12.36	0.66	0.04	6.53	0.80	OK
I-469-A	26174.004	13027	0	0	39201	0.900	66.8	0.65	0.10	0.33	4	4	4	24.0	0.0008	5.0	1.7	3.44	85.7	0.067	1010	4.88	10.55	6.61	11.25	0.59	0.04	4.88	0.74	OK
I-469-B	31239.233	4880	0	0	36119	0.829	86.5	0.83	0.10	0.15	4	4	4	24.0	0.0008	5.0	0.8	4.20	93.0	0.030	1010	5.49	11.18	7.20	11.68	0.62	0.04	5.49	0.76	OK
I-470-A	4535.8309	11293	0	0	15829	0.363	28.7	0.31	0.10	0.79	4	3	6	12.0	0.0008	5.0	4.0	2.17	71.6	0.159	991	1.22	5.08	2.50	7.91	0.32	0.04	1.22	0.49	OK
I-470-B	1583.9292	14230	0	0	15814	0.363	10.0	0.14	0.10	1.09	4	3	6	12.0	0.008	5.0	5.5	1.63	64.7	0.218	969	0.90	2.27	0.92	5.75	0.16	0.04	0.90	0.98	OK
I-476	62484	11815	0	408.64	74707	1.715	83.6	0.80	0.10	0.17	4	4	4	20.0	0.0089	5.0	0.9	4.09	92.1	0.035	1010	11.08	8.70	5.00	9.98	0.50	0.04	11.08	2.22	OK
I-477	48796	14698	0	7799	71293	1.637	68.4	0.67	0.10	0.26	4	2	2	20.9	0.0089	5.0	1.3	3.71	88.4	0.052	1010	9.58	8.86	4.04	7.30	0.55	0.04	9.58	2.37	OK
I-478	4920	11591	0	2807	19318	0.443	25.5	0.28	0.10	0.73	4	3	6	12.0	0.0089	5.0	3.7	2.30	73.2	0.147	995	1.58	3.03	1.30	6.33	0.20	0.04	1.58	1.22	OK

NOTE:

1. Time of concentration is assumed to be 0.10 hr for all the 'K' inlets
2. When sand storage BMP is proposed the actual bottom of grass channel may be wider but 4' is used for all WQ computations and 10-YR storm computation
3. When inlet is located at the sump an average slope of 50' from inlet to upstream is used for channel design



SEGMENT D1D2
ISSUED FOR REVIEW

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DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
HIGHWAY DESIGN DIVISION

INTERCOUNTY CONNECTOR
CONTRACT A
SWM FACILITY D1-F, G, H FINAL DESIGN

INTERCOUNTY CONSTRUCTORS
TWO TAFT COURT * ROCKVILLE, MARYLAND 20850 * 301-354-8600

REVISIONS

INLET DRAINAGE AREA

SCALE 1" = 100' DATE OCT. 2007 CONTRACT NO. AT3765960

DESIGNED BY M.B.
DRAWN BY Y.A.
CHECKED BY P.S.
F.A.P. NO. AC-NH-ICC-1(1)N

COUNTY MONTGOMERY
LOGMILE

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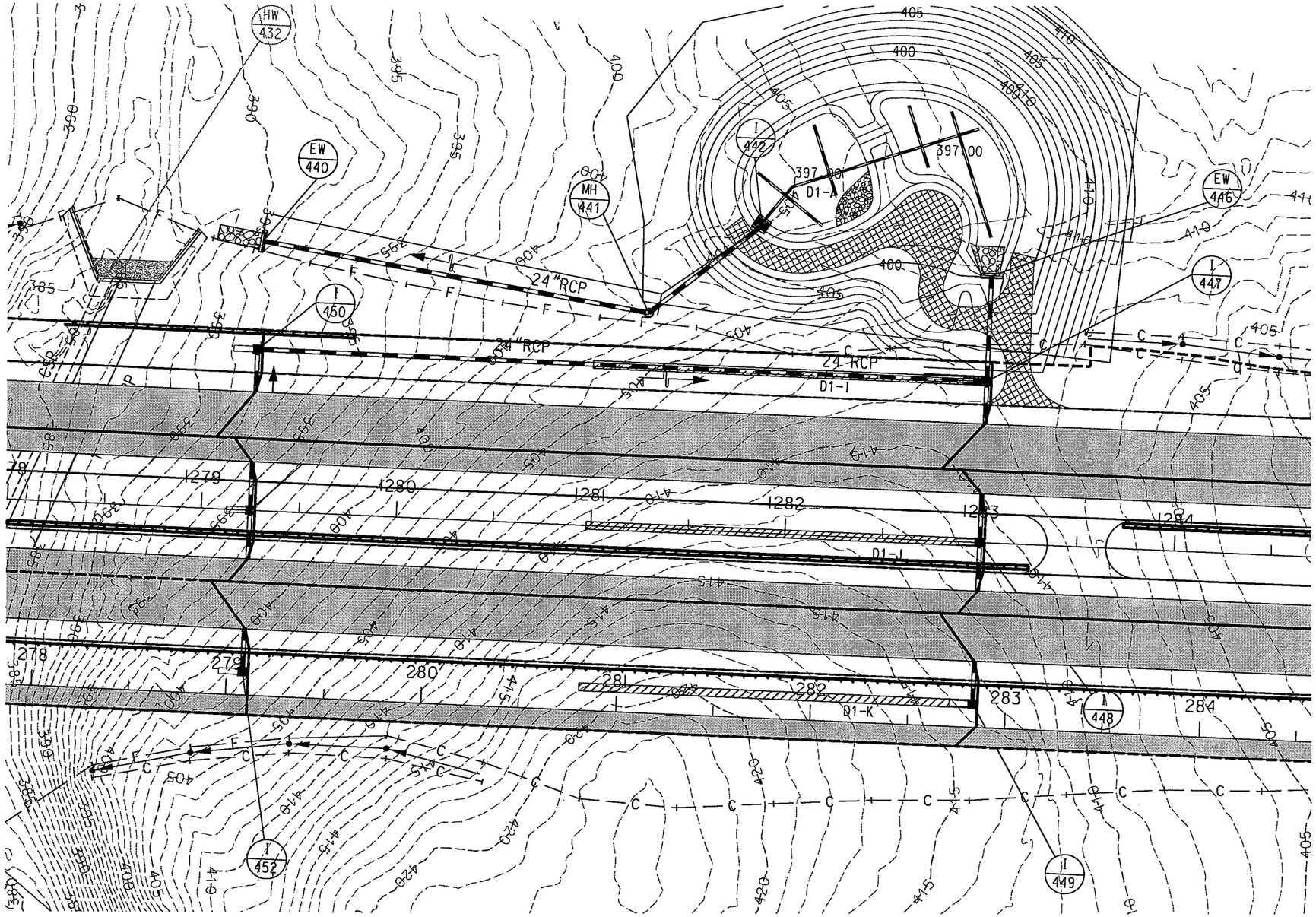
BY: C0039124



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DESIGNED BY M.B. COUNTY MONTGOMERY
DRAWN BY Y.A. LOGMILE
CHECKED BY P.S.
F.A.P. NO. AC-NH-ICC-1(1)N

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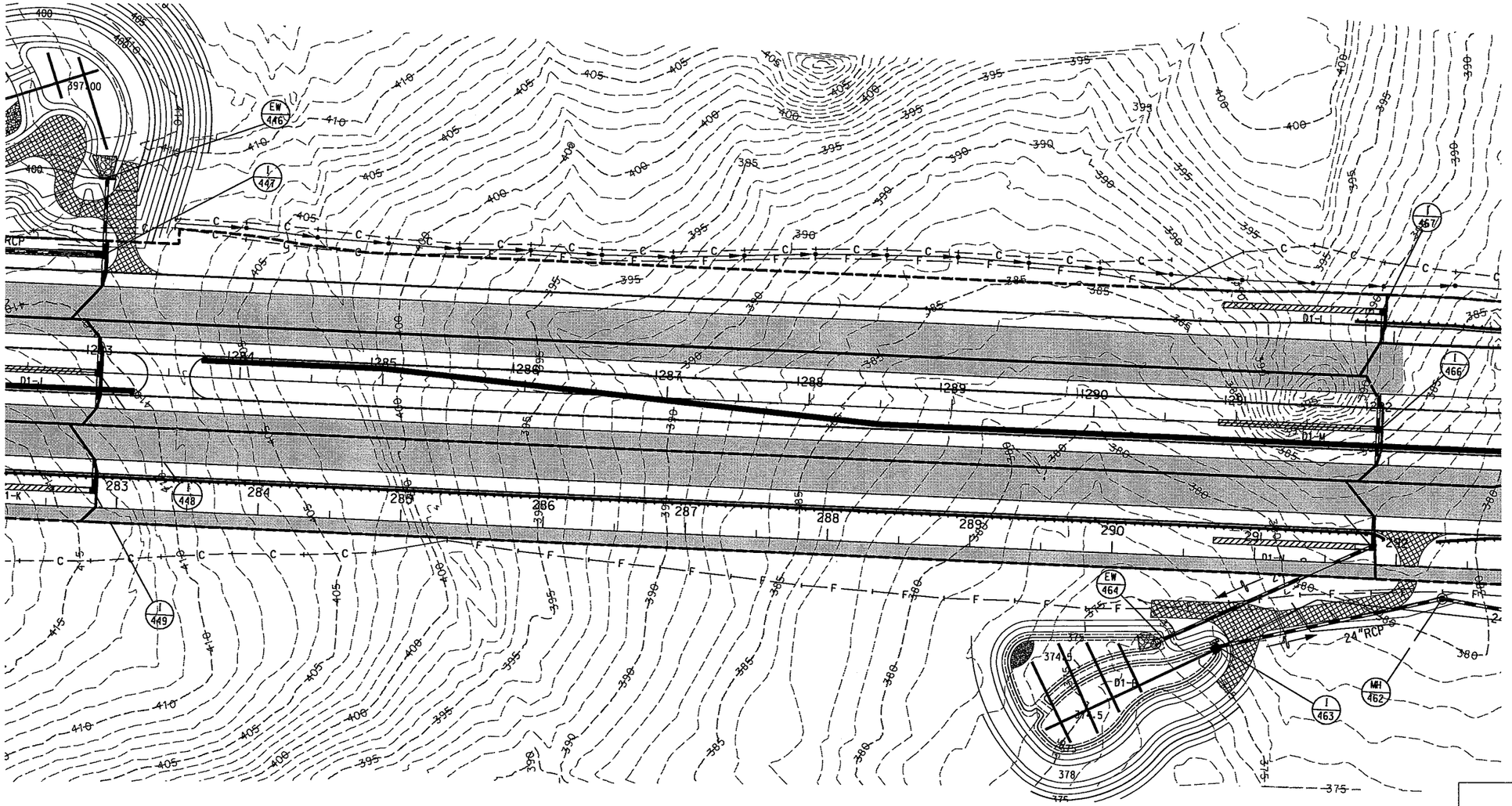

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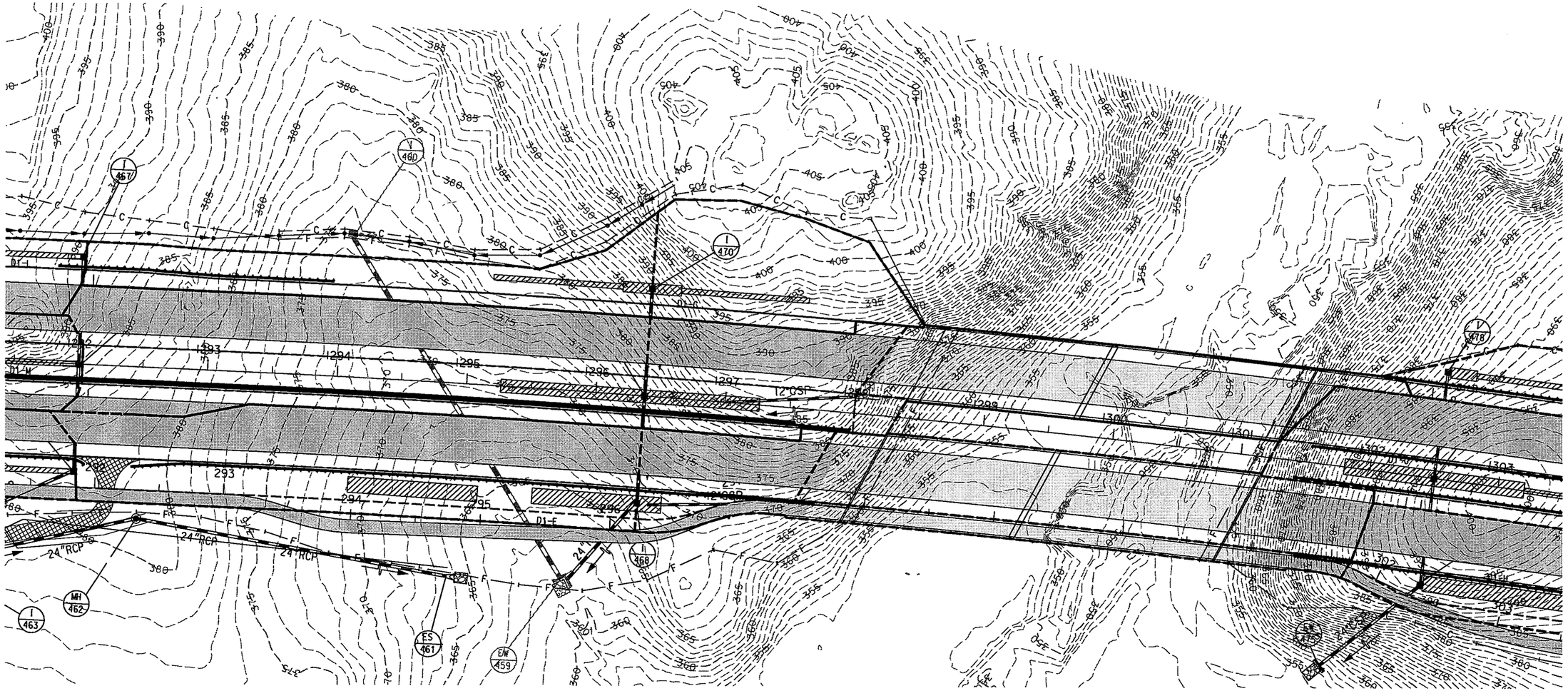

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REVISIONS

INLET DRAINAGE AREA

SCALE 1" = 100' DATE OCT. 2007 CONTRACT NO. AT3765960

DESIGNED BY M.B. COUNTY MONTGOMERY
DRAWN BY Y.A. LOGMILE
CHECKED BY P.S.
F.A.P. NO. AC-NH-ICC-1(1)N

DRAWING NO. D1D2_DR_SW_DA-04 SHEET NO. OF

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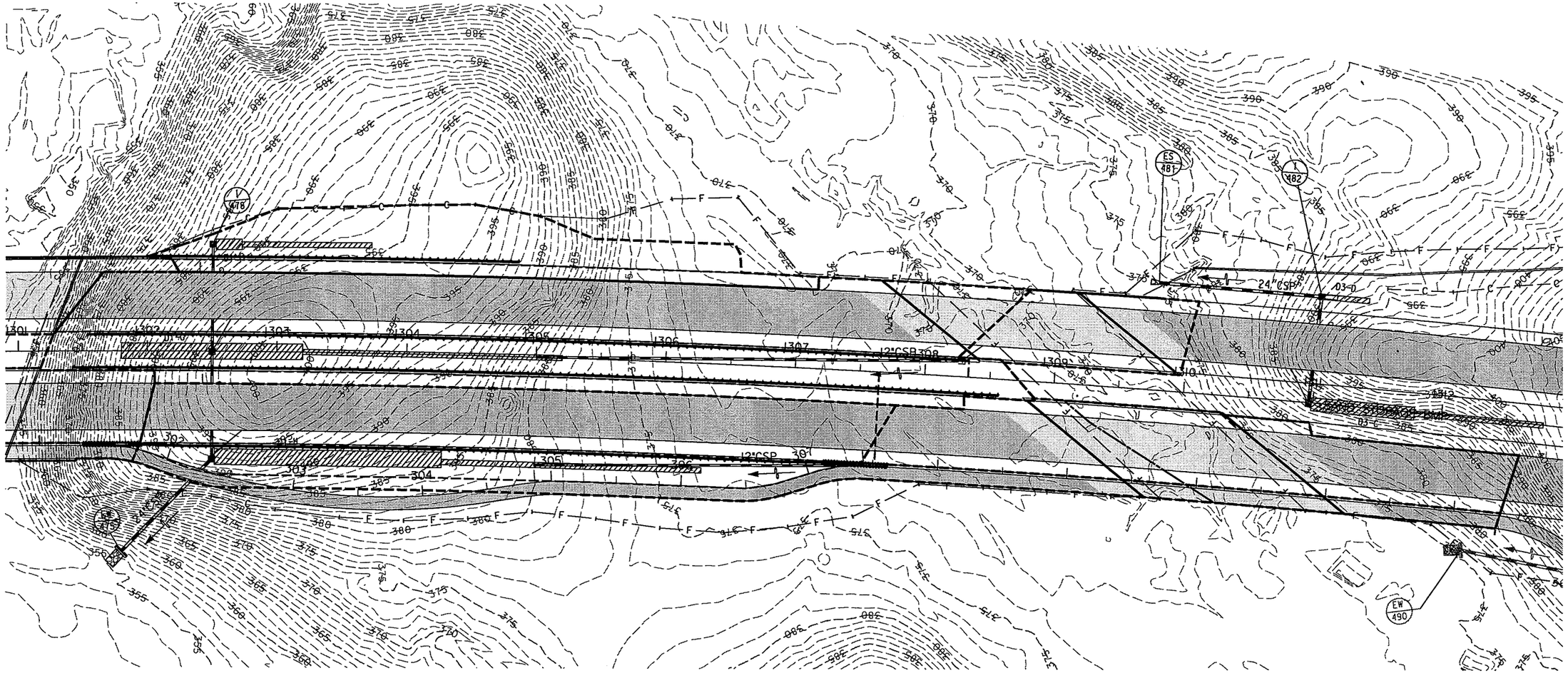

SEGMENT D1D2
ISSUED FOR REVIEW

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
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TWO TAFT COURT * ROCKVILLE, MARYLAND 20850 * 301-354-8600

REVISIONS

INLET DRAINAGE AREA

SCALE 1" = 100' DATE OCT. 2007 CONTRACT NO. AT3765960

DESIGNED BY M.B.
DRAWN BY Y.A.
CHECKED BY P.S.
F.A.P. NO. AC-NH-ICC-1(1)N

COUNTY MONTGOMERY
LOGMILE

DRAWING NO. D1D2_DR_SW_DA-05 SHEET NO. OF

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BY: C0039124

APPENDIX G

STORM DRAINAGE DESIGN COMPUTATIONS

STR. NO.	TYPE	BASELINE			OFFSET		INVERT OUT	STRUCTURE DEPTH	DOWNSTREAM CULVERT INFORMATION								TOP ELEV.
		NAME	STATION	ELEV.	(FT)	LT/RT			SIZE (IN)	TYPE	INV. IN	INV. OUT	L. (FT)	S (%)	Hf (FT)		
EW-440	STD TYPE 'C' ENDWALL - 24" PIPE	ICC	1279+25	411.31	139.00'	LT	387.90	--	24"	RCP	387.90	387.90	0.00	0.00	0.00		--
MH-441	48" MANHOLE FOR 24" PIPE	ICC	1281+25	408.19	111.00'	LT	388.93	13.56	24"	RCP	388.93	387.90	202.00	0.51	1.03		402.49
I-442	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1281+82	407.30	159.00'	LT	389.50	8.50	24"	RCP	389.50	389.13	74	0.5	0.37		398.00
EW-446	STD TYPE 'C' ENDWALL - 24" PIPE	ICC	1283+00	405.33	137.00'	LT	397.00	--	24"	RCP	397.00	397.00	0.00	0.50	0.00		398.82
I-447	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1283+00	405.33	83.00'	LT	397.27	5.55	24"	RCP	397.27	397.00	55.00	0.50	0.28		402.82
I-448	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1283+00	405.33	0.00'	MED	397.72	5.71	24"	RCP	397.72	397.30	83.00	0.51	0.42		403.43
I-449	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1283+00	405.33	83.00'	RT	398.32	4.50	24"	RCP	398.32	397.90	83.00	0.51	0.42		402.82
I-450	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1279+25	411.31	83.00'	LT	402.80	6.01	24"	RCP	402.80	397.30	375.00	1.47	5.50		408.80
I-451	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1279+25	411.31	0.00'	MED	404.61	4.80	24"	RCP	404.61	404.11	83.00	0.60	0.50		409.41
I-452	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1279+25	411.31	83.00'	RT	405.30	3.50	24"	RCP	405.30	404.81	83.00	0.60	0.50		408.80
EW-459	STD TYPE 'C' ENDWALL - 36" PIPE	ICC	1295+82	378.92	145.50'	RT	361.00	--	36"	RCP	361.00	361.00	0.00	2.50	0.00		--
I-460	STD. COMBINATION 'S' INLET	ICC	1294+07	380.51	108.00'	LT	368.75	4.69	36"	RCP	368.75	361.00	310.00	2.50	7.75		373.44
ES-461	END SECTION FOR 24" RCP	ICC	1294+93	379.47	149.00'	RT	365.77	--	24"	RCP	365.77	365.77	0.00	0.00	0.00		--
MH-462	48" MANHOLE FOR 24" PIPE	ICC	1292+50	383.62	117.00'	RT	366.99	13.83	24"	RCP	366.99	365.77	243.00	0.50	1.22		380.82
I-463	RISER STRUCTURE	ICC	1290+94	387.27	157.00'	RT	368.00	8.00	24"	RCP	368.00	367.19	163.00	0.50	0.82		376.00
ES-464	STD TYPE 'C' ENDWALL - 24" PIPE	ICC	1290+56	388.16	154.00'	RT	375.00	--	24"	RCP	375.00	375.00	0.00	1.00	0.00		--
I-465	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1292+00	384.79	83.00'	RT	376.29	5.99	24"	RCP	376.29	375.00	160.00	0.81	1.29		382.28
I-466	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1292+00	384.79	0.00'	MED	377.32	5.57	24"	RCP	377.32	376.49	83.00	1.00	0.83		382.89
I-467	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1292+00	384.79	85.00'	LT	378.35	3.93	24"	RCP	378.35	377.52	83.00	1.00	0.83		382.28
I-468	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1296+38	378.80	79.00'	RT	367.79	7.69	24"	RCP	367.79	361.00	80.00	8.49	6.79		375.48
I-469	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1296+38	378.80	0.00'	MED	368.82	7.38	24"	RCP	368.82	367.99	83.00	1.00	0.83		376.20
I-470	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1296+38	378.80	83.00'	LT	369.85	7.50	24"	RCP	369.85	369.02	83.00	1.00	0.83		377.35
I-471	WATER QUALITY INLET	ICC	1297+70	379.36	71.00'	RT	373.44	5.00	12"	CSP	373.44	372.86	116.00	0.50	0.58		378.44
I-472	WATER QUALITY INLET	ICC	1298+08	379.70	15.00'	LT	374.90	5.00	12"	CSP	374.90	374.40	101.00	0.50	0.51		379.90
EW-475	STD TYPE 'C' ENDWALL - 24" PIPE	ICC	1301+79	382.99	155.00'	RT	355.02	--	24"	RCP	355.02	355.02	0.00	0.00	0.00		--
I-476	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1302+50	383.62	83.00'	RT	372.03	8.40	24"	RCP	372.03	355.02	100.00	17.01	17.01		380.43
I-477	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1302+50	383.62	0.00'	MED	373.06	7.34	24"	RCP	373.06	372.23	83.00	1.00	0.83		380.40
I-478	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1302+50	383.62	85.00'	LT	374.09	8.32	24"	RCP	374.09	373.26	83.00	1.00	0.83		382.41
I-479	WATER QUALITY INLET	ICC	1307+65	388.18	71.00'	RT	382.26	5.00	12"	CSP	382.26	380.99	255.00	0.50	1.28		387.26
I-480	WATER QUALITY INLET	ICC	1308+33	388.78	15.00'	LT	383.15	5.00	12"	CSP	383.15	381.51	328.00	0.50	1.64		388.15

IIC CONTACT-A SEGMENT D1D2 INLET COMPUTATIONS

INLET LOCATION							DA INFORMATION			UPSTREAM INLETS BYPASS Q (CFS)	RUNOFF (CFS)	% PICKUP	BYPASS Q (CFS)	25+ Year "C"					
INLET NO	TYPE	BASELINE	STATION	Elevation	OFFSET (FT)	LT/RT	AREA (SF)	AREA (AC)	"C"						AREA (SF)	Impervious Area	Grass B	Grass C	Grass D
I-447	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1283+00	405.33	83	LT	20969.48	0.48	0.58	0.00	1.51	100%	0.00	0.66	20969	12721	8249	0	0
I-448	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1283+00	405.33	0.00	MED	27741.43	0.64	0.58	0.00	1.97	100%	0.00	0.65	27741	16495	11246	0	0
I-449	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1283+00	405.33	83	RT	25405.96	0.58	0.51	0.00	1.60	100%	0.00	0.58	25406	12731	12675	0	0
I-450	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1279+25	411.31	83	LT	59834.33	1.37	0.55	0.00	4.08	100%	0.00	0.63	59834	33109	23213	0	3512
I-451	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1279+25	411.31	0	MED	72500.88	1.66	0.58	0.00	5.20	100%	0.00	0.66	72501	43035	25112	0	4354
I-452	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1279+25	411.31	83	RT	66529.25	1.53	0.52	0.00	4.26	100%	0.00	0.59	66529	33495	28266	0	4769
I-465	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1292+00	384.79	83	RT	61157.62	1.40	0.51	0.00	3.86	100%	0.00	0.58	61158	30557	29805	0	796
I-466	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1292+00	384.79	0	MED	66598.00	1.53	0.58	0.00	4.74	100%	0.00	0.65	66598	39580	27018	0	0
I-467	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1292+00	384.79	85	LT	51402.39	1.18	0.58	0.00	3.68	100%	0.00	0.66	51402	30819	20584	0	0
I-468	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1296+38	378.8	79	RT	48638.72	1.12	0.70	0.00	4.18	100%	0.00	0.78	48639	36748	7837	0	4054
I-469	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1296+38	378.8	0	MED	54815.34	1.26	0.64	0.00	4.35	100%	0.00	0.72	54815	36904	10432	0	7479
I-470	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1296+38	378.8	83	LT	31643.00	0.73	0.32	0.00	1.24	100%	0.00	0.37	31643	6120	16367	0	9156
I-476	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1302+50	383.62	83	RT	49315.99	1.13	0.69	0.00	4.22	100%	0.00	0.78	49316	37480	11815	0	22
I-477	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1302+50	383.62	0	MED	62602.82	1.44	0.62	0.00	4.78	100%	0.00	0.70	62603	40106	14698	0	7799
I-478	STD TYPE 'K' INLET -SINGLE OPENING	ICC	1302+50	383.62	85	LT	19320.00	0.44	0.35	0.00	0.83	100%	0.00	0.41	19320	4920	11591	0	2809
NOTE:	TC = 5 MIN IS USED FOR ALL INLETS ALONG PROPOSED ROADWAY																		
	ALL INLETs ALONG PROPOSED DITCH HAS 100% PICKUP																		

MARYLAND STATE HIGHWAY ADMINISTRATIONS

STORM DRAIN DESIGN

DESIGNED BY: *MB* 1/24/2008 CONTRACT: AT3765960 RAINFALL FACTOR: 1.000

CHECKED BY: *KH* 1/25/2008 TITLE: ICC CONTRACT A - D1D2 DURATION: 0-10 10.1-40 40.1-150

Structure		Contributing Area				10 Year Runoff				Pipe							
From	To	C Area (#)	A Area ac.	Δ CA	Σ A	ΣCA	tc Time Conc. Min	iir Rainfall Intens. in./hr.	Q cfs	Size (in)	Type	n Mann-ing's Coef.	S_o Slope %	V_o Vel. fps	L Leng. Ft.	t_t Travel Time Min	Capac. Full cfs
I-452	I-451	0.5182	1.527	0.791	1.527	0.791	5.00	7.00	5.54	24	RCP	0.013	0.6	3.0	83	0.46	17.6
I-451	I-450	0.5803	1.664	0.966	3.192	1.757	5.46	6.90	12.12	24	RCP	0.013	0.6	3.9	83	0.36	17.6
I-450	I-447	0.552	1.374	0.758	4.565	2.516	5.82	6.81	17.13	24	RCP	0.013	1.466	5.5	375	1.15	27.4
I-449	I-448	0.5108	0.583	0.298	0.583	0.298	5.00	7.00	2.09	24	RCP	0.013	0.51	3.0	83	0.46	16.2
I-448	I-447	0.5762	0.637	0.367	1.220	0.665	5.46	6.90	4.59	24	RCP	0.013	0.51	3.0	83	0.46	16.2
I-447	EW-446	0.5846	0.481	0.281	6.267	3.462	6.97	6.55	22.67	24	RCP	0.013	0.5	7.2	55	0.13	16.0
EW-446	--				10.832	5.977	6.97	6.55	22.67	24				7.2			
I-467	I-466	0.5797	1.18	0.684	1.180	0.684	5.00	7.00	4.79	24	RCP	0.013	1	3.0	83	0.46	22.7
I-466	I-465	0.576	1.529	0.881	2.709	1.565	5.46	6.90	10.79	24	RCP	0.013	1	3.4	83	0.40	22.7
I-465	EW-464	0.5108	1.404	0.717	4.113	2.282	5.86	6.80	15.51	24	RCP	0.013	0.806	4.9	160	0.54	20.3
ES-464	--				4.113	2.282	5.86	6.80	15.51								
I-463	MH-462	0.529	4.8	2.539	4.800	2.539	6.40	6.68	16.96	24	RCP	0.013	0.5	5.4	163	0.50	16.0
MH-462	ES-461				4.800	2.539	6.40	6.68	16.96	24	RCP	0.013	0.5	5.4	243	0.75	16.0
ES-461	--				4.800	2.539	6.40	6.68	16.96	24	RCP	0.013	0	5.4		0.00	0.0
I-470	I-469	0.3185	0.726	0.231	0.726	0.231	5.00	7.00	1.62	24	RCP	0.013	1	3.0	83	0.46	22.7
I-469	I-468	0.6422	1.258	0.808	1.985	1.040	5.46	6.90	7.17	24	RCP	0.013	1	3.0	83	0.46	22.7
I-468	EW-459	0.6955	1.117	0.777	3.101	1.816	5.92	6.79	12.32	24	RCP	0.013	9.7375	3.9	80	0.34	70.7
EW-459	--				3.101	1.816	5.92	6.79	35.32	36	RCP	0.013		5.0	0		
I-478	I-477	0.3499	0.444	0.155	0.444	0.155	5.00	7.00	1.09	24	RCP	0.013	1	3.0	83	0.46	22.7
I-477	I-476	0.6184	1.437	0.889	1.881	1.044	5.46	6.90	7.20	24	RCP	0.013	1	3.0	83	0.46	22.7
I-476	EW-475	0.692	1.132	0.783	3.013	1.827	5.92	6.79	12.40	24	RCP	0.013	17.01	3.9	100	0.42	93.5
EW-475	--				3.013	1.827	5.92	6.79	12.40	24	RCP	0.013		3.9			
I-442	MH-441	0.5174	7.46	3.860	7.460	3.860	7.00	6.54	25.24	24	RCP	0.013	0.5	8.0	74	0.15	16.0
MH-441	EW-440				7.460	3.860	7.00	6.54	25.24	24	RCP	0.013	0.51	8.0	202	0.42	16.2
EW-440	--				7.460	3.860	7.00	6.54	25.24	24	RCP	0.013					

ICC CONTRACT A - SEGMENT D1D2

STORM DRAIN DESIGN

DESIGNED BY: MB 1/24/2008 CONTRACT: AT3765960 RAINFALL FACTOR: 1 RET. PERIOD: 25

CHECKED BY: KH 1/25/2008 TITLE: ICC CONTRACT A - D1D2 DURATION: 0-10 10.1-40 40.1-150

KCI TECHNOLOGIES

Structure		Contributing Area				25 Year Runoff				Pipe								Hydraulic Gradient								
From	To	C Area (#)	A Area ac.	Δ CA	Σ A	ΣCA	tc Time Conc. Min	i_{if} Rainfall Intens. in./hr.	Q cfs	Size (in)	Type	n Mann-ing's Coef.	S_o Slope %	S_f Slope %	V_f Vel. fps	L Leng. Ft.	d_n Normal Depth ft	Angle (0)	Kb	Hb (ft)	Hf (ft)	INV IN	INV OUT	Elev. Out	Elev. In	Top Elev
I-452	I-451	0.52	1.527	0.791	1.527	0.791	5.00	8.00	6.33	24	RCP	0.013	0.6	0.08	3.0	83	0.83	0	0.50	0.07	0.06	405.30	404.81	406.46	406.53	408.80
I-451	I-450	0.58	1.664	0.966	3.192	1.757	5.46	7.86	13.82	24	RCP	0.013	0.6	0.37	4.4	83	1.34	90	1.50	0.45	0.31	404.61	404.11	405.94	406.40	409.41
I-450	I-447	0.55	1.374	0.758	4.565	2.516	5.82	7.76	19.51	24	RCP	0.013	1.466	0.74	6.2	375	1.25	90	1.50	0.90	2.78	402.80	397.30	404.05	404.94	408.80
I-449	I-448	0.51	0.583	0.298	0.583	0.298	5.00	8.00	2.38	24	RCP	0.013	0.51	0.01	3.0	83	0.52	0	0.50	0.07	0.01	398.32	397.90	400.44	400.51	402.82
I-448	I-447	0.58	0.637	0.367	1.220	0.665	5.46	7.86	5.23	24	RCP	0.013	0.51	0.05	3.0	83	0.78	0	0.50	0.07	0.04	397.72	397.30	400.36	400.43	403.43
I-447	EW-446	0.58	0.481	0.281	1.701	0.946	6.97	7.56	26.67	24	RCP	0.013	0.5	1.38	8.5	55	2.00	0	0.50	0.56	0.76	397.27	397.00	399.76	400.32	402.82
EW-446	--				6.267	3.462	6.97		26.67	24	RCP	0.013			8.5							397.00	397.00	399.00	399.00	398.82
I-467	I-466	0.58	1.180	0.684	1.180	0.684	5.00	8.00	5.47	24	RCP	0.013	1	0.06	3.0	83	0.67	0	0.50	0.07	0.05	378.35	377.52	379.02	379.09	382.28
I-466	I-465	0.58	1.529	0.881	2.709	1.565	5.46	7.86	12.30	24	RCP	0.013	1	0.29	3.9	83	1.05	64	1.28	0.30	0.24	377.32	376.49	378.46	378.77	382.89
I-465	EW-464	0.51	1.404	0.717	4.113	2.282	5.86	7.74	17.67	24	RCP	0.013	0.806	0.61	5.6	160	1.44	0	0.50	0.25	0.97	376.29	375.00	377.97	378.22	382.28
ES-464	--				4.113	2.282	5.86															375.00	375.00	377.00	377.00	--
I-463	MH-462	0.53	4.800	2.539	4.800	2.539	5.00	8.00	20.31	24	RCP	0.013	0.5	0.80	6.5	163	2.00	0	0.50	0.32	1.31	368.00	367.19	371.33	371.65	376.00
MH-462	ES-461						5.46		20.31	24	RCP	0.013	0.5	0.80	6.5	243	2.00	23	0.46	0.30	1.95	366.99	365.77	369.72	370.02	380.82
ES-461	--						5.86		20.31	24	RCP	0.013	0	0.80	6.5			0			0.00	365.77	365.77	367.77	367.77	--
I-470	I-469	0.32	0.726	0.231	0.726	0.231	5.00	8.00	1.85	24	RCP	0.013	1	0.01	3.0	83	0.39	0	0.50	0.07	0.01	369.85	369.02	370.24	370.31	377.35
I-469	I-468	0.64	1.258	0.808	1.985	1.040	5.46	7.86	8.17	24	RCP	0.013	1	0.13	3.0	83	0.83	48	1.13	0.16	0.11	368.82	367.99	369.65	369.81	376.20
I-468	EW-459	0.70	1.117	0.777	3.101	1.816	5.92	7.72	14.03	24	RCP	0.013	8.4875	0.38	4.5	80	0.63	0	0.50	0.15	0.31	367.79	361.00	368.42	368.57	375.48
EW-459	--				3.101	1.816	5.92															361.00	361.00	363.00	363.00	--
I-478	I-477	0.35	0.444	0.155	0.444	0.155	5.00	8.00	1.24	24	RCP	0.013	1	0.00	3.0	83	0.32	0	0.50	0.07	0.00	374.09	373.26	374.41	374.48	382.41
I-477	I-476	0.62	1.437	0.889	1.881	1.044	5.46	7.86	8.21	24	RCP	0.013	1	0.13	3.0	83	0.83	45	1.10	0.15	0.11	373.06	372.23	373.89	374.05	380.40
I-476	EW-475	0.69	1.132	0.783	3.013	1.827	5.92	7.72	14.12	24	RCP	0.013	17.01	0.39	4.5	100	0.53	0	0.50	0.16	0.39	372.03	355.02	372.56	372.71	380.43
EW-475	--						5.92															355.02	355.02	357.00	357.00	--
I-442	MH-441	0.52	7.460	3.860	7.460	3.860	5.00	8.00	30.88	24	RCP	0.013	0.5	1.86	9.8	74	2.00	0	0.50	0.75	1.37	389.50	389.13	396.18	396.93	398.00
MH-441	EW-440								30.88	24	RCP	0.013	0.51	1.86	9.8	202	2.00	48	0.77	1.15	3.75	388.93	387.90	393.65	394.80	402.49
EW-440	--								30.88	24	RCP	0.013	0	1.86	9.8	0		0				387.90	387.90	389.90	389.90	--

ICC CONTRACT A - SEGMENT D1D2

STORM DRAIN DESIGN

DESIGNED BY: MB 1/24/2008 CONTRACT: AT3765960 RAINFALL FACTOR: 1 RET. PERIOD: 100

CHECKED BY: KH 1/25/2008 TITLE: ICC CONTRACT A - D1D2 DURATION: 0-10 10.1-40 40.1-150

KCI TECHNOLOGIES

Structure		Contributing Area				25 Year Runoff				Pipe								Hydraulic Gradient								
From	To	C Area (#)	A Area ac.	Δ CA	Σ A	ΣCA	tc Time Conc. Min	i_{ir} Rainfall Intens. in./hr.	Q cfs	Size (in)	Type	n Mann-ing's Coef.	S_o Slope %	S_f Slope %	V_f Vel. fps	L Leng. Ft.	d_n Normal Depth ft	Angle (0)	Kb	Hb (ft)	Hf (ft)	INV IN	INV OUT	Elev. Out	Elev High	Top Elev
I-452	I-451	0.518	1.527	0.791	1.527	0.791	5.000	9.50	7.52	24	RCP	0.013	0.6	0.11	3.0	83	0.92	0	0.50	0.07	0.09	405.30	404.81	406.89	406.96	408.80
I-451	I-450	0.580	1.664	0.966	3.192	1.757	5.461	9.41	16.53	24	RCP	0.013	0.6	0.53	5.3	83	1.55	90	1.50	0.65	0.44	404.61	404.11	406.15	406.80	409.41
I-450	I-447	0.552	1.374	0.758	4.565	2.516	5.819	9.34	23.49	24	RCP	0.013	1.466	1.07	7.5	375	1.43	90	1.50	1.30	4.03	402.80	397.30	404.22	405.53	408.80
																		0								
I-449	I-448	0.511	0.583	0.298	0.583	0.298	5.000	9.50	2.83	24	RCP	0.013	0.51	0.02	3.0	83	0.57	0	0.50	0.07	0.01	398.32	397.90	399.29	399.36	402.82
I-448	I-447	0.576	0.637	0.367	1.220	0.665	5.461	9.41	6.26	24	RCP	0.013	0.51	0.08	3.0	83	0.86	0	0.50	0.07	0.06	397.72	397.30	399.21	399.28	403.43
I-447	EW-446	0.585	0.481	0.281	1.701	0.946	6.965	9.01	8.53	24	RCP	0.013	0.5	0.14	3.0	55	1.04	0	0.50	0.07	0.08	397.27	397.00	399.08	399.15	402.82
EW-446	--				6.267	3.462												0				397.00	397.00	399.00	399.00	398.82
I-467	I-466	0.580	1.18	0.684	1.180	0.684	5.000	9.50	6.50	24	RCP	0.013	1	0.08	3.0	83	0.73	0	0.50	0.07	0.07	378.35	377.52	379.62	379.69	382.28
I-466	I-465	0.576	1.5289	0.881	2.709	1.565	5.461	9.41	14.72	24	RCP	0.013	1	0.42	4.7	83	1.18	64	1.28	0.44	0.35	377.32	376.49	379.12	379.55	382.89
I-465	EW-464	0.511	1.404	0.717	4.113	2.282	5.864	9.33	21.29	24	RCP	0.013	0.806	0.88	6.8	160	2.00	0	0.50	0.36	1.41	376.29	375.00	378.41	378.77	382.28
ES-464	--				4.113	2.282	5.864											0				375.00	375.00	377.00	377.00	--
I-463	MH-462	0.529	4.8	2.539	4.800	2.539	6.403	9.18	23.31	24	RCP	0.013	0.5	1.06	7.4	163	2.00	0	0.50	0.43	1.72	368.00	367.19	372.46	372.88	376.00
MH-462	ES-461				4.800	2.539	6.403		23.31	24	RCP	0.013	0.5	1.06	7.4	243	2.00	23	0.46	0.39	2.57	366.99	365.77	370.34	370.73	380.82
ES-461	--				4.800	2.539	6.403		23.31	24	RCP	0.013	0	1.06	7.4	0		0			0.00	365.77	365.77	367.77	367.77	--
I-470	I-469	0.319	0.7264	0.231	0.726	0.231	5.000	9.50	2.20	24	RCP	0.013	1	0.01	3.0	83	0.42	0	0.50	0.07	0.01	369.85	369.02	370.27	370.34	377.35
I-469	I-468	0.642	1.2584	0.808	1.985	1.040	5.461	9.41	9.78	24	RCP	0.013	1	0.19	3.1	83	0.92	48	1.13	0.17	0.15	368.82	367.99	369.74	369.91	376.20
I-468	EW-459	0.696	1.1166	0.777	3.101	1.816	5.922	9.32	16.92	24	RCP	0.013	8.4875	0.56	5.4	80	0.69	0	0.50	0.23	0.45	367.79	361.00	368.48	368.71	375.48
EW-459	--				3.101	1.816	5.922															361.00	361.00	363.00	363.00	--
I-478	I-477	0.350	0.4435	0.155	0.444	0.155	5.000	9.50	1.47	24	RCP	0.013	1	0.00	3.0	83	0.35	0	0.50	0.07	0.00	374.09	373.26	374.44	374.51	382.41
I-477	I-476	0.618	1.4372	0.889	1.881	1.044	5.461	9.41	9.82	24	RCP	0.013	1	0.19	3.1	83	0.92	45	1.10	0.17	0.16	373.06	372.23	373.98	374.15	380.40
I-476	EW-475	0.692	1.1321	0.783	3.013	1.827	5.922	9.32	17.02	24	RCP	0.013	17.01	0.56	5.4	100	0.58	0	0.50	0.23	0.56	372.03	355.02	372.61	372.84	380.43
EW-475	--				3.013	1.827	5.922			24	RCP	0.013	0			0		0				355.02	355.02	357.00	357.00	--
																		0								
I-442	MH-441	0.517	7.46	3.860	7.460	3.860	7.000	9.00	34.74	24	RCP	0.013	0.5	2.35	11.1	74	2.00	0	0.50	0.95	1.74	389.50	389.13	397.85	398.79	398.00
MH-441	EW-440				7.460	3.860	7.000		34.74	24	RCP	0.013	0.51	2.35	11.1	202	2.00	48	0.77	1.46	4.75	388.93	387.90	394.65	396.11	402.49
EW-440	--				7.460	3.860	7.000		34.74	24	RCP	0.013	0	2.35	11.1	0		0				387.90	387.90	389.90	389.90	--

SUBJECT: ICC CONTRACT A — DESIGN MB — DATE 1/24/2008

CONTRACT NO. AT3765960 — CHECK KH — DATE 1/25/2008

OUTLET STRUCTURE NO. EW-440 — LOCATION: STATION: 1279+25

OUTLET STRUCTURE TYPE ENDWALL — OFFSET: 139 LT

PIPE SIZE = 24 INCH

Q_{10} = 25.2 CFS

V_{10} = 8.00 FPS

NORMAL DEPTH = 2.00 FT

OUTFALL DITCH SLOPE = 5.00% OR _____

BOTTOM= 2 FT

SIDE SLOPE S1 = 2:1 SIDE SLOPE S2 = 2:1 DEPTH= 2'

TAILWATER CONDITION MAXIMUM TAILWATER

REFER TO 1994 MD STD AND SPEC FOR SOIL EROSION AND SEDIMENT CONTROL, SECTION F-18

D_{50} = 3.0 INCH USE SHA CLASS 1 RIP-RAP

D_{50} = 9.5 INCH

D_{100} = 19 INCH

THICKNESS= 19 INCH

APRON LENGTH = 20 FT

APRON WIDTH = 10 FT

RIP-RAP QUANTITY= 22 SY

SUBJECT: ICC CONTRACT A | DESIGN: MB | DATE: 1/24/2008
CONTRACT NO. AT3765960 | CHECK: KH | DATE: 1/25/2008

OUTLET STRUCTURE NO. EW-446 LOCATION: STATION: 1283+00
OUTLET STRUCTURE TYPE ENDWALL OFFSET: 137 LT

PIPE SIZE = 24 INCH
Q_{10} = 22.7 CFS
V_{10} = 7.20 FPS
NORMAL DEPTH = 1.35 FT
OUTFALL DITCH SLOPE = 0.00% OR TO BMP
BOTTOM= FT
SIDE SLOPE S1 = SIDE SLOPE S2 = DEPTH=
TAILWATER CONDITION MAXIMUM TAILWATER

REFER TO 1994 MD STD AND SPEC FOR SOIL EROSION AND SEDIMENT CONTROL, SECTION F-18

D_{50} = 3.0 INCH USE SHA CLASS I RIP-RAP

D_{50} = 9.5 INCH
D_{100} = 15 INCH
THICKNESS= 19 INCH

APRON LENGTH = 12 FT
APRON WIDTH = 7 FT
RIP-RAP QUANTITY= 9 SY

SUBJECT: ICC CONTRACT A — DESIGN: MB — DATE: 1/24/2008
CONTRACT NO. AT3765960 — CHECK: KH — DATE: 1/25/2008

OUTLET STRUCTURE NO. EW-459 — LOCATION: STATION: 1295+82
OUTLET STRUCTURE TYPE ENDWALL — OFFSET: 145.5 RT

PIPE SIZE = 36 INCH
Q_{10} = 35.0 CFS
V_{10} = 12.97 FPS
NORMAL DEPTH = 1.22 FT
OUTFALL DITCH SLOPE = 5.00% OR _____
BOTTOM= 4 FT
SIDE SLOPE S1 = 2:1 SIDE SLOPE S2 = 2:1 DEPTH= _____
TAILWATER CONDITION MINIMUM TAILWATER

REFER TO 1994 MD STD AND SPEC FOR SOIL EROSION AND SEDIMENT CONTROL, SECTION F-18

D_{50} = 9.0 INCH USE SHA CLASS I RIP-RAP

D_{50} = 9.5 INCH
D_{100} = 19 INCH
THICKNESS= 19 INCH

APRON LENGTH = 14 FT
APRON WIDTH = 10 FT
RIP-RAP QUANTITY= 16 SY

SUBJECT: ICC CONTRACT A — DESIGN: MB — DATE: 1/24/2008
CONTRACT NO. AT3765960 — CHECK: KH — DATE: 1/25/2008

OUTLET STRUCTURE NO. ES-461 — LOCATION: STATION: 1294+93
OUTLET STRUCTURE TYPE END SECTION — OFFSET: 149 RT

PIPE SIZE = 24 INCH
Q_{10} = 17.0 CFS
V_{10} = 5.40 FPS
NORMAL DEPTH = 1.59 FT
OUTFALL DITCH SLOPE = 1.00% OR _____
BOTTOM= 2 FT
SIDE SLOPE S1 = 2:1 SIDE SLOPE S2 = 2:1 DEPTH= _____
TAILWATER CONDITION MAXIMUM TAILWATER

REFER TO 1994 MD STD AND SPEC FOR SOIL EROSION AND SEDIMENT CONTROL, SECTION F-18

D_{50} = 3.0 INCH USE SHA CLASS I RIP-RAP

D_{50} = 9.5 INCH
D_{100} = 15 INCH
THICKNESS= 19 INCH

APRON LENGTH = 10 FT
APRON WIDTH = 8 FT
RIP-RAP QUANTITY= 9 SY

SUBJECT: ICC CONTRACT A — DESIGN: MB — DATE: 1/24/2008
CONTRACT NO. AT3765960 — CHECK: KH — DATE: 1/25/2008

OUTLET STRUCTURE NO. EW-464 — LOCATION: STATION: 1290+56
OUTLET STRUCTURE TYPE END WALL — OFFSET: 154 RT

PIPE SIZE = 24 INCH
Q_{10} = 15.5 CFS
V_{10} = 4.90 FPS
NORMAL DEPTH = 1.17 FT
OUTFALL DITCH SLOPE = 0.00% OR TO BMP
BOTTOM= _____ FT
SIDE SLOPE S1 = _____ SIDE SLOPE S2 = _____ DEPTH= _____
TAILWATER CONDITION MAXIMUM TAILWATER

REFER TO 1994 MD STD AND SPEC FOR SOIL EROSION AND SEDIMENT CONTROL, SECTION F-18

D_{50} = 4.0 INCH — USE SHA CLASS 1 RIP-RAP

D_{50} = 9.5 INCH
D_{100} = 19 INCH
THICKNESS= 19 INCH

APRON LENGTH = 10 FT
APRON WIDTH = 8 FT
RIP-RAP QUANTITY= 9 SY

SUBJECT: ICC CONTRACT A — DESIGN MB — DATE 1/24/2008

CONTRACT NO. AT3765960 — CHECK KH — DATE 1/25/2008

OUTLET STRUCTURE NO. EW-475 — LOCATION: STATION: 1301+76

OUTLET STRUCTURE TYPE ENDWALL — OFFSET: 155 RT

PIPE SIZE = 24 INCH

Q_{10} = 12.4 CFS

V_{10} = 3.90 FPS

NORMAL DEPTH = 2.00 FT

OUTFALL DITCH SLOPE = 5.00% OR _____

BOTTOM= 2 FT

SIDE SLOPE S1 = 2:1 SIDE SLOPE S2 = 2:1 DEPTH= 1'

TAILWATER CONDITION MAXIMUM TAILWATER

REFER TO 1994 MD STD AND SPEC FOR SOIL EROSION AND SEDIMENT CONTROL, SECTION F-18

D_{50} = 3.0 INCH USE SHA CLASS 1 RIP-RAP

D_{50} = 9.5 INCH

D_{100} = 19 INCH

THICKNESS= 19 INCH

APRON LENGTH = 10 FT

APRON WIDTH = 8 FT

RIP-RAP QUANTITY= 9 SY

APPENDIX H

PHOTOGRAPHS

Photographs 1 and 2 - SP D-1-1 Looking U/S and D/S Respectively

Photographs 3 and 4- SP D-1-2 Looking U/S and D/S Respectively

Photographs 5 and 6- SP D-2-1 Looking U/S and D/S Respectively

Photographs 7 and 8- SP D-2-2 Looking U/S and D/S Respectively

Photographs 9 and 10- SP D-2-3 Looking U/S and D/S Respectively

Photographs 11 and 12- SP D-2-4 Looking U/S and D/S Respectively