CONSTRUCTION PERMIT APPLICATION
SECTION 1
CLASS I CAPACITY EXPANSION, SOUTHEAST COUNTY LANDFILL
HILLSBOROUGH COUNTY, FLORIDA

VOLUME 3 OF 3
STORMWATER MANAGEMENT SYSTEM

Submitted to:

Florida Department of Environmental Protection
Southwest District
3804 Coconut Palm Drive
Tampa, Florida 33619

For:

Hillsborough County Solid Waste Management Department
601 East Kennedy Boulevard
P.O. Box 1110
Tampa, Florida 33601

Submitted by:

SCS ENGINEERS
3012 U.S. Highway 301 North
Suite 700
Tampa, Florida 33619
(813) 621-0080

March 16, 2000
Job No. 0995029.35

K.10 STORMWATER MANAGEMENT SYSTEM

This volume presents the design of the stormwater management system for the Capacity Expansion at the Southeast County Landfill, and follows the format of the solid waste permit application. The Capacity Expansion utilizes the existing surface and stormwater management system, that are designed in accordance with Chapter 62-25, FAC, and Chapter 62-701, FAC, and serves to prevent intrusion of stormwater runoff into areas with MSW. In addition, the design maintains conformance with the site's Southwest Florida Water Management District Permit (No. 100330) presented in Attachment A.

K.10.a Stormwater Management

Stormwater for the Capacity Expansion of the Southeast County Landfill (Sections 1 through 10) is designed to meet the requirements of the Southwest Florida Water Management District. The stormwater management system is designed to prevent surface water flow onto waste filled areas and to manage runoff from the landfilled areas. Ponds have been designed with overflow structures and underdrain systems to attenuate the peak discharges so that the peak discharge flowing off site after the landfill is built will be less than the peak discharge that existed before building.

The site drainage pattern is shown in drawings presented in Attachment B. The perimeter ditch system handles surface water runoff around the site, prevents off-site drainage from entering the landfill area, and carries the runoff to existing basins "C" and "D".

K.10.b Watershed Areas

The pre-condition watershed area is shown on drawing presented in Attachment B. This map shows the contour lines and topography of the area in addition to the direction of runoff for time of concentration calculations. The post-condition watershed areas were defined using the designed contours and layout of the proposed landfill expansion and is shown in the Drawings (Attachment D-1). Contributing areas were calculated using the "area" command in AutoCAD.

K.10.c Time of Concentration

The time of concentration is the time for runoff to travel from the hydraulically most distant point in the watershed to the exit point of the watershed. The TR-55 computer model was used to solve the time of concentration for both the pre-condition and post-condition watersheds based on inputs of surface roughness, water flow length, and input storm.

The time of concentration value as determined by TR-55 is divided into three sections: sheet flow, shallow flow, and open channel flow. Sheet flow occurs usually over the first 300 feet of the water travel path, after which it becomes shallow concentrated flow as water accumulates. Open channel flow occurs where manmade or natural channels are formed.

Manning's roughness coefficient is an input parameter for the sheet flow. For the pre-condition watershed of the landfill site, a Manning's value of 0.15 was used, which corresponds to short prairie grass. For the post-condition watershed, a value of 0.24 was used, which corresponds to dense grasses. The equation used by TR-55 to calculate the time in hours for sheet flow for up to 300 feet is:

$$T = \frac{.007 * (n * L)^{0.8}}{P2^{0.5} * s^{0.4}}$$

where n is Manning's roughness coefficient

L is the flow length in feet

P2 is the two-year, 24-hour rainfall event

s is the slope in ft/ft

Summary	**Pre-Condition**	**Post-Condition**
Surface Description	Short grass	Dense grass
Manning's "n"	0.15	0.24
Flow Length (ft)	300	300
2-year, 24-hour rain (in)	4.1	4.1
Land slope (ft/ft)	0.0066	0.05
Travel time (hrs)	0.54	0.35

The slopes used for the time of concentration for the pre-condition watershed were determined from the change in elevation along the flow path divided by the length of the path. The slopes used for the post-condition are equal to the proposed slopes for the various terraces and surfaces of the landfill.

The two-year, twenty-four hour rainfall event used for the sheet flow time of concentration was determined to be 4.1 inch based in interpolation of the SWFWMD rainfall contour curves as shown in the Southwest Florida Water Management District's Permit Information Manual, 1994, shown in Attachment B.

After 300 feet of sheet flow, the flow is considered shallow flow and flows much quicker due to the buildup of water upon itself (decreased friction losses). The velocity for shallow concentrated flow is determined from a graph in TR-55 (see graph in Attachment B) and is determined from the slope and whether or not the surface is paved or unpaved. The travel time in hours for this segment is computed from the equation:

$$T = \frac{L}{3600 * V}$$

where L is the length of flow in feet

V is the velocity of flow from the velocity graph

Runoff water continues to flow overland as shallow flow until it reaches a channel or pond. For channel flow, the velocity of flow is calculated using Manning's equation:

$$V = \frac{1.49 * r^{\frac{2}{3}} * s^{\frac{1}{2}}}{n}$$

where V is velocity in ft/sec

r is the hydraulic radius = area divided by wetted perimeter

s is the slope in ft/ft

n is Manning's roughness coefficient

Travel time for this section is computed as length divided by velocity as above. Time of concentration is the summation of all of the travel times shown above.

Pre-Condition	Tc = 0.96 hours
Post-Condition	Tc = 0.45 hours

K.10.d Rainfall

Runoff from rainfall is calculated using the 24-hour, 25-year rainfall event as specified in the Southwest Florida Water Management District Stormwater Design Manual. In addition, 24-hour, 2-year design rainfall event is used with TR-55 in calculating the travel time for sheet flow. According to our interpolation between the isopluvial contours on the rainfall maps supplied by SWFWMD, the 24-hour, 25-year storm for the landfill is approximately 8.4 inches, and the 24-hour, 2-year storm event is approximately 4.1 inches. The rainfall maps are shown in Attachment B.

K.10.e Runoff Curve Numbers (CN)

The CN values were included in the runoff analysis using Haestad Method's "Quick TR-55 Release 5.0" modeling software, which uses the Soil Conservation Service's Technical Release Number 55 as the basis for the model. The CN values were obtained from TR-55 based on the existing and proposed soil conditions for the landfill.

The pre-condition soil type for the prospective landfill expansion was based on the survey maps provided in the United States Department of Agriculture's Soil Survey of Hillsborough County, Florida, 1989. The soil survey map (copy presented in Attachment B) shows that the soils in the area are predominantly Quartzipsamments (CN = 68). There are also some Haplaquents (CN = 84) and a gravel road (CN = 91) that were not included since they are a small percentage and including them would make the design less conservative. Haplaquents are predominantly clayey soils while Quatzipsamments are predominantly sandy soils.

Pre-Condition	CN = 68
Post-Condition	CN = 86

K.10.f Pond "C" and Pond "D"

Pond "C" is an existing stormwater pond. It will receive runoff from the expansion of the landfill. Runoff will also be flowing to the existing Pond "D", which is also receiving flow from the existing landfill. Hydrograph routing for Pond "D" includes the hydrograph input from the existing landfill. The outflow from Ponds "C" and "D" are divided into 3 areas:

- Flow over the overflow weir
- Flow into the standpipe
- Flow infiltration through pond bottom similar to effect of constant head permeameter

Flow over the overflow weir is modeled using the standard contracted weir equation:

$$Q = 3.33(L - 0.2H) * H^{\frac{3}{2}}$$

where L is the width of the rectangular notch in feet

H is the height of the water above the weir in feet

Flow into the standpipe through the orifice in the standpipe is governed by the orifice equation:

$$Q = C_d * A * \sqrt{2 * g * h}$$

where C_d is the coefficient of discharge = 0.60

A is the cross-sectional area

g is the gravity constant

h is the hydrostatic head above the center of the orifice

Flow into the stop of the standpipe is similar to the weir equation above, except without the contraction coefficient and with a weir coefficient of 2.67.

Flow through the underdrain system is based on Darcy's equation:

$$v = k * i * a$$

where v is the velocity of flow

k is the hydraulic conductivity of the soil

I is the gradient based on head

a is the cross-sectional area

Photographs showing Ponds "C" and "D" are shown in Attachment B, including the standpipes and overflow weirs.

K.10.g Hydrograph Generation

The TR-55 software generated hydrographs for the pre-condition and post-condition watershed based on the inputs from the runoff coefficient file, the time of concentration file, and design storm inputs. The design storm is the 25-year, 24-hour and was determined to be 8.4 inches based on the SWFWMD isopluvial map shown in Attachment B. The storm type used was SCS Type II. The output hydrograph was printed and the peak flow was determined. The input and output files from TR-55 are contained in Attachment B.

	Volume of Runoff (ft^3)	Peak Flow (cfs)
Pre-Condition to Pond "C"	994,500	157.00
Post-Condition from Pond "C"	1,468,260	58.59
Pre-Condition to Pond "D"	1,373,400	320.00
Post-Condition from Pond "D"	2,012,400	117.39

K.10.h Conclusions

The stormwater calculations demonstrate that Ponds "C" and "D" are adequately sized to provide sufficient storage and treatment volume to accommodate design storms in accordance with Southwest Florida Water Management District regulations. The peak outflow from each pond from the entire Southeast County Facility for post-development conditions is less than the pre-development peak flow. The stormwater design incorporates advanced features such as underdrain systems, standpipes, and energy dissipators at the landfill to ensure maximum efficiency in the treatment and conveyance of stormwater from this site.

K.10.i Gabion Downchute Design

The proposed final landfill sideslopes will be constructed at a 3H:1V grade. At this slope, water will flow at critical velocities. These high velocity/high energy flows may cause erosion damage to any type of earthen or grassed lined swales, even when reinforced with geotextile material. Swales constructed of reno mattresses and underlain with a geomembrane material to prevent bedding erosion will provide a drainage system that is durable, can hold rip-rap in place, and which is able to adjust for landfill settlement.

The proposed downchute design was analyzed for its ability to convey the peak discharge of a 24-hour, 25-year storm, as calculated in the previous section. As shown, Downchute 2 produces the worst case stormwater runoff situation at the landfill, with a 25-year, 24-hour storm event producing a calculated stormwater runoff of less than 118 cubic feet per second (cfs). This peak flow was used to create a standard downchute design.

To make use of the standard gabion basket sizes available, the downchute geometry was set to the following:

- 3H:1V sideslopes.
- 3-foot bottom width.
- 2-foot depth.

The resulting 15-foot width of the downchute can be constructed by using a combination of 6- and 9-foot long reno (gabion) mattresses to create the channel lining. At the peak flow, the depth of flow in the swale was calculated to be 0.98 feet. This will provide about 1-foot of freeboard as a factor of safety against overtopping.

K.10.j Velocity Dissipator Design

The design of the velocity dissipators was based on the need to control the hydraulic jump of the stormwater flow discharging from a downchute, and to provide for the total absorption of water impact forces in cases where the stormwater flow needs to be redirected. The velocity dissipators will be constructed of gabion baskets (lined with geomembrane) and reno mattresses, creating a floor and up to two walls of gabion baskets. The dissipators are of similar design as that of the existing landfill, which has higher velocity and flows. As the structure dissipates the stormwater flow impact forces, the runoff also is redirected into a receiving swale or culvert.

A 6- or 7-foot high gabion wall comprised of combinations of 1- and 3-foot tall stacked gabion baskets and reno mattresses will provide adequate height to avoid the overtopping of the stormwater as it discharges from the downchutes.

Downchutes will discharge stormwater runoff directly into a perimeter channel which runs along the footprint of the landfill. As the peak flow in this case is relatively low and does not need to change direction laterally, a standard rip-rap velocity dissipator of sufficient length can be used. Based on a peak flow rate of 118 cfs entering the channel via a 15-foot wide trapezoidal culvert, a velocity dissipator comprised of 9-inch d_{50} stone, 30 feet in length, will be sufficient to avoid scouring the channel area immediately downstream of the discharge point. This same configuration is currently being utilized successfully at the existing Southeast County Landfill, which has a peak flow rate of 185 cfs.

ATTACHMENT A

SITE PERMIT

BEST AVAILABLE COPY

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

2379 BROAD STREET, BROOKSVILLE, FLORIDA 33512-9712
PHONE (904) 796-7211 SUNCOM 684-0111

December 9, 1983

DEC 12 1983

Mr. Warren N. Smith
Hillsborough County, Dept. of Solid Wastes
800 Twiggs Street, 3rd Floor, Edgecomb Public Serv.
Tampa, Florida 33601

DEPA... WASTE

Re: Application for Permit No. 100330 - Southeast County Sanitary Landfill

Dear Mr. Smith:

The above referenced Application for Permit was approved by the Board of Governors of the District on December 7, 1983.

A Permit may be required from the Department of Environmental Regulation (7601 U.S. Highway 301 North, Tampa, FL 33610) and it would be your responsibility to obtain it.

The Application for Permit, when signed by the Surface Permits Coordinator, Resource Regulation Department, constitutes your approved Permit.

Sincerely,

OLIVER R. DEWITT
Surface Permits Coordinator
Resource Regulation Dept.

ORD:aa
Enclosure: Approved Permit
Completion Report

cc: J.E. Curren

Copies to: ...

CONSERVE WATER TODAY ...

NO CARBON REQUIRED

APPLICATION FOR PERMIT

Number 100330

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
5060 US Highway 41 South
Brooksville, Florida 33512

1. Description of construction or use: five (5) detention basins and associated facilities to collect, store, and treat the runoff from the first inch of rainfall from a 25-year storm for water that will enter State waters from a new sanitary landfill.

2. Location: See Section II of Permit Application

   County: Hillsborough Section: 13, 14, 15, 22, 23, 24 Township: 31S Range 21E

   See Sections III and IV of Permit Application
   Block: .... Lot: .... Subdivision: ....

3. Body of water involved: unnamed tributary to Long Flat Creek

4. Name of applicant: Hillsborough County Department of Solid Waste Phone: Mr. Warren Smith, Director (813) 272-6674

   Street or P.O. Box: 800 Twiggs Street, 3rd Floor, Edgecomb Public Service Center

   City: Tampa State: Florida Zip: 33601

5. Name of owner if other than applicant: See Section III Phone ....

   Street or P.O. Box ....

   City .... State: .... Zip: ....

   If applicant is not the owner, a letter dated and signed by owner authorizing the applicant to act for him/her must accompany this application.

6. Area (acres) proposed to be served: (If application is for drainage or irrigation connection, list the acreages involved.) Basin A-32 acres; Basin B-64 acres; Basin C-96 acres; Basin D-293 acres; Basin E-3 acres.

7. How soon after receipt of the permit will work commence? unknown days. When will work be completed? August, 1983

8. In the event that the requirements or interests of the Southwest Florida Water Management District indicate that the removal alteration or repair of any structure or works installed by the permittee is necessary, or becomes in an unsafe condition, the structure or works must be removed, altered or repaired within 60 days of notice and at no cost to the District. Should the permittee fail or refuse to perform the required action when so notified, the SWFWMD may alter, repair or remove the structure or work and the costs incidental thereto must be paid by the permittee.

9. Any erosion or shoaling caused by the permittee's construction or operation of permitted facilities, upon written notice by the District, shall be repaired promptly by the permittee at no cost to the District.

10. This application including sketches, drawing or plans and specifications attached contains a full and complete description of the work proposed or use desired and for which permit is herewith applied. It shall be a part of any permit that may be issued.

11. This application becomes an APPROVED PERMIT upon affixing of signature of Director Regulatory Division and transmittal to applicant.

Sworn to this 20 day of Oct. 1983

Signature of Applicant

Notary Public

12-7-83
O.R. [illegible]

NOTARY PUBLIC STATE OF [illegible]
MY COMMISSION EXPIRES [illegible]
BONDED THRU GENERAL INS. UNDERWRITERS

10-10-83

ATTACHEMNT B

DESIGN CALCULATIONS

SCS ENGINEERS

Client	Project	Job No.
Hillsborough County	Southeast County Landfill Expansion	0995029.35

Subject	By	Date
Landfill Expansion Design Calculations	KAS/WST	16-Feb-00
	Checked: KAS	Date: 3-15-00

Objective: Provide stormwater calculations for the proposed expansion of the Southeast County Landfill.

Approach:

1. Manage stormwater runoff from the proposed landfill expansion in accordance with regulations promulgated by the Southwest Florida Water Management District.

2. Provide a step-by-step analysis of the flow of water from the hydraulically most distant point in the watershed to the ultimate discharge off site.

Calculations:

1. The site contains a total of 147 acres and site plans are shown in the attached drawings. As shown in the site plans (Appendix A pre-condition, Appendix B post-condition), most of the water flows to Pond "C" and some to Pond "D".

2. Appendix C contains worksheets and tables from TR-55 shows the pre-condition Runoff Curve Number CN = 68, post-condition CN = 86. Pre-condition soil types were found using the soil maps from the *Soil Survey of Hillsborough County* by the Soil Conservation Service.

3. The 24-hour, 25-year rainfall event was interpolated to be 8.4" as shown in Appendix D isopluvial map from the Southwest Florida Water Management District Permit Information Manual. The 24-hour, 2-year rainfall event was interpolated to be 4.1" as shown in a separate map.

4. Time of concentration calculations are shown in the worksheets and tables in Appendix E from TR-55. The pre-condition Tc for Section 1 is 0.50 hours, and the post-condition Tc for Section 1 is 0.53 hours. The pre-condition Tc for the Entire Landfill is 0.96 hours, and the post-condition Tc for the Entire Landfill is 0.49 hours. The following assumptions and calculations were used for Tc:
   - A. Pre-condition Manning's "n" = 0.15 for short prairie grass
   - B. Post-condition Manning's "n" = 0.24 for dense grasses
   - C. Sheet flow defined by Manning's kinematic solution for first 300 feet of flow
   - D. Shallow concentrated flow after first 300 feet based on slope and paving conditions estimated from attached Figure 3-1 from TR-55
   - E. Side slope channel velocity calculated using Manning's Equation assuming triangular channel with 3:1 sides and a channel slope of 1%
   - F. Downchute channel velocity calculated using Manning's Equation assuming trapezoidal channel with 3' bottom and 3:1 sides and a channel slope of 38%
   - G. Bottom Swale channel velocity calculated using Manning's Equation assuming trapezoidal channel with 6' bottom and 3:1 sides and a channel slope of 0.5%
   - H. Manning's "n" for side slopes and bottom swale = 0.06 for maintained grass/sodded ditches per FDOT Drainage Manual Table 7-3 (attached)
   - I. Manning's "n" for downchute with riprap = 0.033 for 4" riprap per HEC-15 equation (attached)

Client	Project	Job No.
Hillsborough County	Southeast County Landfill Expansion	0995029.35

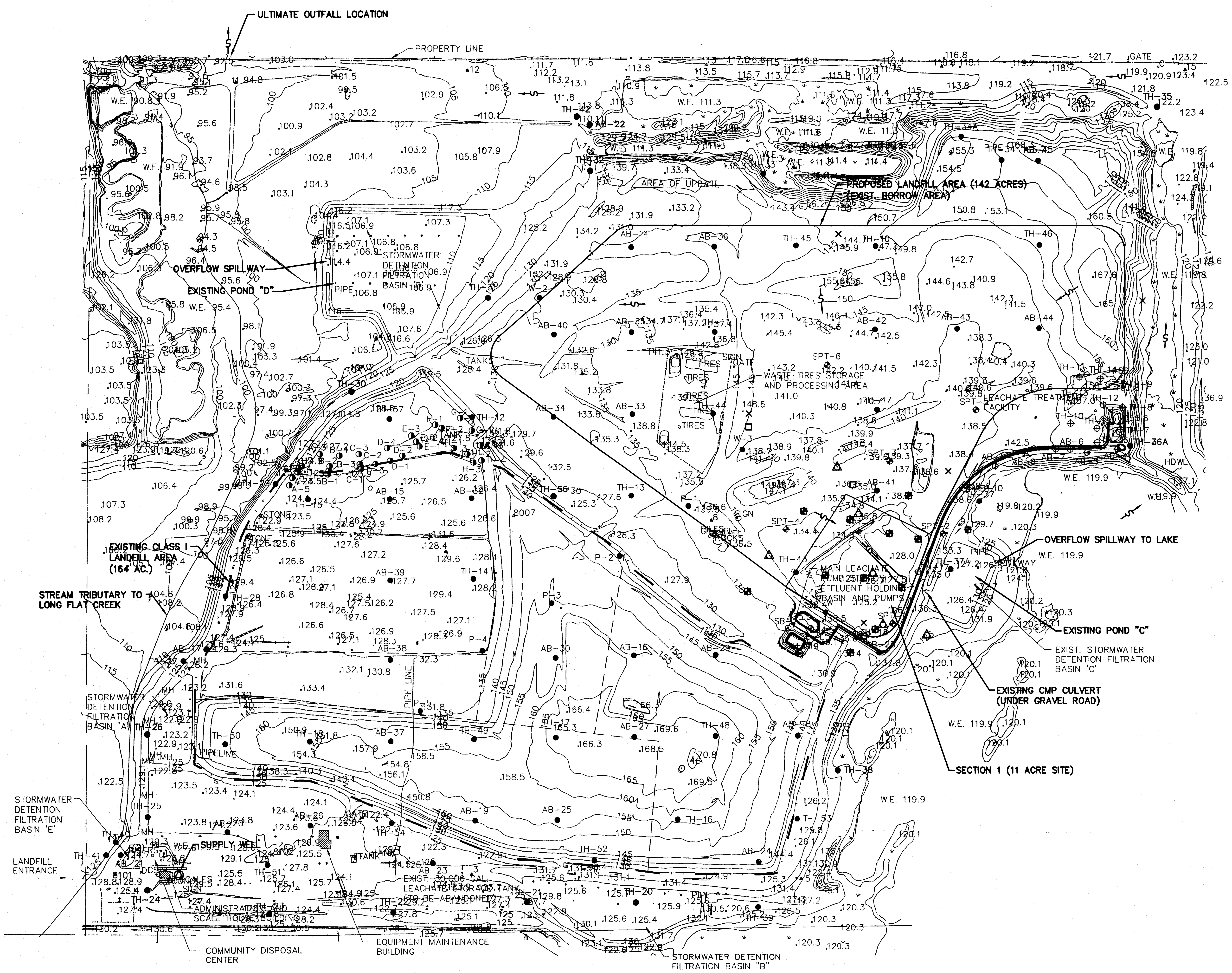
Subject	By	Date
Landfill Expansion Design Calculations	KAS/WST	16-Feb-00
	Checked KAS	Date 3-15-00

Summary of important TR-55 and Pondpack information (see Appendix F):

	Pond "C"	**Pond "D"**
Contributing Area	62.23 Acres	85.31 Acres
Volume required to treat first 1/2" of runoff	2.59 ac-ft	3.55 ac-ft
Required control elev.	128.5 ft NGVD	107.9 ft NGVD
Bottom infiltration	See table	See table
Standpipe diameter	3 feet	5 feet
Rectangular weir length	20 feet	80 feet
Weir elevation	130.75 ft NGVD	115 ft NGVD
Pre-condition runoff vol.	994,500 cubic feet	1,373,400 cubic feet
Pre-condition peak flow	157 cfs	320 cfs
Post-condition runoff vol.	1,468,260 cubic feet	2,012,400 cubic feet
Post-condition peak flow	58.59 cfs	117.39 cfs
Post-condition peak elevation	130.57 ft NGVD	109.59 ft NGVD
Existing top of bank elevation	132 ft NGVD	116 ft NGVD

APPENDIX A
PRE-CONDITION
SITE PLAN WITH HYDRAULIC FLOW PATHS

1565482



LEGEND

- AB-34 ● EXISTING SOIL BORING LOCATION BY ARDAMAN & ASSOC. (1983)
- TH-4 ⊕ EXISTING SOIL BORING LOCATION BY ARDAMAN & ASSOC. (1990)
- SPT-5 ⊗ EXISTING SOIL BORING LOCATION BY JAMMAL & ASSOC. (1990)
- C-3 ◑ EXISTING SOIL BORING LOCATION BY ARDAMAN & ASSOC. (1991)
- SB-2 ⊙ EXISTING SOIL BORING LOCATION BY ATLANTIC & ASSOC. (1991)
- CONE PENETRATION TEST (CPT)
- △ STANDARD PENETRATION TEST (SPT)
- × PIEZOMETER–SURFICIAL AQUIFER
- □ PIEZOMETER–PERCHED WATER TABLE
- FLOW DIRECTION

REV.	DATE	DESCRIPTION	CK. BY
1			
2			
3			
4			
5			

DRAWING TITLE
STORMWATER PRE-DEVELOPMENT CONDITION

PROJECT TITLE
SOUTHEAST COUNTY LANDFILL CAPACITY EXPANSION

CLIENT
HILLSBOROUGH COUNTY SOLID WASTE MANAGEMENT DEPARTMENT
TAMPA, FLORIDA

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
3030 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757

PROJ. NO. 09199029.42 | DWN. BY: VDP | Q/A RVW BY: LER
CHK. BY: – | APP. BY: BLJ | RBG

CADD FILE: STORMPRE.DWG

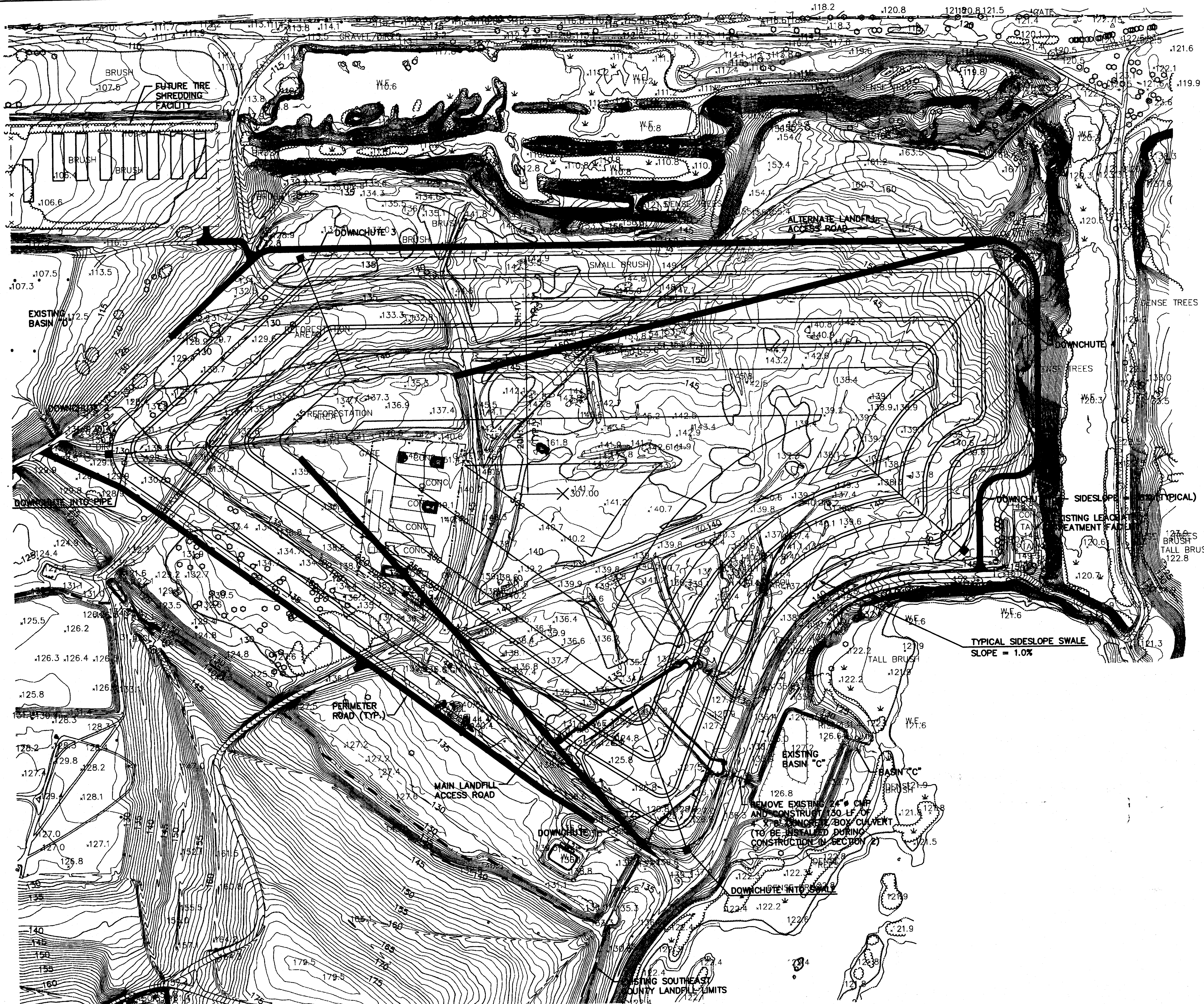
DATE: JANUARY 27, 2000

SCALE: 1"=300'

DRAWING NO. 1 of 1

D.E.P. MAR 17 2000 Southwest District Tampa

APPENDIX B
POST-CONDITION
SITE PLAN WITH HYDRAULIC FLOW PATHS



NOTE:
EXISTING TOPOGRAPHY COMPILED FROM AERIAL SURVEY BY AEROMAP U.S. FOR WASTE MANAGEMENT INC. OF FLORIDA DATED MARCH 8, 1997.

REV.	DATE	DESCRIPTION	CK. BY
△			
△			
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DRAWING TITLE: STORMWATER POST-DEVELOPMENT CONDITION

PROJECT TITLE: SOUTHEAST COUNTY LANDFILL CAPACITY EXPANSION

CLIENT: HILLSBOROUGH COUNTY SOLID WASTE MANAGEMENT DEPARTMENT TAMPA, FLORIDA

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS
3012 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757

PROJ. NO. 0995029.42 | DWN. BY: BLJ | Q/A RVW BY: RBG
DSN. BY: LER/KAS | CHK. BY: LER | APP. BY: RBG

CADD FILE: STORMPST.DWG

DATE: JANUARY 27, 2000

SCALE: AS SHOWN

DRAWING NO. 1 of 1

(2)

APPENDIX C
RUNOFF CURVE NUMBER (CN)
WORKSHEETS

Worksheet 2: Runoff curve number and runoff

Project SOUTHEAST LANDFILL EXPANSION By BST Date 12/6/99

Location HILLSBOROUGH COUNTY Checked ____ Date ____

Circle one: (Present) Developed ____________

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi^2 ☒ %	Product of CN x area
QUARTZIPSAMMENTS GROUP A	GRASSLAND WITH POOR COVERAGE	68			100	68
	– ALSO SOME HAPLAQUENTS (CN=84) AND GRAVEL ROAD (CN=91) NOT					
	INCLUDED IN PRE-CONDITION FOR CONSERVATISM					

1/ Use only one CN source per line. Totals = 100 | 68

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ______ = ______; Use CN = 68

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	25	2	
Rainfall, P (24-hour)	in	8.4	4.1	
Runoff, Q .... (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Worksheet 2: Runoff curve number and runoff

Project SOUTHEAST LANDFILL EXPANSION By BST Date 12/7/99

Location HILLSBOROUGH COUNTY Checked ____ Date ____

Circle one: Present (Developed)

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi^2 ☒ %	Product of CN x area
BACKFILL - VERY LITTLE CLAY - SOIL GROUP	OPEN SPACE LAWN - ASSUME POOR CONDITION (<50% COVER)	86			100	86
B OR C	AND SOIL GROUP C FOR CONSERVATISM					
				Totals =	100	86

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = **86**

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	25	2	
Rainfall, P (24-hour)	in	8.4	4.1	
Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

SOUTHEAST LANDFILL EXPANSION

POST - CONDITION

Table 2-2a.—Runoff curve numbers for urban areas[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)				POST CONDITION	
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91 ← GRAVEL ROAD
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1]Average runoff condition, and $I_a = 0.2S$.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

SOUTHEAST LANDFILL EXPANSION
PRE-CONDITION

Table 2-2c.—Runoff curve numbers for other agricultural lands[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing.[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element.[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	[4]30	48	65	73
Woods—grass combination (orchard or tree farm).[5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods.[6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	[4]30	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

QUARTZIPSAMMENTS with little ground cover

HAPLAQUENTS with fair ground cover

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Poor:* <50% ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: >75% ground cover and lightly or only occasionally grazed.

[3]*Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

[4]Actual curve number is less than 30; use CN = 30 for runoff computations.

[5]CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

[6]*Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

about 54 inches, is brown fine sand. The substratum to a depth of about 80 inches is white fine sand. In places, the upper part of the subsoil is within 30 inches of the soil surface. In places, the upper part of the subsoil is at a depth of more than 50 inches. In some of the lower parts of the landscape, the soil is somewhat poorly drained.

The Urban land part of this complex is covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so that their identification is not feasible.

Included in mapping are Felda, Immokalee, and Smyrna soils in small areas. These soils are poorly drained and are in slightly lower positions on the landscape than Pomello soil.

In most years, a seasonal high water table is at a depth of 24 to 40 inches for 1 to 4 months and recedes to a depth of 40 to 60 inches during dry periods. The permeability of Pomello soil is very rapid in the surface and subsurface layers, moderately rapid in the subsoil, and rapid in the substratum. The available water capacity is very low.

Present land use precludes the use of the soils in this map unit for cultivated crops, pasture, or commercial trees. Pomello soil in the Urban land part of this complex is used for lawns, parks, playgrounds, or cemeteries, or it is left as open space.

If the soils in this map unit are used for building site development, the main management concerns are instability of cutbanks and possible contamination of the ground water. Population growth has resulted in increased construction of houses on this soil. Cutbanks are not stable and are subject to slumping. If the density of housing is moderate to high, a community sewage system can help to prevent contamination of water supplies by seepage. Droughtiness, a result of the very low available water capacity, is a limitation, especially during extended dry periods. Selection of vegetation that is adapted to these soils is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The soils in this map unit have not been assigned to a capability subclass, to a woodland group, or to a range site.

→ **43—Quartzipsamments, nearly level.** These soils are nearly level and moderately well drained to excessively drained. They formed in accumulations of sand from phosphate mining operations. Quartzipsamments generally are confined to areas in specially constructed basins. Sand, a by-product of phosphate mining operations, has been pumped into these basins and allowed to dry.

The color and thickness of these soils vary from one area to another, but one of the more common profiles has a surface layer of mixed dark gray, gray, and light gray fine sand about 15 inches thick. Below the surface layer, to a depth of about 55 inches, is pale brown fine sand. Below that layer to a depth of more than 80 inches is light brownish yellow fine sand.

Included in mapping are natural soils in small areas, which have not been altered, and sand tailings with inclusions of loamy or clayey bodies (slickens). In areas where slickens have been added, the amount of clay in the soil is variable. The variations in the amount of clay is caused by the differential settling velocity of sand and slickens. In some places, the clay has been carried by the water, has settled, and has formed slight depressions on the landscape. Also included are small areas of Haplaquents, small areas of soil that has slope ranging from 0 to 5 percent, and small depressions with intermittent pools of water.

Quartzipsamments have a variable water table that is dependent upon the water table of the surrounding soils. In most areas, the seasonal high water table is at a depth of more than 72 inches. In some areas, the seasonal high water table fluctuates between depths of 20 to 72 inches of the surface. Permeability is variable but generally is very rapid. The available water capacity is also variable but generally is very low.

In most areas, these soils are used for pasture or have been left idle. A few areas are used for homesite or urban development.

The soils in this map unit have not been assigned to a capability subclass, to a woodland group, or to a range site.

44—St. Augustine fine sand. This soil is nearly level and somewhat poorly drained. It is on flats and ridges bordering Tampa Bay. It is subject to flooding for very brief periods during hurricanes. The slope is 0 to 2 percent.

In 95 percent of the areas mapped as St. Augustine fine sand, the St. Augustine soil and similar soils make up 91 to 99 percent of the mapped areas. Dissimilar soils make up 1 to 9 percent of the mapped areas.

Typically, this soil has a surface layer of dark gray fine sand about 3 inches thick. The upper part of the underlying material, to a depth of about 12 inches, is light brownish gray fine sand. The middle part, to a depth of about 30 inches, is light gray, mottled fine sand containing balls of sandy clay. The lower part to a depth of about 80 inches is gray fine sand. Similar soils included in mapping, in some areas, have a surface layer of sandy loam or loamy sand. Other similar soils, in some places, have an underlying material that consists of stratified lenses of sandy clay loam, clay loam, or loamy sand.

Dissimilar soils included in mapping are Kesson and Myakka soils in small areas. Kesson soils are very poorly drained. Myakka soils are poorly drained.

In most years, a seasonal high water table is at a depth of 20 to 30 inches for 2 to 6 months and recedes to a depth of 50 inches during prolonged dry periods.

p soil moisture and thus ensure maximum yields. :eting all crop residue to the soil and using a ropping system that includes grasses, legumes, or a rass-legume mixture help to maintain fertility. Frequent pplications of fertilizer and lime are generally needed to nprove soil quality.

This soil is well suited to pasture. Proper stocking, asture rotation, and timely deferment of grazing help eep the pasture in good condition. Fertilizer and lime re needed for optimum growth of grasses and legumes.

The potential of this soil for the production of slash ines is high. This soil has few limitations for woodland se and management.

If this soil is used for building site development, the ıain management concerns are excessive soil wetness, ıstability of cutbanks, and possible contamination of the round water. Drainage is needed to lower the high 'ater table, and fill material is needed in most areas. :utbanks are not stable and are subject to slumping. eptic tank absorption fields are mounded in most areas. the density of housing is moderate to high, a ommunity sewage system can help prevent ontamination of water supplies by seepage.

This Seffner soil is in capability subclass IIIw, in 'oodland group 10W, and in the Oak Hammocks range te.

50 ickens. This miscellaneous area consists of ve y poorly drained accumulations of fine-textured ıa from phosphate mining operations. Slickens enerally are confined in specially constructed basins or olding ponds. The basins are designed to allow water) flow through a series of holding ponds and allow the ickens to settle out. These areas are ponded for very ng periods. The slope is less than 1 percent.

Slickens do not have an orderly sequence of soil yers. Typically, the slickens are gray or light gray and ave mottles in various hues, values, and chromas. lickens are clayey and contain about 88 percent clay, 8 ercent silt, and 4 percent sand. The clay mainly is ıontmorillonite but includes kaolinite, illite, and :tapulgite. The clayey material is fluid or very fluid ıroughout except, in some places, the upper few inches e firm.

Included with this soil in mapping are uartzipsamments in small areas. Also included are ıort, steep to very steep slopes of exposed encircling kes.

In most years, undrained areas are ponded except ıring extended dry periods. A seasonal high water table ıctuates from the soil surface to a depth of about 10 ches. Permeability is very slow. The available water ıpacity is high.

Most areas in this map unit have been left idle. ickens generally do not support vegetation. They also e t ft and boggy to support livestock. Slickens are ıt d to cultivated crops, pasture, or commercial trees. An individual assessment of each site is necessary to determine its potential for different uses.

The soils in this unit have not been assigned to a capability subclass, to a woodland group, or to a range site.

51—Haplaquents, clayey. This soil is nearly level and very poorly drained. It formed in accumulations of fine-textured material from phosphate mining operations. Haplaquents are confined in specially constructed basins that are surrounded by short, steep dikes. Undrained areas are ponded for very long periods. The slope is less than 1 percent.

Typically, the surface layer is dark grayish brown clay about 3 inches thick. The underlying material to a depth of about 80 inches is gray clay that has mottles in various hues, values, and chromas. The clay is consolidated and will support the weight of livestock. Generally, Haplaquents range in thickness from about 3 feet near the edges to more than 30 feet in the centers of the basins. These soils contain about 88 percent clay, 8 percent silt, and 4 percent sand. The clay is principally montmorillonite but includes kaolinite, illite, and attapulgite.

Included in mapping are Slickens, Quartzipsamments, and water in small areas. Also included are short, steep to very steep slopes of exposed encircling dikes.

In most years, undrained areas of this map unit are ponded except during dry periods. A seasonal high water table fluctuates from the soil surface to a depth of about 10 inches. Permeability is variable but generally is very slow. The available water capacity is high.

In most areas, this soil is used as pasture or has been left idle in natural vegetation. The natural vegetation consists of primrose willow and Coastal Plain willow. The understory includes smartweed, maidencane, and cattails. An individual assessment of each site is necessary to determine its potential for different uses.

The soils in this map unit have not been assigned to a capability subclass, to a woodland group, or to a range site.

52—Smyrna fine sand. This soil is nearly level and poorly drained. It is on broad, low-lying, convex swells on the flatwoods. The slope is 0 to 2 percent.

In 95 percent of the areas mapped as Smyrna fine sand, the Smyrna soil and similar soils make up 90 to 99 percent of the mapped areas. Dissimilar soils make up 1 to 10 percent of the mapped areas.

Typically, the soil has a surface layer of very dark gray fine sand about 4 inches thick. The subsurface layer, to a depth of about 12 inches, is gray fine sand. The upper part of the subsoil, to a depth of about 15 inches, is dark brown fine sand. The lower part, to a depth of about 20 inches, is very dark grayish brown fine sand. The upper part of the substratum, to a depth of about 45 inches, is light brownish gray, mottled fine sand. The lower part to moderate to high, a community sewage system can help to prevent contamination of water supplies by seepage.

This Archbold soil is in capability subclass VIs, in woodland group 3S, and in the Sand Pine-Scrub Oak range site.

4—Arents, nearly level. Arents consist of nearly level, heterogeneous soil material. This material has been excavated, reworked, and reshaped by earthmoving equipment. Arents are near urban centers, phosphate-mining operations, major highways, and sanitary landfills.

Arents do not have an orderly sequence of soil layers. This map unit is not associated with or confined to a particular kind of soil. Arents are variable and contain discontinuous lenses, pockets, or streaks of black, gray, grayish brown, brown, or yellowish brown sandy or loamy fill material. The thickness of the fill material ranges from 30 to 80 inches or more.

Included in this map unit are areas used as sanitary landfills. Refuse consists of concrete, glass, metal, plastic, wood, and other materials and ranges in thickness from 2 to 10 feet. It is generally stratified with layers of soil material that were used as daily cover. These areas are identified on soil maps by the words "sanitary landfill." Also included are small areas of soil that has slope that ranges from 0 to 5 percent.

Most soil properties are variable. The depth to the seasonal high water table varies with the amount of fill material and artificial drainage. Permeability and the available water capacity vary widely from one area to another.

In most areas, the soil in this map unit has been left idle or is used for homesites, recreation, and urban development. In a few areas, the soil is used for pasture (fig. 2). An individual assessment of each site is necessary to determine its potential for different uses.

The soils in this map unit have not been assigned to a capability subclass, a woodland group, or range site.

5—Basinger, Holopaw and Samsula soils, depressional. The soils in this map unit are nearly level and very poorly drained. They are in swamps and depressions on the flatwoods. Generally, Basinger soil is along the exterior of swamps or in shallow depressions. Holopaw and Samsula soils are in the interior areas of the swamps or in deeper depressions. Undrained areas are frequently ponded for very long periods. The slope is 0 to 2 percent.

In 90 percent of the areas of this map unit, Basinger, Holopaw and Samsula soils, depressional, and similar soils make up 78 to 96 percent of the mapped areas, and dissimilar soils make up about 4 to 22 percent of the mapped areas. Generally, the mapped areas consist of about 35 percent Basinger soil and similar soils, 31 percent Holopaw soil and similar soils, and 18 percent Samsula soil and similar soils. The individual soils are generally in large enough areas to be mapped separately, but in considering their present and predicted use, they were mapped as one unit.

Typically, the surface layer of Basinger soil is black fine sand about 7 inches thick. The subsurface layer, to a depth of about 28 inches, is gray fine sand. The subsoil, to a depth of about 42 inches, is brown and grayish brown fine sand. The substratum to a depth of about 80 inches is light brownish gray fine sand. Similar soils included in mapping, in some areas, have a surface layer of mucky fine sand, and it is more than 7 inches thick.

Typically, the surface layer of Holopaw soil is black mucky fine sand about 6 inches thick. The upper part of the subsurface layer, to a depth of about 12 inches, is dark gray fine sand. The middle part, to a depth of about 42 inches, is light gray fine sand. The lower part, to a depth of about 52 inches, is grayish brown fine sand. The upper part of the subsoil, to a depth of about 64 inches, is grayish brown fine sand. The lower part to a depth of about 80 inches is gray, mottled sandy loam. Similar soils included in mapping, in some areas, have a black surface layer more than 10 inches thick.

Typically, the upper part of the surface tiers of Samsula soil is black muck about 10 inches thick. The lower part, to a depth of about 34 inches, is dark reddish brown muck. The layer below the organic material, to a depth of about 40 inches, is black fine sand. The underlying material to a depth of 80 inches is light brownish gray fine sand. Similar soils included in mapping, in some areas, have organic material that is more than 51 inches thick.

Dissimilar soils included in mapping are the Ona and other sandy soils, all in small areas. These soils have a well-developed sandy subsoil at a depth of more than 40 inches.

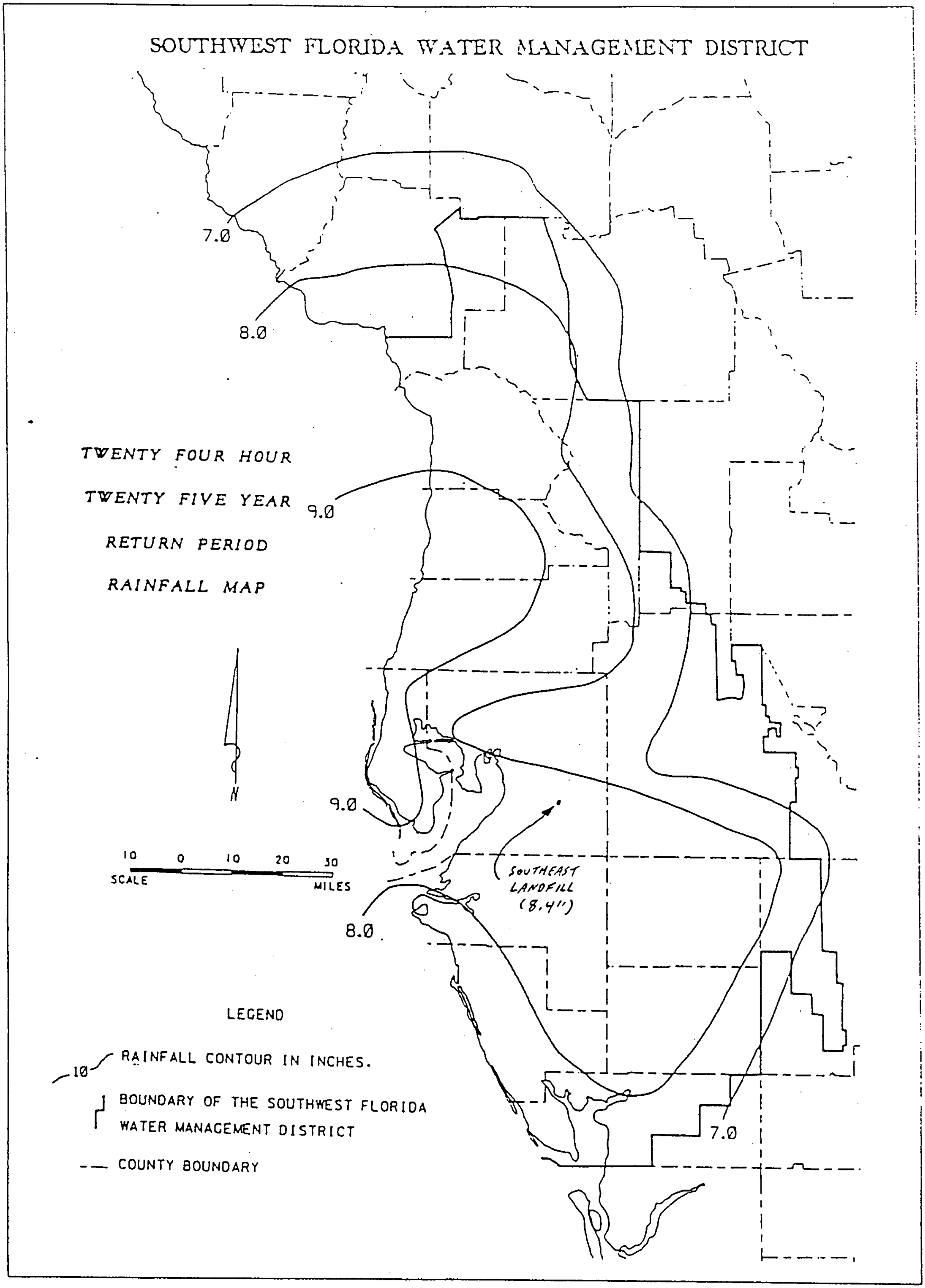
In most years, the undrained areas in this map unit are ponded for about 6 months. Permeability is rapid in Basinger and Samsula soils. It is rapid in the surface and subsurface layer of Holopaw soil and moderately slow or moderate in the subsoil. The available water capacity is low in Basinger soil, low or moderate in Holopaw soil, and high in Samsula soil.

In most areas, the soils making up this map unit have been left in natural vegetation. In some drained areas, the soils are used as pasture. In other areas that have been filled, the soils are used for homesite or urban development. The natural vegetation consists of cypress. The understory includes bluestem, maidencane, panicum, Jamaica sawgrass, and cutgrass.

The soils are generally not suited to most cultivated crops, citrus crops, or pasture because of ponding, excessive wetness, and low natural fertility. A drainage system is needed in most areas to remove excess surface water and reduce soil wetness, but suitable outlets are generally not available.

These soils are generally not suited to the production of pines because of ponding or extended wetness. They

APPENDIX D
RAINFALL MAPS



SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
7.0
8.0
TWENTY FOUR HOUR
TWENTY FIVE YEAR
RETURN PERIOD
RAINFALL MAP
9.0
9.0
N
10 0 10 20 30
SCALE
MILES
SOUTHEAST
LANDFILL
(8.4")
8.0
LEGEND
10 RAINFALL CONTOUR IN INCHES.
BOUNDARY OF THE SOUTHWEST FLORIDA
WATER MANAGEMENT DISTRICT
COUNTY BOUNDARY
7.0

Figure C-5

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

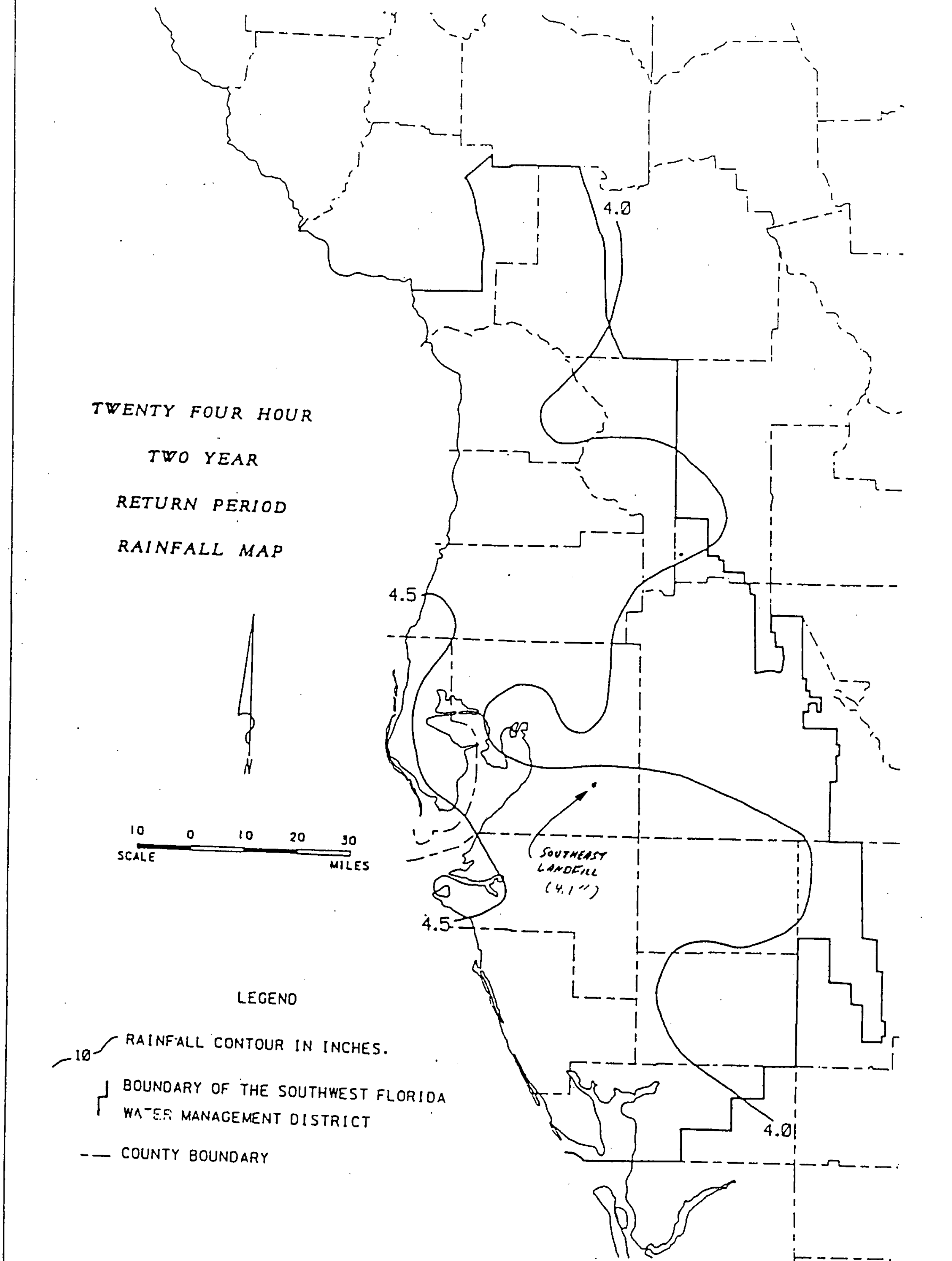


Figure C-1

APPENDIX E
TIME OF CONCENTRATION (Tc)
WORKSHEETS AND TABLES

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

Project SOUTHEAST LANDFILL EXPANSION By BST Date 12/7/99

Location HILLSBOROUGH COUNTY Checked ______ Date ______

Circle one: (Present) Developed ENTIRE LANDFILL EXPANSION

Circle one: (T_c) T_t through subarea

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		NE CORNER TOWARD SW				
1. Surface description (table 3-1)		SHORT GRASS PRAIRIE				
2. Manning's roughness coeff., n (table 3-1)		0.15				
3. Flow length, L (total L ≤ 300 ft)	ft	300				
4. Two-yr 24-hr rainfall, P_2	in	4.1				
5. Land slope, s (15 ft/2266 ft)	ft/ft	0.0066				
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	0.54	+		=	0.54

Shallow concentrated flow

Segment ID		CONTINUE TO SE POND		POND TO BASIN "C"		
7. Surface description (paved or unpaved)		UNPAVED				
8. Flow length, L (2266′ − 300 = 1966′)	ft	1966				
9. Watercourse slope, s	ft/ft	0.0066				
10. Average velocity, V (figure 3-1)	ft/s	1.3				
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.42	+	0	=	0.42

Channel flow

Segment ID						
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, p_w	ft					
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft					
15. Channel slope, s	ft/ft					
16. Manning's roughness coeff., n						
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s					
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		+		=	

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) .... hr **0.96**

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

Project SOUTHEAST LANDFILL EXPANSION By BST Date 12/7/99

Location HILLSBOROUGH COUNTY Checked ____ Date ____

Circle one: Present **(Developed)** ENTIRE LANDFILL EXPANSION

Circle one: **(T_c)** T_t through subarea ____

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	TOP MIDDLE OF LANDFILL TOWARDS SIDESLOPE SWALE		
1. Surface description (table 3-1)			DENSE GRASS		
2. Manning's roughness coeff., n (table 3-1) ..			0.24		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		4.1		
5. Land slope, s 1:20	ft/ft		0.05		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr		0.35	+	= 0.35

Shallow concentrated flow

		Segment ID	CONTINUE TO SIDESLOPE		
7. Surface description (paved or unpaved)			UNPAVED		
8. Flow length, L .... 647-300=347 ...	ft		347		
9. Watercourse slope, s	ft/ft		0.05		
10. Average velocity, V (figure 3-1)	ft/s		3.6		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		0.03	+	= 0.03

Channel flow

		Segment ID	SIDESLOPE	DOWNCHUTE	
12. Cross sectional flow area, a = zd² = 3(4)	ft²		12	18	
13. Wetted perimeter, p_w = 2d√(z²+1) = 2(2)√(9+1)	ft		12.65	15.65	
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft		0.95	1.15	
15. Channel slope, s	ft/ft		0.01	0.38	
16. Manning's roughness coeff., n			0.06	0.033	
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.40	30.55	
18. Flow length, L	ft		535	736	(+)
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		0.06	+ 0.01	= 0.11
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr				0.49

SEE NEXT SHEET

SIDESLOPE

3:1 ↕2' 3:1

$R_H = \frac{zd}{2\sqrt{z^2+1}} = \frac{3(2)}{2\sqrt{9+1}}$

= 0.95

DOWNCHUTE

3:1 ↕2' 3:1

3'

a = bd + zd² = 3(2) + 3(2²) = 18 ft²

Pw = b + 2d√(z²+1) = 3 + 2(2)√(9+1) = 15.65 ft

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

Project SOUTHEAST LANDFILL EXPANSION By BST Date 12/7/95

Location HILLSBOROUGH COUNTY Checked ____ Date ____

Circle one: Present (Developed) ENTIRE LANDFILL EXPANSION (CONTINUED)

Circle one: (T_c) T_t through subarea

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)

	Unit	Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1)				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

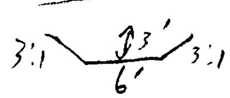
Shallow concentrated flow

	Unit	Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow

	Unit	Segment ID: BOTTOM SWALE		
12. Cross sectional flow area, a	ft^2	45		
13. Wetted perimeter, p_w	ft	24.97		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.8		
15. Channel slope, s	ft/ft	0.005		
16. Manning's roughness coeff., n		.06		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	2.6		
18. Flow length, L	ft	375		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.04	+	=

BOTTOM SWALE



$a = bd + zd^2$

$p = b + 2d\sqrt{z^2+1}$

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) .... hr

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

Project SOUTHEAST LANDFILL EXPANSION By BST Date 12/7/99

Location HILLSBOROUGH COUNTY Checked ____ Date ____

Circle one: (Present) Developed — SECTION 1 ONLY

Circle one: (T_c) T_t through subarea

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: NW CORNER TO SE	Segment ID: (blank)	Total
1. Surface description (table 3-1)		SHORT GRASS PRAIRIE		
2. Manning's roughness coeff., n (table 3-1)		0.15		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	4.1		
5. Land slope, s (3/363')	ft/ft	0.0083		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	0.49	+	= 0.49

Shallow concentrated flow

		Segment ID: CONTINUE TO POND	Segment ID: POND → BASIN "C" (INSTANTANEOUS)	
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	63		
9. Watercourse slope, s (3'/363')	ft/ft	0.0083		
10. Average velocity, V (figure 3-1)	ft/s	1.5		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.01	+ 0	= 0.01

Channel flow

		Segment ID	Segment ID	
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s			
18. Flow length, L	ft			
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		+	=

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) .... hr **0.50**

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

Project SOUTHEAST LANDFILL EXPANSION By BST Date 12/9/99

Location HILLSBOROUGH COUNTY Checked ____ Date ______

Circle one: Present (Developed) SECTION 1 ONLY

Circle one: (T_c) T_t through subarea

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)

	Unit	Segment 1	Segment 2	Total
Segment ID		TOP MIDDLE OF LANDFILL TOWARD SIDESLOPE SWALE		
1. Surface description (table 3-1)		DENSE GRASS		
2. Manning's roughness coeff., n (table 3-1)		0.24		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	4.1		
5. Land slope, s	ft/ft	0.05		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	0.35	+	= 0.35

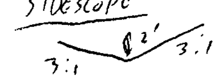
Shallow concentrated flow

	Unit	Segment 1	Segment 2	Total
Segment ID		CONTINUE TO SIDESLOPE		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	36		
9. Watercourse slope, s	ft/ft	0.05		
10. Average velocity, V (figure 3-1)	ft/s	3.6		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.003	+	= 0

Channel flow

	Unit	Segment 1	Segment 2	Total
Segment ID		SIDESLOPE TO DOWNCHUTE	DOWNCHUTE	
12. Cross sectional flow area, a	ft^2	12	18	
13. Wetted perimeter, P_w	ft	12.65	15.65	
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft	0.95	1.15	
15. Channel slope, s	ft/ft	0.01	0.27	
16. Manning's roughness coeff., n		0.06	0.033	
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	2.40	25.75	
18. Flow length, L	ft	388	212	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.045	+ 0.002	= 0.18
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			0.53

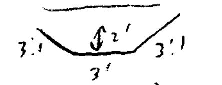
SIDESLOPE



$a = 2d^2$

$P_w = 2d\sqrt{z^2+1}$

DOWNCHUTE



$a = bd + zd^2$

$P = b + 2d\sqrt{z^2+1}$

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

Project SOUTHEAST LANDFILL EXPANSION By BST Date 12/9/99

Location HILLSBOROUGH COUNTY Checked ____ Date ____

Circle one: Present (Developed) SECTION 1 ONLY (CONTINUED)

Circle one: (T_c) T_t through subarea ____

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		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1)				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

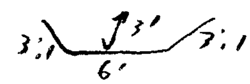
Shallow concentrated flow

		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow

		Segment ID: BOTTOM SWALE TO "C"		
12. Cross sectional flow area, a	ft^2	45		
13. Wetted perimeter, p_w	ft	24.97		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.8		
15. Channel slope, s	ft/ft	0.005		
16. Manning's roughness coeff., n		0.06		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	2.6		
18. Flow length, L	ft	1212		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.13	+	=
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			

BOTTOM SWALE



$a = bd + zd^2$

$P = b + 2d\sqrt{z^2+1}$

Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overton and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007\,(nL)^{0.8}}{(P_2)^{0.5}\,s^{0.4}} \qquad \text{[Eq. 3-3]}$$

Table 3-1.—Roughness coefficients (Manning's n) for sheet flow

Surface description	n[1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses[2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

[1]The n values are a composite of information compiled by Engman (1986).
[2]Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3]When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

where

- T_t = travel time (hr),
- n = Manning's roughness coefficient (table 3-1),
- L = flow length (ft),
- P_2 = 2-year, 24-hour rainfall (in), and
- s = slope of hydraulic grade line (land slope, ft/ft).

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bank-full elevation.

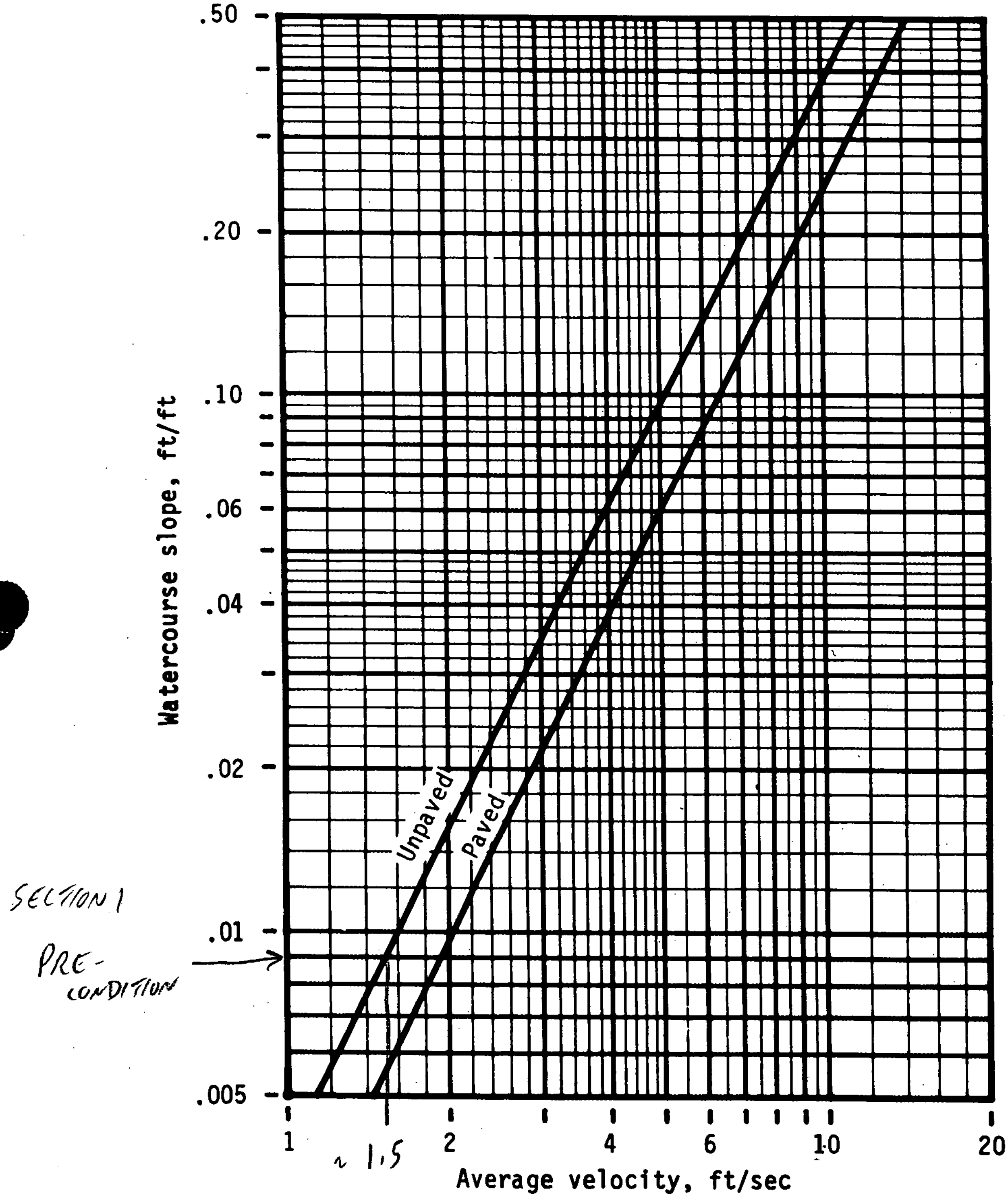


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

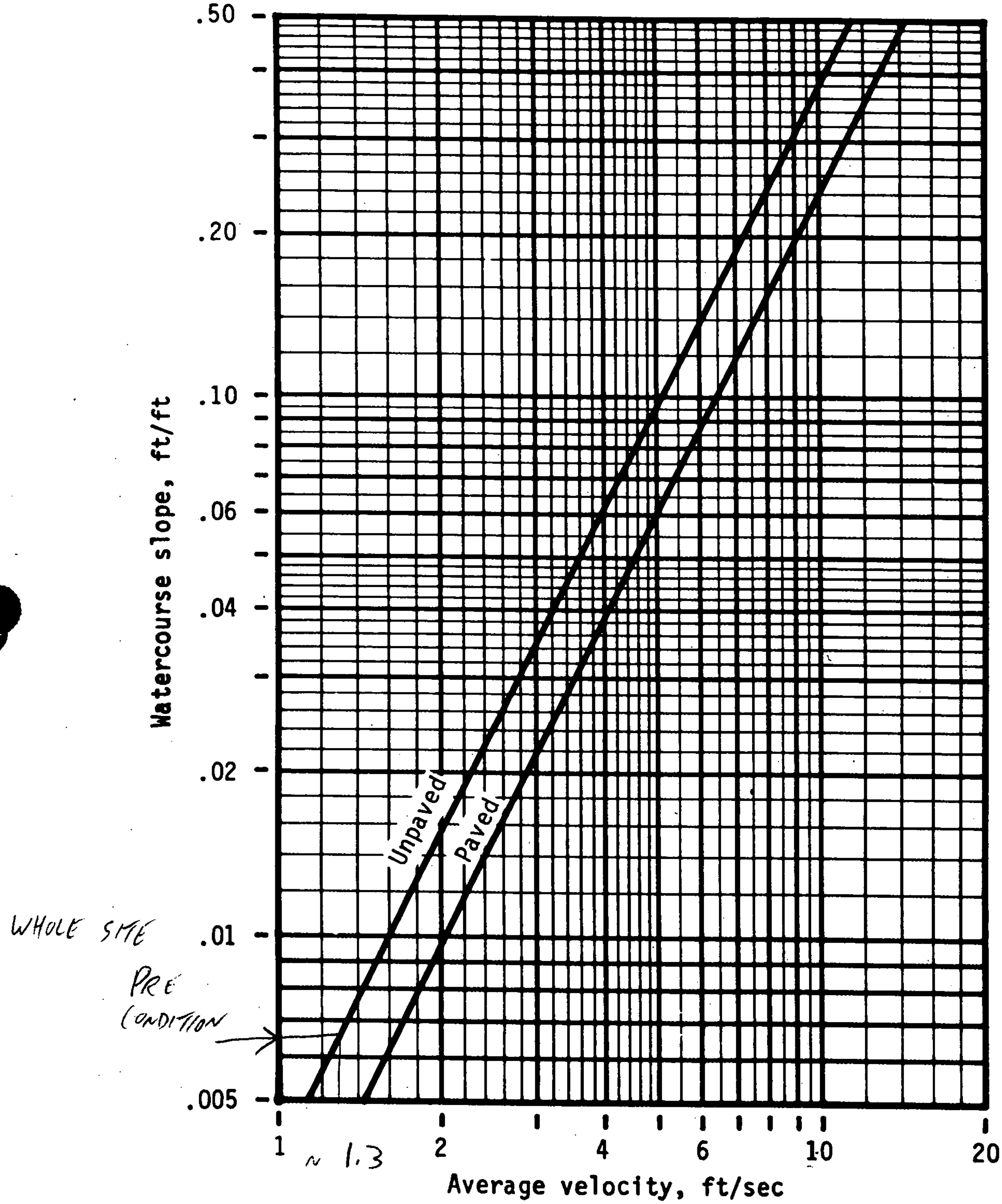


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

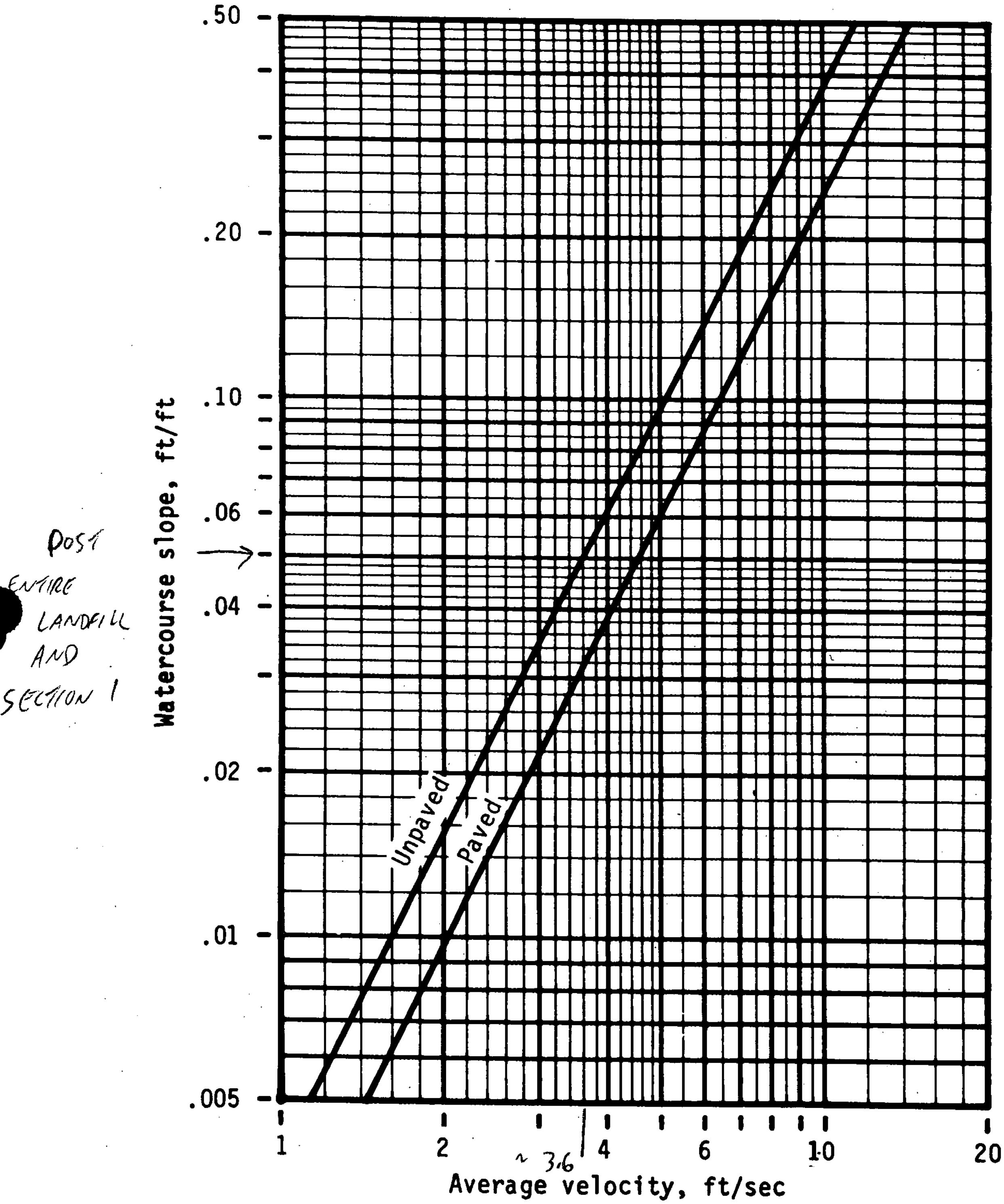


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

Table 7-3
RECOMMENDED MANNING'S n VALUES FOR ARTIFICIAL CHANNELS
WITH BARE SOIL AND VEGETATIVE LININGS

Channel Lining	Description	Design Manning's n Value
Bare Earth, Fairly Uniform	Clean, recently completed	0.022
Bare Earth, Fairly Uniform	Short grass and some weeds	0.028
Dragline Excavated	No vegetation	0.030
Dragline Excavated	Light brush	0.040
Channels not Maintained	Dense weeds to flow depth	0.10
Channels not Maintained	Clear bottom, brush sides	0.08
Maintained Grass or Sodded Ditches	Good stand, well maintained 2" - 6"	0.06* ←
Maintained Grass or Sodded Ditches	Fair strand, length 12" - 24"	0.20*

.042

*Decrease 30 percent for flows >0.7' depth (maximum flow depth 1.5').

Table 7-4
RECOMMENDED MANNING'S n VALUES FOR
ARTIFICIAL CHANNELS WITH RIGID LININGS

Channel Lining	Finish Description	Design Manning's n Value
Concrete Paved	Broomed*	0.016
Concrete Paved	"Roughened" - Standard	0.020
Concrete Paved	Gunite	0.020
Concrete Paved	Over rubble	0.023
Asphalt Concrete	Smooth	0.013
Asphalt Concrete	Rough	0.016

*Because this is not the standard finish, it must be specified (see Section 5.24-7 of Standard Specifications).

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1987

The recommended values for vegetative linings should be checked using the procedure presented in Section 7.5.3. Recommended Manning's n values for artificial channels with concrete and asphalt paving are presented in Table 7-4. For rock riprap, the Manning's n value should be estimated with the following equation from HEC-15 (USDOT, FHWA, 1975):

$$n = 0.0395\, D_{50}^{1/6} \qquad (7\text{-}1)$$

where:

$D_{50} = 4_{IN} = 0.33$ ft
$n = 0.033$ FOR DOWNCHUTE

D_{50} = Rock size for which 50 percent of the material is smaller, in ft

For natural stream channels, Manning's n value should be estimated using Cowan's Equation (Cowan, 1956) as presented below:

$$n = (n_0 + n_1 + n_2 + n_3 + n_4)m_5 \qquad (7\text{-}2)$$

where:

n = Manning's roughness coefficient for a natural or excavated channel

n_0 = Coefficient associated with channel lining material

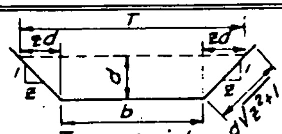
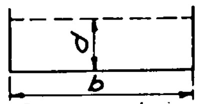
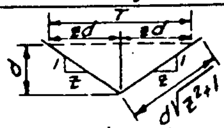
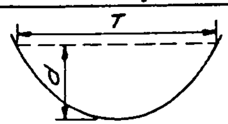
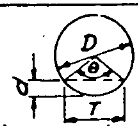
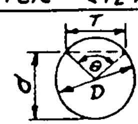
n_1 = Coefficient associated with the degree of channel irregularity

n_2 = Coefficient associated with variations of the channel cross section

n_3 = Coefficient associated with the relative effect of channel obstructions

n_4 = Coefficient associated with channel vegetation

m_5 = Coefficient associated with the degree of channel meandering

Section	Area a	Wetted Perimeter p	Hydraulic Radius r	Top Width T	Critical Depth Factor, Z
 Trapezoid	$bd+zd^2$	$b+2d\sqrt{z^2+1}$	a/wp $\frac{bd+zd^2}{b+2d\sqrt{z^2+1}}$	$b+2zd$	$\frac{[(b+zd)d]^{1.5}}{\sqrt{b+2zd}}$
 Rectangle	bd	$b+2d$	$\frac{bd}{b+2d}$	b	$bd^{1.5}$
 Triangle	zd^2	$2d\sqrt{z^2+1}$	$\frac{zd}{2\sqrt{z^2+1}}$	$2zd$	$\frac{\sqrt{2}}{2} zd^{2.5}$
 Parabola	$\frac{2}{3} dT$	$T+\frac{8d^2}{3T}$ [1]	$\frac{2dT^2}{3T^2+8d^2}$ [1]	$\frac{3a}{2d}$	$\frac{2}{9}\sqrt{6}\, Td^{1.5}$
 Circle – <½ full [2]	$\frac{D^2}{8}\left(\frac{\pi\theta}{180}-\sin\theta\right)$	$\frac{\pi D\theta}{360}$	$\frac{45D}{\pi\theta}\left(\frac{\pi\theta}{180}-\sin\theta\right)$	$D\sin\frac{\theta}{2}$ or $2\sqrt{d(D-d)}$	$a\sqrt{\frac{a}{D\sin\frac{\theta}{2}}}$
 Circle – >½ full [3]	$\frac{D^2}{8}\left(2\pi-\frac{\pi\theta}{180}+\sin\theta\right)$	$\frac{\pi D(360-\theta)}{360}$	$\frac{45D}{\pi(360-\theta)}\left(2\pi-\frac{\pi\theta}{180}+\sin\theta\right)$	$D\sin\frac{\theta}{2}$ or $2\sqrt{d(D-d)}$	$a\sqrt{\frac{a}{D\sin\frac{\theta}{2}}}$

[1] Satisfactory approximation for the interval $0 < \frac{d}{T} \leq 0.25$
When $d/T > 0.25$, use $p = \frac{1}{2}\sqrt{16d^2+T^2} + \frac{T^2}{8d}\sinh^{-1}\frac{4d}{T}$

[2] $\theta = 4\sin^{-1}\sqrt{d/D}$ } Insert θ in degrees in above equations
[3] $\theta = 4\cos^{-1}\sqrt{d/D}$

Reference: USDA, SCS, NEH-5 (1956).

FIGURE 7-2
Open Channel Geometric Relationships for Various Cross Sections

HILLSBOROUGH COUNTY
SOUTHEAST COUNTY LANDFILL EXPANSION

POND BOTTOM INFILTRATION TABLES

Assumptions: $k = 1 \times 10^{-3}$ cm/sec
L = depth of sand = 2 feet
Q = kiA i = h/L

Pond "C"

Elevation (feet)	Head (feet)	Infiltration Rate (ft/ft)	Area (sq. ft)	Flow Q (cfs)
127.5	2.0	1.00	116,173	3.81
128.0	2.5	1.25	116,173	4.76
128.5	3.0	1.50	116,173	5.72
129.0	3.5	1.75	116,173	6.67
129.5	4.0	2.00	116,173	7.62
130.0	4.5	2.25	116,173	8.58
130.5	5.0	2.50	116,173	9.53
131.0	5.5	2.75	116,173	10.48

Pond "D"

Elevation (feet)	Head (feet)	Infiltration Rate (ft/ft)	Area (sq. ft)	Flow Q (cfs)
108.0	2.0	1.00	431,943	14.17
108.5	2.5	1.25	431,943	17.71
109.0	3.0	1.50	431,943	21.26
109.5	3.5	1.75	431,943	24.80
110.0	4.0	2.00	431,943	28.34
110.5	4.5	2.25	431,943	31.89
111.0	5.0	2.50	431,943	35.43
111.5	5.5	2.75	431,943	38.97
112.0	6.0	3.00	431,943	42.51
112.5	6.5	3.25	431,943	46.06
113.0	7.0	3.50	431,943	49.60
113.5	7.5	3.75	431,943	53.14
114.0	8.0	4.00	431,943	56.69
114.5	8.5	4.25	431,943	60.23
115.0	9.0	4.50	431,943	63.77
115.5	9.5	4.75	431,943	67.31
116.0	10.0	5.00	431,943	70.86

Manning's equation is

$$V = \frac{1.49\, r^{2/3}\, s^{1/2}}{n} \qquad \text{[Eq. 3-4]}$$

where

- V = average velocity (ft/s),
- r = hydraulic radius (ft) and is equal to a/p_w,
- a = cross sectional flow area (ft^2),
- p_w = wetted perimeter (ft),
- s = slope of the hydraulic grade line (channel slope, ft/ft), and
- n = Manning's roughness coefficient for open channel flow.

Manning's n values for open channel flow can be obtained from standard textbooks such as Chow (1959) or Linsley et al. (1982). After average velocity is computed using equation 3-4, T_t for the channel segment can be estimated using equation 3-1.

Reservoirs or lakes

Sometimes it is necessary to estimate the velocity of flow through a reservoir or lake at the outlet of a watershed. This travel time is normally very small and can be assumed as zero.

Limitations

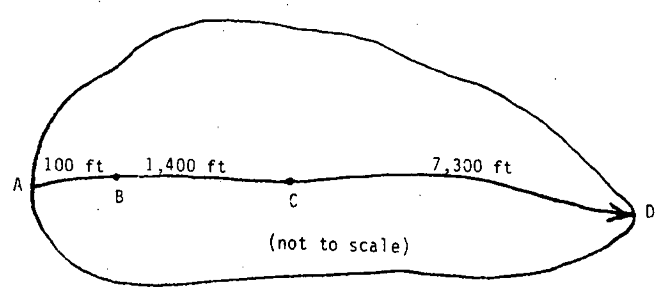
- Manning's kinematic solution should not be used for sheet flow longer than 300 feet. Equation 3-3 was developed for use with the four standard rainfall intensity-duration relationships.
- In watersheds with storm sewers, carefully identify the appropriate hydraulic flow path to estimate T_c. Storm sewers generally handle only a small portion of a large event. The rest of the peak flow travels by streets, lawns, and so on, to the outlet. Consult a standard hydraulics textbook to determine average velocity in pipes for either pressure or nonpressure flow.
- The minimum T_c used in TR-55 is 0.1 hour.
- A culvert or bridge can act as a reservoir outlet if there is significant storage behind it. The procedures in TR-55 can be used to determine the peak flow upstream of the culvert. Detailed storage routing procedures should be used to determine the outflow through the culvert.

Example 3-1

The sketch below shows a watershed in Dyer County, northwestern Tennessee. The problem is to compute T_c at the outlet of the watershed (point D). The 2-year 24-hour rainfall depth is 3.6 inches. All three types of flow occur from the hydraulically most distant point (A) to the point of interest (D). To compute T_c, first determine T_t for each segment from the following information:

Segment AB:	Sheet flow; dense grass; slope (s) = 0.01 ft/ft; and length (L) = 100 ft.
Segment BC:	Shallow concentrated flow; unpaved; s = 0.01 ft/ft; and L = 1400 ft.
Segment CD:	Channel flow; Manning's n = .05; flow area (a) = 27 ft^2; wetted perimeter (p_w) = 28.2 ft; s = 0.005 ft/ft; and L = 7300 ft.

See figure 3-2 for the computations made on worksheet 3.



APPENDIX F
HAESTAD METHODS *TR-55 AND PONDPACK*
INPUT DATA AND OUTPUT RESULTS

```
Quick TR-55 Ver.5.46   S/N:1803000009
Executed: 13:20:11   01-28-2000    a:SEALLPRE.TCT

       Southeast Landfill Expansion - Entire Landfill Precondition


                       Tc COMPUTATIONS FOR:

 SHEET FLOW (Applicable to Tc only)
     Segment ID                                      NEtoSW
     Surface description                        Short Grass
     Manning's roughness coeff., n                   0.1500
     Flow length, L (total < or = 300)      ft       300.0
     Two-yr 24-hr rainfall, P2              in       4.100
     Land slope, s                       ft/ft      0.0066
                         0.8
          .007 * (n*L)
     T =  --------------                    hrs       0.54          =  0.54
             0.5    0.4
           P2   *   s

 SHALLOW CONCENTRATED FLOW
     Segment ID                                     To Pond
     Surface (paved or unpaved)?                    Unpaved
     Flow length, L                          ft      1966.0
     Watercourse slope, s                 ft/ft      0.0066

                           0.5
     Avg.V =  Csf *   (s)                  ft/s      1.3108
     where:   Unpaved Csf = 16.1345
              Paved   Csf = 20.3282

     T = L / (3600*V)                       hrs       0.42          =  0.42


 CHANNEL FLOW
     Segment ID
     Cross Sectional Flow Area, a         sq.ft        0.00
     Wetted perimeter, Pw                    ft        0.00
     Hydraulic radius, r = a/Pw              ft       0.000
     Channel slope, s                     ft/ft      0.0000
     Manning's roughness coeff., n                   0.0000

                      2/3     1/2
          1.49  *  r    *  s
     V =  --------------------             ft/s      0.0000
                   n

     Flow length, L                          ft           0

     T = L / (3600*V)                       hrs        0.00          =  0.00

    ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                              TOTAL TIME (hrs)       0.96
```

Quick TR-55 Ver.5.46 S/N:1803000009
Executed: 13:20:11 01-28-2000 a:SEALLPRE.TCT

SUMMARY SHEET FOR Tc or Tt COMPUTATIONS
(Solved for Time using TR-55 Methods)

Southeast Landfill Expansion - Entire Landfill Precondition

Subarea descr.	Tc or Tt	Time (hrs)
	Tc	0.96

```
Quick TR-55 Ver.5.46   S/N:1803000009
Executed: 13:21:46   01-28-2000    a:SEALLPOS.TCT

       Southeast Landfill Expansion - Entire Expansion Postcondition


                        Tc COMPUTATIONS FOR:

 SHEET FLOW (Applicable to Tc only)
     Segment ID                                      ToptoSi
     Surface description                          Dense Grass
     Manning's roughness coeff., n                     0.2400
     Flow length, L (total < or = 300)      ft          300.0
     Two-yr 24-hr rainfall, P2              in          4.100
     Land slope, s                       ft/ft         0.0500
                               0.8
          .007 * (n*L)
     T =  --------------                    hrs          0.35              =  0.35
             0.5    0.4
           P2    *   s

 SHALLOW CONCENTRATED FLOW
     Segment ID                                       To Side
     Surface (paved or unpaved)?                      Unpaved
     Flow length, L                         ft          347.0
     Watercourse slope, s                ft/ft         0.0500


                                  0.5
     Avg.V =  Csf  *   (s)               ft/s          3.6078
     where:   Unpaved Csf = 16.1345
              Paved   Csf = 20.3282

     T = L / (3600*V)                       hrs          0.03              =  0.03


 CHANNEL FLOW
     Segment ID                                       Side       Downchu
     Cross Sectional Flow Area, a        sq.ft          12.00        18.00
     Wetted perimeter, Pw                   ft          12.65        15.65
     Hydraulic radius, r = a/Pw             ft          0.949        1.150
     Channel slope, s                    ft/ft         0.0100       0.3800
     Manning's roughness coeff., n                     0.0600       0.0330

                           2/3    1/2
          1.49  *  r    *  s
     V =  --------------------           ft/s          2.3975     %30.5541
                      n

     Flow length, L                         ft            535          736

     T = L / (3600*V)                       hrs          0.06  +     0.01  =  0.07

   ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                                TOTAL TIME (hrs)             0.45
```

Quick TR-55 Ver.5.46 S/N:1803000009
Executed: 13:21:46 01-28-2000 a:SEALLPOS.TCT

SUMMARY SHEET FOR Tc or Tt COMPUTATIONS
(Solved for Time using TR-55 Methods)

Southeast Landfill Expansion - Entire Expansion Postcondition

Subarea descr.	Tc or Tt	Time (hrs)
	Tc	0.45

Quick TR-55 Ver.5.46 S/N:1803000009
Executed: 13:22:30 01-28-2000

Southeast Landfill Expansion
Precondition

RUNOFF CURVE NUMBER SUMMARY

Subarea Description	Area (acres)	CN (weighted)
	147.00	68

Quick TR-55 Ver.5.46 S/N:1803000009
Executed: 13:22:30 01-28-2000

Southeast Landfill Expansion
Precondition

RUNOFF CURVE NUMBER DATA

Composite Area:

SURFACE DESCRIPTION	AREA (acres)	CN	
Grassland w/ poor coverage (A)	147.00	68	
COMPOSITE AREA --->	147.00	68.0	(68)

Quick TR-55 Ver.5.46   S/N:1803000009
Executed: 13:26:28   01-28-2000

Southeast Landfill Expansion
Post Condition

RUNOFF CURVE NUMBER SUMMARY

::

Subarea Description	Area (acres)	CN (weighted)
	147.00	86

Quick TR-55 Ver.5.46 S/N:1803000009
Executed: 13:26:28 01-28-2000

Southeast Landfill Expansion
Post Condition

RUNOFF CURVE NUMBER DATA

Composite Area:

SURFACE DESCRIPTION	AREA (acres)	CN	
Open Space Lawn, poor cover (C)	147.00	86	
COMPOSITE AREA --->	147.00	86.0	(86)

POND-2 Version: 5.20 S/N: 1903052002

>>>>> HYDROGRAPH PRINTOUT <<<<<

01-28-2000 13:27:40

Hydrograph file: a:SEALLPRE.HYD

HYDROGRAPH ORDINATES (cfs)
Time increment = 0.100 Hours
Time on left represents time for first Q in each row.

Time Hours							
11.000	6.00	7.00	8.00	9.00	10.00	11.00	12.00
11.700	14.00	15.00	17.00	20.00	27.00	42.00	66.00
12.400	100.00	138.00	173.00	198.00	215.00	202.00	190.00
13.100	168.00	145.00	126.00	107.00	94.00	81.00	72.00
13.800	63.00	57.00	51.00	47.00	43.00	39.00	36.00
14.500	34.00	31.00	30.00	28.00	26.00	25.00	24.00
15.200	23.00	23.00	22.00	21.00	20.00	20.00	19.00
15.900	19.00	18.00	18.00	17.00	17.00	16.00	16.00
16.600	16.00	15.00	15.00	14.00	14.00	14.00	14.00
17.300	13.00	13.00	13.00	13.00	13.00	12.00	12.00
18.000	12.00	12.00	12.00	12.00	12.00	12.00	11.00
18.700	11.00	11.00	11.00	11.00	11.00	11.00	10.00
19.400	10.00	10.00	10.00	10.00	9.00	9.00	9.00
20.100	9.00	9.00	9.00	9.00	9.00	9.00	9.00
20.800	9.00	9.00	8.00	8.00	8.00	8.00	8.00
21.500	8.00	8.00	8.00	8.00	8.00	8.00	8.00
22.200	8.00	7.00	7.00	7.00	7.00	7.00	6.00
22.900	6.00	6.00	6.00	6.00	5.00	5.00	5.00
23.600	5.00	5.00	4.00	4.00	4.00	4.00	4.00
24.300	3.00	3.00	3.00	3.00	3.00	2.00	2.00
25.000	2.00	2.00	2.00	1.00	1.00	1.00	1.00
25.700	1.00	0.00	0.00				

POND-2 Version: 5.20 S/N: 1903052002

>>>>> HYDROGRAPH PRINTOUT <<<<<

01-28-2000 13:28:14

Hydrograph file: a:SEALLPOS.HYD

HYDROGRAPH ORDINATES (cfs)
Time increment = 0.100 Hours
Time on left represents time for first Q in each row.

Time Hours							
11.000	26.00	29.00	33.00	36.00	40.00	45.00	49.00
11.700	62.00	75.00	88.00	145.00	262.00	475.00	721.00
12.400	817.00	783.00	620.00	458.00	349.00	282.00	216.00
13.100	182.00	148.00	131.00	114.00	104.00	94.00	88.00
13.800	82.00	77.00	73.00	70.00	66.00	63.00	61.00
14.500	58.00	56.00	54.00	52.00	51.00	49.00	48.00
15.200	47.00	47.00	46.00	45.00	44.00	43.00	42.00
15.900	41.00	40.00	39.00	38.00	38.00	37.00	36.00
16.600	35.00	34.00	34.00	33.00	32.00	32.00	32.00
17.300	31.00	31.00	31.00	31.00	30.00	30.00	29.00
18.000	29.00	29.00	28.00	28.00	27.00	27.00	27.00
18.700	26.00	26.00	25.00	25.00	25.00	24.00	24.00
19.400	24.00	24.00	23.00	23.00	23.00	22.00	22.00
20.100	22.00	22.00	22.00	21.00	21.00	21.00	21.00
20.800	21.00	21.00	20.00	20.00	20.00	20.00	20.00
21.500	20.00	20.00	19.00	19.00	19.00	19.00	19.00
22.200	18.00	18.00	17.00	17.00	16.00	16.00	15.00
22.900	15.00	14.00	14.00	13.00	13.00	12.00	12.00
23.600	11.00	11.00	10.00	10.00	10.00	9.00	9.00
24.300	8.00	8.00	7.00	7.00	6.00	6.00	5.00
25.000	5.00	4.00	4.00	3.00	3.00	2.00	2.00
25.700	1.00	1.00	0.00				

POND-2 Version: 5.20 S/N: 1903052002

>>>>> HYDROGRAPH PRINTOUT <<<<<

01-28-2000 13:28:34

Hydrograph file: a:DTOTAL .HYD

HYDROGRAPH ORDINATES (cfs)
Time increment = 0.100 Hours
Time on left represents time for first Q in each row.

Time Hours							
11.000	17.00	19.00	22.00	24.00	28.00	31.00	35.00
11.700	51.00	66.00	82.00	150.00	281.00	434.00	499.00
12.400	462.00	376.00	290.00	225.00	180.00	150.00	119.00
13.100	102.00	85.00	76.00	68.00	63.00	57.00	54.00
13.800	50.00	46.00	43.00	42.00	40.00	39.00	37.00
14.500	34.00	32.00	32.00	32.00	31.00	31.00	30.00
15.200	29.00	29.00	28.00	27.00	26.00	26.00	25.00
15.900	25.00	24.00	24.00	23.00	23.00	22.00	22.00
16.600	21.00	21.00	20.00	20.00	19.00	19.00	19.00
17.300	18.00	18.00	18.00	18.00	18.00	18.00	18.00
18.000	18.00	18.00	18.00	17.00	17.00	17.00	17.00
18.700	17.00	16.00	16.00	16.00	16.00	15.00	15.00
19.400	15.00	14.00	14.00	14.00	14.00	13.00	13.00
20.100	13.00	13.00	13.00	13.00	12.00	12.00	12.00
20.800	12.00	12.00	12.00	12.00	12.00	12.00	12.00
21.500	12.00	11.00	11.00	11.00	11.00	11.00	11.00
22.200	10.00	10.00	10.00	10.00	9.00	9.00	9.00
22.900	9.00	8.00	8.00	8.00	7.00	7.00	7.00
23.600	7.00	6.00	6.00	6.00	6.00	5.00	5.00
24.300	5.00	4.00	4.00	4.00	4.00	3.00	3.00
25.000	3.00	2.00	2.00	2.00	2.00	1.00	1.00
25.700	1.00	1.00	0.00				

POND-2 Version: 5.20 S/N: 1903052002
Executed 01-28-2000 13:29:33

>>>>>>>> Summary of Hydrograph Volume <<<<<<<<

Hydrograph: a:SEALLPRE.HYD

Volume = 1,373,400 cu.ft.
31.53 ac-ft

Warning: Incomplete volume -- left side of hydrograph is truncated.
(1st Q is > 0.0)

```
POND-2 Version: 5.20  S/N: 1903052002
Executed 01-28-2000     13:29:42


          >>>>>>>> Summary of Hydrograph Volume <<<<<<<<

          Hydrograph: a:SEALLPOS.HYD

          Volume =     3,476,521 cu.ft.
                           79.81 ac-ft


Warning:  Incomplete volume -- left  side of hydrograph is truncated.
                                                   (1st Q is > 0.0)
```

```
POND-2 Version: 5.20  S/N: 1903052002
Executed 01-28-2000     13:29:57


          >>>>>>>> Summary of Hydrograph Volume <<<<<<<<

          Hydrograph: a:BASINCPR.HYD

          Volume =        994,500 cu.ft.
                            22.83 ac-ft


Warning:  Incomplete volume -- left  side of hydrograph is truncated.
                                                     (1st Q is > 0.0)
```

```
POND-2 Version: 5.20  S/N: 1903052002
Executed 01-28-2000     13:30:03


          >>>>>>>> Summary of Hydrograph Volume <<<<<<<<

          Hydrograph: a:BASINCPO.HYD

          Volume =     1,468,260 cu.ft.
                           33.71 ac-ft


Warning:  Incomplete volume -- left  side of hydrograph is truncated.
                                                 (1st Q is > 0.0)
```

POND-2 Version: 5.20 S/N: 1903052002
Executed 01-28-2000 13:30:11

>>>>>>>> Summary of Hydrograph Volume <<<<<<<<

Hydrograph: a:BASINDPR.HYD

Volume = 1,373,400 cu.ft.
31.53 ac-ft

Warning: Incomplete volume -- left side of hydrograph is truncated.
(1st Q is > 0.0)

```
POND-2 Version: 5.20  S/N: 1903052002
Executed 01-28-2000     13:30:18


          >>>>>>>> Summary of Hydrograph Volume <<<<<<<<

          Hydrograph: a:BASINDPO.HYD

          Volume =    2,012,400 cu.ft.
                          46.20 ac-ft


Warning:  Incomplete volume -- left  side of hydrograph is truncated.
                                                      (1st Q is > 0.0)
```

POND-2 Version: 5.20
S/N: 1903052002

Basin "C"

CALCULATED 01-28-2000 13:33:08
DISK FILE: a:BASIN-C .VOL

Planimeter scale: 1 inch = 1 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
127.00	79,321.00	1.82	0.00	0.00	0.00
128.00	114,961.00	2.64	6.65	2.22	2.22
128.13	*I*	2.67	7.96	0.34	2.56
129.00	124,254.00	2.85	8.24	2.75	4.96
130.00	133,978.00	3.08	8.89	2.96	7.93
131.00	144,790.00	3.32	9.60	3.20	11.12
132.00	156,475.00	3.59	10.37	3.46	14.58

I ---> Interpolated area from closest two planimeter readings.

$$IA = (\text{sq.rt}(Area1) + ((Ei-E1)/(E2-E1))*(\text{sq.rt}(Area2)-\text{sq.rt}(Area1)))^{2}$$

where: E1, E2 = Closest two elevations with planimeter data
Ei = Elevation at which to interpolate area
Area1,Area2 = Areas computed for E1, E2, respectively
IA = Interpolated area for Ei

* Incremental volume computed by the Conic Method for Reservoir Volumes.

$$Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + \text{sq.rt.}(Area1*Area2))$$

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

POND-2 Version: 5.20
S/N: 1903052002

Basin "D"

CALCULATED 01-28-2000 13:33:40
DISK FILE: a:BASIN-D .VOL

Planimeter scale: 1 inch = 1 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
107.00	220,245.00	5.06	0.00	0.00	0.00
108.00	439,435.00	10.09	22.29	7.43	7.43
109.00	477,390.00	10.96	31.56	10.52	17.95
110.00	494,197.00	11.35	33.46	11.15	29.10
110.52	*I*	11.58	34.39	5.96	35.06
111.00	513,980.00	11.80	34.71	11.57	40.67
112.00	533,627.00	12.25	36.07	12.02	52.70
113.00	562,851.00	12.92	37.75	12.58	65.28
114.00	609,300.00	13.99	40.35	13.45	78.73
115.00	635,944.00	14.60	42.88	14.29	93.02
116.00	975,819.00	22.40	55.09	18.36	111.39

I ---> Interpolated area from closest two planimeter readings.

$$IA = (sq.rt(Area1) + ((Ei-E1)/(E2-E1))*(sq.rt(Area2)-sq.rt(Area1)))^{2}$$

where: E1, E2 = Closest two elevations with planimeter data
Ei = Elevation at which to interpolate area
Area1,Area2 = Areas computed for E1, E2, respectively
IA = Interpolated area for Ei

* Incremental volume computed by the Conic Method for Reservoir Volumes.

$$Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))$$

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

POND-2 Version: 5.20
S/N: 1903052002

Southeast Landfill Expansion Pond "C" (proposed)

CALCULATED 01-28-2000 13:34:02
DISK FILE: a:SEPONDC .VOL

Planimeter scale: 1 inch = 1 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
127.50	116,155.00	2.67	0.00	0.00	0.00
128.00	118,954.00	2.73	8.10	1.35	1.35
128.50	121,801.00	2.80	8.29	1.38	2.73
129.00	124,647.00	2.86	8.49	1.41	4.15
130.00	130,469.00	3.00	8.78	2.93	7.07
131.00	136,419.00	3.13	9.19	3.06	10.14
132.00	142,496.00	3.27	9.60	3.20	13.34

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

POND-2 Version: 5.20
S/N: 1903052002

Southeast Pond "D" (existing)

CALCULATED 01-28-2000 13:34:26
DISK FILE: a:SEPONDD .VOL

Planimeter scale: 1 inch = 1 ft.

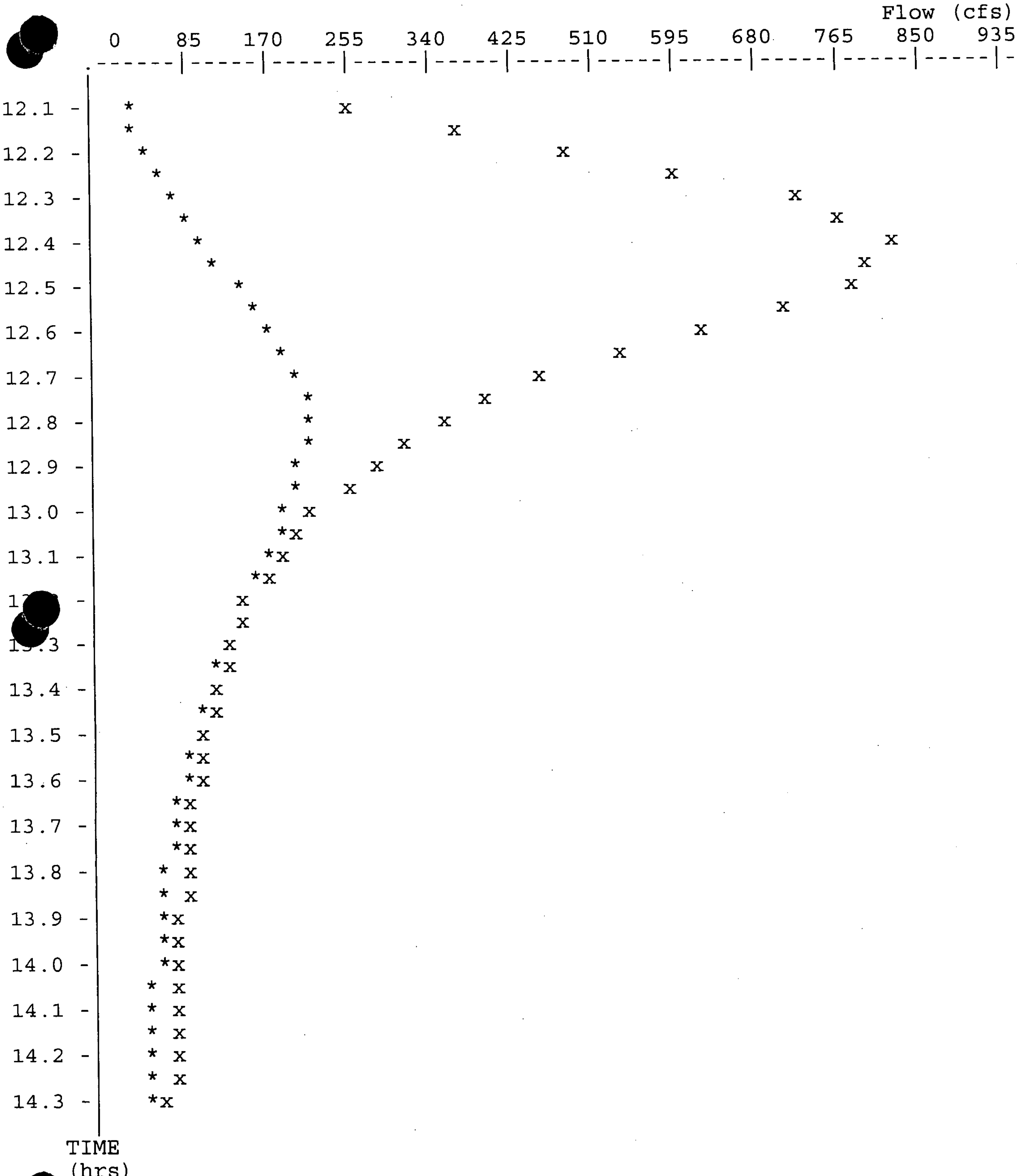
Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
107.00	32,375.00	0.74	0.00	0.00	0.00
107.90	391,986.00	9.00	12.33	3.70	3.70
108.00	431,943.00	9.92	28.36	0.95	4.64
109.00	472,514.00	10.85	31.13	10.38	15.02
110.00	494,313.00	11.35	33.29	11.10	26.12
111.00	523,719.00	12.02	35.05	11.68	37.80
112.00	553,125.00	12.70	37.08	12.36	50.16
113.00	582,531.00	13.37	39.10	13.03	63.20
114.00	611,937.00	14.05	41.13	13.71	76.90
115.00	641,343.00	14.72	43.15	14.38	91.29
116.00	670,747.00	15.40	45.18	15.06	106.35

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

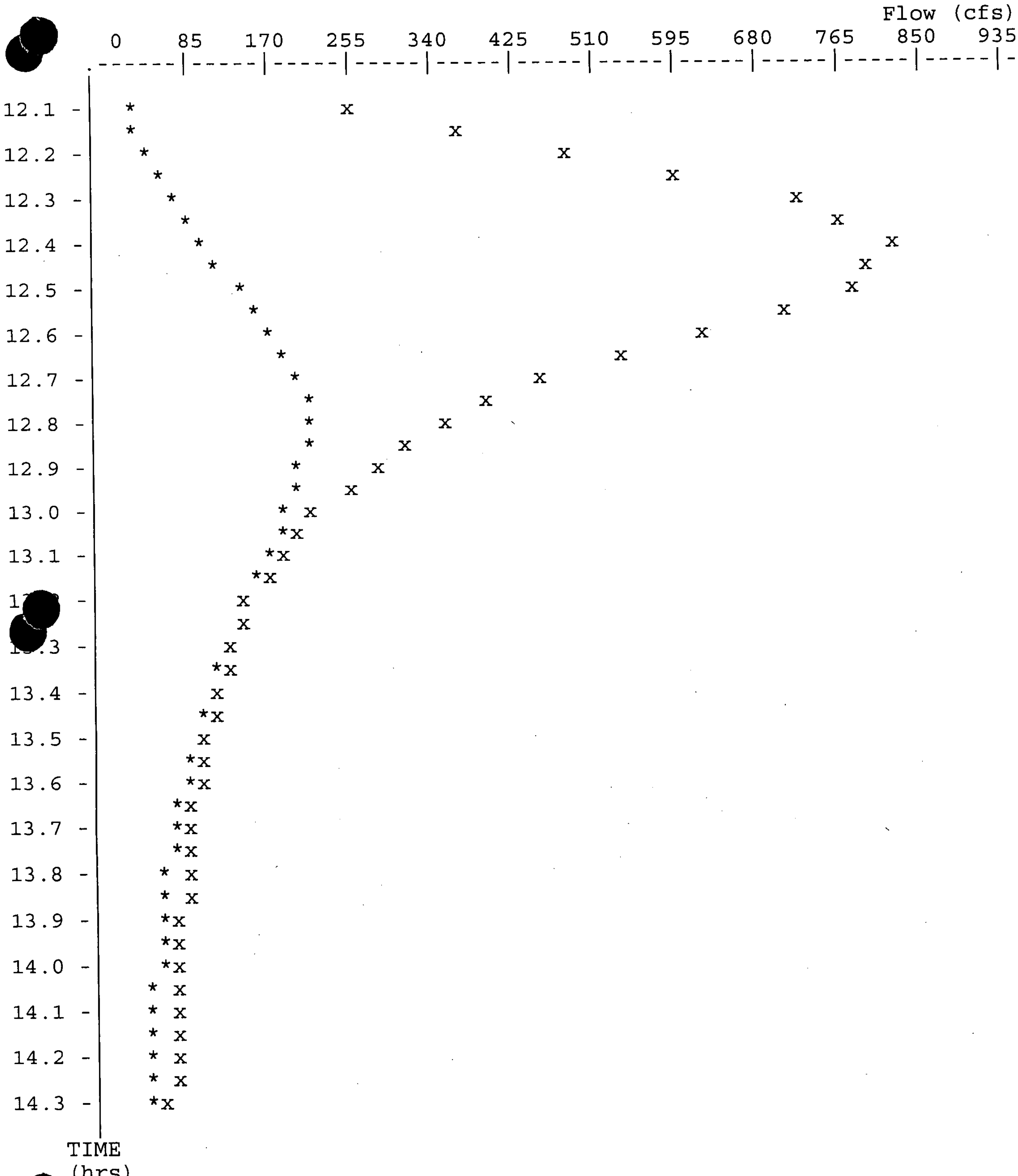
where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

POND-2 Version: 5.20 S/N: 1903052002
Plotted: 01-28-2000



x File: a:SEALLPOS.HYD Qmax = 817.0 cfs
File: a:SEALLPRE.HYD Qmax = 215.0 cfs

POND-2 Version: 5.20 S/N: 1903052002
Plotted: 01-28-2000



* File: a:SEALLPRE.HYD Qmax = 215.0 cfs
x File: a:SEALLPOS.HYD Qmax = 817.0 cfs

```
**********************************************
*                                            *
*   Basin-C Post condition routed to Pond "C" *
*                                            *
*                                            *
*                                            *
*                                            *
**********************************************
```

Inflow Hydrograph: a:BASINCPR.HYD
Rating Table file: a:BASIN-C .PND

----INITIAL CONDITIONS----
Elevation = 127.50 ft
Outflow = 3.80 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + 0 (cfs)
127.50	3.8	0.000	0.0	3.8
127.75	4.3	0.671	162.3	166.6
128.00	4.8	1.349	326.5	331.3
128.25	5.2	2.036	492.7	497.9
128.50	5.7	2.731	660.9	666.6
128.75	9.3	3.434	831.1	840.4
129.00	15.6	4.145	1003.2	1018.8
129.25	23.5	4.865	1177.3	1200.8
129.50	32.8	5.593	1353.4	1386.2
129.75	43.3	6.329	1531.6	1574.9
130.00	50.3	7.073	1711.8	1762.1
130.25	54.1	7.827	1894.0	1948.1
130.50	57.7	8.588	2078.3	2136.0
130.75	61.1	9.358	2264.6	2325.7
131.00	72.6	10.137	2453.1	2525.7
131.25	90.8	10.924	2643.6	2734.4
131.50	113.3	11.720	2836.2	2949.5
131.75	139.2	12.525	3030.9	3170.1
132.00	168.0	13.338	3227.8	3395.8

Time increment (t) = 0.100 hrs.

POND-2 Version: 5.20 S/N: 1903052002
EXECUTED: 01-28-2000 13:37:53

Pond File: a:BASIN-C .PND
Inflow Hydrograph: a:BASINCPR.HYD
Outflow Hydrograph: a:OUT .HYD

INFLOW HYDROGRAPH | ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
11.000	5.00	-----	-3.8	3.8	3.80	127.50
11.100	5.00	10.0	-1.4	6.2	3.81	127.50
11.200	6.00	11.0	1.9	9.6	3.82	127.51
11.300	6.00	12.0	6.3	13.9	3.83	127.52
11.400	7.00	13.0	11.6	19.3	3.85	127.52
11.500	7.00	14.0	17.9	25.6	3.87	127.53
11.600	8.00	15.0	25.1	32.9	3.89	127.54
11.700	9.00	17.0	34.2	42.1	3.92	127.56
11.800	11.00	20.0	46.3	54.2	3.95	127.58
11.900	12.00	23.0	61.3	69.3	4.00	127.60
12.000	15.00	27.0	80.2	88.3	4.06	127.63
12.100	20.00	35.0	106.9	115.2	4.14	127.67
12.200	31.00	51.0	149.4	157.9	4.27	127.74
12.300	48.00	79.0	219.4	228.4	4.49	127.84
12.400	73.00	121.0	330.8	340.4	4.82	128.01
12.500	101.00	174.0	494.3	504.8	5.22	128.26
12.600	126.00	227.0	707.7	721.3	6.83	128.58
12.700	144.00	270.0	949.4	977.7	14.15	128.94
12.800	157.00	301.0	1198.4	1250.4	25.99	129.32
12.900	148.00	305.0	1424.7	1503.4	39.32	129.66
13.000	139.00	287.0	1614.9	1711.7	48.42	129.93
13.100	122.00	261.0	1770.7	1875.9	52.63	130.15
13.200	106.00	228.0	1888.5	1998.7	55.07	130.32
13.300	92.00	198.0	1973.0	2086.5	56.75	130.43
13.400	78.00	170.0	2027.4	2143.0	57.83	130.51
13.500	69.00	147.0	2057.6	2174.4	58.39	130.55
13.600	59.00	128.0	2068.4	2185.6	58.59	130.57
13.700	52.00	111.0	2062.5	2179.4	58.48	130.56
13.800	46.00	98.0	2044.2	2160.5	58.14	130.53
13.900	42.00	88.0	2016.9	2132.2	57.63	130.49
14.000	37.00	79.0	1982.1	2095.9	56.93	130.45
14.100	34.00	71.0	1940.8	2053.1	56.11	130.39
14.200	31.00	65.0	1895.4	2005.8	55.21	130.33
14.300	28.00	59.0	1846.0	1954.4	54.22	130.26
14.400	26.00	54.0	1793.8	1900.0	53.12	130.19
14.500	25.00	51.0	1740.8	1844.8	51.99	130.11
14.600	23.00	48.0	1687.1	1788.8	50.85	130.04
14.700	22.00	45.0	1633.7	1732.1	49.18	129.96
14.800	20.00	42.0	1581.6	1675.7	47.07	129.88
14.900	19.00	39.0	1530.6	1620.6	45.01	129.81
15.000	18.00	37.0	1481.8	1567.6	42.89	129.74
15.100	17.00	35.0	1436.7	1516.8	40.07	129.67
15.200	17.00	34.0	1395.7	1470.7	37.50	129.61
15.300	16.00	33.0	1358.3	1428.7	35.16	129.56
15.400	16.00	32.0	1324.3	1390.3	33.03	129.51

POND-2 Version: 5.20 S/N: 1903052002
EXECUTED: 01-28-2000 13:37:53

Pond File: a:BASIN-C .PND
Inflow Hydrograph: a:BASINCPR.HYD
Outflow Hydrograph: a:OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
15.500	15.00	31.0	1292.8	1355.3	31.25	129.46
15.600	15.00	30.0	1263.6	1322.8	29.62	129.41
15.700	14.00	29.0	1236.4	1292.6	28.10	129.37
15.800	14.00	28.0	1211.0	1264.4	26.69	129.34
15.900	13.00	27.0	1187.2	1238.0	25.36	129.30
16.000	13.00	26.0	1165.0	1213.2	24.12	129.27
16.100	13.00	26.0	1144.9	1191.0	23.07	129.24
16.200	13.00	26.0	1126.5	1170.9	22.20	129.21
16.300	12.00	25.0	1108.7	1151.5	21.36	129.18
16.400	12.00	24.0	1091.6	1132.7	20.55	129.16
16.500	12.00	24.0	1076.0	1115.6	19.80	129.13
16.600	12.00	24.0	1061.8	1100.0	19.13	129.11
16.700	11.00	23.0	1047.9	1084.8	18.46	129.09
16.800	11.00	22.0	1034.2	1069.9	17.82	129.07
16.900	10.00	21.0	1020.9	1055.2	17.18	129.05
17.000	10.00	20.0	1007.7	1040.9	16.56	129.03
17.100	10.00	20.0	995.8	1027.7	15.99	129.01
17.200	10.00	20.0	984.8	1015.8	15.49	129.00
17.300	10.00	20.0	974.6	1004.8	15.11	128.98
17.400	10.00	20.0	965.1	994.6	14.74	128.97
17.500	10.00	20.0	956.3	985.1	14.41	128.95
17.600	10.00	20.0	948.1	976.3	14.10	128.94
17.700	10.00	20.0	940.4	968.1	13.81	128.93
17.800	9.00	19.0	932.4	959.4	13.50	128.92
17.900	9.00	18.0	924.1	950.4	13.19	128.90
18.000	9.00	18.0	916.3	942.1	12.89	128.89
18.100	9.00	18.0	909.0	934.3	12.62	128.88
18.200	9.00	18.0	902.3	927.0	12.36	128.87
18.300	9.00	18.0	896.1	920.3	12.12	128.86
18.400	9.00	18.0	890.3	914.1	11.90	128.85
18.500	8.00	17.0	883.9	907.3	11.66	128.84
18.600	8.00	16.0	877.1	899.9	11.40	128.83
18.700	8.00	16.0	870.8	893.1	11.16	128.82
18.800	8.00	16.0	864.9	886.8	10.94	128.82
18.900	8.00	16.0	859.5	880.9	10.73	128.81
19.000	8.00	16.0	854.4	875.5	10.54	128.80
19.100	8.00	16.0	849.7	870.4	10.36	128.79
19.200	8.00	16.0	845.3	865.7	10.19	128.79
19.300	8.00	16.0	841.2	861.3	10.04	128.78
19.400	8.00	16.0	837.4	857.2	9.89	128.77
19.500	8.00	16.0	833.9	853.4	9.76	128.77
19.600	7.00	15.0	829.7	848.9	9.60	128.76
19.700	7.00	14.0	824.9	843.7	9.42	128.75
19.800	7.00	14.0	820.3	838.9	9.27	128.75
19.900	7.00	14.0	816.0	834.3	9.17	128.74
20.000	7.00	14.0	811.8	830.0	9.08	128.74

EXECUTED: 01-28-2000 13:37:53

Pond File: a:BASIN-C .PND
Inflow Hydrograph: a:BASINCPR.HYD
Outflow Hydrograph: a:OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
20.100	7.00	14.0	807.8	825.8	9.00	128.73
20.200	7.00	14.0	804.0	821.8	8.92	128.72
20.300	7.00	14.0	800.3	818.0	8.84	128.72
20.400	7.00	14.0	796.8	814.3	8.76	128.71
20.500	6.00	13.0	792.4	809.8	8.67	128.71
20.600	6.00	12.0	787.3	804.4	8.56	128.70
20.700	6.00	12.0	782.4	799.3	8.45	128.69
20.800	6.00	12.0	777.7	794.4	8.35	128.68
20.900	6.00	12.0	773.2	789.7	8.25	128.68
21.000	6.00	12.0	768.9	785.2	8.16	128.67
21.100	6.00	12.0	764.8	780.9	8.07	128.66
21.200	6.00	12.0	760.8	776.8	7.98	128.66
21.300	6.00	12.0	757.0	772.8	7.90	128.65
21.400	6.00	12.0	753.4	769.0	7.82	128.65
21.500	6.00	12.0	749.9	765.4	7.75	128.64
21.600	5.00	11.0	745.6	760.9	7.65	128.64
21.700	5.00	10.0	740.5	755.6	7.54	128.63
21.800	5.00	10.0	735.6	750.5	7.44	128.62
21.900	5.00	10.0	730.9	745.6	7.34	128.61
22.000	5.00	10.0	726.5	740.9	7.24	128.61
22.100	5.00	10.0	722.2	736.5	7.15	128.60
22.200	5.00	10.0	718.0	732.2	7.06	128.59
22.300	5.00	10.0	714.1	728.0	6.97	128.59
22.400	4.00	9.0	709.4	723.1	6.87	128.58
22.500	4.00	8.0	703.9	717.4	6.75	128.57
22.600	4.00	8.0	698.6	711.9	6.64	128.57
22.700	4.00	8.0	693.5	706.6	6.53	128.56
22.800	4.00	8.0	688.7	701.5	6.42	128.55
22.900	4.00	8.0	684.0	696.7	6.32	128.54
23.000	4.00	8.0	679.6	692.0	6.23	128.54
23.100	4.00	8.0	675.3	687.6	6.13	128.53
23.200	4.00	8.0	671.2	683.3	6.05	128.52
23.300	3.00	7.0	666.3	678.2	5.94	128.52
23.400	3.00	6.0	660.7	672.3	5.82	128.51
23.500	3.00	6.0	655.3	666.7	5.70	128.50
23.600	3.00	6.0	649.9	661.3	5.68	128.49
23.700	3.00	6.0	644.6	655.9	5.67	128.48
23.800	3.00	6.0	639.3	650.6	5.65	128.48
23.900	3.00	6.0	634.0	645.3	5.64	128.47
24.000	2.00	5.0	627.8	639.0	5.62	128.46
24.100	2.00	4.0	620.6	631.8	5.60	128.45
24.200	2.00	4.0	613.4	624.6	5.58	128.44
24.300	2.00	4.0	606.3	617.4	5.55	128.43
24.400	2.00	4.0	599.3	610.3	5.53	128.42
24.500	2.00	4.0	592.2	603.3	5.51	128.41
24.600	2.00	4.0	585.2	596.2	5.49	128.40

EXECUTED: 01-28-2000 13:37:53

Pond File: a:BASIN-C .PND
Inflow Hydrograph: a:BASINCPR.HYD
Outflow Hydrograph: a:OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
24.700	2.00	4.0	578.3	589.2	5.47	128.39
24.800	2.00	4.0	571.4	582.3	5.45	128.38
24.900	1.00	3.0	563.6	574.4	5.43	128.36
25.000	1.00	2.0	554.8	565.6	5.40	128.35
25.100	1.00	2.0	546.0	556.8	5.37	128.34
25.200	1.00	2.0	537.3	548.0	5.35	128.32
25.300	1.00	2.0	528.7	539.3	5.32	128.31
25.400	1.00	2.0	520.1	530.7	5.30	128.30
25.500	1.00	2.0	511.5	522.1	5.27	128.29
25.600	0.00	1.0	502.0	512.5	5.24	128.27
25.700	0.00	0.0	491.6	502.0	5.21	128.26
25.800	0.00	0.0	481.2	491.6	5.18	128.24
25.900	0.00	0.0	470.9	481.2	5.16	128.22

****************** SUMMARY OF ROUTING COMPUTATIONS ******************

Pond File: a:BASIN-C .PND
Inflow Hydrograph: a:BASINCPR.HYD
Outflow Hydrograph: a:OUT .HYD

Starting Pond W.S. Elevation = 127.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

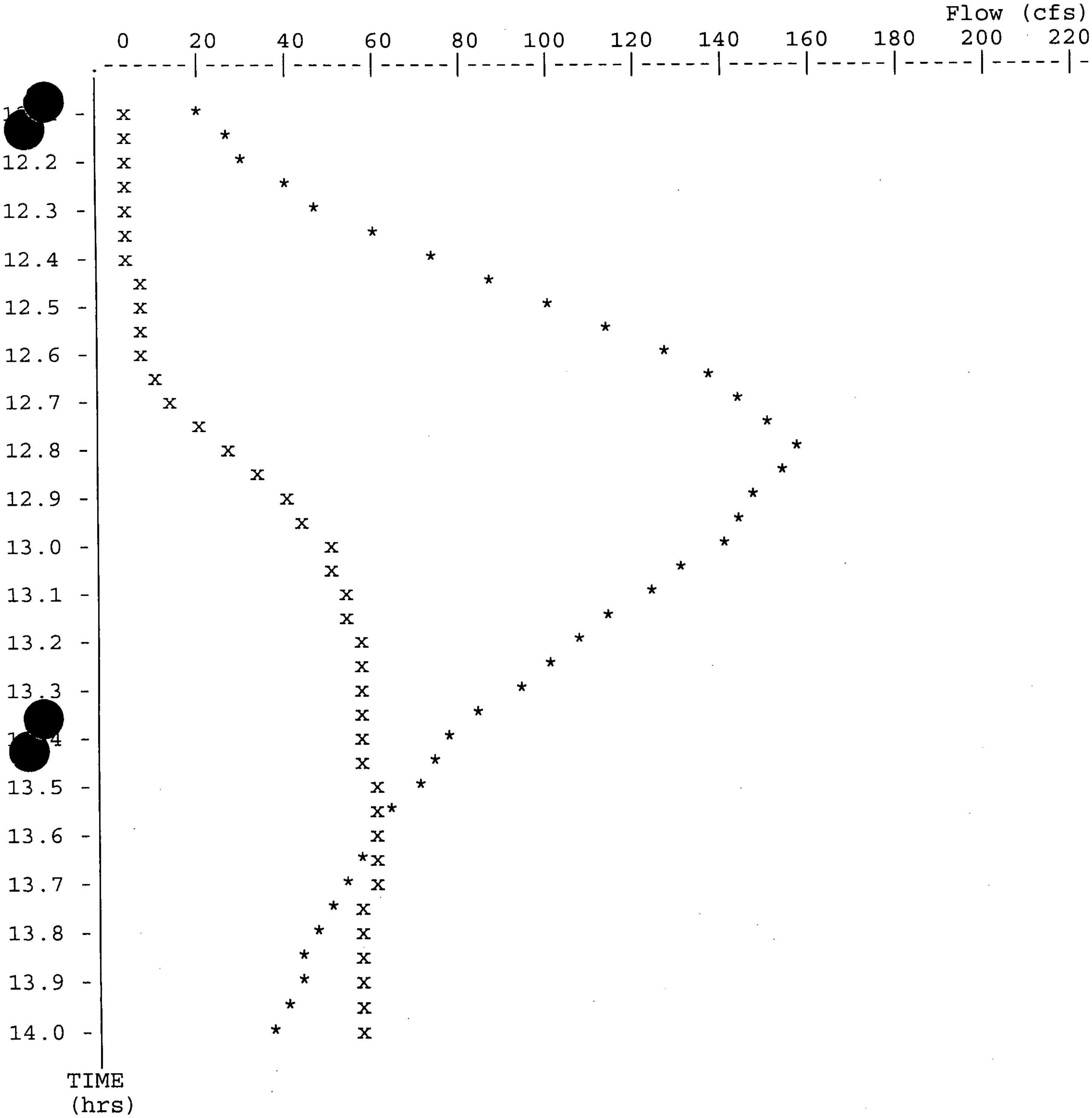
Peak Inflow	=	157.00	cfs
Peak Outflow	=	58.59	cfs
Peak Elevation	=	130.57	ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0.00	ac-ft
Peak Storage From Storm	=	8.79	ac-ft
Total Storage in Pond	=	8.79	ac-ft

Warning: Inflow hydrograph truncated on left side.

```
Pond File:             a:BASIN-C .PND
Inflow Hydrograph:     a:BASINCPR.HYD
Outflow Hydrograph:    a:OUT      .HYD
                                                EXECUTED: 01-28-2000
                                                          13:37:53
Peak Inflow     =   157.00 cfs
Peak Outflow    =    58.59 cfs
Peak Elevation  =   130.57 ft
```

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*  File:   a:BASINCPR.HYD    Qmax =    157.0 cfs
x  File:   a:OUT      .HYD    Qmax =     58.6 cfs
```

POND-2 Version: 5.20 S/N: 1903052002
EXECUTED: 01-28-2000 13:47:14

Basin-D Post condition routed to Pond "D"

Inflow Hydrograph: a:BASINDPO.HYD
Rating Table file: a:BASIN-D .PND

----INITIAL CONDITIONS----
Elevation = 108.00 ft
Outflow = 15.50 cfs
Storage = 4.64 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + 0 (cfs)
108.00	15.5	4.644	1123.8	1139.3
108.25	24.6	7.151	1730.6	1755.2
108.50	37.2	9.717	2351.4	2388.6
108.75	52.4	12.340	2986.2	3038.6
109.00	69.6	15.022	3635.3	3704.9
109.25	88.8	17.749	4295.4	4384.2
109.50	109.7	20.508	4962.9	5072.6
109.75	132.1	23.298	5638.0	5770.1
110.00	156.0	26.119	6320.7	6476.7
110.25	175.0	28.977	7012.3	7187.3
110.50	184.3	31.876	7714.1	7898.4
110.75	193.3	34.818	8426.0	8619.3
111.00	201.9	37.803	9148.2	9350.1
111.25	210.2	40.829	9880.6	10090.8
111.50	218.4	43.898	10623.2	10841.6
111.75	226.2	47.008	11376.0	11602.2
112.00	233.9	50.161	12139.1	12373.0
112.25	241.5	53.357	12912.4	13153.9
112.50	248.8	56.594	13695.8	13944.6
112.75	256.0	59.874	14489.4	14745.4
113.00	263.1	63.196	15293.3	15556.4
113.25	270.0	66.560	16107.4	16377.4
113.50	276.9	69.966	16931.7	17208.6
113.75	283.6	73.414	17766.2	18049.8
114.00	290.2	76.905	18611.0	18901.2
114.25	296.7	80.438	19465.9	19762.6
114.50	303.1	84.013	20331.0	20634.1
114.75	309.4	87.630	21206.4	21515.8
115.00	315.7	91.289	22092.0	22407.7
115.25	355.1	94.991	22987.8	23342.9
115.50	422.0	98.734	23893.7	24315.7

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)
115.75	506.7	102.520
116.00	605.7	106.349

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + 0 (cfs)
24809.9	25316.6
25736.4	26342.1

Time increment (t) = 0.100 hrs.

POND-2 Version: 5.20 S/N: 1903052002
EXECUTED: 01-28-2000 13:47:14

Pond File: a:BASIN-D .PND
Inflow Hydrograph: a:BASINDPO.HYD
Outflow Hydrograph: a:OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
11.000	10.00	-----	1108.3	1139.3	15.50	108.00
11.100	11.00	21.0	1098.6	1129.3	15.36	108.00
11.200	12.00	23.0	1091.1	1121.6	15.26	108.00
11.300	13.00	25.0	1085.7	1116.1	15.18	108.00
11.400	15.00	28.0	1083.4	1113.7	15.15	108.00
11.500	16.00	31.0	1084.1	1114.4	15.16	108.00
11.600	18.00	34.0	1087.6	1118.1	15.21	108.00
11.700	21.00	39.0	1096.0	1126.6	15.33	108.00
11.800	23.00	44.0	1109.0	1140.0	15.51	108.00
11.900	26.00	49.0	1126.4	1158.0	15.78	108.01
12.000	31.00	57.0	1151.1	1183.4	16.15	108.02
12.100	42.00	73.0	1190.6	1224.1	16.75	108.03
12.200	64.00	106.0	1261.0	1296.6	17.82	108.06
12.300	100.00	164.0	1385.5	1425.0	19.72	108.12
12.400	150.00	250.0	1589.9	1635.5	22.83	108.20
12.500	207.00	357.0	1890.0	1946.9	28.41	108.33
12.600	259.00	466.0	2282.9	2356.0	36.55	108.49
12.700	295.00	554.0	2741.6	2836.9	47.68	108.67
12.800	320.00	615.0	3235.3	3356.6	60.61	108.87
12.900	300.00	620.0	3707.6	3855.3	73.85	109.06
13.000	280.00	580.0	4115.5	4287.6	86.07	109.21
13.100	247.00	527.0	4449.2	4642.5	96.64	109.34
13.200	214.00	461.0	4700.7	4910.2	104.77	109.44
13.300	186.00	400.0	4879.5	5100.7	110.60	109.51
13.400	157.00	343.0	4993.4	5222.5	114.51	109.55
13.500	138.00	295.0	5055.2	5288.4	116.63	109.58
13.600	119.00	257.0	5077.4	5312.2	117.39	109.59
13.700	106.00	225.0	5068.2	5302.4	117.08	109.58
13.800	92.00	198.0	5034.4	5266.2	115.92	109.57
13.900	83.00	175.0	4981.2	5209.4	114.09	109.55
14.000	74.00	157.0	4914.6	5138.2	111.81	109.52
14.100	68.00	142.0	4838.2	5056.6	109.21	109.49
14.200	62.00	130.0	4755.1	4968.2	106.53	109.46
14.300	56.00	118.0	4665.8	4873.1	103.64	109.43
14.400	52.00	108.0	4572.6	4773.8	100.63	109.39
14.500	49.00	101.0	4478.4	4673.6	97.59	109.36
14.600	45.00	94.0	4383.4	4572.4	94.51	109.32
14.700	43.00	88.0	4288.5	4471.4	91.45	109.28
14.800	40.00	83.0	4194.6	4371.5	88.44	109.25
14.900	38.00	78.0	4101.3	4272.6	85.65	109.21
15.000	36.00	74.0	4009.5	4175.3	82.90	109.17
15.100	35.00	71.0	3920.1	4080.5	80.22	109.14
15.200	34.00	69.0	3833.8	3989.1	77.63	109.10
15.300	32.00	66.0	3749.6	3899.8	75.11	109.07
15.400	31.00	63.0	3667.3	3812.6	72.64	109.04

EXECUTED: 01-28-2000 13:47:14

Pond File: a:BASIN-D .PND
Inflow Hydrograph: a:BASINDPO.HYD
Outflow Hydrograph: a:OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
15.500	30.00	61.0	3587.8	3728.3	70.26	109.01
15.600	29.00	59.0	3510.6	3646.8	68.10	108.98
15.700	28.00	57.0	3435.5	3567.6	66.05	108.95
15.800	28.00	56.0	3363.3	3491.5	64.09	108.92
15.900	27.00	55.0	3293.9	3418.3	62.20	108.89
16.000	26.00	53.0	3226.2	3346.9	60.36	108.87
16.100	25.00	51.0	3160.1	3277.2	58.56	108.84
16.200	25.00	50.0	3096.4	3210.1	56.83	108.81
16.300	24.00	49.0	3035.1	3145.4	55.16	108.79
16.400	24.00	48.0	2976.0	3083.1	53.55	108.77
16.500	23.00	47.0	2918.9	3023.0	52.03	108.74
16.600	23.00	46.0	2863.6	2964.9	50.68	108.72
16.700	22.00	45.0	2809.9	2908.6	49.36	108.70
16.800	22.00	44.0	2757.7	2853.9	48.08	108.68
16.900	21.00	43.0	2707.0	2800.7	46.84	108.66
17.000	21.00	42.0	2657.8	2749.0	45.63	108.64
17.100	21.00	42.0	2610.8	2699.8	44.48	108.62
17.200	20.00	41.0	2565.1	2651.8	43.36	108.60
17.300	20.00	40.0	2520.6	2605.1	42.26	108.58
17.400	19.00	39.0	2477.2	2559.6	41.20	108.57
17.500	19.00	38.0	2434.9	2515.2	40.16	108.55
17.600	19.00	38.0	2394.5	2472.9	39.17	108.53
17.700	19.00	38.0	2356.1	2432.5	38.23	108.52
17.800	18.00	37.0	2318.5	2393.1	37.30	108.50
17.900	18.00	36.0	2281.4	2354.5	36.52	108.49
18.000	18.00	36.0	2245.9	2317.4	35.78	108.47
18.100	18.00	36.0	2211.7	2281.9	35.08	108.46
18.200	17.00	35.0	2177.9	2246.7	34.38	108.44
18.300	17.00	34.0	2144.6	2211.9	33.69	108.43
18.400	17.00	34.0	2112.5	2178.6	33.02	108.42
18.500	16.00	33.0	2080.8	2145.5	32.36	108.40
18.600	16.00	32.0	2049.4	2112.8	31.71	108.39
18.700	16.00	32.0	2019.2	2081.4	31.09	108.38
18.800	16.00	32.0	1990.2	2051.2	30.49	108.37
18.900	15.00	31.0	1961.4	2021.2	29.89	108.35
19.000	15.00	30.0	1932.8	1991.4	29.30	108.34
19.100	15.00	30.0	1905.4	1962.8	28.73	108.33
19.200	15.00	30.0	1879.0	1935.4	28.18	108.32
19.300	14.00	29.0	1852.7	1908.0	27.64	108.31
19.400	14.00	28.0	1826.5	1880.7	27.10	108.30
19.500	14.00	28.0	1801.4	1854.5	26.58	108.29
19.600	14.00	28.0	1777.2	1829.4	26.08	108.28
19.700	14.00	28.0	1754.1	1805.2	25.59	108.27
19.800	13.00	27.0	1730.8	1781.1	25.11	108.26
19.900	13.00	26.0	1707.6	1756.8	24.63	108.25
20.000	13.00	26.0	1685.0	1733.6	24.28	108.24

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Pond File: a:BASIN-D .PND
Inflow Hydrograph: a:BASINDPO.HYD
Outflow Hydrograph: a:OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
20.100	13.00	26.0	1663.1	1711.0	23.95	108.23
20.200	13.00	26.0	1641.9	1689.1	23.62	108.22
20.300	13.00	26.0	1621.2	1667.9	23.31	108.21
20.400	13.00	26.0	1601.2	1647.2	23.00	108.21
20.500	12.00	25.0	1580.8	1626.2	22.69	108.20
20.600	12.00	24.0	1560.1	1604.8	22.38	108.19
20.700	12.00	24.0	1539.9	1584.1	22.07	108.18
20.800	12.00	24.0	1520.4	1563.9	21.77	108.17
20.900	12.00	24.0	1501.4	1544.4	21.49	108.16
21.000	12.00	24.0	1483.0	1525.4	21.20	108.16
21.100	12.00	24.0	1465.2	1507.0	20.93	108.15
21.200	12.00	24.0	1447.8	1489.2	20.67	108.14
21.300	12.00	24.0	1431.0	1471.8	20.41	108.13
21.400	12.00	24.0	1414.7	1455.0	20.16	108.13
21.500	12.00	24.0	1398.8	1438.7	19.92	108.12
21.600	11.00	23.0	1382.5	1421.8	19.67	108.11
21.700	11.00	22.0	1365.6	1404.5	19.42	108.11
21.800	11.00	22.0	1349.3	1387.6	19.17	108.10
21.900	11.00	22.0	1333.4	1371.3	18.93	108.09
22.000	11.00	22.0	1318.1	1355.4	18.69	108.09
22.100	11.00	22.0	1303.1	1340.1	18.47	108.08
22.200	10.00	21.0	1287.7	1324.1	18.23	108.08
22.300	10.00	20.0	1271.7	1307.7	17.99	108.07
22.400	10.00	20.0	1256.2	1291.7	17.75	108.06
22.500	10.00	20.0	1241.1	1276.2	17.52	108.06
22.600	9.00	19.0	1225.6	1260.1	17.29	108.05
22.700	9.00	18.0	1209.5	1243.6	17.04	108.04
22.800	9.00	18.0	1193.9	1227.5	16.80	108.04
22.900	9.00	18.0	1178.7	1211.9	16.57	108.03
23.000	8.00	17.0	1163.1	1195.7	16.33	108.02
23.100	8.00	16.0	1146.9	1179.1	16.09	108.02
23.200	8.00	16.0	1131.2	1162.9	15.85	108.01
23.300	7.00	15.0	1115.0	1146.2	15.60	108.00
23.400	7.00	14.0	1098.3	1129.0	15.36	108.00
23.500	7.00	14.0	1082.0	1112.3	15.13	108.00
23.600	7.00	14.0	1066.2	1096.0	14.91	108.00
23.700	6.00	13.0	1049.8	1079.2	14.68	108.00
23.800	6.00	12.0	1032.9	1061.8	14.45	108.00
23.900	6.00	12.0	1016.5	1044.9	14.22	108.00
24.000	6.00	12.0	1000.5	1028.5	13.99	108.00
24.100	5.00	11.0	984.0	1011.5	13.76	108.00
24.200	5.00	10.0	966.9	994.0	13.52	108.00
24.300	5.00	10.0	950.4	976.9	13.29	108.00
24.400	4.00	9.0	933.3	959.4	13.05	108.00
24.500	4.00	8.0	915.6	941.3	12.81	108.00
24.600	4.00	8.0	898.5	923.6	12.57	108.00

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Pond File: a:BASIN-D .PND
Inflow Hydrograph: a:BASINDPO.HYD
Outflow Hydrograph: a:OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
24.700	4.00	8.0	881.8	906.5	12.33	108.00
24.800	3.00	7.0	864.7	888.8	12.09	108.00
24.900	3.00	6.0	847.0	870.7	11.85	108.00
25.000	3.00	6.0	829.8	853.0	11.60	108.00
25.100	2.00	5.0	812.0	834.8	11.36	108.00
25.200	2.00	4.0	793.8	816.0	11.10	108.00
25.300	2.00	4.0	776.1	797.8	10.85	108.00
25.400	2.00	4.0	758.9	780.1	10.61	108.00
25.500	1.00	3.0	741.2	761.9	10.37	108.00
25.600	1.00	2.0	723.0	743.2	10.11	108.00
25.700	1.00	2.0	705.2	725.0	9.86	108.00
25.800	1.00	2.0	688.0	707.2	9.62	108.00
25.900	0.00	1.0	670.2	689.0	9.37	108.00

****************** SUMMARY OF ROUTING COMPUTATIONS ******************

Pond File: a:BASIN-D .PND
Inflow Hydrograph: a:BASINDPO.HYD
Outflow Hydrograph: a:OUT .HYD

Starting Pond W.S. Elevation = 108.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 320.00 cfs
Peak Outflow = 117.39 cfs
Peak Elevation = 109.59 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	4.64 ac-ft
Peak Storage From Storm	=	16.82 ac-ft

Total Storage in Pond	=	21.47 ac-ft

Warning: Inflow hydrograph truncated on left side.

>>>>> Warning, initial pond outflow > 1st inflow ordinate. <<<<<

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Pond File:             a:BASIN-D .PND
Inflow Hydrograph:     a:BASINDPO.HYD
Outflow Hydrograph:    a:OUT     .HYD
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Peak Inflow    =   320.00 cfs
Peak Outflow   =   117.39 cfs
Peak Elevation =   109.59 ft
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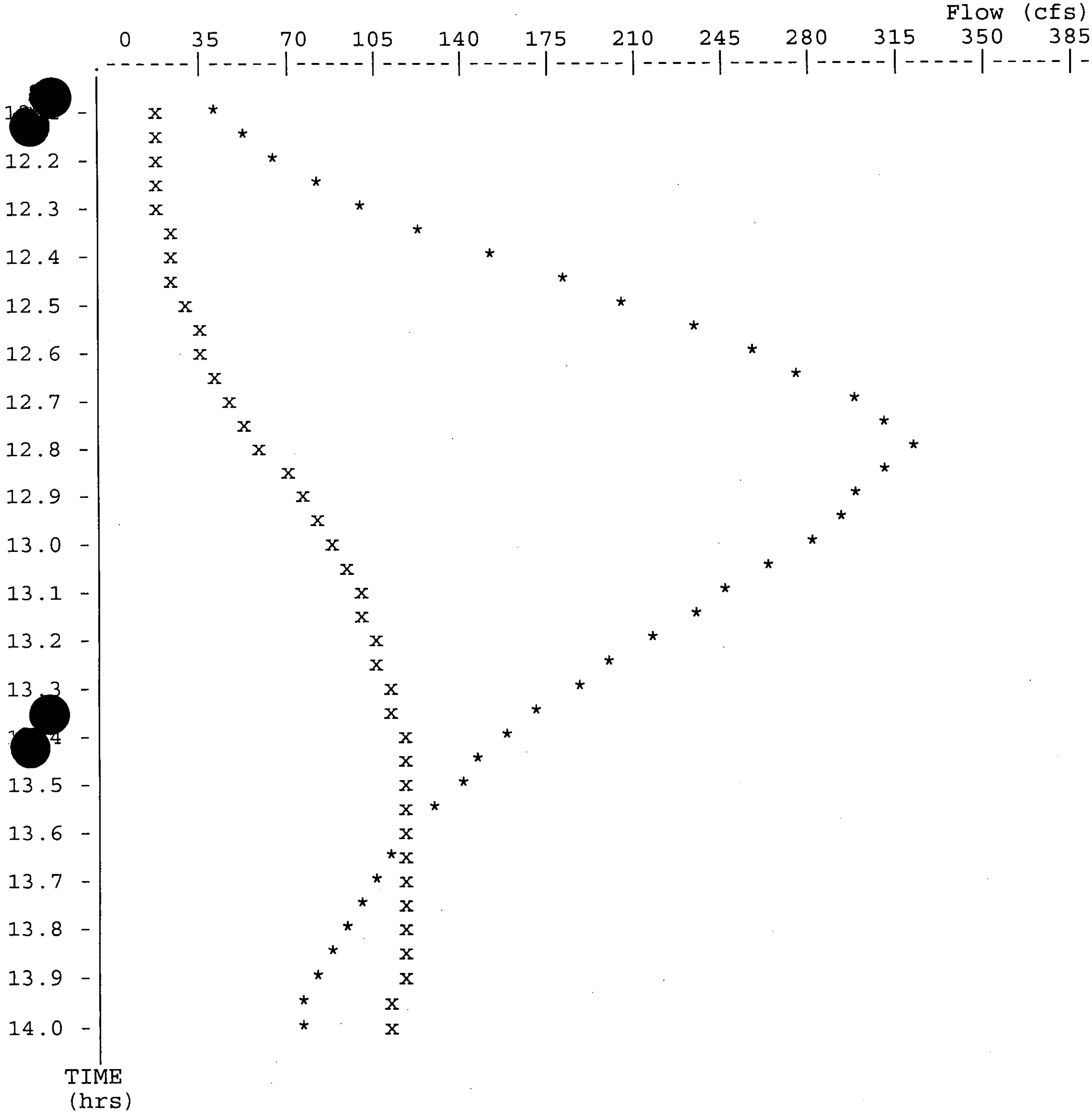

* File: a:BASINDPO.HYD Qmax = 320.0 cfs
x File: a:OUT .HYD Qmax = 117.4 cfs