OFF-SITE HYDROLOGY REPORT

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67TH AVENUE STORMDRAIN

BELL ROAD TO ACDC

PREPARED FOR:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PREPARED BY:

GREINER, INC.

PHOENIX, ARIZONA

SEPTEMBER 1988

CONTRACT FCD 88-21

PROJECT No. E-111-124

Greiner

FLOOD CONTROL DISTRICT
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REMARKS

OFF-SITE HYDROLOGY REPORT

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BELL ROAD TO ACDC

Prepared for:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
3335 W. Durango
Phoenix, Arizona 85009

Prepared by:

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September 1988

Contract FCD 88-21
Project No. E-111-124

Registered Professional Engineer (Civil)
CERTIFICATE NO. 17756
SHI-EN SHIAU
Date Signed 9/16/88
ARIZONA, U.S.A.

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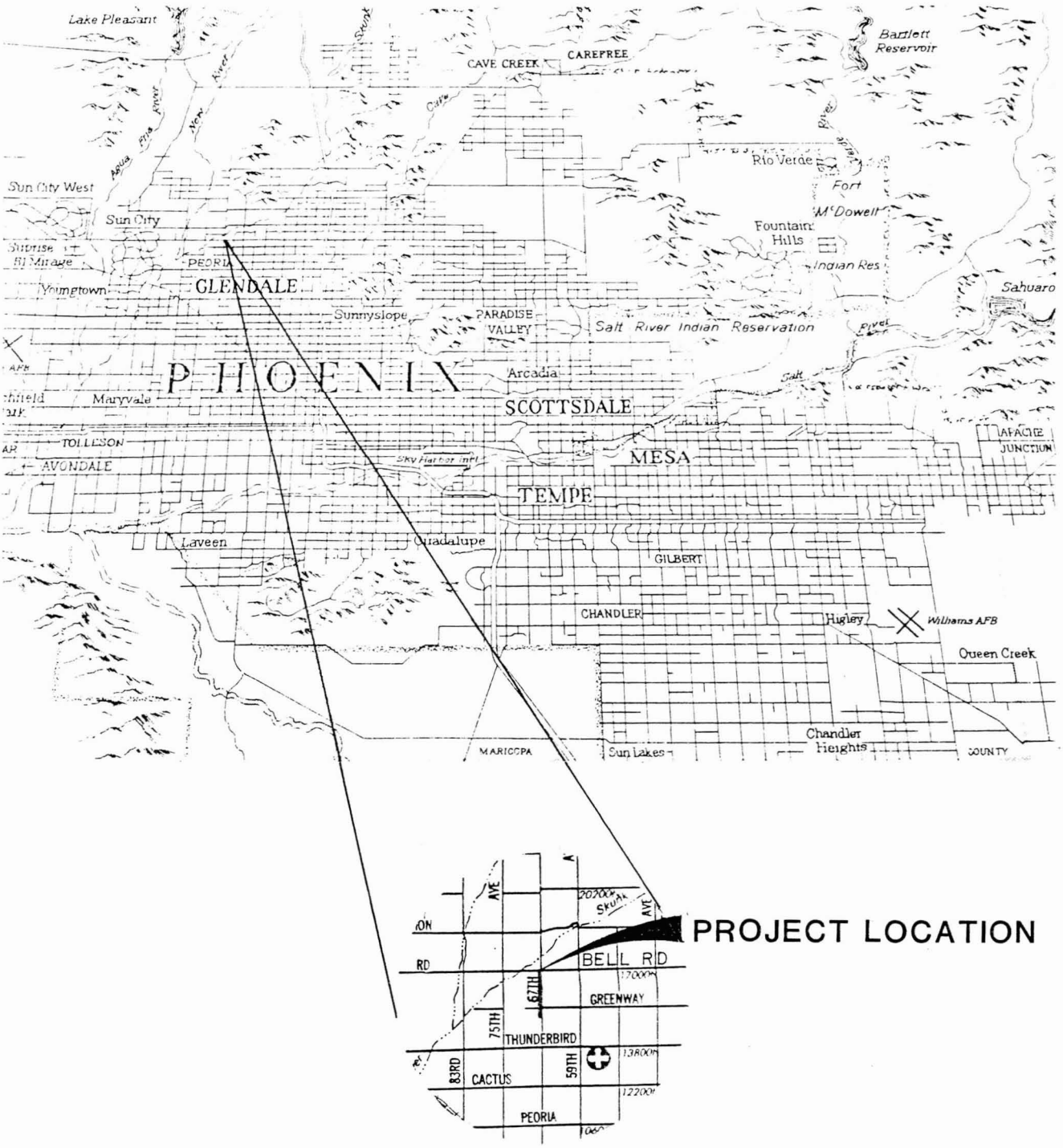
III. INTRODUCTION

The 67th Avenue stormdrain project consists of approximately 1.5 miles of trunk stormdrain improvements in Glendale, Arizona (Figure 1 shows the project vicinity). The stormdrain alignment is along 67th Avenue from Bell Road to the Arizona Canal Diversion Channel (ACDC). Major laterals located along Bell Road, Paradise Lane and Greenway Road will tie into the 67th Avenue stormdrain and will extend eastward to approximately 61st Avenue.

The 67th Avenue stormdrain and its major laterals are a portion of the Stormwater Management Plan developed for the City of Glendale (Reference 1). The design and construction of the trunkline between Bell Road and the ACDC is under the sponsorship of the Flood Control District of Maricopa County (FCD). The lateral along Bell Road is under concurrent design as part of the Bell Road Project sponsored by the Maricopa County Highway Department. The laterals along Paradise Lane and Greenway Road east of 67th Avenue will be designed and constructed in the future by the City of Glendale.



PROJECT VICINTY MAP

FIGURE 1

IV. OBJECTIVES

The objectives of this report are to document the following:

A. Review of the existing hydrology for the City of Glendale Stormwater Management Plan developed by Camp Dresser & McKee (CD&M) and for the Bell Road Drainage Study by Greiner, Inc.

B. The off-site hydrology for the project. The 10-year, 6-hour storm peak discharges were calculated using the SWMM program.

C. The development of preliminary stormdrain pipe sizes for the trunk-line and laterals.

This report is to be used as the basis for design of the 67th Avenue stormdrain as well as the stormdrain laterals to be located along Bell Road, Paradise Lane and Greenway Road east of 67th Avenue.

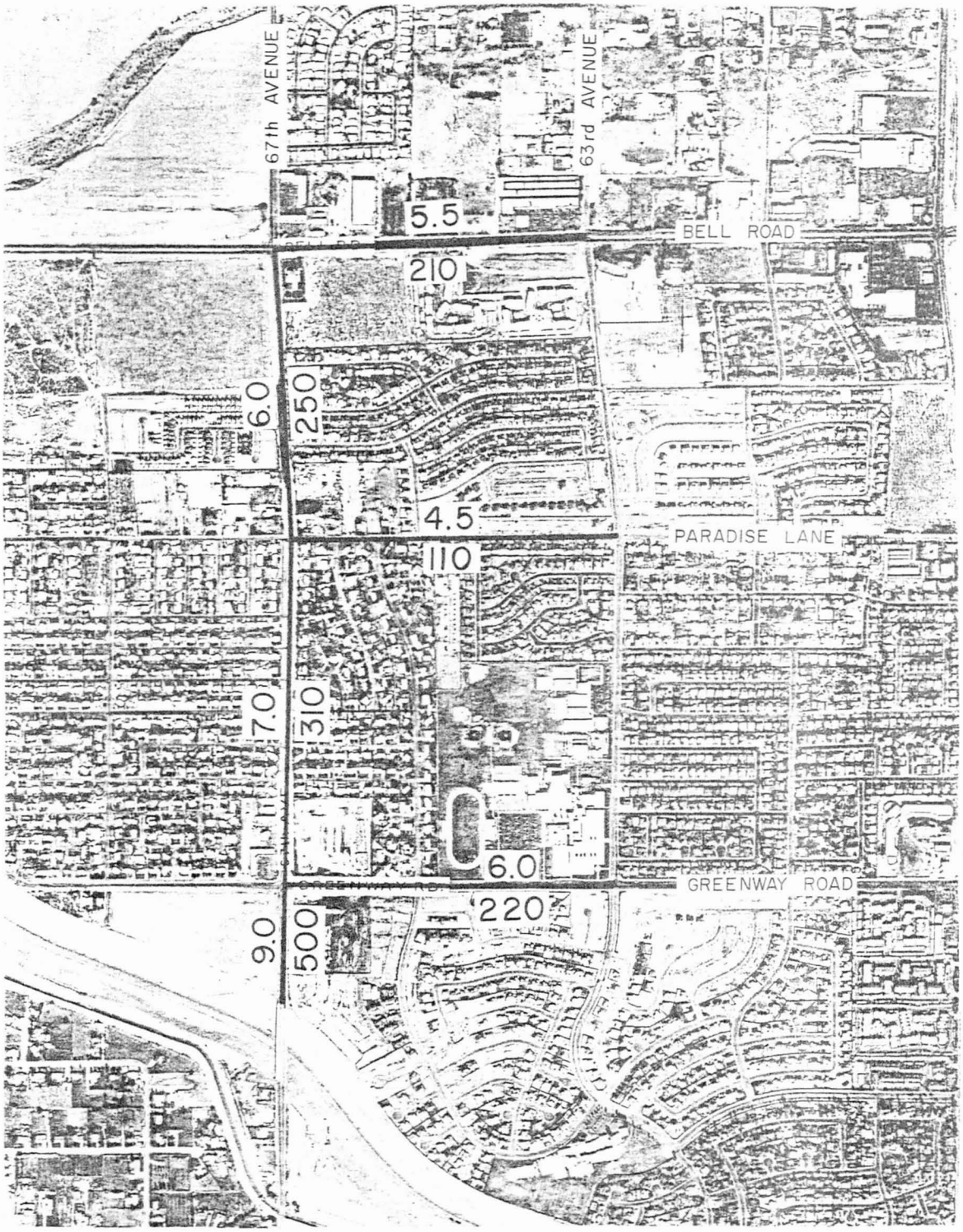
V. REVIEW OF EXISTING HYDROLOGIC MODELS

The off-site hydrology for the 67th Avenue stormdrain was first developed to a concept level in the City of Glendale Stormwater Management Plan, developed in 1986 by CD&M (Reference 1). The Stormwater Management Model (SWMM) developed by the Environmental Protection Agency was used to determine runoff peak discharges from the 10-year, 6-hour storm.

Input data for the SWMM were estimated from topographic maps, land-use maps and soils maps. Future land-use conditions, based on current zoning, were incorporated into the model. The model also accounted for the then-current requirement that new residential and commercial development retain all stormwater from a 10-year, two-hour storm. To meet the plan objectives of intercepting 10-year stormwater flows a stormdrain to be located along 67th Avenue between Bell Road and the ACDC was recommended with major laterals extending eastward to 63rd Avenue along Bell Road, Paradise Lane and Greenway Road. Refer to Figure 2 for a schematic of the recommended plan.

A hydrologic study was initiated in 1986 by the FCD in conjunction with Bell Road Project. Greiner, Inc. used the HEC-1 program to develop the off-site hydrology for Bell Road including the portion tributary to 67th Avenue (Reference 2). Drainage down gradient of Bell Road was not considered. The 2-, 5-, 10-, 50- and 100-year 24-hour storms were modelled and drainage concept plans developed for each. However, at the request of the FCD and the City of Glendale, the plan recommended by CD&M was ultimately adopted by the Bell Road Project to maintain the design consistency between all components of the Stormwater Management Plan.

The SWMM program developed by CD&M was carefully reviewed by Greiner, Inc. In addition, CD&M's San Francisco office was contacted for further information on their development of the model. Data pertinent to the hydrology of the project watershed was collected by Greiner, evaluated and compared to the data developed by CD&M. Data collected included



LEGEND

9.0 PIPE SIZE (FT.)
500 DESIGN FLOW (CFS)

City Of Glendale Storm Water Management Plan

Greiner

FIGURE 2

topographic maps at a scale of 1"=100′ and with C.I. = 2′, detailed soil surveys, current City of Glendale zoning map and current literature on hydrology. A detailed site investigation was also conducted. This data and findings of the literature search and field investigation are described in greater detail in Section VI.

On the basis of the evaluation of the data, Greiner, Inc. has concluded that a more detailed SWMM program is required to determine design discharge values for the 67th Avenue stormdrain and its laterals. The following is a summary of the major factors that have led to this determination.

- Watershed Boundary Change - The boundary of the off-site watershed north of Bell Road and south of Greenway Road was substantially modified to reflect more detailed topographic mapping available to Greiner, Inc., recent commercial development and proposed residential development with on-site retention.

- Drainage Concentration Locations - More detail is required to identify all off-site drainage concentration points along the project alignment for the purpose of design.

- Hydrologic Parameters - The hydrology for the Stormwater Management Plan was developed using regionalized data and hydrologic parameter values from the general literature. This data needs to be refined to better reflect local conditions within the project drainage subareas.

- Changes in On-Site Retention - Since the completion of the Stormwater Management Plan, significant commercial development with full, on-site retention has occurred in the watershed. The City of Glendale has also adopted a more stringent policy requiring full retention of runoff from the 100-year, 2-hour storm.

The SWMM program was selected for the 67th Avenue Stormdrain Project, rather than the HEC-1 program, to enable the City of Glendale to update its SWMM program developed for the Stormwater Management Plan.

VI. PROCEDURES AND METHODOLOGY

A. Hydrology Modelling Using SWMM

General - The EPA Stormwater Management Model (SWMM) was developed in 1969-71 as a comprehensive mathematical model for simulation of urban runoff quantity and quality in storm and combined sewer systems. The program has undergone significant changes in 1975 (Version II) and 1981 (Version III). SWMM Version III.3 was utilized in this study.

SWMM simulates rainfall runoff events on the basis of a given rainfall pattern (hyetograph) and the physical characteristics of the watershed. Drainage system features that affect drainage patterns, including street gutter, channels and stormdrains may also be input.

SWMM contains features for quantifying runoff pollutant loads and the affects of treatment alternatives. These features, however, are not required for this project and only the rainfall runoff simulation aspects of SWMM will be discussed further.

Model Structure - The SWMM program is constructed in the form of "blocks." The blocks relevant to this project are as follows:

1) The Executive Block is a service block which assigns logical units (disk/drum/tape) and determines the sequence of blocks to be executed.

2) The Runoff Block generates runoff based on input watershed and drainage system parameters. The block is also capable of flow routing through a stormdrain system using the method of non-linear reservoir, cascade of conduits.

More advanced flow routing of SWMM found in the Transport Block and EXTRAN were not utilized. The "Storm" program developed by the Los Angeles County Road Department will be utilized for the hydraulic analysis of pipe flow.

B. Hydrologic Procedures

Developing Drainage Pattern - Watershed subareas were delineated on City of Glendale aerial maps scaled at 1"=100′ and with 2′contour intervals. Subarea boundaries and drainage patterns were subsequently verified through field investigations. Existing development with on-site retention were identified and deleted from the drainage system. The City of Glendale Zoning Map prepared by Community Development and dated March 10, 1988 was used to identify areas of future development for which on-site retention will be required. These areas were also eliminated from the drainage system. Refer to Figure 3 for a delineation of project subareas and those areas deleted because of on-site retention.

Refer to Appendix A for the hydrologic data sheet for each subarea.

Precipitation - The 10-year, 6-hour storm hyetograph developed by CD&M for the Stormwater Management Plan will be utilized. The rainfall intensity values used are shown in Table 1.

Infiltration - The Horton equation will be used:

$$f_p = f_c + (f_o - f_c)e^{-kt}$$

PROJECT WATERSHED MAP

LEGEND

——— DRAINAGE AREA BOUNDARY

608 DRAINAGE AREA IDENTIFICATION

/// EXISTING OR FUTURE ON-SITE RETENTION

SCALE 1" = 1200'

FIGURE 3

PHOTO DATE 11-87

TABLE 1

Design Storm Rainfall Intensity

Time (Hours and Minutes)	Rainfall Intensity (Inches Per Hour)
0 - 0:15	3.25
0:15 - 0:30	1.15
0:30 - 0:45	0.72
0:45 - 1:00	0.48
1:00 - 1:15	0.32
1:15 - 1:30	0.22
1:30 - 1:45	0.18
1:45 - 2:00	0.17
2:00 - 2:15	0.15
2:15 - 2:30	0.14
2:30 - 2:45	0.13
2:45 - 3:00	0.12
3:00 - 3:15	0.12
3:15 - 3:30	0.12
3:30 - 3:45	0.11
3:45 - 4:00	0.10
4:15 - 4:30	0.10
4:30 - 4:45	0.10
4:45 - 5:00	0.096
5:00 - 5:15	0.092
5:15 - 5:30	0.088
5:30 - 5:45	0.084
5:45 - 6:00	0.080

Source: Reference 1

Where: f_p = infiltration capacity inches/hour

f_o = initial infiltration capacity inches/hour

f_c = final capacity inches/hour

t = time from beginning of storm

k = decay coefficient

The values of f_o and f_c are a function of soil type and antecedent conditions. Project area soils were identified from Soil Survey of Maricopa County, Arizona: Central Part published by the Soil Conservation Service in 1977. Project area soils were found to fall into three representative groupings with the following values of f_o and f_c:

Soil Type	f_o	f_c
Loam	3.0	0.23
Clay-Loam	2.0	0.18
Clay	1.0	0.01

These values and a value for k of 0.0015 are derived from the SWMM Version III.3, User's Manual (Reference 2). Dry antecedent conditions are assumed.

Depression Storage - Values of 0.18 inches for pervious areas and 0.031 inches for impervious areas were selected consistent with current literature and accounting for a "splash" factor expected during an intense rainfall (References 2, 3 and 4).

Percent Imperviousness - For the purpose of the kinematic wave method of estimating runoff, impervious areas include only those impervious areas that directly contribute runoff to street gutters or inlets. Impervious areas that contribute to pervious areas are not included (Reference 2). Percent imperviousness for each subarea was measured directly from the aerial photo maps.

Subcatchment Width - This factor is the critical element in the process by which SWMM idealizes the catchment shape using the length of the longest drainage path and its skew.

Subcatchment width is calculated as follows:

$$\text{Width} = (2 - \gamma)L \qquad \text{(Reference 2)}$$

Where: L = length of drainage path ft

γ = skew factor

$$\frac{A_2 - A_1}{\text{total area}}$$

A_1 = area to one side of channel

A_2 = area to other side of channel

Roughness Factor (n) - Roughness factors for overland flow were developed for pervious and impervious areas. For pervious developed areas, a value of 0.17 was used to reflect desert landscaping or short cropped bermuda grass. A factor of 0.013 was used for impervious areas (streets and parking lots). These values are consistent with a number of sources (References 2 and 5).

C. Development of SWMM Input

The input components used in the Runoff Block of the SWMM program are described in this section.

Job Initialization - The "B1" and "B2" control cards are used to specify the type of parameter input used, units, time and date of the storm, number of time steps in the simulation and the integration period (time step). A time step of one minute was selected and 32 time steps were specified. Additional time steps were not required since it was anticipated that the peak would occur within the first half-hour (30 time steps) of the storm.

Precipitation Data - The "E1" and "E2" Cards are used to input rainfall intensity values. Card "E1" was used to give the number of data points and the time interval between each value to be input on Card "E2." Only 10 values were input at 15 minute intervals (2.5 hours into the storm). Additional values were not input, as it was anticipated that peak runoff would occur within the first half-hour of the storm and total storm runoff volume is not needed.

Evaporation - Average daily evaporation rate (inches/day) are input by month on Card "F1." It was assumed for the purpose of this model that the storm would occur in July and a value of 0.33 inches/day was input.

Pipe Network - The stormdrain system is described on the "G1" Cards, one per pipe segment. The pipe segments are numbered, tributary pipes are specified and pipe size, length, slope and Manning's roughness coefficient are input. Pipe sizes were set from preliminary discharges developed without pipe routing. A standard pipe flow chart derived from the Manning equation for normal depth flow was used for the pipe sizing. The system was allowed to surcharge. An average pipe slope of 0.0035 foot/foot was used for all pipe segments as a preliminary approximation. A roughness coefficient of 0.013 was used, as concrete pipe will be the likely choice.

Subarea Data - The physical properties of each subarea are input on the "H1" Cards. Data is input in the following order: subarea identification, inlet number for drainage, width of subarea, area, percent imperviousness, ground slope, roughness factor (impervious area, pervious area), depression storage (impervious area, pervious area) and Horton equation parameters (f_o, f_c, k). Data input on the "H1" Cards is summarized in Table 2.

Print Control - Cards M1 and M2 are used to specify for which inlet or pipe a hydrograph should be printed.

TABLE 2

Drainage Area Summary

Area Identification	Area (AC)	Percent Impervious	Slope (ft./ft.)	f_o (in./hr.)	f_c (in./hr.)	Basin Width (ft.)
601	9.7	25	.0034	2.80	0.21	998
602	18.3	25	.0035	1.95	0.14	609
603	54.0	32	.0035	2.71	0.20	6,643
604	34.2	26	.0038	2.00	0.16	2,872
605	1.1	100	.002	0.0	0.0	1,580
606	46.2	28	.0033	2.30	0.20	4,109
607	119.7	25	.0032	2.70	0.20	7,035
608	82.4	33	.0034	2.45	0.17	4,900
609	12.2	20	.0031	2.30	0.16	3,090
610	6.3	30	.0029	1.25	0.04	2,800
611	9.0	35	.0033	3.00	0.23	2,160
612	31.9	28	.0038	2.60	0.21	4,378
613	1.4	100	.0006	0.0	0.0	1,360
614	10.5	25	.0037	1.20	0.04	2,680
615	16.8	10	.0024	2.10	0.16	3,241
616	5.9	20	.0015	3.00	0.23	2,060
617	5.9	20	.0019	2.85	0.22	2,060
618	1.5	100	.004	0.0	0.0	1,500
3101	22.6	20	.0046	1.85	0.22	5,270
3102	6.2	30	.0032	2.40	0.18	1,900
3103	34.1	11	.0034	3.00	0.23	3,303
3104	2.2	100	.0041	0.0	0.0	4,540

VII. ANALYSIS AND DESIGN RECOMMENDATIONS

A. Analysis of SWMM Results

The project watershed was modelled in two parts. The watershed was first modelled without the stormdrain network. The discharges from each subarea could then be used to develop preliminary pipe sizes. The pipe network was then input on the "G1" Cards and the model rerun. The results of both models are summarized in Table 3. Figure 4 is a schematic representation of the hydrologic system. The SWMM computer program printout may be found in Appendix B.

The results of Greiner's model were compared to CD&M's. This comparison is found in Table 4. It is apparent from the comparison that with the exception of the Greenway Road system, there are significant differences in the results, both in terms of contributing area and in runoff per unit of area. Table 5 was developed to compare some of the critical input parameters used by Greiner, Inc. and CD&M.

The significant differences in results for the Bell Road system and the Paradise Lane system may be attributed to differences in the percent impervious area used, delineation of drainage area limits and in the identification of on-site retention areas.

A lower percent impervious value was adopted by Greiner, Inc. to reflect significant on-lot retention by enclosed yards and because a significant amount of runoff from roof tops either drains into the enclosed backyards or into landscaped areas. It is consistent with the SWMM methodology that only impervious areas draining directly into the street (including the street area itself) be incorporated into the percent impervious.

TABLE 3

SWMM Summary

Drainage Area	Discharge (cfs)	To Pipe	Location	Cumulative Discharge (cfs)
601	9	1	61st Avenue at Paradise Lane	--
602	18	1	61st Avenue at Paradise Lane	27
603	59	2	63rd Avenue at Paradise Lane	84
604	32	3	65th Avenue at Paradise Lane	109
605	4	13	67th Avenue at Paradise Lane	109
606	45	4	61st Avenue at Greenway Road	45
607	93	5	63rd Avenue at Greenway Road	138
608	87	6	Cactus H.S. Drainage Way	212
609	10	7	65th Avenue at Greenway Road	220
610	10	17	67th Avenue at Greenway Road	220
3101	17	8	Bell Road at 61st Avenue	--
3102	7	8	Bell Road at 61st Avenue	24
3103	13	9	Bell Road at 63rd Avenue	35
3104	7	10	Bell Road at 67th Avenue	34
611	11	11	Phelps Road at 67th Avenue	41
612	32	12	Kings Avenue at 67th Avenue	69
613	5	13	Paradise Lane at 67th Avenue	174
614	13	14	Nancy Road at 67th Avenue	--
615	8	14	Nancy Road at 67th Avenue	178
616	4	15	Carol Ann Way at 67th Avenue	170
617	4	16	Mary Jane Lane at 67th Avenue	170
618	5	17	Greenway Road at 67th Avenue	382
			Routed to ACDC	

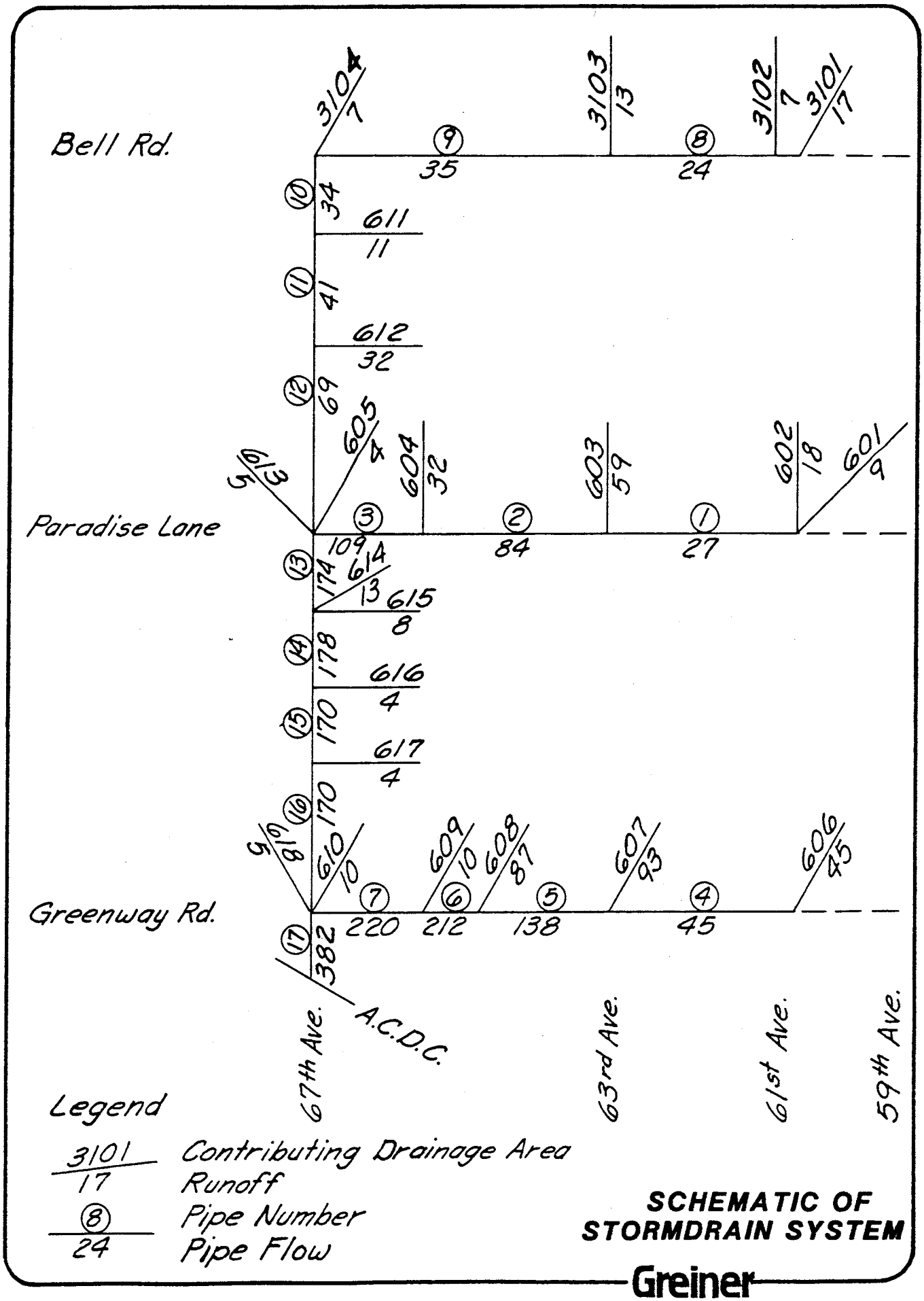

Bell Rd.
Paradise Lane
Greenway Rd.
67th Ave.
A.C.D.C.
63rd Ave.
61st Ave.
59th Ave.
3104 / 7
3103 / 13
3102 / 7
3101 / 17
9 35
8 24
10 34
611 / 11
11 41
612 / 32
12 69
605 / 4
613 / 5
604 / 32
603 / 59
602 / 18
601 / 9
3 109
2 84
1 27
13 174
614 / 13
615 / 8
14 178
616 / 4
15 170
617 / 4
16 170
619 / 8
610 / 10
609 / 10
608 / 87
607 / 93
606 / 45
7 220
6 212
5 138
4 45
17 382
Legend
3101 / 17 Contributing Drainage Area Runoff
8 / 24 Pipe Number Pipe Flow
SCHEMATIC OF STORMDRAIN SYSTEM
Greiner

FIGURE 4

TABLE 4

Comparison of SWMM Results

Location	Greiner Q_{10}	Greiner D.A.	CD&M Q_{10}	CD&M D.A.
Bell Road at 67th Avenue	34 cfs	65 Ac	210 cfs	194 Ac
Paradise Lane at 67th Avenue	109 cfs	117 Ac	110 cfs	59 Ac
Greenway Road at 67th Avenue	220 cfs	267 Ac	210 cfs	296 Ac
Stormdrain at ACDC	382 cfs	532 Ac	500 cfs	637 Ac*

*Includes an area south of Greenway and east of 67th Avenue.

TABLE 5

Comparison of Averaged Input Parameters

	Impervious n	Pervious n	Percent Impervious	Infiltration Rate f_o	Infiltration Rate f_c
Greiner	0.013	0.170	27	2.4	0.18
CD&M	0.013	0.250	35	2.6	0.45

Drainage area delineations and identification of on-site retention areas were developed by Greiner, Inc. using more detailed and current information, including zoning maps and topographic aerial photos not available to CD&M. It should be noted that both Greiner, Inc. and CD&M models derived similar discharge values for the Greenway Road System.

B. Preliminary Design Recommendations

The results of the first SWMM model run were used to develop preliminary stormdrain pipe sizes. A standard pipe capacity chart developed from the Mannings equation for normal depth flow was used for sizing. A uniform pipe slope of 0.0035 foot/foot was selected as representative of the system. Recommended pipe sizes were selected one size less than the chart recommended size to allow for surcharging. At the time of final design analysis, the "Storm" hydraulic analysis program developed by the Los Angeles County Road Department will be utilized to analyze the hydraulic performance of the system using pressure flow conditions. Table 6 is a summary of recommended pipe sizes.

TABLE 6

Recommended Pipe Summary

Pipe No.	Discharge (cfs)	Recommended Size (Inches)
1	27	36
2	84	48
3	109	54
4	45	36
5	138	54
6	212	66
7	220	66
8	24	30
9	35	36
10	34	36
11	41	36
12	69	42
13	174	60
14	178	60
15	170	60
16	170	60
17	382	84

VIII. REFERENCES

1. Stormwater Management Plan, City of Glendale. Developed by Camp Dresser & McKee, Inc., January 1986.

2. Stormwater Management Model User's Manual Version III, U.S. EPA. Prepared by the Department of Environmental Engineering Sciences, University of Florida, Gainesville, November 1981.

3. Introduction to Hydrology, Warren Viessman Jr., John W. Knapp, Gary L. Lewis, Terence E. Harbaugh, Second Edition, 1977.

4. Design and Construction of Sanitary and Storm Sewer, America Society of Civil Engineers and the Water Pollution Control Federation, 1969.

5. HEC-1 Flood Hydrograph Package User's Manual, U.S. Army Corps of Engineers, The Hydrologic Engineering Center, September 1981.

Greiner Engineering

Appendix A

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-12 Sheet No. 1

Checked by _____ Date _____ of _____

Subcatchment Number 0601 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{7.86 - 1.83}{9.7} = 0.62$

Length of Drainage Path (l) 1450 ft

Width = $(2 - \gamma)l$ = 1998 ft

Area of Subcatchment 9.7 Ac Subcatchment Slope:

Upstream Elevation 1242 ft

Slope 0.0034 ft/ft

Downstream Elevation 1237 ft

Land Use and Zoning SFR R1-6 (Fully developed)

Density 4 RAC Percent Imperviousness 25 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 90 %

Loam-Clay(Mr) Ø %

Clay (Vf) 10 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 2.80 in/hr

Minimum Infiltration Rate (f_c) 0.21 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-12 Sheet No. 2

Checked by _____ Date _____ of _____

Subcatchment Number 0602 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{14.53 - 3.79}{18.3} = 0.59$

Length of Drainage Path (l) 1850 ft

Width = $(2 - \gamma)l$ = 2609 ft

Area of Subcatchment 18.3 Ac

Subcatchment Slope:

Upstream Elevation 1243 ft

Slope 0.0035 ft/ft

Downstream Elevation 1236.5 ft

Land Use and Zoning SFR (fully-developed) - R1-6

Density 4 RAC

Percent Imperviousness 25 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 25 %

Loam-Clay(Mr) 45 %

Clay (Vf) 30 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_o) 1.95 in/hr

Minimum Infiltration Rate (f_c) 0.14 in/hr

Decay Constant (k) 0.0015

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Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-12 Sheet No. 3

Checked by _____ Date _____ of _____

Subcatchment Number 0603 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{32-22}{54} = 0.19$

Length of Drainage Path (l) 3670 ft

Width = $(2 - \gamma)l$ = 6643 ft

Area of Subcatchment 54 Ac Subcatchment Slope:

Upstream Elevation 1747.6 ft

Slope 0.0035 ft/ft

Downstream Elevation 1734.6 ft

Land Use and Zoning R1-6 (Fully developed) SFR

Density 4 RAC Percent Imperviousness 32 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 83 %

Loam-Clay(Mr) 5 %

Clay (Vf) 12 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 2.71 in/hr

Minimum Infiltration Rate (f_c) 0.20 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-12 Sheet No. 4

Checked by _____ Date _____ of _____

Subcatchment Number 0604 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{27.9 - 6.3}{34.2} = 0.63$

Length of Drainage Path (l) 2100 ft

Width = $(2 - \gamma)l$ = 2872 ft

Area of Subcatchment 34.2 Ac Subcatchment Slope:

Upstream Elevation 1238 ft

Slope 0.0038 ft/ft

Downstream Elevation 1230 ft

Land Use and Zoning R1-6 (Fully-developed) SFD

Density 4 RAC Percent Imperviousness 26 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 15 %

Loam-Clay(Mr) 70 %

Clay (Vf) 15 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 2.0 in/hr

Minimum Infiltration Rate (f_c) 0.16 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-12 Sheet No. 5

Checked by _____ Date _____ of _____

Subcatchment Number 0605 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A}$ = _____ = Ø

Length of Drainage Path (l) 790 ft

Width = $(2 - \gamma)l$ = 1580 ft

Area of Subcatchment 1.09 Ac Subcatchment Slope:

Upstream Elevation 1230.3 ft

Slope 0.002 ft/ft

Downstream Elevation 1228.7 ft

Land Use and Zoning Paradise Lane

Density N/A Percent Imperviousness 100 %

Roughness Factor (n)

Impervious area 0.013

Pervious area N/A

Depression Storage

Impervious area 0.031

Pervious area N/A

Soils

Loam(Tw, Le, Lca) _____ %

Loam-Clay(Mr) _____ %

Clay (Vf) _____ %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) Ø in/hr

Minimum Infiltration Rate (f_c) Ø in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

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Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-12 Sheet No. 6

Checked by _____ Date _____ of _____

Subcatchment Number 0606 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{37.9 - 8.3}{46.2} = 0.64$

Length of Drainage Path (l) 3025 ft

Width = $(2 - \gamma)l$ = 4109 ft

Area of Subcatchment 46.2 Ac Subcatchment Slope:

Upstream Elevation 1238 ft

Slope 0.0033 ft/ft

Downstream Elevation 1228 ft

Land Use and Zoning R1-6 (Fully-developed) SFR

Density 4 PAC Percent Imperviousness 28 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 30 %

Loam-Clay(Mr) 70 %

Clay (Vf) Ø %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 2.30 in/hr

Minimum Infiltration Rate (f_c) 0.20 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-12 Sheet No. 7

Checked by _____ Date _____ of _____

Subcatchment Number 0607 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{95.6 - 24.1}{119.7} = 0.60$

Length of Drainage Path (l) 5025 ft

Width = $(2 - \gamma)l$ = 7035 ft

Area of Subcatchment 119.7 Ac Subcatchment Slope:

Upstream Elevation 1242 ft

Slope 0.0032 ft/ft

Downstream Elevation 1226 ft

Land Use and Zoning R1-6 (fully developed) A-1 (fully developed)

Density 4 RAC Percent Imperviousness 25 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 80 %

Loam-Clay(Mr) 10 %

Clay (Vf) 10 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 2.70 in/hr

Minimum Infiltration Rate (f_c) 0.20 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-12 Sheet No. 8

Checked by _____ Date _____ of _____

Subcatchment Number 06083 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{66.7 - 15.7}{82.4} = 0.62$

Length of Drainage Path (l) 3550 ft

Width = $(2 - \gamma)l$ = 4900 ft

Area of Subcatchment 82.4 Ac Subcatchment Slope:

Upstream Elevation 1234 ft

Slope 0.0024 ft/ft

Downstream Elevation 1222 ft

Land Use and Zoning 65% Cactus H.S.; 32% R1-6; 3% R1-6 T.D.

Density _____ Percent Imperviousness 33 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 70 %

Loam-Clay(Mr) 5 %

Clay (Vf) 25 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 2.45 in/hr

Minimum Infiltration Rate (f_c) 0.17 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-12 Sheet No. 9

Checked by _____ Date _____ of _____

Subcatchment Number 0609 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{11 - 1.2}{12.2} = 0.80$

Length of Drainage Path (l) 2575 ft

Width = $(2 - \gamma)l$ = 3090 ft

Area of Subcatchment 12.2 Ac Subcatchment Slope:

Upstream Elevation 1230 ft

Slope 0.0031 ft/ft

Downstream Elevation 1222 ft

Land Use and Zoning RI-6 T.D. (fully Developed)

Density 3.7 RAC Percent Imperviousness 30 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 60 %

Loam-Clay(Mr) 10 %

Clay (Vf) 30 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_o) 2.30 in/hr

Minimum Infiltration Rate (f_c) 0.16 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-12 Sheet No. 10

Checked by _____ Date _____ of _____

Subcatchment Number 0610 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A}$ = _____ = 0

Length of Drainage Path (l) 1400 ft

Width = $(2 - \gamma)l$ = 2800 ft

Area of Subcatchment 6.3 Ac Subcatchment Slope:

Upstream Elevation 1223 ft

Slope 0.00029 ft/ft

Downstream Elevation 1219 ft

Land Use and Zoning 30% Greenway Rd. and 70% R1-6 T.D.

Density n/a Percent Imperviousness 30 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 10 %

Loam-Clay(Mr) 5 %

Clay (Vf) 85 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 1.25 in/hr

Minimum Infiltration Rate (f_c) 0.04 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-13 Sheet No. 11

Checked by _____ Date _____ of _____

Subcatchment Number 0611 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{5.4 - 3.6}{9.0} = 0.20$

Length of Drainage Path (l) 1700 ft

Width = $(2 - \gamma)l$ = 2160 ft

Area of Subcatchment 9.0 Ac Subcatchment Slope:

Upstream Elevation 1234 ft

Slope 0.0033 ft/ft

Downstream Elevation 1230 ft

Land Use and Zoning R1-6 (fully developed) < FR

Density 4 RAC Percent Imperviousness 35 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 0 %

Loam-Clay(Mr) 100 %

Clay (Vf) 0 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 3.0 in/hr

Minimum Infiltration Rate (f_c) 0.23 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-13 Sheet No. 12

Checked by _____ Date _____ of _____

Subcatchment Number 0612 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{21.5 - 10.4}{31.9} = 0.35$

Length of Drainage Path (l) 2650 ft

Width = $(2 - \gamma)l$ = 4375 ft

Area of Subcatchment 31.9 Ac Subcatchment Slope:

Upstream Elevation 1239 ft

Slope 0.0038 ft/ft

Downstream Elevation 1229 ft

Land Use and Zoning R1-6 (fully-developed) SFR

Density 4 RAC Percent Imperviousness 78 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 60 %

Loam-Clay(Mr) 40 %

Clay (Vf) 0 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 2.60 in/hr

Minimum Infiltration Rate (f_c) 0.21 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.
Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer
Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-13 Sheet No. 3
Checked by _____ Date _____ of _____

Subcatchment Number 0613 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A}$ = _____ = 0

Length of Drainage Path (l) 680 ft

Width = $(2 - \gamma)l$ = 12,60 ft

Area of Subcatchment 1.4 Ac Subcatchment Slope:

Upstream Elevation 1229 ft

Slope 0.0006 ft/ft

Downstream Elevation 1228.6 ft

Land Use and Zoning Section of 67th Ave

Density N/A Percent Imperviousness 100 %

Roughness Factor (n)

Impervious area 0.013

Pervious area N/A

Depression Storage

Impervious area 0.031

Pervious area N/A

Soils

Loam(Tw, Le, Lca) _____ %

Loam-Clay(Mr) _____ %

Clay (Vf) _____ %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) Ø in/hr

Minimum Infiltration Rate (f_c) Ø in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-13 Sheet No. 14

Checked by _____ Date _____ of _____

Subcatchment Number 0614 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A}$ = _____ = 0

Length of Drainage Path (l) 1340 ft

Width = $(2 - \gamma)l$ = 2680 ft

Area of Subcatchment 10.5 Ac Subcatchment Slope:

Upstream Elevation 1229 ft

Slope 0.0037 ft/ft

Downstream Elevation 1224 ft

Land Use and Zoning R1-6 T.D. (fully-developed)

Density 1.8 PAC Percent Imperviousness 25 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 0 %

Loam-Clay(Mr) 20 %

Clay (Vf) 80 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_o) 1.20 in/hr

Minimum Infiltration Rate (f_c) 0.04 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-12 Sheet No. 15

Checked by _____ Date _____ of _____

Subcatchment Number 0615 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{11.4 - 5.4}{16.8} = 0.36$

Length of Drainage Path (l) 1975 ft

Width = $(2 - \gamma)l$ = 2241 ft

Area of Subcatchment 16.8 Ac Subcatchment Slope:

Upstream Elevation 1229 ft

Slope 0.0024 ft/ft

Downstream Elevation 1224.2 ft

Land Use and Zoning R1-6 T.D. (fully - developed)

Density 2.6 DAC Percent Imperviousness 10 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 30 %

Loam-Clay(Mr) 50 %

Clay (Vf) 20 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 2.10 in/hr

Minimum Infiltration Rate (f_c) 0.16 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-13 Sheet No. 16

Checked by _____ Date _____ of _____

Subcatchment Number 0616 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = ____ = 0$

Length of Drainage Path (l) 1030 ft

Width = $(2 - \gamma)l$ = 2060 ft

Area of Subcatchment 5.9 Ac Subcatchment Slope:

Upstream Elevation 1225 ft

Slope 0.0015 ft/ft

Downstream Elevation 1223.5 ft

Land Use and Zoning R1-6 T.D. (fully developed)

Density 3 RAC Percent Imperviousness 20 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 100 %

Loam-Clay(Mr) _____ %

Clay (Vf) _____ %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 3.0 in/hr

Minimum Infiltration Rate (f_c) 0.23 in/hr

Decay Constant (k) 0.0015

Subcatchment Number 0617 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A}$ = _____ = 0

Length of Drainage Path (l) 1030 ft

Width = $(2 - \gamma)l$ = 2060 ft

Area of Subcatchment 5.9 Ac Subcatchment Slope:

Upstream Elevation 1274 ft

Slope 0.0019 ft/ft

Downstream Elevation 1272 ft

Land Use and Zoning R1-6 T.D. (fully developed)

Density 3 RAC Percent Imperviousness 20 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 85 %

Loam-Clay(Mr) 15 %

Clay (Vf) _____ %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 2.85 in/hr

Minimum Infiltration Rate (f_c) 0.22 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-13 Sheet No. 18

Checked by _____ Date _____ of _____

Subcatchment Number 0618 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A}$ = _____ = Ø

Length of Drainage Path (l) 750 ft

Width = $(2 - \gamma)l$ = 1500 ft

Area of Subcatchment 1.5 Ac Subcatchment Slope:

Upstream Elevation 1222 ft

Slope 0.004 ft/ft

Downstream Elevation 1219 ft

Land Use and Zoning Section of 67th Ave

Density N/A Percent Imperviousness 100 %

Roughness Factor (n)

Impervious area 0.013

Pervious area N/A

Depression Storage

Impervious area 0.031

Pervious area N/A

Soils

Loam(Tw, Le, Lca) _____ %

Loam-Clay(Mr) _____ %

Clay (Vf) _____ %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_o) Ø in/hr

Minimum Infiltration Rate (f_c) Ø in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-13 Sheet No. 19

Checked by _____ Date _____ of _____

Subcatchment Number 3101 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = ____ = \emptyset$

Length of Drainage Path (l) 2635 ft

Width = $(2 - \gamma)l$ = 5270 ft

Area of Subcatchment 22.6 Ac Subcatchment Slope:

Upstream Elevation 1258 ft

Slope 0.0046 ft/ft

Downstream Elevation 1246 ft

Land Use and Zoning A-1 and Section of Bell Rd

Density _____ Percent Imperviousness 20 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 85 %

Loam-Clay(Mr) 15 %

Clay (Vf) _____ %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 2.85 in/hr

Minimum Infiltration Rate (f_c) 0.22 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-13 Sheet No. 10

Checked by _____ Date _____ of _____

Subcatchment Number 3102 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = ____ = \phi$

Length of Drainage Path (l) 950 ft

Width = $(2 - \gamma)l$ = 1960 ft

Area of Subcatchment 6.2 Ac Subcatchment Slope:

Upstream Elevation 1248 ft

Slope 0.0032 ft/ft

Downstream Elevation 1245 ft

Land Use and Zoning C-O No onsite retention
extensive unpaved area

Density _____ Percent Imperviousness 30 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 60 %

Loam-Clay(Mr) 20 %

Clay (Vf) 20 %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) 2.40 in/hr

Minimum Infiltration Rate (f_c) 0.18 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date 7-13 Sheet No. 31

Checked by _____ Date _____ of _____

Subcatchment Number 3103 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A} = \frac{36.6 - 5.5}{34.1} = 0.68$

Length of Drainage Path (l) 2500 ft

Width = $(2 - \gamma)l$ = 33.03 ft

Area of Subcatchment 34.1 Ac Subcatchment Slope:

Upstream Elevation 1251 ft

Slope 0.0034 ft/ft

Downstream Elevation 1242.5 ft

Land Use and Zoning A-1 and Section of Bell Rd.

Density _____ Percent Imperviousness 11 %

Roughness Factor (n)

Impervious area 0.013

Pervious area 0.17

Depression Storage

Impervious area 0.031

Pervious area 0.18

Soils

Loam(Tw, Le, Lca) 100 %

Loam-Clay(Mr) _____ %

Clay (Vf) _____ %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_o) 3.0 in/hr

Minimum Infiltration Rate (f_c) 0.23 in/hr

Decay Constant (k) 0.0015

Greiner

Greiner Engineering Sciences, Inc.

Tucson 602 887-1800
Phoenix 602 275-5400

Job E111124 67th Avenue Storm Sewer

Description SWMM Input Data--Runoff Block

Calculated by MC Date _____ Sheet No. 22

Checked by _____ Date _____ of _____

Subcatchment Number 3104 Gutter/Inlet Number _____

Subcatchment Width:

Skew Factor: $\gamma = \frac{A_2 - A_1}{A}$ = _____ = ϕ

Length of Drainage Path (l) 2270 ft

Width = $(2 - \gamma)l$ = 4540 ft

Area of Subcatchment 7.2 Ac Subcatchment Slope:

Upstream Elevation 1742 ft

Slope 0.0041 ft/ft

Downstream Elevation 1732.6 ft

Land Use and Zoning Section of Bell Rd. Same C-O

Density _____ Percent Imperviousness 100 %

Roughness Factor (n)

Impervious area 0.013

Pervious area N/A

Depression Storage

Impervious area 0.031

Pervious area N/A

Soils

Loam(Tw, Le, Lca) _____ %

Loam-Clay(Mr) _____ %

Clay (Vf) _____ %

Horton Equation Parameters (Infiltration)

Maximum Infiltration Rate (f_0) ϕ in/hr

Minimum Infiltration Rate (f_c) ϕ in/hr

Decay Constant (k) 0.0015

Greiner Engineering

Appendix B

Input file name : FHYDRO.DAT Output file name : FHYDRO.out

14-SEP-88 17:09:06

ENVIRONMENTAL PROTECTION AGENCY - STORM WATER MANAGEMENT MODEL *** RELEASE III.3 ***

DEVELOPED BY METCALF & EDDY, INC.

UNIVERSITY OF FLORIDA

WATER RESOURCES ENGINEERS, INC.

SEPTEMBER 1970

UPDATED BY THE UNIVERSITY OF FLORIDA

MARCH 1975

NOVEMBER 1977

NOVEMBER 1981

AUGUST 1983

THIS IS A NEW RELEASE OF THE SWMM. IF ANY PROBLEMS

OCCUR IN RUNNING THIS MODEL PLEASE CONTACT WAYNE

HUBER AT THE UNIVERSITY OF FLORIDA.

PHONE 1-904-392-0846

****

THIS IS THE FULL IMPLEMENTATION OF EPA SWMM III.3

****

DISK OR TAPE ASSIGNMENTS FOR BLOCKS CALLED. THEY ARE IN THE SAME ORDER IN WHICH THE BLOCKS ARE CALLED.

JIN(1)	JIN(2)	JIN(3)	JIN(4)	JIN(5)	JIN(6)	JIN(7)	JIN(8)	JIN(9)	JIN(10)
0	0	0	0	0	0	0	0	0	0

JOUT(1)	JOUT(2)	JOUT(3)	JOUT(4)	JOUT(5)	JOUT(6)	JOUT(7)	JOUT(8)	JOUT(9)	JOUT(10)
9	0	0	0	0	0	0	0	0	0

SCRATCH DISKS OR TAPES WHICH CAN BE USED BY ANY BLOCK CALLED.

NSCRAT(1)	NCSRAT(2)	NSCRAT(3)	NSCRAT(4)	NSCRAT(5)
1	0	0	4	0

RUNOFF BLOCK CALLED.

ENTRY MADE TO RUNOFF BLOCK

RUNOFF BLOCK WAS LAST UPDATED BY THE UNIVERSITY OF FLORIDA JANUARY 1983.

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

CONTINUOUS SWMM PARAMETER - ICRAIN.....	0
SNOWMELT PARAMETER - ISNOW.....	0
NUMBER OF RAIN GAGES - NRGAG.....	1
HORTON IFILTRATION EQUATION USED - INFILM.....	0
QUALITY IS NOT SIMULATED - KWALTY.....	0
READ MONTHLY EVAPORATION DATA ON CARD F1.....	1
HOUR OF DAY AT START OF STORM - NHR.....	0
MINUTE OF HOUR AT START OF STORM - NMN.....	0
TIME TZERO AT START OF STORM (HOURS).....	0.000
USE U.S. CUSTOMARY UNITS FOR MOST I/O - METRIC...	0
INPUT NUMBER OF TIME STEPS - NSTEP.....	32
INTEGRATION TIME INTERVAL (MINUTES) - DELT.....	1.00
MONTH, DAY, YEAR OF START OF STORM IS:	7/ 1/88
PERCENT OF IMPERVIOUS AREA WITH ZERO DETENTION DEPTH	25.0

**HORTON INFILTRATION MODEL BEING USED
RATE FOR REGENERATION OF INFILTRATION = REGEN * DECAY
DECAY IS READ IN FOR EACH SUBCATCHMENT
REGEN = ... 0.01000

FOR 10 RAINFALL STEPS, THE TIME INTERVAL IS 15.00 MINUTES UNITS ARE IN/HR.

FOR RAINGAGE NUMBER 1, TIME IS 0.0 HOURS OR 0.0 DAYS FROM START OF STORM, RAINFALL HISTORY IS

3.25	1.15	0.72	0.48	0.32	0.22	0.18	0.17	0.15	0.14

CARD GROUP F1

EVAPORATION RATE (IN/DAY).

JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00

***** G U T T E R A N D P I P E D A T A *****

GUTTER NUMBER	GUTTER CONNECTION	WIDTH (FT)	LENGTH (FT)	SLOPE (FT/FT)	SIDE SLOPES L	SIDE SLOPES R	MANNING N	MAX DEPTH (FT)
1 * 1	2	3.00	1000.0	0.0035	0.00	0.00	0.013	0.00
2 * 2	3	4.00	1500.0	0.0035	0.00	0.00	0.013	0.00
3 * 3	13	4.50	950.0	0.0035	0.00	0.00	0.013	0.00
4 * 4	5	3.00	1300.0	0.0035	0.00	0.00	0.013	0.00
5 * 5	6	4.50	1300.0	0.0035	0.00	0.00	0.013	0.00
6 * 6	7	5.50	150.0	0.0035	0.00	0.00	0.013	0.00
7 * 7	17	5.50	1000.0	0.0035	0.00	0.00	0.013	0.00
8 * 8	9	2.50	1350.0	0.0035	0.00	0.00	0.013	0.00
9 * 9	10	3.00	2350.0	0.0035	0.00	0.00	0.013	0.00
10 * 10	11	3.00	900.0	0.0035	0.00	0.00	0.013	0.00
11 * 11	12	3.00	600.0	0.0035	0.00	0.00	0.013	0.00
12 * 12	13	3.50	650.0	0.0035	0.00	0.00	0.013	0.00
13 * 13	14	5.00	1300.0	0.0035	0.00	0.00	0.013	0.00
14 * 14	15	5.00	300.0	0.0035	0.00	0.00	0.013	0.00
15 * 15	16	5.00	300.0	0.0035	0.00	0.00	0.013	0.00
16 * 16	17	5.00	800.0	0.0035	0.00	0.00	0.013	0.00

TOTAL NUMBER OF GUTTERS/PIPES, 16

ASTERISK (*) DENOTES CIRCULAR PIPE, DIAMETER=.WIDTH.
DOLLAR SIGN ($) DENOTES DUMMY GUTTER, USED TO OBTAIN PRINT OUTS ONLY.

***** SUBCATCHMENT DATA *****

SUBCATCH-MENT NO.		GUTTER OR INLET	WIDTH (FT)	AREA (AC)	PERCENT IMPERV.	SLOPE (FT/FT)	RESISTANCE FACTOR IMPERV.	RESISTANCE FACTOR PERV.	DEPRES. STORAGE(IN) IMPERV.	DEPRES. STORAGE(IN) PERV.	INFILTRATION RATE(IN/HR) MAXIMUM	INFILTRATION RATE(IN/HR) MINIMUM	DECAY RATE (1/SEC)	GAGE NO.
1	601	1	1998.00	9.70	25.00	0.0034	0.013	0.170	0.031	0.180	2.80	0.21	0.00115	1
2	602	1	2609.00	18.30	25.00	0.0035	0.013	0.170	0.031	0.180	1.95	0.14	0.00115	1
3	603	2	6643.00	54.00	32.00	0.0035	0.013	0.170	0.031	0.180	2.71	0.20	0.00115	1
4	604	3	2872.00	34.20	26.00	0.0038	0.013	0.170	0.031	0.180	2.00	0.16	0.00115	1
**WARNING:- ONE OR MORE OF THE INFILTRATION PARAMETERS HAVE NOT BEEN SET TO NON-ZERO VALUES														
5	605	13	1580.00	1.10	100.00	0.0020	0.013	0.170	0.031	0.180	0.00	0.00	0.00000	1
6	606	4	4109.00	46.20	28.00	0.0033	0.013	0.170	0.031	0.180	2.30	0.20	0.00115	1
7	607	5	7035.00	119.70	25.00	0.0032	0.013	0.170	0.031	0.180	2.70	0.20	0.00115	1
8	608	6	4900.00	82.40	33.00	0.0034	0.013	0.170	0.031	0.180	2.45	0.17	0.00115	1
9	609	7	3090.00	12.20	20.00	0.0031	0.013	0.170	0.031	0.180	2.30	0.16	0.00115	1
10	610	17	2800.00	6.30	30.00	0.0029	0.013	0.170	0.031	0.180	1.25	0.04	0.00115	1
11	611	11	2160.00	9.00	35.00	0.0033	0.013	0.170	0.031	0.180	3.00	0.23	0.00115	1
12	612	12	4378.00	31.90	28.00	0.0038	0.013	0.170	0.031	0.180	2.60	0.21	0.00115	1
**WARNING:- ONE OR MORE OF THE INFILTRATION PARAMETERS HAVE NOT BEEN SET TO NON-ZERO VALUES														
13	613	13	1360.00	1.40	100.00	0.0006	0.013	0.170	0.031	0.180	0.00	0.00	0.00000	1
14	614	14	2680.00	10.50	25.00	0.0037	0.013	0.170	0.031	0.180	1.20	0.04	0.00115	1
15	615	14	3241.00	16.80	10.00	0.0024	0.013	0.170	0.031	0.180	2.10	0.16	0.00115	1
16	616	15	2060.00	5.90	20.00	0.0015	0.013	0.170	0.031	0.180	3.00	0.23	0.00115	1
17	617	16	2060.00	5.90	20.00	0.0019	0.013	0.170	0.031	0.180	2.85	0.22	0.00115	1
**WARNING:- ONE OR MORE OF THE INFILTRATION PARAMETERS HAVE NOT BEEN SET TO NON-ZERO VALUES														
18	618	17	1500.00	1.50	100.00	0.0040	0.013	0.170	0.031	0.180	0.00	0.00	0.00115	1
19	3101	8	5270.00	22.60	20.00	0.0046	0.013	0.170	0.031	0.180	2.85	0.22	0.00115	1
20	3102	8	1900.00	6.20	30.00	0.0032	0.013	0.170	0.031	0.180	2.40	0.18	0.00115	1
21	3103	9	3303.00	34.10	11.00	0.0034	0.013	0.170	0.031	0.180	3.00	0.23	0.00115	1
**WARNING:- ONE OR MORE OF THE INFILTRATION PARAMETERS HAVE NOT BEEN SET TO NON-ZERO VALUES														
22	3104	10	4540.00	2.20	100.00	0.0041	0.013	0.170	0.031	0.180	0.00	0.00	0.00000	1

TOTAL NUMBER OF SUBCATCHMENTS.. 22

TOTAL TRIBUTARY AREA (ACRES).... 532.10

IMPERVIOUS AREA (ACRES)..... 142.63

PERVIOUS AREA (ACRES)..... 389.47

TOTAL WIDTH (FEET)..... 72088.00

PERCENT IMPERVIOUSNESS..... 26.81

★★★★★ ARRANGEMENT OF SUBCATCHMENTS AND GUTTERS/PIPE ★★★★★

GUTTER OR PIPE	TRIBUTARY GUTTER/PIPE	TRIBUTARY SUBAREA
1		601 602
2	1	603
3	2	604
4		606
5	4	607
6	5	608
7	6	609
8		3101 3102
9	8	3103
10	9	3104
11	10	611
12	11	612
13	3 12	605 613
14	13	614 615
15	14	616
16	15	617
INLET	TRIBUTARY GUTTERS AND/OR PIPES	TRIBUTARY SUBAREAS
17	7 16	610 618

HYDROGRAPHS WILL BE STORED FOR THE FOLLOWING 1 INLETS

17

.....QUALITY SIMULATION NOT INCLUDED IN THIS RUN .....

* * * CARD GROUP M1 * * *

TOTAL NUMBER OF PRINTED GUTTERS/INLETS...NPRNT.. 17
NUMBER OF TIME STEPS BETWEEN PRINTINGS..INTERV.. 1
STARTING AND STOPPING PRINTOUT DATES..... 0 0
0 0
0 0
0 0
0 0

* * * CARD GROUP M2 * * *

GUTTER INLET PRINT CARDS..... 1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17

MESSAGE FROM SUBROUTINE HYDRO... THE PLOTTING INTERVAL FOR SUBROUTINE HCURVE IS.. 1 TIME STEPS

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***** GUT. NO., ORDER OF INPUT =  14 SURCHARGED. TIME = 0.90E+03 VOLUME = 0.51E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  12 SURCHARGED. TIME = 0.96E+03 VOLUME = 0.14E+03 CU. FT., FULL FLOW =.64E+02 CFS
***** GUT. NO., ORDER OF INPUT =  14 SURCHARGED. TIME = 0.96E+03 VOLUME = 0.12E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =   5 SURCHARGED. TIME = 0.96E+03 VOLUME = 0.36E+03 CU. FT., FULL FLOW =.13E+03 CFS
***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.96E+03 VOLUME = 0.25E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  14 SURCHARGED. TIME = 0.10E+04 VOLUME = 0.19E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.10E+04 VOLUME = 0.41E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  14 SURCHARGED. TIME = 0.11E+04 VOLUME = 0.27E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.11E+04 VOLUME = 0.54E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  14 SURCHARGED. TIME = 0.11E+04 VOLUME = 0.34E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.11E+04 VOLUME = 0.66E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  14 SURCHARGED. TIME = 0.12E+04 VOLUME = 0.40E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.12E+04 VOLUME = 0.77E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  16 SURCHARGED. TIME = 0.12E+04 VOLUME = 0.13E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  14 SURCHARGED. TIME = 0.13E+04 VOLUME = 0.42E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.13E+04 VOLUME = 0.89E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  16 SURCHARGED. TIME = 0.13E+04 VOLUME = 0.25E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  14 SURCHARGED. TIME = 0.13E+04 VOLUME = 0.41E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.13E+04 VOLUME = 0.99E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  16 SURCHARGED. TIME = 0.13E+04 VOLUME = 0.37E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  14 SURCHARGED. TIME = 0.14E+04 VOLUME = 0.36E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.14E+04 VOLUME = 0.11E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  16 SURCHARGED. TIME = 0.14E+04 VOLUME = 0.49E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  14 SURCHARGED. TIME = 0.14E+04 VOLUME = 0.26E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.14E+04 VOLUME = 0.12E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  16 SURCHARGED. TIME = 0.14E+04 VOLUME = 0.61E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  14 SURCHARGED. TIME = 0.15E+04 VOLUME = 0.12E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.15E+04 VOLUME = 0.13E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  16 SURCHARGED. TIME = 0.15E+04 VOLUME = 0.73E+03 CU. FT., FULL FLOW =.17E+03 CFS
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***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.16E+04 VOLUME = 0.12E+04 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  16 SURCHARGED. TIME = 0.16E+04 VOLUME = 0.86E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  15 SURCHARGED. TIME = 0.16E+04 VOLUME = 0.14E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  16 SURCHARGED. TIME = 0.16E+04 VOLUME = 0.99E+03 CU. FT., FULL FLOW =.17E+03 CFS
***** GUT. NO., ORDER OF INPUT =  16 SURCHARGED. TIME = 0.17E+04 VOLUME = 0.29E+03 CU. FT., FULL FLOW =.17E+03 CFS


END OF TIME STEP DO-LOOP IN RUNOFF.

FINAL DATE (MO/DAY/YEAR) =  7/ 1/88
FINAL JULIAN DATE =  31
FINAL TIME OF DAY =  0.5333 HOURS.
FINAL RUNNING TIME =  0.1920000E+04 SECONDS.
TOTAL NUMBER OF TIME STEPS =     32
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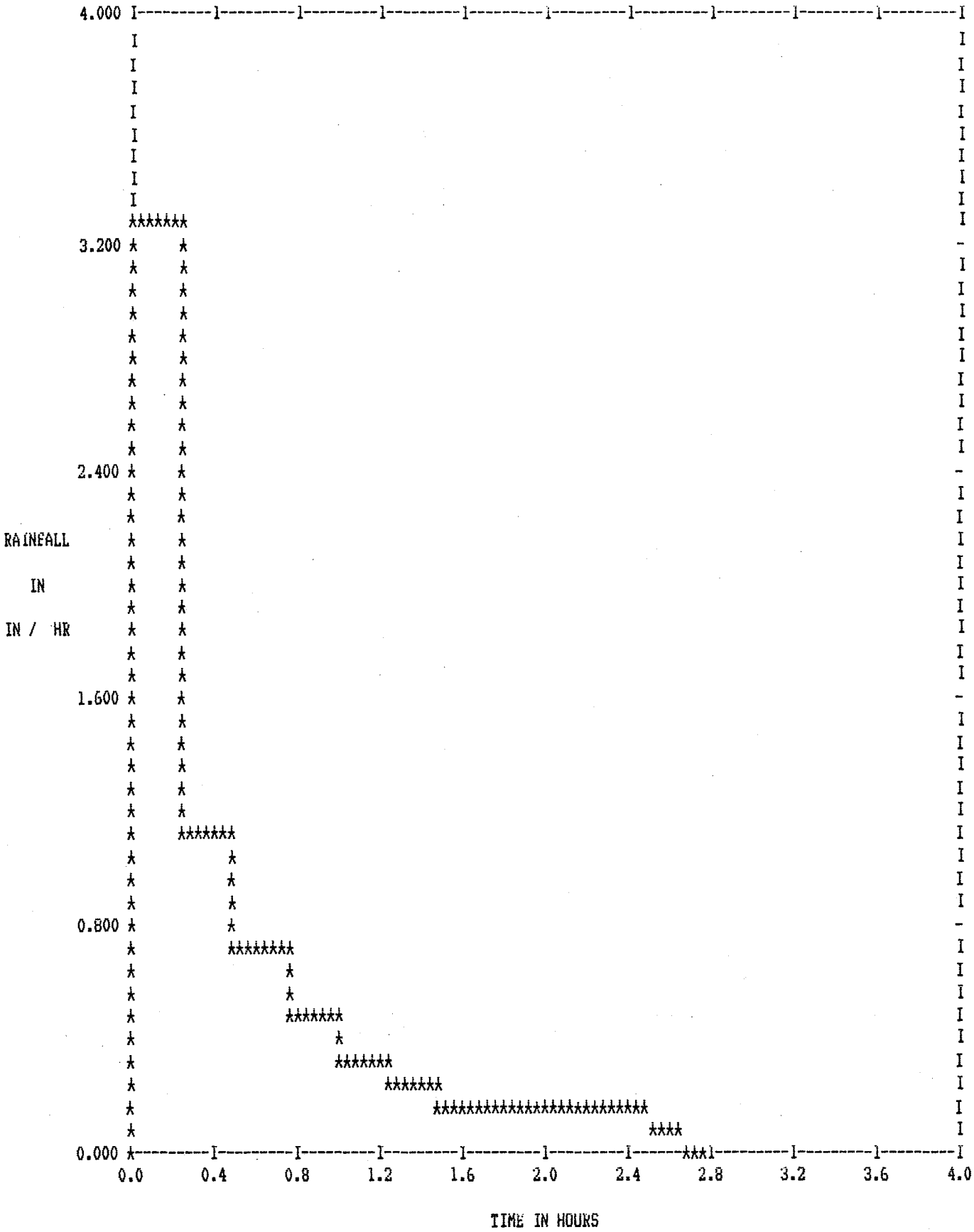
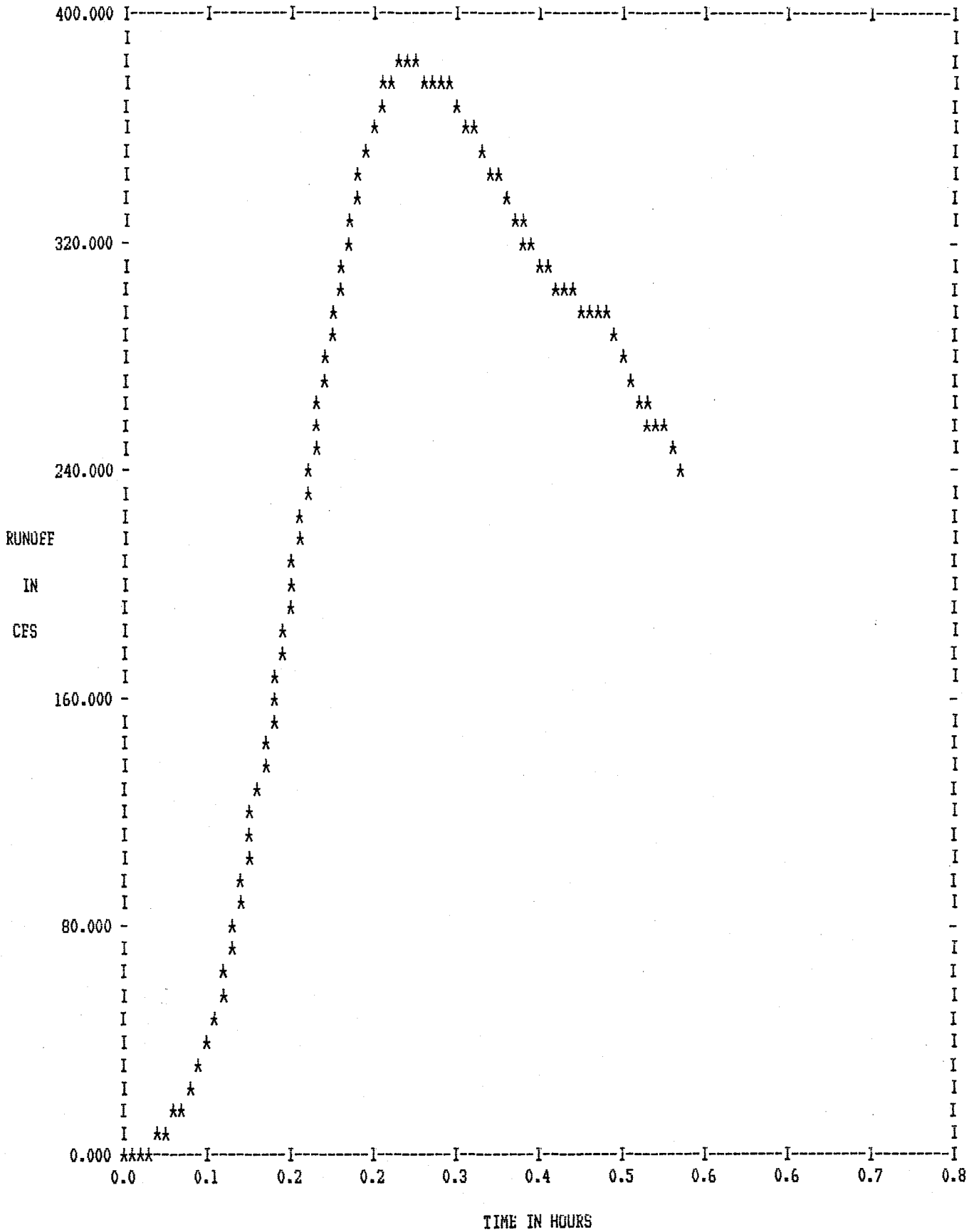


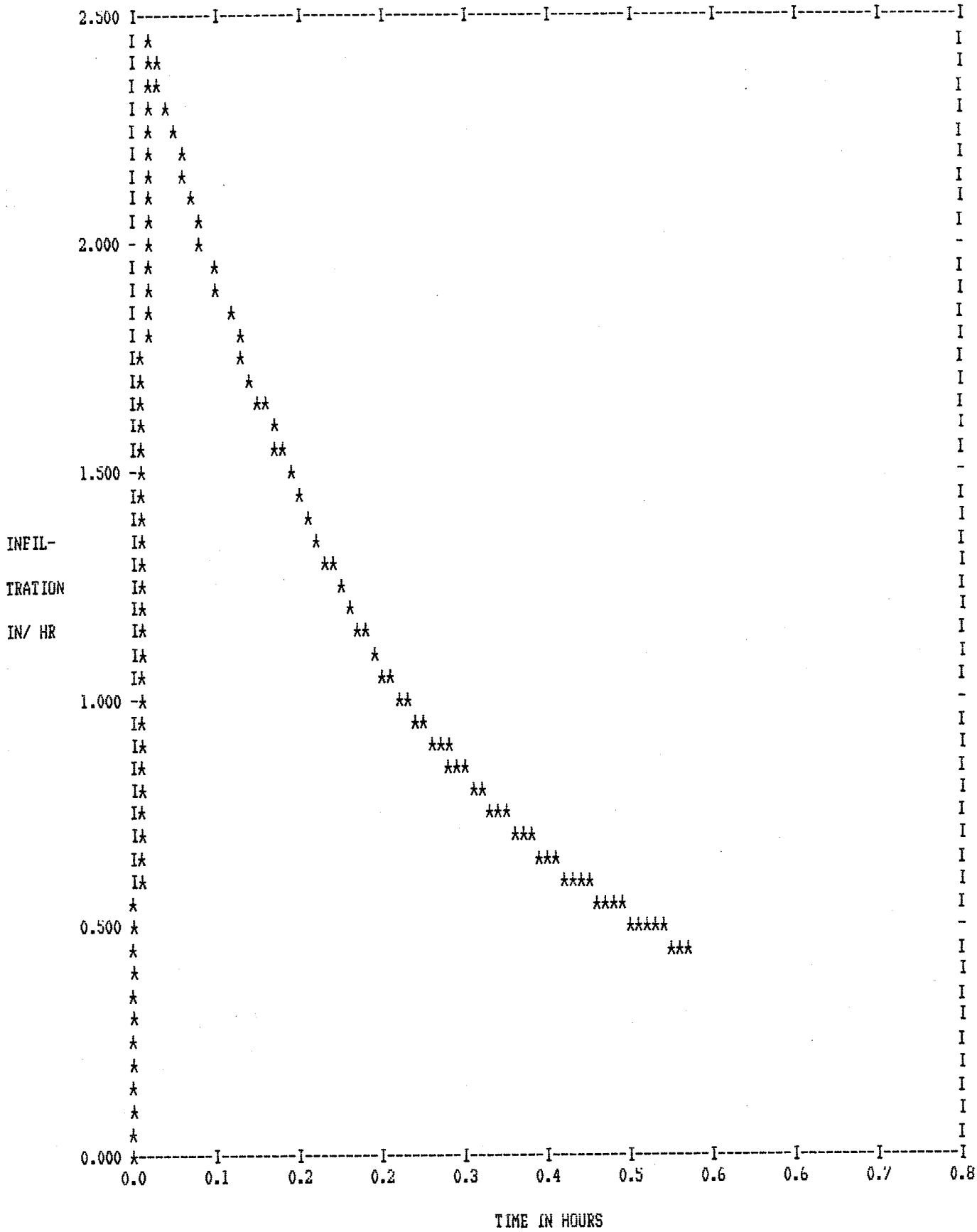
RAINFALL HYETOGRAPH INLETS 0

HYETOGRAPH FOR RAIN GAGE NUMBER 1



INLET HYDROGRAPH INLETS 0

THE HYDROGRAPH IS THE SUM OF THE FLOW IN ALL INLETS



INFILTRATION VERSUS TIME INLETS 0

THE INFILTRATION PLOT IS THE ACTUAL INFILTRATION OVER THE PERVIOUS AREA ONLY

$ $ $ --- CONTINUITY CHECK FOR QUANTITY --- $ $ $

	CUBIC FEET	INCHES OVER TOTAL BASIN
TOTAL PRECIPITATION (RAIN PLUS SNOW)	2.171032E+06	1.124
TOTAL INFILTRATION	8.483650E+05	0.439
TOTAL EVAPORATION	1.416449E+04	0.007
TOTAL GUTTER/PIPE/SUBCAT FLOW AT INLETS	4.694411E+05	0.243
TOTAL WATER REMAINING IN GUTTER/PIPES	1.056670E+05	0.055
TOTAL WATER REMAINING IN SURFACE STORAGE	7.430418E+05	0.385
INFILTRATION OVER THE PERVIOUS AREA...	8.483650E+05	0.600
INFILTRATION + EVAPORATION + SNOW REMOVAL + INLET FLOW + WATER REMAINING IN GUTTER/PIPES + WATER REMAINING IN SURFACE STORAGE + WATER REMAINING IN SNOW COVER.....	2.180679E+06	1.129

THE ERROR IN CONTINUITY IS CALCULATED AS

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*****************************************
* PRECIPITATION + INITIAL SNOW COVER  *
*      - INFILTRATION -               *
*EVAPORATION - SNOW REMOVAL -         *
*INLET FLOW - WATER IN GUTTER/PIPES - *
*WATER IN SURFACE STORAGE -           *
*WATER REMAINING IN SNOW COVER        *
*-------------------------------------*
* PRECIPITATION + INITIAL SNOW COVER  *
*****************************************
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ERROR..... -0.444 PERCENT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 1

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	1.554
7/ 1/88	0 2.0	6.617
7/ 1/88	0 3.0	11.897
7/ 1/88	0 4.0	15.964
7/ 1/88	0 5.0	18.691
7/ 1/88	0 6.0	20.393
7/ 1/88	0 7.0	21.432
7/ 1/88	0 8.0	22.148
7/ 1/88	0 9.0	22.695
7/ 1/88	0 10.0	23.180
7/ 1/88	0 11.0	23.707
7/ 1/88	0 12.0	24.300
7/ 1/88	0 13.0	24.973
7/ 1/88	0 14.0	25.729
7/ 1/88	0 15.0	26.572
7/ 1/88	0 16.0	20.438
7/ 1/88	0 17.0	17.197
7/ 1/88	0 18.0	15.353
7/ 1/88	0 19.0	14.265
7/ 1/88	0 20.0	13.618
7/ 1/88	0 21.0	13.245
7/ 1/88	0 22.0	13.048
7/ 1/88	0 23.0	12.970
7/ 1/88	0 24.0	12.973
7/ 1/88	0 25.0	13.034
7/ 1/88	0 26.0	13.137
7/ 1/88	0 27.0	13.271
7/ 1/88	0 28.0	13.430
7/ 1/88	0 29.0	13.606
7/ 1/88	0 30.0	13.798
7/ 1/88	0 31.0	12.865
7/ 1/88	0 32.0	12.253

FLOW WT'D MEANS 16.511

FLOW WT'D STD-DEVS 97.382

TOTAL LOADS 31701.229 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 2

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	2.341
7/ 1/88	0 2.0	10.974
7/ 1/88	0 3.0	22.658
7/ 1/88	0 4.0	34.991
7/ 1/88	0 5.0	46.266
7/ 1/88	0 6.0	55.571
7/ 1/88	0 7.0	62.712
7/ 1/88	0 8.0	67.946
7/ 1/88	0 9.0	71.693
7/ 1/88	0 10.0	74.468
7/ 1/88	0 11.0	76.714
7/ 1/88	0 12.0	78.658
7/ 1/88	0 13.0	80.478
7/ 1/88	0 14.0	82.292
7/ 1/88	0 15.0	84.182
7/ 1/88	0 16.0	71.815
7/ 1/88	0 17.0	62.345
7/ 1/88	0 18.0	55.285
7/ 1/88	0 19.0	50.109
7/ 1/88	0 20.0	46.357
7/ 1/88	0 21.0	43.669
7/ 1/88	0 22.0	41.771
7/ 1/88	0 23.0	40.462
7/ 1/88	0 24.0	39.594
7/ 1/88	0 25.0	39.058
7/ 1/88	0 26.0	38.775
7/ 1/88	0 27.0	38.686
7/ 1/88	0 28.0	38.746
7/ 1/88	0 29.0	38.924
7/ 1/88	0 30.0	39.193
7/ 1/88	0 31.0	37.311
7/ 1/88	0 32.0	35.676

FLOW WT'D MEANS 50.304

FLOW WT'D STD-DEVS 302.461

TOTAL LOADS 96583.188 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 3

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	1.079
7/ 1/88	0 2.0	5.350
7/ 1/88	0 3.0	12.296
7/ 1/88	0 4.0	21.822
7/ 1/88	0 5.0	33.401
7/ 1/88	0 6.0	45.921
7/ 1/88	0 7.0	58.130
7/ 1/88	0 8.0	69.181
7/ 1/88	0 9.0	78.605
7/ 1/88	0 10.0	86.352
7/ 1/88	0 11.0	92.641
7/ 1/88	0 12.0	97.787
7/ 1/88	0 13.0	102.094
7/ 1/88	0 14.0	105.825
7/ 1/88	0 15.0	109.188
7/ 1/88	0 16.0	103.802
7/ 1/88	0 17.0	97.093
7/ 1/88	0 18.0	89.943
7/ 1/88	0 19.0	83.054
7/ 1/88	0 20.0	76.877
7/ 1/88	0 21.0	71.616
7/ 1/88	0 22.0	67.297
7/ 1/88	0 23.0	63.852
7/ 1/88	0 24.0	61.174
7/ 1/88	0 25.0	59.147
7/ 1/88	0 26.0	57.660
7/ 1/88	0 27.0	56.619
7/ 1/88	0 28.0	55.941
7/ 1/88	0 29.0	55.558
7/ 1/88	0 30.0	55.416
7/ 1/88	0 31.0	54.122
7/ 1/88	0 32.0	52.654

FLOW WT'D MEANS 65.047

FLOW WT'D STD-DEVS 395.724

TOTAL LOADS 124889.883 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 4

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	1.389
7/ 1/88	0 2.0	6.416
7/ 1/88	0 3.0	12.865
7/ 1/88	0 4.0	19.271
7/ 1/88	0 5.0	24.885
7/ 1/88	0 6.0	29.446
7/ 1/88	0 7.0	32.972
7/ 1/88	0 8.0	35.622
7/ 1/88	0 9.0	37.692
7/ 1/88	0 10.0	39.337
7/ 1/88	0 11.0	40.688
7/ 1/88	0 12.0	41.847
7/ 1/88	0 13.0	42.896
7/ 1/88	0 14.0	43.892
7/ 1/88	0 15.0	44.876
7/ 1/88	0 16.0	37.041
7/ 1/88	0 17.0	31.881
7/ 1/88	0 18.0	28.366
7/ 1/88	0 19.0	25.913
7/ 1/88	0 20.0	24.175
7/ 1/88	0 21.0	22.935
7/ 1/88	0 22.0	22.051
7/ 1/88	0 23.0	21.427
7/ 1/88	0 24.0	20.999
7/ 1/88	0 25.0	20.718
7/ 1/88	0 26.0	20.551
7/ 1/88	0 27.0	20.473
7/ 1/88	0 28.0	20.465
7/ 1/88	0 29.0	20.513
7/ 1/88	0 30.0	20.606
7/ 1/88	0 31.0	19.362
7/ 1/88	0 32.0	18.426

FLOW WT'D MEANS 26.562

FLOW WT'D STD-DEVS 159.561

TOTAL LOADS 50999.672 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 5

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	2.380
7/ 1/88	0 2.0	11.455
7/ 1/88	0 3.0	24.595
7/ 1/88	0 4.0	39.951
7/ 1/88	0 5.0	55.989
7/ 1/88	0 6.0	71.397
7/ 1/88	0 7.0	85.248
7/ 1/88	0 8.0	97.071
7/ 1/88	0 9.0	106.796
7/ 1/88	0 10.0	114.725
7/ 1/88	0 11.0	121.233
7/ 1/88	0 12.0	126.593
7/ 1/88	0 13.0	131.078
7/ 1/88	0 14.0	134.921
7/ 1/88	0 15.0	138.304
7/ 1/88	0 16.0	123.463
7/ 1/88	0 17.0	111.372
7/ 1/88	0 18.0	101.271
7/ 1/88	0 19.0	92.860
7/ 1/88	0 20.0	85.973
7/ 1/88	0 21.0	80.425
7/ 1/88	0 22.0	76.018
7/ 1/88	0 23.0	72.556
7/ 1/88	0 24.0	69.870
7/ 1/88	0 25.0	67.816
7/ 1/88	0 26.0	66.274
7/ 1/88	0 27.0	65.148
7/ 1/88	0 28.0	64.363
7/ 1/88	0 29.0	63.855
7/ 1/88	0 30.0	63.575
7/ 1/88	0 31.0	60.669
7/ 1/88	0 32.0	58.085

FLOW WT'D MEANS 80.791

FLOW WT'D STD-DEVS 489.068

TOTAL LOADS 155119.578 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 6

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	1.745
7/ 1/88	0 2.0	8.816
7/ 1/88	0 3.0	20.597
7/ 1/88	0 4.0	37.032
7/ 1/88	0 5.0	57.458
7/ 1/88	0 6.0	80.307
7/ 1/88	0 7.0	103.605
7/ 1/88	0 8.0	125.611
7/ 1/88	0 9.0	145.281
7/ 1/88	0 10.0	162.216
7/ 1/88	0 11.0	176.423
7/ 1/88	0 12.0	188.177
7/ 1/88	0 13.0	197.820
7/ 1/88	0 14.0	205.626
7/ 1/88	0 15.0	211.530
7/ 1/88	0 16.0	200.722
7/ 1/88	0 17.0	192.150
7/ 1/88	0 18.0	181.967
7/ 1/88	0 19.0	169.697
7/ 1/88	0 20.0	157.462
7/ 1/88	0 21.0	146.430
7/ 1/88	0 22.0	137.007
7/ 1/88	0 23.0	129.205
7/ 1/88	0 24.0	122.876
7/ 1/88	0 25.0	117.815
7/ 1/88	0 26.0	113.824
7/ 1/88	0 27.0	110.721
7/ 1/88	0 28.0	108.353
7/ 1/88	0 29.0	106.593
7/ 1/88	0 30.0	105.336
7/ 1/88	0 31.0	101.865
7/ 1/88	0 32.0	98.264

FLOW WT'D MEANS 125.704

FLOW WT'D STD-DEVS 768.888

TOTAL LOADS 241351.938 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 7

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	1.398
7/ 1/88	0 2.0	8.351
7/ 1/88	0 3.0	21.519
7/ 1/88	0 4.0	38.719
7/ 1/88	0 5.0	59.355
7/ 1/88	0 6.0	82.481
7/ 1/88	0 7.0	106.225
7/ 1/88	0 8.0	128.835
7/ 1/88	0 9.0	149.235
7/ 1/88	0 10.0	166.947
7/ 1/88	0 11.0	181.937
7/ 1/88	0 12.0	194.442
7/ 1/88	0 13.0	204.805
7/ 1/88	0 14.0	213.299
7/ 1/88	0 15.0	219.913
7/ 1/88	0 16.0	212.906
7/ 1/88	0 17.0	200.140
7/ 1/88	0 18.0	190.535
7/ 1/88	0 19.0	178.099
7/ 1/88	0 20.0	165.571
7/ 1/88	0 21.0	154.141
7/ 1/88	0 22.0	144.362
7/ 1/88	0 23.0	136.254
7/ 1/88	0 24.0	129.681
7/ 1/88	0 25.0	124.435
7/ 1/88	0 26.0	120.310
7/ 1/88	0 27.0	117.118
7/ 1/88	0 28.0	114.698
7/ 1/88	0 29.0	112.917
7/ 1/88	0 30.0	111.664
7/ 1/88	0 31.0	108.468
7/ 1/88	0 32.0	104.382

FLOW WT'D MEANS 131.348

FLOW WT'D STD-DEVS 802.996

TOTAL LOADS 252188.672 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 8

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	2.573
7/ 1/88	0 2.0	9.766
7/ 1/88	0 3.0	15.314
7/ 1/88	0 4.0	18.307
7/ 1/88	0 5.0	19.712
7/ 1/88	0 6.0	20.337
7/ 1/88	0 7.0	20.609
7/ 1/88	0 8.0	20.727
7/ 1/88	0 9.0	20.823
7/ 1/88	0 10.0	20.955
7/ 1/88	0 11.0	21.287
7/ 1/88	0 12.0	21.817
7/ 1/88	0 13.0	22.524
7/ 1/88	0 14.0	23.397
7/ 1/88	0 15.0	24.425
7/ 1/88	0 16.0	17.009
7/ 1/88	0 17.0	13.958
7/ 1/88	0 18.0	12.516
7/ 1/88	0 19.0	11.798
7/ 1/88	0 20.0	11.448
7/ 1/88	0 21.0	11.302
7/ 1/88	0 22.0	11.275
7/ 1/88	0 23.0	11.323
7/ 1/88	0 24.0	11.421
7/ 1/88	0 25.0	11.555
7/ 1/88	0 26.0	11.716
7/ 1/88	0 27.0	11.899
7/ 1/88	0 28.0	12.100
7/ 1/88	0 29.0	12.316
7/ 1/88	0 30.0	12.547
7/ 1/88	0 31.0	11.364
7/ 1/88	0 32.0	10.702

FLOW WT'D MEANS 15.276

FLOW WT'D STD-DEVS 89.870

TOTAL LOADS 29329.393 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 9

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	1.149
7/ 1/88	0 2.0	5.138
7/ 1/88	0 3.0	10.168
7/ 1/88	0 4.0	15.161
7/ 1/88	0 5.0	19.506
7/ 1/88	0 6.0	22.988
7/ 1/88	0 7.0	25.645
7/ 1/88	0 8.0	27.620
7/ 1/88	0 9.0	29.075
7/ 1/88	0 10.0	30.158
7/ 1/88	0 11.0	31.031
7/ 1/88	0 12.0	31.884
7/ 1/88	0 13.0	32.785
7/ 1/88	0 14.0	33.780
7/ 1/88	0 15.0	34.900
7/ 1/88	0 16.0	30.891
7/ 1/88	0 17.0	27.567
7/ 1/88	0 18.0	24.876
7/ 1/88	0 19.0	22.769
7/ 1/88	0 20.0	21.169
7/ 1/88	0 21.0	19.987
7/ 1/88	0 22.0	19.139
7/ 1/88	0 23.0	18.554
7/ 1/88	0 24.0	18.174
7/ 1/88	0 25.0	17.955
7/ 1/88	0 26.0	17.862
7/ 1/88	0 27.0	17.871
7/ 1/88	0 28.0	17.961
7/ 1/88	0 29.0	18.118
7/ 1/88	0 30.0	18.331
7/ 1/88	0 31.0	17.722
7/ 1/88	0 32.0	17.115

FLOW WT'D MEANS 21.783

FLOW WT'D STD-DEVS 129.087

TOTAL LOADS 41822.949 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 10

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	1.534
7/ 1/88	0 2.0	5.017
7/ 1/88	0 3.0	7.065
7/ 1/88	0 4.0	8.565
7/ 1/88	0 5.0	10.354
7/ 1/88	0 6.0	12.615
7/ 1/88	0 7.0	15.235
7/ 1/88	0 8.0	18.024
7/ 1/88	0 9.0	20.806
7/ 1/88	0 10.0	23.453
7/ 1/88	0 11.0	25.891
7/ 1/88	0 12.0	28.104
7/ 1/88	0 13.0	30.111
7/ 1/88	0 14.0	31.946
7/ 1/88	0 15.0	33.652
7/ 1/88	0 16.0	31.625
7/ 1/88	0 17.0	31.002
7/ 1/88	0 18.0	30.366
7/ 1/88	0 19.0	29.554
7/ 1/88	0 20.0	28.611
7/ 1/88	0 21.0	27.612
7/ 1/88	0 22.0	26.622
7/ 1/88	0 23.0	25.687
7/ 1/88	0 24.0	24.838
7/ 1/88	0 25.0	24.089
7/ 1/88	0 26.0	23.447
7/ 1/88	0 27.0	22.913
7/ 1/88	0 28.0	22.481
7/ 1/88	0 29.0	22.148
7/ 1/88	0 30.0	21.905
7/ 1/88	0 31.0	21.155
7/ 1/88	0 32.0	20.630

FLOW WT'D MEANS 22.096

FLOW WT'D STD-DEVS 131.530

TOTAL LOADS 42423.375 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 11

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	0.759
7/ 1/88	0 2.0	3.511
7/ 1/88	0 3.0	7.051
7/ 1/88	0 4.0	10.473
7/ 1/88	0 5.0	13.516
7/ 1/88	0 6.0	16.322
7/ 1/88	0 7.0	19.094
7/ 1/88	0 8.0	21.941
7/ 1/88	0 9.0	24.862
7/ 1/88	0 10.0	27.787
7/ 1/88	0 11.0	30.642
7/ 1/88	0 12.0	33.397
7/ 1/88	0 13.0	35.998
7/ 1/88	0 14.0	38.432
7/ 1/88	0 15.0	40.710
7/ 1/88	0 16.0	39.027
7/ 1/88	0 17.0	37.669
7/ 1/88	0 18.0	36.637
7/ 1/88	0 19.0	35.724
7/ 1/88	0 20.0	34.814
7/ 1/88	0 21.0	33.869
7/ 1/88	0 22.0	32.902
7/ 1/88	0 23.0	31.939
7/ 1/88	0 24.0	31.014
7/ 1/88	0 25.0	30.153
7/ 1/88	0 26.0	29.376
7/ 1/88	0 27.0	28.696
7/ 1/88	0 28.0	28.118
7/ 1/88	0 29.0	27.643
7/ 1/88	0 30.0	27.269
7/ 1/88	0 31.0	26.383
7/ 1/88	0 32.0	25.572

FLOW WT'D MEANS 26.916

FLOW WT'D STD-DEVS 160.694

TOTAL LOADS 51678.023 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 12

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	1.596
7/ 1/88	0 2.0	7.316
7/ 1/88	0 3.0	14.802
7/ 1/88	0 4.0	22.601
7/ 1/88	0 5.0	29.757
7/ 1/88	0 6.0	35.823
7/ 1/88	0 7.0	40.839
7/ 1/88	0 8.0	45.087
7/ 1/88	0 9.0	48.862
7/ 1/88	0 10.0	52.465
7/ 1/88	0 11.0	55.974
7/ 1/88	0 12.0	59.400
7/ 1/88	0 13.0	62.736
7/ 1/88	0 14.0	65.964
7/ 1/88	0 15.0	69.070
7/ 1/88	0 16.0	63.250
7/ 1/88	0 17.0	59.036
7/ 1/88	0 18.0	55.878
7/ 1/88	0 19.0	53.465
7/ 1/88	0 20.0	51.557
7/ 1/88	0 21.0	49.978
7/ 1/88	0 22.0	48.612
7/ 1/88	0 23.0	47.396
7/ 1/88	0 24.0	46.304
7/ 1/88	0 25.0	45.329
7/ 1/88	0 26.0	44.475
7/ 1/88	0 27.0	43.745
7/ 1/88	0 28.0	43.143
7/ 1/88	0 29.0	42.667
7/ 1/88	0 30.0	42.314
7/ 1/88	0 31.0	40.671
7/ 1/88	0 32.0	39.205

FLOW WT'D MEANS 44.666

FLOW WT'D STD-DEVS 263.517

TOTAL LOADS 85759.031 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 13

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	0.687
7/ 1/88	0 2.0	3.802
7/ 1/88	0 3.0	10.505
7/ 1/88	0 4.0	21.895
7/ 1/88	0 5.0	37.580
7/ 1/88	0 6.0	56.031
7/ 1/88	0 7.0	75.402
7/ 1/88	0 8.0	94.118
7/ 1/88	0 9.0	111.164
7/ 1/88	0 10.0	126.115
7/ 1/88	0 11.0	138.982
7/ 1/88	0 12.0	149.988
7/ 1/88	0 13.0	159.427
7/ 1/88	0 14.0	167.547
7/ 1/88	0 15.0	174.338
7/ 1/88	0 16.0	174.384
7/ 1/88	0 17.0	171.355
7/ 1/88	0 18.0	164.321
7/ 1/88	0 19.0	154.940
7/ 1/88	0 20.0	145.484
7/ 1/88	0 21.0	136.868
7/ 1/88	0 22.0	129.371
7/ 1/88	0 23.0	123.010
7/ 1/88	0 24.0	117.704
7/ 1/88	0 25.0	113.339
7/ 1/88	0 26.0	109.803
7/ 1/88	0 27.0	106.990
7/ 1/88	0 28.0	104.804
7/ 1/88	0 29.0	103.165
7/ 1/88	0 30.0	101.997
7/ 1/88	0 31.0	100.192
7/ 1/88	0 32.0	97.745

FLOW WT'D MEANS 108.846

FLOW WT'D STD-DEVS 667.684

TOTAL LOADS 208983.391 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 14

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	1.783
7/ 1/88	0 2.0	6.810
7/ 1/88	0 3.0	11.279
7/ 1/88	0 4.0	15.794
7/ 1/88	0 5.0	22.586
7/ 1/88	0 6.0	33.444
7/ 1/88	0 7.0	48.570
7/ 1/88	0 8.0	66.843
7/ 1/88	0 9.0	86.476
7/ 1/88	0 10.0	105.800
7/ 1/88	0 11.0	123.717
7/ 1/88	0 12.0	139.718
7/ 1/88	0 13.0	153.702
7/ 1/88	0 14.0	165.774
7/ 1/88	0 15.0	176.023
7/ 1/88	0 16.0	177.314
7/ 1/88	0 17.0	178.490
7/ 1/88	0 18.0	178.448
7/ 1/88	0 19.0	177.023
7/ 1/88	0 20.0	173.356
7/ 1/88	0 21.0	167.365
7/ 1/88	0 22.0	160.072
7/ 1/88	0 23.0	152.559
7/ 1/88	0 24.0	145.521
7/ 1/88	0 25.0	139.294
7/ 1/88	0 26.0	133.984
7/ 1/88	0 27.0	129.577
7/ 1/88	0 28.0	126.002
7/ 1/88	0 29.0	123.176
7/ 1/88	0 30.0	121.007
7/ 1/88	0 31.0	118.135
7/ 1/88	0 32.0	115.586

FLOW WT'D MEANS 114.851

FLOW WT'D STD-DEVS 715.977

TOTAL LOADS 220513.656 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 15

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	0.662
7/ 1/88	0 2.0	3.892
7/ 1/88	0 3.0	9.419
7/ 1/88	0 4.0	15.213
7/ 1/88	0 5.0	21.522
7/ 1/88	0 6.0	30.534
7/ 1/88	0 7.0	43.825
7/ 1/88	0 8.0	61.116
7/ 1/88	0 9.0	80.695
7/ 1/88	0 10.0	100.569
7/ 1/88	0 11.0	119.287
7/ 1/88	0 12.0	136.115
7/ 1/88	0 13.0	150.760
7/ 1/88	0 14.0	163.050
7/ 1/88	0 15.0	169.977
7/ 1/88	0 16.0	168.642
7/ 1/88	0 17.0	168.072
7/ 1/88	0 18.0	167.796
7/ 1/88	0 19.0	167.654
7/ 1/88	0 20.0	167.582
7/ 1/88	0 21.0	167.549
7/ 1/88	0 22.0	167.539
7/ 1/88	0 23.0	167.543
7/ 1/88	0 24.0	167.556
7/ 1/88	0 25.0	167.577
7/ 1/88	0 26.0	160.675
7/ 1/88	0 27.0	134.428
7/ 1/88	0 28.0	129.627
7/ 1/88	0 29.0	126.488
7/ 1/88	0 30.0	124.043
7/ 1/88	0 31.0	121.310
7/ 1/88	0 32.0	118.472

FLOW WT'D MEANS 115.600

FLOW WT'D STD-DEVS 723.474

TOTAL LOADS 221951.266 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 16

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	0.551
7/ 1/88	0 2.0	2.769
7/ 1/88	0 3.0	7.137
7/ 1/88	0 4.0	13.497
7/ 1/88	0 5.0	20.461
7/ 1/88	0 6.0	28.597
7/ 1/88	0 7.0	40.002
7/ 1/88	0 8.0	55.734
7/ 1/88	0 9.0	74.777
7/ 1/88	0 10.0	94.991
7/ 1/88	0 11.0	114.512
7/ 1/88	0 12.0	132.250
7/ 1/88	0 13.0	147.724
7/ 1/88	0 14.0	160.627
7/ 1/88	0 15.0	169.053
7/ 1/88	0 16.0	168.762
7/ 1/88	0 17.0	168.199
7/ 1/88	0 18.0	167.938
7/ 1/88	0 19.0	167.811
7/ 1/88	0 20.0	167.751
7/ 1/88	0 21.0	167.728
7/ 1/88	0 22.0	167.727
7/ 1/88	0 23.0	167.738
7/ 1/88	0 24.0	167.759
7/ 1/88	0 25.0	167.787
7/ 1/88	0 26.0	167.819
7/ 1/88	0 27.0	167.856
7/ 1/88	0 28.0	140.296
7/ 1/88	0 29.0	130.091
7/ 1/88	0 30.0	127.459
7/ 1/88	0 31.0	124.646
7/ 1/88	0 32.0	121.729

FLOW WT'D MEANS 116.306

FLOW WT'D STD-DEVS 731.546

TOTAL LOADS 223306.609 CUB-FT

67TH AVENUE STORMDRAIN GREINER, INC. SEPTEMBER, 1988: FINAL HYDRO

BELL ROAD TO ACDC 10-YR, 6-HR STORM

SUMMARY OF QUANTITY RESULTS (INFLOW IN CFS) AT LOCATION 17

DATE MO/DA/YR	TIME HR:MIN	FLOW CFS
7/ 1/88	0 1.0	1.403
7/ 1/88	0 2.0	5.937
7/ 1/88	0 3.0	12.627
7/ 1/88	0 4.0	24.241
7/ 1/88	0 5.0	43.045
7/ 1/88	0 6.0	69.117
7/ 1/88	0 7.0	101.247
7/ 1/88	0 8.0	138.051
7/ 1/88	0 9.0	177.984
7/ 1/88	0 10.0	218.940
7/ 1/88	0 11.0	258.498
7/ 1/88	0 12.0	294.680
7/ 1/88	0 13.0	326.367
7/ 1/88	0 14.0	353.085
7/ 1/88	0 15.0	374.106
7/ 1/88	0 16.0	381.276
7/ 1/88	0 17.0	381.559
7/ 1/88	0 18.0	376.990
7/ 1/88	0 19.0	368.872
7/ 1/88	0 20.0	357.864
7/ 1/88	0 21.0	345.802
7/ 1/88	0 22.0	334.162
7/ 1/88	0 23.0	323.744
7/ 1/88	0 24.0	314.844
7/ 1/88	0 25.0	307.469
7/ 1/88	0 26.0	301.482
7/ 1/88	0 27.0	296.703
7/ 1/88	0 28.0	292.950
7/ 1/88	0 29.0	280.742
7/ 1/88	0 30.0	264.289
7/ 1/88	0 31.0	252.486
7/ 1/88	0 32.0	243.456

FLOW WT'D MEANS 244.501

FLOW WT'D STD-DEVS 1530.616

TOTAL LOADS 469441.063
CUB-FT

* * * * * RUNOFF SIMULATION ENDED NORMALLY * * * * *