### AVAILABILITY OF FLOOD DATA

#### FROM DENVER METROPOLITAN WATERSHEDS

### A Status Report

by

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# TABLE OF CONTENTS

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																							Page
List of Figures.	·	•	•	•	·	·	·	•	·	•	·	•	•	•	•	·	•	•	·	·	·	·	iii
List of Tables .		•	•	•	•		•	•		•				•	•	•		•		•			iv
INTRODUCTION				•						•					•								1
BASIC DATA					•									•									1
Denver Urba	n F	10	00	IN	let	wo	ork	ί.															2
Assembly of	Da	ta	•																•				3
PLANS FOR THE NE	ХΤ	QU	AR	TE	R	•		•									•						5
References Cited				•																			6
Figures			•			•								•					•				7
Tables																							8

# List of Figures

Page

No.

.;

1	Location Map of the Denver USGS Urban Rainfall-Runoff	
	Gaging Stations	8

# List of Tables

\*3

No.	<u> </u>	Page
Ι	List of Gaging Stations Denver Metropolitan Area	9
II	List of Urban Watersheds in Texas	11

### AVAILABILITY OF FLOOD DATA FROM DENVER METROPOLITAN WATERSHEDS

#### A Status Report

The purpose of this report is to summarize the activities on the research project:

"Urban Watershed Response Time" Contract DACW05-73-C-0029 CSU Number 31-1372-2342 Report Period 1 October 1972 to 1 January 1973.

#### INTRODUCTION

The objective is to complete a research investigation and submit a Preliminary Draft of a Report by 31 August 1973. The project is to pay the stipend of a Graduate Research Assistant, the tuition costs of the graduate student and a limited amount of incidental research expenses of the student. Under these circumstances, a graduate student in a Master's Program usually takes from 18 to 30 months to complete his degree requirements. Because of the contract stipulations, it was necessary to support a student who was already in his program at CSU for approximately one year. Mr. Oscar Lopez, a graduate student in the Master's Program is being supported on the project. Fortunately Mr. Lopez has had experience in a consulting engineering office in Denver and is somewhat acquainted with the urban flood problems in the Denver Area.

#### BASIC DATA

The problems of the urban flood hydrograph properties have been recognized and discussed in a number of papers including Eagleson (1962), Van Sickle (1962), Espey et al. (1969), and others. The U.S. Geological Survey and the American Society of Civil Engineers have been implementing a program to document the actual flood hydrographs and causal rainstorms in urban regions. One of the newest gaging networks in the USGS urban program is in the Denver metropolitan area. The Denver network has been described in a report by Gonzales and Ducret (1971). It was proposed to try to use the data measured in the Denver network in this investigation because it was nearby and it represented the best installations of stream gaging and rainfall equipment.

Denver Urban Flood Network: - The location of the gaging stations is shown on Figure 1. Some of the gaging stations have been in operation during the summer months since June 1968. The original plans called for having all 31 stations operational by the end of the summer 1972. The station locations were selected to 1) provide a wide variety of types of urban environment, 2) have both old and newly developed locations, 3) have simple and stable hydrologic configurations. Among the characteristics of an urban watershed are the dynamic changes taking place. These changes militate against the third attribute listed previously. By its very nature, the urban environment is changing and the hydrologic configurations seldom remain the same. Ducret (1972) described some of his difficulties in a seminar at Colorado State University.

A number of the stream gaging stations have been installed at the upstream end of a circular culvert pipe. The rating curves have been developed from a theoretical rating curve for a culvert pipe. Because of the short duration of the runoff, it is usually difficult to obtain field verification of the rating curve. In a number of installations the culvert configuration has changed or is being extended requiring removal of the gaging station. There are also instances where additional runoff has been diverted into the watershed through drainage pipes which have been installed recently. Because of these difficulties a number

2

of the stations have been temporarily removed pending completion of new construction.

Each of the gaging stations has been fitted with a Dual Digital stream gaging station and recording rain gage. The data are recorded on a punched paper tape by a digital water stage recorder. Both rainfall and runoff records are controlled by the same timer so there can be no uncertainty about the synchronization of the hyetograph and the hydrograph. The details of the installations are given in a report by Gonzales and Ducret (1971).

The gaging stations actually in operation at the end of the 1972 summer season are given in Table I. In principle the gaging network has been planned to give flood data from a large range of urban environments from suburban to the 100% impervious watershed at Stapleton Airport. It is apparent that the network will not produce the broad range of data originally envisaged during the time span of this research project. The data available are given in a report by Ducret and Hodges (1973). As an alternative, the availability of data from other urban areas was explored. A great deal of data has been published for urban watersheds in Texas. The data from these watersheds is being considered as an alternate to the Denver data. A list of the Texas watersheds is given in Table II. A second alternative might exist in the use of the basic data used in the Eagleson (1962) study. In Eagleson's paper it is mentioned that these measurements were made as part of a Corps of Engineers storm sewer measurement program.

<u>Assembly of Data</u>: - The efforts to date have been primarily devoted to assembling the flood data and physiographic parameters from the Denver network. The U.S. Geological Survey has provided all of the reliable data they have measured.

3

The watersheds have been plotted on a series of 7 1/2 minute USGS topographic maps. In addition copies of aerial photographs showing the location of watersheds have been obtained. The city engineers of the various local cities and municipalities have been contacted and the plans of the storm drains have been obtained.

### PLANS FOR THE NEXT QUARTER

During the period January to March 1973, acquisition of the basic data will be completed. Card punching of the hydrographs and hyetographs will be completed. Measurement of the physiographic parameters will be partly completed. Derivation of the unit hydrographs will be partly completed.

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- Ducret, G.L. and W. Hodges (1973), "Rainfall-runoff data from small watersheds in Colorado, June 1968 to September 1971," USGS Open File Report, Denver District, 1973.
- Gonzales, D.D. and G.L. Ducret (1971), "Rainfall-runoff investigations in the Denver metropolitan area, Colorado," USGS Open File Report, 71003, Denver, Colorado, September 1971.
- Van Sickle, D. (1962), "The effects of urban development on storm runoff," a paper given to ASCE Conference, El Paso, Texas, 1962.



Figure 1 - Location Map of the Denver Metropolitan USGS Urban Rainfall-Runoff Gaging Stations.

7

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# TABLE I

## LIST OF GAGING STATIONS IN THE DENVER METROPOLITAN AREA

USGS Number	Name and Location	Period of Record	Approximate Drainage Area
6.7102	Big Dry Creek tributary at Littleton, 39°55'46", 104°57'06"	1969-P	600 acres
6.7114.5	Bear Creek tributary at Denver, 39°39'14", 105°02'46"	1971-P	125 acres
6.7115.8	Harvard Gulch tributary at Englewood, 39°39'34", 104°58'23"	1971-P	600 acres
6.7116	Sanderson Gulch tributary at Lakewood, 39°41'09",105°04'54"	1969-P	300 acres
6.7116.5	Lakewood Gulch tributary at Lakewood, 39°42'17", 105°06'33"	1971-P	200 acres
6.7117	Dry Gulch at Lakewood, 39°44'29", 105°06'43"	1971-P	125 acres
6.7142.1	South Platte River tributary at Denver, 39°47'18", 104°56'32"	1971-P	300 acres
6.7142.3	Toll Gate Creek tributary at Aurora, 39°44'10", 104°48'39"	1970-P	180 acres
6.7142.4	Sand Creek tributary at Aurora, 39°45'41", 104°49'36"	1971-P	200 acres
6.7142.7	Westerly Creek tributary at Aurora, 39°45'13", 104°51'51"	1970-P	130 acres
6.7143	Concourse D Drain at Stapleton Airport, 39°46'08", 104°53'12"	1970-P	70 acres will become 120 acres soon
6.7143.1	Sand Creek tributary at Denver, 39°47'07", 104°50'31"	1971-P	400 acres
6.7197.5	Ralston Creek tributary at Arvada, 39°48'53", 105°08'15"	1970-P	400 acres
6.7197.6	Van Bibber Creek at Arvada, 39°47'54", 105°08'15"	1970-P	600 acres
6.7197.7	Clear Creek tributary at Arvada, 39°49'20", 105°03'11"	1970-P	450 acres

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TABLE I continued

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USGS Number	Name and Location	Period of Record	Approximate Drainage Area
6.7198	Schneider Drain at Ar <b>v</b> ada, 39°50'12", 105°04'14"	1968-P	200 acres
6.7198.8	Clear Creek Tributary No. 1 at Westminster, 39°49'54", 105°00'24"	1971-P	650 acres
6.7199.6	Clear Creek tributary No. 2 at Westminster, 39°49'50", 104°58'59"	1971-P	450 acres
6.7201	Tuck Drain at Northglenn, 39°52'35", 104°59'16"	1968-P	40 acres
6.7202	South Platte tributary No. 2 at Northglenn, 39°51'57", 105°0'27"	19 <b>6</b> 8-P	300 acres
6.7202.4	South Platte River tributary at Thornton, 39°51'10", 104°57'18"	1971-P	700 acres
6.7203	Hillcrest Drain at Northglenn, 39°52'57", 104°59'36"	1968-P	180 acres
6.7204	Kennedy Drive Drain at Northglenn, 39°53'26", 104°59'14"	1968-P closed '72	70 acres
6.7204.2	South Platte River tributary No. 5 at Northglenn, 39°54'23", 105°57'34"	1971-P	300 acres
Boulder Wa	tersheds		
6.7283	Skunk Creek at Boulder, 39°59'47", 105°15'51"	1970-P	500 acres
6.7283	Twomile Canyon at Boulder, 40°02'59", 105°18'16"	1970-P	500 acres
6.7283.5	Goose Creek at Boulder, 40°01'35", 105°16'19"	1971-P	400 acres
6.7284	Boulder Creek tributary at Boulder, 39°58'48", 105°14'41"	1970-P	125 acres
6.7304.5	Rock Creek tributary at Broomfield, 39°54'52", 105°06'51"	1971-P	125 acres

# TABLE II

### LIST OF GAGING STATIONS IN THE METROPOLITAN AREAS IN TEXAS

USGS Number	Name and Location	Period of Record	Approximate Drainage Area
Austin Wat	<u>ersheds</u> Waller Creek at 38th Street	1955-P	23] sa mi
0.1570		1054 D	4.12 sq. mi.
8.15/5	Waller Creek at 23rd Street	1954-P	4.13 sq. m1.
8.1591.5	Wilbarger Creek near Pflugerville	1963-P	4.61 sq. mi.
Bryan Wate	rsheds		
8.1110.25	Burton Creek at Villa Maria Road	1968-70* *discontinued	1.33 sq. mi. I
8.1110.5	Hudson Creek near Bryan	1968-70*	1.94 sq. mi.
Dallas Wat	ersheds		
8.0557	Bachman Branch at Dallas	1963-P	9.58 sq. mi.
8.0565	Turtle Creek at Dallas	1948-51; 1951-P	7.98 sq. mi.
8.0571	White Rock Creek at Keller Springs Road	1961-P	29.4 sq. mi.
8.0572	White Rock Creek at Greenville A <b>ven</b> ue	1961-P	66.4 sq. mi.
8.0573	White Rock Creek at White Rock Lake	1962-P	100 sq. mi.
8.0574	White Rock Creek at Seyene Road	1962-P	122 sq. mi.
8.0574.5	Tenmile Creek at Lancaster	1969-P	52.8 sq. mi.
8.0617	Duck Creek near Garland	1958-P	31.6 sq. mi.
8.0619.5	South Mesquite Creek at Mercury Road near Mesquite	1968-P	23.0 sq. mi.
Fort Worth	Watersheds		
8.0486	Dry Branch at Fain Street	1968-P	2.15 sq. mi.
8.0488.5	Little Fossil Creek at Mesquite Street	1968-P	12.3 sq. mi.

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TABLE II continued

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USGS Number	Name and Location	Period of Record	Appro Drai Ar	nage rea	ate e			
8.0485.2	Sycamore Creek at Interstate Highway I 35-W	1969-P	17.7	sq.	mi.			
8.0485.3	Sycamore Creek tributary above Seminary South Shopping Center	1969-P	0.97	sq.	mi.			
8.0485.4	Sycamore Street tributary at Interstate I-35-W	1969-P	1.35	sq.	mi.			
Houston Wa	tersheds							
8.0741.5	Cole Creek at Deihl Road	1964-P	8.81	sq.	mi.			
8.0742.5	Brickhouse Gully at Costa Rica Stree	t 1964-P	11.1	sq.	mi.			
8.0745	Whiteoak Bayou at Houston	1936-P	84.7	sq.	mi.			
8.0748	Keegans Bayou at Roark Road	1964-P	9.28	sq.	mi.			
8.0750	Brays Bayou at Houston	1936-P	88.4	sq.	mi.			
8.0754	Sims Bayou at Hiram Clarke Street	1964-P	20.2	sq.	mi.			
8.0755	Sims Bayou at Houston	1952-P	64.	sq.	mi.			
8.0756.5	Berry Bayou at Forest Oaks Street	1964-P	11.1	sq.	mi.			
8.0757.7	Hunting Bayou at U.S. 90-A Highway	1964-P	14.4	sq.	mi.			
8.0759	Greens Bayou at U.S. 75 Highway	1965-P	35.5	sq.	mi.			
8.0760	Greens Bayou near Houston	1952-P	72.7	sq.	mi.			
8.0765	Halls Bayou at Houston	1952-P	24.7	sq.	mi.			
8.0770	Clear Creek near Pearland 19 19	944;1946; 947-59;1963-P	38.8	sq.	mi.			
San Antonio Watersheds								
8.1777	Olmas Creek at Dresden Drive	1968-P	21.2	sq.	mi.			
8.1780	San Antonio River at San Antonio	1915-29; 1939-P	41.8	sq.	mi.			
8.1787	Salado Creek (Upper Station) at San Antonio	1960-P	137	sq.	mi.			

TABLE II continued

USGS Number	Name and Location	Period of Record	Approximate Drainage Area			
8.1788	Salado Creek (Lower Station) at San Antonio	1960-P	189 sq. mi.			
8.1814	Helotes Creek at Helotes	1968-P	15 sq. mi.			

Note: Period of Record 1968-P means that the station was active during the period 1968-1972 (present).

If an asterisk (\*) is shown in the Period of Record column, the station was inoperative during a significant part of its history.