SOARING EAGLES RESIDENTIAL
MASTER DEVELOPMENT DRAINAGE PLAN (MDDP)

December, 1999
Revised: October, 2000
Revised: April, 2001

Prepared for:

Classic Development -Soaring Eagles LLC
6385 Corporate Drive, Suite 100
Colorado Springs, CO 80919
(719) 785-3256

Prepared by:

Rockwell-Minchow Consultants, Inc.
1873 Austin Bluffs Parkway
Colorado Springs, CO 80918
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Project #99-023

SOARING EAGLES RESIDENTIAL (MDDP)

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ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City of Colorado Springs for drainage reports, and said drainage report is in conformity with the Master Plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Kent D. Rockwell, P.E.

COLORADO REGISTERED KENT D. ROCKWELL 25086 4/25/01 PROFESSIONAL ENGINEER

DEVELOPER'S STATEMENT

I, the developer, have read and will comply with all the requirements specified in this drainage report and plan.

Classic Development - Soaring Eagles, LLC

BY: ____________________ DATE 4/17/01

Ron O'Canna
Development Manager
6385 Corporate Drive, Suite 200
Colorado Springs, CO 80919

CITY OF COLORADO SPRINGS

Filed in accordance with Section 15-3-906 of the code of the City of Colorado Springs, 1980, as amended.

BY: ____________________ 5/15/01
FOR CITY ENGINEER DATE

EL PASO COUNTY

Filed in accordance with Section 51.1 of the El Paso County Land Development Code, 1980, as amended.

BY: ____________________ 4-26-01
John A. McCarty, P.E. DATE
COUNTY ENGINEER/DIRECTOR

SOARING EAGLES RESIDENTIAL
MASTER DEVELOPMENT DRAINAGE PLAN (MDDP)

Purpose

The purpose of this MDDP is to identify the existing runoff patterns, major drainage ways and drainage facilities tributary to the Soaring Eagles Residential Development and to recommend drainage facilities and improvements such as channels, detention ponds and major culvert locations required to facilitate the future development of the site. This plan should serve only as a guide for future planning and design. Site specific design should be completed with individual drainage plans and reports at the time of platting/development.

Summary of Data

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs and El Paso County "Drainage Criteria Manual", October 1987, revised November 1991.

2. Soil Survey for El Paso County, Colorado. U.S. Department of Agriculture, Soil Conservation Service, June 1980.

3. "Flood Insurance Studies for Colorado Springs and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), 1997.

4. "Windmill Gulch Drainage Basin Planning Study", Wilson & Company, January 1991; revised June 1991, February 1992.

5. "Little Johnson/Security Creek Drainage Basin Planning Study", Simons, Li & Associates, April 1988.

6. "Peterson Field Drainage Basin Master Plan Update", URS Consultants, Inc., August 1984.

General Location and Description

The Soaring Eagles Residential Development is located within the City of Colorado Springs, El Paso County, Colorado, encompassing the south 1/2 of Section 36, Township 14 South, Range 65 West of the 6th P.M. (see Vicinity Map - Figure 1). The site is bound on the north by undeveloped land, on the east by Powers Boulevard, on the south by Drennan Road and on the west by Hancock Expressway. The total development contains approximately 250 acres, the residential development contains approximately 85 acres, none of which has been developed to date.

Soaring Eagles will be a multi-use development consisting of open space, park, school, residential, business park, light industrial and commercial areas.

This MDDP is for the proposed residential areas only (Filings 1-4), but encompasses surrounding area to show how the entire site is affected. The future areas to be developed surrounding Soaring Eagles Residential will require additional MDDP's and Final Drainage Reports as they are developed.

Soils

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the soils in the Soaring Eagles Development fall under two soils classifications and two hydrologic classifications (see Soils Map - Figure 2).

The soils underlying the majority of the site are of the Blakeland Series (Soil 8) and classified under Hydrologic Group "A", while a small area in the south central portion of the site is underlain by the Truckton Series (Soil 95 & 96) and falls under Hydrologic Group "B". Hydrologic Group "B" was used for calculation purposes.

Existing ground cover consists of well established native grasses over the entire site with a small stand of deciduous trees at west central end of the site. A 36 acre site in the northeast corner was overlot graded in 1998. The land is currently being used for pasture.

Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel #08041C0761 F a portion of the northern end of the site lies in a designated floodplain area along the Peterson Field Drainage. A Letter of Map Revision (LOMR) has been approved (12/14/99) for a portion of the site along Hancock Expressway due to the installation of drainage/channel improvements. An additional LOMR will have to be approved for the remainder of the drainage/channel improvements along Hancock Expressway to Chelton Road to the west. The new LOMR will be submitted after initial inspection of the channel improvements.

Drainage Criteria

The current City of Colorado Springs/El Paso County Drainage Criteria was utilized for this report. The Rational Method was used for the on site areas. The majority of the areas are less than 100 acres. In the Windmill Gulch Drainage Basin, the rational method was used to determine on site flows. The TR-20 flows from the DBPS were used for the overall area reaching the proposed detention pond. The model should be updated when a plan is determined for the airport property east of Powers Boulevard since this is the largest contributor of runoff to the pond.

The development lies within three major Drainage Basins. The southeast portion of the site lies in the Windmill Gulch Drainage Basin. The southwest portion of the site lies in the Little Johnson Drainage Basin. The northern portion of the site lies in the Peterson Field Drainage Basin.

Drainage Characteristics

The site consists of gently rolling hills of well established native grass with slopes of 1-8%. The site generally slopes from north to south in the Windmill Gulch Drainage Basin area to the Drennan Road culvert crossing at the southeast end of the site. In the Little Johnson Drainage Basin area, the site generally slopes from northeast to southwest to the Drennan Road/Hancock Expressway intersection. The site generally slopes from east to west in the Peterson Field Drainage Basin area to a Hancock Expressway culvert crossing west of the site. The drainageways consist of wide swales with well established vegetation.

HISTORIC DRAINAGE PATTERNS

A brief description of each historic drainage basin for the site is provided in this section of the report. A summary of peak historic runoff for the basins is depicted on the Historic Drainage Plan provided in the appendix. The site has been divided into four on-site historical basins plus two off-site basins.

Historic Basin H-1.1 encompasses approximately 65.8 acres in the Peterson Field Drainage Basin along the northern end of the development. Existing 5 year and 100 year runoff quantities of 37.8 cfs and 92.1 cfs overland and swale flow to the northwest where the runoff combines with the flow from the Peterson Field Drainage Channel. The runoff exits the site to the west and enters five parallel 60"x46" CMP's crossing under the newly constructed Chelton Road. Much of the low lying area in this Basin is in a designated FEMA 100 year floodplain.

Basin H-2.1 is in the Little Johnson Basin and currently overland flows to the northeast corner of Drennan Road and Chelton Road (Hancock) The 60.6 acre basin has runoff of 26.8 cfs during the 5 year storm and 65.4 cfs during the 100 year storm. Currently the water builds up in a low area at the intersection then over tops to the south along the east side of Chelton to the Bradley Road intersection. Currently, the street section is over capacity.

Basin H-3.1 encompasses 31.9 acres of on-site land in the Windmill Gulch Drainage Basin in the south central portion of the site. Runoff quantities of 17.4 cfs/42.5 cfs currently overland flow to a man-made depression used for detention along the north side of Drennan Road. The runoff overtops the depression and travels down the north side of Drennan Road into Basin H-4.1.

Historic Basin H-4.1 covers the bulk of the eastern half of the site and contains approximately 111.8 acres between Powers Boulevard and Drennan Road. Runoff quantities of 55.2 cfs/136.8 cfs currently overland and swale flow to the south where an existing 68" X 43" elliptical RCP crosses Drennan Road. A roadside ditch runs along Powers Boulevard and Drennan Road on the east and south ends of the Basin, collecting runoff from the roadways and associated culverts. This Basin lies in the Windmill Gulch Drainage Basin.

According to the DBPS for Windmill Gulch, there are two off site basins east of Powers Boulevard. These basins are shown as 60 and 62 in the report. The runoff from these two basins travel in a roadside ditch along Powers Boulevard and Drennan Road mentioned above, combining with basins H-3.1and H-4.1 at the existing elliptical pipe crossing under Drennan Road. The total combined flows at this point are 50/230 cfs for the 368.5 acres. The flows appear low compared to the flows from H-4.1 due to the difference between routing with the TR-20 model in the DBPS and the use of the rational method being used for this site. The existing pipe under Drennan Road has a total capacity of approximately 190 cfs in its current condition based on inlet control. The remaining portion of the 100 year flows overtop the roadway to the south and continue south in a wide natural grass swale.

DEVELOPED DRAINAGE PATTERNS

A brief description of each developed drainage basin and proposed detention ponds is provided in this section of the report. Proposed drainage conditions are described, including detention areas. A summary of peak developed runoff for the basins is depicted on the Developed Drainage Plan provided in the appendix. The site has been divided into three major drainage basins. All proposed major drainage facilities are approximate and may vary with actual layout and design. As discussed previously, the site is in three major drainage basins. Each major basin is described separately. Little Johnson has descriptors LJ-1 through LJ-8. Windmill Gulch has descriptors WG-1 through WG-10 and Peterson Field is described with PF-1 through PF-11.

With the development of the Residential Areas included in this MDDP, there will be no impact on downstream facilities and properties in the Little Johnson and Windmill Gulch Basins. The release of developed runoff will be held to at or below historic levels through the use of temporary detention facilities to be installed by the developer and maintained by the Soaring Eagles H.O.A. Development in the Peterson Field Basin will release developed flows. The future areas to be developed surrounding Soaring Eagles Residential will require additional MDDP's and Final Drainage Reports as they are developed. Additional issues, including the possible expansion of Drennan Road to a Freeway/Expressway have not been resolved at this time, and will affect future ultimate drainage and regional detention facilities.

LITTLE JOHNSON

Approximately half of the Little Johnson Basin will developed into 6,000 square foot residential lots. The area along Drennan Road will remain PIP with a commercial development at the northeast corner of Drennan and Chelton. A portion of the future school site is located within the residential area of development. Further study will be required when the City of Colorado Springs determines the location and size of a future freeway for Drennan Road.

The total combined flows at the northeast corner of Drennan and Chelton are 98.2 cfs for the 5 year storm and 194.6 cfs for the 100 year storm (DP-3). This compares with historic flows of 26.8/65.4 cfs respectively. A 4' high by 6' wide concrete box culvert was proposed in the DBPS to be installed under Drennan Road that would be outlet by a 5'high by 5' wide concrete channel along the east side of Chelton to the south. Given the study of the Drennan Road Freeway taking place at this time with a possible interchange located at Drennan and Chelton. The Soaring Eagles Residential Development is proposing a 4.5 acre-foot temporary detention pond be constructed on the commercial site until such time the site is developed or the permanent outfall system is constructed. The temporary pond will be outlet with a 24" HDPE pipe along the east side of Chelton approximately 1300' to the existing 60" RCP crossing under Chelton (Hancock). The additional flows at the 60" pipe under Chelton will not have an adverse affect on the adjacent property. The peak flows will not increase significantly over the existing point discharge at the pipe outlet. The 78" RCP crossing under the Fountain Mutual Canal will be installed with this development to insure storm water does not enter the canal. The Canal crossing is shown in the DBPS (see figure included in appendix) as being a reimbursable facility. All of the above facilities will be constructed with the first development in the Little Johnson Basin.

The ultimate drainage system under Drennan Road and the outfall are shown in the DBPS as being reimbursable against drainage fees. The initial public systems within the project are not reimbursable according to the DBPS. The Temporary pond and outfall are not reimbursable items.

PETERSON FIELD

The northeast corner of this basin will be developed into a commercial / light industrial site. The northwest corner will be commercial with the remaining area being approximately 6,000 square foot residential lots. The commercial / industrial area to the east will flow to the northwest and connect to existing drainage systems installed in 1998 with the partial improvements to Hancock Expressway by the City of Colorado Springs. The area to the west will flow to the north and northwest to the proposed concrete lined channel and concrete box culvert at the Windhover Drive (former Blake Drive) intersection with Hancock Expressway. This channel and box crossing have been designed by URS and approved by the City in 1991.

Inlet and piping systems will be designed with individual plats/developments to keep proposed streets within capacity and discharge the runoff to the proposed Peterson Field Drainage Channel along the north end of the Basin. All of the public facilities within the Peterson Field Basin are reimbursable.

WINDMILL GULCH

The southeast corner of this basin will be developed into office / light industrial sites, with the western area being developed into 6,000 square foot residential lots. Inlet and piping systems will be designed with individual plats/developments. The area will drain to the low area on the north side of Drennan Road where a 20.7 acre foot public (regional) detention pond is proposed. According to the DBPS for Windmill Gulch the total developed flows reaching the pond will be 440/780 cfs. The outlet rate is 240 cfs in the 100 year storm. A 10'x10'drop inlet with a 5' diameter orifice plate will be installed in the pond and outlet by a new 84" RCP under Drennan Road. The detention pond and Drennan Road crossing will be required when the office / light industrial areas are developed or the airport property to the east of Powers Boulevard is developed, whichever is developed first. A temporary detention facility will be constructed with the third filing of the single family residential to limit the developed flows to historic. The final design of the detention pond and road crossing of Drennan Road will need to be done when the configuration of the Drennan Road Freeway is finalized. The proposed detention pond will require approximately 7 acres of land dedication under the proposed layout in the Windmill Gulch DBPS. Final acreage will be determined when the pond is designed. The proposed detention pond will be owned and maintained by the City of Colorado Springs when constructed.

There will be no adverse affect to the areas downstream of Drennan Road with the development of the residential property with the discharge being limited to historic rates.

The detention pond and 84" RCP crossing under Drennan Road are reimbursable against drainage fees. According to the DBPS, initial systems within the development are not reimbursable.

PROPOSED DRAINAGE FACILITIES

Following are the preliminary estimates of cost for the drainage facilities being proposed in the three major basins. All permanent facilities proposed are public. Pipe sizes and inlet sizes are subject to final drainage reports and street design.

LITTLE JOHNSON: Public Reimbursable

Description	Quantity	Unit Cost	Total Cost
78" RCP	160 l.f.	$200.00/lf	$32,000.00
78" Outlet Structure	1 ea.	$17,500.00/ea	17,500.00
48" RCP	60 l.f..	$100.00/lf	6,000.00
		Subtotal	$55,500.00
		Engineering & Contingency (15%)	8,325.00
		TOTAL	$63,825.00

LITTLE JOHNSON: Public Non-reimbursable

Description	Quantity	Unit Cost	Total Cost
42" RCP	530 l.f.	$61.00/lf	$32,330.00
36" RCP	1,350 l.f.	$51.00/lf	68,850.00
30" RCP	450 l.f.	$40.00/lf	18,000.00
24" RCP	350 l.f.	$32.00/lf	11,200.00
18" RCP	350 l.f.	$26.00/lf	9,100.00
Type 1 Manhole	3 ea.	$4,200.00/ea	12,600.00
15' Inlet	1 ea.	$5,500.00/ea	5,500.00
12' Inlet	1 ea.	$4,200.00/ea	4,200.00
10' Inlet	3 ea.	$3,750.00/ea	11,250.00
8' Inlet	1 ea.	$3,450.00/ea	3,450.00
6' Inlet	1 ea.	$3,100.00/ea	3,100.00
4' Inlet	1 ea.	$2,850.00/ea	2,850.00
Temporary Pond	1 ea.	$20,000.00/ea	20,000.00
24" HDPE outfall	1,500 lf.	$40.00/lf	60,000.00
		Subtotal	$262,430.00
		Engineering & Contingency (15%)	39,364.50
		TOTAL	$301,794.50

PETERSON FIELD: Public Reimbursable

Description	Quantity	Unit Cost	Total Cost
36" RCP	70 lf	$51.00/lf	3,570.00
30" RCP	865 lf	$40.00/lf	34,600.00
24" RCP	112 lf	$32.00/lf	3,584.00
18" RCP	410 lf	$26.00/lf	10,660.00
Type 2 Manhole	1 ea	$2,100.00/ea	2,100.00
18' Inlet	1 ea	$5,800.00/ea	5,800.00
15' Inlet	1 ea	$5,400.00/ea	5,400.00
12' Inlet	1 ea	$4,200.00/ea	4,200.00
10' Inlet	4 ea	$3,750.00/ea	15,000.00
4' Inlet	1 ea	$2,850.00/ea	2,850.00
		Subtotal	$ 87,764.00
		Engineering & Contingency (15%)	13,164.60
		TOTAL	$100,928.60

PETERSON FIELD: Hancock Expressway Public-Reimbursable

Description	Quantity	Unit Cost	Total Cost
48" RCP	195 lf	$71.00/lf	$ 13,845.00
36" RCP	220 lf	$51.00/lf	11,220.00
10' Inlet	3 ea	$3,750.00/ea	11,250.00
RCBC (8'x20')	65 lf	$210.00/lf	13,650.00
Conc. Channel	600 lf	$260.00/lf	156,000.00
		Subtotal	$205,965.00
		Engineering & Contingency (15%)	30,894.75
		TOTAL	$236,859.75

Note: The facilities shown are on site. The channel and box culvert improvements have been designed and approved by the City of Colorado Springs for Hancock Expressway.

WINDMILL GULCH: Public Non-reimbursable

Description	Quantity	Unit Cost	Total Cost
60" RCP	300 l.f.	$127.00/lf	$38,100.00
54" RCP	400 l.f.	$109.00/lf	43,600.00
42" RCP	1050 l.f.	$61.00/lf	64,050.00
30" RCP	500 l.f.	$40.00/lf	20,000.00
24" RCP	400 l.f.	$32.00/lf	12,800.00
18" RCP	40 l.f.	$26.00/lf	1,040.00
Type 1 Manhole	4 ea.	$4,200.00/ea	16,800.00
15' Inlet	1 ea.	$5,600.00/ea.	5,600.00
12' Inlet	2 ea.	$4,200.00/ea.	8,400.00
10' Inlet	3 ea.	$3,750.00/ea	11,250.00
6' Inlet	1 ea.	$3,100.00/ea	3,100.00
grass swale	2,100 l.f.	$25.00/lf	52,500.00
		Subtotal	$277,240.00
		Engineering & Contingency (15%)	41,586.00
		TOTAL	$318,826.00

Note: The majority of the facilities shown above will be installed when the commercial / industrial ground is developed. Temporary detention will be provided for the residential development until the permanent detention facilities are constructed.

WINDMILL GULCH: Public Reimbursable

Description	Quantity	Unit Cost	Total Cost
84" RCP	220 l.f.	$300.00/lf	$66,000.00
Excavation-Pond	180,000 cy	$1.50/cy	270,000.00
Outlet Structure	1 ea.	$15,000.00/ea	15,000.00
Dissipater	2 ea.	$17,500.00/ea	35,000.00
		Subtotal	$386,000.00
		Engineering & Contingency (15%)	57,900.00
		TOTAL	$443,900.00

DRAINAGE, BRIDGE and POND FEES

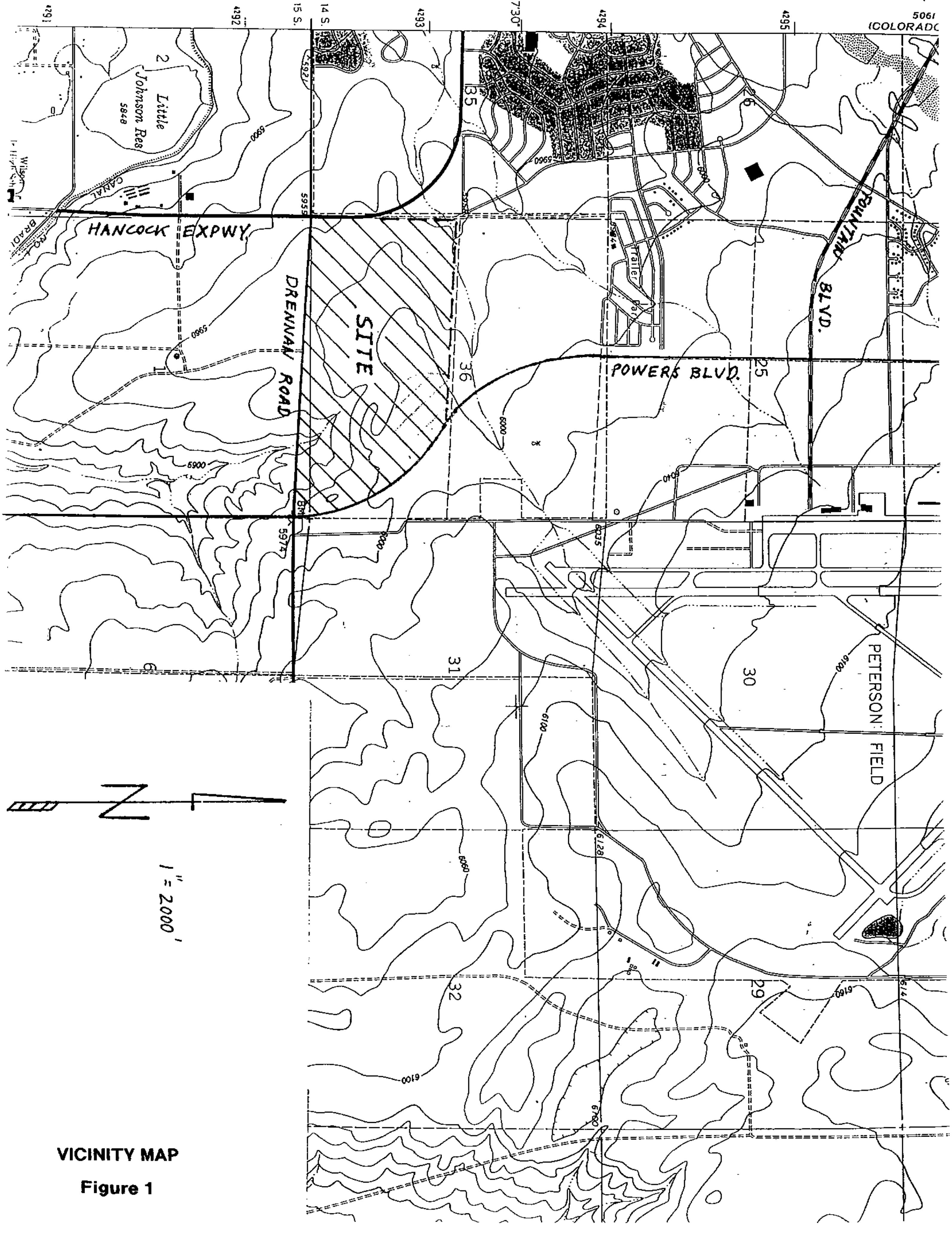
The Soaring Eagles Development lies within three Major Drainage Basins. The Drainage, Bridge and Pond Fee for Windmill Gulch, Little Johnson, and Peterson Field are listed below. No Fees are required with the approval of this report, fees will be paid at the time of final platting individual phases. The 2001 Drainage, Bridge and Pond Fees for these basins are listed below:

Windmill Gulch -	Drainage:	$ 7932/ac.
	Bridge:	$ 161/ac.
	Pond (land):	$ 1451/ac.
Little Johnson -	Drainage:	$ 7525/ac.
	Pond (land):	$ 583/ac.
Peterson Field -	Drainage:	$ 7276/ac.
	Bridge:	$ 337/ac.

CONCLUSION

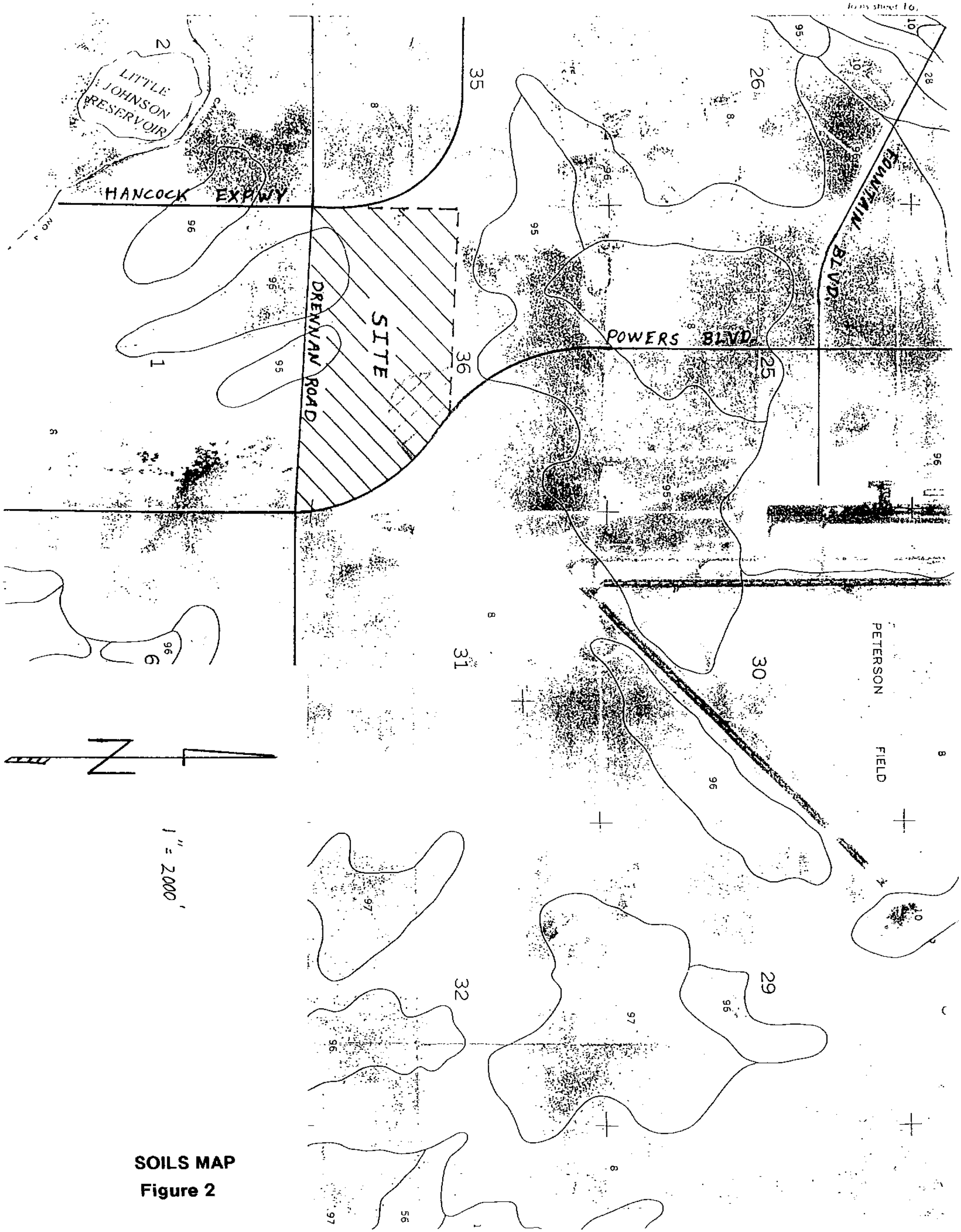
The Soaring Eagles Residential Development is in compliance with the Drainage Basin Planning Studies for the respective basins. The development of this project will not present an adverse effect on downstream properties.

APPENDIX



VICINITY MAP

Figure 1



SOILS MAP
Figure 2

Gary L. Steen, P.E.
487 Anaconda Dr.
Colorado Springs, Co. 80919
719-598-6107

February 12, 2001

Rockwell-Minchow Consultants, Inc.
1873 Austin Bluffs Parkway
Colorado Springs, Co. 80918

Attn: Mr. Dennis Minchow

Re: Soaring Eagles Development Master Drainage Plan

Dear Dennis:

This letter is being submitted on behalf of Fountain Mutual Irrigation Co. (FMIC) with respect to the referenced project. We have received your master drainage plan for this project on January 18, 2001 and offer the following comments pertaining to our review.

The proposed project is located at the northeast corner of Hancock Expressway and Drennan Road. The property is to be developed as residential and commercial uses. The property lies within three (3) designated drainage basins as established by the City of Colorado Springs and El Paso County. The southwesterly portion of this project lies within the Little Johnson Drainage Basin. It is this basin that affects the existing FMIC canal system located to the south and west of this project.

The Little Johnson Drainage Basin Study as prepared by Simons, Li & Assoc. in April of 1988 addressed the drainage in this basin as it affects the existing FMIC canal system. This plan called for a pipe to be installed beneath the canal system to prevent surface stormwater runoff from entering the canal system. Your proposal is consistent with the Drainage Basin Study, namely crossing beneath the canal with a 78" diameter concrete pipe (RCP).

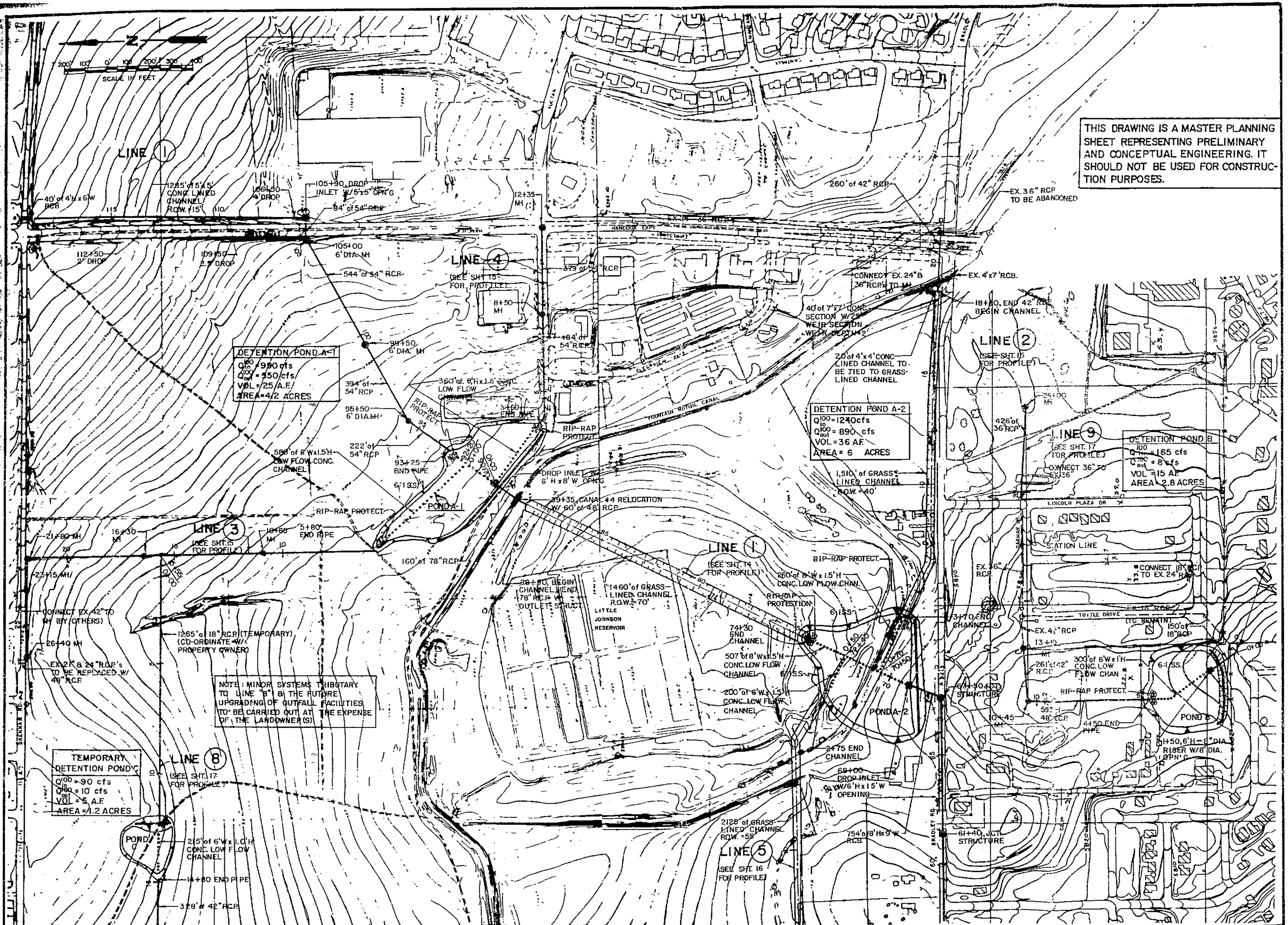
FMIC takes no exception to this drainage proposal to cross beneath the canal system with a concrete pipe. Final plans and specifications will need to be submitted to this office for approval by the FMIC Board of Directors. FMIC will not be responsible to obtain the necessary easements or agreements both upstream and downstream of the proposed canal crossing with this storm pipe.

FMIC appreciates this opportunity to be involved in the preliminary planning for this project. Please review this information and feel free to contact this office if you should have any questions.

Sincerely,

Gary L. Steen, P.E.

Cc: FMIC



Simons, Li & Associates, Inc.
419 West Bijou, Colorado Springs, Colorado 80903

LITTLE JOHNSON / SECURITY CREEK
DRAINAGE BASIN PLANNING STUDY
PRELIMINARY DESIGN
PLAN - REGIONAL DETENTION POND SYSTEM

Project No.	PCO-EPC-01
Date:	10/87
Design:	JYC
Drawn:	EAK
Check:	JYC
Revisions:	

SHEET 11

TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY 10 A&B* (Sandy)	10 C&D* (Clay)	100 A&B*	100 C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90

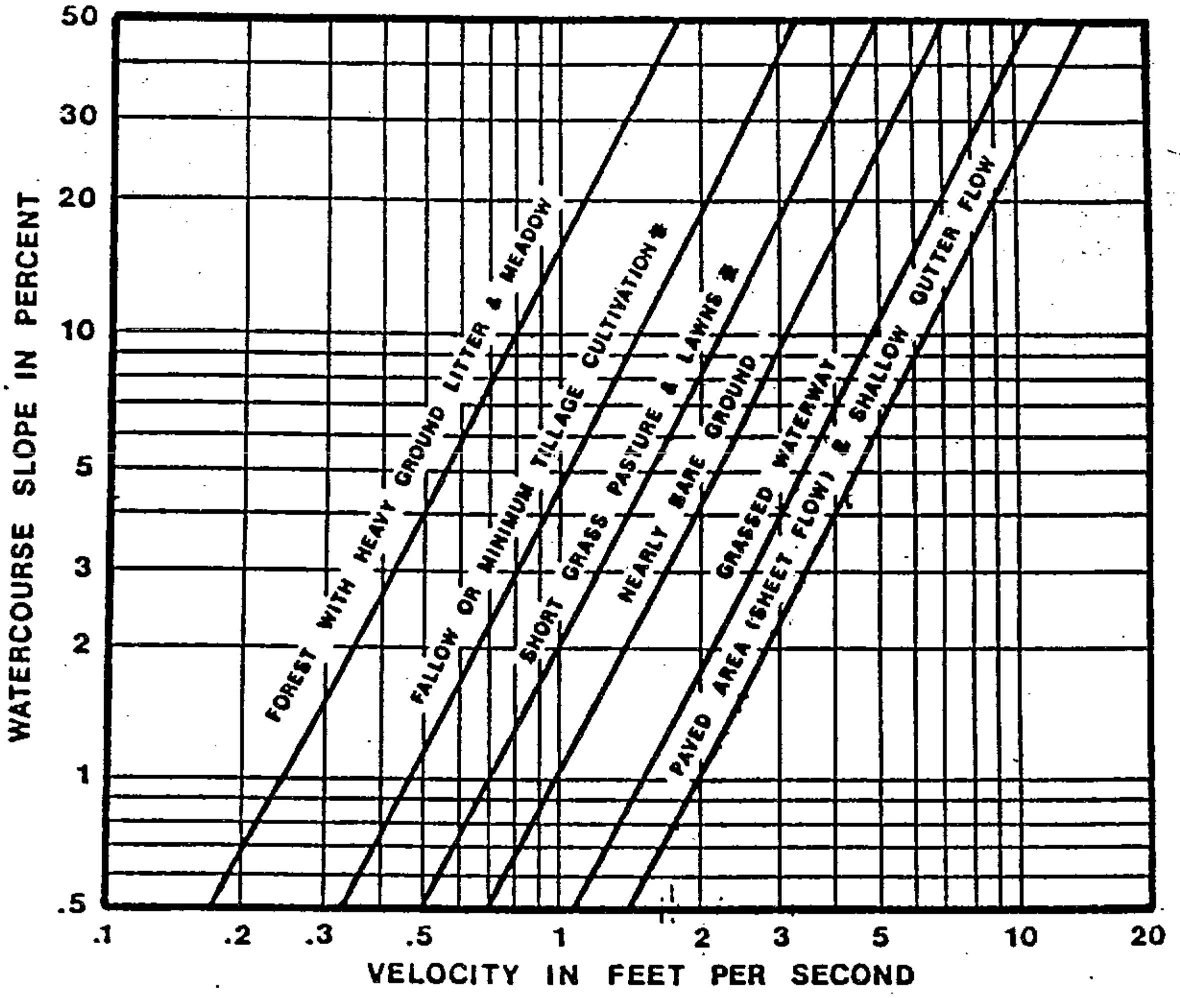


FIGURE 3-2. ESTIMATE OF AVERAGE FLOW VELOCITY FOR USE WITH THE RATIONAL FORMULA.

* MOST FREQUENTLY OCCURRING "UNDEVELOPED" LAND SURFACES IN THE DENVER REGION.

REFERENCE: "Urban Hydrology For Small Watersheds" Technical Release No. 55, USDA, SCS Jan. 1975.

$$T_c = 1.87\ (1.1 - C_{10}) L^{0.5}\ S^{-0.33}$$

where:

C_{10} = adjusted runoff coefficient for ten-year flow;

L = length of overland flow in feet;

S = slope of flow path in percent; and

T_c = travel time in minutes

Times of concentration calculated for fully developed land use should not be less than five (5) minutes to avoid the oversizing of inlets, storm drains and open channels. Overland flow lengths should not exceed 300 feet for developed areas or 1,000 feet for undeveloped areas before being intercepted by a channel or storm sewer inlet. Beyond these distances, gutter flow or channel flow velocities calculated by Manning's Formula must be used. Refer to Section III for discussion on Manning's Formula.

Storm Drain or Road Gutter Flow

Travel time through a storm drain or road gutter system to an open channel is the sum of travel times in each individual component of the drainage system between the uppermost inlet and the outlet. In most cases, average velocities can be used without a significant loss of accuracy. During major storm events, the sewer system may be full and additional channel flow may occur, generally at a significantly lower velocity than the flow in the storm drains. By using the average conduit size and the average slope (excluding any vertical drops in the system), the average velocity can be estimated using Manning's Formula.

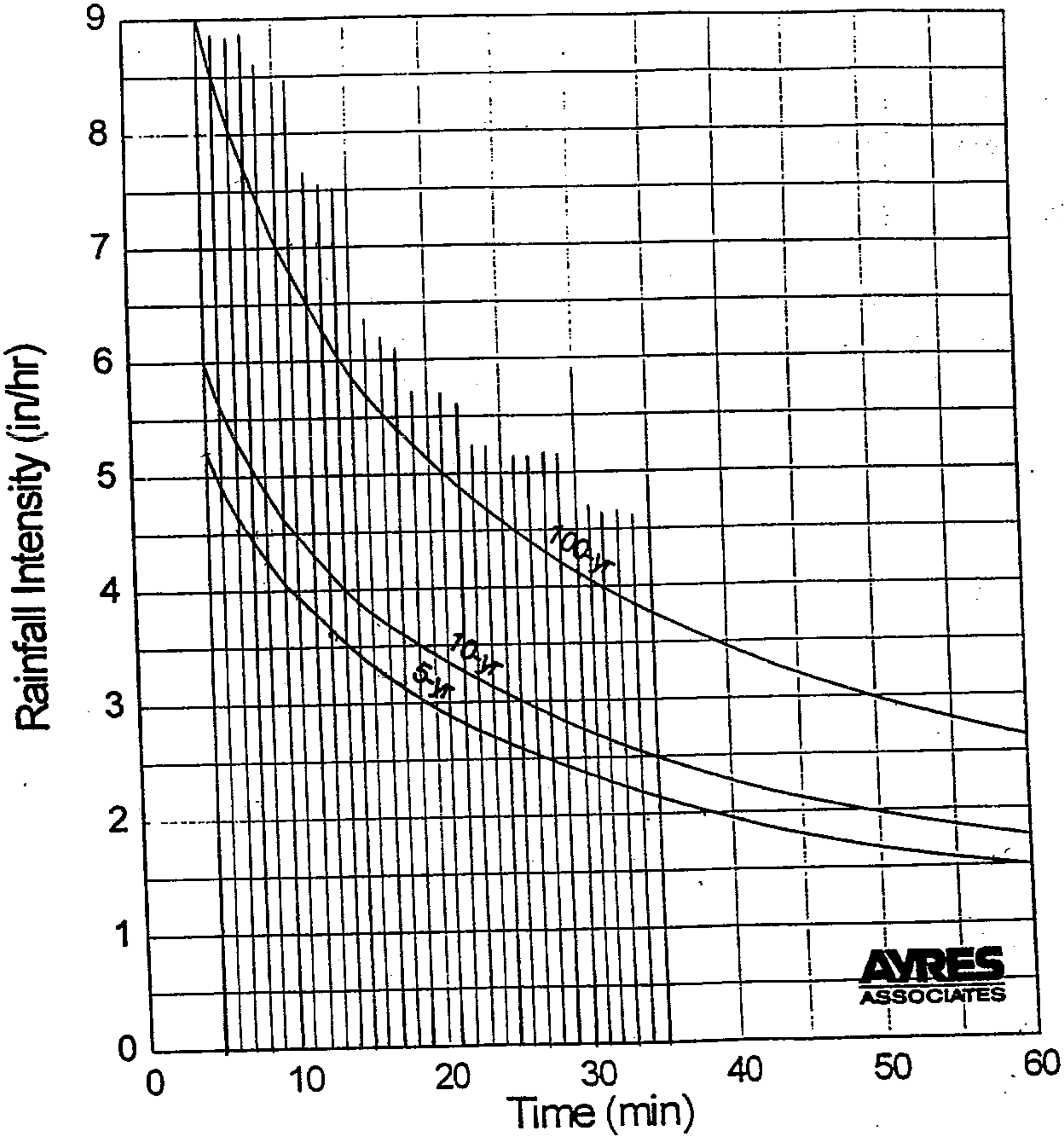
Since the hydraulic radius of a pipe flowing half full is the same as that for a pipe flowing full, the respective velocities are equal. Therefore, travel time may be based on the pipe flowing full or half full. The travel time through a storm sewer is computed by dividing the length of pipe by the average velocity of flow.

Channel Flow

The travel time for flow in an open channel can be determined by using Manning's formula to compute average velocities. Bankfull velocities should be used to compute these averages. Channels may be either natural or in an improved condition.

Example 1

A model urbanized drainage basin is shown on Figure 5-3. Three types of flow exists from the furthermost point of the basin to the outlet. Compute time of concentration (t_c) based on the following data:



Interim Release October 12, 1994 , Rainfall Intensity Curves
City Of Colorado Springs Drainage Criteria Manual

2001 DRAINAGE, BRIDGE AND POND FEES -- CITY OF COLORADO SPRINGS

Code No.	Basin Name		Drainage Fee/Acre	Bridge Fee/Acre	Pond Fees/Acre	
					Land	Facilities
01	Sand Creek	1995	$6,714.00	$400.00	$427.00	$1498.00*
02	Spring Creek	1977	$5,974.00			
03	Templeton Gap	1977	$3,939.00	$4[illegible]		
04	Douglas Creek	1981	$7,244.00	$160.00		
05	19th Street	1964	$2,269.00			
06	Pope's Bluff	1976	$2,307.00	$394.00		
07	Camp Creek	1964	$1,277.00			
08	Peterson Field	1984	$7,276.00	$337.00		
09	South Rockrimmon	1976	$2,708.00			
10	Pulpit Rock	1968	$3,819.00			
11	Dry Creek	1966	$3,285.00			
12	North Rockrimmon	1973	$3,465.00			
13	Cottonwood Creek**	2000	$7,400.00	$637.00		
14	Miscellaneous	n/a	$6,703.00			
15	Mesa	1986	$6,023.00			
16	21st Street	1977	$3,465.00			
17	Bear Creek	1980	$2,229.00	$209.00		
18	Southwest Area	1984	$7,541.00			
19	Windmill Gulch	1991	$7,932.00	$161.00	$1,451.00	
20	Black Squirrel Creek	1989	$7,899.00	$902.00	$373.00	
21	Monument Branch	1987	$5,321.00		$421.00	
22	Middle Tributary	1987	$3,938.00		$532.00	
23	Little Johnson	1988	$7,525.00		$583.00	
25	Big Johnson, Crews	1991	$8,624.00	$708.00	$114.00	
26	Fishers Canyon	1991	$7,224.00		$562.00	

Notes for 2001 Fees:

All Drainage, Bridge and Detention Pond Facility Fees are increased by 5% over 2000 (incl. 1% increase due to underestimation of 2000 fees and 4% increase for 2001 fees); 1/09/01 City Council Resolution.

Land Fees are based on the Park Land Dedication Fee of $36,400.00 per acre for 2001.

*Detention Pond Surcharge:

Pond #1 (per Springs Ranch/U.S. Home Agreement) = $988.00/acre

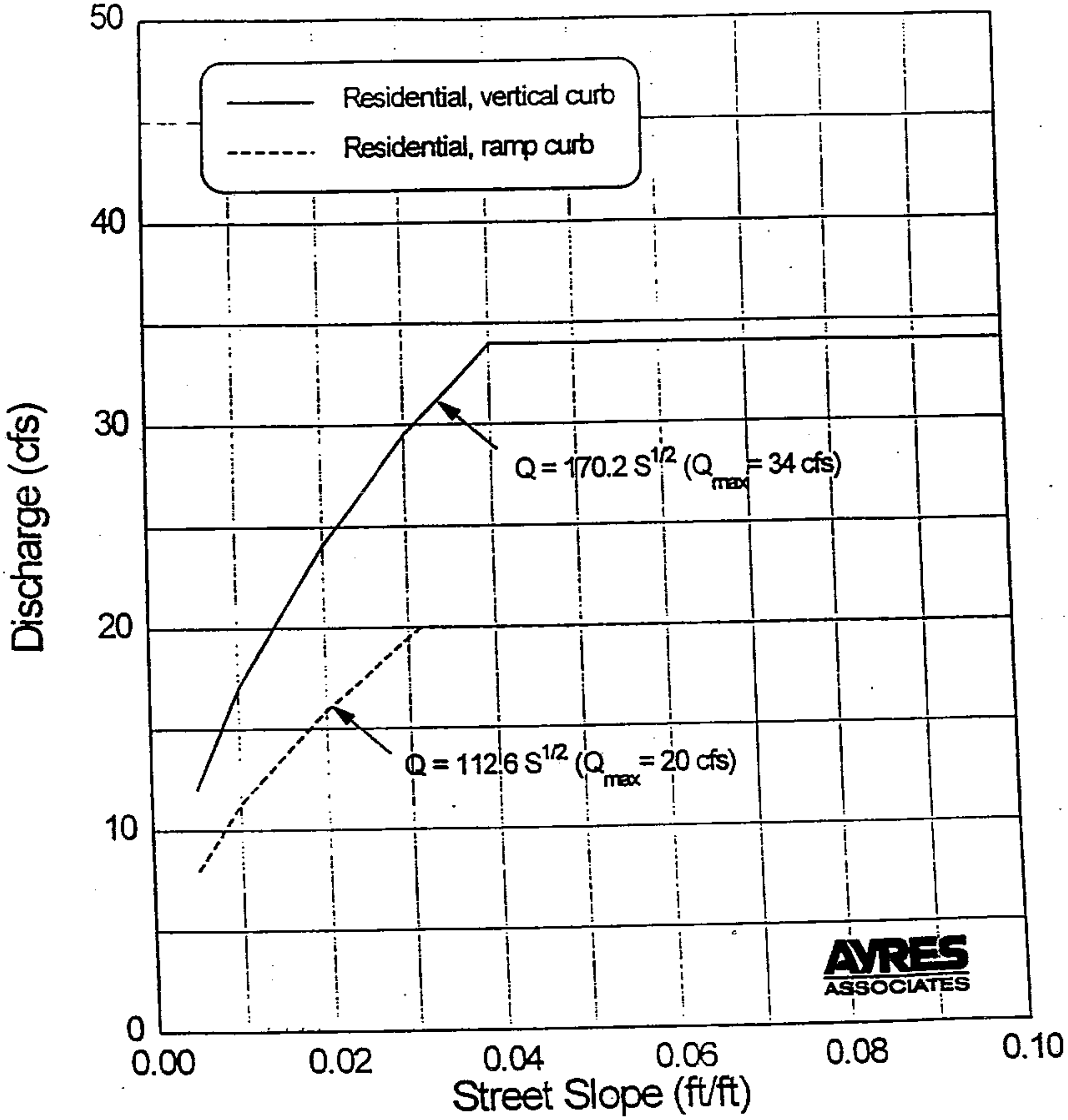
Pond #2 (per Ridgeview MDDP) = $750.00/acre

** 2000 Cottonwood Creek Drainage and Bridge Fees were amended and the Detention Pond Fees were eliminated by City Council Resolution on 7/11/00. The $6714/ac. drainage fee consists of $5215/ac. for capital improvements and $1499/acre for land; the two components will be annually adjusted using different standard procedures but combined together for collection purposes. The $6714/ac. drainage fee includes $372/ac. to be paid to the City in cash for cost-sharing of improvements as outlined in the Drainage Basin Planning Study. 2000 Cottonwood Creek Drainage and Bridge Fees were increased by City Council Resolution on 11/28/00, Drainage Fee = $7037/ac., Bridge Fee = $606/ac. 2000 Drainage Fee increased by $36/ac. to $7073/ac. by City Council Resolution on 1/9/01. The 2001 Cottonwood Creek Drainage Fee = $7400/ac. with $5853/ac. for capital improvements (incl. $391/ac. to be paid to the City in cash) + $1547/ac. for land.

CONCRETE PIPE
Capacity (Velocity)

0.5%		1%	2%	3%	4%	5%	6%	7%	8%
5.0	18"	11.3 (6.6)	16.0 (9.3)	19.6 (11.4)	22.6 (13.2)	25.3 (14.7)	27.7 (16.1)	29.9 (17.4)	32.0 (18.6)
17.2	24"	24.3 (8.1)	34.4 (11.2)	42.2 (13.7)	48.7 (15.8)	54.4 (17.6)	59.6 (19.3)	64.4 (20.9)	68.8 (22.3)
31.2	30"	44.1 (9.5)	62.4 (13.4)	76.4 (16.4)	88.2 (19.0)	98.7 (21.2)	108.1 (23.2)	116.8 (25.1)	124.8 (26.8)
50.7	36"	71.8 (10.3)	101.5 (14.6)	124.3 (17.8)	143.5 (20.6)	160.4 (23.0)	175.8 (25.2)	189.8 (27.2)	202.9 (29.1)
76.5	42"	108.2 (10.8)	153.1 (15.3)	187.5 (18.7)	216.5 (21.6)	242.0 (24.2)	265.1 (26.5)	286.3 (28.6)	306.1 (30.6)
109.3	48"	154.5 (11.2)	218.5 (15.8)	267.6 (19.4)	309.0 (22.4)	345.5 (25.0)	378.5 (27.4)	408.8 (29.6)	437.0 (31.6)
149.6	54"	211.5 (11.5)	299.2 (16.2)	366.4 (19.8)	423.1 (22.9)	473.0 (25.6)	518.2 (28.1)	559.7 (30.3)	598.3 (32.4)
198.1	60"	280.2 (11.7)	396.2 (16.5)	485.3 (20.2)	560.3 (23.3)	626.5 (26.1)	686.3 (28.6)	741.2 (30.9)	792.4 (33.0)
255.4	66"	361.2 (11.8)	510.9 (16.7)	625.7 (20.5)	722.5 (23.7)	807.8 (26.5)	884.8 (29.0)	955.7 (31.3)	1021.7 (33.5)
322.1	72"	455.6 (12.0)	644.3 (17.0)	789.1 (20.8)	911.1 (24.0)	1018.7 (26.8)	1115.9 (29.3)	1205.3 (31.7)	1288.6 (33.9)

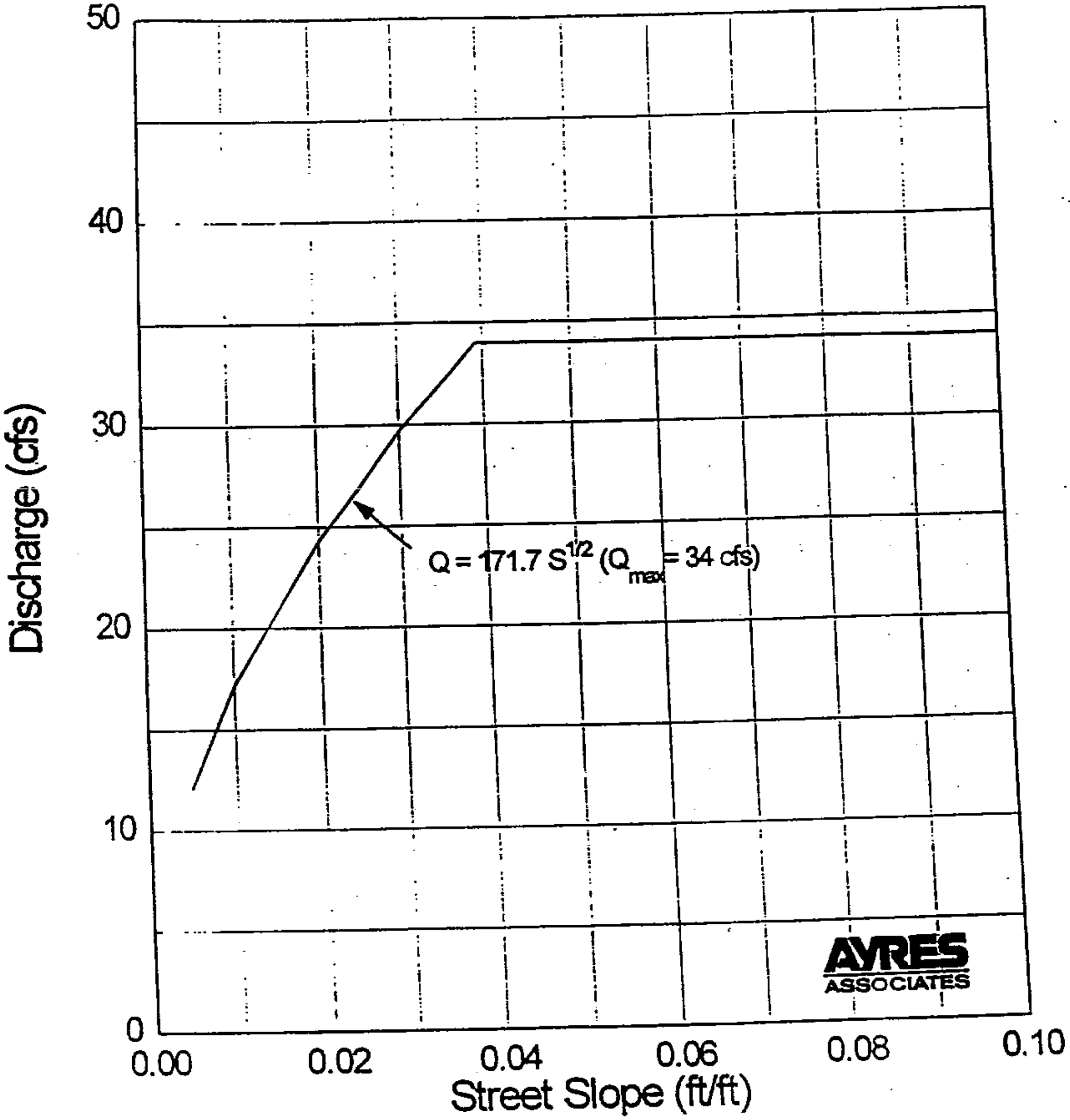
RESIDENTIAL STREET (34′ Flowline to flowline)



Interim Release October 12, 1994
City of Colorado Springs

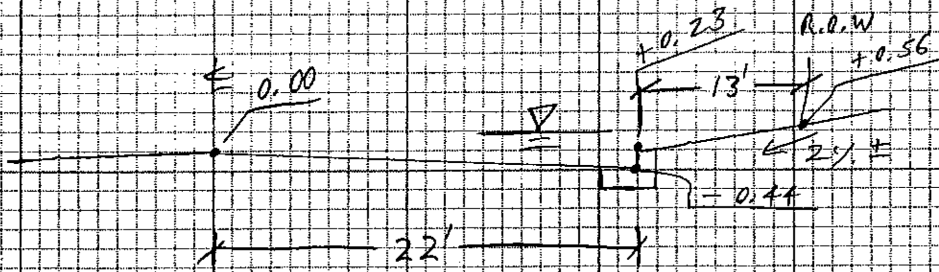
Use this graph to determine the allowable street capacity per side, initial storm, for the typical street section using a 2% crown.

COLLECTOR STREETS (Major and Minor)



Interim Release October 12, 1994
City of Colorado Springs

Use this graph to determine the allowable street capacity per side, initial storm, for the typical street section using a 2% crown. No flow may cross the crown.



1' depth @ FL max

$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

$Q = 1188\ S^{1/2}$

$n = 0.016$

$A = 19.3\ ft^2$

$R = \frac{A}{P} = \frac{19.3}{35.67} = 0.54$

Q(cfs)	S(%)
118.8	1%
168.0	2%
205.8	3%

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE DATE shown on this map to determine when actuarial rates apply to structures in zones where elevations or depths have been established.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 761 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

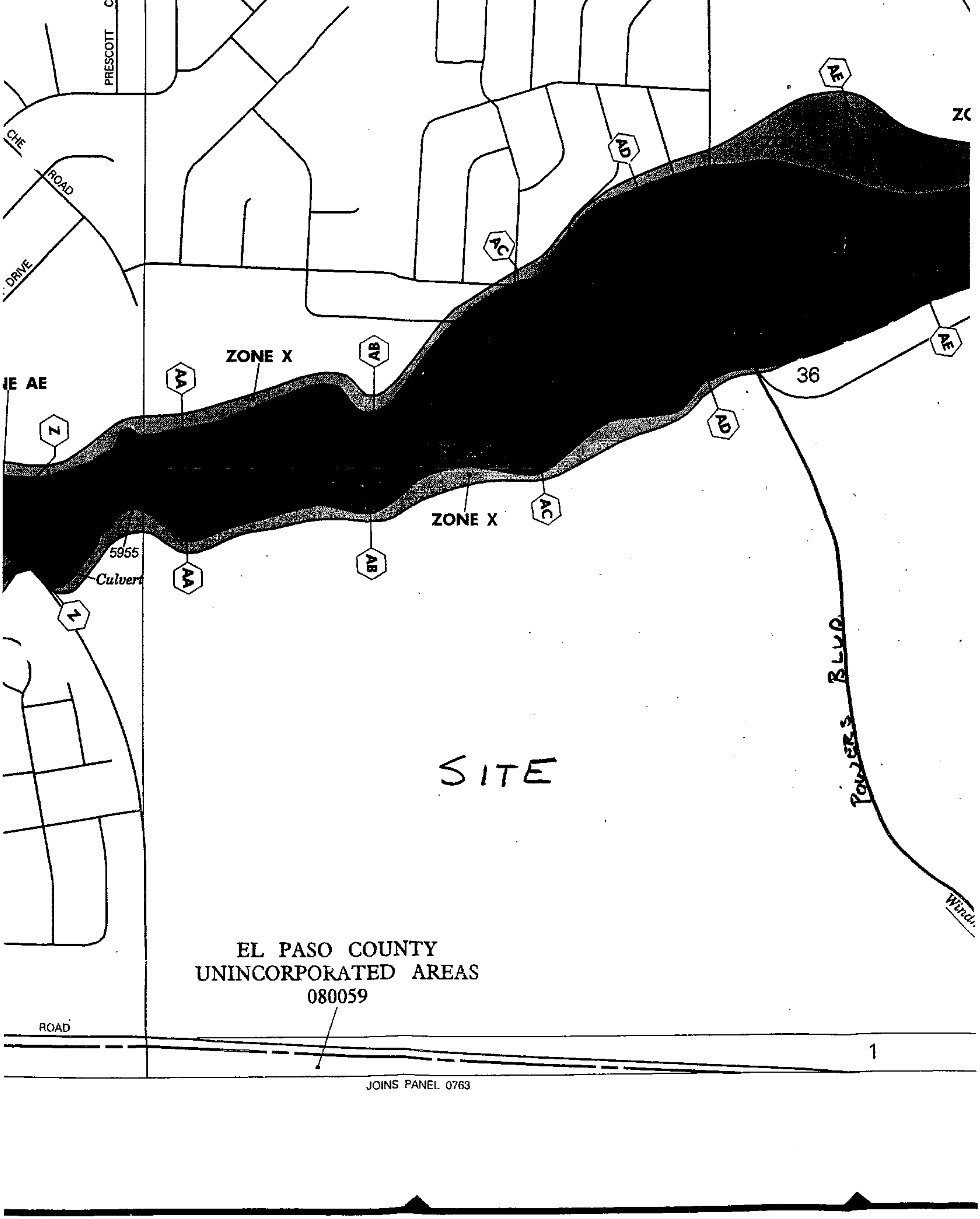
COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0761	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0761	F

MAP NUMBER
08041C0761 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

46'52"



PRESCOTT
ROAD
ZONE X
AA
AB
AC
AD
AE
Z
36
5955
Culvert
ZONE X
SITE
POWERS BLVD
EL PASO COUNTY
UNINCORPORATED AREAS
080059
ROAD
1
JOINS PANEL 0763

CHANGES ARE MADE IN DETERMINATIONS OF BASE FLOOD ELEVATIONS FOR THE CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO, UNDER THE NATIONAL FLOOD INSURANCE PROGRAM

On March 17, 1997, the Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the City of Colorado Springs, El Paso County, Colorado, through issuance of a Flood Insurance Rate Map (FIRM). The Mitigation Directorate has determined that modification of the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) for certain locations in this community is appropriate. The modified base flood elevations (BFEs) revise the FIRM for the community.

The changes are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65.

A hydraulic analysis was performed to incorporate channelization of Peterson Field Drainage from approximately 900 feet upstream to approximately 6,500 feet upstream of Hancock Expressway and construction of two 8-foot by 9-foot concrete box culverts under Powers Avenue approximately 3,300 feet upstream of Hancock Expressway and two 8-foot by 9-foot concrete box culverts under Zeppelin Drive approximately 5,200 feet upstream of Hancock Expressway. This has resulted in a revised delineation of the regulatory floodway, a decrease in SFHA width, and decreased BFEs for the revised reach of Peterson Field Drainage from just upstream to approximately 6,500 feet upstream of Hancock Expressway. As a result of channelization, the base flood and floodway are contained in the engineered channel from approximately 2,000 feet upstream to approximately 6,500 feet upstream of Hancock Expressway. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

Location	Existing BFE (feet)*	Modified BFE (feet)*
Approximately 1,300 feet upstream of Hancock Expressway	5,962	5,960
Approximately 1,700 feet upstream of Hancock Expressway	5,967	5,963
Approximately 2,000 feet upstream of Hancock Expressway	5,972	5,965

*National Geodetic Vertical Datum, rounded to nearest whole foot

Under the above-mentioned Acts of 1968 and 1973, the Mitigation Directorate must develop criteria for floodplain management. To participate in the National Flood Insurance Program (NFIP), the community must use the modified BFEs to administer the floodplain management measures of the NFIP. These modified BFEs will also be used to calculate the appropriate flood insurance premium rates for new buildings and their contents and for the second layer of insurance on existing buildings and contents.

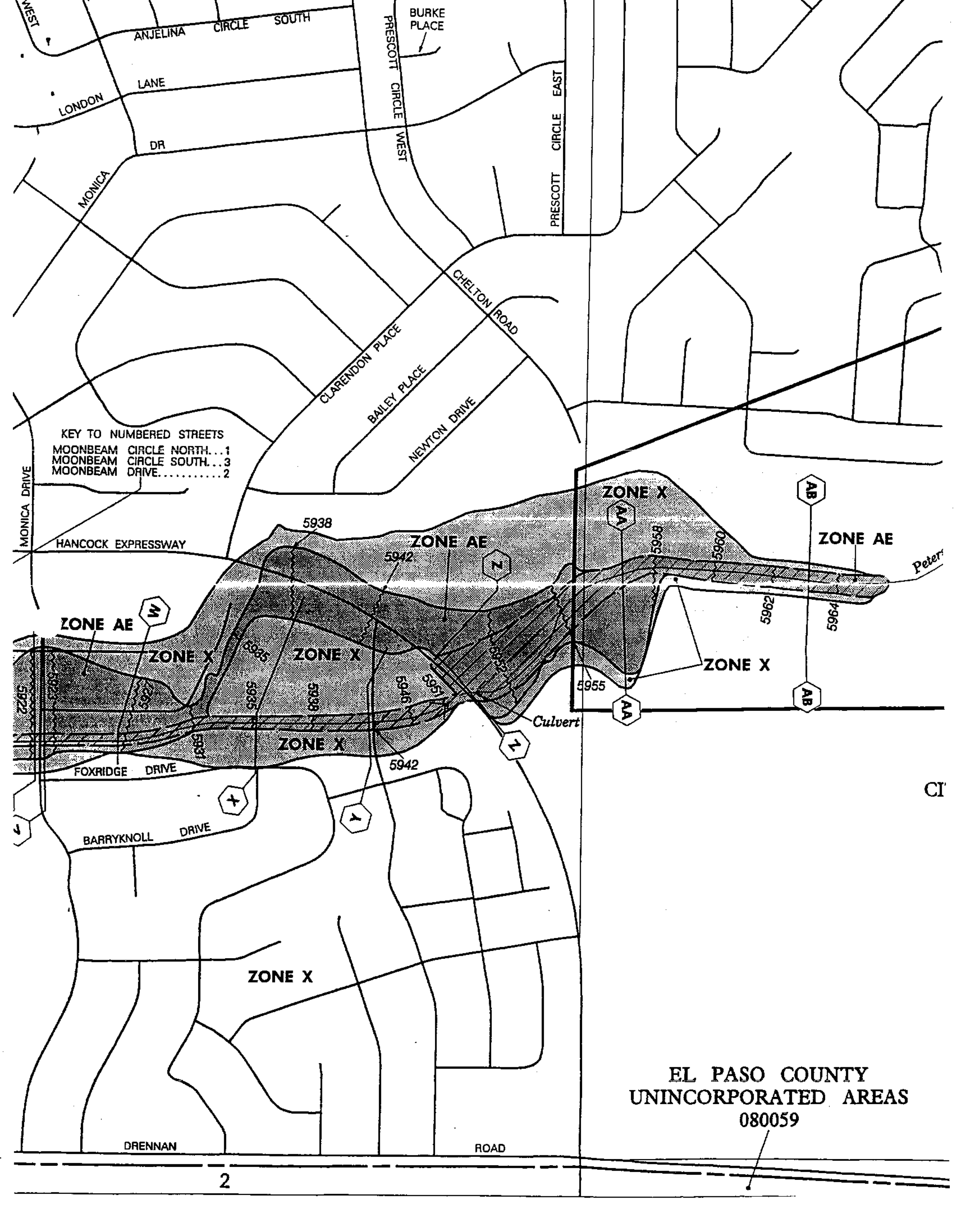
9/25/00

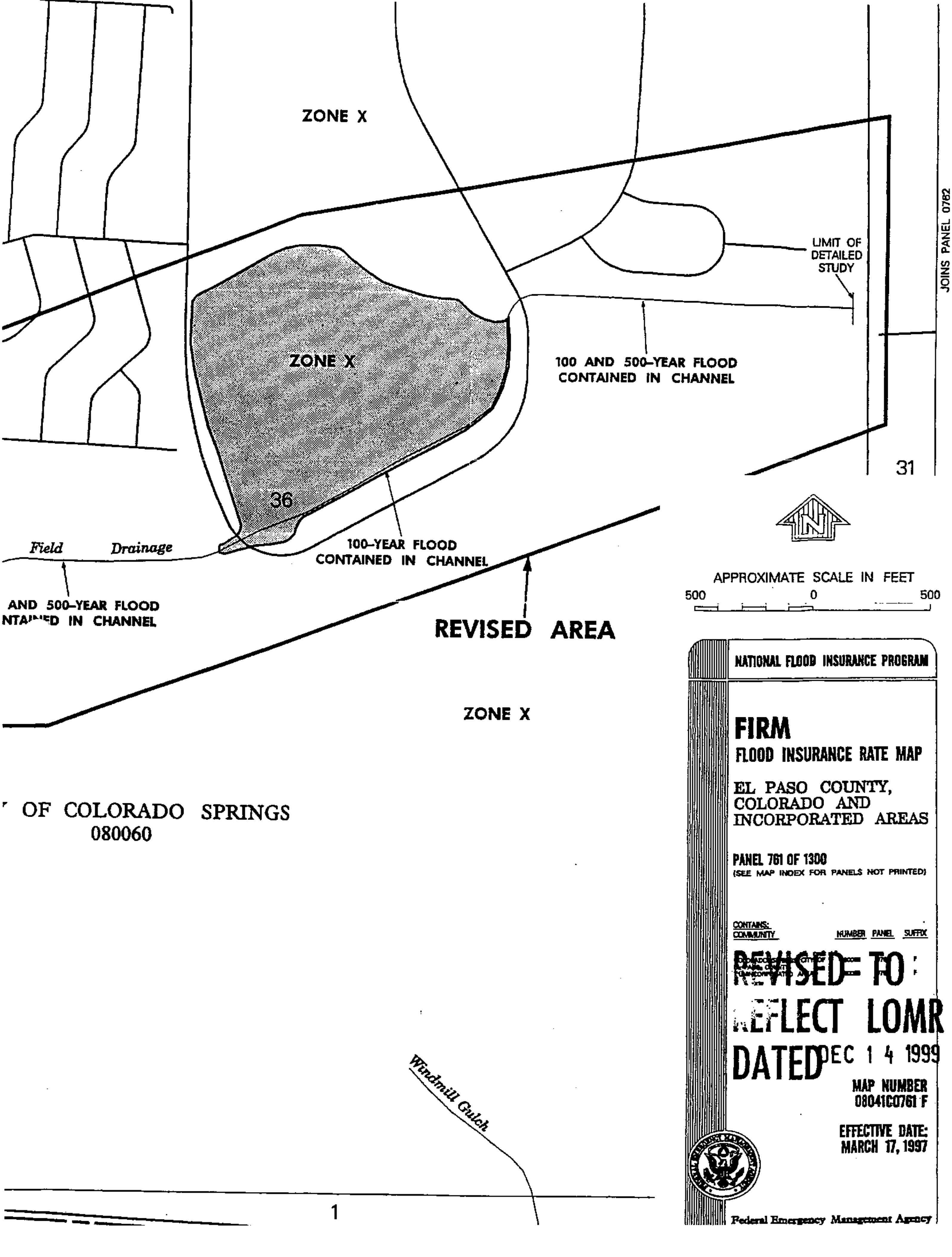
99-023
Engr.

Upon the second publication of notice of these changes in this newspaper, any person has 90 days in which he or she can request, through the Chief Executive Officer of the community, that the Mitigation Directorate reconsider the determination. Any request for reconsideration must be based on knowledge of changed conditions or new scientific or technical data. All interested parties are on notice that until the 90-day period elapses, the Mitigation Directorate's determination to modify the BFEs may itself be changed.

Any person having knowledge or wishing to comment on these changes should immediately notify:

The Honorable Mary Lou Makepeace
Mayor, City of Colorado Springs
P.O. Box 1575
Colorado Springs, Colorado 80901-1575


ANJELINA CIRCLE SOUTH
BURKE PLACE
PRESCOTT CIRCLE WEST
LONDON LANE
DR
PRESCOTT CIRCLE EAST
MONICA
CHELTON ROAD
CLARENDON PLACE
BAILEY PLACE
NEWTON DRIVE
KEY TO NUMBERED STREETS
MOONBEAM CIRCLE NORTH...1
MOONBEAM CIRCLE SOUTH...3
MOONBEAM DRIVE..........2
MONICA DRIVE
HANCOCK EXPRESSWAY
ZONE X
ZONE AE
ZONE AE
ZONE AE
ZONE X
ZONE X
ZONE X
ZONE X
5938
5942
5958
5960
5962
5964
5935
5935
5938
5946
5951
5952
5955
5922
5923
5927
5931
5942
Culvert
FOXRIDGE DRIVE
BARRYKNOLL DRIVE
ZONE X
DRENNAN ROAD
2
EL PASO COUNTY
UNINCORPORATED AREAS
080059


ZONE X
LIMIT OF DETAILED STUDY
JOINS PANEL 0782
ZONE X
100 AND 500-YEAR FLOOD CONTAINED IN CHANNEL
31
36
Field Drainage
100-YEAR FLOOD CONTAINED IN CHANNEL
AND 500-YEAR FLOOD
NTAI''ED IN CHANNEL
REVISED AREA
APPROXIMATE SCALE IN FEET
500 0 500
ZONE X
OF COLORADO SPRINGS
080060
Windmill Gulch
1
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
PANEL 761 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
REVISED TO REFLECT LOMR DATED DEC 1 4 1999
MAP NUMBER
08041C0761 F
EFFECTIVE DATE:
MARCH 17, 1997
Federal Emergency Management Agency

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Peterson Field Drainage (Cont'd)								
			Revised Data					
AA	11,858	60	324	7.6	5,957.0	5,957.0	5,957.0	0.0
AB	12,655	70	301	8.2	5,963.5	5,963.5	5,963.5	0.0

[1]Feet Above Confluence With Sand Creek

REVISED TO REFLECT LOMR DATED DEC 14 1999

TABLE 5

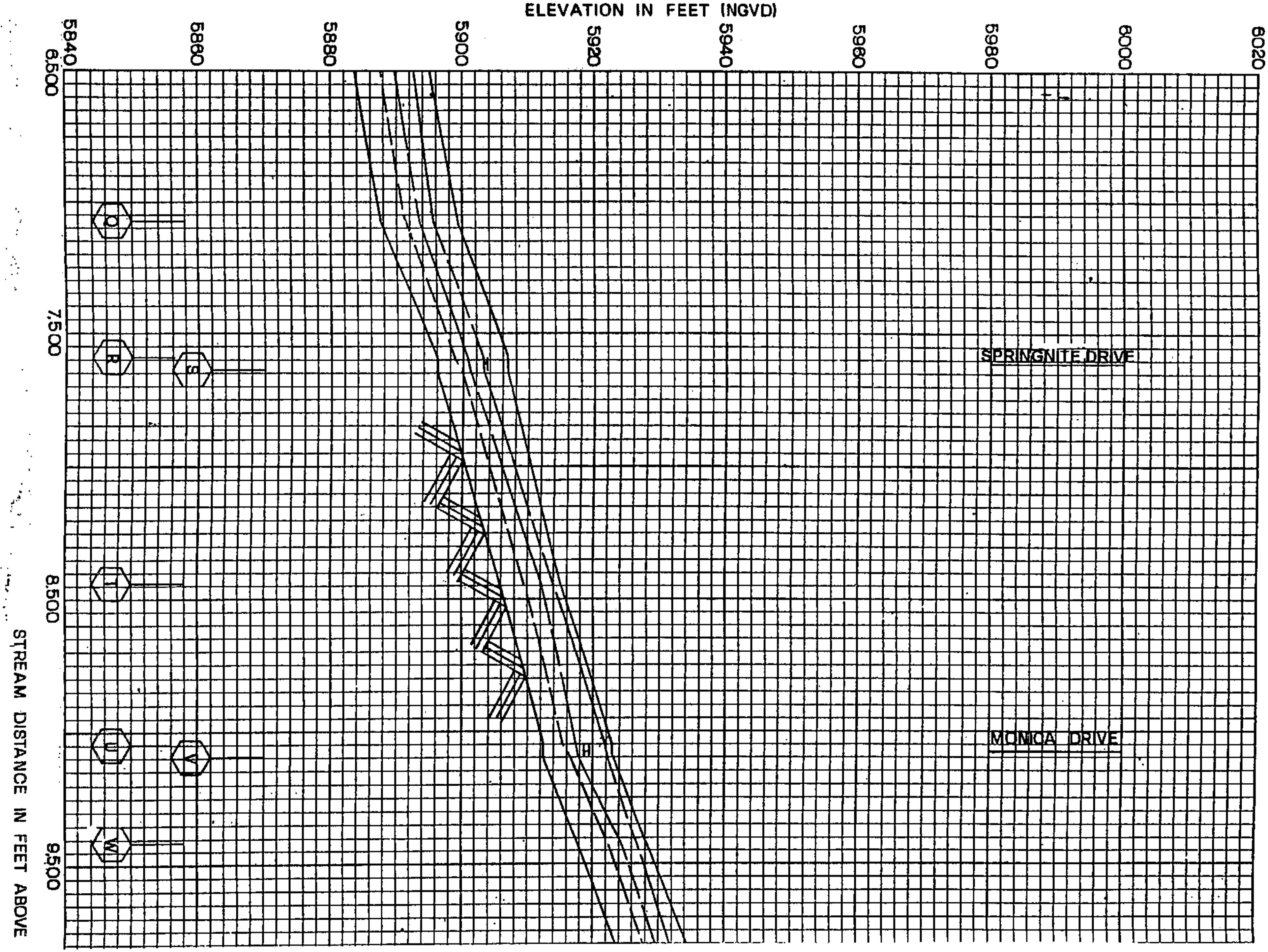
FEDERAL EMERGENCY MANAGEMENT AGENCY

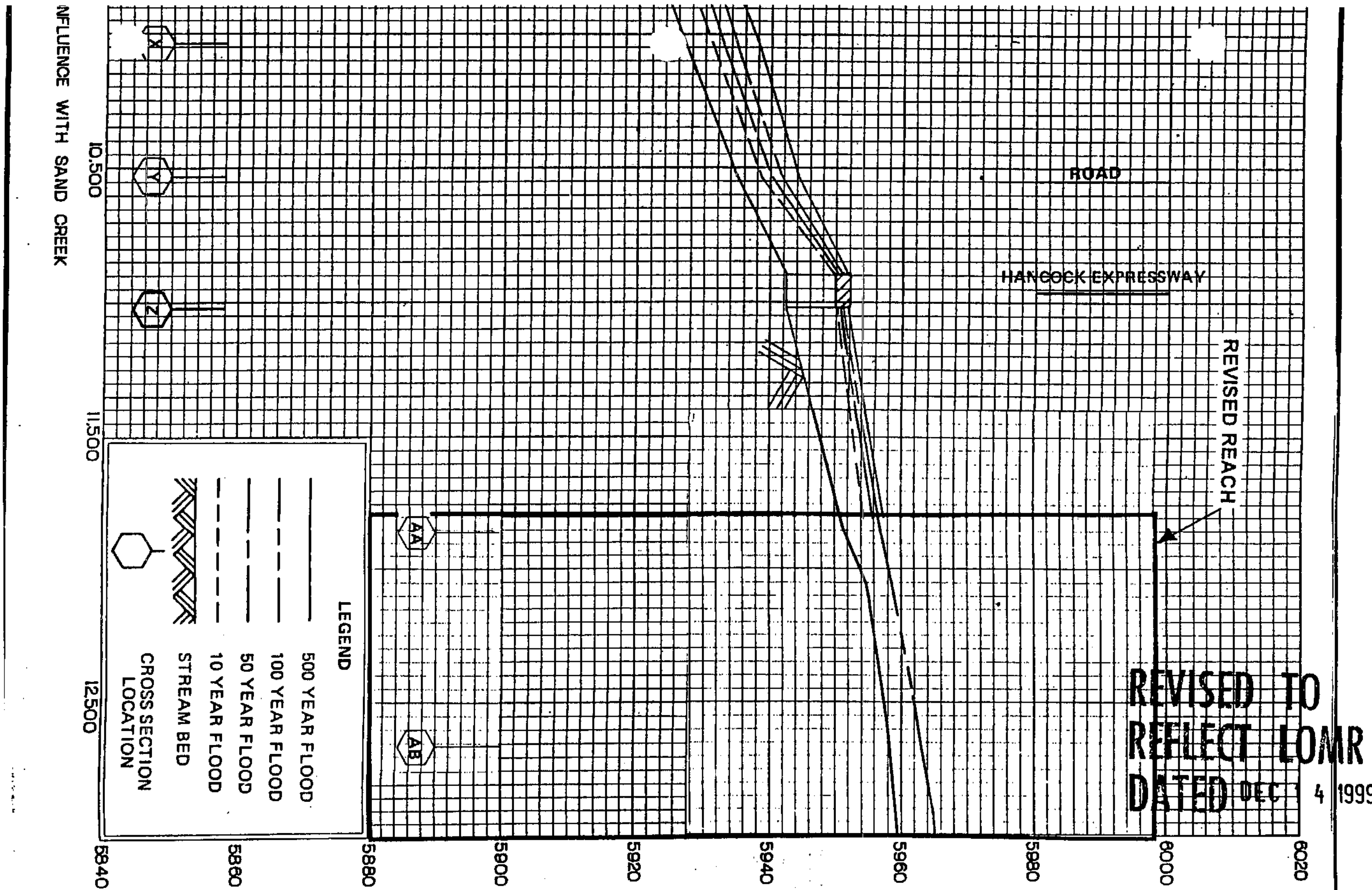
EL PASO COUNTY, CO

AND INCORPORATED AREAS

FLOODWAY DATA

PETERSON FIELD DRAINAGE


ELEVATION IN FEET (NGVD)
5840
5860
5880
5900
5920
5940
5960
5980
6000
6020
6,500
7,500
8,500
9,500
STREAM DISTANCE IN FEET ABOVE
SPRINGNITE DRIVE
MONICA DRIVE
Q
R
S
T
U
V
W



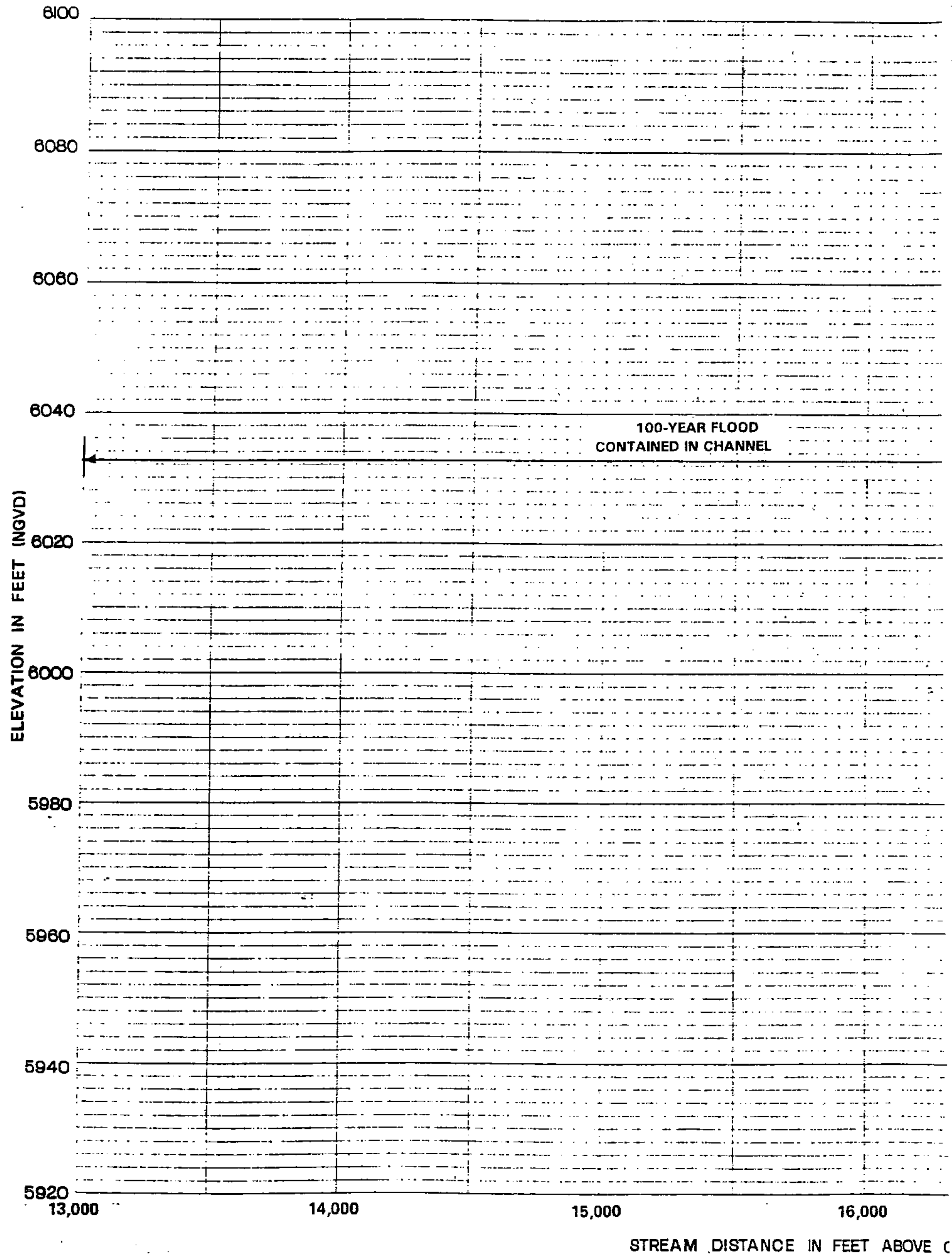
REVISED TO REFLECT LOMR DATED DEC 14 1999

FEDERAL EMERGENCY MANAGEMENT AGENCY

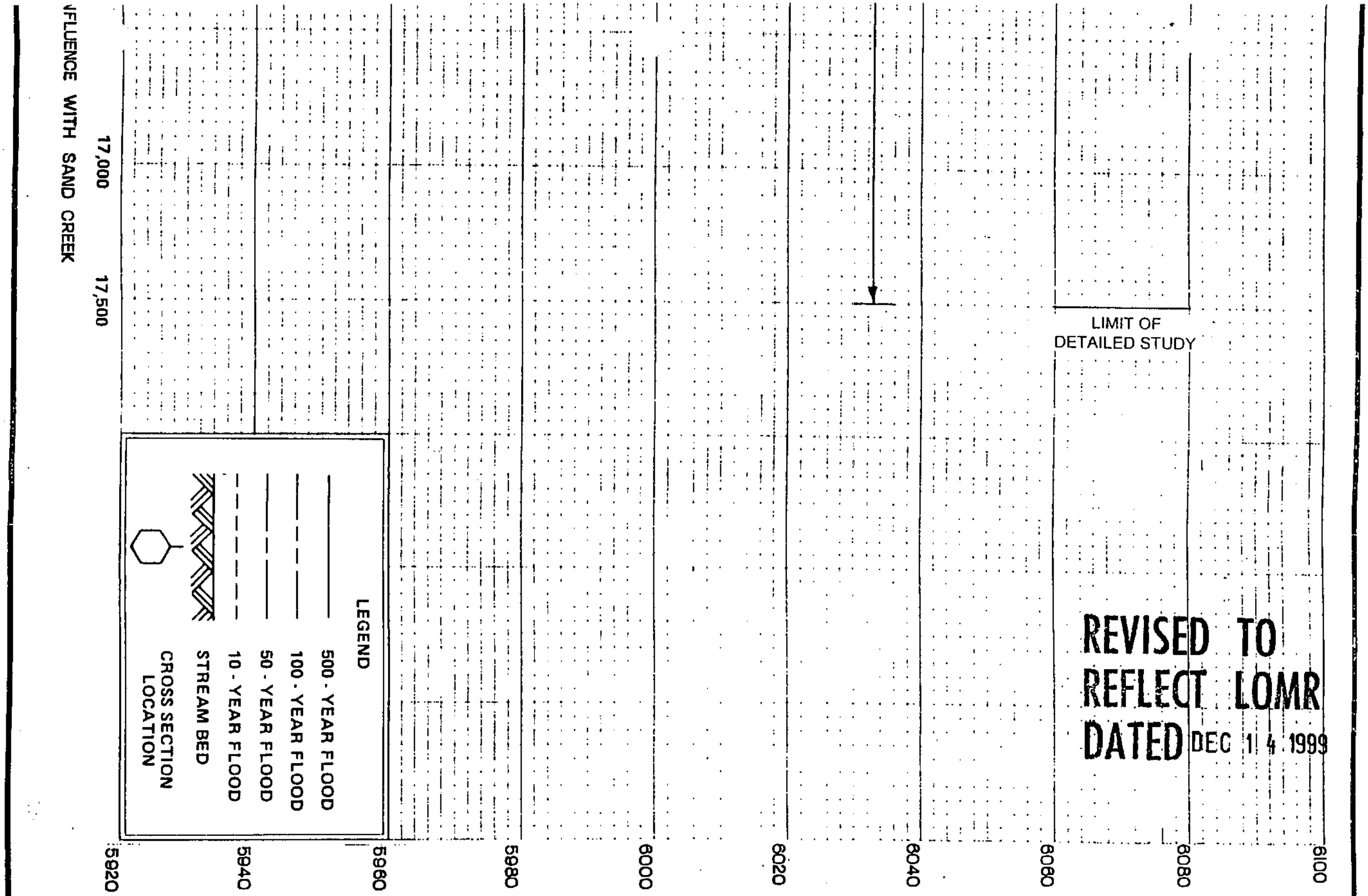
EL PASO COUNTY, CO
AND INCORPORATED AREAS

FLOOD PROFILES

PETERSON FIELD DRAINAGE



ELEVATION IN FEET (NGVD)
6100
6080
6060
6040
6020
6000
5980
5960
5940
5920
100-YEAR FLOOD
CONTAINED IN CHANNEL
13,000
14,000
15,000
16,000
STREAM DISTANCE IN FEET ABOVE C



FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY,CO
AND INCORPORATED AREAS

FLOOD PROFILES

PETERSON FIELD DRAINAGE

178P

Hydrology

Location: LITTLE JOHNSON – HISTORIC H-2.1
Area: 60.6 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
PASTURE	0.25	0.35	99
STREET	0.90	0.95	1

Composite: C5 0.26 C100: 0.36 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
OVERLAND	1000	2		40
SWALE	1400	1.5	2.5	9.3

Tc Total: 48.3

Intensity, I (inches/hr) from Fig 5-1

I5 1.7 in/hr I100: 3.0 in/hr

Peak Flow: Q = CIA in cfs

Q5 26.8 cfs Q100: 65.4 cfs

Hydrology

Location: PETERSON FIELD HISTORIC H-1.1
Area: 65.8 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
PASTURE	0.25	0.35	100

Composite: C5 0.25 C100: 0.35 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
OVERLAND	600	3		27.1
SWALE	700	1.5	2.5	4.7

Tc Total: 31.8

Intensity, I (inches/hr) from Fig 5-1

I5 2.3 in/hr I100: 4.0 in/h

Peak Flow: Q = CIA in cfs

Q5 37.8 cfs Q100: 92.1 cfs

Hydrology

Location: WINDMILL GULCH HISTORIC H-3.1
Area: 31.9 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
PASTURE	0.25	0.35	99
STREET	0.90	0.95	1

Composite: C5 0.26 C100: 0.36 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
OVERLAND	1000	2.5		36.7

Tc Total: 36.7

Intensity, I (inches/hr) from Fig 5-1

I5 2.1 in/hr I100: 3.7 in/hr

Peak Flow: Q = CIA in cfs

Q5 17.4 cfs Q100: 42.5 cfs

Hydrology

Location: WINDMILL GULCH HISTORIC 4.1
Area: 111.8 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
PASTURE	0.25	0.35	99
STREET	0.90	0.95	1

Composite: C5 0.26 C100: 0.36 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
OVERLAND	1000	2.5		36.7
SWALE	1700	5	6	4.7

Tc Total: 41.4

Intensity, I (inches/hr) from Fig 5-1

I5 1.9 in/hr I100: 3.4 in/h

Peak Flow: Q = CIA in cfs

Q5 55.2 cfs Q100: 136.8 cfs

Hydrology

Location: LJ-1
Area: 8.65 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
RESIDENTIAL	0.60	0.70	100

Composite: C5 0.60 C100: 0.70 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
OVERLAND	220	2.5		10.2
GUTTER	740	1.5	2.5	4.9

Tc Total: 15.1

Intensity, I (inches/hr) from Fig 5-1

I5 3.4 in/hr I100: 5.8 in/hr

Peak Flow: Q = CIA in cfs

Q5 17.6 cfs Q100: 35.1 cfs

Hydrology

Location: LJ-2
Area: 4.86 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
RESIDENTIAL	0.60	0.70	100

Composite: C5 0.60 C100: 0.70 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
OVERLAND	200	2		10.5
GUTTER	960	1.5	2.5	6.4

Tc Total: 16.9

Intensity, I (inches/hr) from Fig 5-1

I5 3.2 in/hr I100: 5.6 in/h

Peak Flow: Q = CIA in cfs

Q5 9.3 cfs Q100: 19.1 cfs

REV. 8-5-00

Hydro. . gy

Location: LJ-3
Area: 8.99 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
RES	0.60	0.70	100

Composite: C5 0.60 C100: 0.70 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
OVERLAND	250	2.5		10.9
GUTTER	800	2	3.5	3.8

Tc Total: 14.7

Intensity, I (inches/hr) from Fig 5-1

I5 3.4 in/hr I100: 5.8 in/hr

Peak Flow: Q = CIA in cfs

Q5 18.3 cfs Q100: 36.5 cfs

Hydrology

Location: LJ-4
Area: 0.77 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
STREET	0.90	0.95	80
LANDSCAPE	0.25	0.35	20

Composite: C5 0.77 C100: 0.83 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	10	2		1.6
Gutter	920	1.5	2.5	6.1

Tc Total: 7.7

Intensity, I (inches/hr) from Fig 5-1

I5 4.4 in/hr I100: 7.7 in/h

Peak Flow: Q = CIA in cfs

Q5 2.6 cfs Q100: 4.9 cfs

8-5-00

Hydrology

Location: LS-5
Area: 4.81 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
STREET	0.90	0.95	5
School	0.75	0.85	95

Composite: C5 0.76 C100: 0.86 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	500'	3		14.2

Tc Total: 14.2

Intensity, I (inches/hr) from Fig 5-1

I5 3.5 in/hr I100: 6.0 in/hr

Peak Flow: Q = CIA in cfs

Q5 12.8 cfs Q100: 24.8 cfs

Hydrology

Location: LS-6
Area: 0.85 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
STREET	0.90	0.95	40
PIP.	0.75	0.85	60

Composite: C5 0.81 C100: 0.89 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland			Min.	

Tc Total: Min

Intensity, I (inches/hr) from Fig 5-1

I5 5.2 in/hr I100: 9.0 in/h

Peak Flow: Q = CIA in cfs

Q5 3.6 cfs Q100: 6.8 cfs

Hydrology

Location: LS-7
Area: 7.25 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Industrial	0.70	0.80	100

Composite: C5: 0.70 C100: 0.80 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	300	2		10.3
Swale	200	2	3	3.9

Tc Total: 14.2

Intensity, I (inches/hr) from Fig 5-1

I5: 3.5 in/hr I100: 6.0 in/hr

Peak Flow: Q = CIA in cfs

Q5: 19.0 cfs Q100: 37.2 cfs

Hydrology

Location: LS-8
Area: 14.04 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Industrial	0.70	0.80	100

Composite: C5: 0.70 C100: 0.80 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	300	2		10.3
Swale	600	2	3	3.3

Tc Total: 13.6

Intensity, I (inches/hr) from Fig 5-1

I5: 3.6 in/hr I100: 6.1 in/hr

Peak Flow: Q = CIA in cfs

Q5: 35.4 cfs Q100: 68.5 cfs

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Hydrology

Location: DP-1 LITTLE JOHNSON
Area: 14.39 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
LJ-3 (7.84)	0.60	0.70	54
LJ-4 (0.77)	0.77	0.83	5
LJ-5 (5.78)	0.76	0.86	41

Composite: C5 0.67 C100: 0.77 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
LJ-3				14.7
Pipe	350	1.3	5	1.2

Tc Total: 15.9

Intensity, I (inches/hr) from Fig 5-1

I5 3.9 in/hr I100: 6.8 in/hr

Peak Flow: Q = CIA in cfs

Q5 37.6 cfs Q100: 75.3 cfs

Hydrology

Location: DP-2 LITTLE JOHNSON
Area: 22.11 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
LJ-1 (8.65)	0.60	0.70	39
LJ-2 (4.86)	0.60	0.70	22
LJ-6 (0.85)	0.81	0.89	4
LJ-7 (7.75)	0.70	0.80	35

Composite: C5 0.64 C100: 0.76 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
LJ-2	16.9			16.9
Pipe	430	1.5	5	1.4

Tc Total: 18.3

Intensity, I (inches/hr) from Fig 5-1

I5 3.1 in/hr I100: 5.3 in/hr

Peak Flow: Q = CIA in cfs

Q5 43.9 cfs Q100: 89.1 cfs

8-7-00

Hydrology

Location: DP-3 LITTLE JOHNSON
Area: 50.54 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
DP-1 (14.39)	0.67	0.77	28
DP-2 (22.11)	0.64	0.76	44
LJ-8 (14.04)	0.70	0.80	28

Composite: C5 0.67 C100: 0.77 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
DP-2				18.3
Pipe	820	1.5	5	2.7

Tc Total: 21

Intensity, I (inches/hr) from Fig 5-1

I5 2.9 in/hr I100: 5.0 in/hr

Peak Flow: Q = CIA in cfs

Q5 98.2 cfs Q100: 194.6 cfs

Hydrology

Location: ______
Area: ______ Ac.
Soil or Landuse: ______

Runoff Coefficient, C:

Area Zone	C5	C100	% Area

Composite: C5 ______ C100: ______ 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc

Tc Total: ______

Intensity, I (inches/hr) from Fig 5-1

I5 ______ in/hr I100: ______ in/h

Peak Flow: Q = CIA in cfs

Q5 ______ cfs Q100: ______ cfs

LITTLE JOHNSON BASIN

DP-3 - RESIDENTIAL ONLY

AREA = 50.54 ACRES

BASIN	AREA	C_5	C_{100}	% AREA
LJ-1	8.65	0.60	0.70	17
LJ-2	4.86	0.60	0.70	10
LJ-3	8.99	0.60	0.70	18
LJ-4	0.77	0.77	0.83	1
LJ-5	4.81	0.76	0.86	9
LJ-6	0.85	0.25	0.35	2
LJ-7	7.75	0.25	0.35	15
LJ-8	14.04	0.25	0.35	28
	50.72	0.46	0.56	100

TRAVEL - LJ-2 16.9 min

OVERLAND - 900' S = 1.5% V = 3 5 min
Temp. Swale

21.9 TOTAL

$I_5 = 2.8$

$I_{100} = 4.9$

$Q = CIA$

$Q_5 = 0.46 \times 2.8 \times 50.54 = 65.1$ cfs

$Q_{100} = 0.56 \times 4.9 \times 50.54 = 138.7$ cfs

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TEMPORARY DETENTION POND
LITTLE JOHNSON DP-3

Q = CIA

C_{100} = 0.56 AREA = 50.72 AC

MAXIMUM OUTFLOW = 30 cfs

VOLUME = (Q − MAX OUT) ($\frac{60\ sec}{minute}$) x STORM DURATION

STORM DURATION	INTENSITY	(Q-30)	VOLUME (FT³)
10 min	7.0	168	100,870
20 min	5.1	144	137,210
30 min	4.2	89	159,966
40 min	3.4	66	158,947
50 min	3.0	55	164,721 → 3.8 AC FT
60 min	2.6	44	156,900

→ MAX. OUTFLOW = 20 cfs ←

		(Q-20)	
40 min	3.4	76	182,448
50 min	3.0	65	195,000 → 4.5 AC. FT
60 min	2.6	54	194,400

USE Q_{max} Out = 20 cfs & 4.5 Ac-Ft Pond

Historic Q_5 = 26.8 , Q_{100} = 65.4 cfs

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At-grade Inlet Basin LJ-1

$Q_5 = 17.6$ cfs

$Q_{100} = 35.1$ cfs

$S = 1.4\%$

$T = 3.04\left[\frac{Q}{S^{1/2}}\right]^{0.375}$ $T_5 = 19.8$ $T_{100} = 25.7$

$F_w = 16.4\left[(T-2)(0.02)\right]^{1/6} S^{1/2}$ $F_{w5} = 1.63$ $F_{w100} = 1.70$

$L_1 = 2.49\,(0.02)^{0.3}\,T\,F_w$ $L_{1_5} = 24.8$ $L_{1_{100}} = 33.6$

$L_2 = 3.27\,(0.02)^{0.5}\,T\,F_w$ $L_{2_5} = 14.9$ $L_{2_{100}} = 20.2$

$L_3 = 1.65\,T\,F_w$ $L_{3_5} = 53.3$ $L_{3_{100}} = 72.1$

$Q_i = Q\,\frac{L_i}{L_1}$ for $L_i < L_2$ $Q_i = Q\left(\frac{L_i}{L_3}\right)^{0.4}$ for $L_i > L_2$

Try $L_i = 12'$

$Q_{i_5} = 8.5$ cfs $Q_{i_{100}} = 12.5$ cfs

$Q_{by_5} = 9.1$ cfs $Q_{by_{100}} = 22.6$ cfs

Min 18" RCP @ 2%

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SUMP INLET LJ-2 -

$Q_5 = 9.3$ cfs + 9.1 cfs FROM LJ-1 = 18.4 cfs

$Q_{100} = 19.1$ cfs + 22.6 cfs FROM LJ-1 = 41.7 cfs

TRY L = 12'

$Q_{100} = 1.7(Li + 1.8(w))(d_{max} + 3/12)^{1.85}$

$42 = 1.7(12 + 1.8(3))(d_{max} + 3/12)^{1.85}$

$1.352 = (d_{max} + 3/12)^{1.85}$

$0.93 = d_{max} < 1'$ OK

INLET CAPACITY = 12 x 3 = 36 cfs < 42
6 cfs over top -
NO

TRY L = 15'

$Q_{100} = 1.7(Li + 1.8(w))(d_{max} + 3/12)^{1.85}$

$42 = 1.7(15 + 1.8(3))(d_{max} + 3/12)^{1.85}$

$1.211 = (d_{max} + 3/12)^{1.85}$

$0.86 = d_{max} < 1'$ OK

INLET CAPACITY = 15 x 3 = 45 cfs > 42 OK

30" RCP OUT @ 1% MIN GRADE

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AT GRADE INLET - BASIN LJ-3

$Q_5 = 18.3$ $Q_{100} = 36.5$ $S = 1.3\%$

$T = 3.04\left[\frac{Q}{S^{1/2}}\right]^{.375}$ $T_5 = 19.3$ $T_{100} = 25.1$

$F_W = 16.4\left[(T-2)(0.02)\right]^{1/6} S^{1/2}$ $F_{W_5} = 1.57$ $F_{W_{100}}$ 1.64

$L_1 = 2.49(0.02)^{0.3}(T)(F_W)$ $L_{1_5} = 23.3$ $L_{1_{100}} = 31.7$

$L_2 = 3.27(0.02)^{0.5}(T)(F_W)$ $L_{2_5} = 14.0$ $L_{2_{100}} = 19.0$

$L_3 = 1.65(F_W)(T)$ $L_{3_5} = 50.0$ $L_{3_{100}} = 67.9$

$Q_i = Q\frac{L_i}{L_1}$ for $L_i < L_2$ $Q_i = Q\left(\frac{L_i}{L_3}\right)^{0.4}$ for $L_i > L_2$

Try $L_i = 8'$

$Q_{i_5} = 16.0\left(\frac{8}{23.3}\right) = 5.5$ cfs $Q_{i_{100}} = 31.8\left(\frac{8}{31.7}\right) = 8.0$ cfs

$Q_{5_{by}} = 16.0 - 5.5 = 11.5$ cfs $Q_{100\,by} = 31.8 - 8.0 = 23.8$ cfs

Sump Inlet LJ - 4

$Q_5 = 2.6$ cfs

$Q_{100} = 4.9$ cfs

Try $L_i = 4'$

$$Q_{100} = 1.7\left(L_i + 1.8(w)\right)\left(d_{max} + 3/12\right)^{1.85} \qquad w = 3'$$

$$4.9 = 1.7\left(4 + 1.8(3)\right)\left(d_{max} + 0.25\right)^{1.85}$$

$$d_{max} = 0.28' < 1' \checkmark \text{ ok}$$

Sump Inlet LJ - 5

$Q_5 = 12.8 + 11.5$ (flowby LJ-3) $= 24.3$ cfs

$Q_{100} = 24.8 + 23.8$ (flowby LJ-3) $= 48.6$ cfs

Try $L_i = 15'$

$$Q = 1.7\left(L_i + 1.8(w)\right)\left(d_{max} + w/12\right)^{1.85} \qquad w = 3'$$

$d_{max_5} = 0.57'$ ✓ ok

$d_{max_{100}} = 0.95'$ ✓ ok marginal → if overtop occurs, the 4' inlet to south has extra capacity

Hydrology

Location: PF-1
Area: 9.98 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Comm/Ind.	0.75	0.80	100

Composite: C5 0.75 C100: 0.80 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	300	2.5		8.4
Gutter	800	2.5	3.2	4.2

Tc Total: 12.6

Intensity, I (inches/hr) from Fig 5-1

I5 3.7 in/hr I100: 6.3 in/hr

Peak Flow: Q = CIA in cfs

Q5 27.7 cfs Q100: 50.3 cfs

Hydrology

Location: PF-2A
Area: 1.0 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Street	0.90	0.95	90
Landscape	0.25	0.35	10

Composite: C5 0.84 C100: 0.89 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	100	2		3.9
Gutter	950	3	4	4.0

Tc Total: 7.9

Intensity, I (inches/hr) from Fig 5-1

I5 4.5 in/hr I100: 7.6 in/hr

Peak Flow: Q = CIA in cfs

Q5 3.8 cfs Q100: 6.8 cfs

Hydrology

Location: PF-2B
Area: 5.96 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
COMM/IND	0.75	0.80	80
STREET	0.90	0.95	15
LANDSCAPE	0.25	0.35	5

Composite: C5 0.75 C100: 0.80 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
OVERLAND	300	2.5		8.4
Gutter	450	3	4	1.9

Tc Total: 10.3

Intensity, I (inches/hr) from Fig 5-1

I5 4.0 in/hr I100: 6.8 in/hr

Peak Flow: Q = CIA in cfs

Q5 17.9 cfs Q100: 32.4 cfs

Hydrology

Location: PF-3
Area: 8.83 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
COMM/IND	0.75	0.80	100

Composite: C5 0.75 C100: 0.80 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
OVERLAND	300	2		9.0
GUTTER/SWALE	800	2	3	4.4

Tc Total: 13.4

Intensity, I (inches/hr) from Fig 5-1

I5 3.6 in/hr I100: 6.1 in/h

Peak Flow: Q = CIA in cfs

Q5 23.8 cfs Q100: 43.1 cfs

Hydrology

Location: PF-4
Area: 1.25 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
STREET	0.90	0.95	80
LANDSCAPE	0.25	0.35	20

Composite: C5 0.77 C100: 0.83 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
OVERLAND	20	2		5.7
GUTTER	1400	2	3	7.8

Tc Total: 13.5

Intensity, I (inches/hr) from Fig 5-1

I5 3.6 in/hr I100: 6.1 in/hr

Peak Flow: Q = CIA in cfs

Q5 3.5 cfs Q100: 6.3 cfs

Hydrology

Location: PF-5
Area: 8.68 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
RESIDENTIAL	0.60	0.70	100

Composite: C5 0.60 C100: 0.70 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
OVERLAND	230	2		11.3
GUTTER	860	1.8	2.5	5.7

Tc Total: 17.0

Intensity, I (inches/hr) from Fig 5-1

I5 3.3 in/hr I100: 5.6 in/h

Peak Flow: Q = CIA in cfs

Q5 17.2 cfs Q100: 34.0 cfs

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Hydrology

Location: PF-6
Area: 5.77 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
RES	0.60	0.70	48
PARK	0.30	0.55	52

Composite: C5 0.44 C100: 0.62 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
OVERLAND	300	1.8		18.1
SWALE	250	2.5	3	1.4
GUTTER	200	1.5	2.	1.6

Tc Total: 21.7

Intensity, I (inches/hr) from Fig 5-1

I5 2.9 in/hr I100: 5.0 in/hr

Peak Flow: Q = CIA in cfs

Q5 7.4 cfs Q100: 17.9 cfs

Hydrology

Location: PF-7
Area: 3.03 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
RESIDENTIAL	0.60	0.70	100

Composite: C5 0.60 C100: 0.70 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
OVERLAND	350	2.5		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Tc Total: 12.9

Intensity, I (inches/hr) from Fig 5-1

I5 3.7 in/hr I100: 6.2 in/h

Peak Flow: Q = CIA in cfs

Q5 6.7 cfs Q100: 13.2 cfs

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Hydrc. gy

Location: PF-8
Area: 0.82 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
STREET	0.90	0.95	43
School	0.60	0.70	57

Composite: C5 0.73 C100: 0.81 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	130	2		8.5
Gutter	1200	1.3	2.5	8

Tc Total: 16.5

Intensity, I (inches/hr) from Fig 5-1

I5 3.3 in/hr I100: 5.6 in/hr

Peak Flow: Q = CIA in cfs

Q5 2.0 cfs Q100: 3.7 cfs

Hydrology

Location: PF-9
Area: 2.47 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Res	0.60	0.70	100

Composite: C5 0.60 C100: 0.70 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	200	2		10.5
Gutter	1070	2	3	5.9

Tc Total: 16.4

Intensity, I (inches/hr) from Fig 5-1

I5 3.3 in/hr I100: 5.6 in/h

Peak Flow: Q = CIA in cfs

Q5 12.8 cfs Q100: 25.4 cfs

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Hydrology

Location: PF-10
Area: 19.25 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
School	0.75	0.85	26
Commercial	0.75	0.80	74

Composite: C5 0.75 C100: 0.81 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	300	2		9
Swale	800	2	3	4.4

Tc Total: 13.4

Intensity, I (inches/hr) from Fig 5-1

I5 3.6 in/hr I100: 6.1 in/hr

Peak Flow: Q = CIA in cfs

Q5 52.0 cfs Q100: 95.1 cfs

Hydrology

Location: PF-11
Area: 1.11 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Res.	0.60	0.70	100

Composite: C5 0.60 C100: 0.70 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	100	2.5		6.9

Tc Total: 6.9

Intensity, I (inches/hr) from Fig 5-1

I5 4.6 in/hr I100: 8.0 in/h

Peak Flow: Q = CIA in cfs

Q5 3.1 cfs Q100: 6.2 cfs

AT GRADE INLET - BASIN PF-5

$Q_5 = 17.2$ $Q_{100} = 34.0$ $S = 1.50\%$

$T = 304\left[\frac{Q}{S^{1/2}}\right]^{.375}$ $T_5 = 19.4$ $T_{100} = 25.1$

$F_W = 16.4\left[(T-2)(0.02)\right]^{1/6} S^{1/2}$ $F_{W_5} = 1.68$ $F_{W_{100}} = 1.77$

$L_1 = 2.49(0.02)^{0.3}(T)(F_W)$ $L_{1_5} = 25.1$ $L_{1_{100}} = 34.2$

$L_2 = 3.27(0.02)^{0.5}(T)(F_W)$ $L_{2_5} = 15.1$ $L_{2_{100}}$ 20.5

$L_3 = 1.65(F_W)(T)$ $L_{3_5} = 53.8$ $L_{3_{100}} = 73.3$

$Q_i = Q\frac{L_i}{L_1}$ for $L_i < L_2$ $Q_i = Q\left(\frac{L_i}{L_3}\right)^{0.4}$ for $L_i > L_2$

TRY 12'

$Q_{i_5} = 17.2\left(\frac{12}{25.1}\right) = 8.2$ cfs $Q_{i_{100}} = 34.0\left(\frac{12}{34.2}\right) = 11.9$ cfs

Q_5 by $= 17.2 - 8.2 = 9.0$ cfs Q_{100} by $= 34.0 - 11.9 = 22.1$ cfs

18" RCP OUTLET

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AT GRADE INLET - BASIN PF-6

$Q_5 = 7.4$ $Q_{100} = 17.9$ $S = 1.33\%$

$T = 3.04\left[\frac{Q}{S^{1/2}}\right]^{.375}$ $T_5 = 16.1$ $T_{100} = 22.4$

$F_w = 16.4\left[(T-2)(0.02)\right]^{1/6} S^{1/2}$ $F_{w_5} = .153$ $F_{w_{100}} = .163$

$L_1 = 2.49\,(0.02)^{0.3}(T)(F_w)$ $L_{1\,5} = 19.0$ $L_{1\,100} = 28.1$

$L_2 = 3.27\,(0.02)^{0.5}(T)(F_w)$ $L_{2\,5} = 11.4$ $L_{2\,100} = 16.9$

$L_3 = 1.65\,(F_w)(T)$ $L_{3_5} = 40.6$ $L_{3_{100}} = 60.2$

$Q_i = Q\,\frac{L_i}{L_1}$ for $L_i < L_2$ $Q_i = Q\left(\frac{L_i}{L_3}\right)^{0.4}$ for $L_i > L_2$

TRY 10'

$Q_{i_5} = 9.8\left(\frac{10}{19.0}\right) = 5.2$ cfs $Q_{i_{100}} = 23.7\left(\frac{10}{28.1}\right) = 8.4$ cfs

$Q_{5\,by} = 9.8 - 5.2 = 4.6$ cfs $Q_{100\,by} = 23.7 - 8.4 = 15.3$ cfs

18" RCP OUTLET - 1% MIN. GRADE

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AT GRADE INLET BASIN PF-7

Q_5: 6.7 + 9.0 (PF-5) + 4.6 (PF-6) = 20.3 cfs   S = 1.33%

Q_{100}: 13.2 + 19.1 (PF-5) + 15.3 (PF-6) = 47.6 cfs

$$T = 3.04 \left[\frac{Q}{S^{1/2}}\right]^{.375}$$ $T_5 = 21.1$ $T_{100} = 29.1$

$$F_W = 16.4 \left[(T-2)(0.02)\right]^{1/6} S^{1/2}$$ $F_{W_5} = 1.61$ $F_{W_{100}} = 1.71$

$$L_1 = 2.49 (0.02)^{0.3} (T)(F_W)$$ $L_{1_5} = 26.2$ $L_{1_{100}} = 38.3$

$$L_2 = 3.27 (0.02)^{0.5} (T)(F_W)$$ $L_{2_5} = 15.7$ $L_{2_{100}} = 23.0$

$$L_3 = 1.65 (T)(F_W)$$ $L_{3_5} = 56.1$ $L_{3_{100}} = 82.1$

$Qi = Q \frac{Li}{L_1}$ for $Li < L_2$ $Qi = Q \left(\frac{Li}{L_3}\right)^{0.4}$ for $Li > L_2$

TRY 15'

$Qi_5 = 20.3\left(\frac{15}{26.2}\right) = 11.6$ cfs $Qi_{100} = 47.6\left(\frac{15}{38.3}\right) = 18.6$ cfs

Q_5 by = 20.3 − 11.6 = 8.7 cfs Q_{100} by = 47.6 − 18.6 = 29 cfs

24" RCP outlet

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PETERSON FIELD

DATE 8-8-00 PAGE ___ of ___

SUMP INLET BASIN PF-9

$Q_5 = 12.8 + 8.7\,(PF\text{-}7) = 21.5$ cfs $S = 1.33\%$

$Q_{100} = 25.4 + 29.0\,(PF\text{-}7) = 54.4$ cfs

TRY L = 18'

$Q_{100} = 1.7(L_i + 1.8w)(d_{max} + 3/12)^{1.85}$

$54.4 = 1.7(18 + 1.8(3))(d_{max} + 3/12)^{1.85}$

$1.368 = (d_{max} + 3/12)^{1.85}$

$0.93 = d_{max} < 1'$

$Q_5 = 1.7(L_i + 1.8w)(d_{max} + 3/12)^{1.85}$

$21.5 = 1.7(18 + 1.8(3))(d_{max} + 3/12)^{1.85}$

$0.540 = (d_{max} + 3/12)^{1.85}$

$0.47 = d_{max} < 0.67$ OK

INLET CAPACITY: $18 \times 3 = 54$ cfs ≈ 54.4 cfs

SUMP INLET BASIN PF-8

$Q_5 = 4.4$ cfs $Q_{100} = 8.3$ cfs $S = 1.33\%$ $L_i = 4'$

$Q_{100} = 1.7(L_i + 1.8(w))(d_{max} + 3/12)^{1.85}$

$8.3 = 1.7(4 + 1.8(3))(d_{max} + 3/12)^{1.85}$

$0.519 = (d_{max} + 3/12)^{1.85}$

$0.45 = d_{max}$ OK

INLET CAPACITY: $4 \times 3 = 12$ cfs > 8.3 cfs

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Hydrology

Location: WG-1
Area: 21.23 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
IND/COMM	0.70	0.80	100

Composite: C5 0.70 C100: 0.80 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
OVERLAND	300	2		10.3
SWALE	500	2	3	2.8

Tc Total: 12.1

Intensity, I (inches/hr) from Fig 5-1

I5 3.7 in/hr I100: 6.4 in/hr

Peak Flow: Q = CIA in cfs

Q5 55.0 cfs Q100: 108.7 cfs

Hydrology

Location: WG-2
Area: 8.56 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
RESIDENTIAL	0.60	0.70	100

Composite: C5 0.60 C100: 0.70 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
OVERLAND	250	2		11.8
GUTTER	850	2	3	4.7

Tc Total: 16.5

Intensity, I (inches/hr) from Fig 5-1

I5 3.2 in/hr I100: 5.6 in/h

Peak Flow: Q = CIA in cfs

Q5 18.4 cfs Q100: 37.5 cfs

REV. 8-8-00

Hydrology

Location: WG-3
Area: 6.77 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
RESIDENTIAL	0.60	0.70	100

Composite: C5 0.60 C100: 0.70 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
OVERLAND	210	2		10.8
GUTTER	940	1.5	2.5	6.3

Tc Total: 17.1

Intensity, I (inches/hr) from Fig 5-1

I5 3.2 in/hr I100: 5.5 in/hr

Peak Flow: Q = CIA in cfs

Q5 13.0 cfs Q100: 26.1 cfs

Hydrology

Location: WG-4
Area: 2.20 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
RESIDENTIAL	0.60	0.70	87
STREET	0.90	0.95	13

Composite: C5 0.64 C100: 0.73 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
OVERLAND	200	2.5		9.8
GUTTER	740	1.5	2.5	4.9

Tc Total: 14.7

Intensity, I (inches/hr) from Fig 5-1

I5 3.4 in/hr I100: 5.9 in/h

Peak Flow: Q = CIA in cfs

Q5 4.8 cfs Q100: 9.5 cfs

Hydrology

Location: W6-5
Area: 8.99 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
PIP	0.70	0.80	100

Composite: C5: 0.70 C100: 0.80 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	300	2		10.3
Swale	700	1	2	5.8

Tc Total: 16.1

Intensity, I (inches/hr) from Fig 5-1

I5: 3.3 in/hr I100: 5.6 in/hr

Peak Flow: Q = CIA in cfs

Q5: 20.8 cfs Q100: 40.3 cfs

Hydrology

Location: ______
Area: ______ Ac.
Soil or Landuse: ______

Runoff Coefficient, C:

Area Zone	C5	C100	% Area

Composite: C5: ______ C100: ______ 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc

Tc Total: ______

Intensity, I (inches/hr) from Fig 5-1

I5: ______ in/hr I100: ______ in/h

Peak Flow: Q = CIA in cfs

Q5: ______ cfs Q100: ______ cfs

Hydrology

Location: WG-7
Area: 3.09 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
OFFICE / INDUSTRIAL	0.70	0.80	100

Composite: C5 0.70 C100: 0.80 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
OVERLAND	100	2		6.0
GUTTER	250	2	3	4.2

Tc Total: 10.2

Intensity, I (inches/hr) from Fig 5-1

I5 4.0 in/hr I100: 6.9 in/hr

Peak Flow: Q = CIA in cfs

Q5 8.7 cfs Q100: 17.1 cfs

Hydrology

Location: WG-8
Area: 47.84 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
OFFICE/INDUSTRIAL	0.70	0.80	100

Composite: C5 0.70 C100: 0.80 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
OVERLAND	300	2		10.3
GUTTER/SWALE	800	2	4	3.3
GUTTER/PIPE	1000	4	10	1.7

Tc Total: 15.3

Intensity, I (inches/hr) from Fig 5-1

I5 3.3 in/hr I100: 5.7 in/h

Peak Flow: Q = CIA in cfs

Q5 110.5 cfs Q100: 218.2 cfs

Hydrology

Location: WG-9
Area: 1.57 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
STREET	0.90	0.95	80
LANDSCAPE	0.25	0.35	20

Composite: C5 0.77 C100: 0.83 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
OVERLAND	20	2		2.2
GUTTER	1600	4	5	5.3

Tc Total: 7.5

Intensity, I (inches/hr) from Fig 5-1

I5 4.5 in/hr   I100: 7.8 in/hr

Peak Flow: Q = CIA in cfs

Q5 5.4 cfs   Q100: 10.2 cfs

Hydrology

Location: WG-10
Area: 37.64 Ac.
Soil or Landuse: B

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
OFFICE/INDUSTRIAL	0.70	0.80	100

Composite: C5 0.70 C100: 0.80 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
OVERLAND	300	2		10.3
SWALE	1300	3	3	7.2

Tc Total: 17.5

Intensity, I (inches/hr) from Fig 5-1

I5 3.1 in/hr   I100: 5.4 in/h

Peak Flow: Q = CIA in cfs

Q5 81.7 cfs   Q100: 162.6 cfs

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DATE 8-8-00 PAGE of

AT GRADE INLET BASIN WG-2

$Q_5 = 18.4$ cfs $Q_{100} = 37.5$ cfs $S = 1.5\%$

$$T = 3.04 \left[\frac{Q}{S^{1/2}}\right]^{.375}$$ $T_5 = 19.9$ $T_{100} = 26.0$

$$F_W = 16.4 \left[(T-2)(0.02)\right]^{1/2} S^{1/2}$$ $F_{W_5} = 1.69$ $F_{W_{100}} = 1.78$

$$L_1 = 2.49 (0.02)^{0.3} (T)(F_W)$$ $L_1 5 = 25.9$ $L_1 100 = 35.6$

$$L_2 = 3.27 (0.02)^{0.5} (T)(F_W)$$ $L_2 5 = 15.6$ $L_2 100 = 21.4$

$$L_3 = 1.65 (T)(F_W)$$ $L_3 5 = 55.5$ $L_2 100 = 76.4$

$$Q_i = Q \frac{L_i}{L_1}$$

TRY 15'

$Q_{i_5} = 18.4\left(\frac{15}{25.9}\right) = 10.7$ cfs $Q_{i_{100}} = 37.5\left(\frac{15}{35.6}\right) = 15.8$ cfs

Q_5 by $= 18.4 - 10.7 = 7.7$ cfs Q_{100} by $= 37.5 - 15.8 = 21.7$ cfs

OUTLET IS 24" RCP @ 1.0% min

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AT GRADE INLET BASIN WG-3

$Q_5 = 13.0$ cfs $Q_{100} = 26.1$ cfs $S = 1.25\%$

$T = 3.04 \left[\frac{Q}{S^{1/2}} \right]^{.375}$ $T_5 = 18.1$ $T_{100} = 23.5$

$Fw = 16.4 \left[(T-2)(0.02) \right]^{1/6} S^{1/2}$ $Fw_5 = 1.52$ $Fw_{100} = 1.59$

$L_1 = 2.49\ (0.02)^{0.3}\ (T)(Fw)$ $L_1 5 = 21.2$ $L_1 100 = 28.8$

$L_2 = 3.27\ (0.02)^{0.5}\ (T)(Fw)$ $L_2 5 = 12.7$ $L_2 100 = 17.3$

$L_3 = 1.65\ (T)(Fw)$ $L_3 5 = 45.4$ $L_3 100 = 61.7$

$Qi = Q \frac{Li}{L_1}$

TRY 10'

$Qi_5 = 13.0 \left(\frac{10}{21.2} \right) = 6.1$ cfs $Qi_{100} = 26.1 \left(\frac{10}{28.8} \right) = 9.1$ cfs

Q_5 by $= 13.0 - 6.1 = 6.9$ cfs Q_{100} by $= 26.1 - 9.1 = 17.0$ cfs

STREET CAPACITY - MAGELLANS EAGLE $S = 2\%$

$Q_5 = 6.9$ (WG-3) + 7.7 (WG-2) + 4.8 (WG-4) = 19.4 cfs

STREET CAPACITY = $Q = 171.7\ S^{1/2}$

$Q = 171.7\ (.02)^{1/2} = 24.3 > 19.4$ cfs

OK

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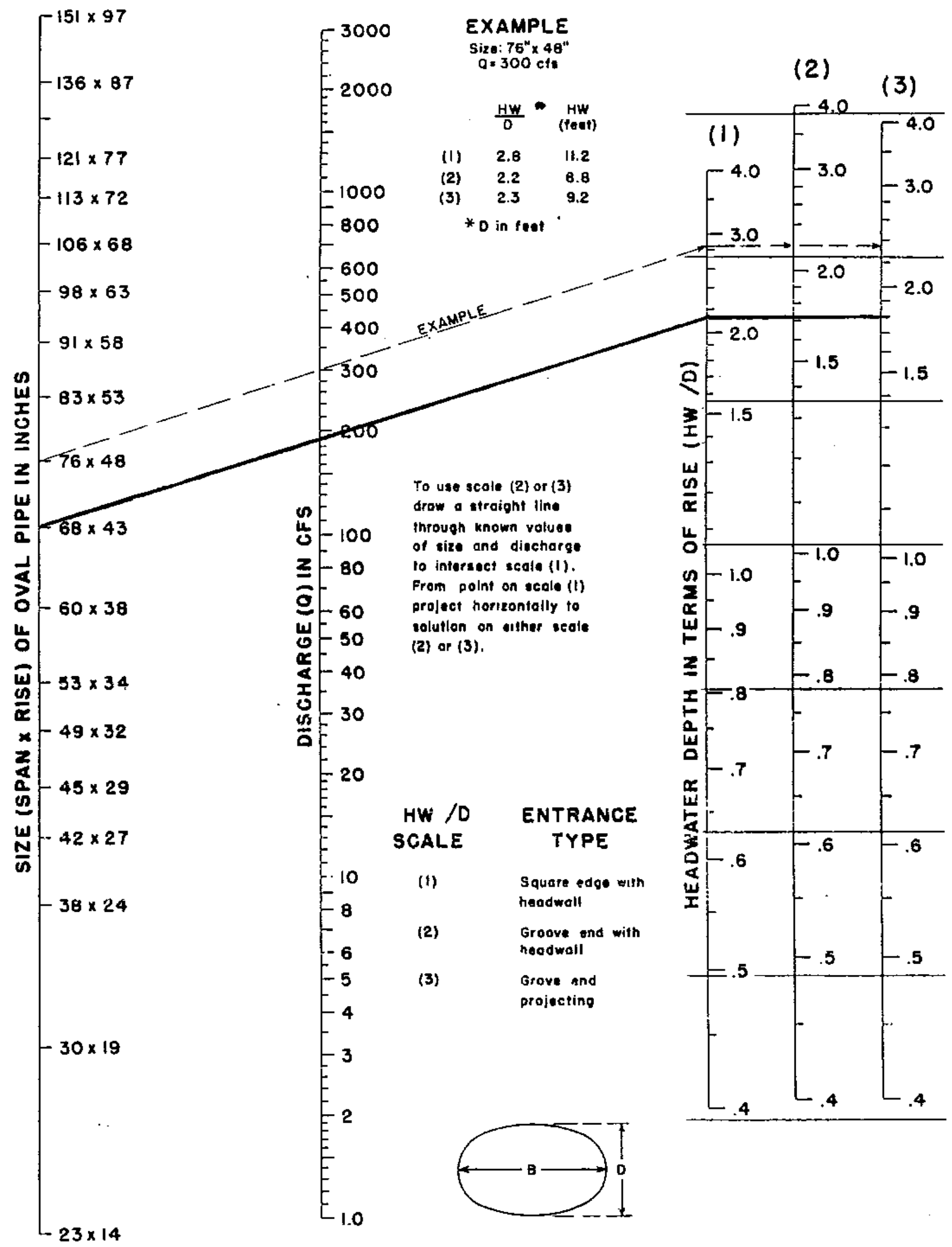

HEADWATER DEPTH FOR OVAL CONCRETE PIPE CULVERTS LONG AXIS HORIZONTAL WITH INLET CONTROL

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