

MASTER DEVELOPMENT DRAINAGE PLAN

FOR

CIRCLE SQUARE SUBDIVISION & PARCEL B

Prepared For:
Circle Square Properties, LLC
15605 East 144th Avenue
Brighton, CO 80601

Prepared By:
Associated Design Professionals, Inc.
1861 Austin Bluffs Parkway, Suite 101
Colorado Springs, Colorado 80918
(719) 266-5212

January 2001
Revised: March 2001
#991101



ENGINEERS 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/County for drainage reports and said 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.



Michael A. Bartusek, P.E. #23329



DEVELOPER'S STATEMENT:

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

Circle Square Properties, LLC

Business Name

By:


Forrest Charlesworth

Title: President

Address: 15605 East 144th Ave.
Brighton, CO 80601

El Pomar Youth Sports Park

Business Name

By:


Title: President CSYSP

Address: 2815 National Place
Colo. Spgs., CO 80906

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


FOR City Engineer

4/20/01
Date

Conditions:

Site-specific Final Drainage Reports will be required for each individual lot upon development.

**MASTER DEVELOPMENT DRAINAGE PLAN
FOR
CIRCLE SQUARE SUBDIVISION
& PARCEL B**

GENERAL

Circle Square Subdivision is a proposed 10.359-acre, six lot subdivision bordered on the east by unplatted Parcel B, an 8.236 acre tract of land. Parcel B will be platted in the future as an additional three lots to Circle Square Subdivision. The site is located in the north ½ of Section 33, Township 14 South, Range 66 West of the Sixth Principal Meridian in the City of Colorado Springs, County of El Paso, State of Colorado. More precisely, the parcels are bounded on the north by South Circle Drive (Colorado Highway No. 29) and an unplatted City maintained wastewater facility, on the east by Fountain Creek and the Colorado Springs Youth Sports Complex, on the south by Harrison Park Filing No. 1 and 12, and the Colorado Springs Youth Sports Complex, and on the west by Janitell Road. See appendix A for vicinity map.

The site is currently undeveloped and covered with native grasses and weeds. The site declines to the east at slopes between 1% and 2%. Investigation of the Soil Conservation Service Soil Survey of El Paso County reveals that Ustic Torrfluvents, hydrologic soil group "B" exists at the site, see soils map, appendix A. The parcels are currently zoned PBC, Planned Business Center, with no zoning changes anticipated. Circle Square Subdivision and Parcel B are located within the Fisher's Canyon Basin per the City of Colorado Springs Fee Basin Map, produced by City Engineering Unit, 1996. Fountain Creek exists approximately 200' due east of the site.

Circle Square Subdivision has been previously analyzed as part of the following studies:

Drainage Report for Harrison Creek Basin, prepared by Drexel Barrell & Co.,
May 27, 1977.

Final Drainage Report for Colorado Springs Youth Sports Complex, prepared by Drexel
Barrell & Co., revised December 1998.

Portions of Parcel B along the eastern property line do lie within the Fountain Creek 100-year floodplain per the Flood Insurance Rate Map, Map Number 08041CO741 F for El Paso County, Colorado and Incorporated areas, effective date, March 17, 1997 published by the Federal Emergency Management Agency, see floodplain map, Appendix A. Per the requirements set forth in the City of Colorado Springs and El Paso County Drainage Criteria Manual, any proposed structure shall have either the lowest finished floor elevation at least one (1) foot above the 100-year floodway water surface elevation or be flood proofed to one (1) foot above the floodway water surface elevation. Overlot grading will occur at the site in the spring of 2001 to prepare the lots for sale. The proposed overlot grading is shown on the drainage plan along with the existing floodplain on Lots 8 and 9 of the site.

The existing floodplain as established by FEMA currently extends into Lots 8 and 9. Upon development of these parcels, additional analysis on Fountain Creek should be completed to more accurately delineate the extents of the floodplain and the impacts, if any on the developments. For the purposes of preliminary grading on the lots, a building pad elevation has been set based upon the depth of flow in Fountain Creek as shown in the profiles of the Flood Insurance Study done by FEMA, and the elevations listed on the Flood Insurance Rate Map, Map Number 08041CO741 F. Any areas which remain in the floodplain when the lots are developed should be, at a minimum, be reseeded. Due to the fact the lots are on the outer limits of the floodplain and the flat topography of the area, water velocities during the 100-year

storm event at the development will be low enough that reseeding any bare ground will adequately protect the floodplain from erosion.

METHOD OF COMPUTATION

The methodology utilized for this report is in accordance with the City/County Drainage Criteria Manual. The Rational Method was used to identify the peak runoff rates for the 5-year and 100-year storm events:

$$Q = C \cdot i \cdot A$$

Where Q = maximum rate of runoff in cubic feet per second

C = runoff coefficient representing drainage area characteristics

i = average rainfall intensity, in inches per hour, for the duration required for the runoff to become established

A = drainage basin size in acres

Runoff coefficients have been selected as follows:

	Runoff Coefficients		<u>Description</u>
	<u>C(5)</u>	<u>C(100)</u>	
Historic	0.25	0.35	pasture/meadow/lawn areas
Developed	0.90	0.90	commercial business areas

EXISTING DRAINAGE CHARACTERISTICS

The site has historically drained overland to the east toward the Colorado Springs Youth Sports Complex and on into Fountain Creek. An irrigation pond does exist directly east of the property and is used to water the sports fields and landscaping on the Colorado Springs Youth Sports Complex. Some runoff from Circle Square Subdivision and Parcel B does currently enter the irrigation pond. However, the runoff travels a significant distance overland on natural vegetation and has a relatively high water quality upon entering the pond. Runoff from the future developed parking lots and buildings will not be allowed to enter the pond due to the fact storm water from impermeable surfaces will have a lower water quality and typical pollutants

associated with developed commercial sites and may impact the well being of the existing pond and the irrigated landscaping across the Colorado Springs Youth Sports Complex.

Existing on-site drainage facilities include a 24" CMP, which transports runoff from Harrison Park Filing No. 2, under Janitell Road, enters the site and is upsized to a 30" CMP at an existing manhole. An additional 24" CMP connects into the manhole from the west transporting runoff from portions of Lot 1 of Harrison Subdivision (sub-basin OS-5). Sub-basin OS-5 (see drainage maps, back pocket) drains approximately 21 acres of developed parking lots, buildings, and sports fields and is directed to the existing 24" CMP. The existing pipe has entrance conditions of a headwall, and 90 degree wingwalls with a grate protecting the pipe. The existing topography only allows a maximum head of 3' at the pipe entrance. The entrance conditions limit a maximum flow of 20 c.f.s. to enter the system and flow to Circle Square Subdivision via storm sewer. Calculated peak runoff rates for sub-basin OS-5 are 37.2 c.f.s for the 5-year storm event and 69.2 c.f.s. for the 100-year storm event. The remaining flow from sub-basin OS-5, which does not enter the storm sewer, overtops the existing headwall, travels across the parking lot in Harrison Park Filing No. 7 and flows south to storm sewer facilities in the Janitell Road right of way. None of the overflow crosses into Circle Square Subdivision.

The off site runoff from the existing on site storm sewer is eventually daylighted within an existing on-site, unlined drainage channel along the southern property line. The channel currently is well defined until it reaches approximately the halfway point of the common boundary shared by Circle Square Subdivision and Harrison Park Filing No. 12. At this point, the channel ends and runoff sheet flows to the Colorado Springs Youth Sports Complex, where defined drainage patterns are again established to outlet points into Fountain Creek.

Circle Square Subdivision will accommodate the current offsite runoff from the northwest portion of Harrison Park Filing No. 1 located to the south, from Harrison Park Filing No. 2 located to the west across Janitell Road, and the flow entering the existing storm sewer system from Lot 1 of Harrison Subdivision. These offsite sub-basins have historically drained onto Circle Square Subdivision.

The *Final Drainage Report for the Colorado Springs Youth Sports Complex* and the approved *Overlot Grading and Erosion Control Plan* call out a trapezoidal grass lined channel, which would adequately transport the 100-year fully developed conditions from Circle Square Subdivision, Parcel B and the offsite flows. The report indicates that all future developed runoff from the site should be directed to this point. Visual observation at the site, however, reveals that no channel currently exists immediately south of the existing irrigation pond. Due to the location of an existing pump house for irrigation, an existing sanitary sewer manhole, and a baseball field, constructing the previously proposed grass lined channel is not feasible. Instead, a storm sewer system will be constructed across the Colorado Springs Youth Sports Complex to Fountain Creek. Coordination with the Colorado Springs Parks and Recreation Department has occurred to obtain the necessary easements for the storm sewer.

Circle Square Subdivision has been divided into fifteen (15) drainage sub-basins based upon predicted future on-site development and existing off-site sub-basins. See drainage map, back pocket, for sub-basin delineations. Historic peak runoff rates for each of the proposed sub-basins have been calculated as follows:

<u>Sub-Basin</u>	<u>5-Year Storm Event</u>	<u>100-Year Storm Event</u>
A	2.1 c.f.s.	5.0 c.f.s.
B-1	0.8 c.f.s.	1.9 c.f.s.
B-2	1.4 c.f.s.	3.4 c.f.s.
B-3	1.0 c.f.s.	2.6 c.f.s.
B-4	0.3 c.f.s.	0.7 c.f.s.
C	1.9 c.f.s.	4.5 c.f.s.
D	1.3 c.f.s.	3.2 c.f.s.
E-1	1.1 c.f.s.	2.8 c.f.s.
E-2	3.5 c.f.s.	8.5 c.f.s.
OS-1	8.6 c.f.s.	15.0 c.f.s.
OS-2	2.1 c.f.s.	3.7 c.f.s.
OS-3	59.0 c.f.s.	117.7 c.f.s.
OS-4	4.2 c.f.s.	8.6 c.f.s.
OS-5	37.2 c.f.s.	69.2 c.f.s.
OS-6	0.7 c.f.s.	1.7 c.f.s.

DEVELOPED DRAINAGE CHARACTERISTICS

Circle Square Subdivision and Parcel B have been divided into fifteen (15) drainage sub-basins consisting of the nine (9) on-site proposed lots and six (6) existing off-site basins. Site-specific Final Drainage Reports will be required as part of the development of each individual lot when developed. A conceptual layout for the site has been completed for the purposes of this Master Development Drainage Plan. Only the improvements associated with the development of Lot 4 will be built at this time. The required storm sewer system along the southern property line of Circle Square Subdivision, and Parcel B will be constructed immediately, along with the storm sewer and inlets within the heart of Lot 4. The storm sewer will be installed with the simultaneous development of Lot 1 and the overlot grading of the site to prepare the lots for sale.

Developed peak runoff rates have been calculated for each proposed sub-basin as follows:

<u>Sub-Basin</u>	<u>5-Year Storm Event</u>	<u>100-Year Storm Event</u>
A	9.5 c.f.s.	16.5 c.f.s.
B-1	5.1 c.f.s.	9.0 c.f.s.
B-2	7.5 c.f.s.	13.1 c.f.s.
B-3	5.5 c.f.s.	9.5 c.f.s.
B-4	1.6 c.f.s.	2.8 c.f.s.
C	9.7 c.f.s.	16.9 c.f.s.
D	7.5 c.f.s.	13.0 c.f.s.
E-1	5.4 c.f.s.	9.4 c.f.s.
E-2	14.4 c.f.s.	25.2 c.f.s.
OS-1	8.6 c.f.s.	15.0 c.f.s.
OS-2	2.1 c.f.s.	3.7 c.f.s.
OS-3	59.0 c.f.s.	117.7 c.f.s.
OS-4	4.2 c.f.s.	8.6 c.f.s.
OS-5	37.2 c.f.s.	69.2 c.f.s.
OS-6	0.7 c.f.s.	1.7 c.f.s.

Construction at the site is anticipated to occur in six (6) different phases per the Concept Plan as follows:

<u>Phase</u>	<u>Lots to be developed</u>
I	Lot 1
II	Lots 2 and 4
III	Lot 3
IV	Lots 5 and 6
V	Future Lot 7 on Parcel B
VI	Future Lots 8 and 9 on Parcel B

Drainage facilities to be built on the site will also be phased with the development of Circle Square Subdivision. Phase I is anticipated to begin construction in the spring of 2001 with the concurrent installation of utilities for Lot 4 of Phase II. Before the construction on Phase I is

completed, the storm sewer along the southern property line and through the heart of Lot 4 will be completed to accommodate the developed runoff from the proposed access road and developed Lot 1. A Final Drainage Report for Lot 1 will be completed upon the approval of this *Master Drainage Development Plan for Circle Square Subdivision and Parcel B, and Final Drainage Report For Lot 4.*

The progression of construction is as follows:

<u>Phase</u>	<u>Facilities to be Built</u>
I (Lot 1) -and- II (Lots 2 and 4)	Proposed storm sewer system connecting the exist. 30" CMP daylighting at the southern property line to the outfall point in Fountain Creek; and the proposed storm sewer from the two 5' D10R sump inlets in the access road on Lot 4 to the proposed storm sewer along the southern property line. Construction to begin by Spring, 2001
III (Lot 3)	None required (will drain to Lot 4 facilities)
IV (Lots 5 and 6)	Future designed facilities to connect into back of the 5' D10R sump inlet built in the private access road built as part of the Lot 4 development.
V (Future Lot 7)	Future designed facilities providing an inlet and storm sewer from Future Lot 7 to the proposed storm sewer system on Lot 4; easements and final placement determined upon development
VI (Future Lots 8 & 9)	Future designed facilities providing an inlet to Lot 8, and required facilities on Lot 9; easements and final placement of facilities determined upon development

Phase I comprises sub-basin A, which covers all of Lot 1 and the entrance of the internal access roadway. The 2.84 acre sub-basin will have runoff directed to the southern portion of the lot via curb and gutter, and surface flow. Runoff will flow to the internal access drive on Lot 4 and into one of two proposed City standard D-10-R sump inlets to be built immediately. The inlets and storm sewer system extending to the south will be built as part of the development

of Lots 1 and 4. Storm water ponding at all inlets at the site will not exceed 1.0' depth during the 100-year storm event per City requirements. After runoff enters the inlets, a RCP storm sewer system to be built immediately will transport storm water southerly to Phase II. Future developed runoff from upstream Phase IV will be accepted into the storm sewer system. Inlets on Phase IV will be determined in the future and a storm sewer will be connected into the back of the proposed north D-10-R inlet within the access drive. The total future developed flow within the storm sewer at this point has been designated as Design Point 1. All of the storm sewer system has been sized to accommodate the fully developed, 100-year storm event. Routed storm water flows for the 5-year and 100-year storm event have been calculated as $Q_5=17.7$ c.f.s. and $Q_{100}=30.9$ c.f.s.

Phase II and III development of the site will be comprised of sub-basins B-1, B-2, B-3, and B-4. Sub-basin B-1 is 1.13 acres in size consisting of most of the parking lot area on Lot 4. Runoff will be collected in a proposed city standard D-9 grated sump inlet within the parking lot and combined with developed runoff from Phase I and Phase IV within the proposed storm sewer at Design Point 2. Calculated runoff rates at this point are $Q_5=22.2$ c.f.s. and $Q_{100}=38.9$ c.f.s.

Sub-basin B-2 covers 2.10 acres in area and is comprised of Lot 2, the northern half of Lot 3, and the front side of a proposed retail building on Lot 4. A proposed city standard D-10-R sump inlet will collect runoff from this sub-basin. Design Point 3 combines upstream flows from Design Point 2 and the sub-basin. Calculated flow rates at this point are $Q_5=28.8$ c.f.s. and $Q_{100}=50.3$ c.f.s.

Sub-basin B-3 is 1.40 acres covering the southern portion of Lot 3 and the southwest corner of Lot 4. Runoff will be collected in a proposed city standard D-10-R sump along the southern property line. Routed runoff rates from the offsite sub-basins and sub-basin B-3, design point

4, have been calculated as $Q_5=30.4$ c.f.s. and $Q_{100}=38.8$ c.f.s. The existing storm sewer system, which daylight within the sub-basin will be extended along the south property line to Fountain Creek.

Sub-basin B-4 is 0.35 acres in size consisting of the southeast corner of Lot 4. A proposed D-10-R sump inlet will collect runoff from the area and transport runoff to the storm sewer system.

Phase IV, sub-basin C, is comprised of Lots 6 and 7 and covers 2.57 acres. As described earlier, runoff will be collected by inlets, and introduced into the storm sewer system on Lot 4. The sizing and locations of the future inlets within sub-basin C will be determined when the lots are developed.

Phase V will be the future Lot 7 designated as sub-basin D. The 1.85-acre drainage area will be collected by inlets and directed southerly to a future storm sewer system in future Lot 8, or connected into the proposed facilities installed as part of the development of Lot 4. With the development of any of the lots on Parcel B, the installation of the right-in, right-out access ramp at Circle Drive will be required by the City of Colorado Springs Traffic Department. When the access ramp is installed, a 72"x44" CMP arch culvert will be required to pass the 5-year and 100-year storm events of $Q_5=59.0$ c.f.s. and $Q_{100}=117.7$ c.f.s., designated as Design Point 7. Because the CMP arch culvert will be within the Colorado Department of Transportation right of way for Circle Drive, approval from CDOT has been obtained. See Appendix B. The upstream areas tributary to Design Point 7 include sub-basins OS-3 and OS-4. Sub-basin OS-3 covers 28.2 acres of Circle Drive and some surrounding business areas and has 5-year and 100-year storm events of $Q_5=59.0$ c.f.s. and $Q_{100}=117.7$ c.f.s. See Drainage Map, back

pocket. Sub-basin OS-4 is 1.8 acres of Circle Drive right-of-way with calculated runoff rates of $Q_5=4.2$ c.f.s. and $Q_{100}=8.6$ c.f.s

Phase VI will be the final portion of the site developed consisting of future Lots 8 and 9. Sub-basin E-1, Lot 9, is 1.46 acres in size. Runoff will be collected by inlets and directed to a future storm sewer on Lot 8.

Sub-basin E-2, which consists of 4.90 acres covering future Lot 8, will have runoff collected by inlets from a future storm sewer system to be determined at the time of development. The storm sewer system will be extended to Lots 7 and 9. The total future developed flow from sub-basins D, E-1, and E-2 on Parcel B have been designated as Design Point 5 with calculated flows of $Q_5=23.2$ c.f.s. and $Q_{100}=40.5$ c.f.s.

Design Point 6 represents the outfall point for Circle Square Subdivision for the fully developed site. Peak runoff rates for the 5-year and 100-year storm event have been calculated as $Q_5=72.3$ c.f.s. and $Q_{100}=112.9$ c.f.s. These runoff rates are consistent with those estimated within the *Final Drainage Report for the Colorado Springs Youth Sports Complex*. A proposed 38"x60" horizontal elliptical RCP storm sewer (48" equivalent pipe) will be constructed across the Colorado Springs Youth Sports Complex from Circle Square Subdivision to Fountain Creek. The City of Colorado Springs Parks and Recreation Department and the builders of the Sports Complex will provide an easement for the proposed storm sewer outfall. The developer of the Circle Square Subdivision will construct the storm sewer across the Colorado Springs Youth Sports Complex.

As part of the construction of the storm sewer, the City of Colorado Springs Parks and Recreation Department and the Colorado Springs Youth Sports Complex have requested an

area drain be constructed between two existing baseball diamonds located immediately south of Parcel B. The developer of Circle Square Subdivision has agreed to construct an area drain to eliminate this problem. Runoff to this point has been designated as sub-basin OS-6. A 24" diameter grated drain will accept the 5-year and 10-year storm events of 0.7 c.f.s. and 1.7 c.f.s. respectively.

ENGINEER'S CONST ESTIMATE FOR DRAINAGE FACILITIES

PUBLIC, REIMBURSEABLE FACILITIES

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
30" RCP	L.F.	602	\$ 45.00	\$ 27,090.00
48" RCP	L.F.	359	\$ 70.00	\$ 25,130.00
38"x60" RCP	L.F.	418	\$ 100.00	\$ 41,800.00
Type I MH	EA.	3	\$ 2,500.00	\$ 7,500.00
5' D10R Inlet	EA.	2	\$ 3,500.00	\$ 7,000.00
Saddle Headwall	EA.	1	\$ 5,000.00	\$ 5,000.00
Sub-Total				\$ 113,520.00
15% Contingency and Engineering				\$ 17,028.00
GRAND TOTAL				\$ 130,548.00

PRIVATE, NON-REIMBURSEABLE FACILITIES

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
24" RCP	L.F.	30	\$ 35.00	\$ 1,050.00
30" RCP	L.F.	139	\$ 45.00	\$ 6,255.00
36" RCP	L.F.	216	\$ 55.00	\$ 11,880.00
42" RCP	L.F.	164	\$ 65.00	\$ 10,660.00
Type I MH	EA.	1	\$ 2,500.00	\$ 2,500.00
5' D10R Inlet	EA.	3	\$ 3,500.00	\$ 10,500.00
7.5 D9 Inlet	EA.	1	\$ 2,500.00	\$ 2,500.00
24" Dia. Area Drain	EA.	1	\$ 1,500.00	\$ 1,500.00
Sub-Total				\$ 46,845.00
15% Contingency and Engineering				\$ 7,027.00
GRAND TOTAL				\$ 53,872.00

DRAINAGE FEES

Circle Square Subdivision has not been previously platted. The site is subject to the Fishers Canyon Drainage Basin fees as established by the City of Colorado Springs. The 2001

Drainage Fees for Circle Square Subdivision have been calculated as follows:

Drainage Basin Fee: 10.36 acres x \$ 7,224.00/acre = \$ 74,841.00

Pond Fee (Land): 10.36 acres x \$ 562.00/acre = \$ 5,822.00

Grand Total = \$ 80,663.00

There are no Bridge or Pond Facility Fees charged by the City of Colorado Springs within the Fishers Canyon Drainage Basin.

Drainage fees for Parcel B will be calculated when the 8.236 acres is platted in the future.

The estimated cost of reimbursable drainage facilities is \$130,548.00. Since the reimbursable costs are greater than the drainage fees, no drainage fees are required to be posted at the time of platting.

SUMMARY

The development of Circle Square Subdivision will not negatively impact existing downstream facilities and will be developed in accordance to previous studies for Fishers Canyon Drainage Basin.

REFERENCES

City of Colorado Springs / El Paso County Drainage Criteria Manual, City of Colorado Springs, HDR Infrastructure, Inc., El Paso County, latest revision.

Soil Survey of El Paso County Area, Colorado, U.S. Department of Agriculture Soil Conservation Service, June 1981.

Final Drainage Report for Harrison Park Filing No. 13, Drexel Barrell & Co., January 1998.

Final Drainage Report for Colorado Springs Youth Sports Complex, Drexel Barrell & Co., revised December 1998.

Drainage Conditions at and Recommended Modifications to the Harrison Outfall, Drexel Barrell & Co., February 12, 1997.

Drainage Report for Multi Flex 14, Harrison Park #1, Colorado Springs, Colorado, Drexel Barrell & Co., June 1977.

Drainage Report for Lot 1, Block 1, Harrison Park Filing No. 2, Colorado Springs, Colorado, Drexel Barrell & Co., September 8, 1977

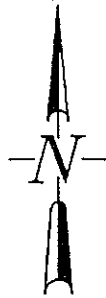
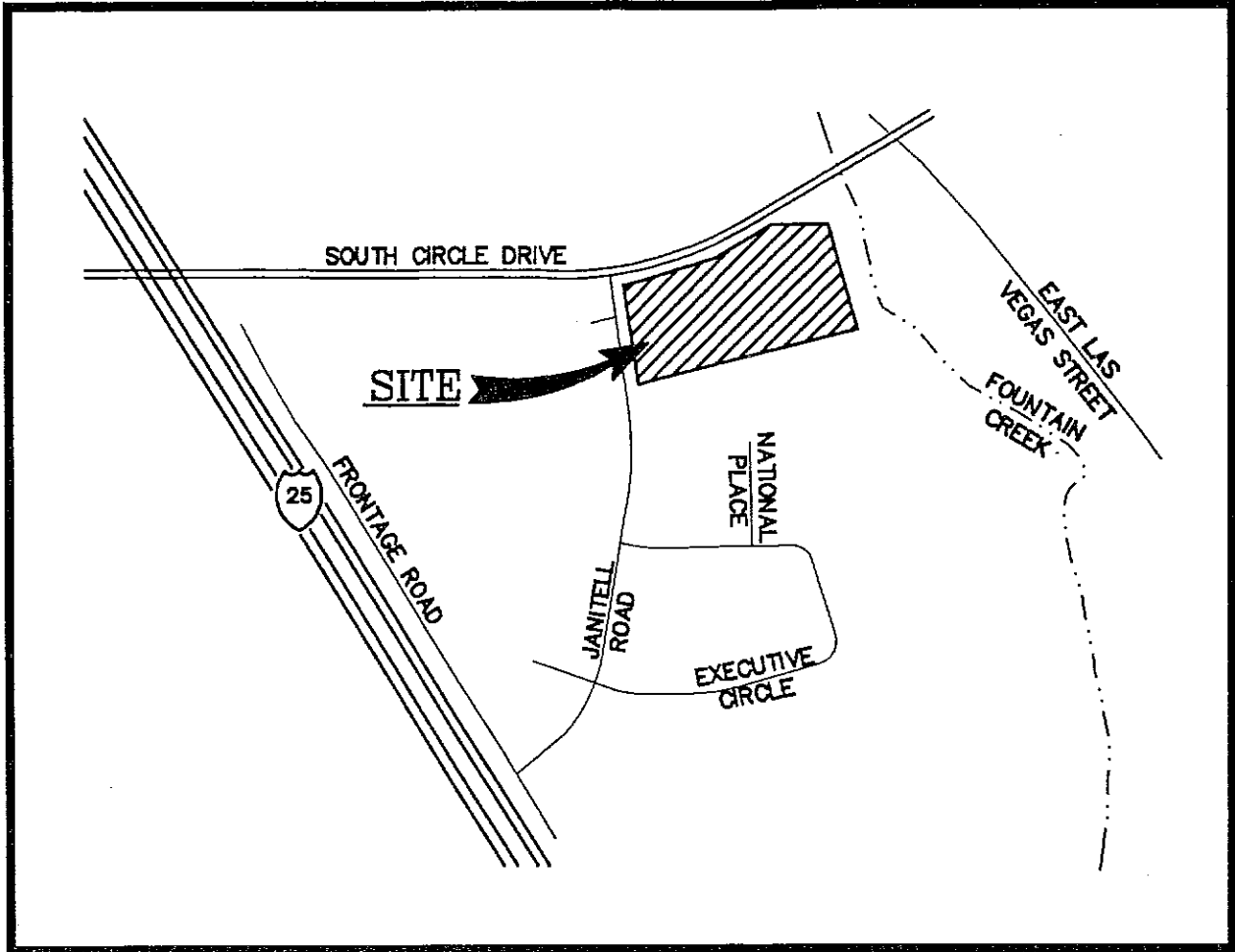
Master Development Drainage Plan for Circle Square Subdivision, Associated Design Professionals, Inc., January 13, 2000.

Master Drainage Plan Harrison Street – I-25 Vicinity, Cheyenne Mountain Ranch, Hartzell – Pfeifferberger and Associates, Inc., November 15, 1973.

Preliminary / Final Drainage Report for Harrison Park Filing No. 12, Drexel Barrell & Co., May 1997.

APPENDIX A

MAPS



VICINITY MAP

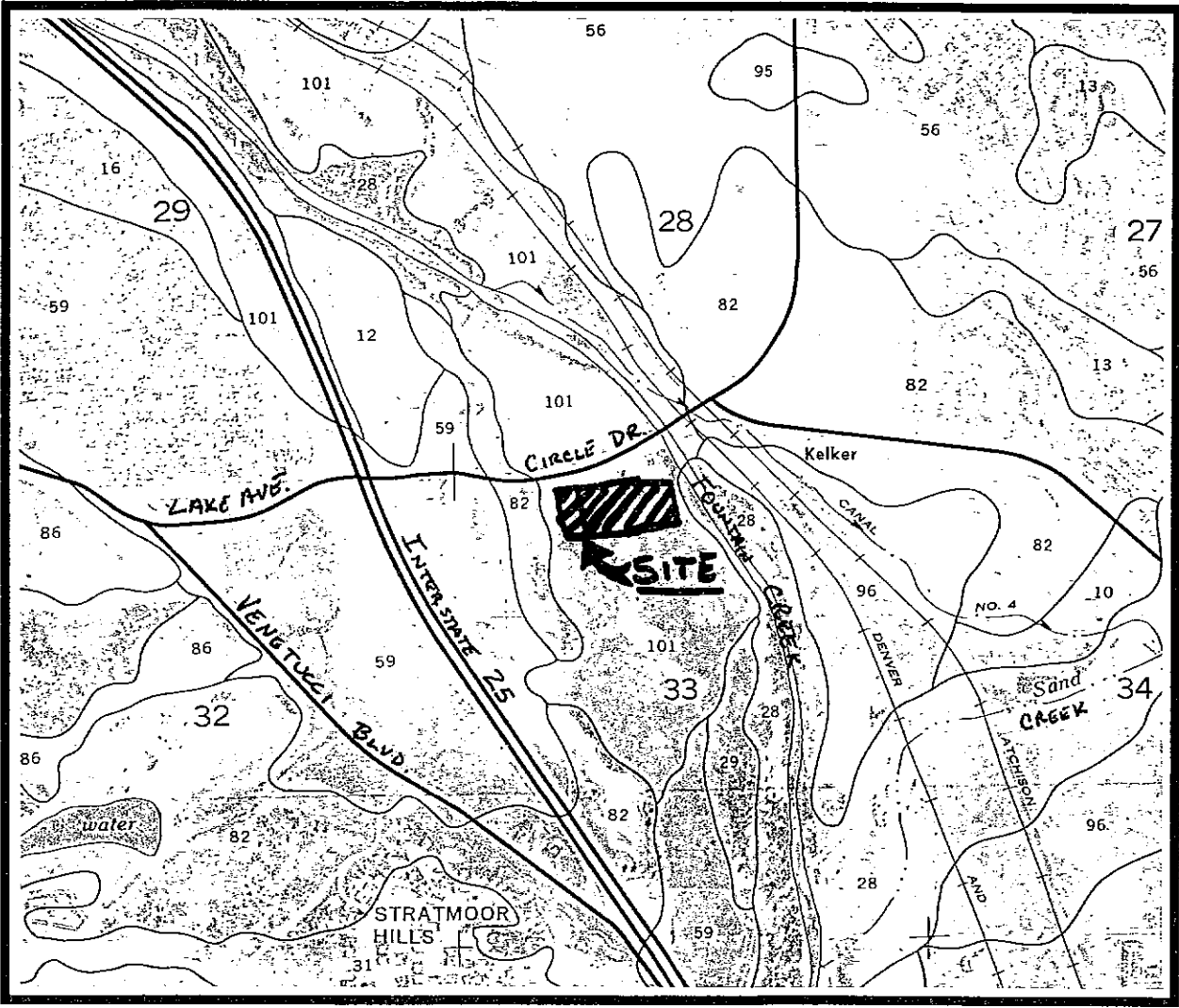
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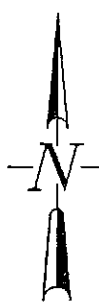
PREPARED BY:



Associated Design Professionals, Inc.

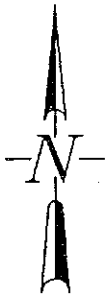
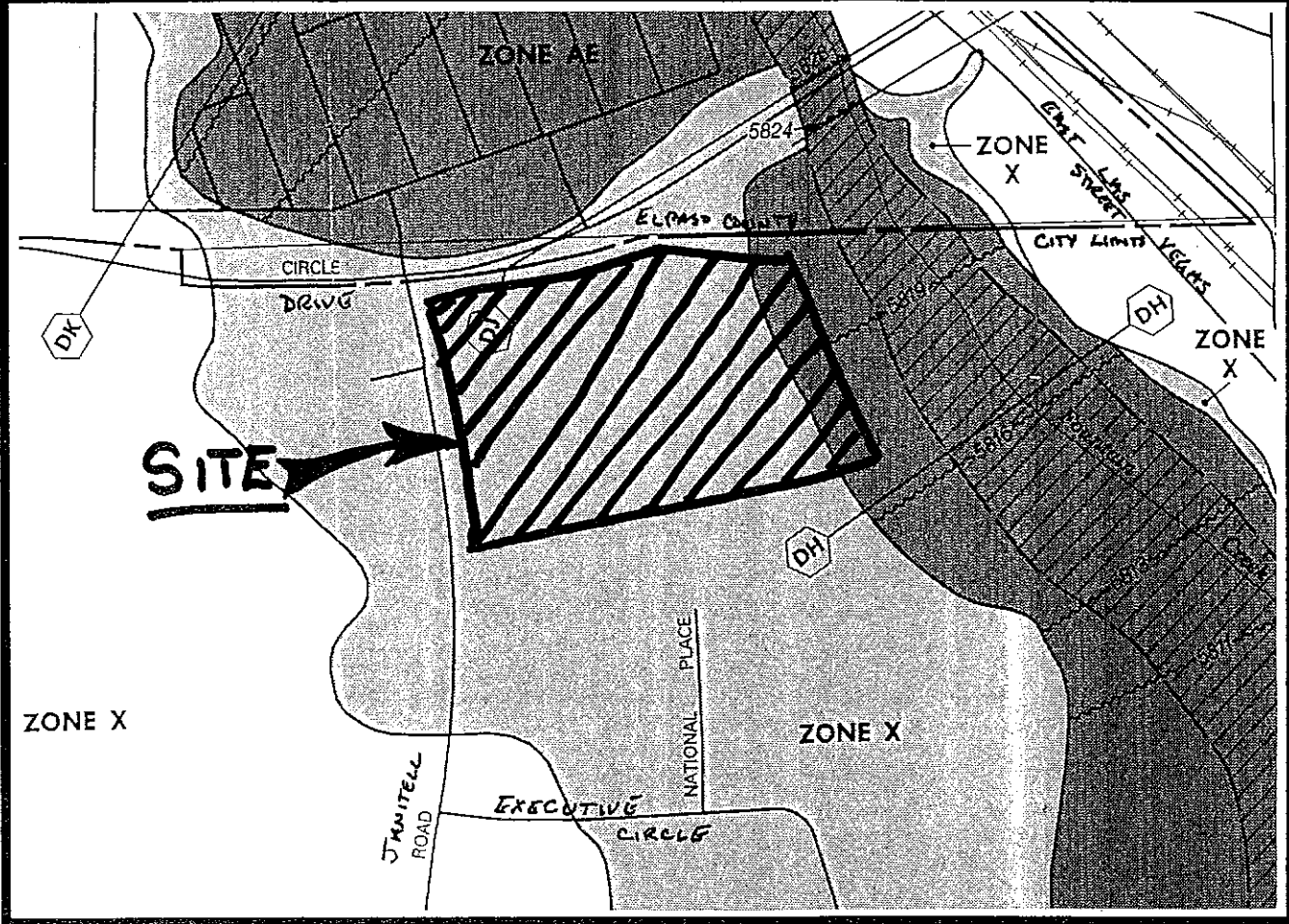
1861 Austin Bluffs Pkwy, Suite 101
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 (719) 266-5212
 fax (719) 266-5341



 **SOIL MAP**
N.T.S.



1861 Austin Bluffs Pkwy, Suite 101
Colorado Springs, CO 80918
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fax: (719) 268-5341



FLOOD PLAIN MAP

N.T.S.



1861 Austin Bluffs Pkwy, Suite 101
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NATIONAL FLOOD INSURANCE PROGRAM

FIRM
 FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
 COLORADO AND
 INCORPORATED AREAS

PANEL 741 OF 1300
 (SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS
 COMMUNITY NUMBER PANEL SUFFIX

COLORADO SPRINGS CITY OF	08069	074	F
EL PASO COUNTY	08068	074	F
UNINCORPORATED AREAS			

MAP NUMBER
 08041C0741 F

EFFECTIVE DATE:
 MARCH 17, 1997



Federal Emergency Management Agency

APPENDIX B

C.D.O.T APPROVAL

STATE OF COLORADO

DEPARTMENT OF TRANSPORTATION



Region 2 – Access
P.O. Box 536
Pueblo, Colorado 81002
Phone (719) 546-5403
Fax (719) 546-5414

March 9, 2001

Rich Gallegos
Associated Design Professionals, Inc.
1861 Austin Bluffs Parkway, Suite 101
Colorado Springs, CO 80918

RE: Review of Master Development Drainage Plan for Circle Square Subdivision SH 29

Dear Mr. Gallegos:

Mr. Paul Reinsma, CDOT Hydraulics Engineer, has reviewed the Master Development Drainage Plan for Circle Square Subdivision located in the southeast quadrant of the Janitell (SH 25FR) and South Circle Drive (SH 29). His comments are as follows:

- ✓ The flows for this project are away from the CDOT infrastructure and therefore meets CDOT hydraulics criteria for approval.

If you have any questions regarding the review of this drainage plan, please contact Mr. Reinsma at (719) 634-2323. All other questions pertaining to access should be directed to me at (719) 546-5407.

Sincerely,

Valerie Watkins
Access Manager

Xc: Poling
Reinsma
Hall/file

APPENDIX C

DRAINAGE CALCULATIONS

Circle Square Subdivision - Historic Runoff

RATIONAL METHOD (Q=CiA)

BASIN	TOTAL AREA (acres)	WEIGHTED		OVERLAND FLOW				STREET FLOW				Tc TOTAL (min.)	INTENSITY		PEAK FLOWS	
		C(5)	C(100)	C(5)	Length (feet)	Slope (%)	Ti (min.)	Slope (%)	Length (feet)	Velocity (f.p.s.)	Tt (min.)		I(5) (in./hr.)	I(100) (in./hr.)	Q(5) (c.f.s.)	Q(100) (c.f.s.)
A	2.84	0.25	0.35	0.25	260	2.0%	20.3	1.0%	0	2.0	0.0	20.3	2.9	5.0 CA(equiv)	2.1 0.71	5.0 0.99
B-1	1.13	0.25	0.35	0.25	300	2.0%	21.9	1.0%	20	2.0	0.2	22.0	2.8	4.8 CA(equiv)	0.8 0.28	1.9 0.40
B-2	2.10	0.25	0.35	0.25	300	2.0%	21.9	1.0%	200	2.0	1.7	23.5	2.7	4.7 CA(equiv)	1.4 0.53	3.4 0.74
B-3	1.40	0.25	0.35	0.25	180	2.0%	16.9	1.0%	260	2.0	2.2	19.1	3.0	5.2 CA(equiv)	1.0 0.35	2.6 0.49
B-4	0.35	0.25	0.35	0.25	120	2.0%	13.8	1.0%	120	2.0	1.0	14.8	3.4	5.9 CA(equiv)	0.3 0.09	0.7 0.12
C	2.57	0.25	0.35	0.25	250	2.0%	19.9	1.0%	50	2.0	0.4	20.4	2.9	5.0 CA(equiv)	1.9 0.64	4.5 0.90
D	1.85	0.25	0.35	0.25	250	2.0%	19.9	1.0%	100	2.0	0.8	20.8	2.9	5.0 CA(equiv)	1.3 0.46	3.2 0.65

Circle Square Subdivision - Historic Runoff

RATIONAL METHOD (Q=CiA)

BASIN	TOTAL AREA (acres)	WEIGHTED		OVERLAND FLOW				STREET FLOW				Tc TOTAL (min.)	INTENSITY		PEAK FLOWS	
		C(5)	C(100)	C(5)	Length (feet)	Slope (%)	Ti (min.)	Slope (%)	Length (feet)	Velocity (f.p.s.)	Tt (min.)		I(5) (in./hr.)	I(100) (in./hr.)	CA(equiv)	Q(5) (c.f.s.)
E-1	1.46	0.25	0.35	0.25	200	2.0%	17.8	1.0%	0	2.0	0.0	17.8	3.1	5.4	1.1 0.37	2.8 0.51
E-2	4.90	0.25	0.35	0.25	200	2.0%	17.8	1.0%	400	2.0	3.3	21.2	2.8	4.9	3.5 1.23	8.5 1.72
OS-1	2.40	0.90	0.90	0.25	25	2.0%	6.3	1.0%	500	2.0	4.2	10.5	4.0	6.9	8.6 2.16	15.0 2.16
OS-2	0.50	0.90	0.90	0.25	15	2.0%	4.9	1.0%	250	2.0	2.1	7.0	4.7	8.1	2.1 0.45	3.7 0.45
OS-3	28.20	0.70	0.80	0.25	400	1.5%	13.1	2.0%	1800	5.0	6.0	19.1	3.0	5.2	59.0 19.74	117.7 22.56
OS-4	1.80	0.60	0.70	0.25	60	2.0%	5.8	1.0%	450	1.5	5.0	10.8	3.9	6.9	4.2 1.08	8.6 1.26
OS-5	20.96	0.62	0.66	0.25	200	2.0%	17.8	5.0%	1700	10.0	2.8	20.7	2.9	5.0	37.2 13.00	69.2 13.83
OS-6	0.90	0.25	0.35	0.25	150	1.5%	17.0	2.0%	80	2.0	0.7	17.7	3.1	5.4	0.7 0.23	1.7 0.31

Circle Square Subdivision - Developed Runoff

RATIONAL METHOD (Q=CiA)

BASIN	TOTAL AREA (acres)	WEIGHTED		OVERLAND FLOW				STREET FLOW				Tc TOTAL (min.)	INTENSITY		PEAK FLOWS	
		C(5)	C(100)	C(5)	Length (feet)	Slope (%)	Ti (min.)	Slope (%)	Length (feet)	Velocity (f.p.s.)	Tt (min.)		I(5) (in./hr.)	I(100) (in./hr.)	CA(equiv)	Q(5) (c.f.s.)
A	2.84	0.90	0.90	0.25	30	2.0%	6.9	1.0%	650	2.0	5.4	12.3	3.7	6.5 CA(equiv)	9.5 2.56	16.5 2.56
B-1	1.13	0.90	0.90	0.25	10	2.0%	4.0	1.0%	180	2.0	1.5	5.5	5.0	8.8 CA(equiv)	5.1 1.02	9.0 1.02
B-2	2.10	0.90	0.90	0.25	25	2.0%	6.3	1.0%	500	2.0	4.2	10.5	4.0	6.9 CA(equiv)	7.5 1.89	13.1 1.89
B-3	1.40	0.90	0.90	0.25	25	2.0%	6.3	1.0%	260	2.0	2.2	8.5	4.3	7.6 CA(equiv)	5.5 1.26	9.5 1.26
B-4	0.35	0.90	0.90	0.25	5	2.0%	2.8	1.0%	275	2.0	2.3	5.1	5.2	9.0 CA(equiv)	1.6 0.32	2.8 0.32
C	2.57	0.90	0.90	0.25	25	2.0%	6.3	1.0%	350	2.0	2.9	9.2	4.2	7.3 CA(equiv)	9.7 2.31	16.9 2.31
D	1.85	0.90	0.90	0.25	20	2.0%	5.6	1.0%	250	2.0	2.1	7.7	4.5	7.8 CA(equiv)	7.5 1.67	13.0 1.67

Circle Square Subdivision - Developed Runoff

RATIONAL METHOD (Q=CiA)

BASIN	TOTAL AREA (acres)	WEIGHTED		OVERLAND FLOW				STREET FLOW				Tc TOTAL (min.)	INTENSITY		PEAK FLOWS	
		C(5)	C(100)	C(5)	Length (feet)	Slope (%)	Ti (min.)	Slope (%)	Length (feet)	Velocity (f.p.s.)	Tt (min.)		I(5) (in./hr.)	I(100) (in./hr.)	Q(5) (c.f.s.)	Q(100) (c.f.s.)
E-1	1.46	0.90	0.90	0.25	30	2.0%	6.9	1.0%	325	2.0	2.7	9.6	4.1	7.2 CA(equiv)	5.4 1.31	9.4 1.31
E-2	4.90	0.90	0.90	0.25	50	2.0%	8.9	1.0%	850	2.0	7.1	16.0	3.3	5.7 CA(equiv)	14.4 4.41	25.2 4.41
OS-1	2.40	0.90	0.90	0.25	25	2.0%	6.3	1.0%	500	2.0	4.2	10.5	4.0	6.9 CA(equiv)	8.6 2.16	15.0 2.16
OS-2	0.50	0.90	0.90	0.25	15	2.0%	4.9	1.0%	250	2.0	2.1	7.0	4.7	8.1 CA(equiv)	2.1 0.45	3.7 0.45
OS-3	28.20	0.70	0.80	0.25	400	1.5%	13.1	2.0%	1800	5.0	6.0	19.1	3.0	5.2 CA(equiv)	59.0 19.74	117.7 22.56
OS-4	1.80	0.60	0.70	0.25	60	2.0%	5.8	1.0%	450	1.5	5.0	10.8	3.9	6.9 CA(equiv)	4.2 1.08	8.6 1.26
OS-5	20.96	0.62	0.66	0.25	200	2.0%	17.8	2.0%	1500	10.0	2.5	20.3	2.9	5.0 CA(equiv)	37.5 13.00	69.8 13.83
OS-6	0.90	0.25	0.35	0.25	150	1.5%	17.0	2.0%	80	2.0	0.7	17.7	3.1	5.4 CA(equiv)	0.7 0.23	1.7 0.32

Circle Square Subdivision

DEVELOPED RUNOFF SURFACE ROUTING

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent)		Tc (min.)	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)		I(5) (in./hr.)	I(100) (in./hr.)	Q(5) (c.f.s)	Q(100) (c.f.s.)
DP-1	A C	2.56	2.56	12.3 Travel Pipe	3.6 Length 150	6.3 Velocity 5	17.7	30.9
		2.31	2.31				Tt	Routed Tc
		4.87	4.87				0.5	12.8
DP-2	DP-1 B-1	4.87	4.87	12.8 Travel Pipe	3.6 Length 80	6.3 Velocity 5	22.2	38.9
		1.31	1.31				Tt	Routed Tc
		6.18	6.18				0.3	13.1
DP-3	DP-2 B-2	6.18	6.18	13.1 Travel Street	3.6 Length 75	6.2 Velocity 5	28.8	50.3
		1.89	1.89				Tt	Routed Tc
		8.07	8.07				0.3	13.3
DP-4	B-3 OS-1 OS-2 OS-5	1.26	1.26	20.3 Travel Street	2.8 Length 400	4.9 Velocity 8	30.4	38.8
		2.16	2.16				Tt	Routed Tc
		0.45	0.45				0.8	21.2
		6.90	4.00					
		10.77	7.87					
DP-5	D E-1 E-2	1.67	1.67	16.0 Travel Street	3.1 Length 400	5.5 Velocity 5	23.2	40.5
		1.31	1.31				Tt	Routed Tc
		4.41	4.41				1.3	17.3
		7.39	7.39					
DP-6	DP-3 DP-4 DP-5 OS-6	8.07	8.07	21.2 Travel Street	2.7 Length 400	4.8 Velocity 5	72.3	112.9
		10.77	7.87				Tt	Routed Tc
		7.39	7.39				1.3	22.5
		0.23	0.32					
		26.46	23.65					
DP-7	OS-3 OS-4	19.74	22.56	19.1 Travel Street	2.6 Length 450	4.6 Velocity 1.5	54.8	109.5
		1.08	1.26				Tt	Routed Tc
		20.82	23.82				5.0	24.1

PROJECT: CIRCLE SQUARE DEV

STATION: _____

CULVERT DESIGN FORM

SHEET _____ OF _____

DESIGNER / DATE: MAB / 1/17/68

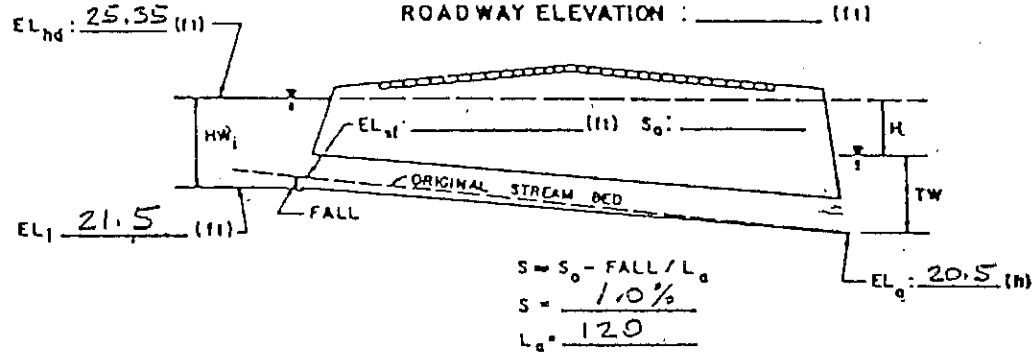
REVIEWER / DATE: _____ / _____

HYDROLOGICAL DATA

- SEE ADD'L SHEETS.
- METHOD: RATIONAL
 - DRAINAGE AREA: 30 STREAM SLOPE: 1%
 - CHANNEL SHAPE: TRAPAZOIDAL
 - ROUTING: _____ OTHER: _____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
<u>5</u>	<u>59.0</u>	_____
<u>100</u>	<u>117.7</u>	_____



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS											CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
			INLET CONTROL					OUTLET CONTROL								
			HW _i /D (2)	HW _i (3)	FALL (3)	EL _{hi} (4)	TW (5)	d _c	$\frac{d_c + D}{2}$	h ₀ (6)	k _e	H (7)	EL _{ho} (8)			
<u>CMP ARCH 72" X 44" W/FES</u>	<u>117.7</u>	<u>117.7</u>	<u>1.05</u>	<u>3.85</u>		<u>25.35</u>	<u>1.7</u>	<u>2.4</u>	<u>3.03</u>	<u>3.03</u>	<u>0.5</u>	<u>2.30</u>	<u>25.83</u>	<u>25.83</u>	<u>6.5</u>	

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) $HW_i / D = HW_i / D$ OR HW_i / D FROM DESIGN CHARTS

(3) $FALL = HW_i - (EL_{hd} - EL_{st})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) $h_0 = TW$ OR $(d_c + D / 2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + k_e \cdot (29 n^2 L) / R^{1.33} \right] v^2 / 2g$

(8) $EL_{ho} = EL_0 + H + h_0$

SUBSCRIPT DEFINITIONS:

- a. APPROXIMATE
- i. CULVERT FACE
- hd. DESIGN HEADWATER
- hi. HEADWATER IN INLET CONTROL
- ho. HEADWATER IN OUTLET CONTROL
- 1. INLET CONTROL SECTION
- o. OUTLET
- st. STREAMBED AT CULVERT FACE
- tw. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: _____

SHAPE: _____

MATERIAL: _____

ENTRANCE: _____

RUNOFF COEFF FOR SUB-BASIN OS-5

OFF SITE AREA = 21.0 ac

9.2 ac Bare Fields/LAWN $C_s = 0.25$ $C_{100} = 0.35$

11.8 ac DEVELOPED w/ BUILDINGS $C_s = 0.90$ $C_{100} = 0.90$

$$C_s = \frac{9.2(0.25) + 11.8(0.90)}{21.0} = 0.62$$

$$C_{100} = \frac{9.2(0.35) + 11.8(0.90)}{21.0} = 0.66$$

FLOW ENTERING STORM SEW FROM OS-5

24" CMP w/ HEADWALL

36" MAX HEAD OVER PIPE

$$\therefore HW/D = 3/2 = 1.5$$

From FIG 9-37,
24" CMP w/ HW/D = 1.5...

$$Q_{in} = 20 \text{ CFS (REMAINING FLOW OVERTOPS EXIST$$

SUMP FLOWS TO PARKING LOT &
JANITEL RD)

$$CA_{EQUIV} \dots CA_s = \frac{Q_{in}}{f_s} = \frac{20 \text{ cfs}}{2.9 \text{ in/hr}} = 6.89 \text{ FT}^2$$

$$CA_{100} = \frac{Q_{in}}{f_{100}} = \frac{20 \text{ cfs}}{5.0 \text{ in/hr}} = 4.00 \text{ FT}^2$$

APPENDIX D

DESIGN CHARTS

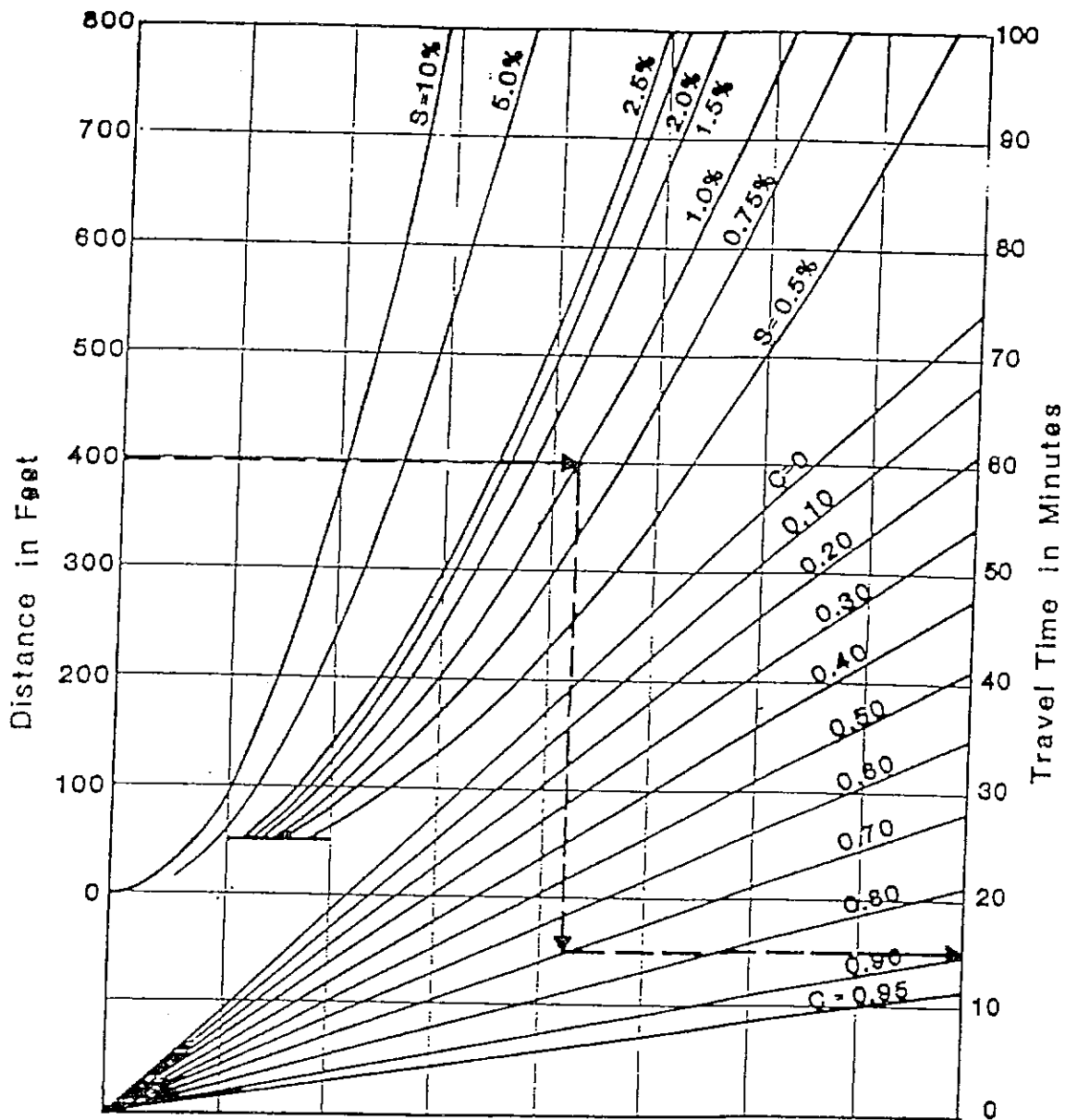
TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY			
		10		100	
		A&B*	C&D*	A&B*	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



REFERENCE : Wright - McLaughlin Engineers, Urban Storm Drainage Criteria Manual, Vol. 1,
 Denver Regional Council of Governments, Denver, Co. 1977



HDR Infrastructure, Inc.
 A Centerra Company

The City of Colorado Springs / El Paso County
 Drainage Criteria Manual

Overland Flow Curves

Date
 OCT. 1987

Figure
 5-2

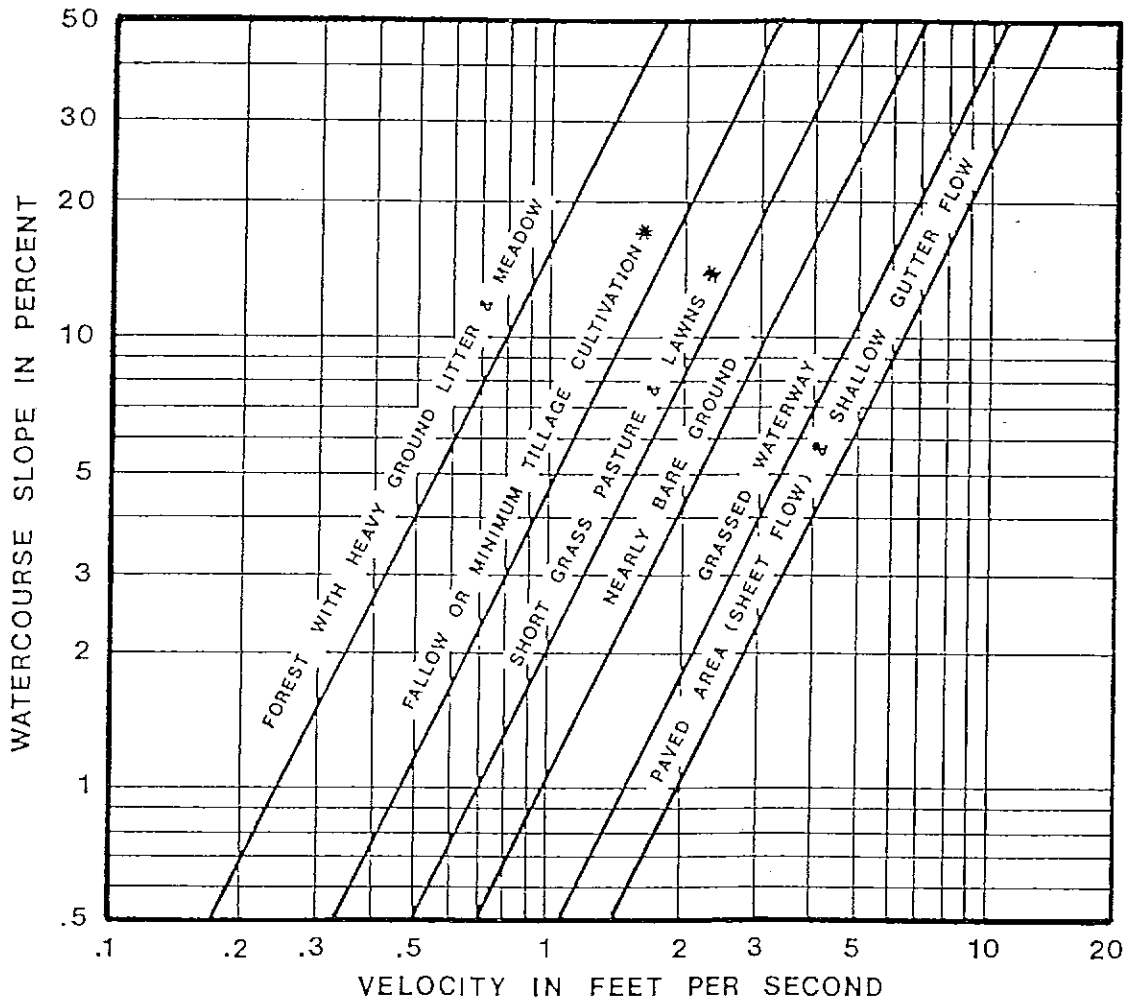
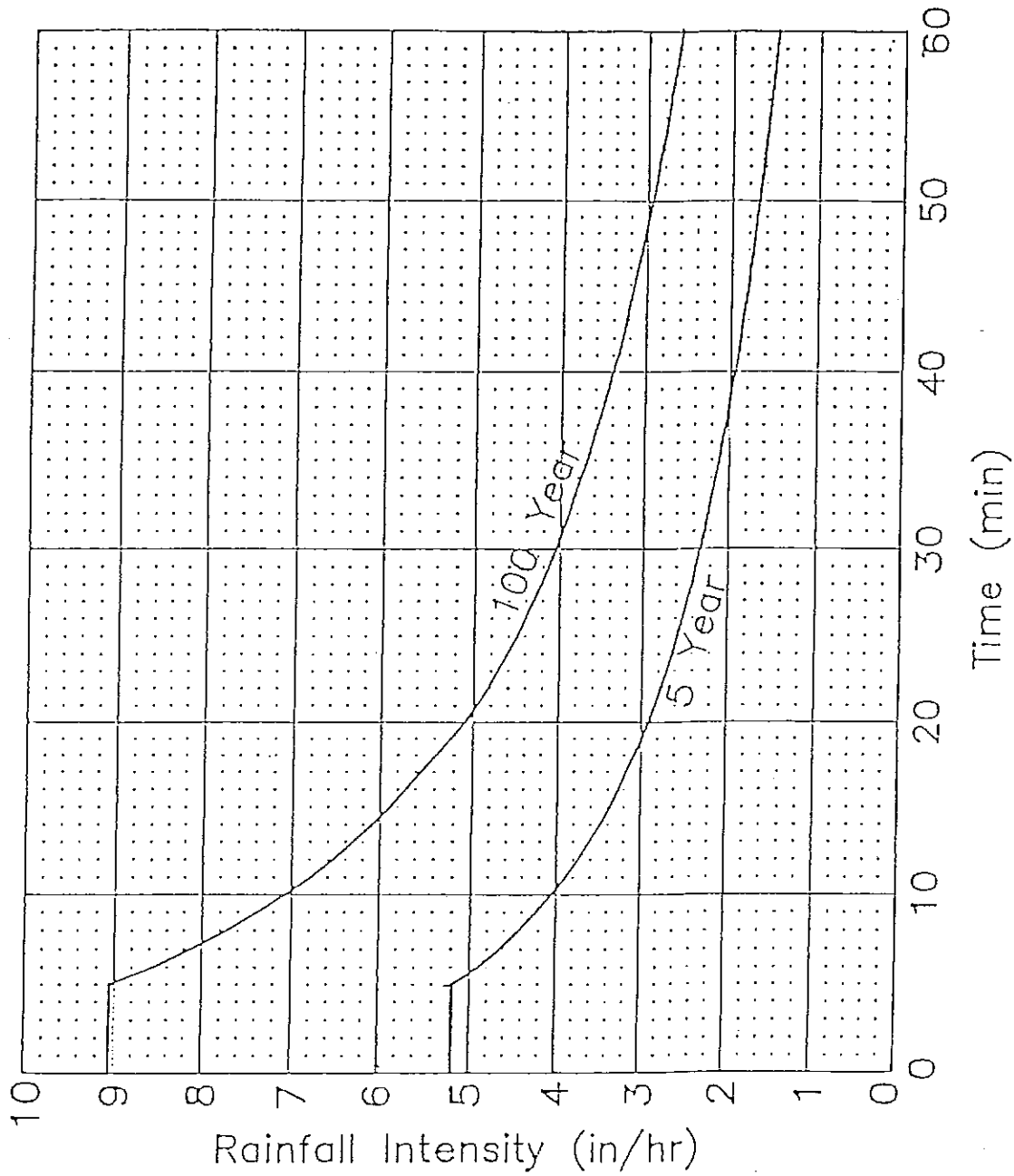


FIGURE 3-2. ESTIMATE OF AVERAGE FLOW VELOCITY FOR USE WITH THE RATIONAL FORMULA.

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

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

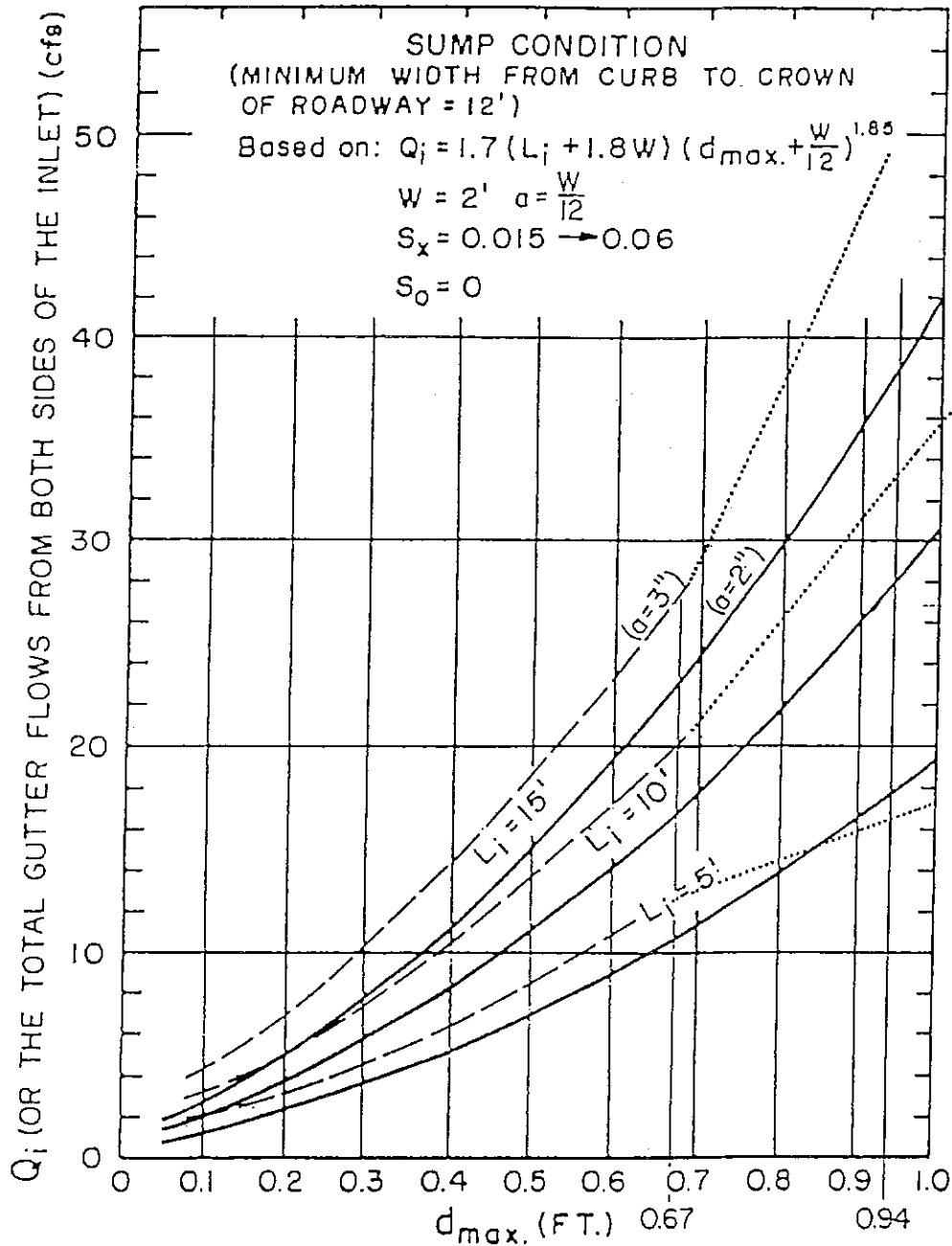


$$I_t = \frac{36.4 * I_{60}}{t^{0.41} + 6.72}$$

5 Year: $I_{60} = 1.50$
 100 Year: $I_{60} = 2.62$

RE: Based upon Pikes Peak Area Council of Governments
 Areawide Urban Runoff Control Manual.

The City of Colorado Springs / El Paso County Drainage Criteria Manual Storm Rainfall Time Intensity - Frequency Curves 5-9	Date: MAR. 1995
	Figure: 5 - 1



REFERENCE : Izzard, Carl, I., Report presented at the Annual Meeting of the National Transportation Board, January 1977; Simplified Method For Design of Curb-opening Inlets
 --- (As Modified by El Paso County, per Type R Inlet)
 Note: Depth of ponding measured at curb above depressed area ; $a = 3''$, For $d \leq .67$
 $Q_i = (1.7 L_i + 6.12)(d_{max} + .25)^{1.85}$; $Q_i = 3.60 L_i (d - .08)^{-5}$ For $d \geq .94$; Note: No Clogging Factor

9/30/90



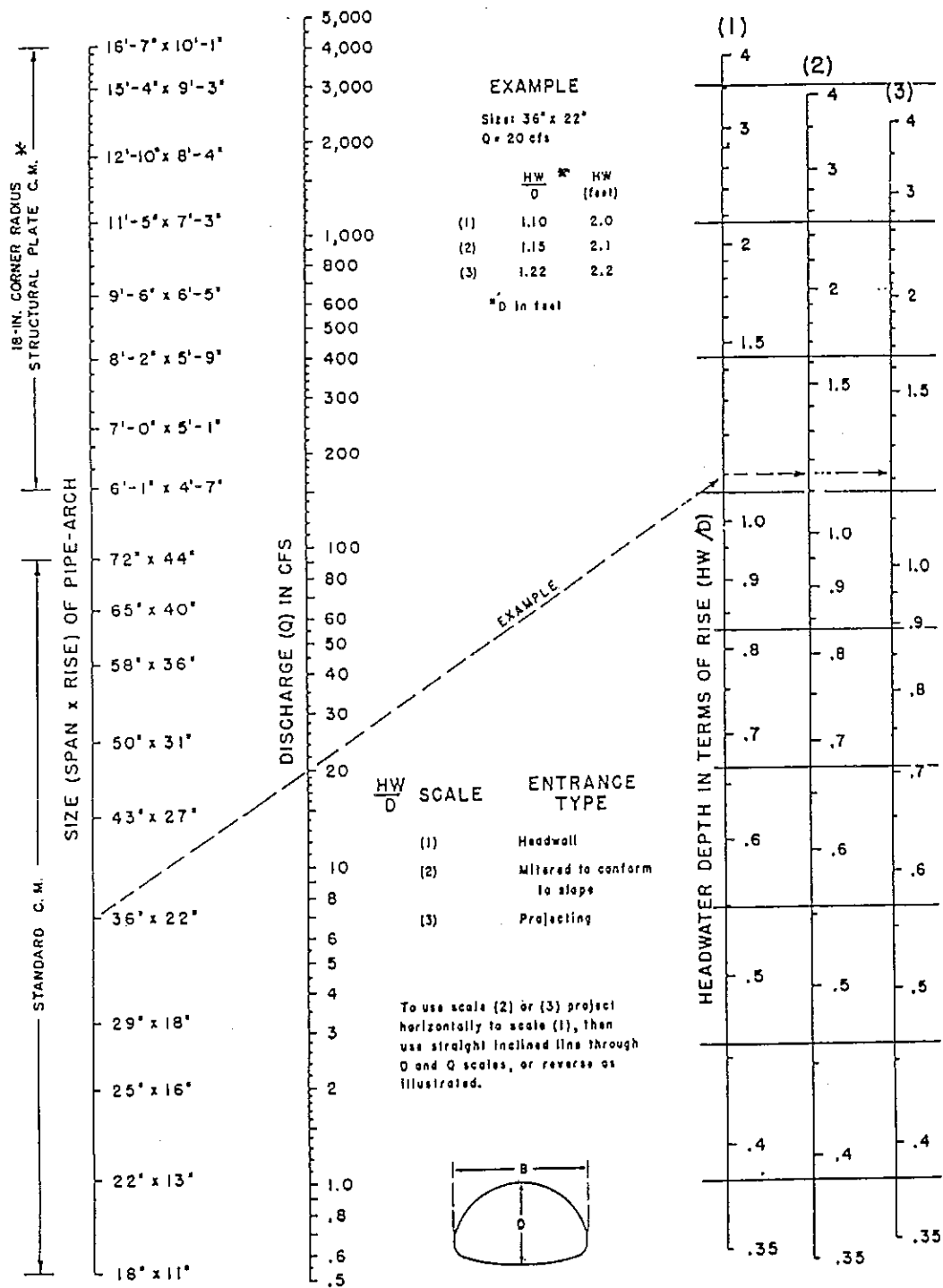
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Drainage Criteria Manual

Sump Capacity for Curb-opening Inlets

7-36

Date	OCT. 1987
Figure	7-11

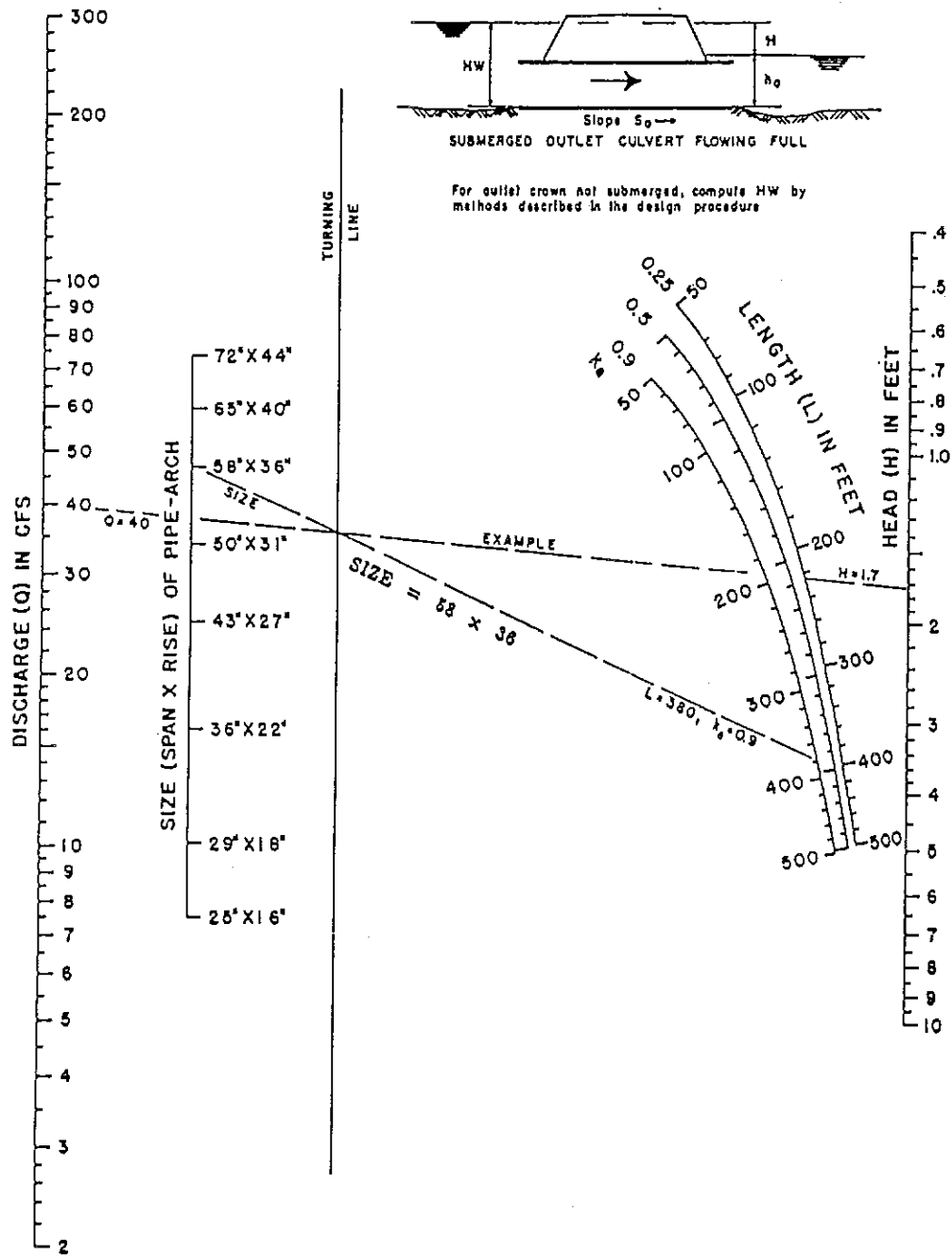


*ADDITIONAL SIZES NOT DIMENSIONED ARE LISTED IN FABRICATOR'S CATALOG

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL

The City of Colorado Springs / El Paso County Drainage Criteria Manual	Date
	9-30-90
9-66	Figure
	9-38



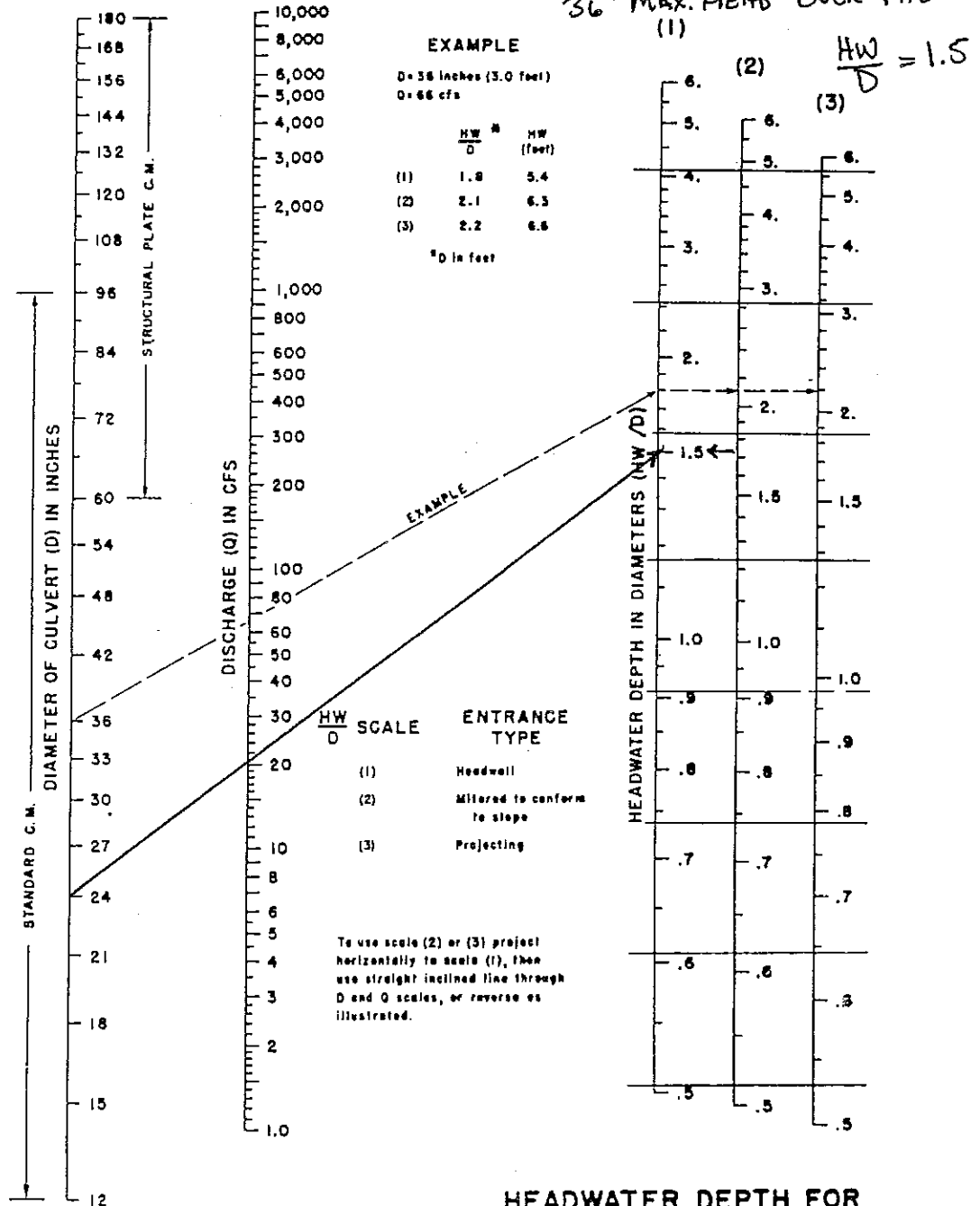
**HEAD FOR
STANDARD C.M. PIPE-ARCH CULVERTS
FLOWING FULL
n=0.024**

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

Date
9-30-90

Figure
9-25

*** INLET CAPACITY FOR SUB-BASIN OS-5**
24" CMP
36" MAX. HEAD OVER PIPE
(1)



**HEADWATER DEPTH FOR
 C. M. PIPE CULVERTS
 WITH INLET CONTROL**

BUREAU OF PUBLIC ROADS JAN. 1963



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The City of Colorado Springs / El Paso County
 Drainage Criteria Manual

Date

OCT. 1987

Figure

9-37