Broadmoor Bluffs Ests

MICROFICHED

ADDENDUM TO THE
FINAL DRAINAGE REPORT FOR
BROADMOOR BLUFFS DRIVE AND FARTHING DRIVE AND
FINAL DRAINAGE REPORT FOR
THE SCHOOL SITE AT
BROADMOOR BLUFFS ESTATES
A PORTION OF
CHEYENNE MOUNTAIN RANCH
COLORADO SPRINGS, COLORADO

NOT TO BE CHECKED OUT

DREXEL, BARRELL & CO.
ENGINEERS — SURVEYORS
1700 38TH STREET BOULDER, COLORADO 80301 (303) 442-4338

ADDENDUM TO THE FINAL DRAINAGE REPORT FOR BROADMOOR BLUFFS DRIVE AND FARTHING DRIVE AND FINAL DRAINAGE REPORT FOR THE SCHOOL SITE AT BROADMOOR BLUFFS ESTATES A PORTION OF CHEYENNE MOUNTAIN RANCH COLORADO SPRINGS, COLORADO

PREPARED FOR:

GATES LAND COMPANY
155 WEST LAKE AVENUE
COLORADO SPRINGS, COLORADO 80906
(303) 576-8515

PREPARED BY:

DREXEL, BARRELL & CO.
1700 38TH STREET
BOULDER, COLORADO 80301
(303) 442-4338

DATE PREPARED: OCTOBER 8, 1984
E-3146
(0155R)

CERTIFICATIONS

The attached drainage plan and report entitled "Addendum to the Final Drainage Report for Broadmoor Bluffs Drive and Farthing Drive and Final Drainage Report for the School Site at Broadmoor Bluffs Estates" 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 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 the negligent acts, errors, or omissions on my part in preparing this report.

For: DREXEL, BARRELL & CO.

By: _____
John Common, P.E. #11956

The developer has read and will comply with all of the requirements specified in this drainage report as approved by the City Engineer.

By : _____
Robert F. Svejkovsky
Title : Director of Engineering
Address: 155 West Lake Avenue
Colorado Springs, CO 80906

City of Colorado Springs:

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

City Engineer: _____ Date: 9/24/84

Conditions:

CONDITIONS:
1) All berms and swales shown on the drainage plan to be privately maintained.
2) Gates Land Co. to accept and maintain developed flows onto their property.

FLOODPLAIN STATEMENT

FOR
BROADMOOR BLUFFS ESTATES

Broadmoor Bluffs Estates including the elementary school site is not in a designated Floodplain as shown on the Flood Insurance Rating Maps.

ADDENDUM TO THE FINAL DRAINAGE REPORT FOR BROADMOOR BLUFFS DRIVE AND FARTHING DRIVE AND FINAL DRAINAGE REPORT FOR THE SCHOOL SITE AT BROADMOOR BLUFFS ESTATES COLORADO SPRINGS, COLORADO

LOCATION

Broadmoor Bluffs Estates is a proposed single-family residential development. The subdivision includes approximately 59.22 acres of residential lots. An adjacent property of 11.8 acres has been set aside for Elementary School No. 4, Cheyenne Mountain School District No. 12. These areas are located in the SE1/4 of the SE1/4 of Section 6, and in the NE1/4, the East 1/2 of the NW1/4 and the NE1/4 of the SW1/4 of Section 7, all in T15S, R66W of the 6th P.M., Colorado Springs, Colorado. More generally, the area lies west of Colorado State Highway No. 115, across from the Fort Carson Military Reservation. It is bounded on the north by Broadmoor Bluffs Park No. 2 and 4; on the west by Broadmoor Bluffs Filing No. 8 and Neal Ranch Filing No. 2. The remaining surrounding properties are unplatted and owned by Gates Land Company.

INTENT

This report is an Addendum to the City approved Final Drainage Report for Broadmoor Bluffs Drive and Farthing Drive prepared by Drexel, Barrell & Co., and dated August 31, 1984. It is also a Final Drainage Report for the Elementary School Site at Broadmoor Bluffs Estates. The proposed development of the elementary school site south of Farthing Drive will result in a slight increase in tributary flows to the street. This necessitated a recalculation of capacities of Farthing Drive and related drainage facilities. Flows which originate on the school site but are not tributary to Farthing Drive have also been analyzed to determine any possible need for the development of additional drainage facilities. This report does not address internal drainage at the School Site but only considers the storm run-off developed on the property as it leaves the site.

DESIGN REFERENCES

The drainage design criteria was taken from the City of Colorado Springs "Determination of Storm Runoff Criteria Manual". Flows from the school site which outfall to Farthing Drive were calculated using the modified SCS methodology for the 6 hour initial 5 year, and major 100 year rainfalls. No flows over 500 cfs occur, so all culverts were sized to pass the 5 year flows with no backwater and pass the 100 year flows with no overtopping of the curbs. Storm sewers were designed so as to not allow curb and gutter flow to exceed 12 cfs with the initial rainfall and allow major rainfall to be channelized within the right-of-way. Hydrologic soil groups were determined from maps published by the Soil Conservation Service. School site flows which outfall to an existing swale ("C") to the south of the property were calculated using the rational method, since the basin is less than 20 acres in size.

EXISTING DRAINAGE CHARACTERISTICS

Two major drainage basins were established in the Final Drainage Report for Broadmoor Bluffs Drive and Farthing Drive. Each basin contains at least one existing drainage swale. The southerly basin, "I", outfalls runoff from approximately 84.7 acres to a swale which carries flows to a pair of existing 72" culverts under Colorado State Highway No. 115, located approximately 1250 feet south of the Academy Boulevard overpass. Farthing Drive flows are included in Basin "I".

Existing site conditions range from grassy 6% slopes, in Basins K & L, to heavily vegetated slopes ranging from 8 to 65% in Basins A through E. The soils are predominantly of the razor series with some ustic torrifluvents existing around Basins K, L & the Academy overpass area, in addition to Jarre-Tecolote complex in Basins A, B, C and D. The existing drainage swales are generally heavily vegetated; ranging from natural grasses to scrub oak.

DESIGN DRAINAGE CHARACTERISTICS

As indicated by the Final Drainage Report for Broadmoor Bluffs Drive and Farthing Drive, approximately 39.9 acres (offsite Basins 1 & 2) are tributary to major Basin I. Two forks from Swale "A" extend westerly through the single-family area and eventually pick up these flows. Future culverts will be required beneath Cardiff Circle to pass these flows. The two forks merge within Basin G and continue easterly, paralleling the proposed Farthing Drive. This swale dissipates in Basin J and the storm runoff turns into sheet flow. To contain this sheet flow and effectively pass it under Broadmoor Bluffs Drive, a temporary swale section is proposed across Basin J. This swale will direct flows to a proposed 48" culvert at the intersection of Farthing and Broadmoor Bluffs Drives. These flows will then be directed to an existing major swale outfalling to the previously mentioned twin 72" culverts under Colorado State Highway No. 115.

The flows generated in Farthing Drive and in Basin "O" of the school site are to be picked up by a series of inlets at the intersection of Farthing Drive and Broadmoor Bluffs Drive and directed to the same outfall as discussed above. Basin J is proposed as a future commercial area. With the existing topography, and proposed street grades, it would be difficult to direct future design runoff from Basin J to the 48" culvert. Therefore a 36" culvert is proposed to release flows from this basin. In the event, prior to street construction, this area should be designated for another use, this culvert may be redesigned.

Additional school site flows (Basin "P") will outfall to the two 72" culverts south of Academy Blvd. at Highway 115, but are to be routed to this point through an existing swale ("C") located to the south of Farthing Drive. At the time of future Broadmoor Bluffs Drive construction to the south of its intersection with Farthing Drive, it will be necessary to provide a culvert or other means of passing Basin "P" flows across the roadway.

Swales "A" & "C" are to remain natural and privately maintained. Future culverts, in this area, have been preliminary sized and will be detailed with the final drainage report for the single-family area.

CONCLUSION

This study slightly modifies the flows to be passed along and under Broadmoor Bluffs Drive and Farthing Drive. The intent is to provide sufficient design criteria for the street construction at this time. The calculations indicate that previously designed and approved drainage facilities are adequate to carry additional flows to Farthing Drive due to school site development. A slight modification in the Farthing Drive design was necessary to provide sufficient street flow capacity.

Additional flows developed on the school property will be directed to an existing swale ("C") located to the south of the site. These flows from the school site appear to negligibly increase flows in the existing channel. Based upon inspection of the respective times of concentration, peak storm run-off flows from the school site will enter the existing channel long before the peak run-off arrives from the upstream basin. Hence the run-off from the Shcool Site should have little or no impact on the existing channel. The channel will be studied further in future reports as development within the basin progresses.

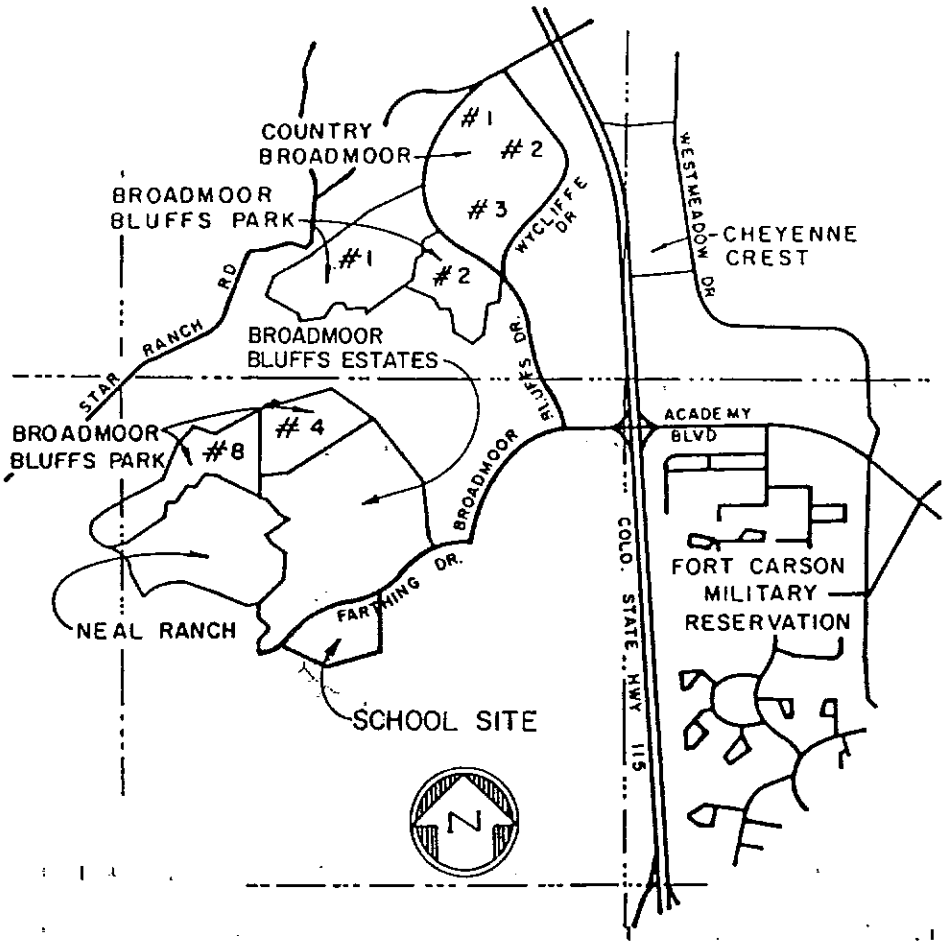
Copies of the calculations, with support material, follow for your review. By agreement with the City of Colorado Springs, no drainage basin fees are paid by Gates Land Company. Drainage structure cost estimates calculated in the "Final Drainage Report for Broadmoor Bluffs Drive and Farthing Drive" will remain the same. The drainage facilities proposed in the Final Report for Broadmoor Bluffs Drive and Farthing Drive will be built and paid for by Gates Land Company. A copy of the drainage plan has been included for your review.

Respectfully submitted,

Constell Sturdevant

Constell Sturdevant
Drexel, Barrell & Co.

EXHIBIT "A"



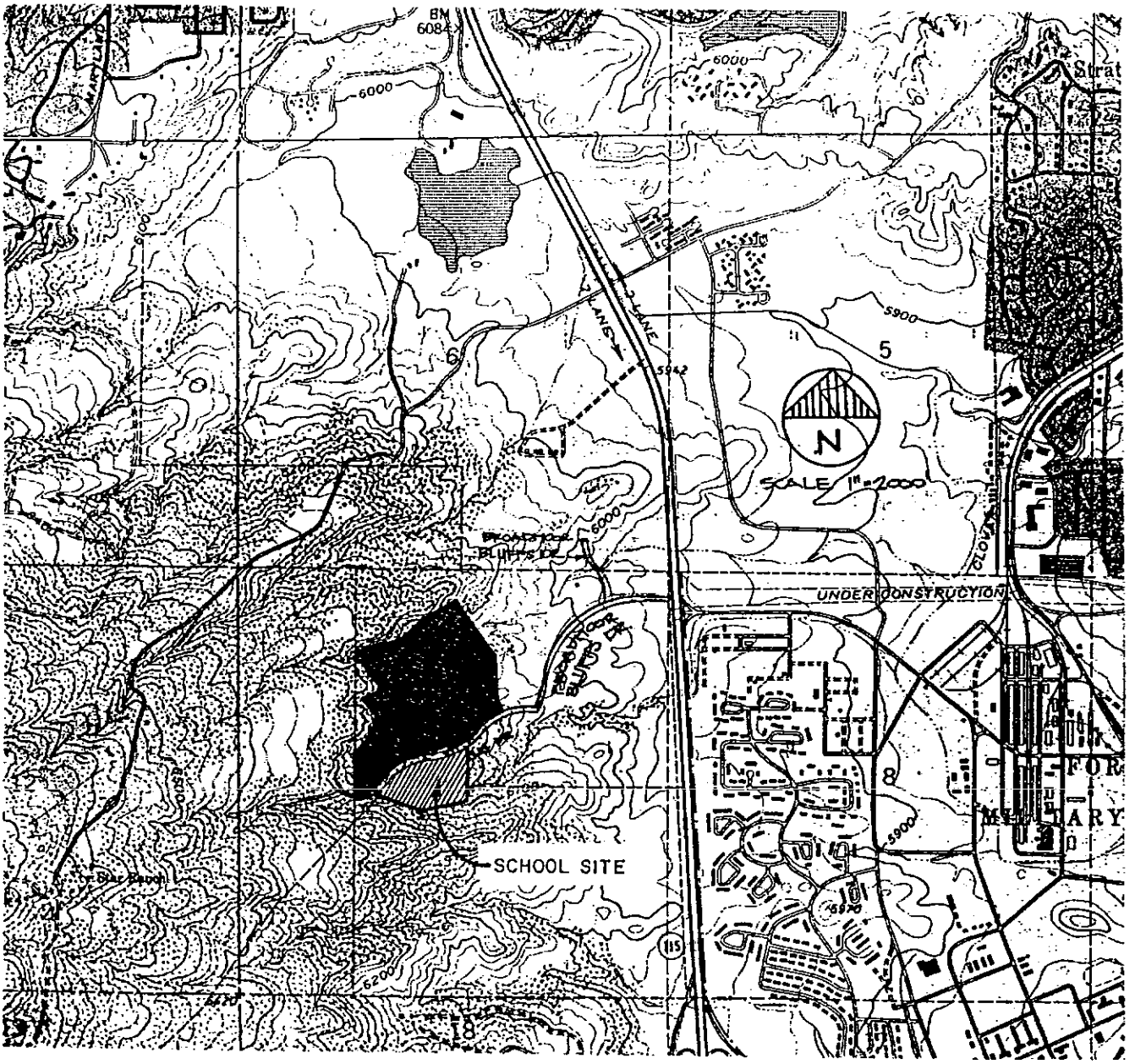
VICINITY MAP

SCALE : 1" = 2000'

BENCH MARKS

GATES GRID NO. 55,000 N
105,000 E
ELEVATION = 5959.26 (U.S.G.S.)

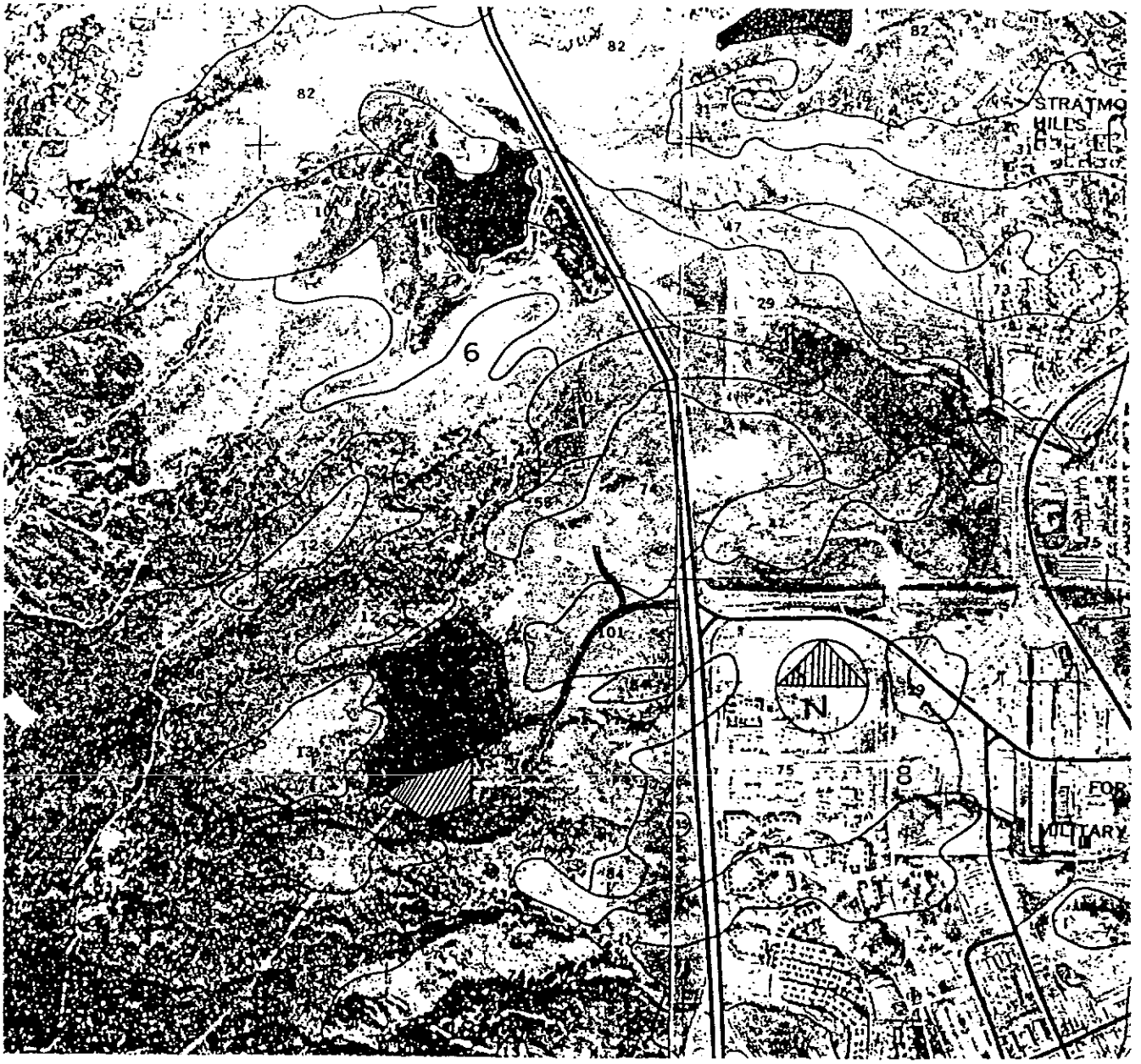
EXHIBIT "A1"



U.S.G.S.
VICINITY MAP

SCALE: 1" = 2000'

EXHIBIT "B"



SOILS MAP

SCALE 1" = 2000'

SEE NEXT PAGE FOR
DESCRIPTIONS.

EXHIBIT "B"

HYDROLOGIC SOILS GROUPS
FOR
BROADMOOR BLUFFS ESTATES STUDY

No.	Classification	Hydrologic Group
12	Bresser	B
13	Bresser	B
38	Jarre Tecolote Series	B
74	Razor	C
84	Stapleton	B
101	Ustic Torrifluvents	B

EXHIBIT "C"

STREET CAPACITY AND INLET
SIZING CALCULATIONS

Project	Job No
BROADMOOR BLUFFS ESTATES	E-3098
Client	**By** / **Date**
GATES	JGS 25 SEPT 1984

BASIN "O" AREA = 2.01 ACRES SCHOOL SITE

SOIL GROUP = 74 (C) USE C+B CN = 94

T_c: 270' OVERLAND @ 8 %

VELOCITY = 0.7 f/s t_c = 270/(60)(0.7) = 6.4 MIN.

225' ASPHALT FLOW @ 5 %

VELOCITY = 4.5 f/s t_c = 225/(60)(4.5) = 0.8 MIN

T_c = 6.4 + 0.8 = 7.2 MIN. = 0.12 h.

q_p = 1220 CSM/INCH

Q_5 = 1.49 IN.

Q_{100} = 2.84 IN.

q_5 = 1220 * (2.01/640)(1.49) = 5.7 CFS QA/640 = 0.0047

q_{100} = 1220 * (2.01/640)(2.84) = 10.9 CFS 0.0089

STREET CAPACITY & INLET SIZING

BASIN "A" UNCHANGED

BASIN "H" (FLOW TO 17+00) 50/50 SPLIT EXCEPT S. SIDE RECEIVES BASIN "O"

½ ST. QA/640 5 YR = 0.0032 100 YR = 0.0056

S ½ STREET Σ QA/640 = 0.0003 + 0.0032 + 0.0047 = 0.0082 5 YR
0.0007 + 0.0056 + 0.0089 = 0.0152 100 YR

T_c = 90' CURB FLOW @ 7 % 0.3 MIN
950' CURB FLOW @ 10 % 2.6 MIN
BASIN "O" 7.2 MIN
10.1 MIN = 0.17 h. q_p = 1120 CSM/IN.

Q_5 = 1120 * (0.0082) = 9.2 CFS
Q_{100} = 1120 * (0.0152) = 17.0 CFS

Project: BROADMOOR BLUFFS ESTATES — Job No: E-3098

Client: GATES — By: JGS — Date: 25 SEPT. 1984

BASIN "H" CONTINUED

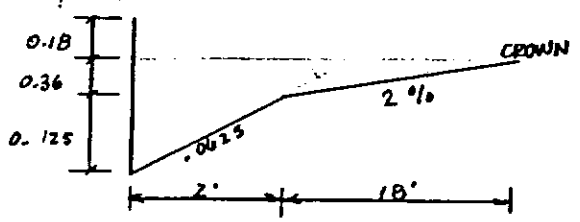
N ½ STREET

TOTAL "CA/640" 5YR : 0.0031 + 0.0032 = 0.0063
100 YR : 0.0087 + 0.0056 = 0.0143

T_c = 7.1 MIN + 3.3 MIN = 10.4 MIN = 0.17 HOUR

q_P = 1120 CSM/INCH q_5 = 1120 * 0.0063 = 7.1 CFS
q_{100} = 1120 * 0.0143 = 16.0 CFS

CHECK ST. CAPACITY S > 6 %



S = 0.10
n = 0.016

R/n = 1000	d = 0.485	Q = 27 CFS	
R/n = 1000	d = 0.36	Q = 11 CFS	
R/n = 3125	d = 0.36	Q = 36 CFS	

½ STREET = 52 CFS

ALLOWABLE = 52 CFS * 0.2 (RP) = 10.4 CFS TO CROWN OK

BRAEL, BARRELL & CO. CIVIL ENGINEERS

Project: BROADMOOR BLUFFS ESTATES. Job No: E-3098

Client: GATES By: VGS Date: 25 SEPT. 1984

BASIN "I" (FLOW TO STA 10+00) AREA = 1.16 ACRES

½ ST. QA/640 = 0.0017 5 YR
0.00295 100 YR

5½ STREET

Σ QA/640 = 0.0017 + 0.0082 = 0.0099
0.00295 + 0.0152 = 0.01815

T_c : 10.1 MIN + 2.1 MIN = 12.2 MIN = 0.2 h

q_p = 1060 CSM/IN

q_5 = 1060 * (0.0099) = 10.5 CFS q_{100} = 1060 * 0.01815 = 19.2 CFS

N ½ STREET

Σ QA/640 = 0.0017 + 0.0063 = 0.008
0.00295 + 0.0143 = 0.01725

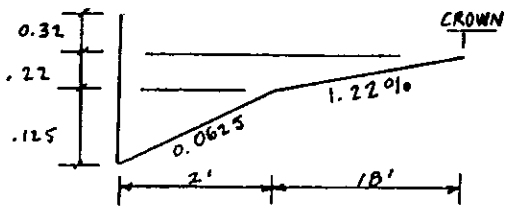
T_c = 10.4 MIN + 2.1 MIN = 12.5 MIN = 0.21 h

q_p = 1050 CSM/IN

q_5 = 1050 * 0.008 = 8.4 CFS q_{100} = 1050 * 0.01725 = 18.1 CFS

STREET CAPACITY

SOUTH SIDE HAS ROTATING X-SLOPE
STA 11+50 ℄ SLOPE = 6.13% X-SLOPE = 1.22% η = 0.016



z/n = 1000 d = 0.345 Q = 8.0 CFS

z/n = 1000 d = 0.22 Q = 2.5 CFS

z/n = 5123 d = 0.22 Q = 13.0 CFS

18.5 CFS

ALLOWABLE Q = (18.5) * (0.40) (RF) = 7.4 CFS

UHLER, BARRELL & CO. LAND SURVEYORS CIVIL ENGINEERS

Project: BROADMOOR BLUFFS ESTATES — Job No. E-3098

Client: GATES — By: JBS — Date: 25 SEPT. 1984

BASIN "I" CONTINUED

N SIDE HAS TYPICAL SECTION
STATION 10+75 ℄ SLOPE = 4.4% X-SLOPE = 2%

TABLE S INTERPOLATION = 89.4 CFS / 2 = 44.7 CFS ½ ST. OK

STATION CHECK (13+00)

17+00 → S½ T_c = 10.1 MIN q_5 = 9.2 q_{100} = 17.0

400' CURBFLOW AT 10 % = 1.1 MIN

QA/640 = (1.87)(0.18)/640 = 0.00054 5 yr

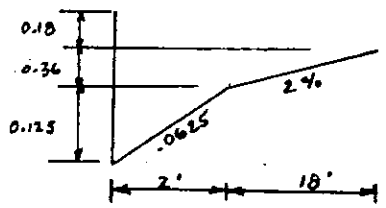
= (3.27)(0.18)/640 = 0.00092 100 yr

Σ QA/640 = 0.0082 + 0.00054 = 0.00874 5 YR
0.0152 + 0.00092 = 0.01612 100 YR

TOTAL T_c = 10.1 + 1.1 = 11.2 = 0.19 h ⇒ q_p = 1080 CSM/IN.

q_5 = 1080 * 0.00874 = 9.4 CFS q_{100} = 1080 * 0.01612 = 17.4 CFS

STREET CAPACITY S = 0.10 n = 0.016



z/n = 1000	d = 0.485	Q = 27 CFS	
z/n = 1000	d = 0.36	Q = 12 CFS	
z/n = 3125	d = 0.36	Q = 36 CFS	
		51 CFS	

ALLOWABLE = (51)(0.2) = 10.2 CFS ok

S = 10% 6' INLET = 6.12 CFS @ 11+50

@ 13+00, 10%, q_c = 9.4, (.6)(9.4) = 5.64 ⇒ 6' INLET

Exhibit

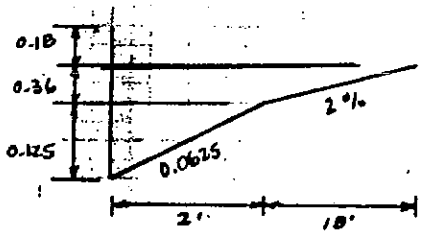
CIVIL ENGINEERS

Project: BROADMOOR BLUFFS ESTATES — Job No: G-3098

Client: GATES — By: JGS — Date: 25 SEPT. 1984

IF NORMAL AT 11+50 IS CAPACITY SUFFICIENT?

ASSUME ℄ SLOPE = 6.13% ; X-SLOPE = 2% ; η = 0.016



z/n = 1000 ; d = 0.405 ; Q = 21 cfs

z/n = 1666 ; d = 0.38 ; Q = 9 cfs

z/n = 3125 ; d = 0.36 ; Q = 28 cfs

Σ = 40 cfs

ALLOWABLE = (40 cfs)(0.4) = 16 cfs OK

- LEAVE INLETS IN SAME LOCATION.
- REDESIGN TRANSITION FROM BROADMOOR BLUFFS TO FARTHING DRIVES.
- USE ONLY 100' VC.

JGS/CS 12 Oct. 1984

Pursuant to the vertical realignment of Farthing Drive, dated Oct. 8, 1984., the following calculations were performed to show the agreement between calculated 5 year flows & allowable street capacities.

ALLOWABLE CAPACITY at STA 11+30 ; S = 0.0552 ; n = 0.016

Typical Section, as above: Q = 90 cfs

(for Slope = 5.5%) $-Q$ = 9 cfs

Q = 96 cfs

Σ 37 cfs

Allowable = (37)(0.45) = 16.7 cfs → use 12 cfs for 5 year flow

From Basin I: q_5 = 16.5 cfs

q_{100} = 19.2 cfs

6' Inlet Capacity = 8.7 cfs

5 year pick-up = 6.3 cfs ; 5 year flow by = 4.9 cfs

100 year pick-up = 8.7 cfs ; 100 year flow by = 10.5 cfs

EXHIBIT "D"

SCHOOL SITE DEVELOPED RUN-OFF
CALCULATIONS

DREXEL, BARRELL & CO. LAND SURVEYORS CIVIL ENGINEERS

Project	Job Nº
Chey. Mtn. / School Site	E-3146

Client	By	Date
Gates	CS	10-5-84

✓ BJB 90CT84

Total Site Area = 11.8 ac.

7203 2797
7206 2741
2770

Basin Use: "O" Drains to Farthing Dr.
A = 2.0 Ac.

Use:	Area; Ac.:	C
Drive + Parking	0.9	0.90
Open Space	1.1	0.30
	2.0	0.55 (Composite)

(see Basin "O" Calculations)

T_c = 0.12 hrs. (from previous calc's — Jim Sokolowski) see p.1, Exhibit C

I_5 = 5.2 in/hr. I_{100} = 7.9

$Q_5 = CIA = (0.55)(5.2)(2) = 5.7$ cfs → these flows included in Broadmoor Bluffs estates sheet flows to Farthing Drive. (Basin "8")

$Q_{100} = CIA = (0.55)(7.9)(2) = 8.4$ cfs*

*This calculates as lower than the number designed for using the SCS method, so street design is conservative.

Basin "P": Release to existing swales to East/South
A = 11.8 - 2.0 = 9.8 ac.

Use:	Area; Ac:	C
Buildings/Roofs	0.6	0.90
Asphalt Drives + Play Areas	0.3	0.90
Gravel Play Areas	1.7	0.70
Open Space	7.2	0.30
	9.8 ac.	0.42 (Composite)

T_c = 0.07 hr Aeler. = 24' L = 660'

I_5 = 6.1 in/hr I_{100} = 9.0 in/hr

$Q_5 = CIA = (0.42)(6.1 \text{ in/hr})(9.8 \text{ ac.}) = 25.1$ cfs

$Q_{100} = (0.42)(9.0 \text{ in/hr})(9.8 \text{ ac}) = 37.0$ cfs

DREXEL, BARRELL & CO. LAND SURVEYORS CIVIL ENGINEERS

Project	Job No
Chey. Mtn. / Soroco Site	E-3146

Client	By	Date
Gates	CS	10-5-84

✓ BJB 9OCT84

Basin "P" Historic Flows

$T_c = 0.07$ hr
$I = 6.1$ in/hr
$C = 0.30$

$Q = CIA = (0.30)(6.1)(9.8) = 17.9$ cfs

∴ This results in only a 7.9 cfs increase in flow downstream due to development.

Checking possible impact on Swale "C" due to Basin "O" flows:

Swale "C" drainage basin is approximately 350 ac. in size & corresponds to Basins V & VII of a Master Drainage Plan for Cheyenne Mtn. Ranch presently in progress at Drexel, Barrell, & Co. These basins are based on previous basin divisions made by Hartzell, Pfeiffenberger & Assoc. dated May 17, 1971. This tributary basin is also comparable to Basin A-96 identified in "Drainage Study, Fort Carson, Colorado" prepared by Higgenbotham & Assoc., Morgan & Assoc., Inc., and Karcich & Weber, Inc. for the U.S. Army Corps of Engineers.

DREXEL, BARRELL & CO.

LAND SURVEYORS
CIVIL ENGINEERS

Project			Job №
Qhey Mtn./School Site			E-3146
Client	**By**	**Date**	
Gates	CS	10-10-84	

CN: V + VII

Basin V: Area = 258 ac. + 18.5 ac. not prev. included = 276.5 ac.

CN:

Use	Soil Type	Acreage	% Area	CN	% CN
Industrial	B	4	1.4	88	1.2
Industrial	C	24	8.7	91	7.9
Multi-Family 6 units/ac	C	10.0	3.6	90	3.2
School Site	C	9.8	3.5	76	2.7
Park Area	C	16.0	5.8	74	4.3
Single-Family 1 Unit/Ac	B	11.0	4.0	68	2.7
Single-Family 2.4 Units/Ac.	B	13.5	4.9	72	3.5
Single-Family* 3 Units-Ac	B	69.0	25.0	72	18.0
Open Space* Fair Condition		118.7	42.9	69	29.6
		276.5	100.0		73.

* These areas are presently unplatted + these assumptions have been made regarding future development.

T_c = 1500' at 60% slope from Figure 15.2. V = 8.0 fps for alluvial fans

$T_t = (1500')/(8\ ft/s)(60 s/min)$
$= 3.1$ min

4000' at 20% slope: V = 6.9 fps for grassed waterways
$T_t = 9.7$ min

4500' at 12% slope, V = 5.2 fps for grassed waterways
$T_t = 14.4$ min

Project	Job Nº
Clay Mtn / School Site	E-3146

Client	By	Date
Gates	CS	10-10-84

Basin V, cont. T_c = 3.1 min + 9.7 min + 14.4 min
= 27.2 min = 0.45 hr.

q_p = 780 csm/in

CN = 73 Q = 1.18 in

Q_{100} = (276.6 ac)/640 ac/mi² × (1.18 in)(780 csm/in)
= 398 cfs

DREXEL, BARRELL & CO. LAND SURVEYORS CIVIL ENGINEERS

Project	Job Nº
Cheyenne Mtn / School Site	E-3146

Client	By	Date
Gates	DS	10-16-84

Basin VII : Area = 73.5 ac.

Corresponds to Basins 1, 2, A, H, I, O, B, C, F, & G of Broadmoor Bluffs Estates (see previously approved drainage study).

For Basins A, H, I, O :

Area = 0.015 mi²
CN = 89
T_c = 0.32 hr. q_p = 900 csm/inch
Q = 2.36 in

$Q = (0.015\ mi^2)(2.36\ in)(900\ csm/inch)$
$= 31.9\ cfs$

For Basins 1, 2, B, C, G, F :

Area = 0.100 mi²
CN = 75
T_c = 0.47 hr. q_p = 750 csm/in
Q = 1.30 in

$Q = (0.100)(1.30)(770)$
$= 100\ cfs$ (99.8 cfs)

Q_{total} = 99.8 + 31.9 + 398
= 530 cfs } the school outflow of 37 cfs accounts for only about 7% of these flows.

Also, the school outflow will arrive at the channel in approximately 0.07 hr (4.2 min), while the T_c for the upper basins are around half an hour. Thus, the peak from the school site will reach Swale "C" prior to upper basin peak flows, and have a negligible impact on the hydrograph peak for the basin.

EXHIBIT "E"

CHARTS USED IN CALCULATIONS

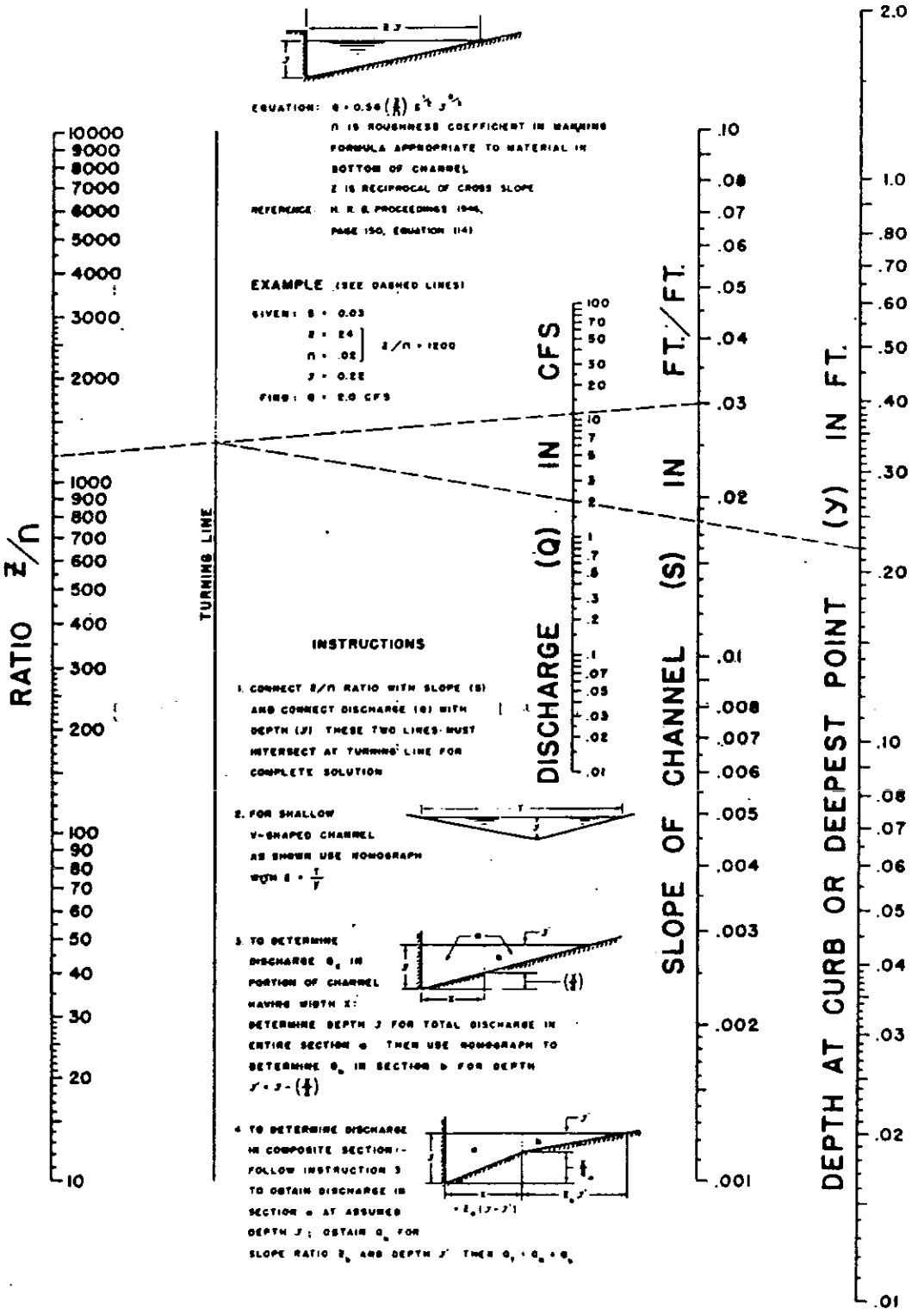


FIGURE 6-1. NOMOGRAPH FOR FLOW IN TRIANGULAR GUTTERS.

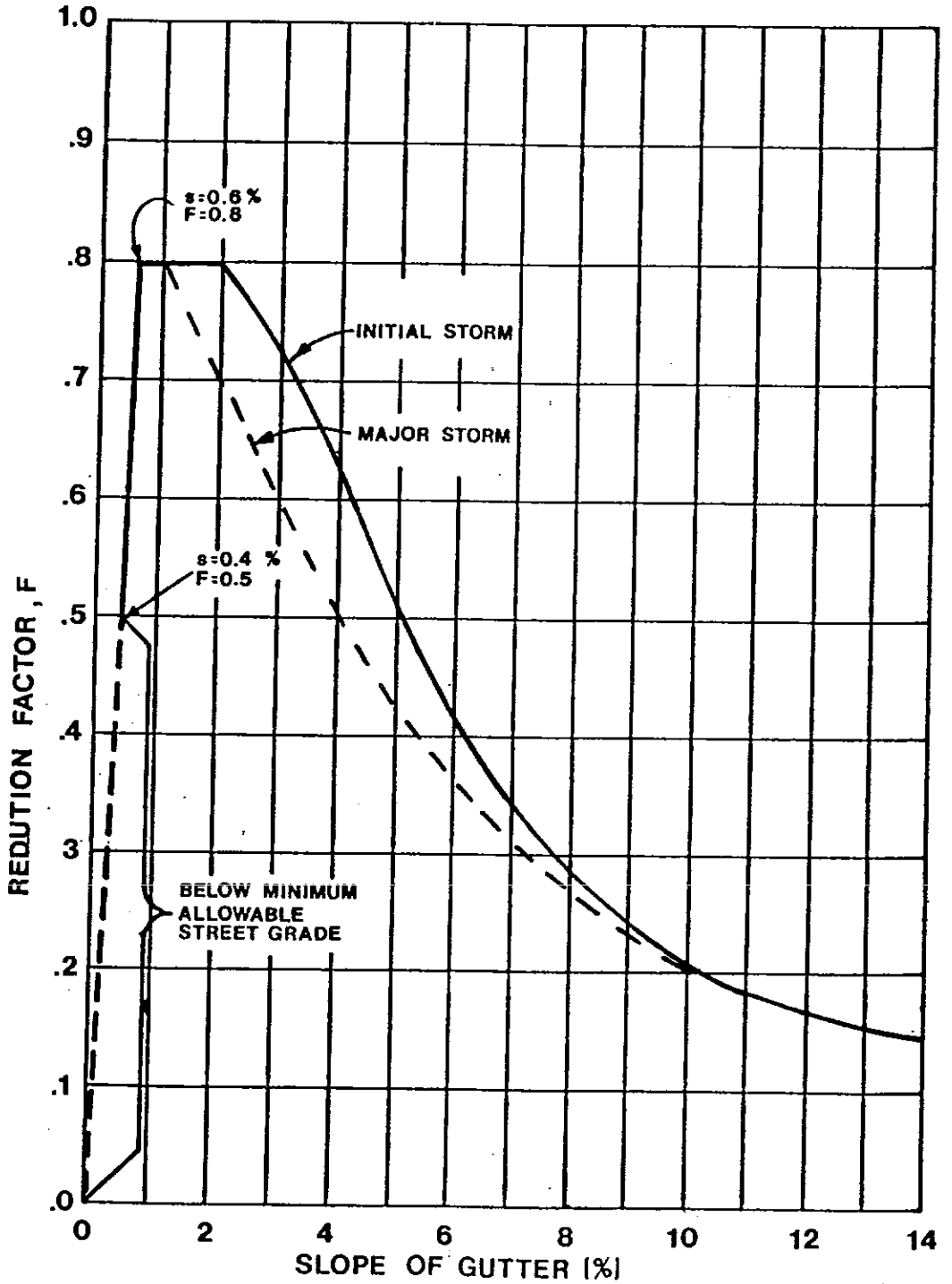


FIGURE 6-2 REDUCTION FACTOR FOR ALLOWABLE GUTTER CAPACITY LOCAL AND COLLECTOR STREETS

APPLY REDUCTION FACTOR FOR APPLICABLE SLOPE TO THE THEORETICAL GUTTER CAPACITY TO OBTAIN ALLOWABLE GUTTER CAPACITY APPROACHING ARTERIAL STREET

Table 5 Permissible Drainage Street Capacities with 8" Vertical Curbs *
8" Curb - Full Storm Water Capacity (with level curbs)

S	34' Residential		36' Residential		40' Residential		34' One-Way Art.		60' & 76' Arterial		S
	FPS	CFS	FPS	CFS	FPS	CFS	FPS	CFS	FPS	CFS	
0.5	4.08	28.9	4.02	29.5	3.90	30.1		20.0		20.0	0.5
1.0	5.76	40.9	5.70	41.7	5.51	42.6		30.0		30.0	1.0
1.5	7.06	50.1	6.97	51.1	6.75	52.2	6.97	30.0	6.97	30.0	1.5
2.0	8.15	57.8	8.05	59.0	7.79	60.2	8.05	34.0	8.05	34.0	2.0
2.5	9.11	64.7	9.00	65.9	8.71	67.4	9.00	36.0	9.00	36.0	2.5
3.0	9.98	70.9	9.86	72.2	9.54	73.8	9.86	38.0	9.86	38.0	3.0
3.5	10.78	76.5	10.65	78.0	10.31	79.7	10.65	40.0	10.65	40.0	3.5
4.0	11.52	81.8	11.38	83.4	11.02	85.2	11.33	42.0	11.38	42.0	4.0
4.5	12.22	86.8	12.07	88.5	11.69	90.4	12.07	43.0	12.07	43.0	4.5
5.0	12.89	91.5	12.73	93.3	12.32	95.3	12.73	45.0	12.73	45.0	5.0
5.5	13.52	95.9	13.35	97.8	12.92	99.9	13.35	47.0	13.35	47.0	5.5
6.0	14.12	100.0	13.94	102.2	13.49	104.3	13.94	49.0	13.94	49.0	6.0

* Intermediate Values may be Obtained by Arithmetic Interpolation

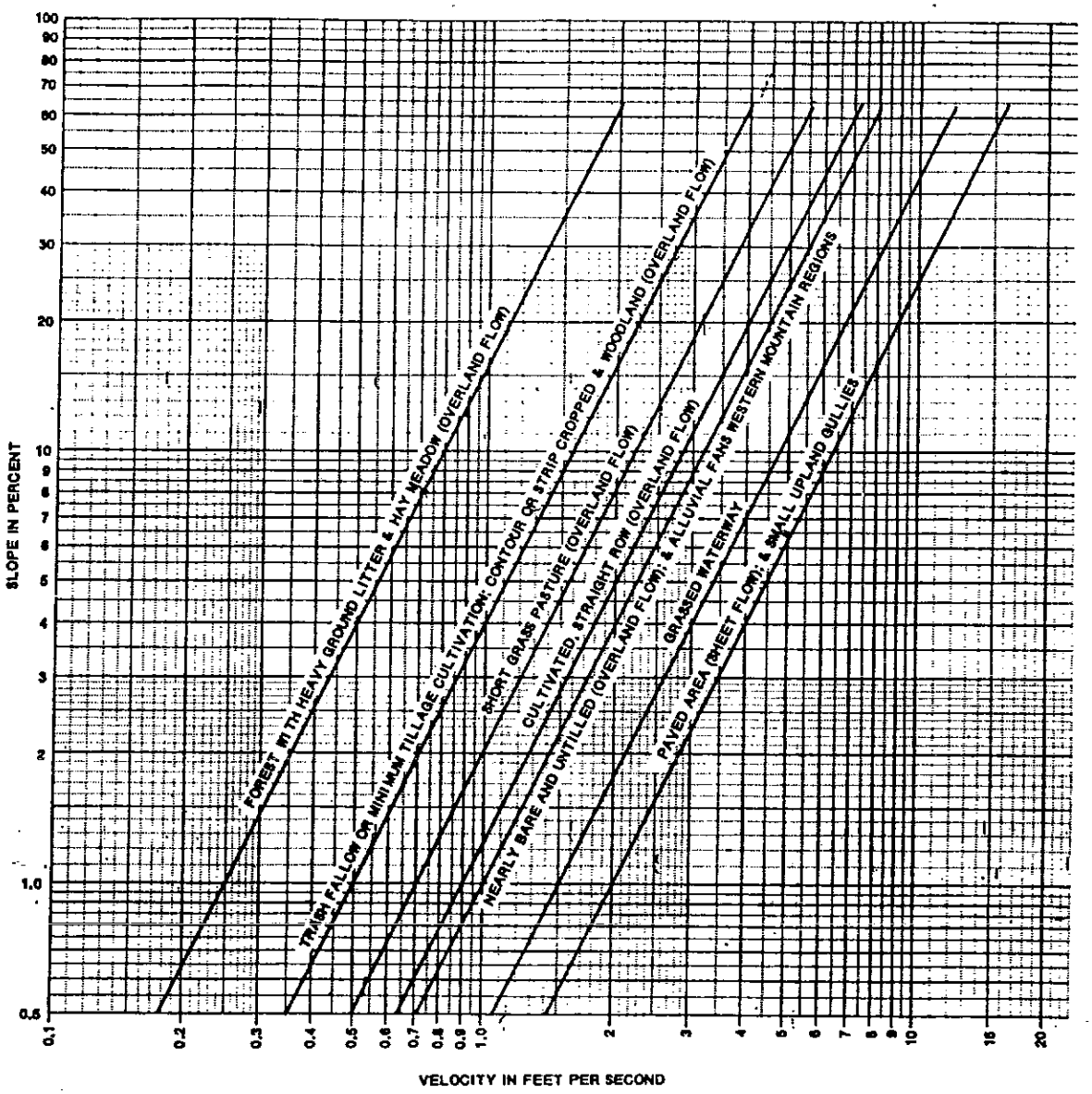


Figure 15.2.—Velocities for upland method of estimating T_c