

APPENDIX B
DRAINAGE REPORT
FOR
WESTGATE HEIGHTS UNIT 4

1001 WYOMING BOULEVARD N.E. • SUITE F • ALBUQUERQUE, NEW MEXICO 87110 • 505/282-1001

MEURER, SERAFINI AND MEURER, INC. CONSULTING ENGINEERS



DRAINAGE REPORT
WESTGATE HEIGHTS UNIT 4
ALBUQUERQUE, NEW MEXICO

DRAINAGE REPORT
WESTGATE HEIGHTS UNIT 4
ALBUQUERQUE, NEW MEXICO

Prepared For
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WESTGATE HEIGHTS, UNIT 4
COMPREHENSIVE DRAINAGE STUDY

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DRAINAGE REPORT
WESTGATE HEIGHTS SUBDIVISION
UNIT 4

PURPOSE AND INTRODUCTION

The following report with the supporting calculations and exhibits describes the drainage characteristics affecting the development of Westgate Heights, Unit 4. A number of recommendations regarding the design and implementation of drainage improvements are included within the text to assist the City of Albuquerque, the Albuquerque Metropolitan Flood Control Authority and the developer in the engineering design and implementation of drainage facilities such that urban planning and development can be accomplished with a minimum risk to life and property.

THE SITE

Westgate Heights, Unit 4, a proposed R-1 development, is located within the southwest quadrant of the City of Albuquerque, east of Snow Vista Boulevard and south of Sage Road. It is bounded on the west by Truman Middle School and on the north by Westgate Heights Units 2 and 3, on the south and the east by unplatted lands.

GENERAL SITE CHARACTERISTICS

The site encompasses 65.06 acres, more or less, slopes from west to east with an average slope of 2%. The surface soils are predominantly sandy with little clay and can be considered open and highly absorbent with a high degree of porosity.

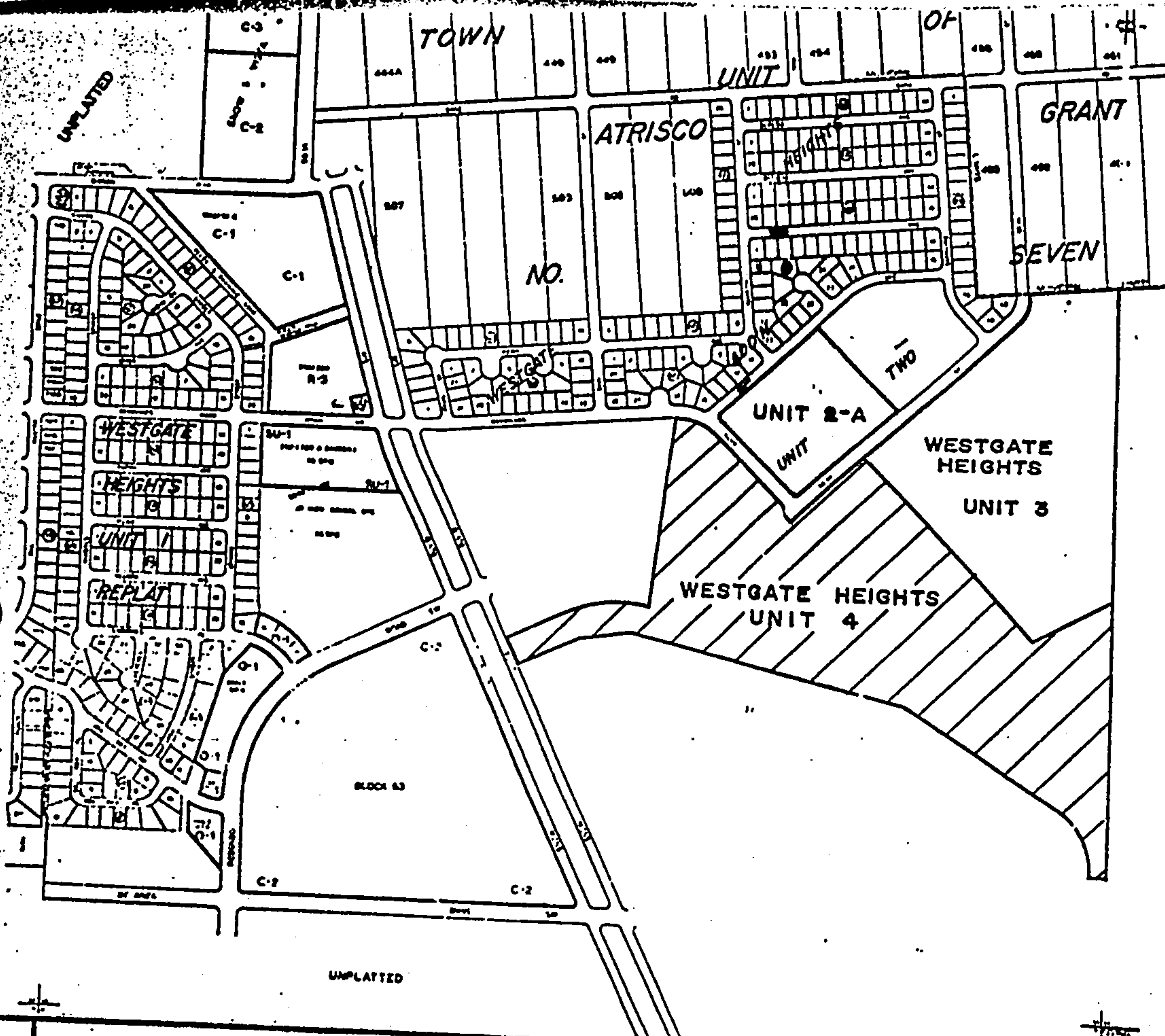
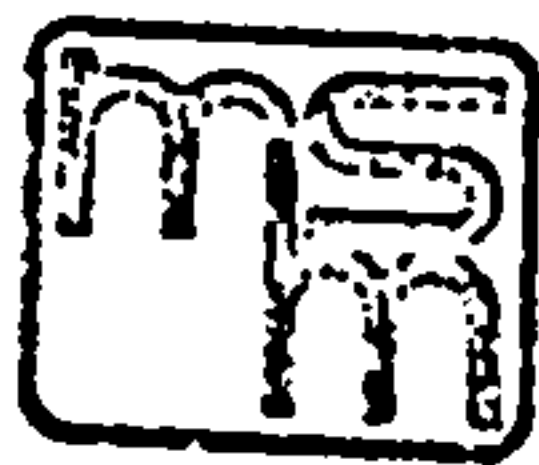


FIGURE 1
WESTGATE HEIGHTS
UNIT 4
VICINITY & LOCATION MAP



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DESIGN CRITERIA

In analyzing the storm runoff, the Rational Formula, $Q = C \cdot C_f \cdot I \cdot A$, was used. See Urban Storm Drainage, Criteria Manual, Vol. 1, Runoff, Section 3 "Rational Method".

Where:

Q = Runoff quantity in cubic feet/second.

A = Contributing area in acres.

C_f = Frequency Factor for Rational Formula.

I = Intensity in inches/hour for a duration equal to the time of concentration (duration) measured in minutes and obtained from Figure IV, Intensity Duration Frequency Curves, Albuquerque Area 1961.

(Note: Where a Time of Concentration [Tc] is less than ten minutes from Figure III, the intensity value equal to ten minutes was employed.)

C = Runoff Coefficient (No Unit). This coefficient represents the integrated effects of infiltration, detention storage, evaporation, retention, flow routing, and interception which all affect the time distribution and peak rate of runoff.

ESTIMATED RUNOFF UNDEVELOPED STATE

Drainage within the boundary of the primary drainage basin is in the form of sheet flow with general accumulation into several small arroyos. Offsite drainage from the west passes through the subdivision. The total runoff in the undeveloped site forms the basis for comparison with the flow in the developed state.

TABLE 1

RUNOFF IN UNDEVELOPED STATE

Elev. Diff.	Length of Flow	Tc ¹ .	1100 Yr. In./Hr.	C2.	Area Ac.	Q100 C.F.S.
80'	3500'	18	4.4	.4	97.62	172

ESTIMATED RUNOFF DEVELOPED STATE

As development occurs, the area of impervious surfaces increases and thereby the amount of runoff also increases. To offset this increase, onsite restrictions of flows must be incorporated into the development. While this may take different forms, the most practical solution for this type of development is to utilize on-lot ponding. The contributing area to the backyard ponding includes the backyard, sideyard, and in a majority of cases, one-half the roof area due to the popularity of the pitched roof concept. The area drained to the street includes the front yard, driveway, sidewalk-parkway areas, and one-half the roof area. This approach is to satisfy AMAFCA's requirement that the runoff rate from the developed tract not exceed the runoff rate from the tract in its natural state.

SUMMARY OF RESULTS

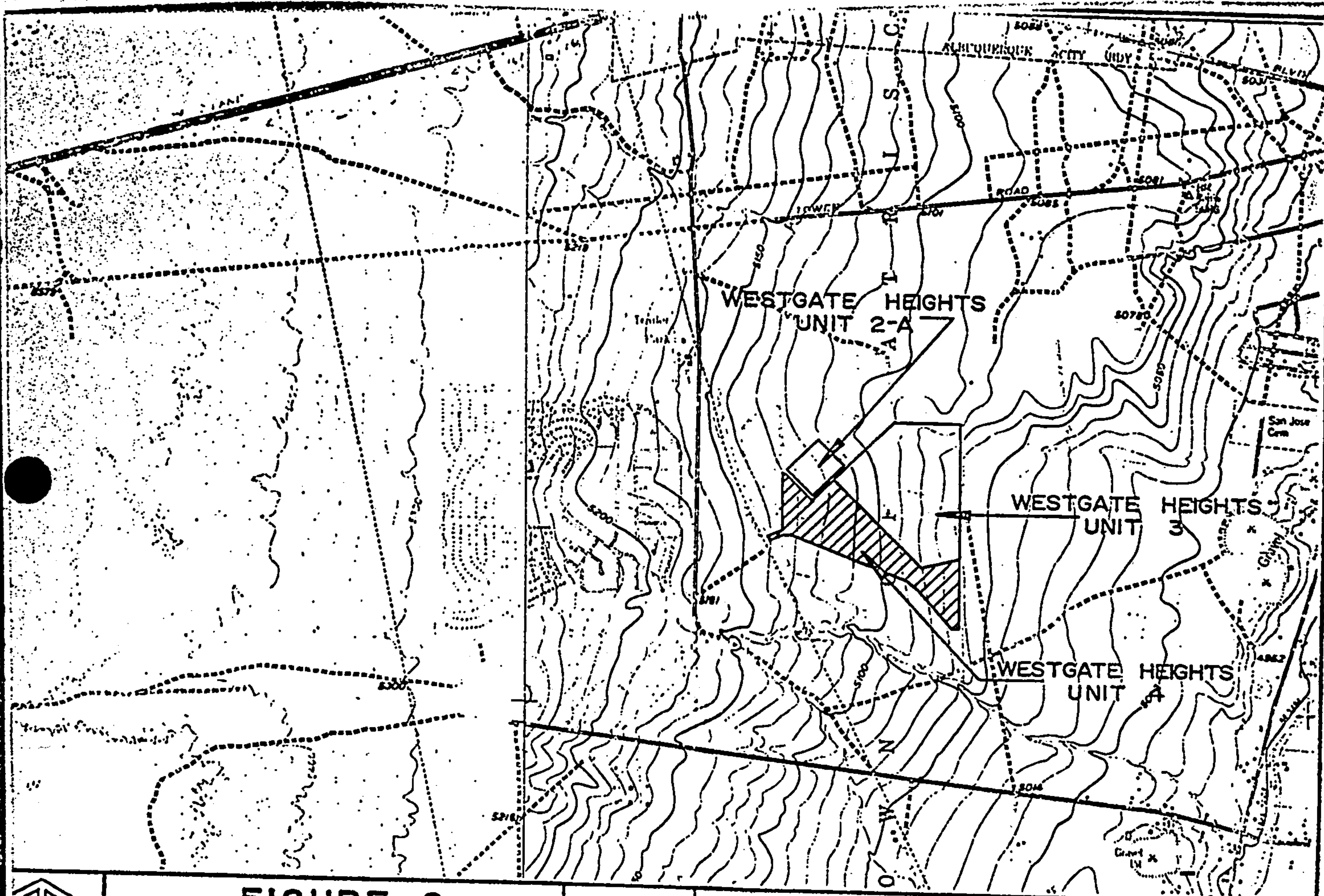
Total Undeveloped Runoff (See Page 3)

172 c.f.s.

Developed Runoff

0-S-1	12.26 c.f.s.
0-S-2	14.94 c.f.s.
0-S-3	41.06 c.f.s.
0-S-4	4.34

1. See Appendix; Rational Method Calculations.
2. See Appendix: Composite "C" Computations.



2000'

FIGURE 2
WESTGATE HEIGHTS
UNIT 4
PRIMARY DRAINAGE BASIN



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Developed Runoff (cont'd.)

Single Family Area 35.95

Total Developed Runoff

See Comp. site Flows (Table 2)

77.89 c.f.s.

TABLE 2

RUNOFF IN DEVELOPED STATE

<u>Area Designation</u>	<u>Acreage (Ac.)</u>	<u>I100 In./Hr.</u>	<u>"C"3.</u>	<u>Qmax. (cfs)</u>	<u>Q100 (cfs)</u>
<u>Offsite</u>					
O-S-1	3.29	5.4	.69	12.26	12.26
O-S-2	4.79	4.5	.69	14.94	14.94
O-S-3	19.01	5.4	.40	41.06	41.06
O-S-4	2.01	5.4	.40	4.34	4.34
A-1	9.68	4.47	.53	22.93	
B-1	2.81	5.17	.54	7.84	
B-2	.88	5.4	.48	2.28	
B-3	1.58	5.4	.43	3.67	
B-4	0.37	5.4	.80	1.61	
B-5	1.37	5.4	.47	3.48	
B-6	.75	5.4	.46	1.86	
B-7	3.50	5.4	.43	8.13	
C-1	2.88	5.09	.47	6.89	
C-2	0.67	5.4	.19	0.69	
C-3	0.97	5.4	.66	3.46	
C-4	0.91	5.4	.45	2.21	
C-5	1.96	5.4	.51	5.4	
C-6	1.29	5.4	.51	3.55	
C-7	1.32	5.4	.44	1.32	

TABLE 2 (cont'd.)

RUNOFF IN DEVELOPED STATE

Area Designation	Acreage (Ac.)	I ₁₀₀ In./Hr.	C ₃	Q _{max} (cfs)	Q ₁₀₀ (cfs)
D-1	1.82	5.4	.47	4.62	
D-2	0.52	5.4	.35	0.98	
D-3	0.53	5.4	.38	1.09	
E-1	0.96	5.4	.50	2.59	

TABLE 3

COMPOSITE FLOWS - DEVELOPED STATE

Area Designation	Acreage (Ac.)	I ₁₀₀ In./Hr.	"C" ³ .	Q _{max.} (cfs)	Q ₁₀₀ (cfs)
W6 #4 Total	34.77	2.11	.49	35.95	
A + O ^I -S-4	11.69	4.04	.51	24.09	
B-1 thru B-7 + O-S-1	14.55	2.71	.53	20.9	
C-1 thru C-7 + O-S-3 & 4	31.02	2.11	.43	27.87	
I + II ^{IV}	26.24	2.71	.52	36.98	
III + IV ^V	57.26	2.71	.47	73.13	
V + D ^{VI}	60.13	2.71	.47	76.28	
VI + E ^{VII}	61.09	2.71	.47	77.89	<u>77.89 cfs</u>

SUMMARY OF RESULTS

Total Undeveloped Runoff (see Page 3) 172 cfs

Developed Runoff:

O-S-1	12.26 cfs
O-S-2	14.94 cfs
O-S-3	41.06 cfs
O-S-4	<u>4.34 cfs</u>

Total Developed Runoff 72.6 cfs

As shown above, the development of this project including the lot ponding will not increase the storm runoff over that occurring in the natural undeveloped state. Further, offsite flows entering the site on the west perimeter are to be intercepted by and conveyed in Benavidez Road and Locura Road to Ladrones Road.

RECOMMENDATIONS

The following recommendations regarding the design and implementation of drainage improvements are included to assist the City of Albuquerque, the Albuquerque Metropolitan Flood Control Authority and the developer in the engineering design and implementation of drainage facilities:

1. Flows within the streets of the development are distributed so that only Benavidez Road and Ladrones Road assume the major role in conveying offsite flows. These streets should be graded at not less than .5% slope in order to insure adequate capacity.
2. Paving and other surface improvements as shown on Figure 3 should be constructed in accordance with the typical sections

shown on Figure 4, therein providing permanent definition of flow patterns for offsite runoff.

3. The ponding areas in each backyard should be situated toward the rear of the yard. There should be a minimum of a five foot buffer zone between the rear property lines and the edge of the pond to protect any walls which might be constructed. In no case should ponded waters be allowed to stand against a wall or house foundation.
4. Ponds should average 6" deep and the minimum surface area should not be less than 15% of the total area drained into the pond. See Appendix, Lot Ponding Calculation.

SUMMARY

The subject property, by utilizing backyard ponding on single family lots and outlet control in the multi-family and commercial areas, will contribute no more surface runoff to surrounding areas than that which existed before development.

In conclusion, the development of this site should have a beneficial effect on the drainage characteristics of this area, and can be developed safely with no harm to life or property.

Prepared by:

Approved:

Carl A. Tebbens
N.M.P.E. No. 6309

APPENDIX #

"RATIONAL METHOD"

COMPOSITE RUNOFF COEFFICIENTS

For purposes of this report the runoff coefficient (C) and frequency factor (C_f) are combined in one factor designated (C). Each of the following determinations of composite runoff coefficients is first computed upon the basis of relative percentages of surface characteristics for the individual areas, and coefficients for 2 to 10 year frequency storms. Each is then multiplied by the frequency factor (C_f) of 1.25 for 100 year storms.

UNDEVELOPED LAND

$$C = 0.30^1 \times 1.25^2 = 0.38$$

DEVELOPED LAND

Typical Lot Area - Westgate Heights, Unit 4

Gross Area	65.09 Ac.
Less: Area in Streets	14.81 Ac.
Area in Lots	50.25 Ac.
Average Lot Area (253 Lots)	86.18 Sq.Ft.
Typical Lot Width	65 Ft.

-
1. See Bibliography; Item (1) Table XII
 2. See Bibliography; Item (2) Article 3.7

Ponded Lots - Westgate Heights, Unit 4

C = 0.80

Streets & Walk Area	20 x 65	1,300 S.F.
Roof Area	20 x 55	1,100 S.F.
Driveway	30 x 15	<u>450 S.F.</u>
Total Impervious Area		2,850 S.F.

C = 0.12

Front and Side Yards		3,250 S.F.
Less Roof Area		-1,100 S.F.
Less Driveway		<u>-450 S.F.</u>
Total Pervious Area		1,700 S.F.

Impervious Area	2850 Sq.Ft.	63% @ 0.80	0.504
Pervious Area	1700 Sq.Ft.	37% @ 0.12	<u>0.044</u>
Total Area	4550 Sq.Ft.	100%	0.548

Composite Runoff Coefficient = $C \times C_f = 0.55 \times 1.25 = \underline{\underline{0.69}}$

PONDING REQUIREMENTS

Typical Lot Area

Average Lot Area	8,618 S.F.
Less: Front & Side Yards	-3,250 S.F.
Area Draining to Pond	5,368 S.F.
Roof Area 20 x 55	1,100 S.F.
Patio Area	100 S.F.
Lawn Area	4,168 S.F.

Runoff Coefficient

Impervious Area	1200 S.F.	22% @ 0.80	0.18
Pervious Area	4168 S.F.	78% @ 0.12	<u>0.09</u>
			0.27

$$C \times C_1 = 0.27 \times 1.25 = 0.34$$

Pond Volume Requirement

100-year 6-hour precipitation = 2.2 in.

Volume = Runoff coefficient x area x precipitation

$$V = 0.34 \times 5368 \times 0.18 = 329 \text{ cu.ft.}$$

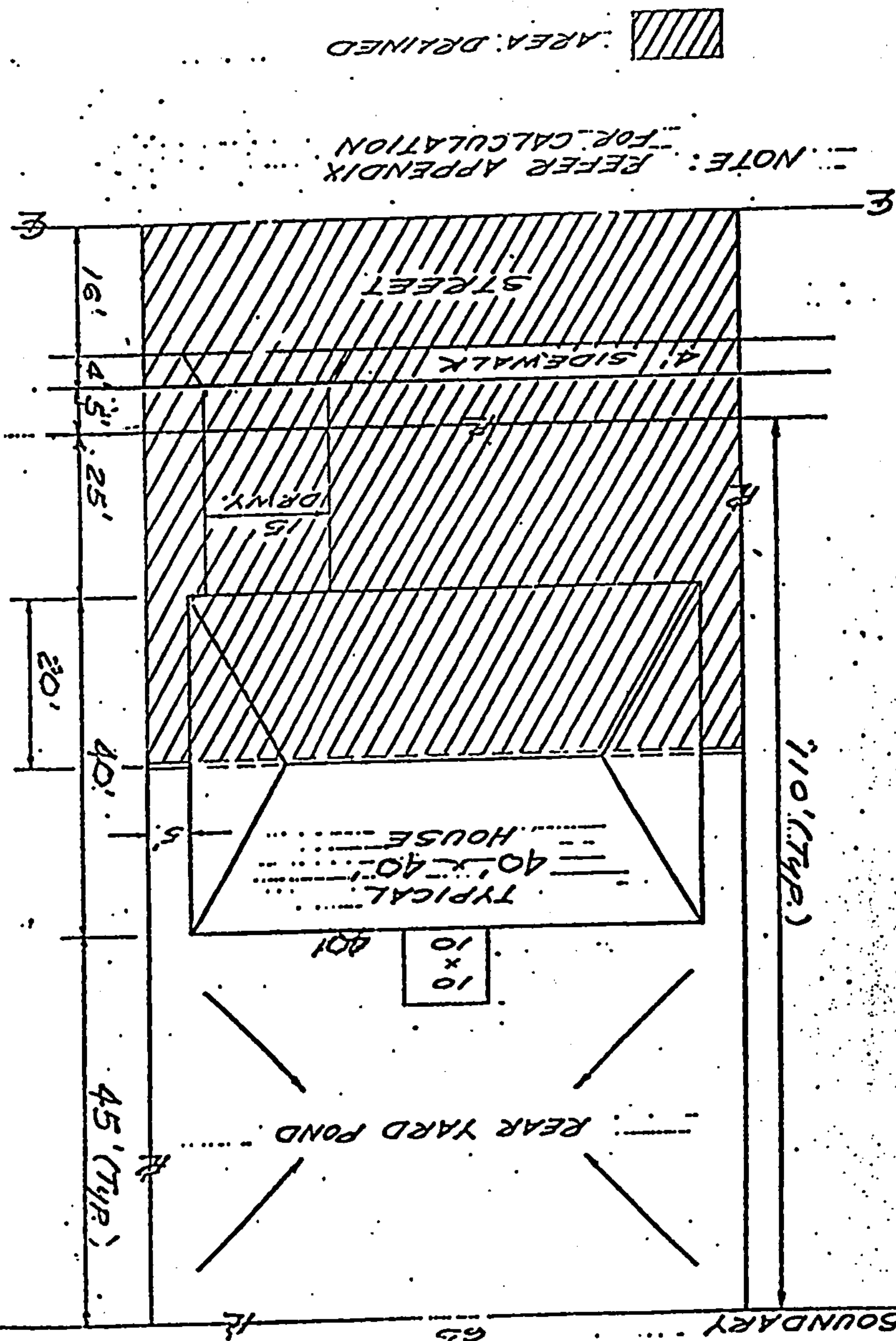
Depth of pond 0.50 ft. (6")

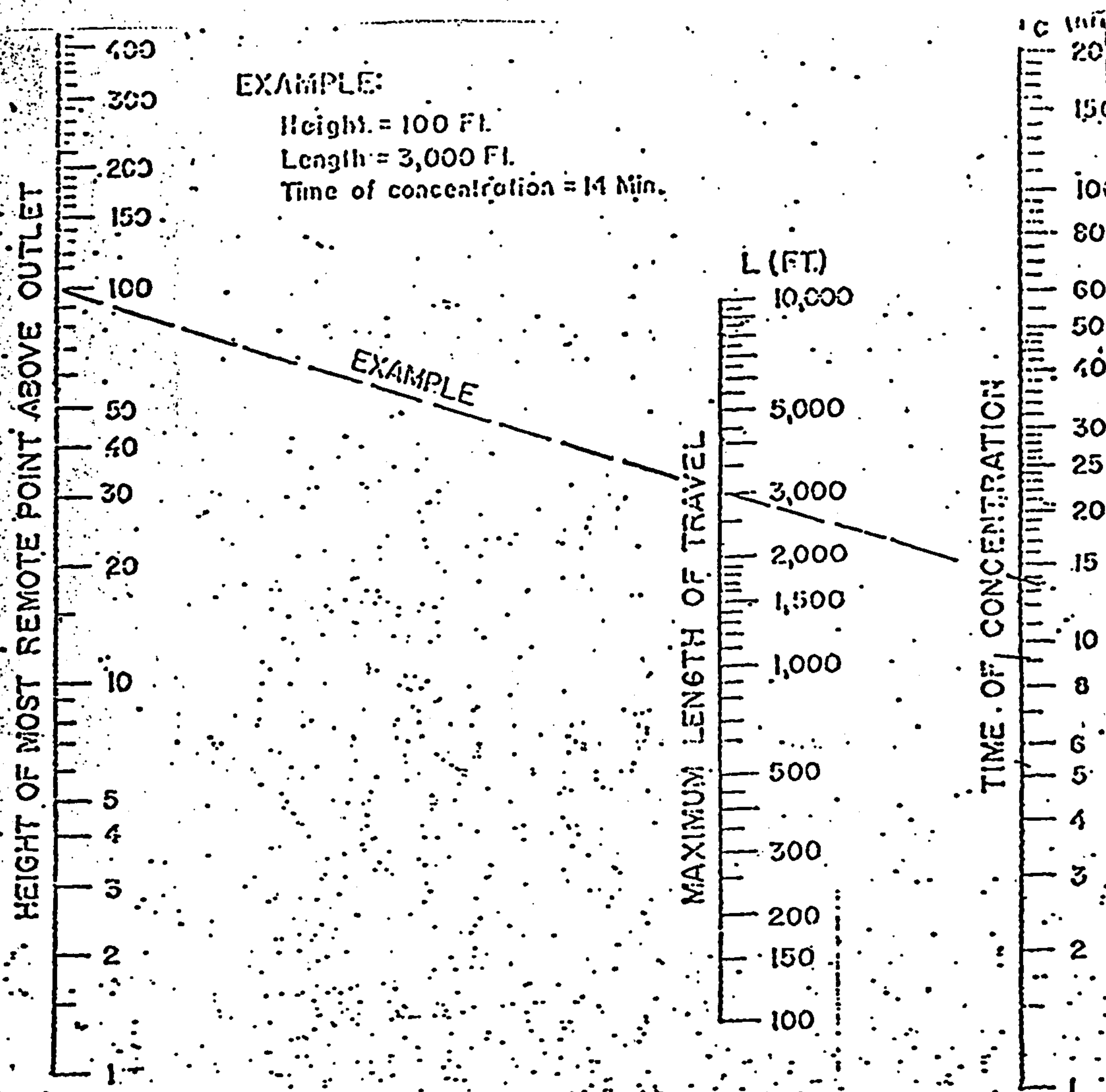
Minimum area of pond 657 sq.ft.

Pond area as a percentage of area drained = 12% - use 15%

$$V = 15\% \times 5368 \text{ sq.ft.} \times 0.5 \text{ ft.} = 403 \text{ cu.ft.}$$

FIGURE-5
TYPICAL LOT DRAINAGE





Based on study by P. Z. Kirsch,
 Civil Engineering, Vol. 10, No. 6, June 1940, p. 332

TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

Reprinted from "Design of Roadside
 Drainage Channels - Hydraulic Engineering"
 Circular No. 6, April 1962, U. S. Dept.

FIGURE - 6

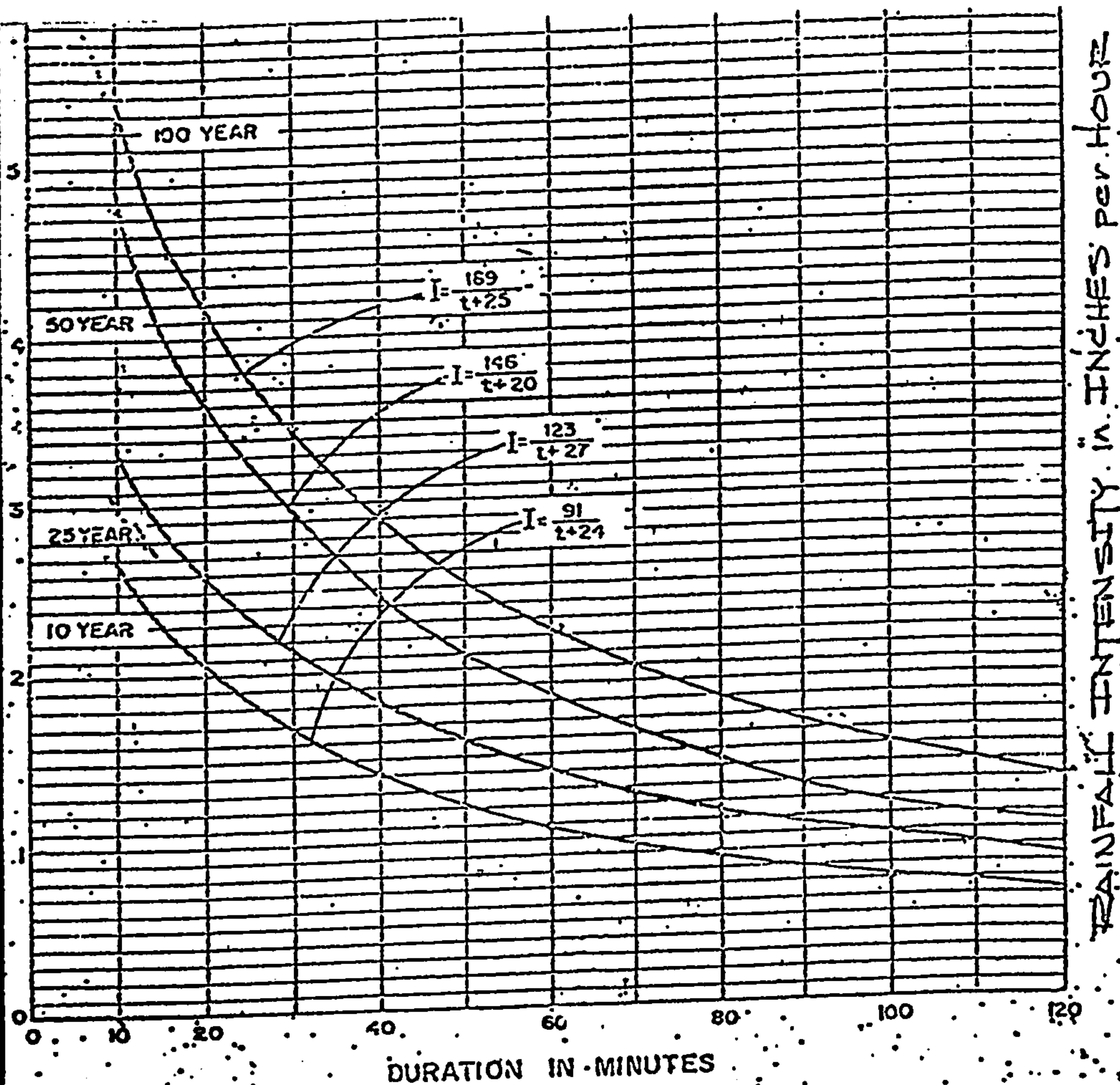


FIGURE 7

INTENSITY-DURATION
CURVES

MASTER PLAN OF DRAINAGE
CITY OF ALBUQUERQUE-NEW MEXICO
AND ENVIRONS

INTENSITY DURATION
FREQUENCY CURVES

(ALBUQUERQUE AREA-1950)

GORDON HERKENHOFF & ASSOC CHART
CONSULTING ENGINEERS



MURRAY-McCORMICK, INC.
ENVIRONMENTAL DESIGN
ENGINEERING-PLANNING-SURVEYING

2401 WYOMING BLVD., NE SUITE F / ALBUQUERQUE, NEW MEXICO 87110 / 505-242-1936

JOB NO. _____ DATE _____
PROJECT Wastewater Hts. No 4
SCALE A-6.2

DWG N001

Westgate Hts. No 4

N-11-L

N-10-L

N-6-L

FIGURE 8

A-72

R-1-E

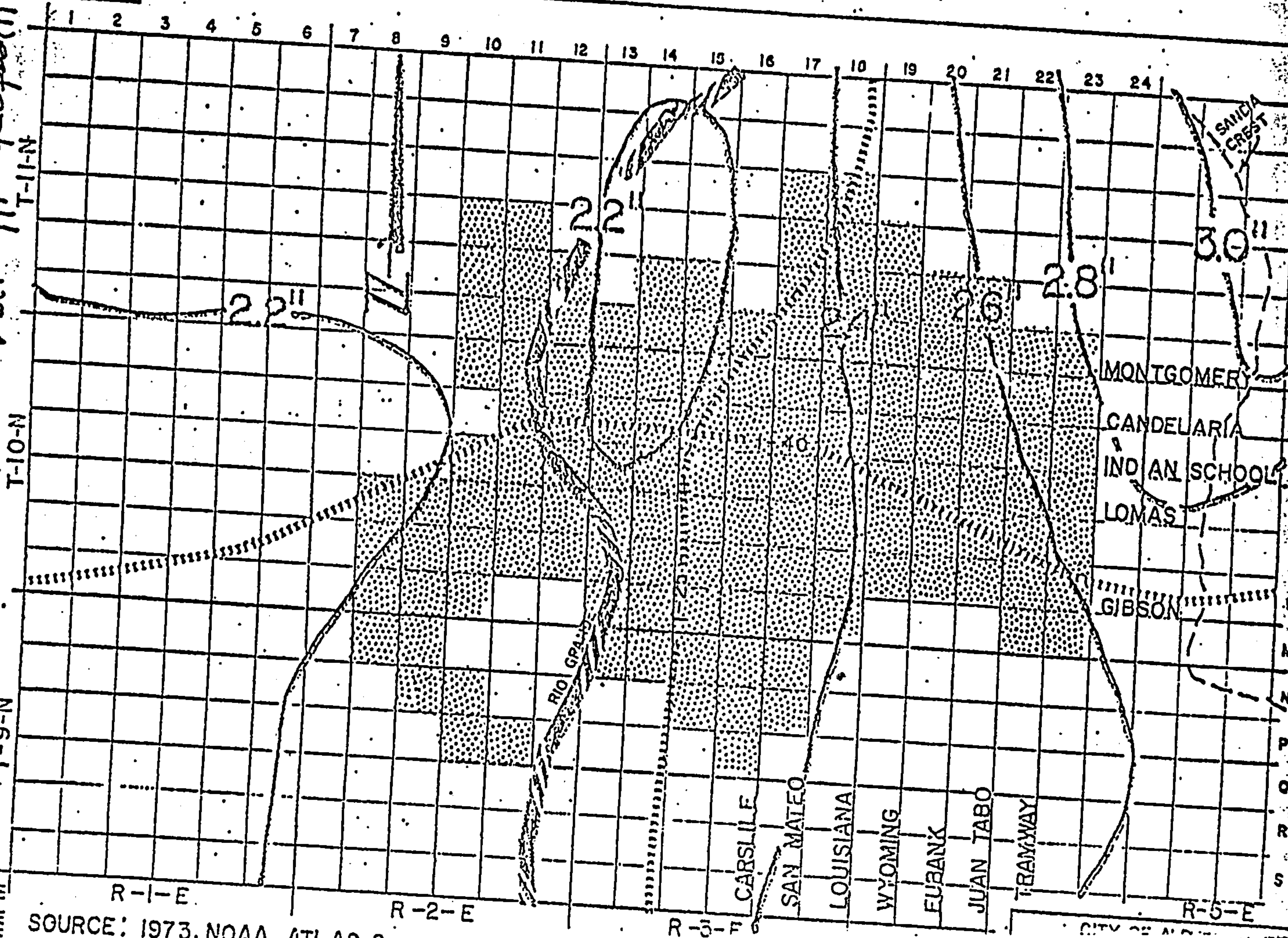
R-2-E

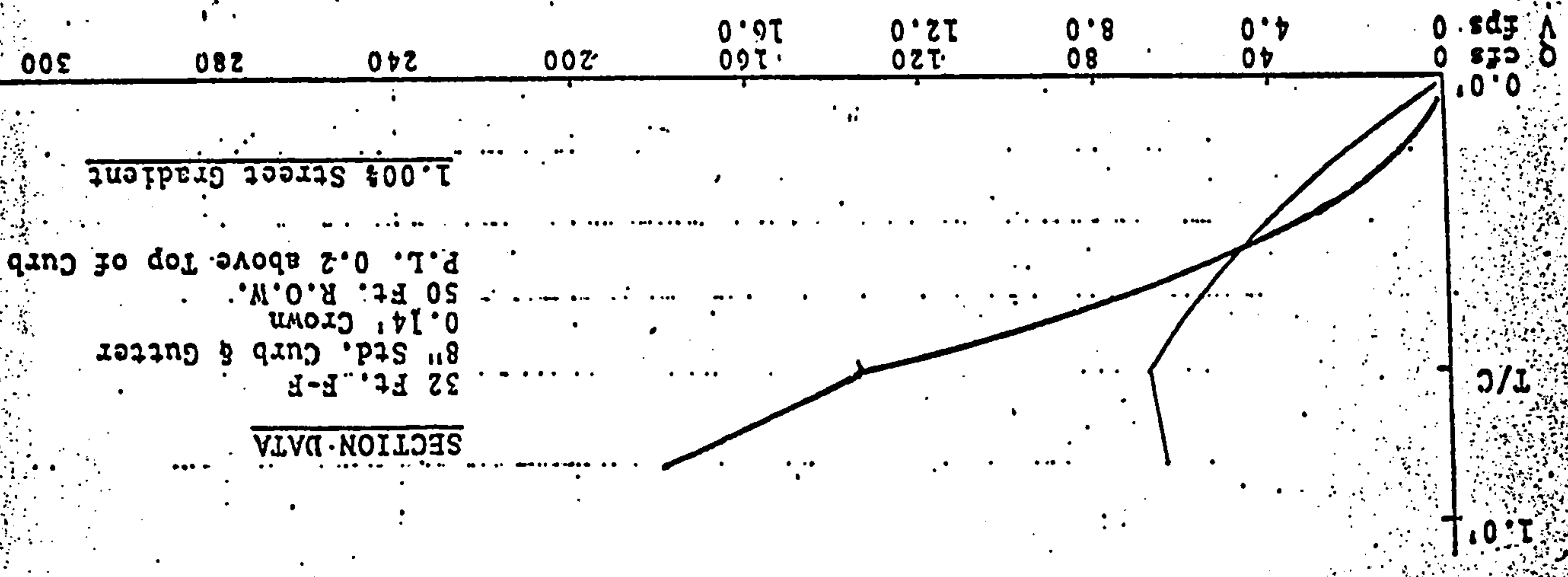
R-3-E

R-5-E

SOURCE: 1973. NOAA ATLAS

CITY OF ALBUQUERQUE





SECTION DATA

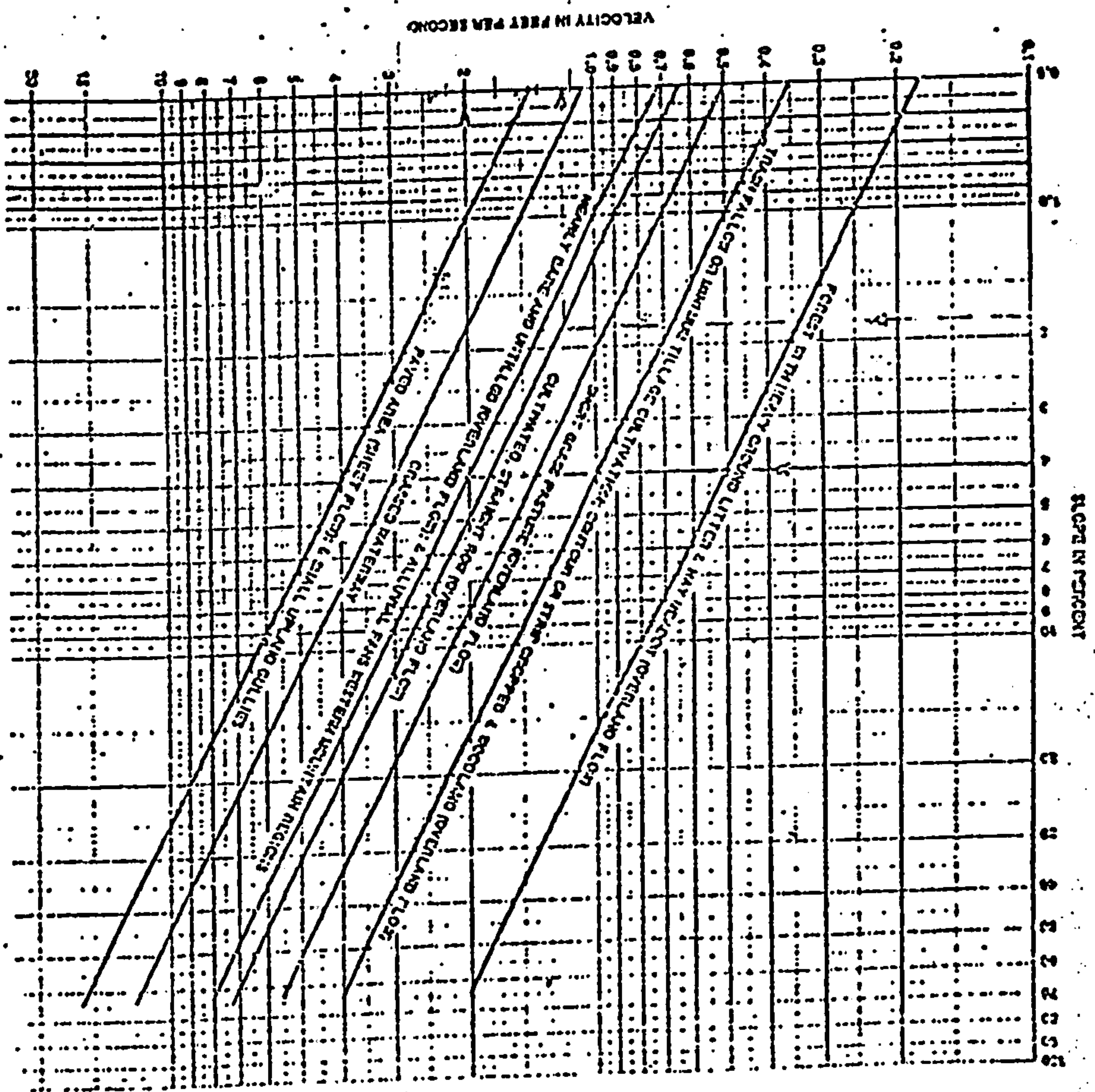
32 Ft. F-F
 8" Std. Curb & Gutter
 0.14' Crown
 50 Ft. R.O.W.
 P.L. 0.2 above Top of Curb
 1.00% Street Gradient

STREET FLOW CAPACITY CHARACTERISTICS

FIGURE 9

MURRAY-McCORMICK, INC. JOB NO. _____ DATE _____
 ENVIRONMENTAL DESIGN PROJECT Westgate Heights No. 4
 ENGINEERING-PLANNING-SURVEYING SCALE _____
2001 WYOMING BLVD., SUITE 27 ALABAMA, NEW BRIDGE CITY, N.J. 08008

Figure 10. - Volatilities for upland method of estimating T_c



RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS 4

Drainage Area No. 05.1

Area = 4.43 3.29 acres

Maximum Overland Flow: L = 650' S = 1.8%

Maximum Channel Flow:

Channel No. 1 L = _____ S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 7.74 min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = $\frac{\text{_____}}{\text{X } 60}$ = _____ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\text{_____}}{\text{X } 60}$ = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\text{_____}}{\text{X } 60}$ = _____ min.

Total Accumulation Time: 7.74 min.

$$I = 1.49(7.74 + 2.5) = 1.49 / 32.74 = 5.77 \text{ USE } 5.4$$

$$Q = CIA = (1.69) (5.4) (3.29) = 12.24 \text{ c.f.s.}$$

Date: 10-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: K. Lucas

Checked by: _____

80 % Ponded e _____

80 % Non-Ponded e 34 32.83

40 % e 1.0 SEE "C" CORRS. W.C. 2-A

100 % TOTAL 1.0 69

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS 4

Drainage Area No. 0.5.2

Area = 4.79 acres

Maximum Overland Flow:

L = _____ S = _____

Maximum Channel Flow:

Channel No. 1

L = 2320 S = 2.10

Channel No. 2

L = _____ S = _____

Channel No. 3

L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time:

13 min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = $\frac{2320}{X 60} = 15.9$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Total Accumulation Time:

T = 16.8 min.

$I = \frac{189}{16.8 + 25} = \frac{189}{41.8} = 4.52$

$Q = CIA = (.69) (4.52) (4.79) = 14.94$ c.f.s.

Date: 10 - 77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: R. J. J. J.

30 % Ponded e .12 34

Checked by: _____

70 % Non-Ponded e .7 56.0

_____ % _____ e 59.6

100 % TOTAL .69

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS d

Drainage Area No. O.S. 3

Area = 19.01 acres

Maximum Overland Flow:

L = 7400' S = 1.9%

Maximum Channel Flow:

Channel No. 1

L = _____ S = _____

Channel No. 2

L = _____ S = _____

Channel No. 3

L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 9.4 min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Total Accumulation Time:

T = 9.4 min.

$I = 1.49 / 9.4 + 2.5 = 1.49 / 34.6 = 5.46 \text{ in.} \times 5.4$

$Q = CIA = (.4) (5.4) (19.01) = 41.86 \text{ c.f.s.}$

Date: 10-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: R. J. Lewis

100 % Ponded e .4

Checked by: _____

_____ % Non-Ponded e _____

_____ % _____ e _____

100 % TOTAL .4

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS 4

Drainage Area No. 0.5.4

Area = 2.01 acres

Maximum Overland Flow: L = 600 S = 2.5 %

Maximum Channel Flow:

Channel No. 1 L = _____ S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 4.5 min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Total Accumulation Time: T = 4.5 min.

$1 = \frac{184}{4.5 + 25} = \frac{184}{29.5} = 6.21$ USE 5.4

$Q = CIA = (.4) (5.4) (2.01) = 4.34$ c.f.s.

Date: 10 - 77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: R. J. Lewis

Checked by: _____

100 % Ponged @ _____

100 % Non-Ponged @ _____

100 % @ 1.4

100 % TOTAL 1.4

RUNOFF COMPUTATIONS

Sheet No. _____

Project: Westgate Heights Unit 4

Drainage Area No. A-1

Area = 968 acres

Maximum Overland Flow:

L = 50 S = 1.0%

Maximum Channel Flow:

Channel No. 1 L = _____ S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: _____ min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Total Accumulation Time: T = 17.24 min.

$1 = \frac{1.49}{17.24} \times 25 = \frac{1.49}{17.24} = 4.47$

$Q = CIA = (1.53) (4.47) (968) = 22.93$ c.f.s.

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: E. Lucero

4.0 Ponded 0.12 4.8

Checked by: _____

0.5 Non-Ponded 0.8 4.0

_____ 0. _____ 5.3

100 % TOTAL 5.3

RUNOFF COMPUTATIONS

Sheet No. _____

Project: Westgate Heights Unit 4

Drainage Area No. B-1

Area = 2.81 acres

Maximum Overland Flow: L = 50' S = 1.0%

Maximum Channel Flow:

Channel No. 1 L = 900' S = 0.56%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 43 min.

Channel No. 1 Flow:

Velocity = 1.4 ft/sec; Time = $\frac{900}{1.4 \times 60} = \underline{10.71}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Total Accumulation Time:

T = 11.54 min.

i = $\frac{1.89}{11.54 + 25} = \frac{1.89}{36.54} = \underline{0.0517}$

Q = CIA = (.54) (0.0517) (2.81) = 0.784 c.f.s.

Date: 11-77

Comp. by: P. W. Lee

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

38 % Paved @ 0.12 4.56

62 % Non-Paved @ 0.4 2.52

_____ % _____ @ _____ 54.16

100 % TOTAL 0.54

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS UNIT 4

Drainage Area No. B-2

Area = .88 acres

Maximum Overland Flow: L = 60' S = 1.0%

Maximum Channel Flow:

Channel No. 1 L = 120' S = 1.5%

Channel No. 2 L = S =

Channel No. 3 L = S =

Accumulation Time

Overland Flow or Inlet Time: .83 min.

Channel No. 1 Flow:

Velocity = 2.5 ft/sec; Time = $\frac{120}{X 60} = .8$ min.

Channel No. 2 Flow:

Velocity = ft/sec; Time = $\frac{ }{X 60} =$ min.

Channel No. 3 Flow:

Velocity = ft/sec; Time = $\frac{ }{X 60} =$ min.

Total Accumulation Time: T = 1.63 min.

$I = \frac{184}{1.63 + 25} = \frac{184}{26.63} = 7.1 \text{ use } (5.4)$

$Q = CIA = (.48) (5.4) (.88) = 2.28 \text{ c.f.s.}$

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: R. L. LEE

47 % Paved @ .12 5.64

Checked by:

53 % Non-Paved @ .8 42.40

 % @ 45.64

100 % TOTAL .48

RUNOFF COMPUTATIONS

Sheet No. _____

Project: Westlake Heights Unit 4

Drainage Area No. B-3

Area = 1.58 acres

Maximum Overland Flow:

L = 50 S = 1.5%

Maximum Channel Flow:

Channel No. 1

L = 600 S = 1%

Channel No. 2

L = _____ S = _____

Channel No. 3

L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 5.83 min.

Channel No. 1 Flow:

Velocity = 2 ft/sec; Time = $\frac{600}{2 \times 60} = \underline{5.0}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Total Accumulation Time: $T = \underline{5.83}$ min.

$I = \frac{184}{5.83 + 2.5} = \frac{184}{8.33} = 22.1$ use (5.4)

$Q = CIA = (.43) (5.4) (1.58) = \underline{3.67}$ c.f.s.

Date: 11-77

Comp. by: R. L. L. L.

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

54 % Ponded @ .12 6.48

46 % Non-Ponded @ .8 36.90

_____ % _____ @ _____ 42.8

100 % TOTAL .43

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTLARK HEIGHTS UNIT 4

Drainage Area No. 3-4

Area = 1.37 acres

Maximum Overland Flow: L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = 310' S = 1.2%

Channel No. 2 L = 263' S = 1.3%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: _____ min.

Channel No. 1 Flow:

Velocity = 2.4 ft/sec; Time = $\frac{310}{2.4 \times 60} = \underline{1.92}$ min.

Channel No. 2 Flow:

Velocity = 2.3 ft/sec; Time = $\frac{263}{2.3 \times 60} = \underline{1.91}$ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Total Accumulation Time: $T = \underline{3.83}$ min.

$1 = \frac{1.84}{3.83 + 25} = \frac{1.84}{28.83} = \underline{0.064}$ USE (5.4)

$Q = CIA = (.8) (5.4) (1.37) = \underline{5.91}$ c.f.s.

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

 % Ponded e

 % Non-Ponded e

 % e .8

100 % TOTAL .8

Comp. by: R. L. WILSON

Checked by: _____

RUNOFF COMPUTATIONS

Sheet No. _____

Project: Westgate Heights Div. 4

Drainage Area No. B-5

Area = 1.37 acres

Maximum Overland Flow:

L = 50' S = 1.0%

Maximum Channel Flow:

Channel No. 1

L = 395' S = 1.20%

Channel No. 2

L = _____ S = _____

Channel No. 3

L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time:

1.83 min.

Channel No. 1 Flow:

Velocity = 7.2 ft/sec; Time = $\frac{395}{60} = \underline{2.89}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{60} = \underline{\quad}$ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{60} = \underline{\quad}$ min.

Total Accumulation Time:

T = 3.82 min.

$$I = \frac{189}{3.32 + 25} = \frac{189}{28.32} = 6.56 \text{ c.f.s. (5.4)}$$

$$Q = CIA = (.47) (5.4) (1.37) = \underline{3.48} \text{ c.f.s.}$$

Date: 11-77

Comp. by: R. Lucas

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

49 % Ponded @ .12 5.88

51 % Non-Ponded @ .8 40.8

_____ % _____ @ _____ 46.68

100 % TOTAL 47

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HUNTS UNIT 4

Drainage Area No. B-6

Area = 0.75 acres

Maximum Overland Flow:

L = 50' S = 1%

Maximum Channel Flow:

Channel No. 1

L = 140' S = 1.4%

Channel No. 2

L = _____ S = _____

Channel No. 3

L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time:

183 min.

Channel No. 1 Flow:

Velocity = 2.4 ft/sec; Time = $\frac{140}{X 60} = \underline{.91}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Total Accumulation Time:

T = 1.8 min.

$I = \frac{184}{1.5 \times .25} = \frac{184}{.375} = 490.67$

$Q = CIA = (.16) (5.4) (.75) = \underline{.6264}$ c.f.s.

Date: 11-77

Comp. by: R. L. L. L.

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

50 % Ponded e .12 6.0

15 % Non-Ponded e .8 46.3

_____ % _____ e _____ 46.3

100 % TOTAL .46

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTLAKE HEIGHTS UNIT 4

Drainage Area No. B-7

Area = 3.5 acres

Maximum Overland Flow:

L = 50' S = 1%

Maximum Channel Flow:

Channel No. 1

L = 550' S = 1.5%

Channel No. 2

L = 200' S = 1.5%

Channel No. 3

L = 136' S = 1.3%

Accumulation Time

Overland Flow or Inlet Time:

83 min.

Channel No. 1 Flow:

Velocity = 2.5 ft/sec; Time = $\frac{550}{X 60} = \underline{3.67}$ min.

Channel No. 2 Flow:

Velocity = 1.4 ft/sec; Time = $\frac{200}{X 60} = \underline{2.38}$ min.

Channel No. 3 Flow:

Velocity = 2.3 ft/sec; Time = $\frac{136}{X 60} = \underline{0.99}$ min.

Total Accumulation Time:

T = 7.87 min.

$$I = \frac{1.84}{7.87 + 25} = \frac{1.84}{32.87} = \underline{5.75 \text{ use } (5.4)}$$

$$Q = CIA = (.43) (5.4) (3.5) = \underline{8.13} \text{ c.f.s.}$$

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: P. L. Leno

55% Ponded e .12 6.6

Checked by: _____

45% Non-Ponded e .8 36.0

_____ e 42.0

100% TOTAL .43

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE ELEVATED UNIT 4

Drainage Area No. C-1

Area = 2.88 acres

Maximum Overland Flow:

L = 50' S = 1%

Maximum Channel Flow:

Channel No. 1

L = 950' S = 0.5%

Channel No. 2

L = _____ S = _____

Channel No. 3

L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time:

13 min.

Channel No. 1 Flow:

Velocity = 1.4 ft/sec; Time = $\frac{950}{X 60} = \underline{15.83}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Total Accumulation Time:

T = 12.14 min.

$I = \frac{1.49}{12.14 + 25} = \frac{1.49}{37.14} = \underline{0.04}$

$Q = CIA = (.47) (.04) (2.88) = \underline{0.54}$ c.f.s.

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: P. Luceas

.44 Ponded e .12 .588

Checked by: _____

.51 Non-Ponded e .18 .408

_____ e .468

100 TOTAL .47

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS UNIT 4

Drainage Area No. C-2

Area = .167 acres

Maximum Overland Flow:

L = 50' S = 1%

Maximum Channel Flow:

Channel No. 1

L = 130' S = 0.4%

Channel No. 2

L = _____ S = _____

Channel No. 3

L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: .83 min.

Channel No. 1 Flow:

Velocity = 1.4 ft/sec; Time = $\frac{130}{\times 60} = 1.55$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Total Accumulation Time:

T = 2.38 min.

$$I = \frac{184}{2.38 + 2.5} = \frac{184}{27.38} = 6.9 \text{ use } (5.4)$$

$$Q = CIA = (.19) (5.4) (.167) = 0.169 \text{ c.f.s.}$$

Date: 11-77

Comp. by: R. Luens

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

89 % Ponded e .12 10.63

11 % Non-Ponded e .8 8.8

_____ % _____ e _____ 19.43

100 % TOTAL .19

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS UNIT 4

Drainage Area No. C-3

Area = 0.91 acres

Maximum Overland Flow:

L = 50 S = 1%

Maximum Channel Flow:

Channel No. 1 L = _____ S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 1.83 min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Total Accumulation Time:

T = 6.19 min.

$$I = \frac{184}{6.19 + 25} = \frac{184}{31.19} = 5.91 \text{ USE } (5.4)$$

$$Q = CIA = (.66) (5.4) (0.91) = 3.46 \text{ c.f.s.}$$

Date: 11-77

Comp. by: R. Wick

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

20 % Ponded e .12 2.4

80 % Non-Ponded e .8 64.2

_____ % _____ e 66.4

100 % TOTAL .66

RUNOFF COMPUTATIONS

Sheet No. _____

Project: Westgate Heights Unit 4

Drainage Area No. C-4

Area = 0.91 acres

Maximum Overland Flow:

L = 50' S = 1%

Maximum Channel Flow:

Channel No. 1 L = 250' S = 2.0%

Channel No. 2 L = 200' S = 1.8%

Channel No. 3 L = 156' S = 1.8%

Accumulation Time

Overland Flow or Inlet Time: 1.83 min.

Channel No. 1 Flow:

Velocity = 2.8 ft/sec; Time = $\frac{250}{\times 60} = \underline{1.49}$ min.

Channel No. 2 Flow:

Velocity = 2.3 ft/sec; Time = $\frac{200}{\times 60} = \underline{1.45}$ min.

Channel No. 3 Flow:

Velocity = 2.75 ft/sec; Time = $\frac{156}{\times 60} = \underline{2.76}$ min.

Total Accumulation Time:

T = 6.53 min.

i = $\frac{189}{6.53 + 25} = \frac{189}{31.53} = \underline{5.99}$ use (5.4)

Q = CIA = (.45) (5.4) (.91) = 2.21 c.f.s.

Date: 11-77

Comp. by: P. Lucas

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

52% Ponded e .12 6.24

48% Non-Ponded e .8 38.40

_____ e 44.64

100% TOTAL .45

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTWATER REWATER UNIT 4

Drainage Area No. C-5

Area = 1.96 acres

Maximum Overland Flow:

L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = 100' S = 1.7%

Channel No. 2 L = 350' S = 2.3%

Channel No. 3 L = 110' S = 2.0%

Accumulation Time

Overland Flow or Inlet Time: _____ min.

Channel No. 1 Flow:

Velocity = 2.6 ft/sec; Time = $\frac{100}{2.6 \times 60} = 0.64$ min.

Channel No. 2 Flow:

Velocity = 3.0 ft/sec; Time = $\frac{350}{3.0 \times 60} = 1.94$ min.

Channel No. 3 Flow:

Velocity = 3.25 ft/sec; Time = $\frac{110}{3.25 \times 60} = 0.56$ min.

Total Accumulation Time:

T = 3.14 min.

$I = \frac{1.96}{3.14 + 2.5} = \frac{1.96}{5.64} = 0.347$ (5.4)

$Q = CIA = (.51) (5.4) (1.96) = 5.4$ c.f.s.

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: T. L. W. K. R. D.

Checked by: _____

43 % Ponded @ .12 5.16

57 % Non-Ponded @ .4 45.43

_____ % _____ @ _____ 50.70

100 % TOTAL .57

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS UNIT 4

Drainage Area No. C-6

Area = 1.29 acres

Maximum Overland Flow:

L = 50 S = 1%

Maximum Channel Flow:

Channel No. 1

L = 320 S = 2.5%

Channel No. 2

L = 130 S = 5.5%

Channel No. 3

L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time:

1.83 min.

Channel No. 1 Flow:

Velocity = 3.2 ft/sec; Time = $\frac{320}{X 60} = \underline{1.67}$ min.

Channel No. 2 Flow:

Velocity = 4.75 ft/sec; Time = $\frac{130}{X 60} = \underline{.46}$ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Total Accumulation Time:

T = 2.96 min.

$I = \frac{1.83}{2.96 + 2.5} = \frac{1.83}{2.796} = \underline{6.76 \text{ USE } (5.4)}$

$Q = CIA = (.51) (5.4) (1.29) = \underline{3.55} \text{ c.f.s.}$

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: JR Lucas

43 % Ponded @ .12 5.16

Checked by: _____

57 % Non-Ponded @ .8 4.56

_____ % _____ @ _____ 50.76

100 % TOTAL 1.51

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS UNIT 4

Drainage Area No. C-7

Area = 1.32 acres

Maximum Overland Flow:

L = 50' S = 1%

Maximum Channel Flow:

Channel No. 1 L = 150' S = 0.7%

Channel No. 2 L = 450' S = 1.6%

Channel No. 3 L = 105' S = 5.5%

Accumulation Time

Overland Flow or Inlet Time: 1.83 min.

Channel No. 1 Flow:

Velocity = 1.75 ft/sec; Time = $\frac{150'}{1.75 \times 60} = \underline{1.45}$ min.

Channel No. 2 Flow:

Velocity = 2.5 ft/sec; Time = $\frac{450'}{2.5 \times 60} = \underline{3.0}$ min.

Channel No. 3 Flow:

Velocity = 3.5 ft/sec; Time = $\frac{105'}{3.5 \times 60} = \underline{0.5}$ min.

Total Accumulation Time:

T = 4.43 min.

$I = \frac{1.89}{4.43 + 2.5} = \frac{1.89}{6.93} = \underline{0.27}$ use (5.4)

Q = CIA = (.44) (5.4) (1.32) = 3.14 c.f.s.

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

53 % Ponded @ .82 6.36

47 % Non-Ponded @ .8 37.60

1 % @ 43.96

100 % TOTAL 44

Comp. by: R. Ward

Checked by: _____

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS UNIT 4

Drainage Area No. D-1

Area = 1.82 acres

Maximum Overland Flow:

L = 50'

S = 1 1/2%

Maximum Channel Flow:

Channel No. 1

L = 100'

S = 1.1%

Channel No. 2

L = 350'

S = 0.59%

Channel No. 3

L = 230'

S = 0.71%

Accumulation Time

Overland Flow or Inlet Time:

1.88 min.

Channel No. 1 Flow:

Velocity = 2.1 ft/sec; Time = $\frac{100}{X 60} = \underline{1.74}$ min.

Channel No. 2 Flow:

Velocity = 1.6 ft/sec; Time = $\frac{350}{X 60} = \underline{3.65}$ min.

Channel No. 3 Flow:

Velocity = 1.75 ft/sec; Time = $\frac{230}{X 60} = \underline{2.17}$ min.

Total Accumulation Time:

T = 7.56 min.

$I = \frac{184}{7.56 + 25} = \frac{184}{32.56} = \underline{5.64}$ (5.4)

Q = CIA = (.47) (5.4) (1.82) = 4.62 c.f.s.

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: T. L. L...

49 % Paved @ .12 5.88

Checked by: _____

51 % Non-Paved @ .8 40.50

_____ % _____ @ _____ 46.68

100 % TOTAL .47

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS UNIT 4

Drainage Area No. D-2

Area = 0.52 acres

Maximum Overland Flow: L = 50' S = 1%

Maximum Channel Flow:

Channel No. 1 L = 200' S = 2%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: .73 min.

Channel No. 1 Flow:

Velocity = 2.8 ft/sec; Time = $\frac{200}{X 60} = \underline{1.19}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{X 60} = \underline{\quad}$ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{X 60} = \underline{\quad}$ min.

Total Accumulation Time:

T = 2.02 min.

$I = \frac{1.89}{2.02 + 2.5} = \frac{1.89}{4.52} = \underline{0.42} \text{ (5.4)}$

$Q = CIA = (.35) (5.4) (0.52) = \underline{0.98} \text{ c.f.s.}$

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: P. Wene

66 % Ponded @ .12 7.42

Checked by: _____

34 % Non-Ponded @ .18 21.2

_____ % _____ @ _____ 35.12

100 % TOTAL .35

RUNOFF COMPUTATIONS

Sheet No. _____

Project: WESTGATE HEIGHTS UNIT 4

Drainage Area No. D-3

Area = 0.53 acres

Maximum Overland Flow: L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = 400' S = 1.5%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: _____ min.

Channel No. 1 Flow:

Velocity = 2.5 ft/sec; Time = $\frac{400}{2.5 \times 60} = \underline{2.67}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Total Accumulation Time: T = 2.67 min.

$$I = \frac{1.49}{2.67 + 2.5} = \frac{1.49}{27.67} = 6.83 \text{ USE } (5.4)$$

$$Q = CIA = (.38) (5.4) (0.53) = \underline{1.09} \text{ c.f.s.}$$

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: K. W. K. W.

62 % Ponded e .12 7.44

Checked by: _____

38 % Non-Ponded e .5 3.4

_____ % _____ e 37.54

100 % TOTAL .38

RUNOFF COMPUTATIONS

Sheet No. _____

Project: Westgate Heights Unit 4

Drainage Area No. E-1

Area = 0.96 acres

Maximum Overland Flow:

L = 50' S = 1%

Maximum Channel Flow:

Channel No. 1 L = 190' S = 1.6%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 1.83 min.

Channel No. 1 Flow:

Velocity = 2.5 ft/sec; Time = $\frac{190}{2.5 \times 60} = 1.27$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Total Accumulation Time:

T = 2.10 min.

$I = \frac{1.83}{2.1 + 2.5} = \frac{1.83}{27.1} = 6.77 \text{ use } (5.4)$

$Q = CIA = (.50) (5.4) (0.96) = 2.59 \text{ c.f.s.}$

Date: 11-77

WEIGHTED RUNOFF COEFFICIENT

Comp. by: P. W. L. W. L.

44% Ponded @ 1.12 5.28

Checked by: _____

56% Non-Ponded @ .8 44.30

_____ @ _____ 50.08

100% TOTAL .50

11
12
13

C

14
15
16

APPENDIX C

DRAINAGE REPORT

FOR

WESTGATE HEIGHTS UNIT 3

Received 27 Oct 76

DRAINAGE REPORT
WESTGATE HEIGHTS UNIT 3
ALBUQUERQUE, NEW MEXICO
ZONE MAP NO 11-9



MURRAY-McCORMICK, INC.
ENVIRONMENTAL DESIGN

ECOSYSTEMS ANALYSIS • PLANNING • LAND SURVEYS • ENGINEERING

2601 WYOMING BLVD., NE. SUITE F / ALBUQUERQUE, N.M. 87110 / 505-292-1938

DRAINAGE REPORT
WESTGATE HEIGHTS UNIT 3
ALBUQUERQUE, NEW MEXICO
ZONE MAP NY 11-9

Prepared For
Mortgage Investment Company
2727 San Pedro, N.E.
Albuquerque, New Mexico

Prepared By
Murray-McCormick, Inc.
2601 Wyoming Blvd., N.E.
Albuquerque, New Mexico
505 292-1936

October 22, 1976

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APPENDIX

- Figure Ia U.S.G.S. Topographic Map of Major Watersheds
 Affecting the Site.
- Figure Ib Drainage Characteristics Plan
- Composite Runoff Coefficients - Rational Method
- Lot Ponding Requirements
- Figure II Typical Lot Drainage
- Figure III Time of Concentration for Small Drainage Basins -
 Seelye
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APPENDIX - Cont'd.

Figure V 100 Year - 6 Hour Precipitation

a. Unit Hydrograph Calculations

Figure VIb. Determination of Effective Rainfall

c. Determination of Storm Hydrograph

d. Depth-Duration-Frequency Graphs

e. Unit Hydrograph - Watershed "A"

f. Storm Hydrograph - Watershed "A"

Figure VII Street Flow Capacity Characteristics

Rational Method - Runoff Computations

Reference Copy

Storm Drainage Study Relative to the Development of Westgate Heights, Unit 2

Campbell-Hicks & Associates, Inc.

By Donald L. Campbell P.E. & L.S. No. 3633

Figure VIII Area Grading Plan, Unit No. 2, Westgate Heights

Bibliography of References

DRAINAGE REPORT
WESTGATE HEIGHTS SUBDIVISION
UNIT NO. 3

PURPOSE AND INTRODUCTION

The following report with its supporting calculations and exhibits describes the drainage characteristics affecting the development of the above subdivision. Further, a number of recommendations regarding the design and grading of the project are included within the text to guide and control the engineering design and drainage such that urban planning and development can be accomplished with a minimum risk to life and property.

A two phase approach is utilized to evaluate the effect of development on the area. The first phase determines the existing characteristics of the watersheds affecting the site and the quantities of water entering the project from upstream. In addition, the present (undeveloped) runoff of the subject site is also determined for later comparison with the developed runoff and the resultant compliance with requirements of the City of Albuquerque and the Albuquerque Metropolitan Arroyo Flood Control Authority. The second phase is the runoff in the developed state and the further evaluation of means to control runoff in the upstream watersheds.

THE SITE

Westgate Heights, Unit No. 3, a proposed R-1 development, is located within the southwest quadrant of the City of Albuquerque, east of Snow Vista Boulevard and south of Sage Road. It is bounded

on the west and northwest by Westgate Heights, Unit 2, on the north by Unit 7 of Atrisco Village, and on the east, south and southwest by unplatted lands.

GENERAL SITE CHARACTERISTICS

The site encompassing 36.0 acres, more or less, slopes from northwest to southeast with an average slope of 2%. The soil in this unit and vicinity is sandy with little clay and can be considered open and highly absorbant with a high degree of porosity. Percolation tests were made in October 1975 in Westgate Heights, Unit 2, and the results have been included in the Appendix. Due to the general uniformity of soils in the vicinity, it can be assumed the porosity of the surface soils indicated by the above percolation tests for Unit 2 also apply to Unit 3. The existing vegetation is sparse bunch grass and few shrubs.

ANALYTICAL METHOD

Due to the complexity of the upstream watershed characteristics, and magnitude of the area, two methods of analysis have been utilized in the evaluation of offsite flows. The "Rational Method" was utilized to determine the present (undeveloped) runoff from the subject site and for the ultimate determination of flows passing through or near the site. However, in order to establish the basic drainage pattern for the offsite flows, the Colorado Unit Hydrograph Procedure (CUHP) was utilized. This Procedure allowing for a more objective evaluation of the effects of infiltration, detention and depression

storage and the relative pervious vs. impervious characteristics of the analyzed watersheds.

The logic, method and application of the Colorado Unit Hydrograph Procedure and the "Rational Method" will not be included within the text of this report. Reference is made to Urban Storm Drainage Criteria Manual, Volume 1, prepared by Wright-McLaughlin Engineers, Denver, Colorado, as amended under the date of March 1969.

The procedures and calculations contained in this report parallel those given in the section entitled "Runoff", where assumptions or data unique to the subject area are employed, a discussion of their applicability appears in the report.

OFFSITE WATERSHEDS

Offsite flows affecting Westgate Heights, Unit 3, are produced by two watersheds. The largest area, shown on Figure 1 as Area "A", consists of undeveloped and unplatted lands above Units 1 through 3 of Atrisco Village. Although the natural watershed extends somewhat farther west, flows from this area have been diverted to the south by an intercepting ditch along the existing power line approximately 1,300 feet west of the western limit of the above units of Atrisco Village. The adequacy of this channel to function during the 100 year storm was established within the Drainage Management Plan, Western Albuquerque Metropolitan Area, prepared by William Matotan & Associates, Inc., Engineers, and sustained by this report subject to adequate maintenance by those authorities having jurisdiction. The remainder of the area south of De Vargas Road has been platted

as R-1 single family, along with other uses including schools, commercial, and office and institutional zoning. At this writing a significant portion of the single family area is developed. For the purposes of this report the entire single family area is considered to be developed. The higher density and non-single family uses which are undeveloped at this time are treated as undeveloped land as each parcel will, at the time of development, have to meet the discharge requirements of the Albuquerque Metropolitan Arroyo Flood Control Authority Resolution 72-2.

Land use distribution in this watershed is:

Single Family Residential	294 Ac.	30%
Existing Mobile Home Park	10 Ac.	1%
Undeveloped	<u>687 Ac.</u>	<u>69%</u>
Total Watershed "A"	991 Ac.	100%

Watershed "B" abutts that above on the north and its discharge enters the study area at Sage Road along the northern boundary of Westgate Heights, Unit 2. This watershed consists of 533 acres of undeveloped land.

At the writing of this report a diversion berm exists within the median of Snow Vista Blvd. This berm causes the flow from the southern portion of watershed "A" to be diverted ^{South} north to the intersection of ~~Snow Vista Boulevard and Sage Road~~. Furthermore, the northern portion of this watershed is also concentrated at ^{the} ~~this~~ intersection. The ^{flow} ~~flow~~ is then distributed to Sage Road and an existing ditch flowing south-easterly through undeveloped land to the western limit of Westgate Heights, Unit 2. Due to the nature of the intersection of Snow Vista

Boulevard and Sage Road, the quantitative determination of the flow distribution to these corridors is next to impossible; therefore, it will be assumed that all flows arriving at this intersection are to be conducted easterly by Sage Road. *not consistent with previous sentence*

It should be noted at this time that the previously mentioned report by Matotan makes two recommendations affecting flows at the Sage-Snow Vista intersection. The most significant recommendation is the construction of the Westgate diversion channel from the Amole Arroyo northward approximately 12,000 feet and thus intercepting 1,390 acres of upstream watershed. The second recommendation is the extension of the existing diversion dike above Atrisco Village to Central Avenue. The probability of timing of either improvement cannot be measured, and; therefore, this report further assumes that control of flows in Sage Road must be limited to protection of Westgate Heights, Unit 2 and 3, as the upstream flows entering Unit 2 must pass through Unit 3.

ESTIMATED OFFSITE FLOWS

Watershed "A"

Study Point No. 1 (Snow Vista & Sage Road)

Area 991 Ac. 1.55 sq. miles

L 10,300 Ft. 1.95 Miles

Lca 4,600 Ft. 0.87 Miles

Unit Duration 10 minutes

Frequency 100 years

Duration 6 hours

(Estimated Offsite Flows cont'd.)

Assumptions:

	<u>Area Pervious</u>	<u>Area Impervious</u>	<u>Total</u>
Single Family	55%	45%	100%
Mobile Home Park	45%	55%	100%
Undeveloped	80%	20%	100%

Pervious Area

Maximum infiltration	0.50 inch per hour
Detention & Depression Storage	0.40 inch

Impervious Areas

Detention & Depression Storage	0.10 inch
--------------------------------	-----------

Calculation of the various parameters depicting the unit hydrograph (Figure IVa) and the resultant storm hydrograph appear in the Appendix to this report. As can be seen on the storm hydrograph, the peak flow at this intersection occurs at 60 minutes and a flow rate (Q) of 815 cubic feet per second (c.f.s.).

Conversion to "Rational Method"

$$Q = C_f \times C \times I \times A \quad \text{Where: } Q = 815$$

$$T_c = 60 \text{ min.}$$

$$I = 2.22$$

$$A = 291 \text{ Ac. } 717$$

Solve for: $[C_f \times C]$

$$\text{Where } C_f = 1.25$$

(Estimated Offsite Flows cont'd.)

$$[C_f \times C] = \frac{Q}{I \times A}$$

$$[C_f \times C] = \frac{815}{(2.22)(991)}$$

$$[C_f \times C] = \underline{0.37} \quad 0.24$$

Proceeding eastward along Sage Road as the primary corridor for offsite drainage and utilizing the "Rational Method" to study point No. 2.

Study Point No. 2

Channel Flow

Channel Flow = 3,000 ft.

Velocity = 7.0 ft. per second

Flow Time in channel = 7 minutes

T_c at Study Point #1 = 60 minutes

Total T_c = 67 minutes

$$I = \frac{189}{t+25} = \frac{189}{67+25} = 2.05 \text{ inches per hour}$$

COMPOSITE RUNOFF COEFFICIENT

		<u>$C_f \times C$</u>	<u>% Area</u>	
Watershed "A"	991.0 Ac.	0.37	64%	0.24
Area "B"	18.0 Ac.	0.18 ⁽¹⁾	1%	0.00
Watershed "C"	533.0 Ac.	0.18	35%	0.06
Total	1542.0 Ac.			0.30

(1) See Appendix - Composite Runoff Coefficients for Rational Method

(Estimated Offsite Flows - cont'd.)

Flow at Study Point No. 2

$$Q = [C_f C] IA$$

$$A = (0.30)(2.05)(1542) = 948 \text{ c.f.s.}$$

(say 950 c.f.s.)

WESTGATE HEIGHTS, UNIT 2

The drainage report covering Westgate Heights, Unit 2, considered the subdivision to contain no lot ponding. The subdivision, however, was constructed in accordance with an area grading plan dated August 1, 1972, and prepared by Ralph K. Hicks, N.M.L.S. No. 3367. This plan included ponding on selected lots. Due to this alteration, the report of Ralph K. Hicks & Associates dated March 1972 was used as reference material and a re-evaluation of the Westgate Heights Unit 2 water shed draining to Unit 3 was undertaken. The results of that study appear in the Appendix, pages A-10.1 thru A-10.5 and Figure 1b.

UNPLATTED LANDS TO THE SOUTHWEST

Approximately 34 acres east of Snow Vista Boulevard and south of Units 2 and 3 flow in an easterly manner and are conducted by Benavides Road to the east. The control of these flows for the development of Unit No. 3 is included within the recommendations of this report.

UNDEVELOPED RUNOFF - UNIT NO. 3

Drainage Basin	Elev. Diff.	Length of Flow	Tc	1100 yr. in./hr.	C	Area Acres	Q C.F.S.
On-Site	30	1250'	16	4.61	0.38	36.0	63

Offsite:

Westgate Heights Unit 2 (northwesterly)	140
Atrisco Village (northerly)	5
Unplatted (southwesterly)	41
Total Offsite Flow As Modified by This Report	<u>186</u>
Total Undeveloped Runoff	214

186
63

249

ESTIMATED RUNOFF DEVELOPED STATE

As development occurs, the area of impervious surfaces increases and thereby the amount of runoff also increases. To offset this increase, onsite restrictions of flows must be incorporated into the development. While this can take different forms, the most practical solution for this type of development is to utilize on-lot ponding. The contributing area to the backyard ponding includes the backyard, sideyard, and in a majority of cases, one-half the roof area due to the popularity of the pitched roof concept. The area drained to the street includes the front yard, driveway, sidewalk-parkway areas, and one-half the roof area. This approach satisfies AMAFCA's requirement that the runoff rate from the developed tract not exceed the runoff rate from the tract in its natural state.

For non-ponded runoff, a composite runoff coefficient is developed based upon the percentage of different types of surfaces in the drainage area. The runoff coefficients for various surfaces are as follows:

Streets, Walks and Drives	C = 0.80
Roofs	C = 0.80
Lawns, sandy soils, (Average 2 to 7% slope)	C = 0.12

SUMMARY OF RESULTS

Developed Runoff:

Saphire Street	150 c.f.s.
Kimela	⁵¹ ~~73~~ c.f.s.
Total flow	²⁰⁷ ~~223~~ c.f.s.
Less: Total Offsite Flow	²¹⁴ ~~186~~ c.f.s.

214 over page

As shown above, the development of this project including the lot ponding will not increase the storm runoff over that occurring in the natural undeveloped state. Further, offsite flow entering the project on the northwest and north perimeters is to be conducted to the east via Saphire Avenue. This flow will then be conducted by existing arroyos easterly in the course of historical drainage. Onsite flows from Areas W3(2) thru W3(7), A-7 and A-8 are conducted to Kimela Avenue and thence northeasterly in the historical course of natural drainage within existing arroyos. As the development of this site will not increase runoff above the current "undeveloped" runoff level, it is not within the scope of this report nor the responsibility of the developer to provide determination of the adequacy of downstream facilities.

but should show there is such facility in which to concentrate flows.

RECOMMENDATIONS

The following recommendations are made to enable the developer of this site and the local government to complete this project within the framework required by the City of Albuquerque and A.M.A.F.C.A.:

1. Due to the lack of clear flow pattern at the intersection of Snow Vista and Sage Road, a compacted earthen berm should be constructed to prevent upstream flows from entering Area O.S.(1).
2. A diversion wall should be constructed along the north line of Block 72 to direct flows from O.S.(5) to the proposed 10' drainage R.O.W.
3. The platted and future streets to the southwest of the subject site should be subgraded a minimum of 2.0 ft. below existing ground to provide interception and control of flows from the southwest.
4. Flows within the streets of the development are distributed so that only Sapphire Avenue assumes a major role in conveying off-site flows. This street should be graded at not less than 1.0% slope and ^{2.00}~~0.50%~~ crown in order to insure adequate carrying capacity. Diversion walls should be installed as shown on Figure 1 to provide freeboard protection through the horizontal curve.
5. The ponding areas in each backyard should be situated toward the rear of the yard. There should be a minimum of five foot buffer zone between the rear property lines and the edge of the pond

to protect any walls which might be constructed. In no case should ponded waters be allowed to stand against a wall or house foundation.

6. Ponds should average 6" deep and the minimum surface area should not be less than 15% of the total area drained into the pond.

SUMMARY

The subject property, by utilizing backyard ponding on single family lots and outlet control in the multi-family and commercial areas, will contribute no more surface runoff to downstream areas than that which existed before development.

A number of points, however, must be recognized. At this time considerable flow has been channeled to the intersection of Snow Vista and Sage Road, and within current planning, interception of this flow is provided by the Westgate Heights channel. Therefore, this report provides only for interim or temporary protection and definition of flow distribution in this area and further makes no attempt to evaluate the capability of Sage Road to handle its existing flow.

In conclusion, the development of this site should have a beneficial effect on the drainage characteristics of this area, and can be developed safely with no harm to life or property.

Respectfully submitted,

Bo K. Johnson
N.M.P.E. No. 5922
October 22, 1976

pg 3 / Supplement
958 hbl

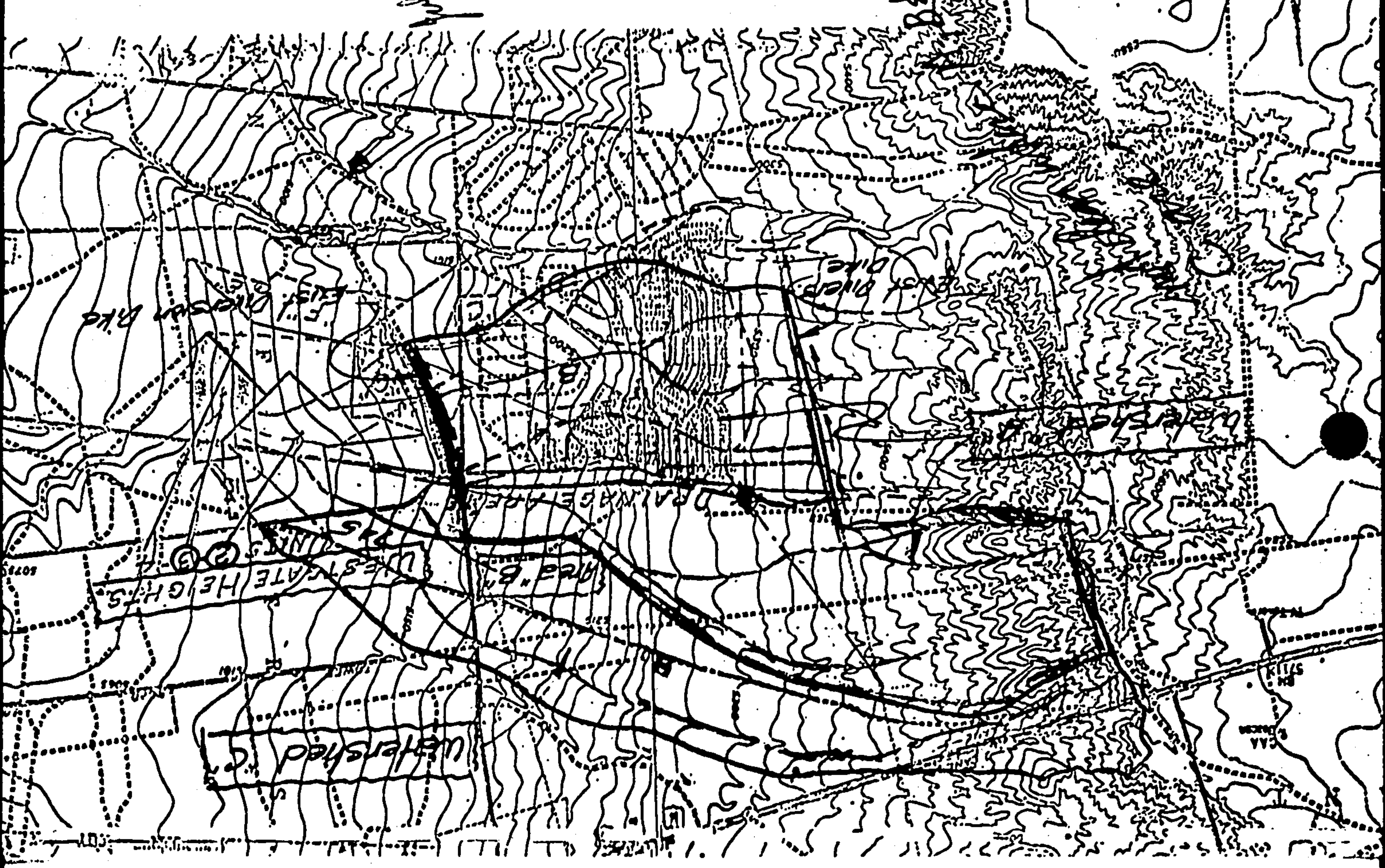
10-A is water shed A 425
10-B, 10-G no water shed 10-
10-R, 10-C, 10-D, 10-F.
744

MURRAY-McCORMICK, INC.
 ENVIRONMENTAL DESIGN
 ENGINEERING IN ANIMALS RESERVE UNIT
 PROJECT WORKSHEET H-1-N-3
 DATE _____ JOB NO _____ SCALE A-1.0



Scale: 1" = 2000'

MAJOR WATERSHEDS
 AFFECTING THE SITE
 FIGURE I



"RATIONAL METHOD"

COMPOSITE RUNOFF COEFFICIENTS

For purposes of this report the runoff coefficient (C) and Frequency Factor (C_f) are combined in one factor designated (C). Each of the following determinations of composite runoff coefficients is first computed upon the basis of relative percentages of surface characteristics for the individual areas, and coefficients for 2 to 10 year frequency storms. Each is then multiplied by the Frequency Factor (C_f) of 1.25 for 100 year storms.

UNDEVELOPED LAND

$$C = 0.30^1 \times 1.25^2 = 0.38$$

DEVELOPED LAND

Typical Lot Area - Westgate Heights, Unit 2

Gross Area	72.1 Ac.
Less: Park Site	7.8 Ac.
School Site	11.4 Ac.
Area in Streets	11.2 Ac.
Area in Lots	41.7 Ac.
Average Lot Area (219 Lots)	8,294 Sq.Ft.
Typical Lot width	65 Ft.

-
1. See Bibliography; Item (1) Table XII
 2. See Bibliography; Item (2) Article 3.7

Ponded Lots - Westgate Heights, Unit 2

C = 0.80

Streets & Walk Area	20x65	1,300 S.F.
Roof Area	20x55	1,100 S.F.
Driveway	30x15	<u>450 S.F.</u>
Total Impervious Area		2,850 S.F.

C = 0.12

Front and Side Yards	3,250 S.F.
Less Roof Area	-1,100 S.F.
Less Driveway	<u>-450 S.F.</u>
Total Pervious Area	1,700 S.F.

Impervious Area	2850 Sq.Ft.	63% @ 0.80	0.504
Pervious Area	1700 Sq.Ft.	37% @ 0.12	<u>0.044</u>
Total Area	4550 Sq.Ft.	100%	0.548

Composite Runoff Coefficient - $C \times C_p = 0.55 \times 1.25 = \underline{0.69}$

Elementary School Site

C = $0.30 \times 1.25 = 0.38$

Park Site

C = $0.20 \times 1.25 = 0.25$

Typical Lot Area - Westgate Heights, Unit 3

Gross Area	36.0 Ac.
Less: Well Site	3.4 Ac.
Area in Streets	5.1 Ac.
Area in lots	27.5 Ac.
Average lot area (136 lots)	8,808 Sq.Ft.
Typical lot width	65 Ft.

Ponded Lots - Westgate Heights, Unit 3

C = 0.80

Streets & Walk Area	20x65	1,300 S.F.
Roof Area	20x55	1,100 S.F.
Driveway	30x15	<u>450 S.F.</u>
Total Impervious Area		2,850 S.F.

C = 0.12

Front and Side Yards	3,250 S.F.
Less Roof Area	-1,100 S.F.
Less Driveway	- <u>450 S.F.</u>
Total Pervious Area	1,700 S.F.

Impervious Area	2850 Sq.Ft.	63% @ 0.80	0.504
Pervious Area	1700 Sq.Ft.	37% @ 0.12	<u>0.044</u>
Total Area	4550 Sq.Ft.	100%	0.548
Composite Runoff Coefficient - $C \times C_f = 0.55 \times 1.25 =$			<u>0.69</u>

Non-Ponded Lots - Westgate Heights, Unit 3

C = 0.80

Streets & Walk Area	20x65	1,300 S.F.
Roof Area	40x55	2,200 S.F.
Driveway	30x15	450 S.F.
Patio	10x10	<u>100 S.F.</u>
Total Impervious Area		4,050 S.F.

$$C = 0.12$$

Total Lot Area
 Less Roof Area
 Less Driveway
 Total Pervious Area
 8,808 S.F.
 -2,200 S.F.
 - 450 S.F.
 6,158 S.F.

Impervious Area 4050 Sq.Ft. 40% @ 0.80 0.320
 Pervious Area 6158 Sq.Ft. 60% @ 0.12 0.072
 Total Area 10208 Sq.Ft. 100% 0.392

$$\text{Composite Runoff Coefficient} - C \times C_p = 0.39 \times 1.25 = 0.49$$

A-2.4

PONDING REQUIREMENTS

Typical Lot Area

Average Lot Area	8,808 S.F.
Less: Front & Side Yards	3,250 S.F.
Area Draining to Pond	5,558 S.F.
Roof Area 20 x 55	1,100 S.F.
Patio Area	100 S.F.
Lawn Area	4,358 S.F.

Runoff Coefficient

Impervious Area	1200 S.F.	22% @ 0.80	0.18
Pervious Area	4358 S.F.	78% @ 0.12	<u>0.09</u>
			0.27

$$C \times C_1 = 0.27 \times 1.25 = 0.34$$

Pond Volume Requirement

$$100 \text{ year 6-hour precipitation} = 2.2 \text{ in.}$$

$$\text{Volume} = \text{Runoff coefficient} \times \text{area} \times \text{precipitation}$$

$$V = 0.34 \times 5558 \times 0.18 = 340 \text{ cu.ft.}$$

$$\text{Depth of pond } 0.50 \text{ ft (6")}$$

$$\text{Minimum area of pond } 680 \text{ sq.ft.}$$

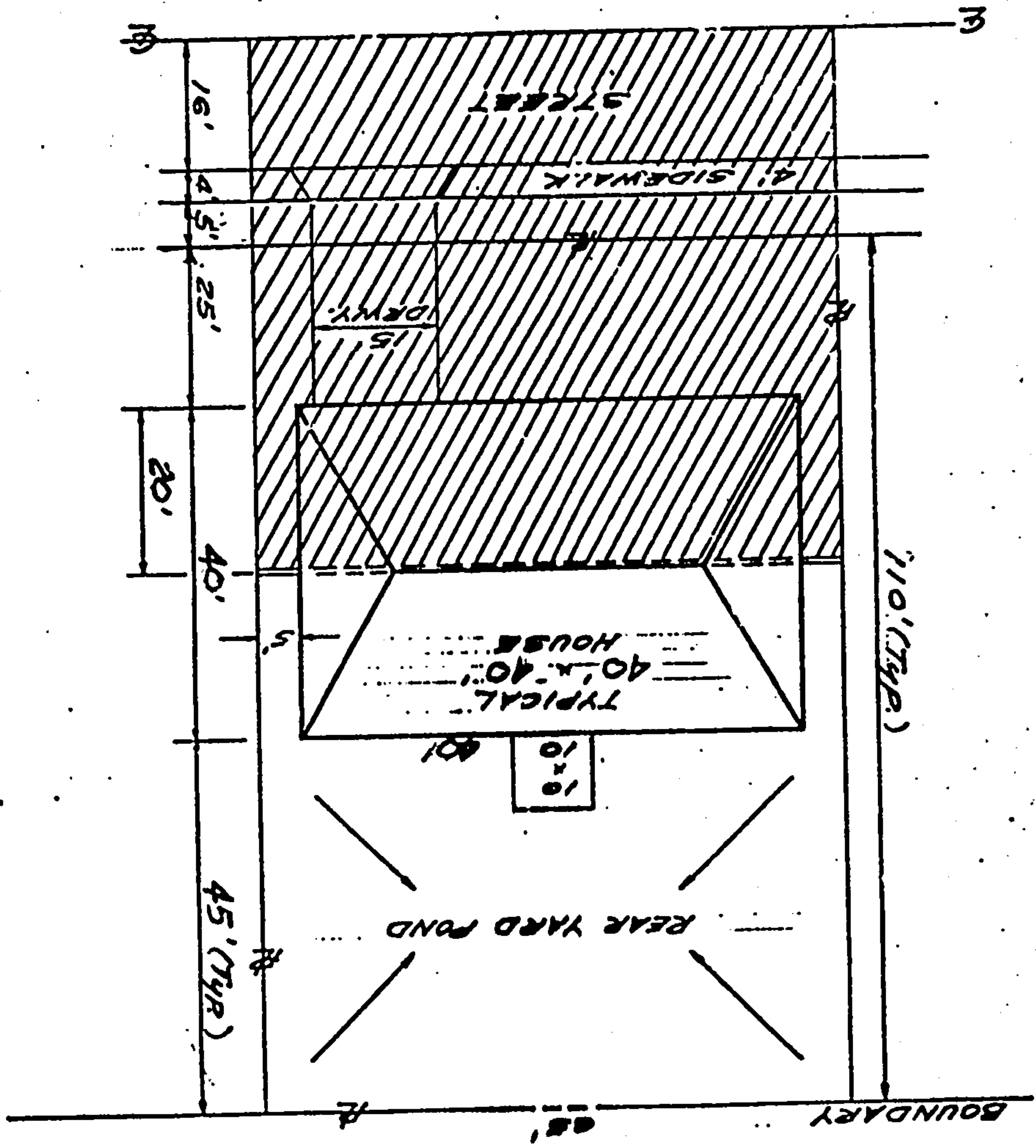
$$\text{Pond area as a percentage of area drained} = 12\% - \text{use } 15\%$$

$$V = 15\% \times 5558 \text{ sq.ft.} \times 0.5 \text{ ft.} = 416 \text{ cu.ft.}$$

FIGURE II
TYPICAL LOT DRAINAGE

AREA DRAINED

NOTE: REFER APPENDIX FOR CALCULATION



TIME OF CONCENTRATION FOR SMALL DRAINAGE BASINS

FIGURE III

FIG. G-INTENSITY EXPECTATION FOR ONE-HOUR RAINFALL.

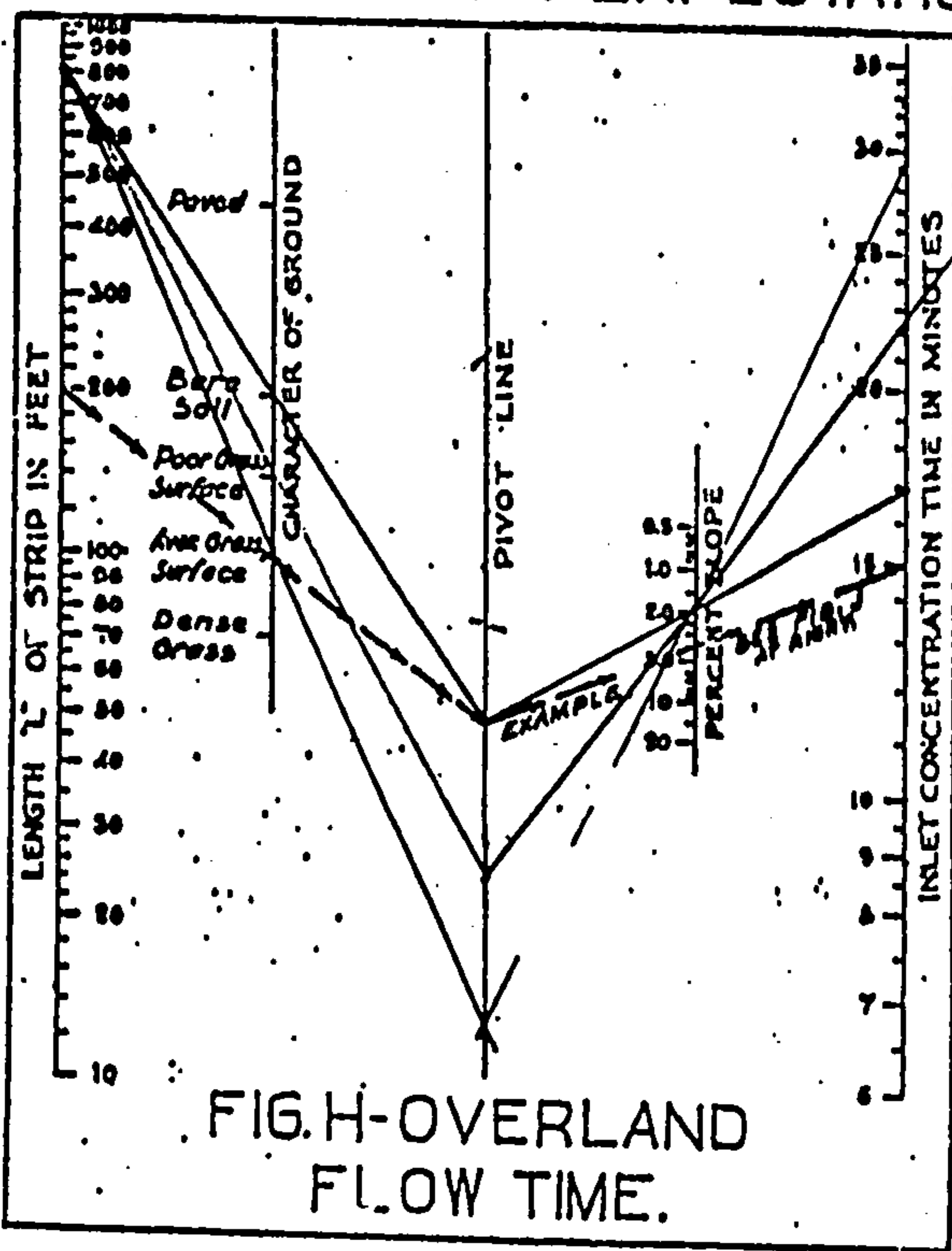


FIG. H-OVERLAND
FLOW TIME.

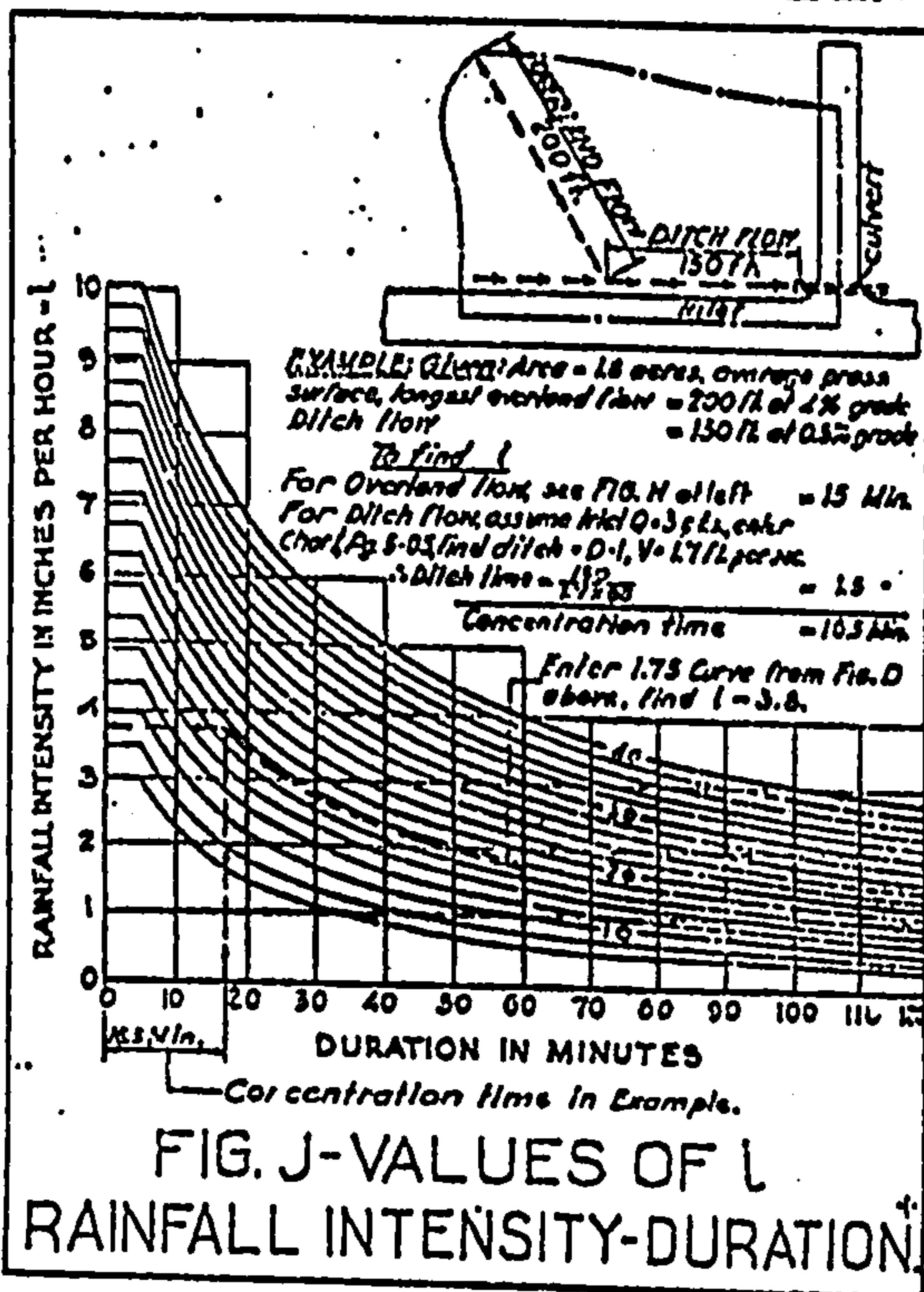


FIG. J-VALUES OF L
RAINFALL INTENSITY-DURATION.

*Reproduced from Miscellaneous Publication No. 204, U.S. Dept. of Agriculture, by David L. Yarnall;
+Adapted from Engineering Manual of the War Department, Part VIII, Chap. I, Dec. 45.

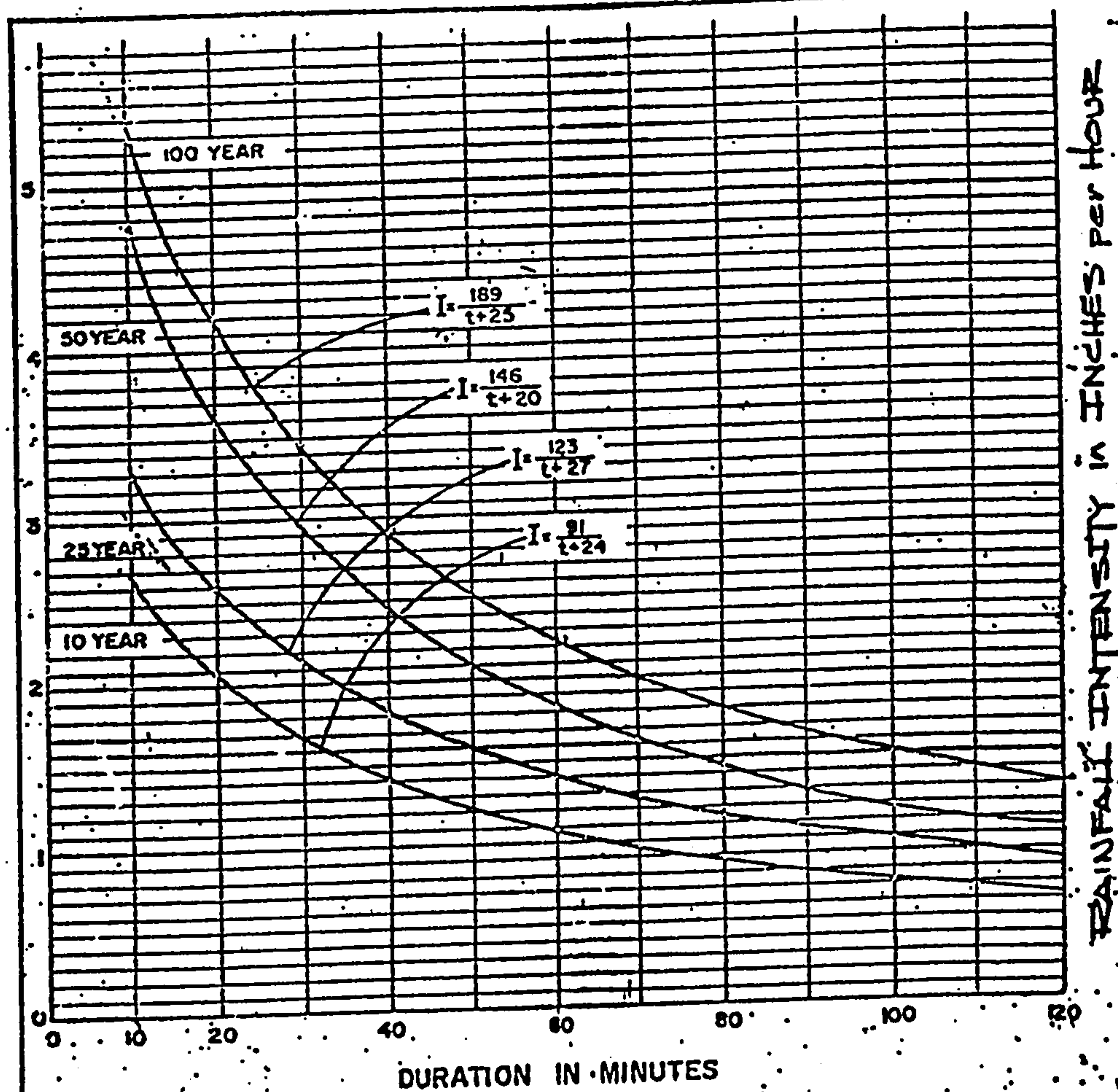


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JOB NO. _____ DATE _____

PROJECT _____

SCALE A-5-2



INTENSITY-DURATION CURVES

FIGURE IV

MASTER PLAN OF DRAINAGE
CITY OF ALBUQUERQUE - NEW MEXICO
AND ENVIRONS

INTENSITY DURATION
FREQUENCY CURVES

(ALBUQUERQUE AREA-1951)

GORDON HERKENHOFF & ASSOC CHART
CONSULTING ENGINEERS



MURRAY-McCORMICK, INC.
ENVIRONMENTAL DESIGN
ENGINEERING-PLANNING-SURVEYING

7001 WYOMING BLVD., NE SUITE F / ALBUQUERQUE, NEW MEXICO 87110 / 505-292-1030

JOB NO. _____ DATE _____

PROJECT Westgate Hts. No. 3

SCALE A-6.0

DWG N2D1

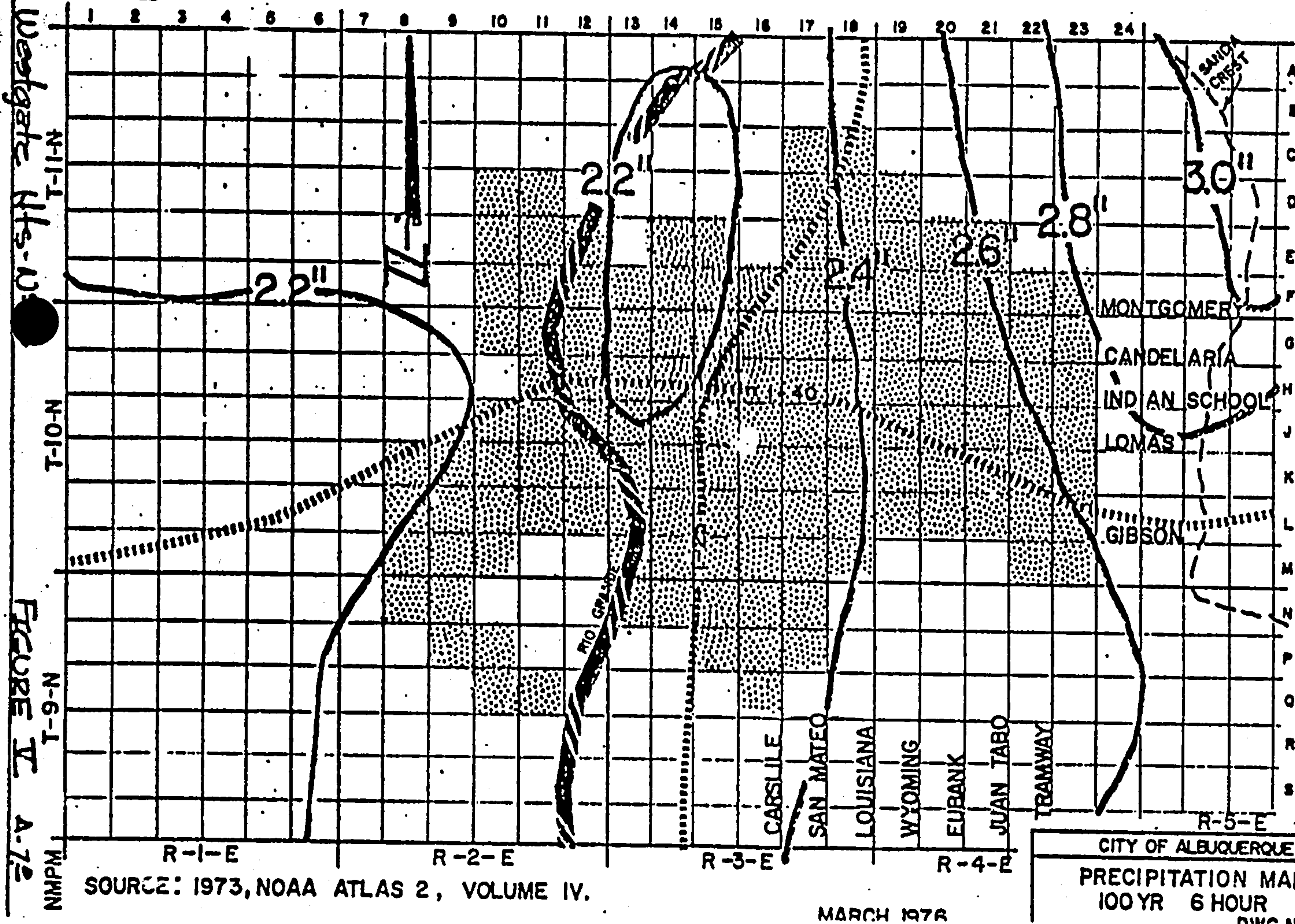


FIGURE VIa

UNIT HYDROGRAPH CALCULATIONS

Watershed "A"

Study Point No. 1 (Snow Vista & Sage Road)

Area	991 Ac.	1.55 Sq. Miles
L	10,300 Ft.	1.95 Miles
Lca	4,600 Ft.	0.87 Miles

10 minute unit storm

PERVIOUS-IMPERVIOUS AREAS

(Table 2-1 C.U.H.P.)

	<u>Area</u>	<u>% of Area</u>	<u>% Pervious Area</u>	
Single Family Residential	294 Ac.	30%	55%	17%
Mobile Home Park	10 Ac.	1%	45%	0%
Undeveloped Area	687 Ac.	69%	80%	55%
	991 Ac.	100%		72%
Pervious Area	72%			
Impervious Area	28% = I_a			

(1) $C_t = \frac{7.81}{(I_a)0.78}$

$C_t = \frac{7.81}{(28)0.78} = \underline{0.58}$

(3) $C_p = 0.89 C_t^{0.46}$
 $C_p = 0.89(0.58)^{0.46} = \underline{0.69}$

(5) $Q_p = q_p A$
 $Q_p = 650(1.55) = 1008 \text{ c.f.s.}$

(2) $t_p = C_t [LxLca]^{0.3}$
 $t_p = 0.58 [1.95x0.87]^{0.3} = \underline{0.68}$

(4) $q_p = \frac{640(C_p)}{t_p}$
 $q_p = \frac{640(0.69)}{0.68} = 649$

Say 650

(6) $W_{75\%q} = 0.40 \text{ hrs. : 24 min.}$
 $W_{50\%q} = 0.85 \text{ hrs. = 51 min.}$

FIGURE VIA - cont'd.

(8) See Figure VIA.

$$(7) \quad T_p = 60t_p + \frac{t_u}{2} = 60(0.68) + \frac{10}{2} = 46 \text{ minutes}$$

(9 & 10)

$$99 \text{ Ac.} \times 0.08 = 79.3 \text{ Ac.Ft.} \quad 1 \text{ ft.} = (200 \text{ c.f.s.} \times 60 \text{ sec./min.} \times 20 \text{ min.}) \div 43560 = 5.51 \text{ Ac.Ft.}$$

$$(79.3 \text{ Ac.Ft.}) \div 5.51 = 14.39 \text{ sq.in.} \quad (13.67 \rightarrow 15.11)$$

(11 thru 13)

Detention & Depression Storage - Red

$$\text{Pervious Area} = 72\% = 0.18 \quad 0.13$$

$$\text{Imperv.} = 28\% = 0.90 \quad 0.38$$

$$0.38$$

Distribution of Flow at Various Vistas & Segs

TO SOUTH

$$294 \text{ AC} = 79\% \times 0.45 \text{ IMP. AC.} = 0.36$$

$$80 \text{ AC} = 21\% \times 0.20 \text{ IMP. AC.} = 0.09$$

$$0.40 \times 374 = 149.6 = 54\%$$

TO EAST

$$10 \text{ AC} = 2\% \times 0.55 \text{ IMP. AC.} = 0.01$$

$$607 \text{ AC} = 48\% \times 0.20 \text{ IMP. AC.} = 0.20$$

$$0.21 \times 617 = 124.6 = 46\%$$

54% & 81% = 142% to south
46% & 21% = 67% to east

A-8.5

A-8.6

Figure VII

Sheet 1 of 2

Time (min.)	Total Precipitation (in.)	Incremental Precipitation (in.)	Rearranged Incremental Precipitation (in.)	Maximum Infiltration (in.)	Detention & Storage (in.)	Effective Precipitation (in.)	Effective Precipitation (in.)	Detention & Storage (in.)	Loss Precipitation (in.)	Effective Precipitation (in.)	Total Average Effective Precipitation (in.)
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.95	0.95	0.14	0.14	0.06	0.00	0.00	0.00	0.00	0.00	0.00
20	1.95	0.40	0.40	0.40	0.92	0.00	0.00	0.10	0.00	0.00	0.01
30	1.70	0.35	0.35	0.35	0.02	0.85	0.00	0.00	0.00	0.00	0.11
40	1.88	0.18	0.35	0.35	0.00	0.27	0.19	0.00	0.00	0.00	0.86
50	2.08	0.30	0.20	0.20	0.00	0.12	0.09	0.01	0.00	0.00	0.28
60	2.82	0.14	0.18	0.18	0.00	0.10	0.07	0.01	0.00	0.00	0.18
70	2.88	0.06	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.12
80	2.93	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.02
90	2.37	0.04	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.01
100	2.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110	2.45	0.04	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120	2.48	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
130	2.51	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
140	2.53	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150	2.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
160	2.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
170	2.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
180	2.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
190	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200	2.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
220	2.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
230	2.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
240	2.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
250	2.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
260	2.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
270	2.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
280	2.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
290	2.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300	2.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Location: Westgate Hts. No 3
Design Storm: 100 Year Recurrence Interval
DETERMINATION OF EFFECTIVE RAINFALL

Sheet 2 of 2

Time (hr.)	Total Precipitation (in.)	Incremental Precipitation (in.)	Rearranged Precipitation (in.)	Maximum Infiltration (in.)	Detention & Storage (in.)	Effective Precipitation (in.)	Effective Precipitation (in.)	Detention & Storage (in.)	Loss (in.)	Effective Precipitation (in.)	Total Average Effective Precipitation (in.)
140	2.73	0.02	0.02	0.08	0.00	0.00	0.00	0.00	0.00	0.02	0.01
150	2.75										0.01
160	2.77										
170	2.79										
180	2.81										
190	2.83										
200	2.85										
210	2.87										
220	2.89										
230	2.91	0.02	0.02								
240	2.92										
250	2.93										
260	2.94	0.01	0.01	0.08	0.00	0.00	0.00	0.00		0.01	0.00
270	2.94										0.00
280											
290											
300											
310											
320											
330											
340											
350											
360											
370											
380											
390											
400											
410											
420											
430											
440											
450											
460											
470											
480											
490											
500											
510											
520											
530											
540											
550											
560											
570											
580											
590											
600											
610											
620											
630											
640											
650											
660											
670											
680											
690											
700											
710											
720											
730											
740											
750											
760											
770											
780											
790											
800											
810											
820											
830											
840											
850											
860											
870											
880											
890											
900											
910											
920											
930											
940											
950											
960											
970											
980											
990											
1000											

DETERMINATION OF EFFECTIVE RAINFALL
Location: Wadsworth Hts. - No 3 - (Cont'd)
Design Storm: 100 Year Recurrence Interval

WESTGATE HTS. - No 3

DETERMINATION OF STORM HYDROGRAPH

Excess Precipitation in inches

Time (min.)	Unit Hydrograph (cfs)	Storm Hydrograph (cfs)
0	0	0
10	0	0
20	300	15
30	480	33
40	650	53
50	540	72
60	420	53
70	290	46
80	280	37
90	240	31
100	210	26
110	190	23
120	170	21
130	160	19
140	150	18
150	145	17
160	140	16
170	135	15
180	130	15
190	121	14
200	118	13
210	104	12
220	96	11
230	88	11
240	80	10
250	75	9
260	74	7
270	72	5
280	63	4
290	51	3
300	48	3
310	46	2
320	41	2
330	36	2
340	34	2
350	31	1
360	29	1
370	27	1
380	25	1
390	23	1
400	22	1
410	21	1
420	20	1
430	18	1
440	17	1
450	16	1
460	15	1
470	14	1
480	13	1
490	12	1
500	11	1
510	10	1
520	9	1
530	8	1
540	7	1
550	6	1
560	5	1
570	4	1
580	3	1
590	2	1
600	1	1
610	1	1
620	1	1
630	1	1
640	1	1
650	1	1
660	1	1
670	1	1
680	1	1
690	1	1
700	1	1
710	1	1
720	1	1
730	1	1
740	1	1
750	1	1
760	1	1
770	1	1
780	1	1
790	1	1
800	1	1
810	1	1
820	1	1
830	1	1
840	1	1
850	1	1
860	1	1
870	1	1
880	1	1
890	1	1
900	1	1
910	1	1
920	1	1
930	1	1
940	1	1
950	1	1
960	1	1
970	1	1
980	1	1
990	1	1
1000	1	1

SHEET 1A of 5

WESTGATE HTS - NO. 3

Excess precipitation in inches

SYSTEM
Hydro:gas
(cfs)

SHEET 13 OF 5
PLATE VI - 100

WESTGATE HTS No 3

DETERMINATION OF STORM HYDROGRAPH

Time (min.)	Unit Hydrograph (cfs)	Excess Precipitation in inches	Storm Hydrograph (cfs)
260	0.01 (3)	0.01 (16)	0.01 (17)
270	0.01 (4)	0.01 (15)	0.01 (16)
280	0.01 (5)	0.01 (14)	0.01 (15)
290	0.01 (6)	0.01 (13)	0.01 (14)
300	0.01 (7)	0.01 (12)	0.01 (13)
310	0.01 (8)	0.01 (11)	0.01 (12)
320	0.01 (9)	0.01 (10)	0.01 (11)
330	0.01 (10)	0.01 (9)	0.01 (10)
340	0.01 (11)	0.01 (8)	0.01 (9)
350	0.01 (12)	0.01 (7)	0.01 (8)
360	0.01 (13)	0.01 (6)	0.01 (7)
370	0.01 (14)	0.01 (5)	0.01 (6)
380	0.01 (15)	0.01 (4)	0.01 (5)
390	0.01 (16)	0.01 (3)	0.01 (4)
400	0.01 (17)	0.01 (2)	0.01 (3)
410	0.01 (18)	0.01 (1)	0.01 (2)
420	0.01 (19)	0.01 (0)	0.01 (1)
430	0.01 (20)	0.01 (0)	0.01 (0)
440	0.01 (21)	0.01 (0)	0.01 (0)
450	0.01 (22)	0.01 (0)	0.01 (0)
460	0.01 (23)	0.01 (0)	0.01 (0)
470	0.01 (24)	0.01 (0)	0.01 (0)
480	0.01 (25)	0.01 (0)	0.01 (0)
490	0.01 (26)	0.01 (0)	0.01 (0)
500	0.01 (27)	0.01 (0)	0.01 (0)
510	0.01 (28)	0.01 (0)	0.01 (0)
520	0.01 (29)	0.01 (0)	0.01 (0)
530	0.01 (30)	0.01 (0)	0.01 (0)
540	0.01 (31)	0.01 (0)	0.01 (0)
550	0.01 (32)	0.01 (0)	0.01 (0)
560	0.01 (33)	0.01 (0)	0.01 (0)
570	0.01 (34)	0.01 (0)	0.01 (0)
580	0.01 (35)	0.01 (0)	0.01 (0)
590	0.01 (36)	0.01 (0)	0.01 (0)
600	0.01 (37)	0.01 (0)	0.01 (0)
610	0.01 (38)	0.01 (0)	0.01 (0)
620	0.01 (39)	0.01 (0)	0.01 (0)
630	0.01 (40)	0.01 (0)	0.01 (0)
640	0.01 (41)	0.01 (0)	0.01 (0)
650	0.01 (42)	0.01 (0)	0.01 (0)
660	0.01 (43)	0.01 (0)	0.01 (0)
670	0.01 (44)	0.01 (0)	0.01 (0)
680	0.01 (45)	0.01 (0)	0.01 (0)
690	0.01 (46)	0.01 (0)	0.01 (0)
700	0.01 (47)	0.01 (0)	0.01 (0)
710	0.01 (48)	0.01 (0)	0.01 (0)
720	0.01 (49)	0.01 (0)	0.01 (0)
730	0.01 (50)	0.01 (0)	0.01 (0)
740	0.01 (51)	0.01 (0)	0.01 (0)
750	0.01 (52)	0.01 (0)	0.01 (0)
760	0.01 (53)	0.01 (0)	0.01 (0)
770	0.01 (54)	0.01 (0)	0.01 (0)
780	0.01 (55)	0.01 (0)	0.01 (0)
790	0.01 (56)	0.01 (0)	0.01 (0)
800	0.01 (57)	0.01 (0)	0.01 (0)
810	0.01 (58)	0.01 (0)	0.01 (0)
820	0.01 (59)	0.01 (0)	0.01 (0)
830	0.01 (60)	0.01 (0)	0.01 (0)
840	0.01 (61)	0.01 (0)	0.01 (0)
850	0.01 (62)	0.01 (0)	0.01 (0)
860	0.01 (63)	0.01 (0)	0.01 (0)
870	0.01 (64)	0.01 (0)	0.01 (0)
880	0.01 (65)	0.01 (0)	0.01 (0)
890	0.01 (66)	0.01 (0)	0.01 (0)
900	0.01 (67)	0.01 (0)	0.01 (0)
910	0.01 (68)	0.01 (0)	0.01 (0)
920	0.01 (69)	0.01 (0)	0.01 (0)
930	0.01 (70)	0.01 (0)	0.01 (0)
940	0.01 (71)	0.01 (0)	0.01 (0)
950	0.01 (72)	0.01 (0)	0.01 (0)
960	0.01 (73)	0.01 (0)	0.01 (0)
970	0.01 (74)	0.01 (0)	0.01 (0)
980	0.01 (75)	0.01 (0)	0.01 (0)
990	0.01 (76)	0.01 (0)	0.01 (0)
1000	0.01 (77)	0.01 (0)	0.01 (0)

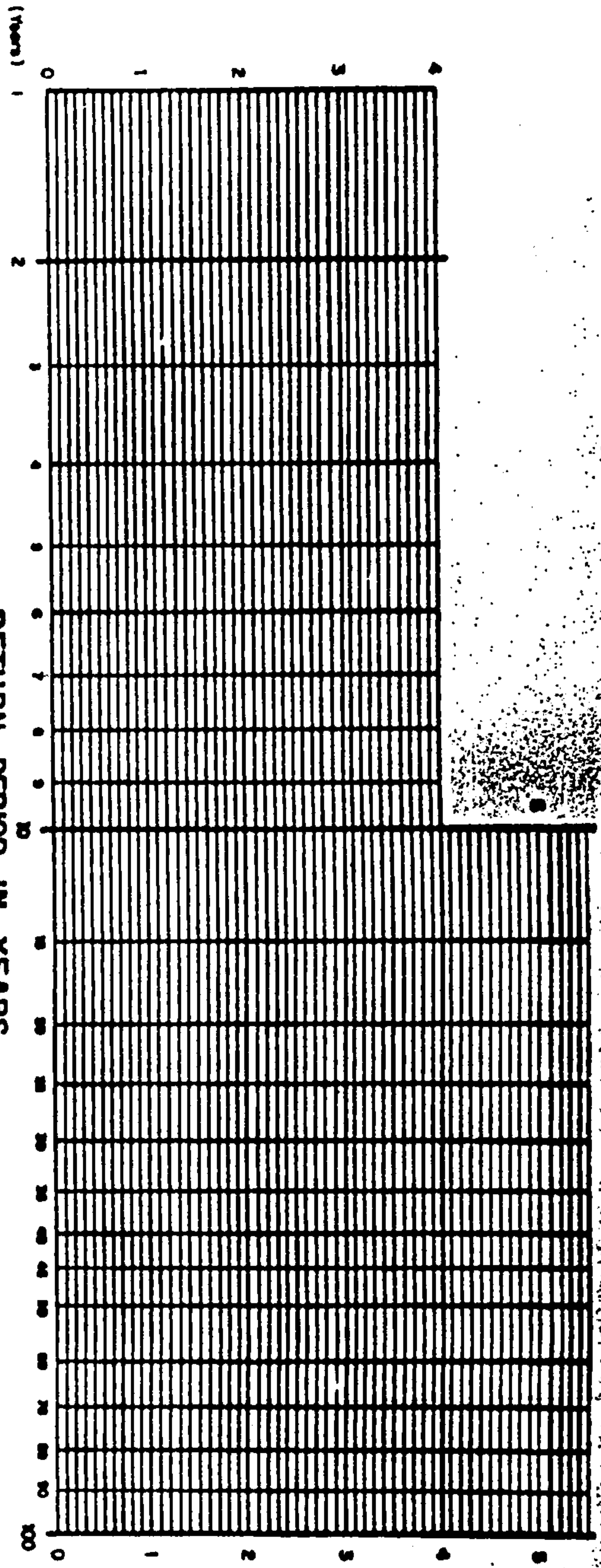
WESTGATE H.S. No 3

52 55

DETERMINATION OF STORM HYDROGRAPH

Unit (cfs)	Hydrograph (cfs)	Storm (cfs)
60	67	
70	60	
80	54	
90	47	
100	40	
110	34	
120	27	
130	21	
140	14	
150	8	
160	0	
170		
180		
190		
200		
210		
220		
230		
240		
250		
260		
270		
280		
290		
300		
310		
320		
330		
340		
350		
360		
370		
380		
390		
400		
410		
420		
430		
440		
450		
460		
470		
480		
490		
500		
510		
520		
530		
540		
550		
560		
570		
580		
590		
600		
610		
620		
630		
640		
650		
660		
670		
680		
690		
700		
710		
720		
730		
740		
750		
760		
770		
780		
790		
800		
810		
820		
830		
840		
850		
860		
870		
880		
890		
900		
910		
920		
930		
940		
950		
960		
970		
980		
990		
1000		

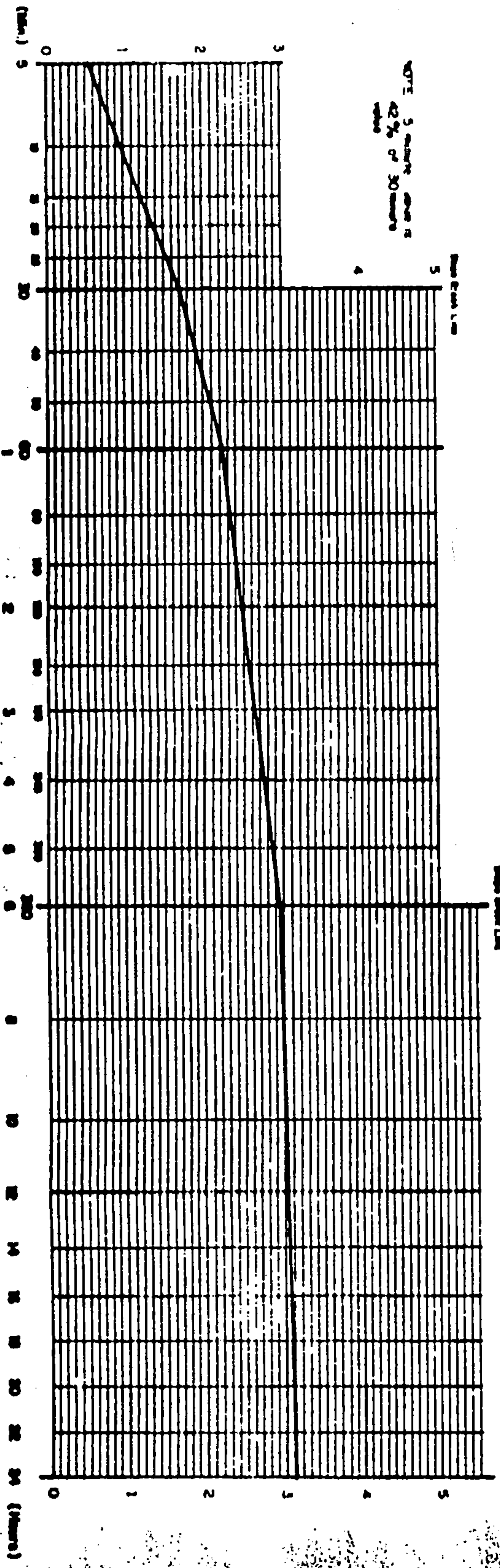
TOTAL RAINFALL DEPTH IN INCHES



RETURN PERIOD IN YEARS

Base Graph Line

TOTAL RAINFALL DEPTH IN INCHES



DURATION IN MINUTES AND HOURS

FIGURE VI. d

DENVER REGIONAL COUNCIL OF GOVERNMENTS

WESTGATE HTS.-N=3

DEPTH-DURATION-FREQUENCY GRAPHS

Single - Intergraph - Diagrams

Section - 1 - 1 - R - 1 - 1

Denver Region

STREET FLOW CAPACITY CHARACTERISTICS

FIGURE VII

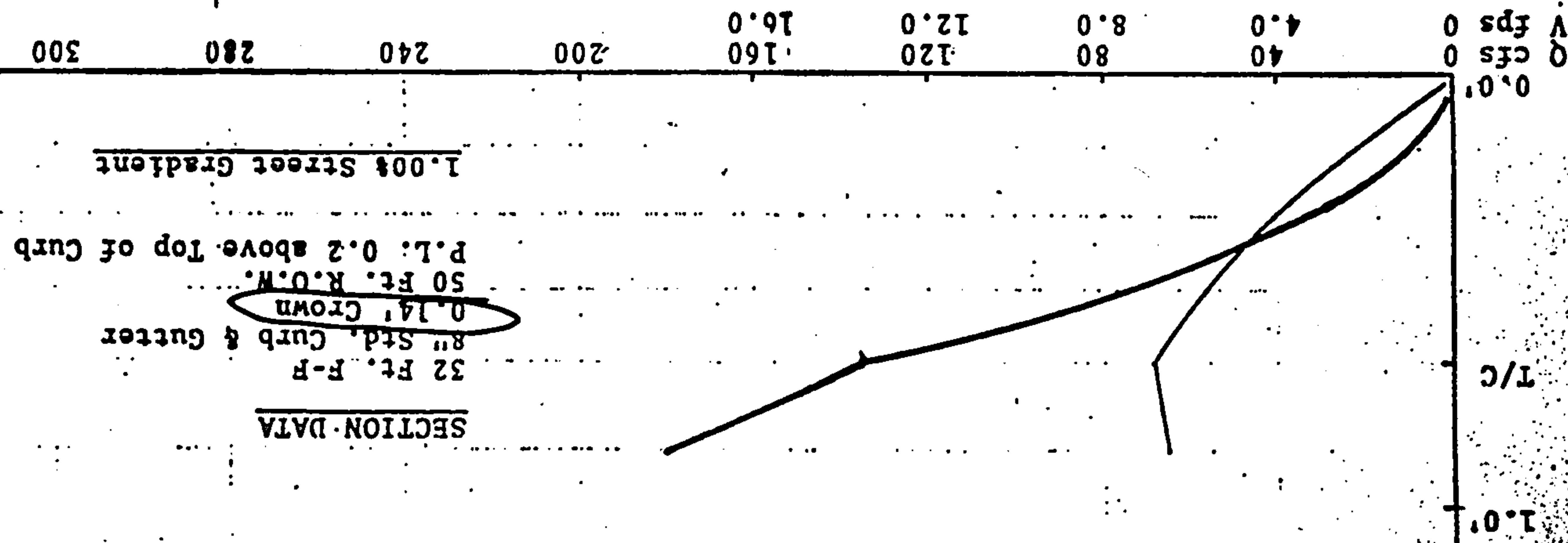
JOB NO. _____ DATE _____

PROJECT _____

SCALE _____

MURRAY-McCORMICK, INC.
ENVIRONMENTAL DESIGN
ENGINEERING-PLANNING-SURVEYING

3001 WYOMING BLVD., NE SUITE 7 / ALBUQUERQUE, NM 87110 505-263-1333



SECTION DATA

32 Ft. F-F
8" Std. Curb & Gutter

0.14' Crown

50 Ft. R.O.W.

P.L. 0.2 above Top of Curb

1.00% Street Gradient

RATIONAL METHOD

RUNOFF COMPUTATIONS

Sheet No. A-10.1

Project: WESTGATE HTS. UNIT 2

Drainage Area No. 0.5 (1) Atvisco Village Unit 7

Area = 39.2 acres

Maximum Overland Flow:

L = 800' S = 2.02%

Maximum Channel Flow:

Channel No. 1 L = 1000' S = 2.00%

Channel No. 2 L = S =

Channel No. 3 L = S =

Accumulation Time

Overland Flow or Inlet Time: 22 min.
(Fig. 4, S = 1.4%)

Channel No. 1 Flow:
7.2 FPS. Velocity 5.2 ft/sec; Time = 1000 / 5.2 = 30.2 min.
Velocity = 5.2 ft/sec; Time = 1000 / 5.2 = 30.2 min.

Channel No. 2 Flow:

Velocity = ft/sec; Time = / 60 = min.

Channel No. 3 Flow:

Velocity = ft/sec; Time = / 60 = min.

Total Accumulation Time:

T = 25.2 min.

$I = 189 / (25 + 25) = 3.78$

$Q = CIA = (0.38) (3.78) (39) = 56$ c.f.s.

Date: 10-19-76

Comp. by: [Signature]

Checked by:

why both overland & channel flow

about half of the site explain flow for next half

RATIONAL METHOD

RUNOFF COMPUTATIONS

Sheet No. A-10.2

Project: Westport, Hts-Unit 2.

Drainage Area No. Q5.1) + U22(1)

Area = 27.215 + 40.4 acres

Maximum Overland Flow: L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = 110' S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time:

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = 0 min.
X 60

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Total Accumulation Time:

T = 25.3 min.

$I = 189 / (25 + 25) = 3.78$

$Q = CIA = (0.37) (378) (40 \pm) = 60$ c.f.s.

392 @ 0.33 1-1/2 0.37
14 @ 0.67 3% 0.62
0.37

Date: _____

Comp. by: _____

Checked by: _____

RATIONAL METHOD

RUNOFF COMPUTATIONS

Sheet No. A-10.3

Project: WESTGATE Hg. - UNIT 2

Drainage Area No. OS(1) + WZ(1) + WZ(2) + WZ(3) + WZ(4)

Area = 40.4 + 1.1 + 6.2 + 0.8 = 48.5 acres

Maximum Overland Flow: L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = 430' S = 0.50%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 25.2 min.

Channel No. 1 Flow:

Velocity = 4.2 ft/sec; Time = $\frac{430}{4 \times 60} = \underline{1.8}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Total Accumulation Time: T = 27.1 min.

$I = \frac{189}{(27+25)} = \underline{3.62} = \underline{\quad}$

$Q = CIA = (0.44) (3.63) (48.5) = \underline{78} \text{ c.f.s.}$

40.4 @ 0.29 33% 0.22

8.1 @ 0.43 17% 0.12

48.5

0.44

Date: _____

Comp. by: _____

Checked by: _____

RATIONAL METHOD

RUNOFF COMPUTATIONS

Sheet No. A-10.7

Project: WESTGATE HTS. N^o 3

Drainage Area No. W3(2)

Area = 2.3 acres

Maximum Overland Flow:

L = 110

S = 1.00%

Maximum Channel Flow:

Channel No. 1

L =

S =

Channel No. 2

L =

S =

Channel No. 3

L =

S =

Accumulation Time

Overland Flow or Inlet Time:

12 min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Total Accumulation Time:

T = 12 min.

$1 = 1.49 \sqrt{12+25} = 5.11$

$Q = CIA = (0.69) (5.11) (2.3) = 8.1$ c.f.s.

Date: 10-19-76

Comp. by: [Signature]

Checked by: _____

RATIONAL METHOD

RUNOFF COMPUTATIONS

Sheet No. A-10.6

Project: Westgate Hts. - Unit 3

Drainage Area No. Westgate Hts Unit 2 + W3(1) + 0.3(5)

Area = 88.7 + 5.3 + 4.1 = 98.1 acres

Maximum Overland Flow: L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = 700' S = 1.00%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 30.4 min.

Channel No. 1 Flow:

Velocity = 7 ft/sec; Time = $\frac{700}{7 \times 60} = \underline{1.67}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Total Accumulation Time:

T = 32.1 min.

I = $\frac{189}{32+25} = \underline{3.32}$

Q = CIA = (0.44) (3.32) (98.1) = 150 c.f.s.

88.7 @ 0.44 71% 0.42
5.3 @ 0.49 5% 0.02
4.1 @ 0.38 4% 0.02
98.1 0.46

Date: 10-19-76

Comp. by: [Signature]

Checked by: _____

RATIONAL METHOD

RUNOFF COMPUTATIONS

Sheet No. A-10.5

Project: WESTSIDE HTS - UNIT 2

Drainage Area No. 0.5(1) + W2(1 thru 6) + W2(7) + W2(8) + W2(9) + 0.5(2 thru 6)
 $6.2 + 0.8 + 0.7 + 7.2 + 6.8$
 Area = 28.7 acres

Maximum Overland Flow: L = 400' S = 2.00%

Maximum Channel Flow:

Channel No. 1 L = _____ S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 29.6 min.

Channel No. 1 Flow:

Velocity = 8.2 ft/sec; Time = $\frac{400}{8 \times 60} = \underline{0.83}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Total Accumulation Time: T = 30.4 min.

$I = \frac{1.49}{(30+25)} = \underline{3.44}$

Q = CIA = (0.46) (30.4) (88.7) = 140 c.f.s.

62.3 @ 0.49	70%	0.34
3.8 @ 0.67	4%	0.03
7.2 @ 0.38	8%	0.03
6.8 @ 0.25	8%	0.02
8.2 @ 0.33	10%	0.04
<u>88.7</u>		<u>0.46</u>

Date: 10-19-76

Comp. by: [Signature]

Checked by: _____

RATIONAL METHOD

6

RUNOFF COMPUTATIONS

Sheet No. A-10.4Project: WESTGATE H/S - UNIT 2Drainage Area No. Q.S.(1)+WZ(1)+WZ(2)+WZ(3)+WZ(4)+WZ(5)+WZ(6)Area = 48.5+2.8+11.2 = 62.5 acres

Maximum Overland Flow:

L = _____ S = _____

Maximum Channel Flow:

Channel No. 1

L = 1030' S = 1.00%

Channel No. 2

L = _____ S = _____

Channel No. 3

L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time:

27.1 min.

Channel No. 1 Flow:

Velocity = 7 ft/sec; Time = $\frac{1030}{7 \times 60} = \underline{2.5}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\times 60} = \underline{\quad}$ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\times 60} = \underline{\quad}$ min.

Total Accumulation Time:

T = 29.6 min.I = $\frac{1.87}{(0.47+2.5)} = \underline{0.44}$ Q = CIA = (0.47) (2.04) (62.5) = 105 c.f.s.

48.5 @ 0.41 7.5% 0.30
 13.2 @ 0.67 22% = 0.15
 0.47

Date: 10-19-76Comp. by: [Signature]

Checked by: _____

RATIONAL METHOD

RUNOFF COMPUTATIONS

Sheet No. A-10.11

Project: Westgate Hts. No. 3

Drainage Area No. 0.3(6) + W3(2) thru W3(7)

Area = 34.2 + 14.2 = 48.2 acres

Maximum Overland Flow: L = 800' S = 2.5%

Maximum Channel Flow:

Channel No. 1 L = 500' S = 0.50%

Channel No. 2 L = 850' S = 1.20%

Channel No. 3 L = 1350' S = 1.80%

Accumulation Time

Overland Flow or Inlet Time: 20 min.

Channel No. 1 Flow:

Velocity = 2.0 ft/sec; Time = $\frac{500}{2.0 \times 60} = \underline{4.2}$ min.

Channel No. 2 Flow:

Velocity = 3.5 ft/sec; Time = $\frac{850}{3.5 \times 60} = \underline{4.0}$ min.

Channel No. 3 Flow:

Velocity = 4.0 ft/sec; Time = $\frac{1350}{4.0 \times 60} = \underline{5.6}$ min.

Total Accumulation Time: T = 33.8 min.

I = $\frac{189}{(34+25)} = \underline{3.20}$

Q = CIA = (0.47) (320) (48.2) = 72.6 c.f.s.

34.2 @ 0.38 70% 0.27

14.2 @ 0.66 30% 0.20

48.2

0.47

Date: _____

Comp. by: _____

Checked by: _____

RUNOFF COMPUTATIONS

Sheet No. A-10.10Project: Westgate Hts. Unit 3Drainage Area No. W3(3)Area = 39 acresMaximum Overland Flow: L = 110 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = _____ S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 12 min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Total Accumulation Time:

T = 12 min. $I = \frac{189}{(2+25)} = 5.11$ $Q = CIA = (0.49) (5.11) (39) = 13.8$ c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

RATIONAL METHOD

RUNOFF COMPUTATIONS

Sheet No. A-10.9

Project: Westgate Hts. 1.2.3

Drainage Area No. W3(2) + W3(3) + W3(4) + W(5) + W3(6) + W3(

Area = 7.2 + 3.2 + 3.4 + 1.7 + 1.7 = 14.2 acres

Maximum Overland Flow: + 2.02 L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = 1400' S = 0.50%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 12 min.

Channel No. 1 Flow:

Velocity = 2.5 ft/sec; Time = $\frac{1400}{X 60} = \underline{9.3}$ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.

Total Accumulation Time:

T = 21.3 min.

$I = \frac{189}{(21+25)} = \underline{4.11}$

$Q = CIA = (0.66) (411) (14.2) = \underline{38.8}$ c.f.s.

1.7 @ 0.45 12% 0.05
12.6 @ 0.69 55% 0.61
14.3 0.66

Date: 10-19-76

Comp. by: [Signature]

Checked by: _____

RATIONAL METHOD

RUNOFF COMPUTATIONS

Sheet No. A-10.8

Project: W1-3+gate Hts

Drainage Area No. W3(4)+W3(5)

Area = 3.4 + 1.7 = 5.1 acres

Maximum Overland Flow:

L = 110 S = 1.00%

Maximum Channel Flow:

Channel No. 1

L = _____ S = _____

Channel No. 2

L = _____ S = _____

Channel No. 3

L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time:

_____ min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ min.
X 60

Total Accumulation Time:

T = 12 min.

I = 189(12.25) = 5.11

Q = CIA = (0.61) (5.11) (5.1) = 15.9 cfs c.f.s.

Date: 10-12-76

Comp. by: [Signature]

Checked by: _____

3.4 @ 0.67, 67% 0.46
1.7 @ 0.45 33% 0.15
5.1 0.61

APPENDIX D

DRAINAGE REPORT

FOR

WESTGATE HEIGHTS UNIT 2.

$\frac{H_{12}}{H_{11}} = \frac{H_{22}}{H_{21}}$

CAMPBELL-HICKS and ASSOCIATES, Inc.

Soils Testing Laboratory

Consulting Civil Engineers

232 Muriel Street, N.E.

Phone (505) 298-7139

Albuquerque, New Mexico 87123

**STORM DRAINAGE STUDY RELATIVE TO THE DEVELOPMENT OF
WESTGATE HEIGHTS, UNIT 2
ALBUQUERQUE, NEW MEXICO**

MARCH 1972

DRAINAGE STUDY INDEX

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STORM DRAINAGE STUDY RELATIVE TO THE DEVELOPMENT OF WESTGATE HEIGHTS, UNIT 2

I. GENERAL

This report has been prepared to present findings of a study of storm drainage conditions in an area proposed for development as Westgate Heights, Unit 2, and to describe proposed methods for providing adequate storm drainage in the area.

II. LOCATION

The area proposed for development is located in Section 33, Township 10 North, Range 2 East, N.M.P.M. It is bounded on the North by Unit Seven of Atrisco Village; on the West by Snow Vista Blvd., S.W.; on the South by unplatted land; and on the East by unplatted land.

III. EXISTING DRAINAGE CONDITIONS

A. General

This area, being generally located between Snow Vista Blvd., S.W., and unplatted land, lies on the east side of the west mesa. Physiographic features: sloping surfaces lightly ribbed with minor arroyo washes; sandy soil with sparse vegetation; and small valleys, bluffs, flat surfaces, and raw gullies. The Albuquerque volcanos are between this sub-area and the flat mesa top.*

B. Topography

The area of proposed development slopes gradually upward toward the top of the west mesa at a nearly uniform rate of about one to one and one-half percent. It is crossed by several minor drainage areas which are outlined on Exhibit "B", a scale photograph by Koogler and Pouls Engineering, Inc. Through field investigation it is considered that the photograph (dated 11-2-71) is satisfactory for the purpose of determining the original division lines.

C. Drainage Areas and Channels

At the present time only one major and one semi-major

*See Reference #1.

drainage areas contributing 396 c.f.s. and 60 c.f.s. respectively from the West end of the development exist. However, the runoff from these areas can be carried by aligning master planned streets in such a manner (i.e. set property lines high enough and adjust grades on streets within the development) as to carry water around the development, redepositing it in its original channel.

IV. PROPOSED DRAINAGE PLANS

A. General

In order to provide an adequate system of storm drainage for this proposed development, it was necessary to:

- (1) Determine the drainage areas which can and will contribute storm runoff during a 100 year design storm.
- (2) Determine the amount of runoff which could be expected after the entire area is developed.
- (3) Prepare a table of street carrying capacities for use in sizing streets and overflow sections (section above high curb to property line).
- (4) Determine the points where the storm runoff will concentrate.
- (5) Determine the ability of each of the drainage channels, streets plus overflow sections, and structures to handle the runoff that may concentrate on them.
- (6) Determine and recommend the means by which the expected runoff can be carried by the master planned area.
- (7) Design additional channels and structures to simulate and distribute the expected runoff in a manner similar to the existing terrain at the outlet end.

B. Drainage Areas

A study of the photography, Exhibit "B", to determine the areas which could conceivably contribute runoff to the proposed development was made, from which a copy of computations is contained in Exhibit "D" of this report. Finally, the Master Plan of Drainage, Exhibit "C", was prepared showing the entire area with directions of flow as well as runoff quantities.

C. Runoff Quantities

The quantities of storm runoff to be expected from each drainage area were determined using the Rational Formula, $Q=CIA$, where: Q =quantity of storm runoff in cubic feet per second; C =coefficient of runoff dependent upon the type of surface drained; I =intensity of rainfall in inches per hour for a duration equal to the total accumulation time in minutes; and A =area of contributing watershed in acres.

The area (A) of each separate contributing area was determined by outlining the watershed on a scale photograph or the contour map and measuring the area in acres (by planimeter).

The intensity of rainfall (I) was determined by assuming a 100 year frequency rainfall and then utilizing Intensity Duration Frequency Curves (Chart 1) for the Albuquerque Area, "Master Plan of Drainage - City of Albuquerque, New Mexico and Environs," 1963, prepared by Gordon Herkenhoff and Associates, Consulting Engineers, together with expected accumulation of runoff from each of the areas. The total accumulation times are determined by a combination of Yarnell's method and probable future streets and drainage channel alignments and grades, as shown, assuming overland flows to cross either poor grass, asphalt pavement or bare soil surfaces, depending upon the probable type of development in each area and estimating the probable type of grading to be done in each area; assuming future streets to be asphalt paved with either full crown (8"), 3/4 crown (6"), or 1/2 crown (4"). These times of flow were calculated by use of tables on pages 5.00, 5.04 and 5.05 of Design by E.E. Seelye.

The coefficient of runoff (C) was determined by assuming the maximum possible development in the areas under consideration. A coefficient of 0.45 is used for maximum runoff condition in suburban areas.* A coefficient of 0.283 is used for areas where undeveloped areas are shown.* A coefficient of 0.70 should be used for commercial areas or where a large amount of the exposed surface is impermeable.

The quantities of runoff are shown along with the areas after development on Exhibit "C", the Master Plan of Drainage for this subdivision.

D. Drainage Channels and Facilities

All existing structure capacities, as well as any future proposed structures were verified from com-

*See Reference #2

puter output sheets which form a part of Exhibit "D" and are based on Manning's Equation, $Q=AV$, where $V=1.486 R^{2/3} S^{1/2}$ when A =cross-sectional area of the

channel or structure; R =hydraulic radius of channel or area divided by wetted perimeter; S =slope of channel or facility in feet per foot; and " n " values of 0.015 for concrete and asphalt surfaces, 0.013 for concrete pipes, 0.0225 for dirt lined channels or a composite " n " value based on proportional wetted surfaces with different values.

V. CONCLUSIONS AND RECOMMENDATIONS

The main conclusion of this study was that a master plan of drainage of this entire area from the top of the ridge one and one-half to two miles west to the valley area about the same distance to the east of 98th Street, S.W., is badly needed. A discussion with the Flood Plain Management Branch of the Corps of Engineers revealed one has been begun but that it is not scheduled for completion until probably June or July of this year. The only available study found by this firm is the one referenced in this report (Reference #2 - Plate 10). That study suggests the runoff coefficients which are used as indicated on page 3 of this report.

Two areas which can conceivably contribute runoff in addition to that runoff from Westgate Heights Addition just to the west are shown as Areas A and B on Exhibit "B". These two areas will contribute considerable runoff particularly when curb and gutter is placed along 98th Street and Sage Road, S.W. It is felt that if a minimum of three foot water blocks are located at the upstream end of all incoming streets no serious flooding will occur until the remaining area in this vicinity is developed.

In addition to the above recommendation the following recommendations must be complied with:

- A. A 15' paved drainage easement to be constructed at about 795' south of the northwest property corner on Sage Road, S.W., is recommended.
- B. Comply with the minimum grade requirements outlined in Exhibit "F".
- C. Provide temporary structures under both streets that have access off Sage Road and one under Benavides until further development (curb and gutter, lined channels along Sage Road and Snow Vista Blvd. and others) requires their removal.
- D. An extension of the street at the east edge of the 6.835 acre park or the providing of a drainage easement in the

next subdivision to the east is required to transport the runoff to the existing semi-major channel near that point.

An example of other measures that may prove desirable in the future are the following:

- A. Provide a lined channel along the west edge of Snow Vista Blvd.
- B. Provide a waterblock in Sage Road, S.W., and maybe a lined channel along its north side.
- C. Divert some runoff east on San Ygnacio Road, S.W., and Tower Road, S.W., by providing minor waterblocks in 98th Street, S.W., as curb and gutter is constructed.

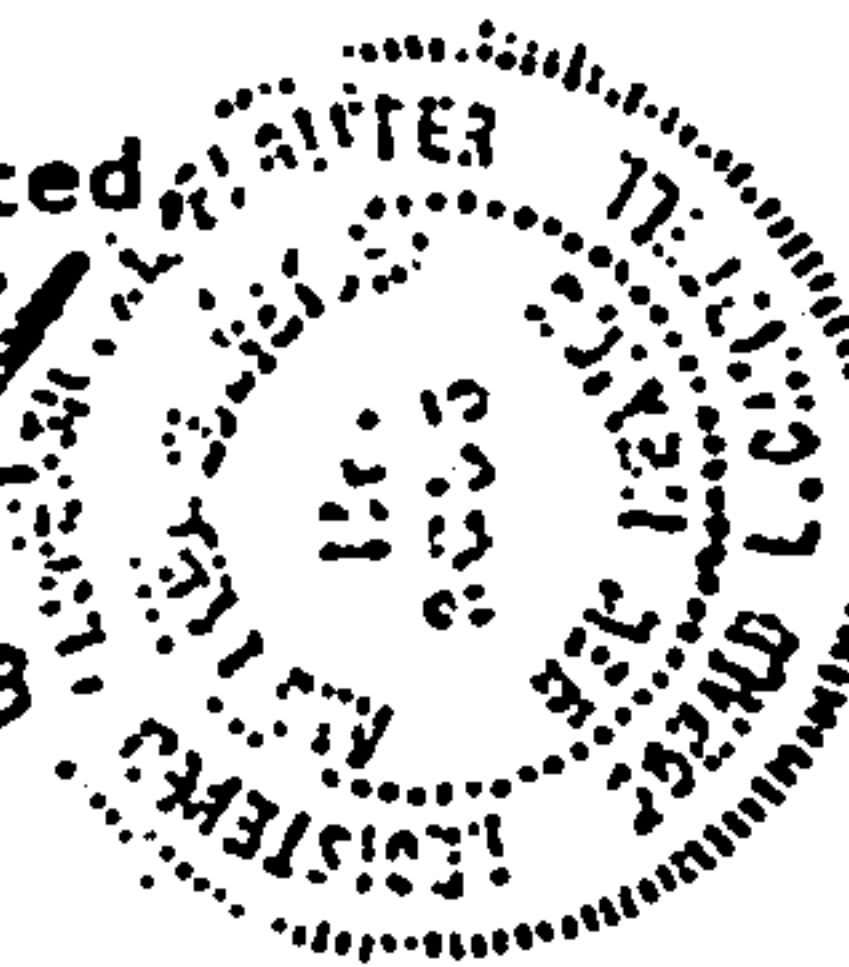
From the above recommendations and suggestions it may be seen that after the Corps of Engineers' drainage study is completed in connection with the Southwest Valley or A.M.A.F.C.A. channel completion, this area as well as others may be modified or adjusted by constructing waterblocks as required to make possible not altering the original drainage pattern.

If all the recommendations are adhered to, it is felt that this will improve the area as well as force an early solution to many of the drainage problems.

Respectfully submitted,

Donald L. Campbell

Donald L. Campbell
P.E. & L.S. No. 3633



7-6-73

100' to 150'
150' to 200'
200' to 250'

100' to 150'
150' to 200'
200' to 250'

UNPLATTED

UNPLATTED

UNPLATTED

UNPLATTED

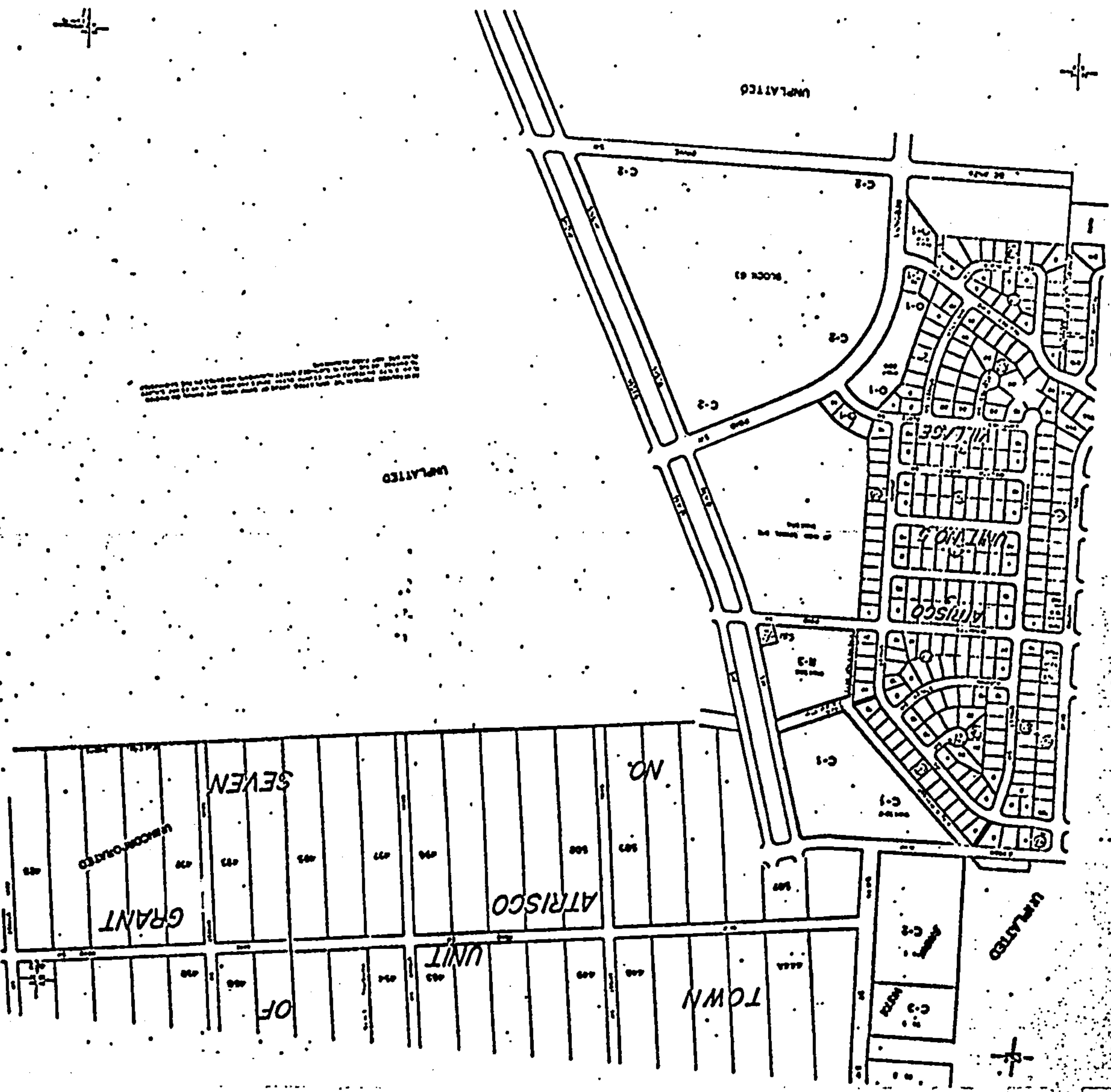
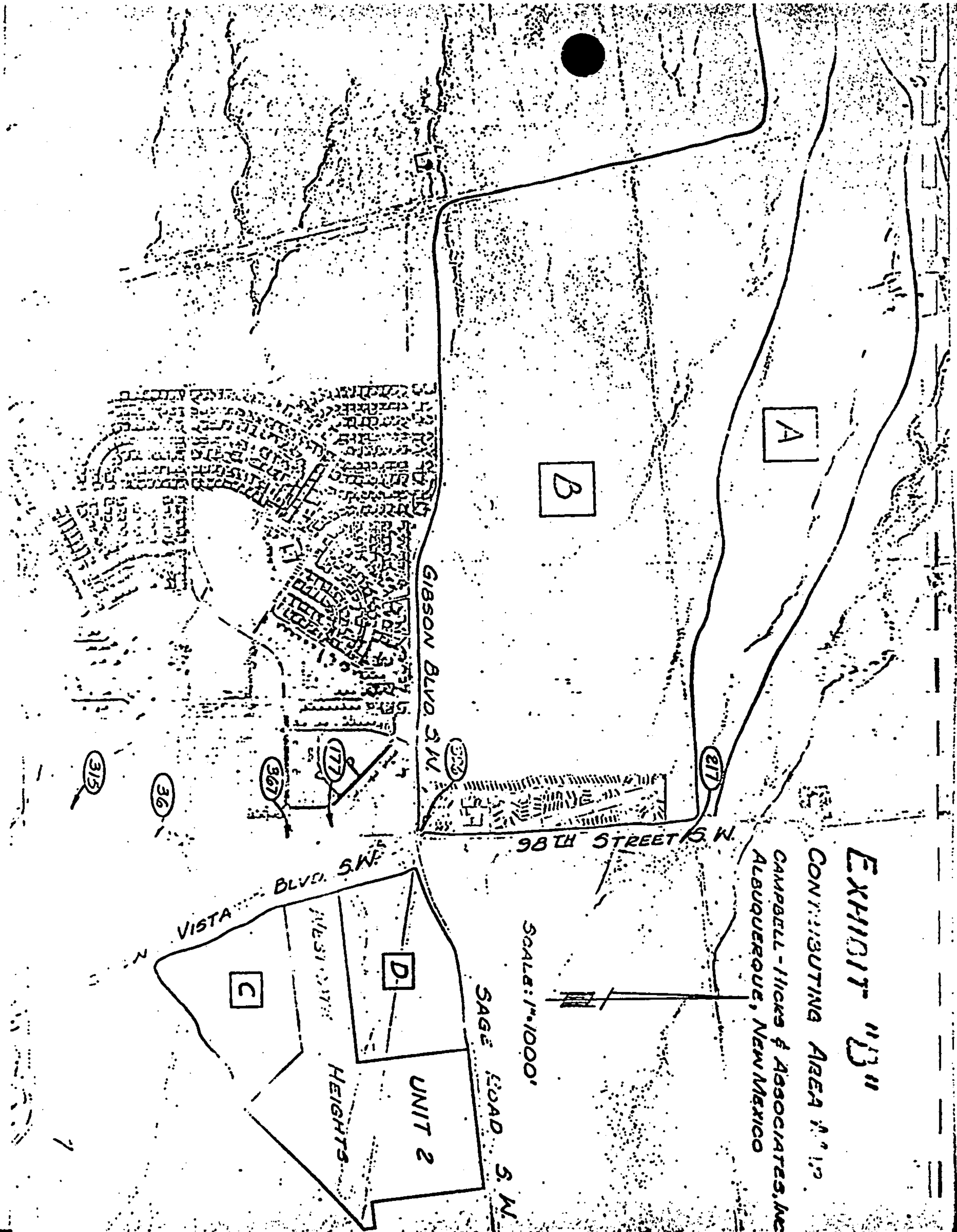


EXHIBIT "B"

CONTRIBUTING AREA A-10

CAMPBELL-HICKS & ASSOCIATES, INC.
ALBUQUERQUE, NEW MEXICO

SCALE: 1"=1000'



SUMMARY OF RUNOFF COMPUTATIONS

Sheet No.	Area Number	Area (in acres)	Expected Runoff (in C.F.S.)	Individual	Total
1	A	264	217		
2	B	479	396		
3	C	34	60		
4	D	39	67		
5	1	15	31		
6	2	36	69		
7	3	25	43		
8	4	11	22		
			217		82
			396		210
			60		167
			67		98
			31		
			22		

RUNOFF COMPUTATIONS

Sheet No. 1

Job No. Westgate #2

Drainage Area No. A

Area = 264 acres

Maximum Overland Flow: L = 1000' S = 0.5%

Maximum Channel Flow:

Channel No. 1 L = 5000' S = 5.8%

Channel No. 2 L = 5500' S = 3.0%

Channel No. 3 L = S =

Accumulation Time

Overland Flow: 31.1 min.

Channel No. 1 Flow:

Velocity = 20.2 ft/sec; Time = $\frac{5000}{20.2 \times 60} = \underline{4.1}$ min.

Channel No. 2 Flow:

Velocity = 19.1 ft/sec; Time = $\frac{5500}{19.1 \times 60} = \underline{4.8}$ min.

Channel No. 3 Flow:

Velocity = ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Total Accumulation Time:

T = 40.0 min.

$$I = \frac{189}{T+25} = \frac{189}{65} = \underline{2.91}$$

$$Q = CIA = (0.285)(2.91)(264) = \underline{217} \text{ c.f.s.}$$

Date: 3-7-72

Comp. by: NH

Checked by: HEP

RUNOFF COMPUTATIONS

Sheet No. 2

Job No. Westgate #2

Drainage Area No. B

Area = 479 acres

Maximum Overland Flow:

L = 1000'

S = 0.6 %

Maximum Channel Flow:

Channel No. 1

L = 5000'

S = 6.4 %

Channel No. 2

L = 5850'

S = 2.7 %

Channel No. 3

L =

S =

Accumulation Time

Overland Flow:

30.8 min.

Channel No. 1 Flow:

Velocity = 23.2 ft/sec; Time = $\frac{5000}{23.2 \times 60} = \underline{3.6}$ min.

Channel No. 2 Flow:

Velocity = 18.4 ft/sec; Time = $\frac{5850}{18.4 \times 60} = \underline{5.3}$ min.

Channel No. 3 Flow:

Velocity = ft/sec; Time = min.

Total Accumulation Time:

T = 39.7 min.

$$I = \frac{189}{T+25} = \frac{189}{64.7} = \underline{2.92}$$

$$Q = CIA = (0.283)(2.92)(479) = \underline{396} \text{ c.f.s.}$$

Date: 3-7-77

Comp. by: WPC

Checked by: H&P

RUNOFF COMPUTATIONS

Sheet No. 3

Job No. Westgate #2

Drainage Area No. C

Area = 34 acres

Maximum Overland Flow: L = 800' S = 2.0 %

Maximum Channel Flow:

Channel No. 1 L = 850' S = 2.3 %

Channel No. 2 L = S =

Channel No. 3 L = S =

Accumulation Time

Overland Flow:

22.0 min.

Channel No. 1 Flow:

Velocity = 10 ft/sec; Time = $\frac{850}{10 \times 60} = \underline{1.4}$ min.

Channel No. 2 Flow:

Velocity = ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Channel No. 3 Flow:

Velocity = ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Total Accumulation Time:

T = 23.4 min.

$$I = \frac{189}{T+25} = \frac{189}{48.4} = \underline{3.90}$$

$$Q = CIA = (0.45)(3.90)(34) = \underline{60} \text{ c.f.s.}$$

Date: 3-8-72

Comp. by: WPC

Checked by: HSP

RUNOFF COMPUTATIONS

Sheet No. 4

Job No. Westgate 2

Drainage Area No. D

Area = 39 acres

Maximum Overland Flow:

L = 800'

S = 2.0 %

Maximum Channel Flow:

Channel No. 1

L = 800'

S = 3.0 %

Channel No. 2

L =

S =

Channel No. 3

L =

S =

Accumulation Time

Overland Flow:

22.0 min.

Channel No. 1 Flow:

Velocity = 6.0 ft/sec; Time = $\frac{800}{6.0 \times 60} = \underline{2.2}$ min.

Channel No. 2 Flow:

Velocity = ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Channel No. 3 Flow:

Velocity = ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Total Accumulation Time:

T = 24.2 min.

$$I = \frac{109}{T+25} = \frac{109}{49.2} = \underline{3.84}$$

$$Q = CIA = (0.45)(3.84)(39) = \underline{67} \text{ c.f.s.}$$

Date: 2-28-72

Comp. by: MP

Checked by: NEP

RUNOFF COMPUTATIONS

Sheet No. 5

Job No. Wetgate #2

Drainage Area No. 1

Area = 15 acres

Maximum Overland Flow: L = 139' S = 2.0 %

Maximum Channel Flow:

Channel No. 1 L = 1765' S = 2.5 %

Channel No. 2 L = S =

Channel No. 3 L = S =

Accumulation Time

Overland Flow: 11.0 min.

Channel No. 1 Flow:

Velocity = 5.6 ft/sec; Time = $\frac{1765}{5.6 \times 60} =$ 5.2 min.

Channel No. 2 Flow:

Velocity = ft/sec; Time = min.

Channel No. 3 Flow:

Velocity = ft/sec; Time = min.

Total Accumulation Time:

T = 16.2 min.

$$I = \frac{189}{T+25} = \frac{189}{41.2} = 4.58$$

$$Q = CIA = (0.45)(4.58)(15) = 31 \text{ c.f.s.}$$

$$67 + 31 = 98$$

Date: 2-28-72

Comp. by: DPP

Checked by: WEP

RUNOFF COMPUTATIONS

Sheet No. 6

Job No. Kbztgale 2

Drainage Area No. 2

Area = 36 acres

Maximum Overland Flow: L = 150' S = 2.0 %

Maximum Channel Flow:

Channel No. 1 L = 1013' S = 1.2 %

Channel No. 2 L = 910' S = 1.5 %

Channel No. 3 L = S =

Accumulation Time

Overland Flow: 11.2 min.

Channel No. 1 Flow:

Velocity = 3.8 ft/sec; Time = $\frac{1013}{3.8 \times 60} =$ 4.4 min.

Channel No. 2 Flow:

Velocity = 4.3 ft/sec; Time = $\frac{910}{4.3 \times 60} =$ 3.5 min.

Channel No. 3 Flow:

Velocity = ft/sec; Time = $\frac{ }{ \times 60} =$ min.

Total Accumulation Time: T = 19.1 min.

$$I = \frac{189}{T+25} = \frac{189}{44.1} = 4.29$$

$$Q = CIA = (0.45)(4.29)(36) = 69 \text{ c.f.s.}$$

$$.98 + 69 = 167$$

Date: 2-28-72

Comp. by: RRP

Checked by: HEP

RUNOFF COMPUTATIONS

Sheet No. 7

Job No. Westgate #2

Drainage Area No. 3

Area = 25 acres

Maximum Overland Flow: L = 300' S = 0.5%

Maximum Channel Flow:

Channel No. 1 L = 1000' S = 1.3%

Channel No. 2 L = S =

Channel No. 3 L = S =

Accumulation Time

Overland Flow: 20.0 min.

Channel No. 1 Flow:

Velocity = 3.5 ft/sec; Time = $\frac{1000}{3.5 \times 60} = \underline{4.8}$ min.

Channel No. 2 Flow:

Velocity = ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Channel No. 3 Flow:

Velocity = ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Total Accumulation Time:

T = 24.8 min.

$$I = \frac{189}{T+25} = \frac{189}{49.8} = \underline{3.79}$$

$$Q = CIA = (0.45)(3.79)(25) = \underline{43} \text{ c.f.s.}$$

$$167 + 43 = 210$$

Date: 2-28-72

Comp. by: WPS

Checked by: HEP

RUNOFF COMPUTATIONS

Sheet No. 8

Job No. Westgate #2

Drainage Area No. 4

Area = 11 acres

Maximum Overland Flow: L = 129' S = 2.0 %

Maximum Channel Flow:

Channel No. 1 L = 2340' S = 2.0 %

Channel No. 2 L = S =

Channel No. 3 L = S =

Accumulation Time

Overland Flow: 10.5 min.

Channel No. 1 Flow:

Velocity = 5.0 ft/sec; Time = $\frac{2340}{5.0 \times 60} = \underline{7.8}$ min.

Channel No. 2 Flow:

Velocity = ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Channel No. 3 Flow:

Velocity = ft/sec; Time = $\frac{\quad}{\quad \times 60} = \underline{\quad}$ min.

Total Accumulation Time: T = 18.3 min.

$$I = \frac{189}{T+25} = \frac{189}{43.3} = \underline{4.37}$$

$$Q = CIA = (0.45)(4.37)(11) = \underline{22} \text{ c.f.s.}$$

$$60+22 = 82$$

Date: 2-28-72

Comp. by: [Signature]

Checked by: [Signature]

EXHIBIT E
STREET CARRYING CAPACITIES
AT VARIOUS GRADES
IN CFS

$n(\text{conc})=.015$ $n(\text{soil})=.0225$ $n(\text{composite})=.006$

STREET WIDTH	TYPE CROWN	CURB HT	.0050	.0100	.0150	.0200	.0250	.0300	.0350	.0400
32'	8"	8"	18	25	31	36	40	44	47	50
	6"	8"	35	49	61	70	78	86	92	99
	4"	8"	56	80	98	113	126	133	145	160
	2"	8"	82	116	142	164	183	201	217	232
40'	8"	8"	22	32	39	45	50	55	59	63
	6"	8"	44	62	76	88	98	108	116	124
	4"	8"	71	100	123	142	159	174	183	201
	2"	8"	103	146	178	206	230	252	272	291
44'	8"	8"	25	35	43	49	55	60	65	70
	6"	8"	48	68	84	97	103	119	128	137
	4"	8"	78	111	135	156	175	192	207	221
	2"	8"	113	160	196	227	254	278	300	321
48'	8"	8"	27	38	47	54	60	66	71	76
	6"	8"	53	75	92	106	118	130	140	150
	4"	8"	85	121	148	171	191	209	226	242
	2"	8"	124	175	215	248	277	304	328	351

R/W TO R/W
OVERFLOW SECTIONS CAPACITIES

R/W	ST WD	RI CURB DEPTH	.0050	.0100	.0150	.0200	.0250	.0300	.0350	.0400
50'	32'	0.1	14	19	23	27	30	33	36	39
		0.2	43	61	75	86	96	105	114	122
		0.4	137	193	237	273	305	335	361	386

ST HI CURB	R/W	WD DEPTH	OVERFLOW SECTIONS CAPACITIES									
			.0050	.0100	.0150	.0200	.0250	.0300	.0350	.0400	.0450	.0500
60'	40'	0.1	17	24	29	33	37	41	44	47	150	476
		0.2	53	75	92	106	119	130	140	150	476	936
		0.4	168	238	292	337	376	412	445	476	936	150
		0.6	331	468	573	662	740	810	875	936	150	50
60'	44'	0.1	18	25	31	36	40	44	47	50	160	503
		0.2	57	80	98	113	127	139	150	160	503	999
		0.4	180	254	311	359	402	440	475	503	999	174
		0.6	353	499	612	706	790	865	934	999	174	55
64'	48'	0.1	19	27	33	39	43	47	51	55	1013	1083
		0.2	61	87	106	123	137	150	162	174	551	551
		0.4	195	275	337	390	436	477	515	551	1083	1083
		0.6	383	541	663	766	856	938	1013	1083	1083	1083

15' LINED CHANNEL

45	64	78	90	101	111	120	128	136	143
.0050	.0100	.0150	.0200	.0250	.0300	.0350	.0400	.0450	.0500

EXHIBIT F
RECOMMENDED STREET GRADES

<u>STREET DESCRIPTION & LOCATION</u>	<u>MIN. % GRADE</u>	<u>CROWN HEIGHT</u>	<u>PROPERTY LINE ABOVE HIGH CURB</u>
A. Street #1; 50' R/W, 32' F. to F.	0.5	8"	0.0'
B. 94th Street, S.W.; 60' R/W, 40' F. to F.	0.5	8"	0.0'
C. Benavides Rd., S.W.; 64' R/W, 48' F. to F., from junction with Street #1 to Street #8	0.5	8"	0.2'
D. Street #2; 50' R/W, 32' F. to F. from junction with Street #1 to junction with Street #3	0.5	8"	0.3'
E. Street #3; 50' R/W, 32' F. to F. from Sage Road to junction with Street #4	0.5	8"	0.1'
F. Street #4; 50' R/W, 32' F. to F. from Benavides Rd., S.W. to junction with Street #10.....	0.5	8"	0.1'
Street #4-from Street #10 to junction with Street #8	1.0	8"	0.4'
G. Streets #5, 6 and 7; 50' R/W, 32' F. to F. from Street #3 to Street #8	0.5	8"	0.1'
H. Street #8; 50' R/W, 32' F. to F. from Sage Rd. to junction with Street #4	0.5	8"	0.2'
....from Street #4 to junction with Street #9	1.0	8"	0.4'
I. Street #9; 60' R/W, 44' F. to F. from Benavides Road, S.W. to Street #8	0.5	8"	0.1'
J. Street #10; 50' R/W, 32' F. to F. from Street #2 and #3 to Street #4	1.0	8"	0.3'

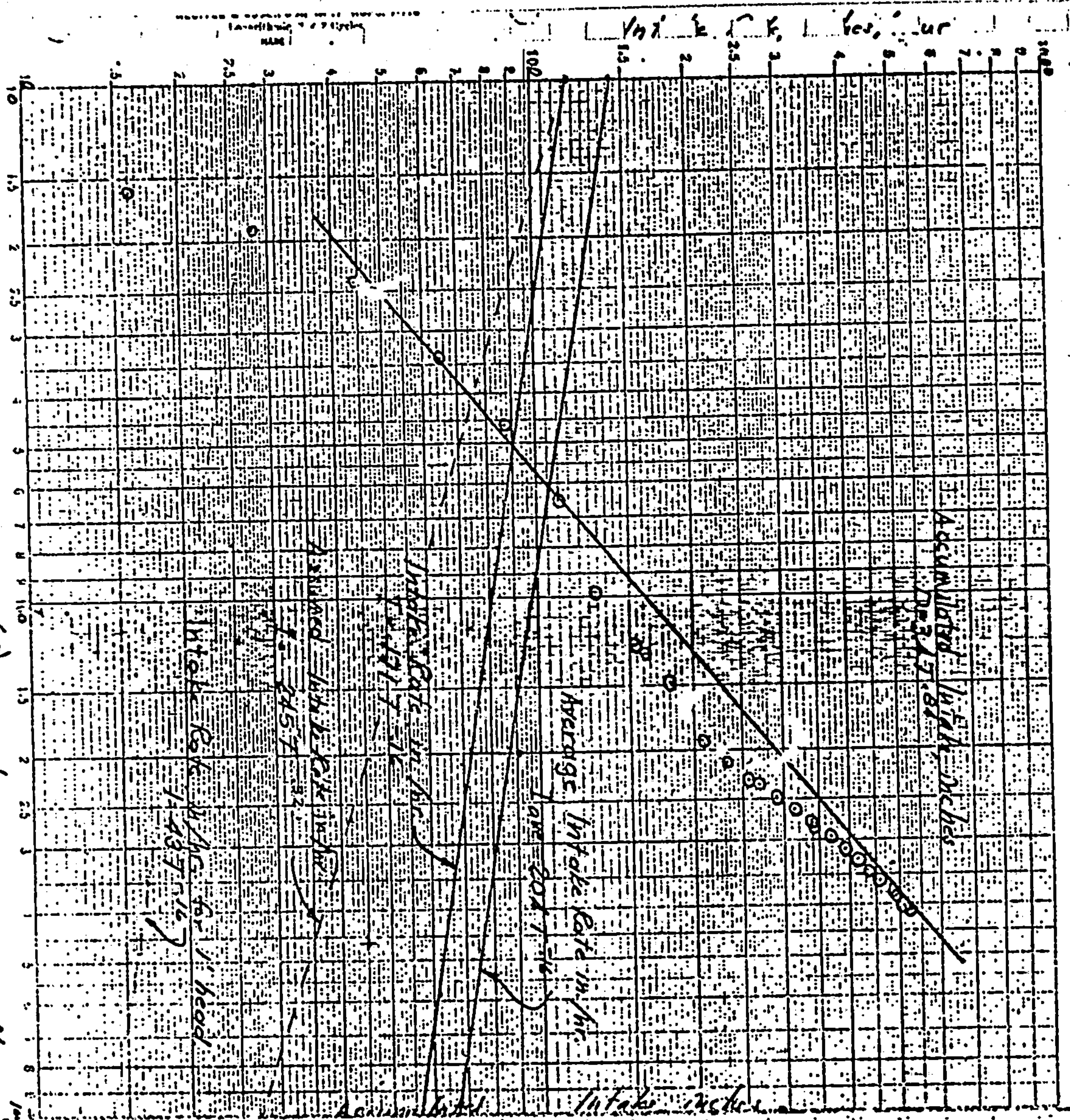
REFERENCES

1. Quality in Environment by David A. Crane and Associates, February 1970.
2. "Master Plan of Drainage - City of Albuquerque, New Mexico and Environs," by Gordon Harkenhoff and Associates, Consulting Engineers, 1963.
3. Design by Elwyn E. Seelye, Volume 1, 2nd edition, 1945.

Hole #2
Percolation

Westgate Hts. Unit 2

5 Oct 1973



Elapsed time (T) in minutes

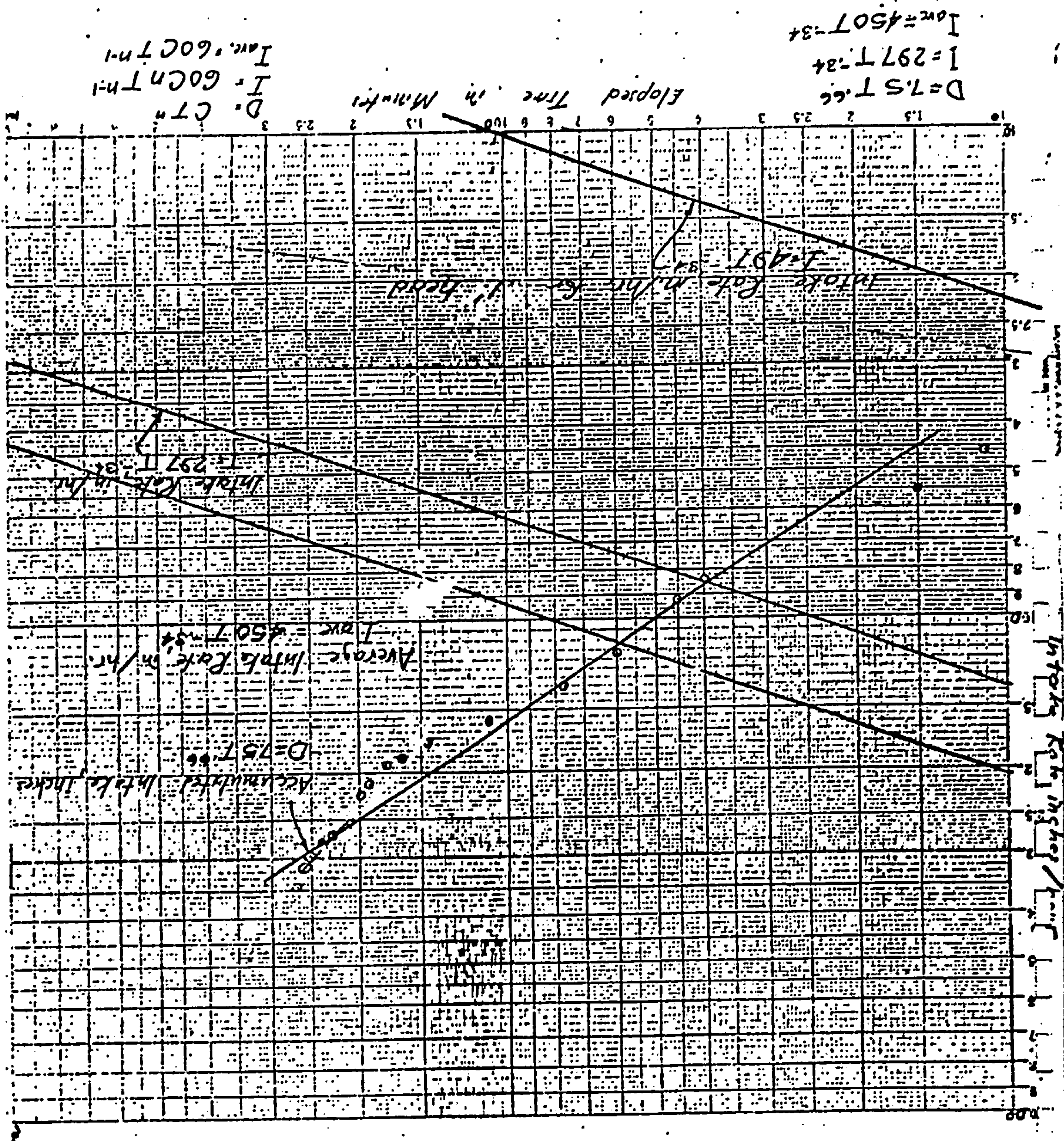
D-CT_n = 34 T^{0.4}

I = 60 C_n Tⁿ⁻¹ / 171 T^{-1.6}

I_{ave} = 60 C_n Tⁿ⁻¹ / 204 T^{-1.6}

1.437 T^{1/2}

12/20/44



Westgate Hts. Unit 2
4 Oct 73 Coen

Time	d ₁	d ₂	Δd	ΣΔd	Σt	Rate
			in.	in.	min.	in/hr.
10:15	64 1/2"	22"	1"	1"	7	197
10:22	45"	20"	23"	23"	11	251
10:26	43"	18"	23"	46"	15	220
10:30	41"	16"	9"	55"	40	126
10:55	45"	12"	29"	84"	45	127
11:00	20"	9"	8"	92"	60	117
11:15	34"	9 1/2"	25"	117"	77	106
11:32	28"	8"	18 1/2"	135 1/2"	109	87
12:04	30"	30"	22"	157 1/2"	145	71
12:40	45"	10"	15"	172 1/2"	164	68
12:53	23"	9"	13"	185 1/2"	177	66
1:12	17"	9"	8"	193 1/2"	190	67
1:25	27"	11"	18"	211 1/2"	198	67
1:33	20"	0"	9"	220 1/2"	209	72
1:44	31"	0"	31"	251 1/2"	226	72
2:01	18"	7"	18"	269 1/2"	238	70
2:13	24"	0"	17"	286 1/2"	251	74
2:26	23"	0"	23"	309 1/2"	258	76
2:33	16"	0"	16"	325 1/2"	265	78
2:40	20"	0"	20"	345 1/2"		

—

[illegible]

5 Oct 73

Time	d	d _z	Δd	ΣΔd	Σt
9:15	Dry	22"			
9:20		0"			
9:23	24"	0"			
9:27		12"			
9:29	17"	12"	5	5	2
9:43	23	7	11	16	16
9:46	19	4	12	28	19
9:51	20	0	16	44	24
10:01	21	0	21	65	34
10:18	22	0	22	87	46
10:32	23	8	23	110	65
11:05	27	0	19	129	98
11:32	24	8	24	153	125
11:37	16	0	8	161	130
11:55	19	7	19	180	148
12:14	19	4	12	192	167
12:40	20	0	16	208	193
1:00	24	0	24	232	213
1:14	24	8	24	256	227
1:19	19	0	11	267	232
1:36	24	0	24	291	249
1:50	24	0	24	315	263
2:05	24	10	24	339	278
2:08	17	0	7	346	281
2:23	24	0	24	370	296
2:40	24	0	24	394	313
2:57	24	7	24	418	330
3:12	21	0	17	435	345
3:29	24	0	24	459	362
3:47	24	16	24	483	380
3:51	19	0	3	486	384
4:09	21	0	24	510	402
4:20	18		18	528	413

BIBLIOGRAPHY OF REFERENCES

- (1) Herkenhoff, Gordon & Associates, "Master Plan of Drainage City of Albuquerque, New Mexico and Environs, 1963". Albuquerque; Gordon Herkenhoff & Associates, Consulting Engineers.
- (2) Wright-McLaughlin Engineers, "Urban Storm Drainage Criteria Manual, Volume 1", Denver, Colorado: Wright-McLaughlin Engineers, 1969.
- (3) National Oceanic and Atmospheric Administration, "NOAA Atlas 2, Volume IV", U.S. Department of Commerce, Washington, D.C., U.S. Government Printing Office, 1976.
- (4) William Matotan & Associates, Inc., Engineers, "Drainage Management Plan, Western Albuquerque Metropolitan Area, Volume I & II", Albuquerque: William I, Matotan & Associates, Inc., Engineers, June 1975.
- (5) Campbell-Hicks and Associates, Inc., "Storm Drainage Study Relative to the Development of Westgate Heights, Unit 2, Albuquerque, New Mexico", Albuquerque: Donald L. Campbell N.M.P.E. & L.S. #3633, March 1972

INSTRUCTIONS FOR DRAINAGE STUDY REVISIONS

WESTGATE HEIGHTS, UNIT 2

1. Page 1, Drainage Study Index: Change title of Exhibit "F" to "STREETS AND MAXIMUM RUNOFFS".
2. Page 4, V. CONCLUSIONS AND RECOMMENDATIONS: Delete recommendation "8" and replace it with recommendation "8. Design streets to carry maximum runoffs contained in Exhibit 'F' through use of tables in Exhibit 'E'".
3. Pages 18 and 19, Exhibit "E": Delete " $n(\text{composite})=.006$ " and table "R/W TO R/W - OVERFLOW SECTIONS CAPACITIES". Do not delete "15' Lined Channel".
4. Replace pages 24, 25, 26 and 27 with revised pages 24A-24D, 25A-25D, 26A-26D, and 27A-27D.
5. Replace page 29 with revised page 29 entitled "STREETS AND MAXIMUM RUNOFFS".

REVISED MAY 1972

50' R.O.W.									
32' FACE-FACE		8" CURB		2" CROWN		.2' OVERFLOW			
N	.0165	SI/2	R	R2/3	V	Q			
A	15.3611	.0707	.2990	.4472	2.8545	43.8477			
P	51.3731	.0050	.2990	.4472	2.8545	43.8477			
S	51.3731	.0707	.2990	.4472	2.8545	43.8477			
	.0050	.0707	.2990	.4472	2.8545	43.8477			
	.0100	1.000	.2990	.4472	4.20368	62.0100			
	51.3731	.0150	.2990	.4472	4.9441	75.9464			
	51.3731	.1225	.2990	.4472	5.7089	87.6954			
	51.3731	.1414	.2990	.4472	6.3828	98.0464			
	51.3731	.1581	.2990	.4472	6.9920	107.4045			
	51.3731	.1732	.2990	.4472	7.5522	116.0101			
	51.3731	.1871	.2990	.4472	8.0736	124.0200			
	.0400	.2000	.2990	.4472					
	.0350	.1871	.2990	.4472					
	.0300	.1732	.2990	.4472					
	.0250	.1581	.2990	.4472					
	.0200	.1414	.2990	.4472					
	.0150	.1225	.2990	.4472					
	.0100	1.000	.2990	.4472					
	51.3731	.0707	.2990	.4472					
	51.3731	.0050	.2990	.4472					
	51.3569	.0100	.3683	.5138	3.2801	62.0482			
	51.3569	.0150	.3683	.5138	4.6387	87.7494			
	51.3569	.1225	.3683	.5138	5.6813	107.4706			
	51.3569	.1414	.3683	.5138	6.5602	124.0964			
	51.3569	.1581	.3683	.5138	7.3345	138.7439			
	51.3569	.1732	.3683	.5138	8.0345	151.9864			
	51.3569	.1871	.3683	.5138	8.6783	164.1640			
	51.3569	.2000	.3683	.5138	9.2775	175.4988			
	.0400	.2000	.3683	.5138					
	.0350	.1871	.3683	.5138					
	.0300	.1732	.3683	.5138					
	.0250	.1581	.3683	.5138					
	.0200	.1414	.3683	.5138					
	.0150	.1225	.3683	.5138					
	.0100	1.000	.3683	.5138					
	51.3569	.0707	.3683	.5138					
	51.3569	.0050	.3683	.5138					
	18.9167	.0050	.3683	.5138					
	18.9167	.0100	.3683	.5138					
	18.9167	.0150	.3683	.5138					
	18.9167	.1225	.3683	.5138					
	18.9167	.1414	.3683	.5138					
	18.9167	.1581	.3683	.5138					
	18.9167	.1732	.3683	.5138					
	18.9167	.1871	.3683	.5138					
	18.9167	.2000	.3683	.5138					

24 B

50' R.O.W.	32' FACE-FACE	8" CURB	2" CROWN	4' OVERFLOW
N .0165	A 35.0278	S .0050	R2/3 .7748	V 4.9454
.0165	51.3557	.0100	.6821	6.9939
.0165	51.3557	.0150	.6821	8.5657
.0165	51.3557	.0200	.7748	9.8908
.0165	51.3557	.0250	.7748	11.0583
.0165	51.3557	.0300	.7748	12.1137
.0165	51.3557	.0350	.7748	13.0843
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.0165	51.3557	.0500	.7748	15.80.9590
.0165	51.3557	.0550	.7748	16.71.9590
.0165	51.3557	.0600	.7748	17.62.9590
.0165	51.3557	.0650	.7748	18.53.9590
.0165	51.3557	.0700	.7748	19.44.9590
.0165	51.3557	.0750	.7748	20.35.9590
.0165	51.3557	.0800	.7748	21.26.9590
.0165	51.3557	.0850	.7748	22.17.9590
.0165	51.3557	.0900	.7748	23.08.9590
.0165	51.3557	.0950	.7748	23.99.9590
.0165	51.3557	.1000	.7748	24.90.9590
.0165	51.3557	.1050	.7748	25.81.9590
.0165	51.3557	.1100	.7748	26.72.9590
.0165	51.3557	.1150	.7748	27.63.9590
.0165	51.3557	.1200	.7748	28.54.9590
.0165	51.3557	.1250	.7748	29.45.9590
.0165	51.3557	.1300	.7748	30.36.9590
.0165	51.3557	.1350	.7748	31.27.9590
.0165	51.3557	.1400	.7748	32.18.9590
.0165	51.3557	.1450	.7748	33.09.9590
.0165	51.3557	.1500	.7748	34.00.9590
.0165	51.3557	.1550	.7748	34.91.9590
.0165	51.3557	.1600	.7748	35.82.9590
.0165	51.3557	.1650	.7748	36.73.9590
.0165	51.3557	.1700	.7748	37.64.9590
.0165	51.3557	.1750	.7748	38.55.9590
.0165	51.3557	.1800	.7748	39.46.9590
.0165	51.3557	.1850	.7748	40.37.9590
.0165	51.3557	.1900	.7748	41.28.9590
.0165	51.3557	.1950	.7748	42.19.9590
.0165	51.3557	.2000	.7748	43.10.9590
.0165	51.3557	.2050	.7748	44.01.9590
.0165	51.3557	.2100	.7748	44.92.9590
.0165	51.3557	.2150	.7748	45.83.9590
.0165	51.3557	.2200	.7748	46.74.9590
.0165	51.3557	.2250	.7748	47.65.9590
.0165	51.3557	.2300	.7748	48.56.9590
.0165	51.3557	.2350	.7748	49.47.9590
.0165	51.3557	.2400	.7748	50.38.9590
.0165	51.3557	.2450	.7748	51.29.9590
.0165	51.3557	.2500	.7748	52.20.9590
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.0165	51.3557	.2600	.7748	54.02.9590
.0165	51.3557	.2650	.7748	54.93.9590
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.0165	51.3557	.9300	.7748	175.96.9590
.0165	51.3557	.9350	.7748	176.87.9590
.0165	51.3557	.9400	.7748	177.78.9590
.0165	51.3557	.9450	.7748	178.69.9590
.0165	51.3557	.9500	.7748	179.60.9590
.0165	51.3557	.9550	.7748	180.51.9590
.0165	51.3557	.9600	.7748	181.42.9590
.0165	51.3557	.9650	.7748	182.33.9590
.0165	51.3557	.9700	.7748	183.24.9590
.0165	51.3557	.9750	.7748	184.15.9590
.0165	51.3557	.9800	.7748	185.06.9590
.0165	51.3557	.9850	.7748	185.97.9590
.0165	51.3557	.9900	.7748	186.88.9590
.0165	51.3557	.9950	.7748	187.79.9590
.0165	51.3557	1.0000	.7748	188.70.9590
.0165	51.3557	1.0050	.7748	189.61.9590
.0165	51.3557	1.0100	.7748	190.52.9590
.0165	51.3557	1.0150	.7748	191.43.9590
.0165	51.3557	1.0200	.7748	192.34.9590
.0165	51.3557	1.0250	.7748	193.25.9590
.0165	51.3557	1.0300	.7748	194.16.9590
.0165	51.3557	1.0350	.7748	195.07.9590
.0165	51.3557	1.0400	.7748	195.98.9590
.0165	51.3557	1.0450	.7748	196.89.9590
.0165	51.3557	1.0500		

50' R.O.W.									
N	A	P	S	SI/2	R	R2/3	6" CROWN	6" OVERFLOW	Q
.0165	44.0278	51.3889	.0050	.0707	.8568	.9021	5.7560	253.4243	Q
.0165	44.0278	51.3889	.0100	.1000	.8568	.9021	8.1402	358.3961	
.0165	44.0278	51.3889	.0150	.1225	.8568	.9021	9.9697	438.9438	
.0165	44.0278	51.3889	.0200	.1414	.8568	.9021	11.5120	506.8487	
.0165	44.0278	51.3889	.0250	.1581	.8568	.9021	12.8708	566.6741	
.0165	44.0278	51.3889	.0300	.1732	.8568	.9021	14.0993	620.7603	
.0165	44.0278	51.3889	.0350	.1871	.8568	.9021	15.2290	670.4978	
.0165	44.0278	51.3889	.0400	.2000	.8568	.9021	16.2805	716.7923	
N	A	P	S	SI/2	R	R2/3	6" CROWN	6" OVERFLOW	Q
.0165	40.4722	51.3958	.0050	.0707	.7875	.8527	5.4414	220.2241	Q
.0165	40.4722	51.3958	.0100	.1000	.7875	.8527	7.6953	311.4440	
.0165	40.4722	51.3958	.0150	.1225	.7875	.8527	9.4247	381.4394	
.0165	40.4722	51.3958	.0200	.1414	.7875	.8527	10.8827	440.4483	
.0165	40.4722	51.3958	.0250	.1581	.7875	.8527	12.1673	492.4362	
.0165	40.4722	51.3958	.0300	.1732	.7875	.8527	13.3286	539.4368	
.0165	40.4722	51.3958	.0350	.1871	.7875	.8527	14.3965	582.6583	
.0165	40.4722	51.3958	.0400	.2000	.7875	.8527	15.3905	622.8879	
N	A	P	S	SI/2	R	R2/3	6" CROWN	6" OVERFLOW	Q
.0165	36.9167	51.4074	.0050	.0707	.7181	.8019	5.1172	188.9082	Q
.0165	36.9167	51.4074	.0100	.1000	.7181	.8019	7.2367	267.1566	
.0165	36.9167	51.4074	.0150	.1225	.7181	.8019	8.8632	327.1987	
.0165	36.9167	51.4074	.0200	.1414	.7181	.8019	10.2343	377.8165	
.0165	36.9167	51.4074	.0250	.1581	.7181	.8019	11.4423	422.4116	
.0165	36.9167	51.4074	.0300	.1732	.7181	.8019	12.5344	462.7288	
.0165	36.9167	51.4074	.0350	.1871	.7181	.8019	13.5387	499.8042	
.0165	36.9167	51.4074	.0400	.2000	.7181	.8019	14.4735	534.3132	
N	A	P	S	SI/2	R	R2/3	6" CROWN	6" OVERFLOW	Q
.0165	33.3611	51.4236	.0050	.0707	.6488	.7494	4.7822	159.5397	Q
.0165	33.3611	51.4236	.0100	.1000	.6488	.7494	6.7631	225.6231	
.0165	33.3611	51.4236	.0150	.1225	.6488	.7494	8.2830	276.3308	
.0165	33.3611	51.4236	.0200	.1414	.6488	.7494	9.5644	319.0793	
.0165	33.3611	51.4236	.0250	.1581	.6488	.7494	10.6933	356.7415	
.0165	33.3611	51.4236	.0300	.1732	.6488	.7494	11.7140	390.7908	
.0165	33.3611	51.4236	.0350	.1871	.6488	.7494	12.6525	422.1023	
.0165	33.3611	51.4236	.0400	.2000	.6488	.7494	13.5261	451.2463	
N	A	P	S	SI/2	R	R2/3	6		

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50' R.O.W.	32' FACE-FACE	8" CURB	2" CROWN	.7' OVERFLOW
N .0165	P 51.4114	S .0050	R .9439	V 6.1390
.0165	48.5278	.0100	.9622	8.6819
.0165	48.5278	.0150	.9622	421.3143
.0165	51.4114	.0200	.9622	516.0025
.0165	51.4114	.0250	.9622	595.8284
.0165	51.4114	.0300	.9622	666.1564
.0165	51.4114	.0350	.9622	729.7377
.0165	51.4114	.0400	.9622	788.2068
.0165	51.4114	.0450	.9622	842.6286
A 48.5278			R2/3 .9622	Q 297.9142
N .0165	P 51.4184	S .0050	R .8746	V 5.8349
.0165	44.9722	.0100	.9146	8.2518
.0165	44.9722	.0150	.9146	371.1039
.0165	51.4184	.0200	.9146	262.4101
.0165	51.4184	.0250	.9146	454.5076
.0165	51.4184	.0300	.9146	524.8202
.0165	51.4184	.0350	.9146	586.7668
.0165	51.4184	.0400	.9146	642.7709
.0165	51.4184	.0450	.9146	694.2719
.0165	51.4184	.0500	.9146	742.2079
A 44.9722			R2/3 .9146	Q 742.2079
N .0165	P 51.4167	S .0050	R .8053	V 5.5225
.0165	41.4167	.0100	.8656	7.8100
.0165	41.4167	.0150	.8656	323.4624
.0165	51.4299	.0200	.8656	228.7225
.0165	51.4299	.0250	.8656	457.4449
.0165	51.4299	.0300	.8656	511.4390
.0165	51.4299	.0350	.8656	560.2533
.0165	51.4299	.0400	.8656	605.1428
.0165	51.4299	.0450	.8656	646.9248
A 41.4167			R2/3 .8656	Q 228.7225
N .0165	P 51.4461	S .0050	R .7359	V 5.2008
.0165	37.8611	.0100	.8151	7.3550
.0165	37.8611	.0150	.8151	278.4680
.0165	51.4461	.0200	.8151	341.0523
.0165	51.4461	.0250	.8151	393.8132
.0165	51.4461	.0300	.8151	440.2966
.0165	51.4461	.0350	.8151	482.3207
.0165	51.4461	.0400	.8151	520.9659
.0165	51.4461	.0450	.8151	556.9360
A 37.8611			R2/3 .8151	Q 196.9066

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N	.0165	32.1889	61.3375	.0050	.0707	.5248	R2/3	.6506	4.1514	133.6289
A	.0165	32.1889	61.3375	.0100	.1000	.5248	R	.6506	5.8710	188.9798
P	.0165	32.1889	61.3375	.0150	.1225	.5248	S1/2	.6506	7.1904	231.4521
S	.0165	32.1889	61.3375	.0200	.1414	.5248	8" CURB	.6506	8.3028	267.2578
40" FACE-FACE	.0165	32.1889	61.3375	.0250	.1581	.5248	2" CROWN	.6506	9.2828	298.8033
60" R.O.W.	.0165	32.1889	61.3375	.0300	.1732	.5248	.2' OVERFLOW	.6506	10.1688	327.3227
	.0165	32.1889	61.3375	.0350	.1871	.5248		.6506	10.9836	353.5489
	.0165	32.1889	61.3375	.0400	.2000	.5248		.6506	11.7414	377.9596

N	.0165	27.7444	61.3430	.0050	.0707	.4523	R2/3	.5892	3.7597	104.3104
A	.0165	27.7444	61.3430	.0100	.1000	.4523	R	.5892	5.3170	147.5172
P	.0165	27.7444	61.3430	.0150	.1225	.4523	S1/2	.5892	6.5120	180.6710
S	.0165	27.7444	61.3430	.0200	.1414	.4523	8" CURB	.5892	7.5194	208.6209
40" FACE-FACE	.0165	27.7444	61.3430	.0250	.1581	.4523	4" CROWN	.5892	8.4069	233.2452
60" R.O.W.	.0165	27.7444	61.3430	.0300	.1732	.4523	.2' OVERFLOW	.5892	9.2093	255.5074
	.0165	27.7444	61.3430	.0350	.1871	.4523		.5892	9.9472	275.9795
	.0165	27.7444	61.3430	.0400	.2000	.4523		.5892	10.6340	295.0345

N	.0165	23.3000	61.3523	.0050	.0707	.3798	R2/3	.5244	3.3663	77.9692
A	.0165	23.3000	61.3523	.0100	.1000	.3798	R	.5244	4.7324	110.2651
P	.0165	23.3000	61.3523	.0150	.1225	.3798	S1/2	.5244	5.7960	135.0466
S	.0165	23.3000	61.3523	.0200	.1414	.3798	8" CURB	.5244	6.6926	155.9384
40" FACE-FACE	.0165	23.3000	61.3523	.0250	.1581	.3798	6" CROWN	.5244	7.4826	174.3444
60" R.O.W.	.0165	23.3000	61.3523	.0300	.1732	.3798	.2' OVERFLOW	.5244	8.1968	190.9848
	.0165	23.3000	61.3523	.0350	.1871	.3798		.5244	8.8535	206.2871
	.0165	23.3000	61.3523	.0400	.2000	.3798		.5244	9.4648	220.5302

N	.0165	18.8556	61.3652	.0050	.0707	.3073	R2/3	.4553	2.9056	54.7868
A	.0165	18.8556	61.3652	.0100	.1000	.3073	R	.4553	4.1091	77.4802
P	.0165	18.8556	61.3652	.0150	.1225	.3073	S1/2	.4553	5.0327	94.8935
S	.0165	18.8556	61.3652	.0200	.1414	.3073	8" CURB	.4553	5.8112	109.5736
40" FACE-FACE	.0165	18.8556	61.3652	.0250	.1581	.3073	6" CROWN	.4553	6.4971	122.5070
60" R.O.W.	.0165	18.8556	61.3652	.0300	.1732	.3073	.2' OVERFLOW	.4553	7.1172	134.1997
	.0165	18.8556	61.3652	.0350	.1871	.3073		.4553	7.6875	144.9522
	.0165	18.8556	61.3652	.0400	.2000	.3073		.4553	8.2183	154.9604

60' R.O.W.	40' FACE-FACE	8" CURB	2" CROWN	.4' OVERFLOW
N	A	S1/2	R2/3	V
.0165	61.3519	.0050	.7007	216.2774
.0165	61.3519	.0100	.7007	306.0039
.0165	61.3519	.0150	.7007	374.7767
.0165	61.3519	.0200	.7007	432.7549
.0165	61.3519	.0250	.7007	483.8346
.0165	61.3519	.0300	.7007	530.0143
.0165	61.3519	.0350	.7007	572.4809
.0165	61.3519	.0400	.7007	612.0078
A	P	S	R2/3	V
42.9889	61.3519	.0050	.7889	5.0333
42.9889	61.3519	.0100	.7889	7.1182
42.9889	61.3519	.0150	.7889	8.7180
42.9889	61.3519	.0200	.7889	10.0667
42.9889	61.3519	.0250	.7889	11.2549
42.9889	61.3519	.0300	.7889	12.3291
42.9889	61.3519	.0350	.7889	13.3169
42.9889	61.3519	.0400	.7889	14.2364

60' R.O.W.	40' FACE-FACE	8" CURB	4" CROWN	.4' OVERFLOW
N	A	S1/2	R2/3	V
.0165	61.3574	.0050	.6282	180.3842
.0165	61.3574	.0100	.6282	255.1018
.0165	61.3574	.0150	.6282	312.4346
.0165	61.3574	.0200	.6282	360.7684
.0165	61.3574	.0250	.6282	403.3514
.0165	61.3574	.0300	.6282	441.8493
.0165	61.3574	.0350	.6282	477.2518
.0165	61.3574	.0400	.6282	510.2036
A	P	S	R2/3	V
38.5444	61.3574	.0050	.7335	4.6799
38.5444	61.3574	.0100	.7335	6.6184
38.5444	61.3574	.0150	.7335	8.1058
38.5444	61.3574	.0200	.7335	9.3598
38.5444	61.3574	.0250	.7335	10.4646
38.5444	61.3574	.0300	.7335	11.4634
38.5444	61.3574	.0350	.7335	12.3819
38.5444	61.3574	.0400	.7335	13.2368

60' R.O.W.	40' FACE-FACE	8" CURB	6" CROWN	.4' OVERFLOW
N	A	S1/2	R2/3	V
.0165	61.3667	.0050	.5557	147.0556
.0165	61.3667	.0100	.5557	207.9681
.0165	61.3667	.0150	.5557	254.7078
.0165	61.3667	.0200	.5557	294.1113
.0165	61.3667	.0250	.5557	328.8264
.0165	61.3667	.0300	.5557	360.2113
.0165	61.3667	.0350	.5557	389.0727
.0165	61.3667	.0400	.5557	415.9362
A	P	S	R2/3	V
34.1000	61.3667	.0050	.6759	4.3125
34.1000	61.3667	.0100	.6759	6.0988
34.1000	61.3667	.0150	.6759	7.4694
34.1000	61.3667	.0200	.6759	8.6250
34.1000	61.3667	.0250	.6759	9.6430
34.1000	61.3667	.0300	.6759	10.5634
34.1000	61.3667	.0350	.6759	11.4098
34.1000	61.3667	.0400	.6759	12.1975

60' R.O.W.	40' FACE-FACE	8" CURB	8" CROWN	.4' OVERFLOW
N	A	S1/2	R	V
.0165	61.3796	.0050	.4831	3.9286
.0165	61.3796	.0100	.4831	5.5559
.0165	61.3796	.0150	.4831	6.8046
.0165	61.3796	.0200	.4831	7.8573
.0165	61.3796	.0250	.4831	8.7847
.0165	61.3796	.0300	.4831	9.6232
.0165	61.3796	.0350	.4831	10.3942
.0165	61.3796	.0400	.4831	11.1119
A	P	S	R2/3	V
29.6556	61.3796	.0050	.6157	3.9286
29.6556	61.3796	.0100	.6157	5.5559
29.6556	61.3796	.0150	.6157	6.8046
29.6556	61.3796	.0200	.6157	7.8573
29.6556	61.3796	.0250	.6157	8.7847
29.6556	61.3796	.0300	.6157	9.6232
29.6556	61.3796	.0350	.6157	10.3942
29.6556	61.3796	.0400	.6157	11.1119

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60' R.O.W.									
N	A	P	S	S1/2	R	R2/3	V	Q	.6' OVERFLOW
.0165	53.7889	61.3796	.0050	.0707	.8763	.9158	5.8418	314.2221	
.0165	53.7889	61.3796	.0100	.1000	.8763	.9158	8.2615	444.3771	
.0165	53.7889	61.3796	.0150	.1225	.8763	.9158	10.1182	544.2486	
.0165	53.7889	61.3796	.0200	.1414	.8763	.9158	11.6835	628.4442	
.0165	53.7889	61.3796	.0250	.1581	.8763	.9158	13.0626	702.6219	
.0165	53.7889	61.3796	.0300	.1732	.8763	.9158	14.3093	769.6838	
.0165	53.7889	61.3796	.0350	.1871	.8763	.9158	15.4559	831.3535	
.0165	53.7889	61.3796	.0400	.2000	.8763	.9158	16.5230	888.7542	
60' R.O.W.									
N	A	P	S	S1/2	R	R2/3	V	Q	.6' OVERFLOW
.0165	49.3444	61.3851	.0050	.0707	.8038	.8645	5.5151	272.1386	
.0165	49.3444	61.3851	.0100	.1000	.8038	.8645	7.7995	384.8621	
.0165	49.3444	61.3851	.0150	.1225	.8038	.8645	9.5524	471.3579	
.0165	49.3444	61.3851	.0200	.1414	.8038	.8645	11.0302	544.2772	
.0165	49.3444	61.3851	.0250	.1581	.8038	.8645	12.3321	608.5204	
.0165	49.3444	61.3851	.0300	.1732	.8038	.8645	13.5091	666.6007	
.0165	49.3444	61.3851	.0350	.1871	.8038	.8645	14.5915	720.0111	
.0165	49.3444	61.3851	.0400	.2000	.8038	.8645	15.5990	769.7242	
60' R.O.W.									
N	A	P	S	S1/2	R	R2/3	V	Q	.6' OVERFLOW
.0165	44.9000	61.3944	.0050	.0707	.7313	.8117	5.1783	232.5051	
.0165	44.9000	61.3944	.0100	.1000	.7313	.8117	7.3232	328.8119	
.0165	44.9000	61.3944	.0150	.1225	.7313	.8117	8.9691	402.7107	
.0165	44.9000	61.3944	.0200	.1414	.7313	.8117	10.3566	465.0102	
.0165	44.9000	61.3944	.0250	.1581	.7313	.8117	11.5790	519.8972	
.0165	44.9000	61.3944	.0300	.1732	.7313	.8117	12.6842	569.5189	
.0165	44.9000	61.3944	.0350	.1871	.7313	.8117	13.7005	615.1507	
.0165	44.9000	61.3944	.0400	.2000	.7313	.8117	14.6464	657.6237	
60' R.O.W.									
N	A	P	S	S1/2	R	R2/3	V	Q	.6' OVERFLOW
.0165	40.4536	61.4074	.0050	.0707	.6588	.7571	4.8301	195.4036	
.0165	40.4536	61.4074	.0100	.1000	.6588	.7571	6.8308	276.3425	
.0165	40.4536	61.4074	.0150	.1225	.6588	.7571	8.3659	338.4490	
.0165	40.4536	61.4074	.0200	.1414	.6588	.7571	9.6602	390.8073	
.0165	40.4536	61.4074	.0250	.1581	.6588	.7571	10.8004	436.9358	
.0165	40.4536	61.4074	.0300	.1732	.6588	.7571	11.8312	478.6392	
.0165	40.4536	61.4074	.0350	.1871	.6588	.7571	12.7792	516.9894	
.0165	40.4536	61.4074	.0400	.2000	.6588	.7571	13.6615	552.6850	
60' R.O.W.									
N	A	P	S	S1/2	R	R2/3	V	Q	.6' OVERFLOW
.0165	40.4536	61.4074	.0050	.0707	.6588	.7571	4.8301	195.4036	
.0165	40.4536	61.4074	.0100	.1000	.6588	.7571	6.8308	276.3425	
.0165	40.4536	61.4074	.0150	.1225	.6588	.7571	8.3659	338.4490	
.0165	40.4536	61.4074	.0200	.1414	.6588	.7571	9.6602	390.8073	
.0165	40.4536	61.4074	.0250	.1581	.6588	.7571	10.8004	436.9358	
.0165	40.4536	61.4074	.0300	.1732	.6588	.7571	11.8312	478.6392	
.0165	40.4536	61.4074	.0350	.1871	.6588	.7571	12.7792	516.9894	
.0165	40.4536	61.4074	.0400	.2000	.6588	.7571	13.6615	552.6850	

60' R.O.W.	40' FACE-FACE	8" CURB	8" CROWN	.8' OVERFLOW				
N	A	P	S	S1/2	R	R2/3	V	Q
.0165	51.2556	61.4482	.0050	.0707	.8341	.8861	5.6515	289.6713
.0165	51.2556	61.4482	.0100	.1000	.8341	.8861	7.9924	409.771
.0165	51.2556	61.4482	.0150	.1225	.8341	.8861	9.7887	501.7254
.0165	51.2556	61.4482	.0200	.1414	.8341	.8861	11.3030	579.3426
.0165	51.2556	61.4482	.0250	.1581	.8341	.8861	12.6372	647.7247
.0165	51.2556	61.4482	.0300	.1732	.8341	.8861	13.8433	709.5469
.0165	51.2556	61.4482	.0350	.1871	.8341	.8861	14.9525	766.3982
.0165	51.2556	61.4482	.0400	.2000	.8341	.8861	15.9849	819.3141

60' R.O.W.	40' FACE-FACE	8" CURB	6" CROWN	.8' OVERFLOW				
N	A	P	S	S1/2	R	R2/3	V	Q
.0165	55.7000	61.4353	.0050	.0707	.9066	.9368	5.9744	332.7735
.0165	55.7000	61.4353	.0100	.1000	.9066	.9368	8.4491	470.6128
.0165	55.7000	61.4353	.0150	.1225	.9066	.9368	10.3479	576.3806
.0165	55.7000	61.4353	.0200	.1414	.9066	.9368	11.9488	665.5469
.0165	55.7000	61.4353	.0250	.1581	.9066	.9368	13.3591	744.1041
.0165	55.7000	61.4353	.0300	.1732	.9066	.9368	14.6342	815.1252
.0165	55.7000	61.4353	.0350	.1871	.9066	.9368	15.8067	880.4358
.0165	55.7000	61.4353	.0400	.2000	.9066	.9368	16.8981	941.2255

60' R.O.W.	40' FACE-FACE	8" CURB	4" CROWN	.8' OVERFLOW				
N	A	P	S	S1/2	R	R2/3	V	Q
.0165	60.1444	61.4260	.0050	.0707	.9791	.9860	6.2887	378.2280
.0165	60.1444	61.4260	.0100	.1000	.9791	.9860	8.8935	534.8951
.0165	60.1444	61.4260	.0150	.1225	.9791	.9860	10.8923	655.1101
.0165	60.1444	61.4260	.0200	.1414	.9791	.9860	12.5773	756.4560
.0165	60.1444	61.4260	.0250	.1581	.9791	.9860	14.0619	845.7435
.0165	60.1444	61.4260	.0300	.1732	.9791	.9860	15.4040	926.4656
.0165	60.1444	61.4260	.0350	.1871	.9791	.9860	16.6382	1000.6972
.0165	60.1444	61.4260	.0400	.2000	.9791	.9860	17.7870	1069.7903

60' R.O.W.	40' FACE-FACE	8" CURB	2" CROWN	.8' OVERFLOW				
N	A	P	S	S1/2	R	R2/3	V	Q
.0165	64.5889	61.4205	.0050	.0707	1.0516	1.0341	6.5951	425.9711
.0165	64.5889	61.4205	.0100	.1000	1.0516	1.0341	9.3269	602.4141
.0165	64.5889	61.4205	.0150	.1225	1.0516	1.0341	11.4231	737.8036
.0165	64.5889	61.4205	.0200	.1414	1.0516	1.0341	13.1902	851.9422
.0165	64.5889	61.4205	.0250	.1581	1.0516	1.0341	14.7471	952.5004
.0165	64.5889	61.4205	.0300	.1732	1.0516	1.0341	16.1547	1043.4119
.0165	64.5889	61.4205	.0350	.1871	1.0516	1.0341	17.4490	1127.0136
.0165	64.5889	61.4205	.0400	.2000	1.0516	1.0341	18.6538	1204.8282

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.0160	N	60' R.O.W.	44' FACE-FACE	8" CURB	2" CROWN	.4' OVERFLOW
.0160	A	46.1778	61.3600	.0050	.0707	5.4400
.0160	P	46.1778	61.3600	.0100	.8274	7.6934
.0160	S	46.1778	61.3600	.0150	.8274	9.4224
.0160	R	46.1778	61.3600	.1225	.8274	10.8801
.0160	S1/2	46.1778	61.3600	.1414	.8274	12.1643
.0160	R	46.1778	61.3600	.1581	.8274	13.3253
.0160	S	46.1778	61.3600	.1732	.8274	14.3930
.0160	R	46.1778	61.3600	.1871	.8274	15.3867
.0160	S	46.1778	61.3600	.2000	.8274	16.347
.0160	R	46.1778	61.3600	.2132	.8274	17.288
.0160	S	46.1778	61.3600	.225	.8274	18.2083
.0160	R	46.1778	61.3600	.2376	.8274	19.1055
.0160	S	46.1778	61.3600	.2500	.8274	20.000
.0160	R	46.1778	61.3600	.2626	.8274	20.8801
.0160	S	46.1778	61.3600	.2752	.8274	21.7188
.0160	R	46.1778	61.3600	.2878	.8274	22.5244
.0160	S	46.1778	61.3600	.3000	.8274	23.3930
.0160	R	46.1778	61.3600	.3126	.8274	24.2799
.0160	S	46.1778	61.3600	.3252	.8274	25.188
.0160	R	46.1778	61.3600	.3378	.8274	26.1055
.0160	S	46.1778	61.3600	.3500	.8274	27.000
.0160	R	46.1778	61.3600	.3626	.8274	27.8801
.0160	S	46.1778	61.3600	.3752	.8274	28.7188
.0160	R	46.1778	61.3600	.3878	.8274	29.5244
.0160	S	46.1778	61.3600	.4000	.8274	30.3930
.0160	R	46.1778	61.3600	.4126	.8274	31.2799
.0160	S	46.1778	61.3600	.4252	.8274	32.188
.0160	R	46.1778	61.3600	.4378	.8274	33.1055
.0160	S	46.1778	61.3600	.4500	.8274	34.000
.0160	R	46.1778	61.3600	.4626	.8274	34.8801
.0160	S	46.1778	61.3600	.4752	.8274	35.7188
.0160	R	46.1778	61.3600	.4878	.8274	36.5244
.0160	S	46.1778	61.3600	.5000	.8274	37.3930
.0160	R	46.1778	61.3600	.5126	.8274	38.2799
.0160	S	46.1778	61.3600	.5252	.8274	39.188
.0160	R	46.1778	61.3600	.5378	.8274	40.1055
.0160	S	46.1778	61.3600	.5500	.8274	41.000
.0160	R	46.1778	61.3600	.5626	.8274	41.8801
.0160	S	46.1778	61.3600	.5752	.8274	42.7188
.0160	R	46.1778	61.3600	.5878	.8274	43.5244
.0160	S	46.1778	61.3600	.6000	.8274	44.3930
.0160	R	46.1778	61.3600	.6126	.8274	45.2799
.0160	S	46.1778	61.3600	.6252	.8274	46.188
.0160	R	46.1778	61.3600	.6378	.8274	47.1055
.0160	S	46.1778	61.3600	.6500	.8274	48.000
.0160	R	46.1778	61.3600	.6626	.8274	48.8801
.0160	S	46.1778	61.3600	.6752	.8274	49.7188
.0160	R	46.1778	61.3600	.6878	.8274	50.5244
.0160	S	46.1778	61.3600	.7000	.8274	51.3930
.0160	R	46.1778	61.3600	.7126	.8274	52.2799
.0160	S	46.1778	61.3600	.7252	.8274	53.188
.0160	R	46.1778	61.3600	.7378	.8274	54.1055
.0160	S	46.1778	61.3600	.7500	.8274	55.000
.0160	R	46.1778	61.3600	.7626	.8274	55.8801
.0160	S	46.1778	61.3600	.7752	.8274	56.7188
.0160	R	46.1778	61.3600	.7878	.8274	57.5244
.0160	S	46.1778	61.3600	.8000	.8274	58.3930
.0160	R	46.1778	61.3600	.8126	.8274	59.2799
.0160	S	46.1778	61.3600	.8252	.8274	60.188
.0160	R	46.1778	61.3600	.8378	.8274	61.1055
.0160	S	46.1778	61.3600	.8500	.8274	62.000
.0160	R	46.1778	61.3600	.8626	.8274	62.8801
.0160	S	46.1778	61.3600	.8752	.8274	63.7188
.0160	R	46.1778	61.3600	.8878	.8274	64.5244
.0160	S	46.1778	61.3600	.9000	.8274	65.3930
.0160	R	46.1778	61.3600	.9126	.8274	66.2799
.0160	S	46.1778	61.3600	.9252	.8274	67.188
.0160	R	46.1778	61.3600	.9378	.8274	68.1055
.0160	S	46.1778	61.3600	.9500	.8274	69.000
.0160	R	46.1778	61.3600	.9626	.8274	69.8801
.0160	S	46.1778	61.3600	.9752	.8274	70.7188
.0160	R	46.1778	61.3600	.9878	.8274	71.5244
.0160	S	46.1778	61.3600	1.0000	.8274	72.3930
.0160	R	46.1778	61.3600	1.0126	.8274	73.2799
.0160	S	46.1778	61.3600	1.0252	.8274	74.188
.0160	R	46.1778	61.3600	1.0378	.8274	75.1055
.0160	S	46.1778	61.3600	1.0500	.8274	76.000
.0160	R	46.1778	61.3600	1.0626	.8274	76.8801
.0160	S	46.1778	61.3600	1.0752	.8274	77.7188
.0160	R	46.1778	61.3600	1.0878	.8274	78.5244
.0160	S	46.1778	61.3600	1.1000	.8274	79.3930
.0160	R	46.1778	61.3600	1.1126	.8274	80.2799
.0160	S	46.1778	61.3600	1.1252	.8274	81.188
.0160	R	46.1778	61.3600	1.1378	.8274	82.1055
.0160	S	46.1778	61.3600	1.1500	.8274	83.000
.0160	R	46.1778	61.3600	1.1626	.8274	83.8801
.0160	S	46.1778	61.3600	1.1752	.8274	84.7188
.0160	R	46.1778	61.3600	1.1878	.8274	85.5244
.0160	S	46.1778	61.3600	1.2000	.8274	86.3930
.0160	R	46.1778	61.3600	1.2126	.8274	87.2799
.0160	S	46.1778	61.3600	1.2252	.8274	88.188
.0160	R	46.1778	61.3600	1.2378	.8274	89.1055
.0160	S	46.1778	61.3600	1.2500	.8274	90.000
.0160	R	46.1778	61.3600	1.2626	.8274	90.8801
.0160	S	46.1778	61.3600	1.2752	.8274	91.7188
.0160	R	46.1778	61.3600	1.2878	.8274	92.5244
.0160	S	46.1778	61.3600	1.3000	.8274	93.3930
.0160	R	46.1778	61.3600	1.3126	.8274	94.2799
.0160	S	46.1778	61.3600	1.3252	.8274	95.188
.0160	R	46.1778	61.3600	1.3378	.8274	96.1055
.0160	S	46.1778	61.3600	1.3500	.8274	97.000
.0160	R	46.1778	61.3600	1.3626	.8274	97.8801
.0160	S	46.1778	61.3600	1.3752	.8274	98.7188
.0160	R	46.1778	61.3600	1.3878	.8274	99.5244
.0160	S	46.1778	61.3600	1.4000	.8274	100.3930
.0160	R	46.1778	61.3600	1.4126	.8274	101.2799
.0160	S	46.1778	61.3600	1.4252	.8274	102.188
.0160	R	46.1778	61.3600	1.4378	.8274	103.1055
.0160	S	46.1778	61.3600	1.4500	.8274	104.000
.0160	R	46.1778	61.3600	1.4626	.8274	104.8801
.0160	S	46.1778	61.3600	1.4752	.8274	105.7188
.0160	R	46.1778	61.3600	1.4878	.8274	106.5244
.0160	S	46.1778	61.3600	1.5000	.8274	107.3930
.0160	R	46.1778	61.3600	1.5126	.8274	108.2799
.0160	S	46.1778	61.3600	1.5252	.8274	109.188
.0160	R	46.1778	61.3600	1.5378	.8274	110.1055
.0160	S	46.1778	61.3600	1.5500	.8274	111.000
.0160	R	46.1778	61.3600	1.5626	.8274	111.8801
.0160	S	46.1778	61.3600	1.5752	.8274	112.7188
.0160	R	46.1778	61.3600	1.5878	.8274	113.5244
.0160	S	46.1778	61.3600	1.6000	.8274	114.3930
.0160	R	46.1778	61.3600	1.6126	.8274	115.2799
.0160	S	46.1778	61.3600	1.6252	.8274	116.188
.0160	R	46.1778	61.3600	1.6378	.8274	117.1055
.0160	S	46.1778	61.3600	1.6500	.8274	118.000
.0160	R	46.1778	61.3600	1.6626	.8274	118.8801
.0160	S	46.1778	61.3600	1.6752	.8274	119.7188
.0160	R	46.1778	61.3600	1.6878	.8274	120.5244
.0160	S	46.1778	61.3600	1.7000	.8274	121.3930
.0160	R	46.1778	61.3600	1.7126	.8274	122.2799
.0160	S	46.1778	61.3600	1.7252	.8274	123.188
.0160	R	46.1778	61.3600	1.7378	.8274	124.1055
.0160	S	46.1778	61.3600	1.7500	.8274	125.000
.0160	R	46.1778	61.3600	1.7626	.8274	125.8801
.0160	S	46.1778	61.3600	1.7752	.8274	126.7188
.0160	R	46.1778	61.3600	1.7878	.8274	127.5244
.0160	S	46.1778	61.3600	1.8000	.8274	128.3930
.0160	R	46.1778	61.3600	1.8126	.8274	129.2799
.0160	S	46.1778	61.3600	1.8252	.8274	130.188
.0160	R	46.1778	61.3600	1.8378	.8274	131.1055
.0160	S	46.1778	61.3600	1.8500	.8274	132.000
.0160	R	46.1778	61.3600	1.8626	.8274	132.8801
.0160	S	46.1778	61.3600	1.8752	.8274	133.7188
.0160	R	46.1778	61.3600	1.8878	.8274	134.5244
.0160	S	46.1778	61.3600	1.9000	.8274	135.3930
.0160	R	46.1778	61.3600	1.9126	.8274	136.2799
.0160	S	46.1778	61.3600	1.9252	.8274	137.188
.0160	R	46.1778	61.3600	1.9378	.8274	138.1055
.0160	S	46.1778	61.3600	1.9500	.8274	139.000
.0160	R	46.1778	61.3600	1.9626	.8274	139.8801
.0160	S	46.1778	61.3600	1.9752	.8274	140.7188
.0160	R	46.1778	61.3600	1.9878	.8274	141.5244
.0160	S	46.1778	61.3600	2.0000	.8274	142.3930
.0160	R	46.1778	61.3600	2.0126	.8274	143.2799
.0160	S	46.1778	61.3600	2.0252	.8274	144.188
.0160	R	46.1778	61.3600	2.0378	.8274	145.1055
.0160	S	46.1778	61.3600	2.0500	.8274	146.000
.0160	R	46.1778	61.3600	2.0626	.8274	146.8801
.0160	S	46.1778	61.3600	2.0752	.8274	147.7188
.0160	R	46.1778	61.3600	2.0878	.8274	148.5244
.0160	S	46.1778	61.3600	2.1000	.8274	149.3930
.0160	R	46.1778	61.3600	2.1126	.8274	150.2799
.0160	S	46.1778	61.3600	2.1252	.8274	151.188
.0160	R	46.1778	61.3600	2.1378	.8274	152.1055
.0160	S	46.1778	61.3600	2.1500	.8274	153.000
.0160	R	46.1778	61.3600	2.1626	.8274	153.8801
.0160	S	46.1778	61.3600	2.1752	.8274	154.7188
.0160	R					

60' R.O.W.	44' FACE-FACE	8" CURB	8" CROWN	.5' OVERFLOW				
N	A	P	S	S1/2	R	R2/3	V	Q
.0160	37.1111	61.4035	.0050	.0707	.6044	.7148	4.6997	174.4103
.0160	37.1111	61.4035	.0100	.1000	.6044	.7148	6.6463	246.6533
.0160	37.1111	61.4035	.0150	.1225	.6044	.7148	8.1401	302.0874
.0160	37.1111	61.4035	.0200	.1414	.6044	.7148	9.3994	348.8205
.0160	37.1111	61.4035	.0250	.1581	.6044	.7148	10.5088	389.9932
.0160	37.1111	61.4035	.0300	.1732	.6044	.7148	11.5118	427.2161
.0160	37.1111	61.4035	.0350	.1871	.6044	.7148	12.4342	461.4461
.0160	37.1111	61.4035	.0400	.2000	.6044	.7148	13.2927	493.3067

60' R.O.W.	44' FACE-FACE	8" CURB	6" CROWN	.5' OVERFLOW				
N	A	P	S	S1/2	R	R2/3	V	Q
.0160	42.0000	61.3918	.0050	.0707	.6841	.7764	5.1044	214.3868
.0160	42.0000	61.3918	.0100	.1000	.6841	.7764	7.2188	303.1887
.0160	42.0000	61.3918	.0150	.1225	.6841	.7764	8.8412	371.3288
.0160	42.0000	61.3918	.0200	.1414	.6841	.7764	10.2089	428.7735
.0160	42.0000	61.3918	.0250	.1581	.6841	.7764	11.4139	479.3834
.0160	42.0000	61.3918	.0300	.1732	.6841	.7764	12.5033	525.1382
.0160	42.0000	61.3918	.0350	.1871	.6841	.7764	13.5051	567.2141
.0160	42.0000	61.3918	.0400	.2000	.6841	.7764	14.4376	606.3773

60' R.O.W.	44' FACE-FACE	8" CURB	4" CROWN	.5' OVERFLOW				
N	A	P	S	S1/2	R	R2/3	V	Q
.0160	46.8889	61.3834	.0050	.0707	.7639	.8356	5.4937	257.5936
.0160	46.8889	61.3834	.0100	.1000	.7639	.8356	7.7693	364.2924
.0160	46.8889	61.3834	.0150	.1225	.7639	.8356	9.5154	446.1652
.0160	46.8889	61.3834	.0200	.1414	.7639	.8356	10.9874	515.1872
.0160	46.8889	61.3834	.0250	.1581	.7639	.8356	12.2843	575.9968
.0160	46.8889	61.3834	.0300	.1732	.7639	.8356	13.4568	630.9729
.0160	46.8889	61.3834	.0350	.1871	.7639	.8356	14.5350	681.5286
.0160	46.8889	61.3834	.0400	.2000	.7639	.8356	15.5385	728.5847

60' R.O.W.	44' FACE-FACE	8" CURB	2" CROWN	.5' OVERFLOW				
N	A	P	S	S1/2	R	R2/3	V	Q
.0160	51.7778	61.3783	.0050	.0707	.8436	.8928	5.8695	303.9106
.0160	51.7778	61.3783	.0100	.1000	.8436	.8928	8.3008	429.7944
.0160	51.7778	61.3783	.0150	.1225	.8436	.8928	10.1663	526.3885
.0160	51.7778	61.3783	.0200	.1414	.8436	.8928	11.7390	607.8211
.0160	51.7778	61.3783	.0250	.1581	.8436	.8928	13.1246	679.5647
.0160	51.7778	61.3783	.0300	.1732	.8436	.8928	14.3773	744.4258
.0160	51.7778	61.3783	.0350	.1871	.8436	.8928	15.5293	804.0718
.0160	51.7778	61.3783	.0400	.2000	.8436	.8928	16.6015	859.5889

27A

N	.0159	38.0000	65.3383	.0050	.0707	.5816	.6968	4.5991	174.7662
A	.0159	38.0000	65.3383	.0100	1.000	.5816	.6968	6.5041	247.1567
P	.0159	38.0000	65.3383	.0150	1.225	.5816	.6968	7.9659	302.7039
S	.0159	38.0000	65.3383	.0200	1.414	.5816	.6968	9.1982	349.5324
S1/2	.0159	38.0000	65.3383	.0250	1.581	.5816	.6968	10.2839	390.7891
R	.0159	38.0000	65.3383	.0300	1.732	.5816	.6968	11.2655	428.0880
R2/3	.0159	38.0000	65.3383	.0350	1.871	.5816	.6968	12.1681	462.3879
Q	.0159	38.0000	65.3383	.0400	2.000	.5816	.6968	13.0082	494.3134

64' R.O.W. 48' FACE-FACE 8" CURB 2" CROWN .2' OVERFLOW

N	.0159	32.6667	65.3429	.0050	.0707	.4999	.6299	4.1579	135.8232
A	.0159	32.6667	65.3429	.0100	1.000	.4999	.6299	5.8801	192.0830
P	.0159	32.6667	65.3429	.0150	1.225	.4999	.6299	7.2016	235.2527
S	.0159	32.6667	65.3429	.0200	1.414	.4999	.6299	8.3157	271.6465
S1/2	.0159	32.6667	65.3429	.0250	1.581	.4999	.6299	9.2972	303.7100
R	.0159	32.6667	65.3429	.0300	1.732	.4999	.6299	10.1846	332.6976
R2/3	.0159	32.6667	65.3429	.0350	1.871	.4999	.6299	11.0006	359.3545
Q	.0159	32.6667	65.3429	.0400	2.000	.4999	.6299	11.7602	384.1661

64' R.O.W. 48' FACE-FACE 8" CURB 4" CROWN .2' OVERFLOW

N	.0159	27.3333	65.3506	.0050	.0707	.4183	.5593	3.6917	100.9073
A	.0159	27.3333	65.3506	.0100	1.000	.4183	.5593	5.2209	142.7044
P	.0159	27.3333	65.3506	.0150	1.225	.4183	.5593	6.3943	174.7765
S	.0159	27.3333	65.3506	.0200	1.414	.4183	.5593	7.3835	201.8145
S1/2	.0159	27.3333	65.3506	.0250	1.581	.4183	.5593	8.2550	225.6355
R	.0159	27.3333	65.3506	.0300	1.732	.4183	.5593	9.0429	247.1713
R2/3	.0159	27.3333	65.3506	.0350	1.871	.4183	.5593	9.7674	266.9755
Q	.0159	27.3333	65.3506	.0400	2.000	.4183	.5593	10.4418	285.4089

64' R.O.W. 48' FACE-FACE 8" CURB 6" CROWN .2' OVERFLOW

N	.0159	22.0000	65.3614	.0050	.0707	.3366	.4839	3.1940	70.2688
A	.0159	22.0000	65.3614	.0100	1.000	.3366	.4839	4.5170	99.3750
P	.0159	22.0000	65.3614	.0150	1.225	.3366	.4839	5.5322	121.7097
S	.0159	22.0000	65.3614	.0200	1.414	.3366	.4839	6.3881	140.5375
S1/2	.0159	22.0000	65.3614	.0250	1.581	.3366	.4839	7.1421	157.1257
R	.0159	22.0000	65.3614	.0300	1.732	.3366	.4839	7.8238	172.1226
R2/3	.0159	22.0000	65.3614	.0350	1.871	.3366	.4839	8.4506	185.9136
Q	.0159	22.0000	65.3614	.0400	2.000	.3366	.4839	9.0341	198.7500

64' R.O.W. 48' FACE-FACE 8" CURB 8" CROWN .2' OVERFLOW

64' R.O.W.	48' FACE-FACE	8" CURB	8" CROWN	4' OVERFLOW
N .0159	A 34.0000	S1/2 .0707	R2/3 .6467	V 4.2680
.0159	P 65.3830	S .0050	R .5200	Q 145.1111
.0159	65.3830	.0100	.5200	205.2182
.0159	65.3830	.0150	.5200	251.3399
.0159	65.3830	.0200	.5200	290.2223
.0159	65.3830	.0250	.5200	324.4784
.0159	65.3830	.0300	.5200	335.4483
.0159	65.3830	.0350	.5200	381.9280
.0159	65.3830	.0400	.5200	410.4363
N .0159	A 34.0000	S1/2 .0707	R2/3 .6467	V 12.0717
.0159	P 65.3830	S .0050	R .5200	Q 145.1111
.0159	65.3830	.0100	.5200	205.2182
.0159	65.3830	.0150	.5200	251.3399
.0159	65.3830	.0200	.5200	290.2223
.0159	65.3830	.0250	.5200	324.4784
.0159	65.3830	.0300	.5200	335.4483
.0159	65.3830	.0350	.5200	381.9280
.0159	65.3830	.0400	.5200	410.4363
N .0159	A 39.3333	S1/2 .0707	R2/3 .7127	V 4.7038
.0159	P 65.3722	S .0050	R .6017	Q 185.0181
.0159	65.3722	.0100	.6017	261.6551
.0159	65.3722	.0150	.6017	320.4607
.0159	65.3722	.0200	.6017	370.0362
.0159	65.3722	.0250	.6017	413.7130
.0159	65.3722	.0300	.6017	453.1999
.0159	65.3722	.0350	.6017	489.5118
.0159	65.3722	.0400	.6017	523.3102
N .0159	A 39.3333	S1/2 .0707	R2/3 .7127	V 4.7038
.0159	P 65.3722	S .0050	R .6017	Q 185.0181
.0159	65.3722	.0100	.6017	261.6551
.0159	65.3722	.0150	.6017	320.4607
.0159	65.3722	.0200	.6017	370.0362
.0159	65.3722	.0250	.6017	413.7130
.0159	65.3722	.0300	.6017	453.1999
.0159	65.3722	.0350	.6017	489.5118
.0159	65.3722	.0400	.6017	523.3102
N .0159	A 44.6667	S1/2 .0707	R2/3 .7758	V 5.1204
.0159	P 65.3645	S .0050	R .6833	Q 228.7091
.0159	65.3645	.0100	.6833	323.4434
.0159	65.3645	.0150	.6833	396.1357
.0159	65.3645	.0200	.6833	457.4181
.0159	65.3645	.0250	.6833	511.4090
.0159	65.3645	.0300	.6833	560.2205
.0159	65.3645	.0350	.6833	605.1073
.0159	65.3645	.0400	.6833	646.8869
N .0159	A 44.6667	S1/2 .0707	R2/3 .7758	V 5.1204
.0159	P 65.3645	S .0050	R .6833	Q 228.7091
.0159	65.3645	.0100	.6833	323.4434
.0159	65.3645	.0150	.6833	396.1357
.0159	65.3645	.0200	.6833	457.4181
.0159	65.3645	.0250	.6833	511.4090
.0159	65.3645	.0300	.6833	560.2205
.0159	65.3645	.0350	.6833	605.1073
.0159	65.3645	.0400	.6833	646.8869
N .0159	A 50.0000	S1/2 .0707	R2/3 .8364	V 5.5205
.0159	P 65.3599	S .0050	R .7650	Q 276.0236
.0159	65.3599	.0100	.7650	390.3563
.0159	65.3599	.0150	.7650	478.0869
.0159	65.3599	.0200	.7650	552.0472
.0159	65.3599	.0250	.7650	617.2075
.0159	65.3599	.0300	.7650	676.1169
.0159	65.3599	.0350	.7650	730.2897
.0159	65.3599	.0400	.7650	780.7126
N .0159	A 50.0000	S1/2 .0707	R2/3 .8364	V 5.5205
.0159	P 65.3599	S .0050	R .7650	Q 276.0236
.0159	65.3599	.0100	.7650	390.3563
.0159	65.3599	.0150	.7650	478.0869
.0159	65.3599	.0200	.7650	552.0472
.0159	65.3599	.0250	.7650	617.2075
.0159	65.3599	.0300	.7650	676.1169
.0159	65.3599	.0350	.7650	730.2897
.0159	65.3599	.0400	.7650	780.7126

27c

Q	V	R2/3	R	S1/2	S	P	A	N
942.7363	16.8346	.9019	.8566	.2000	.0400	65.3782	56.0000	.0159
881.8491	15.7473	.9019	.8566	.1871	.0350	65.3782	56.0000	.0159
816.4336	14.5792	.9019	.8566	.1732	.0300	65.3782	56.0000	.0159
745.2985	13.3089	.9019	.8566	.1581	.0250	65.3782	56.0000	.0159
666.6153	11.9038	.9019	.8566	.1414	.0200	65.3782	56.0000	.0159
577.3057	10.3090	.9019	.8566	.1225	.0150	65.3782	56.0000	.0159
471.3682	8.4173	.9019	.8566	.1000	.0100	65.3782	56.0000	.0159
333.3076	5.9519	.9019	.8566	.0707	.0050	65.3782	56.0000	.0159

5. OVERFLOW

2" CROWN

8- 2222

48. PAGE-PAGE

64 X.O.H.

	N	A	P	S	SL/2	R	R2/3	V	Q
0.159	50.6667	50.6667	65.3828	.0050	.0707	.7749	.8437	5.5675	282.0874
0.159	50.6667	50.6667	65.3828	.0100	1.000	.7749	.8437	7.8737	398.9318
0.159	50.6667	50.6667	65.3828	.0150	.1225	.7749	.8437	9.6432	488.5897
0.159	50.6667	50.6667	65.3828	.0200	.1414	.7749	.8437	11.1350	564.1748
0.159	50.6667	50.6667	65.3828	.0250	.1581	.7749	.8437	12.4493	630.7666
0.159	50.6667	50.6667	65.3828	.0300	.1732	.7749	.8437	13.6376	690.9702
0.159	50.6667	50.6667	65.3828	.0350	.1871	.7749	.8437	14.7303	746.3331
0.159	50.6667	50.6667	65.3828	.0400	.2000	.7749	.8437	15.7473	797.8637

5. 0211140

7 CROWN

84-200

48. PAGE-PAGE

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Q	A	R2/3	R	SI/2	S	P	A	N
234.3391	5.1692	.7833	.6933	.0707	.0050	65.3905	45.3333	0159
331.4055	7.3104	.7833	.6933	.1000	.0100	65.3905	45.3333	0159
405.8872	8.9534	.7833	.6933	.1225	.0150	65.3905	45.3333	0159
468.6782	10.3385	.7833	.6933	.1414	.0200	65.3905	45.3333	0159
523.9981	11.5588	.7833	.6933	.1581	.0250	65.3905	45.3333	0159
574.0112	12.6620	.7833	.6933	.1732	.0300	65.3905	45.3333	0159
620.0029	13.6765	.7833	.6933	.1871	.0350	65.3905	45.3333	0159
662.8110	14.6208	.7833	.6933	.2000	.0400	65.3905	45.3333	0159

5. OVERLAP

64 CROWN

8-00000

87-2541-2541

• 1979

Q	V	R2/3	R	81/2	S	P	A	N
190.1976	4.7549	.7205	.6116	.0707	.0050	65.4013	40.0000	.0159
268.9800	6.7245	.7205	.6116	.1000	.0100	65.4013	40.0000	.0159
329.4319	8.2358	.7205	.6116	.1225	.0150	65.4013	40.0000	.0159
380.3952	9.5099	.7205	.6116	.1414	.0200	65.4013	40.0000	.0159
425.2947	10.6324	.7205	.6116	.1581	.0250	65.4013	40.0000	.0159
465.8870	11.6472	.7205	.6116	.1732	.0300	65.4013	40.0000	.0159
503.2155	12.5804	.7205	.6116	.1871	.0350	65.4013	40.0000	.0159
537.9600	13.4490	.7205	.6116	.2000	.0400	65.4013	40.0000	.0159

NOVEMBRO '57

8. CHRON

8-100

48. PAGE-ACK

94 X.O.H.

EXHIBIT F
STREETS AND MAXIMUM RUNOFFS

<u>STREET DESCRIPTION & LOCATION</u>	<u>MAXIMUM RUNOFF (in c.f.s.)</u>
A. Street #1 - 50' R/W, 32' f. to f.	14
B. 94th Street SW - 60' R/W, 40' f. to f.	12
C. Benavides Rd., SW - 64' R/W, 48' f. to f. from junction with Street #1 to street #8	82
D. Street #2 - 50' R/W, 32' f. to f. from junction with Street #1 to junction with Street #3	21
E. Street #3 - 50' R/W, 32' f. to f. from Sage Road to junction with Street #4	10
F. Street #4 - 50' R/W, 32' f. to f. from Benavides Rd. SW to junction with Street #10	4
Street #4 - from Street #10 to junction with Street #8	111
G. Streets #5, 6 and 7 - 50' R/W, 32' f. to f. from Street #3 to Street #8	16
H. Street #8 - 50' R/W, 32' f. to f. from Sage Rd to junction with Street #4	22
Street #8 - from Street #4 to junction with Street #9	18
I. Street #9 - 60' R/W, 44' f. to f. from Benavides Road, SW to Street #8	40
J. Street #10 - 50' R/W, 32' f. to f. from Street #2 and #3 to Street #4	98

REVISED MAY 1972

Problems with Westgate Heights

Beam on N. W. corner does not appear

to be constructed as specified in any case

is it on other portion's property?

Dr. comment and foundation does not appear

to be functioning and in any case it does not

protect adjacent property

What is on site pending?

lots on W side of Block already approved

to surface runoff

O.S. (2) at 7.04c showing info lots N & S

intersection of BCK & Springfield

Museum, Scientific and Museum, Inc.
2601 Weyburning Blvd., NE
Worship Heights, Wash DC 20004
87110

Dear Carl Tubbs

I have reviewed the drawing report for Unit 2 of
Worship Heights and have no objections therefore

approval is hereby granted

Regarding Unit 4 of Worship Heights my concurrence
is somewhat reticent and limited to the proposed

for the on site handling of the material. I find that

the attention given to the waste plans is not as

comprehensive as it needs to be desirable.

No discussion is found on the manner in which the
material from off-site 13 & 4 will be generated from

affecting the waste water development.

I have no objection to the division of the flow to
Reman's But provided that a denitrification basin

will prevent sediment to be conveyed to the

public street. I believe that a solution may

be worked out with the A.P.S. People but some

concrete agreement must be on hand

Another concern regarding the impeller part of the

model of the Area and cost of new visit. Also which from

the concern (not supplied in the report) appears to

affect the job along with the ^{advises} in a progressively

greater manner. The discharge of the ^{advises} does

not indicate any contribution from this area but

must be taken in consideration. I appreciate the fact
that when the property to the south will be developed this
problem will be eliminated; in the meantime an interim
solution must be provided
The provisions for the R.O.C. for the Chambers and
of which 3 or 4 and the disk construction shown
on the revised figure I B bridge height was 3
on in agreement with previous drawings. The
implementation of these facilities will have to be discussed
in an addendum to the report on driving report
together with answers to the other questions raised above

Area	
5200 x 2 = 544 + 48,560 =	2155
479 Ac.	
1284 x 3200 = 2144 ⁺	24 AC.
2	551 x 3200 = 41 AC
3	275 x 3200 = 20 AC
4	1818 x 3200 = 133 AC + 6 = 139 AC
5	155 x 3200 = 12 ÷ 2 = 6
6	299 x 3200 = 22 AC
7	1296 x 3200 = 95 AC + 6 = 101 AC
8	164 x 3200 = 12 AC
9	650 x 3200 = 48 AC

886

Mr. Roberts letter on Westgate Unit 2.

1. The storm runoff from Drainage Areas

A & B, are outside of Westgate Unit 2 Area.

Question: What would Roberts comments be

if Drainage Areas A & B were to be developed?

Also with the present drainage what happens to

the run-off.

2. Per Roberts recommendations

a. What City policy? It is like saying

something is ~~not~~ does not comply with something

else, but you will not find out what the something

are.

b. The 993 act of run-off is generated

outside of the proposed development. That

should be made out on the files from A & B.

F

111

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