Boyle Engineering Corporation

consulting engineers

1721 Girard Boulevard, N.E.
Albuquerque, New Mexico 87106

505 / 266-7789

December 20, 1977

522-01

City Drainage Engineer
CITY OF AlBUQUERQUE
P. O. Box 1293
Albuquerque, New Mexico 87103

A.S.C.I.M. Addition - Regrading Plan

Attached for your approval is a copy of the revised grading plan for the referenced project as verbally approved by your Mr. Conigliano on December 9, 1977 pending the submittal of a retaining wall and waterproofing detail for the easternmost wall of the structures. This grading plan is supplemental to the Drainage Report for A.S.C.I.M. Addition, prepared by Genge/Murray - McCormick, Inc. and dated June, 1977. Any additional changes required by the grade changes shown will be reflected in the final construction plans prepared by the project architect as well as the required details.

Your help in expediting this matter is appreciated.

BOYLE ENGINEERING CORPORATION

Victor J. Chavez

Victor J. Chavez, PE

VJC:mm
Enc.

Genge/Murray-McCormick
2601 Wyoming Blvd., N.E. Suite F
Albuquerque, N.M. 87110/505 292-1936
Engineering · Surveying · Planning
Tucson · Phoenix · Denver · Pueblo

August 4, 1977

Mr. V. M. Kimmick, City Engineer
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico 87103

Re: ASCIM Addition at Chelwood Park and Constitution

Dear Mr. Kimmick:

This is an addendum to my letter dated August 1, 1977, regarding the flood plain for the above referenced site.

Using the flow information (300 cfs in Chelwood Park Blvd.) supplied by Bruno at our meeting on Wednesday afternoon, August 3, 1977, I have assumed that 300 cfs will be flowing in Chelwood Park Boulevard at the extension of the north boundary of the subject site. I calculated the street capacity for Chelwood (64' right-of-way, 48' curb face to curb face) from ROW to ROW based on the minimum grade (0.23%), which is north of the site and found that 300 cfs will top the ROW elevation by 0.50'. As the slope of Chelwood steepens adjacent to the site the street capacity (ROW to ROW) is 267 cfs thereby allowing 0.05' to over-top the ROW elevation.

The recommendation to alleviate the over-topping along the northerly portion of the site is to grade a berm with a top elevation 0.5' higher than the ROW elevation. The berm will run along the northerly two lots then taper to no berm at the driveway location on Lot 2. Since the Chelwood grade steepens adjacent to Lots 1 and 2, the street (grade = 1.31%) will carry the vast majority of the runoff and will allow 0.05' of water to top the ROW elevation.

By providing a berm and elevated driveway (water block in the driveway) along Lot 1 and a portion of Lot 2, the flood will be contained in the Chelwood ROW. As the street steepens in grade adjacent to Lots 3 through 10, the overflow onto the lots will be approximately 0.05'. The buildings to be constructed in accordance to the grading plan will generally have a finished floor elevation 1.0' above the adjacent parking lot top of curb. As calculated in the earlier study, the displacement created by the buildings will increase the depth of flow around the buildings by a factor of 2. Therefore, the possible depth of the flood water running between the buildings will be 0.10'.

Genge/Murray-McCormick

Therefore, I feel that, based on the available information given to me to calculate the potential flooding of the subject site, the proposed finished floor elevations of the buildings will be above the flood elevation.

Very truly yours,

GENGE/MURRAY-McCORMICK, INC.

Carl A. Tebbens

Carl A. Tebbens, P.E.
Vice President

CAT:dw

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinhenz

July 13, 1977

J22-01

Genge/Murray-McCormick, Inc.
2601 Wyoming Blvd., NE
Albuquerque, New Mexico 87110

Dear Mr. Goncalves:

I have reviewed the drainage plan submitted for the ASCIM Addition, and it is accepted. The construction plans for the individual quadruplexes will have to reflect on their grading plan the information contained in the approved drainage report.

The double "c" inlet on Chelwood will have to be reconstructed as a "d" inlet per City of Albuquerque Standards.

Very truly yours,

Bruno Conegliano

Bruno Conegliano
Assistant City Engineer-Hydrology

BC/kr

Genge/Murray-McCormick

2601 Wyoming Blvd., N.E. Suite F
Albuquerque, N.M. 87110/505 292-1936
Engineering · Surveying · Planning
Tucson · Phoenix · Denver · Pueblo

July 8, 1977

Mr. Bruno Conegliano
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico 87103

Dear Mr. Conegliano:

Enclosed are three (3) copies of the drainage report for the ASCIM Addition fourplex subdivision in eastern Albuquerque for your review.

Please feel free to contact me if you have any questions.

Very truly yours,

GENGE/MURRAY-McCORMICK, INC.

Ricardo J. Goncalves, P.E.

RJG:dw

Encls.

Boyle Engineering Corporation

BY ______ DATE ______ SUBJECT ASCIM GRADING DRAINAGE SHEET NO. 1 OF 4
CHKD. BY ______ DATE ______ JOB NO. ______

Discharge from Embudo Arroyo & upper runoff area

$$Q = 300 = \frac{1.486}{0.015}(h' \times 48)(1.143\%)^{\frac{1}{2}}\left(\frac{h' \times 48}{48 + 2h'}\right)^{2/3}$$

$h' = 0.72'$ $H = 0.72' + 0.33' = 1.05'$ —— (Calc. OR ON page 2)

the height flowing over weir (curb) $h = 1.05' - 0.66' = 0.39' \simeq 0.4'$

Acceptable Capacity in Street & Street double inlet

$$Q_{st} + Q_{inlet} = \frac{1.486}{0.015}(48 \times 0.33)(1.143\%)^{\frac{1}{2}}\left(\frac{0.33 \times 48}{48 + 0.66}\right)^{2/3} + 0.6 \times 2 \times 5 \times \sqrt{2 \times 32.2 \times 1.5} \times 2/3 \times 50\% = \underline{79.9} + \underline{23.5} = \underline{103.4\ cfs}$$

$Q_{1\,in} = CL(H)^{3/2} = 3.5 \times 132 \times (0.365)^{3/2} = 102$ cfs

$Q_{1\,out} = 3.5 \times 9 \times (1.61)^{3/2} + 0.6 \times 0.5 \times 1\sqrt{2 \times 32.2 \times 1.5} = 67.1$ cfs
(for culvert)

$Q_{2\,in} = 3.5 \times 132 \times (0.195)^{3/2} = 39.7$ cfs

$Q_{2\,out} = 3.5 \times 9 \times (1.3)^{3/2} + 2.9 = 48$ cfs

$Q_{3\,in} = 3.5 \times 132 \times (0.12)^{3/2} = 19$ cfs

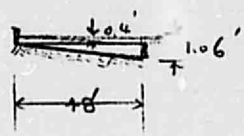
$Q_{3\,out} = 3.5 \times 9 \times (0.9)^{3/2} + 2.9 = 29.5$ cfs

$Q_{4\,in} = 3.5 \times 132 \times (0.065)^{3/2} = 7.7$ cfs

OR

$$300 = \frac{1.486}{0.015} \times \left(h + 48 + \tfrac{1}{2}\,48 \times 0.67\right)(1.1438)^{\frac{1}{2}} \left(\frac{48h + 24 \times 0.67}{48 + h + h_1}\right)^{2/3}$$

$h = 0.4$ $\quad H = 0.4 + 0.66 = 1.06'$



Boyle Engineering Corporation

BY______ DATE______ SUBJECT ASCIM Regrading Drainage SHEET NO. 3 OF 4
CHKD. BY______ DATE______ JOB NO.______

$Q_{1\,out} = 67.1\ cfs = \frac{1.486}{0.015} \times (4\%)^{\frac{1}{2}} \times \left(\frac{17 \times h'}{17 + 2h'}\right)^{2/3} \times (17 \times h')$

$\rightarrow h'_1 \simeq 0.4'$

$Q_{2\,out} = 48\ cfs = \frac{1.486}{0.015} (4\%)^{\frac{1}{2}} \times \left(\frac{17 \times h'}{17 + 2h'}\right)^{2/3} \times (17 \times h')$

$\rightarrow h'_2 \simeq 0.33'$

$Q_3 = 29.5\ cfs = \frac{1.486}{0.015} (4\%)^{\frac{1}{2}} \left(\frac{17 \times h'}{17 + 2h'}\right)^{2/3} \times (17 \times h')$

$\rightarrow h'_3 \simeq 0.3'$

$67.1 = \frac{1.486}{0.015} \times (1.92\%)^{\frac{1}{2}} (15 \times h_1) \left(\frac{15 \times h_1}{15 + 2h_1}\right)^{2/3}$

$\rightarrow h_1 = 0.55'$

$67.1 + 48 = 115.1 = \frac{1.486}{0.015} \times (1.92\%)^{\frac{1}{2}} (15 \times h_2) \left(\frac{15 \times h_2}{15 + 2h_2}\right)^{2/3}$

$\rightarrow h_2 = 0.72'$

$67.1 + 48 + 29.5 = 144.4 = \frac{1.486}{0.015} \times (1.92\%)^{\frac{1}{2}} (15 \times h_3) \left(\frac{15 \times h_3}{15 \times 2h_3}\right)^{2/3}$

$\rightarrow h_3 = 0.85'$

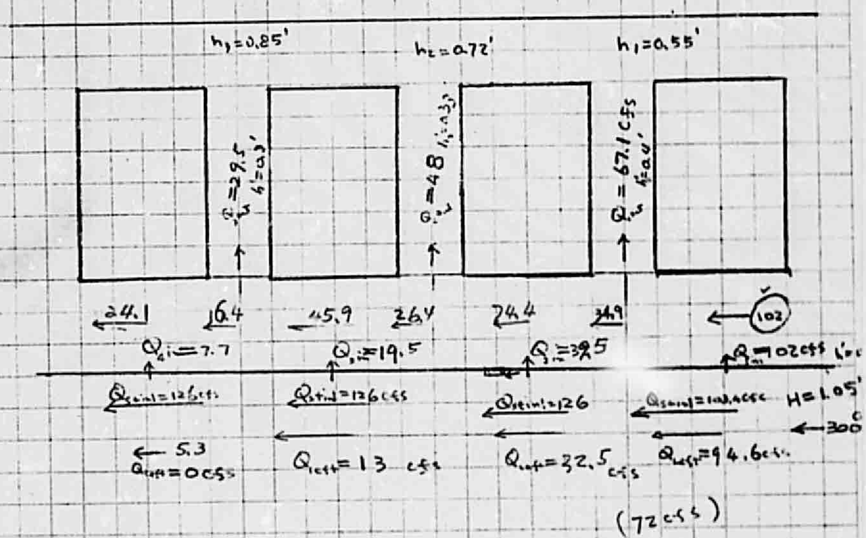
WATER DEPTH AT PONDING AREA

$h = 0.19\ \text{Acre-ft} \Big/ 6460/43560 = 1.2\ \text{ft} \leftarrow$

Boyle Engineering Corporation

BY ______ DATE ______ SUBJECT ______ SHEET NO. 4 OF 4

CHKD. BY ______ DATE ______ JOB NO. ______



DRAINAGE REPORT

FOR

ASCIM ADDITION

ALBUQUERQUE, NEW MEXICO

MURRAY-McCORMICK, INC.
ENVIRONMENTAL DESIGN
ECOSYSTEMS ANALYSIS · PLANNING · LAND SURVEYS · ENGINEERING

2601 WYOMING BLVD., NE. SUITE F / ALBUQUERQUE, N.M. 87110 / 505-292-1936

DRAINAGE REPORT

FOR

ASCIM ADDITION

ALBUQUERQUE, NEW MEXICO

Prepared By

Genge/Murray-McCormick, Inc.
2601 Wyoming Boulevard N.E.
Albuquerque, New Mexico 87110
(505) 292-1936

June 1977

DRAINAGE REPORT

ASCIM ADDITION
ALBUQUERQUE, NEW MEXICO

TABLE OF CONTENTS

APPENDIX

DRAINAGE REPORT

PURPOSE AND SCOPE

Mr. Christopher Inman is currently developing a 2.5 acre parcel of land located in the eastern metropolitan Albuquerque area called the ASCIM Addition. This parcel is a multi-family subdivision consisting of fourplexes on ten lots.

The purpose of this report is to present a plan for controlling surface runoff from the said subdivision in a manner acceptable to the Albuquerque Metropolitan Arroyo Flood Control Authority and the Albuquerque City Engineer's office.

SITE LOCATION AND TOPOGRAPHY

The said parcel of land is bounded on the east by Chelwood Boulevard N.E., and on the south by Constitution Avenue N.E. The surrounding terrain is generally improved land on all sides.

The soil of the site is generally comprised of SM sand and silt. The natural ground slopes from northeast to southwest at an average of 5%.

DESIGN CRITERIA

In analyzing the storm runoff, the Rational Formula, $Q = CIA\ C_f$ is used.[1]

1. See Bibliography, Item (2), Paragraph 3.7 - Appendix-3

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 accumulation (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 derived from a Tc of ten minutes is employed.)

C = Runoff Coefficient (No Units). 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 site is in the form of sheet flow exiting the site at the west boundary. There is no offsite runoff that flows onto the site.

The total runoff in the undeveloped site forms the basis for comparison with the flow in the developed state. See Table I for a listing of undeveloped runoff.

TABLE I

Runoff in Undeveloped State

Drainage Basin	Elev. Diff.	Length of Flow	Tc (Min.)	I 100 yr. In./Hr.	C[2]	Area (Ac)	Q (cfs)
A-1	10.5	170	12	5.1	.38	0.83	1.61
A-2	6.5	170	12.9	4.99	.38	0.95	1.80
A-3	5.5	150	12.9	4.99	.38	0.78	1.48
Σ A-1 - A-3			12.9	4.99	.38	2.56	4.85
TOTAL							4.85

ESTIMATED RUNOFF DEVELOPED STATE

As development occurs, the area of impervious surfaces increases and thereby the amount of runoff usually increases. In order to offset this increase, onsite restrictions of flows must be incorporated into the development. While this can take different forms, the usual solution for this type of development is to utilize on-lot ponding.

The runoff coefficient for various surfaces is as follows:

Streets, Walks and Drives	C = 0.80
Roofs	C = 0.80
Lawns, Sandy Soil (Average 2 to 7% slope)	C = 0.30

See Appendix-1 for computations on composite runoff coefficients.

2. See Appendix-1

TABLE II

Runoff in Developed State

Drainage Basin	Area Acres	$\overline{C}$ [3]	$A*\overline{c}$	Tc (Min.)	I 100 yr. (in./hr.)	Q (cfs)
A6	0.20	0.60	0.12	16	4.61	0.55
A5	0.28	0.69	0.19	18	4.39	0.85
A6 - A5			0.31	33	3.25	1.01
A4	0.19	0.78	0.15	16	4.61	0.68
A6 - A4			0.46	48	2.59	1.19
A3	0.19	0.78	0.15	16	4.61	0.69
A6 - A3			0.61	63	2.15	1.31
A2	0.19	0.78	0.15	16	4.61	0.69
A6 - A2			0.76	78	1.83	1.39
A1	0.15	0.62	0.09	14	4.84	0.45
A6 - A1			0.85	89	1.66	1.41
TOTAL DEVELOPED FLOW						1.41

EXPLANATION OF RESULTS

OFFSITE FLO

No offsite runoff flows onto the site.

HISTORIC RUNOFF

Runoff from the project in the undeveloped state is generally in sheet flow and can be divided loosely into three drainage areas.

3. See Appendix-1.

Due to steepness of the terrain, and the undiverted path of the runoff, the times of concentration are low, 12.9 minutes, resulting in a total historic drainage for the area of 4.85 cfs.

DEVELOPED RUNOFF

Runoff in the developed state varies from that in the historic state in that most of the runoff is intercepted by a drainage swale at the downhill end of the project, diverting the water into a longer path, and at a less steep slope. This effect creates a much longer time of concentration in comparison to the historic time of concentration. In addition all the runoff from the building roofs and areas in front of the buildings will be ponded, thus decreasing the area and total volume of runoff. These ponds will be non-discharging, thus allowing no more volume of runoff to leave the site than left in the historic state. As a result, the total 100-year flood runoff from the developed site is 1.41 cfs, less than the 4.74 cfs undeveloped runoff. The developed volume of runoff is 0.16 ac-ft; less than the 0.18 ac-ft in the undeveloped state.

RECOMMENDATIONS

The following recommendations are made to enable the developer of this site and the local government to complete this project within the design criteria:

1. Offsite runoff from the north end of the property will not enter the site.

2. Runoff from the buildings will be ponded in the yards of each lot. Pond depths of 1.3 feet will be sufficient to retain the amount of developed volume of runoff greater than undeveloped runoff on the site.
3. Runoff from the uphill lots will drain into the lower lots at the west edge of the site, through a drainage swale. The developed runoff will not exceed the historic runoff.

SUMMARY

The subject property will have ponded lots. All the developed runoff not ponded will be carried by a drainage swale at the west property line.

In conclusion, the development of this site should have a beneficial effect on the drainage characteristics of the area, and the site can be developed without harm to life or property.

Respectfully submitted,

Prepared by:

Ricardo J. Goncalves

Reviewed by:

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

APPENDIX-1

Development of Composite Runoff Coefficients for Unponded Areas.

A1:	Total unponded area	=	0.15 Ac.
	Pervious	=	0.09
	Impervious	=	0.06
	R.C.	=	0.50
A2:	Total Area	=	0.19
	Pervious	=	0.07
	Impervious	=	0.12
	R.C.	=	0.62
A3:	Same as A2		
A4:	Same as A3		
A5:	Area	=	0.28
	Pervious	=	0.14
	Impervious	=	0.14
	R.C.	=	0.55
A6:	Area	=	0.20
	Pervious	=	0.13
	Impervious	=	0.07
	R.C.	=	0.48

UBDIVISION CHELWOOD & CONSTITUTION
OCATION
OB NO.
ESIGN STORM 100 YR. RECURRENCE INTERVAL
AJOR STORM 100 YR.
OMPUTATIONS BY RJG DATE 6/13/77

APPENDIX-2

DEVELOPED RUNOFF

RUNOFF COMPUTATIONS
(Rational Method)

PAGE ____ OF ____

Area Designation	A (Acres)	c	c_f	$\bar{c}$ = ($c \times c_f$)	$A \cdot \bar{c}$	$\Sigma A \cdot \bar{c}$	tc (min)	I (in/hr)	Q = ($\Sigma A \cdot \bar{c}$) x I cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Slope %	Length ft.	VEL V fps	∆t (min)	
A-6	0.20	0.48	1.25	0.60	.12	.12	16	4.61	.55				2.38	232		16	
A-5	.28	.55	1.25	1.69	.19	.19	18	4.39	.85				2.10	290		18	
ΣA6-A5						.31	33	3.25	1.01				1.48	170		17	
A4	.19	.62	1.25	.78	.15	.15	16	4.61	.68				2.92	240		16	
ΣA6-A4						.46	48	2.59	1.19				1.5	130		15	
A3	.19	.62	1.25	.78	.15	.15	16	4.61	.69				2.92	240		16	
ΣA6-A3						.61	63	2.15	1.31				1.5	130		15	
A2	.19	.62	1.25	.78	.15	.15	16	4.61	.69				2.92	240		16	
ΣA6-A2						.76	78	1.83	1.39				1.5	130		15	
A1	.15	.50	1.25	.62	.09	.09	14	4.84	.45				3.3	145		14	
ΣA6-A1						0.85	89	1.66	1.41				2.3	85		11	

Determination of Pond Volumes:

A1:	Total Area Draining to Pond	=	.13 Ac.
	Impervious Areas	=	0.10
	Pervious	=	.03
	Runoff Coefficient (R.C.)	=	0.68
	VR = .68 x .13 x 2.8 = Ac.-In.	=	904 ft^3
A2:	Total Area	=	0.26 Ac.
	VR = 2 x A1 = 2 x 904 = 1808 ft^3		
	Pond depth	=	1.0 ft.
A3:	Same as A2		
A4:	Same as A3		
A5:	Same as A4		
A6:	Same as A1		

For pyramidal volumes, depth of A1 = 1.25'

depth of all ponds = 1.25'

RUNOFF VOLUME COMPUTATIONS

Runoff Volume Before Development

= C x f x Area x 6 hr. rainfall

= .30 x 1.25 x 2.5 x 2.8 = 2.62 ac. in.
= .22 Ac.Ft.

Allowable developed runoff after development = .22 Ac. Ft.

Areas Draining to Pond:

A-1 = 5586 ft^2

A-2 = 11172 ft^2

A-3 = 11172 ft^2

A-4 = 11172 ft^2

A-5 = 11172 ft^2

A-6 = 5586 ft^2

Total = 1.28 Ac.

Runoff Area = 1.22 Ac.

Pervious = 0.58 Ac.

Impervious = 0.64 Ac.

Runoff Coefficient = $\frac{.58}{1.22}(.30) + \frac{.64}{1.22}(.80) = .56$

Runoff Volume = $\frac{.56 \times 1.25 \times 2.8 \times 1.22}{12} = 0.19$ Ac.Ft.

Developed runoff volume is less than historic, 3.6 Continued

TABLE 3-2 (8)

RATIONAL METHOD RUNOFF COEFFICIENTS FOR COMPOSITE ANALYSIS

Character of Surface	Runoff Coefficients
Streets:	
Asphaltic	0.70 to 0.95
Concrete	0.80 to 0.95
Drives and Walks	0.75 to 0.85
Roofs	0.75 to 0.95
Lawns, Sandy Soil:	
Flat, 2%	0.05 to 0.10
Average, 2 to 7%	0.10 to 0.15
Steep, 7%	0.15 to 0.20
Lawns, Heavy Soil:	
Flat, 2%	0.15 to 0.20
Average, 2 to 7%	0.20 to 0.25
Steep, 7%	0.25 to 0.35

The coefficients in these two tabulations are applicable for storms of 5-year to 10-year frequencies. Less frequent higher-intensity storms will require modification of the coefficient because infiltration and other losses have a proportionally smaller effect on runoff, as given in the following section.

3.7 Adjustment for Infrequent Storms

The adjustment of the Rational Method for use with major storms can be made by multiplying the right side of the Rational Formula by a frequency factor C_f, which is used to account for antecedent precipitation conditions. The Rational Formula now becomes:

$$Q = CIAC_f \qquad (3-2)$$

The following table of C_f values can be used. The product of C times C_f should not exceed 1.0.

3.7 Continued

TABLE 3-3

FREQUENCY FACTORS FOR RATIONAL FORMULA

Recurrence Interval (years)	C_f
2 to 10	1.0
25	1.1
50	1.2
100	1.25

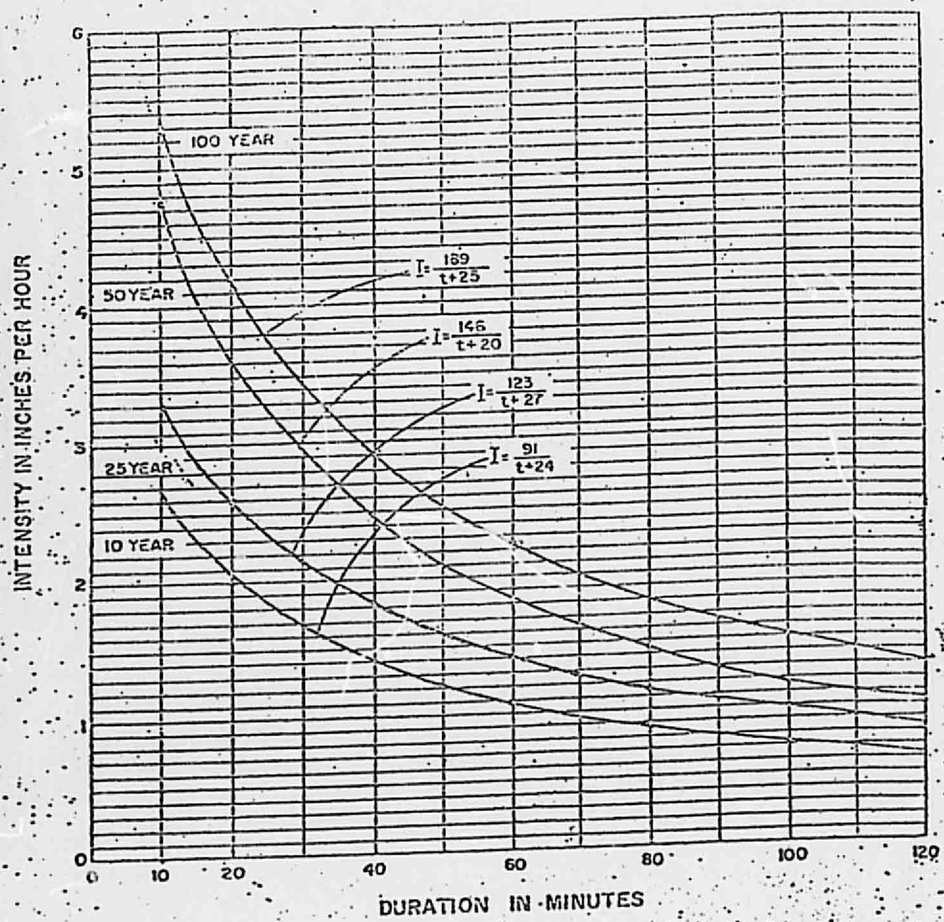


FIGURE III

MASTER PLAN OF DRAINAGE
CITY OF ALBUQUERQUE - NEW MEXICO
AND . EN[illegible]ORS

INTENSITY [illegible]RATION
FREQUEN[illegible] CURVES

(ALBUQUERQ[illegible] AREA-1961)

GORDON HERKENHOFF & ASSOC. CONSULTING ENGINEERS ALBUQUERQUE, NEW MEXICO	CHART 1

MURRAY-McCORMICK, INC.
ENVIRONMENTAL DESIGN
ENGINEERING·PLANNING·SURVEYING
2401 WYOMING BLVD. NE SUITE F / ALBUQUERQUE, NEW MEXICO 87112 / 505-292-1936

JOB NO.______ DATE______
PROJECT______
SCALE______

FIGURE IV

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

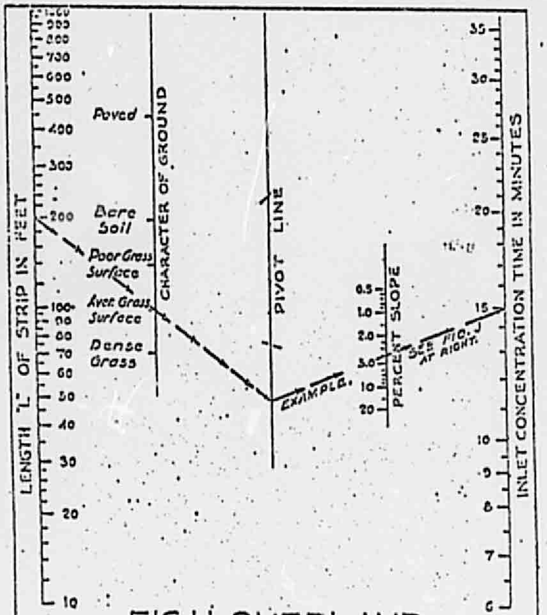


FIG. H-OVERLAND FLOW TIME.

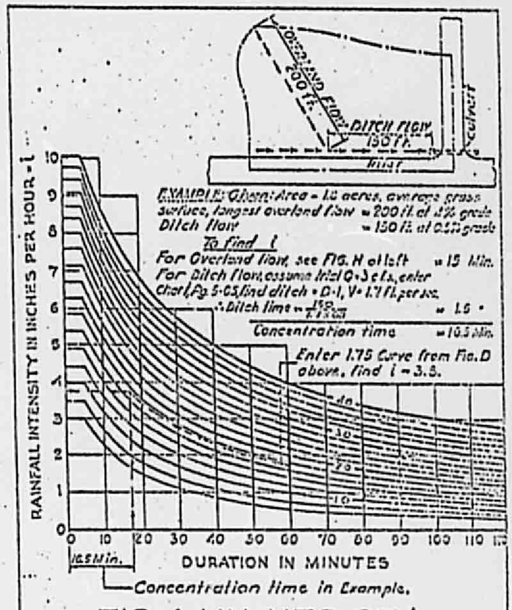


FIG. J-VALUES OF i
RAINFALL INTENSITY-DURATION.⁺

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

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) U.S. Department of Commerce, "Technical Paper, No. 40, Rainfall Frequency Atlas of the United States", Washington, D.C., U.S. Government Printing Office, 1963.