HYDROLOGY E19/D1 2 PLANS

E19/D1

2 Plans

ACADEMY ACRES
UNIT 9

PRELIMINARY DRAINAGE STUDY
RELATIVE TO THE DEVELOPMENT OF
ACADEMY ACRES, UNIT 9

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PRELIMINARY
DRAINAGE STUDY RELATIVE TO THE DEVELOPMENT OF ACADEMY ACRES, UNIT 9
ALBUQUERQUE, NEW MEXICO

MARCH 1972

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PRELIMINARY
DRAINAGE STUDY RELATIVE TO THE DEVELOPMENT OF
ACADEMY ACRES, UNIT 9

I. GENERAL

The purpose of this report is to present findings pertinent to estimating and handling of runoff for use in the master planned development of Academy Acres, Unit 9, and to describe a proposed method for providing adequate storm drainage in the area.

II. LOCATION

Academy Acres, Unit 9, is bounded on the west by Academy Acres, Unit 8 (proposed); on the north and east by parcels of unplatted land; and on the south by Meadowood Manor, Unit 2 (proposed). It is situated mainly in the northwest one-quarter (NW 1/4) of Section 30, Township 11 North, Range 4 East, N.M.P.M.

III. EXISTING DRAINAGE CONDITIONS

A. General

This area is generally located between Louisiana Blvd., N.E., on the west and Truchas Drive, N.E., on the east. It is crossed by three small arroyos in a general east-west direction.

B. Topography

Academy Acres, Unit 9, lies between Louisiana Blvd., N.E., and Truchas Drive, N.E., north of Burlison Drive, N.E. It is crossed by three minor drainage areas with the drainage area limits on the east at Truchas Drive in Bear Canyon Village (reference 6) as shown in Exhibit "A", a portion of a scale photograph by Koogle and Pouls Engineering, Inc., and Exhibit "C", a plat by Ralph K. Hicks and Associates, Inc. Through field investigation, it is considered that the photograph is satisfactory for the purpose of determining the original division lines.

C. Drainage Areas and Channels

Upon completion of Truchas Drive, N.E., the drainage area contributing runoff from east of the development will be non-existent. The runoff within the development can be carried by planning streets in such a manner (set property lines high enough and adjust grades on streets) as to carry the water across the development.

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 which could be expected 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 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 to determine the areas which could conceivably contribute runoff to the proposed development was made for which a copy of computations is contained in Exhibit "D" of this report. Finally, the Master Plan of Drainage, Exhibit "B", 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 (by planimeter) in acres.

The intensity of rainfall (I) was determined by assuming a 100 year frequency rainfall and then utilizing Intensity Duration Frequency Curves (Chart I) 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 be across 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 concrete curbs and crowned with full crown (8"). 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 area under consideration. A coefficient of 0.65 is used for areas where dense residential development was most probable.

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

D. Drainage Channels and Facilities

All existing structure capacities, as well as any proposed future structures, were verified from computer output which forms a part of Exhibit "E" and is based on Manning's Equation, Q = AV, where $V=\frac{1.486}{n} R^{2/3}S^{1/2}$ 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

On the basis of this study and its computations, it is concluded that the development of this area can be satisfactorily accomplished provided adequate storm drainage is done.

Completion of Truchas Drive, N.E., prior to or at least concurrently with construction of Academy Acres, Unit 9, is necessary.

Recommended street grades are contained in Exhibit "F".

A protective berm will be required for the upstream side of the boundary lots if the area north and east of Unit 9 is not developed prior to or concurrently with the construction of Unit 9.

If all of the above recommendations and conclusions are followed, this plan of handling drainage should provide the necessary requirements to make this a very satisfactory development.

Respectfully submitted,

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

THIS MICROIMAGE IS THE BEST POSSIBLE
REPRODUCTION DUE TO THE POOR QUALITY
OF THE ORIGINAL DOCUMENT

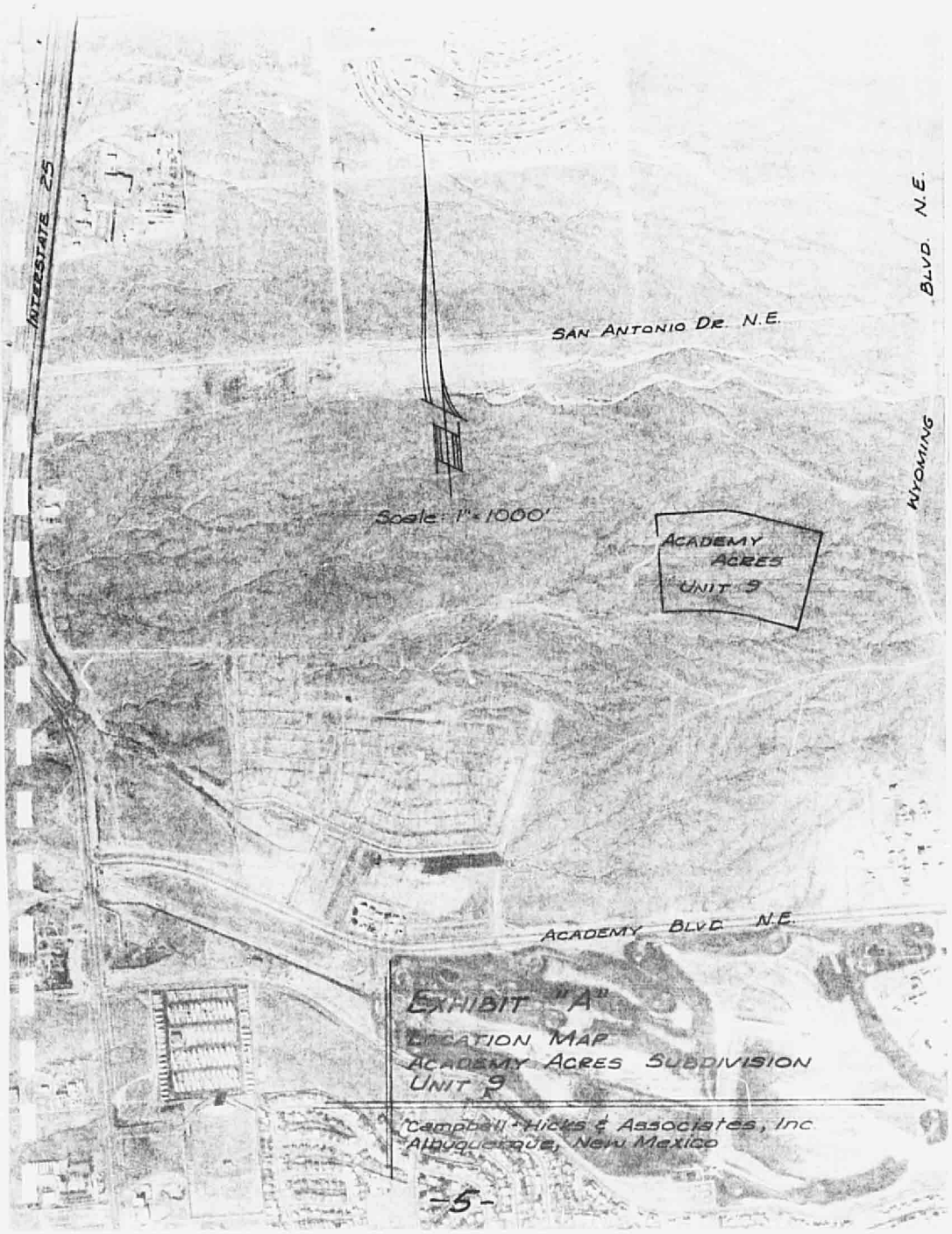

EXHIBIT "A"
LOCATION MAP
ACADEMY ACRES SUBDIVISION
UNIT 9

Campbell + Hicks & Associates, Inc
Albuquerque, New Mexico

EXHIBIT D

SUMMARY OF RUNOFF COMPUTATIONS

Sheet No.	Area Number	Area (in acres)	Expected Runoff (in c.f.s.) Individual	Total
1	1	10	29	
2	2	9	26	
3	3	6	15	

RUNOFF COMPUTATIONS

Sheet No. 1

Job No. AA #9

Drainage Area No. 1

Area = 10 acres

Maximum Overland Flow: L = 135' S = 3.7%

Maximum Channel Flow:

Channel No. 1 L = 1516' S = 2.9%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 12.8 min.

Channel No. 1 Flow:

Velocity= 6.1 ft/sec; Time= $\frac{1516}{6.1 \times 60}$ = 4.1 min.

Channel No. 2 Flow:

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

Channel No. 3 Flow:

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

Total Accumulation Time: T = 16.9 min.

$$I = \frac{189}{T+25} = \frac{189}{41.9} = 4.51$$

Q = CIA = (0.65)(4.51)(10) = 29 c.f.s.

Date: 3-21-72

Comp. by: [illegible]

Checked by: [illegible]

RUNOFF COMPUTATIONS

Sheet No. 2

Job No. AA #9

Drainage Area No. 2

Area = 9 acres

Maximum Overland Flow: L = 140' S = 2.1 %

Maximum Channel Flow:

Channel No. 1 L = 1289' S = 3.1 %

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 14.3 min.

Channel No. 1 Flow:

Velocity= 6.2 ft/sec; Time= $\frac{1289}{6.2 \times 60}$ = 3.5 min.

Channel No. 2 Flow:

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

Channel No. 3 Flow:

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

Total Accumulation Time: T = 17.8 min.

$I = \frac{189}{T+25} = \frac{189}{42.8} = 4.41$

Q = CIA = (0.65)(4.41)(9) = 26 c.f.s.

Date: 3-21-72

Comp. by: ZKP

Checked by: TA

RUNOFF COMPUTATIONS

Sheet No. 3

Job No. AA#9

Drainage Area No. 3

Area = 6 acres

Maximum Overland Flow: L = 140' S = 0.5%

Maximum Channel Flow:

Channel No. 1 L = 1286' S = 2.9%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 20.0 min.

Channel No. 1 Flow:

Velocity= 6.1 ft/sec; Time= $\frac{1286}{6.1 \times 60}$ = 3.5 min.

Channel No. 2 Flow:

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

Channel No. 3 Flow:

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

Total Accumulation Time: T = 23.5 min.

$I = \frac{189}{T+25} = \frac{189}{48.5} = 3.90$ = 9.6 (cfs)

Q = CIA = (0.65)(3.90)(6) = 15 c.f.s.

Date: 3-21-72

Comp. by: [illegible]

Checked by: [illegible]

[illegible] 2.9% carries 86 cfs.

EXHIBIT E

STREET CARRYING CAPACITIES
AT VARIOUS GRADES
IN CFS

n(conc)=.015 n(soil)=.0225 n(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	138	149	160
	2"	8"	82	116	142	164	183	201	217	232

R/W TO R/W
OVERFLOW SECTIONS CAPACITIES

R/W	ST WD	HI CURB DEPTH	.0050	.0100	.0150	.0200	.0250	.0300	.0350	.0400
50'	32'	0.1	14	19	23	27	30	33	36	38
		0.2	43	61	75	86	96	105	114	122
		0.4	137	193	237	273	305	335	361	386

09/21/71. 09.48.14.
PROGRAM NAPIMAN

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 8

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	7.1111	33.3703	.0050	.0707	.2131	.3568	2.6998	17.7719
.0150	7.1111	33.3703	.0100	.1000	.2131	.3568	3.5344	25.1333
.0150	7.1111	33.3703	.0150	.1225	.2131	.3568	4.3287	30.7819
.0150	7.1111	33.3703	.0200	.1414	.2131	.3568	4.9984	35.5439
.0150	7.1111	33.3703	.0250	.1581	.2131	.3568	5.5883	39.7398
.0150	7.1111	33.3703	.0300	.1732	.2131	.3568	6.1217	43.5322
.0150	7.1111	33.3703	.0350	.1871	.2131	.3568	6.6192	47.0201
.0150	7.1111	33.3703	.0400	.2000	.2131	.3568	7.0687	50.2666

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 6

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	10.6667	33.3542	.0050	.0707	.3198	.4676	3.2759	34.9430
.0150	10.6667	33.3542	.0100	.1000	.3198	.4676	4.6398	49.4169
.0150	10.6667	33.3542	.0150	.1225	.3198	.4676	5.6740	60.5231
.0150	10.6667	33.3542	.0200	.1414	.3198	.4676	6.5518	69.8660
.0150	10.6667	33.3542	.0250	.1581	.3198	.4676	7.3252	78.1350
.0150	10.6667	33.3542	.0300	.1732	.3198	.4676	8.0243	85.5926
.0150	10.6667	33.3542	.0350	.1871	.3198	.4676	8.6672	92.4505
.0150	10.6667	33.3542	.0400	.2000	.3198	.4676	9.2657	98.8338

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 4

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	14.2222	33.3426	.0050	.0707	.4265	.5666	3.5694	56.4537
.0150	14.2222	33.3426	.0100	.1000	.4265	.5666	5.6136	79.8375
.0150	14.2222	33.3426	.0150	.1225	.4265	.5666	6.8752	97.7806
.0150	14.2222	33.3426	.0200	.1414	.4265	.5666	7.9388	112.9073
.0150	14.2222	33.3426	.0250	.1581	.4265	.5666	8.8758	126.2348
.0150	14.2222	33.3426	.0300	.1732	.4265	.5666	9.7230	138.2927
.0150	14.2222	33.3426	.0350	.1871	.4265	.5666	10.5020	149.3623
.0150	14.2222	33.3426	.0400	.2000	.4265	.5666	11.2278	159.6751

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 2

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	17.7778	33.3356	.0050	.0707	.5333	.6576	4.6067	81.8978
.0150	17.7778	33.3356	.0100	.1000	.5333	.6576	6.5149	115.8801
.0150	17.7778	33.3356	.0150	.1225	.5333	.6576	7.9791	141.8501
.0150	17.7778	33.3356	.0200	.1414	.5333	.6576	9.2138	163.7944
.0150	17.7778	33.3356	.0250	.1581	.5333	.6576	10.3009	183.1877
.0150	17.7778	33.3356	.0300	.1732	.5333	.6576	11.2841	200.6064
.0150	17.7778	33.3356	.0350	.1871	.5333	.6576	12.1882	216.6796
.0150	17.7778	33.3356	.0400	.2000	.5333	.6576	13.0298	231.6603

FACE

0.640 / 1.192 /

50' R.O.W. 32' F to F

R above fit curb

	n	A	P	S	R	R2/3	S1/2	V	Q=AV
	.0060	4.1000	50.0000	.0050	.0820	.1887	.0707	3.3054	13.5522
	.0060	4.1000	50.0000	.0100	.0820	.1887	.1000	4.6745	19.1658
	.0060	4.1000	50.0000	.0150	.0820	.1887	.1224	5.7251	23.4732
0.1	.0060	4.1000	50.0000	.0200	.0820	.1887	.1414	6.6108	27.1045
	.0060	4.1000	50.0000	.0250	.0820	.1887	.1581	7.3911	30.3038
	.0060	4.1000	50.0000	.0300	.0820	.1887	.1732	8.0966	33.1961
	.0060	4.1000	50.0000	.0350	.0820	.1887	.1870	8.7453	35.8559
	.0060	4.1000	50.0000	.0400	.0820	.1887	.2000	9.3491	38.3316
	.0060	8.2000	50.0040	.0050	.1639	.2995	.0707	5.2467	43.0235
	.0060	8.2000	50.0040	.0100	.1639	.2995	.1000	7.4200	60.8444
	.0060	8.2000	50.0040	.0150	.1639	.2995	.1224	9.0876	74.5189
	.0060	8.2000	50.0040	.0200	.1639	.2995	.1414	10.4935	86.0470
	.0060	8.2000	50.0040	.0250	.1639	.2995	.1581	11.7321	96.2034
0.2	.0060	8.2000	50.0040	.0300	.1639	.2995	.1732	12.8519	105.3856
	.0060	8.2000	50.0040	.0350	.1639	.2995	.1870	13.8816	113.8295
	.0060	8.2000	50.0040	.0400	.1639	.2995	.2000	14.8401	121.6888
	.0060	16.4000	50.0160	.0050	.3278	.4755	.0707	8.3273	136.5692
	.0060	16.4000	50.0160	.0100	.3278	.4755	.1000	11.7767	193.1381
	.0060	16.4000	50.0160	.0150	.3278	.4755	.1224	14.4234	236.5449
	.0060	16.4000	50.0160	.0200	.3278	.4755	.1414	16.6547	273.1385
0.4	.0060	16.4000	50.0160	.0250	.3278	.4755	.1581	18.6206	305.3781
	.0060	16.4000	50.0160	.0300	.3278	.4755	.1732	20.3978	334.5250
	.0060	16.4000	50.0160	.0350	.3278	.4755	.1870	22.0322	361.3283
	.0060	16.4000	50.0160	.0400	.3278	.4755	.2000	23.5534	386.2762

50' R.O.W. 32' F to F

R above the card

	n	A	P	S	R	R2/3	S1/2	V	Q=AV
	.0060	4.1000	50.0000	.0050	.0820	.1887	.0707	3.3054	13.5522
	.0060	4.1000	50.0000	.0100	.0820	.1887	.1000	4.6745	19.1658
	.0060	4.1000	50.0000	.0150	.0820	.1887	.1224	5.7251	23.4732
0.1	.0060	4.1000	50.0000	.0200	.0820	.1887	.1414	6.6108	27.1045
	.0060	4.1000	50.0000	.0250	.0820	.1887	.1581	7.3911	30.3038
	.0060	4.1000	50.0000	.0300	.0820	.1887	.1732	8.0966	33.1961
	.0060	4.1000	50.0000	.0350	.0820	.1887	.1870	8.7453	35.8559
	.0060	4.1000	50.0000	.0400	.0820	.1887	.2000	9.3491	38.3316
	.0060	8.2000	50.0040	.0050	.1639	.2995	.0707	5.2467	43.0235
	.0060	8.2000	50.0040	.0100	.1639	.2995	.1000	7.4200	60.8444
	.0060	8.2000	50.0040	.0150	.1639	.2995	.1224	9.0876	74.5189
	.0060	8.2000	50.0040	.0200	.1639	.2995	.1414	10.4935	86.0470
0.2	.0060	8.2000	50.0040	.0250	.1639	.2995	.1581	11.7321	96.2034
	.0060	8.2000	50.0040	.0300	.1639	.2995	.1732	12.8519	105.3856
	.0060	8.2000	50.0040	.0350	.1639	.2995	.1870	13.8816	113.8295
	.0060	8.2000	50.0040	.0400	.1639	.2995	.2000	14.8401	121.6888
	.0060	16.4000	50.0160	.0050	.3278	.4755	.0707	8.3273	136.5692
	.0060	16.4000	50.0160	.0100	.3278	.4755	.1000	11.7767	193.1381
	.0060	16.4000	50.0160	.0150	.3278	.4755	.1224	14.4234	236.5449
	.0060	16.4000	50.0160	.0200	.3278	.4755	.1414	16.6547	273.1385
0.4	.0060	16.4000	50.0160	.0250	.3278	.4755	.1581	18.6206	305.3781
	.0060	16.4000	50.0160	.0300	.3278	.4755	.1732	20.3978	334.5250
	.0060	16.4000	50.0160	.0350	.3278	.4755	.1870	22.0322	361.3283
	.0060	16.4000	50.0160	.0400	.3278	.4755	.2000	23.5534	386.2762

EXHIBIT G

RECOMMENDED STREET GRADES

STREET DESCRIPTION & LOCATION	MIN. % GRADE	CROWN HEIGTH	PROPERTY LINE ABOVE HIGH CURB
A. East-west street 145' north of Burlison Drive, N.E. between Louisiana Blvd., N.E., and Truchas Drive, N.E. - 50' R/W, 32' face to face	0.5	8"	0.0'
B. East-west street 435' north of Burlison Drive, N.E., between Louisiana Blvd., N.E., and Truchas Drive, N.E. - 50' R/W, 32' face to face	0.5	8"	0.1'
C. Avenida La Costa, N.E., between Louisiana Blvd., N.E., and Truchas Drive, N.E., 50' R/W, 32' face to face	0.5	8"	0.1'

REFERENCES

1. Design by E.E. Seelye, 1945.

2. Handbook of Hydraulics by Horace W. King and Ernest F. Brater, 1963.

3. Miscellaneous Publication No. 204 by David L. Yarnell, U.S. Department of Agriculture, 1961.

4. "Storm Drainage Conditions Relative to the Development of Academy Acres Subdivision, Bernalillo County, New Mexico" by Basil Smith Engineering Company, 1971.

5. "Master Plan of Drainage - City of Albuquerque, New Mexico and Environs" by Gordon Herkenhoff and Associates, 1963.

6. "Plan of Drainage, Bear Canyon Village" by Mossman-Gladden, Inc., undated.