HYDROLOGY K23/D6 4 PLANS

K23/D6

4 Plans

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

January 9, 1980

Mr. Lee Smith
Inter-West Limited
4004 Carlisle N.E.
Suite-N
Albuquerque, N.M. 87107

K23-06

Reference: Liberty View Estates Construction Plans

Dear Mr. Smith:

The following is a list of comments regarding the construction plans for the referenced development:

1. Street plans over box structure do not show the same thing on sheets 2 and 13.

2. How will the properties next to the unlined channel be protected?

3. What happens between the park area and the adjoining properties? In most cases there is a 2 ft. to 3 ft. difference in elevation between the park contours and the property line. No retaining walls are shown, nor how the flows in the park will be conveyed to the two easements. No construction details of the rundown from the park are supplied. The construction plans must show what grading will be done in the park and such grading must be acceptable to the Parks Department before the plans are approved. A method must also be devised to prevent silt sediment from reaching the pavement in the subdivision.

4. The drainage rundown between lots 7 and 8 at the east end of Hope Place is directed toward the driveway of lot 9 on the opposite corner.

5. Can the flow be turned 90 degrees from the rundowns shown between lots 39 and 40 and 18 and 19 on Monte Alto Drive (Locations "V" and "K" on sheet 2) without jumping the opposite curb?

6. Plans indicate "see sheet 16 for details." There is no sheet 16.

7. Are rundowns deep enough to require fencing on the sides? None is indicated. How high are the walls? In all cases a profile must show both the flow line and the proposed top of the ground at the property line.

8. The rundowns into the Tramway Channel have changes of slope in them. Is there protection on the sides of the hydraulic jumps that will occur and the increase in depth? What are the proposed depths of flow? Is 8 inches enough for these jumps? The proposed channels are not of standard design which will make it impossible for Street Maintenance to maintain; there are no construction details on how the rundowns will be tied to the lining of the Tramway Blvd. Channel; details and dimensions for the transitions in the rundowns are also missing.

9. Some of the valley gutters appear to be at right angles to the direction of flow. Won't the water flow on across them?

10. Is the northeast corner of the park a ponding area? Some of the areas along the western border of the park look like they might be ponding areas. How will this affect the adjoining properties?

11. The street grades are very deep. Will the cross flow top the mountable curbs? For instance, at the western end of Knox Place, there is a 4 to 5 ft. drop from the east to the west. The water will have a high velocity. Will this water go over the curb into lots 10, 11 and 12, or at least into the driveways?

Since I was absent at the time of the review and approval of the plat for the subdivision, I did not have a chance to make comments regarding the hydrology presented in the drainage report. I made three different estimates for the flows carried by the Copper Channel, and all three gave a discharge value twice as great as the one in the report.

1. The use of the Rational method yielded a value of 1397 c.f.s.;

2. The use of the area discharge curve prepared by the U.S. Corps of Engineers (see enclosure) yielded the value of 1300 c.f.s.;

3. The use of the Soil Conservation approach (ref. "Peak Rates of Discharge For Small Watersheds) yielded a discharge of 1190 c.f.s. per second.

Given the existing structure crossing the Copper Avenue Channel at Jewel Place, and an anticipated flow velocity of 26.5 f.p.s., a hydraulic jump will undoubtedly occur, subjecting this development to innundation.

Therefore, I believe that it is mandatory that the crossing structure at Jewel Place be redesigned and constructed, simultaneously with the development, in order to supply the necessary protection.

Further, in the absence of the necessary improvements in the Copper Ave. channel (concrete lining), all the lots along the South boundary line of City View Estates, Unit B, should be withheld from development at this time. Incidentally, I am not aware of the existence of a City accepted final grade and configuration for the Copper Channel; is this grade available? if so, it should be supplied with the plans (these show the 1977 design by Bohannan and Houston which may not be applicable.)

Finally, the crossing structure on Monte Alto Drive should be built in such a manner as not to cause discontinuities to the flow: a box culvert as proposed, would very likely cause the supercritical flow to jump. The construction plans do not indicate any construction details for the structure which, according to #3 of "Scope of Work" (p. 2 of 15) should be built with this contract.

I believe that these issues must be resolved before the construction plans are signed and development can began.

Very truly yours,

Bruno Conegliano
Assistant City Engineer/Hydrology

BC/lc
attachments
xc: Orland Sedillo, Parks & Rec.
George Rutherford
Drainage file

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

July 30, 1979

Mr. John Leverton
Leverton Engineering
4022-I Rio Grande N.W.
Albuquerque, New Mexico 87107

Re: City View Estates

K23-06

Dear Mr. Leverton:

The captioned development has been reviewed by staff and the following points need to be addressed:

1) The proposed extension of Monte Alto to Copper Avenue will have to be designed as a clear-span trapazoidal structure across the channel section to eliminate any hydraulic jump from occurring upstream from the crossing.

2) Provisions should be made to divert the flows from Monte Also directly into the channel rather than allow the flows to enter Copper Ave.

3) The proposed rundown from the site into the Tramway Channel will have to be lined to the flowline of the channel. This design will have to be consistant with the Tramway Channel cross-sections and elevations designed by Bohannan-Huston.

4) Details need to be supplied on method of routing offsite flows from the park to the outlet points within the subdivision.

Very truly yours,

Richard S. Heller
Richard S. Heller
City Engineer

RSH/fs

cc - Drainage File

CITY OF ALBUQUERQUE, NEW MEXICO
CITY ENGINEER'S OFFICE

MEMORANDUM - November 18, 1977

TO: V.M. Kimmick
FROM: Bruno Conegliano, Assit. City Engineer - Hydrology R.C.
RE: Copper Channel South of City View Estates

I have received a complaint form Mr. Bill Zimmerman, 14332 Camino Del Rey, (lot 22, Block 2 above ref. subd.) who contends that the channel has been washing off and it is two feet from his block wall fence. He is afraid that the 24" pipe that is discharging from the reservoir right opposite from his property, in combination with the flow from the channel will cause his wall to fail with the next rain.

I have not been able to find out who is responsible for the channel or if it has been formally accepted by the City. I'd like to give him an advice as to how he can obtain relief.

BC/gm

PAUL A. PHILLIPS
ATTORNEY AND COUNSELOR AT LAW
510 SANDIA SAVINGS BUILDING
ALBUQUERQUE, NEW MEXICO 87102
TELEPHONE (505) 765-1000

August 19, 1976

City Engineer's Office
City of Albuquerque
City Hall
Fifth and Marquette NW
Albuquerque, New Mexico

F.I.A. Code #350002

Attn: Mr. Laws

Dear Sir:

I hand you herewith a copy of Bohannan et al's Drainage Report for City View Estates - Unit D, to be transmitted to Washington, D. C. in pursuance of protest letter delivered to your office on August 12, 1976.

Sincerely yours,

Paul A. Phillips

PAP:aa
enc.

LEVERTON ENGINEERING

TELEPHONE 898-2457 OR 344-2462

5629 PARADISE BLVD., N.W.
ALBUQUERQUE, NEW MEXICO 87114

June 9, 1971

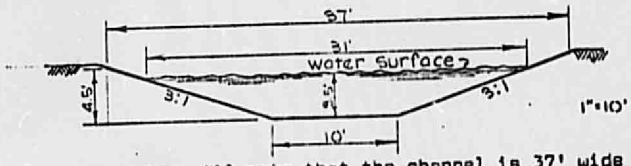
Mr. Coda Roberson
Roberson Construction Co.
Albuquerque, New Mexico

Re: Surface Drainage - Units "B", "C", & "D" of City View Estates

Dear Mr. Roberson;

The channel section sketched below will conduct more than 1010 cfs of storm water flow built on a longitudinal slope of 0.0275 with earth sides and bottom.

If this section were built along the north side of Copper Avenue in the captioned Units of City View Estates the hydraulic capacity would be increased somewhat if built on the existing natural ground slope which is about 0.029. According to the drainage report prepared for you by others the storm water flow in this reach is less than 300 cfs.



You will note that the channel is 37' wide which allows for one foot of freeboard for the stated flow condition. Your subdivision plan shows a 30' drainage easement for this channel with a 60' right of way width for Copper Avenue. I respectfully suggest that the City of Albuquerque be approached to include the northerly 7' of Copper Avenue as part of the drainage easement.

If we can be of further help please let us know.

John G. Leverton
P.E. No. 1874
New Mexico

A DRAINAGE STUDY

FOR CITY VIEW ESTATES, A RESIDENTIAL DEVELOPMENT

BY

CODA ROBERSON CONSTRUCTION CO. INC.

ALBUQUERQUE, NEW MEXICO

REGISTERED PROFESSIONAL ENGINEER AND LAND SURVEYOR
No. 3334
NEW MEXICO
STEWART H. WHITTIER

A-2

J.W. MAY 5 1971

Prepared by
Stewart Whittier & Associates
Albuquerque, New Mexico

I. LOCATION OF PROJECT

The propored subdivision is made of 160 acres and is to be developed in 40 acre tracts as shown on plot plan in appendix. Unit A is planned to be developed at the present time. Units B, C,&D to be developed at a later date. The legal description of the the respective tracts is NE1/4 SW1/4, SW1/4 NE1/4, SE1/4NW1/4, SW1/4NE1/4 all in Section 23, T10N, R4E within the City limits of Albequerque, New Mexico.

II. SCOPE OF WORK

The purpose of this report is 3 fold. The first consideration is to show the magnitude and disposition of the off-site drainage affecting the development. The second is to show the magnitude, routing and type of lot and block grading within the subdivision. Finally that of determining the amount of runoff that will enter the proposed Monte Largo channel and the amount of runoff to be added to other streets downstream from this subdivision.

III GENERAL TOPOGRAPHIC CHARACTERISTICS

The proposed subdivision is in the foothills of the Sandia Mountains. The ground cover consists of grama grass and western wheat grass with very little cactus growth. This type of cover is very effective in preventing erosion. The soil is a silty type mixed with decomposed feldspar alluvium washed down from the mountains. Based on the ground cover and type of soil, a runoff factor of 0.50 is to be used for offsite drainage and a factor of 0.50 within the subdivision. The general slope of the land is to the west at an average of 5-6% at the site and an average of 13.5%(weighted) for offsite conditions.

The subdivision will be, for the most part, developed into a residential development of 4.0 lots per acre.

A-3
J.W. MAY 5 1971

IV. ONSITE DRAINAGE CALCULATIONS

The Rational method , Q=CiA where:

Q=peak runoff in cfs
C=runoff factor of 0.50 for residential areas
i=intensity of rainfall for time of concentration, in/hr
A=area, acres

Intensity-duration curves from Albuquerque Master Plan of Drainage by Gordon Herkenhoff & Associates for a 100 year storm frequency were used.

As nearly as possible, the streets cross the contour or run east and west and follow the natural waterways. This permits grading of lots in a feasible and economical manner and at the same time having as much runoff as possible, retained on the rear portion of the lots. This is to be done by step grading the lots as shown. There are two types of block grading proposed. Number one being that of step grading the lots to retain runoff in the rear portion of the lot and grading the front 25 feet to drain to the street. Number two is that of FHA block grading type 3 with the upper lots draining into a rear ditch and the lower lots draining to the streets.

A systematic routing and estimated runoff quantities are tabulated in appendix and shown as point to point flows on the accompanying plats. The final consideration of Unit B is not included in this study and is deferred until such time as the definite location of the Monte Largo channel is determined. This can be done without affecting the functioning of the other units because it is further west than the other units. However, runoff from Units C & D entering unit B is to be carried to Copper Ave via paved or unpaved streets or channels until such time as Monte Largo channel is completed and at that time Monte Largo will collect all the runoff from this subdivision. For the present, water is to be carried off via ~~Lousesnee~~ Mel Smith and Copper Ave.

A-4

J.W. MAY 5 1971

As additional protection to dwellings within this subdivision it is recommended that lots have a minimum finish grade at building site of 1.5 feet above curb grade with a protective side and rear slope of 2%.

V. OFFSITE DRAINAGE CALCULATIONS

The runoff from the offsite areas have been determined from the USGS Tijeras quadrangle map with a contour interval of 40 feet. In order to show more detail and especially the flow lines as they affect this development, a 5 foot contour map at a scale of 1" = 400 feet is included in the appendix. The drainage areas that affect this subdivision are outlined as A,B,C,D,E,F & G.

Albuquerque Master Plan of Drainage by Gordon Herkenhoff & Associates 100 year frequency duration curves was used to determine the rainfall intensity. The Rational formula, Q=Aci where:

Q=runoff in cfs

A=area in acres

c=runoff (0.50)

i=rainfall intensity in inches per hour.

Results of these calculations are tabulated in appendix figure i and point of entrance to the subdivision are indicated on plat.

A-5

J.W. MAY 5 1971

APPENDIX

A-6

J.W. MAY 5 1971

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

METHOD OF CALCULATION

		OVERLAND FLOW			LITCH FLOW						
		Length	Slope	Tc	Length	Slope	Tc				
	22.2	1000	175	7	–	–	–	7	5.8	–	46.2
	16.2	1000	350	3				3	5.8	–	98.0
	10.0	1700	370	5				5	5.8		83.5
	28.8	3050	400	8				8	5.8		79
	27.2	3050	375	8				8	5.8		25.6
	7.8	1650	125	6				6	5.8		68
	5.8	1600	120	6							

A-8

I.W. MAY 5 1971

ONSITE DRAINAGE, Rational Design, Q=CIA

Designation	Acres (A)	Overland Flow Ht of high pt.	Overland Flow Length of flow	Overland Flow T_c	Ditch Flow Ht of hi pt	Ditch Flow Length of flow	Ditch Flow T_c	Total T_c (min)	Rainfall Intensity I(inches)	Q (cfs)	C(runoff factor)
A-1	.45	2.0	33.5	0.4				0.4	9	2.0	0.5
A-2	.7	12	450	3.4				3.4	8.5	3.0	
A-3	1.6	7.0	113.5	1.0	7.0	370	1.3	2.3	9	7.2	
A-4	1.9	2.0	33.5	0.4	45	950	1.8	2.2	9	8.5	
A-5	10.0	10	113.5	1.0	10	500	1.7	2.7	9	9.0	
A-6	1.5	2	33.5	0.4	35	700	1.5	1.9	9	6.8	
A-7	2.2	2	33.5	0.4	10	600	2.0	2.4	9	9.9	
A-8	1.2	2	113.5	0.4	7	300	1.1	1.5	9	5.4	
A-9	3.4	2	113.5	0.4	50	1140	2.4	2.8	9	15.3	
A-10	2.9	2	113.5	0.4	45	700	3.5	1.8	9	13.0	
A-11	0.6	2	113.5	0.4	20	520	1.3	1.7	9	2.7	
A-12	1.0	5	600	-	-	-	-	6.8	8.2	4.1	
C-1	2.0	5	165	1.5	5	300	3.0	2.7	9	9.0	
C-2	1.8	7	900	7.5	-	-	-	10	8.2	8.1	
C-3	1.9	5	113.5	1.0	10	600	5.2	3.1	7	9.0	
C-4	0.7	7	360	3.0	-	-	-	3.0	9	3.2	
C-5	1.6	5	108	1.0	10	210	1.5	1.6	9	7.2	
C-6	deleted										
C-7	1.3	2	33.5	0.4	35	700	9.0	4.0	9	6.3	
C-8	1.0	5	170	1.5	-	-	-	1.5	9	9.0	
C-9	1.6	5	170	1.5	5	200	1.8	2.2	9	7.2	
C-10	0.7	7	115	1.0	-	-	-	1.0	9	3.2	
C-11	0.5	2	33.5	0.4	12	280	2.1	1.2	9	2.3	
C-12	0.5	2	33.5	0.4	5	280	2.8	1.5	9	2.3	

X-8
MAY 3 1971

SITE DRAINAGE, Rational Design, Q=CiA

Designation	Acres (A)	Overland Flow: Ht of high pt.	Overland Flow: Length of Flow	Overland Flow: T_c	Ditch Flow: Ht of hi pt	Ditch Flow: Length of Flow	Ditch Flow: T_c	Total T_c (min)	Rainfall Intensity i(inches) **	Q (cfs)	C(runoff factor)
C-13	2.3	2	33.5	0.4	30	1400	6.2	2.9	9	11.0	0.50
C-14	0.5	2	33.5	0.4	12	280	2.1	1.2	9	2.3	
C-15	1.8	2	33.5	0.4	40	300	4.5	2.0	9	8.1	
C-16	1.0	5	113.5	1.0	10	250	1.8	1.7	9	3.0	
C-17	0.6	2	33.5	0.4	5	340	3.3	1.7	9	2.7	
C-18	1.3	2	33.5	0.4	35	920	4.6	2.2	9	6.3	
C-19	0.7	2	33.5	0.4	25	550	3.5	1.8	9	3.2	
C-20	0.9	2	33.5	0.4	30	500	2.9	1.5	9	4.0	
C-21	1.5	7	113.5	0.4	5	350	3.5	1.8	9	6.7	
C-22	0.9	5	105	1.0	-	-	-	1.0	9	8.1	
D-1	1.4	5	113.5	1.0	5	310	3.1	2.1	9	6.3	
D-2	0.7	5	120	1.0	-	-	-	1.0	9	3.1	
D-3	1.2	12	170	1.2	3	130	2.0	2.0	9	5.4	
D-4	1.7	10	170	1.2	2	50	1.0	1.6	9	7.6	
D-5	1.5	2	33.5	0.4	50	330	4.1	2.0	9	6.7	
D-6	1.2	20	400	2.5	-	-	-	2.5	9	5.4	
D-7	1.2	2	33.5	0.4	40	720	3.8	1.9	9	5.4	
D-8	1.3	5	115	1.0	10	330	2.6	2.1	9	5.9	
D-9	1.7	15	600	4.5	-	-	-	4.5	9	7.7	
D-10	2.4	10	120	1.0	5	400	4.0	2.6	9	11.0	
D-11	1.0	2	33.5	0.4	22	550	3.6	1.8	9	4.5	
D-12	1.4	2	33.5	0.4	30	600	3.5	1.8	9	6.3	
D-13	0.4	2	33.5	0.4	12	270	1.6	1.0	9	1.8	

A-9
T.W. MAY 5 1971

ONSITE DRAINAGE, Rational Design, Q=CiA

Designation	Acres (A)	Overland Flow Ht of high pt.	Overland Flow Length of flow	Overland Flow T_c	Ditch Flow Ht of hi pt	Ditch Flow Length of flow	Ditch Flow *T_c	Total T_c (min)	**Rainfall Intensity i (inches)	Q (cfs)	C (runoff factor)
D-14	0.9	2	33.5	0.4	20	530	3.5	1.8	9	4.0	0.50
D-15	0.7	2	33.5	0.4	5	400	4.1	2.0	9	3.1	"
D-16	0.9	2	33.5	0.4	30	600	3.5	1.8	9	4.0	"

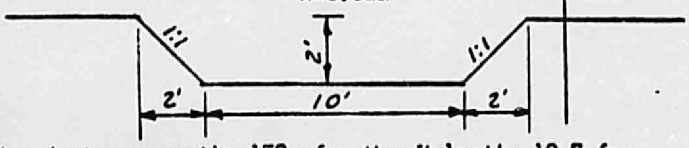
*For asphalt ditch time, multiply T_c by 0.4

**Bureau of Public Roads recommends time of concentration (T_c) to be no less than 5 min, thus curve on pg 90, Handbook of Steel Drainage yeilds min. intensity (i) of 9 in/hr.

A-10

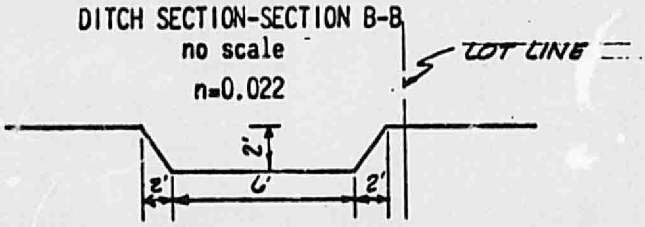
J.W. MAY 5 1971

DITCH SECTION-SECTION A-A
no scale
n=0.022



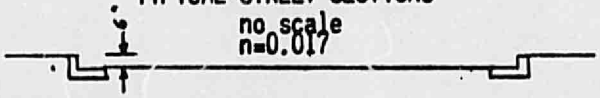
Max design capacity=152 cfs, Max Velocity=12.7 fps
Avg slope=5% E-W, 1.4% N-S

DITCH SECTION-SECTION B-B
no scale
n=0.022



Max design capacity=94cfs, Max Velocity=11.8 fps, S=5%
Min design capacity=50cfs, Min Velocity=6.2 fps, S=1.4%

TYPICAL STREET SECTIONS
no scale
n=0.017

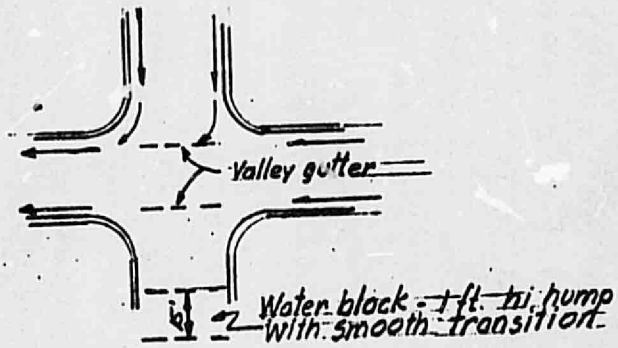


48' street (Copper Ax)
Max design capacity= 303cfs, Max Vel=12.1fps, S=5%
33' street
Max design capacity=200cfs, Max Vel=12.1fps, S=5%
Min design capacity=89cfs , Min Vel=5.4fps, , S=1.4%

Note: All open channel carrying capacities calculated from Manning equation, $V=1.486/n \times R^{2/3} \times S^{1/2}$ and $Q=aV$ where: V=fps, Q=cfs, n=roughness factor, R=hydraulic radius, S=slope, a=cross section area.

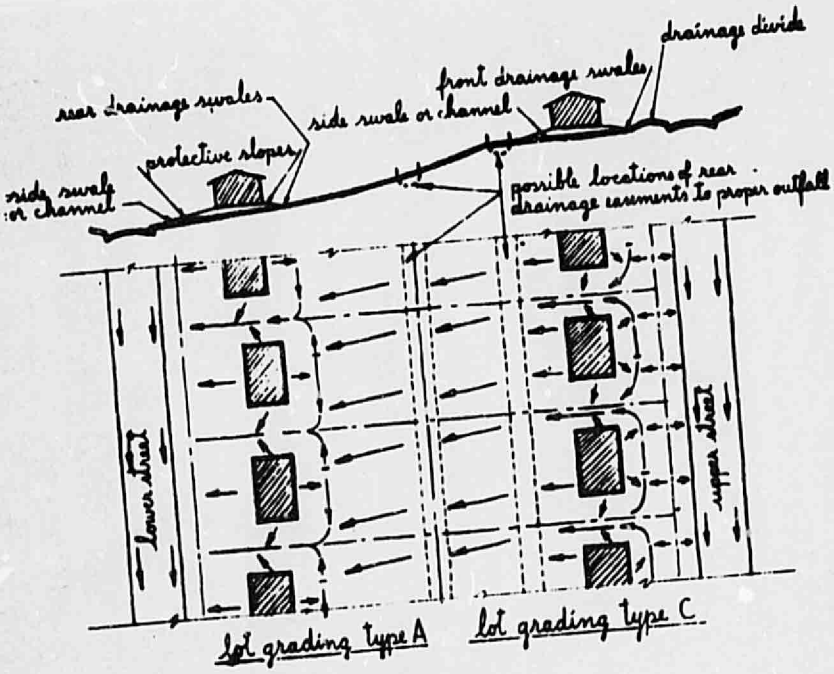
A-11.
J.W. MAY 5 1971

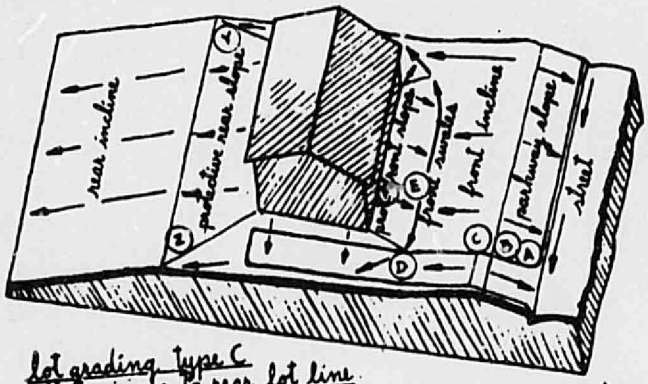
TYPICAL SECTION OF STEP GRADING OF LOTS-POND IN REAR
no scale



TYPICAL DETAIL OF VALLEY GUTTER & WATER BLOCKS
no scale

A-12
J.W. MAY 5 1971





lot grading type C
all drainage to rear lot line

(90)

example: block grading type 3: steep cross-slope 1202

243

A-13.

J.W. MAY 5 1971

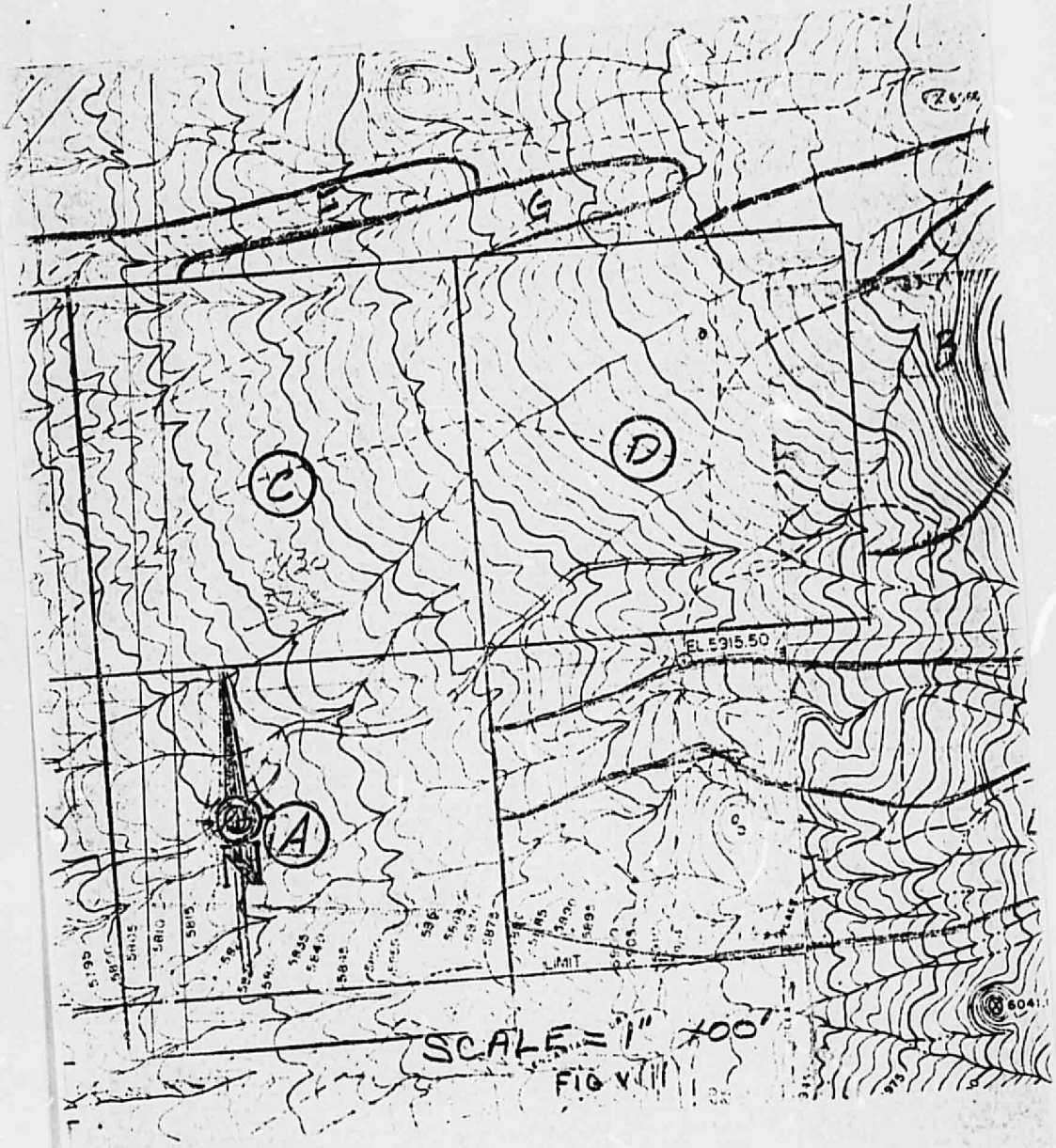
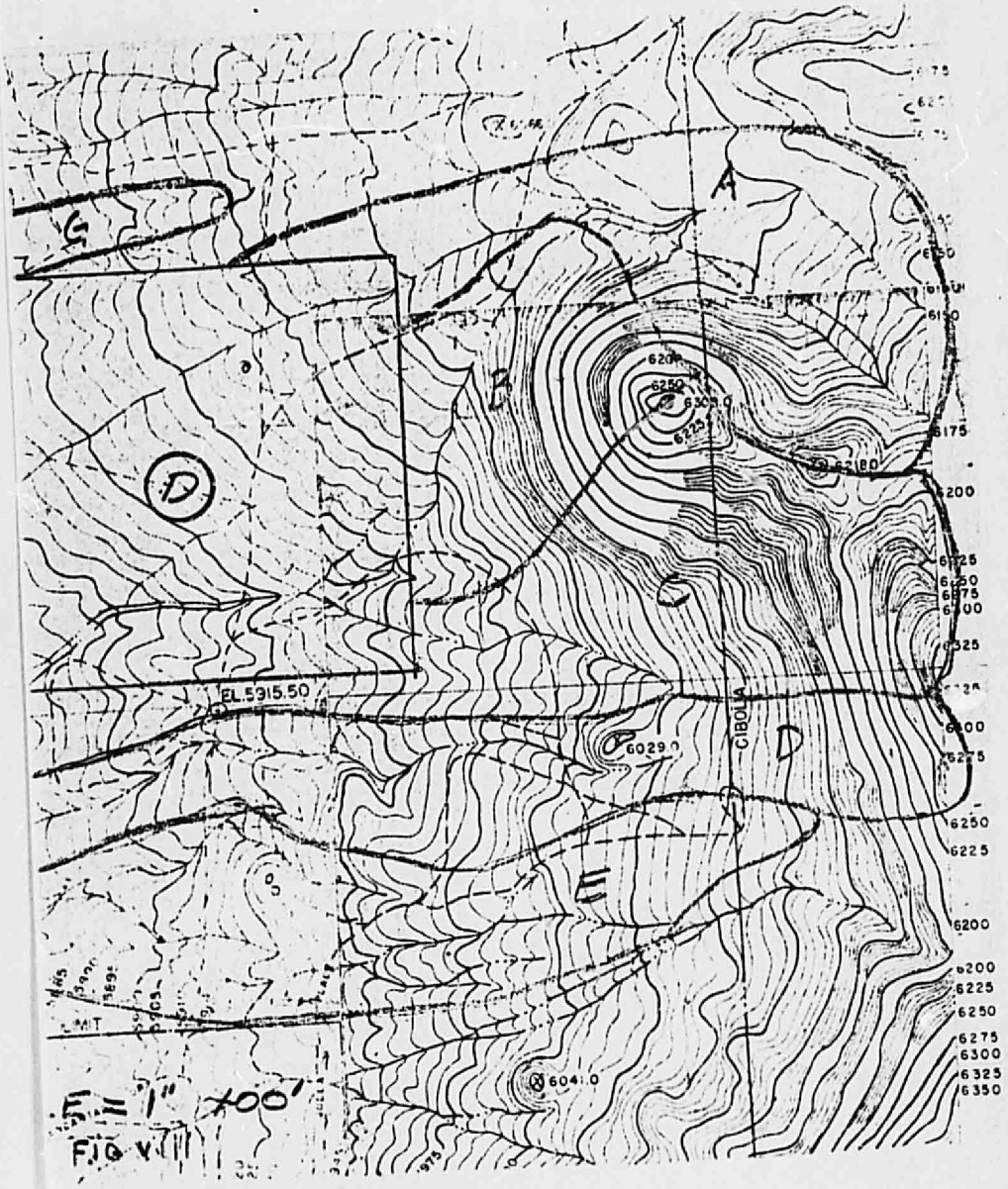
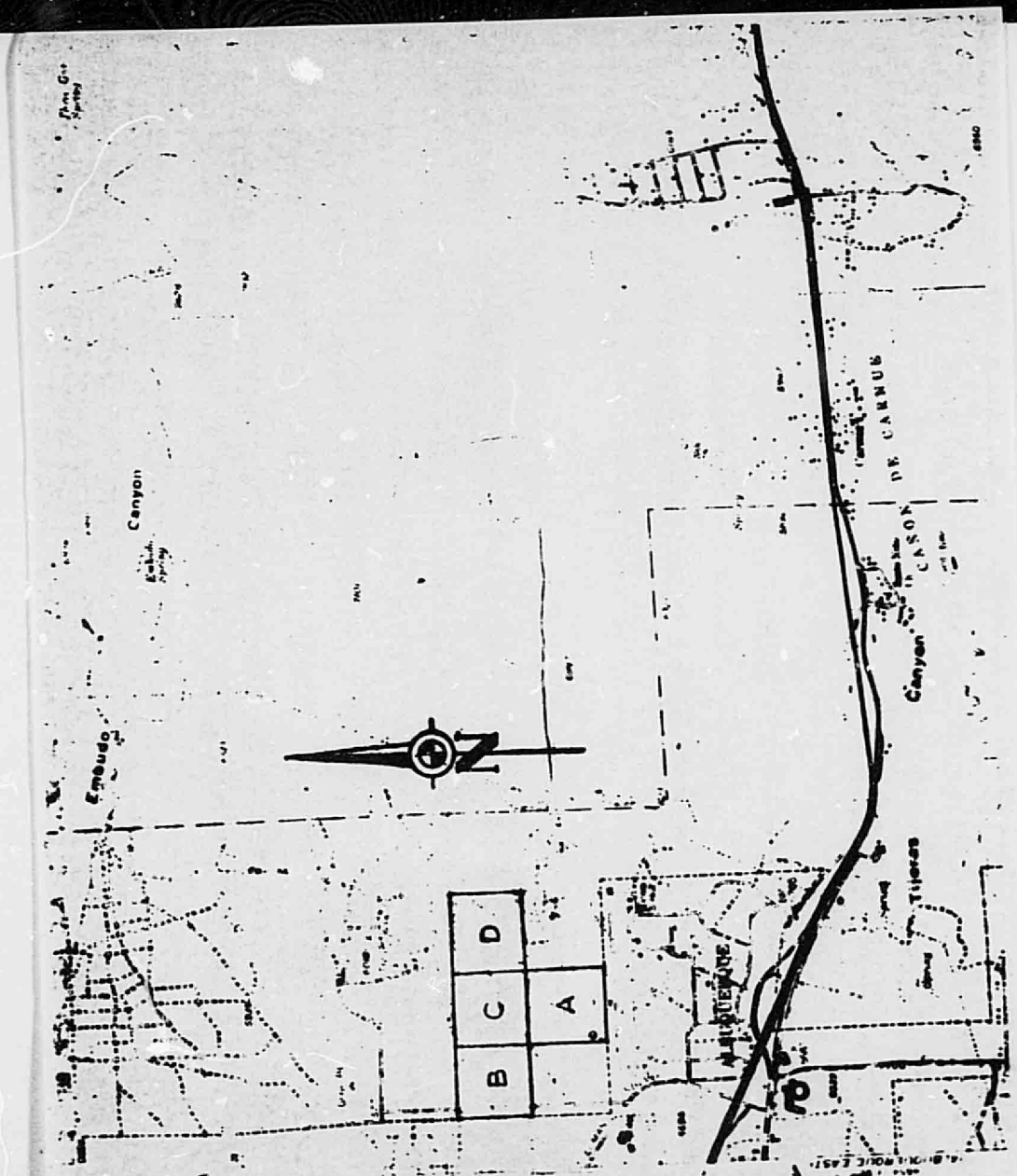


FIG V


A
B
C
D
E
G
EL.5915.50
CIBOLA
6029.0
6041.0
6180
6200
6225
6250
6275
6300
6325
6350
E = 1" = 100'
FIG VIII



LOCATION MAP 2"=1 mile J.W. MAY 5 1971

A-15

IX

LEVERTON ENGINEERING

TELEPHONE 888-2457 OR 344-2462

5629 PARADISE BLVD., N.W.
ALBUQUERQUE, NEW MEXICO 87114

June 9, 1971

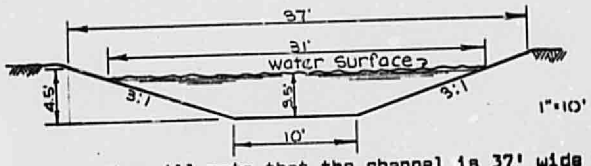
Mr. Cody Roberson
Roberson Construction Co.
Albuquerque, New Mexico

Re: Surface Drainage - Units "B", "C", & "D" of City View Estates

Dear Mr. Roberson;

The channel section sketched below will conduct more than 1010 cfs of storm water flow built on a longitudinal slope of 0.0275 with earth sides and bottom.

If this section were built along the north side of Copper Avenue in the captioned Units of City View Estates the hydraulic capacity would be increased somewhat if built on the existing natural ground slope which is about 0.029. According to the drainage report prepared for you by others the storm water flow in this reach is less than 300 cfs.



You will note that the channel is 37' wide which allows for one foot of freeboard for the stated flow condition. Your subdivision plan shows a 30' drainage easement for this channel with a 60' right of way width for Copper Avenue. I respectfully suggest that the City of Albuquerque be approached to include the northerly 7' of Copper Avenue as part of the drainage easement.

If we can be of further help please let us know.

John G. Leverton
P.E. No. 1874
New Mexico

LEVERTON ENGINEERING

TELEPHONE 898-2457 OR 344-2462

5629 PARADISE BLVD., N.W.
ALBUQUERQUE, NEW MEXICO 87114

June 9, 1971

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Albuquerque, New Mexico

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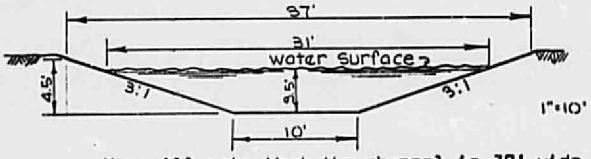

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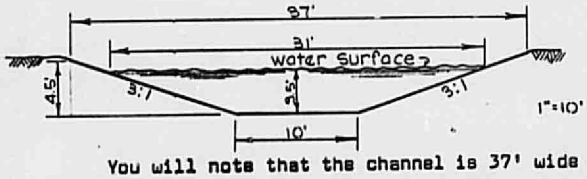

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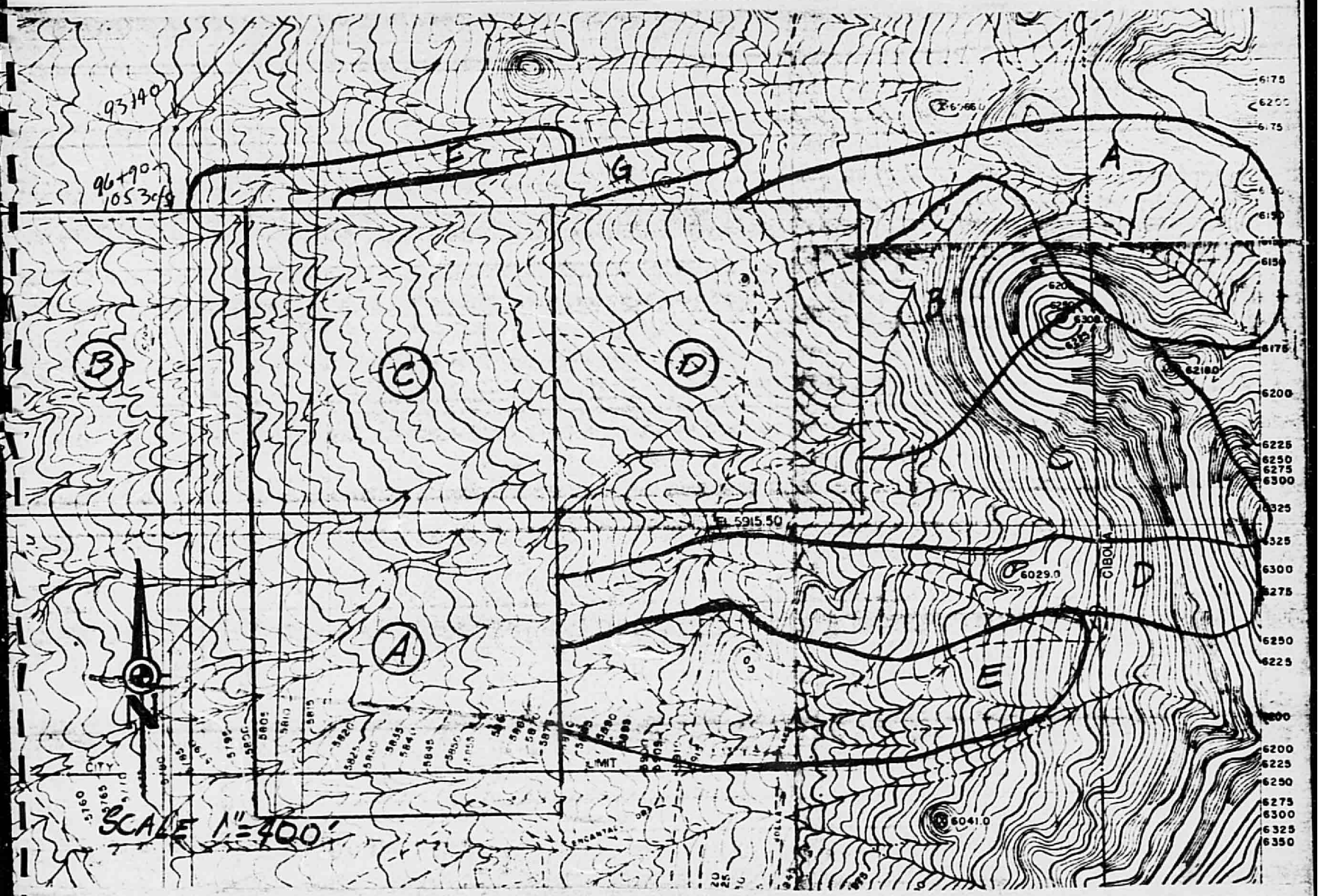

93+40
96+90
1053cfs
F
G
A
B
C
D
E
El. 5915.50
6029.0
6041.0
6218.0
CIBOLA
CITY
LIMIT
N
SCALE 1"=400'

A DRAINAGE STUDY

FOR CITY VIEW ESTATES, A RESIDENTIAL DEVELOPMENT

BY

CODA ROBERSON CONSTRUCTION CO. INC.

ALBUQUERQUE, NEW MEXICO

STEWART WHITTIER & ASSOCIATES

A DRAINAGE STUDY

FOR CITY VIEW ESTATES, A RESIDENTIAL DEVELOPMENT

BY

CODA ROBERSON CONSTRUCTION CO. INC.

ALBUQUERQUE, NEW MEXICO

APPROVAL

This report has been submitted to the City Engineering Department and found to be in accordance with the overall planning and design standards of the City of Albuquerque and is hereby approved.

City Engineer

REGISTERED PROFESSIONAL ENGINEER AND LAND SURVEYOR
No. 3334
NEW MEXICO
STEWART H. WHITTIER

Prepared by
Stewart Whittier & Associates
Albuquerque, New Mexico

I. Location of Project

The proposed subdivision is made of 160 acres and is to be developed in 40 acre tracts as shown on plot plan as is found in appendix. Unit A is planned to be developed at the present time. Units B, C & D to be developed at a later date. The legal description of the respective tracts is NE 1/4 SW1/4, SW1/4 NE1/4, SE1/4 NW1/4, SW1/4 NE1/4 all in Section 23, T10N, R4E within the City limits of Albuquerque, New Mexico.

II. Scope of Work

The purpose of this report is 3 fold. The first consideration is to show the magnitude and disposition of the offsite drainage affecting the proposed subdivision. The second consideration is to show the magnitude, routing and type of lot and block grading within the subdivision. The final consideration is that of determining the amount of runoff that will enter the proposed Monte Largo Drainage Channel (to be built in 1971 or 1972) and the amount of runoff to be added to other streets downstream from this subdivision.

III. General Topographic Characteristics

The proposed subdivision is in the foothills of the Sandia Mountains. The ground cover consists of grama and western wheat grass with very little cactus growth. This type of cover is very effective in preventing erosion. The soil is a silty type mixed with decomposed feldspar alluvium washed down from the mountains. Based on the ground cover and type of soil, a runoff factor of 0.35 would be appropiate but to build in additional safety, a factor or 0.50 will be used in design calculations. The general slope of the land is to the west at an average of 5-6% for the location of the subdivision and 8-10% for that of the offsite drainage areas further east towards the mountains.

The subdivision will be, for the most part, developed into a residential development with approximately 3.5 lots per acre. The general layout is to have the streets cross the contour at 90°, or nearly so and step grade the lots in order to retain as much runoff on the lots as possible. Obviously, this cannot be accomplished entirely. In this case, the lots are to be graded according to FHA Block Grading Type2, Lot grading Types A & B. Block and lot grading details are to be found in appendix.

IV. Design Calculations

The Rational method of calculating runoff is used in the following tabulation of quantities. Plats showing designated drainage areas for offsite and onsite drainage are to be found in appendix. Contour maps were obtained from those in use by the City of Albuquerque Planning and Engineering offices as prepared by the Sandia Conservancy District. The contour interval is five feet and the scale is one inch equals four hundred feet. The rational formula, Q=CiA, where

Q= peak runoff in cfs
C= runoff factor, 0.50 used throughout
i= average intensity of rainfall, in inches per hour(for the selected frequency and for the durattion equal to the time of concentration.
A= drainage area, in acres, tributary to the point under design.

A design storm of 50 year frequency is used throughout in the accompanying calculations. "Rainfall Frequency Atlas of the United States" Technical paper #40, U S Weather Bureau was used to determine a 2 inch storm for Albuquerque,(50yr-2hr). Runoff within the subdivision will either utilize the drainage easements as shown or the streets with details as shown in appendix.

V. Offiste Drainage

The runoff from the slopes to the east that will affect

this development have been determined from the aforementioned contour maps as well as a physical inspection of the site. No change in the natural water courses of the offsite runoff is necessary and the drainage areas and the respective runoff quantities are to be found in the appendix. The point where offsite runoff will enter the subdivision may have to be shaped or improved by means of a dike to insure point of entrance and this is indicated on accompanying drainage area contour maps found in appendix.

The runoff from areas A, B & C is to enter Unit D as shown and be carried south in a 15 foot drainage easement via an open ditch as detailed in appendix to Copper Ave. then flow west on Copper. This runoff will enter the storm drain system along Copper near Juan Tabo until such time as the Monte Largo Channel is built. Runoff form Areas F & G is to enter Unit C into an open ditch along the north side of Unit C and flow west until it reaches the easement and ditch which flows south to Camino Del Norte. The runoff from Areas D & E is to enter Unit A as shown into an open ditch within a 10 foot easement to Jewel Loop and Lawerence Drive, respectively. There is an arroyo that will drain into the Cenaroca Subdivision, already dedicated.

All of the offsite drainage affecting the proposed subdivision has been routed through the subdivision via easements and streets and accompanying typical sections indicate their effectiveness.

VI. ONSITE DRAINAGE

As nearly as possible, the streets cross the contour or run east and west and follow the natural waterways. This permits grading of lots in a feasible and economical manner and at the same time having as much runoff as possible retained on the rear

portion of the lots. This is to be done by step grading the lots as shown. There are 2 types of Block grading proposed. Number one being that of step grading the lots to retain runoff in the rear portion of the lot and grading the front 25 feet to drain to the street. Number two is that of FHA block grading type 3 with the upper lots draining into a rear drainage ditch and the lower lots draining to the street.

A systematic routing and estimated runoff quantities are tabulated in appendix and shown as point to point flows on the accompanying plats, based on the "Rational approach" design. The final consideration of Unit B is not included in this study and is deferred until such time as the definite location of the Monte Largo Channel is determined. This can be done without affecting the functioning of the other units because it is further west than the other units. However, runoff from units C & D entering unit B is to be carried to Copper Av via of paved or unpaved streets or channels until such time as Monte Largo channel is completed and at that time Monte Largo will collect all the runoff from this subdivision.

As additional protection to dwellings within this subdivision it is recommended that lots regardless of grading type have a minimum finish grade at building site 1.5 feet above curb grade with a protective side and rear slope of 2%.

APPENDIX

OFFSITE DRAINAGE CALCULATIONS

Designation	Acres A	Ht of hight pt.	Leng. of flow (ft)	Time of con. *T_c (min)	Rainfall intensity (in/hr)	Q cfs	C Runoff factor
A	26.2	150	2000	14	6.5	60.0	0.35
B	16.1	95	1100	9	8.0	45.0	
C	23.8	370	1700	9	8.0	90.0	
D	28.8	400	3050	17.6	6.0	53.0	
E	44.0	375	3050	17.0	6.1	59.0	
F	7.8	125	1650	12.4	7.5	20.4	
G	5.8	120	1000	12.2	7.6	15.4	

*for grassed overland flow multiply T_c by 2.

See map heading

ONSITE DRAINAGE, Rational Design, Q=CiA

Designation	Acres (A)	Overland Flow Ht of high pt.	Overland Flow Length of Flow	Overland Flow T_c	Ditch Flow Ht of hi pt	Ditch Flow Length of Flow	Ditch Flow T_c	Total T_c (min)	Rainfall Intensity i(inches)	Q (cfs)	C(runoff factor)
A-1	.45	2.0	33.5	0.4				0.4	9	2.0	0.5
A-2	.7	12	450	3.4				3.4	8.5	3.0	
A-3	1.6	7.0	113.5	1.0	7.0	370	1.3	2.3	9	7.2	
A-4	1.9	2.0	33.5	0.4	45	950	1.8	2.2	9	8.5	
A-5	10.0	10	113.5	1.0	10	500	1.7	2.7	9	9.0	
A-6	1.5	2	33.5	0.4	35	700	1.5	1.9	9	6.8	
A-7	2.2	2	33.5	0.4	10	600	2.0	2.4	9	9.9	
A-8	1.2	2	113.5	0.4	7	300	1.1	1.5	9	5.4	
A-9	3.4	2	113.5	0.4	50	1140	2.4	2.8	9	15.3	
A-10	2.9	2	113.5	0.4	45	700	3.5	1.8	9	13.0	
A-11	0.6	2	113.5	0.4	20	520	1.3	1.7	9	2.7	
A-12	1.0	5	600	-	-	-	-	6.8	8.2	4.1	
C-1	2.0	5	165	1.5	5	300	3.0	2.7	9	9.0	
C-2	1.8	7	900	7.5	-	-	-	10	8.2	8.1	
C-3	1.9	5	113.5	1.0	10	600	5.2	3.1	7	9.0	
C-4	0.7	7	360	3.0	-	-	-	3.0	9	3.2	
C-5	1.6	5	108	1.0	10	210	1.5	1.6	9	7.2	
C-6	deleted										
C-7	1.3	2	33.5	0.4	35	700	9.0	4.0	9	6.3	
C-8	1.0	5	170	1.5	-	-	-	1.5	9	9.0	
C-9	1.6	5	170	1.5	5	200	1.8	2.2	9	7.2	
C-10	0.7	7	115	1.0	-	-	-	1.0	9	3.2	
C-11	0.5	2	33.5	0.4	12	280	2.1	1.2	9	2.3	
C-12	0.5	2	33.5	0.4	5	280	2.8	1.5	9	2.3	

NSITE DRAINAGE, Rational Design, Q=CiA

esigna tion	Acres (A)	Overland Flow Ht of high pt.	Overland Flow Length of flow	Overland Flow T_c	Ditch Flow Ht of hi pt	Ditch Flow Length of flow	Ditch Flow T_c	Total T_c (min) *	Rainfall Intensity i(inches) **	Q (cfs)	C(runoff factor)
											0.50
C-13	2.3	2	33.5	0.4	30	1400	6.2	2.9	9	11.0	
C-14	0.5	2	33.5	0.4	12	280	2.1	1.2	9	2.3	
C-15	1.8	2	33.5	0.4	40	300	4.5	2.0	9	8.1	
C-16	1.0	5	113.5	1.0	10	250	1.8	1.7	9	9.0	
C-17	0.6	2	33.5	0.4	5	340	3.3	1.7	9	2.7	
C-18	1.3	2	33.5	0.4	35	820	4.6	2.2	9	6.3	
C-19	0.7	2	33.5	0.4	25	550	3.5	1.8	9	3.2	
C-20	0.9	2	33.5	0.4	30	500	2.8	1.5	9	4.0	
C-21	1.5	7	113.5	0.4	5	350	3.5	1.8	9	6.7	
C-22	0.9	5	105	1.0	-	-	-	1.0	9	8.1	
D-1	1.4	5	113.5	1.0	5	310	3.1	2.1	9	6.3	
D-2	0.7	5	120	1.0	-	-	-	1.0	9	3.1	
D-3	1.2	12	170	1.2	3	180	2.0	2.0	9	5.4	
D-4	1.7	10	170	1.2	2	50	1.0	1.6	9	7.6	
D-5	1.5	2	33.5	0.4	50	330	4.1	2.0	9	6.7	
D-6	1.2	20	400	2.5	-	-	-	2.5	9	5.4	
D-7	1.2	2	33.5	0.4	40	720	3.8	1.9	9	5.4	
D-8	1.3	5	115	1.0	10	330	2.6	2.1	9	5.9	
D-9	1.7	15	600	4.5	-	-	-	4.5	9	7.7	
D-10	2.4	10	120	1.0	5	400	4.0	2.6	9	11.0	
D-11	1.0	2	33.5	0.4	22	550	3.6	1.8	9	4.5	
D-12	1.4	2	33.5	0.4	30	600	3.5	1.8	9	6.3	
D-13	0.4	2	33.5	0.4	12	270	1.6	1.0	9	1.8	

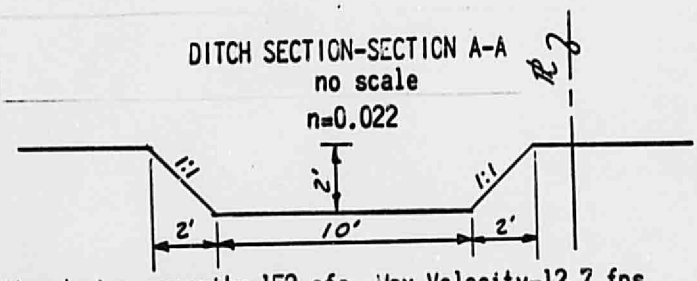
NSITE DRAINAGE, Rational Design, Q=CiA

Designation	Acres (A)	Overland Flow Ht of high pt.	Overland Flow Length of Flow	T_c	Ditch Flow Ht of hi pt	Ditch Flow Length of Flow	*T_c	Total T_c (min)	**Rainfall Intensity i(inches)	Q (cfs)	C(runoff factor)
D-14	0.9	2	33.5	0.4	20	530	3.5	1.8	9	4.0	0.50
D-15	0.7	2	33.5	0.4	5	400	4.1	2.0	9	3.1	"
D-16	0.9	2	33.5	0.4	30	600	3.5	1.8	9	4.0	"

*For asphalt ditch time, multiply T_c by 0.4

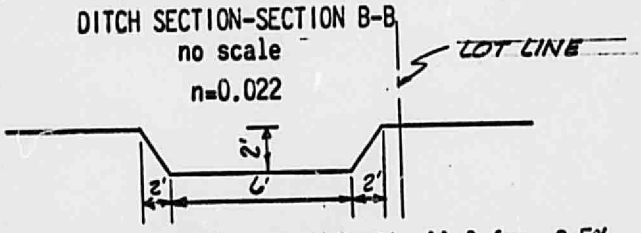
**Bureau of Public Roads recommends time of concentration (T_c) to be no less than 5 min, thus curve on pg 90, Handbook of Steel Drainage yeilds min. intensity (i) of 9 in/hr.

DITCH SECTION-SECTION A-A
no scale
n=0.022



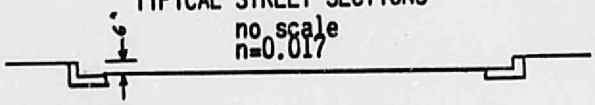
Max design capacity=152 cfs, Max Velocity=12.7 fps
Avg slope=5% E-W, 1.4% N-S

DITCH SECTION-SECTION B-B
no scale
n=0.022



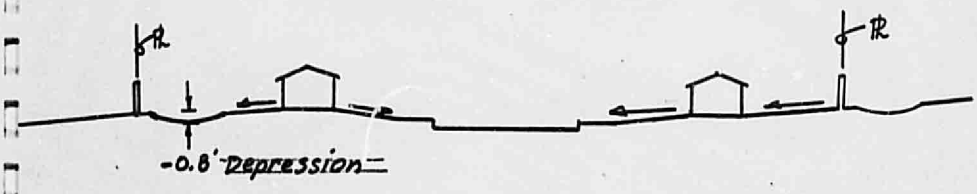
Max design capacity=94cfs, Max Velocity=11.8 fps, S=5%
Min design capacity=50cfs, Min Velocity=6.2 fps, S=1.4%

TYPICAL STREET SECTIONS
no scale
n=0.017

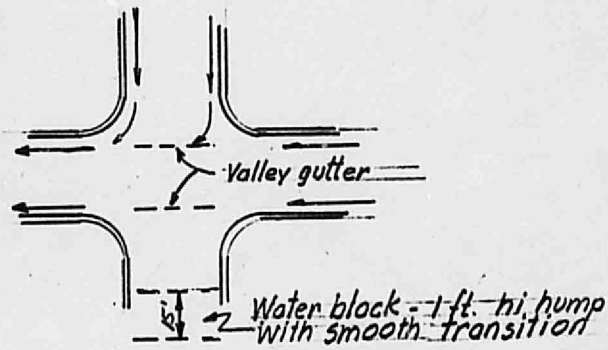


48' street (Copper Av)
Max design capacity= 303cfs, Max Vel=12.1fps, S=5%
33' street
Max design capacity=200cfs, Max Vel=12.1fps, S=5%
Min design capacity=89cfs , Min Vel=5.4fps , S=1.4%

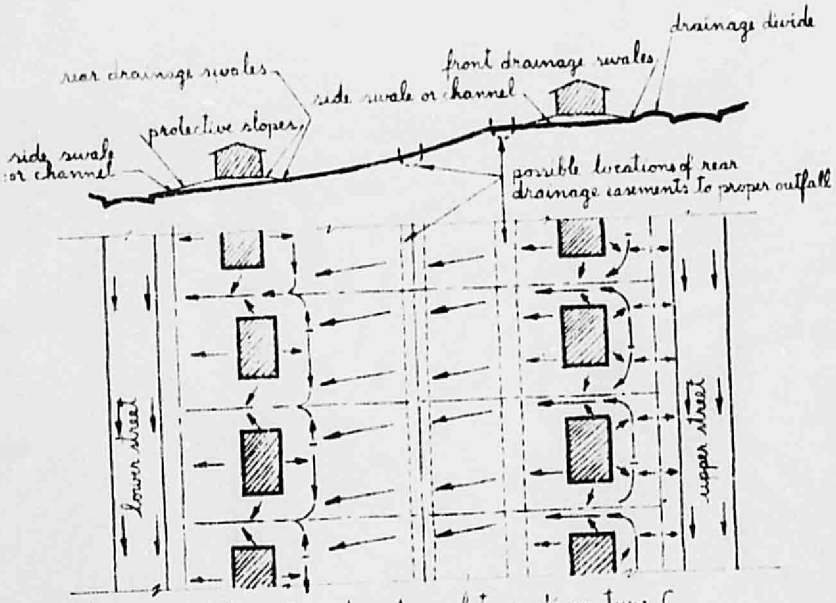
Note: All open channel carrying capacities calculated from Manning equation, $V=1.486/n \times R^{2/3} \times S^{1/2}$ and $Q=aV$ where: V=fps, Q=cfs, n=roughness factor, R=hydraulic radius, S=slope, a=cross section area.



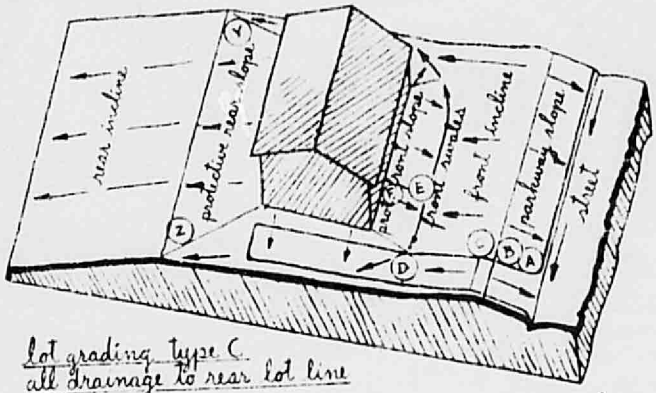
TYPICAL SECTION OF STEP GRADING OF LOTS-POND IN REAR
no scale



TYPICAL DETAIL OF VALLEY GUTTER & WATER BLOCKS
no scale



lot grading type A lot grading type C



lot grading type C
all drainage to rear lot line

(90)

example: block grading type 3: steep cross-slope 1202

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3. Design of Roadside Drainage Channels
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