J23/D

BOHANNAN-HUSTON INC.

4126 CARLISLE BLVD. N.E. ALBUQUERQUE, NEW MEXICO 87107 505 881-2000
UNIVERSITY PLAZA, 330 GARFIELD SUITE 104 SANTA FE, N.M. 87509 505 988-7671
6713 VISCOUNT BLVD. EL PASO, TEXAS 79925 915 778-4491

November 2, 1984

Mr. Billy Goolsby
Staff Hydrologist
City Engineering
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

Re: Non-Standard Drivepads on Lomas Boulevard Adjacent to the Sandia Manor Water Facilities in Embudo Hills, Project 2007

Dear Billy:

This letter is sent in reference to our discussion at the Design Review Committee on Wednesday, October 31, 1984, concerning the referenced project.

Due to the difference in elevation between the Lomas street grades and the existing driveway at the Sandia Manor site, building standard drivepads adjacent to Lomas Boulevard, and tying the proposed driveway down to existing ground at the existing gate would create a ramp breakover angle that would not be navigable for most vehicles. Therefore, we propose installation of drivepads that would rise only 4" up from the gutter flowline to a point 4' from the back of the curb. To the southerly drivepad, an asphalt paved driveway would slope down to the right-of-way, and no asphalt would be provided at the northerly access point. When sidewalks are installed at a later date, their vertical alignment would be altered to allow them to dip down to meet the proposed drivepads.

Enclosed is a sheet showing the hydraulic calculations done to prove that the street section with a 4" rise at the drivepad could contain the flow expected.

If you have any questions or comments, please call.

Sincerely,

Kerry L. Davis

Kerry L. Davis
Design Engineer

Enclosure

cc: Mr. Archie Martinez

KLD/cs
Job No. 4 259 1

DRAINAGE BASIN - CAMINO DE LA SIERRA

ASSUME ONE TIER LOTS EAST OF STREET = 150'
+ FULL R/W WIDTH - CAMINO DE LA SIERRA = 50'
200' WIDE

13+44 - 23+00 = 656' LONG

TOTAL DRAINAGE AREA = $\frac{(200)(656)}{43560}$ = 3.0 ACRES

ASSUME COMPLETELY IMPERVIOUS C FACTOR = 0.90

$Q = CIA = (0.90)(2.5")(2.3)(3.0) = 15.5$ CFS

X

MANNINGS N=.0170 SLOPE =.0590

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	0.67	3	16.00	0.32	5	32.00	0.67
2	0.10	0.00	4	31.90	0.00			

WSEL FT.	DEPTH INC	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID PLUS OBSTRUCTIONS
0.05	0.05	0.12	0.22	5.07	1.79	4.98
0.10	0.10	0.50	1.42	10.14	2.85	9.97
0.15	0.15	1.12	4.19	15.21	3.73	14.95
0.20	0.20	1.99	9.01	20.28	4.52	19.93
0.25	0.25	3.11	16.34	25.35	5.25	24.92
0.30	0.30	4.49	26.58	30.43	5.93	29.90
0.35	0.35	6.06	41.99	32.51	6.93	31.90
0.40	0.40	7.66	61.85	32.62	8.08	31.92
0.45	0.45	9.25	84.64	32.72	9.15	31.93
0.50	0.50	10.85	110.14	32.82	10.15	31.95
0.55	0.55	12.45	138.19	32.92	11.10	31.96
0.60	0.60	14.05	168.68	33.02	12.01	31.98
0.65	0.65	15.65	201.48	33.12	12.88	31.99
0.67	0.67	16.29	215.22	33.16	13.22	32.00

PROJECT NAME EMBUDO HILLS SHEET 1 OF 1
PROJECT NO. 2007 - 42591 BY ICLD DATE 11/1/07
SUBJECT LOMAS BLVD REDESIGN CH'D _____ DATE _____

J23-29

MSM/SP Group

2601 Wyoming Boulevard, NE
Albuquerque, NM 87112
(505) 292-1936

A Member of the
SP Group of Professional
Services Companies

- Engineering
- Surveying
- Energy Services

December 13, 1983

Mr. Fred Aguirre
Civil Engineer/Hydrology
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico 87192

Re: Embudo Hills Drainage Exhibit (American Service Corp. Portion) Map No. J-23 - 29

Dear Fred:

Transmitted herewith are two copies of the drainage exhibit for the subject project for review and approval. This exhibit is in general compliance with the approved Drainage Master Plan for Embudo Hills prepared by Bohannan-Huston, Inc., in March 1981. As was agreed upon at the meeting of October 31, 1983, attended by yourself, representatives of Bohannan-Huston (Marlin Larsen, Dave Woods, Brian Burnett, Dave Milliken) and Fred Haas of MSM/SP Group, an additional drainage report to address only the on-site flows within this portion of Embudo Hills was not required. Instead a **Grading/Drainage** Exhibit would be submitted which addresses the quantification and location of these on-site flows and thereby shows general compliance with the approved Drainage Master Plan. **All drainage improvements to serve the site** (storm drains, off-site diversion, etc.) are to be addressed and designed by Bohannan-Huston. In this exhibit we merely reference these improvements as they are an integral part of the overall drainage picture. Bohannan-Huston has prepared a Construction Phasing Plan which was heard and approved by the D.R.B. on November 29, 1983 (D.R.B. 83-468).

Off-site Flows

Off-site flows are addressed in the Bohannan-Huston report and will enter the site at the two locations shown on the Drainage Exhibit. Diversions to direct the runoff to those locations, again, are being addressed by Bohannan-Huston.

On-site Flows

On-site flow calculations are attached. These flows are lower than the on-site flows from the Drainage Master Plan. They were calculated using current City of Albuquerque procedures. A reduced planned density, resulting in reduced impervious area, also contributed to lower computed flows. All runoff will be contained in the streets except in the locations shown on the drainage exhibit where a storm sewer is proposed. The size and exact locations of the sewer and inlets are to be addressed by Bohannan-Huston as part of their design.

MSM/SP Group

Comparison of the Drainage Exhibit with the Master Drainage Plan

The approved Drainage Master Plan for Embudo Hills proposes the following drainage scheme.

A) Off-site flows are ultimately intercepted by the Upper Lomas Drainage Channel or diverted to entry points along the boundary of the site and discharged into the proposed internal storm sewer system.

B) On-site flows are directed to the streets. Any excess runoff beyond the acceptable capacity of the street will be collected by the internal storm drain system. Per the plan, this system consists of a storm sewer which will ultimately connect the Lomas desilting basin with the northeast boundary of the site. A leg from the midpoint of the system to the east is also proposed.

The drainage exhibit is in general compliance with the scheme proposed by the Master Plan. Easements will be provided to convey the off-site flows to the internal storm drain system at the entry points recommended by the Master Plan. On-site flows will be collected in the streets as required. Private drainage easements are provided where needed to convey these flows to the streets.

It should be noted that the on-site flows from the Drainage Master Plan are significantly higher than the flows presented in this exhibit. There are two basic reasons for this.

A) The average density is less than originally assumed.

B) The Drainage Master Plan was prepared to define the upper limit of costs for the drainage improvements that would be incurred by developing the project. As a result, some conservative assumptions were made which had a dramtic effect on the on-site flows generated. This may have been sound financial planning at the time the report was prepared, however, these flows could be lowered for final design of the drainage improvements if analyzed by the City of Albuquerque drainage criteria now that more definite information regarding the development of the site is known. As agreed upon in the meeting of October 31, 1983, referenced previously, any changes in the flowrates would be addressed by Bohannan-Huston in the form of an addendum to the Master Plan or a more detailed report since that document is the basis for the drainage in Embudo Hills. Furthermore, all the storm drainage improvements designed to service the American Service portion of the development, which will be designed by Bohannan-Huston, will be based on the flows presented in the Master Plan and any future addendums.

MSM/SP Group

Additional items which have been addressed previously include:

A) Downstream capacity and impact on existing structures was proven in the Drainage Master Plan.

B) Timeliness of this development relative to future development of the surrounding area, and any interim measures necessary to accomodate the phasing of the site were addressed in the Construction Phasing Plan.

C) The erosion control measures necessary for the construction phase of the American Service portion of Embudo Hills is addressed on the attached drainage exhibit.

If you have any question, please advise.

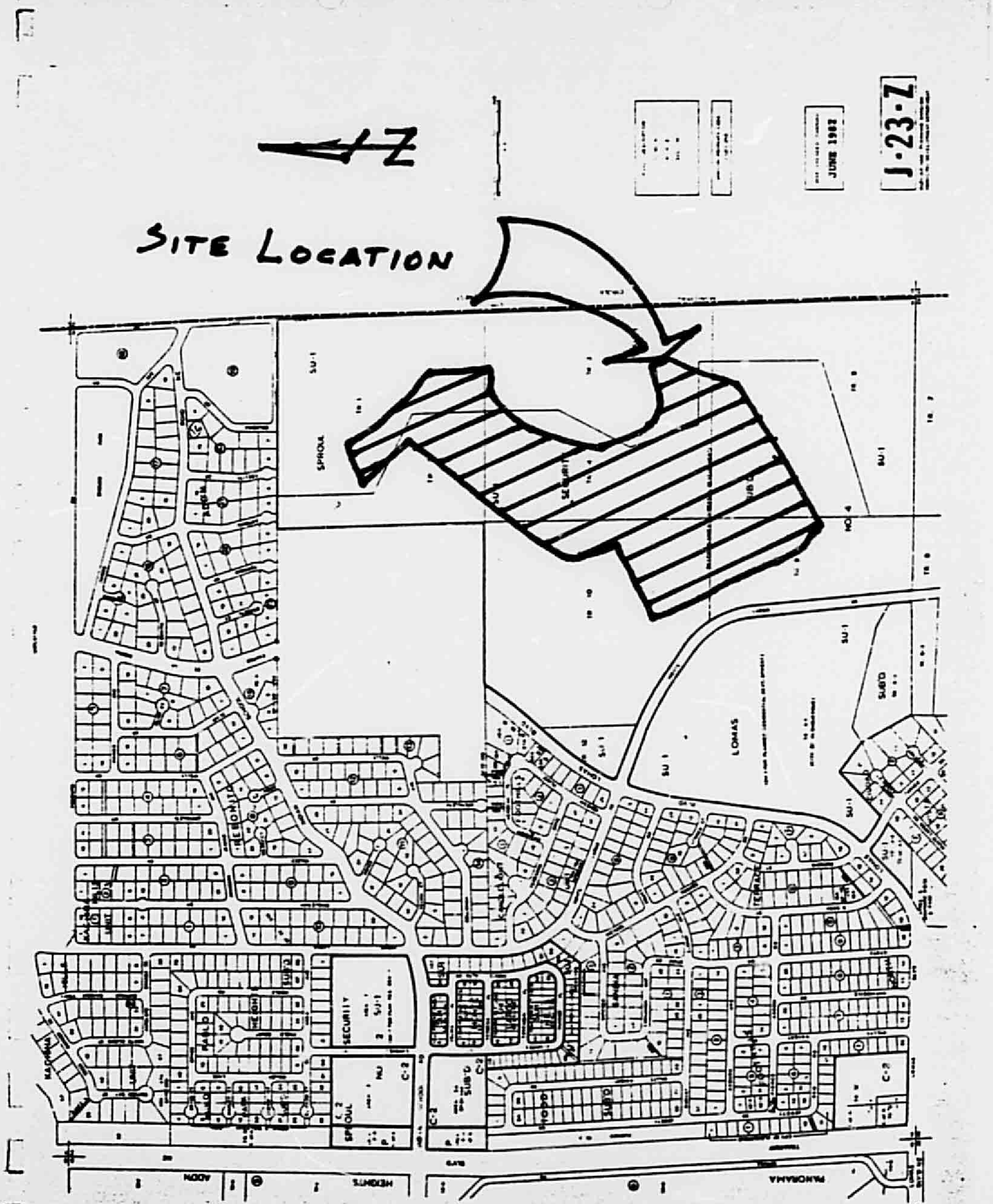
Sincerely,

MSM/SP Group

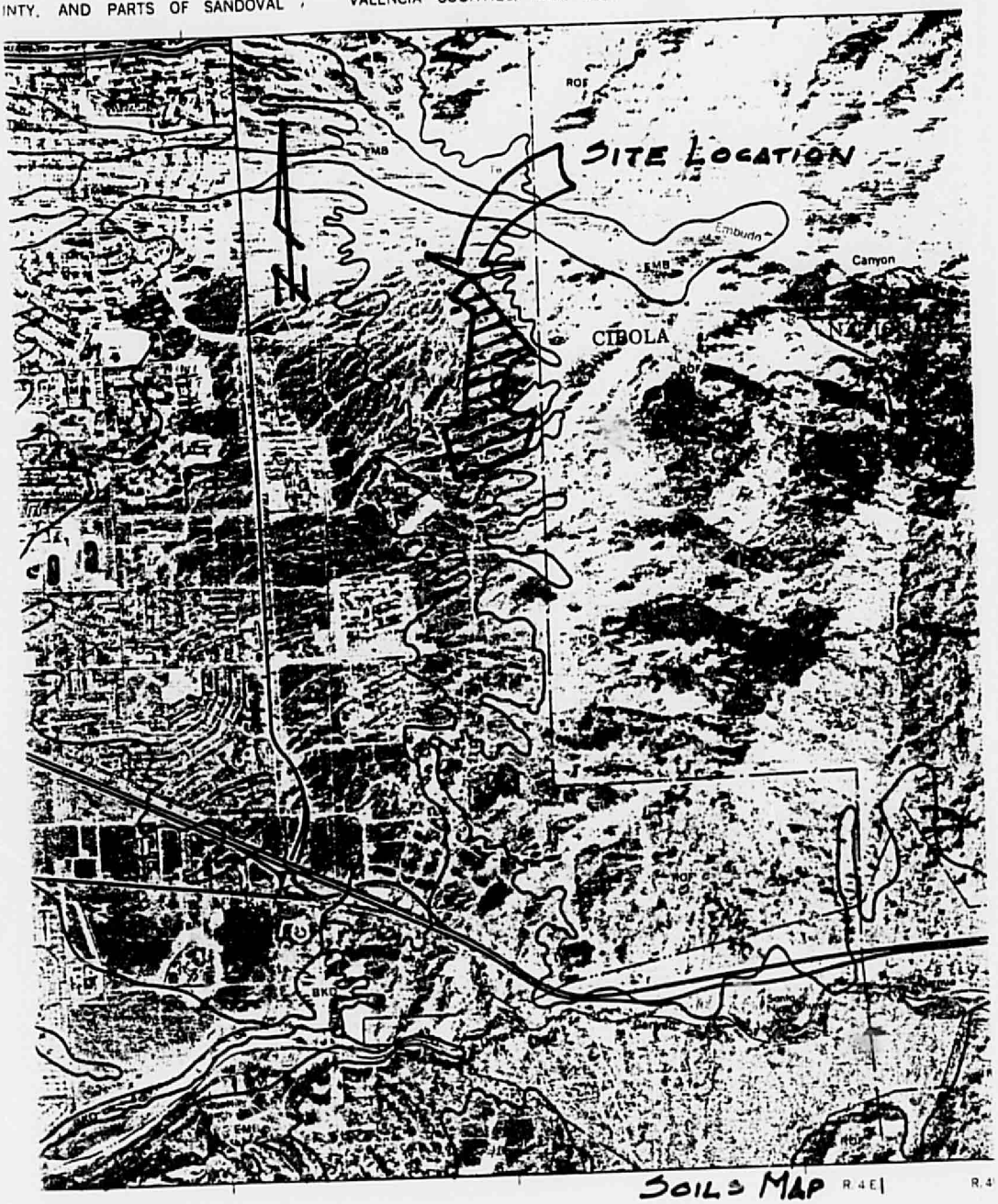
Fred Haas
Design Engineer

FH:jb

cc: Bohannan-Huston Inc.

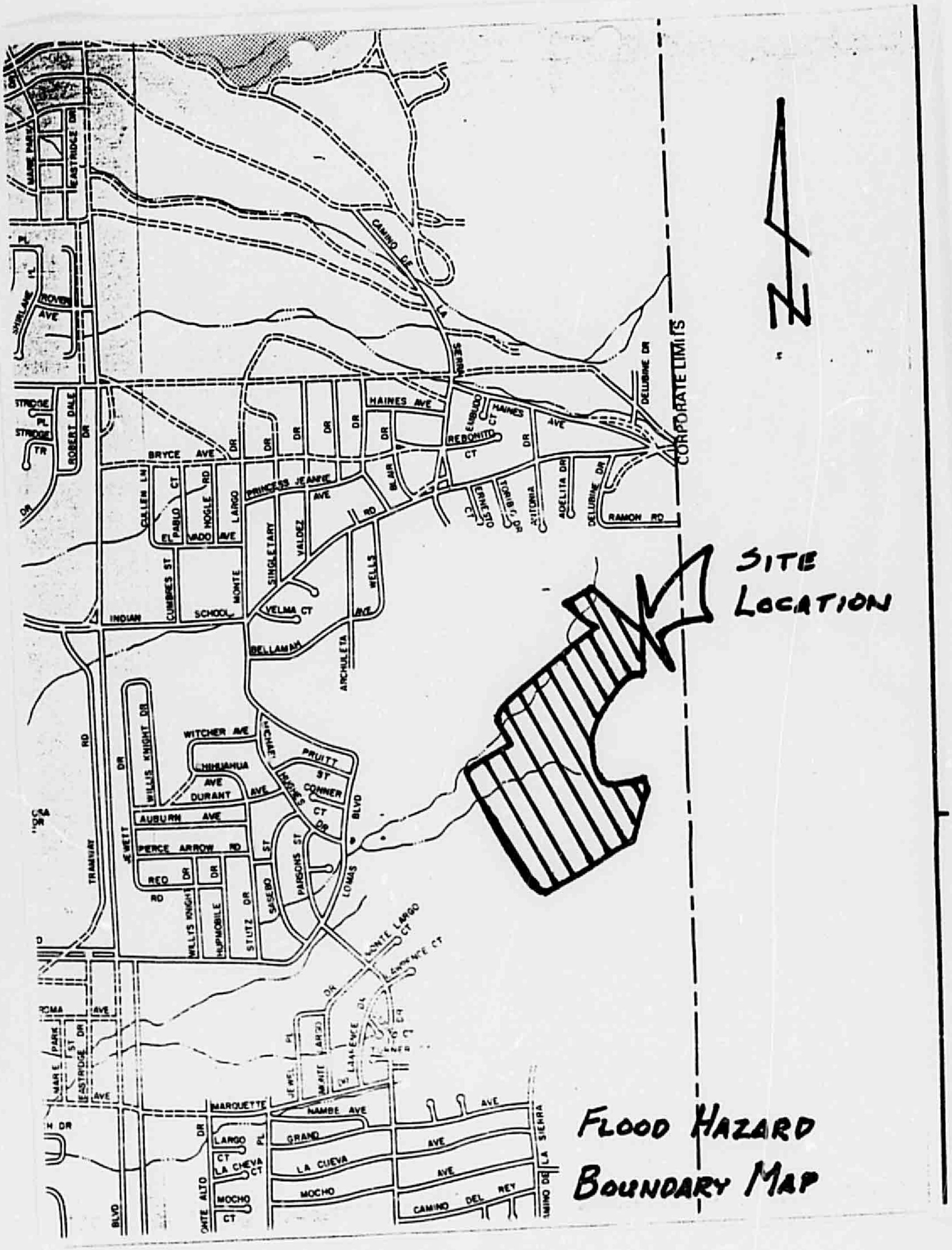


LOCATION MAP



SOILS MAP R.4E

R.4


N
SITE LOCATION
CORPORATE LIMITS
FLOOD HAZARD BOUNDARY MAP
CAMINO DE LA SIERRA
HAINES AVE
BRYCE AVE
PRINCESS JEANNE AVE
INDIAN SCHOOL
MONTE LARGO
BELLAMAH
WITCHER AVE
PRUITT
AUBURN AVE
PIERCE ARROW RD
LOMAS BLVD
TRAMWAY
MARQUETTE
NAMBE AVE
GRAND AVE
LA CUEVA AVE
MOCHO
CAMINO DEL REY
RAMON RD

MSM/SP GROUP — ALBUQUERQUE N.M.

By. F.N.H. Date 12/6/83 PROJECT BIMBUDO HILLS — sheet No. 1 of 2

Checked By ____ Date ____ DRAINAGE CALCS. — Job No. ____

DRAINAGE AREA	AREA (ACRES)	ΔE (FT)	L (FT)	T_c (MIN)	L^*_{100} (IN/HR)	C	Q_{100} (CFS)
A-1	14.65	61	1280	6.2	5.5	0.42	35
A-2	10.79	60	1250	6.1	5.5	0.35	25
A-3	5.86	36	760	4.2	5.5	0.30	10
A-4	7.76	63	1480	7.3	5.5	0.30	15
A-5	1.62	50	1100	5.6	5.5	0.54	5
A-6	0.65	26	550	3.3	5.5	0.54	2
A-7	13.00	70	1800	8.8	5.5	0.30	25
B	7.48	90	1400	6.0	5.5	0.30	15

* T_c = 10 MIN FOR T_c < 10 MIN PER D.P.M., R = 2.61 IN. PLATE 22.2D-1

FROM PLATES 22.2 C-1 AND C-2

"C" FACTOR AREA A-1

5.15 AC. 8 D.U./ACRE TYPE "A" SOIL - $C = 0.52\left(\frac{5.15}{14.65}\right) = .18$

2.01 AC. 2.3 D.U./ACRE TYPE "D" SOIL - $C = 0.67\left(\frac{2.01}{14.65}\right) = .09$

7.49 AC. 2.3 D.U./ACRE TYPE "A" SOIL - $C = 0.30\left(\frac{7.49}{14.65}\right) = .15$

COMPOSITE C = 0.42

AREA A-2

1.48 AC. 2.3 D.U./ACRE TYPE "D" SOIL - $C = 0.67\left(\frac{1.48}{10.79}\right) = .09$

9.31 AC. 2.3 D.U./ACRE TYPE "A" SOIL - $C = 0.30\left(\frac{9.31}{10.79}\right) = .26$

COMPOSITE C = 0.35

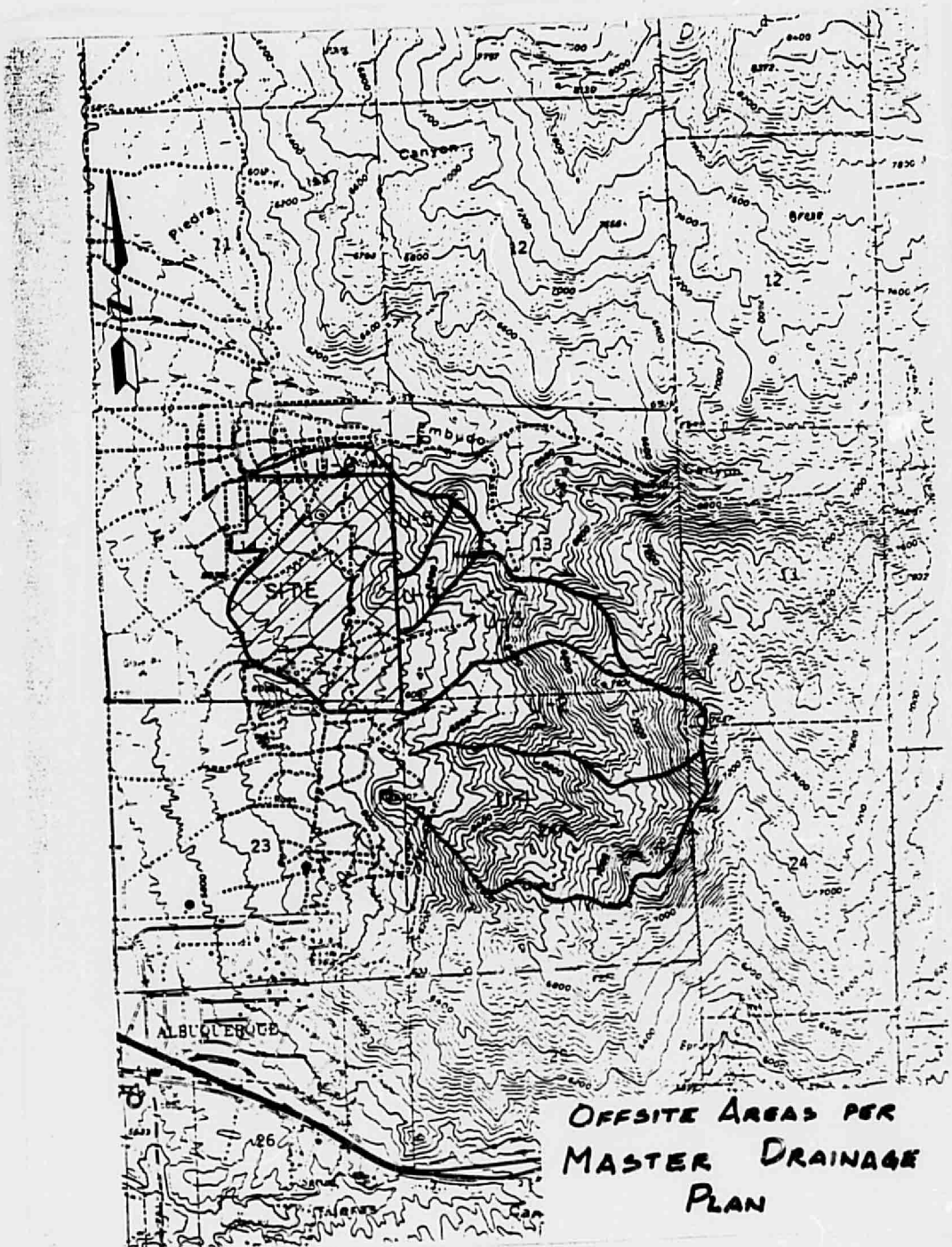
AREA A-5 AND A-6

% IMPERVIOUS - 60' R.O.W. 32' ST + 2-4' SW. = $\frac{40'}{60'} = 67\%$

67% IMPERVIOUS TYPE "A" SOIL C = 0.54

ALL OTHER AREAS

2.3 D.U./ACRE TYPE "A" SOIL - C = 0.30



OFFSITE AREAS PER MASTER DRAINAGE PLAN

MSM/SP GROUP — ALBUQUERQUE N.M.

By FHH Date 12/6/83 PROJECT EMBUDO HILLS sheet No. 2 of 2

Checked By ____ Date ____ DRAINAGE CALCS Job No. ____

ANALYSIS POINT	CONTRIBUTING AREAS	AREA (ACRES)	C	t_c (MIN.)	i_{100}* (IN/HR)	Q_{100} (CFS)
1	A-1	14.65	.42	6.2	5.5	35
2	A-2	10.79	.35	6.1	5.5	25
3	A-2, A-3	16.65	.33	8.0	5.5	30
5	A-1 THRU A-5	40.68	.37	11.8	5.1	80
6	A-1 THRU A-6	41.33	.37	15.1	4.5	70
7	A-7	13.00	.30	8.8	5.5	25
8	A-1 THRU A-7	54.33	.35	15.1	4.5	85
9	B	7.48	.30	6.0	5.5	15

* T_c = 10 MIN. FOR T_c < 10 MIN. PER D.P.M., R = 2.6 IN PLATE 22.2D-1

WEIGHTED "C" FACTOR

ANALYSIS POINT 3

$$.35\left(\frac{10.79}{16.65}\right) + .30\left(\frac{5.86}{16.65}\right) = .33$$

ANALYSIS POINT 5

$$.42\left(\frac{14.65}{40.68}\right) + .35\left(\frac{10.79}{40.68}\right) + .30\left(\frac{13.62}{40.68}\right) + .54\left(\frac{1.62}{40.68}\right) = .37$$

ANALYSIS POINT 6

$$.42\left(\frac{14.65}{41.33}\right) + .35\left(\frac{10.79}{41.33}\right) + .30\left(\frac{13.62}{41.33}\right) + .54\left(\frac{2.27}{41.33}\right) = .37$$

ANALYSIS POINT 8

$$.42\left(\frac{14.65}{54.33}\right) + .35\left(\frac{10.79}{54.33}\right) + .30\left(\frac{26.62}{54.33}\right) + .54\left(\frac{2.27}{54.33}\right) = .35$$

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

June 30, 1981

Mr. Michael Irwin, P.E.
Bohannan-Huston, Inc.
4125 Carlisle Blvd. N.E.
Albuquerque, N.M. 87107

Re: Drainage Master Plan For Embudo Hills

Dear Mr. Irwin:

We have reviewed your drainage report and the concepts outlining agree with current City practices, procedures and AMAFCA Res. 80-15. It is therefore approved.

In submitting your preliminary final plans for grading and drainage, incorporate the attached lists to facilitate review procedures. It is difficult to evaluate one without the other, hence, approval of a drainage report does not constitute approval of construction plans.

If you have any questions contact me at 766-7467.

Very truly yours,

Charles M. Easterling
Principal Asst. City Engineer/Hydrology

CC/CME/fs
Enclosures

MUNICIPAL DEVELOPMENT DEPARTMENT
Richard S. Heller, P.E., City Engineer ENGINEERING DIVISION Telephone (505) 766-7467

REVISED EMBUDO HILLS CONSTRUCTION PHASING

Embudo Hills Subdivision is jointly owned by 3 entities; Sproul Enterprises, American Service Corporation and and a partnership named Embudo Hills Forty, comprised of J. Michael Miller, Ronald D. Brown and K. Robert Scholz. American Service Corporation (ASC) appears to be the first that will actually go to construction. Their site is the eastern portion of Embudo Hills which presently has no access. The ASC site plan is also included in this submittal for information purposes only.

It is the intent of this request to describe the Public Infrastructure Improvements Construction Phasing of this area. A master plan for this subdivision has been reviewed by the EPC and is referred to as Z-81-46.

Monte Largo Drive no longer connects to Scenic Drive which formerly traversed the west fringe of the open space. It is, therefore, no longer necessary to maintain the entire length of this road as a major local street. It is desired to arrange the major local (residential) streets as shown in Figure 1. It is felt this alignment would better serve the subdivision due to its more centralized location. The 90° intersections along the street will also serve to restrict the maximum speed to a reasonable rate for a residential area.

These roads will have a 32' face to face width in a 60' right-of-way. There will be a 14' landscape buffer on each side utilizing serpentine sidewalks. There will be no private access or parking allowed on these streets as indicated in the master plan. A typical street section detail is included as Figure 2.

Lomas Blvd. should also be a major residential street conforming to the above criteria since a master plan collector making this north-south connection is already constructed in a different nearby alignment. The extent and character of the landscaping to be done on Lomas Blvd. will be dependent upon decisions relating to Rebonito Subdivision and on the City's participation in Lomas Blvd. improvements.

The intent of the phasing plan is to provide all public access and utilities required for the development of the American Services Corp. (ASC) portion of Embudo Hills in a timely and economical manner. ASC's current construction plan involves development of single family units starting at the southern end of their land and working north. It is felt the phasing plan to be presented will provide adequate infrastructure for this development.

Note to be placed in revised agreement is that approval of interim outfall is subject to review and approval by the City Engineers Office 11/12/83 Discussed w/ Mike Emery + Dave Woods

PHASE I

The initial construction will include all the facilities required to service the southern portion of the ASC Land (Figure 2). Phase I construction will be completed concurrently or prior to the ASC development. This will include:

1. The entire Upland Diversion Channel
2. The entire Monte Largo Drive including all utilities
3. The major residential street in Area F including water, sanitary sewer, and the underground storm drain
4. Sanitary sewer construction in Areas H, I & L including extension of the line in Lomas Boulevard
5. Rough grading for an emergency access road through Areas M, N, O, P & Q
6. Installation of the upper 9E master plan line in Areas P & Q
7. An earth lined drainage outfall to the Lomas desilting basin
8. Grading, sanitary sewer, and underground storm drain through Areas B, C & D
9. Berms, desilting basin and inlet structure for storm drain in Area B

PHASE II

Phase II construction will start upon completion of 150 units within the ASC land, or sooner, or within five (5) years of the completion of Phase I. It is assumed that at this time SAD 207 will be completed. The secondary access route will be from the Rebonito Subdivision via the major residential street (Figure 3). Phase II construction will include:

1. Pavement of the major residential street including all required utilities and the 10E waterline in Areas O & P
2. Pavement of streets in Areas B, C, D & Q

PHASE III

Phase III construction is a collection of smaller projects each having different paramenters affecting their construction dates. Each project is independent of the others and consequently may be constructed in any order. Phase III construction shall be started no later than five (5) years from the completion of Phase II.

PHASE III A

Lomas Boulevard will be completed at the time construction commences on any land adjoining its undeveloped reach. The only utilities in Lomas are two master plan waterlines which are already in place. The only construction involved will be the grading and paving of Lomas Boulevard through Areas M & N (Figure 4). City participation in the paving of Lomas Boulevard will be required in these areas.

PHASE III B

Completion of the underground storm drain will be accomplished when an area adjoining Reach H or I is developed (Figure 5). This construction would include the storm drain, local waterline and paving of the street in Area H, construction of the storm drain in Area I, removal of silt from the Lomas Basin, and backfilling of the temporary earth channel.

PHASE III C

When water is required in the northern portion of Embudo Hills, the 10E waterline will be constructed through Areas A, R [illegible] S (Figure 6). This construction will include rough grading of the roads, installation of the sanitary sewer line, and installation of the master plan waterline.

Any subsequent improvements will be designed and built as required. They will be designed to conform with the existing facilities and master plan.

The construction phases outined in this plan shall be substantially completed within fifteen (15) years from the start of Phase I.

EMBUDO HILLS

MAJOR RESIDENTIAL STREET LAYOUT

MAJOR RESIDENTIAL STREET

OTHER RESIDENTIAL STREET

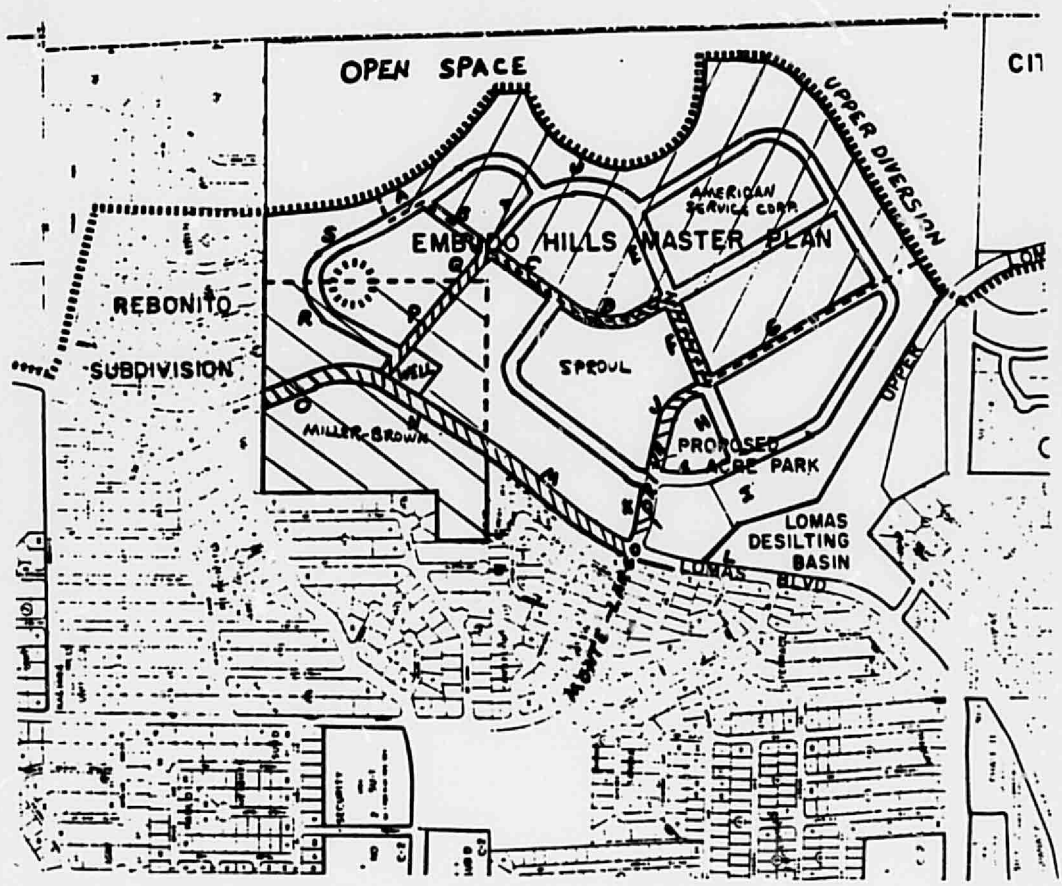
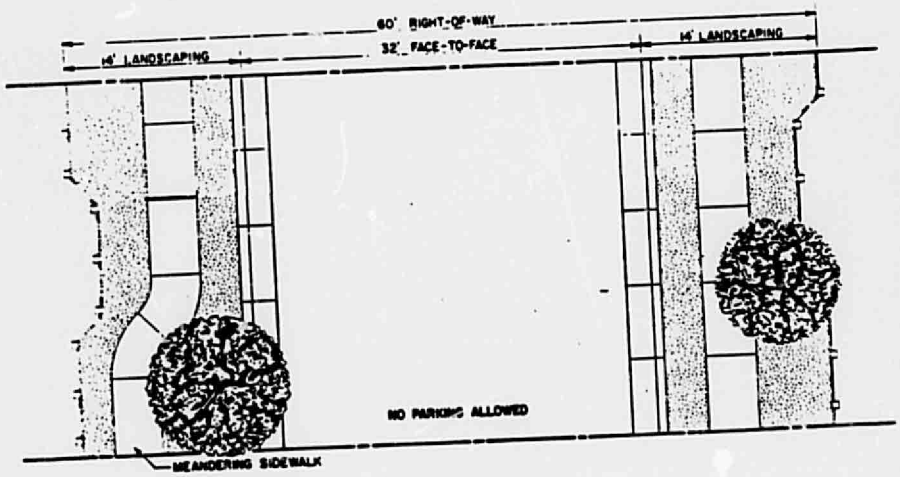


FIGURE 1

TYPICAL SECTION



TYPICAL PLAN

PROPOSED MONTE LARGO RIGHT-OF-WAY

EMBUDO HILLS MASTER PLAN

FIGURE 2

DRAINAGE MASTER PLAN
FOR
EMBUDO HILLS
Zone Atlas Sheet J–23
March, 1981

BOHANNAN–HUSTON INC.

4125 CARLISLE BOULEVARD, NORTHEAST, ALBUQUERQUE, NEW MEXICO 87107 (505) 881-2000

DRAINAGE MASTER PLAN FOR EMBUDO HILLS

Zone Atlas Sheet J–23

PREPARED FOR

Sproul Investment Corporation
P.O. Box 3158, Station D
Albuquerque, NM 87190
March, 1981

PREPARED BY

Bohannan–Huston, Inc.
4125 Carlisle Blvd., N.E.
Albuquerque, NM 87107

Michael J. Irwin, P.E.
N.M.P.E. 7498

Job No. 1 008 4

TABLE OF CONTENTS

APPENDIX

TABLES

PLATES

DRAINAGE MASTER PLAN FOR EMBUDO HILLS

Zone Atlas Sheet J–23

PURPOSE

The purpose of this report is to determine the undeveloped and developed runoff from the plan area and its upland basins resulting from a 100-year storm. Recommendations for development of the plan area are made with respect to drainage.

LOCATION AND PROJECT DESCRIPTION

The plan area is located between Lomas Boulevard and the proposed Scenic Drive. It lies north of the Upper Lomas Channel and south of Rebonito Subdivision. In addition, a parcel of land lying west of Lomas Boulevard contained in Sproul Security Subdivision No. 4 is included in this plan. The plan area contains approximately 179 acres of land to be developed into several smaller parcels.

The existing ground slopes from east to west on grades between five and fourty percent. The soil consists of granular decomposed Granite and is covered with moderate amounts of native grasses and brush. See Plate 1 in the back of this report for the site location.

HYDROLOGIC ANALYSIS

The 100-year, 6-hour rainfall was used in conjunction with a modified version of the Agricultural Research Services' computerized watershed model "HYMO" to compute the flow rates of storm water originating upstream of the property and the flow rates originating from the site. See Table I for the rainfall distribution of the 100-year storm (Page 10, Appendix). The model uses the Soil Conservation Services' "Runoff Curve Number Method" from the Soil Conservation Services' National Engineering Handbook, Section 4 – Hydrology. Hydrograph shape parameters are derived from watershed area, length, slope, and hydraulic characteristics. See Tables II and III for the hydrologic data used in the analyses (Pages 11–13, Appendix). The model "HYMO" uses a method for channel routing called "Variable Travel Time Routing."

To implement the use of the computer model, the undeveloped area was divided into five drainage basins. The basins are shown on Plate II. The hydrograph for each basin was computed and the flow was routed through the next downstream basin and added to the intervening hydrograph. The results of this analysis are summarized in Table II (Page 11, Appendix).

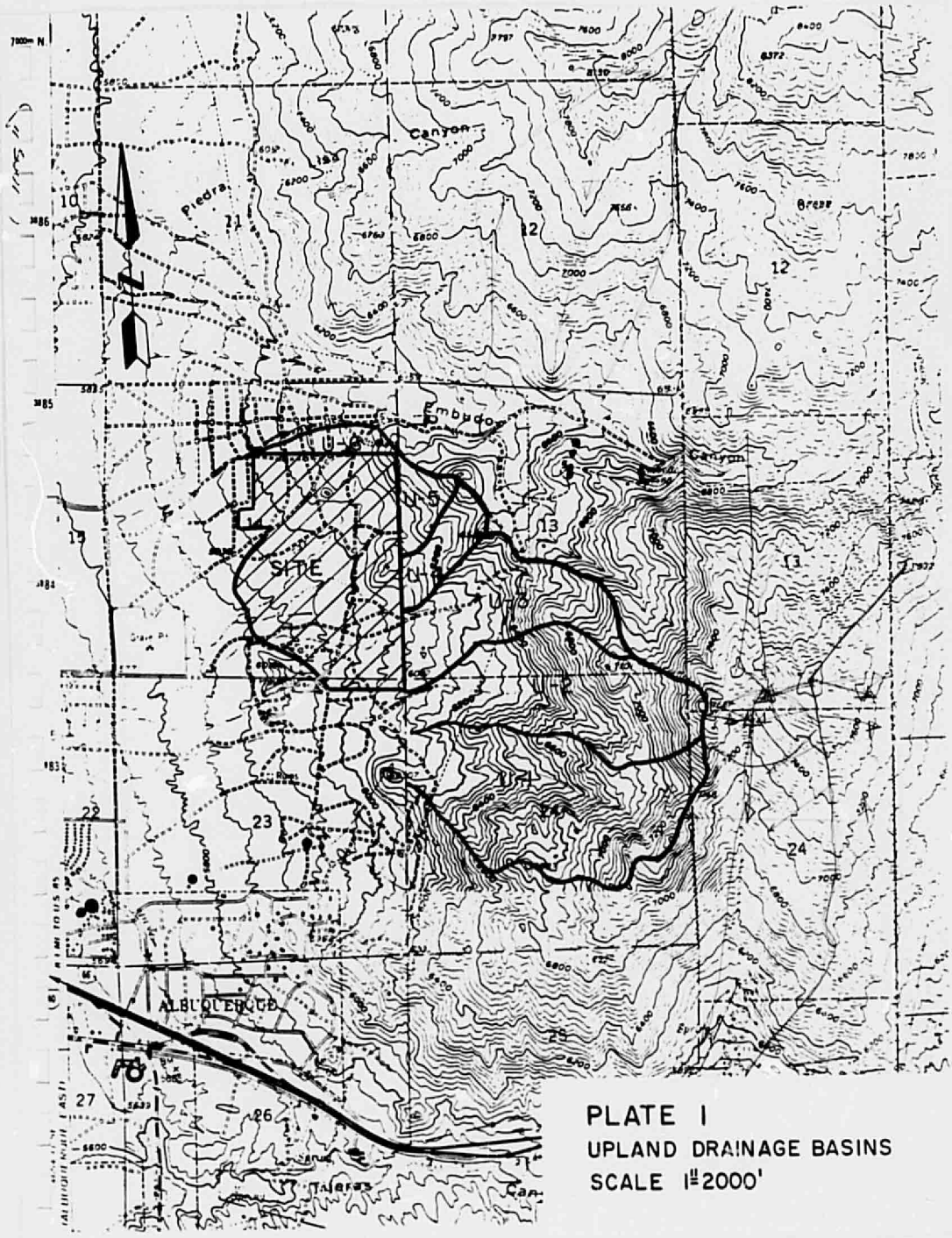


PLATE I
UPLAND DRAINAGE BASINS
SCALE 1"=2000'

The following assumptions were made to facilitate the hydrologic analysis of the undeveloped site:

1. Uniform rainfall covers the entire area.

2. The rangeland is in fair condition (the curve number utilized was an average of the good and poor conditions reported in T. R. 55 of the Soil Conservation Service).

3. Seven feet per second average velocity for the runoff in the upland basins.

The developed area was divided into sixteen internal basins and five upland basins as shown on Plate III. The 100-year six-hour storm was routed through the site to determine peak flow rates at analysis points and to use this data to size the proposed storm sewer. The results of the analysis are summarized in Table III (Pages 12 and 13, Appendix).

The following additional assumptions were made concerning the hydrologic analysis of the developed site:

1. Land use plan will be implemented as shown on the master plan.

2. The runoff curve numbers change from the undeveloped condition to those of the developed condition as shown on Tables II and III (Pages 11 – 13, Appendix).

3. Seven feet per second average velocity for the runoff in the developed basins.

DRAINAGE BEFORE DEVELOPMENT

Upland runoff – The upland runoff originates in several basins north and east of the plan area. The total area of the upland sources is approximately 252 acres and includes areas U-3 through U-6. Plate II shows where the upland flows enter the plan area and the anticipated peak discharge rates for the 100-year storm.

Internal runoff – The internal runoff for the majority of the plan area flows to the southwest and into the existing Lomas Basin drainage facility. The remaining runoff from the plan area flows onto either Lomas Boulevard or into Rebonito Subdivision and Candlelight Foothills Subdivision.

The undeveloped flow rates derived in this report are more conservative than the flow rates previously derived by the Corps of Engineers (Flood Plain Information, Albuquerque Arroyos Part II) or those used to design the Lomas Basin facilities. More conservative curve numbers and shorter times of concentration, used in this analysis, account for this difference. This approach was utilized to determine the most severe stress that is likely to be placed on down stream drainage facilities.

DRAINAGE AFTER DEVELOPMENT

Upland runoff — The upland runoff generated in basins U-1 and U-2 flow directly into the Upper Lomas Drainage Channel and therefore do not directly affect the site. The upland runoff generated in basin U-3 will be conveyed to the existing Upper Lomas Drainage Channel approximately 1400 feet upstream of the desilting basin (approximately 1000 feet upstream of where it naturally enters the drainage channel). The basin U-3 would be entering the channel much sooner than it would naturally, however, the channel capacity is actually greater at that point than downstream. The critical section for channel capacity is located in the reach channel lining 25 feet to 500 feet from the basin. Therefore, this transfer has no substantial adverse affects on the existing facility. Basin U-4 will enter the same conveyance facility as basin U-3 east of the study area, and will also be diverted to the Upper Lomas Channel. See Plate III for details of the drainage plan.

Basin U-5 will be directed to the entry point shown on Plate III and discharged into the proposed internal storm sewer system. Approximately eight (8) acres of basin U-5 will require an offsite berm to direct the runoff onto the plan area in an acceptable location. This berm should be constructed in the existing right-of-way for Adelita Drive in the Rebonito Addition. Runoff generated in basin U-6 flows into the site at its northern boundary. Runoff should be diverted into the planned parcels with diversion berms at locations where flows will enter in the future.

Internal drainage — The backbone of the internal drainage system will be the storm sewer that starts at the Lomas Desilting Basin and proceeds to the northeast boundary of the site. This storm sewer will have a leg going off to the east at the midpoint of the system. The basic function of the storm sewer is to pick up excess runoff beyond the acceptable capacity of the street. Internal basins drain toward the storm sewer and as runoff is directed to the street, inlets are installed to direct the runoff into the storm sewer. Each internal basin is sized so that the velocity times the depth criteria of 4.8 in the receiving streets is not violated for the 10-year storm. See Plate III for the schematic location of the internal storm sewer facilities.

All internal runoff will be directed to the streets and will flow to the desilting basin with the exception of basin 13, which will discharge onto Lomas Boulevard, and basin 14 which will discharge into Candlelight Foothills. This will cause an increase in runoff into the desilting basin. Included in the HYMO run is a routing for the desilting basin. The conclusion is that the increased flow into the basin does not exceed the design depth for the basin. The inflow and outflow channels were also analyzed to check for possible problems. All channels function with the increased flow rate. The only consequence of this increased flow rate is the reduced amount of freeboard in the channels. Cross-sections with flow depths of the critical sections are provided in the appendix (see Pages 14–19 for these sections).

RECOMMENDATIONS

1. Construct a diversion channel to convey runoff from basins U-3 and U-4 to the Upper Lomas Channel before it enters the site.

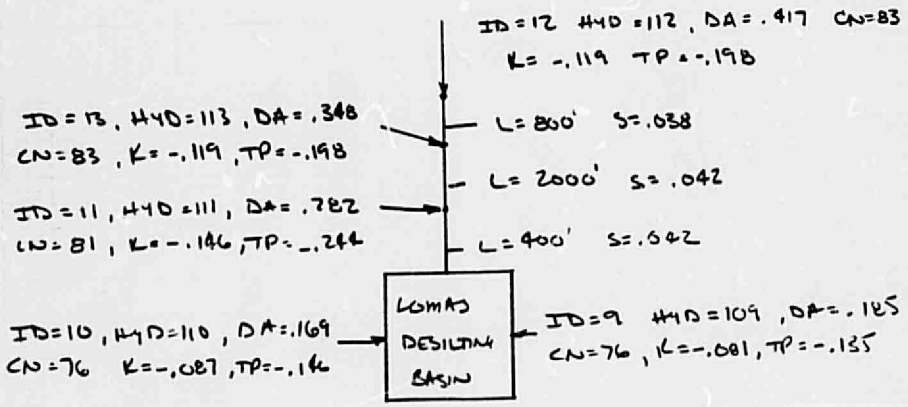
2. Direct runoff generated in basin U-5 to enter the site as shown on Plate III.

3. Construct the storm sewer system to collect the internal drainage flows and transport them to the desilting basin.

4. Grade the interior streets to drain as shown on Plate III.

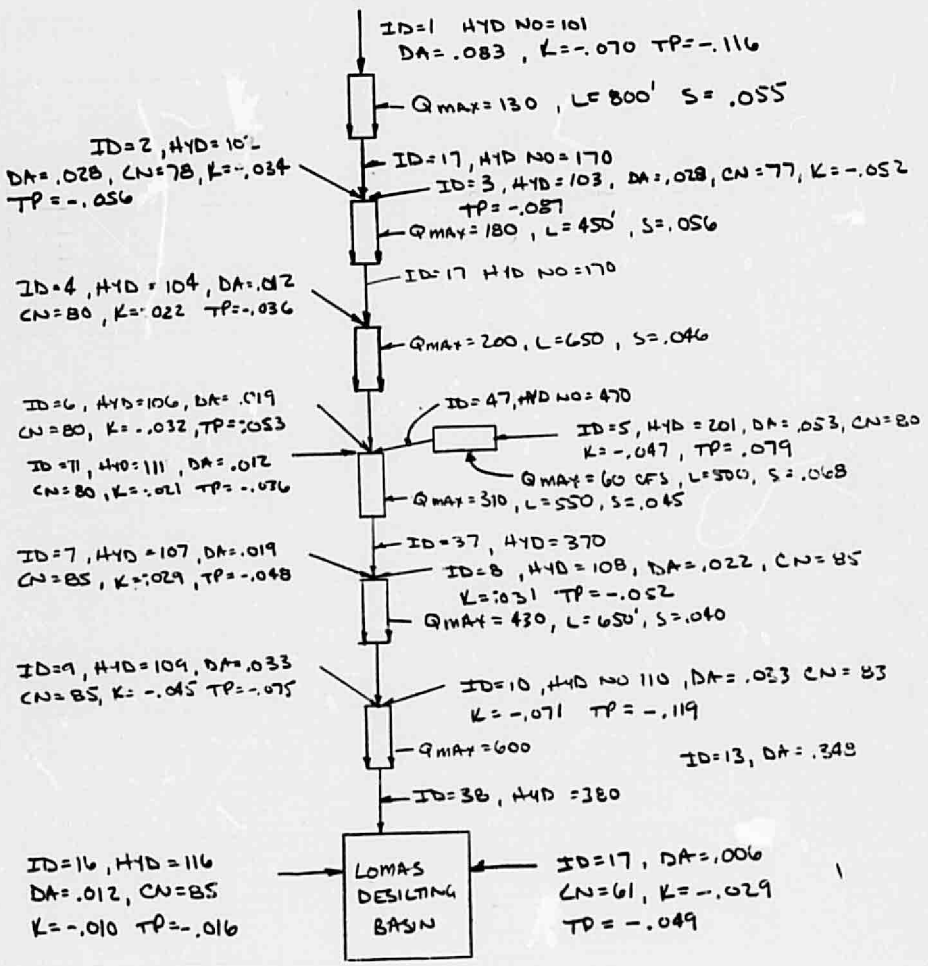
5. Discharge basin 13 directly to Lomas Boulevard.

6. Discharge basin 14 into the Candlelight Foothills development through an existing drainage easement.



UNDEVELOPED FLOW SCHEMATIC

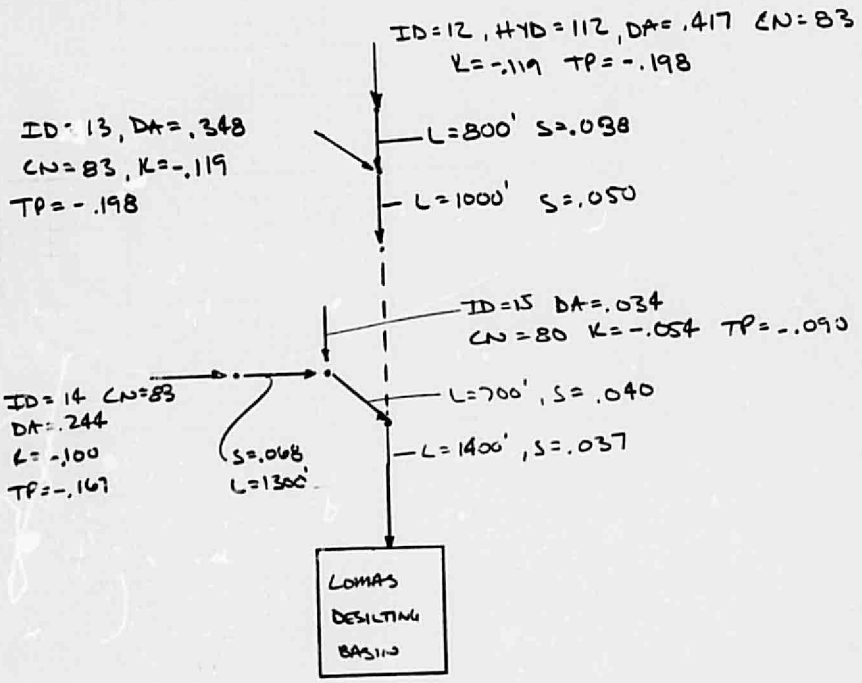
PROJECT NAME	EMBUDO HILLS	SHEET	1	OF	20
PROJECT NO.	10084	BY		DATE	
SUBJECT	FLOW SCHEMATIC	CH'D		DATE	



INTERNAL FLOW SCHEMATIC

DEVELOPED CONDITION

PROJECT NAME	EMBUDO HILLS	SHEET	2	OF	20
PROJECT NO.	10084	BY	WW	DATE	
SUBJECT	FLOW SCHEMATIC	CH'D		DATE	



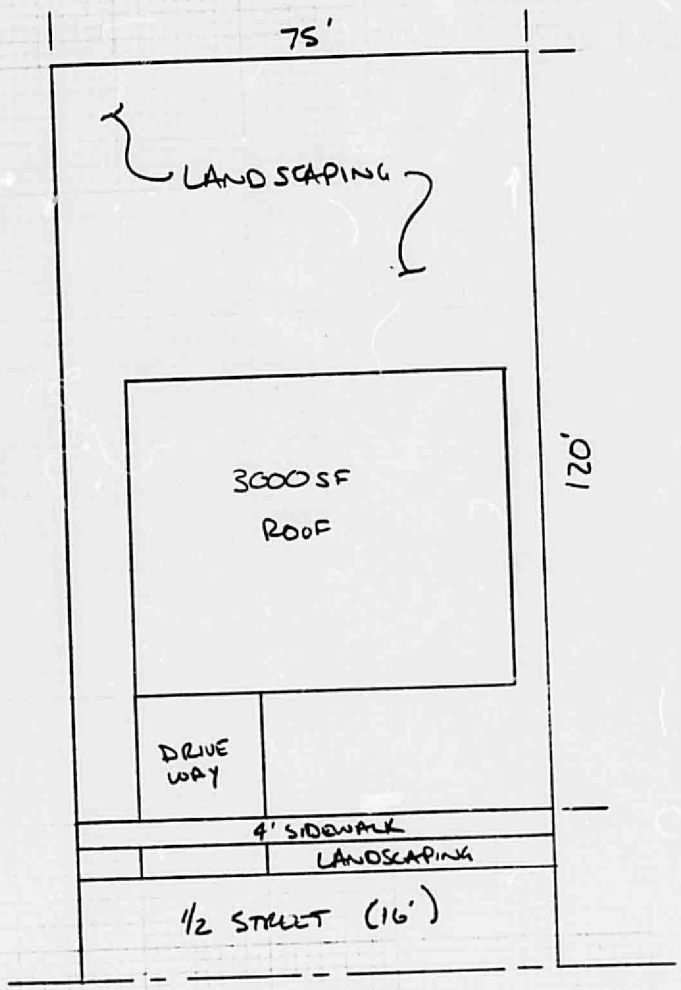
UPLAND FLOW SCHEMATIC

DEVELOPED CONDITION

PROJECT NAME EMBUDO HILLS SHEET 3 OF 20

PROJECT NO. 10084 BY DATE

SUBJECT FLOW SCHEMATIC CH'D DATE



4 DU / ACRE

TYPICAL LOT

PROJECT NAME Embudo Hills SHEET 4 OF 20

PROJECT NO. 10084 BY DA DATE

SUBJECT TYPICAL LOTS CH'D DATE

TOTAL LOT AREA W/ 1/2 STREET

$A = 75.(120+25)$

$= 10,875 \cong 1/4$ ACRE

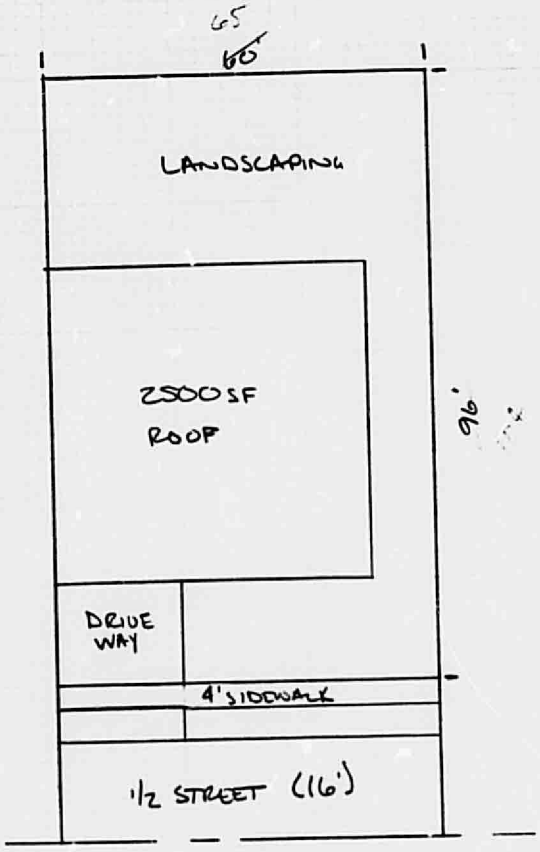
$\%$ HARDENED $= \dfrac{3000 + 20\times20 + 20\times5 + 4(75) + 16(75)}{10875}$

$= 46\%$

COMPOSIT $C = .46(1.0) + .54(.4)$

$= .68$

PROJECT NAME Emerald Hills SHEET 5 OF 20
PROJECT NO. 10084 BY KH DATE
SUBJECT TYPICAL LOTS CH'D DATE



6 DU/ACRE
TYPICAL LOT

PROJECT NAME EMBUDO HILLS SHEET 6 OF 20
PROJECT NO. 10084 BY DL DATE
SUBJECT TYPICAL LOT CH'D DATE

TOTAL LOT AREA w/ 1/2 STREET

$A = 60 \times (96+25)$

$= 7260$ SF (1/6 ACRE)

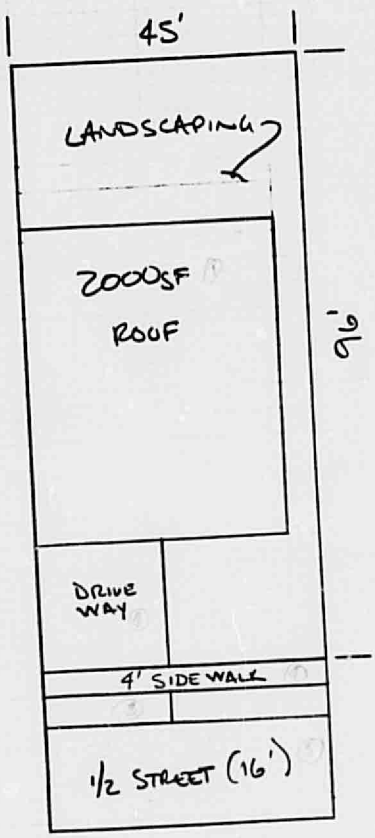
$$\% \text{ HARDENED} = \frac{2500 + 20\times20 + 4(60) + 5(20) + 1/6(60)}{7260}$$

$= 58\%$

COMPOSIT $C = .58(1.0) + .42(.4)$

$= .75$

PROJECT NAME	EMBUDO HILLS	SHEET	7	OF	20
PROJECT NO.	10084	BY		DATE	
SUBJECT	TYPICAL LOTS	CH'D		DATE	



8 DU / ACRE

TYPICAL LOT

PROJECT NAME EMBUDO HILLS SHEET 8 OF 20
PROJECT NO. 10084 BY M DATE
SUBJECT TYPICAL LOT CH'D DATE

TOTAL LOT AREA w/ 1/2 STREET

$A = 45(96+25)$

$= 5445$ SF $= 1/8$ ACRE

$$\% \text{ HARDENED} = \frac{2000 + 20(20) + 5(20) + 4(45) + 16(45)}{5445}$$

$= .63\%$

COMPOSIT C $= .63(1.0) + .37(.4)$

$= .78$

PROJECT NAME	Embudo Hills	SHEET	9	OF	20
PROJECT NO.	10084	BY	CH	DATE	
SUBJECT	Typical Lots	CH'D		DATE	

TABLE 1

100-YEAR FREQUENCY STORM

RAINFALL TABLE

0.000	1.670	1.778	1.845	1.894	1.932	1.964	1.992	2.016	2.038
2.057	2.075	2.092	2.107	2.121	2.134	2.147	2.159	2.170	2.180
2.191	2.200	2.210	2.218	2.227	2.235	2.243	2.251	2.258	2.265
2.272	2.279	2.286	2.292	2.298	2.304	2.310	2.316	2.322	2.327
2.332	2.338	2.343	2.348	2.353	2.357	2.362	2.367	2.371	2.376
2.380	2.384	2.388	2.393	2.397	2.401	2.405	2.408	2.412	2.416
2.420	2.423	2.427	2.430	2.434	2.437	2.441	2.444	2.447	2.450
2.454	2.457	2.460	2.463	2.466	2.469	2.472	2.475	2.478	2.481
2.483	2.486	2.489	2.492	2.494	2.497	2.500	2.502	2.505	2.508
2.510	2.513	2.515	2.518	2.520	2.522	2.525	2.527	2.529	2.532
2.534	2.536	2.539	2.541	2.543	2.545	2.548	2.550	2.552	2.554
2.556	2.558	2.560	2.562	2.564	2.566	2.568	2.570	2.572	2.574
2.576	2.578	2.580	2.582	2.584	2.586	2.588	2.590	2.591	2.593
2.595	2.597	2.599	2.600	2.602	2.604	2.606	2.607	2.609	2.611
2.612	2.614	2.616	2.618	2.619	2.621	2.622	2.624	2.626	2.627
2.629	2.630	2.632	2.634	2.635	2.637	2.638	2.640	2.641	2.643
2.644	2.646	2.647	2.649	2.650	2.652	2.653	2.655	2.656	2.657
2.659	2.660	2.662	2.663	2.664	2.666	2.667	2.669	2.670	2.671
2.673	2.674	2.675	2.677	2.678	2.679	2.681	2.682	2.683	2.684
2.686	2.687	2.688	2.690	2.691	2.692	2.693	2.695	2.696	2.697
2.698	2.699	2.701	2.702	2.703	2.704	2.705	2.707	2.708	2.709
2.710	2.711	2.712	2.714	2.715	2.716	2.717	2.718	2.719	2.720
2.722	2.723	2.724	2.725	2.726	2.727	2.728	2.729	2.730	2.731
2.733	2.734	2.735	2.736	2.737	2.738	2.739	2.740	2.741	2.742
2.743	2.744	2.745	2.746	2.747	2.748	2.749	2.750	2.751	2.752
2.753	2.754	2.755	2.756	2.757	2.758	2.759	2.760	2.761	2.762
2.763	2.764	2.765	2.766	2.767	2.768	2.769	2.770	2.771	2.772
2.773	2.773	2.774	2.775	2.776	2.777	2.778	2.779	2.780	2.781
2.782	2.784	2.783	2.784	2.785	2.786	2.787	2.788	2.789	2.790
2.791	2.791	2.792	2.793	2.794	2.795	2.796	2.797	2.797	2.798

TABLE II

UNDEVELOPED HYDROLOGIC DATA

DRAINAGE BASIN	ID NO.	LENGTH FT.	SLOPE FT/FT	AREA ACRES	AREA SQ. MI.	T_c* HOURS	T_p* HOURS	K* HOURS	% A-SOILS	% B SOILS	% D SOILS	CURVE NO.	Q
1	12	7500	.197	267	.417	.298	.198	.119	1	0	99	83	663
2	13	7500	.224	223	.348	.298	.198	.119	4	0	96	83	554
3	11	8000	.146	150.5	.282	.317	.211	.127	20	0	80	80	328
4	10	5500	.115	108	.169	.218	.146	.087	50	0	50	76	202
5	9	5000	.127	118.5	.185	.198	.132	.079	45	5	50	76	234

* T_c BASED ON 7 FPS VELOCITY IN UNDEVELOPED BASINS.

$T_p = 2/3(T_c)$

$K = .6(T_p)$

TABLE III

DEVELOPED HYDROLOGIC DATA

DRAINAGE BASIN	ID NO.	LENGTH FT	SLOPE FT/FT	AREA ACRES	AREA SQ. MI.	T_L* HOURS	T_p* HOURS	K* HOURS	% A SOILS	% B SOILS	% D SOILS	DU/ ACRE	CURVE NO.	Q
1	5	2000	.090	33.7	.053	.079	.079	.048	40	0	60	4	80	142
2	6	1300	.051	12.3	.019	.052	.052	.031	100	0	0	6	80	73
3	8	1300	.038	14.1	.022	.052	.052	.031	100	0	0	8	85	125
4	10	3000	.047	20.9	.033	.119	.119	.071	100	0	0	8	85	80
5	16	400	.05	7.6	.012	.016	.016	.010	100	0	0	8	35	174
6	2	1400	.067	17.9	.028	.056	.056	.033	100	0	0	5	78	87
7	11	900	.067	7.9	.012	.036	.036	.021	100	0	0	6	80	65
8	7	1200	.043	12.0	.019	.048	.048	.029	100	0	0	8	85	109
9	17	600	.070	4.0	.006	.083	.083	.050	0	100	0	0	61	2
10	3	2600	.043	22.5	.035	.103	.103	.062	100	0	0	5	77	60
11	4	900	.051	7.5	.012	.036	.036	.021	100	0	0	6	80	65
12	9	1900	.053	21.3	.033	.075	.075	.045	100	0	0	8	85	138
13	18	2000	.047	22.0	.034	.079	.079	.048	100	0	0	6	80	90
14	19	400	.075	2.6	.004	.016	.016	.010	100	0	0	6	80	** 12

** COMPUTED USING RATIONAL METHOD

PROJECT NAME EMBUDO HILLS SHEET 12 OF 20
PROJECT NO. 10084 BY DM DATE
SUBJECT TABLE III CH'D DATE

TABLE III CONT.

UPLAND DEVELOPED HYDROLOGIC DATA

DRAINAGE BASIN	ID NO.	LENGTH FT.	SLOPE FT/FT	AREA ACRES	AREA SQ. MI.	TC* HOURS	TP* HOURS	K* HOURS	% A SOILS	% B SOILS	% D SOILS	CURVE NO.	Q
U-1	12	7500	.197	267	.417	.298	.198	.119	1	0	99	83	663
U-2	13	7500	.224	223	.348	.298	.198	.119	4	0	96	83	554
U-3/4	14	6300	.163	156	.244	.250	.167	.100	5	0	95	83	448
U-5	1	4400	.146	53	.083	.175	.116	.070	5	0	95	83	205
U-7**	15	3400	.152	22	.034	.135	.090	.054	15	0	85	80	83

** U-6 WAS DIVIDED BY DIVERSION BERMS AND ADDED TO BASINS U-5, 6, & 13.

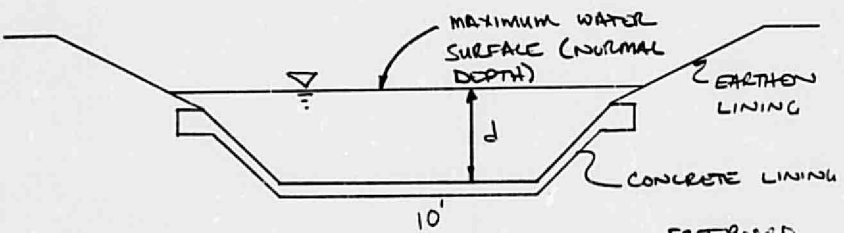
* T_c BASED ON 7 FPS VELOCITY IN UPLAND BASINS AND DEVELOPED BASINS.

$T_p = T_c$ FOR DEVELOPED BASINS

$K = .6(T_p)$

LOWER LOMAS CHANNEL
(STA 4+25 to STA 13+50)

SIDE SLOPE = 1.5:1
BOTTOM WIDTH = 10'
N = .018
S = .056



				FREEBOARD
$Q \cong$ 1970 CFS	d = 3.62	DEVELOPED		2.38'
$Q \cong$ 1710 CFS	d = 3.04	UNDEVELOPED		2.96'

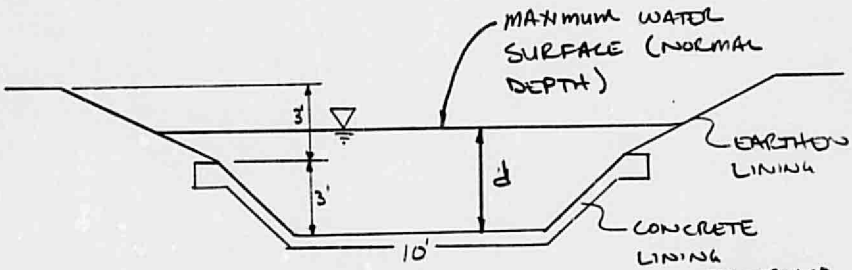
LOWER LOMAS CHANNEL CRITICAL SECTION
(STA 13+50 TO STA 23+00)

SIDE SLOPE = 1.5:1

BOTTOM WIDTH = 10'

N = .020

S = .033



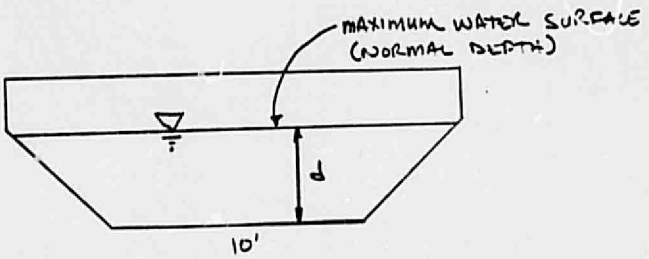
Q = 1915 CFS	d = 4.34'	DEVELOPED	FREEBOARD 1.66'
Q = 1654	d = 3.45	UNDEVELOPED	2.55'

LOWER LOMAS CHANNEL TURNOUT STRUCTURE
(STA 2H60)
SIDE SLOPE = 1.5:1

BOTTOM WIDTH = 10'

N = .015

S = .033



			FREEBOARD
Q = 1915 CFS	d = 3.73'	DEVELOPED	2.27'
Q = 1654 CFS	d = 3.45	UNDEVELOPED	2.55'

PROJECT NAME EMBUDO HILLS SHEET 16 OF 20
PROJECT NO. 10084 BY DATE
SUBJECT CHANNEL CROSS SECTIONS CH'D DATE

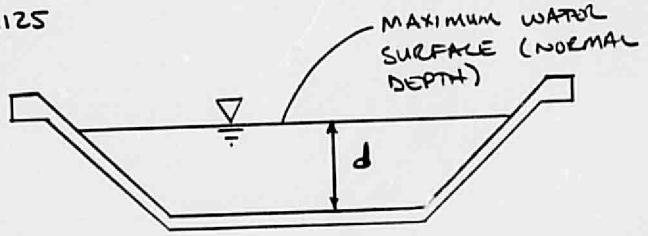
UPPER LOMAS CHANNEL CRITICAL SECTION
(STA 1+80 TO STA 5+00)

SIDE SLOPE = 1.5:1

BOTTOM WIDTH = 10'

N = .015

S = .03125



			FREEBOARD
Q = 1678 CFS	d = 3.52'	DEVELOPED	1.48'
Q = 1523 CFS	d = 3.35'	UNDEVELOPED	1.65'

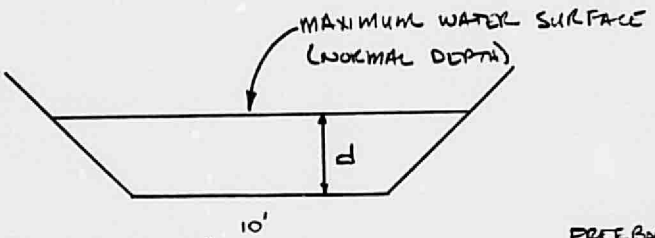
UPPER LOMAS CHANNEL
(STA 5+00 TO STA 9+00)

SIDE SLOPE = 1.5:1

BOTTOM WIDTH = 10'

N = .015

S = .0425



			FREEBOARD
Q = 1678 CFS	d = 3.24'	DEVELOPED	1.76'
Q = 1217 CFS	d = 2.72'	UNDEVELOPED	2.38'

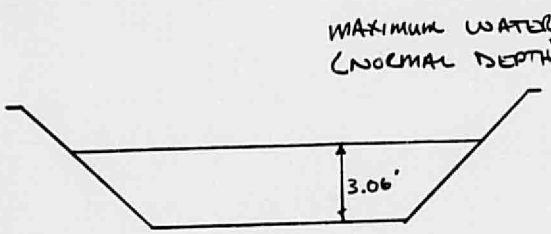
UPPER LOMAS CHANNEL
(STA 9+00 TO STA 15+00)

SIDE SLOPE = 1.5:1

BOTTOM WIDTH = 10'

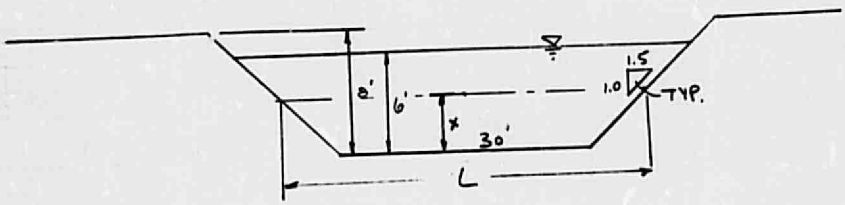
N = .015

S = .0525



			FREEBOARD
Q = 1678 CFS	d = 3.06'	DEVELOPED	1.94'
Q = 1217 CFS	d = 2.57	UNDEVELOPED	2.43'

LOMAS BASIN SPILLWAY RATING



SINCE SPILLWAY IS TRAPIZOIDAL TAKE L @ CENTROID OF AREA

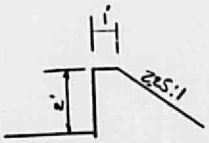
$$X = \frac{180 \times 3' + 27(4) + 27(4)}{180 + 27 + 27}$$

$X = 3.23'$

$L = 30 + 3.23(1.5)2$

$= 39.69'$

$C = 3.51$ *



SPILLWAY SECTION

$Q = CLH^{3/2}$

$Q = 3.51 \times 39.69 \times 6^{3/2}$

$= 2048$ CFS

* TABLE 5-9 HANDBOOK OF HYDROLICS, BRATER & KING, 6TH ED.

PROJECT NAME EMBUDO HILLS SHEET 20 OF 20
PROJECT NO. 10084 BY DATE
SUBJECT SPILLWAY RATING CH'D DATE