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State of New Mexico

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March 19, 1998

Marvin R. Kortum, P.E.
1605 Speakman Dr. SE
Albuquerque, New Mexico 87123

**RE: Grading and Drainage Plan for Lot 437, Sandia Heights South Unit 4 (C23/D56)
(PWD-98-47) Engineer's Stamp Dated 3/9/98.**

Dear Mr. Kortum:

Based on the information provided with the submittal of March 10, 1998, the plan for the above referenced Lot is approved for Building Permit release.

As you are aware, the Engineer's Certification must be submitted to and approved by the County and my office prior to release of the Certificate of Occupancy for this residence. It is very important that the depth of the foundation wall for the construction within the erosion setback be certified.

If you have any questions, or if I may be of further assistance to you, please call me at 924-3982.

Sincerely,

A handwritten signature in cursive script, reading "Susan Calongne".

Susan M. Calongne, P.E.

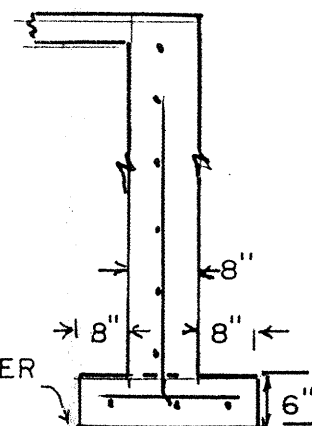
City/County Floodplain Administrator

c: Andrew Garcia, City Hydrology
Brad Catanach, Bernalillo County Public Works Division
Kurt Browning, Albuquerque Metropolitan Arroyo Flood Control Authority
Kerney Bolton, Owner
File

FFE PER PLAN

(M)

BOTTOM OF FOOTER
6156



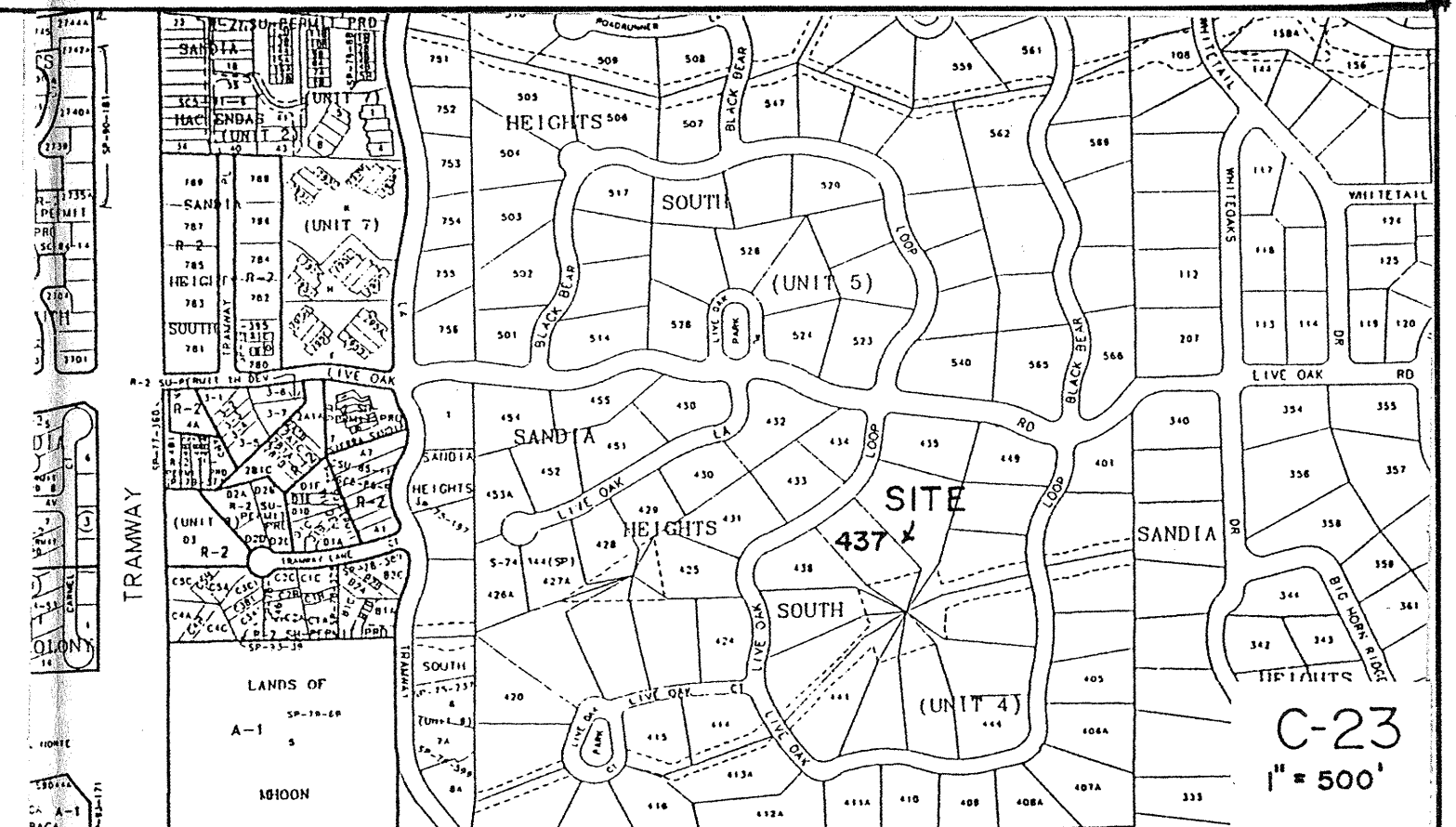
NOTES FOR FOUNDATION WALL CONSTRUCTION WITHIN THE EROSION SETBACK AREA:

- Wall may be cast in place portland cement concrete (PCC) or PCC filled concrete masonry unit (CMU) blocks.
- Place # 4 r'bar at 8" on center (o. c.) horizontally, and 16" o. c. vertically.
- Soil to be compacted to 90% of maximum dry density (ASTM 1557).

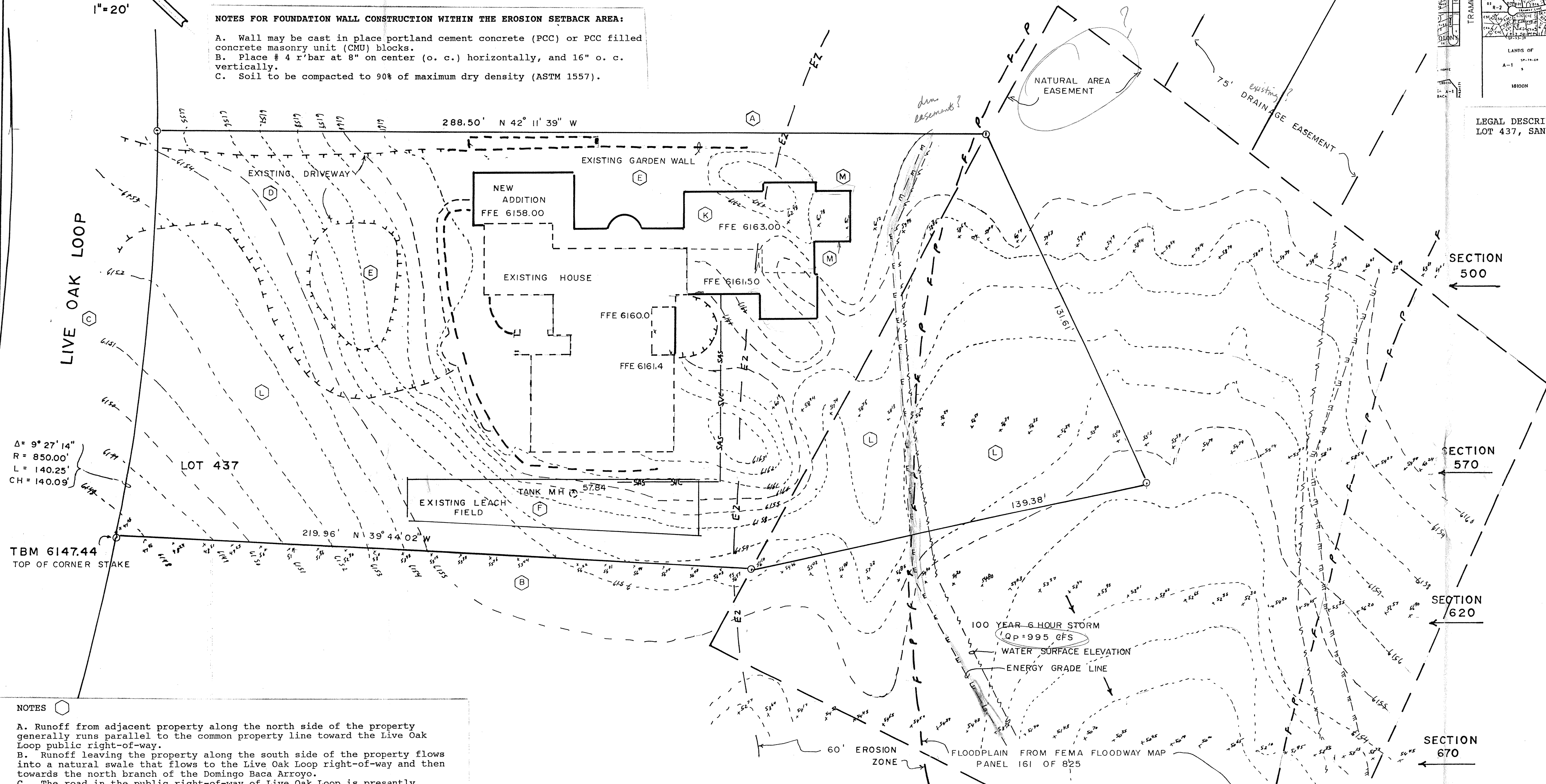
I certify that I have personally inspected the Lot 437 SANDIA HEIGHTS SOUTH UNIT 4 site and the surrounding terrain. The representation of the land and the contours are as presented on these drawings and the accompanying text as of MARCH 1998. There natural surface within the boundaries of lot 437 have been altered by the past construction of the existing house on the lot.

Marvin R Kortum *MRK* MARCH 9, 1998
Spot elevations by Marvin R Kortum. Topography by owner.

BENCHMARK: Station 1-C23, located at the southeast corner of Lot 870 Tramway Lane, within the Tramway Boulevard right-of-way, on the east side of the right-of-way, 800 feet south of Live Oak Road. The station is a 1" diameter iron pipe set in a concret pedestal at the ground level.
Elevation: 6062.966



LEGAL DESCRIPTION
LOT 437, SANDIA HEIGHTS SOUTH UNIT 4, BERNALILLO COUNTY, NEW MEXICO



NOTES

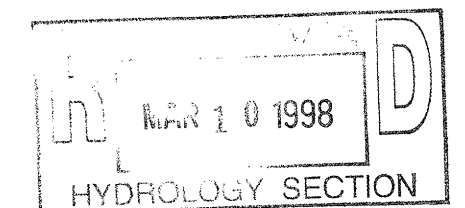
- Runoff from adjacent property along the north side of the property generally runs parallel to the common property line toward the Live Oak Loop public right-of-way.
- Runoff leaving the property along the south side of the property flows into a natural swale that flows to the Live Oak Loop right-of-way and then towards the north branch of the Domingo Baca Arroyo.
- The road in the public right-of-way of Live Oak Loop is presently graded with an asphalt surface.
- The driveway within the lot is surfaced with gravel.
- Landscape, garden or orchard area.
- General location of the existing septic tank drain field. Size and depth of additional tank and leach field shall be as required by County of Bernalillo permit. The site itself is verified as more than 100 feet from an existing well because the site is on a community water system. Surface runoff from the existing house and the addition will not adversely impact on the leach field location. If an additional tank is required for the addition the tank may be placed along the line leading from the addition to the present leach field.
- For detailed house dimensions see architectural drawings. The designated finished floor elevation is based on slab on grade construction, and may be varied up to 2 feet up or down with only minor changes in exterior grading required. Alternative construction methods such as suspended floor or other methods may require revisions to the grading plan.
- Quantitative earthwork estimates should be based on more detailed topographic cross sections of the work area.
- No solid walls or other structures, berms or swales shall be constructed on the lot property lines which will obstruct cross flow of sheet flow runoff from the adjacent property to the east. Buildings and partial yard fencing and walls as shown on this plan are permitted. Future buildings, landscaping, or other treatment interior to the lot must provide for cross flow of runoff from adjacent property.
- All berms and earthwork supporting structures must be compacted to 95% of maximum dry density (Modified Proctor Test).
- Footings for foundation walls may be stepped. See architectural drawings for details on footings.
- Undisturbed area.
- Construct foundation wall to depth as shown within the Erosion Setback Zone. See detail for wall construction.

N. All cut and fill slopes and constructed drainage swales are to be provided with an erosion control surface by developer/owner. Coverings may be turf, rock, terraced with garden walls or timbers or similar according to the landscape plan. Erosion control is for protection and ease of maintenance. To prevent damage to downstream property, erosion control must be placed within six months of completion of the building, or one year from the issuing of the building permit. Erosion control may be provided by seeding with a native grass mixture as follows:

Common name	Genus-species	Pounds/Acre
"Palma"	Oryzopsis	
Indian rice grass	Hymenoides	2.0
"Viva" Galleta grass	Hilaria Jasmessii	2.0
"Niner" Sideoates Gramma	Bouteloua curti Pedula	2.0
"Hatchita" Blue Gramma	Bouteloua Gracilis	3.0
Sand dropseed (NM Region)	Sporobolus Cryptandrus	1.0
Four-wing Saltbrush	Atriplex Canesoens	1.0

The seed will be spread on loose surface soil, raked or worked into the soil about one-half inch, and a straw mulch or a mulch mat placed over the seed to prevent erosion. The seeded area is to be watered daily until a turf is established.

P. Additional fill may be placed around the perimeter foundation wall. All wall materials below the finished exterior grade shall be approved for direct contact with the earth. All fill so placed shall have a minimum slope of 5% away from the building.



Preliminary APPROVALS, REVISIONS MRK BY MARCH 9, 1998 DATE

MARVIN R. KORTUM, P.E.
Civil Engineering
NM PE 6519
1605 Speakman Drive, S.E.
Albuquerque, New Mexico 87123
(505) 298-0774

GRADING AND DRAINAGE PLAN
LOT 437 LIVE OAK LOOP
SANDIA HEIGHTS SOUTH UNIT 4
ADDITION TO HOUSE

PROJECT NO. PWD MAP NO. C-23 SHEET OF 1/4

PURPOSE:

The purpose of this grading and drainage plan is to obtain approval for a building permit for an addition to an existing residential house on lot 437.

SOILS:

Soils on lot are 9 identified by reference C as Embudo-Tijeras complex, 0-3% slopes (EUC). The Embudo soil is in drainage ways and depressions. Runoff is medium and the hazard of water erosion is moderate. The soil is suited for residential buildings and septic drain fields. Soils may be susceptible to consolidation, particularly when wetted, so care must be taken to direct runoff and landscape watering away from building foundations.

DISCUSSION:

A. The proposed construction is to be located on an existing natural ridge just north of a branch of the North Arroyo de Domingo Baca. The existing house is located about 80 feet from the north edge of the arroyo. The proposed addition will extend toward the arroyo, to within about 30 feet of the edge of the designated 100 year floodplain.

B. The proposed addition will increase the amount of impervious area on the lot by about 3000 SF from that which presently exists. Table A shows the estimated total runoff from the lot with improvements, with an increase to 3.3 CFS from the original 2.4 CFS from the undeveloped lot. Most of this runoff leaves the lot by existing natural swales that flow parallel to the major arroyo, entering the major arroyo downstream from lot 437.

C. The current Flood Insurance Rate Map, panel 161 of 825, shows a 100 year floodway along the northeast portion of lot 437, with a Zone AO depth of about 2 feet. This arroyo has been analysed as shown on these drawings. The arroyo drains a basin of about 410 acres, the eastern limits of the basin being the first ridge line of the Sandia Mountains. There are four sub-basins within the 410 acres, with separate channels running parallel to each other from east to west. These channels enter the Sandia Heights housing area in fairly deep arroyos, separated by rock ridges. About 1000 feet east of the lot 437 site, the small channels converge into the single channel which then continues west, crossing the south part of lot 437. After leaving the zone of the well defined rock ridges (as shown along Big Horn Ridge Road), the channels converge on an alluvial fan, with evidence that the channel has moved (meandered), as shown by numerous parallel channels, and the build up of a levee along either side of the channel, most prominent along the north side of the arroyo. The 1973 aerial photograph indicated that the arroyo was experiencing a build up of sediment in the immediate vicinity of lot 437, as shown by the spreading of the channel. Current field check show that there is a gradual degradation of the channel, as indicated by slight undercutting of the vegetation and rocks within the active channel. The channel itself is now partially stabilized by the paved street crossing, two such crossings being within 200 feet north and south of lot 437 as the arroyo crosses Live Oak Loop. Upstream the arroyo is fixed by the crossing structure on White Oaks Drive, the crossing structure consisting of 4-48" RCP pipes.

D. Flow within the channel is estimated at 950 CFS (see separate calculations). About one-half of this flow will be from the north sub-basin (Basin A), and the rest evenly split among the other basins. All channels cross Big Horn Ridge Road by means of pipes under the road berm. For the purpose of estimating peak flow, these pipes and berms are considered open channels. For the Basin A channel this assumption is realistic in that the road berm is fairly shallow, only 4 feet high, and there are only two 36" pipe through the berm. The 100 year design storm will overflow the berm. For basins B and C, the road berms are higher, and may provide a significant storage and lowering of the peak flow, but no credit is being taken for such storage. There is no significant storage capability within Basin D.

E. The 100 year floodplain is shown on the drawing. A HEC 2 flow estimate was done, and the results of computations closely agree with the 100 year floodplain markings. Using the rule of 6 feet erosion setback for each 100 CFS of peak flow, a 60 feet erosion setback is shown on the drawing. The original house was beyond the limits, but the new addition will be within the erosion limits. It is proposed that the foundation of the addition for that portion within the erosion limits be floodproofed by setting the foundation walls below the estimated scour depth. The required depth is estimated by the formula 3-87 of reference H, which states that scour depth divided by the channel flow depth is equal to 4 times the channel flow Froude number to the 1/3 power. The Froude number for the wide shallow channel is estimate at about 1, so a scour depth of about 4 times the average channel depth of 1 foot is used for head-on scour. The configuration of the house addition is such that any channel movement will result in a direct impact, as opposed to a sweeping impact. There is no control proposed for restraining the opposite bank of the channel. An alternative to placing a foundation to the scour depth would be to place an intercept wall between the foundation and the channel, but such a wall would have to be equally as deep, and longer, to provide full protection to the foundation. The proposed house foundation placed below the estimated scour depth will provide protection for a number of major flows, but if erosion occurs up to the wall additional corrective measures may be required at a later date. The additional depth on the foundation walls at this time is a reasonable economical solution.

CONCLUSIONS:

A. The proposed construction is not within a designated 100 year floodplain.

B. Construction as proposed will not increase the hazard from flooding to downstream properties.

C. This Grading and Drainage Plan does not propose changes to the FLOODWAY or FIRM maps.

REFERENCES:

- Bernalillo County Ordinance No. 90-6
- Section 22.2, Hydrology, of the Development Process Manual, Volume 2, Design Criteria, for the City of Albuquerque...Bernalillo County...AMAFCA, January 1993.
- Soil Survey of Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico, USDA-SCS.
- Flood Insurance Rate Map (FIRM), City of Albuquerque, Bernalillo County, New Mexico, Federal Emergency Management Agency (FEMA), Panel 161 of 825, effective date, September 20, 1996, scale 1"=500'.
- Flood Insurance Rate Map (FIRM), City of Albuquerque, Bernalillo County, New Mexico, Federal Emergency Management Agency (FEMA), Panel 11 of 50.
- Topographic Orthophoto Map, Albuquerque Metropolitan Arroyo Flood Control Authority, Bernalillo County, New Mexico, Sheet C-23, Aerial Photography dated May 15, 1973. Scale 1"=200'.
- Open-channel Hydraulics, Richard H. French, McGraw-Hill Book Company, 1985.
- Sediment and Erosion Design Guide, AMAFCA, December, 1993.

MARCH 9, 1998
RUNOFF FOR LOT 437, UNIT 4, SANDIA HEIGHTS SOUTH

TABLE A
RUNOFF ESTIMATE FOR ON-SITE BASIN OF 1.045 ACRES, (LOT 437).

Land use	Runoff Factors		CURRENT USE		PROPOSED USE			
	Zone 4							
	Peak	Total	Area	Percent	Peak	Total	Area	Percent
	CFS/acre	inches	SF		Runoff	Runoff	SF	
					CFS	CF		
A	2.26	0.66	45520	1.000	2.4	2503.6	23520	0.517
B	3.05	0.85	0	0.000	0.0	0.0	10000	0.220
C	3.94	1.13	0	0.000	0.0	0.0	5000	0.110
D	5.74	2.57	0	0.000	0.0	0.0	7000	0.154
TOTALS			45520	1.000	2.4	2503.6	45520	1.000
			1.045 acre				1.045 acre	

NOTES:

- Runoff factors from Section 22.2, Hydrology, of the Development Process Manual, Volume 2, Design Criteria, City of Albuquerque, Bernalillo County and AMAFCA, January, 1993
 - Land use descriptions:
 - Uncompacted soil
 - Lawn, shrubs
 - Compacted soil
 - Impervious areas
 - Peak runoff = Area (acres) x factor (CFS/acre) = CFS
 - Total runoff = Area (SF) x factor (inches) / 12 (inches / foot) = CF
 - Peak and total runoff is based on 6 hour, 100 year frequency storm
 - The current use is for the site in its natural state, or partially developed if off-site.
- The proposed use is for full development of the basin, under present zoning

HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991

T1 RUN 1: LIVE OAK 437 SINGLE PROFILE SUBCRITICAL RUN, 100 YEAR STORM
T2 PROFILE AND CROSS SECTIONS
T3 NORTH DOMINGO DE BACA
T4

	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0					-1			950	6152	
J2	NPROF	IPILOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
-1		0	10	2	40		-1			
J3	VARIABLE CODES FOR SUMMARY PRINTOUT									
38		1	3	57	68	150	2			
NC	.04	.04	.035	.1	.3					
SECNO	DEPTH	CWSEL	CRWS	WSELK	EG	HV	HL	GLOSS	L-BANK ELEV	
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV	
TIME	VLOB	VCH	VROB	XLN	XLCH	XLNR	WLN	ELMIN	SSA	
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST	

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CEHVV= .100 CEHVV= .300

*SECNO 670.000	3720	CRITICAL DEPTH ASSUMED								
670.000	2.37	6152.37	6152.37	6152.00	6153.06	.69	.00	.00	6153.15	
950.0	.0	950.0	.0	.0	143.0	.0	.0	.0	6154.40	
.00	.00	6.64	.00	.000	.035	.000	.000	6150.00	29.69	
.016157	0.	0.	0.	0	7	0	.00	104.45	134.15	

*SECNO 620.000

3265 DIVIDED FLOW

3280 CROSS SECTION 620.00 EXTENDED .01 FEET

7185 MINIMUM SPECIFIC ENERGY

3720	CRITICAL DEPTH ASSUMED									
620.000	2.37	6154.67	6154.67	.00	6155.31	.64	.76	.00	6152.30	
950.0	83.3	855.2	11.5	16.7	130.0	5.6	.2	.1	6154.80	
.00	4.99	6.58	2.05	.040	.035	.040	.000	6152.30	39.67	
.014339	50.	50.	50.	0	5	0	.00	127.92	220.00	

*SECNO 570.000

7185 MINIMUM SPECIFIC ENERGY

3720	CRITICAL DEPTH ASSUMED									
570.000	2.12	6156.91	6156.91	.00	6157.50	.59	.79	.01	6156.00	
950.0	5.6	944.4	.0	1.9	153.3	.0	.3	.3	6158.70	
.00	2.86	6.16	.00	.040	.035	.000	.000	6154.79	45.71	
.017433	50.	50.	50.	0	15	0	.00	137.27	182.98	

500.000	2.17	6160.24	6160.24	.00	6160.78	.54	1.19	.00	6159.39	
950.0	21.8	691.5	236.7	7.5	110.7	46.9	.6	.5	6159.60	
.01	2.91	6.25	5.04	.040	.035	.040	.000	6158.07	29.24	
.016457	70.	70.	70.	0	8	0	.00	163.88	202.75	

NORTH DOMINGO DE BACA

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRWS	EG	10*KS	VCH	AREA
*	670.000	.00	.00	.00	6150.00	950.00	6152.37	6152.37	6153.06	161.57	6.64	143.02
*	620.000	50.00	.00	.00	6152.30	950.00	6154.67	6154.67	6155.31	143.39	6.58	152.34
*	570.000	50.00	.00	.00	6154.79	950.00	6156.91	6156.91	6157.50	174.33	6.16	155.30
*	500.000	70.00	.00	.00	6158.07	950.00	6160.24	6160.24	6160.78	164.57	6.25	165.13

NORTH DOMINGO DE BACA

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH	CWSEL	EG	ALPHA	FRCH
*	670.000	950.00	6152.37	.00	.00	.37	104.45	.00	6152.37	6153.06	1.00	1.00
*	620.000	950.00	6154.67	.00	2.30	.00	127.92	50.00	6154.67	6155.31	1.06	.96
*	570.000	950.00	6156.91	.00	2.24	.00	137.27	50.00	6156.91	6157.50	1.01	1.01
*	500.000	950.00	6160.24	.00	3.33	.00	163.88	70.00	6160.24	6160.78	1.06	.99

MARCH 9 1998

RUN OFF ESTIMATE BASED ON DPM SECTION 22.2

CONVEYANCE

$$b-4 \quad K = \frac{L}{1/T_1 + L^2/T_2 + L^3/T_3 + L^4/T_4}$$

$$L = \text{CHANNEL} + \text{UPPER SLOPE} = 7500' + 2200'$$

$$S_1 = \frac{8000 - 7600}{400} = 1.0 \quad K_1 = 1.7 \quad \text{SEE TABLE B-1}$$

$$S_2 = \frac{7600 - 7000}{1800} = .333 \quad K_2 = 2$$

$$S_3 = \frac{7000 - 6600}{2000} = .20 \quad K_3 = 3$$

$$S_4 = \frac{6600 - 6160}{5500} = .08 \quad K_4 = 3$$

$$S = \frac{8000 - 6160}{9700} = .18769$$

$$K = \frac{9700 / T_1 .18769}{400 / T_1 + 1800 / 2 .333 + 2000 / 3 .2 + 5500 / 3 .28} = 2.20449$$

$$\text{BASIN FACTOR } K_n = \frac{(2200(.042) + (2000(.035) + 5500(.025))}{9700} = .03051$$

SEE TABLE B-2

TIME OF CONCENTRATION: b-6 LCA = 6000

$$t_c = \frac{12000 - L}{(7200)(K)(S)^{.33}} + \frac{(L - 4000) K_n (LCA / L)^{.33}}{(552.2)(S)^{.165}}$$

$$= .03327 + .35359 = .38686 \text{ HR}$$

INTENSITY: a-12 P₅₀ = 2.23 TABLE A-2

$$I = .726 (\log_{10} 24.6 \times t_c) \times P_{50} = .726 (.97899) 2.23 = 4.0949$$

$$UNADJUSTED Q = CIA = (.66)(4.0949)(410) = 1100 \text{ CFS}$$

$$A = 195 + 80 + 65 + 70 = 410$$

ADJUSTMENT FOR STEEP SLOPES

$$b-10; S = .18769 \quad (-62.375 \times S)$$

$$S' = .052467 + .063627 \times S - .018197 \text{ E}$$

$$S' = .052467 + .01207 - .00000132 = .06454$$

$$b-11 \text{ \& } b-12 \quad S' = .06454$$

$$K' = .302 \quad S' = .06454 \quad Q_{0.18} = (.302 / .25405) (.852737)$$

$$K'' = .207 \quad S' = .06454 \quad Q_{0.18} = (.207 / .25405) (.852737)$$

$$K' = .419313 \quad K'' = .287410$$

K is LESS THAN K'', RECOMPUTE Qp USING K''

$$Q_{0.18} = \frac{12000 - 9700}{(7200)(K'')(S')^{.33}} + \frac{(9700 - 4000)(.03051)(\frac{6000}{9700})^{.33}}{(552.2)(.06454)^{.165}}$$

$$= \frac{2300}{52571.3} + \frac{(5700)(.03051)(.85341)}{(552.2)(.06454)^{.165}} =$$

$$.04375 + .42243 = .46618$$

$$I = .726 [\log_{10} (24.6 \times t_c)] 2.23 = .726 (.97899) 2.23$$

$$= .46618$$

$$= 3.67946$$

$$Q = CIA = 995 \text{ CFS}$$

Preliminary
APPROVALS, REVISIONS

MRK
BY
DATE

MARCH 9, 1998

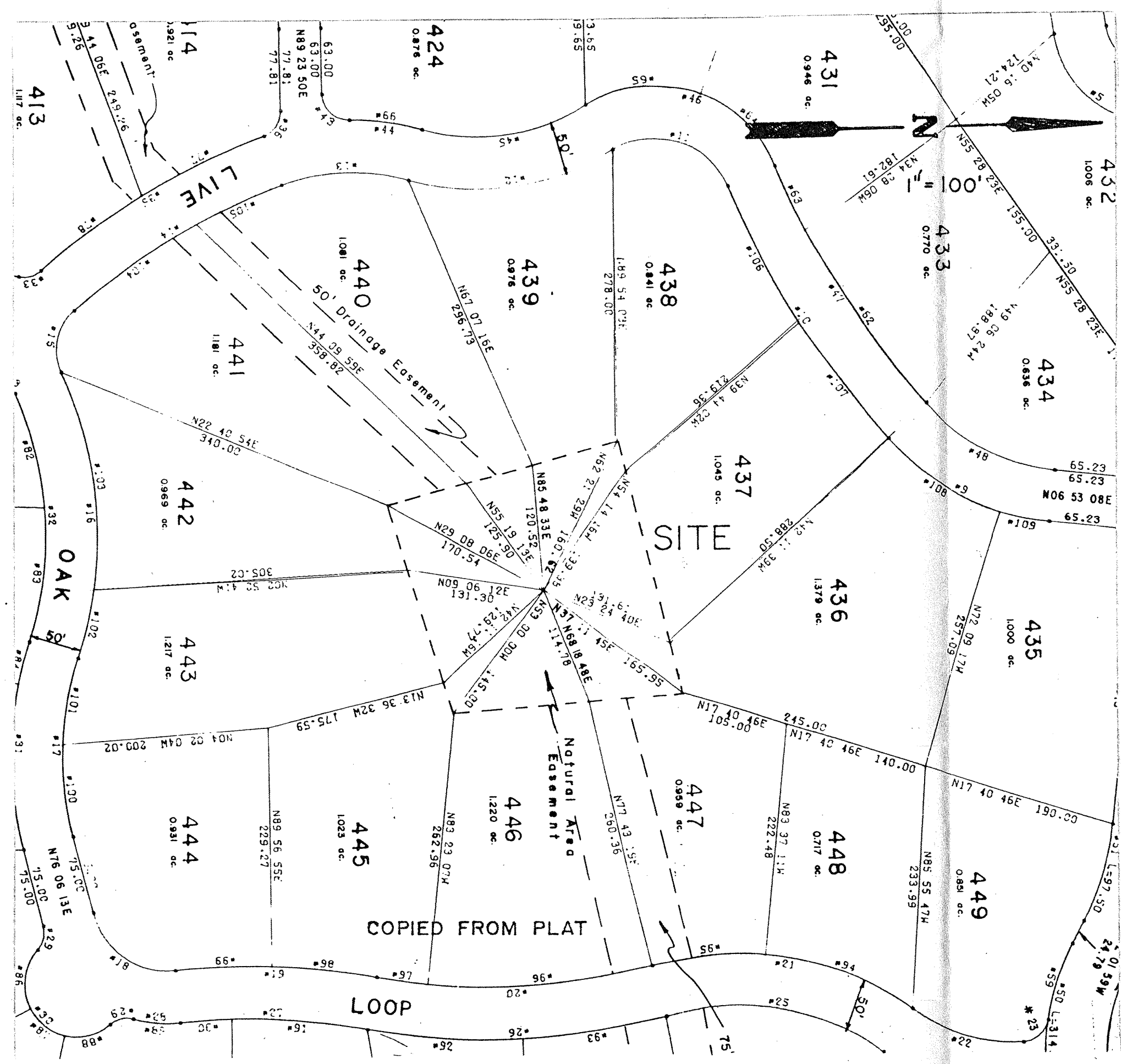
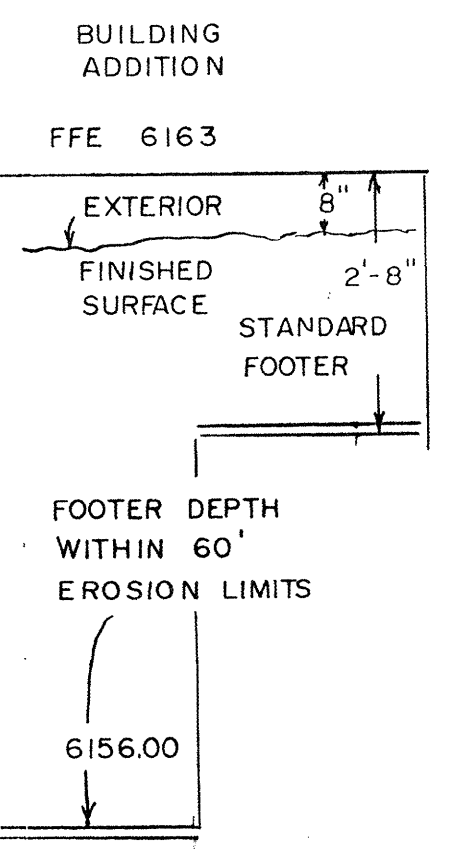
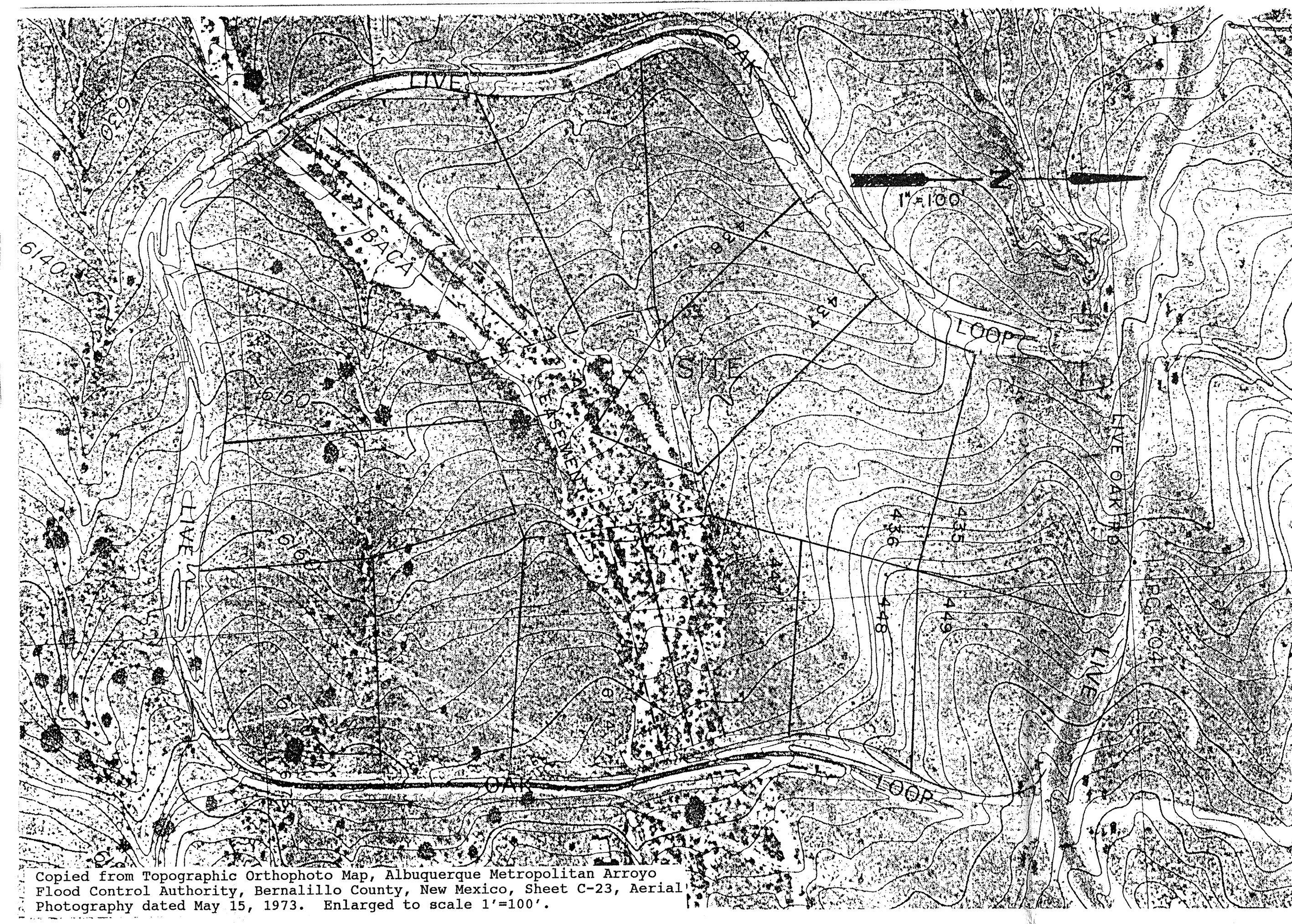
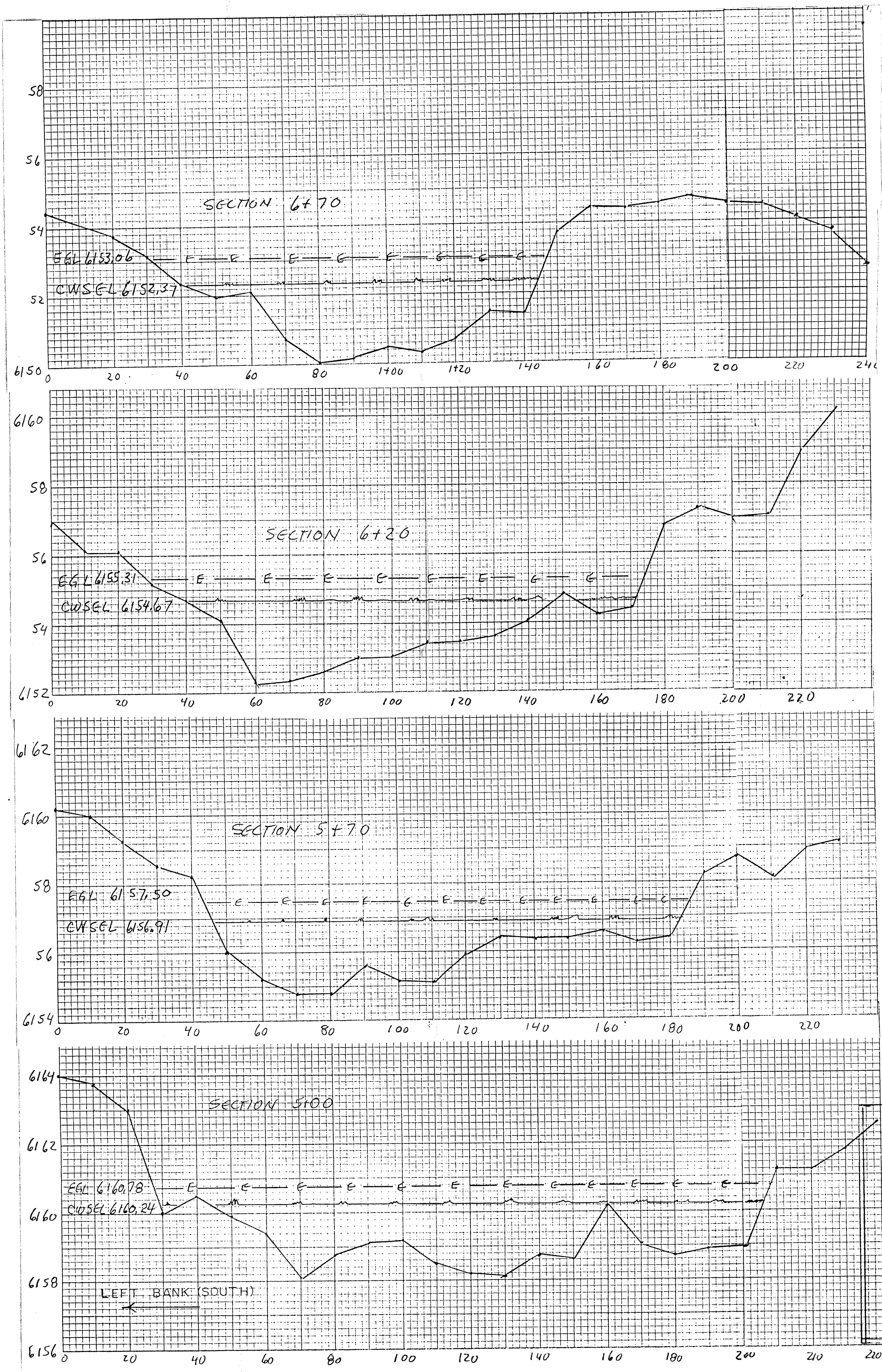
MARVIN R. KORTUM, P.E.
Civil Engineering
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1605 Speakman Drive, S.E.
Albuquerque, New Mexico 87123
(505) 299-0774

GRADING AND DRAINAGE PLAN
LOT 437 LIVE OAK LOOP
SANDIA HEIGHTS SOUTH UNIT 4
RUNOFF CALCULATIONS

PWD

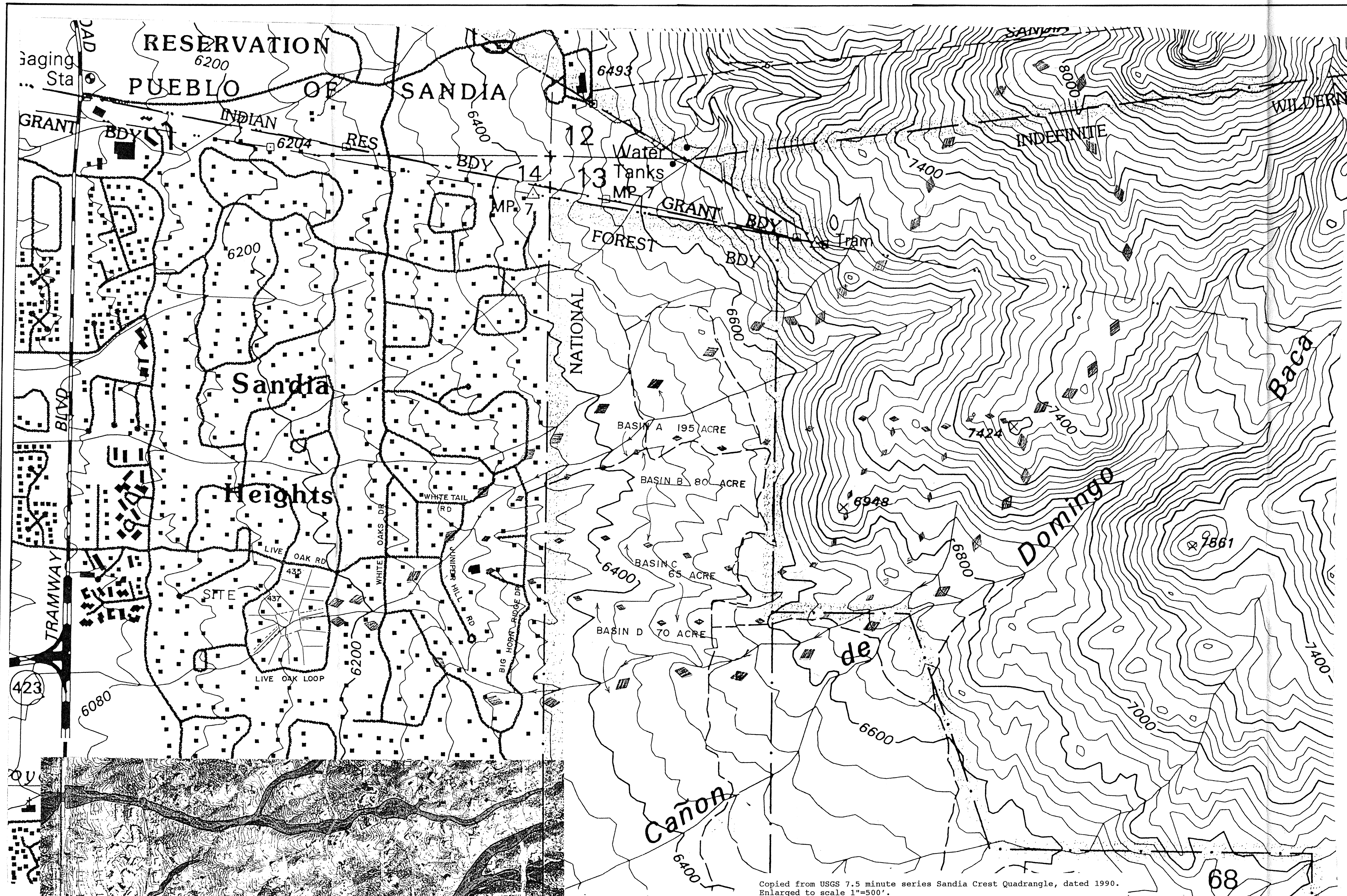
C-23 2/4

CHANNEL SECTIONS LOOKING DOWNSTREAM (WEST) H: 1" = 20' V: 1" = 2'



Preliminary APPROVALS, REVISIONS MRK BY DATE MARCH 9, 1998
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GRADING AND DRAINAGE PLAN
LOT 437 LIVE OAK LOOP
SANDIA HEIGHTS SOUTH UNIT 4
HEC-2 WATER SURFACE CROSS SECTIONS



Preliminary
APPROVALS, REVISIONS

MRK
BY

MARCH 9, 1998
DATE

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GRADING AND DRAINAGE PLAN
LOT 437 LIVE OAK LOOP
SANDIA HEIGHTS SOUTH UNIT 4
DRAINAGE BASINS

PWD

REC'D C-23
MAR 10 1998
HYDROLOGY SECTION

4/4