COMPILATIONS ON: MOON VALLEY

- USA CORPS OF ENGINEERS DATA/RELATED INFORMATION

Property of
Flood C... MC Library
...01 W...
Phoenix, AZ ...09

Property of
Flood Co... of MC Library
Please Return to:
2801 W. Durango
Phoenix, AZ 85009

100 YEAR DISCHARGE

Location	C.F.S.	Location	C.F.S.
1	309	44	62
2	522	45	99
3	831	46	16
4	926	47	116
5	98	48	211
6	94	49	446
7	248	50	417
8	366	51	245
9	26	52	352
10	460	53	100
11	114	54	327
12	304	55	706
13	57	56	698
14	108	57	73
15	399	58	229
16	289	59	885
17	691	61	69
18	630	62	126
19	92	63	128
20	695	64	22
21	2589	65	41
22	113	66	165
23	185	67	2647
24	243	68	56
25	49	69	108
26	194	70	258
27	194	71	292
28	697	72	2816
29	921	89	175
30	968	90	10
31	1017	91	20
32	978	92	200
33	979	93	271
34	983	94	72
35	1117	95	48
36	1104	96	295
37	1117	107	42
38	1104	108	119
39	16	138	876
40	180	139	1532
41	109	161	2620
42	130	162	2711
43	372	168	2562
		171	2842

MOON VALLEY
HYDROLOGY MODEL

DESIGN : JM	DATE	SCALE	SHEET
DRAWN : HM	5-1-76	1" = 400'	1 OF 1
CHECKED: JM			

HCI
HYDROLOGY CONSULTANTS, INC.
PHOENIX, ARIZONA

CONTENTS OF BOUND REPORT

Note: Report may or may not be stapled

A. Comments on Moon Valley Floodplain Project as of February 1992 (Tom Hieb and Max De Vera)

B. Draft of USArmy Corps of Engineer Preliminary Report (not completed)

C. Map Indicating Project Area

D. Limited Map Maintenance Program Scope of Work

E. Miscellaneous communication letters and notes

F. City of Phoenix communication letters

G. Drainage Study of Hillcrest(Thunderbird to Bell Road by F.M.Whitmore Engrs. (No date)

H. Floodplain Analysis for Moon Valley Gardens VII Lot 54
by Water Resources Associate, Inc. Oct 5, 1987
Appendix A - HEC2 Cross Section Plots
Appendix B - HEC2 Input/Output Data

I Culvert Analysis at 7th Street and 10th Place (dated 10/89)

J. Moon Valley Watershed Delineation by Hydrology Consultants, Inc.(1976)

K. Topographic Maps Sheets 32-26,27,28,29 and 33-27,28,29 with floodplains

L. Moon Valley plotted profiles by COE with indicated sections

M. FEMA Flood Plain Map

N. Detention Dams Plans and Specifications

O. Miscellaneous Floodplain Delineations draft

P. Color Photographs of Site and Microfilms provided by COE, 2 disketks HEC-1 input/output

Printout of HEC-2 Runs in separate bound report which includes also duplicate of topographic maps used by the Corps of Engineer. Peak Q's from HEC-2 runs were extracted by Amir Motamedi and indicated on a draft layout of channels.

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SOME COMMENTS ON MOON VALLEY FLOODPLAIN PROJECT
(for discussion purposes)

A review of available data of the Corp of Engineers (unclassfied) and those of Kaminski Hubbard Enginering, Inc has been made and the following are initial comments as of February 3, 1992.

Topographic Map Comparison

1. The topomap used by the COE (prepared using air photo taken 1975) was compared with the topomap prepared by Kaminski Hubbard Enginnering, Inc. (using air photo taken 1991). Some contour line comparison are as follows:

   a. C.L. 1320 upstream of intersection of Thunderbird Rd. and Moon Valley Wash is located closer to wash in the KH topomap as shown in the annex map(Annex A)

   b. C.L. 1330 through delineated floodplain area in North Split portion is located lower in the KH topomap; this will decrease the delineated flood plain area if KH map is considered.

   c. C.L. 1340 near upstream of junction of south branch and diversion channel is displaced by as much as 300-400' for a lenght of about 400'. Its intersection with wash is 260' u/s of junction point in the KH topomap and 750' u/s of same point in the COE topomap (Annex B)

   d. C.L. 1352 near intersection marked 1344 in KH topomap is located at about the location of Contour 1350, an elev. diff of 2 for a distance of about 400'.

   e. C.L. 1360 near intersection of north branch and 7th street is also placed lower compared to the COE topomap.

2. It appears therefore that based on the above comparisons the contour lines in the KH topomap seem to be located lower than those in the COE topomap, indicating lesser floodplain area using the newer topomap, if previously estimated discharges are used.

Discharge Estimates Comparison

1. Based on Standard Project Flood analysis done by COE in 1973 for Moon Valley Wash for DA = 4.17 sq.mi. the Q100 is 6,200 (Refer to available microfilms) which is equivalent to 1487 cfs/sq.mile. Presumably this was the basis for the Flood Insurance Rate Map (FIRM) which covers large area for the Moon Valley Wash.

2. In Water Resources Associate, Inc report dated October 1987, Lot 54 near intersection of Thunderbird Rd. and Moon Valley Wash was subjected to Floodplain Analysis. Based on their field inspection "n" value should be 0.08 - 0.100 with severely overgrown vegetation. In the previous FEMA study a value of n = 0.023 was used. WRA decided to use 0.027 in anticipation of the effect of channel improvement program of Phoenix. The previous Q

estimate of 2720 cfs was also used in the analysis. HEC-2 was run using n=0.09 resulting in flood depths increase of 2 to 2.5 ft.

3. With the new HEC-1 by Kaminski Hubbard Engineering Co. the peak Q's are: 2897 cfs for 6hr-100yr storm and 3045 cfs for 24hr-100yr storm. These are not far off the original estimates of WRA in 1987 as used for Lot 54 above.

4. At Sec. # 7435 in North branch portion where flow starts to divide, the previous Q estimate was 980 cfs as used by COE in HEC-2 run. In the new HEC-1 run the peak Q is 1393 cfs (approx. location at HC 202.) which could be significant in terms of wider flooding area.

   At about point where N-split flow joins the main wash, total flow from split and wash is 1976 cfs (976 from split and 1000 cfs in wash from HEC-2 results). The new HEC-1 run has 1957 cfs (approx location at HC 206). There is a upstream flow diversion of 243 cfs from wash (HEC2-COE). The flow balance appears to be satisfactory at this point.

5. Further analysis of HEC-1 input show that left and right bank "n" from station RM202 to RM206 is 0.045, occupying 88% of top channel width, while in the previous HEC-2 run the left and right bank "n" are assumed 0.035. This could be one reason of discrepancy in Q estimates.

5. Analysis of unit discharge of nearby wash/creeks as reported in the USGS 1989 Basin Characteristics and Streamflow Statistics show the following:

Wash/Creek	DA (sq.mi)	25 yr	50 yr	100 yr
1. Cave Creek	121	93 cfs/sm	126	165
2. Skunk Creek	65	211	326	477
3. Indian Bend W.	62	103	170	271
4. Sycamore Cr.	164	143	216	350
5. New River	67	271	382	516
MEAN		164	244	356 cfs/sq.mile

   USGS used Log Pearson Type III method of frequency analysis for the 25 yr, 50 yr and 100 yr floods (USWRC computer program).

   It can be noted that at Moon Valley Wash intersection with Thunderbird the Kaminski Hubbard Engineering Co estimated Q is 3045 cfs (100 yr freq) for DA of 5.68 sq. miles resulting in unit discharge of 536 cfs/sq.mile which is still greater than the unit Q for nearby rivers/washes as shown above.

Initial Conclusions and Recommendation

1. There are some differences in contour line locations which is difficult to reconcile. However, if the KH topomap is acceptable then the flood plain areas must have also a topomap of scale 1" = 100' which is not available for better delineation of flood plain areas.

2. Peak discharge estimates are not much different in so far as the area between Thunderbird Rd. and Moon Valley Dr is concerned. With more areas

being developed originally predicted depth of flooding will increase, however with channelization improvement program, the "n" value will decrease and conveyance efficiency will increase compensating the probable increase in flooding depth.

3. The KH estimated peak Q of 3045 cfs or 536 cfs/s.m at intersection of Moon Valley Wash with Thunderbird Rd is higher than the mean unit Q of 356 cfs/sq.mile in the area based on USGS report. It could be safe therefore to assume as the most probable peak Q.

4. A new HEC-2 model should be prepared for the questionable floodzones with actual cross-section profile survey of wash or channels, using the results of the latest HEC-1 run. Annex C shows delineated floodzones using COE results with 1" = 100' topomap

Reports/Maps Reviewed

1. Copy of Interagency Agreement dated Jan 30, 1989 for USCOE to undertake re-study of floodzones in Moon Valley Wash for City of Phoenix.

2. Topographic Maps of 1"=100' scale with contour interval of 2' as provided by City of Phoenix to Corps of Engineer of Moon Valley Wash flood plain, consisting of 14 sheets (the 100 yr water surface is already indicated by COE in the map).

3. Drainage Study for Hillcrest, 7th Street and Thunderbird to Bell Road by Floyd M. Whitmore Engineers, Inc (undated)

4. Floodplain Analysis for Moon VAlley Wash, Lot 54 of Moon VAlley Gardens VII prepared by Water Resources Associates, Inc, for Mr. Lee Niles, Oct. 5, 1987.

5. Flood Insurance Study (LMMP), Moon Valley Wash,prepared by LA District US Army Corps of Engineers for FEMA, draft dated Nov 1989, no appendices.

6. Topographic Maps of scale 1"=400" prepared by Kaminski Hubbard Engineering Co. for Area Drainage Master Study (MCFCD).

7. Results of HEC-1 run dated 12/04/91 for Moon Valley Wash Watershed with input data revised by DLB 11/22/91.

8. Results of HEC-2 run dated Oct/Nov 1989 for Moon Valley Wash by USArmy COE

9. Moon Valley Hydrology Model Map prepared by Hydrology Consultants, Inc. dated 5/1/76 with indicated watershed delineations.

10. FEMA Flood Insurance Rate Map covering Moon Valley Wash, Apr 15, 1988.

11. Several photographs of project site and microfilms of related reports, data and miscellaneous documents.

12. Plans and Specifications of several drainage structures located in the project site as prepared by the City of Phoenix are as follows:

a. North Mountains Detention Dams No. 2A and 2B (7th str. & Thunderbird Rd
b. Thunderbird Road, 19th Ave. to Coral Gables Drive
c. West Thunderbird Rd Bridge Over Sweetwater Wash
d. Thunderbird Road, 7th Street to Cave Creek Road
e. Thunderbird Road, 7th Street to Bell Road
f. Storm Sewer Detention Basin No 7, Central Ave. and Cactuc Rd.

M. R. De Vera - project review status as of 2/4/92

ANNEX (A)

1400
1330
1320
1320
1320
1320
1320
1320
1330
1330
THUNDERBIRD RD
Discrepancy
1320 COE Topomap
1320 Kaminski Hubbard Topo Map
SCALE 1" = 400'

ANNEX (B)

1330

1338

1340

1338

1340

1340

1340

1340

1338

1338

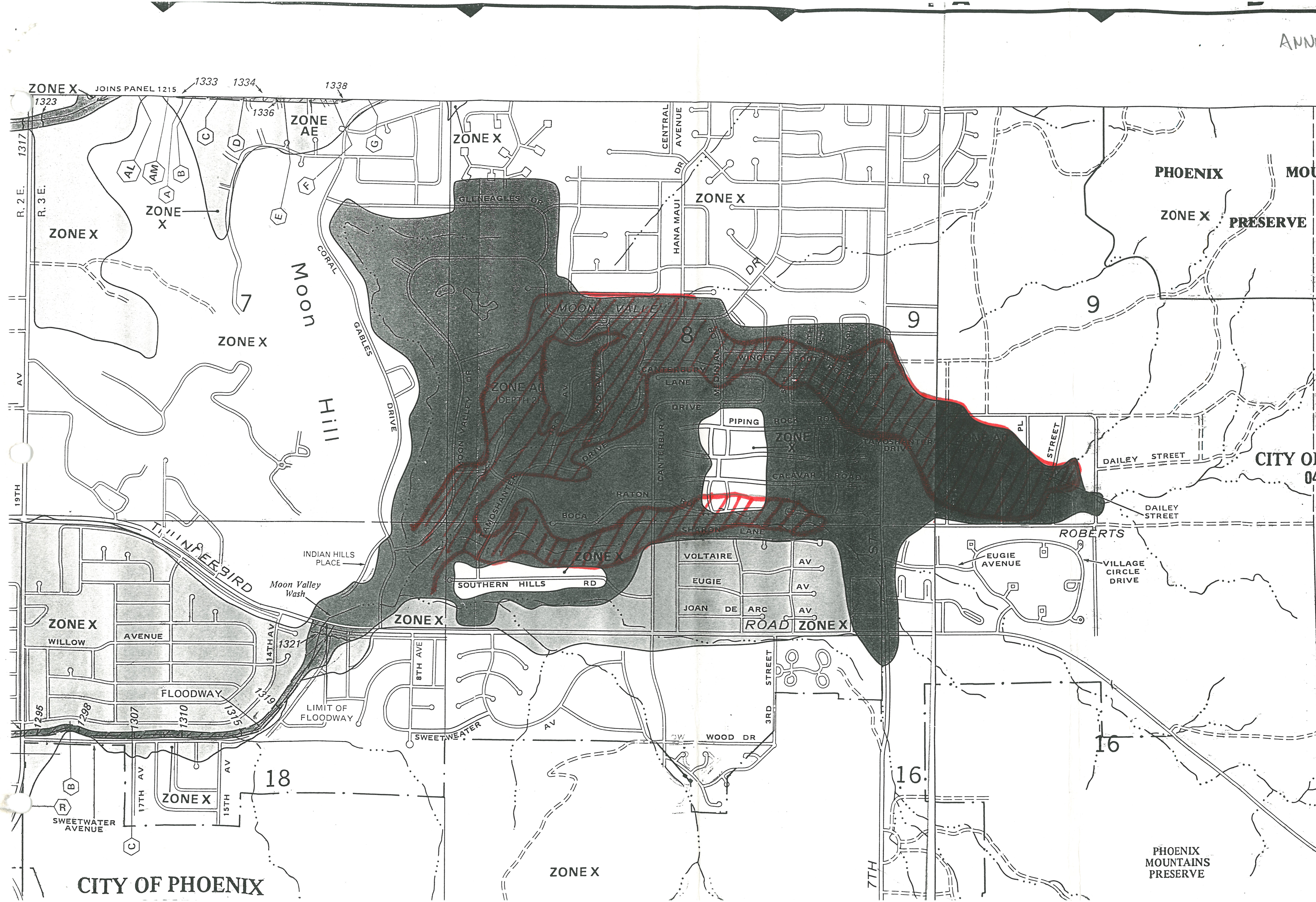
1340 — COE Topo Map

1340 — Kaminski Hubbard Topo Map

Discrepancy

Scale: 1" = 400'

ANNEX C



ZONE X
JOINS PANEL 1215
1323
1333
1334
1336
1338
ZONE AE
R. 2 E.
R. 3 E.
1317
ZONE X
Moon Hill
CORAL GABLES DRIVE
GLENEAGLES DR
MOON VALLEY
ZONE AO (DEPTH 2)
CANTERBURY LANE
WINGED FOOT
PIPING ROCK
TAMOSHANTER DRIVE
CALAVAR ROAD
RATON
BOCA
SHARON LANE
CENTRAL AVENUE
HANA MAUI
PHOENIX MOUNTAINS PRESERVE
CITY OF
DAILEY STREET
ROBERTS
EUGIE AVENUE
VILLAGE CIRCLE DRIVE
INDIAN HILLS PLACE
Moon Valley Wash
THUNDERBIRD
SOUTHERN HILLS RD
VOLTAIRE
EUGIE
JOAN DE ARC
ROAD
WILLOW
AVENUE
14TH AV
1321
FLOODWAY
LIMIT OF FLOODWAY
8TH AVE
SWEETWATER AV
WOOD DR
3RD STREET
7TH ST
1295
1298
1307
1310
1315
1319
SWEETWATER AVENUE
17TH AV
15TH AV
18
16
7
8
9
CITY OF PHOENIX
PHOENIX MOUNTAINS PRESERVE

DRAFT

FLOOD INSURANCE STUDY (LMMP)

MOON VALLEY WASH

CITY OF PHOENIX

MARICOPA COUNTY, ARIZONA

PREPARED FOR

FEDERAL EMERGENCY MANAGEMENT AGENCY

BY

LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS

NOVEMBER 1989

Flood Insurance Study

City of Phoenix

Maricopa County, Arizona

1.0 INTRODUCTION

1.1 Purpose of Study

This study provides the technical information required for a limited update of the existing flood insurance study for the City of Phoenix in the Moon Valley area. It includes a detailed water surface profile analysis of Moon Valley Wash, north branch and south branch, with 100-year flood overflow boundary and floodway delineated.

1.2 Authority and Acknowledgements

The sources of authority for this study are the National Flood Insurance Act of 1968, as amended, and the Flood Disaster Protection Act of 1973. This study conforms to the criteria of the Limited Map Maintenance Program (LMMP) as set forth in a report transmitted by a memorandum on August 26, 1986 from the Executive Deputy Administrator of the Federal Insurance Administration to Regional Directors.

The hydraulic analysis for this study was performed by the U.S. Army Corps of Engineers, Los Angeles District, for the Federal Emergency Management Agency under Inter-Agency Agreement Number EMW-89-E-2994 Project Order Number 8. The analysis was completed in November of 1989.

2.0 ENGINEERING METHODS

Standard hydrologic and hydraulic study methods were used to determine the flood overflow information. Only the 100-year flood and floodway were analyzed. The downstream study limit was approximately 1500 feet downstream of Thunderbird Road bridge near Coral Gables Drive. This most downstream reach is approximately 3700 feet long and is bounded on the upstream end by a confluence. Above this confluence, are the north branch and the south branch of Moon Valley Wash, which are approximately 9400 feet and 7500 feet long, respectively.

2.1 Hydrology

The Corps of Engineers evaluated hydrologic information developed by Hydrology Consultants, Inc. (HCI), which provided the data in 1984 for the original flood insurance study. HCI revised the earlier work by the Corps, published in "Hydrology for Flood

Insurance Studies (FIS), City of Phoenix, Maricopa County, Arizona," April 1973. The report by the consultants states that they used the computer program HEC-1, the Soil Conservation Service dimensionless unit hydrograph, and n-year 6-hour NOAA rainfall, and that they took into account the effect of three detention basins. Their resulting discharges are 40 to 50 percent lower than those of the original Corps study.

The current evaluation of the hydrology by the Corps was hampered by the lack of the HCI computer information and details about the detention basins. The Los Angeles District's Hydrology Section states in a memoradum dated 2 October 1989, that the HCI discharges seem unreasonably low when compared to the 1973 Corps data and when compared to other discharge frequency values in the original 1984 FEMA study. In the absence of hard data to the contrary, however, the Corps accepts the discharges determined by HCI.

2.2 Hydraulics

Water surface profiles, flood boundaries, and floodways were determined using the Corps computer program HEC-2. Geometric data for cross-sections was obtained from City of Phoenix topography, scale 1"=100', two-foot contour intervals, dated August, 1975. A field trip yielded observations of channel roughness and measurements of all bridges and culverts. Manning's roughness coefficients used were .030 for the short grass of the golf course, .035 for longer grass and sparse trees, .02 for rough concrete channels, and .20 for overbank areas with closely spaced houses, cinderblock walls, and fences.

The culvert program HY8 from the Federal Highway Administration was used to calculate water surface profiles through several culverts. The resulting backwater increments were then input to HEC-2. See the appendix for the HY8 results.

The profile slope of the north branch varies from about .0021 to .012 and varies for the south branch from about .003 to .018. The 100-year discharge at the downstream end of the study is 2810 cfs. The north branch discharge is 1530 cfs at the downstream end and varies to 970 cfs at the upstream end. On the south branch the 100-year discharge varies from 695 cfs to 114 cfs.

For the north branch of Moon Valley Wash, a minor split of flow occurs near cross-section 7435. For the 100-year flood, approximately 100 cfs splits from the flow in the north branch and joins overland flow west along Moon Valley Drive. About 1200 feet later this flow joins another south-flowing wash, flows into the golf course and rejoins the north branch at cross-section 4675. A separate HEC2 run was analyzed for the water surface profile of this split flow, assuming conservatively that the split discharge coincided with the peak 100-year overland flow on Moon Valley Drive and the peak 100-year flow in the south-flowing wash.

At cross-section 6590 of the north branch a diversion channel contributes additional discharge, having split flow off from the south branch at cross-section 4060. The water surface profile in this diversion channel was computed in a separate HEC2 run.

At 7th Street and Hearn on the north branch the flow encounters a five barrel CMP pipe-arch culvert. The 100-year discharge flows through the culvert, but also over 7th Street. A considerably wide weir length is required, resulting in minor street flooding along Canterbury Lane. As an appropriately conservative approach, the cross-sections between 5th Street and 7th Street are considered to see the full discharge, even though Canterbury Lane carries some minor discharge.

On the south branch just downstream of cross-section 850, the lay of the land causes a storage of flow on the right overbank. Essentially, shallow flooding ponds on the golf course and is contiguous with flow ponding on Tam O'Shanter Drive.

Upstream of cross-section 4765 on the south branch, for about 800 feet, the wash is very undefined. Downstream of this cross-section this essentially overland flow drops through critical depth into a concrete trapezoidal channel.

Upstream of cross-section 5615 on the south branch, near 7th Street, the channel is natural and contains the full 100-year discharge. The floodway boundary in this reach, therefore, is defined as the channel banks.

Appendix

Phoenix – Micro Film

Plate 1 – Ltr M. Sage COE-LAD 10/29/75

2 – Frequency Curves - Present Conditions and Discharge Table
Moon Valley Wash SPF 6/19/73

CP 13 (D.A = 6.52) = 17,000 cfs
Q 100 = 7,300 cfs

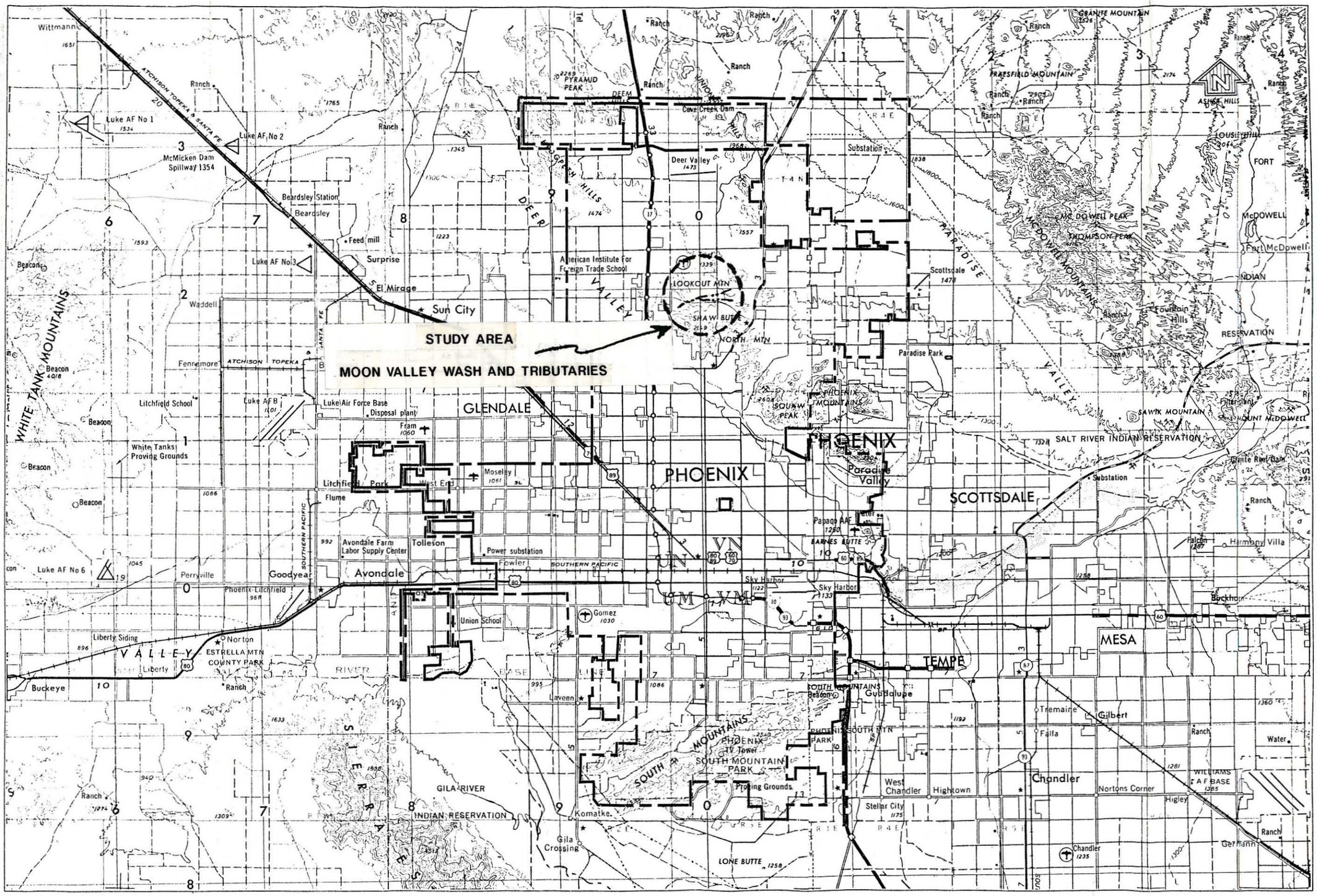
CP 14 (D.A. = 4.17) = 13,200
Q100 = 6,200

CP 15 (DA = 1.07) = 3,200
Q100 = 2,100

10 – HEC-II Input / Output
Moon Valley Wash & S. Fork
Sta 0.08 to 3.29 Sta .09 to .99

12 – Same 10, 50, 100, 500 Floodway

13 – Same



APPROXIMATE SCALE

0 4 8 12 MILES

VICINITY MAP

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

MOON VALLEY WASH AND TRIBUTARIES

CITY OF PHOENIX, AZ

(MARICOPA CO.)

FIGURE 1

WORK REQUEST

SUBJECT: Moon Valley Wash

WORK REQUESTED:

1. Review the HEC-2 analysis done by the COE for Moon Valley Wash and its tributaries. Note any concerns that you would have in accepting this analysis for floodplain delineation.

    a. Compare the COE topography with the Kaminsky Hubbard topography.
    b. Determine how split flows were calculated in the COE HEC-2 model.
    c. Compare the peak discharges from the Kaminsky Hubbard and COE studies.

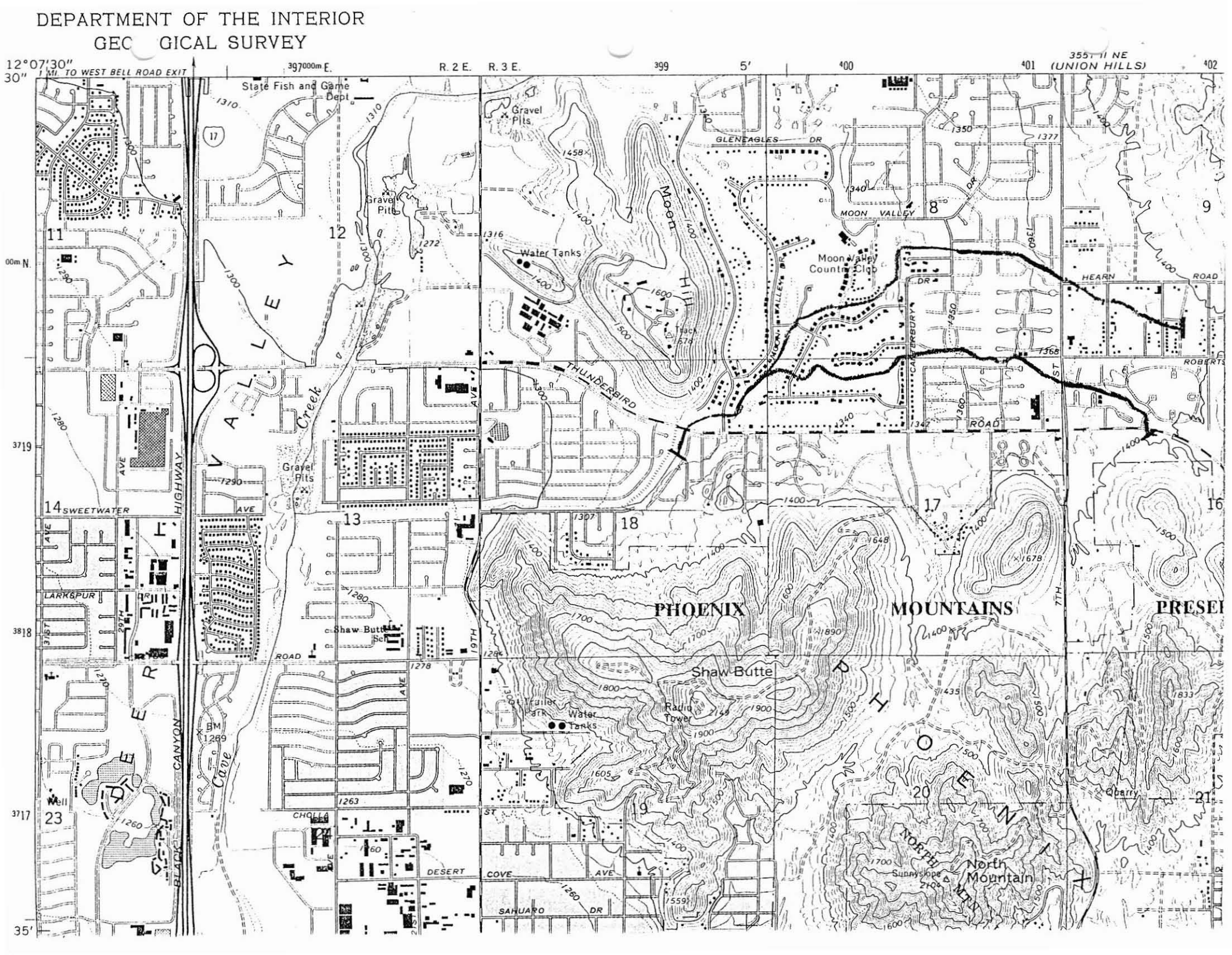
2. Organize the COE material into ring binders that can be cataloged and stored for future reference.

SCOPE OF WORK
LIMITED MAP MAINTENANCE PROGRAM
FOR
MOON VALLEY, CITY OF PHOENIX, ARIZONA

1. **The Moon Valley is located** in the City of Phoenix, north of Thunderbird Road between 7th and 19th Avenues. The present Flood Insurance Maps show the area subject to AO shallow flooding from Moon Valley Wash and its tributaries. The restudy is to perform detail hydraulics on two of the tributaries in Moon Valley (3.6 miles) as marked on the attached U.S.G.S map.

2. The City of Phoenix has provided Topographic mapping for the entire study area, 1" = 100' with 2' contour interval. The hydrology data for Moon Valley has been developed both by the Corps of Engineers and the Hydrology Consultants Inc. in Phoenix. We will review both sources for best available data before using it in our hydraulic analysis. The final product will show the 100-year floodplains and floodways for the two tributaries in Moon Valley.

3. The study will be performed in accordance with FEMA guidelines published in September 1985. This study will be completed in 6 months following the receipt of funds.


DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
12°07'30"
30"
MI. TO WEST BELL ROAD EXIT
397000m E.
R. 2 E.
R. 3 E.
399
5'
400
401
(UNION HILLS)
402
State Fish and Game Dept.
Gravel Pits
GLENEAGLES DR
MOON VALLEY DR
Moon Valley Country Club
HEARN ROAD
ROBERTS
THUNDERBIRD ROAD
CANTERBURY
Water Tanks
Tank
Moon Hill
Creek
Gravel Pits
SWEETWATER AVE
LARKSPUR
HIGHWAY
BLACK CANYON
Shaw Butte
Radio Tower
Water Tanks
Trailer Park
PHOENIX MOUNTAINS
PRESE
Shaw Butte
NORTH MTN
North Mountain
Sunnyslope
Quarry
Well
BM 1269
Cave
CHOLLA ST
DESERT COVE AVE
SAHUARO DR
19TH AVE
7TH ST
00m N.
3719
3818
3717
35'
11
12
13
14
16
17
18
20
21
23

FLOOD INSURANCE STUDY TIME AND COST ESTIMATE
Federal Agency

PROPOSAL FROM: Los Angeles District, Corps of Engineers

COMMUNITY: Phoenix, Moon Valley STATE AZ STUDY TYPE LMMP

PROPOSED STARTING DATE: August 1989 COMPLETION DATE January 1990

PLANNED WORK:

I. Detail Study:

Length of stream(s) 3.6 mi. coastline _____ mi.
Community Area _____ sq. mi.
Number of Hydraulic Structures (Bridges, culverts, dams, etc) 15 culverts
Number Valley Cross sections (existing): _____
(new): _____
Avg. Cost (new): _____
Source(s) (existing): _____

II. Approximate Study:

Length of Stream(s): _____ Cost per Stream Mile: $ _____
Estimated Cost: $ _____

III. Summary of Cost Estimate:

A. Labor Category	Grade/ Step	Hourly Rate	Hours	Dollar Amount
1.0 Reconnaissance, Bibliography	GM-13	22.88	32 24	732
	GS-12-2	17.54	24	421
2.0 Approximate Flood Boundaries				
3.0 Aerial Surveys				

FIA 1500.2 (8-88)

	Grade/ Step	Hourly Rate	Hours	Dollar Amount
3.1 Land Surveys				
4.0 Hydrology	GS-12-10	21.89	40	876
5.0 Hydraulics	GS-12-2	17.54	300	5262
5.1 Profile Concurrence	GS-12-2	17.54	~~24~~ 8	421
6.0 Base Map Material	GS-12-2	17.54	~~24~~ 8	421
7.0 Work Map Preparation	GS-12-2	17.54	~~24~~ 8	421
	GS-9-5	12.99	24	311
8.0 Flood Insurance Study Report Preparation	GM-13	22.88	~~24~~ 8	549
	GS-12-2	17.54	24	421
	GS-4/3	8.40	40	336
9.0 Coordination Activities	GM-13	22.88	24	549
	GS-12-2	17.54	32	561

	Grade/ Step	Hourly Rate	Hours	Dollar Amount
10.0 Other (Explain)	GS-12-2	17.54	40	701
1. Respond to FEMA Tech. Comments				
	GS-13	22.88	40	915
2. SPD review Fee				
Total Direct Labor Cost:				12896

B. Fringe Benefits

Direct Labor Cost 11981* x Fringe Rate 36% = $ 4313

C. Computer (machine charges)

Rate $_____ x _____ Hours = $ ~~638~~ 740

7% labor charge

D. Direct Material (show basis of estimate)

Chronoflex: Base Maps and blue lines (60 sheets)

$ 700

E. Special Equipment (show basis of estimate)

$_____

F. Travel

Milage:

Miles _____ x Rate $ 100 Airfare = $ 400

No. of Trips 4

Per Diem

No. Days: 8 x Rate: $100 = $ 800

* SPD review fee excluded.

G. Consultant (specify purpose and rate) $_____

H. Subcontracts (furnish separate cost basis justification for each) $_____

I. Other Direct Cost (identify kind and basis for estimate) $_____

J. General and Administration Cost

Labor Cost 11981 x Rate 1.11 = $ 13298

Indirect = 70%
Overhead = 41%

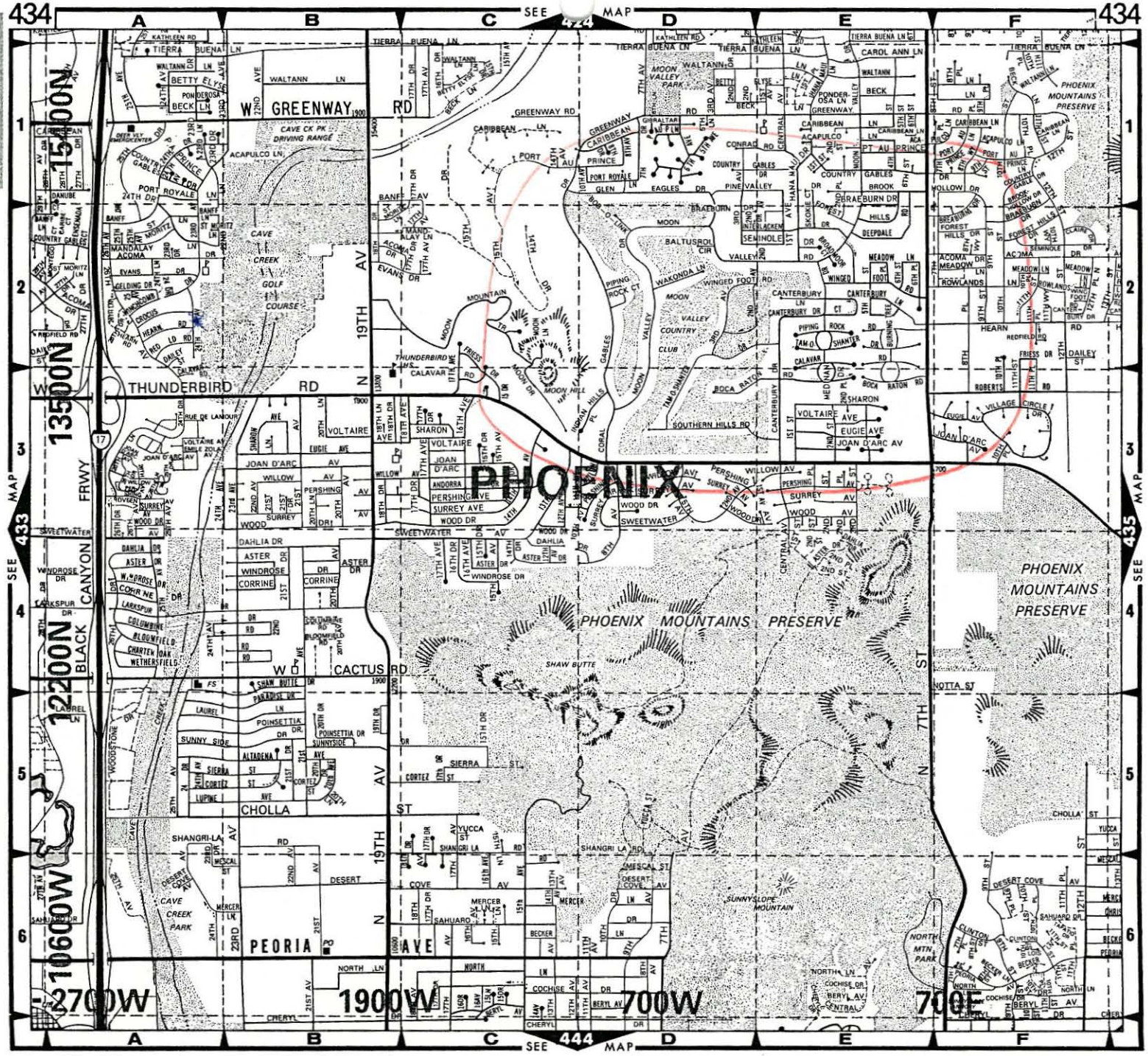
K. Grand Total Estimated Cost: $ 33245 ~~29,722~~

Remarks:

Following negotiation LAD may accept the $30,000 fee for this study

Name: Jaya Jayaram Title: Chief Flood Plain Mgt Sec Date: 6/8/89

Telephone Number: (213) 894-5375


PHOENIX
DETAIL
434
SEE MAP 424
SEE MAP 444
SEE MAP 433
SEE MAP 435
A
B
C
D
E
F
1
2
3
4
5
6
PHOENIX
PHOENIX MOUNTAINS PRESERVE
PHOENIX MOUNTAINS PRESERVE
GREENWAY
THUNDERBIRD RD
CACTUS RD
PEORIA AVE
CHOLLA ST
SHANGRI-LA RD
19TH AV
7TH ST
7TH AV
CENTRAL AV
15400N
13500N
12200N
10600W
2700W
1900W
700W
700E
17
FRWY
BLACK CANYON
CAVE CREEK GOLF COURSE
CAVE CREEK PARK
NORTH MTN PARK
SUNNYSLOPE MOUNTAIN
SHAW BUTTE
MOON VALLEY PARK
MOON VALLEY COUNTRY CLUB
MOON MOUNTAIN
MOON HILL
CAVE CK PK DRIVING RANGE
PHOENIX MOUNTAINS PRESERVE
COPYRIGHT, © 1987 BY Thomas Bros. Maps
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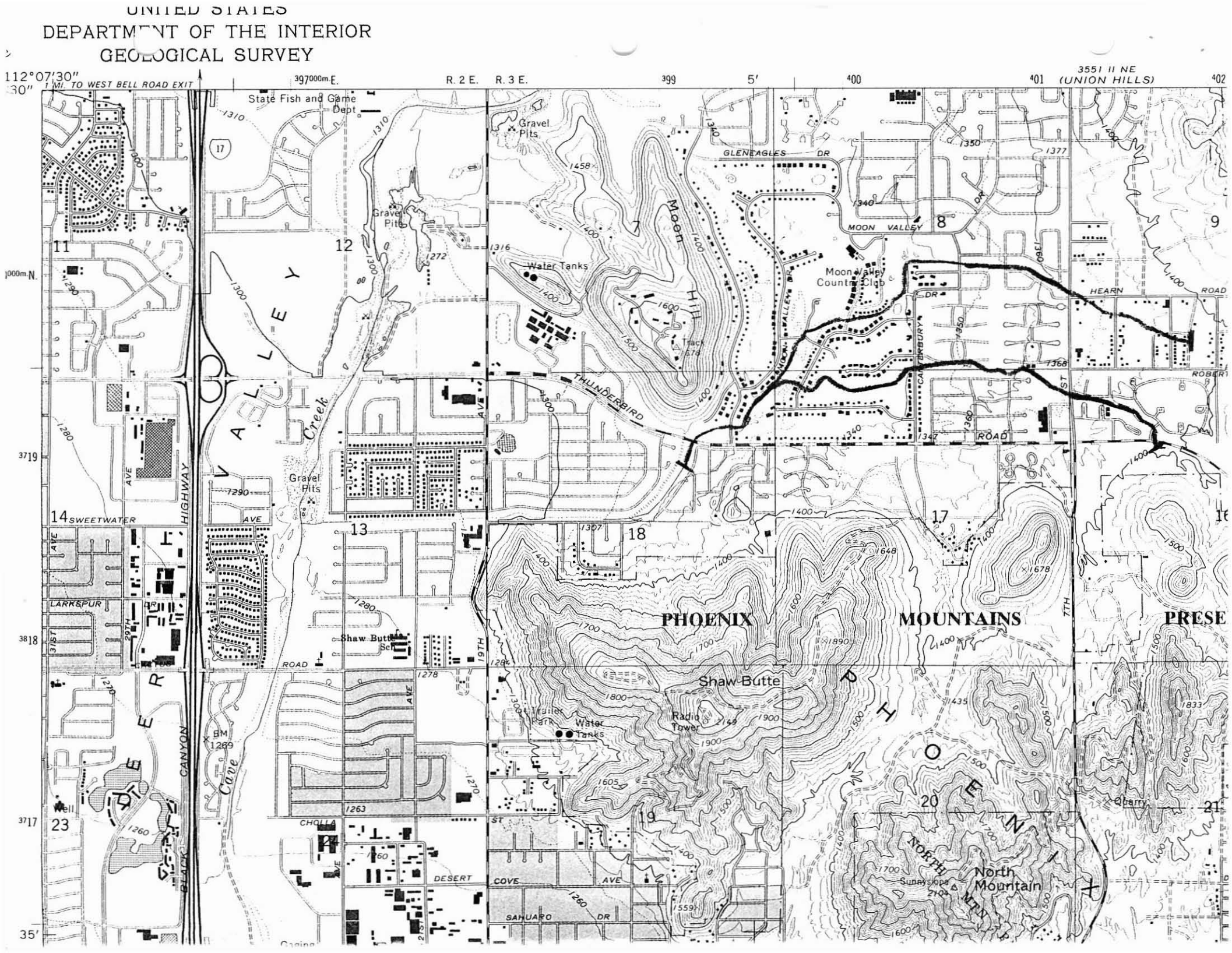

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
112°07'30"
33°00"
1 MI. TO WEST BELL ROAD EXIT
397000m E.
R. 2 E.
R. 3 E.
399
5'
400
401
3551 II NE
(UNION HILLS)
402
State Fish and Game Dept.
Gravel Pits
Water Tanks
Moon Valley Country Club
GLENEAGLES DR
MOON VALLEY
HEARN ROAD
THUNDERBIRD
ROAD
Moon Hill
Track
Creek
Cave
Gravel Pits
SWEETWATER
AVE
HIGHWAY
LARKSPUR
ROAD
Shaw Butte
Shaw Butte Sch.
Trailer Park
Water Tanks
Radio Tower
PHOENIX
MOUNTAINS
PRESE
NORTH
PHOENIX
North Mountain
Sunnyslope
MTN
Quarry
BM 1269
Well
CANYON
BLACK
CHOLLA
DESERT
COVE
SAHUARO DR
ST
AVE
DR
7TH
19TH
29TH
31ST
3719
3718
3717
35'
000m N.

BZ23230 20100030 BZ2313824100030 2

INTRA-ARMY ORDER FOR REIMBURSABLE SERVICES For use of this form, see AR 37-108 and AR 37-110; the proponent agency is USAFAC.	1. RECEIVING OFFICE CONTROL NUMBER 96x3122 S96041 (BZ 231) 3018 #47W101 ☐ FUNDED ☐ AUTOMATIC	2. ORDER a. NUMBER: Ltr b. DATE: 24 Jul 89 3. CHANGE ORDER a. NUMBER: b. DATE:

4. TO BE PERFORMED BY (Command, Installation or Activity), ADDRESS (Include ZIP Code), AND AUTOVON NUMBER	5. ORDERED BY (Command, Installation or Activity), ADDRESS (Include ZIP Code), AND AUTOVON NUMBER
US ARmy Corps of Engineers PO Box 2711 Los Angeles, CA 90043-2325	Federal Emergency Management Agency REgion IX Bldg 105 Presidio of San Francisco, CA 94129

6. DESCRIPTION OF SERVICES TO BE PERFORMED

1. Funds are provided for Limtied Map Maintenance Program (LMMP) IAW Interagency agreement EMW-89-E-2994, Project Order 8 dtd 30 Jan 89 and FEMA ltr dtd 30 Jun 89.

2. Description of Project:

Community: City of Phoenix, Arizona

3. SF 1080 or DA 4445-r billings will be submitted to above ordering office, Regional Project Officer, Raymond T. Lenaburg (415)923-7181 for certification prior to our forwarding to Headquarters for payment.

4. FEMA POC: Raymond T. Lenaburg (415)923-7181
LAD POC: Gregor Grigorian (213)894-5375

7a. NAME AND TITLE OF ORDERING OFFICER	b. SIGNATURE	c. DATE

ORIGINATING FINANCE AND ACCOUNTING OFFICE APPROVAL

8a. ACCOUNTING CLASSIFICATION	b. AMOUNT
	$29,715.00

c. CHANGE

INCREASE AMOUNT _____ DECREASE AMOUNT _____ REVISED AMOUNT _____

9. Services to be performed pursuant to this order are properly chargeable to the appropriations or other accounts indicated above until _____ (Day - Month - Year) the expiration date of this order.

10a. TYPED NAME AND TITLE OF APPROVING OFFICER	b. SIGNATURE	c. DATE

ACCEPTING OFFICER

11. THE ABOVE TERMS AND CONDITIONS ARE SATISFACTORY AND ARE ACCEPTED.

a. TYPED NAME AND TITLE OF ACCEPTING OFFICER	b. SIGNATURE	c. DATE ACCEPTED
MARY MCFADDEN Budget Officer	Mary McFadden	24 Jul 89

DA FORM 1 JUN 77 2544 EDITION OF 1 DEC 75 WILL BE USED UNTIL EXHAUSTED.

☆U.S.GPO: 1986-498-385

JUN 30 1989

Colonel Tadahiko Ono
District Engineer
U.S. Army Corps of Engineers
P.O. Box 2111
Los Angeles, California 90053

Dear Colonel Ono:

Interagency Agreement EMW-89-E-2994, Project Order 8, was signed January 30, 1989, authorizing FEMA Region IX to obligate monies to the Corps of Engineers (COE), Los Angeles District, for the purpose of maintaining the accuracy of our Flood Insurance Studies. The program, the Limited Map Maintenance Program (LMMP), allows us to accomplish this task by identifying critical errors in our existing studies; identifying areas that are experiencing previously unexpected development and "contracting" with the COE to reanalyze or study those identified areas.

The purpose of this letter is to authorize the COE, Los Angeles District, to proceed as of the date of this letter, with work and expend monies not to exceed the amount of the estimate provided below. This letter is the task letter mentioned in the "Limited Map Maintenance Program Guidelines", dated December 1987.

Description of Project

A. Community: City of Phoenix, Arizona

B. Flooding Source: Moon Valley Wash and Moon Valley Tributary

C. Limits of Study: See attached map showing methods and areas of study.

D. Scope of Work: For this LMMP project the study will produce the 100-year flood and floodway boundaries with elevations for 1.8 miles of Moon Valley Tributary and 1.8 miles of Moon Valley Wash.
Specifically, the task will include:

1. Coordination with the City of Phoenix and Maricopa County to obtain topographic information, hydrology, cross-sections, improvement plans and historical flood information for the study area.

2. Review, modification and development of 100-year flood discharge information.

3. Review and modification as necessary of existing HEC-II model to produce 100-year flood and floodway elevations for the study areas.

4. Draft 100-year flood and floodway boundaries with elevations where appropriate on to best available topographic maps.

5. Draft 100-year flood profile of study areas.

6. Submit hydrology and HEC-II input/output data and basic data narrative format to Regional Project Officer.

E. Submission Date: January 31, 1990.

F. Regional Office Project Officer: Raymond T. Lenaburg

Cost Estimate - To accomplish this task, we have negotiated the staff hours required by the Los Angeles District with your Floodplain Management Branch.

We have listed below subtask items, staff hours and costs.

Subtask	Staff Hours	Costs
1. Reconnaissance, Bibliography	48	$ 2,396
2. Hydrology	40	2,164
3. Hydraulics	300	12,997
4. Profile Concurrence	8	346
5. Accumulate Map Material	8	346
6. Work Map Preparation	32	1 114
7. Study Report Preparation	72	2,322
8. Coordination Activities	136	5,388
9. Travel and subsistence		1,200
10. Direct Material and Computer		1,442
Totals	644	$ 29,715

Funds in the amount of $ 29,715 are available from the following account: EMW-89-E-2994

Reporting and Billing - Monitoring of this project will be done on a quarterly basis with additional communications done by phone. All 1080 billings for this project must be sent to the Regional Project Officer for certification prior to our forwarding to Headquarters for payment.

If you have any questions regarding this task letter, please contact the Regional Project Officer, Raymond T. Lenaburg at (415) 923-7181.

Sincerely,

Nicholas B. Nikas
Chief
Natural & Technological Hazards Division

cc:
Record File: RIX NTH
Reading File
Chron File

FEMA/RIX/NTHD/RLenalburg/em 6/28/89

COORD: _____ 6-29-89
Chief, FIP Branch date

COORD _____ 6-30
Regional Director date

DISPOSITION FORM

For use of this form, see AR 340-15, the proponent agency is TAGO.

S:

REFERENCE OR OFFICE SYMBOL	SUBJECT
CESPL-RM-8	Order for Reimbursable Services B2231

TO FROM C, Budget Branch DATE CMT 1

The following order for reimbursable services has been received in the Budget Branch and a copy is forwarded for your evaluation. Please complete CMT 2 identifying applicable dollar amount equal to total funds provided and return to the Budget Branch within ten (10) working days otherwise order will be returned without acceptance.

Ordering Office: _____

Order Number: _____ Chg # _____

Project Description: City of Phoenix

Dollar Amount: 29,715

Appropriation Symbol: _____ Description: _____

Appropriation Expires: _____ Order Expiration: _____

Encl

Mary McFadden
MARY McFADDEN
Budget Officer

TO C, Budget Branch FROM Ch. Fld. Pln. Mgt. Sec DATE 7/18/89 CMT

1. Recommend acceptance of enclosed order ____; an ENG Form 3013 will be provided Finance and Accounting prior to commencement of work IAW ER 37-2-10 and ER 37-345-10.

2. Do not recommend acceptance of this order ____; reason: _____

3. Funds provided on this order will be used for the following:

A. Contract

(1) Military ____; Civil ____

(2) A-E Design Contract ____; Open-End A-E Contract ____

(3) Basic Contract:

(a) Limitation - Related to Construction (ECC $ _____) $ _____

(b) Non-Limitation - Related to Construction (ECC $ _____) $ _____

(c) Non-Limitation - Not Related to Construction $ _____

(4) Contract Modification

(a) Modification is: Within Scope ____; Outside Scope ____

(b) Contract # _____ ADP _____

(c) New Delivery Order ____: Existing D.O.# _____ ADP _____

(d) Limitation - Related to Construction (ECC $ _____) $ _____

(e) Non-Limitation - Related to Construction (ECC $ _____) $ _____

(f) Non-Limitation - Not Related to Construction $ _____

(5) Other (Specify) $ _____

Greenhorne & O'Mara, Inc.

7500 GREENWAY CENTER DRIVE • SUITE 700 • GREENBELT, MD 20770 • (301) 220-2019

ENGINEERS ARCHITECTS PLANNERS SCIENTISTS SURVEYORS PHOTOGRAMMETRISTS

Federal Regional Center, Region IX Building 105 Presidio of San Francisco San Francisco, CA 94129	DATE 4/19/89 JOB NO. 68 RE: ESDP Information Request Phoenix (CY) AZ SC 1551
ATTENTION: Mr. Ray Lenaburg	

GENTLEMEN:

WE ARE SENDING YOU THE FOLLOWING ITEMS ☒ ATTACHED: ☐ UNDER SEPARATE COVER:

☐ TRACINGS ☐ PRINTS ☐ COMPUTATIONS ☐ DESCRIPTIONS ☐ SPECIFICATIONS

☐ APPLICATIONS ☐ COPY OF LETTER ☒ See Below

VIA: ☒ MAIL ☐ INSURED ☐ BY HAND ☐ MESSENGER ☐ PICK UP

COPIES	DATE OR NO.	DESCRIPTIONS
1	set	Microfiche containing HEC-2 data for Phoenix (CO) AZ
		*Please note that there are no work maps available at FEMA's ESDP
		Archives

THESE ARE TRANSMITTED AS CHECKED BELOW:

☐ FOR APPROVAL ☐ AS APPROVED BY

☐ FOR REVIEW ☐ AS SUBMITTED FOR APPROVAL TO

☒ FOR YOUR USE ☐

☒ AS REQUESTED BY you ☐ PLEASE RETURN TO US AFTER USING

REMARKS: This microfiche is for your use and need not be returned. If you have questions, please call Faith Diehl at (301) 345-7924 or me at (301) 220-1863.

IF ENCLOSURES ARE NOT AS NOTED, KINDLY NOTIFY US AT ONCE.

CC: Mr. Alan Johnson w/o enclosures
FTD/MGH

SIGNED:

Albert V. Romano, Asst. Proj. Manager

NOTES TO ESDP MICROFICHE USERS

This set of microfiche contains a microfilm record of some of the backup materials for the Flood Insurance Study (FIS). These materials were developed by the Study Contractor and Technical Evaluation Contractor under contract to the Federal Emergency Management Agency (FEMA).

Immediately following the notes is an Inventory Sheet that lists the available FIS backup materials. The Inventory Sheet indicates which items were microfilmed as well as the number of pages associated with each item. Materials larger than 11"x17" or of poor image quality were not microfilmed. These materials were maintained in hard-copy form at FEMA's Engineering Study Data Package (ESDP) Information Facility.

A title sheet precedes the listing of all data for each item. Data for items 6A, Hydrologic and Hydraulic Computations, and 6B, Computer Listings, are listed by flooding source for ease of retrieval. To further assist the user, the name of each flooding source on the title sheet can be read without the aid of a microfiche reader.

Portions of the FIS may have been revised since the original study was completed. The community has been notified of the revisions. To ensure that you have the most complete and up to date data, please contact the community.

DWR

602/ 542-1566

FLOOD MANAGEMENT SECTION
ARIZONA DEPARTMENT OF WATER RESOURCES

FLOODPLAIN DELINEATION REQUEST

Requesting Agency: City of Phoenix

Floodplain Management Jurisdiction: City of Phoenix

Contact/Requestor: Bill Boring Paul Kienow, Floodplain Management Engineer

Address: 125 East Washington Street, SW Corner Main Floor

Phoenix, Arizona 85004

Telephone number: (602) 262-4960

Description of area(s) to be delineated. Attach map denoting area(s).

Moon Valley Wash Floodplain - above Sweetwater Avenue (map attached.)

Approx. 2 miles - urbanized. Now it's shown as an AO zone with depths of 2 feet. No study was done and there's no way to justify requirements.

Is topographic mapping available? X Yes ___ No

Date: 2-20-86 Scale: 1"=100' Contour Interval: 2'

Are there any information sources such as past studies or reports?
X Yes ___ No If so list all known sources of information.

Report by Bob Ward, P.E.

Detail the Reason(s) why this area needs to be delineated, including problems and inaccuracies of existing studies, development pressure or any other factors which would justify the need for the delineation.

Area has never been studied by detailed methods - many homes are obviously too high to flood.

FEMA — Frank Thomas

Selling 80% of Insurance handled by Private Insurance Co

1. write your own program

write your own Insurance Program

2. Selling more F-I policies.

3. FIS initial studies are complete
CRS ↑ UP → high

4. * * Coastal erosion data gathering for FEMA
New work from FEMA.

5. Improved loss reduction program.

6. Stafford Disaster mitigation fund.

7. Mitigating flood erosion problem before it occurs

8. Aug 23, 11:00 EST N.I. Program.

9. Community Assistance Manual Oct 1989
National Weather Program

10. Allowed Fans Hazards local brochures

11. Community Rating Programs.

12. New Rules published for manufactured Homes.

COE Jerry Peterson
FPM &
Chief of Coastal Res. Br.

1 Planning Assistance to St 1974

2 Flood Plain Mgt Services

3. The Cost Sharing Program.

Emergency Prep

Flood proofing Plans

Comprehensive flood plain studies.

Guides, pamphlets, research, Training

1980 → 6.5M
1989 → 10M

Comprehensive Water needs program.

84 2.3 M
88 4.4 M

FY 90 ↓ ↓ ↓ ↓

10 → 5M to + 50% + 50% cost sharing

5 → 2.5M to + 50% + 50% cost sharing

apply with beneficiary

MFMC have to charge them 100%

Postal Service for full charge 100%

→ Fee schedules for ≈ 1 day activity ←

Letter agreement or cost sharing agreement

Which states would like to cost share FY 90 work

We can gather New data under Sec 22
new charge

What everyone can do as alternative

EPA

404 permit with EPA & Corp jointly

→ No Net loss of Wet lands ?

Ex. Ord. 11990 may revised the ordinance.

for

[City of Los Angeles water loose through
City pipe lines]

none point source pollution

roadway
overland flow
that carry pollutants

flows that have
no - one, pipe
flow discharge.

Storm Water regulations

treat in plants
treat in the middle ponds.

Mr. ~~Schellings~~ Jean Stellings. NWS.

Water Yr water Yr.

drought of 1988.

flood forecasting prog, low priority

Law enforcement FBI trying to take over flood warning ~~Mixed~~ radio signal bands from the NWS. for continuous state to state.

Jim Wright TVA

Becky = Rebecca.

→ Reauthorize of coastal zone Mangt Act.

1:30 at the front desk.

Moon Valley AO
↳ go detail

Bell
Park
Tonto
Ref

One Major study at
(1) lower end of the

(2) Hydrology data for streams
100 yr FP + FW

(3) Use care for FW. Areal Photos.

problem area

Calj & staff copy 1

Packard. U.S.G.S. maps

Scatter Wash. near Hydrology

Jim Morris need staff to Review the Q, before final Maps.

Cave Creek below I-17 below have F.W.

No-Action Alternative

Regional 2020 Baseline Conditions

Under this alternative, buildout of existing water contracts would negatively affect the aesthetic value of Shasta Reservoir, but it would also improve aesthetic conditions on the Sacramento River and at Clair Engle Reservoir.

Sacramento River. Under the No-Action Alternative, the frequency of low flows in both the Keswick Dam to Red Bluff reach and in reaches below Red Bluff would decrease. Thus the primary visual quality indices for this alternative are positive (see Table 4J-1).

There would be some riparian vegetation changes associated with this alternative but the aesthetic changes (secondary effects) caused by these vegetation changes would be minor. The combined primary and secondary effects of this alternative are expected to have a minor effect on the aesthetic quality of the river.

Reservoirs. Under the No-Action Alternative, the visual quality index for Shasta Reservoir would be -8, indicating that out of the 171 summer months of record (3 months x 57 years of record), 8 more months had severe drawdowns than under existing conditions (Table 4J-2). This represents a 15-percent increase in the frequency of severe drawdowns. Clair Engle Reservoir has a +12 index value under this alternative, indicating a reduction in the frequency of severe summer drawdown in that reservoir.

Site-Specific 2020 Baseline Conditions

Under this alternative, growth would occur only in urban agencies in Yolo and Solano Counties. Secondary aesthetic effects associated with urban development in these counties would include loss of open space vistas along major highways due to conversions of oak woodland, grassland, and wetlands to urban uses, and loss of scenic rural roadway vistas due to urban conversions. Existing wetlands in refuges would be converted to upland habitat, resulting in some visual changes, but no open space or scenic vistas would be lost.

Alternative 1 - Option A

Regional Impacts

Sacramento River. Alternative 1 - Option A would reduce the frequency of low flows on the Sacramento River from Keswick Dam to Red Bluff (primary visual impact index of +20) and increase the frequencies of low flows below Red Bluff (index value of -10). Table 4J-3 presents the Sacramento River primary visual quality impact indices.

There would be no significant secondary aesthetic impacts of Alternative 1 - Option A because there would be no significant vegetative changes as compared to the No-Action

Table 4J-1. Aesthetic Effects of the No-Action Alternative:

Sacramento River Service Area

Location	Months												Visual Quality Index	Percent Change from 1985
	O	N	D	J	F	M	A	M	J	J	A	S		
Keswick Dam	+7	+3	0	-3	+1	+3	-1	-1	+1	-3	-5	+3	+5	2
Red Bluff	+10	+5	0	+3	+3	+4	+1	+5	+17	+8	+16	+7	+79	36

Note: A negative value indicates an increased frequency in low flow conditions.

river. For each alternative the frequency of flows equal to or less than the mean monthly flows from the 10 years in the 57 years of record designated as dry years were compared to the frequency of dry-year flows under the No-Action Alternative. A primary visual impact index was developed for each water contracting alternative using this comparison. This analysis was done for two stations: below Keswick Dam and below the Red Bluff Diversion Dam. The comparisons were done on a monthly basis using mean monthly flows for all 12 months of the year. No-Action Alternative flows were compared to the 1985 flows. All other alternatives were then compared to No-Action Alternative.

Although this index methodology cannot detect subtle changes to visual quality caused by small reductions in flows, it is useful as a tool to compare the degree of impact caused by each alternative. Index values that lead to a 50 percent or greater increase in the frequency of low flows are considered to represent significant impacts.

Estimated changes in vegetation (see the "Vegetation and Wildlife" section of this chapter) were used to evaluate the secondary impacts of altered river flows on the aesthetic values of the Sacramento River. The results of the vegetation impact assessment were combined with the primary impact index values to determine overall aesthetic impacts of each water contracting alternative.

Reservoirs

Aesthetic quality data are also lacking for Shasta and Clair Engle Reservoirs. No benchmark water surface elevations below which visual quality is significantly reduced have been identified. Primary visual quality impact indices were developed for Shasta and Clair Engle Reservoirs in a way similar to that described for the Sacramento River except that only the months of June, July, and August were used. The analysis was limited to these months because the majority of the recreational user days occur on these reservoirs during summer.

No secondary visual quality impacts would occur at the reservoirs.

Site-Specific Service Areas

The only impacts of the water contracting alternatives on upland areas would be secondary impacts associated with urban growth at the site-specific level. In most cases these impacts would be associated with growth likely to occur with or without the project and thus cannot be attributed solely to water contracting. These secondary impacts could also vary greatly depending on local land use planning. Because specific development areas and development types are not clearly defined, the aesthetic impacts of water contracting on upland areas were only generally evaluated.

AESTHETICS

Introduction

The aesthetic effects of reduced flows may be classified as primary or secondary (Sands 1985). Primary effects are those that directly alter the intactness, vividness, and variety of the visual resources through manipulation of water as a visual element in the landscape. Secondary effects are the result of long-term flow reductions on other visual elements combine with water to form the visual resources of the landscape. These issues were the primary issues raised during the scoping process and are therefore the focus of the analysis below.

Primary Impact Mechanisms

Primary visual resource impacts are those caused by direct manipulation of water, which in turn causes a change in the balance of the visual scene. Examples of primary effects that could occur along the Sacramento River include larger expanses of exposed banks and gravel bars, reduced expanses of water, and changes in the amount of rapid or riffle area. The major primary visual resource impact that could occur at reservoirs would be a larger, more exposed bathtub ring or a more frequently exposed ring.

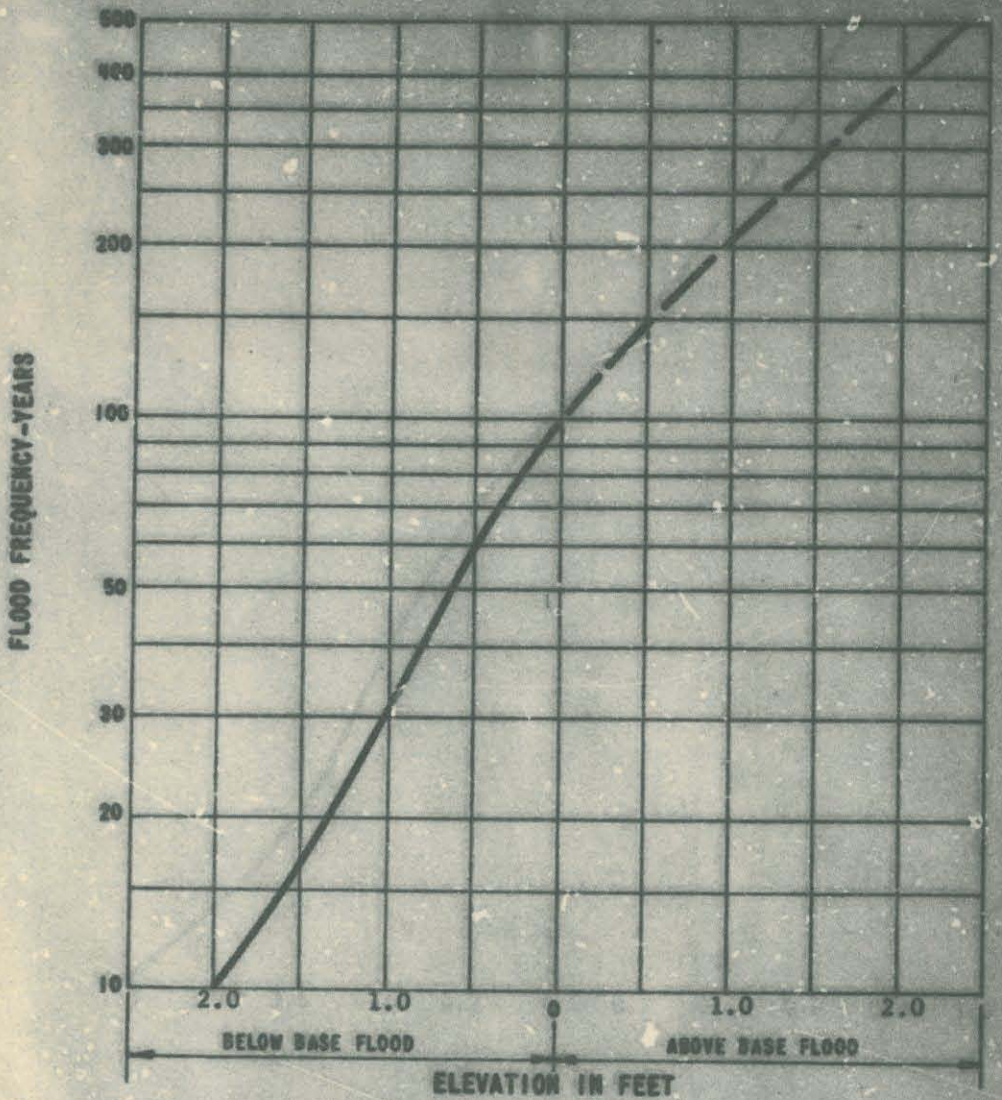
Secondary Impact Mechanisms

Examples of secondary impacts along the river include vegetation changes, reduction in wildlife use, and drying up of pond or wetland areas adjacent to the river.

In the long term, vegetation along the river could be altered in several ways by flow changes including a dying-back of high-terrace riparian vegetation, willow encroachment on gravel bars, reduced regeneration potential due to drier soils and lower groundwater levels. (See "Vegetation and Wildlife" section of this chapter.) These mechanisms could result in less peripheral vegetation for the focusing and framing of views and could detract from the visual buffer between the river and adjacent agriculture or urban activities. The species composition of the vegetation along the river could also change with differences in the flow regime, thus affecting the balance of the visual scenes.

Sacramento River

No visual assessment studies have been done to determine benchmark flows at which primary visual quality impacts can be perceived on the Sacramento River. To evaluate the impact of the water contracting alternatives on the aesthetic quality of the river, it was assumed that low flows associated with critically dry or dry years in the past were less intact and vivid than those of wetter years. Based on this assumption, each alternative was evaluated with regard to changes in the frequency of low flows. It was assumed that changes in high flow would not have a significant primary effect on visual quality of the



NOTES: CURVE CORRESPONDS TO FLOOD HAZARD FACTOR 020 E
CURVE DEVELOPED FOR INDEX STATION AT MILE 0.61
ZONE AND REACH LOCATIONS SHOWN ON PLATE 11
WATER SURFACE PROFILE SHOWN ON PLATES 82 AND 83

PLOTTING DATA	
FREQUENCY IN YEARS	FLOOD ELEVATION
500	1299.0
250	1298.3
100	1297.0
50	1296.3
25	1295.7
10	1295.0

MOON VALLEY WASH
REACH 15

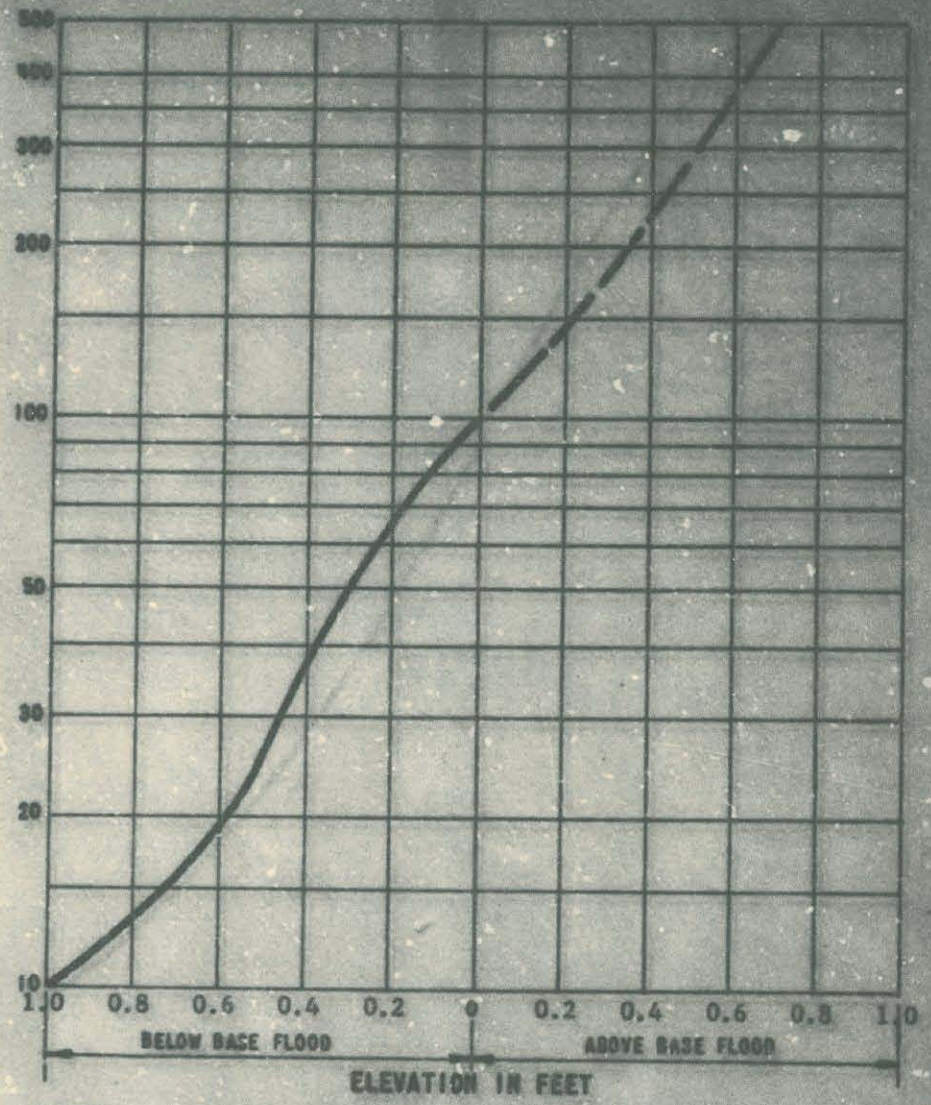
FLOOD INSURANCE STUDY

PHOENIX, ARIZONA

ELEVATION FREQUENCY RELATIONSHIP

CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
PREPARED FOR
FEDERAL INSURANCE ADMINISTRATION
DECEMBER 1975

EXHIBIT 15



NOTES: CURVE CORRESPONDS TO FLOOD HAZARD FACTOR 010 B
CURVE DEVELOPED FOR INDEX STATION AT MILE 2.20
ZONE AND REACH LOCATIONS SHOWN ON PLATES 06, 11, AND 12
WATER SURFACE PROFILE SHOWN ON PLATES 83 AND 84

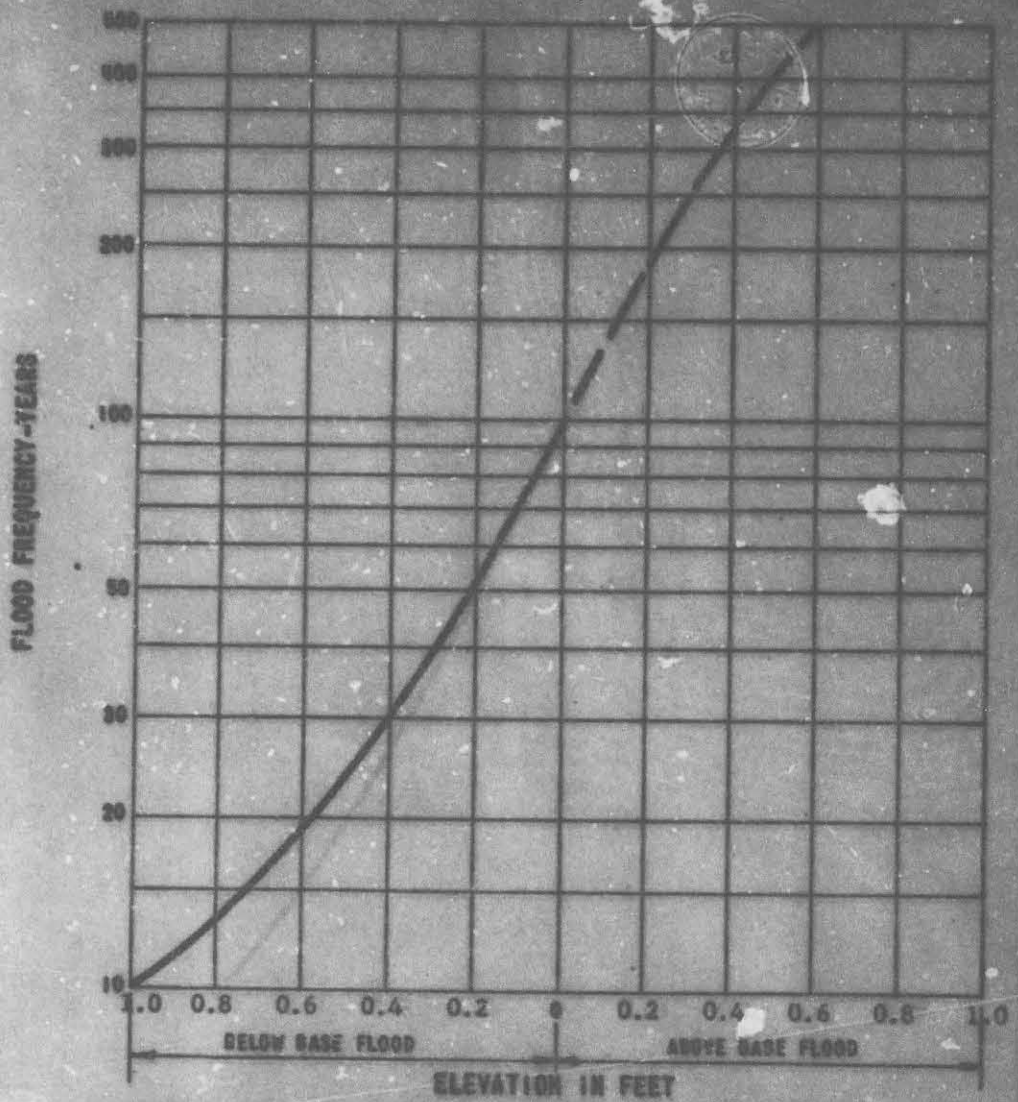
PLOTTING DATA	
FREQUENCY IN YEARS	FLOOD ELEVATION
500	1339.2
250	1338.9
100	1338.5
50	1338.2
25	1338.0
10	1337.5

MOON VALLEY WASH
REACH 16

FLOOD INSURANCE STUDY
PHOENIX, ARIZONA
ELEVATION FREQUENCY RELATIONSHIP

CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
PREPARED FOR
FEDERAL INSURANCE ADMINISTRATION
DECEMBER 1973

EXHIBIT 16



NOTES: CURVE CORRESPONDS TO FLOOD HAZARD FACTOR 010 B
CURVE DEVELOPED FOR INDEX STATION AT MILE 0.80
ZONE AND REACH LOCATIONS SHOWN ON PLATES 11 AND 12
WATER SURFACE PROFILE SHOWN ON PLATE 85

PLOTTING DATA	
FREQUENCY IN YEARS	FLOOD ELEVATION
500	1365.2
250	1364.9
100	1364.6
50	1364.4
25	1364.1
10	1363.6

S. FORK MOON VALLEY WASH
REACH 17

FLOOD INSURANCE STUDY
PHOENIX, ARIZONA
ELEVATION FREQUENCY RELATIONSHIP
CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
PREPARED FOR
FEDERAL INSURANCE ADMINISTRATION
DECEMBER 1978

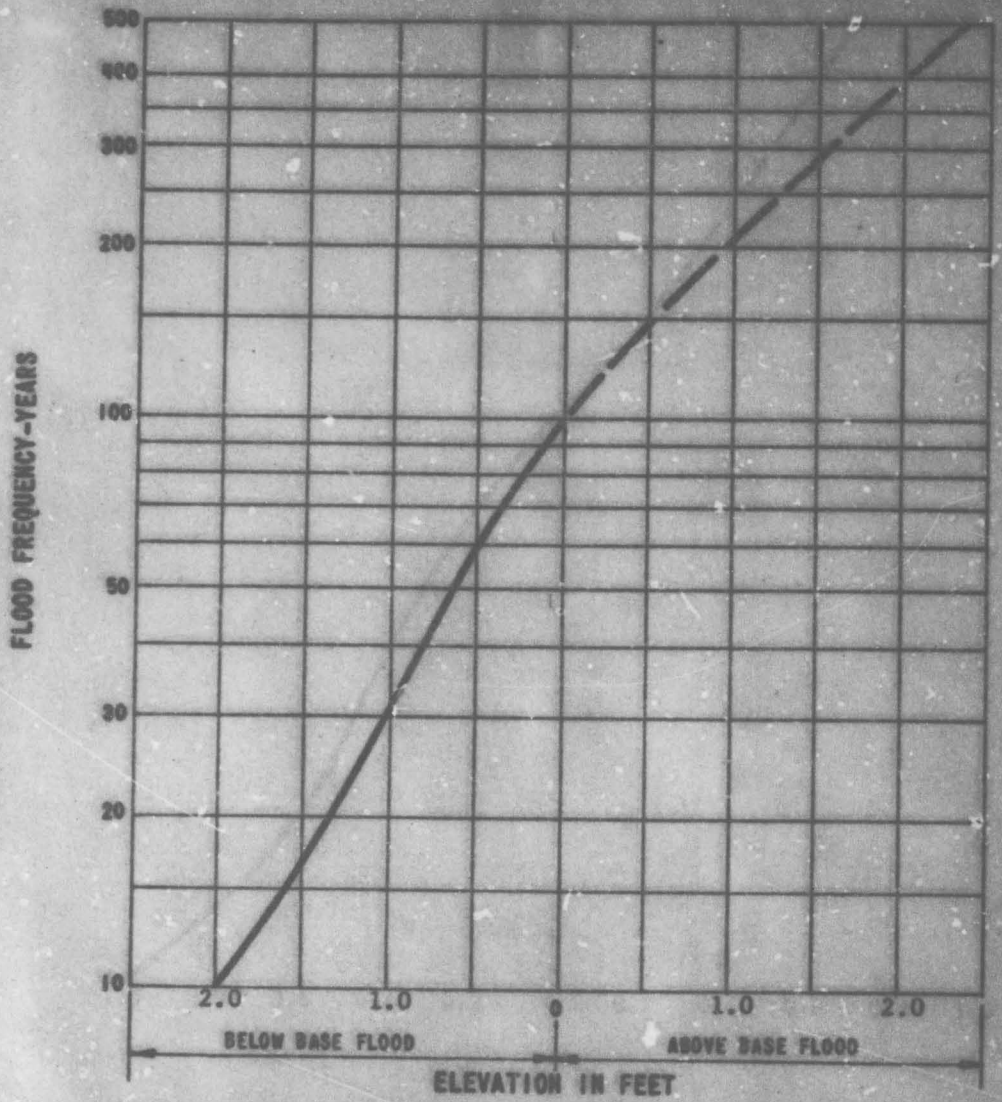
EXHIBIT 17

Table 2 - BASE FLOOD WATER SURFACE ELEVATIONS

Stream	Cross-Section Number	Elevation in Feet (N.G.V.D.) Existing Conditions	Elevation in Feet (N.G.V.D.) With Allowable Encroachments
Cave Creek* (continued)	20.91	1497.2	
	21.20	1508.5	
	21.50	1517.8	
Moon Valley Wash*	0.00	1287.8	
	0.47	1293.7	
	0.61	1296.9	
	0.62	1297.0	
	0.63	1297.2	
	0.64	1297.9	
	0.74	1300.6	
	0.88	1306.9	
	1.20	1317.3	
	1.34	1319.6	
	1.45	1320.8	
	1.67	1325.8	
	1.99	1332.8	
	2.32	1341.7	
	2.71	1355.1	
	2.99	1367.7	
	3.29	1383.9	
Moon Valley Wash* South Fork	0.09	1327.1	
	0.35	1338.8	
	0.58	1350.4	
	0.75	1362.0	
	0.99	1375.1	
East Fork Cave Creek*	0.12	1339.0	
	0.24	1339.0	
	0.35	1339.1	
	0.57	1342.0	
	0.75	1344.4	
	0.88	1347.9	
	1.04	1351.2	
	1.20	1354.7	
	1.36	1357.9	
	1.58	1362.7	
	1.88	1373.6	
	2.02	1376.7	

*Velocities without encroachment exceed 5 feet per second.

See next page 18



NOTES: CURVE CORRESPONDS TO FLOOD HAZARD FACTOR 020 E
CURVE DEVELOPED FOR INDEX STATION AT MILE 0.61
ZONE AND REACH LOCATIONS SHOWN ON PLATE 11
WATER SURFACE PROFILE SHOWN ON PLATES 82 AND 83

PLOTTING DATA	
FREQUENCY IN YEARS	FLOOD ELEVATION
500	1299.0
250	1298.3
100	1297.0
50	1296.3
25	1295.7
10	1295.0

MOON VALLEY WASH
REACH 15

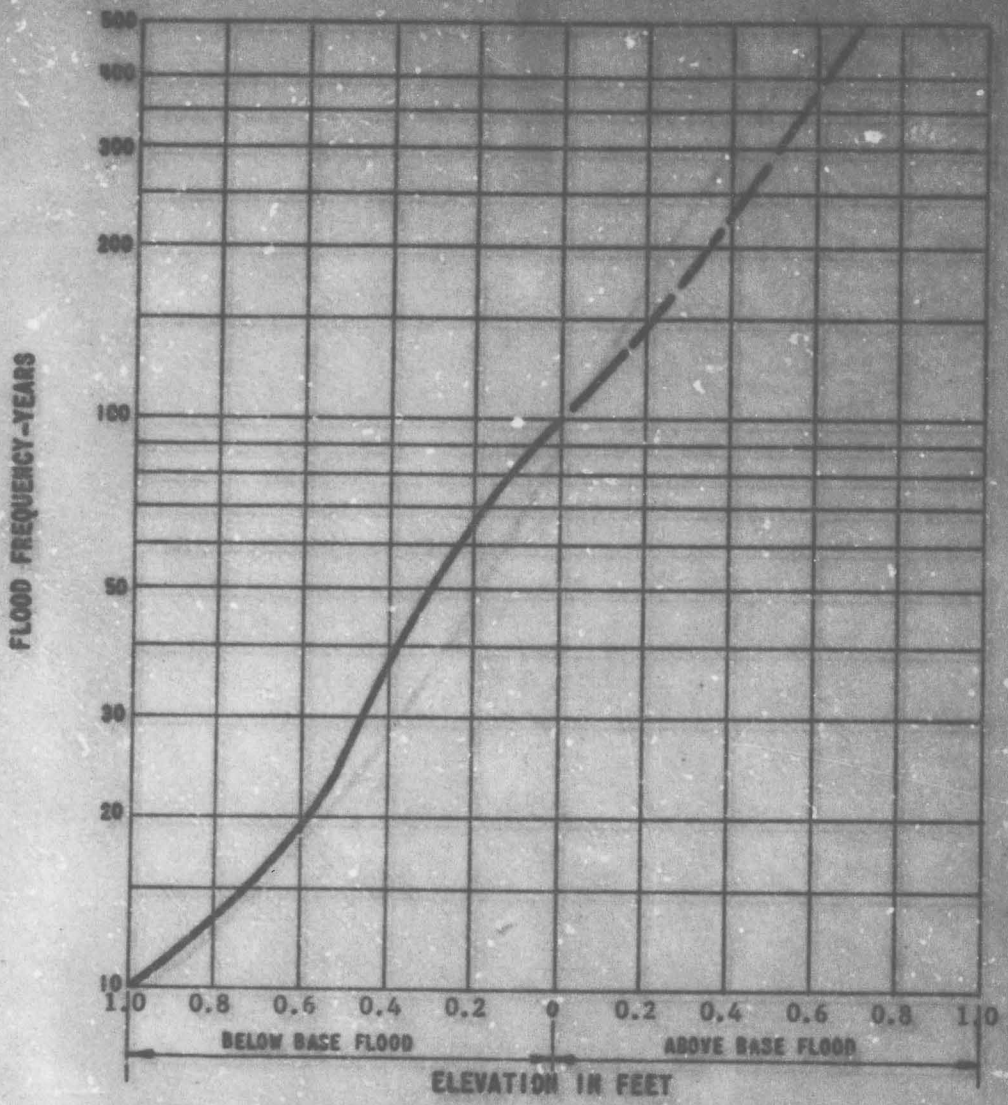
FLOOD INSURANCE STUDY

PHOENIX, ARIZONA

ELEVATION FREQUENCY RELATIONSHIP

CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
PREPARED FOR
FEDERAL INSURANCE ADMINISTRATION
DECEMBER 1975

EXHIBIT 15



NOTES: CURVE CORRESPONDS TO FLOOD HAZARD FACTOR 010 B
CURVE DEVELOPED FOR INDEX STATION AT MILE 2.20
ZONE AND REACH LOCATIONS SHOWN ON PLATES 06, 11, AND 12
WATER SURFACE PROFILE SHOWN ON PLATES 83 AND 84

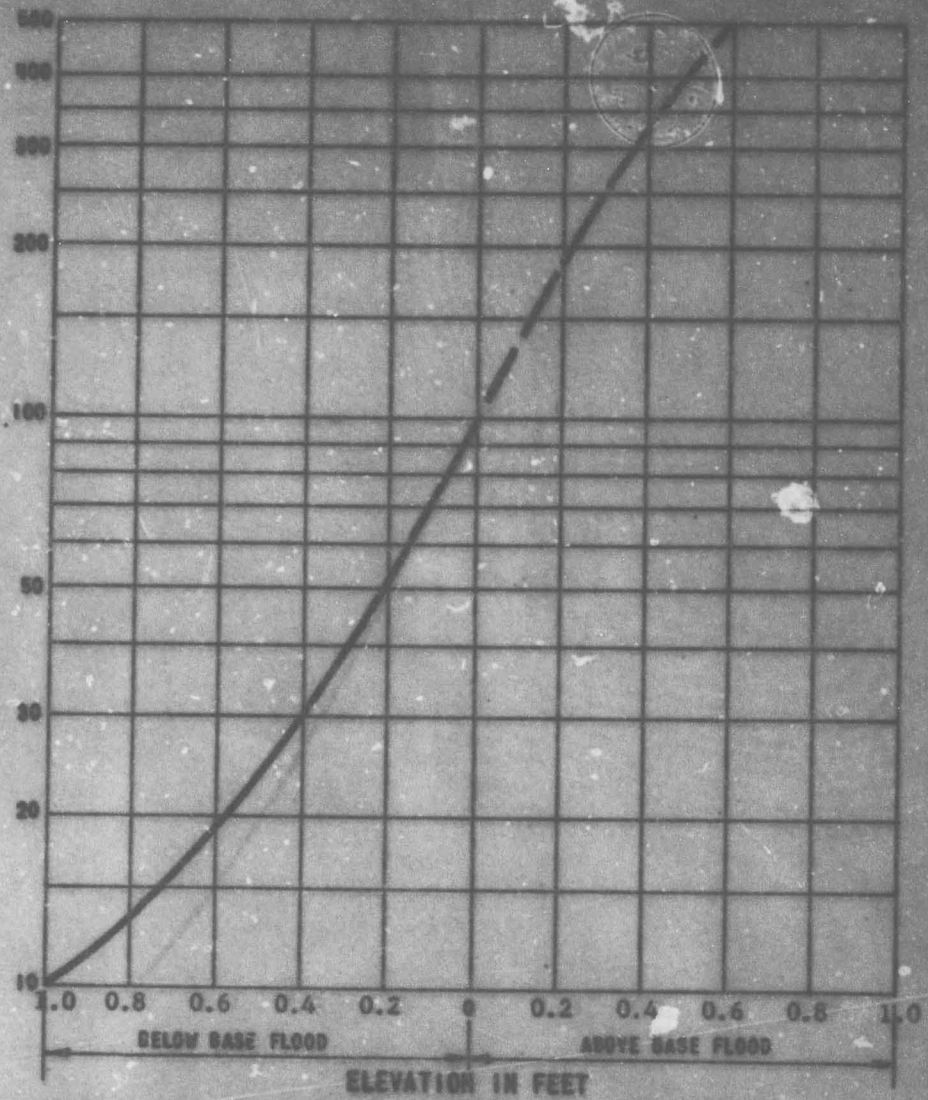
PLOTTING DATA	
FREQUENCY IN YEARS	FLOOD ELEVATION
500	1339.2
250	1338.9
100	1338.5
50	1338.2
25	1338.0
10	1337.5

MOON VALLEY WASH
REACH 16

FLOOD INSURANCE STUDY
PHOENIX, ARIZONA
ELEVATION FREQUENCY RELATIONSHIP

CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
PREPARED FOR
FEDERAL INSURANCE ADMINISTRATION
DECEMBER 1973

EXHIBIT 16



NOTES: CURVE CORRESPONDS TO FLOOD HAZARD FACTOR 010 B
CURVE DEVELOPED FOR INDEX STATION AT MILE 0.80
ZONE AND REACH LOCATIONS SHOWN ON PLATES 11 AND 12
WATER SURFACE PROFILE SHOWN ON PLATE 85

PLOTTING DATA	
FREQUENCY IN YEARS	FLOOD ELEVATION
500	1365.2
250	1364.9
100	1364.6
50	1364.4
25	1364.1
10	1363.6

S. FORK MOON VALLEY WASH
REACH 17

FLOOD INSURANCE STUDY
PHOENIX, ARIZONA
ELEVATION FREQUENCY RELATIONSHIP

CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
PREPARED FOR
FEDERAL INSURANCE ADMINISTRATION
DECEMBER 1973

EXHIBIT 17

Table 2 - BASE FLOOD WATER SURFACE ELEVATIONS

Stream	Cross-Section Number	Elevation in Feet (N.G.V.D.) Existing Conditions	With Allowable Encroachments
Cave Creek* (continued)	20.91	1497.2	
	21.30	1508.5	
	21.50	1517.8	
Moon Valley Wash*	0.00	1287.8	
	0.47	1293.7	
	0.61	1296.9	
	0.62	1297.0	
	0.63	1297.2	
	0.64	1297.9	
	0.74	1300.6	
	0.88	1306.9	
	1.20	1317.3	
	1.34	1319.6	
	1.45	1320.8	
	1.67	1325.8	
	1.99	1332.8	
	2.32	1641.7	
	2.71	1355.1	
	2.99	1367.7	
	3.29	1383.9	
Moon Valley Wash* South Fork	0.09	1327.1	
	0.35	1338.8	
	0.58	1350.4	
	0.75	1362.0	
	0.99	1375.1	
East Fork Cave Creek*	0.12	1339.0	
	0.24	1339.0	
	0.35	1339.1	
	0.57	1342.0	
	0.75	1344.4	
	0.88	1347.9	
	1.04	1351.2	
	1.20	1354.7	
	1.36	1357.9	
	1.58	1362.7	
	1.88	1373.6	
	2.02	1376.7	

*Velocities without encroachment exceed 5 feet per second.

See next page 1C

City of Phoenix
ENGINEERING DEPARTMENT

September 1, 1989

U. S. ARMY CORPS OF ENGINEERS
Hydraulics Section
300 North Los Angeles Street
Los Angeles, California 90053

Attn: Mr. Dan Moore
Room 6042

Dear Dan:

MOON VALLEY WASH
FLOODPLAIN REFINEMENT

As discussed in our telephone conversation of last Friday, enclosed are 100 scale prints of: quarter-section maps, aerial maps, and 2 ft.-interval contour maps of an additional square mile of land contributing to the Moon Valley Wash floodplain. Also included is a composite print of property lines and topographic contours for each of:

Quarter Section 33-29, 30
32-29, 30

In addition, a copy is enclosed of a floodplain analysis prepared by Water Resources Associates, Inc., for a client situated on the south side of Thunderbird Road west of 13th Lane. That report includes a HEC-2 run.

We are seeking to compile data on the culverts located within this floodplain. In particular, we expect to furnish information about the culvert under Thunderbird Road west of Coral Gables, and the one under 7th Street @ Hearn Road. We will forward this material within a few days.

Thank you for your efforts toward providing us improved floodplain mapping for the Moon Valley area.

Very truly yours,

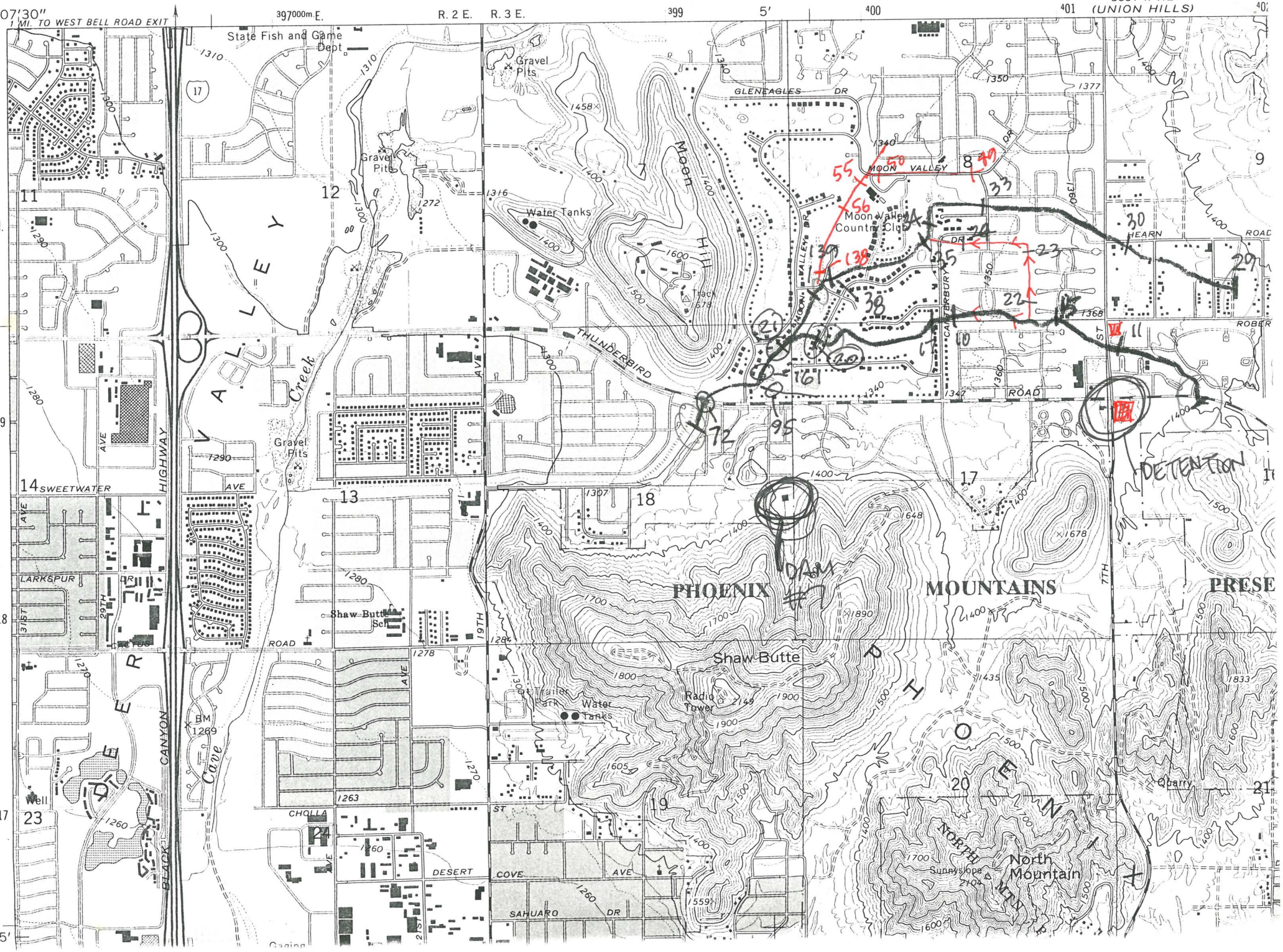
WILLIAM BORING, P.E.
Floodplain Engineer

WB/aff

Attachments

c: Mr. Saldamando
Mr. Kienow

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



City of Phoenix
ENGINEERING DEPARTMENT

April 3, 1989

125 East Washington St.
Phoenix, Arizona
85004-2342

Mr. Ray Lenaburg
FEDERAL EMERGENCY MANAGEMENT AGENCY
REGION IX
Presidio of San Francisco, Building 105
San Francisco, California 94129

Dear Ray:

MOON VALLEY WASH FLOODPLAIN
FLD 0803

Enclosed are the blueline prints we discussed last Friday morning. They consist of 9-sheet sets of the following maps:

- Contour/Topographic
- Composite of Contour and property quarter-sections
- Aerials

The scale of all (27) maps is 1"=100'.

The City is hopeful that this information, along with the background data you have ordered from Washington, will enable FEMA to revise the present AO (2') zone to one that is more precise and well-defined.

Please contact us (602-262-1883) if we can furnish any further information. Thank you for your attention to this determination.

Very truly yours,

WILLIAM BORING, P.E.
Floodplain Engineer

WB/aff

Attachments

c: Mr. Gofonia
Mr. Kienow
Ms. Miller, ADWR
Mr. Saldamando

City of Phoenix
ENGINEERING DEPARTMENT

October 10, 1989

Mr. Dan Moore
U. S. ARMY CORPS OF ENGINEERS
Hydraulic Section, Room 6042
300 North Los Angeles Street
Los Angeles, California 90053

Dear Dan:

MOON VALLEY WASH
FLOODPLAIN REFINEMENT

Enclosed are mylar reproductions of the six quarter-section contour maps you requested:

Q.S. 33-27, 28, 29
32-26, 27, 29

Please do not hesitate to contact us if we can provide any further information.

Very truly yours,

WILLIAM BORING, P.E.
Floodplain Engineer

WB/aff

Attachment

c: Mr. Kienow
Mr. Saldamando
Ms. Miller, ADWR

B223/30 2010 0030

INTRA-ARMY ORDER FOR REIMBURSABLE SERVICES For use of this form, see AR 37-106 and AR 37-110; the proponent agency is USAFAC.	1 RECEIVING OFFICE CONTROL NUMBER 96x3122 S96041 (BZ 231) 3018 #47W101 ☐ FUNDED ☐ AUTOMATIC	2 ORDER a NUMBER: Ltr b DATE: 24 Jul 89 3. CHANGE ORDER a NUMBER: b DATE:

4. TO BE PERFORMED BY (Command, Installation or Activity), ADDRESS (Include ZIP Code), AND AUTOVON NUMBER	5. ORDERED BY (Command, Installation or Activity), ADDRESS (Include ZIP Code), AND AUTOVON NUMBER
US ARmy Corps of Engineers PO Box 2711 Los Angeles, CA 90043-2325	Federal Emergency Management Agency REgion IX Bldg 105 Presidio of San Francisco, CA 94129

6. DESCRIPTION OF SERVICES TO BE PERFORMED

1. Funds are provided for Limtied Map Maintenance Program (LMMP) IAW Interagency agreement EMW-89-E-2994, Project Order 8 dtd 30 Jan 89 and FEMA ltr dtd 30 Jun 89.

2. Description of Project:

Community: City of Phoenix, Arizona

3. SF 1080 or DA 4445-r billings will be submitted to above ordering office, Regional Project Officer, Raymond T. Lenaburg (415)923-7181 for certification prior to our forwarding to Headquarters for payment.

4. FEMA POC: Raymond T. Lenaburg (415)923-7181
LAD POC: Gregor Grigorian (213)894-5375

Total / HL = 2.37
29715/2.37 = $12,538

7a NAME AND TITLE OF ORDERING OFFICER	b. SIGNATURE	c DATE

ORIGINATING FINANCE AND ACCOUNTING OFFICE APPROVAL

8a. ACCOUNTING CLASSIFICATION	b. AMOUNT
	$29,715.00

c. CHANGE
INCREASE AMOUNT _____ DECREASE AMOUNT _____ REVISED AMOUNT _____

9. Services to be performed pursuant to this order are properly chargeable to the appropriations or other accounts indicated above until _____ (Day - Month - Year) the expiration date of this order.

10 a. TYPED NAME AND TITLE OF APPROVING OFFICER	b. SIGNATURE	c. DATE

ACCEPTING OFFICER

11. THE ABOVE TERMS AND CONDITIONS ARE SATISFACTORY AND ARE ACCEPTED.

a. TYPED NAME AND TITLE OF ACCEPTING OFFICER	b. SIGNATURE	c. DATE ACCEPTED
MARY MCFADDEN Budget Officer	Mary McFadden	24 Jul 89

DA FORM 1 JUN 77 2544 EDITION OF 1 DEC 75 WILL BE USED UNTIL EXHAUSTED.

☆ U.S.GPO: 1986-498-385

JUN 30 1989

Colonel Tadahiko Ono
District Engineer
U.S. Army Corps of Engineers
P.O. Box 2111
Los Angeles, California 90053

Dear Colonel Ono:

Interagency Agreement EMW-89-E-2994, Project Order 8, was signed January 30, 1989, authorizing FEMA Region IX to obligate monies to the Corps of Engineers (COE), Los Angeles District, for the purpose of maintaining the accuracy of our Flood Insurance Studies. The program, the Limited Map Maintenance Program (LMMP), allows us to accomplish this task by identifying critical errors in our existing studies; identifying areas that are experiencing previously unexpected development and "contracting" with the COE to reanalyze or study those identified areas.

The purpose of this letter is to authorize the COE, Los Angeles District, to proceed as of the date of this letter, with work and expend monies not to exceed the amount of the estimate provided below. This letter is the task letter mentioned in the "Limited Map Maintenance Program Guidelines", dated December 1987.

Description of Project

A. Community: City of Phoenix, Arizona

B. Flooding Source: Moon Valley Wash and Moon Valley Tributary

C. Limits of Study: See attached map showing methods and areas of study.

D. Scope of Work: For this LMMP project the study will produce the 100-year flood and floodway boundaries with elevations for 1.8 miles of Moon Valley Tributary and 1.8 miles of Moon Valley Wash.
Specifically, the task will include:

1. Coordination with the City of Phoenix and Maricopa County to obtain topographic information, hydrology, cross-sections, improvement plans and historical flood information for the study area.

2. Review, modification and development of 100-year flood discharge information.

3. Review and modification as necessary of existing HEC-II model to produce 100-year flood and floodway elevations for the study areas.

4. Draft 100-year flood and floodway boundaries with elevations where appropriate on to best available topographic maps.

5. Draft 100-year flood profile of study areas.

6. Submit hydrology and HEC-II input/output data and basic data narrative format to Regional Project Officer.

E. Submission Date: January 31, 1990.

F. Regional Office Project Officer: Raymond T. Lenaburg

Cost Estimate - To accomplish this task, we have negotiated the staff hours required by the Los Angeles District with your Floodplain Management Branch.

We have listed below subtask items, staff hours and costs.

Subtask	Staff Hours	Costs
1. Reconnaissance, Bibliography	48	$ 2,396
2. Hydrology	40	2,164
3. Hydraulics	300	12,997
4. Profile Concurrence	8	346
5. Accumulate Map Material	8	346
6. Work Map Preparation	32	1 114
7. Study Report Preparation	72	2,322
8. Coordination Activities	136	5,388
9. Travel and subsistence		1,200
10. Direct Material and Computer		1,442
Totals	644	$ 29,715

Funds in the amount of $ 29,715 are available from the following account:
EMW-89-E-2994

Reporting and Billing - Monitoring of this project will be done on a quarterly basis with additional communications done by phone. All 1080 billings for this project must be sent to the Regional Project Officer for certification prior to our forwarding to Headquarters for payment.

If you have any questions regarding this task letter, please contact the Regional Project Officer, Raymond T. Lenaburg at (415) 923-7181.

Sincerely,

Nicholas B. Nikas
Chief
Natural & Technological Hazards Division

cc:
Record File: RIX NTH
Reading File
Chron File

FEMA/RIX/NTHD/RLenalburg/em 6/28/89 6/28/89

COORD: F 6-29-89
Chief, FIP Branch date

COORD 6.30
Regional Director date

DISPOSITION FORM

S:

For use of this form, see AR 340-15, the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL	SUBJECT
CESPL-RM-B	Order for Reimbursable Services B2231

TO FROM C, Budget Branch DATE CMT 1

The following order for reimbursable services has been received in the Budget Branch and a copy is forwarded for your evaluation. Please complete CMT 2 identifying applicable dollar amount equal to total funds provided and return to the Budget Branch within ten (10) working days otherwise order will be returned without acceptance.

Ordering Office: _____

Order Number: _____ Chg # _____

Project Description: City of Phoenix

Dollar Amount: 29,715

Appropriation Symbol: _____ Description: _____

Appropriation Expires: _____ Order Expiration: _____

Encl

Mary McFadden

MARY McFADDEN
Budget Officer

TO C, Budget Branch FROM Ch, Rd, Pk, Mgt Sec DATE 7/18/89 CMT

1. Recommend acceptance of enclosed order ____; an ENG Form 3013 will be provided Finance and Accounting prior to commencement of work IAW ER 37-2-10 and ER 37-345-10.

2. Do not recommend acceptance of this order ____; reason: _____

3. Funds provided on this order will be used for the following:

A. Contract

(1) Military ____; Civil ____

(2) A-E Design Contract ____; Open-End A-E Contract ____

(3) Basic Contract:

(a) Limitation - Related to Construction (ECC $_____) $_____

(b) Non-Limitation - Related to Construction (ECC $_____) $_____

(c) Non-Limitation - Not Related to Construction $_____

(4) Contract Modification

(a) Modification is: Within Scope ____; Outside Scope ____

(b) Contract #_____ ADP _____

(c) New Delivery Order ____: Existing D.O.#____ ADP _____

(d) Limitation - Related to Construction (ECC $_____) $_____

(e) Non-Limitation - Related to Construction (ECC $_____) $_____

(f) Non-Limitation - Not Related to Construction $_____

(5) Other (Specify) $

B. Government Costs

(1) Design:

(a) Limitation - Related to Construction (ECC $_____) $_____

(b) Non-Limitation - Related to Construction (ECC $_____) $_____

(c) Non-Limitation - Not Related to Construction $_____

(2) Master Planning $_____

(3) Real Estate $_____

(4) Planning Support for Others (5% Burden) $_____

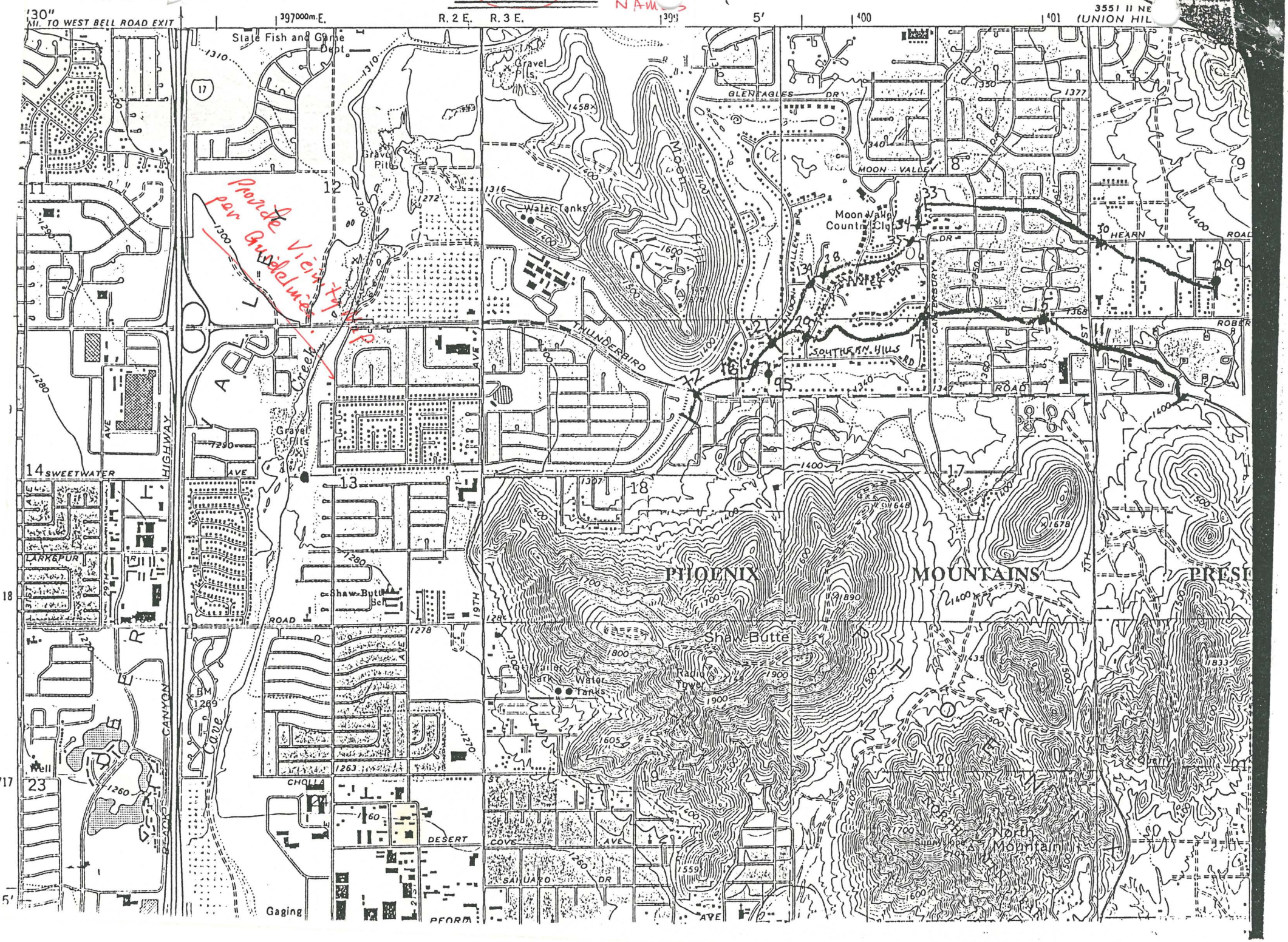
(5) Other (Specify) Hired labor $29,715

C. Remarks: _____

Jason Sapora Ext: 5375
Project Manager

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Figure 1 PLATE 1 PROJECT - NORTH ARROYO & STREAM NAMES



PROJECT NO. P-856013

7th STREET
THUNDERBIRD ROAD TO BELL ROAD

DRAINAGE STUDY FOR:
HILLCREST (Five, Six, Seven, & Eight)

FLOYD M. WHITMORE ENGINEERS, INC.
ONE WEST ELLIOT ROAD SUITE 112
TEMPE, ARIZONA 85284
(602) 820-3669

B

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1. INTRODUCTION

The City of Phoenix awarded a contract to Floyd M. Whitmore Engineers, Inc. to prepare construction plans for pavement improvements to 7th Street between Roberts Road and Grandview Road.

Part of the contract "Scope Of Work" directed Floyd M. Whitmore Engineers,Inc. as follows: "From Thunderbird Road to Breaburn Drive the existing cross drainage structures shall be removed and replaced as necessary with pipe or box structures of equal capacity. The catch basins shall be connected to the existing or replacement cross drainage structures."

During the course of design, Floyd M. Whitmore Engineers, Inc. alerted the City of Phoenix Engineering Department that designing the project drainage per the above mentioned portion of the contract "Scope Of Work" might have an undesirable impact on the peak rate of rainfall runoff reaching certain private streets west of 7th Street.

After "in-house" study by the City of Phoenix Engineering Department, a contract change order was issued authorizing the study contained in this report.

2. PURPOSE OF STUDY

The purpose of this study is to investigate and determine the sources of two-year-storm event rainfall runoff that presently drains onto and across the area roughly bounded by 7th Street on the east; a drainage way parallel to and approximately 1,320 feet west of 7th Street on the west; a drainage way approximately along the south line of Section 8, T.3N., R.3E., on the south; and Hearn Road and a westerly extension of the monument line of Hearn Road on the north. After the rainfall runoff sources have been identified, it is the continued purpose of this study to determine the volume of two-year storm runoff that presently reaches the private streets within this area and

to investigate and make a cost estimate comparison of drainage design alternatives that limit the rainfall runoff onto the private streets, after 7th Street pavement has been widened, to an amount no greater than what exists at present.

3. AREA CONTAINING PRIVATE STREETS INVESTIGATED BY STUDY

The area roughly bounded by 7th Street on the east; a drainage way parallel to and approximately 1,320 feet west of 7th Street on the west; a drainage way approximately along the south line of Section 8, T.3N., R.3E., on the south; and Hearn Road and a westerly extension of the monument line of Hearn Road on the north, is a planned residential area development of individual homes.

The following subdivisions comprise the area: Hillcrest Five 163/149, Hillcrest Six 170/36, Hillcrest Seven 186/1 and Hillcrest Eight 192/26. These four subdivisions contain a total area of approximately 38 acres. Approximately 35% of this 38 acres is impervious. Street pavements cover approximately 16% of the total area, paved driveways cover approximately 3% of the total area, and building roof cover approximately 16% of the total area.

These four subdivisions are divided into 110 residential lots, two recreation tracts, and numerous other tracts for drainage, public utilities, and access for emergency and service vehicles. A single-family dwelling unit exists on each residential lot and a community building exists on one of the recreation area tracts.

Street pavements within the area are asphaltic concrete with curbs and sidewalks. The streets are private and all lot owners have an undivided interest in the street tracts. The east-west streets are: Boca Raton Road, Calavar Road, Tam-O-Shanter Drive and Piping Rock Road. The north-south street is Burning Tree Place. Calavar Road has an inverted crown pavement; the other streets

have pavements with raised crown along the centerline. Only Calavar Road and Piping Rock Road receive runoff from drainage areas east of 7th Street.

Residential lots in these subdivisions have been graded so the front part of the lot drains onto the adjacent street pavement and the rear of the lot is a.sump that retains rainfall runoff.

4. SCOPE OF FIELD WORK

The scope of field work for this study includes the following:

A. Cross section the grass area on the west side of 7th Street from Roberts Road to Hearn Road and the south side of Hearn Road from 7th Street to Cantebury Lane between the back of existing sidewalk and masonry wall parallel to the sidewalk;at intervals of 25 feet or less.

B Cross section the existing concrete lined drainage channel located along the south line of Section 8, T.3N., R.3N., R.3E., from 7th Street to a point approximately 1,400 feet west of 7th Street, at intervals of approximately 50 feet.

C. Cross section the existing concrete lined drainage channel known as "Moon Valley Wash", located north of Hearn Road, from 7th Street to a point approximately 1,400 feet west of 7th Street, at intervals of approximately 50 feet.

D. Cross section the private streets named in the "Area Containing The Private Streets Investigated By Study" at close enough intervals to be able to determine the hydraulic characteristics needed to estimate the rainfall runoff spread for the 2-year storm.

E. Field check the drainage maps prepared in the office.

5. SCOPE OF OFFICE WORK

The scope of office work for this study includes the following.

A. Preparation of hydrologic base map of the study area.

B. Delineation of drainage areas showing flow paths.

C. Preparation of cross sections of the grass area between the back of sidewalk and the masonry wall.

D. Evaluation of the existing grass area between the back of sidewalk and the masonry wall.

E. Evaluation of existing concrete lined drainage channels.

F. Evaluation of existing private street pavements.

G. Analyze effects upon rainfall runoff onto private streets due to widening the 7th Street pavement, employing various drainage design alternatives.

6. HYDROLOGY BASIS

Information contained in the latest edition of City of Phoenix "Storm Drain Design Manual - Storm Drains With Paving Of Major Streets" and "Storm Drain Design Manual - Subdivision Drainage Design" is the basis for the hydrology calculations made for this study.

The "Major Streets" manual is the source of criteria used in making all calculations except that the "Subdivision" manual is the source of criteria for detention basins and for roughness coefficients used in the Manning Formula.

Time of concentration calculations made for this study conform to the criteria contained on page 2 and the graphs contained on pages 21, 26 & 35 of the "Major Streets Storm Drain Manual". The referenced graphs are included in this report for the convenience of the reader.

7. EXISTING GRASS AREA ON WEST SIDE OF 7th STREET

Depressions in the grass area form retention basins between the back of existing sidewalk and the masonry wall on the west side that extend from, Station 18+60 to Station 21+00, Station 21+25 to Station 22+00, Station 23+86 to Station 25+06, and Station 25+59 to Station 26+93.

There is approximately 860 cubic feet of existing depression storage between Station 18+60 and Station 21+00, 35 cubic feet between Station 21+25 and Station 22+00, 710 cubic feet between Station 23+86 and Station 25+06, and 1,510 cubic feet between Station 25+59 and Station 26+93.

The balance of the grass area between the back of sidewalk and the masonry wall, from Station 15+90 to Station 22+50, is a swale that channels runoff to a 29" x 18" C.M.P.A. at Station 18+47. The pipe drains the runoff from the grass swale to the east end of Calavar Road.

The balance of the grass area between the back of sidewalk and the masonry wall, from Station 22+50 to Station 25+06, is a swale that channels the runoff to the south side of Piping Rock Road. There is a depressed section of curb on the south side of Piping Rock Road, west of the curb return, and the runoff from the grass swale drains through the depression into the south gutter of Piping Rock Road.

8. CONTRIBUTING DRAINAGE AREAS

A. Boca Raton Road

Rainfall runoff onto Boca Raton Road comes from residential lots adjacent to Boca Raton Road. This is drainage area ⟨5⟩ on the drainage map.

B. Calavar Road

Three separate drainage areas contribute rainfall runoff onto Calavar Road.

Drainage area ⟨1⟩ is an area east of 7th Street that extends approximately 2,900 feet east of 7th Street at its most easterly point. The runoff from this drainage area collects in the north gutter of Roberts Road and flows west to 7th Street; thence north along the east side of 7th Street to an existing storm inlet on the east side of 7th Street, approximately 240 feet north of Roberts Road; thence west under 7th Street through a pipe culvert to the grass area between the west sidewalk and the masonry wall on the west side of 7th Street.

Drainage area ⟨2⟩ is an area east of 7th Street that extends approximately 800 feet east of 7th Street and drains towards the east side of 7th Street and collects into a storm inlet approximately 510 feet north of Roberts Road; thence west under 7th Street through a pipe culvert to the grass area between the west sidewalk and the masonry wall on the west side of 7th Street.

Some of the rainfall runoff reaching the grass area between the west sidewalk and the masonry wall on the west side of 7th Street is impounded in a grass covered retention basin; the balance of the runoff drains into a pipe culvert located between Lots 157 & 158 of Hillcrest Six; the runoff drains westerly through the pipe culvert and empties onto the east end of the pavement on Calavar Road.

Drainage area 6 is comprised of residential lots and tracts located within the Hillcrest subdivisions. The runoff from the residential lots and tracts combines with the runoff flowing through the pipe culvert located between Lots 157 & 158 and flows west in Calavar Road.

C. Tam-O-Shanter Drive

Rainfall runoff onto Tam-O-Shanter Drive comes from residential lots located within the Hillcrest subdivisions. This is drainage area ⟨7⟩ on the drainage map.

D. Piping Rock Road

Three separate drainage areas contribute rainfall onto Piping Rock Road.

Drainage area ⟨3⟩ is an area east of 7th Street that extends approximately 800 feet east of 7th Street and drains toward the east side of 7th Street and collects into a storm inlet approximately 955 feet north of Roberts Road; thence west under 7th Street through a pipe culvert to the grass area between the west sidewalk and the masonry wall on the west side of 7th Street, south of Piping Rock Road. Some of this runoff ponds in a retention basin, the balance drains through a depressed curb section on the south side of Piping Rock Road and continues west on Piping Rock Road.

Drainage area ⟨4⟩ is an area east of 7th Street that extends approximately 800 feet east of 7th Street and drains towards the east side of 7th Street and collects into a storm inlet approximately 35 feet south of Hearn Road; thence west under 7th Street through a pipe culvert to the grass area between the west sidewalk and the masonry wall on the west side of 7th Street, between Piping Rock Road and Hearn Road. Some of the runoff reaching the grass area drains onto Piping Rock Road through a depressed curb section on the north side of Piping Rock Road, but a large amount

ponds in a retention basin and evaporates and/or percolates through the masonry wall onto private property west of the masonry wall.

Drainage area (8) is comprised of residential lots and tracts located within the Hillcrest subdivisions; runoff from the residential lots and tracts combines with the runoff flowing from the grass area through the curb depressions, and this combined runoff flows west in Piping Rock Road.

9. RUNOFF ONTO CALAVAR ROAD (2-YEAR STORM) EXISTING CONDITIONS

The maximum rate of runoff flow onto Calavar Road, during a two-year storm, is approximately 8.3 c.f.s.

Approximately 55% of this 8.3 c.f.s. flow rate is runoff from drainage areas east of 7th Street. Approximately 45% of this 8.3 c.f.s. flow rate is runoff from the drainage area west of 7th Street.

Calavar Road pavement is inundated to a depth of approximately 3-1/2 inches at the inverted crown during the peak runoff from a two-year storm. The width of water at peak two-year flow is approximately 25 feet; 25 feet width is almost from lip of curb to lip of curb.

The spread of water on Calavar Road doesn't increase in direct proportion to an increase in volume of runoff, after the spread reaches the lip of gutter. This phenomenon is the result of a combination of the hydraulic radius, the flow velocity,and the wetted cross-section increasing at a much greater rate than the spread because the curbs restrict the spread. The capacity of Calavar Road pavement, flowing full from top of curb to top of curb , is approximately 59 c.f.s.

10. RUNOFF ONTO PIPING ROCK ROAD (2-YEAR STORM) EXIST. CONDITIONS

The maximum rate of runoff flow onto Piping Rock Road, during a two-year storm,is approximately 7.8 c.f.s.

100% of this 7.8 c.f.s. flow rate is runoff from the residential drainage area west of 7th Street.

Runoff from the two contributing drainage areas east of 7th Street fill the retention basins in the grass area between the back of sidewalk and the masonry wall, on the west side of 7th Street, before any runoff from these two drainage areas drains onto Piping Rock Road. By the time the two drainage areas east of 7th Street are contributing runoff to Piping Rock Road, the rainfall intensity has decreased to an amount that the total runoff onto Piping Rock Road from the combined drainage areas east and west of 7th Street is less than the peak runoff rate from the drainage area west of 7th Street.

The depth of runoff at the curb is approximately 3" at the peak runoff from a two-year storm. The width of water at the peak two-year storm flow is approximately 11 feet.

The capacity of the Piping Rock Road pavement, flowing full from top of curb to top of curb, is approximately 15 c.f.s.

11. EXISTING CULVERTS

The existing culverts under 7th Street at Stations 16+40, 19+20, 23+80 and 26+85 are very shallow 29-inch x 18-inch corrugated-metal-arch-pipe. Minimum cover is believed to be approximately one-half foot. Because of this shallow depth, it will be necessary to remove and replace part or all of these pipes with pipes or box culverts having more cover, if the existing drainage pattern is to be continued.

An existing 20-inch R.C.P. water line, located 20 feet east of the monument line of 7th Street, has approximately 3.5 feet to 4.5 feet of cover between Roberts Road and Hearn Road. An existing 12-inch V.C.P. sanitary sewer, located 20 feet west of the monument line of 7th Street, has approximately 6.5 to 7.5 feet of cover between Roberts Road and Hearn Road. Consequently the available vertical location for installing culvert pipe across 7th Street is very restricted.

A 29-inch x 18-inch C.M.P.A. is approximately of equal periphery to a 24-inch diameter pipe.

Therefore, the options for continued use of culverts at Stations 16+40, 19+20, 23+80 and 26+85 for conveying drainage from the east side of 7th Street to the west side of 7th Street are:

1. Remove all portions of existing culvert pipe having inadequate cover and replace with same size pipe at flatter slopes and more cover.

2. Remove existing culvert pipe and replace with 24-inch diameter pipe on very flat slopes at locations where the 20-inch water line can be crossed with adequate cover over the new pipe.

3. Remove existing culvert pipe and replace with multiple 15-inch pipe crossing above the 20-inch water line.

4. Remove existing culvert pipe and replace with very shallow and wide box culvert crossing above the 20-inch water line.

5. Remove existing culvert pipe and replace with pipe crossing under the 12-inch sanitary sewer. This will result in stagnant water being in the pipes most of the time.

12. ROBERTS ROAD DRAINAGE CHANNEL

The drainage channel west of 7th Street, in line with Roberts Road extended west, is a concrete lined, trapezoidal cross-section.

It is reasonably uniform in cross-section; the distance across the top is approximately 19 feet; the bottom width is approximately 8 feet; and the depth is approximately 3.5 feet in most areas, although the depth is only about 3 feet in locations where the bank is depressed to allow the entrance of runoff and the depth is about 4 feet in some other locations.

The slope of the easterly 500 feet of channel is approximately 0.0045 ft./ft. and the slope west of the east 500 feet is approximately 0.0078 ft./ft. Using a coefficient of roughness (n) of 0.16 for the Manning formula, the estimated capacity of the channel flowing full in the reach having a slope of 0.0078 ft./ft. is 660 c.f.s.

The Moon Valley Storm Drainage Study, Project No. ST-79190.01 estimated the capacity of this channel to be 500 c.f.s. The same study estimated the 2-year storm runoff into this channel to be 95 c.f.s. and the 100-year storm runoff to be 365 c.f.s.

13. MOON VALLEY WASH

Moon Valley Wash is a concrete lined, trapezoidal cross-section, drainage channel north of Hearn Road from the west side of 7th Street to 5th Street.

The east 50 feet of the channel varies in width and depth. The cross-section of the balance of the channel is reasonably uniform. The distance across the top is approximately 16.5 feet; the bottom width is approximately 8 feet; and the depth is approximately 4 feet.

The slope of the east 200 feet of channel is approximately 0.0189 ft./ft. The slope west of the east 200 feet flattens out to approximately 0.0079 ft./ft. Using a coefficient of roughness (n) of 0.016 for the Manning formula, the estimated capacity of the channel, flowing full in the reach having a slope of 0.0079 ft./ft/, is 735 c.f.s.

The Moon Valley Storm Drainage Study, Project No. ST-79190.01, estimated the capacity of this portion of the Moon Valley Wash to be 1,100 c.f.s. The same study estimated the 2-year storm runoff into this reach to be 245 c.f.s. and the 100-year storm runoff to be 1,135 c.f.s.

14. EFFECTS OF WIDENING 7th STREET

Widening 7th Street so the west curb will be 15 feet farther west than the existing curb, south of Station 22+58.5, will have several detrimental effects upon the existing drainage characteristics of the grass area between the back of sidewalk and the masonry wall.

The existing retention basins between Station 18+60 and Station 21+00 and between Station 21+25 and Station 22+00 will be obliterated. This will result in a loss of 895 cubic feet of depression storage.

The existing retention basin between Station 23+86 and Station 25+06 will be reduced in size from 710 cubic feet to 535 cubic feet. The existing retention basin between Station 25+59 and Station 26+93 will be reduced in size from 1,510 cubic feet to 1,450 cubic feet.

The flow line of the existing grassy swale between the outlet structure at Station 16+39 and the pipe culvert between Lots 157 and 158 at Station 18+47 will be blocked.

There is enough area between the back of the proposed sidewalk and the existing masonry wall to excavate new retention basins that will be equal in volume to the depression storage that will be

lost because of widening 7th Street. However, it will be necessary to remove many of the existing trees in order to construct new retention basins.

A new flow line can be excavated between the outlet structure at Station 16+39 and the pipe culvert at Station 18+47. Again, it will be necessary to remove many of the existing trees in order to excavate a new flow line. A new channel between Station 16+39 and Station 18+47 will have improved hydraulic characteristics compared to the existing grassy swale. A new channel will result in a lesser time of concentration and a greater rate of runoff onto Calavar Road; it will also result in decreasing the infiltration area as compared to what now exists in the grassy swale.

15. STRAIGHT GRADING 7TH STREET (ROBERTS ROAD TO HEARN ROAD)

City of Phoenix Administrative Procedure No. 55 states "Minimum desirable longitudinal grade shall be 0.15% with O.10% as absolute minimum". City Engineering Department reviewers usually red-line any longitudinal grade design less than O.15%. Therefore, in investigating the possibility of straight grading 7th Street from Roberts Road to Hearn Road, the minimum longitudinal grade considered was O.15%.

Roberts Road, east of 7th Street, drains from the east towards the west. The existing drainage direction of Roberts Road precludes raising the 7th Street and Roberts Road intersection, unless the westerly portion of Roberts Road is reconstructed, and catch basins and storm sewer are constructed to sumps in Roberts Road at some point east of 7th Street. Raising of the 7th Street and Roberts Road intersection was not considered for this reason.

The first investigation consisted of projecting a longitudinal grade from the north end of the northeast Roberts Road curb return, at a grade of O.15%, to Hearn Road. This proved to be an impractical grade line for 7th Street because it blocks the drainage from the driveways and lots on

the east side of 7th Street. This grade line would result in flooding on the east side of 7th Street at locations where flooding doesn't presently exist.

The second investigation consisted of projecting a longitudinal grade from the north end of the existing driveway entrance at Station 15+60.7 to Hearn Road. This grade line will work and all of the 2-year storm runoff originating east of 7th Street, that presently crosses under 7th Street through culverts and onto Calavar Road and Piping Rock Road, will be contained between the east gutter and the crown of 7th Street. A catch basin in a sump will be required at the south end of the southeast curb return at Hearn Road. A connector pipe will be required across 7th Street between the catch basin and the Moon Valley Wash west of 7th Street. Moon Valley Wash will be the outfall for runoff collected in the catch basin. The 2-year storm flow in 7th Street, just south of Hearn Road, will be 9.4 c.f.s. and it will have a curb depth of 0.36 feet and a pavement spread of 12.0 feet. This curb depth and pavement spread are well within acceptable design limits.

7th Street pavement between Roberts Road and Hearn Road could be given additional protection from runoff originating east of 7th Street if a catch basin were constructed at the east end of the northeast curb return of Roberts Road. One M-1 L=10' catch basin would reduce the 2-year storm runoff quantity to 8.7 c.f.s.; the curb depth would be reduced to 0.34 feet and the spread to 11.3 feet just south of Hearn Road. Inclusion of a catch basin at Roberts Road doesn't reduce the design numbers significantly, but it would be prudent to split the runoff into both the drainage channel on the west side of 7th Street at Roberts Road and the Moon Valley Wash north of Hearn Road.

16. STORM SEWER

It is feasible to drain 7th Street from Roberts Road to Hearn Road by installing storm sewer pipe from Boca Raton Road to the Moon Valley Wash north of Hearn Road.

The two-year storm runoff would require a 24-inch diameter pipe installed at a grade of 0.0040 ft./ft. between Station 16+40 and the Moon Valley Wash at Station 28+30.

It would be necessary to install the new storm sewer pipe approximately 42 feet west of the monument line of 7th Street. This location is necessary for three reasons:

1. To clear the existing east-west sanitary sewer in Hearn Road.

2. To clear parallel existing water and electric lines.

3. To have entry into the Moon Valley Wash at a point west of the existing C.M.P.A. under 7th Street pavement.

The invert elevation of the 24-inch diameter pipe outfall at the Moon Valley Wash would be lower than the existing wash bottom. Therefore, it would be necessary to remove and replace approximately 200 linear feet of concrete lining to new elevations.

17. UNDERGROUND STORAGE

895 cubic feet of underground storage would be required to replace the existing retention basin storage that will be lost as a result of widening 7th Street between Station 18+60 and Station 22+00.

175 cubic feet of underground storage would be required to replace the existing retention basin storage that will be lost as a result of widening 7th Street between Station 23+86 and Station 25+00

60 cubic feet of underground storage would be required to replace the existing retention basin storage that will be lost as a result of widening 7th Street between Station 25+59 and Station 26+93.

The largest diameter pipe that could be installed with one-foot of cover under the area from Station 18+60 to Station 22+00, and have a gravity drain into the concrete lined channel west of 7th Street at Roberts Road, is a 24-inch diameter pipe. 285 linear feet of 24-inch diameter pipe would be required to provide 895 cubic feet of volume. 475 linear feet of 6-inch bleed line would be required to reach the drainage channel.

It is impractical to consider installing pipe for underground storage to replace the volume of retention basin that will be lost between Station 23+86 and Station 25+06 and between Station 25+59 and Station 26+93. The lost volume of depression storage in these areas would best be restored by deepening the existing basins.

18. COST COMPARISON

The following is a simplified estimate of cost comparison of feasible drainage design alternatives that will limit the rainfall runoff rate onto Calavar Road and Piping Rock Road, after 7th Street is widened, to an amount that does not exceed the existing drainage runoff onto these streets. This is a simplified cost estimate because none of the construction items; e.g. curb, sidewalk, pavement, etc; that are common to all of the alternatives are included in the cost estimate.

FLOODPLAIN ANALYSIS
FOR
MOON VALLEY WASH
MOON VALLEY GARDENS VII
LOT 54
PHOENIX, ARIZONA

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OCTOBER 5, 1987

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EXECUTIVE SUMMARY

This report presents a detailed hydraulic analysis of floodplain characteristics for that portion of Moon Valley Wash located in the vicinity of Thunderbird Road and Moon Valley Gardens VII subdivision. The primary objective of this report is to define a specific floodplain boundary for Lot 54 of this subdivision. Between Thunderbird Road and Coral Gables Drive floodplain characteristics are complicated by the inability of Moon Valley Wash to contain the runoff from a 100-year event within its channel boundaries. As a result, flood waters escape from the main channel and flow across Thunderbird Road at a point approximately 350 feet east of the Thunderbird Road Bridge. This overflow is captured by an east/west frontage road along the south side of Thunderbird Road. This frontage road conveys the overflow in a westerly direction back to Moon Valley Wash.

Lot 54 is bounded by Moon Valley Wash on the west and the frontage road channel on the north. Accordingly, a divided-flow technique was used in this analysis to determine the distribution of flood waters in the main channel of Moon Valley Wash versus the overflow that is captured by the frontage road channel. Once this flow distribution was found, separate water surface profiles were generated for each channel. These profiles were used as the basis for defining a high-water line around the perimeter of Lot 54. The analysis was based on a total discharge of 2720 cfs in Moon Valley Wash.

The results of this analysis indicate that approximately 60% of Lot 54 is presently elevated above the 100-year floodplain. With certain limitations, additional fill could be placed along the northern end of the lot without causing any significant increase in computed water surface elevations.

Due to the complex hydraulic characteristics associated with this location, it is recommended that the building pad elevation for Lot 54 be at least one-foot above the water surface profile in the adjacent frontage road channel. It would be prudent to set a finished floor elevation an additional one-foot above the building pad elevation. Final authority for establishing pad and finished floor elevations rests with the City of Phoenix.

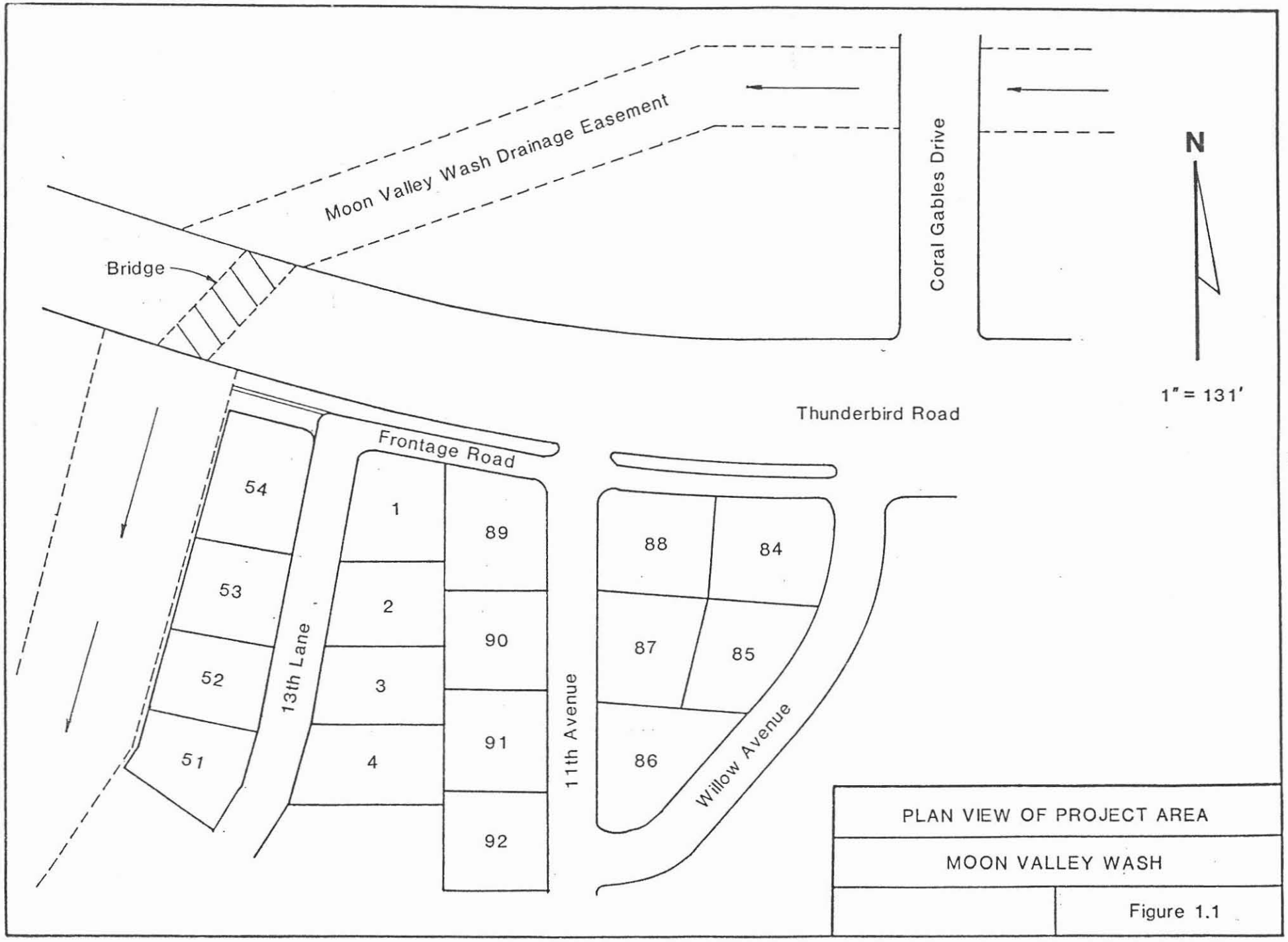

Moon Valley Wash Drainage Easement
Bridge
Coral Gables Drive
N
1" = 131'
Thunderbird Road
Frontage Road
54
53
52
51
13th Lane
1
2
3
4
89
90
91
92
11th Avenue
88
84
87
85
86
Willow Avenue
PLAN VIEW OF PROJECT AREA
MOON VALLEY WASH
Figure 1.1

Figure 1.1

was only increased to accommodate the new roadway width of Thunderbird Road. As part of this road widening project, significant encroachments were made into an existing drainage channel (constructed in 1971) that is tributary to Moon Valley Wash along the south side of Thunderbird Road.

3. A "Grading and Drainage" plan was prepared by Clouse Engineering, Inc. in 1984 - 1985. This plan dedicated approximately 70% of Lot 54 for a drainage easement as part of the frontage road drainage channel referenced under the previous item. Accordingly, this drainage plan excluded Lot 54 from being developed.

4. Through discussions with City of Phoenix personnel and a review of City records, it appears that unauthorized "fill" has been placed on Lot 54 sometime during the 1983 - 1985 era. This has raised additional concerns relative to a possible reduction in the flow capacity of the frontage road drainage channel located along the north side of Lot 54.

The following sections of this report present a discussion of the technical procedures and assumptions that were used to develop water surface profiles that acknowledge the present topography of the drainage system in the vicinity of Lot 54 of the Moon Valley Gardens VII subdivision.

This analysis is based on a 100-year flood, which has an estimated peak discharge of 2720 cfs. Although possible upstream flood control projects may ultimately change this discharge, the City of Phoenix recommended that this study be conducted on the basis of 2720 cfs.

II. TOPOGRAPHIC DATA SOURCES

Several studies have been completed for this reach of Moon Valley Wash. In addition to the previously referenced study by Clouse Engineering, Inc., the following analyses have also been conducted:

1. Flood Insurance Study, City of Phoenix, Arizona, Maricopa County (preliminary, November 5, 1982), Federal Emergency Management Agency (FEMA).

2. Floodplain Delineation of Moon Valley Wash And The Effect Of Encroachment Into The Moon Valley Floodplain By Lots 50 Thru 54 And 2, Moon Valley Gardens Subdivision, Phoenix, Arizona, Water Resources Associates, Inc. (WRA), March 1984.

Although this current study is an effort to present an unbiased investigation of existing floodplain conditions, the majority of the cross-sectional geometry for Moon Valley Wash was taken from the 1984 Water Resources Associates, Inc. study, which in turn relied heavily on the 1982 FEMA study for cross-section data. Field inspections of the project site did not indicate that any major construction had taken place (with the exception of the frontage road channel) which would render these previous sections obsolete for use in this new study.

To reflect the unauthorized "fill" that has allegedly been placed on Lot 54, Clouse Engineering, Inc. was retained to survey two new cross-sections of Moon Valley Wash adjacent to Lot 54. The ends of these two cross-sections, which were surveyed in September 1987, extended from the top of a levee on the west side

of Moon Valley Wash to the east side of Lot 1, of Moon Valley Gardens VII subdivision. Accordingly, the entire width of Lot 54 was included in the cross-sections. This new survey also included spot elevations for the corners and centers of Lots 52 and 53.

On the north side of Lot 54, six new cross-sections were surveyed by Clouse Engineering (Sept 1987) to reflect changes in the frontage road tributary channel (due to the widening of Thunderbird Road in 1985) and possible "fill" along the north side of Lot 54. These six sections were used to model the hydraulic characteristics of the frontage road channel from its outlet at Moon Valley Wash to 11th Avenue.

Field inspections of the floodplain indicate that considerable fill has also been placed on portions of the vacant lot located on the north side of Thunderbird Road, between Moon Valley Wash and Coral Gables Drive. Since the low elevations on this lot provide a potential overflow area for Moon Valley Wash, Clouse Engineering was also retained (Sept.1987) to survey a ground profile along the top of this fill, extending from the Thunderbird Road Bridge to Coral Gables Drive. The alignment of this profile was located approximately 20 feet north of the north sidewalk of Thunderbird Road. This profile provided the necessary field data to determine if overflows from Moon Valley Wash would cross Thunderbird Road, east of the bridge.

Geometric data for the Thunderbird Road Bridge was obtained from field inspections (Sept. 1987) and design drawings from City of Phoenix Project No. P-78015.00 (FMS Index No. P-780155)-

Thunderbird Road, 19th Avenue to Coral Gables Drive. These plans were also used in conjunction with the September 1987 Clouse Engineering survey to supplement the hydraulic modeling of the frontage road drainage channel.

III. TECHNICAL APPROACH

This section of the report presents details of the hydraulic modeling that was used to generate water surface profiles for the 100-year flood. The Corps of Engineers HEC-2 Program (Water Surface Profiles) was used for the analysis.

3.1 Modeling Procedure

Upstream of Thunderbird Road, the main channel of Moon Valley Wash is not capable of containing, within its banks, a peak discharge of 2720 cfs. This creates the potential for a divided flow condition as water exceeds the bank elevations of the main channel and flows south towards a low point in Thunderbird Road, approximately 350 feet east (at 11th Avenue) of the bridge. During such large floods, water will be flowing both under the bridge (in Moon Valley Wash) and east of the bridge (through the low-spot on Thunderbird Road) into the south frontage road channel. The frontage road channel carries this overflow west where it outlets into Moon Valley Wash, immediately downstream of the Thunderbird Road Bridge. Accordingly, the hydraulic analysis of this floodplain requires a split-flow investigation to determine the amount of water passing through the bridge, as well as through the low area east of the bridge. Such an analysis was conducted by creating two computerized

hydraulic models to simulate the flow in the main channel of Moon Valley Wash and the flow through the frontage road channel. Numerous combinations of discharge values were run through these models until a combination was found which produced approximately equal water surface elevations (in both models) at the low-point in Thunderbird Road (350 feet east of the bridge).

Key assumptions used in this analysis are listed as follows:

1. Water will pond along the north side of Thunderbird Road at an elevation equal to the computed water surface elevation on the upstream side of the Thunderbird Road Bridge (XSEC 78.002). For the range of discharges investigated in this study, the bridge inlet is submerged and the bridge is operating under pressure flow conditions. This tends to pond water on the upstream side of the bridge. This ponded elevation is assumed to be constant along an easterly, horizontal extension of XSEC 78.002 to the low-point in Thunderbird Road.

2. The upstream end of the water surface profile for the frontage road channel is located at 11th Avenue. This location is adjacent to the low-spot in Thunderbird Road. Accordingly, it is assumed that the computed water surface elevation at 11th Avenue (XSEC 4) would pond water into the low-spot on Thunderbird Road, where it would match the ponded elevation of the water in Moon Valley Wash at the upstream side of the bridge (Assumption #1).

3. The separate flows (in the frontage road channel and Moon Valley Wash) that produce the water surface match listed in Assumption #2 are considered to be representative of the flow-split that would occur for a total peak discharge of 2720 cfs.

Using the preceding assumptions, the steps in the modeling procedure are listed as follows (refer to Figure 3.1 for cross-section locations):

1. Run HEC-2 model for Moon Valley Wash. Use a starting discharge of 2720 cfs at XSEC 69.242 (200 feet downstream of XSEC 71.242) and a starting water surface elevation of 1318.59 (this discharge and elevation match that used in the 1984 WRA study for this same cross-section). Near the outlet of the frontage road channel (XSEC 76.772) this discharge is reduced by an amount equal to that assumed to be flowing in the frontage road channel.

Record computed water surface elevations at XSEC 75.822, 76.772, and 78.002.

2. Based on a linear interpolation of the water surface profile between XSEC 75.822 and 76.772, compute the water surface elevation at a point opposite the outlet of the frontage road channel. For the purpose of this study, the outlet of the frontage road channel was considered to be 62 feet upstream from XSEC 75.822 in Moon Valley Wash.

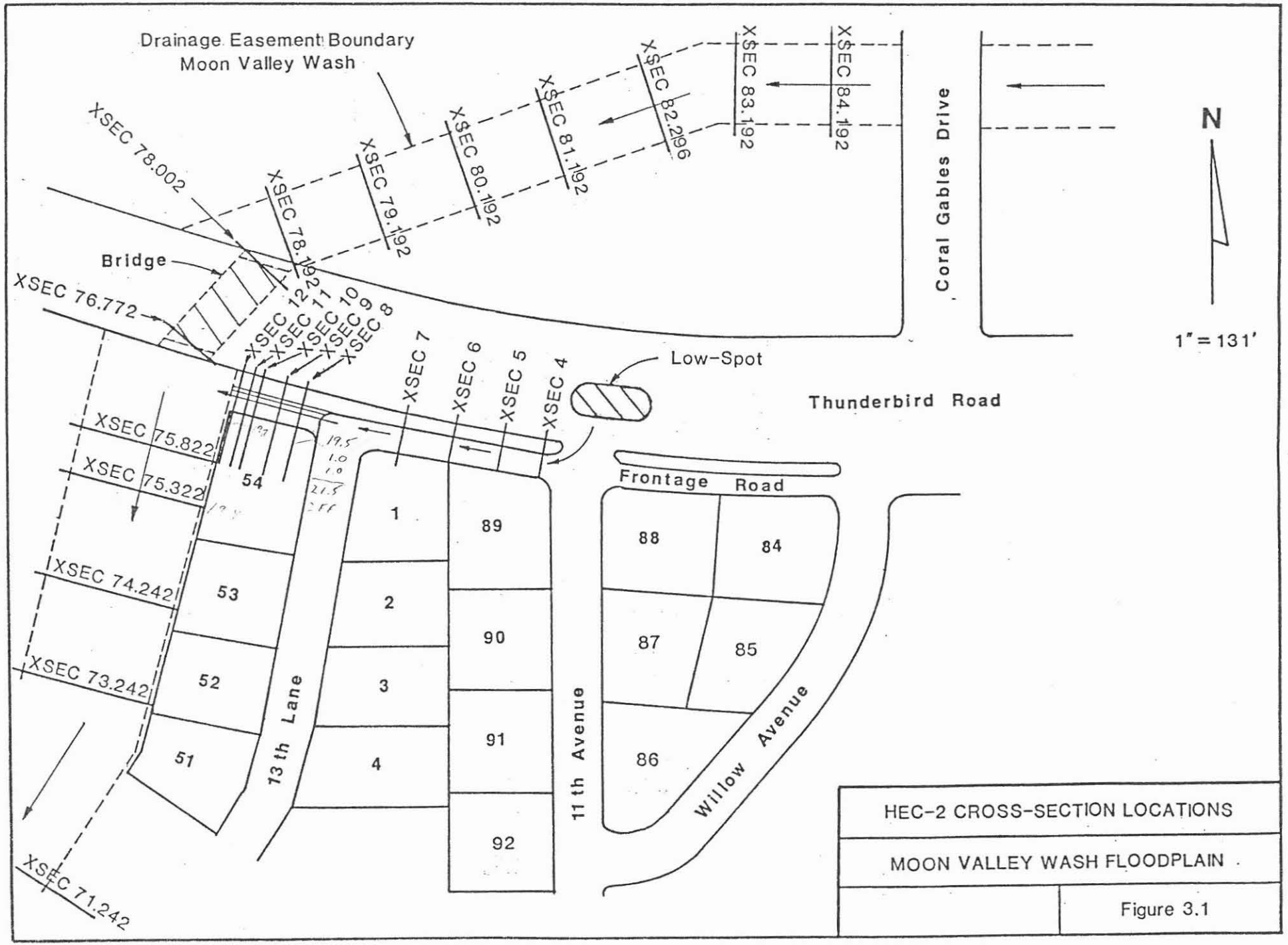

Drainage Easement Boundary
Moon Valley Wash
XSEC 78.002
XSEC 78.192
XSEC 79.192
XSEC 80.192
XSEC 81.192
XSEC 82.296
XSEC 83.192
XSEC 84.192
Coral Gables Drive
N
1" = 131'
Bridge
XSEC 76.772
XSEC 12
XSEC 11
XSEC 10
XSEC 9
XSEC 8
XSEC 7
XSEC 6
XSEC 5
XSEC 4
Low-Spot
Thunderbird Road
XSEC 75.822
XSEC 75.322
XSEC 74.242
XSEC 73.242
XSEC 71.242
54
53
52
51
1
2
3
4
89
90
91
92
88
84
87
85
86
Frontage Road
13th Lane
11th Avenue
Willow Avenue
HEC-2 CROSS-SECTION LOCATIONS
MOON VALLEY WASH FLOODPLAIN
Figure 3.1

Figure 3.1

3. Use the water surface elevation computed in Step 2 to initiate the HEC-2 model for the frontage road channel. Use a peak discharge equal to 2720 cfs minus the amount assumed to pass under the Thunderbird Road Bridge (peak discharge at XSEC 76.772 from Step 1).

After running this model, record the computed water surface elevation at XSEC 4.

4. Compare the computed water surface elevation at XSEC 78.002 (Step 1) with that at XSEC 4 (Step 3). If these elevations are approximately equal (a tolerance of +/-0.05 feet was used), the correct flow-split has been found. If they are more than +/-0.05 feet apart, assume a new flow-split and repeat the entire procedure.

In performing this analysis, it should be noted that no attempt was made to generate a difference (energy gradient) in water surface profile across the low-spot in Thunderbird Road. In actuality, if water were flowing across the road, the water surface elevation on the north side of the road would be slightly higher than that on the south side of the road (excluding a hydraulic jump condition). The assumption of a level, ponded condition in this low-spot represents a conservative approach relative to the flooding potential in the residential area adjacent to the frontage road channel. In order to develop an energy gradient across the road, the water surface profile in the frontage road channel would have to be lower than that across Thunderbird Road. This would require a reduction in discharge

for the frontage road channel and a corresponding increase in the discharge in Moon Valley Wash, upstream of Thunderbird Road Bridge.

Additional conservatism is included in the analysis of the frontage road channel by the fact that sub-critical flow conditions were assumed, when in fact the HEC-2 model was forced to assume critical depth at XSECs 4, 6, and 7. This indicates the potential for supercritical flow near the upstream end of the channel. Under supercritical conditions, the upper reach of the profile would actually be lower than that for subcritical conditions.

Sections 3.2 and 3.3 of this report present details relative to the input data for the HEC-2 models that were used to implement the described procedure.

3.2 HEC-2 Model For Moon Valley Wash

3.21 Cross-Section Location And Effective Flow Areas

As indicated previously, Figure 3.1 presents a plan view of the cross-section locations used for the Moon Valley Wash model. Appendix A contains plots of all cross-sections used in the analysis.

XSEC 75.332 and 75.822 were surveyed by Clouse Engineering, Inc. in September 1987. XSEC 76.772 and 78.002 were generated from field inspections and a review of bridge plans. All other Moon Valley Wash cross-sections were taken from the 1984 WRA report. It should be noted that in reviewing the WRA report, those cross-sections upstream of the Thunderbird Road Bridge were found to be oriented left to right, looking upstream, while those

downstream of the bridge were oriented left to right looking downstream. For use in this current (1987) report, all cross-sections have been recoded so as to be oriented left to right, looking downstream. The only possible exception to this rule might be XSECs 69.242 and 71.242. A plot of these sections indicates a high levee embankment on the left side of each section. Based on field inspections near Lot 54, the high levee embankment is on the right side of the wash. Since the orientation of these two sections will not alter the hydraulic calculations, they were not recoded. However, encroachment stations were set at the top of the levee on these two sections so as to preclude flow behind the levee. Encroachment stations were also set near the top of the bank on the right side of these sections to simulate the effect of block wall fences constructed on the lots adjacent to Moon Valley Wash (this assumes these two sections are oriented left-to-right, looking upstream). As a matter of interest, it should be noted that a supplemental HEC-2 model was created to determine the impact of possible future construction of block wall fences along the west side of Lots 52, 53, and 54. Using approximate property line locations, this supplemental analysis indicated an insignificant rise of 0.01-feet would occur to portions of the water surface profile for Moon Valley Wash.

An encroachment station was also set along the toe of the east bank of XSEC 75.822. This simulates the non-effective flow area that will occur along the east bank immediately downstream

of the bridge. This will occur in response to the bridge skew directing water into the west bank rather than the center of the channel.

Only the geometry of the main channel (bank to bank) was modeled upstream of Thunderbird Road. Overbank areas were assumed to be non-effective, since hydraulic control was being provided by the bridge opening and the backwater profile from the frontage road channel. The peak discharge used in these upstream channel cross-sections has been reduced to reflect losses into the left (south) overbank. Encroachment stations were set on both the left and right sides of XSEC 78.192 to simulate the contraction of effective flow area as water approaches the Thunderbird Road Bridge.

3.22 Mannings Roughness Values

Field inspections of this reach of Moon Valley Wash indicate that the majority of the wash downstream of Thunderbird Road is severely overgrown with a thick stand of weeds and desert brush. Under such conditions, a Mannings "n" value of 0.080 to 0.100 would be appropriate. The previous FEMA Flood Insurance Study used a roughness value of 0.023 for earth bottom channels and 0.035 for earth overbanks. Such values are not representative of existing conditions in Moon Valley Wash.

In anticipation that the City of Phoenix will implement a channel maintenance program, a channel "n" value of 0.027 was used in this analysis. Again, it should be emphasized that this value does not represent present-day conditions, and is only being used to generate a floodplain analysis that would simulate

conditions that might occur with periodic channel maintenance. A value of 0.027 allows for some scattered brush and grass in the channel.

If Moon Valley Wash were to be modeled with an "n" value of 0.080 to 0.100, floodplain conditions would undoubtedly be severe. When the Moon Valley Wash HEC-2 model was run with a main channel "n" value of 0.090, depths of flow were found to increase on the order of 2 to 2.5 feet. Lots 54, 53, and 52 (along with several more in the neighborhood) would be inundated.

Although very little overbank flow is allowed to occur in the model (due to encroachment stations and limits on the available cross-sectional geometry), an overbank "n" value of 0.035 was used. This is consistent with previous modeling by FEMA and WRA. No overbank flow was modeled upstream of Thunderbird Road.

An "n" value of 0.023 was used for the Thunderbird Road Bridge. This acknowledges a smooth earth bottom and concrete side-walls.

3.23 Energy Loss Coefficients

Energy losses, associated with changes in the shape of the channel cross-sections, were modeled with the following coefficients:

	Contraction	Expansion
1. Gradual transitions	0.1	0.3
2. Thunderbird Road Bridge	0.3	0.5
3. Confluence with frontage road channel	0.6	0.8

The confluence of the frontage road channel and Moon Valley Wash uses higher loss coefficients to acknowledge the turbulence that will occur as the two watercourses join at a 90 degree angle.

3.24 Bridge Model For Thunderbird Road

The cross-sectional geometry for Thunderbird Road Bridge was based on actual field measurements and cross-checked with the bridge plans for verification. The span length was measured perpendicular to the bridge walls so that the data used for the cross-sectional geometry on the GR cards will reflect an area that is truly perpendicular to flow. This eliminates the need for applying a skew factor to the cross-section data.

The vertical height of the bridge opening was measured from the low-chord (soffet) to the top of existing sediment deposits under the bridge. This produced a dimension of 6.5 feet. Actual bridge plans list an average soffet elevation of 1318.86 and an invert elevation of 1312.0, which provides 6.86 feet of depth. The measured depth of 6.5 feet was used in the model to provide an allowance for sediment movement through the bridge.

Due to the presence of a bridge pier, and the occurrence of pressure flow, the Special Bridge routine in HEC-2 was used for this analysis. The following parameters were used on the SB card:

1. Pier Shape Coefficient - Although the actual pier has a rounded nose and tail, a square nose and tail was assumed on the theory that debris would collect on the pier and destroy the

streamlined effect of the round nose. Accordingly a coefficient of 1.25 was selected. This is consistent with the 1984 HEC-2 analysis by WRA.

2. Total Loss Coefficient - Based on recommendations in the HEC-2 Manual, a value of 1.56 was used.

3. Coefficient of Discharge (weir flow) - Since overflow in the HEC-2 model was confined to the bridge deck, a coefficient of 2.6 was selected. This is based on recommendations in the HEC-2 Manual.

4. Length of Weir Crest - A value of 50 feet was used to simulate weir flow over the bridge deck. This length is based on a measurement of the bridge span (perpendicular to flow) between the wing-walls.

5. Bottom Width of Bridge Opening - Based on field inspections, the total wall to wall span length is 48.25 feet. This dimension, which is measured perpendicular to flow, includes the pier width of 1.5 feet.

6. Width of Obstructions - The actual pier width is 1.5 feet. Two feet of debris are assumed to collect on each side of the pier, this providing a total obstruction width of 5.5 feet.

7. Net Area of Bridge Opening - This parameter was based on the results of field measurements which identified the depth of the bridge opening as 6.5 feet and two clear-span (excludes pier width) lengths of 23.375 feet each. The span lengths were then reduced by 4 feet to account for the debris obstruction assumed under Item 6. This yields a net bridge area of 278 square feet.

8. Side-Slopes - The bridge has vertical walls. Accordingly, a value of zero was used for this parameter.

9. Channel Invert, Upstream Side of Bridge - Based on the bridge plans and field measurements, an invert elevation of 1312.36 was used. As indicated previously, this provides a 0.36 foot allowance for sediment movement through the bridge.

10. Channel Invert, Downstream Side of Bridge - Same as Item 9, elevation 1312.36

In addition to the parameters listed above, an X2 card was used to define the upstream low-chord (soffet) elevation of the bridge and the top-of-roadway over the bridge. Based on the bridge plans, an average low-chord elevation of 1318.86 was selected. The crest elevation used for weir flow computations was set at 1321.15 feet. This elevation was based on both judgement and a review of the bridge plans. It acknowledges the potential for some debris collection on the guardrail along the upstream side of the bridge.

3.3 HEC-2 Model For Frontage Road Channel

3.31 Cross-Section Location and Effective Flow Areas

Figure 3.1 also presents a plan view of the cross-section locations used for the frontage road channel. Geometry for XSEC 5, 6, 7, 8, 9, and 10 were provided by Clouse Engineering, Inc. on the basis of a September 1987 survey of the area.

In order to provide a slight upstream and downstream extension of the data, some additional cross-sections (4, 11, and 12) were added to the HEC-2 model. XSEC 4 is a repeat of XSEC 5, with 0.38 feet added to all the station elevations. This

increase in elevation is based on a review of curb and gutter elevations shown on the 1985 record drawings for the Thunderbird Road improvements.

XSEC 11 and 12 were added to extend the model to Moon Valley Wash. The geometry of these two cross-sections is identical, the only difference being a constant 0.40 feet of elevation having been added to XSEC 12 to get XSEC 11. The shape of these two cross-sections was based on a modification to the surveyed geometry of XSEC 10. This modification was made in accordance with field observations. The invert elevation of these two sections was based on a ground profile of this channel which was included in the Thunderbird Road improvement plans. This ground profile provided excellent correlation with that profile generated by the 1987 Clouse survey data for this channel.

Due to the location of a residential fence at the left side of XSEC 6 (between Lots 1 and 89), a flow constriction will occur. Downstream of this constriction, the effective flow boundary (south side) was assumed to expand at a 4:1 ratio. This boundary was used to establish encroachment stations for effective flow widths on XSECs 8, and 9.

None of the cross-sections for the frontage road channel include any geometry for areas north of the sidewalk along the south side of Thunderbird Road. Thunderbird Road was not considered effective in conveying flow to the west because the road has an uphill slope, from east to west, as it approaches the bridge.

3.32 Manning's Roughness Values

The main conveyance in the frontage road channel will occur in the street, through XSEC 4, 5, 6, and 7, and in the concrete drainage channel through XSEC 8, 9, 10, 11, and 12. However, some overbank flow was allowed to occur beyond the south sidewalk (as water spreads across Lots 1 and 54) and in the landscaped median between the frontage road and Thunderbird Road. The following "n" values were used for different elements of the cross-sections:

1. Landscaped medians and residential lots - 0.035
2. Bare dirt lot - 0.028
3. Asphalt street - 0.016
4. Concrete channel - 0.013

3.33 Energy Loss Coefficients

Energy losses, associated with changes in the shape of the channel cross-sections, were modeled with the following coefficients:

	Contraction	Expansion
1. Gradual transitions	0.1	0.3
2. Confluence with Moon Valley Wash	0.6	0.8

The turbulence that will occur at the confluence with Moon Valley Wash was modeled in both XSEC 12 and 11 through the use of contraction/expansion loss coefficients. Since XSEC 12 is actually at the edge of the wash, values of 0.6 and 0.8 were used. These values were reduced to 0.1 and 0.3 at XSEC 10 since it is 22 feet upstream from the confluence.

IV. RESULTS OF HEC-2 ANALYSES

Since previous discussions have already been presented on modeling procedures and input data, this section of the report will only address the results of the analyses.

As a result of several trial and error runs with the HEC-2 models, a flow-split of 2220 cfs in Moon Valley Wash and 500 cfs in the frontage road channel was found to provide a balanced water surface elevation at the low-spot in Thunderbird Road, 350 east of the bridge. Specific data on the water surface profiles is presented in the following paragraphs.

4.1 Moon Valley Wash

Appendix B presents a complete listing of the input and output data for the Moon Valley Wash model. For convenient reference, Table 4.1 lists pertinent hydraulic data from the analysis. This information is graphically illustrated in Figure 4.1, which is a profile plot for Moon Valley Wash. Figure 4.1 also includes a ground profile of the existing pad elevations for Lots 50, 51, 52, 53, and 54. These pad elevations are representative of ground conditions near the center of the lots.

4.2 Frontage Road Channel

Appendix C presents a complete listing of the input and output data for the frontage road channel. Table 4.2 lists pertinent hydraulic data from this analysis. Figure 4.2 is a profile plot for the frontage road channel. This figure includes ground elevations from Lot 54 that were measured at the intersection of XSEC 75.822 with XSECs 8, 9, and 10. A sidewalk

TABLE 4.1
SUMMARY OF HYDRAULIC DATA
FOR MOON VALLEY WASH
100-YEAR FLOOD

Cross-Section	Discharge (cfs)	Water Surface Elevation (MSL)	Main Channel Velocity (fps)
69.242	2720	1318.59	5.45
71.242	2720	1318.73	6.39
73.242	2720	1319.05	6.17
74.242	2720	1319.36	5.12
75.322	2720	1319.35	6.33
75.822	2720	1319.36	7.27
76.772	2220	1319.88	6.12
78.002	2220	1320.96	5.35
78.192	2220	1321.32	3.38
79.192	2220	1321.30	4.05
80.192	2220	1321.32	4.44
81.192	2220	1321.36	4.67
82.296	2220	1321.48	4.33
83.192	2220	1321.49	4.88
84.192	2220	1321.54	5.36

Note: See Appendix B for a complete printout of HEC-2 data

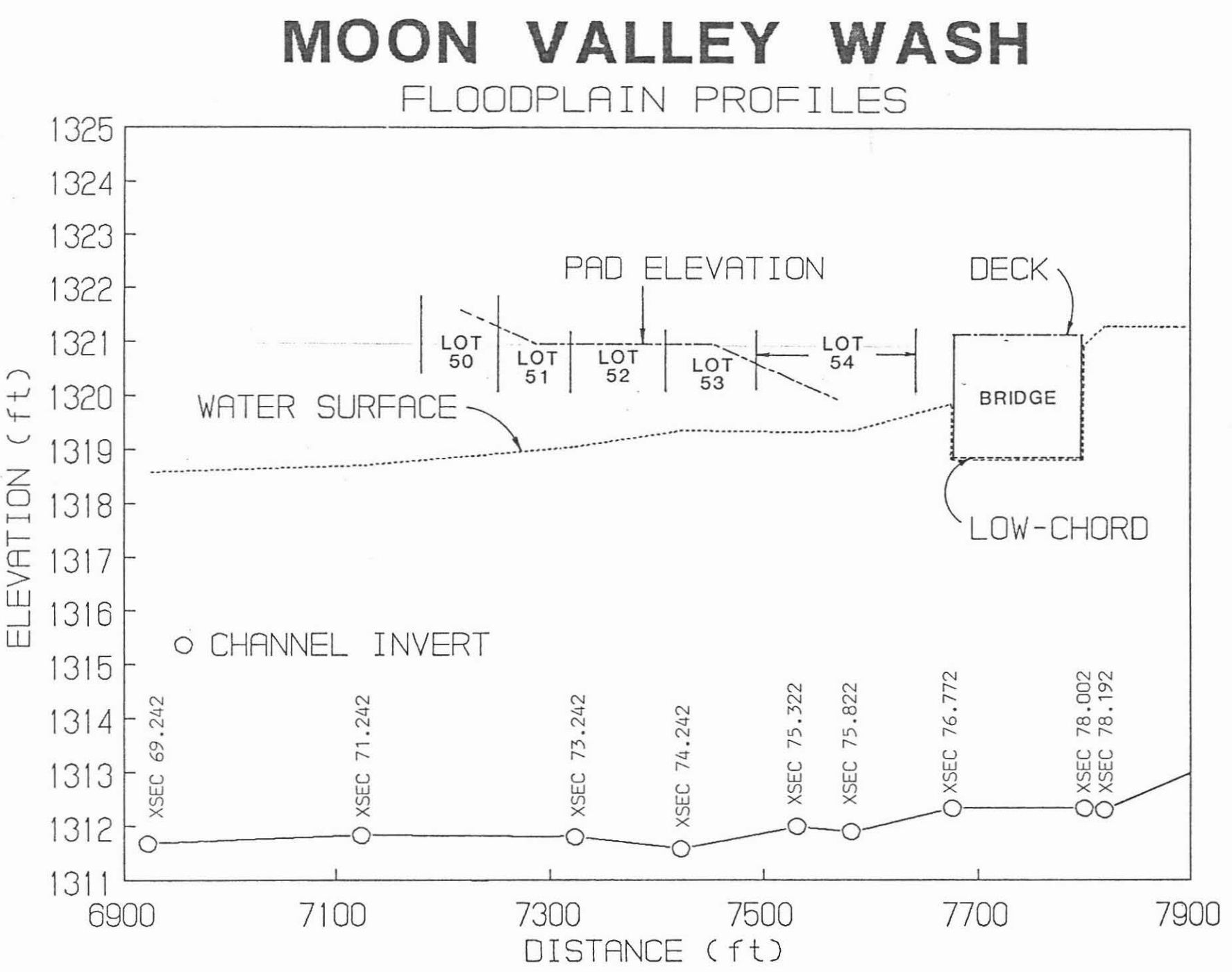

MOON VALLEY WASH
FLOODPLAIN PROFILES
ELEVATION (ft)
1325
1324
1323
1322
1321
1320
1319
1318
1317
1316
1315
1314
1313
1312
1311
PAD ELEVATION
DECK
LOT 50
LOT 51
LOT 52
LOT 53
LOT 54
BRIDGE
WATER SURFACE
LOW-CHORD
CHANNEL INVERT
XSEC 69.242
XSEC 71.242
XSEC 73.242
XSEC 74.242
XSEC 75.322
XSEC 75.822
XSEC 76.772
XSEC 78.002
XSEC 78.192
6900
7100
7300
7500
7700
7900
DISTANCE (ft)

Figure 4.1

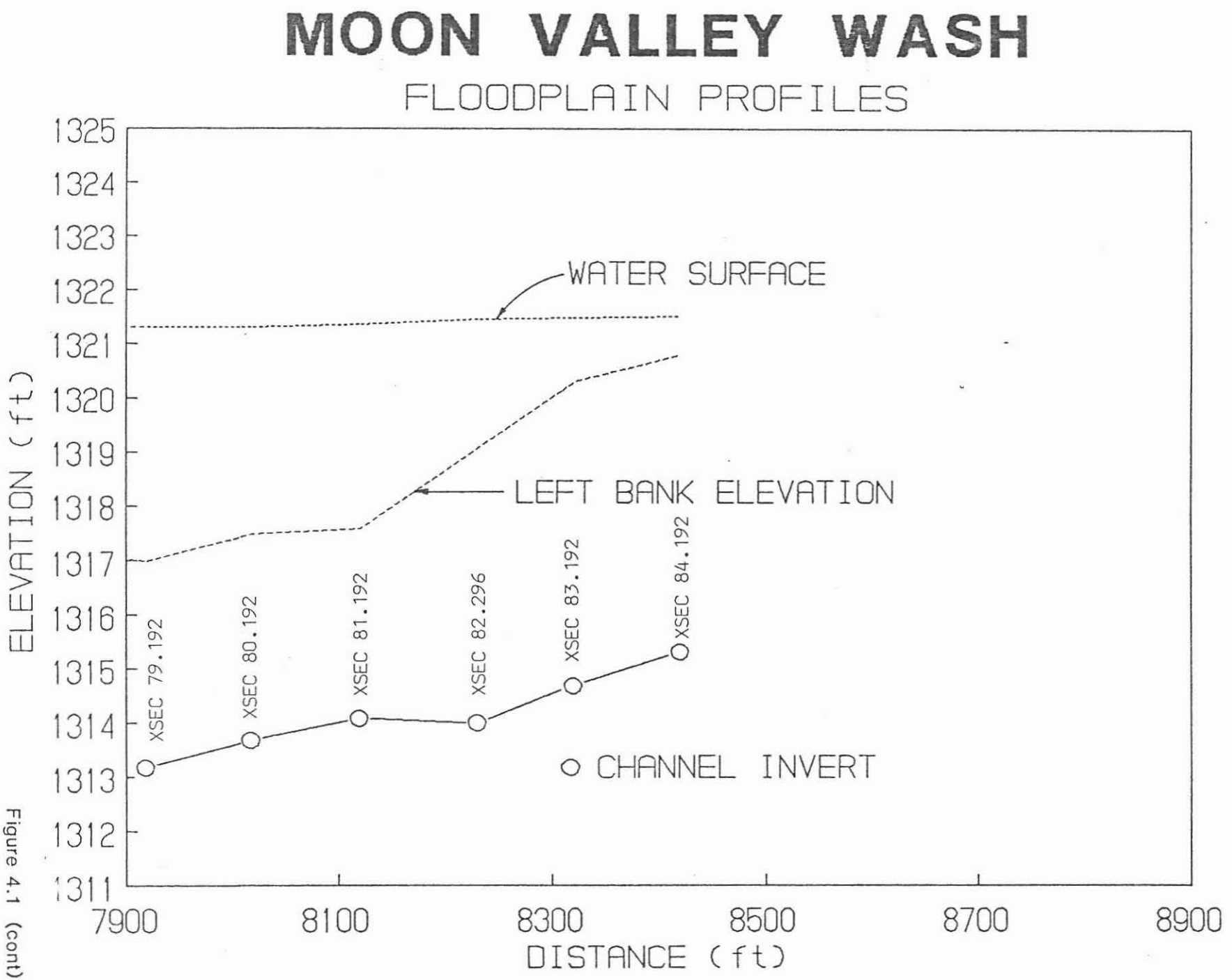


Figure 4.1 (cont)

TABLE 4.2
SUMMARY OF HYDRAULIC DATA
FOR SOUTH FRONTAGE ROAD CHANNEL
100-YEAR FLOOD

					Water Surface Elevation Comparison For Different Encroachment Stations			
Cross-Section	Discharge (cfs)	Main Channel Velocity (fps)	South Encroachment Station (STENCL)	Water Surface Elevation (MSL)	South Encroachment Station (STENCL)	Water Surface Elevation (MSL)	South Encroachment Station (STENCL)	Water Surface Elevation (MSL)
12	500	4.18	0	1319.70	24**	1319.70	54***	1319.70
11	500	5.12	0	1319.68 (1319.71)*	24**	1319.69	54***	1319.69
10	500	5.73	0	1319.60 (1319.71)*	24**	1319.56	54***	1319.55
9	500	6.29	3	1319.56 (1319.73)*	24**	1319.51	54***	1319.47
8	500	5.87	11	1319.70 (1319.74)*	24**	1319.66	54***	1319.44
7	500	8.25	0	1319.93	0	1319.93	0	1319.94
6	500	8.45	0	1320.52	0	1320.52	0	1320.53
5	500	6.86	0	1321.06	0	1321.06	0	1321.05
4	500	8.42	0	1321.00	0	1321.00	0	1321.00

* Numbers in parentheses represent elevations based on an estimated M1 profile. See Section 4.2 for explanation.

** Encroachment to East/West line located 30' south of north boundary of Lot 54.

*** Complete encroachment to north boundary (edge of concrete slab) of Lot 54.

Note: See Appendix C for a complete printout of HEC-2 data.

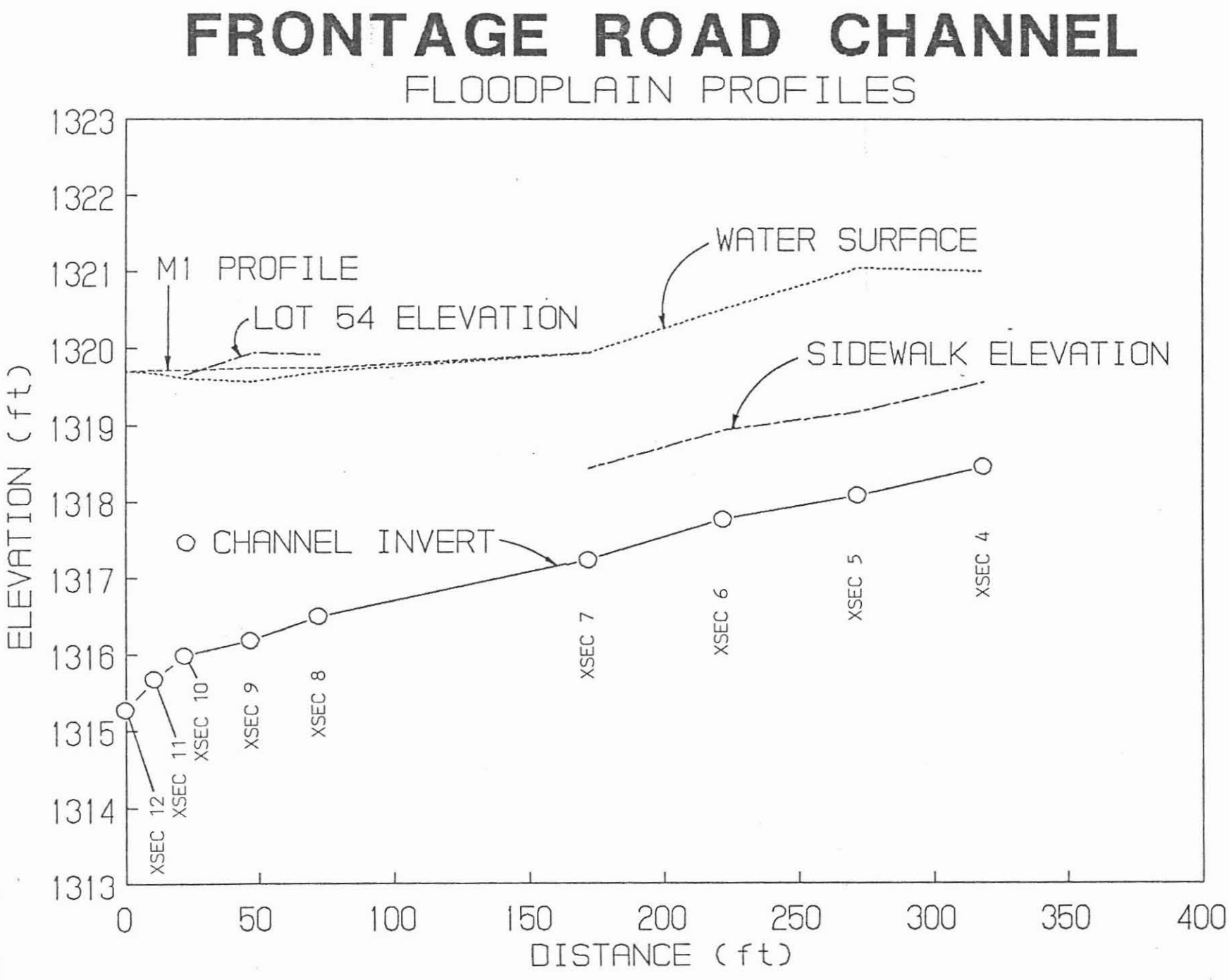

FRONTAGE ROAD CHANNEL
FLOODPLAIN PROFILES
ELEVATION (ft)
DISTANCE (ft)
1323
1322
1321
1320
1319
1318
1317
1316
1315
1314
1313
0
50
100
150
200
250
300
350
400
M1 PROFILE
LOT 54 ELEVATION
WATER SURFACE
SIDEWALK ELEVATION
CHANNEL INVERT
XSEC 12
XSEC 11
XSEC 10
XSEC 9
XSEC 8
XSEC 7
XSEC 6
XSEC 5
XSEC 4

Figure 4.2

profile is also included in Figure 4.2 for XSECs 4, 5, 6, and 7 in order to convey an indication of the flooding potential that might occur to residential lots in the vicinity of these cross-sections. The plotted sidewalk profile represents elevations at the south side of the sidewalk located on the south side of the frontage road.

As a matter of interest, it should be noted that the frontage road water surface profile will cause a ponded flooding condition on both 13th Lane and 11th Avenue. On 13th Lane, it is estimated that water will pond to near the south edge of Lot 51 (gutter elevation=1319.88'), while on 11th avenue, water will pond southerly to near the intersection with Willow Avenue.

In reviewing the data in Table 4.2, it should be noted that the computed water surface elevations at XSECs 11, 10, 9, and 8 are slightly lower than the starting water surface elevation at XSEC 12 (confluence with Moon Valley Wash). This is occurring in response to the backwater computations being forced to start with an elevation of 1319.70 at XSEC 12 (this matches the computed profile at this location in Moon Valley Wash). This is undoubtedly creating a depth of flow at this section which is significantly greater than normal depth for the given discharge of 500 cfs. As a result, the energy balance in the four succeeding upstream cross-sections is being forced to converge at water surface elevations slightly less than that at XSEC 12. In actuality, an M1 profile would probably occur in response to the backwater from Moon Valley Wash. An approximation of an M1 profile is shown in Figure 4.2. For conservatism, the estimated

M1 profile elevations were used in lieu of the HEC-2 elevations in identifying potential inundation limits through XSECs 11, 10, 9, and 8.

Table 4.2 also contains water surface profile elevations from two additional HEC-2 runs made for the frontage road channel. These runs were made to determine the impact of additional encroachments along the north side of Lot 54. Such encroachments simulate the effects of additional fill, or construction of a block-wall fence, that might be undertaken to remove additional area of Lot 54 from the frontage road channel floodplain. Only the "complete encroachment" profile causes an increase (0.01 feet) in water surface elevation upstream of XSEC 8. However, this result should be interpreted with some degree of caution since all three models assumed critical depth at XSEC 4, 6, and 7. Accordingly, there is probable super-critical flow and a hydraulic jump occurring through these sections. The actual flow depths under such conditions are being masked by the models assumption of critical depth. Adopting the sub-critical profile computed by HEC-2 is a conservative approach for the floodplain delineation. Consequently, for the assumption of sub-critical conditions, the additional encroachments listed in Table 4.2 create no significant increase in computed water surface elevations.

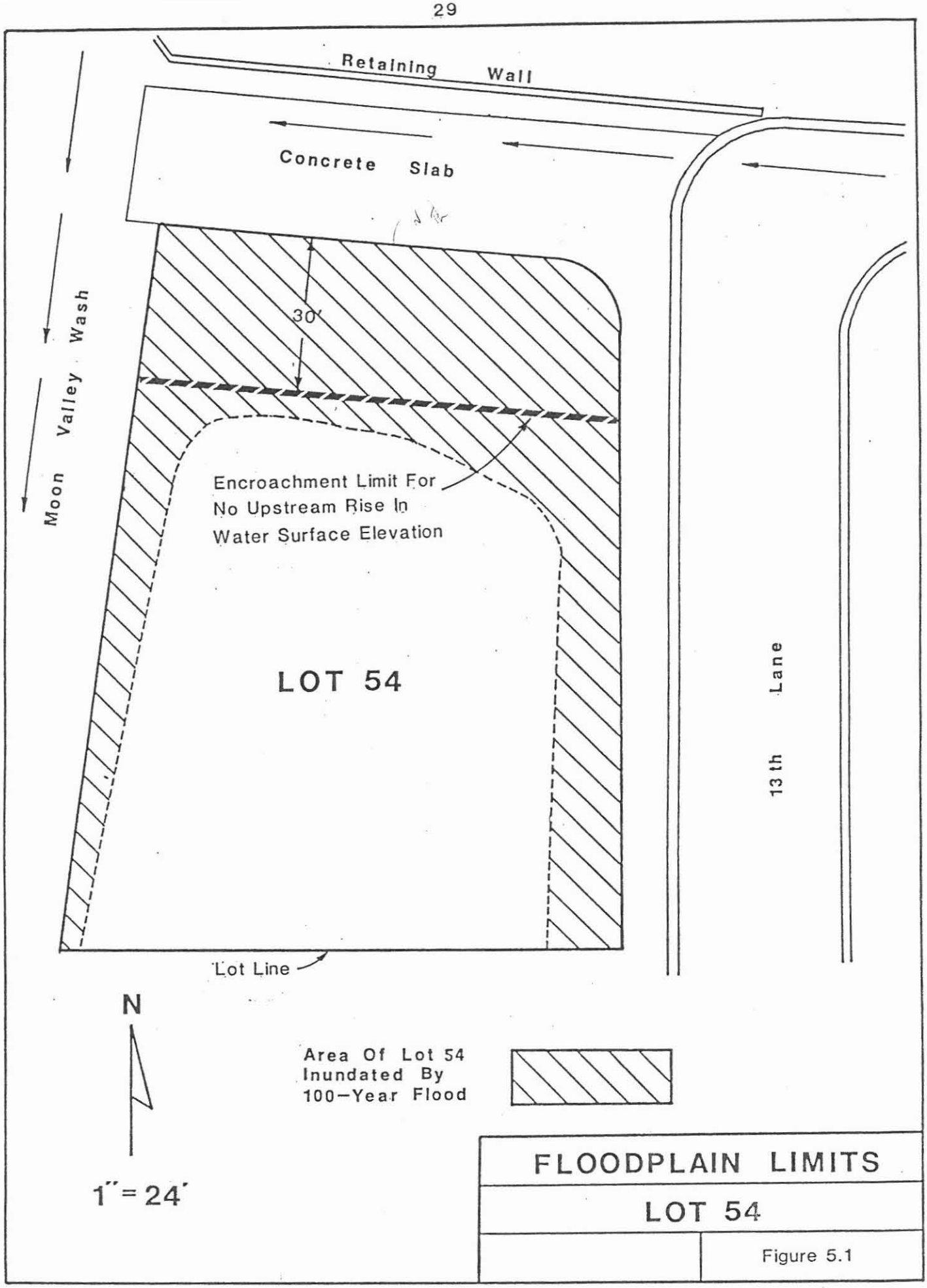
V. CONCLUSIONS

A review of the hydraulic data for Moon Valley Wash indicates that the pad elevations (measured at center of lots) for Lots 50, 51, 52, and 53 are more than 1.5 feet above the water surface elevation associated with a peak discharge of 2720 cfs. The center of Lot 54 (measured at XSEC 75.822) is approximately 0.57 feet (1319.93-1319.36) above the water surface profile in Moon Valley Wash.

Along the north side of Lot 54, the hydraulic data for the frontage road channel indicates that the center of Lot 54 (measured at XSEC 9) is approximately 0.20 feet (1319.93-1319.73) above the water surface profile for this east/west channel.

This information is graphically illustrated in Figure 5.1, which is a plan view showing the approximate floodplain boundaries on Lot 54. The information shown in this figure is based on results from the HEC-2 models discussed in this report and the September 1987 topographic surveys conducted by Clouse Engineering, Inc. Appendix D includes expanded cross-section plots for HEC-2 XSECs 75.322 and 75.822. These two sections extend completely across Lot 54.

If required by the City of Phoenix, additional "fill" could be placed on Lot 54 to elevate the building pad above a prescribed elevation. As long as this "fill" is placed in the unshaded area depicted on Figure 5.1, there would be no encroachments or impacts to the surrounding floodplain identified in this report.



FLOODPLAIN LIMITS

LOT 54

Figure 5.1

Should additional building pad area be desired to the north, "fill" could be placed northerly to a line located 30 feet south of the south edge of the existing concrete slab (based on the Clouse surveys and Grading and Drainage Plan for Moon Valley Gardens VII, the south edge of this slab appears to be the north property line for Lot 54). This encroachment into the frontage road channel floodplain would cause a maximum rise of 0.01 feet in the computed water surface elevations along the north side of Lot 54. This encroachment causes no change in the computed water surface elevations at upstream XSECs 7, 6, 5, and 4. The slight rise (0.01') created along Lot 54 is still below the estimated M1 profile elevations that were previously recommended (Section 4.2) to be used for an "existing" condition water surface profile through XSECs 8, 9, 10, and 11. The inundation limits shown in Figure 5.1 are based on this estimated M1 profile.

By placing additional fill to the north boundary of Lot 54 (edge of existing concrete slab), a 0.01-foot increase in water surface elevation is created at upstream XSECs 7 and 6.

Due to the fact that Lot 54 is located at the confluence of two channels (the analysis of which is further complicated by a bridge located immediately upstream of the confluence), it would be prudent to include "freeboard" in any prescribed building pad or finished floor elevations for this lot. A recommended building pad elevation would be 1-foot above the adopted water surface profile for the frontage road channel. The finished floor elevation of any structure located on Lot 54 should be an additional 1-foot above the pad elevation. This will provide a

factor of safety for variations in the water surface profiles that may occur in response to high energy losses and complex flow patterns that accompany confluence hydraulics. Precise simulation of these phenomena is very difficult with a one-dimensional model such as HEC-2.

As a matter of interest, it should be noted that the 1982 Flood Insurance Study for Moon Valley Wash shows a 100-year water surface elevation of about 1319.20 at Thunderbird Road. This compares to an elevation of approximately 1321.00 from this study for the same location. It should be understood that this 1987 study presents a much more detailed, site-specific analysis of the Thunderbird Road area than did the FEMA study. There have also been major alterations to the frontage road channel geometry since the FEMA study was completed.

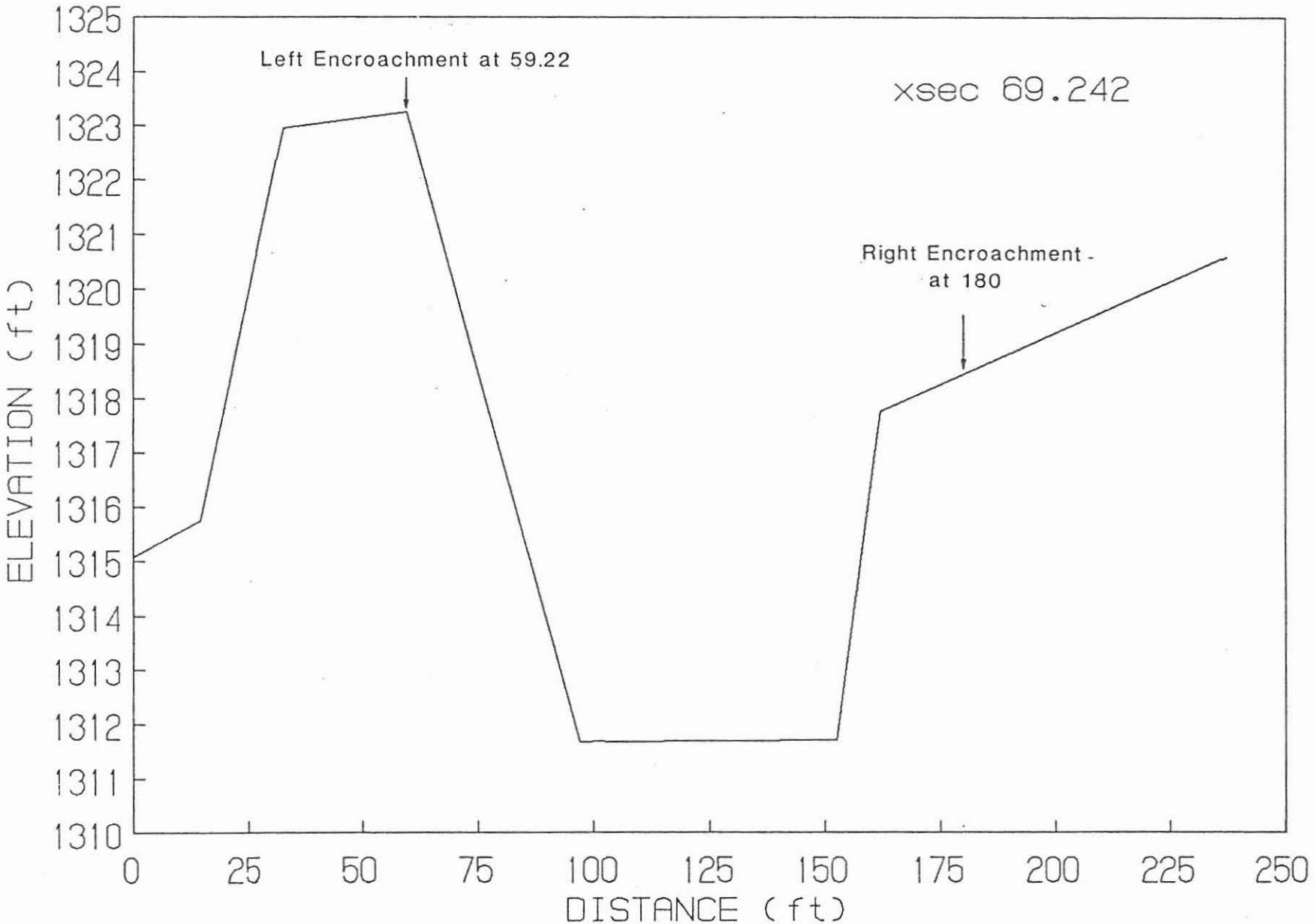
Based on the assumptions and results presented in this study, it appears that an acceptable building pad could be created on Lot 54 without causing any significant adverse impacts to the "existing condition" floodplain delineated in this study.

APPENDIX A

HEC-2 Cross-Section Plots

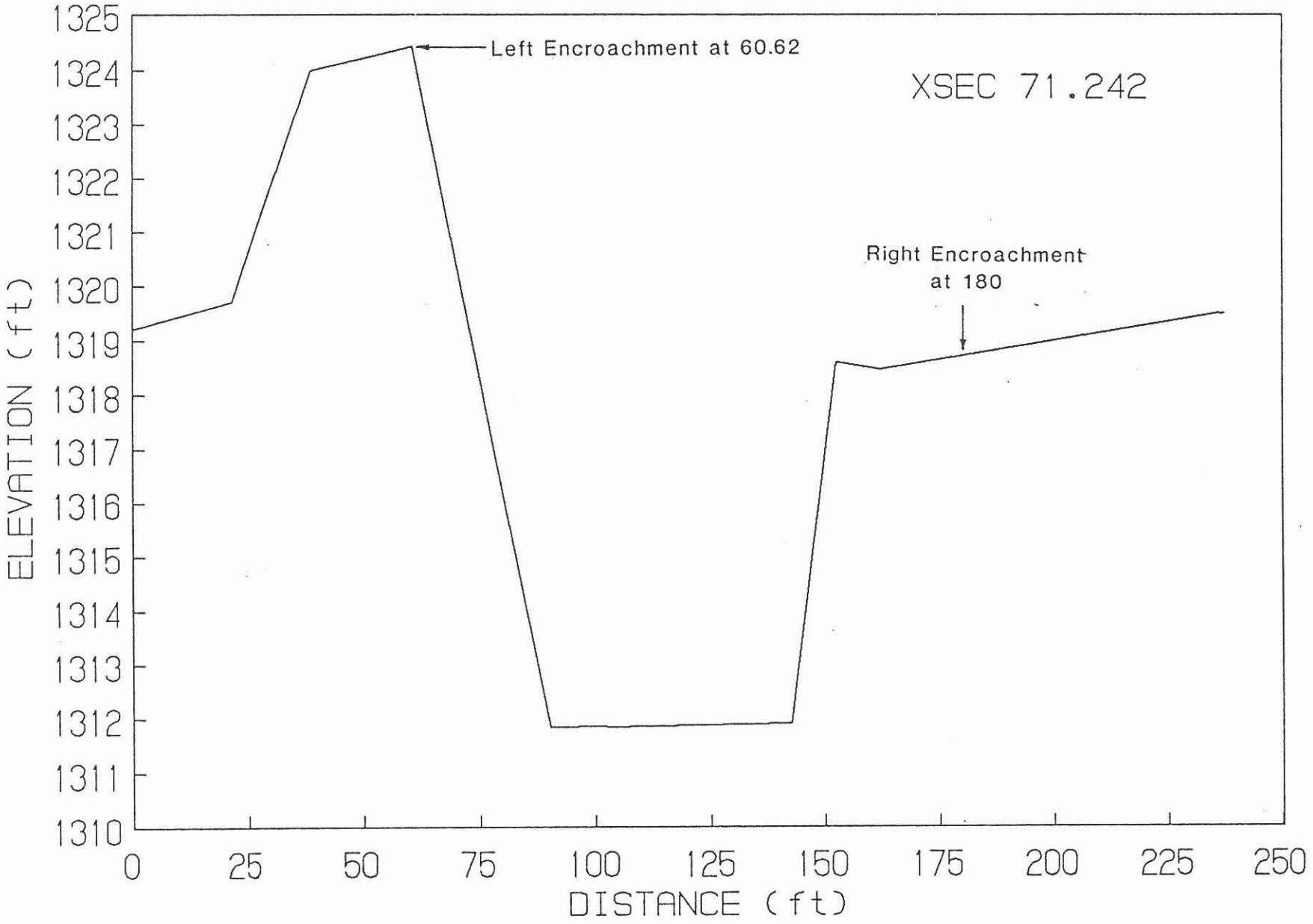
MOON VALLEY WASH

XSEC 69.242



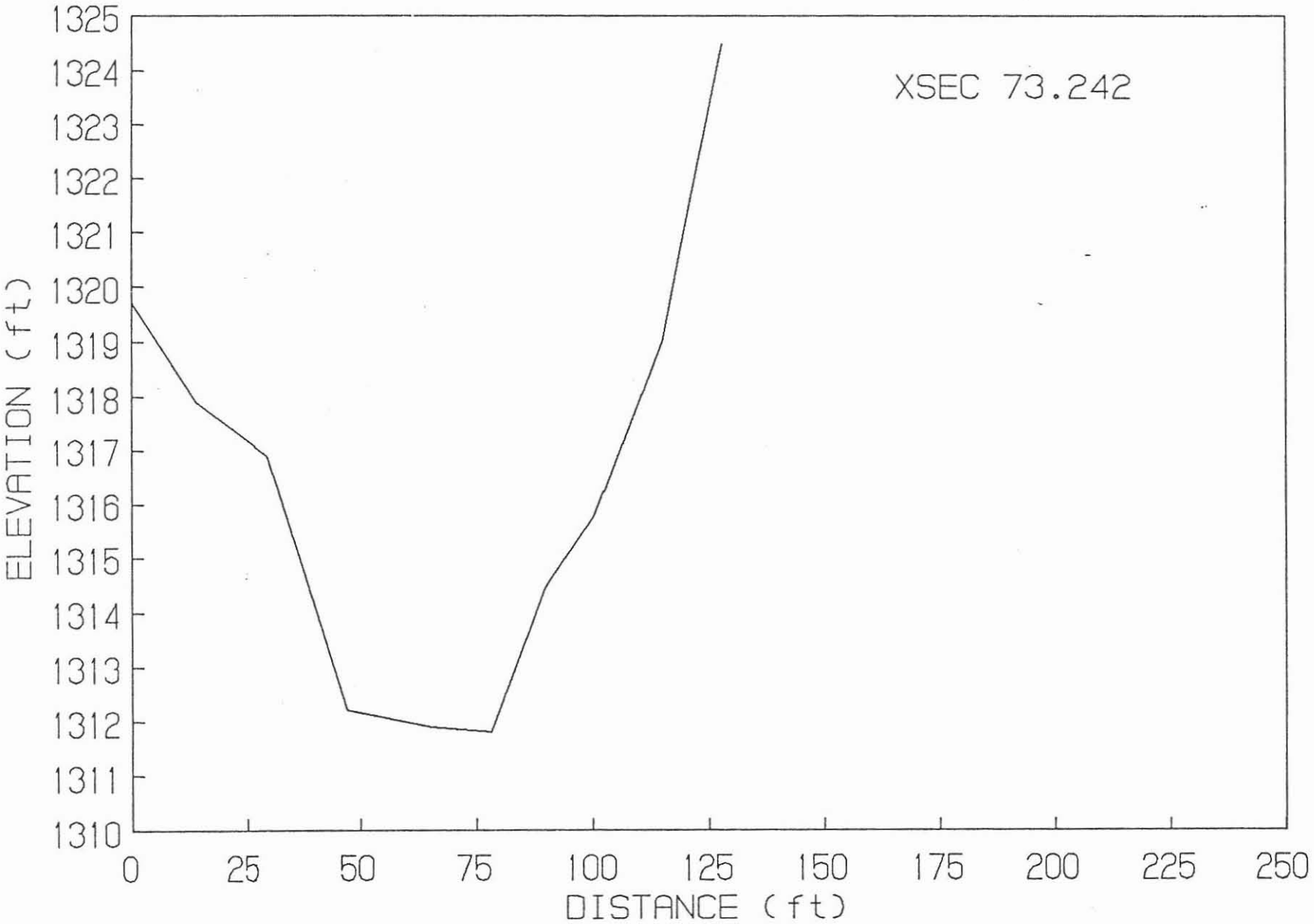
MOON VALLEY WASH

XSEC 71.242



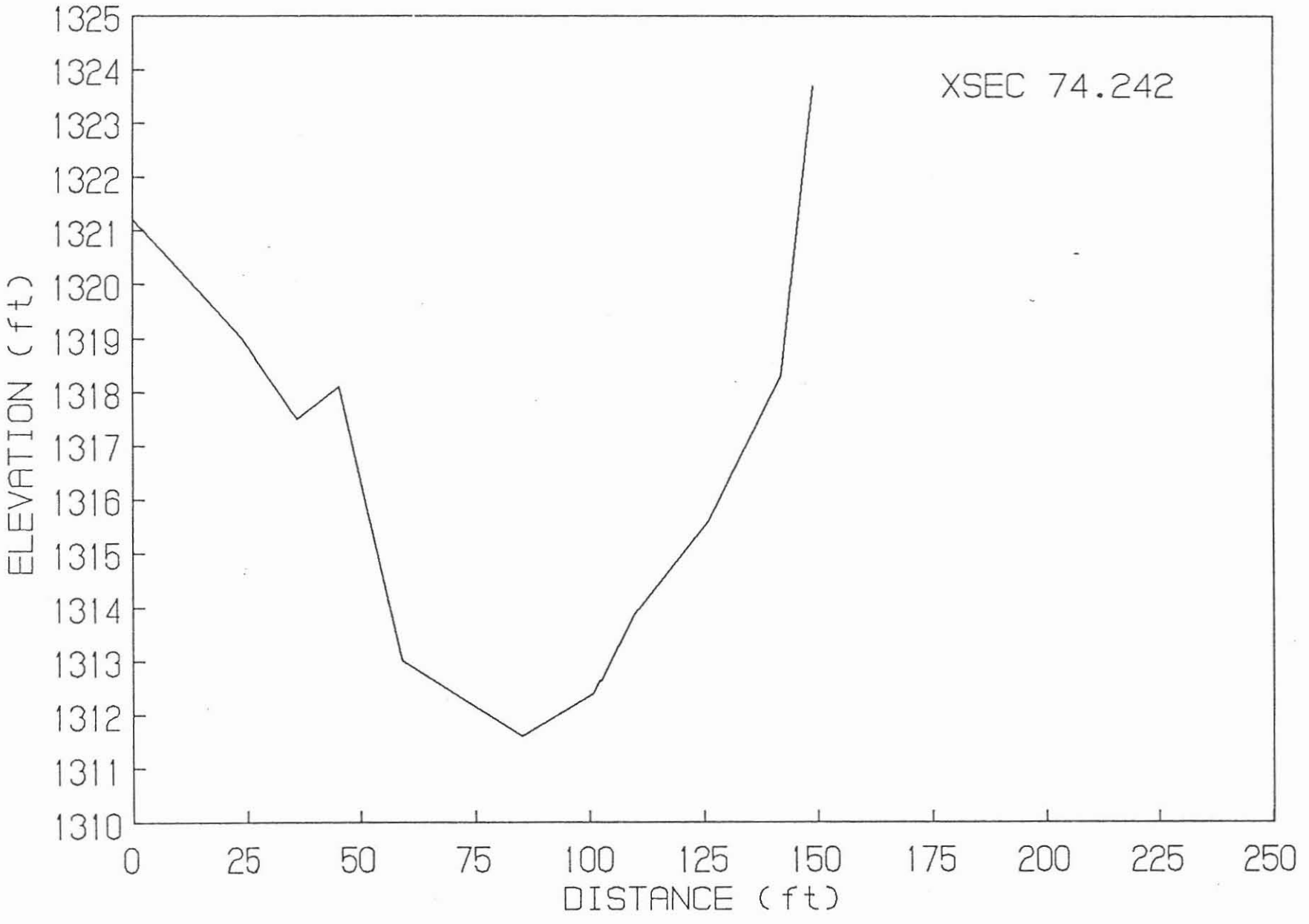
MOON VALLEY WASH

XSEC 73.242



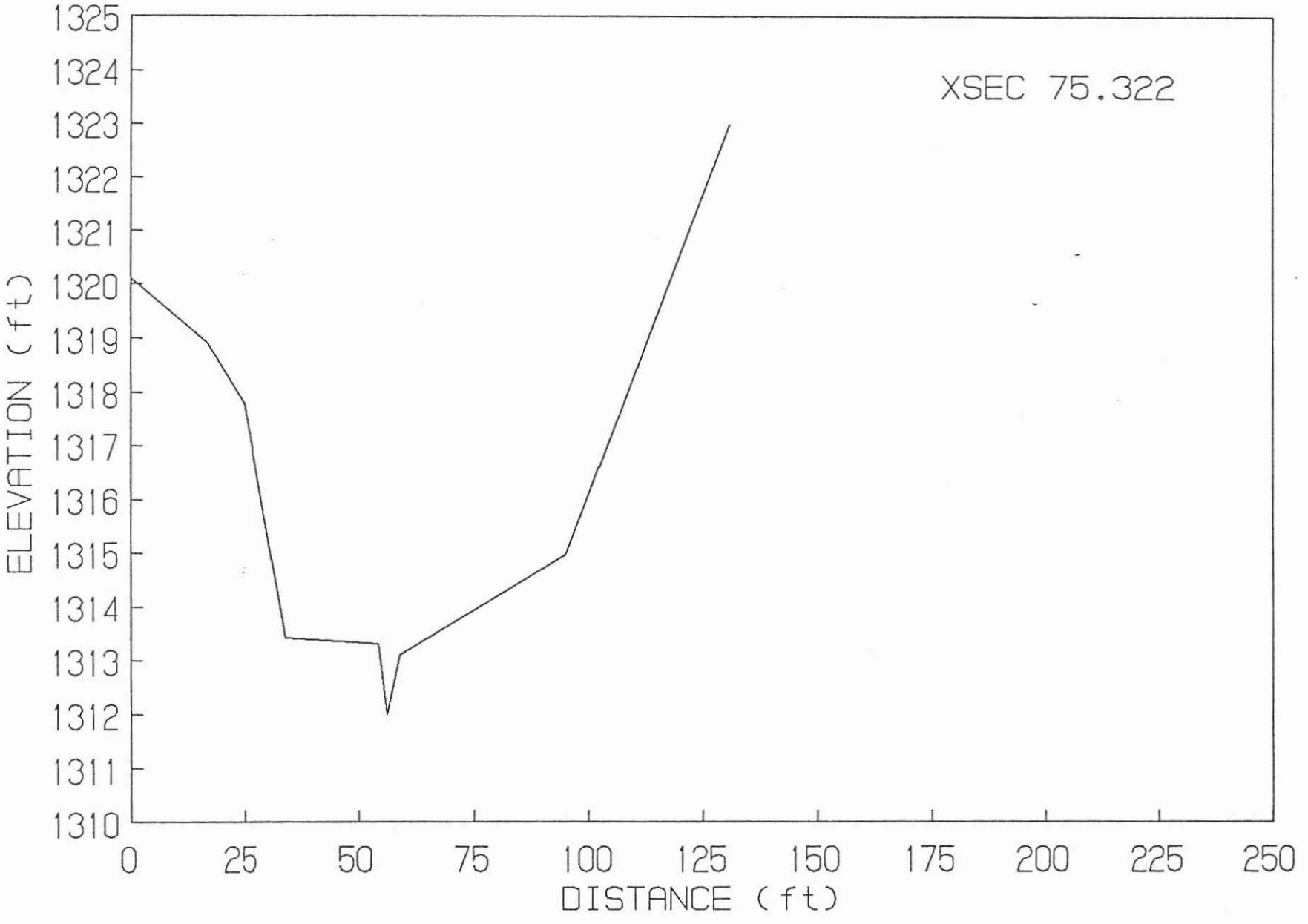
MOON VALLEY WASH

XSEC 74.242



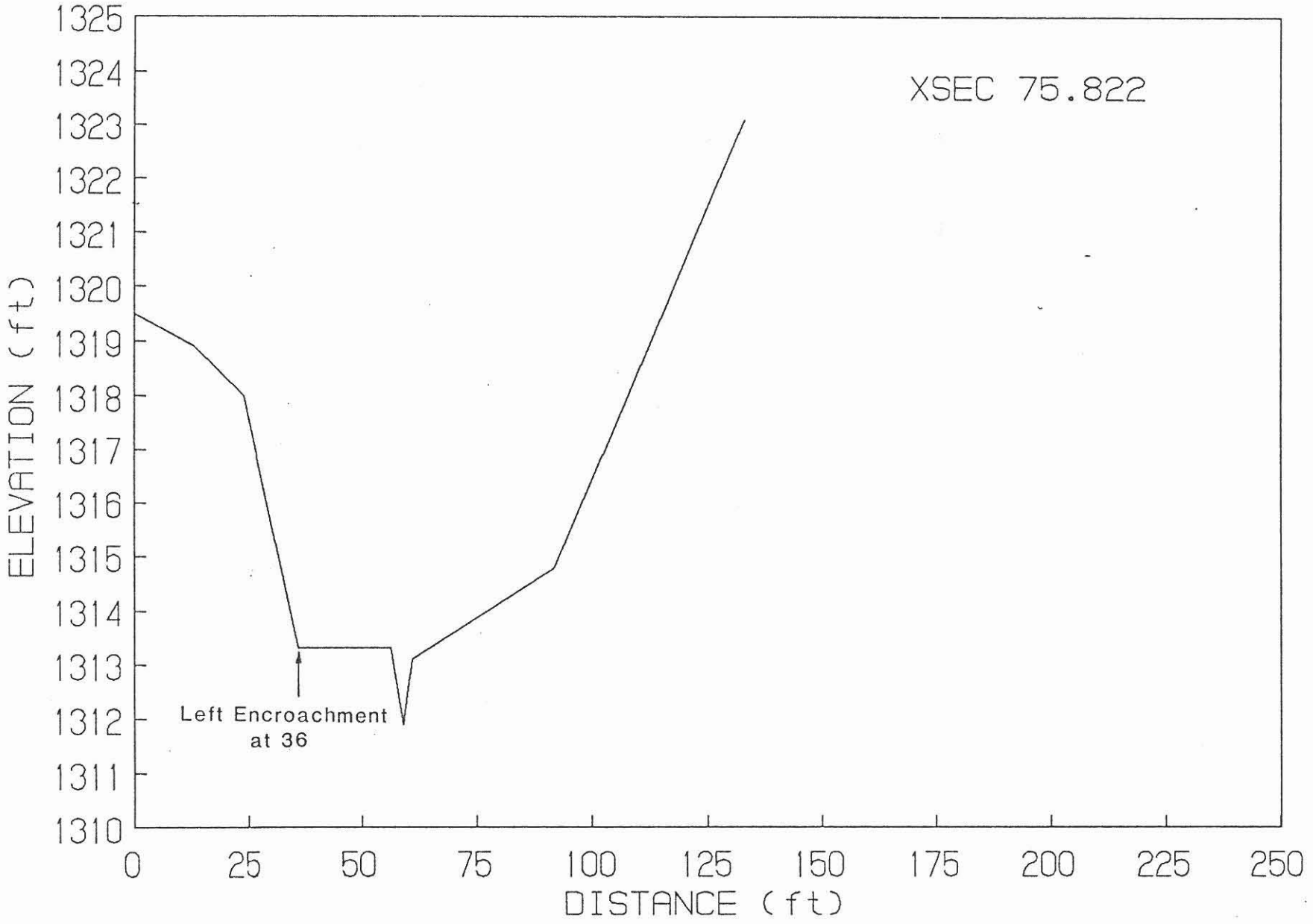
MOON VALLEY WASH

XSEC 75.322



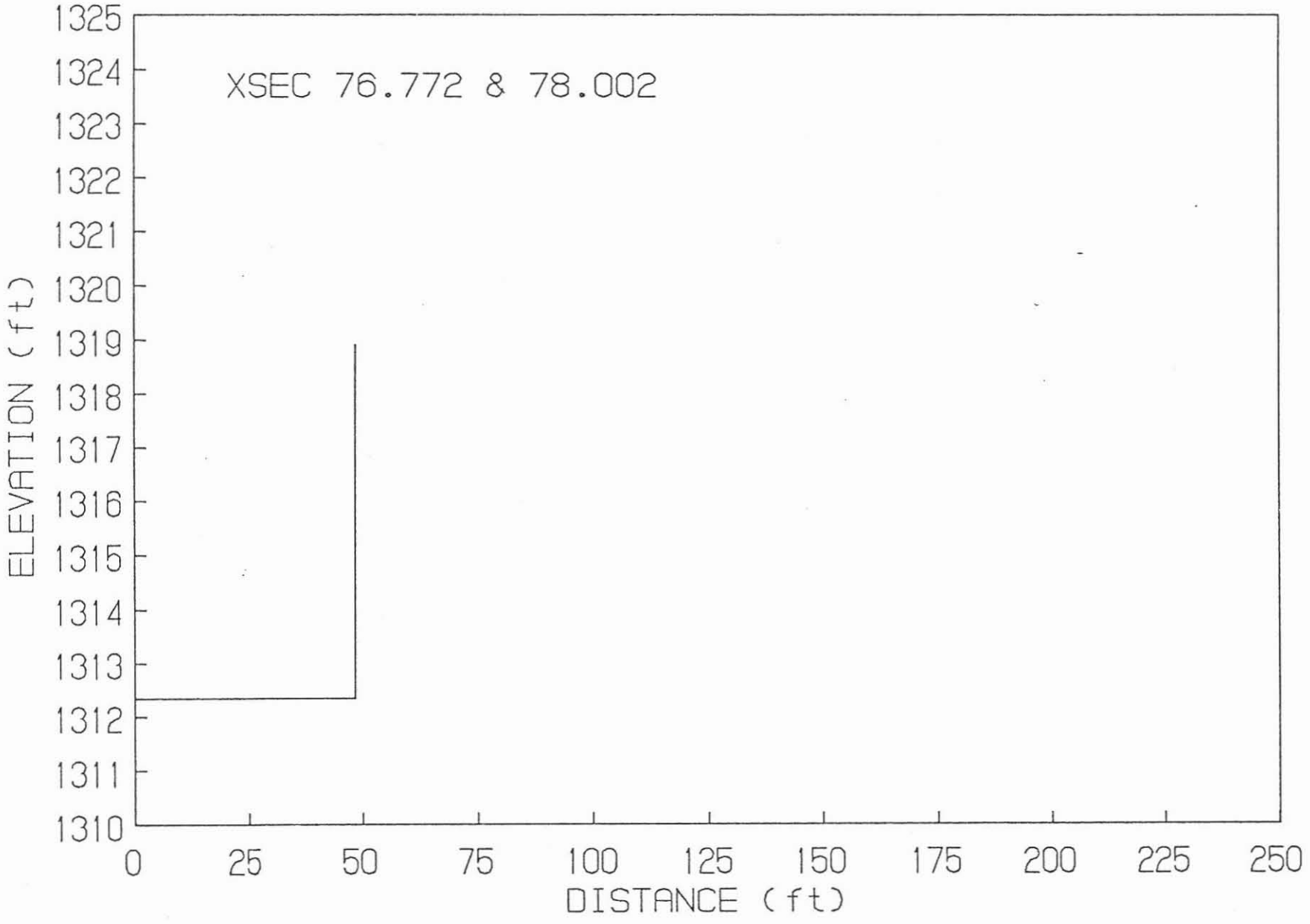
MOON VALLEY WASH

XSEC 75.822



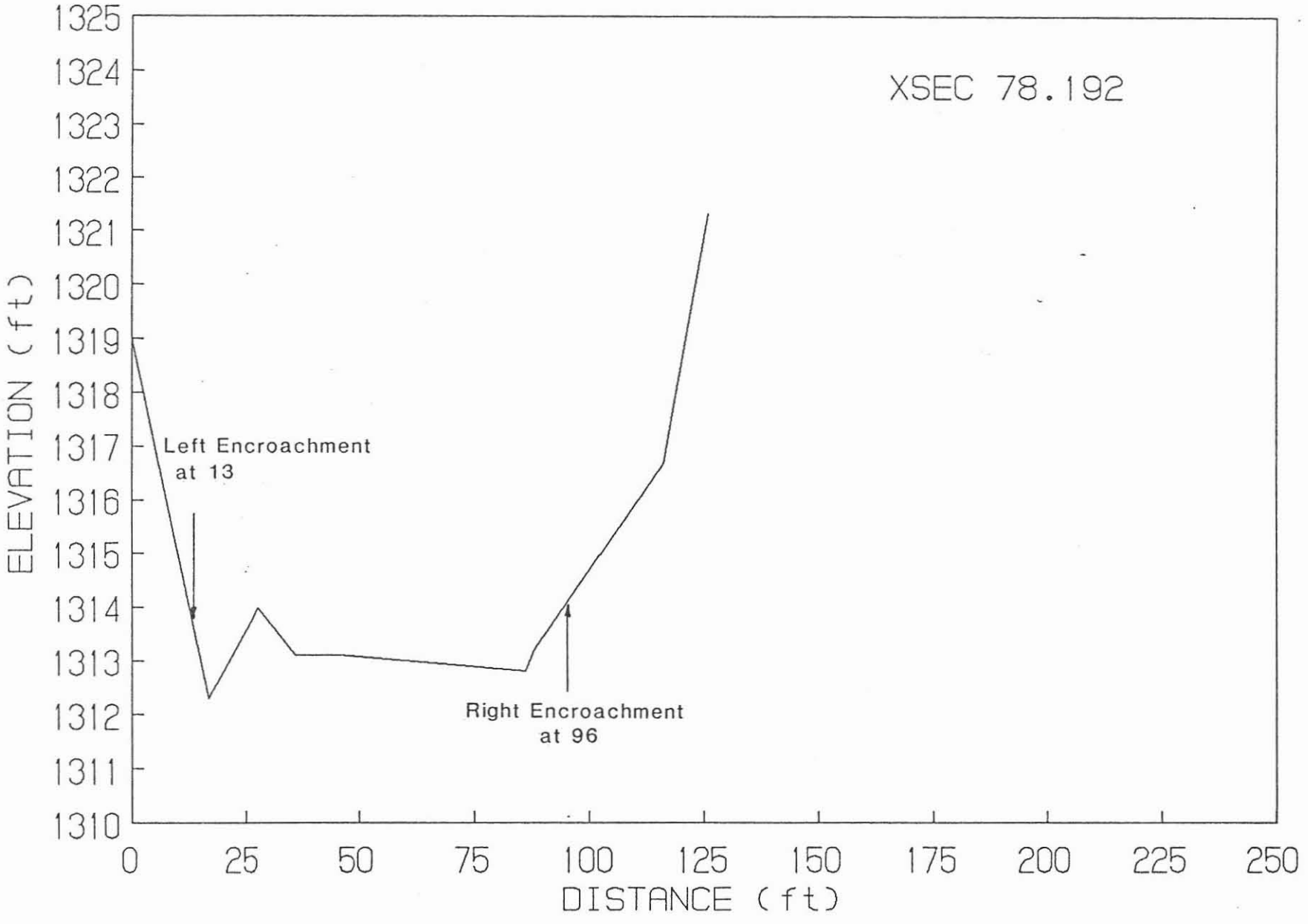
MOON VALLEY WASH

XSEC 76.772 & 78.002



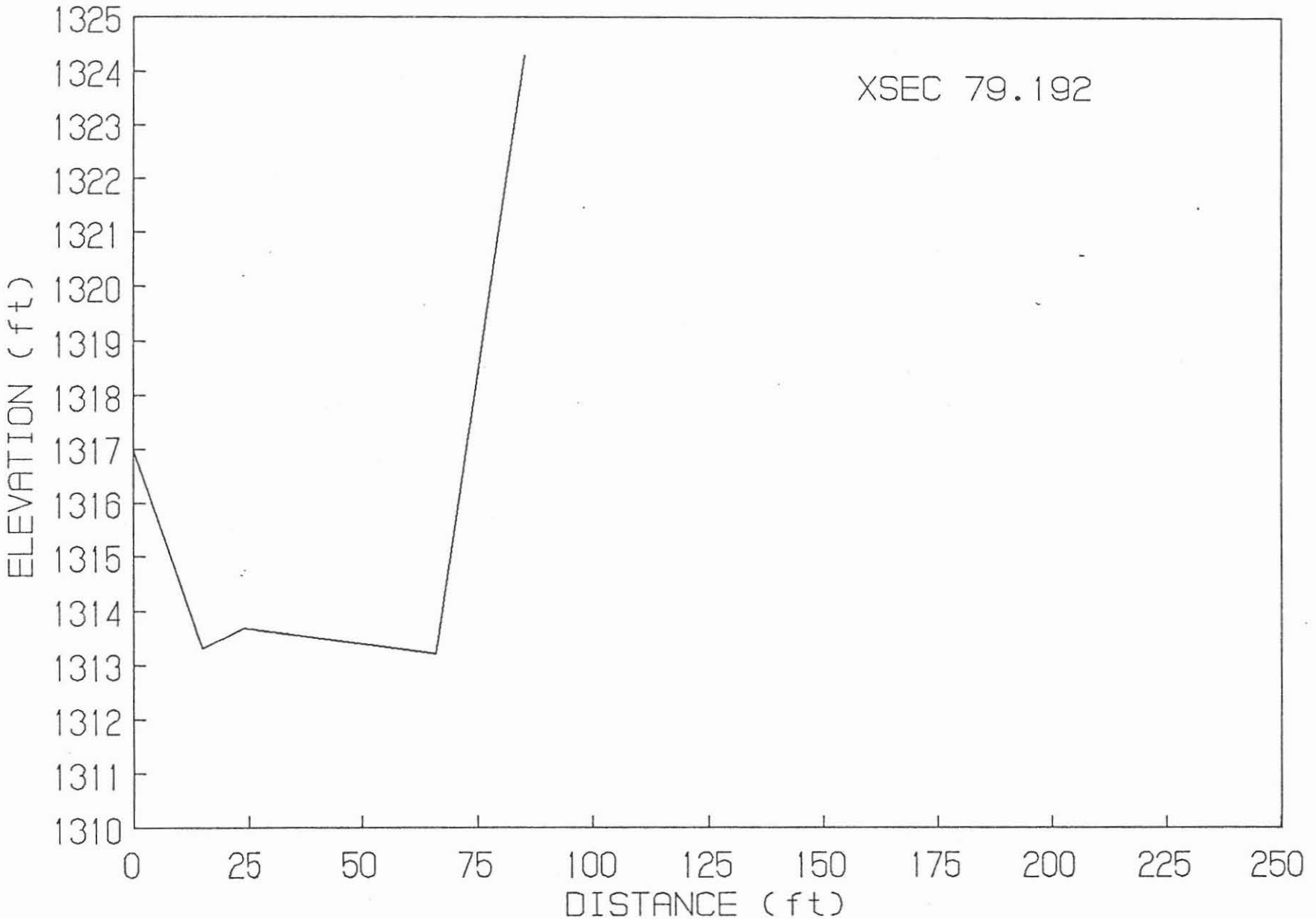
MOON VALLEY WASH

XSEC 78.192



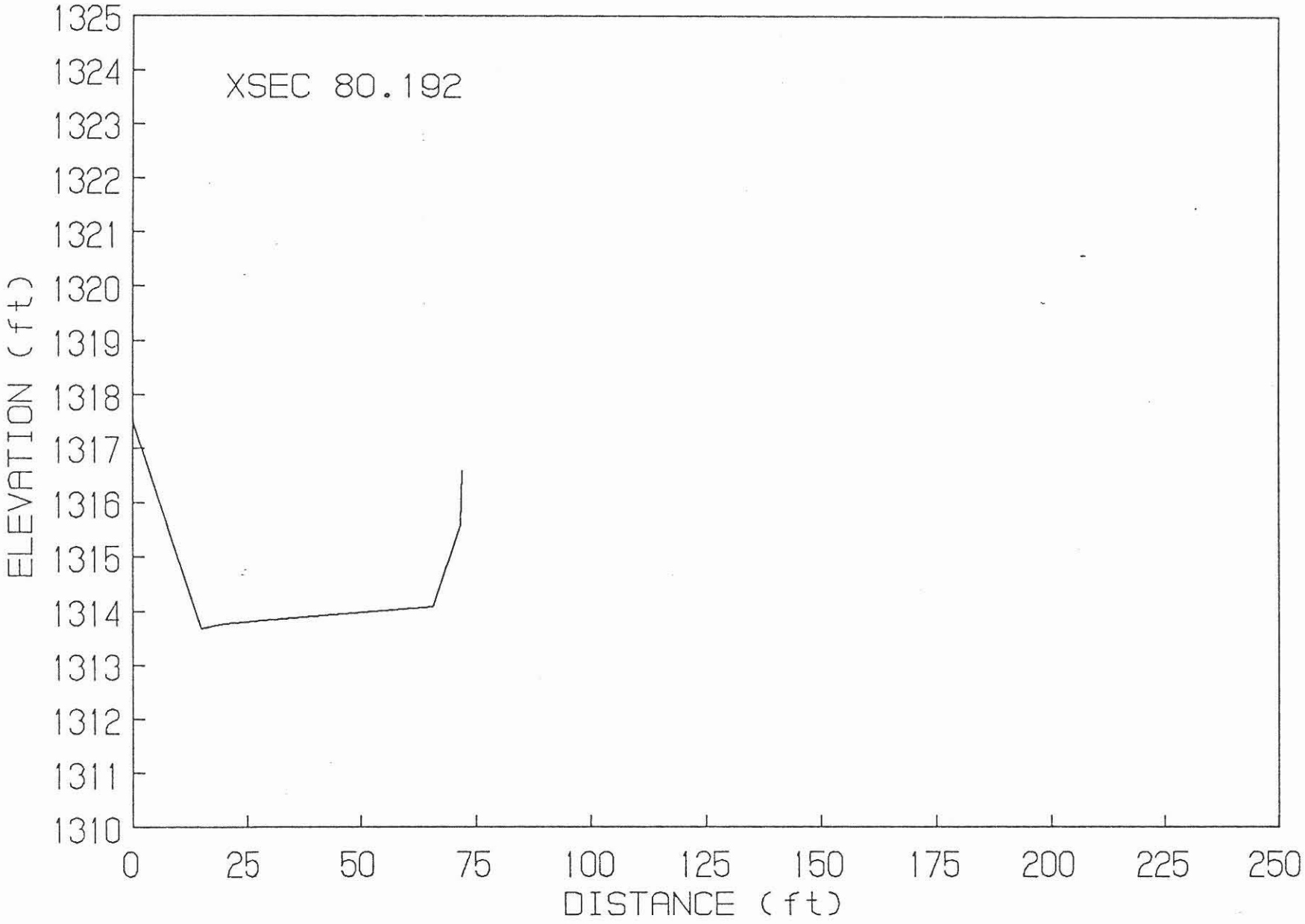
MOON VALLEY WASH

XSEC 79.192



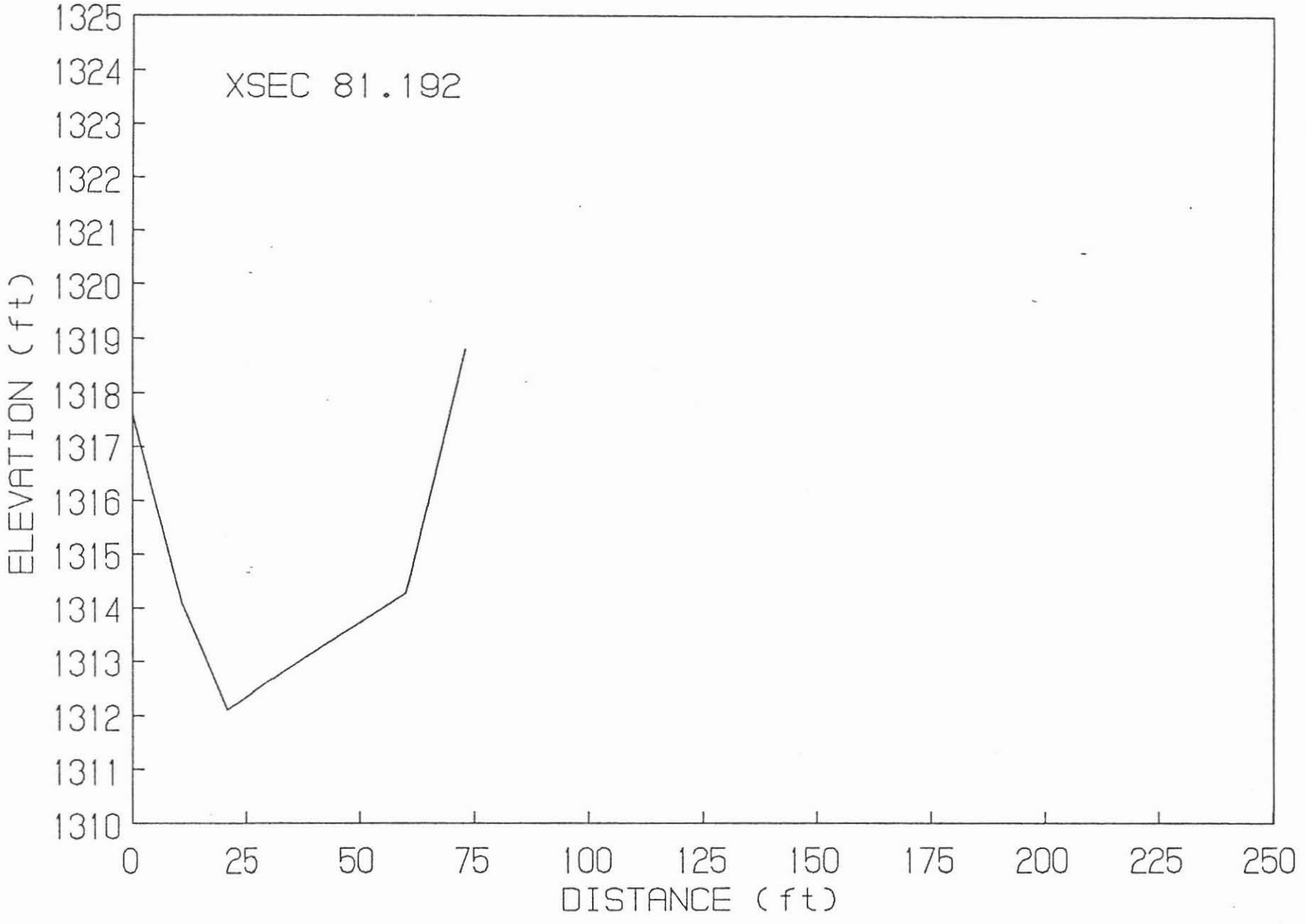
MOON VALLEY WASH

XSEC 80.192



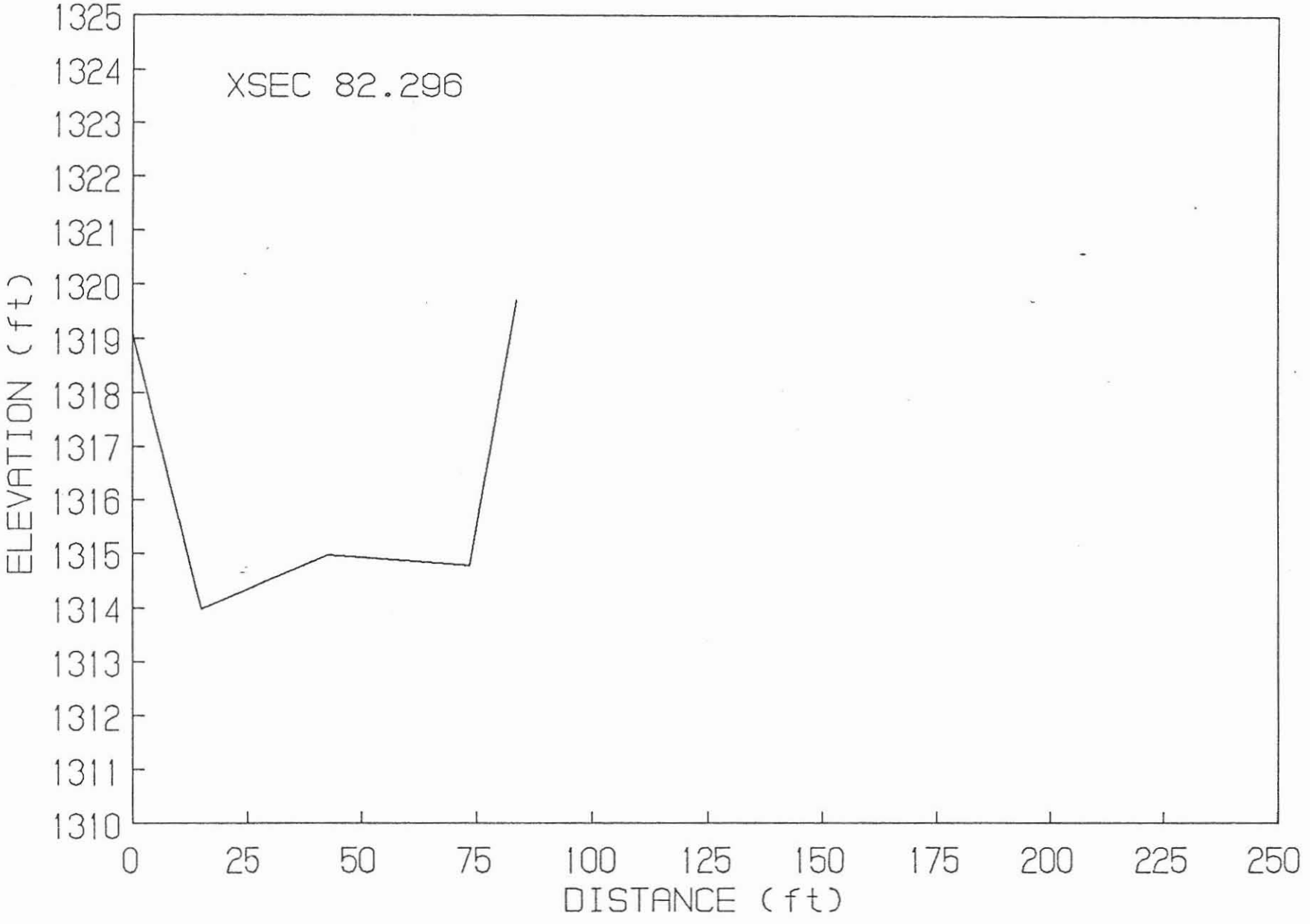
MOON VALLEY WASH

XSEC 81.192



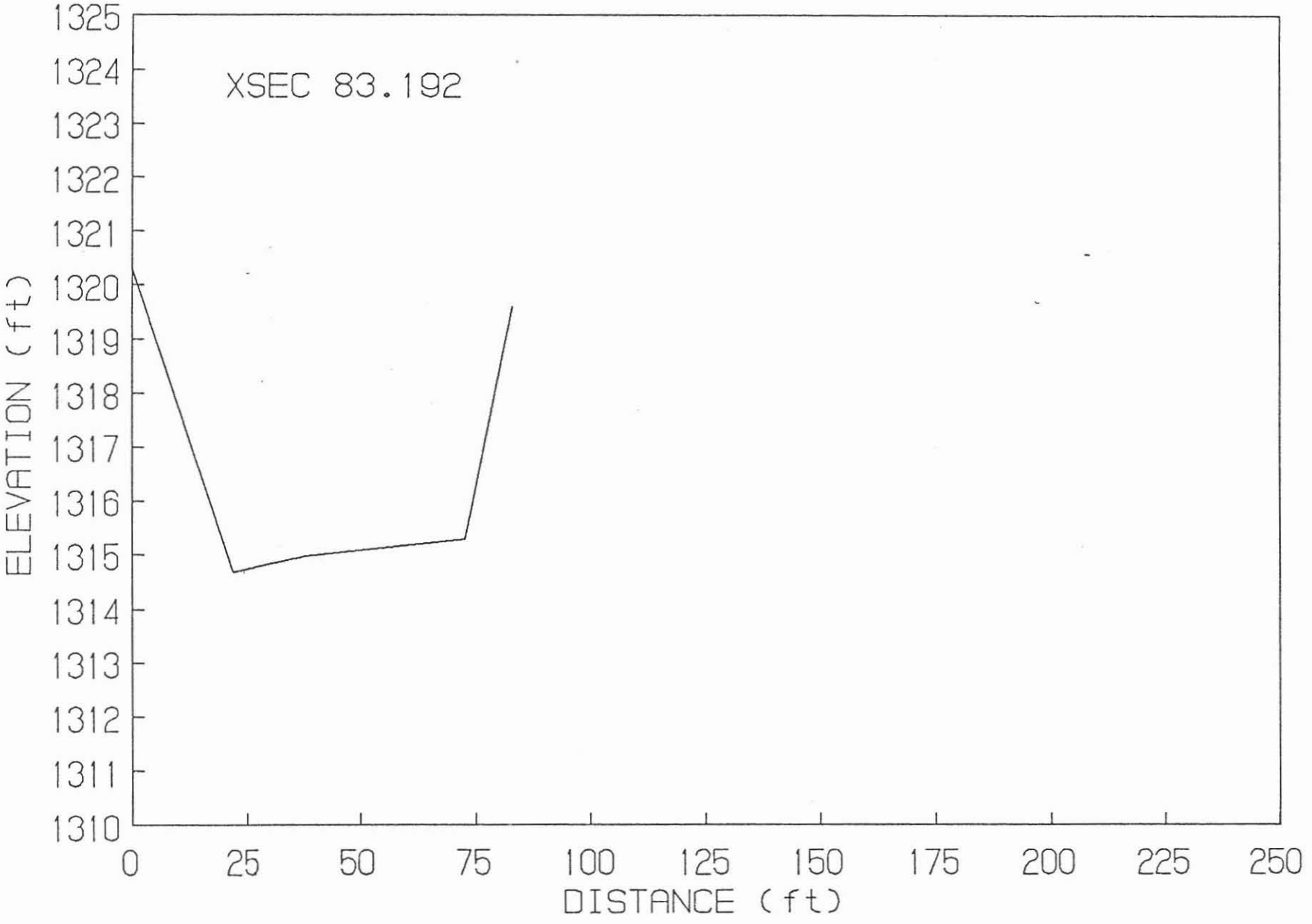
MOON VALLEY WASH

XSEC 82.296



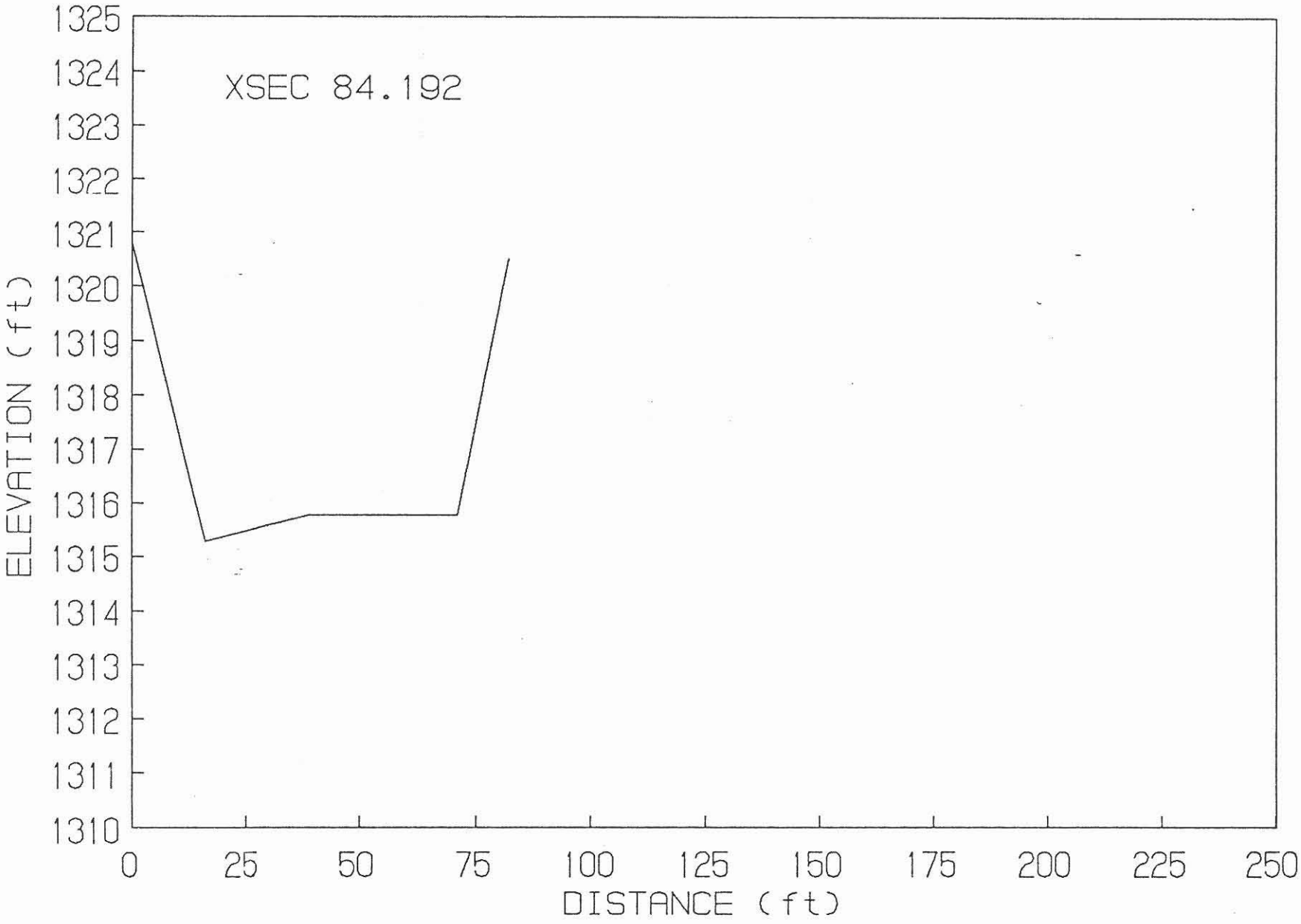
MOON VALLEY WASH

XSEC 83.192



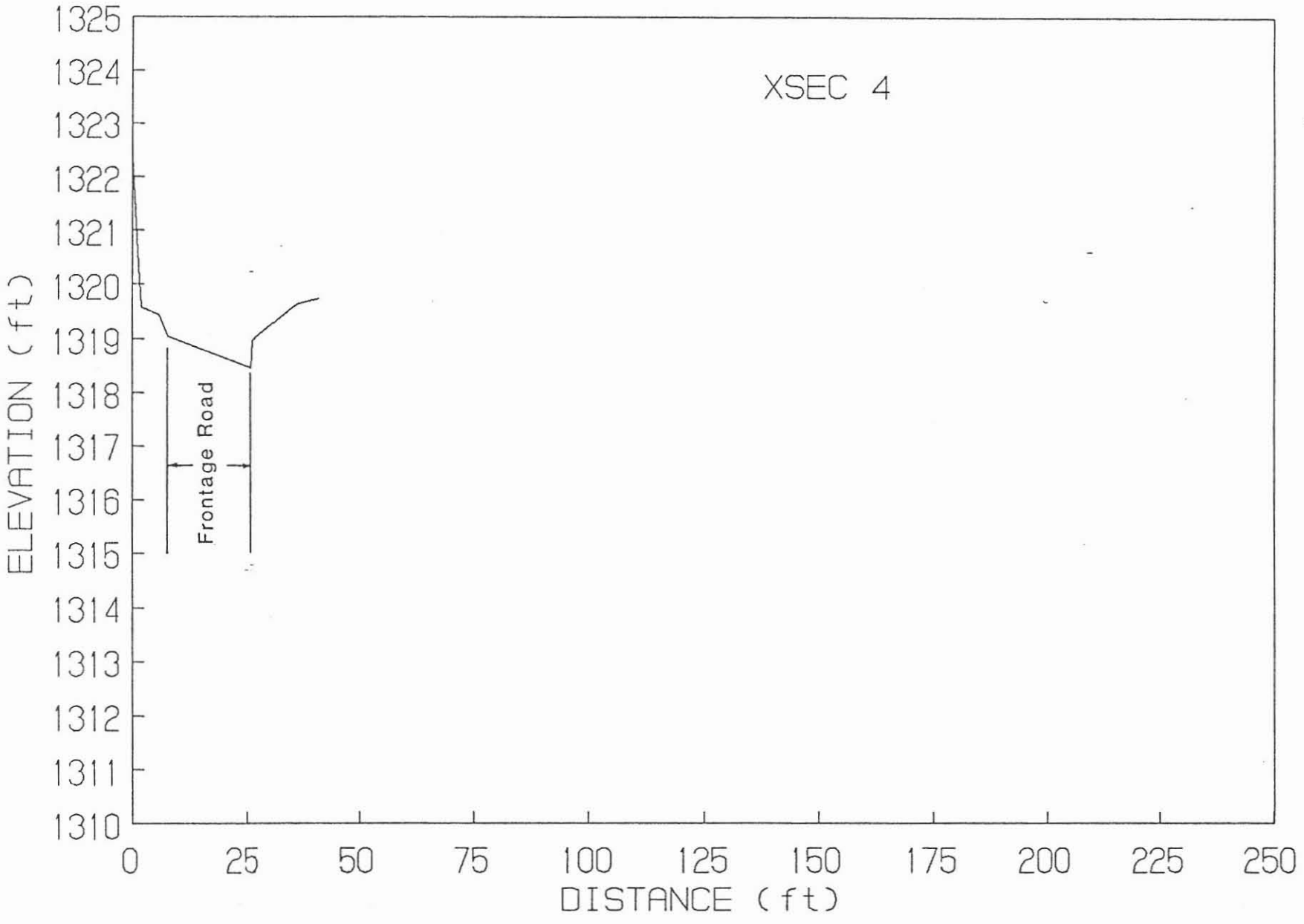
MOON VALLEY WASH

XSEC 84.192

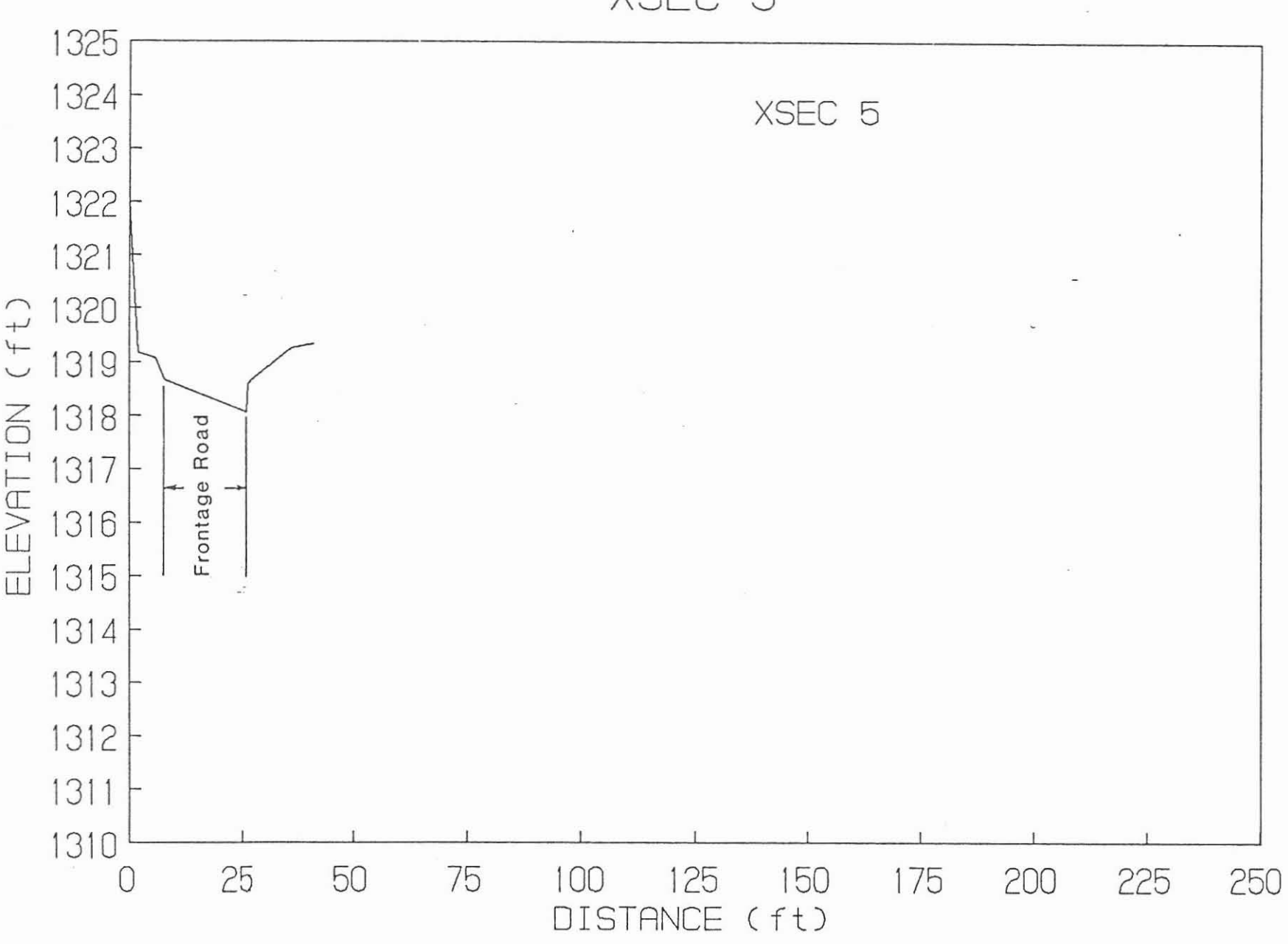


FRONTAGE ROAD CHANNEL

XSEC 4



FRONTAGE ROAD CHANNEL



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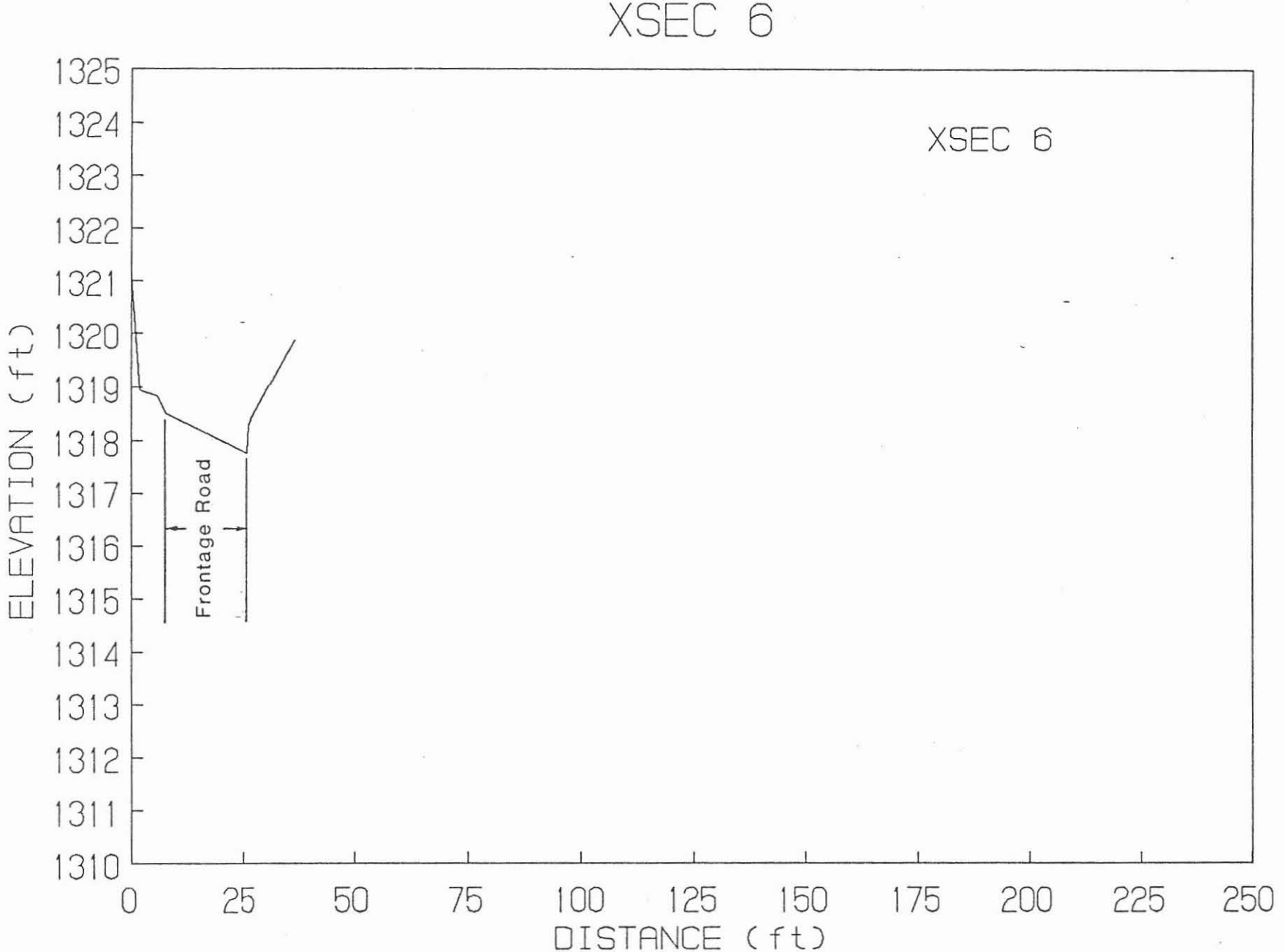
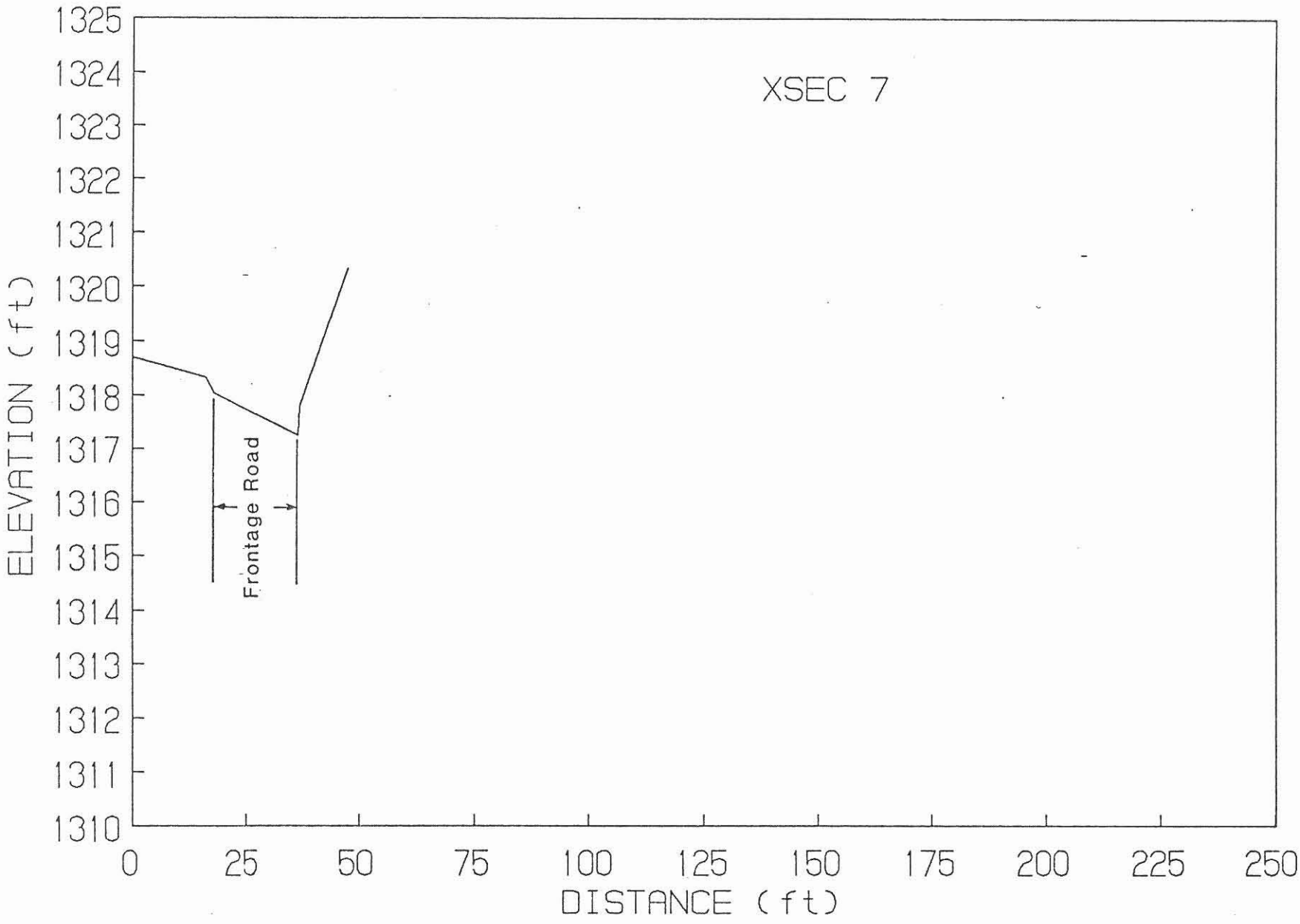
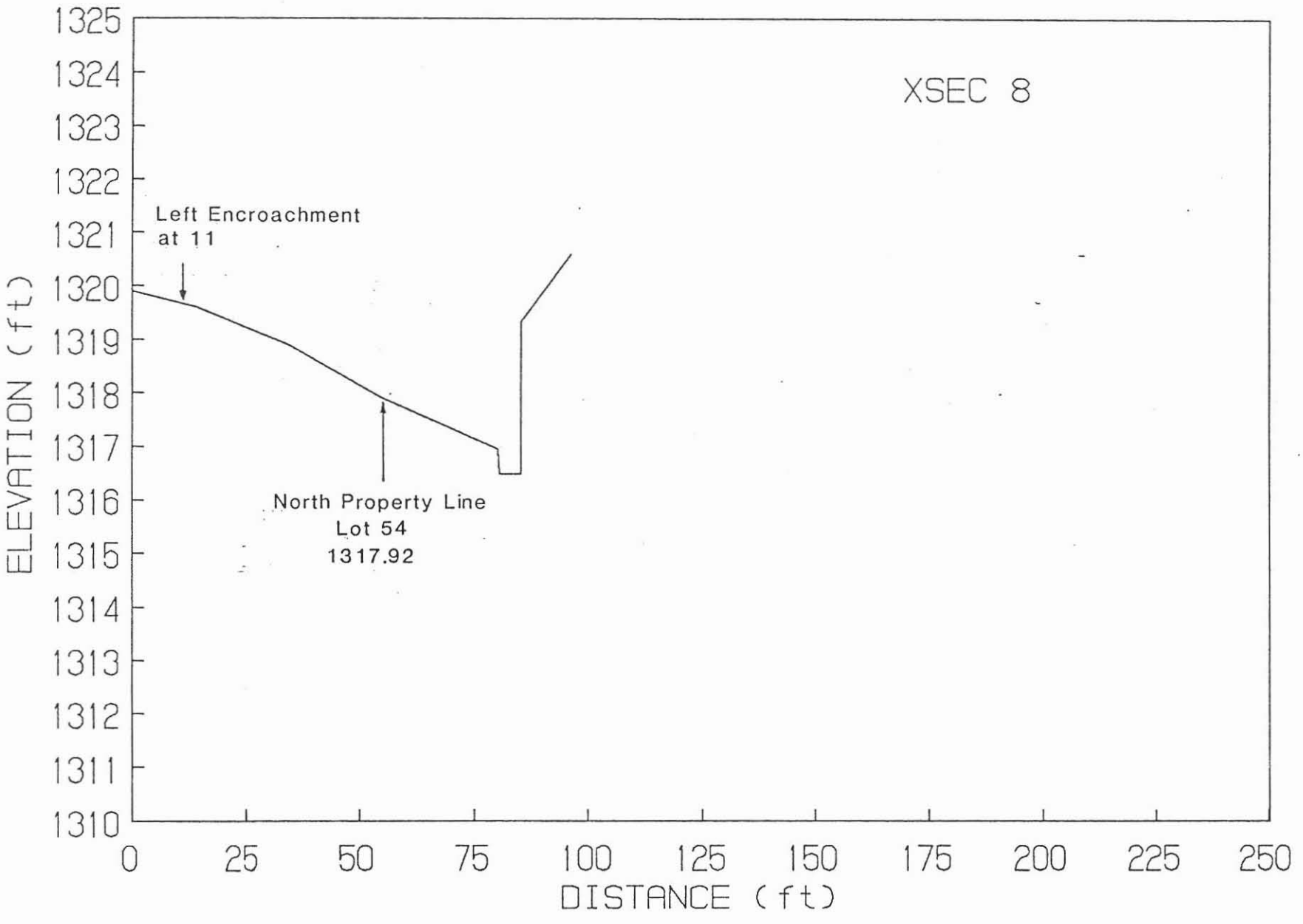


FRONTAGE ROAD CHANNEL

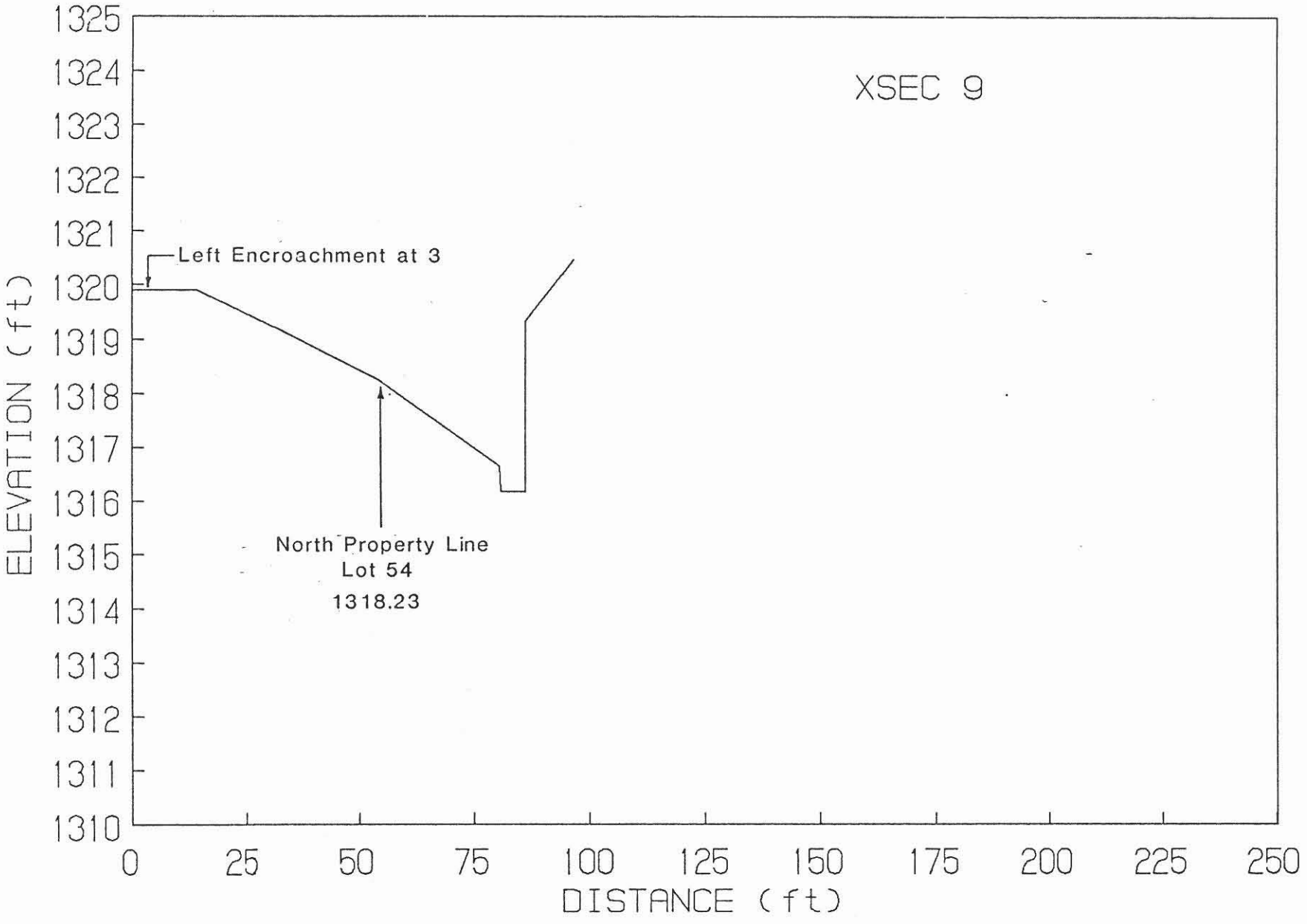


FRONTAGE ROAD CHANNEL

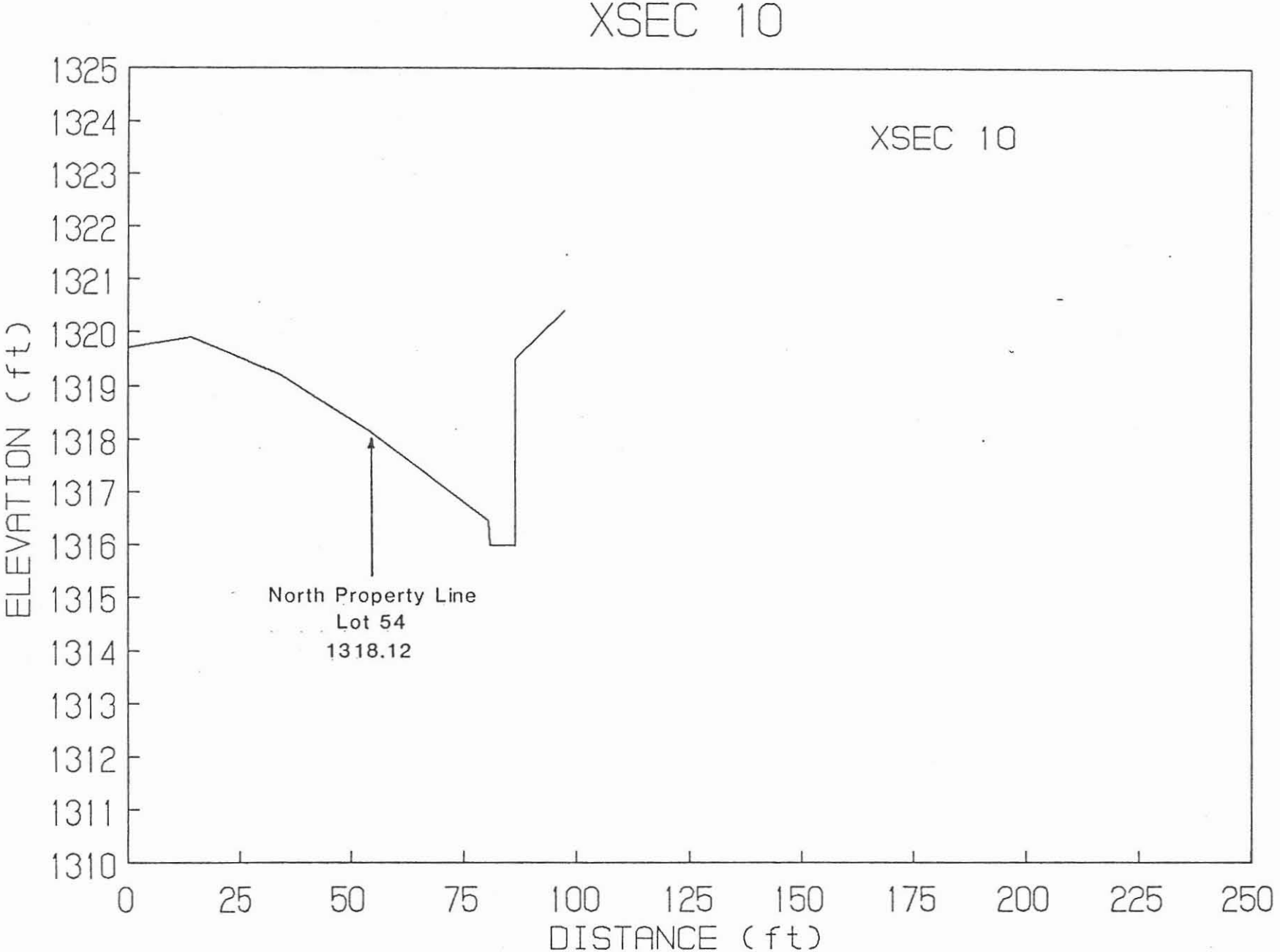


FRONTAGE ROAD CHANNEL

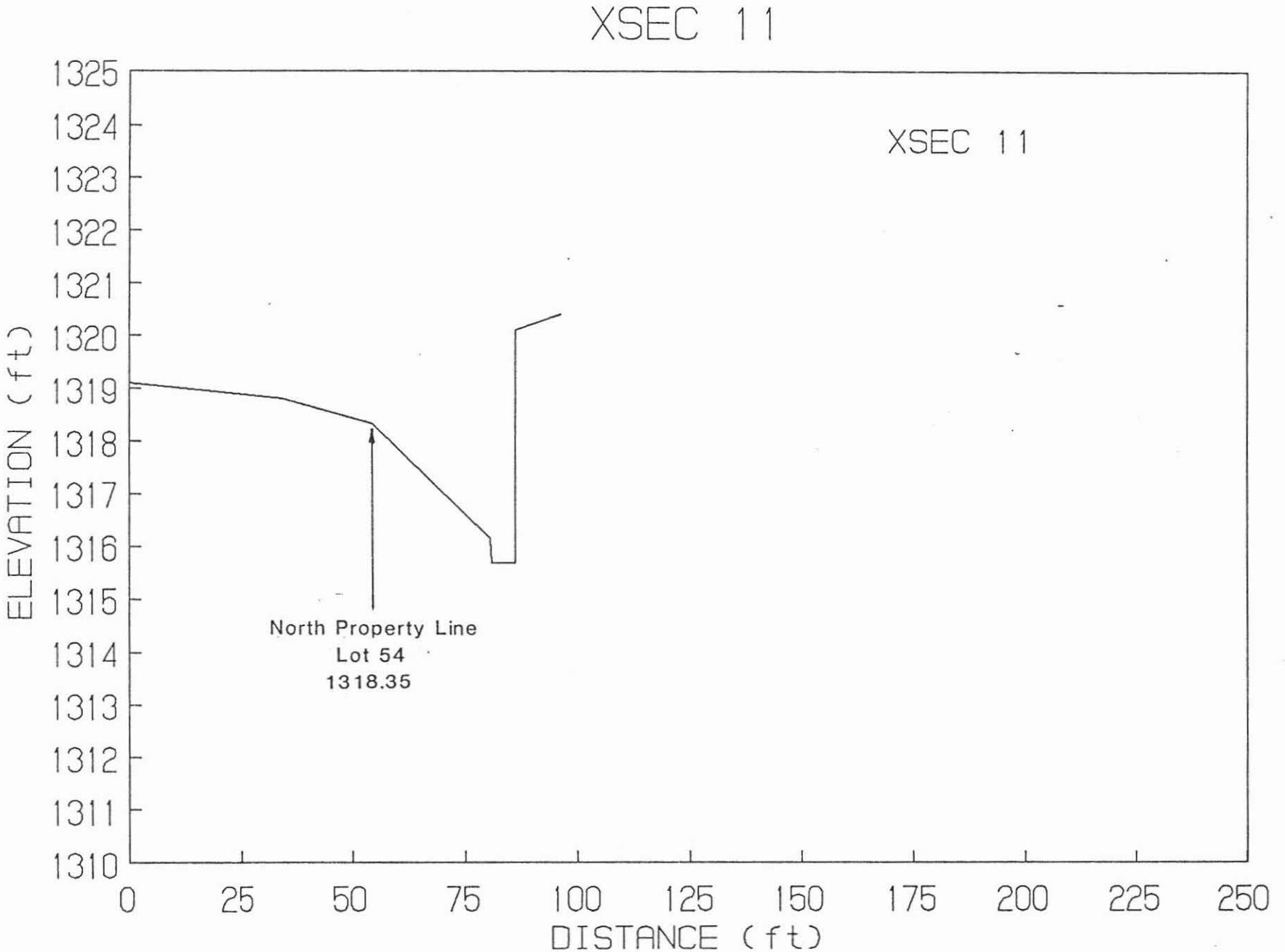
XSEC 9



FRONTAGE ROAD CHANNEL

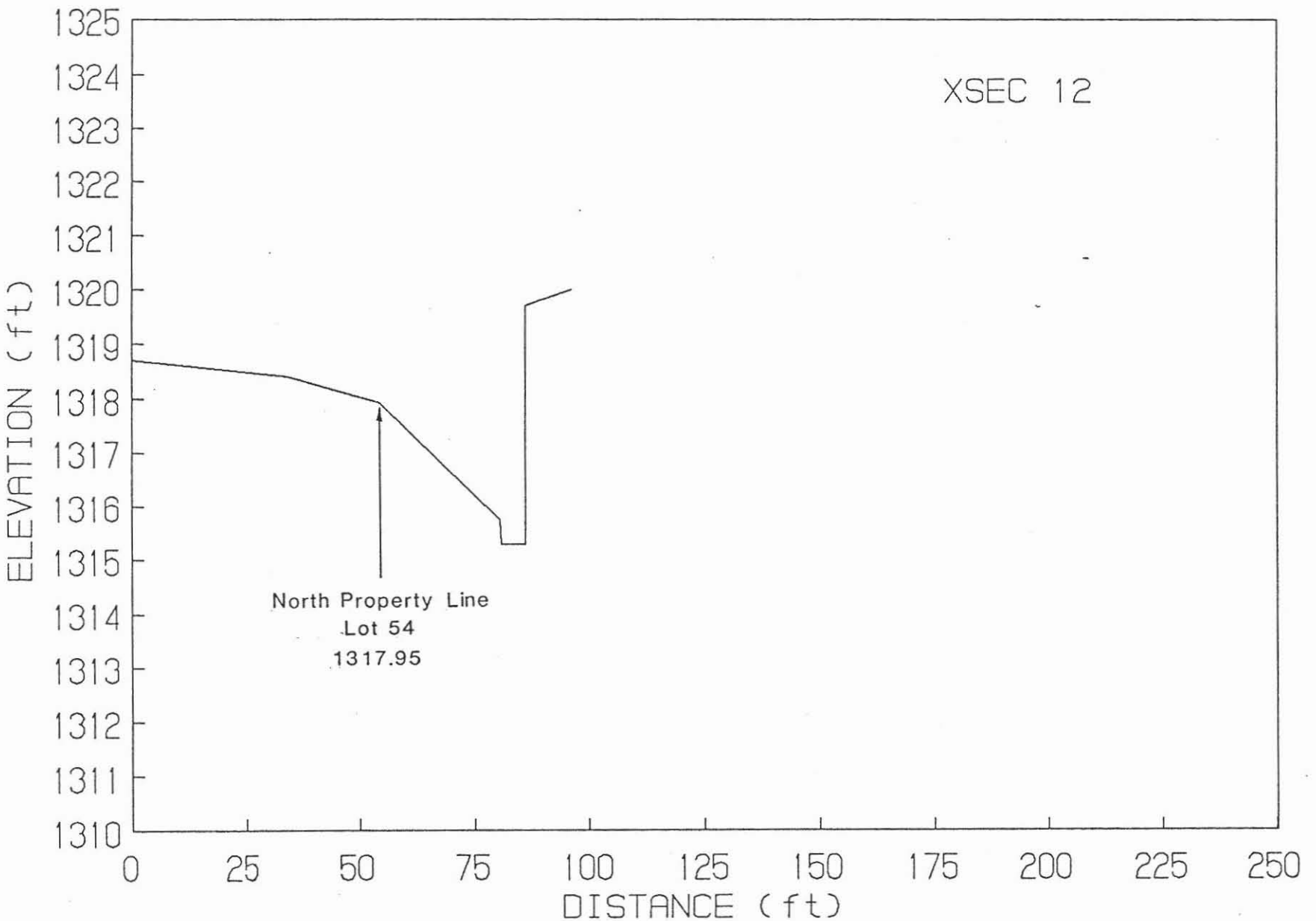


FRONTAGE ROAD CHANNEL



FRONTAGE ROAD CHANNEL

XSEC 12



APPENDIX B

HEC-2 Input/Output Data
Moon Valley Wash

```
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*  WATER SURFACE PROFILES                                *
*  VERSION OF NOVEMBER 1976                              *
*  UPDATED MAY 1984                                      *
*  IBM-PC-XT VERSION AUGUST 1985                         *
*  RUN DATE  10-05-87   TIME  09:51:23                   *
**********************************************************
```
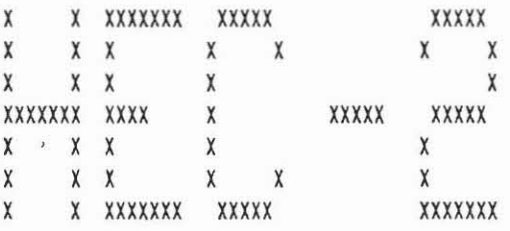


```
**************************************
*  U.S. ARMY CORPS OF ENGINEERS      *
*  THE HYDROLOGIC ENGINEERING CENTER *
*  609 SECOND STREET, SUITE D        *
*  DAVIS, CALIFORNIA 95616           *
*  (916) 440-2105 (FTS) 448-2105     *
**************************************
```

THIS RUN EXECUTED 10-05-87

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  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION AUGUST 1985
**************************************************

T1      FLOODPLAIN ANALYSIS FOR LOT 54, MOON VALLEY GARDENS VII
T2      RLW REVISIONS TO 1984 WRA MODEL, INCLUDES NEW BRIDGE MODEL & 'n' VALUES
T3      MOON VALLEY WASH        USING 1987 XSEC, LOOKING D/S  -  LONG BRIDGE

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

       0.        0.        0.        0.   .000000       .00        .0     2720.  1318.590      .000

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     -1.000      .000    -1.000      .000      .000      .000    -1.000      .000      .000      .000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38.000     1.000     2.000    43.000    14.000    26.000     8.000     4.000    53.000    54.000


     27.000    28.000      .000      .000      .000      .000      .000      .000      .000      .000


NC       .035      .035      .027      .100      .300      .000      .000      .000      .000      .000
X1     69.242     8.000    59.220   161.920      .000      .000      .000      .000      .000      .000
X3       .000      .000      .000    59.220      .000   180.000      .000      .000      .000      .000
GR  1315.100      .000  1315.750    14.490  1322.950    32.420  1323.260    59.220  1311.690    96.930
GR  1311.700   152.730  1317.780   161.920  1320.610   237.350      .000      .000      .000      .000

X1     71.242     9.000    90.390   161.920   200.000   200.000   200.000      .000      .000      .000
X3       .000      .000      .000    60.620      .000   180.000      .000      .000      .000      .000
GR  1319.200      .000  1319.700    21.510  1323.990    38.490  1324.430    60.620  1311.850    90.390
GR  1311.900   142.680  1318.600   152.730  1318.460   161.920  1319.510   237.350      .000      .000

X1     73.242    10.000    30.000   115.000   200.000   200.000   200.000      .000      .000      .000
GR  1319.700      .000  1317.900    14.000  1316.900    30.000  1312.200    47.000  1311.900    65.000
GR  1311.800    78.000  1314.500    90.000  1315.800   100.000  1319.000   115.000  1324.500   128.000

X1     74.242    11.000    45.000   142.000   100.000   100.000   100.000      .000      .000      .000
GR  1321.200      .000  1319.000    24.000  1317.500    36.000  1318.100    45.000  1313.000    59.000
GR  1311.600    85.000  1312.400   101.000  1313.900   110.000  1315.600   126.000  1318.300   142.000
GR  1323.700   149.000      .000      .000      .000      .000      .000      .000      .000      .000

X1     75.322     9.000      .000   131.000   108.000   108.000   108.000      .000      .000      .000
X3       .000      .000      .000      .000      .000      .000      .000      .000      .000      .000
GR  1320.100      .000  1318.900    17.000  1317.800    25.000  1313.400    34.000  1313.300    54.000
GR  1312.000    56.000  1313.100    59.000  1315.000    95.000  1323.000   131.000      .000      .000
```

NC	.035	.035	.027	.300	.500	.000	.000	.000	.000	.000
X1	75.822	9.000	.000	133.000	50.000	50.000	50.000	.000	.000	.000
X3	.000	.000	.000	36.000	.000	.000	.000	.000	.000	.000
GR	1319.500	.000	1318.900	13.000	1318.000	24.000	1313.300	36.000	1313.300	56.000
GR	1311.900	59.000	1313.100	61.000	1314.800	92.000	1323.100	133.000	.000	.000
X2	2220.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
NC	.035	.035	.023	.600	.800	.000	.000	.000	.000	.000
X1	76.772	4.000	.000	48.250	95.000	95.000	95.000	.000	.000	.000
GR	1318.900	.000	1312.360	.000	1312.360	48.250	1318.890	48.250	.000	.000
NC	.035	.035	.023	.300	.500	.000	.000	.000	.000	.000
SB	1.250	1.560	2.600	50.000	48.250	5.500	278.000	.000	1312.360	1312.360
X1	78.002	4.000	.000	48.250	123.000	123.000	123.000	.000	.000	.000
X2	.000	.000	1.000	1318.860	1321.150	.000	.000	.000	.000	.000
GR	1318.900	.000	1312.360	.000	1312.360	48.250	1318.860	48.250	.000	.000
NC	.035	.035	.027	.300	.500	.000	.000	.000	.000	.000
X1	78.192	9.000	.000	126.000	7.000	55.000	30.000	.000	.000	.000
X3	.000	.000	.000	13.000	.000	96.000	.000	.000	.000	.000
GR	1319.000	.000	1312.300	17.000	1314.000	28.000	1313.100	36.000	1313.100	46.000
GR	1312.800	86.000	1316.200	88.000	1316.700	116.000	1321.300	126.000	.000	.000
NC	.035	.035	.027	.100	.300	.000	.000	.000	.000	.000
X1	79.192	5.000	.000	85.000	100.000	100.000	100.000	.000	.000	.000
GR	1317.000	.000	1313.300	15.000	1313.700	24.000	1313.200	66.000	1324.300	85.000
X1	80.192	6.000	.000	72.000	100.000	100.000	100.000	.000	.000	.000
GR	1317.500	.000	1313.700	15.000	1313.800	20.000	1314.100	65.500	1315.600	71.500
GR	1316.600	72.000	.000	.000	.000	.000	.000	.000	.000	.000
X1	81.192	5.000	.000	73.000	100.000	100.000	100.000	.000	.000	.000
GR	1317.600	.000	1314.100	11.000	1314.100	21.000	1314.300	60.000	1318.800	73.000
X1	82.296	5.000	.000	83.500	110.400	110.400	110.400	.000	.000	.000
GR	1319.100	.000	1314.000	15.000	1315.000	43.000	1314.800	73.500	1319.700	83.500
X1	83.192	5.000	.000	83.000	89.600	89.600	89.600	.000	.000	.000
GR	1320.300	.000	1314.700	22.000	1315.000	38.000	1315.300	72.500	1319.600	83.000
X1	84.192	5.000	.000	82.000	100.000	100.000	100.000	.000	.000	.000
GR	1320.800	.000	1315.300	16.000	1315.800	39.000	1315.800	71.000	1320.500	82.000
EJ	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV= .100 CEHV= .300

*SECNO 69.242

3470 ENCROACHMENT STATIONS= 59.2 180.0 TYPE= 1 TARGET= 120.780

69.24	6.90	1318.59	1315.64	1318.59	1319.05	.46	.00	.00	1323.26
2720.	0.	2713.	7.	0.	498.	9.	0.	0.	1317.78
.00	.00	5.45	.81	.035	.027	.035	.000	1311.69	74.44
.001008	0.	0.	0.	0	10	0	.00	105.56	180.00

*SECNO 71.242

3470 ENCROACHMENT STATIONS= 60.6 180.0 TYPE= 1 TARGET= 119.380

71.24	6.88	1318.73	1316.06	.00	1319.33	.60	.24	.04	1311.85
2720.	194.	2525.	1.	56.	395.	3.	2.	0.	1318.46
.01	3.47	6.39	.44	.035	.027	.035	.000	1311.85	74.11
.001431	200.	200.	200.	2	14	0	.00	105.89	180.00

*SECNO 73.242

73.24	7.25	1319.05	1316.87	.00	1319.62	.58	.29	.00	1316.90
2720.	66.	2654.	0.	31.	430.	0.	4.	1.	1319.00
.02	2.08	6.17	.02	.035	.027	.035	.000	1311.80	5.08
.001475	200.	200.	200.	2	19	0	.00	110.03	115.11

*SECNO 74.242

74.24	7.76	1319.36	1316.58	.00	1319.76	.40	.12	.02	1318.10
2720.	43.	2676.	1.	28.	523.	1.	5.	1.	1318.30
.02	1.54	5.12	.73	.035	.027	.035	.000	1311.60	20.11
.000935	100.	100.	100.	2	19	0	.00	123.26	143.37

*SECNO 75.322

75.32	7.35	1319.35	1317.48	.00	1319.97	.62	.14	.07	1320.10
2720.	0.	2720.	0.	0.	430.	0.	7.	2.	1323.00
.03	.00	6.33	.00	.035	.027	.035	.000	1312.00	10.67
.002044	108.	108.	108.	2	19	0	.00	103.89	114.56

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

CCHV= .300 CEHV= .500
*SECNO 75.822

3470 ENCROACHMENT STATIONS= 36.0 133.0 TYPE= 1 TARGET= -36.000

75.82	7.46	1319.36	1317.70	.00	1320.18	.82	.11	.10100000.00	
2720.	0.	2720.	0.	0.	374.	0.	7.	2. 100000.00	
.03	.00	7.27	.00	.035	.027	.035	.000	1311.90	36.00
.002447	50.	50.	50.	2	15	0	.00	78.51	114.51

CCHV= .600 CEHV= .800
*SECNO 76.772
3280 CROSS SECTION 76.77 EXTENDED .99 FEET

76.77	7.52	1319.88	1316.38	.00	1320.46	.58	.14	.14	1318.90
2220.	0.	2220.	0.	0.	363.	0.	8.	2.	1318.89
.03	.00	6.12	.00	.035	.023	.035	.000	1312.36	.00
.000873	95.	95.	95.	2	11	0	.00	48.25	48.25

CCHV= .300 CEHV= .500

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.25	1.56	2.60	50.00	48.25	5.50	278.00	.00	1312.36	1312.36

*SECNO 78.002
3280 CROSS SECTION 78.00 EXTENDED 2.10 FEET

PRESSURE AND WEIR FLOW

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	TRAPEZOID AREA	ELLC	ELTRD
1321.42	1320.67	.24	17.	2206.	278.	278.	1318.86	1321.15

78.00	8.60	1320.96	.00	.00	1321.40	.44	.94	.00	1318.90
2220.	0.	2220.	0.	0.	415.	0.	9.	2.	1318.86
.04	.00	5.35	.00	.000	.023	.000	.000	1312.36	.00
.000584	123.	123.	123.	2	0	2	.00	48.25	48.25

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

CCHV= .300 CEHV= .500
*SECNO 78.192
3280 CROSS SECTION 78.19 EXTENDED .02 FEET

3470 ENCROACHMENT STATIONS= 13.0 96.0 TYPE= 1 TARGET= 83.000

78.19	9.02	1321.32	1316.10	.00	1321.50	.18	.01	.08100000.00	
2220.	0.	2220.	0.	0.	656.	0.	9.	2.	100000.00
.04	.00	3.38	.00	.035	.027	.035	.000	1312.30	13.00
.000299	7.	30.	55.	2	14	0	.00	83.00	96.00

CCHV= .100 CEHV= .300
*SECNO 79.192
3280 CROSS SECTION 79.19 EXTENDED 4.30 FEET

79.19	8.10	1321.30	1317.02	.00	1321.56	.25	.04	.02	1317.00
2220.	0.	2220.	0.	0.	548.	0.	11.	2.	1324.30
.05	.00	4.05	.00	.035	.027	.035	.000	1313.20	.00
.000463	100.	100.	100.	2	18	0	.00	79.87	79.87

*SECNO 80.192
3280 CROSS SECTION 80.19 EXTENDED 4.72 FEET

80.19	7.62	1321.32	1317.44	.00	1321.62	.31	.05	.02	1317.50
2220.	0.	2220.	0.	0.	500.	0.	12.	2.	1316.60
.06	.00	4.44	.00	.035	.027	.035	.000	1313.70	.00
.000582	100.	100.	100.	2	14	0	.00	72.00	72.00

*SECNO 81.192
3280 CROSS SECTION 81.19 EXTENDED 3.76 FEET

81.19	7.26	1321.36	1317.83	.00	1321.70	.34	.06	.01	1317.60
2220.	0.	2220.	0.	0.	475.	0.	13.	2.	1318.80
.06	.00	4.67	.00	.035	.027	.035	.000	1314.10	.00
.000677	100.	100.	100.	1	8	0	.00	73.00	73.00

*SECNO 82.296
3280 CROSS SECTION 82.30 EXTENDED 2.38 FEET

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
82.30	7.48	1321.48	1318.00	.00	1321.77	.29	.07	.00	1319.10
2220.	0.	2220.	0.	0.	512.	0.	14.	3.	1319.70
.07	.00	4.33	.00	.035	.027	.035	.000	1314.00	.00
.000607	110.	110.	110.	2	11	0	.00	83.50	83.50

*SECNO 83.192
3280 CROSS SECTION 83.19 EXTENDED 1.89 FEET

83.19	6.79	1321.49	1318.62	.00	1321.86	.37	.06	.02	1320.30
2220.	0.	2220.	0.	0.	455.	0.	15.	3.	1319.60
.07	.00	4.88	.00	.035	.027	.035	.000	1314.70	.00
.000873	90.	90.	90.	2	11	0	.00	83.00	83.00

*SECNO 84.192
3280 CROSS SECTION 84.19 EXTENDED 1.04 FEET

84.19	6.24	1321.54	1319.14	.00	1321.98	.45	.10	.02	1320.80
2220.	0.	2220.	0.	0.	414.	0.	16.	3.	1320.50
.08	.00	5.36	.00	.035	.027	.035	.000	1315.30	.00
.001159	100.	100.	100.	2	11	0	.00	82.00	82.00

THIS RUN EXECUTED 10-05-87

```
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION AUGUST 1985
**************************************************
```

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

MOON VALLEY WASH

SUMMARY PRINTOUT

SECNO	CWSEL	CRIWS	Q	QCH	VCH	DEPTH	TOPWID	SSTA	ENDST	STENCL	STENCR
69.242	1318.59	1315.64	2720.00	2713.09	5.45	6.90	105.56	74.44	180.00	59.22	180.00
71.242	1318.73	1316.06	2720.00	2524.78	6.39	6.88	105.89	74.11	180.00	60.62	180.00
73.242	1319.05	1316.87	2720.00	2654.44	6.17	7.25	110.03	5.08	115.11	.00	.00
74.242	1319.36	1316.58	2720.00	2676.45	5.12	7.76	123.26	20.11	143.37	.00	.00
75.322	1319.35	1317.48	2720.00	2720.00	6.33	7.35	103.89	10.67	114.56	.00	.00
75.822	1319.36	1317.70	2720.00	2720.00	7.27	7.46	78.51	36.00	114.51	36.00	133.00
76.772	1319.88	1316.38	2220.00	2220.00	6.12	7.52	48.25	.00	48.25	.00	.00
78.002	1320.96	.00	2220.00	2220.00	5.35	8.60	48.25	.00	48.25	.00	.00
78.192	1321.32	1316.10	2220.00	2220.00	3.38	9.02	83.00	13.00	96.00	13.00	96.00
79.192	1321.30	1317.02	2220.00	2220.00	4.05	8.10	79.87	.00	79.87	.00	.00
80.192	1321.32	1317.44	2220.00	2220.00	4.44	7.62	72.00	.00	72.00	.00	.00
81.192	1321.36	1317.83	2220.00	2220.00	4.67	7.26	73.00	.00	73.00	.00	.00
82.296	1321.48	1318.00	2220.00	2220.00	4.33	7.48	83.50	.00	83.50	.00	.00
83.192	1321.49	1318.62	2220.00	2220.00	4.88	6.79	83.00	.00	83.00	.00	.00
84.192	1321.54	1319.14	2220.00	2220.00	5.36	6.24	82.00	.00	82.00	.00	.00

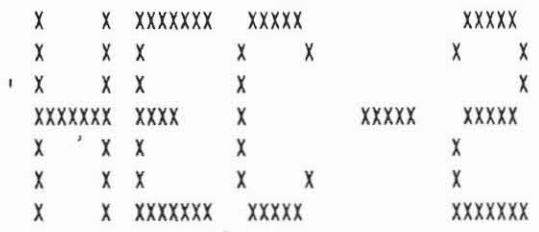
SUMMARY OF ERRORS AND SPECIAL NOTES

APPENDIX C

HEC-2 Input/Output Data
Frontage Road Channel

```
**********************************************************
*  WATER SURFACE PROFILES                                *
*  VERSION OF NOVEMBER 1976                              *
*  UPDATED MAY 1984                                      *
*  IBM-PC-XT VERSION AUGUST 1985                         *
*  RUN DATE  10-05-87   TIME  09:47:43                     *
**********************************************************
```


```
**************************************
*  U.S. ARMY CORPS OF ENGINEERS      *
*  THE HYDROLOGIC ENGINEERING CENTER *
*  609 SECOND STREET, SUITE D        *
*  DAVIS, CALIFORNIA 95616           *
  *  (916) 440-2105 (FTS) 448-2105
**************************************
```

THIS RUN EXECUTED 10-05-87

```
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION AUGUST 1985
**************************************************

T1      FLOODPLAIN ANALYSIS FOR LOT 54, MOON VALLEY GARDENS VII
T2      EAST/WEST PROFILE ALONG SOUTH SIDE OF THUNDERBIRD ROAD, 1987 CONDITIONS
T3      SOUTH FRONTAGE ROAD     DOWNSTREAM END TERMINATES AT MOON VALLEY WASH

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

       0.        0.        0.        0.   .000000       .00        .0      500.  1319.700      .000

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     -1.000      .000    -1.000      .000      .000      .000    -1.000      .000      .000      .000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38.000     1.000     2.000    43.000    14.000    26.000     8.000     4.000    53.000    54.000


     27.000    28.000      .000      .000      .000      .000      .000      .000      .000      .000


NC       .028      .035      .013      .600      .800      .000      .000      .000      .000      .000
X1     12.000     8.000    54.000    86.100      .000      .000      .000      .000      .000      .000
X3       .000      .000      .000      .000      .000      .000      .000      .000      .000      .000
GR    1318.700      .000  1318.400    34.000  1317.950    54.000  1315.750    80.500  1315.280    81.000
GR    1315.300    86.000  1319.700    86.100  1320.000    96.000      .000      .000      .000      .000

X1     11.000      .000      .000      .000    11.000    11.000    11.000      .000      .400      .000
X3       .000      .000      .000      .000      .000      .000      .000      .000      .000      .000

NC       .028      .035      .013      .100      .300      .000      .000      .000      .000      .000
X1     10.000     9.000    54.000    86.400    11.000    11.000    11.000      .000      .000      .000
X3       .000      .000      .000      .000      .000      .000      .000      .000      .000      .000
GR    1319.700      .000  1319.900    14.000  1319.200    34.000  1318.120    54.000  1316.470    80.500
GR    1316.000    81.000  1316.000    86.300  1319.500    86.400  1320.420    97.500      .000      .000

X1      9.000     9.000    54.000    86.100    25.000    25.000    25.000      .000      .000      .000
X3       .000      .000      .000     3.000      .000      .000      .000      .000      .000      .000
GR    1319.900      .000  1319.900    14.000  1319.100    34.000  1318.230    54.000  1316.670    80.500
GR    1316.200    81.000  1316.200    86.000  1319.350    86.100  1320.470    96.500      .000      .000

X1      8.000     9.000    54.000    85.300    25.000    25.000    25.000      .000      .000      .000
X3       .000      .000      .000    11.000      .000      .000      .000      .000      .000      .000
GR    1319.900      .000  1319.600    14.000  1318.900    34.000  1317.920    54.000  1316.970    80.000
GR    1316.500    80.500  1316.500    85.200  1319.340    85.300  1320.600    96.000      .000      .000
```

NC	.035	.035	.016	.100	.300	.000	.000	.000	.000	.000
X1	7.000	7.000	12.000	36.800	100.000	97.000	99.000	.000	.000	.000
X3	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
GR	1318.700	.000	1318.440	12.000	1318.330	16.000	1318.030	18.000	1317.250	36.500
GR	1317.800	36.800	1320.350	47.500	.000	.000	.000	.000	.000	.000
X1	6.000	7.000	2.000	26.500	50.000	50.000	50.000	.000	.000	.000
X3	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
GR	1321.100	.000	1318.930	2.000	1318.850	6.000	1318.500	8.000	1317.780	26.000
GR	1318.300	26.500	1319.890	36.500	.000	.000	.000	.000	.000	.000
X1	5.000	8.000	2.000	26.500	50.000	50.000	50.000	.000	.000	.000
X3	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
GR	1322.000	.000	1319.180	2.000	1319.060	6.000	1318.670	8.000	1318.080	26.000
GR	1318.600	26.500	1319.270	36.000	1319.350	41.000	.000	.000	.000	.000
X1	4.000	.000	.000	.000	47.000	47.000	47.000	.000	.380	.000
X3	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
EJ	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV= .600 CEHV= .800
*SECNO 12.000
3280 CROSS SECTION 12.00 EXTENDED 1.00 FEET

12.00	4.42	1319.70	1318.71	1319.70	1319.93	.23	.00	.00	1317.95
500.	82.	418.	0.	70.	100.	0.	0.	0.	1319.70
.00	1.18	4.18	.00	.028	.013	.035	.000	1315.28	.00
.000352	0.	0.	0.	0	14	0	.00	86.10	86.10

*SECNO 11.000
3280 CROSS SECTION 11.00 EXTENDED .58 FEET

11.00	4.00	1319.68	1319.11	.00	1320.04	.36	.01	.11	1318.35
500.	58.	442.	0.	47.	86.	0.	0.	0.	1320.10
.00	1.23	5.12	.00	.028	.013	.035	.000	1315.68	.00
.000631	11.	11.	11.	2	15	0	.00	86.09	86.09

CCHV= .100 CEHV= .300
*SECNO 10.000

10.00	3.60	1319.60	1319.02	.00	1320.09	.48	.01	.04	1318.12
500.	29.	471.	0.	21.	82.	0.	0.	0.	1319.50
.00	1.37	5.73	.01	.028	.013	.035	.000	1316.00	22.46
.000838	11.	11.	11.	2	15	0	.00	65.20	87.65

*SECNO 9.000

3470 ENCROACHMENT STATIONS= 3.0 96.5 TYPE= 1 TARGET= -3.000

9.00	3.36	1319.56	1319.25	.00	1320.14	.58	.02	.03	1318.23
500.	31.	469.	0.	21.	74.	0.	0.	0.	1319.35
.00	1.52	6.29	.32	.028	.013	.035	.000	1316.20	22.49
.001123	25.	25.	25.	2	15	0	.00	65.56	88.05

*SECNO 8.000

3470 ENCROACHMENT STATIONS= 11.0 96.0 TYPE= 1 TARGET= -11.000

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
8.00	3.20	1319.70	1319.28	.00	1320.17	.48	.03	.01	1317.92
500.	58.	442.	0.	35.	75.	1.	0.	0.	1319.34
.00	1.65	5.87	.41	.028	.013	.035	.000	1316.50	11.00
.000920	25.	25.	25.	2	15	0	.00	77.36	88.36

CCHV= .100 CEHV= .300
*SECNO 7.000
3280 CROSS SECTION 7.00 EXTENDED 1.23 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

7.00	2.68	1319.93	1319.93	.00	1320.86	.93	.15	.14	1318.44
500.	43.	435.	22.	16.	53.	9.	0.	0.	1317.80
.01	2.65	8.25	2.36	.035	.016	.035	.000	1317.25	.00
.002942	100.	99.	97.	0	15	0	.00	45.73	45.73

*SECNO 6.000
3280 CROSS SECTION 6.00 EXTENDED .63 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

6.00	2.74	1320.52	1320.52	.00	1321.55	1.03	.15	.03	1318.93
500.	2.	459.	39.	1.	54.	14.	0.	0.	1318.30
.01	1.52	8.45	2.76	.035	.016	.035	.000	1317.78	.54
.002911	50.	50.	50.	0	8	0	.00	35.97	36.50

*SECNO 5.000
3280 CROSS SECTION 5.00 EXTENDED 1.71 FEET

5.00	2.98	1321.06	1320.62	.00	1321.69	.63	.11	.04	1319.18
500.	1.	424.	75.	1.	62.	29.	1.	0.	1318.60
.01	1.13	6.86	2.58	.035	.016	.035	.000	1318.08	.67
.001610	50.	50.	50.	5	11	0	.00	40.33	41.00

*SECNO 4.000
3280 CROSS SECTION 4.00 EXTENDED 1.27 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
4.00	2.54	1321.00	1321.00	.00	1321.96	.97	.10	.10	1319.56
500.	1.	429.	70.	1.	51.	23.	1.	0.	1318.98
.01	1.32	8.42	3.09	.035	.016	.035	.000	1318.46	.98
.003140	47.	47.	47.	0	15	0	.00	40.02	41.00

THIS RUN EXECUTED 10-05-87

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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION AUGUST 1985
**************************************************
```

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SOUTH FRONTAGE ROAD

SUMMARY PRINTOUT

	SECNO	CWSEL	CRIWS	Q	QCH	VCH	DEPTH	TOPWID	SSTA	ENDST	STENCL	STENCR
	12.000	1319.70	1318.71	500.00	417.84	4.18	4.42	86.10	.00	86.10	.00	.00
	11.000	1319.68	1319.11	500.00	442.15	5.12	4.00	86.09	.00	86.09	.00	.00
	10.000	1319.60	1319.02	500.00	470.88	5.73	3.60	65.20	22.46	87.65	.00	.00
	9.000	1319.56	1319.25	500.00	468.59	6.29	3.36	65.56	22.49	88.05	3.00	96.50
	8.000	1319.70	1319.28	500.00	441.99	5.87	3.20	77.36	11.00	88.36	11.00	96.00
*	7.000	1319.93	1319.93	500.00	434.55	8.25	2.68	45.73	.00	45.73	.00	.00
*	6.000	1320.52	1320.52	500.00	458.88	8.45	2.74	35.97	.54	36.50	.00	.00
	5.000	1321.06	1320.62	500.00	424.05	6.86	2.98	40.33	.67	41.00	.00	.00
*	4.000	1321.00	1321.00	500.00	429.37	8.42	2.54	40.02	.98	41.00	.00	.00

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO= 7.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 7.000 PROFILE= 1 MINIMUM SPECIFIC ENERGY

CAUTION SECNO= 6.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 6.000 PROFILE= 1 MINIMUM SPECIFIC ENERGY

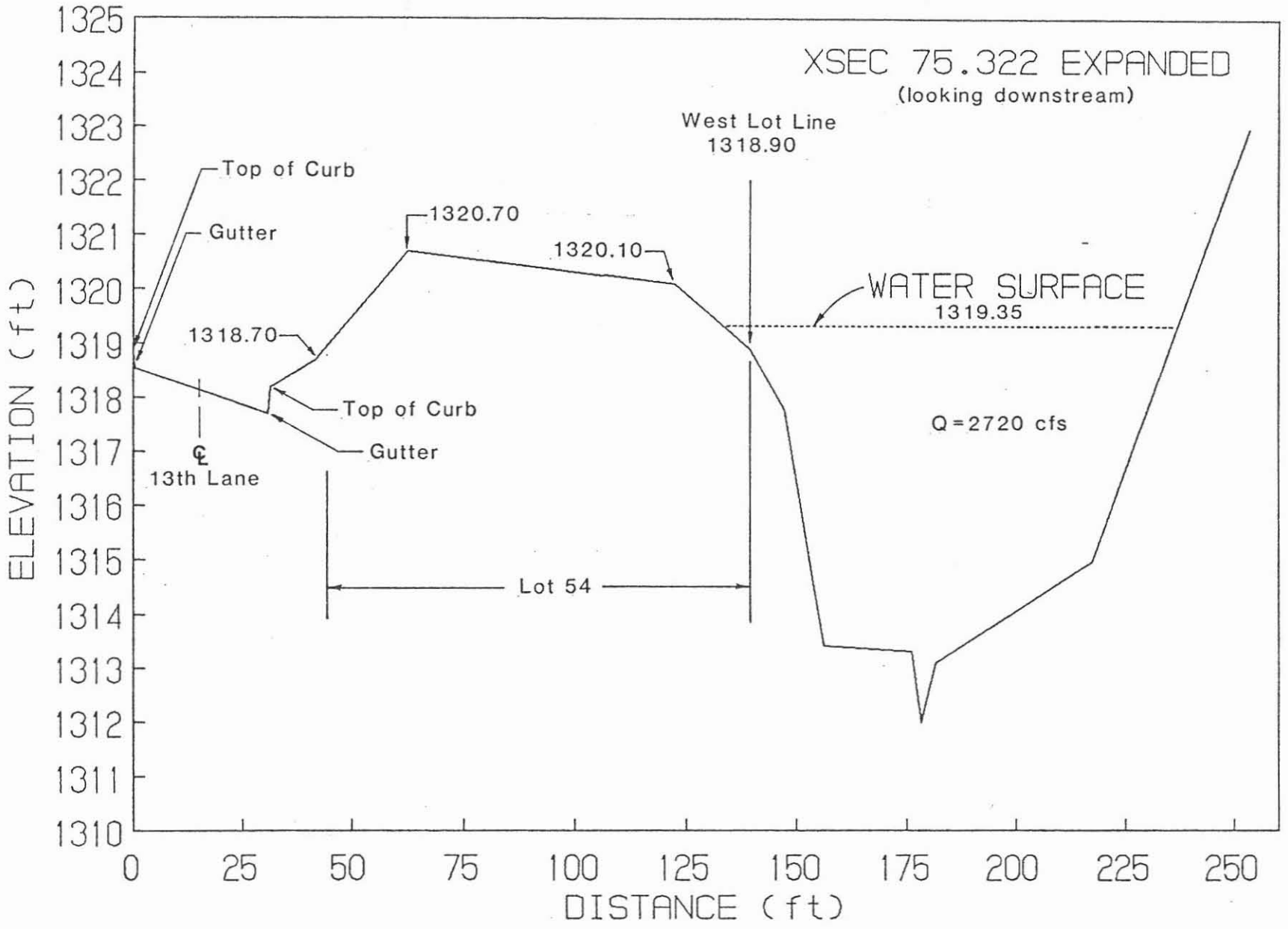
CAUTION SECNO= 4.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 4.000 PROFILE= 1 MINIMUM SPECIFIC ENERGY

APPENDIX D

Expanded Cross-Section Plots
Lot 54

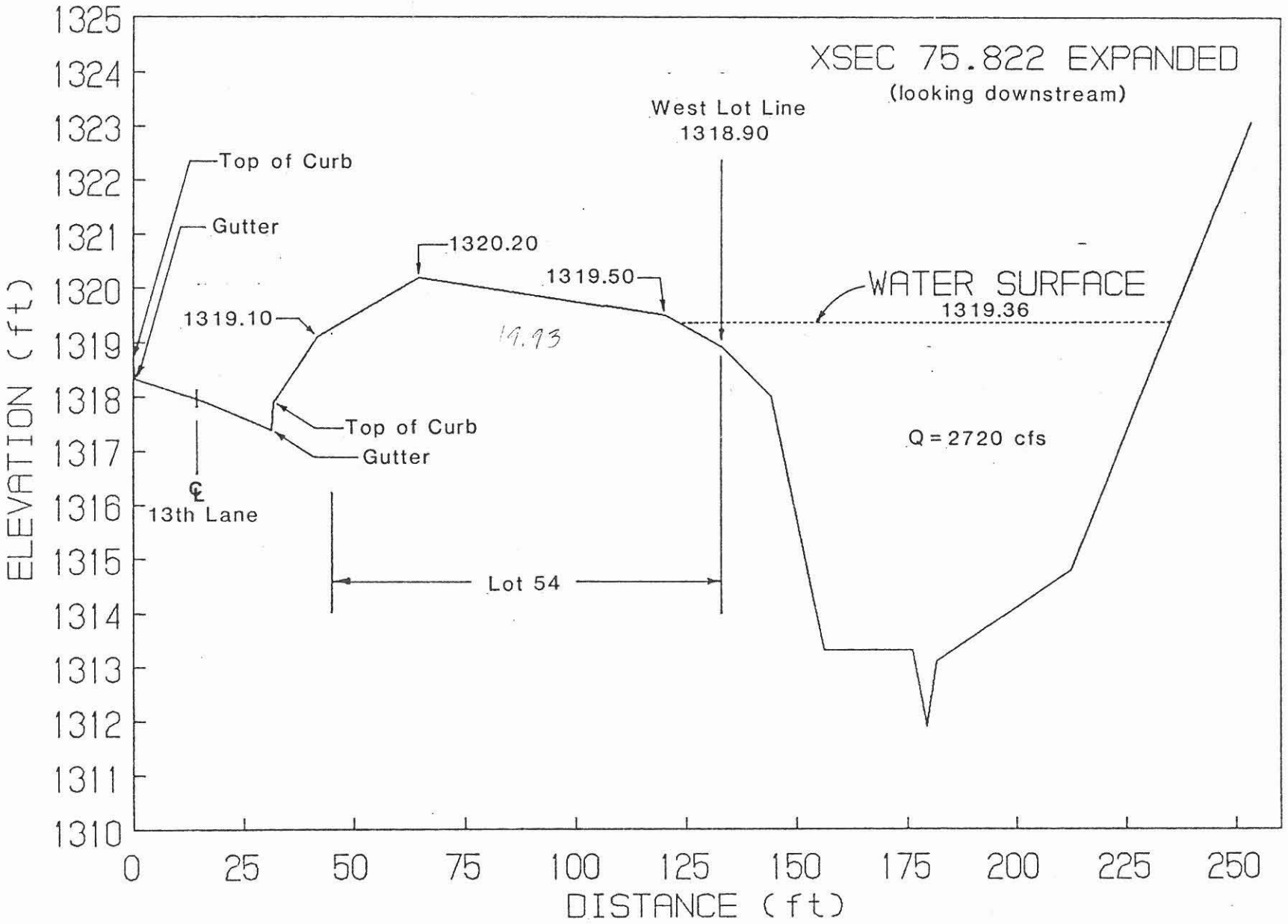
MOON VALLEY WASH / LOT 54

EXPANDED XSEC FOR LOT 54



MOON VALLEY WASH / LOT 54

EXPANDED XSEC FOR LOT 54



CULVERT ANALYSIS 1.1 — 10th PLACE — DATE: 10-24-89
CULVERT FILE NAME: MOON.3 — SUMMARY TABLE

CU	A - SITE DATA			B - CULVERT SHAPE, MATERIAL, INLET				
NO.	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	82.40	81.80	66	2 -CSP	66	66	0.024	CONVENTIONAL
2								
3								
4								
5								
6								

TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

TAILWATER RATING CURVE

NO	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	83.33	0.00	0.00
2	20.00	83.33	0.00	0.00
3	40.00	83.33	0.00	0.00
4	60.00	83.33	0.00	0.00
5	80.00	83.33	0.00	0.00
6	100.00	83.33	0.00	0.00
7	120.00	83.33	0.00	0.00
8	140.00	83.33	0.00	0.00
9	160.00	83.33	0.00	0.00
10	180.00	83.33	0.00	0.00
11	200.00	83.33	0.00	0.00

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	83.33	83.33	0.00	0.93	1.53	0.00
20.00	83.66	83.33	1.13	1.26	1.53	1.84
40.00	84.20	83.33	1.63	1.80	1.53	3.69
60.00	84.64	83.33	2.02	2.24	1.53	5.53
80.00	85.01	83.33	2.35	2.61	1.71	6.35
100.00	85.35	83.33	2.65	2.95	1.91	6.81
120.00	85.66	83.33	2.93	3.26	2.11	7.15
140.00	85.95	83.33	3.21	3.55	2.28	7.50
160.00	86.21	83.33	3.47	3.81	2.44	7.86
180.00	86.48	83.33	3.72	4.08	2.59	8.16
200.00	86.73	83.33	3.97	4.33	2.75	8.42

114 85.57

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

CULVERT ANALYSIS 1.1 — 7th STREET AT HEARN — DATE: 10-18-89
CULVERT FILE NAME: MOON.1 — SUMMARY TABLE

CULVERT NO.	A - SITE DATA			B - CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	62.00	59.00	100	5 -CSPA	50	31	0.028	CONVENTIONAL
2								
3								
4								
5								
6								

TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	500.00	62.08	12.40	1.92
2	600.00	62.42	13.07	2.13
3	700.00	62.73	13.66	2.33
4	800.00	63.02	14.18	2.51
5	900.00	63.29	14.66	2.68
6	1000.00	63.55	15.10	2.84
7	1100.00	63.80	15.50	2.99
8	1200.00	64.03	15.87	3.14
9	1300.00	64.25	16.22	3.28
10	1400.00	64.47	16.55	3.41
11	1500.00	64.68	16.86	3.54

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 10-18-89
CULVERT FILE: MOON.1

ENTER TAILWATER CHANNEL DATA

NO.	ITEM	VALUE
1	BOTTOM WIDTH (FT)	10
2	SIDE SLOPE H/V __:1	1
3	CHANNEL SLOPE V/H (FT/FT)	.01
4	MANNING'S N (.01-0.1)	.02
5	CHANNEL INVERT ELEVATION (FT)	59

CULVERT #1 OUTLET INVERT ELEVATION AT 59 FT

TYPE ITEM NO. TO EDIT ITEM
(RET) TO CONTINUE DATA INPUT

CULVERT ANALYSIS 1.1 DATE:
CULVERT FILE: OVERTOPPING DATA INPUT

SELECTED OVERTOPPING CREST

(1) SHAPE : IRREGULAR: 3 COORDINATE POINTS

(2) CROSS-SECTION DATA

(3) ROADWAY SURFACE: P

OR WEIR COEFFICIENT: 0

(4) EMBANKMENT TOP WIDTH (FT): 140

TYPE NO. TO EDIT ITEM:
(RET) TO CONTINUE
(ESC) FOR LAST MENU

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0	65.2
2	350	64.8
3	650	66

TYPE COORD. NO. TO EDIT COORD.
(I) OR (D) TO INSERT OR DELETE
(RET) TO CONTINUE LISTING *
(V) TO VIEW CROSS-SECTION

SUMMARY OF CULVERT FLOWS (CFS) file: MOON.1 date:10-18-09

ELEV (FT)	TOTAL	1	2	3	4	5	6	OVERTOP	ITER
65.32	500	276	0	0	0	0	0	229	4
65.40	600	269	0	0	0	0	0	321	3
65.49	700	259	0	0	0	0	0	434	3
65.56	800	249	0	0	0	0	0	547	3
65.63	900	238	0	0	0	0	0	650	2
65.69	1000	228	0	0	0	0	0	763	2
65.75	1100	218	0	0	0	0	0	875	2
65.81	1200	208	0	0	0	0	0	987	2
65.86	1300	198	0	0	0	0	0	1098	2
65.91	1400	187	0	0	0	0	0	1210	2
65.95	1500	176	0	0	0	0	0	1321	2

PRESS:
(1) TO PLOT TOTAL RATING CURVE
(2) TO DETERMINE SPECIFIC INFORMATION ABOUT EACH CULVERT
(3) TO SEE MULTIPLE CULVERT COMPUTATIONAL ERROR TABLE
(ENTER) TO RETURN FOR NEW RUN OR EXIT

CULVERT ANALYSIS 1.1 DATE:
CULVERT FILE: OVERTOPPING DATA INPUT

SELECTED OVERTOPPING CREST FOR FLOODWAY

(1) SHAPE : CONSTANT ROADWAY ELEVATION 65 FT

(2) CROSS-SECTION DATA

(3) ROADWAY SURFACE: P

OR WEIR COEFFICIENT: 0

(4) EMBANKMENT TOP WIDTH (FT): 140

TYPE NO. TO EDIT ITEM:
(RET) TO CONTINUE
(ESC) FOR LAST MENU

CULVERT ANALYSIS 1.1 DATE:
CULVERT FILE: OVERTOPPING DATA INPUT

ENTER PROFILE DATA

NO.	ITEM	VALUE
1	CREST LENGTH (FT)	200
2	OVERTOPPING CREST ELEVATION (FT)	65

TYPE ITEM NO. TO EDIT ITEM
(RET) TO CONTINUE DATA INPUT

SUMMARY OF CULVERT FLOWS (CFS) file: MOON.2 date:10-18-89

ELEV (FT)	TOTAL	1	2	3	4	5	6	OVERTOP	ITER
65.54	500	290	0	0	0	0	0	217	4
65.69	600	282	0	0	0	0	0	313	4
65.83	700	274	0	0	0	0	0	417	3
65.96	800	267	0	0	0	0	0	528	3
66.08	900	260	0	0	0	0	0	637	3
66.19	1000	254	0	0	0	0	0	744	3
66.30	1100	247	0	0	0	0	0	852	3
66.40	1200	240	0	0	0	0	0	959	3
66.50	1300	234	0	0	0	0	0	1066	3
66.59	1400	227	0	0	0	0	0	1170	2
66.68	1500	221	0	0	0	0	0	1276	2

PRESS:
(1) TO PLOT TOTAL RATING CURVE
(2) TO DETERMINE SPECIFIC INFORMATION ABOUT EACH CULVERT
(3) TO SEE MULTIPLE CULVERT COMPUTATIONAL ERROR TABLE
(ENTER) TO RETURN FOR NEW RUN OR EXIT

N1/4 COR. SEC. 17
(FOUND IRON PIPE)
279
PIPE ELEV. 1345.32
(FLUSH)

NE COR. SEC. 17
(FOUND MA CO. B.C. IN H.H.)
274
B.C. 136.265
(GR. ELEV. 1369.09)

E 453,000

DRAINAGE DITCH

SOUTH BRANCH

THUNDERBIRD ROAD

N 949,000

N 948,000

E 454,000

CEN. SEC. 17
(FOUND IRON PIPE)
279
PIPE ELEV. 1364.76
(GR. ELEV. 1365.24)

E 1/4 COR. SEC. 17
(FOUND REBAR)
278
PIN ELEV. 1397.37
(GR. ELEV. 1397.55)

LEGEND

- 100-YR WATER SURFACE
- FLOODWAY
- STREAM CENTERLINE
- 1364 BASE FLOOD ELEVATION

NOTE:
BENCH MARKS ARE SUITABLE FOR EVALUATING TOPOGRAPHIC INFORMATION ONLY.
CALL SURVEY SECTION AT 257-9599 FOR CURRENT BENCH MARK DATA.

NOTE CORNERS NOT CERTIFIED

CITY OF PHOENIX

32-28

SCALE 1" = 100'

CONTOUR INTERVAL 2'

DATE FLOWN 8-3-75

AERIAL MAPPING CO. INC.

AERIAL MAPPING COMPANY, INC.
2958 WEST CLARENDON AVENUE
PHOENIX, ARIZONA 85017

ARIZONA STATE PLANE COORDINATE
DECLINATION AT CENTER OF SHEET
GRID TO GROUND FACTOR 1.000

W. 1/4 COR. SEC. 9
(FOUND MA. CO. B.C. in H.H.)
2.73
B.C. ELEV. 1368.32
GR. ELEV. 1368.82

CEN. SEC. 9
(FOUND CHISLED STONE)
4.28
STONE ELEV. 1446.39
(GR. ELEV. 1445.89)

E455,000 E456,000 E457,000

N952,000

MEADOW LANE

ROWLANDS

7 STREET

NORTH BRANCH

HEARN ROAD

ROBERTS ROAD

11 STREET

12 TH PLACE

7 TH PLACE

N950,000

1370 1380 1390 1400 1410 1420 1430 1440

ZONE AE

ZONE X

DRY

1365 1366 1372 1376 1381 1389

10132 10310 10553 10800 11140 11415 11810 12000 12242 12571 12910

Add 1388 BFE @ End of Study

LIMIT OF STUDY

SW COR SEC. 9
(FOUND MA. CO. B.C. IN H.H.)
7.34
B.C. 1367.66
(GR. ELEV. 1368.09)

S. 1/4 COR SEC. 9
(CORNER NOT TIED)
SET REBAR (REF. PT.)
3.42
PIN ELEV. 1398.61
(FLUSH)

AERIAL MAPPING COMPANY, INC.
2958 WEST CLARENDON AVENUE
PHOENIX, ARIZONA 85017

ARIZONA STATE PLANE COORDINATE
DECLINATION AT CENTER OF SHEET
GRID TO GROUND FACTOR 1.0001

NOTE CORNERS NOT CERTIFIED

NOTE:
BENCH MARKS ARE SUITABLE FOR EVALUATING TOPOGRAPHIC INFORMATION ONLY.
CALL SURVEY SECTION AT 257-9599 FOR CURRENT BENCH MARK DATA.

CITY OF PHOENIX

33-29

SCALE 1" = 100'

CONTOUR INTERVAL 2'

DATE FLOWN 8-3-75

AERIAL MAPPING CO. INC.

LEGEND

100-YR WATERSURFACE

FLOODWAY

STREAM CENTERLINE

1381 BASE FLOOD ELEV

N 950,000 | E 447,000 | E 448,000 | E 449,000

N. 1/4 COR. SEC. 18
(FOUND SCRIBED STONE)
274
STONE ELEV. 1329.30
(FLUSH)

N.E. COR. SEC. 18
(FOUND CITY OF PHX. B.C.)
327
B.C. ELEV. 1325.74
(FLUSH)

INDIAN HILLS P.C.

ROAD NAME

CORAL GABLES DR.

DRY

SHOW 0'OD SOUTH BRANCH CONFLUENCE

THUNDERBIRD RD.

ZONE AE

11TH AVE

WILLOW

PERSHING

10TH AVE

SURREY CIR.

7TH DR.

8TH AVE

WOOD DR.

SURREY AVE.

SWEETWATER AVE.

LIMIT OF STUDY

N 949,000 | N 948,000 | N 947,000 | E 447,000 | E 449,000

CEN. SEC. 18
(FOUND 1/2" REBAR)
682
PIN ELEV. 1315.59
(FLUSH)

E. 1/4 COR. SEC. 18
(CORNER NOT TIED)
SET REBAR (REF. PT.)
330
PIN ELEV. 1406.10
(FLUSH)

NOTE
BENCH MARKS ARE SUITABLE FOR EVALUATING TOPOGRAPHIC INFORMATION ONLY
CALL SURVEY SECTION AT 257-9599 FOR CURRENT BENCH MARK DATA.

NOTE: CORNERS NOT CERTIFIED

ARIZONA STATE PLANE COORDINATE
DECLINATION AT CENTER OF SHEET
GRID TO GROUND FACTOR: 1.00016995

GN 5° 40.3" N

LEGEND
100-YR WATERSURFACE
FLOODWAY
STREAM CENTERLINE
1321 BASE FLOOD ELEV

CITY OF PHOENIX
32-26

SCALE: 1" = 100' CONTOUR INTERVAL: 2'
DATE FLOWN: 8-3-71
AERIAL MAPPING CO. INC.

NW. COR. SEC. 17
(FOUND CITY OF PHOENIX B.C.)
327
B.C. ELEV. 1325.79
(FLUSH)

E 450,000

N 949,000

SOUTHERN HILLS ROAD

SOUTH BRANCH

DRY

DRY

DRY

ZONE AE

ZONE X

slope overflow

1/4 COR. SEC. 17
(FOUND IRON PIPE)
PIPE ELEV. 1345.32
(FLUSH)

1% annual chance flood by graphical delineation

THUNDERBIRD ROAD

CANTERBURY DRIVE

E 451,000

N 948,000

E 452,000

W 1/4 COR. SEC. 17
(CORNER NOT TIED)
SET REBAR (REF PT)
330
PIN ELEV. 1406.18
(FLUSH)

E 450,000

CEN. SEC. 17
(FOUND IRON PIPE)
279
PIPE ELEV. 1364.76
(GR. ELEV. 1365.24)

AERIAL MAPPING COMPANY, INC.
2958 WEST CLARENDON AVENUE
PHOENIX, ARIZONA 85017

ARIZONA STATE PLANE COORDINATE
DECLINATION AT CENTER OF SHEET
GRID TO GROUND FACTOR 1.000

NOTE: CORNERS NOT CERTIFIED

NOTE:
BENCH MARKS ARE SUITABLE FOR
EVALUATING TOPOGRAPHIC INFORMATION
ONLY.
CALL SURVEY SECTION AT 257-9599
FOR CURRENT BENCH MARK DATA.

CITY OF PHOENIX

32-27

SCALE 1" = 100' CONTOUR INTERVAL 2'

DATE FLOWN 8-3-75

AERIAL MAPPING CO. INC.

LEGEND

100-WATER SURFACE

FLOODWAY

STREAM CENTERLINE

1336 BASE FLOOD ELEV

NW COR SEC 16
(FOUND MA. CO. B.C. IN H.H.)
734
B.C. 1367.66
(GR. ELEV. 1368.09)

E 455,000

E 456,000

E 457,000

ROBERTS ROAD

N 949,000

5240

5420

5615

5770

5970

6170

6275

6480

6680

6950

7030

7120

7215

7400

7520

1380

1390

1400

1410

1420

1430

1440

1450

1460

1470

1480

1490

1500

1510

1520

1530

1540

SOUTH BRANCH

THUNDERBIRD ROAD

N 948,000

100-YR & FW Symbols Different from Other Panels

Street Name

Stream 100-YR BFE Terminates Downstream

1374 BFE

1360 BFE

1363 BFE

Add'l BFE

STUDY LIMIT

W 1/4 COR SEC 16
(FOUND REBAR)
272
PIN ELEV. 1397.37
(GR. ELEV. 1397.55)

CEN. SEC. 16
(FOUND IRON PIPE)
430
PIPE ELEV. 1420.93
(GR. ELEV. 1420.36)

AERIAL MAPPING COMPANY, INC.
2958 WEST CLARENDON AVENUE
PHOENIX, ARIZONA 85017

ARIZONA STATE PLANE COORDINATE
DECLINATION AT CENTER OF SHEET
GRID TO GROUND FACTOR 1.000

NOTE: CORNERS NOT CERTIFIED

NOTE:
BENCH MARKS ARE SUITABLE FOR EVALUATING TOPOGRAPHIC INFORMATION ONLY.
CALL SURVEY SECTION AT 257-9599 FOR CURRENT BENCH MARK DATA.

CITY OF PHOENIX

32-29

SCALE 1" = 100'

CONTOUR INTERVAL 2'

DATE FLOWN 8-3-75

AERIAL MAPPING CO., INC.

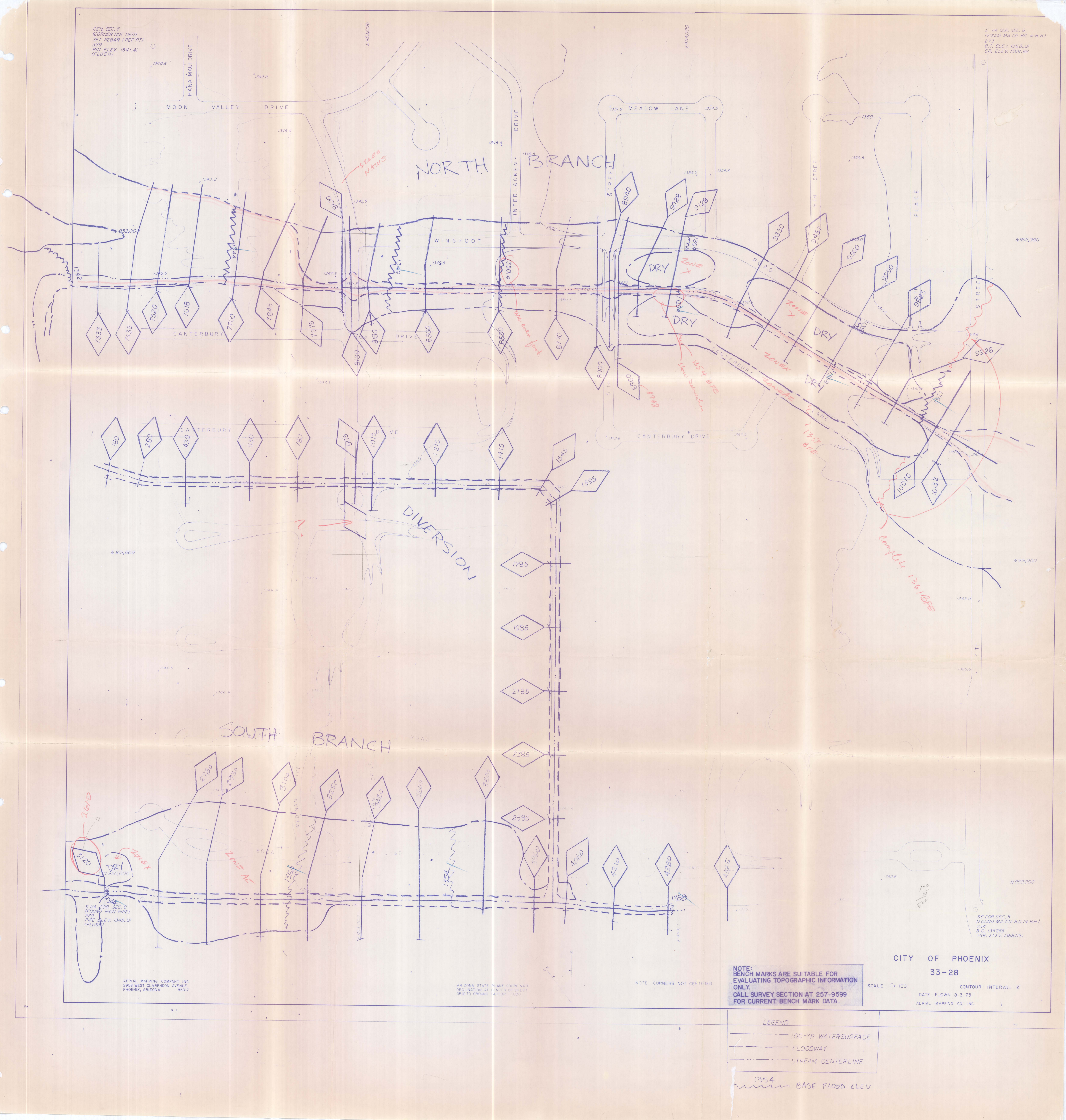
LEGEND

100-YR WATERSURFACE

FLOODWAY

STREAM CENTERLINE

1377 BASE FLOOD ELEV


CEN. SEC. 8
(CORNER NOT TIED)
SET REBAR (REF PT)
329
PIN ELEV. 1341.41
(FLUSH)
E 1/4 COR. SEC. 8
(FOUND MA. CO. B.C. in H.H.)
273
B.C. ELEV. 1368.32
GR. ELEV. 1368.82
HANA MAUI DRIVE
MOON VALLEY DRIVE
MEADOW LANE
INTERLACKEN DRIVE
NORTH BRANCH
WINGFOOT
ROAD
CANTERBURY DRIVE
CANTERBURY LANE
5TH STREET
6TH STREET
PLACE
7TH STREET
N 952,000
N 951,000
N 950,000
E 453,000
E 454,000
DRY
ZONE X
DIVERSION
SOUTH BRANCH
S 1/4 COR. SEC. 8
(FOUND IRON PIPE)
270
PIPE ELEV. 1345.32
(FLUSH)
SE COR. SEC. 8
(FOUND MA. CO. B.C. IN H.H.)
734
B.C. 1367.66
(GR. ELEV. 1368.09)
AERIAL MAPPING COMPANY INC
2958 WEST CLARENDON AVENUE
PHOENIX, ARIZONA 85017
ARIZONA STATE PLANE COORDINATE
NOTE: CORNERS NOT CERTIFIED
NOTE:
BENCH MARKS ARE SUITABLE FOR
EVALUATING TOPOGRAPHIC INFORMATION
ONLY.
CALL SURVEY SECTION AT 257-9599
FOR CURRENT BENCH MARK DATA.
CITY OF PHOENIX
33-28
SCALE 1" = 100'
CONTOUR INTERVAL 2'
DATE FLOWN 8-3-75
AERIAL MAPPING CO. INC.
LEGEND
100-YR WATERSURFACE
FLOODWAY
STREAM CENTERLINE
1354
BASE FLOOD ELEV

STUDY LIMIT

NORTH SPLIT

MOON VALLEY DRIVE

WAKONDA LANE

ROAD

ZONE AE

ZONE X

DRY

NORTH BRANCH

DIVERSION

CANTERBURY

BOCA RATON

N 952,000

N 951,000

N 950,000

E 451,000

E 452,000

CEN. SEC. 8
(CORNER NOT TIED)
SET REBAR (REF. PT.)
329
PIN ELEV. 1341.41
(FLUSH)

SW COR. SEC. 8
(FOUND CITY OF PHOENIX B.C.)
327
B.C. ELEV. 1325.79
(FLUSH)

S 1/4 COR. SEC. 8
(FOUND IRON PIPE)
270
PIPE ELEV. 1345.32
(FLUSH)

AERIAL MAPPING COMPANY, INC.
2958 WEST CLARENDON AVENUE
PHOENIX, ARIZONA 85017

ARIZONA STATE PLANE COORDINATE
DECLINATION AT CENTER OF SHEET
GRID TO GROUND FACTOR 1.0000

NOTE: CORNERS NOT CERTIFIED

NOTE:
BENCH MARKS ARE SUITABLE FOR EVALUATING TOPOGRAPHIC INFORMATION ONLY.
CALL SURVEY SECTION AT 257-9599 FOR CURRENT BENCH MARK DATA.

CITY OF PHOENIX

33-27

SCALE 1" = 100'

CONTOUR INTERVAL 2'

DATE FLOWN 8-3-75

AERIAL MAPPING CO. INC.

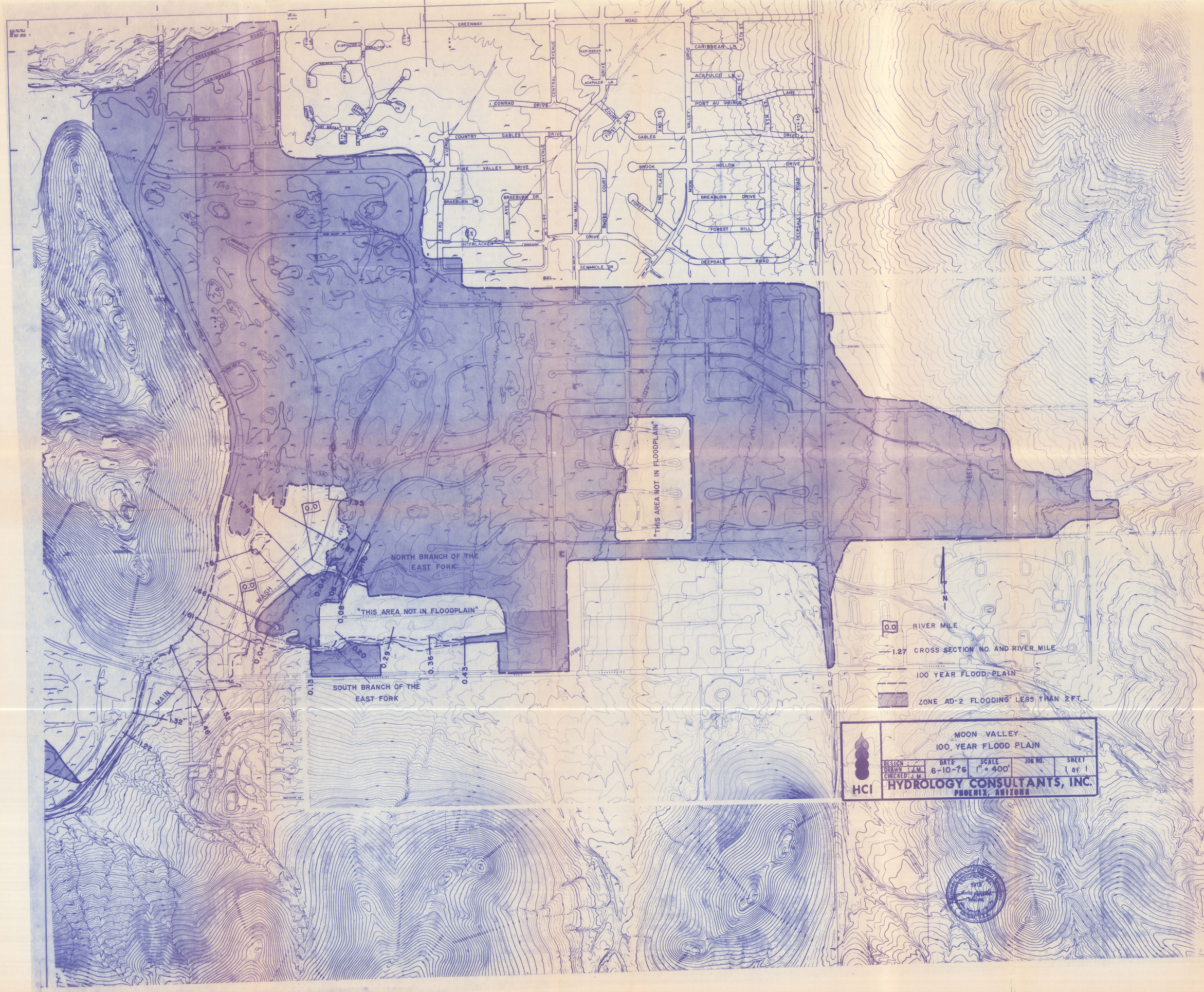
LEGEND

100-yr WATER SURFACE

FLOODWAY

STREAM CENTERLINE

1339 BASE FLOOD ELEV



MOON VALLEY
100 YEAR FLOOD PLAIN

DESIGN :	DATE	SCALE	JOB NO.	SHEET
DRAWN : J.M.	6-10-76	1" = 400'		1 OF 1
CHECKED: J. M.				

HCI
HYDROLOGY CONSULTANTS, INC.
PHOENIX, ARIZONA

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

ELEVATION

54
52
50
48
46
44
42
40
38
36

100
180
280
430
630
780
930
965
1015
1215
1415

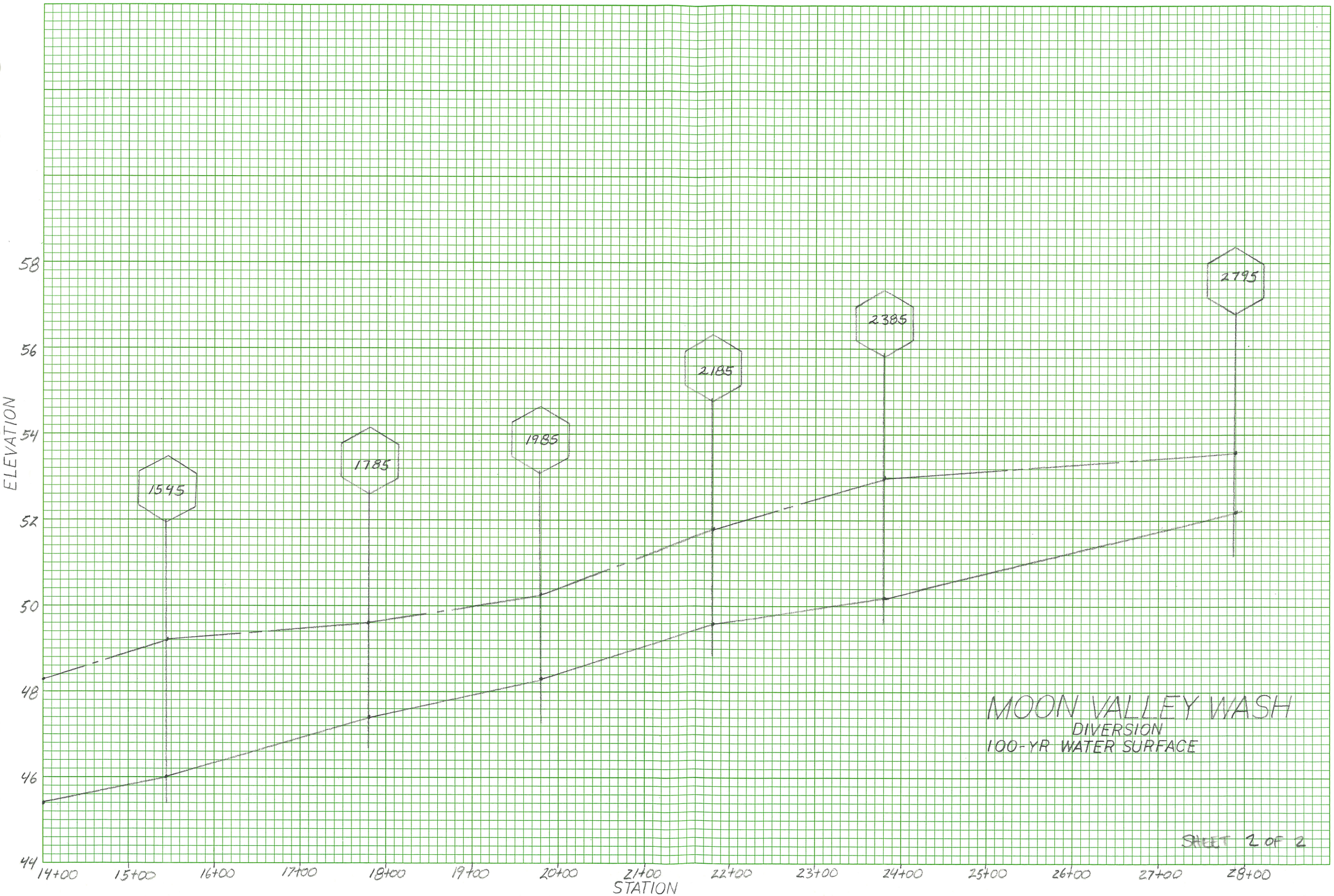
0
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00
13+00
14+00

STATION

MOON VALLEY WASH
DIVERSION
100-YR WATER SURFACE

SHEET 1 OF 2

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



MOON VALLEY WASH
DIVERSION
100-YR WATER SURFACE

SHEET 2 OF 2

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

ELEVATION

1326
24
22
20
18
16
14
12
1310

0
407
810
1090
1038
1182
1338
THUNDERBIRD ROAD
1587
1462
1704
1850
2060
2300
CORAL GABLES DR.
2465
2620
2840
2234
2360

0 2+00 4+00 6+00 8+00 10+00 12+00 14+00 16+00 18+00 20+00 22+00 24+00 26+00 28+00 30+00

STATION

MOON VALLEY WASH

NORTH BRANCH

100-YR WATER SURFACE

SHEET 1 OF 5

47 0700
10 X 10 TO THE INCH 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

CONFLUENCE, NORTH & SOUTH BRANCHES

3RD AVE

3120 3445 3745 3964 4096 4180 4290 4340 4395 4500 4675 4860 5085 5222 5320 5400 5430 5500 5585 5677 5830

ELEVATION

1338
36
34
32
30
28
26
24
22
1320

30+00 32+00 34+00 36+00 38+00 40+00 42+00 44+00 46+00 48+00 50+00 52+00 54+00 56+00 58+00 60+00

STATION

MOON VALLEY WASH

NORTH BRANCH

100-YR WATER SURFACE

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

SMALL GOLF CART BRIDGE

CHANNEL ENTERS FROM LEFT BANK

GOLF COURSE DRIVING RANGE

6590 6457 6349 6520 6640 6400 6340 6726 6250 6150 6050

6882 6810 6970 7060 7160

7295 7255 7333 7520 7435 7618 7760 7845

7975 8100 8130 8180 8360 8590

ELEVATION

1350
48
46
44
42
40
38
36
34
1332

60+00 62+00 64+00 66+00 68+00 70+00 72+00 74+00 76+00 78+00 80+00 82+00 84+00 86+00

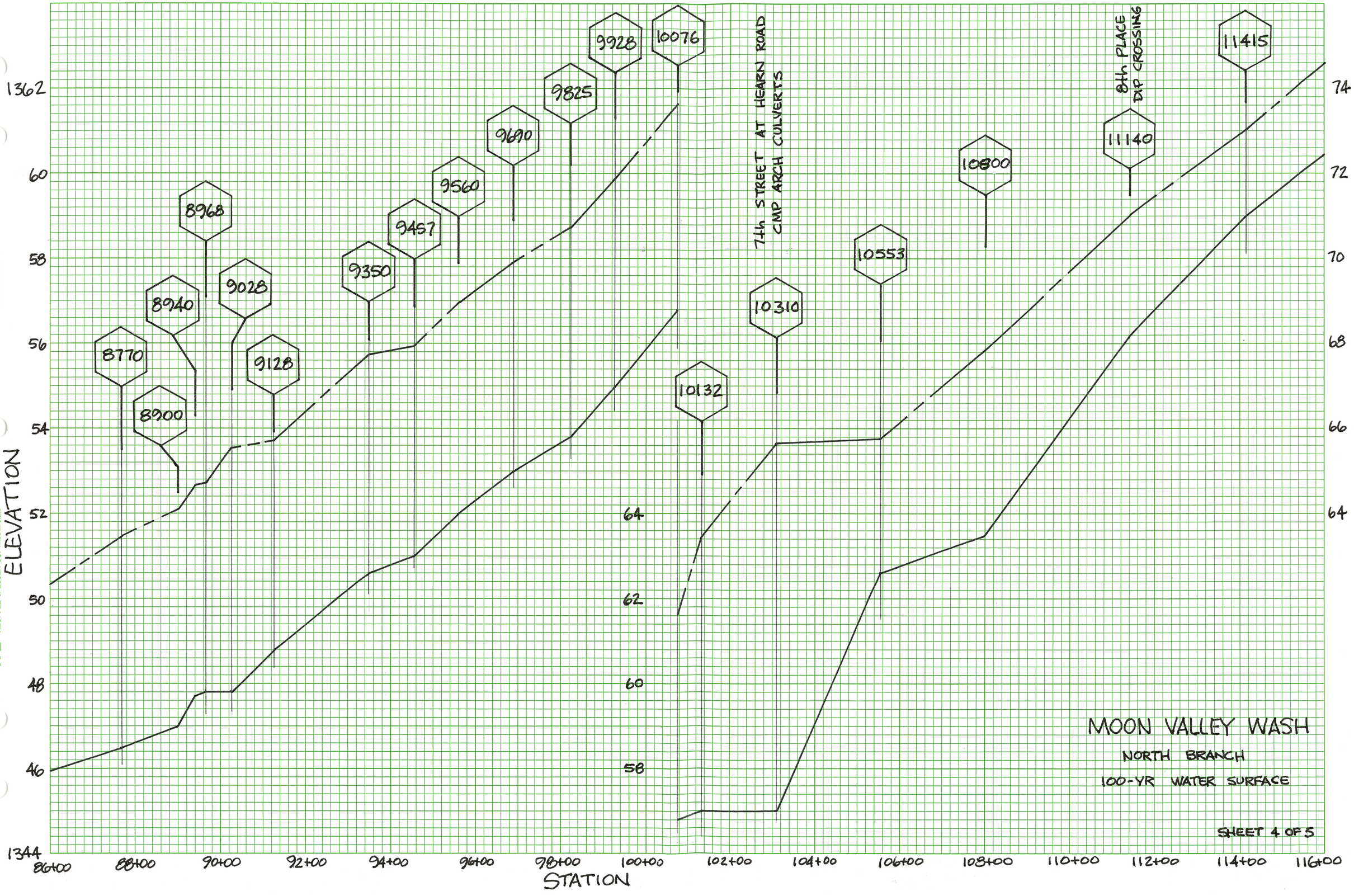
STATION

MOON VALLEY WASH

NORTH BRANCH

100-YR WATER SURFACE

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



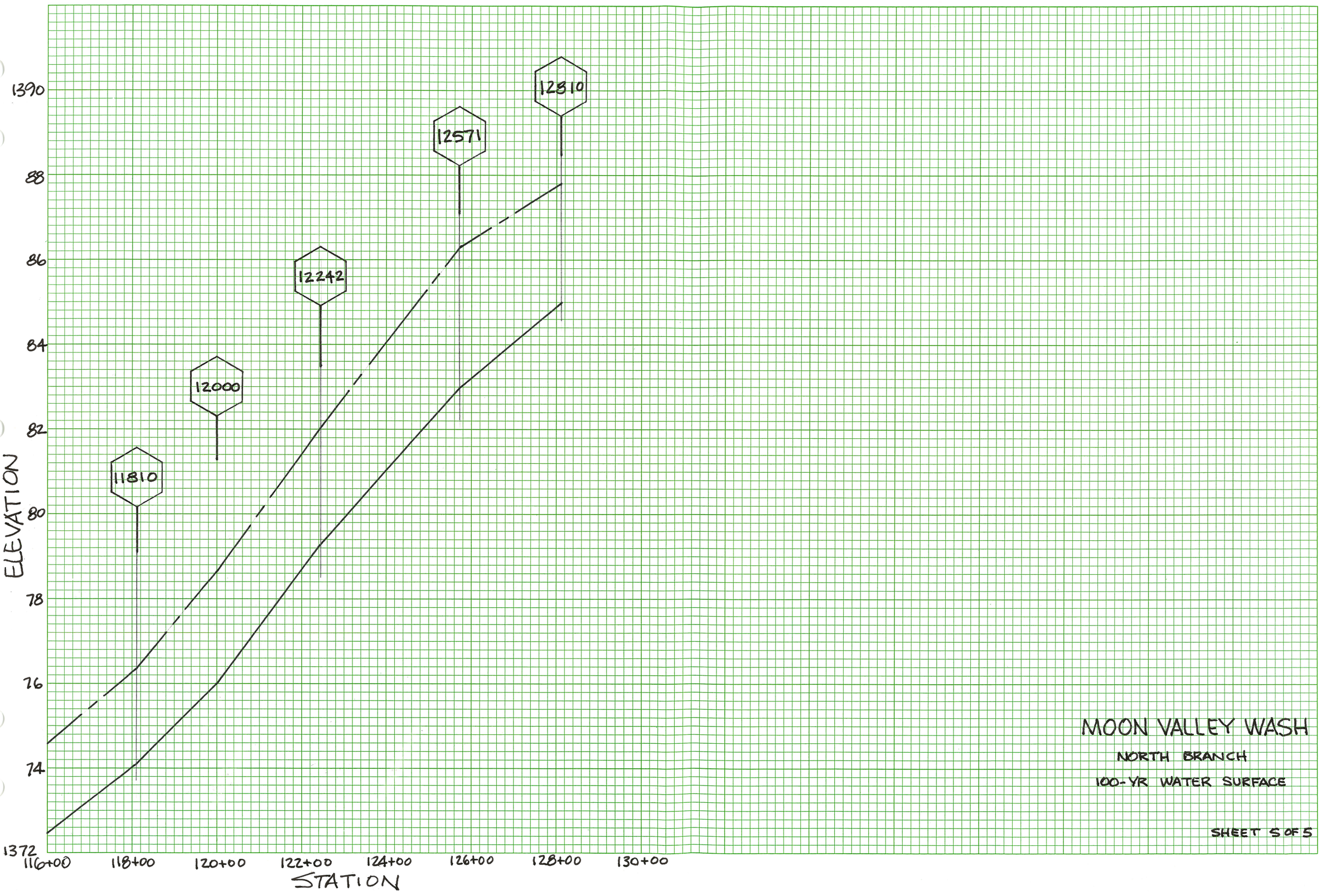
MOON VALLEY WASH

NORTH BRANCH

100-YR WATER SURFACE

SHEET 4 OF 5

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



MOON VALLEY WASH

NORTH BRANCH

100-YR WATER SURFACE

TAM O'SHANTER DRIVE DIP CROSSING

GOLF COURSE REACH

0
175
225
275
395
530
680
850
1055
1195
1345
1555
1745
1920
2075

ELEVATION

1342
40
38
36
34
32
30
28
26
1324

0 2+00 4+00 6+00 8+00 10+00 12+00 14+00 16+00 18+00 20+00 22+00 24+00

STATION

MOON VALLEY WASH

SOUTH BRANCH

100-YR WATER SURFACE

SHEET 1 OF 3

47 0700
K&E 10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

GOLF COURSE REACH

CANTERBURY DRIVE DIP CROSSING

CONCRETE TRAPEZOIDAL CHANNEL REACH

FLOW SPLIT: DIVERSION CHANNEL TO NORTH BRANCH

CONCRETE TRAPEZOIDAL CHANNEL REACH

2310
2480
2610
2780
2930
3100
3250
3420
3600
3800
3960
4060
4210
4380
4565
4765
4835
4965
5110

ELEVATION

1336 54 52 50 48 46 44 42 40 1338

1356 54 52 50 48 46 44 42 40 1338

1354 60 58 56 1352

68 66 64 62 60

22+00 24+00 26+00 28+00 30+00 32+00 34+00 36+00 38+00 40+00 42+00 44+00 46+00 48+00 50+00 52+00

STATION

MOON VALLEY WASH

SOUTH BRANCH

100-YR WATER SURFACE

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

7th STREET DIP CROSSING

10TH PLACE CULVERT

6880
7520
7400
7215
6680
6480
7120
6275
7030
6170
5970
5770
5615
5420
5240

ELEVATION

1382 80 78 76 74 72 70 68 66 1364

90 88 86 84 82 82 80 78

52+00 54+00 56+00 58+00 60+00 62+00 64+00 66+00 68+00 70+00 72+00 74+00 76+00 78+00

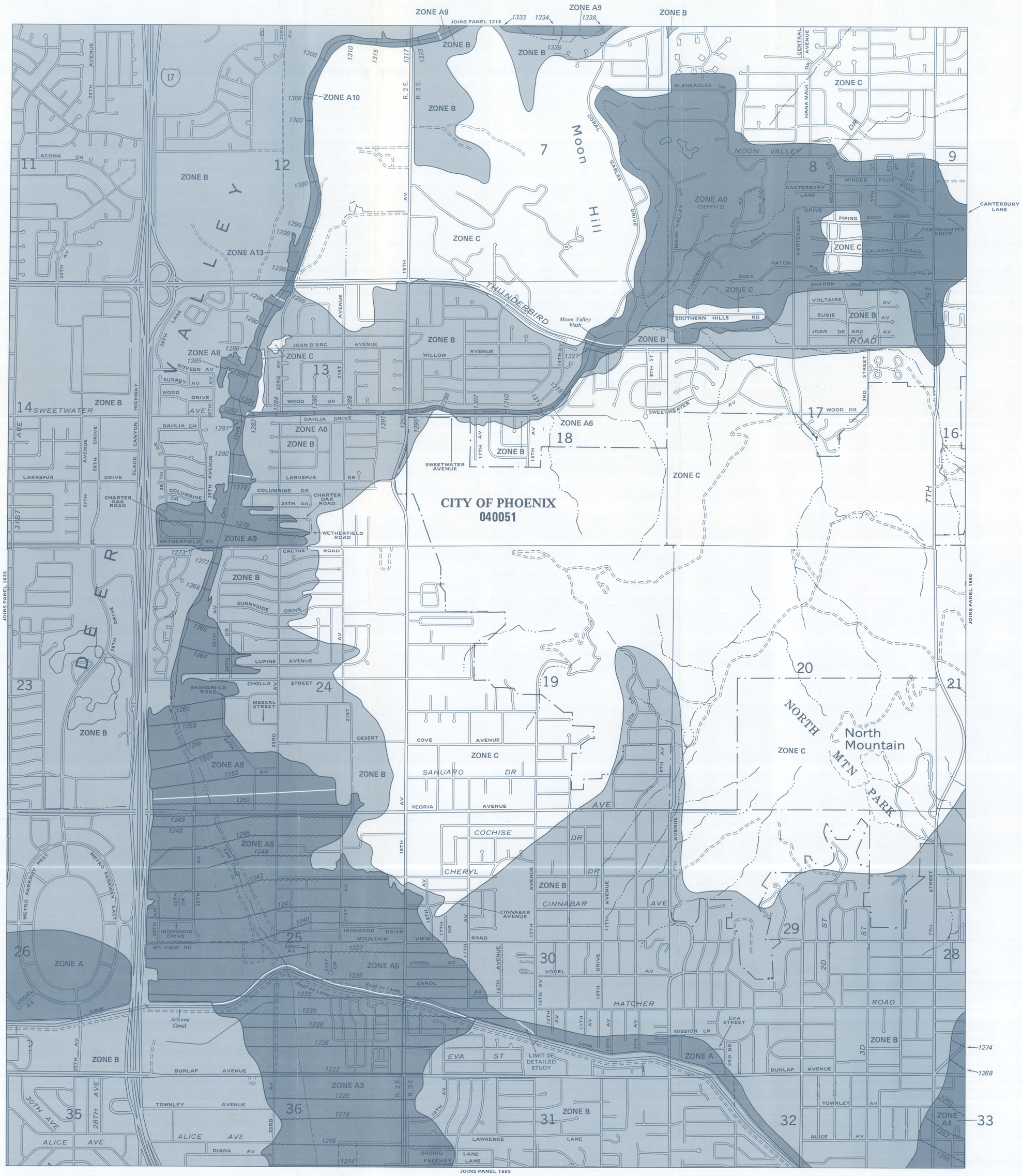
STATION

MOON VALLEY WASH

SOUTH BRANCH

100-YR WATER SURFACE

SHEET 3 OF 3



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 3 NORTH, RANGE 2 EAST AND TOWNSHIP 3 NORTH, RANGE 3 EAST

KEY TO MAP

- 500-Year Flood Boundary
- 100-Year Flood Boundary
- Zone Designations
- 100-Year Flood Boundary
- 500-Year Flood Boundary
- Base Flood Elevation Line With Elevation In Feet**
- Base Flood Elevation in Feet Where Uniform Within Zone**
- Elevation Reference Mark
- Zone D Boundary
- River Mile

ZONE B / ZONE A1 / ZONE A8 / ZONE B

513

(EL 987)

RM7×

•M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

Certain areas not in the Special Flood Hazard Areas (zones A and V) may be protected by flood control structures.

Coastal base flood elevations apply only landward of the shoreline.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of the map.

For community map revision history prior to countywide mapping, see Section 5.4 of the Flood Insurance Study Report.

For adjoining map panels, see separately printed Map Index.

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:

APRIL 15, 1988

EFFECTIVE DATE (S) OF REVISION (S) TO THIS PANEL:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.

APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1655 OF 4350

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PHOENIX, CITY OF	040051	1655	D

MAP NUMBER
04013C1655 D

EFFECTIVE DATE:
APRIL 15, 1988

Federal Emergency Management Agency

DETENTION DAM # 7

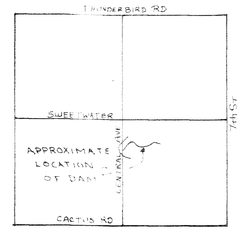
Located in the SE 1/4 of
Sec. 17 T3NR3E
G&SRB&M
Maricopa County, Arizona

I CERTIFY THAT THE ELEVATIONS SHOWN HEREON WERE TAKEN UNDER MY SUPERVISION DURING THE MONTH of APRIL, 1986

MICHAEL JON MILLER
SURVEY ENGINEER
CITY of PHOENIX

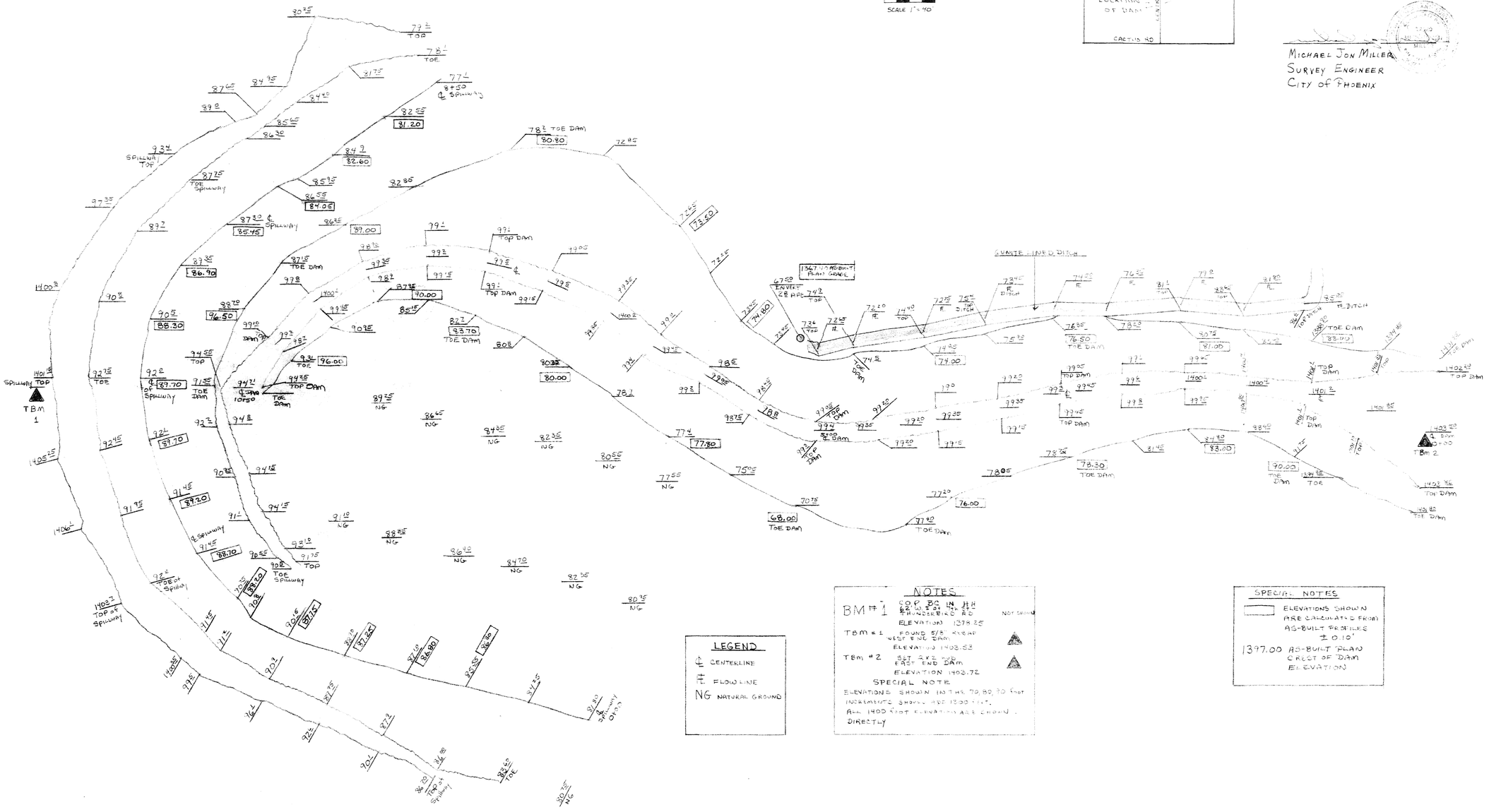
N

SCALE 1" = 40'



SURVEY PARTY
C. PADDACK PC, LSIT #16
R. VERGARA
J. TURNBAUGH
C. WILSON

DRAWN BY: C. PADDACK



LEGEND

- ℄ CENTERLINE
- ℄ FLOW LINE
- NG NATURAL GROUND

NOTES

BM # 1 COP BC IN HH 60' W of ℄ of THUNDERBIRD RD NOT SHOWN
ELEVATION 1378.25

TBM # 1 FOUND 5/8" REBAR WEST END DAM
ELEVATION 1403.62

TBM # 2 5/8" RVE TOP EAST END DAM
ELEVATION 1403.72

SPECIAL NOTE
ELEVATIONS SHOWN IN THE 70, 80, 90 (not intermediate shown) are 1300 feet. ALL 1400 (not elevations) are shown directly

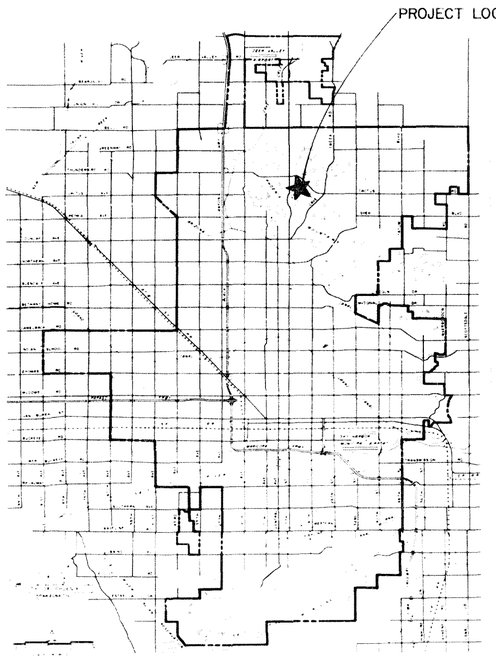
SPECIAL NOTES

ELEVATIONS SHOWN ARE CALCULATED FROM AS-BUILT PROFILES ± 0.10'

1397.00 AS-BUILT PLAN CREST OF DAM ELEVATION

CITY OF PHOENIX
ENGINEERING DEPARTMENT
STORM DRAIN

NORTH MOUNTAIN DETENTION DAMS NO. 2a & 2b
7TH STREET AND THUNDERBIRD ROAD
PROJECT NO. ST. 71183.00



VICINITY MAP

INDEX

SHEET NO.	TITLE
1	COVER SHEET
2	LOCATION MAP & CAPACITY CHARTS
3	DAM 2a PLAN & SECTIONS
4	" " FOUNDATION & PROFILES
5	DAM 2b PLAN & SECTIONS
6	" " FOUNDATION & PROFILES
7	MISCELLANEOUS DETAILS
8	DAM 2a LANDSCAPING PLAN
9	" " IRRIGATION SYSTEM
10	" " CROSS SECTIONS
11	" " CROSS SECTIONS
12	DAM 2b LANDSCAPING PLAN
13	" " IRRIGATION SYSTEM
14	" " CROSS SECTIONS
15	LANDSCAPING DETAILS
16	IRRIGATION CONTROL & PIPING DETAILS

MAYOR
TIMOTHY A. BARROW

CITY COUNCIL

CALVIN C. GOODE	GARY PETER KLAHR
ROSENDO "ROSIE" GUTIERREZ	H.J. "JERRY" LEWKOWITZ
MARGARET T. HANCE	JIM WEEKS

CITY MANAGER	JOHN B. WENTZ
CITY ENGINEER & SUP'T OF STS.	JAMES E. ATTEBERY
STREET MAINT. DIRECTOR	GARY FARMER

APPROVALS:

Harold Hanna — ACTING CITY ENGINEER — 5/14/75 DATE

Jay P. Farmer — STREET MAINTENANCE DIRECTOR — 5/14/75 DATE

Herbert B. Bowden — MARICOPA FLOOD CONTROL DISTRICT — 5/14/75 DATE

I HEREBY CERTIFY THAT THESE ARE OFFICIAL AS-BUILT PLANS

Robert J. Spittal Jr. 5-3-76 DATE

As-Built RICHARD BENITEZ

Inspector DICK TURK

Party Chief JOE HERNANDEZ

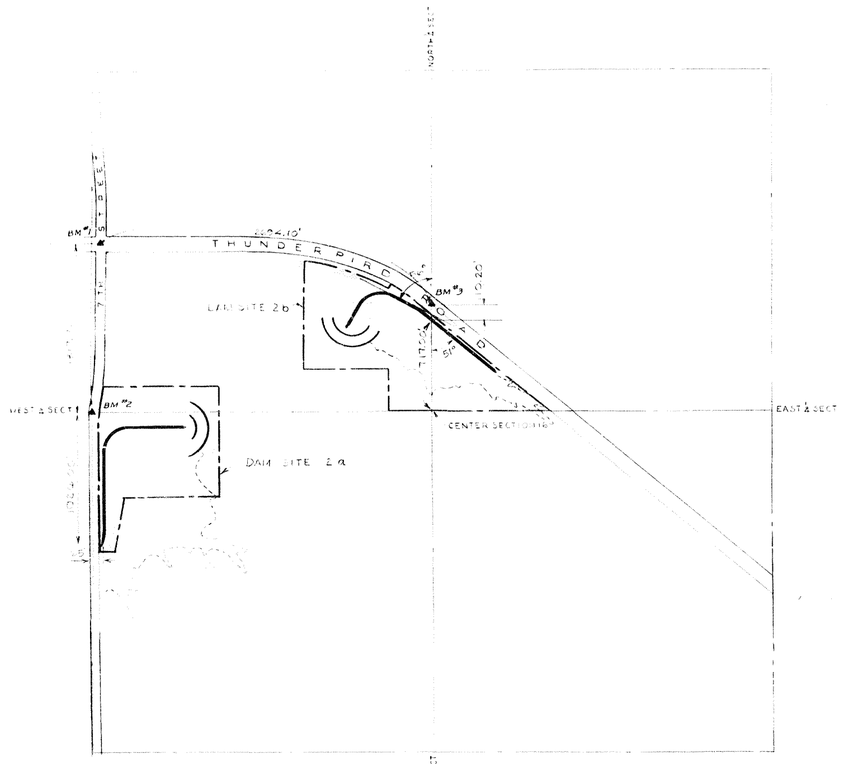
Contractor EDWARD S. KELTON

Two working days before you dig CALL FOR THE BLUE STAKERS 263-1100 Blue Stake Center

	NO. SERVICES WITHIN PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
ARIZONA PUBLIC SERVICE			
SALT RIVER POWER DISTRICT			
SALT RIVER ASSOCIATION			
MT STATES TEL. & TEL. CO.			
COUNTY HIGHWAY DEP'T.			
ARIZ. STATE HIGHWAY DEP'T.			
WATER & SEWERS DEP'T.			

ST-71183.00

46660



SECTION 16
T 5N R 3E
G & S R & M

LOCATION MAP

LEGEND

SECTION LINE

PROPERTY LINE

N

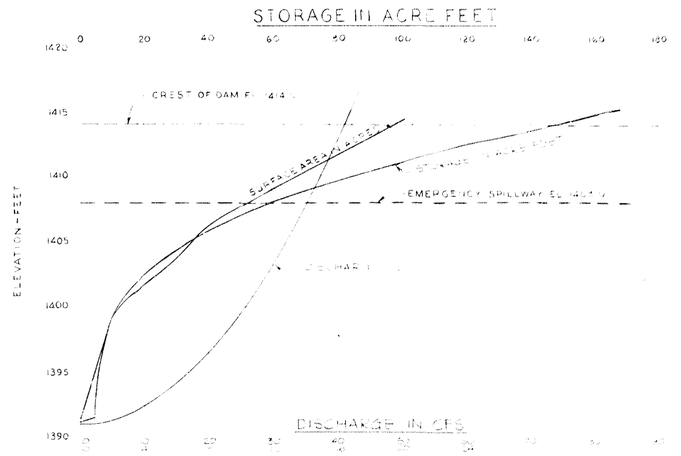
▲ BENCH MARK

B.M. #1: B.C. IN H/H, THUNDERBIRD RD. & 7th ST.
ELEV. 1377.71

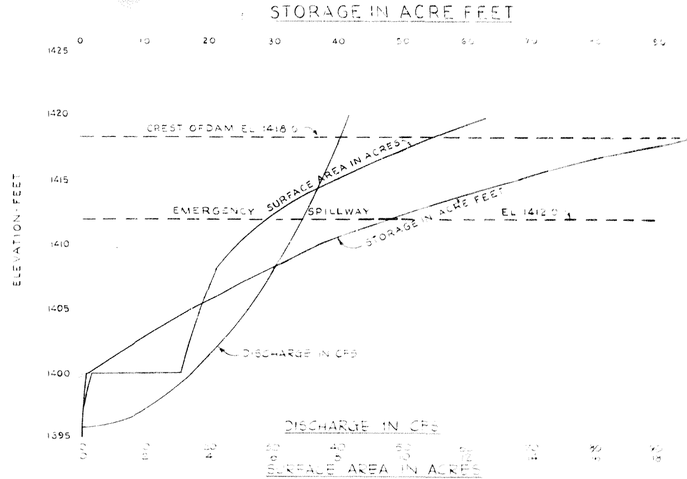
B.M. #2: A.H.D.B.C. ON TOP OF STORM DRAIN
H/W, W. SIDE OF 7th ST, N. OF SWEETWATER, EL. 1391.28

B.M. #3: B.C. IN H/H, 11th ST. & THUNDERBIRD
ELEV. 1413.92

1 ADDED B.M.'S R.S.C. A.N.A. 5-75



CAPACITY CHART
FLOOD DETENTION DAM NO 2a



CAPACITY CHART
FLOOD DETENTION DAM [illegible]

[illegible]
5-3-76

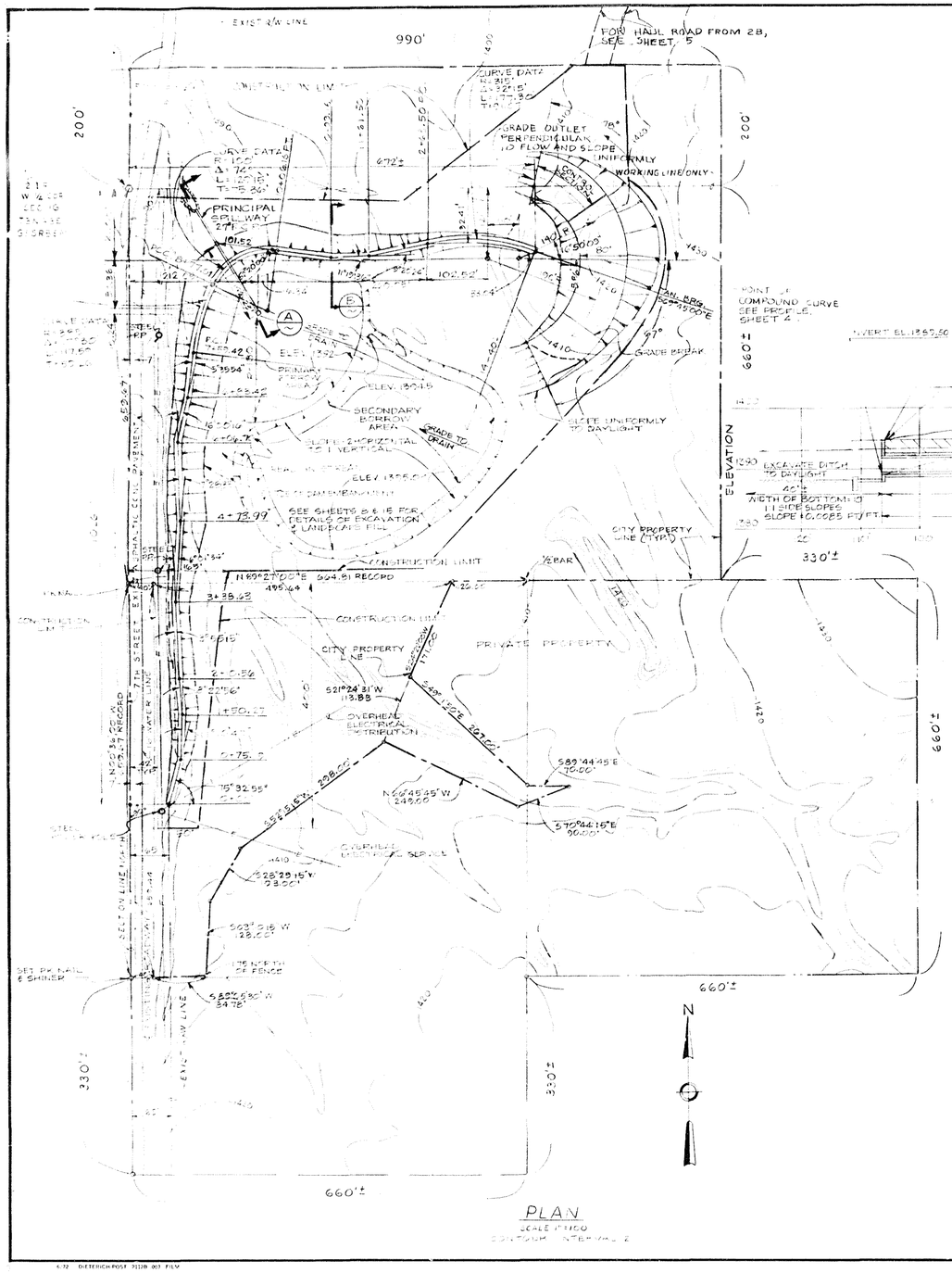
JOHN CAROLLO ENGINEERS
PHOENIX ARIZONA · LAFAYETTE CALIFORNIA · SANTA ANA CALIFORNIA

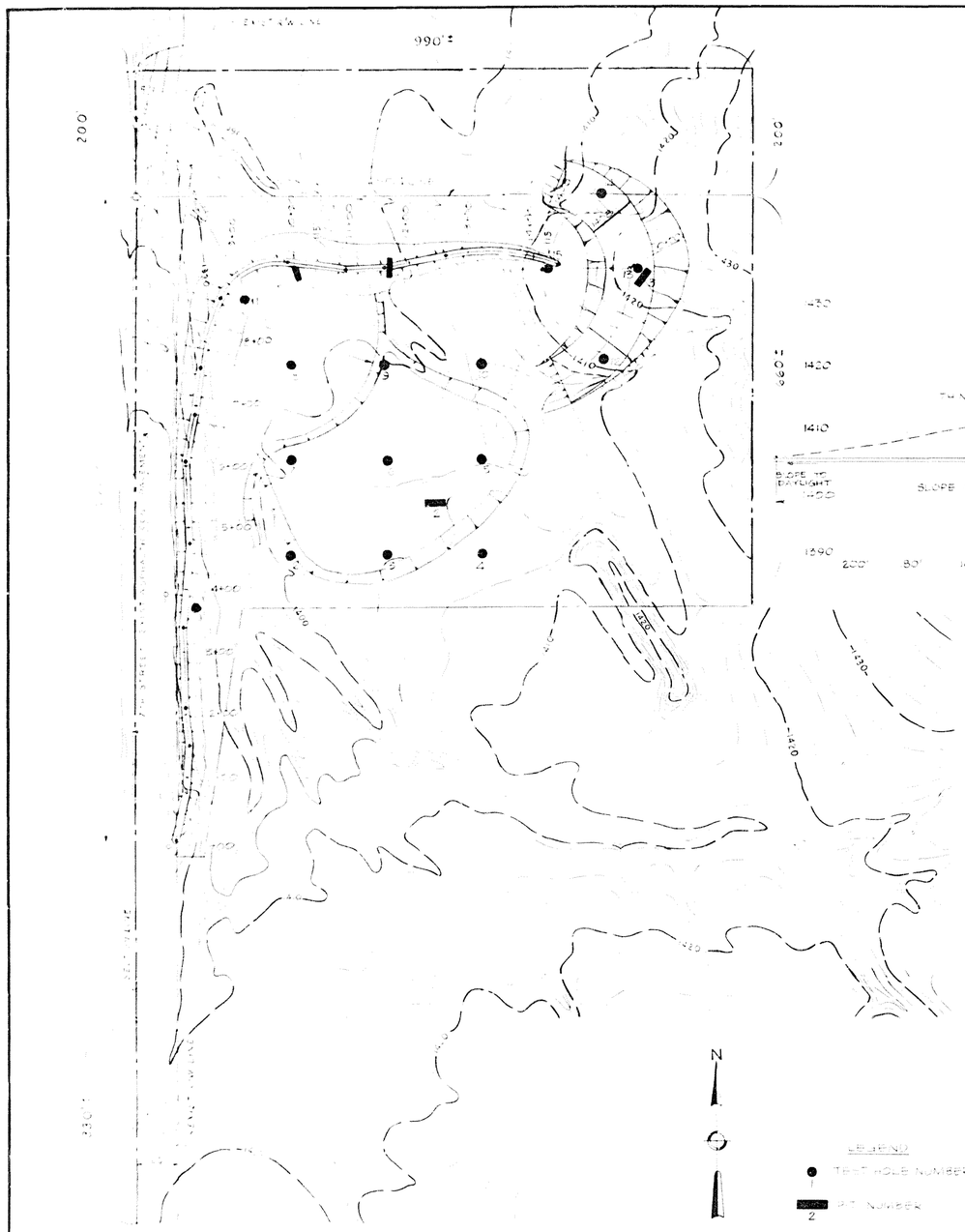
CITY OF PHOENIX, ARIZONA
NORTH MOUNTAIN FLOOD DETENTION DAMS NOS 2a & 2b

LOCATION MAP & CAPACITY CHARTS

Designed	Checked	Date		Drawing No.	Sheet
A.N.A.		5-3-76			No. 2 of 16
Drawn	Traced	Revised			

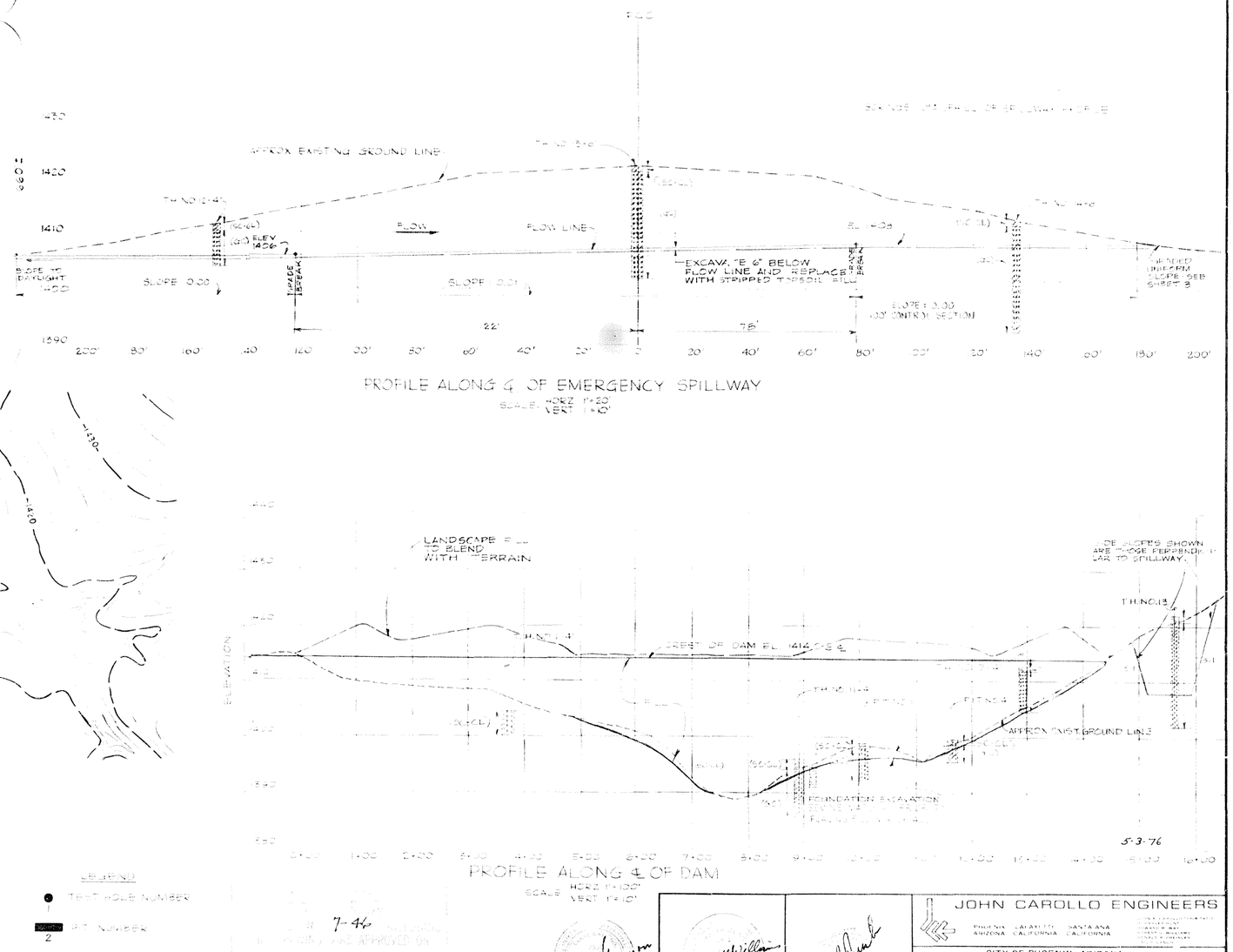
46661


EXIST R/W LINE
990'
FOR HAUL ROAD FROM 2B, SEE SHEET 5
CURVE DATA R=315' Δ=32°15' L=177.30' T=91.50'
GRADE OUTLET PERPENDICULAR TO FLOW AND SLOPE UNIFORMLY
WORKING LINE ONLY
CURVE DATA R=100' Δ=74°00' L=129.15' T=75.46'
PRINCIPAL SPILLWAY
CONTROL SECTION
672'±
102.52'
CONC. RIPRAP
SLOPE
GRADE BREAK
SLOPE UNIFORMLY TO DAYLIGHT
SECONDARY BORROW AREA
GRADE TO DRAIN
SLOPE 2:1 HORIZONTAL TO 1 VERTICAL
ELEV. 1375.0
4+73.99
SEE SHEETS 5 & 15 FOR DETAILS OF EXCAVATION & LANDSCAPE FILL
CONSTRUCTION LIMIT
CITY PROPERTY LINE (TYP.)
½ BAR
N 89°27'00" E 994.81 RECORD
195.44
3+38.63
PRIVATE PROPERTY
CITY PROPERTY LINE
S21°24'31"W 113.88
OVERHEAD ELECTRICAL DISTRIBUTION
S 43° 20'E 287.00'
S89°44'45"E 30.00'
N 0°45'45"W 249.00'
S70°44'15"E 30.00'
S 28°29'15"W 23.00'
S63°01'15"W 28.00'
SET PK NAIL & SHINER
S 89°04'56"W 84.78'
EXIST. R/W LINE
660'±
330'±
N
PLAN
SCALE 1"=100
CONTOUR INTERVAL 2
POINT OF COMPOUND CURVE SEE PROFILE SHEET 4
INVERT EL. 1365.50
660'±
ELEVATION
S 3.7 DETAIL
EXCAVATE DITCH TO DAYLIGHT
WIDTH OF BOTTOM=10 1:1 SIDE SLOPES SLOPE 1.0 CUBES PER FT.
204' 27" RCP S=.2097
CONC ENCASEMENT (SEE DETAILS)
106.59'
APPROX. EXIST. GROUND LINE
EARTH EMBANKMENT
FOUNDATION EXCAVATION
A PRINCIPAL SPILLWAY SECTION
1"=10' HOR.
1"=10' VERT.
NOTES
1 SEE SHEET NO 4 FOR DESIGNATED FOUNDATION EXCAVATION.
2 THIS DAM IS NOT DESIGNED FOR PERMANENT STORAGE OF WATER.
3 FIGURES DENOTED X+Y DENOTE DISTANCES ALONG THE Q OF THE DAM
4 D.S.I. ENGR. SHALL DESIGNATE REMOVAL OF ANY UNSATISFACTORY FOUNDATION MATERIAL.
LANDSCAPING FILL LINE SEE SHEET NO 8
LANDSCAPING FILL VARIABLE SLOPE
DAM EMBANKMENT
APPROX. EXISTING GROUND
FOUNDATION EXCAVATION
EXCAVATION
RESERVOIR
B TYPICAL DAM SECTION
1"=10' HOR.
1"=10' VERT.
STATE OF ARIZONA DEPARTMENT OF WATER RESOURCES
APPROVED NO 7-46 INCLUDING
SHEETS
WESLEY E. STEIGER STATE WATER ENGINEER
BY: BENSON G. SCOTT
CHIEF, SUPERVISOR OF DAM SAFETY
5-3-76
JOHN CAROLLO ENGINEERS
PHOENIX ARIZONA LAFAYETTE CALIFORNIA SANTA ANA CALIFORNIA
CITY OF PHOENIX, ARIZONA
NORTH MOUNTAIN FLOOD DETENTION DAM NO. 2a
PLAN AND SECTIONS
DESIGNED AEP/TEK
DRAWN JM
CHECKED
TRACED
DATE 2-7-75
REVISED
DRAWING NO.
SHEET NO 3 of 16
46662



PLAN

SCALE 1"=100'
MAIN INTERVAL



PROFILE ALONG ℄ OF EMERGENCY SPILLWAY

SCALE: HORZ 1"=20'
VERT 1"=10'

PROFILE ALONG ℄ OF DAM

SCALE HORZ 1"=100'
VERT 1"=10'

7-44

JOHN CAROLLO ENGINEERS

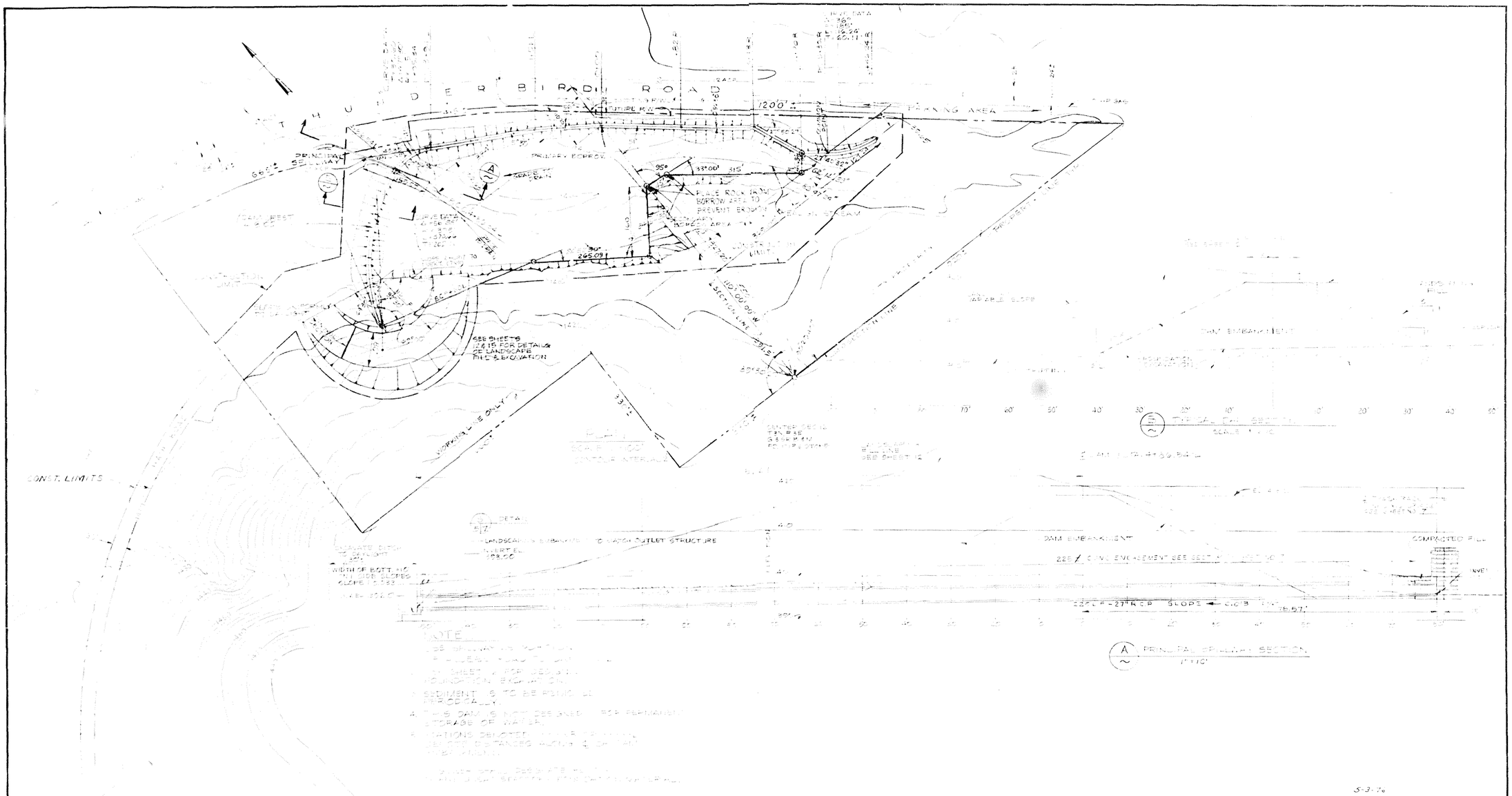
PHOENIX, ARIZONA · LAFAYETTE, CALIFORNIA · SANTA ANA, CALIFORNIA

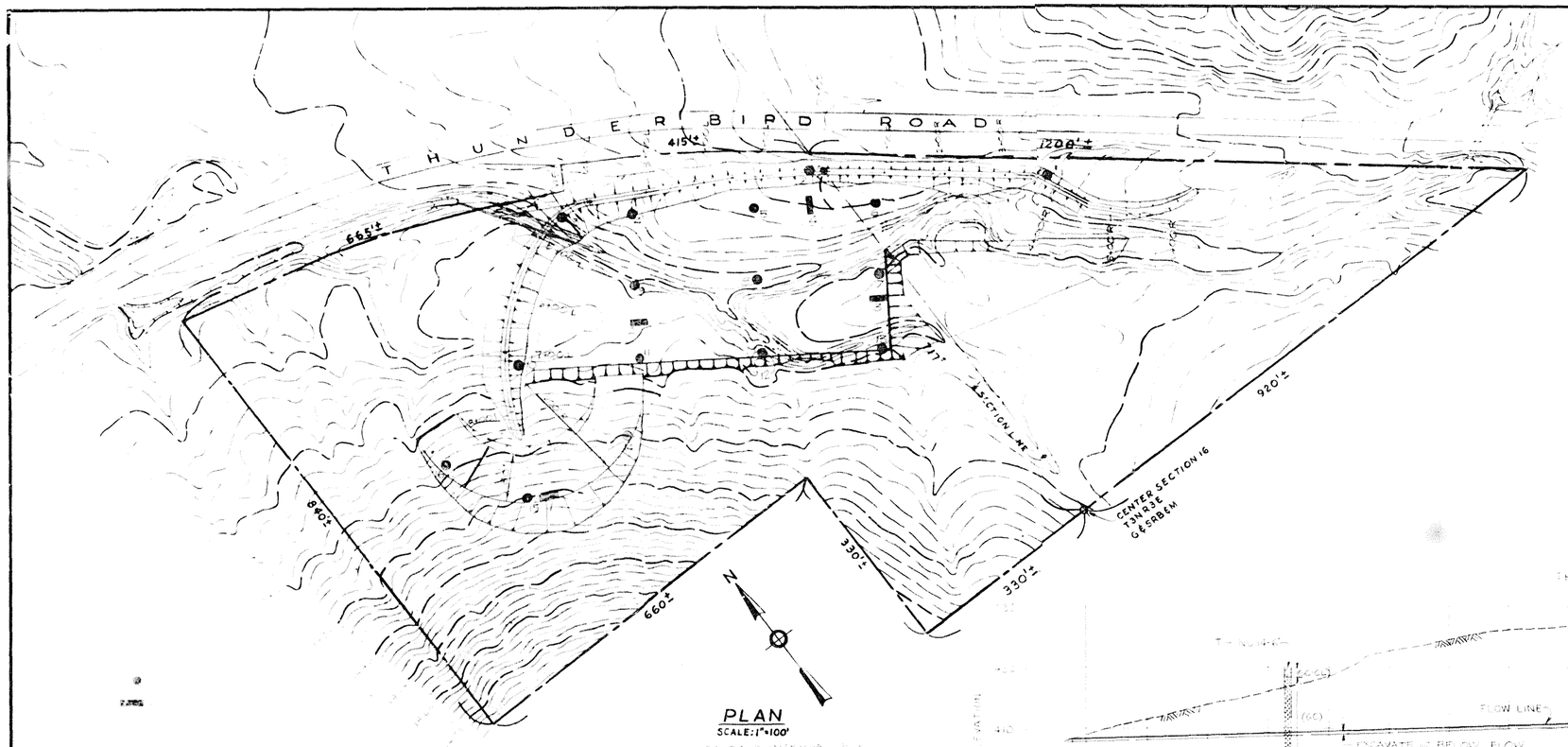
CITY OF PHOENIX, ARIZONA
NORTH MOUNTAIN FLOOD DETENTION DAM NO. 2a

FOUNDATION AND PROFILES

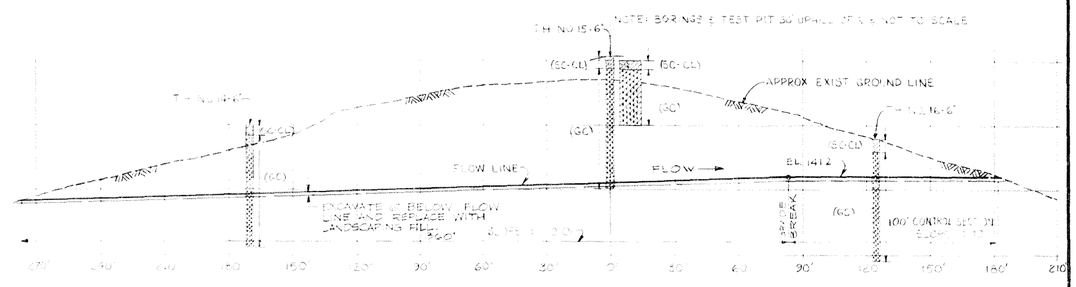
DESIGNED	CHECKED	DATE		EXAMINED	SHEET
DRAWN	TRACED	RECEIVED 2-7-75			No. 4 of 16

46663

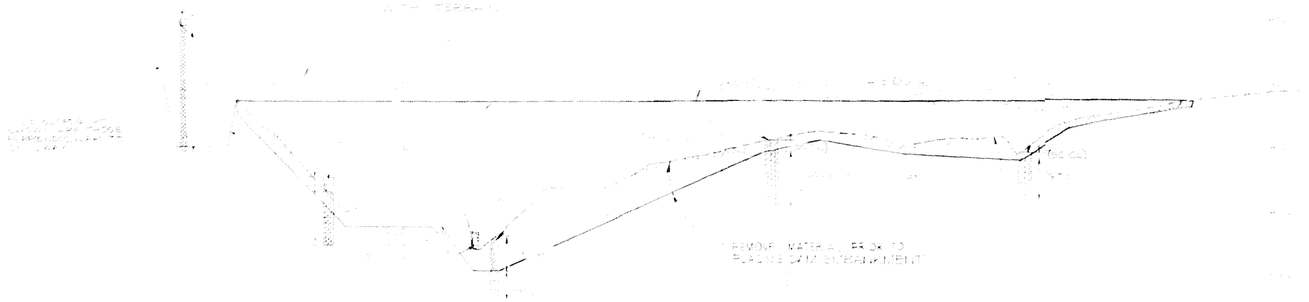

THUNDERBIRD ROAD
PRINCIPAL SPILLWAY
TRAINING AREA
1200'±
SEE SHEETS 7 & 15 FOR DETAILS OF LANDSCAPE FILL & EXCAVATION
CONST. LIMITS
DETAIL
LANDSCAPING & BERMING TO MATCH OUTLET STRUCTURE
INVERT EL. 1923.00
WIDTH OF BOTTOM
SLOPE 1.5:1
DAM EMBANKMENT
22E / CONVEYANCEMENT SEE SHEET 12 FOR DETAILS
22E L.E. - 27'R.C.P. SLOPES 4:1 & 3:1
COMPACTED FILL
INVERT
PRINCIPAL SPILLWAY SECTION
SCALE 1"=10'
NOTE
1 CHANGED ANGLE R.S.C. A.N.A. 5-75
2 ADD CONST. LIMITS, N.R.D. " " "
5-3-76
JOHN CAROLLO ENGINEERS
PHOENIX ARIZONA
LAFAYETTE CALIFORNIA
SANTA ANA CALIFORNIA
CITY OF PHOENIX, ARIZONA
NORTH MOUNTAIN FLOOD DETENTION DAM NO. 2b
PLAN & SECTION
DRAWING NO.
SHT. NO. 5 OF 16
46664



PLAN
SCALE: 1"=100'
CONTOUR INTERVAL 2'



PROFILE ALONG ℄ OF EMERGENCY SPILLWAY
SCALE - HORIZ 1"=40'
VERT 1"=10'



NOTE: BORE HOLES NOT NECESSARILY IN ℄

5-3-76

JOHN CAROLLO ENGINEERS			
PHOENIX ARIZONA	LAFAYETTE CALIFORNIA	SANTA ANA CALIFORNIA	JOHN A. CAROLLO (1908-1971) H. HAZLETT HUNT HOWARD W. WAY ROBERT E. WILLIAMS ROBERT D. STEELE GAIL P. LYNCH

CITY OF PHOENIX, ARIZONA
NORTH MOUNTAIN FLOOD DETENTION DAM NO. 2b

FOUNDATION AND PROFILES

DESIGNED	CHECKED	DATE	DRAWING NO.	SHEET
JSH K	WB	5/74		
DRAWN	TRACED	REVISED		No. 6 of 16
WB		2-7-75		

46665

THUNDERBIRD ROAD – MAJOR STREETS
PHOENIX STREETS – MARICOPA COUNTY

FHWA REGION	STATE	PROJ. NO	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ		1	80	

LENGTH OF PROJECT
STA. 7+37.76 TO STA. 50+60
= 4322.24 FEET
= 0.8186 MILES

CITY OF PHOENIX
ENGINEERING DEPARTMENT
DIVISION OF DESIGN

THUNDERBIRD ROAD

19TH AVENUE TO CORAL GABLES DRIVE

FMS INDEX NO. P-780155

P-78015.00

MAYOR

MARGARET T. HANCE

CITY COUNCIL

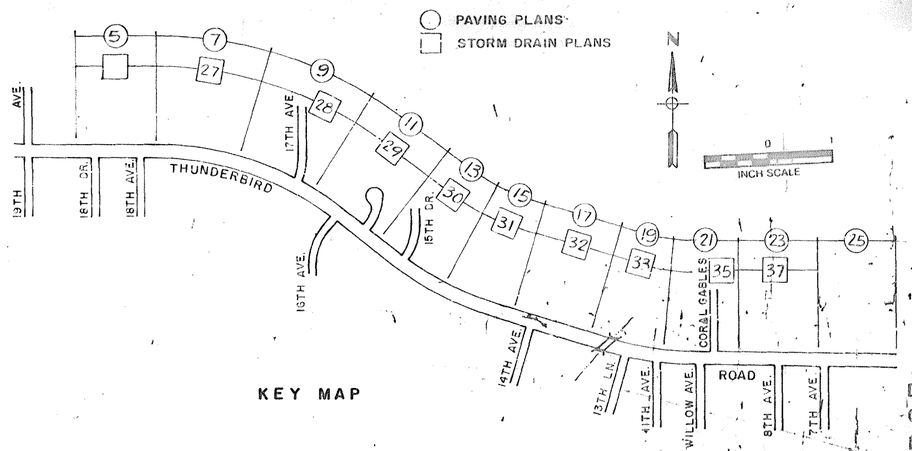
HOWARD ADAMS	KEN O'DELL
CALVIN C. GOODE	BARRY STARR
ED KORRICK	JIM WHITE

CITY MANAGER	MARVIN A. ANDREWS
CITY ENGINEER & SUP'T. OF STREETS	JAMES E. ATTEBERY
CITY TRAFFIC ENGINEER	DONALD C. MORGAN
STREET MAINT. ADMINISTRATOR	RICHARD SHINE

APPROVED _____ DEPUTY CITY ENGINEER — DATE 8/15/83

APPROVED _____ DEPUTY CITY TRAFFIC ENGINEER — DATE 8-9-83

○ PAVING PLANS
□ STORM DRAIN PLANS



KEY MAP

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
PHOENIX – ARIZONA

I HEREBY CERTIFY THAT THESE ARE OFFICIAL RECORD DRAWINGS

Robert J. Spittler 12-12-85
DATE

Drawn By J. Doyle
Inspector M. Musich
Party Chief Marage, Jr.
Contractor Hunter Contracting

SHEET INDEX

SHEET NUMBER	TITLE
1	TITLE SHEET & KEY MAP
2	SUMMARY NOTES
3	QUANTITY SUMMARY
4	TYPICAL SECTION
5-26	PAVING PLAN & PROFILE
27-38	STORM DRAIN PLAN & PROFILE
39-43	C.B. CONNECTION PROFILES
44	ALTERNATE TABLE
45-48	MEDIAN ISLAND DETAILS
49-50	RETAINING WALL DETAILS
51-53	MISC. DETAILS
54	SOIL BORING LOGS
55-64	BRIDGE OVER SWEETWATER WASH
65-68	TRAFFIC SIGNAL DRAWINGS
69-80	LANDSCAPE DRAWINGS

84365 LOG NUMBER

	NO SERVICES WITHIN PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
ARIZONA PUBLIC SERVICE			
SALT RIVER POWER DISTRICT			
S.R.V.W.U.A.			
MT. STATES TEL. & TEL. CO.			
COUNTY HIGHWAY DEPT.			
ARIZ. DEPT. OF TRANSPORTATION			
WATER & SEWERS DEPT.			

THUNDERBIRD ROAD
19TH AVENUE TO 8TH AVENUE
PHOENIX STREETS-MARICOPA CO.

DIBBLE & ASSOCIATES

M.G.I. A.M.C. J.J.D. 9/24/00

REMOVAL NOTES

1. Remove 462 L.F. Guard Rail
2. Sawcut & Remove ~~71~~ L.F. C&G
3. Sawcut & Remove 10 L.F. Single Curb
4. Remove Gas Sign
5. Sawcut & Remove 20 L.F. C&G
6. Sawcut & Remove ~~297~~ 279.2 S.F. Conc. S/W
7. Remove 174 S.F. Conc. Paving
8. Sawcut & Remove ~~10~~ L.F. C&G
9. Remove ~~470~~ 207.5 S.F. Conc. Slab

(Z1) Lt. Median Curb Sta. 38+00 to 42+58
(Z2) Rt. Median Curb Sta. 38+00 to 40+22
(Z3) Rt. Curb Sta. 40+22 to 42+51

Constr. & Survey Line Curve Data
Δ = 16°35'06" Lt.
D = 3°00'11"
R = 1907.95'
L = 552.28'
T = 278.08'

87.5' L.F. Guard Rail Connect to Bridge Dado A.D.O.T. Std. C-10.04 G-4(1W) C-10.15 C-10.16, B-21.10 ± Detail Sheet 52

87.5 L.F. Guard Rail Connect to Bridge Dado A.D.O.T. Std. C-10.04G-4(1W) C-10.15 C-10.16 B-21.10 ± Detail Sheet 52

56.25 L.F. Guard Rail Connect to Bridge Dado A.D.O.T. Std. C-10.04 G-4(1W) C-10.15, C-10.16 B-21.10 ± Det. Sh. 52

Sta. 39+31 to 40+60
130 L.F. Conc. Ret. Wall
See Detail Sh. 48

Sta. 40+03 to 40+65
~~60~~ 62.5 L.F. Conc. Ret. Wall
See Detail Sh. 49

678 S.F. Conc. Drainage Swale See Detail Sh. 49

Constr. ℄ P.C. Sta. 40+16.35 New Survey Mon Std. Det. (120-1-B)

Const. 125 L.F. Guard Rail A.D.O.T. Std. C-10.04 G-4(1W) Const. Tea Guard Rail Anchor Assy. A.D.O.T. Std. C-10.21 Connect to Bridge DADO A.D.O.T. Std. B-21.10. Adjust Pole Spacing to avoid Sewer Manhole and Storm Drain Pipe

0.28' Rt. Constr. ℄ Sta. 42+80.00 Found Brass Cap Flush Install New Survey Mon. Sta. Det. (120-1-B)

1.01' Rt. Constr. ℄ Sta. 41+48.00 Found Brass Cap Flush Install New Survey Mon Std. Det. (120-1-B)

S/W Ramp Type D Std. Det. P-1236 (132.99)

S/W Ramp Type H See Detail Sh. 50

S/W Ramp Type D Std. Det. P-1236 (132.90) 89

Depress 6 L.F. Curb For Drainage Swale

2" A.C. on 6" A.B.C.

New S.D.

Profile Grade

Survey Line P.C. Sta. 39+77.81

Const. ℄

Temporary Construction Easement

Drainage Easement

SWEETWATER WASH

Exist. Drainage Easement

See Detail on Sheet 47

THUNDERBIRD

MATCH LINE STA. 38+00

MATCH LINE STA. 43+00

13TH LANE

11TH AVENUE

MOON VALLEY

GARDENS VII Bk. 144, Pg. 35

MOONRIDGE ESTATES Bk. 120, Pg. 21

▲B.M. -"4" S.W. Cor. Bridge Deck 25.5' Rt. Sta. 38+84 Elev. 1319.69

INCH SCALE

For Storm Drain See Sheet 33

RECORD DRAWING
FIELD ENGINEERING DIVISION
DATE 12-12-00

PAVING PLAN

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

THUNDERBIRD ROAD
STA. 38+00 TO 43+07
FMS INDEX NO. P-780155

DES.	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE			
SCALE 1"= 20' HORIZONTAL - VERTICAL		19	80	

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD BY	DATE
1	Changed Median 2's/end	M.F.	J.M.F.	5-25-83

PHOENIX STREETS-MARICOPA CO.

20

REVISION BY CITY OF PHOENIX
NO. | DESCRIPTION | REV BY | CKD BY | DATE

98.32' V.C. (True Distance)
PIE 39+55 404+34.57
Corr.=0.18 G=19.37
404+34.57 P.I. C=19.39 G=18.89
FULL SUPER
97.54' V.C. (True Dist.)
S=+0.1350%
S=+0.1017%
BRIDGE
S=-1.3537%
S=-0.9022%
200' V.C.
C=19.86 G=19.36
394+25.57 C=19.94 G=19.44 MEET BRIDGE
PVC 394+84.57 C=20.00 G=19.50 MEET BRIDGE
84.15' V.C. (True Dist.)
Median Gutter 12'Lt of ℄
C=18.13 G=17.63
Island Return
Sta. 41+98 C=18.64
End Gutter 12'Lt. G=18.14
Begin Pvmt. 12'Lt. C=12.21
41+80
C=18.80 G=18.30
Island Return
Sta. 41+98 C=18.79
End Gutter 12'Rt. G=18.29
Begin Pvmt. 12'Rt. C=12.20
PVC C=12.69 G=17.19
42+30 PVC C=18.36 G=17.86
99.38' V.C. (True Dist.)
Pvmt. 12'Lt ℄
PT 42+80 E=16.75 Corr.=0.25 P=17.00
PT 42+80 E=17.42 Corr.=0.25 P=17.67
P=17.72
1.00.62' V.C. (True Dist.)
Pvmt. 12'Rt. ℄
PT 42+80 E=17.42 Corr. 0.31 P=17.73
P=17.83
℄ Profile
S=+0.1246%
200' V.C.
S.Ds. = 389'
51 mph
P=20.10
394+65.36 MEET BRIDGE
C=20.44 G=19.94
BRIDGE
394+64.36 MEET BRIDGE C=20.50 G=20.00
PVC 40+00 C=20.55 G=20.05
PI 40+42.28 Elev=20.11 Corr.=0.15 G=19.96
PT 40+84.57 C=20.06 G=19.56
S=-1.3286%
S=-0.9022%
P=20.14
38+28+98.43 MEET BRIDGE
C=20.42 G=19.92
S=+0.1017%
BRIDGE
S=-0.3465%
Median Gutter 12'Rt. of ℄
C=20.38 G=19.88 MEET BRIDGE
39+80.50 MEET BRIDGE
C=20.03 G=19.53
S=-1.0468%
38+70
C=19.88 G=19.38
38+91.50 MEET BRIDGE
40+80
102.46' V.C. (True Dist.)
42+30 PVC C=18.45 G=17.95
108.16' V.C. (True Dist.)
PT 42+80 E=17.42 Corr. 0.31 P=17.73
P=17.83
S=+0.1017%
S=+0.4998%
FLAT
BRIDGE
200' V.C.
38+71.29 MEET BRIDGE G=19.38
39+30.29 MEET BRIDGE G=19.44
PVC C=20.44 G=19.94
40+30
PT 40+80 E=20.20 Corr.=0.20 G=20.00
PT C=20.17 G=19.67
41+30
FULL SUPER
S=-1.0248%
42+30 C=15.12 (62.24') G=18.62
42+51 (62'Rt) C=18.88 G=18.38
PT 42+80 Elev.18.09 Corr. 0.31 P=18.40
P=18.51
1320
1318
(℄ Profile)
38+00
39+00
40+00
41+00
42+00
43+00

RECORD DRAWING
FIELD ENGINEERING
DIVISION
DATE 12-12-95

PAVING PROFILE

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT
THUNDERBIRD ROAD
STA. 38+00 TO 43+00
FMS INDEX NO. P-180155

SCALE	DATE	SHEET NO.	TOTAL SHEETS	AS BUILT
HORIZONTAL 20'		20	80	
VERTICAL 2'				

84 S 84

THUNDERBIRD ROAD
19TH AVENUE TO 8TH AVENUE
PHOENIX STREETS-MARICOPA CO.

DIBBLE & ASSOCIATES
MGJ AMC TTD 8/22/62

REVISION BY CITY OF PHOENIX
NO. | DESCRIPTION | REV. INSPECTED | DATE

REVISION BY CITY OF PHOENIX
NO. | DESCRIPTION | REV. INSPECTED | DATE

REVISION BY CITY OF PHOENIX
NO. | DESCRIPTION | REV. INSPECTED | DATE

Full Super 44+90

Normal Crown 45+90.22

EQUATION
P.T. Sta. 45+68.63 Bk.
= P.T. Sta. 45+67.02 Ahd.

1320 1318 1316 1324 1322

C:17.79 G:17.29

Exist. Grd. 47' Lt.

+1.0905%

12.05

97.54' V.C. +30

99.38' V.C. +30

P: 18.29 18.12

12.83 12.22 11.96

C:19.54 G:19.04

44+90 Bk. Lt.

Top Lt. Curb

+1.3570 %

Lt. Gutter Grade

Pvmt. of Gutter 12' Rt. of ℄

Pvmt. of Gutter 12' Lt. of ℄

Exist. ℄ Grade

Fin. Constr. ℄ Grade

20.37 19.71

C:20.90 G:20.40

45+89.3 45+90.22 Ref.

End Ref. Meet Exist.

C:21.50 G:21.00

+1.0593%

C:21.90 G:21.40

End Ref. Meet Exist.

C:22.15 G:21.65

47+03.9 47+08.22 Ref.

Top Fr. Rd. Curb

+1.0896 % Exist. Fr. Rd. Gutter Grade Lt.

C:23.15 G:22.65

Break Rt. & Lt.

Fin. Const. Grade ℄, 12' Rt. and 12' Lt.

21.12

S=+1.0865%

S=+1.4100 %

46+00 Grd. Break Rt.

48+00 Grade P=23.40

Top Rt. Curb

Top Fr. Rd. Curb

+0.1455%

Rt. Gutter Grade

+0.5500%

C:22.80 G:22.30

S=+1.3725% Exist. Fr. Rd. Gutter Grade Rt.

P: 18.51 18.12

End Rt. (60' Rt.) C:19.41 G:18.91

(47' Rt.) C:19.11 G:18.61

C:19.29 G:18.79

102+16 V.C. (True Dist.) +30

44+40 P.V.C. C:20.80 G:20.30

P.T. 44+90 Grd. Bk. Rt. C:21.39 G:20.89

Grd. = (-0.15')

P.T. 45+40 C:21.61 G:21.11

C:21.70 G:21.20

Full Super 44+90

Normal Crown 47+40

0 1 INCH SCALE

RECORD DRAWING
FIELD ENGINEERING
DIVISION
DATE 12-12-62

PAVING PROFILE

CITY OF PHOENIX, ARIZONA
PUBLIC WORKS DEPARTMENT

THUNDERBIRD ROAD
STA. 43+00 TO 48+00
FMS INDEX NO. P-780155

22 80

43 44 45 46 47 48

84.386

THUNDERBIRD ROAD
19TH AVENUE TO 8TH AVENUE
PHOENIX STREETS-MARICOPA CO.

DIBBLE & ASSOCIATES
MGJ AMC TTD 8/22/62

REVISION BY CITY OF PHOENIX
NO. | DESCRIPTION | REV. INSPECTED | DATE

REVISION BY CITY OF PHOENIX
NO. | DESCRIPTION | REV. INSPECTED | DATE

REVISION BY CITY OF PHOENIX
NO. | DESCRIPTION | REV. INSPECTED | DATE

Full Super 44+90

Normal Crown 45+90.22

EQUATION
P.T. Sta. 45+68.63 Bk.
= P.T. Sta. 45+67.02 Ahd.

1320 1318 1316 1324 1322

C:17.79 G:17.29

Exist. Grd. 47' Lt.

+1.0905%

12.05

97.54' V.C. +30

99.38' V.C. +30

P: 18.29 18.12

12.83 12.22 11.96

C:19.54 G:19.04

44+90 Bk. Lt.

Top Lt. Curb

+1.3570 %

Lt. Gutter Grade

Pvmt. of Gutter 12' Rt. of ℄

Pvmt. of Gutter 12' Lt. of ℄

Exist. ℄ Grade

Fin. Constr. ℄ Grade

20.37 19.71

C:20.90 G:20.40

45+89.3 45+90.22 Ref.

End Ref. Meet Exist.

C:21.50 G:21.00

+1.0593%

C:21.90 G:21.40

End Ref. Meet Exist.

C:22.15 G:21.65

47+03.9 47+08.22 Ref.

Top Fr. Rd. Curb

+1.0896 % Exist. Fr. Rd. Gutter Grade Lt.

C:23.15 G:22.65

Break Rt. & Lt.

Fin. Const. Grade ℄, 12' Rt. and 12' Lt.

21.12

S=+1.0865%

S=+1.4100 %

46+00 Grd. Break Rt.

48+00 Grade P=23.40

Top Rt. Curb

Top Fr. Rd. Curb

+0.1455%

Rt. Gutter Grade

+0.5500%

C:22.80 G:22.30

S=+1.3725% Exist. Fr. Rd. Gutter Grade Rt.

P: 18.51 18.12

End Rt. (60' Rt.) C:19.41 G:18.91

(47' Rt.) C:19.11 G:18.61

C:19.29 G:18.79

102+16 V.C. (True Dist.) +30

44+40 P.V.C. C:20.80 G:20.30

P.T. 44+90 Grd. Bk. Rt. C:21.39 G:20.89

Grd. = (-0.15')

P.T. 45+40 C:21.61 G:21.11

C:21.70 G:21.20

Full Super 44+90

Normal Crown 47+40

0 1 INCH SCALE

RECORD DRAWING
FIELD ENGINEERING
DIVISION
DATE 12-12-62

PAVING PROFILE

CITY OF PHOENIX, ARIZONA
PUBLIC WORKS DEPARTMENT

THUNDERBIRD ROAD
STA. 43+00 TO 48+00
FMS INDEX NO. P-780155

22 80

43 44 45 46 47 48

84.386

– MAJOR STREETS
PHOENIX STREETS – MARICOPA COUNTY

FHWA REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
IX	ARIZ.	BR-71112.00	1	7	

LENGTH OF PROJECT

CITY OF PHOENIX
ENGINEERING DEPARTMENT
DIVISION OF DESIGN
PROJECT NO. BR 71112.00
W. THUNDERBIRD RD.
BRIDGE OVER
SWEETWATER WASH

MAYOR
JOHN D. DRIGGS

CITY COUNCIL

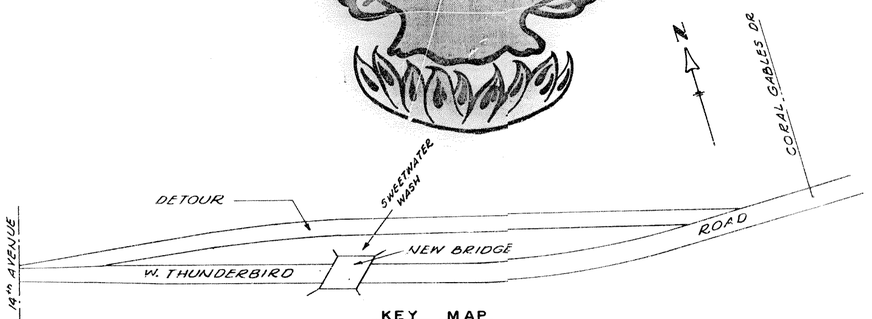
HENRY E. BRODERSEN	ED KORRICK
ARMANDO deLEON	CALVIN C. GOODE
JOHN T. KATSENES	MARGARET T. HANCE

CITY MANAGER	JOHN B. WENTZ
CITY ENGINEER & SUP'T. OF STREETS	JAMES E. ATTEBERY
CITY TRAFFIC ENGINEER	CHARLES E. HALEY
STREET MAINT. DIRECTOR	JAMES A. STOKELY

APPROVED _____ CITY ENGINEER _____ DATE

INDEX OF SHEETS

SHEET NO	DESCRIPTION
1	CITY OF PHOENIX COVER SHEET
2-3	PLAN AND PROFILE
4	LOCATION PLAN, NOTES & QUANTITIES
5	FOUNDATION DATA
6-7	BRIDGE DETAILS



KEY MAP

HOFFMAN-MILLER ENGINEERS INC.
PHOENIX, ARIZONA

I HEREBY CERTIFY THAT THESE ARE OFFICIAL AS-BUILT PLANS
Robert J. Spittal Jr. 4-3-74
DATE

As-Built TOM J. CELAYA
Inspector DICK TURK
Party Chief DICK FUELD
Contractor TIFFANY CONST.

LOG NUMBER

	NO. SERVICES WITHIN PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
ARIZONA PUBLIC SERVICE			
SALT RIVER POWER DISTRICT			
S.R.V.W.U.A.			
MT. STATES TEL. & TEL. CO.			
COUNTY HIGHWAY DEPT.			
ARIZ. STATE HIGHWAY DEPT.			
WATER & SEWERS DEPT.			

40387 BR-71112.00

W. THUNDERBIRD ROAD
PHOENIX STREETS-MARICOPA CO.

FED. ROAD REG. NO.	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
7	ARIZ.	BR-71112.00	2	7	

HOFFMAN-MILLER ENGINEERS
CONSULTING ENGINEER
DES: DRD DR: RHS CK: DATE: 8 7 72

B.M. Brass Cap On Surface
15th Ave. & Thunderbird Rd.
215'± E. Of 15th Dr. Elev. 1311.59

New Delineators
40' c.c. (typ.)
See Detail Sheet #4

Remove 2-42" Dia.
Conc. Pipe Culverts ①②

New Guard Rail Lt 312.5' & Rt 312.5'
Spaced Symmetrically About ℄ Pier
AHD Std C-10.01, C-10.02, C-10.03, C-10.06

DETOUR See Sheet 3 of 7

SWEETWATER WASH FLOW

Install 2-24" dia. C.M.P. 45' Long 14 Gage

CURVE DATA CONSTRUCTION ℄
Δ = 13°27'36"
T = 214'
R = 1800'
L = 426'

Temporary Easement

Replace B.C. Det. 193

Undergr. Telephone

Exist P.P.

Sawcut

THUNDERBIRD
N 73°40'34" W

Exist Brass Cap Sta 2+00

Existing Brass Cap

204.28'

30:1 Taper

40:1 Taper

Grade to Drain

Typ.

Mortared Rip-Rap

See Cross-Sections Sheet #3

Taper 55' Each Edge of Pavement on Curve to Match Existing Pavement Edge @ Sta. 11+40±

Adjust M.Hs. to Grade.

ROAD

CONST. ℄

R/W

Exist P.R.

Meet Existing
Sta. ~~4+00~~ 3+97.7
Elev. 1316.49

Meet Exist.
Sta. ~~11+40~~ 11+56
Elev. 1318.40

PROFILE SEE REVISION

P.I.V.C. Sta. 5+80 Elev. 1319.75 Corr. = -0.34'

P.I.V.C. Sta. 8+35 Elev. 1319.75 Corr. = -0.19'

P.I.V.C. Sta. 10+65 Elev. 1317.46 Corr. = +0.42

+1.8111%

-0.9957%

+1.2533%

Fin. ℄ Grade

Exist. ℄ Grade

Level

Elev. 1317.9
Q_{50} = 2200 cfs

Approx. Depth of Telephone Line As Per Mountain States Information

2-Exist. 42" Pipe Culverts

Top of Gas Main

150' V.C.

59'-0"

Note: See X-Sections Sheet 3

32'-0" Roadway

6' Max | 8' min | 10' Sh'lder | Varies-See Plan | Constr. ℄ | Varies-See Plan | 10' Sh'lder

Profile Grade

0.015'/ft

6" Agg. Base

3" Asph. Conc.

Slope 4:1 Sta. 4+00 to 6+80.5

Slope 2:1 Max Sta. 7+39.5 to 11+40

Note: See Special Provisions for Compacted Fill Specifications

ROADWAY SECTION
Sta 4+00 to 6+80.5, Sta 7+39.5 to 11+40
Scale: 1"=5'

14' max.

Approximate Earthwork Quantities (Inc. Channel Excavation)
(See Note at Right)
Rdwy. Emb. = 1220 CY
Rdwy. Exc. = 1560 CY

B.M. - Nail in S. Face Power Pole
N. Side Thunderbird Rd. 426'W.
Of Coral Gables Dr. Elev. 1317.77

14th Ave. | 56.9' Rt. Stop Sign | 48' Rt. W. Valve | 63.6' Tel. Junct. Box, 6' P. Elec. Junct. Box | 63.1' St. Light | 63.7' Tel. J.B. | 62' Elec. J.B. | 44'-10" Citrus | 43.4' Irr. Lt. Abandoned | 48.8' Water Riser | 62.8' Tel. J.B. | 62.1' St. Light | Top of Dike (No Road) | 66' Guy Anchor | 18.8' Traffic Sign | 59.5' Power Pole | 39.3' Guy Anchor | 104.4' S.S.M.H. | 18.3' Hazard Marker | 20' Hazard Marker | 19' Traffic Sign | 13th Pl. | 0.0' Exist. Brass Cap | 24' S.S.M.H. | 68' W. Valve | 20' S.S.M.H. | 11th Ave. | 19.9' Traffic Sign | 24' Traffic Sign | 37.0' Guy Anchor | 40.0' Power Pole | 0.0' Exist Brass Cap | 248' Traffic Sign

MISCELLANEOUS REMOVALS

REMOVE 42" CONCRETE PIPE

	Sta.		L.F.
①	7+15±	Lt. & Rt.	64
②	7+25±	Lt. & Rt.	64

REMOVE A.C. PAVEMENT

Sta	S.Y.
4+00 to 11+40	2226

SHEET SUMMARY

Description	Standard	Quantity
Guard Rail-Steel	* See Below	437 L.F.
New A.C. Pav't.		2300 S.Y.
Delineators **		31 Ea.
Adjust M.H.		2 Ea.

** See Detail Sheet 4

* A.H.D. Standards C-10.01, C-10.02, C-10.03, C-10.06

NOTE:
The approx. earthwork quantities shown are for informational purposes ONLY. These quantities do not reflect shrinkage or ground comp. and therefore should be adjusted accordingly.

ASBUILT
DIVISION OF ENGINEERING
DATE 4-3-74

CITY OF PHOENIX, ARIZONA
PUBLIC WORKS DEPT. DIV. OF ENGINEERING

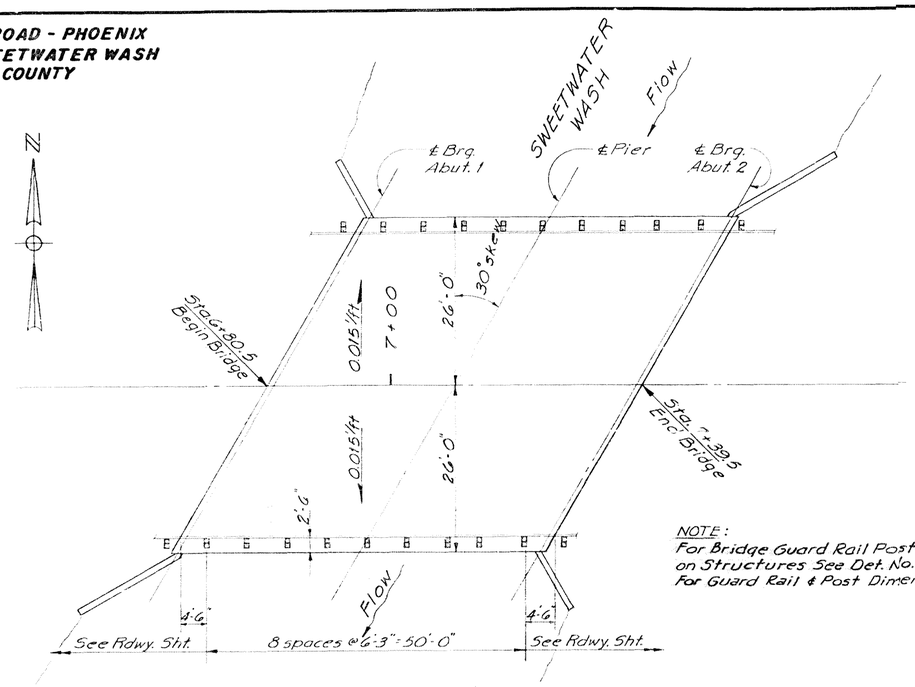
W. THUNDERBIRD ROAD
BR 71112.00

DES. DRD	DR. RJS	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE: 8/72	DATE: 8/72	DATE:	2	7	

SCALE 1" = 40' HORIZONTAL, 4' VERTICAL

10388

W. THUNDERBIRD ROAD - PHOENIX
BRIDGE OVER SWEETWATER WASH
MARICOPA COUNTY

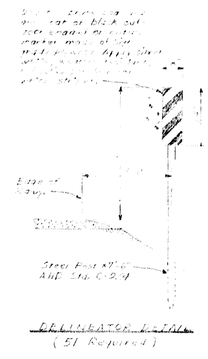


STA. 7+
LOCATION PLAN
New 2 Span R.C. Slab Bridge
Scale 1"=10'-0"

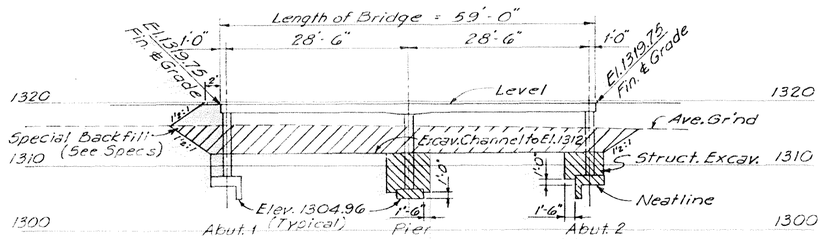
NOTE:
For Bridge Guard Rail Post Installation on Structures See Det. No. 1 A.H.D. Std. C-10.02
For Guard Rail & Post Dimensions See A.H.D. Std C-10.01

GENERAL NOTES

Construction: City of Phoenix Standard Specifications, revised to date.
Design: A.A.S.H.O. Specification for Highway Bridges, Edition of 1969, revised to date.
Loading Class: HS 20-44
Allowable Stresses:
Class "A" Concrete - f_c = 1200 #/in²; n=10
Reinforcing Steel - f_s = 20,000 #/in²
Reinforcing Steel shall be Grade 40 conforming to A.S.T.M. A-615.
Structural Steel shall conform to A.S.T.M. A-36.
All dimensions for reinforcing steel shall be from the surface of the concrete to the ctr. of the bars unless otherwise noted on plans.
Chamfer all exposed corners & edges ¾" unless otherwise noted on plans.



DELINEATOR (51 Required)



SECTION ON CONSTRUCTION ℄
Scale 1"=10'-0"

Item	Reinf. Steel lbs.	Concrete Cu. Yds. Class "A"	Struct. Excav. C.Y.**	Special Backfill C.Y.**	Steel Guard Rail L.F.
Deck	30,772	149.93	—	—	625
1 Pier	3,270	45.46	102	—	—
2 Abutments*	8,418	125.14	194	296	—
Total	42,460	320.53	296	296	625

* Includes Wingwalls
** For Informational Purposes ONLY. No Pay Item.

ASBUILT
DIVISION OF ENGINEERING
DATE 4-3-74

CITY OF PHOENIX

SCALE 1"=10'	LOCATION PLAN	DRAWN BY DRD	
DATE 8-'72		REVISED	
STA. 7+ W. THUNDERBIRD ROAD BRIDGE OVER SWEETWATER WASH			
HOFFMAN-MILLER ENGINEERS PHOENIX ARIZONA		DRAWING NUMBER 4 of 7	

40390 BR-71112.00

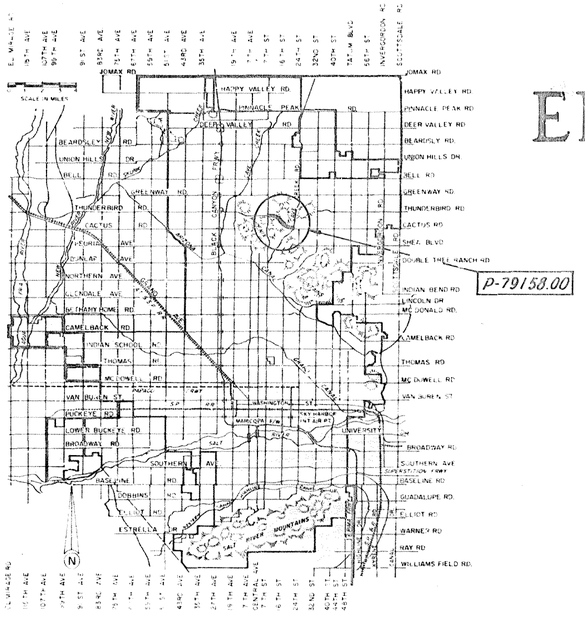
DIETZGEN PORT CLEARPRINT 1000H

FHWA REGION	STATE	PROJ NO	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ		1	89	

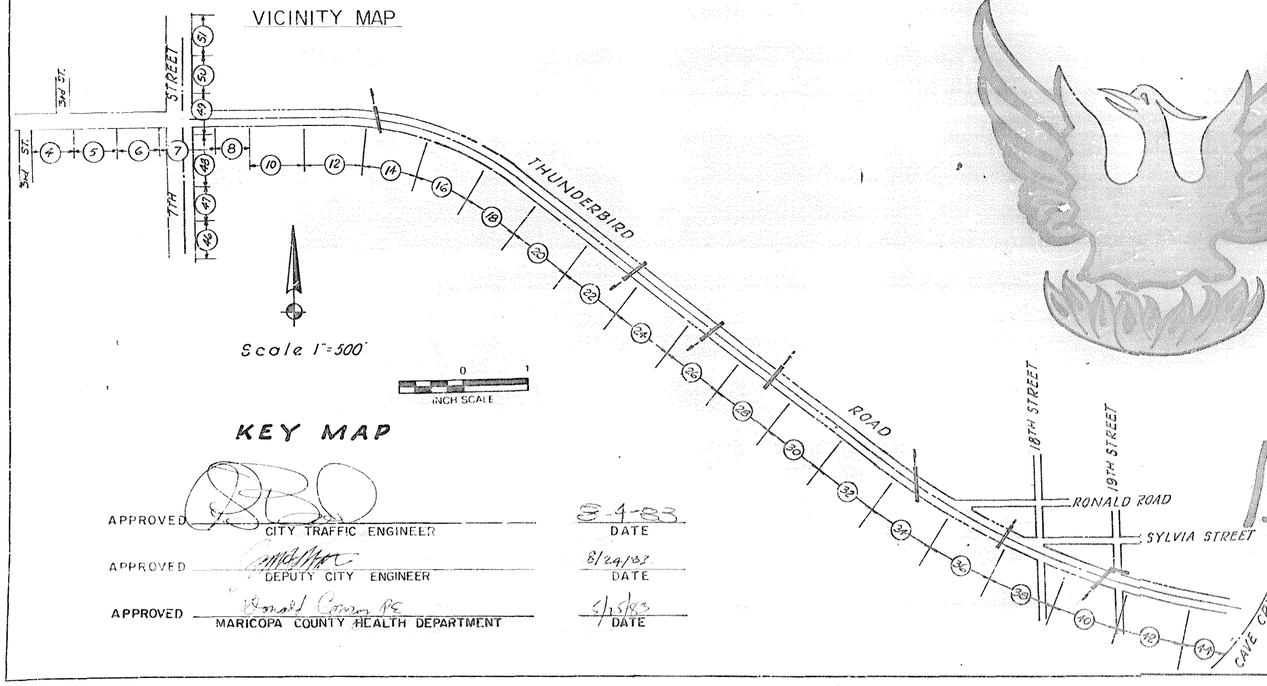
LENGTH OF PROJECT
Sta. 4+10.43 to Sta. 91+48.05
8,737.62 Feet = 1.6549 Miles

CITY OF PHOENIX
ENGINEERING DEPARTMENT
DIVISION OF DESIGN
P-79158.00
THUNDERBIRD ROAD
7TH STREET TO CAVE CREEK ROAD

INDEX NO. P-791582



VICINITY MAP



KEY MAP

APPROVED _____ CITY TRAFFIC ENGINEER — 8-1-83 DATE

APPROVED _____ DEPUTY CITY ENGINEER — 8/24/83 DATE

APPROVED _____ MARICOPA COUNTY HEALTH DEPARTMENT — 5/25/83 DATE

15-86-17

MAYOR
MARGARET T HANCE

CITY COUNCIL

HOWARD ADAMS	KEN O'DELL
ED. KORRICK	BARRY STARR
CALVIN C. GOODE	JIM WHITE

CITY MANAGER	MARVIN A. ANDREWS
CITY ENGINEER & SUP'T. OF STREETS	JAMES E. ATTEBERY
CITY TRAFFIC ENGINEER	DONALD C. MORGAN
STREET MAINT. ADMINISTRATOR	RICHARD SHINE

SHEET INDEX

Sheet No. 1 This Sheet, Key Map, Index
Sheet No. 2 Legend and Notes
Sheet No. 2A&2B Roadway Summary
Sheet No. 4 to 51 Paving Plan and Profile
Sheet No. 52 Alternate Pipe Chart
Sheet No. 53 to 59 Pipe Profiles
Sheet No. 60,to 64 Details
Sheet No. 65 to 70 X Sections
Sheet No. 71 & 72 Traffic Signals
Sheet No. 73 to 89 Landscape Plans

I HEREBY CERTIFY THAT THESE ARE OFFICIAL RECORD DRAWINGS
Robert J. Spitler 10-21-87 DATE

Drawn By J. Doyle
Inspector F. Gardner
Party Chief C. Paddock
Contractor The Tanner Co

84445 LOG NUMBER

	NO. SERVICES WITHIN PROJECT	REVISED	PERMIT RECEIVED
ARIZ PUBLIC SERVICE			
SALT RIVER POWER DISTRICT			
S. R. V. W. U. A.			
MT. STATES TEL. & TEL. CO.			
COUNTY HIGHWAY DEPT.			
ARIZ. DEPT. OF TRANSPORTATION			
WATER & SEWERS DEPT			

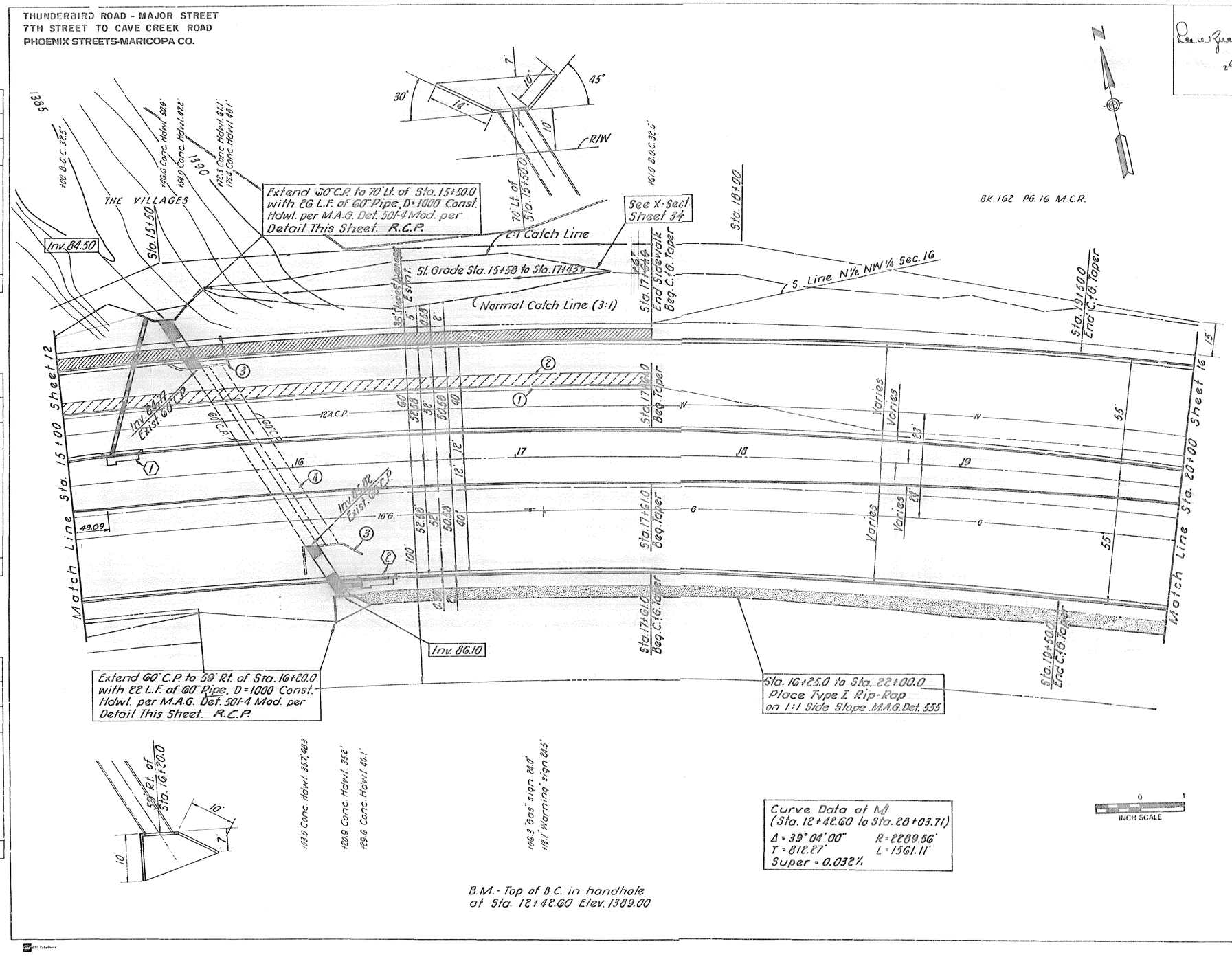
P-791582

THUNDERBIRD ROAD - MAJOR STREET
7TH STREET TO CAVE CREEK ROAD
PHOENIX STREETS-MARICOPA CO.

REVISION BY CITY OF PHOENIX			
NO.	DESCRIPTION	REV BY/CK'D BY	DATE

REVISION BY CITY OF PHOENIX			
NO.	DESCRIPTION	REV BY/CK'D BY	DATE

REVISION BY CITY OF PHOENIX			
NO.	DESCRIPTION	REV BY/CK'D BY	DATE



F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.		14	89	

HOOK ENGINEERING, INC. CONSULTING ENGINEER

DES. | DR. | CK. | DATE

REMOVAL NOTES

1. Remove 261 L.F. of curb & gutter
2. Remove 1305 S.F. of sidewalk
3. Remove 2 exist. culvert headwalls
4. Remove 97 L.F. of 60" C.P., Fill and compact excavation.

CATCH BASIN & PIPE CONNECTION

No.	Station	Type	Size & L.F.	X-Sect.
1	15+16.8 Lt.	M-1, L-10	15"x 65' M.R.C.P. Class 3	Sht. 53
2	16+30.0 Rt.	M-1, L-10	15"x 11' M.R.C.P. Class 3	Sht. 53

SHEET SUMMARY

~~Curb & Gutter, M.A.G. Det. 220-A 1502 L.F.~~
~~Single Curb, M.A.G. Det. 222-A 498 L.F.~~
~~Sidewalk, M.A.G. Det. 230 1336 S.F.~~
~~60" R.C.P. Culvert Pipe, D=1000 40 L.F.~~
~~M.A.G. Det. 501-4 Mod. Headwalls 2 Ea.~~
~~M.A.G. Det. 555, Type L Riprap 354 S.Y.~~

RECORD DRAWING
FIELD ENGINEERING
DIVISION
DATE 10-21-81

PAVING PLAN

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

THUNDERBIRD ROAD
7TH STREET TO CAVE CREEK ROAD
84458 P-79158.00

DR. L.W.Z.	DES. L.W.Z.	CK. T.M.H.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE 1-80	DATE 2-80	DATE 6-81			
Scale 1"=20'			14	89	

THUNDERBIRD ROAD - MAJOR STREET
7TH STREET TO CAVE CREEK ROAD
PHOENIX STREETS-MARICOPA CO.

FHWA REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ		15	89	

HOOK ENGINEERING, INC. CONSULTING ENGINEER

DES. | DR. | CK. | DATE

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV. BY	CKD BY	DATE
1.	Change Street Name Items	AHF		11-81

Top of exist curb Lt.
Exist. gutter Lt.
Exist profile of back of curb Lt.
Exist profile of Mf.
Finish Profile Grade
Top of Curb Lt.
Gutter Lt.
Exist. profile at back of curb Rt.
Top of Curb Rt.
Gutter Rt.
Beg. Curb Trans.
End Curb Trans.
409.19' V.C.
390.81' V.C.
C=93.63
G=93.13
C=95.11
G=95.02
C=96.19
G=96.10
C=97.08 (PI)
G=96.58 (PI)
C=99.92
G=99.42
C=99.10
G=98.60
C=91.04
G=90.54
C=92.52
G=92.02
C=94.49 (PI)
G=93.99 (PI)
C=96.37
G=96.37
C=96.10
G=95.60
P=91.35
P=93.33
P=95.30 (PI)
P=97.91
+0.9843%
+0.9843%
+1.8134%
+1.7231%
+1.6325%
-1.0078%
-0.3540%
1394
1392
1390
1388
1386
1400
1398
1396
1394
1392
15
16
17
18
19
20

RECORD DRAWING
FIELD ENGINEERING
DIVISION
DATE 10-21-82

PAVING PROFILE

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

THUNDERBIRD ROAD
7TH STREET TO CAVE CREEK ROAD
84458 P-79158.00

DES. L.W.Z.	TER.	L.W.Z.	TCK.	J.M.H.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE 2-80		DATE 7-80		DATE 6-81			
SCALE 1" = 50' HORIZONTAL / 5' VERTICAL					15	89	

KEY TO MAP

500-Year Flood Boundary
100-Year Flood Boundary
Zone Designations* With Date of Identification e.g., 12/2/74
100-Year Flood Boundary
500-Year Flood Boundary

ZONE B
ZONE A1 DATE
ZONE A5 DATE
ZONE B

Base Flood Elevation Line With Elevation In Feet** — 513
Base Flood Elevation in Feet Where Uniform Within Zone** (EL 987)
Elevation Reference Mark RM7×
Zone D Boundary
River Mile •M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

For description of Elevation Reference Marks, see Panel 040051 0120 C.

INITIAL IDENTIFICATION:
JUNE 28, 1974

FLOOD HAZARD BOUNDARY MAP REVISIONS:
SEPTEMBER 12, 1975

FLOOD INSURANCE RATE MAP EFFECTIVE:
DECEMBER 4, 1979

FLOOD INSURANCE RATE MAP REVISIONS:
June 1, 1984—to [illegible] special flood hazard area, to change corporate limits, to change flood elevations, to add [illegible] flood elevations.

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE
1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY OF
PHOENIX, ARIZONA
MARICOPA COUNTY

PANEL 50 OF 135
(SEE MAP INDEX FOR PANELS NOT PRINTED)

RECORD SET

COMMUNITY-PANEL NUMBER
040051 0050 C

MAP REVISED:

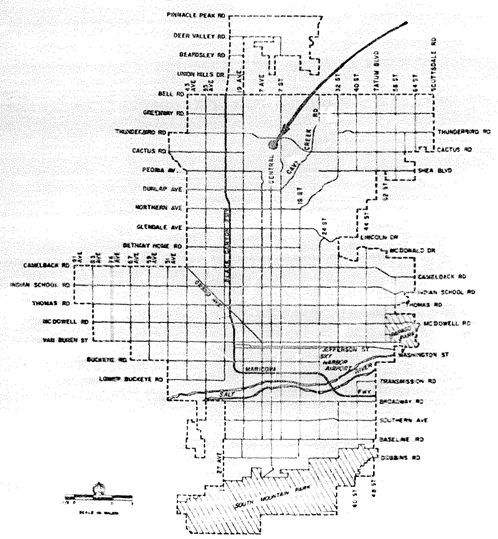
ENGINEERING DEPARTMENT

STORM SEWER

DETENTION BASIN NO. 7

CENTRAL AVE. & CACTUS RD.

ST-75093.00



VICINITY MAP

MAYOR

MARGARET T. HANCE

CITY COUNCIL

JOY W. CARTER	ROSENDO "ROSIE" GUTIERREZ
WILLIAM C."BILL" DONAHUE	KEN O'DELL
CALVIN C. GOODE	AMY T. WORTHEN

CITY MANAGER	MARVIN A. ANDREWS
CITY ENGINEER	JAMES E. ATTEBERY
ASST. DIRECTOR MAINT. & SAN. DEPT.	GARY P. FARMER

I HEREBY CERTIFY THAT THESE ARE OFFICIAL AS-BUILT PLANS

Robert J. Spittel 8-8-79
DATE

As-Built R.J. SPITTEL

Inspector R. TURK

Party Chief A. ROBLES

Contractor MARDIAN

Donald B. Burns 11-1-79

APPROVALS:

CITY ENGINEER — DATE 11/9/79

ASST. DIRECTOR MAINT. & SAN. DEPT. — DATE

FLOOD CONTROL DIST., MARICOPA COUNTY
HERBERT P. DONALD, CHIEF ENGINEER

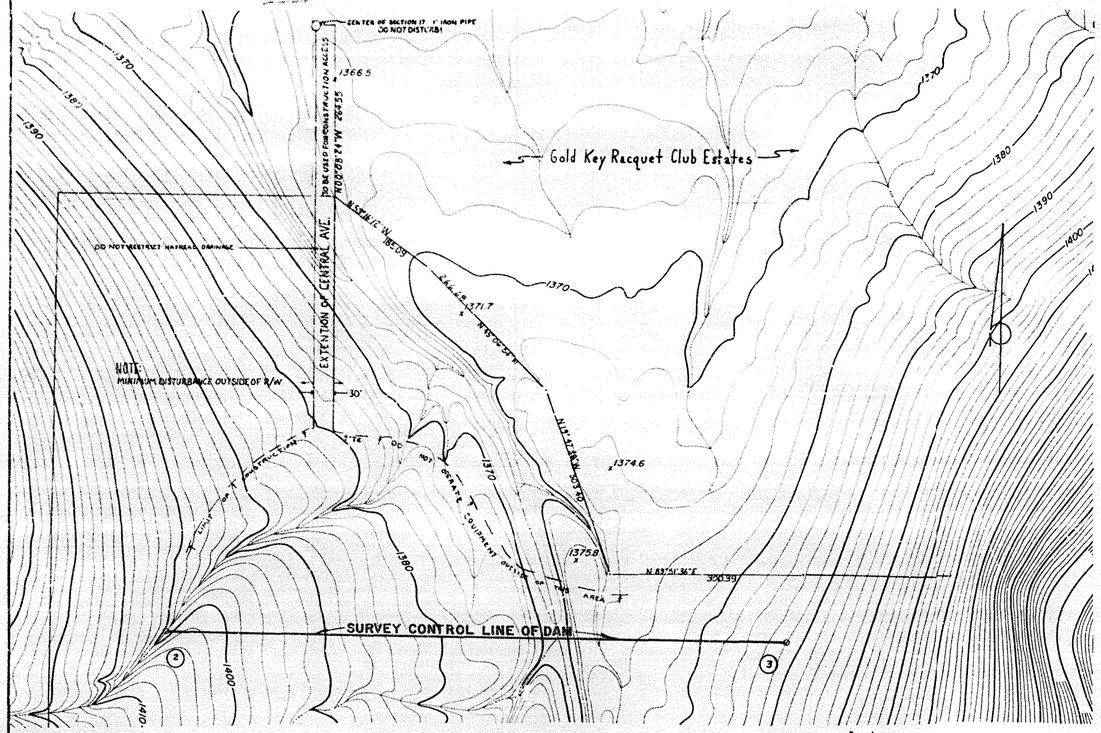
APPROVED BY: CHIEF ENGINEER — DATE

24X

ST-75093.00

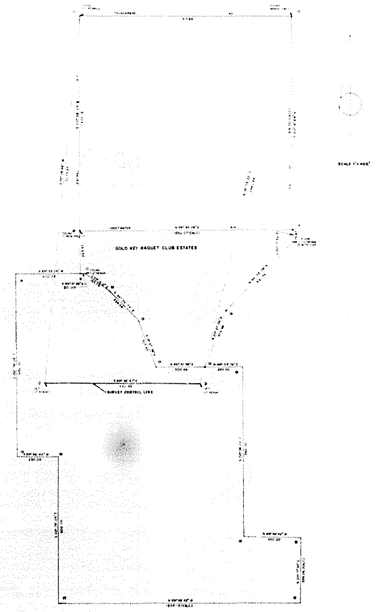
54804

G

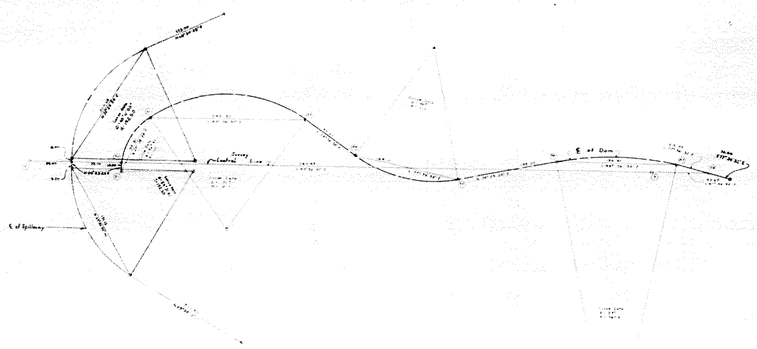


PROPERTY LINES

SCALE 1"=100'



LOCATION SURVEY



DAM GEOMETRY

SCALE 1"=100'

24X

ASBUILT
DIVISION OF ENGINEERING
DATE 8-8-78

DAM No.7
HORIZONTAL CONTROL
64805

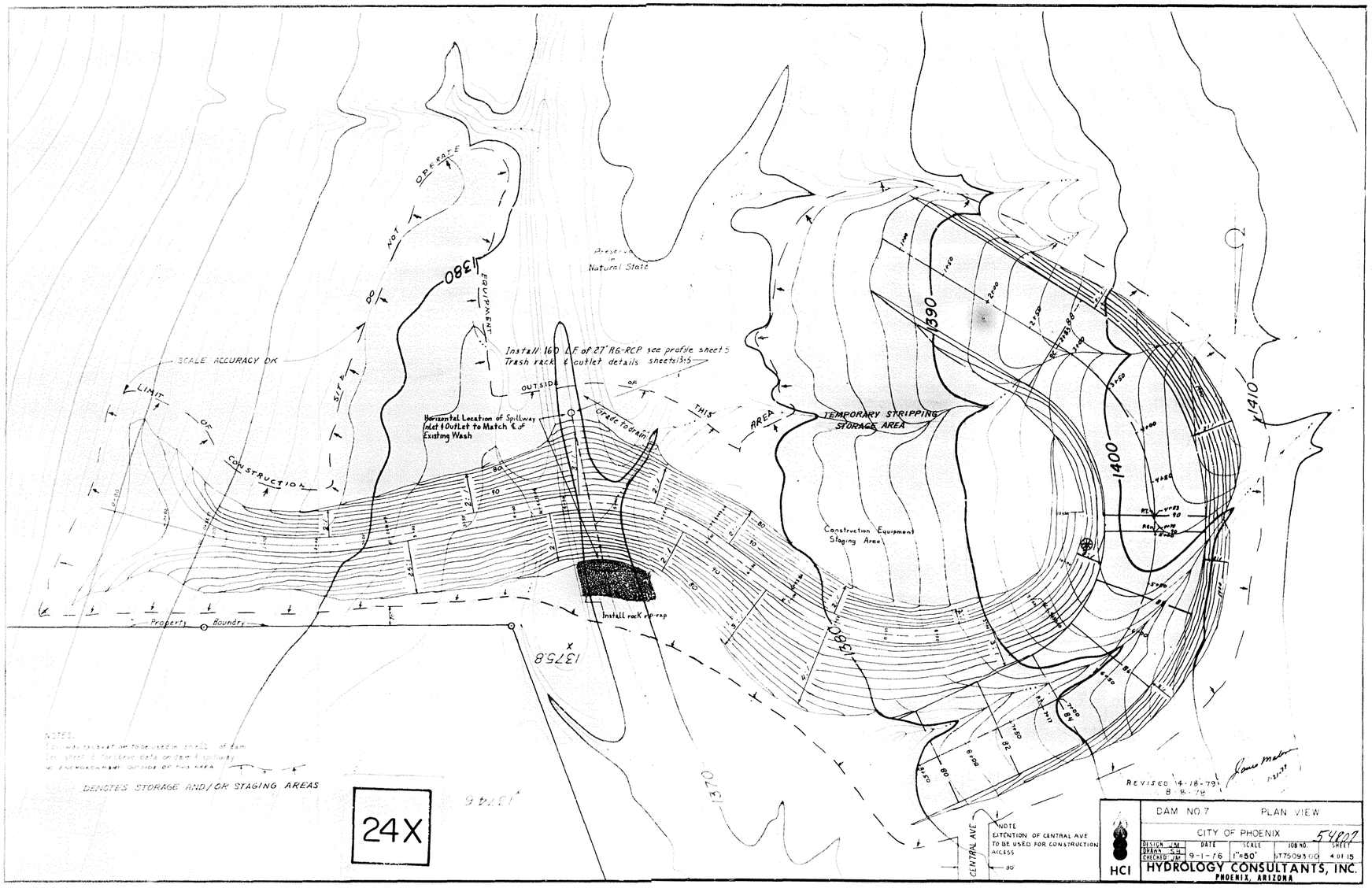
CITY OF PHOENIX

DESIGN :JM	DATE	SCALE	JOB NO.	SHEET
DRAWN :HM	9/19/76		ST75093.0	2 OF 15
CHECKED:				

HCI

HYDROLOGY CONSULTANTS, INC.
PHOENIX, ARIZONA

April 4, 1979
Set ½" rebar on slope of west end of dam, adjacent to spillway. Elev. 1395.75, City of Phoenix Datum. Marked with 2 long lath with yellow flagging. Flagging around rebar.



DAM NO. 7 PLAN VIEW

CITY OF PHOENIX 54827

DESIGN JM	DATE	SCALE	JOB NO	SHEET
DRAWN SH				
CHECKED JM	9-1-76	1"=50'	5775093.00	4 OF 15

HCI HYDROLOGY CONSULTANTS, INC.
PHOENIX, ARIZONA

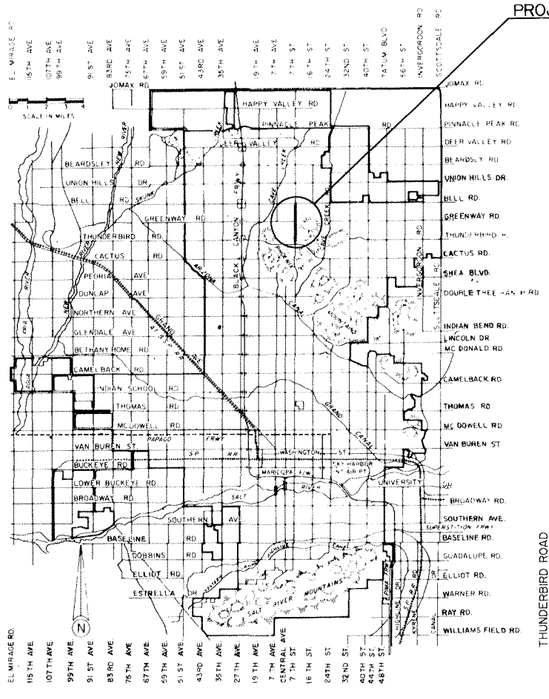
FHWA REGION	STATE	PROJ NO	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	P-856013	1		

LENGTH OF PROJECT: 8,773.6Ft.=1.6617Mi.

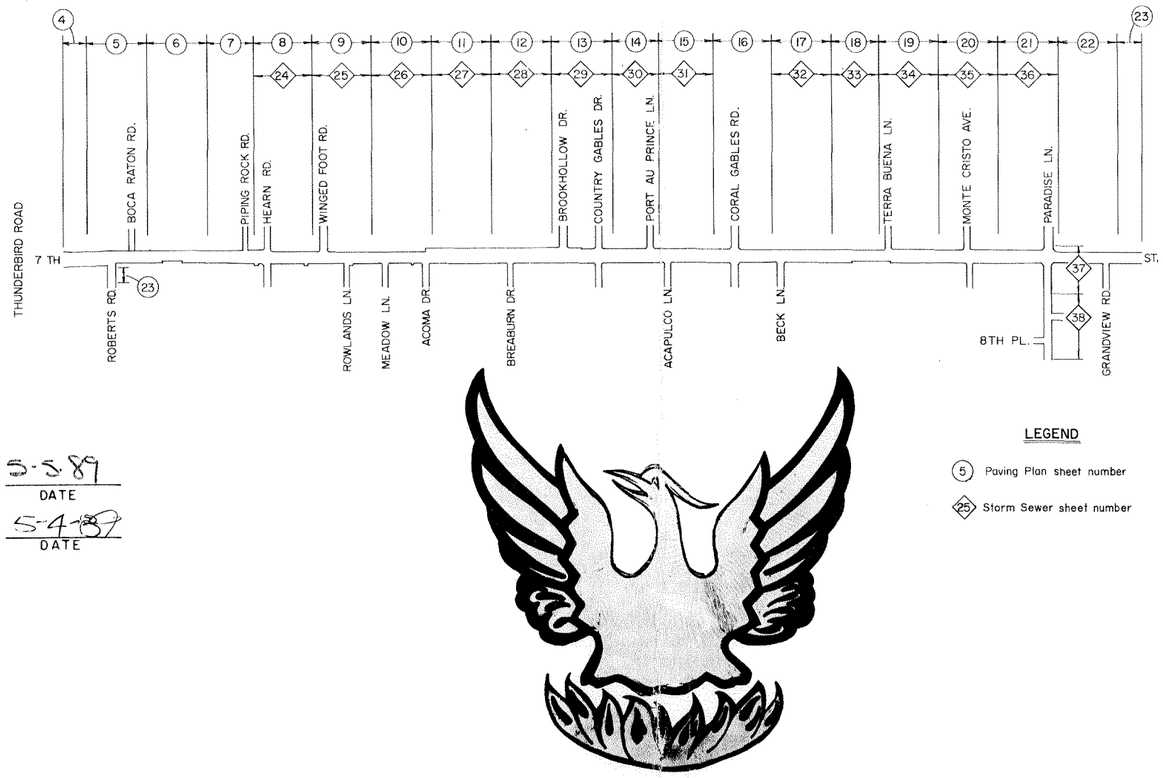
CITY OF PHOENIX
ENGINEERING DEPARTMENT
DIVISION OF DESIGN

7TH STREET *(THUNDERBIRD ROAD TO BELL ROAD)* P-856013

PROJECT NO. P-856013



VICINITY MAP



LEGEND

(5) Paving Plan sheet number

◇25◇ Storm Sewer sheet number

APPROVED _____ DEPUTY CITY ENGINEER, DESIGN — DATE 5-5-89

APPROVED _____ DEPUTY STREETS TRANSPORTATION DIRECTOR — DATE 5-4-89

1988

MAYOR

TERRY GODDARD

CITY COUNCIL

DISTRICT NO.1	DR. BILL PARKS	DISTRICT NO. 5	HOWARD ADAMS
DISTRICT NO.2	DUANE PELL	DISTRICT NO. 6	LINDA NADOLSKI
DISTRICT NO.3	PAUL JOHNSON	DISTRICT NO. 7	MARY ROSE WILCOX
DISTRICT NO.4	JOHN B. NELSON	DISTRICT NO. 8	CALVIN C. GOODE

CITY MANAGER	MARVIN A. ANDREWS
DIRECTOR OF ENGINEERING	RAMON F. MIGUEZ
STREETS & TRAFFIC DIRECTOR	JAMES H. MATTESON
DEPUTY STREETS TRANSPORTATION DIRECTOR	THOMAS E. CALLOW

INDEX

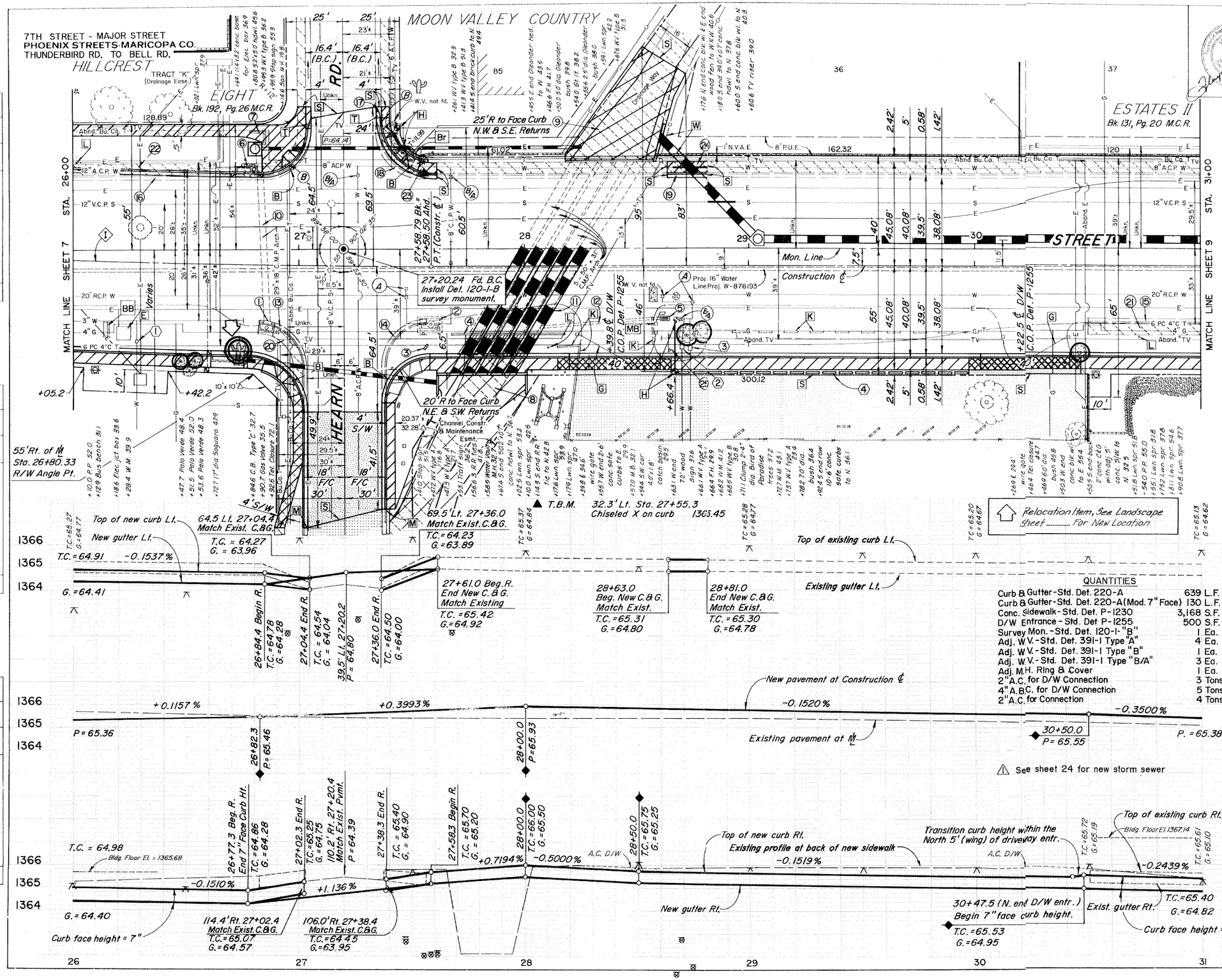
SHEET NO. 1. . . . . THIS SHEET
SHEET NO. 2 . . . . . LEGEND AND NOTES
SHEET NO. 2A,2B. . . . . SUMMARY SHEETS
SHEET NO. 3 . . . . . TYPICAL SECTIONS
SHEET NO. 4-23 . . . . . PAVING PLAN & PROFILE
SHEET NO. 24-38. . . . . STORM SEWER PLAN & PROFILE
SHEET NO. 39. . . . . SOIL BORING LOG
SHEET NO. 40. . . . . ALTERNATE PIPE TABLE
SHEET NO. 41-53 . . . . . CATCH BASIN CROSS SECTIONS
SHEET NO. 54-56 . . . . . HEADWALL DETAILS

LOG NUMBER

Sheet 1 of

for working days before you dig CALL FOR THE BLUE STAKES 263-1100 Blue Stake Center

	NO. SERVICES WITHIN PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
ARIZONA PUBLIC SERVICE			
SALT RIVER POWER DISTRICT			
S R V W U A			
MT STATES TEL & TEL. CO			
COUNTY HIGHWAY DEPT.			
ARIZ DEPT OF TRANSPORTATION			
WATER & SEWERS DEPT			



FHWA REGION	STATE	PROJ. NO	SHEET NO	TOTAL SHEETS	AS BUILT
9	ARIZ.	P-856013	8		

FLOYD M. WHITMORE ENGINEERS, INC. — CONSULTING ENGINEER

DES B.W. | DR S.E.L. | CK F.M.W. | DATE 1986

[B] Sidewalk ramp C.O.P. Det. P-1234, Type 'B'.
[E] Relocate electrical cabinet by A.P.S.
[G] Relocate wire gate by owner.
[H] Relocate fire hydrant.
[K] Precast safety curb; see note on sheet 2.
[L] Irrig. sprinkler system; see note on sheet 2.
[M] Match existing.
[S] Sawcut and match existing.
[T] 5' curb transition M.A.G. Det. 221.
[W] Remove wood fence and concrete block wall in conflict with new construction. Replace in kind after new construction is completed. See detail on sheet 55.
[BB] Relocate bus bench to new sidewalk.
[MB] Relocate mail box behind new sidewalk.
[Br] Remove 19± L.F. brick curb. Non pay item.

CONSTRUCTION ℄ CURVE DATA

No.	Radius	△	T	L
1	4000'	2°51'32"	99.81'	199.59'

REMOVE STRUCTURE - FILL & COMPACT HOLE

No.	Station	to Station	Description
1	26+81.5 Rt.	26+89.2 Rt.	5.7' × 4.8' C.B.
2	27+53.5 Rt.	27+63.4 Rt.	9.8' × 6.1' Water Vault (Water lines killed on Project W-876193)
3	27+56.7 Rt.		3 - Vertical R.R. ties
4	27+67.5 Rt.	28+17.6 Rt.	0.7' × 50.1' Conc. hdwl. and trash rack
5	28+59.4 Rt.	28+63.4 Rt.	4.0' x 1.8' C.B.
6	26+76.0 Lt.	26+80.4 Lt.	Sidewalk scupper
7	26+78.6 Lt.	26+86.4 Lt.	7.3' x 5.0' Blk. hdwl.

SAWCUT & REMOVE CONC. CHANNEL LINING

No.	Station	to Station	S.F.
8	27+37.0 Rt.	28+17.6 Rt.	6,761
9	28+18.0 Lt.	28+71.5 Lt.	4,509

REMOVE PIPE - FILL & COMPACT HOLE

No.	Station	to Station	Description
10	26+83.4 Lt.	26+84.8 Rt.	29" × 18" × 75' CMPA
11	27+78.0 Rt.	28+11.0 Rt.	5-50"x31"x43'± CMPA
12	28+06.0 Rt.	28+59.0 Rt.	12" × 53' CMP

REMOVE CONCRETE CURB

No.	Station	to Station	Type	L.F.
13	26+81.5 Rt.	27+02.4 Rt.	2' Comb.	100.8
14	27+38.4 Rt.	27+56.6 Rt.	2' Comb.	92.7
15	30+50.5 Rt.	31+00.0 Rt.	2' Comb.	49.5
16	26+00.0 Lt.	27+04.4 Lt.	2' Comb.	121.2
17	27+36.1 Lt.		2' Roll	10.0
18	27+36.1 Lt.	27+61.0 Lt.	2' Comb.	37.4
19	28+63.0 Lt.	28+81.0 Lt.	2' Comb.	18.0

REMOVE CONCRETE SLAB

No.	Station	to Station	Type	S.F.
20	26+81.5 Rt.	27+01.8 Rt.	S/W	388.7
21	30+50.5 Rt.	31+00.0 Rt.	S/W	247.5
22	26+00.0 Lt.	27+03.8 Lt.	S/W	539.9
23	27+36.6 Lt.	27+61.0 Lt.	S/W	188.5
24	28+63.0 Lt.	28+81.0 Lt.	S/W	90.0

REMOVE SIGN (CONTINGENT ITEM)

No.	Station	Description
25	28+63.1 Rt.	7.2' wood sign

RELOCATE WATER METER & BOX BEHIND NEW SIDEWALK

No.	Station	Existing Pipe	New Pipe
1	26+28.4 Rt.	3/4" Copper	3/4" Copper
2	28+68.2 Rt.	2" Steel	2" Copper
3	28+72.7 Rt.	2" Steel	2" Copper

PRECAST SAFETY CURB (M.A.G. Det. 150, Type B-3)

No.	Station	to Station	Location	Units
4	28+67.0 Rt.	29+97.5 Rt.	46.5' Rt. Constr. ℄	18

QUANTITIES

Curb & Gutter-Std. Det. 220-A	639 L.F.
Curb & Gutter-Std. Det. 220-A(Mod. 7" Face)	130 L.F.
Conc. Sidewalk-Std. Det. P-1230	3,168 S.F.
D/W Entrance-Std. Det P-1255	500 S.F.
Survey Mon.-Std. Det. 120-1-"B"	1 Ea.
Adj. W.V.-Std. Det. 391-1 Type "A"	4 Ea.
Adj. W.V.-Std. Det. 391-1 Type "B"	1 Ea.
Adj. W.V.-Std. Det. 391-1 Type "B/A"	3 Ea.
Adj. M.H. Ring & Cover	1 Ea.
2" A.C. for D/W Connection	3 Tons
4" A.C. for D/W Connection	5 Tons
2" A.C. for Connection	4 Tons

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV. BY	CK'D BY	DATE
1	Revised Sidewalk, Lt. Revised Storm Sewer, Sta. 27+45 to Sta. 27+65 Rt.	LMH	LMH	5-89
2		LMH	LMH	8-89

PAVING PLANS

CITY OF PHOENIX, ARIZONA

ENGINEERING DEPARTMENT

7TH STREET

THUNDERBIRD ROAD TO BELL ROAD

P-856013

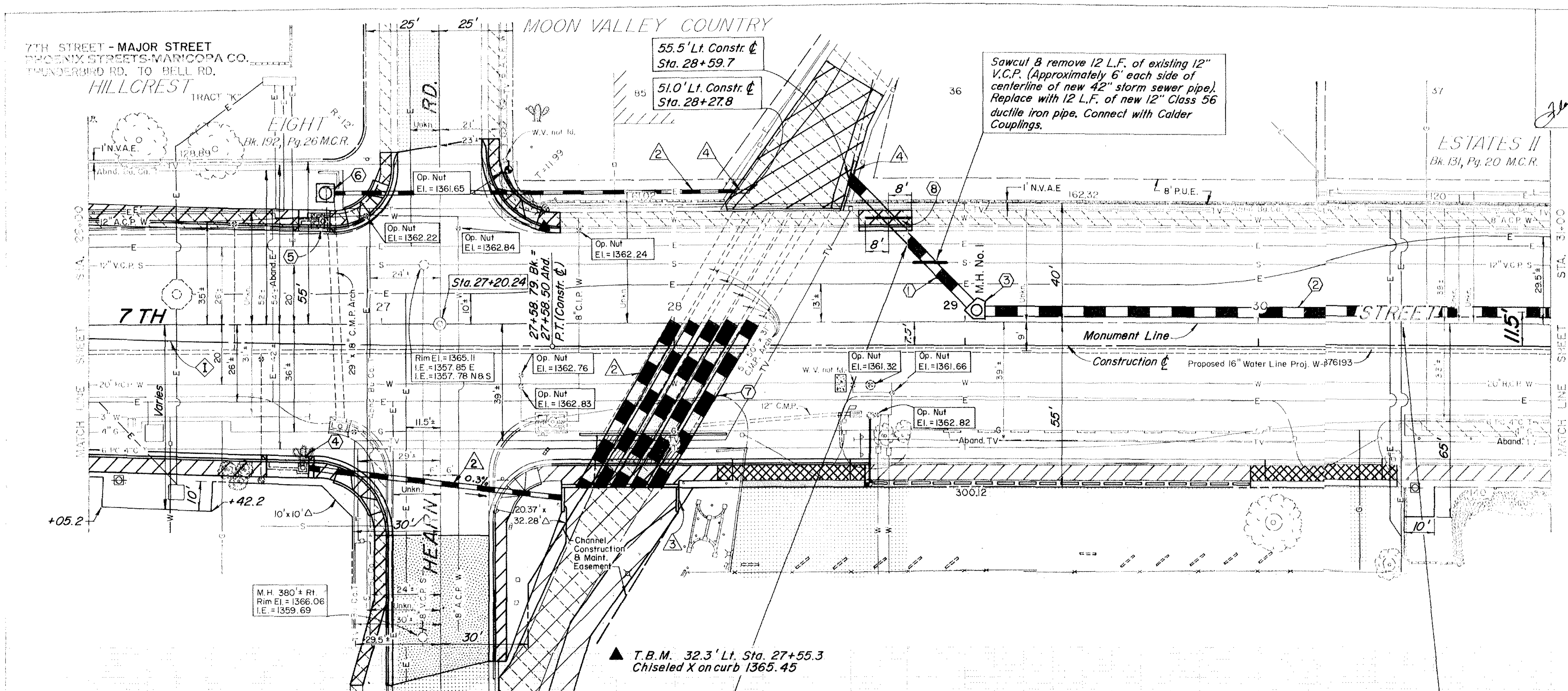
DES B.W.	DR S.E.L.	CK F.M.W.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE 1986	DATE 1986	DATE 1986	8		

SCALE 1" = 20' HORIZONTAL, 2' VERTICAL

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.
9	ARIZ	P-856013	24

FLOYD M. WHITMORE ENGINEERING, INC.

DES. H.W. DR. S.E.L. CK. F.V.A.



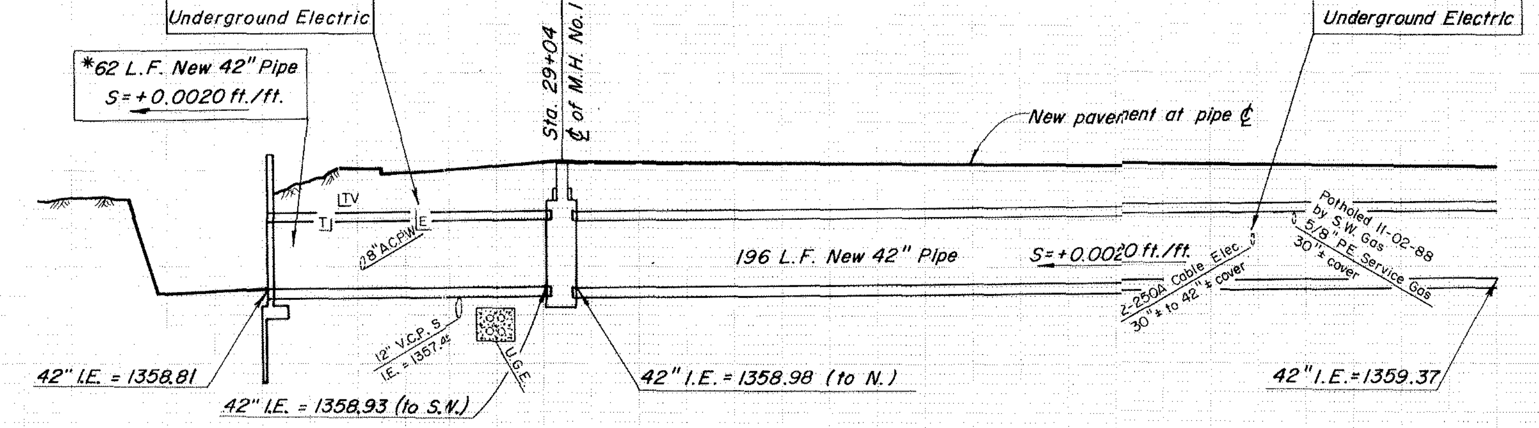
CAUTION TO CONTRACTOR

Contractor shall phone Blue Stake at 263-1100 and arrange for the field location of ALL underground electric lines within the limits of this project before contractor digs.

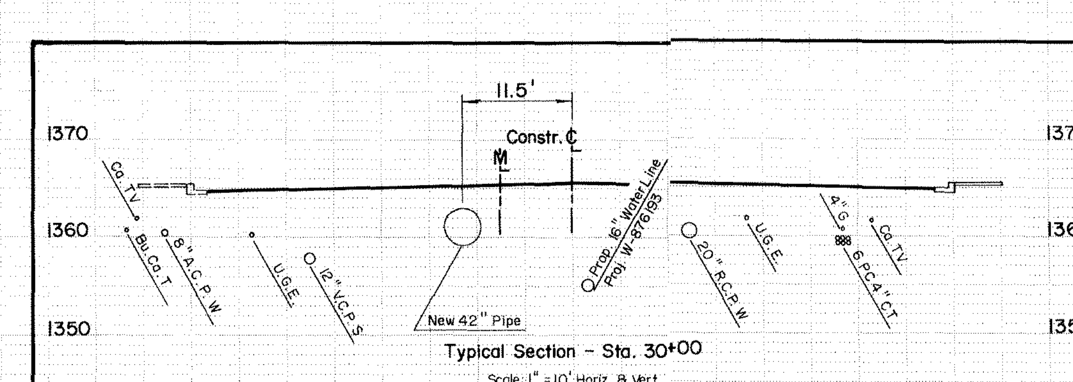
Contractor shall phone Arizona Public Service Co. at 371-6837 and arrange to have an Arizona Public Service Co. representative determine which underground electric lines, within the limits of this project, are energized and which are dead.

CAUTION: Underground Electric

CAUTION: Underground Electric



*Slope as necessary to clear sanitary sewer. New 42" pipe may contact 12" D.I.P. sanitary sewer if necessary. Negative slope from sanitary sewer crossing to manhole acceptable if necessary.



Typical Section - Sta. 30+00

Scale: 1" = 10' Horiz. & Vert.

Removed Catch Basin against Curb Line ... Catch Basin Connector ... D.L.P. 7-24-89

CONSTRUCTION ℄ CURVE DATA

No.	Radius	Δ	T	L
◇1	4000'	2°51'32"	99.81'	199.59'

STORM SEWER PIPE

No.	Station to Station		L.F.	Size
(1)	28+59.7	29+04	62	42"
(2)	29+04	31+00	196	42"

STORM SEWER MANHOLE

No.	Station	Shaft	Base
(3)	29+04	M.A.G. 522 Shallow Manhole	M.A.G. 520 Modified See detail on sheet 55
(6)	26+81	M.A.G. 522 Shallow Manhole	M.A.G. 520

CONC. CATCH BASINS & CONNECTOR PIPE

No.	Station	Type	Detail	Conn.	L.F.	Size
(4)	26+73.6 Rt.	M-1 L=10'	P-1569	C.B.	90	15"
(5)	26+80.7 Lt.	M-1 L=6'	P-1569	M.H.	6	15"
				Ditch	145	15"

CONNECTOR PIPE TO NEW HEADWALL

No.	Station	L.F.	Size
(7)	27+82.0 Rt.	5 at 64 = 320	49"x33" C.M.P.A.

M.A.G. DET. 403.3 WATER PIPE REPLACEMENT (or M.A.G. Det. 370 if needed)

No.	Station	Size	Exist. Type	L.F.
(8)	28+73±	8"	A.C.P.	16'

For paving see sheet 8

△2 For catch basin X-Sections see sheet 42

△3 See sheet 54 for headwall details.

△4 See sheet 55 for headwall details.

STORM SEWER PLANS

CITY OF PHOENIX, ARIZONA

ENGINEERING DEPARTMENT

7TH STREET

THUNDERBIRD ROAD TO BELL ROAD

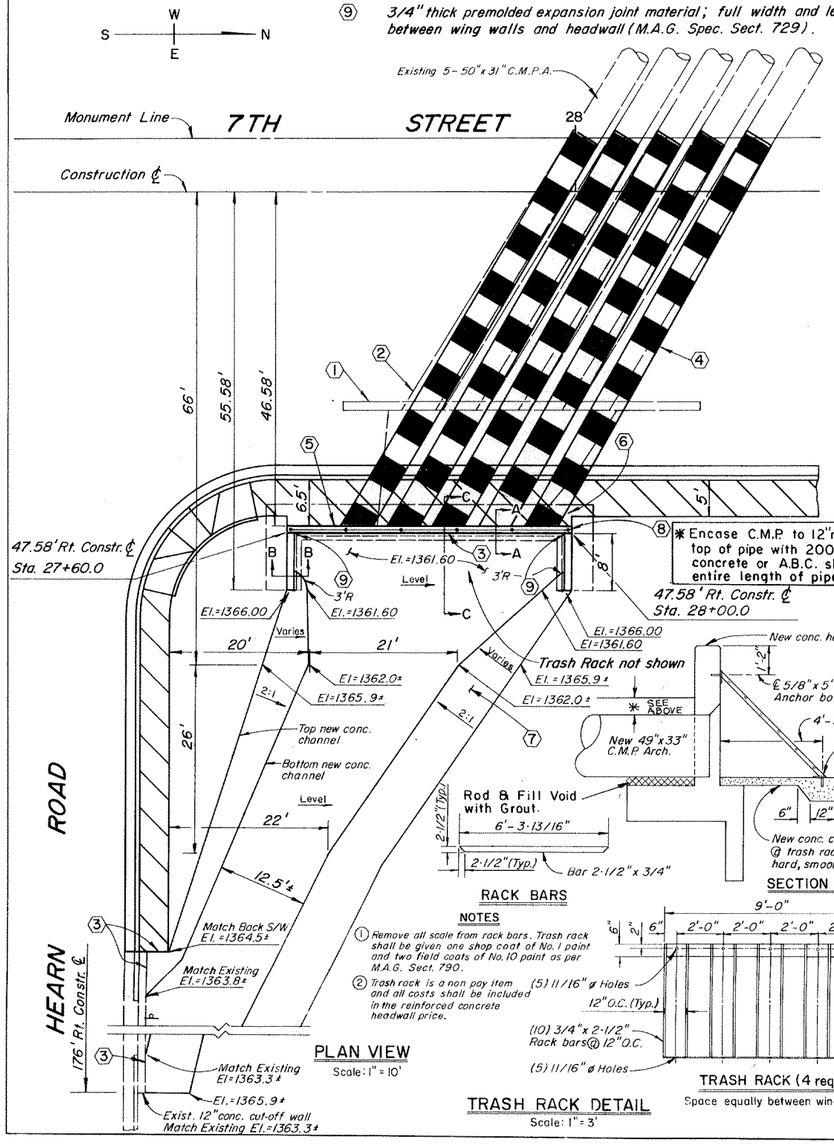
SCALE 1" = 20' HORIZONTAL, 5' VERTICAL

107950

7TH STREET - MAJOR STREET
PHOENIX STREETS-MARICOPA CO.
THUNDERBIRD RD. TO BELL RD.

NOTES

1. Remove existing headwall, trash rack and concrete channel lining. 2,254 S.F. (lining)
2. Remove 5-50"x31" C.M.P.A. East of Monument Line.
3. 3/4" thick premolded expansion joint material. M.A.G. Spec. Sect. 729
4. Five x 64± L.F. of new 49"x33" C.M.P.A.; connect to existing C.M.P.A. at Monument Line. See sheet 42.
5. New headwall and trash rack with wingwalls and handrail per details on this sheet.
6. 6.5' wide concrete sidewalk.
7. Reshape channel. See note on sheet 42. Construct new 4" thick concrete lining (M.A.G. Spec. Sect. 725, Class 'B' concrete 2,500psi at 28 days). Reinforce with WWF, 6"x6", D-4/D-4 (A.S.T.M. A497). 3,365 S.F.
8. Pipe handrail. See detail on this sheet. 39 L.F.
9. 3/4" thick premolded expansion joint material; full width and length of contact surface between wing walls and headwall (M.A.G. Spec. Sect. 729).



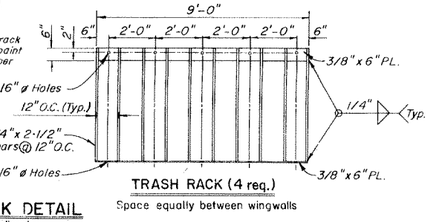
PLAN VIEW
Scale: 1" = 10'

SECTION C-C

RACK BARS

NOTES

1. Remove all scale from rack bars. Trash rack shall be given one shop coat of No.1 paint and two field coats of No.10 paint as per M.A.G. Sect. 790.
2. Trash rack is a non pay item and all costs shall be included in the reinforced concrete headwall price.

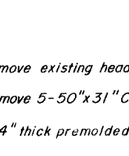


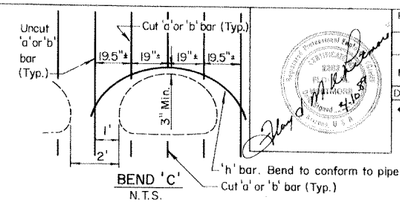
TRASH RACK (4 req.)
Space equally between wingwalls

TRASH RACK DETAIL
Scale: 1" = 3'

HEADWALL STEEL LIST

Bar	Bend	Size	Length	Quantity
✱a	A	#6	8'-5"	24
✱b	Str.	#4	6'-10"	24
◎c	Str.	#5	39'-6"	2
◎d	Str.	#4	39'-6"	2
◆e	Str.	#5	4'-6"	46
◎f	Str.	#4	39'-6"	5
g	B	#4	3'-7"	24
h	C	#6	as needed	10
k	Str.	#4	39'-6"	1





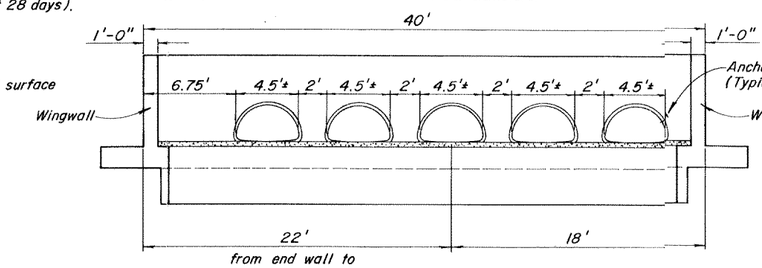
F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	P-856013	54		

FLOYD M. WHITMORE ENGRS., INC. CONSULTING ENGINEER
DES. F.M.W. | DR. J.W.C. | CK. F.M.W. | DATE 1988

◆ *Length of 3-'e' bars in south corner of footing & 3-'e' bars in north corner as needed. See sheet 56 for typical placement of 'e' bars in corners.*

✱ *'a' and 'b' bars shall be placed at 19-1/2"O.C., cut as necessary to clear outside of pipes by 3". They shall be placed so one uncut 'a' bar and one uncut 'b' bar will be located midway between adjacent pipes. The balance of the 'a' and 'b' bars shall be evenly spaced at 19"±O.C. between uncut bars and to the ends of wall.*

◎ *Stagger splices; lap splices a minimum of 40 bar diameters.*

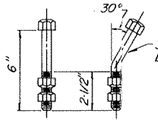


ELEVATION
(Steel Reinforcement Not Shown)

NOTES

1. Concrete for headwall and wingwalls shall conform to M.A.G. Sect. 725, Class A (3,000 psi).
2. Steel reinforcement shall conform to A.S.T.M. Spec. A615, Grade 60.
3. Headwall and wingwall footing shall be placed on undisturbed soil or on backfill compacted to 95% as per M.A.G. Section 301.
4. All reinforcing steel shall have 2" clear cover unless otherwise noted.
5. Footing shall be continous. No joint in footing.

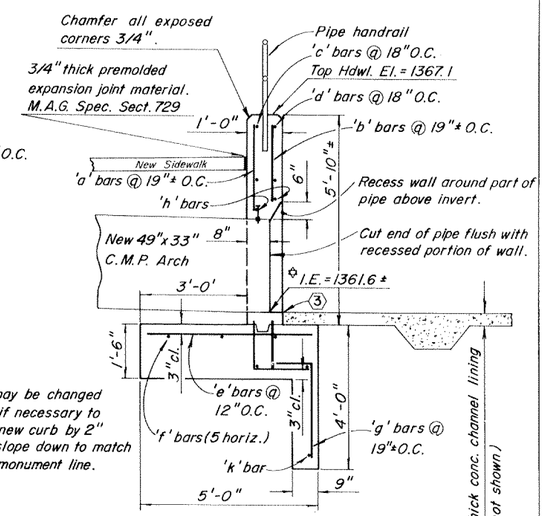
NOTE:
When straight anchor bolt will not fit in headwall use alternate bolt.



ANCHOR BOLT DETAIL
N.T.S.

ALTERNATE ANCHOR BOLT
N.T.S.

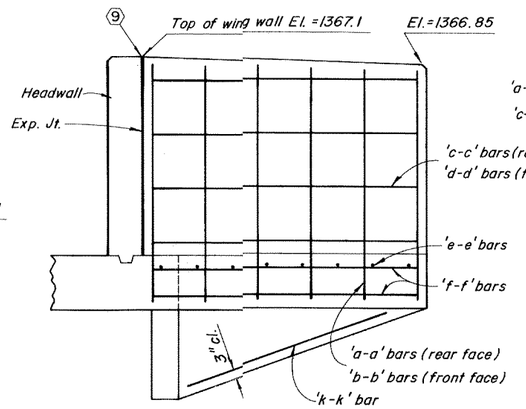
Anchor bolts to be used to secure C.M.P. arch to headwall. Bolts to be set 18" apart around pipe and 2" from end of pipe.



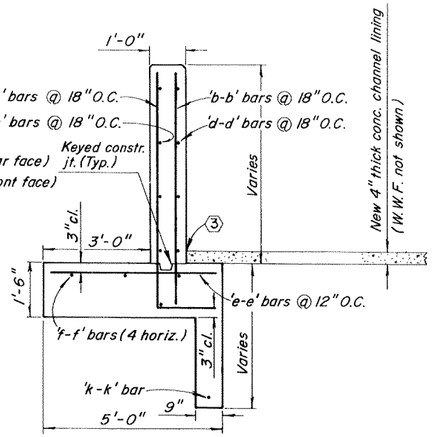
SECTION A-A

✡ *Invert elevation may be changed slightly, in field, if necessary to have pipes clear new curb by 2" minimum and to slope down to match existing pipe at monument line.*

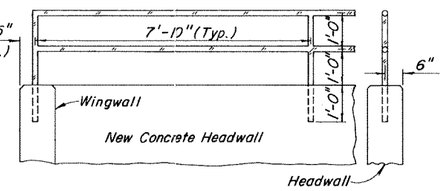
HEADWALL DETAIL
Scale: 1" = 2'



ELEVATION
(Looking North)



SECTION B-B



HANDRAIL DETAIL
Scale: 1" = 2'

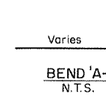
NOTES

1. Handrail shall be steel pipe. Horizontal rails shall be 1-1/2" standard pipe; vertical posts shall be 1-1/2" extra strong pipe. Pipes may be joined with threaded fittings, approved mechanical connectors, or pipe may be cut for close fit and welded all around each mating surface. Welds shall be free of sharp projections.
2. Pipe and fittings for handrail shall be given one shop coat of No.1 paint and two field coats of No.10 paint as per M.A.G. Sect. 790.
3. Pipe handrail 39.2 L.F.

WINGWALL STEEL LIST

Bar	Bend	Size	Length	Quantity
a-a	A-A	#6	Varies	12
b-b	Str.	#4	Varies	12
c-c	Str.	#5	✱ 7'-6"	8
d-d	Str.	#4	✱ 7'-6"	8
e-e	Str.	#5	4'-6"	16
f-f	Str.	#4	7'-6"	8
k-k	Str.	#4	6'-0"	2

✱ *Cut 'a-a' and 'b-b' bars to length in field.*



WINGWALL DETAIL
Scale: 1" = 2'

DETAILS

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

7TH STREET
THUNDERBIRD ROAD TO BELL ROAD
P-856013

DR. J.W.C.	DES. F.M.W.	CK. F.M.W.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE: 1988	DATE: 1988	DATE: 1988	54		

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CK'D BY	DATE

107950

7TH STREET MAJOR STREET
PHOENIX STREETS-MARICOPA CO.
THUNDERBIRD RD. TO BELL RD.

LEGEND

- Drainage area boundary
- Zoning boundary
- Existing wash used for T.C. calculations
- Major washes
- Street drainage flow
- Existing culvert
- (2) Inlet / Area No.
- Existing catch basin or inlet

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	P-856013			

FLOYD M. WHITMORE ENGINEERS, INC. — CONSULTING ENGINEER

DES F.M.W.	DR J.W.C.	CK F.M.W.	DATE 1988

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CK'D BY	DATE

N

Scale: 1" = 200'
Contour Interval = 2'
0 50 200
10 100

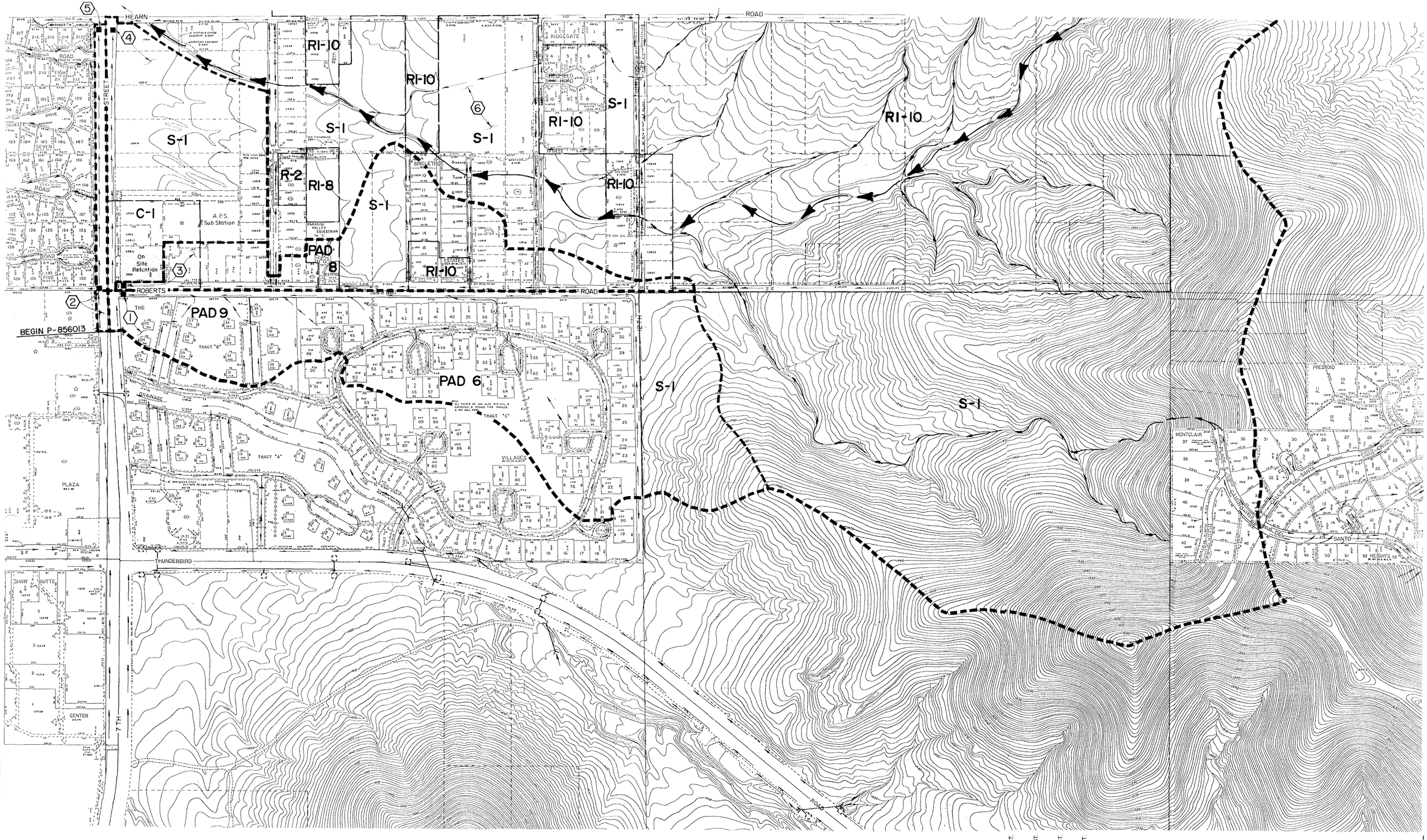
CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

7TH STREET
THUNDERBIRD ROAD TO BELL ROAD
P-856013

DR J.W.C.	DES F.M.W.	CK F.M.W.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE: 1988	DATE 1988	DATE: 1988	1	1	

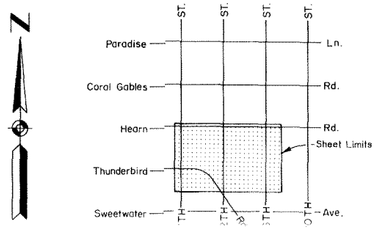
DRAINAGE MAP OF EXISTING CONDITION

SHOWING SOURCES OF RUNOFF ONTO BOCA RATON ROAD, CALAVAR ROAD, TAM-O-SHANTER DRIVE AND PIPING ROCK ROAD



LEGEND

- Drainage area boundary
- Zoning boundary
- Existing wash used for T.C. calculations
- Major washes
- Street drainage flow
- Existing culvert
- On site retention area
- (2) Inlet / Area No.
- New catch basin or drop inlet
- Existing catch basin or inlet



Scale: 1" = 200'
Contour Interval = 2'

0 50 200
10 100

DRAINAGE MAP

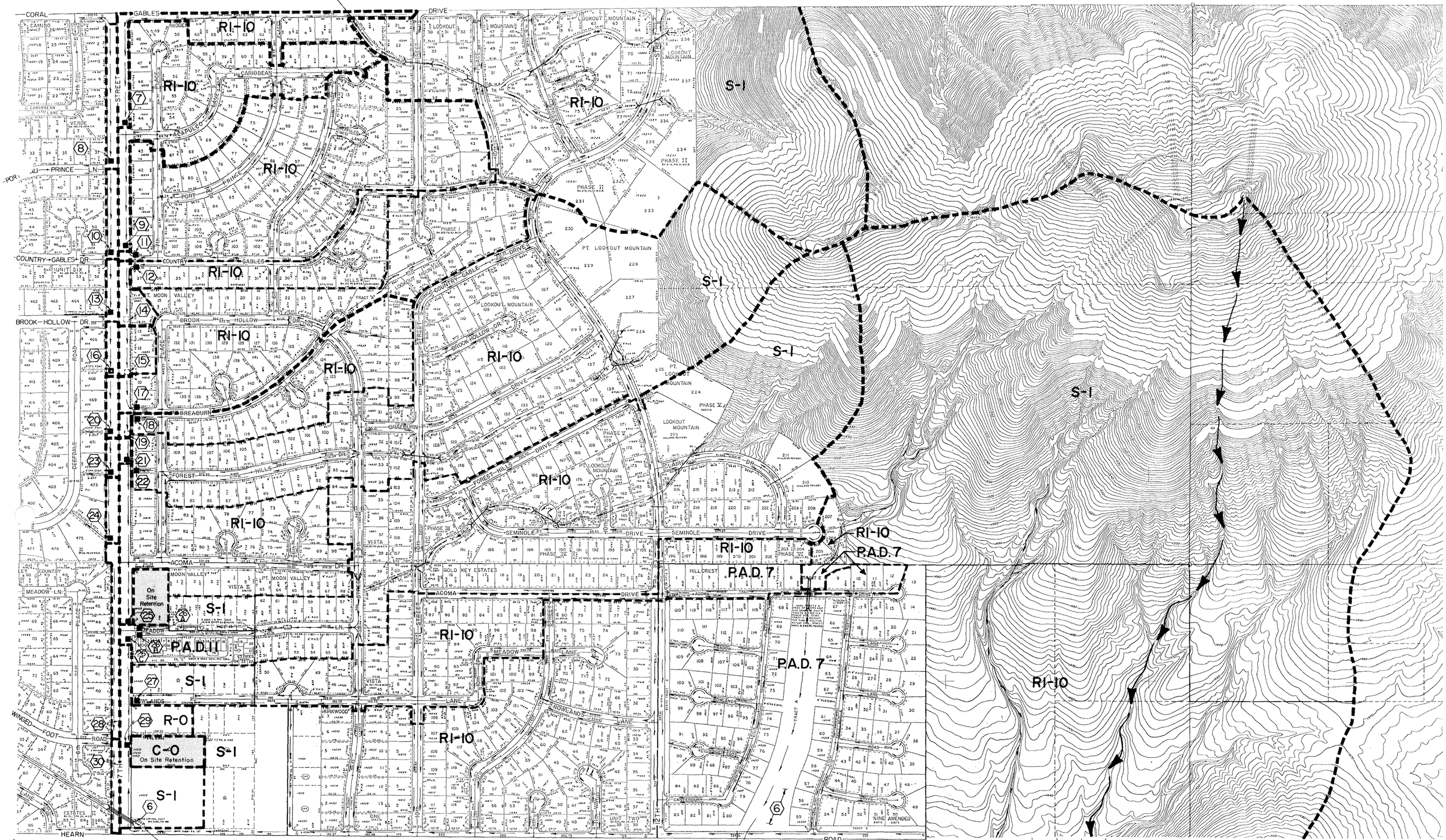
CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

7TH STREET

Thunderbird Rd. to Bell Rd.

P - 856013

Sheet 1 of 3



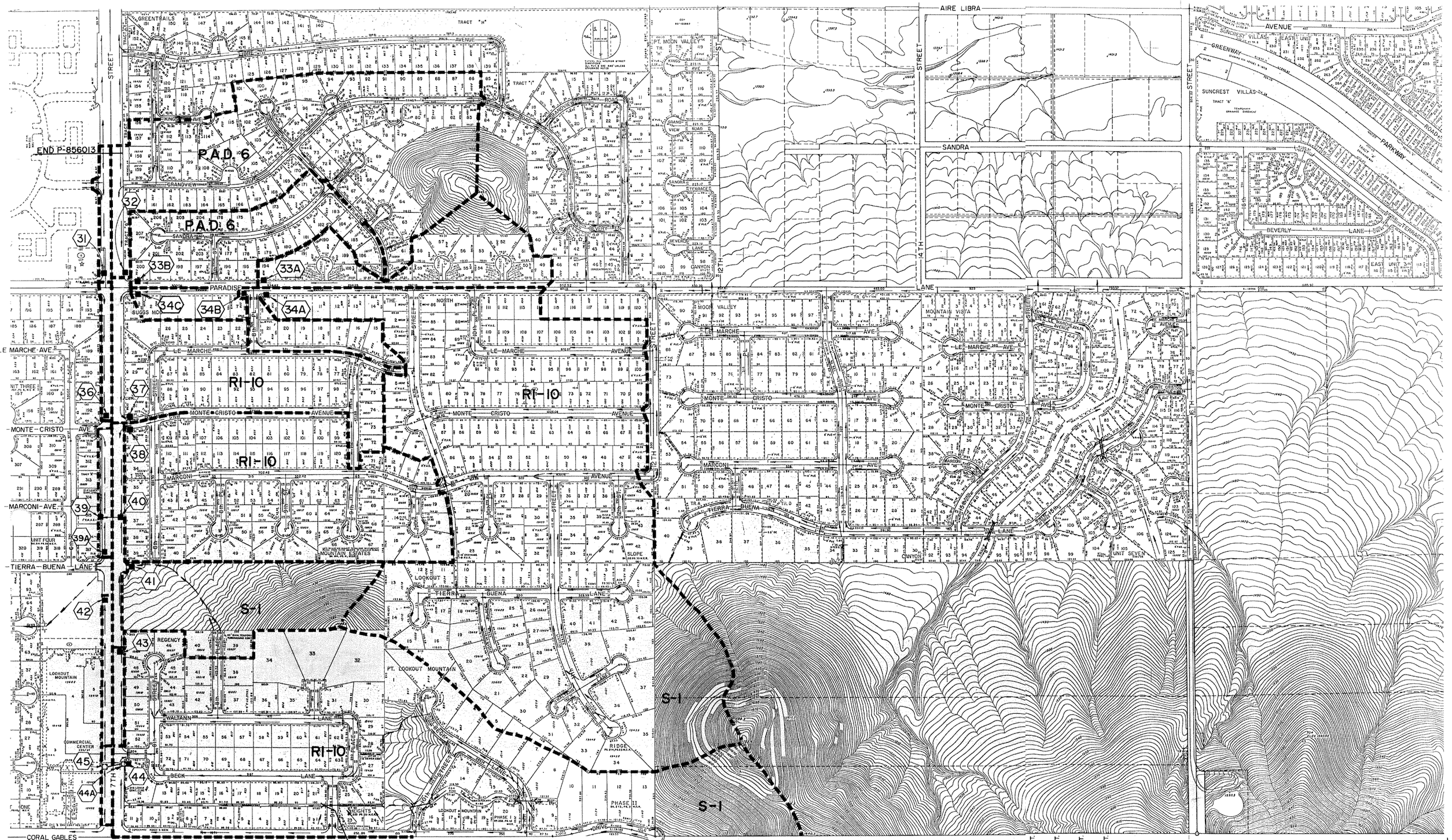
DRAINAGE MAP

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

7TH STREET

Thunderbird Rd. to Bell Rd.

P - 856013



Paradise Ln. — Sheet Limits
Coral Gables Rd.
Hearn Rd.
Thunderbird
Sweetwater Ave

Scale: 1" = 200'
Contour Interval = 2'
0 50 200
100

DRAINAGE MAP

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

7TH STREET

Thunderbird Rd. to Bell Rd.

P - 856013

7TH STREET
PHOENIX STREETS-MARICOPA CO.
THUNDERBIRD RD. TO BELL RD.

MAJOR STREETS STORM DRAIN DESIGN SUMMARY SHEET

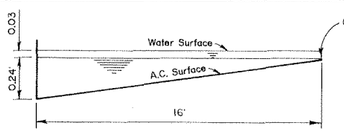
FHWA REGION	STATE	PROJ NO	SHEET NO	TOTAL SHEETS	AS BUILT
9	ARIZ	P - 856013			

FLOYD M. WHITMORE ENGINEERS, INC. — CONSULTING ENGINEER

DES B.W. | DR S.E.L. | CK F.M.W. | DATE 1986

Storm Drainage Design Data — Paving Project M - P - 856013 — Location: 7TH STREET (Roberts Rd. to Grandview Rd.)

AREA NO.	Inlet No.	INLET Sta.	Area - Acres: Total Area Acres	Zoning Factor	Imperv. Area Ai	Infiltration in / hr. f_c	For Concentration Time: Street Slope ft. / ft.	Max. Dist.	T_C Min.	Inlet I	Runoff to Inlet: Pervious Q = .8(I-fc)Ap	Impervious Q=.9(I-.2)Ai	Q	Average Upstream Gutter Slope ft. / ft.	Cross Slope At Inlet ft. / ft.	Flowby To This Catch Basin	Flowby + Runoff (Q)	Depth Of Water In Upstream Gutter	Width Of Water In Street	Gutter Velocity	Depth Of Sump If A Sump	Inlet Type	Q Accepted By C.B.	Flowby	To Inlet No.	T_{C2} Main Storm Drain: Total Area Imper.	T_C (Min.)	Main Storm Drain: I	Q_2	Slope Main Storm Drain ft. / ft.	Size Main Storm Drain	Velocity Main Storm Drain f. p. s.	Length Main Storm Drain	ΔT_{C2} Min.	Elevation: Crown Inlet	Crown Outlet	Hydraulic Grade Line: S_f ft. / ft.	H_L ft.	Elevation Inlet	Elevation Outlet	Head Between 0.5' Below Lip Gutter To H.G. Main	Length Conn. Pipe	Dia. Conn. Pipe	Depth Catch Basin
1	1	13+78.2 RT.	44.9	0.25	11.2		0.0108 (Gutter) 0.0815 (Overland)	3,565 650	32	1.32		11.3	11.3	0.0080	0.032	0.0	11.3	0.43	13.6	3.8	0.38	M-I L=17'	11.3																	N.A.	7'	35"x24" CMPA	3.0'
2	2	14+11.0 LT.	0.2	1.00	0.2		0.0113	215	10	2.40		0.4	0.4	0.0154	0.030	0.0	0.4	0.11	3.6	2.1		16' Depressed D/W Entr.	0.4																N.A.	N.A.	N.A.	N.A.
3	3	14+22.0 RT.	1.0 / 2.2 / 14.1	0.85 / 0.25 / 0.15	3.5		0.0112	2,830	17	1.90		5.5	5.5	0.0118	0.030	0.0	5.5	0.30	10.0	3.6	0.30	M-2 L=17'	5.5																N.A.	5', 124', 8.21	28"x20" CMPA	3.5'
4	4	26+73.6 RT.	2.4 / 14.5	0.85 / 0.15	4.2		0.0024	1,280	13	2.16		7.4	7.4	0.0015	0.028	0.0	7.4	0.48	17.2	1.7	0.47	M-I L=10'	7.4																N.A.	81'	15"	3.5'
5	5	26+80.7 LT.	1.3	1.00	1.3		0.0028	1,265	12	2.24		2.4	2.4	0.0015	0.030	0.0	2.4	0.32	10.8	1.4		M-I L=6'	1.8	0.6	West in South gutter of Hearn Rd.														N.A.	6', 8.45'	15"	3.7'
6	6	27+80.0 Rt.	473.0	See calculation on page 13 of Catch Basin Design Report									225.0	N.A.	N.A.	0.0	225.0	N.A.	N.A.	N.A.		Hdwl.	225.0	Drains into Moon Valley Wash															N.A.	N.A.	50"x31" CMPA	N.A.
7	7	61+44.9 RT.	3.0 / 1.1	0.25 / 1.00	1.9		0.0263	1,950	10	2.40		3.6	3.6	0.0057	0.017	0.0	3.6	0.24	13.9	2.2		M-I L=10'	2.1	1.5	9	1.9	10.0	2.40	2.1						1376.00					1375.08	4.7'	35'	15"	4.0'
8	8	59+71.1 LT.	0.7	1.00	0.7		0.0045	655	10	2.40		1.4	1.4	0.0052	0.023	0.0	1.4	0.19	8.3	1.8	0.19	R	1.4			2.6	10.6	2.35	5.0	0.0060	18"	5.0	174	0.6		1374.96		0.0060			1374.21	4.5'	41'	15"	3.5'
9	9	55+36.0 RT.	10.6 / 0.8	0.25 / 1.00	3.5		0.0222	1,950	10	2.40		6.8	6.8	0.0047	0.026	1.5	8.3	0.40	15.2	2.7	0.37	M-I L=17'	8.3			6.1	11.1	2.31	11.6	0.0060 / 0.0146	18" / 18"	5.0 / 7.8	141 / 294	0.5 / 0.6		1369.82		0.0060 / 0.0146			1369.51	6.8'	37'	15"	5.0'
10	10	55+35.6 LT.	0.5	1.00	0.5		0.0058	395	10	2.40		1.0	1.0	0.0058	0.030	0.0	1.0	0.18	6.1	1.8	0.15	M-I L=6'	1.0			6.6	11.1	2.31	12.5	0.0146	18"	7.8	5	0.0		1369.75		0.0146			1369.51	6.6'	43'	15"	3.5'
11	11	55+14.1 RT.	24.4	0.25	6.1		0.0257	2,180	10	2.40		12.1	12.1	0.0630	0.021	0.0	12.1	0.26	12.3	7.6	0.40	M-I L=17'	12.1			14.4	11.1	2.31	27.3	0.0146	18"	7.8	17	0.0											
12	12	54+78.3 RT.	6.6	0.25	1.7		0.0280	1,890	10	2.40		3.3	3.3	0.0630	0.024	0.0	3.3	0.17	7.0	5.7		M-I L=17'	2.0	1.3	14					0.0500	18"	14.3	58	0.1	1369.50	1369.40		0.0050		1369.50	1369.26	6.9'	58'	18"	5.8'
13	13	52+40.1 LT.	0.3	1.00	0.3		0.0058	300	10	2.40		0.6	0.6	0.0058	0.021	0.0	0.6	0.13	6.2	1.5		M-I L=3'	0.4	0.2	West in North gutter of Brook Hollow Dr.	30.8	13.7	2.11	53.5	0.0060	36"	7.8	300	0.6		1364.26		0.0055	1.65		(ST-856500) 1363.29				
14	14	52+10.9 RT.	0.8	0.25	0.2		0.0057	255	10	2.40		0.4	0.4	0.0059	0.018	1.3	1.7	0.18	10.0	1.8		Exist. Type C	0.9	0.7	15	30.5	13.6	2.12	53.5	0.0060	36"	7.8	30	0.1		1364.43		0.0055	0.17		1364.94	9.6'	44'	15"	3.5'
15	15	49+77.2 RT.	1.0	0.25	0.3		0.0057	235	10	2.40		0.5	0.5	0.0057	0.019	0.7	1.2	0.17	8.74	1.7		Exist. Type C	0.8	0.4	17	30.3	13.1	2.15	53.5	0.0060	36"	7.8	234	0.5		1365.84		0.0055	1.29		1365.11	9.3'	37'	15"	3.3'
16	16	49+65.6 LT.	0.3	1.00	0.3		0.0055	230	10	2.40		0.6	0.6	0.0055	0.024	0.0	0.6	0.14	5.8	1.5		M-I L=3'	0.5	0.1	20					0.0050	36"	7.8	52	0.1							1366.40	6.7'	37'	15"	2.9'
17	17	47+80.2 RT.	18.1	0.25	4.5		0.0424	2,540	10	2.40		9.0	9.0	0.0170	0.015	0.4	*9.4	0.27	16.0	4.0	0.30	M-I L=17'	7.6	*1.8	18	30.0	12.7	2.18	53.5						1366.88					1367.48	4.5'	58'	15"	4.0'
18	18	47+44.5 RT.	8.7	0.25	2.2		0.0127	1,420	10	2.40		4.3	4.3	0.0170	0.017	1.8	6.1	0.24	13.9	3.7		M-I L=17'	3.3	2.8	19					0.0050	36"	7.2	114	0.3				0.0035	0.40			4.6'	33'	15"	4.0'
19	19	46+66.0 RT.	0.1	1.00	0.1		0.0055	100	10	2.40		0.3	0.3	0.0055	0.021	2.8	3.1	0.25	11.7	2.2		Exist. Type C	1.4	1.7	21	23.3	12.4	2.21	42.4						1367.45					1367.88	3.4'	34'	15"	3.0'
20	20	46+65.2 LT.	0.4	1.00	0.4		0.0055	300	10	2.40		0.8	0.8	0.0055	0.024	0.2	1.0	0.17	6.9	1.7		M-I L=3'	0.6	0.4	23					0.0050	36"	7.2	121	0.3				0.0035	0.42			N.A	7'	15"	3.5'
21	21	45+44.7 RT.	0.2	1.00	0.2		0.0055	120	10	2.40		0.3	0.3	0.0055	0.022	1.7	2.0	0.21	9.6	2.0		M-I L=17'	1.7	0.2	25	23.2	12.1	2.23	42.4						1368.05					1368.30	2.2'	35'	15"	4.0'
22	22	44+85.0 RT.	47.3	See calculation on page 16 of Catch Basin Design Report									42.2	N.A.	N.A.	0.0	42.2	Doesn't drain onto 7th St.				M-2 L=17'	42.2	Drains directly into storm sewer		23.0	12	2.24	42.2	0.0060	36"	7.2	60	0.1		1368.35		0.0035	0.21		1368.51	1.9'	41'	42"x29" CMPA	4.7'
23	23	44+66.4 LT.	0.3	1.00	0.3		0.0055	200	10	2.40		0.5	0.5	0.0055	0.024	0.4	0.9	0.16	6.6	1.6		M-I L=3'	0.6	0.3	24																	N.A.	7'	15"	3.5'
24	24	41+59.0 LT.	0.4	1.00	0.4		0.0051	305	10	2.40		0.8	0.8	0.0040	0.024	0.3	1.1	0.18	7.7	1.5		M-I L=3'	0.7	0.4	South in West gutter of 7th St. to Winged Foot Ln.																	N.A.	20'	15"	3.5'



North Half of Breaburn Dr. - Sta. 47+80. 2 Rt.

- Total Q = 9.0 C.F.S.
- Q contained in North half of street = $\frac{(0.5 \times 0.24 \times 16) \times 9.0}{(0.5 \times 0.24 \times 16) + (0.03 \times 16)} = 7.2$ C.F.S.
- Q that tops street crown = 9.0 - 7.2 = 1.8 C.F.S.

REVISED JAN. 18, 1984 FLZ

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

7TH STREET
THUNDERBIRD ROAD TO BELL ROAD
P-856013

DR B.W.	DES S.E.L.	CK F.M.W.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE 1986	DATE 1986	DATE 1986			

REVISION BY CITY OF PHOENIX — NO | DESCRIPTION | REV. BY | CK'D BY | DATE

REVISION BY CITY OF PHOENIX — NO | DESCRIPTION | REV. BY | CK'D BY | DATE

7TH STREET
PHOENIX STREETS-MARICOPA CO.
THUNDERBIRD ROAD TO BELL ROAD

MAJOR STREETS STORM DRAIN DESIGN SUMMARY SHEET

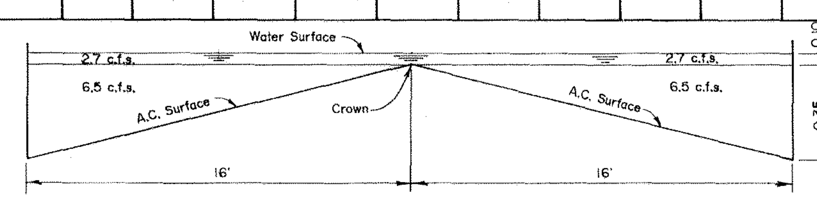
FHWA REGION	STATE	PROJ NO	SHEET NO	TOTAL SHEETS	AS BUILT
9	ARIZ	P - 856013			

FLOYD M. WHITMORE ENGINEERS, INC.
CONSULTING ENGINEER
DES F.M.W. DR J.W.C. CK F.M.W. DATE 1988

Storm Drainage Design Data Paving Project M - P - 856013 Location: 7TH STREET (Roberts Rd. to Grandview Rd.)

Area No.	Inlet No.	Inlet Sta.	Area – Acres: Total Area Acres	Zoning Factor	Imperv. Area Ai	Infiltration in / hr. fc	For Concentration Time: Street Slope ft. / ft.	Max. Dist.	Tc Min.	Inlet I	Runoff to Inlet: Pervious Q=.8(I-fc)Ap	Impervious Q=.9(I-.2)Ai	Q	Average Upstream Gutter Slope ft. / ft.	Cross Slope At Inlet ft. / ft.	Flowby To This Catch Basin	Flowby + Runoff (Q)	Depth Of Water In Upstream Gutter	Width Of Water In Street	Gutter Velocity	Depth Of Sump If A Sump	Inlet Type	Q Accepted By C.B.	Flowby	To Inlet No.	Tc2 Main Storm Drain: Total Area Imper.	Tc (Min.)	Main Storm Drain: I	Q2	Slope Main Storm Drain ft. / ft.	Size Main Storm Drain	Velocity Main Storm Drain f. p. s.	Length Main Storm Drain	ΔTc2 Min.	Elevation Crown: Inlet	Elevation Crown: Outlet	Hydraulic Grade Line: Sf ft. / ft.	HL ft.	Elevation: Inlet	Elevation: Outlet	Head Between 0.5' Below Lip Gutter To H.G. Main	Length Conn. Pipe	Dia. Conn. Pipe	Depth Catch Basin
25	25	37+50.7 RT.	11.8	0.25	3.0		0.0182	1,435	10	2.40		5.9	5.9	0.0061	0.022	0.2	6.1	0.32	14.3	2.7	0.26	M-1 L=17'	6.1																	1.8'	49'	15"	3.5'
26	26A	37+28.8 RT.	28.8	See calculation on page 16 of Catch Basin Design Report									20.8	0.0133	0.014	0.0	20.8	0.36	Curb to	4.4	0.48	M-2 L=17'	20.8																	1.9'	26'	24"	4.5'
																				Curb in											(20.8+10.5)+0.9(2.02-0.2) 3.0 = 36.2														
26	26B	36+93.0 RT.	28.8	See calculation on page 16 of Catch Basin Design Report									20.8	0.0121	0.013	0.0	20.8	0.36	Meadow Lane	4.4		M-2 L=17'	10.5	10.3	26C	13.7	15	2.02	36.2							1364.35				1364.56	1.9'	2'	24"	4.5'
																														0.0024	36"	5.0	45	0.2			0.0026	0.12						
26	26C	36+53.5 RT.	28.8	See calculation on page 16 of Catch Basin Design Report									0.0	0.0038	0.015	10.3	10.3	0.36	24.2	2.3		M-1 L=17'	5.6	4.7	29	13.7	15.2	2.02	41.8	(36.2+5.6) = 41.8						1363.82				1364.44	1.7'	51'	15"	4.0'
																														0.0024 0.0020	36" 42"	5.0 5.0	260 32	0.9 0.1			0.0035 0.0016	0.91 0.05						
27	27	33+60.8 RT.	20.4 2.5	0.25 0.15	5.5		0.0264	4,510	18	1.85		8.2	8.2	0.0142	0.011	0.0	8.2	0.23	Rowlands Ln. 21.0	3.3		M-1 L=17'	3.4	4.8	29	19.2	16.2	1.95	41.8							1363.40				1363.48	1.8'	72'	15"	3.5'
																														0.0020	42"	5.0	211	0.7			0.0018	0.38						
28	28	32+37.0 LT.	1.1	1.00	1.1		0.0047	920	10	2.40		2.1	2.1	0.0041	0.026	0.4	2.5	0.26	10.0	2.0		None		2.5	West in North gutter of Winged Foot Rd.																N.A.	N.A.	N.A.	N.A.
29	29	31+50.0 RT.	1.2 (N) 2.9 (S)	0.40 0.15	0.5 (N) 0.4 (S)		0.0019	390	10	2.40		1.0 (N) 0.8 (S)	1.0 (N) 0.8 (S)	0.0034 (N) 0.0024 (S)	0.013 (N) 0.013 (S)	4.7 + 4.8 = 9.5 (N) 0.0 (S)	10.5 (N) 0.8 (S)	0.35 (N) 0.14 (S)	27.2 (N) 11.1 (S)	2.2 (N) 1.0 (S)	0.35	M-2 L=10'	11.3			20.1	16.9	1.90	42.3							1362.97				1363.10	1.2'	50'	18"	3.5'
																														0.0020	42"	5.0	308	1.0			0.0026	0.80						
30	30	31+27.0 LT.	0.5	1.00	0.5		0.0010	370	10	2.40		1.0	1.0	0.0010	0.018	0.0	1.0	0.21	11.6	0.8		None		1.0	West in South gutter of Winged Foot Rd.											1362.30	Moon Valley Wash				1362.30	N.A.	N.A.	N.A.	N.A.
31	31	93+79.8 LT.	0.9	1.00	0.9		0.0039	620	10	2.40		1.8	1.8	0.0020	0.029	0.0	1.8	0.27	9.4	1.4		M-1 L=6'	1.4	0.4	West in North gutter of Paradise Ln.																4.6'	42'	15"	3.5'
32	32	93+80.3 RT.	24.4	See calculation on page 17 of Catch Basin Design Report									12.2	0.0042	0.029	0.0	12.2	0.49	16.8	3.0	0.55	M-1 L=10'	12.2			9.4	19	1.80	13.5	~~0.0500~~	~~18"~~	~~14.3~~	~~73~~	~~0.1~~		1369.78				1369.15	4.4'	35'	18"	4.0'
34	34A	7+47.4 Rt. Paradise Lane	67.7	See calculation on page 18 of Catch Basin Design Report									32.6	0.0166	0.038	0.0	32.6	0.60	15.8	6.8		M-2, L=17'	19.5	8.4 *4.8	34 B	24.4	17.0	~~1.90~~	~~19.5~~	~~0.0068~~	~~30"~~	~~7.5~~	~~14~~	~~0.0~~		1371.25	~~0.0020~~	~~0.03~~		1370.32	5.2'	5'	18"	6.0'
33	33A	7+33.0 Lt. Paradise Lane	8.7	See calculation on page 17 of Catch Basin Design Report									6.0	0.0165	0.043	0.0	6.0	0.33	7.8	4.6		M-1 L=17'	4.3	1.7	33B	24.4	17.0	~~1.90~~	~~23.8~~	~~0.0068~~	~~30"~~	~~7.5~~	~~100~~	~~0.02~~		1371.15	~~0.0024~~	~~0.24~~		1370.32	4.9'	34'	15"	4.0'
34	34B	6+33.0 Rt. Paradise Lane	2.9	0.25	0.73		0.0125	1,150	10	2.40			1.4	0.0024	0.031	8.4	9.8	0.51	16.4	2.3		M-1 L=17'	7.1	2.7	34C	25.1	17.2	~~1.89~~	~~30.9~~	~~0.0068~~	~~30"~~	~~7.5~~	~~562~~	~~1.2~~		1370.47	~~0.0048~~	~~2.70~~		1369.97	5.1'	6'	15"	5.0'
33	33B	0+70.8 Lt. Paradise Lane	7.8	0.25	1.95		0.0063	1,760	12	2.24			3.6	0.0013	0.024	1.7 + 1.7 = 3.4	7.0	0.46	19.1	1.6	0.55	M-1 L=6'	7.0			27.5	18.4	~~1.83~~	~~40.3~~	~~0.0068~~	~~30"~~	~~8.0~~	~~75~~	~~0.2~~							7.2'	34'	15"	3.5'
34	34C	0+70.9 Rt. Paradise Lane	1.9	0.25	0.47		0.0015	565	10	2.40			0.9	0.0017	0.022	2.7 + 3.1 = 5.8	6.7	0.41	18.8	1.7		M-1 L=17'	5.1	1.6	37	27.5	18.4									1366.65				1367.04	7.2'	6'	15"	8.0'
																														0.0023 0.0018	42" 48"	5.4 5.3	435 185	1.3 0.6			0.0023 0.0012	1.00 0.22						
36	36	86+87.4 LT.	0.9	1.00	0.9		0.0038	690	10	2.40		1.8	1.8	0.0035	0.027	0.0	1.8	0.24	8.9	1.7		M-1 L=6'	1.3	0.5	West in North gutter of Monte Cristo Ave.	37.8	21.0	1.71	52.8							1364.81				1365.21	6.6'	46'	15"	3.5'
37	37	86+88.1 RT.	13.0	0.25	3.3		0.0133	2,075	10	2.40		6.5	6.5	0.0028	0.024	1.6 + 2.7 = 4.3	*** 10.8	0.45	Curb to	2.4	0.41	M-1 L=17'	10.8																	6.6'	33'	15"	4.0'
																				Curb in											0.0018	43"	5.3	35	0.1			0.0012	0.04						
38	38	86+52.3 RT.	24.0	0.25	6.0		0.0149	1,875	10	2.40		11.9	11.9	0.0030	0.022	*** -(2.7)	9.2	0.45	Monte Cristo Ave.	2.3		M-1 L=17'	6.4	2.8	40	47.1	21.1	1.71	64.0							1364.75				1365.17	6.7'	58'	18"	4.4'
																														0.0018	48"	5.3	427	1.3			0.0017	0.73						
39	39	82+25.0 LT.	0.5 (N) 0.2 (S)	1.00 1.00	0.5 (N) 0.2 (S)		0.0015	420	10	2.40		1.0 (N) 0.4 (S)	1.0 (N) 0.4 (S)	0.0015 (N) 0.0015 (S)	0.015 (N) 0.015 (S)	0.0 (N) 0.0 (S)	1.0 (N) 0.4 (S)	0.18 (N) 0.13 (S)	12.0 (N) 8.5 (S)	0.9 (N) 0.7 (S)	0.40	M-1 L=17'	1.4																	6.4'	42'	15"	4.0'
39	39A	80+27.2 LT.	Additional protection for storms that exceed capacity of Inlets No. 39 & 40.																																						N.A.	80'	15"	3.5'
40	40	82+25.0 RT.	0.6 (N) 0.9 (S)	1.00 1.00	0.6 (N) 0.9 (S)		0.0113	660	10	2.40		1.2 (N) 1.8 (S)	1.2 (N) 1.8 (S)	0.0015 (N) 0.0049 (S)	0.010 (N) 0.010 (S)	2.8 (N) 0.7 (S)	4.0 (N) 2.5 (S)	0.26 (N) 0.17 (S)	26.1 (N) 17.5 (S)	1.2 (N) 1.6 (S)	0.27	M-1 L=17'	6.5			49.3	22.4	1.65	64.3							1363.98				1364.44	6.6'	36'	15"	4.0'
																														0.0018	48"	5.3	233	0.7			0.0017	0.40						
41	41	79+92.2 RT.	5.0 3.8	0.85 0.15	4.8		Overland 0.1075	Overland 1,100	10	2.40		9.5	9.5	N.A.	N.A.	0.0	9.5	Not applicable; doesn't drain into street				Exist. Drop	9.5			54.1	23.1	1.62	69.1							1363.56				1364.04	8.1'	41'	18"	5.9'
																						Inlet				54.1 42.7	23.2 13.6	1.62 2.11	69.1 75.6 ¤	0.0010 0.0338	48" 36"	12.2 19.5	100 115	0.1 0.1		1362.46 1361.98	0.0020 0.0110	0.20 1.80		(ST-856500) 1363.84				
																										42.7	13.4	2.14	75.8															
42	42	78+28.9 LT.	0.8	1.00	0.8		0.0096	730	10	2.40		1.6	1.6	0.0169	0.029	0.0	1.6	0.17	6.0	3.0		M-1 L=3'	0.7	0.9	West along South side of Tierra Buena Ln.					0.0094	36"	9.9	49	0.1		1366.32				1365.64	8.6'	43'	15"	3.5'
																														0.0094	36"	9.9	264	0.4			0.0110	2.90						
43	43	75+65.0 RT.	0.7	1.00	0.7		0.0076	490	10	2.40		1.4	1.4	0.0093	0.025	0.0	1.4	0.18	7.0	2.3		M-1 L=3'	0.7	0.7	40	41.9	13.0	2.16	75.8							1368.80				1368.54	9.9'	37'	15"	3.5'
																														0.0094	36"	9.9	565	1.0			0.0110	5.56						
44	44	70+17.4 RT.	96.3	See calculaton on page 19 of Catch Basin Design Report								73.8	73.8	N.A.	N.A.	0.7	74.5	N.A.	N.A.	N.A.		"C" MAG 532	74.5			41.2	12.0	2.24	75.8							1373.55				1374.10	7.5'	60'	36"	8.0'
44	44A	70+17.4 RT.	1.0	1.00	1.0		0.0235	1,295	10	2.40		2.0	2.0	0.0016	0.022	0.0	2.0	0.27	12.1	1.2		Exist. "C"	1.3	0.7	44 (Via Beck Ln.)																N.A.	77'	50"x31" CMPA	3.5'
45	45	70+12.0 LT.	0.1 (N) 0.3 (S)	1.00 1.00	0.1 (N) 0.3 (S)		0.0029	275	10	2.40		0.2 (N) 0.6 (S)	0.2 (N) 0.6 (S)	0.0018 (N) 0.0029 (S)	0.027 (N) 0.027 (S)	0.0 (N) 0.0 (S)	0.2 (N) 0.6 (S)	0.12 (N) 0.16 (S)	4.4 (N) 6.1 (S)	0.8 (N) 1.2 (S)	0.14	Exist. "E" Mod	0.8																	N.A.	N.A.	N.A.	N.A.

*4.8 cfs will top crown and flow to North gutter of Paradise Lane,. East of 8th St. Immediately West of 8th St, 3.1 c.f.s. will top crown and flow to C.B. 34C, and 1.7 c.f.s. will continue to flow in North gutter to C.B. 33 B.



Monte Cristo Ave. (East of 7th Street)

*** Runoff from Area 38 in South gutter will top pavement crown and 2.7 c.f.s. will flow into North gutter.

¤ Q to Proj. P-856500
Total Area (Impervious) = 96.8 Acre
T.C. = 23.2 min.
I = 1.62 in./hr.
Q = 123.7 cfs

REVISED JAN. 18, 1984 FLZ

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

7TH STREET
THUNDERBIRD ROAD TO BELL ROAD
P-856013

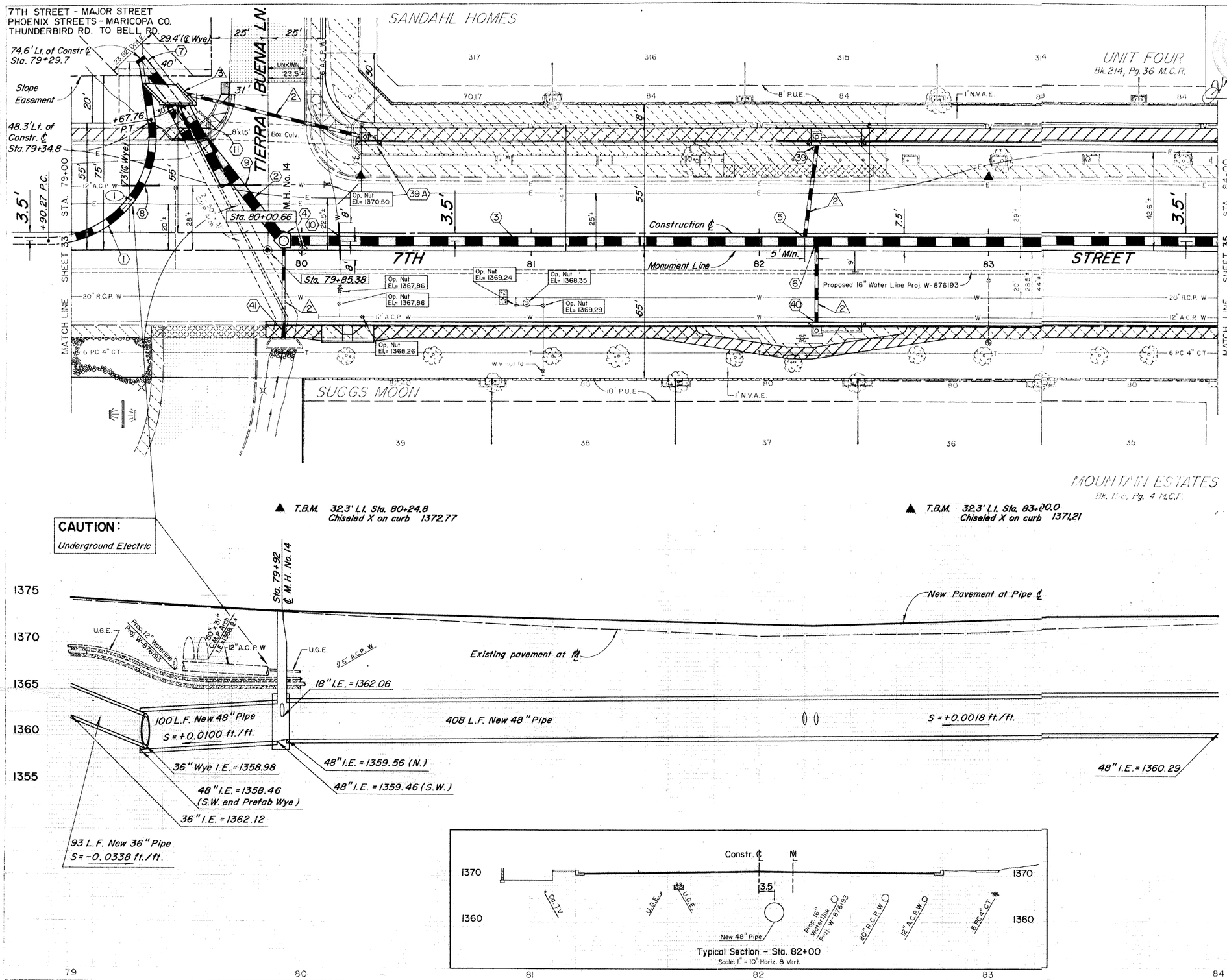
DR F.L.Z. DATE 1-18-84	DES DATE	CK J.M.F. DATE 1-18-84	SHEET NO.	TOTAL SHEETS	AS BUILT

REVISION BY CITY OF PHOENIX — NO | DESCRIPTION | REV BY | CKD BY | DATE
REVISION BY CITY OF PHOENIX — NO | DESCRIPTION | REV BY | CKD BY | DATE
REVISION BY CITY OF PHOENIX — NO | DESCRIPTION | REV BY | CKD BY | DATE

OZALID 80165

[redacted]

7TH STREET - MAJOR STREET
PHOENIX STREETS - MARICOPA CO.
THUNDERBIRD RD. TO BELL RD.



▲ T.B.M. 32.3' Lt. Sta. 80+24.8
Chiseled X on curb 1372.77

▲ T.B.M. 32.3' Lt. Sta. 83+20.0
Chiseled X on curb 1371.21

CAUTION:
Underground Electric

Typical Section - Sta. 82+00
Scale: 1" = 10' Horiz. & Vert.

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	P-856013	34		

FLOYD M. WHITMORE ENGINEERS, INC. CONSULTING ENGINEERS

DES. B.W.	DR. S.E.S.	CK. F.M.W.	DATE 4-19-89

STORM SEWER PIPE

No.	Station to Station		L.F.	Size
①	79+00	79+31	93	36"
②	79+29.7	79+92	100	48"
③	79+92	84+00	408	48"

STORM SEWER MANHOLE

No.	Station	Shaft	Base
④	79+92	M.A.G. 522	M.A.G. 520 Mod. Det. on Sht. 55

PREFABRICATED TEES

No.	Station	Size
⑤	82+20	48" x 48" x 15"
⑥	82+25	48" x 48" x 15"

PREFABRICATED WYE

No.	Station	Size
⑦	79+31	48" x 36" (branch) x 30°

M.A.G. DET. 403.3 WATER PIPE REPLACEMENT
(or M.A.G. Det. 370 if needed)

No.	Station	Size	Exist. Type	L.F.
⑧	79+30±	12"	A.C.P.	16
⑨	79+73±	12"	A.C.P.	18
⑩	80+16±	6"	A.C.P.	16

CONC. CATCH BASINS & CONNECTOR PIPE

No.	Station	Type	Detail	Conn.	L.F.	Size
39A	80+27.2 Lt.	M-1 L=3'	P-1569	Wing Wall	80	15"
39	82+25.0 Lt.	M-1 L=17'	P-1569	Tee	42	15"
40	82+25.0 Rt.	M-1 L=17'	P-1569	Tee	36	15"

***CONNECTOR PIPE TO EXISTING DROP INLET**

No.	Station	Conn.	L.F.	Size
41	79+92.2 Rt.	M.H.	41	18"

*Connect into existing West wall.

CONNECTOR PIPE TO NEW HEADWALL

No.	Station	L.F.	Size
11	79+46.4 Lt.	17 at 17 at 39 = 56	49" x 33" C.M.P.A.

PIPE ℄ CURVE DATA

No.	Radius	△	T	L
①	45'	98°39'53"	52.38'	77.49'

For paving see sheet 19

2 For catch basin X-Sections see sheet 51

3 See sheet 56 for headwall details.

To Be Revised
JFK 5-5-89

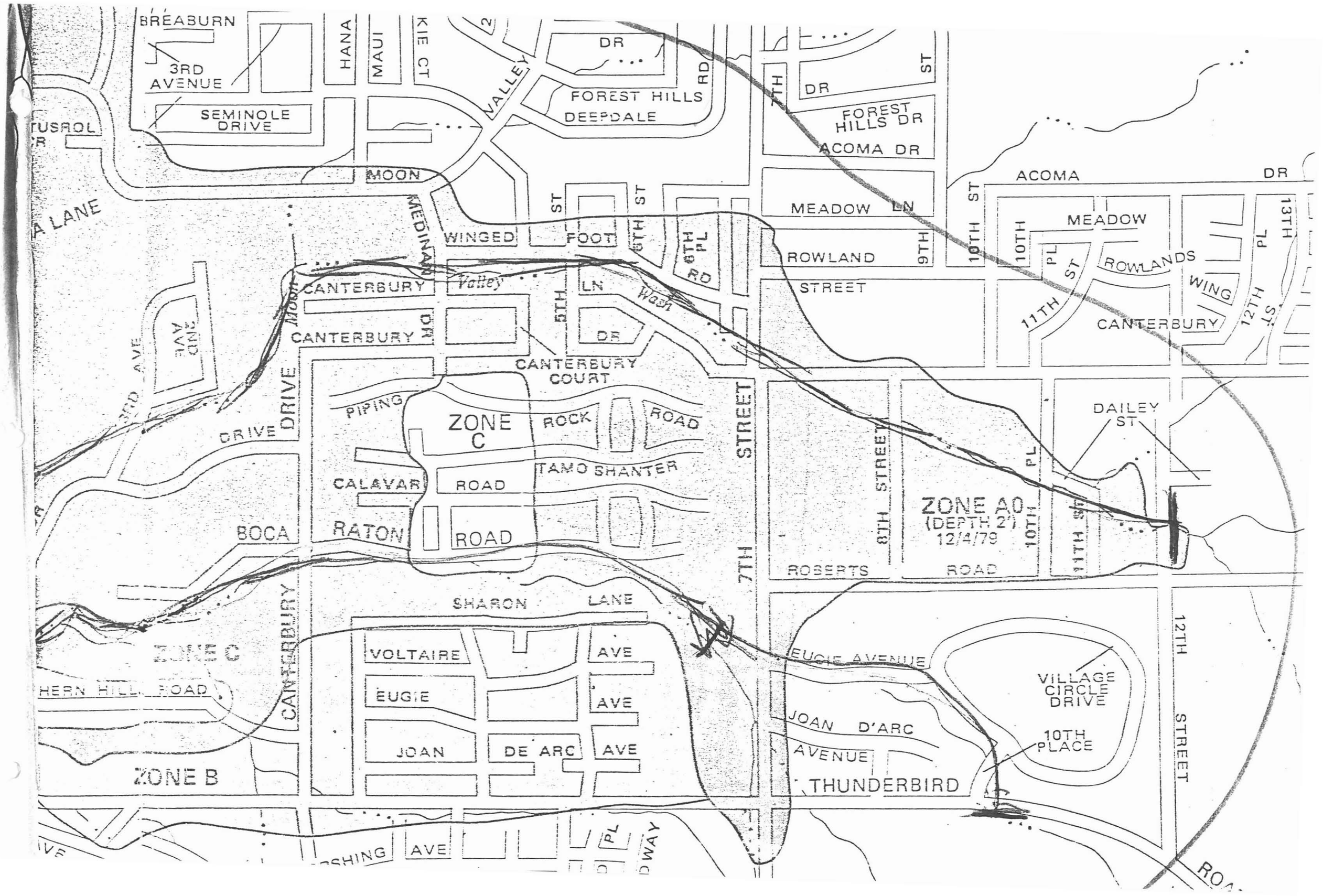
STORM SEWER PLANS

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

7TH STREET
THUNDERBIRD ROAD TO BELL ROAD
P-856013

DES. B.W.	DR. S.E.S.	CK. F.M.W.	DATE 4-19-89
DATE INSP.	DATE ACCEPTED	DATE	NO.

SCALE 1" = 20' HORIZONTAL, 5' VERTICAL | 34


BREABURN
3RD AVENUE
SEMINOLE DRIVE
HANA
MAUI
KIE CT
VALLEY
FOREST HILLS
DEEPDALE
RD
DR
ST
7TH
FOREST HILLS DR
ACOMA DR
ACOMA
DR
MEADOW LN
MEADOW
10TH ST
10TH PL ST
ROWLAND
9TH
STREET
ROWLANDS
WING
12TH PL ST
13TH
CANTERBURY
11TH ST
MOON
MEDINAH
WINGED FOOT
6TH
6TH PL RD
5TH LN
Valley Wash
CANTERBURY DR
CANTERBURY COURT
DRIVE
PIPING ROCK ROAD
ZONE C
CALAVAR ROAD
TAMO SHANTER
BOCA RATON ROAD
7TH STREET
8TH STREET
10TH PL
11TH ST
ZONE AO
(DEPTH 2')
12/4/79
ROBERTS ROAD
DAILEY ST
SHARON LANE
VOLTAIRE AVE
EUGIE AVE
JOAN DE ARC AVE
EUGIE AVENUE
JOAN D'ARC AVENUE
THUNDERBIRD
VILLAGE CIRCLE DRIVE
10TH PLACE
12TH STREET
ZONE B
ZONE C

47 0700

10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

ELEVATION

58
56
54
52
50
48
46
44

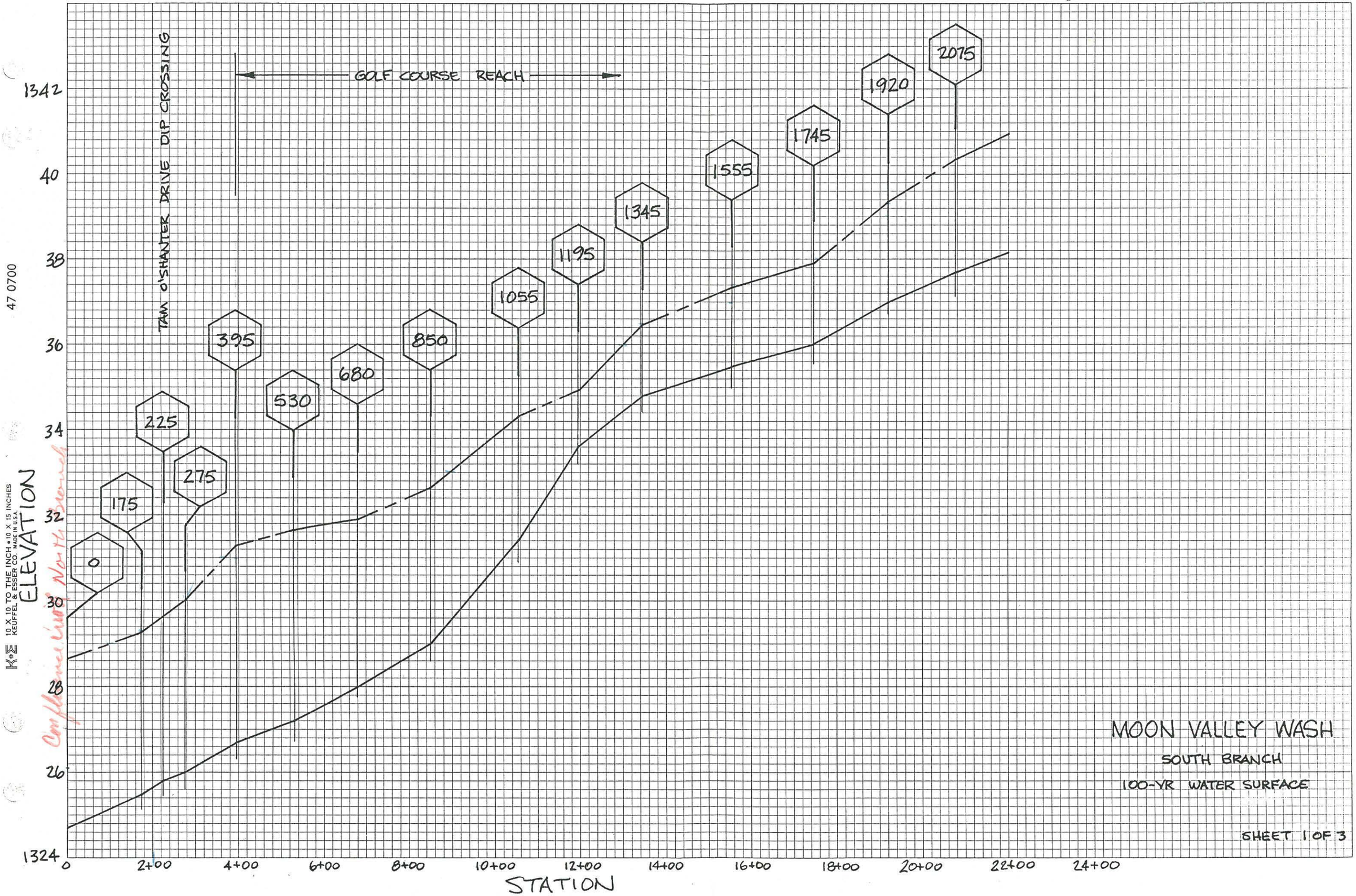
1545
1785
1985
2185
2385
2795

14+00 15+00 16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00

STATION

MOON VALLEY WASH
DIVERSION
100-YR WATER SURFACE

SHEET 2 OF 2


TAM O'SHANTER DRIVE DIP CROSSING
GOLF COURSE REACH
1342
40
38
36
34
32
30
28
26
1324
ELEVATION
0
175
225
275
395
530
680
850
1055
1195
1345
1555
1745
1920
2075
0
2+00
4+00
6+00
8+00
10+00
12+00
14+00
16+00
18+00
20+00
22+00
24+00
STATION
MOON VALLEY WASH
SOUTH BRANCH
100-YR WATER SURFACE
SHEET 1 OF 3
47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

GOLF COURSE REACH

CANTERBURY DRIVE DIP CROSSING

CONCRETE TRAPEZOIDAL CHANNEL REACH

FLOW SPLIT: DIVERSION CHANNEL TO NORTH BRANCH

CONCRETE TRAPEZOIDAL CHANNEL REACH

2310 2480 2610 2780 2930 3100 3250 3420 3600 3800

3960 4060 4210 4380 4565 4765 4835 4965 5110

ELEVATION

1338 40 42 44 46 48 50 52 54 1356

1352 54 56 58 60 62 64 66 68

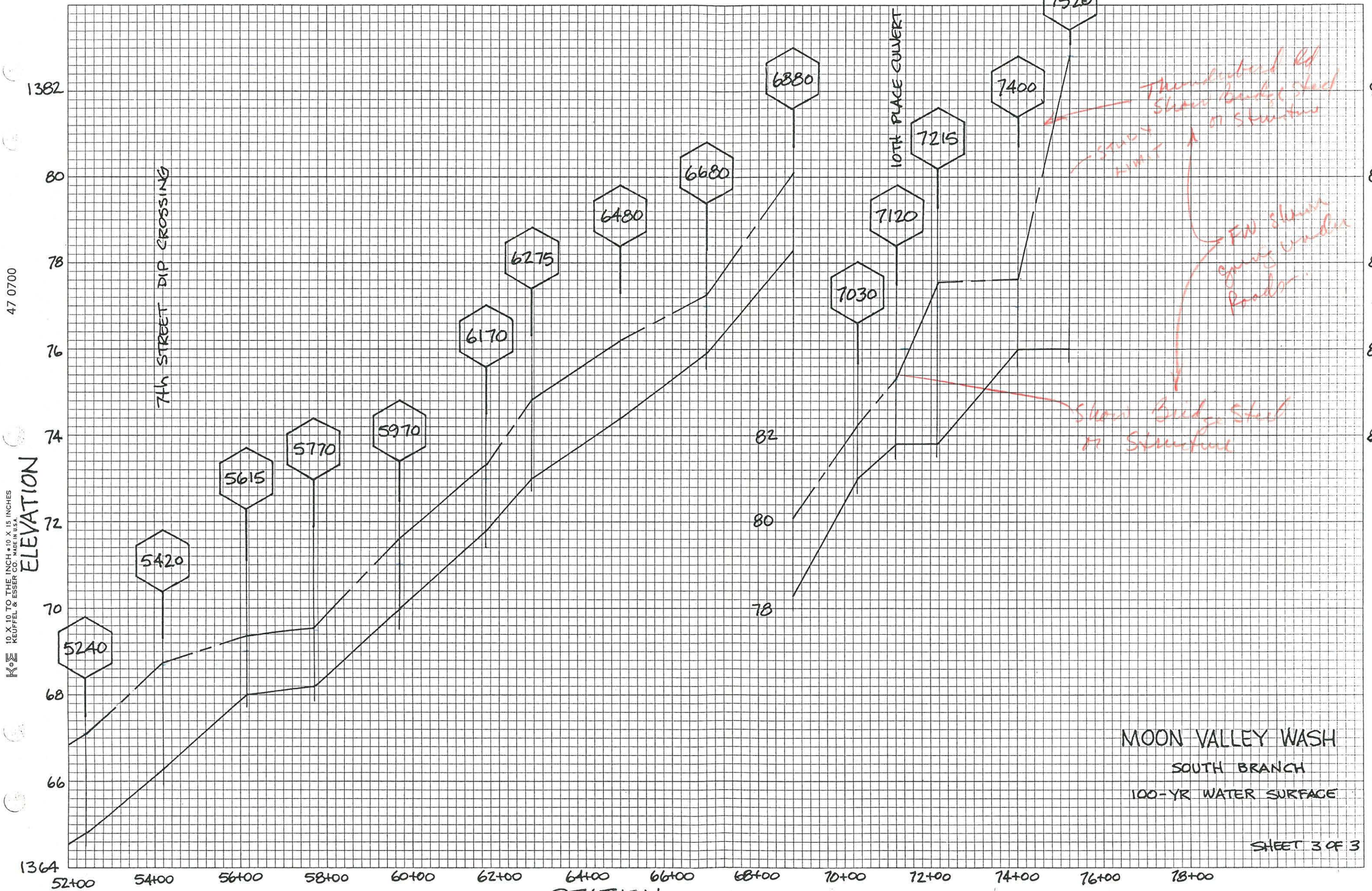
22+00 24+00 26+00 28+00 30+00 32+00 34+00 36+00 38+00 40+00 42+00 44+00 46+00 48+00 50+00 52+00

STATION

MOON VALLEY WASH

SOUTH BRANCH

100-YR WATER SURFACE


7th STREET DIP CROSSING
10TH PLACE CULVERT
5240
5420
5615
5770
5970
6170
6275
6480
6680
6880
7030
7120
7215
7400
7520
1382
80
78
76
74
72
70
68
66
1364
90
88
86
84
82
80
78
52+00
54+00
56+00
58+00
60+00
62+00
64+00
66+00
68+00
70+00
72+00
74+00
76+00
78+00
ELEVATION
STATION
47 0700
K&E 10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.
MOON VALLEY WASH
SOUTH BRANCH
100-YR WATER SURFACE
SHEET 3 OF 3

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

ELEVATION

54
52
50
48
46
44
42
40
38
36

100
180
280
430
630
780
930
965
1015
1215
1415

0
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00
13+00
14+00

STATION

MOON VALLEY WASH
DIVERSION
100-YR WATER SURFACE

SHEET 1 OF 2

Any Bridge Steel

0
407
810
1090
1038
1182
1338
THUNDERBIRD ROAD
1587
1462
1704
1850
2060
2300
CORAL GABLES DR.
2465
2620
2840
2234
2360

LIMIT OF STUDY

1326
24
22
20
18
16
14
12
1310

ELEVATION

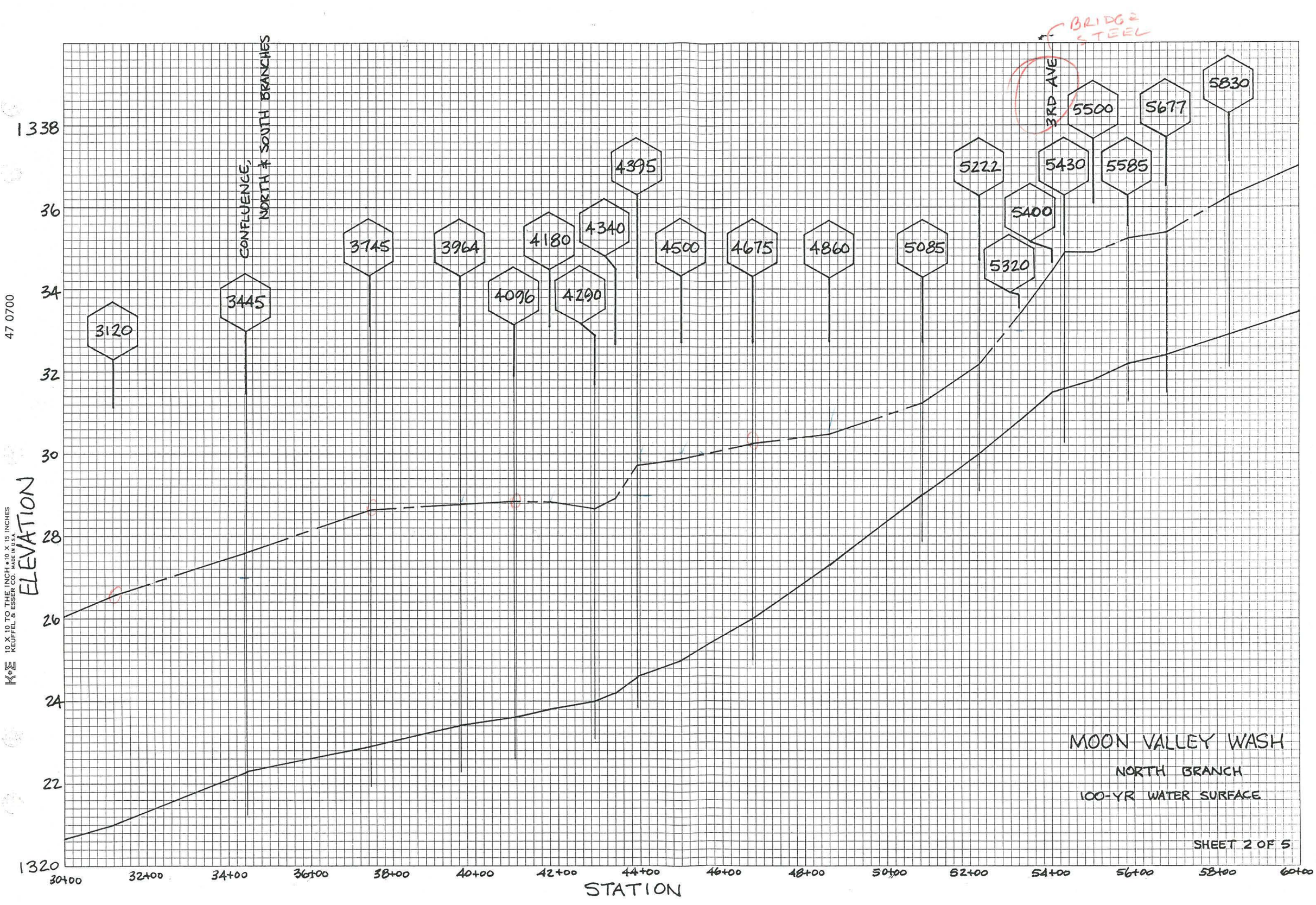
0
2+00
4+00
6+00
8+00
10+00
12+00
14+00
16+00
18+00
20+00
22+00
24+00
26+00
28+00
30+00

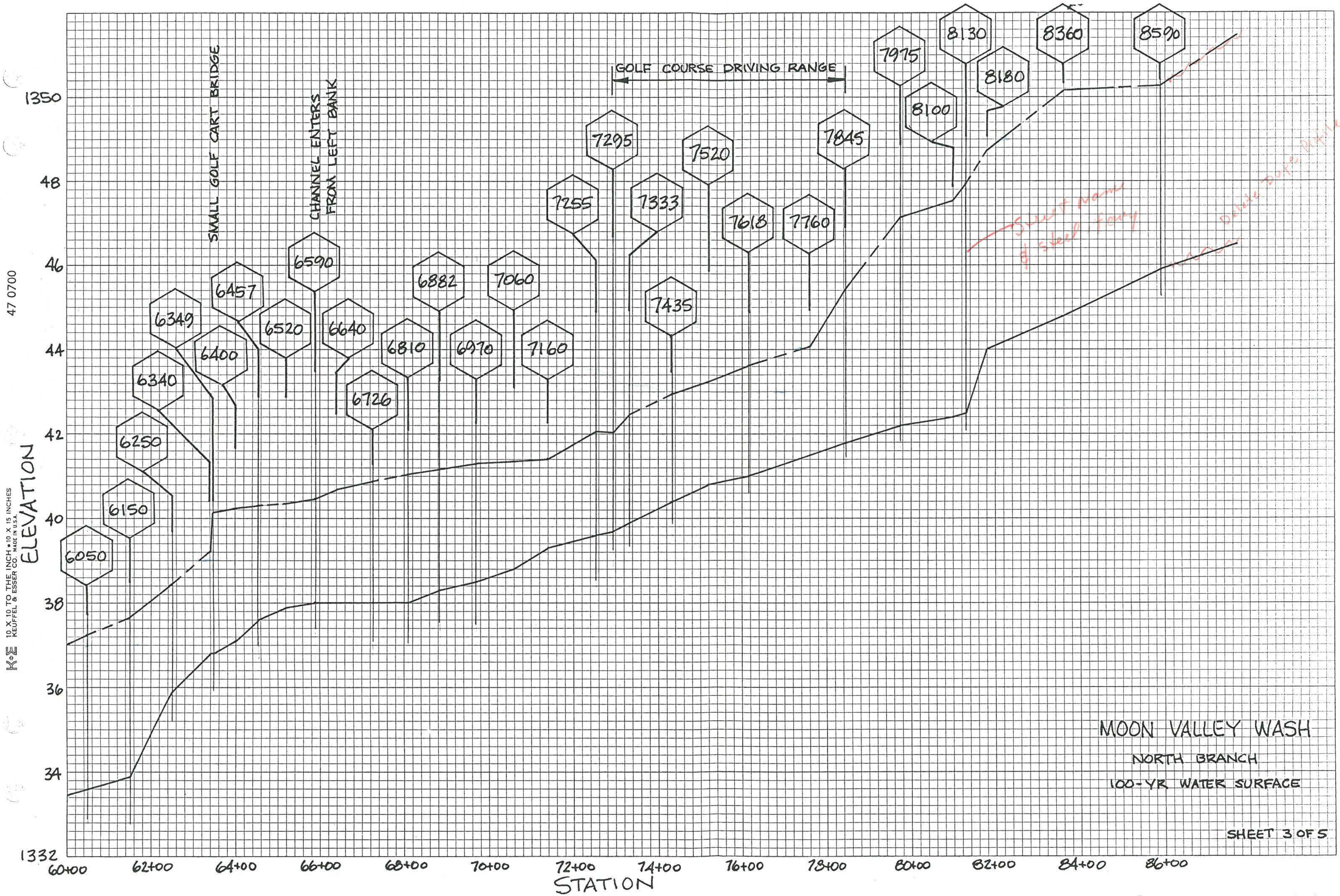
STATION

MOON VALLEY WASH
NORTH BRANCH
100-YR WATER SURFACE

SHEET 1 OF 5

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.


BRIDGE STEEL
3RD AVE
CONFLUENCE, NORTH & SOUTH BRANCHES
3120
3445
3745
3964
4096
4180
4290
4340
4395
4500
4675
4860
5085
5222
5320
5400
5430
5500
5585
5677
5830
1338
36
34
32
30
28
26
24
22
1320
ELEVATION
30+00
32+00
34+00
36+00
38+00
40+00
42+00
44+00
46+00
48+00
50+00
52+00
54+00
56+00
58+00
60+00
STATION
MOON VALLEY WASH
NORTH BRANCH
100-YR WATER SURFACE
SHEET 2 OF 5
47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.


MOON VALLEY WASH
NORTH BRANCH
100-YR WATER SURFACE
SHEET 3 OF 5
ELEVATION
STATION
1350
48
46
44
42
40
38
36
34
1332
60+00
62+00
64+00
66+00
68+00
70+00
72+00
74+00
76+00
78+00
80+00
82+00
84+00
86+00
SMALL GOLF CART BRIDGE
CHANNEL ENTERS FROM LEFT BANK
GOLF COURSE DRIVING RANGE
6050
6150
6250
6340
6349
6400
6457
6520
6590
6640
6726
6810
6882
6970
7060
7160
7255
7295
7333
7435
7520
7618
7760
7845
7975
8100
8130
8180
8360
8590
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.
47 0700

47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

ELEVATION

1362 60 58 56 54 52 50 48 46 1344

64 62 60 58

74 72 70 68 66 64

8968 8940 8770 8900 9028 9128 9350 9457 9560 9690 9825 9928 10076

7th STREET AT HEARN ROAD CMP ARCH CULVERTS

10310 10553 10132 10800

8th PLACE DIP CROSSING 11140 11415

new Bridge Street @ 5th St

Storm Structure

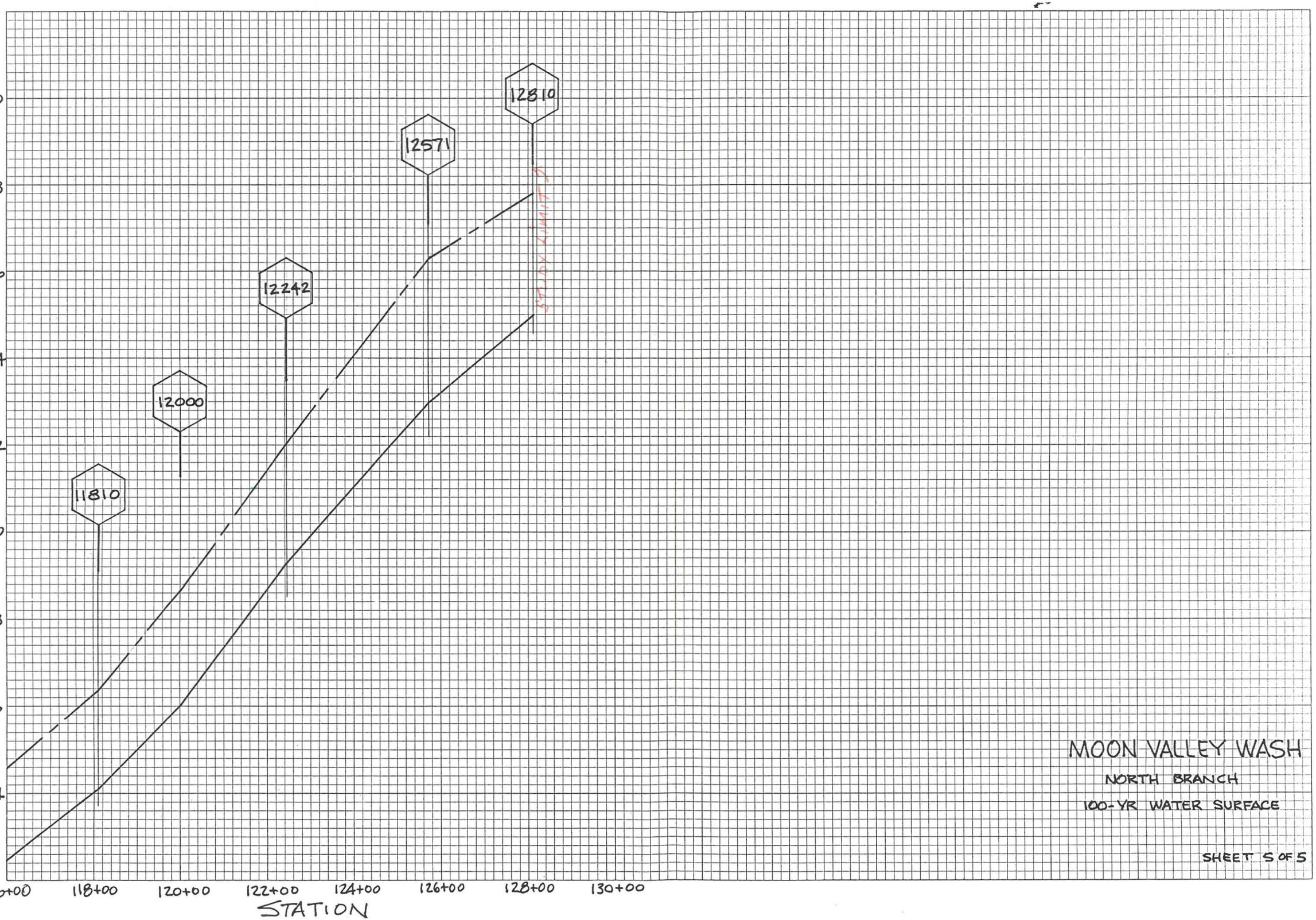
86+00 88+00 90+00 92+00 94+00 96+00 98+00 100+00 102+00 104+00 106+00 108+00 110+00 112+00 114+00 116+00

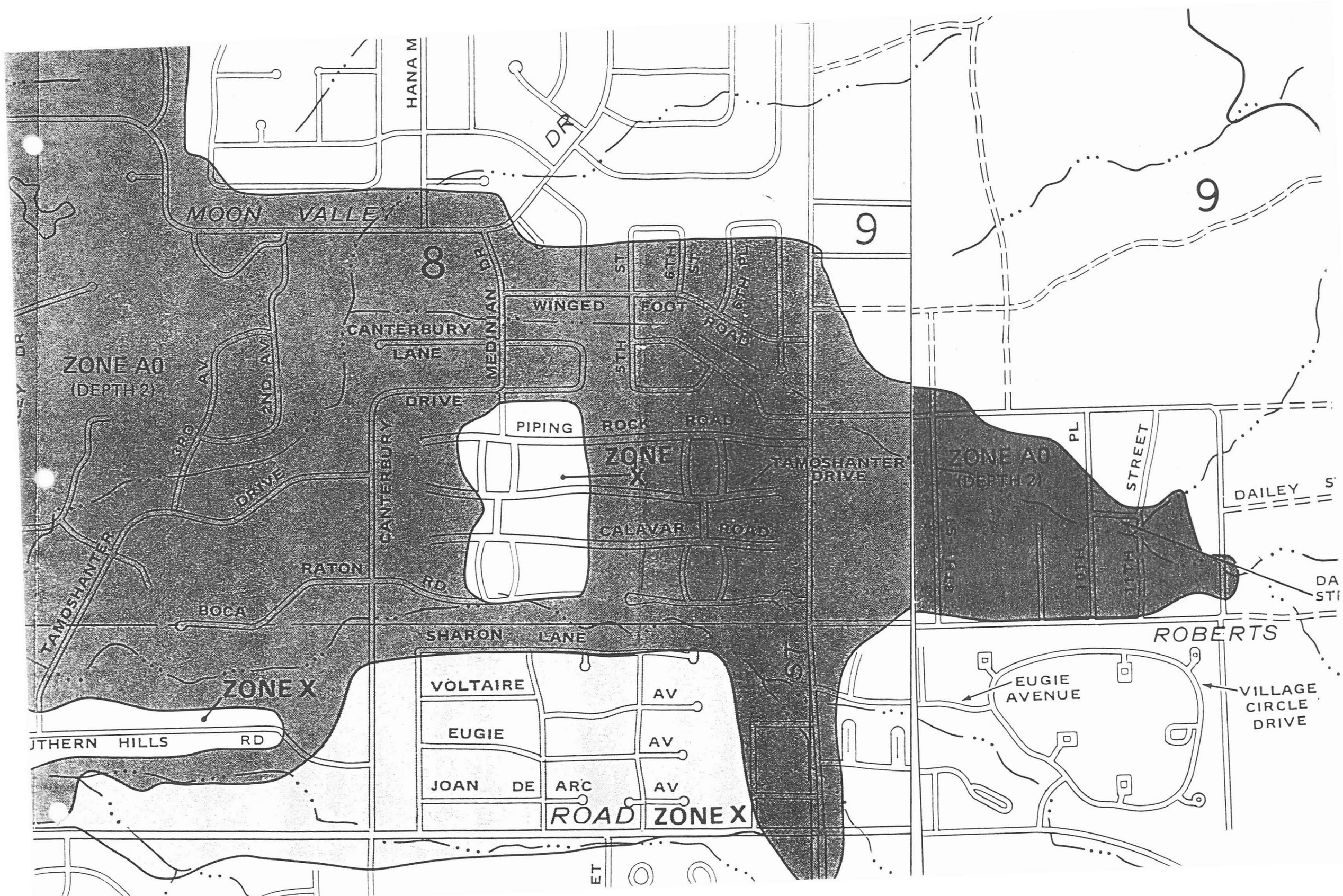
STATION

MOON VALLEY WASH

NORTH BRANCH

100-YR WATER SURFACE


12810
12571
12242
12000
11810
1390
88
86
84
82
80
78
76
74
1372
116+00
118+00
120+00
122+00
124+00
126+00
128+00
130+00
STATION
ELEVATION
MOON VALLEY WASH
NORTH BRANCH
100-YR WATER SURFACE
SHEET 5 OF 5
47 0700
10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.


HANA M
DR
MOON VALLEY
8
9
9
WINGED FOOT
CANTERBURY LANE
MEDINIAN DR
5TH ST
6TH ST
7TH ST
RED ROAD
ZONE A0
(DEPTH 2)
3RD AV
2ND AV
DRIVE
PIPING ROCK ROAD
ZONE X
TAMOSHANTER DRIVE
CANTERBURY
DRIVE
CALAVAR ROAD
RATON RD
BOCA
TAMOSHANTER
SHARON LANE
ZONE X
VOLTAIRE AV
EUGIE AV
JOAN DE ARC AV
ROAD ZONE X
UTHERN HILLS RD
ET
ZONE A0
(DEPTH 2)
PL
STREET
DAILEY ST
10TH
HILL
DA
STI
ROBERTS
EUGIE AVENUE
VILLAGE CIRCLE DRIVE

PHOENIX

ZONE X

PRESI

ZONE X

HANA MAUI DR

DR

9

ON VALLEY

8

WINGED FOOT ROAD

CANTERBURY LANE

DRIVE

PIPING ROCK ROAD

ZONE X

TAMOSHANTER DRIVE

CALAVAR ROAD

CANTERBURY DRIVE

RATON RD

SHARON LANE

VOLTAIRE AV

EUGIE AV

ONE X

RD

9

ZONE AO (DEPTH 2)

STREET

DAILEY STREET

DAILEY STREET

ROBERTS

EUGIE AVENUE

VILLAGE CIRCLE DRIVE

208

206-6
(Club House
(Assume C-1)

206-4
(Golf Course)

206-5
(R1-10)
(PAD)

206-7
(Golf Course)

206-8
(R1-10)

208-1
(Golf Course)

208-2
(R1-10)

208-3
(R1-10)

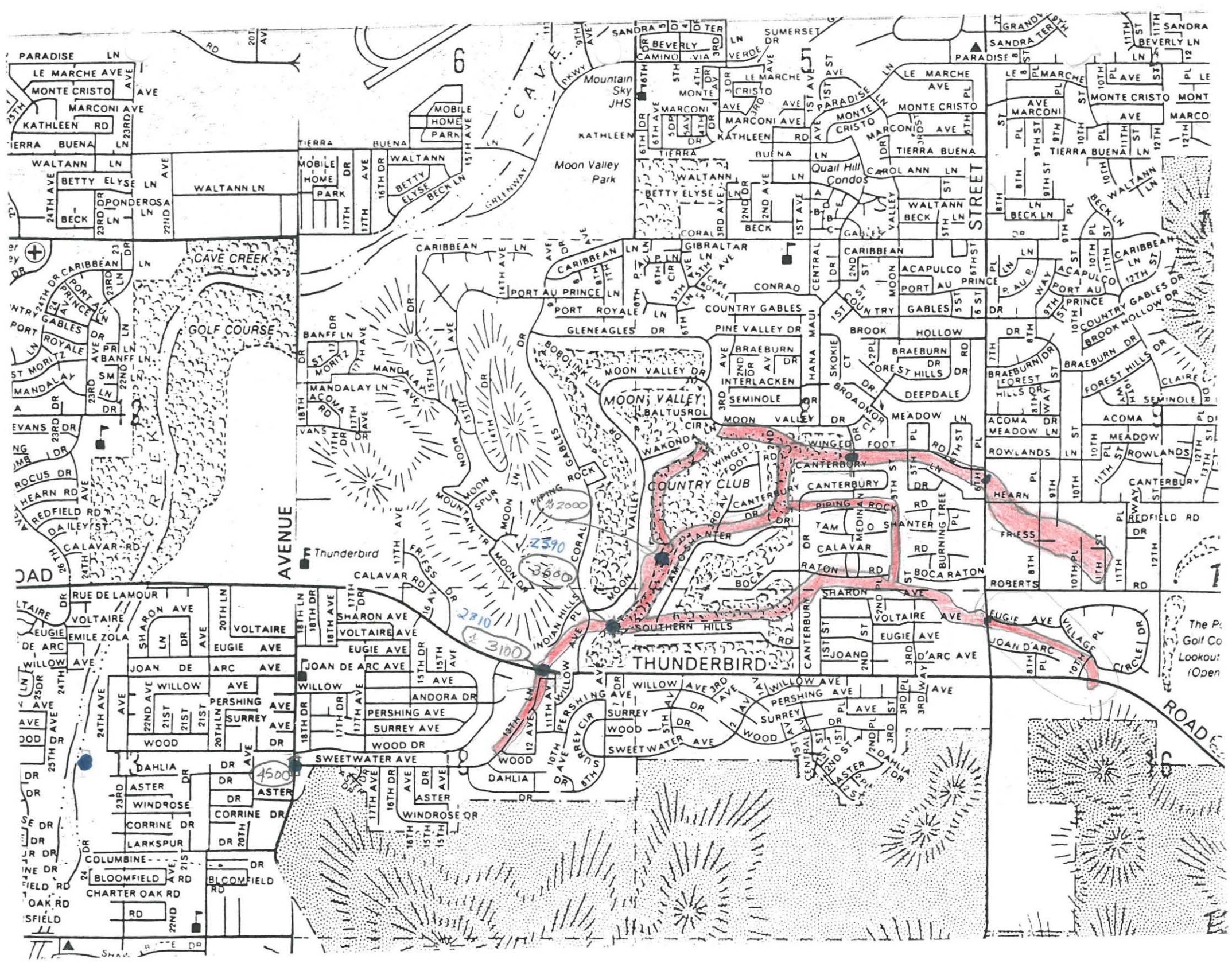
50482
1339.58

1340

1330

1327

37 2
33 2
34 1
32 6
34 7
40 4
39 7
43 2
44 2
37 8
39 9
40 6
45 3
30 2
36 4
44 8
39 0
34 7
31 4
30 5
47 9
29 0
36 1
32.8


PARADISE LN
LE MARCHE AVE
MONTE CRISTO AVE
MARCONI AVE
KATHLEEN RD
TIERRA BUENA LN
WALTANN LN
BETTY ELYSE LN
BECK LN
PONDEROSA LN
MOBILE HOME PARK
CAVE CREEK
GOLF COURSE
CAVE CREEK AVENUE
Thunderbird
Mountain Sky JHS
Moon Valley Park
Quail Hill Condos
CAROL ANN LN
CARIBBEAN LN
PORT AU PRINCE LN
PORT ROYALE LN
GIBRALTAR
CONRAD
COUNTRY GABLES
GLENEAGLES DR
PINE VALLEY DR
BANFF LN
MANDALAY LN
ACOMA RD
MOON VALLEY DR
BOBOLINK LN
INTERLACKEN
SEMINOLE DR
BALTUSROL
WAKONDA CIR
BRAEBURN DR
FOREST HILLS DR
DEEPDALE
BROOKHOLLOW DR
MEADOW LN
ACOMA DR
ROWLANDS LN
CANTERBURY
WINGED FOOT RD
COUNTRY CLUB
PIPING ROCK
TAM O SHANTER
MEDINAH
BURNING TREE
CALAVAR RD
BOCA RATON
SHARON AVE
VOLTAIRE AVE
EUGIE AVE
JOAN D'ARC AVE
VILLAGE PL
CIRCLE DR
ROBERTS
FRIESS
HEARN
REDFIELD RD
DAILEY ST
CALAVAR RD
RUE DE LAMOUR
EMILE ZOLA
WILLOW AVE
PERSHING AVE
SURREY AVE
WOOD DR
SWEETWATER AVE
DAHLIA DR
ASTER DR
WINDROSE DR
CORRINE DR
LARKSPUR
COLUMBINE
BLOOMFIELD RD
CHARTER OAK RD
SOUTHERN HILLS
INDIAN HILLS PL
THUNDERBIRD
2000
2390
2600
2710
3100
4500
The Pi
Golf Co
Lookout
(Open
ROAD

CORPORATE LIMITS
BELL ROAD
SHOW STREAM + PROFILE!
BLACK CANYON HIGHWAY
WALTANN LANE
GREENWAY ROAD
CENTRAL AVE
DEEPDALE ROAD
MEADOW LANE
WAKONDA LANE
HEARN ROAD
ZONE AO
BOCA RATON ROAD
CANTERBURY
THUNDERBIRD ROAD
ZONE C
SURRY EXT.
8TH STREET
S. FORK
MOON VALLEY WASH
7TH STREET
ZONE B
KSPUR DRIVE
19TH AVENUE
SUNNYSIDE DRIVE
DESERT
PEORIA
CHERYL DRIVE
13TH AVE
11TH AVE
17TH AVE
MT. VIEW
SUNNYSLOPE SCHOOL
CINNABAR
BROWN ST
VOGEL AVE
ZONE A5
ARIZONA CANAL
HATCHER ROAD