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DRAINAGE DESIGN REPORT

PROJECT NO.: I-IG-10-2(37)C
HIGHWAY: EHRENBERG-PHOENIX HIGHWAY
SECTION: BULLARD-DYSART ROAD

RECEIVED
APR 15 '76
STRUCTURES SECTION

Prepared by:

DIBBLE AND ASSOCIATES
CONSULTING ENGINEERS

Designed by: Nelson Checked by: Pegany

January, 1976

TABLE OF CONTENTS

Cover and Title Sheet
Table of Contents
I. Recommendation Summary
II. Introduction
III. Discussion
A. Hydrology
B. Hydraulics
1. Alternate One
2. Alternate Two
3. Alternate Three
C. Comparisons of the Three Alternates
1. Essential Features
2. Excavation and Borrow Requirements
3. Cost Comparisons
IV. Drainage Structures under Railroad and Litchfield Road Crossings
V. Summary and Recommendation
VI. Appendix
A. Drainage Area Map
B. Plan and Profile of Alternate Three
C. Hydrologic Design Data
D. Outflow Hydrographs
E. Outlet Pipe Hydraulics (Culvert Computation Sheets)
F. Stage - Storage - Discharge Curves
G. Results of Flood Routing
H. Cost - Drainage Time Charts
I. Hydraulics - Drainage Structures Under Railroad and Litchfield Crossing
J. Channel and Spillways

I. RECOMMENDATION SUMMARY

Of the three alternates studied, it is recommended to select Alternate Three for final design and plans. Alternate Three utilizes 745' wide storage basins and provides sufficient borrow for embankment required for this project. A 48" R.C.P. culvert under Southern Pacific Railroad and two-78" R.C.P. culverts under Litchfield Road are also recommended to connect the storage basins to provide for a continuous flow through the basins.

II. INTRODUCTION

The firm of Dibble and Associates Consulting Engineers was retained on September, 1974, by the Division of Highways, Department of Transportation, to design and prepare the construction plans for the Ehrenberg-Phoenix Highway, Section Bullard Avenue-Dysart Road, Project No. I-IG-10-2(37)C. As a part of this contract, the "Drainage Design Concept Development Report" was submitted in May, 1975.

The concept report was approved with instructions to design the offsite storm water drainage system by providing storage basins and an underground storm drain system with the outlet at the junction of Van Buren and the Agua Fria River. Specifically, the instructions were to design the basins for a 50-year storm with continuous flow from the westerly beginnings of the basins to the outlet pipe and to provide borrow requirements for the project. Further, in designing the outlet pipe, an analysis must be conducted to determine the optimum size of the outlet pipe. The analysis compares the costs of various outlet pipe sizes provided for various storage basins.

Consequently, three separate alternates were studied and analyzed and are presented for your consideration and approval.

Alternate One is 600' wide and 8,150' long and is

II. INTRODUCTION (continued)

the size storage basin based on drainage requirements using a 60" outfall pipe that can be accommodated between two cross utility lines at Van Buren Street (see Appendix VI-B-12) and 10th Street (see Appendix VI-B-13).

Alternate Two is based on borrow requirements for the freeway embankment and is 100' wider and 1' deeper than Alternate One.

Alternate Three is shown on the plans provided in Appendix VI-B and is based on borrow requirements for the freeway embankment and is 145' wider than Alternate One.

The analysis of the alternates is based on the hydrologic Design for Highway Drainage in Arizona" distributed in 1969. The hydraulics conforms to the criteria of the Hydrologic and Hydraulic Training Session" held in October, 1972. All drainage computations are for 50-year storm recurrence interval.

III. DISCUSSION

A. Hydrology

1. Drainage Areas

The entire watershed north of the freeway consists of three drainage areas as approximately delineated on the drainage area map provided in Appendix VI-A.

2. Type of Flow

The existing terrain is primarily flat farmland with few scattered residential buildings. As a result, most of the storm water flows south to the freeway project as overland sheet flow, with a small amount concentrated in waste ditches along the crossroads and fields. The Roosevelt Irrigation District canal which crosses the watershed acts as a barrier but it is assumed that the canal will break during a 50-year storm and overland flow will continue south to the freeway. When the area is developed, most of the runoff will concentrate in collector streets and man-made swales and the rest will be carried in Litchfield Park Properties proposed two-year storm sewer system.

3. Land Use

a. Existing

At the present, most of the watershed consists of flat cultivated land.

III. DISCUSSION (continued)

b. Projected

Projected land use is planned by Litchfield Park Properties for three broad categories, "commercial, residential and parks", as shown on the drainage area map. Although the timing of these developments is uncertain, the hydrologic computations for this project are based on the projected land use.

4. SCS Curve Number and Rational "C" Values

SCS Curve No. 90 is based on projected land use; Rational "C" 0.59 is based on weighted projected land use.

5. Precipitation Values

6 hour p = 2.8 inches

24 hour p = 3.5 inches.

6. Soil Groups

C.

III. DISCUSSION (continued)

B. Hydraulics

Three alternates for the storage basins and corresponding outlet storm drains are design based on the hydrology and concepts developed and approved by the Arizona Department of Transportation in the "Drainage Design Concept Development Report". The plans provided in Appendix VI-B are for Alternate Three and may be used for Alternate One or Two with minor revisions.

The hydraulic analysis of the flood routing through the basins for each alternate is accomplished by using the Soil Conservation computer program "TR20". TR20 accomplishes two tasks. First, TR20 develops synthetic outflow hydrographs from each sub-watershed and combines them to form the total inflow hydrograph into the basins. Second, TR20 performs the flood routing through the various outlet pipes investigated.

In performing the first task TR20 simulates each sub-watershed. This is accomplished by inputting the drainage area, time of concentration, SCS curve number, storm percipitation and rainfall distribution. The outflow hydrographs from each area are added together assuming no time lag between the individual basins and form the total inflow hydrograph into the storage basins. The individual hydrographs and combined hydrographs are shown in the Appendix VI-D for the 1,

2, 3, 6, 12 and 24 hour 50-year frequency storm.

In performing the second task TR20 takes the total hydrograph and routes it through the storage basin and the following outlet pipes: 36", 42", 48", 54", 60", 66" and 72". (Assumed Manning's n = .014). The program uses the "Storage Indication Method". This method uses the relationships of stage vs. storage in the basins and stage vs. discharge through the outlet pipe, to perform the flood routing through the storage basins. The stage vs. storage relationships are developed by using the ADOT computer program "ASHES" and the stage vs. discharge relationships are developed by using the Bureau of Public Roads procedures as outlined in BPR Circular 10. The work sheets for this relationship (culvert computation sheets), the curves for stage vs. storage and stage vs. discharge and the flood routing results are provided in Appendices VI-E, F, and G.

1. Alternate One (Size Storage Basin based only on drainage requirement)

a. Storage Basin

The basic size of the storage basin is 600' wide and 8,150' long. The above basin provides a capacity of 773 acre-feet which is sufficient to handle the peak flow from a 12-hour duration storm which controls the size of the basins.

The storage basin size and outlet storm drain size are based only on the drainage need and do not take into consideration the borrow required for freeway embankment.

The entrance of storm water into the basins from the north is controlled by a channel and/or ditch and dyke and concrete spillways to prevent slope erosion. Two alternates are presented for your consideration and selection.

Alternate A utilizes 10' x 1.5' channel with 2:1 slopes using plain riprap for slope protection.

Alternate B utilizes 18' x 1.5' grader type ditch with 10:1 back slopes. See detail of triangular channel, dyke and concrete spillway in Appendix VI-J.6.

The cost of both alternates is about the same. Alternate B is recommended because of flatter slopes.

A minimum of 20-feet is provided for an access road between the storage basin and the I-10 Freeway embankment. This access road is within the standard right of way for the project to minimize the right of way taken for the basins. A buffer zone of 300' is provided along the right of way of Litchfield Road and the storage basin slopes. All 50' right of way for the Southern Pacific Railroad is clear of the basins. A buffer zone of 10' is provided at the westerly and easterly ends of the storage basins.

III. DISCUSSION (continued)

b. Outlet Storm Drain

Various outlet storm drain pipes are analyzed. As shown on the tabulated results of flood routing in Appendix VI-G, only the 60" pipe provide the storm capacity in the basins required for a 50-year storm. The flowline elevation of the outlet pipe is controlled by the high water elevation in the Agua Fria River at Van Buren and is estimated to be about 970.5' by the Army Corps of Engineers. This sets the criteria for the bottom elevation of the storage basin and the entrance elevation of the storm drain.

100 YR 971 - 1990 STDY
969' - 1996 RE-STDY (100-YR)

The profile of the storm drain is controlled by two 10" sanitary sewer lines in Van Buren. The storm drain crosses under a sanitary sewer line at Station 55+ and over a sanitary sewer line at Station 68. The location of the outlet of the storm drain at Agua Fria River is selected away from the low flow area of the river. The cover requirement over the pipe in Van Buren also controls the location of the outlet. A small amount of channel cleanout in the river is necessary at the outlet.

Advantages

(1) Provides the size storage basin based on drainage requirements only.

(2) The outlet flowline elevation is above the Agua Fria River high water for a 50-year storm.

III. DISCUSSION (continued)

(3) Required right of way purchase is the least of the three alternates.

(4) Drains the basin in the shortest time.

(5) Minimum self-cleansing velocity is provided.

Disadvantages

(1) Does not provide sufficient borrow for the roadway embankment.

(2) Storage capacity is sufficient only for a 60" outlet pipe.

(3) Costs the most of the three alternates.

2. Alternate Two (Based on borrow required for freeway embankment and requires a basin 100' wider and 1' deeper than Alternate One)

a. Storage Basin

The essential features of Alternate Two are identical to Alternate One except that it is 100' wider and 1' deeper. The basin capacity of 1,068 acre-feet is sufficient for any size of outlet pipe from 36" to 72".

b. Outlet Storm Drain

A cost vs. draining time relationship is established for Alternate Two and is shown graphically in Appendix VI-H. The optimum pipe sizes from this relationship are 48" to 60". The 48" pipe is recommended to keep the draining time

III. DISCUSSION (continued)

within the range of 10 to 15 days.

The storm drain profile is similar to Alternate Three.

Advantages

(1) Provides sufficient borrow required for freeway embankment.

(2) Storage capacity is sufficient for any size outlet pipe (36" or larger).

(3) Costs the least of the three alternates.

(4) Required right of way purchase is less than Alternate Three but more than Alternate One.

Disadvantages

(1) The outlet flowline elevation of the pipe and basins is below the Agua Fria highwater for a 50-year storm.

(2) Self-cleansing velocity at 1/4 full is less than the required minimum of 2 fps.

(3) Maintenance costs would be higher than other alternates.

3. Alternate Three (Based on borrow required for freeway embankment and requires a basin 145' wider than Alternate One)

III. DISCUSSION (continued)

a. Storage Basin

The alignment and grade of the recommended Alternate Three are shown on the plans provided in Appendix VI-B.

The essential features of Alternate Three are identical to Alternate One except that it is 145' wider. The basin capacity of 1,020 acre-feet is sufficient for any size pipe from 36" to 72".

b. Outlet Storm Drain

The cost vs. draining time relationship for Alternate Three is nearly identical to that of Alternate Two. The optimum pipe sizes are 48" to 60". The 48" pipe is recommended.

Advantages

(1) Provides sufficient borrow required for freeway embankment.

(2) Storage capacity is sufficient for any size outlet pipe (36" or larger).

(3) Cost is less than Alternate One but more than Alternate Two.

(4) The outlet elevation is above the Agua Fria River high water for a 50-year storm.

#1
8,150' L
600' w

#2
745' x 8150'
STOR = 1020
HW = 988' FROM CURVES

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III. DISCUSSION (continued)

(5) The minimum self-cleansing velocity is provided.

Disadvantages

(1) The required right of way purchase is the largest of the three alternates.

III. DISCUSSION (continued)

C. Comparisons of the Three Alternates

1. Essential Features: TABLE A

Feature	Alternate 1	Alternate 2	Alternate 3
1. Right of way required (acres)	110	128	136
2. Nominal basin width (ft)	600	700	745
Nominal basin length (ft)	8,150	8,150	8,150
3. Highwater elevation (minimum freeboard = 1.3')	983.5'	982.5'	982.1'
4. Storage capacity (acre-feet)	773	1,068	1,020
5. Runoff for 24-hour storm (acre-feet)	945	945	945
6. Available excavation (c.y.)	1,859,000	2,450,000	2,409,000
7. Outlet pipe data:			
a. Recommended pipe size	60"	48"	48"
b. Manning's "n" value	.014	.014	.014
c. Outlet flowline elevation	970.5'	969.5'	970.5'
d. 50-year storm highwater elevation at Van Buren and the Agua Fria River	970.5'	970.5'	970.5'
e. Minimum pipe grade (%)	.0624	.0451	.0624
Average pipe grade (%)	.0923	.0769	.0923
f. Pipe length	5,600'	5,600'	5,600'
g. Velocity @ 1/2 full (cfs)	3.9	2.5	3.0
Velocity @ 1/4 full (cfs)	2.7	1.8	2.1
h. Time to empty basins (days)	7	14	12
i. Estimated cost/l.f. of pipe (dollars)	70	55	55

III. DISCUSSION (continued)

2. Excavation and Borrow Requirement: TABLE B

Item	Alternate 1 c.y. x 10^3	Alternate 2 c.y. x 10^3	Alternate 3 c.y. x 10^3
Excavation available from basins.	1,859	2,450	2,409
Less 15% shrinkage	- 279	- 368	- 361
Total excavation available after shrinkage	1,580	2,082	2,048
Less borrow required for project.***	-2,008	-2,008	-2,008
Total surplus or deficiency ( ) after shrinkage	(428)	74	40
Total surplus or deficiency ( ) before shrinkage	(503)	87	47

***Includes 5% additional for shrinkage factor variation.

3. Cost Comparison: TABLE C

Item	Alternate 1	Alternate 2	Alternate 3
Right of way @ $5,000/acre	$ 550,000	$ 640,000	$ 680,000
60" Pipe @ $70/l.f.	392,000	-	-
48" Pipe @ $55/l.f.	-	308,000	308,000
Excavation @ $0.75/c.y.	1,394,000	1,838,000	1,807,000
Borrow for freeway embankment @ $1.75/c.y.	880,000	-	-
Culverts under Litchfield Road and Railroad crossings	258,000	81,000	80,000
TOTAL*	$3,474,000	**$2,867,000	$2,875,000
Savings Over Alternate One	-	$ 607,000	$ 599,000

*Costs common to all alternates are not included.

**Does not include maintenance cost which would be higher than other alternates.

IV. DRAINAGE STRUCTURES UNDER THE RAILROAD AND LITCHFIELD ROAD CROSSINGS

In order to provide a continuous flow through the storage basins, a preliminary design of the drainage structures under the Southern Pacific Railroad and Litchfield Road crossings is submitted for your consideration. The input data and hydraulics of the solution are contained in Appendix VI-I.

A 48" pipe culvert is recommended under the railroad since there is ample storage capacity available in Basin No. 3 to store all the storm water generated by a 50-year storm from 24 hour duration. By allowing the high water to rise to an elevation of 986 in Basin No. 3, 320 acre-feet storage capacity is estimated which is also the inflow runoff from Area No. 3. Therefore, 48" pipe is adequate and compatible with the 48" outfall pipe.

To establish the peak discharge for the structure under Litchfield Road, no inflow from Basin No. 3 to Basin No. 2 is assumed. Furthermore, the storm water in Basin No. 2 is allowed to rise to the design highwater elevation of 983.5. From the hydrograph of Area No. 2 the peak discharge is established for each duration of 1-24 hour storm after the basin has filled to its allowable capacity. From these graphs a maximum peak of 700 cfs is established for a duration of 3-hour storm. By using this peak discharge, two-78" culverts are recommended to route this required flow through the structure under Litchfield Road.

V. SUMMARY AND RECOMMENDATIONS

Alternate One can be eliminated because it does not provide sufficient borrow for the project. Additionally, it is the most expensive alternate.

Alternate Two and Three each provide sufficient storage capacity for any size storm drain over 36". The only limiting factor is the time required to empty the basins. A 48" pipe which will empty the basins in about 12 to 14 days is recommended. Moreover, either Alternate Two or Three provides sufficient borrow for freeway embankment. The essential difference between Alternates Two and Three is that the former provides the bottom elevation of the storage basins below the Agua Fria River high water and does not have sufficient self-cleansing velocity in the outlet pipe, while the latter requires about eight acres more of right of way purchase. The cost of additional right of way of eight acres is insignificant to the maintenance problems associated with having the bottom elevation of storage basins below the Agua Fria River high water and the unacceptable self-cleansing velocity in the storm drain. Therefore, Alternate Three is recommended for further development of design and plans.

Additionally, pipe culverts are recommended for the drainage structures at the railroad and Litchfield crossings.

VI. APPENDIX

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
SCS METHOD: PART II

Future

LOCATION DATA:
Highway Ehrenberg-Phoenix County Maricopa
Location Bullard Ave-Desert Rd
Project No. I-IG-10-2(37) Station 6760 (Flow from North (3)
Name of Stream

DESIGN DATA:
Design Frequency 50 years
Drainage Area 0.82 Commercial, 1.84 Residential — 2.66 square miles
Drainage Length 21,700 feet
Elevation
Top of Drainage area 1073 feet
At Structure 986 feet
Drainage Area Slope 0.40 % Not Representative
Vegetative Cover Type —
Vegetative Cover Density — % 0.82% for 3400', 0.43% for 4700', 0.29% for 13,600'
Soil Group C
Precipitation
P = 6 hour = 2.8 inches
P = 24 hour = 3.3 inches

DESIGN COMPUTATION: $\bar{C} = [(0.82 \times 0.80) + (1.84 \times 0.50)] \div 2.66 = 0.59$
Curve Number 90
Time of Concentration 2.3 hours
Peak Design Discharge
$Qp = \frac{484AQ}{\frac{D}{2} + .6Tc} =$ 931 cfs

Storm Duration	Point Precipitation	Areal Reduction	Areal Precipitation	Direct Runoff	Peak Discharge	Direct Runoff Acre-Feet
1 hour	2.3	–	2.3	1.36	931	193
2 hour	2.42	–	2.42	1.45	790	207
3 hour	2.53	–	2.53	1.56	702	223
6 hour	2.80	–	2.8	1.80	529	255
12 hour	3.05	–	3.05	2.05	356	291
24 hour	3.3	–	3.3	2.26	217	320

Computed by: F. M. Nelson Date January, 1976

AHD 22-040 11-66

VII-C-1

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
SCS METHOD: PART II

Future

LOCATION DATA:
Highway Ehrenberg-Phoenix County Maricopa
Location Bullard Ave-Desert Rd
Project No. I-IG-10-2(37) Station 6780+ (Flow from North (2)
Name of Stream

DESIGN DATA:
Design Frequency 50 years
Drainage Area 0.61 Commercial, 1.36 Residential — 1.97 square miles
Drainage Length 18,500 feet
Elevation
Top of Drainage area 1080 feet
At Structure 486 feet
Drainage Area Slope 0.51 % Not Representative
Vegetative Cover Type —
Vegetative Cover Density — % 1.00% for 5300', 0.31% for 13,200'
Soil Group C
Precipitation
P = 6 hour = 2.8 inches
P = 24 hour = 3.3 inches

DESIGN COMPUTATION: $\bar{C} = [(0.61 \times 0.80) + (1.36 \times 0.50)] \div 1.97 = 0.59$
Curve Number 90
Time of Concentration 2.3 hours
Peak Design Discharge
$Qp = \frac{484AQ}{\frac{D}{2} + .6Tc} =$ 790 cfs

Storm Duration	Point Precipitation	Areal Reduction	Areal Precipitation	Direct Runoff	Peak Discharge	Direct Runoff Acre-Feet
1 hour	2.3	–	2.3	1.36	790	143
2 hour	2.42	–	2.42	1.45	646	152
3 hour	2.53	–	2.53	1.56	563	164
6 hour	2.8	–	2.8	1.80	415	189
12 hour	3.05	–	3.05	2.05	274	215
24 hour	3.3	–	3.3	2.26	164	237

Computed by: F. M. Nelson Date January, 1976

AHD 22-040 11-66

VII-C-2

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
SCS METHOD: PART II

Future

LOCATION DATA:
Highway Ehrenberg-Phoenix County Maricopa
Location Pollard Rd - Dysart Rd
Project No. I-IG-10-2(37) Station 6300+ (Flow from North) (1)
Name of Stream

DESIGN DATA:

Design Frequency	50	years
Drainage Area (1.00 Commercial, 2.22 Residential)	3.22	square miles
Drainage Length	20,000	feet
Elevation		
Top of Drainage area	1065	feet
At Structure	1036	feet
Drainage Area Slope	0.40	%
Vegetative Cover Type	—	
Vegetative Cover Density	—	%
Soil Group	C	
Precipitation		
P = 6 hour =	2.8	inches
P = 24 hour =	3.2	inches

DESIGN COMPUTATION:

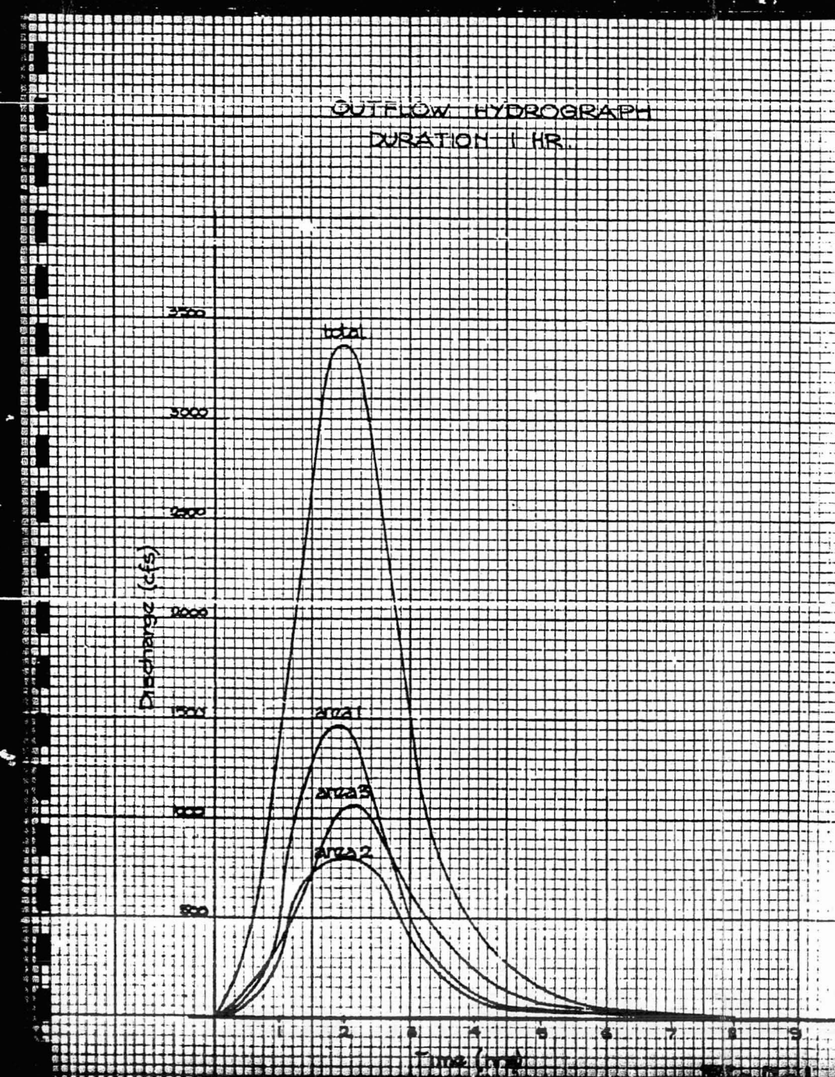
$\bar{C} = [(1.00 \times 0.80) + (2.22 \times 0.50)] \div 3.22 = 0.59$

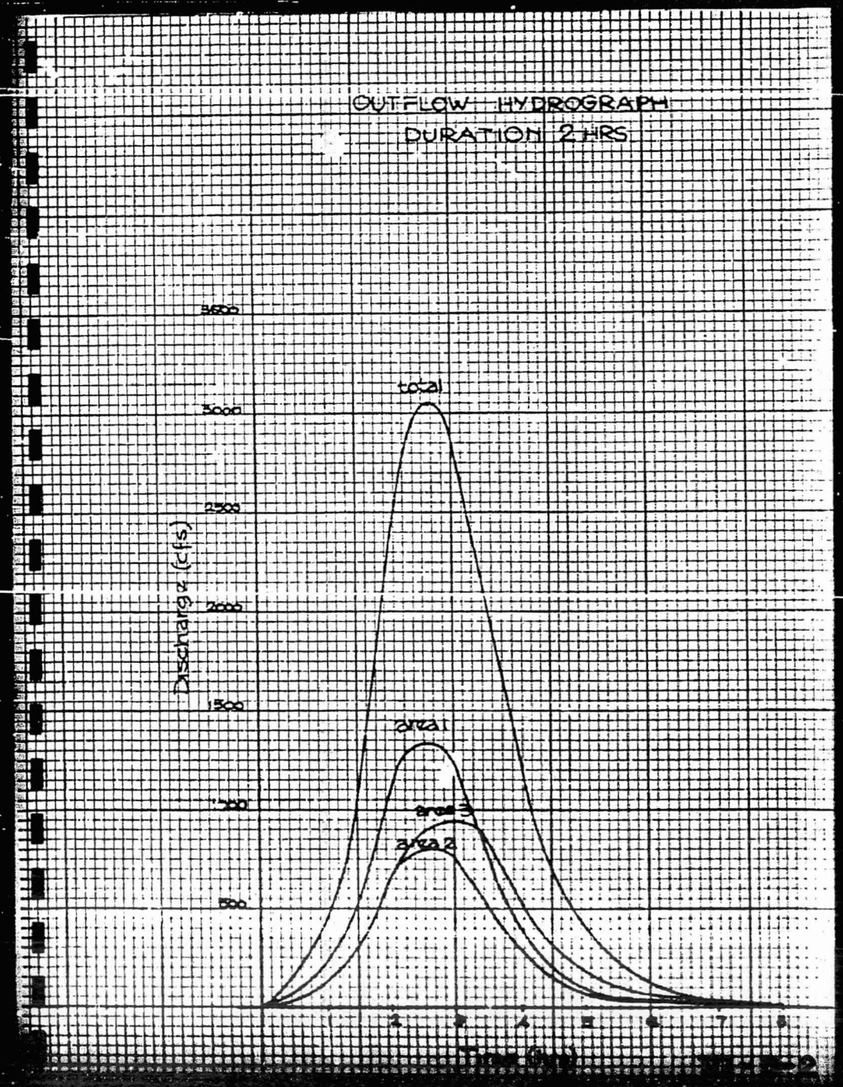
Curve Number	40	
Time of Concentration	1.8	hours
Peak Design Discharge $Qp = \frac{484AQ}{D/2 + .6Tc}$ =	1341	cfs

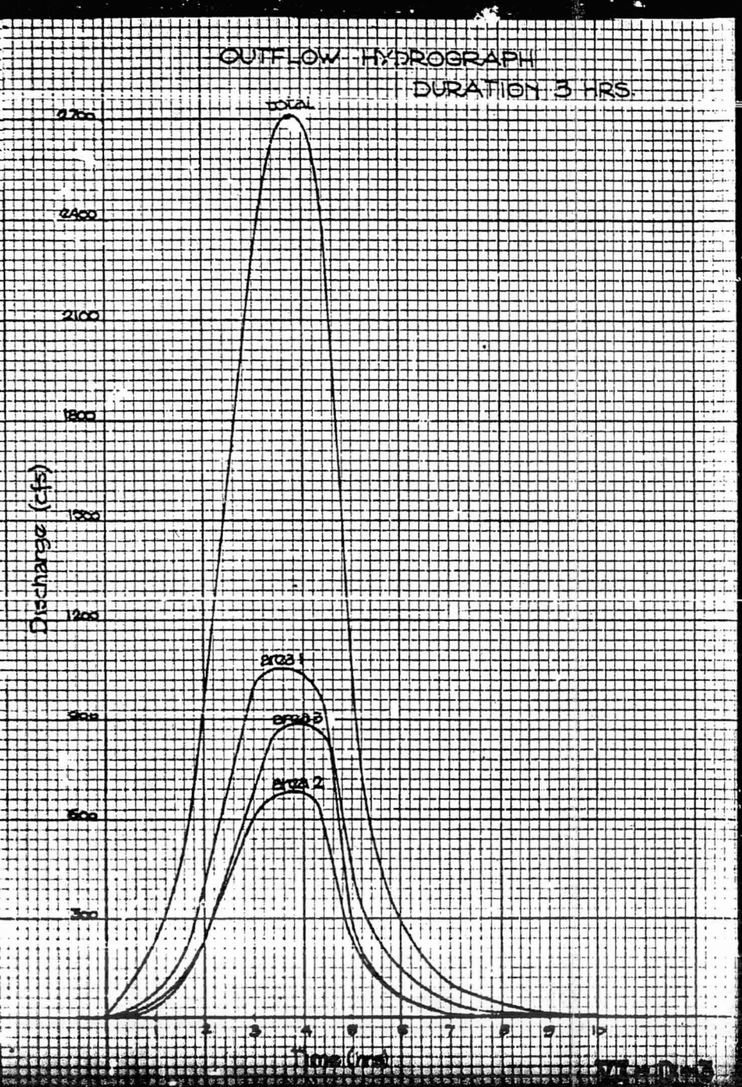
Storm Duration	Point Precipitation	Areal Reduction	Areal Precipitation	Direct Runoff	Peak Discharge	Direct Runoff Acre-Feet
1 hour	2.3	—	2.3	1.36	1341	233
2 hour	2.42	—	2.42	1.45	1096	249
3 hour	2.53	—	2.53	1.56	942	268
6 hour	2.8	—	2.8	1.80	688	301
12 hour	3.05	—	3.05	2.05	451	352
24 hour	3.3	—	3.3	2.26	269	389

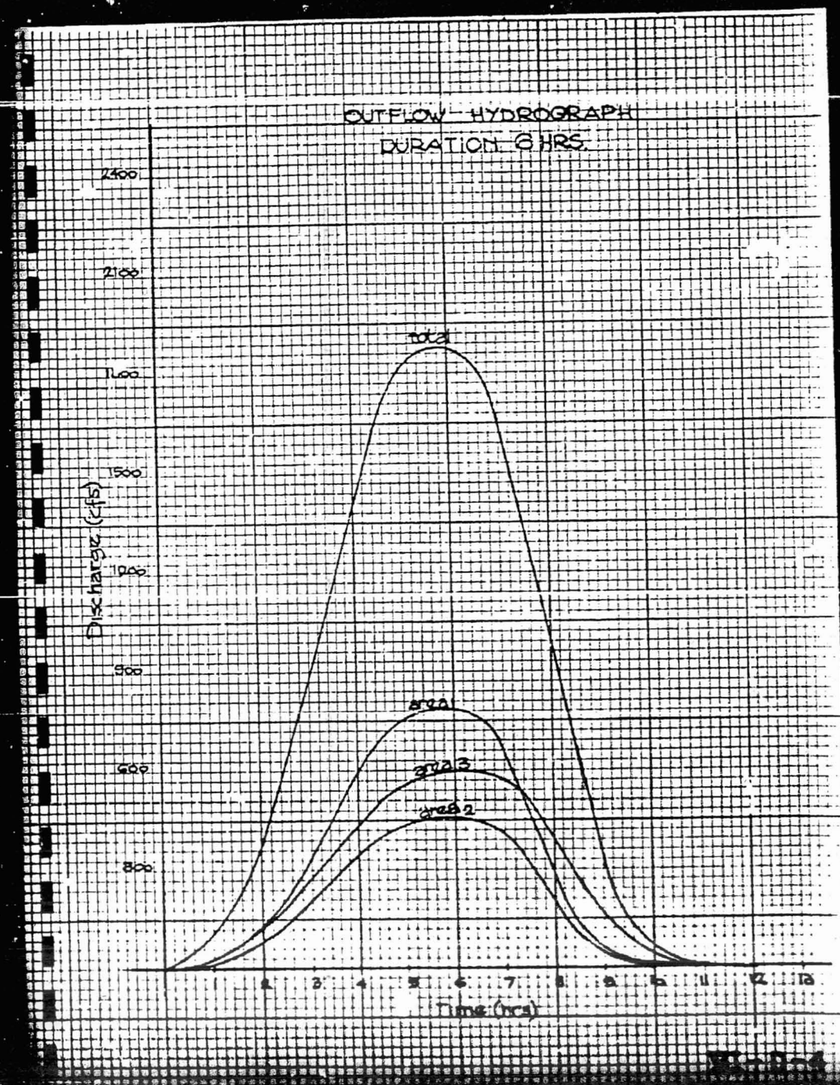
Computed by: F. M. Nelson Date January, 1976

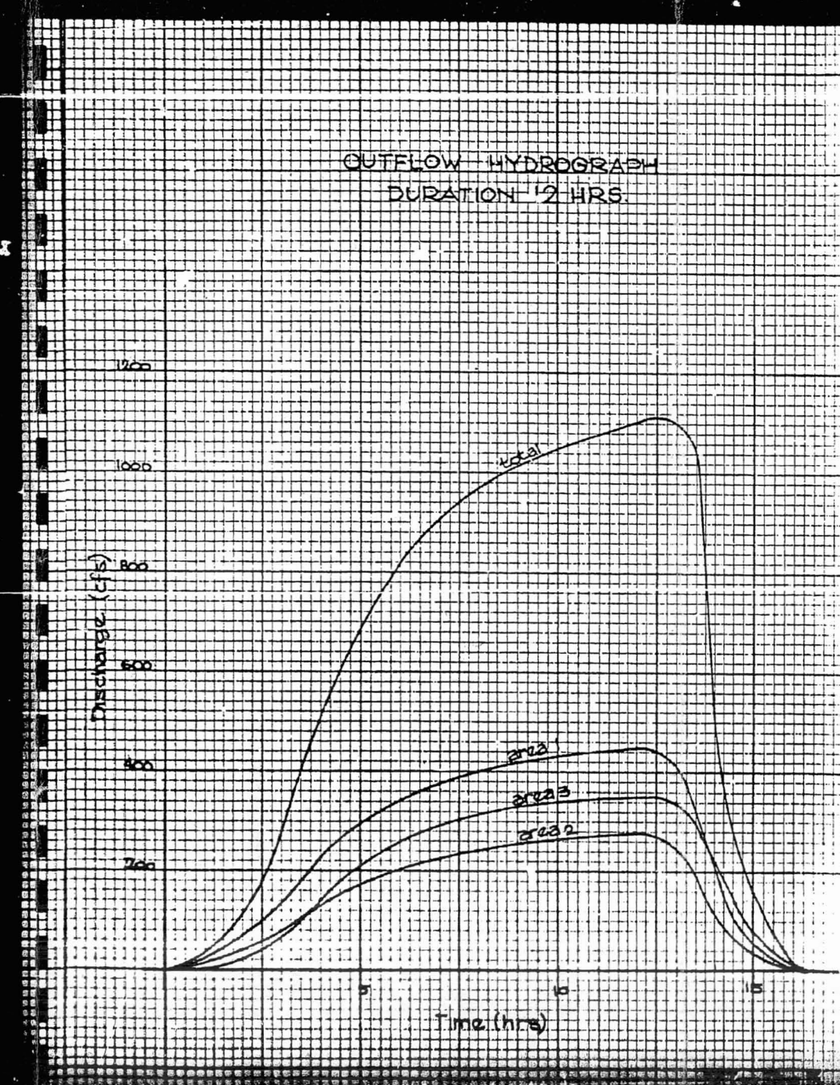
VI-C-3

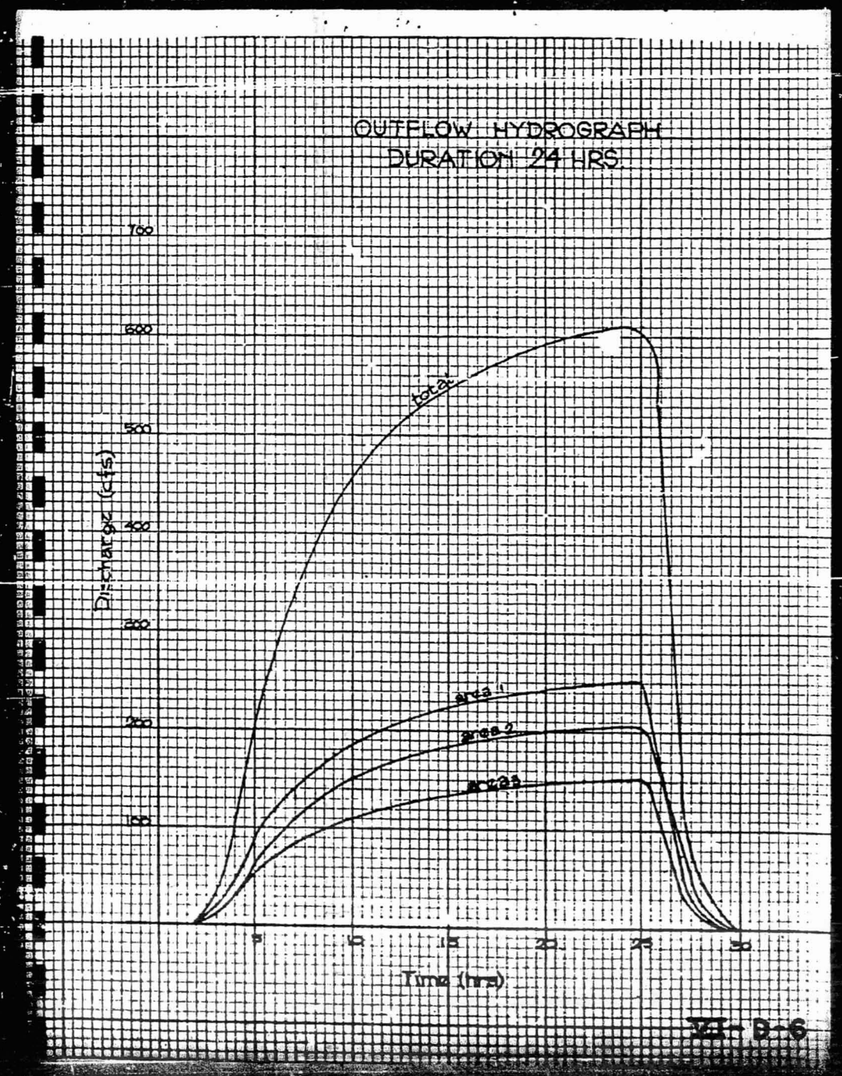



OUTFLOW HYDROGRAPH
DURATION 2 HRS
total
area 1
area 3
area 2
Discharge (cfs)
3500
3000
2500
2000
1500
1000
500
1
2
3
4
5
6
7
8


OUTFLOW HYDROGRAPH
DURATION 3 HRS
total
area 1
area 3
area 2
Discharge (cfs)
2700
2400
2100
1800
1500
1200
900
600
300
1
2
3
4
5
6
7
8
9
10


OUTFLOW HYDROGRAPH
DURATION 9 HRS.
Discharge (cfs)
2400
2100
1800
1500
1200
900
600
300
total
area 1
area 3
area 2
1
2
3
4
5
6
7
8
9
10
11
12
13
Time (hrs)


OUTFLOW HYDROGRAPH
DURATION 12 HRS.
Discharge (cfs)
1200
1000
800
600
400
200
total
area 1
area 3
area 2
5
10
15
Time (hrs)



VII-B-6

ARIZONA HIGHWAY DEPARTMENT

CULVERT COMPUTATION SHEET

PROJECT: I-IG-10-2(37)

DESIGNER: GA

STATION: Alternate 1

DATE: 11-15-75

HYDROLOGIC AND CHANNEL INFORMATION

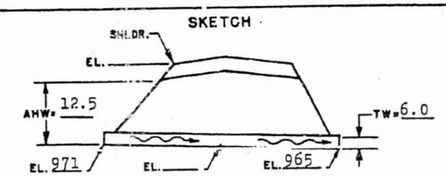
DRAINAGE AREA _____

Q_1 = _____ TW_1 = _____

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50})

SKETCH

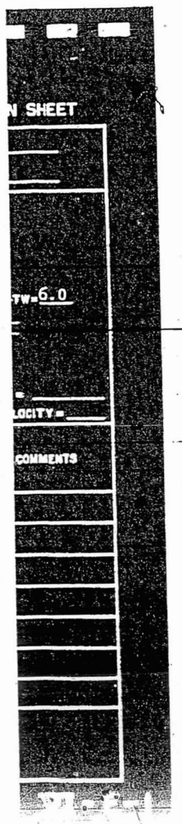


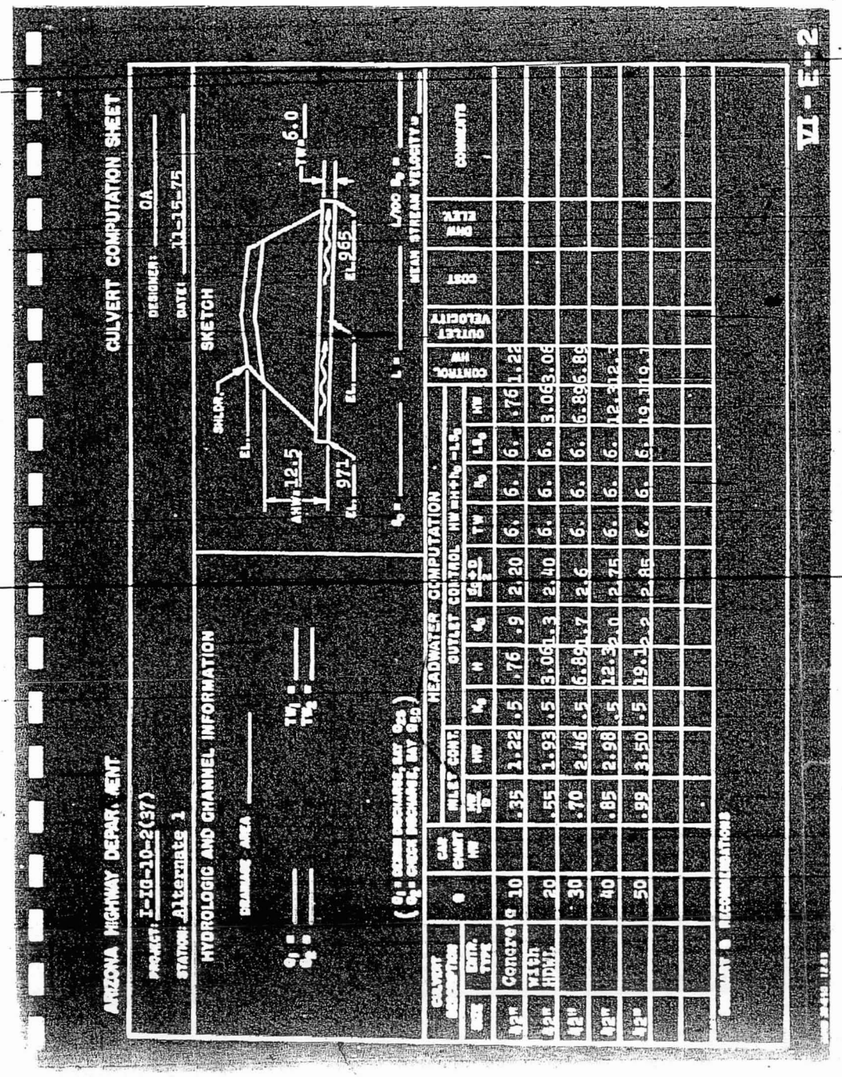
S_o = _____ L = _____ L/100 S_o = _____

MEAN STREAM VELOCITY = _____

CULVERT DESCRIPTION		Q	CAP CHART HW	HEADWATER COMPUTATION														
				INLET CONT.		OUTLET CONTROL HW = H + h_o − LS_o												
SIZE	ENTR. TYPE			HW/D	HW	K_e	H	d_c	$\frac{d_c + D}{2}$	TW	h_o	LS_o	HW	CONTROL HW	OUTLET VELOCITY	COST	DHW ELEV.	COMMENTS
36"	Concrete	10		.45	1.35	.5	1.73	1.0	2.	6.	6.	6.	1.73	1.73				
36"	with HDWL	20		.69	2.09	.5	6.92	1.4	2.2	6.	6.	6.	6.92	6.92				
36"		30		.90	2.70	.5	15.6	1.7	2.35	6.	6.	6.	15.6	15.6				

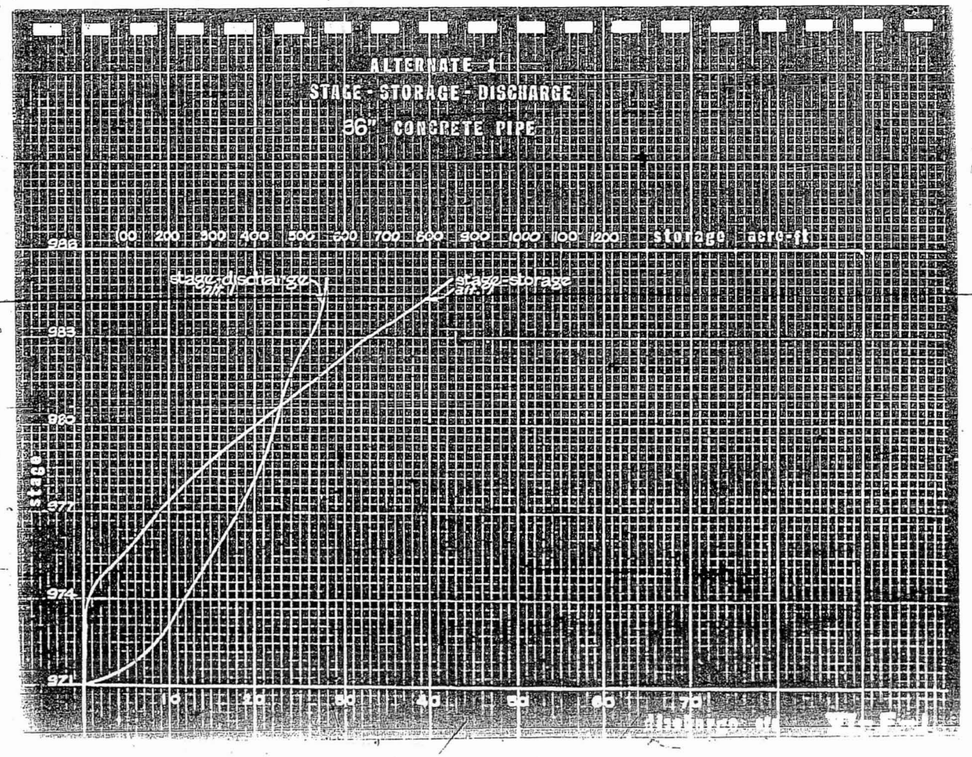
SUMMARY & RECOMMENDATIONS

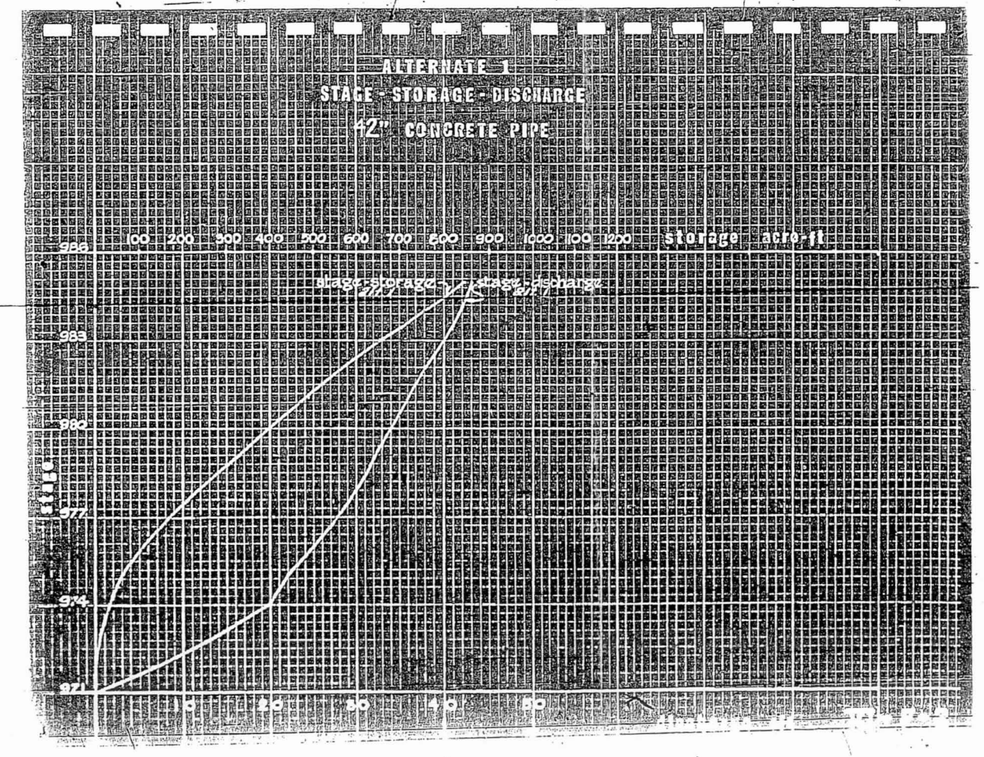


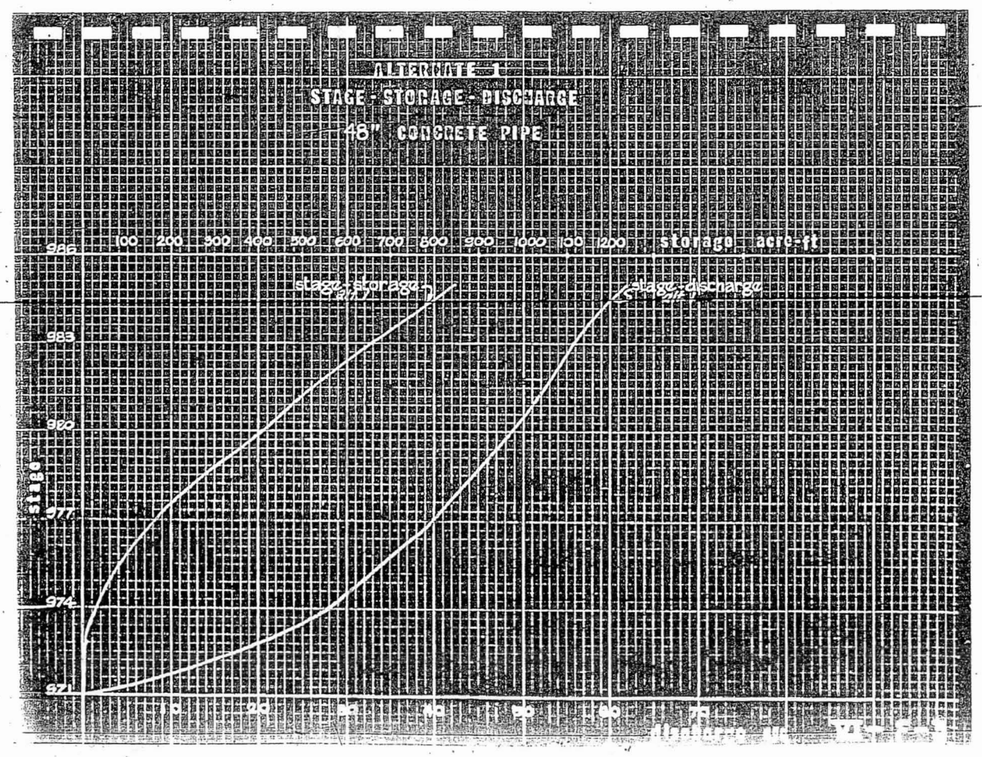


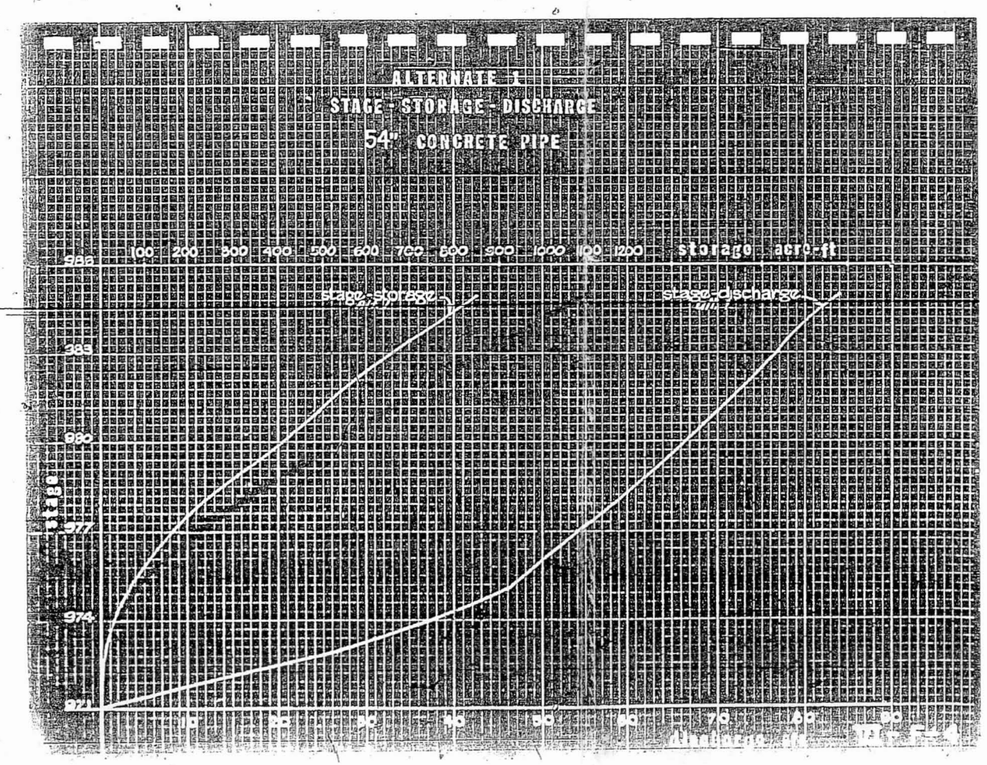
CORRECTION

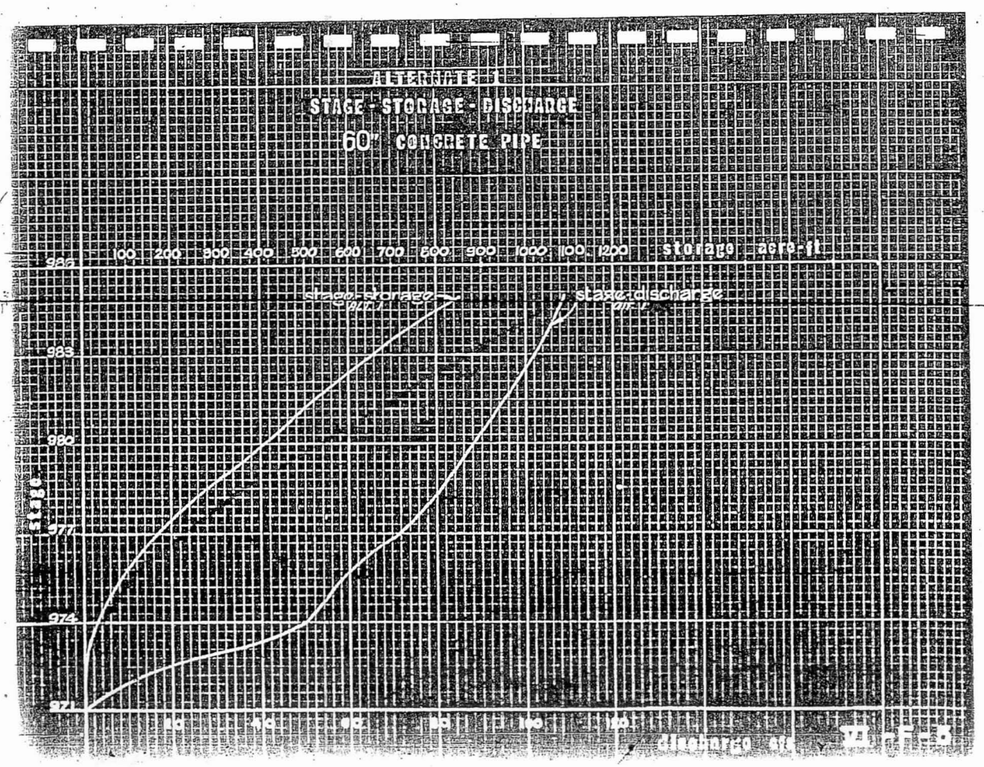
THE PRECEDING DOCUMENT HAS BEEN **REPHOTOGRAPHED** TO ASSURE LEGIBILITY AND ITS **IMAGE** APPEARS IMMEDIATELY HEREAFTER.

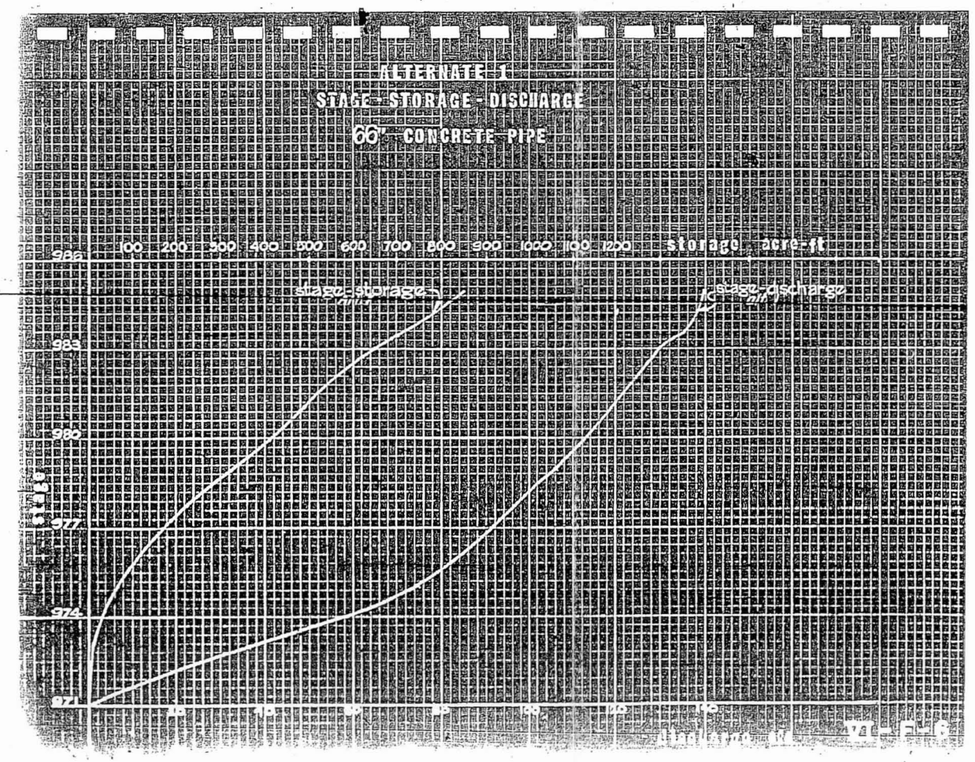

ALTERNATE 1
STAGE - STORAGE - DISCHARGE
36" CONCRETE PIPE
100 200 300 400 500 600 700 800 900 1000 1100 1200
storage acre-ft
stage-discharge
stage-storage
stage
986
985
984
983
982
981
980
979
978
977
976
975
974
973
972
971
10 20 30 40 50 60 70
discharge cfs

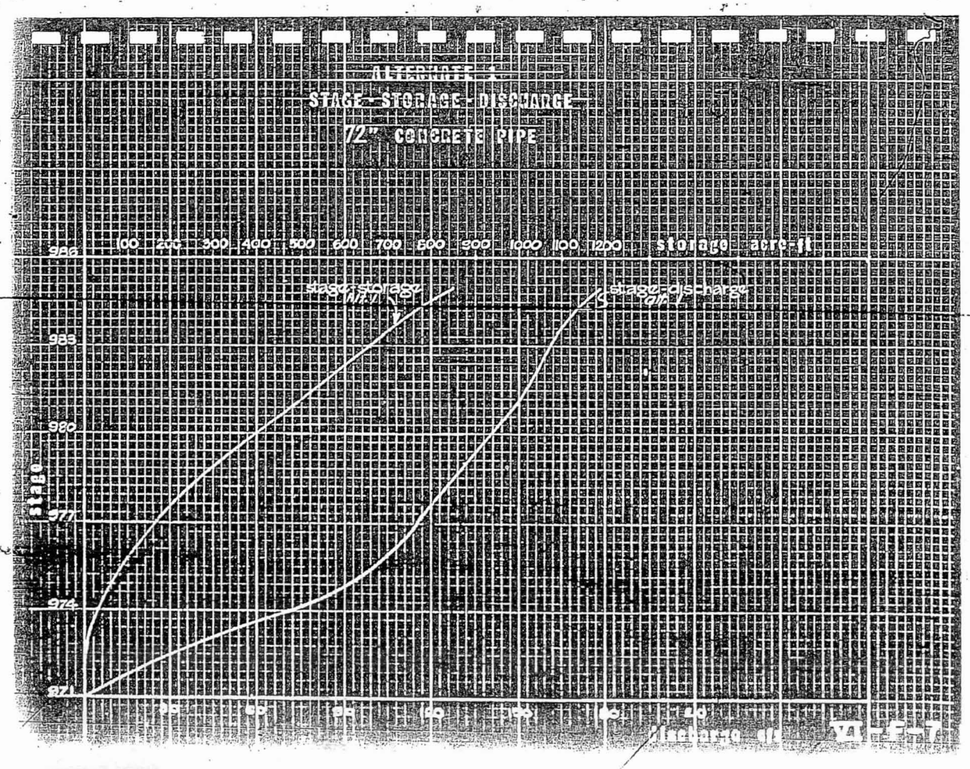

ALTERNATE 1
STAGE - STORAGE - DISCHARGE
42" CONCRETE PIPE
100 200 300 400 500 600 700 800 900 1000 1100 1200
storage acre-ft
stage-discharge
stage-storage
stage
986
985
984
983
982
981
980
979
978
977
976
975
974
973
972
971
10 20 30 40 50 60

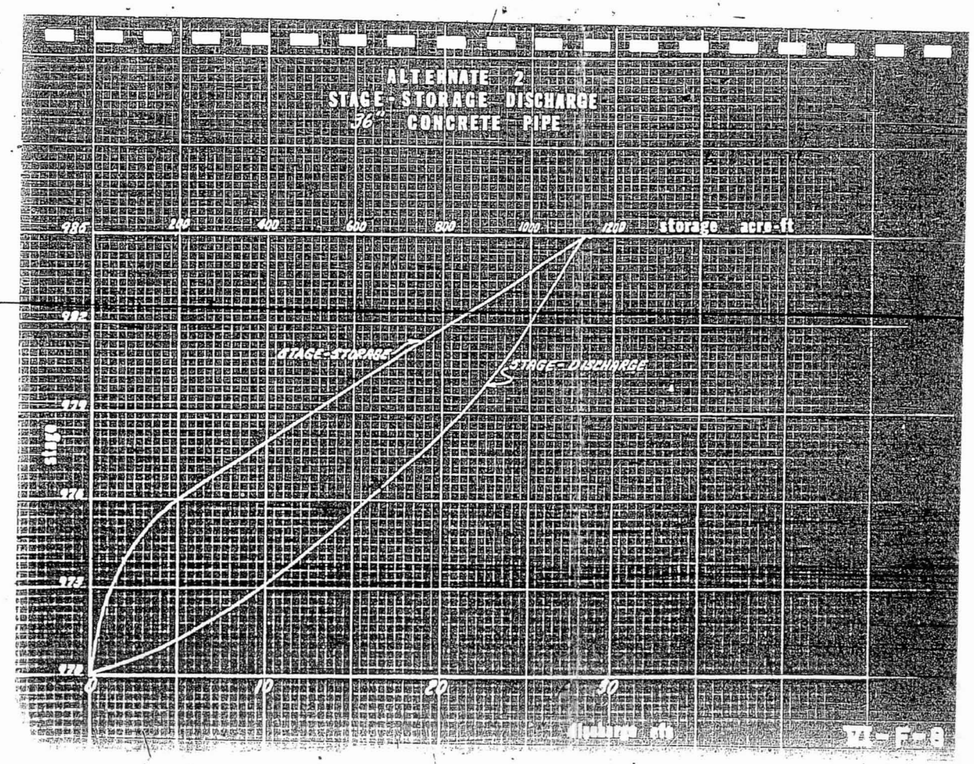

ALTERNATE 3
STAGE-STORAGE-DISCHARGE
48" CONCRETE PIPE
100 200 300 400 500 600 700 800 900 1000 100 1200
storage acre-ft
986
983
980
977
974
971
stage-storage
stage-discharge

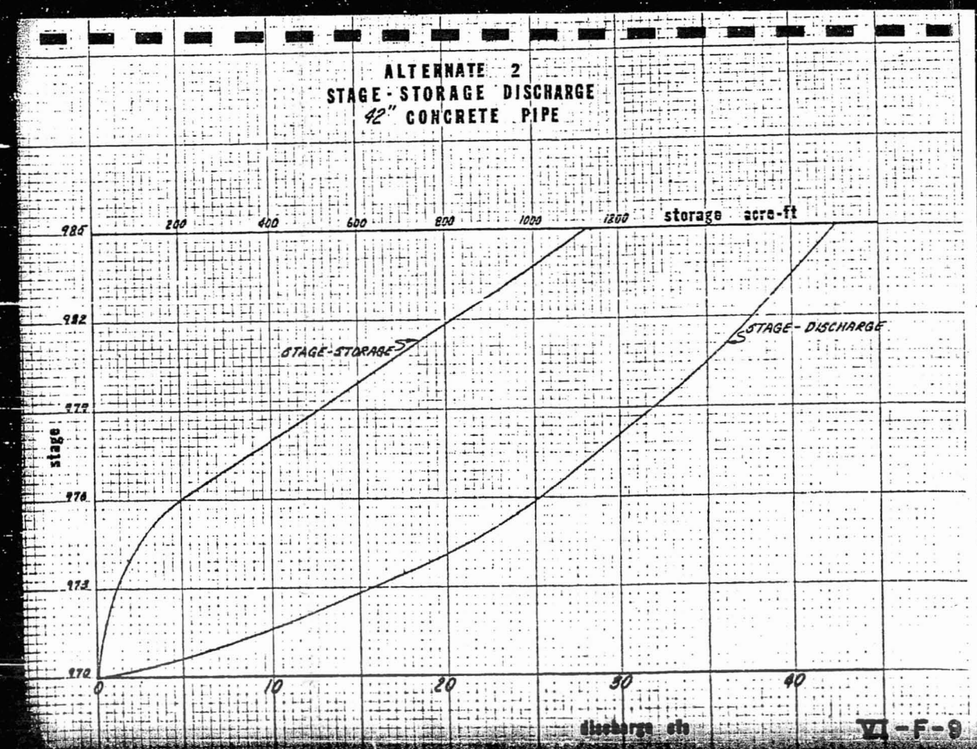

ALTERNATE 3
STAGE-STORAGE-DISCHARGE
54" CONCRETE PIPE
100 200 300 400 500 600 700 800 900 1000 100 1200
storage acre-ft
986
983
980
977
974
971
stage-storage
stage-discharge


ALTERNATE 3
STAGE - STORAGE - DISCHARGE
60" CONCRETE PIPE
100 200 300 400 500 600 700 800 900 1000 1100 1200
storage acre-ft
stage storage
stage discharge
989
988
987
986
985
984
983
982
981
980
979
978
977
976
975
974
973
972
stage feet

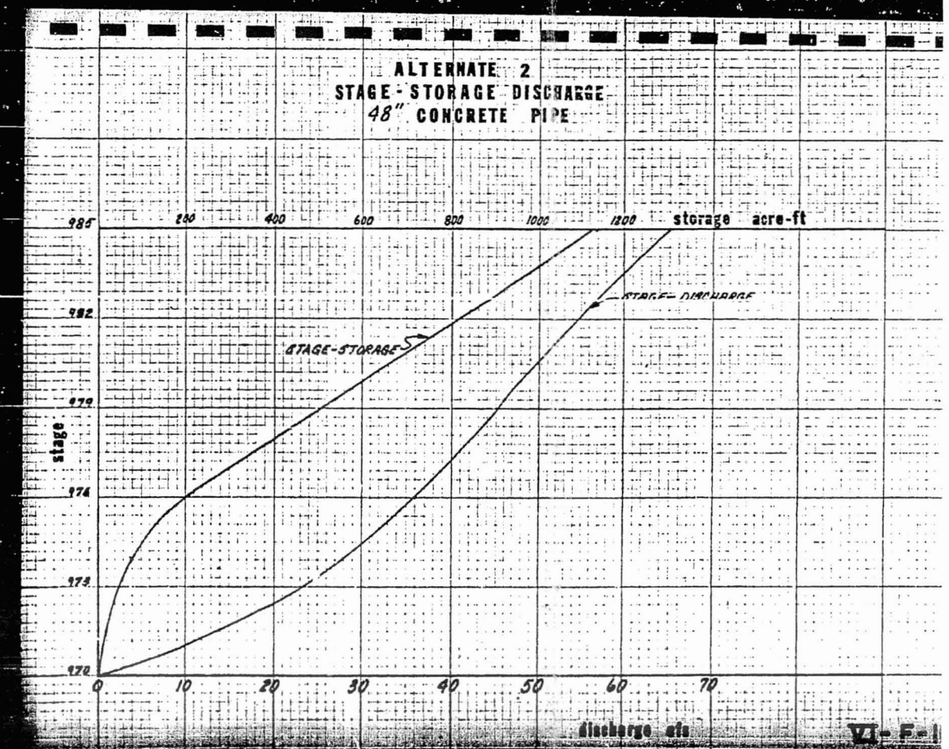

ALTERNATE 5
STAGE - STORAGE - DISCHARGE
60" CONCRETE PIPE
100 200 300 400 500 600 700 800 900 1000 1100 1200
storage acre-ft
stage storage
stage discharge
989
988
987
986
985
984
983
982
981
980
979
978
977
976
975
974
973
972
stage feet


ALTERNATE 1
STAGE STORAGE DISCHARGE
72" CONCRETE PIPE
storage acre-ft
stage storage
stage discharge
stage
discharge cfs
M-F-7

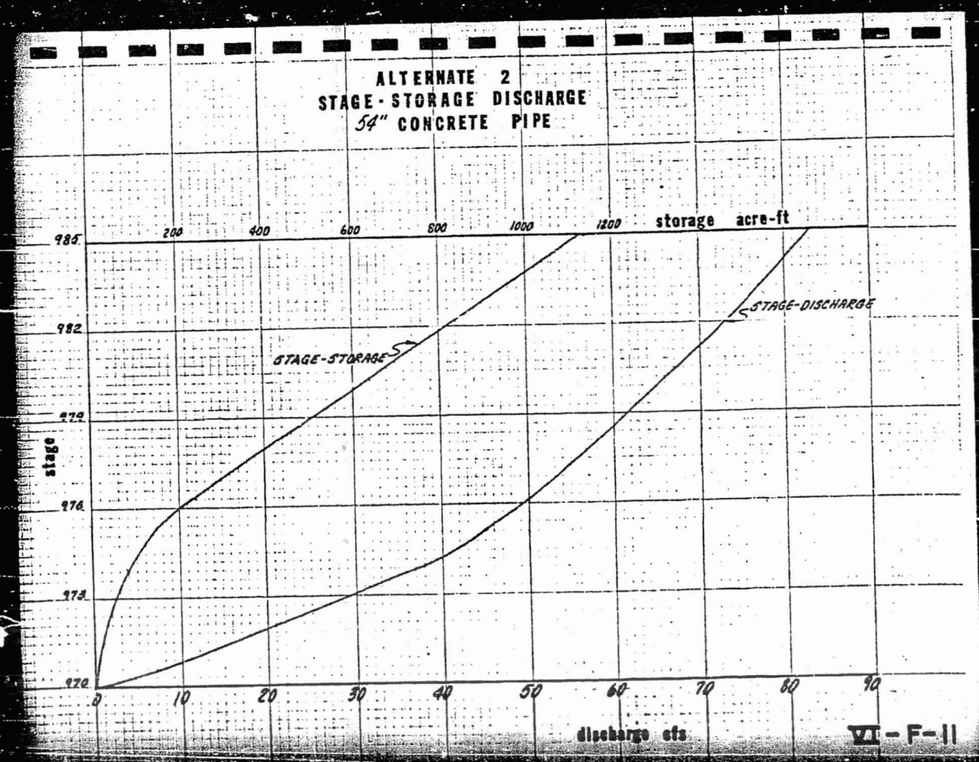

ALTERNATE 2
STAGE STORAGE DISCHARGE
56" CONCRETE PIPE
storage acre-ft
STAGE-STORAGE
STAGE-DISCHARGE
stage
discharge cfs
M-F-8


ALTERNATE 2
STAGE - STORAGE DISCHARGE
42" CONCRETE PIPE
storage acre-ft
200
400
600
800
1000
1200
STAGE-STORAGE
STAGE-DISCHARGE
stage
986
982
978
974
970
0
10
20
30
40
discharge cfs

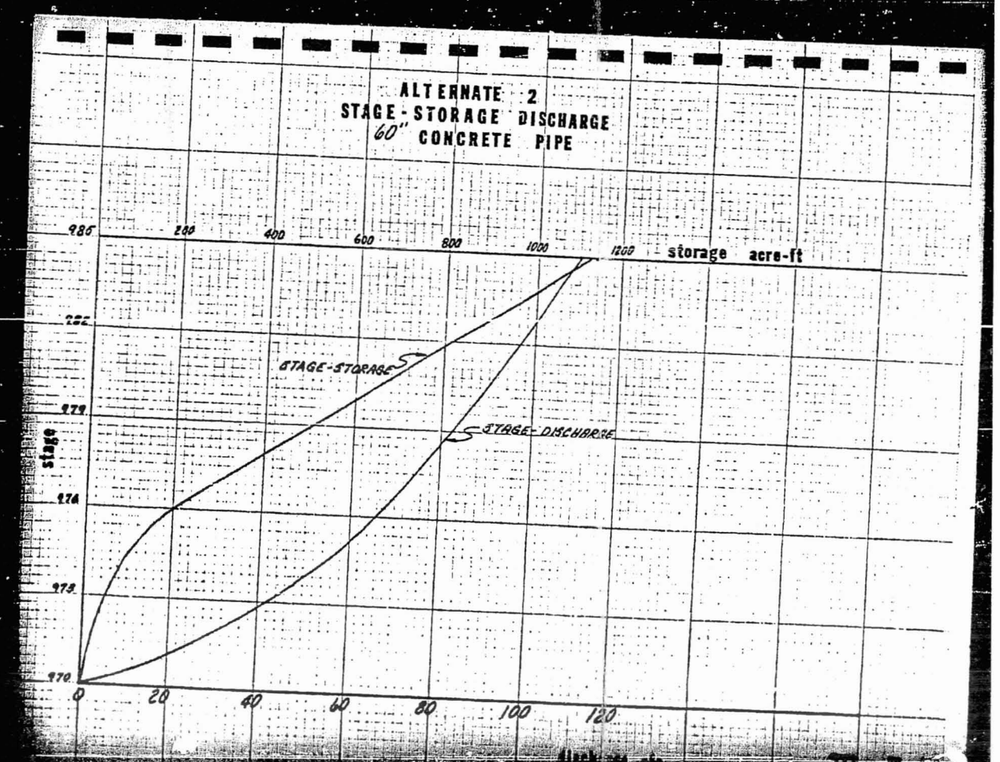
VI-F-9

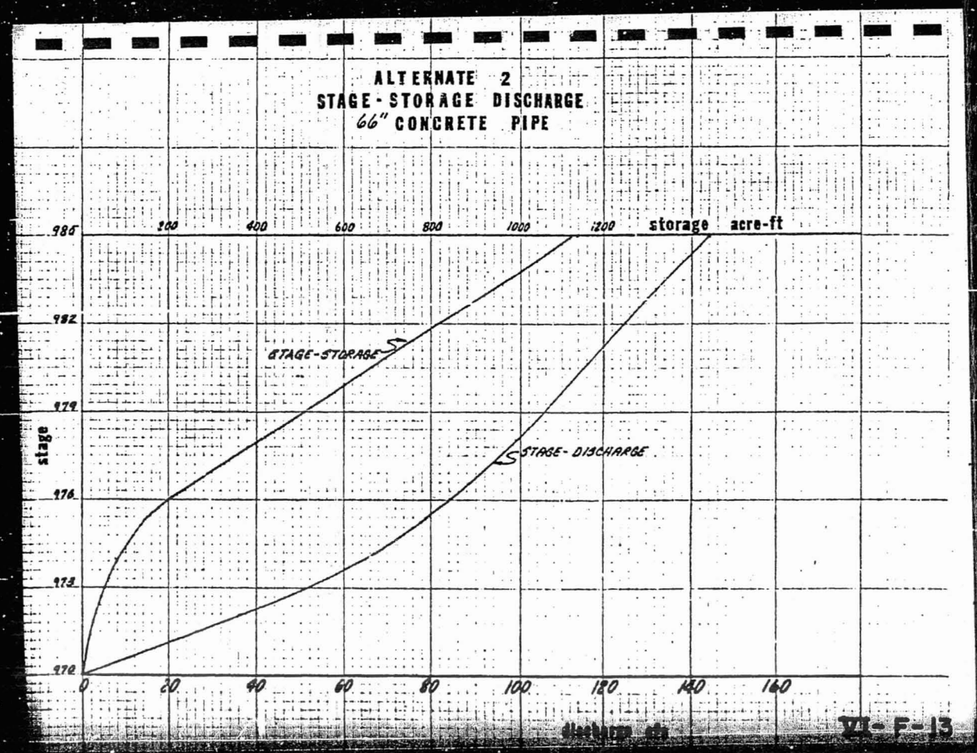

ALTERNATE 2
STAGE - STORAGE DISCHARGE
48" CONCRETE PIPE
storage acre-ft
200
400
600
800
1000
1200
STAGE-DISCHARGE
STAGE-STORAGE
stage
986
982
978
974
970
0
10
20
30
40
50
60
70
discharge cfs

VI-F-1

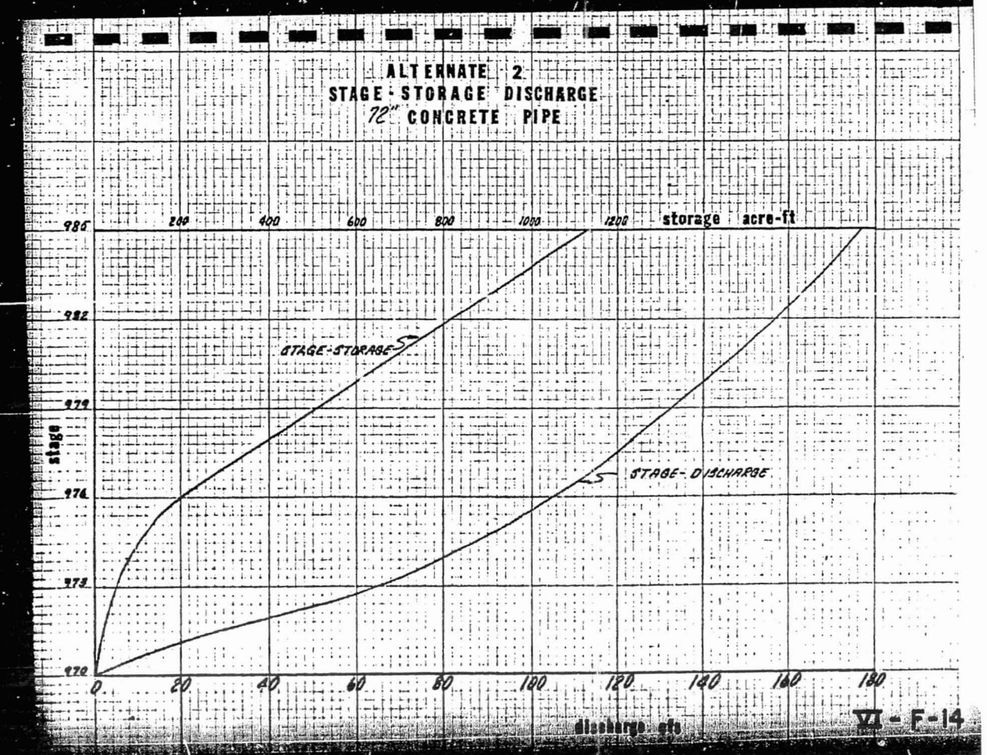

ALTERNATE 2
STAGE-STORAGE DISCHARGE
54" CONCRETE PIPE
storage acre-ft
200
400
600
800
1000
1200
STAGE-DISCHARGE
STAGE-STORAGE
stage
985
982
979
976
973
970
0
10
20
30
40
50
60
70
80
90
discharge cfs

VI - F-11

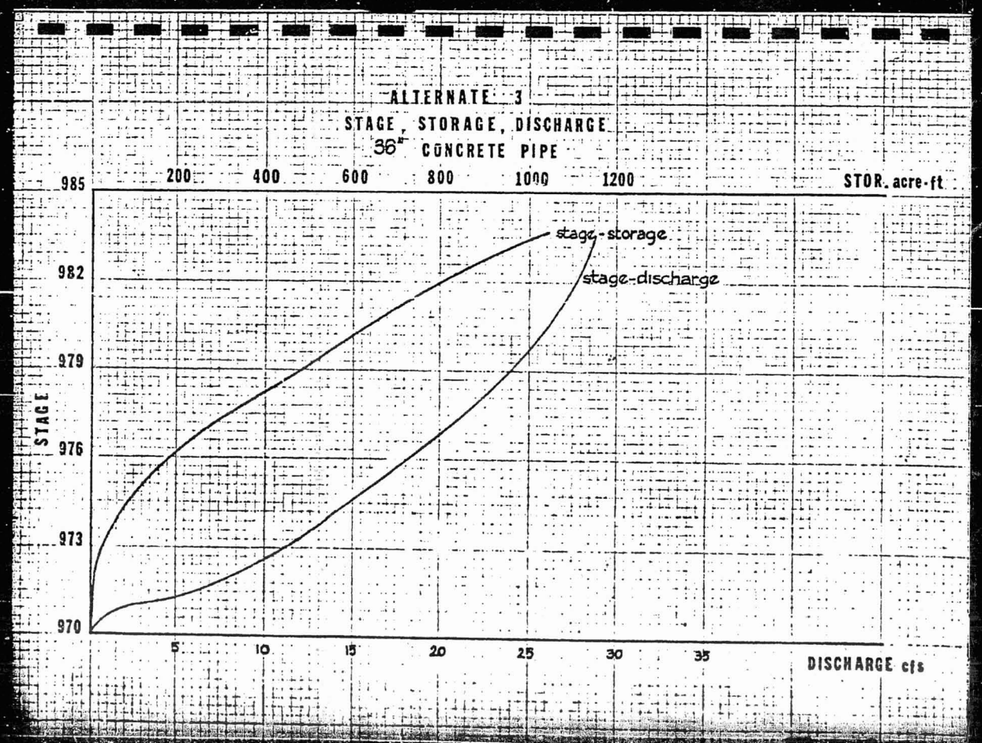

ALTERNATE 2
STAGE-STORAGE DISCHARGE
60" CONCRETE PIPE
storage acre-ft
200
400
600
800
1000
1200
STAGE-STORAGE
STAGE-DISCHARGE
stage
985
982
979
976
973
970
0
20
40
60
80
100
120

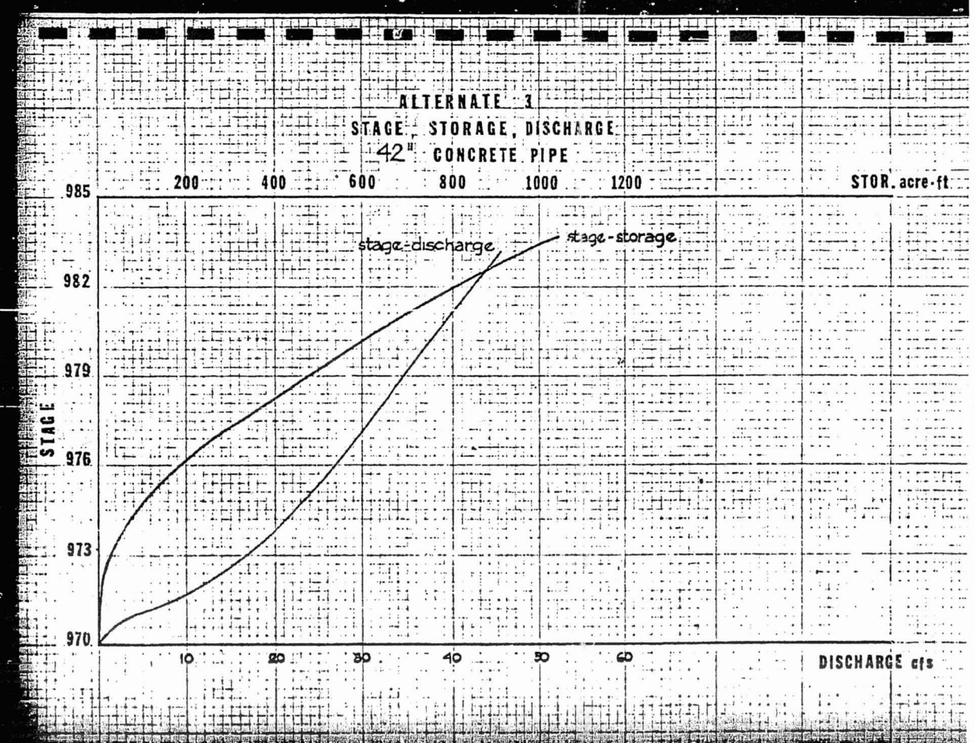

ALTERNATE 2
STAGE - STORAGE DISCHARGE
66" CONCRETE PIPE
storage acre-ft
200
400
600
800
1000
1200
STAGE-STORAGE
STAGE- DISCHARGE
stage
985
982
979
976
973
970
0
20
40
60
80
100
120
140
160
discharge cfs

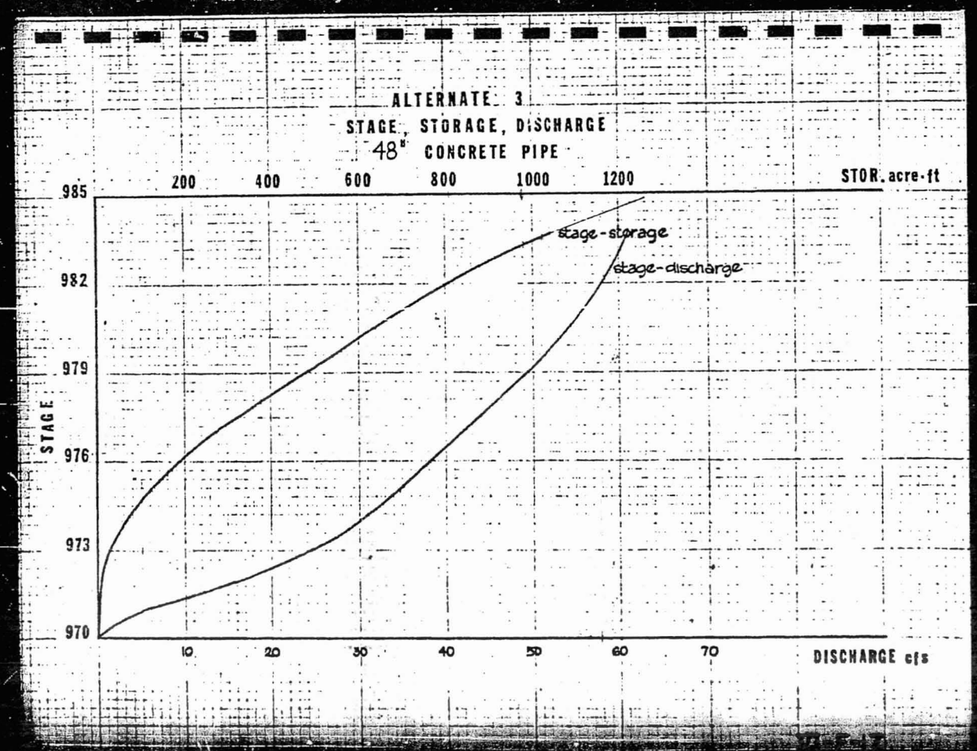
VI - F-13

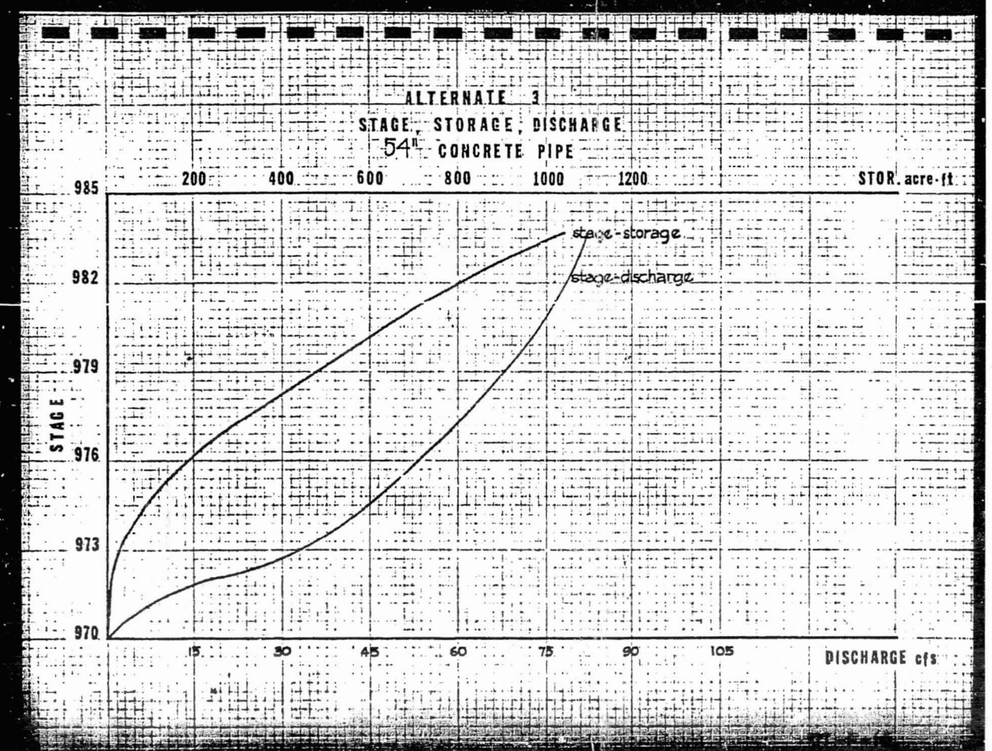

ALTERNATE 2
STAGE - STORAGE DISCHARGE
72" CONCRETE PIPE
storage acre-ft
200
400
600
800
1000
1200
STAGE-STORAGE
STAGE- DISCHARGE
stage
985
982
979
976
973
970
0
20
40
60
80
100
120
140
160
180
discharge cfs

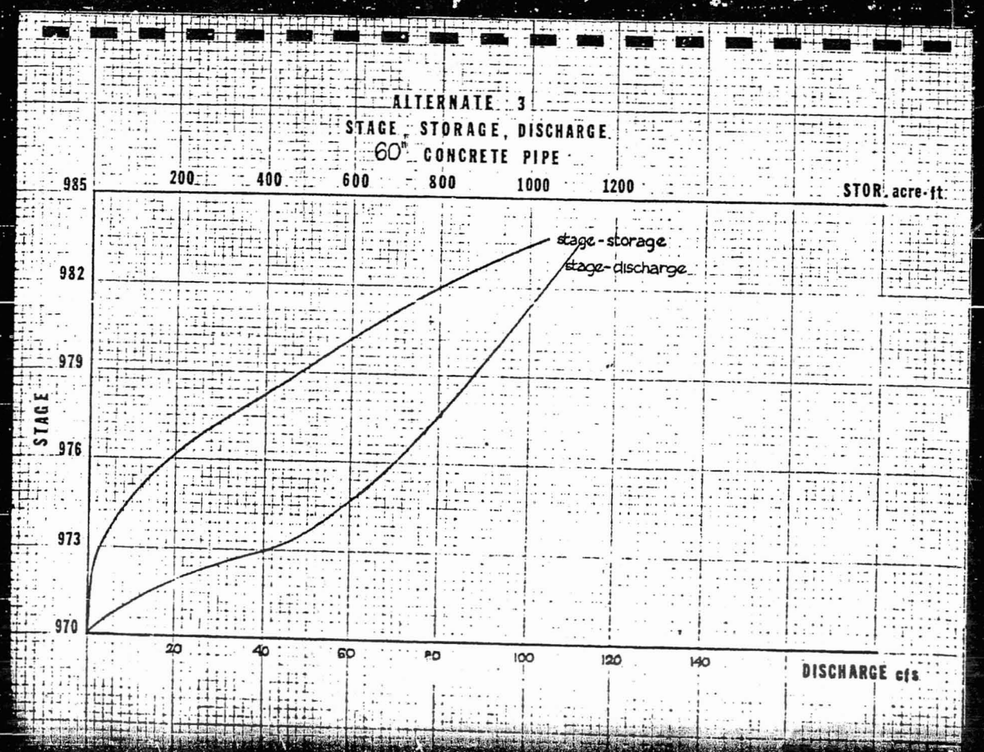
VI - F-14

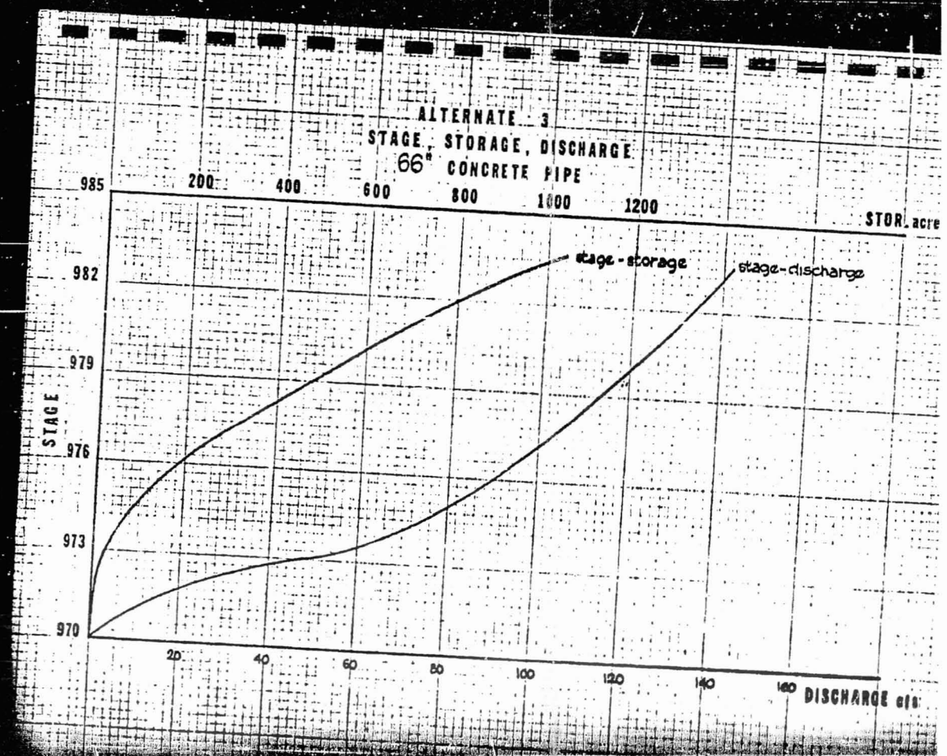

ALTERNATE 3
STAGE, STORAGE, DISCHARGE
36" CONCRETE PIPE
STOR. acre-ft
200
400
600
800
1000
1200
985
982
979
976
973
970
STAGE
stage-storage
stage-discharge
5
10
15
20
25
30
35
DISCHARGE cfs

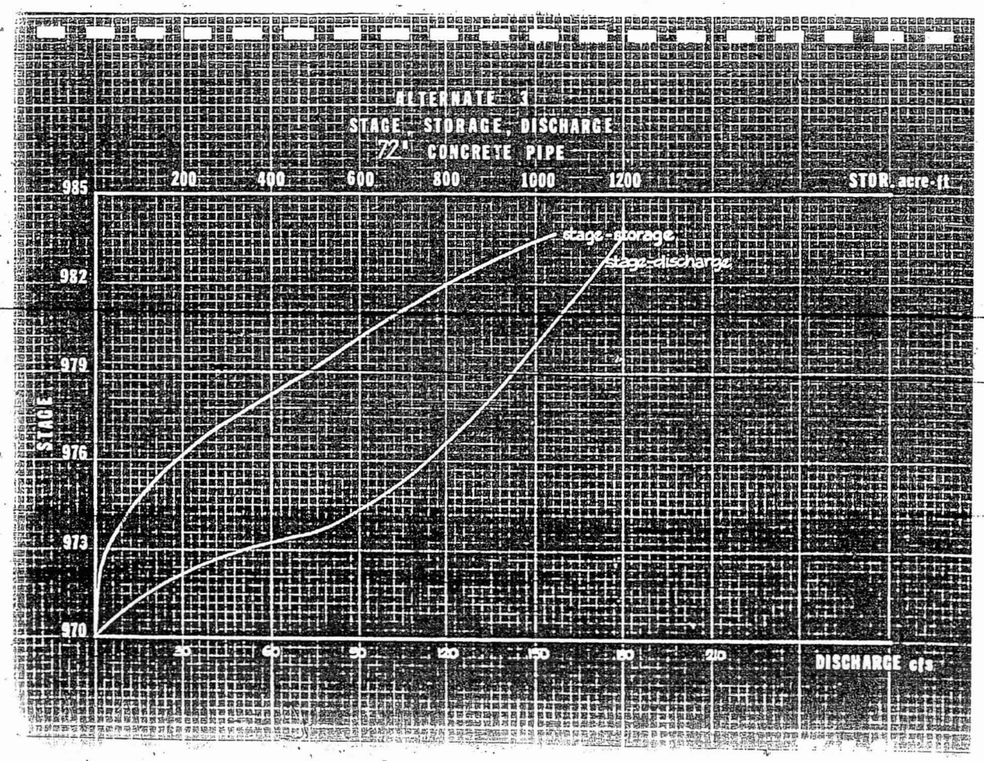

ALTERNATE 3
STAGE, STORAGE, DISCHARGE
42" CONCRETE PIPE
STOR. acre-ft
200
400
600
800
1000
1200
985
982
979
976
973
970
STAGE
stage-discharge
stage-storage
10
20
30
40
50
60
DISCHARGE cfs


ALTERNATE 3
STAGE, STORAGE, DISCHARGE
48" CONCRETE PIPE
STOR. acre-ft
200
400
600
800
1000
1200
985
982
979
976
973
970
STAGE
stage-storage
stage-discharge
10
20
30
40
50
60
70
DISCHARGE cfs


ALTERNATE 3
STAGE, STORAGE, DISCHARGE
54" CONCRETE PIPE
STOR. acre-ft
200
400
600
800
1000
1200
985
982
979
976
973
970
STAGE
stage-storage
stage-discharge
15
30
45
60
75
90
105
DISCHARGE cfs


ALTERNATE 3
STAGE, STORAGE, DISCHARGE
60" CONCRETE PIPE
STOR. acre-ft.
200
400
600
800
1000
1200
985
982
979
976
973
970
STAGE
stage-storage
stage-discharge
20
40
60
80
100
120
140
DISCHARGE cfs


ALTERNATE 3
STAGE, STORAGE, DISCHARGE
66" CONCRETE PIPE
STOR. acre
200
400
600
800
1000
1200
985
982
979
976
973
970
STAGE
stage-storage
stage-discharge
20
40
60
80
100
120
140
160
DISCHARGE cfs



ALTERNATE 1

PEAK ELEVATION IN RESERVOIR

TIME TO DRAIN RESERVOIR

STORM HRS	PEAK INFLOW POND CFS	36" PIPE PEAK ELEV FT	36" PIPE TIME DRAIN HRS	42" PIPE PEAK ELEV FT	42" PIPE TIME DRAIN HRS	48" PIPE PEAK ELEV FT	48" PIPE TIME DRAIN HRS	54" PIPE PEAK ELEV FT	54" PIPE TIME DRAIN HRS	60" PIPE PEAK ELEV FT	60" PIPE TIME DRAIN HRS	66" PIPE PEAK ELEV FT	66" PIPE TIME DRAIN HRS	72" PIPE PEAK ELEV FT	72" PIPE TIME DRAIN HRS
1	3426	981.78	235* 976.83	981.72	258* 971.09	981.65	204.	981.56	153.	981.47	123.	981.37	98.	981.26	81.
[illegible]	3167	982.29	237* 976.83	982.22	273* 971.09	982.14	215.	982.05	161.	981.95	128.	981.84	103.	981.72	85.
3	2798	982.75	278* 976.83	982.67	286* 971.09	982.59	225.	982.49	168.	982.38	134.	982.26	108.	982.13	88.
6	1910	983.51	324* 976.83	983.73	317* 971.09	983.63	248.	983.50	185.	983.36	147.	983.21	118.	983.04	97.
12	1111	984.73	369* 976.83	984.59	347* 971.09	984.43	269.	984.24	202.	984.02	163.	983.78	131.	983.52	107.
24	614	985.17	392* 976.83	985.11	370* 971.09	985.01	292.	984.68	219.	984.30	176.	983.87	143.	983.40	119.

* Ex. 235 hr.
976.83 ft. - At 235 hrs. the elevation in the reservoir was 976.83 feet.

RESULTS OF FLOOD ROUTING

run

PROJECT NUMBER ______

PROJECT NAME ______

STATION ______

INPUT NO. OF STAGES FOR STAGE-STORAGE AND STAGE-DISCHARGE RELATIONS

? 11

INPUT ELEV (FT), STORAGE (AF), DISCHARGE (CFS)

```
? 975.69,0,0
? 976,.1,1
? 977,13,8
? 978,29.31,25
? 979,63,46
? 980,97.65,75
? 981,133,98
? 982,169.08,119
? 983.5,223.91,144
? 985,279.82,165
? 987,339,188
```

INPUT NO. OF POINTS FOR INFLOW HYDROGRAPH

? 17

INPUT TIME (HRS), INFLOW (CFS)

```
? 0,0
? 4,45.23
? 6,54.57
? 8.5,72.56
? 10.5,132.4
? 11.5,188.15
? 12,407.91
? 12.5,647.45
? 13.13,933.2
? 14,738.27
? 14.85,483.31
? 16,145.99
? 16.38,128.37
? 20,71.19
? 22,55.17
? 24.38,39.55
? 28.35,0
```

INPUT.. DELTA TIME (HRS.)

? .15

INPUT DATA

ELEVATION (FT)	STORAGE (AF)	DISCHARGE (CFS)
975.6899	0	0
976	9.9999996E-02	1
977	13	9
978	29.31000	25
979	63	46
980	97.64999	75
981	133	98
982	[illegible]	119
[illegible]	[illegible]	[illegible]

INFLOW HYDROGRAPH

TIME (HRS)	INFLOW (CFS)
0	0
4	45.23000
6	54.56999
8.500000	72.56000
10.50000	132.4000
11.50000	188.1500
12	407.9099
12.50000	647.4500
13.13000	933.2000
14	730.2698
14.85000	483.3098
16	145.9900
16.37999	120.3700
20	71.18999
22	55.17000
24.37999	39.54999
28.34999	0

FLOOD ROUTING BY THE STORAGE-INDICATION METHOD, DELTA TIME = 0.15 HRS.

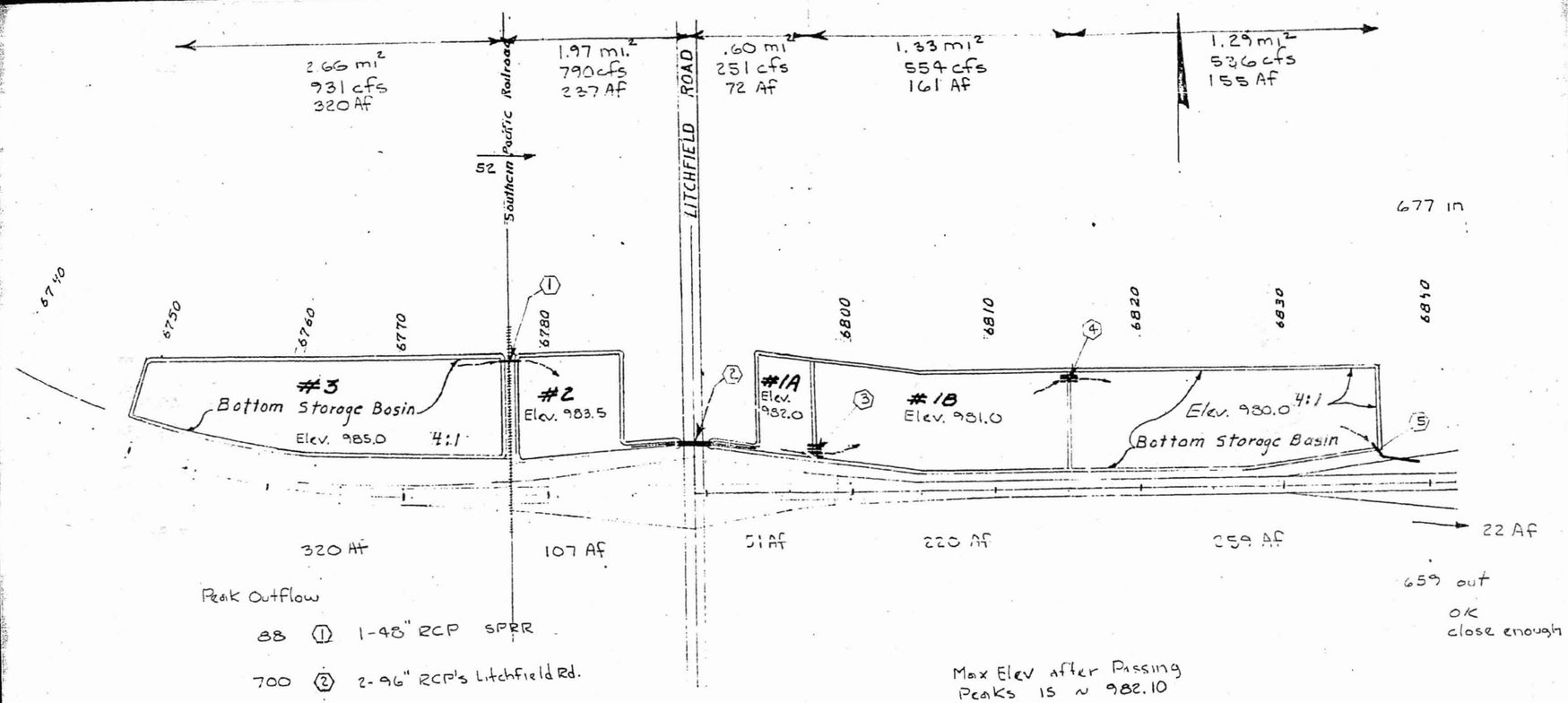
TIME (HRS)	INFLOW (CFS)	S2/T + O2/2 (CFS)	OUTFLOW (CFS)
0	0	0	0
.1500000	1.696124	1.696124	.1979911
.3000000	3.392249	4.890302	.5708617
.4499999	5.088373	9.407893	1.005639
.5999999	6.784498	15.18675	1.044383
.7499999	8.480622	22.62299	1.094238
.8999999	10.17675	31.70540	1.155130
1.049999	11.87286	42.42322	1.226985
1.200000	13.56900	54.76523	1.309731
1.349999	15.26512	68.72061	1.403292
1.499999	16.96123	84.27053	1.507598
1.650000	18.65736	101.4283	1.622576
1.799999	20.35349	120.1592	1.740154
1.949999	22.04961	140.4606	1.884261
2.099999	23.74573	162.3221	2.030828
2.249999	25.44185	185.7331	2.187783
2.400000	27.13799	210.6833	2.355058
2.549999	28.83411	237.1624	2.532582
2.699999	30.53023	265.1599	2.720287
2.849999	32.22636	294.6658	2.918105
2.999999	33.92249	325.6699	3.125967
3.149999	35.61859	358.1624	3.343807
3.299999	37.31473	392.1331	3.571558
3.449999	39.01085	427.5723	3.809155
3.599999	40.70699	464.4700	4.056529
3.749999	42.40311	502.8164	4.313617
3.899999	44.09923	542.6018	4.580352
4.049999	45.46349	583.4849	4.854445
4.199999	46.16399	624.7942	5.131397
4.349999	46.86449	666.5271	5.411109
4.499999	47.56499	708.6807	5.693800
4.649999	48.26549	751.2522	5.979215
4.799999	48.96599	794.2380	6.267411
4.949999	49.66647	837.6377	6.558372
5.099998	50.36697	881.4459	6.852070
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
5.699999	53.16398	1060.721	8.103104
5.849998	53.86948	1106.487	8.690956
5.999999	54.56998	1152.360	9.279959
6.149999	55.64937	1198.735	9.875258
6.299998	56.72876	1245.589	[illegible]
6.449999	57.80818	1292.920	11.08442
6.599998	58.88757	1340.723	11.69813
6.749998	59.96696	1388.992	12.31781
6.899999	61.04637	1437.720	12.94340
7.049998	62.12578	1486.903	13.57401
7.199999	63.20510	1536.533	14.21198
7.349998	64.28450	1586.606	14.85482
7.499998	65.36397	1637.115	15.50326
7.649999	66.44337	1688.055	16.15723
7.799998	67.52278	1739.420	16.81667
7.949998	68.60217	1791.206	17.48151
8.099998	69.68158	1843.406	18.15166
8.249998	70.76097	1896.015	18.82706
8.399999	71.84038	1949.028	19.50766
8.549998	74.05594	2003.576	20.20796
8.699998	78.54393	2061.912	20.95689
8.849998	83.03194	2123.987	21.75301
8.999998	87.51993	2189.753	22.59813
9.149998	92.00792	2259.163	23.48923
9.299998	96.49594	2332.169	24.42650
9.449998	100.9039	2408.727	25.24544
9.599998	105.4719	2488.953	25.86299
9.749998	109.9599	2573.050	26.51033
9.899998	114.4479	2660.987	27.10723
10.05000	118.9359	2752.736	27.89346
10.20000	123.4239	2848.266	28.62880
10.35000	127.9119	2947.549	29.39304
10.50000	132.3999	3050.556	30.18593
10.65000	140.7624	3161.132	31.03709
10.80000	149.1249	3279.220	31.94600
10.95000	157.4874	3404.761	32.91243
11.10000	165.8499	3537.690	33.93571
11.25000	174.2124	3677.975	35.01549
11.40000	182.5749	3825.534	36.15132
11.55000	210.1248	3999.508	37.49049
11.70000	276.0530	4230.066	39.32680
11.85000	341.9807	4540.719	41.65646
12	407.9089	4906.969	44.47568
12.15000	479.7708	5342.262	48.44899
12.30000	551.6326	5845.441	53.64268
12.45000	623.4949	6415.293	59.52455
12.60000	692.8059	7048.574	66.06111
12.75000	760.8416	7743.352	73.23244
12.90000	828.8777	8498.996	79.69467
13.05000	896.9133	9316.211	86.25963
13.20000	917.5161	10147.46	92.93730
13.35000	883.9075	10938.43	99.15584
13.50000	850.2991	11689.57	104.5561
13.65000	816.6902	12401.71	109.6759
13.80000	783.0818	13075.11	114.5173
13.95000	749.4731	13710.06	119.0645
14.10000	708.2751	14299.27	123.3055
14.25000	663.2822	14840.16	125.4342
14.40000	618.2893	15333.02	128.2121
14.55000	573.2964	15778.10	130.7208
14.70000	528.3035	16175.60	132.9617
14.85000	483.3105	16526.00	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

PEAK OUTFLOW = 141.50 CFS

END OF ROUTING PROGRAM

EDIT, end

READY.



Peak Outflow

88 ① 1-48" RCP SPRR

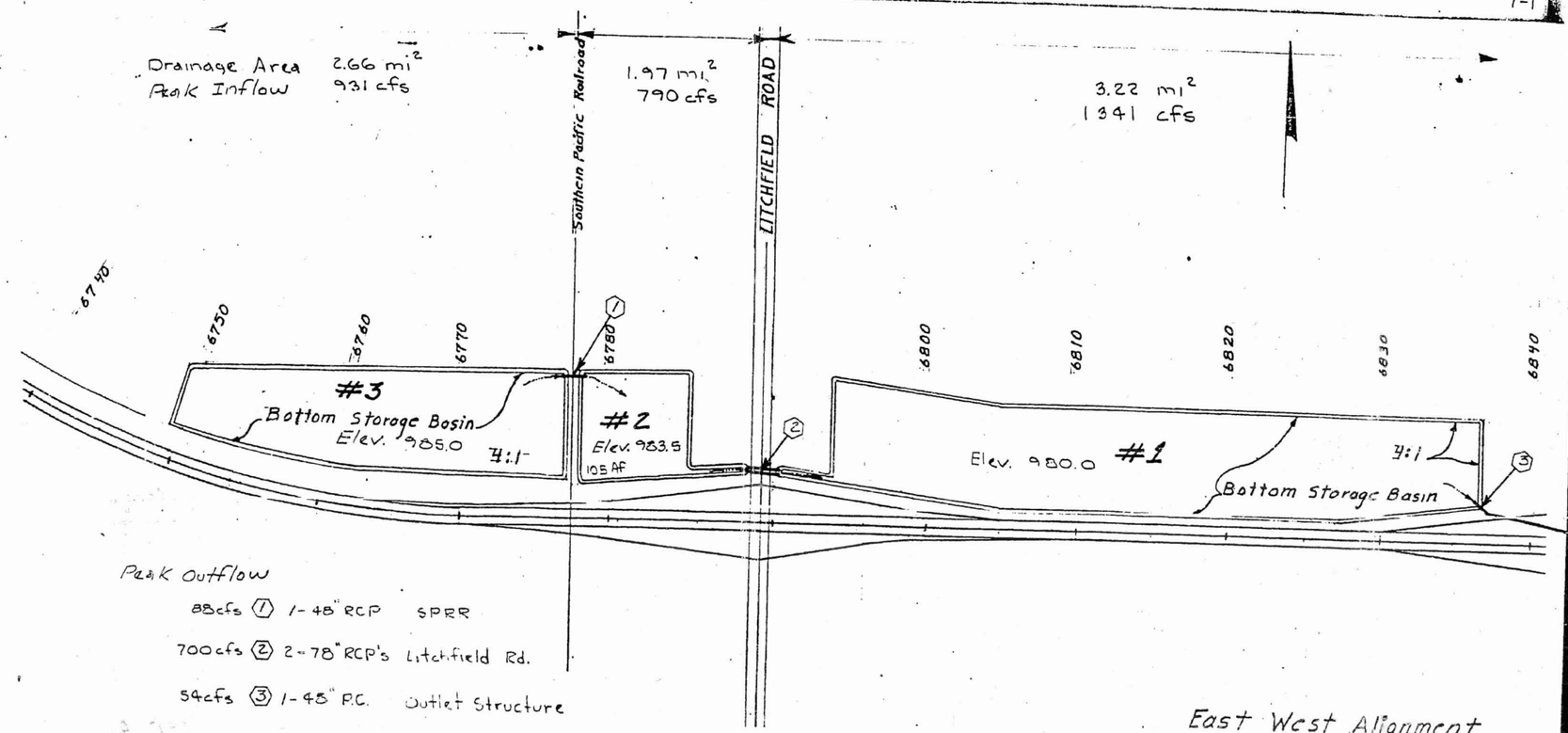
700 ② 2-96" RCP's Litchfield Rd.

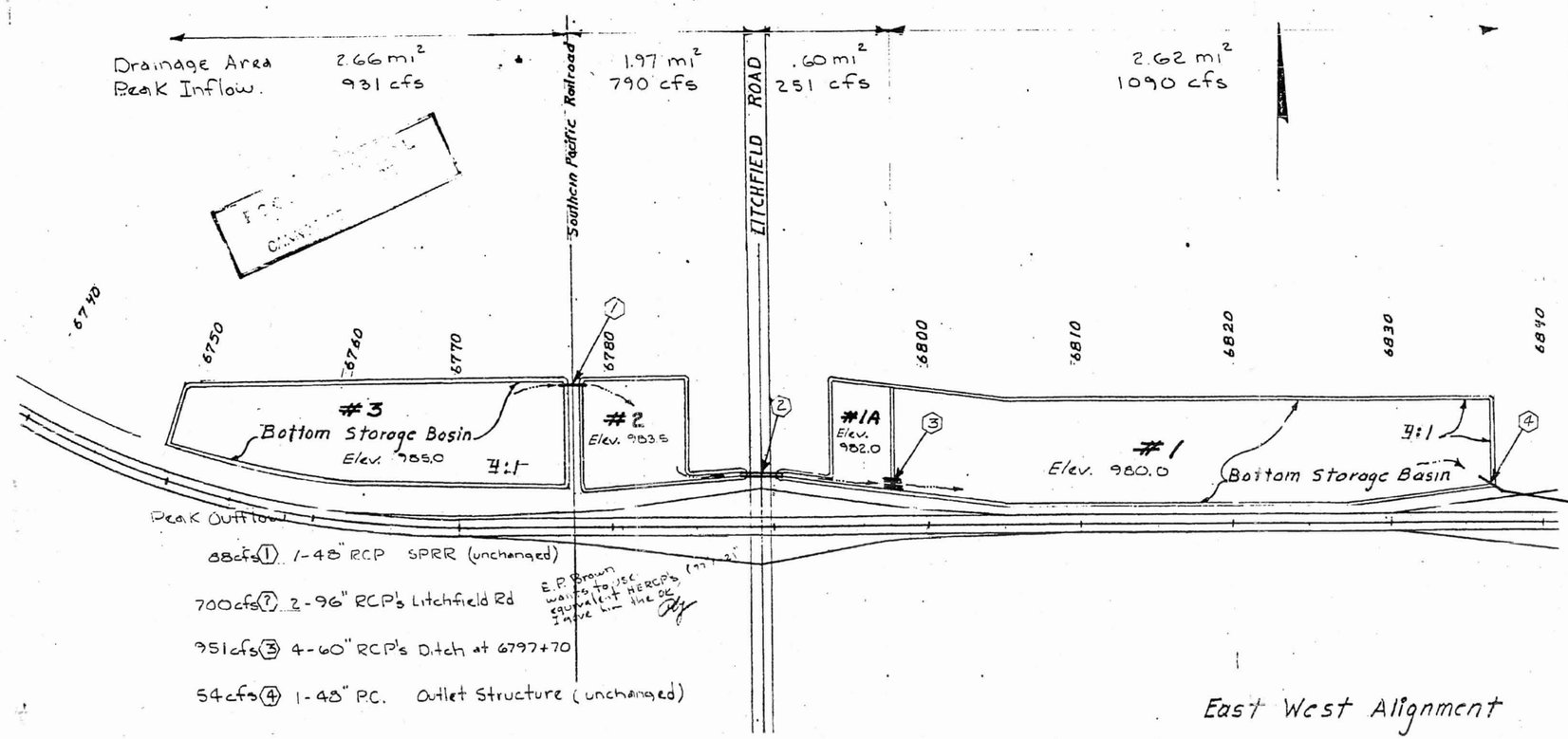
951 ③ 4-84" RCP's Sta 6797+70

620 ④ 3-78" RCP's Sta 6815+10

54 ⑤ 1-48" PC. Outlet Structure

Max Elev after Passing Peaks is ~ 982.10


Drainage Area 2.66 mi²
Peak Inflow 931 cfs
1.97 mi²
790 cfs
3.22 mi²
1341 cfs
Southern Pacific Railroad
LITCHFIELD ROAD
6740
6750
6760
6770
6780
6800
6810
6820
6830
6840
#3
Bottom Storage Basin
Elev. 985.0
4:1
#2
Elev. 983.5
105 AF
Elev. 980.0
#1
4:1
Bottom Storage Basin
Peak Outflow
88cfs (1) 1-48" RCP SPRR
700cfs (2) 2-78" RCP's Litchfield Rd.
54cfs (3) 1-48" R.C. Outlet Structure
East West Alignment
Basin Design as Proposed by Dibble
and Okeed by D.R.S.
I-16-10-2 (37)
Scale 1" = 600'

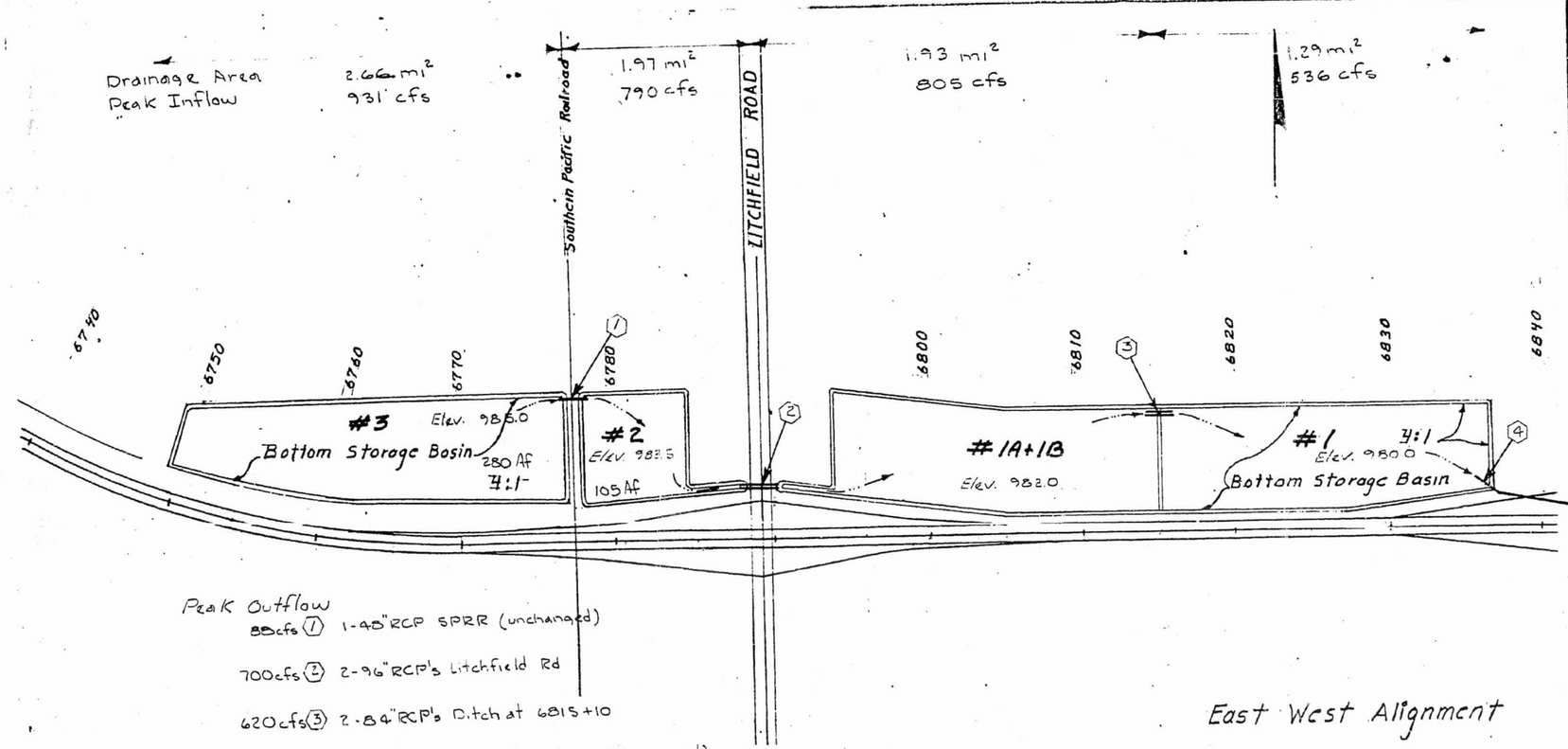


East West Alignment

Basin Design as Proposed by E.P. Brown
(Sta. 6797+70)

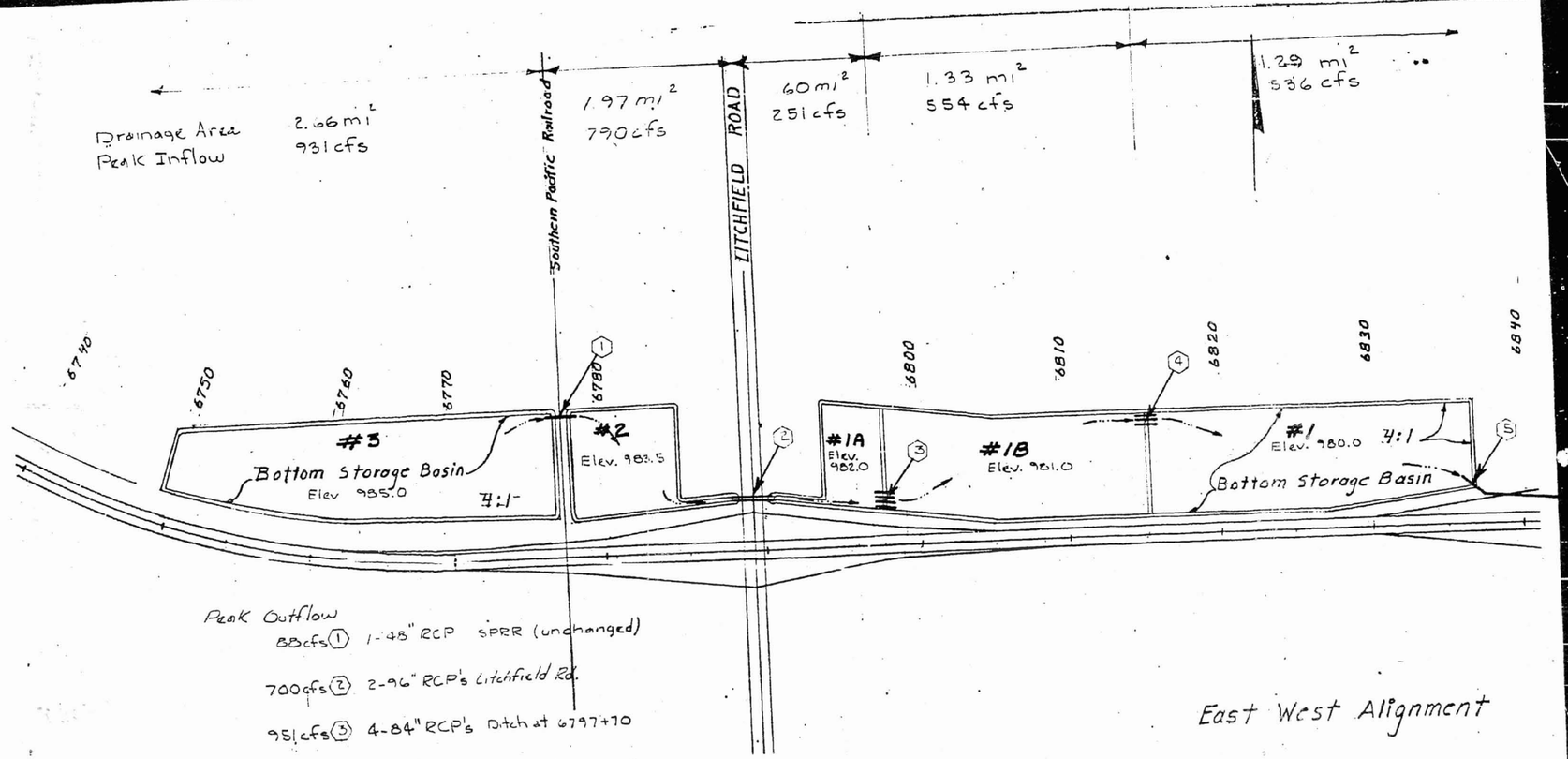
I-IG-10-2 (37)
Scale 1" = 600'

As per plans



I-16-10-2 (37)
Scale 1" = 600'

3-28


Drainage Area
Peak Inflow
2.66 mi²
931 cfs
1.97 mi²
790 cfs
60 mi²
251 cfs
1.33 mi²
554 cfs
1.29 mi²
536 cfs
Southern Pacific Railroad
LITCHFIELD ROAD
6740
6750
6760
6770
6780
6800
6810
6820
6830
6840
#3
Bottom Storage Basin
Elev 985.0
4:1
#2
Elev. 983.5
#1A
Elev. 982.0
#1B
Elev. 981.0
#1
Elev. 980.0
4:1
Bottom Storage Basin
Peak Outflow
88cfs (1) 1-48" RCP SPRR (unchanged)
700cfs (2) 2-96" RCP's Litchfield Rd.
951cfs (3) 4-84" RCP's Ditch at 6797+70
620cfs (4) 3-78" RCP's Ditch at 6815+10
54cfs (5) 1-48" RC Outlet Structure (unchanged)
East West Alignment
Drain Design as Proposed by EP Brown
(Sta. 6797+70 & 6815+10)
I-16-10-2 (37)
Scale 1" = 600'
3-31

cnt

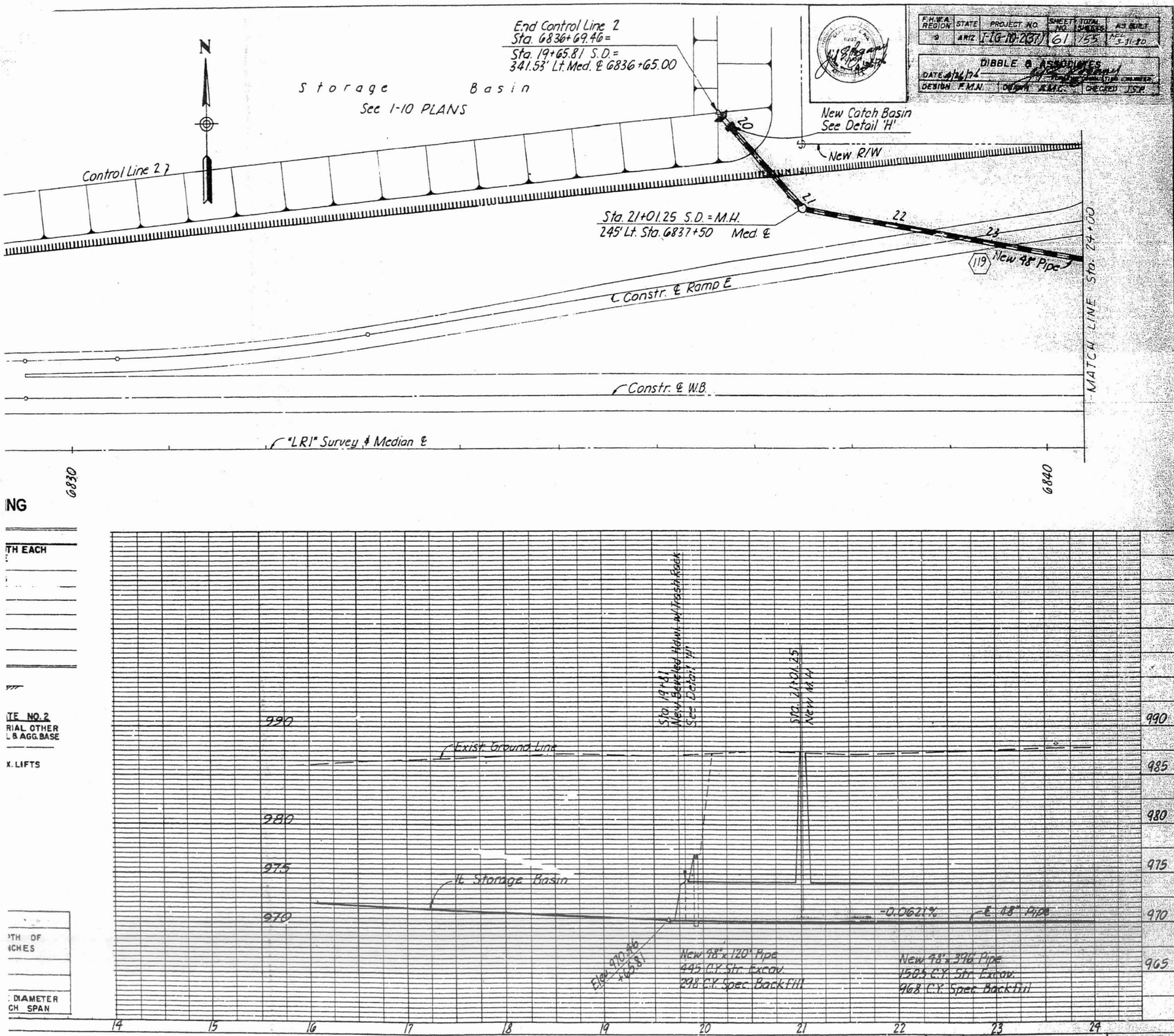
(37)
00'

3-28

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-IG-10-2(37)	61	155	5-31-80

DIBBLE & ASSOCIATES

DATE 4/26/74 DESIGN F.M.N. DRAWN K.M.C. CHECKED J.S.P.



NG

TH EACH

TE NO. 2
RIAL OTHER
L & AGG. BASE

X. LIFTS

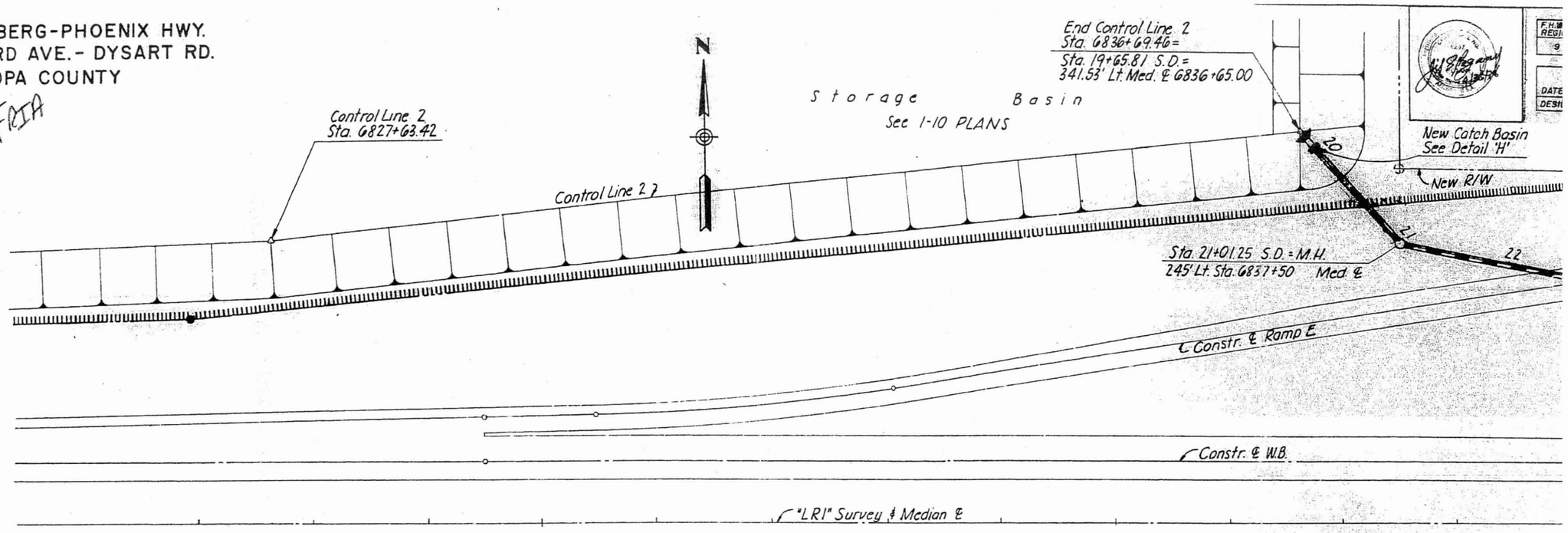
TH OF
NCHES

DIAMETER
CH SPAN

PLATE 1 SINGLE PLAN - PROFILE
CHARLES BRUNING CO.
MADE IN U.S.A.

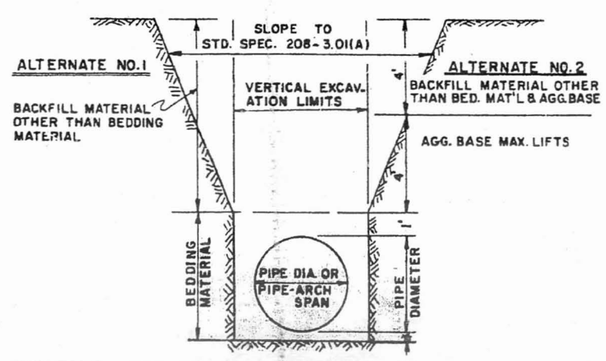
RENBERG-PHOENIX HWY.
LLARD AVE.- DYSART RD.
RICOPA COUNTY

48" S.D. BASINS TO AGUA FRIA



DETAIL FOR EXCAVATING AND BACKFILLING FOR PIPE IN TRENCHES

PIPE SIZE	VERTICAL EXCAVATION LIMITS	
INSIDE DIAMETER OR PIPE-ARCH SPAN	MAXIMUM WIDTH GREATER THAN OUTSIDE DIAMETER OR PIPE-ARCH SPAN	MINIMUM WIDTH EACH SIDE OF PIPE
INCHES	INCHES	INCHES
LESS THAN 18	16	6
18 - 24	19	7 1/2
25 - 39	22	9
40 - 60	1/2 OUTSIDE DIAMETER OR PIPE-ARCH SPAN	12
60 OR LARGER	36	12



*BEDDING MATERIAL UNDER PIPE, EITHER ALTERNATE		
TYPE OF PIPE	SIZE OF PIPE (INSIDE PIPE DIA. OR PIPE-ARCH SPAN)	MINIMUM DEPTH OF MATERIAL, INCHES
CORRUGATED METAL	ALL	6
OTHER THAN C.M.P.	39" & UNDER	4
OTHER THAN C.M.P.	OVER 39"	1/12 OUTSIDE DIAMETER OR PIPE-ARCH SPAN

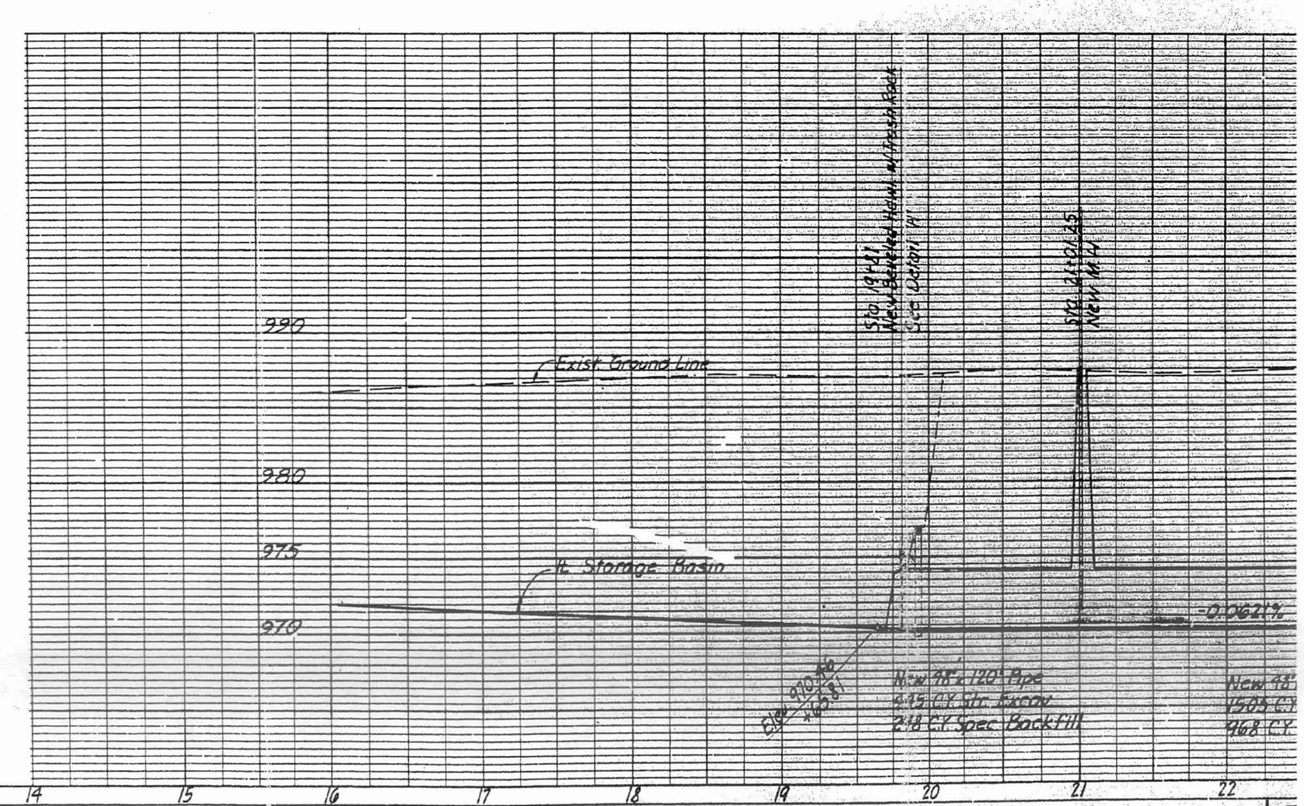
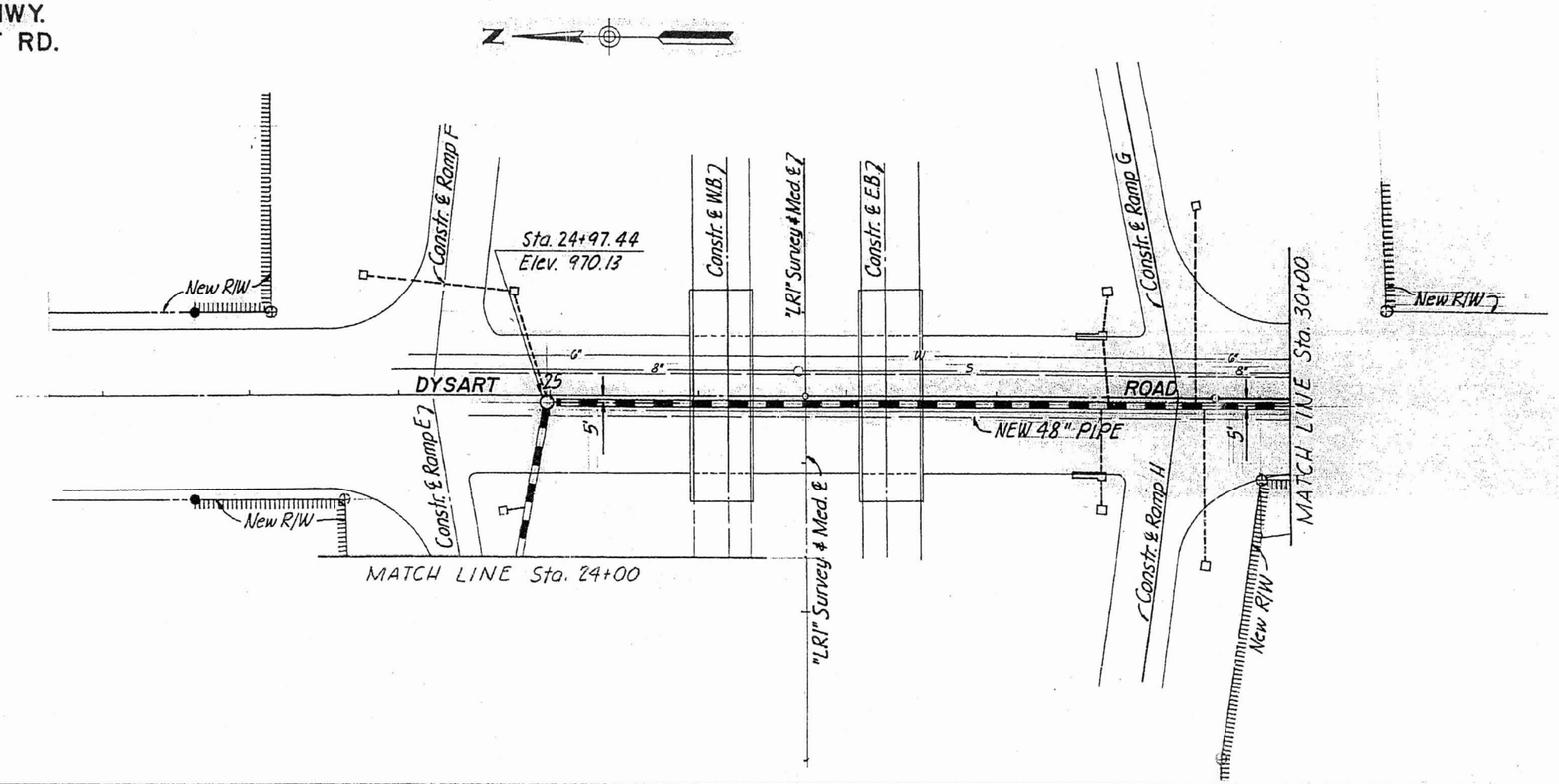


PLATE 1 SINGLE PLAN - PROFILE
CHARLES BRUNING CO.
MADE IN U.S.A.

EHRENBERG-PHOENIX HWY.
BULLARD AVE. - DYSART RD.
MARICOPA COUNTY



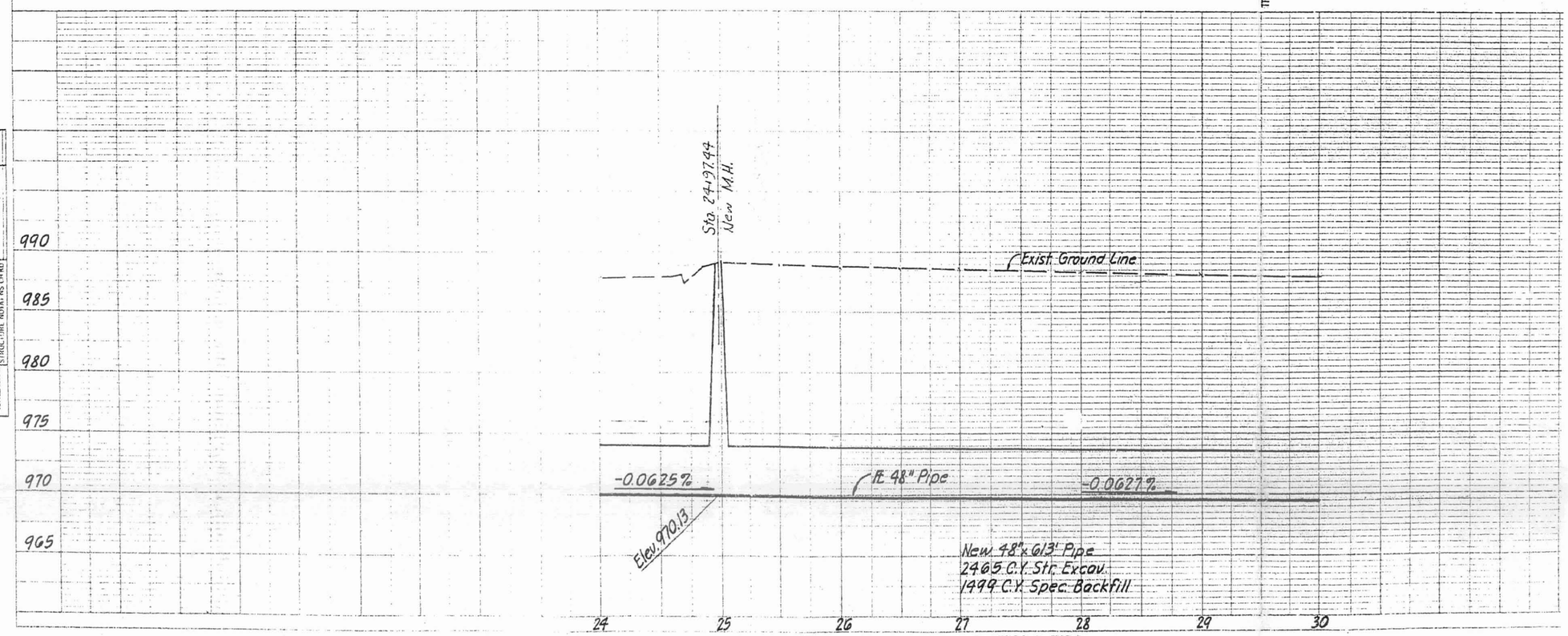


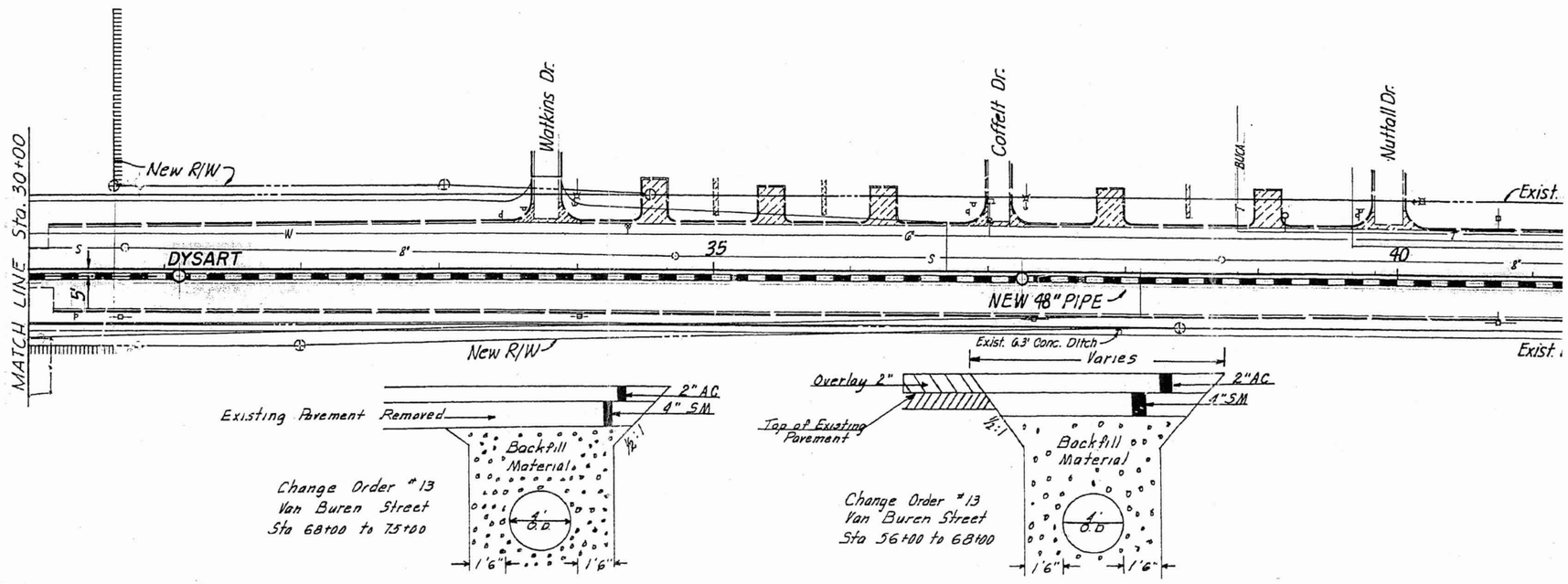
PLATE 1 SINGLE PLAN - PROFILE

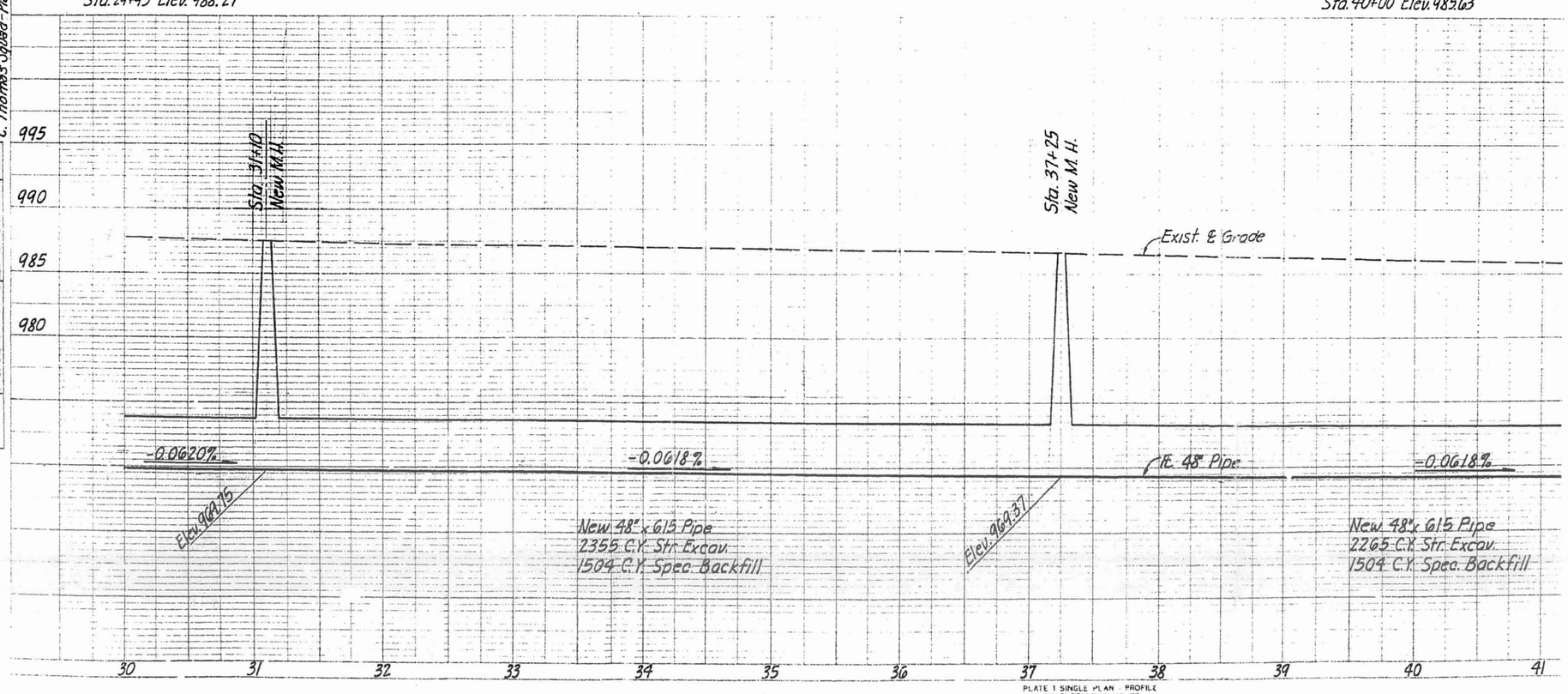
PLAN		BY	DATE
NOTE BOOK NO.	SURVEYED ..... PLOTTED ..... ALIGNMENT CHECKED ..... RT OF WAY CHECKED		

PROFILE		BY	DATE
NOTE BOOK NO.	SURVEYED ..... PLOTTED ..... GRADES CHECKED ..... STRUCTURE NOTA PHS CHKD		

62

EHRENBERG-PHOENIX HWY.
BULLARD AVE.- DYSART RD.
MARICOPA COUNTY





PLAN
SURVEYED
PLOTTED
RIGHT OF WAY CHECKED
NOTE BOOK
NO.
BY
DATE

PROFILE
SURVEYED
PLOTTED
GRADES CHECKED
B.M.'S NOTED
STRUCTURE NOTATIONS CHKD.
NOTE BOOK
NO.
BY
DATE

C. Thomas Squad - Plans Services 10-76

PLATE 1 SINGLE PLAN - PROFILE
CHARLES BRUNING CO

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS-BUILT
9	ARIZ.	I-IG-10-2(37)	63	155	3-31-80

DIBBLE & ASSOCIATES
CONSULTING ENGINEER

DATE 4/08/76 | DESIGN F.M.N. | DRAWN A.M.C. | CHECKED J.S.P.

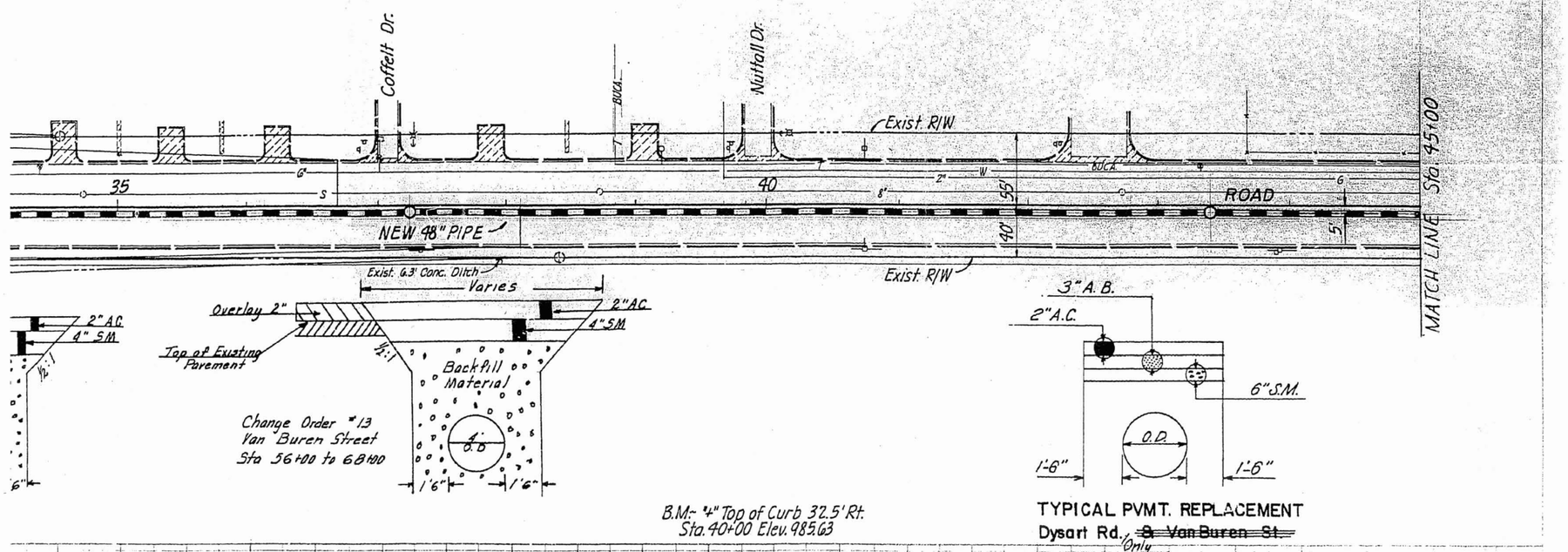


PLATE 1 SINGLE PLAN - PROFILE
CHARLES BRUNING CO.
MADE IN U.S.A.

ULLARD AVE.- DYSART RD.
ARICOPA COUNTY

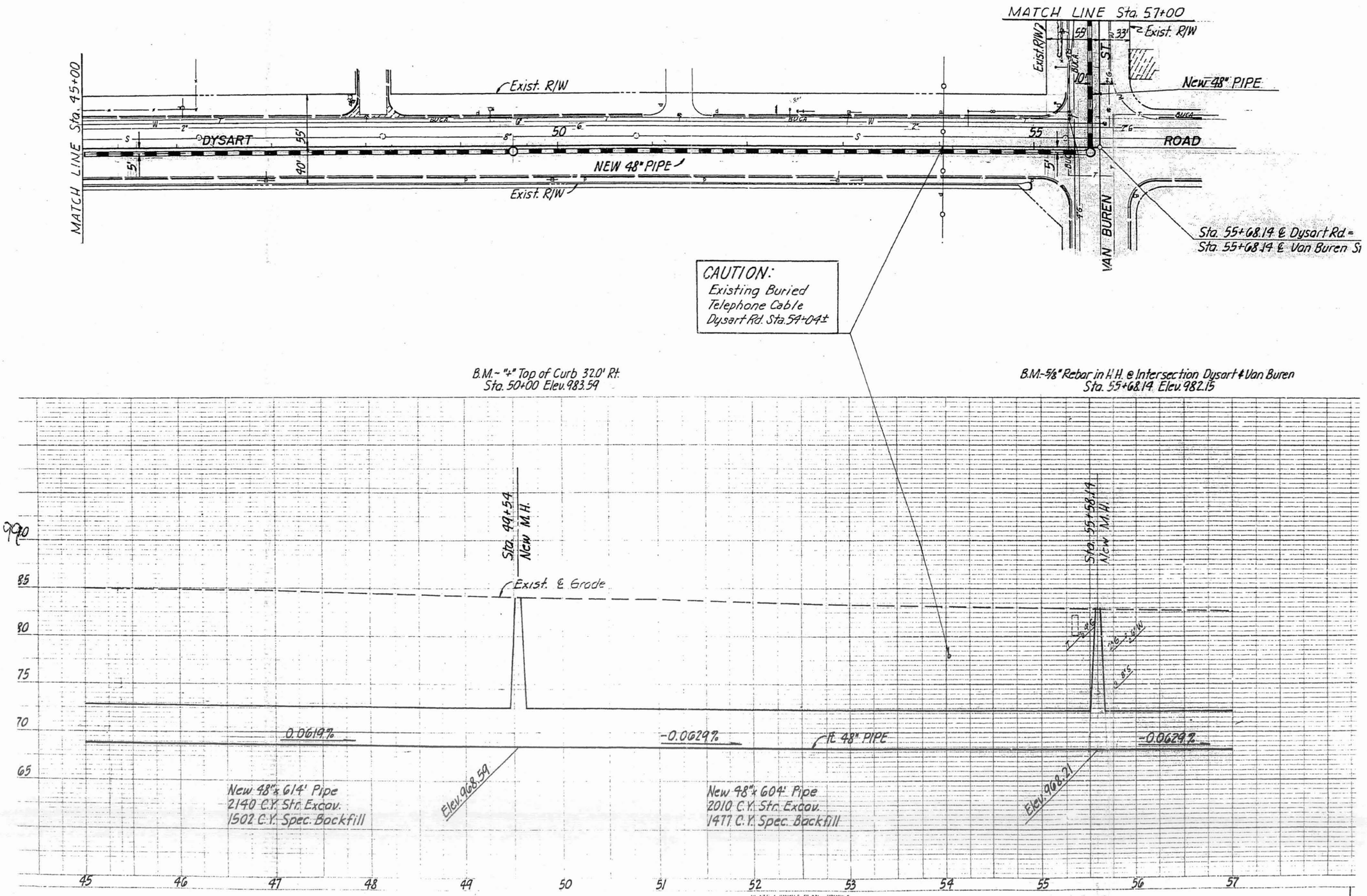
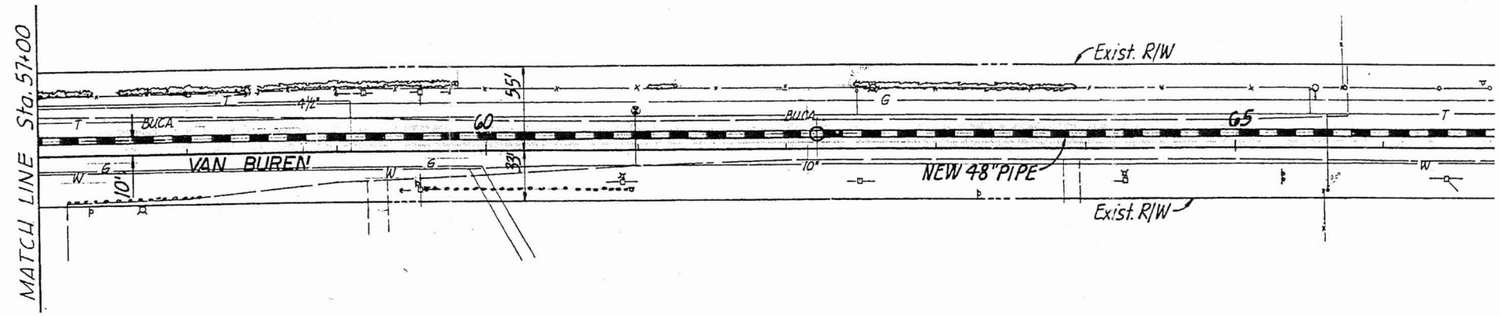


PLATE 1 SINGLE PLAN - PROFILE
CHARLES BRUNING CO
MADE IN U.S.A.

64

BULLARD AVE.- DYSART RD.
MARICOPA COUNTY



B.M.- Set ½" Rebar in Con
Sta. 66+00 Elev. 97

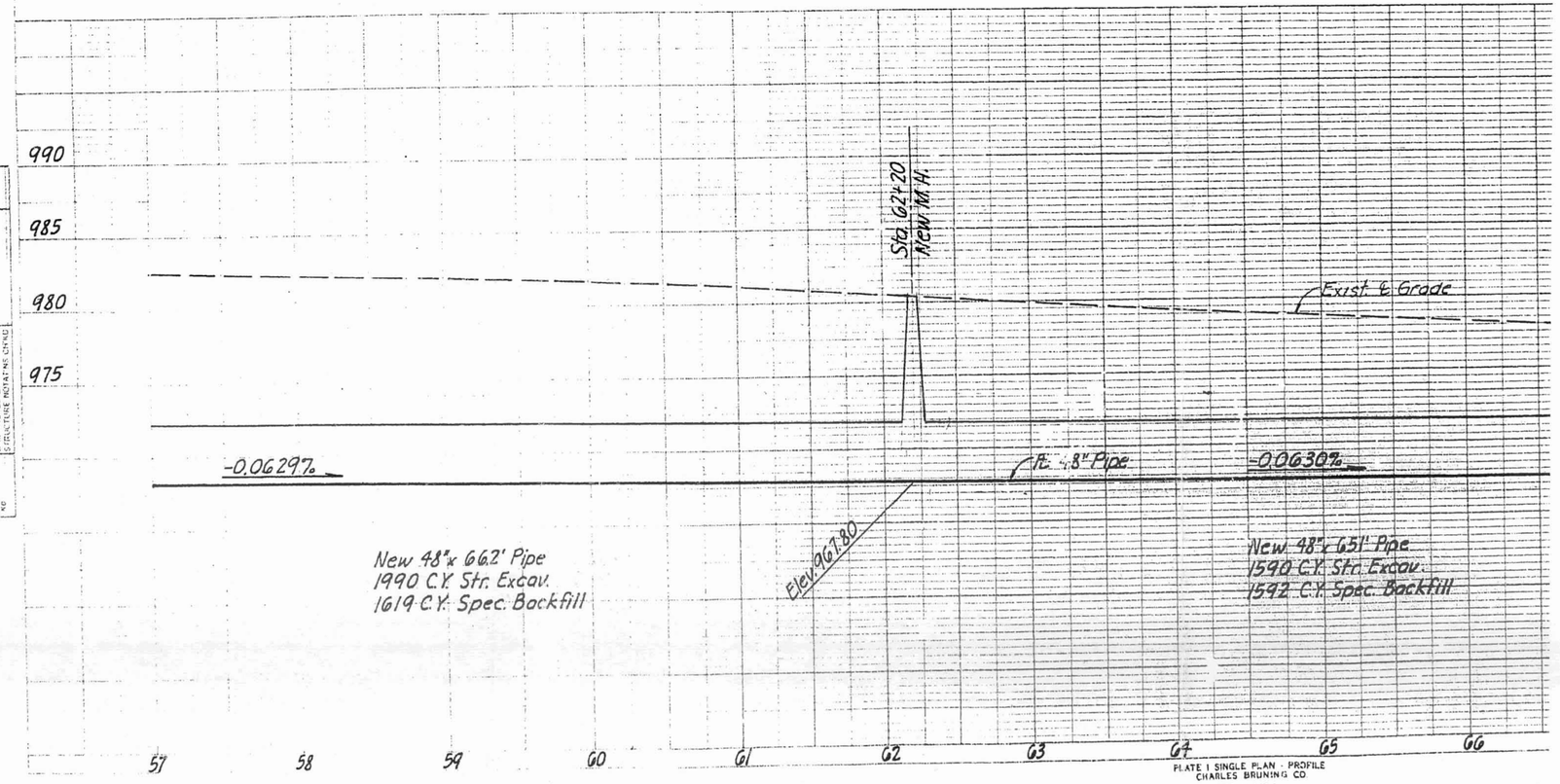


PLATE 1 SINGLE PLAN - PROFILE
CHARLES BRUNING CO.
MADE IN U.S.A.

PLAN		BY	DATE
NOTE BOOK NO.	SURVEYED PLOTTED AL GINMENT CHECKED RT OF WAY CHECKED		

PROFILE		BY	DATE
NOTE BOOK NO.	SURVEYED PLOTTED GRADES CHECKED B. M. NOTED STRUCTURE NOTED		

65

9	ARIZ.	I-IG-10-2(37)	65	155	M.L. 3-31-80

DIBBLE & ASSOCIATES
FOR THE CONSULTING ENGINEER

DATE 4/26/76 DESIGN F.M.N. DRAWN A.M.C. CHECKED J.S.P.

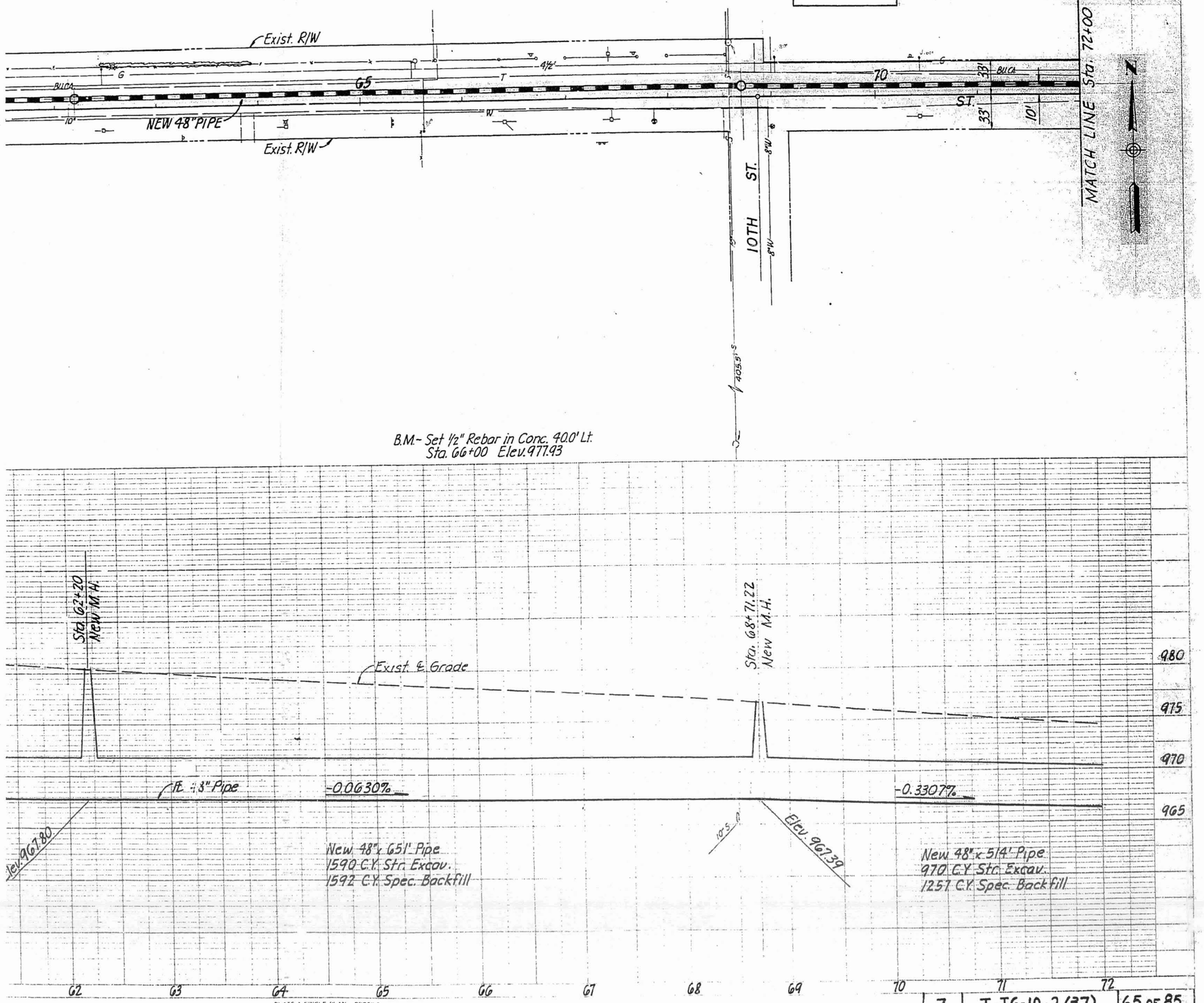
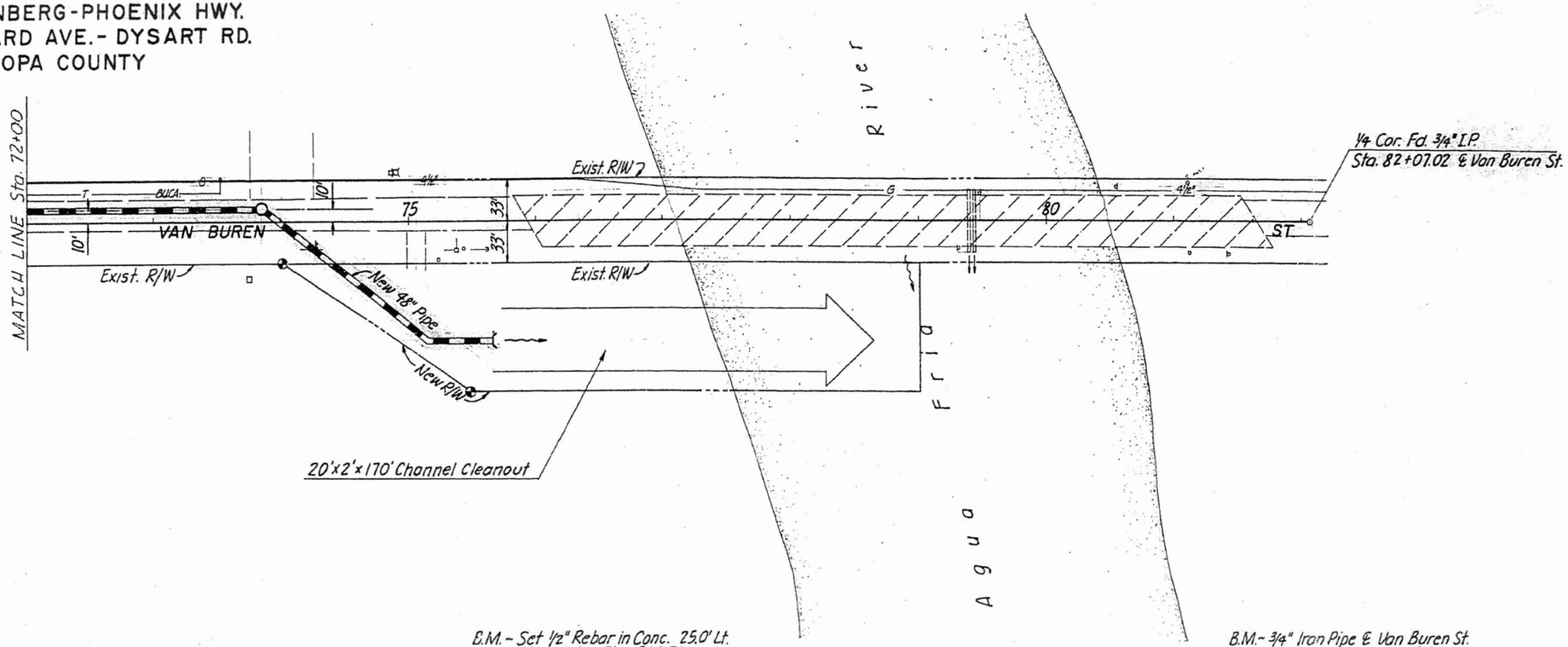


PLATE 1 SINGLE PLAN PROFILE
CHARLES BRUNING CO

7	I-IG-10-2 (37)	65 OF 85

EHRENBERG-PHOENIX HWY.
BULLARD AVE.- DYSART RD.
MARICOPA COUNTY



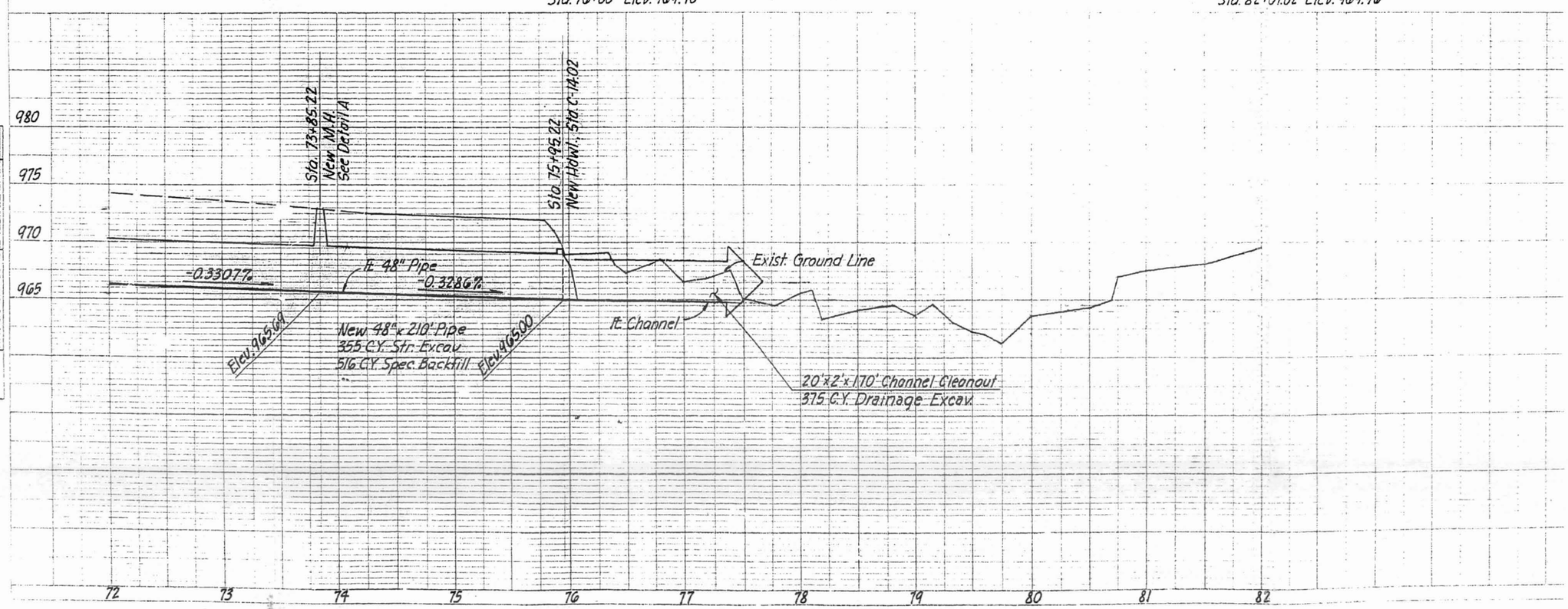
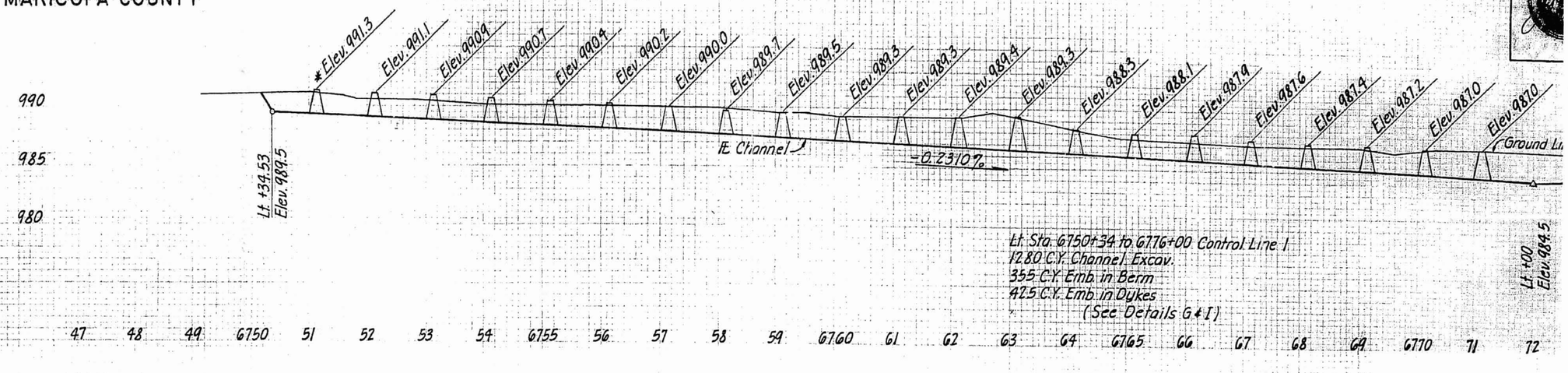


PLATE 1 SINGLE PLAN - PROFILE

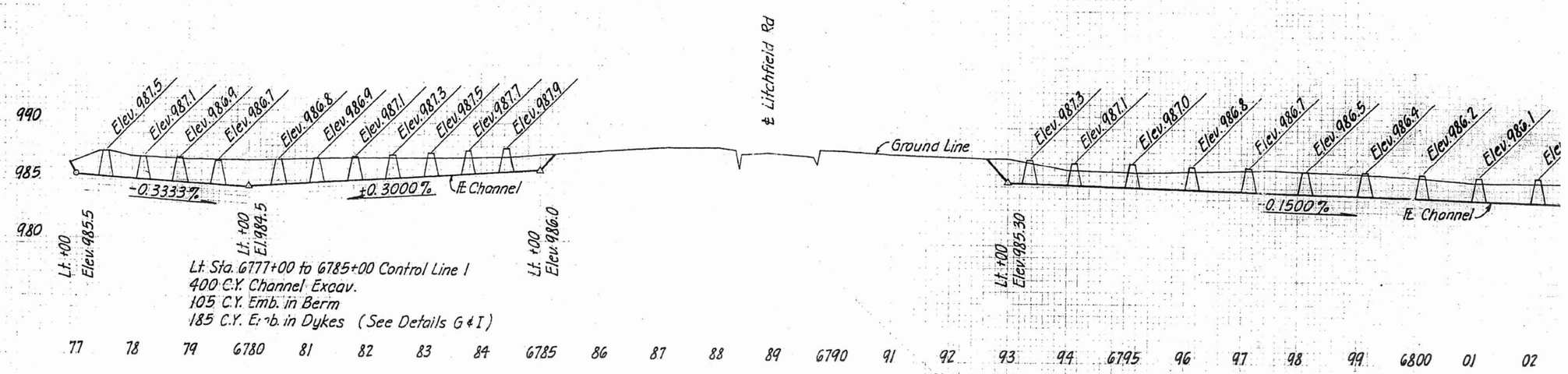
66

EHRENBERG-PHOENIX HWY.
BULLARD AVE.-DYSART RD.
MARICOPA COUNTY

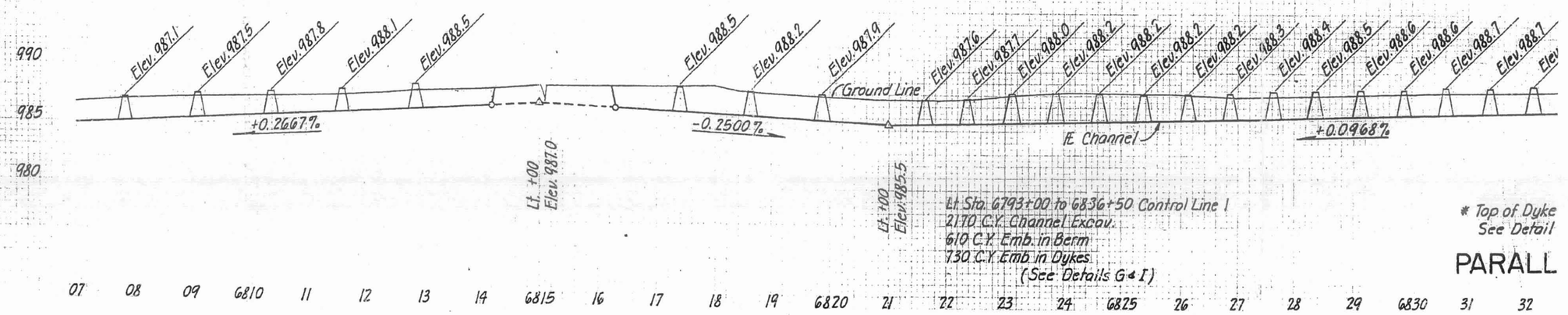
PARALLEL CHANNEL



Lt. Sta. 6750+34 to 6776+00 Control Line 1
1280 C.Y. Channel Excav.
355 C.Y. Emb. in Berm
425 C.Y. Emb. in Dykes
(See Details G & I)



Lt. Sta. 6777+00 to 6785+00 Control Line 1
400 C.Y. Channel Excav.
105 C.Y. Emb. in Berm
185 C.Y. Emb. in Dykes (See Details G & I)



Lt. Sta. 6793+00 to 6836+50 Control Line 1
2170 C.Y. Channel Excav.
610 C.Y. Emb. in Berm
730 C.Y. Emb. in Dykes
(See Details G & I)

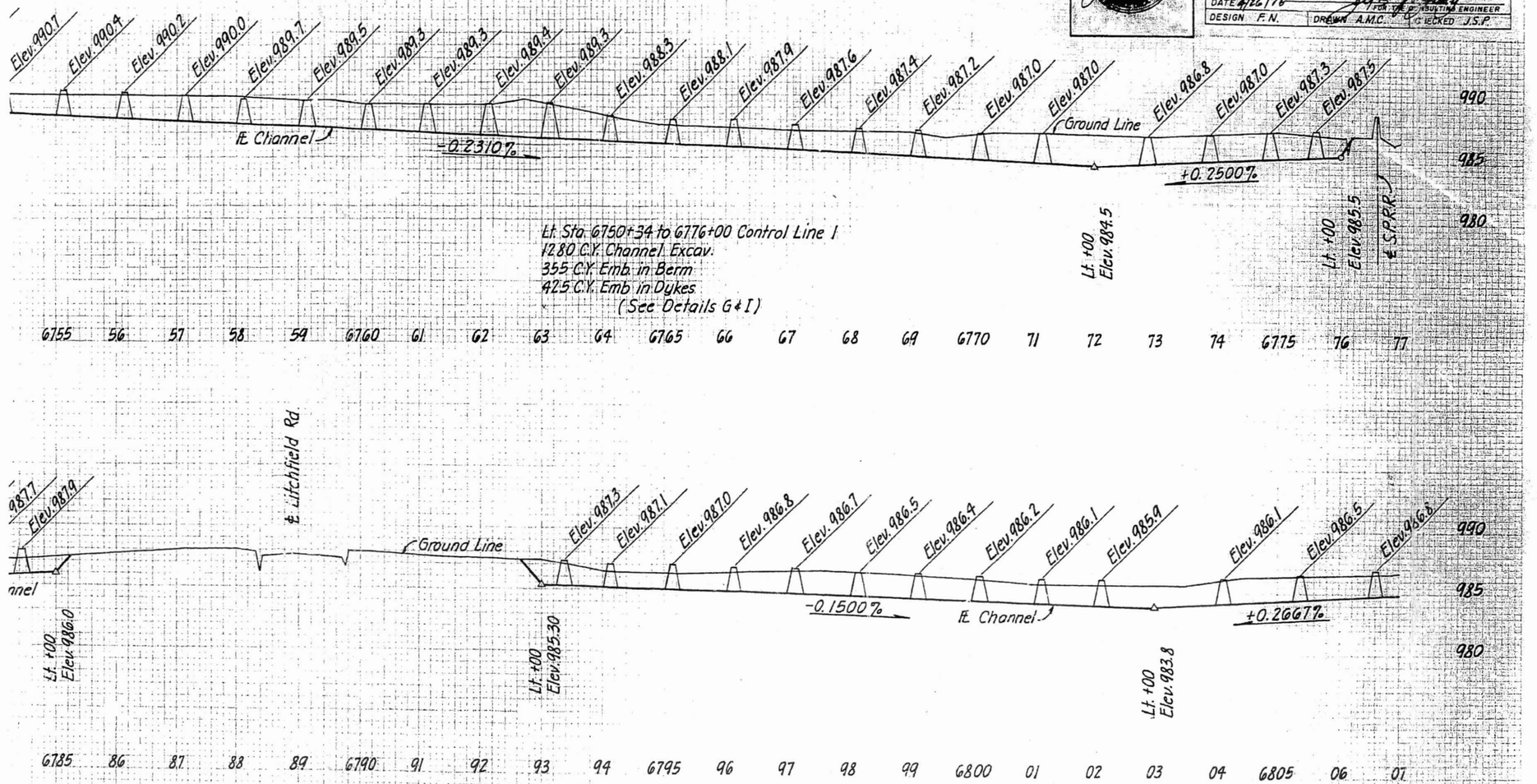
* Top of Dyke
See Detail

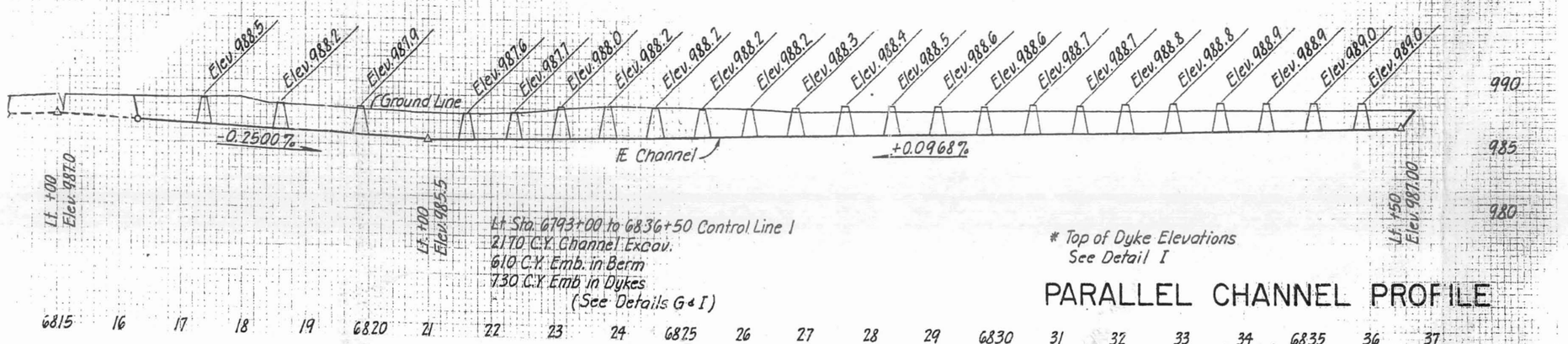
PARALL

71

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	HG-10-2(37)	71	135	2-81-PD

DIBBLE & ASSOCIATES
DATE 4/26/76 FOR THE CONSULTING ENGINEER
DESIGN F.N. DRAWN A.M.C. CHECKED J.S.P.





* Top of Dyke Elevations
See Detail I

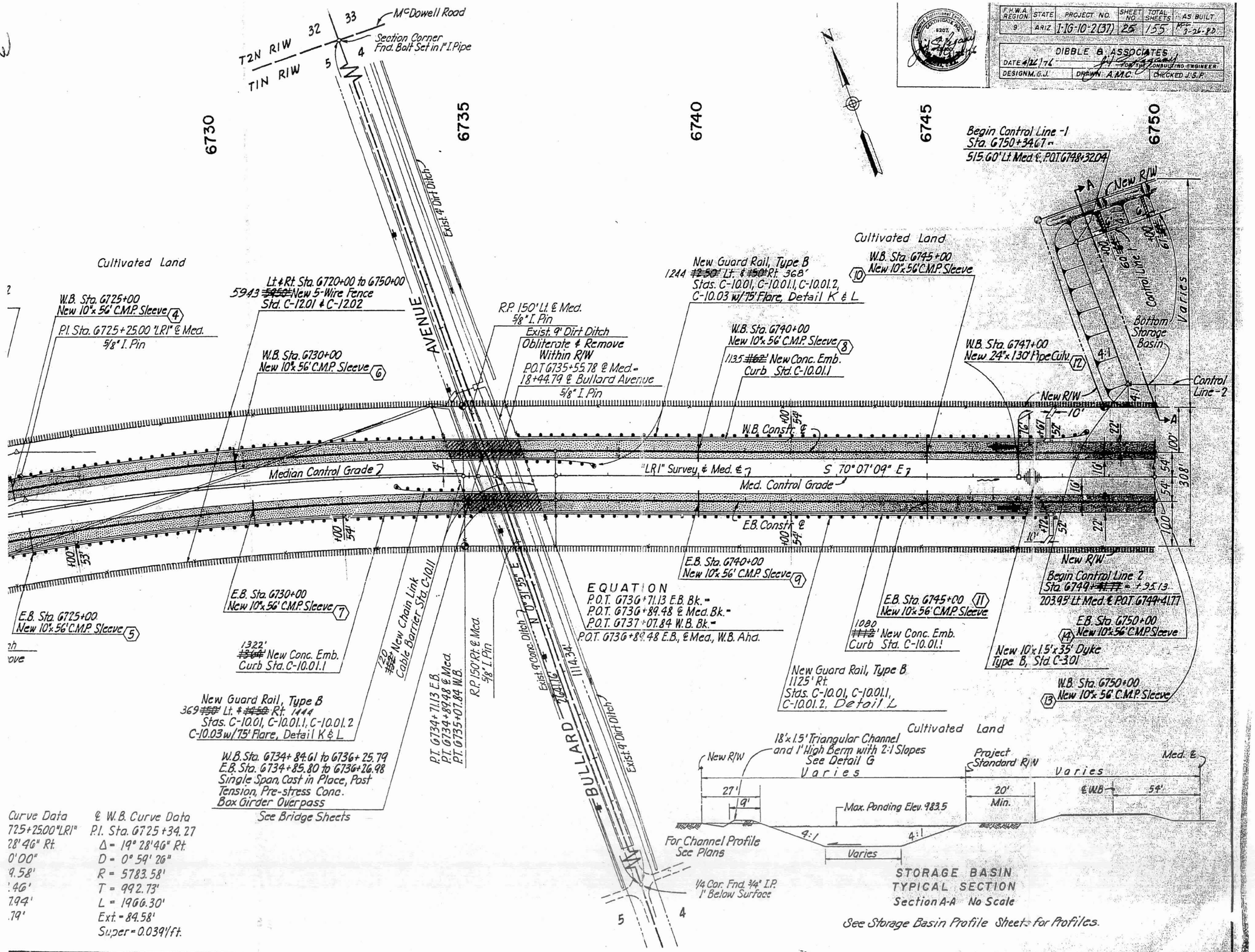
PARALLEL CHANNEL PROFILE

71

BASIN 5 PLAN VIEW

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-IG-10-2(37)	25	155	3-26-80

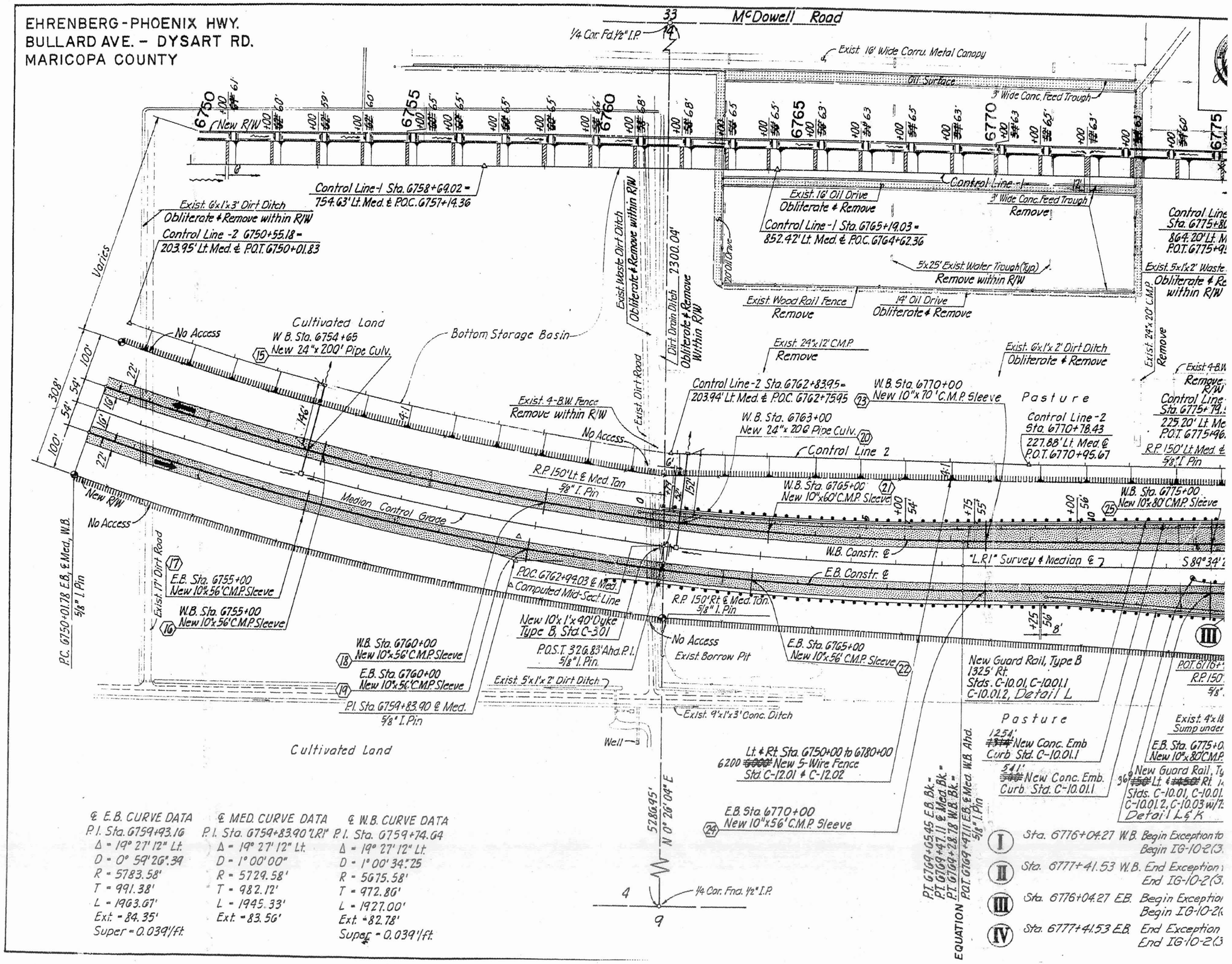
DIBBLE & ASSOCIATES
DATE 4/12/76 FOR THE CONSULTING ENGINEER
DESIGN M.G.J. DRAWN A.M.C. CHECKED J.S.P.



Curve Data
72.5+25.00 "LR1"
28' 46" Rt.
0' 00"
9.58'
.46'
7.94'
.79'

℄ W.B. Curve Data
P.I. Sta. G725+34.27
Δ = 19° 28' 46" Rt.
D = 0° 59' 26"
R = 5783.58'
T = 992.73'
L = 1966.30'
Ext. = 84.58'
Super = 0.039'/ft.

EHRENBERG-PHOENIX HWY.
BULLARD AVE. - DYSART RD.
MARICOPA COUNTY



℄ E.B. CURVE DATA	℄ MED. CURVE DATA	℄ W.B. CURVE DATA
P.I. Sta. 6759+93.16	P.I. Sta. 6759+83.90 "L.R.I"	P.I. Sta. 6759+74.64
Δ = 19° 27' 12" Lt.	Δ = 19° 27' 12" Lt.	Δ = 19° 27' 12" Lt.
D = 0° 59' 26".39	D = 1° 00' 00"	D = 1° 00' 34".25
R = 5783.58'	R = 5729.58'	R = 5675.58'
T = 991.38'	T = 982.12'	T = 972.86'
L = 1963.67'	L = 1945.33'	L = 1927.00'
Ext. = 84.35'	Ext. = 83.56'	Ext. = 82.78'
Super = 0.039'/ft.		Super = 0.039'/ft.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-IG-10-2(37)	27	155	1-26-80

DIBBLE & ASSOCIATES
DATE 4/26/76 — FOR THE CONSULTING ENGINEER
DESIGN M.G.J. — DRAWN A.M.C. — CHECKED J.S.P.

33 — McDowell Road

1/4 Cor. Fd. 1/2" I.P.

Exist. 16' Wide Corru. Metal Canopy

Oil Surface

3' Wide Conc. Feed Trough

6755 6760 6765 6770 6775

Control Line-1 Sta. 6758+69.02 = 3' Lt. Med. & P.O.C. 6757+14.36

Exist. 16' Oil Drive — Obliterate & Remove

Control Line-1 Sta. 6765+19.03 = 852.42' Lt. Med. & P.O.C. 6764+62.36

3' Wide Conc. Feed Trough — Remove

5'x25' Exist. Water Trough (Typ.) — Remove within R/W

Exist. Wood Rail Fence — Remove

14' Oil Drive — Obliterate & Remove

Exist. Waste Dirt Ditch — Obliterate & Remove within R/W

Dirt Drain Ditch 2300.04' — Obliterate & Remove Within R/W

Bottom Storage Basin

Exist. 24"x12' C.M.P. — Remove

Exist. 6'x1'x2' Dirt Ditch — Obliterate & Remove

Exist. Dirt Road

Exist. 4-B.W. Fence — Remove within R/W

No Access

Control Line-2 Sta. 6762+83.95 = 203.94' Lt. Med. & P.O.C. 6762+75.95 (23)

W.B. Sta. 6770+00 New 10"x 70' C.M.P. Sleeve

W.B. Sta. 6763+00 New 24"x 206' Pipe Culv. (20)

Control Line 2

R.P. 150' Lt. & Med. Tan 5/8" I. Pin

W.B. Sta. 6765+00 New 10"x60' C.M.P. Sleeve (21)

Median Control Grade

W.B. Constr. ℄

E.B. Constr. ℄

"L.R.I" Survey & Median ℄

S 89°34'21"E

P.O.C. 6762+94.03 ℄ Med. & Computed Mid-Sect. Line

R.P. 150' Rt. & Med. Tan. 5/8" I. Pin

New 10'x 1'x 40' Dyke Type B, Std. C-301

P.O.S.T. 3269.83' Ahd. P.I. 5/8" I. Pin.

No Access

Exist. Borrow Pit

E.B. Sta. 6765+00 New 10'x 56' C.M.P. Sleeve (22)

W.B. Sta. 6760+00 New 10'x 56' C.M.P. Sleeve (8)

E.B. Sta. 6760+00 New 10'x 56' C.M.P. Sleeve (7)

P.I. Sta. 6759+83.90 ℄ Med. 5/8" I. Pin

Exist. 5'x1'x2' Dirt Ditch

Exist. 9'x1'x3' Conc. Ditch

Well

Lt. & Rt. Sta. 6750+00 to 6780+00 6200 ~~5000~~ New 5-Wire Fence Std. C-12.01 & C-12.02

E.B. Sta. 6770+00 New 10"x56' C.M.P. Sleeve (24)

528.95' N 0° 26' 04" E

1/4 Cor. Fnd. 1/2" I.P.

4 9

Control Line-1 Sta. 6775+80.01 = 864.20' Lt. Med. & P.O.T. 6775+95.92

Exist. 5'x1'x2' Waste Ditch — Obliterate & Remove within R/W

Exist. 24"x 20' C.M.P. — Remove

Exist. 4-B.W. Fence — Remove within R/W

Control Line-2 Sta. 6775+79.50 225.20' Lt. Med. & P.O.T. 6775+96.73

R.P. 150' Lt. Med. & 5/8" I. Pin

W.B. Sta. 6775+00 New 10'x 80' C.M.P. Sleeve (25)

Control Line-2 Sta. 6770+78.43 227.88' Lt. Med. ℄ P.O.T. 6770+95.67

Pasture

Railroad

New R/W

Control Line-1 Sta. 6777+30.18 = 916.65' Lt. Med. & P.O.T. 6777+45.91

850' Lt. 6776+14 to 6777+28 Med. ℄, New 48" x ~~114~~ 114' R.C.P. (27)

Exist. 5'x1'x2' Conc. Ditch To Remain

157' Lt. Med. ℄ New Drop Inlet Hdwl. & Trash Rack Invert Elev. = 984.4 Std. C-14.03 & Detail "H" & "P"

Control Line-2 Sta. 6777+29.10 230.74' Lt. Med. & P.O.T. 6777+46.72

Med. Sta. 6777+13 New 36"x 322' RGRCP (13)

Constr. ℄ Ramp A

Constr. ℄ Ramp D

New Guard Rail, Type B 132.5' Rt. Stds. C-10.01, C-10.01.1, C-10.01.2, Detail L

P.O.T. 6776+47.02 R.P. 150' Rt. & Med. 5/8" I. Pin

Exist. 4"x 18" R.R. Tie Sump under Tracks

E.B. Sta. 6775+00 New 10"x 80' C.M.P. Sleeve (26)

New Guard Rail, Type B 369 ~~150~~ Lt. & ~~450~~ Rt. 1444 Stds. C-10.01, C-10.01.1, C-10.01.2, C-10.03 w/ 75' Flare, Detail L & K

Pasture

1254' ~~1344~~ New Conc. Emb. Curb Std. C-10.01.1

541' ~~580~~ New Conc. Emb. Curb Std. C-10.01.1

Southern Pacific

New R/W

New Guard Rail, Type B 369 ~~150~~ Rt. Stds. C-10.01, C-10.01.1, C-10.01.2, C-10.03 w/ 75' Flare, Detail L & K

112 ~~136~~ New Chain Link Cable Barrier Std. C-10.11

165' Rt. Med. ℄ New Outlet Headwall Inv. Elev. = 984.20 See Detail "N" & "P"

Sta. 6776+04.40 to 6777+41.40 W.B. & E.B. 3 Span, Pre-Cast, Pre-Stress Conc. Girder Overpasses A.A.S.H.T.O. Type II

See Bridge Sheet

EQUATION
P.T. 6769+65.45 E.B. Bk. = P.T. 6769+47.11 ℄ Med. Bk. = P.T. 6769+28.78 W.B. Bk. = P.O.T. 6769+47.11 E.B. & Med. W.B. Ahd. 5/8" I. Pin

(I) Sta. 6776+04.27 W.B. Begin Exception to I-10-2(37) Begin IG-10-2(37)

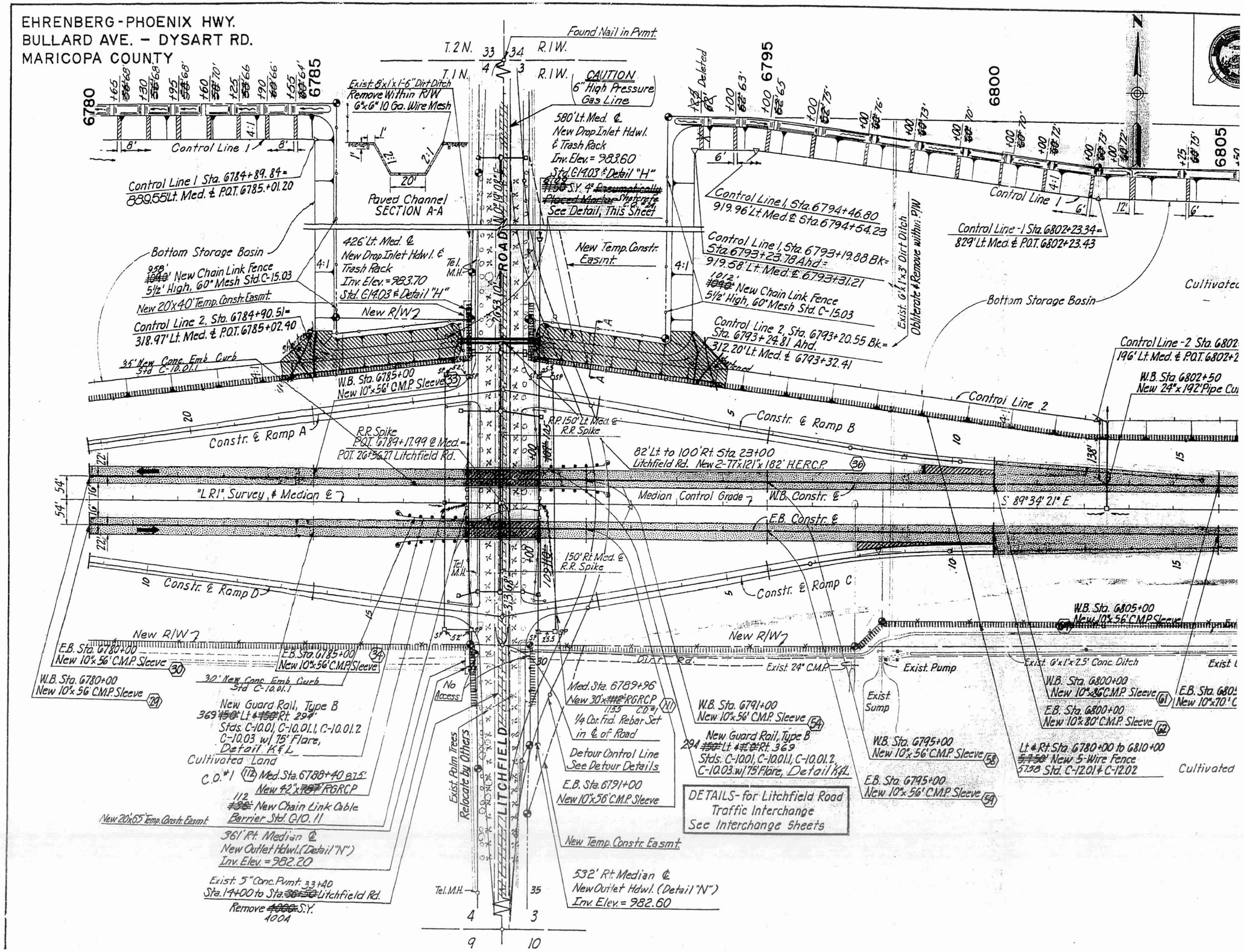
(II) Sta. 6777+41.53 W.B. End Exception to I-10-2(37) End IG-10-2(37)

(III) Sta. 6776+04.27 E.B. Begin Exception to I-10-2(37) Begin IG-10-2(37)

(IV) Sta. 6777+41.53 E.B. End Exception to I-10-2(37) End IG-10-2(37)

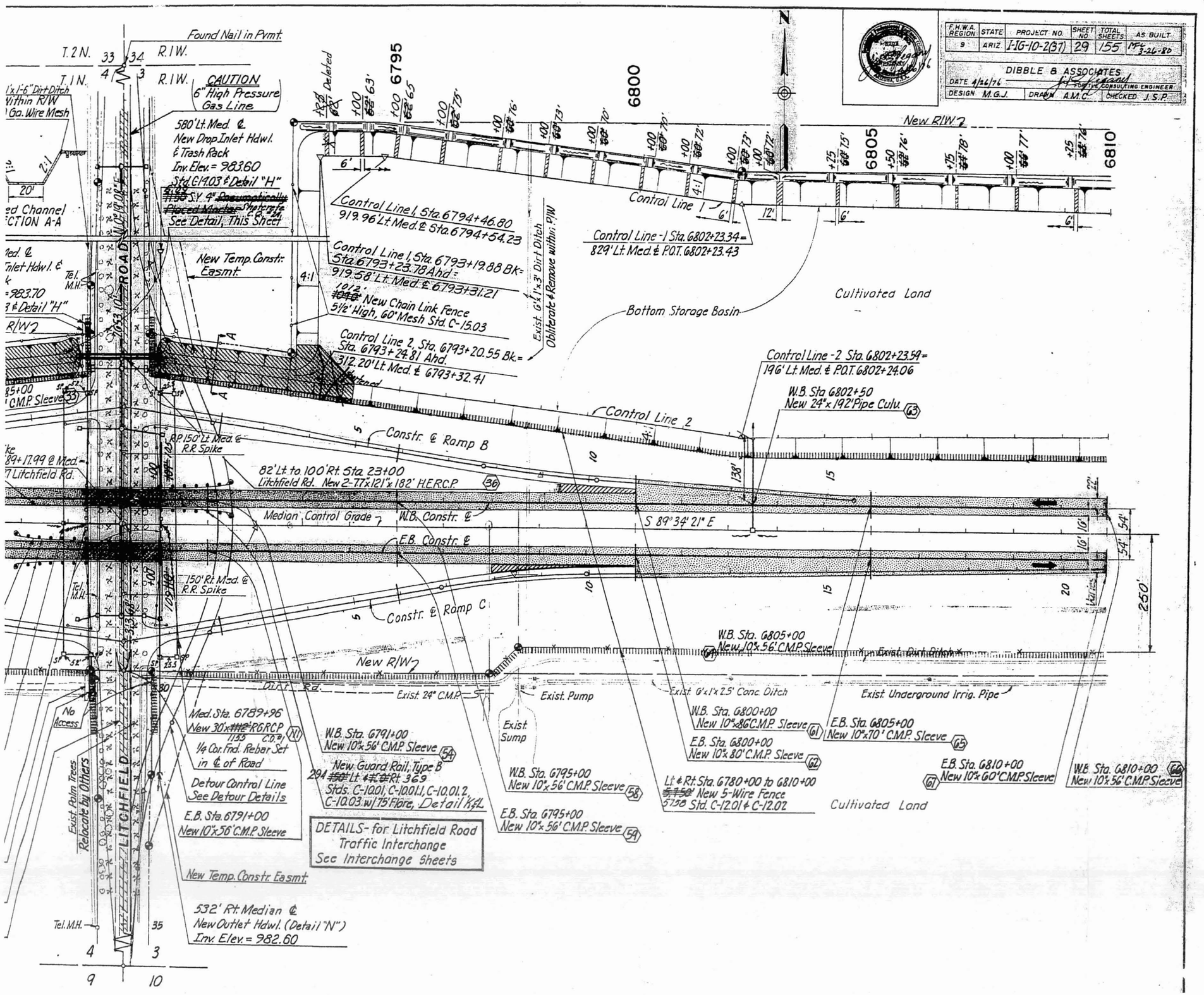
℄ W.B. CURVE DATA
1. Sta. 6759+74.64
Δ = 19° 27' 12" Lt.
D = 1° 00' 34".25
T = 5675.58'
L = 972.86'
R = 1927.00'
Ext. = 82.78'
Super = 0.039'/ft.

EHRENBERG-PHOENIX HWY.
BULLARD AVE. - DYSART RD.
MARICOPA COUNTY

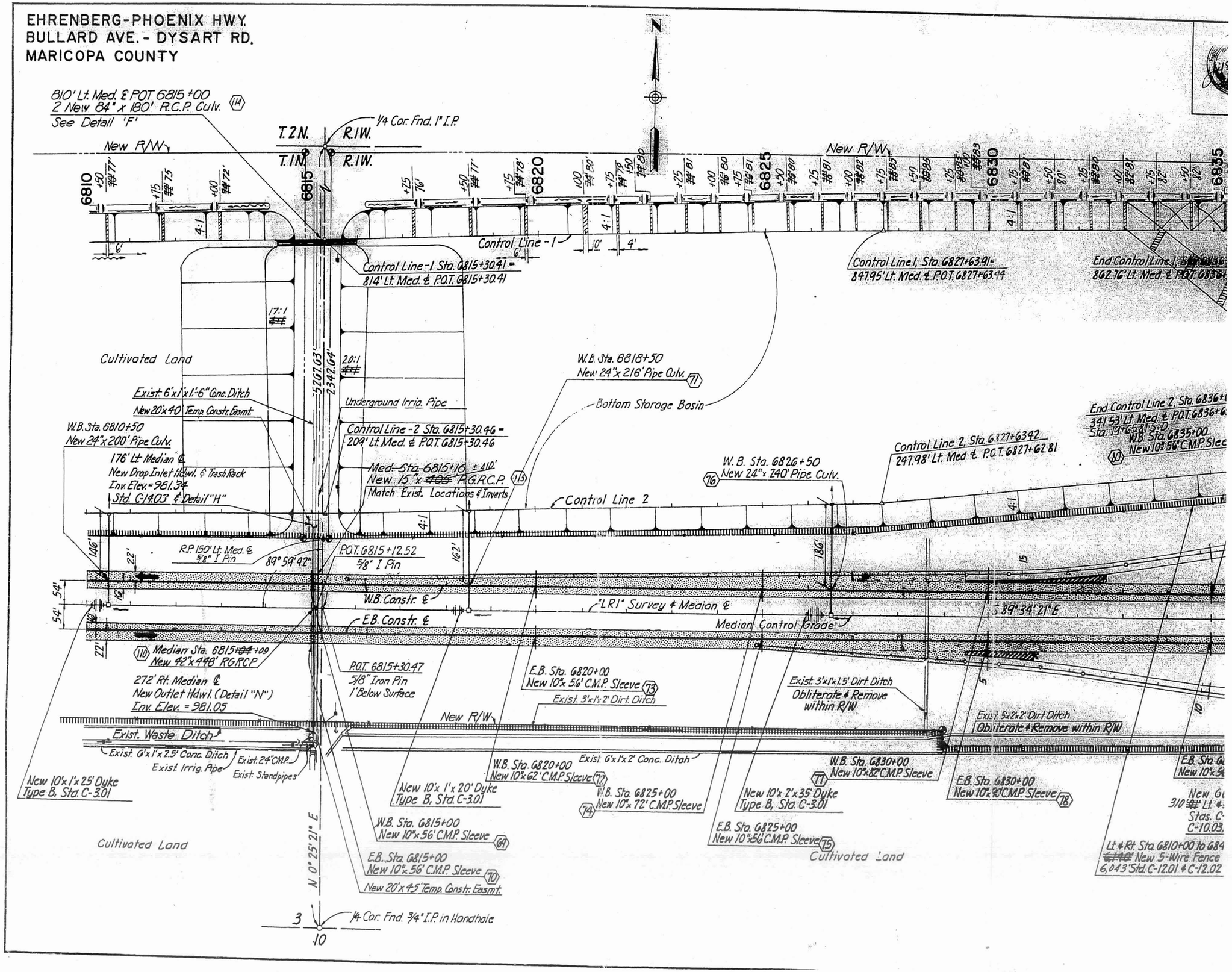


F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-IG-10-2(37)	29	155	3-26-80

DIBBLE & ASSOCIATES
DATE 4/26/76 — CONSULTING ENGINEER
DESIGN M.G.J. DRAWN A.M.C. CHECKED J.S.P.

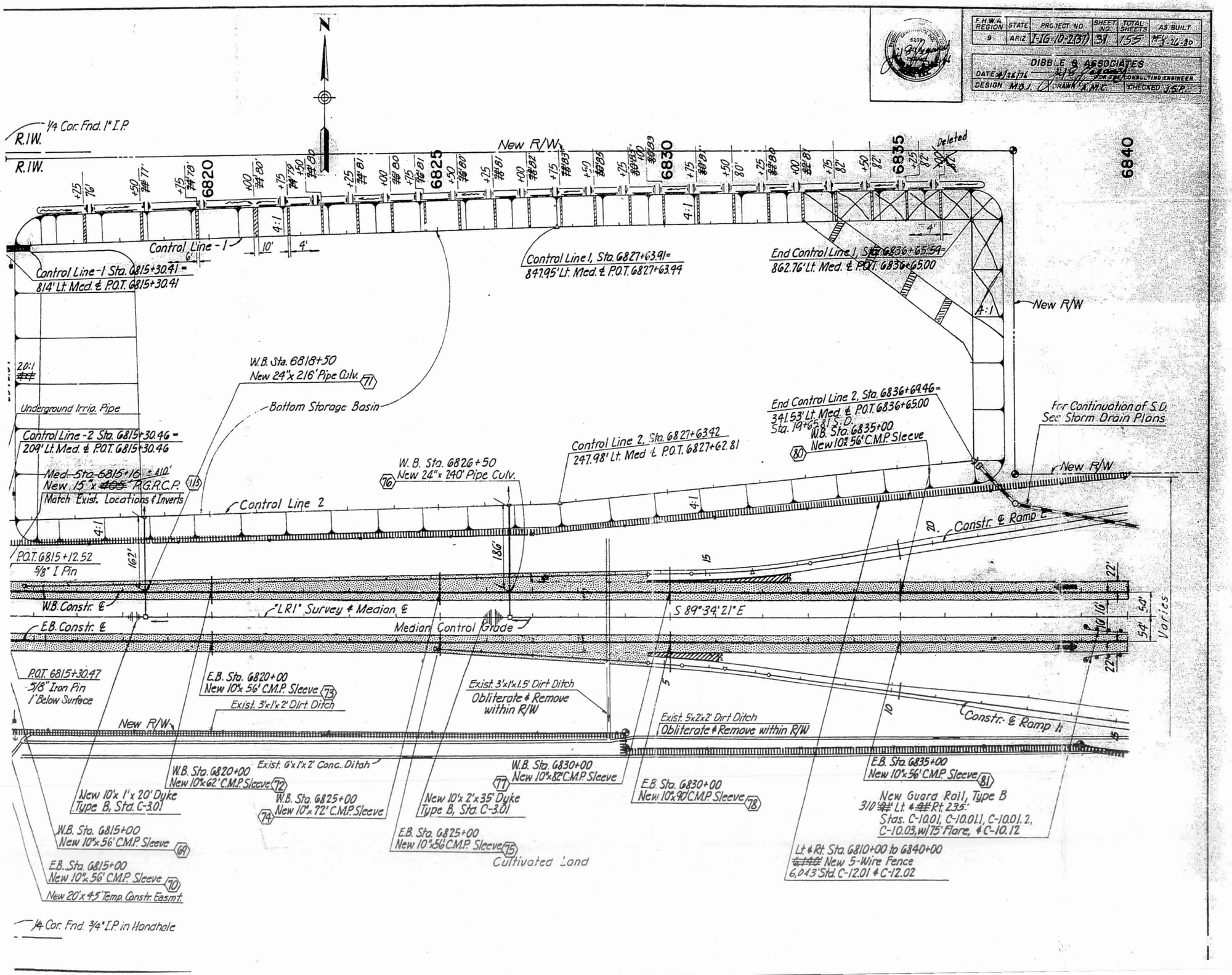


EHRENBERG-PHOENIX H.W.Y.
BULLARD AVE. - DYSART RD.
MARICOPA COUNTY

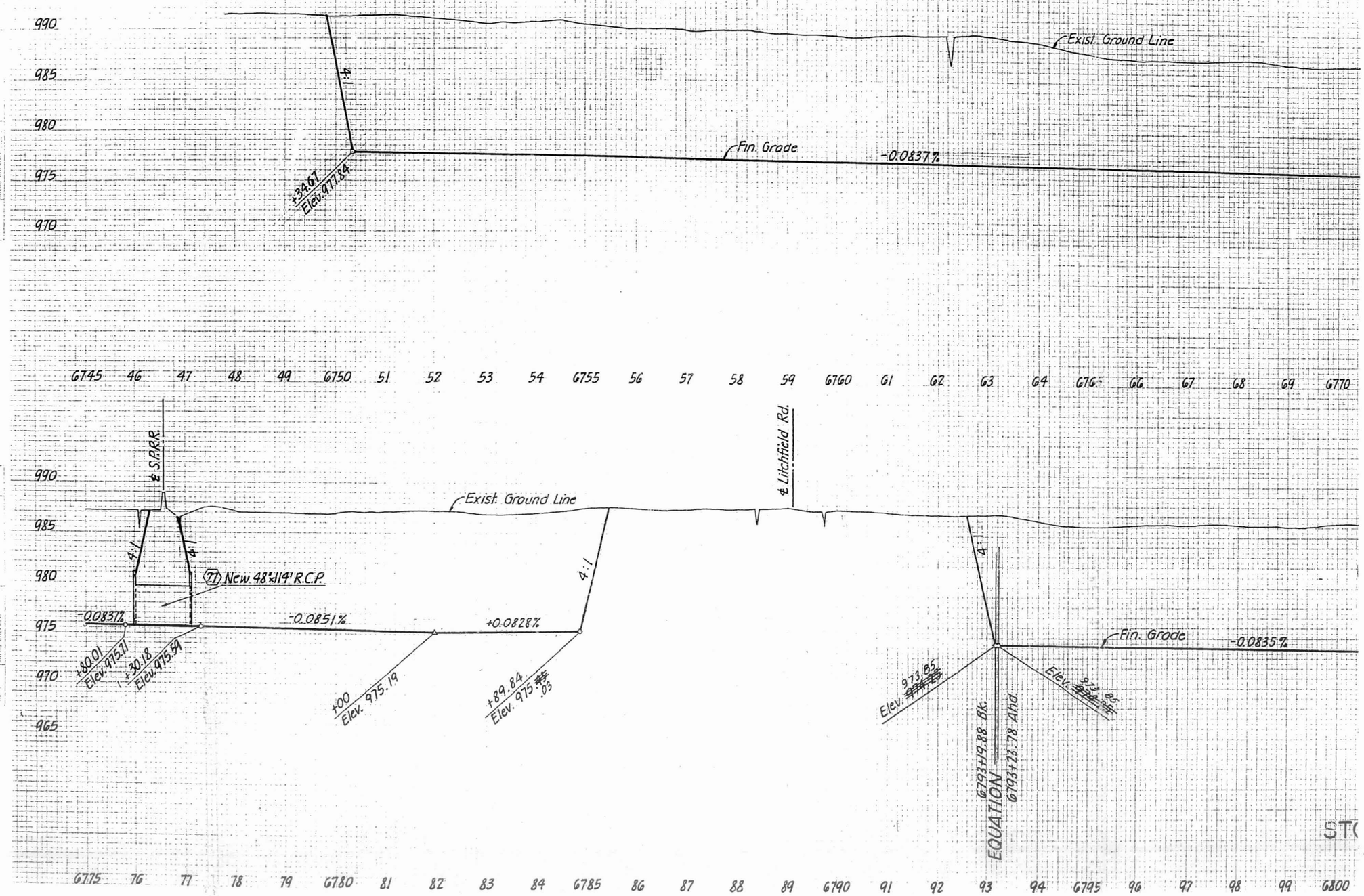


F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-IG-10-2(37)	31	155	4-26-80

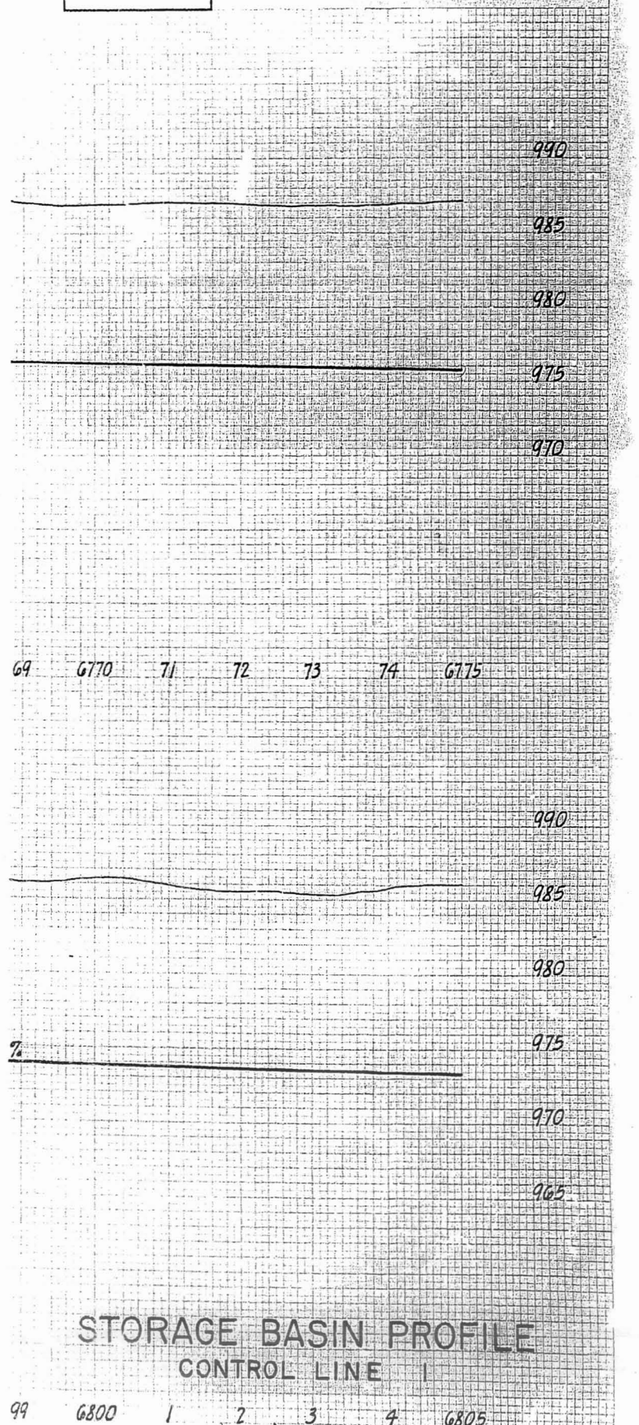
DIBBLE & ASSOCIATES
DATE 4/22/76 — CONSULTING ENGINEER
DESIGN M.S.J. — DRAWN A.M.C. — CHECKED J.S.P.

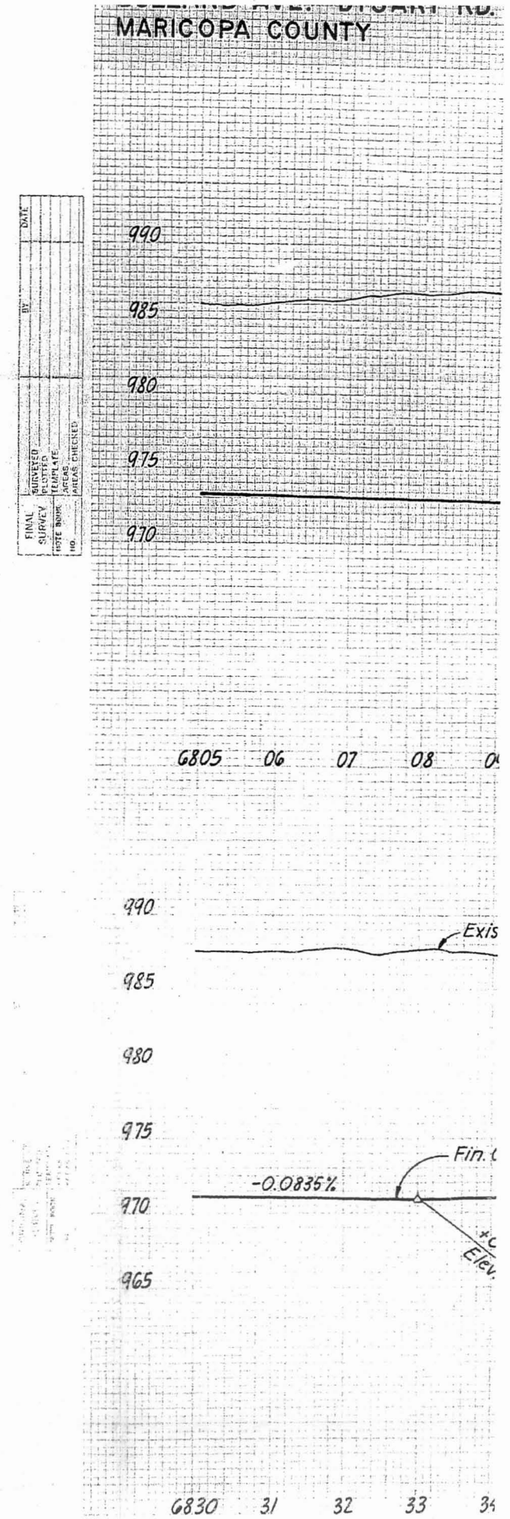


3 BASINS
CONTROL LINE 1



DIBBLE & ASSOCIATES
DATE 4/26/76 FOR THE CONSULTING ENGINEER
DESIGN F.M.N. DRAWN A.M.C. CHECKED J.S.P.

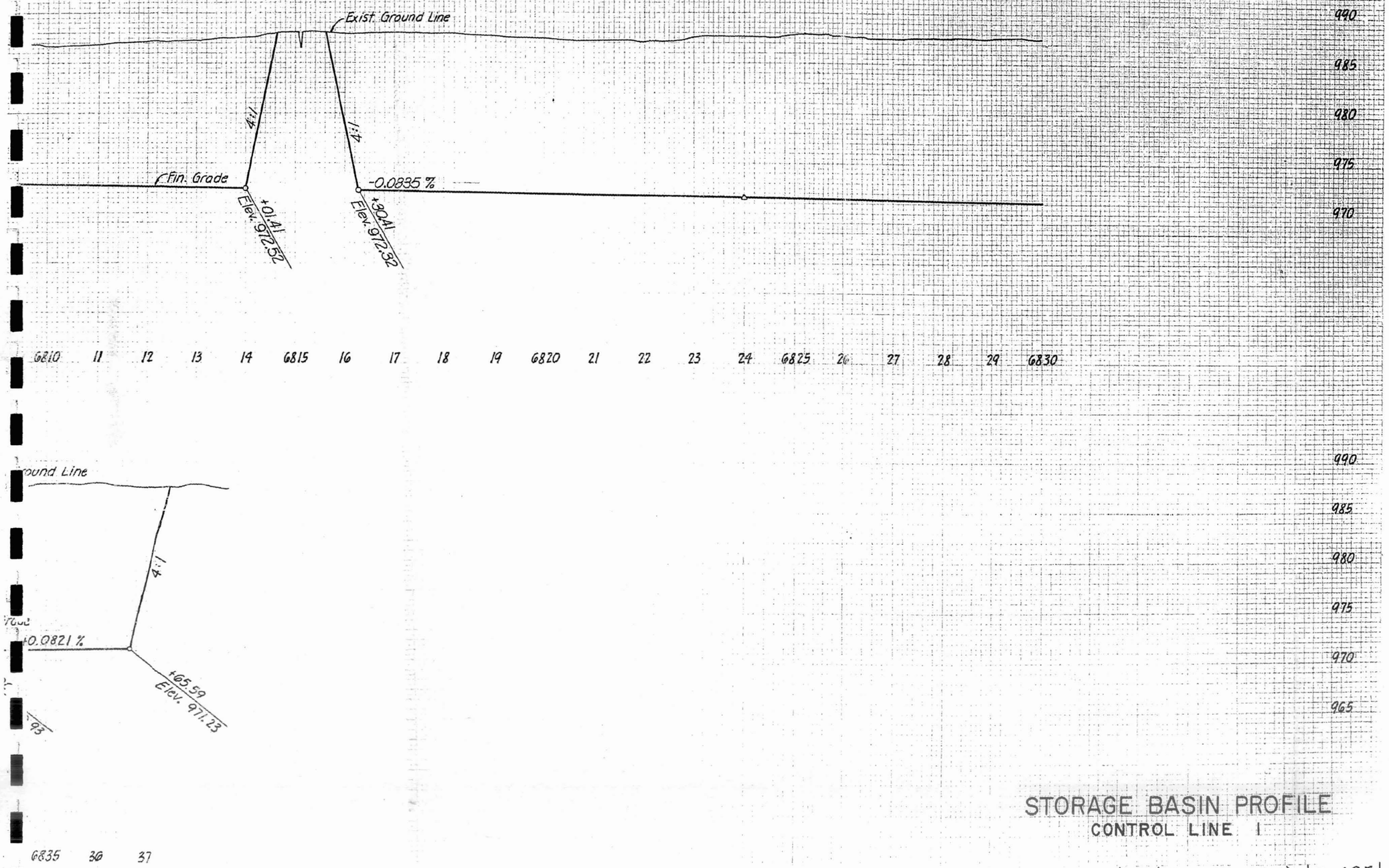




FINAL SURVEY	SURVEYED	BY	DATE
	PLOTTED		
	TRANSFERRED		
NOTE BOOK	AREAS CHECKED		
NO.	AREAS CHECKED		

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-IG-10-2(37)	58	155	3-31-80

DIBBLE & ASSOCIATES
DATE 4/26/76 — FOR THE CONSULTING ENGINEER
DESIGN F.M.N. DRAWN A.M.C. CHECKED J.S.P.

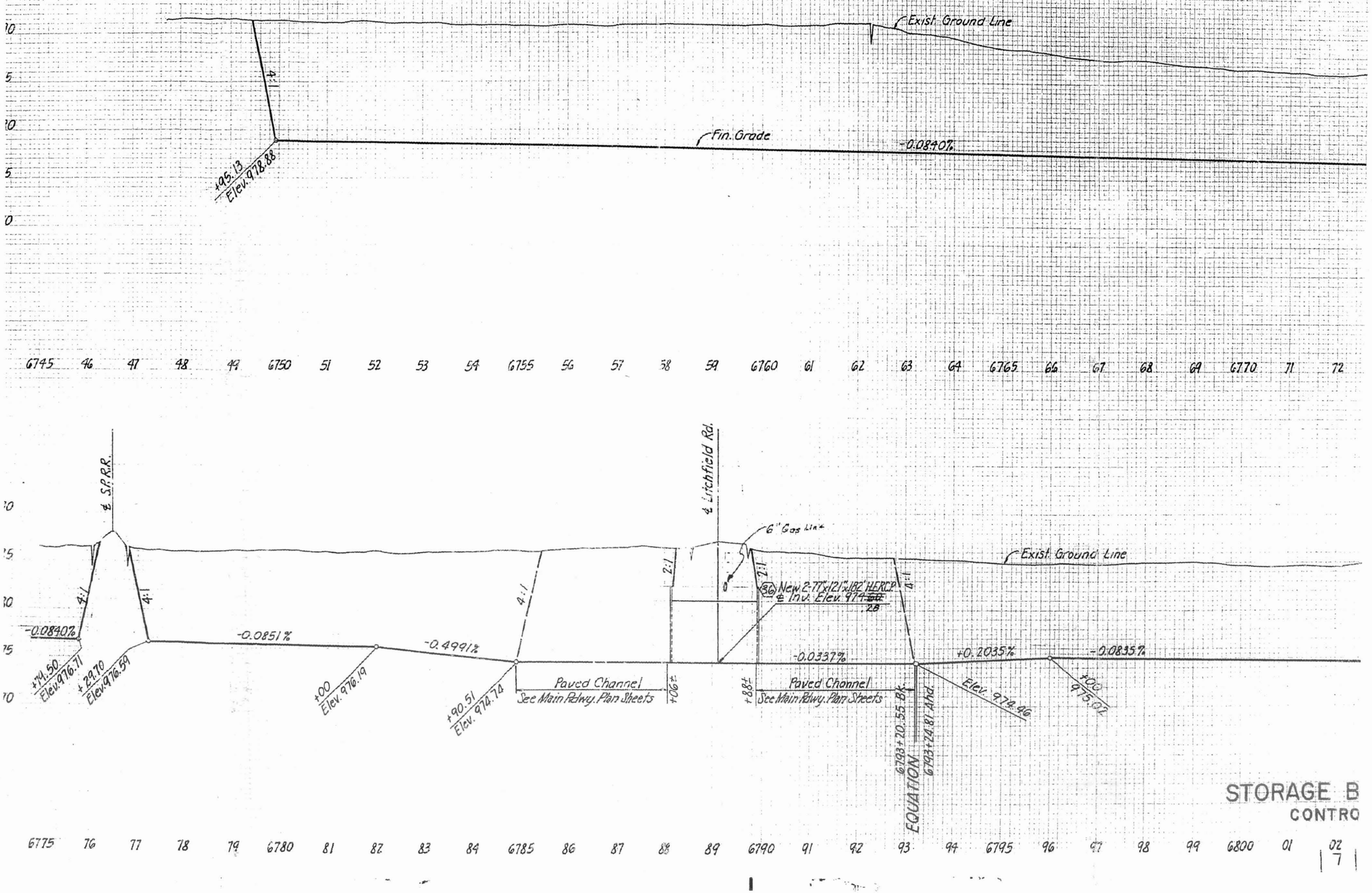


STORAGE BASIN PROFILE
CONTROL LINE 1

3 BASINS
INTRO LINE 2

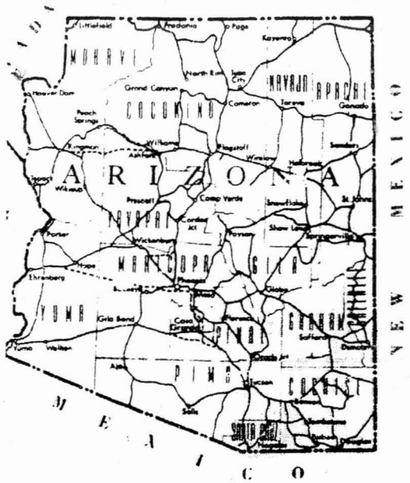
RENDERS PHOENIX AW
LLARD AVE.- DYSART RD.
RICOPA COUNTY

REGION 9
DATE 4/2
DESIGN



STORAGE B
CONTRO

7

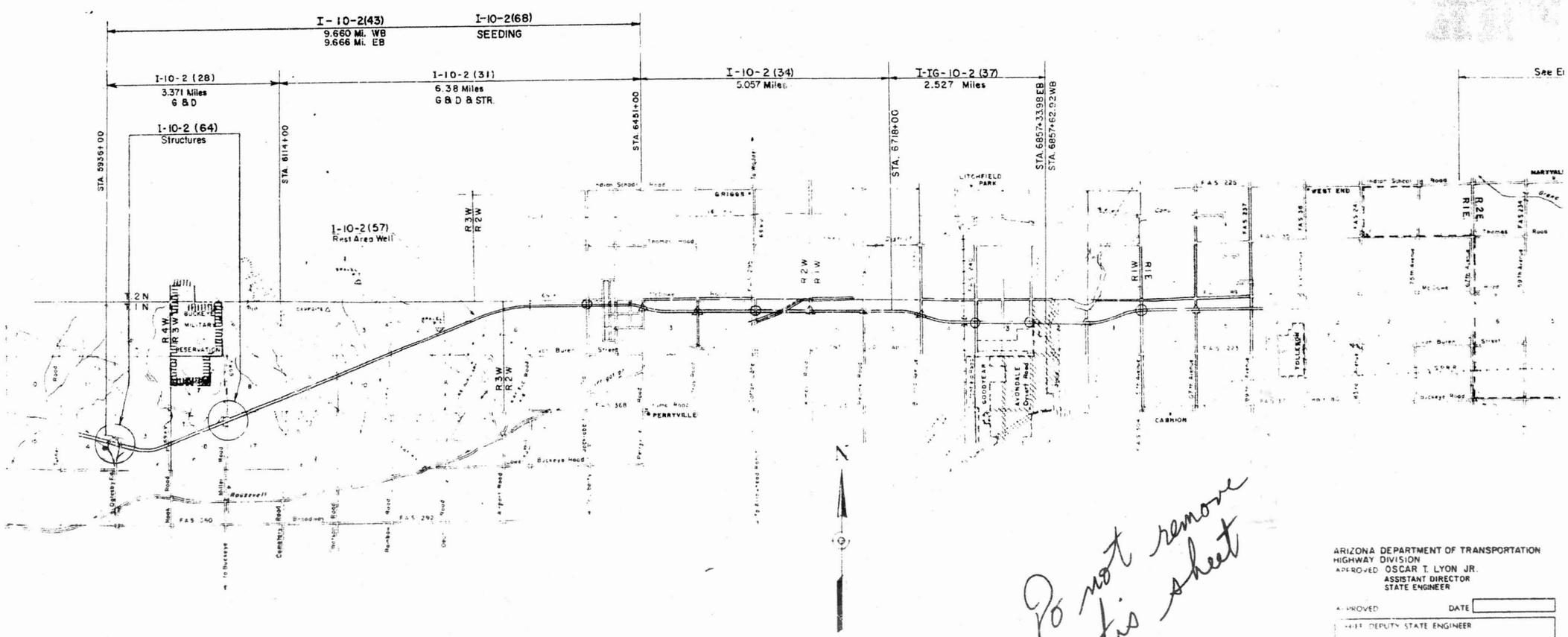


DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PLAN AND PROFILE OF PROPOSED

STATE HIGHWAY
EHRENBERG — PHOENIX
MARICOPA COUNTY
I-IG-10-2(37)

AS BUILT
DATE 2-24-70



Do not remove this sheet

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
APPROVED OSCAR T. LYON JR.
ASSISTANT DIRECTOR
STATE ENGINEER

APPROVED DATE
ASST. DEPUTY STATE ENGINEER

APPROVED DATE
DEPUTY STATE ENGINEER