

REMARKS

ARIZONA CANAL DIVERSION CHANNEL STUDY

BILTMORE PROPERTIES AND VICINITY

Sverdrup & Parcel

PHOENIX

ST. LOUIS

SAN FRANCISCO • NEW YORK • BOSTON • WASHINGTON, D.C.
CHARLESTON, W. VA. • JACKSONVILLE • GAINESVILLE
SILVER SPRING, MD. • SEATTLE • NASHVILLE • PHOENIX
BANGKOK • OSLO

A118.917

Property of
Flood Control District of MC Library
Please Return to
2501 W. Durango
Phoenix, AZ 85009

FLOOD CONTROL DISTRICT
RECEIVED

NOV 21 '78

PHASE II REPORT

CH ENG	HYDRO
ASST	LMgt
ADMIN	SUSP
C & O	FILE
ENGR	DESTROY
REMARKS	

ARIZONA CANAL DIVERSION CHANNEL STUDY

BILTMORE PROPERTIES AND VICINITY

PREPARED FOR
MARICOPA COUNTY FLOOD CONTROL DISTRICT
PHOENIX, ARIZONA

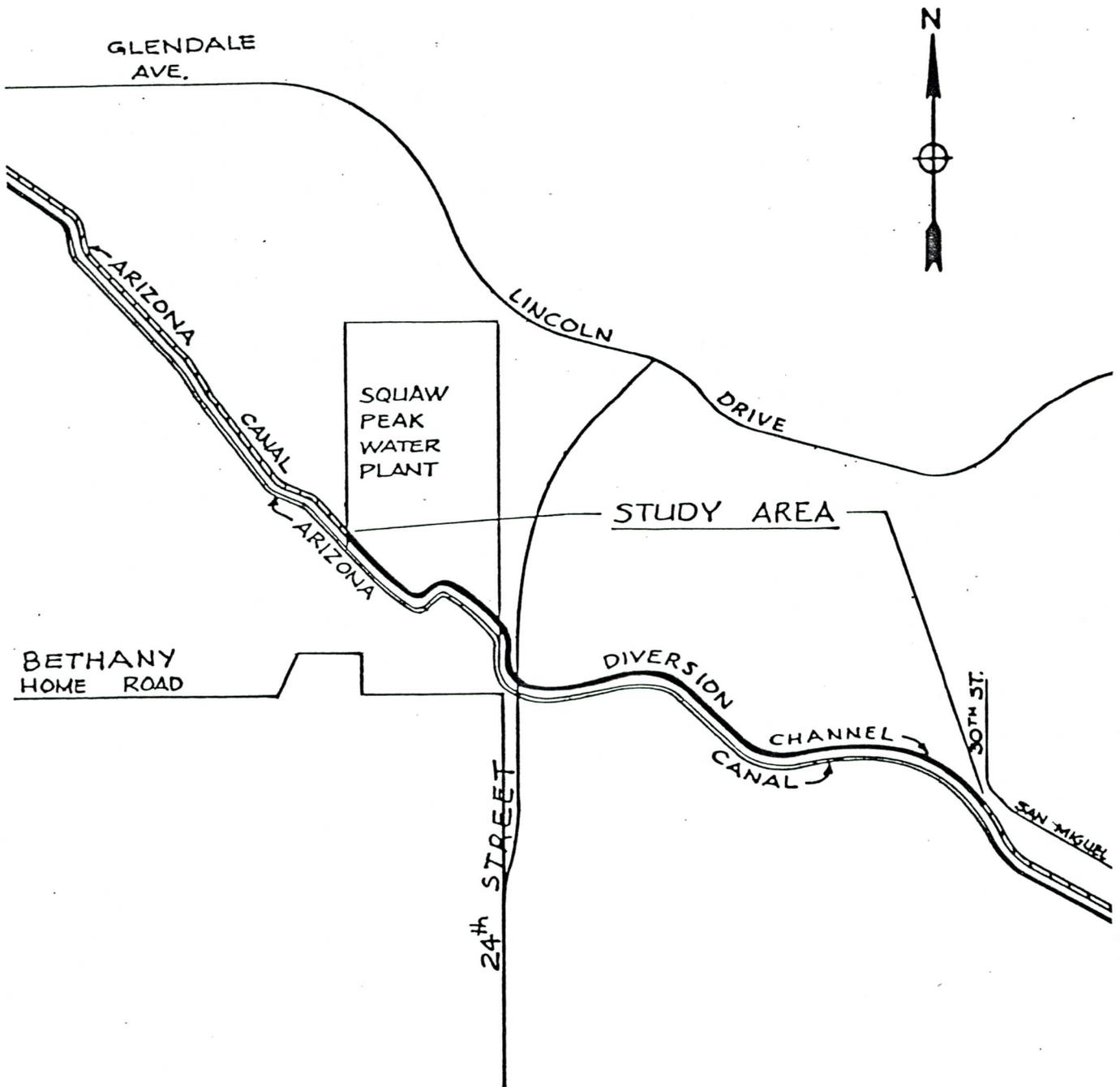


NOVEMBER 1978



BY

SVERDRUP & PARCEL AND ASSOCIATES, Inc.
CONSULTING ENGINEERS - ARCHITECTS
TEMPE, ARIZONA



— VICINITY MAP —

FOREWORD

This report is submitted in fulfillment of Phase II of the contract for engineering and surveying services, number FCC-77-23, between the Maricopa County Flood Control District and Sverdrup & Parcel and Associates, Inc.

The report presents three alternate plans, associated cost of construction and cost of utility relocation for the Arizona Canal Diversion Channel in the vicinity of the Arizona Biltmore Resort Hotel, Phoenix, Arizona.

SUMMARY

This report is the second in a series of two. It presents the results of an engineering and economic study of three alternate alignments for the Arizona Canal Diversion Channel, a rectangular open concrete flood control channel proposed by the Army Corps of Engineers in the vicinity of the Arizona Biltmore Resort Hotel, Phoenix, Arizona.

The three alternates consist of both open and covered channel types with slightly differing alignments summarized as follows:

Alternate A is a completely covered channel 6,790 feet long, costing an estimated total of \$10,791,000 or \$1,589 per lineal foot.

Alternate B is a combination of open and covered channels that is 6,450 feet long. The total estimated cost is \$9,630,000 or \$1,493 per lineal foot.

Alternate C is a completely open channel (excepting bridge and road crossings). It is 6,560 feet long and the estimated cost is \$10,084,000, or \$1,537 per lineal foot. This alternate is similar to that proposed by the Corps of Engineers.

The costs do not include Right-of-Way acquisition or their related costs.

TABLE OF CONTENTS

FRONTISPIECE

FOREWORD i

SUMMARY. ii

I. INTRODUCTION 1

II. STUDY CONSIDERATIONS 2-3

III. ALTERNATE DESCRIPTIONS 4-5

IV. COST ESTIMATES 6-10

APPENDICES

A. COST ESTIMATE. 11-16

B. CHANNEL SECTIONS 17-18

C. ALTERNATE ALIGNMENTS 19-31



I. INTRODUCTION

The proposed Arizona Canal Diversion Channel will provide storm water runoff protection for areas south of the Arizona Canal in Phoenix, Glendale and Peoria. It has been proposed to cover a portion of this channel that runs in front of the Arizona Biltmore Hotel and Resort. This portion is between 30th Street and a point west of the Squaw Peak Water Treatment Plant (SPWTP).

Three alternate plans and their related costs are presented in this report. The background information, study data and structural types are developed in detail in "Phase I Report - Arizona Canal Diversion Channel Study - Biltmore Properties and Vicinity," February 1978 by Sverdrup & Parcel and Associates, Inc., Consulting Engineers, Tempe, Arizona.

II. STUDY CONSIDERATIONS

A. Two types of structures are considered in the development of the three alternate plans. The open channel structure is the "Type I" discussed in the first report. The covered channel is the "Type V Structure," also discussed in the first report. The alignment and structural type for each of the three alternates was reviewed and approved by the Maricopa County Flood Control District during the preliminary phase of Part II of the project.

B. The Salt River Project has stated that it would require a minimum right-of-way of 50 feet on each side of the high water line of the existing Arizona Canal including a minimum channel and canal separation of 50 feet from the proposed Arizona Canal relocation. This right-of-way is deemed necessary for vehicular access and ongoing maintenance operations of the Salt River Project. Mr. D. L. Weesner, Assistant General Manager of Water for the Salt River Project, was contacted concerning the possibility of reducing the fifty foot minimum requirement on the north side of the canal. For those portions of the channel that would be covered, Mr. Weesner stated that the SRP would consider reducing the 50 foot minimum R/W if the reduction does not interfere with vehicular access and maintenance operations or future plans for use of R/W over the covered portion of the channel. The 50 foot right-of-way has been reduced as required and is shown on Plates I and II and the plan sheets. The reduction has not been approved by the Salt River Project.

C. The cost estimates for each alternate includes costs for canal relocation, roads and public and private utilities. Costs were obtained from the latest estimating guides and from material suppliers. Right-of-way acquisition, condemnation, litigation, family or business relocations and all costs associates are not included in the cost estimates. These costs will be supplied by the Maricopa County Flood Control District.

III. ALTERNATE DESCRIPTIONS

A. Alternate A

Alternate A utilizes the covered "Type V" structure. It is covered for the entire length of the study area. This extends from about 700 feet west of the Squaw Peak Water Treatment Plant (SPWTP) easterly to a point reaching about 200 feet west of the Arizona Canal's Spillway No. 4. The total length of this alternate is 6,790 feet, measured along the center-line of the new channel. This alternate is the longest of the three because it runs nearly parallel to the meandering Ariona Canal. It is the alternate that requires the least amount of new right-of-way north of the canal.

The costs of construction is estimated to be \$8,663,000. The cost of municipal and private utility relocations is \$2,128,000. The total cost of Alternate A is \$10,791,000 or \$1,589 per lineal foot.

B. Alternate B

Alternate B utilizes a combination of the "Type I" open channel and the "Type V" covered channel. The open section extends from about 700 feet west of the SPWTP to the west side of the 24th Street R/W. It is then covered for the remainder of the distance to the Arizona Canal's Spillway No. 4.

This route is the shortest of the three alternates at 6,450 feet. The diversion channel does not parallel the meandering canal but rather uses a shorter and more direct route from just west of 24th Street to a point about 600 feet west of the Biltmore Hotel. This route will require the acquisition of new right-of-way that bisects the parcel of land north of the canal and east of 24th Street. The cost of construction for Alternate B is estimated to be \$7,927,000. The cost of municipal and private utility relocations is \$1,703,000. The total cost is estimated to be \$9,630,000 or \$1,493 per lineal foot.

C. Alternate C

Alternate C utilizes the open channel. It is open for the entire length of the study area. The total length is 6,560 foot. This route has the intermediate length of the three alternates. This alternate is similar to that proposed by the Army Corps of Engineers.

This alternate is located south of the existing Arizona Canal west of 24th Street. It requires that the canal be relocated southward over existing residences. East of 24th Street the diversion channel nearly parallels the existing Arizona Canal. This alternate will require the largest area of new right-of-way due partially to the width requirements of the alternate. Access must be provided on both sides of the open channel and on both sides of the existing and relocated Arizona Canal for access and maintenance purposes for both the channel and the canal.

The cost of construction is estimated to be \$7,438,000. The cost of municipal and private utility relocations is estimated to be \$2,645,000. The total cost is estimated to be \$10,084,000, or \$1,537 per lineal foot.

IV. COST ESTIMATES

Tables I & II present summaries of channel construction costs and utility (municipal & private) relocation costs respectively. Table III is a summary of the totals for the three alternate plans. The detailed estimates for Tables I & II are presented in the appendix. These estimates include unit costs and quantities.

TABLE I
CHANNEL CONSTRUCTION COST ESTIMATES
(in thousands)

<u>Item</u>	<u>Alternate A</u>	<u>Alternate B</u>	<u>Alternate C</u>
1. Clearing & Grubbing	\$ 50	\$ 50	\$ 50
2. Excavation	915	870	885
3. Channel Structure	5,704(c)	3,528(c) 1,575(o)	109(c) 4,501(o)
4. Compacted Backfill	183	140	88
5. Excess Material Disposal	600	600	658
6. Side Drains	48	48	48
7. A.C. Pavement	--	14	16
8. Fencing	--	38	85
9. Esthetic Treatment (5%)	375	343	332
10. Contingencies (10%)	<u>788</u>	<u>721</u>	<u>676</u>
Construction Cost	\$8,663	\$7,927	\$7,438

(c) Covered Section

(o) Open Section

TABLE II
 UTILITIES, ROAD AND CANAL RELOCATION
 COST ESTIMATES
 (in thousands)

Item	<u>ALTERNATE A</u>	<u>ALTERNATE B</u>	<u>ALTERNATE C</u>
1. Canal			
A. Excavation	76.5	33.6	73.5
B. Fill	115.0	78.8	263.0
C. Lining	69.4	62.7	86.5
2. Water			
A. 66" Transmission	570.0	331.5	331.5
B. Canal Siphon	530.0	508.0	657.0
C. 12" Distrib.	3.9	3.9	6.9
3. Sewer			
A. 12" Inverted Siphon	229.0	229.0	229.0
B. 15" New Collector	108.5	108.5	108.5
4. Roadway Relocation	25.2	25.2	81.7
5. Telephone	4.8	4.8	3.9
6. Gas	2.	2.	3.5
7. Electric Pole & Line Relocation	200.0	160.0	260.0
8. Additional Clearing & Grubbing	--	--	50.0
9. Bridges			
A. Temporary Access	--	--	80.0
B. Removal	--	--	20.0
C. New (Over channel)	--	--	150.0
10. Contingencies (10%)	<u>193.4</u>	<u>154.8</u>	<u>204.5</u>
TOTAL	2,127.6	1,702.7	2,645.5

TABLE III
TOTAL CONSTRUCTION AND RELOCATION COSTS
(in thousands)

	ALTERNATE A	ALTERNATE B	ALTERNATE C
Construction	\$ 8,633	\$ 7,927	\$ 7,438
Relocations*	2,128	1,703	2,646
TOTAL	\$ 10,761	\$ 9,630	\$ 10,084
Length of Alternate in Feet	6,790'	6,450'	6,560'
Average Cost per Linear Foot	\$ 1,589.	\$ 1,493	\$ 1,537

*Relocation costs do not include right-of-way acquisition or any other related costs.

APPENDIX

A. COST ESTIMATES

ALTERNATE A - Construction Estimate

ALTERNATE A - Relocation Estimate

ALTERNATE B - Construction Estimate

ALTERNATE B - Relocation Estimate

ALTERNATE C - Construction Estimate

ALTERNATE C - Relocation Estimate

B. CHANNEL SECTIONS

PLATE I - Typical Open Channel Section

PLATE II - Typical Covered Channel Section

C. ALTERNATE ALIGNMENTS

ALTERNATE A - Alignment

ALTERNATE B - Alignment

ALTERNATE C - Alignment

CONSTRUCTION COST ESTIMATE
ALTERNATE A

<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total</u>
1. Clear & Grub	-	L.S.	\$ 50,000
2. Excavation	305,000 C.Y.	\$ 3.00/C.Y.	\$ 915,000
3. Channel Structure (covered)	6,790 L.F.	\$ 840.00/L.F.	\$5,704,000
4. Compacted Backfill	73,000 C.Y.	\$ 2.50/C.Y.	\$ 183,000
5. Dispose Excess Material	240,000 C.Y.	\$ 2.50/C.Y.	\$ 600,000
6. Side Drains	6 ea.	\$8,000.00/ea.	\$ 48,000 <u>\$7,500,000</u>
7. Esthetic Treatment (5%)		L.S.	\$ 375,000
8. Contingencies (10%)		L.S.	\$ <u>788,000</u>
		TOTAL	\$8,663,000

UTILITY RELOCATIONS
ALTERNATE A

<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total</u>
1. Earthwork			
Excavation	25,500 C.Y.	\$ 3.00/C.Y.	\$ 76,500
Fill	46,000 C.Y.	\$ 2.50/C.Y.	\$ 115,000
2. Canal Lining	3,650 S.Y.	\$ 19.00/S.Y.	\$ 69,350
3. Water Treatment Plant Siphon	Inlet, Outlet & 580 L.F.-84" R.G.R.C.P.	L.S.	\$ 530,000
4. 66" Water Relocation (40' Deep)	570 L.F.	\$ 1,000/L.F.	\$ 570,000
5. 12" Sewer Siphon (40' Deep)	300 L.F.	\$ 763.00/L.F.	\$ 229,000
6. New 15" Sewer	1,750 L.F.	\$ 62.00/L.F.	\$ 108,500
7. Telephone Cable Relocation	600 L.F.	\$ 8.00/L.F.	\$ 4,800
8. Gas Main Relocation	300 L.F.	\$ 6.50/L.F.	\$ 1,950
9. 12" Water Main Relocation	150 L.F.	\$ 26.00/L.F.	\$ 3,900
10. Power Line & Pole Relocations	20 ea.	\$ 10,000/ea.	\$ 200,000
11. New Roadway	600 L.F.	\$ 42.00/L.F.	\$ 25,200
			<u>\$1,934,200</u>
12. Contingencies (10%)			\$ 193,400
		TOTAL	\$2,127,600

CONSTRUCTION COST ESTIMATE
ALTERNATE B

	<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Clear & Grub		L.S.	\$ 50,000
2.	Excavation	290,000 C.Y.	\$ 3.00/C.Y.	\$ 870,000
3.	Channel Structure Covered	4,200 L.F.	\$ 840.00/L.F.	\$3,528,000
4.	Channel Structure Open	2,250 L.F.	\$ 700.00/L.F.	\$1,575,000
5.	Compacted Backfill	56,000 C.Y.	\$ 2.50/C.Y.	\$ 140,000
6.	Dispose Excess Mat.	240,000 C.Y.	\$ 2.50/C.Y.	\$ 600,000
7.	A.C. Pavement	700 Tons	\$ 20.00/Ton	\$ 14,000
8.	Side Drains	6 ea.	\$8,000.00/ea.	\$ 48,000
9.	Fencing	5,500 L.F.	\$ 7.00/L.F.	\$ 38,000
				<u>\$6,863,000</u>
10.	Esthetic Treatment (5%)			\$ 343,000
11.	Contingency (10%)			<u>\$ 721,000</u>
			TOTAL	\$7,927,000

UTILITY RELOCATIONS
ALTERNATE B

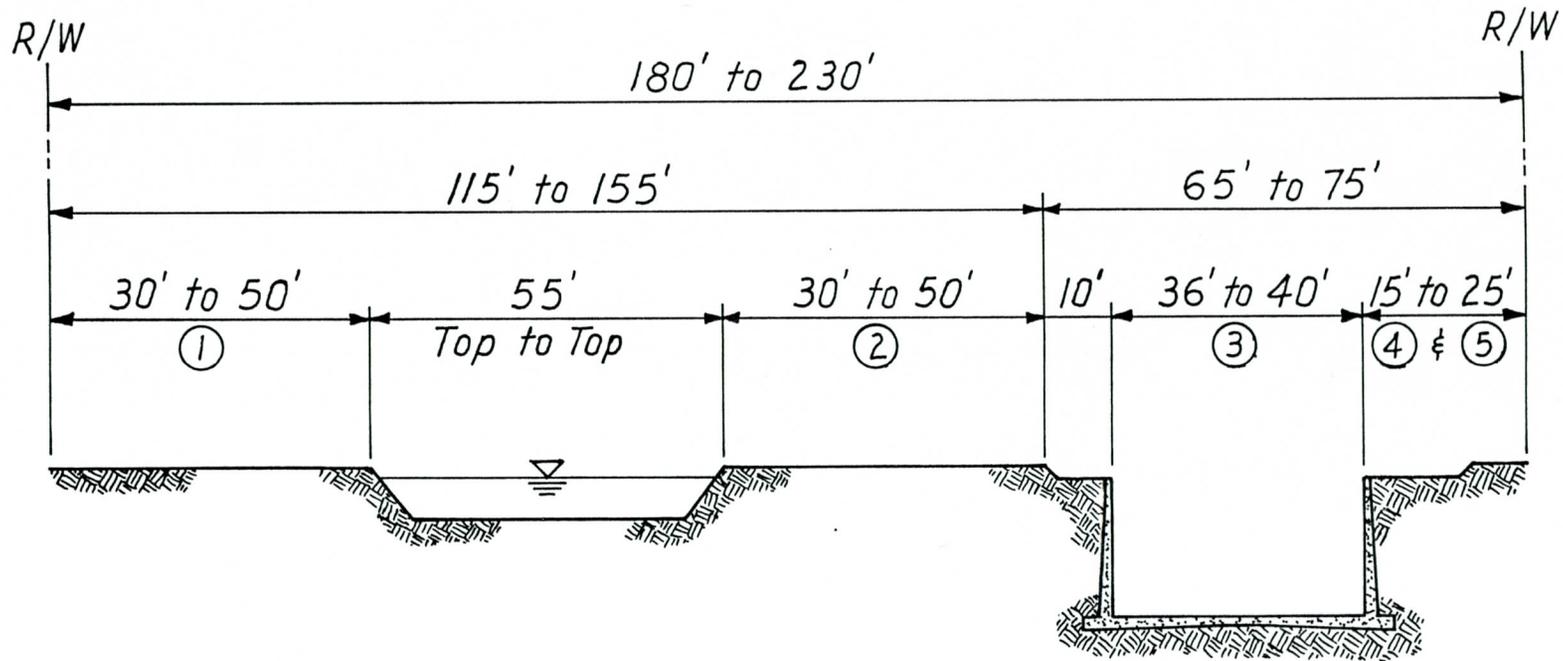
	<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Earthwork			
	Excavation	11,200 C.Y.	\$ 3.00/C.Y.	\$ 33,600
	Fill	31,500 C.Y.	\$ 2.50/C.Y.	\$ 78,750
2.	Canal Lining	3,300 S.Y.	\$ 19.00/S.Y.	\$ 62,700
3.	Water Treatment Plant New Siphon	Inlet, Outlet & 530'-84" R.G.R.C.P.	L.S.	\$ 508,000
4.	66" Water Reloc.	250 L.F.	\$ 1,326.00/L.F.	\$ 331,500
5.	12" Sewer Siphon	300 L.F.	\$ 763.00/L.F.	\$ 229,000
6.	New 15" Sewer	1,750 L.F.	\$ 62.00/L.F.	\$ 108,500
7.	Telephone Cable Relocation	600 L.F.	\$ 8.00/L.F.	\$ 4,800
8.	Gas Main Relocation	300 L.F.	\$ 6.50/L.F.	\$ 1,950
9.	12" Water Main Relocation	150 L.F.	\$ 26.00/L.F.	\$ 3,900
10.	Power Line & Pole Relocations	16 ea.	\$ 10,000/ea.	\$ 160,000
11.	New Roadway	600 L.F.	\$ 42.00/L.F.	\$ 25,200
				<u>\$1,547,900</u>
12.	Contingency (10%)			\$ 154,800
			TOTAL	<u>\$1,702,700</u>

CONSTRUCTION COST ESTIMATE
ALTERNATE C

	<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Clear & Grub	-	L.S.	\$ 50,000
2.	Excavation	295,000 C.Y.	\$ 3.00/C.Y.	\$ 885,000
3.	Channel Structure (covered)	130 L.F.	\$ 840.00/L.F.	\$ 109,000
4.	Channel Structure (open)	6,430 L.F.	\$ 700.00/L.F.	\$4,501,000
5.	Compacted Backfill	35,000 C.Y.	\$ 2.50/C.Y.	\$ 88,000
6.	Dispose Excess Material	263,000 C.Y.	\$ 2.50/C.Y.	\$ 658,000
7.	A.C. Pavement	790 Tons	\$ 20.00/Ton	\$ 16,000
8.	Side Drains	6 ea.	\$8,000.00/ea.	\$ 48,000
9.	Fencing	12,100 L.F.	\$ 7.00/L.F.	\$ 85,000 <u>\$6,440,000</u>
10.	Esthetic (5%)			322,000
11.	Contingency (10%)			<u>\$ 676,000</u>
			TOTAL	\$7,438,000

UTILITY RELOCATIONS
ALTERNATE C

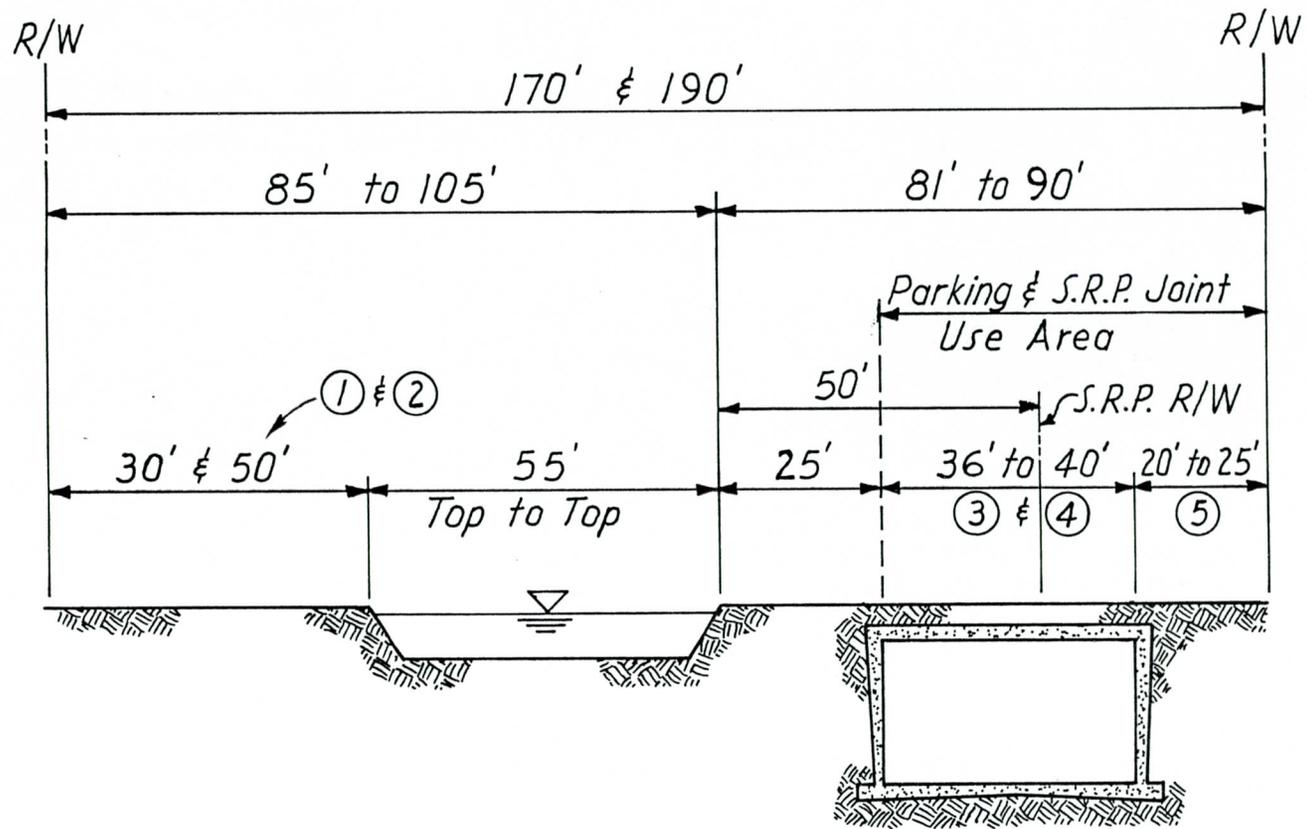
	<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Earthwork			
	Excavation	24,500 C.Y.	\$ 3.00/C.Y.	\$ 73,500
	Fill	105,250 C.Y.	\$ 2.50/C.Y.	\$ 263,000
2.	Canal Lining	4,550 S.Y.	\$ 19.00/S.Y.	\$ 86,500
3.	Water Treatment Plant New Siphon	Inlet, Outlet & 810 L.F.-84" R.G.R.C.P.	L.S.	\$ 657,000
4.	66" Water Relocation	250 L.F.	\$ 1,326.00/L.F.	\$ 331,500
5.	12" Sewer Siphon	300 L.F.	\$ 763.00/L.F.	\$ 229,000
6.	New 15" Sewer	1,750 S.F.	\$ 62.00/L.F.	\$ 108,500
7.	Telephone Cable Re- location	300 L.F.	\$ 13.00/L.F.	\$ 3,900
8.	Gas Main Relocation	300 L.F.	\$ 11.50/L.F.	\$ 3,450
9.	12" Water Main Relocation	150 L.F.	\$ 46.00/L.F.	\$ 6,900
10.	Power Line & Pole Relocations	26 ea.	\$ 10,000/ea.	\$ 260,000
11.	New Roadway	1,900 L.F.	\$ 43.00/ea.	\$ 81,700
12.	Add. Clear & Grubbing	-	L.S.	\$ 50,000
13.	Temp. Access Bridges	2 ea.	\$ 40,000	\$ 80,000
14.	Bridge Removals	2 ea.	\$ 10,000	\$ 20,000
15.	New Bridges - 40' Span	3 ea.	\$ 50,000/ea.	\$ 150,000
				<u>\$2,405,000</u>
16.	Contingency			\$ 240,500
			TOTAL	\$2,645,500



OPEN CHANNEL SECTION

- ① Alt. "B" - Sta. 15+00 to 16+00 Tapers From 50' to 30'
- ② Alt. "B" - Sta. 15+00 to 18+00 Tapers From 50' to 30'
- ③ Alt. "C" - Sta. 25+75 to 26+30 Tapers From 40' to 36'
- ④ Alt. "B" - Sta. 15+00 to 17+30 Tapers From 25' to 15'
- ⑤ Alt. "B" - Sta. 17+30 to 18+00 Tapers From 25' to 15'

PLATE I

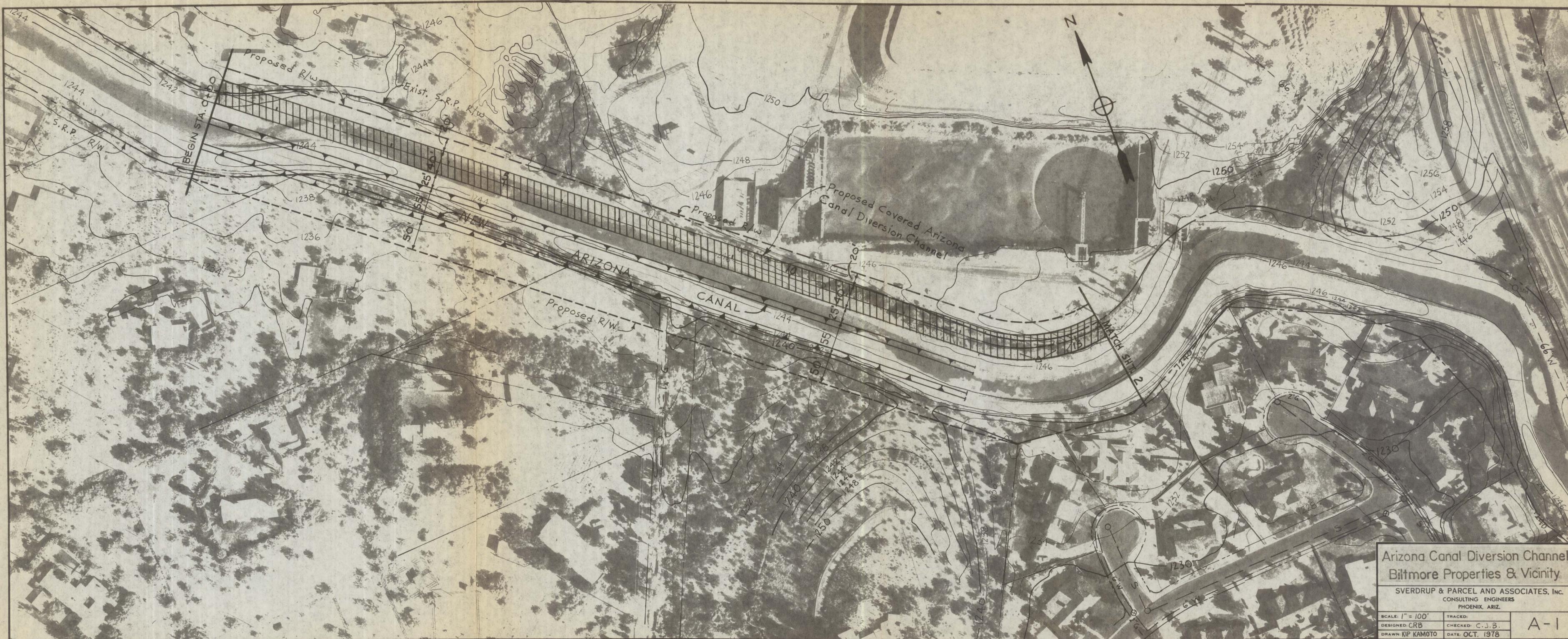


COVERED CHANNEL SECTION

- ① Alt. "A" - Sta. 15+50 to 16+40 Tapers From 50' to 30'
- ② Alt. "A" - Sta. 16+40 to 18+20 is 30'
- ③ Alt. "A" - Sta. 27+90 to 28+30 Tapers From 40' to 36'
- ④ Alt. "B" - Sta. 24+45 to 24+70 Tapers From 40' to 36'
- ⑤ Alt. "B" - Sta. 24+45 to 24+70 Tapers From 25' to 20'

PLATE II

ALTERNATE "A"

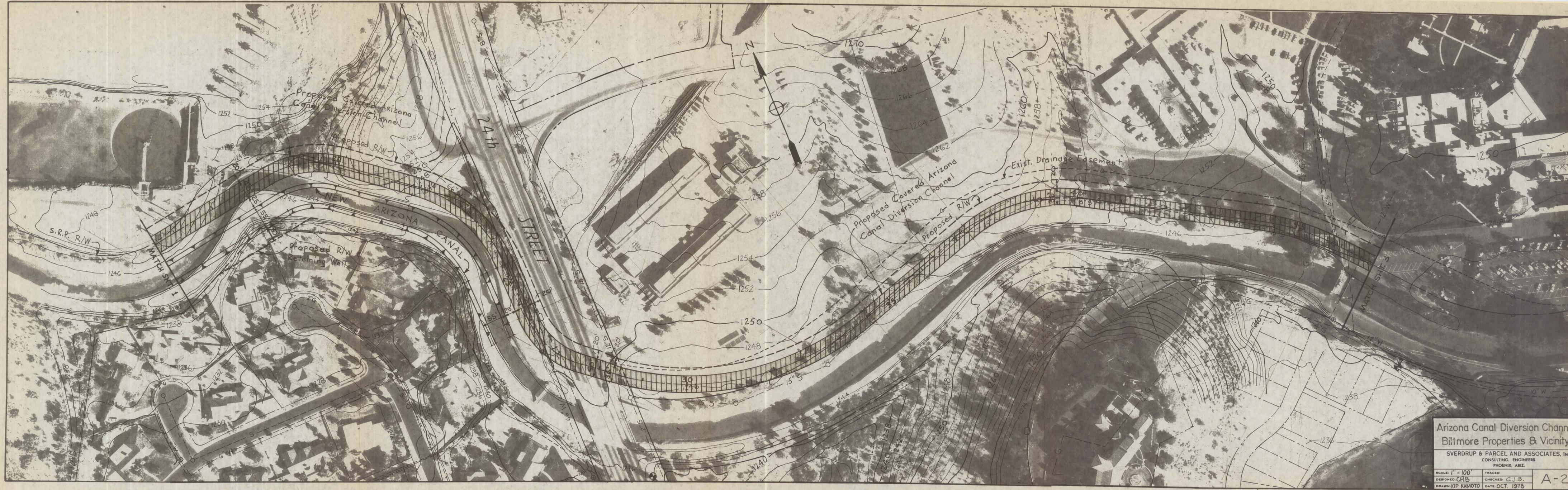


Arizona Canal Diversion Channel
Biltmore Properties & Vicinity

SVERDRUP & PARCEL AND ASSOCIATES, INC.
CONSULTING ENGINEERS
PHOENIX, ARIZ.

SCALE: 1" = 100'	TRACED:
DESIGNED: CRB	CHECKED: C.J.B.
DRAWN: KIP KAMOTO	DATE: OCT. 1978

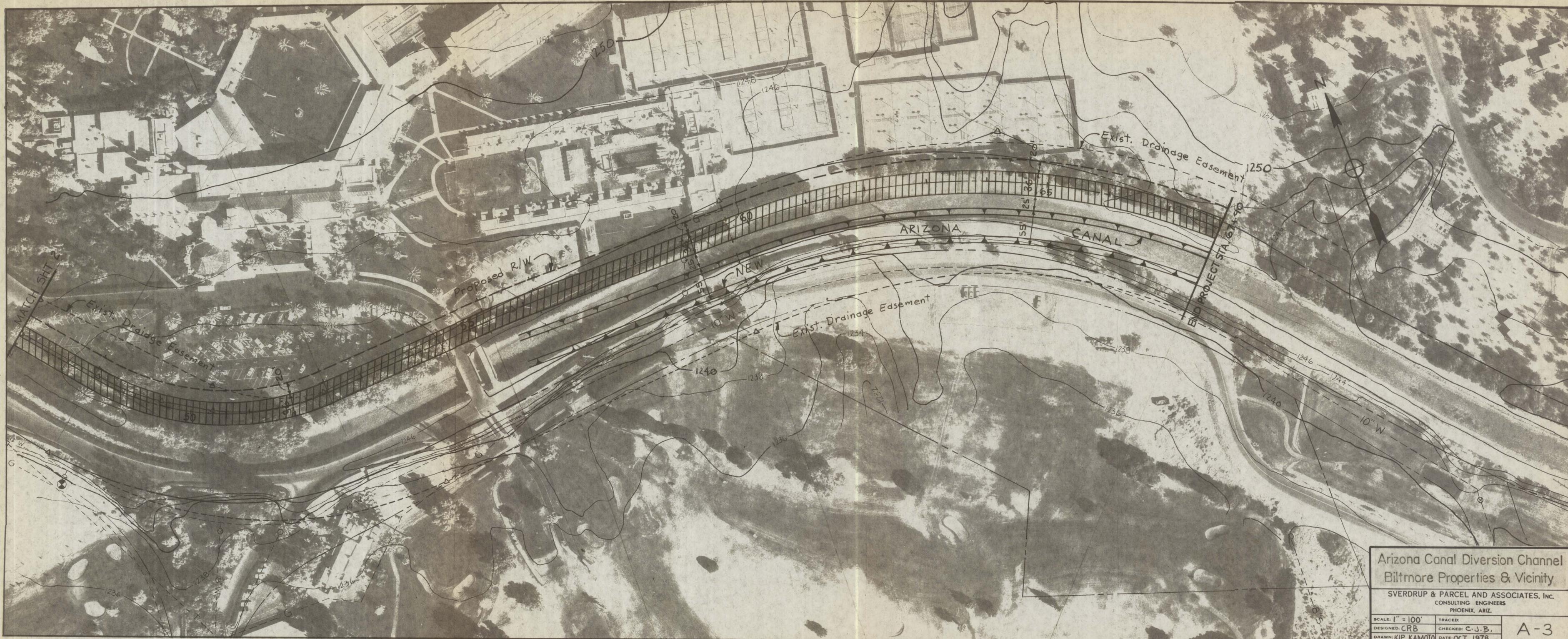
A-1



Arizona Canal Diversion Channel
 Billmore Properties & Vicinity

SVERDRUP & PARCEL AND ASSOCIATES, INC.
 CONSULTING ENGINEERS
 PHOENIX, ARIZ.

SCALE: 1" = 100'	TRACED:	A-2
DESIGNED: CRB	CHECKED: C.J.B.	
DRAWN: KIP KAMOTO	DATE: OCT. 1978	



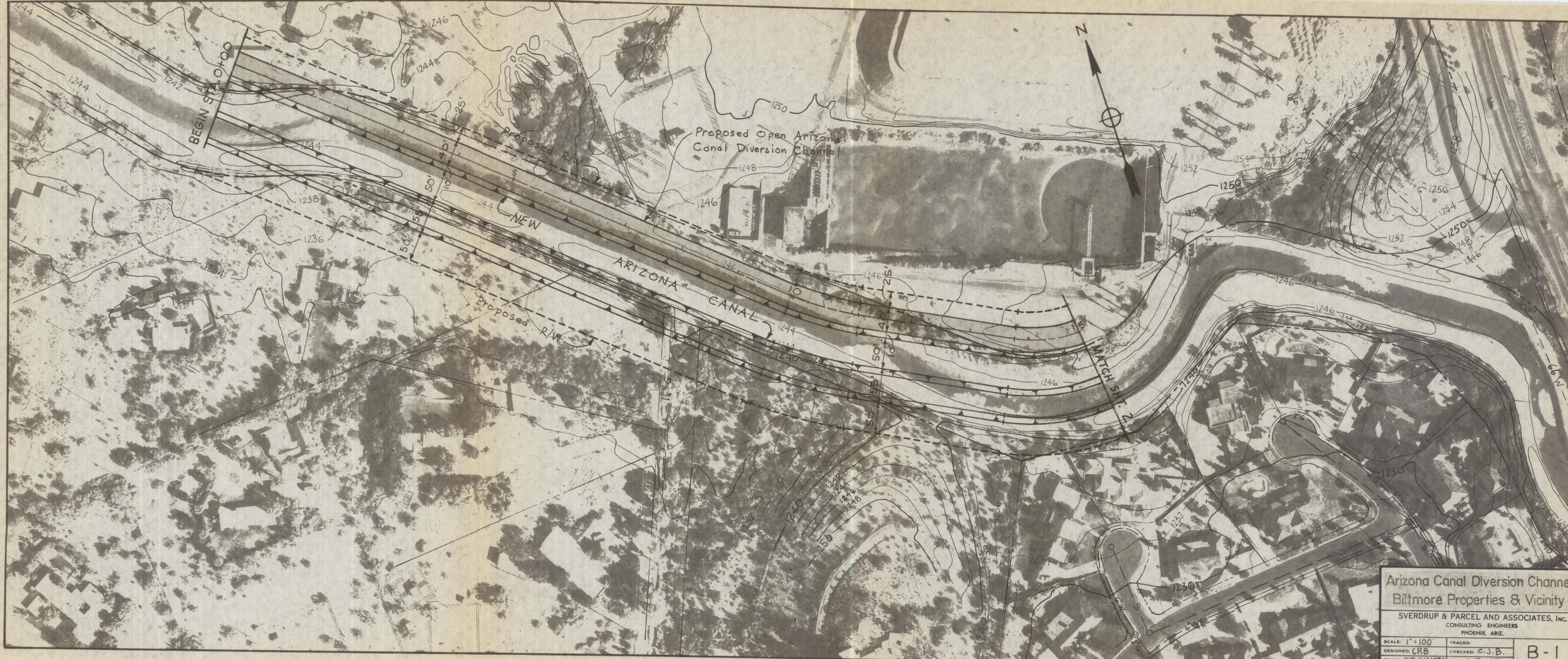
Arizona Canal Diversion Channel
 Biltmore Properties & Vicinity

SVERDRUP & PARCEL AND ASSOCIATES, Inc.
 CONSULTING ENGINEERS
 PHOENIX, ARIZ.

SCALE: 1" = 100'	TRACED:
DESIGNED: CRB	CHECKED: C.J.B.
DRAWN: KIP KAMOTO	DATE: OCT. 1978

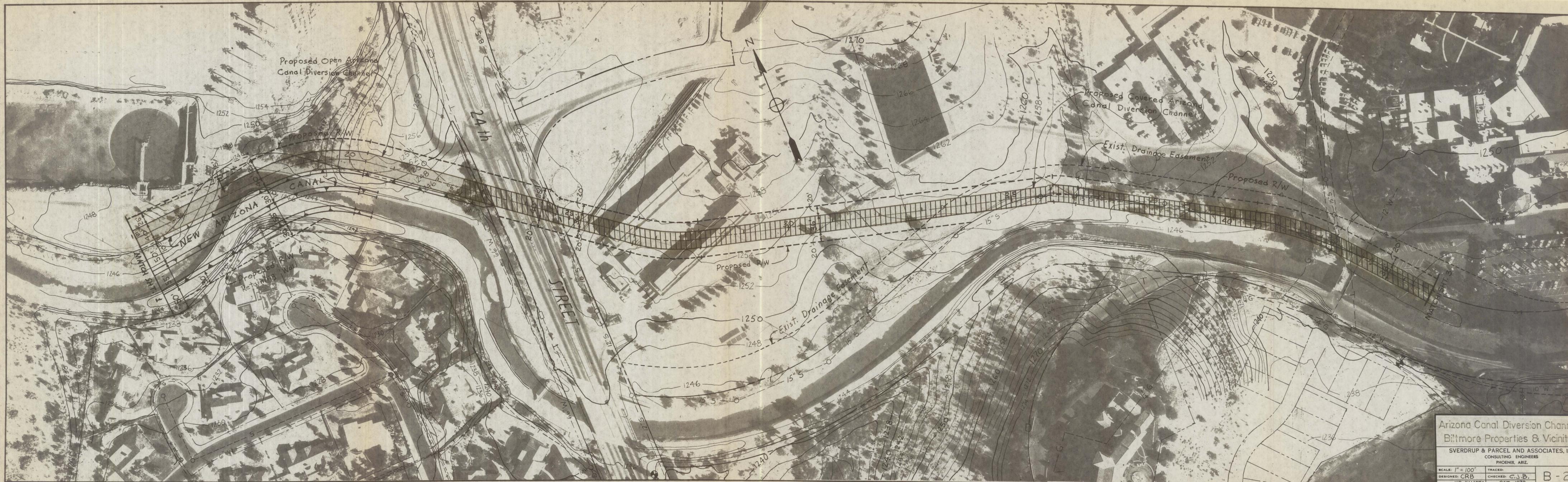
A-3

ALTERNATE "B"



Arizona Canal Diversion Channel
 Biltmore Properties & Vicinity
 SVDRUP & PARCEL AND ASSOCIATES, INC.
 CONSULTING ENGINEERS
 PHOENIX, ARIZ.

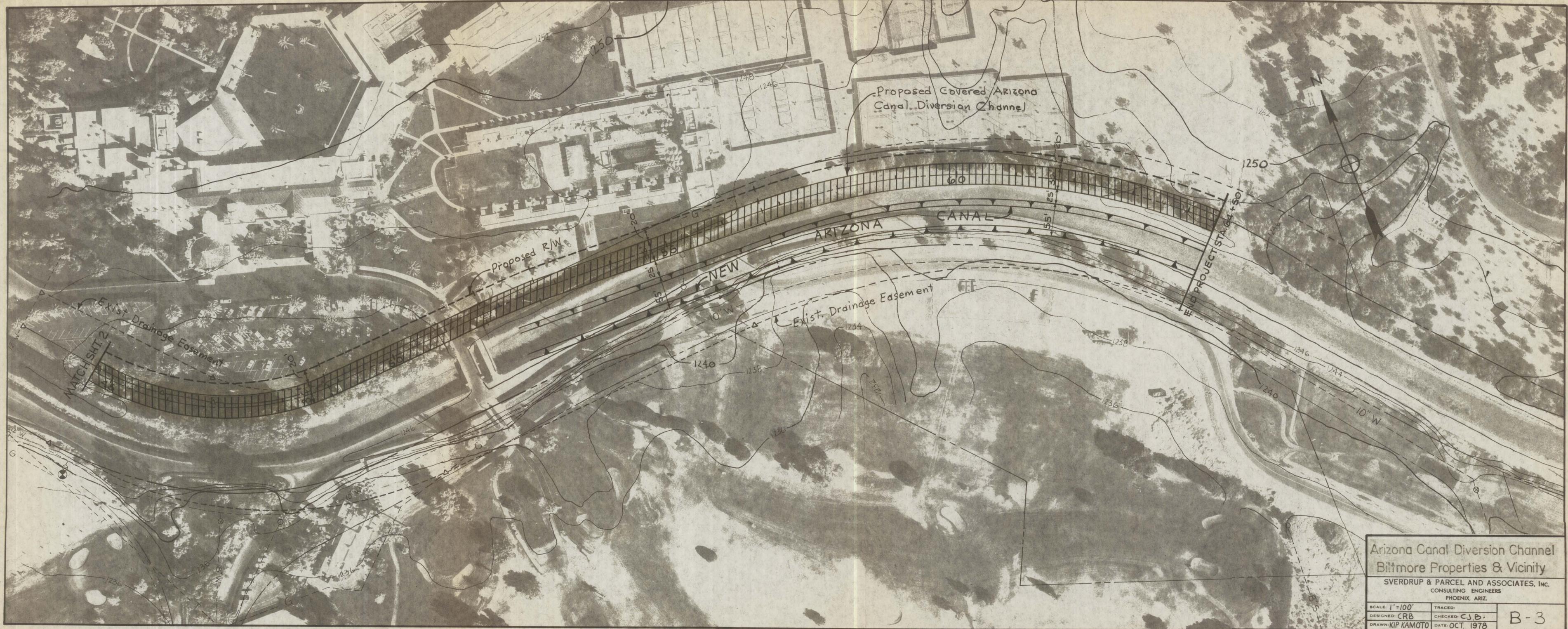
SCALE: 1" = 100'	TRACED:	B-1
DESIGNED: CRB	CHECKED: C.J.B.	
DRAWN: KIP KAMOTO	DATE: OCT. 1978	



Arizona Canal Diversion Channel
Billmore Properties & Vicinity

SVERDRUP & PARCEL AND ASSOCIATES, Inc.
CONSULTING ENGINEERS
PHOENIX, ARIZ.

SCALE: 1" = 100'	TRACED:	B-2
DESIGNED: CRB	CHECKED: C.J.B.	
DRAWN: KIP KAMOTO	DATE: OCT. 1978	



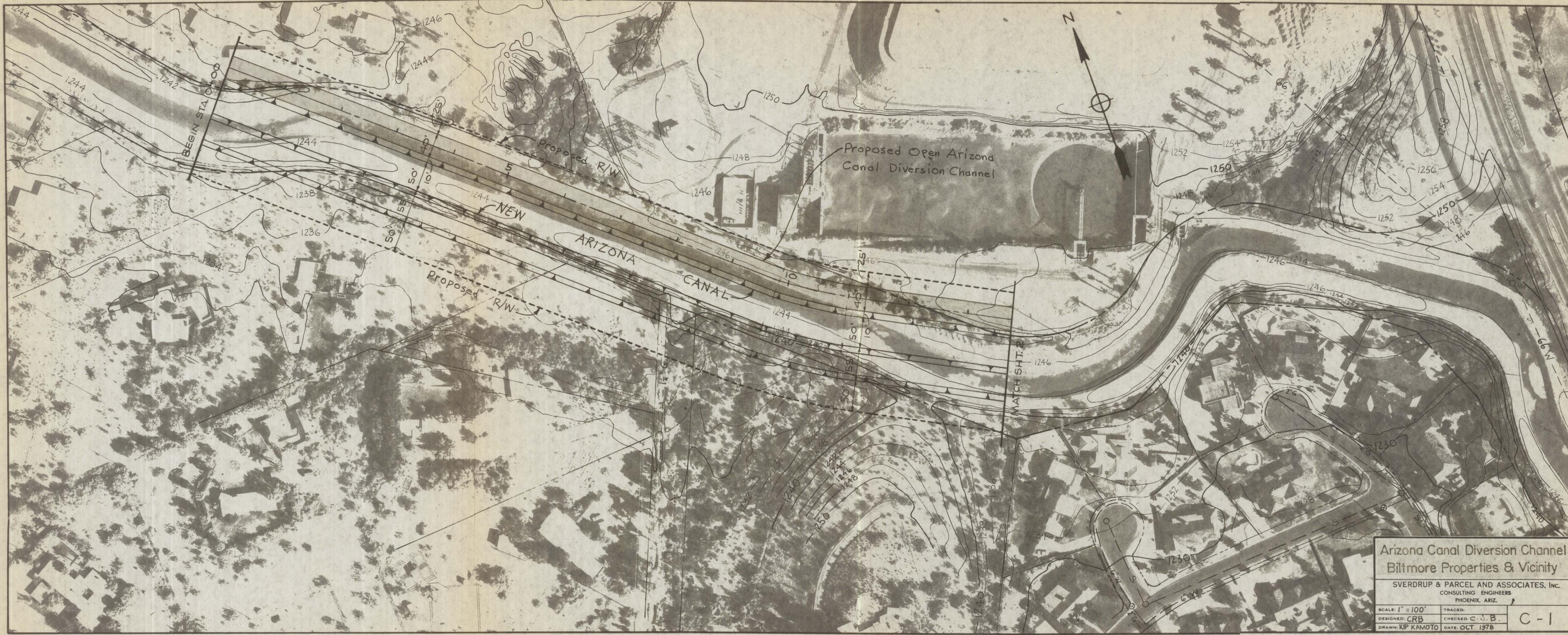
Arizona Canal Diversion Channel
 Biltmore Properties & Vicinity

SVERDRUP & PARCEL AND ASSOCIATES, INC.
 CONSULTING ENGINEERS
 PHOENIX, ARIZ.

SCALE: 1" = 100'	TRACED:
DESIGNED: CRB	CHECKED: CJB
DRAWN: KIP KAMOTO	DATE: OCT. 1978

B-3

ALTERNATE "C"



Arizona Canal Diversion Channel
Biltmore Properties & Vicinity

SVERDRUP & PARCEL AND ASSOCIATES, Inc.
CONSULTING ENGINEERS
PHOENIX, ARIZ.

SCALE: 1" = 100'	TRACED:
DESIGNED: CRB	CHECKED: C. J. B.
DRAWN: KIP KAMOTO	DATE: OCT. 1978

C-1

Proposed Open Arizona Canal Diversion Channel

Proposed Open Arizona Canal Diversion Channel

NEW ARIZONA CANAL

STREET

Exist. Drainage Easement

Proposed R/W

Proposed R/W

Proposed R/W

MATCH SMT. 3

MATCH SMT. 1

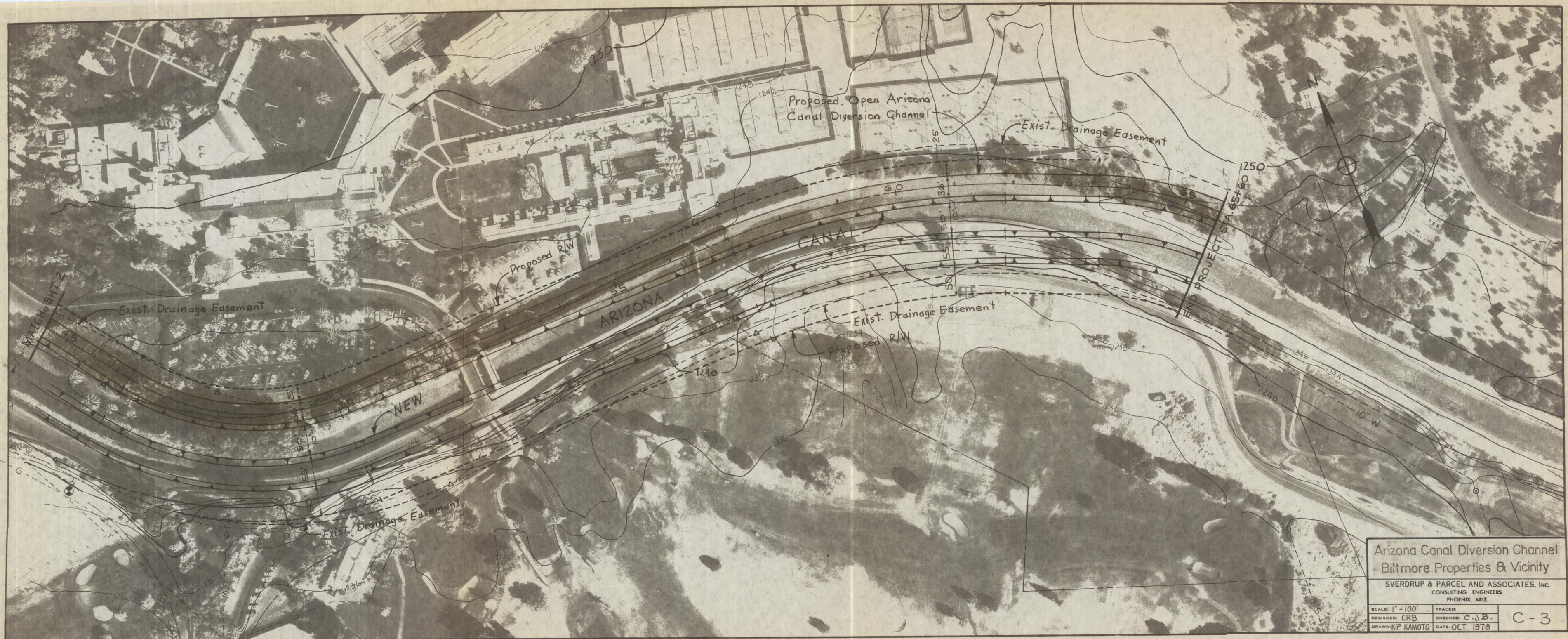
N

Arizona Canal Diversion Channel
Bitmore Properties & Vicinity

SVERDRUP & PARCEL AND ASSOCIATES, INC.
CONSULTING ENGINEERS
PHOENIX, ARIZ.

SCALE: 1" = 100'
DESIGNED: C.R.B. CHECKED: C.J.B.
DRAWN: KIP KAMOTO DATE: OCT. 1978

C-2



Arizona Canal Diversion Channel
Biltmore Properties & Vicinity

SVERDRUP & PARCEL AND ASSOCIATES, INC.
CONSULTING ENGINEERS
PHOENIX, ARIZ.

SCALE: 1" = 100'	TRACED:	C-3
DESIGNED: CRB	CHECKED: C.J.B.	
DRAWN: KIP KAMOTO	DATE: OCT. 1978	