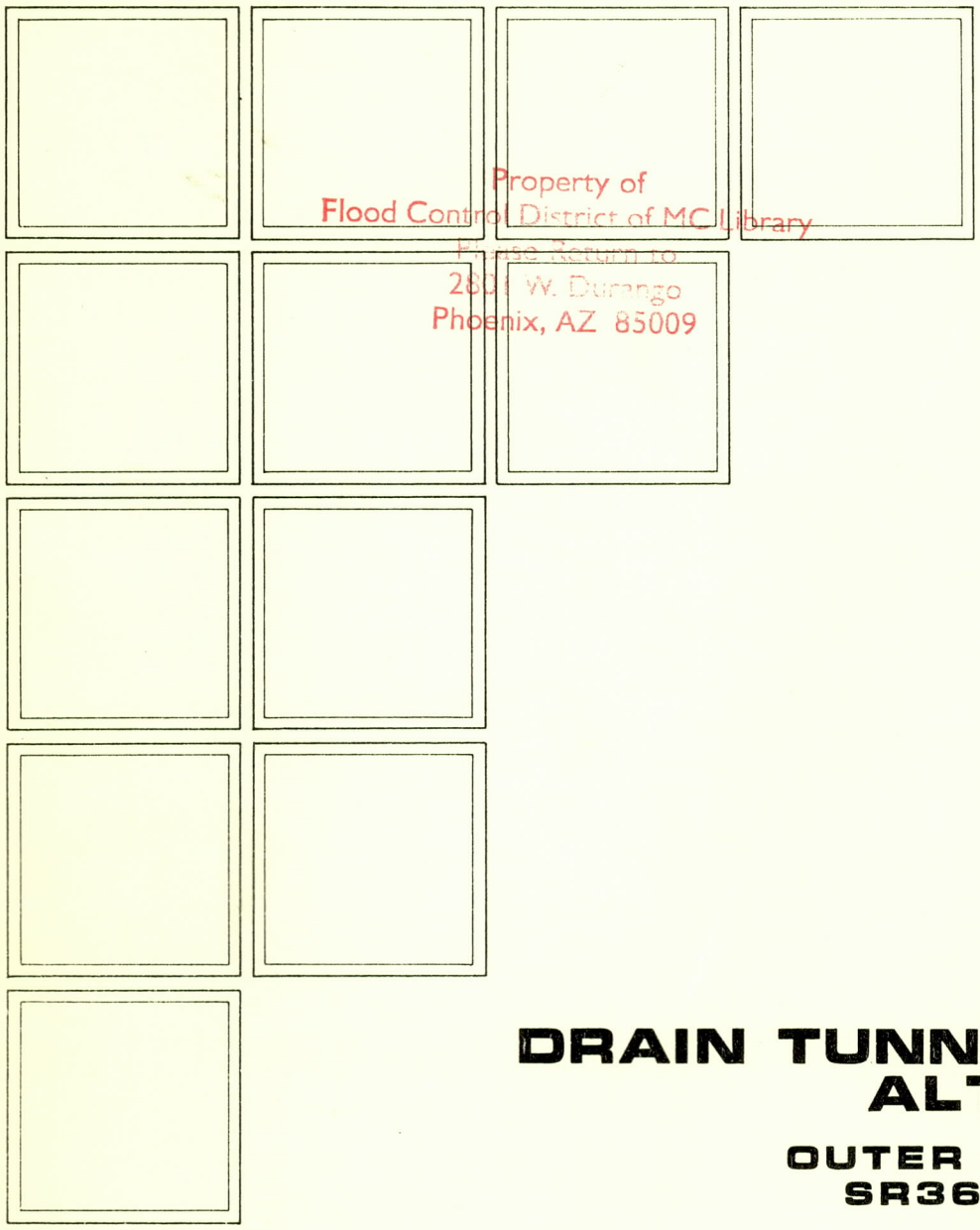

DRAIN TUNNEL OUTFALL ALTERNATIVES

OUTER LOOP HIGHWAY/ SR360 INTERCHANGE

PROJECT NO.
RBM600·1·304

JUNE 23, 1987

HNTB
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DRAIN TUNNEL OUTFALL ALTERNATIVES

CONTRACT NO. 86-8

PROJECT NO. RBM-600-1-304

OUTER LOOP HIGHWAY/SR360 INTERCHANGE

Prepared For:

Arizona Department of Transportation, and
DeLeuw Cather Company (Management Consultant)

June 23, 1987

By:

HOWARD NEEDLES TAMMEN & BERGENDOFF

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I. PURPOSE AND BACKGROUND OF STUDY

A. Purpose

The purpose of this study is to determine the most feasible outfall alignment for the proposed drainage tunnel serving the SR360 traffic interchange with the future Outer Loop Highway located in Tempe, Arizona. This report outlines the five routes investigated and compares them for cost and functionality.

B. Background

The design and construction contracts for the drainage tunnel have been separated from those for the tunnel outfall. They were divided into separate contracts in order to expedite construction of the tunnel while still allowing sufficient time to determine the best route for the tunnel outfall. Waiting to finish design and begin construction of the tunnel until the outfall route is determined could negatively impact other aspects of the Outer Loop Highway construction schedule. The time needed to complete construction of the outfall will be shorter than that required to build the tunnel and its related structures. Thus, even with the extra time needed for a decision on the nature and alignment of the outfall, it would still be possible to complete construction of the outfall at the same time that the tunnel is completed. However, if the outfall decision is delayed and the tunnel is finished prior to completion of the outfall, the tunnel would still be usable as a storm water detention structure for all of Section 12 of the Outer Loop Highway. The tunnel can easily contain a 10-year storm on Section 12 and can nearly contain all of a 50-year storm (24-hour event). After the storm's peak has passed, dewatering pumps connected to the tunnel would pump the water into an existing 72-inch diameter storm drain adjacent to the drainage tunnel that empties into the Salt River. The tunnel, however, would be unable to handle a 100-year storm event without completion of the outfall.

II. ALTERNATIVE DESCRIPTION AND COSTS

Following are the five alignments investigated as being the most possible. With each alternative is a description of the alignment, a discussion of the route selected including constraints and impacts that require consideration, and approximate costs.

A. Alternative 1

1. Route

Construct a two cell box culvert north from the terminus of the drainage tunnel at 5th Street to the Salt River.

2. Discussion

This route assumes that the proposed East Papago - Red Mountain Interchange will be located on the south side of the Salt River and that the river would be channelized. If either of these two conditions were not met, storm water from the outfall would flood the gravel pit operations both in the immediate outfall area and upstream (in this area water can "flow upstream" due to the change in grade that has resulted from the gravel pit operations). This would most likely result in flooding the gravel pit operations. If the interchange is located south of the river, right-of-way would have been acquired eliminating the gravel pit operations in the immediate outfall area but not in the areas upstream. Also, if the river was not channelized then water would still "flow upstream" and flood gravel pit operations there. This route proves to be the most cost effective provided the above conditions prevail or the legal questions concerning possible damages to the gravel pit operators can be mitigated.

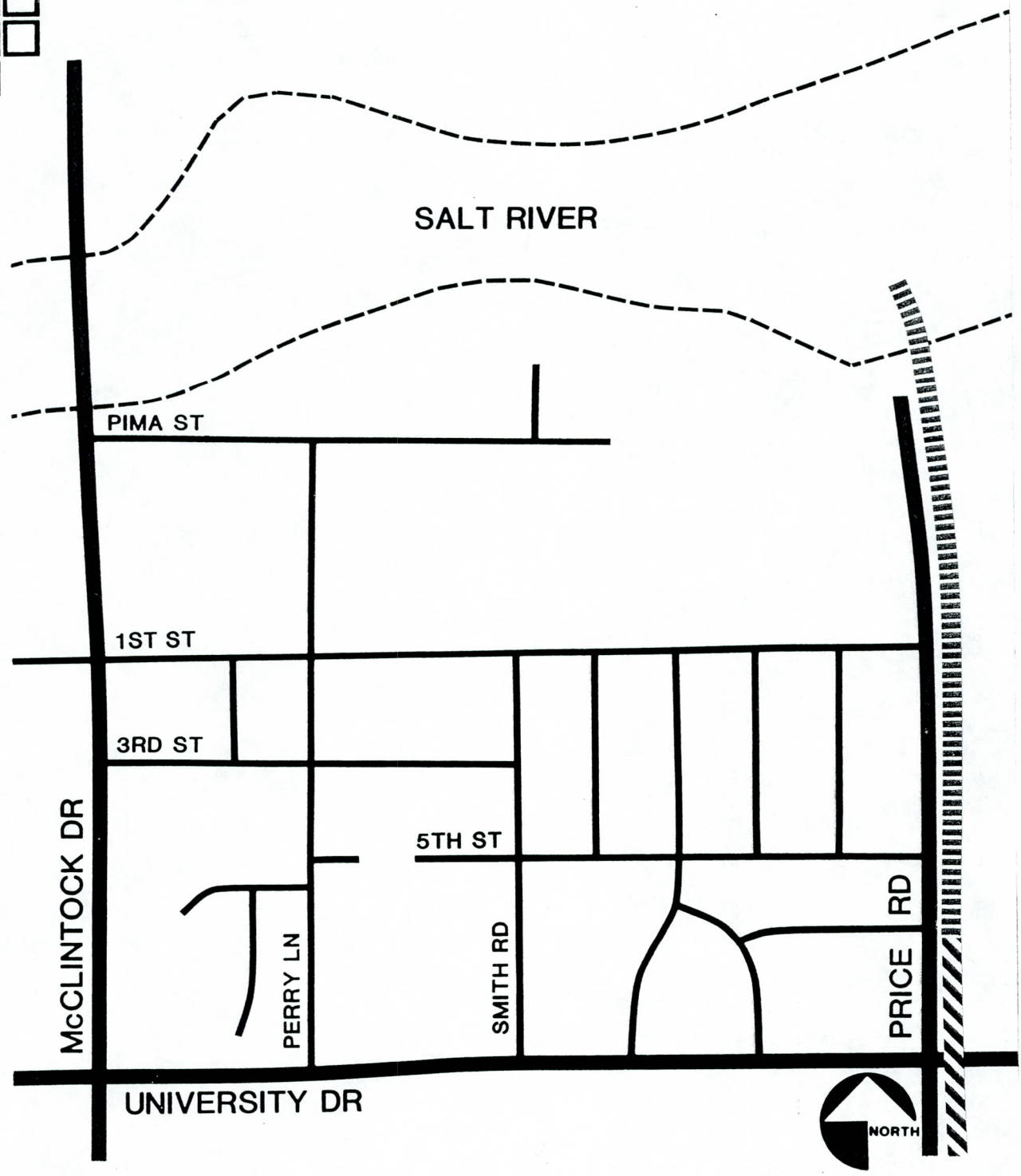
The only known utility impacted by this route is the 90" water main located in 1st Street. This main would require lowering by about 5 feet in the area of the box culvert.

3. Costs

From end of drainage tunnel north to the Salt River to point of surface ("daylight") = 2700'; open channel to outlet = 1600'.

Box Culvert	2700' x $1600/ft.	=	$4.3M
Open Channel	1600' x 700	=	1.1
1 ea. Shaft		=	0.7
Outlet Works		=	2.5
Utility Relocation		=	0.1
			$8.7M

PLUS: Possible legal damages.



LEGEND

TUNNEL

OUTFALL

DRAIN TUNNEL OUTFALL ALTERNATES

ALTERNATIVE 1

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B. Alternative 2

1. Route

Extend drainage tunnel north from 5th Street to Salt River, cross under river, then continue west to McClintock Drive (Hayden Road) in open channel.

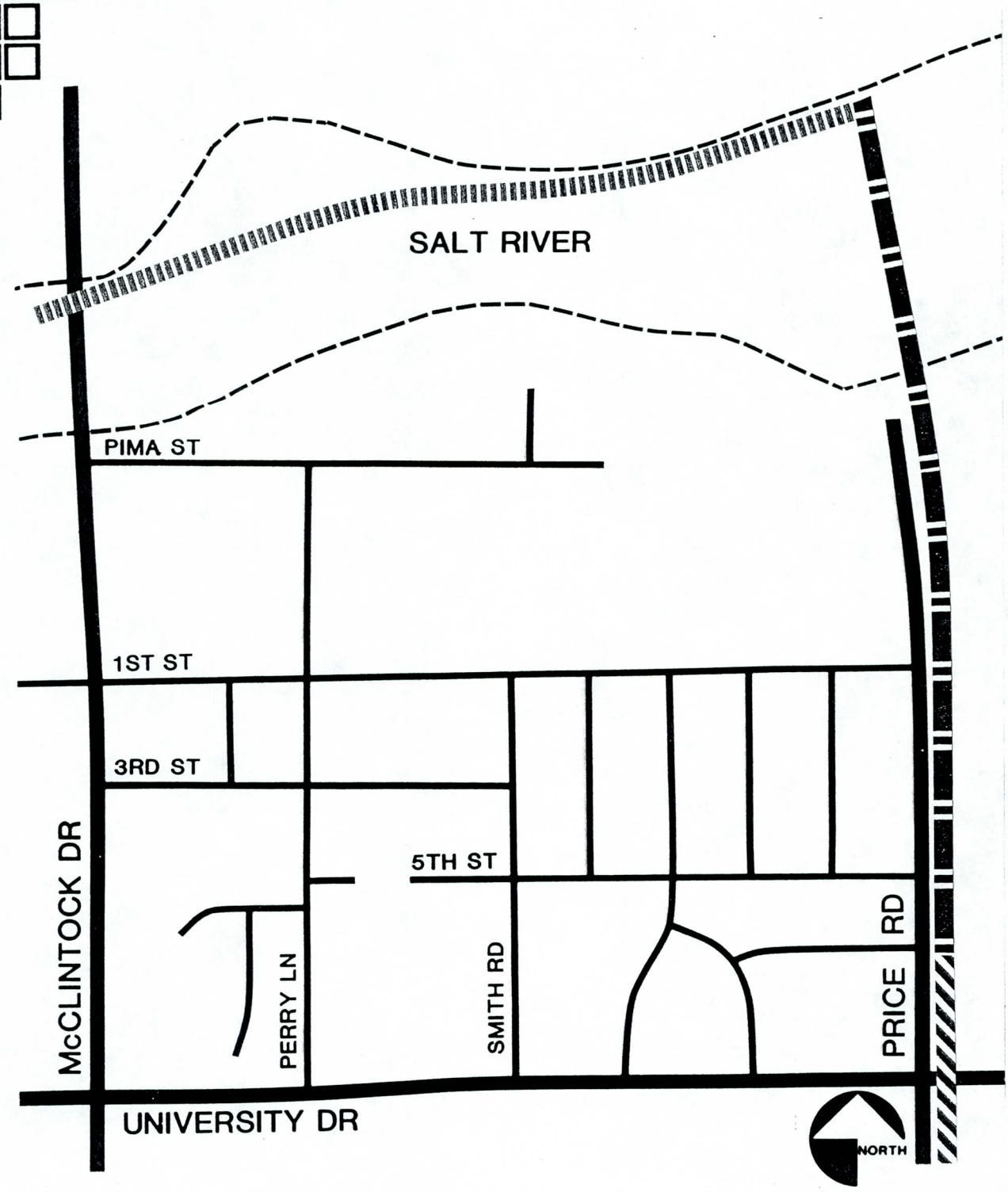
2. Discussion

This route assumes the East Papago - Red Mountain Interchange will be located north of the river and was considered in order to alleviate possible legal damages from the gravel pit operations. However, this route is very costly and technologically quite difficult to carry out due to existing sub-surface water beneath the Salt River. It appears that compressed-air tunneling may be necessary due to the high water table.

3. Costs

From end of drainage tunnel north to the Salt River = 5,000′; river crossing = 1850′; channel west to McClintock Drive = 5600′

Tunnel	5000′ x $1500	=	$ 7.5M
Tunnel (River Crossing)	1850′ x $3000	=	5.6
2 Ea. Shafts x $0.75M Ea.		=	1.5
Open Channel	5600′ x $ 700	=	3.9
Outlet Works		=	2.5
River Right of Way			
(1850′ + 5600′)	x 50′ x $1.50	=	0.6
Utility Relocation		=	0.2
			$21.8M



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EXISTING TUNNEL

TUNNEL EXTENSION

OUTFALL

DRAIN TUNNEL OUTFALL ALTERNATES

ALTERNATIVE 2

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C. Alternative 3

1. Route

Construct a two cell box culvert north from the terminus of the drainage tunnel to the Salt River; channel flow along south bank of Salt River to McClintock Drive.

2. Discussion

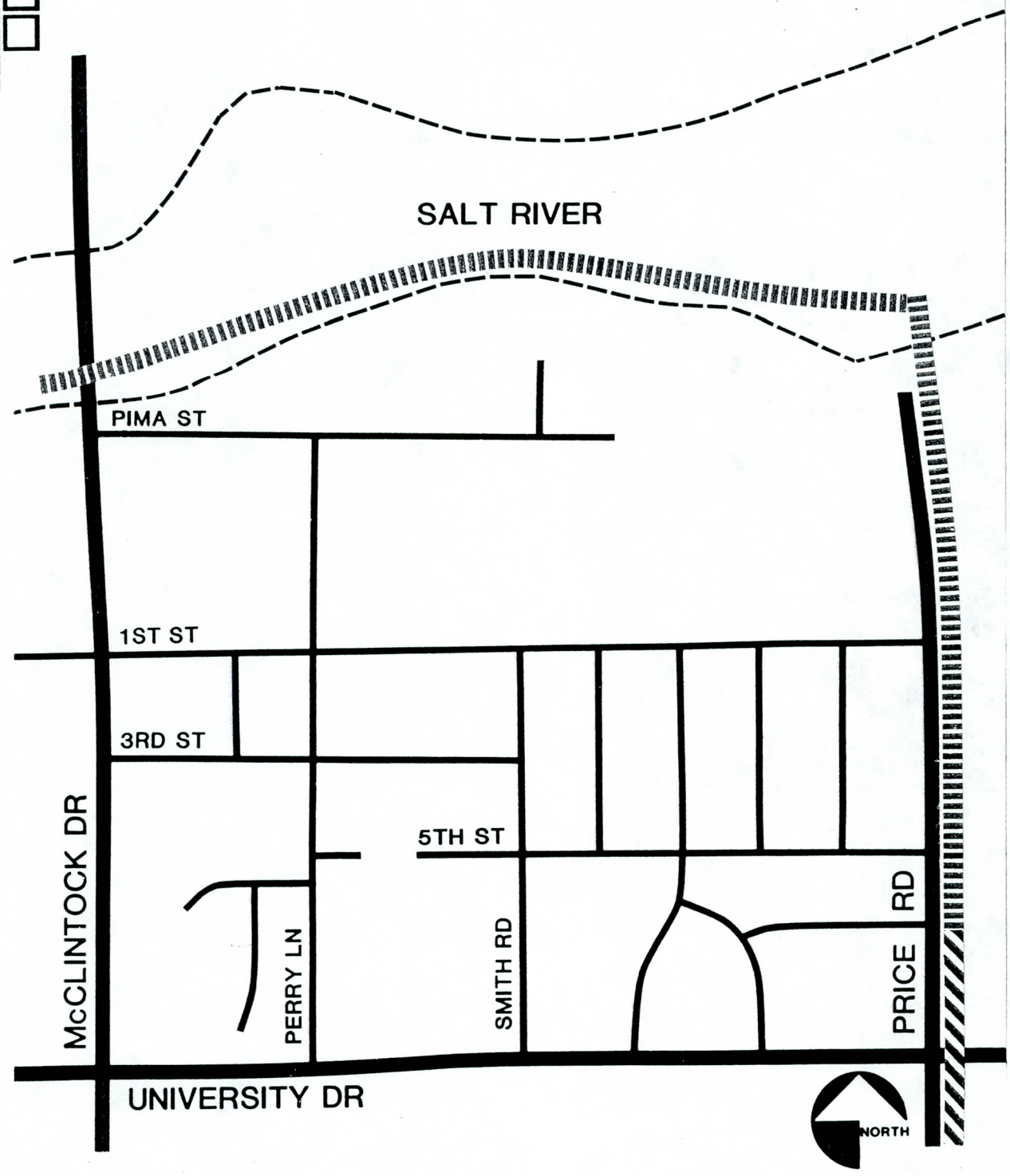
This variation of Alternative 1 assumes that the East Papago - Red Mountain Interchange will be located south of the river and that the river will remain unchannelized. The addition of the open channel will take the flows south to McClintock Drive in order to avoid the possible legal damages resulting from flooding the gravel pit areas upstream.

This alternative, therefore, represents the lowest cost to avoid the liability inherent in Alternative 1.

3. Costs

From end of drainage tunnel north to Salt River to point of surface = 2700′; open channel outlet = 8450′.

Box Culvert	2700′ x $1600	=	$ 4.3M
Open Channel	8450′ x 700	=	5.9
1 Ea. Shaft		=	0.7
Outlet Works		=	2.5
River Right-of-Way	(8450 x 50) x $1.50	=	0.6
Utility Relocation		=	0.1
			$14.1M



LEGEND

TUNNEL

OUTFALL

DRAIN TUNNEL OUTFALL ALTERNATES

ALTERNATIVE 3

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D. Alternative 4

1. Route

Construct a box culvert north from the terminus of the drainage tunnel to 1st Street, west on 1st Street to McClintock Drive (Hayden Road), north on McClintock Drive to Salt River. (As the culvert approaches the river, it would offset to the east in order to bypass the McClintock bridge abutment. The culvert would then "daylight" and curve to the south under the bridge where it would outfall to the river).

2. Discussion

a. This route is the most viable option to the previous alternatives if either the East Papago - Red Mountain Interchange will be located north of the river or if an outfall route decision must be made prior to selection of the interchange's location.

b. At 1st Street and Price Road, the culvert will conflict with an existing 90" water main. The main will have to be vertically offset approximately 5' in the area of conflict with the culvert.

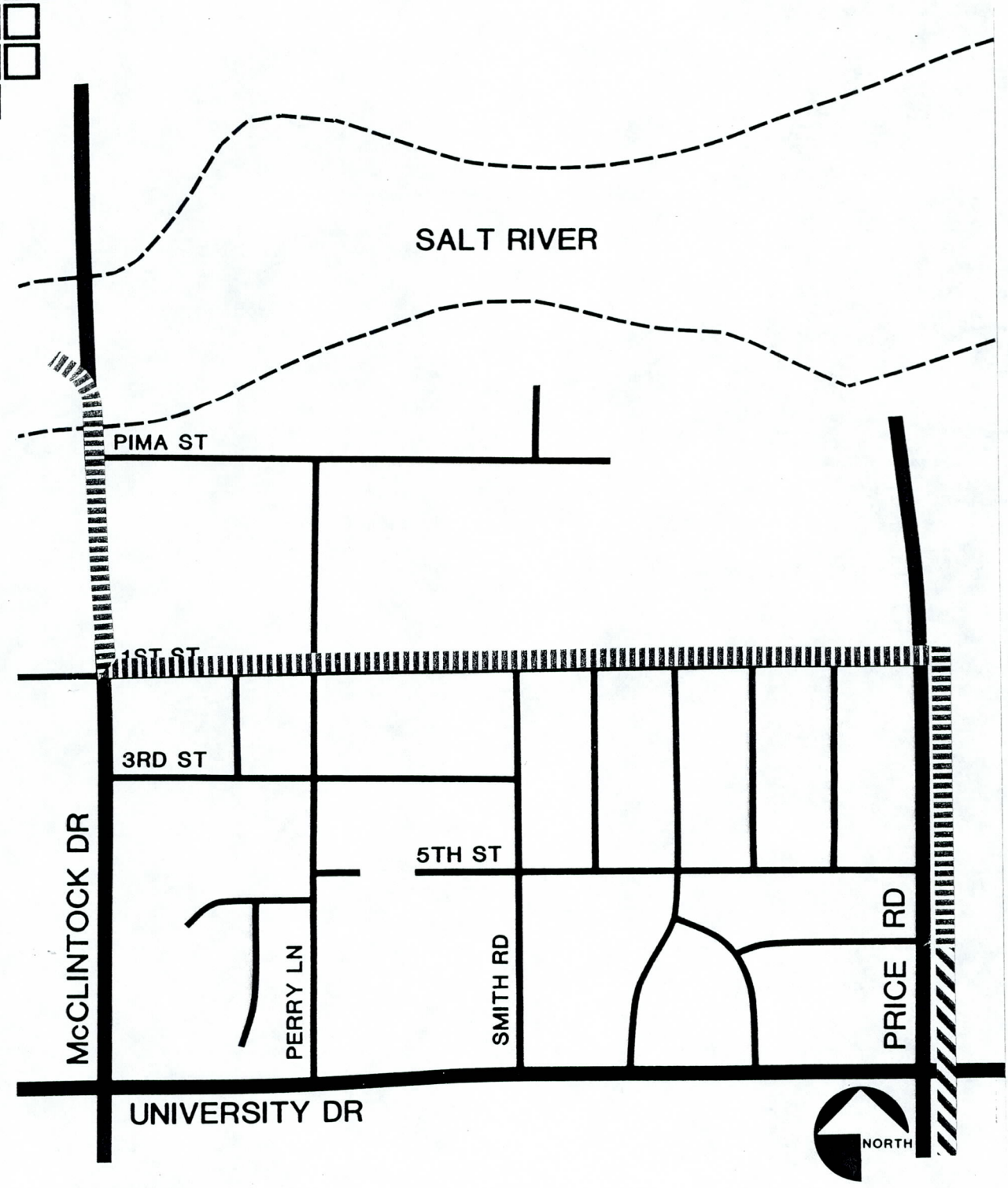
c. As the culvert turns to proceed west down 1st Street it will also intersect an existing 72" storm drain (which also discharges into the Salt River). This pipe would have to be intercepted and its flows added to the box culvert. Otherwise it would have to be siphoned under the box culvert.

d. Since some of the property lines actually extend to the center line of the 1st Street section line, some additional utility easements may have to be acquired (Approx. 900' x 40' + 268' x 7' = 37,876 sq. ft.).

3. Cost

From end of drainage tunnel north to 1st Street = 1610'; 1st Street to outfall = 7050'.

Box Culvert	8660' x $1600	=	$13.9M
1 Ea. Shaft		=	0.7
Outlet Works		=	2.5
Drainage Easements	37,876 sq.ft. x $3.00	=	0.1
Utility Relocation		=	0.2
			$17.4M



LEGEND

TUNNEL

OUTFALL

DRAIN TUNNEL OUTFALL ALTERNATES

ALTERNATIVE 4

HNTB

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E. Alternative 5

1. Route

Construct a box culvert from the terminus of the drainage tunnel west along 5th Street to Perry Lane, north on Perry Lane to 3rd Street, west on 3rd Street to McClintock Drive (Hayden Road) then north on McClintock Drive to the Salt River. (As the culvert approaches the river, it would offset to the east in order to bypass the McClintock bridge abutment. The culvert would then "daylight" and curve to the south under the bridge where it would outfall to the river).

2. Discussion

This route was studied as a possible option to Alternative 4 but has a number of difficulties that must be considered.

a. As the box culvert crosses Price Road, it immediately conflicts with a 10" sewer line that would require significant redesign.

b. As the culvert crosses Rockford Drive it intersects an 8" sewer line that would require redesign.

c. Between Smith Road and Perry lane, a 21" sewer line would have to be relocated or the culvert moved further to the south of centerline. If the culvert were moved further south to avoid the sewer, approximately 9600 sq. ft. of additional right-of-way (16′ x 600′) would be required.

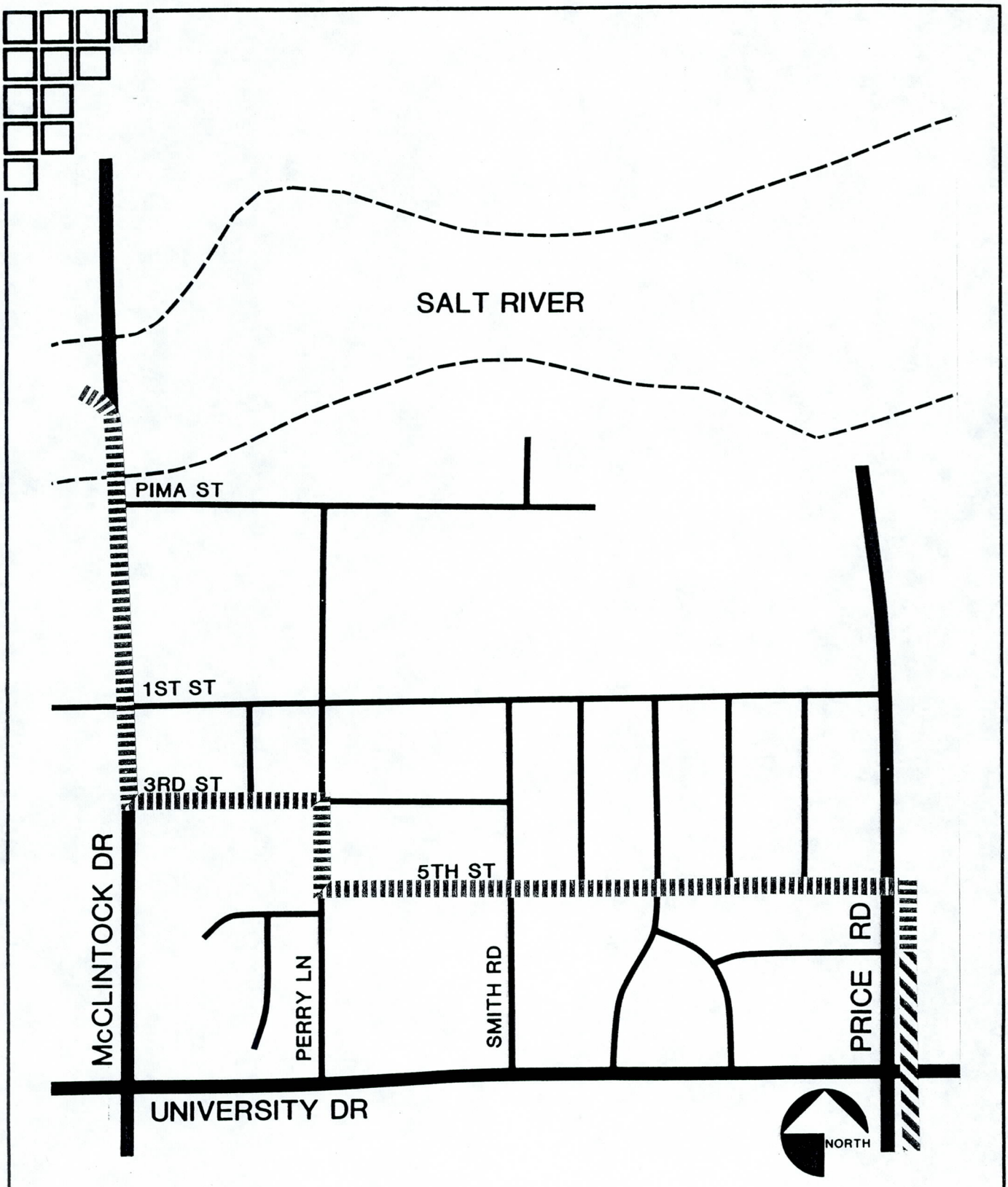
d. At the intersection of McClintock Drive and 1st Street, the culvert would intersect a 27" sewer running within 1st Street. This sewer line would have to be lowered about 36" for it to clear the culvert. It would also conflict with the 90" water line running down 1st Street, which would have to be lowered.

e. In numerous locations along 5th Street, businesses would be completely isolated from the road, requiring construction of temporary roads or bridges across the culvert excavation. The costs associated with these temporary construction elements would have to be added to those listed below.

3. Cost

From end of drainage tunnel to 5th Street = 290';
5th Street to outfall = 8370'.

Box Culvert	8660' x $1600	=	$13.9M
1 Ea. Shaft		=	0.7
Outlet Works		=	2.5
Drainage Easement	(16'x600') x $3.00	=	< 0.1
Utility Relocation		=	0.4
			$17.5M



LEGEND

TUNNEL

OUTFALL

DRAIN TUNNEL OUTFALL ALTERNATES

ALTERNATIVE 5

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III. ALTERNATIVE COST COMPARISON - SUMMARY

COST ITEM	ALTERNATIVE / COSTS IN $M				
	NO. 1	NO. 2	NO. 3	NO. 4	NO. 5
Tunnel	-	13.1	-	-	-
Box Culvert	4.3	-	4.3	13.9	13.9
Open Channel	1.1	3.9	5.9	-	-
Shafts	0.7	1.5	0.7	0.7	0.7
Outlet Works	2.5	2.5	2.5	2.5	2.5
Right-of-Way/ Easements	-	0.6	0.6	0.1	-
Utility Relocation	0.1	0.2	0.1	0.2	0.4
TOTALS	**$8.7M**	**$21.8M**	**$14.1M**	**$17.4M**	**$17.5M**

UNIT PRICES

Tunnel (Including New Mobilization)	=	$1500/LF
Tunnel (River Crossing)	=	$3000/LF
Box Culvert (2 - 14 x 13)	=	$1600/LF
Open Channel	=	$ 700/LF
River Bed Right-of-Way	=	$1.50/Sq. Ft.
River Bank Right-of-Way	=	$3.50/Sq. Ft.
Drainage Easement	=	$3.00/Sq. Ft.

IV. OUTER LOOP MASTER SCHEDULE IMPACT

ADOT is committed to advertising the drainage tunnel in August, 1987 with anticipated start of construction in early 1988. Tunnel construction is expected to be complete by August, 1989.

The outfall is estimated to require 12 months to construct. Allowing six months for design and three months for pre-bidding activities, project duration from decision on alignment to completion is estimated to be 21 months. Therefore a decision on the outfall alignment must be made by the end of 1987 in order to have the outfall operational at the time the tunnel is complete.

Once the tunnel and outfall are complete the Mesa Drain can be diverted to this system. This will allow construction of the east pipe for Tempe Canal conveyance and the Carriage Lane Outfall to begin, with completion estimated to be October, 1990.

The interchange cannot be constructed until the Tempe Canal is removed from its present alignment. If SRP will permit temporary service using only the west pipe, then construction could start by early 1990. If, however, SRP will not allow service with only a single west pipe, then the interchange construction will be delayed until October, 1990. In this situation, delays in the decision on the outfall alignment will delay completion of Sections 12 and 13 of the Outer Loop.

V. CONCLUSION

The outfall route of choice depends to a large extent upon the final location of the East Papago - Red Mountain Highway Interchange. If the interchange is located south of the Salt River, Alternative 1 (river channelized) or Alternative 3 (river unchannelized) are the most cost effective. If the interchange is to be located north of the river or if its location remains uncertain, Alternative 4 becomes the most attractive option.

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