CONCEPT DESIGN MEMORANDUM

Pima Freeway Drainage System
North of the Arizona Canal

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Prepared by:

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for

Parsons De Leuw, Inc.

February 27, 1992
Revised: April 27, 1992

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INTRODUCTION

This memorandum is a precursor to a detailed engineering report that will document the hydrologic and hydraulic design recommendations for a portion of the offsite drainage system that will serve that segment of the Pima Freeway located between Via Linda Drive and the Arizona Canal. Specifically, this memorandum addresses the design of a concrete-lined channel that will extend approximately 2400 feet east of Pima Road, along the north side of the Arizona Canal.

The intent of this memorandum is to provide interested parties (primarily agencies such as the City of Scottsdale, Salt River Project, Salt River-Pima-Maricopa Indian Community and the Flood Control District of Maricopa County) an opportunity to review the proposed drainage concept before further efforts are spent on final design. Any design comments resulting from this review process can be subjected to additional engineering analysis prior to completing final design of the channel.

Several previous design concepts have been evaluated for this channel by DeLeuw, Cather & Company, Inc. (DCCO). These concepts are discussed in engineering reports published in September 1989, September 1990, October 1990, and December 1990. In early 1991, questions arose regarding the potential of the DCCO drainage system concept to increase the magnitude of flows through a proposed golf course located immediately west of Pima Road and north of the Arizona Canal. Concerns were also expressed regarding any adverse impacts that the drainage system might have on SRP facilities and the Indian Bend Wash Interceptor Channel.

During the period extending from March 1991 through February 1992, the DCCO concept was refined in an effort to find an optimum design that would be compatible with the objectives of all interested parties. As a result of this additional study,

a concept has been identified which would appear to meet this objective. This concept has been subjected to an extensive engineering analysis and was found to produce minimal adverse impacts on adjoining facilities.

The following sections of this memorandum describe the current drainage system concept and summarize the engineering methodologies and assumptions upon which the concept is based.

PROPOSED DRAINAGE SYSTEM PLAN

Figure 1 illustrates the proposed offsite drainage system for that portion of the Pima Freeway in the vicinity of the Arizona Canal. Although the focus of this memorandum is only the east-west channel segment located between Pima Road and the Pima Freeway, the surrounding segments of the overall drainage system are also shown on Figure 1 for convenient reference in subsequent discussions.

As proposed in the previously referenced DCCO reports, the east-west drainage channel will consist of a concrete-lined, trapezoidal cross-section with a 100-foot bottomwidth and 2H:1V side-slopes. The channel will maintain a constant bed-slope of 0.0014 feet/feet. Plate 1 presents a plan/profile view of the proposed channel as well as a typical channel cross-section.

The west end of the channel will terminate with a new multi-cell concrete box culvert (7-10'W x 8'H) to be built under Pima Road. This structure will outlet to the east end of the Indian Bend Wash (IBW) Interceptor Channel.

An energy dissipater will be constructed at the culvert outlet to prevent scour and erosion as low-flows transition from a fully lined concrete channel section to the earth-lined IBW Interceptor Channel. During major floods, such as the 100-year event, the culvert outlet will be submerged by the Interceptor Channel backwater. Under these extreme backwater conditions, exit velocities will be very low and scour processes should be insignificant. However, during the more frequent events, such as a 2-year flood, backwater effects will be less severe and channel exit velocities could be sufficiently high to cause scour problems. Accordingly, an energy dissipater has been included at this concept design level to prevent any potential scour damage during low-flow events.

It should be noted that previous golf course development plans included a lake at the approximate outlet location of the proposed ADOT channel. The proposed water surface elevation of this lake was 1269.0 feet MSL. At the present time, the outlet elevation of the ADOT channel (at the west end of the proposed 7-10'x8' CBC) is

1270.0 feet MSL. Any future plans for development of this golf course should include provisions for a design that would not jeopardize the performance or structural stability of the proposed ADOT energy dissipater.

The upstream (east) end of the proposed channel will connect to the south end of the Pima Freeway channel that extends from Via Linda Drive to the Arizona Canal. In order to restrict the magnitude of low-flows into the upstream end of the IBW Interceptor Channel, a non-erodible berm will be constructed along a portion of the east side of the north-south Pima Freeway channel. This berm, which will tie into the north bank of the Arizona Canal, will have a crest elevation of 1283.2 feet MSL.

This berm was designed on the basis of maintaining the post-project, peak discharge from the 2-year, 12-hour storm into the IBW Interceptor Channel at approximately the same value that would occur under existing conditions. The preservation of the peak discharge associated with this frequent hydrologic event was an important issue relative to the possible construction of a golf course within the IBW Interceptor Channel right-of-way.

The configuration of the proposed ADOT berm was also a critical factor in the design of the Salt River-Pima-Maricopa Indian Community (SRPMIC) detention basin/channel that extends from the east side of the Pima Freeway right-of-way to 96th Street. The berm elevation had to be adjusted to prevent backwater conditions in the SRPMIC basin/channel from causing an upstream water surface profile that would exceed the existing floodplain profile. Accordingly, the berm elevation had to be designed as a function of two somewhat opposing criteria, i.e., 1) regulating low-flows to the IBW Interceptor Channel, and 2) preserving continuity to the upstream floodplain profile.

It should be noted that the proposed channel/detention basin to be located along the north bank of the Arizona Canal, between the Pima Freeway and 96th Street, is being designed by Evans-Kuhn & Associates, Inc. for the Salt River-Pima-Maricopa Indian Community. Due to the proposed ADOT berm along the east side of the Pima Freeway, the SRPMIC detention basin will incorporate a 24" diameter pipe (under the Arizona Canal) to drain the basin to the south for connection to the proposed offsite drainage system for that reach of the Pima Freeway located south of the Arizona Canal.

A third design criteria was to insure that the proposed ADOT berm would not cause an increase of flow into the Arizona Canal, beyond the flow rates presently predicted to enter the canal. As will be discussed in a subsequent section of this memorandum, this objective was achieved.

A final feature of the ADOT drainage system is the proposed elevation of a portion of the north bank of the Arizona Canal to isolate the canal flows from the rapid draw-down profile associated with floodwaters flowing over the proposed ADOT berm. This raised barrier would extend approximately 178 feet east of the ADOT berm. Without this barrier, there would be a tendency for substantial canal flows to be drawn into the ADOT channel, as floodwaters cascade over the weir crest created by the ADOT berm.

Due to substantial backwater effects associated with the 100-year event in the IBW Interceptor Channel, the proposed ADOT channel may incur minor overtopping during a 100-year flood. This may require raising some portions of the existing north bank of the Arizona Canal (between Pima Road and the Pima Freeway) to achieve a minimum continuous freeboard dimension of 1 foot along the south bank of the ADOT channel. Figure 2 presents a profile of the existing north canal bank, the existing 100-year floodplain, and the proposed ADOT channel 100-year water surface profile. Except for a short reach near the Pima Freeway centerline, Figure 2 indicates that there is in excess of 1 foot of freeboard along the remainder of the south bank of the channel. *

Table 1 summarizes the 100-year and 2-year peak discharge values for the proposed drainage system at several key concentration points. The 100-year values are compared to the Corps of Engineers discharges used for the design of the IBW Interceptor Channel, as well as to the discharges for existing conditions (i.e., no ADOT or SRPMIC drainage channels being in-place). The Corps did not develop data for the 2-year event. The discharge comparisons listed in Table 1 are graphically illustrated in Figures 3 and 4. — yes for 24hr storm

The locations of the Concentration Points in Table 1 are shown on Figure 1 and defined as follows:

CP 548 West side of Pima Road and north side of Arizona Canal, upstream of IBW Interceptor Channel spillway. This location reflects all water flowing over or under Pima Road, excluding any Arizona Canal flows.

CP 549 This location represents all flows crossing Pima Road through the Arizona Canal. This CP is located at the upstream side of the IBW Interceptor Channel spillway. Accordingly, spillway flows have not yet occurred.

CP 550 This CP reflects the amount of water from the Arizona Canal that flows over the IBW Interceptor Channel spillway.

CP 551 The point is located in the Arizona Canal at the west (downstream) end of the IBW Interceptor Channel spillway. This CP reflects the water left in the canal after the spillway flows have occurred.

CP 552 This location reflects the total flow in the IBW Interceptor Channel obtained by combining the spillway discharge with the flow crossing Pima Road north of the Arizona Canal, i.e., CP 548 + CP 550.

In order to preserve continuity in the flow distribution between the Arizona Canal and the IBW Interceptor Channel, a critical project objective is to design the ADOT drainage system to replicate the existing condition discharges at CP 549, CP 551, and CP 552. Using the existing condition HEC-1 model (developed for this project) as a baseline condition, a review of the information in Table 1 indicates that the proposed drainage plan does not cause an increase in the flows to the Arizona Canal, but does cause a slight increase in the total 100-year discharge being delivered to the IBW Interceptor Channel.

It should be noted that the IBW Interceptor Channel was designed by the Corps of Engineers to accept 5,500 cfs west of Pima Road. This Corps' discharge was not used as the baseline hydrologic condition because of substantial differences between the Corps' methodology and the hydrologic and hydraulic methods used in this study, i.e., any comparisons of pre- and post-project discharges should be based on identical methods and assumptions. However, the Corps' design value of 5,500 cfs must be treated as a design limitation when evaluating the overall performance of the proposed ADOT drainage system. Even though the ADOT system only shows a 4.8 percent increase above the 5,500 cfs value used by the Corps, a downstream hydraulic analysis should be conducted to determine if this small increase in discharge might cause any adverse impacts. This downstream hydraulic analysis was not part of the Scope of Work for this study.

HYDROLOGY

The hydrology data generated for this study was based on an extensive HEC-1 model developed for an approximate 19.5 square mile drainage area. Figure 5 illustrates the watershed boundaries. This model was originally developed for the design of the north-south offsite drainage channel for that segment of the Pima Freeway that lies between Via Linda Drive and the Arizona Canal. A detailed

Meeting w/ DCCO, ADOT 6,18,92
(Pima Freeway Crossing at AZ Canal)

- Pima Indian Reservation will impose retention on their development

- widen Pima Road
- new box culvert at Pima Road

4N-3W, sec 15

Meeting w/ ADOT 7,9,92

- Indian Comm. most likely will provide retention standards for area developed above.

- Scottsdale (Bill Erickson) was receptive to the idea of increased low flow dump
→ into the channel, if the Indian Comm. imposes retention criteria.

_ADOT may have to apply to for 404 + 401

Ted

discussion of this model is published in the Final Hydrology Report, Outer Loop Highway, Camelback Walk Channel To The Arizona Canal, Simons, Li & Associates, Inc., May 1989. need this

Modifications were subsequently made to this original model to reflect minor highway alignment changes and proposed drainage improvements on SRPMIC lands. Several of these modeling changes are published in Preliminary Design Report, Landscaped Channel Concept, Outer Loop Highway, Via Linda To The Arizona Canal, Robert L. Ward, P.E., Consulting Engineer, March 16, 1990.

Several additional modeling changes have been made as a part of this current study. These new changes address runoff that originates between Pima Road and the Pima Freeway, revised channel routing geometries, the inclusion of additional channel routing operations, and the addition of divert operations to simulate flow exchanges along the Arizona Canal. These modeling changes will be discussed in more detail in the engineering report that will be published subsequent to this concept design memorandum.

The HEC-1 models were run with both 12-hour and 24-hour hypothetical rainfall distributions. The 100-, 10-, and 2-year events were modeled for each storm duration. The 100-year, 12-hour event was ultimately selected for design because it produced an existing-condition, total peak discharge of 7,985 cfs at Pima Road and the Arizona Canal, which compares favorably with the Corps of Engineers value of 8,000 cfs for this same location.

The SCS curve number methodology was used to simulate rainfall losses within the model and kinematic wave procedures were used to generate runoff from overland flow planes. Both kinematic wave and modified Puls (normal depth) channel routing operations were used in the model.

Other specific elements of the HEC-1 model include: 1) numerous reservoir routing operations to simulate the effects of urban and commercial detention basins; 2) the inclusion of an outflow hydrograph to simulate the storage effects of a large lake in Scottsdale Ranch; and 3) the inclusion of outflow hydrographs to simulate cross-drainage under and over the CAP aqueduct.

In order to identify the impacts of incremental land-use changes in the watershed, the following three conditions were modeled:

1. Existing conditions with no Scottsdale Pavilions and no Pima Freeway in-place.

2. Existing conditions with Scottsdale Pavilions in-place, but no Pima Freeway in-place.

3. Existing conditions with Scottsdale Pavilions in-place, with the Pima Freeway in-place, and with the SRPMIC proposed 96th Street channel in-place.

A review of the results of these three modeling scenarios revealed that construction of the Scottsdale Pavilions did not cause any increase in runoff to the Pima Road-Arizona Canal intersection. In fact, due to the inclusion of approximately 20 AF of retention storage that was constructed on the Scottsdale Pavilions site, there was a very slight decrease in runoff to the Pima Road-Arizona Canal intersection.

The design of the ADOT offsite drainage system was based on the third land-use condition, which included the influence of the Scottsdale Pavilions and the proposed 96th Street channel on the SRPMIC lands.

As will be discussed in the final engineering report, several refinements were made to both the HEC-1 and HEC-2 models as this study evolved over a 12-month period. In order to expedite the final phases of this study, only the 2-year and 100-year, 12-hour storms were carried forward for analysis as part of this Concept Design Memorandum. Some additional modeling refinements have been made in the HEC-1 models (that were used for the data in Table 1) that were not included in previous modeling efforts. The most significant of these recent refinements are the inclusion of a base flow in the Arizona Canal for the 2-year event, and the combination of this base flow with diverted north overbank flows for routing through the canal and past the IBW Interceptor Channel spillway. The proposed SRPMIC channel geometry has also been combined with the Arizona Canal cross-sectional geometry (using a normal-depth, 8-point cross-section) for routing flows from 96th Street to the Pima Freeway alignment.

It should be noted that the 2-year event was analyzed with the assumption that a 1,600 cfs base flow would be in the Arizona Canal during the entire duration of the storm. It was assumed that SRP would drain all irrigation water from the canal during the 100-year event. This latter condition is consistent with the Corps of Engineers design assumption for the IBW Interceptor Channel.

HYDRAULIC ANALYSIS FOR ADOT CHANNEL DESIGN

The hydraulic analysis that was performed to develop design parameters for the

proposed ADOT channel was relatively complex and required substantial amounts of computer modeling and manual calculations. Several refinements were made to the modeling process during the course of the study. A brief discussion of the analysis will be presented in this memorandum, with a more detailed discussion to follow in the final engineering report.

For existing conditions, the hydraulic analysis focused on routing flows both through and along the north bank of the Arizona Canal. In addition to generating hydraulic design data for the proposed ADOT channel, an equally important objective of this analysis was to ultimately determine how much water would cross Pima Road as canal flow versus north overbank/channel flow. The analysis was complicated by intermittent divided flow conditions, side-spillway flows, numerous bridges and culverts, an elevated Pima Road embankment, and uncertainty about compatibility between the survey datum used by the Corps of Engineers for the Interceptor Channel design and the survey datum used for the 1"=50' topographic mapping (7/19/89) prepared for the Pima Freeway channel analysis. Substantial engineering judgement and numerous assumptions were required to complete the analysis.

HEC-2 models were developed for both the Arizona Canal and the overbank area along the north side of the canal. Separate models were created for both existing conditions and for conditions with the proposed ADOT channel concept in-place.

An "n" value of 0.018 was originally used for both the canal model and for the ADOT drainage channel model. This value simulates a gunite lining, with sediment movement along the channel bottom. The final hydraulic analysis used a canal "n" value of 0.021, but retained the 0.018 value for the ADOT channel. The change in the canal "n" value was made because an "n" value of 0.021 was found to produce a better simulation of side-spillway flows from the canal to the IBW Interceptor Channel.

This "better simulation" was determined from a previous analysis that used the results of HEC-2 split-flow models as input to a divert operation in the HEC-1 model to simulate the IBW Interceptor Channel side-spillway hydrograph. Canal roughness values of 0.018, 0.021, and 0.024 were used in this analysis. An "n" value of 0.021 produced a flow-split of 5687/2607 cfs at the spillway, which compared favorably with the Corp's flow-split of 5500/2500 cfs at the same location. Accordingly, a canal "n" value of 0.021 was retained in all subsequent hydrologic and hydraulic revisions that were made as part of this study. As a matter of technical interest, the Corps of Engineers used a canal "n" value of 0.024 in the design analysis for the Interceptor Channel.

The north overbank area exhibits a dense cover of mesquite trees that extend about 200 to 300 feet north of the Arizona Canal. Beyond this band of trees, the vegetation becomes very sparse. On the basis of engineering judgement, a weighted "n" value of 0.053 was used to model existing conditions in the north overbank area. This value is purposely at the low end of a realistic roughness envelope for the north overbank. During the split-flow analysis, a lower overbank "n" value generates a higher discharge to the proposed ADOT channel. Accordingly, the selected "n" value promotes some safety in the ADOT channel design.

The starting water surface elevations for the canal models, east of Pima Road, were based on the results of a HEC-2 split-flow analysis conducted for the COE Interceptor Channel spillway located west of Pima Road. Spillway length and crest elevations were taken from the 1989 topographic map (1"=50', 1' C.I.) provided by ADOT. This split-flow model was started at the upstream side of the Hayden Road bridge with an assumption of normal depth (slope = 0.0025 ft/ft). Consideration was given to starting the split-flow model at the Indian Bend Wash wasteway gates, but SRP was unable to provide rating curves at this location for flows in excess of 1,428 cfs.

For existing conditions in the north overbank area, starting water surface elevations were based on critical depth occurring at Pima Road. Between 200 and 300 cfs, the existing box culvert (1-10'x4' CBC) under Pima Road is unable to convey 100 percent of the incoming flow. As a result, the Pima Road embankment becomes a hydraulic control and acts like a weir. This weir effect promotes a ponding of water east of Pima Road and creates a substantial backwater effect, which is propagated a considerable distance upstream.

For the condition with the proposed ADOT channel and a seven cell box culvert being in-place, starting water surface elevations west of Pima Road were based on published Corps of Engineers backwater conditions in the IBW Interceptor Channel.

The routing of flows through and along the Arizona Canal was based on the use of hydraulic rating tables developed for flows confined to the canal and for flows confined to the existing north overbank area, both with and without the proposed ADOT channel in-place. Rating tables were prepared for a wide range of discharges for numerous cross-sections through the canal and overbank areas.

As a matter of technical interest, it should be noted that the HEC-2 models used to develop rating tables for the case with the ADOT and SRPMIC drainage improvements in-place were based on the assumption that only 250 feet of the proposed ADOT berm crest would be effective in spilling water into the ADOT channel. This assumption was based on the fact that the SRPMIC detention basin/channel corridor

along the north side of the Arizona Canal has an effective flow width of 200 feet. It was concluded that the constriction created by this 200-foot wide corridor would limit the effective length of the ADOT berm. Accordingly, only a 50-foot wide expansion was used at the west end of the SRPMIC detention basin corridor. The actual crest length of the ADOT berm, at Elevation 1283.2 feet MSL, is about 530 feet. The final design of this berm should be coordinated with the SRPMIC detention basin to insure that the ADOT berm will function with an effective crest length of 250 feet. This may require some earth-fill being placed along the east side of the north/south Freeway channel to limit the berm length to this value. For concept design purposes, this berm will probably be constructed of concrete or soil-cement and will essentially function as a dam spillway.

For a given discharge, the hydraulic routing procedure involved making an estimate of the flow distribution at a specific cross-section in both the canal and the overbank area. Using the rating tables, water surface elevations were then determined for the assumed canal flow and for the assumed overbank flow. These elevations were also compared to the elevation of the north canal bank to determine if divided flow conditions might exist. If both water surface elevations exceeded the north canal bank elevation, iterative adjustments were made to the assumed flow distribution until a matching water surface elevation was obtained for both the canal and overbank flows. This balanced flow distribution was then carried to the next downstream cross-section and the iteration process repeated. At the end of each iteration, a check was also made to determine whether the balanced water surface elevation would exceed the south canal bank elevation.

This manual routing operation was initiated at the upstream (east) end of the available canal bank topography (1"=50', 1989) and carried west to Pima Road. This topographic mapping ends about 3700 feet east of Pima Road. Accordingly, the hydraulic calculations did not extend east of these mapping limits.

The iterative routing operation worked very well for large flows (such as the 100-year event) that submerged long segments of the north bank of the Arizona Canal. However, routing the low-flows (associated with the 2-year event) along the north bank of the canal required a different approach because the base canal flow does not exceed the canal bank elevations and mingle with the overbank flows. In reality, the north overbank flows will move westerly along the north canal bank and spill into the canal upon encountering any low spot in the canal embankment.

To simulate this phenomenon, the north canal bank was treated as a weir. Using a plot of the vertical profile of the north canal bank, in conjunction with the hydraulic rating tables for the north overbank flows, the water surface elevation (for a given discharge) was determined at each HEC-2 cross-section location along

the canal. This water surface elevation was compared to the average canal bank elevation for a specific bank length through the cross-section. If the water surface elevation was below the canal bank, no overflow occurred into the canal. However, if the water surface elevation exceeded the canal bank elevation, the hydraulic head was computed as the difference between the two elevations and the weir equation was used to compute the approximate flow that would occur from the overbank into the canal. The total discharge in the north overbank was then reduced by this amount and the process was carried to the next downstream cross-section and repeated.

This low-flow routing analysis was applied to the baseline, existing land-use condition model. For the case with the proposed ADOT berm in-place along the east side of the Pima Freeway, a slightly different approach was used for analyzing low-flow spills into the Arizona Canal. The proposed berm was treated like a dam embankment with a level upstream reservoir pool. Using the berm crest elevation as the pool elevation, the continual difference between the reservoir pool elevation and the north canal bank elevation was computed for an approximate 1,045 foot length of depressed canal bank east of the Pima Freeway. The head differentials between these two profiles were used to compute the total weir flow that would occur over the canal bank. The total discharge resulting from this analysis was taken as the amount of north overbank flow that would be directed into the Arizona Canal (east of the Pima Freeway) prior to water spilling over the ADOT berm and entering the ADOT channel.

Additional elements of interest in the hydraulic analysis are the treatment of bridges and culverts. The Special Bridge routine in HEC-2 was used to model the Pima Road Bridge, the SRP de-mossing bridge, and, for flows in excess 1000 cfs, the existing 10'x4' CBC at Pima Road. The Normal Bridge Routine was used for the Arizona Canal foot-bridge (west of Pima Road) and for the existing 10'x4' Pima Road culvert when analyzing flows less than 1000 cfs. The Special Culvert routine in HEC-2 was used to model the proposed 7-10'x8' CBC that will be constructed under Pima Road to accept flows from the new ADOT channel.

Perhaps the most judgmental assumption in the bridge analysis was the selection of debris loads. For the Pima Road bridge (over the Arizona Canal) 2 feet of debris was added to <u>each</u> of the two 16-inch piers. Two feet of debris was also added to the single 18-inch pier on the SRP de-mossing bridge. Three feet of horizontal blockage was assumed for the existing 10 foot wide box culvert under Pima Road. At the request of DeLeuw, Cather & Co., no debris blockage was applied to the

proposed 7-10'x8' CBC under Pima Road. No debris loads were used for the Arizona Canal foot-bridge, (located immediately west of Pima Road) since this structure has no piers.

PRELIMINARY CONCLUSIONS

Based on the data presented in Table 1, it can be concluded that the proposed drainage plan will not cause an increase in canal flows during the adopted 100-year, 12-hour design storm. Under existing conditions, this study predicts a peak discharge of 2,638 cfs will continue west in the Arizona Canal, downstream of the IBW Interceptor Channel spillway. With the proposed ADOT drainage system in-place, the canal flow downstream of the IBW spillway decreases to 2,620 cfs.

Computationally, the results of this study indicate that the proposed drainage plan will cause an increase in the peak 100-year discharge to the IBW Interceptor Channel. Under existing conditions, a peak discharge of 5,206 cfs is predicted to enter this channel, downstream of the side-spillway. With the proposed drainage system in-place, this discharge increases to 5,763 cfs.

Since the Interceptor Channel was designed by the Corps of Engineers on the basis of receiving 5,500 cfs, there is a legitimate concern as to what impact an additional 263 cfs (4.8%) might have on the hydraulic performance of the Interceptor Channel. There has recently been a significant amount of re-contouring of the Interceptor Channel geometry as a result of the proposed golf course construction. It is not known what impact this earthwork may have had on the hydraulic performance of the Interceptor Channel. No agency has been able to provide a HEC-2 model that would document the impact that the golf course grading has had on the channel.

A recommended course of action would be to obtain the Corps' HEC-2 model that was used for the Interceptor Channel design and to re-run that model with the increased 100-year peak discharge (5,763 cfs) predicted by this study. This would provide a direct quantification of the hydraulic changes produced by the proposed ADOT drainage system. It would seem logical to require any future golf course developer to provide sound engineering documentation as to what impact the golf course re-contouring has on the hydraulic performance of the Interceptor Channel.

Regarding the 2-year event, the results of this analysis indicate that the proposed drainage plan will cause a reduction in the peak discharge to both the Arizona Canal (CP 551) and to the IBW Interceptor Channel (CP 552).

Enclosures: Table 1
Figure 1
Figure 2
Figure 3
Figure 4
Figure 5
Plate 1

Registered Professional Engineer (Civil)
CERTIFICATE NO.
13505
ROBERT L.
WARD
Date Signed 4/27/92
ARIZONA, U.S.A.

Table 1
Pima Freeway Drainage Study
Comparison Of Peak Discharge Values
Existing Conditions vs Proposed Design Conditions

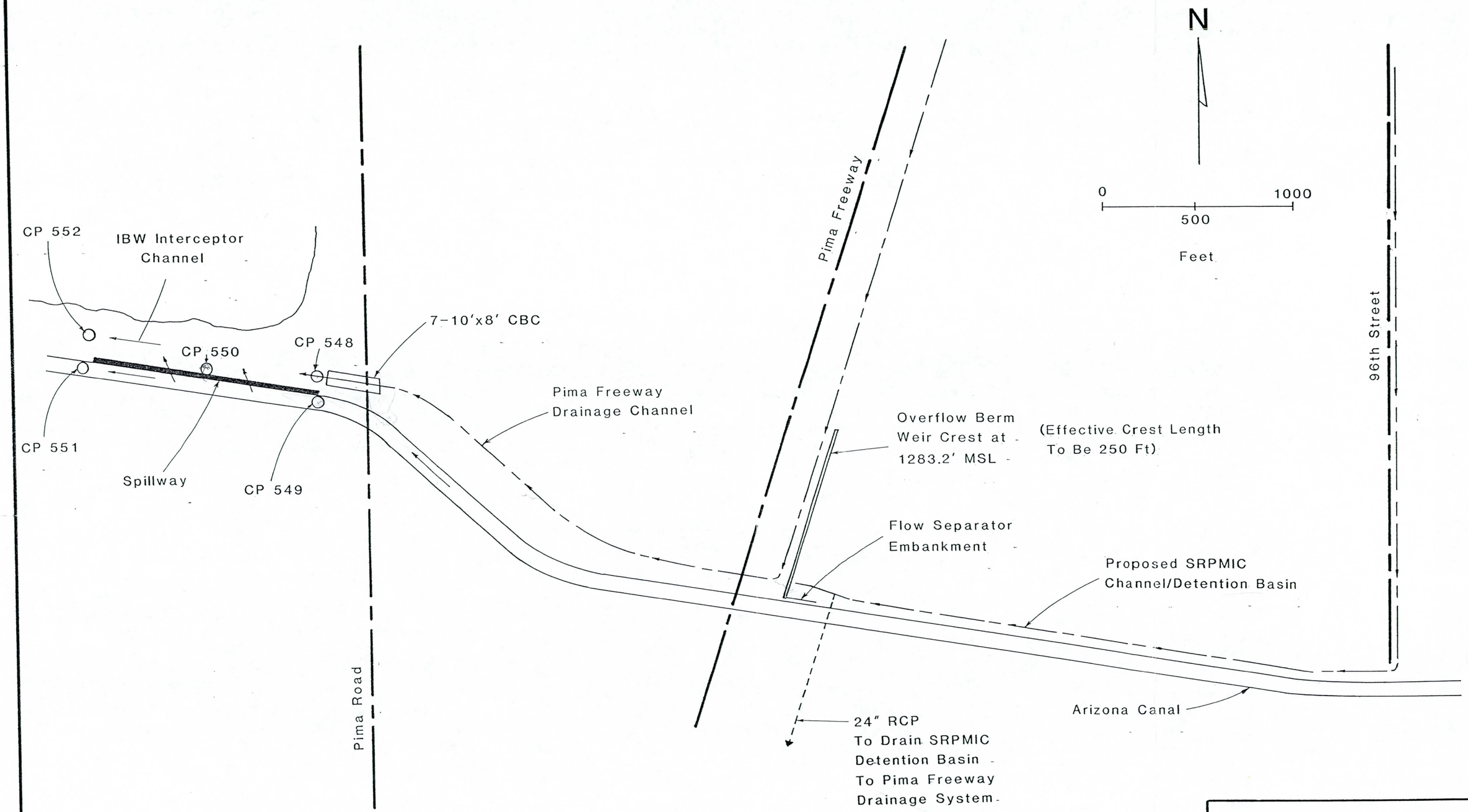
Concentration Point	Peak Discharge (cfs) 100-Year Event			Peak Discharge (cfs) 2-Year Event	
	Corps of Engineers	Existing Conditions	With Pima Freeway & SRPMIC Drainage System 12 hr	Existing Conditions w/o Berm	With Pima Freeway & SRPMIC Drainage System
548	900	2,570	3,324	91	107
549	7,100	5,275	5,075	2,051	2,007
550	4,600	2,637	2,455	38	7
551	2,500	2,638	2,620	2,012	2,000
552	5,500	5,206	5,763	115	107

506 cfs

Note: A base flow of 1,600 cfs is assumed to be in the Arizona Canal during the 2-Year event.
It is assumed that SRP will drain the Arizona Canal of all irrigation waters during the 100-Year event.

HEC-1 Models:	100-Year	2-Year
Existing Condition:	B1A2.12I	B2A.12I
Design Condition:	OL1I.12I	OL2I.12I

File: TAB1.WK1

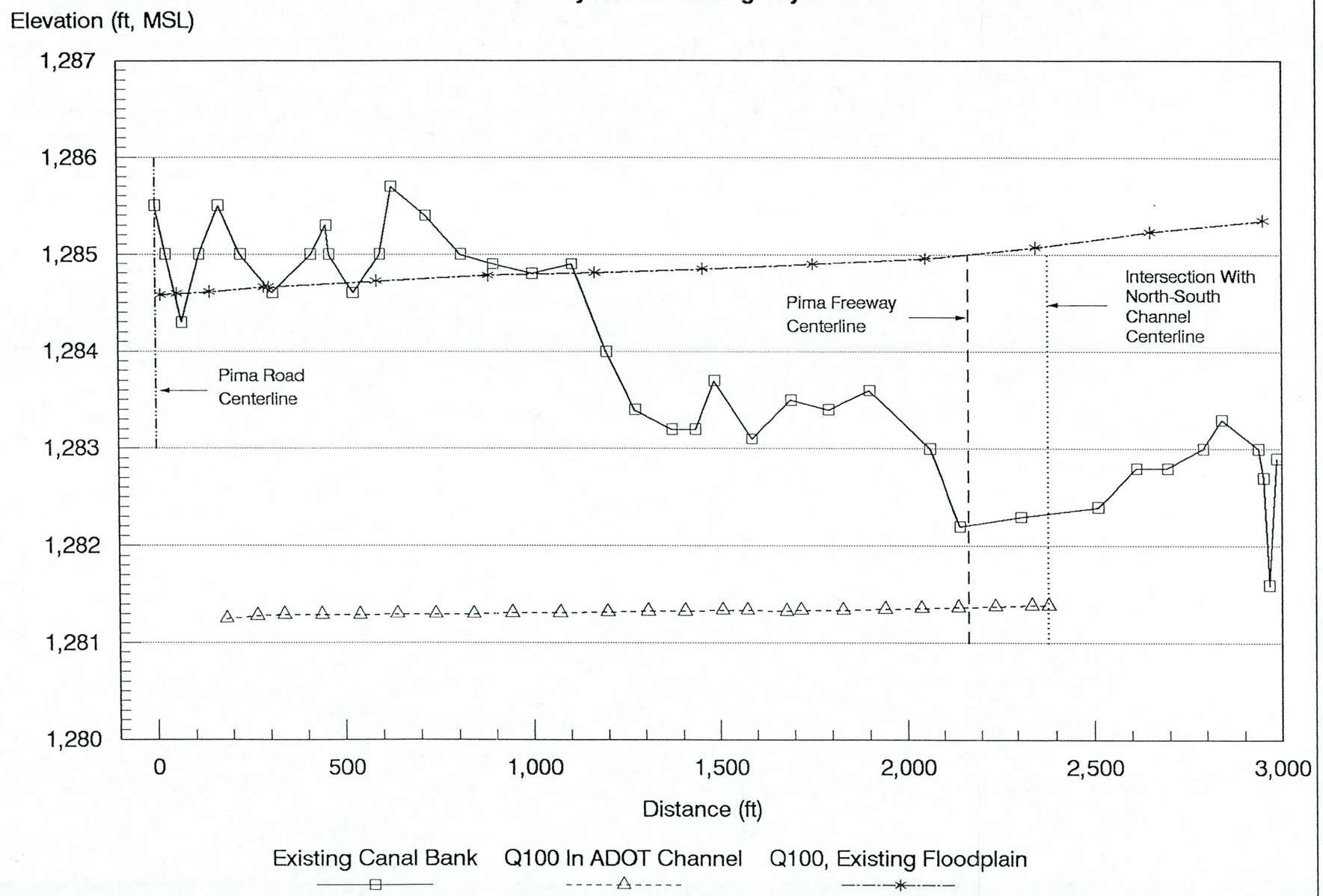


DRAINAGE SYSTEM SCHEMATIC

PIMA FREEWAY

FIGURE 1

Figure 2
Profile Along North Bank Of Arizona Canal
Pima Freeway Offsite Drainage System



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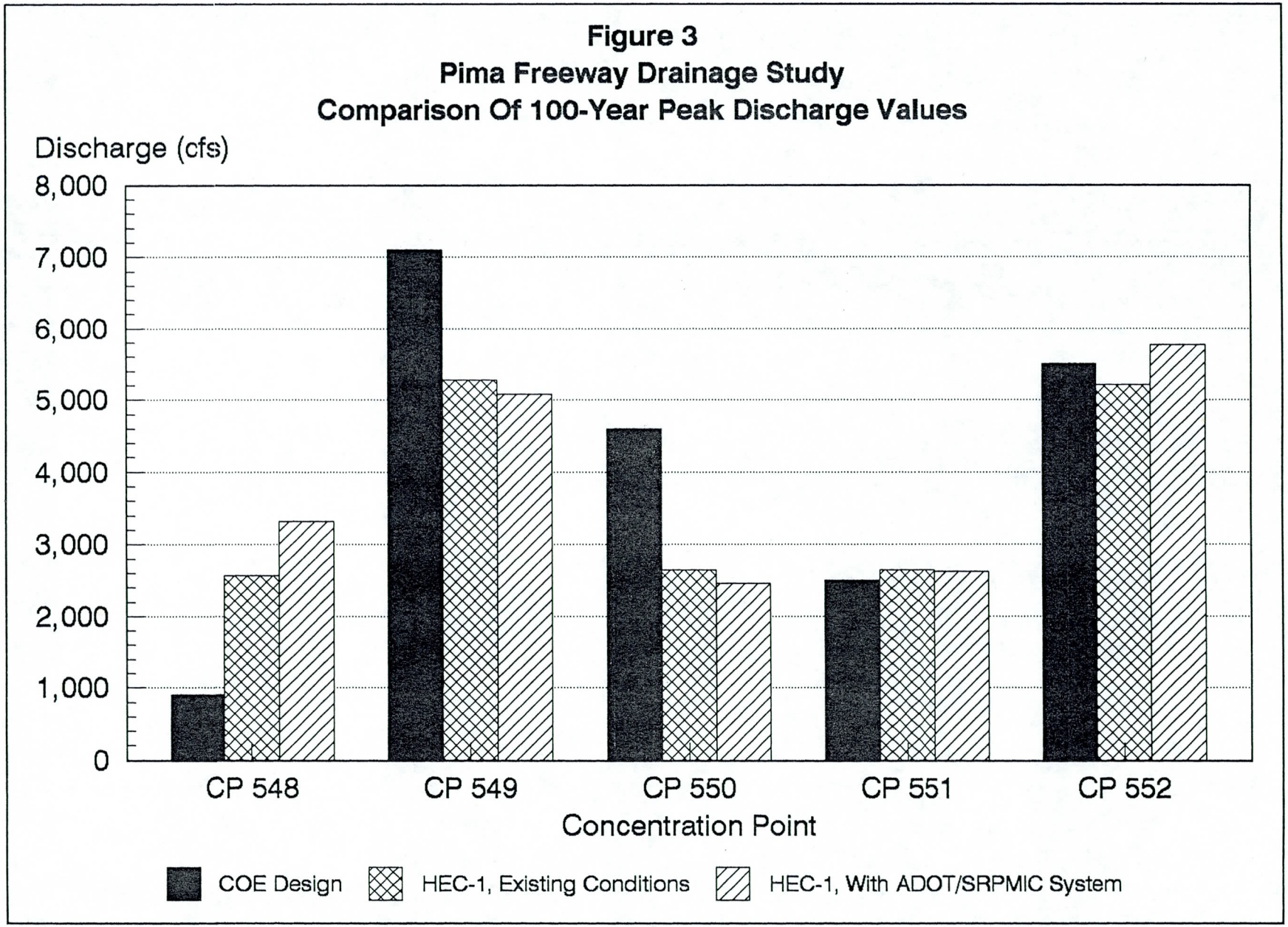


Figure 3
Pima Freeway Drainage Study
Comparison Of 100-Year Peak Discharge Values
Discharge (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
CP 548
CP 549
CP 550
CP 551
CP 552
Concentration Point
COE Design
HEC-1, Existing Conditions
HEC-1, With ADOT/SRPMIC System

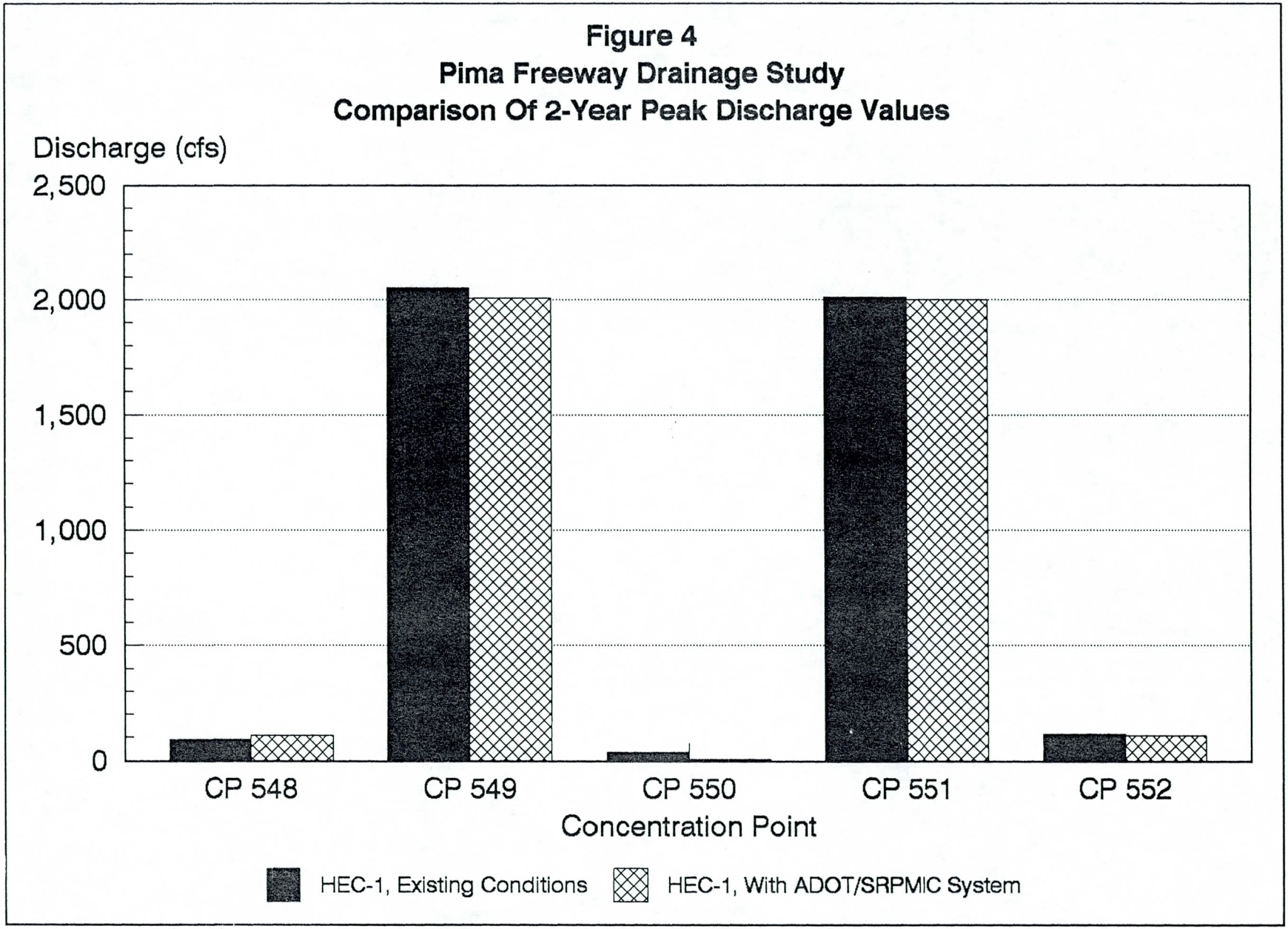
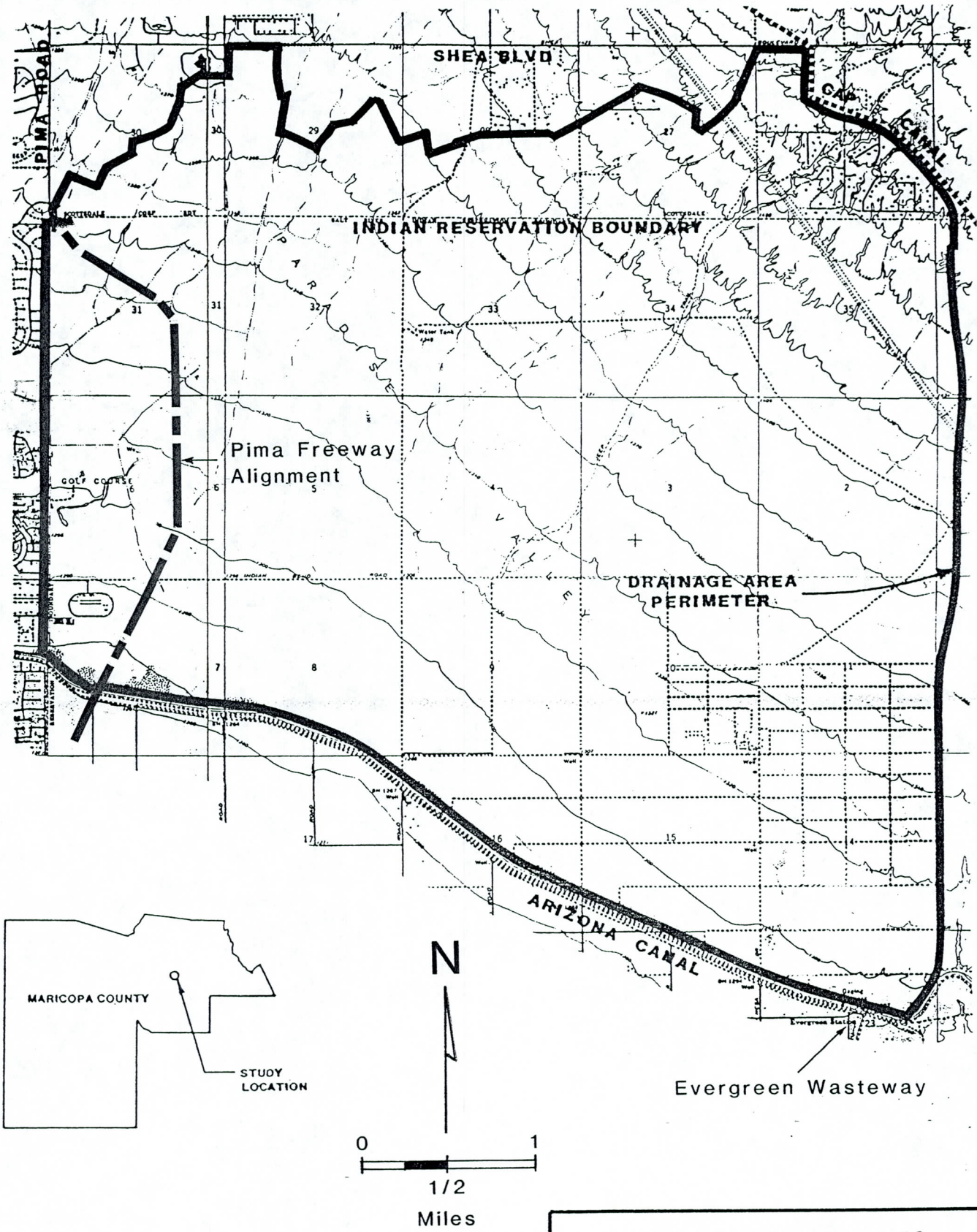


Figure 4
Pima Freeway Drainage Study
Comparison Of 2-Year Peak Discharge Values
Discharge (cfs)
2,500
2,000
1,500
1,000
500
0
CP 548
CP 549
CP 550
CP 551
CP 552
Concentration Point
HEC-1, Existing Conditions
HEC-1, With ADOT/SRPMIC System



WATERSHED BOUNDARIES

PIMA FREEWAY DRAINAGE STUDY

FIGURE 5

Terminate Fence 0'-6" from Face of Bridge Piers

175+00

180+00

185+00

190+00

195+00

Fnd. S.R.P. B.C. To Remain

Fnd. S.R.P. B.C. To Remain

Fnd. S.R.P. B.C. To Remain

Fnd. S.R.P. B.C. Remove and Reset

R/W

AZ Canal Conveyance Channel

50'

50'

PI 169+57.84

PC 174+64.37

PT 176+33.71

PC 180+78.71

PT 183+12.79

PC 188+96.12

PT 191+04.15

N 39° 59' 58.2" W

New 7-10' x 8' x 287' CBC
Sta 193+15.42
AZ Canal Conveyance Channel

New 78'x25' Energy Dissapator
Sta 196+36

New Chain Link Fence
Type I (72"), 4415 L.F.
Std. C-12.20

SECTION LINE
S 01°14'18.9" W

MATCH LINE

167+00

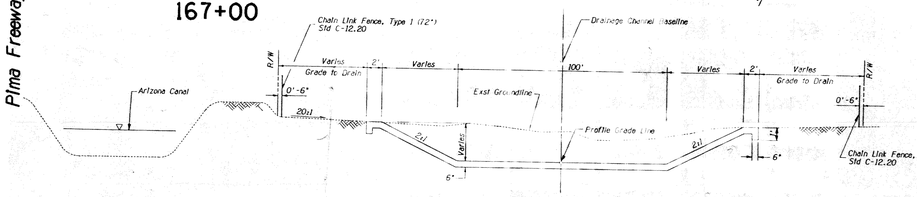
Cst ℄

Pima Freeway

ARIZONA CANAL

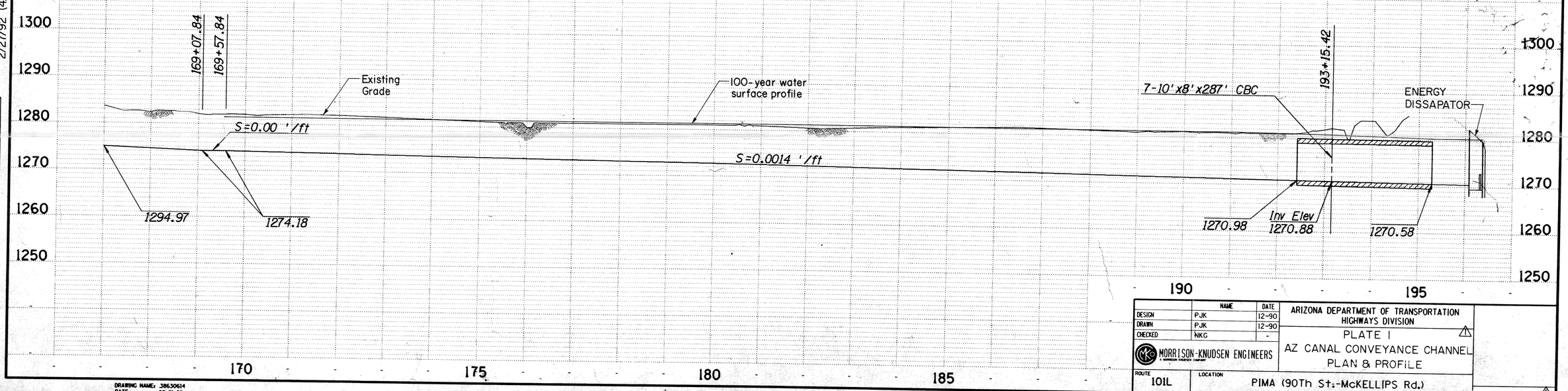
171+55.37

CURVE DATA					
REF. NO.	△	R	L	T	EXT.
A	12°18' 00"R	788.85'	169.35'	85.00'	4.57'
B	22°00'00"R	609.63'	234.08'	118.50'	11.41'
C	19°12'00"L	620.79'	208.03'	105.00'	8.82'



TYPICAL SECTION
Sta 00+00.00 - Sta 00+00.00
See Dwg. No. D-10.2

FOR INFORMATION ONLY △
NOT FOR CONSTRUCTION



	NAME	DATE
DESIGN	PJK	12-90
DRAWN	PJK	12-90
CHECKED	NKG	-

MORRISON-KNUDSEN ENGINEERS

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PLATE I △

AZ CANAL CONVEYANCE CHANNEL
PLAN & PROFILE

ROUTE 101L

LOCATION PIMA (90Th St.-McKELLIPS Rd.)

△ Revised 4/92 by Parsons DeLeuw, Inc. As Dwg. 'PLATE I', Exhibit to R.L. Ward Concept Design Memo.- 2/27/92 (4/27/92 Rev.)

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

DRAWING NAME: J8630614
DATE: 03-31-92

△ △ OF