MEMORANDUM

REGIONAL FLOOD CONTROL DISTRICT
FLOODPLAIN MANAGEMENT DIVISION

DATE: July 8, 2010

TO: Floodplain Management Division Staff

FROM: Eric Shepp, P.E., Division Manager
Floodplain Management Division

SUBJECT: Update to Special Studies 18 and 33 – Soldier Canyon Wash

On June 10, 2010, the Chief Engineer approved the use of the floodplain delineations from the Technical Design Notebook for the Soldier Canyon Wash and its tributaries, prepared by Flood Control District staff.

This new study replaces the older Soldier Canyon Wash Study prepared by RGA Engineer, and sealed by Antonio Figueroa-Iturralde on 8/7/92, as well as Special Study 33 for Milagrosa Hills Wash, prepared by Simons, Li & Associates and sealed by John Wallace on March 13, 1998.

This study has been included in the Special Studies GIS layer.

Please let me know if you have any questions.

Approved
RTH
7-5-94

ARROYO
ENGINEERING, INC.
Water Resources & Civil Engineering Consultants

HYDROLOGIC AND HYDRAULIC DESIGN REPORT FOR A WASH CROSSING OF THE PLANNED SOLDIER TRAIL EXTENSION

Prepared for:

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AND FLOOD CONTROL DISTRICT
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Justin M. Turner

June 29, 1994

ARROYO ENGINEERING, INC.

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I. INTRODUCTION

1.1 Introduction and Project Location

The Pima County Department of Transportation and Flood Control District (District) intends to extend Soldier Trail, from its existing intersection with Mount Lemmon Short Road, northward to Coronado Road. This will be a rural roadway and will provide access to existing and future residents of the area. It is currently planned that this rural roadway will not be paved. Arroyo Engineering, Inc. was retained by the District to study a portion of the Millagrosa Hills Wash and its possible affect on the design of this new roadway.

This hydrologic and hydraulic design report pertains to the engineering assessment of improvements that will be done to Soldier Trail in order to cross the Millagrosa Hills Wash. This dip crossing of Soldier Trail occupies a portion of the southeast one-quarter of Section 18 of Township 13 South, Range 16 East, Gila and Salt River Base and Meridian. The planned extension to Soldier Trail is generally bounded by the existing paved portion of Soldier Trail on the south and Mount Lemmon Short Road on the west. Figure 1 of this report contains a location map of the roadway project. With regard to stormwater runoff, the Millagrosa Hills Wash is within the upper Soldier Trail Wash watershed.

1.2 Purpose

The purpose of this report is to present the engineering analyses made of five alternative wash crossings, and to support the recommendation of a "best" roadway crossing of Millagrosa Hills Wash. The major drainage related objectives of this study were to:

1. Predict the 5-year, 10-year, 25-year, and 100-year flood discharges for the Millagrosa Hills Wash, upstream from the roadway crossing;

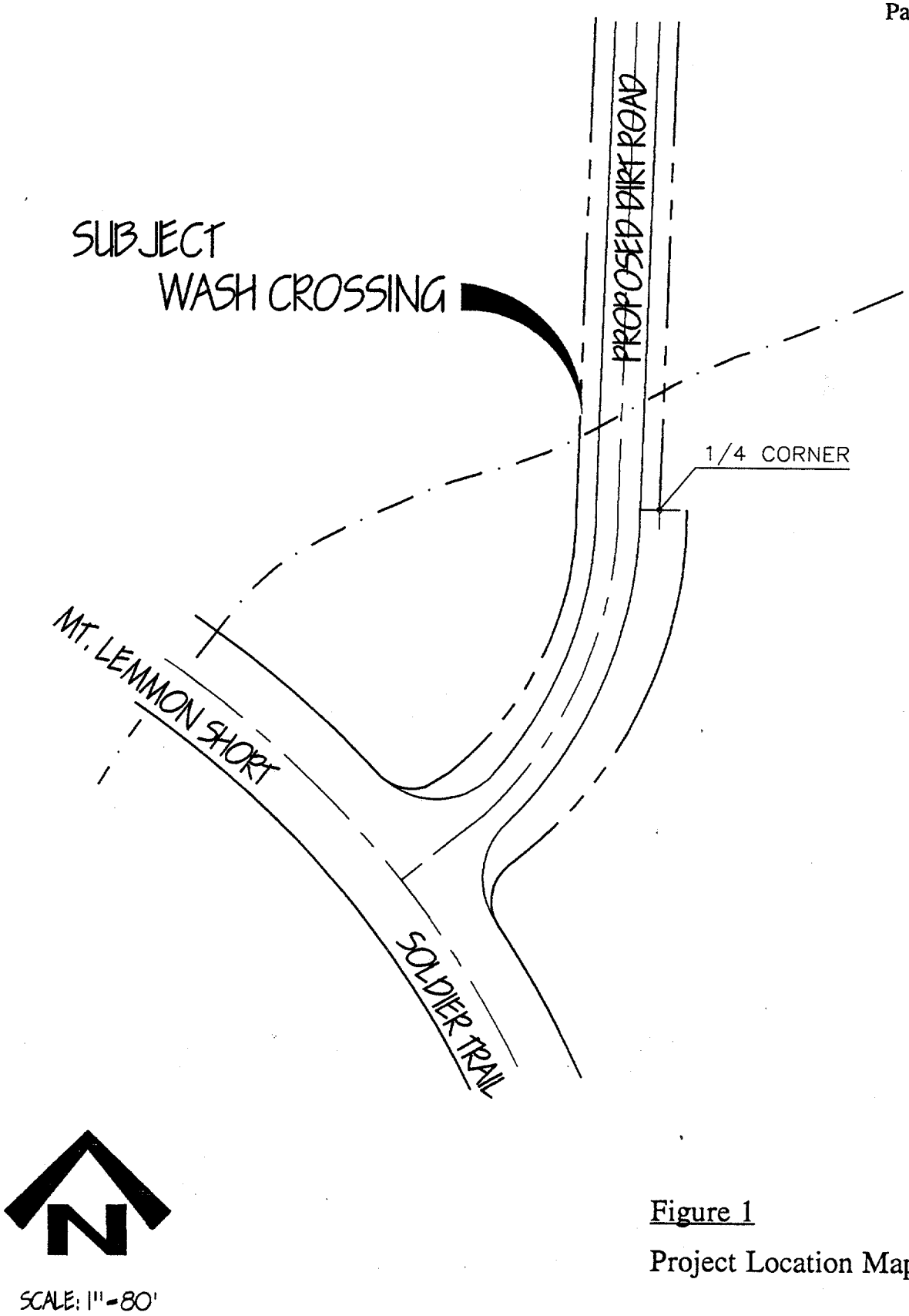

Figure 1

Project Location Map

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2. Evaluate the existing hydraulic capacity of the upstream portion of Millagrosa Hills Wash, and predict the amount of floodwaters that will break out of the channel and flow southward away from the planned roadway crossing;
3. Evaluate the hydraulic capacities of alternative wash crossings;
4. Evaluate the generalized merits of each alternative wash crossing; and,
5. Recommend a single "best" alternative based upon consideration of total estimated construction cost, anticipated long-term maintenance cost, and least problematic to implement.

1.3 Description of Alternative Wash-Crossing Structures

Within the context of this investigation, there are many possible wash-crossing designs that may be practicable. However, each of these possible concept designs have certain attributes and limitations. In this investigation, only five possible wash-crossing designs were considered. A brief description is given below of these five alternative wash-crossing structures considered in the investigation.

1. Alternative No. 1: An at-grade wash crossing of Millagrosa Hills Wash with the capacity to convey the entire range of flows up to and including the 100-year flood without increasing the likelihood of a flow breakout. All flows would be conveyed over the top of the roadbed, and "all-weather access" would not be provided to those motorists using the road during times of flood. This Alternative includes the grading of the approach roadways so that the relative high leftbank would be maintained, thereby helping prevent floodwaters from leaving the main channel during extreme events. A concrete apron and upstream and downstream cutoff walls would also help prevent erosion of the otherwise earthen roadbed. Figure 2 of this report contains a plan and profile sheet showing the preliminary design of this alternative.

2. Alternative No. 2: An elevated roadway crossing of Millagrosa Hills Wash with five 24-inch-diameter corrugated metal pipe culverts (5-24" CMP's). This alternative was based upon the preliminary design prepared by Mr. J.B. Trimble, P.E., and dated March 8, 1994. In keeping with the concept design presented by Mr. Trimble, the pipe culverts do not have inlet or outlet headwall. A concrete apron, without upstream and downstream cutoff walls, would help prevent erosion of the otherwise earthen roadbed. Nearly all flows would be conveyed over the top of the roadbed, and "all-weather access" would not be provided to those motorists using the road during times of flood. This Alternative includes the grading of the approach roadways so that the relative high leftbank would be maintained, thereby helping to prevent floodwaters from leaving the main channel during extreme events. Figure 3 of this report contains a plan and profile sheet showing the preliminary design of this alternative.

3. Alternative No. 3: An elevated roadway crossing of Millagrosa Hills Wash with five 60-inch-diameter reinforced concrete pipe culverts (5-60" RCP's). The pipe culverts have standard ADOT inlet and outlet wings with a skew angle of 20 degrees (Std. Drawing No. B-04.30 and B-04.10). Nearly all flows would be conveyed within the culverts, yet "all-weather access" would not be provided to those motorists using the road during times of flood. This Alternative includes the construction of an elevated roadway embankment having a minimum of 18 inches of cover over the top of the culverts. During extreme events, when the culvert capacity is exceeded, floodwaters would overtop the roadbed and cause floodwaters to leave the main channel. For the purposes of this investigation, it was assumed that the embankment fill slopes would be set at 2h:1v in order to minimize the need to obtain slope easements from adjoining property owners located both upstream and downstream from the wash crossing. Figure 4 of this report contains a plan and profile sheet showing the preliminary design of this alternative.

4. Alternative No. 4: An elevated roadway crossing of Millagrosa Hills Wash with a 3-cell, 10-foot-wide by 4-foot-high reinforced concrete box culvert (3-10' X 4' RCBC). The

box culverts have standard ADOT inlet and outlet wings with a skew angle of 20 degrees (Std. Drawing No. B-04.30 and B-04.10). Nearly all flows would be conveyed within the culverts, yet "all-weather access" would not be provided to those motorists using the road during times of flood. This Alternative includes the construction of an elevated roadway embankment having a minimum of 24 inches of cover over the top of the culverts. During extreme events, when the culvert capacity is exceeded, floodwaters would overtop the roadbed and cause floodwaters to leave the main channel. For the purposes of this investigation, it was assumed that the embankment fill slopes would be set at 2h:1v in order to minimize the need to obtain slope easements from adjoining property owners located both upstream and downstream from the wash crossing. Figure 5 of this report contains a plan and profile sheet showing the preliminary design of this alternative.

5. Alternative No. 5: An elevated roadway crossing of Millagrosa Hills Wash with a 5-cell, 10-foot-wide by 4-foot-high reinforced concrete box culvert (5-10' X 4' RCBC). The box culverts have standard ADOT inlet and outlet wings with a skew angle of 20 degrees (Std. Drawing No. B-04.30 and B-04.10). All flows would be conveyed within the culverts, and "all-weather access" would be provided to those motorists using the road during times of flood. This Alternative includes the construction of an elevated roadway embankment having a minimum of 24 inches of cover over the top of the culverts. During extreme events, the culvert would still have adequate capacity and floodwaters would not overtop the roadbed and cause floodwaters to leave the main channel. For the purposes of this investigation, it was assumed that the embankment fill slopes would be set at 2h:1v in order to minimize the need to obtain slope easements from adjoining property owners located both upstream and downstream from the wash crossing. Figure 6 of this report contains a plan and profile sheet showing the preliminary design of this alternative.

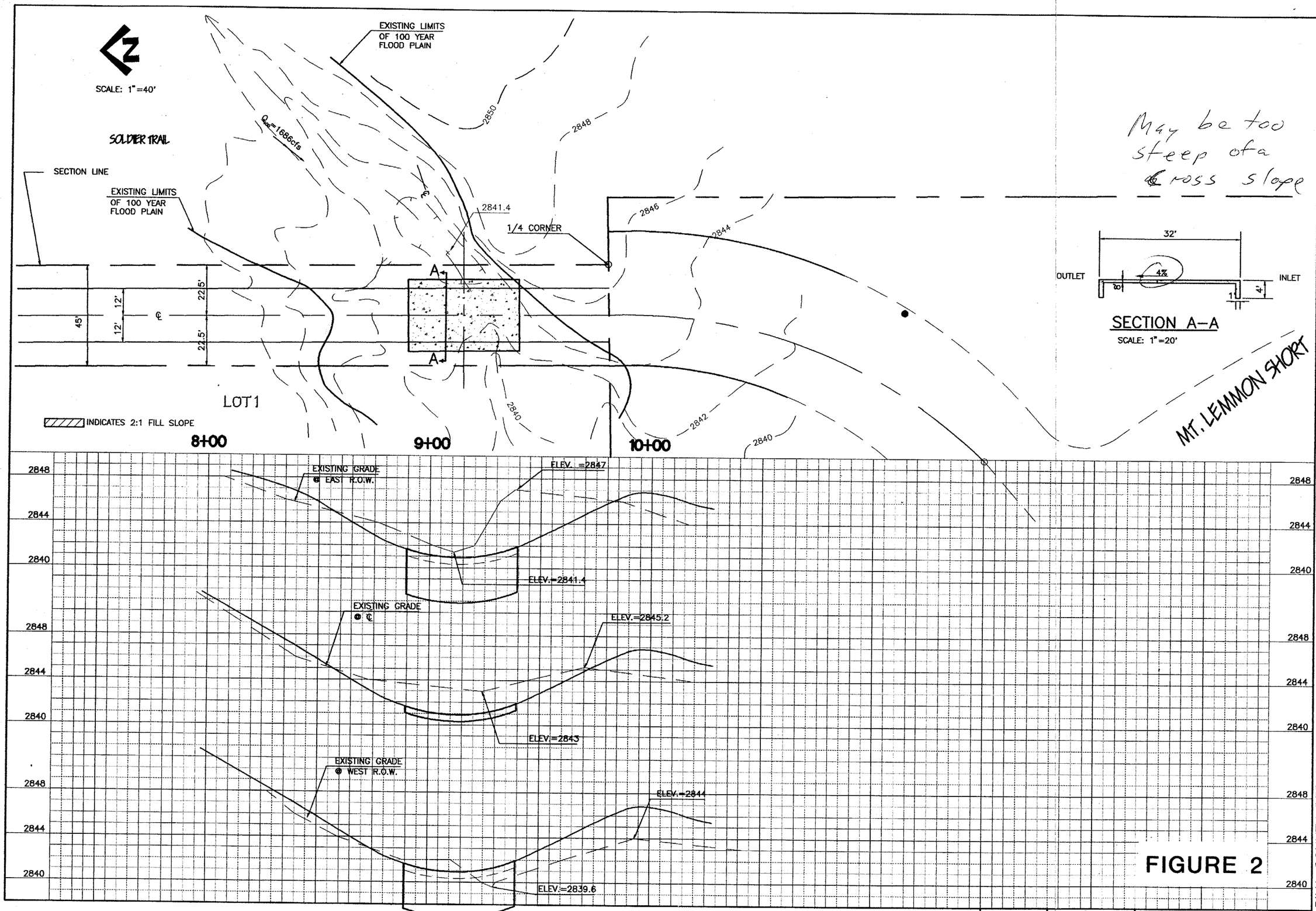

FIGURE 2

SCALES	HORIZ. 1"= 40' / VERT. 1"= 8'	SHEET	OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

ALTERNATIVE 1
AT–GRADE DIP CROSSING
WITH CONCRETE APRON

NO.	REVISION DESCRIPTION	DIV./SECT.ENGR.	DATE

	DATE
DESIGNED	
DRAWN	
CHECKED	
PROJ.ENGR.	

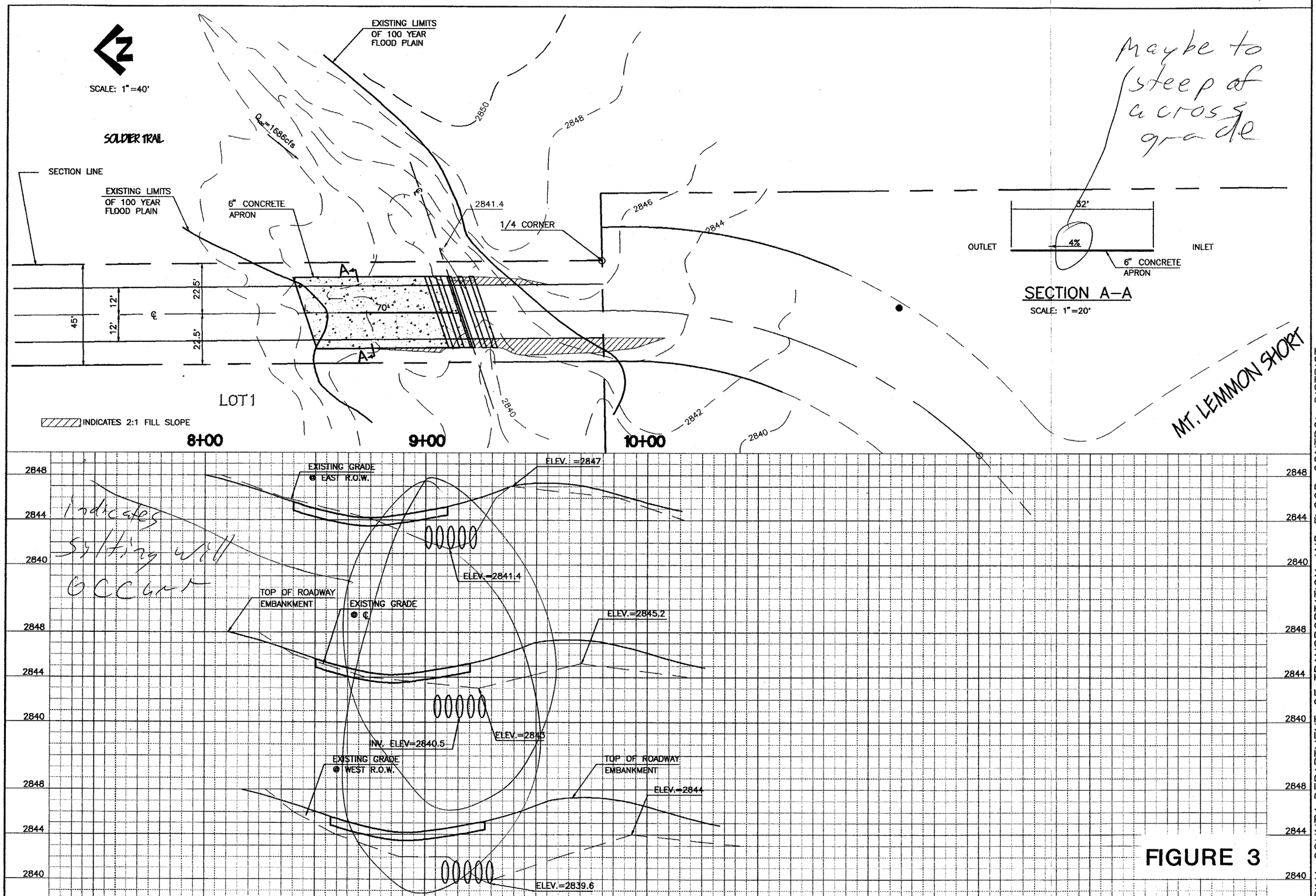

FIGURE 3

SCALES	HORIZ. 1"= 40'
	VERT. 1"= 8'

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

ALTERNATIVE 2
5–24" CMP's

NO.	REVISION DESCRIPTION	DIV./SECT.ENGR.	DATE

	DATE
DESIGNED	
DRAWN	
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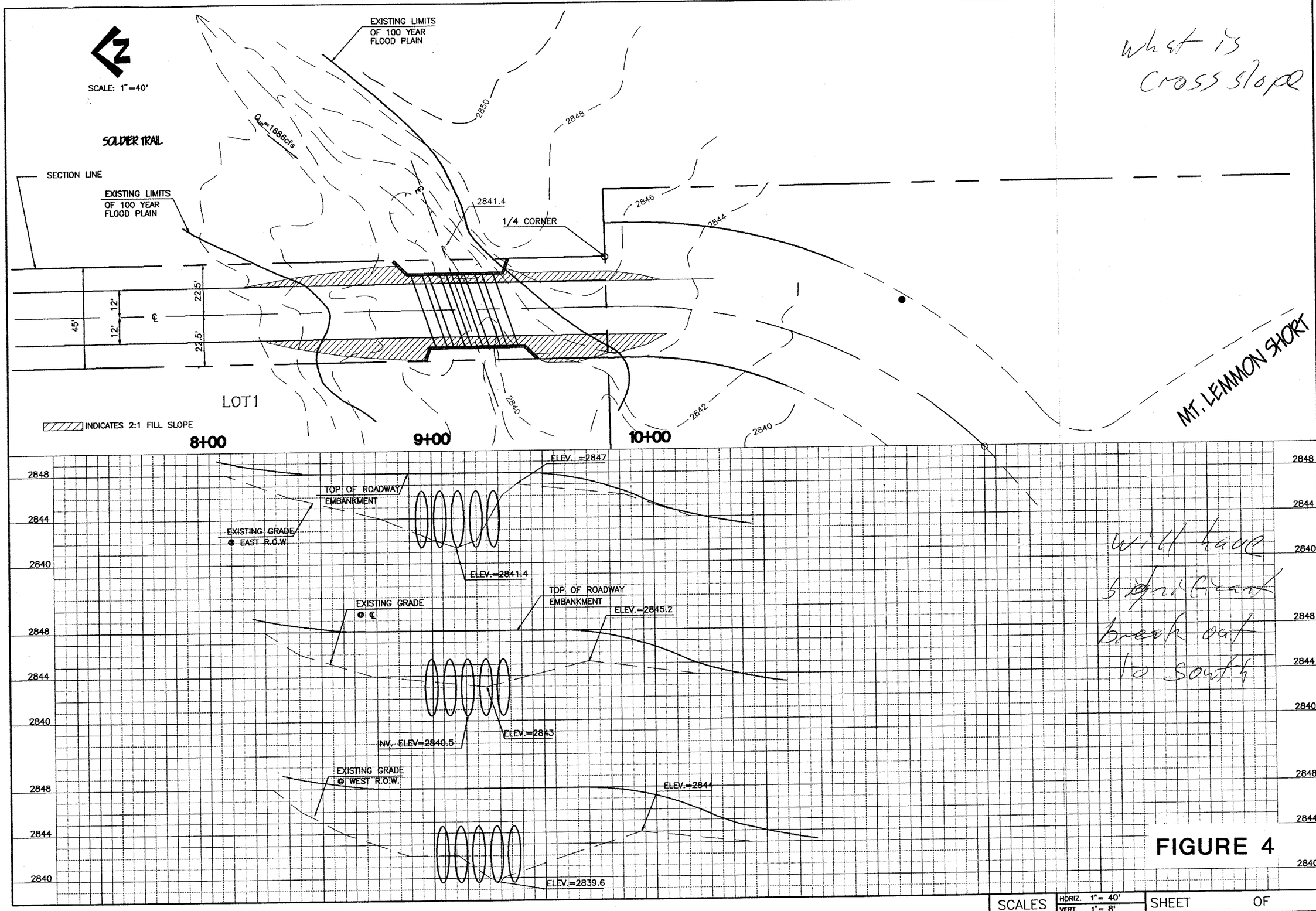

FIGURE 4

SCALES HORIZ. 1"= 40' VERT. 1"= 8'

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

ALTERNATIVE 3
5-60" RCP's WITH ADOT INLET WINGS

NO.	REVISION DESCRIPTION	DIV./SECT.ENGR.	DATE

DESIGNED
DRAWN
CHECKED
PROJ.ENGR.

DATE

12

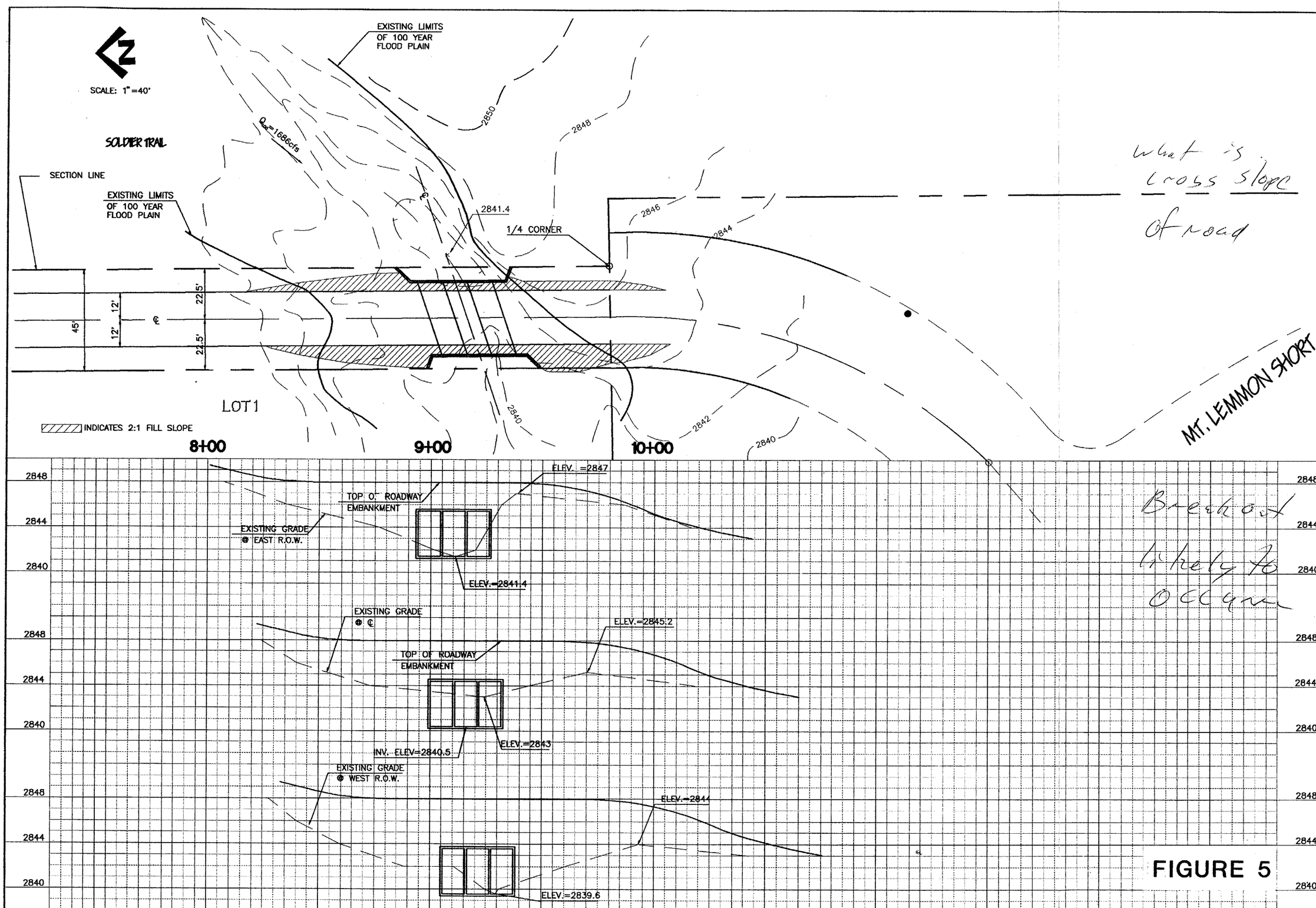

FIGURE 5

SCALES	HORIZ. 1"= 40'	SHEET	OF
	VERT. 1"= 8'		

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

ALTERNATIVE 4
3-10'x4' RCBC's WITH ADOT INLET WINGS

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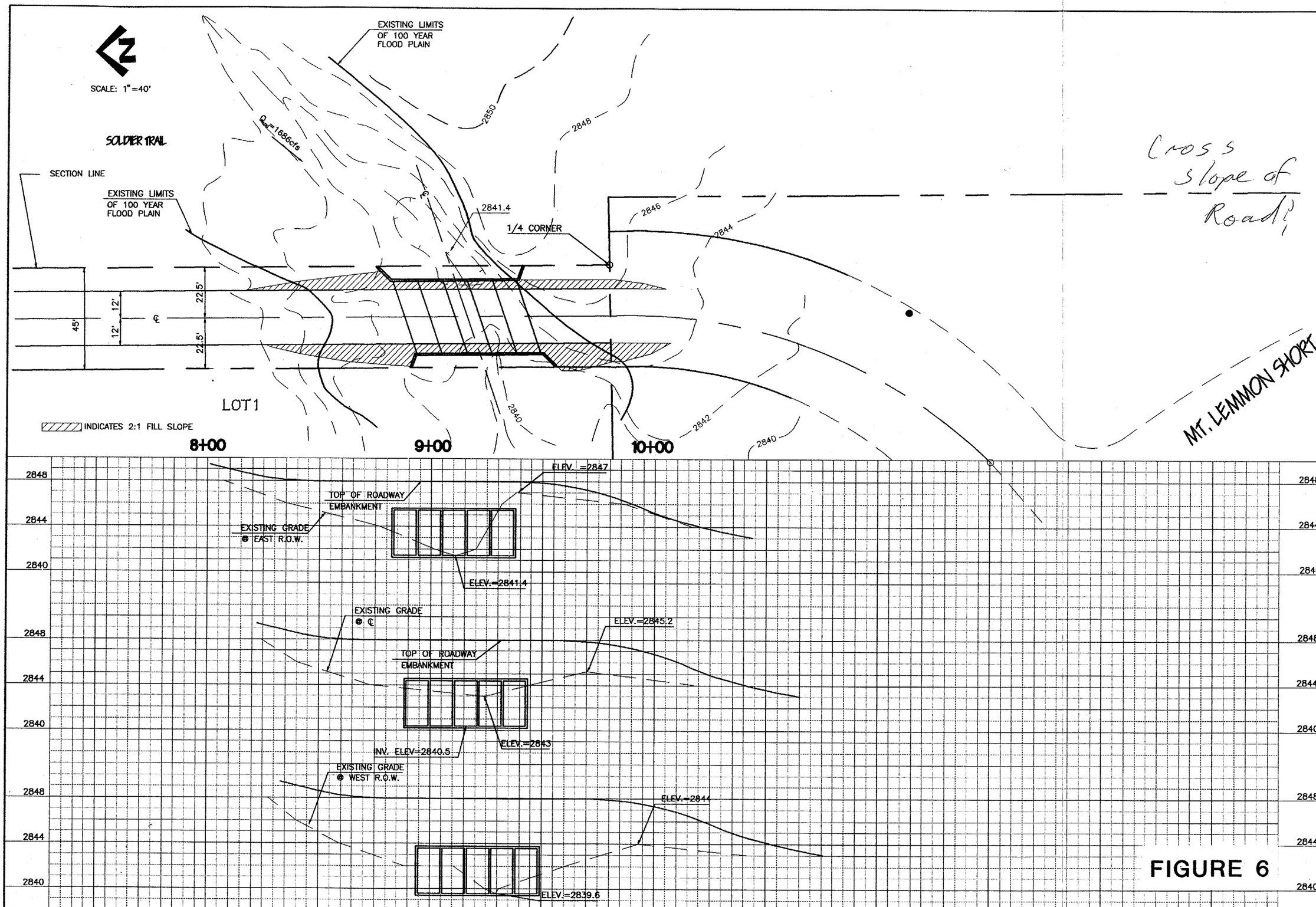

FIGURE 6

SCALES	HORIZ. 1"= 40' / VERT. 1"= 8'	SHEET	OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

ALTERNATIVE 5
5-10'x4' RCBC's WITH ADOT INLET WINGS

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II. HYDROLOGIC AND HYDRAULIC ANALYSES

2.1 Hydrologic Analysis of Millagrosa Hills Wash

Peak discharges for Millagrosa Hills Wash were predicted for existing conditions by using the Pima County Hydrology Method. Basic data for use in the hydrologic calculations consisted of watershed characteristics (area, watercourse length, and slope), watershed type, hydrologic soil groups, vegetative cover density, impervious cover, runoff coefficients, precipitation depths, and basin factors.

The drainage area affecting the subject roadway was delineated using a 2000-scale 7.5-Minute Topographic Quadrangle Map. Afterwards, the overall drainage patterns were verified in the field. A map showing the watershed boundary is given in Appendix Number 1 of this report.

may be a little low

For the purposes of this hydrologic investigation, the subject watershed was characterized as being "Natural", and the impervious cover was estimated to be 0% for existing conditions. Hydrologic soil groups were selected using the information given on the Soil Conservation Service soil maps for the area. Vegetative cover types and densities were selected based upon field investigation. Corresponding runoff coefficients were determined by utilizing the tables given in the Pima County Hydrology Manual. The one-hour, 100-year precipitation depth of 2.63 inches was used in accordance with guidelines and isopluvial maps found in the Pima County Hydrology Manual.

Table 1 of this report contains a summary of the 5-, 10-, 25-, and 100-year flood peaks estimated for Millagrosa Hills Wash at a point located upstream from the predicted breakout. In addition, Appendix Number 1 of this report contains the Hydrologic Computation Sheets prepared as part of this project.

TABLE 1. SUMMARY OF CALCULATED FLOOD PEAKS FOR MILLAGROSA HILLS WASH AT A POINT LOCATED UPSTREAM FROM THE FLOW BREAKOUT

Drainage Area (Acres)	5-Year Flood Peak (cfs)	10-Year Flood Peak (cfs)	25-Year Flood Peak (cfs)	100-Year Flood Peak (cfs)
660	429	1074	1181	2147

NOTE: Flood peaks for this concentration point are representative of conditions found upstream from the flow breakout.

2.2 Hydraulic Analysis of Millagrosa Hills Wash

In order to develop information needed to analyze the relative hydraulic characteristics of each of the five alternative wash-crossing structures, a detailed hydraulic analysis was undertaken based upon a HEC-2 model of Millagrosa Hills Wash. This particular analytical model was selected because of its ability to readily calculate the necessary hydraulic characteristics corresponding to each of the many varied cross sections that were used to represent the local river system. Ground-profile data used to assemble this hydraulic model were based upon digitized cross sections developed from a detailed topographic map of the Millagrosa Subdivision provided by Mr. Jeremy Braun. This 40-scale topographic map was based upon aerial photography taken in 1989, and represents the best-available topographic information for the area. During initial visits to the subject wash crossing, it was noted by staff from Arroyo Engineering, Inc. that some grading and earthwork has taken place in the vicinity of the crossing since 1989 when the aerial photography was taken. Consequently, because of these changes made to the existing dirt roadway, it is recommended that a new survey of the ground elevations near the wash crossing be done during the design phase of this project.

For the purposes of this study, eleven hydraulic cross sections were used to model the approximately one-eighth-mile-long reach of Millagrosa Hills Wash. This HEC-2 model began about 150 feet upstream from Mount Lemmon Short Road, and continued upstream another 670 feet. The individual cross-section numbers correspond to distances, in feet, measured upstream from Mount Lemmon Short Road. Figure 7 of this report contains a copy of the aforementioned topographic map of the study area, which shows the locations of these HEC-2 cross sections relative to the planned extension to Soldier Trail. In addition, copies of the input files, output files for the HEC-2 models of the wash can be found in Appendix Number 2 to this report. A total of four HEC-2 models were analyzed. These four models represent existing conditions.

Table 2 of this report contains a summary of the 5-, 10-, 25-, and 100-year flood peaks estimated for Millagrosa Hills Wash, at a point located downstream from the predicted breakout.

TABLE 2. SUMMARY OF CALCULATED FLOOD PEAKS FOR MILLAGROSA HILLS WASH AT THE SOLDIER TRAIL CROSSING

Drainage Area (Acres)	5-Year Flood Peak (cfs)	10-Year Flood Peak (cfs)	25-Year Flood Peak (cfs)	100-Year Flood Peak (cfs)
660	424	925	1006	1686

NOTE: Flood peaks for this concentration point are representative of conditions found downstream from the flow breakout in the vicinity of the wash crossing.

2.3 Hydraulic Analysis of Alternative Wash-Crossing Structures

In order to evaluate the At-Grade Dip Crossing (i.e., Alternative Number 1), the HEC-2 model of the existing Millagrosa Hills Wash was modified to include the eastern, higher edge of the roadway profile. Copies of the revised input files, output files for the HEC-2 models of

the wash can be found in Appendix Number 3 to this report. A total of four HEC-2 models were analyzed. These four models represent conditions that might occur should Alternative Number 1 be implemented.

Rather than further modify the HEC-2 model to represent the conditions that might occur if each of the remaining four alternatives were to be built, the roadway culverts were analyzed using the standard analytical procedure given in the Federal Highway Administration's "Hydraulic Design of Highway Culverts". In addition, the amount of flow overtopping the roadway was analyzed using the analytical procedure given in the City of Tucson's "Standards Manual for Drainage Design". These computations provided information concerning the relative amount of flow that would go through a culvert system or over the roadway embankment for various alternatives and storm frequencies.

Table 3 of this report contains a summary of the computed 5-, 10-, 25-, and 100-year flow depths and flow velocities. Except for the elevated roadway embankment with a 5-Cell 10' X 4' RCBC (i.e., Alternative Number 5), these data show that 100-Year All-Weather Access will not be provided by any of the alternatives examined. These data also show that flow depths computed for an elevated roadway with 2-24" CMP's (i.e., Alternative Number 2) are less than those computed for an At-Grade Dip Crossing (i.e., Alternative Number 1).

Table 3 also contains a summary of the flood frequency at which the roadway is overtopped and whether or not this overtopping will result in a flow breakout. These data show that the likelihood of a flow breakout during a 100-year flood will be less for an At-Grade Dip Crossing (Alternative Number 1) or a 5-Cell 10' X 4' RCBC (Alternative Number 5). Copies of the hydraulic computation sheets for analyzing culvert flow and roadway-embankment overflow can be found in Appendix Number 4 to this report.

TABLE 3. SUMMARY OF COMPUTED FLOW DEPTHS AND FLOW VELOCITIES

Alternative	Flood Frequency (Years)	Rise In CWSEL Caused By Alternative (ft)	Maximum Flow Depth Over Roadway Embankment (ft)	Maximum Flow Velocity Over Embankment (fps)	Will Alternative Increase Chances Of Flow Breakout? (Yes or No)
1. At-Grade Dip	5	-1.19	1.73	6.39	no
	10	-1.14	2.58	7.84	no
	25	-1.13	2.69	8.05	no
	100	-1.09	3.51	9.35	no
2. 5-24" CMP	5	1.88	2.77	3.31	no
	10	1.98	3.89	4.36	no
	25	2.08	4.10	4.46	no
	100	2.10	4.86	5.12	yes
3. 5-60" RCP	5	1.28	0.00	0.00	no
	10	3.48	0.20	1.30	yes
	25	3.58	0.40	1.86	yes
	100	3.70	1.30	3.40	yes
4. 3-10' X 4' RCBC	5	0.28	0.00	0.00	no
	10	1.78	0.00	0.90	no
	25	1.88	0.00	1.30	no
	100	3.40	1.00	3.27	yes
5. 5-10' X 4' RCBC	5	-0.42	0.00	0.00	no
	10	0.08	0.00	0.00	no
	25	0.18	0.00	0.00	no
	100	1.40	0.00	0.00	no

best options for flow containment

Note: Refer to Appendices Number 3 and 4 for Calculations. In this Table, CWSEL refers to Computed Water Surface Elevation.

2.4 Analysis of Culvert Sedimentation

In order to develop information needed to analyze the relative need for maintenance of the wash-crossing structure following floods, the likelihood of sediment deposition within the culvert or at its entrance was evaluated using the analytical procedure given in the City of Tucson "Standards Manual for Drainage Design". Copies of the culvert sedimentation computation sheets can be found in Appendix Number ~~5~~ 6 to this report. These computations show that, with exception of the At-Grade Dip Crossing, all of the culverts will become clogged with sediment during floods having a frequency equal to or greater than a 10-year event. Furthermore, in the absence of detailed calculations, it is believed that the 5-Cell 24" CMP's (i.e., Alternative Number 2) may become clogged during storms as frequent as a 2-year event. Therefore, from a long-term maintenance perspective, all of the culvert alternatives will require frequent, and possibly labor-intensive and expensive maintenance.

Only the "at grade crossing" had no sediment problems

III. RESULTS AND CONCLUSIONS

3.1 Summary of Results

This hydrologic and hydraulic design report pertains to the engineering assessment of improvements that will be done to Soldier Trail in order to cross the Millagrosa Hills Wash. This dip crossing of Soldier Trail occupies a portion of the southeast one-quarter of Section 18 of Township 13 South, Range 16 East, Gila and Salt River Base and Meridian.

Based upon the calculations previously presented in this report, the following general observations were made relative to the design of a roadway crossing of Millagrosa Hills Wash:

1. The hydraulic capacity of Millagrosa Hills Wash, upstream from the planned roadway extension, is insufficient to convey floods larger than a 5-year event without a substantial portion of the flow breaking out or overtopping the left or south bank of the channel. Based upon a detailed hydraulic analysis of Millagrosa Hills Wash, it is predicted that 424 cfs, 925 cfs, 1006 cfs, and 1686 cfs will remain in the main wash channel and overtop the planned roadway extension during a 5-, 10-, 25-, and 100-year flood, respectively;

2. The hydraulic capacity of Millagrosa Hills Wash, at the roadway crossing itself, is also insufficient to convey floods larger than a 100-year event without a substantial portion of the flow breaking out or overtopping the left or south bank of the channel. In other words, the existing channel at the roadway has ample capacity to convey floods smaller than or equal to the 100-year event, and any floods larger than a 100-year event, or any further obstruction in floodwater-carrying capacity caused by roadway construction, may result in a potentially hazardous break out;

3. Five alternative wash-crossing structures, consisting of an At-Grade Dip Crossing and four different culvert design concepts, were examined with regard to hydraulic capacity. These computations showed that, with the exception of the At-Grade Dip Crossing (i.e., Alternative Number 1), all of the remaining alternatives will result in a break out at the roadway crossing, thereby potentially harming downstream property owners or motorists;

4. These same five alternative wash-crossing structures were examined with regard to their relative ability to convey the incoming sediment load without clogging. These computations showed that, with the exception of the At-Grade Dip Crossing (i.e., Alternative Number 1), all of the remaining alternatives will experience partial clogging by sediment deposition during storms as frequent as a 5-year event;

5. The five alternative wash-crossing structures were examined with regard to the need for flowage and slope easements. These analyses showed that, with the exception of the At-Grade Dip Crossing (i.e., Alternative Number 1), all of the remaining alternatives will require the acquisition of an upstream flowage easement resulting from increases in 100-year water surface elevations ranging from as little as 1.4 feet to as much as 3.7 feet. Neither the total area encompassed within the required flowage easement, nor the cost of the easement were specifically quantified as part of this investigation. For the purposes of this hydraulic investigation, it was assumed that the embankment fill slopes will be built at a slope of 2-foot-horizontal to 1-foot-vertical (2h:1v). This was done in order to eliminate the need for a slope easement outside the available right-of-way for this project. However, if a fill slope of 4h:1v were to be used, as required by AASHTO, then, with the exception of the At-Grade Dip Crossing (i.e., Alternative Number 1), all of the remaining alternatives will require additional right-of-way or a slope easement for construction. Furthermore, with the exception of the At-Grade Dip Crossing (i.e., Alternative Number 1), all of the remaining alternatives will require additional right-of-way or a slope easement on the downstream side of the roadway in order to allow for the construction of rock riprap splash pads to control erosion at the culvert outlets; and,

6. The five alternative wash-crossing structures were examined with regard to total probable construction cost. These analyses are given in Appendix Number 7 to this report, and are summarized below in Table 4. These costs include material and construction labor, however, these costs do not include engineering, or right-of-way acquisition. These costs are preliminary and are intended for general planning purposes only.

TABLE 4: OPINION OF PROBABLE COST

Alternative	Opinion of Probable Cost
1. At-Grade Dip Crossing	$ 13,000
2. 5-24" CMP	$ 14,500
3. 5-60" RCP	$ 43,500
4. 3-10' X 4' RCBC	$ 54,900
5. 5-10' X 4' RCBC	$ 75,000

3.2 Conclusions and Recommendations

Based upon the engineering analyses presented in this report, it is concluded that a relatively inexpensive At-Grade Dip Crossing can be build in conjunction with the planned extension to Soldier Trail. This alternative is better than the remaining four elevated wash-crossing alternatives examined. It is believed that the At-Grade Dip Crossing will be less expensive to construct than the other four culvert alternatives, and furthermore, the At-Grade Dip Crossing will not require the acquisition of additional right-of-way or easements for flowage or embankment slope constructions. In addition, the At-Grade Dip Crossing will require substantially less maintenance resulting from culvert clogging.

Even though the At-Grade Dip Crossing is the preferred alternative for this particular project, it does have the highest, or nearly highest, risk associated with access during floods. It is predicted that maximum flow depths over the At-Grade Dip Crossing will be about 1.7 feet during a 5-year flood, and as much as 3.5 feet during a 100-year flood. Because of the relatively narrow width of the existing channel, and the resulting deep, high-velocity flood flows, only the construction of large capacity culverts, such as those represented by Alternative Numbers 3, 4, and 5, will eliminate floodwaters from overtopping the roadway except for brief periods during a 100-year flood.

The At-Grade Dip Crossing is the least expensive to construct, will have the lowest, long-term maintenance cost, and be the least problematical to construct, when compared to the other four other alternatives examined as part of this project. Based upon the foregoing summary and conclusions, the following recommendations are made with regard to the design of a roadway crossing of Millagrosa Hills Wash:

1. It is recommended that an At-Grade Dip Crossing be constructed in conjunction with the dirt road extension to Soldier Trail;

2. In order to alert motorists and pedestrians of the extreme hazard that may exist within the Dip Crossing during large flood events, it is recommended that appropriate roadway signs be erected in the vicinity of the dip crossing in accordance with County policy; and,

3. Because of possible inaccuracies in the base map used as part of this investigation, it is recommended that a field survey be made of the roadway grades for use in the final design.

IV. REFERENCES

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American Concrete Pipe Association, 1977, "Design Data, A Method of Determining Permissible Earth Cover Loads on Concrete Cylinder Pipe", Vienna, Virginia.

American Iron and Steel Institute, 1990, "Modern Sewer Design", Second Edition, Falls Church, Virginia.

American Society of Civil Engineers, 1972, "Spatially Varied Flow Over Side-Weirs", Journal of the Hydraulics Division, January, 1972, pp HY1-HY9.

Arizona Dept. of Transportation, 1988, "Standard Drawings", Highways Division, Structures Section, Phoenix, Arizona.

Arroyo Engineering, Inc., 1994, "Hydraulic Assessment of the Splitflows Affecting the 2.39-Acre Parcel Located at 5150 North Soldier Trail, Pima County, Arizona", an unpublished consulting report approved by Pima County on June 15, 1994.

City of Tucson, 1989, "Standards Manual For Drainage Design And Floodplain Management In Tucson, Arizona", Department of Transportation, Engineering Division, Tucson, Arizona.

Federal Highway Administration, 1985, "Hydraulic Design of Highway Culverts", Hydraulic Design Series No. 5

Pima County Dept. of Transportation and Flood Control District, 1984, "Drainage and Channel Design Standards for Local Drainage", Tucson, Arizona.

Pima County Dept. of Transportation and Flood Control District, 1977, "Prediction of Peak Discharges From Surface Runoff on Small Semiarid Watersheds", (Pima County Hydrology Manual), Tucson, Arizona.

U.S. Army Corps of Engineers, 1990, "HEC-2, Water Surface Profiles, User's Manual", Davis, California.

APPENDIX NUMBER 1:

HYDROLOGIC CALCULATION SHEETS

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Arroyo Engineering Inc.

2/7

Client:

Project Name: Flood-Hazard Study

Concentration Point: Main Wash

Prepared by: JMT

Date: 5/14/1994

Job #: PAZ-VC-01

Watershed Area (A): 660.0 Acres

Length of WaterCourse (L_c): 14900 feet

Length to Center of Gravity (L_{cA}): 8000 feet

Incremental Change in Length (L_i) ft.			Incremental Change in Elevation (H_i) ft.			Basin Factors (n_b)		
1: 2100	2: 3100	3: 2800	1: 160	2: 400	3: 600	1: 0.060	2: 0.060	3: 0.060
4: 2700	5: 2200	6: 2000	4: 400	5: 400	6: 640	4: 0.060	5: 0.060	6: 0.060

$I = SUM(L_i^3/H_i)^{0.5}$: 37996

Mean Slope (S_c) = $(L_c/I)^2$: 0.15377

Watershed Type: Desert Brush

Mean Basin Factor (n_b): 0.060

Flood Frequency: 100 years

Precipitation Depths

P_{24}(24-hour): 4.45 in.	Areal Value: N/A in.
P_6 (6-hour): 3.55 in.	Areal Value: N/A in.
P_3 (3-hour): 3.15 in.	Areal Value: N/A in.
P_2 (2-hour): 2.95 in.	Areal Value: N/A in.
P_1 (1-hour): 2.63 in.	Areal Value: N/A in.

Soil Groups: 0 %A, 0 %B, 0 %C, 100 %D

Vegetative Cover: 30 %

Impervious Cover: 0 %

Curve Numbers (CN):	Adjusted Curve Numbers (CN*):	Runoff to Rainfall Ratios (C):
A) N/A	A) N/A	A) N/A
B) N/A	B) N/A	B) N/A
C) N/A	C) N/A	C) N/A
D) 90.0	D) 92.32	D) 0.701
	Impervious areas 99 (constant)	Impervious areas 0.000

Runoff Supply Rate (q): 0.701 * i in./hr. (function of i)

Iterative Solution of T_c: 25 minutes

Rainfall Intensity (i) at Tc: 4.61 in./hr.

Runoff Supply Rate (q) at T_c: 3.23 in./hr.

Peak Discharge = 1.008qA(acres): 2147 cfs

Equation for T_c:

$$T_c = \frac{n_b(L_c L_{cA})^{0.3} q^{-0.4}}{50(S_c)^{0.4}} \text{ hours}$$

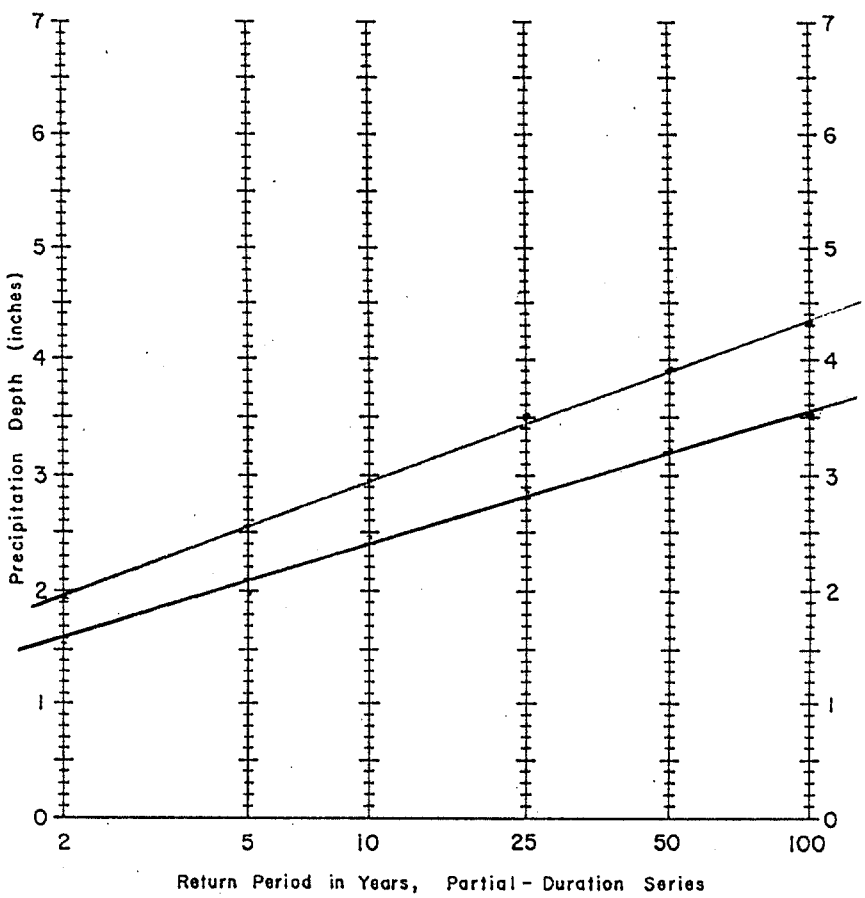
For Return Periods Other Than Q_{100} :

	2-Year	10-Year	25-Year	50-Year
Ratio to 100-year peak :	0.05	0.50	0.55	0.75
Q (cubic feet per sec.):	107	1074	1181	1611

Client _____ Job. No. VM01 Page 4/7
Project 5150 N. Soldier Tr. Date Checked 5-04 Date 5-04
Detail Hydrology Checked By JT Computed By JD

Return Period (Years)	Precipitation Values (inches)			
	6 Hour Duration		24 Hour Duration	
	MAP VALUE	CORRECTED VALUE	MAP VALUE	CORRECTED VALUE
2	1.58	1.60	1.92	1.95
5	1.94	2.10	2.55	2.55
10	2.16	2.40	2.96	2.95
25	2.58	2.80	3.50	3.45
50	3.21	3.20	3.90	3.90
100	3.50	3.55	4.40	4.45

Latitude 32°18' Longitude 111°16'



Precipitation Depth Versus Return Period For
Partial - Duration Series

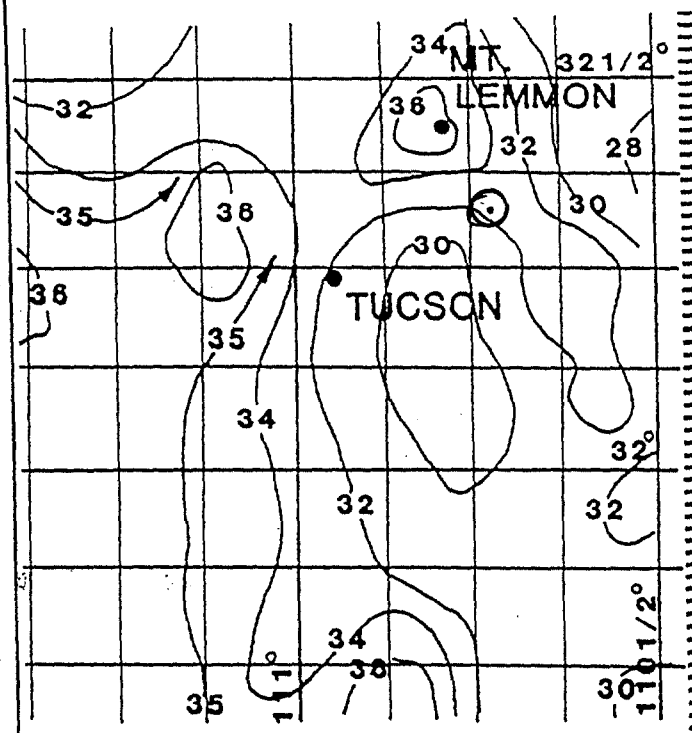
(92)

ARROYO ENGINEERING, INC.

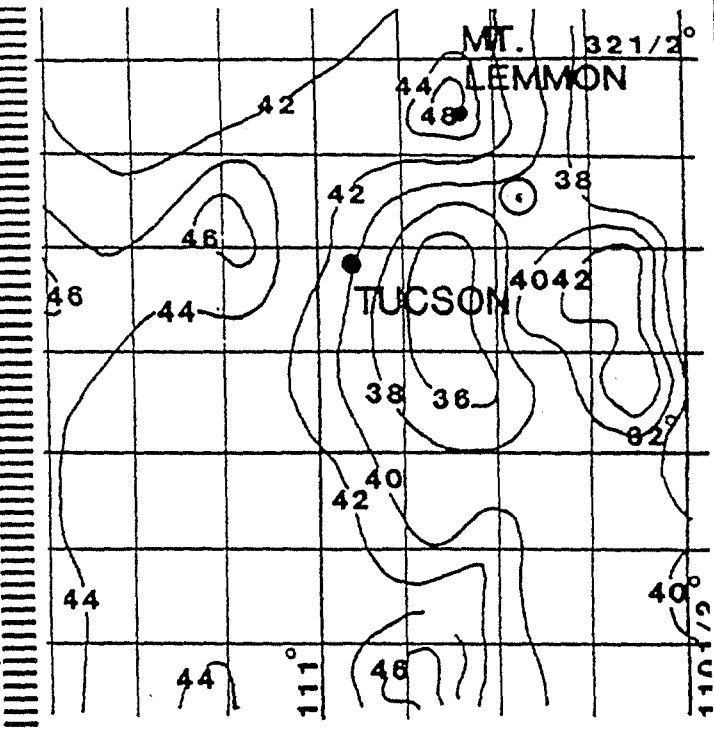
Client
Project
Detail

Job. No. VM01
Date Checked
Checked By

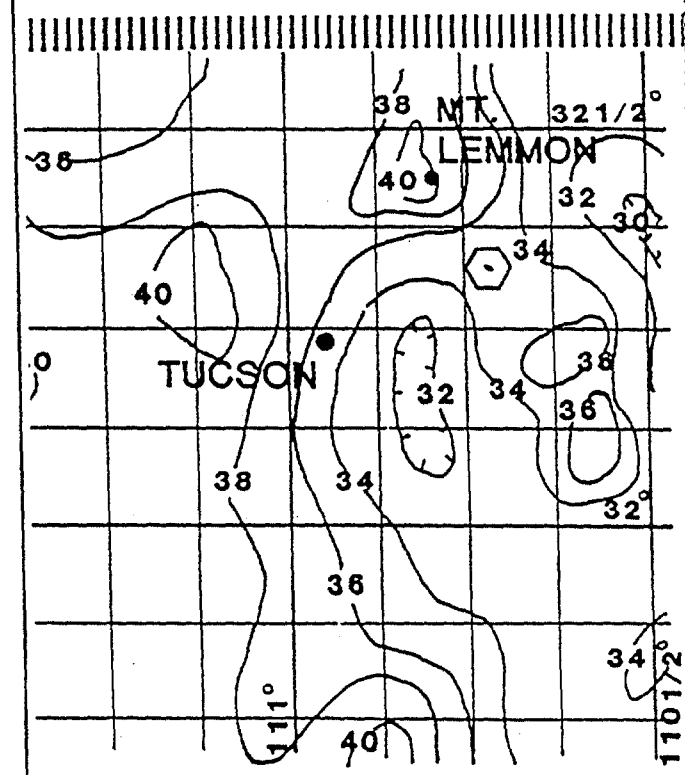
Page 7/7
Date 5-94
Computed By JD



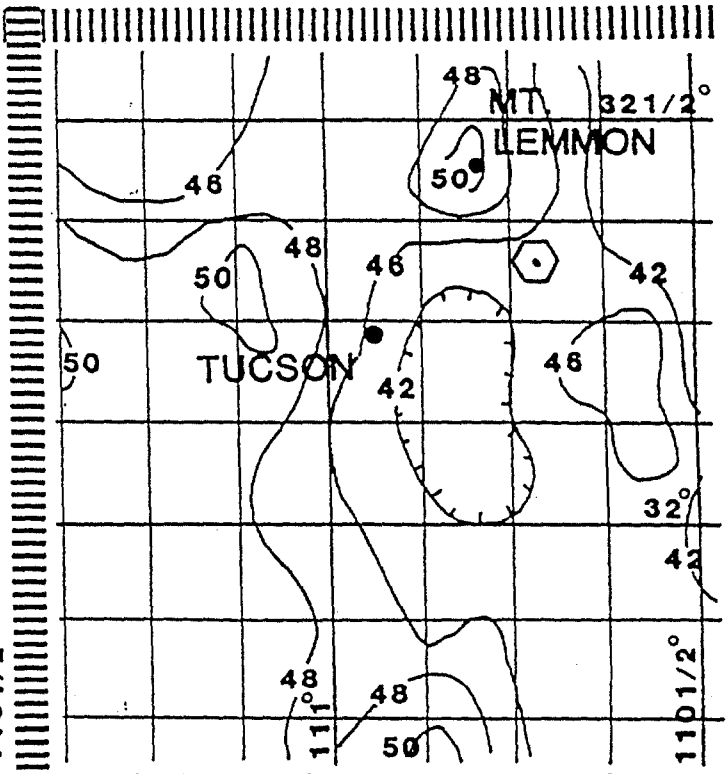
50-YEAR 6-HOUR



50-YEAR 24-HOUR



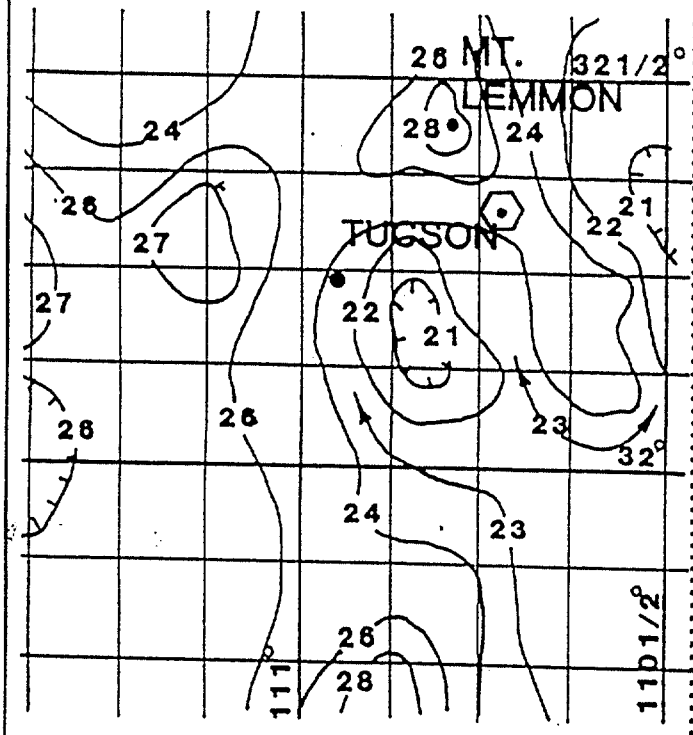
100-YEAR 6-HOUR



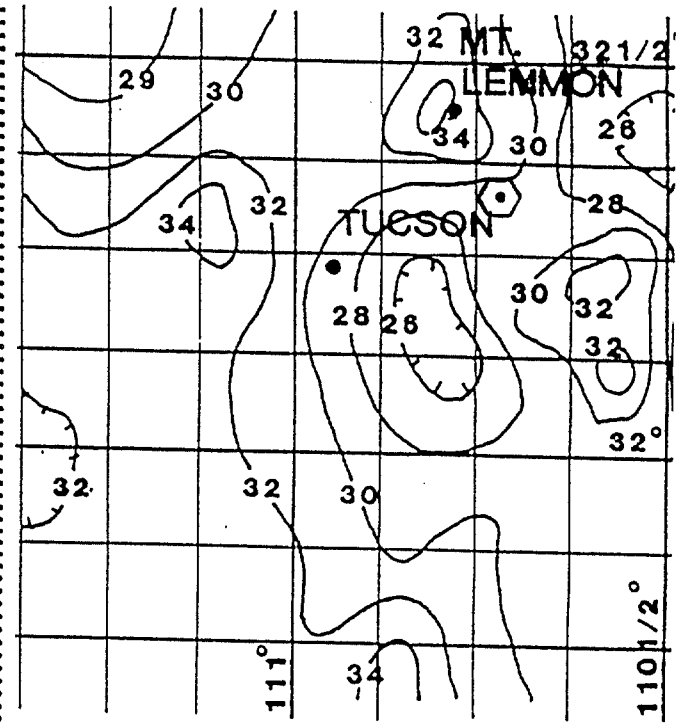
100-YEAR 24-HOUR

ARROYO ENGINEERING, INC.

Client _____ Job. No. VM01 Page 6/7
Project _____ Date Checked _____ Date 5-94
Detail _____ Checked By _____ Computed By SD



10-YEAR 6-HOUR



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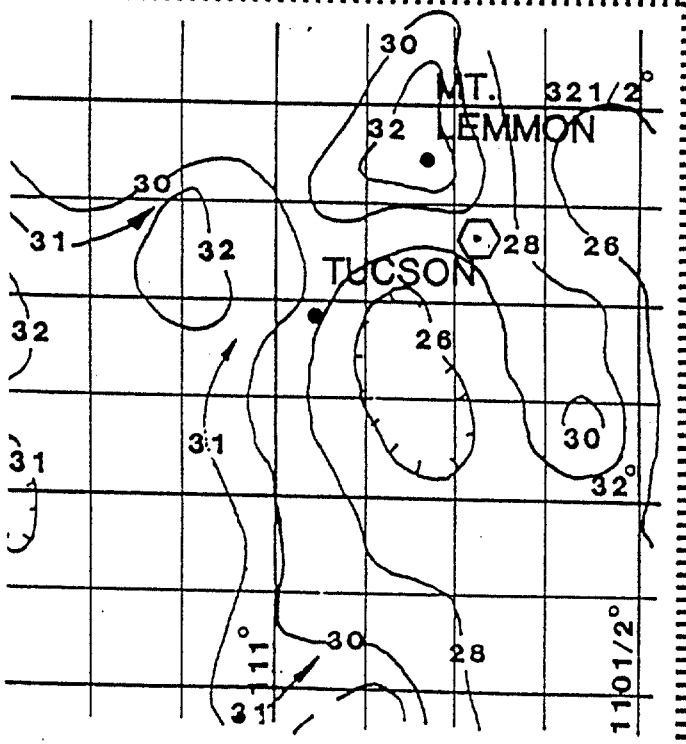
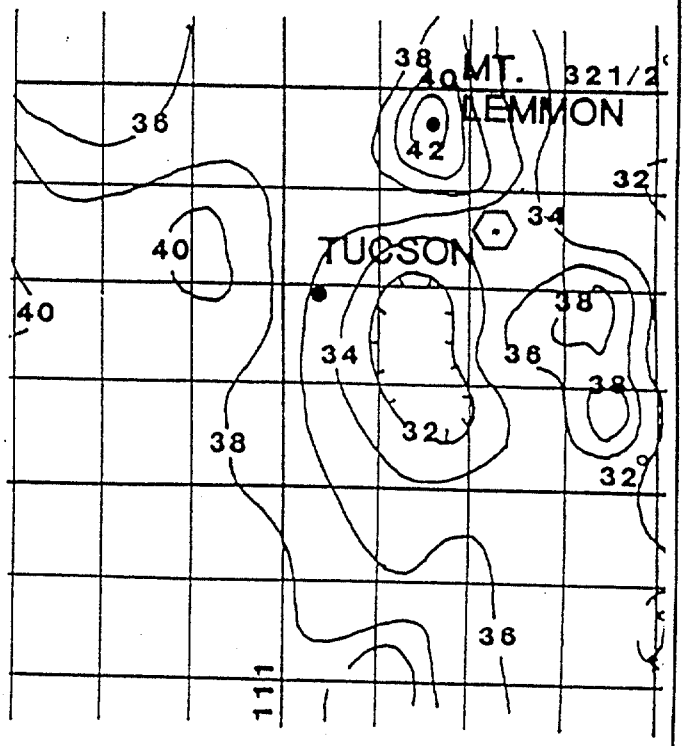


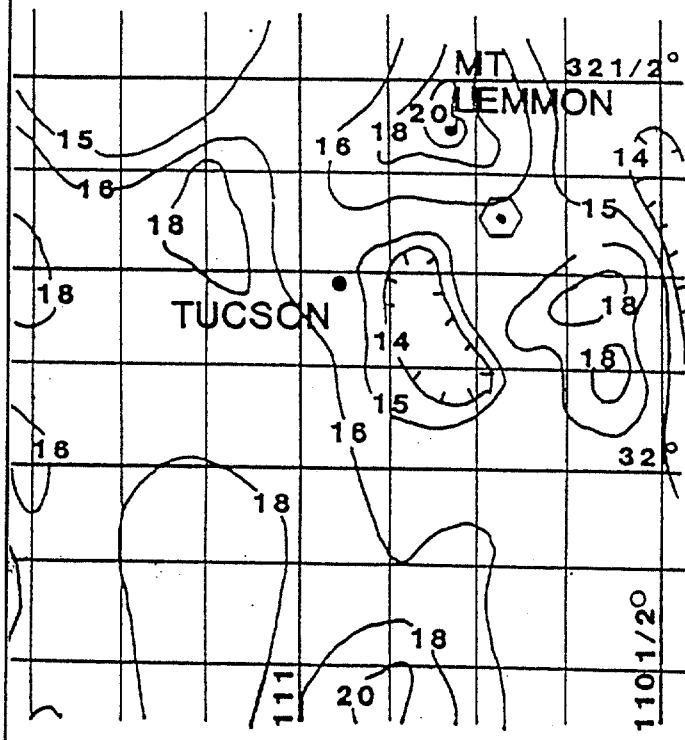
25-YEAR 6-HOUR



25-YEAR 24-HOUR

ARROYO ENGINEERING, INC.

Client _____ Job. No. VM01 Page 5/7
Project _____ Date Checked ✓ Date 5-94
Detail _____ Checked By ✓ Computed By JD



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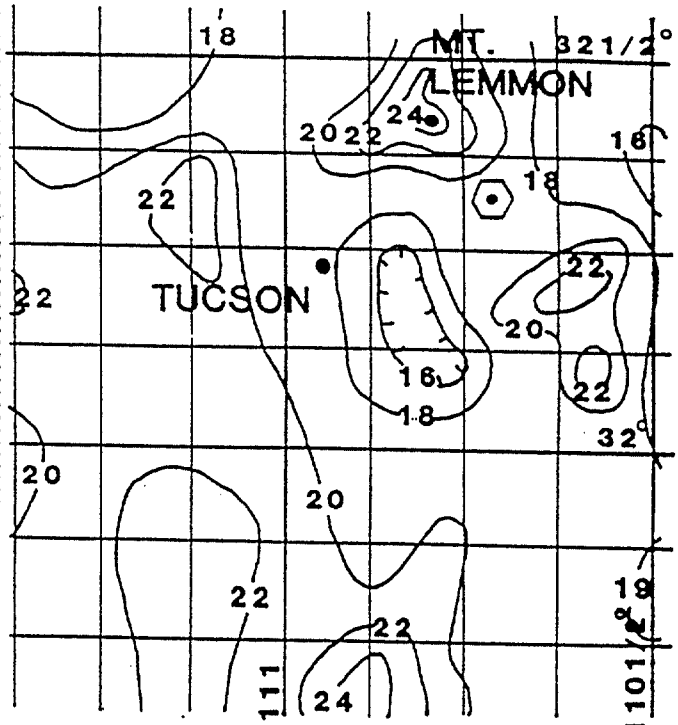

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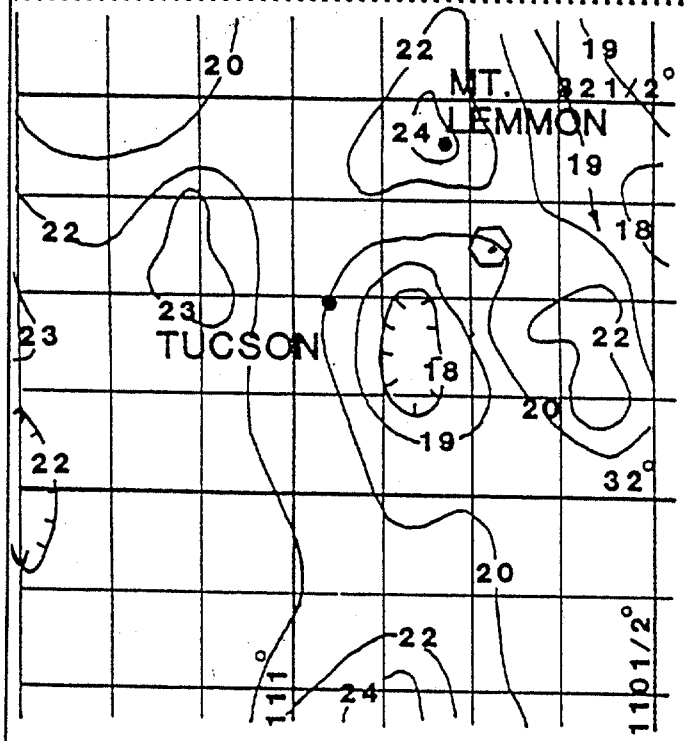
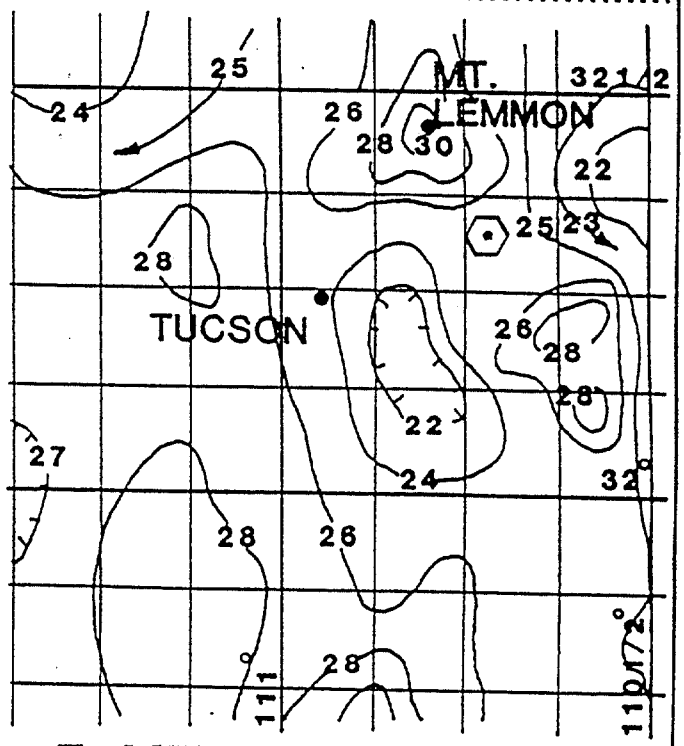
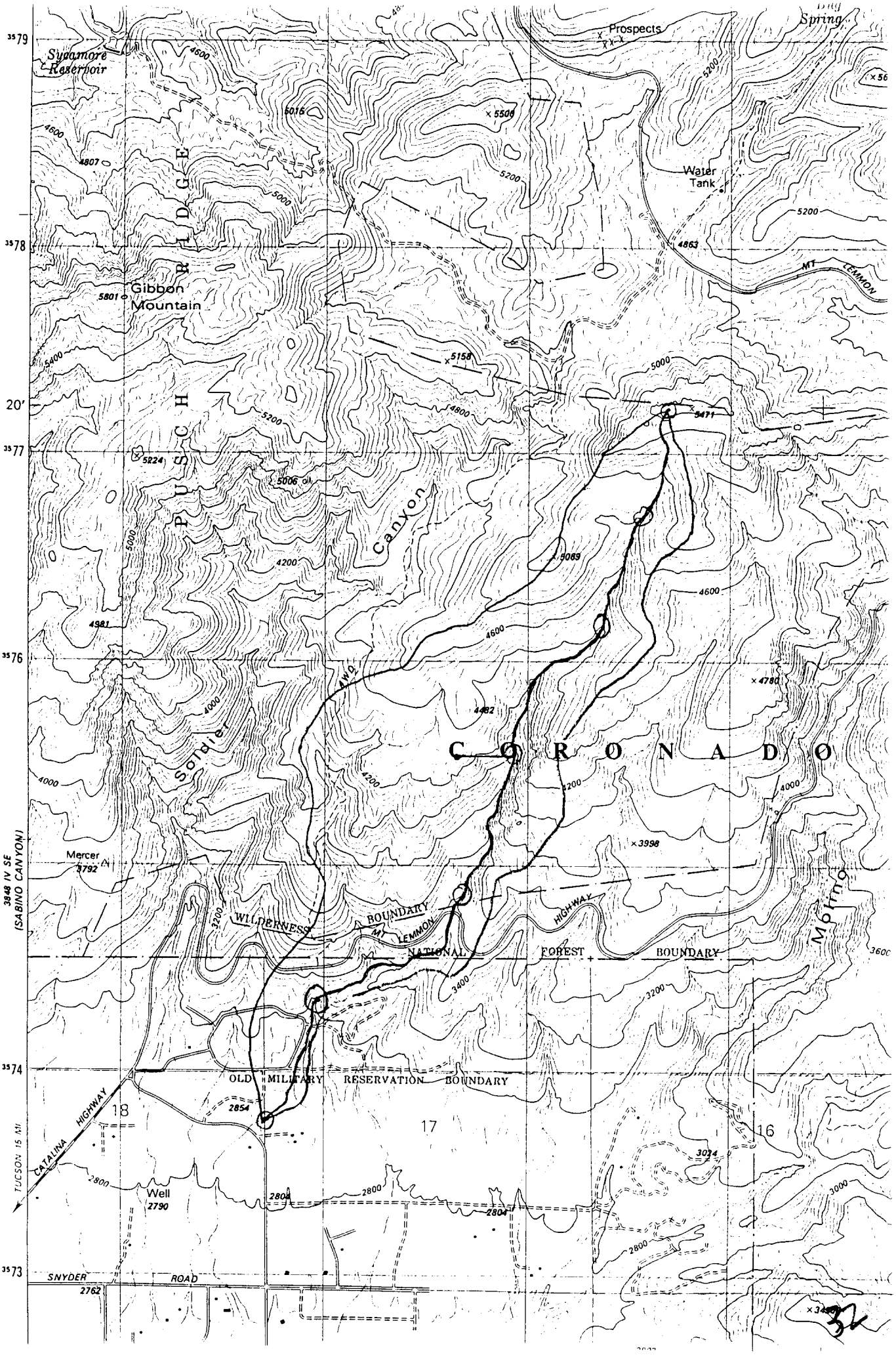


5-YEAR 6-HOUR



5-YEAR 24-HOUR

ARROYO ENGINEERING, INC.



Sycamore Reservoir
Prospects
Spring
Water Tank
Gibbon Mountain
PUSCH RIDGE
Canyon
Soldier
CORONADO
Mercer
3792
WILDERNESS BOUNDARY
MT LEMMON HIGHWAY
NATIONAL FOREST BOUNDARY
OLD MILITARY RESERVATION BOUNDARY
CATALINA HIGHWAY
TUCSON 15 MI
Well
2790
SNYDER ROAD
2762
3848 IV SE (SABINO CANYON)
18
17
16
20'

APPENDIX NUMBER 2:

HEC-2 INPUT AND OUTPUT FILES FOR EXISTING CONDITIONS

Input

```
SF  SPLIT FLOW ANALYSIS OF THE MAIN UN-NAMED WASH
JC  SPLIT FLOW ANALYSIS OF LEFT-BANK OVERFLOW
JP     0       0       0       0   +0.00
TW  SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)
WS     4    0842    0892      -1     1.2
WC     0    2868      16    2868      30    2872      52    2872
TW  SPLIT FLOW REACH 0822 TO 0842
WS     2    0822    0842      -1     1.2
WC     0  2867.5      20    2868
TW  SPLIT FLOW REACH 0773 TO 0822
WS     3     773     822      -1     1.2
WC     0    2864      41    2867      69  2867.5
TW  SPLIT FLOW REACH 0721 TO 0773
WS     2    0721    0773      -1     1.2
WC     0    2864      57    2866
EE
T1  ARRROYO ENGINEERING, INC., JOB NO. PAZ-PDOT-01.3, HEC2 FILE VM03.H2I
T2  SUBCRITICAL HYDRAULIC ANALYSIS OF THE MAIN UN-NAMED WASH: 100-YR STORM
T3  6-21-94
J1     0       2       0       0      -1       0       0       0 2837.56       0
J2     1       0      -1       0       0       0      -1       0       0       0
J3    38       1       2       3      26      68      43       8      25      13
J3    14      15
NC   .07     .07     .05   0.100   0.300
*  Q5   =  429 cfs, upstream from breakout
*  Q10  = 1074 cfs, upstream from breakout
*  Q25  = 1181 cfs, upstream from breakout
*  Q100 = 2147 cfs, upstream from breakout
QT     1    2147
X1  0152      11      75     103     0.0     0.0     0.0
GR  2840       0    2838      18    2836      27    2836      43    2836      75
GR2835.7      82  2835.7      90    2836     103    2838     114    2840     128
GR  2842     139
X1  0268      11      26     105      92   115.5     107
GR2846.4       0  2846.3      14    2846      26    2845      35    2844      40
GR  2843      49    2842      58  2842.1      73    2843      86    2844     105
GR  2845     120
X1  0409      12      75     101    56.5      58      57
GR  2854       0    2852      37    2850      51    2848      64    2846      75
GR2845.5      79  2845.5      87    2846     101    2848     143    2850     160
GR  2852     171    2854     186
X1  0497      14      81      96      86      91      88
GR2856.7       0    2856    27.5    2854      39    2852      48    2850      70
GR  2848      81  2847.2      85  2847.2      93    2848      96    2850     103
GR  2852     116    2854     126    2856     132    2858     149
X1  0552      10      86     103      55      55    55.5
GR  2856       0    2854      67    2852      77    2850      86  2849.7      90
GR2849.7      98    2850     103    2852     107    2854     135    2856     147
X1  0644       8      59      77      95      89      92
GR  2860       0    2858    26.5    2854      59  2852.5    65.5  2852.5    73.5
GR  2854      77    2856      82  2857.2      90
X1  0721       9      52      62      78    78.5    77.5
GR  2864       0    2862      20    2860      52  2858.2      55  2858.2      59
GR  2860      62    2862      74    2864      79    2866     108
X1  0773       9      37      51    52.5      52      52
GR  2866       0    2864    21.5    2862      37  2861.5      40  2861.5      48
GR  2862      51    2864      61    2866      77    2868      88
X1  0822       9      26      42      53      41      49
GR2867.5       0    2866      26    2864      31    2864      39    2866      42
GR  2868      69    2868    74.5    2868      82  2869.6      90
```

```
X1  0842      7      33      49      21      20    20.5
GR  2868      0    2866      33  2864.6      37  2864.6      45    2866      49
GR  2868     80    2870      90
X1  0892      9      50    68.5      71      68      70
GR  2872      0  2870.2      22    2870      27    2868      50  2866.1      55
GR2866.1     63    2868    68.5    2870      70    2872      93
EJ
ER
```

Q5

```
*******************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
*  Version   4.6.2;  May 1991             *
*                                         *
*  RUN DATE    22JUN94    TIME   08:49:06 *
*******************************************
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```
*****************************************
*  U.S. ARMY CORPS OF ENGINEERS         *
*  HYDROLOGIC ENGINEERING CENTER        *
*  609 SECOND STREET, SUITE D           *
*  DAVIS, CALIFORNIA 95616-4687         *
*          (916) 756-1104               *
*****************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X         XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
```

THIS RUN EXECUTED 22JUN94 08:49:06

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************



SPLIT FLOW BEING PERFORMED


SF  SPLIT FLOW ANALYSIS OF THE MAIN UN-NAMED WASH


JC  SPLIT FLOW ANALYSIS OF LEFT-BANK OVERFLOW
JP     0       0       0       0   +0.00

TW  SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)
WS     4    0842    0892      -1     1.2
WC     0    2868      16    2868      30    2872      52    2872

TW  SPLIT FLOW REACH 0822 TO 0842
WS     2    0822    0842      -1     1.2
WC     0  2867.5      20    2868

TW  SPLIT FLOW REACH 0773 TO 0822
WS     3     773     822      -1     1.2
WC     0    2864      41    2867      69  2867.5

TW  SPLIT FLOW REACH 0721 TO 0773
WS     2    0721    0773      -1     1.2
WC     0    2864      57    2866
```

```
T1  ARRROYO ENGINEERING, INC., JOB NO. PAZ-PDOT-01.3, HEC2 FILE VM03.H2I
T2  SUBCRITICAL HYDRAULIC ANALYSIS OF THE MAIN UN-NAMED WASH: 100-YR STORM
T3  6-21-94

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0        2        0        0       -1        0        0        0    2837.56     0

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

      1        0       -1        0        0        0       -1        0        0        0


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38       1        2        3       26       68       43        8       25       13
     14      15

NC     .07      .07      .05     0.100    0.300
   Q5   =  429 cfs, upstream from breakout
   Q10  = 1074 cfs, upstream from breakout
   Q25  = 1181 cfs, upstream from breakout
   Q100 = 2147 cfs, upstream from breakout
QT       1      429
X1    0152       11       75      103      0.0      0.0      0.0
GR    2840        0     2838       18     2836       27     2836       43     2836       75
GR  2835.7       82   2835.7       90     2836      103     2838      114     2840      128
GR    2842      139

X1    0268       11       26      105       92    115.5      107
GR  2846.4        0   2846.3       14     2846       26     2845       35     2844       40
GR    2843       49     2842       58   2842.1       73     2843       86     2844      105
GR    2845      120

X1    0409       12       75      101     56.5       58       57
GR    2854        0     2852       37     2850       51     2848       64     2846       75
GR  2845.5       79   2845.5       87     2846      101     2848      143     2850      160
GR    2852      171     2854      186

X1    0497       14       81       96       86       91       88
GR  2856.7        0     2856     27.5     2854       39     2852       48     2850       70
GR    2848       81   2847.2       85   2847.2       93     2848       96     2850      103
GR    2852      116     2854      126     2856      132     2858      149

X1    0552       10       86      103       55       55     55.5
GR    2856        0     2854       67     2852       77     2850       86   2849.7       90
GR  2849.7       98     2850      103     2852      107     2854      135     2856      147
```

X1	0644	8	59	77	95	89	92			
GR	2860	0	2858	26.5	2854	59	2852.5	65.5	2852.5	73.5
GR	2854	77	2856	82	2857.2	90				
X1	0721	9	52	62	78	78.5	77.5			
GR	2864	0	2862	20	2860	52	2858.2	55	2858.2	59
GR	2860	62	2862	74	2864	79	2866	108		
X1	0773	9	37	51	52.5	52	52			
GR	2866	0	2864	21.5	2862	37	2861.5	40	2861.5	48
GR	2862	51	2864	61	2866	77	2868	88		
X1	0822	9	26	42	53	41	49			
GR	2867.5	0	2866	26	2864	31	2864	39	2866	42
GR	2868	69	2868	74.5	2868	82	2869.6	90		
X1	0842	7	33	49	21	20	20.5			
GR	2868	0	2866	33	2864.6	37	2864.6	45	2866	49
GR	2868	80	2870	90						
X1	0892	9	50	68.5	71	68	70			
GR	2872	0	2870.2	22	2870	27	2868	50	2866.1	55
GR	2866.1	63	2868	68.5	2870	70	2872	93		

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

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV= .100 CEHV= .300

*SECNO 152.000

3720 CRITICAL DEPTH ASSUMED

152.000	1.26	2836.96	2836.96	2837.56	2837.45	.48	.00	.00	2836.00
424.4	201.1	216.6	6.7	48.3	32.3	2.5	.0	.0	2836.00
.00	4.17	6.70	2.64	.070	.050	.070	.000	2835.70	22.67
.041913	0.	0.	0.	0	18	0	.00	85.62	108.29

*SECNO 268.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

268.000	1.92	2843.92	2843.92	.00	2844.48	.57	3.99	.02	2846.00
424.4	.0	424.4	.0	.0	70.3	.0	.2	.2	2844.00
.00	.00	6.04	.00	.000	.050	.000	.000	2842.00	40.75
.035567	92.	107.	116.	0	14	0	.00	62.66	103.41

*SECNO 409.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

409.000	2.01	2847.51	2847.51	.00	2848.16	.65	1.70	.03	2846.00
424.4	17.5	339.6	67.3	6.3	47.8	24.0	.3	.3	2846.00
.01	2.78	7.10	2.81	.070	.050	.070	.000	2845.50	66.69
.025415	57.	57.	58.	0	8	0	.00	66.06	132.75

*SECNO 497.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

497.000	2.99	2850.19	2850.19	.00	2851.12	.93	2.00	.08	2848.00
424.4	44.4	352.2	27.8	13.3	42.1	8.5	.4	.4	2848.00
.01	3.33	8.37	3.28	.070	.050	.070	.000	2847.20	67.87
.020334	86.	88.	91.	0	14	0	.00	36.39	104.26

*SECNO 552.000

7185 MINIMUM SPECIFIC ENERGY

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


3720 CRITICAL DEPTH ASSUMED
  552.000     2.63   2852.33   2852.33       .00   2853.26       .93      1.18       .00   2850.00
    424.4     45.4     359.3      19.7      12.2      43.3       6.1        .5        .4   2850.00
      .01     3.71      8.29      3.24      .070      .050      .070      .000   2849.70     75.35
  .022366      55.       56.       55.         0        11         0       .00     36.25    111.61


*SECNO 644.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  644.000     3.04   2855.54   2855.54       .00   2856.53       .99      2.06       .02   2854.00
    424.4     25.4     391.5       7.5       9.6      47.2       3.0        .6        .5   2854.00
      .02     2.65      8.30      2.53      .070      .050      .070      .000   2852.50     46.51
  .022338      95.       92.       89.         0         8         0       .00     34.34     80.84


*SECNO 721.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  721.000     4.01   2862.21   2862.21       .00   2862.85       .64      1.39       .04   2860.00
    424.4    113.3     269.0      42.1      39.0      34.7      14.6        .8        .6   2860.00
      .02     2.91      7.75      2.89      .070      .050      .070      .000   2858.20     17.89
  .014691      78.       78.       79.         0        12         0       .00     56.64     74.53


*SECNO 773.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  773.000     2.78   2864.28   2864.28       .00   2865.09       .81       .90       .05   2862.00
    424.4     71.5     307.0      45.8      20.3      37.5      13.1        .9        .6   2862.00
      .02     3.52      8.19      3.49      .070      .050      .070      .000   2861.50     18.46
  .020627      53.       52.       52.         0        19         0       .00     44.81     63.26


*SECNO 822.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  822.000     3.44   2867.44   2867.44       .00   2868.19       .76       .90       .01   2866.00
    425.1     39.2     355.4      30.5      17.8      47.0      13.9        .9        .7   2866.00
      .02     2.20      7.57      2.20      .070      .050      .070      .000   2864.00      1.13
  .016716      53.       49.       41.         0        11         0       .00     60.25     61.37
```

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

*SECNO 842.000
3280 CROSS SECTION 842.00 EXTENDED .13 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.48

842.000	3.52	2868.12	2867.60	.00	2868.46	.33	.22	.04	2866.00
425.4	74.6	280.5	70.3	37.2	50.8	35.0	1.0	.7	2866.00
.02	2.01	5.52	2.01	.070	.050	.070	.000	2864.60	.00
.007677	21.	21.	20.	2	11	0	.00	80.63	80.63

*SECNO 892.000

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

892.000	3.17	2869.27	2869.27	.00	2870.30	1.03	.86	.21	2868.00
429.0	21.9	406.1	1.0	9.3	48.7	.6	1.1	.8	2868.00
.03	2.36	8.34	1.68	.070	.050	.070	.000	2866.10	35.39
.022730	71.	70.	68.	0	11	0	.00	34.07	69.45

TW SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
3.58	3.58	.01	3.58	3.58	.01	5	2868.124	2869.271	842.000	892.000

TW SPLIT FLOW REACH 0822 TO 0842

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.28	.27	1.05	3.86	3.85	.06	5	2867.435	2868.124	822.000	842.000

TW SPLIT FLOW REACH 0773 TO 0822

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.76	.74	1.75	4.61	4.60	.34	5	2864.283	2867.435	773.000	822.000

TW SPLIT FLOW REACH 0721 TO 0773

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.00	.00	.00	4.61	4.60	.34	5	2862.211	2864.283	721.000	773.000

THIS RUN EXECUTED 22JUN94 08:50:05

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

-94

SUMMARY PRINTOUT

	SECNO	CWSEL	CRIWS	EG	VCH	FRCH	Q	DEPTH	AREA	QLOB	QCH	QROB
*	152.000	2836.96	2836.96	2837.45	6.70	1.10	424.39	1.26	83.15	201.09	216.58	6.72
*	268.000	2843.92	2843.92	2844.48	6.04	1.01	424.39	1.92	70.27	.00	424.39	.00
*	409.000	2847.51	2847.51	2848.16	7.10	.92	424.39	2.01	78.08	17.46	339.60	67.33
*	497.000	2850.19	2850.19	2851.12	8.37	.88	424.39	2.99	63.92	44.37	352.21	27.80
*	552.000	2852.33	2852.33	2853.26	8.29	.91	424.39	2.63	61.65	45.43	359.29	19.66
*	644.000	2855.54	2855.54	2856.53	8.30	.90	424.39	3.04	59.74	25.45	391.45	7.49
*	721.000	2862.21	2862.21	2862.85	7.75	.73	424.39	4.01	88.27	113.25	269.04	42.09
*	773.000	2864.28	2864.28	2865.09	8.19	.88	424.39	2.78	70.93	71.55	306.99	45.85
*	822.000	2867.44	2867.44	2868.19	7.57	.78	425.14	3.44	78.71	39.22	355.40	30.52
*	842.000	2868.12	2867.60	2868.46	5.52	.55	425.42	3.52	123.00	74.63	280.52	70.27
*	892.000	2869.27	2869.27	2870.30	8.34	.91	429.00	3.17	58.57	21.91	406.07	1.02

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION SECNO=    152.000  PROFILE=  1  CRITICAL DEPTH ASSUMED

CAUTION SECNO=    268.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    268.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    409.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    409.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    497.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    497.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    552.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    552.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    644.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    644.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    721.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    721.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    773.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    773.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    822.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    822.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

WARNING SECNO=    842.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=    892.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    892.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY
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Q10

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*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    22JUN94    TIME   08:55:06   *
*********************************************
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*          (916) 756-1104           *
*************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
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THIS RUN EXECUTED 22JUN94 08:55:06

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************



SPLIT FLOW BEING PERFORMED


SF  SPLIT FLOW ANALYSIS OF THE MAIN UN-NAMED WASH


JC  SPLIT FLOW ANALYSIS OF LEFT-BANK OVERFLOW
JP     0       0       0       0   +0.00

TW  SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)
WS     4    0842    0892      -1     1.2
WC     0    2868      16    2868      30    2872      52    2872

TW  SPLIT FLOW REACH 0822 TO 0842
WS     2    0822    0842      -1     1.2
WC     0  2867.5      20    2868

TW  SPLIT FLOW REACH 0773 TO 0822
WS     3     773     822      -1     1.2
WC     0    2864      41    2867      69  2867.5

TW  SPLIT FLOW REACH 0721 TO 0773
WS     2    0721    0773      -1     1.2
WC     0    2864      57    2866
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T1  ARRROYO ENGINEERING, INC., JOB NO. PAZ-PDOT-01.3, HEC2 FILE VM03.H2I
T2  SUBCRITICAL HYDRAULIC ANALYSIS OF THE MAIN UN-NAMED WASH: 100-YR STORM
T3  6-21-94

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

      0         2         0         0        -1         0         0         0   2837.56         0

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

      1         0        -1         0         0         0        -1         0         0         0


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38         1         2         3        26        68        43         8        25        13
     14        15

NC      .07       .07       .05     0.100     0.300
   Q5   =  429 cfs, upstream from breakout
   Q10  = 1074 cfs, upstream from breakout
   Q25  = 1181 cfs, upstream from breakout
   Q100 = 2147 cfs, upstream from breakout
QT        1      1074
X1     0152        11        75       103       0.0       0.0       0.0
GR     2840         0      2838        18      2836        27      2836        43      2836        75
GR   2835.7        82    2835.7        90      2836       103      2838       114      2840       128
GR     2842       139

X1     0268        11        26       105        92     115.5       107
GR   2846.4         0    2846.3        14      2846        26      2845        35      2844        40
GR     2843        49      2842        58    2842.1        73      2843        86      2844       105
GR     2845       120

X1     0409        12        75       101      56.5        58        57
GR     2854         0      2852        37      2850        51      2848        64      2846        75
GR   2845.5        79    2845.5        87      2846       101      2848       143      2850       160
GR     2852       171      2854       186

X1     0497        14        81        96        86        91        88
GR   2856.7         0      2856      27.5      2854        39      2852        48      2850        70
GR     2848        81    2847.2        85    2847.2        93      2848        96      2850       103
GR     2852       116      2854       126      2856       132      2858       149

X1     0552        10        86       103        55        55      55.5
GR     2856         0      2854        67      2852        77      2850        86    2849.7        90
GR   2849.7        98      2850       103      2852       107      2854       135      2856       147
```

X1	0644	8	59	77	95	89	92			
GR	2860	0	2858	26.5	2854	59	2852.5	65.5	2852.5	73.5
GR	2854	77	2856	82	2857.2	90				
X1	0721	9	52	62	78	78.5	77.5			
GR	2864	0	2862	20	2860	52	2858.2	55	2858.2	59
GR	2860	62	2862	74	2864	79	2866	108		
X1	0773	9	37	51	52.5	52	52			
GR	2866	0	2864	21.5	2862	37	2861.5	40	2861.5	48
GR	2862	51	2864	61	2866	77	2868	88		
X1	0822	9	26	42	53	41	49			
GR	2867.5	0	2866	26	2864	31	2864	39	2866	42
GR	2868	69	2868	74.5	2868	82	2869.6	90		
X1	0842	7	33	49	21	20	20.5			
GR	2868	0	2866	33	2864.6	37	2864.6	45	2866	49
GR	2868	80	2870	90						
X1	0892	9	50	68.5	71	68	70			
GR	2872	0	2870.2	22	2870	27	2868	50	2866.1	55
GR	2866.1	63	2868	68.5	2870	70	2872	93		

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

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV= .100 CEHV= .300

*SECNO 152.000

3720 CRITICAL DEPTH ASSUMED

152.000	1.92	2837.62	2837.62	2837.56	2838.40	.78	.00	.00	2836.00
925.3	463.7	435.9	25.7	83.9	50.9	7.3	.0	.0	2836.00
.00	5.53	8.57	3.54	.070	.050	.070	.000	2835.70	19.69
.037527	0.	0.	0.	0	7	0	.00	92.24	111.93

*SECNO 268.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

268.000	2.72	2844.72	2844.72	.00	2845.57	.85	3.38	.02	2846.00
925.3	.0	918.3	7.0	.0	123.5	3.9	.3	.2	2844.00
.00	.00	7.43	1.81	.000	.050	.070	.000	2842.00	36.41
.028675	92.	107.	116.	0	11	0	.00	79.36	115.77

*SECNO 409.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

409.000	2.95	2848.45	2848.45	.00	2849.29	.85	1.41	.00	2846.00
925.3	63.4	619.4	242.5	16.6	72.1	61.6	.5	.3	2846.00
.01	3.83	8.59	3.94	.070	.050	.070	.000	2845.50	61.10
.021495	57.	57.	58.	0	8	0	.00	85.69	146.79

*SECNO 497.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

497.000	4.35	2851.55	2851.55	.00	2852.75	1.20	1.72	.10	2848.00
925.3	178.6	636.1	110.7	41.4	62.5	25.7	.8	.5	2848.00
.01	4.32	10.18	4.30	.070	.050	.070	.000	2847.20	52.91
.017772	86.	88.	91.	0	14	0	.00	60.19	113.10

*SECNO 552.000

7185 MINIMUM SPECIFIC ENERGY

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


3720 CRITICAL DEPTH ASSUMED
  552.000      4.00   2853.70   2853.70       .00   2854.90      1.20      1.00       .00   2850.00
    925.3     151.4     666.2     107.6      31.5      66.6      30.9        .9        .5   2850.00
      .01      4.81     10.01      3.48      .070      .050      .070      .000   2849.70     68.52
  .018390       55.       56.       55.         0         8         0       .00     62.22    130.74


*SECNO 644.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  644.000      4.51   2857.01   2857.01       .00   2858.30      1.29      1.68       .03   2854.00
    925.3     137.0     738.8      49.5      36.8      73.7      13.4       1.2        .7   2854.00
      .01      3.72     10.03      3.68      .070      .050      .070      .000   2852.50     34.55
  .018007       95.       92.       89.         0         8         0       .00     54.19     88.73


*SECNO 721.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  721.000      4.92   2863.12   2863.12       .00   2864.12      1.00      1.45       .03   2860.00
    925.3     343.6     455.6     126.1      74.2      43.8      27.0       1.5        .8   2860.00
      .02      4.63     10.40      4.66      .070      .050      .070      .000   2858.20      8.77
  .019362       78.       78.       79.         0         8         0       .00     68.03     76.81


*SECNO 773.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  773.000      3.96   2865.46   2865.46       .00   2866.53      1.06      1.00       .02   2862.00
    925.3     230.9     543.8     150.6      49.7      54.0      33.2       1.6        .9   2862.00
      .02      4.64     10.07      4.53      .070      .050      .070      .000   2861.50      5.76
  .019120       53.       52.       52.         0        16         0       .00     66.96     72.72


*SECNO 822.000
3280 CROSS SECTION    822.00 EXTENDED      1.14 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  822.000      4.64   2868.64   2868.64       .00   2869.55       .91       .84       .02   2866.00
    992.4     195.3     614.6     182.5      49.2      66.3      53.7       1.8        .9   2866.00
      .02      3.97      9.27      3.40      .070      .050      .070      .000   2864.00       .00
  .015861       53.       49.       41.         0         8         0       .00     85.21     85.21
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 842.000
3280 CROSS SECTION 842.00 EXTENDED 1.33 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.40

842.000	4.73	2869.33	2868.69	.00	2869.82	.49	.23	.04	2866.00
1025.4	259.8	508.4	257.2	77.0	70.1	76.8	1.9	1.0	2866.00
.02	3.37	7.25	3.35	.070	.050	.070	.000	2864.60	.00
.008617	21.	21.	20.	2	15	0	.00	86.67	86.67

*SECNO 892.000

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

892.000	5.01	2871.11	2871.11	.00	2872.32	1.21	.80	.21	2868.00
1074.0	234.0	817.3	22.7	58.8	82.8	10.3	2.2	1.1	2868.00
.02	3.98	9.87	2.20	.070	.050	.070	.000	2866.10	10.84
.015699	71.	70.	68.	0	8	0	.00	71.97	82.80

TW SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
48.58	48.47	.22	48.58	48.47	.22	5	2869.332	2871.113	842.000	892.000

TW SPLIT FLOW REACH 0822 TO 0842

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
33.00	33.04	.12	81.58	81.52	.08	5	2868.642	2869.332	822.000	842.000

TW SPLIT FLOW REACH 0773 TO 0822

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
67.11	67.10	.02	148.69	148.62	.05	5	2865.465	2868.642	773.000	822.000

TW SPLIT FLOW REACH 0721 TO 0773

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.00	.00	.00	148.69	148.62	.05	5	2863.123	2865.465	721.000	773.000

THIS RUN EXECUTED 22JUN94 08:55:39

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

-94

SUMMARY PRINTOUT

	SECNO	CWSEL	CRIWS	EG	VCH	FRCH	Q	DEPTH	AREA	QLOB	QCH	QROB
*	152.000	2837.62	2837.62	2838.40	8.57	1.12	925.31	1.92	141.99	463.71	435.93	25.67
*	268.000	2844.72	2844.72	2845.57	7.43	.98	925.31	2.72	127.41	.00	918.30	7.00
*	409.000	2848.45	2848.45	2849.29	8.59	.91	925.31	2.95	150.23	63.36	619.44	242.50
*	497.000	2851.55	2851.55	2852.75	10.18	.88	925.31	4.35	129.58	178.56	636.07	110.67
*	552.000	2853.70	2853.70	2854.90	10.01	.89	925.31	4.00	128.94	151.44	666.22	107.65
*	644.000	2857.01	2857.01	2858.30	10.03	.87	925.31	4.51	123.92	136.98	738.84	49.48
*	721.000	2863.12	2863.12	2864.12	10.40	.88	925.31	4.92	145.09	343.57	455.59	126.15
*	773.000	2865.46	2865.46	2866.53	10.07	.90	925.31	3.96	136.96	230.90	543.76	150.65
*	822.000	2868.64	2868.64	2869.55	9.27	.80	992.42	4.64	169.16	195.27	614.63	182.52
*	842.000	2869.33	2868.69	2869.82	7.25	.61	1025.42	4.73	223.99	259.84	508.39	257.19
*	892.000	2871.11	2871.11	2872.32	9.87	.82	1074.00	5.01	151.84	233.98	817.34	22.67

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION SECNO=    152.000  PROFILE=  1  CRITICAL DEPTH ASSUMED

CAUTION SECNO=    268.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    268.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    409.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    409.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    497.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    497.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    552.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    552.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    644.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    644.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    721.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    721.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    773.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    773.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    822.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    822.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

WARNING SECNO=    842.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=    892.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    892.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY
```

Q 25

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*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    22JUN94    TIME   08:58:08   *
*********************************************
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*          (916) 756-1104           *
*************************************
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X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
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THIS RUN EXECUTED 22JUN94 08:58:08

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************



SPLIT FLOW BEING PERFORMED


SF  SPLIT FLOW ANALYSIS OF THE MAIN UN-NAMED WASH


JC  SPLIT FLOW ANALYSIS OF LEFT-BANK OVERFLOW
JP     0       0       0       0   +0.00

TW  SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)
WS     4    0842    0892      -1     1.2
WC     0    2868      16    2868      30    2872      52    2872

TW  SPLIT FLOW REACH 0822 TO 0842
WS     2    0822    0842      -1     1.2
WC     0  2867.5      20    2868

TW  SPLIT FLOW REACH 0773 TO 0822
WS     3     773     822      -1     1.2
WC     0    2864      41    2867      69  2867.5

TW  SPLIT FLOW REACH 0721 TO 0773
WS     2    0721    0773      -1     1.2
WC     0    2864      57    2866
```

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T1  ARRROYO ENGINEERING, INC., JOB NO. PAZ-PDOT-01.3, HEC2 FILE VM03.H2I
T2  SUBCRITICAL HYDRAULIC ANALYSIS OF THE MAIN UN-NAMED WASH: 100-YR STORM
T3  6-21-94

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0        2        0        0       -1        0        0        0    2837.56     0

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

      1        0       -1        0        0        0       -1        0        0        0


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38       1        2        3       26       68       43        8       25       13
     14       15

NC     .07      .07      .05     0.100    0.300
   Q5   =  429 cfs, upstream from breakout
   Q10  = 1074 cfs, upstream from breakout
   Q25  = 1181 cfs, upstream from breakout
   Q100 = 2147 cfs, upstream from breakout
QT       1     1181
X1     0152      11       75      103      0.0      0.0      0.0
GR     2840       0     2838       18     2836       27     2836       43     2836       75
GR   2835.7      82   2835.7       90     2836      103     2838      114     2840      128
GR     2842     139

X1     0268      11       26      105       92    115.5      107
GR   2846.4       0   2846.3       14     2846       26     2845       35     2844       40
GR     2843      49     2842       58   2842.1       73     2843       86     2844      105
GR     2845     120

X1     0409      12       75      101     56.5       58       57
GR     2854       0     2852       37     2850       51     2848       64     2846       75
GR   2845.5      79   2845.5       87     2846      101     2848      143     2850      160
GR     2852     171     2854      186

X1     0497      14       81       96       86       91       88
GR   2856.7       0     2856     27.5     2854       39     2852       48     2850       70
GR     2848      81   2847.2       85   2847.2       93     2848       96     2850      103
GR     2852     116     2854      126     2856      132     2858      149

X1     0552      10       86      103       55       55     55.5
GR     2856       0     2854       67     2852       77     2850       86   2849.7       90
GR   2849.7      98     2850      103     2852      107     2854      135     2856      147
```

X1	0644	8	59	77	95	89	92			
GR	2860	0	2858	26.5	2854	59	2852.5	65.5	2852.5	73.5
GR	2854	77	2856	82	2857.2	90				
X1	0721	9	52	62	78	78.5	77.5			
GR	2864	0	2862	20	2860	52	2858.2	55	2858.2	59
GR	2860	62	2862	74	2864	79	2866	108		
X1	0773	9	37	51	52.5	52	52			
GR	2866	0	2864	21.5	2862	37	2861.5	40	2861.5	48
GR	2862	51	2864	61	2866	77	2868	88		
X1	0822	9	26	42	53	41	49			
GR	2867.5	0	2866	26	2864	31	2864	39	2866	42
GR	2868	69	2868	74.5	2868	82	2869.6	90		
X1	0842	7	33	49	21	20	20.5			
GR	2868	0	2866	33	2864.6	37	2864.6	45	2866	49
GR	2868	80	2870	90						
X1	0892	9	50	68.5	71	68	70			
GR	2872	0	2870.2	22	2870	27	2868	50	2866.1	55
GR	2866.1	63	2868	68.5	2870	70	2872	93		

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

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV= .100 CEHV= .300

*SECNO 152.000

3720 CRITICAL DEPTH ASSUMED

152.000	2.02	2837.72	2837.72	2837.56	2838.54	.82	.00	.00	2836.00
1006.4	506.6	470.2	29.6	89.2	53.6	8.1	.0	.0	2836.00
.00	5.68	8.78	3.64	.070	.050	.070	.000	2835.70	19.26
.036768	0.	0.	0.	0	7	0	.00	93.20	112.46

*SECNO 268.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

268.000	2.82	2844.82	2844.82	.00	2845.72	.89	3.31	.02	2846.00
1006.4	.0	996.4	10.1	.0	130.9	5.1	.3	.2	2844.00
.00	.00	7.61	1.97	.000	.050	.070	.000	2842.00	35.88
.028116	92.	107.	116.	0	11	0	.00	81.50	117.37

*SECNO 409.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

409.000	3.05	2848.55	2848.55	.00	2849.44	.89	1.40	.00	2846.00
1006.4	71.8	660.9	273.7	18.0	74.8	66.4	.5	.3	2846.00
.01	3.98	8.84	4.12	.070	.050	.070	.000	2845.50	60.43
.021653	57.	57.	58.	0	8	0	.00	87.24	147.67

*SECNO 497.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

497.000	4.48	2851.68	2851.68	.00	2852.95	1.27	1.76	.12	2848.00
1006.4	201.6	680.0	124.8	45.0	64.4	27.9	.8	.5	2848.00
.01	4.48	10.56	4.47	.070	.050	.070	.000	2847.20	51.52
.018389	86.	88.	91.	0	14	0	.00	62.39	113.92

*SECNO 552.000

7185 MINIMUM SPECIFIC ENERGY

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

3720 CRITICAL DEPTH ASSUMED

552.000	4.22	2853.92	2853.92	.00	2855.09	1.17	.98	.01	2850.00
1006.4	171.2	704.0	131.2	35.6	70.4	37.6	1.0	.6	2850.00
.01	4.81	9.99	3.49	.070	.050	.070	.000	2849.70	67.38
.017013	55.	56.	55.	0	8	0	.00	66.54	133.93

*SECNO 644.000
3280 CROSS SECTION 644.00 EXTENDED .01 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

644.000	4.71	2857.21	2857.21	.00	2858.52	1.31	1.59	.04	2854.00
1006.4	159.9	786.7	59.7	41.9	77.3	15.9	1.3	.7	2854.00
.01	3.82	10.18	3.75	.070	.050	.070	.000	2852.50	32.92
.017413	95.	92.	89.	0	8	0	.00	57.08	90.00

*SECNO 721.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

721.000	5.04	2863.24	2863.24	.00	2864.29	1.05	1.45	.03	2860.00
1006.4	383.4	482.6	140.4	79.3	45.0	28.8	1.6	.8	2860.00
.02	4.83	10.73	4.88	.070	.050	.070	.000	2858.20	7.61
.019909	78.	78.	79.	0	8	0	.00	69.48	77.10

*SECNO 773.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

773.000	4.09	2865.59	2865.59	.00	2866.71	1.12	1.03	.02	2862.00
1006.4	257.9	579.8	168.7	53.7	55.8	36.0	1.7	.9	2862.00
.02	4.80	10.40	4.68	.070	.050	.070	.000	2861.50	4.41
.019537	53.	52.	52.	0	15	0	.00	69.31	73.72

*SECNO 822.000
3280 CROSS SECTION 822.00 EXTENDED 1.23 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

822.000	4.73	2868.73	2868.73	.00	2869.72	.99	.88	.01	2866.00
1085.9	217.6	659.4	208.9	51.4	67.6	57.4	1.9	1.0	2866.00
.02	4.23	9.75	3.64	.070	.050	.070	.000	2864.00	.00
.017044	53.	49.	41.	0	11	0	.00	85.64	85.64

61

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

*SECNO 842.000
3280 CROSS SECTION 842.00 EXTENDED 1.50 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.45

842.000	4.89	2869.49	2868.81	.00	2870.01	.52	.24	.05	2866.00
1124.0	291.0	542.5	290.5	82.4	72.7	83.0	2.0	1.0	2866.00
.02	3.53	7.46	3.50	.070	.050	.070	.000	2864.60	.00
.008692	21.	21.	20.	2	15	0	.00	87.48	87.48

*SECNO 892.000

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

892.000	5.21	2871.31	2871.31	.00	2872.55	1.23	.80	.22	2868.00
1181.0	276.9	873.0	31.1	66.8	86.5	13.4	2.3	1.1	2868.00
.02	4.14	10.10	2.33	.070	.050	.070	.000	2866.10	8.40
.015483	71.	70.	68.	0	8	0	.00	76.70	85.10

TW SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
56.99	56.98	.03	56.99	56.98	.03	7	2869.492	2871.313	842.000	892.000

TW SPLIT FLOW REACH 0822 TO 0842

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
38.10	38.10	.02	95.09	95.08	.01	7	2868.728	2869.492	822.000	842.000

TW SPLIT FLOW REACH 0773 TO 0822

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
79.49	79.46	.04	174.58	174.54	.02	7	2865.590	2868.728	773.000	822.000

TW SPLIT FLOW REACH 0721 TO 0773

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.00	.00	.00	174.58	174.54	.02	7	2863.239	2865.590	721.000	773.000

THIS RUN EXECUTED 22JUN94 08:59:08

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

-94

SUMMARY PRINTOUT

	SECNO	CWSEL	CRIWS	EG	VCH	FRCH	Q	DEPTH	AREA	QLOB	QCH	QROB
*	152.000	2837.72	2837.72	2838.54	8.78	1.12	1006.42	2.02	150.91	506.55	470.24	29.62
*	268.000	2844.82	2844.82	2845.72	7.61	.97	1006.42	2.82	136.03	.00	996.37	10.05
*	409.000	2848.55	2848.55	2849.44	8.84	.92	1006.42	3.05	159.18	71.82	660.88	273.72
*	497.000	2851.68	2851.68	2852.95	10.56	.90	1006.42	4.48	137.32	201.60	680.01	124.80
*	552.000	2853.92	2853.92	2855.09	9.99	.87	1006.42	4.22	143.59	171.20	704.03	131.19
*	644.000	2857.21	2857.21	2858.52	10.18	.87	1006.42	4.71	135.07	159.94	786.74	59.73
*	721.000	2863.24	2863.24	2864.29	10.73	.89	1006.42	5.04	153.08	383.41	482.57	140.44
*	773.000	2865.59	2865.59	2866.71	10.40	.92	1006.42	4.09	145.51	257.95	579.78	168.69
*	822.000	2868.73	2868.73	2869.72	9.75	.84	1085.91	4.73	176.52	217.57	659.40	208.94
*	842.000	2869.49	2868.81	2870.01	7.46	.62	1124.01	4.89	238.12	291.00	542.48	290.52
*	892.000	2871.31	2871.31	2872.55	10.10	.82	1181.00	5.21	166.68	276.87	872.99	31.13

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION SECNO=    152.000  PROFILE=  1  CRITICAL DEPTH ASSUMED

CAUTION SECNO=    268.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    268.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    409.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    409.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    497.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    497.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    552.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    552.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    644.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    644.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    721.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    721.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    773.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    773.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    822.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    822.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

WARNING SECNO=    842.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=    892.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    892.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY
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Q100

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*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    22JUN94    TIME    08:46:11  *
*********************************************
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*****************************************
*  U.S. ARMY CORPS OF ENGINEERS         *
*  HYDROLOGIC ENGINEERING CENTER        *
*  609 SECOND STREET, SUITE D           *
*  DAVIS, CALIFORNIA 95616-4687         *
*          (916) 756-1104               *
*****************************************
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X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X         XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
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THIS RUN EXECUTED 22JUN94 08:46:11

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************



SPLIT FLOW BEING PERFORMED


SF  SPLIT FLOW ANALYSIS OF THE MAIN UN-NAMED WASH


JC  SPLIT FLOW ANALYSIS OF LEFT-BANK OVERFLOW
JP     0       0       0       0   +0.00

TW  SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)
WS     4    0842    0892      -1     1.2
WC     0    2868      16    2868      30    2872      52    2872

TW  SPLIT FLOW REACH 0822 TO 0842
WS     2    0822    0842      -1     1.2
WC     0  2867.5      20    2868

TW  SPLIT FLOW REACH 0773 TO 0822
WS     3     773     822      -1     1.2
WC     0    2864      41    2867      69  2867.5

TW  SPLIT FLOW REACH 0721 TO 0773
WS     2    0721    0773      -1     1.2
WC     0    2864      57    2866
```

```
T1  ARRROYO ENGINEERING, INC., JOB NO. PAZ-PDOT-01.3, HEC2 FILE VM03.H2I
T2  SUBCRITICAL HYDRAULIC ANALYSIS OF THE MAIN UN-NAMED WASH: 100-YR STORM
T3  6-21-94

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0        2        0        0       -1        0        0        0    2837.56     0

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

      1        0       -1        0        0        0       -1        0        0        0


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38       1        2        3       26       68       43        8       25       13
     14      15

NC      .07      .07      .05     0.100    0.300
   Q5   =  429 cfs, upstream from breakout
   Q10  = 1074 cfs, upstream from breakout
   Q25  = 1181 cfs, upstream from breakout
   Q100 = 2147 cfs, upstream from breakout
QT        1     2147
X1     0152       11       75      103      0.0      0.0      0.0
GR     2840        0     2838       18     2836       27     2836       43     2836       75
GR   2835.7       82   2835.7       90     2836      103     2838      114     2840      128
GR     2842      139

X1     0268       11       26      105       92    115.5      107
GR   2846.4        0   2846.3       14     2846       26     2845       35     2844       40
GR     2843       49     2842       58   2842.1       73     2843       86     2844      105
GR     2845      120

X1     0409       12       75      101     56.5       58       57
GR     2854        0     2852       37     2850       51     2848       64     2846       75
GR   2845.5       79   2845.5       87     2846      101     2848      143     2850      160
GR     2852      171     2854      186

X1     0497       14       81       96       86       91       88
GR   2856.7        0     2856     27.5     2854       39     2852       48     2850       70
GR     2848       81   2847.2       85   2847.2       93     2848       96     2850      103
GR     2852      116     2854      126     2856      132     2858      149

X1     0552       10       86      103       55       55     55.5
GR     2856        0     2854       67     2852       77     2850       86   2849.7       90
GR   2849.7       98     2850      103     2852      107     2854      135     2856      147
```

X1	0644	8	59	77	95	89	92			
GR	2860	0	2858	26.5	2854	59	2852.5	65.5	2852.5	73.5
GR	2854	77	2856	82	2857.2	90				
X1	0721	9	52	62	78	78.5	77.5			
GR	2864	0	2862	20	2860	52	2858.2	55	2858.2	59
GR	2860	62	2862	74	2864	79	2866	108		
X1	0773	9	37	51	52.5	52	52			
GR	2866	0	2864	21.5	2862	37	2861.5	40	2861.5	48
GR	2862	51	2864	61	2866	77	2868	88		
X1	0822	9	26	42	53	41	49			
GR	2867.5	0	2866	26	2864	31	2864	39	2866	42
GR	2868	69	2868	74.5	2868	82	2869.6	90		
X1	0842	7	33	49	21	20	20.5			
GR	2868	0	2866	33	2864.6	37	2864.6	45	2866	49
GR	2868	80	2870	90						
X1	0892	9	50	68.5	71	68	70			
GR	2872	0	2870.2	22	2870	27	2868	50	2866.1	55
GR	2866.1	63	2868	68.5	2870	70	2872	93		

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

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV= .100 CEHV= .300

*SECNO 152.000

3720 CRITICAL DEPTH ASSUMED

152.000	2.73	2838.43	2838.43	2837.56	2839.50	1.07	.00	.00	2836.00
1686.2	865.5	744.4	76.3	130.6	73.6	16.4	.0	.0	2836.00
.00	6.63	10.12	4.64	.070	.050	.070	.000	2835.70	14.09
.031996	0.	0.	0.	0	10	0	.00	102.95	117.04

*SECNO 268.000

3280 CROSS SECTION 268.00 EXTENDED .60 FEET

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

268.000	3.60	2845.60	2845.60	.00	2846.75	1.14	2.96	.02	2846.00
1686.2	.0	1627.7	58.4	.0	186.9	16.5	.5	.2	2844.00
.00	.00	8.71	3.54	.000	.050	.070	.000	2842.00	29.58
.025753	92.	107.	116.	0	11	0	.00	90.42	120.00

*SECNO 409.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

409.000	3.81	2849.31	2849.31	.00	2850.47	1.16	1.36	.01	2846.00
1686.2	151.2	984.9	550.0	30.9	94.5	104.1	.8	.4	2846.00
.01	4.89	10.43	5.28	.070	.050	.070	.000	2845.50	55.51
.022086	57.	57.	58.	0	8	0	.00	98.59	154.10

*SECNO 497.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

497.000	5.62	2852.82	2852.82	.00	2854.25	1.43	1.70	.08	2848.00
1686.2	447.0	964.3	274.9	83.7	81.6	52.2	1.2	.5	2848.00
.01	5.34	11.82	5.27	.070	.050	.070	.000	2847.20	44.29
.016816	86.	88.	91.	0	14	0	.00	75.83	120.12

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

*SECNO 552.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

552.000	5.36	2855.06	2855.06	.00	2856.29	1.23	.87	.02	2850.00
1686.2	353.9	986.1	346.2	75.9	89.7	77.2	1.5	.6	2850.00
.01	4.66	10.99	4.48	.070	.050	.070	.000	2849.70	31.54
.014890	55.	56.	55.	0	11	0	.00	109.81	141.35

*SECNO 644.000
3280 CROSS SECTION 644.00 EXTENDED 1.23 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

644.000	5.93	2858.43	2858.43	.00	2859.96	1.53	1.43	.09	2854.00
1686.2	384.6	1148.0	153.6	80.4	99.3	31.9	2.0	.8	2854.00
.01	4.78	11.56	4.82	.070	.050	.070	.000	2852.50	20.74
.016061	95.	92.	89.	0	8	0	.00	69.26	90.00

*SECNO 721.000
3280 CROSS SECTION 721.00 EXTENDED .19 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

721.000	5.99	2864.19	2864.19	.00	2865.46	1.27	1.40	.03	2860.00
1686.2	747.7	670.6	267.8	125.8	54.5	44.5	2.4	1.0	2860.00
.02	5.94	12.31	6.02	.070	.050	.070	.000	2858.20	.00
.020301	78.	78.	79.	0	5	0	.00	81.74	81.74

*SECNO 773.000
3280 CROSS SECTION 773.00 EXTENDED .60 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

773.000	5.10	2866.60	2866.60	.00	2867.95	1.35	1.03	.02	2862.00
1703.6	518.1	836.8	348.7	90.1	69.9	62.5	2.7	1.1	2862.00
.02	5.75	11.98	5.58	.070	.050	.070	.000	2861.50	.00
.019186	53.	52.	52.	0	15	0	.00	80.29	80.29

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

*SECNO 822.000
3280 CROSS SECTION 822.00 EXTENDED 2.19 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

822.000	5.69	2869.69	2869.69	.00	2871.00	1.31	.92	.00	2866.00
1928.3	433.1	976.5	518.7	76.4	83.0	101.7	2.9	1.2	2866.00
.02	5.67	11.76	5.10	.070	.050	.070	.000	2864.00	.00
.018879	53.	49.	41.	0	8	0	.00	90.00	90.00

*SECNO 842.000
3280 CROSS SECTION 842.00 EXTENDED 2.53 FEET

3301 HV CHANGED MORE THAN HVINS

842.000	5.93	2870.53	2869.74	.00	2871.33	.80	.28	.05	2866.00
2015.4	565.5	849.1	600.7	116.5	89.3	124.8	3.1	1.2	2866.00
.02	4.85	9.51	4.81	.070	.050	.070	.000	2864.60	.00
.010754	21.	21.	20.	3	15	0	.00	90.00	90.00

*SECNO 892.000
3280 CROSS SECTION 892.00 EXTENDED .63 FEET

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

892.000	6.53	2872.63	2872.63	.00	2874.09	1.46	.89	.20	2868.00
2147.0	687.9	1302.7	156.4	129.8	110.8	42.9	3.6	1.4	2868.00
.02	5.30	11.75	3.64	.070	.050	.070	.000	2866.10	.00
.015072	71.	70.	68.	0	8	0	.00	93.00	93.00

TW SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
131.64	131.69	.04	131.64	131.69	.04	7	2870.532	2872.630	842.000	892.000

TW SPLIT FLOW REACH 0822 TO 0842

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
87.10	87.11	.01	218.74	218.80	.03	7	2869.690	2870.532	822.000	842.000

TW SPLIT FLOW REACH 0773 TO 0822

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
224.69	224.78	.04	443.43	443.58	.03	7	2866.598	2869.690	773.000	822.000

TW SPLIT FLOW REACH 0721 TO 0773

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
17.39	17.45	.34	460.82	461.03	.05	7	2864.189	2866.598	721.000	773.000

THIS RUN EXECUTED 22JUN94 08:46:52

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

-94

SUMMARY PRINTOUT

	SECNO	CWSEL	CRIWS	EG	VCH	FRCH	Q	DEPTH	AREA	QLOB	QCH	QROB
*	152.000	2838.43	2838.43	2839.50	10.12	1.10	1686.18	2.73	220.61	865.46	744.44	76.28
*	268.000	2845.60	2845.60	2846.75	8.71	.98	1686.18	3.60	203.40	.00	1627.73	58.45
*	409.000	2849.31	2849.31	2850.47	10.43	.96	1686.18	3.81	229.46	151.23	984.91	550.04
*	497.000	2852.82	2852.82	2854.25	11.82	.89	1686.18	5.62	217.49	447.01	964.29	274.88
*	552.000	2855.06	2855.06	2856.29	10.99	.84	1686.18	5.36	242.87	353.91	986.07	346.20
*	644.000	2858.43	2858.43	2859.96	11.56	.87	1686.18	5.93	211.56	384.60	1148.03	153.55
*	721.000	2864.19	2864.19	2865.46	12.31	.93	1686.18	5.99	224.77	747.73	670.62	267.83
*	773.000	2866.60	2866.60	2867.95	11.98	.94	1703.57	5.10	222.52	518.12	836.75	348.69
*	822.000	2869.69	2869.69	2871.00	11.76	.91	1928.26	5.69	261.17	433.06	976.54	518.66
	842.000	2870.53	2869.74	2871.33	9.51	.71	2015.36	5.93	330.57	565.55	849.14	600.67
*	892.000	2872.63	2872.63	2874.09	11.75	.85	2147.00	6.53	283.55	687.87	1302.72	156.41

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION SECNO=    152.000  PROFILE=  1  CRITICAL DEPTH ASSUMED

CAUTION SECNO=    268.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    268.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    409.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    409.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    497.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    497.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    552.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    552.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    644.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    644.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    721.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    721.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    773.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    773.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    822.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    822.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    892.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    892.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY
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APPENDIX NUMBER 3:

HEC-2 INPUT AND OUTPUT FILES FOR AN AT-GRADE DIP CROSSING (ALTERNATIVE NUMBER 1)

Alt. #2

At-Grade Dip

```
SF  SPLIT FLOW ANALYSIS OF THE MAIN UN-NAMED WASH
JC  SPLIT FLOW ANALYSIS OF LEFT-BANK OVERFLOW
JP     0       0       0       0   +0.00
TW  SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)
WS     4    0842    0892      -1     1.2
WC     0    2868      16    2868      30    2872      52    2872
TW  SPLIT FLOW REACH 0822 TO 0842
WS     2    0822    0842      -1     1.2
WC     0  2867.5      20    2868
TW  SPLIT FLOW REACH 0773 TO 0822
WS     3     773     822      -1     1.2
WC     0    2864      41    2867      69  2867.5
TW  SPLIT FLOW REACH 0721 TO 0773
WS     2    0721    0773      -1     1.2
WC     0    2864      57    2866
EE
T1  ARRROYO ENGINEERING, INC., JOB NO. PAZ-PDOT-01.3, HEC2 FILE VM04.H2I
T2  SUBCRITICAL HYDRAULIC ANALYSIS OF THE MAIN UN-NAMED WASH: 100-YR STORM
T3  6-21-94, Alternative No. 2: At-Grade Dip Crossing
J1     0       2       0       0      -1       0       0       0 2837.56       0
J2     1       0      -1       0       0       0      -1       0       0       0
J3    38       1       2       3      26      68      43       8      25      13
J3    14      15
NC   .07     .07     .05   0.100   0.300
*  Q5   =  429 cfs, upstream from breakout
*  Q10  = 1074 cfs, upstream from breakout
*  Q25  = 1181 cfs, upstream from breakout
*  Q100 = 2147 cfs, upstream from breakout
QT     1    2147
X1  0152      11      75     103     0.0     0.0     0.0
GR  2840       0    2838      18    2836      27    2836      43    2836      75
GR2835.7      82  2835.7      90    2836     103    2838     114    2840     128
GR  2842     139
X1  0268      11      40     100      92   115.5     107
GR2847.0       0  2845.4      20  2843.4      40    2842      60    2841      80
GR  2841     100  2846.2     120  2844.8     140    2846     160    2847     180
GR  2848     200
X1  0409      12      75     101    56.5      58      57
GR  2854       0    2852      37    2850      51    2848      64    2846      75
GR2845.5      79  2845.5      87    2846     101    2848     143    2850     160
GR  2852     171    2854     186
X1  0497      14      81      96      86      91      88
GR2856.7       0    2856    27.5    2854      39    2852      48    2850      70
GR  2848      81  2847.2      85  2847.2      93    2848      96    2850     103
GR  2852     116    2854     126    2856     132    2858     149
X1  0552      10      86     103      55      55    55.5
GR  2856       0    2854      67    2852      77    2850      86  2849.7      90
GR2849.7      98    2850     103    2852     107    2854     135    2856     147
X1  0644       8      59      77      95      89      92
GR  2860       0    2858    26.5    2854      59  2852.5    65.5  2852.5    73.5
GR  2854      77    2856      82  2857.2      90
X1  0721       9      52      62      78    78.5    77.5
GR  2864       0    2862      20    2860      52  2858.2      55  2858.2      59
GR  2860      62    2862      74    2864      79    2866     108
X1  0773       9      37      51    52.5      52      52
GR  2866       0    2864    21.5    2862      37  2861.5      40  2861.5      48
GR  2862      51    2864      61    2866      77    2868      88
X1  0822       9      26      42      53      41      49
GR2867.5       0    2866      26    2864      31    2864      39    2866      42
GR  2868      69    2868    74.5    2868      82  2869.6      90
```

```
X1  0842     7     33     49     21     20    20.5
GR  2868     0   2866     33 2864.6     37 2864.6     45   2866     49
GR  2868    80   2870     90
X1  0892     9     50   68.5     71     68     70
GR  2872     0 2870.2     22   2870     27   2868     50 2866.1     55
GR2866.1    63   2868   68.5   2870     70   2872     93
EJ
ER
```

Q5

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*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    26JUN94    TIME   13:29:10   *
*********************************************
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*          (916) 756-1104           *
*************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX              XXXXXXX
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THIS RUN EXECUTED 26JUN94 13:29:11

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*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*************************************



SPLIT FLOW BEING PERFORMED


SF  SPLIT FLOW ANALYSIS OF THE MAIN UN-NAMED WASH


JC  SPLIT FLOW ANALYSIS OF LEFT-BANK OVERFLOW
JP     0       0       0       0   +0.00

TW  SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)
WS     4    0842    0892      -1     1.2
WC     0    2868      16    2868      30    2872      52    2872

TW  SPLIT FLOW REACH 0822 TO 0842
WS     2    0822    0842      -1     1.2
WC     0  2867.5      20    2868

TW  SPLIT FLOW REACH 0773 TO 0822
WS     3     773     822      -1     1.2
WC     0    2864      41    2867      69  2867.5

TW  SPLIT FLOW REACH 0721 TO 0773
WS     2    0721    0773      -1     1.2
WC     0    2864      57    2866
```

```
T1  ARRROYO ENGINEERING, INC., JOB NO. PAZ-PDOT-01.3, HEC2 FILE VM04.H2I
T2  SUBCRITICAL HYDRAULIC ANALYSIS OF THE MAIN UN-NAMED WASH: 100-YR STORM
T3  6-21-94, Alternative No. 2: At-Grade Dip Crossing

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0        2        0        0       -1        0        0        0    2837.56     0

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

      1        0       -1        0        0        0       -1        0        0        0


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38       1        2        3       26       68       43        8       25       13
     14       15

NC     .07      .07      .05     0.100    0.300
   Q5   =  429 cfs, upstream from breakout
   Q10  = 1074 cfs, upstream from breakout
   Q25  = 1181 cfs, upstream from breakout
   Q100 = 2147 cfs, upstream from breakout
QT       1      429
X1     0152      11       75      103      0.0      0.0      0.0
GR     2840       0     2838       18     2836       27     2836       43     2836       75
GR   2835.7      82   2835.7       90     2836      103     2838      114     2840      128
GR     2842     139

X1     0268      11       40      100       92    115.5      107
GR   2847.0       0   2845.4       20   2843.4       40     2842       60     2841       80
GR     2841     100   2846.2      120   2844.8      140     2846      160     2847      180
GR     2848     200

X1     0409      12       75      101     56.5       58       57
GR     2854       0     2852       37     2850       51     2848       64     2846       75
GR   2845.5      79   2845.5       87     2846      101     2848      143     2850      160
GR     2852     171     2854      186

X1     0497      14       81       96       86       91       88
GR   2856.7       0     2856     27.5     2854       39     2852       48     2850       70
GR     2848      81   2847.2       85   2847.2       93     2848       96     2850      103
GR     2852     116     2854      126     2856      132     2858      149

X1     0552      10       86      103       55       55     55.5
GR     2856       0     2854       67     2852       77     2850       86   2849.7       90
GR   2849.7      98     2850      103     2852      107     2854      135     2856      147
```

X1	0644	8	59	77	95	89	92			
GR	2860	0	2858	26.5	2854	59	2852.5	65.5	2852.5	73.5
GR	2854	77	2856	82	2857.2	90				
X1	0721	9	52	62	78	78.5	77.5			
GR	2864	0	2862	20	2860	52	2858.2	55	2858.2	59
GR	2860	62	2862	74	2864	79	2866	108		
X1	0773	9	37	51	52.5	52	52			
GR	2866	0	2864	21.5	2862	37	2861.5	40	2861.5	48
GR	2862	51	2864	61	2866	77	2868	88		
X1	0822	9	26	42	53	41	49			
GR	2867.5	0	2866	26	2864	31	2864	39	2866	42
GR	2868	69	2868	74.5	2868	82	2869.6	90		
X1	0842	7	33	49	21	20	20.5			
GR	2868	0	2866	33	2864.6	37	2864.6	45	2866	49
GR	2868	80	2870	90						
X1	0892	9	50	68.5	71	68	70			
GR	2872	0	2870.2	22	2870	27	2868	50	2866.1	55
GR	2866.1	63	2868	68.5	2870	70	2872	93		

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

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV= .100 CEHV= .300

*SECNO 152.000

3720 CRITICAL DEPTH ASSUMED

152.000	1.26	2836.96	2836.96	2837.56	2837.45	.48	.00	.00	2836.00
424.4	201.1	216.6	6.7	48.3	32.3	2.5	.0	.0	2836.00
.00	4.17	6.70	2.64	.070	.050	.070	.000	2835.70	22.67
.041913	0.	0.	0.	0	18	0	.00	85.62	108.29

*SECNO 268.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

268.000	1.73	2842.73	2842.73	.00	2843.35	.61	3.92	.04	2843.40
424.4	.0	404.1	20.2	.0	63.2	5.8	.2	.2	2841.00
.00	.00	6.39	3.50	.000	.050	.070	.000	2841.00	49.51
.034316	92.	107.	116.	0	11	0	.00	57.16	106.67

*SECNO 409.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

409.000	2.02	2847.52	2847.52	.00	2848.16	.64	1.66	.01	2846.00
424.4	17.6	339.1	67.7	6.4	48.0	24.3	.3	.2	2846.00
.01	2.76	7.06	2.79	.070	.050	.070	.000	2845.50	66.64
.024939	57.	57.	58.	0	8	0	.00	66.29	132.93

*SECNO 497.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

497.000	2.99	2850.19	2850.19	.00	2851.12	.93	1.98	.09	2848.00
424.4	44.4	352.2	27.8	13.3	42.1	8.5	.4	.4	2848.00
.01	3.33	8.37	3.28	.070	.050	.070	.000	2847.20	67.87
.020335	86.	88.	91.	0	14	0	.00	36.39	104.26

*SECNO 552.000

7185 MINIMUM SPECIFIC ENERGY

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

3720 CRITICAL DEPTH ASSUMED

552.000	2.63	2852.33	2852.33	.00	2853.26	.93	1.18	.00	2850.00
424.4	45.4	359.3	19.7	12.2	43.3	6.1	.5	.4	2850.00
.01	3.71	8.29	3.24	.070	.050	.070	.000	2849.70	75.35
.022366	55.	56.	55.	0	11	0	.00	36.25	111.61

*SECNO 644.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

644.000	3.04	2855.54	2855.54	.00	2856.53	.99	2.06	.02	2854.00
424.4	25.4	391.5	7.5	9.6	47.2	3.0	.6	.5	2854.00
.02	2.65	8.30	2.53	.070	.050	.070	.000	2852.50	46.51
.022338	95.	92.	89.	0	8	0	.00	34.34	80.84

*SECNO 721.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

721.000	4.01	2862.21	2862.21	.00	2862.85	.64	1.39	.04	2860.00
424.4	113.3	269.0	42.1	39.0	34.7	14.6	.8	.6	2860.00
.02	2.91	7.75	2.89	.070	.050	.070	.000	2858.20	17.89
.014691	78.	78.	79.	0	12	0	.00	56.64	74.53

*SECNO 773.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

773.000	2.79	2864.29	2864.29	.00	2865.09	.80	.90	.05	2862.00
424.4	71.6	306.9	45.9	20.4	37.5	13.2	.9	.6	2862.00
.02	3.52	8.18	3.48	.070	.050	.070	.000	2861.50	18.43
.020552	53.	52.	52.	0	19	0	.00	44.85	63.28

*SECNO 822.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

822.000	3.44	2867.44	2867.44	.00	2868.19	.76	.90	.00	2866.00
425.1	39.2	355.4	30.5	17.9	47.0	13.9	.9	.7	2866.00
.02	2.20	7.57	2.20	.070	.050	.070	.000	2864.00	1.12
.016710	53.	49.	41.	0	11	0	.00	60.26	61.38

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

*SECNO 842.000
3280 CROSS SECTION 842.00 EXTENDED .13 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.48

842.000	3.52	2868.12	2867.60	.00	2868.46	.33	.22	.04	2866.00
425.4	74.6	280.5	70.3	37.2	50.8	35.0	1.0	.7	2866.00
.02	2.01	5.52	2.01	.070	.050	.070	.000	2864.60	.00
.007674	21.	21.	20.	2	11	0	.00	80.64	80.64

*SECNO 892.000

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

892.000	3.17	2869.27	2869.27	.00	2870.30	1.03	.86	.21	2868.00
429.0	21.9	406.1	1.0	9.3	48.7	.6	1.1	.8	2868.00
.03	2.36	8.35	1.68	.070	.050	.070	.000	2866.10	35.40
.022777	71.	70.	68.	0	11	0	.00	34.05	69.45

85

TW SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
3.58	3.58	.00	3.58	3.58	.00	6	2868.124	2869.269	842.000	892.000

TW SPLIT FLOW REACH 0822 TO 0842

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.27	.27	.08	3.85	3.85	.01	6	2867.435	2868.124	822.000	842.000

TW SPLIT FLOW REACH 0773 TO 0822

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.76	.76	.10	4.61	4.61	.01	6	2864.285	2867.435	773.000	822.000

TW SPLIT FLOW REACH 0721 TO 0773

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.00	.00	.00	4.61	4.61	.01	6	2862.211	2864.285	721.000	773.000

THIS RUN EXECUTED 26JUN94 13:29:45

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

-94, Alternative No. 2:

SUMMARY PRINTOUT

	SECNO	CWSEL	CRIWS	EG	VCH	FRCH	Q	DEPTH	AREA	QLOB	QCH	QROB
*	152.000	2836.96	2836.96	2837.45	6.70	1.10	424.39	1.26	83.15	201.09	216.58	6.72
*	268.000	2842.73	2842.73	2843.35	6.39	1.01	424.39	1.73	69.01	.00	404.15	20.24
*	409.000	2847.52	2847.52	2848.16	7.06	.92	424.39	2.02	78.67	17.56	339.09	67.74
*	497.000	2850.19	2850.19	2851.12	8.37	.88	424.39	2.99	63.92	44.37	352.21	27.80
*	552.000	2852.33	2852.33	2853.26	8.29	.91	424.39	2.63	61.65	45.43	359.29	19.66
*	644.000	2855.54	2855.54	2856.53	8.30	.90	424.39	3.04	59.74	25.45	391.45	7.49
*	721.000	2862.21	2862.21	2862.85	7.75	.73	424.39	4.01	88.27	113.25	269.04	42.09
*	773.000	2864.29	2864.29	2865.09	8.18	.88	424.39	2.79	71.03	71.63	306.86	45.90
*	822.000	2867.44	2867.44	2868.19	7.57	.78	425.15	3.44	78.72	39.23	355.39	30.53
*	842.000	2868.12	2867.60	2868.46	5.52	.55	425.42	3.52	123.02	74.64	280.50	70.28
*	892.000	2869.27	2869.27	2870.30	8.35	.91	429.00	3.17	58.52	21.86	406.12	1.02

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION SECNO=    152.000  PROFILE=  1  CRITICAL DEPTH ASSUMED

CAUTION SECNO=    268.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    268.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    409.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    409.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    497.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    497.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    552.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    552.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    644.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    644.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    721.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    721.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    773.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    773.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    822.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    822.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

WARNING SECNO=    842.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=    892.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    892.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY
```

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*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    26JUN94    TIME   13:32:11   *
*********************************************
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****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  HYDROLOGIC ENGINEERING CENTER       *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616-4687        *
*          (916) 756-1104              *
****************************************
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```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X      X     X            X     X
X     X  X        X                       X
XXXXXXX  XXXX     X          XXXXX   XXXXX
X     X  X        X                 X
X     X  X        X     X           X
X     X  XXXXXXX   XXXXX            XXXXXXX
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THIS RUN EXECUTED 26JUN94 13:32:12

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************


SPLIT FLOW BEING PERFORMED


SF  SPLIT FLOW ANALYSIS OF THE MAIN UN-NAMED WASH


JC  SPLIT FLOW ANALYSIS OF LEFT-BANK OVERFLOW
JP     0       0       0       0   +0.00

TW  SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)
WS     4    0842    0892      -1     1.2
WC     0    2868      16    2868      30    2872      52    2872

TW  SPLIT FLOW REACH 0822 TO 0842
WS     2    0822    0842      -1     1.2
WC     0  2867.5      20    2868

TW  SPLIT FLOW REACH 0773 TO 0822
WS     3     773     822      -1     1.2
WC     0    2864      41    2867      69  2867.5

TW  SPLIT FLOW REACH 0721 TO 0773
WS     2    0721    0773      -1     1.2
WC     0    2864      57    2866
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T1  ARRROYO ENGINEERING, INC., JOB NO. PAZ-PDOT-01.3, HEC2 FILE VM04.H2I
T2  SUBCRITICAL HYDRAULIC ANALYSIS OF THE MAIN UN-NAMED WASH: 100-YR STORM
T3  6-21-94, Alternative No. 2: At-Grade Dip Crossing

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0        2        0        0       -1        0        0        0     2837.56     0

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

      1        0       -1        0        0        0       -1        0        0        0


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38        1        2        3       26       68       43        8       25       13
     14       15

NC      .07      .07      .05     0.100    0.300
   Q5   =  429 cfs, upstream from breakout
   Q10  = 1074 cfs, upstream from breakout
   Q25  = 1181 cfs, upstream from breakout
   Q100 = 2147 cfs, upstream from breakout
QT        1     1074
X1     0152       11       75      103      0.0      0.0      0.0
GR     2840        0     2838       18     2836       27     2836       43     2836       75
GR   2835.7       82   2835.7       90     2836      103     2838      114     2840      128
GR     2842      139

X1     0268       11       40      100       92    115.5      107
GR   2847.0        0   2845.4       20   2843.4       40     2842       60     2841       80
GR     2841      100   2846.2      120   2844.8      140     2846      160     2847      180
GR     2848      200

X1     0409       12       75      101     56.5       58       57
GR     2854        0     2852       37     2850       51     2848       64     2846       75
GR   2845.5       79   2845.5       87     2846      101     2848      143     2850      160
GR     2852      171     2854      186

X1     0497       14       81       96       86       91       88
GR   2856.7        0     2856     27.5     2854       39     2852       48     2850       70
GR     2848       81   2847.2       85   2847.2       93     2848       96     2850      103
GR     2852      116     2854      126     2856      132     2858      149

X1     0552       10       86      103       55       55     55.5
GR     2856        0     2854       67     2852       77     2850       86   2849.7       90
GR   2849.7       98     2850      103     2852      107     2854      135     2856      147
```

X1	0644	8	59	77	95	89	92			
GR	2860	0	2858	26.5	2854	59	2852.5	65.5	2852.5	73.5
GR	2854	77	2856	82	2857.2	90				
X1	0721	9	52	62	78	78.5	77.5			
GR	2864	0	2862	20	2860	52	2858.2	55	2858.2	59
GR	2860	62	2862	74	2864	79	2866	108		
X1	0773	9	37	51	52.5	52	52			
GR	2866	0	2864	21.5	2862	37	2861.5	40	2861.5	48
GR	2862	51	2864	61	2866	77	2868	88		
X1	0822	9	26	42	53	41	49			
GR	2867.5	0	2866	26	2864	31	2864	39	2866	42
GR	2868	69	2868	74.5	2868	82	2869.6	90		
X1	0842	7	33	49	21	20	20.5			
GR	2868	0	2866	33	2864.6	37	2864.6	45	2866	49
GR	2868	80	2870	90						
X1	0892	9	50	68.5	71	68	70			
GR	2872	0	2870.2	22	2870	27	2868	50	2866.1	55
GR	2866.1	63	2868	68.5	2870	70	2872	93		

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

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV= .100 CEHV= .300

*SECNO 152.000

3720 CRITICAL DEPTH ASSUMED

152.000	1.92	2837.62	2837.62	2837.56	2838.40	.78	.00	.00	2836.00
925.3	463.7	435.9	25.7	83.9	50.9	7.3	.0	.0	2836.00
.00	5.53	8.57	3.54	.070	.050	.070	.000	2835.70	19.69
.037527	0.	0.	0.	0	7	0	.00	92.24	111.93

*SECNO 268.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

268.000	2.58	2843.58	2843.58	.00	2844.50	.91	3.51	.04	2843.40
925.3	.1	869.8	55.4	.2	111.0	12.8	.3	.2	2841.00
.00	.75	7.84	4.31	.070	.050	.070	.000	2841.00	38.16
.030650	92.	107.	116.	0	11	0	.00	71.77	109.94

*SECNO 409.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

409.000	2.96	2848.46	2848.46	.00	2849.29	.83	1.44	.01	2846.00
925.3	63.7	618.0	243.6	16.7	72.4	62.1	.5	.3	2846.00
.01	3.81	8.53	3.92	.070	.050	.070	.000	2845.50	61.02
.021084	57.	57.	58.	0	8	0	.00	85.87	146.90

*SECNO 497.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

497.000	4.35	2851.55	2851.55	.00	2852.75	1.20	1.71	.11	2848.00
925.3	178.6	636.1	110.7	41.4	62.5	25.7	.8	.4	2848.00
.01	4.32	10.18	4.30	.070	.050	.070	.000	2847.20	52.91
.017772	86.	88.	91.	0	14	0	.00	60.19	113.10

*SECNO 552.000

7185 MINIMUM SPECIFIC ENERGY

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


3720 CRITICAL DEPTH ASSUMED
  552.000      4.00    2853.70    2853.70       .00    2854.90       1.20       1.00        .00    2850.00
    925.3     151.4      666.2      107.6      31.5       66.6       30.9         .9         .5    2850.00
      .01      4.81      10.01       3.48      .070       .050       .070       .000    2849.70      68.52
  .018390       55.        56.        55.         0          8          0        .00      62.22     130.74


*SECNO 644.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  644.000      4.51    2857.01    2857.01       .00    2858.30       1.29       1.68        .03    2854.00
    925.3     137.1      738.7       49.5      36.9       73.7       13.5        1.2         .6    2854.00
      .01      3.72      10.02       3.68      .070       .050       .070       .000    2852.50      34.53
  .017966       95.        92.        89.         0          8          0        .00      54.22      88.75


*SECNO 721.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  721.000      4.92    2863.12    2863.12       .00    2864.12       1.00       1.45        .03    2860.00
    925.3     343.3      455.9      126.1      74.1       43.8       27.0        1.5         .8    2860.00
      .02      4.63      10.41       4.67      .070       .050       .070       .000    2858.20       8.81
  .019437       78.        78.        79.         0          8          0        .00      67.99      76.80


*SECNO 773.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  773.000      3.96    2865.46    2865.46       .00    2866.53       1.06       1.01        .02    2862.00
    925.3     230.9      543.8      150.6      49.7       54.0       33.2        1.6         .8    2862.00
      .02      4.64      10.07       4.53      .070       .050       .070       .000    2861.50       5.76
  .019131       53.        52.        52.         0         16          0        .00      66.95      72.71


*SECNO 822.000
3280 CROSS SECTION    822.00 EXTENDED      1.14 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  822.000      4.64    2868.64    2868.64       .00    2869.55        .91        .84        .02    2866.00
    992.4     195.3      614.6      182.5      49.2       66.3       53.7        1.8         .9    2866.00
      .02      3.97       9.27       3.40      .070       .050       .070       .000    2864.00        .00
  .015860       53.        49.        41.         0          8          0        .00      85.21      85.21
```

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

*SECNO 842.000
3280 CROSS SECTION 842.00 EXTENDED 1.33 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.40

842.000	4.73	2869.33	2868.69	.00	2869.82	.49	.23	.04	2866.00
1025.4	259.8	508.5	257.1	77.0	70.1	76.8	1.9	1.0	2866.00
.02	3.37	7.25	3.35	.070	.050	.070	.000	2864.60	.00
.008628	21.	21.	20.	2	15	0	.00	86.67	86.67

*SECNO 892.000

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

892.000	5.01	2871.11	2871.11	.00	2872.32	1.21	.80	.21	2868.00
1074.0	233.9	817.4	22.7	58.8	82.8	10.3	2.2	1.1	2868.00
.02	3.98	9.88	2.20	.070	.050	.070	.000	2866.10	10.84
.015707	71.	70.	68.	0	8	0	.00	71.95	82.80

TW SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
48.63	48.44	.40	48.63	48.44	.40	5	2869.331	2871.113	842.000	892.000

TW SPLIT FLOW REACH 0822 TO 0842

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
32.99	33.03	.11	81.62	81.47	.19	5	2868.642	2869.331	822.000	842.000

TW SPLIT FLOW REACH 0773 TO 0822

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
67.08	67.08	.00	148.70	148.54	.11	5	2865.464	2868.642	773.000	822.000

TW SPLIT FLOW REACH 0721 TO 0773

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.00	.00	.00	148.70	148.54	.11	5	2863.119	2865.464	721.000	773.000

THIS RUN EXECUTED 26JUN94 13:33:06

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HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

-94, Alternative No. 2:

SUMMARY PRINTOUT

	SECNO	CWSEL	CRIWS	EG	VCH	FRCH	Q	DEPTH	AREA	QLOB	QCH	QROB
*	152.000	2837.62	2837.62	2838.40	8.57	1.12	925.30	1.92	141.99	463.71	435.92	25.67
*	268.000	2843.58	2843.58	2844.50	7.84	1.02	925.30	2.58	124.01	.13	869.81	55.36
*	409.000	2848.46	2848.46	2849.29	8.53	.90	925.30	2.96	151.28	63.68	618.00	243.62
*	497.000	2851.55	2851.55	2852.75	10.18	.88	925.30	4.35	129.58	178.56	636.07	110.67
*	552.000	2853.70	2853.70	2854.90	10.01	.89	925.30	4.00	128.94	151.44	666.22	107.65
*	644.000	2857.01	2857.01	2858.30	10.02	.87	925.30	4.51	124.04	137.09	738.67	49.54
*	721.000	2863.12	2863.12	2864.12	10.41	.88	925.30	4.92	144.88	343.31	455.92	126.06
*	773.000	2865.46	2865.46	2866.53	10.07	.90	925.30	3.96	136.93	230.88	543.80	150.63
*	822.000	2868.64	2868.64	2869.55	9.27	.80	992.38	4.64	169.16	195.26	614.60	182.51
*	842.000	2869.33	2868.69	2869.82	7.25	.61	1025.37	4.73	223.88	259.79	508.47	257.11
*	892.000	2871.11	2871.11	2872.32	9.88	.82	1074.00	5.01	151.80	233.94	817.40	22.66

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SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION SECNO=    152.000  PROFILE=  1  CRITICAL DEPTH ASSUMED

CAUTION SECNO=    268.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    268.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    409.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    409.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    497.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    497.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    552.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    552.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    644.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    644.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    721.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    721.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    773.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    773.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    822.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    822.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

WARNING SECNO=    842.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=    892.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    892.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY
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Q25

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*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    26JUN94    TIME   13:35:57   *
*********************************************
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*          (916) 756-1104           *
*************************************
```

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X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X         XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
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THIS RUN EXECUTED 26JUN94 13:35:58

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************



SPLIT FLOW BEING PERFORMED


SF  SPLIT FLOW ANALYSIS OF THE MAIN UN-NAMED WASH


JC  SPLIT FLOW ANALYSIS OF LEFT-BANK OVERFLOW
JP     0       0       0       0   +0.00

TW  SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)
WS     4    0842    0892      -1     1.2
WC     0    2868      16    2868      30    2872      52    2872

TW  SPLIT FLOW REACH 0822 TO 0842
WS     2    0822    0842      -1     1.2
WC     0  2867.5      20    2868

TW  SPLIT FLOW REACH 0773 TO 0822
WS     3     773     822      -1     1.2
WC     0    2864      41    2867      69  2867.5

TW  SPLIT FLOW REACH 0721 TO 0773
WS     2    0721    0773      -1     1.2
WC     0    2864      57    2866
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T1  ARRROYO ENGINEERING, INC., JOB NO. PAZ-PDOT-01.3, HEC2 FILE VM04.H2I
T2  SUBCRITICAL HYDRAULIC ANALYSIS OF THE MAIN UN-NAMED WASH: 100-YR STORM
T3  6-21-94, Alternative No. 2: At-Grade Dip Crossing

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0        2        0        0       -1        0        0        0    2837.56     0

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

      1        0       -1        0        0        0       -1        0        0        0


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38        1        2        3       26       68       43        8       25       13
     14       15

NC     .07      .07      .05    0.100    0.300
   Q5   =  429 cfs, upstream from breakout
   Q10  = 1074 cfs, upstream from breakout
   Q25  = 1181 cfs, upstream from breakout
   Q100 = 2147 cfs, upstream from breakout
QT       1     1181
X1    0152       11       75      103      0.0      0.0      0.0
GR    2840        0     2838       18     2836       27     2836       43     2836       75
GR  2835.7       82   2835.7       90     2836      103     2838      114     2840      128
GR    2842      139

X1    0268       11       40      100       92    115.5      107
GR  2847.0        0   2845.4       20   2843.4       40     2842       60     2841       80
GR    2841      100   2846.2      120   2844.8      140     2846      160     2847      180
GR    2848      200

X1    0409       12       75      101     56.5       58       57
GR    2854        0     2852       37     2850       51     2848       64     2846       75
GR  2845.5       79   2845.5       87     2846      101     2848      143     2850      160
GR    2852      171     2854      186

X1    0497       14       81       96       86       91       88
GR  2856.7        0     2856     27.5     2854       39     2852       48     2850       70
GR    2848       81   2847.2       85   2847.2       93     2848       96     2850      103
GR    2852      116     2854      126     2856      132     2858      149

X1    0552       10       86      103       55       55     55.5
GR    2856        0     2854       67     2852       77     2850       86   2849.7       90
GR  2849.7       98     2850      103     2852      107     2854      135     2856      147
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X1	0644	8	59	77	95	89	92			
GR	2860	0	2858	26.5	2854	59	2852.5	65.5	2852.5	73.5
GR	2854	77	2856	82	2857.2	90				
X1	0721	9	52	62	78	78.5	77.5			
GR	2864	0	2862	20	2860	52	2858.2	55	2858.2	59
GR	2860	62	2862	74	2864	79	2866	108		
X1	0773	9	37	51	52.5	52	52			
GR	2866	0	2864	21.5	2862	37	2861.5	40	2861.5	48
GR	2862	51	2864	61	2866	77	2868	88		
X1	0822	9	26	42	53	41	49			
GR	2867.5	0	2866	26	2864	31	2864	39	2866	42
GR	2868	69	2868	74.5	2868	82	2869.6	90		
X1	0842	7	33	49	21	20	20.5			
GR	2868	0	2866	33	2864.6	37	2864.6	45	2866	49
GR	2868	80	2870	90						
X1	0892	9	50	68.5	71	68	70			
GR	2872	0	2870.2	22	2870	27	2868	50	2866.1	55
GR	2866.1	63	2868	68.5	2870	70	2872	93		

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

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV= .100 CEHV= .300

*SECNO 152.000

3720 CRITICAL DEPTH ASSUMED

152.000	2.02	2837.72	2837.72	2837.56	2838.54	.82	.00	.00	2836.00
1006.4	506.6	470.2	29.6	89.2	53.6	8.1	.0	.0	2836.00
.00	5.68	8.78	3.64	.070	.050	.070	.000	2835.70	19.26
.036769	0.	0.	0.	0	7	0	.00	93.20	112.46

*SECNO 268.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

268.000	2.69	2843.69	2843.69	.00	2844.65	.96	3.43	.04	2843.40
1006.4	.4	945.0	61.0	.4	117.5	13.9	.3	.2	2841.00
.00	1.01	8.05	4.38	.070	.050	.070	.000	2841.00	37.09
.029972	92.	107.	116.	0	11	0	.00	73.26	110.35

*SECNO 409.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

409.000	3.06	2848.56	2848.56	.00	2849.44	.87	1.43	.01	2846.00
1006.4	72.1	659.6	274.7	18.2	75.1	66.9	.5	.3	2846.00
.01	3.97	8.79	4.11	.070	.050	.070	.000	2845.50	60.36
.021295	57.	57.	58.	0	8	0	.00	87.41	147.76

*SECNO 497.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

497.000	4.48	2851.68	2851.68	.00	2852.95	1.27	1.75	.12	2848.00
1006.4	201.6	680.1	124.8	45.0	64.4	27.9	.8	.5	2848.00
.01	4.48	10.56	4.47	.070	.050	.070	.000	2847.20	51.53
.018399	86.	88.	91.	0	14	0	.00	62.39	113.91

*SECNO 552.000

7185 MINIMUM SPECIFIC ENERGY

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

3720 CRITICAL DEPTH ASSUMED

552.000	4.22	2853.92	2853.92	.00	2855.09	1.17	.98	.01	2850.00
1006.4	171.2	703.9	131.3	35.6	70.5	37.6	1.0	.5	2850.00
.01	4.81	9.99	3.49	.070	.050	.070	.000	2849.70	67.38
.016987	55.	56.	55.	0	8	0	.00	66.57	133.95

*SECNO 644.000
3280 CROSS SECTION 644.00 EXTENDED .01 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

644.000	4.71	2857.21	2857.21	.00	2858.52	1.31	1.59	.04	2854.00
1006.4	159.9	786.9	59.7	41.8	77.3	15.9	1.3	.7	2854.00
.01	3.82	10.19	3.75	.070	.050	.070	.000	2852.50	32.93
.017439	95.	92.	89.	0	8	0	.00	57.07	90.00

*SECNO 721.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

721.000	5.04	2863.24	2863.24	.00	2864.29	1.05	1.45	.03	2860.00
1006.4	383.3	482.7	140.4	79.3	45.0	28.8	1.6	.8	2860.00
.02	4.84	10.73	4.88	.070	.050	.070	.000	2858.20	7.62
.019938	78.	78.	79.	0	8	0	.00	69.47	77.09

*SECNO 773.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

773.000	4.09	2865.59	2865.59	.00	2866.71	1.12	1.03	.02	2862.00
1006.4	257.9	579.9	168.6	53.7	55.7	36.0	1.7	.9	2862.00
.02	4.80	10.40	4.69	.070	.050	.070	.000	2861.50	4.42
.019576	53.	52.	52.	0	15	0	.00	69.28	73.71

*SECNO 822.000
3280 CROSS SECTION 822.00 EXTENDED 1.23 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

822.000	4.73	2868.73	2868.73	.00	2869.72	.99	.88	.01	2866.00
1085.9	217.5	659.6	208.8	51.4	67.6	57.4	1.9	.9	2866.00
.02	4.23	9.75	3.64	.070	.050	.070	.000	2864.00	.00
.017075	53.	49.	41.	0	11	0	.00	85.63	85.63

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

*SECNO 842.000
3280 CROSS SECTION 842.00 EXTENDED 1.50 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.45

842.000	4.89	2869.49	2868.81	.00	2870.01	.52	.24	.05	2866.00
1124.0	291.0	542.5	290.5	82.4	72.7	83.0	2.0	1.0	2866.00
.02	3.53	7.46	3.50	.070	.050	.070	.000	2864.60	.00
.008692	21.	21.	20.	2	15	0	.00	87.48	87.48

*SECNO 892.000

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

892.000	5.21	2871.31	2871.31	.00	2872.55	1.24	.80	.22	2868.00
1181.0	276.8	873.1	31.1	66.8	86.5	13.4	2.3	1.1	2868.00
.02	4.14	10.10	2.33	.070	.050	.070	.000	2866.10	8.40
.015491	71.	70.	68.	0	8	0	.00	76.69	85.09

TW SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
56.99	56.99	.00	56.99	56.99	.00	7	2869.492	2871.313	842.000	892.000

TW SPLIT FLOW REACH 0822 TO 0842

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
38.11	38.08	.08	95.10	95.08	.03	7	2868.727	2869.492	822.000	842.000

TW SPLIT FLOW REACH 0773 TO 0822

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
79.47	79.28	.24	174.57	174.35	.13	7	2865.588	2868.727	773.000	822.000

TW SPLIT FLOW REACH 0721 TO 0773

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.00	.00	.00	174.57	174.35	.13	7	2863.238	2865.588	721.000	773.000

THIS RUN EXECUTED 26JUN94 13:36:34

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

-94, Alternative No. 2:

SUMMARY PRINTOUT

	SECNO	CWSEL	CRIWS	EG	VCH	FRCH	Q	DEPTH	AREA	QLOB	QCH	QROB
*	152.000	2837.72	2837.72	2838.54	8.78	1.12	1006.43	2.02	150.91	506.56	470.25	29.62
*	268.000	2843.69	2843.69	2844.65	8.05	1.01	1006.43	2.69	131.80	.43	944.97	61.03
*	409.000	2848.56	2848.56	2849.44	8.79	.91	1006.43	3.06	160.14	72.12	659.57	274.74
*	497.000	2851.68	2851.68	2852.95	10.56	.90	1006.43	4.48	137.29	201.57	680.07	124.79
*	552.000	2853.92	2853.92	2855.09	9.99	.86	1006.43	4.22	143.69	171.24	703.91	131.28
*	644.000	2857.21	2857.21	2858.52	10.19	.87	1006.43	4.71	134.98	159.87	786.88	59.69
*	721.000	2863.24	2863.24	2864.29	10.73	.89	1006.43	5.04	153.00	383.31	482.71	140.41
*	773.000	2865.59	2865.59	2866.71	10.40	.92	1006.43	4.09	145.39	257.86	579.94	168.63
*	822.000	2868.73	2868.73	2869.72	9.75	.84	1085.90	4.73	176.40	217.50	659.61	208.79
*	842.000	2869.49	2868.81	2870.01	7.46	.62	1124.01	4.89	238.12	291.00	542.49	290.52
*	892.000	2871.31	2871.31	2872.55	10.10	.82	1181.00	5.21	166.64	276.83	873.06	31.12

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO=	152.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	268.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	268.000	PROFILE=	1	MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	409.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	409.000	PROFILE=	1	MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	497.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	497.000	PROFILE=	1	MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	552.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	552.000	PROFILE=	1	MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	644.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	644.000	PROFILE=	1	MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	721.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	721.000	PROFILE=	1	MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	773.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	773.000	PROFILE=	1	MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	822.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	822.000	PROFILE=	1	MINIMUM SPECIFIC ENERGY
WARNING SECNO=	842.000	PROFILE=	1	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
CAUTION SECNO=	892.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	892.000	PROFILE=	1	MINIMUM SPECIFIC ENERGY

Q100

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*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    26JUN94    TIME   13:22:23   *
*********************************************
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*          (916) 756-1104           *
*************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX              XXXXXXX
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THIS RUN EXECUTED 26JUN94 13:22:23

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************



SPLIT FLOW BEING PERFORMED


SF  SPLIT FLOW ANALYSIS OF THE MAIN UN-NAMED WASH


JC  SPLIT FLOW ANALYSIS OF LEFT-BANK OVERFLOW
JP     0       0       0       0   +0.00

TW  SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)
WS     4    0842    0892      -1     1.2
WC     0    2868      16    2868      30    2872      52    2872

TW  SPLIT FLOW REACH 0822 TO 0842
WS     2    0822    0842      -1     1.2
WC     0  2867.5      20    2868

TW  SPLIT FLOW REACH 0773 TO 0822
WS     3     773     822      -1     1.2
WC     0    2864      41    2867      69  2867.5

TW  SPLIT FLOW REACH 0721 TO 0773
WS     2    0721    0773      -1     1.2
WC     0    2864      57    2866
```

```
T1  ARRROYO ENGINEERING, INC., JOB NO. PAZ-PDOT-01.3, HEC2 FILE VM04.H2I
T2  SUBCRITICAL HYDRAULIC ANALYSIS OF THE MAIN UN-NAMED WASH: 100-YR STORM
T3  6-21-94, Alternative No. 2: At-Grade Dip Crossing

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0        2        0        0       -1        0        0        0    2837.56     0

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

      1        0       -1        0        0        0       -1        0        0        0


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38        1        2        3       26       68       43        8       25       13
     14       15

NC      .07      .07      .05    0.100    0.300
   Q5   =  429 cfs, upstream from breakout
   Q10  = 1074 cfs, upstream from breakout
   Q25  = 1181 cfs, upstream from breakout
   Q100 = 2147 cfs, upstream from breakout
QT        1     2147
X1     0152       11       75      103      0.0      0.0      0.0
GR     2840        0     2838       18     2836       27     2836       43     2836       75
GR   2835.7       82   2835.7       90     2836      103     2838      114     2840      128
GR     2842      139

X1     0268       11       40      100       92    115.5      107
GR   2847.0        0   2845.4       20   2843.4       40     2842       60     2841       80
GR     2841      100   2846.2      120   2844.8      140     2846      160     2847      180
GR     2848      200

X1     0409       12       75      101     56.5       58       57
GR     2854        0     2852       37     2850       51     2848       64     2846       75
GR   2845.5       79   2845.5       87     2846      101     2848      143     2850      160
GR     2852      171     2854      186

X1     0497       14       81       96       86       91       88
GR   2856.7        0     2856     27.5     2854       39     2852       48     2850       70
GR     2848       81   2847.2       85   2847.2       93     2848       96     2850      103
GR     2852      116     2854      126     2856      132     2858      149

X1     0552       10       86      103       55       55     55.5
GR     2856        0     2854       67     2852       77     2850       86   2849.7       90
GR   2849.7       98     2850      103     2852      107     2854      135     2856      147
```

X1	0644	8	59	77	95	89	92			
GR	2860	0	2858	26.5	2854	59	2852.5	65.5	2852.5	73.5
GR	2854	77	2856	82	2857.2	90				
X1	0721	9	52	62	78	78.5	77.5			
GR	2864	0	2862	20	2860	52	2858.2	55	2858.2	59
GR	2860	62	2862	74	2864	79	2866	108		
X1	0773	9	37	51	52.5	52	52			
GR	2866	0	2864	21.5	2862	37	2861.5	40	2861.5	48
GR	2862	51	2864	61	2866	77	2868	88		
X1	0822	9	26	42	53	41	49			
GR	2867.5	0	2866	26	2864	31	2864	39	2866	42
GR	2868	69	2868	74.5	2868	82	2869.6	90		
X1	0842	7	33	49	21	20	20.5			
GR	2868	0	2866	33	2864.6	37	2864.6	45	2866	49
GR	2868	80	2870	90						
X1	0892	9	50	68.5	71	68	70			
GR	2872	0	2870.2	22	2870	27	2868	50	2866.1	55
GR	2866.1	63	2868	68.5	2870	70	2872	93		

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

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV= .100 CEHV= .300

*SECNO 152.000

3720 CRITICAL DEPTH ASSUMED

152.000	2.73	2838.43	2838.43	2837.56	2839.50	1.07	.00	.00	2836.00
1686.2	865.5	744.4	76.3	130.6	73.6	16.4	.0	.0	2836.00
.00	6.63	10.12	4.64	.070	.050	.070	.000	2835.70	14.09
.031996	0.	0.	0.	0	10	0	.00	102.95	117.04

*SECNO 268.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

268.000	3.51	2844.51	2844.51	.00	2845.79	1.28	2.94	.06	2843.40
1686.2	14.1	1558.0	114.1	6.2	166.6	23.7	.5	.2	2841.00
.00	2.28	9.35	4.82	.070	.050	.070	.000	2841.00	28.89
.025386	92.	107.	116.	0	11	0	.00	84.61	113.50

*SECNO 409.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

409.000	3.81	2849.31	2849.31	.00	2850.47	1.16	1.35	.01	2846.00
1686.2	151.4	984.3	550.5	31.0	94.6	104.4	.8	.3	2846.00
.01	4.88	10.41	5.28	.070	.050	.070	.000	2845.50	55.48
.021958	57.	57.	58.	0	8	0	.00	98.66	154.14

*SECNO 497.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

497.000	5.62	2852.82	2852.82	.00	2854.25	1.43	1.69	.08	2848.00
1686.2	446.9	964.5	274.8	83.7	81.5	52.2	1.2	.5	2848.00
.01	5.34	11.83	5.27	.070	.050	.070	.000	2847.20	44.30
.016838	86.	88.	91.	0	14	0	.00	75.82	120.11

*SECNO 552.000

7185 MINIMUM SPECIFIC ENERGY

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


3720 CRITICAL DEPTH ASSUMED
  552.000      5.36   2855.06   2855.06       .00   2856.29      1.23       .87       .02   2850.00
   1686.2     353.9     986.1     346.2      75.9      89.7      77.2       1.5        .6   2850.00
      .01      4.66     10.99      4.48      .070      .050      .070      .000   2849.70     31.54
  .014890       55.       56.       55.         0        11         0       .00    109.81    141.35


*SECNO 644.000
3280 CROSS SECTION    644.00 EXTENDED      1.23 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  644.000      5.93   2858.43   2858.43       .00   2859.96      1.53      1.43       .09   2854.00
   1686.2     384.5    1148.1     153.5      80.4      99.3      31.8       2.0        .8   2854.00
      .01      4.79     11.56      4.82      .070      .050      .070      .000   2852.50     20.75
  .016070       95.       92.       89.         0         8         0       .00     69.25     90.00


*SECNO 721.000
3280 CROSS SECTION    721.00 EXTENDED      .19 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  721.000      5.99   2864.19   2864.19       .00   2865.46      1.27      1.40       .03   2860.00
   1686.2     747.6     670.8     267.8     125.7      54.5      44.4       2.4       1.0   2860.00
      .01      5.95     12.31      6.03      .070      .050      .070      .000   2858.20       .00
  .020330       78.       78.       79.         0         5         0       .00     81.72     81.72


*SECNO 773.000
3280 CROSS SECTION    773.00 EXTENDED      .60 FEET

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  773.000      5.10   2866.60   2866.60       .00   2867.95      1.35      1.03       .02   2862.00
   1703.5     518.1     836.9     348.6      90.1      69.9      62.5       2.7       1.1   2862.00
      .02      5.75     11.98      5.58      .070      .050      .070      .000   2861.50       .00
  .019204       53.       52.       52.         0        15         0       .00     80.28     80.28


*SECNO 822.000
3280 CROSS SECTION    822.00 EXTENDED      2.19 FEET
```

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

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

822.000	5.69	2869.69	2869.69	.00	2871.00	1.31	.92	.00	2866.00
1928.2	433.0	976.7	518.5	76.4	83.0	101.7	2.9	1.2	2866.00
.02	5.67	11.76	5.10	.070	.050	.070	.000	2864.00	.00
.018896	53.	49.	41.	0	8	0	.00	90.00	90.00

*SECNO 842.000
3280 CROSS SECTION 842.00 EXTENDED 2.53 FEET

3301 HV CHANGED MORE THAN HVINS

842.000	5.93	2870.53	2869.74	.00	2871.33	.80	.28	.05	2866.00
2015.3	565.6	849.1	600.7	116.5	89.3	124.8	3.1	1.2	2866.00
.02	4.85	9.51	4.81	.070	.050	.070	.000	2864.60	.00
.010750	21.	21.	20.	3	15	0	.00	90.00	90.00

*SECNO 892.000
3280 CROSS SECTION 892.00 EXTENDED .63 FEET

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

892.000	6.53	2872.63	2872.63	.00	2874.09	1.46	.89	.20	2868.00
2147.0	687.8	1302.9	156.3	129.7	110.8	42.9	3.6	1.3	2868.00
.02	5.30	11.76	3.64	.070	.050	.070	.000	2866.10	.00
.015084	71.	70.	68.	0	8	0	.00	93.00	93.00

115

TW SPLIT FLOW REACH 0842 TO 0892 (CROSS SECTIONS LISTED FROM U/S TO D/S)

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
131.67	131.69	.01	131.67	131.69	.01	7	2870.532	2872.629	842.000	892.000

TW SPLIT FLOW REACH 0822 TO 0842

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
87.08	87.09	.01	218.75	218.78	.01	7	2869.689	2870.532	822.000	842.000

TW SPLIT FLOW REACH 0773 TO 0822

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
224.70	224.61	.04	443.45	443.39	.01	7	2866.597	2869.689	773.000	822.000

TW SPLIT FLOW REACH 0721 TO 0773

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
17.39	17.37	.07	460.84	460.76	.02	7	2864.187	2866.597	721.000	773.000

THIS RUN EXECUTED 26JUN94 13:23:23

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

-94, Alternative No. 2:

SUMMARY PRINTOUT

	SECNO	CWSEL	CRIWS	EG	VCH	FRCH	Q	DEPTH	AREA	QLOB	QCH	QROB
*	152.000	2838.43	2838.43	2839.50	10.12	1.10	1686.16	2.73	220.61	865.45	744.43	76.28
*	268.000	2844.51	2844.51	2845.79	9.35	.99	1686.16	3.51	196.52	14.05	1557.96	114.15
*	409.000	2849.31	2849.31	2850.47	10.41	.96	1686.16	3.81	229.94	151.41	984.26	550.49
*	497.000	2852.82	2852.82	2854.25	11.83	.89	1686.16	5.62	217.38	446.89	964.48	274.80
*	552.000	2855.06	2855.06	2856.29	10.99	.84	1686.16	5.36	242.87	353.90	986.06	346.20
*	644.000	2858.43	2858.43	2859.96	11.56	.87	1686.16	5.93	211.51	384.52	1148.12	153.53
*	721.000	2864.19	2864.19	2865.46	12.31	.93	1686.16	5.99	224.65	747.58	670.79	267.79
*	773.000	2866.60	2866.60	2867.95	11.98	.95	1703.55	5.10	222.44	518.05	836.86	348.63
*	822.000	2869.69	2869.69	2871.00	11.76	.91	1928.25	5.69	261.08	433.03	976.69	518.53
	842.000	2870.53	2869.74	2871.33	9.51	.71	2015.33	5.93	330.61	565.55	849.08	600.69
*	892.000	2872.63	2872.63	2874.09	11.76	.85	2147.00	6.53	283.46	687.76	1302.90	156.34

SUMMARY OF ERRORS AND SPECIAL NOTES

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CAUTION SECNO=    152.000  PROFILE=  1  CRITICAL DEPTH ASSUMED

CAUTION SECNO=    268.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    268.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    409.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    409.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    497.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    497.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    552.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    552.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    644.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    644.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    721.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    721.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    773.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    773.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    822.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    822.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=    892.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    892.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY
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APPENDIX NUMBER 4

ROADWAY-EMBANKMENT OVERFLOW COMPUTATION SHEETS

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 2: 5–24" CMP

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2845.8 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2848.0	2845.8	0.0	0.00		
	20					3.0	0.0
820.0		2847.0	2845.8	0.0	0.00		
	20					3.0	3.9
840.0		2845.5	2845.8	0.3	0.05		
	20					3.0	45.1
860.0		2844.5	2845.8	1.3	1.93		
	20					3.0	116.2
880.0		2844.0	2845.8	1.8	4.35		
	20					3.0	100.4
900.0		2844.8	2845.8	1.0	1.00		
	20					3.0	32.6
920.0		2845.5	2845.8	0.3	0.05		
	20					3.0	3.9
940.0		2847.2	2845.8	0.0	0.00		
	20					3.0	0.0
960.0		2847.3	2845.8	0.0	0.00		
						Total Overflow =	302.1

SUMMARY

Water Surface Elev. (ft)	=	2845.8
Culvert Discharge (cfs)	=	130.0
Roadway Overflow (cfs)	=	302.1
Total Discharge (cfs)	=	432.1

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 2: 5–24" CMP

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2846.7 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2848.0	2846.7	0.0	0.00		
	20					3.0	0.0
820.0		2847.0	2846.7	0.0	0.00		
	20					3.0	31.5
840.0		2845.5	2846.7	1.2	1.58		
	20					3.0	134.4
860.0		2844.5	2846.7	2.2	7.18		
	20					3.0	230.4
880.0		2844.0	2846.7	2.7	11.98		
	20					3.0	210.1
900.0		2844.8	2846.7	1.9	4.98		
	20					3.0	116.5
920.0		2845.5	2846.7	1.2	1.58		
	20					3.0	31.5
940.0		2847.2	2846.7	0.0	0.00		
	20					3.0	0.0
960.0		2847.3	2846.7	0.0	0.00		
						Total Overflow =	754.5

SUMMARY

Water Surface Elev. (ft)	=	2846.7
Culvert Discharge (cfs)	=	155.0
Roadway Overflow (cfs)	=	754.5
Total Discharge (cfs)	=	909.5

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS
for the planned Soldier Trail Dip Crossing

Alternative 2: 5–24" CMP

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2846.9 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2848.0	2846.9	0.0	0.00		
	20					3.0	0.0
820.0		2847.0	2846.9	0.0	0.00		
	20					3.0	39.8
840.0		2845.5	2846.9	1.4	2.32		
	20					3.0	158.5
860.0		2844.5	2846.9	2.4	8.92		
	20					3.0	259.1
880.0		2844.0	2846.9	2.9	14.32		
	20					3.0	237.9
900.0		2844.8	2846.9	2.1	6.39		
	20					3.0	139.6
920.0		2845.5	2846.9	1.4	2.32		
	20					3.0	39.8
940.0		2847.2	2846.9	0.0	0.00		
	20					3.0	0.0
960.0		2847.3	2846.9	0.0	0.00		
						Total Overflow =	874.7

SUMMARY

Water Surface Elev. (ft)	=	2846.9
Culvert Discharge (cfs)	=	160.0
Roadway Overflow (cfs)	=	874.7
Total Discharge (cfs)	=	1034.7

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 2: 5–24" CMP

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2847.7 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2848.0	2847.7	0.0	0.00		
	20					3.0	14.1
820.0		2847.0	2847.7	0.7	0.41		
	20					3.0	108.3
840.0		2845.5	2847.7	2.2	7.18		
	20					3.0	267.3
860.0		2844.5	2847.7	3.2	18.32		
	20					3.0	384.7
880.0		2844.0	2847.7	3.7	26.33		
	20					3.0	360.3
900.0		2844.8	2847.7	2.9	14.32		
	20					3.0	244.9
920.0		2845.5	2847.7	2.2	7.18		
	20					3.0	98.9
940.0		2847.2	2847.7	0.5	0.18		
	20					3.0	18.1
960.0		2847.3	2847.7	0.4	0.10		
						Total Overflow =	1496.7

SUMMARY

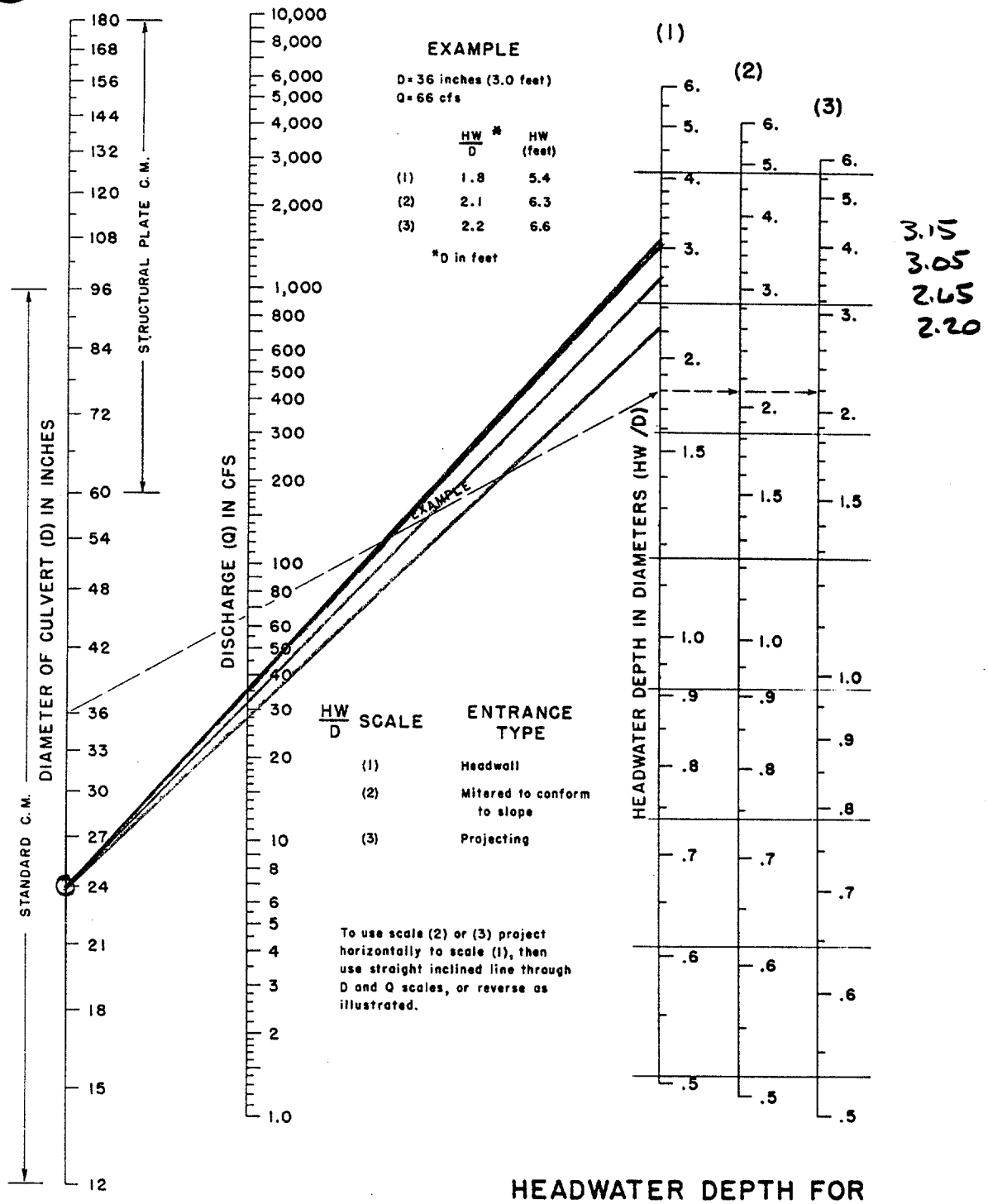
Water Surface Elev. (ft)	=	2847.7
Culvert Discharge (cfs)	=	175.0
Roadway Overflow (cfs)	=	1496.7
Total Discharge (cfs)	=	1671.7

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

CHART 2



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

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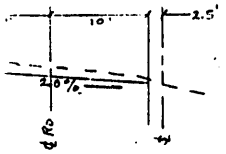
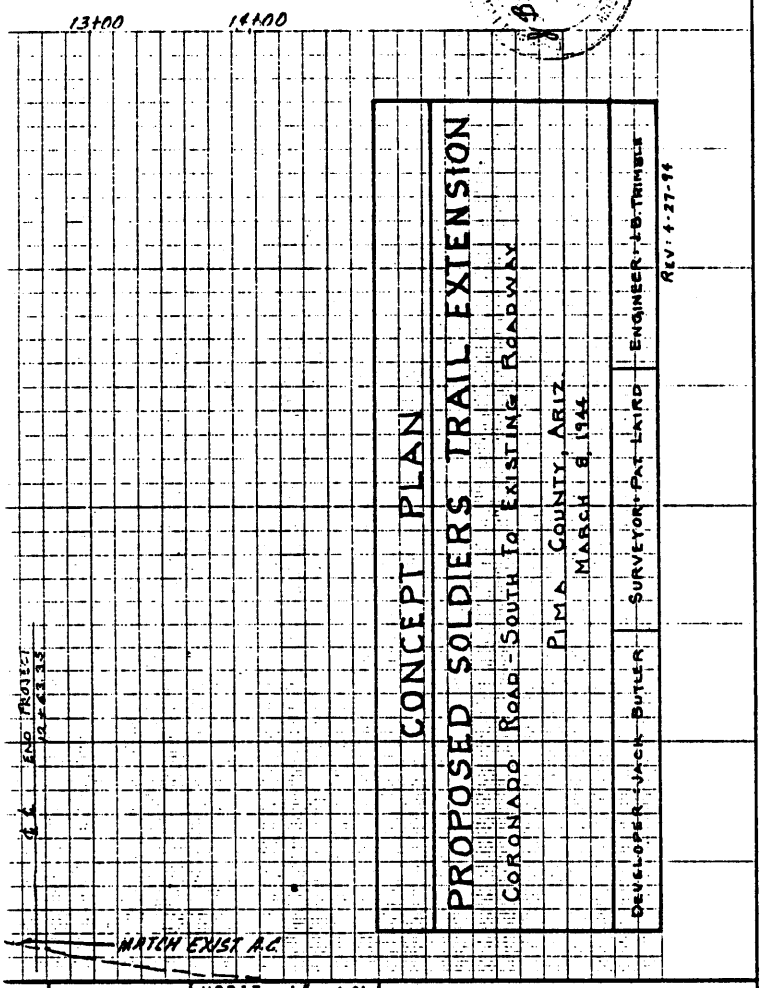
CURVE DATA

No.	DELTA	RADIUS	LENGTH
1	50° 07' 17"	573.15'	501.79
2	26° [illegible] 6 5"	603.15'	2[illegible].71'
3	84° 58' 36"	25.00'	37.08'
4	49° 24' 47"	180.00'	155.24'
5	49° 24' 47"	210.00'	181.11'
6	49° 24' 47"	240.00'	206.98'
7	10° 03' 47"	603.15'	105.76'
8	84° 58' 36"	25.00'	37.08'
9	9° 11' 26"	603.15'	96.75'



TION A-A
(TYPICAL)



CONCEPT PLAN

PROPOSED SOLDIERS TRAIL EXTENSION

CORONADO ROAD - SOUTH TO EXISTING ROADWAY

PIMA COUNTY, ARIZ.

MARCH 8, 1944

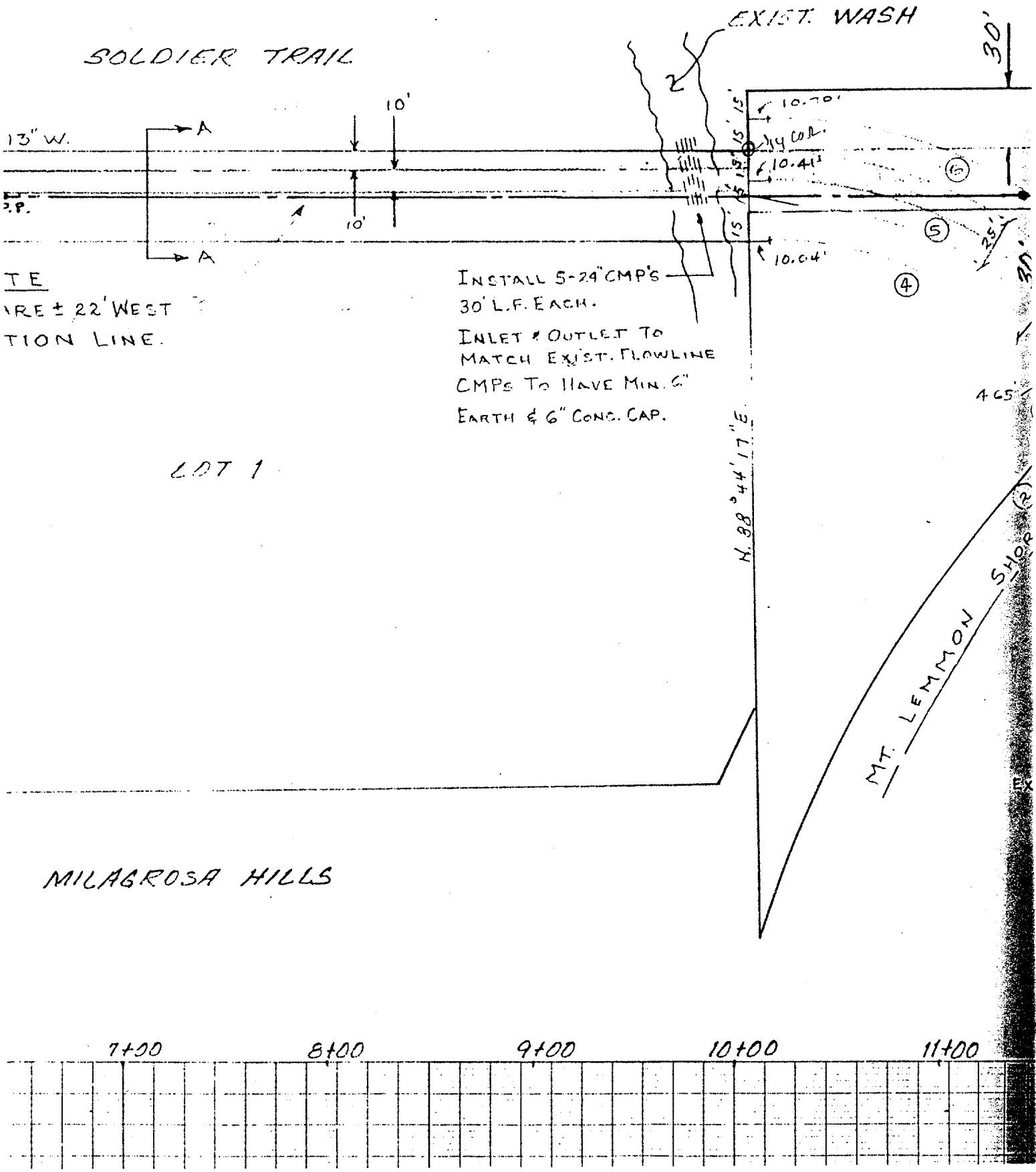
DEVELOPER - JACK BUTLER | SURVEYOR - PAT LAIRD | ENGINEER - J.B. TRIMBLE

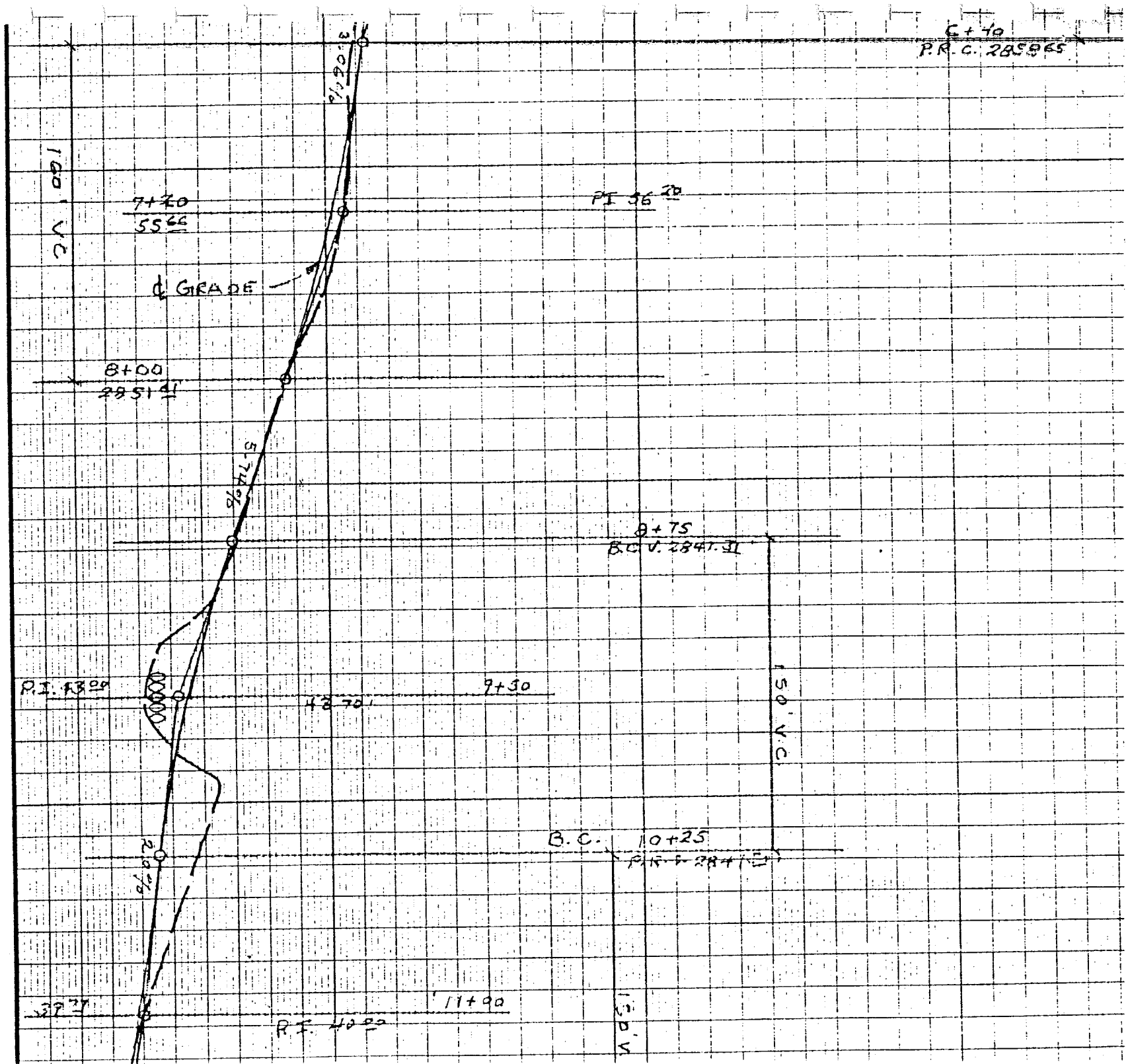
REV: 4-27-94

SCALES	HORIZ. 1" = 60'
	VERT. 1" = 10'

SHEET 1 OF 1

125


SOLDIER TRAIL
EXIST. WASH
30'
10'
13" W.
A
A
10'
10.70'
14 COR.
10.41'
10.04'
25'
TE
RE ± 22' WEST
TION LINE.
INSTALL 5-24" CMP'S
30' L.F. EACH.
INLET & OUTLET TO
MATCH EXIST. FLOWLINE
CMPS TO HAVE MIN. 6"
EARTH & 6" CONC. CAP.
465'
LOT 1
N. 88°44'17"E.
MT. LEMMON SHOR
MILAGROSA HILLS
7+00
8+00
9+00
10+00
11+00



6+40
P.R.C. 2858.65
3.06%
160' V.C.
7+20
55.66
PI 56.20
℄ GRADE
8+00
2851.41
5.74%
8+75
B.C.V. 2841.31
P.I. 43.00
9+30
43.70
150' V.C.
B.C.
10+25
20%
11+00
P.I. 40.00

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 3: 5–60" RCP

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2845.2 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2848.0	2845.2	0.0	0.00		
	20					3.0	0.0
820.0		2848.0	2845.2	0.0	0.00		
	20					3.0	0.0
840.0		2848.0	2845.2	0.0	0.00		
	20					3.0	0.0
860.0		2848.0	2845.2	0.0	0.00		
	20					3.0	0.0
880.0		2848.0	2845.2	0.0	0.00		
	20					3.0	0.0
900.0		2848.0	2845.2	0.0	0.00		
	20					3.0	0.0
920.0		2848.0	2845.2	0.0	0.00		
	20					3.0	0.0
940.0		2848.0	2845.2	0.0	0.00		
	20					3.0	0.0
960.0		2848.0	2845.2	0.0	0.00		
						Total Overflow =	0.0

SUMMARY

Water Surface Elev. (ft)	=	2845.2
Culvert Discharge (cfs)	=	424.0
Roadway Overflow (cfs)	=	0.0
Total Discharge (cfs)	=	424.0

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 3: 5–60" RCP

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2848.2 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2848.0	2848.2	0.2	0.02		
	20					3.0	5.2
820.0		2848.0	2848.2	0.2	0.02		
	20					3.0	5.2
840.0		2848.0	2848.2	0.2	0.02		
	20					3.0	5.2
860.0		2848.0	2848.2	0.2	0.02		
	20					3.0	5.2
880.0		2848.0	2848.2	0.2	0.02		
	20					3.0	5.2
900.0		2848.0	2848.2	0.2	0.02		
	20					3.0	5.2
920.0		2848.0	2848.2	0.2	0.02		
	20					3.0	5.2
940.0		2848.0	2848.2	0.2	0.02		
	20					3.0	5.2
960.0		2848.0	2848.2	0.2	0.02		
						Total Overflow =	41.3

SUMMARY

Water Surface Elev. (ft)	=	2848.2
Culvert Discharge (cfs)	=	890.0
Roadway Overflow (cfs)	=	41.3
Total Discharge (cfs)	=	931.3

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 3: 5–60" RCP

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2848.4 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2848.0	2848.4	0.4	0.10		
	20					3.0	14.9
820.0		2848.0	2848.4	0.4	0.09		
	20					3.0	14.9
840.0		2848.0	2848.4	0.4	0.10		
	20					3.0	14.9
860.0		2848.0	2848.4	0.4	0.09		
	20					3.0	14.9
880.0		2848.0	2848.4	0.4	0.10		
	20					3.0	14.9
900.0		2848.0	2848.4	0.4	0.09		
	20					3.0	14.9
920.0		2848.0	2848.4	0.4	0.10		
	20					3.0	14.9
940.0		2848.0	2848.4	0.4	0.09		
	20					3.0	14.9
960.0		2848.0	2848.4	0.4	0.10		
						Total Overflow =	119.2

SUMMARY

Water Surface Elev. (ft)	=	2848.4
Culvert Discharge (cfs)	=	910.0
Roadway Overflow (cfs)	=	119.2
Total Discharge (cfs)	=	1029.2

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 3: 5–60" RCP

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2849.3 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2848.0	2849.3	1.3	1.93		
	20					3.0	88.4
820.0		2848.0	2849.3	1.3	1.89		
	20					3.0	88.4
840.0		2848.0	2849.3	1.3	1.93		
	20					3.0	88.4
860.0		2848.0	2849.3	1.3	1.89		
	20					3.0	88.4
880.0		2848.0	2849.3	1.3	1.93		
	20					3.0	88.4
900.0		2848.0	2849.3	1.3	1.89		
	20					3.0	88.4
920.0		2848.0	2849.3	1.3	1.93		
	20					3.0	88.4
940.0		2848.0	2849.3	1.3	1.89		
	20					3.0	88.4
960.0		2848.0	2849.3	1.3	1.93		
						Total Overflow =	707.4

SUMMARY

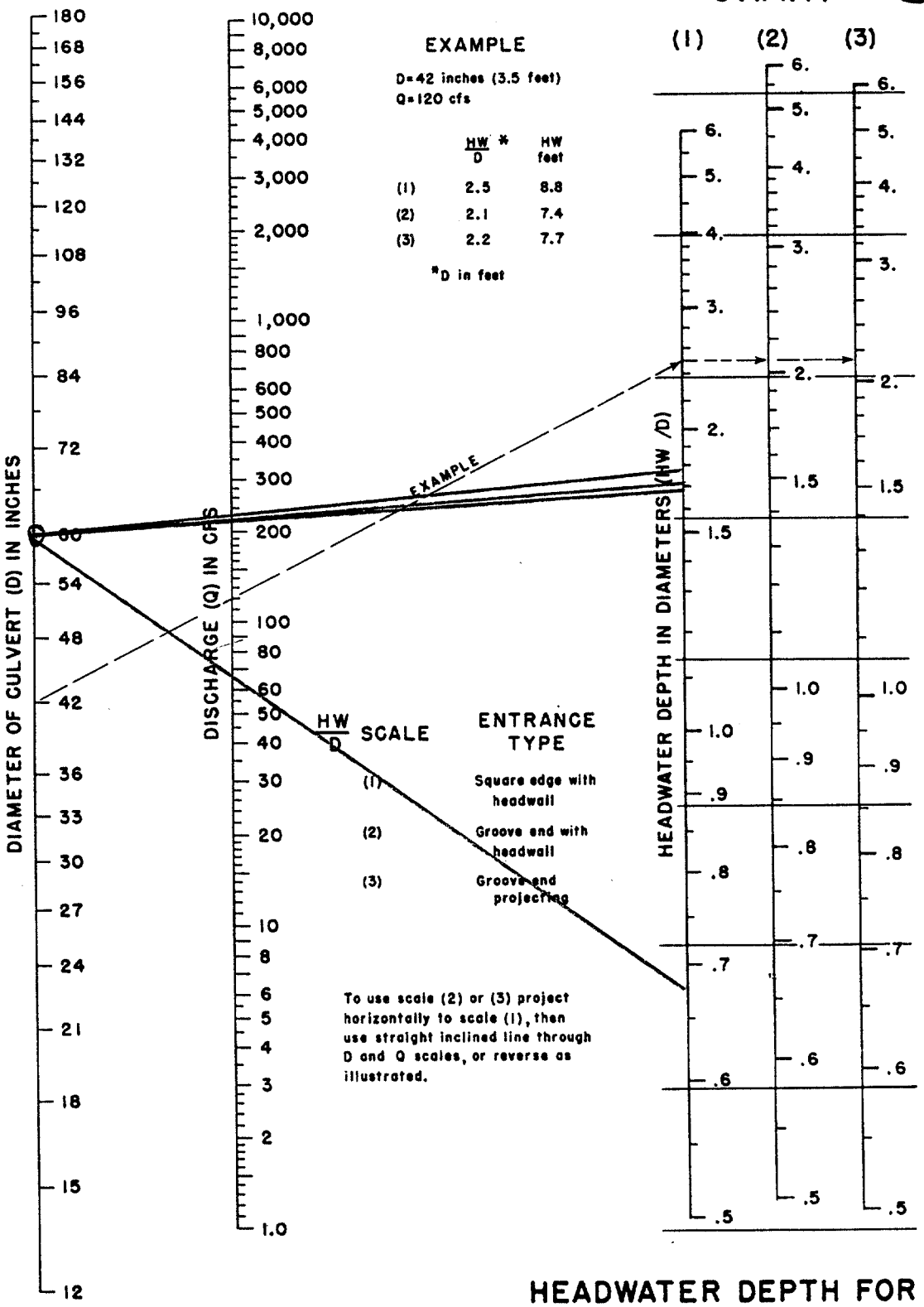
Water Surface Elev. (ft)	=	2849.3
Culvert Discharge (cfs)	=	1000.0
Roadway Overflow (cfs)	=	707.4
Total Discharge (cfs)	=	1707.4

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

CHART 1



1.58
1.40
1.36
0.76

HEADWATER SCALES 2&3
REVISED MAY 1964

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

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ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 4: 3–10' X 4' RCBC

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2844.2 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2849.0	2844.2	0.0	0.00		
	20					3.0	0.0
820.0		2848.0	2844.2	0.0	0.00		
	20					3.0	0.0
840.0		2848.0	2844.2	0.0	0.00		
	20					3.0	0.0
860.0		2848.0	2844.2	0.0	0.00		
	20					3.0	0.0
880.0		2848.0	2844.2	0.0	0.00		
	20					3.0	0.0
900.0		2848.0	2844.2	0.0	0.00		
	20					3.0	0.0
920.0		2848.0	2844.2	0.0	0.00		
	20					3.0	0.0
940.0		2848.0	2844.2	0.0	0.00		
	20					3.0	0.0
960.0		2849.0	2844.2	0.0	0.00		

Total Overflow = 0.0

SUMMARY

Water Surface Elev. (ft)	=	2844.2
Culvert Discharge (cfs)	=	424.0
Roadway Overflow (cfs)	=	0.0
Total Discharge (cfs)	=	424.0

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 4: 3–10' X 4' RCBC

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2846.5 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2849.0	2846.5	0.0	0.00		
	20					3.0	0.0
820.0		2848.0	2846.5	0.0	0.00		
	20					3.0	0.0
840.0		2848.0	2846.5	0.0	0.00		
	20					3.0	0.0
860.0		2848.0	2846.5	0.0	0.00		
	20					3.0	0.0
880.0		2848.0	2846.5	0.0	0.00		
	20					3.0	0.0
900.0		2848.0	2846.5	0.0	0.00		
	20					3.0	0.0
920.0		2848.0	2846.5	0.0	0.00		
	20					3.0	0.0
940.0		2848.0	2846.5	0.0	0.00		
	20					3.0	0.0
960.0		2849.0	2846.5	0.0	0.00		
						Total Overflow =	0.0

SUMMARY

Water Surface Elev. (ft)	=	2846.5
Culvert Discharge (cfs)	=	930.0
Roadway Overflow (cfs)	=	0.0
Total Discharge (cfs)	=	930.0

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 4: 3–10' X 4' RCBC

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2846.7 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2849.0	2846.7	0.0	0.00		
	20					3.0	0.0
820.0		2848.0	2846.7	0.0	0.00		
	20					3.0	0.0
840.0		2848.0	2846.7	0.0	0.00		
	20					3.0	0.0
860.0		2848.0	2846.7	0.0	0.00		
	20					3.0	0.0
880.0		2848.0	2846.7	0.0	0.00		
	20					3.0	0.0
900.0		2848.0	2846.7	0.0	0.00		
	20					3.0	0.0
920.0		2848.0	2846.7	0.0	0.00		
	20					3.0	0.0
940.0		2848.0	2846.7	0.0	0.00		
	20					3.0	0.0
960.0		2849.0	2846.7	0.0	0.00		
						Total Overflow =	0.0

SUMMARY

Water Surface Elev. (ft)	=	2846.7
Culvert Discharge (cfs)	=	1006.0
Roadway Overflow (cfs)	=	0.0
Total Discharge (cfs)	=	1006.0

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 4: 3–10' X 4' RCBC

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2849 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2849.0	2849.0	0.0	0.00		
	20					3.0	23.6
820.0		2848.0	2849.0	1.0	0.98		
	20					3.0	59.6
840.0		2848.0	2849.0	1.0	1.00		
	20					3.0	59.6
860.0		2848.0	2849.0	1.0	0.98		
	20					3.0	59.6
880.0		2848.0	2849.0	1.0	1.00		
	20					3.0	59.6
900.0		2848.0	2849.0	1.0	0.98		
	20					3.0	59.6
920.0		2848.0	2849.0	1.0	1.00		
	20					3.0	59.6
940.0		2848.0	2849.0	1.0	0.98		
	20					3.0	23.6
960.0		2849.0	2849.0	0.0	0.00		
						Total Overflow =	404.6

SUMMARY

Water Surface Elev. (ft)	=	2849
Culvert Discharge (cfs)	=	1350.0
Roadway Overflow (cfs)	=	404.6
Total Discharge (cfs)	=	1754.6

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

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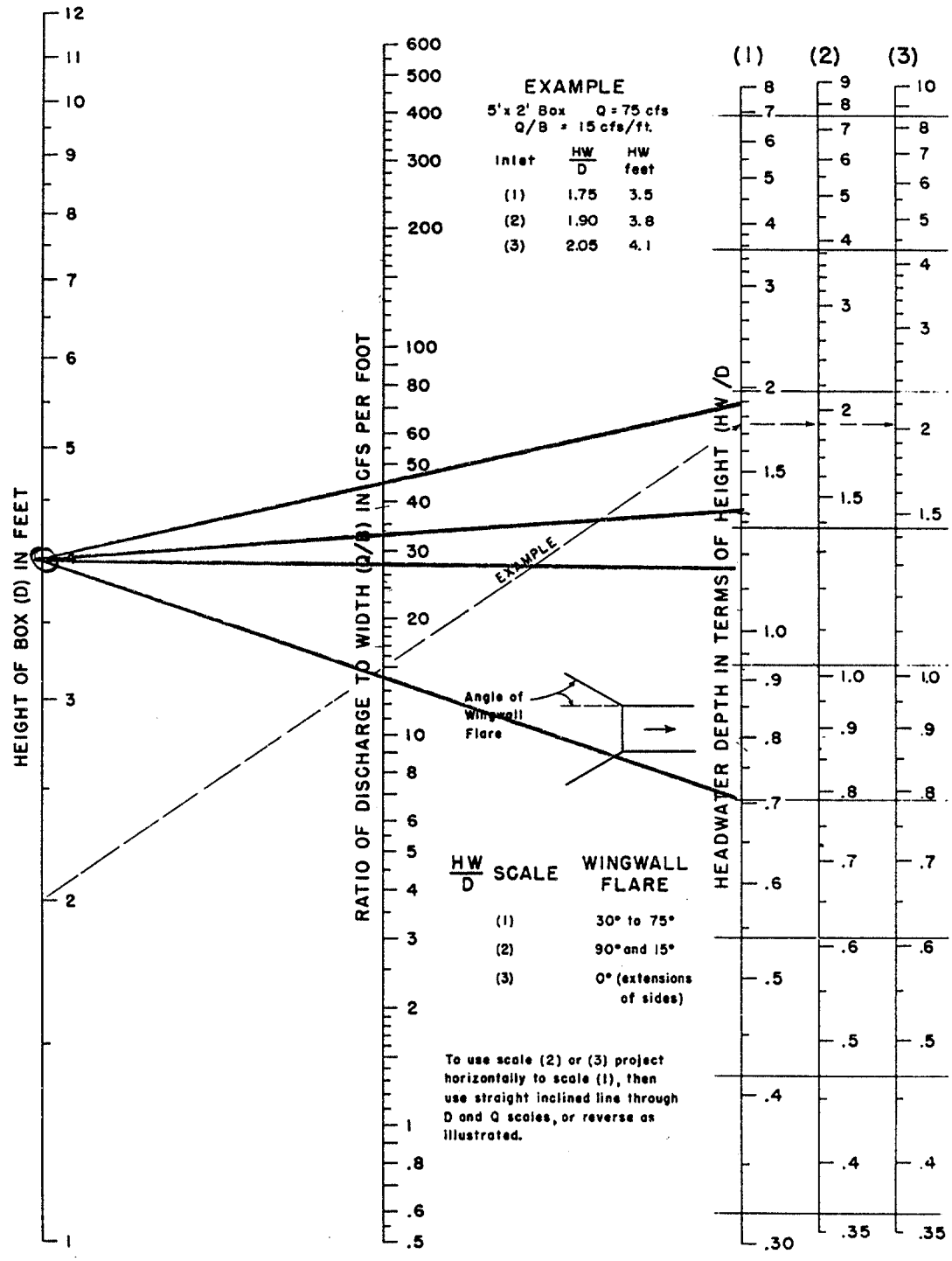
CHART 8



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

$Q = CLH^{3/2}$; $C = 3.0$

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ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 5: 5–10' X 4' RCBC

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2843.5 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2849.0	2843.5	0.0	0.00		
	20					3.0	0.0
820.0		2848.0	2843.5	0.0	0.00		
	20					3.0	0.0
840.0		2848.0	2843.5	0.0	0.00		
	20					3.0	0.0
860.0		2848.0	2843.5	0.0	0.00		
	20					3.0	0.0
880.0		2848.0	2843.5	0.0	0.00		
	20					3.0	0.0
900.0		2848.0	2843.5	0.0	0.00		
	20					3.0	0.0
920.0		2848.0	2843.5	0.0	0.00		
	20					3.0	0.0
940.0		2848.0	2843.5	0.0	0.00		
	20					3.0	0.0
960.0		2849.0	2843.5	0.0	0.00		
						Total Overflow =	0.0

SUMMARY

Water Surface Elev. (ft)	=	2843.5
Culvert Discharge (cfs)	=	450.0
Roadway Overflow (cfs)	=	0.0
Total Discharge (cfs)	=	450.0

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 5: 5–10' X 4' RCBC

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2844.8 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2849.0	2844.8	0.0	0.00		
	20					3.0	0.0
820.0		2848.0	2844.8	0.0	0.00		
	20					3.0	0.0
840.0		2848.0	2844.8	0.0	0.00		
	20					3.0	0.0
860.0		2848.0	2844.8	0.0	0.00		
	20					3.0	0.0
880.0		2848.0	2844.8	0.0	0.00		
	20					3.0	0.0
900.0		2848.0	2844.8	0.0	0.00		
	20					3.0	0.0
920.0		2848.0	2844.8	0.0	0.00		
	20					3.0	0.0
940.0		2848.0	2844.8	0.0	0.00		
	20					3.0	0.0
960.0		2849.0	2844.8	0.0	0.00		
						Total Overflow =	0.0

SUMMARY

Water Surface Elev. (ft)	=	2844.8
Culvert Discharge (cfs)	=	925.0
Roadway Overflow (cfs)	=	0.0
Total Discharge (cfs)	=	925.0

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 5: 5–10' X 4' RCBC

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2845 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2849.0	2845.0	0.0	0.00		
	20					3.0	0.0
820.0		2848.0	2845.0	0.0	0.00		
	20					3.0	0.0
840.0		2848.0	2845.0	0.0	0.00		
	20					3.0	0.0
860.0		2848.0	2845.0	0.0	0.00		
	20					3.0	0.0
880.0		2848.0	2845.0	0.0	0.00		
	20					3.0	0.0
900.0		2848.0	2845.0	0.0	0.00		
	20					3.0	0.0
920.0		2848.0	2845.0	0.0	0.00		
	20					3.0	0.0
940.0		2848.0	2845.0	0.0	0.00		
	20					3.0	0.0
960.0		2849.0	2845.0	0.0	0.00		
						Total Overflow =	0.0

SUMMARY

Water Surface Elev. (ft)	=	2845.0
Culvert Discharge (cfs)	=	1000.0
Roadway Overflow (cfs)	=	0.0
Total Discharge (cfs)	=	1000.0

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

ROADWAY–EMBANKMENT OVERFLOW COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative 5: 5–10' X 4' RCBC

Station (Feet)	Incremental Weir Length (Feet)	Top of Roadway Elevation (Feet)	Water Sfc Elevation 2847 (Feet)	Headwater Depth (Feet)	H**2.5	Weir Coefficient 3.0	Incremental Discharge (cfs)
800.0		2849.0	2847.0	0.0	0.00		
	20					3.0	0.0
820.0		2848.0	2847.0	0.0	0.00		
	20					3.0	0.0
840.0		2848.0	2847.0	0.0	0.00		
	20					3.0	0.0
860.0		2848.0	2847.0	0.0	0.00		
	20					3.0	0.0
880.0		2848.0	2847.0	0.0	0.00		
	20					3.0	0.0
900.0		2848.0	2847.0	0.0	0.00		
	20					3.0	0.0
920.0		2848.0	2847.0	0.0	0.00		
	20					3.0	0.0
940.0		2848.0	2847.0	0.0	0.00		
	20					3.0	0.0
960.0		2849.0	2847.0	0.0	0.00		
						Total Overflow =	0.0

SUMMARY

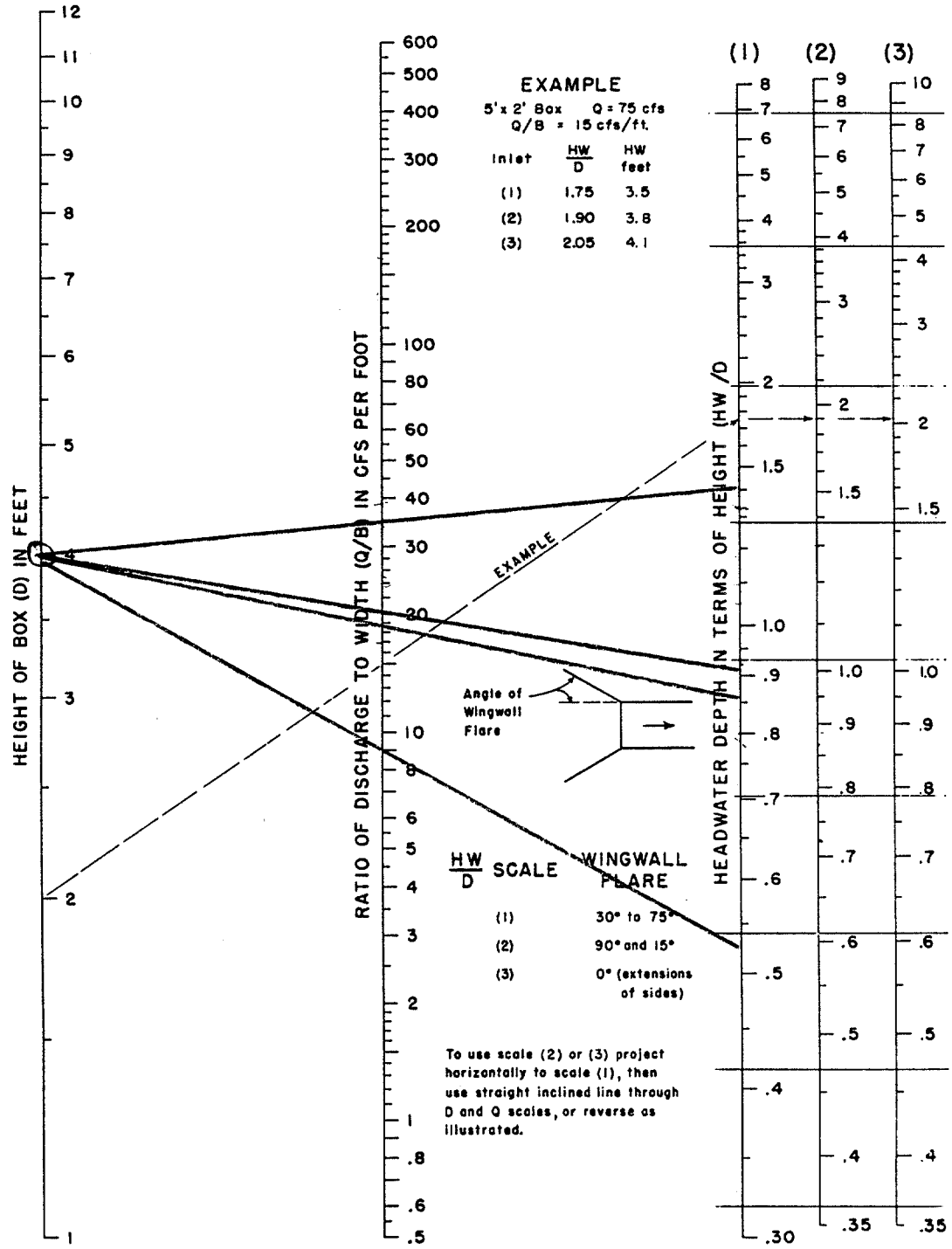
Water Surface Elev. (ft)	=	2847.0
Culvert Discharge (cfs)	=	1750.0
Roadway Overflow (cfs)	=	0.0
Total Discharge (cfs)	=	1750.0

Q5 = 424 cfs
Q10 = 925 cfs
Q25 = 1006 cfs
Q100 = 1686 cfs

Reference: Equn. 11.8 COT "Standards Manual for Drainage Design"

ARROYO ENGINEERING, INC.

CHART 8



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

$Q = CLH^{3/2}$; $C = 3.0$

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APPENDIX NUMBER 5

SUMMARY OF MAXIMUM COMPUTED ROADWAY OVERFLOW DEPTHS

SUMMARY OF MAXIMUM OVERFLOW DEPTHS

for the planned Soldier Trail Dip Crossing

Alternative No./ Flood Frequency	Future 100-Year CWSEL (ft)	Existing 100-Year CWSEL (ft)	Increase 100-Year CWSEL (ft)	May Increase Chances of Breakout (yes/no)	Max.Flow Depth Over Road (ft)	Max.Flow Velocity Over Road (ft/sec)	D+V2/2g Over Road (ft)
0. Existing Cond.							
0. 5-yr	2843.92	2843.92	0.00	no	1.92	6.04	2.49
0. 10-yr	2844.72	2844.72	0.00	no	2.72	7.43	3.58
0. 25-yr	2844.82	2844.82	0.00	no	2.82	7.61	3.72
0. 100-yr	2845.60	2845.60	0.00	no	3.60	8.71	4.78
1. At-Grade Dip							
1. 5-yr	2842.73	2843.92	-1.19	no	1.73	6.39	2.36
1. 10-yr	2843.58	2844.72	-1.14	no	2.58	7.84	3.53
1. 25-yr	2843.69	2844.82	-1.13	no	2.69	8.05	3.70
1. 100-yr	2844.51	2845.60	-1.09	no	3.51	9.35	4.87
2. 5-24" CMP (per JBT)							
2. 5-yr	2845.80	2843.92	1.88	no	2.77	3.31	2.94
2. 10-yr	2846.70	2844.72	1.98	no	3.89	4.36	4.19
2. 25-yr	2846.90	2844.82	2.08	no	4.10	4.46	4.41
2. 100-yr	2847.70	2845.60	2.10	yes	4.86	5.12	5.27
3. 5-60" RCP							
3. 5-yr	2845.20	2843.92	1.28	no	0.00	0.00	0.00
3. 10-yr	2848.20	2844.72	3.48	yes	0.20	1.30	0.23
3. 25-yr	2848.40	2844.82	3.58	yes	0.40	1.86	0.45
3. 100-yr	2849.30	2845.60	3.70	yes	1.30	3.40	1.48
4. 3-10' X 4' RCBC							
4. 5-yr	2844.20	2843.92	0.28	no	0.00	0.00	0.00
4. 10-yr	2846.50	2844.72	1.78	no	0.00	0.90	0.01
4. 25-yr	2846.70	2844.82	1.88	no	0.00	1.30	0.03
4. 100-yr	2849.00	2845.60	3.40	yes	1.00	3.27	1.17
5. 5-10' X 4' RCBC							
5. 5-yr	2843.50	2843.92	-0.42	no	0.00	0.00	0.00
5. 10-yr	2844.80	2844.72	0.08	no	0.00	0.00	0.00
5. 25-yr	2845.00	2844.82	0.18	no	0.00	0.00	0.00
5. 100-yr	2847.00	2845.60	1.40	no	0.00	0.00	0.00

APPENDIX NUMBER 6

CULVERT SEDIMENTATION COMPUTATION SHEETS

CULVERT SEDIMENTATION COMPUTATIONS

for the planned Soldier Trail Dip Crossing

Alternative No./ Flood Frequency	Qac (cfs)	Qp (cfs)	Sac (ft/ft)	Sp (ft/ft)	nac	np	Rac (ft)	Rp (ft)	Rs	May Result In Culvert Blockage (yes/no)
1. At–Grade Dip										
1.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
2. 5–24" CMP										
2. 5–yr	424	130	0.0077	0.0091	0.05	0.025	1.53	0.50	2.34	yes
2. 10–yr	925	155	0.0086	0.0091	0.05	0.025	2.58	0.50	8.26	yes
2. 25–yr	1006	160	0.0087	0.0091	0.05	0.025	2.72	0.50	9.31	yes
2. 100–yr	1686	175	0.0107	0.0091	0.05	0.025	3.67	0.50	26.41	yes
3. 5–60" RCP										
3. 5–yr	424	424	0.0077	0.0021	0.05	0.012	1.53	1.25	1.14	no
3. 10–yr	925	890	0.0086	0.0021	0.05	0.012	2.58	1.25	2.28	yes
3. 25–yr	1006	910	0.0087	0.0021	0.05	0.012	2.72	1.25	2.60	yes
3. 100–yr	1686	1000	0.0107	0.0021	0.05	0.012	3.67	1.25	7.34	yes
4. 3–10' X 4' RCBC										
4. 5–yr	424	424	0.0077	0.0021	0.05	0.012	1.53	1.42	1.01	no
4. 10–yr	925	930	0.0086	0.0021	0.05	0.012	2.58	1.42	1.95	yes
4. 25–yr	1006	1020	0.0087	0.0021	0.05	0.012	2.72	1.42	2.06	yes
4. 100–yr	1686	1140	0.0107	0.0021	0.05	0.012	3.67	1.42	5.73	yes
5. 5–10' X 4' RCBC										
5. 5–yr	424	424	0.0077	0.0021	0.05	0.012	1.53	1.42	1.01	no
5. 10–yr	925	925	0.0086	0.0021	0.05	0.012	2.58	1.42	1.96	yes
5. 25–yr	1006	1006	0.0087	0.0021	0.05	0.012	2.72	1.42	2.09	yes
5. 100–yr	1686	1686	0.0107	0.0021	0.05	0.012	3.67	1.42	3.88	yes

Reference: Equn. 11.9 COT "Standards Manual for Drainage Design"

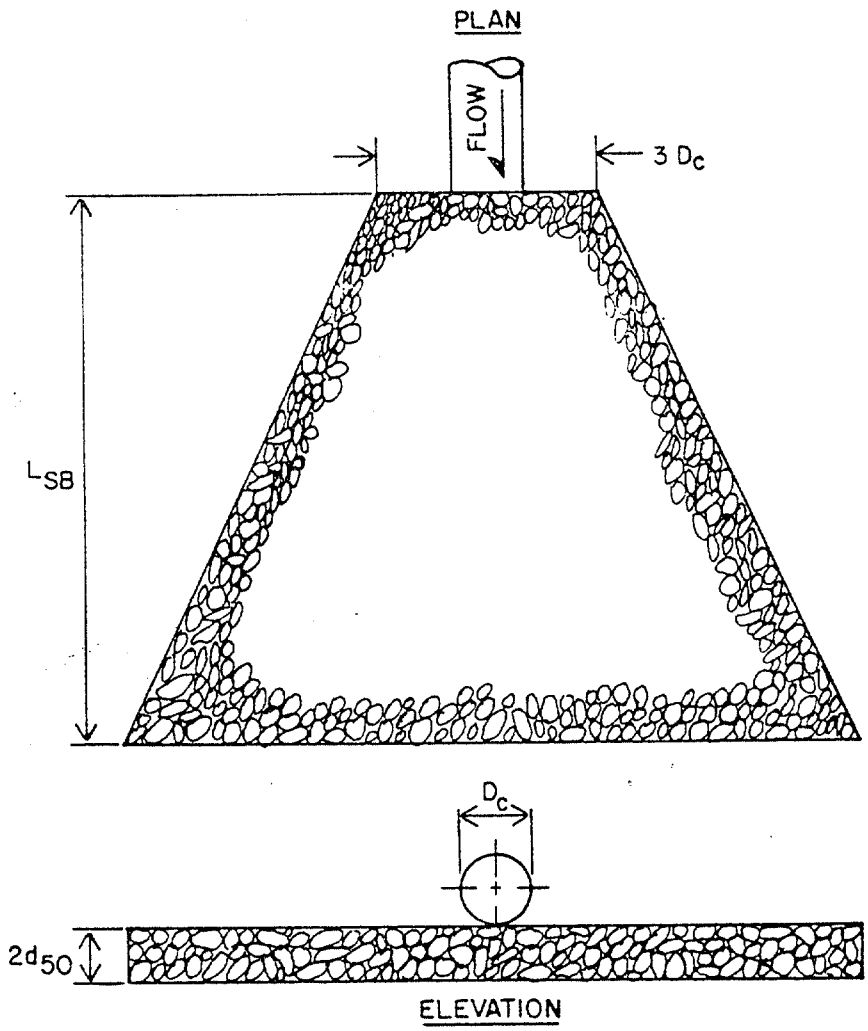
ARROYO ENGINEERING, INC.

Sedimentation at Culvert Inlet

$$R_s = \frac{Q_{ac}}{Q_p} \left(\frac{S_{ac}}{S_p}\right)^{1.66} \left(\frac{n_{ac}}{n_p}\right)^{-1.55} \left(\frac{R_{ac}}{R_p}\right)^{0.91} \qquad \{\text{Equn } 11.9\}$$

where,

R_s = Sedi.-Transport Ratio
Q_{ac} = Discharge in approach channel, cfs
Q_p = Total culvert discharge, cfs
S_{ac} = Longitudinal slope of approach channel, ft/ft
S_p = " " " Culvert, "
n_{ac} = Manning's n for approach channel
n_p = " " " culvert
R_{ac} = Hydraulic radius of approach channel, ft
R_p = " " " culvert, ft



Recommended Configuration Of Riprap Blanket

k = 2 for minimum tailwater

k = 5 for maximum tailwater

L_{SB} = Length of scour basin, ft. = 8 Dc

D_c = Culvert diameter, ft. = varies

d_{50} = Riprap median diameter = 12"

APPENDIX NUMBER 7

SUMMARY OF OPINION OF PROBABLE COST

OPINION OF PROBABLE COST

Project Alternative Number 1: At-grade Dip Crossing Date:

Item No.	Item Description	Unit	Quantity	Unit Price (Dollars)	Amount (Dollars)
1	Roadway excavation and backfill	Cu. Yd.	200	10	2,000
2	Concrete apron	Cu. Yd.	45	150	6,750
3	Concrete cut-off walls	Cu. Yd.	15	150	2,250
				Subtotal =	11,000
				Contingencies =	1,650
				@ 15%	
				Total =	12,650
				Say =	13,000

ROYO ENGINEERING, INC.

OPINION OF PROBABLE COST

Project Alternative Number 2: 5-24" CMP's Date:

Item No.	Item Description	Unit	Quantity	Unit Price (Dollars)	Amount (Dollars)
1	Roadway excavation and backfill	Cu. Yd.	225	10	2,250
2	Concrete apron	Cu. Yd.	40	150	6,000
3	5-24" CMP	L.F.	160	26	4,100
4	Rock apron	Cu. Yd.	10	30	300
				Subtotal =	12,710
				Contingencies =	1,907
				@ 15%	
				Total =	14,617
				Say =	14,500

ROYO ENGINEERING, INC.

OPINION OF PROBABLE COST

Project Alternative Number 3: 5-60" RCP's w/ Inlet Wings Date:

Item No.	Item Description	Unit	Quantity	Unit Price (Dollars)	Amount (Dollars)
1	Roadway excavation and backfill	Cu. Yd.	1000	10	10,000
2	5-60" RCP	L.F.	160	125	20,000
3	Structural concrete	Cu. Yd.	22	275	6,050
4	Rock apron	Cu. Yd.	60	30	1,800
				Subtotal =	37,850
				Contingencies =	5,678
				@ 15%	
				Total =	43,528
				Say =	43,500

ROYO ENGINEERING, INC.

OPINION OF PROBABLE COST

Project Alternative Number 4: 3-10' x 4' RCBC w/ Inlet Wings Date:

Item No.	Item Description	Unit	Quantity	Unit Price (Dollars)	Amount (Dollars)
1	Roadway excavation and backfill	Cu. Yd.	1300	10	13,000
2	3-10' x 4' RCBC	Cu. Yd.	100	275	27,500
3	Structural concrete	Cu. Yd.	20	275	5,500
4	Rock apron	Cu. Yd.	40	30	1,200
				Subtotal =	47,200
				Contingencies =	7,080
				@ 15%	
				Total =	54,280
				Say =	54,000

ROYO ENGINEERING, INC.

OPINION OF PROBABLE COST

Project Alternative Number 5: 5-10' x 4' RCBC w/ Inlet Wings Date:

Item No.	Item Description	Unit	Quantity	Unit Price (Dollars)	Amount (Dollars)
1	Roadway excavation and backfill	Cu. Yd.	1300	10	13,000
2	5-10' x 4' RCBC	Cu. Yd.	155	275	42,625
3	Structural concrete	Cu. Yd.	30	275	8,250
4	Rock apron	Cu. Yd.	50	30	1,500
				Subtotal =	65,375
				Contingencies =	9,805
				@ 15%	
				Total =	75,180
				Say =	75,000

ROYO ENGINEERING, INC.

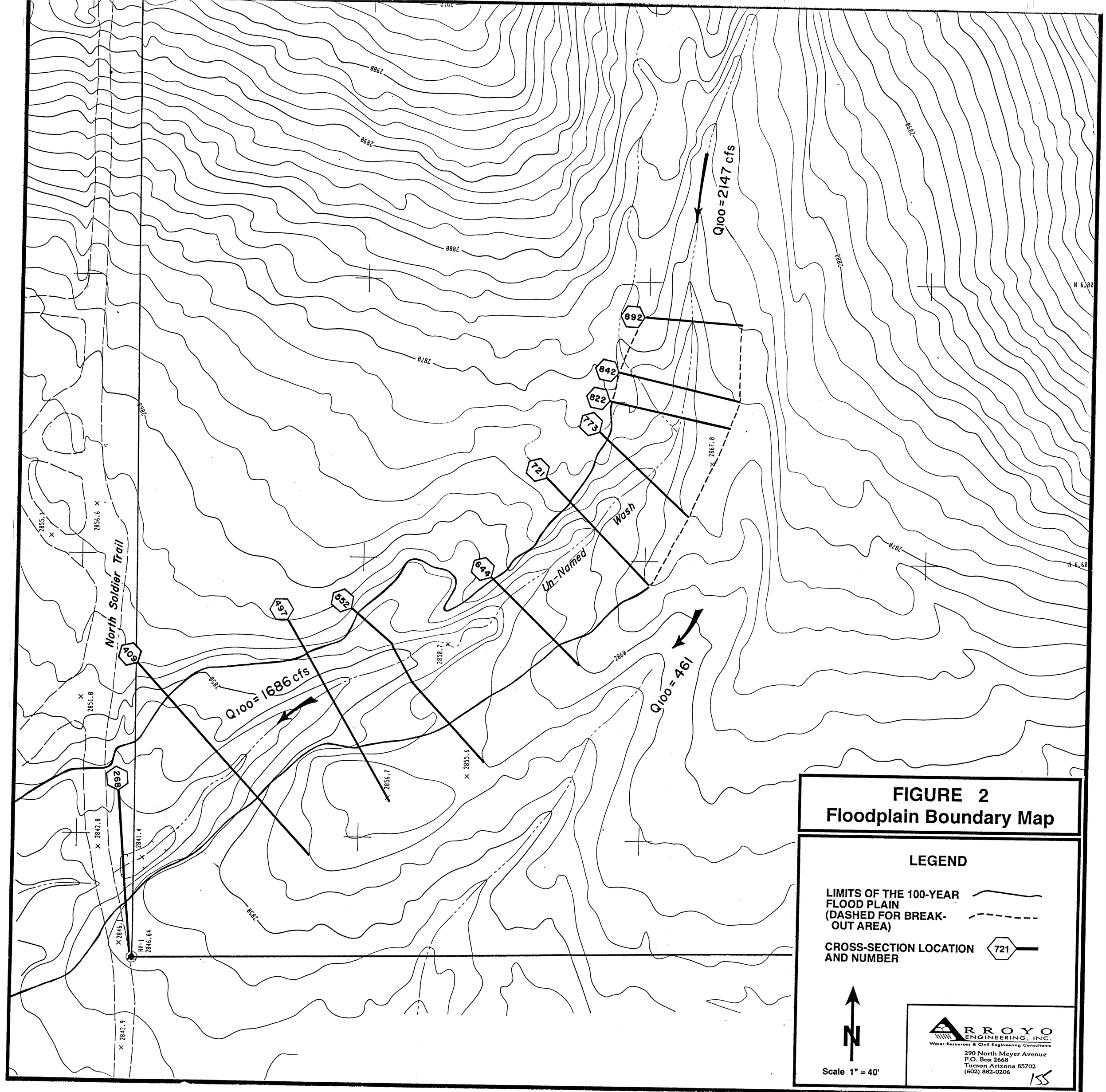


FIGURE 2
Floodplain Boundary Map

LEGEND

LIMITS OF THE 100-YEAR FLOOD PLAIN (DASHED FOR BREAK-OUT AREA)

CROSS-SECTION LOCATION AND NUMBER (721)

N

Scale 1" = 40'

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